Prepared for:
U. S. Army Corps of Engineers – Chicago District
111 N. Canal St., Suite 600, Chicago, IL 60606

Observation Well Network Installation McHenry County, Illinois

AECOM, Inc.
August 2009
Document No.: 09000-460-8000-001

AECOM

AECOM Environment
750 Corporate Woods Parkway, Vernon Hills, IL 60061
T 847.279.2500 F 847.279.2510 www.aecom.com

August 5, 2009

Mr. William A. Rochford, P.E.
U.S. Army Corps of Engineers, Chicago District
111 N. Canal Street, Suite 600
Chicago, Illinois 60606-7206

Subject: Installation Report for the Observation Well Network in McHenry County, Illinois.
AECOM Project No. 09000-460
COE Contract No. W912P6-06-D-0001
Task Order No. 0013

Dear Mr. Rochford:

Attached please find four final copies of the Observation Well Installation Report for the glacial aquifer system in McHenry County, Illinois. This report provides a summary of the work completed by AECOM, Inc. (AECOM) from September 2008 through July 2009. Included in Appendix A of each report are well folios that provide data for each of the fourteen well sites that were installed by AECOM as part of our work scope. For your convenience, we have also included an electronic version of the entire report on CD which is also included in each report.

Once again, we appreciate the opportunity to be of service to the USACE on this project.

Yours sincerely,

AECOM

Gary M. Braun, P.G.
Project Hydrogeologist

Jamie Matus, CPG
Vice President

Contents

1.0 Introduction 1-1

1.1 Project Background 1-1

1.2 Purpose and Scope 1-1

1.3 Organization 1-1

1.4 Overview of Investigation Program 1-2

2.0 FIELD EXPLORATION PROGRAM 2-1

2.1 Utility Clearance 2-1

2.2 Advancement of Boreholes 2-1

2.3 Observation Well Installation 2-3

2.4 Naming Convention for Observation Wells 2-5

2.5 Soil Testing 2-6

2.6 Surveying 2-7

2.7 Well Development and Disinfection 2-7

2.8 Water Quality Sampling and Analysis 2-8

2.9 Hydraulic Conductivity Testing 2-9

2.10 Water Level Monitoring 2-10

3.0 RESULTS OF FIELD PROGRAM TESTING 3-1

3.1 Soil Test Results 3-1

3.2 Water Quality Results 3-1

3.3 Hydraulic Conductivity Results 3-2

3.4 Water Level Monitoring Results 3-3

3.5 Downhole Geophysical Testing Results 3-4

4.0 WELL SITE DATA SUMMARY AND COMMENTARY 4-1

5.0 CONCLUSIONS 5-1

6.0 REFERENCES 6-1

List of Appendices

Appendix A Well Site Folios

Well Site 1 Chemung Township (1-CHE-S & 1-CHE-D)
Well Site 2 Alden Township (2-ALD-D)
Well Site 3 Hebron Township (3-HEB-I & 3-HEB-D)
Well Site 4 Richmond Township (4-RCH-S, 4-RCH-I & 4-RCH-D)
Well Site 7 Hartland Township (7-HRT-S, 7-HRT-I & 7-HRT-D)
Well Site 8 Greenwood Township (8-GRN-I & 8-GRN-D)
Well Site 9 McHenry Township (9-MCH-S & 9-MCH-D)
Well Site 10 Marengo Township (10-MAR-S)
Well Site 11 Seneca Township (11-SEN-I & 11-SEN-D)
Well Site 13 Nunda Township (13-NUN-I & 13-NUN-D)
Well Site 14 Riley Township (14-RIL-S)
Well Site 15 Coral Township (15-COR-S, 15-COR-I & 15-COR-D)
Well Site 16 Grafton Township (16-GRF-I & 16-GRF-D)
Well Site 17 Algonquin Township (17-ALG-S & 17-ALG-D)

Folio Table of Contents

I.) Site Location Map – Location in County
II.) Site Location Map – Location on USGS Topographic Map
III.) Site Location Map – Location on USGS High Resolution Orthophoto
IV.) Site Boring Log
V.) Well Construction Diagram
VI.) Well Site Summary and Commentary
VII.) Particle Size Distribution Report
VIII.) Table of Water Level Measurements
IX.) Well Development Field Log
X.) Water Quality Analysis Results
XI.) Groundwater Sampling Field Log
XII.) Hydraulic Conductivity Testing Results
XIII.) In-Situ LevelTroll™ Calibration Report
XIV.) Site Photographs
XV.) Downhole Geophysical Testing

Appendix B Equipment Procurement Documentation

- Solinst® Integra Bladder Pump Data Sheet
- In-Situ Documentation
  - Quick Start Guides
  - Software License Certificates
  - Artesian Well Cable Information Sheet
  - Material Safety Data Sheet – Activated Dessicant
  - Cable Calibration Reports

Appendix C Hydraulic Conductivity Testing Information

Appendix D ITR Comments and QA/QC Checklist

Appendix D-1 ITR Comments

Appendix D-2 QA/QC Checklist

List of Tables

Table 1 Observation Well Location Summary

Table 2 Field Exploration Summary: Drilling and Well Installation Details

Table 3 Summary of Particle Size Distribution Testing

Table 4 Field Parameters of Groundwater Quality Samples

Table 5 Summary of Groundwater Quality Sampling Results (mg/L)

Table 6 Summary of Groundwater Quality Sampling Results (meq/L)

Table 7 Summary of Hydraulic Conductivity Test Results

List of Figures

Figure 1 Observation Well Network Location Map

Figure 2 Piper Trilinear Diagram – All Wells

Figure 3 Groundwater Level Hydrograph

1.0 Introduction

1.1 Project Background

1. Population growth in McHenry County, Illinois has increased groundwater withdrawals. Since groundwater is the sole source of public water supplies it must be treated as a vital resource to the residents and economy of the county. Groundwater quality and availability must be protected to prevent water quality degradation and over-usage. To acquire background datasets for groundwater modeling efforts for resource conservation, environmental protection and land development planning, an observation well network within the unconsolidated glacial aquifers of McHenry County was planned.

1.2 Purpose and Scope

2. AECOM was contracted by the US Army Corps of Engineers (COE) under contract number W912P6-06-D-0001 Task 0013 to assist in a major portion of the observation well network installation. The main objective of this work was to install and initiate monitoring of the new observation wells located throughout the county. The wells were to be installed at varying depths to obtain groundwater data from the area's glacial aquifers.

3. AECOM's work scope included installation of 28 observation wells at 14 sites located throughout the County. The locations of the 14 sites were chosen to both represent a relative uniform spatial distribution in fourteen of the County's seventeen townships, but the locations were also chosen to acquire a representative dataset of upgradient and downgradient wells within the overall groundwater flow regime within the unconsolidated aquifer system. The well sites are displayed on Figure 1. A summary of the specific well locations is summarized in Table 1. An additional three observation wells which will comprise part of the network are to be completed by the ISGS. These three wells had water level recording devices purchased for them as part of AECOM's scope of services.

4. The work scope for the well installations was prepared to efficiently collect the best available data on the glacial hydro-stratigraphic units while minimizing the project oversite costs. The primary tasks for the observation well network installation included:

- Geologic Logging of subsurface materials;
- Installation of nested observation probes;
- Development of the new observation wells;
- Water quality sampling for general chemistry constituents;
- Hydraulic conductivity testing;
- Installation of water level monitoring devices; and
- Reporting of the above task items.

A detailed summary of the scope of work completed by AECOM is provided in Section 2.0.

1.3 Organization

5. The observation well network installation report presented herein was prepared by AECOM (formerly known as STS Consultants) of Vernon Hills, Illinois. This report is part of the comprehensive subsurface characterization and modeling effort intended to gather information on McHenry County's shallow groundwater resources for conservation, protection and planning purposes.

6. AECOM has strived to maintain close working relationships with the various parties involved, including the COE, the McHenry County Water Resources Department, the McHenry County Conservation District (MCCD) and the Illinois State Geological Survey (ISGS), to foster open communication for reaching common goals of

the project. This report has been organized in such a way that both regional and local well site discussions are provided.

7. General overviews of the procedures and results of the well installation, water sampling and testing procedures are provided. However, data at each well site are provided as an individual folio so they can be easily extracted as separate documents for convenience. The individual well folios are included as numbered attachments in Appendix A of this report. However, the folios are critical for this report and a copy should be maintained with this report. The text section of the observation well network installation report is organized as follows:

Section	Topic
1.0	Introduction;
2.0	Field Exploration Program;
3.0	Results of Field Program Testing;
4.0	Well Site Data Summary and Commentary;
5.0	Qualifications; and
6.0	References.

1.4 Overview of Investigation Program

8. The project was initiated with kick-off meetings with AECOM, COE and McHenry County personnel. Each of the observation well sites was visited and the well location was inspected. If vehicular access was considered inadequate for a truck-mounted drill rig, then the borehole was relocated to accommodate the use of the truck mounted rig and support equipment. Other than suggesting shifting well locations based on poor access, AECOM was not involved with the due diligence of the well location siting. Existing subsurface data reported in Circular 559 (1997) by ISGS was used by COE to identify locations of various aquifer locations and determine optimal well sites. Therefore, identifying areas of potential environmental concern or determination of offsets for such areas was not included as a part of AECOM's work scope. It should be noted however, that many of the sites are located within MCCD natural areas so the potential for encountering existing areas of aquifer degradation appear to be low.

9. A variety of issues had to be resolved at each of the well sites that did not involve site access with the drill rig. These issues included: accounting for future recreational use at MCCD properties, evaluating topography for possible artesian conditions, accessing well sites and protecting the well after installation. After agreement was reached for the well location, the proposed site was staked, labeled and flagged. A county-wide map showing the 14 well locations is provided in Figure 1.

10. Nearly all of the townships in the County are represented in the observation network. However, this spatial distribution created unique problems in moving the drilling and support equipment, obtaining water sources and coordinating utility clearances across the County. To simplify the logistics of the large work area, the County was divided into four quadrants (i.e. NE, SE, SW, NW) to establish smaller working areas. Each working area was planned to have a high-capacity source of water, a lay-down area for the drill casing to be temporarily held and a clean-fill disposal area to deposit the drill cuttings.

11. Drilling water was obtained from four sources: 1) a private high-capacity well owned by the J.H. Huemann & Sons, Inc Well Drilling (Huemann) company in Ringwood, IL, 2) a municipal well in the city of Crystal Lake, 3) a municipal well in the City of Marengo and 4) a municipal well in the City of Harvard. However, due to the generosity of Huemann & Sons to allow the storage of equipment and supplies at their shop throughout the

course of the project, the majority of water used was obtained from them. Only a single clean-fill site was used for disposal of the soil cuttings. A private resident in Hartland Township accepted the cuttings for fill on his property. Additional fill sites were not required because there was a small volume of cuttings and the Hartland site was centrally located.

12. The work was commenced in a clock-wise fashion starting in the northeast quadrant. This process allowed for the staging of equipment, well supplies and water at only a few select sites which minimized excess travel. This clock-wise staging also helped in status reporting and estimating schedule. Details of the subsurface exploration program are provided in the following section.

2.0 FIELD EXPLORATION PROGRAM

13. The site investigations conducted by AECOM in McHenry County, Illinois included the following work tasks:

- Utility clearance;
- Drilling and soil sampling;
- Observation well installation;
- Geotechnical analyses of soil samples collected from the site;
- Surveying of the wells and monuments;
- Observation well development and disinfection;
- Groundwater quality monitoring;
- Hydraulic conductivity slug testing; and
- Groundwater elevation monitoring.

2.1 Utility Clearance

14. Once the well locations were staked at each site, maps and descriptions of the well locations were prepared and forwarded to the drilling contractor for underground utility clearance. Pursuant to Illinois Regulations, the contractor initiated all locates with JULIE (Joint Utility Locating Information for Excavators) for marking subsurface utilities. AECOM also assisted in obtaining private utility maps from Township or County Public Works Departments (such as Valley Hi maintenance personnel) for clearing buried utilities not covered under JULIE. With the possible exception of the Hartland and Seneca Township sites, underground utilities were not proximal to the well locations because of the rural and recreational settings of the public land that most of the wells were located in.

15. In Hartland Township, a County-owned fiber optic line runs from the old Annex building to the new Valley Hi building. Since poorly detailed maps were the only available as-built data available for review, the first 48" of the Hartland borehole was dug by hand. It is believed that the fiber optic line (which was reportedly cased in PVC) is buried closer to the parking lot (approximately 5ft offset) because there was evidence of several depressed areas that ran parallel to the parking lot. The linear depressions, which were offset approximately 5ft from the asphalt, were filled with excess cuttings and samples from the well. In Seneca Township, a telephone cable runs from a Garden Valley Road telephone pole to the north side of the building. The buried communication line was located approximately 15 feet south of where the boring was advanced. A photograph of the marked utility line is included in Folio #11 of Appendix A.

2.2 Advancement of Boreholes

16. AECOM subcontracted WDC Exploration & Wells from Clearwater, MN (WDC) to conduct the drilling and well construction activities of the observation well network. WDC has extensive experience in advancing boreholes through glacial materials using a Roto-Sonic drilling rig. WDC established an agreement with an approved drilling firm listed as a signatory to the local Operators Union (Local 150) for this project. All drilling equipment used was WDC owned and was operated by an experience driller from WDC and two experienced laborers from the local labor hall.

17. AECOM utilized roto-sonic drilling methods because of its ability to quickly advance boreholes through unconsolidated materials while obtaining a continuous record of the subsurface materials. This minimized over-sight time and increased the quality of the sample recovery. The near-continuous sample recovery allowed the on-site geologist to characterize larger structures, bedding planes and other depositional features

which would not be otherwise apparent using traditional sampling methods. In addition, a greater accuracy in stratigraphic contact depths and nature of those contacts was obtained because of the good recovery. Also, it is believed that the use of the multiple roto-sonic casings led to higher quality (increased yield, lower turbidity etc.) observation wells. This is maintained because drilling mud was not used during sampling or drilling. In addition, all boreholes were held open by the casing and did not have to be held open by drilling additives. By extending the casings to the desired screened depths within the target aquifer, it was possible to place the screen intervals with a high degree of accuracy. Furthermore, the cased borehole provided environmental benefits by minimizing the vertical water leakage between aquifers at locations where multiple water bearing units were penetrated.

18. Another advantage of roto-sonic drilling is the dramatic reduction in spoils emanating during the drilling process. There was an estimated 60 to 70% reduction in the amount of drill spoil that was produced compared to rotary (i.e. mud-rotary or hollow stem auger) methods. The majority of the drill cuttings that had to be removed from each site were from extra sample recovery (i.e. after AECOM and ISGS collected their samples). The excess samples and any additional drill spoils were removed from each well site. As previously mentioned the cuttings were transported by WDC and deposited at a clean-fill site in Hartland Township.

19. Care was taken to restore the sites to their original condition. No deep ruts were apparent at any site. Minor ruts were re-graded prior to the rig leaving the site. As a result of the careful planning and minimal duration spent at each site, no additional restoration was required (i.e. not requested by the COE or McHenry County).

20. The roto-sonic rig advanced a “4-inch sampler” casing to collect subsurface samples. The “sampler bit” (as it is referred to in the boring logs) consists of a 3½” inside diameter (ID) and a 4½” outer diameter (OD) carbide-tooth bit with a 10-ft long core barrel. The reciprocating drill head produces a frequency of 150 Hz which is transferred through the casing to the drill bit and is reflected back. This intense vertical vibration causes a thin layer of particles next to the casing to lose structure and behave like a fluid. This liquefaction dramatically reduces friction on the inside and outside of the casing which acts as lubrication reducing sidewall friction. This allows rapid penetration of the drill casing and returns a continuous sample through the center of the drill string. Some of the advantages of using a roto-sonic rig are production rates that can be as much as 4 times faster than traditional methods, the rig can independently rotate for advancing a downhole hammer bit, and it does not produce significant cuttings, other than the actual soil sample.

21. As the bit penetrated through the subsurface material, the samples fed into the hollow core barrel. The sampler was advanced in 10-ft intervals. Once the 10-ft run was complete, a 6” ID casing was advanced to the same depth so the core barrel could be withdrawn. The 6-inch casing is advanced in a similar fashion as the sampler bit except that water is used to pressurize the annular space between the sampler and the casing so that cuttings do not lodge within this area. Water pressures up to 700 psi were used to prevent accretion of cuttings within this annual space. The water used during this process was supplied by the support/water truck that sat back-to-back to the drill at each hole.

22. After the “sampler bit” was tripped out of the hole, long plastic bags were used to collect the subsurface cuttings which were held through surface tension in the core barrel. Sonic vibrations were then used to break the tension to let the sample fall out of the barrel and into the plastic recovery bags. Depending on the subsurface conditions, three to five bags of were used to collect the 10ft of recovery. The bags, which were approximately 6” in diameter, were generally three to four feet long. The bottom of the run’s first bag was labeled with the run’s bottom depth. The remaining bags were laid out in front of first bag in order of extraction. It was generally assumed that this bag had the greatest accuracy of depth. The remainder of the recovery was measured from the bottom of the run.

23. During the first several holes, a 10-ft core barrel was used exclusively to retrieve each 10-ft sampling run. However, since clay particles within the till tended to expand and squeeze into the drill rods during each run due to the heat and pressure, an additional 10-ft core barrel was added. The additional 10ft barrel was added to the drill string so that there was room to accommodate expansion of the sample recovery. Even though core recovery often appeared to be longer than the actual 10-foot run to acquire the sample, the actual recovery had to be estimated based on the volume of recovery. In highly plastic clay-rich tills, a 10-ft recovery could be measured as having over 14ft of sample. However, the expanded recovery would have smaller diameters than the 3½" ID of the core barrel. On the contrary, granular deposits yielded much shorter length recoveries. Although these samples appeared to be shorter than clay recoveries, the recovery of the sand and gravel were estimated based on volume recovered.

24. The longer sampling core barrel also yielded advantages in granular deposits. Typically, a "flapper-bit" is used in granular soils that do not maintain cohesion within the core barrel. After the run is complete, a flap will close at the bit and hold the column of granular material above it. However, the flapper continued to be damaged because of the high gravel content. The 20ft core barrel was frequently utilized since it increased the chances of encountering a cohesive soil layer that would hold all the granular samples in the core barrel above it.

25. At each site, the borehole was advanced to the top of bedrock. The borehole was considered to be at an acceptable termination depth when the recovery of bedrock core or disaggregated samples was confirmed by the on-site geologist. Typically, the borehole was terminated once a few feet of rock was drilled and confirmed. The completed boring logs for each of the well sites are included in the Appendix A well folios. Bedrock depths vary considerably throughout the area (refer to Table 2). In boreholes completed by AECOM, bedrock depths varied from 29 feet in Riley Township to 345.5 feet in Alden Township. Bedrock thicknesses vary because of surface relief, geomorphology settings and topographic irregularities (and lithology) of the formerly exposed bedrock surface.

26. The nearly continuous geologic record of the initial borehole was observed and logged by the AECOM geologist. Jar samples of the subsurface materials were collected at regular intervals for future inspection and laboratory testing. The unconsolidated geologic samples were placed in glass sample containers, boxed and labeled with the following information:

- Project Name
- AECOM Project Number
- Boring Number
- Sample Number
- Depth of Sample
- Sampling Date

27. The soil samples are currently being held at our Milwaukee office, but can be transferred to the County if desired. AECOM maintains soil samples for a period of 2 years after acquisition. It also should be noted that a complete record of the subsurface samples were collected by the ISGS.

2.3 Observation Well Installation

28. After the borehole and boring log were completed, the hydro-stratigraphic sequence at the well site was reviewed by the on-site geologist and a recommendation of the well construction(s) was forwarded to the COE and to the McHenry County Water Resource personnel for review. If the proposed well screen distribution was different than what was anticipated in the original scope of work (SOW), a narrative describing the probable causes of the discrepancy was provided. Well installation activities were initiated after completion of the initial boring and approval of the number of wells to be installed at each site and their screens depths.

29. All observation wells at each well site were installed in the same borehole, with the exception of the intermediate well at Coral Township which was installed at a later date. The screen intervals of multiple wells installed in the same borehole were separated by bentonite hole plug. This eliminated hydraulic connections within the borehole. Installing multiple wells in the same borehole saved considerable set-up and installation time over the duration of the project. The quality of the well seals were also shown to be very effective. Strong artesian flows were encountered while drilling the Hebron Township wells. It is estimated that flows of over 15 gallons a minute were flowing out of the 6" casing when the deep well was installed. However, after the well seal was placed, the flow inside the casing stopped. After the 6" casing was completely removed from the borehole leaving only the 8" diameter casing the hole, artesian flow resumed when the aquifer was exposed during intermediate well installation. However, after the intermediate well's seal was placed, flow stopped once again. The magnitude of the vertical head differences and the artesian flows in the borehole demonstrates that multiple well seals can be effective when employed properly in a single borehole.

30. Well construction reports are included for each well site in the well folios located in Appendix A. The well installation details are also summarized in Table 2. Details of the well installation procedures are summarized below. To install multiple 2" diameter observation wells within a single borehole, the following procedures were conducted:

- Advance 4" diameter core barrel sampling bit and the 6" diameter casing from the ground surface to the bedrock surface,
- Evaluate hydro-stratigraphic record to determine positioning (number and depths) of observation wells,
- In cases where a 2nd well was planned, an 8" diameter casing was advanced on the outside of the 6" casing to the desired depth,
- In cases where a 3rd well was planned, a 10" diameter casing was then advanced on the outside of the 8" casing to the depth of nested well #3,
- Installation of the deeper observation well was completed first, making sure bentonite chips were placed over the filter pack and extended continually to the depth of the 2nd well, and
- Finally, the well nest was completed by constructing shallower well(s) in a similar fashion.

31. As mentioned, the deepest observation well within each nested well site was installed first followed by the shallower well(s). If the screened portion of the deep well was at the bottom of the borehole, then the well was placed at the bottom of the borehole and the well was backfilled with coarse silica filter pack sand. If the deep well screen was not to be offset from bottom of the borehole, the borehole was backfilled with bentonite hole plug. Hole plug was added until the desired depth was reached. The backfilling process was closely monitored so that the screen intervals were not inadvertently sealed.

32. The annular space between the well casing and the borehole wall was backfilled with either No. 5 coarse silica filter pack sand (from the R.W. Sidley Co.), 3/8" bentonite chips (from Black Hills Bentonite) or neat bentonite cement grout (from WYO-BEN, Inc.). The sand and bentonite were gravity fed at the surface and allowed to settle through the casing. If bridging occurred within the drill casing, the roto-sonic reciprocating drill head would be started to free any clogged materials between the well and the casing. The roto-sonic casing was also utilized to maintain the integrity of the borehole. If blown-in sands heaved beneath the bit and into the drill casing, the drill head would be attached to the casing and water would be pumped into the casing to maintain the hydrostatic head above the groundwater head, thus forcing the sands out of the casing.

33. The deep observation well was set by slowly adding the filter pack sand and slowly removing the casing as it filled. Filter packs were extended to a depth of 2-ft above the top of the screened interval. At that depth, bentonite was added to create the well seal. For most of the well sites, bentonite hole plug was used to the

seal the entire borehole. At three wells, a minimum of 8 feet of bentonite seal was place above the filter pack and the remaining annular space was backfilled with bentonite cement grout. If multiple wells were installed, hole plug was used to create the stable backfill for well construction. This allowed the shallower observation wells to be installed immediately after the deep well was set without having to wait for grout to cure. As mentioned, grout was used only in a few occasions to fill the annular space above the shallowest well seals.

34. If a 2nd well was planned for the site, then the hole plug was added to a depth of 2 feet below the planned screened interval. Then approximately 2 feet of filter pack sand was added prior to setting the 2nd observation well. Again, the filter pack sand was advanced to a depth of 2 feet above the top of the 2nd well screen and was sealed with bentonite hole plug. This same procedure was followed in instances where a 3rd well was installed. For the 28 observation wells that were installed, there was an average of 2½ feet of filter pack above and below the slotted section of the well screen. Thus, most of the observation wells had 10 ft intervals (i.e. 2½ ft below well + 5ft well screen + 2 ½ ft above well) that are exposed to the aquifer.

35. In all cases, observation wells consisted of a 5-ft long, 2” diameter Schedule 40 PVC well screen and 10-ft long, 2” diameter PVC Schedule 40 solid riser pipe extending to the ground surface. Well screens had 0.010 in. machine slotted openings over an approximate 4.5-foot length. Taking the well cap on the bottom of the well into account, the well screens were 5.38 ft long that included: 0.5 ft from the bottom of the well to the first slot on the bottom of the well, 4.5 ft between the slots and 0.38 ft between the top slot and the threads at the top of the well.

36. Observation wells were extended to a height of ~2.5ft above ground surface. Protective casings were placed in concrete over the wells to a height of ~3 ft above ground surface. The annular space in the well casing from the ground surface to approximately 8” below the top of the PVC riser was filled with coarse silica sand. The protective casing was set 6” higher than the PVC riser so that there would be extra space within the protective casing to allow room for the water level monitoring devices. The transducer cords are coiled within the wellhead for protection. The size and type of protective casing varied from site to site based on the number of wells at each site. For the sites with three observation wells installed within the same borehole, such as Richmond and Hartland Townships, a 12” diameter steel casing was used to protect the PVC wells. The large diameter casing was painted green and locked pursuant to the Quality Control Plan (QCP) developed pursuant to the statement of work. Sites with two wells had either 8” diameter steel or aluminum protective covers installed over the observation wells. Blue anodized aluminum well covers were ordered since green aluminum covers were unavailable. Single well sites utilized either 4-inch or 6-inch diameter steel casings. All of the steel covers were painted green pursuant to the QCP. All of the well sites were secured using keyed-alike, long-shank Master Locks™.

37. The protective casing was encased in a concrete pad that was installed around each well. The concrete pads were approximately 2-foot square and at least 4-inches thick. Protective bollards were also installed around each well nest as a safeguard from vehicular traffic. The 7-ft long, 3” diameter bollards were placed in concrete and stick-up at least 3.5 ft above ground surface. The sand and concrete-filled bollards, were primed and painted green for rust protection and identification.

38. Each new observation well was also fitted with labels identifying the well. One label was installed inside the well cover, while the other was installed on the outside of the cover. The well labels were permanently fixed to the well and indicated the well number(s), top of PVC riser elevation, screen depth and the date of well installation.

2.4 Naming Convention for Observation Wells

39. A naming convention was developed to delineate the numerous wells that were installed in the various hydro-stratigraphic units of the glacial deposits. The wells were given a five character name to relate the well site number, its township location and general screened depth. For example, the two wells installed at the

Greenwood Township site (Site #8) were named 8-GRN-I and 8-GRN-D. The first number relates to the list of sites provided by the Corps in their SOW. These numbers were maintained because they follow logical east-west, north-south order and can be continued when additional observation well sites are added in the future. The next the three characters abbreviate the name of the township and the last character refers to the general depth the well was completed at. As is explained below, the depth suffix is a simple, but useful tool to determine the general placement of the well screens at a given site. A general description of the well name suffixes are provided in the following paragraphs.

40. Shallow Wells (S) – The "S" suffix wells typically correspond to observation wells that are representative of water table conditions. These wells are installed in either the uppermost water bearing zone (e.g. 4-RCH-S) or in the most prolific zone within a granular unit that is contiguous with an unconfined aquifer (e.g. 1-CHE-S). The wells installed in Marengo and Riley Townships encountered bedrock at a relatively shallow depths (i.e. 25 and 35ft, respectively) so multiple wells were not installed at these locations. The single wells were screened in the coarsest portion of the overburden deposits. Despite the fact that these wells were installed close to the top of bedrock, they were labeled with an S suffix because it was felt that they more closely represented water table conditions. Other deep wells were typically screened in confined hydro-static units that were hydraulically separated from the uppermost water bearing unit.

41. Intermediate Wells (I) – "I" suffix wells typically correspond to observation wells that are screened in granular deposits that appeared to be hydraulically separated from other shallow and deep hydrostatic zones. If shallow and deep wells were installed without an intermediate well - such as the case at Chemung, McHenry, and Algonquin Townships – a significant water bearing unit was not found in the intra-till sequence. Close inspection of the cuttings and boring logs may have revealed small granular deposits or coarsening of till units, but these units were determined to be minor intra-till sequences that were insignificant to the regional water supply observation network.

42. Deep Wells (D) – "D" suffix wells represent wells that were screened in the most prolific hydrostatic unit near the bedrock / over-burden interface. In some cases, the borehole was backfilled with bentonite in order to screen a portion of the aquifer that was above the bedrock surface. In other cases, the wells were set at the bottom of the borehole. In general, there were four different configurations for which the deep wells were installed. These configurations include:

- Wells that were screened across the bedrock and overburden interface (4-RCH-D, 7-HRT-D & 13-NUN-D);
- Boreholes that were backfilled with bentonite in order to screen a more prolific unit a at higher elevation (3-HEB-D, 8-GRN-D, 15-COR-D & 16-ALG-D);
- Wells that were screened entirely in the bedrock because no other granular units were productive enough (1-CHE-D & 17-ALG-D); and
- Wells that were screened in sand units immediately above the bedrock surface (2-ALD-D & 11-NUN-D).

43. As stated above, the single observation wells in Marengo and Riley Townships were assigned shallow well labels since they are representative of water table conditions. In addition, these wells were less than 25ft deep, so a deep classification did not appear warranted.

2.5 Soil Testing

44. For each of the observation wells completed within the overburden, a representative grain size sample from the screened interval of the glacial deposited materials was collected. The soil samples were delivered to AECOM's Soil Laboratory in Vernon Hills, Illinois for particle size distribution testing conducted pursuant to ASTM D-2217. Grain size tests were not completed for wells that were installed entirely in bedrock. A

summary of the particle size distribution tests is provided in Table 3. Individual well results are included in Appendix A for each site folio.

2.6 Surveying

45. Each site had a brass survey monument installed within a couple of feet from the observation wells. The survey monuments were obtained from the COE to serve as a benchmark for surveying of the observation wells. The survey monuments were constructed in general accordance with the US Army Corps Engineer Manual 1110-1-1002. The elevation and position of each observation well was surveyed by an AECOM survey crew. A summary of the survey results is presented in Table 1. As shown on Table 1, the horizontal position of the well site was determined at the survey monument.

46. Tie-ins acquired from the McHenry County GPS network had to be located so AECOM's equipment could be calibrated. After the tie-ins were located (often under piles of snow), the horizontal and vertical positions of each site's brass survey monument was surveyed. Then, using the monument's elevation as a benchmark, the surveyors measured the ground surface, top of PVC riser and top of casing of each well using traditional survey techniques. Horizontal site coordinates are referenced to Illinois State Plane-east based on the 1983 North American Datum (NAD83). Vertical elevations are referenced to the 1988 North American Vertical Datum (NAVD88). The horizontal coordinates are also provided in Universal Transverse Mercator (UTM) Zone 16 coordinates for convenience. The coordinate re-projection from State Plane to UTM was provided completed within a GIS platform. This additional horizontal coordinate site was provided because several regional datasets are reference to UTM coordinates

47. The highest point on the top PVC riser was used as the point at which water levels are measured. This point was marked on the PVC, recorded to the nearest 0.01 ft and set to be open when the transducers were deployed.

2.7 Well Development and Disinfection

48. Each new well was disinfected pursuant to the request of the COE and McHenry County. It is our understanding that chlorination was requested for the prevention of bacteria forming within the shallow aquifers of McHenry County. The following procedures were used to disinfect the observation wells after installation. These procedures disinfected the well but also minimized residual sodium hypochlorite (i.e. bleach) so that the reagent's effect on the well's geochemistry was minimized. The disinfection procedures were conducted as follows:

- Introduce sufficient chlorine so that a 100 mg/L (100 ppm) dosage of chlorine was introduced to the well. Four ounces of Chlorox™ Bleach was added to the well for every 100 feet of water column.
- Allow disinfectant to settle in the well for a minimum of a 2-hour period prior to development.
- Develop the observation wells as described in the procedures below using surge and purge methods.
- Extract the chlorinated water during the purging portion of the well development.

These disinfection procedures follow the general guidelines provided by the US EPA and the Illinois Water Well Construction Code (IAC Section 920.110).

49. Well development was completed for each new observation well to remove or entrain fine particulates suspended during drilling and/or well installation. Development was performed by AECOM personnel between December 8th and 30th, 2008 following the surface completions. Development occurred prior to water quality sampling and hydraulic conductivity testing. The primary well development method consisted of alternatively surging and purging the well. For most of the wells, a Waterra™ Inertial Pump was used to surge and purge the well in alternating strokes. The inertial pump surged the well using a nominal 2" diameter PVC surge block

and extracted the water using a foot valve. The foot valve is a simple check-valve that was installed at the bottom of the 1" OD high density polyethylene (HDPE) tubing. It was found that the inertial pump was effective in developing the wells because it did not wear out due to turbidity and it surged the well screen during every stroke. A few of the first wells to be purged were done so using a HydroLift2™ submersible pump. The use of this submersible pump was discontinued because it was mechanically unreliable.

50. The Alden Township well was surged using a 3 ft long, 1.75 inch diameter aluminum surge block and then purged using 7-foot long disposable HDPE bailers. These tools were necessary due to the depth of the well screen (340-345 ft bgs) and the depth to the static water level (approximately 220 ft bgs).

51. Water quality field parameters of the purge water were recorded periodically using a Horiba U-10 water quality monitoring device and a custom flow-through cell. Development continued until pH, specific conductance and temperature readings stabilized for three consecutive five minute sampling intervals. In some instances purging continued until the discharge water was clear to the naked eye or until 10 well volumes were removed. No visual or olfactory evidence suggested that the purge water was impaired, so development purge water was diverted away from well and allowed to re-infiltrate at the ground surface. The well development field forms are presented in Appendix A for each of the well sites.

2.8 Water Quality Sampling and Analysis

52. Water quality samples were collected at each of the 28 new observation wells and were analyzed for general chemistry indicator parameters. A water quality sample was also taken from Huemann's high-capacity well. As stated previously, since their lot was used as a lay-down area, many of the wells were drilled using water pumped from their well. Additional water was not introduced during well development or hydraulic conductivity testing.

53. The observation wells were sampled using a QED bladder pump. This pump was owned by AECOM, and operated in a similar fashion to the bladder pump purchased for the County as part of this project. The only well not sampled with a bladder pump was the Alden Township well (2-ALD-D), which was sampled (and purged) using a 7-ft disposable HDPE bailer. After collection, the samples were labeled, placed in zip-lock bags and placed on ice such that sample temperatures were maintained at <4º C. The samples were submitted to First Environmental Labs of Naperville, IL for analysis. Samples were either shipped via courier or sent via priority carrier so US EPA recommended holding times were met. Standard turnaround times were used. It should be noted that the proposed laboratory (Genapure Analytical Services) no longer serves the Chicago market.

54. A Solinst™ brand portable Integra Bladder Pump (Model No. 407) was purchased for the McHenry County Water Resources Department along with 10 extra disposable bladders and 1000 ft of the required tubing. The bladder pump consists of a 2-ft long, 1.66" diameter 316 stainless steel tube that has screened opening at the bottom and two openings at the top. The small port (1/4" OD) at the top of the pump allows air to pressurize the outside of the bladder tube. The larger port (3/8" OD) allows the discharged water to be released from the bladder. The low density polyethylene (LDPE) bladder acts as a membrane between the intermittent pressurized air chamber (on the outside of the chamber) and the groundwater (which bottom-fills the inside of the bladder). The purge rate is adjusted by changing the duration of pressurization and intake time. These are adjusted at the surface using the control unit. A complete summary data sheet of the Model 407 bladder pump is included in Appendix B. All operational and maintenance documentation for the bladder pump was given to the County during a training session for the pump.

55. The bladder pump provides an intermittent, but consistent low flow rate which is ideal for minimizing purge water volumes and reducing turbidity in the water samples. The low flow rate assists in stabilizing field parameters for collection of the ground water sample. The Integra Bladder Pump can be regulated to provide continuous output from 100 ml/min to 2L/min using the Electronic Pump Control Unit. The compressor which

came with the unit can operate up to ~125 ft below grade, so wells that had deeper water levels (only Alden Township, at this time) will either have to use an alternate air source (i.e. compressed nitrogen or a larger compressor) or will need to be sampled using another method. As stated previously, 2-ALD-D which was sampled (and purged) using a 7-ft bailer.

56. Field parameters of pH, conductivity & temperature were monitored using a Horiba U-10 water quality checker placed within a flow-through cell. Water samples were taken once values of these parameters stabilized within approximately 10% of previous readings. The field parameters taken at the time of sample collection are summarized in Table 4. Since dissolved metals were not analyzed, in-line field filters were not used. No evidence of contaminated water was encountered (i.e. sheen, odors, etc). As result, purge water was directed away from the well and allowed to infiltrate. Water samples were analyzed for the following major anion - cation parameters: calcium, iron, magnesium, potassium, sodium, chloride, bicarbonate/carbonate, and sulfate. The results of the water quality test results are summarized in Table 5 and Table 6, reported in milligrams per liter (mg/L) and milliequivalents per liter (meq/L), respectively. Individual well samples are included in each well folios included in Appendix A. The analytical results are also presented graphically in a Piper-Trilinear diagram (refer to Figure 2). The sample results are distributed based on well depth and water source.

2.9 Hydraulic Conductivity Testing

57. In-Situ hydraulic conductivity testing was performed at each new observation well location. The tests were conducted using rising head test methods in general accordance with ASTM field procedure D-4044. This method is performed by pressurizing the well head space and lowering the water level using compressed nitrogen. The rate of water level recovery after the pressure is released was monitored using an In-Situ LevelTROLL700™ pressure transducer and data-logger. In instances of very fast recovery, an additional test was run. There were no cases in which the water table intersected the well screen, so alternative test methods were not utilized.

58. Two responses were observed from the instantaneous change in head: under-damped and over-damped. Because of the very permeable nature of the aquifers in which several wells were screened in, an under-damped (or damped oscillatory) response occurred. This implies that after the air-pressure was released, the water level initially recovered to an elevation greater than the static water elevation measured before the test. The water level typically fluctuated above and below the static level before equilibrium was reached. Other wells had more typical responses in which water levels recovered in an approximately exponential manner to static conditions without going higher than the static level.

59. Water level recovery data were either analyzed using the Bouwer and Rice (1976, 1989) method in the software program AQTESOLV™ (v 3.01) or were calculated using the ASTM method D5785. The ASTM method D5785 is based on under-damped solutions derived by van der Kamp (1990).

60. The only exceptions are the two artesian wells installed in Hebron Township that were not slug tested. Instead, the hydraulic conductivity at these wells was estimated using injection test equations using static pressures and flow rates that were taken at the wellhead. These calculations were based on the assumption that formation conductivities are the same whether water is injected into the formation at a constant rate or water is produced by the formation at a constant rate. The injection test equations were developed for the COE by Hvorslev in 1951 and summarized by Cedergren (1977). A summary of the hydraulic conductivity test results is provided in Table 7. Individual well calculation sheets are found in each well site folio provided in Appendix A.

61. A compilation of references used in the hydraulic conductivity calculations are included in Appendix C. Included in this Appendix are the ASTM D5785 reference, a spreadsheet of the sample problem listed in ASTM D5785 that was used for the under-damped responses and a copy of the injection test methods.

62. Calculation of an under-damped test result (as provided in ASTM D5785) is summarized as follows:

i. Plot the water-level response in the well to the sudden change in head;

ii. Calculate the angular frequency, ω:

$$\omega = 2\pi / \tau$$

where:

$\tau = t_1 - t_2$, and t_1 1and t_2 are time of successive maxima or minima of the oscillatory wave;

iii. Calculate the damping factor, γ :

$$\gamma = \ln[w(t_1) / w(t_2)] / t_2 - t_1$$

where:

$w(t_1)$ and $w(t_2)$ are the water-level displacements at times t_1 and t_2 , respectively;

iv. Determine transmissivity, T ,

$$T = b + a \ln T$$

where:

$$a = [r_c^2 (g / L)^{1/2}] / 8d$$
$$d = \gamma / (g / L)^{1/2}$$
$$L = g / (\omega^2 + \gamma^2)$$

and:

$$b = -a \ln[0]$$

v. Solve for transmissivity iteratively using an initial estimate value for transmissivity, T, and a known or estimated value of storage coefficient, S.

2.10 Water Level Monitoring

63. Water levels were measured at several times during the drilling process and after the wells were installed. During drilling, readings were measured from ground surface and recorded on the boring log. After the wells were installed, water levels were recorded from the high point of the PVC casing which is marked on most of the wells. Water levels were measured using an electronic measuring tape accurate to the nearest 0.01 ft. These data are included in the water level measurement table within each well folio (refer to Appendix A). Besides the measurements collected during and after drilling activities, levels were also taken prior to and after well development, prior to water quality sampling and hydraulic conductivity testing. Two other additional independent water level monitoring rounds were also completed. A hydrograph of the water level monitoring data is included on Figure 3.

64. Since the week of February 22, 2009, most of the wells have been recording water level on an hourly basis. Per our work scope, In-Situ brand LevelTROLL™ 500 electronic water level recording devices were installed in all of the 28 observation wells. These devices are being used to simultaneously record hourly ground water level readings at each of the discretely screened observation wells. The groundwater level data

generated from these instruments will be used in the evaluation of the unconsolidated glacial aquifers and in the calibration of a regional groundwater model.

65. The LevelTROLLs are attached to a rugged, vented poly cable using twist-lock connections. The instruments were then submerged to a depth that will enable water levels to be recorded without over-pressurizing or exposing them. The instruments are secured to the well using 2" diameter PVC compression caps. The well caps are placed on the top of the PVC riser and have 1¼" holes drilled in them which are positioned so that the PVC's measuring point (i.e. high point on riser) is exposed. This allows water level readings to be made without shifting the transducer's position or removing the well cap. The Troll cable is attached to the well cap using the service grip that is factory installed on the cable. The service grip is then held in place at the well using ¼" diameter stainless steel or brass screws that are attached to the well cap. The well cap fits snug onto the top of PVC riser, but can be easily removed by simply tapping it upward. A customized tool was provided to the County for this task.

66. The LevelTROLLs were installed in the wells so that they were either 5 feet above the top of the well screen or approximately 50 feet below the static head in the well. In very shallow wells, such as 4-RCH-S, 10-MAR-S and 14-RIL-S, 15 psi transducers were used. All of the remaining wells utilized 30 psi transducers.

67. Information on the In-Situ equipment is included in Appendix B. Included in this Appendix are calibration reports for the vented cables, Quick Start guides for equipment use, copies of software licenses, an informational sheet on the artesian well cable, as well as a copy of the Material Safety Data Sheet (MSDS) for the dessicant gel used to collect moisture at the cable's exposed end. Calibration reports for the LevelTROLL 500 instruments are also included in this report, but have been placed in the individual well site folio where the instrument was deployed (refer to Appendix A).

3.0 RESULTS OF FIELD PROGRAM TESTING

3.1 Soil Test Results

68. The particle size distribution reports for each well screen interval are included in the individual well folios attached in Appendix A. The results of the size distribution tests are summarized in Table 3. As shown on Table 3, all of the screened intervals consist of gravel, sand, or a mixture of the two in accordance with USCS classifications. Gravel content ranged from 1 to 86%, while sand content varied from 11 to 92%. The percentage of particles with sizes less than the #200 sieve (i.e. silt and clay) ranged from less than 1% to approximately 30%. The highest frequency of fine particles (29.9%) was found in the deep well installed at the Nunda Township site. The well with the next highest amount of <#200 size particles (17.2%) was the nearby deep well in McHenry Township. All of the remaining wells had less than 15% of their volumes consisting of silt and clay sized particles. Nearly half of the wells (12 out of 28 wells) had more than half of their volume consisting of gravel sized particles or larger. Less than 20% of the wells (5 out of 28 wells) had more than a 10% content of clay and silt particles.

69. As would be suspected, the summary of the particle sized distribution results are indicative of the diversity of the glacial deposits that make of the shallow subsurface aquifers. Some areas have very well sorted (or poorly graded) deposits (such as the Hartland Township wells), while other deposits are very poorly sorted (or well graded) such as the Grafton Township wells. No spatial trends were present in the data which would suggest areas (horizontal variations) or depths (vertical variations) in which there were similar grained-sized trends.

3.2 Water Quality Results

70. A single round of groundwater levels and samples were taken at each of the 28 new observation wells installed by AECOM. Groundwater samples were collected by AECOM personnel on January 5th through 12th, 2009. Samples were collected at least one week after well developments were complete. As previously mentioned, the wells that exhibited artesian conditions (i.e. 3-HEB-I, 3-HEB-D & 17-ALG-S), were sampled several months after the initial sampling round (i.e. April 15, 2009) because the wells were inaccessible during freezing conditions.

71. The groundwater quality parameter list included general groundwater quality indicator parameters including:

- Calcium,
- Iron,
- Magnesium,
- Potassium,
- Sodium,
- Alkalinity Bicarbonate/Carbonate,
- Chloride, and
- Sulfate.

72. The groundwater quality results are summarized in Tables 5 and 6 where they are listed in mg/L and meq/L, respectively. The sample results and sampling field logs are included in each of their respective well site folios included in Appendix A. A summary of the field parameters is also provided in Table 4. As shown in Table 4, the field pH readings varied from 6.6 to 8.35 standard units. However, if the high and low values are removed, the remaining 26 wells varied only between 7.03 and 7.96 standard units. The high pH reading was recorded at the Hartland Township shallow well site and is believed to be related to the large retention pond that is located within a few hundred feet northwest of the well on the Valley Hi campus (although it is not

shown in folio #7). Additional rounds of data should be taken to evaluate pH trends at the low pH reading at 15-COR-S (6.6 s.u.) to be evaluated.

73. Water temperatures measurements showed a wide range of readings, but it is believed that the results may be biased low due to the fact that the samples were taken in early January. In some instances, it was reported that the bladder pump discharge line was freezing prior to reaching the flow through cell. Due to very cold temperatures, the temperature readings would be affected even when the flow-through cell was maintained within the vehicle. Turbidity levels showed less variation since nearly all of the wells were sampled with turbidity levels less than 50 nephelomatric turbidity units (NTU). All the wells except for the artesian wells at Hebron Township were purged at rates less than 1 liter/min.

74. In general, shallow wells completed near roadways in granular aquifers were observed to have elevated conductivity levels compared to other site wells. For instance, the shallow wells at Richmond, McHenry, Marengo and Riley townships average conductivities over 2000 umhos/cm, whereas, the County-wide average was just over 1000 umhos/cm (even including those wells in the overall average value). The conductivity value at the shallow well in Richmond Township was relatively elevated at 3160 umhos/cm. The sodium and chloride concentrations at these wells were also elevated. Road salt runoff may contribute to these elevated levels.

75. The results of the groundwater samples were utilized to construct piper trilinear diagrams in order to evaluate groundwater intermixing and geochemical indications of the hydrostratigraphy within the aquifers. The piper-trilinear graph (Figure 2) shows all the wells combined on a single graph, but uses separate symbols to delineate the wells of different depths.

76. As shown in Figure 2, the shallow wells at Richmond, Riley, Marengo and McHenry townships are particularly susceptible to road salt runoff. The only other notable result on the trilinear graph is the chloride result at the deep well at the Richmond site. The chloride result of 177 mg/L is noteworthy because it's somewhat close to the Federal Maximum Contaminant Level (MCL) (250 mg/L) for chloride and because it may indicate aquifer recharge area vulnerability to anthropogenic influences (road salt etc.). Other than that, most of the other wells appear to have a similar general chemical composition.

3.3 Hydraulic Conductivity Results

77. A summary of the hydraulic conductivity results are provided in Table 7. Hydraulic conductivities ranged nearly four orders of magnitude from 8.9×10^{-5} cm/s to 1.3×10^{-1} cm/s. Where applicable, these values were based on the geometric mean of all the tests conducted at an individual well. In addition, results from the different deep well geometry scenarios (i.e., aquifer thickness, penetration depth etc.) were evaluated so the most likely aquifer configuration was presented. Different aquifer configurations were developed for some of the deep wells because they were screened across the bedrock interface. Thus, they partially penetrated the bedrock aquifer. The conductivity analysis also considered whether the aquifer was confined or unconfined in nature. As previously mentioned, three different methods were used to calculated conductivity:

- The Bouwer and Rice method (1976 & 1989) for over-damped responses;
- The van der Kamp (1976) solution outlined in ASTM Method D5785 for under-damped responses; and
- The Hvorslev (1951) solution for constant head injection tests that was presented in Cedergren (1977).

78. Both confined and unconfined scenarios were calculated using the same general method depending on well response. As observed by Bouwer (1989), the Bouwer-Rice (1976) model for a slug test in an unconfined aquifer also could be applied to approximate conditions in confined aquifers. This is due to the fact that the

water-table boundary in an unconfined aquifer has little effect on slug test response. For the under-damped solution, the application was considered acceptable since the aquifers were typically highly stratified and horizontal conductivity was assumed to be much greater than vertical conductivity. For the purpose of these analyses, it was assumed that the horizontal conductivity (K_h) was 3 times greater than vertical hydraulic conductivity (K_v). Thus the anisotropy ratio (K_v/K_h) of 0.33 was used. This assumption is similar to reported values of K_v/K_h ranging between 0.1 and 0.5 for alluvium by Todd (1980).

79. Sixteen out of the twenty-eight wells had conductivities greater than $1x10^{-2}$ cm/sec. Only the Riley Township well ($1.3x10^{-1}$) was found to have a conductivity higher than $1x10^{-1}$ cm/sec. The lowest conductivities (i.e. < $5x10^{-4}$ cm/sec) were found in wells that were screened entirely within the upper portion of bedrock. These wells (1-CHE-D, 17-ALG-D and the bedrock solution at 7-HRT-D) were completed in bedrock because there was no appropriate place to screen the wells within the overburden. The deep well in Hartland Township was screened across the bedrock interface and displayed recovery curves for both the bedrock and the sand overlying it.

80. Besides the deep well in Hartland Township, the deep well at the Nunda Township Site (13-NUN-D) was the only other well to show a dual conductivity response indicative of the a well being screened across an interface. The water level recovery curve at the Nunda well was much more subtle than the Hartland well because the conductivity of the sand and the bedrock were more similar. In fact, the conductivity results for both the sand and bedrock were averaged to determine the deep well's conductivity.

81. For the artesian wells, the assumption that the hydraulic conductivity could be calculated using constant head test injection methods appears to be acceptable. The injection test calculations for the Hebron wells 3-HEB-I and 3-HEB-D yielded conductivity values (i.e. $9.0x10^{-3}$ cm/sec and $3.3e^{-3}$ cm/sec for the I & D wells, respectively) that were within the range of other well sites. It should be noted that when the stainless steel packers were installed on April 15th, the pressures and flows were measured and similar readings were found. The results of the pressure readings are provided in the water level monitoring sheet in the Folio #3 of Appendix A. A detailed discussion of the packers that were installed in the artesian wells is provided in Section 4.0.

3.4 Water Level Monitoring Results

82. A hydrograph of all of the manual water levels taken at the new observation wells is shown in Figure 3. Groundwater levels vary considerably throughout the County. The highest elevation (960.29 ft msl) was observed at the Alden well on Feb. 24, 2009, while the lowest elevation (737.95 ft msl) was recorded at the intermediate well at the Nunda site on Dec. 5, 2008. The Alden Township well is located in the highest point in the County close to the regional recharge area for the glacial aquifers. Conversely, the Nunda Township site is closest site to the Fox River which acts as the regional discharge for the glacial aquifers.

83. Perhaps the most interesting water level was observed at the shallow well in Algonquin Township. The shallow well is installed in a sand and gravel seam between 42 and 45 ft bgs. Water levels were continually observed to be 1 to 1.5 feet above ground surface (i.e. approximately 881 to 881.5 ft msl). This is interesting considering the well is located at an elevated topographic location compared to the surrounding area. Review of the USGS topo map for the Algonquin Site (see Appendix A-17), indicates that there are only a few areas where ground surface elevations appear to be greater than 880 ft. A possible scenario to account for the high head in this well, may be the fact that recharge is occurring in the sand and gravel seam some distance upgradient the well. However, regardless of the cause of the high water levels observed in the well, since water is above ground surface and freezes in the winter-time, it also required a packer. The 6-ft long stainless steel expandable rubber packer seals the well off below the frost line. A detailed schematic of the packer assembly is included in Appendix A-17.

84. Gradients between nested observation wells varied throughout the County based on the location of the wells in relation to recharge and discharge areas. Downward gradients (i.e. sites that had decreasing groundwater heads with deeper wells) were typically observed in areas where deeper aquifers were being recharged. Upward gradients (i.e. higher heads in deeper wells) indicated lower portions of the aquifer were flowing to surface discharge areas. Water level results at individual well sites are described in Section 4.0.

3.5 Downhole Geophysical Testing Results

85. Downhole geophysical logs were collected by the ISGS for each of the observation wells installed by AECOM. The raw geophysical logs obtained from the ISGS are included as the last attachment in each of the well folios located in Appendix A. The geophysical logs include (1) natural gamma and induced EM (electro-magnetic) logs which consist of both (2) conductivity and (3) resistivity measurements. In northeast Illinois, gamma counts are typically associated with higher clay content which thus includes more radioactive minerals (Jason Thomason, ISGS personal communication). High resistivity is typically associated with more electrically resistive materials (sand, gravel) relative to clay (electrically charged material). Thus, changes in those properties will often be coincident with the appropriate change in lithology. However, variabilities such as oxidation and reduction in the subsurface, which are not detected by natural gamma, can often be indicated by EM logs. Also, more detailed variability within coarse-grained units (sand vs. gravel), which is almost never detected with gamma, can sometimes be detected with EM induction (Thomason, ISGS personal communication).

86. The downhole geophysical logs are included only as references to this report. Further interpretation of the logs will be completed independently by the ISGS.

4.0 WELL SITE DATA SUMMARY AND COMMENTARY

87. This section provides a narrative summary for the subsurface conditions observed at each observation well site. The summary includes much of the following information:

- Location of the major permeable zones,
- General depths at which the wells were installed,
- Thicknesses of aquifer(s) found onsite,
- Description of noteworthy features and their significance,
- Water level information (i.e. depth, gradients, etc),
- Possible significance of water quality & hydraulic conductivity test results, and
- Operation and Maintenance Issues.

Specific information about each well site including the boring log data, well construction diagrams and other test data are summarized in Tables 1 through 7 and included in the well folios which were prepared for each site.

Well Site #1 - Chemung Township
Meyer Material Property on Lawrence Rd

88. The Chemung Township is located west of the Marengo Moraine margin, which indicates that the area received alluvial pro-glacial deposits in front of Wisconsin Episode advances (Curry et al, 1997). Stratified sand and gravel outwash deposits (that are likely Henry Formation deposits) were found between 6 feet and 54 feet below ground surface. A shallow well was installed in a medium gravel zone with some cobbles that were recovered. The particle size distribution of the well screen interval is likely biased low because the 3½" ID core barrel would limit the recovery of the cobble-size pieces. The shallow well was the only occurrence where an unconfined well had an under-damped response from slug testing. However, the confined assumption of the van der Kamp (1977) solution was considered valid since K_h is likely several orders of magnitude greater than K_v due to the poorly graded gravelly sequence where the well was screened. The shallow hydrostatic zone consists of an approximate 47 foot thick aquifer and is underlain by 49 feet of clay-rich diamicton. The well construction details for the Chemung observation wells are included in Table 2.

89. No intermediate well was installed at the Chemung Township location. The one possible zone where a possible well could be installed is through granular deposits that were found at a depth of 81 to 83 feet. It was determined that these thin medium sand seams were not considered significant enough to justify an additional well at the site.

90. The deep well was installed in bedrock that was encountered at 103 ft bgs. No sand or gravel deposits were found below 83 feet. A possible buried soil horizon consisting of mottled dark brown and black organic silt was observed at a depth of 96 to 97 ft bgs. The possible paleosol was deposited overlying the basal till unit. The borehole was advanced to a depth of roughly 111 ft and the well was set entirely within rock. The deep well appeared to produce an adequate volume of water since a high head in the well was observed shortly after installation (i.e. static water level was < 8 ft bgs). A slight upward gradient between the deep and shallow well was also observed. However, based on the conductivity testing, the deep well had the lowest permeability of all the wells.

91. The Chemung Township well site is located in an area of flat outwash deposits that provide good recharge conditions to the shallow aquifer. The site does not appear to be located in a deeply incised tributary to the

Troy Bedrock Valley which is located northwest of the site. These tributary buried valleys have been suggested as targets for potential groundwater resource exploration by Curry and others (1997).

Well Site #2 – Alden Township
MCCD Property at McHenry County's topographic high point on Reese Rd.

92. The Alden Township site is located on top of the Marengo-Woodstock Moraine which if one of Illinois' highest topographic locations. The Alden site had the thickest sequence of overburden of the 14 sites which is may have formed from the both diamicton deposits from the Marengo glaciation phase and the Woodstock Phase. The primary thick sequence of diamicton deposits were deposited as the Tiskilwa Till during formation of the Marengo Moraine. However, during the Woodstock Phase, diamicton was deposited atop the Marengo Moraine which formed the Marengo-Woodstock Moraine (Curry et al, 1997). Possible differentiation within the diamicton from the two moraines was not recognized from field classification.

93. The thick sequence of diamicton contained only one possible zone where an observation well would be appropriate. Fine to coarse sand was found at shallow depths between 10 and 12 feet below ground surface, but was not saturated. Below the sand, the next water bearing unit of any significance was found at a depth of 340 feet below ground surface. The massive till sequence was found to be over 300 ft thick. The till varied in composition from very hard silty clay to softer sandy-clay, but no water bearing units of any significance were observed within the till. The borehole was advanced 0.5 ft in bedrock which was encountered at a depth of 345.5 ft bgs. The approximate 5 ft sequence of sand at the bottom of the well was fully penetrated by the 5-ft well screen installed (refer to Table 2). The Alden well was found to have the highest groundwater elevation of the 28 wells installed for this project.

94. Care must be taken when working at the Alden well. The depth of the well, distance to water, and the well's small diameter limit options in conducting rehabilitation work. For example, retrieval of lost equipment in the well (such as a dropped bailer, bladder pump, etc.) would be difficult. The weight of the rugged troll cable should also be considered when working at the well because there is approximately 220 ft of cable hanging unsaturated in the well with an additional 50 ft that is submerged. Currently, the cable is hanging on a well cap similar to other wells, but a safety cable is attached to the pro-cover in case the well cap would fail.

Well Site #3 – Hebron Township
MCCD Property at Hebron Peatland - Freeman Rd.

95. The Hebron Township monitoring well site is located on McHenry County Conservation District (MCCD) property in a low-lying depression on Freeman Road. The property is situated 35 to 85 feet lower than the surrounding agricultural land to the north and west. Artesian conditions were first observed at a depth of 65 feet and continued throughout the remainder of the borehole. Bedrock was encountered at a depth of 110 feet and the borehole was terminated 3 feet into bedrock at a depth of 113 feet below ground surface (bgs). Two observation wells were installed at depths of 62-67 feet (intermediate) and 90-95 feet (deep) below ground surface. A shallow well, which would have been likely targeted for 20-24 ft or 35-38.5 ft, was not installed. The annular space between the sand filter pack intervals in the borehole (i.e. 58.4-69.7ft and 87.6-97ft, respectively) was backfilled with granular bentonite. Above the intermediate well, the remainder of the borehole was also backfilled with granular bentonite. AECOM conducted nearly a dozen inspections of the well between October 2008 and April 2009 and no leakage was observed at the ground surface after the well seal backfill was completed.

96. The effectiveness of the seals between the multiple well screens within the single borehole was evident when the Hebron wells were installed. When the 6" casing was in the ground at the depth of the deep well, it was estimated that about 10 gpm of groundwater was discharging from the borehole. After the deep well was installed and the filter pack was placed, discharge stopped. After the 6" casing was completely removed from

the borehole leaving only the 8" diameter casing the hole, artesian flow resumed when the aquifer was exposed during intermediate well installation. However, after the intermediate well's seal was placed, flow stopped once again. The magnitude of the head differences and the artesian flow that were stopped in the borehole demonstrates that multiple well seals can be effective when employed in a single borehole.

97. The deep well at the Hebron well site (3-HEB-D) was measured to have a static pressure of 5.5 psi and a discharge rate of 6 gpm at 2.5 ft above ground surface. The intermediate well (3-HEB-I) had a 5 psi static pressure and a flow of 15 gpm which was also measured at 2.5 ft above ground surface. The wells were initially sealed using an expandable well cap before temperatures dropped in November. At that time, a simple cost effective packer system (finned rubber packers) was installed in each of the Hebron wells which maintained groundwater at a depth of 44" below ground surface. However, these packers proved difficult to remove by hand so alternative options were sought. Several design considerations were investigated during the development of different sealing options. These considerations included: ease of use, practicability and durability.

98. Based on our discussions with the COE, County and AECOM agreed that a "freeze-plug" or mechanical type packer would be used to seal the County's artesian wells. This option was chosen because:

- It is mechanical in nature and does not rely on air or water pressure,
- It can be ordered at various lengths between 5 and 10ft so sealing depth can be customized,
- Side wall pressure can be adjusted for specific applications (up to 50 psi),
- It is light weight (<10 lbs.) and removable so periodic water sampling and packer inspection can occur,
- It has a hollow center plug which allows for real-time water level monitoring with the use of vented In-Situ LevelTROLLTM instruments equipped with artesian well fittings, and
- Maintains compatibility with other County monitoring equipment.

99. Three (3) mechanical packers were ordered from QSP Packers, LLC (QSP) of Sumner, WA. The custom mechanical packers consisted of a dual-wall drop pipes constructed with Type 304 stainless steel (refer to Figures and Photographs in Appendix A-3). The 6-foot long drop pipes consisted of a 1" OD inner pipe and a 1½" OD outer pipe. The six foot long drop pipe was proposed so that weight of the assembly is minimized while still maintaining a hydraulic seal approximately 42" below ground surface (assuming a ~2.5 ft stick-up).

100. The outer pipe in the dual-wall pipe system is held in place by washers and nuts that are threaded onto the inner pipe at the top and bottom of the assembly. The sealing mechanism consists of a 3-inch long, 1.9" outer diameter expandable rubber packer that is constructed of Buna-N Rubber. The rubber packer is placed between two washers that are attached to the bottom of the drop pipe. By tightening and loosening the nut affixed at the top of the inner pipe, the rubber packer expands and retracts. The assembly is held in position on top of the well casing by a lip which is welded perpendicular to the drop pipe. The lip provides a stable surface to start hand-tightening the actuator nut and prevents it from dropping it into the well. QSP rates the mechanical packer at 50 psi which should provide adequate sealing from the anticipated hydrostatic pressures at the Hebron site (i.e. <10 psi) at 4 ft below ground surface.

101. The bottom fitting on the inner pipe was fixed with a ¾" ID half coupling so that female threads open downward. A male ¾" NPT threaded In-Situ™ artesian fitting (with cable sealed inside of it) was attached to the bottom of the mechanical packer assembly to prevent upward leakage through the center of the packer. The artesian compression fittings are factory-installed on the vented cable before the LevelTROLL® 500 electronic data recording device and communication fittings are welded onto the ends of the cable. The artesian well cable fitting includes a black dome compression fitting that makes a water- and air-tight seal around the cable. The ¾" NPT threads allows for easy removal if the TROLLs need to be extracted from the well. The artesian well fitting is also rated for applications less than 50 psi.

102. The Twist-Lock™ connector (0.72" OD) for the communication end of the LevelTROLL cable was carefully fed through the inner pipe of the packer assembly (0.76"). The upside down artesian fitting will be securely fastened to the bottom of the packer and the communication end of the TROLL cable will be secured outside of the inner pipe at the top of the wellhead. The end of the cable is vented through a small dessicant chamber to allow the transducer to equilibrate to atmospheric conditions. Therefore head readings of the TROLL indicate actual piezometric levels. This means that barometric corrections are not needed to obtain the actual water level data in the well. The depth of the TROLLs was measured from the top of PVC casing so accurate water levels can be recorded. The packers were installed on April 15, 2009.

Well Site #4 – Richmond Township
MCCD Property at Trail Crossing - Hwy 173 (E. of Broadway St.)

103. The Richmond Township well location was shifted several times prior to its present day location. After the ISGS had reported artesian conditions near the initial well location near Lake Elizabeth (east of Richmond), the well site was relocated west of Richmond on Keystone Rd south of Genoa City. However, after discussions with MCCD, the well was again relocated to an open field north of Hwy 173 between Hwy 12 and Broadway Street. The well was positioned on high ground close to the road in hopes of avoiding artesian conditions. The Richmond well site was drilled immediately after the Hebron wells were installed.

104. The shallow well was installed through a series of fine saturated sand seams that were observed to be inter-bedded within a shallow till sequence between 19 and 24 ft bgs. The next permeable zone was found below 58 feet of till that was underlying the shallow sand. The intermediate well was installed at a depth of 98 ft bgs in a clean gravelly zone. The intermediate hydrostatic zone was 16.5 feet thick and appeared to be fining upwards. Below the intermediate hydrostatic zone, a fairly thick (i.e. >68ft) gray clayey silt to silty clay deposit was encountered. These materials were underlain by thin (7ft) clayey sand to silty-gravel deposits that are situated on bedrock. Bedrock was encountered at 174.5 ft bgs. Since there appeared to be a relatively higher percentage of fines within the deep sand zone, the borehole was continued 3.5ft into rock and the well was screened across the interface. The deep well was set between 171 and 176 ft bgs.

105. Two hydraulic conductivity models were run to evaluate the sensitivity of the aquifer thickness parameter for the deep well response. However, as shown in Table 7, modifying the aquifer thickness did not change the results significantly. The thinner of two aquifer thicknesses (10.5 ft) was used as a representative conductivity since the well is only open to a foot of bedrock.

106. The shallow well at the Richmond site was found to have a moderate hydraulic conductivity (i.e. 4×10^{-4} cm/sec), but there is a limited water source at the well. During development and sampling the well was observed to have large drawdowns. Additionally, the shallow well at Richmond appears to observe salt water runoff from Hwy 173 de-icing activities because of the high conductivity, sodium and chloride concentrations detected during water quality sampling.

Well Site #7 – Hartland Township
Valley Hi Senior Facility on Hartland Rd

107. The Hartland Township well site encountered three distinct sandy hydrostatic zones that were separated by a minimum of 20 ft thick till deposits. Monitoring wells were installed within each other these stratigraphic zones. Initial review of the borehole stratigraphy indicates that the site consists of a complex sequence of deposits from the Marengo and Woodstock Phase advances. The three hydrostatic zones where the monitoring wells were installed were located between the following depths: 56-62 ft (shallow), 81-117 ft (intermediate) and 159-163 ft (deep). The borehole was advanced approximately 3 ft into bedrock, so the deep well was screened across the overburden/bedrock interface. The contrast of the hydraulic conductivities between the sand and bedrock in the deep well were evident in the slug test response curve. Two distinct

conductivities were interpreted and solved to represent approximate conductivities of the sand ($1.1x10^{-2}$ cm/s) and bedrock ($1.9x10^{-4}$ cm/s), respectively. This solution suggests the conductivity of the sand unit is two orders of magnitude greater than the bedrock assuming the curves were assigned to the correct hydrostatic unit.

Well Site #8 – Greenwood Township
MCCD Property at Barber Fen on Wondermere Rd

108. The Greenwood Township site is located on the property of an abandoned farm house. Some former buildings can be seen in the aerial photo of the site in Appendix A-8. Demolition debris from the house or out-buildings could be seen at the surface during site inspections, but were especially evident during installation of the protective bollards in the upper 4-feet of the soil. Below the surficial fill, a 20 foot thick till sequence overlies the uppermost water bearing unit. The upper water bearing unit is approximately 15 feet thick and consists of gravelly coarse sands that grade to fine sands below 34 feet. Although a shallow well was not installed at this depth, this shallow unit is likely critical to the Barber Fen because it likely discharges along the banks of Nippersink Creek. The base of the upper water bearing unit occurs at an elevation of approximately 820 ft msl, while the elevation of the creek is approximately 815 ft msl at the site. Since fens are typically fed by cool, mineralized groundwater that supports the unique flora and fauna, an additional well screened within the upper water bearing unit (roughly between 25 and 33 ft bgs) may be of interest of the MCCD for resource protection purposes.

109. The intermediate hydrostatic zone appears to also discharge to Nippersink Creek based on head levels, but discharge likely occurs upward along the creek and not along the stream bank. However, the intermediate hydrostatic zone at the Greenwood site appears to be very productive. The intermediate aquifer is approximately 20 feet thick and consists of nearly 70% gravel based on the particle size test results. The conductivity test result of 2.7E-10 cm/sec also showed that this interval was very permeable.

110. The deepest well at the site was installed in a thicker aquifer (48 ft thick aquifer between 120 and 168 ft bgs), but had a lower conductivity. Based on the water level monitoring data, it appears this unit maybe utilized by nearby residents as a potable water source based on the “choppy” appearance of the water level hydrograph. These pronounced head fluctuations may be indicative of nearby pumping wells. The well construction details for this site are summarized in Table 2.

Well Site #9 – McHenry Township
Harrison-Benwell Park on McCullom Lake Rd

111. Two wells were installed at the McHenry Township well site in sand units that were separated by a thick till sequence that is believed to be the main diamicton unit of the of the Tiskilwa Formation between 29 and 153 feet below ground surface. A very thin intratill silt seam was observed between 73 and 74 ft, but was deemed relatively insignificant and not worthy of a separate monitoring installation. The McHenry Township well site was one of the most difficult boreholes to advance using the roto-sonic drilling method. Unconfined compressive strength measurements taken in the field were frequently greater than 4.5 tons per square foot (tsf) throughout the very hard till. Another noteworthy occurrence in the samples was an organic silt layer that was observed near the bottom of the hole between 181-183 ft bgs. It is suspected that the organic-rich silt represents windblown deposits and the former soil horizon of the Morton-Robein-Berry Clay complex. The organic-rich silt is a marker bed for the Sangamon Episode where climate conditions were similar to those of today (Curry et al, 1997).

112. The deep well is set immediately overlying the paleosol between 175 and 180 ft bgs, in a 34 foot thick sand aquifer. If the paleosol is part of the Sangamon Episode, then the deep hydrostatic zone is likely the

Pearl/Ashmore aquifer. According to the well construction report obtained for the Harrison School located next to the site, the deep well is likely screened in the same unit as the school's well.

113. Groundwater quality results at the shallow well indicated elevated levels of sodium and chloride. These results were interpreted to be anthropogenic results of road salt runoff.

Well Site #10 – Marengo Township
MCCD Land on County Line Rd

114. The western-most well in County, the Marengo site is located south and west of Wisconsin-aged deposits. The site is located in the flat outwash plain of the Kishwaukee River valley. The sand deposits at the surface are 26 feet and are underlain by a 16 foot till sequence. The till overlies weathered Ordovician Maquoketa Group bedrock. The well site is located in close proximity to Rush Creek and the Kishwaukee River. Because of the high water table in the sand (~776 ft msl) and river (~773 ft msl), it is recommended that the surface water bodies (i.e. the Kishwaukee River and Rush Creek) be monitored for stage and flow to obtain data on the local surface and ground water interactions and water budget.

Well Site #11 – SenecaTownship
Seneca Town Hall on Garden Valley Rd

115. The Seneca Township well site is located in one of the most prolific aquifers in the County. Located between the Marengo Moraine to the west and the Woodstock Moraine to the east, the Seneca well site has thick coarse sand and gravel deposits of the Henry Formation. Both of the wells installed at the site were characterized by high hydraulic conductivity and elevated hydrostatic head. The elevations at which the wells are completed are summarized in Table 2. It appears that this site is characterized by a slight upward gradient. This possibly suggests that groundwater is discharging to the nearby Kishwaukee River.

Well Site #13 – Nunda Township
Stickney Run Park (north entrance) on State Park Rd.

116. The Nunda Township well site is located close to the Fox River, which acts the regional discharge for the quaternary aquifers. As a result, groundwater elevations in the well are the lowest observed among the new observation wells. Discharge conditions are suggested by the slight upward gradients observed between the shallow and deep wells. Similar to the McHenry Township site located at Harrison-Benwell Park, the Nunda site also consisted of very hard till. The difficult drilling at the two sites is believed to be related to similar depositional environments of the Tiskwila Till. However, a shallow well was installed in McHenry, whereas the surficial aquifer at the Nunda site was not instrumented with a monitoring well. Had a shallow observation well been installed, Nunda shallow well would have been targeted for sand and/or gravel deposits between 16 and 24 feet below grade. Instead, an intermediate and a deep well were installed. The intermediate well was installed within a relatively coarse sand and gravel aquifer that was 26 feet thick (between 95 and 121 ft bgs). The deep well was installed at the bedrock interface. Limited granular units were found overlying the bedrock surface.

Well Site #14 – Riley Township
Right-of-way embankment at Harmony Road bridge over I-90

117. The Riley Township site is located west of the Marengo Moraine and has limited thickness of materials overlying bedrock. Only 29 feet of unconsolidated glacial drift is present at the well, which consists of about 15 feet of saturated sand. Although this observation well provides little direct information on the primary Quaternary aquifer, it will be useful for the overall water budget of the County. The unconfined near-surface

sand deposits are very conductive and are located in close proximity to Coon Creek. The Riley Township well was calculated to have the highest conductivity of all the site wells (i.e. $1.3x10^{-1}$ cm/s), which can be used to assume that groundwater has a strong hydraulic connection to the nearby creek. Coon Creek is a tributary to the Kishwaukee River. The Riley Township site is also valuable since other information such as atmospheric data and surface water data are collected nearby. A weather station is located on the Harmony Rd bridge and a gauging station is located on Harmony Rd where Coon Creek crosses.

118. The well is installed in a right-of-way embankment along the Harmony Road Bridge over Interstate 90. The de-icing activities on the Interstate and bridge are believed to have an impact on the shallow groundwater quality. Groundwater quality results indicate elevated levels of sodium and chloride at this location. The high conductivity of the shallow materials indicates this area is particularly susceptible to anthropogenic impacts.

Well Site #15 – Coral Township
MCCD Pleasant Valley Property on Hemmingsen Rd.

119. The Coral Township well site is located in a similar physiographic area as the Seneca Township, which is located approximately 6 miles to the northwest. However, unlike Seneca Township, the Coral Township site is located in a hummocky topographic area which is believed to be low-lying remnants of either the Barlina or Huntley Moraine (Curry et al, 1997). The Coral site had a relatively thick sequence of sand and gravel deposits that were overlaid by a 30 foot thick diamicton unit. The sand and gravel aquifer was observed from 39 to 108 feet below grade. A thin organic silt deposit (which may be a Sangamon episode paleosol) separates the upper hydrostatic unit, with another 6-foot thick hydrostatic unit between 110 and 116 feet. These units are hydraulically similar, however, since conductivities, heads and chemistry are comparable. Three wells were installed at this site at approximate depths of 50-55 ft, 98-103 ft and 111-116 ft below ground surface (refer to Table 2).

Well Site #16 – Grafton Township
MCCD Exner Marsh on Miller Rd

120. The Exner Marsh site in Lake in the Hills is a low-lying area in south-central McHenry County. The lowland which is located south of the wells includes a large wetland and surface water bodies that appear to be in a localized depression along the surface water divide between the Fox and Kishwaukee River drainage areas. Only an intermittent flowing ditch allows for surface water to discharge northward towards the South Branch of the Kishwaukee River. A small intermittent outlet such a large wetland area suggests that the lowland may act as a groundwater recharge source. Downward gradients observed between the intermediate and deep wells at the site also suggest that the site is a recharge area for the quaternary aquifers.

121. The well site is located in a newly developed residential area that is indicative of the suburban-sprawl common along the Randall Road corridor between Crystal Lake and Joliet. As such, groundwater supplies in the area are critical because of the high demand for potable water resources. Interpretation of the site's boring record indicated that three distinct hydrostatic zones were present. The uppermost hydrostatic zone within the overburden was observed at a depth of 20 to 24 feet below grade. The saturated sand deposits at these depths represented the uppermost hydrostatic zone (or water table materials) that are likely in close hydraulic communication with the surficial wetland and water bodies of the Exner Marsh. However, because of the shallow nature of the sand seam and the likely surface water interaction within the unit, a well was not installed in the shallow unit. Instead, two wells within the intermediate and deep hydrostatic units were installed at the site.

122. The intermediate well is screened from 94 to 99 feet below ground surface in an approximate 20.5 foot thick aquifer. The intermediate aquifer was found between 79.5 and 100 feet below ground surface. This unit

was found to have one of the highest hydraulic conductivities within the County. Conductivities for the intermediate well averaged over $5.8e10^{-2}$ cm/sec.

123. The deep hydrostatic unit was located 35 feet below the intermediate unit, approximately 31 feet above the top of bedrock. The relatively thin unit (i.e. only 3 feet thick from 135 to 138 ft bgs), was the only feasible hydrostatic unit between the intermediate sand unit and bedrock. A very hard diamicton unit was found below the deep hydrostatic unit which directly overlied bedrock. Potentiometric levels within the bedrock aquifer would be useful to be monitored simultaneously at this location. This information could be used to evaluate gradients and flow patterns across the bedrock interface.

124. It should be noted that the upper four feet of the borehole consisted of coarse grained granular fill material. It is our interpretation that fill was used to construct at least a portion of the existing parking lot.

Well Site #17 – Algonquin Township
MCCD Rothschild Parcel on Jefferson St.

125. The Algonquin Township well site is located north of Miller Road and east of Randall Road approximately 2½ miles east of the Grafton Township site. It is believed that the Algonquin site is located on the Barlina Moraine which trends northwest-southeast from Woodstock to Lake-in-the-Hills, IL (Curry, 2005). The upper diamicton deposits (that are likely part of the Yorkville member of the Lemont Formation) overlie the upper hydrostatic unit which was observed to be from 42 to 45 feet below ground surface. As previously discussed, groundwater levels within the upper sand and gravel hydrostatic unit were at or above ground surface for each of the groundwater level monitoring events. The sand and gravel deposits are likely members of the Henry Formation (Curry, 2005) which thicken towards the east. Underlying the upper hydrostatic unit, a thick sequence of Tiskilwa Formation diamicton was found between 48 and 179 feet below ground surface. No proglacial outwash was observed overlying bedrock at this location so the monitoring well was set partially in bedrock (refer to Table 2).

126. The artesian conditions within the Algonquin shallow well are not easily explained. The site appears to be at a topographic high location along the Barlina Moraine, so the source of the high groundwater head is not immediately apparent. In addition, the sand and gravel deposits of the artesian upper hydrostatic unit thicken towards the east and are believed to discharge at the Lake in the Hills Fen. This means that heads within the sand and gravel seam shouldn't build-up since the discharge area is not confined. Based on the USGS topo map for the Algonquin Site (see Appendix A-17), there are limited areas where the ground surface elevations are greater than at the well (880 ft msl). These areas are limited to the northwest of the site near the intersection of Randall Road and Ackman Road. This location is the topographic high between two tributaries that flow to Goose Lake and the Lake in the Hills to the east and west, respectively. Thus recharge is likely occurring in the sand and gravel seam at some distance upgradient (northwest) of the well.

127. However, regardless of the cause of the artesian conditions observed in the well, since water is above the ground surface within the well it is susceptible to damage in freezing conditions. Thus, the shallow Algonquin well also required a packer. A 6-ft long stainless steel pipe with an expandable rubber packer was installed in the well to seal water below the frost line. A detailed schematic of the packer assembly is included in Appendix A-17.

5.0 CONCLUSIONS

128. The data presented in this report are based on information obtained from subsurface borings and in-situ tests. Variations within subsurface material, such as grain size, permeability and water quality occur spatially and in the case of water quality, varying temporally. The nature and extent of these variations may not become evident until after several years of additional monitoring. This report has been prepared in accordance with generally accepted soil and groundwater engineering practices to aid in the evaluation of McHenry County. No other warranty, either expressed or implied, is made.

129. The conclusions and recommendations provided in this report are based upon the opinions of the preparers of the report and were made independently from the COE, McHenry County, its employees, and its representatives.

6.0 REFERENCES

ASTM Method D 4044 Test Method (Field Procedure for) Instantaneous Change in Head (Slug Test) for Determining Hydraulic Properties of Aquifers.

ASTM Method D 5785-95. Standard Method for Determining Transmissivity of Confined Nonleaky Aquifers by Underdamped Well Response to Instantaneous Change.

Bouwer, H., 1989. The Bouwer and Rice slug test--an update, Ground Water, vol. 27, no. 3, pp. 304-309.

Bouwer, H. and R.C. Rice, 1976. A slug test method for determining hydraulic conductivity of unconfined aquifers with completely or partially penetrating wells, Water Resources Research, vol. 12, no. 3, pp. 423-428.

Cedergren, H.R., 1977. Seepage, Drainage, and Flow Nets, John Wiley & Sons, New York, NY, 534 p.

Curry, Brandon B, 2005. Surficial Geology of Crystal Lake Quadrangle – McHenry and Kane Counties, Illinois, Illinois State Geological Survey, Illinois Geologic Quadrangle Map, IGQ Crystal Lake-SG, 1:24,000.

Curry, Brandon, B., Richard C. Berg, and Robert C. Vaiden, 1997. Geologic mapping for environmental planning, McHenry County, Illinois, Illinois State Geologic Survey, Circular 559.

Hvorslev, M.J., 1951. Time Lag and Soil Permeability in Ground-Water Observations, Bulletin No. 36, Waterways Experiment Station, Corps of Engineers, Vicksburg, MS.

Hyder, Z, J.J. Butler, Jr., C.D. McElwee and W. Liu, 1994. Slug tests in partially penetrating wells, Water Resources Research, vol. 30, no. 11, pp. 2945-2957.

Todd, D.K., 1980. Groundwater Hydrology, John Wiley & Sons, New York, 535p.

van der Kamp, Garth, “Determining Aquifer Transmissivity by Means of Well Response Tests: The Underdamped Case,” Water Resources Research, Vol. 12, No. 1, 1976, pp. 71-77.

Table 1

Observation Well Location Summary

Observation Well Network

McHenry County, Illinois

AECOM Project No. 09000-460 (200804080)

Site No.	Township	Site Location Description	Horizontal Location of Monument (IL State Plane - East)		Horizontal Location of Monument (UTM Zone 16)		Elevation	Description
			NAD 83(1997) - US Survey Feet		NAD 83 (1997)		NAVD-88	
			Northing (ft)	Easting (ft)	Northing (m)	Easting (m)	(feet MSL)	
1	Chemung	Meyer Material Prop. - Lawrence Rd.	2,107,167.6	899,321.6	4,701,188.5	364,481.8	896.08 896.24 898.69 898.69 899.20	USACE Brass Monument #1 Ground Shot Top of North PVC (1-CHE-S) Top of South PVC (1-CHE-D) Top of Casing
2	Alden	McHenry County High Point - Reese Rd.	2,115,612.8	923,300.5	4,703,647.0	371,828.9	1177.40 1176.35 1179.41 1179.90	USACE Brass Monument #2 Ground Shot Top of PVC (2-ALD-D) Top of Casing
3	Hebron	Hebron Peatland - Freeman Rd.	2,121,235.3	957,721.0	4,705,195.3	382,343.9	867.85 867.93 870.54 870.51 871.08	USACE Brass Monument #3 Ground Shot Top of East PVC (3-HEB-I) Top of West PVC (3-HEB-D) Top of Casing
4	Richmond	Trail Crossing - Hwy 173 (E. of Broadway St.)	2,117,464.7	988,032.2	4,703,901.3	391,561.6	844.15 844.15 846.27 846.30 846.26 846.67	USACE Brass Monument #4 Ground Shot Top of NE PVC (4-RCH-S) Top of South PVC (4-RCH-I) Top of NW PVC (4-RCH-D) Top of Casing
7	Hartland	Valley Hi Nursing Home - Hartland Rd.	2,074,449.6	936,852.1	4,691,039.5	375,761.2	924.09 924.14 926.61 926.60 926.61 927.24	USACE Brass Monument #7 Ground Shot Top of Center PVC (7-HRT-S) Top of South PVC (7-HRT-I) Top of East PVC (7-HRT-D) Top of Casing
8	Greenwood	Barber Fen - Wondermere Rd.	2,083,102.6	969,971.2	4,693,517.7	385,894.0	855.95 855.97 858.36 858.39 858.86	USACE Brass Monument #8 Ground Shot Top of West PVC (8-GRN-I) Top of East PVC (8-GRN-D) Top of Casing
9	McHenry	Harrison-Benwell Park - McCullom Lake Rd.	2,083,060.2	984,550.4	4,693,435.1	390,336.1	863.06 863.18 865.92 865.92 866.36	USACE Brass Monument #9 Ground Shot Top of North PVC (9-MCH-S) Top of South PVC (9-MCH-D) Top of Casing
10	Marengo	MCCD Land - County Line Rd	2,037,239.6	883,605.7	4,679,955.3	359,358.7	780.66 780.93 782.91 783.50	USACE Brass Monument #10 Ground Shot Top of PVC (10-MAR-S) Top of Casing

Table 1

Observation Well Location Summary

Observation Well Network

McHenry County, Illinois

AECOM Project No. 09000-460 (200804080)

Site No.	Township	Site Location Description	Horizontal Location of Monument (IL State Plane - East)		Horizontal Location of Monument (UTM Zone 16)		Elevation	Description
			NAD 83(1997) - US Survey Feet		NAD 83 (1997)		NAVD-88	
			Northing (ft)	Easting (ft)	Northing (m)	Easting (m)	(feet MSL)	
11	Seneca	Seneca Town Hall - Garden Valley Rd.	2,042,491.0	933,561.1	4,681,317.2	374,605.8	830.35	USACE Brass Monument #11
							830.63	Ground Shot
							832.73	Top of SE PVC (11-SEN-I)
							832.73	Top of NW PVC (11-SEN-D)
							833.27	Top of Casing
13	Nunda	Stickney Run - State Park Rd.	2,053,938.7	1,003,376.8	4,684,472.1	395,933.2	785.08	USACE Brass Monument #13
							785.32	Ground Shot
							787.58	Top of NW PVC (13-NUN-I)
							787.58	Top of SE PVC (13-NUN-D)
							788.10	Top of Casing
14	Riley	RWIS - Harmony Rd.	2,009,182.3	902,363.0	4,671,316.4	364,940.6	806.88	USACE Brass Monument #14
							806.75	Ground Shot
							809.13	Top of PVC (14-RIL-S)
							809.73	Top of Casing
15	Coral	Pleasant Valley - Hemmingsen Rd.	2,025,727.4	945,338.0	4,676,153.0	378,114.4	851.28	USACE Brass Monument #15
							851.23	Ground Shot (@ north wells)
							853.67	Top of NW PVC (15-COR-S)
							853.68	Top of SE PVC (15-COR-D)
							854.13	Top of North Casing (S & D)
							851.48	Ground Shot (@ 15-COR-I)
							854.30	Top of South Casing (I)
							853.97	Top of PVC (15-COR-I)
16	Grafton	Exner Marsh - Miller Rd.	2,011,623.1	973,156.6	4,671,722.9	386,523.5	879.57	USACE Brass Monument #16
							879.51	Ground Shot
							881.98	Top of NW PVC (16-GRF-I)
							881.95	Top of SE PVC (16-GRF-D)
							882.45	Top of Casing
17	Algonquin	Rothschild Parcel - Jefferson St.	2,013,921.7	985,121.2	4,672,366.3	390,180.0	880.02	USACE Brass Monument #17
							880.03	Ground Shot
							882.48	Top of W PVC (17-ALG-S)
							882.52	Top of E PVC (17-ALG-D)
							882.81	Top of Casing

Table 2
Field Exploration Summary: Drilling and Well Installation Details
McHenry County Observation Well Network
AECOM Environment Project No. 09000-460 (h200804080)

Well Designation			Elevation of Ground Surface	Depth to Bedrock	Elevation of Bedrock Surface	Depth of Borehole	Elevation of Borehole Bottom	# of Wells Per Site	Suffix of Well	Top of PVC Riser Elevation	Total Length of Well	Depth to Bottom of Well	Elevation of Well Bottom	Depth to Well Screen Below Ground Surface			Elevation of Well Screen Interval (first slot to last slot)			Depth to Sand Pack			Elevation of Sand Pack		
														Top	-	Bottom	Top	-	Bottom	Top	-	Bottom	Top	-	Bottom
Site No.	Township	Name	(ft MSL)	(ft bgs)	(ft MSL)	(ft bgs)	(ft MSL)			(ft MSL)	(ft btPVC)	(ft bgs)	(ft MSL)	(ft bgs)	-	(ft bgs)	(ft MSL)	-	(ft MSL)	(ft bgs)	-	(ft bgs)	(ft MSL)	-	(ft MSL)
1	Chemung	1-CHE-S	896.24	103	793.2	110.8	785.4	2	S	898.69	42.70	40.3	855.99	35.3	-	39.8	860.99	-	856.49	32.6	-	43.8	863.6	-	852.4
		1-CHE-D							D	898.69	113.20	110.8	785.49	105.8	-	110.3	790.49	-	785.99	102.9	-	110.8	793.3	-	785.4
2	Alden	2-ALD-D	1176.35	345.5	830.9	346	830.4	1	D	1179.41	347.50	344.4	831.91	339.4	-	343.9	836.91	-	832.41	337.9	-	346	838.5	-	830.4
3	Hebron	3-HEB-I	867.93	110	757.9	113	754.9	2	I	870.54	68.88	66.3	801.66	61.3	-	65.8	806.66	-	802.16	58.4	-	69.7	809.5	-	798.2
		3-HEB-D							D	870.51	97.00	94.4	773.51	89.4	-	93.9	778.51	-	774.01	87.6	-	97	780.3	-	770.9
4	Richmond	4-RCH-S	844.15	174.5	669.7	178	666.2	3	S	846.27	26.15	24.0	820.12	19.0	-	23.5	825.12	-	820.62	16.9	-	26.3	827.3	-	817.9
		4-RCH-I							I	846.30	100.46	98.3	745.84	93.3	-	97.8	750.84	-	746.34	90.5	-	100.7	753.7	-	743.5
		4-RCH-D							D	846.26	178.10	176.0	668.16	171.0	-	175.5	673.16	-	668.66	168.2	-	178	676.0	-	666.2
7	Hartland	7-HRT-S	924.14	163	761.1	165.7	758.4	3	S	926.61	64.80	62.3	861.81	57.3	-	61.8	866.81	-	862.31	54.6	-	64.5	869.5	-	859.6
		7-HRT-I							I	926.60	117.40	114.9	809.20	109.9	-	114.4	814.20	-	809.70	107.7	-	118.5	816.4	-	805.6
		7-HRT-D							D	926.61	168.20	165.7	758.41	160.7	-	165.2	763.41	-	758.91	157.8	-	165.5	766.3	-	758.6
8	Greenwood	8-GRN-I	855.97	173.5	682.5	176	680.0	2	I	858.36	72.68	70.3	785.68	65.3	-	69.8	790.68	-	786.18	63.2	-	73.4	792.8	-	782.6
		8-GRN-D							D	858.39	155.50	153.1	702.89	148.1	-	152.6	707.89	-	703.39	145.9	-	155.2	710.1	-	700.8
9	McHenry	9-MCH-S	863.18	208.5	654.7	210	653.2	2	S	865.92	28.61	25.9	837.31	20.9	-	25.4	842.31	-	837.81	18.7	-	27.8	844.5	-	835.4
		9-MCH-D							D	865.92	182.70	180.0	683.22	175.0	-	179.5	688.22	-	683.72	172.6	-	182.2	690.6	-	681.0
10	Marengo	10-MAR-S	780.93	42	738.9	50	730.9	1	S	782.91	22.26	20.3	760.65	15.3	-	19.8	765.65	-	761.15	12.9	-	22	768.0	-	758.9
11	Seneca	11-SEN-I	830.63	154	676.6	155	675.6	2	I	832.73	77.50	75.4	755.23	70.4	-	74.9	760.23	-	755.73	67.5	-	77.6	763.1	-	753.0
		11-SEN-D							D	832.73	155.30	153.2	677.43	148.2	-	152.7	682.43	-	677.93	145.3	-	155	685.3	-	675.6
13	Nunda	13-NUN-I	785.32	150	635.3	153	632.3	2	I	787.58	115.25	113.0	672.33	108.0	-	112.5	677.33	-	672.83	105	-	114.3	680.3	-	671.0
		13-NUN-D							D	787.58	154.50	152.2	633.08	147.2	-	151.7	638.08	-	633.58	144.6	-	153	640.7	-	632.3
14	Riley	14-RIL-S	806.75	29	777.8	31	775.8	1	S	809.13	22.77	20.4	786.36	15.4	-	19.9	791.36	-	786.86	13.2	-	22	793.6	-	784.8
15	Coral	15-COR-S	851.23	122.5	728.7	125	726.2	3	S	853.67	57.53	55.1	796.14	50.1	-	54.6	801.14	-	796.64	48	-	57	803.2	-	794.2
		15-COR-I*							I	853.97	104.45	102.0	749.52	97.0	-	101.5	754.52	-	750.02	96	-	103.3	755.5	-	748.2
		15-COR-D							D	853.68	118.55	116.1	735.13	111.1	-	115.6	740.13	-	735.63	109.5	-	117	741.7	-	734.2
16	Grafton	16-GRF-I	879.51	170	709.5	171	708.5	2	I	881.98	101.50	99.0	780.48	94.0	-	98.5	785.48	-	780.98	91.7	-	101.8	787.8	-	777.7
		16-GRF-D							D	881.95	141.50	139.1	740.45	134.1	-	138.6	745.45	-	740.95	131.7	-	141.5	747.8	-	738.0
17	Algonquin	17-ALG-S	880.03	179	701.0	189	691.0	2	S	882.48	49.72	47.3	832.76	42.3	-	46.8	837.76	-	833.26	39.5	-	49.5	840.5	-	830.5
		17-ALG-D							D	882.52	190.30	187.8	692.22	182.8	-	187.3	697.22	-	692.72	180	-	189	700.0	-	691.0

Notes:
*The intermediate well in Coral Township was installed approximately 20ft south of original borehole after the shallow and deep wells were already installed. The ground surface elevation of 851.48 ft msl was used for 15-COR-I.

ft MSL (feet above mean sea level using NAD83 datum)
ft bgs (feet below ground surface)
Well Designations:
- S Shallow
- I Intermediate
- D Deep

Table 3

Summary of Particle Size Distribution Testing

McHenry County Observation Well Network
AECOM Project 09000-460

Sample	Depth	% Gravel			% Sand				Percent Fines	USCS
		Coarse	Fine	Total % Gravel	Coarse	Medium	Fine	Total % Sand		
1-CHE-S	39-40	0	54.4	*54.4*	26.3	15.5	1.9	*43.7*	1.9	GP
2-ALD-D	342-343	9.8	5.1	*14.9*	4.6	22.1	45.9	*72.6*	12.5	SM
3-HEB-S	63-64	59.5	16.1	*75.6*	5.7	7.8	8.4	*21.9*	2.5	GP
3-HEB-D	91-92	48.9	20.1	*69*	6.8	11.2	8	*26*	5	GW-GM
4-RCH-S	22-22.5	0	1.4	*1.4*	1.1	11.6	74.3	*87*	11.6	SP-SM
4-RCH-I	96-97	55.4	28.4	*83.8*	7.9	4.8	2.2	*14.9*	1.3	GW
4-RCH-D	174-175	35.9	22.6	*58.5*	3.8	11.1	11.7	*26.6*	14.9	GM
7-HRT-S	59-60	22.9	22	*44.9*	14.3	23.3	15.9	*53.5*	1.6	SP
7-HRT-I	112-113	7.6	31.3	*38.9*	9.3	29.6	20.5	*59.4*	1.7	SP
7-HRT-D	161-162	0	5.6	*5.6*	3.6	33.2	55	*91.8*	2.6	SP
8-GRN-I	69-70	27.7	40	*67.7*	11.4	15.1	4.8	*31.3*	1	GW
8-GRN-D	150-151	18.6	28.9	*47.5*	23	23.2	5.4	*51.6*	0.9	SP
9-MCH-S	24-25	22.2	14.3	*36.5*	6.9	24.9	29.7	*61.5*	2	SP
9-MCH-D	176-177	0	2	*2*	0.5	6.8	73.5	*80.8*	17.2	SP
10-MAR-S	18-19	0	16.1	*16.1*	22.4	44.9	15.2	*82.5*	1.4	SP
11-SEN-I	73-74	3.8	82.3	*86.1*	9.6	1.4	0.4	*11.4*	2.4	GP
11-SEN-D	151-152	35.9	29	*64.9*	9.9	16.8	6.6	*33.3*	1.8	GW
13-NUN-S	108-109	43.1	25.2	*68.3*	7.6	11.3	9.7	*28.6*	3.1	GW
13-NUN-D	145-146	11.5	19.1	*30.6*	7.5	12.1	19.9	*39.5*	29.9	SM
14-RIL-S	18-19	0	34.8	*34.8*	23.3	25.7	15.2	*64.2*	1	SW
15-COR-S	54-55	20.7	38.6	*59.3*	16.1	17.3	5.2	*38.6*	2.1	GW
15-COR-I	104-105	26.5	14.7	*41.2*	2.7	17.4	37	*57.1*	1.7	SP
15-COR-D	114-115	0	14.5	*14.5*	19.6	33.7	26.5	*79.8*	5.7	SP-SM
16-GRF-I	96-97	13.3	49.6	*62.9*	21.9	13.5	0.4	*35.8*	1.3	GW
16-GRF-D	137-138	4.4	36.2	*40.6*	22.8	22.6	9.2	*54.6*	4.8	SW
17-ALG-S	46-47	7.1	48.7	*55.8*	19.5	12.9	8.7	*41.1*	3.1	GP

Particle size tests were not completed on 1-CHE-D and 17-ALG-D because they were screened entirely in bedrock.

Table 4

Field Parameters of Groundwater Quality Samples

McHenry County Observation Well Network

AECOM Project 09000-460

Date	Well ID	pH (s.u.)	Conductivity (umhos/cm)	Temperature (Deg. C)	Discharge Rate (mL/min)
1/9/2009	1-CHE-S	7.03	1190	10.8	250
1/9/2009	1-CHE-D	7.55	644	10.3	250
1/12/2009	2-ALD-D	7.61	950	7.7	N/A
4/15/2009	3-HED-I	7.59	716	10.2	57,000 (artesian)
4/15/2009	3-HEB-D	7.58	725	10.2	37,850 (artesian)
1/7/2009	4-RCH-S	7.23	3160	6.3	250
1/7/2009	4-RCH-I	7.79	883	8.6	250
1/7/2009	4-RCH-D	7.9	1440	7.8	250
1/8/2009	7-HRT-S	8.35	1140	7.2	50
1/8/2009	7-HRT-I	7.96	785	11.1	250
1/8/2009	7-HRT-D	7.94	878	10.2	250
1/12/2009	8-GRN-I	7.32	1080	7.3	250
1/12/2009	8-GRN-D	7.3	750	10.4	1000
1/12/2009	9-MCH-S	7.19	1870	9	250
1/12/2009	9-MCH-D	7.86	682	10.6	1000
1/7/2009	10-MAR-S	7.6	1180	3.8	250
1/9/2009	11-SEN-I	7.61	756	9.5	250
1/9/2009	11-SEN-D	7.55	718	8	250
1/10/2009	13-NUN-I	7.54	852	8.7	250
1/12/2009	13-NUN-D	7.67	1120	8.6	250
1/8/2009	14-RIL-S	7.51	1980	8.3	250
1/5/2009	15-COR-S	6.6	789	0.3	250
1/6/2009	15-COR-I	7.18	895	9.3	250
1/5/2009	15-COR-D	7.22	741	1.7	250
1/6/2009	16-GRF-I	7.67	1040	2.6	250
1/6/2009	16-GRF-D	7.97	572	1.6	250
4/15/2009	17-ALG-S	7.33	820	11	500
1/6/2009	17-ALG-D	7.61	919	5	250

Table 5

Summary of Groundwater Quality Sampling Results

McHenry County Observation Well Network
AECOM Environment Project No. 09000-460-5000

<Shown in mg/L>

Project ID: AECOM# 09000-460-5000			1-CHE-S	1-CHE-D	2-ALD-D	3-HEB-I	3-HEB-D	4-RCH-S	4-RCH-I	4-RCH-D	7-HRT-S	7-HRT-I	7-HRT-D	8-GRN-I	8-GRN-D	9-MCH-S	9-MCH-D
Date of Sample Collection:			1/9/2009	1/9/2009	1/12/2009	4/15/2009	4/15/2009	1/7/2009	1/7/2009	1/7/2009	1/8/2009	1/8/2009	1/8/2009	1/12/2009	1/12/2009	1/12/2009	1/12/2009
Time of Sample Collection:			11:45 AM	1:20 PM	2:00 PM	9:05 AM	8:15 AM	11:20 AM	12:35 PM	1:45 PM	11:55 AM	1:45 PM	2:30 PM	10:35 AM	10:45 AM	1:00 PM	12:55 PM
Analyte:	**Units**	**Rep. Limit**															
Calcium	mg/L	0.1	**132**	**101**	**51.3**	**80.1**	**85.7**	**197**	**71.3**	**112**	**296**	**70**	**79.3**	**107**	**74.7**	**140**	**44.5**
Iron	mg/L	0.01	**3.55**	**7.37**	**1.7**	**1.9**	**2**	**1.9**	**2.66**	**1.89**	**13.8**	**0.87**	**0.65**	**1.36**	**1.08**	**1.03**	**0.51**
Magnesium	mg/L	0.1	**62.3**	**60.9**	**32.7**	**43.3**	**44.7**	**99.6**	**44.9**	**72.5**	**128**	**36.9**	**42.7**	**56.5**	**40.6**	**69.6**	**33.2**
Potassium	mg/L	0.1	**8.5**	**3.3**	**3.8**	**1.3**	**1.3**	**2.5**	**2.4**	**4.3**	**4**	**1.5**	**2.2**	**1.8**	**1.7**	**3**	**2.9**
Sodium	mg/L	0.1	**15.9**	**21.5**	**77.2**	**12.7**	**11.8**	**260**	**49.8**	**88.7**	**68**	**34.8**	**32.3**	**38.6**	**16.2**	**102**	**79**
Alkalinity, Bicarbonate (CaCO3)	mg/L	5	**380**	**300**	**320**	**390**	**400**	**420**	**330**	**400**	**390**	**360**	**370**	**350**	**300**	**410**	**320**
Alkalinity, Carbonate (CaCO3)	mg/L	5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Chloride	mg/L	5	**51**	**10**	**52**	**16**	**15**	**630**	**45**	**177**	**42**	**10**	**32**	**35**	**16**	**266**	**88**
Sulfate	mg/L	15	**90**	<15	**39**	**36**	**23**	**76**	**39**	**57**	**79**	**26**	**21**	**95**	**61**	**54**	**54**

Project ID: AECOM# 09000-460-5000			10-MAR-S	11-SEN-I	11-SEN-D	13-NUN-I	13-NUN-D	14-RIL-S	15-COR-S	15-COR-I	15-COR-D	16-GRF-I	16-GRF-D	17-ALG-S	17-ALG-D	Drilling Water
Date of Sample Collection:			1/7/2009	1/9/2009	1/9/2009	1/10/2009	1/12/2009	1/8/2009	1/5/2009	1/6/2009	1/5/2009	1/6/2009	1/6/2009	4/15/2009	1/6/2009	1/12/2009
Time of Sample Collection:			3:55 PM	2:45 PM	3:30 PM	1:50 PM	3:45 PM	4:45 PM	12:00 PM	10:15 AM	1:35 PM	2:45 PM	3:50 PM	2:35 PM	12:30 PM	11:10 AM
Analyte:	**Units**	**Rep. Limit**														
Calcium	mg/L	0.1	**96**	**84.6**	**67.8**	**75.8**	**81.4**	**102**	**107**	**103**	**102**	**94.9**	**40**	**92.5**	**69.6**	**126**
Iron	mg/L	0.01	**2**	**3.6**	**1.02**	**3.37**	**0.38**	**0.69**	**3.97**	**1.93**	**2.89**	**1.45**	**0.64**	**0.58**	**0.42**	**0.87**
Magnesium	mg/L	0.1	**43.1**	**43.4**	**42.4**	**45.9**	**49.3**	**54.3**	**50**	**51.8**	**53.3**	**50.5**	**30**	**50.5**	**46.1**	**66.2**
Potassium	mg/L	0.1	**3.3**	**1.8**	**1.6**	**4.8**	**2.2**	**2.5**	**1.6**	**1.8**	**1.3**	**2.3**	**1.5**	**2**	**2**	**4.5**
Sodium	mg/L	0.1	**47.5**	**6.3**	**12.9**	**37.9**	**56.2**	**186**	**10.6**	**9.6**	**8.8**	**28.3**	**34.2**	**28.7**	**55.6**	**58.5**
Alkalinity, Bicarbonate (CaCO3)	mg/L	5	**290**	**330**	**350**	**350**	**360**	**330**	**340**	**350**	**340**	**380**	**280**	**380**	**350**	**380**
Alkalinity, Carbonate (CaCO3)	mg/L	5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Chloride	mg/L	5	**121**	**10**	**6**	**28**	**84**	**350**	**27**	**15**	**15**	**60**	<5	**52**	**55**	**94**
Sulfate	mg/L	15	**88**	**57**	<15	**39**	**66**	**47**	**84**	**77**	**72**	**51**	<15	**53**	**31**	**65**

Notes:
Detected values are indicated in bold font.
"<" Indicates concentrations are less than reporting limit

Table 6

Summary of Groundwater Quality Sampling Results

McHenry County Observation Well Network
AECOM Environment Project No. 09000-460-5000

<Shown in meq/L>

Project ID: AECOM# 09000-460-5000		1-CHE-S	1-CHE-D	2-ALD-D	3-HEB-I	3-HEB-D	4-RCH-S	4-RCH-I	4-RCH-D	7-HRT-S	7-HRT-I	7-HRT-D	8-GRN-I	8-GRN-D	9-MCH-S	9-MCH-D
Date of Sample Collection:		1/9/2009	1/9/2009	1/12/2009	4/15/2009	4/15/2009	1/7/2009	1/7/2009	1/7/2009	1/8/2009	1/8/2009	1/8/2009	1/12/2009	1/12/2009	1/12/2009	1/12/2009
Time of Sample Collection:		11:45 AM	1:20 PM	2:00 PM	9:05 AM	8:15 AM	11:20 AM	12:35 PM	1:45 PM	11:55 AM	1:45 PM	2:30 PM	10:35 AM	10:45 AM	1:00 PM	12:55 PM
Analyte:																
Total Metals (6020A)	**Units**															
Calcium	meq/L	**6.59**	**5.04**	**2.56**	**4.00**	**4.28**	**9.83**	**3.56**	**5.59**	**14.77**	**3.49**	**3.96**	**5.34**	**3.73**	**6.99**	**2.22**
Iron	meq/L	**0.13**	**0.26**	**0.06**	**0.07**	**0.07**	**0.07**	**0.09**	**0.07**	**0.49**	**0.03**	**0.02**	**0.05**	**0.04**	**0.04**	**0.02**
Magnesium	meq/L	**5.13**	**5.01**	**2.69**	**3.56**	**3.68**	**8.20**	**3.70**	**5.97**	**10.53**	**3.04**	**3.51**	**4.65**	**3.34**	**5.73**	**2.73**
Potassium	meq/L	**0.22**	**0.08**	**0.10**	**0.03**	**0.03**	**0.06**	**0.06**	**0.11**	**0.10**	**0.04**	**0.06**	**0.05**	**0.04**	**0.08**	**0.07**
Sodium	meq/L	**0.69**	**0.93**	**3.35**	**0.55**	**0.51**	**11.28**	**2.16**	**3.85**	**2.95**	**1.51**	**1.40**	**1.68**	**0.70**	**4.43**	**3.43**
Alkalinity, Bicarbonate (CaCO3)	meq/L	**6.23**	**4.92**	**5.25**	**6.40**	**6.56**	**6.89**	**5.41**	**6.56**	**6.40**	**5.90**	**6.07**	**5.74**	**4.92**	**6.72**	**5.25**
Alkalinity, Carbonate (CaCO3)	meq/L	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17
Chloride	meq/L	**1.44**	**0.28**	**1.47**	**0.45**	**0.42**	**17.77**	**1.27**	**4.99**	**1.18**	**0.28**	**0.90**	**0.99**	**0.45**	**7.50**	**2.48**
Sulfate	meq/L	**1.87**	< 0.31	**0.81**	**0.75**	**0.48**	**1.58**	**0.81**	**1.19**	**1.64**	**0.54**	**0.44**	**1.98**	**1.27**	**1.12**	**1.12**

Project ID: AECOM# 09000-460-5000		10-MAR-S	11-SEN-I	11-SEN-D	13-NUN-I	13-NUN-D	14-RIL-S	15-COR-S	15-COR-I	15-COR-D	16-GRF-I	16-GRF-D	17-ALG-S	17-ALG-D	Drilling Water
Date of Sample Collection:		1/7/2009	1/9/2009	1/9/2009	1/10/2009	1/12/2009	1/8/2009	1/5/2009	1/6/2009	1/5/2009	1/6/2009	1/6/2009	4/15/2009	1/6/2009	1/12/2009
Time of Sample Collection:		3:55 PM	2:45 PM	3:30 PM	1:50 PM	3:45 PM	4:45 PM	12:00 PM	10:15 AM	1:35 PM	2:45 PM	3:50 PM	2:35 PM	12:30 PM	11:10 AM
Analyte:															
Total Metals (6020A)	**Units**														
Calcium	meq/L	**4.79**	**4.22**	**3.38**	**3.78**	**4.06**	**5.09**	**5.34**	**5.14**	**5.09**	**4.74**	**2.00**	**4.62**	**3.47**	**6.29**
Iron	meq/L	**0.07**	**0.13**	**0.04**	**0.12**	**0.01**	**0.02**	**0.14**	**0.07**	**0.10**	**0.05**	**0.02**	**0.02**	**0.01**	**0.03**
Magnesium	meq/L	**3.55**	**3.57**	**3.49**	**3.78**	**4.06**	**4.47**	**4.12**	**4.26**	**4.39**	**4.16**	**2.47**	**4.16**	**3.79**	**5.45**
Potassium	meq/L	**0.08**	**0.05**	**0.04**	**0.12**	**0.06**	**0.06**	**0.04**	**0.05**	**0.03**	**0.06**	**0.04**	**0.05**	**0.05**	**0.12**
Sodium	meq/L	**2.06**	**0.27**	**0.56**	**1.64**	**2.44**	**8.07**	**0.46**	**0.42**	**0.38**	**1.23**	**1.48**	**1.25**	**2.41**	**2.54**
Alkalinity, Bicarbonate (CaCO3)	meq/L	**4.76**	**5.41**	**5.74**	**5.74**	**5.90**	**5.41**	**5.58**	**5.74**	**5.58**	**6.23**	**4.59**	**6.23**	**5.74**	**6.23**
Alkalinity, Carbonate (CaCO3)	meq/L	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17	< 0.17
Chloride	meq/L	**3.41**	**0.28**	**0.17**	**0.79**	**2.37**	**9.87**	**0.76**	**0.42**	**0.42**	**1.69**	< 0.14	**1.47**	**1.55**	**2.65**
Sulfate	meq/L	**1.83**	**1.186**	< 0.31	**0.81**	**1.37**	**0.98**	**1.75**	**1.60**	**1.50**	**1.06**	< 0.31	**1.10**	**0.64**	**1.35**

Notes:
Detected values are indicated in bold font.
"<" Indicates concentrations are less than reporting limit

Table 7

Summary of Hydraulic Conductivity Test Results

McHenry County Observation Well Network

Well Designation			Aquifer Type	Solution Notes	Test No.	Hydraulic Conductivity Testing Results (cm/sec)				
Site No.	Township	Name[1]				Bouwer and Rice (1976, 1989)	van der Kamp	Hvorslev	Geometric Mean of Tests[2] (per well)	
1	Chemung	1-CHE-S	Unconfined	Underdamped Response	Test #1	-	1.48E-02	-	1.5E-02	
					Test #2	-	1.51E-02	-		
		1-CHE-D	Confined	Assuming 100ft Bedrock Aquifer	Test #1	8.96E-05	-	-	9.0E-05	
2	Alden	2-ALD-D	Confined	Assuming 5ft Thick SAND Aquifer	Test #1	8.13E-04	-	-	7.9E-04	(Mean of 5ft thick aquifer solutions)
				Assuming 150ft Thick SAND Aquifer		7.08E-04	-	-		
				Assuming 5ft Thick SAND Aquifer	Test #2	7.77E-04	-	-		
				Assuming 150ft Thick SAND Aquifer		6.76E-04	-	-		
3	Hebron	3-HEB-I	Confined	Artesian Well[3]	Test #1	-	-	9.03E-03	9.0E-03	
		3-HEB-D	Confined	Artesian Well[3]	Test #1	-	-	3.27E-03	3.3E-03	
4	Richmond	4-RCH-S	Confined	---	Test #1	3.97E-04	-	-	4.0E-04	
		4-RCH-I	Confined	Underdamped Response	Test #1	-	2.65E-02	-	2.6E-02	
					Test #2	-	2.57E-02	-		
		4-RCH-D	Confined	Assuming 10.5ft Aquifer Thickness	Test #1	2.66E-03	-	-	2.7E-03	
				Assuming 150ft Aquifer Thickness		2.54E-03	-	-		
7	Hartland	7-HRT-S	Confined	---	Test #1	1.42E-02	-	-	1.4E-02	
		7-HRT-I	Confined	---	Test #1	3.25E-02	-	-	3.3E-02	
		7-HRT-D	Confined *(Dual Recovery Curves)*	Assuming 7ft Thick SAND Aquifer	Test #1	1.30E-02	-	-	1.1E-02	(Unconsolidated Basal Sand Unit)
				Assuming 150ft Thick SAND Aquifer		9.15E-03	-	-		
				Assuming 7ft Thick BEDROCK Aquifer		1.98E-04	-	-	1.9E-04	(Assumption of Bedrock Conductivity)
				Assuming 150ft Thick BEDROCK Aquifer		1.75E-04	-	-		
8	Greenwood	8-GRN-I	Confined	Underdamped Response	Test #1	-	2.65E-02	-	2.7E-02	
		8-GRN-D	Confined	Underdamped Response	Test #1	-	4.02E-03	-	4.0E-03	
					Test #2	-	3.92E-03	-		
9	McHenry	9-MCH-S	Confined	---	Test #1	1.08E-02	-	-	1.1E-02	
		9-MCH-D	Confined	---	Test #1	2.00E-02	-	-	2.0E-02	
10	Marengo	10-MAR-S	Unconfined	---	Test #1	8.00E-02	-	-	7.5E-02	
					Test #2	7.01E-02	-	-		
11	Seneca	11-SEN-I	Confined	Underdamped Response	Test #1	-	5.51E-02	-	5.5E-02	
					Test #2	-	5.56E-02	-		
		11-SEN-D	Confined	Underdamped Response	Test #1	-	4.54E-02	-	4.6E-02	
					Test #2	-	4.57E-02	-		
13	Nunda	13-NUN-I	Confined	---	Test #1	4.14E-02	-	-	3.9E-02	
					Test #2	3.77E-02	-	-		
		13-NUN-D	Confined *(Subtle Dual Recovery Curves)*	Assuming 8' Aquifer (Interface)	Test #1	8.45E-03	-	-	7.9E-03	(Includes all results)
				Assuming 150' thick Bedrock Aquifer		7.35E-03	-	-		
				Assuming 8' Aquifer (Interface)	Test #2	8.45E-03	-	-		
				Assuming 150' thick Bedrock Aquifer		7.35E-03	-	-		
14	Riley	14-RIL-S	Unconfined	---	Test #1	1.31E-01	-	-	1.3E-01	
				---	Test #2	1.30E-01	-	-		
15	Coral	15-COR-S	Confined	Underdamped Response	Test #1	-	9.83E-03	-	9.8E-03	
		15-COR-I*	Confined	---	Test #1	1.97E-02	-	-	2.0E-02	
		15-COR-D	Confined	---	Test #1	1.26E-02	-	-	1.2E-02	
					Test #2	1.22E-02	-	-		
16	Grafton	16-GRF-I	Confined	Underdamped Response	Test #1	-	6.02E-02	-	5.8E-02	
					Test #2	-	5.55E-02			
		16-GRF-D	Confined	---	Test #1	2.04E-03	-	-	2.3E-03	
				---	Test #2	2.70E-03	-	-		
17	Algonquin	17-ALG-S	Confined	---	Test #1	6.22E-03	-	-		
		17-ALG-D	Confined	---	Test #1	4.40E-04	-	-	4.6E-04	
					Test #2	4.78E-04	-	-		

Notes:

[1]Well Designations:

S Shallow

I Intermediate

D Deep

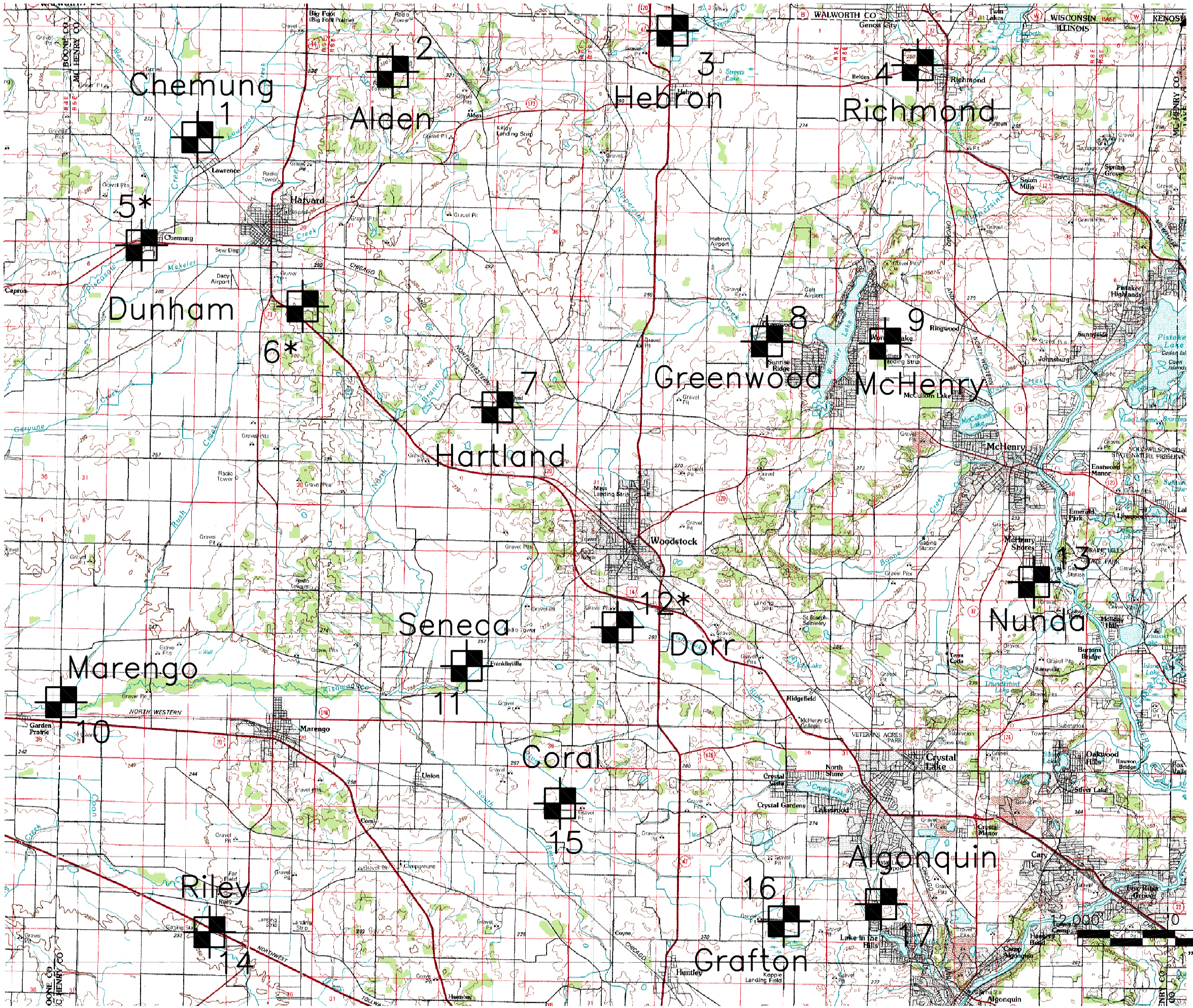
[2]Mean value calculated when multiple tests were run.

[3]Conductivity calculated assuming that artesian flow is equivalent to constant head injection test.

Summary Statistics

Minimum:	8.96E-05
Geometric Mean:	7.6E-03
Maximum:	1.31E-01

Z:\Projects\200804080\CtyWide\D-09000-460-8000_CtyOverviewMap_004.dwg; 4/20/2009 5:33:59 PM; BRAUN, GARY



LEGEND:

AECOM Well Installation Site

McHenry 9

Well Installations By Others

Dunham 6*

0 12,000 24,000'

" = 12,000'

AECOM

750 Corporate Woods Pkwy
Vernon Hills, IL 60061
847-279-2500
www.aecom.com

Copyright © By: STS Consultants, Ltd.

LOCATION MAP OF WELL SITES

Observation Well Network for Glacial Aquifers
McHenry County, Illinois

Drawn :	CJH	3/11/2009
Checked:	GMB	4/18/2009
Approved:	CSR	4/27/2009
PROJECT NUMBER	09000-460	
FIGURE NUMBER	1	

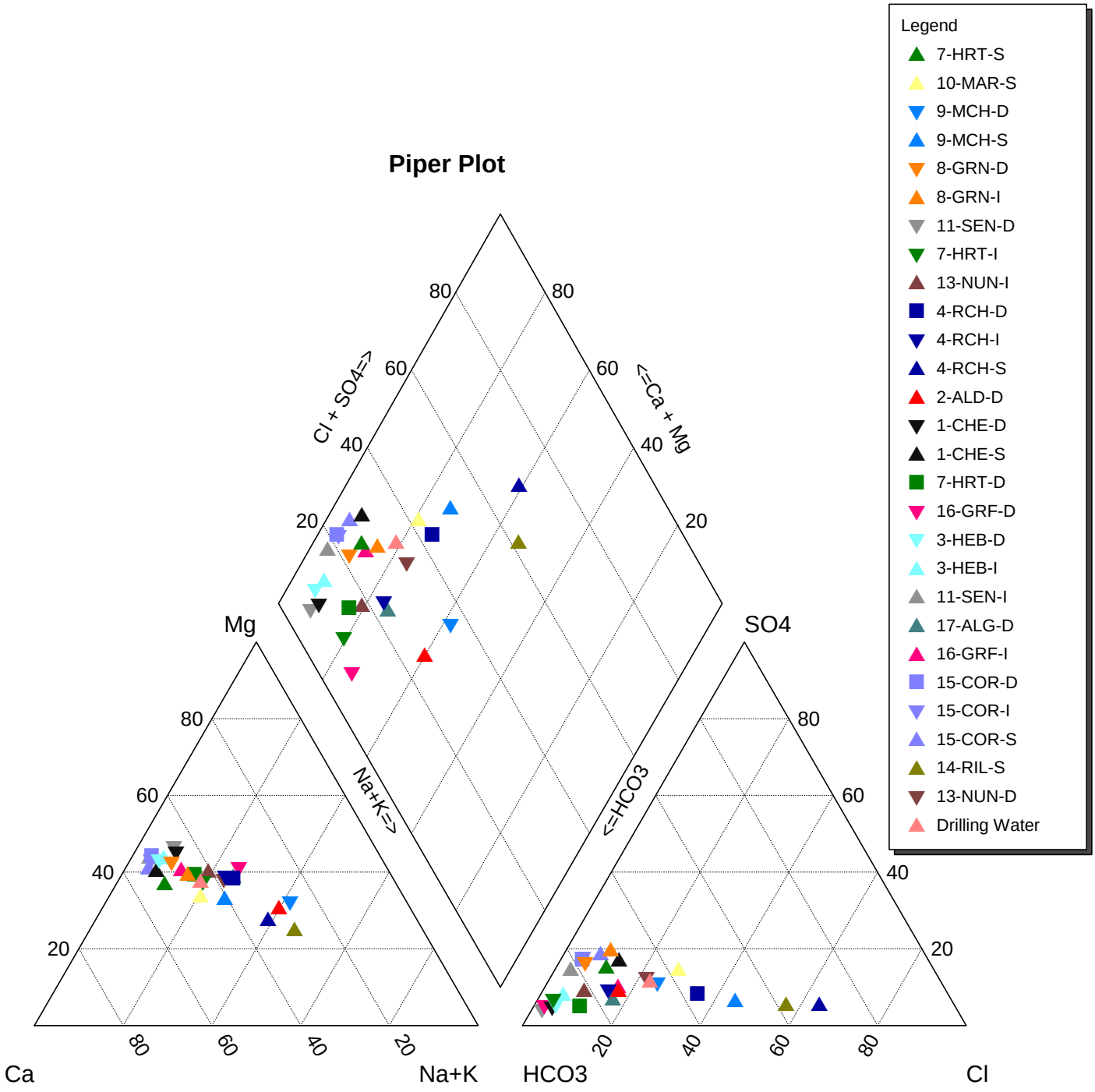


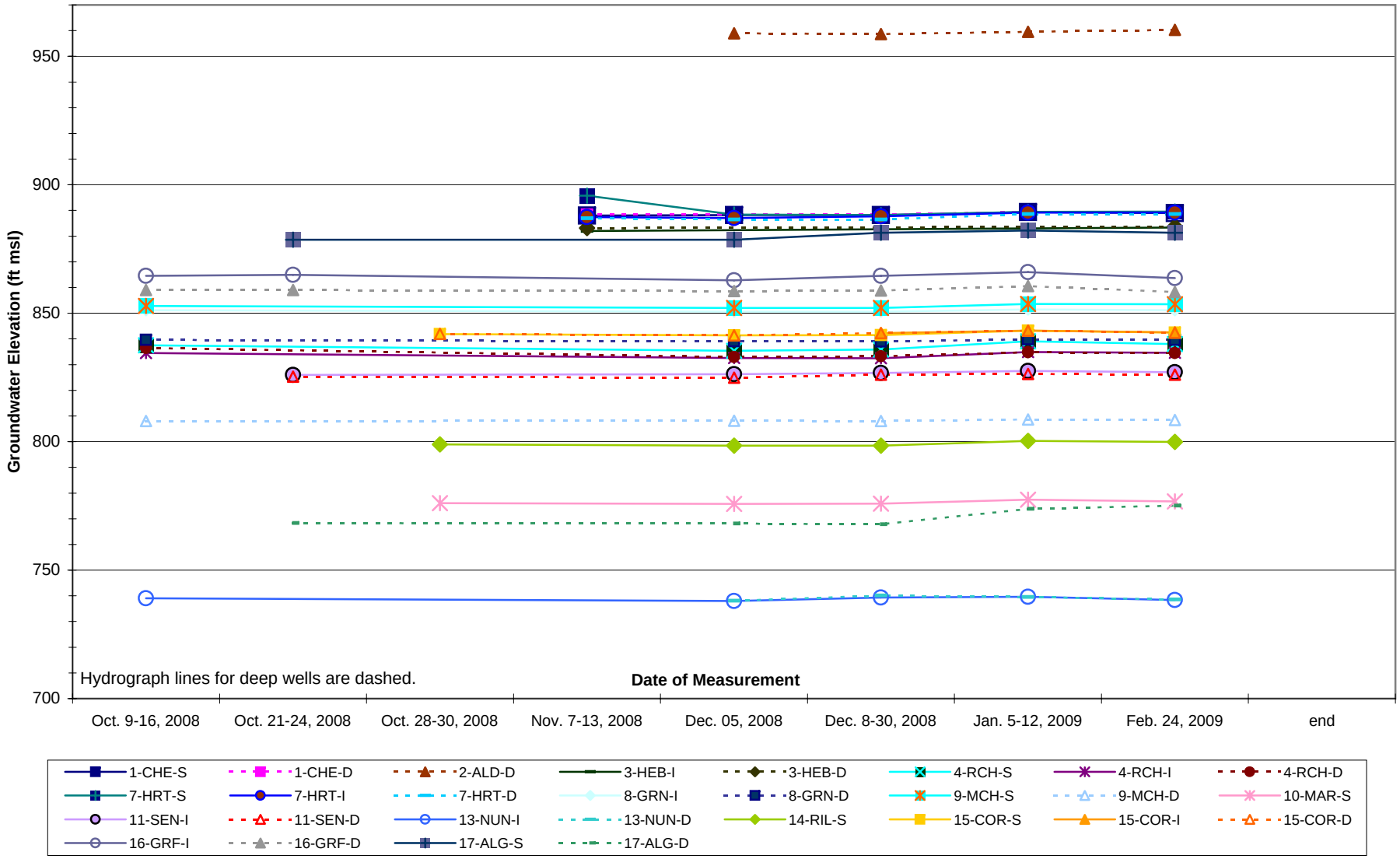
Figure 2

DESCRIPTION: Piper Trilinear Diagram - All Wells

AECOM	PROJECT: McHenry County	PROJECT NO: 09000460
	CLIENT: Army Corps of Engineers	DATE: 7/31/2009

Figure 3
Groundwater Level Hydrograph
ALL AECOM INSTALLED WELLS
McHenry County Obervation Well Network

AECOM Project 09000-460



Appendix A

Well Site Folios

Well Site 1	Chemung Township (1-CHE-S & 1-CHE-D)
Well Site 2	Alden Township (2-ALD-D)
Well Site 3	Hebron Township (3-HEB-I & 3-HEB-D)
Well Site 4	Richmond Township (4-RCH-S, 4-RCH-I & 4-RCH-D)
Well Site 7	Hartland Township (7-HRT-S, 7-HRT-I & 7-HRT-D)
Well Site 8	Greenwood Township (8-GRN-I & 8-GRN-D)
Well Site 9	McHenry Township (9-MCH-S & 9-MCH-D)
Well Site 10	Marengo Township (10-MAR-S)
Well Site 11	Seneca Township (11-SEN-I & 11-SEN-D)
Well Site 13	Nunda Township (13-NUN-I & 13-NUN-D)
Well Site 14	Riley Township (14-RIL-S)
Well Site 15	Coral Township (15-COR-S, 15-COR-I & 15-COR-D)
Well Site 16	Grafton Township (16-GRF-I & 16-GRF-D)
Well Site 17	Algonquin Township (17-ALG-S & 17-ALG-D)

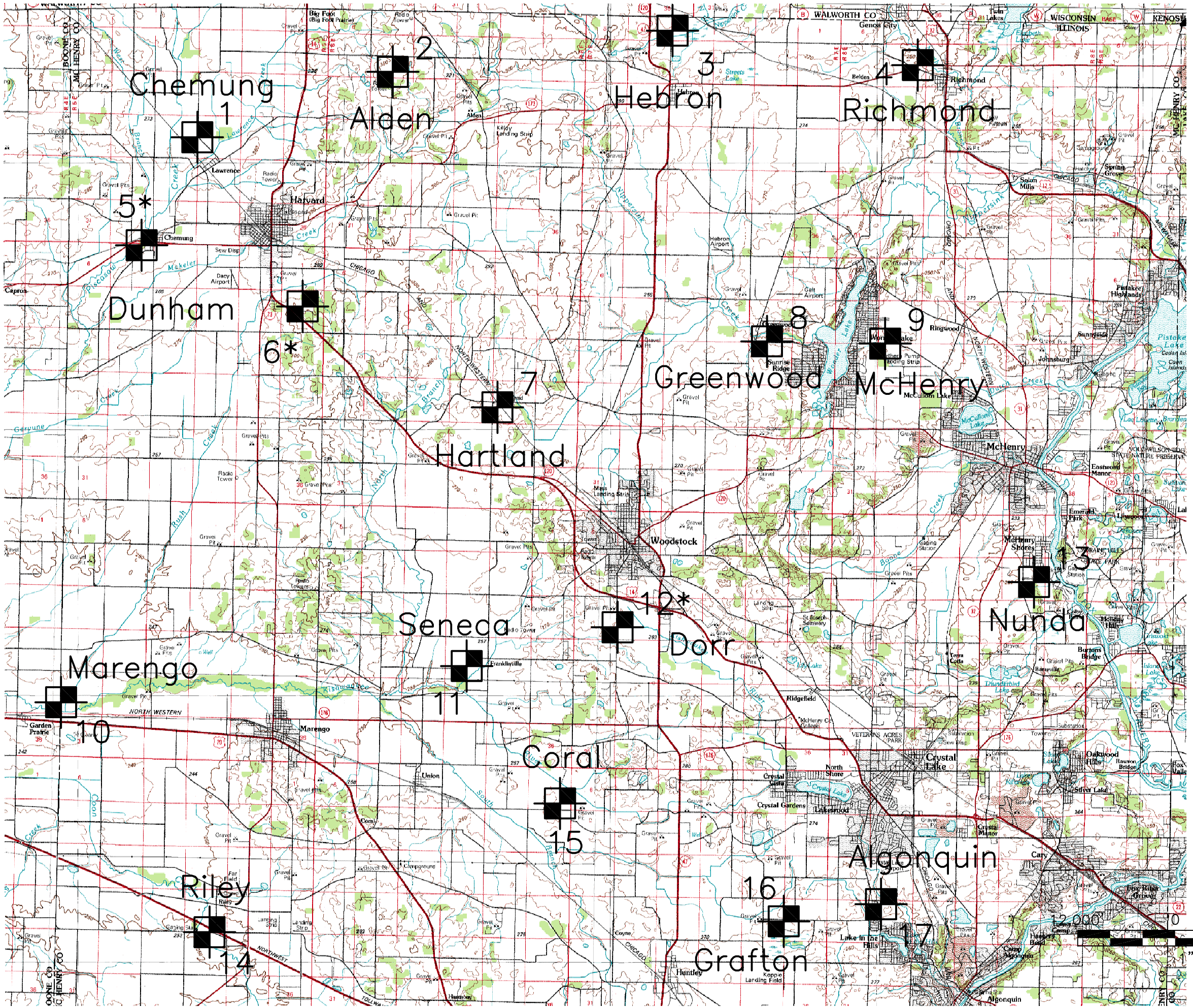
A-1: Folio for Well Site #1 – Chemung Township

Table of Contents

I.) Site Location Map – Location in County
II.) Site Location Map – Location on USGS Topographic Map
III.) Site Location Map – Location on USGS High Resolution Orthophoto
IV.) Site Boring Log
V.) Well Construction Diagram
VI.) Well Site Summary and Commentary
VII.) Particle Size Distribution Report
VIII.) Table of Water Level Measurements
IX.) Well Development Field Log
X.) Water Quality Analysis Results
XI.) Groundwater Sampling Field Log
XII.) Hydraulic Conductivity Testing Results
XIII.) In-Situ LevelTroll™ Calibration Report
XIV.) Site Photographs
XV.) Downhole Geophysical Testing

Well Site Location Maps

Z:\Projects\200804080\CtyWide\D-09000-460-8000_CtyOverviewMap_004.dwg; 4/20/2009 5:33:59 PM; BRAUN, GARY



LEGEND:

AECOM Well Installation Site

McHenry 9

Well Installations By Others

Dunham 6*

0 12,000 24,000'

" = 12,000'

AECOM

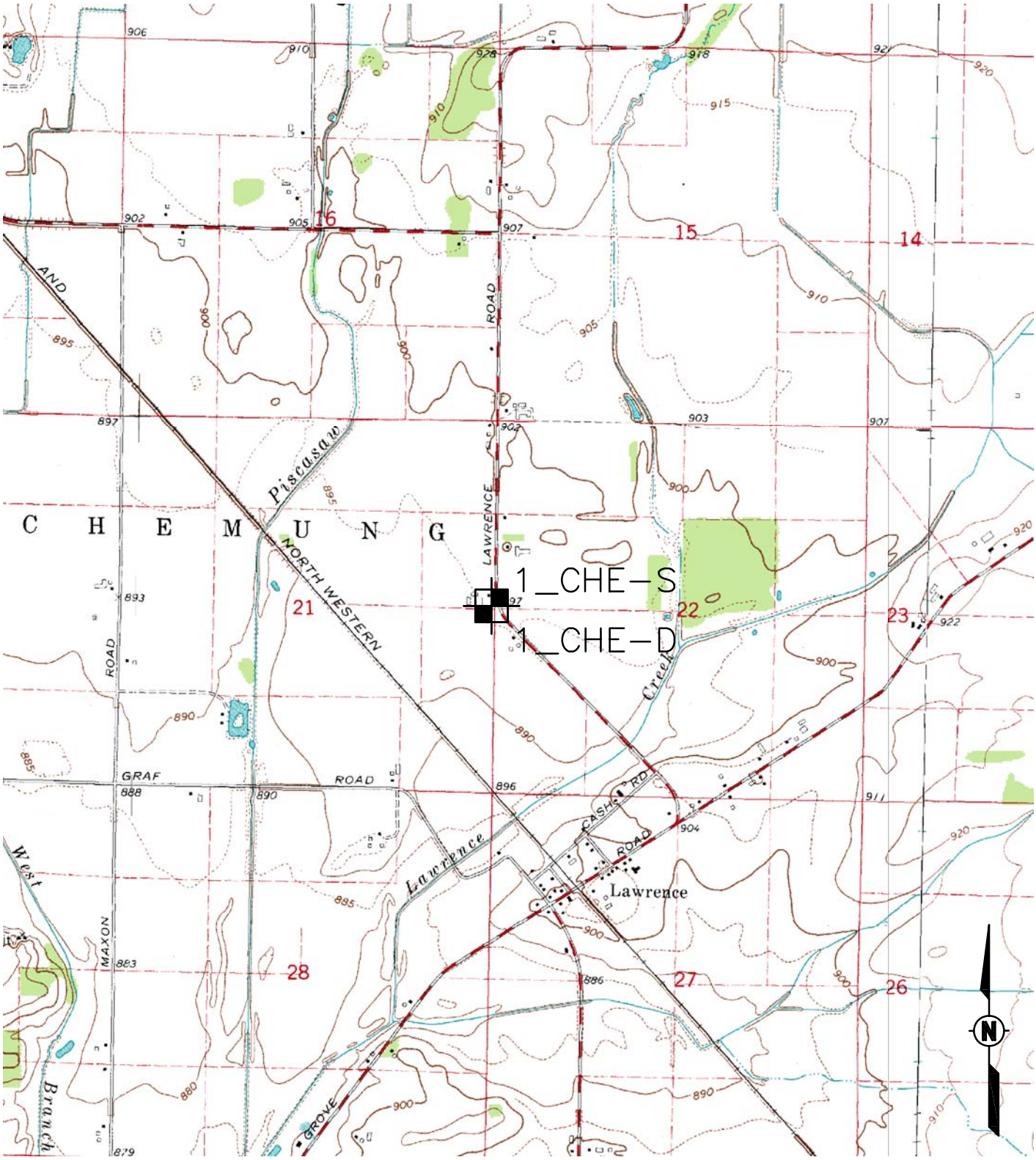
750 Corporate Woods Pkwy
Vernon Hills, IL 60061
847-279-2500
www.aecom.com

Copyright © By: STS Consultants, Ltd.

LOCATION MAP OF WELL SITES

Observation Well Network for Glacial Aquifers
McHenry County, Illinois

Drawn :	CJH	3/11/2009
Checked:	GMB	4/18/2009
Approved:	CSR	4/27/2009
PROJECT NUMBER	09000-460	
FIGURE NUMBER	1	



2000 0 2000 4000

1" = 2000'

AECOM

750 Corporate Woods Parkway
Vernon Hills, IL 60061
847.279.2500
www.aecom.com

Copyright © 2009, By: AECOM

Site Location on USGS Topographic Map
Site No. 1 - Chemung Township
Meyer Material Property - Lawrence Rd.
Observation Well Network
McHenry County, Illinois

Drawn :	CJH	04/01/2009
Checked:	GMB	04/15/2009
Approved:	CSR	04/24/2009
PROJECT NUMBER	09000-460	
FIGURE NUMBER	Folio_1 #2	

Z:\Projects\200804080\CtyWide\D-09000-460-8000_TopoMaps_v02.dwg; 4/20/2009 9:54:36 AM; BRAUN, GARY; STS_BLACK_040102.ctb

AECOM

750 Corporate Woods Parkway
Vernon Hills, IL 60061
847.279.2500
www.aecom.com
Copyright © 2009, By: AECOM

2005 USGS High Resolution Orthophoto
Site No. 1 - Chemung Township
Meyer Material Property - Lawrence Rd.
Observation Well Network
McHenry County, Illinois

Drawn :	CJH	04/01/2009
Checked:	GMB	04/15/2009
Approved:	CSR	04/24/2009
PROJECT NUMBER	09000-460	
FIGURE NUMBER	Folio_1 #3	

Z:\Projects\200804080\CtyWide\D-09000-460-8000_AerialsMap_004.dwg; 4/20/2009 11:46:52 AM; BRAUN, GARY; STS_BLACK_040102.ctb

Boring and Well Construction Details

DRILLING LOG

DIVISION	USACE
INSTALLATION	Chicago District
SHEET	1 OF 5 SHEETS
1. PROJECT	McHenry County Observation Wells
2. LOCATION (Coordinates or Station)	McHenry County, Illinois N 2,107,167.00 E 899,321.00
3. DRILLING AGENCY	WDC Exploration & Wells
4. HOLE NO. *(As shown on drawing title and file number)*	1-CHEMUNG
5. NAME OF DRILLER	Dan Tonnancour
6. DIRECTION OF HOLE	☒ VERTICAL ☐ INCLINED --- DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN	103.0
8. DEPTH DRILLED INTO ROCK	7.0
9. TOTAL DEPTH OF HOLE	110.8
10. SIZE AND TYPE OF BIT	3 7/8" Carbide Bit / 5 7/8" Casing
11. DATUM FOR ELEVATION SHOWN *(TBM or MSL)*	NAVD 88
12. MANUFACTURER'S DESIGNATION OF DRILL	Super Sonic II
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN	DISTURBED 18 / UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES	N/A
15. ELEVATION GROUND WATER	888.4
16. DATE HOLE	STARTED 11/6/2008 / COMPLETED 11/7/2008
17. ELEVATION TOP OF HOLE	+896.2
18. TOTAL CORE RECOVERY FOR BORING	96 %
19. GEOLOGIST	Gary Braun, LPG IL

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS *(Drilling time, water loss, depth weathering, etc., if significant)* g
+896.2	0.0		Topsoil: OL, Dark brown organic clayey silt, stiff	90	1 0.0 5.0	
+894.7	1.5		CL, Light brown silty clay, trace sand, gravel and organics, mottled black and orange, stiff, high plasticity, moist			Sample No. 1 from 4.0' - 5.0'
+890.2	6.0			90	2 5.0 15.0	
+889.2	7.0		SP, Brown medium sand, dense, moist			
			GW, Brown medium sand, medium dense, moist			Sample No. 2 from 14.0' - 15.0'
				95	3 15.0 25.0	Sample No. 3 from 19.0' - 20.0'
+876.2	20.0					

DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE 896.2

Hole No. 1-CHEMUNG

PROJECT: McHenry County Observation Wells

INSTALLATION: Chicago District

SHEET 2 OF 5 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
			SW, Gray gravelly sand, loose, wet			
+871.2	25.0					
			GP, Gray fine gravel, little medium to coarse gravel and sand, loose, well sorted	90	4 25.0 35.0	
						Sample No. 4 from 29.0' to 30.0'
						Sample No. 5 from 33.0' to 34.0'
				100	5 35.0 45.0	
						% Gravel/% Sand/% Fines = 54/44/2 from 39.0' to 40.0'
						Sample No. 6 from 41.0' to 42.0'
+853.2	43.0					
			SP, Gray medium sand, trace gravel, loose, wet			
+852.2	44.0					
			ML, Gray silt, dense, wet			Sample No. 7 from 44.0' to 45.0'
+851.2	45.0					
			SP, Greenish gray medium sand, medium dense	100	6 45.0	

DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE 896.2

Hole No. 1-CHEMUNG

PROJECT: McHenry County Observation Wells

INSTALLATION: Chicago District

SHEET 3 OF 5 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
			SP, Greenish gray medium sand, medium dense *(continued)*		55.0	
+849.2	47.0					
			GW, Brownish gray gravelly medium sand, loose, wet			Sample No. 8 from 48.0' to 49.0'
+847.2	49.0					
			SP, Brownish gray medium sand, trace fien gravel, dense, wet			
+845.2	51.0					
			GW, Gray gravelly sand, loose, wet			
+842.2	54.0					
			CL, Dark olive gray silty clay to clayey silt, little coarse sand and fine gravel, hard, not plastic			Sample No. 9 from 54.0' to 55.0'
				100	7 55.0 65.0	
						Qp = >4.5 TSF @57.0'
						Qp = >4.5 TSF @59.0'
+835.2	61.0					
+834.7	61.5		SP, Gray medium sand seam, dense, wet			
			CL, Reddish brown silty loamy clay, little sand and gravel, hard, not plastic, low water content Note: Matrix Supported Diamicton			
						Qp = >4.5 TSF @63.0'
						Sample No. 10 from 64.0' to 65.0'
				100	8 65.0 75.0	
						Qp = >4.5 TSF @67.0'
						Qp = >4.5 TSF @69.0'

DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE 896.2

Hole No. 1-CHEMUNG

PROJECT: McHenry County Observation Wells

INSTALLATION: Chicago District

SHEET 4 OF 5 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
			CL, Reddish brown silty loamy clay, little sand and gravel, hard, not plastic, low water content Note: Matrix Supported Diamicton *(continued)*			Qp = >4.5 TSF @73.0' Sample No. 11 from 74.0' to 75.0'
				100	9 75.0 85.0	
						Qp = 4.5+ TSF @77.0'
						Qp = 4.5+ TSF @80.0'
			Note: Gray medium dense sand seams (SP) with trace gravel and red mottles encountered from 81.0' to 83.5'			
						Sample No. 12 from 84.0' to 85.0' Qp = >4.5 TSF @84.0'
				100	10 85.0 95.0	
						Qp = >4.5 TSF @88.0'
						Qp = >4.5 TSF @91.0'
						Qp = >4.5 TSF @93.0'
						Sample No. 13 from 94.0' to 95.0'
				100	11 95.0 105.0	
+800.2	96.0					
+799.2	97.0		CL, Dark brown with black mottling and bedding silty clay, some organics, stiff, high plasticity			Sample Nos. 14 & 15 from 96.0' to 97.0'

DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE 896.2

Hole No. 1-CHEMUNG

PROJECT: McHenry County Observation Wells

INSTALLATION: Chicago District

SHEET 5 OF 5 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
			CL, Olive gray silty loam, some sand and gravel, not plastic, hard, damp *(continued)*			Sample No. 16 from 98.0' to 99.0'
						Sample No. 17 from 101.0' to 102.0'
+793.2	103.0					
			Light gray to buff dolomite, thinly bedded with muddy interbeds evident			Sample No. 18 from 104.0' to 105.0'
				80	12 105.0 110.0	
+785.4	110.8					
			END OF BORING - 125.0' BGS			AECOM Project No. 60095270

Hole No. 1 - CHEMUNG TWP

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 1 OF 8 SHEETS

1. PROJECT McHenry Cty Wells	10. SIZE AND TYPE OF BIT 3 7/8" Carbide Sampler
2. LOCATION (Coordinates or Station) N 2107167' E 899321' IL ST PLANE	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) NAVD 88
3. DRILLING AGENCY WDC Exploration & Wells	12. MANUFACTURERS DESIGNATION OF DRILL Sonar Sonic II
4. HOLE NO. (As shown on drawing title and title number) 1-CHE	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 18; UNDISTURBED Ø
5. NAME OF DRILLER DAN TONNMANCOUR	14. TOTAL NUMBER CORE BOXES Ø
6. DIRECTION OF HOLE ☑ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER 888.4 D FT MSL (11-7-08)
	16. DATE HOLE: STARTED 11-6-08; COMPLETED 11-7-08
7. THICKNESS OF OVERBURDEN 103'	17. ELEVATION TOP OF HOLE 896.2 FT MSL
8. DEPTH DRILLED INTO ROCK 7'	18. TOTAL CORE RECOVERY FOR BORING 106' / 110' = 96% REC
9. TOTAL DEPTH OF HOLE 110'	19. SIGNATURE OF INSPECTOR Gary M. Brown LPG IL

ROTO-SONIC 5 7/8" CASING

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
896.2	0		Dark Brown, TOPSOIL Organic Clayey SILT, stiff (OL)			RUN 1 (0-5) Rec/Run = 4.5'/5' = 90% 1400
	1				Bag 1	
	2		Lt. Brown, Silty CLAY, trace Sand, gravel & organics, mottled black & orange, stiff, high plasticity, moist (CL)	Rec 90%		
	3					
	4					
	5				S1	1420
	6		Brown MEDIUM SAND, medium dense, moist (SP)			1425 RUN 2 (5-15) Rec/Run 9/10 = 90%
	7		Brown Sandy Fld. GRAVEL loose, wet (GW) OUTWASH		Bag 2	
	8					
	9			Rec 90%		
886.2	10					Drive 6" CASING 1439
	11					
	12				Bag 3	
	13					
	14					
	15				S2	

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT McHenry Cty Wells | HOLE NO. 1 - CHEMUNG TWP

Hole No. 1-CHEMUNG TWP

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 2 OF 8 SHEETS

1. PROJECT: McHenry City Wells
2. LOCATION (Coordinates or Station):
3. DRILLING AGENCY: NDC Exploration & Wells
4. HOLE NO. (As shown on drawing title and title number): 1-CHE
5. NAME OF DRILLER: DAN TONNANCOUR
6. DIRECTION OF HOLE: ☑ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 103'
8. DEPTH DRILLED INTO ROCK: 7'
9. TOTAL DEPTH OF HOLE: 110'
10. SIZE AND TYPE OF BIT: 3 7/8" Carbide Sampler
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): NAVD88
12. MANUFACTURERS DESIGNATION OF DRILL: Super Sonic II
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 18 UNDISTURBED 6
14. TOTAL NUMBER CORE BOXES: Ø
15. ELEVATION GROUND WATER: 888.4 Ft MSL (11-7-08)
16. DATE HOLE: STARTED 11-6-08 COMPLETED 11
17. ELEVATION TOP OF HOLE: 896.2 Ft MSL
18. TOTAL CORE RECOVERY FOR BORING: 106'
19. SIGNATURE OF INSPECTOR: Gary M. Braun LPG/L

ROTO-SONIC 5 7/8" CASING

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	15		cont.			Run 3 (15-25)
	16		OUTWASH			Rec/Run = 9.5'/10' = 95%
	17				Bag 4	
	18					
	19					
876.2	20			Rec 95%	S3	
	21		Gray Gravelly SAND, loose, wet (SW)			
	22				Bag 5	
	23					
	24		primarily SAND			
	25					
	26		Gray Fine Gravel, 1/4"/e M.-C. gravel & sand, clean, loose, well sorted Gravel (GP)			Run 4 (25-35)
	27					Rec/Run 9.0'/10' = 90%
	28			Rec 90%	Bag 6	
	29					
866.2	30				S4	

1443 ↓ 4" casing 1444

Drive 6" casing ↓ 1449

Extract Samples 1452

Heavy Rain Starts

1455 ↓ 4" 1456

↓ 1502

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT: McHenry City Wells | HOLE NO. 1-CHEMUNG TWP

Hole No. 1-CHEMUNG TWP

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 3 OF 8 SHEETS

1. PROJECT: McHenry Cty Wells
2. LOCATION (Coordinates or Station):
3. DRILLING AGENCY: WDC Exploration & Wells
4. HOLE NO. (As shown on drawing title and title number): 1-CHE
5. NAME OF DRILLER: Dan Tonwancour
6. DIRECTION OF HOLE: ☑ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 103'
8. DEPTH DRILLED INTO ROCK: 7'
9. TOTAL DEPTH OF HOLE: 110'
10. SIZE AND TYPE OF BIT: 3 7/8" Carbide Sampler
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): NAVD 88
12. MANUFACTURERS DESIGNATION OF DRILL: Super Sonic II
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 18 / UNDISTURBED ∅
14. TOTAL NUMBER CORE BOXES: ∅
15. ELEVATION GROUND WATER: 888.4' (11-7-08)
16. DATE HOLE: STARTED 11-6-08 / COMPLETED 11-7-08
17. ELEVATION TOP OF HOLE: 896.2 ft MSL
18. TOTAL CORE RECOVERY FOR BORING: 106'
19. SIGNATURE OF INSPECTOR: Gary M. Brown LPG IL

Roto-Sonic 5 7/8" Casing

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
866.2	30		Cont.			Run 4 (25-35) cont.
	31		Gravel outwash	Cont.		
	32			Rec 90%	Bag 7	
	33					
	34		Very Sandy Gravel		S5	
	35					Run 5 (35-45) Rec/Run 10'/10' = 100%
	36		Sandy Zone Gravel		Bag 8	1513 Drive 4" 1515
	37					
	38		Clean Med. Gravel; thin sand layers			1517 Drive 6" Casing 1520
	39		Large Cobble			
856.2	40		Med. Gravel Zone	Rec 100%	Bag 9	
	41				S6	
	42					
	43		Gray med. SAND, tr. gravel, moist, well (SP)		Bag 10	1524 Extract Samples
	44		Gray SILT, dense, wet (ML)			
	45				S7	

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT: McHenry Cty Wells | HOLE NO. 1-CHEMUNG TWP

Hole No. 1-CHEMUNG TWP

Roto-Sonic 5 7/8" Casing

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 4 OF 8 SHEETS

1. PROJECT McHenry Cty Wells	10. SIZE AND TYPE OF BIT 3 7/8" Carbide Sampler
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) NAVD 88
3. DRILLING AGENCY WDC Exploration & Wells	12. MANUFACTURERS DESIGNATION OF DRILL Super Sonic II
4. HOLE NO. (As shown on drawing title and title number) 1-CHE	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN — DISTURBED 18 — UNDISTURBED Ø
5. NAME OF DRILLER DAN TONNANCOUR	14. TOTAL NUMBER CORE BOXES Ø
6. DIRECTION OF HOLE ☑ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.	15. ELEVATION GROUND WATER 888.4' 11-7-08
	16. DATE HOLE — STARTED 11-6-08 — COMPLETED 11-7-08
7. THICKNESS OF OVERBURDEN 103'	17. ELEVATION TOP OF HOLE 896.2 FT MSL
8. DEPTH DRILLED INTO ROCK 7'	18. TOTAL CORE RECOVERY FOR BORING 106'
9. TOTAL DEPTH OF HOLE 110'	19. SIGNATURE OF INSPECTOR Gary M. Brown LPG IL

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	45		Brownish Gray Medium SAND, Med. Dense (SP) well sorted			Run 6 (45-55) Rec/Run = 10'/10' = 100%
	46				Bag 11	
	47		← thin Clay Stringer			
	48		Brownish Gray Gravelly Med. SAND, loose, wet (GW/SP)		s8	
	49					
846.2	50		Brownish Gray Medium SAND, dense, wet (SP) (trace f. gravel)	Rec 100%	Bag 12	
	51		Gray Gravelly SAND loose, wet (GW-SP)			
	52		> well sorted sand lens — PRO-GLACIAL ALLUVIUM			
	53				Bag 13	
	54		Very Abrupt Gradation		s9	
	55		Dark Olive Gray Silty CLAY to Clayey SILT (Loamy), little c. sand & f gravel, hard, not plastic (low water content)			Run 7 (55-65) Rec/Run = 10'/10' = 100%
	56				Bag 14	
	57			Rec 100%		>4.5 tsf
	58					Difficult Drilling 58-65'
	59		Matrix Supported Loamy Diamicton		Bag 15	>4.5 tsf
836.2	60		ILLN TILL?			

Contacts fairly abrupt despite granular deposits

1535 ↓ Drive 4" core barrel 1537

1540 ↓ Drive 6" Casing 1545

Extract @ 1550

1554 ↓ Drive 4" Core Barrel 1602

1604 ↓ Drive 6" 1613

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT McHenry Cty Wells — HOLE NO. 1-CHEMUNG TWP

Hole No. 1-CHEMUNG TWP

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 5 OF 8 SHEETS

1. PROJECT: McHenry Cty Wells
2. LOCATION (Coordinates or Station):
3. DRILLING AGENCY: WDC Exploration & Wells
4. HOLE NO. (As shown on drawing title and title number): 1-CHE
5. NAME OF DRILLER: DAN TONWANCOUR
6. DIRECTION OF HOLE: ☑ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 103'
8. DEPTH DRILLED INTO ROCK: 7'
9. TOTAL DEPTH OF HOLE: 110'
10. SIZE AND TYPE OF BIT: 3 7/8" Carbide Sampler — ROTO-SONIC 5 7/8" CASING
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): NAVD 88
12. MANUFACTURERS DESIGNATION OF DRILL: Super Sonic II
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 18; UNDISTURBED Ø
14. TOTAL NUMBER CORE BOXES: Ø
15. ELEVATION GROUND WATER: 888.4' 11-7-08
16. DATE HOLE: STARTED 11-6-08; COMPLETED 11-7-08
17. ELEVATION TOP OF HOLE: 896.2 FT MSL
18. TOTAL CORE RECOVERY FOR BORING: 106'
19. SIGNATURE OF INSPECTOR: Lon M. Brown LPG IL

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g	
836.2	60		SAME		cont Bag 15	RUN 7 (cont.)	1620 Extract Samples
	61		Gray Med. SAND Semi dense, wet (SP)				
	62		Reddish Brown, Silty Loamy CLAY, little sand & gravel, hard, not plastic, low water content matrix supported Diamicton.	cont. 100%			
	63				Bag 16	> 4.5 tsf	
	64				s10		
	65					RUN 8 (65-75') Rec/Run = 10'/10' = 100%	1627 Drive 4"
	66		(TILL)		Bag 17		
	67					> 4.5 tsf	1640 HARD!
	68						Drive 6"
	69					> 4.5 tsf	
826.2	70			Rec 100%	Bag 18	• core recovery is very brittle, breaks at bedding planes/planes of weakness between 1/4" thick to 4" thick.	1634
	71						
	72						
	73		> 4.5 tsf		Bag 19	• Recovery warm, continues to appear to have low water content.	Extract
	74						1657
	75				s11		End of Day 11/6/08

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT: McHenry Cty Wells | HOLE NO. 1-CHEMUNG TWP

Hole No. 1 - CHEMUNG TWP

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 6 OF 8 SHEETS

1. PROJECT: McHenry Cty Wells
2. LOCATION (Coordinates or Station):
3. DRILLING AGENCY: WDC Exploration & Wells
4. HOLE NO. (As shown on drawing title and title number):
5. NAME OF DRILLER: DAN TONNANCOUR
6. DIRECTION OF HOLE: ☑ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 103'
8. DEPTH DRILLED INTO ROCK: 3'
9. TOTAL DEPTH OF HOLE: 110'
10. SIZE AND TYPE OF BIT: 3 7/8" Carbide Sampler
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): NAVD 88
12. MANUFACTURERS DESIGNATION OF DRILL: Super Sonic II
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 18 UNDISTURBED Ø
14. TOTAL NUMBER CORE BOXES: Ø
15. ELEVATION GROUND WATER: D: 888.4 FT MSL (11-7-08)
16. DATE HOLE: STARTED 11-6-08 COMPLETED 11-7-08
17. ELEVATION TOP OF HOLE: 896.2 FT MSL
18. TOTAL CORE RECOVERY FOR BORING: 106'
19. SIGNATURE OF INSPECTOR: Gary M. Brown LPG IL

ROTO-SONIC 5 7/8" CASING

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g	
	75		Cont, Reddish Brown Till			RUN 9 (75-85)	0735
	76				Bag 20	Rec/Run = 10'/10' = 100%	↓ 4" 0748
	77					4.5+tsf	
	78						0750
	79			REC 100%		4.5+tsf	↓ 6" 0803
816.2	80				Bag 21		
	81		Gray Med. SAND SEAMS Dense (SP) trace gravel & red mottles				Extract 0811
	82						
	83				Bag 22		
	84				S12	>4.5+tsf	
	85					RUN 10 (85-95)	0832
	86					Rec/Run = 10'/10' = 100%	↓ Drive 4"
	87				Bag 23		0843
	88			REC 100%		>4.5+tsf	0845 ↓ Drive 6"
	89				Bag 24		0900
806.2	90						

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT: McHenry Cty Wells | HOLE NO. 1-CHEMUNG TWP

Hole No. 1-CHEMUNG TWP

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 7 OF 8 SHEETS

1. PROJECT McHenry Cty Wells	10. SIZE AND TYPE OF BIT 3 7/8" Carbide Sampler & 5 7/8" Roto-Sonic Casing
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) NAVD88
3. DRILLING AGENCY WDC Exploration	12. MANUFACTURERS DESIGNATION OF DRILL SUPER SONIC II
4. HOLE NO. (As shown on drawing title and title number) 1-CHE	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN — DISTURBED 18 — UNDISTURBED Ø
5. NAME OF DRILLER DAN TONNANCOUR	14. TOTAL NUMBER CORE BOXES Ø
6. DIRECTION OF HOLE ☑ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.	15. ELEVATION GROUND WATER D: 888.4' (11-7-08)
	16. DATE HOLE — STARTED 11-6-08 — COMPLETED 11-7-08
7. THICKNESS OF OVERBURDEN 103'	17. ELEVATION TOP OF HOLE 896.2 Ft MSL
8. DEPTH DRILLED INTO ROCK 7'	18. TOTAL CORE RECOVERY FOR BORING 106'
9. TOTAL DEPTH OF HOLE 110'	19. SIGNATURE OF INSPECTOR [signature] LPG IL

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
806.2	90		cont.	cont	Bag 24 cont.	Run 10 (85-95) cont.
	91		grades to Dark Brown			
	92			Rec 100%		
	93				Bag 25	> 4.5 tsf
	94		drilled through large cobble		s13	Extractions 0905
	95				Bag 26	Run 11 (95-105)
	96		Dark Brown w/ Black Mottling & Beckling Silty CLAY some organics, stiff high plasticity (CL) Buried Soil Horizon?		s14½, s15	Rec/Run = 10'/10' = 100% — 0914 ↓ 0923
	97				Bag 27	0930 Water Run
	98		Olive Gray Silty LOAM, some sand & gravel (content increases w/depth) not plastic, hard, damp (CL)		s16	
796.2	99			Rec 100%		
	100				Bag 28	
	101		BASAL TILL		s17	
	102					
→ 793.2	103		Light Gray to Buff DOLOMITE, thinly bedded w/ muddy interbeds evident (next page)		Bag 29	• Driller: chatter evident at ~103 ft while advancing 4" core barrel
	104					
	105				s18	

Hole No. 1-CHEMUNG TWP

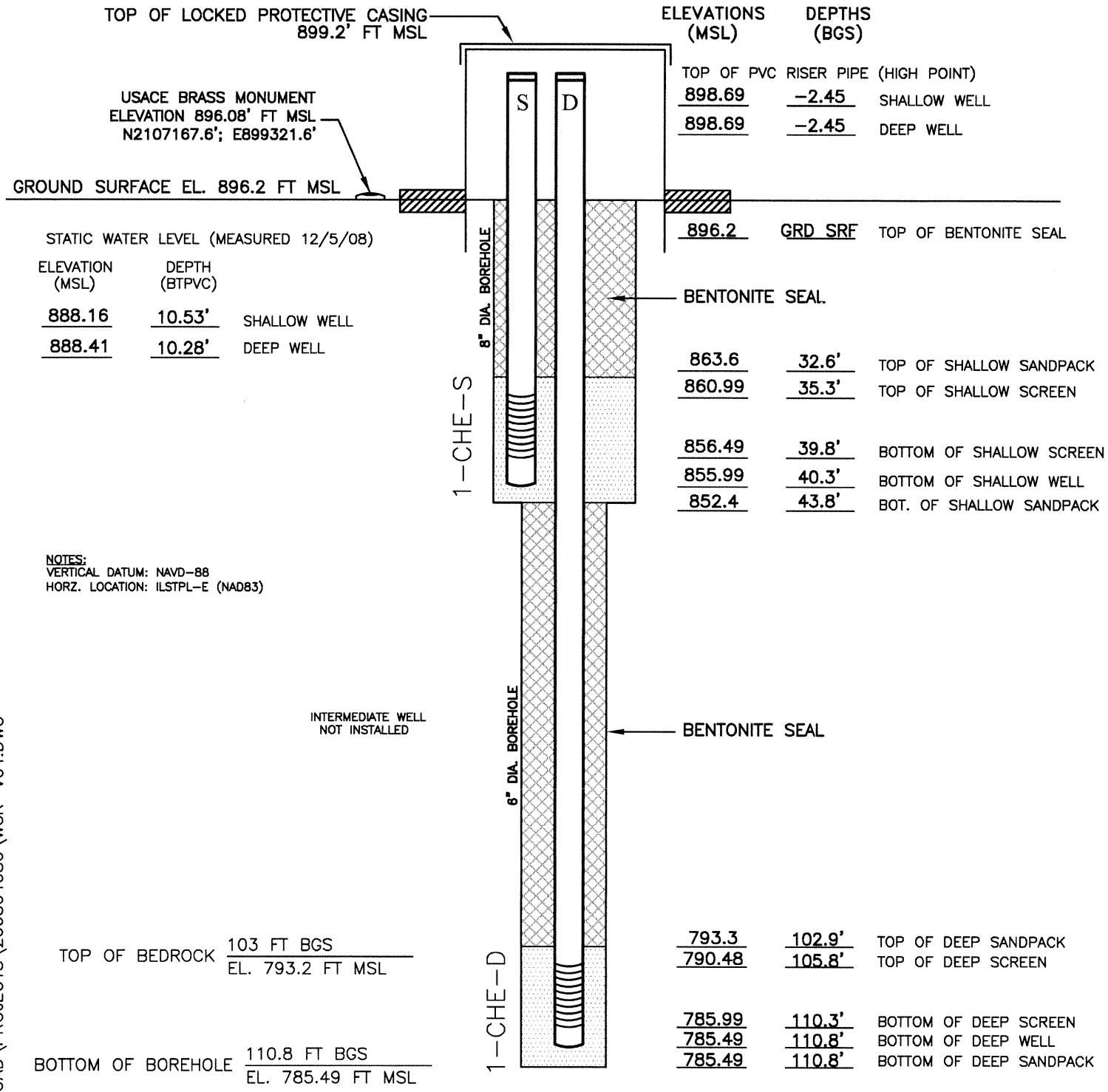
ROTO-SONIC 5 7/8" Casing

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 8 OF 8 SHEETS

1. PROJECT McHenry City Wells	10. SIZE AND TYPE OF BIT 3 7/8" Carbide Sampler
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) NAVD 88
3. DRILLING AGENCY WDC Exploration & Wells	12. MANUFACTURERS DESIGNATION OF DRILL Super Sonic II
4. HOLE NO. (As shown on drawing title and title number) 1-CHE	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 18; UNDISTURBED Ø
5. NAME OF DRILLER Dan Townancowe	14. TOTAL NUMBER CORE BOXES Ø
6. DIRECTION OF HOLE ☑ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.	15. ELEVATION GROUND WATER 888.4' (11-7-08)
	16. DATE HOLE: STARTED 11-6-08; COMPLETED 11-7-08
	17. ELEVATION TOP OF HOLE 896.2 FT MSL
7. THICKNESS OF OVERBURDEN 103'	18. TOTAL CORE RECOVERY FOR BORING 106'
8. DEPTH DRILLED INTO ROCK 7'	19. SIGNATURE OF INSPECTOR Harry M. Brown LPG IL
9. TOTAL DEPTH OF HOLE 110'	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	105		In upper 2 ft while drilling w/o water. No shaly interbed recovery 105-110			Run 12 (105-110) Rec/Run = 4'/5' = 90%
	106					1140 ↓ Drive 4" core barrel 1150
	107					Driller Noted: Advancing 4" core barrel was inconsistent. Thin voids or soft spots made rods skip downward.
	108					
	109					Also, driller thought that water level rose in well — Top of Bedrock was producing water.
786.2	110					
			11/7/08 END OF BOREHOLE 110.8 ft bgs			•WL taken after lunch (i.e. 50 min of run) to allow for stabilization was 6.35 ft bgs.
						Note: Run 12 drilled using water (No water used in Run 11)

PROJECT McHENRY COUNTY OBSERVATION WELL NETWORK INSTALLATION (#09000-460)	WELL NO. 1-CHE-S & 1-CHE-D
LOCATION CHEMUNG TOWNSHIP – McHENRY COUNTY, ILLINOIS	
CLIENT U.S. ARMY CORPS OF ENGINEERS / McHENRY COUNTY	
GEOLOGIST GARY BRAUN, P.G. (AECOM)	INSTALLATION DATE NOV. 7, 2008
DRILLER WDC EXPLORATION AND WELLS, INC. (DAN TONNANCOUR)	DRILLING METHOD ROTO-SONIC



ELEVATIONS (MSL)	DEPTHS (BGS)	
TOP OF PVC RISER PIPE (HIGH POINT)		
898.69	-2.45	SHALLOW WELL
898.69	-2.45	DEEP WELL
896.2	GRD SRF	TOP OF BENTONITE SEAL
863.6	32.6'	TOP OF SHALLOW SANDPACK
860.99	35.3'	TOP OF SHALLOW SCREEN
856.49	39.8'	BOTTOM OF SHALLOW SCREEN
855.99	40.3'	BOTTOM OF SHALLOW WELL
852.4	43.8'	BOT. OF SHALLOW SANDPACK
793.3	102.9'	TOP OF DEEP SANDPACK
790.48	105.8'	TOP OF DEEP SCREEN
785.99	110.3'	BOTTOM OF DEEP SCREEN
785.49	110.8'	BOTTOM OF DEEP WELL
785.49	110.8'	BOTTOM OF DEEP SANDPACK

STATIC WATER LEVEL (MEASURED 12/5/08)

ELEVATION (MSL)	DEPTH (BTPVC)	
888.16	10.53'	SHALLOW WELL
888.41	10.28'	DEEP WELL

NOTES:
VERTICAL DATUM: NAVD-88
HORZ. LOCATION: ILSTPL-E (NAD83)

TOP OF BEDROCK 103 FT BGS / EL. 793.2 FT MSL

BOTTOM OF BOREHOLE 110.8 FT BGS / EL. 785.49 FT MSL

NOT TO SCALE

WELL CONSTRUCTION MATERIALS*

PROTECTIVE CASING	5' L X 8" DIA. ALUMINUM CASING W/ LOCKING CAP
RISER PIPE ABOVE W.T.	SCHEDULE 40 PVC (2.07" I.D./ 2.38" O.D.)
RISER PIPE BELOW W.T.	SCHEDULE 40 PVC (2.07" I.D./ 2.38" O.D.)
SCREEN	2" I.D. SCHEDULE 40 PVC W/ 0.010" SCREEN SLOT SIZE
TYPE OF BENTONITE SEAL	BLACK HILLS BENTONITE – 3/8" CHIPS (HOLE PLUG)
TYPE OF SAND PACK	R.W. SIDLEY CO. – NO. 5 FILTER PACK SAND

CASING MEASUREMENTS

BOTTOM OF SCREEN TO END CAP (FT)*		0.50
SCREEN LENGTH (1ST SLOT TO LAST SLOT) (FT)*		4.50
TOTAL LENGTH OF CASING (FT):	SHALLOW WELL	42.70
	DEEP WELL	113.20

* MEASUREMENT REFERS TO ALL WELLS

USMWK2FP001\05CAD\PROJECTS\20080408O\WCR-V04.DWG

WELL SITE DATA SUMMARY AND COMMENTARY

Well Site #1 - Chemung Township
Meyer Material Property on Lawrence Rd

The Chemung Township is located west of the Marengo Moraine margin, which indicates that the area received alluvial pro-glacial deposits in front of Wisconsin Episode advances (Curry et al, 1997). Stratified sand and gravel outwash deposits (that are likely Henry Formation deposits) were found between 6 feet and 54 feet below ground surface. A shallow well was installed in a medium gravel zone with some cobbles that were recovered. The particle size distribution of the well screen interval is likely biased low because the 3½" ID core barrel would limit the recovery of the cobble-size pieces. The shallow well was the only occurrence where an unconfined well had an under-damped response from slug testing. However, the confined assumption of the van der Kamp (1977) solution was considered valid since K_h is likely several orders of magnitude greater than K_v due to the poorly graded gravelly sequence where the well was screened. The shallow hydrostatic zone consists of an approximate 47 foot thick aquifer and is underlain by 49 feet of clay-rich diamicton.

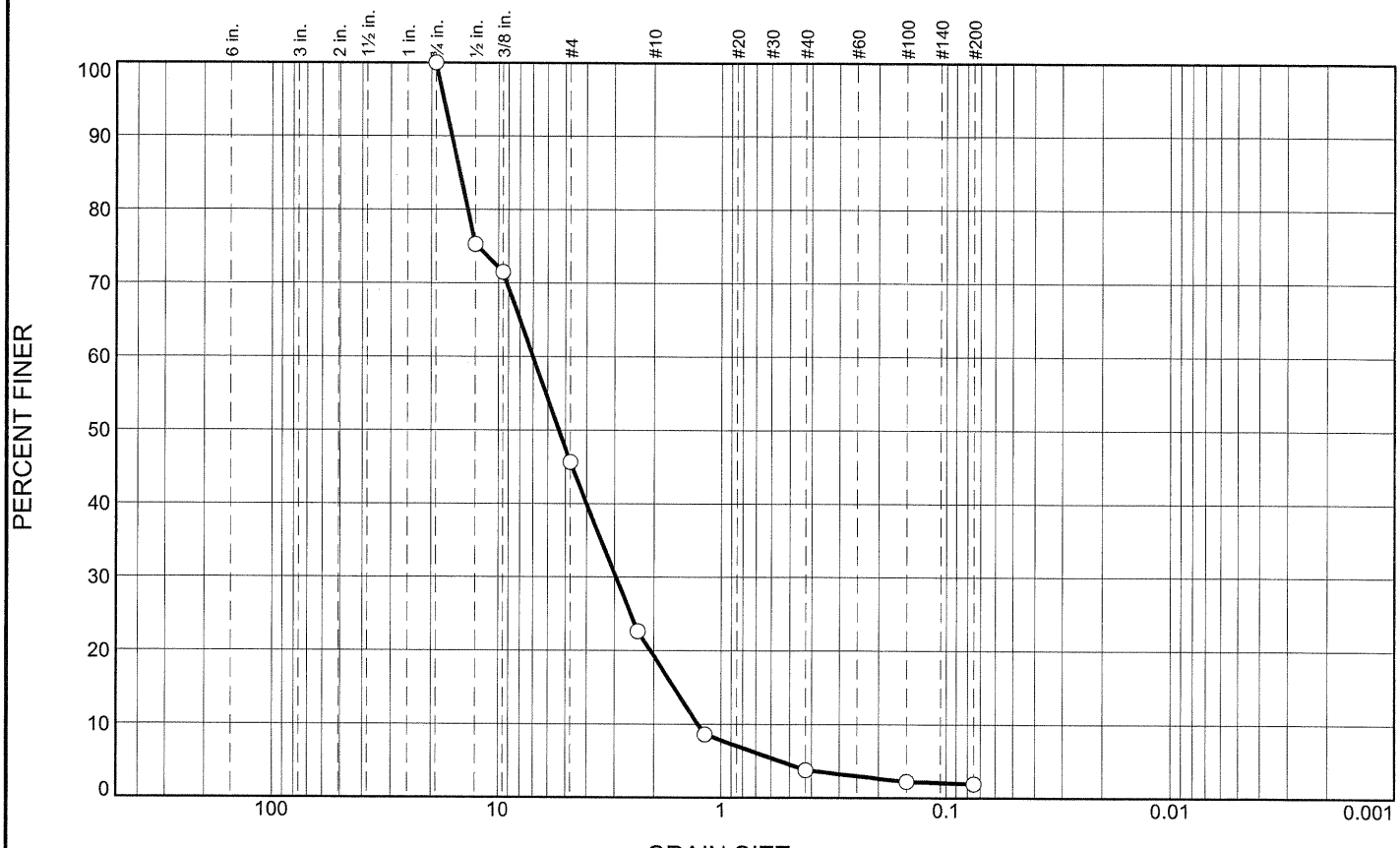
No intermediate well was installed at the Chemung Township location. The one possible zone where a possible well could be installed is through granular deposits that were found at a depth of 81 to 83 feet. It was determined that these thin medium sand seams were not considered significant enough to justify an additional well at the site.

The deep well was installed in bedrock that was encountered at 103 ft bgs. No sand or gravel deposits were found below 83 feet. A possible buried soil horizon consisting of mottled dark brown and black organic silt was observed at a depth of 96 to 97 ft bgs. The possible paleosol was deposited overlying the basal till unit. The borehole was advanced to a depth of roughly 111 ft and the well was set entirely within rock. The deep well appeared to produce an adequate volume of water since a high head in the well was observed shortly after installation (i.e. static water level was < 8 ft bgs). A slight upward gradient between the deep and shallow well was also observed. However, based on the conductivity testing, the deep well had the lowest permeability of all the wells.

The Chemung Township well site is located in an area of flat outwash deposits that provide good recharge conditions to the shallow aquifer. The site does not appear to be located in a deeply incised tributary to the Troy Bedrock Valley which is located northwest of the site. These tributary buried valleys have been suggested as targets for potential groundwater resource exploration by Curry and others (1997).

Well Site Testing Results

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	54.4	26.3	15.5	1.9	1.9	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.75	100.0		
.5	75.3		
.375	71.5		
#4	45.6		
#8	22.6		
#16	8.6		
#40	3.8		
#100	2.2		
#200	1.9		

* (no specification provided)

Material Description

F-C Sand and Gravel Trace Silt

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 16.1674 D_{85}= 14.8940 D_{60}= 6.9903
D_{50}= 5.3414 D_{30}= 2.9540 D_{15}= 1.6179
D_{10}= 1.2624 C_u= 5.54 C_c= 0.99

Classification

USCS= GP AASHTO=

Remarks

Source of Sample: 1-CHE-S **Depth:** 39.0-40.0

Date: 12/05/08

STS | AECOM

Client: USACE
Project: McHenry County Wells
Project No: 200804080 **Figure**

Tested By: JRT

Groundwater Level Measurements

McHenry County Monitoring Well Installations
AECOM Project 09000-460

Site Number	1	
Township Name	Chemung	
Well Number	1-CHE-S	1-CHE-D
Ground Surface Elevation (ft msl)	896.24	896.24
Top of PVC Casing Elevation (ft)	898.69	898.69
Location of PVC Casing within Wellhead	North Well	South Well
Well Depth (Feet from TOC)[A]	42.70	113.20

Date	Depth to GW from TOC (ft)	GW Elevation (ft msl)	Depth to GW from TOC (ft)	GW Elevation (ft msl)
Sep. 26, 2008				
Oct. 09, 2008				
Oct. 14, 2008				
Oct. 16, 2008				
Oct. 21, 2008				
Oct. 22, 2008				
Oct. 24, 2008				
Oct. 28, 2008				
Oct. 29, 2008				
Oct. 30, 2008				
Nov. 07, 2008	10.64	888.05	10.25	888.44
Nov. 13, 2008				
Dec. 05, 2008	10.53	888.16	10.28	888.41
Dec. 08, 2008	10.52	888.17	10.27	888.42
Dec. 09, 2008				
Dec. 12, 2008				
Dec. 15, 2008				
Dec. 16, 2008				
Dec. 17, 2008				
Dec. 18, 2008				
Dec. 19, 2008				
Dec. 22, 2008				
Dec. 23, 2008				
Dec. 29, 2008				
Dec. 30, 2008				
Jan. 05, 2009				
Jan. 06, 2009				
Jan. 07, 2009				
Jan. 08, 2009				
Jan. 09, 2009	9.28	889.41	9.18	889.51
Jan. 10, 2009				
Jan. 12, 2009				
Feb. 24, 2009	9.67	889.02	9.51	889.18
Mar. 20, 2009				
end				

Notes:

ft msl = Elevation referenced to feet above mean sea level using the North American Vertical

TOC = Top of PVC Casing

ft = feet

[A] = as measured inside well

NI = Not Installed

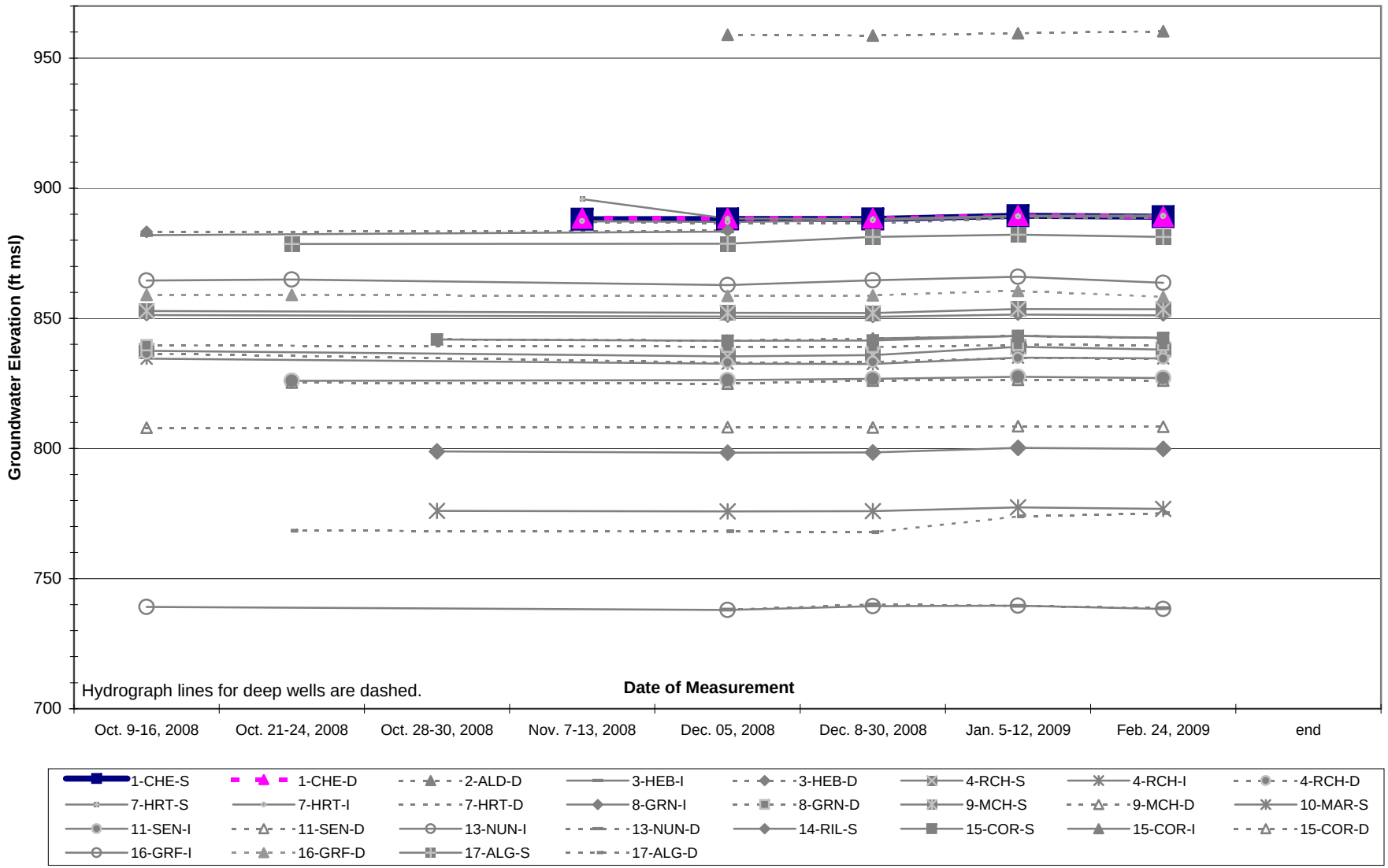
--- No Elevation

Well 17-Alg-S was frozen or partially frozen from December 5th, 2008.

Site 1 Groundwater Level Hydrograph
(includes ALL AECOM INSTALLED WELLS)

McHenry County Obervation Well Network

AECOM Project 09000-460

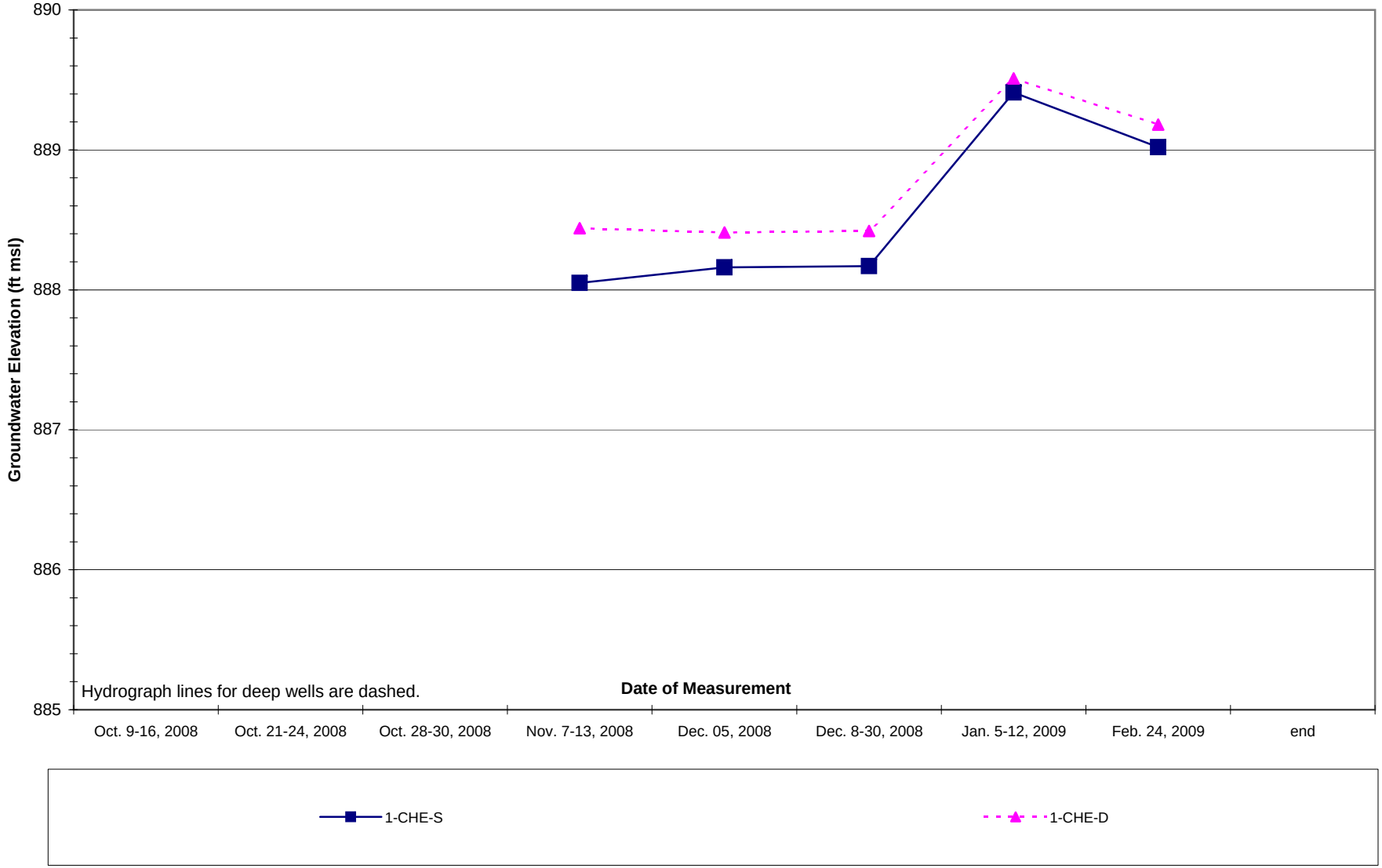


K:\PROJECTS\200804080\In_Progress\STS-McHenry Cty_WLs IN PROGRESS - figs for each site.xls

Site 1 Groundwater Level Hydrograph

McHenry County Obervation Well Network

AECOM Project 09000-460



K:\PROJECTS\200804080\In_Progress\STS-McHenry Cty_WLs IN PROGRESS - figs for each site.xls

Well Development Record

STS Consultants, Ltd.
11425 West Lake Park Drive
Milwaukee, Wisconsin 53224

Site Name: McHenry County

Well ID Number: 1-CHE-S

Date of Completion: 12/8/08

STS Job Number: 200804080 p4.4000

Start Time: 11:30

End Time: 13:55

Water color at start of development: Brown

Water color at end of development: Clear

Amount of water removed during development:

Contained water? ☐ Yes ☒ No

If not contained, where water disposed? Ground

Well Development Methods:

- ☐ Surged with bailer and bailed
- ☐ Surged with block and bailed
- ☐ Surged with block, bailed & pumped
- ☐ Bailed only
- ☐ Pumped slowly
- ☒ Surged with bailer and pumped
- ☐ Surged with block and pumped
- ☐ Compressed Air
- ☐ Pumped only
- ☐ Other

Equipment Used

- ☐ PVC bailer
- ☐ Well wizard
- ☐ Bean or Moino pump (on drill rig)
- ☐ Surge block
- ☒ Whale pumps
- ☒ Stainless Bailer

Notes: Surge Start: 11:30

End: 11:45

Purge Start: 11:55

End: 13:55

WL: 10.52'

WELL DEVELOPMENT FIELD RECORD

Job Name McHenry County Job No. 200804080 Well No. 1-CHE-5

Developed By Brian Schmidt Date of Install. _____ Sheet ____ of ____

Started Devel. ____ / ____ (DATE / TIME) Completed Devel. ____ / ____ (DATE / TIME)

W.L. Before Devel. 12/8/08 / ____ / ____ (DATE / TIME / DEPTH) After Devel. 12/8/08 / ____ / ____ (DATE / TIME / DEPTH)

Well Depth: Before Devel. _____ After Devel. _____ Well Dia. (in.) _____

Standing Water Column (ft.) _____ Standing Well Volume _____ gal.

Screen Length 5' Drilling Water Loss _____ gal.

DATE / TIME	VOLUME REMOVED (Gallons)	FIELD PARAMETERS SPEC. COND. (umhos/cm)	TEMP. (C°)	pH (s.u.)	TURB ~~Other~~	ORP	REMARKS
12/8/08 GAL	–	4520	12.1	3.96	0	✓	
12:05	6 GAL/min	939.0	9.0	5.75	266	–	RESURGED
12:15		934.0	9.1	6.78	999		" "
12:25		928.0	9.2	6.83	215		" "
12:35		927.0	9.2	6.86	236		" "
12:45		926.0	9.4	6.87	280		" "
12:55		925.0	9.2	6.88	37		
13:05		923.0	9.3	6.88	22		RESURGED
13:15		923.0	9.3	6.89	68		
13:25		924.0	9.4	6.89	18		
13:35		923.0	9.3	6.89	15		
13:45		921.0	9.3	6.89	12		
13:55		922.0	9.3	6.89	12		
		= TOTAL VOLUME REMOVED (Gallons)					

Development Method: _____

Notes:

Well Development Record

STS Consultants, Ltd.
11425 West Lake Park Drive
Milwaukee, Wisconsin 53224

Site Name: McHenry County

Well ID Number: 1-CH6-P

Date of Completion: 12/8/08

STS Job Number: 20080408 0 PH. 4000

Start Time: 12:15

End Time: 16:45

Water color at start of development: MILKY WHITE

Water color at end of development: CLEAR

Amount of water removed during development:

Contained water? ☐ Yes ☒ No

If not contained, where water disposed? GROUND

Well Development Methods:

- ☐ Surged with bailer and bailed
- ☐ Surged with block and bailed
- ☐ Surged with block, bailed & pumped
- ☐ Bailed only
- ☐ Pumped slowly
- ☒ Surged with bailer and pumped
- ☐ Surged with block and pumped
- ☐ Compressed Air
- ☐ Pumped only
- ☐ Other

Equipment Used

- ☐ PVC bailer
- ☐ Well wizard
- ☐ Bean or Moino pump (on drill rig)
- ☐ Surge block
- ☒ Whale pumps
- ☒ STAINLESS STEEL BAILER

Notes: SURGE START: 12:15

END: 12:30

PURGE START: 14:05

END: 16:45

WL: 10.27'

WELL DEVELOPMENT FIELD RECORD

Job Name: McHenry County | Job No. 20880480 | Well No. 1-CHE-D

Developed By: Brian Schmidt | Date of Install. _____ | Sheet ____ of ____

Started Devel. 12/8/08 / DATE / TIME | Completed Devel. 12/8/08 / DATE / TIME

W.L. Before Devel. ____ / DATE / TIME / DEPTH | After Devel. ____ / DATE / TIME / DEPTH

Well Depth: Before Devel. _____ | After Devel. _____ | Well Dia. (in.) _____

Standing Water Column (ft.) _____ | Standing Well Volume _____ gal.

Screen Length 5' | Drilling Water Loss _____ gal.

DATE / TIME	VOLUME REMOVED (Gallons)	FIELD PARAMETERS SPEC. COND. (umhos/cm)	TEMP. (C°)	pH (s.u.)	TURB ~~Other~~	ORP	REMARKS
12/8/08 14:10	6/GAL/MIN	654	9.9	7.29	999	–	
14:15		642	9.5	7.33	714	–	Pump Started Pumping WL 50
14:55	250 ML/MIN	818	4.5	7.70	999		Tried Bailing
15:15	" "	621	5.6	7.45	999		Restart Pump @ Well
15:25	" "	636	7.4	7.38	999	–	WL @ 14:50
15:35		502	6.6	7.38	999	–	
15:45	" "	488	8.7	7.39	999	–	
15:55		484	9.3	7.41	999	–	
16:05		476	9.2	7.41	999	–	
16:15		480	9.6	7.40	105	–	WL: 30.30
16:25	" "	473	9.7	7.42	21	–	
16:35		475	9.7	7.42	17	–	" "
16:45	" "	479	9.7	7.40	15	–	" "
		= TOTAL VOLUME REMOVED (Gallons)					

Development Method: _____

Notes:

First Environmental Laboratories, Inc.
IL ELAP / NELAC Accreditation # 100292
1600 Shore Road • Naperville, Illinois 60563 • Phone (630) 778-1200 • Fax (630) 778-1233

Analytical Report

Client: STS CONSULTANTS (VERN)
Project ID: McHenry County 200804080
Sample ID: 1-CHE-S
Sample No: 9-0115-011

Date Collected: 01/09/09
Time Collected: 11:45
Date Received: 01/13/09
Date Reported: 01/20/09

Analyte		Result	R.L.	Units	Flags
Total Metals	**Method: 6020A**		**Preparation Method 3010A**		
Analysis Date: 01/16/09			Preparation Date: 01/15/09		
Calcium		132	0.1	mg/L	
Iron		3.55	0.01	mg/L	
Magnesium		62.3	0.1	mg/L	
Potassium		8.5	0.1	mg/L	
Sodium		15.9	0.1	mg/L	
Alkalinity, Bicarbonate (CaCO3)	**Method: 2320B**				
Analysis Date: 01/15/09 13:30					
Alkalinity, Bicarbonate (CaCO3)		380	5	mg/L	
Alkalinity, Carbonate (CaCO3)	**Method: 2320B**				
Analysis Date: 01/15/09 13:30					
Alkalinity, Carbonate (CaCO3)		< 5	5	mg/L	
Chloride	**Method: 4500Cl, E**				
Analysis Date: 01/14/09					
Chloride		51	5	mg/L	
Sulfate	**Method: 375.2R2.0**				
Analysis Date: 01/15/09					
Sulfate		90	15	mg/L	

First Environmental Laboratories, Inc.

IL ELAP / NELAC Accreditation # 100292

1600 Shore Road • Naperville, Illinois 60563 • Phone (630) 778-1200 • Fax (630) 778-1233

Analytical Report

Client: STS CONSULTANTS (VERN)
Project ID: McHenry County 200804080
Sample ID: 1-CHE-D
Sample No: 9-0115-010

Date Collected: 01/09/09
Time Collected: 13:20
Date Received: 01/13/09
Date Reported: 01/20/09

Analyte		Result	R.L.	Units	Flags
Total Metals	**Method: 6020A**		**Preparation Method 3010A**		
Analysis Date: 01/16/09			Preparation Date: 01/15/09		
Calcium		101	0.1	mg/L	
Iron		7.37	0.01	mg/L	
Magnesium		60.9	0.1	mg/L	
Potassium		3.3	0.1	mg/L	
Sodium		21.5	0.1	mg/L	
Alkalinity, Bicarbonate (CaCO3)	**Method: 2320B**				
Analysis Date: 01/15/09 13:30					
Alkalinity, Bicarbonate (CaCO3)		300	5	mg/L	
Alkalinity, Carbonate (CaCO3)	**Method: 2320B**				
Analysis Date: 01/15/09 13:30					
Alkalinity, Carbonate (CaCO3)		< 5	5	mg/L	
Chloride	**Method: 4500Cl, E**				
Analysis Date: 01/14/09					
Chloride		10	5	mg/L	
Sulfate	**Method: 375.2R2.0**				
Analysis Date: 01/15/09					
Sulfate		< 15	15	mg/L	

Field Well Sampling Sheet

Fill out the entire form. If it does not apply, mark N/A.

Project Name: McHenry County
STS Job No. 200804080
Location: Chemung
Tester: Brian Schmidt
Well Number: 1-CHE-S
Date Sampled: 1/9/09
Previous Well Sampled: 14-RIL-S

GENERAL CONDITIONS:

						If Missing Replaced?	
Surface Seal:	X	Ok		Damaged		Missing:	Yes No
Protector Pipe:	X	Ok		Damaged		Missing:	Yes No
Well Cap:	X	Ok		Damaged		Missing:	Yes No
Ambient Temperature: 20 °F				Clear	X Cloudy	Rain	

WELL DATA:

Measuring Device: Solinist Water Level Meter
Stick Up or Down: Up (from Ground Surface)
Depth to Water: 9.28 (from TPVC)
Depth to Bottom: 40 (from TPVC)
Length of Water:
Free Product Observed: ☐ Yes ☒ No Thickness: N/A

PURGING/SAMPLING:

Well Purging Calculations: Amount to purge = 0.163 gallons/foot times height of water column in feet for one well volume

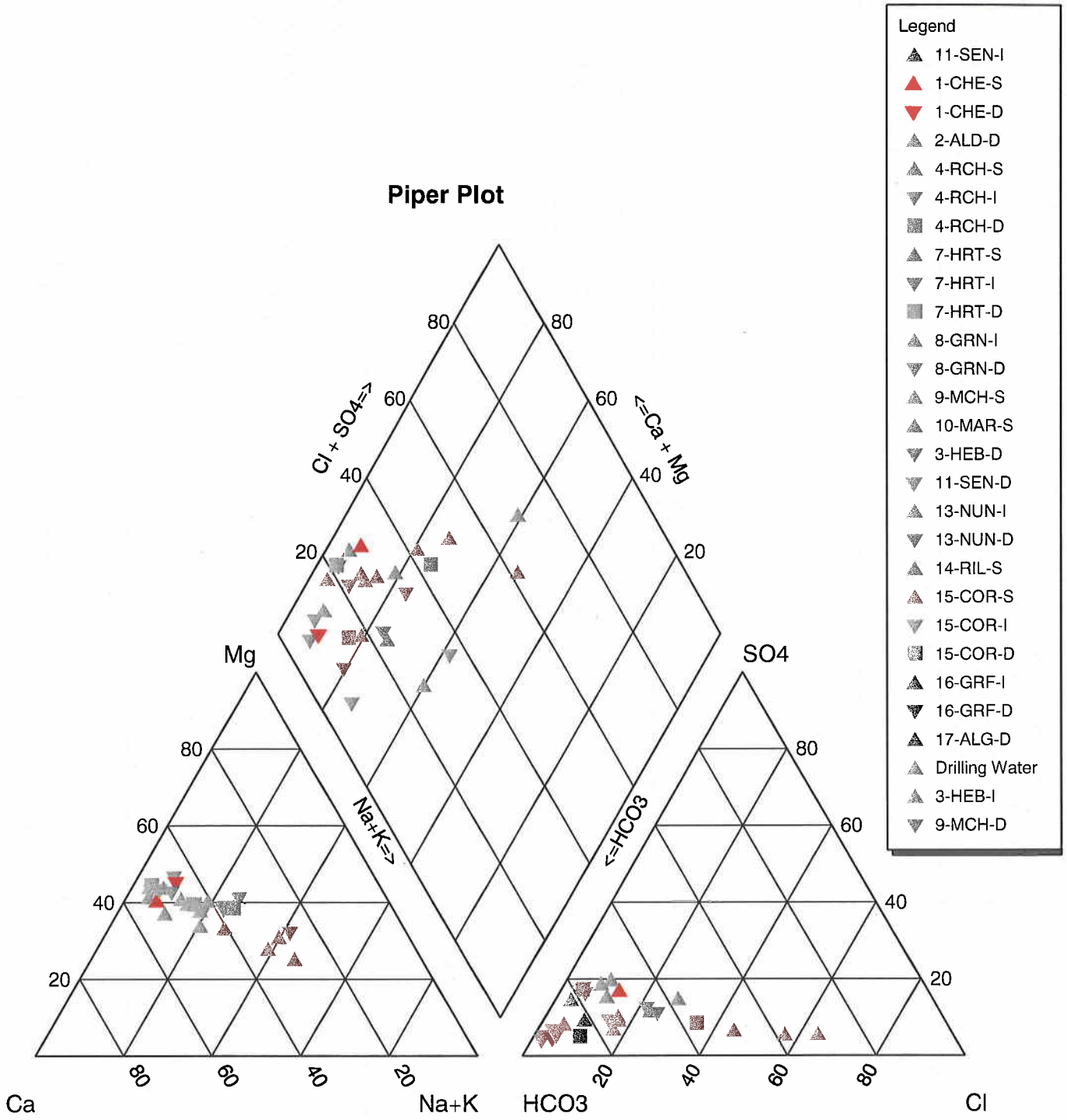
Purging Device: Bladder Pump
Sampling Device: Bladder Pump
Volume Required:
☒ See back of page for field readings during purge
Volume Purged:
Could Well Bail Dry? ☐ Yes ☒ No
Purging - Time Start: 10:45
Time Ended: 1150
Decon Method: Alconox

IN-SITU TESTING:

Turbidity: ☐ Turbid ☐ Opaque
Odor:
Color
pH @ degrees C
Uncorrected Conductivity X
Water Temp. (from Cond.)
Comments: ST: 1145

SAMPLES COLLECTED

Vocs -		Cyanide	
Metals -		Hexchrome	
SVOC		Alkalinity	
TOC		Chloride	
Sulfide		Ammonia	
Phenolics		COD	



DESCRIPTION: Piper Linear Diagram - Well Site #1

AECOM	PROJECT: McHenry County	PROJECT NO: 09000460
	CLIENT: Army Corps of Engineers	DATE: 7/30/2009

Well Purging Log

Date 1/9/09

Time	Temp	pH	Conductivity	~~ORP~~ TURB	~~DO~~ RATE
1/9/09 CAL	11.5	3.97	4530	0	—
1100	2.5	6.33	1670	999	250 mL/min
1105	3.6	6.43	1350	999	"
1110	6.4	6.46	1200	999	"
1115	9.4	6.45	1140	285	"
1120	9.8	6.52	1160	138	"
1125	10.3	6.59	1170	86	"
1130	10.7	7.03	1200	32	"
1135	10.7	6.95	1190	28	"
1140	10.7	7.02	1190	20	"
1145	10.8	7.03	1190	20	"
ST: 1145					

Field Well Sampling Sheet

Fill out the entire form. If it does not apply, mark N/A.

Project Name: Mahoning County
STS Job No. 200804080
Location: Chemung 6
Tester: Brian Schmidt
Well Number: 1-CHE-D
Date Sampled: 1/9/09
Previous Well Sampled: 1-CHE-S'

GENERAL CONDITIONS:

					If Missing Replaced?
Surface Seal:	X Ok	Damaged		Missing:	Yes No
Protector Pipe:	X Ok	Damaged		Missing:	Yes No
Well Cap:	X Ok	Damaged		Missing:	Yes No
Ambient Temperature: 20 °F		Clear	X Cloudy	Rain	

WELL DATA:

Measuring Device: Solinist Water Level Meter
Stick Up or Down: UP (from Ground Surface)
Depth to Water: 9.18 (from TPVC)
Depth to Bottom: 110 (from TPVC)
Length of Water:
Free Product Observed: ☐ Yes ☒ No Thickness: N/A

PURGING/SAMPLING:

Well Purging Calculations: Amount to purge = 0.163 gallons/foot times height of water column in feet for one well volume

Purging Device: Bladder Pump
Sampling Device: Bladder Pump
Volume Required:
☒ See back of page for field readings during purge
Volume Purged:
Could Well Bail Dry? ☐ Yes ☒ No
Purging - Time Start: 1210
Time Ended: 1330
Decon Method: Alconox

IN-SITU TESTING:

Turbidity: ☐ Turbid ☐ Opaque
Odor:
Color
pH @ degrees C
Uncorrected Conductivity X
Water Temp. (from Cond.)
Comments: ST 1320

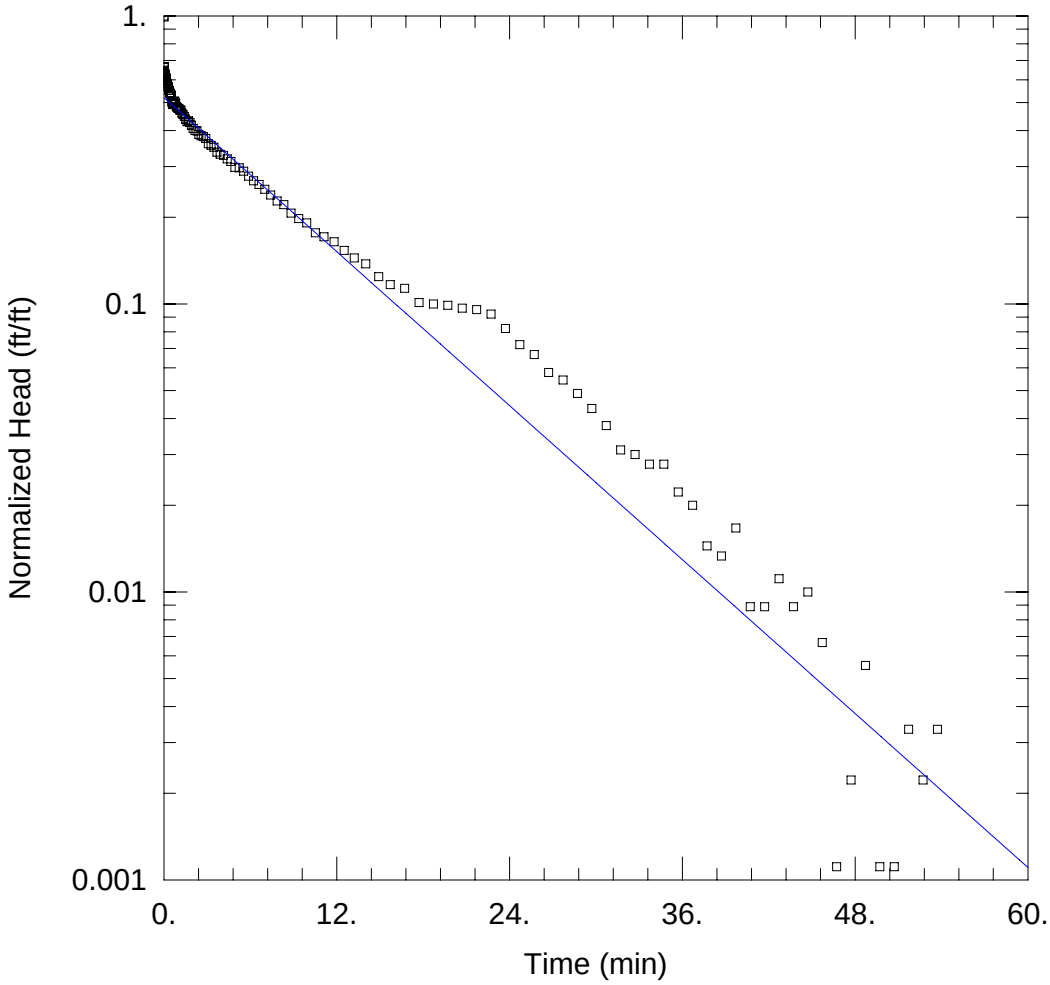
SAMPLES COLLECTED

Vocs -		Cyanide	
Metals -		Hexchrome	
SVOC		Alkalinity	
TOC		Chloride	
Sulfide		Ammonia	
Phenolics		COD	

Well Purging Log

Date 1/9/09

Time	Temp	pH	Conductivity	~~ORP~~ TURB	~~DO~~ RATE
1/9/09 1220	6.5	7.53	696	283	250 ML/MIN
1225	8.2	7.53	681	999	"
1230	8.6	7.54	677	999	"
1235	9.3	7.64	675	999	"
1240	9.6	7.68	674	999	"
1245	10.2	7.62	667	970	"
1250	10.4	7.64	665	883	"
1255	10.8	7.70	660	680	"
1300	9.9	7.69	655	472	"
1305	9.9	7.50	652	390	"
1310	10.3	7.55	645	335	"
1315	10.2	7.65	647	237	"
1320	10.3	7.55	644	200	"
ST: 1320					



WELL TEST ANALYSIS

Data Set: K:\PROJECTS\200804080\In_Progress\Troll-files\AQTESOLV-files\1-CHE-D_c001_B&R.aqt
Date: 04/05/09 Time: 12:08:58

PROJECT INFORMATION

Company: AECOM
Client: USACE / McHenry Cty
Project: 09000-460 (h200804080)
Location: McHenry County, IL
Test Date: Feb. 22, 2009

AQUIFER DATA

Saturated Thickness: 100. ft
Anisotropy Ratio (Kz/Kr): 0.33

WELL DATA (1-CHE-D)

Initial Displacement: 0.9 ft
Total Well Penetration Depth: 6.5 ft
Casing Radius: 0.083 ft
Static Water Column Height: 103. ft
Screen Length: 4.5 ft
Well Radius: 0.25 ft
Gravel Pack Porosity: 0.3

SOLUTION

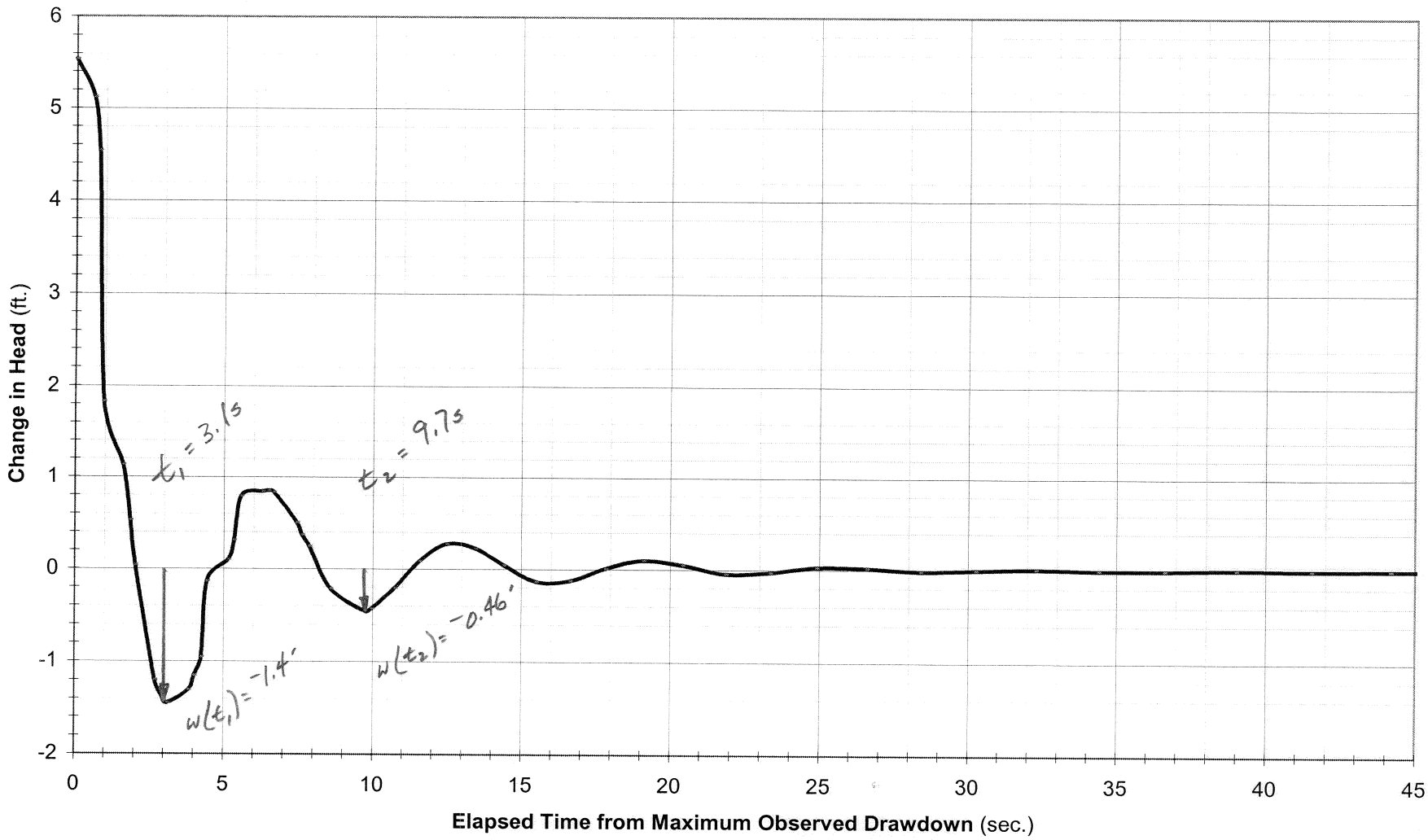
Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 8.958E-5 cm/sec
y0 = 0.468 ft

Underdamped Response to Sudden Change in Water Level

Hydraulic Conductivity Test Result

Chemung Township #1 - Shallow Well (Test #1)



Underdamped Wells.xls

1_CHE-S_t1

Calculation of Transmissivity of Underdamped Well Response to Slug Test

Chemung Township - Shallow Well (Test #1)
McHenry County Monitoring Well Network Installation
AECOM Environment Project No. 09000-460

Expression		Value	Units
$w(t_1)$	=	-1.4	ft.
$w(t_2)$	=	-0.46	ft.
t_1	=	3.1	sec.
t_2	=	9.7	sec.
R_c	=	0.083	ft.
R_s	=	0.083	ft.
L_c	=	27.2	ft.
L_s	=	5	ft.
τ	=	6.6	sec.
ϖ	=	0.9520	s^{-1}
γ	=	0.16864	s^{-1}
T	=	b+a lnT	
$(g/L)^{1/2}$	=	0.9668	
d	=	0.1744	
a	=	0.00477	ft^2/sec
Assume S	=	4.0E-02	
b	=	0.040	ft^2/sec
T_1	=	$b+a \ln T_0$	
Assume T_0	≈	b_1	
T_1	=	0.0251	ft^2/sec
T_2	=	0.0228	ft^2/sec
T	=	1972	ft^2/day
Aquifer Thickness	=	47	ft.
Hydraulic Conductivity	**=**	**42**	**ft/day**
		1.48E-02	**cm/sec**

Reference:
ASTM D5785-95 - (Analytical Procedure) for Determining Transmissivity of Confined Nonleaky Aquifers by Underdamped Well Response to Instantaneous Change in Head (Slug Test)

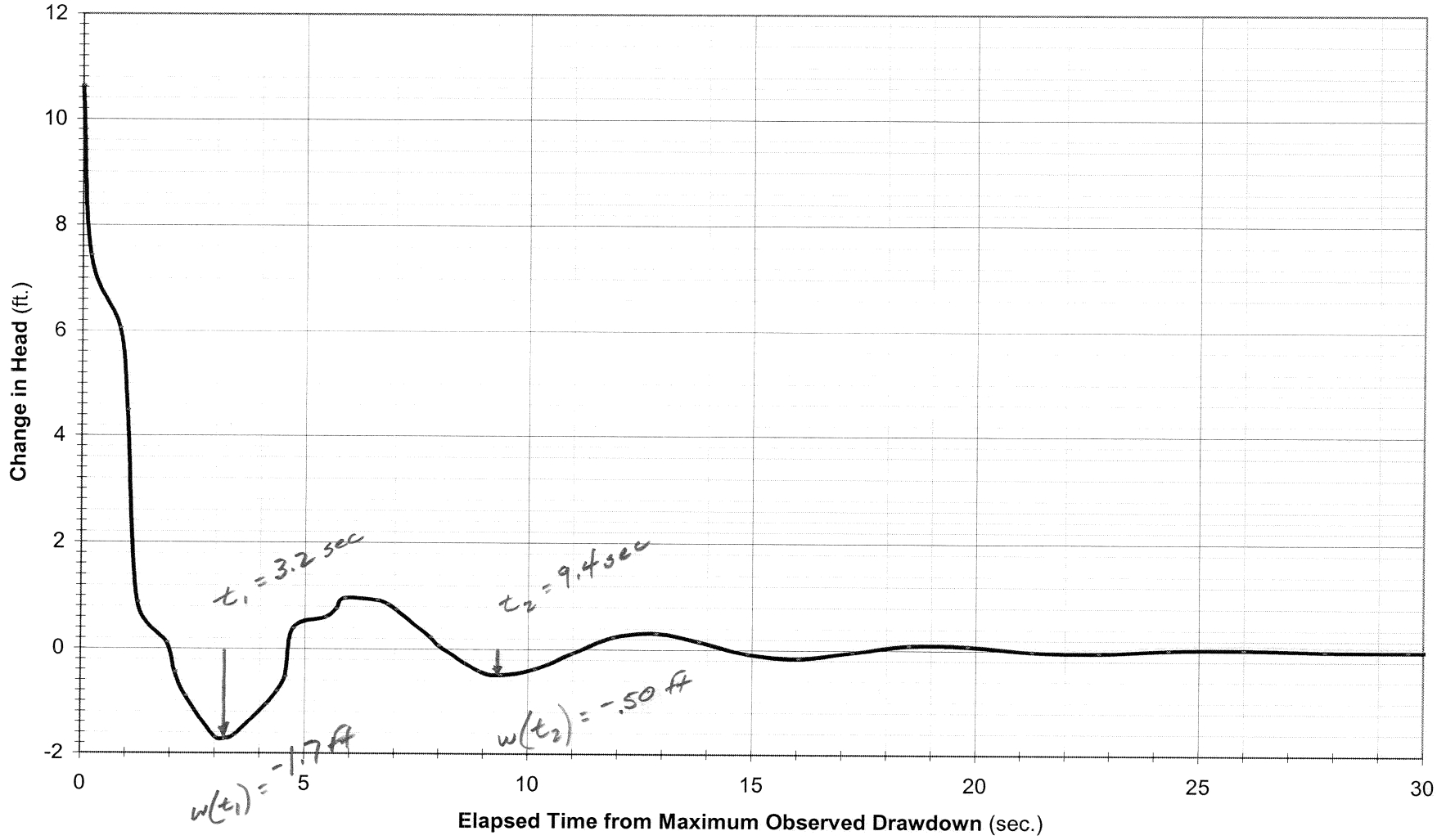
Check the results:

L	=	34.2 ft	-4.5	-13.2%	less than 20%?	**YES**
L	=	29.7 ft				
α	=	9.62E-02	less than 0.1?	**YES**		
d	=	0.1744	less than 0.7?	**YES**		

Underdamped Response to Sudden Change in Water Level

Hydraulic Conductivity Test Result

Chemung Township #1 - Shallow Well (Test #2)



Calculation of Transmissivity of Underdamped Well Response to Slug Test

Chemung Township - Shallow Well (Test #2)
McHenry County Monitoring Well Network Installation
AECOM Environment Project No. 09000-460

Expression		Value	Units
$w(t_1)$	=	-1.7	ft.
$w(t_2)$	=	-0.50	ft.
t_1	=	3.2	sec.
t_2	=	9.4	sec.
R_c	=	0.083	ft.
R_s	=	0.083	ft.
L_c	=	27.2	ft.
L_s	=	5	ft.
τ	=	6.2	sec.
ϖ	=	1.0134	s^{-1}
γ	=	0.19738	s^{-1}
T	=	b+a lnT	
$(g/L)^{1/2}$	=	1.0325	
d	=	0.1912	
a	=	0.00465	ft^2/sec
Assume S	=	3.0E-02	
b	=	0.040	ft^2/sec
T_1	=	b+a $\ln T_0$	
Assume T_0	≈	b_1	
T_1	=	0.0255	ft^2/sec
T_2	=	0.0233	ft^2/sec
T	=	2016	ft^2/day
Aquifer Thickness	=	47	ft.
Hydraulic Conductivity	**=**	**43**	**ft/day**
		1.51E-02	**cm/sec**

Reference:
ASTM D5785-95 - (Analytical Procedure) for Determining Transmissivity of Confined Nonleaky Aquifers by Underdamped Well Response to Instantaneous Change in Head (Slug Test)

Check the results:

L	=	30.0 ft	-0.3	-1.1%	less than 20%?	**YES**
L	=	29.7 ft				
α	=	8.51E-02	less than 0.1?	**YES**		
d	=	0.1912	less than 0.7?	**YES**		

Additional Well Site Information

In-Situ Inc.

1-CHE-5

Calibration Report

Report Number: 20090123211733-140964

221 East Lincoln Avenue, Fort Collins, CO 80524 USA
1-970-498-1500, 1-800-446-7488, FAX: 1-970-498-1598
Visit us at www.in-situ.com

Instrument Details:

Instrument Model:	**Level TROLL 500**
Full Scale Pressure Range	**206.84 KPa (30 PSI) vented**
Serial Number:	**140964**

Calibration Details:

Calibration Result:	**PASS**
Calibration Date:	2009-01-23 21:17:33 (UTC)
Nominal Range of Applied Temperature:	-5 C to +50 C
Temperature Accuracy Specification:	+/- 0.1 C From 0 C to +50 C
Nominal Range of Applied Pressure:	0 KPa to 206.8 KPa (0.0 PSI to 30.0 PSI)
Pressure Accuracy Specification:	+/- 0.1 %FS from -5 C to +50 C, +/- 0.05 %FS at +15 C

Post-Calibration Check:

Parameter	Applied	Reported	Deviation
Pressure	30.0000	29.9992	-0.0025
Pressure	0.0001	-0.0025	-0.0087
Temperature	19.9970	20.0146	0.0176

Calibration Procedures and Equipment Used:

Automated calibration procedures used.
Manu Agilent Model 34970A SerialNo MY44038788
Manu Instrulab Model 3312A-14-15-24 SerialNo 31138
Manu Instrulab Model 406X-0031-01 SerialNo 1-31118
Manu MENSOR Model 600 SerialNo 622742
Manu Agilent Model 53131A SerialNo MY47000169
Manu MENSOR Model 600 SerialNo 621385

Notes:

1. Standards used in this calibration are traceable to the National Institute of Standards and Technology.
2. This calibration report shall not be reproduced, except in full, without the written approval of In-Situ, Inc.
3. A calibration interval of 12 to 18 months is recommended.
4. The post-calibration data is collected at nominal +20 C.
5. 1.0 PSI = 6.894757 KPa

Performed By: JBO

Copyright © 2006 In-Situ, Inc.

In-Situ Inc.

1-CHE-D

Calibration Report

Report Number: 20090109141844-140446

221 East Lincoln Avenue, Fort Collins, CO 80524 USA
1-970-498-1500, 1-800-446-7488, FAX: 1-970-498-1598
Visit us at www.in-situ.com

Instrument Details:

Instrument Model:	**Level TROLL 500**
Full Scale Pressure Range	**206.84 KPa (30 PSI) vented**
Serial Number:	**140446**

Calibration Details:

Calibration Result:	**PASS**
Calibration Date:	2009-01-09 14:18:44 (UTC)
Nominal Range of Applied Temperature:	-5 C to +50 C
Temperature Accuracy Specification:	+/- 0.1 C From 0 C to +50 C
Nominal Range of Applied Pressure:	0 KPa to 206.8 KPa (0.0 PSI to 30.0 PSI)
Pressure Accuracy Specification:	+/- 0.1 %FS from -5 C to +50 C, +/- 0.05 %FS at +15 C

Post-Calibration Check:

Parameter	Applied	Reported	Deviation
Pressure	30.0002	29.9977	-0.0085
Pressure	0.0008	-0.0015	-0.0077
Temperature	19.8930	19.8996	0.0066

Calibration Procedures and Equipment Used:

Automated calibration procedures used.
Manu Agilent Model 34970A SerialNo MY44015965
Manu Instrulab Model 3312A-14-15-24 SerialNo 31103-(41012)
Manu Instrulab Model 406X-0031-01 SerialNo 2-31138
Manu MENSOR Model 600 SerialNo 621435
Manu Agilent Model 53131A SerialNo MY47000169
Manu MENSOR Model 600 SerialNo 621385

Notes:

1. Standards used in this calibration are traceable to the National Institute of Standards and Technology.
2. This calibration report shall not be reproduced, except in full, without the written approval of In-Situ, Inc.
3. A calibration interval of 12 to 18 months is recommended.
4. The post-calibration data is collected at nominal +20 C.
5. 1.0 PSI = 6.894757 KPa

Performed By: NJH

Copyright © 2006 In-Situ, Inc.

Chemung Township Well Site

Chemung Township Well Site

Chemung Township Subsurface Samples

Chemung Township Subsurface Samples

Chemung Township Well Site

Chemung Township Well Site – Well with Protective Bollards

Chemung Township Well Site – Inside Well Casing

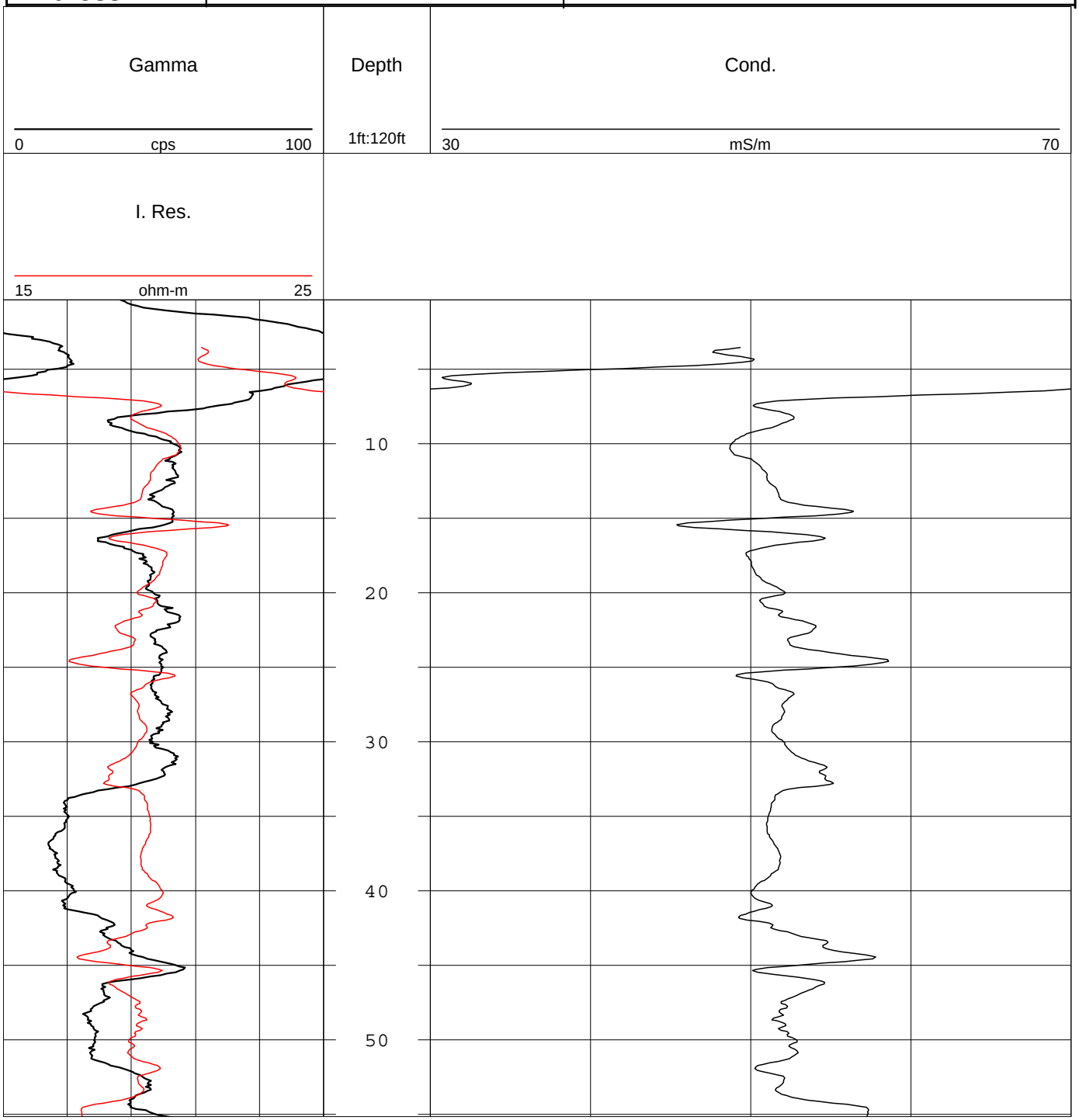
Chemung Township Well Site – Casing & Monument

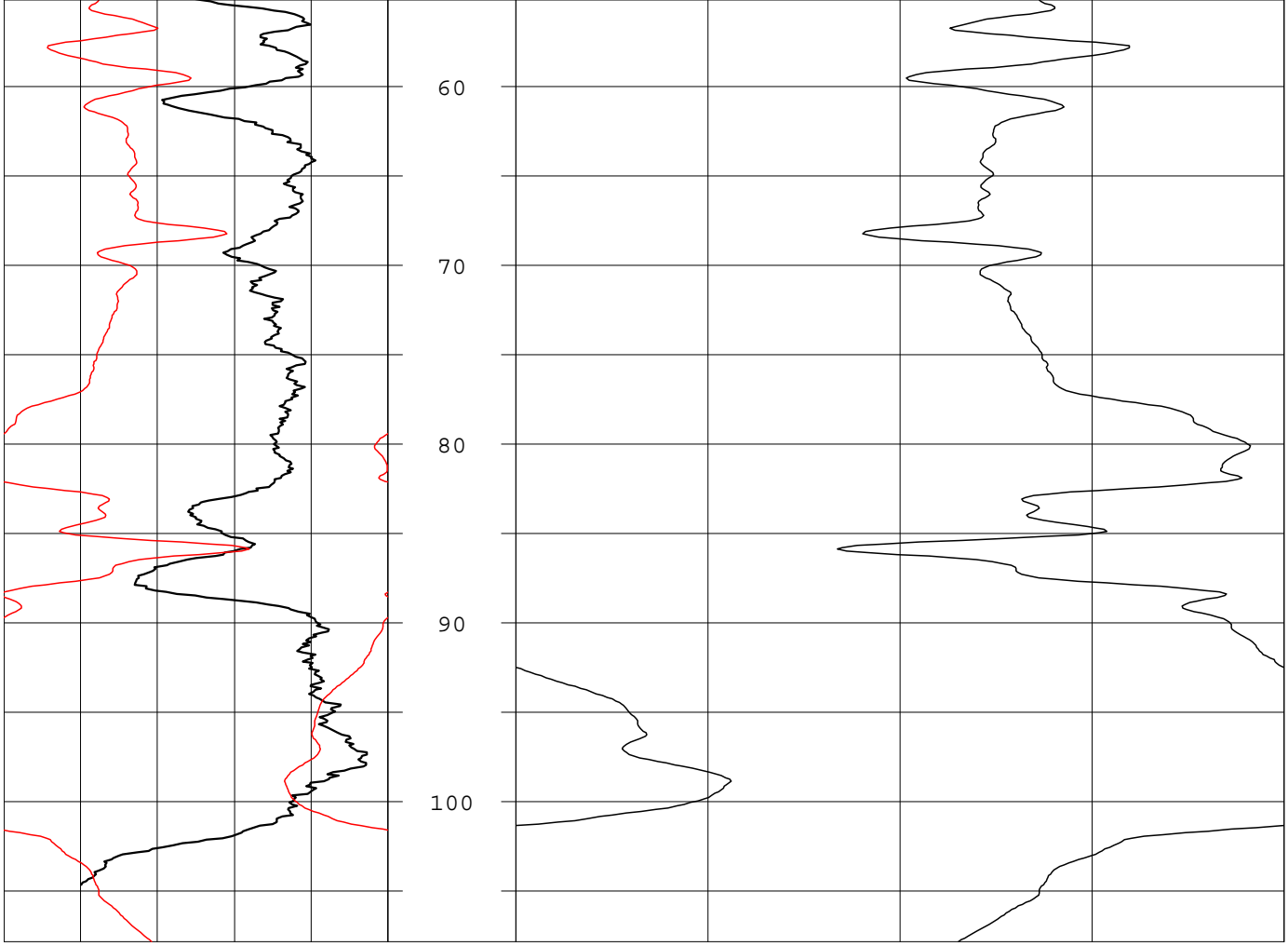
COMPANY:	MCHENRY CO. & USACE
Location:	CHEMUNG TWP

Well	CHEMUNG TWP #		
Date	1/22/2009	BH Fluid	FORMATION
Casing	2" PVC 2.3' AGS - 110 'BGS		
File Name	MCHTHCHEMUNG-09EMGAM		
Depth Driller	110.0' BGS		
Depth Logger	110.2' BGS		
Logged by:	T. YOUNG		
Witness:	NOT WITNESSED		

OTHER SERVICES

H2O LEVEL & GPS




60
70
80
90
100

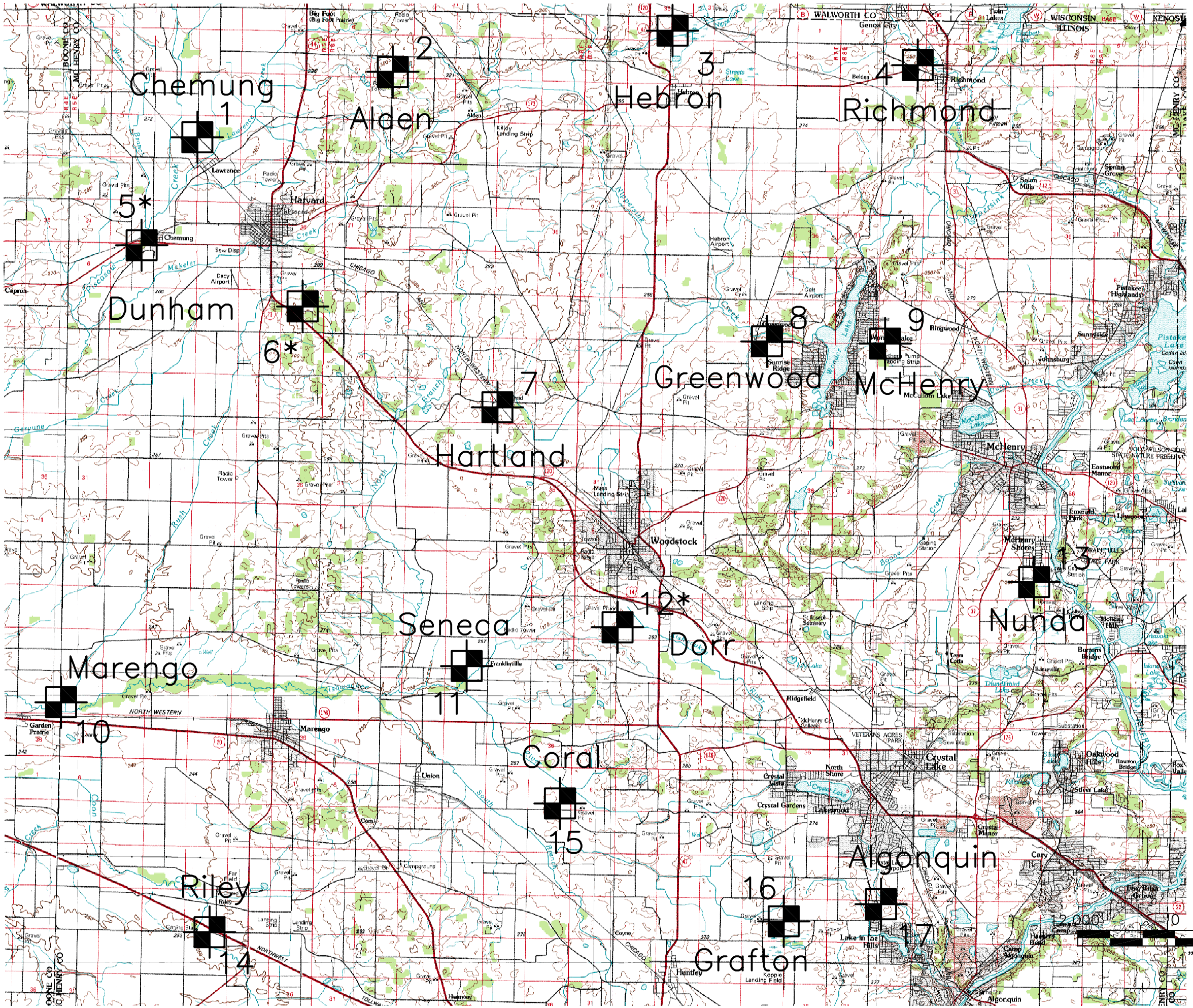
A-2: Folio for Well Site #2 – Alden Township

Table of Contents

I.) Site Location Map – Location in County
II.) Site Location Map – Location on USGS Topographic Map
III.) Site Location Map – Location on USGS High Resolution Orthophoto
IV.) Site Boring Log
V.) Well Construction Diagram
VI.) Well Site Summary and Commentary
VII.) Particle Size Distribution Report
VIII.) Table of Water Level Measurements
IX.) Well Development Field Log
X.) Water Quality Analysis Results
XI.) Groundwater Sampling Field Log
XII.) Hydraulic Conductivity Testing Results
XIII.) In-Situ LevelTroll™ Calibration Report
XIV.) Site Photographs
XV.) Downhole Geophysical Testing

Well Site Location Maps

Z:\Projects\200804080\CtyWide\D-09000-460-8000_CtyOverviewMap_004.dwg; 4/20/2009 5:33:59 PM; BRAUN, GARY



LEGEND:

AECOM Well Installation Site

McHenry 9

Well Installations By Others

Dunham 6*

0 12,000 24,000'

" = 12,000'

AECOM

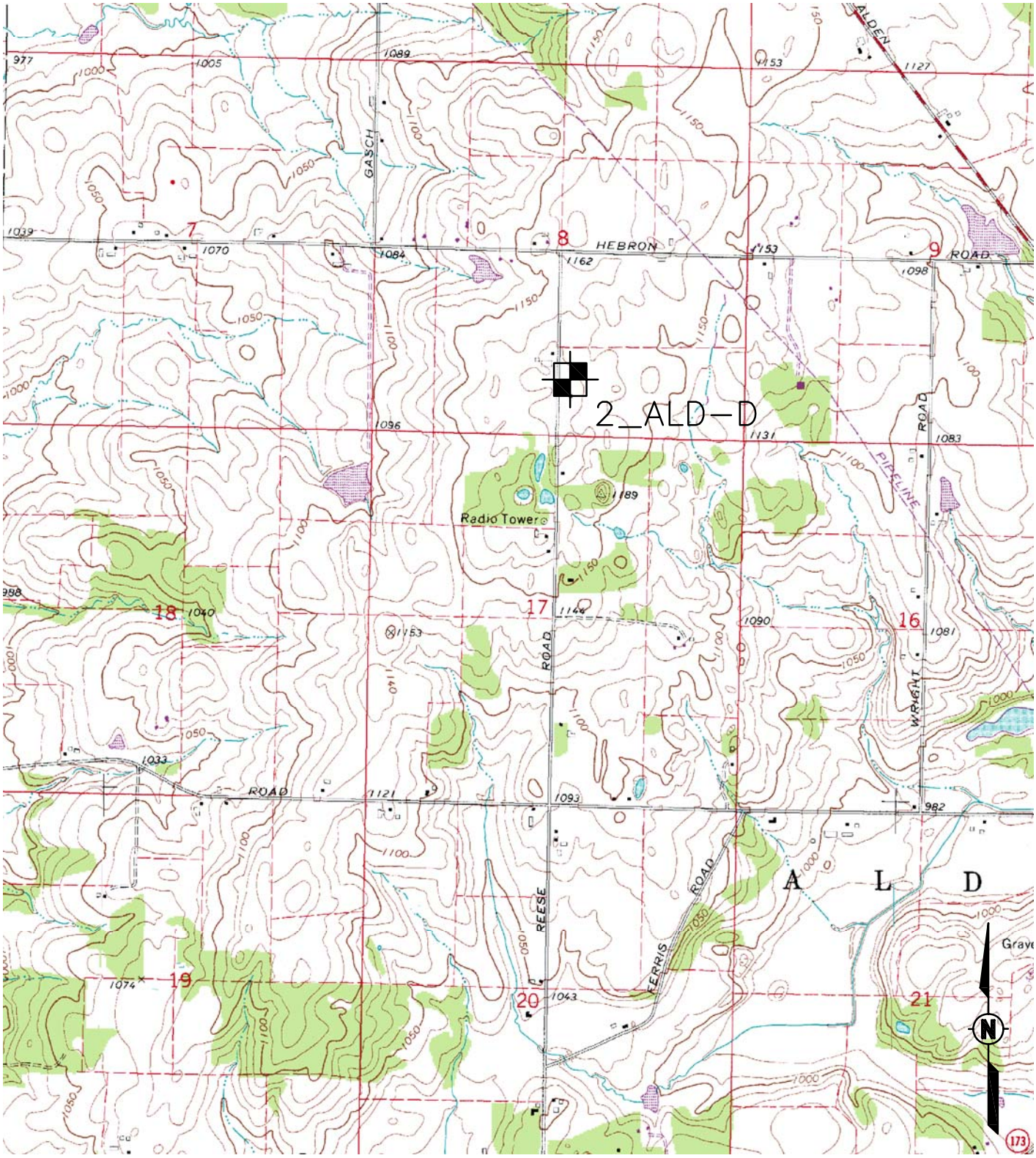
750 Corporate Woods Pkwy
Vernon Hills, IL 60061
847-279-2500
www.aecom.com

Copyright © By: STS Consultants, Ltd.

LOCATION MAP OF WELL SITES

Observation Well Network for Glacial Aquifers
McHenry County, Illinois

Drawn :	CJH	3/11/2009
Checked:	GMB	4/18/2009
Approved:	CSR	4/27/2009
PROJECT NUMBER	09000-460	
FIGURE NUMBER	1	



2000 0 2000 4000

1" = 2000'

AECOM

750 Corporate Woods Parkway
Vernon Hills, IL 60061
847.279.2500
www.aecom.com

Copyright © 2009, By: AECOM

Site Location on USGS Topographic Map
Site No. 2 - Alden Township
Cty Topographic High - MCCD Property - Reese Rd.
Observation Well Network
McHenry County, Illinois

Drawn :	CJH	04/01/2009
Checked:	GMB	04/15/2009
Approved:	CSR	04/24/2009
PROJECT NUMBER	09000-460	
FIGURE NUMBER	Folio_2 #2	

Z:\Projects\200804080\CtyWide\D-09000-460-8000_TopoMaps_v02.dwg; 4/20/2009 9:55:28 AM; BRAUN, GARY; STS_BLACK_040102.ctb

AECOM

750 Corporate Woods Parkway
Vernon Hills, IL 60061
847.279.2500
www.aecom.com
Copyright © 2009, By: AECOM

2005 USGS High Resolution Orthophoto
Site No. 2 - Alden Township
Cty Topographic High - MCCD Property - Reese Rd.
Observation Well Network
McHenry County, Illinois

Drawn :	CJH	04/01/2009
Checked:	GMB	04/15/2009
Approved:	CSR	04/24/2009
PROJECT NUMBER	09000-460	
FIGURE NUMBER	Folio_2 #3	

Z:\Projects\200804080\CtyWide\D-09000-460-8000_AerialsMap_004.dwg; 4/20/2009 11:48:25 AM; BRAUN, GARY; STS_BLACK_040102.ctb

Boring and Well Construction Details

DRILLING LOG

DIVISION	USACE
INSTALLATION	Chicago District
SHEET	1 OF 14 SHEETS
1. PROJECT	McHenry County Observation Wells
2. LOCATION (Coordinates or Station)	McHenry County, Illinois N 2,115,612.00 E 923,300.00
3. DRILLING AGENCY	WDC Exploration & Wells
4. HOLE NO. *(As shown on drawing title and file number)*	2-ALDEN
5. NAME OF DRILLER	Dan Tonnancour
6. DIRECTION OF HOLE	☒ VERTICAL ☐ INCLINED --- DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN	345.5
8. DEPTH DRILLED INTO ROCK	0.5
9. TOTAL DEPTH OF HOLE	346.0
10. SIZE AND TYPE OF BIT	3 7/8" Carbide Bit / 5 7/8" Casing
11. DATUM FOR ELEVATION SHOWN *(TBM or MSL)*	NAVD 88
12. MANUFACTURER'S DESIGNATION OF DRILL	Super Sonic II
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN	DISTURBED 35 / UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES	N/A
15. ELEVATION GROUND WATER	958.9
16. DATE HOLE	STARTED 10/31/2008 / COMPLETED 11/5/2008
17. ELEVATION TOP OF HOLE	+1176.4
18. TOTAL CORE RECOVERY FOR BORING	99 %
19. GEOLOGIST	Gary Braun, LPG IL

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
+1176.4	0.0		Topsoil: CL-ML, Dark brown clayey silt, some organics, soft	100	1 0.0 5.0	
+1175.4	1.0		SM, Brown sandy silt, some fine to coarse gravel, loose to 6.0', dense below, wet below 7.0' Note: Red mottling from 1.0' to 3.0'			
				100	2 5.0 15.0	Sample No. 1 from 5.0' to 6.0'
+1166.4	10.0					
+1164.4	12.0		SW, Brown fine to coarse sand, little fine gravel, dense, moist to wet			Sample No. 2 from 11.0' to 12.0'
+1161.4	15.0		CL, Brown sandy clay, trace to little gravel, stiff, damp			
			CL, Light pinkish gray sandy clay, little gravel, soft, moist, matrix supported massive diamicton Note: Mottled brown from 15.0' to 17.0'	100	3 15.0 25.0	

DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE 1176.4

Hole No. 2-ALDEN

PROJECT: McHenry County Observation Wells

INSTALLATION: Chicago District

SHEET 2 OF 14 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
			CL, Light pinkish gray sandy clay, little gravel, soft, moist, matrix supported massive diamicton Note: Mottled brown from 15.0' to 17.0' *(continued)*			Qp = 0.0 TSF at 23.0' Sample No. 3 from 24.0' - 25.0'
				100	4 25.0 35.0	
+1149.4	27.0					
			CL, Light pinkish gray silty clay, little sand and gravel, stiff to very stiff, damp			Qp = 0.0 TSF @27.0' Qp = 1.25 TSF @30.0' Qp = 1.5 TSF @33.0' Sanple No. 4 from 34.0' to 35.0'
				100	5 35.0 45.0	Qp = 1.25 TSF @37.0' Qp = 1.0 TSF @40.0' Qp = 0.5 TSF @43.0' Sample No. 5 from 44.0' to 45.0'
				100	6 45.0	

DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE 1176.4

Hole No. 2-ALDEN

PROJECT: McHenry County Observation Wells

INSTALLATION: Chicago District

SHEET 3 OF 14 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
			CL, Light pinkish gray silty clay, little sand and gravel, stiff to very stiff, damp *(continued)*		55.0	
						Qp = 1.5 TSF @47.0'
						Qp = 1.5 TSF @50.0'
						Qp = 2.5 TSF @53.0'
						Sample No. 6 from 54.0' to 55.0'
				100	7 55.0 65.0	
						QP = 2.5 TSF @58.0'
						Sample No. 7 from 61.0' to 62.0'
			Note: Fine sand seam encountered from 65.8' to 65.9'	100	8 65.0 75.0	
						Qp = 2.0 TSF @67.0'
						Qp = 4.5 TSF @68.5'
						Qp = 2.5 TSF at 70.0'

DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE 1176.4

Hole No. 2-ALDEN

PROJECT: McHenry County Observation Wells

INSTALLATION: Chicago District

SHEET 4 OF 14 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
			CL, Light pinkish gray silty clay, little sand and gravel, stiff to very stiff, damp *(continued)*			Qp = 2.5 TSF at 73.0' Sample No. 8 from 74.0' to 75.0'
+1101.4	75.0		CL-ML, Pink and brownish gray clayey silt, some sand and gravel, stiff, moist	100	9 75.0 85.0	Qp = 0.5 TSF @77.0' Qp = 2.0 TSF @80.0' Qp = 2.0 TSF @83.0' Sample No. 9 from 84.0' to 85.0'
+1091.4	85.0		CL, Pink and brownish gray silty clay, some sand and gravel, very stiff, moist	95	10 85.0 95.0	Qp = 1.25 TSF @91.0' Qp = 0.5 TSF @93.0' Sample No. 10 from 94.0' to 95.0'
				100	11 95.0 105.0	

DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE 1176.4

Hole No. 2-ALDEN

PROJECT: McHenry County Observation Wells

INSTALLATION: Chicago District

SHEET 5 OF 14 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
+1078.9	97.5					Qp = 0.5 TSF @97.0'
			GC, Brownish gray clayey sand and gravel, soft, slightly cohesive, moist			
+1076.4	100.0					
			CL, Pink and brownish gray silty clay, some sand and gravel, soft, moist			
						Qp = 0.75 TSF @101.0'
						Qp = 1.0 TSF @103.0'
						Sample No. 11 from 104.0' to 105.0'
				100	12 105.0 115.0	
						Qp = 0.0 TSF @108.0'
						Qp = 0.25 TSF @111.0'
						Qp = 0.0 TSF @113.0'
						Sample No. 12 from 114.0' to 115.0'
				100	13 115.0 125.0	
						Qp = 0.0 TSF @118.0'
						Qp = 0.25 TSF @121.0'

DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE 1176.4

Hole No. 2-ALDEN

PROJECT: McHenry County Observation Wells

INSTALLATION: Chicago District

SHEET 6 OF 14 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
			CL, Pink and brownish gray silty clay, some sand and gravel, soft, moist *(continued)*			Qp = 0.0 TSF @123.0'
						Sample No. 13 from 124.0' to 125.0'
				100	14 125.0 135.0	
			Note: Soft clayey sand lens (SC) encountered from 131.6' to 132.5' and 133.4' to 134.2'			
						Sample No. 14 from 132.0' to 133.0'
				90	15 135.0 145.0	
						Qp = 0.5 TSF @138.0'
						Qp = 1.0 TSF @141.0'
+1033.4	143.0					
			GW/SW, Brown sandy gravel-gravelly sand, some silt, moist			Sample No. 15 from 143.0' to 144.0'
+1030.9	145.5			100	16 145.0 155.0	
			GC, Brown silty-clayey-sandy-gravel, moist			

DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE 1176.4

Hole No. 2-ALDEN

PROJECT: McHenry County Observation Wells

INSTALLATION: Chicago District

SHEET 7 OF 14 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
			GC, Brown silty-clayey-sandy-gravel, moist *(continued)*			
			Note: Till			
			Note: Sand and gravel content decreases with depth			Sample No. 16 from 153.0' to 154.0'
+1021.4	155.0					
			CL, Brown silty clay, some sand and gravel, stiff to very stiff, moist	100	17 155.0 165.0	
						Sample No. 17 from 163.0' to 164.0'
				100	18 165.0 175.0	
						Qp = 2.5 TSF @168.0'
			Note: Less larger gravel in matrix below 170.0'			
						Sample No. 18 from 173.0' to 174.0'

DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE 1176.4

Hole No. 2-ALDEN

PROJECT: McHenry County Observation Wells

INSTALLATION: Chicago District

SHEET 8 OF 14 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
			CL, Brown silty clay, some sand and gravel, stiff to very stiff, moist *(continued)*			
				100	19 175.0 185.0	
						Sample No. 19 from 182.0' to 183.0'
				100	20 185.0 195.0	
						Sample No. 20 from 193.0' to 194.0'
				100	21 195.0 205.0	

DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE 1176.4

Hole No. 2-ALDEN

PROJECT: McHenry County Observation Wells

INSTALLATION: Chicago District

SHEET 9 OF 14 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
			CL, Brown silty clay, some sand and gravel, stiff to very stiff, moist *(continued)*			Qp = 3.5 TSF @200.0'
						Sample No. 21 from 203.0' to 204.0'
				100	22 205.0 215.0	
						Sample No. 22 from 213.0' to 214.0'
				100	23 215.0 225.0	
			Note: Trace gravel layers (1/2" - 1.0" thick) in matrix between 216.0' and 222.0'			
						Sample No. 23 from 223.0' to 224.0'
				100	24 225.0	

DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE 1176.4

Hole No. 2-ALDEN

PROJECT: McHenry County Observation Wells

INSTALLATION: Chicago District

SHEET 10 OF 14 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
			CL, Brown silty clay, some sand and gravel, stiff to very stiff, moist *(continued)*		235.0	
						Qp = 3.5 TSF @228.0'
						Qp = 3.5 TSF @230.0'
						Qp = 4.0 - 4.5 @233.0' Sample No. 24 from 233.0' to 234.0'
				100	25 235.0 245.0	
			Note: Trace coarse gravel encountered in till from 237.0' to 240.0'			
						Qp = 3.5 - 4.5 TSF @242.0'
				100	26 245.0 255.0	
						Qp = 2.5 - 3.0 TSF @247.0'
						Qp = 3.0 TSF @250.0'

DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE 1176.4

Hole No. 2-ALDEN

PROJECT: McHenry County Observation Wells

INSTALLATION: Chicago District

SHEET 11 OF 14 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
			CL, Brown silty clay, some sand and gravel, stiff to very stiff, moist *(continued)*			
						Qp = 3.5 - 4.5 TSF @253.0'
						Sample No. 26 from 253.0' to 254.0'
				100	27 255.0 265.0	
						Qp = 4.0 - 4.5 TSF @259.0'
						Sample No. 27 from 263.0' to 264.0'
				100	28 265.0 275.0	
						Qp = 4.0 - 4.5 TSF @272.0'
						Sample No. 28 from 273.0' to 274.0'
				100	29 275.0 285.0	

DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE 1176.4

Hole No. 2-ALDEN

PROJECT: McHenry County Observation Wells

INSTALLATION: Chicago District

SHEET 12 OF 14 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
			CL, Brown silty clay, some sand and gravel, stiff to very stiff, moist *(continued)*			
						Qp = 4.5 TSF @278.0'
			Note: Higher silt content encountered from 281.0' to 283.0'			
						Sample No. 29 from 283.0' to 284.0'
				100	30 285.0 295.0	
						Qp = >4.5 TSF @289.0'
						Sample No. 30 from 293.0' to 294.0'
				100	31 295.0 305.0	
						Qp = 4.0 - 4.5 TSF @301.0'

DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE 1176.4

Hole No. 2-ALDEN

PROJECT: McHenry County Observation Wells

INSTALLATION: Chicago District

SHEET 13 OF 14 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
			CL, Brown silty clay, some sand and gravel, stiff to very stiff, moist *(continued)*			Sample No. 31 from 303.0' to 304.0'
				100	32 305.0 315.0	
						Qp = 4.5 TSF @309.0'
						Sample No. 32 from 313.0' to 314.0'
				100	33 315.0 325.0	
			Note: Slight color change to gray brown below 317.0'			
						Sample No. 33 from 323.0' to 324.0'
				100	34 325.0 335.0	
						Qp = 4.5+ TSF @328.0'

DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE 1176.4

Hole No. 2-ALDEN

PROJECT: McHenry County Observation Wells

INSTALLATION: Chicago District

SHEET 14 OF 14 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
			CL, Brown silty clay, some sand and gravel, stiff to very stiff, moist *(continued)*			
+844.4	332.0					
			CL, Gray silty clay, little sand and gravel, hard, moist, low plasticity, matrix supported Diamicton			Sample No. 34 from 334.0' to 335.0'
				100	35 335.0 345.0	
						Qp = 4.5+ TSF @338.0'
+836.4	340.0					
			SW, Gray medium sand, little silt, fine to coarse sand and fine gravel, trace clay, wet			
						Sample No. 35 from 342.0' to 343.0' % Gravel/% Sand/% Fines = 15/73/13 from 342.0' to 343.0'
+830.9	345.5			100	36 345.0 346.0	Sample No. 36 from 345.0' to 346.0' (plus extra for sieve Analysis)
+830.4	346.0		Bedrock, light gray to light greenish gray shaley dolomite, moderately hard but fissile, slightly weathered, micro-crystalline, thinly bedded Note: Driller noted chatter, difficult drilling starting at 345.5'			AECOM Project No. 60095270
			END OF BORING - 346.0' BGS			

Hole No. 2 - ALDEN TWP

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 1 OF 24 SHEETS

1. PROJECT: McHenry City Wells
2. LOCATION (Coordinates or Station): N2,115,612' E 923,300' ILST PLE
3. DRILLING AGENCY: WDC Exploration & Wells
4. HOLE NO. (As shown on drawing title and title number): 2-ALD
5. NAME OF DRILLER: Dan Tonnancowe
6. DIRECTION OF HOLE: ☑ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 345.5 ft
8. DEPTH DRILLED INTO ROCK: 0.5 ft
9. TOTAL DEPTH OF HOLE: 346 ft
10. SIZE AND TYPE OF BIT: 3 7/8" Carbide Sampler
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): NAVD 88
12. MANUFACTURERS DESIGNATION OF DRILL: Super Sonic II
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 35 / UNDISTURBED Ø
14. TOTAL NUMBER CORE BOXES: Ø
15. ELEVATION GROUND WATER: 958.9 ft MSL Measured (12/5/08)
16. DATE HOLE: STARTED 10-31-08 / COMPLETED 11-5-08
17. ELEVATION TOP OF HOLE: 1176.4 ft MSL
18. TOTAL CORE RECOVERY FOR BORING: 344.5' (99%+)
19. SIGNATURE OF INSPECTOR: Gary M. Brown LPG IL

Roto-Sonic 5 7/8" Casing

WELL LOCATED IN FIELD N/ of 10207 N. Reese Road, ALDEN TWP [HARVARD, IL MAILING ADD.]

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
1176.4	0		Dark Brown Clayey SILT, some organics, soft (CL-ML) Topsoil		Bag 1	Run 1 (0-5) Rec/Run = 5/5 = 100%
	1		Brown Sandy SILT, some F-C. gravel, loose to 6 ft, dense below, wet below 7 ft, no cohesiveness (SM) Red Mottling (1-3 ft)	REC. 100%		
	2					
	3				Bag 2	
	4					
	5					
	6				s1 Bag 3	Run 2 (5-15) Rec/Run = 10'/10' = 100%
	7					
	8					
	9				Bag 4	
1166.4	10		Brown fine to Coarse SAND, little fine gravel, dense, moist to wet (SW) Abrupt clay seam	REC 100%		
	11				s2	
	12					
	13		Brown Sandy CLAY, trace to little gravel, stiff, damp (CL) Diamicton		Bag 5	
	14					
	15					

0848
0852
0853 Drive 4" Core Barrel
0855
0856 Drive 6" Casing
0900
Extract Samples 0902

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT: McHenry City Wells — HOLE NO. 2 - ALDEN TWP

Hole No. 2 - ALDEN TWP

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 2 OF 24 SHEETS

1. PROJECT McHenry City Wells	10. SIZE AND TYPE OF BIT 3 7/8" Carbide Jumper 5 7/8" Casing
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) NAVD 88
3. DRILLING AGENCY WDC Exploration & Wells	12. MANUFACTURERS DESIGNATION OF DRILL Super Sonic II
4. HOLE NO. (As shown on drawing title and title number) 2-ALD	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 35; UNDISTURBED Ø
5. NAME OF DRILLER Dan Townsend Cowie	14. TOTAL NUMBER CORE BOXES Ø
6. DIRECTION OF HOLE ☑ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER 958.9 - 12-5-08
	16. DATE HOLE: STARTED 10-31-08; COMPLETED 11-5-08
7. THICKNESS OF OVERBURDEN 345.5'	17. ELEVATION TOP OF HOLE 1176.4 FT MSL
8. DEPTH DRILLED INTO ROCK 0.5'	18. TOTAL CORE RECOVERY FOR BORING 344.5'
9. TOTAL DEPTH OF HOLE 346'	19. SIGNATURE OF INSPECTOR Thomas M. Brown LPG IL

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	15		Light Pinkish Gray Sandy CLAY, little gravel, soft, moist (CL), Matrix supported massive diamicton, Mottled Brown 15-17ft			Run 3 (15-25) Rec/Run = 10'/10' = 100%
	16				Bag 6	
	17					
	18					
	19					0909 ↓ Drive 6" Casing 0910
1156.4	20		Tiskilwa Till	REC. 100%	Bag 7	
	21					
	22					
	23				Bag 8	0.0 tsf
	24					Extract Samples 0913
	25				S3	
	26				Bag 9	Run 4 (25-35) Rec/Run = 10'/10' = 100% 0.0 tsf 0917 ↓ Drive 4" Core Barrel 0919
	27		Thin sand seam, then Abrupt contact			
	28		Light Pinkish Gray Silty CLAY, little sand & gravel, stiff to very stiff, damp (CL) cont. Tiskilwa Till	REC 100%	Bag 10	Drive 6" Casing 0921 ↓ 0923
1146.4	30					1.25 tsf

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT McHenry City Wells — HOLE NO. 2-ALDEN TWP

Hole No. 2 - ALDEN TWP

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 3 OF 24 SHEETS

1. PROJECT McHenry Cty Wells	10. SIZE AND TYPE OF BIT 3 7/8" Carbide Sampler
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) NAVD 88
3. DRILLING AGENCY WDC Exploration & Wells	12. MANUFACTURERS DESIGNATION OF DRILL Super Sonic II
4. HOLE NO. (As shown on drawing title and title number) 2 - ALD	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 35; UNDISTURBED Ø
5. NAME OF DRILLER DAN TONNAN COUR	14. TOTAL NUMBER CORE BOXES Ø
6. DIRECTION OF HOLE ☑ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.	15. ELEVATION GROUND WATER 958.9' 12-5-08
	16. DATE HOLE: STARTED 10-31-08; COMPLETED 11-5-08
7. THICKNESS OF OVERBURDEN 345.5'	17. ELEVATION TOP OF HOLE 1176.4 FT MSL
8. DEPTH DRILLED INTO ROCK 0.5'	18. TOTAL CORE RECOVERY FOR BORING 344.5'
9. TOTAL DEPTH OF HOLE 346'	19. SIGNATURE OF INSPECTOR Gary M. Brown LPG IL

Roto-Sonic 5 7/8" Casing

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
1146.4	30		cont.	cont.	cont. Bag 10	Run 4 (25-35') cont.
	31		Tiskilwa Till			
	32		from p.2 Medium Plasticity, Matrix Supported Massive Diamicton	100% REC.		Extract 0928
	33				Bag 11	1.5 tsf
	34					
	35				34	
	36					Run 5 (35-45) 0932 Drive 4" Core Barrel ↓ 0935
	37				Bag 12	REC/RUN = 10'/10' = 100% 1.25 tsf
	38					Drive 6" Casing 937 ↓ 939
	39					
1136.4	40			REC. 100%	Bag 13	1.0 tsf
	41					
	42					
	43				Bag 14	Extract Samples 0945
	44					0.5 tsf
	45				55	

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT McHenry Cty Wells | HOLE NO. 2 - ALDEN TWP

Hole No. 2-ALDEN TWP

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 4 OF 24 SHEETS

1. PROJECT McHenry Cty Wells	10. SIZE AND TYPE OF BIT 3 7/8" Carbide Sampler
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) NAVD 88
3. DRILLING AGENCY WDC Exploration & Wells	12. MANUFACTURERS DESIGNATION OF DRILL Super Sonic II
4. HOLE NO. (As shown on drawing title and title number) 2-ALD	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 35; UNDISTURBED Ø
5. NAME OF DRILLER DAN TOWNANCOUR	14. TOTAL NUMBER CORE BOXES Ø
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.	15. ELEVATION GROUND WATER 958.9' 12-5-08
	16. DATE HOLE: STARTED 10-31-08; COMPLETED 11-5-08
7. THICKNESS OF OVERBURDEN 345.5'	17. ELEVATION TOP OF HOLE 1126.4 FT MSL
8. DEPTH DRILLED INTO ROCK 0.5'	18. TOTAL CORE RECOVERY FOR BORING 344.5'
9. TOTAL DEPTH OF HOLE 346.'	19. SIGNATURE OF INSPECTOR Gary M. Brown LPG IL

5 7/8" CASING

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	45		Cont.			Run 6 (45-55)
	46		Tiskilwa Till		Bag 15	REC/RUN = 10'/10' = 100%
	47					1.5 tsf
	48					
	49			REC 100%	Bag 16	1.5 tsf
1126.4	50					
	51					
	52					
	53				Bag 17	2.5 tsf
	54					
					56	
	55					
	56				Bag 18	Run 7 (55-65') REC/RUN = 10'/10' = 100%
	57					
	58			REC 100%	Bag 19	2.5 tsf
	59					
1116.4	60					

0950 Drive 4" Casing 0953

Drive 6" Casing 0955 0957:30

Extract Samples 1003 BRK

1058 Drive 4" 1106

1109 Drive 6" Casing 1118

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT McHenry Cty Wells HOLE NO. 2-ALDEN TWP

Hole No. 2-ALDEN TWP

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 5 OF 24 SHEETS
1. PROJECT McHenry Cty Wells		10. SIZE AND TYPE OF BIT 3 7/8" Carbide Sampler	Roto-Sonic 5 7/8" Casing
2. LOCATION (Coordinates or Station)		11. DATUM FOR ELEVATION SHOWN (TBM or MSL) NAVD 88	
3. DRILLING AGENCY WDC Exploration & Wells		12. MANUFACTURERS DESIGNATION OF DRILL Super Sonic II	
4. HOLE NO. (As shown on drawing title and title number) 10-MAR		13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 35	UNDISTURBED Ø
5. NAME OF DRILLER DAN TONNANCOUR		14. TOTAL NUMBER CORE BOXES Ø	
6. DIRECTION OF HOLE ☑ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.		15. ELEVATION GROUND WATER 958.9 ft (12-5-08)	
		16. DATE HOLE: STARTED 10-31-08	COMPLETED 11-5-08
7. THICKNESS OF OVERBURDEN 345.5'		17. ELEVATION TOP OF HOLE 1176.4 ft MSL	
8. DEPTH DRILLED INTO ROCK 0.5'		18. TOTAL CORE RECOVERY FOR BORING 344.5 ft	
9. TOTAL DEPTH OF HOLE 346'		19. SIGNATURE OF INSPECTOR Gary M. Brown LPG IL	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
1116.4	60		SAME TILL AS ABOVE	CONT.		RUN 7 (55-65)
	61			70%	Bag 19 cont.	4.0+sf continued
	62			REC		57
	63				NR	
	64					Extract Samples 1122
	65					
	66		SAND SEAM		Bag 20	RUN 8 (65-75) 1127 Drive 4" Corebarrel
	67					REC/RUN = 10'+/10' = 100%+ 1130
	68				Bag 21	2.0 +sf 1132 Drive 6" Casing
	69					4.5 +sf 1138
1106.4	70			REC 100%	Bag 22	2.5 +sf
	71					
	72					
	73				Bag 23	2.5+sf
	74					Extract Sample 1144
	75				58	

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT McHenry Cty Wells | HOLE NO. 2-ALDEN TWP

Hole No. 2 - ALDEN TWP

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 6 OF 24 SHEETS
1. PROJECT McHenry Cty Wells		10. SIZE AND TYPE OF BIT 3 3/4" Carbide Sampler	
2. LOCATION (Coordinates or Station)		11. DATUM FOR ELEVATION SHOWN (TBM or MSL) NAVD 88	
3. DRILLING AGENCY WDC Exploration & Wells		12. MANUFACTURERS DESIGNATION OF DRILL Super Sonic II	
4. HOLE NO. (As shown on drawing title and title number)	2-ALD	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN	DISTURBED 35 / UNDISTURBED Ø
5. NAME OF DRILLER DAN TONNANCOUR		14. TOTAL NUMBER CORE BOXES Ø	
6. DIRECTION OF HOLE ☑ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.		15. ELEVATION GROUND WATER 958.9' 12-5-08	
		16. DATE HOLE	STARTED 10-31-08 / COMPLETED 11-5-08
7. THICKNESS OF OVERBURDEN 345.5'		17. ELEVATION TOP OF HOLE 1176.4 FT MSL	
8. DEPTH DRILLED INTO ROCK 0.5'		18. TOTAL CORE RECOVERY FOR BORING 344.5'	
9. TOTAL DEPTH OF HOLE 346'		19. SIGNATURE OF INSPECTOR [signature] LPG IL	

RotoSonic 5 7/8" CASING

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g	
	75		Pink & Brownish Gray Clayey SILT, some sand & gravel, stiff, moist (CL-ML)			Run 9 (75-85)	1150 Drive 4"
	76				Bag 24	REC/RUN = 10+'/10' = 100%	1153
	77					0.5 tsf	1155 Drive 6" Casing
	78		cont. (Diamicton)				1159
	79		Tiskilwa Till cont	REC 100%			
1096.4	80				Bag 25	2.0 tsf	
	81						
	82						
	83				Bag 26	2.0 tsf	Extract Samples 1205
	84						
	85		Gradual Transition		59		
	86		Pink & Brownish Gray, Silty CLAY, some sand & gravel, very stiff, moist (CL)			Run 10 (85-95)	1305 Drive 4" Core Barrel
	87				Bag 27	REC/RUN = 9.5'/100' = 95%	1308
	88		cont. Diamicton of the Tiskilwa Till	REC 95%			1309 Drive 6" Casing
	89						1313
1086.4	90				Bag 28		

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT McHenry Cty Wells — HOLE NO. 2 - ALDEN TWP

Hole No. 2 - ALDEN TWP

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 7 OF 24 SHEETS

1. PROJECT McHenry Cty Wells	10. SIZE AND TYPE OF BIT 3 7/8" Carbide Sampler
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) NAVD 88
3. DRILLING AGENCY WDC Exploration & Wells	12. MANUFACTURERS DESIGNATION OF DRILL Super Sonic II
4. HOLE NO. (As shown on drawing title and title number) 2 - ALD	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 35; UNDISTURBED 0
5. NAME OF DRILLER DAN TONNANCOUR	14. TOTAL NUMBER CORE BOXES 9
6. DIRECTION OF HOLE ☑ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER 958.9' 12-5-08
	16. DATE HOLE: STARTED 10-31-08; COMPLETED 11-5-08
7. THICKNESS OF OVERBURDEN 345.5'	17. ELEVATION TOP OF HOLE 1176.4 FT MSL
8. DEPTH DRILLED INTO ROCK 0.5'	18. TOTAL CORE RECOVERY FOR BORING 344.5 ft
9. TOTAL DEPTH OF HOLE 346'	19. SIGNATURE OF INSPECTOR Gary M. Brown LPG IL

5 7/8" CASING

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
1086.2	90		cont.		cont.	RUN 10 (85-95) cont.
	91		Tiskilwa Till	REC 95%	Bag 28	1.25 tsf
	92			cont.		
	93				Bag 29	0.5 tsf
	94					Extract Samples 1318
					s10	
	95					1323 ↓ 4" coring
	96					RUN 11 (95-105) REC/RUN = 10'/10' = 100% 1326
	97		0.5 ft gradations upper & lower		Bag 30	0.5 tsf 1329 ↓ Drive 6"
	98		Brownish Gray Clayey SAND & GRAVEL, soft, slightly cohesive, moist (GC/SC)			1332
	99			REC 100%		
1076.4	100		Pink & Brownish Gray Silty CLAY, some Sand & Gravel, soft moist (CL)		Bag 31	0.75 tsf
	101					
	102					
	103		cont Till (SAME AS ABOVE)		Bag 32	1.0 tsf
	104					Extract Samples 1337
	105				s11	

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT McHenry Cty Wells — HOLE NO. 2 - ALDEN TWP

Hole No. 2 - ALDEN TWP

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 8 OF 24 SHEETS

1. PROJECT McHenry Cty Wells	10. SIZE AND TYPE OF BIT 3 7/8" Carbide Sampler 5 7/8" casing
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) NAVD88
3. DRILLING AGENCY WDC Exploration & Wells	12. MANUFACTURERS DESIGNATION OF DRILL SuperSonic II
4. HOLE NO. (As shown on drawing title and title number) 10 - MAR	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 35; UNDISTURBED Ø
5. NAME OF DRILLER DAN TONNAN COUR	14. TOTAL NUMBER CORE BOXES Ø
6. DIRECTION OF HOLE ☑ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER 958.9' 12-5-08
	16. DATE HOLE: STARTED 10-31-08; COMPLETED 11-5-08
7. THICKNESS OF OVERBURDEN 345.5'	17. ELEVATION TOP OF HOLE 1176.4 Ft MSL
8. DEPTH DRILLED INTO ROCK 0.5'	18. TOTAL CORE RECOVERY FOR BORING 344.5'
9. TOTAL DEPTH OF HOLE 346'	19. SIGNATURE OF INSPECTOR Gary M Brown LPG IL

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g	
	105		cont.		Bag 33	RUN 12 (105-115) REC/RUN = 10'+/10' = 100%	1342 ↓ Sample w/4" 1344
	106		Silty CLAY w/ some sand & gravel				
	107		(higher sand content than above?)				
	108				Bag 34	0.0+sf	1346 ↓ Drive 6" Casing 1348
	109						
1066.4	110			REC 100%			
	111		Tiskilwa Till (cont.)		Bag 35	0.25+sf	
	112						
	113				Bag 36	0.0+sf	Extraction ~1357
	114				S/2		
	115				Bag 37	RUN 13 (115-125') REC/RUN = 10'+/10' = 100%	1404 ↓ Drive 4" (soft) 1405
	116						
	117				Bag 38	0.0+sf	1406 ↓ Drive 6" Casing 1408
	118			REC 100%			
	119						
1056.4	120				Bag 39		

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT McHenry Cty Wells | HOLE NO. 2 - ALDEN TWP

Hole No. 2 - ALDEN TWP

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 9 OF 24 SHEETS

1. PROJECT McHenry Cty Wells	10. SIZE AND TYPE OF BIT 3 7/8" Carbide Sampler
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) NAVD 88
3. DRILLING AGENCY WDC Exploration & Wells	12. MANUFACTURERS DESIGNATION OF DRILL Super Sonic II
4. HOLE NO. (As shown on drawing title and title number) 2-ALD	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 35; UNDISTURBED 0
5. NAME OF DRILLER DAN TONNANCOUR	14. TOTAL NUMBER CORE BOXES 0
6. DIRECTION OF HOLE ☑ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER 958.9' 12-5-08
	16. DATE HOLE: STARTED 10-31-08; COMPLETED 11-5-08
7. THICKNESS OF OVERBURDEN 345.5'	17. ELEVATION TOP OF HOLE 1176.4 FT MSL
8. DEPTH DRILLED INTO ROCK 0.5'	18. TOTAL CORE RECOVERY FOR BORING 344.5'
9. TOTAL DEPTH OF HOLE 346'	19. SIGNATURE OF INSPECTOR Gary M. Brown LPG 16

Roto Sonic 5 7/8" Casing

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
1056	120		cont.	cont.	cont.	Run 13 (115-125) cont.
	121		Tiskilwa Till	REC. 100%	Bag 39	0.25 tsf
	122		(lithology same as above)			
	123				Bag 40	0.0 tsf
	124				s13	Extract Samples @ 1419
	125					
	126				Bag 41	Run 14 (125-135) REC/Run = 10'/10' = 100%
	127					1455 Drive 4" Core Barrel 1456
	128					1458 Drive 6" Casing 1500
	129			REC 100%	Bag 42	
1046	130					
	131					
	132		soft clayey SAND lens (SC)		s14	
	133					
	134				Bag 43	Extract Samples 1508
	135					END OF DAY 10/31/08

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT McHenry Cty Wells — HOLE NO. 2 - ALDEN TWP

Hole No. 2 - ALDEN TOWNSHIP

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 10 OF 24 SHEETS

1. PROJECT: McHenry Cty Wells
2. LOCATION (Coordinates or Station): N2,115,612 E 923,300' IL St. Pl E
3. DRILLING AGENCY: WDC Exploration & Wells
4. HOLE NO. (As shown on drawing title and title number): 2 - ALD
5. NAME OF DRILLER: DAN TONNANCOUR
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 345.5'
8. DEPTH DRILLED INTO ROCK: 0.5'
9. TOTAL DEPTH OF HOLE: 346'
10. SIZE AND TYPE OF BIT: 3 7/8" Carbide Sampler & 5 7/8" Roto Sonic CASING
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): NAVD 88
12. MANUFACTURERS DESIGNATION OF DRILL: Super Sonic II
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 35; UNDISTURBED Ø
14. TOTAL NUMBER CORE BOXES: Ø
15. ELEVATION GROUND WATER: 958.9 Ft MSL → Measured (12/5/08)
16. DATE HOLE: STARTED 10-31-08; COMPLETED 11-5-08
17. ELEVATION TOP OF HOLE: 1176.4 Ft MSL
18. TOTAL CORE RECOVERY FOR BORING: 344.5'/346' = 99%+
19. SIGNATURE OF INSPECTOR: Barry M. Brown LPGIL

& DAN McHALE (135'-325')

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
11/3/08	135		Tiskilwa Till (cont.) Brown Silty CLAY, some sand & gravel, soft, moist (CL)		Bag 44	Run 15 (135-145) Rec 9.0 / Run 10 = 90%
	136					0740 ↓ 4" barrel 0741
	137					743 ↓ 6" Casing 746
	138			REC 90%	Bag 45	0.5 tsf
	139					
1036.4	140					
	141		grades to more sand ↓			1.0 tsf
	142					
	143		Brown Sandy GRAVEL, gravelly sand, some silt, moist (GW/SW)	5/5	Bag 46	
	144					
	145					
	146		interlayered w/ till from above	Rec 100%	Bag 47	Run 16 (145-155) Rec 10+ (12") / Run 10' = 100%+ 0808 ↓ 4" barrel 0810
	147					0811 ↓ 6" Casing 0814
Till less clayey higher % of S&G ↓	149		Brown Silty-Clayey-Sandy-Gravel (GC) moist			No tsf (not plastic enough)
	149					Samples @ 825
1026.4	150		cont. next pg		Bag 48	

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT: McHenry Cty Wells | HOLE NO. 2 - ALDEN TWP

Hole No. 2 - ALDEN TOWNSHIP

DRILLING LOG	DIVISION Chicago	INSTALLATION	SHEET 11 OF 24 SHEETS

1. PROJECT: McHenry Cty Wells
2. LOCATION (Coordinates or Station): N2,115,612 E 923,300 IL St. Pl. E
3. DRILLING AGENCY: WDC Exploration & Wells
4. HOLE NO. (As shown on drawing title and title number): 2 - ALD
5. NAME OF DRILLER: DAN TONNMANCOUR
6. DIRECTION OF HOLE: ☑ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 345.5'
8. DEPTH DRILLED INTO ROCK: 0.5'
9. TOTAL DEPTH OF HOLE: 346'
10. SIZE AND TYPE OF BIT: 3 7/8" Carbide Sampler & 5 7/8" Rotosonic Casing
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): NAVD 88
12. MANUFACTURERS DESIGNATION OF DRILL: Super Sonic II
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 35; UNDISTURBED Ø
14. TOTAL NUMBER CORE BOXES: Ø
15. ELEVATION GROUND WATER: 958.9 Ft MSL → Measured (12/5/08)
16. DATE HOLE: STARTED 10-31-08; COMPLETED 11-5-08
17. ELEVATION TOP OF HOLE: 1176.4 Ft MSL
18. TOTAL CORE RECOVERY FOR BORING: 344.5'/346' = 99%+
19. SIGNATURE OF INSPECTOR: Sam M Brown LPG IL

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
1026.4	150		from previous page: Till, more diamicton than above (ie 135-145') (less massive?) higher ~~[illegible]~~ sand & gravel content		Bag 49 (cont.)	Run 16 (cont)
	151					
	152					
	153			s16	Bag 49	
	154					
sand & gravel content decreases w/depth	155		Brown silty clay, some sand & gravel, moist, stiff to v. stiff, (CL)			Run 17 (155-165) 0828 ↓ 4" 0830
	156					Rec/Run = 11'/10' = 100% 832 ↓ 6" 836
	157				Bag 50	
	158		(Till similar to lithology above 140')			
	159			REC 100%		
1016.4	160				Bag 51	
	161					
	162					
	163			s17	Bag 52	Samples Extracted @ 0840
	164					
	165					

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT: McHenry Cty Wells | HOLE NO.: 2 - ALDEN TWP

Hole No. 2 - ALDEN TOWNSHIP

DRILLING LOG	DIVISION Chicago	INSTALLATION	SHEET 12 OF 24 SHEETS

1. PROJECT: McHenry Cty Wells
2. LOCATION (Coordinates or Station): N2,115,612 E 923,300' ILST. PLE
3. DRILLING AGENCY: WDC Exploration & Wells
4. HOLE NO. (As shown on drawing title and title number): 2 - ALD
5. NAME OF DRILLER: DAN TONNANCOUR
6. DIRECTION OF HOLE: [x] VERTICAL [ ] INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 345.5'
8. DEPTH DRILLED INTO ROCK: 0.5'
9. TOTAL DEPTH OF HOLE: 346'
10. SIZE AND TYPE OF BIT: 3 7/8" Carbide Sampler & 5 7/8" RotoSonic CASING
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): NAVD 88
12. MANUFACTURERS DESIGNATION OF DRILL: Super Sonic II
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 35; UNDISTURBED Ø
14. TOTAL NUMBER CORE BOXES: Ø
15. ELEVATION GROUND WATER: 958.9 Ft MSL → Measured (12/5/08)
16. DATE HOLE: STARTED 10-31-08; COMPLETED 11-5-08
17. ELEVATION TOP OF HOLE: 1176.4 Ft MSL
18. TOTAL CORE RECOVERY FOR BORING: 344.5'/346' = 99%+
19. SIGNATURE OF INSPECTOR: Barry M Brown LPG IL

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	165		SAME AS ABOVE (CL)			RUN 18 (165-175) 855 / 857 ↓ 4"
	166					REC/RUN 12'/10' = 100%+
	167				Bag 53	859 / 901 ↓ 6"
	168			REC 100%		2.5 tsf throughout run (except 165-166' which was softer @ 1.5 tsf)
	169					
1006.4	170		Note: less larger gravel in matrix		Bag 54	
	171					
	172					
	173				Bag 55	
	174			S18		
	175					
	176					RUN 19 (175-180) 948 ↓ 4" barrel 950
	177			REC 100%	Bag 56	REC/RUN 12'/10' = 100%+ 952 ↓ 6" casing 955
	178					
	179				Bag 57	
996.4	180					

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT: McHenry Cty Wells | HOLE NO. 2 - ALDEN TWP

Hole No. 2 - ALDEN TOWNSHIP

DRILLING LOG	DIVISION Chicago	INSTALLATION	SHEET 13 OF 24 SHEETS

1. PROJECT: McHenry Cty Wells
2. LOCATION (Coordinates or Station): N2,115,612 E 923,300 IL St. Pl E
3. DRILLING AGENCY: WDC Exploration & Wells
4. HOLE NO. (As shown on drawing title and title number): 2 - ALD
5. NAME OF DRILLER: DAN TONNANCOUR
6. DIRECTION OF HOLE: ☑ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 345.5'
8. DEPTH DRILLED INTO ROCK: 0.5'
9. TOTAL DEPTH OF HOLE: 346'
10. SIZE AND TYPE OF BIT: 3 7/8" Carbide Sampler & 5 7/8" Rotosonic Casing
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): NAVD 88
12. MANUFACTURERS DESIGNATION OF DRILL: Super Sonic II
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 35; UNDISTURBED Ø
14. TOTAL NUMBER CORE BOXES: Ø
15. ELEVATION GROUND WATER: 958.9 Ft MSL → Measured (12/5/08)
16. DATE HOLE: STARTED 10-31-08; COMPLETED 11-5-08
17. ELEVATION TOP OF HOLE: 1176.4 Ft MSL
18. TOTAL CORE RECOVERY FOR BORING: 344.5'/346' = 99%+
19. SIGNATURE OF INSPECTOR: Barry M. Brown LPG IL

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
996.4	180		SAME AS ABOVE (i.e. Brown Silty CLAY, some sand & gravel, moist very stiff (CL))		Cont.	Run 19 (cont.)
	181				Bag 57	
	182					
	183			517	Bag 59	
	184					
	185					Run 20 (185-195)
	186					Rec 12' / Run 10' = 100%+
	187				Bag 59	1018 ↓ 4" 1022
	188					1024 ↓ 6" casing 1028
	189			Rec 100%		
986.4	190				Bag 60	
	191					
	192					
	193			520	Bag 61	
	194					
	195					

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT: McHenry Cty Wells | HOLE NO. 2 - ALDEN TWP

Hole No. 2 - ALDEN TOWNSHIP

DRILLING LOG	DIVISION Chicago	INSTALLATION	SHEET 14 OF 24 SHEETS

1. PROJECT: McHenry Cty Wells
2. LOCATION (Coordinates or Station): N2,115,612 E 923,300' IL St. Pl. E
3. DRILLING AGENCY: WDC Exploration & Wells
4. HOLE NO. (As shown on drawing title and title number): 2 - ALD
5. NAME OF DRILLER: DAN TONNMANCOUR
6. DIRECTION OF HOLE: [X] VERTICAL [ ] INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 345.5'
8. DEPTH DRILLED INTO ROCK: 0.5'
9. TOTAL DEPTH OF HOLE: 346'
10. SIZE AND TYPE OF BIT: 3 7/8" Carbide Sampler & 5 7/8" RotoSonic CASING
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): NAVD 88
12. MANUFACTURERS DESIGNATION OF DRILL: Super Sonic II
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 35; UNDISTURBED Ø
14. TOTAL NUMBER CORE BOXES: Ø
15. ELEVATION GROUND WATER: 958.9 Ft MSL → Measured (12/5/08)
16. DATE HOLE: STARTED 10-31-08; COMPLETED 11-5-08
17. ELEVATION TOP OF HOLE: 1176.4 Ft MSL
18. TOTAL CORE RECOVERY FOR BORING: 344.5'/346' = 99%+
19. SIGNATURE OF INSPECTOR: Barry M. Brown LPG IL

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g	
	195		SAME AS ABOVE, but Sand content seems to be decreasing			RUN 21 (195-205)	1050 ↓ 4" 1053
	196				Bag 62	REC/RUN = 13'/10' = 100%+	1055 ↓ 6" Casing 1058
	197						
	198			REC 100%			
	199						
976.4	200				Bag 63	3.5 cof	
	201						
	202						
	203				Bag 64		
	204			521			
	205					RUN 22 (205-215)	1129 ↓ 4" 1131
	206				Bag 65	REC/RUN = 10'/10' = 100%	
	207			REC 100%			1134 ↓ 6" 1138
	208						
	209				Bag 66		
966.4	210						

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT: McHenry Cty Wells | HOLE NO. 2 - ALDEN TWP

Hole No. 2 - ALDEN TOWNSHIP

DRILLING LOG	DIVISION Chicago	INSTALLATION	SHEET 15 OF 24 SHEETS

1. PROJECT: McHenry Cty Wells
2. LOCATION (Coordinates or Station): N2,115,612 E 923,300' IL St. Pl. E
3. DRILLING AGENCY: WDC Exploration & Wells
4. HOLE NO. (As shown on drawing title and title number): 2 - ALD
5. NAME OF DRILLER: DAN TONNMANCOUR
6. DIRECTION OF HOLE: [x] VERTICAL [ ] INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 345.5'
8. DEPTH DRILLED INTO ROCK: 0.5'
9. TOTAL DEPTH OF HOLE: 346'
10. SIZE AND TYPE OF BIT: 3 7/8" Carbide Sampler & 5 7/8" Rotosonic Casing
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): NAVD 88
12. MANUFACTURERS DESIGNATION OF DRILL: Super Sonic II
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 35; UNDISTURBED Ø
14. TOTAL NUMBER CORE BOXES: Ø
15. ELEVATION GROUND WATER: 958.9 Ft MSL → Measured (12/5/08)
16. DATE HOLE: STARTED 10-31-08; COMPLETED 11-5-08
17. ELEVATION TOP OF HOLE: 1176.4 Ft MSL
18. TOTAL CORE RECOVERY FOR BORING: 344.5'/346' = 99%+
19. SIGNATURE OF INSPECTOR: Barry M. Brown LPG IL

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
966.4	210		SAME		Bag 66 Cont.	cont. RUN 22
	211					
	212					
	213			522	Bag 67	
	214					End of Day 11/3/08 DAN. M.
	215					RUN 23 (215-225) START 11/4/08
	216					Rec/Run = 12/10' = 100%+ 0725 ↓ 4"
	217				Bag 68	0727
	218					3-3.5 tsf (over run) 0730 ↓ 6" Casing
	219		Three gravel layers (1/2-1") thick in matrix between 216-222'			0734
956.4	220				Bag 69	0750 Sample
	221					
	222		(More gravel than previous run(s))			
	223			523	Bag 70	
	224					
	225					

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT: McHenry Cty Wells | HOLE NO. 2 - ALDEN TWP

Hole No. 2 - ALDEN TOWNSHIP

DRILLING LOG	DIVISION Chicago	INSTALLATION	SHEET 24 OF 24 SHEETS

1. PROJECT: McHenry Cty Wells
2. LOCATION (Coordinates or Station): N2,115,612 E 923,300' IL St. Pl. E
3. DRILLING AGENCY: WDC Exploration & Wells
4. HOLE NO. (As shown on drawing title and title number): 2 - ALD
5. NAME OF DRILLER: DAN TONNANCOUR
6. DIRECTION OF HOLE: ☑ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 345.5'
8. DEPTH DRILLED INTO ROCK: 0.5'
9. TOTAL DEPTH OF HOLE: 346'
10. SIZE AND TYPE OF BIT: 3 7/8" Carbide Sampler & 5 7/8" RotoSonic CASING
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): NAVD 88
12. MANUFACTURERS DESIGNATION OF DRILL: Super Sonic II
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 35; UNDISTURBED Ø
14. TOTAL NUMBER CORE BOXES: Ø
15. ELEVATION GROUND WATER: 958.9 Ft MSL → Measured (12/5/08)
16. DATE HOLE: STARTED 10-31-08; COMPLETED 11-5-08
17. ELEVATION TOP OF HOLE: 1176.4 Ft MSL
18. TOTAL CORE RECOVERY FOR BORING: 344.5'/346' = 99%+
19. SIGNATURE OF INSPECTOR: Sam M. Brown LPG IL

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g	
	225		SAME AS ABOVE			Run 24 (225-235)	0815
	226					Rec/Run = 13'/10' = 100%+	↓ 4" 0820
	227		Brown Silty CLAY, some gravel, trace sand, moist, very stiff to hard (CL)	REC 100%	Bag 71	3.5 tsf	0821 ↓ 6" 0826
	228						
	229						845 Extract Samples
946.4	230				Bag 72	3.5 tsf	
	231						
	232						
	233		stiffer	524	Bag 73	4-4.5 tsf	
	234						
	235					Run 25 (235-245)	0910
	236					Rec/Run = 14'/10' = 100%+	↓ 4" core barrel 0917
	237			REC 100%	Bag 74		0918
	238		tr. coarse (m 2.5"+) ~~large~~ gravel in till (237-240)			3.5-4.5 tsf (over run)	↓ 6" Casing 0924
	239				Bag 75		
936.4	240						

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT: McHenry Cty Wells | HOLE NO. 2 - ALDEN TWP

Hole No. 2 - ALDEN TOWNSHIP

DRILLING LOG	DIVISION Chicago	INSTALLATION	SHEET 17 OF 24 SHEETS

1. PROJECT: McHenry Cty Wells
2. LOCATION (Coordinates or Station): N2,115,612 E 923,300 IL St. Pl E
3. DRILLING AGENCY: WDC Exploration & Wells
4. HOLE NO. (As shown on drawing title and title number): 2 - ALD
5. NAME OF DRILLER: DAN TONNMACHER
6. DIRECTION OF HOLE: ☑ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 345.5'
8. DEPTH DRILLED INTO ROCK: 0.5'
9. TOTAL DEPTH OF HOLE: 346'
10. SIZE AND TYPE OF BIT: 3 7/8" Carbide Sampler & 5 7/8" RotoSonic CASING
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): NAVD 88
12. MANUFACTURERS DESIGNATION OF DRILL: Super Sonic II
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 35; UNDISTURBED Ø
14. TOTAL NUMBER CORE BOXES: Ø
15. ELEVATION GROUND WATER: 958.9 FT MSL → Measured (12/5/08)
16. DATE HOLE: STARTED 10-31-08; COMPLETED 11-5-08
17. ELEVATION TOP OF HOLE: 1176.4 FT MSL
18. TOTAL CORE RECOVERY FOR BORING: 344.5'/346' = 99%+
19. SIGNATURE OF INSPECTOR: Barry M. Brown LPG IL

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
936.4	240			cont.		Run 25 cont.
	241		SAME AS ABOVE	Rec		
	242			100%	Bag 76	3.5-4.5 tsf
	243					
	244				Bag 77	0940 Extract Samples
	245					Run 26 (245-255) 0952
	246				Bag	Rec/Run = 11.5'/10' = 100%+ ↓ 4" barrel 1006
	247		"slightly softer"	Rec	78	2.5-3 tsf 1007
	248			100%		↓ 6" Casing 1012
	249					1024 Rod in
926.4	250				Bag 79	3 tsf 1040 Next 4"
	251					
	252					
	253		"hard"		Bag	3.5-4.5 tsf
	254			526	80	
	255					

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT: McHenry Cty Wells | HOLE NO. 2 - ALDEN TWP

Hole No. 2 - ALDEN TOWNSHIP

DRILLING LOG	DIVISION Chicago	INSTALLATION	SHEET 18 OF 24 SHEETS

1. PROJECT: McHenry Cty Wells
2. LOCATION (Coordinates or Station): N2,115,612 E 923,300' IL St. Pl E
3. DRILLING AGENCY: WDC Exploration & Wells
4. HOLE NO. (As shown on drawing title and title number): 2 - ALD
5. NAME OF DRILLER: DAN TONNMANCOUR
6. DIRECTION OF HOLE: [X] VERTICAL [ ] INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 345.5'
8. DEPTH DRILLED INTO ROCK: 0.5'
9. TOTAL DEPTH OF HOLE: 346'
10. SIZE AND TYPE OF BIT: 3 7/8" Carbide Sampler & 5 7/8" RotoSonic CASING
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): NAVD 88
12. MANUFACTURERS DESIGNATION OF DRILL: Super Sonic II
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 35; UNDISTURBED Ø
14. TOTAL NUMBER CORE BOXES: Ø
15. ELEVATION GROUND WATER: 958.9 Ft MSL → Measured (12/5/08)
16. DATE HOLE: STARTED 10-31-08; COMPLETED 11-5-08
17. ELEVATION TOP OF HOLE: 1176.4 Ft MSL
18. TOTAL CORE RECOVERY FOR BORING: 344.5'/346' = 99%+
19. SIGNATURE OF INSPECTOR: Brian M Brown LPG IL

cont. Dan McHale

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g	
	255		SAME AS ABOVE			RUN 27 (255-265)	1040
	256				Bag 81	REC/RUN = 11'/10' = 100%+	↓ 4" barrel 1042
	257						1043 ↓ 6" casing
	258						1051
	259			REC 100%		4-4.5 tsf	
916.4	260				Bag 82		
	261						
	262						
	263			527	Bag 83		
	264						1110 sample
	265					RUN 28 (265-275)	1122
	266				Bag 84	REC/RUN = 12'/10' = 100%+	↓ 4" 1126
	267			REC 100%			1127 ↓ 6" casing
	268						1134
	269				Bag 85		1150 Sample
906.4	270						

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT: McHenry Cty Wells | HOLE NO. 2 - ALDEN TWP

Hole No. 2 - ALDEN TOWNSHIP

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 19 OF 24 SHEETS

1. PROJECT: McHenry Cty Wells
2. LOCATION (Coordinates or Station): N2,115,612 E 923,300' IL St. Pl E
3. DRILLING AGENCY: WDC Exploration & Wells
4. HOLE NO. (As shown on drawing title and title number): 2 - ALD
5. NAME OF DRILLER: DAN TONNANCOUR
6. DIRECTION OF HOLE: ☑ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 345.5'
8. DEPTH DRILLED INTO ROCK: 0.5'
9. TOTAL DEPTH OF HOLE: 346'
10. SIZE AND TYPE OF BIT: 3 7/8" Carbide Sampler & 5 7/8" RotoSonic CASING
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): NAVD 88
12. MANUFACTURERS DESIGNATION OF DRILL: Super Sonic II
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 35; UNDISTURBED Ø
14. TOTAL NUMBER CORE BOXES: Ø
15. ELEVATION GROUND WATER: 958.9 Ft MSL → Measured (12/5/08)
16. DATE HOLE: STARTED 10-31-08; COMPLETED 11-5-08
17. ELEVATION TOP OF HOLE: 1176.4 Ft MSL
18. TOTAL CORE RECOVERY FOR BORING: 344.5'/346' = 99%+
19. SIGNATURE OF INSPECTOR: Gary M. Brown LPG IL

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g	
906.4	270		SAME AS ABOVE		cont.	Run 28 (cont.)	
	271					4-4.5 tsf	
	272						
	273				Bag 86		
	274			S28			
	275					Run 29 (275-285)	1240
	276		HARD			Rec/Run = 14'/10' = 100%+	↓ 4" 1241
	277			Rec 100%	Bag 87		1243
	278					4.5 tsf	↓ 6" 1250
	279						
896.4	280				Bag 88		
	281						
	282		higher silt content				
	283			S29	Bag 89		samples Extracted @ 1306
	284						
	285						

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT: McHenry Cty Wells | HOLE NO. 2 - ALDEN TWP

Hole No. 2 - ALDEN TOWNSHIP

DRILLING LOG	DIVISION Chicago	INSTALLATION	SHEET 20 OF 24 SHEETS

1. PROJECT McHenry Cty Wells	10. SIZE AND TYPE OF BIT 3 7/8" Carbide Sampler & 5 7/8" Rotosonic Casing
2. LOCATION (Coordinates or Station) N2,115,612 E 923,300' IL St. Pl E	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) NAVD 88
3. DRILLING AGENCY WDC Exploration & Wells	12. MANUFACTURERS DESIGNATION OF DRILL Super Sonic II
4. HOLE NO. (As shown on drawing title and title number) 2 - ALD	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 35; UNDISTURBED Ø
5. NAME OF DRILLER DAN TONNANCOUR	14. TOTAL NUMBER CORE BOXES Ø
6. DIRECTION OF HOLE ☑ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.	15. ELEVATION GROUND WATER 958.9 Ft MSL → Measured (12/5/08)
	16. DATE HOLE: STARTED 10-31-08; COMPLETED 11-5-08
7. THICKNESS OF OVERBURDEN 345.5'	17. ELEVATION TOP OF HOLE 1176.4 Ft MSL
8. DEPTH DRILLED INTO ROCK 0.5'	18. TOTAL CORE RECOVERY FOR BORING 344.5'/346' = 99%+
9. TOTAL DEPTH OF HOLE 346'	19. SIGNATURE OF INSPECTOR Sam M. Brown LPG IL

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	285					Run 30 (295-295)
	286		Harder than Run 29			Rec/Run = 12'/10' = 100%+
	287			Rec 100%	Bag 90	
	288		Same lithology As Above:			
	289		Brown, Silty CLAY some Sand & gravel → more gravel than sand, moist, hard (CL)			> 4.5 tsf for Run
886.4	290				Bag 91	
	291					
	292					
	293				Bag 92	
	294			530		
	295					
	296				Bag 93	Run 31 (295-305)
	297			Rec 100%		Rec/Run = 13.5'/10' = 100%+
	298					
	299				Bag 94	
876.4	300					

1322 ↓ 4" Core Barrel 1324
1326 ↓ 6" 1332
Sample 1345
1401 ↓ 4" 1403
1405 ↓ 6" 1415

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT McHenry Cty Wells | HOLE NO. 2 - ALDEN TWP

Hole No. 2 - ALDEN TOWNSHIP

DRILLING LOG	DIVISION Chicago	INSTALLATION	SHEET 21 OF 24 SHEETS

1. PROJECT: McHenry Cty Wells
2. LOCATION (Coordinates or Station): N2,115,612 E 923,300' IL St. Pl. E
3. DRILLING AGENCY: WDC Exploration & Wells
4. HOLE NO. (As shown on drawing title and title number): 2 - ALD
5. NAME OF DRILLER: DAN TONNANCOUR
6. DIRECTION OF HOLE: ☑ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 345.5'
8. DEPTH DRILLED INTO ROCK: 0.5'
9. TOTAL DEPTH OF HOLE: 346'
10. SIZE AND TYPE OF BIT: 3 7/8" Carbide Sampler & 5 7/8" RotoSonic CASING
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): NAVD 88
12. MANUFACTURERS DESIGNATION OF DRILL: Super Sonic II
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 35; UNDISTURBED Ø
14. TOTAL NUMBER CORE BOXES: Ø
15. ELEVATION GROUND WATER: 958.9 Ft MSL → Measured (12/5/08)
16. DATE HOLE: STARTED 10-31-08; COMPLETED 11-5-08
17. ELEVATION TOP OF HOLE: 1176.4 Ft MSL
18. TOTAL CORE RECOVERY FOR BORING: 344.5'/346' = 99%+
19. SIGNATURE OF INSPECTOR: Gary M Brown LPG IL

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
876.4	300		SAME AS ABOVE		cont. Bag 94	cont. RUN 31
	301					4.0-4.5 tsf
	302			REC. 100%		
	303				Bag 95	
	304			S31		
	305					RUN 32 (305-315)
	306		SLOUGH (Top of Run) [soft, wet clay] mixed w/ sample ~305-307'		Bag 96	REC/RUN = 13.5'/10' = 100%+
	307					
	308					
	309			REC 100%	Bag 97	4.5 tsf
866.4	310					
	311					
	312					
	313				Bag 98	
	314			S32		
	315					

1502 ↓ 4" Barrel 1508

1518 ↓ 6" Casing 1524

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT: McHenry Cty Wells | HOLE NO.: 2 - ALDEN TWP

Hole No. 2 - ALDEN TOWNSHIP

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 22 OF 24 SHEETS

1. PROJECT: McHenry Cty Wells
2. LOCATION (Coordinates or Station): N2,115,612 E 923,300' IL St. Pl. E
3. DRILLING AGENCY: WDC Exploration & Wells
4. HOLE NO. (As shown on drawing title and title number): 2 - ALD
5. NAME OF DRILLER: DAN TONNANCOUR
6. DIRECTION OF HOLE: ☑ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 345.5'
8. DEPTH DRILLED INTO ROCK: 0.5'
9. TOTAL DEPTH OF HOLE: 346'
10. SIZE AND TYPE OF BIT: 3 7/8" Carbide Sampler & 5 7/8" RotoSonic CASING
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): NAVD 88
12. MANUFACTURERS DESIGNATION OF DRILL: Super Sonic II
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 35; UNDISTURBED Ø
14. TOTAL NUMBER CORE BOXES: Ø
15. ELEVATION GROUND WATER: 958.9 FT MSL → Measured (12/5/08)
16. DATE HOLE: STARTED 10-31-08; COMPLETED 11-5-08
17. ELEVATION TOP OF HOLE: 1176.4 FT MSL
18. TOTAL CORE RECOVERY FOR BORING: 344.5'/346' = 99%+
19. SIGNATURE OF INSPECTOR: Barry M Brown LPG IL

& Dan McHale till 325'

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	315		SAME AS ABOVE, but with slight color change to grey brown (below 317')			RUN 33 (315-325)
	316				Bag 99	REC/RUN = 10+/10' = 100%
	317			REC 100%		
	318					
	319					
856.4	320				Bag 100	
	321					
	322					
	323			S33	Bag 101	
	324					
	325					RUN 34 (325-335)
	326				Bag 102	REC/RUN = 10+/10' = 100%
	327			REC 100%		
	328				Bag 103	4.5+ tsf
	329					
846.4	330				104	

1610 ↓ 4" 1612
1615 ↓ 6" Casing 1622
1640 Extract Samples END OF DAY 11/4 (D.M.)
11/5 START GMB onsite 4" 0900-0910 Drive 6" 0915 ↓ 0930

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT: McHenry Cty Wells | HOLE NO. 2 - ALDEN TWP

Hole No. 2 - ALDEN TWP

ROTO-SONIC 5 7/8" CASING

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 23 OF 24 SHEETS

1. PROJECT McHenry Cty Wells	10. SIZE AND TYPE OF BIT 3 7/8" Carbide Sampler
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) NAVD 88
3. DRILLING AGENCY WDC Exploration & Wells	12. MANUFACTURERS DESIGNATION OF DRILL Super Sonic II
4. HOLE NO. (As shown on drawing title and title number) 2 - ALD	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 35; UNDISTURBED Ø
5. NAME OF DRILLER DAN TONNANCOUR	14. TOTAL NUMBER CORE BOXES Ø
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER 958.9' 12-5-08
	16. DATE HOLE: STARTED 10-31-08; COMPLETED 11-5-08
7. THICKNESS OF OVERBURDEN 345.5'	17. ELEVATION TOP OF HOLE 1176.4 FT MSL
8. DEPTH DRILLED INTO ROCK 0.5'	18. TOTAL CORE RECOVERY FOR BORING 344.5'
9. TOTAL DEPTH OF HOLE 346'	19. SIGNATURE OF INSPECTOR Gary M Brown LPG-IL

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
846.4	330		cont. Tiskilwa Till	cont.	Bag 104	Run 34 (325-335) cont
	331					
	332		Gray silty CLAY, little sand & gravel, hard, moist (CL) — Low Plasticity matrix Supported Diamicton	Rec 100%		
	333				Bag 105	
	334				334	
	335					Run 35 (335-345)
	336				Bag 106	Rec/Run = 10'+/10' = 100%
	337					
	338				Bag 107	4.5 tsf +
	339			Rec 100%		
836.4	340		SHARP contact (grades over 0.2')			
	341		Gray Medium SAND, little silt, F.-C. sand & gravel, trace clay wet (SW) quite dense in places (small clumps of clay)		Bag 108	
	342					
	343				335	
	344				Bag 109	
	345					

0930 ↓ Drive 4" 0935

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT McHenry Cty Wells | HOLE NO. 2 - ALDEN TWP

Hole No. 2 - ALDEN TWP

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 24 OF 24 SHEETS

1. PROJECT: McHenry Cty Wells
2. LOCATION (Coordinates or Station):
3. DRILLING AGENCY: WDC Exploration & Wells
4. HOLE NO. (As shown on drawing title and title number): 2-ALD
5. NAME OF DRILLER: DAN TONNANCOUR
6. DIRECTION OF HOLE: ☑ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 345.5'
8. DEPTH DRILLED INTO ROCK: 0.5'
9. TOTAL DEPTH OF HOLE: 346.0'
10. SIZE AND TYPE OF BIT: 3 7/8" Carbide Sampler — 5 7/8" CASING
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): NAVD 88
12. MANUFACTURERS DESIGNATION OF DRILL: Super Sonic II
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 35 / UNDISTURBED Ø
14. TOTAL NUMBER CORE BOXES: Ø
15. ELEVATION GROUND WATER: 958.9' - 12-5-08
16. DATE HOLE: STARTED 10-31-08 / COMPLETED 11-5-08
17. ELEVATION TOP OF HOLE: 1176.4 FT MSL
18. TOTAL CORE RECOVERY FOR BORING: 344.5
19. SIGNATURE OF INSPECTOR: Gary M. Brown LPG IL

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	345		SAND	REC 100%	Bag 110	RUN 36* (345-346 REC/RUN = 1+'/1.0' = 100%+
830.4	346		BEDROCK: Light Gray to light Greenish gray Shaley DOLOMITE, moderately hard but Fissile, slightly weathered, micro-crystalline, thinly bedded; BRAINARD FORMATION OF MAQUOKETA GROUP (ORDOVICIAN SYS.)			36 (+ extra for seive analysis) loud chatter *Hard, vibrations at start of run. Driller notes that bedrock is hard, similar to Dolomite in other parts of County (e.g. Greenwood)
	347					
	348					
	349					
	350					
	351		END OF BOREHOLE 11-5-08	346 ft bgs		
	352					
	353					
	354					
	355					
	356					
	357					
	358					
	359					
	360					

1018 drive 4" through slough (20ft core barrel used)
1021' Quickly hit Rock on R36.

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT: McHenry Cty Wells — HOLE NO. 2-ALDEN TWP

PROJECT McHENRY COUNTY OBSERVATION WELL NETWORK INSTALLATION (#09000-460)

LOCATION ALDEN TOWNSHIP – McHENRY COUNTY, ILLINOIS

CLIENT U.S. ARMY CORPS OF ENGINEERS / McHENRY COUNTY

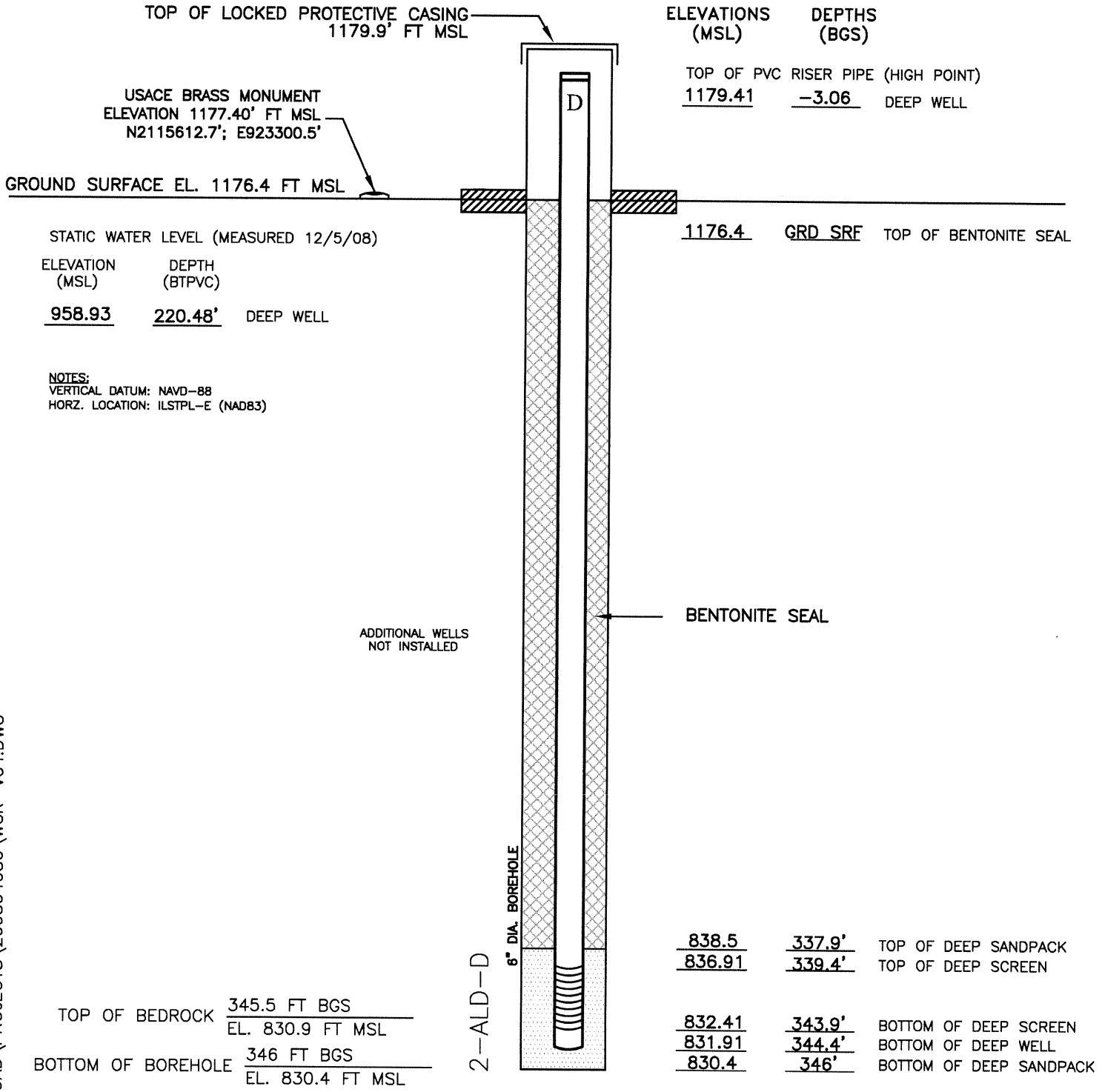
GEOLOGIST GARY BRAUN, P.G. (AECOM)

DRILLER WDC EXPLORATION AND WELLS, INC. (DAN TONNANCOUR)

WELL NO. 2-ALD-D

INSTALLATION DATE NOV. 5, 2008

DRILLING METHOD ROTO-SONIC



ELEVATIONS (MSL)	DEPTHS (BGS)	
1179.41	-3.06	TOP OF PVC RISER PIPE (HIGH POINT) DEEP WELL
1176.4	GRD SRF	TOP OF BENTONITE SEAL
838.5	337.9'	TOP OF DEEP SANDPACK
836.91	339.4'	TOP OF DEEP SCREEN
832.41	343.9'	BOTTOM OF DEEP SCREEN
831.91	344.4'	BOTTOM OF DEEP WELL
830.4	346'	BOTTOM OF DEEP SANDPACK

STATIC WATER LEVEL (MEASURED 12/5/08)

ELEVATION (MSL)	DEPTH (BTPVC)	
958.93	220.48'	DEEP WELL

NOTES:
VERTICAL DATUM: NAVD-88
HORZ. LOCATION: ILSTPL-E (NAD83)

TOP OF BEDROCK 345.5 FT BGS / EL. 830.9 FT MSL

BOTTOM OF BOREHOLE 346 FT BGS / EL. 830.4 FT MSL

NOT TO SCALE

WELL CONSTRUCTION MATERIALS*

PROTECTIVE CASING	5' L X 6" DIA. STEEL CASING W/ LOCKING CAP
RISER PIPE ABOVE W.T.	SCHEDULE 40 PVC (2.07" I.D./ 2.38" O.D.)
RISER PIPE BELOW W.T.	SCHEDULE 40 PVC (2.07" I.D./ 2.38" O.D.)
SCREEN	2" I.D. SCHEDULE 40 PVC W/ 0.010" SCREEN SLOT SIZE
TYPE OF BENTONITE SEAL	BLACK HILLS BENTONITE – 3/8" CHIPS (HOLE PLUG)
TYPE OF SAND PACK	R.W. SIDLEY CO. – NO. 5 FILTER PACK SAND

CASING MEASUREMENTS

BOTTOM OF SCREEN TO END CAP (FT)*	0.50
SCREEN LENGTH (1ST SLOT TO LAST SLOT) (FT)*	4.50
TOTAL LENGTH OF CASING (FT): DEEP WELL	347.50

* MEASUREMENT REFERS TO ALL WELLS

USMWK2FP001\05CAD\PROJECTS\200804080\WCR-V04.DWG

WELL SITE DATA SUMMARY AND COMMENTARY

Well Site #2 – Alden Township
MCCD Property at McHenry County's topographic high point on Reese Rd.

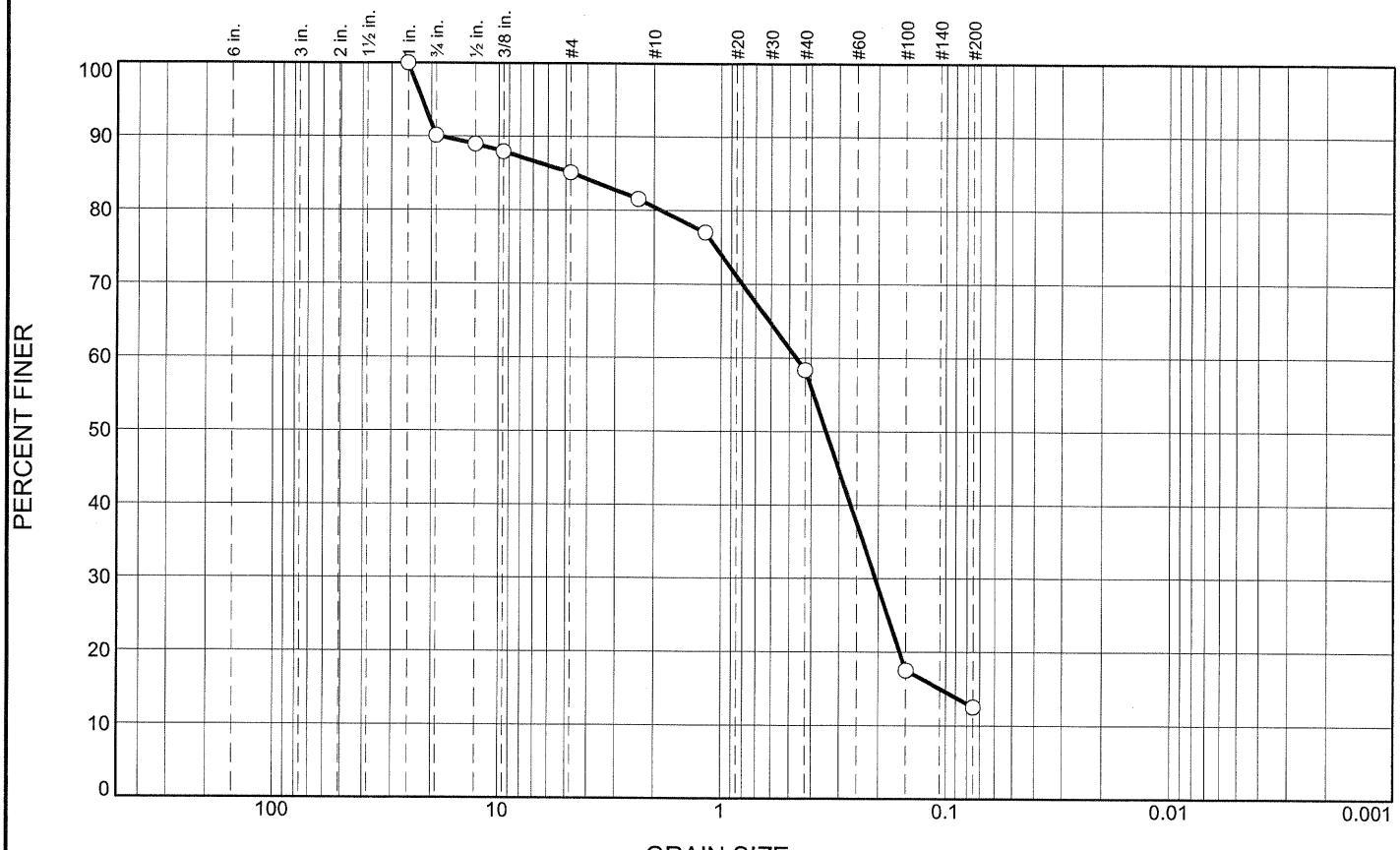
The Alden Township site is located on top of the Marengo-Woodstock Moraine which if one of Illinois' highest topographic locations. The Alden site had the thickest sequence of overburden of the 14 sites which is may have formed from the both diamicton deposits from the Marengo glaciation phase and the Woodstock Phase. The primary thick sequence of diamicton deposits were deposited as the Tiskilwa Till during formation of the Marengo Moraine. However, during the Woodstock Phase, diamicton was deposited atop the Marengo Moraine which formed the Marengo-Woodstock Moraine (Curry et al, 1997). Possible differentiation within the diamicton from the two moraines was not recognized from field classification.

The thick sequence of diamicton contained only one possible zone where an observation well would be appropriate. Fine to coarse sand was found at shallow depths between 10 and 12 feet below ground surface, but was not saturated. Below the sand, the next water bearing unit of any significance was found at a depth of 340 feet below ground surface. The massive till sequence was found to be over 300 ft thick. The till varied in composition from very hard silty clay to softer sandy-clay, but no water bearing units of any significance were observed within the till. The borehole was advanced 0.5 ft in bedrock which was encountered at a depth of 345.5 ft bgs. The approximate 5 ft sequence of sand at the bottom of the well was fully penetrated by the 5-ft well screen installed. The Alden well was found to have the highest groundwater elevation of the 28 wells installed for this project.

Care must be taken when working at the Alden well. The depth of the well, distance to water, and the well's small diameter limit options in conducting rehabilitation work. For example, retrieval of lost equipment in the well (such as a dropped bailer, bladder pump, etc.) would be difficult. The weight of the rugged troll cable should also be considered when working at the well because there is approximately 220 ft of cable hanging unsaturated in the well with an additional 50 ft that is submerged. Currently, the cable is hanging on a well cap similar to other wells, but a safety cable is attached to the pro-cover in case the well cap would fail.

Well Site Testing Results

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	9.8	5.1	4.6	22.1	45.9	12.5	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1	100.0		
.75	90.2		
.5	89.0		
.375	88.0		
#4	85.1		
#8	81.6		
#16	77.0		
#40	58.4		
#100	17.5		
#200	12.5		

* (no specification provided)

Material Description

F-C Sand Little Gravel Little Silt

Atterberg Limits

PL= np LL= nv PI=

Coefficients

D_{90}= 18.0687 D_{85}= 4.6429 D_{60}= 0.4646
D_{50}= 0.3433 D_{30}= 0.2062 D_{15}= 0.1057
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO= A-2-4(0)

Remarks

Source of Sample: 2-AL-D **Depth:** 342.0-343.0

Date: 12/05/08

STS | AECOM

Client: USACE
Project: McHenry County Wells
Project No: 200804080 **Figure**

Tested By: JRT

Groundwater Level Measurements

McHenry County Monitoring Well Installations
AECOM Project 09000-460

Site Number	2
Township Name	Alden
Well Number	2-ALD-D
Ground Surface Elevation (ft msl)	1176.35
Top of PVC Casing Elevation (ft)	1179.41
Location of PVC Casing within Wellhead	Single Well
Well Depth (Feet from TOC)[A]	347.50

Date	Depth to GW from TOC (ft)	GW Elevation (ft msl)
Sep. 26, 2008		
Oct. 09, 2008		
Oct. 14, 2008		
Oct. 16, 2008		
Oct. 21, 2008		
Oct. 22, 2008		
Oct. 24, 2008		
Oct. 28, 2008		
Oct. 29, 2008		
Oct. 30, 2008		
Nov. 07, 2008	190.47	988.94
Nov. 13, 2008		
Dec. 05, 2008	220.48	958.93
Dec. 08, 2008		
Dec. 09, 2008		
Dec. 12, 2008		
Dec. 15, 2008		
Dec. 16, 2008		
Dec. 17, 2008		
Dec. 18, 2008	220.74	958.67
Dec. 19, 2008		
Dec. 22, 2008		
Dec. 23, 2008		
Dec. 29, 2008		
Dec. 30, 2008		
Jan. 05, 2009		
Jan. 06, 2009		
Jan. 07, 2009		
Jan. 08, 2009		
Jan. 09, 2009		
Jan. 10, 2009		
Jan. 12, 2009	219.89	959.52
Feb. 24, 2009	219.12	960.29
Mar. 20, 2009		
end		

Notes:

ft msl = Elevation referenced to feet above mea Datum of 1988 (NAVD

TOC = Top of PVC Casing

ft = feet

[A] = as measured inside well

NI = Not Installed

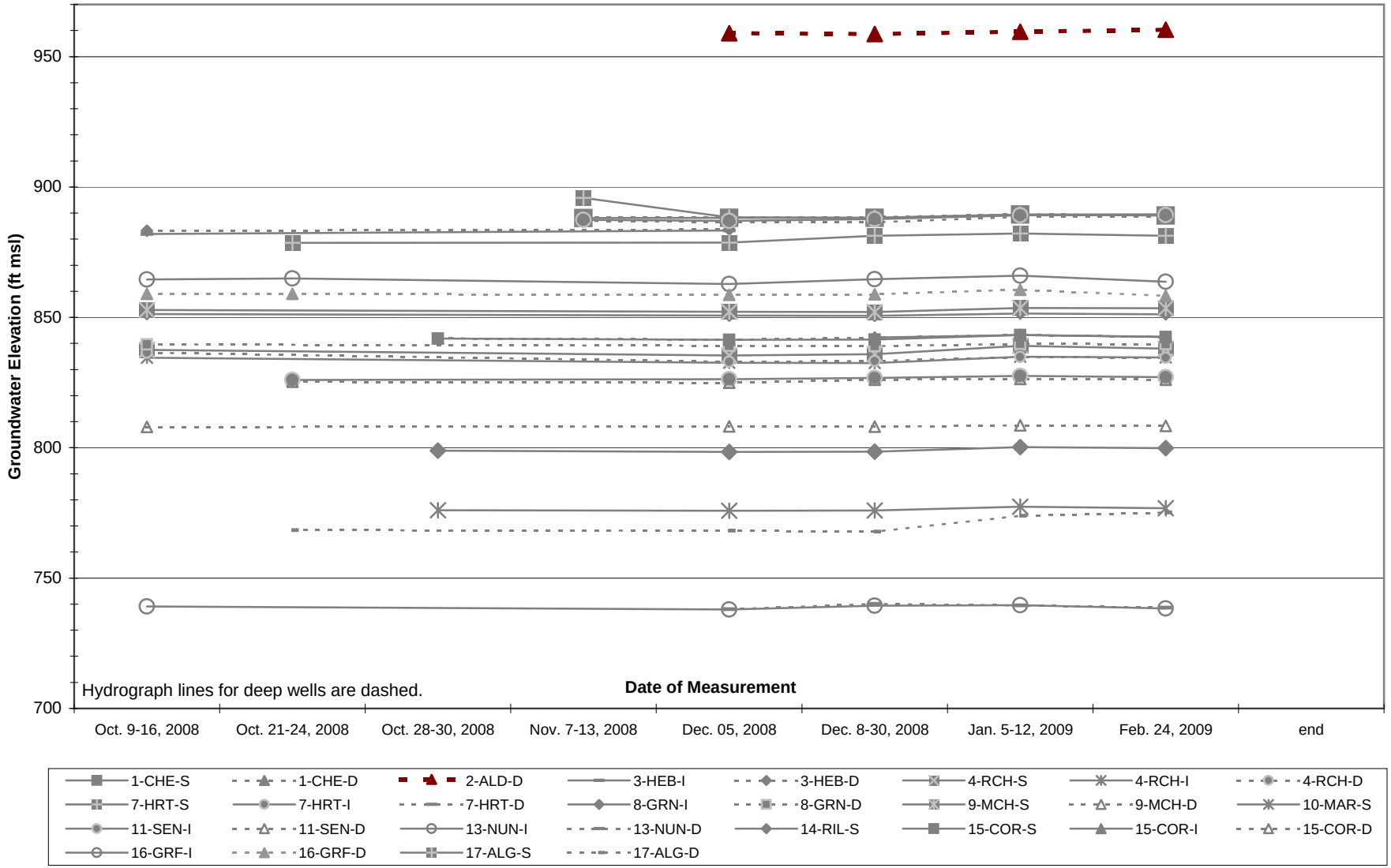
--- No Elevation

Well 17-Alg-S was frozen or partially frozen fro

Site 2 Groundwater Level Hydrograph
(includes ALL AECOM INSTALLED WELLS)

McHenry County Obervation Well Network

AECOM Project 09000-460

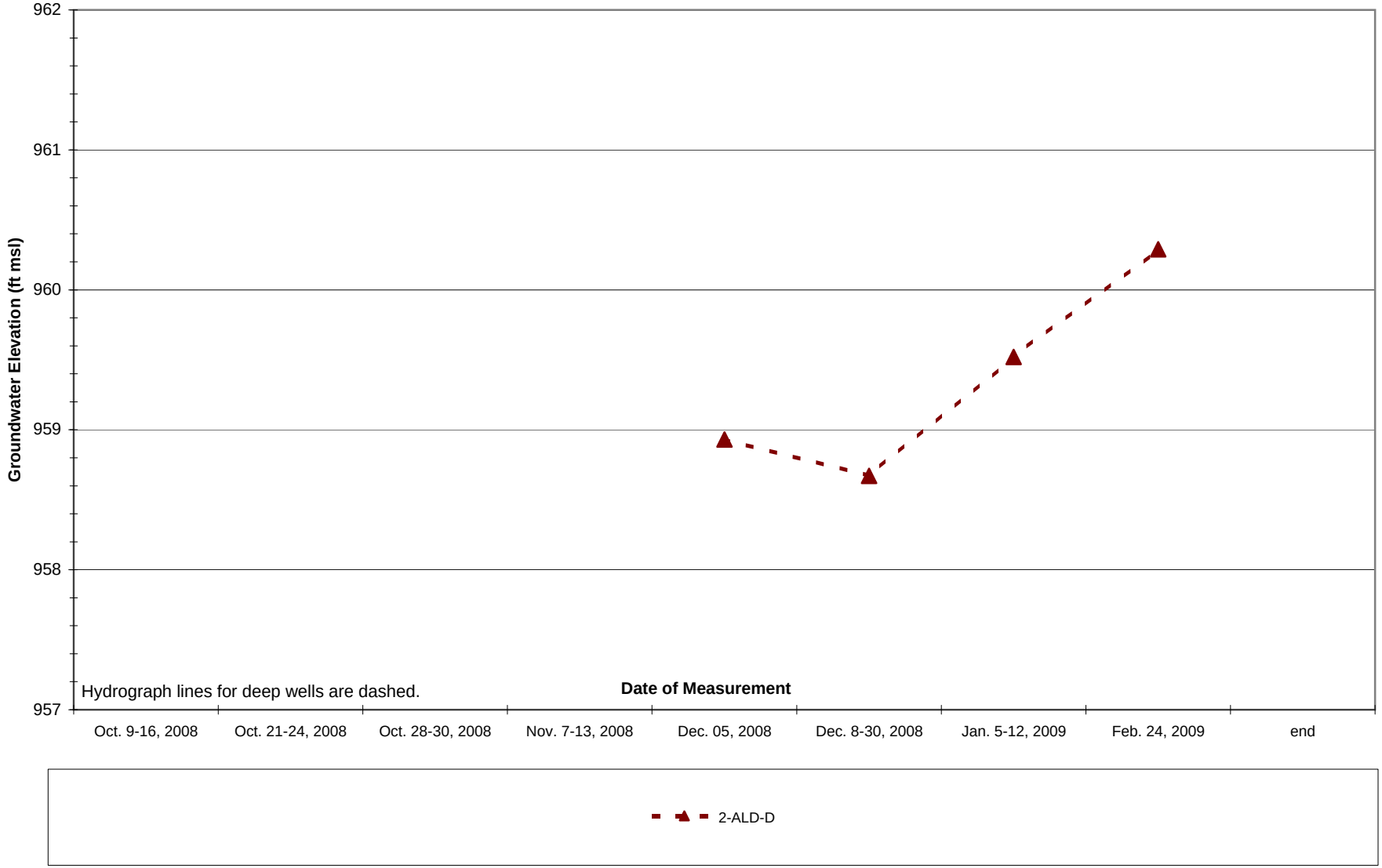


K:\PROJECTS\200804080\In_Progress\STS-McHenry Cty_WLs IN PROGRESS - figs for each site.xls

Site 2 Groundwater Level Hydrograph

McHenry County Obervation Well Network

AECOM Project 09000-460



K:\PROJECTS\200804080\In_Progress\STS-McHenry Cty_WLs IN PROGRESS - figs for each site.xls

Well Development Record

STS Consultants, Ltd.
11425 West Lake Park Drive
Milwaukee, Wisconsin 53224

Site Name: McHenry County

Well ID Number: 2-ALD-D

Date of Completion: 12/18/08

STS Job Number: 20080408U

Start Time: 935

End Time: 1425

Water color at start of development: Brown

Water color at end of development: Milky White

Amount of water removed during development:

Contained water? ☐ Yes ☒ No

If not contained, where water disposed? Ground

Well Development Methods:

- ☐ Surged with bailer and bailed
- ☒ Surged with block and bailed
- ☐ Surged with block, bailed & pumped
- ☐ Bailed only
- ☐ Pumped slowly
- ☐ Surged with bailer and pumped
- ☐ Surged with block and pumped
- ☐ Compressed Air
- ☐ Pumped only
- ☐ Other

Equipment Used

- ☒ PVC bailer
- ☐ Well wizard
- ☐ Bean or Moino pump (on drill rig)
- ☒ Surge block
- ☐ Whale pumps

Notes:

Surge Start: 0915

End: 0930

Purge Start: 0935

End: 1425

WL: 220.74

WL Final: 222.15

WELL DEVELOPMENT FIELD RECORD

Job Name McHenry County Job No. 2008 04080 Well No. 2-ALD-D

Developed By Matt Kogle Date of Install. _____ Sheet ____ of ____

Started Devel. 12/18/08 / _____ (DATE / TIME) Completed Devel. 12/18/08 / _____ (DATE / TIME)

W.L. Before Devel. _____ / _____ / _____ (DATE / TIME / DEPTH) After Devel. _____ / _____ / _____ (DATE / TIME / DEPTH)

Well Depth: Before Devel. _____ After Devel. _____ Well Dia. (in.) _____

Standing Water Column (ft.) _____ Standing Well Volume _____ gal.

Screen Length 5' Drilling Water Loss _____ gal.

DATE / TIME	VOLUME REMOVED (Gallons)	FIELD PARAMETERS SPEC. COND. (umhos/cm)	TEMP. (C°)	pH (s.u.)	TURB ~~Other~~	ORP	REMARKS
12/18/08 0950	CAL	4030	7.4	3.92	0	✓	
0955	2.5 gal	1050	8.8	5.49	43	✓	
1028	5 GAL	1040	8.5	6.49	57	—	
1053	10 gal	1030	8.5	6.33	71	—	
1118	15 GAL	1000	8.4	6.38	376	—	
1139	20 GAL	1000	8.8	6.45	999	—	
1200	25 GAL	1000	8.8	6.52	999	—	
1223	30 GAL	1010	8.5	6.61	999	—	
12:42	35 GAL	1050	8.6	6.60	999	—	
1305	40 GAL	1020	8.8	6.64	958	—	
1323	45 GAL	1040	8.7	6.70	788	—	
1343	50 GAL	1020	8.6	6.55	633	—	
1404	55 GAL	1040	8.6	6.67	422	—	
1425	60 GAL	990	9.0°	6.65	321	—	
		= TOTAL VOLUME REMOVED (Gallons)					

Development Method: 3 WV = 61 GALLONS

Final WL - 222.15'

Notes:

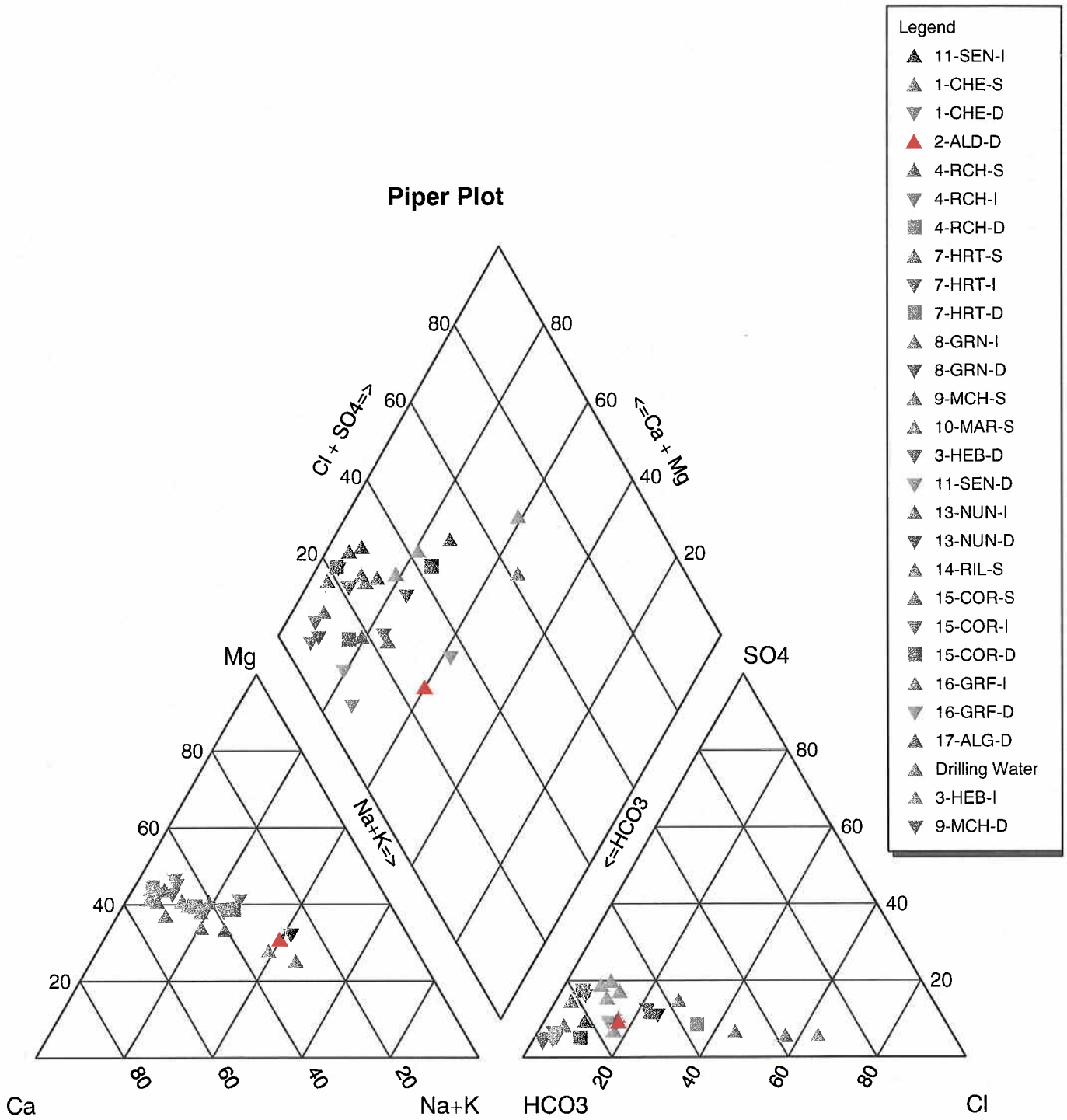
First Environmental Laboratories, Inc.
IL ELAP / NELAC Accreditation # 100292
1600 Shore Road • Naperville, Illinois 60563 • Phone (630) 778-1200 • Fax (630) 778-1233

Analytical Report

Client: AECOM ENVIRONMENT
Project ID: McHenry County 200804080
Sample ID: 2-ALD-D
Sample No: 9-0115-002

Date Collected: 01/12/09
Time Collected: 14:00
Date Received: 01/13/09
Date Reported: 01/20/09

Analyte		Result	R.L.	Units	Flags
Total Metals	**Method: 6020A**		**Preparation Method 3010A**		
Analysis Date: 01/16/09			Preparation Date: 01/15/09		
Calcium		51.3	0.1	mg/L	
Iron		1.70	0.01	mg/L	
Magnesium		32.7	0.1	mg/L	
Potassium		3.8	0.1	mg/L	
Sodium		77.2	0.1	mg/L	
Alkalinity, Bicarbonate (CaCO3)	**Method: 2320B**				
Analysis Date: 01/15/09 13:30					
Alkalinity, Bicarbonate (CaCO3)		320	5	mg/L	
Alkalinity, Carbonate (CaCO3)	**Method: 2320B**				
Analysis Date: 01/15/09 13:30					
Alkalinity, Carbonate (CaCO3)		< 5	5	mg/L	
Chloride	**Method: 4500Cl, E**				
Analysis Date: 01/14/09					
Chloride		52	5	mg/L	
Sulfate	**Method: 375.2R2.0**				
Analysis Date: 01/15/09					
Sulfate		39	15	mg/L	



DESCRIPTION: Piper Linear Diagram - Well Site #2

AECOM	PROJECT: McHenry County	PROJECT NO: 09000460
	CLIENT: Army Corps of Engineers	DATE: 7/30/2009

Field Well Sampling Sheet

Fill out the entire form. If it does not apply, mark N/A.

Project Name: McHenry County
STS Job No. 200804080
Location: Alden
Tester: Mary Neuses
Well Number: 2-ALD-D
Date Sampled: 1/12/09
Previous Well Sampled: N/A

GENERAL CONDITIONS:

						If Missing Replaced?	
Surface Seal:	X Ok		Damaged		Missing:	Yes	No
Protector Pipe:	X Ok		Damaged		Missing:	Yes	No
Well Cap:	X Ok		Damaged		Missing:	Yes	No
Ambient Temperature:	20 °F		Clear	X Cloudy	Rain		

WELL DATA:

Measuring Device: Solinst Water Level Meter
Stick Up or Down: UP (from Ground Surface)
Depth to Water: 219.89 (from TPVC)
Depth to Bottom: 345 (from TPVC)
Length of Water: 125.11

125.11
x .163
61.18 gallons

Free Product Observed: [ ] Yes [X] No Thickness: N/A

PURGING/SAMPLING:

Well Purging Calculations: Amount to purge = 0.163 gallons/foot times height of water column in feet for one well volume

Purging Device: Bailer
Sampling Device: Bailer
Volume Required:
[X] See back of page for field readings during purge
Volume Purged:
Could Well Bail Dry? [ ] Yes [X] No
Purging - Time Start: 8:45
Time Ended: 1400
Decon Method: N/A

IN-SITU TESTING:

Turbidity: [ ] Turbid [ ] Opaque
Odor:
Color
pH @ degrees C
Uncorrected Conductivity X
Water Temp. (from Cond.)

SAMPLES COLLECTED

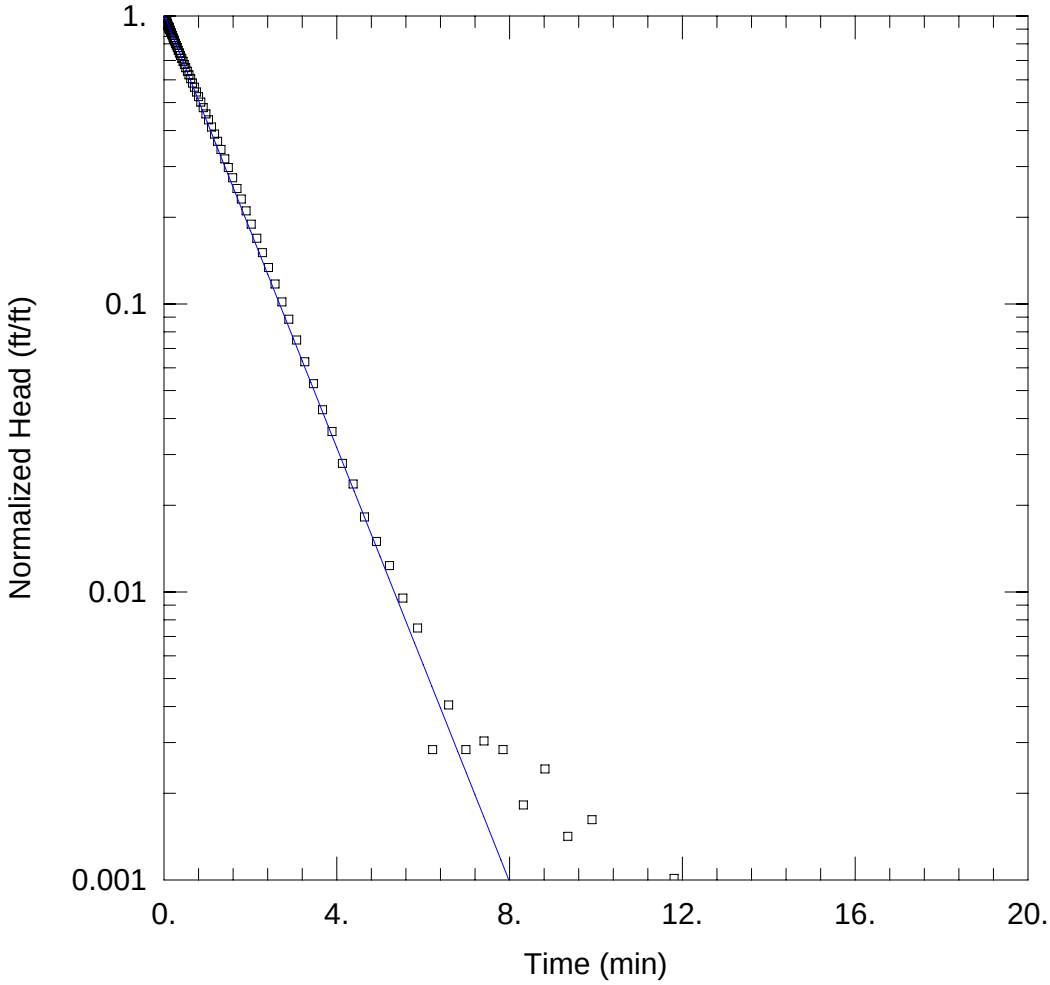
Vocs -		Cyanide	
Metals -		Hexchrome	
SVOC		Alkalinity	
TOC		Chloride	
Sulfide		Ammonia	
Phenolics		COD	

Comments: Sample Time: 14:00 pm

Well Purging Log

Date 1/12/09

Time	Temp	pH	Conductivity	~~ORP~~ TURB	~~DO~~ RATE
1/12/09 1400	7.7	7.61	950	41	N/A



WELL TEST ANALYSIS

Data Set: K:\...\2-ALD-D_001_5ft_cB&R.aqt
Date: 04/05/09 Time: 12:10:53

PROJECT INFORMATION

Company: AECOM
Client: USACE / McHenry Cty
Project: 09000-460 (h200804080)
Location: McHenry County, IL
Test Date: Feb. 22, 2009

AQUIFER DATA

Saturated Thickness: 5. ft
Anisotropy Ratio (Kz/Kr): 0.33

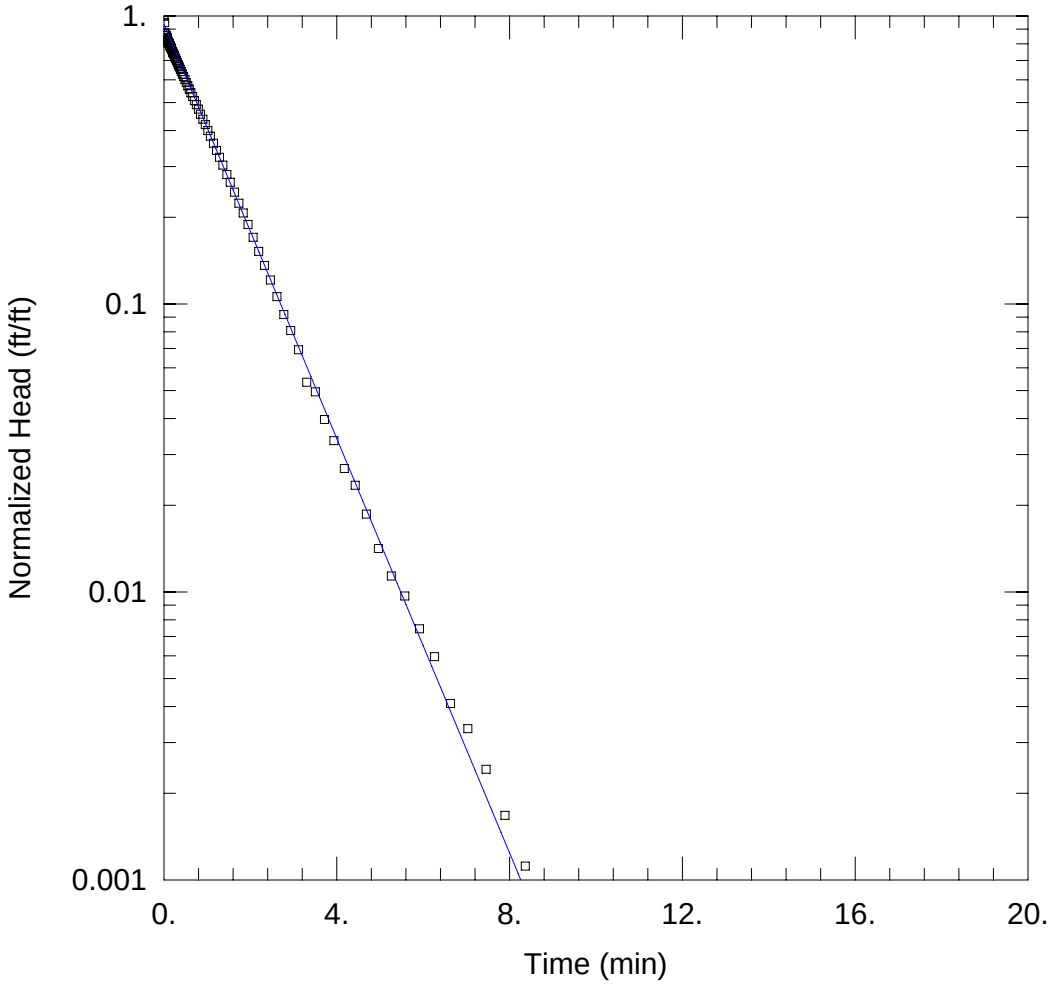
WELL DATA (2-ALD-D)

Initial Displacement: 4.94 ft
Total Well Penetration Depth: 4.5 ft
Casing Radius: 0.083 ft
Static Water Column Height: 124. ft
Screen Length: 4.5 ft
Well Radius: 0.25 ft
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 0.0008131 cm/sec
y0 = 5.025 ft



WELL TEST ANALYSIS

Data Set: K:\...\2-ALD-D_002_5ft_B&R.aqt
Date: 04/05/09 Time: 12:11:52

PROJECT INFORMATION

Company: AECOM
Client: USACE / McHenry Cty
Project: 09000-460 (h200804080)
Location: McHenry County, IL
Test Date: Feb. 22, 2009

AQUIFER DATA

Saturated Thickness: 5. ft
Anisotropy Ratio (Kz/Kr): 0.33

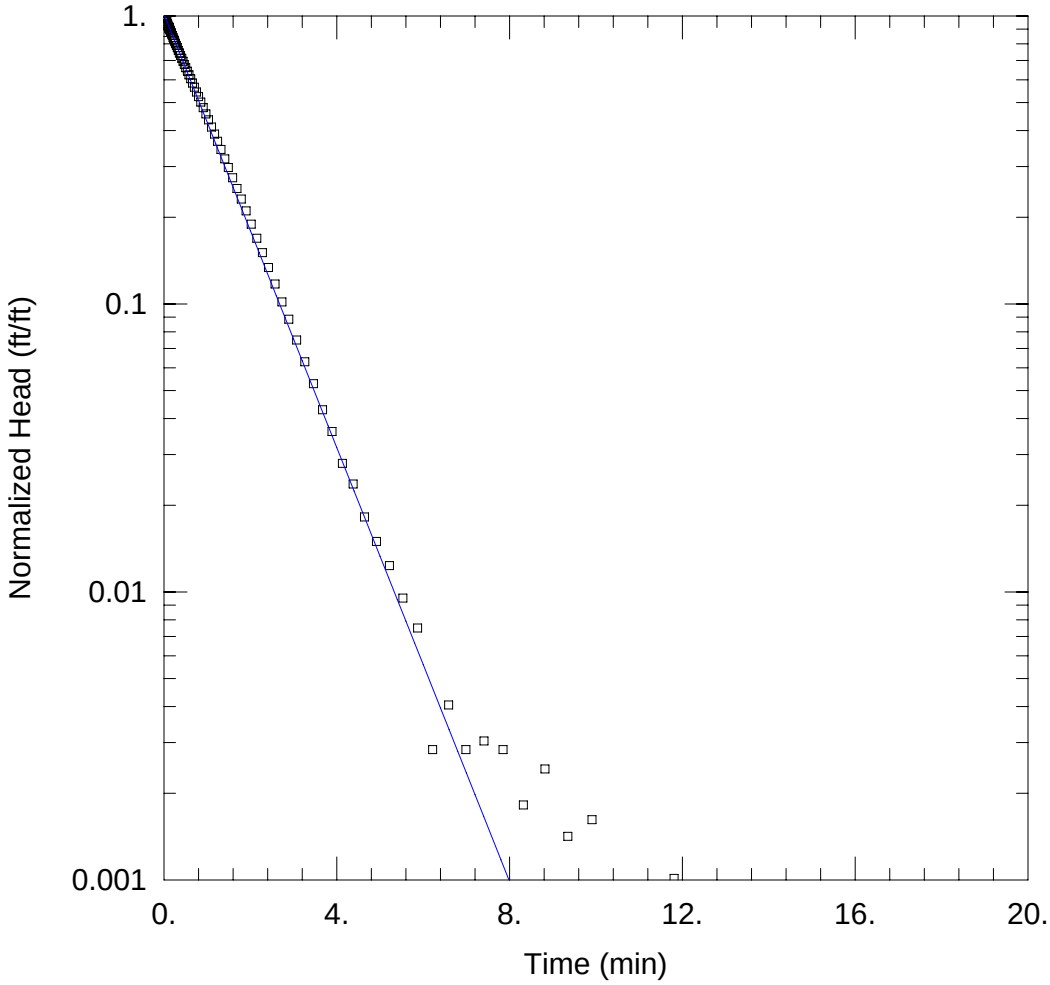
WELL DATA (2-ALD-D)

Initial Displacement: 5.37 ft
Total Well Penetration Depth: 4.5 ft
Casing Radius: 0.083 ft
Static Water Column Height: 124. ft
Screen Length: 4.5 ft
Well Radius: 0.25 ft
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 0.0007765 cm/sec
y0 = 5.025 ft



WELL TEST ANALYSIS

Data Set: K:\...\2-ALD-D_001_150ft_cB&R.aqt
Date: 04/05/09 Time: 12:10:21

PROJECT INFORMATION

Company: AECOM
Client: USACE / McHenry Cty
Project: 09000-460 (h200804080)
Location: McHenry County, IL
Test Date: Feb. 22, 2009

AQUIFER DATA

Saturated Thickness: 150. ft
Anisotropy Ratio (Kz/Kr): 0.33

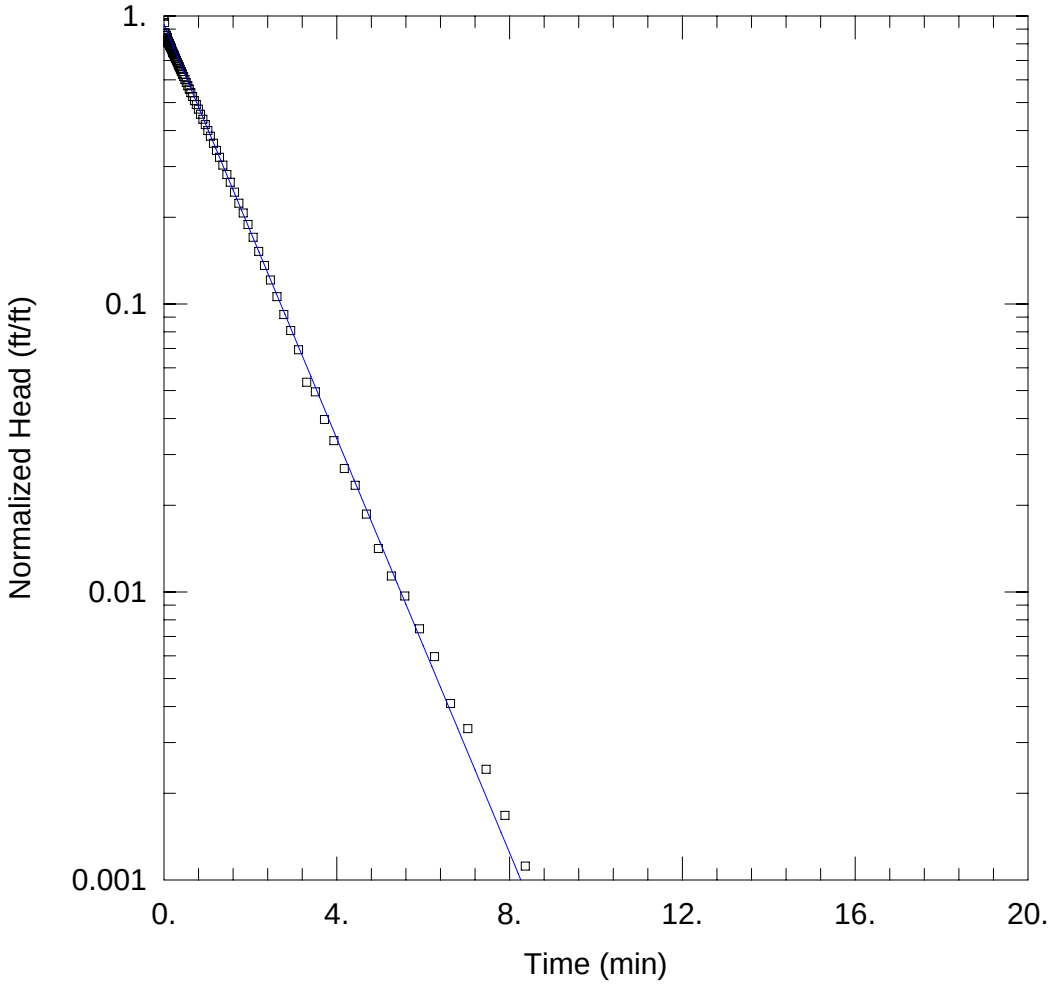
WELL DATA (2-ALD-D)

Initial Displacement: 4.94 ft
Total Well Penetration Depth: 4.5 ft
Casing Radius: 0.083 ft
Static Water Column Height: 124. ft
Screen Length: 4.5 ft
Well Radius: 0.25 ft
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 0.0007082 cm/sec
y0 = 5.025 ft



WELL TEST ANALYSIS

Data Set: K:\...\2-ALD-D_002_150ft_B&R.aqt
Date: 04/05/09 Time: 12:12:19

PROJECT INFORMATION

Company: AECOM
Client: USACE / McHenry Cty
Project: 09000-460 (h200804080)
Location: McHenry County, IL
Test Date: Feb. 22, 2009

AQUIFER DATA

Saturated Thickness: 150. ft
Anisotropy Ratio (Kz/Kr): 0.33

WELL DATA (2-ALD-D)

Initial Displacement: 5.37 ft
Total Well Penetration Depth: 4.5 ft
Casing Radius: 0.083 ft
Static Water Column Height: 124. ft
Screen Length: 4.5 ft
Well Radius: 0.25 ft
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 0.0006763 cm/sec
y0 = 5.025 ft

Additional Well Site Information

In-Situ Inc.

2-ALD-D

Calibration Report

Report Number: 20090126162648-140985

221 East Lincoln Avenue, Fort Collins, CO 80524 USA
1-970-498-1500, 1-800-446-7488, FAX: 1-970-498-1598
Visit us at www.in-situ.com

Instrument Details:

Instrument Model:	**Level TROLL 500**
Full Scale Pressure Range	**206.84 KPa (30 PSI) vented**
Serial Number:	**140985**

Calibration Details:

Calibration Result:	**PASS**
Calibration Date:	2009-01-26 16:26:48 (UTC)
Nominal Range of Applied Temperature:	-5 C to +50 C
Temperature Accuracy Specification:	+/- 0.1 C From 0 C to +50 C
Nominal Range of Applied Pressure:	0 KPa to 206.8 KPa (0.0 PSI to 30.0 PSI)
Pressure Accuracy Specification:	+/- 0.1 %FS from -5 C to +50 C, +/- 0.05 %FS at +15 C

Post-Calibration Check:

Parameter	Applied	Reported	Deviation
Pressure	30.0001	29.9970	-0.0104
Pressure	0.0000	-0.0032	-0.0105
Temperature	19.9960	20.0109	0.0149

Calibration Procedures and Equipment Used:

Automated calibration procedures used.
Manu Agilent Model 34970A SerialNo MY44038788
Manu Instrulab Model 3312A-14-15-24 SerialNo 31138
Manu Instrulab Model 406X-0031-01 SerialNo 1-31118
Manu MENSOR Model 600 SerialNo 622742
Manu Agilent Model 53131A SerialNo MY47000169
Manu MENSOR Model 600 SerialNo 621385

Notes:

1. Standards used in this calibration are traceable to the National Institute of Standards and Technology.
2. This calibration report shall not be reproduced, except in full, without the written approval of In-Situ, Inc.
3. A calibration interval of 12 to 18 months is recommended.
4. The post-calibration data is collected at nominal +20 C.
5. 1.0 PSI = 6.894757 KPa

Performed By: JBO

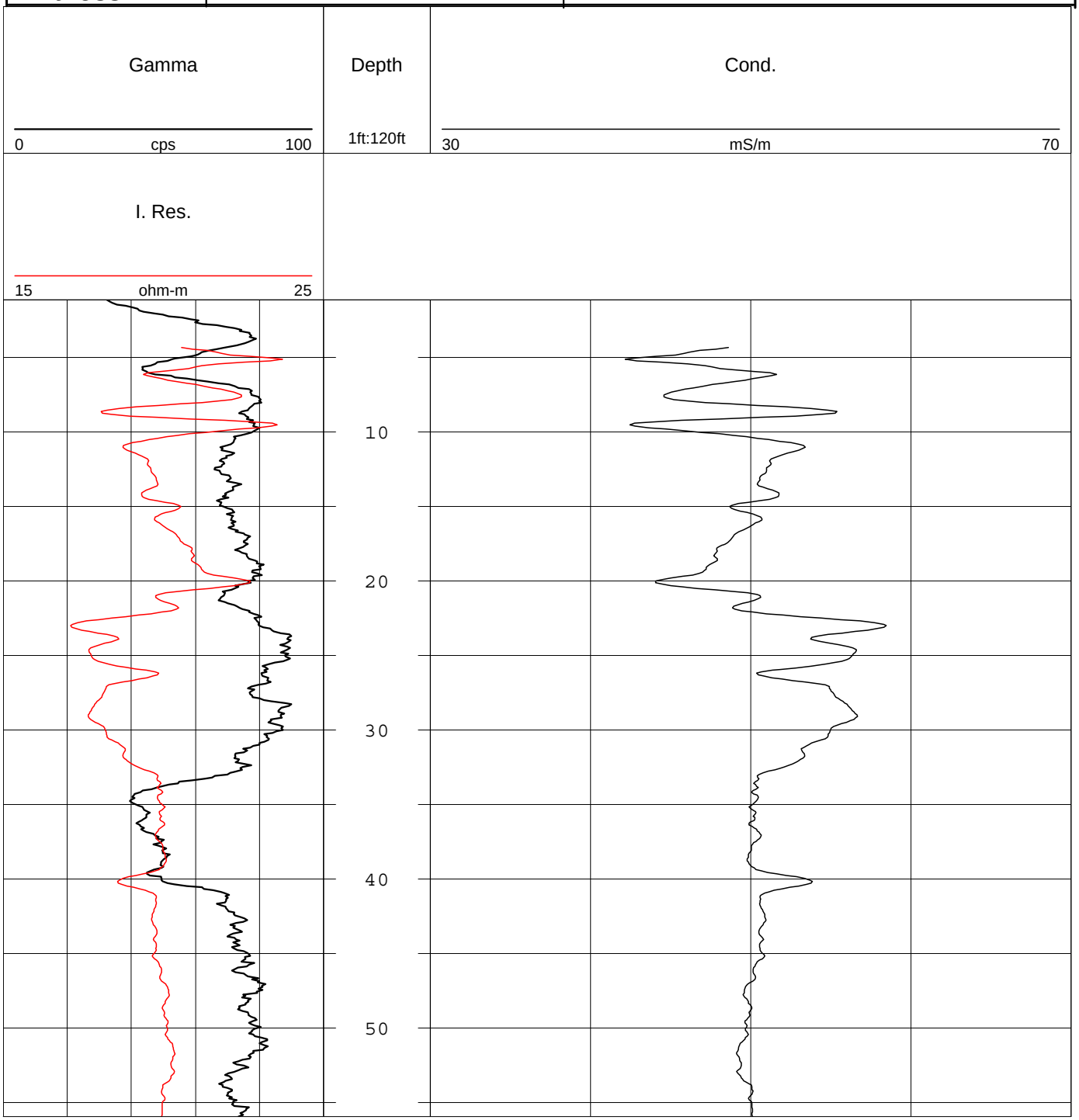
Copyright © 2006 In-Situ, Inc.

COMPANY:	MCHENRY CO. & USACE
Location:	ALDEN TWP

Well	ALDEN TWP #		
Date	1/22/2009	BH Fluid	FORMATION
Casing	2" PVC 2.0' AGS - 345 'BGS		
File Name	MCHTH2-09EMGAM		
Depth Driller	345.0' BGS		
Depth Logger	436.13' BGS		
Logged by:	T. YOUNG		
Witness:	C. MCKINNEY & G HLEPAS		

OTHER SERVICES

H2O LEVEL & GPS



Alden Township Well Site (Staked Location)

Alden Township Well Site (Staked Location)

Alden Township Well Site (Set Up on Hole)

Alden Township Subsurface Samples

Alden Township Subsurface Samples

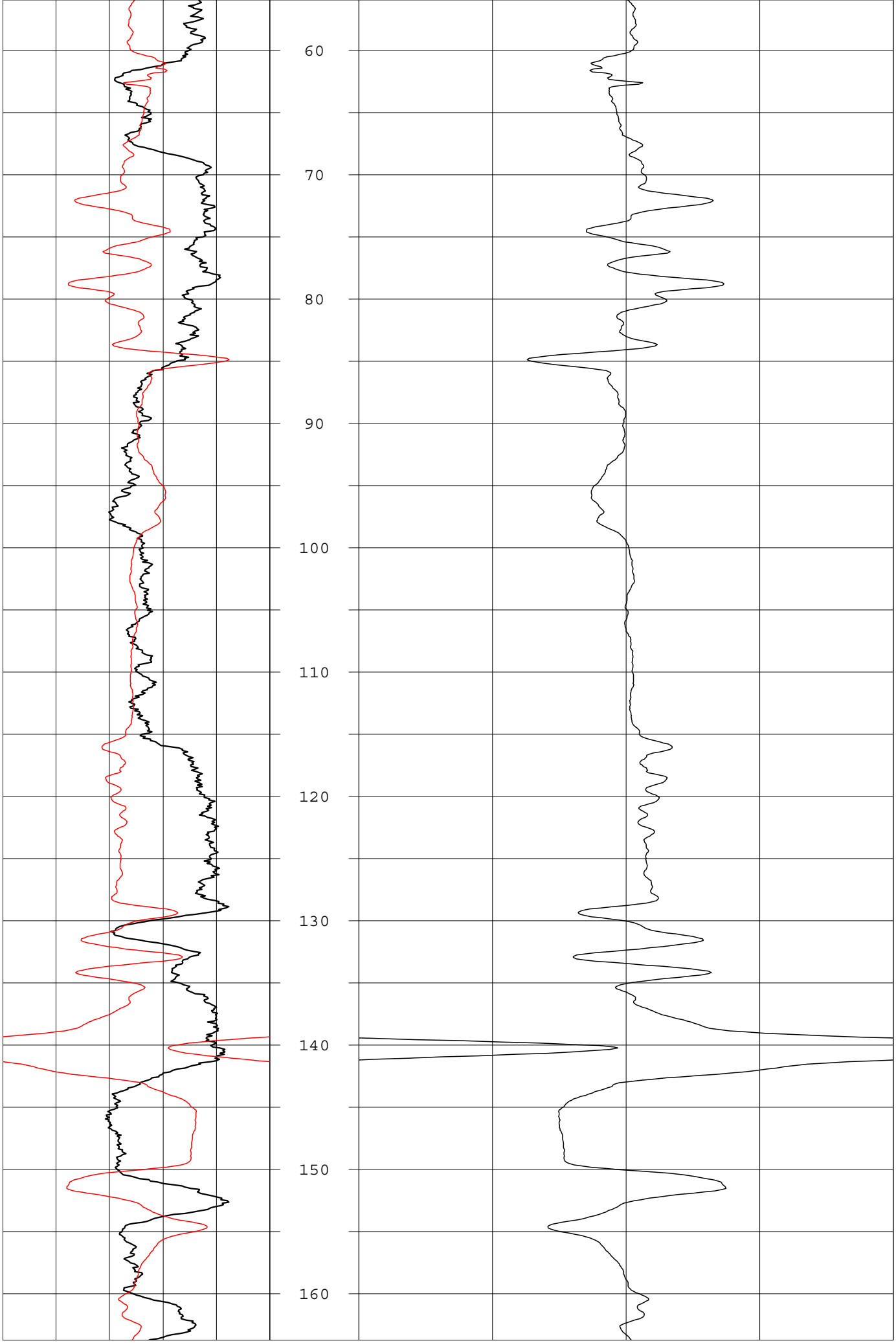
Alden Township Observation Well

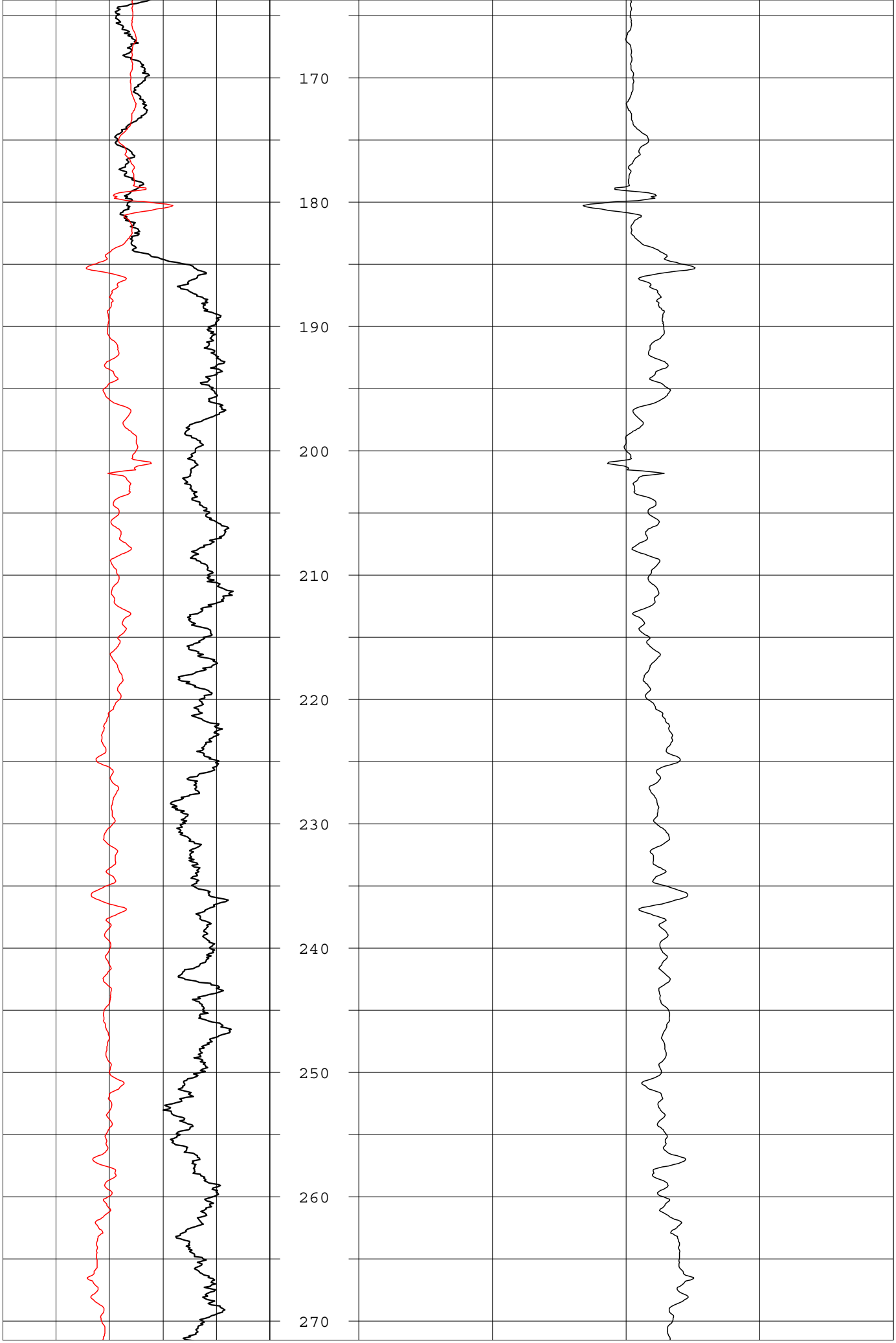
Alden Township Observation Well Site

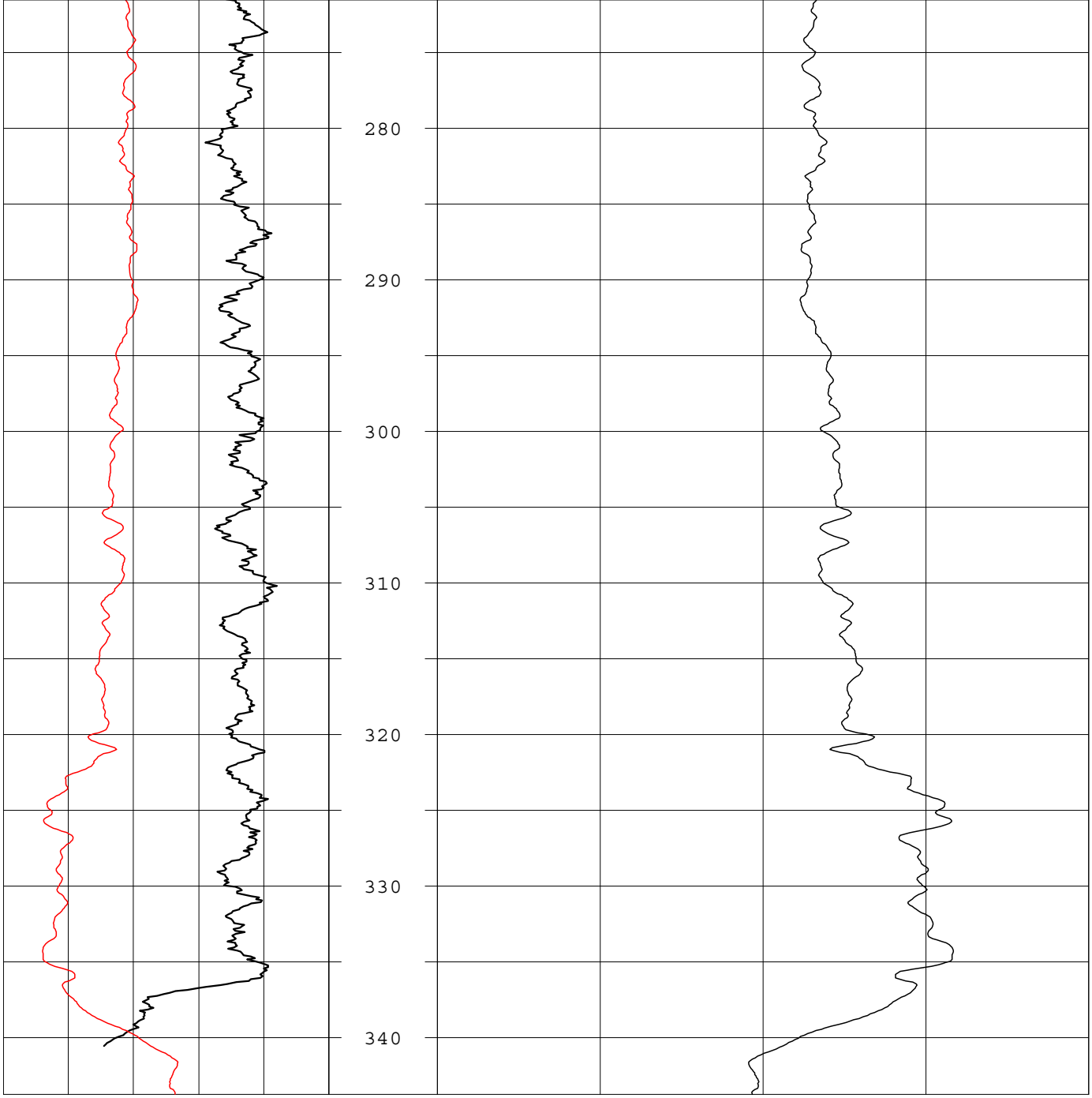
Alden Township Observation Well & Monument

Alden Township Well – Inside Casing

Alden Township Observation Well & Monument


60
70
80
90
100
110
120
130
140
150
160


170
180
190
200
210
220
230
240
250
260
270

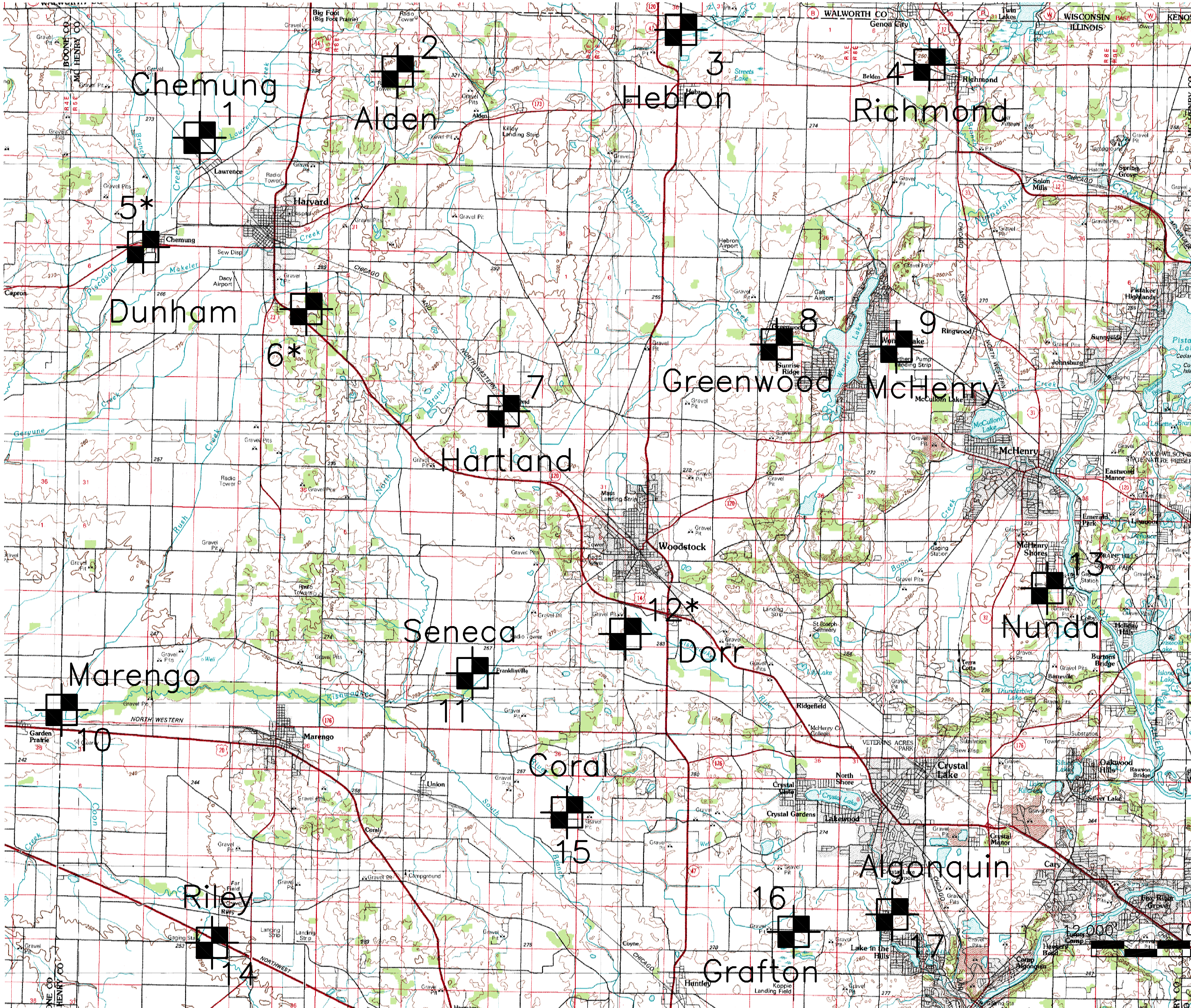

280
290
300
310
320
330
340

A-3: Folio for Well Site #3 – Hebron Township

Table of Contents

I.) Site Location Map – Location in County
II.) Site Location Map – Location on USGS Topographic Map
III.) Site Location Map – Location on USGS High Resolution Orthophoto
IV.) Site Boring Log
V.) Well Construction Diagram
VI.) Well Site Summary and Commentary
VII.) Particle Size Distribution Report
VIII.) Table of Water Level Measurements
IX.) Well Development Field Log
X.) Water Quality Analysis Results
XI.) Groundwater Sampling Field Log
XII.) Hydraulic Conductivity Testing Results
XIII.) In-Situ LevelTroll™ Calibration Report
XIV.) Site Photographs
XV.) Downhole Geophysical Testing

Well Site Location Maps



LEGEND:

AECOM Well Installation Site

McHenry 9

Well Installations By Others

Dunham 6*

N

12,000 0 12,000 24,000'

1" = 12,000'

AECOM

750 Corporate Woods Pkwy
Vernon Hills, IL 60061
847-279-2500
www.aecom.com

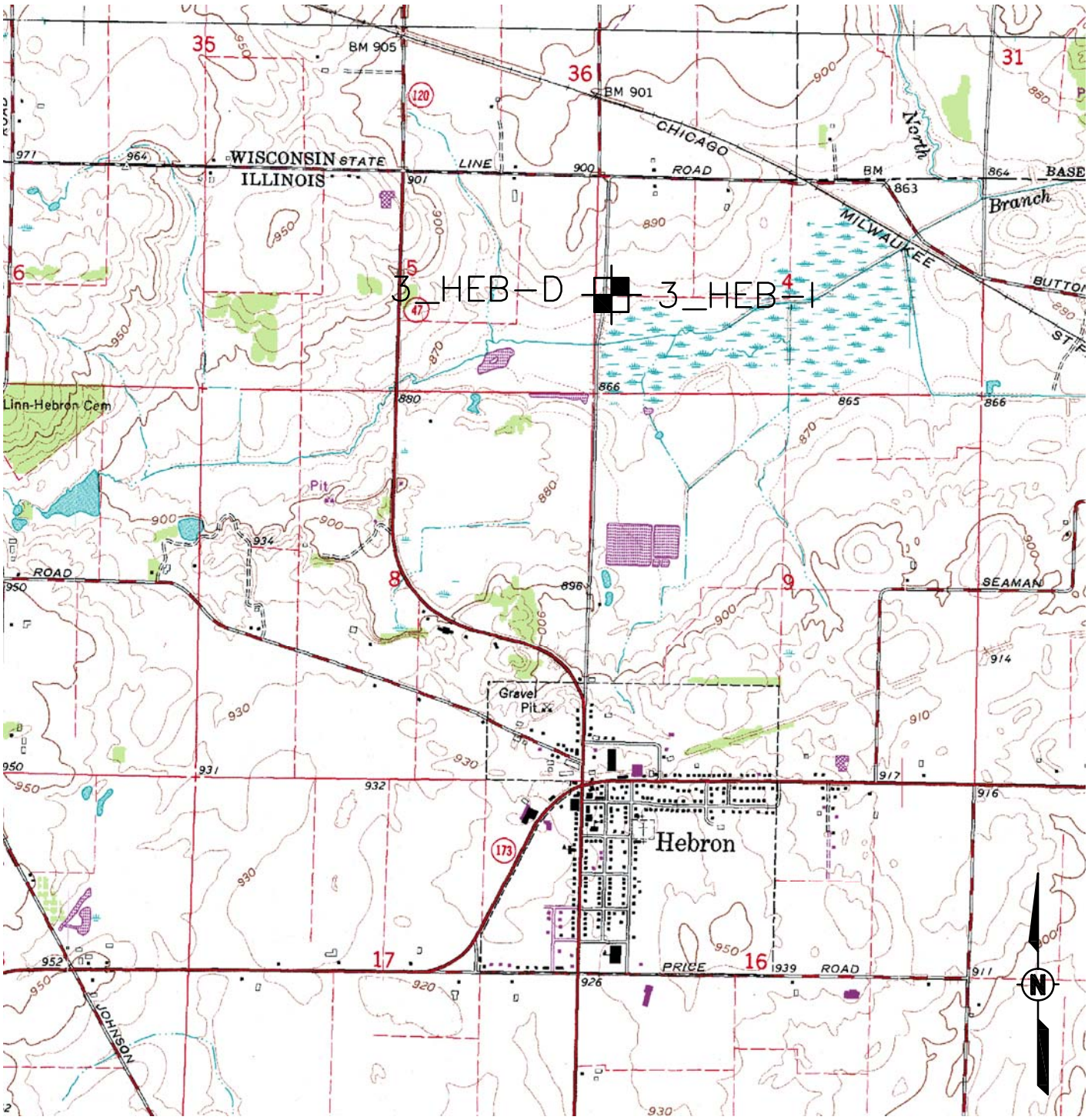
Copyright © By: STS Consultants, Ltd.

LOCATION MAP OF WELL SITES

Observation Well Network for Glacial Aquifers
McHenry County, Illinois

Drawn :	CJH 3/11/2009
Checked:	GMB 4/18/2009
Approved:	CSR 4/27/2009
PROJECT NUMBER	09000-460
FIGURE NUMBER	1

Z:\Projects\200804080\CtyWide\D-09000-460-8000_CtyOverviewMap_004.dwg; 4/20/2009 5:33:59 PM; BRAUN, GARY



2000 0 2000 4000

1" = 2000'

AECOM

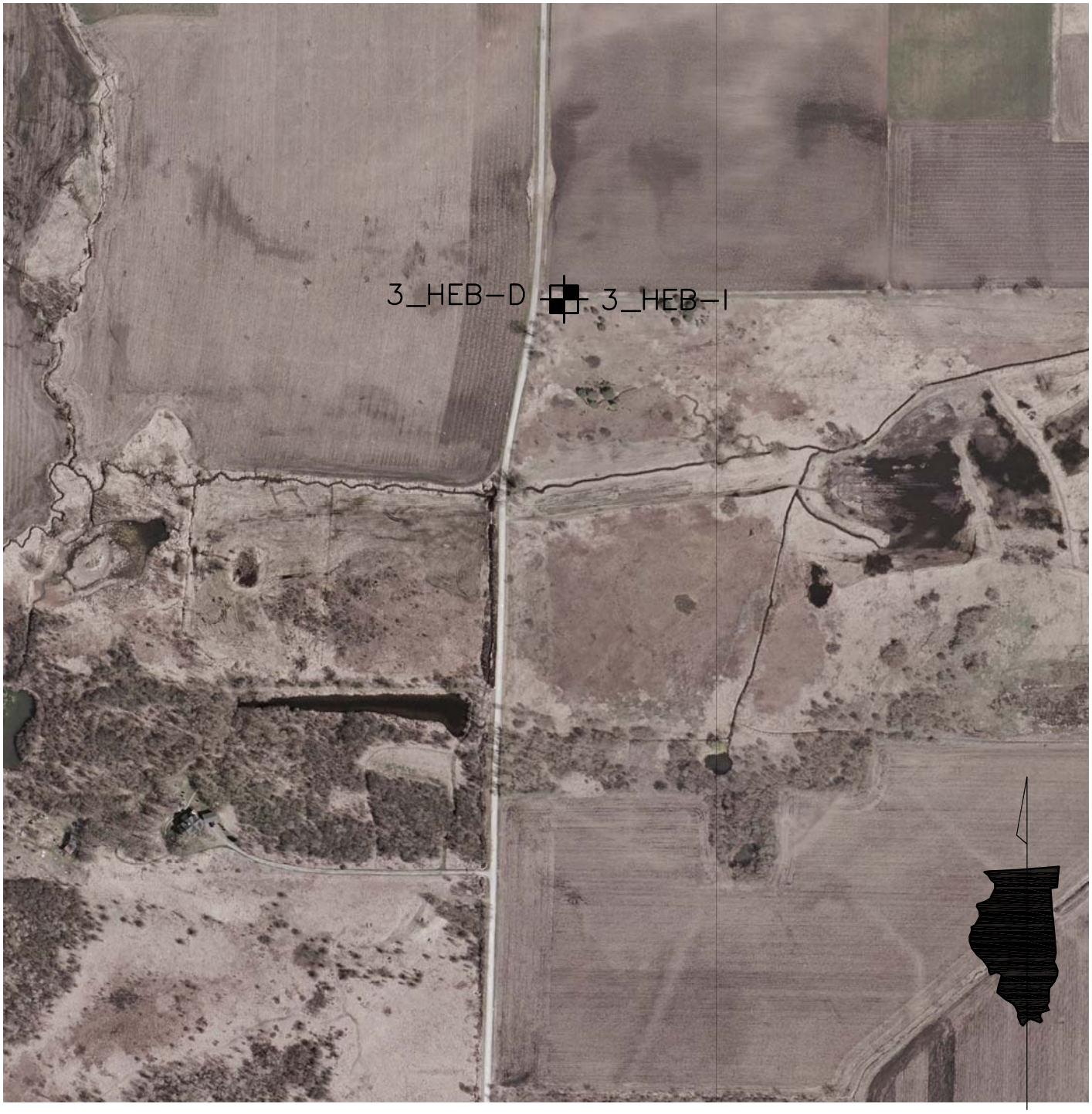
750 Corporate Woods Parkway
Vernon Hills, IL 60061
847.279.2500
www.aecom.com

Copyright © 2009, By: AECOM

Site Location on USGS Topographic Map
Site No. 3 - Hebron Township
Hebron Peatland - Freeman Rd.
Observation Well Network
McHenry County, Illinois

Drawn :	CJH	04/01/2009
Checked:	GMB	04/15/2009
Approved:	CSR	04/24/2009
PROJECT NUMBER	09000-460	
FIGURE NUMBER	Folio_3 #2	

Z:\Projects\200804080\CtyWide\D-09000-460-8000_TopoMaps_v02.dwg; 4/20/2009 9:57:08 AM; BRAUN, GARY; STS_BLACK_040102.ctb



500 0 500 1000

1" = 500'

AECOM

750 Corporate Woods Parkway
Vernon Hills, IL 60061
847.279.2500
www.aecom.com
Copyright © 2009, By: AECOM

2005 USGS High Resolution Orthophoto
Site No. 3 - Hebron Township
Hebron Peatland - Freeman Rd.
Observation Well Network
McHenry County, Illinois

Drawn :	CJH	04/01/2009
Checked:	GMB	04/15/2009
Approved:	CSR	04/24/2009
PROJECT NUMBER	09000-460	
FIGURE NUMBER	Folio_3 #2	

Z:\Projects\200804080\CtyWide\D-09000-460-8000_AerialsMap_004.dwg; 4/20/2009 11:50:15 AM; BRAUN, GARY; STS_BLACK_040102.ctb

Boring and Well Construction Details

DRILLING LOG

DIVISION	USACE
INSTALLATION	Chicago District
SHEET	1 OF 5 SHEETS
1. PROJECT	McHenry County Observation Wells
2. LOCATION (Coordinates or Station)	McHenry County, Illinois N 2,121,235.00 E 957,721.00
3. DRILLING AGENCY	WDC Exploration & Wells
4. HOLE NO. *(As shown on drawing title and file number)*	3-HEBRON
5. NAME OF DRILLER	Dan Tonnancour
6. DIRECTION OF HOLE	☒ VERTICAL ☐ INCLINED --- DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN	110.0
8. DEPTH DRILLED INTO ROCK	3.0
9. TOTAL DEPTH OF HOLE	113.0
10. SIZE AND TYPE OF BIT	3 7/8" Carbide Bit / 5 7/8" Casing
11. DATUM FOR ELEVATION SHOWN *(TBM or MSL)*	NAVD 88
12. MANUFACTURER'S DESIGNATION OF DRILL	Super Sonic II
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN	DISTURBED 16 / UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES	N/A
15. ELEVATION GROUND WATER	852.9
16. DATE HOLE	STARTED 9/26/2008 / COMPLETED 9/29/2008
17. ELEVATION TOP OF HOLE	+867.9
18. TOTAL CORE RECOVERY FOR BORING	96 %
19. GEOLOGIST	Gary Braun, LPG IL

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
+867.9	0.0		Topsoil: ML, Black organic with sand	90	1 0.0 5.0	
+866.9	1.0		Peat, black organic silt/peat			
+865.4	2.5		CL, Gray, reddish brown to dark brown silty clay, little sand, stiff, moist			
+862.4	5.5		SP, Brown-reddish brown mottled medium sand, dense, wet	100	2 5.0 15.0	
+861.4	6.5		ML, Grayish brown mottled medium sand, dense, wet			
+859.9	8.0		CH, Brownish gray fat clay, soft, high plasticity, damp to moist			Qp = 1.0 TSF @9.0'
						Qp = .75 TSF @11.0'
						Sample No. 1 from 14.0' to 15.0' Qp = 1.0 TSF @14.0'
				100	3 15.0 25.0	Qp = .75 TSF @16.0'
						Qp = 1.0 TSF @19.0'
+847.9	20.0					

DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE 867.9

Hole No. 3-HEBRON

PROJECT: McHenry County Observation Wells

INSTALLATION: Chicago District

SHEET 2 OF 5 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
			SP, Brownish gray medium sand, dense, wet			Sample No. 2 from 20.0' - 21.0'
+843.9	24.0					
			CL, Gray silty clay, soft, moist			Qp = .75 TSF @24.0'
+842.9	25.0					
			ML, Brownish Gray fine sandy silt, medium dense, wet, not plastic	100	4 25.0 35.0	Sample No. 3 from 25.0' to 26.0'
			Note: Silty clay lens, soft, moist encountered from 32.5' to 34.0'			Qp = 0.75 TSF @33.0' Sample No. 4 from 34.0' to 35.0'
+832.9	35.0					
			SM, Grayish brown silty sand, loose to medium dense, wet	100	5 35.0 45.0	
+829.4	38.5					
			CH, Brownish gray fat clay, soft, highly plastic			Qp = 0.50 TSF @40.0' Sample No. 5 from 42.0' to 43.0' Qp = 0.25 TSF @42.0'
				100	6 45.0	Qp = 0.50 TSF @45.0'

DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE 867.9

Hole No. 3-HEBRON

PROJECT: McHenry County Observation Wells

INSTALLATION: Chicago District

SHEET 3 OF 5 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
			CH, Brownish gray fat clay, soft, highly plastic *(continued)*		55.0	Qp = 0.25 TSF @47.0' Qp = 0.25 TSF @49.0' Qp = 0.25 TSF @51.0' Sample No. 6 from 54.0' to 55.0' Qp = 0.25 TSF @54.0'
+812.9	55.0		GC, Brownish gray sand and gravelly clay, soft to loose, wet, not plastic	80	7 55.0 65.0	
+807.9	60.0		GW, Gray fine to coarse gravelly sand, loose, wet, outwash			Sample No. 7 from 63.0' to 64.0' % Gravel/% Sand/% Fines = 76/22/3 from 63.0' to 64.0'
				75	8 65.0 75.0	
+800.9	67.0		CL, Brownish gray silty, sandy, gravelly clay, very hard Note: Clayey sand and gravel lens encountered from 68.5' to 69.0'			Qp = 4.0 TSF @68.0' Qp = 4.0 TSF @70.0'
+796.9	71.0					

DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE 867.9

Hole No. 3-HEBRON

PROJECT: McHenry County Observation Wells

INSTALLATION: Chicago District

SHEET 4 OF 5 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
			SW, Brownish gray fine to coarse sand and gravel, little silt and clay, trace black mottling, trace earthy odor, dense, wet *(continued)*			Sample No. 8 from 74.0' to 75.0'
				100	9 75.0 85.0	
+788.9	79.0					
			CL, Grayish brown silty clay with sand and gravel, very hard			Sample No. 9 from 79.0' to 80.0' Qp = 1.25 TSF @79.0'
+786.9	81.0					
			SP, Gray medium sand, little gravel, loose, wet			
+785.4	82.5					
			ML, Brownish gray silt to clayey silt, hard, damp			Sample No. 10 from 84.0' to 85.0'
+782.9	85.0					
			GW, Gray sandy fine gravel, little medium gravel, loose, wet	95	10 85.0 95.0	Sample No. 11 from 90.5' to 91.0' % Gravel/% Sand/% Fines = 69/26/5 from 91.0' to 92.0'
+774.9	93.0					
			SP, Gray gravelly sand, moderately dense to loose, wet			
+772.9	95.0					
			CL-ML, Gray clayey silt, little fine gravel and coarse gravel, hard to very hard with occasional silt interbeds	100	11 95.0 105.0	Sample No. 12 from 95.0' to 96.0' Qp = >4.5 TSF @96.0'

DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE 867.9

Hole No. 3-HEBRON

PROJECT: McHenry County Observation Wells

INSTALLATION: Chicago District

SHEET 5 OF 5 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
			CL-ML, Gray clayey silt, little fine gravel and coarse gravel, hard to very hard with occasional silt interbeds *(continued)*			Qp = >4.5 TSF @98.0' Qp = >4.5 TSF @100.0'
+766.9	101.0					
			SP, Gray medium sand, little gravel, loose			
+765.9	102.0					
			CL, Gray silty clay, extremely hard, little fine gravel and coarse sand, damp			Qp = >4.5 TSF @102.0' Sample No. 13 from 104.0' to 105.0' Qp = >4.5 TSF @104.0'
				100	12 105.0 110.0	Sample No. 14 from 107.0' to 108.0'
+759.4	108.5					
			GP, Gray fine to coarse gravel			Sample No. 15 from 109.0' to 110.0'
+757.9	110.0					
			Dolomite Bedrock	83	13 110.0 113.0	AECOM Project No. 60095270 Sample No. 16 from 112.0' to 113.0'
+754.9	113.0					
			END OF BORING - 125.0' BGS Note: Artesian conditions observed - water flowing out of outer casing at 5.0' above ground surface			

Hole No. #3 - HEBRON TWP

DRILLING LOG	DIVISION CHICAGO	INSTALLATION —	SHEET 1 OF 8 SHEETS

1. PROJECT McHenry City MWells	10. SIZE AND TYPE OF BIT 3 7/8" INNER 5 7/8" OUTER CASING
2. LOCATION (Coordinates or Station) N2121235 E957,721 IL STPLE	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) NAVD88
3. DRILLING AGENCY WDC Drilling & Explor.	12. MANUFACTURERS DESIGNATION OF DRILL SuperSonic II
4. HOLE NO. (As shown on drawing title and title number) #3-HEB	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 16; UNDISTURBED Ø
5. NAME OF DRILLER DAN TONNACOUR	14. TOTAL NUMBER CORE BOXES —
6. DIRECTION OF HOLE ☑ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.	15. ELEVATION GROUND WATER +15 ft (Artesian)
	16. DATE HOLE: STARTED 9/26/08; COMPLETED 9/29/08
	17. ELEVATION TOP OF HOLE 867.9 ft MSL
7. THICKNESS OF OVERBURDEN 110 ft	18. TOTAL CORE RECOVERY FOR BORING 96%
8. DEPTH DRILLED INTO ROCK 3 ft	19. SIGNATURE OF INSPECTOR Gary M. Brown LPG IL
9. TOTAL DEPTH OF HOLE 113 ft	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g	
867.9	0		TOPSOIL - Black, Organic w/ SA/ML			RUN 1 (0-5') Rec/Run = 4.5'/5' = 90%	0705 GRASSLAND SURFACE CONDITIONS
	1		Black Organic SILT / PEAT	Rec 90%	Bag #1		
	2						
	3		Gray, Reddish Brown to Dark Brown, Silty CLAY, 1% Sand, stiff, moist				
	4						
	5						0710
						RUN 2 (5-15') Rec/Run = 10'/10' = 100%	0715
	6		Br - Reddish Br mottled Med. SA. dense, wet (SP)		Bag #2		
	7		Grayish Brown, Sandy SILT, dense, wet (ML) Abrupt gradation to				
	8						
	9		Brownish Gray FAT CLAY, soft, high plasticity, well sorted, w/ less than 1% C.SA/F.grvl damp to moist (CH)	Rec 100%	Bag #3	1.0 tsf	
857.9	10						
	11					0.75 tsf	
	12						
	13				Bag #4		
	14					1.0 tsf	
	15					S1	0730

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT McHenry Twp MWells — HOLE NO. #3-HEBRON

Hole No. #3 - HEBRON

DRI	INSTALLATION — / SHEET 2 OF 8 SHEETS
1. PROJECT	10. SIZE AND TYPE OF BIT 4" Carbide Sampler & 6" outer Rotosonic casing
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) NAVD 88
3. DRILLING AGENCY WDe Exploration & Wells	12. MANUFACTURERS DESIGNATION OF DRILL Super Sonic II
4. HOLE NO. (As shown on drawing title and title number) 3 - HEB	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 16 / UNDISTURBED —
5. NAME OF DRILLER DAN TONNANCOUR	14. TOTAL NUMBER CORE BOXES —
6. DIRECTION OF HOLE ☑ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER +15' (Artesian)
	16. DATE HOLE: STARTED 9/26/08 / COMPLETED 9/29/08
7. THICKNESS OF OVERBURDEN 110'	17. ELEVATION TOP OF HOLE 867.9 FT MSL
8. DEPTH DRILLED INTO ROCK 3	18. TOTAL CORE RECOVERY FOR BORING 96%
9. TOTAL DEPTH OF HOLE 113'	19. SIGNATURE OF INSPECTOR Gary M. Brown LPG IL

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g	
	15		~~Silty~~ CLAY cont. ?		Bag # 5	RUN 3 (15-25) Rec/Run = 10'/10' = 100%	0740
	16		very thinly bedded → trace bedding plane			0.75 tsf	
	17						
	18				Bag # 6	1.0 tsf	
	19			Rec 100%			
847.9	20		Brownish Gray Medium SAND, dense, wet (SP)		S2		
	21						
	22		Intra-Clay Sand Abrupt Contact (less than 0.1')		Bag # 7		
	23						
	24		Gray Silty CLAY soft, moist (CL)			0.75 tsf	0800
	25		Brownish Gray fine sandy SILT, Medium dense, wet (ML-SM) Not plastic		S3 Bag # 8	RUN 4 (25-35) Rec/Run = 10'/10' = 100%	0820
	26						
	27			Rec 100%			
	28		Core Recovery, Breaks at 0.25-0.35' Sandy intervals		Bag # 9		
	29						
837.9	30						

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT McHenry Cty MWells | HOLE NO. #3 - HEBRON

Hole No. #3 - HEBRON

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 3 OF 8 SHEETS

1. PROJECT: McHenry Cty Wells
2. LOCATION (Coordinates or Station): —
3. DRILLING AGENCY: WOC Exploration & Wells
4. HOLE NO. (As shown on drawing title and title number): 3-HEB.
5. NAME OF DRILLER: DAN TENNANCOUR
6. DIRECTION OF HOLE: ☑ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 110'
8. DEPTH DRILLED INTO ROCK: 3'
9. TOTAL DEPTH OF HOLE: 113'
10. SIZE AND TYPE OF BIT: 4" carbide / 6" Casing
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): NAVD 88
12. MANUFACTURERS DESIGNATION OF DRILL: Super Sonic II
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 16 / UNDISTURBED Ø
14. TOTAL NUMBER CORE BOXES: —
15. ELEVATION GROUND WATER: +15' (Artesian)
16. DATE HOLE: STARTED 9/26/08 / COMPLETED 9/29/08
17. ELEVATION TOP OF HOLE: 867.9 ft MSL
18. TOTAL CORE RECOVERY FOR BORING: 96 %
19. SIGNATURE OF INSPECTOR: Gary M. Bom LPG IL

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g	
	30		Continued — Sandy SILT (bedded)		#9	Run 4 cont.	
	31						
	32			Rec 100%			
	33		Silty CLAY lens soft, moist		Bag # 10	0.75 tsf	
	34				S4		0840
	35		Grayish Brown Silty SAND, loose to Medium Dense, wet (SM)			Run 5 (35-45)	0902
	36				Bag #11	Rec/Run = 10'/10' = 100%	
	37						
	38						
FM Contact? (not likely very uniform as 7-19' above)	39		Brownish Gray FAT CLAY, soft, Highly Plastic (CH), very uniform	Rec 100%	Bag #12	0.5 tsf	
827.9	40						
	41						
	42				S5	0.25 tsf	
	43				Bag #13		
	44						
	45					0.5 tsf	0915

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT: McHenry Cty Wells | HOLE NO. #3 - HEBRON

Hole No. #3 - HEBRON

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 4 OF 8 SHEETS

1. PROJECT McHenry Cty Wells	10. SIZE AND TYPE OF BIT 4" Sampler / 6" Casing (Roto-Sonic) Carbide
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) NAVD 88
3. DRILLING AGENCY WDC Explor. & Wells	12. MANUFACTURERS DESIGNATION OF DRILL Super Sonic II
4. HOLE NO. (As shown on drawing title and title number) 3-HEB	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 16, UNDISTURBED 0
5. NAME OF DRILLER DAN TONNANCOUR	14. TOTAL NUMBER CORE BOXES —
6. DIRECTION OF HOLE ☑ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.	15. ELEVATION GROUND WATER +15' (Artesian)
	16. DATE HOLE: STARTED 9/26/08, COMPLETED 9/29/08
7. THICKNESS OF OVERBURDEN 110'	17. ELEVATION TOP OF HOLE 867.9 ft msl
8. DEPTH DRILLED INTO ROCK 3'	18. TOTAL CORE RECOVERY FOR BORING 96%
9. TOTAL DEPTH OF HOLE 113'	19. SIGNATURE OF INSPECTOR Gary M. Brown LPG IL

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g	
	45		cont.			Run 6 (45-55)	0917-0919 Push Sampler
	46		very plastic silty CLAY (CH)		Bag 14	Rec/Run = 10'/10' = 100%	
	47					0.25 t.s.f	
	48						
	49		trace fine to coarse gravel	Rec 100%	Bag 15	0.25 t.s.f	
817.9	50						
	51					0.25 t.s.f	
	52						
	53				Bag 16		
	54						
	55				36	0.25 t.s.f	0930
	56		(Olive) Brownish Gray Sand & Gravelly CLAY, soft to loose wet (GC/SC) sand, gravel, clay mixture not plastic			Run 7 (55-65)	0935
	57			Rec 80%	Bag 17	Rec/Run 8'/10' = 80%	
	58						
	59						
807.9	60						

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT McHenry Cty Wells — HOLE NO. #3-HEBRON

Hole No. #3- HEBRON

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 5 OF 8 SHEETS

1. PROJECT: McHenry Cty Wells
2. LOCATION (Coordinates or Station):
3. DRILLING AGENCY: WDC Exploration & Wells
4. HOLE NO. (As shown on drawing title and title number): 3-HEB
5. NAME OF DRILLER: DAN TONNANCOUR
6. DIRECTION OF HOLE: [X] VERTICAL [ ] INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 110'
8. DEPTH DRILLED INTO ROCK: 3'
9. TOTAL DEPTH OF HOLE: 113'
10. SIZE AND TYPE OF BIT: 4" Carbide Sampler w/ 6" Casing
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): NAVD 88
12. MANUFACTURERS DESIGNATION OF DRILL: Super Sonic II
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 16; UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES: —
15. ELEVATION GROUND WATER: +15' (Artesian)
16. DATE HOLE: STARTED 9/26/08; COMPLETED 9/29/08
17. ELEVATION TOP OF HOLE: 867.9 FMSL
18. TOTAL CORE RECOVERY FOR BORING: 96%
19. SIGNATURE OF INSPECTOR: Gary M. Bu LPG IL

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
807.9	60		Gray fine to coarse gravelly SAND, loose, wet (GW/SW) OUTWASH			RUN 7 (55-65) continued
	61					
	62			Rec. 80%	Bag 18	
	63		Gravel seam		s7	Replicate 63-64' sample for sieve
	64					
	65		Gravel seam			
	66				Bag 19	RUN 8 (65-75) Rec/Run = 9.5/10 = 95%
	67		Brownish Gray Silty-Sandy-Gravelly CLAY, very hard (CL)			
	68					4.0 tsf
	69		Clayey Sand & Gravel lens	Rec. 95%	Bag 20	
797.9	70		DIAMICTON			4.0 tsf
	71		Brownish-Gray fine to coarse SAND & GRAVEL little silt & clay, dense, wet (SW/GW) to (SC/GC) DIAMICTON			
	72					
	73				Bag 21	* tr. black ~~oxidation~~ unoxidized mottling / tr earthy odor
	74				s8	
	75					

INTERMEDIATE

61-66' planned well

GRAVEL

~940 starts raining (consistent medium rain)

0952 Break

1010 - start back up

1030 Extract Samples

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT: McHenry Cty Wells — HOLE NO. #3- HEBRON

Hole No. #3 - HEBRON

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 6 OF 8 SHEETS

1. PROJECT: McHenry Cty Wells
2. LOCATION (Coordinates or Station):
3. DRILLING AGENCY: WDC Exploration & Wells
4. HOLE NO. (As shown on drawing title and title number): 3-HEB
5. NAME OF DRILLER: DAN TONNANCOUR
6. DIRECTION OF HOLE: [X] VERTICAL [ ] INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 110'
8. DEPTH DRILLED INTO ROCK: 3'
9. TOTAL DEPTH OF HOLE: 113'
10. SIZE AND TYPE OF BIT: 4" Carbide Sampler / 6" Casing
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): NAVD 88
12. MANUFACTURERS DESIGNATION OF DRILL: Super Sonic II
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 16 / UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES: 0
15. ELEVATION GROUND WATER: +15' (Artesian)
16. DATE HOLE: STARTED 9/26/08 / COMPLETED 9/29/08
17. ELEVATION TOP OF HOLE: 867.9 FT MSL
18. TOTAL CORE RECOVERY FOR BORING: 96%
19. SIGNATURE OF INSPECTOR: Dan M. [illegible] LPG IL

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	75		Cont. Brownish-Gray SAND & GRAVEL w/silt & clay slightly cohesive where no gravel DIAMICTON			Run 9 (75-85) 1036
	76				Bag 22	Rec / Run = 10'/10' = 100%
	77					
	78					
	79			Rec	Bag 23	
787.9	80		Grayish Brown (slightly reddish) Silty CLAY, w/ sand & gravel, very hard DIAMICTON (CL)	100%	9	1.25 tsf Driller: Hard Fan very hard drilling (79-85')
	81		Gray Medium SAND, little gravel loose, wet (SP)			
	82					
	83		Brownish Gray SILT to Clayey SILT, hard, damp (ML). Occasional (CL-ML) interbeds		Bag 24	
	84					Q = 4.5 tsf ML = 1.25 tsf
					10	CL-ML = 3.5 tsf Extract sample 1102
	85		Gray sandy fine GRAVEL, little Med loose, wet (GW)		Bag 25	Run 10 (85-95) 1116
	86			Rec		Rec 9.5'/Run 10' = 95%
	87		Some Angular gravel	95%		
	88				Bag 26	Driller reports Artesian conditions occurred at 65' and has continued through to 95'
	89					
777.9	90					

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT: McHenry Cty Wells — HOLE NO. #3-HEBRON

Hole No. #3 - HEBRON

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 7 OF 8 SHEETS

1. PROJECT: McHenry Cty Wells
2. LOCATION (Coordinates or Station):
3. DRILLING AGENCY: WOC Exploration & Wells
4. HOLE NO. (As shown on drawing title and title number): 3-HEB
5. NAME OF DRILLER: DAN TONNACOUR
6. DIRECTION OF HOLE: ☑ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 110'
8. DEPTH DRILLED INTO ROCK: 3'
9. TOTAL DEPTH OF HOLE: 113'
10. SIZE AND TYPE OF BIT: 4" Sampler / 6" Casing w/ carbide Bits
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): NAVD88
12. MANUFACTURERS DESIGNATION OF DRILL: SuperSonic II
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 16; UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES: —
15. ELEVATION GROUND WATER: +15' (Artesian)
16. DATE HOLE: STARTED 9/26/08; COMPLETED 9/29/08
17. ELEVATION TOP OF HOLE: 867.9 ft MSL
18. TOTAL CORE RECOVERY FOR BORING: 96%
19. SIGNATURE OF INSPECTOR: Gary M. Brown EPG IL

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
777.9	90		cont. Sandy GRAVEL			Run 10 cont.
	91				S11	
	92			95%	Bag 27	91-92' sample for sieve
	93		Gray Gravelly SAND, med dense to loose, wet (SP)			
	94					
	95		Gray Clayey SILT, little fine gravel & coarse gravel, ~~hard~~ ~~start hard~~ to very hard w/ occasional SILT interbeds (CL-ML) DIAMICTON	S12		Run 11 (95-105) 1140 1150 start Heavy Rain
	96				>4.5+ tsf	Rec 10' / Run 10' = 100%
	97				Bag 28	
	98					4.5+ tsf
	99					
767.9	100			Rec 100%	Bag 29	>4.5 tsf
	101		Gray Medium SAND, little fine grvl, loose (SP)			
	102		Gray Silty Clay Extremely hard, little fine gravel & coarse sand, damp. (CL)			>4.5 tsf
	103				Bag 30	Difficult drilling
	104					>4.5 tsf
	105				S13	1218 Lunch

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT: McHENRY CTY WELLS — HOLE NO. #3-HEBRON

Hole No. #3 HEBRON

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 8 OF 8 SHEETS

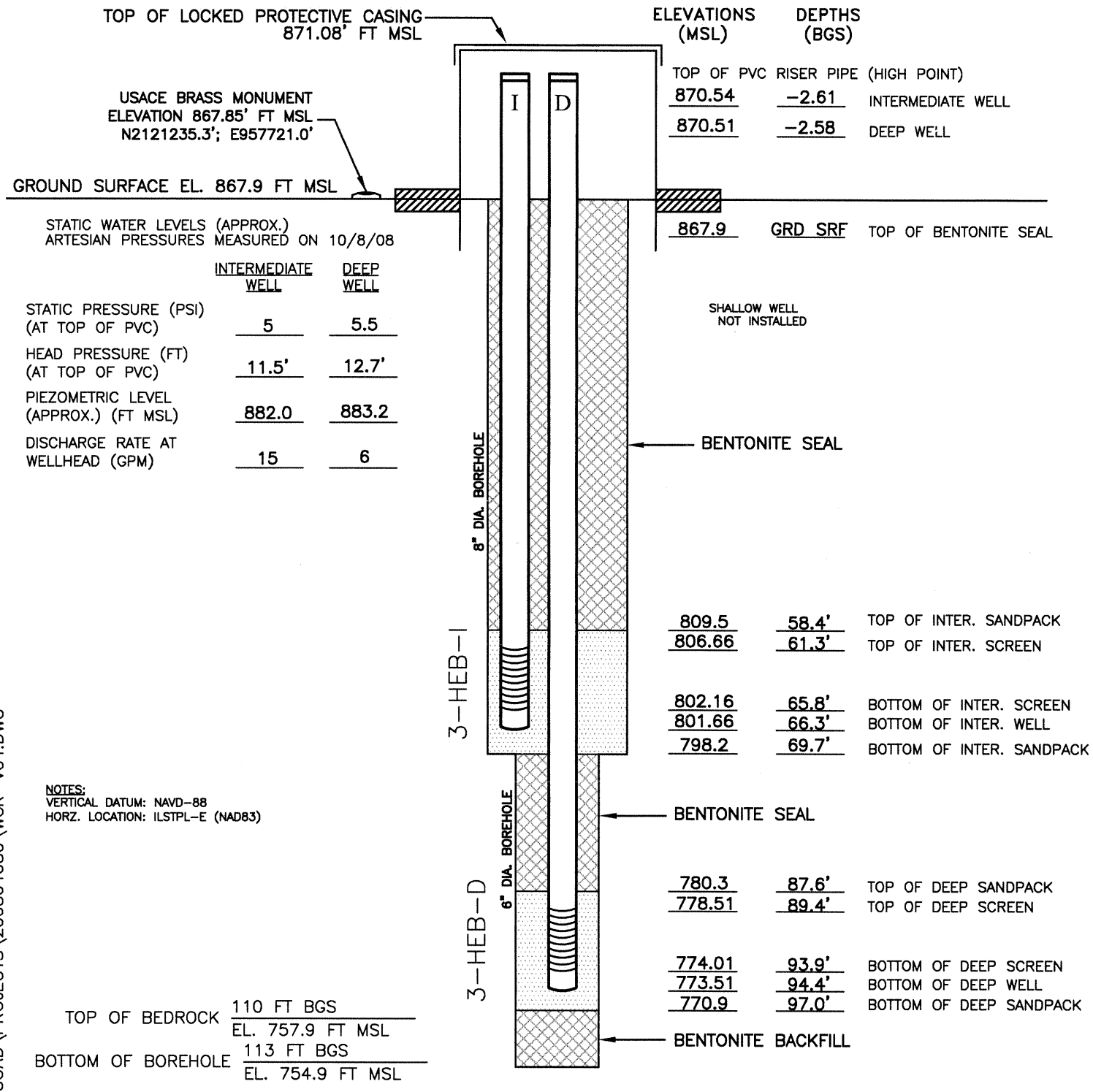
1. PROJECT: McHenry Cty Wells
2. LOCATION (Coordinates or Station):
3. DRILLING AGENCY: WDC Exploration & Wells
4. HOLE NO. (As shown on drawing title and title number): 3-HEB
5. NAME OF DRILLER: DAN TONNANCOUR
6. DIRECTION OF HOLE: [x] VERTICAL [ ] INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 110'
8. DEPTH DRILLED INTO ROCK: 3'
9. TOTAL DEPTH OF HOLE: 113'
10. SIZE AND TYPE OF BIT: 4" Sampler / 6" Casing
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): NAVD 88
12. MANUFACTURERS DESIGNATION OF DRILL: Super Sonic II
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 16; UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES: —
15. ELEVATION GROUND WATER: +15' (Artesian)
16. DATE HOLE: STARTED 9/26/08; COMPLETED 9/29/08
17. ELEVATION TOP OF HOLE: 867.9 ft MSL
18. TOTAL CORE RECOVERY FOR BORING: 96 %
19. SIGNATURE OF INSPECTOR: Gary M. Brown LPG IL

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g	
	105		Cont. Extremely Hard Silty CLAY Hardpan (CL)	Rec. 100%	Bag 31 S14	RUN 12 (105-110) Rec 5' / Run 5' = 100% OUTER CASING ADVANCED TO 105'. Inner casing advanced to 113' to collect samples... cont. below	1318
	106						
	107						
	108						
	109		Gray Med. SAND				
			Gray Fine to Coarse GRAVEL	S15	Bag 32		
757.9	110		DOLOMITE BEDROCK			RUN 13 (110-113) Rec / Run = 2.5 / 3' = 75%	1338
	111			Rec 75%	Bag #33		
	112				S16	... Artesian conditions observed: water flowing out of outer casing at 3 feet above ground surface.	
754.9	113		END OF BORING			Second outer casing 7 5/8" diameter lowered to ~65 ft bgs for shallow well installation.	1400

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT: McHenry Cty Wells | HOLE NO. #3 - HEBRON TWP

PROJECT McHENRY COUNTY OBSERVATION WELL NETWORK INSTALLATION (#09000-460)	WELL NO. 3-HEB-I & 3-HEB-D
LOCATION HEBRON TOWNSHIP – McHENRY COUNTY, ILLINOIS	
CLIENT U.S. ARMY CORPS OF ENGINEERS / McHENRY COUNTY	
GEOLOGIST GARY BRAUN, P.G. (AECOM)	INSTALLATION DATE SEPT. 29, 2008
DRILLER WDC EXPLORATION AND WELLS, INC. (DAN TONNANCOUR)	DRILLING METHOD ROTO-SONIC



ELEVATIONS (MSL)	DEPTHS (BGS)	
TOP OF PVC RISER PIPE (HIGH POINT)		
870.54	-2.61	INTERMEDIATE WELL
870.51	-2.58	DEEP WELL
867.9	GRD SRF	TOP OF BENTONITE SEAL
809.5	58.4'	TOP OF INTER. SANDPACK
806.66	61.3'	TOP OF INTER. SCREEN
802.16	65.8'	BOTTOM OF INTER. SCREEN
801.66	66.3'	BOTTOM OF INTER. WELL
798.2	69.7'	BOTTOM OF INTER. SANDPACK
780.3	87.6'	TOP OF DEEP SANDPACK
778.51	89.4'	TOP OF DEEP SCREEN
774.01	93.9'	BOTTOM OF DEEP SCREEN
773.51	94.4'	BOTTOM OF DEEP WELL
770.9	97.0'	BOTTOM OF DEEP SANDPACK

STATIC WATER LEVELS (APPROX.)
ARTESIAN PRESSURES MEASURED ON 10/8/08

	INTERMEDIATE WELL	DEEP WELL
STATIC PRESSURE (PSI) (AT TOP OF PVC)	5	5.5
HEAD PRESSURE (FT) (AT TOP OF PVC)	11.5'	12.7'
PIEZOMETRIC LEVEL (APPROX.) (FT MSL)	882.0	883.2
DISCHARGE RATE AT WELLHEAD (GPM)	15	6

SHALLOW WELL NOT INSTALLED

NOTES:
VERTICAL DATUM: NAVD-88
HORZ. LOCATION: ILSTPL-E (NAD83)

TOP OF BEDROCK 110 FT BGS / EL. 757.9 FT MSL

BOTTOM OF BOREHOLE 113 FT BGS / EL. 754.9 FT MSL

NOT TO SCALE

WELL CONSTRUCTION MATERIALS*

PROTECTIVE CASING	5' L X 8" DIA. ALUMINUM CASING W/ LOCKING CAP
RISER PIPE ABOVE W.T.	SCHEDULE 40 PVC (2.07" I.D./ 2.38" O.D.)
RISER PIPE BELOW W.T.	SCHEDULE 40 PVC (2.07" I.D./ 2.38" O.D.)
SCREEN	2" I.D. SCHEDULE 40 PVC W/ 0.010" SCREEN SLOT SIZE
TYPE OF BENTONITE SEAL	BLACK HILLS BENTONITE – 3/8" CHIPS (HOLE PLUG)
TYPE OF SAND PACK	R.W. SIDLEY CO. – NO. 5 FILTER PACK SAND

CASING MEASUREMENTS

BOTTOM OF SCREEN TO END CAP (FT)*	0.50
SCREEN LENGTH (1ST SLOT TO LAST SLOT) (FT)*	4.50
TOTAL LENGTH OF CASING (FT): INTERMEDIATE WELL	68.88
DEEP WELL	97.00

* MEASUREMENT REFERS TO ALL WELLS

USMWK2FP001\05CAD\PROJECTS\20080408O\WCR-V04.DWG

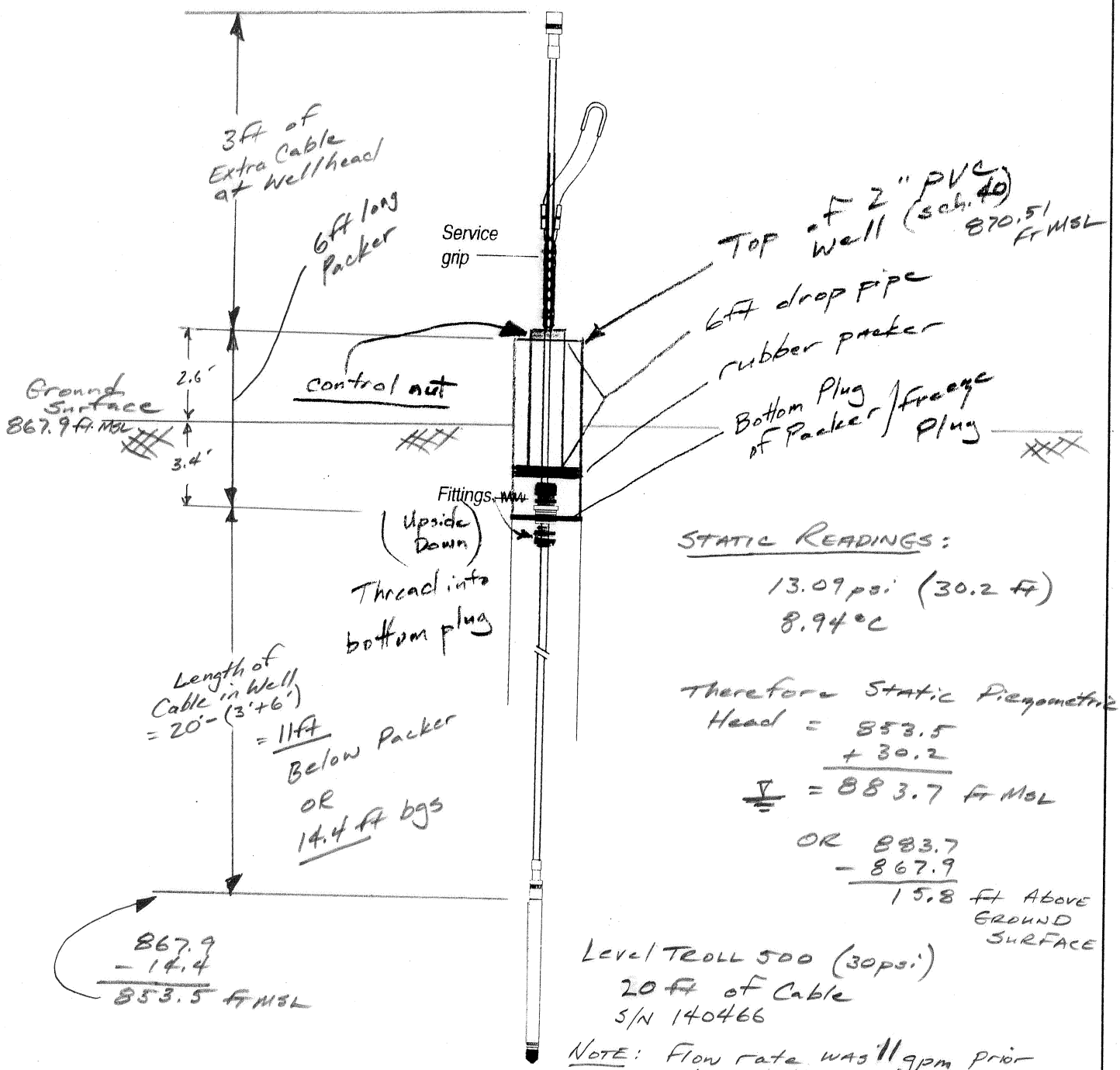
STS | AECOM

Calculation Sheet

Project				Subject		
McHenry Cty Wells				Level TROLL Position in Well		
Originated By	Date	Checked By	Date	STS Job No.	Scale	Sheet No.
gmb	4/20/09			09000-460	NTS	1 Of 2

Level TROLL Positioning through Artesian Packer

SITE: 3 - HEBRON TOWNSHIP
DEEP WELL



STATIC READINGS:

13.09 psi (30.2 ft)
8.94 °C

Therefore Static Piezometric Head = 853.5 + 30.2 = 883.7 ft MSL

OR 883.7 - 867.9 = 15.8 ft Above Ground Surface

Level TROLL 500 (30psi)
20 ft of Cable
S/N 140466

NOTE: Flow rate was 11 gpm prior to sealing well

STS | AECOM

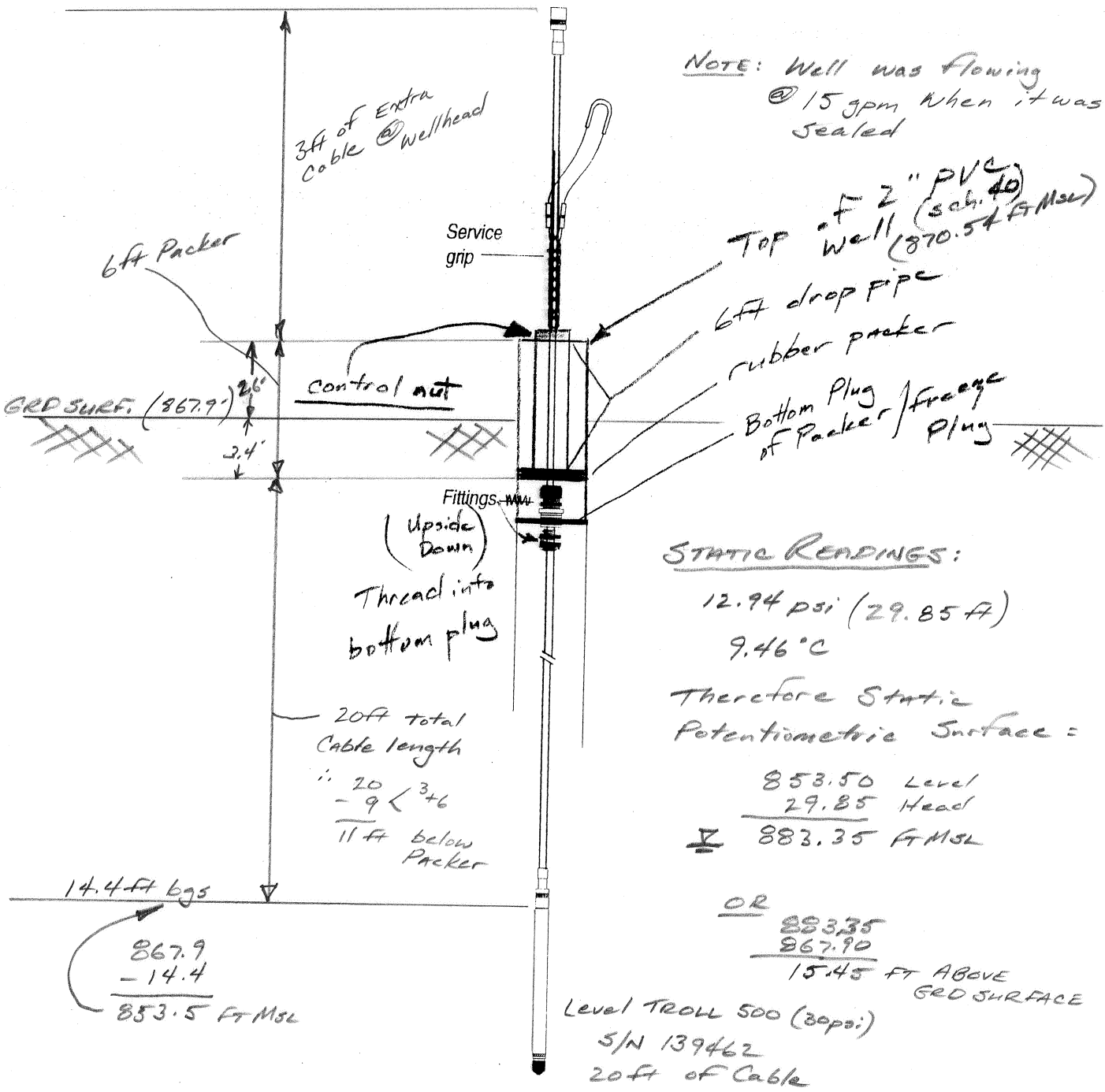
Calculation Sheet

Project				Subject		
McHenry Cty Wells				Level TROLL Position in Well		
Originated By	Date	Checked By	Date	STS Job No.	Scale	Sheet No.
gmb	4/20/09			09000-460	NTS	2 Of 2

Level TROLL Positioning through Artesian Packer

SITE: 3 - HEBRON TOWNSHIP

INTERMEDIATE WELL



NOTE: Well was flowing @ 15 gpm when it was sealed

STATIC READINGS:

12.94 psi (29.85 ft)

9.46 °C

Therefore Static Potentiometric Surface:

853.50 Level
29.85 Head
883.35 ft MSL

OR

883.35
867.90
15.45 ft ABOVE GRD SURFACE

WELL SITE DATA SUMMARY AND COMMENTARY

Well Site #3 – Hebron Township
MCCD Property at Hebron Peatland - Freeman Rd.

The Hebron Township monitoring well site is located on McHenry County Conservation District (MCCD) property in a low-lying depression on Freeman Road. The property is situated 35 to 85 feet lower than the surrounding agricultural land to the north and west. Artesian conditions were first observed at a depth of 65 feet and continued throughout the remainder of the borehole. Bedrock was encountered at a depth of 110 feet and the borehole was terminated 3 feet into bedrock at a depth of 113 feet below ground surface (bgs). Two observation wells were installed at depths of 62-67 feet (intermediate) and 90-95 feet (deep) below ground surface. A shallow well, which would have been likely targeted for 20-24 ft or 35-38.5 ft, was not installed. The annular space between the sand filter pack intervals in the borehole (i.e. 58.4-69.7ft and 87.6-97ft, respectively) was backfilled with granular bentonite. Above the intermediate well, the remainder of the borehole was also backfilled with granular bentonite. AECOM conducted nearly a dozen inspections of the well between October 2008 and April 2009 and no leakage was observed at the ground surface after the well seal backfill was completed.

The effectiveness of the seals between the multiple well screens within the single borehole was evident when the Hebron wells were installed. When the 6" casing was in the ground at the depth of the deep well, it was estimated that about 10 gpm of groundwater was discharging from the borehole. After the deep well was installed and the filter pack was placed, discharge stopped. After the 6" casing was completely removed from the borehole leaving only the 8" diameter casing the hole, artesian flow resumed when the aquifer was exposed during intermediate well installation. However, after the intermediate well's seal was placed, flow stopped once again. The magnitude of the head differences and the artesian flow that were stopped in the borehole demonstrates that multiple well seals can be effective when employed in a single borehole.

The deep well at the Hebron well site (3-HEB-D) was measured to have a static pressure of 5.5 psi and a discharge rate of 6 gpm at 2.5 ft above ground surface. The intermediate well (3-HEB-I) had a 5 psi static pressure and a flow of 15 gpm which was also measured at 2.5 ft above ground surface. The wells were initially sealed using an expandable well cap before temperatures dropped in November. At that time, a simple cost effective packer system (finned rubber packers) was installed in each of the Hebron wells which maintained groundwater at a depth of 44" below ground surface. However, these packers proved difficult to remove by hand so alternative options were sought. Several design considerations were investigated during the development of different sealing options. These considerations included: ease of use, practicability and durability.

Based on our discussions with the COE, County and AECOM agreed that a "freeze-plug" or mechanical type packer would be used to seal the County's artesian wells. This option was chosen because:

It is mechanical in nature and does not rely on air or water pressure,
It can be ordered at various lengths between 5 and 10ft so sealing depth can be customized,
Side wall pressure can be adjusted for specific applications (up to 50 psi),
It is light weight (<10 lbs.) and removable so periodic water sampling and packer inspection can occur,
It has a hollow center plug which allows for real-time water level monitoring with the use of vented In-Situ LevelTROLLTM instruments equipped with artesian well fittings, and
Maintains compatibility with other County monitoring equipment.

Three (3) mechanical packers were ordered from QSP Packers, LLC (QSP) of Sumner, WA. The custom mechanical packers consisted of a dual-wall drop pipes constructed with Type 304 stainless steel (refer to

Figures and Photographs in Appendix A-3). The 6-foot long drop pipes consisted of a 1" OD inner pipe and a 1½" OD outer pipe. The six foot long drop pipe was proposed so that weight of the assembly is minimized while still maintaining a hydraulic seal approximately 42" below ground surface (assuming a ~2.5 ft stick-up).

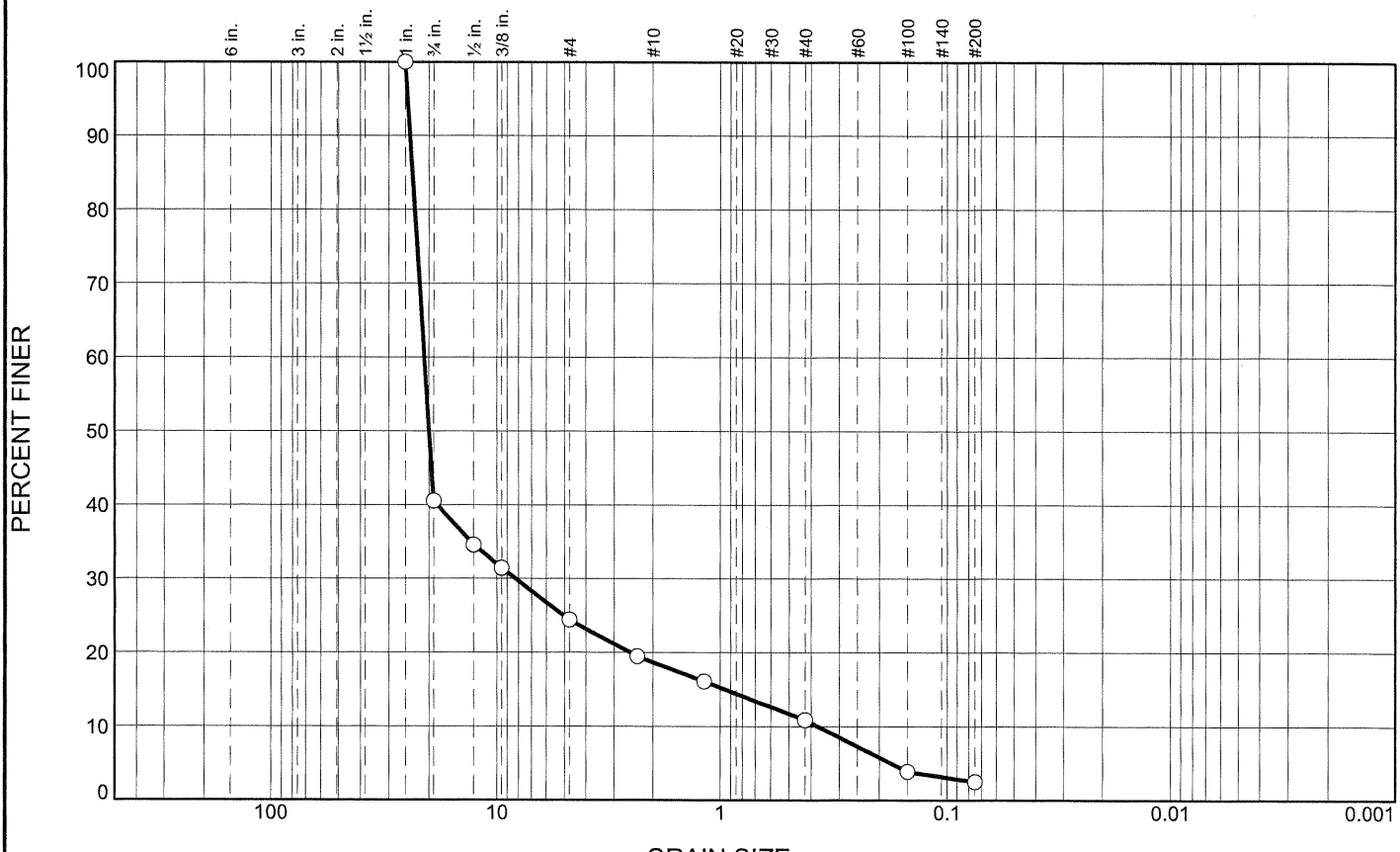
The outer pipe in the dual-wall pipe system is held in place by washers and nuts that are threaded onto the inner pipe at the top and bottom of the assembly. The sealing mechanism consists of a 3-inch long, 1.9" outer diameter expandable rubber packer that is constructed of Buna-N Rubber. The rubber packer is placed between two washers that are attached to the bottom of the drop pipe. By tightening and loosening the nut affixed at the top of the inner pipe, the rubber packer expands and retracts. The assembly is held in position on top of the well casing by a lip which is welded perpendicular to the drop pipe. The lip provides a stable surface to start hand-tightening the actuator nut and prevents it from dropping it into the well. QSP rates the mechanical packer at 50 psi which should provide adequate sealing from the anticipated hydrostatic pressures at the Hebron site (i.e. <10 psi) at 4 ft below ground surface.

The bottom fitting on the inner pipe was fixed with a ¾" ID half coupling so that female threads open downward. A male ¾" NPT threaded In-SituTM artesian fitting (with cable sealed inside of it) was attached to the bottom of the mechanical packer assembly to prevent upward leakage through the center of the packer. The artesian compression fittings are factory-installed on the vented cable before the LevelTROLL® 500 electronic data recording device and communication fittings are welded onto the ends of the cable. The artesian well cable fitting includes a black dome compression fitting that makes a water- and air-tight seal around the cable. The ¾" NPT threads allows for easy removal if the TROLLs need to be extracted from the well. The artesian well fitting is also rated for applications less than 50 psi.

The Twist-LockTM connector (0.72" OD) for the communication end of the LevelTROLL cable was carefully fed through the inner pipe of the packer assembly (0.76"). The upside down artesian fitting will be securely fastened to the bottom of the packer and the communication end of the TROLL cable will be secured outside of the inner pipe at the top of the wellhead. The end of the cable is vented through a small dessicant chamber to allow the transducer to equilibrate to atmospheric conditions. Therefore head readings of the TROLL indicate actual piezometric levels. This means that barometric corrections are not needed to obtain the actual water level data in the well. The depth of the TROLLs was measured from the top of PVC casing so accurate water levels can be recorded. The packers were installed on April 15, 2009.

Well Site Testing Results

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	59.5	16.1	5.7	7.8	8.4	2.5	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1	100.0		
.75	40.5		
.5	34.6		
.375	31.4		
#4	24.4		
#8	19.5		
#16	16.1		
#40	10.9		
#100	3.9		
#200	2.5		

* (no specification provided)

Material Description

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 24.2002 D_{85}= 23.6218 D_{60}= 20.9304
D_{50}= 19.9417 D_{30}= 8.2602 D_{15}= 0.9497
D_{10}= 0.3715 C_u= 56.35 C_c= 8.78

Classification

USCS= GP AASHTO=

Remarks

Source of Sample: 3-HE-S **Depth:** 63.0-64.0

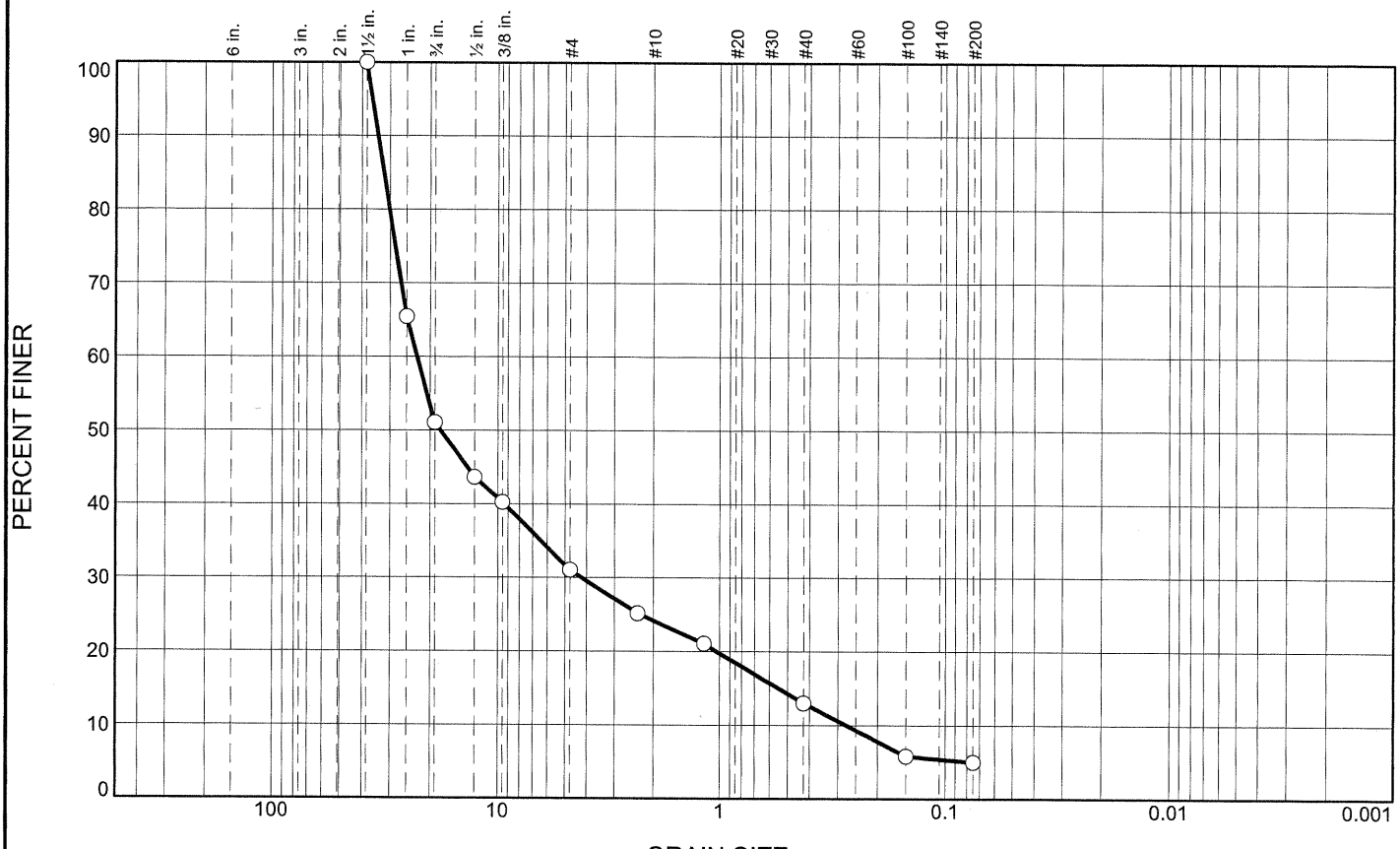
Date: 12/05/08

STS | AECOM

Client: USACE
Project: McHenry County Wells
Project No: 200804080 **Figure**

Tested By: JRT

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	48.9	20.1	6.8	11.2	8.0	5.0	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.5	100.0		
1	65.4		
.75	51.1		
.5	43.6		
.375	40.3		
#4	31.0		
#8	25.1		
#16	21.1		
#40	13.0		
#100	5.8		
#200	5.0		

* (no specification provided)

Material Description

Atterberg Limits

PL= np LL= nv PI=

Coefficients

D_{90}= 33.8831 D_{85}= 31.9531 D_{60}= 22.7826
D_{50}= 17.9779 D_{30}= 4.2027 D_{15}= 0.5469
D_{10}= 0.2747 C_u= 82.93 C_c= 2.82

Classification

USCS= GW-GM AASHTO= A-1-a

Remarks

Source of Sample: 3-HE-D **Depth:** 91.0-92.0

Date: 12/05/08

STS | AECOM

Client: USACE
Project: McHenry County Wells
Project No: 200804080 **Figure**

Tested By: JRT

Groundwater Level Measurements

McHenry County Monitoring Well Installations
AECOM Project 09000-460

Site Number	3	
Township Name	Hebron	
Well Number	3-HEB-I	3-HEB-D
Ground Surface Elevation (ft msl)	867.93	867.93
Top of PVC Casing Elevation (ft)	870.54	870.51
Location of PVC Casing within Wellhead	East Well	West Well
Well Depth (Feet from TOC)[A]	68.88	97.00

Date	Depth to GW from TOC (ft)	GW Elevation (ft msl)	Depth to GW from TOC (ft)	GW Elevation (ft msl)
Sep. 26, 2008				
Oct. 09, 2008	5 psi	882	5.5 psi	883.2
Oct. 14, 2008				
Oct. 16, 2008				
Oct. 21, 2008				
Oct. 22, 2008				
Oct. 24, 2008				
Oct. 28, 2008				
Oct. 29, 2008				
Oct. 30, 2008				
Nov. 07, 2008				
Nov. 13, 2008				
Dec. 05, 2008				
Dec. 08, 2008				
Dec. 09, 2008				
Dec. 12, 2008				
Dec. 15, 2008				
Dec. 16, 2008				
Dec. 17, 2008				
Dec. 18, 2008				
Dec. 19, 2008				
Dec. 22, 2008				
Dec. 23, 2008				
Dec. 29, 2008				
Dec. 30, 2008				
Jan. 05, 2009				
Jan. 06, 2009				
Jan. 07, 2009				
Jan. 08, 2009				
Jan. 09, 2009				
Jan. 10, 2009				
Jan. 12, 2009				
Feb. 24, 2009				
Mar. 20, 2009				
Apr. 15, 2009	-12.81	883.35	-13.19	883.70
end				

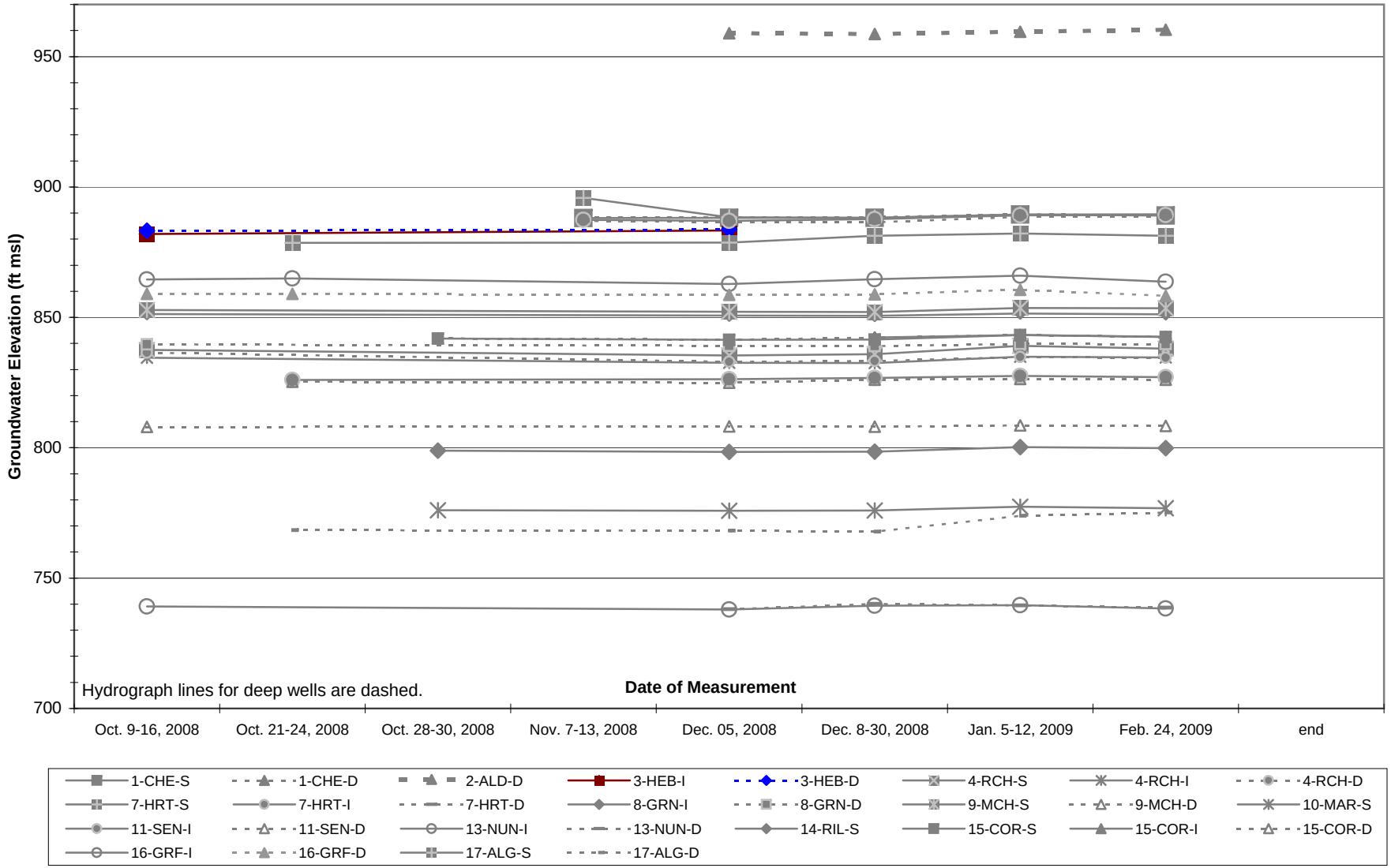
Notes:

ft msl = Elevation referenced to feet above mea88)
TOC = Top of PVC Casing
ft = feet
[A] = as measured inside well
NI = Not Installed
--- No Elevation
Well 17-Alg-S was frozen or partially frozen fror

Site 3 Groundwater Level Hydrograph
(includes ALL AECOM INSTALLED WELLS)

McHenry County Obervation Well Network

AECOM Project 09000-460

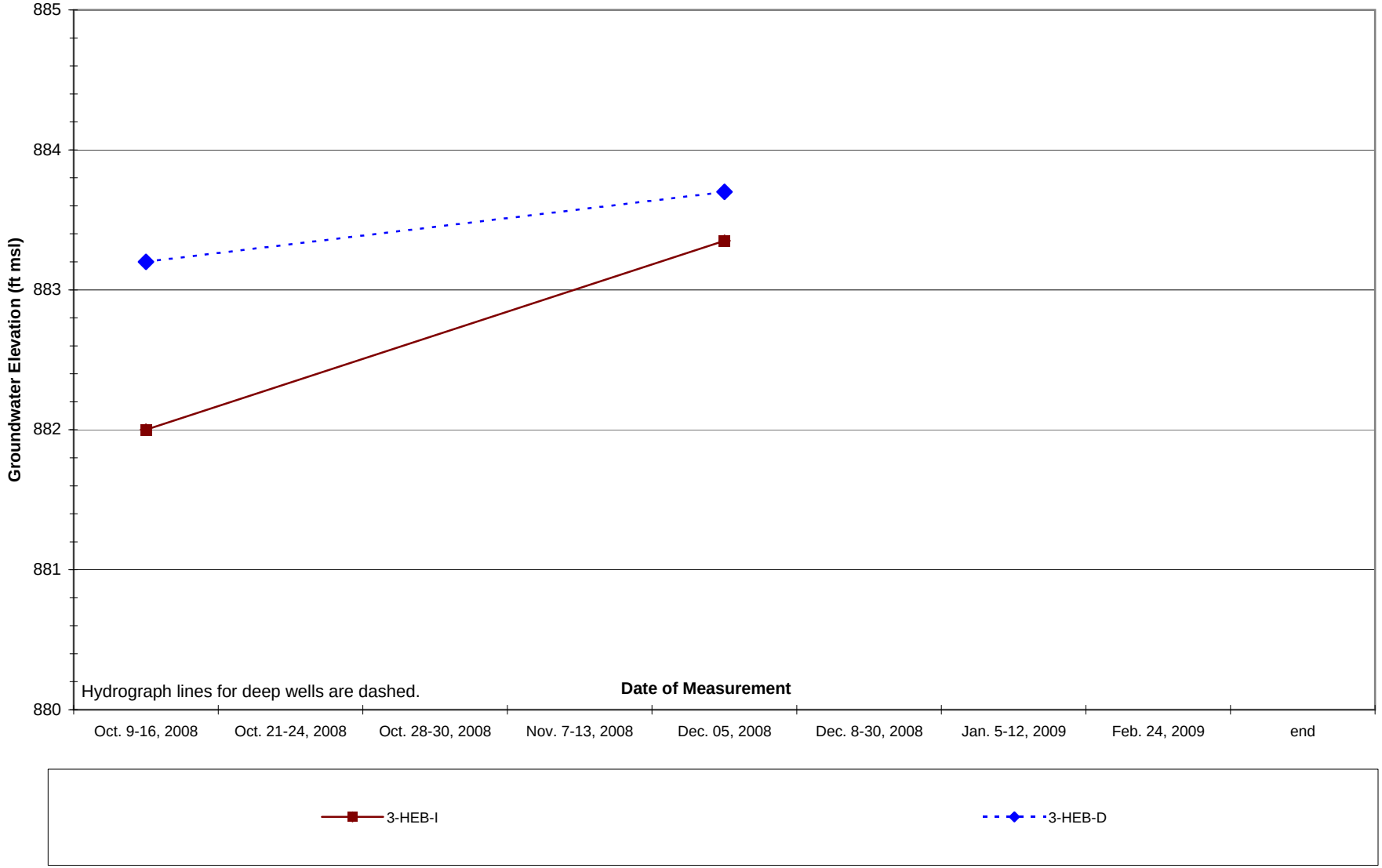


K:\PROJECTS\200804080\In_Progress\STS-McHenry Cty_WLs IN PROGRESS - figs for each site.xls

Site 3 Groundwater Level Hydrograph

McHenry County Obervation Well Network

AECOM Project 09000-460



K:\PROJECTS\200804080\In_Progress\STS-McHenry Cty_WLs IN PROGRESS - figs for each site.xls

First Environmental Laboratories, Inc.

IL ELAP / NELAC Accreditation # 100292

1600 Shore Road • Naperville, Illinois 60563 • Phone (630) 778-1200 • Fax (630) 778-1233

Analytical Report

Client: AECOM ENVIRONMENT
Project ID: McHenry City (09000-460) # 2073737
Sample ID: 3-HEB-I
Sample No: 9-1394-002

Date Collected: 04/15/09
Time Collected: 9:05
Date Received: 04/17/09
Date Reported: 04/27/09

Analyte		Result	R.L.	Units	Flags
Total Metals	**Method: 6010B**		**Preparation Method 3010A**		
Analysis Date: 04/22/09			Preparation Date: 04/20/09		
Calcium		80.1	0.1	mg/L	
Iron		1.90	0.01	mg/L	
Magnesium		43.3	0.1	mg/L	
Potassium		1.3	0.1	mg/L	
Sodium		12.7	0.1	mg/L	
Chloride	**Method: 4500Cl, E**				
Analysis Date: 04/17/09					
Chloride		16	5	mg/L	
Alkalinity, Bicarbonate (CaCO3)	**Method: 2320B**				
Analysis Date: 04/21/09					
Alkalinity, Bicarbonate (CaCO3)		390	5	mg/L	
Alkalinity, Carbonate (CaCO3)	**Method: 2320B**				
Analysis Date: 04/21/09					
Alkalinity, Carbonate (CaCO3)		< 5	5	mg/L	
Sulfate	**Method: 4500S04,E**				
Analysis Date: 04/24/09					
Sulfate		36	15	mg/L	

First Environmental Laboratories, Inc.

IL ELAP / NELAC Accreditation # 100292

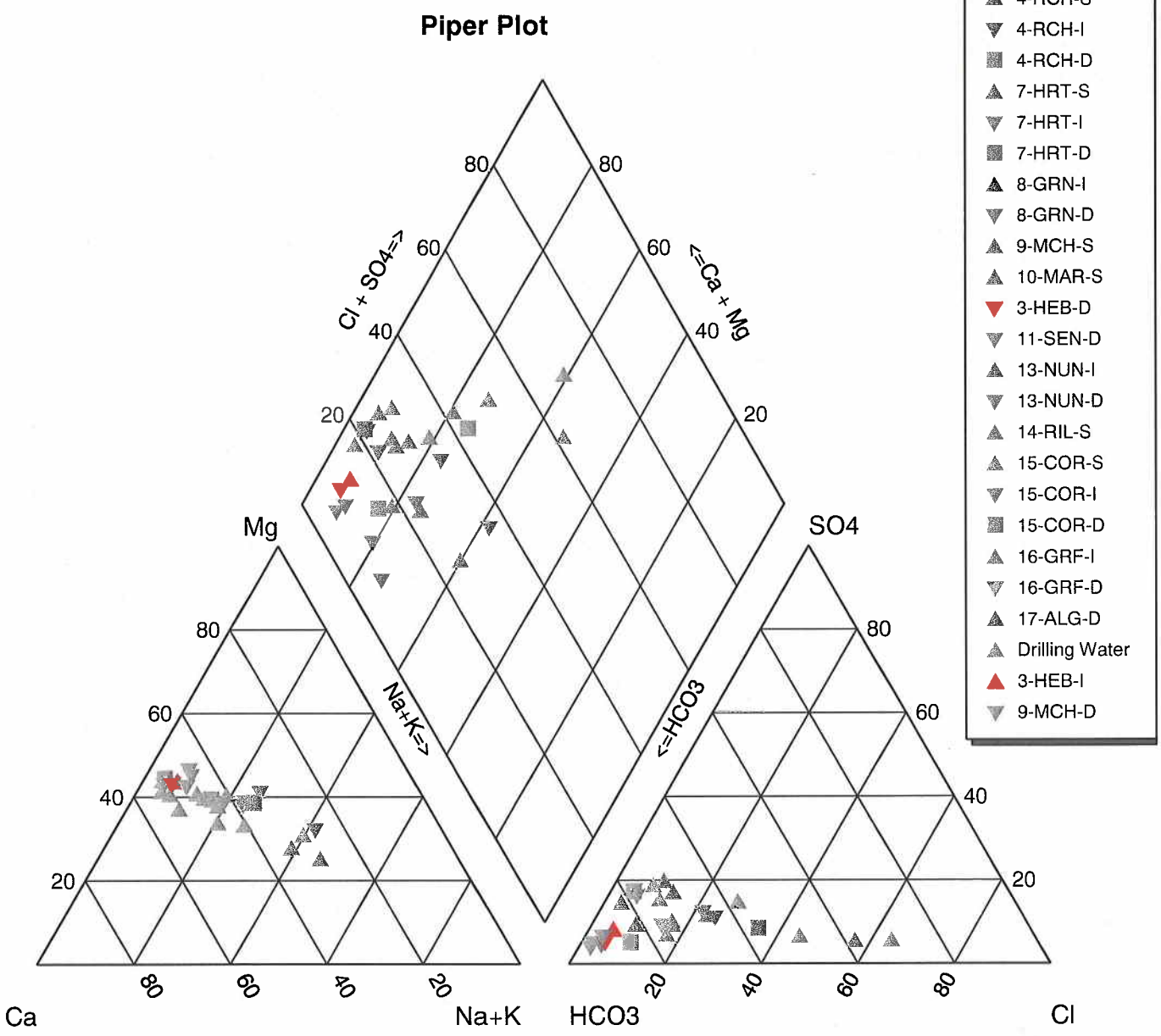
1600 Shore Road • Naperville, Illinois 60563 • Phone (630) 778-1200 • Fax (630) 778-1233

Analytical Report

Client: AECOM ENVIRONMENT
Project ID: McHenry City (09000-460) # 2073737
Sample ID: 3-HEB-D
Sample No: 9-1394-001

Date Collected: 04/15/09
Time Collected: 8:15
Date Received: 04/17/09
Date Reported: 04/27/09

Analyte		Result	R.L.	Units	Flags
Total Metals	**Method: 6010B**		**Preparation Method 3010A**		
Analysis Date: 04/22/09			Preparation Date: 04/20/09		
Calcium		85.7	0.1	mg/L	
Iron		2.00	0.01	mg/L	
Magnesium		44.7	0.1	mg/L	
Potassium		1.3	0.1	mg/L	
Sodium		11.8	0.1	mg/L	
Chloride	**Method: 4500Cl, E**				
Analysis Date: 04/17/09					
Chloride		15	5	mg/L	
Alkalinity, Bicarbonate (CaCO3)	**Method: 2320B**				
Analysis Date: 04/21/09					
Alkalinity, Bicarbonate (CaCO3)		400	5	mg/L	
Alkalinity, Carbonate (CaCO3)	**Method: 2320B**				
Analysis Date: 04/21/09					
Alkalinity, Carbonate (CaCO3)		< 5	5	mg/L	
Sulfate	**Method: 4500S04,E**				
Analysis Date: 04/24/09					
Sulfate		23	15	mg/L	



DESCRIPTION: Piper Linear Diagram - Well Site #3

AECOM	PROJECT: McHenry County	PROJECT NO: 09000460
	CLIENT: Army Corps of Engineers	DATE: 7/30/2009

Field Well Sampling Sheet

Fill out the entire form. If it does not apply, mark N/A.

Project Name: McHenry Cty Wells STS Job No. 200804080 (AECOM 09000-460)

Location: Hebron Township Tester: gmb

Well Number: 3-HEB-I Date Sampled: 4/15/09

Previous Well Sampled: 3-HEB-D

GENERAL CONDITIONS:

					If Missing Replaced?
Surface Seal:	✓ Ok	☐ Damaged	☐ Missing:	Yes	No
Protector Pipe:	✓ Ok	☐ Damaged	☐ Missing:	Yes	No
Well Cap:	✓ Ok	☐ Damaged	☐ Missing:	Yes	No
Ambient Temperature: ___ °F		☐ Clear ☐ Cloudy	☐ Rain		

Depth to Water: At Design (from TPVC)

Depth to Bottom: 68.88 ft (from TPVC)

Length of Water: 68.88 ft +

Free Product Observed: ☐ Yes ✓ No Thickness: —

PURGING/SAMPLING:

Well Purging Calculations: Amount to purge = 0.163 gallons/foot times height of water column in feet for one well volume

Purging Device: None Needed Sampling Device: None Needed

Volume Required: 34 gals ✓ See back of page for field readings during purge

Volume Purged: 300 gals

Could Well Bail Dry? ☐ Yes ✓ No

Purging - Time Start: 0845 Time Ended: 0905

Decon Method: ~~Atomo~~ No Materials needed to be Decon'd.

IN-SITU TESTING:

Turbidity: ☐ Turbid ☐ Opaque

Odor: clear earthy

Color colorless

pH @ ___ degrees C

Uncorrected Conductivity ___ X

Water Temp. (from Cond.) ___

Comments: See Next Page

SAMPLES COLLECTED

Vocs -	☐	Cyanide	☐
Metals -	✓	Hexchrome	☐
SVOC	☐	Alkalinity	✓
TOC	☐	Chloride	✓
Sulfide	☐	Ammonia	☐
Phenolics	☐	COD	☐

Well Purging Log

3-HEB-I

Date 4-15-09

Time	Temp (°C)	pH (S.U.)	Conductivity (umhos/cm)	~~ORP~~ Turbidity (NTU)	~~DO~~ Rate (gpm)
845	[redacted] → Start Purging				
848	10.1	7.58	719	400	Rate = 5 gals / 20 sec
852	10.2	7.59	719	62	∴ Q = 15 gpm
856	10.2	7.59	717	34	"
0900	10.2	7.59	716	24	"
0905 (Sample)	10.2	7.59	716	15	"

[illegible] purge [illegible] to sample collection

Field Well Sampling Sheet

Fill out the entire form. If it does not apply, mark N/A.

Project Name: McHenry City Wells STS Job No. 200804030 (09000-460)

Location: Hebron Twp Tester: gmb

Well Number: 3-HEB-D Date Sampled: 4/13/09

Previous Well Sampled: NA

GENERAL CONDITIONS:

					If Missing Replaced?
Surface Seal:	✓ Ok	☐ Damaged	☐ Missing:	Yes	No
Protector Pipe:	✓ Ok	☐ Damaged	☐ Missing:	Yes	No
Well Cap:	✓ Ok	☐ Damaged	☐ Missing:	Yes	No
Ambient Temperature:	°F	☐ Clear ☐ Cloudy	☐ Rain		

Depth to Water: Artesian (from TPVC)

Depth to Bottom: 97.00 ft (from TPVC)

Length of Water: 97.00 ft

Free Product Observed: ☐ Yes ✓ No Thickness: —

PURGING/SAMPLING:

Well Purging Calculations: Amount to purge = 0.163 gallons/foot times height of water column in feet for one well volume

Purging Device: Artesian Sampling Device: Artesian

Volume Required: 48 gals ☐ See back of page for field readings during purge

Volume Purged: 240 gals

Could Well Bail Dry? ☐ Yes ✓ No

Purging - Time Start: 0751 Time Ended: 0815

Decon Method: —

IN-SITU TESTING:

Turbidity: ☐ Turbid ☐ Opaque

✓Clear Odor: Barthy

Color colorless

pH @ degrees C

Uncorrected Conductivity X

Water Temp. (from Cond.)

Comments: → Next Page

SAMPLES COLLECTED

Vocs -	☐	Cyanide	☐
Metals -	✓	Hexchrome	☐
SVOC	☐	Alkalinity	✓
TOC	☐	Chloride	✓
Sulfide	☐	Ammonia	☐
Phenolics	☐	COD	☐
		✓ Sulfate	

Well Purging Log

Date 4/15/09

Time	Temp (°C)	pH (s.u.)	Conductivity (umhos/cm)	Turbidity ~~ORP~~ (NTU)	Purge Rate ~~DO~~ (gpm)
0751	→ Unseal Well (Start Purging)				
0753	9.9	7.50	731	999	Rate = 5 gals
0759	10.1	7.53	729	272	27 secs.
0801	10.2	7.57	726	48	∴ 11 gpm (±)
0805	10.2	7.57	725	22	(11.1 gpm)
0810	10.2	7.59	725	18	
0815 (Sample)	10.2	7.59	725	[illegible]	

HEBRON SITE (#3) – DEEP WELL
(3 - HEB - D)

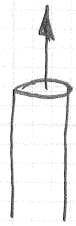
Calculation Sheet

STS | AECOM

Project				Subject		
McHenry Cty Monitoring Wells				Hydraulic Calc @ Hebron Site		
Originated By	Date	Checked By	Date	STS Job No.	Scale	Sheet No. 1 Of 1
gmb	4-10-09			09000-460	NTS	

Problem: Estimate Hydraulic Conductivity from flowing Artesian well based on measured parameters.

Measured at well head:



883.2 FT MSL (STATIC HEAD)

STATIC PRESSURE (5.5 psi)

870.5 FT MSL (TOP OF RISER)

Measured discharge
Q = 6 gpm

Given: 2" Dia. PVC Riser & Screen
& 4.5 ft of Slot Openings

ASSUME CONDUCTIVITY CAN BE CALCULATED USING A CONSTANT HEAD INJECTION TEST METHOD (From Cedergren, 1977)

$$k_h = \frac{q \cdot \ln\left[\frac{mL}{D} + \sqrt{1 + \left(\frac{mL}{D}\right)^2}\right]}{2 \cdot \pi \cdot L \cdot h_e}$$

where
- q = flow (cm^3/s) $= 6 \frac{gal}{min} \times \frac{1 ft^3}{7.48 gal} \times \frac{28317 cm^3}{1 ft^3} \times \frac{min}{60 s} = 378.6 \frac{cm^3}{s}$
- L = Length of intake (cm) $= 4.5$ ft $= 137.2$ cm
- D = Dia. of intake (cm) $= 2$ in $= 5.08$ cm
- m = Transformation Ratio = Assume K_h 3:1 $= 0.33$
- h_e = constant piezo. head (cm) = 883.2 − 870.5 = 12.7 ft = 387.1 cm

$$k_h = \frac{378.6 \cdot \ln\left[\frac{0.33 \cdot 137.2}{5.08} + \sqrt{1 + \left(\frac{0.33 \cdot 137.2}{5.08}\right)^2}\right]}{2\pi \cdot 137.2 \cdot 387.1}$$

$$K_h = 378.6 \cdot \ln\left[8.91 + \sqrt{1 + (8.9)^2}\right]$$

$$378.6 \cdot \ln[8.91 + 8.97] = \frac{378.6 \cdot 2.88}{333{,}700} =$$

$$K_h = 3.27 \times 10^{-3} \frac{cm}{sec}$$

HEBRON SITE (#3) – INTERMEDIATE WELL (3-HEB-I)

STS | AECOM

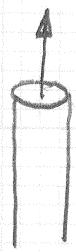
Calculation Sheet

Project	Subject
McHenry Cty Monitoring Wells	Hydraulic Calc @ Hebron Wells

Originated By	Date	Checked By	Date	STS Job No.	Scale	Sheet No.
gmb	4-10-09			09000-460	NTS	1 Of 1

Problem: Estimate Hydraulic Conductivity for the Intermediate Well at the Hebron well Site

Measured at well head: ← Static Pressure @ well head = 5 psi = 11.55 ft
∴ Static Head = 882 FT MSL



← 870.5 FT MSL (Top PVC)

Q = 15 gpm

Given: 2" Dia. PVC Riser & 5 ft Screen (4.5 ft slot openings)

ASSUME CONDUCTIVITY CAN BE CALCULATED USING A CONSTANT HEAD INJECTION TEST METHOD (from Cedergren, 1977)

$$K_h = \frac{q \cdot \ln\left[\frac{mL}{D} + \sqrt{1 + \left(\frac{mL}{D}\right)^2}\right]}{2 \cdot \pi \cdot L \cdot h_e}$$

where
q = Flow (cm^3/s) $= \frac{15g}{min} \times \frac{1ft^3}{7.48g} \times \frac{28312cm^3}{1ft^3} \times \frac{min}{60s} = 946 \frac{cm^3}{s}$
L = Length of Intake (cm) = 4.5 ft = 137.2 cm
D = Dia. of Intake (cm) = 2 in = 5.08 cm
m = transmation ratio $= K_v/K_h = 1/3 = 0.33$ (Assume)
h_e = Constant piezo head (cm) = 882.0 − 870.5 = 11.5 ft = 350.5 cm

$$k_h = \frac{946 \cdot \ln\left[\frac{0.33 \cdot 137.2}{5.08} + \sqrt{1 + \left(\frac{0.33 \cdot 137.2}{5.08}\right)^2}\right]}{2 \cdot \pi \cdot 137.2 \cdot 350.5}$$

$$K_h = \frac{946 \cdot \ln\left[8.91 + \sqrt{1 + (8.9)^2}\right]}{302,149.6}$$

$$946 \cdot \ln[8.91 + 8.97] = 946 \cdot 2.88 = \frac{2728}{302,149.6} = 9.03 \times 10^{-3} \text{ cm/sec}$$

Additional Well Site Information

In-Situ Inc.

Calibration Report

Report Number: 20081222201339-139462

221 East Lincoln Avenue, Fort Collins, CO 80524 USA
1-970-498-1500, 1-800-446-7488, FAX: 1-970-498-1598
Visit us at www.in-situ.com

3-HEB-I

Instrument Details:

Instrument Model:	**Level TROLL 500**
Full Scale Pressure Range	**206.84 KPa (30 PSI) vented**
Serial Number:	**139462**

Calibration Details:

Calibration Result:	**PASS**
Calibration Date:	2008-12-22 20:13:39 (UTC)
Nominal Range of Applied Temperature:	-5 C to +50 C
Temperature Accuracy Specification:	+/- 0.1 C From 0 C to +50 C
Nominal Range of Applied Pressure:	0 KPa to 206.8 KPa (0.0 PSI to 30.0 PSI)
Pressure Accuracy Specification:	+/- 0.1 %FS from -5 C to +50 C, +/- 0.05 %FS at +15 C

Post-Calibration Check:

Parameter	Applied	Reported	Deviation
Pressure	30.0002	30.0005	0.0009
Pressure	0.0001	-0.0019	-0.0065
Temperature	20.0010	20.0240	0.0230

Calibration Procedures and Equipment Used:

Automated calibration procedures used.
Manu Agilent Model 34970A SerialNo MY41012474
Manu Instrulab Model 3312A-14-15-24 SerialNo 31102-(41037)
Manu Instrulab Model 406X-0031-01 SerialNo 31128-1
Manu MENSOR Model 600 SerialNo 621218
Manu Agilent Model 53131A SerialNo MY47000169
Manu MENSOR Model 600 SerialNo 621385

Notes:

1. Standards used in this calibration are traceable to the National Institute of Standards and Technology.
2. This calibration report shall not be reproduced, except in full, without the written approval of In-Situ, Inc.
3. A calibration interval of 12 to 18 months is recommended.
4. The post-calibration data is collected at nominal +20 C.
5. 1.0 PSI = 6.894757 KPa

Performed By: CB

Copyright © 2006 In-Situ, Inc.

In-Situ Inc.

3-HEB-D

Calibration Report

Report Number: 20090112144312-140466

221 East Lincoln Avenue, Fort Collins, CO 80524 USA
1-970-498-1500, 1-800-446-7488, FAX: 1-970-498-1598
Visit us at www.in-situ.com

Instrument Details:

Instrument Model:	**Level TROLL 500**
Full Scale Pressure Range	**206.84 KPa (30 PSI) vented**
Serial Number:	**140466**

Calibration Details:

Calibration Result:	**PASS**
Calibration Date:	2009-01-12 14:43:12 (UTC)
Nominal Range of Applied Temperature:	-5 C to +50 C
Temperature Accuracy Specification:	+/- 0.1 C From 0 C to +50 C
Nominal Range of Applied Pressure:	0 KPa to 206.8 KPa (0.0 PSI to 30.0 PSI)
Pressure Accuracy Specification:	+/- 0.1 %FS from -5 C to +50 C, +/- 0.05 %FS at +15 C

Post-Calibration Check:

Parameter	Applied	Reported	Deviation
Pressure	30.0001	29.9937	-0.0213
Pressure	0.0008	-0.0027	-0.0115
Temperature	19.9010	19.9144	0.0134

Calibration Procedures and Equipment Used:

Automated calibration procedures used.
Manu Agilent Model 34970A SerialNo MY44015965
Manu Instrulab Model 3312A-14-15-24 SerialNo 31103-(41012)
Manu Instrulab Model 406X-0031-01 SerialNo 2-31138
Manu MENSOR Model 600 SerialNo 621435
Manu Agilent Model 53131A SerialNo MY47000169
Manu MENSOR Model 600 SerialNo 621385

Notes:

1. Standards used in this calibration are traceable to the National Institute of Standards and Technology.
2. This calibration report shall not be reproduced, except in full, without the written approval of In-Situ, Inc.
3. A calibration interval of 12 to 18 months is recommended.
4. The post-calibration data is collected at nominal +20 C.
5. 1.0 PSI = 6.894757 KPa

Performed By: JBO

Copyright © 2006 In-Situ, Inc.

Hebron Township Well Site

Hebron Township Well Site

Well Flowing Artesian Flow after Deep Well is installed

Well Flowing Artesian Flow after Deep Well is installed

Flow Ceases after Deep Well Seal is placed

Both Wells Installed – Bentonite Seal in place – No Flow

Artesian Flow out of Intermediate Well

Both Wells Installed – Bentonite Seal in place – No Flow

Hebron Township Well Site

Hebron Township Well Site

QSP Mechanical Packer w/ LevelTROLL Artesian Well Seal

QSP Mechanical Packer w/ LevelTROLL Artesian Well Seal

QSP Mechanical Packer w/ LevelTROLL Artesian Well Seal

QSP Mechanical Packer w/ LevelTROLL Artesian Well Seal

QSP Mechanical Packer w/ LevelTROLL Artesian Well Seal

QSP Mechanical Packer w/ LevelTROLL sealed

Hebron Township Well Site

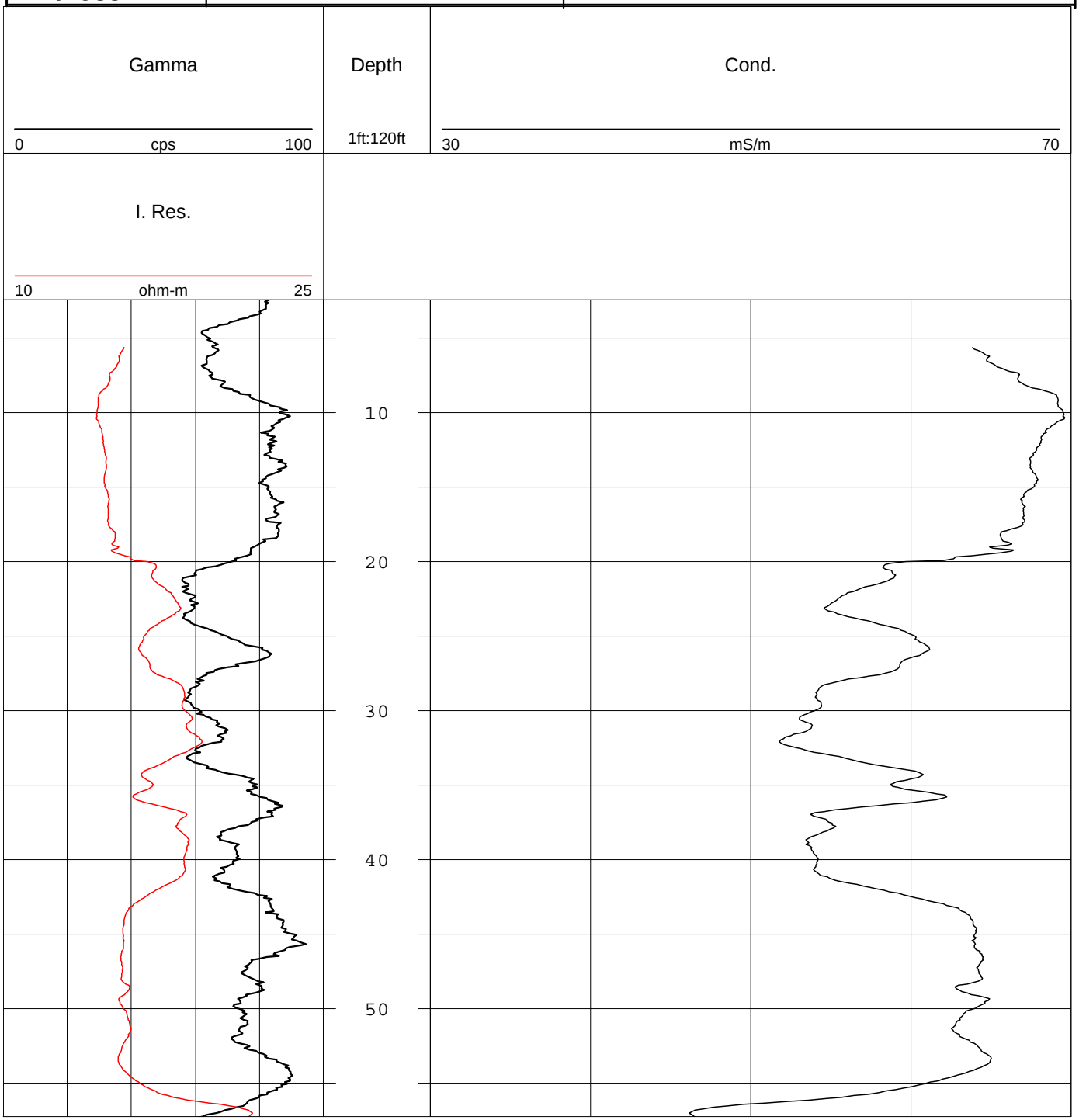
Hebron Township Well Site – Inside Casing

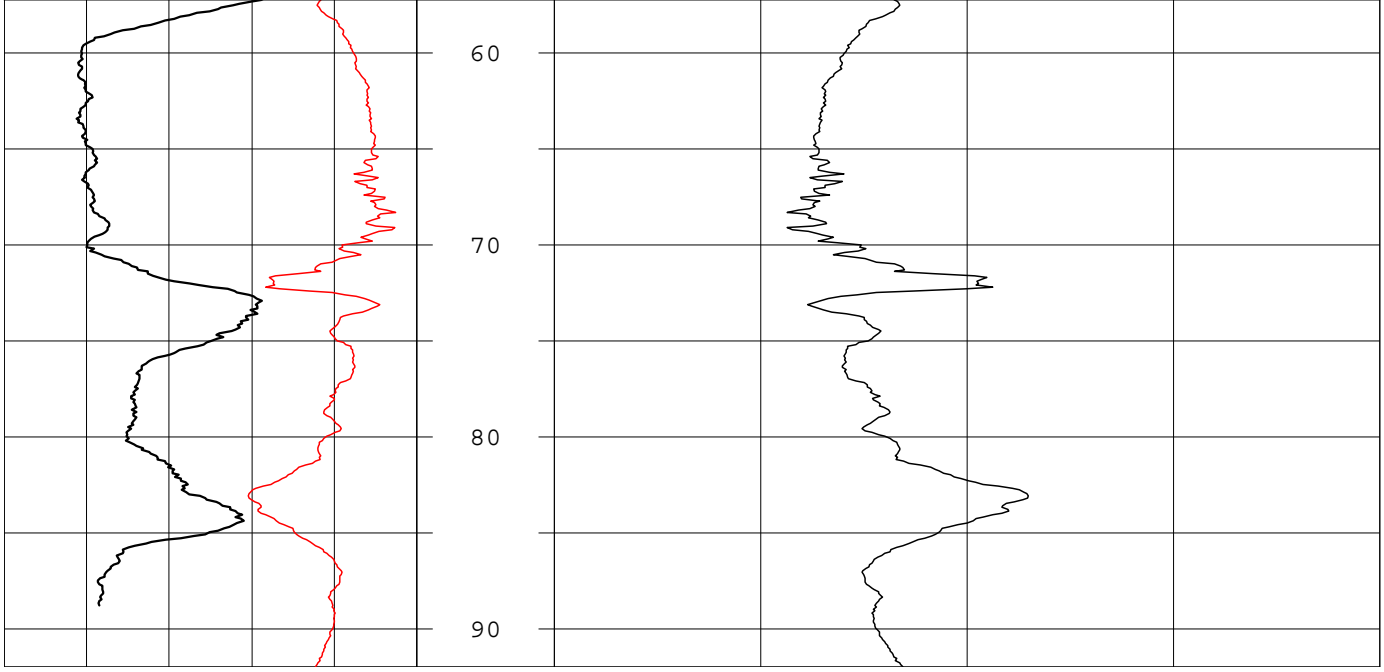
Hebron Township Well Site

Hebron Township Well Site – Inside Casing

COMPANY:	McHenry County & US Corp of Engineers
Location:	

Well	#3 MCH HEBRON TWN			OTHER SERVICES
Date	10/22/08	BH Fluid	Formation	ARTESIAN WELL
Casing	2" PVC +2.4 to -93' bgs			
File Name	MCHTH3-08EMGAM			
Depth Driller	110' bgs			
Depth Logger	94.36' bgs			
Logged by:	T. YOUNG			
Witness:	NOT WITNESSED			




60
70
80
90

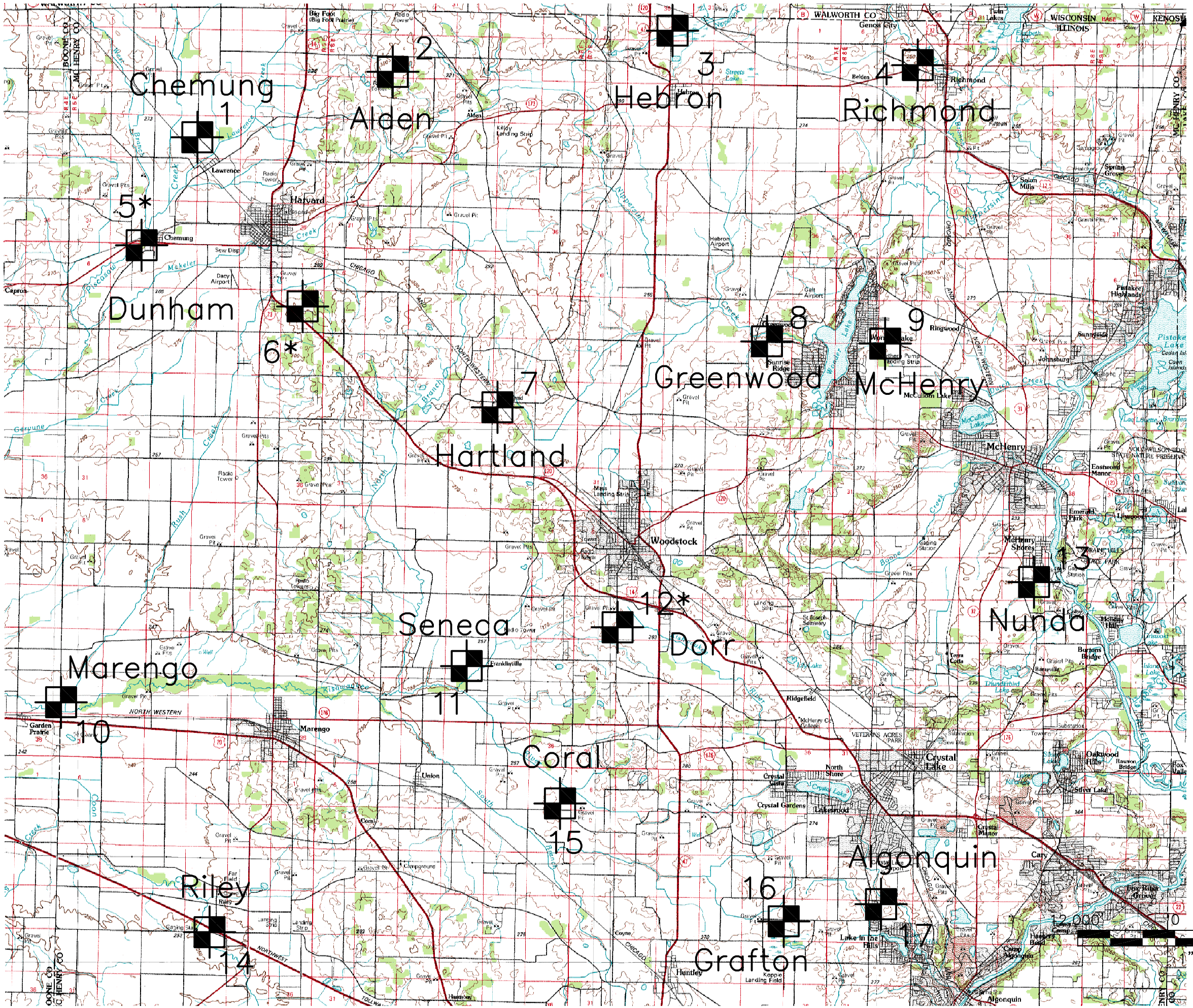
A-4: Folio for Well Site #4 – Richmond Township

Table of Contents

I.) Site Location Map – Location in County
II.) Site Location Map – Location on USGS Topographic Map
III.) Site Location Map – Location on USGS High Resolution Orthophoto
IV.) Site Boring Log
V.) Well Construction Diagram
VI.) Well Site Summary and Commentary
VII.) Particle Size Distribution Report
VIII.) Table of Water Level Measurements
IX.) Well Development Field Log
X.) Water Quality Analysis Results
XI.) Groundwater Sampling Field Log
XII.) Hydraulic Conductivity Testing Results
XIII.) In-Situ LevelTroll™ Calibration Report
XIV.) Site Photographs
XV.) Downhole Geophysical Testing

Well Site Location Maps

Z:\Projects\200804080\CtyWide\D-09000-460-8000_CtyOverviewMap_004.dwg; 4/20/2009 5:33:59 PM; BRAUN, GARY



LEGEND:

AECOM Well Installation Site

McHenry 9

Well Installations By Others

Dunham 6*

0 12,000 24,000'

" = 12,000'

AECOM

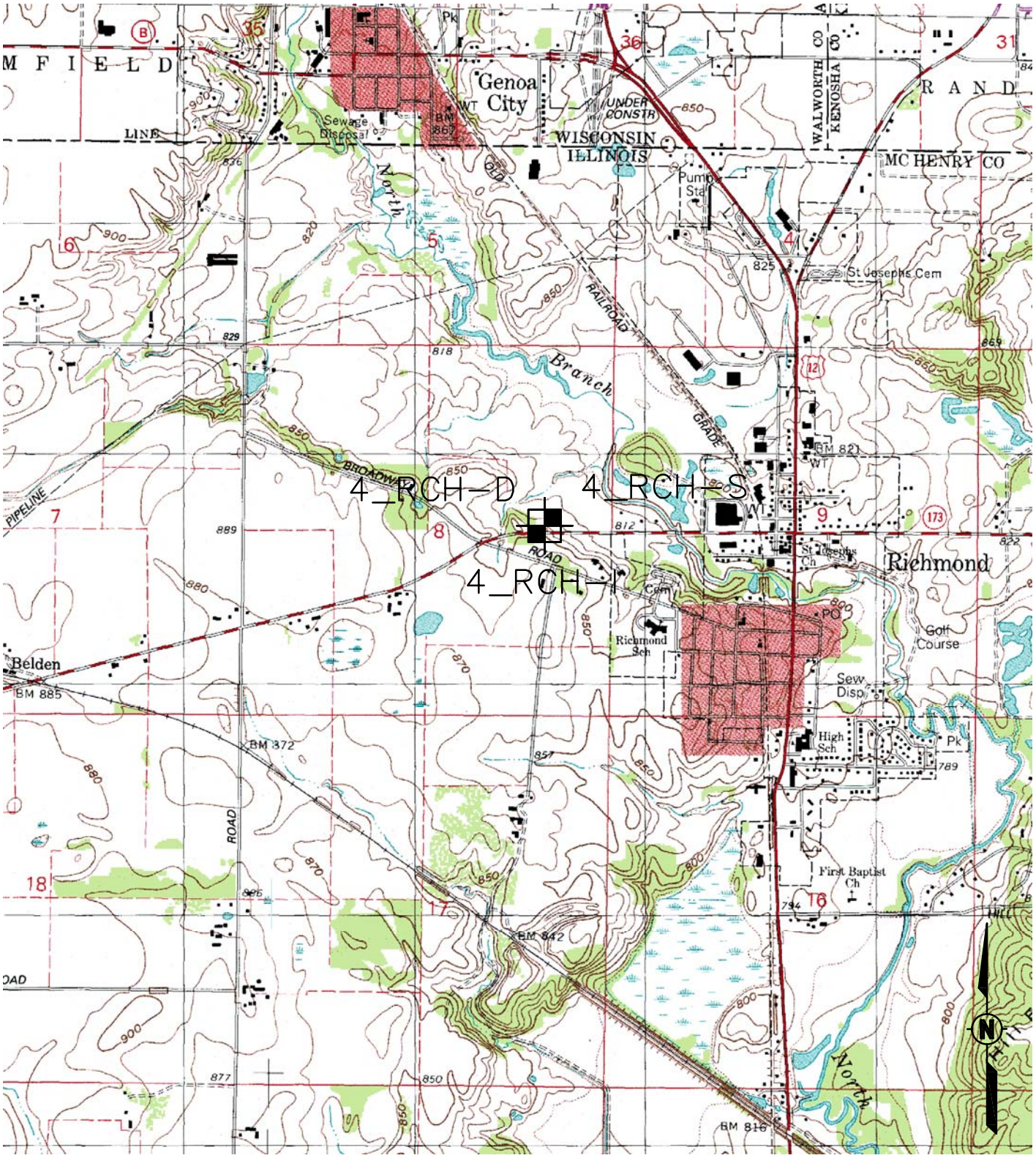
750 Corporate Woods Pkwy
Vernon Hills, IL 60061
847-279-2500
www.aecom.com

Copyright © By: STS Consultants, Ltd.

LOCATION MAP OF WELL SITES

Observation Well Network for Glacial Aquifers
McHenry County, Illinois

Drawn :	CJH	3/11/2009
Checked:	GMB	4/18/2009
Approved:	CSR	4/27/2009
PROJECT NUMBER	09000-460	
FIGURE NUMBER	1	



2000 0 2000 4000

1" = 2000'

AECOM

750 Corporate Woods Parkway
Vernon Hills, IL 60061
847.279.2500
www.aecom.com

Copyright © 2009, By: AECOM

Site Location on USGS Topographic Map
Site No. 4 - Richmond Township
Trail Crossing - Hwy 173 (E. of Broadway St.)
Observation Well Network
McHenry County, Illinois

Drawn :	CJH	04/01/2009
Checked:	GMB	04/15/2009
Approved:	CSR	04/24/2009
PROJECT NUMBER	09000-460	
FIGURE NUMBER	Folio_4 #2	

Z:\Projects\200804080\CtyWide\D-09000-460-8000_TopoMaps_v02.dwg; 4/20/2009 9:58:33 AM; BRAUN, GARY; STS_BLACK_040102.ctb

AECOM

750 Corporate Woods Parkway
Vernon Hills, IL 60061
847.279.2500
www.aecom.com

Copyright © 2009, By: AECOM

2005 USGS High Resolution Orthophoto
Site No. 4 - Richmond Township
Trail Crossing - Hwy 173 (E. of Broadway St.)
Observation Well Network
McHenry County, Illinois

Drawn :	CJH	04/01/2009
Checked:	GMB	04/15/2009
Approved:	CSR	04/24/2009
PROJECT NUMBER	09000-460	
FIGURE NUMBER	Folio_4 #3	

Z:\Projects\200804080\CtyWide\D-09000-460-8000_AerialsMap_004.dwg; 4/21/2009 12:13:36 PM; BRAUN, GARY; STS_BLACK_040102.ctb

Boring and Well Construction Details

DRILLING LOG

DIVISION	USACE
INSTALLATION	Chicago District
SHEET	1 OF 8 SHEETS
1. PROJECT	McHenry County Observation Wells
2. LOCATION (Coordinates or Station)	McHenry County, Illinois N 2,117,464.00 E 988,032.00
3. DRILLING AGENCY	WDC Exploration & Wells
4. HOLE NO. *(As shown on drawing title and file number)*	4-RICHMOND
5. NAME OF DRILLER	Dan Tonnancour
6. DIRECTION OF HOLE	☒ VERTICAL ☐ INCLINED --- DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN	174.5
8. DEPTH DRILLED INTO ROCK	3.5
9. TOTAL DEPTH OF HOLE	178.0
10. SIZE AND TYPE OF BIT	3 7/8" Carbide Bit / 5 7/8" Casing
11. DATUM FOR ELEVATION SHOWN *(TBM or MSL)*	NAVD 88
12. MANUFACTURER'S DESIGNATION OF DRILL	Super Sonic II
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN	DISTURBED 21 / UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES	N/A
15. ELEVATION GROUND WATER	836.5
16. DATE HOLE	STARTED 10/6/2008 / COMPLETED 10/7/2008
17. ELEVATION TOP OF HOLE	+844.2
18. TOTAL CORE RECOVERY FOR BORING	96 %
19. GEOLOGIST	Gary Braun, LPG IL

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS *(Drilling time, water loss, depth weathering, etc., if significant)* g
+844.2	0.0		Topsoil: OL, Dark brown organic silty sandy clay, dry	90	1 0.0 5.0	
+843.2	1.0		ML, Reddish brown clayey silt with organics and sand, little gravel, stiff to dense, damp, low to no plasticity			
+840.2	4.0		SW, Brown sand, little gravel, trace silt, loose, wet, shallow inter-flow zone	100	2 5.0 15.0	
+837.7	6.5		CL, Light reddish brown silty clay, trace to little coarse sand and gravel, hard, damp, low to medium plasticity			Qp = >4.5 TSF @7.0' Sample No. 1 from 8.0' - 9.0' Qp = >4.5 TSF @10.0' Qp = >4.5 TSF @13.0' Sample No. 2 from 14.0' - 15.0'
+829.2	15.0		CL, Gray silty clay, little sand and gravel, with interbeds of clayey sand, stiff, moist to wet (where granular) Note: Clay sand interbedded with medium sand encountered from 19.0' to 24.0'	60	3 15.0 25.0	Qp = 2.5 TSF @18.0'

DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE 844.2

Hole No. 4-RICHMOND

PROJECT: McHenry County Observation Wells

INSTALLATION: Chicago District

SHEET 2 OF 8 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
			CL, Gray silty clay, little sand and gravel, with interbeds of clayey sand, stiff, moist to wet (where granular) *(continued)*			
						Sample No. 3 from 22.0' - 23.0'
						% Gravel/% Sand/% Fines = 1/87/12 from 22.0' to 22.5'
				100	4 25.0 35.0	Qp = 2.0 TSF @25.0'
						Qp = >4.5 TSF @27.0'
						Sample No. 4 from 29.0' - 30.0' Qp = 4.0 TSF @30.0'
						Qp = 4.0 TSF @33.0'
				95	5 35.0 45.0	
						Qp = 4.5 TSF @37.0'
						Qp = 4.0 TSF @39.0'
						Qp = 2.75 TSF @43.0'
						Sample No. 5 from 44.0' to 45.0'
				100	6 45.0	

DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE 844.2

Hole No. 4-RICHMOND

PROJECT: McHenry County Observation Wells

INSTALLATION: Chicago District

SHEET 3 OF 8 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
			CL, Gray silty clay, little sand and gravel, with interbeds of clayey sand, stiff, moist to wet (where granular) *(continued)*		55.0	
						Qp = 4.25TSF @47.0'
						Qp = 4.5 TSF @49.0'
						Sample No. 6 from 54.0' to 55.0' Qp = 42.5 TSF @54.0'
				100	7 55.0 65.0	
						Sample No. 7 from 64.0' to 65.0'
				100	8 65.0 75.0	
						Qp = 0.75 TSF @68.0'
						Qp = 1.0 TSF @69.0'

DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE 844.2

Hole No. 4-RICHMOND

PROJECT: McHenry County Observation Wells

INSTALLATION: Chicago District

SHEET 4 OF 8 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
			CL, Gray silty clay, little sand and gravel, with interbeds of clayey sand, stiff, moist to wet (where granular) *(continued)*			Qp = 1.0 TSF @72.0'
						Sample No. 8 from 74.0' to 75.0' Qp = 1.5 TSF @74.0'
				90	9 75.0 85.0	
						Qp = .75 TSF @78.0'
+761.7	82.5					Qp = 1.0 TSF @82.0'
			SP, Brownish gray fine sand, little silt, dense, wet			
						Sample No. 9 from 84.0' to 85.0'
+759.2	85.0					
			SW, Brownish gray gravelly sand, loose	100	10 85.0 95.0	
+758.2	86.0		Note: Silt, dense lens encounted near bottom of layer			
			SW, Gray medium to coarse sand with fine to coarse gravel (content increases with depth)			
						Sample No. 10 from 89.0' to 90.0'
				95	11 95.0 105.0	
						Sample No. 11 from 96.0' to 97.0'
						% Gravel/% Sand/% Fines = 84/15/1

DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE 844.2

Hole No. 4-RICHMOND

PROJECT: McHenry County Observation Wells

INSTALLATION: Chicago District

SHEET 5 OF 8 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
+745.2	99.0		SW, Gray medium to coarse sand with fine to coarse gravel (content increases with depth) *(continued)*			from 96.0' to 97.0'
			CL-ML, Gray clayey silt, very stiff, damp, low plasticity			Qp = 4.5 TSF @100.0'
						Qp = 4.0 TSF @103.0'
						Sample No. 12 from 104.0' to 105.0' Qp = 4.5 TSF @104.0'
				100	12 105.0 115.0	
						Qp = 2.5 TSF @110.0'
						Sample No. 13 from 114.0' to 115.0'
				100	13 115.0 125.0	
						Qp = 0.25 TSF @116.0'
						Qp = 0.5 TSF @120.0'

DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE 844.2

Hole No. 4-RICHMOND

PROJECT: McHenry County Observation Wells

INSTALLATION: Chicago District

SHEET 6 OF 8 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
			CL-ML, Gray clayey silt, very stiff, damp, low plasticity *(continued)*			Qp = 3.25 TSF @123.0'
						Sample No. 14 from 124.0' to 125.0'
				100	14 125.0 135.0	
						Qp = 3.25 TSF @127.0'
						Qp = 2.75 TSF @130.5'
						Sample No. 15 from 134.0' to 135.0'
						Qp = 2.25 TSF @134.0'
				100	15 135.0 145.0	
						Qp = 3.5 TSF @136.0'
+707.2	137.0					
			CL, Brownish gray silty clay, stiff, moist, high plasticity			
						Qp = 3.5 TSF @139.5'
						Sample No. 16 from 144.0' to 145.0'
						Qp = 2.5 TSF @144.0'
				100	16 145.0 155.0	
						Qp = 2.5 TSF @147.0'

DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE 844.2

Hole No. 4-RICHMOND

PROJECT: McHenry County Observation Wells

INSTALLATION: Chicago District

SHEET 7 OF 8 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
			CL, Brownish gray silty clay, stiff, moist, high plasticity *(continued)*			
						Qp = 1.0 TSF @151.0'
						Qp = 1.25 TSF @153.0'
						Sample No. 17 from 154.0' to 155.0' Qp = 1.25 TSF @154.0'
				100	17 155.0 165.0	
						Qp = 1.25 TSF @157.5'
						Qp = 2.0 TSF @159.5'
						Qp = 2.0 TSF @162.0'
						Sample No. 18 from 164.0' to 165.0' Qp = 2.0 TSF @164.0'
+679.2	165.0					
			ML, Brownish gray clayey silt, trace fine gravel, dense, not plastic	100	18 165.0 175.0	
						Sample No. 19 from 166.0' to 167.0'
+676.7	167.5					
			SC, Brownish gray clayey sand, trace fine to coarse gravel, dense, moist to wet			
						Sample No. 20 from 169.0' to 170.0'
						Sample No. 21 from 172.0' to 173.0'
+671.2	173.0					
			CL, Brownish gray silty clay with fine to medium gravel, very stiff, damp			
+670.2	174.0					

DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE 844.2

Hole No. 4-RICHMOND

PROJECT: McHenry County Observation Wells

INSTALLATION: Chicago District

SHEET 8 OF 8 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
+669.7	174.5		Note: Diamicton Till GP, Brownish gray sandy fine gravel, loose, wet *(continued)*	100	19 175.0 178.0	Qp = >4.5 TSF @174.0' % Gravel/% Sand/% Fines = 59/27/15 from 174.0' to 175.0'
			Dolomite Bedrock			
+666.2	178.0		END OF BORING - 155.0' BGS			AECOM Project No. 60095270

Hole No. 4 - RICHMOND

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 1 OF 12 SHEETS

1. PROJECT McHenry Cty Wells	10. SIZE AND TYPE OF BIT 3 7/8" Carbide Sampler & 5 7/8" ROTO-SONIC CASING
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) NAVD 88
3. DRILLING AGENCY WDC Exploration & Wells	12. MANUFACTURERS DESIGNATION OF DRILL Super Sonic II
4. HOLE NO. (As shown on drawing title and title number) 4-RCH	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 21; UNDISTURBED 0
5. NAME OF DRILLER DAN TONNANCOUR	14. TOTAL NUMBER CORE BOXES —
6. DIRECTION OF HOLE ☑ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER 836.5 ft MSL (Deep) Measured 10/9/08
	16. DATE HOLE: STARTED 10/6/08; COMPLETED 10/7/08
7. THICKNESS OF OVERBURDEN 174.5'	17. ELEVATION TOP OF HOLE 844.2 ft MSL
8. DEPTH DRILLED INTO ROCK 3.5'	18. TOTAL CORE RECOVERY FOR BORING 96% (171.5/178)
9. TOTAL DEPTH OF HOLE 178'	19. SIGNATURE OF INSPECTOR Gary M. Brown LPG IL

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
844.2	0		Dark Brown TOPSOIL organic silty sandy CLAY, dry (OL)			Run 1 (0-5') Rec/Run = 4.5/5.0' = 90 %
	1		Reddish Brown Clayey SILT w/ organics & sand, little gravel, low to no plasticity, stiff to dense damp (ML/OL)	Rec 90%	Bag 1	Grassland @ surface ~100' North of Hwy 173 &
	2					
	3					
	4		Brown SAND, little gravel, trace silt, loose, wet (SW) shallow inter-flow zone 0.5' transition (±)			
	5					
	6				Bag 2	Run 2 (5-15') Rec/Run = 10'/10' = 100%
	7		Lt. Reddish Brown Silty CLAY, trace to little coarse sand & gravel hard, damp (CL) DIAMICTON	Rec 100%		>4.5 tsf
	8				s1	
	9				Bag 3	
834.2	10		Low to Med. Plasticity			>4.5 tsf
	11					
	12					
	13				Bag 4	>4.5 tsf
	14		Very thin sand seam			
	15		Abrupt transition to Gray Till		s2	

1038 start 4" Sampler (3 7/8")
1042 Extract Sample
1044 Start 4" sampler
1045 @ 10'
1046:30 @ 15'
1049 Extract Sample
1052
Drive 6" Casing

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT McHenry Cty Wells — HOLE NO. 4 - Richmond Twp

Hole No. 4- Richmond

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 2 OF 12 SHEETS

1. PROJECT McHenry Cty Wells	10. SIZE AND TYPE OF BIT 3 7/8" Carbide Sampler & 5 7/8" Roto-Sonic Casing
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) NAVD88
3. DRILLING AGENCY WDC Exploration & Wells	12. MANUFACTURERS DESIGNATION OF DRILL Super Sonic II
4. HOLE NO. (As shown on drawing title and title number) 4 - RCH	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN — DISTURBED 21 — UNDISTURBED 0
5. NAME OF DRILLER DAN TONNANCOUR	14. TOTAL NUMBER CORE BOXES —
6. DIRECTION OF HOLE ☑ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.	15. ELEVATION GROUND WATER 836.5 FT MSL (D)
	16. DATE HOLE — STARTED 10/6/08 — COMPLETED 10/7/08
7. THICKNESS OF OVERBURDEN 174.5'	17. ELEVATION TOP OF HOLE 844.2 FT MSL
8. DEPTH DRILLED INTO ROCK 3.5'	18. TOTAL CORE RECOVERY FOR BORING 96%
9. TOTAL DEPTH OF HOLE 178.0'	19. SIGNATURE OF INSPECTOR Barry M. Brown LPG IL

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	15		~~Brownish~~ Gray Silty CLAY, little sand & gravel, stiff moist to wet (where granular) (CL) w/ interbeds of clayey SAND & Medium SAND (DIAMICTON)			Run 3 (15-25') Rec/Run = 6'/10' = 60'
	16				Bag 5	
	17					
	18					2.5 tsf
	19		Cont. DIAMICTON	Rec 60%		
824.2 INTER-TILL SANDS → uppermost hydrostratigraphic unit ~19-24' 4-RMD-S INTERVAL	20		Brownish Gray Clayey SAND interbedded w/ Med SAND			
	21		SAND		Bag 6	
			Clayey SAND			
	22		SAND	wet	s3	22 - 22.5 GRAIN SIZE SAMPLE
	23		Clayey SAND to sand w/ clay			
	24		continue same stratigraphic unit, but			2.0 tsf
	25		Very stiff to hard			Run 4 (25-35) Rec/Run = 10'/10' = 100%
	26				Bag 7	
	27		Very fine granular seam			>4.5 tsf
	28			Rec 100%		
	29				Bag 8	
814.2	30			s4		4.0 tsf

1108 Start 4" sampler
1111 Stop w/ 4" sampler
Drive 6" Casing
1120 Extract sample
1124 Start 4" sampler
1126:30 @ 35'

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT McHenry Cty Well — HOLE NO. 4- Richmond Twp

Hole No. 4 - Richmond Twp

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 3 OF 12 SHEETS

1. PROJECT: McHenry Cty Wells
2. LOCATION (Coordinates or Station):
3. DRILLING AGENCY: WDC Exploration & Wells
4. HOLE NO. (As shown on drawing title and title number): 4 - RCH
5. NAME OF DRILLER: DAN TONNANCOUR
6. DIRECTION OF HOLE: ☑ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 174.5
8. DEPTH DRILLED INTO ROCK: 3.5
9. TOTAL DEPTH OF HOLE: 178
10. SIZE AND TYPE OF BIT: 3 7/8" Carbide Sampler & 5 7/8" Roto-Sonic Casing
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): NAVD 88
12. MANUFACTURERS DESIGNATION OF DRILL: Super Sonic II
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 21; UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES: —
15. ELEVATION GROUND WATER: 836.5 FT MSL (D)
16. DATE HOLE: STARTED 10/6/08; COMPLETED 10/7/08
17. ELEVATION TOP OF HOLE: 844.2 FT MSL
18. TOTAL CORE RECOVERY FOR BORING: 96%
19. SIGNATURE OF INSPECTOR: Gary M. Brown LPG IL

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g	
814.2	30		cont. w/ stiff Silty CLAY DIAMICTON	cont.	8 cont.	Run 4 (25-35) cont.	
	31						
	32			Rec 100%	Bag 9	4.0 tsf	
	33						
	34						1137 Extract samples
	35					Run 5 (35-45)	1143 start 4" Sampler
	36					Rec/Run = 9.5'/10' = 95%	1147 stop
	37				Bag 10	4.5 tsf	Drive 6" Casing 1153 6" @ 45'
	38						
	39			Rec 95%		4.0 tsf	
804.2	40						
	41						
	42				Bag 11	2.75 tsf	
	43						
	44						
	45				S5		1157 Extract Sample

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT: McHenry Cty Wells | HOLE NO. 4 - RICHMOND TWP

Hole No. 4 - Richmond Twp

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 4 OF 12 SHEETS

1. PROJECT: McHenry Cty Wells
2. LOCATION (Coordinates or Station):
3. DRILLING AGENCY: WDC Exploration & Wells
4. HOLE NO. (As shown on drawing title and title number): 4- RCH
5. NAME OF DRILLER: DAN TONNANCOUR
6. DIRECTION OF HOLE: ☑ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 174.5
8. DEPTH DRILLED INTO ROCK: 3.5
9. TOTAL DEPTH OF HOLE: 178
10. SIZE AND TYPE OF BIT: 3 7/8" Carbide Sampler & 5 7/8" Roto-Sonic Casing
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): NAVD88
12. MANUFACTURERS DESIGNATION OF DRILL: Super Sonic II
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 21; UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES: —
15. ELEVATION GROUND WATER: 836.5 ft MSL (D)
16. DATE HOLE: STARTED 10/6/08; COMPLETED 10/7/08
17. ELEVATION TOP OF HOLE: 844.2 Ft MSL
18. TOTAL CORE RECOVERY FOR BORING: 96%
19. SIGNATURE OF INSPECTOR: Gary M. Brown LPG IL

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	45		cont.			Run 6 (45-55')
	46		Gray Silty CLAY Diamicton		Bag 12	Rec/Run = 10'/10' = 100%
	47					4.25 tsf
	48			Rec 100%		
	49					
794.2	50				Bag 13	4.5 tsf
	51					
	52					
	53		53.25' Very fine gravelly seam		Bag 14	
	54					
	55				s6	4.25 tsf
	56				Bag 15	Run 7 (55-65') Rec/Run = 10'/10' = 100%
	57		fine gravel seam			
	58			Rec 100%	Bag 16	
	59					
784.2	60					

1202 Start 4" Sampler
1208 @ 55' Semi-Difficult Drilling Drive 6" Casing
Break for Lunch
1248 Pull Rods
1300 Extract Sample
1309 Drive 4" Sampler
1314 At 65' Drive 6" Casing

Hole No. 4- Richmond Twp

DRILLING LOG	DIVISION CHICAGO	INSTALLATION —	SHEET 5 OF 12 SHEETS

1. PROJECT: McHenry Cty Wells
2. LOCATION (Coordinates or Station):
3. DRILLING AGENCY: WDC Exploration & Wells
4. HOLE NO. (As shown on drawing title and title number): 4-RCH
5. NAME OF DRILLER: DAW TONNWNCOUR
6. DIRECTION OF HOLE: ☑ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 174.5'
8. DEPTH DRILLED INTO ROCK: 3.5'
9. TOTAL DEPTH OF HOLE: 178'
10. SIZE AND TYPE OF BIT: 3 7/8" Carbide Sampler & 5 7/8" Roto-Sonic Casing
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): NAVD 88
12. MANUFACTURERS DESIGNATION OF DRILL: Super Sonic II
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 21; UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES: —
15. ELEVATION GROUND WATER: 836.5 Ft MSL
16. DATE HOLE: STARTED 10/6/08; COMPLETED 10/7/08
17. ELEVATION TOP OF HOLE: 844.2 Ft MSL
18. TOTAL CORE RECOVERY FOR BORING: 96%
19. SIGNATURE OF INSPECTOR: Gary M. Brown LPG IL

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g	
784.2	60		Cont. Gray Silty CLAY Diamicton	Rec 100% cont.	Bag 16 cont.	RUN 7 (55-65) cont.	
	61						
	62				Bag 17		
	63						
	64						1320 Extract Samples
	65				S7		
	66		same, but slightly softer		Bag 18	RUN 8 (65-75) Rec/Run = 10'/10' = 100%	1332 Begin 4" Sampler; 1336 End 4"; 1338 Drive 6" Casing
	67						
	68					0.75 tsf	1344
	69					1.0 tsf	
774.2	70			Rec. 100%	Bag 19	Appears to be Easier Drilling	
	71						
	72					1.0 tsf	
	73				Bag 20		
	74						
	75				S8	1.5 tsf	1351 Extract Samples

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT: McHenry Cty Wells | HOLE NO.: 4- Richmond Twp

Hole No. 4 - Richmond Twp

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 6 OF 12 SHEETS

1. PROJECT: McHenry Cty Wells
2. LOCATION (Coordinates or Station):
3. DRILLING AGENCY: WOC Exploration & Wells
4. HOLE NO. (As shown on drawing title and title number): 4-RCH
5. NAME OF DRILLER: DAN TONNANCOUR
6. DIRECTION OF HOLE: ☑ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 174.5'
8. DEPTH DRILLED INTO ROCK: 3.5'
9. TOTAL DEPTH OF HOLE: 178'
10. SIZE AND TYPE OF BIT: 3 7/8" Carbide Sampler & 5 7/8" CASING ROTOSONIC
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): NAVD 88
12. MANUFACTURERS DESIGNATION OF DRILL: Super Sonic II
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 21 UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES: —
15. ELEVATION GROUND WATER: 836.5 Ft MSL (D)
16. DATE HOLE: STARTED 10/6/08 COMPLETED 10/7/08
17. ELEVATION TOP OF HOLE: 844.2 Ft MSL
18. TOTAL CORE RECOVERY FOR BORING: 96%
19. SIGNATURE OF INSPECTOR: Gary M. Brown LPG IL

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	75		cont.			Run 9 (75-85)
	76		Brownish Gray Silty CLAY (soft, high plasticity)		Bag 21	Rec/Run = 9"/10" = 90%
	77					
	78			Rec 90%		0.75 tsf
	79				Bag 22	
764.2	80					
	81					
	82		Abrupt Transition			1.0 tsf
	83		Brownish Gray Fine SAND, little silt, dense, wet (SP)		Bag 23	
	84					
					S9	
	85		Brownish Gray Gravelly SAND, loose (SW)			Run 10 (85-95)
	86		SILT, dense/loose			Rec/Run = 10"/10" = 100%
	87		Gray Medium to coarse SAND w/ fine to coarse GRAVEL content increasing w/ depth (fining upwards sequence) (SW/GW)		Bag 24	
	88			Rec 100%		Note: smaller drill chatter during run...
	89				Bag 25 S10	Driller: gravel @ 93' (±)
754.2	90					

Run 9 (75-85)
1402:40 start 4" sampler
1404 @ 85'
Drive 6" casing
1405
1411
1420 Extract Samples
1430 Start Run

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT: McHenry Cty Wells | HOLE NO. 4 - Richmond

Hole No. 4-Richmond Twp

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 7 OF 12 SHEETS

1. PROJECT: McHenry Cty Wells
2. LOCATION (Coordinates or Station):
3. DRILLING AGENCY: WDC Exploration & Wells
4. HOLE NO. (As shown on drawing title and title number): 4-RCH
5. NAME OF DRILLER: Dan Tonnancour
6. DIRECTION OF HOLE: [x] VERTICAL [ ] INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 124.5'
8. DEPTH DRILLED INTO ROCK: 3.5'
9. TOTAL DEPTH OF HOLE: 128'
10. SIZE AND TYPE OF BIT: 3 7/8" Carbide Sampler & 5 7/8" CASING ROTO-SONIC
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): NAVD 88
12. MANUFACTURERS DESIGNATION OF DRILL: Super Sonic II
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 21; UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES: —
15. ELEVATION GROUND WATER: 836.5 Ft MSL (D)
16. DATE HOLE: STARTED 10/6/08; COMPLETED 10/7/08
17. ELEVATION TOP OF HOLE: 844.2 Ft MSL
18. TOTAL CORE RECOVERY FOR BORING: 96%
19. SIGNATURE OF INSPECTOR: Gary M. Rau LPG IL

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
754.2	90		cont.		Bag 25 cont.	Run 10 (85-95) cont.
	91		Gray SAND (SW)	Rec 100%		
			↓ to			
	92		GRAVEL (GW) (Medium dense, wet)	cont.	Bag 26	
	93		Predominantly SAND			
Intermediate Hydrostatic Zone	94		GRAVEL			1440 Extract Samples
	95					Run 11 (95-105)
4-RCH-I (93-99')	96		Cleanest Gravel	s11 Grain size sample	Bag 27	Rec/Run = 9.5'/10' = 95% 1456 Start Run w/ 4" Sampler
	97		clay stringer			1457 1458 Drive 6" casing
	98		Abrupt Transition			chatter 96-98'
	99					
744.2	100		Gray Clayey SILT, very stiff, low plasticity (varies based on clay content), damp (CL-ML)	Rec. 95%	Bag 28	4.5 tsf
	101					
	102					4.0 tsf
	103				Bag 29	
	104					
	105				s12	4.5 tsf 1513 Extract Samples

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT: McHenry Cty Wells | HOLE NO. 4-Richmond Twp

Hole No. 4-RICHMOND TWP

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 8 OF 12 SHEETS

1. PROJECT: McHenry Cty Wells
2. LOCATION (Coordinates or Station):
3. DRILLING AGENCY: WPC Exploration & Wells
4. HOLE NO. (As shown on drawing title and title number): 4-RCH
5. NAME OF DRILLER: DAN TONNANCOUR
6. DIRECTION OF HOLE: [X] VERTICAL [ ] INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 174.5'
8. DEPTH DRILLED INTO ROCK: 3.5'
9. TOTAL DEPTH OF HOLE: 178'
10. SIZE AND TYPE OF BIT: 3 7/8" Carbide Sampler & 5 7/8" Casing Roto Sonic
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): NAVD88
12. MANUFACTURERS DESIGNATION OF DRILL: Super Sonic II
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 21 / UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES: —
15. ELEVATION GROUND WATER: 836.5 FT MSL (D) Measured 10/9/08
16. DATE HOLE: STARTED 10/6/08 / COMPLETED 10/7/08
17. ELEVATION TOP OF HOLE: 844.2 FT MSL
18. TOTAL CORE RECOVERY FOR BORING: 96%
19. SIGNATURE OF INSPECTOR: Gary M. Brown LPG IL

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g	
	105		cont.			Run 12 (105-115)	1521 Start 4" sampler
	106		Gray Clayey SILT		Bag 30	Rec/Run 10'/10' = 100%	1524 Sampler @ 115'
	107		(very uniform - No sand/gravel observed)				1532 Casing At 115'
	108		(CL-ML)				
	109		clay content varies slightly	Rec 100%	Bag 31		
734.2	110					2.5 tsf	
	111						
	112						
	113				Bag 32	NA Not Cohesive	
	114				S13		1540 Extract Samples
	115					Run 13 (115-125')	1550 Start 4" sampler
	116					Rec 10'/Run 10' = 100%	1552 @ 125'
	117				Bag 33	0.25 tsf	1554 Drive 6" Casing
	118			Rec 100%			
	119						
724.2	120					0.5 tsf	

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT: McHenry Cty Wells | HOLE NO. 4-Richmond Twp

Hole No. 4-RICHMOND TWP

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 9 OF 12 SHEETS

1. PROJECT: McHenry Cty Wells
2. LOCATION (Coordinates or Station):
3. DRILLING AGENCY: WDC Exploration & Wells
4. HOLE NO. (As shown on drawing title and title number): 4-RHMD
5. NAME OF DRILLER: DANTOWNANCOUR
6. DIRECTION OF HOLE: ☑ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 174.5'
8. DEPTH DRILLED INTO ROCK: 3.5'
9. TOTAL DEPTH OF HOLE: 178'
10. SIZE AND TYPE OF BIT: 3 7/8" Carbide Sampler & 5 7/8" Casing Roto Sonic
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): NAVD 88
12. MANUFACTURERS DESIGNATION OF DRILL: Super Sonic II
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 21 UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES: —
15. ELEVATION GROUND WATER: 836.5 Ft MSL
16. DATE HOLE: STARTED 10/6/08 COMPLETED 10/7/08
17. ELEVATION TOP OF HOLE: 844.2 Ft MSL
18. TOTAL CORE RECOVERY FOR BORING: 96%
19. SIGNATURE OF INSPECTOR: Gary M. Brown LPG IL

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
724.2	120		Cont. Gray Clayey SILT		Bag 34 cont.	Run 13 (115-125) cont.
	121					
	122			Rec 100% cont.	Bag 35	
	123		3.25 tsf			
	124				S14	Extract Samples 1610
	125					
	126				Bag 36	Run 14 (125-135) Rec/Run = 10'/10' = 100%
	127		3.25 tsf			1636 start 4" 1640 stop 4" Drive 6" Casing
	128					
	129			Rec 100%	Bag 37	1650
714.2	130					
			2.75 tsf			
	131					
	132				Bag 38	
	133					OPEN BOREHOLE (135') WATER LEVEL = 10.6' bgs MEASURED 0705 10/7/08
	134		2.25 tsf			1658 Extract Sample End of Day 10/6/08 135'
	135				S15	

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT: McHenry Cty Wells HOLE NO. 4-Richmond Twp

Hole No. 4 - Richmond Twp

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 10 OF 12 SHEETS

1. PROJECT: McHenry Cty Wells
2. LOCATION (Coordinates or Station):
3. DRILLING AGENCY: WDC Exploration & Wells
4. HOLE NO. (As shown on drawing title and title number): 4-RCH
5. NAME OF DRILLER: DAN TONNANCOUR
6. DIRECTION OF HOLE: ☑ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 174.5'
8. DEPTH DRILLED INTO ROCK: 3.5'
9. TOTAL DEPTH OF HOLE: 178'
10. SIZE AND TYPE OF BIT: 3 7/8" Carbide Sampler & 5 7/8" CASING ROTOSONIC
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): NAVD 88
12. MANUFACTURERS DESIGNATION OF DRILL: SuperSonic II
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 21 / UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES: —
15. ELEVATION GROUND WATER: 836.5 FT MSL (D)
16. DATE HOLE: STARTED 10/6/08 COMPLETED 10/7/08
17. ELEVATION TOP OF HOLE: 844.2 FT MSL
18. TOTAL CORE RECOVERY FOR BORING: 96%
19. SIGNATURE OF INSPECTOR: Barry M. Brown LPG IL

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	135		cont.			TUESDAY OCTOBER 7, 2008
	136		Clayey SILT grades to Silty CLAY over 2ft (+/-) interval		Bag 39	RUN 15 (135-145) Rec/Run = 10'/10' = 100% 3.5 tsf → warm-up rig, drop sample rods
	137		Brownish Gray, Silty CLAY, stiff, moist, high plasticity, very uniform (same stratigraphic unit as above — more clay, less silt) (CL) Glaciolacustrine			0741 Start 4" sampler @135'
	138				Bag 40	drilling more difficult 140-145' w/ 4" sampler
	139			Rec		0748 @145' Drive 6" Casing to 145'
704.2	140					3.5 tsf ↓ 0755
	141					
	142					
	143				Bag 41	
	144					2.5 tsf
	145				s16	Pull Rods Extract Sample @ 0806
	146				Bag 42	RUN 16 (145-155) Rec/Run = 10'/10' = 100% 2.5 tsf 0815 Start Run
	147					Run out of water to drive 6" Casing.
	148			Rec 100%		
	149				Bag 43	
694.2	150					

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT: McHenry Cty Wells | HOLE NO. 4-Richmond Twp

Hole No. 4 - Richmond Twp

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 11 OF 12 SHEETS

1. PROJECT: McHenry Cty Wells
2. LOCATION (Coordinates or Station):
3. DRILLING AGENCY: WDC Exploration & Wells
4. HOLE NO. (As shown on drawing title and title number): 4-RCH
5. NAME OF DRILLER: Dan Tonnancour
6. DIRECTION OF HOLE: ☑ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 174.5'
8. DEPTH DRILLED INTO ROCK: 3.5'
9. TOTAL DEPTH OF HOLE: 178'
10. SIZE AND TYPE OF BIT: 3 7/8" Carbide Sampler & 5 7/8" CASING ROTO SONIC
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): NAVD 88
12. MANUFACTURERS DESIGNATION OF DRILL: Super Sonic II
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 21 UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES: —
15. ELEVATION GROUND WATER: 836.5 Ft MSL (D)
16. DATE HOLE: STARTED 10/6/08 COMPLETED 10/7/08
17. ELEVATION TOP OF HOLE: 844.2 Ft MSL
18. TOTAL CORE RECOVERY FOR BORING: 96%
19. SIGNATURE OF INSPECTOR: [signature] LPG IL

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
694.2	150		cont. w/ Brownish Gray Plastic Silty CLAY	cont.	Bag 43 cont.	Run 16 (145-155) cont. 1.0 tsf
	151					
	152			Rec 100%		Water Truck Returns Drive 6" Casing
	153				Bag 44	1.25 tsf
	154					Extract Sample ~945
					S17	1.25 tsf
	155					
	156				Bag 45	Run 17 (155-165) Rec/Run = 10'/10' = 100% 1014 1016 4" casing
	157					Drive 6" Casing
			1.25 tsf			
	158					
	159					
684.2	160		2.0 tsf	Rec 100%	Bag 46	
	161					
	162		2.0 tsf			
	163				Bag 47	
	164		Fairly abrupt transition to silt below 165'			
	165		2.0 tsf		S18	1036 Extract Sample

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT: McHenry Cty Wells HOLE NO. 4-Richmond Twp

Hole No. 4 - Richmond Twp

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 12 OF 12 SHEETS

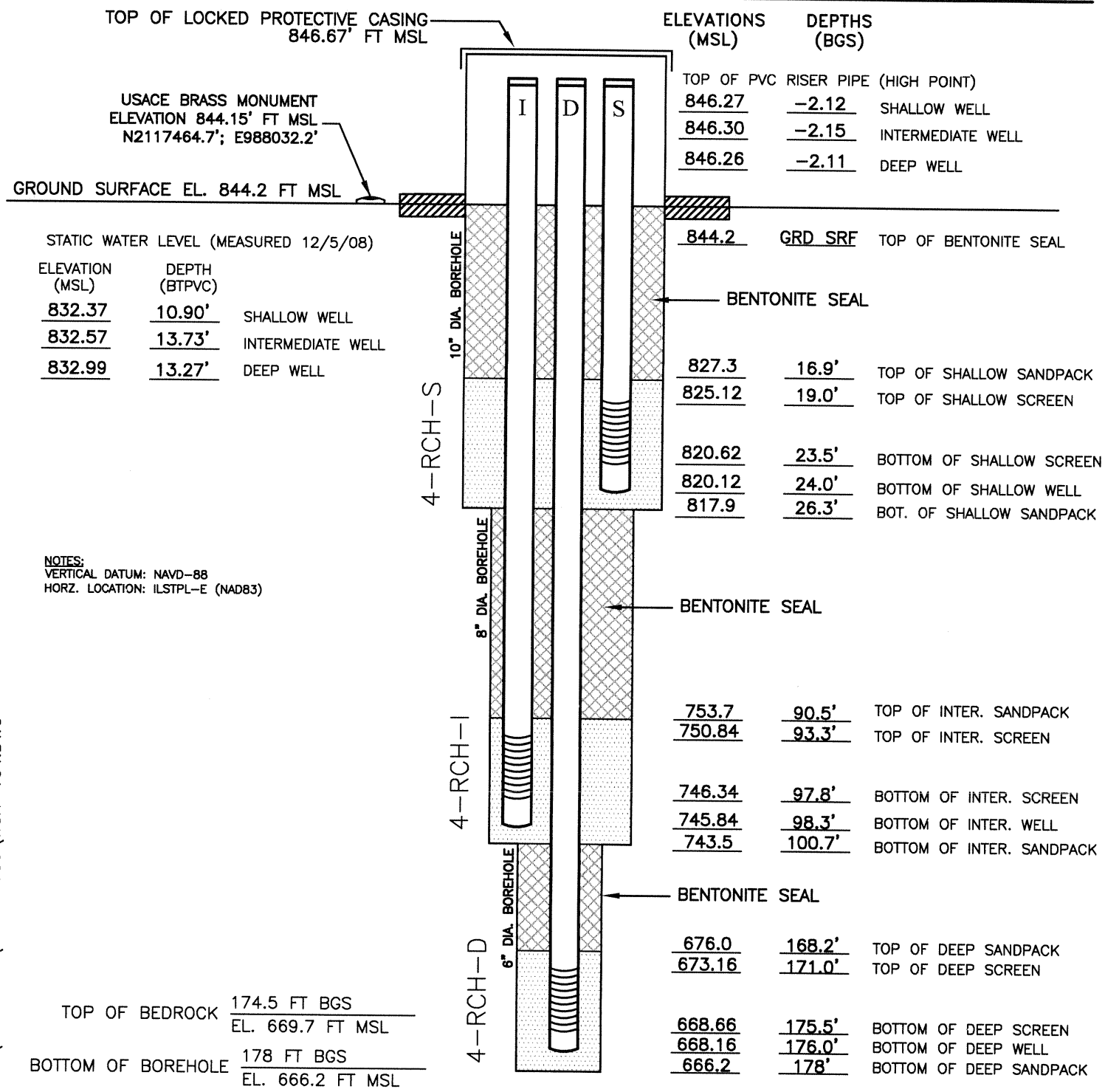
1. PROJECT McHenry Cty Wells	10. SIZE AND TYPE OF BIT 3 7/8" Carbide Sampler & 5 7/8" CASING
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) NAVD88
3. DRILLING AGENCY WDC Exploration & Wells	12. MANUFACTURERS DESIGNATION OF DRILL Super Sonic II
4. HOLE NO. (As shown on drawing title and title number) 4-RCH	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 21; UNDISTURBED 0
5. NAME OF DRILLER Dan Tonnancour	14. TOTAL NUMBER CORE BOXES —
6. DIRECTION OF HOLE ☑ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.	15. ELEVATION GROUND WATER 836.5 ft MSL (d)
	16. DATE HOLE: STARTED 10/6/08; COMPLETED 10/7/08
7. THICKNESS OF OVERBURDEN 174.5'	17. ELEVATION TOP OF HOLE 844.2 ft MSL
8. DEPTH DRILLED INTO ROCK 3.5'	18. TOTAL CORE RECOVERY FOR BORING 96%
9. TOTAL DEPTH OF HOLE 178'	19. SIGNATURE OF INSPECTOR Gary M. Brown LPG IL

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g	
	165		Brownish Gray Clayey SILT, trace fine gravel, dense (not plastic) (ML)		Bag 48	Run 18 (165-175)	1050 start 4"
	166					Rec/Run = 10'/10' = 100%	1052 @ 175'
	167		Transition over 0.25' to SAND		s19		
	168		Brownish Gray Clayey SAND, trace fine - coarse gravel, dense moist (SC) to wet				
	169			Rec 100%	Bag 49		
674.2	170				s20		
	171						
	172				s21		
4-RCH-D DEEP INTERVAL	173		Abrupt Transitions at 173' & 174'		Bag 50	> 4.5 tsf	
(171-176)	174		Brownish Gray Silty CLAY w/ f.-m. gravel, v. stiff, damp (CL) BARRINGTON TILL		grain size sample (174.2-174.6)	Drill chatter & recovery suggests that Hit Rubble / Rock @ ~174.6'	1115 Extract Sample
	175		Brownish Gray Sandy F. GRAVEL, loose, wet (GP)			Run 19 (175-178)	1210
	176		DOLOMITIC BEDROCK	100%	Bag 51	Rec 3'/Run 3' = 100%	Very loud drill chatter
	177						
666.2	178		END OF BOREHOLE AT 178 ft bgs			Water Level in open borehole 10/8/08 at 0715 = 13.86 ft below casing − 6.18 ft casing ags = 7.88 ft bgs ▽	1230 Extract Samples

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT McHenry Cty Wells | HOLE NO. 4 - Richmond Twp

PROJECT McHENRY COUNTY OBSERVATION WELL NETWORK INSTALLATION (#09000-460)	WELL NO. 4-RCH-S, 4-RCH-I & 4-RCH-D
LOCATION RICHMOND TOWNSHIP - McHENRY COUNTY, ILLINOIS	
CLIENT U.S. ARMY CORPS OF ENGINEERS / McHENRY COUNTY	
GEOLOGIST GARY BRAUN, P.G. (AECOM)	INSTALLATION DATE OCT. 8, 2008
DRILLER WDC EXPLORATION AND WELLS, INC. (DAN TONNANCOUR)	DRILLING METHOD ROTO-SONIC



ELEVATIONS (MSL)	DEPTHS (BGS)	
TOP OF PVC RISER PIPE (HIGH POINT)		
846.27	-2.12	SHALLOW WELL
846.30	-2.15	INTERMEDIATE WELL
846.26	-2.11	DEEP WELL
844.2	GRD SRF	TOP OF BENTONITE SEAL
827.3	16.9'	TOP OF SHALLOW SANDPACK
825.12	19.0'	TOP OF SHALLOW SCREEN
820.62	23.5'	BOTTOM OF SHALLOW SCREEN
820.12	24.0'	BOTTOM OF SHALLOW WELL
817.9	26.3'	BOT. OF SHALLOW SANDPACK
753.7	90.5'	TOP OF INTER. SANDPACK
750.84	93.3'	TOP OF INTER. SCREEN
746.34	97.8'	BOTTOM OF INTER. SCREEN
745.84	98.3'	BOTTOM OF INTER. WELL
743.5	100.7'	BOTTOM OF INTER. SANDPACK
676.0	168.2'	TOP OF DEEP SANDPACK
673.16	171.0'	TOP OF DEEP SCREEN
668.66	175.5'	BOTTOM OF DEEP SCREEN
668.16	176.0'	BOTTOM OF DEEP WELL
666.2	178'	BOTTOM OF DEEP SANDPACK

STATIC WATER LEVEL (MEASURED 12/5/08)

ELEVATION (MSL)	DEPTH (BTPVC)	
832.37	10.90'	SHALLOW WELL
832.57	13.73'	INTERMEDIATE WELL
832.99	13.27'	DEEP WELL

NOTES:
VERTICAL DATUM: NAVD-88
HORZ. LOCATION: ILSTPL-E (NAD83)

TOP OF BEDROCK 174.5 FT BGS / EL. 669.7 FT MSL

BOTTOM OF BOREHOLE 178 FT BGS / EL. 666.2 FT MSL

NOT TO SCALE

WELL CONSTRUCTION MATERIALS*

PROTECTIVE CASING	5' L X 10" DIA. STEEL CASING W/ LOCKING CAP
RISER PIPE ABOVE W.T.	SCHEDULE 40 PVC (2.07" I.D./ 2.38" O.D.)
RISER PIPE BELOW W.T.	SCHEDULE 40 PVC (2.07" I.D./ 2.38" O.D.)
SCREEN	2" I.D. SCHEDULE 40 PVC W/ 0.010" SCREEN SLOT SIZE
TYPE OF BENTONITE SEAL	BLACK HILLS BENTONITE - 3/8" CHIPS (HOLE PLUG)
TYPE OF SAND PACK	R.W. SIDLEY CO. - NO. 5 FILTER PACK SAND

CASING MEASUREMENTS

BOTTOM OF SCREEN TO END CAP (FT)*	0.50
SCREEN LENGTH (1ST SLOT TO LAST SLOT) (FT)*	4.50
TOTAL LENGTH OF CASING (FT): SHALLOW WELL	26.15
INTERMEDIATE WELL	100.46
DEEP WELL	178.10

* MEASUREMENT REFERS TO ALL WELLS

USMWK2FP001\05CAD\PROJECTS\20080408O\WCR-V04.DWG

WELL SITE DATA SUMMARY AND COMMENTARY

Well Site #4 – Richmond Township
MCCD Property at Trail Crossing - Hwy 173 (E. of Broadway St.)

The Richmond Township well location was shifted several times prior to its present day location. After the ISGS had reported artesian conditions near the initial well location near Lake Elizabeth (east of Richmond), the well site was relocated west of Richmond on Keystone Rd south of Genoa City. However, after discussions with MCCD, the well was again relocated to an open field north of Hwy 173 between Hwy 12 and Broadway Street. The well was positioned on high ground close to the road in hopes of avoiding artesian conditions. The Richmond well site was drilled immediately after the Hebron wells were installed.

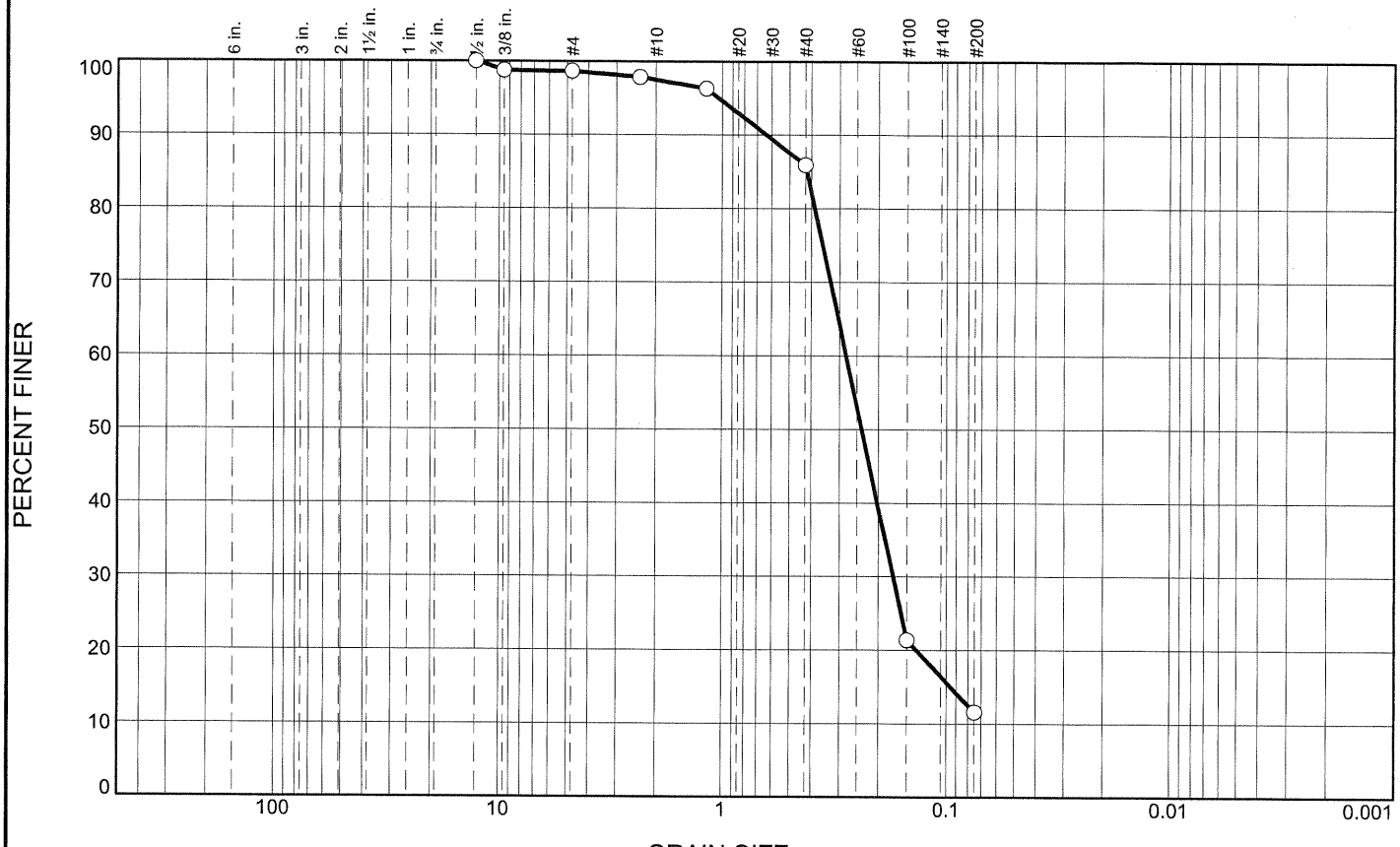
The shallow well was installed through a series of fine saturated sand seams that were observed to be inter-bedded within a shallow till sequence between 19 and 24 ft bgs. The next permeable zone was found below 58 feet of till that was underlying the shallow sand. The intermediate well was installed at a depth of 98 ft bgs in a clean gravelly zone. The intermediate hydrostatic zone was 16.5 feet thick and appeared to be fining upwards. Below the intermediate hydrostatic zone, a fairly thick (i.e. >68ft) gray clayey silt to silty clay deposit was encountered. These materials were underlain by thin (7ft) clayey sand to silty-gravel deposits that are situated on bedrock. Bedrock was encountered at 174.5 ft bgs. Since there appeared to be a relatively higher percentage of fines within the deep sand zone, the borehole was continued 3.5ft into rock and the well was screened across the interface. The deep well was set between 171 and 176 ft bgs.

Two hydraulic conductivity models were run to evaluate the sensitivity of the aquifer thickness parameter for the deep well response. However, as shown in Table 7, modifying the aquifer thickness did not change the results significantly. The thinner of two aquifer thicknesses (10.5 ft) was used as a representative conductivity since the well is only open to a foot of bedrock.

The shallow well at the Richmond site was found to have a moderate hydraulic conductivity (i.e. 4×10^{-4} cm/sec), but there is a limited water source at the well. During development and sampling the well was observed to have large drawdowns. Additionally, the shallow well at Richmond appears to observe salt water runoff from Hwy 173 de-icing activities because of the high conductivity, sodium and chloride concentrations detected during water quality sampling.

Well Site Testing Results

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	1.4	1.1	11.6	74.3	11.6	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.5	100.0		
.375	98.7		
#4	98.6		
#8	97.8		
#16	96.3		
#40	85.9		
#100	21.4		
#200	11.6		

* (no specification provided)

Material Description

F-C Sand Little Silt Trace Fine Gravel

Atterberg Limits

PL= np LL= nv PI=

Coefficients

D_{90}= 0.6342 D_{85}= 0.4186 D_{60}= 0.2797
D_{50}= 0.2381 D_{30}= 0.1724 D_{15}= 0.0955
D_{10}= C_u= C_c=

Classification

USCS= SP-SM AASHTO= A-2-4(0)

Remarks

Source of Sample: 4-RD-S **Depth:** 22.0-22.5

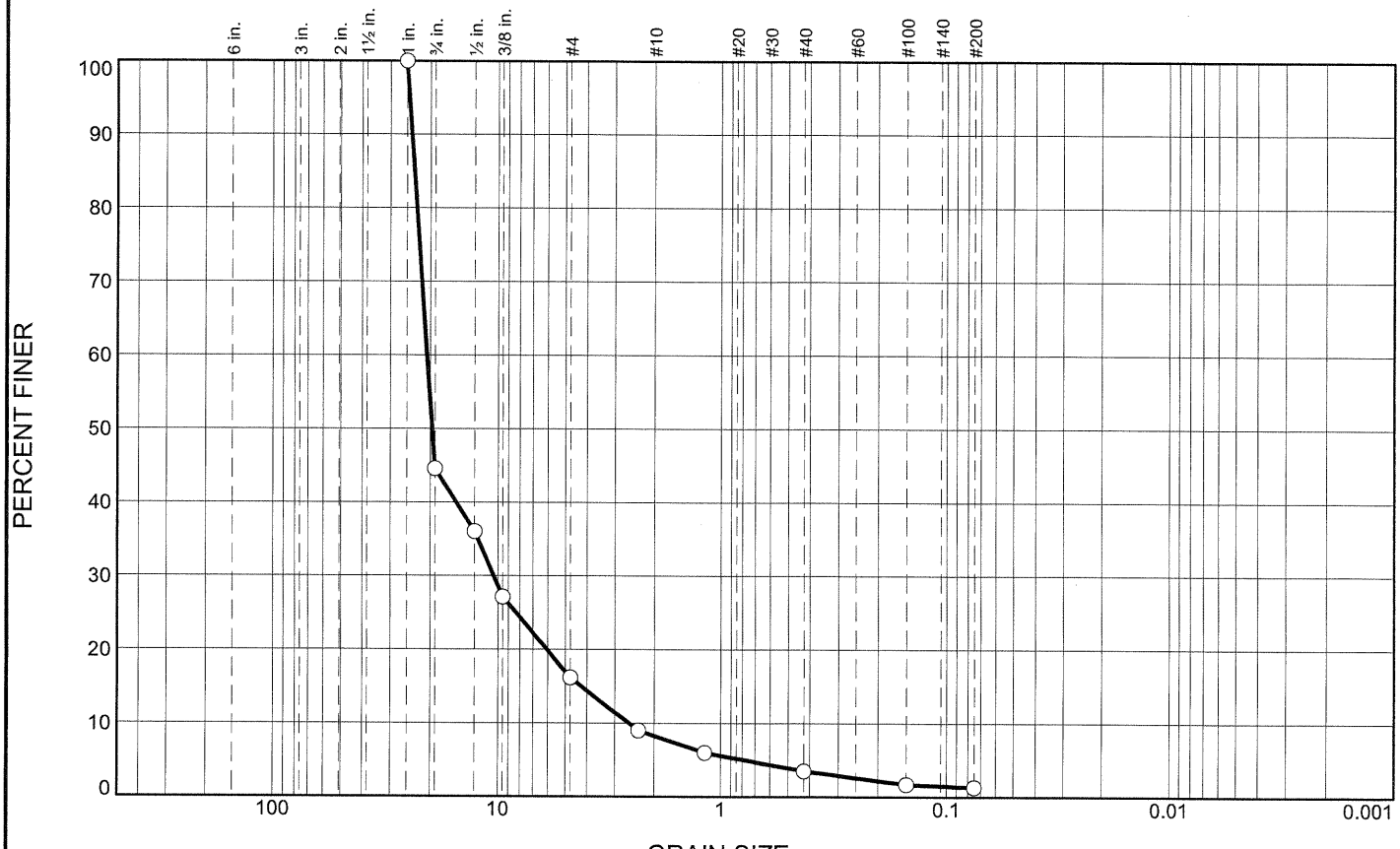
Date: 12/05/08

STS | AECOM

Client: USACE
Project: McHenry County Wells
Project No: 200804080 **Figure**

Tested By: JRT

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	55.4	28.4	7.9	4.8	2.2	1.3	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1	100.0		
.75	44.6		
.5	36.0		
.375	27.1		
#4	16.2		
#8	9.0		
#16	6.0		
#40	3.5		
#100	1.7		
#200	1.3		

* (no specification provided)

Material Description

F-C Gravel Little F-C Sand Trace Silt

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 24.1150 D_{85}= 23.4971 D_{60}= 20.6371
D_{50}= 19.5930 D_{30}= 10.4529 D_{15}= 4.2325
D_{10}= 2.6005 C_u= 7.94 C_c= 2.04

Classification

USCS= GW AASHTO=

Remarks

Source of Sample: 4-RD-I **Depth:** 96.0-97.0

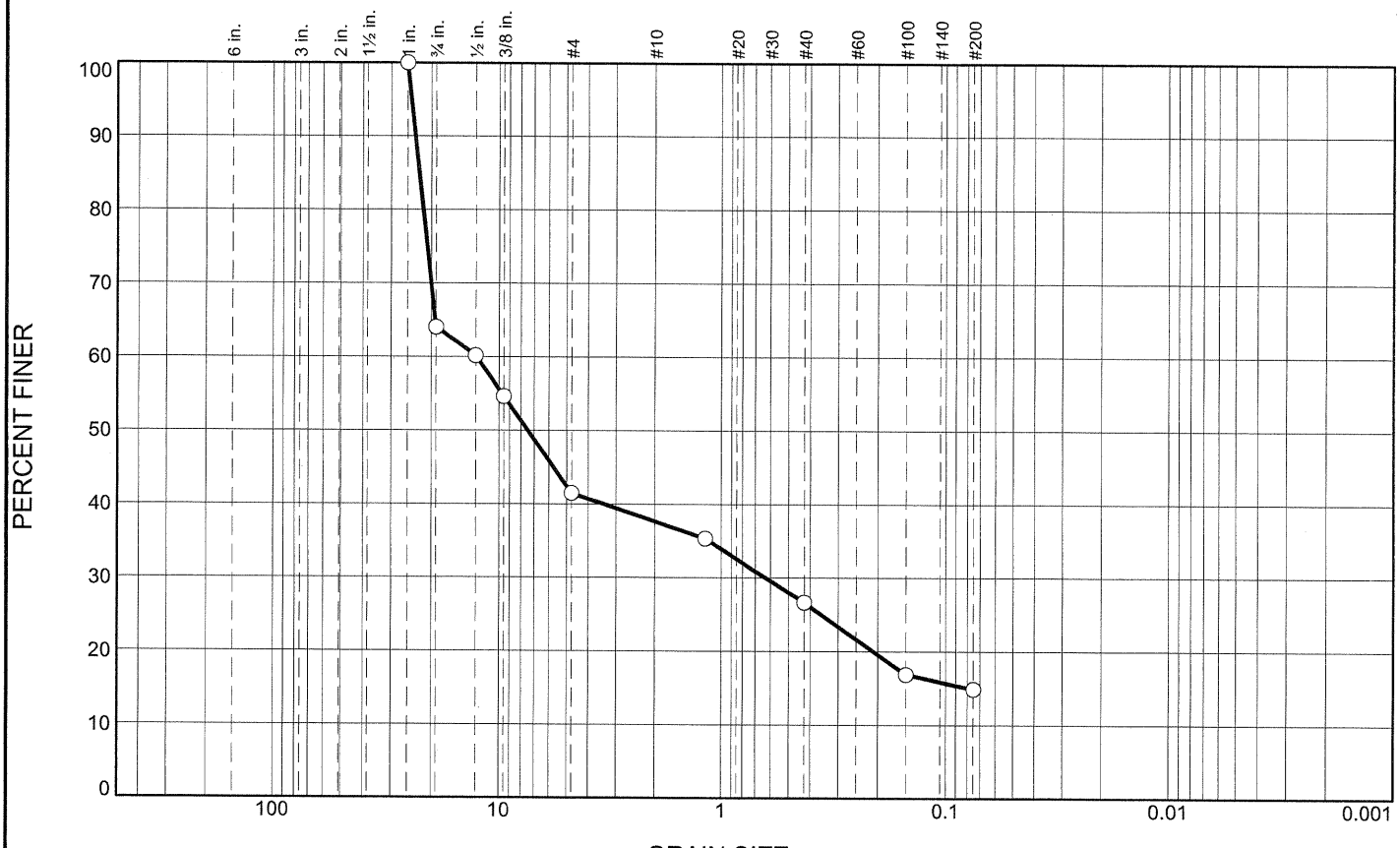
Date: 1//05/08

STS | AECOM

Client: USACE
Project: McHenry County Wells
Project No: 200804080 **Figure**

Tested By: JRT

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	35.9	22.6	3.8	11.1	11.7	14.9	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1	100.0		
.75	64.1		
.5	60.2		
.375	54.6		
#4	41.5		
#16	35.3		
#40	26.6		
#100	16.9		
#200	14.9		

* (no specification provided)

Material Description

F-C Gravel Some F-C Sand Little Silt

Atterberg Limits

PL= np LL= nv PI=

Coefficients

D_{90}= 23.4466 D_{85}= 22.5270 D_{60}= 12.5858
D_{50}= 7.4593 D_{30}= 0.6303 D_{15}= 0.0779
D_{10}= C_u= C_c=

Classification

USCS= GM AASHTO= A-1-a

Remarks

Source of Sample: Richmond TWP **Depth:** 174.2-174.6

Date: 12/05/08

STS | AECOM

Client: USACE
Project: McHenry County Wells
Project No: 200804080 **Figure**

Tested By: JRT

Groundwater Level Measurements

McHenry County Monitoring Well Installations
AECOM Project 09000-460

Site Number	4		
Township Name	Richmond		
Well Number	4-RCH-S	4-RCH-I	4-RCH-D
Ground Surface Elevation (ft msl)	844.15	844.15	844.15
Top of PVC Casing Elevation (ft)	846.27	846.30	846.26
Location of PVC Casing within Wellhead	NE Well	South Well	NW Well
Well Depth (Feet from TOC)[A]	26.15	100.46	178.10

Date	Depth to GW from TOC (ft)	GW Elevation (ft msl)	Depth to GW from TOC (ft)	GW Elevation (ft msl)	Depth to GW from TOC (ft)	GW Elevation (ft msl)
Sep. 26, 2008						
Oct. 09, 2008	8.72	837.55	11.78	834.52	9.78	836.48
Oct. 14, 2008						
Oct. 16, 2008						
Oct. 21, 2008						
Oct. 22, 2008						
Oct. 24, 2008						
Oct. 28, 2008						
Oct. 29, 2008						
Oct. 30, 2008						
Nov. 07, 2008						
Nov. 13, 2008						
Dec. 05, 2008	10.9	835.37	13.73	832.57	13.27	832.99
Dec. 08, 2008						
Dec. 09, 2008						
Dec. 12, 2008	10.38	835.89				
Dec. 15, 2008						
Dec. 16, 2008						
Dec. 17, 2008						
Dec. 18, 2008						
Dec. 19, 2008						
Dec. 22, 2008			13.83	832.47	13.03	833.23
Dec. 23, 2008						
Dec. 29, 2008						
Dec. 30, 2008						
Jan. 05, 2009						
Jan. 06, 2009						
Jan. 07, 2009	7.23	839.04	11.36	834.94	11.5	834.76
Jan. 08, 2009						
Jan. 09, 2009						
Jan. 10, 2009						
Jan. 12, 2009						
Feb. 24, 2009	8.26	838.01	11.68	834.62	11.74	834.52
Mar. 20, 2009						
end						

Notes:

ft msl = Elevation referenced to feet above mea88)

TOC = Top of PVC Casing

ft = feet

[A] = as measured inside well

NI = Not Installed

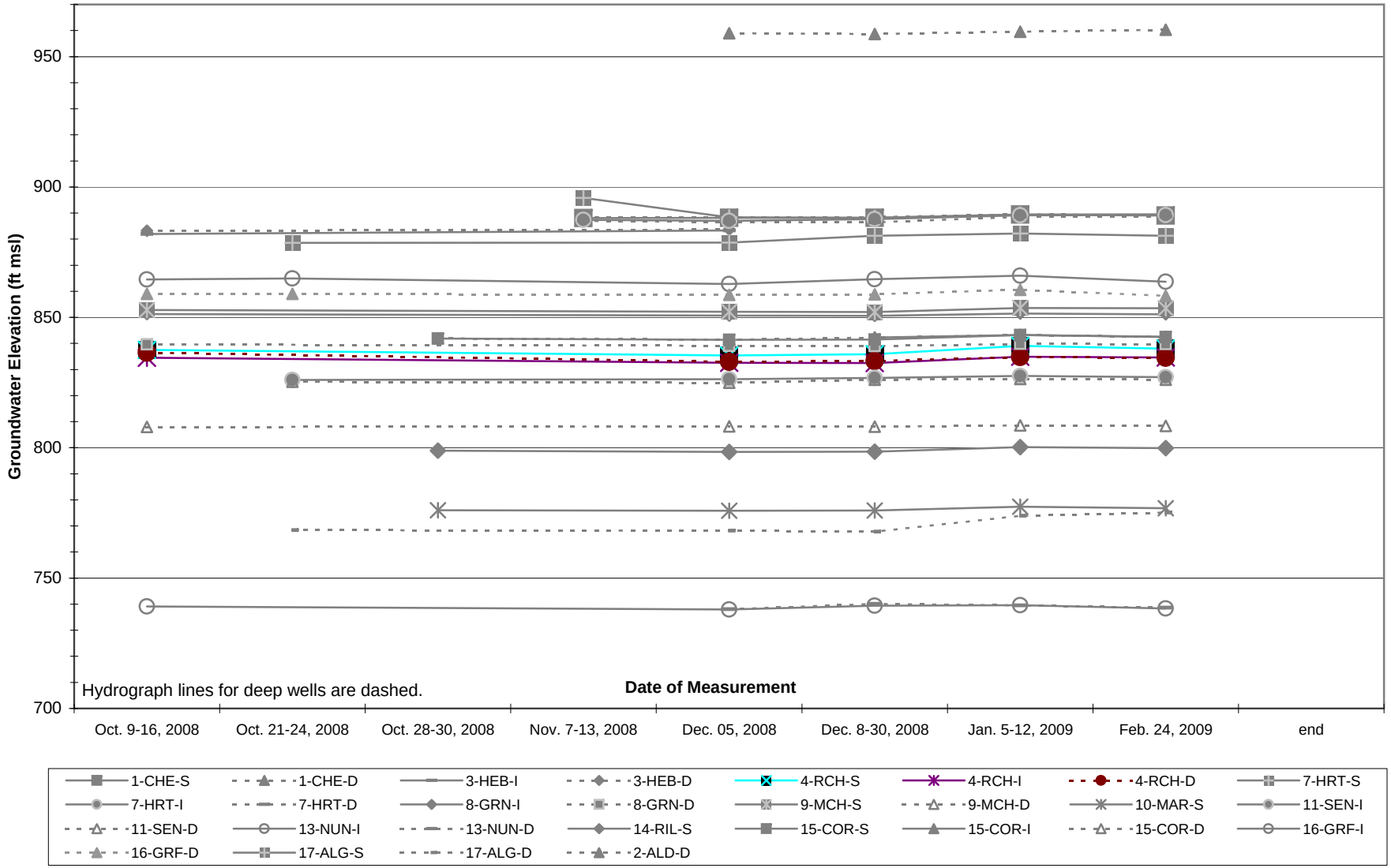
--- No Elevation

Well 17-Alg-S was frozen or partially frozen fror

Site 4 Groundwater Level Hydrograph
(includes ALL AECOM INSTALLED WELLS)

McHenry County Obervation Well Network

AECOM Project 09000-460

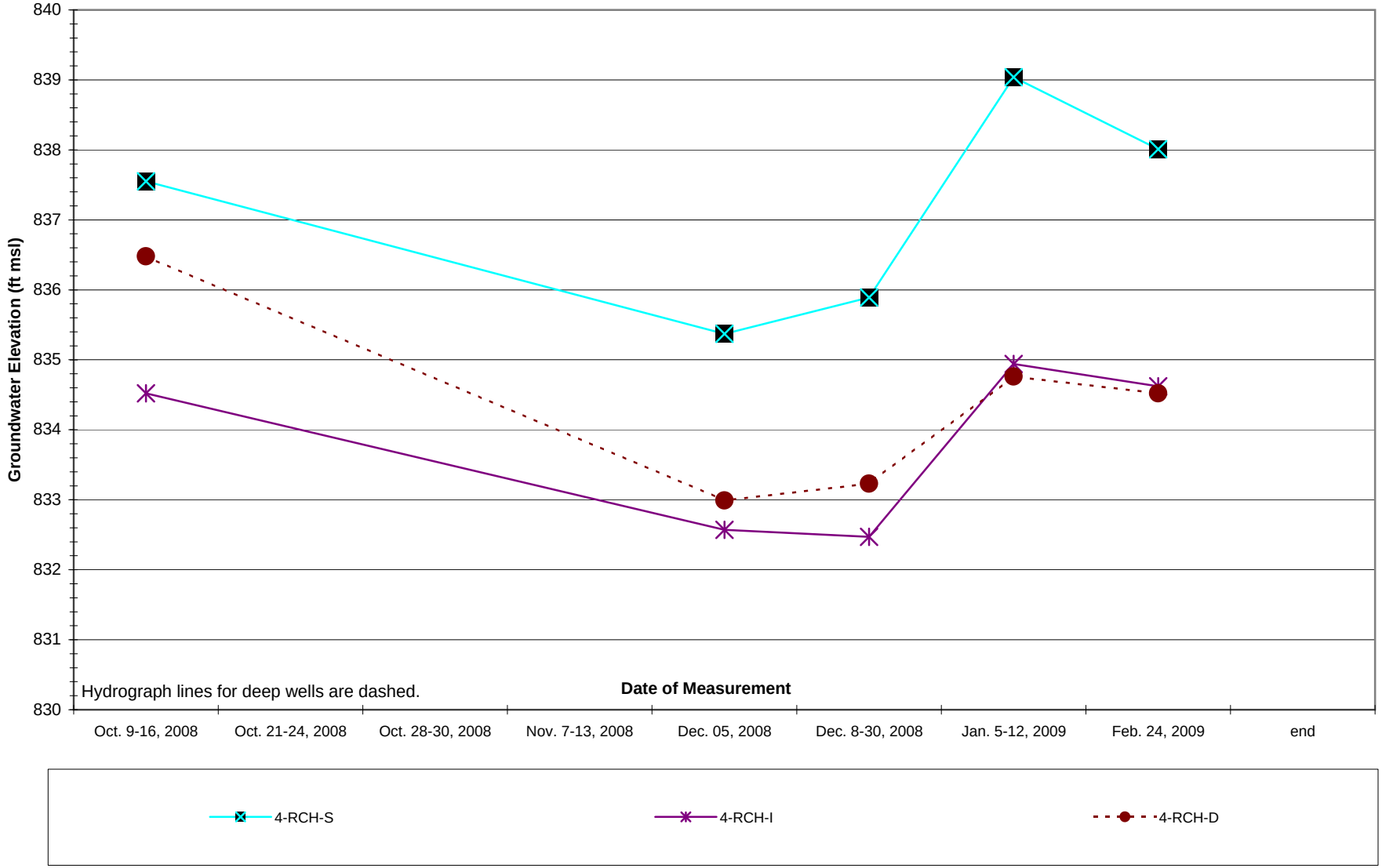


K:\PROJECTS\200804080\In_Progress\STS-McHenry Cty_WLs IN PROGRESS - figs for each site.xls

Site 4 Groundwater Level Hydrograph

McHenry County Obervation Well Network

AECOM Project 09000-460



K:\PROJECTS\200804080\In_Progress\STS-McHenry Cty_WLs IN PROGRESS - figs for each site.xls

Well Development Record

STS Consultants, Ltd.
11425 West Lake Park Drive
Milwaukee, Wisconsin 53224

Site Name: McHenry County

Well ID Number: 4-RCH-5

Date of Completion: 12/12/08

STS Job Number: 200804080

Start Time: 12:45

End Time: 16:25

Water color at start of development: Brown

Water color at end of development: Milky Clear

Amount of water removed during development:

Contained water? ☐ Yes ☒ No

If not contained, where water disposed? Ground

Well Development Methods:

- ☐ Surged with bailer and bailed
- ☐ Surged with block and bailed
- ☐ Surged with block, bailed & pumped
- ☐ Bailed only
- ☐ Pumped slowly
- ☐ Surged with bailer and pumped
- ☒ Surged with block and pumped
- ☐ Compressed Air
- ☐ Pumped only
- ☐ Other

Equipment Used

- ☐ PVC bailer
- ☐ Well wizard
- ☐ Bean or Moino pump (on drill rig)
- ☒ Surge block
- ☒ Whale pumps

Notes: Surge Start: 12:45

End: 13:00

Purge Start: 13:05

End: 16:25

Wt: 10.38

WELL DEVELOPMENT FIELD RECORD

Job Name: McHenry County Job No.: 20080480 Well No.: 4-RCH-5

Developed By: Brian Schmidt Date of Install.: _____ Sheet ____ of ____

Started Devel.: 12/12/08 / _____ (DATE / TIME) Completed Devel.: 12/12/08 / _____ (DATE / TIME)

W.L. Before Devel.: _____ / _____ / _____ (DATE / TIME / DEPTH) After Devel.: _____ / _____ / _____ (DATE / TIME / DEPTH)

Well Depth: Before Devel. _____ After Devel. _____ Well Dia. (in.) _____

Standing Water Column (ft.) _____ Standing Well Volume _____ gal.

Screen Length: 5' Drilling Water Loss _____ gal.

DATE / TIME	VOLUME REMOVED (Gallons)	FIELD PARAMETERS SPEC. COND. (umhos/cm)	TEMP. (C°)	pH (s.u.)	TURB ~~Other~~	ORP	REMARKS
12/12/08 13:10	5 Gal/min	2240	8.7	7.98	370	–	
13:20	"	1880	7.6	7.51	999	–	
	Pump Stalled Restart @ 13:45						
13:50	Pump Died Restart @ 13:55						
14:00	"	1940	7.7	7.63	999	–	
14:10	"	1960	6.5	7.72	548	–	
14:20	"	2030	5.7	7.77	345	–	
14:30	"	2010	5.6	7.75	886	–	
14:40		Pump Dry @ 14:33		Let Sit	Restart	@ 14:40	
14:50	2L/min	2040	8.0	7.77	999		
15:00	"	2050	6.0	7.73	239	–	
15:10	"	2050	5.7	7.75	57	–	Pump Dry @ 1510
15:30	"	2260	4.1	7.97	58	–	Restart @ 1530
1625	"	1600	6.8	7.69	201	–	
		= TOTAL VOLUME REMOVED (Gallons)					

Development Method: Well Dry @ 1555
Restart @ 1605
Well Dry @ 1625

Notes:

Well Development Record

STS Consultants, Ltd.
11425 West Lake Park Drive
Milwaukee, Wisconsin 53224

Site Name: McHenry County Well ID Number: 4-RGH-I

Date of Completion: 12/22/08 STS Job Number: 200804080

Start Time: 14:30 End Time: 16:10

Water color at start of development: Brown Water color at end of development: Clear

Amount of water removed during development:

Contained water? ☐ Yes ☒ No

If not contained, where water disposed? Ground

Well Development Methods:

- ☐ Surged with bailer and bailed
- ☐ Surged with block and bailed
- ☐ Surged with block, bailed & pumped
- ☐ Bailed only
- ☐ Pumped slowly
- ☐ Surged with bailer and pumped
- ☐ Surged with block and pumped
- ☐ Compressed Air
- ☒ Pumped only
- ☐ Other

Equipment Used

- ☐ PVC bailer
- ☐ Well wizard
- ☐ Bean or Moino pump (on drill rig)
- ☐ Surge block
- ☐ Whale pumps
- ☒ Waterra Pump w/ Block

Notes: Purge Start: 14:30

End: 16:10

WL St: 13.83

End: 14:47

WELL DEVELOPMENT FIELD RECORD

Job Name McHenry County Job No. 20080480 Well No. 4-RCH-I

Developed By Brian Summit Date of Install. _____ Sheet ____ of ____

Started Devel. 12/22/08 / _____ (DATE / TIME) Completed Devel. 12/22/08 / _____ (DATE / TIME)

W.L. Before Devel. _____ / _____ / _____ (DATE / TIME / DEPTH) After Devel. _____ / _____ / _____ (DATE / TIME / DEPTH)

Well Depth: Before Devel. _____ After Devel. _____ Well Dia. (in.) _____

Standing Water Column (ft.) _____ Standing Well Volume _____ gal.

Screen Length 5' Drilling Water Loss _____ gal.

DATE / TIME	VOLUME REMOVED (Gallons)	FIELD PARAMETERS SPEC. COND. (umhos/cm)	TEMP. (C°)	pH (s.u.)	TURB ~~Other~~	ORP	REMARKS
12/22/08 14:50	2GAL/MIN	657	7.4	7.45	999	–	
15:10	"	930	7.2	7.46	999	–	
15:30	"	614	7.9	7.38	323	–	
15:50	"	583	8.0	7.47	103	–	
16:10	"	580	7.8	7.49	84	–	
		= TOTAL VOLUME REMOVED (Gallons)					

Development Method: _____

Notes:

Well Development Record

STS Consultants, Ltd.
11425 West Lake Park Drive
Milwaukee, Wisconsin 53224

Site Name: McHenry County

Well ID Number: 4-RCH-D

Date of Completion: 12/22/08

STS Job Number: 200804080

Start Time: 12:30

End Time: 14:30

Water color at start of development: GREY

Water color at end of development: MILKY CLEAR

Amount of water removed during development:

Contained water? ☐ Yes ☒ No

If not contained, where water disposed? GROUND

Well Development Methods:

- ☐ Surged with bailer and bailed
- ☐ Surged with block and bailed
- ☐ Surged with block, bailed & pumped
- ☐ Bailed only
- ☐ Pumped slowly
- ☐ Surged with bailer and pumped
- ☐ Surged with block and pumped
- ☐ Compressed Air
- ☒ Pumped only
- ☐ Other

Equipment Used

- ☐ PVC bailer
- ☐ Well wizard
- ☐ Bean or Moino pump (on drill rig)
- ☐ Surge block
- ☐ Whale pumps
- ☒ WATERRA PUMP

Notes: PURGE START: 12:30

END: 14:30

WL ST: 13.03

WL END: 17.68'

WELL DEVELOPMENT FIELD RECORD

Job Name McHenry County Job No. 200804080 Well No. 4-ROH-D

Developed By Brian Schmitt Date of Install. _____ Sheet ____ of ____

Started Devel. 12/22/08 / DATE / TIME Completed Devel. 12/22/08 / DATE / TIME

W.L. Before Devel. ____ / DATE / TIME / DEPTH After Devel. ____ / DATE / TIME / DEPTH

Well Depth: Before Devel. _____ After Devel. _____ Well Dia. (in.) _____

Standing Water Column (ft.) _____ Standing Well Volume _____ gal.

Screen Length 5' Drilling Water Loss _____ gal.

DATE / TIME	VOLUME REMOVED (Gallons)	FIELD PARAMETERS SPEC. COND. (umhos/cm)	TEMP. (C°)	pH (s.u.)	TURB ~~Other~~	ORP	REMARKS
12/22/08 CAL	—	4730	1.6	3.95	0	—	
12:30	2 GAL/MIN	556	9.2	5.77	639	—	
12:50	"	518	9.6	7.36	999	—	
13:10	"	503	9.4	7.23	999	—	
13:30	"	497	9.2	7.34	749	—	
13:50	"	494	9.4	7.35	523	—	
14:10	"	492	9.2	7.35	416	—	
14:30	"	492	9.0	7.39	380	—	
		= TOTAL VOLUME REMOVED (Gallons)					

Development Method: _____

Notes:

First Environmental Laboratories, Inc.
IL ELAP / NELAC Accreditation # 100292
1600 Shore Road • Naperville, Illinois 60563 • Phone (630) 778-1200 • Fax (630) 778-1233

Analytical Report

Client: STS CONSULTANTS (VERN)
Project ID: McHenry County 200804080
Sample ID: 4-RCH-S
Sample No: 9-0115-019

Date Collected: 01/07/09
Time Collected: 11:20
Date Received: 01/13/09
Date Reported: 01/20/09

Analyte		Result	R.L.	Units	Flags
Total Metals	**Method: 6020A**		**Preparation Method 3010A**		
Analysis Date: 01/16/09			Preparation Date: 01/15/09		
Calcium		197	0.1	mg/L	
Iron		1.90	0.01	mg/L	
Magnesium		99.6	0.1	mg/L	
Potassium		2.5	0.1	mg/L	
Sodium		260	0.1	mg/L	
Alkalinity, Bicarbonate (CaCO3)	**Method: 2320B**				
Analysis Date: 01/15/09 13:30					
Alkalinity, Bicarbonate (CaCO3)		420	5	mg/L	
Alkalinity, Carbonate (CaCO3)	**Method: 2320B**				
Analysis Date: 01/15/09 13:30					
Alkalinity, Carbonate (CaCO3)		< 5	5	mg/L	
Chloride	**Method: 4500Cl, E**				
Analysis Date: 01/14/09					
Chloride		630	5	mg/L	
Sulfate	**Method: 375.2R2.0**				
Analysis Date: 01/15/09					
Sulfate		76	15	mg/L	

First Environmental Laboratories, Inc.

IL ELAP / NELAC Accreditation # 100292

1600 Shore Road • Naperville, Illinois 60563 • Phone (630) 778-1200 • Fax (630) 778-1233

Analytical Report

Client: STS CONSULTANTS (VERN)
Project ID: McHenry County 200804080
Sample ID: 4-RCH-I
Sample No: 9-0115-018

Date Collected: 01/07/09
Time Collected: 12:35
Date Received: 01/13/09
Date Reported: 01/20/09

Analyte		Result	R.L.	Units	Flags
Total Metals	**Method: 6020A**		**Preparation Method 3010A**		
Analysis Date: 01/16/09			Preparation Date: 01/15/09		
Calcium		71.3	0.1	mg/L	
Iron		2.66	0.01	mg/L	
Magnesium		44.9	0.1	mg/L	
Potassium		2.4	0.1	mg/L	
Sodium		49.8	0.1	mg/L	
Alkalinity, Bicarbonate (CaCO3)	**Method: 2320B**				
Analysis Date: 01/15/09 13:30					
Alkalinity, Bicarbonate (CaCO3)		330	5	mg/L	
Alkalinity, Carbonate (CaCO3)	**Method: 2320B**				
Analysis Date: 01/15/09 13:30					
Alkalinity, Carbonate (CaCO3)		< 5	5	mg/L	
Chloride	**Method: 4500Cl, E**				
Analysis Date: 01/14/09					
Chloride		45	5	mg/L	
Sulfate	**Method: 375.2R2.0**				
Analysis Date: 01/15/09					
Sulfate		39	15	mg/L	

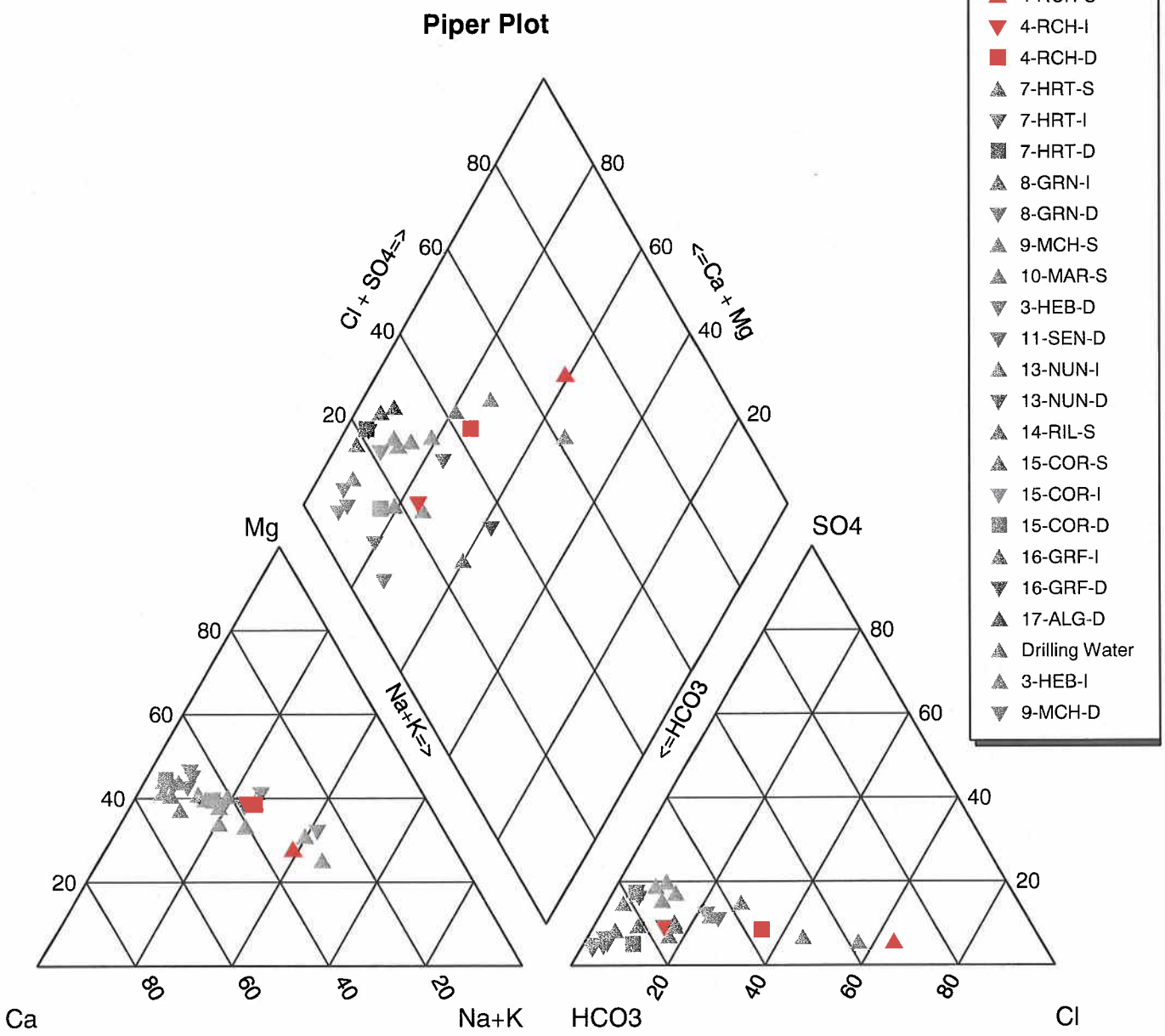
First Environmental Laboratories, Inc.
IL ELAP / NELAC Accreditation # 100292
1600 Shore Road • Naperville, Illinois 60563 • Phone (630) 778-1200 • Fax (630) 778-1233

Analytical Report

Client: STS CONSULTANTS (VERN)
Project ID: McHenry County 200804080
Sample ID: 4-RCH-D
Sample No: 9-0115-017

Date Collected: 01/07/09
Time Collected: 13:45
Date Received: 01/13/09
Date Reported: 01/20/09

Analyte		Result	R.L.	Units	Flags
Total Metals	**Method: 6020A**		**Preparation Method 3010A**		
Analysis Date: 01/16/09			Preparation Date: 01/15/09		
Calcium		112	0.1	mg/L	
Iron		1.89	0.01	mg/L	
Magnesium		72.5	0.1	mg/L	
Potassium		4.3	0.1	mg/L	
Sodium		88.7	0.1	mg/L	
Alkalinity, Bicarbonate (CaCO3)	**Method: 2320B**				
Analysis Date: 01/15/09 13:30					
Alkalinity, Bicarbonate (CaCO3)		400	5	mg/L	
Alkalinity, Carbonate (CaCO3)	**Method: 2320B**				
Analysis Date: 01/15/09 13:30					
Alkalinity, Carbonate (CaCO3)		< 5	5	mg/L	
Chloride	**Method: 4500Cl, E**				
Analysis Date: 01/14/09					
Chloride		177	5	mg/L	
Sulfate	**Method: 375.2R2.0**				
Analysis Date: 01/15/09					
Sulfate		57	15	mg/L	



DESCRIPTION: Piper Linear Diagram - Well Site #4

AECOM	PROJECT: McHenry County	PROJECT NO: 09000460
	CLIENT: Army Corps of Engineers	DATE: 7/30/2009

Field Well Sampling Sheet

Fill out the entire form. If it does not apply, mark N/A.

Project Name: McHenry County
STS Job No. 20280408 0
Location: Richmond
Tester: Brian Schmidt
Well Number: 4-RCH-5'
Date Sampled: 1/7/09
Previous Well Sampled: 16-GRF-D

GENERAL CONDITIONS:

						If Missing Replaced?
Surface Seal:	☒ Ok	☐ Damaged	☐ Missing:	Yes	No
Protector Pipe:	☒ Ok	☐ Damaged	☐ Missing:	Yes	No
Well Cap:	☒ Ok	☐ Damaged	☐ Missing:	Yes	No
Ambient Temperature: 20 °F		☐ Clear ☒ Cloudy	☐ Rain		

WELL DATA:

Measuring Device: Solinist Water Level Meter
Stick Up or Down: UP (from Ground Surface)
Depth to Water: 7.23 (from TPVC)
Depth to Bottom: 24 (from TPVC)
Length of Water:
Free Product Observed: ☐ Yes ☒ No Thickness: N/A

PURGING/SAMPLING:

Well Purging Calculations: Amount to purge = 0.163 gallons/foot times height of water column in feet for one well volume

Purging Device: Bladder Pump
Sampling Device: Bladder Pump
Volume Required:
☒ See back of page for field readings during purge
Volume Purged:
Could Well Bail Dry? ☐ Yes ☒ No
Purging - Time Start: 10:20
Time Ended: 1125
Decon Method: Alconox

IN-SITU TESTING:

Turbidity: ☐ Turbid ☐ Opaque
Odor:
Color
pH @ degrees C
Uncorrected Conductivity X
Water Temp. (from Cond.)
Comments: ST: 1120

SAMPLES COLLECTED

Vocs -	☐	Cyanide	☐
Metals -	☐	Hexchrome	☐
SVOC	☐	Alkalinity	☐
TOC	☐	Chloride	☐
Sulfide	☐	Ammonia	☐
Phenolics	☐	COD	☐

Well Purging Log

Date 1/7/09

Time	Temp	pH	Conductivity	~~ORP~~ TURB	~~DO~~ RATE
1/7/09 CAL	11.6	3.99	4520	0	—
1040	1.3	5.83	3240	50	250 mL/MIN
1045	3.8	6.71	3080	31	"
1055	5.8	6.90	3070	17	"
1100	6.5	7.02	3090	12	"
1105	6.9	7.09	3100	10	"
1110	6.6	7.16	3130	8	"
1115	6.3	7.21	3150	8	"
1120	6.3	7.23	3160	7	"
ST:	1120				

Field Well Sampling Sheet

Fill out the entire form. If it does not apply, mark N/A.

Project Name: McHenry County
STS Job No. 20080408O
Location: Richmond
Tester: Brian Schmidt
Well Number: 4-RCH-I
Date Sampled: 1/7/09
Previous Well Sampled: 4-RCH-5'

GENERAL CONDITIONS:

						If Missing Replaced?
Surface Seal:	☒ Ok	☐ Damaged	☐ Missing:	Yes	No
Protector Pipe:	☒ Ok	☐ Damaged	☐ Missing:	Yes	No
Well Cap:	☒ Ok	☐ Damaged	☐ Missing:	Yes	No
Ambient Temperature: 20 °F		☐ Clear ☒ Cloudy	☐ Rain		

WELL DATA:

Measuring Device: Solinst Water Level Meter
Stick Up or Down: UP (from Ground Surface)
Depth to Water: 11.36 (from TPVC)
Depth to Bottom: 98 (from TPVC)
Length of Water:
Free Product Observed: ☐ Yes ☒ No Thickness: N/A

PURGING/SAMPLING:

Well Purging Calculations: Amount to purge = 0.163 gallons/foot times height of water column in feet for one well volume

Purging Device: Bladder Pump
Sampling Device: Bladder Pump
Volume Required:
☒ See back of page for field readings during purge
Volume Purged:
Could Well Bail Dry? ☐ Yes ☒ No
Purging - Time Start: 1135
Time Ended: 1240
Decon Method: Alconox

IN-SITU TESTING:

Turbidity: ☐ Turbid ☐ Opaque
Odor:
Color
pH @ degrees C
Uncorrected Conductivity X
Water Temp. (from Cond.)
Comments: ST: 1235

SAMPLES COLLECTED

Vocs -	☐	Cyanide	☐
Metals -	☐	Hexchrome	☐
SVOC	☐	Alkalinity	☐
TOC	☐	Chloride	☐
Sulfide	☐	Ammonia	☐
Phenolics	☐	COD	☐

Well Purging Log

Date 1/7/09

Time	Temp	pH	Conductivity	~~ORP~~ TURB	~~DO~~ RATE
1/7/09 1145	7.2	7.63	1300	999	250 ML/MIN
1150	7.7	7.72	1210	999	"
1155	7.9	7.78	1130	756	"
1205	7.9	7.61	1070	202	"
1210	8.3	7.72	1000	137	"
1215	8.8	7.82	970	74	"
1220	8.2	7.83	950	69	"
1225	8.8	7.64	910	71	"
1230	8.6	7.71	910	50	"
1235	8.6	7.79	883	40	"
ST: 1235					

Field Well Sampling Sheet

Fill out the entire form. If it does not apply, mark N/A.

Project Name: McHenry County
STS Job No. 20080480
Location: Richmond
Tester: Brad Schmidt
Well Number: 4-RCH-D
Date Sampled: 1/7/09
Previous Well Sampled: 4-RCH-I

GENERAL CONDITIONS:

					If Missing Replaced?
Surface Seal:	X Ok		Damaged		Missing: Yes No
Protector Pipe:	X Ok		Damaged		Missing: Yes No
Well Cap:	X Ok		Damaged		Missing: Yes No
Ambient Temperature: 20 °F			Clear	X Cloudy	Rain

WELL DATA:

Measuring Device: Solinist Water Level Meter
Stick Up or Down: Up (from Ground Surface)
Depth to Water: 11.50 (from TPVC)
Depth to Bottom: 17.5 (from TPVC)
Length of Water:
Free Product Observed: ☐ Yes ☒ No Thickness: N/A

PURGING/SAMPLING:

Well Purging Calculations: Amount to purge = 0.163 gallons/foot times height of water column in feet for one well volume

Purging Device: Bladder Pump
Sampling Device: Bladder Pump
Volume Required:
☒ See back of page for field readings during purge
Volume Purged:
Could Well Bail Dry? ☐ Yes ☒ No
Purging - Time Start: 12:45
Time Ended: 1350
Decon Method: Alconox

IN-SITU TESTING:

Turbidity: ☐ Turbid ☐ Opaque
Odor:
Color
pH @ degrees C
Uncorrected Conductivity X
Water Temp. (from Cond.)
Comments: ST: 1345

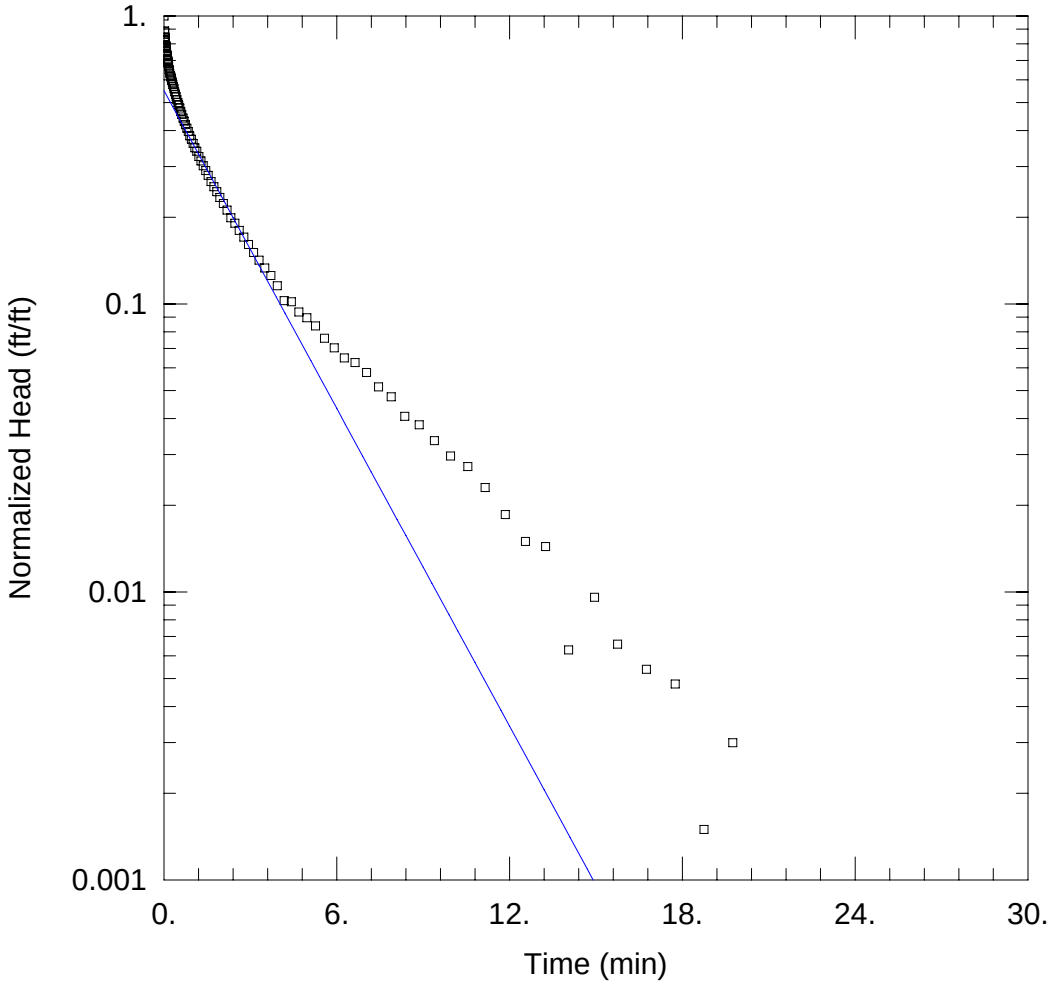
SAMPLES COLLECTED

Vocs -		Cyanide	
Metals -		Hexchrome	
SVOC		Alkalinity	
TOC		Chloride	
Sulfide		Ammonia	
Phenolics		COD	

Well Purging Log

Date 1/7/09

Time	Temp	pH	Conductivity	~~ORP~~ TURB	~~DO~~ RATE
1/7/09 1300	7.9	7.75	1450	110	250 ML/MIN
1305	7.6	7.85	1460	91	"
1310	7.5	7.86	1460	88	"
1315	7.7	7.87	1460	84	"
1320	7.6	7.88	1470	81	"
1325	8.5	7.90	1440	83	"
1330	7.9	7.77	1450	72	"
1335	8.2	7.83	1440	68	"
1340	7.9	7.88	1450	65	"
1345	7.8	7.90	1440	65	"
ST: 1345					



WELL TEST ANALYSIS

Data Set: K:\PROJECTS\200804080\In_Progress\Troll-files\AQTESOLV-files\4-RCH-S_001_B&R.aqt
Date: 04/05/09 Time: 12:16:49

PROJECT INFORMATION

Company: AECOM
Client: USACE / McHenry Cty
Project: 09000-460 (h200804080)
Location: McHenry County, IL
Test Date: Feb. 22, 2009

AQUIFER DATA

Saturated Thickness: 5. ft
Anisotropy Ratio (Kz/Kr): 0.33

WELL DATA (4-RCH-S)

Initial Displacement: 3.34 ft
Total Well Penetration Depth: 4.5 ft
Casing Radius: 0.083 ft
Static Water Column Height: 15.2 ft
Screen Length: 4.5 ft
Well Radius: 0.25 ft
Gravel Pack Porosity: 0.3

SOLUTION

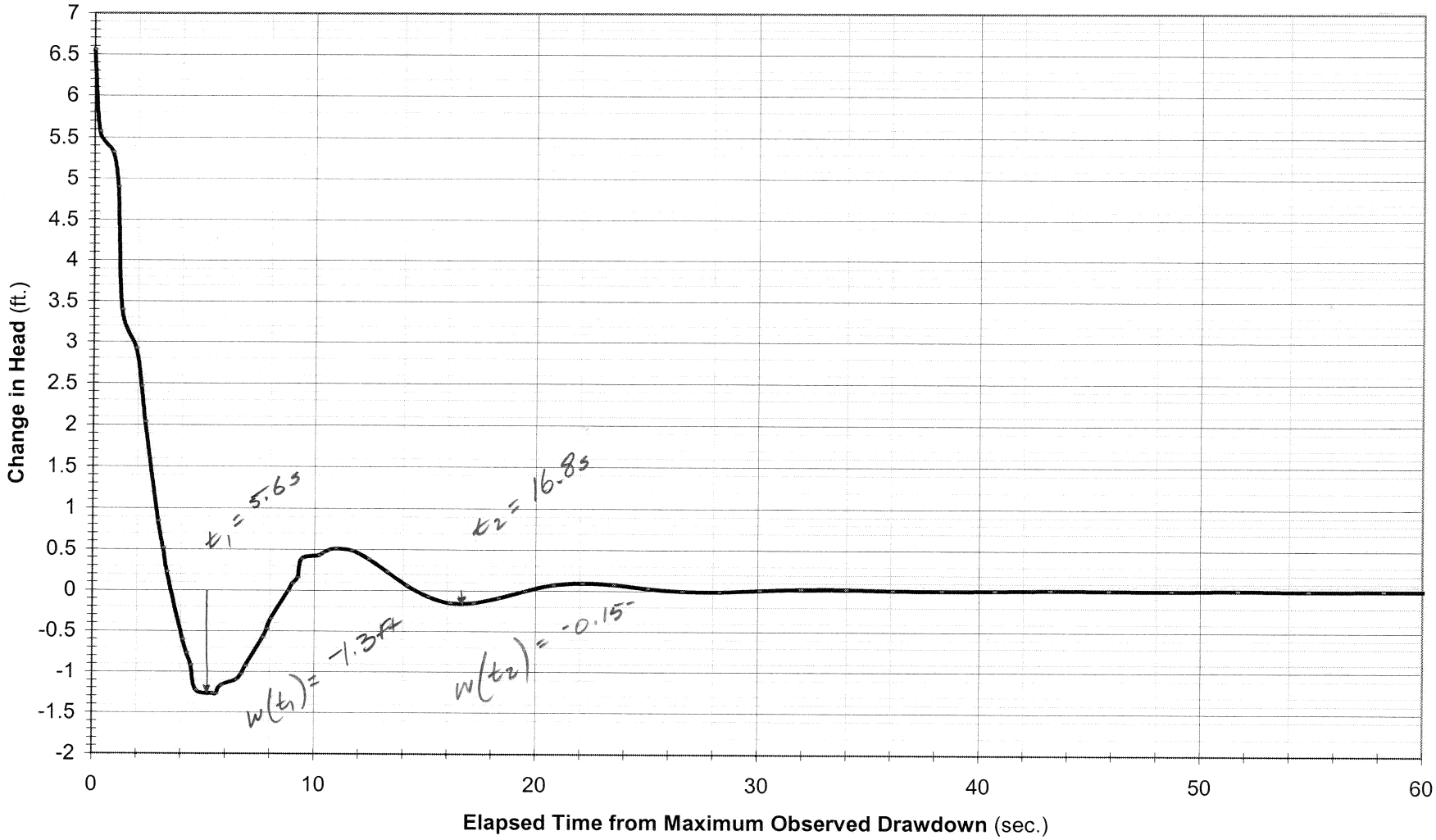
Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 0.000397 cm/sec
y0 = 1.839 ft

Underdamped Response to Sudden Change in Water Level

Hydraulic Conductivity Test Result

Richmond Township #4 - Intermediate Well (Test #1)



Calculation of Transmissivity of Underdamped Well Response to Slug Test

Richmond Township - Intermediate Well (Test #1)
McHenry County Monitoring Well Network Installation
AECOM Environment Project No. 09000-460

Expression		Value	Units
$w(t_1)$	=	-1.3	ft.
$w(t_2)$	=	-0.15	ft.
t_1	=	5.6	sec.
t_2	=	16.8	sec.
R_c	=	0.083	ft.
R_s	=	0.083	ft.
L_c	=	81.8	ft.
L_s	=	5	ft.
τ	=	11.2	sec.
ϖ	=	0.5610	s^{-1}
γ	=	0.19281	s^{-1}
T	=	b+a lnT	
$(g/L)^{1/2}$	=	0.5932	
d	=	0.3250	
a	=	0.00157	ft^2/sec
Assume S	=	5.0E-04	
b	=	0.021	ft^2/sec
T_1	=	b+a $\ln T_0$	
Assume T_0	≈	b_1	
T_1	=	0.0149	ft^2/sec
T_2	=	0.0143	ft^2/sec
T	=	1240	ft^2/day
Aquifer Thickness	=	16.5	ft.
Hydraulic Conductivity	**=**	**75**	**ft/day**
		2.65E-02	**cm/sec**

Reference:
ASTM D5785-95 - (Analytical Procedure) for Determining Transmissivity of Confined Nonleaky Aquifers by Underdamped Well Response to Instantaneous Change in Head (Slug Test)

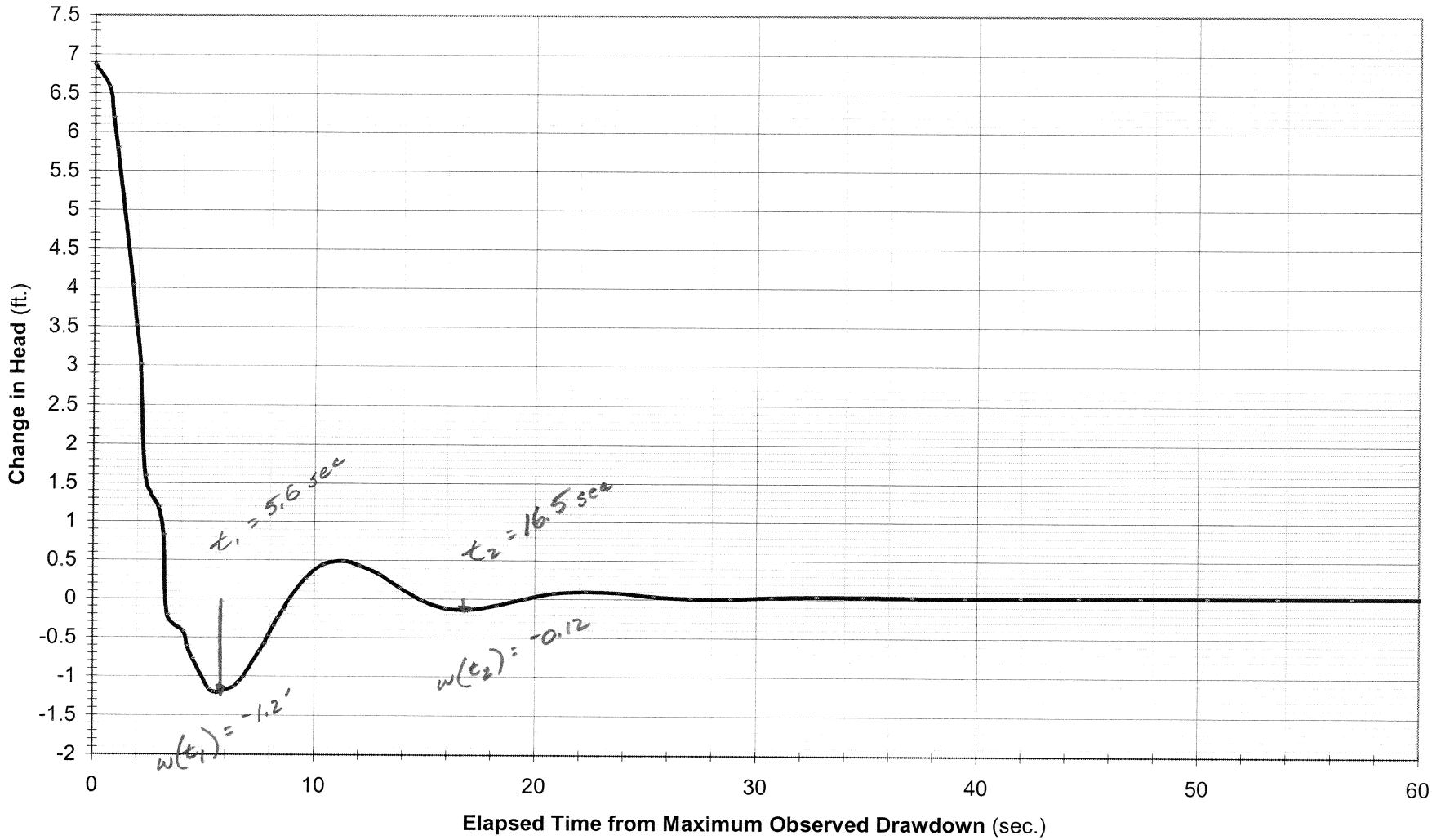
Check the results:

L	=	90.9 ft	-6.6	-7.3%	less than 20%?	**YES**
L	=	84.3 ft				
α	=	1.06E-02	less than 0.1?	**YES**		
d	=	0.3250	less than 0.7?	**YES**		

Underdamped Response to Sudden Change in Water Level

Hydraulic Conductivity Test Result

Richmond Township #4 - Intermediate Well (Test #2)



Calculation of Transmissivity of Underdamped Well Response to Slug Test

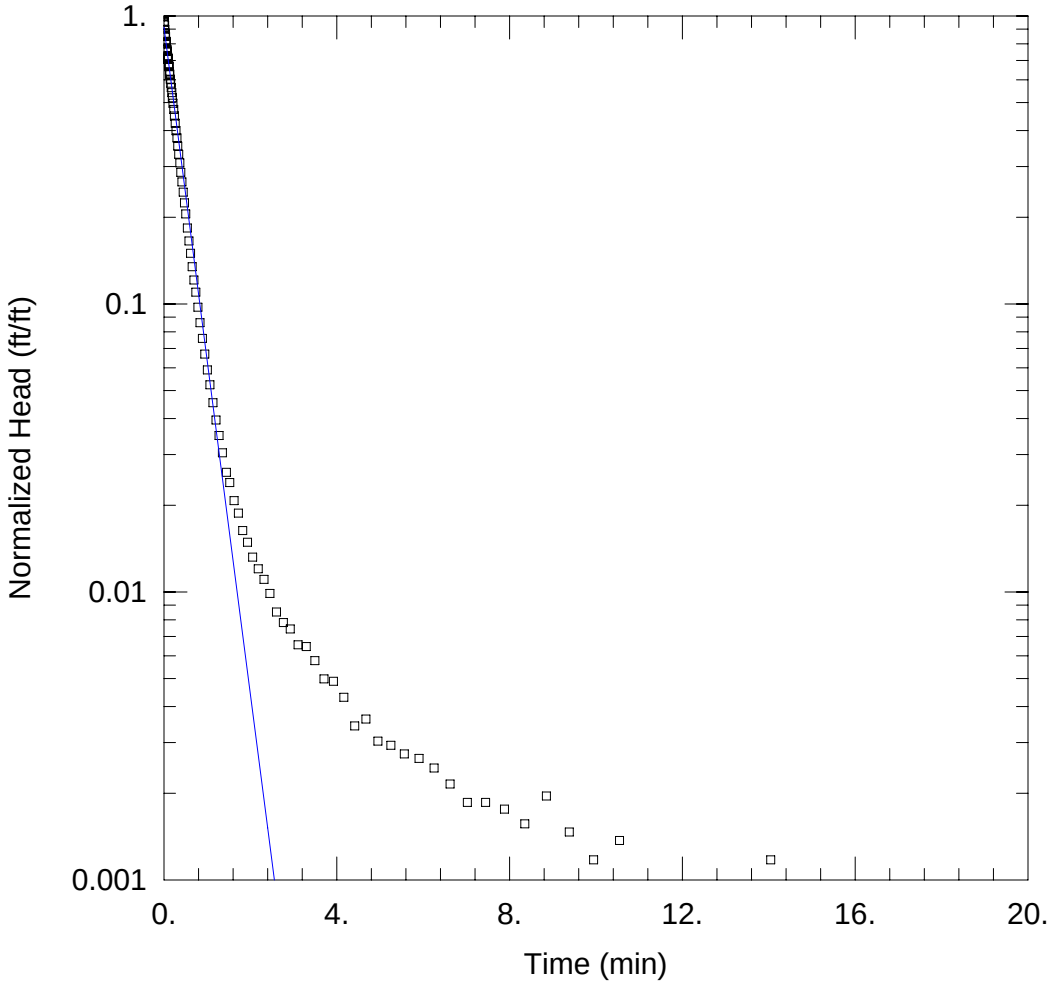
Richmond Township - Intermediate Well (Test #2)
McHenry County Monitoring Well Network Installation
AECOM Environment Project No. 09000-460

Expression		Value	Units
$w(t_1)$	=	-1.2	ft.
$w(t_2)$	=	-0.12	ft.
t_1	=	5.6	sec.
t_2	=	16.5	sec.
R_c	=	0.083	ft.
R_s	=	0.083	ft.
L_c	=	81.8	ft.
L_s	=	5	ft.
τ	=	10.9	sec.
ϖ	=	0.5764	s^{-1}
γ	=	0.21125	s^{-1}
T	=	b+a lnT	
$(g/L)^{1/2}$	=	0.6139	
d	=	0.3441	
a	=	0.00154	ft^2/sec
Assume S	=	5.0E-04	
b	=	0.020	ft^2/sec
T_1	=	b+a $\ln T_0$	
Assume T_0	≈	b_1	
T_1	=	0.0145	ft^2/sec
T_2	=	0.0139	ft^2/sec
T	=	1203	ft^2/day
Aquifer Thickness	=	16.5	ft.
Hydraulic Conductivity	**=**	**73**	**ft/day**
		2.57E-02	**cm/sec**

Reference:
ASTM D5785-95 - (Analytical Procedure) for Determining Transmissivity of Confined Nonleaky Aquifers by Underdamped Well Response to Instantaneous Change in Head (Slug Test)

Check the results:

L	=	84.9 ft	-0.6	-0.7%	less than 20%?	**YES**
L	=	84.3 ft				
α	=	1.10E-02	less than 0.1?	**YES**		
d	=	0.3441	less than 0.7?	**YES**		



WELL TEST ANALYSIS

Data Set: C:\...\4-RCH-D_001_B&R_10.5ft.aqt
Date: 04/20/09 Time: 12:28:53

PROJECT INFORMATION

Company: AECOM
Client: USACE / McHenry Cty
Project: 09000-460 (h200804080)
Location: McHenry County, IL
Test Date: Feb. 22, 2009

AQUIFER DATA

Saturated Thickness: 10.5 ft
Anisotropy Ratio (Kz/Kr): 0.33

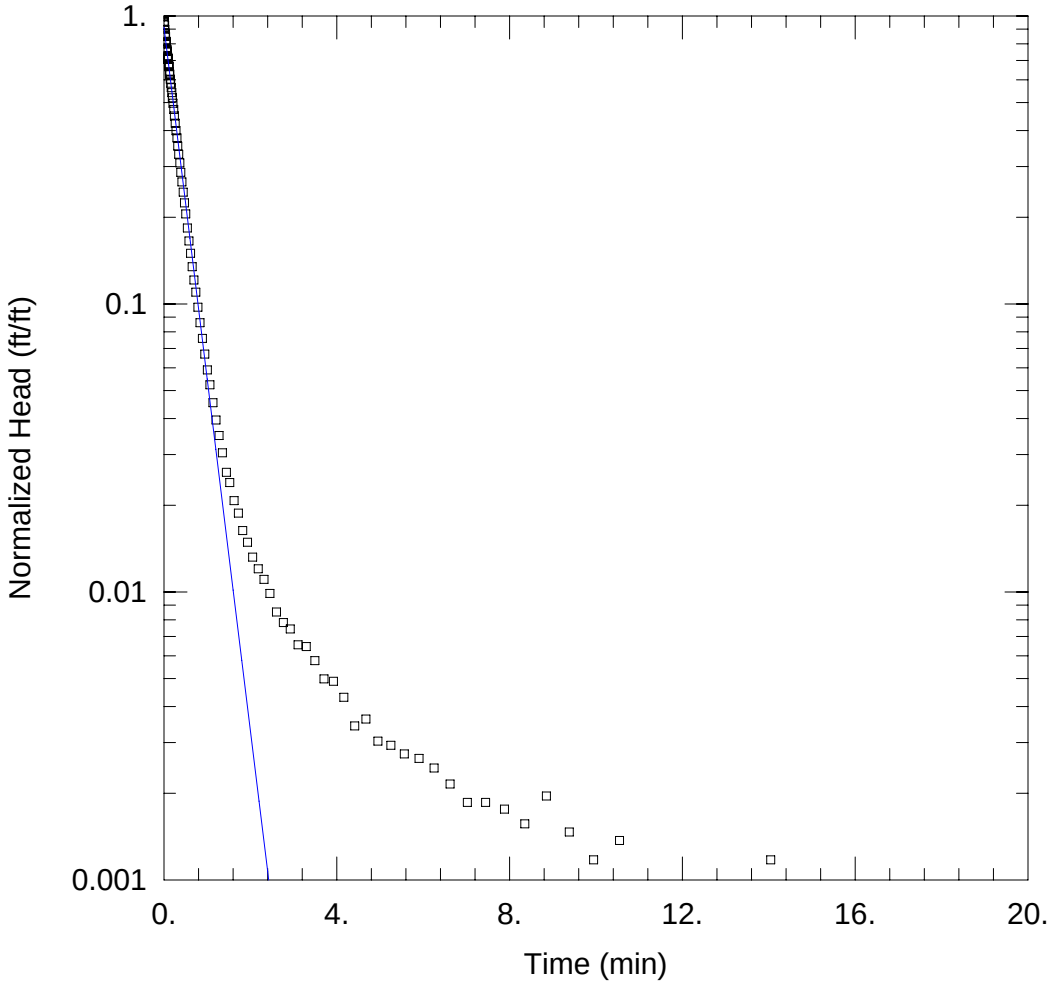
WELL DATA (4-RCH-D)

Initial Displacement: 10.22 ft
Total Well Penetration Depth: 8. ft
Casing Radius: 0.083 ft
Static Water Column Height: 165. ft
Screen Length: 4.5 ft
Well Radius: 0.25 ft
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 0.00266 cm/sec
y0 = 9.334 ft



WELL TEST ANALYSIS

Data Set: K:\...\4-RCH-D_001_B&R_150ft.aqt
Date: 04/05/09 Time: 12:15:39

PROJECT INFORMATION

Company: AECOM
Client: USACE / McHenry Cty
Project: 09000-460 (h200804080)
Location: McHenry County, IL
Test Date: Feb. 22, 2009

AQUIFER DATA

Saturated Thickness: 150. ft
Anisotropy Ratio (Kz/Kr): 0.33

WELL DATA (4-RCH-D)

Initial Displacement: 10.22 ft
Total Well Penetration Depth: 8. ft
Casing Radius: 0.083 ft
Static Water Column Height: 165. ft
Screen Length: 4.5 ft
Well Radius: 0.25 ft
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 0.002541 cm/sec
y0 = 9.334 ft

Additional Well Site Information

In-Situ Inc.

4-RCH-5

Calibration Report

Report Number: 2009011920503-140829

221 East Lincoln Avenue, Fort Collins, CO 80524 USA
1-970-498-1500, 1-800-446-7488, FAX: 1-970-498-1598
Visit us at www.in-situ.com

Instrument Details:

Instrument Model:	**Level TROLL 500**
Full Scale Pressure Range	**103.42 KPa (15 PSI) vented**
Serial Number:	**140829**

Calibration Details:

Calibration Result:	**PASS**
Calibration Date:	2009-01-19 20:50:3 (UTC)
Nominal Range of Applied Temperature:	-5 C to +50 C
Temperature Accuracy Specification:	+/- 0.1 C From 0 C to +50 C
Nominal Range of Applied Pressure:	0 KPa to 103.4 KPa (0.0 PSI to 15.0 PSI)
Pressure Accuracy Specification:	+/- 0.1 %FS from -5 C to +50 C, +/- 0.05 %FS at +15 C

Post-Calibration Check:

Parameter	Applied	Reported	Deviation
Pressure	15.0000	14.9995	-0.0032
Pressure	0.0001	-0.0005	-0.0039
Temperature	19.8170	19.8292	0.0122

Calibration Procedures and Equipment Used:

Automated calibration procedures used.
Manu Agilent Model 34970A SerialNo MY44002404
Manu Instrulab Model 3312A-14-15-24 SerialNo 31127
Manu Instrulab Model 406X-0031-01 SerialNo 31128-2
Manu MENSOR Model 600 SerialNo 620226
Manu Agilent Model 53131A SerialNo MY47000169
Manu MENSOR Model 600 SerialNo 621385

Notes:

1. Standards used in this calibration are traceable to the National Institute of Standards and Technology.
2. This calibration report shall not be reproduced, except in full, without the written approval of In-Situ, Inc.
3. A calibration interval of 12 to 18 months is recommended.
4. The post-calibration data is collected at nominal +20 C.
5. 1.0 PSI = 6.894757 KPa

Performed By: JBO

Copyright © 2006 In-Situ, Inc.

In-Situ Inc.

4-RCH-I

Calibration Report

Report Number: 2009010917584-140461

221 East Lincoln Avenue, Fort Collins, CO 80524 USA
1-970-498-1500, 1-800-446-7488, FAX: 1-970-498-1598
Visit us at www.in-situ.com

Instrument Details:

Instrument Model:	**Level TROLL 500**
Full Scale Pressure Range	**206.84 KPa (30 PSI) vented**
Serial Number:	**140461**

Calibration Details:

Calibration Result:	**PASS**
Calibration Date:	2009-01-09 17:58:4 (UTC)
Nominal Range of Applied Temperature:	-5 C to +50 C
Temperature Accuracy Specification:	+/- 0.1 C From 0 C to +50 C
Nominal Range of Applied Pressure:	0 KPa to 206.8 KPa (0.0 PSI to 30.0 PSI)
Pressure Accuracy Specification:	+/- 0.1 %FS from -5 C to +50 C, +/- 0.05 %FS at +15 C

Post-Calibration Check:

Parameter	Applied	Reported	Deviation
Pressure	30.0001	30.0012	0.0035
Pressure	0.0008	-0.0019	-0.0092
Temperature	19.9010	19.9108	0.0098

Calibration Procedures and Equipment Used:

Automated calibration procedures used.
Manu Agilent Model 34970A SerialNo MY44015965
Manu Instrulab Model 3312A-14-15-24 SerialNo 31103-(41012)
Manu Instrulab Model 406X-0031-01 SerialNo 2-31138
Manu MENSOR Model 600 SerialNo 621435
Manu Agilent Model 53131A SerialNo MY47000169
Manu MENSOR Model 600 SerialNo 621385

Notes:

1. Standards used in this calibration are traceable to the National Institute of Standards and Technology.
2. This calibration report shall not be reproduced, except in full, without the written approval of In-Situ, Inc.
3. A calibration interval of 12 to 18 months is recommended.
4. The post-calibration data is collected at nominal +20 C.
5. 1.0 PSI = 6.894757 KPa

Performed By: NJH

Copyright © 2006 In-Situ, Inc.

In-Situ Inc.

4-RCH-D

Calibration Report

Report Number: 20090109164751-140460

221 East Lincoln Avenue, Fort Collins, CO 80524 USA
1-970-498-1500, 1-800-446-7488, FAX: 1-970-498-1598
Visit us at www.in-situ.com

Instrument Details:

Instrument Model:	**Level TROLL 500**
Full Scale Pressure Range	**206.84 KPa (30 PSI) vented**
Serial Number:	**140460**

Calibration Details:

Calibration Result:	**PASS**
Calibration Date:	2009-01-09 16:47:51 (UTC)
Nominal Range of Applied Temperature:	-5 C to +50 C
Temperature Accuracy Specification:	+/- 0.1 C From 0 C to +50 C
Nominal Range of Applied Pressure:	0 KPa to 206.8 KPa (0.0 PSI to 30.0 PSI)
Pressure Accuracy Specification:	+/- 0.1 %FS from -5 C to +50 C, +/- 0.05 %FS at +15 C

Post-Calibration Check:

Parameter	Applied	Reported	Deviation
Pressure	30.0001	29.9971	-0.0099
Pressure	0.0004	-0.0005	-0.0029
Temperature	19.9950	20.0082	0.0132

Calibration Procedures and Equipment Used:

Automated calibration procedures used.
Manu Agilent Model 34970A SerialNo MY44038788
Manu Instrulab Model 3312A-14-15-24 SerialNo 31138
Manu Instrulab Model 406X-0031-01 SerialNo 1-31118
Manu MENSOR Model 600 SerialNo 622742
Manu Agilent Model 53131A SerialNo MY47000169
Manu MENSOR Model 600 SerialNo 621385

Notes:

1. Standards used in this calibration are traceable to the National Institute of Standards and Technology.
2. This calibration report shall not be reproduced, except in full, without the written approval of In-Situ, Inc.
3. A calibration interval of 12 to 18 months is recommended.
4. The post-calibration data is collected at nominal +20 C.
5. 1.0 PSI = 6.894757 KPa

Performed By: NJH

Copyright © 2006 In-Situ, Inc.

Richmond Township Well Site

Richmond Township Well Site

Richmond Township Well Site

Richmond Township Well Site

Richmond Township Well Site

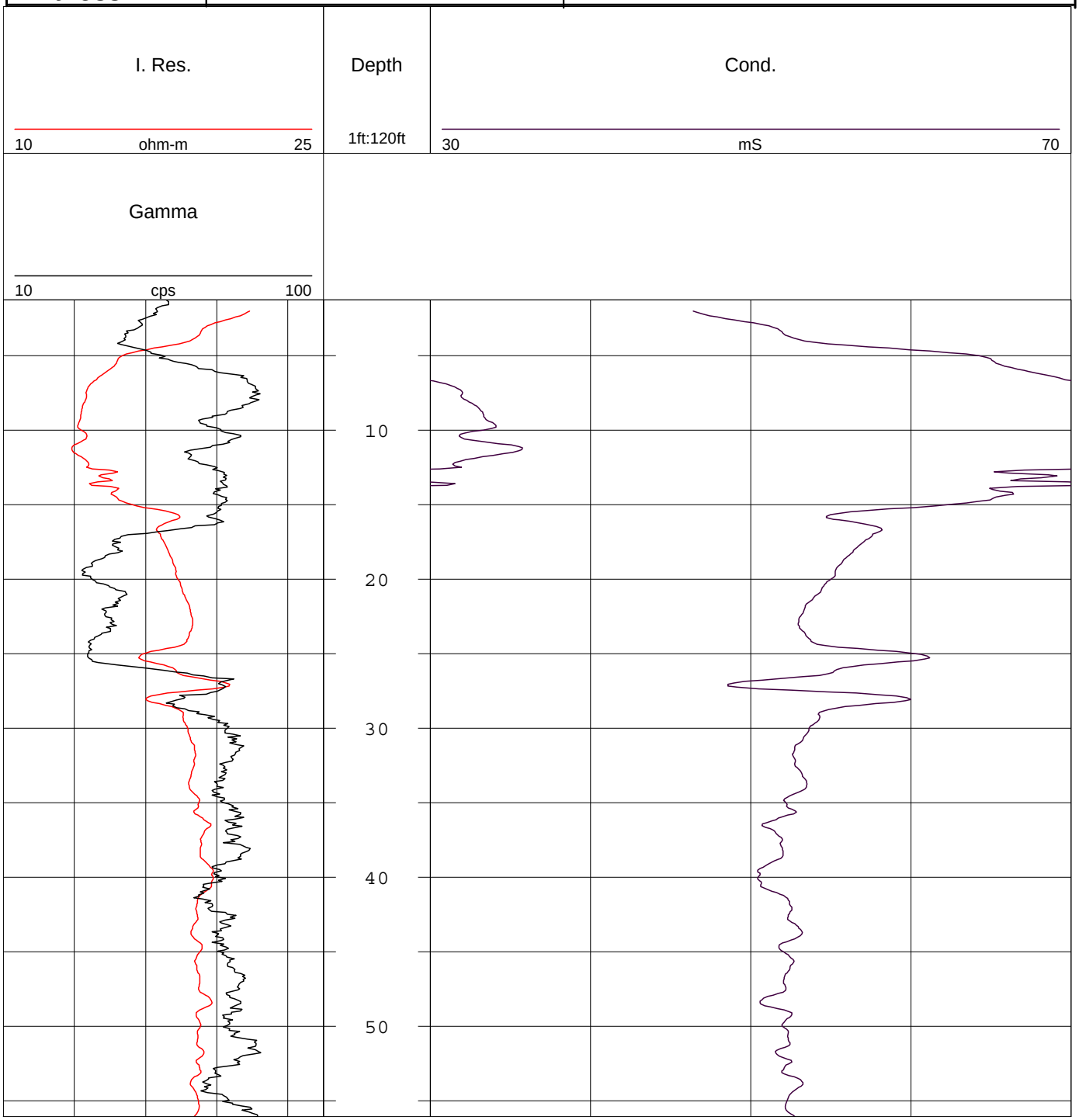
Richmond Township Well Site – Inside Casing

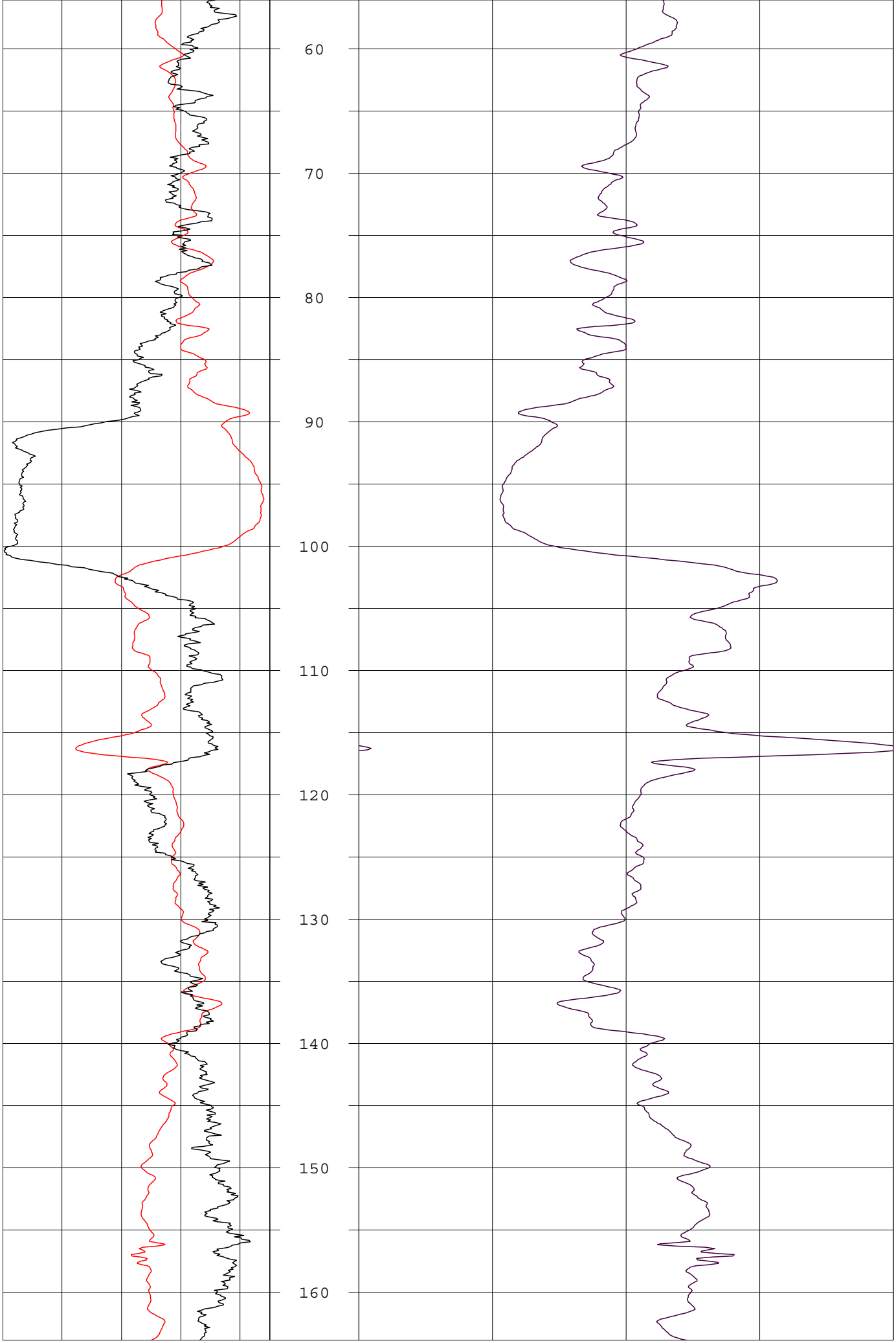
Richmond Township Well Site – Inside Casing w/ Monument

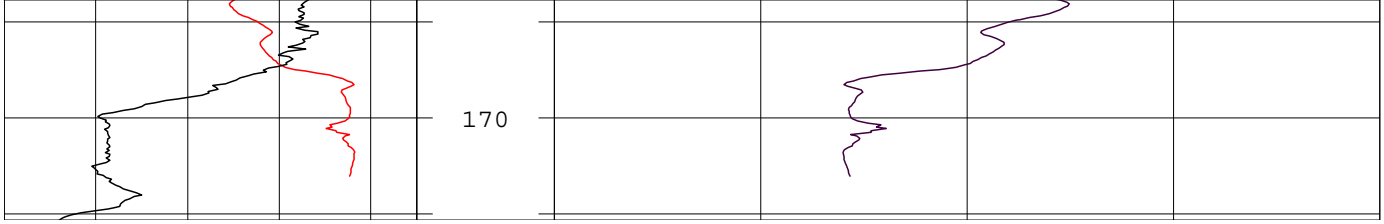
COMPANY:	McHenry County & US Corp of Engineers
Location:	

Well	#4 RICHMOND TWNSHP		
Date	10/21/08	BH Fluid	Formation
Casing	2" PVC +2.3 to -178' bgs		
File Name	MCHTH4-08EMGAM		
Depth Driller	178'		
Depth Logger	175.44' bgs		
Logged by:	T. YOUNG		
Witness:	C MCKINNEY		

OTHER SERVICES




60
70
80
90
100
110
120
130
140
150
160


170

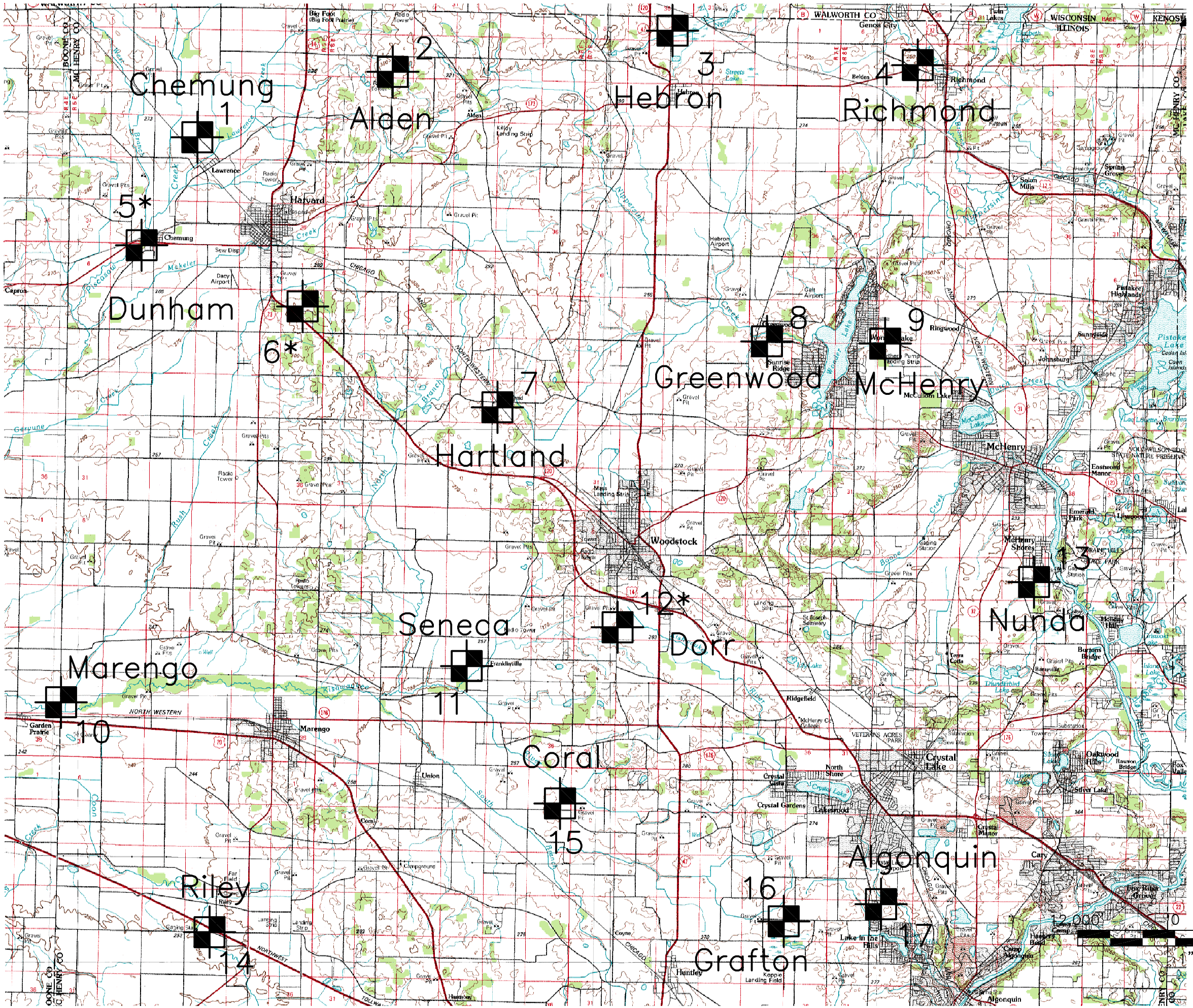
A-7: Folio Well Site #7 – Hartland Township

Table of Contents

I.) Site Location Map – Location in County
II.) Site Location Map – Location on USGS Topographic Map
III.) Site Location Map – Location on USGS High Resolution Orthophoto
IV.) Site Boring Log
V.) Well Construction Diagram
VI.) Well Site Summary and Commentary
VII.) Particle Size Distribution Report
VIII.) Table of Water Level Measurements
IX.) Well Development Field Log
X.) Water Quality Analysis Results
XI.) Groundwater Sampling Field Log
XII.) Hydraulic Conductivity Testing Results
XIII.) In-Situ LevelTroll™ Calibration Report
XIV.) Site Photographs
XV.) Downhole Geophysical Testing

Well Site Location Maps

Z:\Projects\200804080\CtyWide\D-09000-460-8000_CtyOverviewMap_004.dwg; 4/20/2009 5:33:59 PM; BRAUN, GARY



LEGEND:

AECOM Well Installation Site

McHenry 9

Well Installations By Others

Dunham 6*

0 12,000 24,000'

" = 12,000'

AECOM

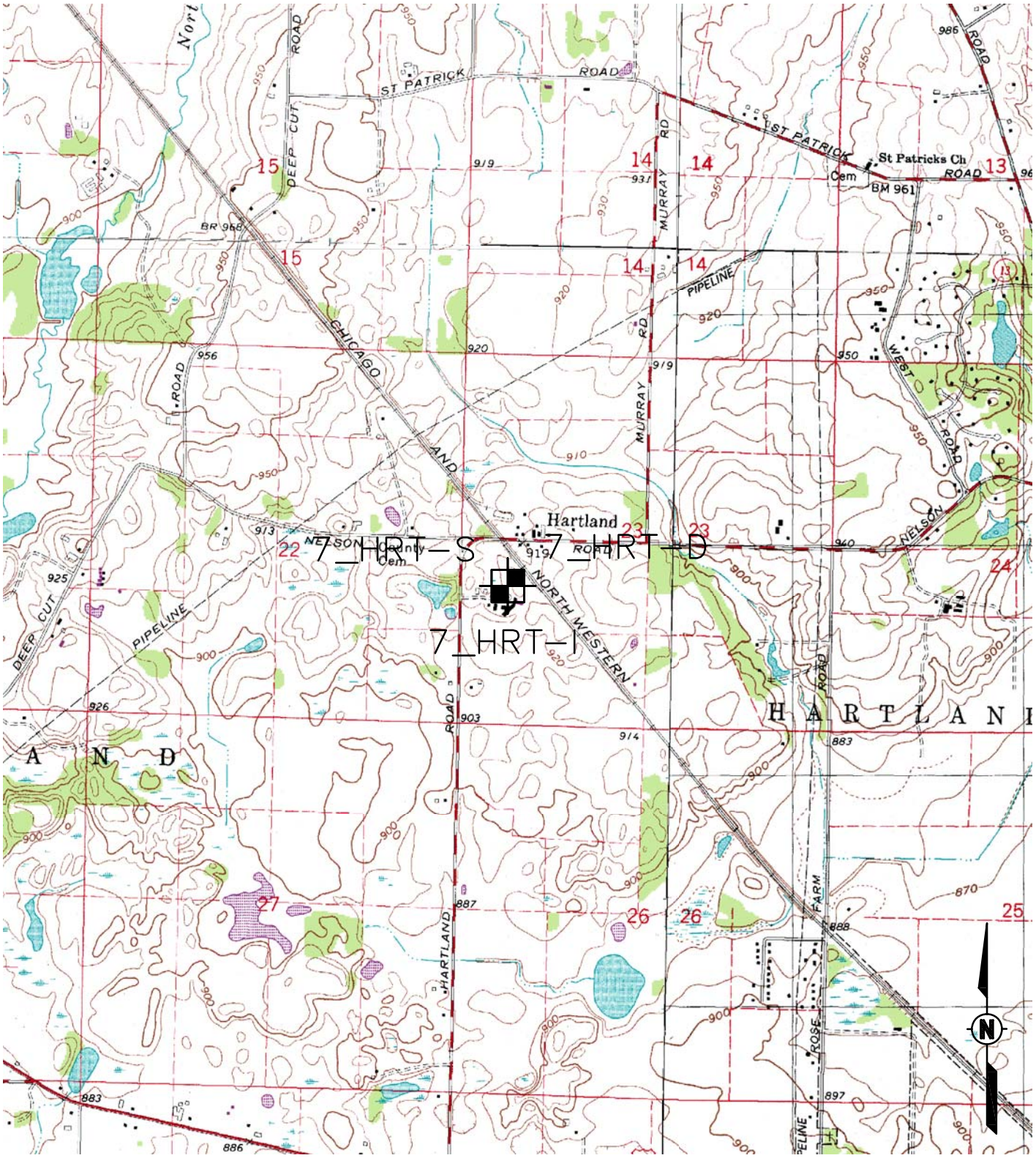
750 Corporate Woods Pkwy
Vernon Hills, IL 60061
847-279-2500
www.aecom.com

Copyright © By: STS Consultants, Ltd.

LOCATION MAP OF WELL SITES

Observation Well Network for Glacial Aquifers
McHenry County, Illinois

Drawn :	CJH	3/11/2009
Checked:	GMB	4/18/2009
Approved:	CSR	4/27/2009
PROJECT NUMBER	09000-460	
FIGURE NUMBER	1	



2000 0 2000 4000

1" = 2000'

AECOM

750 Corporate Woods Parkway
Vernon Hills, IL 60061
847.279.2500
www.aecom.com

Copyright © 2009, By: AECOM

Site Location on USGS Topographic Map
Site No. 7 - Hartland Township
Valley Hi Nursing Home - Hartland Rd.
Observation Well Network
McHenry County, Illinois

Drawn :	CJH	04/01/2009
Checked:	GMB	04/15/2009
Approved:	CSR	04/24/2009
PROJECT NUMBER	09000-460	
FIGURE NUMBER	Folio_7 #2	

Z:\Projects\200804080\CityWide\D-09000-460-8000_TopoMaps_v02.dwg; 4/20/2009 9:59:47 AM; BRAUN, GARY; STS_BLACK_040102.ctb

500 0 500 1000

1" = 500'

AECOM

750 Corporate Woods Parkway
Vernon Hills, IL 60061
847.279.2500
www.aecom.com

Copyright © 2009, By: AECOM

2005 USGS High Resolution Orthophoto
Site No. 7 - Hartland Township
Valley Hi Nursing Home - Hartland Rd.
Observation Well Network
McHenry County, Illinois

Drawn :	CJH	04/01/2009
Checked:	GMB	04/15/2009
Approved:	CSR	04/24/2009
PROJECT NUMBER	09000-460	
FIGURE NUMBER	Folio_7 #3	

Z:\Projects\200804080\CtyWide\D-09000-460-8000_AerialsMap_004.dwg; 4/21/2009 12:27:12 PM; BRAUN, GARY; STS_BLACK_040102.ctb

Boring and Well Construction Details

DRILLING LOG

DIVISION	USACE
INSTALLATION	Chicago District
SHEET	1 OF 7 SHEETS
1. PROJECT	McHenry County Observation Wells
2. LOCATION (Coordinates or Station)	McHenry County, Illinois N 2,117,464.00 E 988,032.00
3. DRILLING AGENCY	WDC Exploration & Wells
4. HOLE NO. *(As shown on drawing title and file number)*	7-HARTLAND
5. NAME OF DRILLER	Dan Tonnancour
6. DIRECTION OF HOLE	☒ VERTICAL ☐ INCLINED --- DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN	163.0
8. DEPTH DRILLED INTO ROCK	2.5
9. TOTAL DEPTH OF HOLE	165.5
10. SIZE AND TYPE OF BIT	3 7/8" Carbide Bit / 5 7/8" Casing
11. DATUM FOR ELEVATION SHOWN *(TBM or MSL)*	NAVD 88
12. MANUFACTURER'S DESIGNATION OF DRILL	Super Sonic II
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN	DISTURBED 21 / UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES	N/A
15. ELEVATION GROUND WATER	887.0
16. DATE HOLE	STARTED 11/11/2008 / COMPLETED 11/11/2008
17. ELEVATION TOP OF HOLE	+924.1
18. TOTAL CORE RECOVERY FOR BORING	95 %
19. GEOLOGIST	Gary Braun, LPG IL

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
+924.1	0.0		Topsoil: OL, Dark brown organic sandy silt, dense, damp		0.0	Hand-augered
+923.1	1.0				5.0	
			SM, Brown sandy silt, little gravel, trace organics, clay, loose, damp			
+919.1	5.0					
			ML, Brown silt, some sand and gravel, trace to little clay, medium dense, damp	100	1 5.0 15.0	Qp = >4.5 TSF @10.0' (despite non-cohesiveness) Qp = >4.5 TSF @13.0' (despite non-cohesiveness) Sample No. 1 from 14.0' - 15.0'
+909.1	15.0					
			ML, Gray sandy silt, little fine to coarse gravel, trace clay, very dense, damp, not plastic, not cohesive Note: Matrix Supported Diamicton Till	100	2 15.0 25.0	

DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE 924.1

Hole No. 7-HARTLAND

PROJECT: McHenry County Observation Wells

INSTALLATION: Chicago District

SHEET 2 OF 7 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
			ML, Gray sandy silt, little fine to coarse gravel, trace clay, very dense, damp, not plastic, not cohesive Note: Matrix Supported Diamicton Till *(continued)*			Qp = >4.5 TSF @20.0' (despite non-cohesiveness)
						Qp = >4.5 TSF @23.5' (despite non-cohesiveness) Sample No. 2 from 24.0' - 25.0'
				100	3 25.0 35.0	
						Qp = >4.5 TSF @29.0' (despite non-cohesiveness)
						Qp = >4.5 TSF @33.0' (despite non-cohesiveness) Sample No. 3 from 34.0' to 35.0'
				100	4 35.0 45.0	
						Qp = >4.5 TSF @40.0' (despite non-cohesiveness)
						Qp = >4.5 TSF @43.0' (despite non-cohesiveness) Sample No. 4 from 44.0' to 45.0'
				80	5 45.0	

DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE 924.1

Hole No. 7-HARTLAND

PROJECT: McHenry County Observation Wells

INSTALLATION: Chicago District

SHEET 3 OF 7 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
					55.0	
+877.1	47.0					
			CL-ML, Gray with pinkish tint silty clay, little fine to coarse sand and gravel, stiff, damp (lean clay)			
						Qp = >4.5TSF @49.0'
						Qp = >4.5 TSF @53.0'
						Sample No. 5 from 54.0' to 55.0'
				100	6 55.0 65.0	
+868.1	56.0					
			SW, Gray coarse sand, little medium sand and fine to medium gravel, trace fine sand, silt and clay, loose, wet			
						Sample No. 6 from 59.0' to 60.0'
						% Gravel/% Sand/% Fines = 45/54/2 from 59.0' to 60.0'
						Sample No. 7 from 61.0' to 62.0'
+862.1	62.0					
			CL, Reddish brown silty clay, little sand and gravel, hard, damp Note: Matrix Supported Diamicton			
						Sample No. 8 from 64.0' to 65.0' Qp = >4.5 TSF @64.0'
				100	7 65.0 75.0	
						Qp = >4.5 TSF @67.0'
						Qp = >4.5 TSF @70.0'

DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE 924.1

Hole No. 7-HARTLAND

PROJECT: McHenry County Observation Wells

INSTALLATION: Chicago District

SHEET 4 OF 7 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
+850.6	73.5		CL, Reddish brown silty clay, little sand and gravel, hard, damp Note: Matrix Supported Diamicton *(continued)*			
+844.1	80.0		CL, Dark olive gray silty clay, little sand and gravel, hard, damp	100	8 75.0 85.0	Sample No. 9 from 74.0' to 75.0' Qp = >4.5 TSF @74.0'
+841.6	82.5		SC, Olive gray clayey sand to sandy clay, trace gravel, stiff to dense, moist			Sample No. 10 from 81.0' to 82.0'
+838.6	85.5		GW, Olive gray to reddish brown gravelly sand, moderately dense, wet	100	9 85.0 95.0	Sample No. 11 from 84.0' to 85.0'
			SP, Gray medium sand, trace to little fine to medium gravel, trace fine sand, loose, wet (SP)	100	10 95.0 105.0	Sample No. 12 from 94.0' to 95.0'

DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE 924.1

Hole No. 7-HARTLAND

PROJECT: McHenry County Observation Wells

INSTALLATION: Chicago District

SHEET 5 OF 7 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
			SP, Gray medium sand, trace to little fine to medium gravel, trace fine sand, loose, wet (SP) *(continued)*			
						Sample No. 13 from 101.0' to 102.0'
				95	11 105.0 115.0	
						% Gravel/% Sand/% Fines = 40/60/2 from 112.0' to 113.0'
						Sample No. 14 from 113.0' to 114.0' - sieve sample taken
				100	12 115.0 125.0	
+807.1	117.0					
			SC, Gray sandy clay, little fine to coarse gravel, soft, moist			
						Sample No. 15 from 122.0' to 123.0'

DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE 924.1

Hole No. 7-HARTLAND

PROJECT: McHenry County Observation Wells

INSTALLATION: Chicago District

SHEET 6 OF 7 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
+800.1	124.0		SC, Gray sandy clay, little fine to coarse gravel, soft, moist *(continued)*			
+799.1	125.0		CL, Reddish brown silty clay, stiff			
+794.6	129.5		SP, Grayish brown fine sand, little medium sand, trace silt, coarse sand and fine to medium gravel, dense, wet	100	13 125.0 135.0	Sample No. 16 from 128.0' to 129.0'
			CL, Gray silty clay, little sand and gravel, very stiff to hard, moist Note: Matrix Supported Diamicton			
				100	14 135.0 145.0	Sample No. 17 from 144.0' to 145.0'
				100	15 145.0 155.0	

DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE 924.1

Hole No. 7-HARTLAND

PROJECT: McHenry County Observation Wells

INSTALLATION: Chicago District

SHEET 7 OF 7 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
			CL, Gray silty clay, little sand and gravel, very stiff to hard, moist Note: Matrix Supported Diamicton *(continued)*			Sample No. 18 from 154.0' to 155.0'
				100	16 155.0 165.0	
+765.1	159.0					
			SP, Gray medium sand, trace fine gravel, moderately dense, wet			Sample No. 19 from 161.0' to 162.0' % Gravel/% Sand/% Fines = 6/92/3 from 39.0' to 40.0'
+761.1	163.0					
			Dolomite Bedrock			Sample No. 20 from 164.0' to 165.0'
+759.1	165.0					
			END OF BORING - 165.7' BGS			AECOM Project No. 60095270

Hole No. 7 - HARTLAND TWP

ROTO-SONIC 5 7/8" CASING

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 1 OF 11 SHEETS

1. PROJECT McHenry Cty Wells	10. SIZE AND TYPE OF BIT 3 7/8" Carbide Smasher
2. LOCATION (Coordinates or Station) N 2117464 / E 988,032 ILSPI	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) NAVD 88
3. DRILLING AGENCY WDC Exploration & Wells	12. MANUFACTURERS DESIGNATION OF DRILL Super Sonic II
4. HOLE NO. (As shown on drawing title and title number) 7 - HRT	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 21; UNDISTURBED Ø
5. NAME OF DRILLER Dan Tonnancour	14. TOTAL NUMBER CORE BOXES Ø
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.	15. ELEVATION GROUND WATER 887 FT MSL 11-13-08
	16. DATE HOLE: STARTED 11-11-08; COMPLETED 11-12-08
7. THICKNESS OF OVERBURDEN 163'	17. ELEVATION TOP OF HOLE 924.1 FT MSL
8. DEPTH DRILLED INTO ROCK 2.5'	18. TOTAL CORE RECOVERY FOR BORING 157.5'/165.5 = 95 % REC.
9. TOTAL DEPTH OF HOLE 165.5'	19. SIGNATURE OF INSPECTOR Harry M. Brown LPG IL

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g	
924.1	0		Dark Brown Organic Sandy SILT, dense, damp (OL)			0-4 ft Hand Augered (Post-hole digger) to confirm location was safe from fiber optic line running from Valleyhi to Annex. No Conduit found → believe to be located closer to parking lot.	
	1						
	2		Brown Sandy SILT, little gravel, trace organics, clay (SM), loose, damp	REC 100%	NA		
	3						
	4		↕ Estimated contact	NR	NA		
	5		Brown SILT, some sand & gravel, tr to little clay, Mod. Dense, damp (ML) TILL			RUN 1 (5-15) REC/RUN = 10'+/10' = 100%	0931 ↓ 4" core barrel 0933
	6						
	7				Bag 1		
	8						
	9						
914.1	10			REC 100%	Bag 2	>4.5 tsf * despite non-cohesiveness	0936 ↓ 6" casing 0939
	11						
	12						
	13				Bag 3	>4.5 tsf**	
	14						0942 Extract
	15				31		

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT McHenry Cty Wells | HOLE NO. 7-HARTLAND TWP

Hole No. 7 - HARTLAND TWP

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 2 OF 11 SHEETS

1. PROJECT McHenry Cty Wells	10. SIZE AND TYPE OF BIT 3 7/8" Carbide Sampler 5 7/8" Casing
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) NAVD 88
3. DRILLING AGENCY WDC Exploration & Wells	12. MANUFACTURERS DESIGNATION OF DRILL SuperSonic II
4. HOLE NO. (As shown on drawing title and title number) 7-HRT	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 21; UNDISTURBED Ø
5. NAME OF DRILLER Dan Tonnancourt	14. TOTAL NUMBER CORE BOXES Ø
6. DIRECTION OF HOLE ☑ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.	15. ELEVATION GROUND WATER 887' 11/13/08
	16. DATE HOLE: STARTED 11/11/08; COMPLETED 11/12/08
7. THICKNESS OF OVERBURDEN 163'	17. ELEVATION TOP OF HOLE 924.1
8. DEPTH DRILLED INTO ROCK 2.5'	18. TOTAL CORE RECOVERY FOR BORING 157.5'
9. TOTAL DEPTH OF HOLE 165.5'	19. SIGNATURE OF INSPECTOR Harry M. Brown LPG IL

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g	
	15		Gray Sandy SILT, little F.-C. gravel, trace clay, very dense, damp (ML) not plastic-not cohesive, matrix supported Diamicton.			RUN 2 (15-25)	0945
	16				Bag 4	REC/RUN = 10'+/10' = 100%	↓ 4" Core barrel 0947
	17						
	18						0949
	19			REC 100%			↓ Drive 6" Casing 0952
904.1	20		TILL		Bag 5	>4.5 tsf*	
	21						
	22						
	23				Bag 6	>4.5 tsf*	
	24						
					SZ		
	25					RUN 3 (25-35)	1001
	26				Bag 7	REC/RUN = 10'+/10' = 100%	↓ 4" barrel 1002:30
	27						1004
	28			REC 100%			↓ Drive 6" Casing 1008
	29				Bag 8	>4.5 tsf*	
894.1	30						

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT McHenry Cty Wells | HOLE NO. 7 - HARTLAND TWP

Hole No. 7-HARTLAND TWP

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 3 OF 11 SHEETS

1. PROJECT McHenry Cty Wells	10. SIZE AND TYPE OF BIT 3 7/8" Carbide Sampler
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) NAVD 88
3. DRILLING AGENCY WDC Exploration & Wells	12. MANUFACTURERS DESIGNATION OF DRILL Super Sonic II
4. HOLE NO. (As shown on drawing title and title number) 7-HRT	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN — DISTURBED 21 — UNDISTURBED —
5. NAME OF DRILLER Dan Tonnmann Comp	14. TOTAL NUMBER CORE BOXES Ø
6. DIRECTION OF HOLE ☑ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.	15. ELEVATION GROUND WATER 887 ft MSL
	16. DATE HOLE — STARTED 11-11-08 — COMPLETED 11-12-08
7. THICKNESS OF OVERBURDEN 163'	17. ELEVATION TOP OF HOLE 924.1
8. DEPTH DRILLED INTO ROCK 2.5'	18. TOTAL CORE RECOVERY FOR BORING 157.5
9. TOTAL DEPTH OF HOLE 165.5'	19. SIGNATURE OF INSPECTOR Gary M. Brown LPG IL

5 7/8" Casing

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
894.1	30		cont. Gray SILT TILL	cont.	cont.	RUN 3 (25-35) cont.
	31				Bag 8	
	32			REC 100%		
	33				Bag 9	> 4.5 tsf*
	34					
	35				s3	
	36					RUN 4 (35-45) REC/RUN = 10'+/10' = 100%
	37				Bag 10	
	38					
	39					
884.1	40			REC. 100%	Bag 11	> 4.5 tsf*
	41					
	42					
	43				Bag 12	> 4.5 tsf*
	44					
	45				s4	

Extract 1011

1015 ↓ 4" core barrel 1018

1020:30 ↓ Drive 6" casing 1023

1028 Extract Samples

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT McHenry Cty Wells — HOLE NO. 7-HARTLAND TWP

Hole No. 7 - HARTLAND TWP

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 4 OF 11 SHEETS

1. PROJECT McHenry Cty Wells	10. SIZE AND TYPE OF BIT 3 7/8" Carbide Sampler (5 7/8" Casing)
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) NAVD 88
3. DRILLING AGENCY WDC Exploration & Wells	12. MANUFACTURERS DESIGNATION OF DRILL SuperSonic II
4. HOLE NO. (As shown on drawing title and title number) 7-HRT	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 21, UNDISTURBED 0
5. NAME OF DRILLER Dan Tonnancour	14. TOTAL NUMBER CORE BOXES Ø
6. DIRECTION OF HOLE ☑ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER 887 FT MSL (11-13-08)
	16. DATE HOLE: STARTED 11-11-08, COMPLETED 11-12-08
7. THICKNESS OF OVERBURDEN 163'	17. ELEVATION TOP OF HOLE 924.1
8. DEPTH DRILLED INTO ROCK 2.5'	18. TOTAL CORE RECOVERY FOR BORING 157.5'
9. TOTAL DEPTH OF HOLE 165.5'	19. SIGNATURE OF INSPECTOR Gary M. Brown LPG IL

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g	
	45		Grades to Silty CLAY (gradation likely over several ft)			Run 5 (45-55)	1037 Drive 4" Core Barrel
	46				NR	Rec/Run = 8'/10' = 80%	1040
	47		Gray w/ Pinkish Tint - Silty CLAY little F.-C. sand & gravel, stiff, damp (LEAN CLAY) (ML-CL)				1042 Drive 6" Casing
	48						
	49				Bag 13	> 4.5 tsf	1046
874.1	50		Mottling Sup. cont. Diamicton	REC 80%			
	51					cont. fairly easy drilling (since start of hole)	
	52		TILL (Tiskilwa)				
	53				Bag 14	> 4.5 tsf	
	54						
	55				s5		1051 Extract
	56		Gray Coarse SAND, little Med. Sand & F.-M. gravel, trace f. sand, silt & clay, loose, wet (SW)		Bag 15	Run 6 (55-65) Rec/Run = 10'/10' = 100%	1058 Drive 4" Core Barrel
	57						1059:30
	58			REC 100%	Bag 16		1103 Drive 6" Casing
	59		Intra Till granular unit				1106
864.1	60				s6		

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT McHenry Cty Wells | HOLE NO. 7-HARTLAND TWP

Hole No. 7-HARTLAND TWP

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 5 OF 11 SHEETS

1. PROJECT McHenry City Wells	10. SIZE AND TYPE OF BIT 3 7/8" Carbide Sampler 5 7/8" Casing
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) NAVD 88
3. DRILLING AGENCY WDC Exploration & Wells	12. MANUFACTURERS DESIGNATION OF DRILL SuperSonic II
4. HOLE NO. (As shown on drawing title and title number) 7-HRT	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 21 / UNDISTURBED Ø
5. NAME OF DRILLER Dan Tonnancourt	14. TOTAL NUMBER CORE BOXES Ø
6. DIRECTION OF HOLE ☑ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.	15. ELEVATION GROUND WATER 887 Ft MSL (11-13-08)
	16. DATE HOLE: STARTED 11-11-08 / COMPLETED 11-12-08
7. THICKNESS OF OVERBURDEN 163'	17. ELEVATION TOP OF HOLE 924.1 Ft MSL
8. DEPTH DRILLED INTO ROCK 2.5'	18. TOTAL CORE RECOVERY FOR BORING 157.5'
9. TOTAL DEPTH OF HOLE 165.5'	19. SIGNATURE OF INSPECTOR Gary M. Brown LPGIL

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g	
864.1	60		cont. Intra-Till Sand	cont.	cont. 16	Run 6 (55-65) cont.	
	61				57		
	62		Reddish Brown Silty CLAY, little sand & gravel, ~~very stiff to~~ hard, damp (CL) low water content Med. plasticity when water added. (Matrix Supported Diamicton)	Rec. 100%	Bag 17	> 4.5 tsf	Extract Samples 1112
	63						
	64				58		
	65					Run 7 (65-75) Rec/Run = 10'/10' = 100%	1119 Drive 4" Barrel
	66				Bag 18	> 4.5 tsf Harder drilling noted.	1126
	67						
	68		TILL (Tiskilwa)				1129 Drive 6" Casing
	69						1137
854.1	70			Rec 100%	Bag 19	> 4.5 tsf	
	71						
	72						
	73		very fine SAND lens; very fine SILT lens		Bag 20		Extract 1144
	74		Dark Olive Gray Silty CLAY → continued Next Pg	Abrupt contact		> 4.5 tsf	
	75				59		

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT McHenry City Wells — HOLE NO. 7-HARTLAND TWP

Hole No. 7 - HARTLAND TWP

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 6 OF 11 SHEETS

1. PROJECT: McHenry Cty Wells
2. LOCATION (Coordinates or Station):
3. DRILLING AGENCY: WDC Exploration & Wells
4. HOLE NO. (As shown on drawing title and title number): 7-HRT
5. NAME OF DRILLER: Dan Tonnancour
6. DIRECTION OF HOLE: ☑ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 163'
8. DEPTH DRILLED INTO ROCK: 2.5'
9. TOTAL DEPTH OF HOLE: 165.5'
10. SIZE AND TYPE OF BIT: 3 7/8" Carbide Sampler — 5 7/8" Casing
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): NAVD 88
12. MANUFACTURERS DESIGNATION OF DRILL: SuperSonic II
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 21 / UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES: 6
15. ELEVATION GROUND WATER: 887 ft MSL (11/13/08)
16. DATE HOLE: STARTED 11-11-08 / COMPLETED 11-12-08
17. ELEVATION TOP OF HOLE: 924.1 ft MSL
18. TOTAL CORE RECOVERY FOR BORING: 157.5'
19. SIGNATURE OF INSPECTOR: Gary M. Brown LPG IL

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	75		little sand & gravel, hard, damp (CL)			Run 8 (75-85) Rec/Run = 10'/10' = 100%
	76				Bag 21	
	77					
	78					
	79			REC 100%		
844.1	80		Olive Gray Clayey SAND to Sandy CLAY, trace gravel, stiff to dense, moist (SC)		Bag 22	
	81				S10	
	82					
	83		Olive gray to Reddish Brown Gravelly SAND, Reddish Br, Med. Dense, wet (GW-SW)		Bag 23	
	84					
	85				S11	
	86		Gray Medium SAND, trace to little F.-M. gravel, trace F. Sand, loose, wet (SP)		Bag 24	Run 9 (85-95) Rec/Run = 10'/10' = 100%
	87			REC 100%		
	88				Bag 25	
	89					
834.1	90					

1214 ↓ Drive 4" 1221
1224 ↓ Drive 6" Casing 1235
RAIN BEGINS
1322 ↓ Drive 4" 1323:30
1326 ↓ Drive 6" 1330
1338 Extract

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT: McHenry Cty Wells — HOLE NO. 7-HARTLAND TWP

Hole No. 7 - HARTLAND TWP

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 7 OF 11 SHEETS

1. PROJECT McHenry City Wells	10. SIZE AND TYPE OF BIT 3 7/8" Carbide Smmper 5 7/8" Casing
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) NAVD 88
3. DRILLING AGENCY WDC Exploration & Wells	12. MANUFACTURERS DESIGNATION OF DRILL Super Sonic II
4. HOLE NO. (As shown on drawing title and title number) 7-HRT	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 21; UNDISTURBED Ø
5. NAME OF DRILLER Dan Tonnancour	14. TOTAL NUMBER CORE BOXES Ø
6. DIRECTION OF HOLE ☑ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER 887 Ft MSL (11-13-08)
	16. DATE HOLE: STARTED 11-11-08; COMPLETED 11-12-08
7. THICKNESS OF OVERBURDEN 163'	17. ELEVATION TOP OF HOLE 924.1 Ft MSL
8. DEPTH DRILLED INTO ROCK 2.5'	18. TOTAL CORE RECOVERY FOR BORING 157.5'
9. TOTAL DEPTH OF HOLE 165.5'	19. SIGNATURE OF INSPECTOR Gary M. Brown LPG IL

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
834.1	90			Cont.	Bag 25 cont.	RUN 9 (85-95) cont.
	91		SAME AS ABOVE	REC= 100%		
	92					
	93				Bag 26	
	94		Well sorted Med. SAND			
	95				5/12	
	96					RUN 10 (95-105) Rec/Run = 10'/10' = 100% — 1344 Drive 4" Casing
	97				Bag 27	1345
	98					1349
	99					Drive 6" Casing
824.1	100			REC 100%	Bag 28	1353
	101				5/13	
	102					
	103		Fine Sand Stringers		Bag 29	Extract Samples
	104					1359
	105		Silt Stringer			

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT McHenry City Wells — HOLE NO. 7 - HARTLAND TWP

1406

Hole No. 7 - HARTLAND TWP

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 8 OF 11 SHEETS

1. PROJECT McHenry Cty Wells	10. SIZE AND TYPE OF BIT 3 7/8" Carbide Sampler 5 7/8" Casing
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) NAVD 88
3. DRILLING AGENCY WDC Exploration & Wells	12. MANUFACTURERS DESIGNATION OF DRILL Super Sonic II
4. HOLE NO. (As shown on drawing title and title number) 7-HRT	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 21; UNDISTURBED Ø
5. NAME OF DRILLER Dan Townsend Corr	14. TOTAL NUMBER CORE BOXES Ø
6. DIRECTION OF HOLE ☑ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.	15. ELEVATION GROUND WATER 887 Ft MSL (11-13-08)
	16. DATE HOLE: STARTED 11-11-08; COMPLETED 11-12-08
7. THICKNESS OF OVERBURDEN 163'	17. ELEVATION TOP OF HOLE 924.1 Ft MSL
8. DEPTH DRILLED INTO ROCK 2.5'	18. TOTAL CORE RECOVERY FOR BORING 157.5'
9. TOTAL DEPTH OF HOLE 165.5'	19. SIGNATURE OF INSPECTOR Gary M. Brown LPG IL

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	105		cont. well sorted Gray SAND			RUN 11 (105-115) REC/RUN = 9.5'/10' = 95%
	106				Bag 30	1406 Advance 4" Casing 1407
	107					
	108					1410 Advance 6" Casing 1412
	109				Bag 31	
814.1	110			REC 95%		
	111					
	112					
	113		Fine Gravelly Zone (½ C. SAND		S14 Bag 32	sieve sample taken
	114					Extract Sample 1420
	115					
	116		Abrupt Contact			RUN 12 (115-125) REC/RUN = 10'+/10' = 100% 1434 Drive 4" Casing
	117		Gray Sandy CLAY, little F. C. gravel soft, moist (SC)		Bag 33	1436
	118			REC 100%		Drive 6" Casing
	119		DIAMICTON Transition			1442
804.1	120				Bag 34	

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT McHenry Cty Wells | HOLE NO. 7-HARTLAND TWP

Hole No. 7- HARTLAND TWP

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 9 OF 11 SHEETS

1. PROJECT McHenry County Wells	10. SIZE AND TYPE OF BIT 3 7/8" Carbide Sampler 5 7/8" CASING ROTO-SONIC
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) NAVD 88
3. DRILLING AGENCY WDC Exploration & Wells	12. MANUFACTURERS DESIGNATION OF DRILL SuperSonic II
4. HOLE NO. (As shown on drawing title and title number) 7-HART	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 21 / UNDISTURBED Ø
5. NAME OF DRILLER DAN TONNANCOUR	14. TOTAL NUMBER CORE BOXES Ø
6. DIRECTION OF HOLE ☑ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.	15. ELEVATION GROUND WATER 887 FT MSL
	16. DATE HOLE: STARTED 11-11-08 / COMPLETED 11-12-08
7. THICKNESS OF OVERBURDEN 163'	17. ELEVATION TOP OF HOLE 924.1 FT MSL
8. DEPTH DRILLED INTO ROCK 2.5'	18. TOTAL CORE RECOVERY FOR BORING 157.5'
9. TOTAL DEPTH OF HOLE 165.5'	19. SIGNATURE OF INSPECTOR Gary M. Brown LPG IL

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
804.1	120		cont.	Rec 100% cont.	Bag 34	Run 12 (115-125) cont.
	121		Sandy CLAY Diamicton			
	122		TILL		315	
	123		3/8" thick SA. seam; thin SILT seam		Bag 35	Extract 1451
	124		Reddish Brown Silty CLAY, stiff (CL)			
	125					
	126		Grayish Brown Fine SAND, little Med. sand, tr. silt, C. sand & F-M. gravel, dense, wet (SP-SW)		Bag 36	Run 13 (125-135) Rec/Run = 10'/10' = 100%
	127					1500 ↓ Drive 4" 1502
	128		(Abrupt contacts above & below)			1505 ↓ Drive 6" 1511
	129				316 Bag 37	
794.1	130		Gray Silty CLAY, little sand & gravel, very stiff to hard, moist (CL)	Rec 100%		
	131					
	132		- Medium Plasticity - Matrix Supported diamicton			
	133				Bag 38	
	134		TILL			
	135					

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT McHenry Cty Wells — HOLE NO. 7-HARTLAND TWP

Hole No. 7- HARTLAND TWP

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 10 OF 11 SHEETS

1. PROJECT McHenry City Wells	10. SIZE AND TYPE OF BIT 3 7/8" Carbide Sampler
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) NAVD 88
3. DRILLING AGENCY WDC Exploration & Wells	12. MANUFACTURERS DESIGNATION OF DRILL SuperSonic II
4. HOLE NO. (As shown on drawing title and title number) 7-HRT	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN — DISTURBED 21 — UNDISTURBED Ø
5. NAME OF DRILLER Dan Tonnancourt	14. TOTAL NUMBER CORE BOXES Ø
6. DIRECTION OF HOLE ☑ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.	15. ELEVATION GROUND WATER 887' (11-13-08)
	16. DATE HOLE — STARTED 11-11-08 — COMPLETED 11-12-08
7. THICKNESS OF OVERBURDEN 163'	17. ELEVATION TOP OF HOLE 924.1 ft MSL
8. DEPTH DRILLED INTO ROCK 2.5'	18. TOTAL CORE RECOVERY FOR BORING 157.5'
9. TOTAL DEPTH OF HOLE 165.5'	19. SIGNATURE OF INSPECTOR Harry M. Brown LPG IL

Roto-Sonic 5 7/8" Casing

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	135		cont.			Run 14 (135-145)
	136		Silty Clay Till (same as above)		Bag 39	Rec/Run = 10'/10' = 100%
	137					
	138					
	139					
784.1	140			Rec 100%	Bag 40	
	141					
	142					
	143				Bag 41	
	144					
	145				S/B	
	146					Run 15 (145-155)
	147				Bag 42	Rec/Run = 10'/10' = 100%
	148					
	149			Rec 100%		
774.1	150				Bag 43	

1547 — Drive 4"

1551

1553 — Drive 6" Casing

1559

Extract @ 1609

Run Time 1615 - 1650

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT McHenry City Wells — HOLE NO. 7- HARTLAND TWP

Hole No. 7-HARTLAND TWP

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 11 OF 11 SHEETS

1. PROJECT: McHenry Cty Wells
2. LOCATION (Coordinates or Station):
3. DRILLING AGENCY: WDC Exploration & Wells
4. HOLE NO. (As shown on drawing title and title number): 7-HRT
5. NAME OF DRILLER: Dan Tonnancour
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 163'
8. DEPTH DRILLED INTO ROCK: 2.5'
9. TOTAL DEPTH OF HOLE: 165.5'
10. SIZE AND TYPE OF BIT: 3 7/8" Carbide Scraper
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): NAVD 88
12. MANUFACTURERS DESIGNATION OF DRILL: Super Sonic II
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 21; UNDISTURBED Ø
14. TOTAL NUMBER CORE BOXES: Ø
15. ELEVATION GROUND WATER: 887 ft MSL
16. DATE HOLE: STARTED 11-11-08; COMPLETED 11-12-08
17. ELEVATION TOP OF HOLE: 924.1 FT MSL
18. TOTAL CORE RECOVERY FOR BORING: 157.5'
19. SIGNATURE OF INSPECTOR: Gary M. Brown LPG IL

Roto-Sonic 5 7/8" Casing

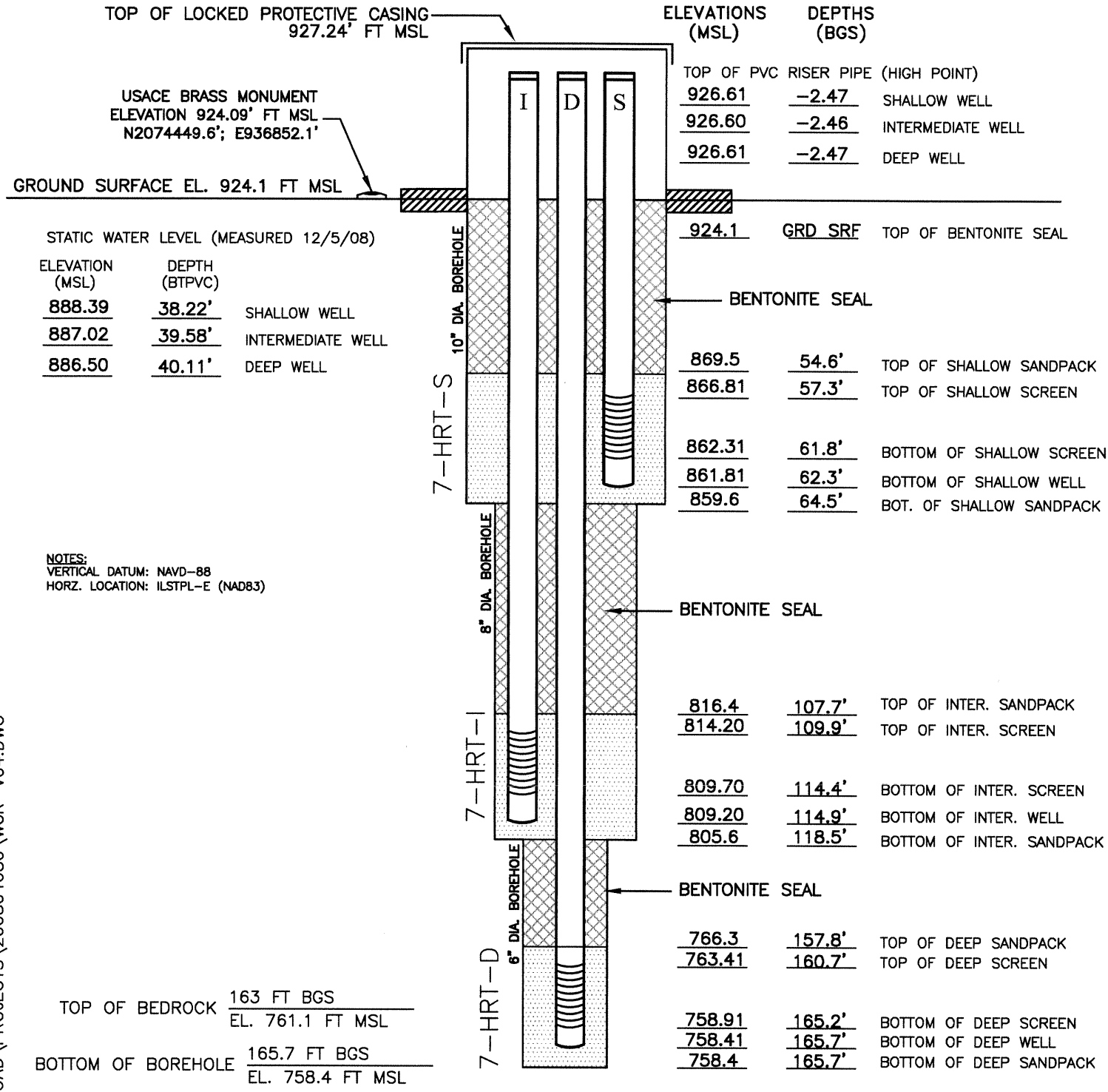
ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
774.1	150		cont. Silty CLAY TILL		Bag 43	cont. Run 15 (145-155)
	151					
	152			Rec 100%		
	153				Bag 44	
	154					
					S19	END OF DAY 11/11/08
	155					Run 16 (155-165) START 11/12/08
	156					Rec/Run = 10'/10' = 100%
	157				Bag 45	
	158					
	159					
764.1	160		Gray Medium SAND, trace fine gravel, Mod. Dense, wet (SP)		Bag 46	• Duplicate Sample taken (161-162') for grain size analysis
	161					
					S20	• Driller mentions he lifted string to get bit rotating again after hit rock. Some sand in rock samples
	162					
761.1	163		Dolomitic BEDROCK		Bag 47	• Driller also reports borehole bottom to be ~165.5 ft
	164					
	165		SAME TO ↓ 165.7' (EOB)		S21	

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

758.4 FT MSL
EOB 165.7 ft bgs 11/12/08

PROJECT: McHenry Cty Wells | HOLE NO. 7-HARTLAND TWP

PROJECT McHENRY COUNTY OBSERVATION WELL NETWORK INSTALLATION (#09000-460)	WELL NO. 7-HRT-S, 7-HRT-I & 7-HRT-D
LOCATION HARTLAND TOWNSHIP - McHENRY COUNTY, ILLINOIS	
CLIENT U.S. ARMY CORPS OF ENGINEERS / McHENRY COUNTY	
GEOLOGIST GARY BRAUN, P.G. (AECOM)	INSTALLATION DATE NOV. 21, 2008
DRILLER WDC EXPLORATION AND WELLS, INC. (DAN TONNANCOUR)	DRILLING METHOD ROTO-SONIC



ELEVATIONS (MSL)	DEPTHS (BGS)	
TOP OF PVC RISER PIPE (HIGH POINT)		
926.61	-2.47	SHALLOW WELL
926.60	-2.46	INTERMEDIATE WELL
926.61	-2.47	DEEP WELL
924.1	GRD SRF	TOP OF BENTONITE SEAL
869.5	54.6'	TOP OF SHALLOW SANDPACK
866.81	57.3'	TOP OF SHALLOW SCREEN
862.31	61.8'	BOTTOM OF SHALLOW SCREEN
861.81	62.3'	BOTTOM OF SHALLOW WELL
859.6	64.5'	BOT. OF SHALLOW SANDPACK
816.4	107.7'	TOP OF INTER. SANDPACK
814.20	109.9'	TOP OF INTER. SCREEN
809.70	114.4'	BOTTOM OF INTER. SCREEN
809.20	114.9'	BOTTOM OF INTER. WELL
805.6	118.5'	BOTTOM OF INTER. SANDPACK
766.3	157.8'	TOP OF DEEP SANDPACK
763.41	160.7'	TOP OF DEEP SCREEN
758.91	165.2'	BOTTOM OF DEEP SCREEN
758.41	165.7'	BOTTOM OF DEEP WELL
758.4	165.7'	BOTTOM OF DEEP SANDPACK

STATIC WATER LEVEL (MEASURED 12/5/08)

ELEVATION (MSL)	DEPTH (BTPVC)	
888.39	38.22'	SHALLOW WELL
887.02	39.58'	INTERMEDIATE WELL
886.50	40.11'	DEEP WELL

NOTES:
VERTICAL DATUM: NAVD-88
HORZ. LOCATION: ILSTPL-E (NAD83)

TOP OF BEDROCK 163 FT BGS / EL. 761.1 FT MSL

BOTTOM OF BOREHOLE 165.7 FT BGS / EL. 758.4 FT MSL

NOT TO SCALE

WELL CONSTRUCTION MATERIALS*

PROTECTIVE CASING	5' L X 10" DIA. STEEL CASING W/ LOCKING CAP
RISER PIPE ABOVE W.T.	SCHEDULE 40 PVC (2.07" I.D./ 2.38" O.D.)
RISER PIPE BELOW W.T.	SCHEDULE 40 PVC (2.07" I.D./ 2.38" O.D.)
SCREEN	2" I.D. SCHEDULE 40 PVC W/ 0.010" SCREEN SLOT SIZE
TYPE OF BENTONITE SEAL	BLACK HILLS BENTONITE - 3/8" CHIPS (HOLE PLUG)
TYPE OF SAND PACK	R.W. SIDLEY CO. - NO. 5 FILTER PACK SAND

CASING MEASUREMENTS

BOTTOM OF SCREEN TO END CAP (FT)*		0.50
SCREEN LENGTH (1ST SLOT TO LAST SLOT) (FT)*		4.50
TOTAL LENGTH OF CASING (FT):	SHALLOW WELL	64.80
	INTERMEDIATE WELL	117.40
	DEEP WELL	168.20

* MEASUREMENT REFERS TO ALL WELLS

USMWK2FP001\05CAD\PROJECTS\20080408O\WCR-V04.DWG

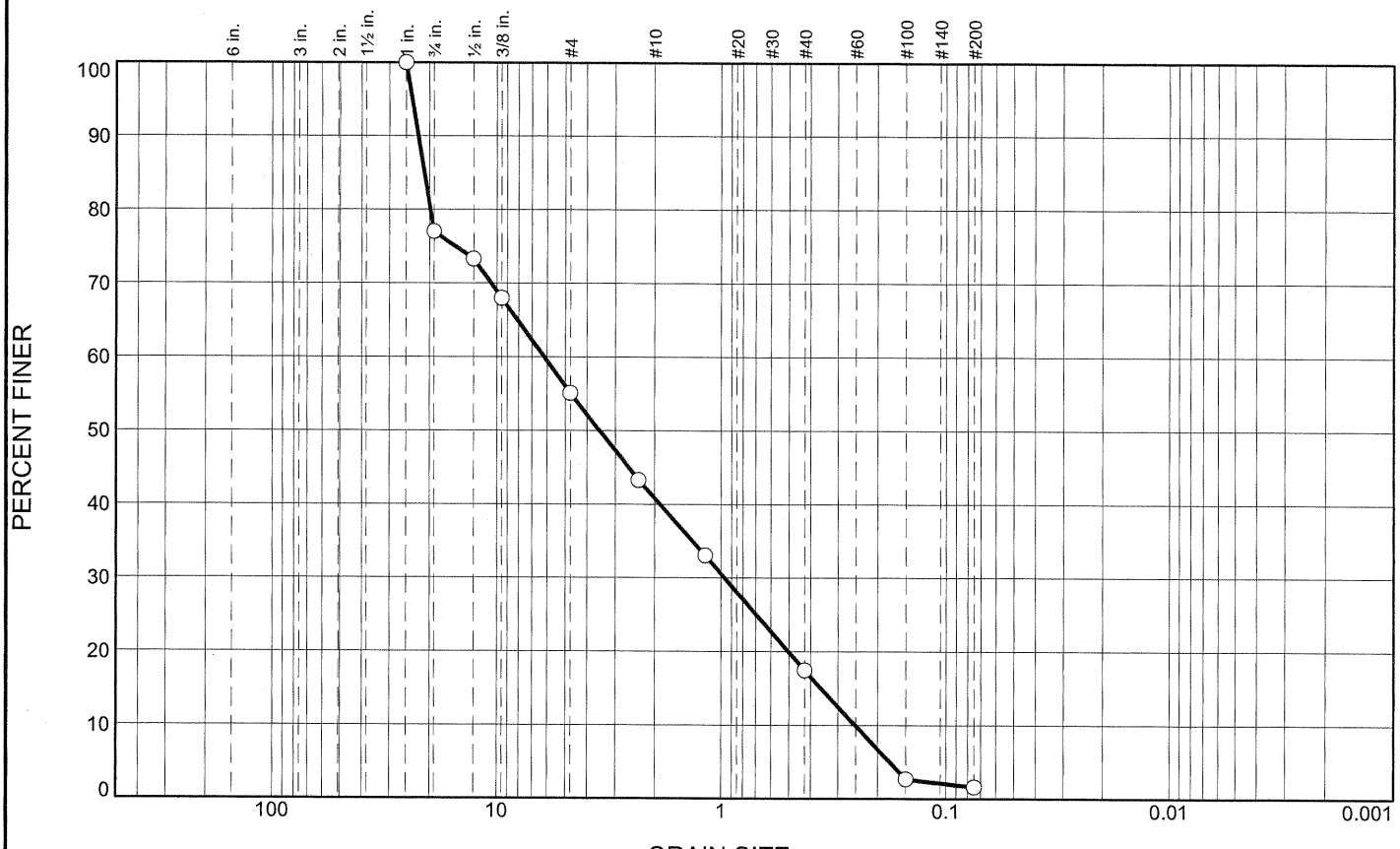
WELL SITE DATA SUMMARY AND COMMENTARY

Well Site #7 – Hartland Township
Valley Hi Senior Facility on Hartland Rd

The Hartland Township well site encountered three distinct sandy hydrostatic zones that were separated by a minimum of 20 ft thick till deposits. Monitoring wells were installed within each other these stratigraphic zones. Initial review of the borehole stratigraphy indicates that the site consists of a complex sequence of deposits from the Marengo and Woodstock Phase advances. The three hydrostatic zones where the monitoring wells were installed were located between the following depths: 56-62 ft (shallow), 81-117 ft (intermediate) and 159-163 ft (deep). The borehole was advanced approximately 3 ft into bedrock, so the deep well was screened across the overburden/bedrock interface. The contrast of the hydraulic conductivities between the sand and bedrock in the deep well were evident in the slug test response curve. Two distinct conductivities were interpreted and solved to represent approximate conductivities of the sand (1.1×10^{-2} cm/s) and bedrock (1.9×10^{-4} cm/s), respectively. This solution suggests the conductivity of the sand unit is two orders of magnitude greater than the bedrock assuming the curves were assigned to the correct hydrostatic unit.

Well Site Testing Results

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	22.9	22.0	14.3	23.3	15.9	1.6	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1	100.0		
.75	77.1		
.5	73.3		
.375	68.0		
#4	55.1		
#8	43.3		
#16	33.1		
#40	17.5		
#100	2.7		
#200	1.6		

* (no specification provided)

Material Description

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 22.4067 D_{85}= 21.0450 D_{60}= 6.1852
D_{50}= 3.5115 D_{30}= 0.9651 D_{15}= 0.3574
D_{10}= 0.2513 C_u= 24.61 C_c= 0.60

Classification

USCS= SP AASHTO=

Remarks

Source of Sample: 7-HART-S **Depth:** 59.0-60.0

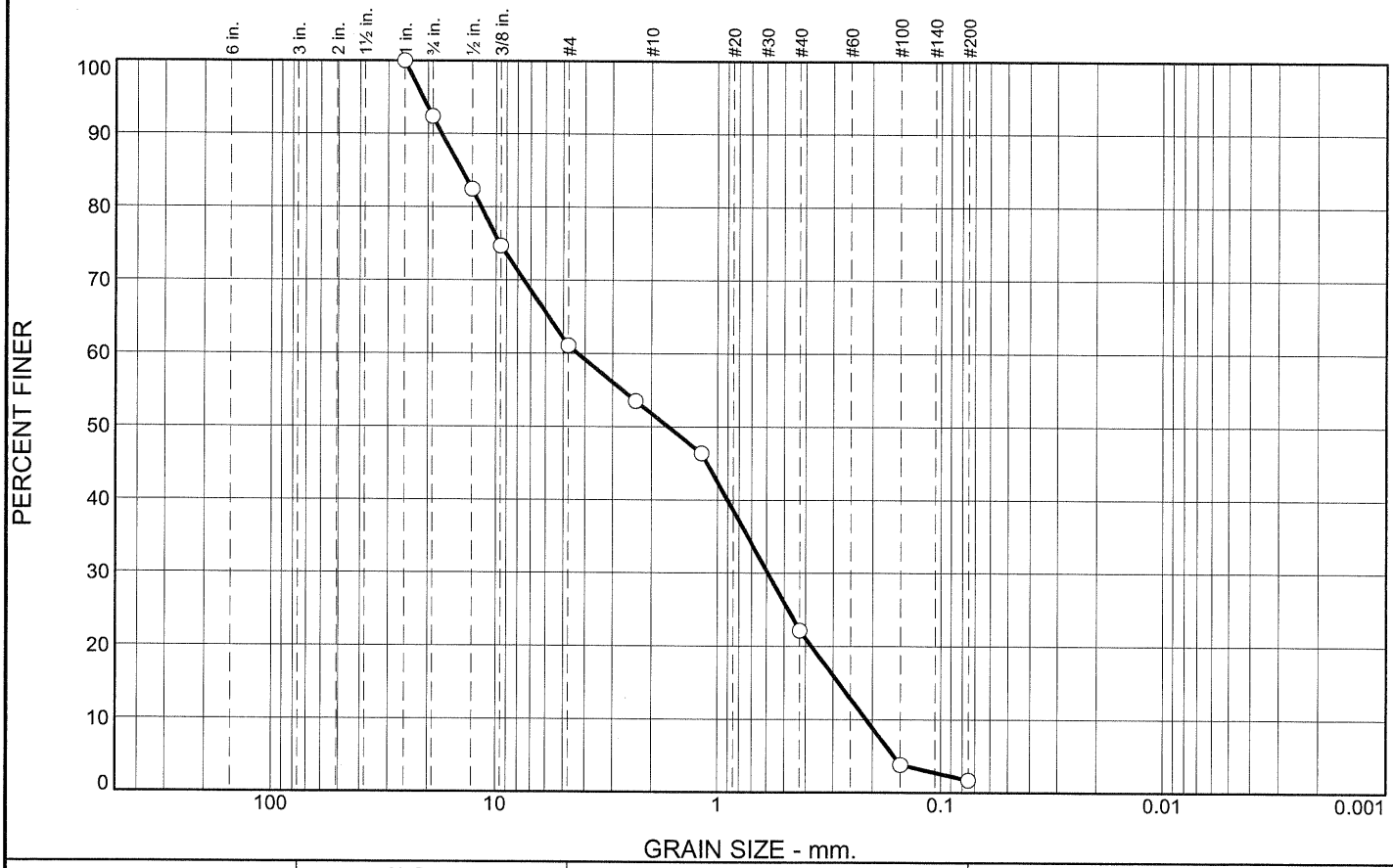
Date: 12/05/08

STS | AECOM

Client: USACE
Project: McHenry County Wells
Project No: 200804080 **Figure**

Tested By: JRT

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	7.6	31.3	9.3	29.6	20.5	1.7	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1	100.0		
.75	92.4		
.5	82.4		
.375	74.7		
#4	61.1		
#8	53.5		
#16	46.4		
#40	22.2		
#100	3.8		
#200	1.7		

* (no specification provided)

Material Description

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 17.2832 D_{85}= 14.0976 D_{60}= 4.3024
D_{50}= 1.6771 D_{30}= 0.5913 D_{15}= 0.2829
D_{10}= 0.2129 C_u= 20.20 C_c= 0.38

Classification

USCS= SP AASHTO=

Remarks

Source of Sample: 7-HART-I **Depth:** 112.0-113.0

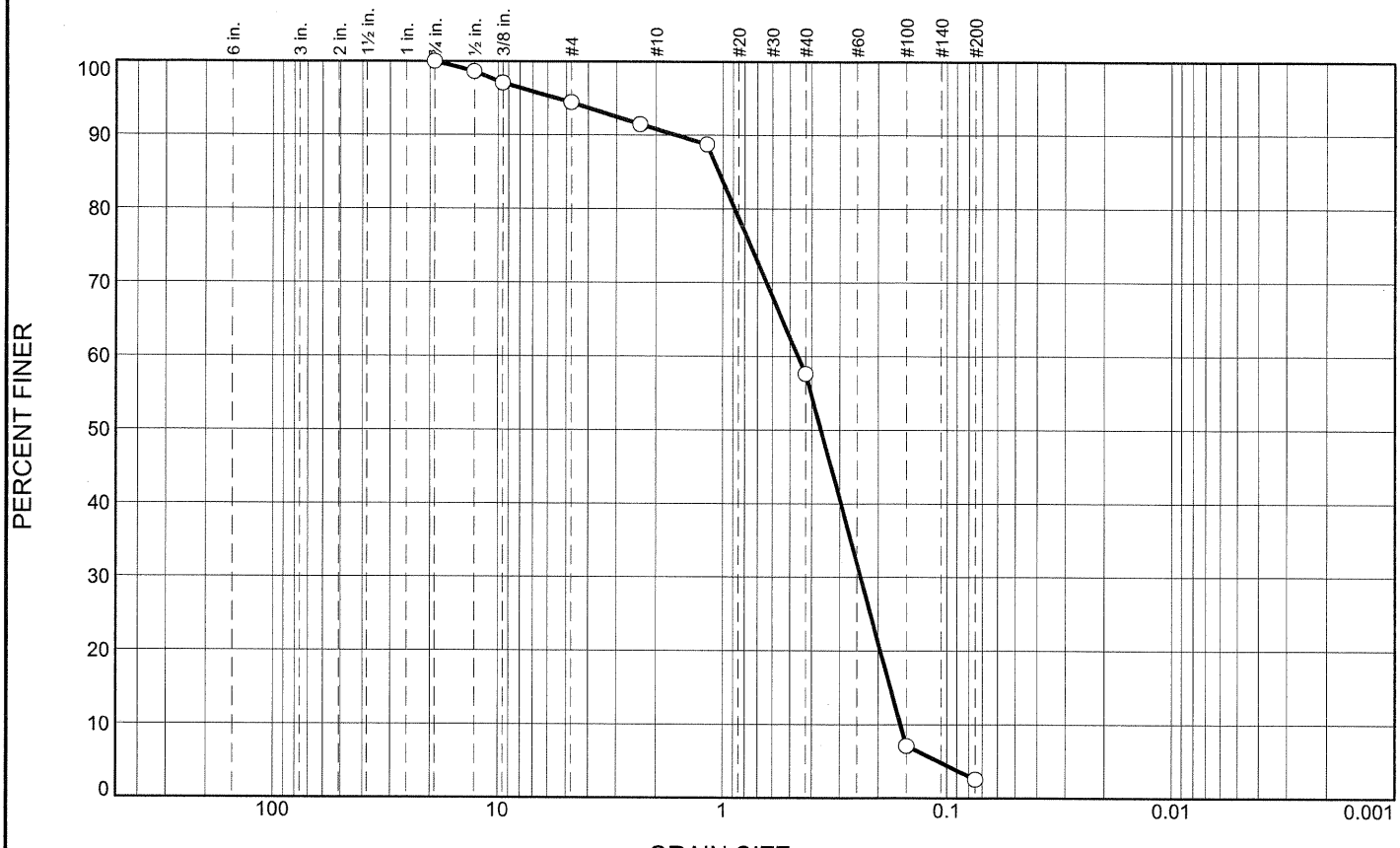
Date: 12/05/08

STS | AECOM

Client: USACE
Project: McHenry County Wells
Project No: 200804080 **Figure**

Tested By: JRT

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	5.6	3.6	33.2	55.0	2.6	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.75	100.0		
.5	98.6		
.375	97.0		
#4	94.4		
#8	91.5		
#16	88.8		
#40	57.6		
#100	7.1		
#200	2.6		

* (no specification provided)

Material Description

F-C Sand Trace Fine Gravel Trace Silt

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 1.6197 D_{85}= 1.0429 D_{60}= 0.4595
D_{50}= 0.3632 D_{30}= 0.2405 D_{15}= 0.1765
D_{10}= 0.1592 C_u= 2.89 C_c= 0.79

Classification

USCS= SP AASHTO=

Remarks

Source of Sample: 7-HART-D **Depth:** 161.0-162.0

Date: 12/05/08

STS | AECOM

Client: USACE
Project: McHenry County Wells
Project No: 200804080 **Figure**

Tested By: JRT

Groundwater Level Measurements

McHenry County Monitoring Well Installations
AECOM Project 09000-460

Site Number	7		
Township Name	Hartland		
Well Number	7-HRT-S	7-HRT-I	7-HRT-D
Ground Surface Elevation (ft msl)	924.14	924.14	924.14
Top of PVC Casing Elevation (ft)	926.61	926.60	926.61
Location of PVC Casing within Wellhead	Center Well	South Well	East Well
Well Depth (Feet from TOC)[A]	64.80	117.40	168.20

Date	Depth to GW from TOC (ft)	GW Elevation (ft msl)	Depth to GW from TOC (ft)	GW Elevation (ft msl)	Depth to GW from TOC (ft)	GW Elevation (ft msl)
Sep. 26, 2008						
Oct. 09, 2008						
Oct. 14, 2008						
Oct. 16, 2008						
Oct. 21, 2008						
Oct. 22, 2008						
Oct. 24, 2008						
Oct. 28, 2008						
Oct. 29, 2008						
Oct. 30, 2008						
Nov. 07, 2008						
Nov. 13, 2008	30.83	895.78	39.16	887.44	39.62	886.99
Dec. 05, 2008	38.22	888.39	39.58	887.02	40.11	886.50
Dec. 08, 2008						
Dec. 09, 2008						
Dec. 12, 2008						
Dec. 15, 2008						
Dec. 16, 2008						
Dec. 17, 2008						
Dec. 18, 2008						
Dec. 19, 2008	38.4	888.21	38.9	887.70	40.16	886.45
Dec. 22, 2008						
Dec. 23, 2008						
Dec. 29, 2008						
Dec. 30, 2008						
Jan. 05, 2009						
Jan. 06, 2009						
Jan. 07, 2009						
Jan. 08, 2009	37.17	889.44	37.45	889.15	38.01	888.60
Jan. 09, 2009						
Jan. 10, 2009						
Jan. 12, 2009						
Feb. 24, 2009	37.06	889.55	37.41	889.19	38.05	888.56
Mar. 20, 2009						
end						

Notes:

ft msl = Elevation referenced to feet above mea

TOC = Top of PVC Casing

ft = feet

[A] = as measured inside well

NI = Not Installed

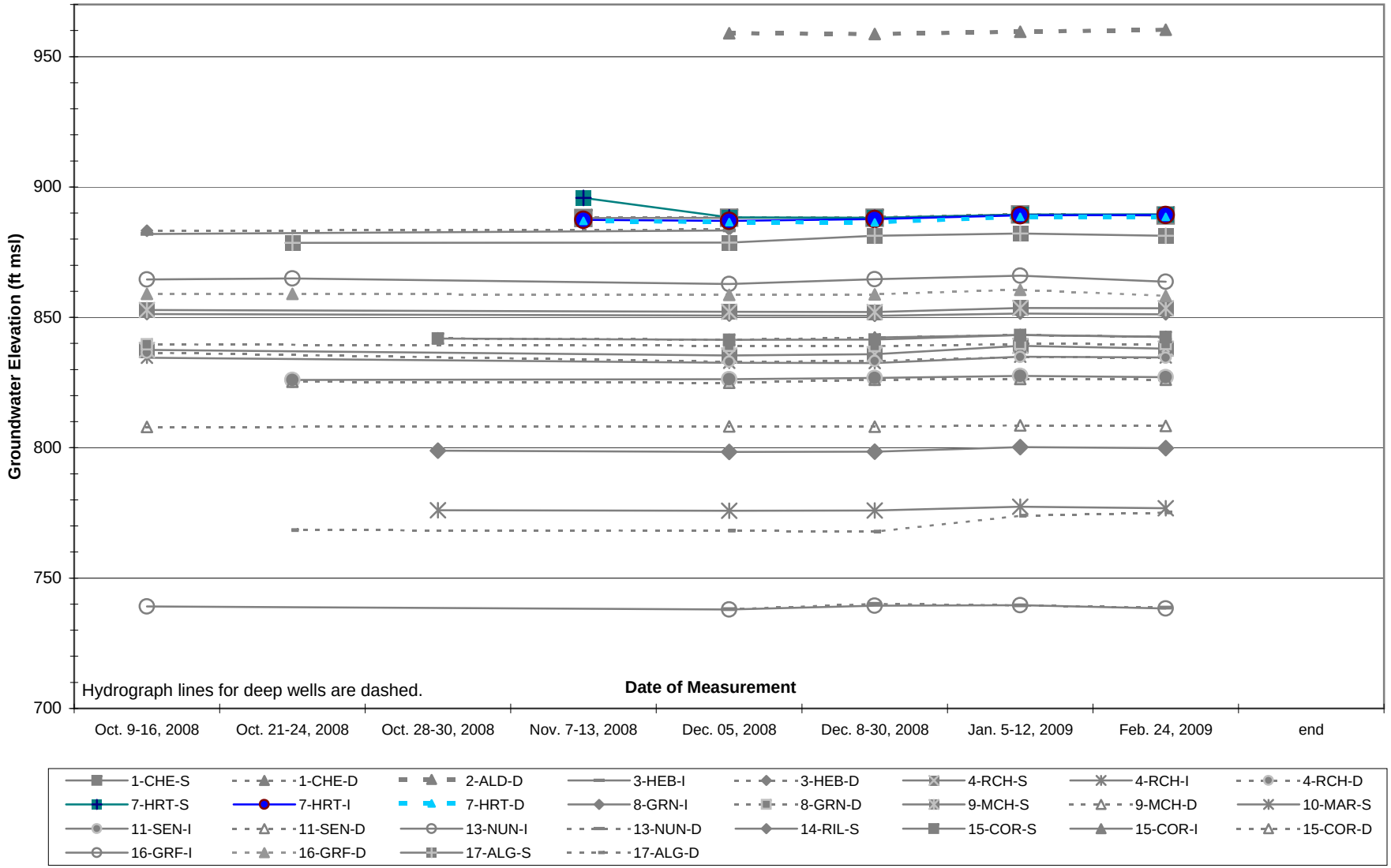
--- No Elevation

Well 17-Alg-S was frozen or partially frozen fror

Site 7 Groundwater Level Hydrograph
(includes ALL AECOM INSTALLED WELLS)

McHenry County Obervation Well Network

AECOM Project 09000-460

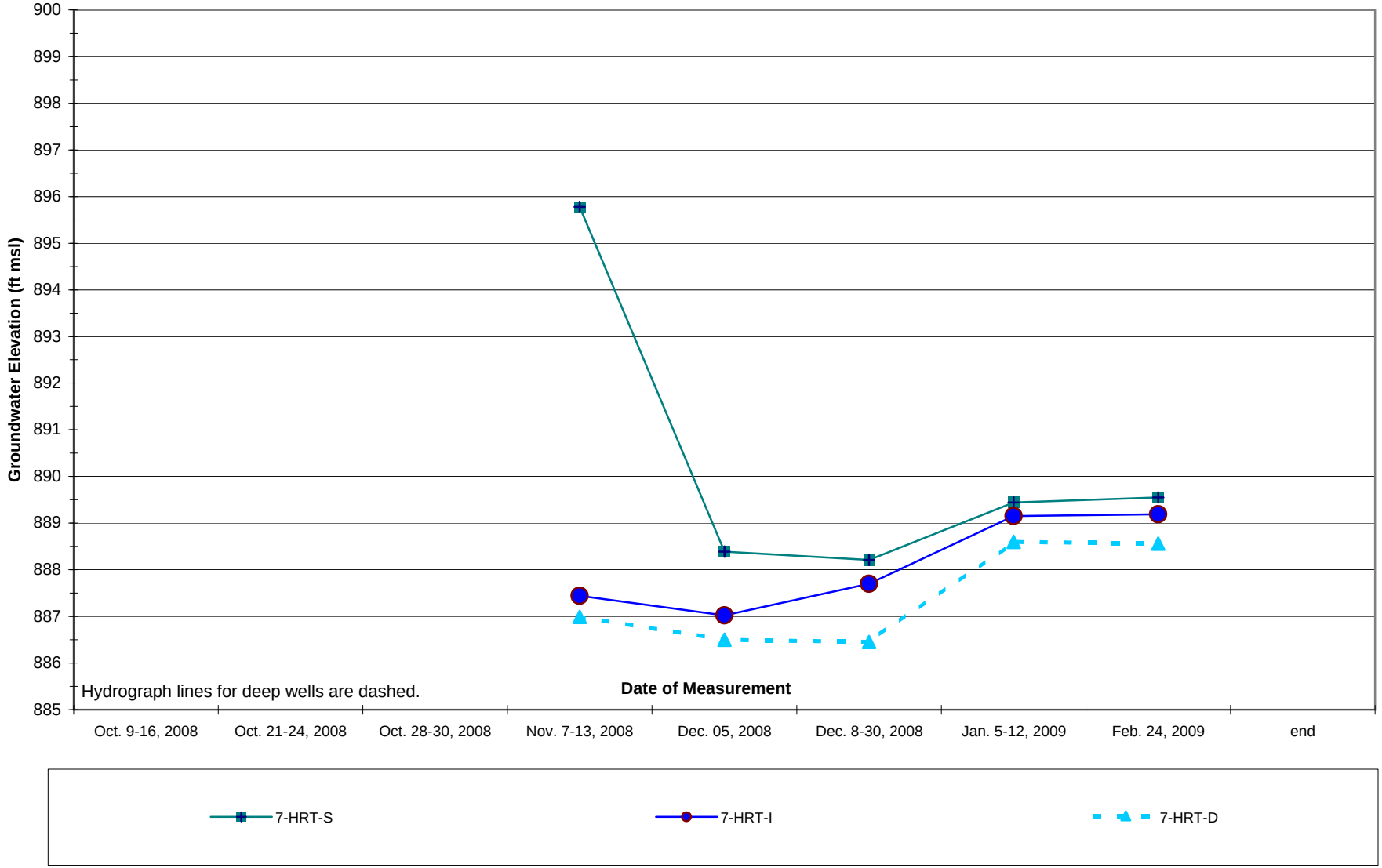


K:\PROJECTS\200804080\In_Progress\STS-McHenry Cty_WLs IN PROGRESS - figs for each site.xls

Site 7 Groundwater Level Hydrograph

McHenry County Obervation Well Network

AECOM Project 09000-460



K:\PROJECTS\200804080\In_Progress\STS-McHenry Cty_WLs IN PROGRESS - figs for each site.xls

Well Development Record

STS Consultants, Ltd.
11425 West Lake Park Drive
Milwaukee, Wisconsin 53224

Site Name: McHenry County Well ID Number: 7-HRT-S

Date of Completion: 12/19/08 STS Job Number: 200804080

Start Time: 11:10 End Time: 14:10

Water color at start of development: Brown Water color at end of development: CLEAR

Amount of water removed during development: _____

Contained water? ☐ Yes ☒ No

If not contained, where water disposed? GROUND

Well Development Methods:

- ☐ Surged with bailer and bailed
- ☐ Surged with block and bailed
- ☐ Surged with block, bailed & pumped
- ☐ Bailed only
- ☐ Pumped slowly
- ☐ Surged with bailer and pumped
- ☒ Surged with block and pumped
- ☐ Compressed Air
- ☐ Pumped only
- ☐ Other _____

Equipment Used

- ☐ PVC bailer
- ☐ Well wizard
- ☐ Bean or Moino pump (on drill rig)
- ☒ Surge block
- ☒ Whale pumps

Notes:

SURGE START: 10:05

END: 10:20

PURGE START: 11:10

END: 14:10

WL: 38.40

WL FINAL: 38.85

WELL DEVELOPMENT FIELD RECORD

Job Name: McHenry County Job No.: 200804080 Well No.: 7-HRT-S

Developed By: Brian Schmidt Date of Install. _____ Sheet ____ of ____

Started Devel.: 12/19/08 (DATE) / (TIME) Completed Devel.: 12/19/08 (DATE) / (TIME)

W.L. Before Devel. ____ (DATE) / ____ (TIME) / ____ (DEPTH) After Devel. ____ (DATE) / ____ (TIME) / ____ (DEPTH)

Well Depth: Before Devel. _____ After Devel. _____ Well Dia. (in.) _____

Standing Water Column (ft.) _____ Standing Well Volume _____ gal.

Screen Length: 5' Drilling Water Loss _____ gal.

DATE / TIME	VOLUME REMOVED (Gallons)	FIELD PARAMETERS SPEC. COND. (umhos/cm)	TEMP. (C°)	pH (s.u.)	TURB ~~Other~~	ORP	REMARKS
12/19/08 1130	1 GAL/min	1350	9.5	7.33	999	—	
1150	"	1120	9.7	7.26	999	—	
1210	"	1060	9.5	7.31	512	—	
1230	"	990	9.1	7.32	390	—	
1250	"	967	9.0	7.36	152	—	
1310	"	960	8.3	7.58	120	—	
1330	"	924	8.8	7.44	89	—	
1350	"	910	8.6	7.46	80	—	
1410	"	910	8.8	7.46	76	—	
		= TOTAL VOLUME REMOVED (Gallons)					

Development Method: WL FINAL: 38.85

Notes:

Well Development Record

STS Consultants, Ltd.
11425 West Lake Park Drive
Milwaukee, Wisconsin 53224

Site Name: McHenry County Well ID Number: 7-4RT-I

Date of Completion: 12/19/08 STS Job Number: 200804080

Start Time: 12:45 End Time: 14:10

Water color at start of development: Brown Water color at end of development: CLEAR

Amount of water removed during development:

Contained water? ☐ Yes ☒ No

If not contained, where water disposed? Ground

Well Development Methods:

- ☐ Surged with bailer and bailed
- ☐ Surged with block and bailed
- ☐ Surged with block, bailed & pumped
- ☐ Bailed only
- ☐ Pumped slowly
- ☐ Surged with bailer and pumped
- ☐ Surged with block and pumped
- ☐ Compressed Air
- ☒ Pumped only
- ☐ Other

Equipment Used

- ☐ PVC bailer
- ☐ Well wizard
- ☐ Bean or Moino pump (on drill rig)
- ☐ Surge block
- ☐ Whale pumps
- ☒ WATERRA PUMP w/ BREAK

Notes: PURGE START: 12:45

END: 14:10

WL ST: 38.90

WL END: 39.02

WELL DEVELOPMENT FIELD RECORD

Job Name: McHenry County Job No.: 200804080 Well No.: 7-4RT-I

Developed By: Brian Schmidt Date of Install. _____ Sheet ____ of ____

Started Devel.: 12/19/08 / _____ (DATE / TIME) Completed Devel.: 12/19/08 / _____ (DATE / TIME)

W.L. Before Devel.: _____ / _____ / _____ (DATE / TIME / DEPTH) After Devel.: _____ / _____ / _____ (DATE / TIME / DEPTH)

Well Depth: Before Devel. _____ After Devel. _____ Well Dia. (in.) _____

Standing Water Column (ft.) _____ Standing Well Volume _____ gal.

Screen Length: 5' Drilling Water Loss _____ gal.

DATE / TIME	VOLUME REMOVED (Gallons)	FIELD PARAMETERS SPEC. COND. (umhos/cm)	TEMP. (C°)	pH (s.u.)	TURB ~~Other~~	ORP	REMARKS
12/19/08 1310	2 GAL/min	639	8.0	7.54	576	-	
1330	"	625	7.5	7.49	119	-	
1350	"	610	8.1	7.50	36	-	
1410	"	604	7.8	7.52	84	-	
		= TOTAL VOLUME REMOVED (Gallons)					

Development Method: WL FINAL: 39.02

Notes:

Well Development Record

STS Consultants, Ltd.
11425 West Lake Park Drive
Milwaukee, Wisconsin 53224

Site Name: McHenry County

Well ID Number: 7-HRT-D

Date of Completion: 12/19/08

STS Job Number: 200804080

Start Time: 1005

End Time: 1230

Water color at start of development: Brown

Water color at end of development: CLEAR

Amount of water removed during development:

Contained water? ☐ Yes ☒ No

If not contained, where water disposed? Ground

Well Development Methods:

- ☐ Surged with bailer and bailed
- ☐ Surged with block and bailed
- ☐ Surged with block, bailed & pumped
- ☐ Bailed only
- ☐ Pumped slowly
- ☐ Surged with bailer and pumped
- ☐ Surged with block and pumped
- ☐ Compressed Air
- ☒ Pumped only
- ☐ Other

Equipment Used

- ☐ PVC bailer
- ☐ Well wizard
- ☐ Bean or Moino pump (on drill rig)
- ☐ Surge block
- ☐ Whale pumps
- ☒ WATERRA Pump w/ Block

Notes: Purge Start: 10:05

End: 1230

WL: 40.16

WL End: 39.53

WELL DEVELOPMENT FIELD RECORD

Job Name: McHenry County Job No.: 20080480 Well No.: 7-HRT-D

Developed By: Brian Schmidt Date of Install.: _____ Sheet ____ of ____

Started Devel.: 12/19/08 / _____ (DATE / TIME) Completed Devel.: 12/19/08 / _____ (DATE / TIME)

W.L. Before Devel.: _____ / _____ / _____ (DATE / TIME / DEPTH) After Devel.: _____ / _____ / _____ (DATE / TIME / DEPTH)

Well Depth: Before Devel. _____ After Devel. _____ Well Dia. (in.) _____

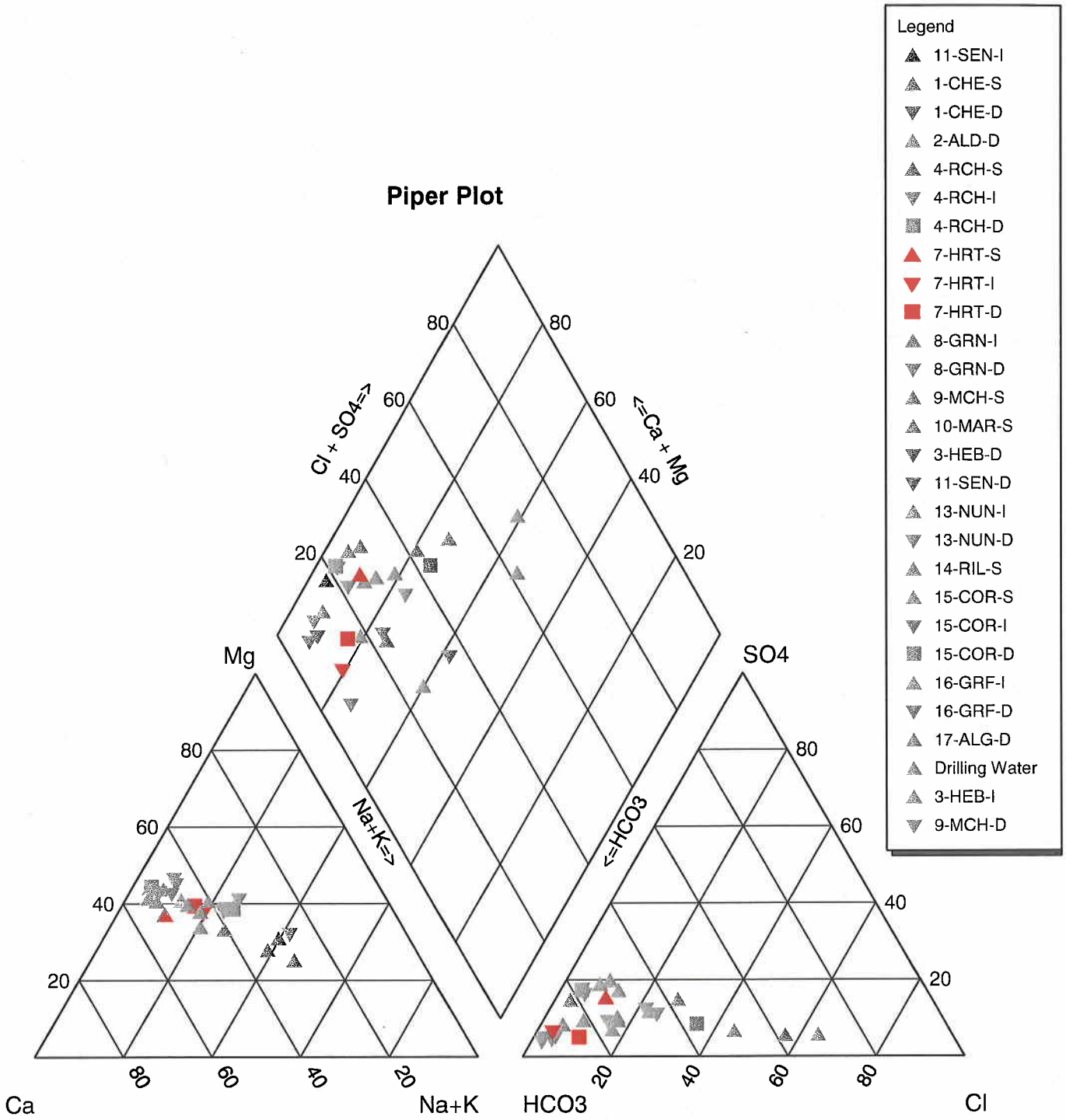
Standing Water Column (ft.) _____ Standing Well Volume _____ gal.

Screen Length: 5' Drilling Water Loss _____ gal.

DATE / TIME	VOLUME REMOVED (Gallons)	FIELD PARAMETERS SPEC. COND. (umhos/cm)	TEMP. (C°)	pH (s.u.)	TURB ~~Other~~	ORP	REMARKS
12/19/08 CAL	—	4500	15.1	3.95	0	—	
10:20	2 GAL/MIN	685	9.9	5.78	999	—	
1050	"	619	10.1	6.80	999	—	
11:10	"	616	9.5	7.05	999	—	
1130	"	616	9.3	7.12	875		
1150	"	633	9.5	7.20	140		
1210	"	626	9.3	7.28	84		
1230	"	627	9.3	7.35	74		
		= TOTAL VOLUME REMOVED (Gallons)					

Development Method: _____

Notes:



DESCRIPTION: Piper Linear Diagram - Well Site #7

AECOM	PROJECT: McHenry County	PROJECT NO: 09000460
	CLIENT: Army Corps of Engineers	DATE: 7/30/2009

First Environmental Laboratories, Inc.
IL ELAP / NELAC Accreditation # 100292
1600 Shore Road • Naperville, Illinois 60563 • Phone (630) 778-1200 • Fax (630) 778-1233

Analytical Report

Client: STS CONSULTANTS (VERN)
Project ID: McHenry County 200804080
Sample ID: 7-HRT-S
Sample No: 9-0115-015

Date Collected: 01/08/09
Time Collected: 11:55
Date Received: 01/13/09
Date Reported: 01/20/09

Analyte		Result	R.L.	Units	Flags
Total Metals	**Method: 6020A**		**Preparation Method 3010A**		
Analysis Date: 01/16/09			Preparation Date: 01/15/09		
Calcium		296	0.1	mg/L	
Iron		13.8	0.01	mg/L	
Magnesium		128	0.1	mg/L	
Potassium		4.0	0.1	mg/L	
Sodium		68.0	0.1	mg/L	
Alkalinity, Bicarbonate (CaCO3)	**Method: 2320B**				
Analysis Date: 01/15/09 13:30					
Alkalinity, Bicarbonate (CaCO3)		390	5	mg/L	
Alkalinity, Carbonate (CaCO3)	**Method: 2320B**				
Analysis Date: 01/15/09 13:30					
Alkalinity, Carbonate (CaCO3)		< 5	5	mg/L	
Chloride	**Method: 4500Cl, E**				
Analysis Date: 01/14/09					
Chloride		42	5	mg/L	
Sulfate	**Method: 375.2R2.0**				
Analysis Date: 01/15/09					
Sulfate		79	15	mg/L	

First Environmental Laboratories, Inc.
IL ELAP / NELAC Accreditation # 100292
1600 Shore Road • Naperville, Illinois 60563 • Phone (630) 778-1200 • Fax (630) 778-1233

Analytical Report

Client: STS CONSULTANTS (VERN)
Project ID: McHenry County 200804080
Sample ID: 7-HRT-I
Sample No: 9-0115-014

Date Collected: 01/08/09
Time Collected: 13:45
Date Received: 01/13/09
Date Reported: 01/20/09

Analyte		Result	R.L.	Units	Flags
Total Metals	**Method: 6020A**		**Preparation Method 3010A**		
Analysis Date: 01/16/09			Preparation Date: 01/15/09		
Calcium		70.0	0.1	mg/L	
Iron		0.87	0.01	mg/L	
Magnesium		36.9	0.1	mg/L	
Potassium		1.5	0.1	mg/L	
Sodium		34.8	0.1	mg/L	
Alkalinity, Bicarbonate (CaCO3)	**Method: 2320B**				
Analysis Date: 01/15/09 13:30					
Alkalinity, Bicarbonate (CaCO3)		360	5	mg/L	
Alkalinity, Carbonate (CaCO3)	**Method: 2320B**				
Analysis Date: 01/15/09 13:30					
Alkalinity, Carbonate (CaCO3)		< 5	5	mg/L	
Chloride	**Method: 4500Cl, E**				
Analysis Date: 01/14/09					
Chloride		10	5	mg/L	
Sulfate	**Method: 375.2R2.0**				
Analysis Date: 01/15/09					
Sulfate		26	15	mg/L	

First Environmental Laboratories, Inc.
IL ELAP / NELAC Accreditation # 100292
1600 Shore Road • Naperville, Illinois 60563 • Phone (630) 778-1200 • Fax (630) 778-1233

Analytical Report

Client: STS CONSULTANTS (VERN)
Project ID: McHenry County 200804080
Sample ID: 7-HRT-D
Sample No: 9-0115-013

Date Collected: 01/08/09
Time Collected: 14:30
Date Received: 01/13/09
Date Reported: 01/20/09

Analyte		Result	R.L.	Units	Flags
Total Metals	**Method: 6020A**		**Preparation Method 3010A**		
Analysis Date: 01/16/09			Preparation Date: 01/15/09		
Calcium		79.3	0.1	mg/L	
Iron		0.65	0.01	mg/L	
Magnesium		42.7	0.1	mg/L	
Potassium		2.2	0.1	mg/L	
Sodium		32.3	0.1	mg/L	
Alkalinity, Bicarbonate (CaCO3)	**Method: 2320B**				
Analysis Date: 01/15/09 13:30					
Alkalinity, Bicarbonate (CaCO3)		370	5	mg/L	
Alkalinity, Carbonate (CaCO3)	**Method: 2320B**				
Analysis Date: 01/15/09 13:30					
Alkalinity, Carbonate (CaCO3)		< 5	5	mg/L	
Chloride	**Method: 4500Cl, E**				
Analysis Date: 01/14/09					
Chloride		32	5	mg/L	
Sulfate	**Method: 375.2R2.0**				
Analysis Date: 01/15/09					
Sulfate		21	15	mg/L	

Field Well Sampling Sheet

Fill out the entire form. If it does not apply, mark N/A.

Project Name: McHenry County
STS Job No. 200804080
Location: Hartland
Tester: Brian Schmidt
Well Number: 7-HRT-5'
Date Sampled: 1/8/09
Previous Well Sampled: 10-MAR-5'

GENERAL CONDITIONS:

						If Missing Replaced?
Surface Seal:	✓ Ok		Damaged		Missing:	Yes No
Protector Pipe:	✓ Ok		Damaged		Missing:	Yes No
Well Cap:	✓ Ok		Damaged		Missing:	Yes No
Ambient Temperature: 20 °F		✓ Clear		Cloudy	Rain	

WELL DATA:

Measuring Device: Solinist Water Level Meter
Stick Up or Down: UP (from Ground Surface)
Depth to Water: 37.17 (from TPVC)
Depth to Bottom: 62 (from TPVC)
Length of Water:
Free Product Observed: ☐ Yes ✓ No Thickness: N/A

PURGING/SAMPLING:

Well Purging Calculations: Amount to purge = 0.163 gallons/foot times height of water column in feet for one well volume

Purging Device: Bladder Pump
Sampling Device: Bladder Pump
Volume Required:
✓ See back of page for field readings during purge
Volume Purged:
Could Well Bail Dry? ☐ Yes ✓ No
Purging - Time Start: 9:20
Time Ended: 1220
Decon Method: Alconox

IN-SITU TESTING:

Turbidity: ☐ Turbid ☐ Opaque
Odor:
Color
pH @ degrees C
Uncorrected Conductivity X
Water Temp. (from Cond.)
Comments: SP: 1155

SAMPLES COLLECTED

Vocs -		Cyanide	
Metals -		Hexchrome	
SVOC		Alkalinity	
TOC		Chloride	
Sulfide		Ammonia	
Phenolics		COD	

Well Purging Log

Date 1/8/09

Time	Temp	pH	Conductivity	~~ORP~~ Turb	~~DO~~ Rate
1/8/09 CAL	8.2	4.00	4560	0	—
STOPPED @ 940	DUE TO LINE FREEZE		RESTART @ 1010		
1030	5.8	7.27	1300	999	250 mL/min
1040	6.3	7.44	1240	999	"
1055	7.8	7.61	1230	312	"
1100	6.9	7.71	1240	283	"
STOPPED @ 1100	DUE TO LINE FREEZE		RESTART @ 1130		
1150	7.2	8.35	1140	394	~ 50 mL/min
ST: 1155					

Field Well Sampling Sheet

Fill out the entire form. If it does not apply, mark N/A.

Project Name: McHenry County
STS Job No. 200804080
Location: Hartland
Tester: Brian Schmidt
Well Number: 7-HRT-I
Date Sampled: 1/8/09
Previous Well Sampled: 7-HRT-5

GENERAL CONDITIONS:

					If Missing Replaced?
Surface Seal:	[X] Ok	[ ] Damaged	[ ] Missing:	Yes	No
Protector Pipe:	[X] Ok	[ ] Damaged	[ ] Missing:	Yes	No
Well Cap:	[X] Ok	[ ] Damaged	[ ] Missing:	Yes	No

Ambient Temperature: 20 °F [X] Clear [ ] Cloudy [ ] Rain

WELL DATA:

Measuring Device: Solinist Water Level Meter
Stick Up or Down: UP (from Ground Surface)
Depth to Water: 37.45 (from TPVC)
Depth to Bottom: 115 (from TPVC)
Length of Water:

Free Product Observed: [ ] Yes [X] No Thickness: N/A

PURGING/SAMPLING:

Well Purging Calculations: Amount to purge = 0.163 gallons/foot times height of water column in feet for one well volume

Purging Device: Bladder Pump
Sampling Device: Bladder Pump
Volume Required:
[X] See back of page for field readings during purge
Volume Purged:
Could Well Bail Dry? [ ] Yes [X] No
Purging - Time Start: 1240
Time Ended:
Decon Method: Alconox

IN-SITU TESTING:

Turbidity: [ ] Turbid [ ] Opaque
Odor:
Color
pH @ degrees C
Uncorrected Conductivity X
Water Temp. (from Cond.)
Comments: ST: 1345

SAMPLES COLLECTED

Vocs -	[ ]	Cyanide	[ ]
Metals -	[ ]	Hexchrome	[ ]
SVOC	[ ]	Alkalinity	[ ]
TOC	[ ]	Chloride	[ ]
Sulfide	[ ]	Ammonia	[ ]
Phenolics	[ ]	COD	[ ]

Well Purging Log

Date 1/8/09

Time		Temp	pH	Conductivity	~~ORP~~ TURB	~~DO~~ RATE
1/8/09	1300	9.8	8.08	1020	999	250 ML/MIN
	1305	9.9	8.01	848	275	"
	1310	8.8	8.00	844	193	"
	1315	10.2	7.96	808	124	"
	1320	10.8	8.00	799	106	"
	1325	11.0	7.98	794	31	"
	1330	11.0	7.82	788	27	"
	1335	11.1	7.98	785	18	"
	1340	11.1	7.96	785	15	"
	ST: 1340					

Field Well Sampling Sheet

Fill out the entire form. If it does not apply, mark N/A.

Project Name: McHenry County
STS Job No. 200304080
Location: Hartland
Tester: Brian Schmidt
Well Number: 7-HRT-D
Date Sampled: 1/8/09
Previous Well Sampled: 7-HRT-I

GENERAL CONDITIONS:

					If Missing Replaced?
Surface Seal:	☒ Ok	☐ Damaged	☐	Missing:	Yes No
Protector Pipe:	☒ Ok	☐ Damaged	☐	Missing:	Yes No
Well Cap:	☒ Ok	☐ Damaged	☐	Missing:	Yes No
Ambient Temperature: 20 °F	☒ Clear	☐ Cloudy	☐	Rain	

WELL DATA:

Measuring Device: Solinist Water Level Meter
Stick Up or Down: UP (from Ground Surface)
Depth to Water: 38.01 (from TPVC)
Depth to Bottom: 165 (from TPVC)
Length of Water:
Free Product Observed: ☐ Yes ☒ No Thickness: N/A

PURGING/SAMPLING:

Well Purging Calculations: Amount to purge = 0.163 gallons/foot times height of water column in feet for one well volume

Purging Device: Bladder Pump
Sampling Device: Bladder Pump
Volume Required:
☒ See back of page for field readings during purge
Volume Purged:
Could Well Bail Dry? ☐ Yes ☒ No
Purging - Time Start: 1350
Time Ended: 1435
Decon Method: Alconox

IN-SITU TESTING:

Turbidity: ☐ Turbid ☐ Opaque
Odor:
Color
pH @ degrees C
Uncorrected Conductivity X
Water Temp. (from Cond.)
Comments: ST: 1430

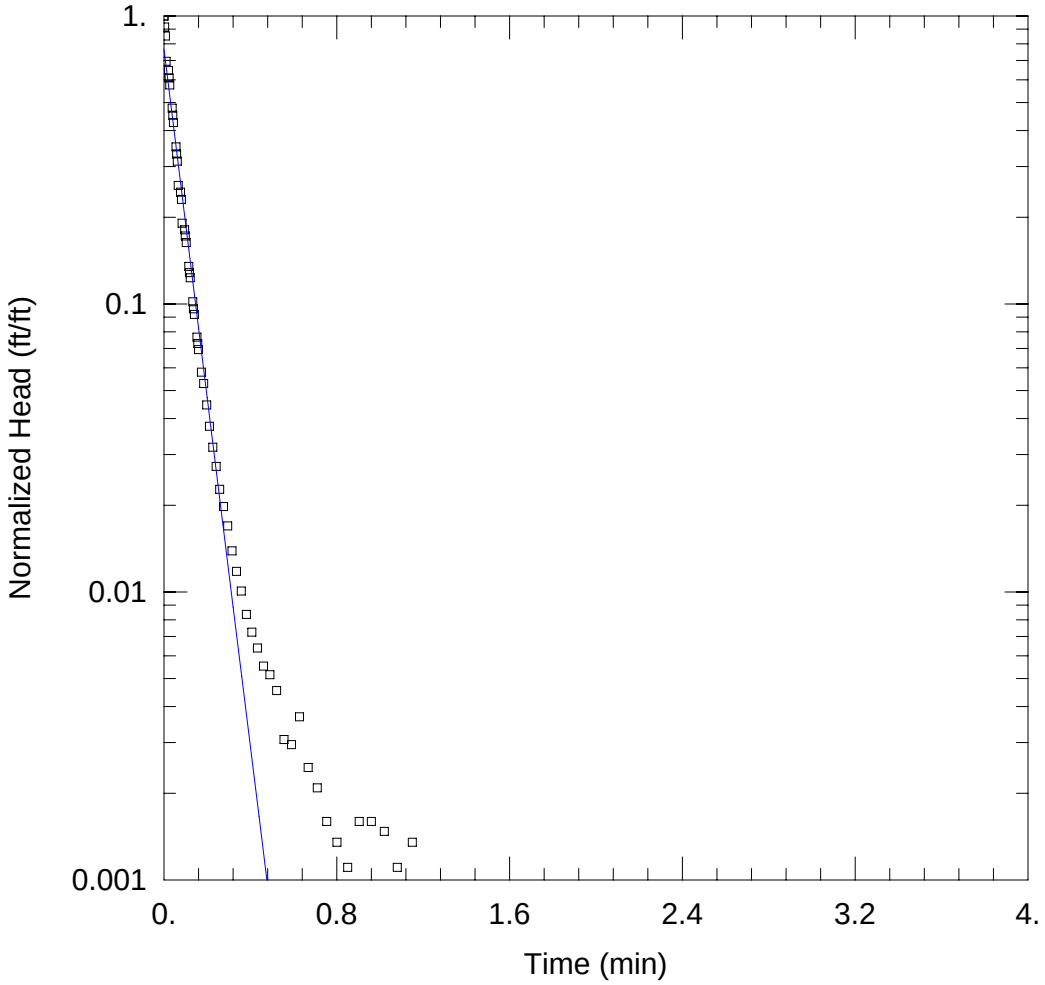
SAMPLES COLLECTED

Vocs -	☐	Cyanide	☐
Metals -	☐	Hexchrome	☐
SVOC	☐	Alkalinity	☐
TOC	☐	Chloride	☐
Sulfide	☐	Ammonia	☐
Phenolics	☐	COD	☐

Well Purging Log

Date 1/8/09

Time		Temp	pH	Conductivity	~~ORP~~ TURB	~~DO~~ RATE
1/8/09	1355	7.5	7.79	880	143	250 ml/min
	1405	10.0	7.78	877	33	"
	1410	10.7	7.95	876	20	"
	1415	10.8	7.95	878	22	"
	1420	10.5	7.94	878	24	"
	1425	10.3	7.94	878	25	"
	1430	10.2	7.94	878	26	"



WELL TEST ANALYSIS

Data Set: K:\PROJECTS\200804080\In_Progress\Troll-files\AQTESOLV-files\7-HRT-S_001_B&R.aqt
Date: 04/05/09 Time: 12:18:25

PROJECT INFORMATION

Company: AECOM
Client: USACE / McHenry Cty
Project: 09000-460 (h200804080)
Location: McHenry County, IL
Test Date: Feb. 22, 2009

AQUIFER DATA

Saturated Thickness: 6. ft
Anisotropy Ratio (Kz/Kr): 0.33

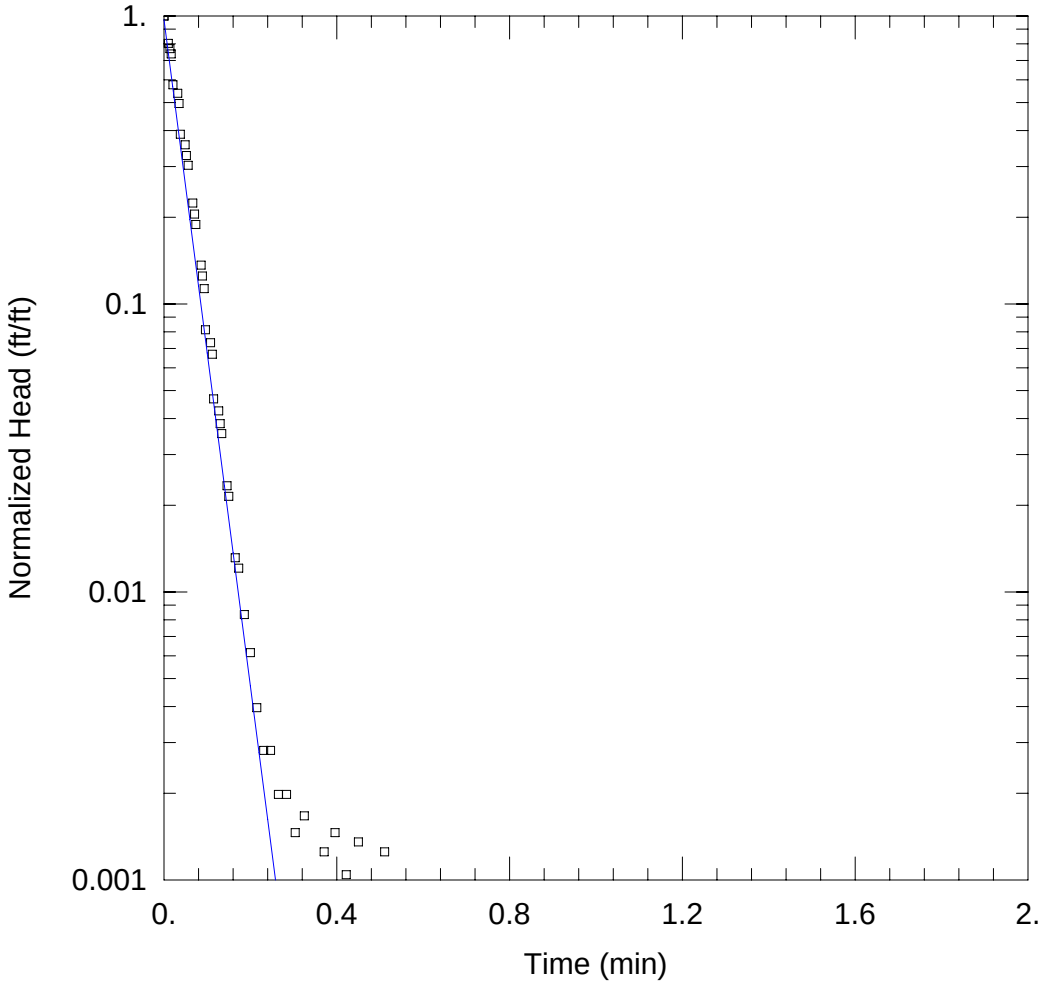
WELL DATA (7-HRT-S)

Initial Displacement: 8.14 ft
Total Well Penetration Depth: 5.8 ft
Casing Radius: 0.083 ft
Static Water Column Height: 26.6 ft
Screen Length: 4.5 ft
Well Radius: 0.25 ft
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 0.01422 cm/sec
y0 = 6.236 ft



WELL TEST ANALYSIS

Data Set: K:\PROJECTS\200804080\In_Progress\Troll-files\AQTESOLV-files\7-HRT-I_001_B&R.aqt
Date: 04/05/09 Time: 09:47:12

PROJECT INFORMATION

Company: AECOM
Client: USACE / McHenry Cty
Project: 09000-460 (h200804080)
Location: McHenry County, IL
Test Date: Feb. 22, 2009

AQUIFER DATA

Saturated Thickness: 36. ft
Anisotropy Ratio (Kz/Kr): 0.33

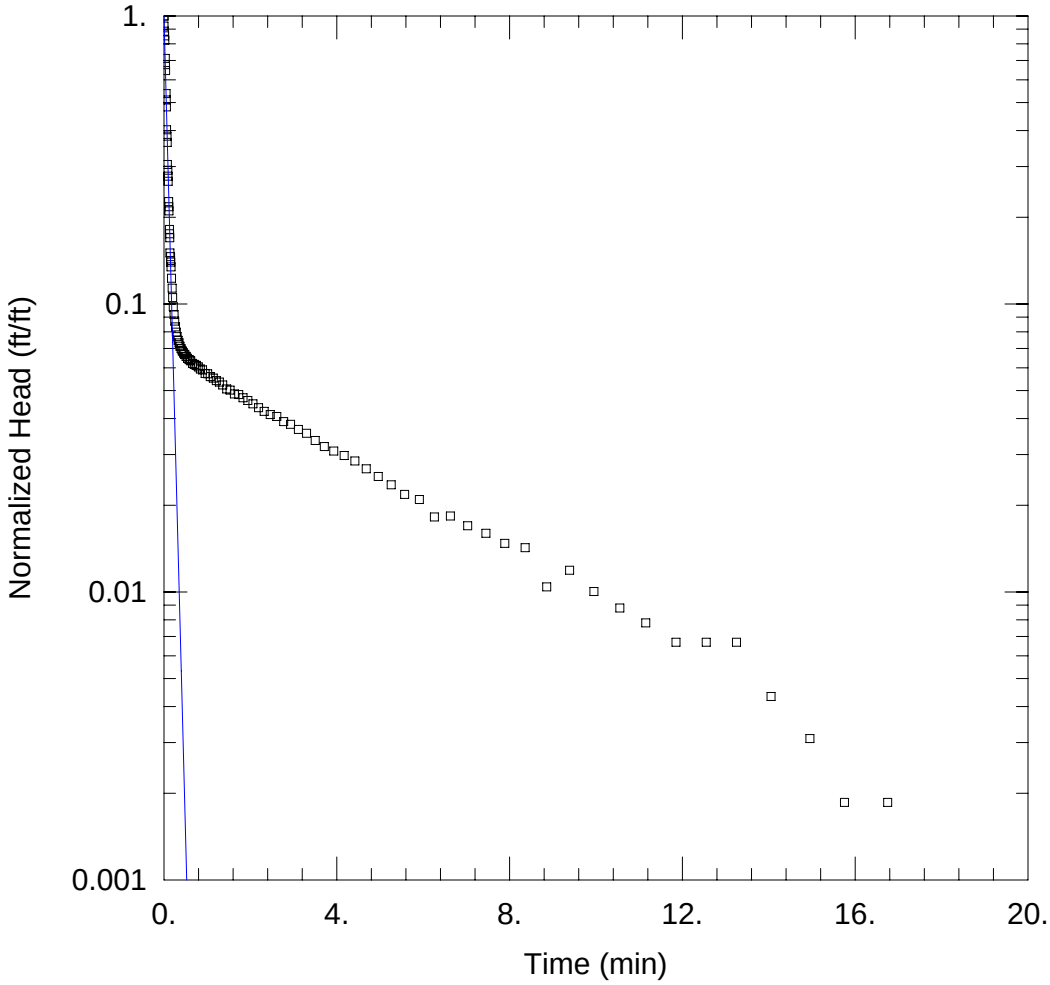
WELL DATA (7-HRT-I)

Initial Displacement: 9.59 ft
Static Water Column Height: 77.1 ft
Total Well Penetration Depth: 33.4 ft
Screen Length: 4.5 ft
Casing Radius: 0.083 ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 0.03252 cm/sec
y0 = 9.306 ft



WELL TEST ANALYSIS

Data Set: C:\...\7-HRT-D_001_B&R_7ft_SAND.aqt
Date: 04/07/09 Time: 10:39:55

PROJECT INFORMATION

Company: AECOM
Client: USACE / McHenry Cty
Project: 09000-460 (h200804080)
Location: McHenry County, IL
Test Date: Feb. 22, 2009

AQUIFER DATA

Saturated Thickness: 7. ft
Anisotropy Ratio (Kz/Kr): 0.33

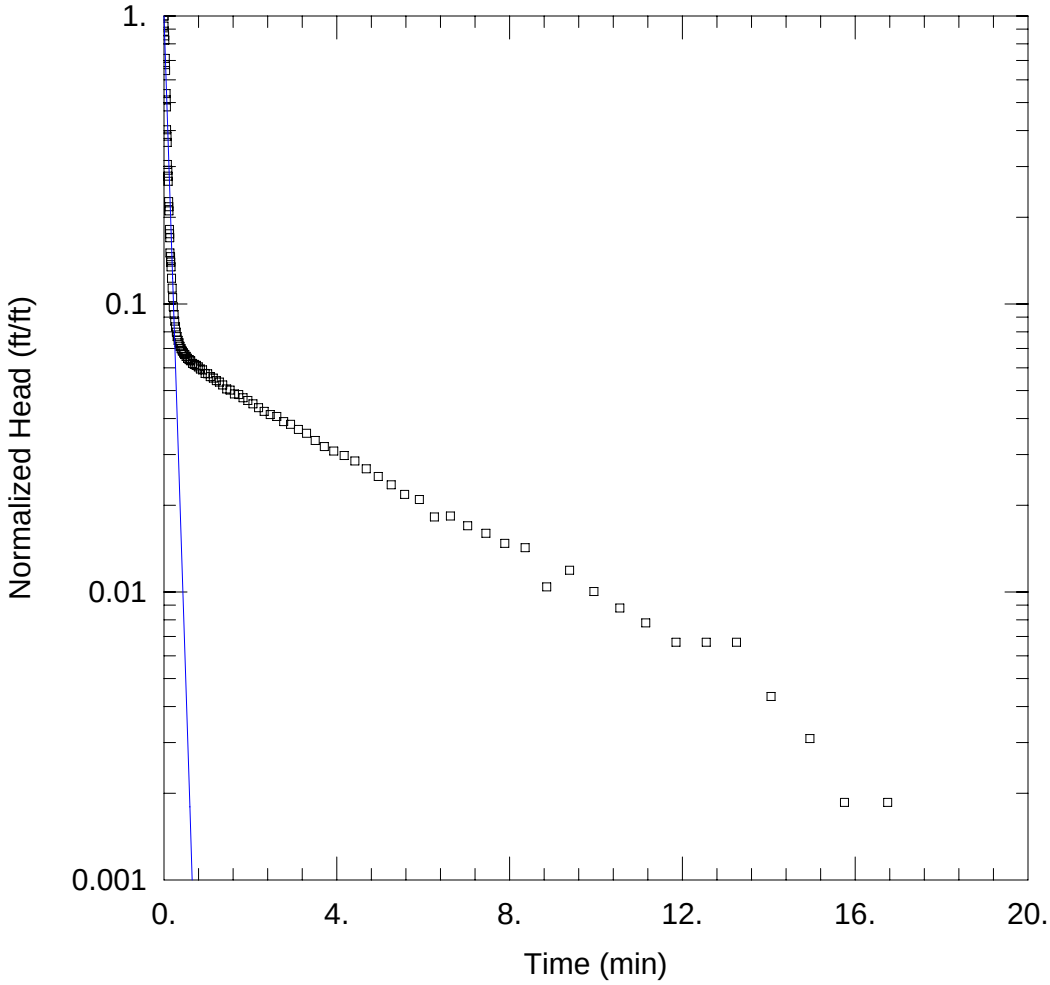
WELL DATA (7-HRT-D)

Initial Displacement: 8.07 ft
Total Well Penetration Depth: 6.2 ft
Casing Radius: 0.083 ft
Static Water Column Height: 128.1 ft
Screen Length: 4.5 ft
Well Radius: 0.25 ft
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 0.01297 cm/sec
y0 = 8.201 ft



WELL TEST ANALYSIS

Data Set: C:\...\7-HRT-D_001_B&R_150ft_SAND.aqt
Date: 04/07/09 Time: 10:40:25

PROJECT INFORMATION

Company: AECOM
Client: USACE / McHenry Cty
Project: 09000-460 (h200804080)
Location: McHenry County, IL
Test Date: Feb. 22, 2009

AQUIFER DATA

Saturated Thickness: 150. ft
Anisotropy Ratio (Kz/Kr): 0.33

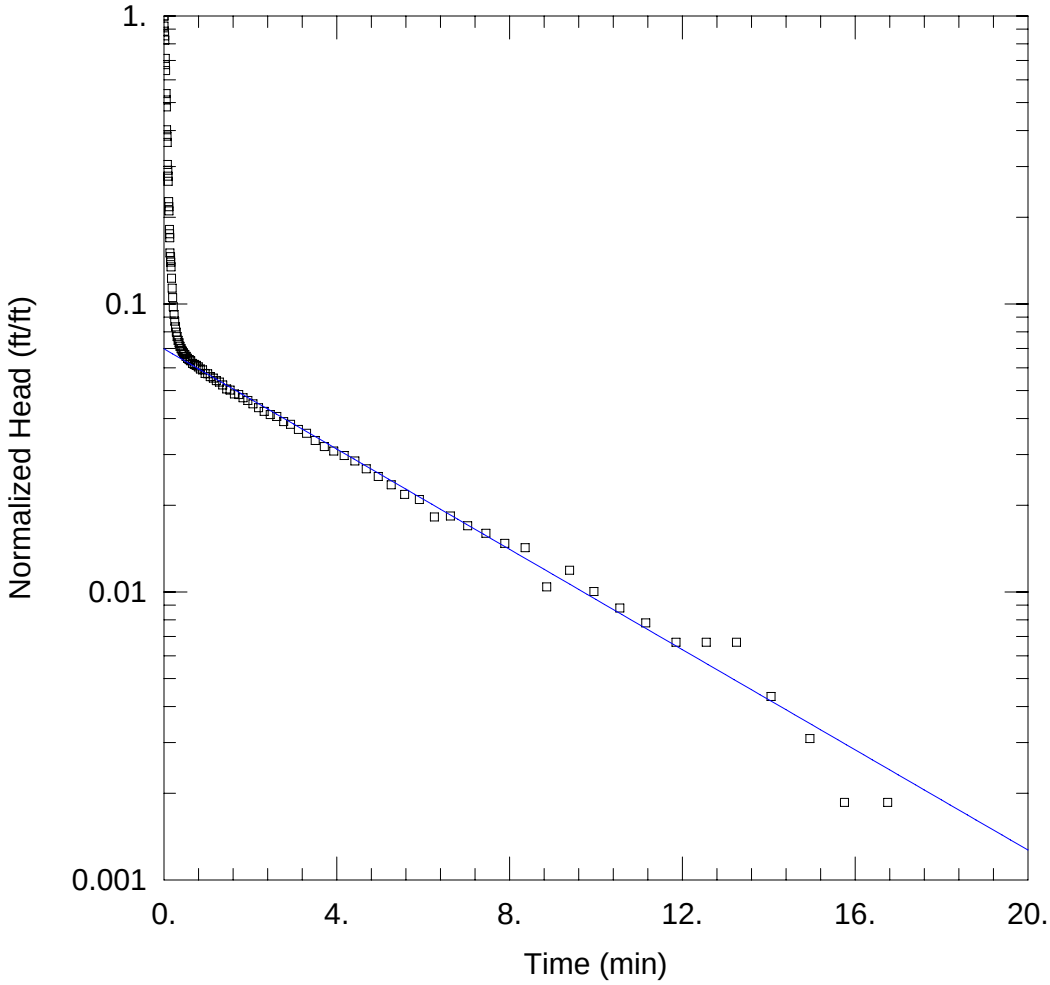
WELL DATA (7-HRT-D)

Initial Displacement: 8.07 ft
Total Well Penetration Depth: 6.2 ft
Casing Radius: 0.083 ft
Static Water Column Height: 128.1 ft
Screen Length: 4.5 ft
Well Radius: 0.25 ft
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 0.009153 cm/sec
y0 = 8.201 ft



WELL TEST ANALYSIS

Data Set: C:\...\7-HRT-D_001_B&R_7ft_BDRKaqt.aqt
Date: 04/07/09 Time: 10:41:39

PROJECT INFORMATION

Company: AECOM
Client: USACE / McHenry Cty
Project: 09000-460 (h200804080)
Location: McHenry County, IL
Test Date: Feb. 22, 2009

AQUIFER DATA

Saturated Thickness: 7. ft
Anisotropy Ratio (Kz/Kr): 0.33

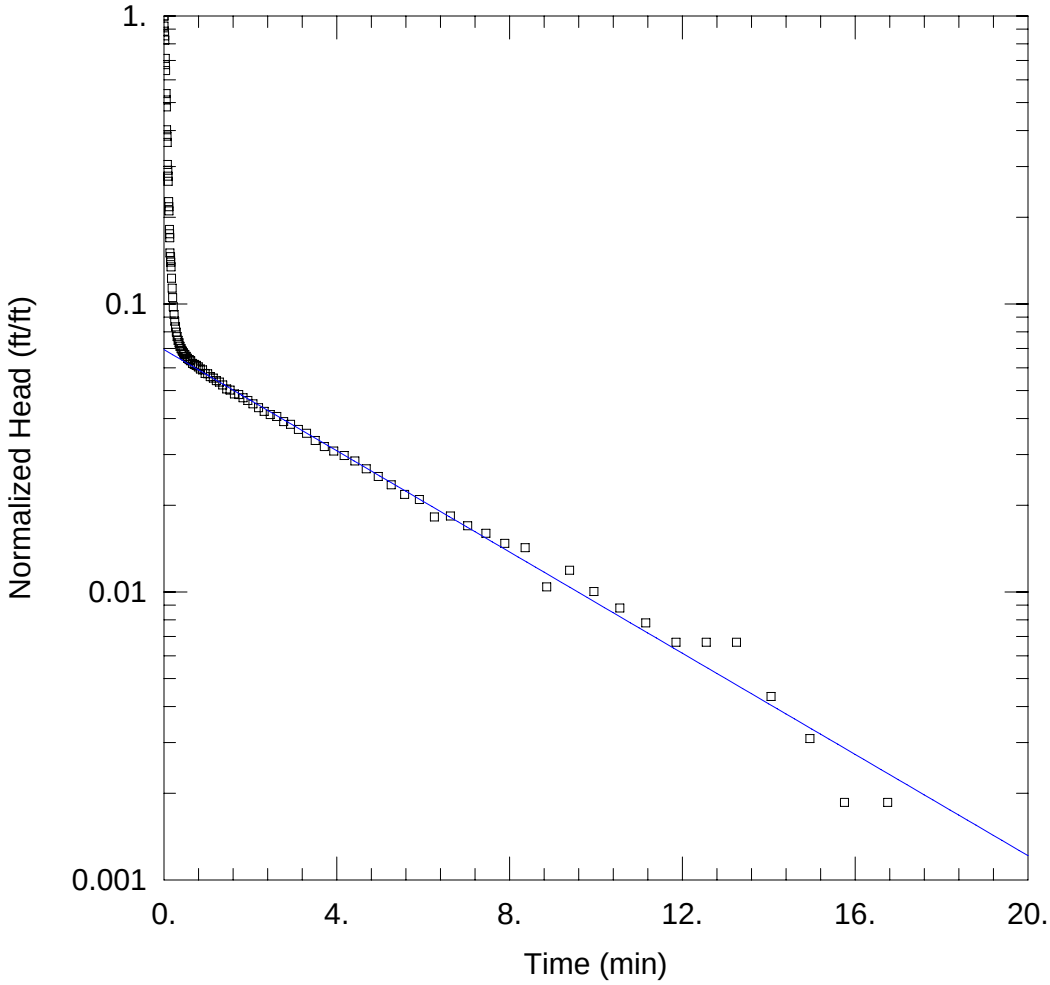
WELL DATA (7-HRT-D)

Initial Displacement: 8.07 ft
Total Well Penetration Depth: 6.2 ft
Casing Radius: 0.083 ft
Static Water Column Height: 128.1 ft
Screen Length: 4.5 ft
Well Radius: 0.25 ft
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 0.0001979 cm/sec
y0 = 0.5634 ft



WELL TEST ANALYSIS

Data Set: C:\...\7-HRT-D_001_B&R_150ft_BDRK.aqt
Date: 04/07/09 Time: 11:42:39

PROJECT INFORMATION

Company: AECOM
Client: USACE / McHenry Cty
Project: 09000-460 (h200804080)
Location: McHenry County, IL
Test Date: Feb. 22, 2009

AQUIFER DATA

Saturated Thickness: 150. ft
Anisotropy Ratio (Kz/Kr): 0.33

WELL DATA (7-HRT-D)

Initial Displacement: 8.07 ft
Total Well Penetration Depth: 6.2 ft
Casing Radius: 0.083 ft
Static Water Column Height: 128.1 ft
Screen Length: 4.5 ft
Well Radius: 0.25 ft
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 0.0001752 cm/sec
y0 = 0.5601 ft

Additional Well Site Information

In-Situ Inc.

7-HRT-5

Calibration Report

Report Number: 20090109195749-140465

221 East Lincoln Avenue, Fort Collins, CO 80524 USA
1-970-498-1500, 1-800-446-7488, FAX: 1-970-498-1598
Visit us at www.in-situ.com

Instrument Details:

Instrument Model:	**Level TROLL 500**
Full Scale Pressure Range	**206.84 KPa (30 PSI) vented**
Serial Number:	**140465**

Calibration Details:

Calibration Result:	**PASS**
Calibration Date:	2009-01-09 19:57:49 (UTC)
Nominal Range of Applied Temperature:	-5 C to +50 C
Temperature Accuracy Specification:	+/- 0.1 C From 0 C to +50 C
Nominal Range of Applied Pressure:	0 KPa to 206.8 KPa (0.0 PSI to 30.0 PSI)
Pressure Accuracy Specification:	+/- 0.1 %FS from -5 C to +50 C, +/- 0.05 %FS at +15 C

Post-Calibration Check:

Parameter	Applied	Reported	Deviation
Pressure	30.0001	29.9970	-0.0104
Pressure	0.0008	-0.0033	-0.0138
Temperature	19.9000	19.9193	0.0193

Calibration Procedures and Equipment Used:

Automated calibration procedures used.
Manu Agilent Model 34970A SerialNo MY44015965
Manu Instrulab Model 3312A-14-15-24 SerialNo 31103-(41012)
Manu Instrulab Model 406X-0031-01 SerialNo 2-31138
Manu MENSOR Model 600 SerialNo 621435
Manu Agilent Model 53131A SerialNo MY47000169
Manu MENSOR Model 600 SerialNo 621385

Notes:

1. Standards used in this calibration are traceable to the National Institute of Standards and Technology.
2. This calibration report shall not be reproduced, except in full, without the written approval of In-Situ, Inc.
3. A calibration interval of 12 to 18 months is recommended.
4. The post-calibration data is collected at nominal +20 C.
5. 1.0 PSI = 6.894757 KPa

Performed By: NJH

Copyright © 2006 In-Situ, Inc.

In-Situ Inc.

7-HRT-I

Calibration Report

Report Number: 20090123142910-140933

221 East Lincoln Avenue, Fort Collins, CO 80524 USA
1-970-498-1500, 1-800-446-7488, FAX: 1-970-498-1598
Visit us at www.in-situ.com

Instrument Details:

Instrument Model:	**Level TROLL 500**
Full Scale Pressure Range	**206.84 KPa (30 PSI) vented**
Serial Number:	**140933**

Calibration Details:

Calibration Result:	**PASS**
Calibration Date:	2009-01-23 14:29:10 (UTC)
Nominal Range of Applied Temperature:	-5 C to +50 C
Temperature Accuracy Specification:	+/- 0.1 C From 0 C to +50 C
Nominal Range of Applied Pressure:	0 KPa to 206.8 KPa (0.0 PSI to 30.0 PSI)
Pressure Accuracy Specification:	+/- 0.1 %FS from -5 C to +50 C, +/- 0.05 %FS at +15 C

Post-Calibration Check:

Parameter	Applied	Reported	Deviation
Pressure	30.0002	29.9996	-0.0019
Pressure	0.0005	-0.0037	-0.0142
Temperature	19.9040	19.9195	0.0155

Calibration Procedures and Equipment Used:

Automated calibration procedures used.
Manu Agilent Model 34970A SerialNo MY44015965
Manu Instrulab Model 3312A-14-15-24 SerialNo 31103-(41012)
Manu Instrulab Model 406X-0031-01 SerialNo 2-31138
Manu MENSOR Model 600 SerialNo 621435
Manu Agilent Model 53131A SerialNo MY47000169
Manu MENSOR Model 600 SerialNo 621385

Notes:

1. Standards used in this calibration are traceable to the National Institute of Standards and Technology.
2. This calibration report shall not be reproduced, except in full, without the written approval of In-Situ, Inc.
3. A calibration interval of 12 to 18 months is recommended.
4. The post-calibration data is collected at nominal +20 C.
5. 1.0 PSI = 6.894757 KPa

Performed By: JBO

Copyright © 2006 In-Situ, Inc.

In-Situ Inc.

7-HRT-D

Calibration Report

Report Number: 20090112162236-140500

221 East Lincoln Avenue, Fort Collins, CO 80524 USA
1-970-498-1500, 1-800-446-7488, FAX: 1-970-498-1598
Visit us at www.in-situ.com

Instrument Details:

Instrument Model:	**Level TROLL 500**
Full Scale Pressure Range	**206.84 KPa (30 PSI) vented**
Serial Number:	**140500**

Calibration Details:

Calibration Result:	**PASS**
Calibration Date:	2009-01-12 16:22:36 (UTC)
Nominal Range of Applied Temperature:	-5 C to +50 C
Temperature Accuracy Specification:	+/- 0.1 C From 0 C to +50 C
Nominal Range of Applied Pressure:	0 KPa to 206.8 KPa (0.0 PSI to 30.0 PSI)
Pressure Accuracy Specification:	+/- 0.1 %FS from -5 C to +50 C, +/- 0.05 %FS at +15 C

Post-Calibration Check:

Parameter	Applied	Reported	Deviation
Pressure	30.0001	29.9983	-0.0060
Pressure	0.0001	-0.0018	-0.0062
Temperature	19.9990	20.0189	0.0199

Calibration Procedures and Equipment Used:

Automated calibration procedures used.
Manu Agilent Model 34970A SerialNo MY44038788
Manu Instrulab Model 3312A-14-15-24 SerialNo 31138
Manu Instrulab Model 406X-0031-01 SerialNo 1-31118
Manu MENSOR Model 600 SerialNo 622742
Manu Agilent Model 53131A SerialNo MY47000169
Manu MENSOR Model 600 SerialNo 621385

Notes:

1. Standards used in this calibration are traceable to the National Institute of Standards and Technology.
2. This calibration report shall not be reproduced, except in full, without the written approval of In-Situ, Inc.
3. A calibration interval of 12 to 18 months is recommended.
4. The post-calibration data is collected at nominal +20 C.
5. 1.0 PSI = 6.894757 KPa

Performed By: JBO

Copyright © 2006 In-Situ, Inc.

Hartland Township Well Site – Staked Location

Hartland Township Well Site – Set up on Hole

Hartland Township Well Site – Wells Installed

Hartland Township Well Site

Hartland Township Well Site

Hartland Township Well Site – Inside Well Casing

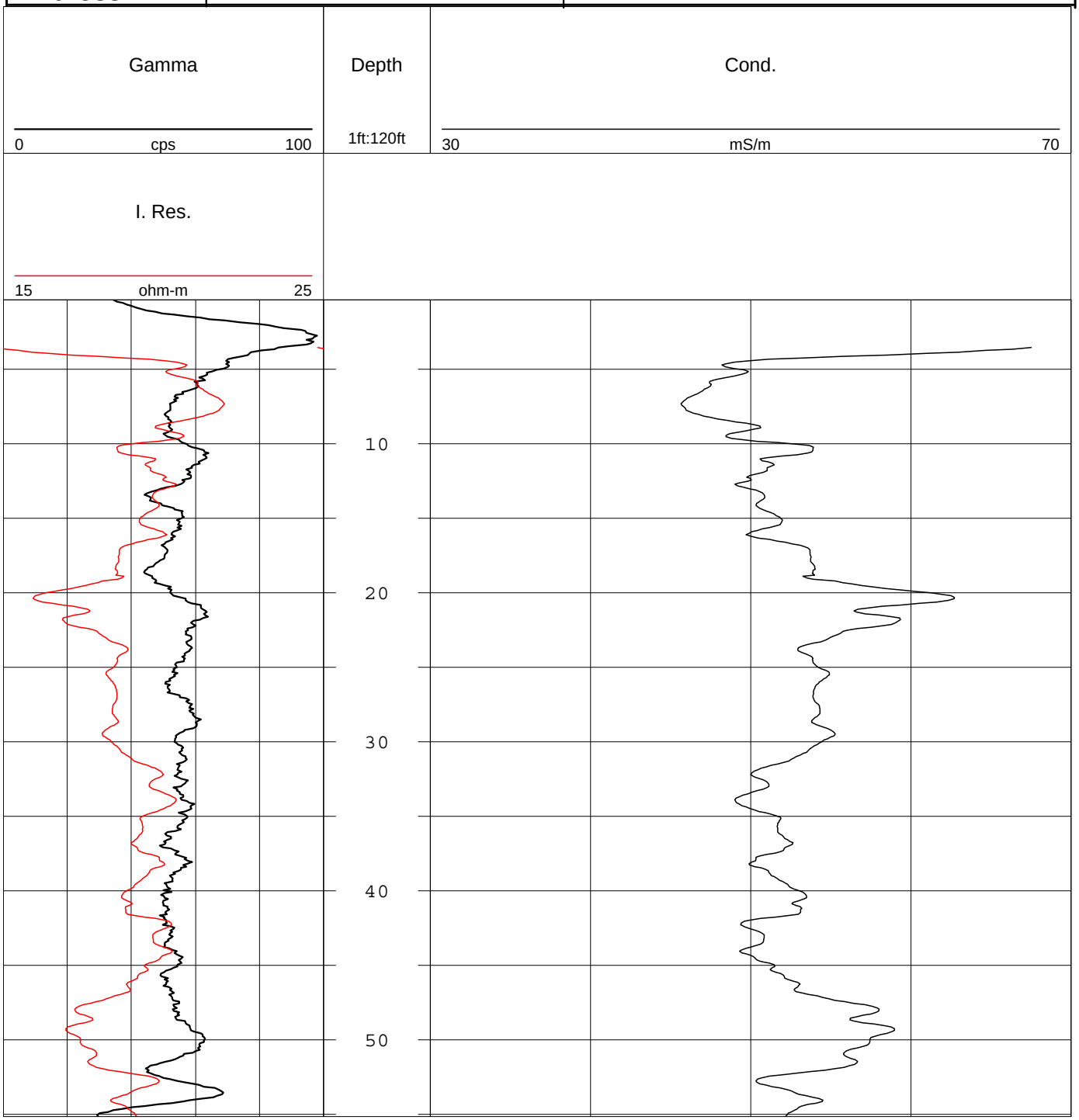
Hartland Township Well Site – Inside Well Casing

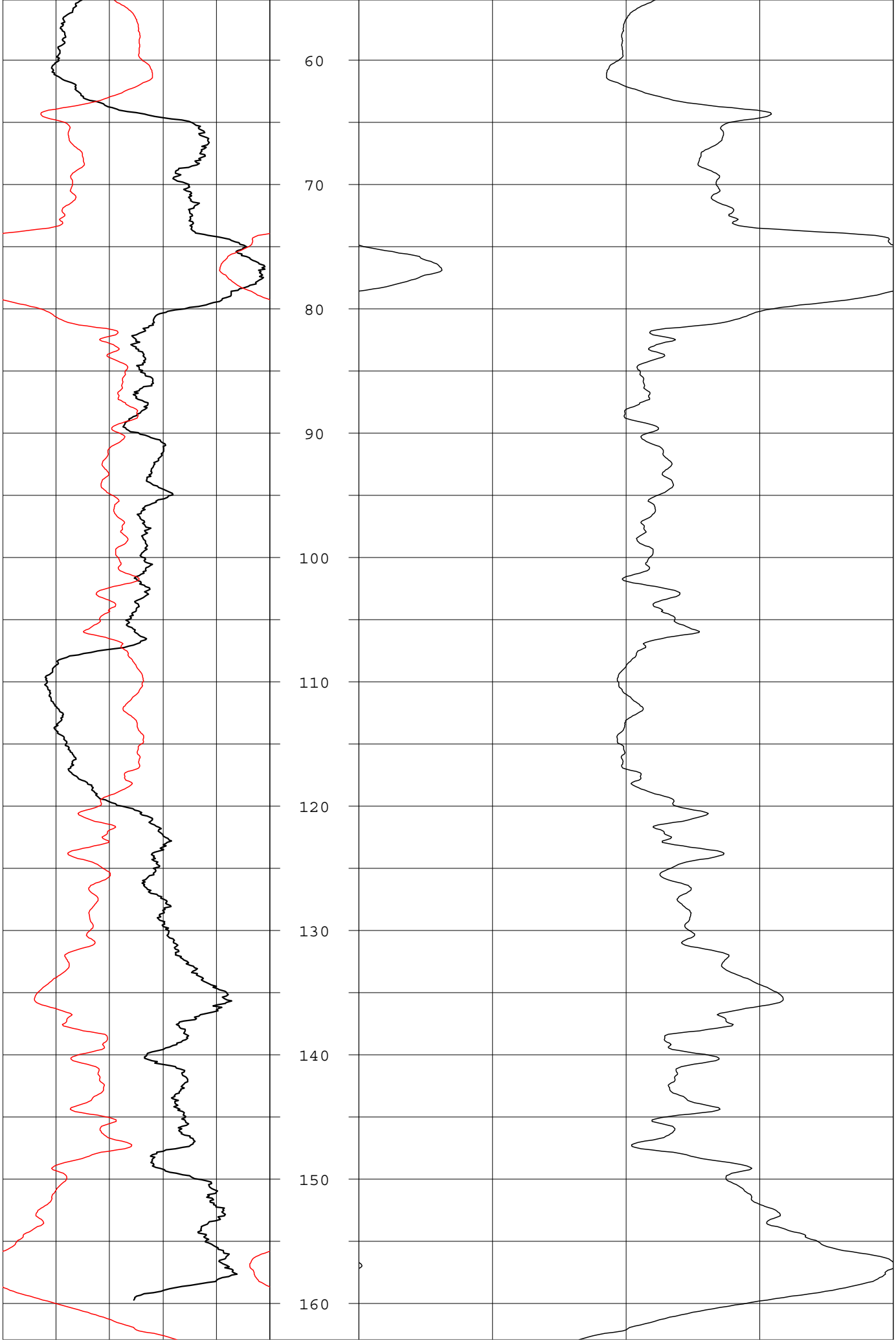
COMPANY:	MCHENRY CO. & USACE
Location:	HARTLAND TWP

Well	HARTLAND TWP #		
Date	1/23/2009	BH Fluid	FORMATION
Casing	2" PVC 2.5' AGS - 165.0 'BGS		
File Name	MCHTH7-09EMGAM		
Depth Driller	165.0' BGS		
Depth Logger	165.3' BGS		
Logged by:	T. YOUNG		
Witness:	C. MCKINNEY		

OTHER SERVICES

H2O LEVEL & GPS




60
70
80
90
100
110
120
130
140
150
160

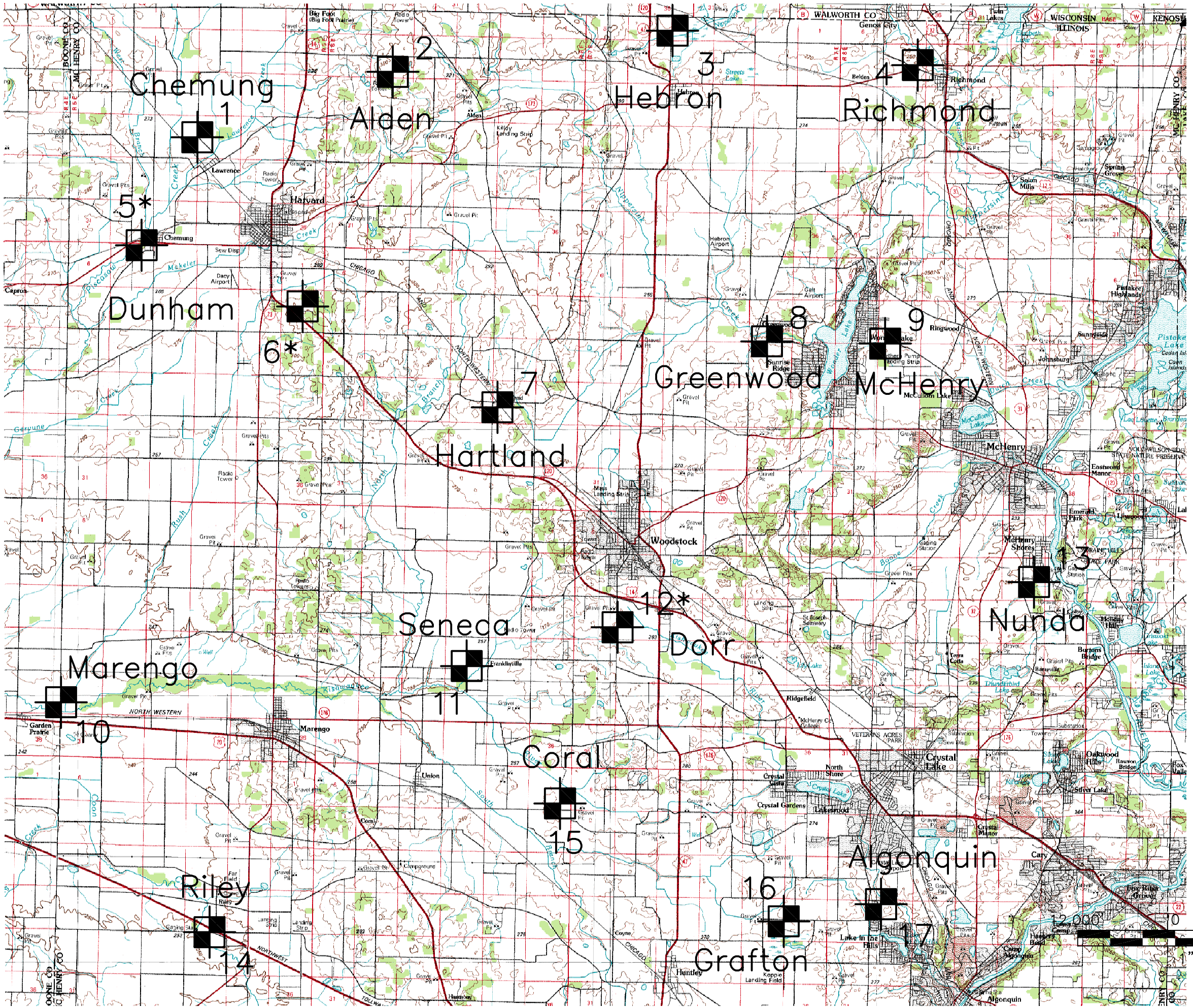
A-8: Folio for Well Site #8 – Greenwood Township

Table of Contents

I.) Site Location Map – Location in County
II.) Site Location Map – Location on USGS Topographic Map
III.) Site Location Map – Location on USGS High Resolution Orthophoto
IV.) Site Boring Log
V.) Well Construction Diagram
VI.) Well Site Summary and Commentary
VII.) Particle Size Distribution Report
VIII.) Table of Water Level Measurements
IX.) Well Development Field Log
X.) Water Quality Analysis Results
XI.) Groundwater Sampling Field Log
XII.) Hydraulic Conductivity Testing Results
XIII.) In-Situ LevelTroll™ Calibration Report
XIV.) Site Photographs
XV.) Downhole Geophysical Testing

Well Site Location Maps

Z:\Projects\200804080\CtyWide\D-09000-460-8000_CtyOverviewMap_004.dwg; 4/20/2009 5:33:59 PM; BRAUN, GARY



LEGEND:

AECOM Well Installation Site

McHenry 9

Well Installations By Others

Dunham 6*

0 12,000 24,000'

" = 12,000'

AECOM

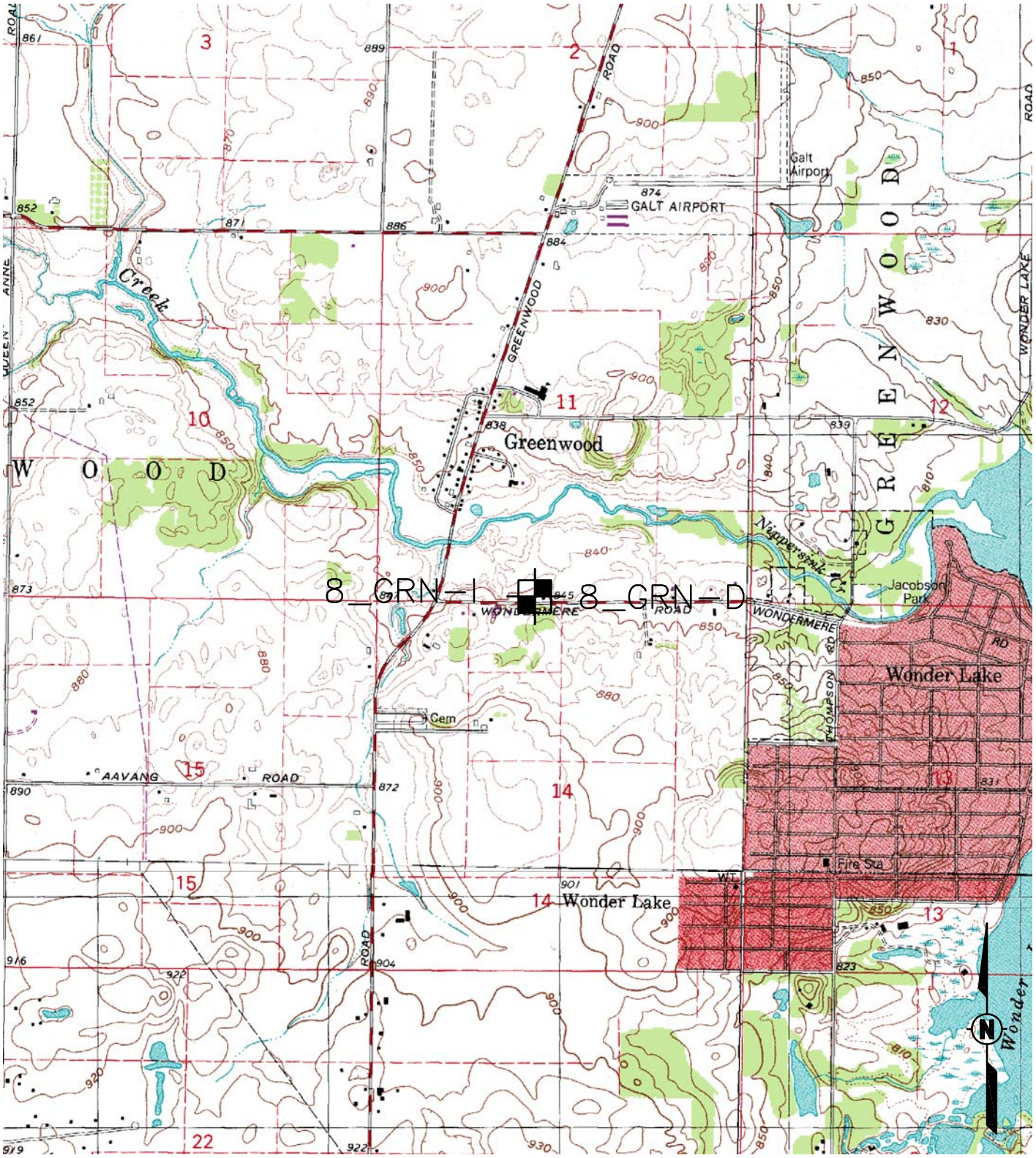
750 Corporate Woods Pkwy
Vernon Hills, IL 60061
847-279-2500
www.aecom.com

Copyright © By: STS Consultants, Ltd.

LOCATION MAP OF WELL SITES

Observation Well Network for Glacial Aquifers
McHenry County, Illinois

Drawn :	CJH	3/11/2009
Checked:	GMB	4/18/2009
Approved:	CSR	4/27/2009
PROJECT NUMBER	09000-460	
FIGURE NUMBER	1	



2000 0 2000 4000

1" = 2000'

AECOM

750 Corporate Woods Parkway
Vernon Hills, IL 60061
847.279.2500
www.aecom.com

Copyright © 2009, By: AECOM

Site Location on USGS Topographic Map
Site No. 8 - Greenwood Township
Barber Fen - Wondermere Rd.
Observation Well Network
McHenry County, Illinois

Drawn :	CJH	04/01/2009
Checked:	GMB	04/15/2009
Approved:	CSR	04/24/2009
PROJECT NUMBER	09000-460	
FIGURE NUMBER	Folio_8 #2	

Z:\Projects\200804080\CityWide\D-09000-460-8000_TopoMaps_v02.dwg; 4/20/2009 10:00:49 AM; BRAUN, GARY; STS_BLACK_040102.ctb

500 0 500 1000

1" = 500'

AECOM

750 Corporate Woods Parkway
Vernon Hills, IL 60061
847.279.2500
www.aecom.com
Copyright © 2009, By: AECOM

2005 USGS High Resolution Orthophoto
Site No. 8 - Greenwood Township
Barber Fen - Wondermere Rd.
Observation Well Network
McHenry County, Illinois

Drawn :	CJH	04/01/2009
Checked:	GMB	04/15/2009
Approved:	CSR	04/24/2009
PROJECT NUMBER	09000-460	
FIGURE NUMBER	Folio_8 #3	

Z:\Projects\200804080\CtyWide\D-09000-460-8000_AerialsMap_004.dwg; 4/21/2009 12:59:34 PM; BRAUN, GARY; STS_BLACK_040102.ctb

Boring and Well Construction Details

DRILLING LOG

DIVISION	USACE
INSTALLATION	Chicago District
SHEET	1 OF 8 SHEETS
1. PROJECT	McHenry County Observation Wells
2. LOCATION (Coordinates or Station)	McHenry County, Illinois N 2,083,102.00 E 969,971.00
3. DRILLING AGENCY	WDC Exploration & Wells
4. HOLE NO. *(As shown on drawing title and file number)*	8-GREENWOOD
5. NAME OF DRILLER	Dan Tonnancour
6. DIRECTION OF HOLE	☒ VERTICAL ☐ INCLINED --- DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN	173.5
8. DEPTH DRILLED INTO ROCK	2.5
9. TOTAL DEPTH OF HOLE	177.0
10. SIZE AND TYPE OF BIT	3 7/8" Carbide Bit / 5 7/8" Casing
11. DATUM FOR ELEVATION SHOWN *(TBM or MSL)*	NAVD 88
12. MANUFACTURER'S DESIGNATION OF DRILL	Super Sonic II
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN	DISTURBED 30 / UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES	N/A
15. ELEVATION GROUND WATER	839.4
16. DATE HOLE	STARTED 9/23/2008 / COMPLETED 9/24/2008
17. ELEVATION TOP OF HOLE	+856.0
18. TOTAL CORE RECOVERY FOR BORING	88 %
19. GEOLOGIST	Gary Braun, LPG IL

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS *(Drilling time, water loss, depth weathering, etc., if significant)* g
+855.5	0.5		Topsoil/Grass	60	1 0.0 5.0	
+854.4	1.6		CL, Brown silty clay, very stiff			
+852.0	4.0		Fill: Gravel, cinder block, sand, loose, damp			
			SC, Mottled brown/reddish brown sandy clay, some fine gravel and silt, trace organics, moist			Sample No. 1 from 4.0' - 5.0' Driller noted cobbles at 4.0'
			Note: Less sandy with depth	100	2 5.0 15.0	Qp = 1.0 TSF @7.0' Sample No. 2 from 8.0' - 9.0'
+845.6	10.4					Qp = 1.0TSF @10.0'
			CL, Reddish brownish gray silty clay, little fine gravel, trace coarse gravel, very stiff damp			Sample No. 3 from 13.0' to 14.0' Qp = 4.5 TSF @14.0'
				98	3 15.0 25.0	Qp = 4.5+ TSF @17.0'
			Note: 1.2' thick intra-till sand seam encountered from 17.8' to 19.0'			Sample No. 4 from 17.0' to 18.0'

DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE 856.0

Hole No. 8-GREENWOOD

PROJECT: McHenry County Observation Wells

INSTALLATION: Chicago District

SHEET 2 OF 8 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
			Note: 1.0" thick sand seam encountered at 19.9' CL, Reddish brownish gray silty clay, little fine gravel, trace coarse gravel, very stiff damp *(continued)* Note: Very thin sand seam encountered at 22.5'			Qp = 4.5+ TSF @21.0' Sample No. 5 from 23.0' to 24.0' Qp = 4.25 TSF @24.0'
+831.0	25.0					
			SW, Gray fine gravelly coarse sand, little fine to medium sand and medium to coarse gravel, loose, wet	75	4 25.0 35.0	Sample No. 6 from 28.0' to 29.0'
+822.5	33.5					
			SP, Grayish brown fine sand, dense, wet			Sample No. 7 from 34.0' to 35.0'
				98	5 35.0 45.0	
			Note: Sample grades to silt from 37.0' to 40.0'			Sample No. 8 from 37.0' to 38.0'
+816.0	40.0					
			CL-ML, Grayish brown clayey silt, trace fine gravel, stiff, moist to wet, medium plasticity			Sample No. 9 from 43.0' to 44.0'
+811.0	45.0					
			CL, Brownish gray sandy and gravelly clay, little silt, medium dense, moist	90	6 45.0	

DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE 856.0

Hole No. 8-GREENWOOD

PROJECT: McHenry County Observation Wells

INSTALLATION: Chicago District

SHEET 3 OF 8 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
			CL, Brownish gray sandy and gravelly clay, little silt, medium dense, moist *(continued)*		55.0	Sample No. 10 from 49.0' to 50.0' Sample No. 11 from 53.0' to 54.0'
+801.2	54.8		GP, Gray fine gravel, some medium gravel, little coarse sand, very loose, wet	40	7 55.0 65.0	Sample No. 12 from 59.0' to 60.0'
+791.0	65.0		SP, Brown medium grained sand, moderately dense, wet	70	8 65.0 75.0	
+787.0	69.0		GW, Brownish gray fine gravel, little fine and coarse gravel, loose, wet Note: Driller noted water production			Sample No. 13 from 69.0' to 70.0' % Gravel/% Sand/% Fines = 68/31/1 from 69.0' to 70.0'

DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE 856.0

Hole No. 8-GREENWOOD

PROJECT: McHenry County Observation Wells

INSTALLATION: Chicago District

SHEET 4 OF 8 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
			approximately 69.0' to 72.0' ; some fines below 72.0' GW, Brownish gray fine gravel, little fine and coarse gravel, loose, wet *(continued)*			Sample No. 14 from 74.0' to 75.0'
+780.0	76.0			100	9 75.0 85.0	
			CL, Brownish gray silty clay, little fine gravel, with occasional gravel seams, stiff, moist to wet			Sample No. 15 from 78.0' to 79.0' Qp = 1.0 TSF @80.0' Qp = >4.5 TSF @81.0' Sample No. 16 from 83.0' to 84.0'
+770.0	86.0			100	10 85.0 95.0	Qp = >4.5 TSF @85.0'
			GP, Brownish gray fine gravel, loose, wet			Sample No. 17 from 88.0' to 89.0'
+767.0	89.0					
			CL, Brownish gray silty clay, trace fine gravel, hard, moist			Sample No. 18 from 93.0' to 94.0' Qp = 4.5+ TSF @94.0'
				100	11 95.0 105.0	

DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE 856.0

Hole No. 8-GREENWOOD

PROJECT: McHenry County Observation Wells

INSTALLATION: Chicago District

SHEET 5 OF 8 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
			CL, Brownish gray silty clay, trace fine gravel, hard, moist *(continued)*			
						Sample No. 19 from 99.0' to 100.0' Qp = 4.5+ TSF @99.0'
						Sample No. 20 from 104.0' to 105.0' Qp = 4.5+ TSF @104.0'
				90	12 105.0 115.0	
						Sample No. 21 from 108.0' to 109.0'
						Sample No. 22 from 114.0' to 115.0'
				95	13 115.0 125.0	
+740.0	116.0					
			ML, Brownish gray clayey silt, dense, wet, low plasticity			
						Sample No. 23 from 119.0' to 120.0'
+736.0	120.0					
			SP, Gray fine sand, dense, wet			

DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE 856.0

Hole No. 8-GREENWOOD

PROJECT: McHenry County Observation Wells

INSTALLATION: Chicago District

SHEET 6 OF 8 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
			SP, Gray fine sand, dense, wet *(continued)*			Qp = 4.5 TSF @123.0'
						Sample No. 24 from 124.0' to 125.0'
				90	14 125.0 135.0	
+723.0	133.0					
			SP, Gray medium sand, trace fine gravel, dense, wet			
						Sample No. 25 from 134.0' to 135.0'
+721.0	135.0					
			SP, Brown medium sand, trace fine gravel, loose, wet	45	15 135.0 145.0	
						Sample No. 26 from 144.0' to 145.0'
				100	16 145.0 155.0	
+708.0	148.0					
			GP, Brownish gray fine gravel, very loose, wet			

DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE 856.0

Hole No. 8-GREENWOOD

PROJECT: McHenry County Observation Wells

INSTALLATION: Chicago District

SHEET 7 OF 8 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
			GP, Brownish gray fine gravel, very loose, wet *(continued)*			
+705.0	151.0					% Gravel/% Sand/% Fines = 48/52/1 from 150.0' to 151.0'
			SP, Brown medium sand, trace fine gravel, moderately dense, wet			
						Sample No. 27 from 154.0' to 155.0'
				70	17 155.0 165.0	
						Sample No. 28 from 164.0' to 165.0'
				100	18 165.0 175.0	
+688.5	167.5					
			ML, Light brownish gray silt, trace coarse gravel, dense, wet, varved			
						Sample No. 29 from 168.5' to 169.5'
+684.0	172.0					
			SM, Light gray silty sand, with fine gravel (angular), moderately dense, wet			Sample No. 30 from 172.0' to 173.0'
+682.5	173.5		Note: Driller noted bedrock encountered at 173.5'			

DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE 856.0

Hole No. 8-GREENWOOD

PROJECT: McHenry County Observation Wells

INSTALLATION: Chicago District

SHEET 8 OF 8 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
			Dolomite, light gray, hard			
			Note: Driller noted very difficult drilling from 174.0' to 176.0' *(continued)*	100	19 175.0 177.0	Sample No. 31 from 175.5' to 176.0'
+680.0	176.0		END OF BORING - 176.0' BGS			
						AECOM Project No. 60095270

Hole No. #8 GREENWOOD TOWNSHIP

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 1 OF 12 SHEETS
1. PROJECT McHenry Cty Wells		10. SIZE AND TYPE OF BIT 4" x 6" Carbide Tip	
2. LOCATION (Coordinates or Station) N2,083,102.6 E 969,991 ILSP PI-E		11. DATUM FOR ELEVATION SHOWN (TBM or MSL) NAVD 88	
3. DRILLING AGENCY WDC Exploration & Wells		12. MANUFACTURERS DESIGNATION OF DRILL Gusch — SuperSonic II	
4. HOLE NO. (As shown on drawing title and title number) 8-GRN		13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN	DISTURBED 30 / UNDISTURBED 0
5. NAME OF DRILLER DAN TONNANCOUR		14. TOTAL NUMBER CORE BOXES Ø	
6. DIRECTION OF HOLE ☑ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.		15. ELEVATION GROUND WATER 839.4' Deep (9/26)	
		16. DATE HOLE	STARTED 9/23/08 / COMPLETED 9/24/08
7. THICKNESS OF OVERBURDEN 173.5'		17. ELEVATION TOP OF HOLE 856.0 FT MSL	
8. DEPTH DRILLED INTO ROCK 2.5'		18. TOTAL CORE RECOVERY FOR BORING 88% (153.1/176')	
9. TOTAL DEPTH OF HOLE 176.0'		19. SIGNATURE OF INSPECTOR Gary M. Cara LPG-IL	

5 7/8" outer casing
3 7/8" inner casing

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
856	0		Topsoil / Grass			GRASSLAND GRD COVER; Run #1 (0-5') Rec/Run = 3.0/5.0 = 60%; Driller notes cobbles @ 4'
	1		Brown Silty CLAY Very Stiff,		#Bag 1	1002
	2		Gravel, Cinder Block, Sand, loose, damp	Rec 60%		
	3		LIKELY FILL			
	4		Mottled Brown Reddish Brown		Bag #2 S1	1005
	5		Sandy CLAY Some fi gravel, silt, trace organics, moist (SC-CL)			Run #2 (5-15') Rec/Run = 10/10.0 = 100%; 1.0 tsf; 1027
	6				Bag #3	
	7		less sandy			
	8		w/ TILL	Rec 100%	S2	
	9		depth		Bag #4	
846	10		Gradual Contact			1.0 tsf
	11		Reddish Brownish Gray Silty CLAY, little fine gravel, trace c. gravel, very stiff, damp (CL)			
	12				Bag	
	13				#5 S3	4.5 tsf
	14		Diamicton			
	15		TISKWILA TILL			1036

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT McHenry Cty Wells | HOLE NO. 8-GREENWOOD

Hole No. #8 - Greenwood Twp

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 2 OF 12 SHEETS
1. PROJECT McHenry Cty Wells		10. SIZE AND TYPE OF BIT 4" x 6" Carbide	
2. LOCATION (Coordinates or Station)		11. DATUM FOR ELEVATION SHOWN (TBM or MSL) NAVD 88	
3. DRILLING AGENCY WDC Exploration & Wells		12. MANUFACTURERS DESIGNATION OF DRILL Super Sonic II	
4. HOLE NO. (As shown on drawing title and title number)	8-GRN	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN	DISTURBED 30 / UNDISTURBED —
5. NAME OF DRILLER DAN TONNAN COUR		14. TOTAL NUMBER CORE BOXES —	
6. DIRECTION OF HOLE ☑ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.		15. ELEVATION GROUND WATER 839.4 Deep 9/26	
		16. DATE HOLE	STARTED 9/23/08 / COMPLETED 9/24/08
7. THICKNESS OF OVERBURDEN 173.5'		17. ELEVATION TOP OF HOLE 856.0 Ft MSL	
8. DEPTH DRILLED INTO ROCK 2.5'		18. TOTAL CORE RECOVERY FOR BORING 153.1/176 = 88%	
9. TOTAL DEPTH OF HOLE 176.0'		19. SIGNATURE OF INSPECTOR Gary M. Brown LPG IL	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	15		cont.			Run #3 (15-25)
	16		Silty CLAY		Bag #6	Rec/Run = 9.75/10' = 97.5%
	17					4.5+ tsf
					S4	
	18		1.2 ft thick Intra-till SAND seam (Brownish-Gray Med. SAND)	REC 97%	Bag #7	
	19					
836	20		~1" thick sand seam			
	21					4.5+ tsf
	22				Bag #8	
	23		- Very thin sand seam			
					S5	
	24					4.25 ton/ft²
	25					1050
	26		Gray fine gravelly Coarse SAND, little fine to medium sand & medium to coarse gravel, loose, wet (SW)		Bag #9	Run #4 (25-35) Rec/Run 7.5'/10' = 75% (shortage of recovery believe to be the result of consolidation of the sand & gravel w/in
	27			REC 75%		
	28					
					S6	
	29					
826	30					

1048

1050

1058

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT) — PROJECT — HOLE NO. #8-

Hole No. #8 - GREENWOOD TWP

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 3 OF 12 SHEETS

1. PROJECT: McHenry Cty Wells
2. LOCATION (Coordinates or Station):
3. DRILLING AGENCY: WDC Exploration & Wells
4. HOLE NO. (As shown on drawing title and title number): 8-GRN
5. NAME OF DRILLER: DAN TONNANCOUR
6. DIRECTION OF HOLE: [X] VERTICAL [ ] INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 173.5'
8. DEPTH DRILLED INTO ROCK: 2.5'
9. TOTAL DEPTH OF HOLE: 176.0'
10. SIZE AND TYPE OF BIT: 4" x 6" Carbide
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): NAVD88
12. MANUFACTURERS DESIGNATION OF DRILL: Super Sonic II
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 30; UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES: —
15. ELEVATION GROUND WATER: 839.4 ft (9/26) Prep
16. DATE HOLE: STARTED 9/23/08; COMPLETED 9/24/08
17. ELEVATION TOP OF HOLE: 856.0 ft MSL
18. TOTAL CORE RECOVERY FOR BORING: 88% (153.1/176')
19. SIGNATURE OF INSPECTOR: Gary M. Gran LDG IL

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
826	30		cont.			the recovered core bag sample - Approx. 3" wide sample resulted in 6" wide in sample bag)
	31		F. gravelly Coarse SAND			
	32		Fining upward	REC 75%	Bag #10	
	33		Gravelly zone above fairly abrupt contact			
	34		Grayish Brown Fine SAND, dense, wet (SP)		S7	
	35					1102
	36				Bag #11	RUN #5 (35-45) 1120 Rec/Run = 9.8'/10'
	37		Grades to SILT (ML)			
	38				S8	Gradational contact over ~3 ft length w/ no bedding/deformation features observed
	39		Grades to Clayey SILT (Gradual Contact)	REC 98%	Bag #12	
816	40		Grayish Brown clayey SILT, stiff, Medium plasticity, trace fine gravel, moist to wet (CL-ML)			
	41					
	42					
	43			S9	Bag #13	
	44					
	45					1124

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT) — PROJECT — HOLE NO. #8 Greenwood TWP

Hole No. #8 - Greenwood

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 4 OF 12 SHEETS

1. PROJECT	McHenry Cty Wells
2. LOCATION (Coordinates or Station)	
3. DRILLING AGENCY	WDC Exploration & Wells
4. HOLE NO. (As shown on drawing title and title number)	8-GRN
5. NAME OF DRILLER	DANTONNANCOUR
6. DIRECTION OF HOLE	☑ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN	173.5'
8. DEPTH DRILLED INTO ROCK	2.5'
9. TOTAL DEPTH OF HOLE	176.0'
10. SIZE AND TYPE OF BIT	4"X6" CARBIDE
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	NAVD88
12. MANUFACTURERS DESIGNATION OF DRILL	Super Sonic II
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN	DISTURBED 30 / UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES	0
15. ELEVATION GROUND WATER	839.4' Deep Well on (9/26)
16. DATE HOLE	STARTED 9/23/08 / COMPLETED 9/24/08
17. ELEVATION TOP OF HOLE	856.0
18. TOTAL CORE RECOVERY FOR BORING	88% (153.1/176')
19. SIGNATURE OF INSPECTOR	Gary M. Brown LPG IL

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	45		Brownish Gray Sandy & Gravelly CLAY, little silt, medium, moist (CL-GC-SC) DIAMICTON		Bag #14	Run #6 (45-55) Rec/Run = 9.0'/10' = 90%
	46					
	47					← Recovering missing from Bag #14 (Logged from bottom of Run)
	48			Rec 90%		
	49				Bag #15	
806	50				s10	
	51					
	52				Bag #16	
	53					
	54				s11	
	~~54.8'~~					
	55		Gray fine GRAVEL, some Medium gravel, little Coarse sand, Very loose, wet (GP to GW) (under confining pressures → sand/gravels heaving into casing)			Run #7 (55-65) Rec Actual 4.0' long by 6" wide Est. 6.0' / Run 10' = 60%
	56				Bag #17	
55-72' Aquifer (intermediate)	57			Rec ~60%		
	58					
	59				s12	
796	60					

1130

1205 Break for lunch. Driller reports 5' of heave in well

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT McHenry Cty | HOLE NO. #8 Greenwood TWP

Hole No. #8 - Greenwood/TWP

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 5 OF SHEETS
1. PROJECT McHenry Cty Wells		10. SIZE AND TYPE OF BIT 4" x 6" Carbide	
2. LOCATION (Coordinates or Station)		11. DATUM FOR ELEVATION SHOWN (TBM or MSL) NAVD 88	
3. DRILLING AGENCY WDC Exploration & Wells		12. MANUFACTURERS DESIGNATION OF DRILL SuperSonic II	
4. HOLE NO. (As shown on drawing title and title number)	8-GRN	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN	DISTURBED 30 / UNDISTURBED 0
5. NAME OF DRILLER DAN TONNANCOUR		14. TOTAL NUMBER CORE BOXES —	
6. DIRECTION OF HOLE ☑ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.		15. ELEVATION GROUND WATER 839.4 ft Deep (9/26)	
		16. DATE HOLE	STARTED 9/23/08 / COMPLETED 9/24/08
7. THICKNESS OF OVERBURDEN 173.5'		17. ELEVATION TOP OF HOLE 856.0 Ft MSL	
8. DEPTH DRILLED INTO ROCK 2.5'		18. TOTAL CORE RECOVERY FOR BORING 88% (153.1/176')	
9. TOTAL DEPTH OF HOLE 176.0'		19. SIGNATURE OF INSPECTOR Gary M. Brian LPG IL	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
796.0	60		cont. Gray GRAVEL			RUN 7 (cont.)
	61					Poor Recovery due to very loose gravel
	62			60%	Bag #17 cont	
	63					
	64		Estimated Contact			
	65		Brown Medium Grained SAND, Moderately Dense, wet (SP)			
	66			Bag #18B	Bag #18	RUN 8 (65-75)
	67					REC Actual Length of Bag = 5' Est. Based on 6" Dia. Bag = 7'
	68		Abrupt Contact			
	69		Brownish Gray Fine GRAVEL, little fine and coarse gravel, loose, wet (GW)			RUN = 10' ≈70%
786	70			REC ~70%	Bag #19	s13 Driller comments that gravelly zone is very Productive
	71					
	72		Grayish Brown Fine GRAVEL, little Coarse Sand, Medium Gravel & silty Clay, moderately dense, wet (GW)			
	73					
	74					s14
	75					

73.4'

73.4'

PROPOSED WELL SCREEN INTERVAL

1315

69 70 sieve sample

1340

ENG FORM 1836
MAR 71

PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT McHenry Cty MWells | HOLE NO. #8 GREENWOOD

Hole No. #8 GREENWOOD TWP

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 6 OF 12 SHEETS

1. PROJECT: McHenry Cty Wells
2. LOCATION (Coordinates or Station):
3. DRILLING AGENCY: WOC Exploration & Wells
4. HOLE NO. (As shown on drawing title and title number): 8-GRN
5. NAME OF DRILLER: DAN TONNANCOUR
6. DIRECTION OF HOLE: [X] VERTICAL [ ] INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 173.5'
8. DEPTH DRILLED INTO ROCK: 2.5'
9. TOTAL DEPTH OF HOLE: 176.0'
10. SIZE AND TYPE OF BIT: 4" x 6" Carbide
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): NAVD 88
12. MANUFACTURERS DESIGNATION OF DRILL: Super Sonic II
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 30; UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES: —
15. ELEVATION GROUND WATER: 839.4 ft (9/26) Deep
16. DATE HOLE: STARTED 9-23-08; COMPLETED 9-24-08
17. ELEVATION TOP OF HOLE: 856.0 ft MSL
18. TOTAL CORE RECOVERY FOR BORING: 88% (153.1/176)
19. SIGNATURE OF INSPECTOR: Gary M. Brown LPG IL

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	75		↓ grades to Gravelly CLAY 75-76			RUN 9 (75-85) 1345
	76		Brownish Gray, Silty CLAY, little fine gravel, ~~stiff~~ soft, moist to wet (CL to GC) with occassional gravel seams.		Bag #20	Rec 10' / Run 10' = 100%
	77					1.0+sf
	78			Rec 100%		
	79				Bag #21	s15
776	80		↓ Grades to VERY STIFF, Brown Gray Silty CLAY, little f.-c. gravel w/ fine gravel seams less frequent & thinner (<1/4" thick)			1.0+sf
	81					>4.5+sf
	82				Bag #22	
	83					s16
	84					>4.5+sf
	85		DIAMICTON			1400
	86		Brownish Gray fine GRAVEL, loose, wet (GP)		Bag #23	RUN 10 (85-95) 1404 Rec 10' / Run 10' = 100%
	87			Rec 100%		
	88				Bag #24	s17
	89		Abrupt Contact			
766	90		Brownish Gray Silty CLAY (next page)			

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT: McHenry Cty MWells | HOLE NO. #8 GREENWOOD TWP

Hole No. #8 GREENWOOD TWP

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 7 OF SHEETS

1. PROJECT McHenry Cty MWells	10. SIZE AND TYPE OF BIT 4" x 6" Carbide
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) NAVD 88
3. DRILLING AGENCY WDC Exploration	12. MANUFACTURERS DESIGNATION OF DRILL Super Sonic II
4. HOLE NO. (As shown on drawing title and title number) #8-GRN	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN — DISTURBED 30 — UNDISTURBED 0
5. NAME OF DRILLER DAN TONNANCOUR	14. TOTAL NUMBER CORE BOXES 0
6. DIRECTION OF HOLE ☑ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.	15. ELEVATION GROUND WATER 839.4' Deep (9/26)
	16. DATE HOLE — STARTED 9-23-08 — COMPLETED 9-24-08
7. THICKNESS OF OVERBURDEN 173.5'	17. ELEVATION TOP OF HOLE 856.0 ft MSL
8. DEPTH DRILLED INTO ROCK 2.5'	18. TOTAL CORE RECOVERY FOR BORING 88% (153.1/176')
9. TOTAL DEPTH OF HOLE 176.0'	19. SIGNATURE OF INSPECTOR Gary M. Braun LPG IL

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
766	90		Brownish Gray SILTY CLAY, trace fine gravel, ~~very stiff~~ HARD, moist (CL)		#25	RUN 10 (85-95)
	91			Rec 100%		
	92		High Plasticity tr. gray mottling (oxidation)		Bag #25	
	93					s18 4.5+tsf
	94					
	95					1418
						RUN 11 (95-105) 1425
	96				Bag #26	Rec/Run = 10'/10' = 100%
	97					
	98			Rec 100%	Bag #27	
	99					+ 4.5 tsf
756	100					s19
	101					
	102					
	103				Bag #28	
	104					s20
	105					+ 4.5 tsf 1440

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT McHenry Cty MWells — HOLE NO. #8 GREENWOOD TWP

Hole No. #8 GREENWOOD TWP

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 8 OF SHEETS

1. PROJECT Mc Henry Cty MWells	10. SIZE AND TYPE OF BIT 4" x 6" Carbide
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) NAVD 88
3. DRILLING AGENCY WOC Exploration & Wells	12. MANUFACTURERS DESIGNATION OF DRILL Super Sonic II
4. HOLE NO. (As shown on drawing title and title number) 8-GRN	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN — DISTURBED 30 — UNDISTURBED 0
5. NAME OF DRILLER DAN TONNANCOUR	14. TOTAL NUMBER CORE BOXES —
6. DIRECTION OF HOLE ☑ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.	15. ELEVATION GROUND WATER 839.4' (Deep on 9/26)
	16. DATE HOLE — STARTED 9/23/08 — COMPLETED 9/24/08
	17. ELEVATION TOP OF HOLE 856.0 Ft MSL
7. THICKNESS OF OVERBURDEN 173.5'	18. TOTAL CORE RECOVERY FOR BORING 88% (153.1/176')
8. DEPTH DRILLED INTO ROCK 2.5'	19. SIGNATURE OF INSPECTOR Gary M. Brown LPG IL
9. TOTAL DEPTH OF HOLE 176.0'	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g	
	105		cont.			RUN 12 (105-115)	1452
	106		V. stiff (CL)		Bag #29	Rec/Run = 9'/10'	
	107					(Recovery Loss from 105-109 in Bag #29)	
	108			Rec	S21	Bag #30 is full recovery	
	109		SILT to Clayey SILT Zone ~3ft thick	90%			
746	110						
	111				Bag #30		
	112						
	113						
	114						
	115		Grades to A Clayey SILT		S22		1508 ← PM Break 1530
	116		Brownish Gray Clayey SILT, low plasticity, dense, wet (ML)			RUN 13 (115-125) Rec/Run = 9.5/10 = 95%	
	117			Rec 95%	Bag #31		
	118						
	119		More Silty Clay 118-120				
736	120		Grades to F. SAND		S23		

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT) — PROJECT — HOLE NO. #8

Hole No. #8 GREENWOOD TWP

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 9 OF 12 SHEETS

1. PROJECT McHenry Cty Wells	10. SIZE AND TYPE OF BIT 4" x 6" Carbide
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) NAVD 88
3. DRILLING AGENCY WDC Exploration	12. MANUFACTURERS DESIGNATION OF DRILL Super Sonic II
4. HOLE NO. (As shown on drawing title and title number) #8-GRN	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 30; UNDISTURBED 0
5. NAME OF DRILLER Dan Tonnancour	14. TOTAL NUMBER CORE BOXES 0
6. DIRECTION OF HOLE ☑ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.	15. ELEVATION GROUND WATER 839.4' Deep (9/26)
	16. DATE HOLE: STARTED 9/23/08; COMPLETED 9/24/08
7. THICKNESS OF OVERBURDEN 173.5'	17. ELEVATION TOP OF HOLE 856.0 Ft MSL
8. DEPTH DRILLED INTO ROCK 2.5'	18. TOTAL CORE RECOVERY FOR BORING 88% (153.1/176')
9. TOTAL DEPTH OF HOLE 176.0'	19. SIGNATURE OF INSPECTOR [signature] LPG IL

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
736	120		Gray Fine SAND, dense, wet (SP)			Run 13 cont.
	121					
	122			Rec. 95%	Bag #32	
	123					
	124				S24	
	125					1603
						Run 14 (125-135) 1608 start
	126		cont. F. SAND		Bag #33	Rec/Run = 9'/10' = 90%
	127					
	128					
	129			Rec 90%		
726	130					
	131				Bag #34	
	132		Silty clay layers			
	133		Gray Medium SAND, tr. f. gravel, Mod Dense, WET (SP)			WATER LEVEL MEASURED AT 30.26 feet bgs (below ground surface) AT 0705 9/24/08 w/ 135' of Casing
	134					
	135				S25	1616 outer casing 1625 unload sample

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT McHenry Cty Wells — HOLE NO. #8

Hole No. #8 GREENWOOD TWP

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 10 OF 12 SHEETS
1. PROJECT McHenry Cty Wells		10. SIZE AND TYPE OF BIT 4" x 6" Carbide	
2. LOCATION (Coordinates or Station)		11. DATUM FOR ELEVATION SHOWN (TBM or MSL) NAVD 88	
3. DRILLING AGENCY WDC Exploration		12. MANUFACTURERS DESIGNATION OF DRILL Super Sonic II	
4. HOLE NO. (As shown on drawing title and title number) #8-GRN		13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN	DISTURBED 30 / UNDISTURBED 0
5. NAME OF DRILLER DAN TONNMANCOUR		14. TOTAL NUMBER CORE BOXES 0	
6. DIRECTION OF HOLE ☑ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.		15. ELEVATION GROUND WATER 839.4' DEEP (9/26)	
		16. DATE HOLE	STARTED 9/23/08 / COMPLETED 9/24/08
7. THICKNESS OF OVERBURDEN 173.5'		17. ELEVATION TOP OF HOLE 856.0 ft MSL	
8. DEPTH DRILLED INTO ROCK 2.5'		18. TOTAL CORE RECOVERY FOR BORING 153.1/176' (88%)	
9. TOTAL DEPTH OF HOLE 176.0'		19. SIGNATURE OF INSPECTOR Gary M. Brown LPG IL	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g	
	135		Brown Medium SAND, trace fine gravel, loose, wet (SP)			RUN 15 (135-145) Approx. 5ft of sand heaved into casing overnight. Rec/Run = 4.5'/10' = 45%	±0715
	136						
	137						
	138			Rec 45%	Bag #35		
	139						
716	140						
	141						
	142						
	143						
	144				526		
	145						±0745
	146					RUN 16 (145-155) Rec/Run = 10'/10' = 100%	±0805
	147				Bag #36		
	148		Brownish Gray, fine GRAVEL, very loose wet (GP)	Rec 100%			
	149						
706	150						

ENG FORM 1836
MAR 71

PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT McHenry TWP | HOLE NO. #8 - Greenwood TWP

Hole No. #8 - Greenwood TWP

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 11 OF 12 SHEETS

1. PROJECT McHenry Cty Wells	10. SIZE AND TYPE OF BIT 4" x 6" Carbide
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) NAVD 88
3. DRILLING AGENCY WOC Exploration & Wells	12. MANUFACTURERS DESIGNATION OF DRILL SuperSonic II
4. HOLE NO. (As shown on drawing title and title number) 8-GRN	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 30, UNDISTURBED 0
5. NAME OF DRILLER DAN TONNAN COUR	14. TOTAL NUMBER CORE BOXES —
6. DIRECTION OF HOLE ☑ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER 839.4' DEEP (9/26)
	16. DATE HOLE: STARTED 9/23/08, COMPLETED 9/24/08
7. THICKNESS OF OVERBURDEN 173.5'	17. ELEVATION TOP OF HOLE 856.0 FT MSL
8. DEPTH DRILLED INTO ROCK 2.5'	18. TOTAL CORE RECOVERY FOR BORING 88% (153.1/176)
9. TOTAL DEPTH OF HOLE 176.0'	19. SIGNATURE OF INSPECTOR [signature] LPG IL

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
706	150		↑ Fining upward ↙ fairly abrupt contact			Run 16 cont.
	151		Brown Medium SAND, trace fine gravel, moderately dense, wet (SP)	Rec 100%	Bag #37	
	152					
	153					
	154					
	155				S27	
	156					Run 17 (155-165) Rec/Run = 7'/10' = 70%
	157					
	158		cont. SAND	Rec 70%		
	159					
696.0	160				Bag #38	
	161					
	162					
	163					
	164				S28	
	165					

Deep Well Screen

150 — 151] sample

0835

0850 start run

1020 Extract sample

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT McHenry MWells | HOLE NO. #8 Greenwood TWP

#8 - Greenwood Twp

Hole No.

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 12 OF 12 SHEETS

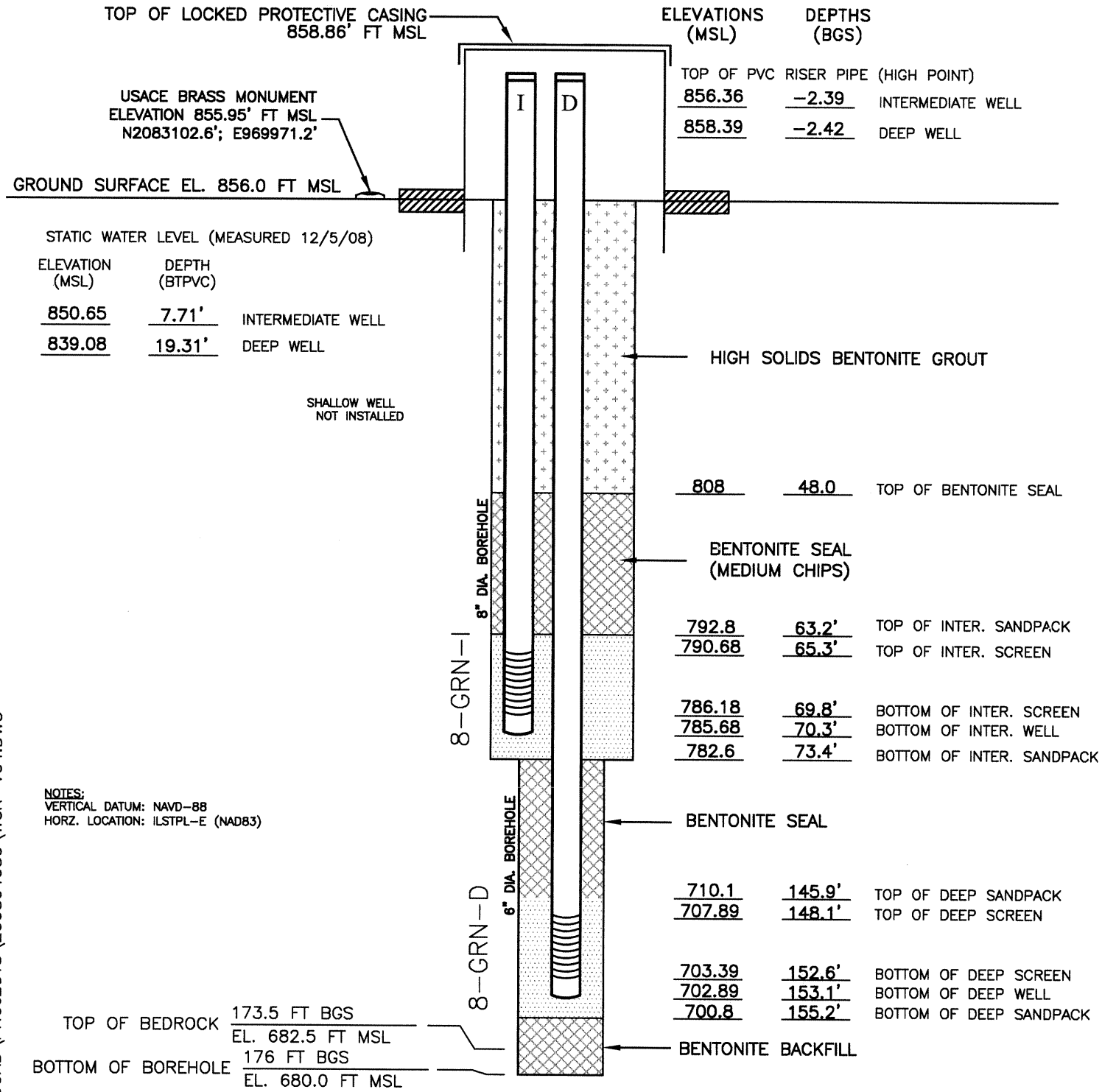
1. PROJECT: McHenry Cty Wells
2. LOCATION (Coordinates or Station):
3. DRILLING AGENCY: WPC Exploration & Wells
4. HOLE NO. (As shown on drawing title and title number): 8-GRN
5. NAME OF DRILLER: DAN TONNANCOUR
6. DIRECTION OF HOLE: ☑ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 173.5'
8. DEPTH DRILLED INTO ROCK: 2.5'
9. TOTAL DEPTH OF HOLE: 176.0'
10. SIZE AND TYPE OF BIT: 4" x 6" Carbide
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): NAVD 88
12. MANUFACTURERS DESIGNATION OF DRILL: SuperSonic II
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 30 UNDISTURBED —
14. TOTAL NUMBER CORE BOXES: —
15. ELEVATION GROUND WATER: 839.4 ft Deep (9/26)
16. DATE HOLE: STARTED 9/23/08 COMPLETED 9/24/08
17. ELEVATION TOP OF HOLE: 856.0 Ft MSL
18. TOTAL CORE RECOVERY FOR BORING: 88% (153.1/176')
19. SIGNATURE OF INSPECTOR: Gary M. Brown LPG IL

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g	
	165		cont.			RUN 18 (165-174)	1048 start run
	166		SAND		Bag #39	Rec 10' / Run 10' = 100%	
	167		FINE GRAVEL ZONE			• outer casing (i.e. 5 7/8" casing) Not driven to 175' because deep well not likely to be set deeper than 165'	
	168		Light Brownish Gray SILT, trace Course gravel, dense (non-cohesive), wet (ML) varved	Rec. 100%	S29		
	169						
686	170				Bag #40	• Borehole stayed open overnight.	
	171		← piece of C. gravel			Driller Notes: Bedrock at 173.5' unable to advance past 174' Auger Refusal at 174 (Broke flapper bit)	BACKFILL TO 155'
	172		Light Gray Silty SAND, with f. gravel (angular), Mod. Dense wet		S30		
	173						
	174		DOLOMITE, Light Gray, Hard				1115 Extract sample
	175			Rec 100%	Bag #41	RUN 19 (174-176) Rec/Run = 2'/2' = 100% Switched to Rock Bit to confirm Bedrock	1120 Start run VERY DIFFICULT DRILLING
680	176		END OF BOREHOLE		S31		1205 Essentially Refusal (stopped so as not to damage drill rods)
	177						
	178						
	179						
	180						

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT: McHenry Cty Wells | HOLE NO. #8 - Greenwood Twp

PROJECT McHENRY COUNTY OBSERVATION WELL NETWORK INSTALLATION (#09000-460)	WELL NO. 8-GRN-I & 8-GRN-D
LOCATION GREENWOOD TOWNSHIP – McHENRY COUNTY, ILLINOIS	
CLIENT U.S. ARMY CORPS OF ENGINEERS / McHENRY COUNTY	
GEOLOGIST GARY BRAUN, P.G. (AECOM)	INSTALLATION DATE SEPT. 25, 2008
DRILLER WDC EXPLORATION AND WELLS, INC. (DAN TONNANCOUR)	DRILLING METHOD ROTO-SONIC



NOTES:
VERTICAL DATUM: NAVD-88
HORZ. LOCATION: ILSTPL-E (NAD83)

NOT TO SCALE

WELL CONSTRUCTION MATERIALS*

PROTECTIVE CASING	5' L X 8" DIA. ALUMINUM CASING W/ LOCKING CAP
RISER PIPE ABOVE W.T.	SCHEDULE 40 PVC (2.07" I.D./ 2.38" O.D.)
RISER PIPE BELOW W.T.	SCHEDULE 40 PVC (2.07" I.D./ 2.38" O.D.)
SCREEN	2" I.D. SCHEDULE 40 PVC W/ 0.010" SCREEN SLOT SIZE
TYPE OF BENTONITE SEAL	BLACK HILLS BENTONITE – 3/8" CHIPS (HOLE PLUG)
TYPE OF SAND PACK	R.W. SIDLEY CO. – NO. 5 FILTER PACK SAND

CASING MEASUREMENTS

BOTTOM OF SCREEN TO END CAP (FT)*		0.50
SCREEN LENGTH (1ST SLOT TO LAST SLOT) (FT)*		4.50
TOTAL LENGTH OF CASING (FT):	INTERMEDIATE WELL	72.68
	DEEP WELL	155.50

* MEASUREMENT REFERS TO ALL WELLS

USMWK2FP001\05CAD\PROJECTS\20080408O\WCR-V04.DWG

WELL SITE DATA SUMMARY AND COMMENTARY

Well Site #8 – Greenwood Township
MCCD Property at Barber Fen on Wondermere Rd

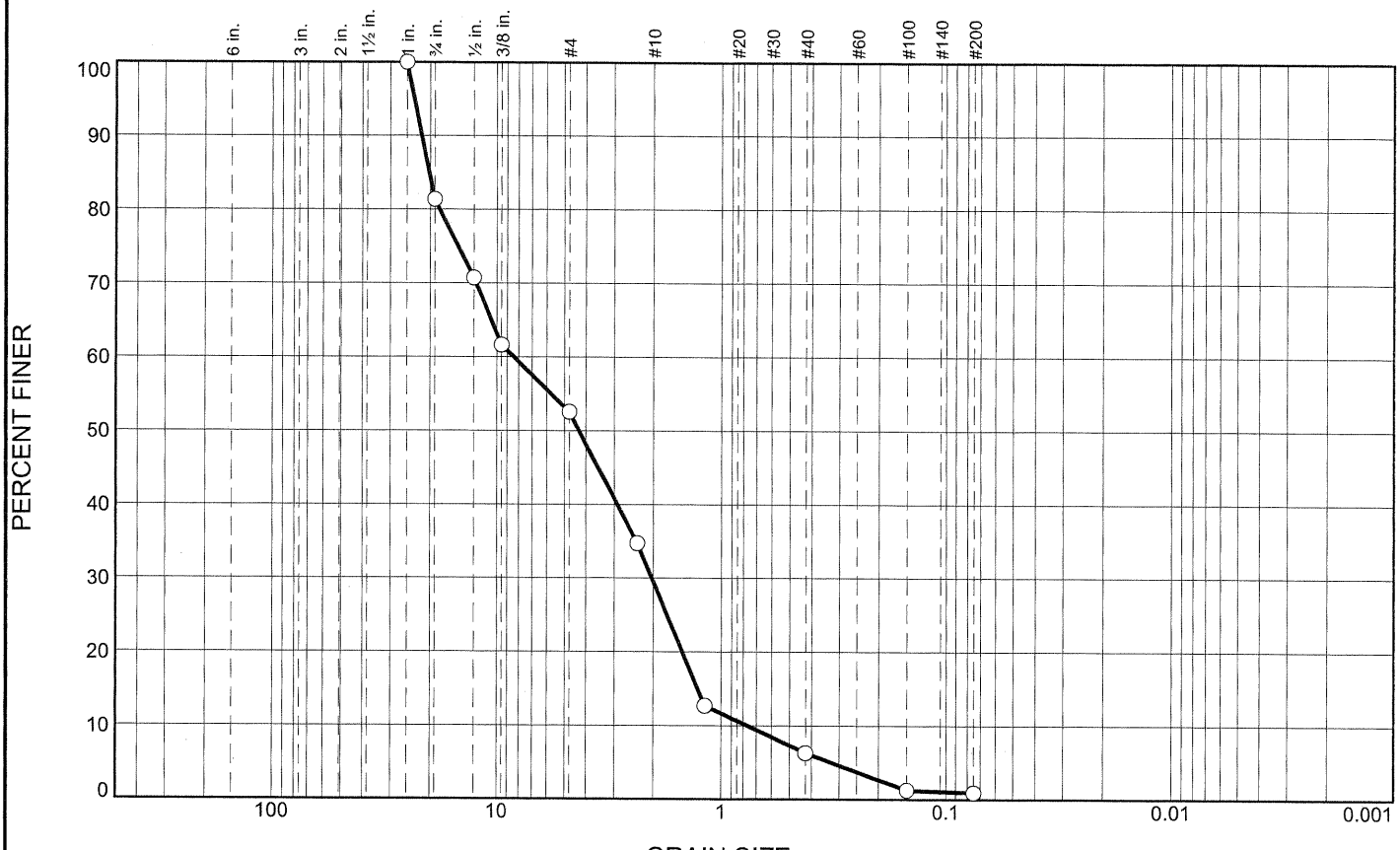
The Greenwood Township site is located on the property of an abandoned farm house. Some former buildings can be seen in the aerial photo of the site in Appendix A-8. Demolition debris from the house or out-buildings could be seen at the surface during site inspections, but were especially evident during installation of the protective bollards in the upper 4-feet of the soil. Below the surficial fill, a 20 foot thick till sequence overlies the uppermost water bearing unit. The upper water bearing unit is approximately 15 feet thick and consists of gravelly coarse sands that grade to fine sands below 34 feet. Although a shallow well was not installed at this depth, this shallow unit is likely critical to the Barber Fen because it likely discharges along the banks of Nippersink Creek. The base of the upper water bearing unit occurs at an elevation of approximately 820 ft msl, while the elevation of the creek is approximately 815 ft msl at the site. Since fens are typically fed by cool, mineralized groundwater that supports the unique flora and fauna, an additional well screened within the upper water bearing unit (roughly between 25 and 33 ft bgs) may be of interest of the MCCD for resource protection purposes.

The intermediate hydrostatic zone appears to also discharge to Nippersink Creek based on head levels, but discharge likely occurs upward along the creek and not along the stream bank. However, the intermediate hydrostatic zone at the Greenwood site appears to be very productive. The intermediate aquifer is approximately 20 feet thick and consists of nearly 70% gravel based on the particle size test results. The conductivity test result of 2.7E-10 cm/sec also showed that this interval was very permeable.

The deepest well at the site was installed in a thicker aquifer (48 ft thick aquifer between 120 and 168 ft bgs), but had a lower conductivity. Based on the water level monitoring data, it appears this unit maybe utilized by nearby residents as a potable water source based on the “choppy” appearance of the water level hydrograph. These pronounced head fluctuations may be indicative of nearby pumping wells.

Well Site Testing Results

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	18.6	28.9	23.0	23.2	5.4	0.9	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1	100.0		
.75	81.4		
.5	70.7		
.375	61.6		
#4	52.5		
#8	34.7		
#16	12.7		
#40	6.3		
#100	1.3		
#200	0.9		

* (no specification provided)

Material Description

F-C Sand and Gravel Trace Silt

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 21.7628 D_{85}= 20.1445 D_{60}= 8.4168
D_{50}= 4.2979 D_{30}= 2.0335 D_{15}= 1.2677
D_{10}= 0.7643 C_u= 11.01 C_c= 0.64

Classification

USCS= SP AASHTO=

Remarks

Source of Sample: 8-GW-D **Depth:** 150.0-151.0

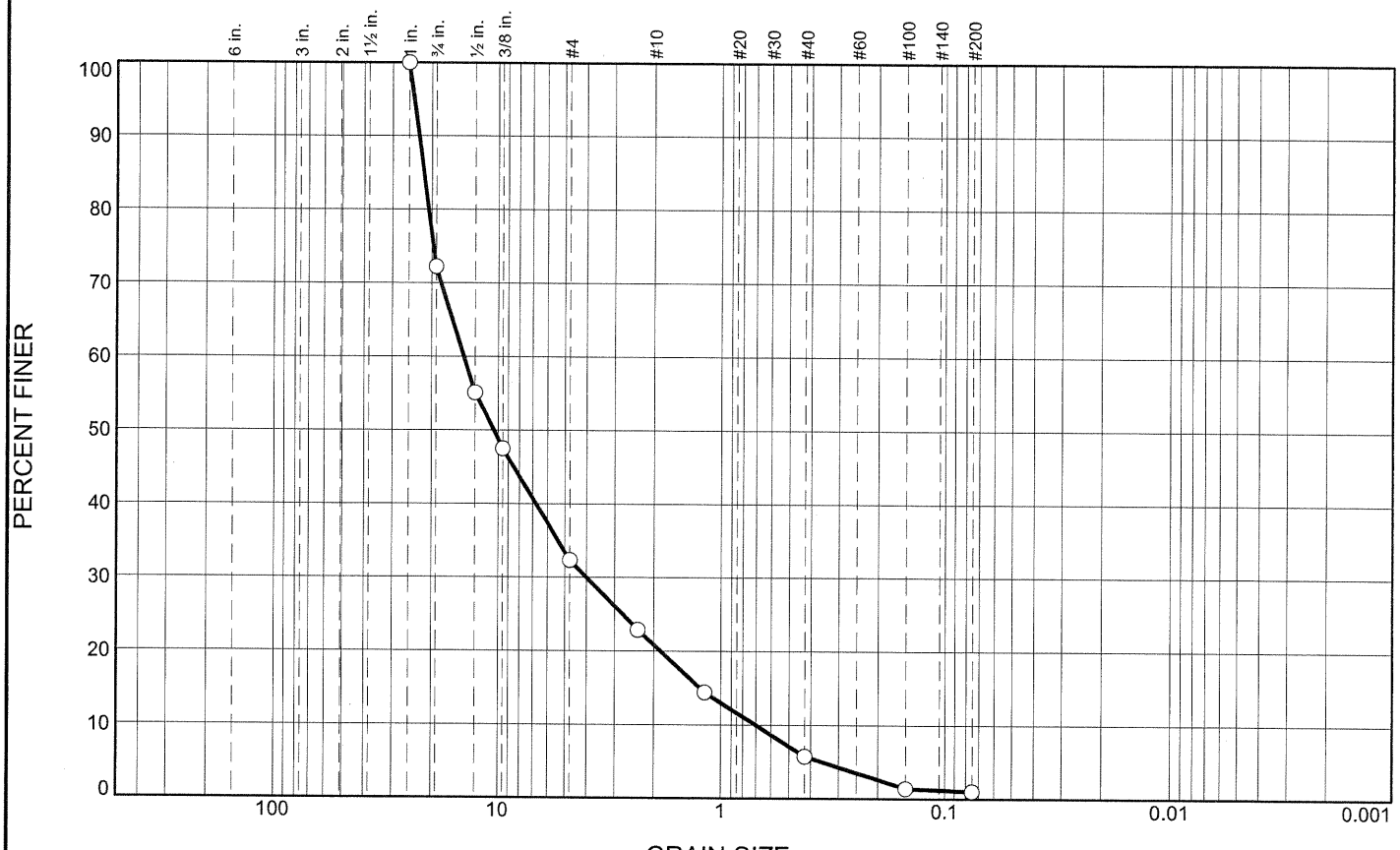
Date: 12/05/08

STS | AECOM

Client: USACE
Project: McHenry County Wells
Project No: 200804080 **Figure**

Tested By: JRT

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	27.7	40.0	11.4	15.1	4.8	1.0	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1	100.0		
.75	72.3		
.5	55.1		
.375	47.5		
#4	32.3		
#8	22.9		
#16	14.4		
#40	5.8		
#100	1.4		
#200	1.0		

* (no specification provided)

Material Description

F-C Gravel Some F-C Sand Trace Silt

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 22.8983 D_{85}= 21.7414 D_{60}= 14.2573
D_{50}= 10.4681 D_{30}= 3.9971 D_{15}= 1.2377
D_{10}= 0.7011 C_u= 20.34 C_c= 1.60

Classification

USCS= GW AASHTO=

Remarks

Source of Sample: 8-GW-S **Depth:** 69.0-70.0

Date: 12/05/08

STS | AECOM

Client: USACE
Project: McHenry County Wells
Project No: 200804080 **Figure**

Tested By: JRT

Groundwater Level Measurements

McHenry County Monitoring Well Installations
AECOM Project 09000-460

Site Number	8	
Township Name	Greenwood	
Well Number	8-GRN-I	8-GRN-D
Ground Surface Elevation (ft msl)	855.97	855.97
Top of PVC Casing Elevation (ft)	858.36	858.39
Location of PVC Casing within Wellhead	West Well	East Well
Well Depth (Feet from TOC)[A]	72.68	155.50

Date	Depth to GW from TOC (ft)	GW Elevation (ft msl)	Depth to GW from TOC (ft)	GW Elevation (ft msl)
Sep. 26, 2008	7.09	851.27	19.03	839.36
Oct. 09, 2008	7.13	851.23	18.7	839.69
Oct. 14, 2008				
Oct. 16, 2008				
Oct. 21, 2008				
Oct. 22, 2008				
Oct. 24, 2008				
Oct. 28, 2008				
Oct. 29, 2008				
Oct. 30, 2008				
Nov. 07, 2008				
Nov. 13, 2008				
Dec. 05, 2008	7.71	850.65	19.31	839.08
Dec. 08, 2008				
Dec. 09, 2008				
Dec. 12, 2008				
Dec. 15, 2008				
Dec. 16, 2008				
Dec. 17, 2008				
Dec. 18, 2008				
Dec. 19, 2008	7.77	850.59	19.41	838.98
Dec. 22, 2008				
Dec. 23, 2008				
Dec. 29, 2008				
Dec. 30, 2008				
Jan. 05, 2009				
Jan. 06, 2009				
Jan. 07, 2009				
Jan. 08, 2009				
Jan. 09, 2009				
Jan. 10, 2009				
Jan. 12, 2009	6.90	851.46	18.55	839.84
Feb. 24, 2009				
Mar. 20, 2009	7.16	851.20	18.69	839.70
end				

Notes:

ft msl = Elevation referenced to feet above mea

TOC = Top of PVC Casing

ft = feet

[A] = as measured inside well

NI = Not Installed

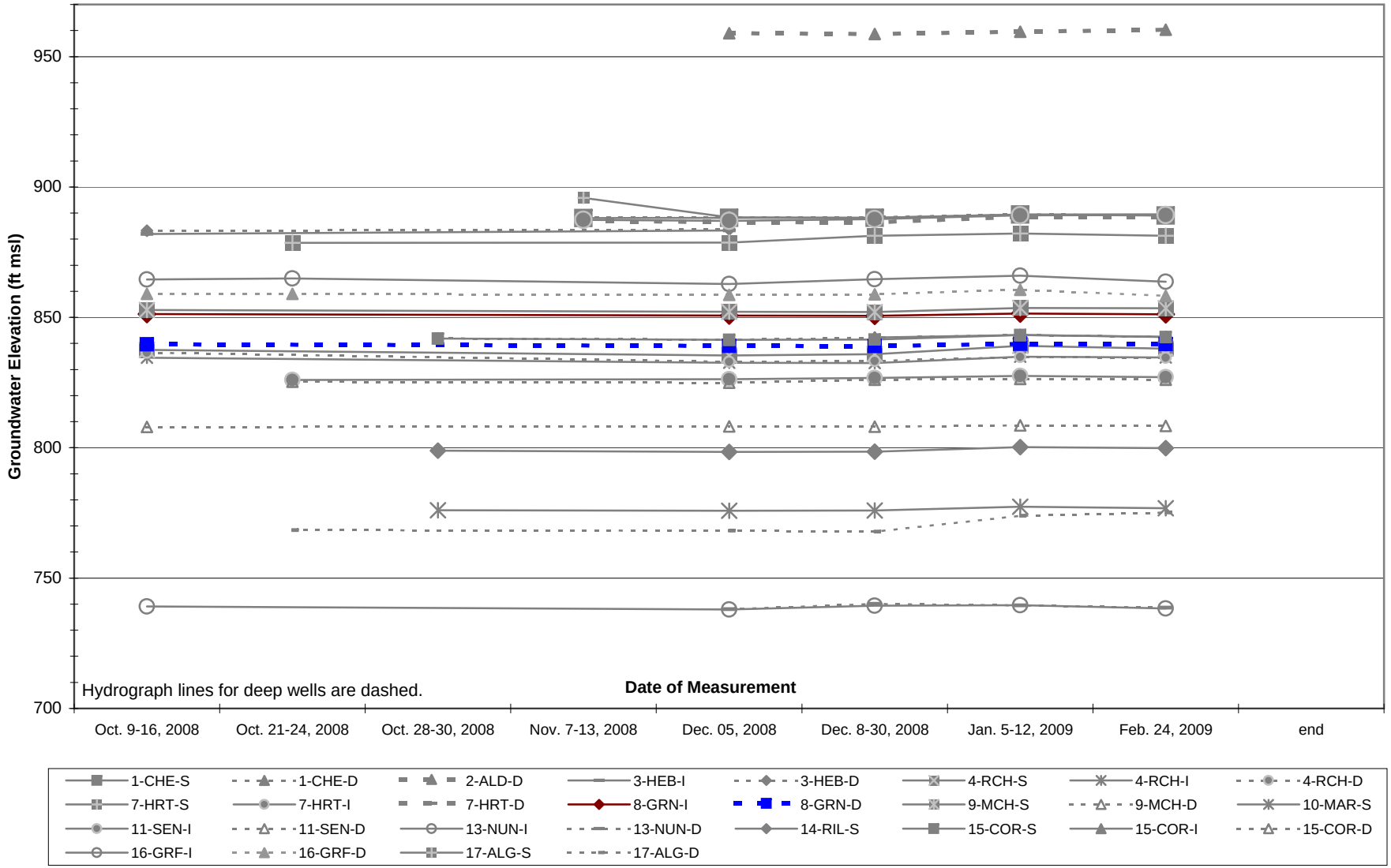
--- No Elevation

Well 17-Alg-S was frozen or partially frozen fror

Site 8 Groundwater Level Hydrograph
(includes ALL AECOM INSTALLED WELLS)

McHenry County Obervation Well Network

AECOM Project 09000-460

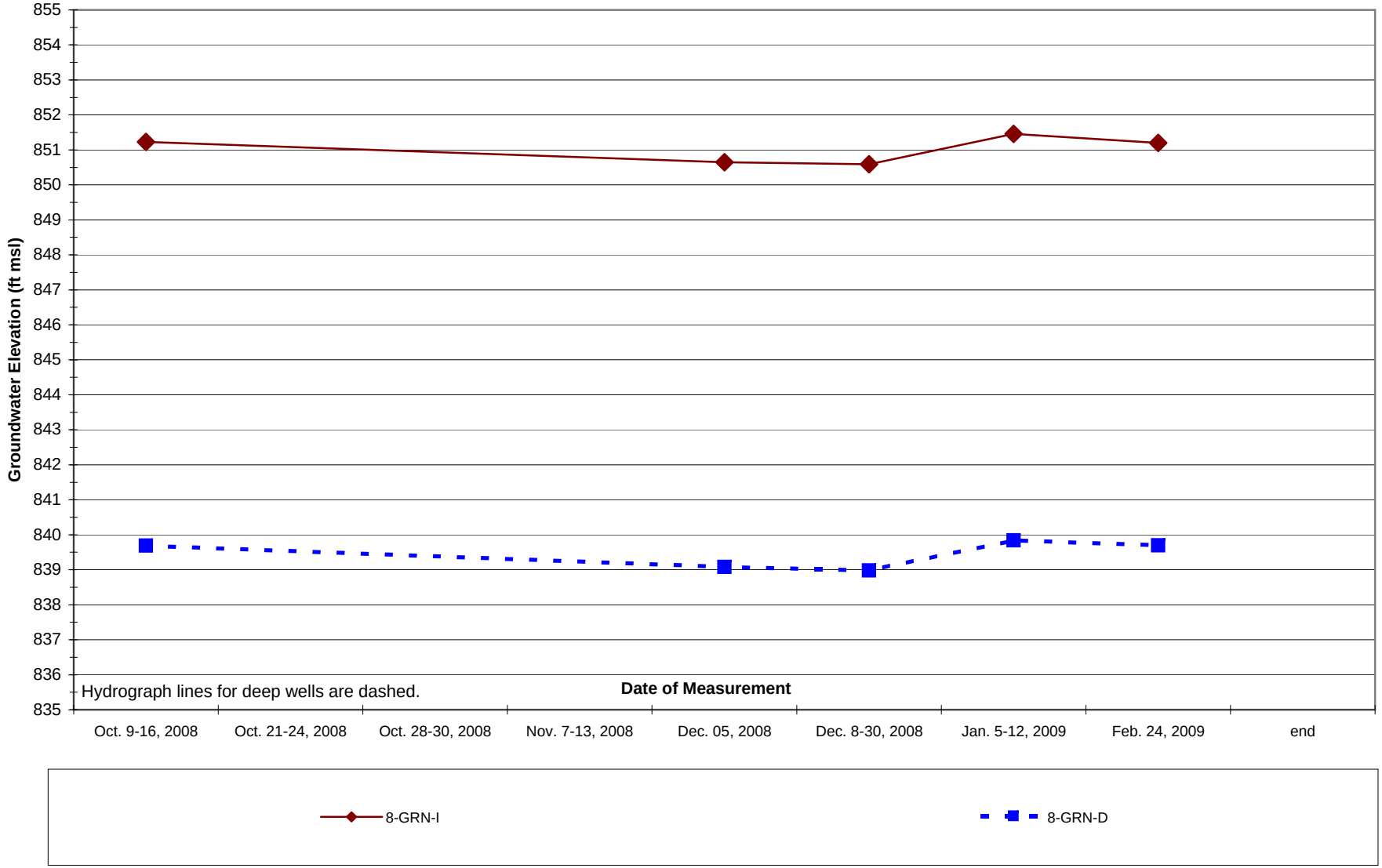


K:\PROJECTS\200804080\In_Progress\STS-McHenry Cty_WLs IN PROGRESS - figs for each site.xls

Site 8 Groundwater Level Hydrograph

McHenry County Obervation Well Network

AECOM Project 09000-460



K:\PROJECTS\200804080\In_Progress\STS-McHenry Cty_WLs IN PROGRESS - figs for each site.xls

Well Development Record

STS Consultants, Ltd.
11425 West Lake Park Drive
Milwaukee, Wisconsin 53224

Site Name: McHenry County

Well ID Number: 8-GRN-I

Date of Completion: 12/19/08

STS Job Number: 200804080

Start Time: 1550

End Time: 1740

Water color at start of development: Brown

Water color at end of development: Clear

Amount of water removed during development:

Contained water? ☐ Yes ☒ No

If not contained, where water disposed? Ground

Well Development Methods:

- ☐ Surged with bailer and bailed
- ☐ Surged with block and bailed
- ☐ Surged with block, bailed & pumped
- ☐ Bailed only
- ☐ Pumped slowly
- ☐ Surged with bailer and pumped
- ☒ Surged with block and pumped
- ☐ Compressed Air
- ☐ Pumped only
- ☐ Other

Equipment Used

- ☐ PVC bailer
- ☐ Well wizard
- ☐ Bean or Moino pump (on drill rig)
- ☒ Surge block
- ☒ Whale pumps

Notes:

Surge Start: 15:35

End: 15:50

Purge Start: 1550

End: 1740

WL St: 7.77

WL End: 8.48

WELL DEVELOPMENT FIELD RECORD

Job Name: McHenry County Job No. 20080480 Well No. 8-GRN-I

Developed By: Brian Schmidt Date of Install. _____ Sheet ____ of ____

Started Devel. 12/19/08 / _____ (DATE / TIME) Completed Devel. 12/19/08 / _____ (DATE / TIME)

W.L. Before Devel. _____ / _____ / _____ (DATE / TIME / DEPTH) After Devel. _____ / _____ / _____ (DATE / TIME / DEPTH)

Well Depth: Before Devel. _____ After Devel. _____ Well Dia. (in.) _____

Standing Water Column (ft.) _____ Standing Well Volume _____ gal.

Screen Length 5' Drilling Water Loss _____ gal.

DATE / TIME	VOLUME REMOVED (Gallons)	FIELD PARAMETERS SPEC. COND. (umhos/cm)	TEMP. (C°)	pH (s.u.)	TURB ~~Other~~	ORP	REMARKS
12/19/08 1620	1 GAL/MIN	893	9.0	7.47	474	—	
" 1640	"	845	8.3	7.46	698	—	
" 1700	2 GAL/MIN	823	7.9	7.44	999	—	SWITCHED TO WATERRA PUMP
1720	"	822	7.8	7.46	149	—	
1740	"	818	7.8	7.42	80	—	
		= TOTAL VOLUME REMOVED (Gallons)					

Development Method: WL FINAL: 8.48

Notes:

Well Development Record

STS Consultants, Ltd.
11425 West Lake Park Drive
Milwaukee, Wisconsin 53224

Site Name: McHenry County

Well ID Number: 8-GRN-D

Date of Completion: 12/19/08

STS Job Number: 200804080

Start Time: 1535

End Time: 1640

Water color at start of development: Brown

Water color at end of development: CLEAR

Amount of water removed during development:

Contained water? ☐ Yes ☒ No

If not contained, where water disposed? GROUND

Well Development Methods:

- ☐ Surged with bailer and bailed
- ☐ Surged with block and bailed
- ☐ Surged with block, bailed & pumped
- ☐ Bailed only
- ☐ Pumped slowly
- ☐ Surged with bailer and pumped
- ☐ Surged with block and pumped
- ☐ Compressed Air
- ☒ Pumped only
- ☐ Other

Equipment Used

- ☐ PVC bailer
- ☐ Well wizard
- ☐ Bean or Moino pump (on drill rig)
- ☐ Surge block
- ☐ Whale pumps
- ☒ WATERRA PUMP W/BLOCK

Notes: PURGE START. 1535

END: 1640

WL ST: 19.41

WL END: 19.52

WELL DEVELOPMENT FIELD RECORD

Job Name McHenry County Job No. 20080408 0 Well No. 8-CPN-D

Developed By Matt Hogue Date of Install. _____ Sheet ____ of ____

Started Devel. 12/19/08 / DATE / TIME Completed Devel. 12/19/08 / DATE / TIME

W.L. Before Devel. ____ / DATE / TIME / DEPTH After Devel. ____ / DATE / TIME / DEPTH

Well Depth: Before Devel. _____ After Devel. _____ Well Dia. (in.) _____

Standing Water Column (ft.) _____ Standing Well Volume _____ gal.

Screen Length 5' Drilling Water Loss _____ gal.

DATE / TIME	VOLUME REMOVED (Gallons)	FIELD PARAMETERS SPEC. COND. (umhos/cm)	TEMP. (C°)	pH (s.u.)	TURB ~~Other~~	ORP	REMARKS
12/19/08 1600	2 gal/min	575	9.0	7.89	147	—	
1620	"	570	9.3	7.51	37	—	
1640	"	581	9.1	7.52	27	—	
		= TOTAL VOLUME REMOVED (Gallons)					

Development Method: WL Final: 19.52

Notes:

First Environmental Laboratories, Inc.

IL ELAP / NELAC Accreditation # 100292

1600 Shore Road • Naperville, Illinois 60563 • Phone (630) 778-1200 • Fax (630) 778-1233

Analytical Report

Client: AECOM ENVIRONMENT
Project ID: McHenry County 200804080
Sample ID: 8-GRN-I
Sample No: 9-0115-005

Date Collected: 01/12/09
Time Collected: 10:35
Date Received: 01/13/09
Date Reported: 01/20/09

Analyte		Result	R.L.	Units	Flags
Total Metals	**Method: 6020A**		**Preparation Method 3010A**		
Analysis Date: 01/16/09			Preparation Date: 01/15/09		
Calcium		107	0.1	mg/L	
Iron		1.36	0.01	mg/L	
Magnesium		56.5	0.1	mg/L	
Potassium		1.8	0.1	mg/L	
Sodium		38.6	0.1	mg/L	
Alkalinity, Bicarbonate (CaCO3)	**Method: 2320B**				
Analysis Date: 01/15/09 13:30					
Alkalinity, Bicarbonate (CaCO3)		350	5	mg/L	
Alkalinity, Carbonate (CaCO3)	**Method: 2320B**				
Analysis Date: 01/15/09 13:30					
Alkalinity, Carbonate (CaCO3)		< 5	5	mg/L	
Chloride	**Method: 4500Cl, E**				
Analysis Date: 01/14/09					
Chloride		35	5	mg/L	
Sulfate	**Method: 375.2R2.0**				
Analysis Date: 01/15/09					
Sulfate		95	15	mg/L	

First Environmental Laboratories, Inc.

IL ELAP / NELAC Accreditation # 100292

1600 Shore Road • Naperville, Illinois 60563 • Phone (630) 778-1200 • Fax (630) 778-1233

Analytical Report

Client: AECOM ENVIRONMENT
Project ID: McHenry County 200804080
Sample ID: 8-GRN-D
Sample No: 9-0115-006

Date Collected: 01/12/09
Time Collected: 10:45
Date Received: 01/13/09
Date Reported: 01/20/09

Analyte		Result	R.L.	Units	Flags
Total Metals	**Method: 6020A**		**Preparation Method 3010A**		
Analysis Date: 01/16/09			Preparation Date: 01/15/09		
Calcium		74.7	0.1	mg/L	
Iron		1.08	0.01	mg/L	
Magnesium		40.6	0.1	mg/L	
Potassium		1.7	0.1	mg/L	
Sodium		16.2	0.1	mg/L	
Alkalinity, Bicarbonate (CaCO3)	**Method: 2320B**				
Analysis Date: 01/15/09 13:30					
Alkalinity, Bicarbonate (CaCO3)		300	5	mg/L	
Alkalinity, Carbonate (CaCO3)	**Method: 2320B**				
Analysis Date: 01/15/09 13:30					
Alkalinity, Carbonate (CaCO3)		< 5	5	mg/L	
Chloride	**Method: 4500Cl, E**				
Analysis Date: 01/14/09					
Chloride		16	5	mg/L	
Sulfate	**Method: 375.2R2.0**				
Analysis Date: 01/15/09					
Sulfate		61	15	mg/L	

Field Well Sampling Sheet

Fill out the entire form. If it does not apply, mark N/A.

Project Name: McHenry County
STS Job No. 20080480
Location: Greenwood
Tester: Brian Schmidt
Well Number: 8-GRN-I
Date Sampled: 1/12/09
Previous Well Sampled: 13-NUN-D

GENERAL CONDITIONS:

						If Missing Replaced?
Surface Seal:	✓ Ok		Damaged		Missing:	Yes No
Protector Pipe:	✓ Ok		Damaged		Missing:	Yes No
Well Cap:	✓ Ok		Damaged		Missing:	Yes No
Ambient Temperature:	20 °F		Clear	✓ Cloudy	Rain	

WELL DATA:

Measuring Device: Solinist Water Level Meter
Stick Up or Down: UP
Depth to Water: 6.90 (from Ground Surface)
Depth to Bottom: 71 (from TPVC)
Length of Water: (from TPVC)

Free Product Observed: ☐ Yes ☑ No Thickness: N/A

PURGING/SAMPLING:

Well Purging Calculations: Amount to purge = 0.163 gallons/foot times height of water column in feet for one well volume

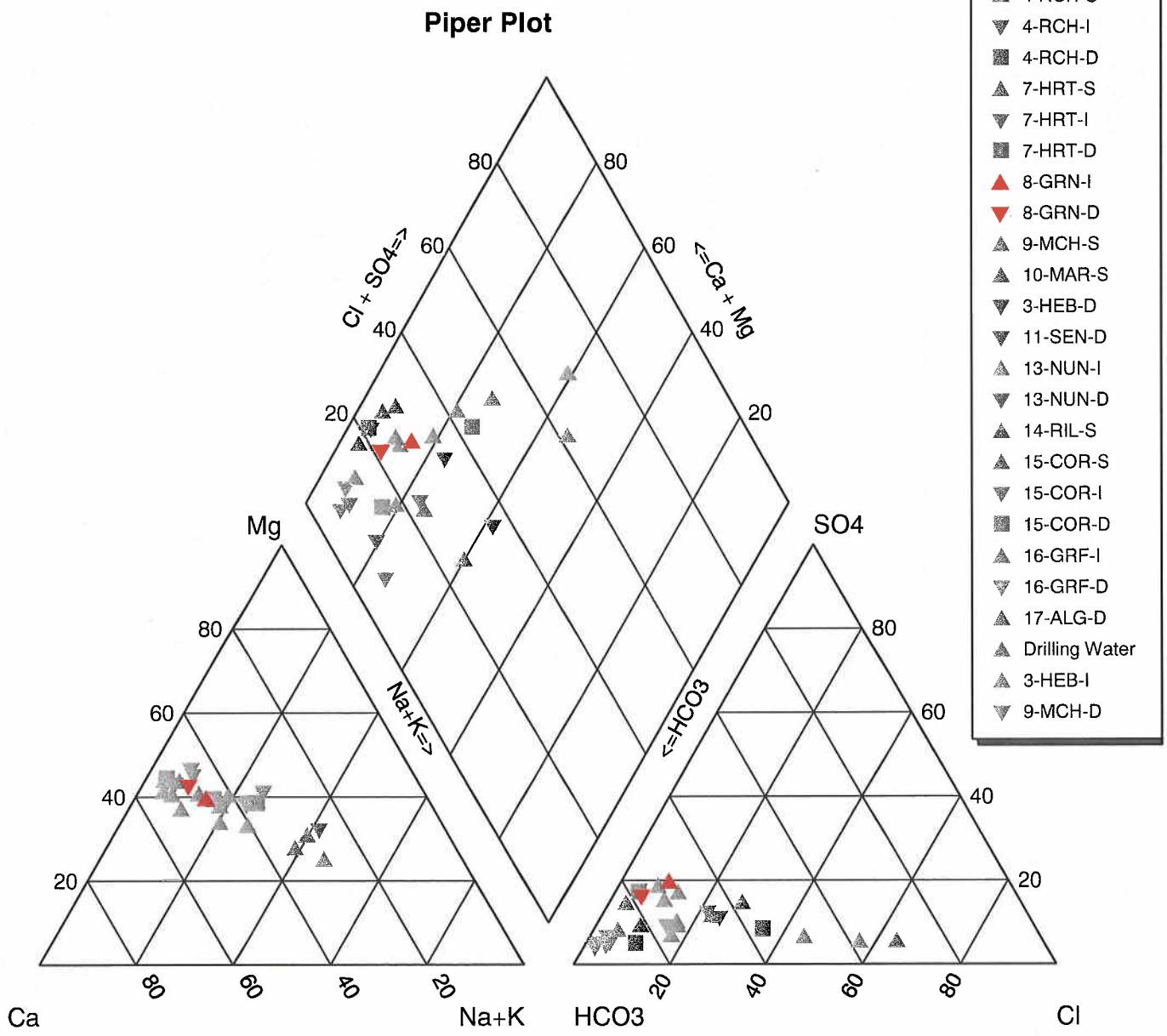
Purging Device: Bladder Pump
Sampling Device: Bladder Pump
Volume Required:
☑ See back of page for field readings during purge
Volume Purged:
Could Well Bail Dry? ☐ Yes ☑ No
Purging - Time Start: 930
Time Ended: 1040
Decon Method: Alconox

IN-SITU TESTING:

Turbidity: ☐ Turbid ☐ Opaque
Odor:
Color
pH @ degrees C
Uncorrected Conductivity X
Water Temp. (from Cond.)
Comments: ST: 1035

SAMPLES COLLECTED

Vocs -		Cyanide	
Metals -		Hexchrome	
SVOC		Alkalinity	
TOC		Chloride	
Sulfide		Ammonia	
Phenolics		COD	



DESCRIPTION: Piper Linear Diagram - Well Site #8

AECOM	PROJECT: McHenry County	PROJECT NO: 09000460
	CLIENT: Army Corps of Engineers	DATE: 7/30/2009

Well Purging Log

Date 1/12/09

8-GRW-I

Time	Temp	pH	Conductivity	~~ORP~~ TURB	~~DO~~ RATE
1/12/09 CAL	10.8	3.97	4530	0	250 ml/min
955	6.9	5.69	1200	71	"
1005	7.6	6.73	1130	22	"
1015	7.8	6.99	1120	12	"
1025	7.5	7.14	1110	12	"
1035	7.3	7.32	1080	9	"
ST: 1035					

Field Well Sampling Sheet

Fill out the entire form. If it does not apply, mark N/A.

Project Name: McHenry County
STS Job No. 20080408O
Location: Greenwood
Tester: Brian Schmidt
Well Number: B-GRN-D
Date Sampled: 1/12/09
Previous Well Sampled: B-GRN-I

GENERAL CONDITIONS:

						If Missing Replaced?
Surface Seal:	✓ Ok	☐ Damaged	☐ Missing:	Yes	No
Protector Pipe:	✓ Ok	☐ Damaged	☐ Missing:	Yes	No
Well Cap:	✓ Ok	☐ Damaged	☐ Missing:	Yes	No
Ambient Temperature: 20 °F		☐ Clear ✓ Cloudy	☐ Rain		

WELL DATA:

Measuring Device: Solinist Water Level Meter
Stick Up or Down: UP
Depth to Water: 18.55 (from Ground Surface)
Depth to Bottom: 153 (from TPVC)
Length of Water: (from TPVC)
Free Product Observed: ☐ Yes ✓ No Thickness: N/A

PURGING/SAMPLING:

Well Purging Calculations: Amount to purge = 0.163 gallons/foot times height of water column in feet for one well volume

Purging Device: Grundfos Pump
Sampling Device: Grundfos Pump
Volume Required:
✓ See back of page for field readings during purge
Volume Purged:
Could Well Bail Dry? ☐ Yes ✓ No
Purging - Time Start: 9:45
Time Ended: 1050
Decon Method: Alconox

IN-SITU TESTING:

Turbidity: ☐ Turbid ☐ Opaque
Odor:
Color
pH @ degrees C
Uncorrected Conductivity X
Water Temp. (from Cond.)
Comments: ST: 1045

SAMPLES COLLECTED

Vocs -	☐	Cyanide	☐
Metals -	☐	Hexchrome	☐
SVOC	☐	Alkalinity	☐
TOC	☐	Chloride	☐
Sulfide	☐	Ammonia	☐
Phenolics	☐	COD	☐

Well Purging Log

8-GRN-D

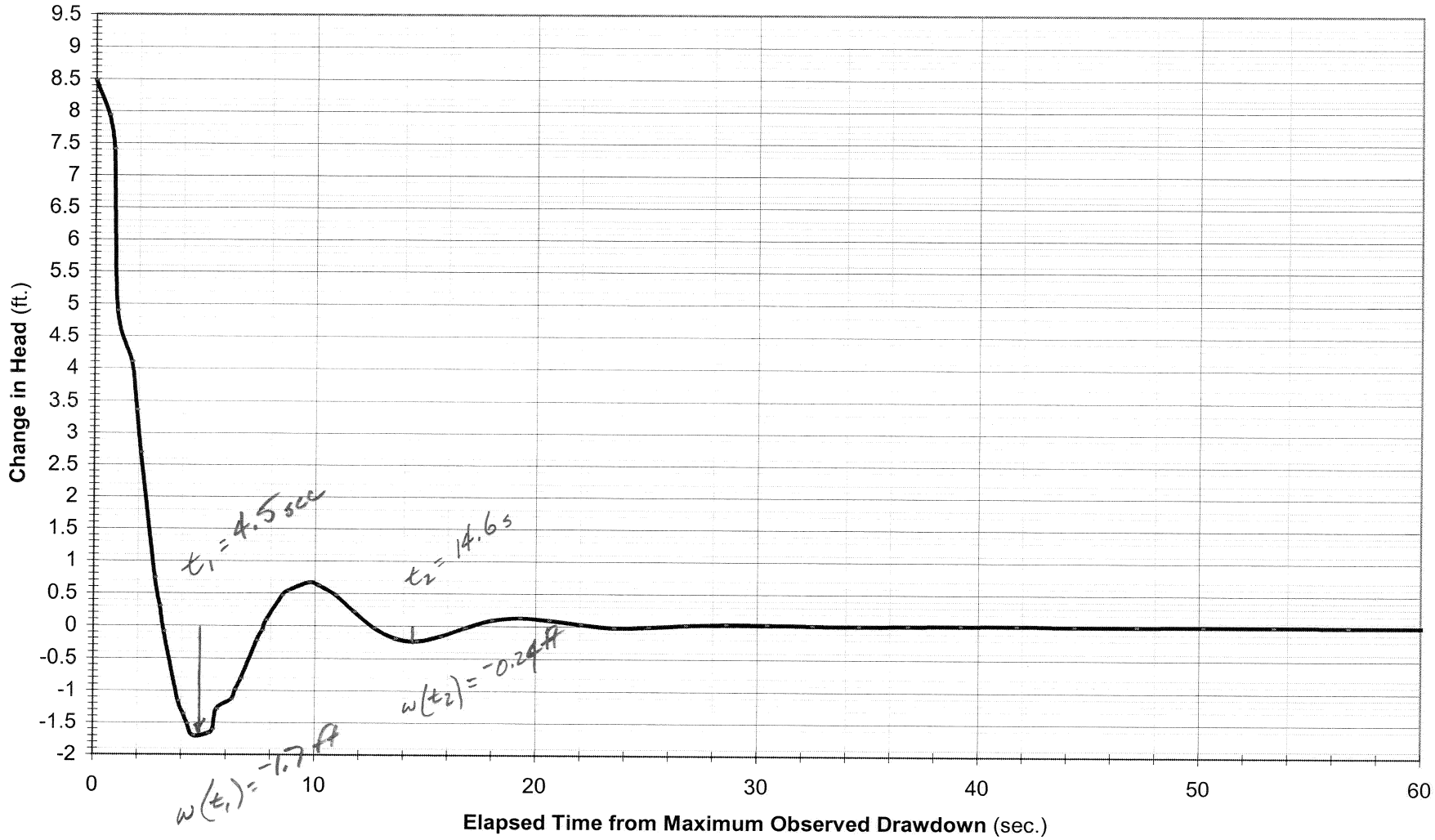
Date 1/12/09

Time	Temp	pH	Conductivity	~~ORP~~ TURB	~~DO~~ RATE
1/12/09 1000	10.2	6.36	1140	17	1000 ML/MIN
1010	10.4	6.91	876	3	"
1020	10.4	7.07	763	2	"
1030	10.5	7.28	~~761~~	3	"
1040	10.4	7.30	750	2	"
ST: 1045					

Underdamped Response to Sudden Change in Water Level

Hydraulic Conductivity Test Result

Greenwood Township #8 - Intermediate Well (Test #1)



Calculation of Transmissivity of Underdamped Well Response to Slug Test

Greenwood Township - Intermediate Well
McHenry County Monitoring Well Network Installation
AECOM Environment Project No. 09000-460

Expression		Value	Units
$w(t_1)$	=	-1.7	ft.
$w(t_2)$	=	-0.24	ft.
t_1	=	4.5	sec.
t_2	=	14.6	sec.
R_c	=	0.083	ft.
R_s	=	0.083	ft.
L_c	=	60	ft.
L_s	=	5	ft.
τ	=	10.1	sec.
ϖ	=	0.6221	s^{-1}
γ	=	0.19384	s^{-1}
T	=	b+a lnT	
$(g/L)^{1/2}$	=	0.6516	
d	=	0.2975	
a	=	0.00189	ft^2/sec
Assume S	=	5.0E-04	
b	=	0.025	ft^2/sec
T_1	=	b+a $\ln T_0$	
Assume T_0	≈	b_1	
T_1	=	0.0180	ft^2/sec
T_2	=	0.0174	ft^2/sec
T	=	1504	ft^2/day
Aquifer Thickness	=	20	ft.
Hydraulic Conductivity	**=**	**75**	**ft/day**
		2.65E-02	**cm/sec**

Reference:
ASTM D5785-95 - (Analytical Procedure) for Determining Transmissivity of Confined Nonleaky Aquifers by Underdamped Well Response to Instantaneous Change in Head (Slug Test)

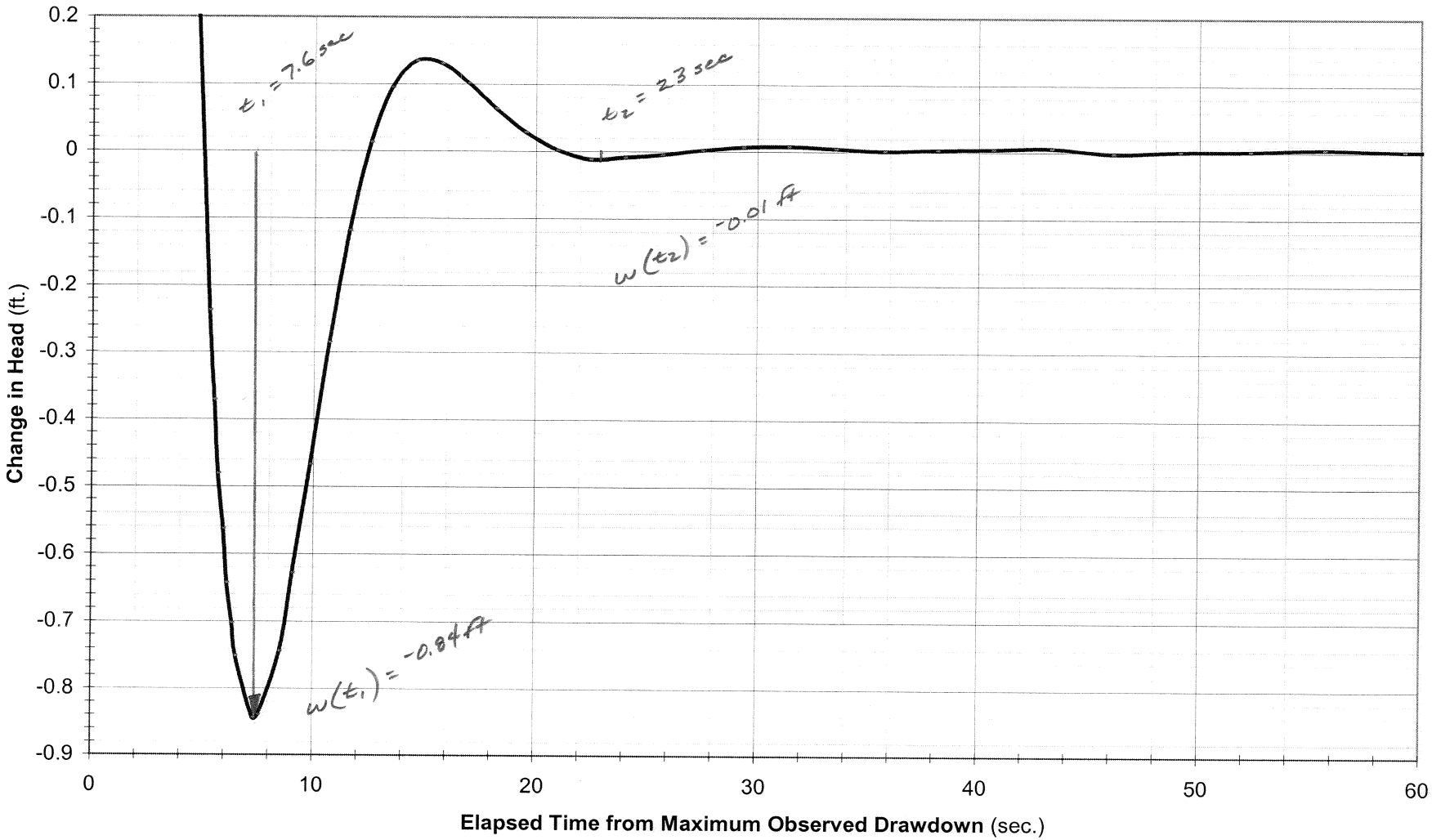
Check the results:

L	=	75.4 ft	-12.9	-17.1%	less than 20%?	**YES**
L	=	62.5 ft				
α	=	1.01E-02	less than 0.1?	**YES**		
d	=	0.2975	less than 0.7?	**YES**		

Underdamped Response to Sudden Change in Water Level

Hydraulic Conductivity Test Result

Greenwood Township #8 - Deep Well (Test #1)



Calculation of Transmissivity of Underdamped Well Response to Slug Test

Greenwood Township - Deep Well (Test #1)
McHenry County Monitoring Well Network Installation
AECOM Environment Project No. 09000-460

Expression		Value	Units
$w(t_1)$	=	-0.8	ft.
$w(t_2)$	=	-0.01	ft.
t_1	=	7.6	sec.
t_2	=	23.0	sec.
R_c	=	0.083	ft.
R_s	=	0.083	ft.
L_c	=	131.2	ft.
L_s	=	5	ft.
τ	=	15.4	sec.
ϖ	=	0.4080	s^{-1}
γ	=	0.28772	s^{-1}
T	=	b+a lnT	
$(g/L)^{1/2}$	=	0.4992	
d	=	0.5763	
a	=	0.00075	ft^2/sec
Assume S	=	5.0E-04	
b	=	0.010	ft^2/sec
T_1	=	b+a $\ln T_0$	
Assume T_0	≈	b_1	
T_1	=	0.0066	ft^2/sec
T_2	=	0.0063	ft^2/sec
T	=	548	ft^2/day
Aquifer Thickness	=	48	ft.
Hydraulic Conductivity	**=**	**11**	**ft/day**
		4.02E-03	**cm/sec**

Reference:
ASTM D5785-95 - (Analytical Procedure) for Determining Transmissivity of Confined Nonleaky Aquifers by Underdamped Well Response to Instantaneous Change in Head (Slug Test)

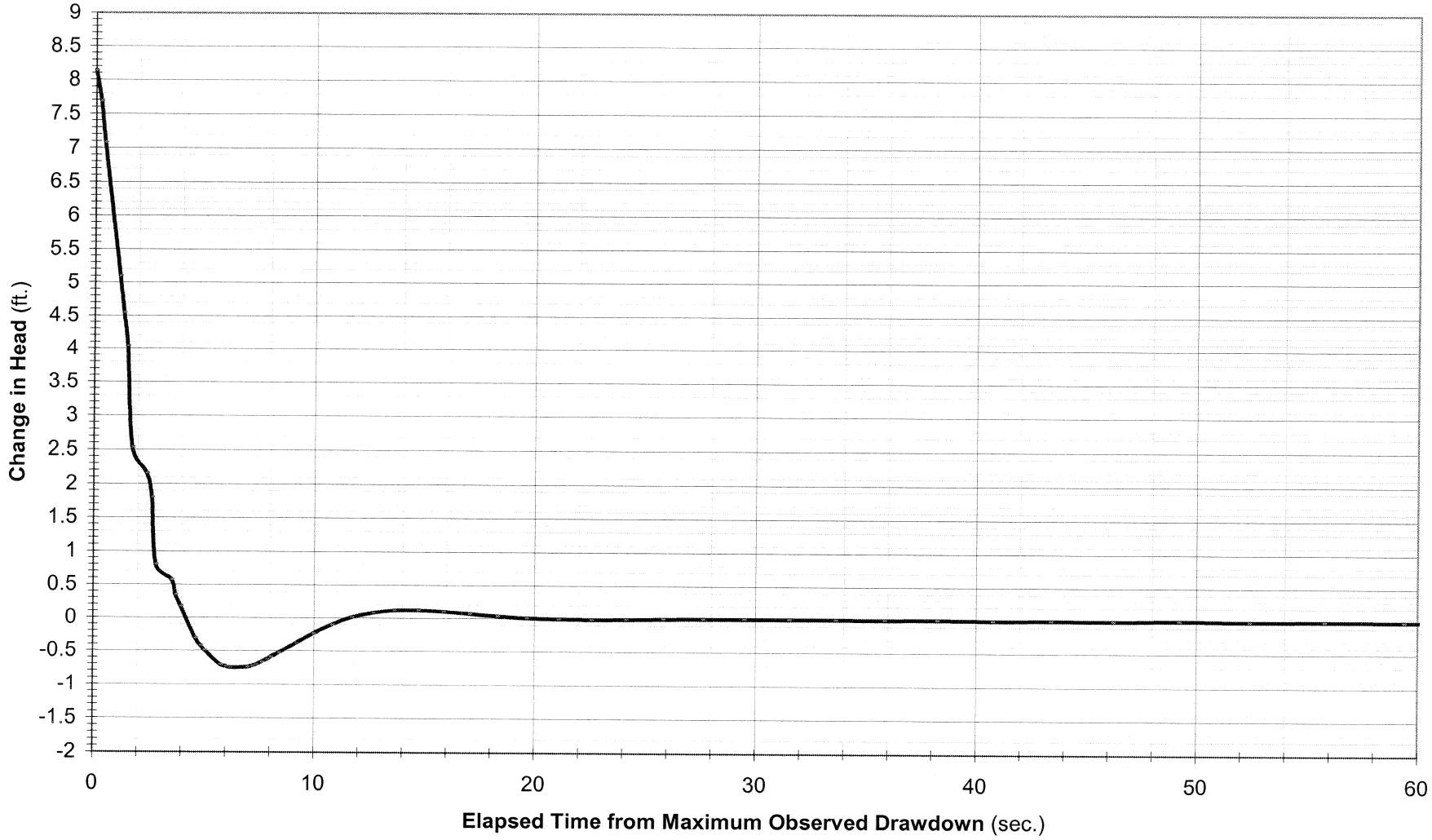
Check the results:

L	=	128.4 ft	5.3	4.1%	less than 20%?	**YES**
L	=	133.7 ft				
α	=	1.47E-02	less than 0.1?	**YES**		
d	=	0.5763	less than 0.7?	**YES**		

Underdamped Response to Sudden Change in Water Level

Hydraulic Conductivity Test Result

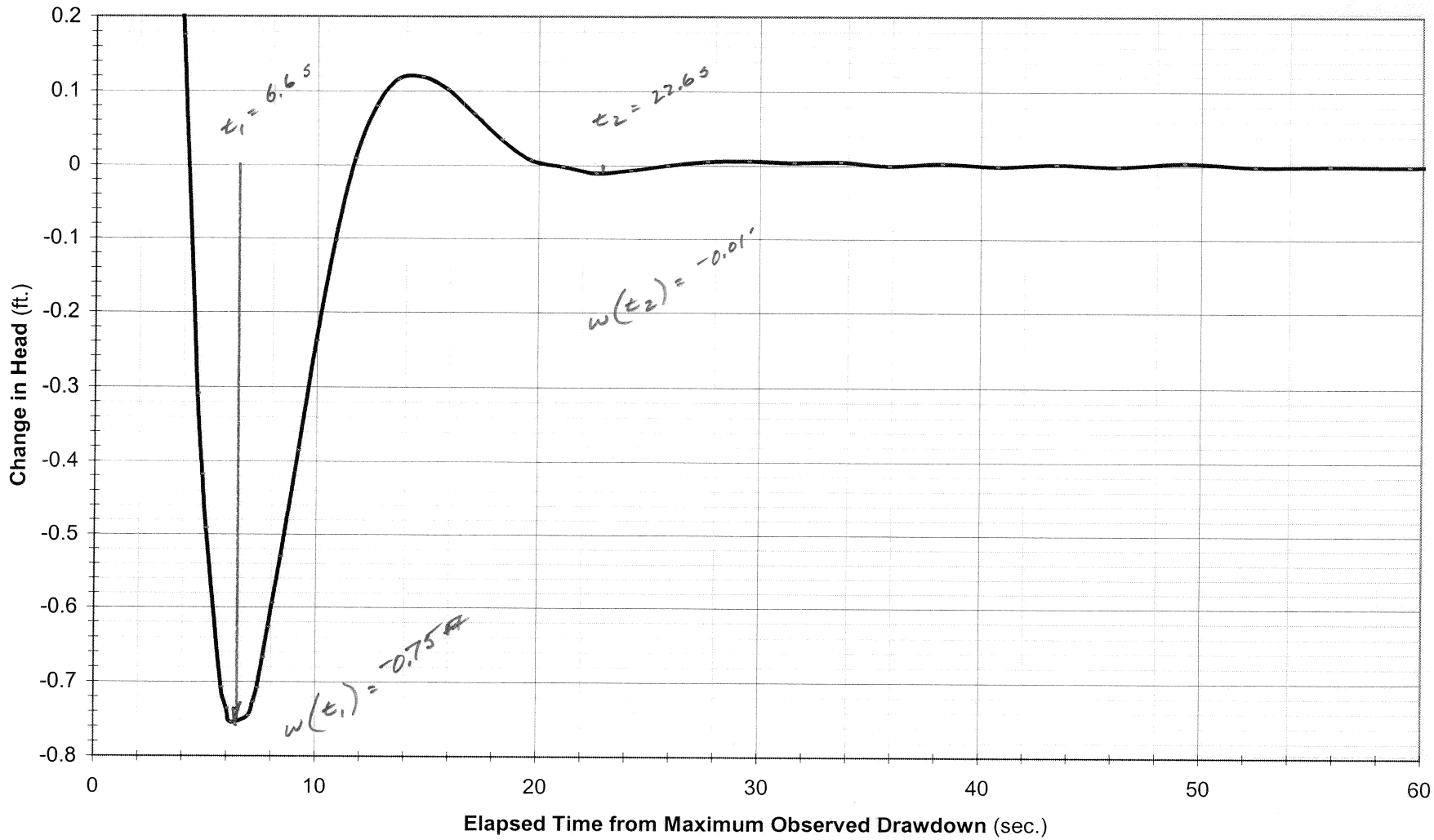
Greenwood Township #8 - Deep Well (Test #2)



Underdamped Response to Sudden Change in Water Level

Hydraulic Conductivity Test Result

Greenwood Township #8 - Deep Well (Test #2)



Calculation of Transmissivity of Underdamped Well Response to Slug Test

Greenwood Township - Deep Well (Test #2)
McHenry County Monitoring Well Network Installation
AECOM Environment Project No. 09000-460

Expression		Value	Units
$w(t_1)$	=	-0.75	ft.
$w(t_2)$	=	-0.01	ft.
t_1	=	6.6	sec.
t_2	=	22.6	sec.
R_c	=	0.083	ft.
R_s	=	0.083	ft.
L_c	=	131.2	ft.
L_s	=	5	ft.
τ	=	16	sec.
ϖ	=	0.3927	s^{-1}
γ	=	0.26984	s^{-1}
T	=	b+a lnT	
$(g/L)^{1/2}$	=	0.4765	
d	=	0.5663	
a	=	0.00072	ft^2/sec
Assume S	=	5.0E-04	
b	=	0.010	ft^2/sec
T_1	=	$b+a \ln T_0$	
Assume T_0	≈	b_1	
T_1	=	0.0065	ft^2/sec
T_2	=	0.0062	ft^2/sec
T	=	533	ft^2/day
Aquifer Thickness	=	48	ft.
Hydraulic Conductivity	**=**	**11**	**ft/day**
		3.92E-03	**cm/sec**

Reference:
ASTM D5785-95 - (Analytical Procedure) for Determining Transmissivity of Confined Nonleaky Aquifers by Underdamped Well Response to Instantaneous Change in Head (Slug Test)

Check the results:

L	=	141.0 ft	-7.3	-5.1%	less than 20%?	**YES**
L	=	133.7 ft				
α	=	1.45E-02	less than 0.1?	**YES**		
d	=	0.5663	less than 0.7?	**YES**		

Additional Well Site Information

In-Situ Inc.

8-GRN-I

Calibration Report

Report Number: 2009012319159-140956

221 East Lincoln Avenue, Fort Collins, CO 80524 USA
1-970-498-1500, 1-800-446-7488, FAX: 1-970-498-1598
Visit us at www.in-situ.com

Instrument Details:

Instrument Model:	**Level TROLL 500**
Full Scale Pressure Range	**206.84 KPa (30 PSI) vented**
Serial Number:	**140956**

Calibration Details:

Calibration Result:	**PASS**
Calibration Date:	2009-01-23 19:1:59 (UTC)
Nominal Range of Applied Temperature:	-5 C to +50 C
Temperature Accuracy Specification:	+/- 0.1 C From 0 C to +50 C
Nominal Range of Applied Pressure:	0 KPa to 206.8 KPa (0.0 PSI to 30.0 PSI)
Pressure Accuracy Specification:	+/- 0.1 %FS from -5 C to +50 C, +/- 0.05 %FS at +15 C

Post-Calibration Check:

Parameter	Applied	Reported	Deviation
Pressure	30.0001	29.9999	-0.0007
Pressure	0.0000	0.0030	0.0098
Temperature	19.9960	20.0125	0.0165

Calibration Procedures and Equipment Used:

Automated calibration procedures used.
Manu Agilent Model 34970A SerialNo MY44038788
Manu Instrulab Model 3312A-14-15-24 SerialNo 31138
Manu Instrulab Model 406X-0031-01 SerialNo 1-31118
Manu MENSOR Model 600 SerialNo 622742
Manu Agilent Model 53131A SerialNo MY47000169
Manu MENSOR Model 600 SerialNo 621385

Notes:

1. Standards used in this calibration are traceable to the National Institute of Standards and Technology.
2. This calibration report shall not be reproduced, except in full, without the written approval of In-Situ, Inc.
3. A calibration interval of 12 to 18 months is recommended.
4. The post-calibration data is collected at nominal +20 C.
5. 1.0 PSI = 6.894757 KPa

Performed By: JBO

Copyright © 2006 In-Situ, Inc.

In-Situ Inc.

8-GRN-D

Calibration Report

Report Number: 20090109142457-140447

221 East Lincoln Avenue, Fort Collins, CO 80524 USA
1-970-498-1500, 1-800-446-7488, FAX: 1-970-498-1598
Visit us at www.in-situ.com

Instrument Details:

Instrument Model:	**Level TROLL 500**
Full Scale Pressure Range	**206.84 KPa (30 PSI) vented**
Serial Number:	**140447**

Calibration Details:

Calibration Result:	**PASS**
Calibration Date:	2009-01-09 14:24:57 (UTC)
Nominal Range of Applied Temperature:	-5 C to +50 C
Temperature Accuracy Specification:	+/- 0.1 C From 0 C to +50 C
Nominal Range of Applied Pressure:	0 KPa to 206.8 KPa (0.0 PSI to 30.0 PSI)
Pressure Accuracy Specification:	+/- 0.1 %FS from -5 C to +50 C, +/- 0.05 %FS at +15 C

Post-Calibration Check:

Parameter	Applied	Reported	Deviation
Pressure	30.0001	30.0052	0.0171
Pressure	0.0005	0.0040	0.0116
Temperature	19.9710	19.9754	0.0044

Calibration Procedures and Equipment Used:

Automated calibration procedures used.
Manu Agilent Model 34970A SerialNo MY41012474
Manu Instrulab Model 3312A-14-15-24 SerialNo 31102-(41037)
Manu Instrulab Model 406X-0031-01 SerialNo 31128-1
Manu MENSOR Model 600 SerialNo 621218
Manu Agilent Model 53131A SerialNo MY47000169
Manu MENSOR Model 600 SerialNo 621385

Notes:

1. Standards used in this calibration are traceable to the National Institute of Standards and Technology.
2. This calibration report shall not be reproduced, except in full, without the written approval of In-Situ, Inc.
3. A calibration interval of 12 to 18 months is recommended.
4. The post-calibration data is collected at nominal +20 C.
5. 1.0 PSI = 6.894757 KPa

Performed By: NJH

Copyright © 2006 In-Situ, Inc.

Greenwood Township Well Site – Staked Location

Greenwood Township Well Site – Set up on Hole

Greenwood Township Subsurface Samples

Greenwood Township Well Site

Greenwood Township Well Site Entrance (Well in Center of Photo)

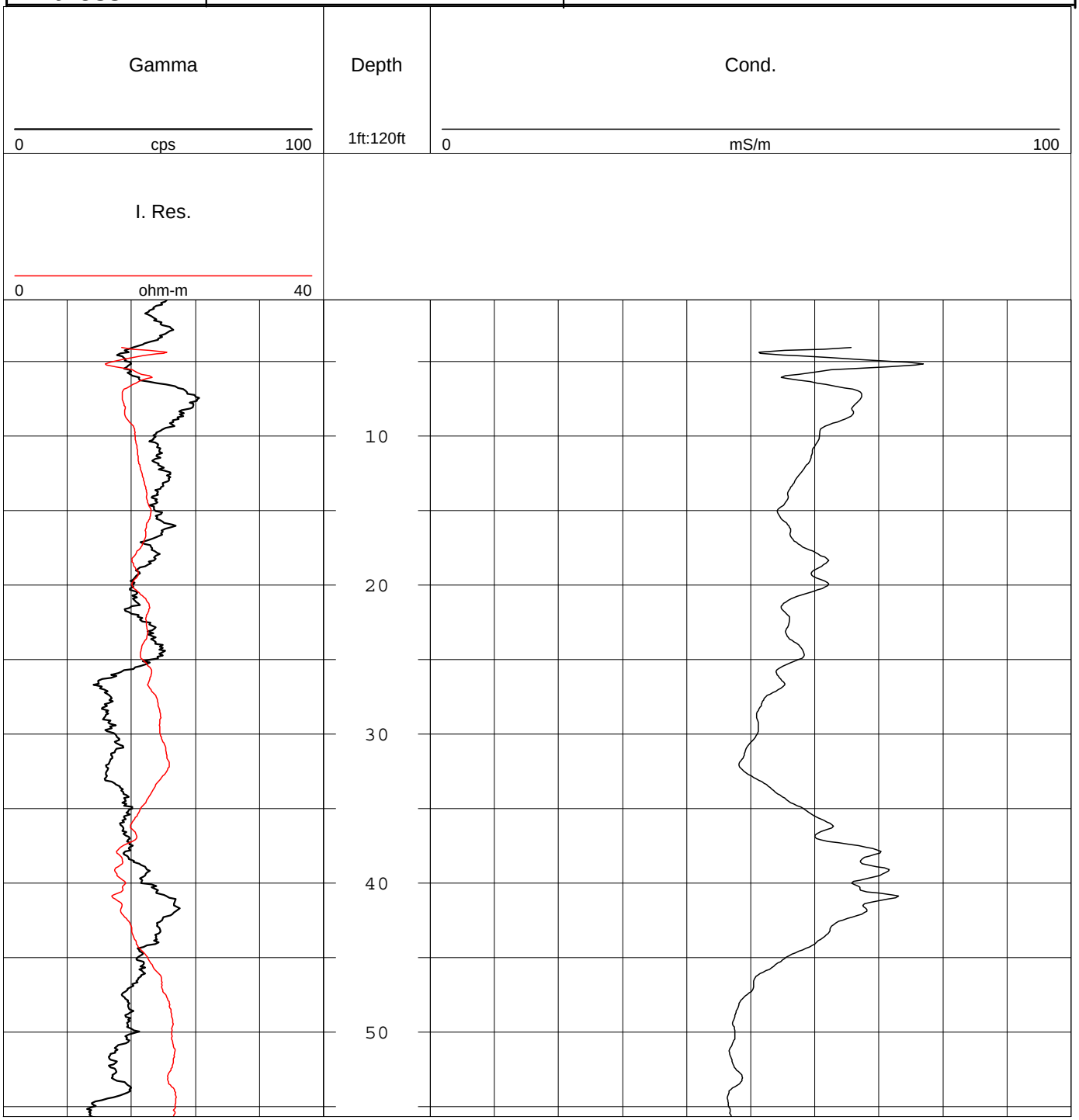
Greenwood Township Well Site

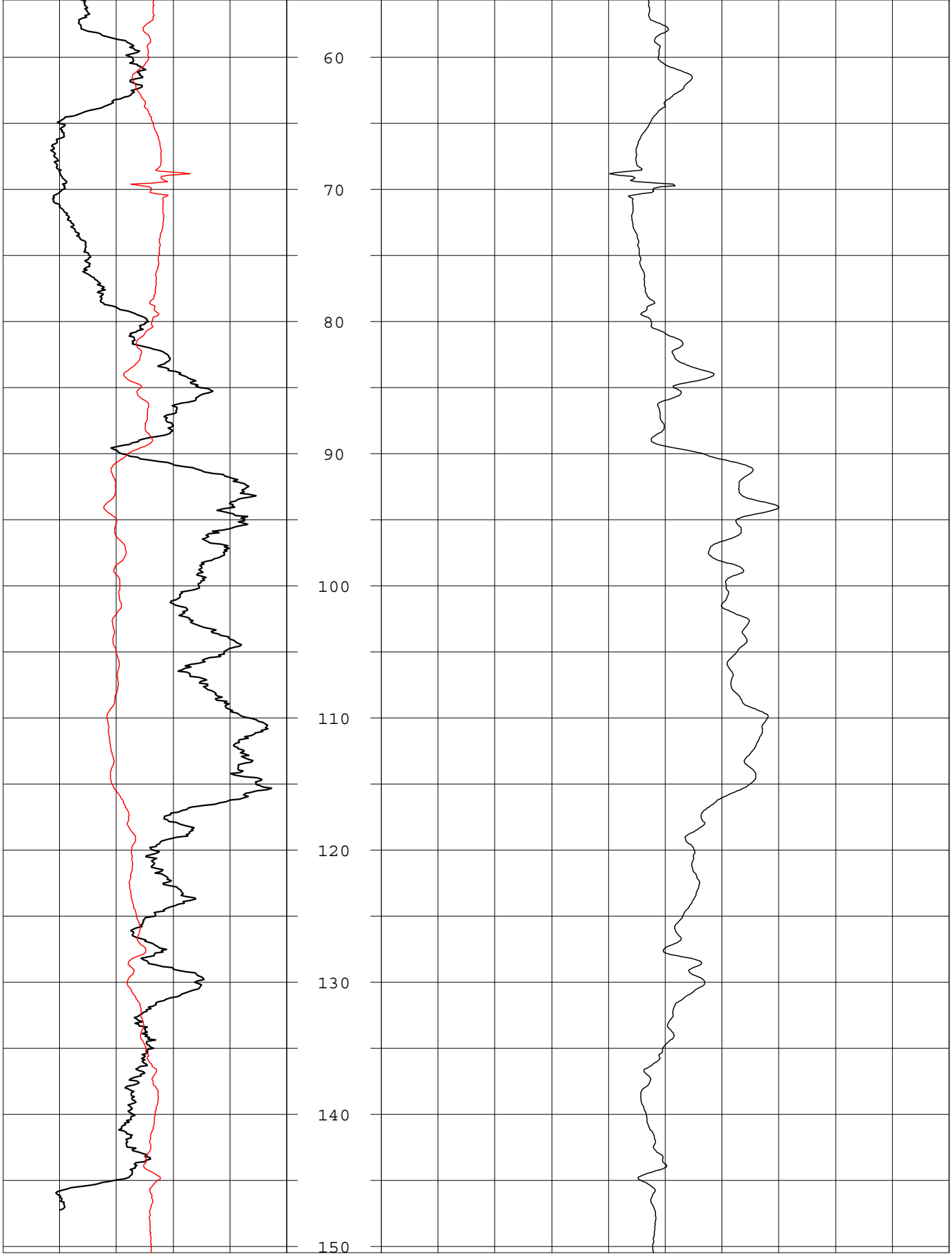
Greenwood Township Well Site – Inside Casing w/ Monument

COMPANY:	McHenry County & US Corp of Engineers
Location:	

Well	#8 Greenwood Township		
Date	10/21/08	BH Fluid	Formation
Casing	2" PVC +2.5 to -153' bgs		
File Name	MCTH8-08EMGAM		
Depth Driller	153'		
Depth Logger	152.84' bgs		
Logged by:	T. YOUNG		
Witness:	NOT WITNESSED		

OTHER SERVICES




60
70
80
90
100
110
120
130
140
150

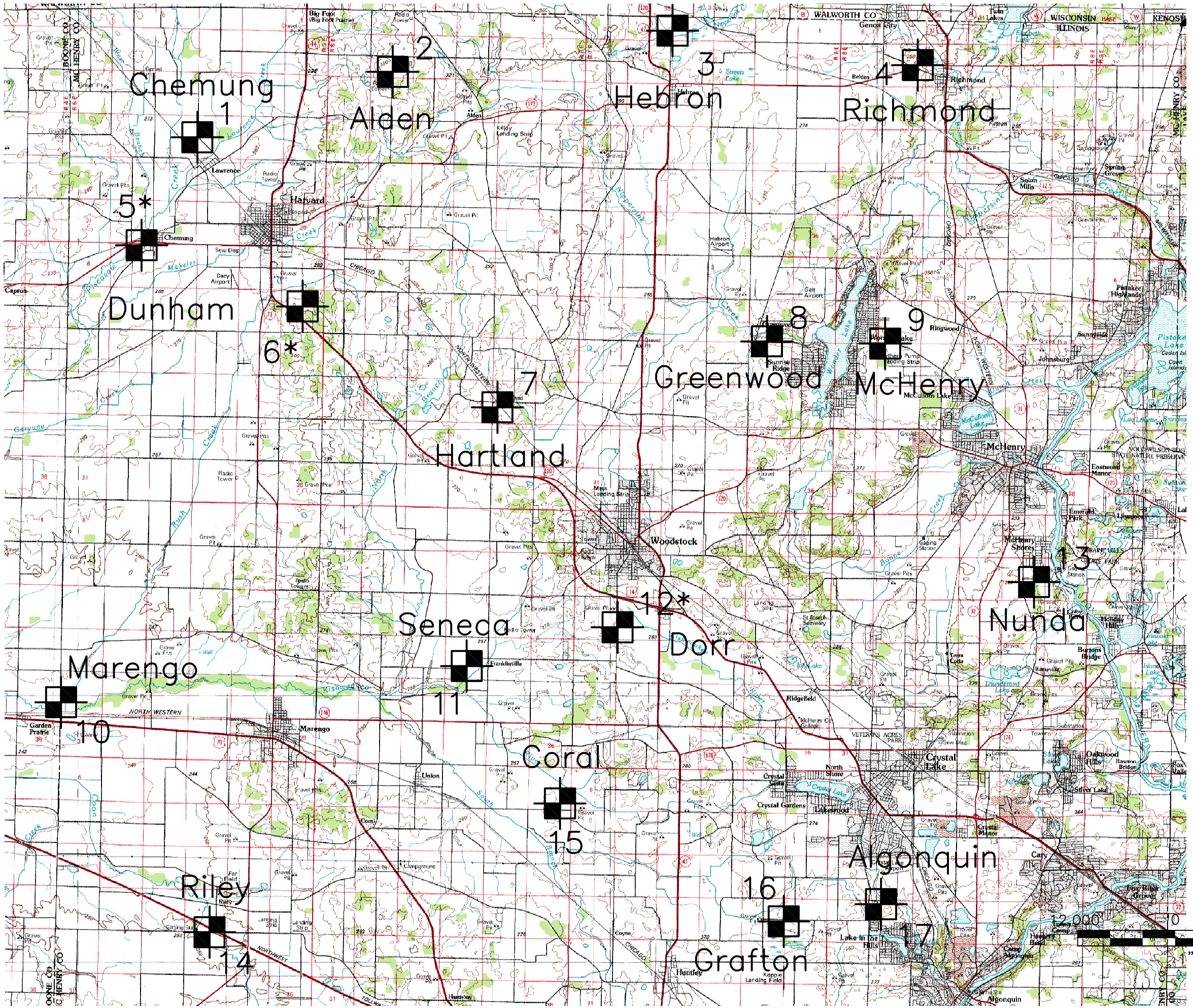
A-9: Folio for Well Site #9 – McHenry Township

Table of Contents

I.) Site Location Map – Location in County
II.) Site Location Map – Location on USGS Topographic Map
III.) Site Location Map – Location on USGS High Resolution Orthophoto
IV.) Site Boring Log
V.) Well Construction Diagram
VI.) Well Site Summary and Commentary
VII.) Particle Size Distribution Report
VIII.) Table of Water Level Measurements
IX.) Well Development Field Log
X.) Water Quality Analysis Results
XI.) Groundwater Sampling Field Log
XII.) Hydraulic Conductivity Testing Results
XIII.) In-Situ LevelTroll™ Calibration Report
XIV.) Site Photographs
XV.) Downhole Geophysical Testing

Well Site Location Maps

Z:\Projects\200804080\CtyWide\D-09000-460-8000_CtyOverviewMap_004.dwg; 4/20/2009 5:33:59 PM; BRAUN, GARY



LEGEND:

AECOM Well Installation Site

McHenry 9

Well Installations By Others

Dunham 6*

0 12,000 24,000'

" = 12,000'

AECOM

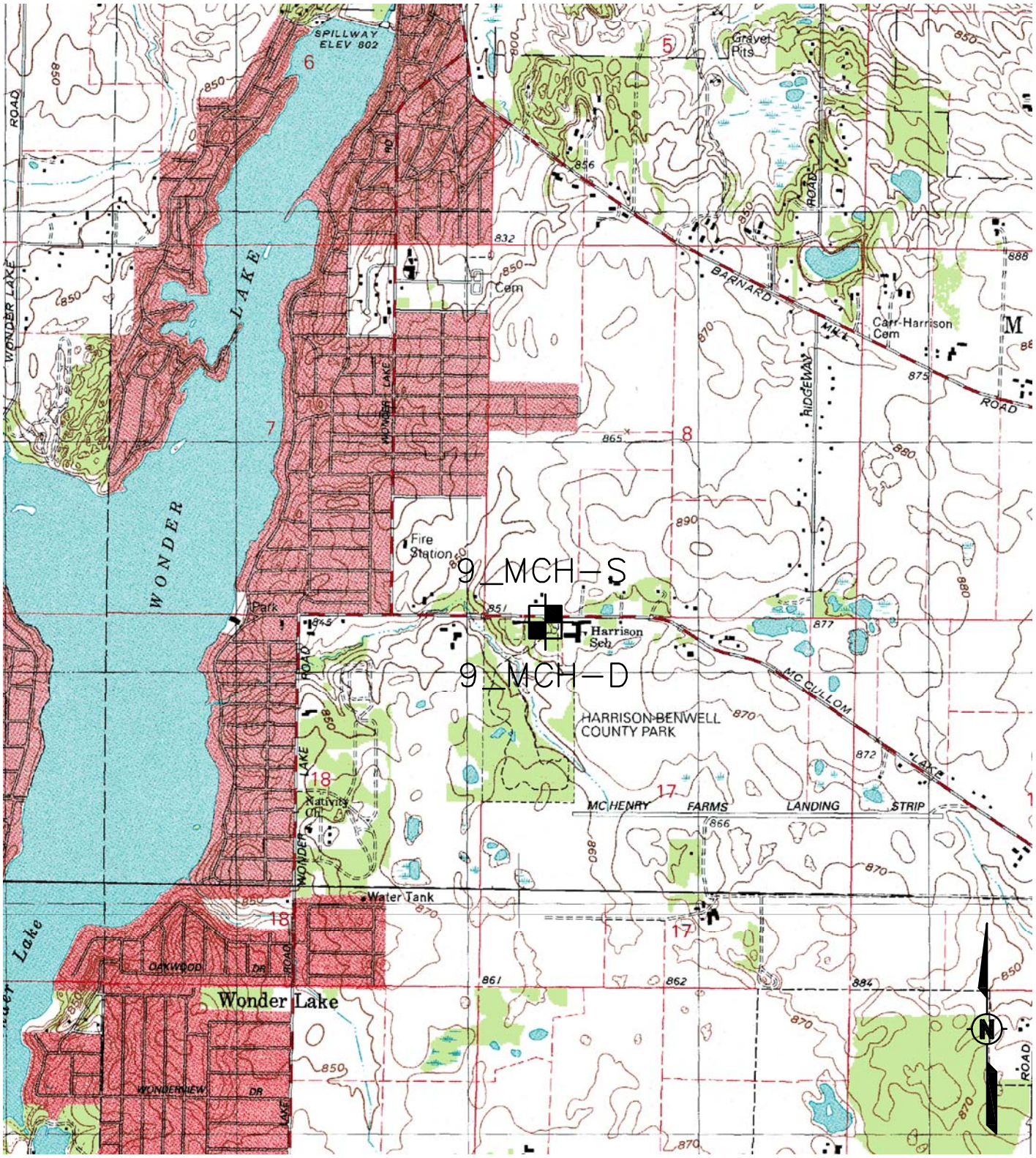
750 Corporate Woods Pkwy
Vernon Hills, IL 60061
847-279-2500
www.aecom.com

Copyright © By: STS Consultants, Ltd.

LOCATION MAP OF WELL SITES

Observation Well Network for Glacial Aquifers
McHenry County, Illinois

Drawn :	CJH	3/11/2009
Checked:	GMB	4/18/2009
Approved:	CSR	4/27/2009
PROJECT NUMBER	09000-460	
FIGURE NUMBER	1	



2000 0 2000 4000

1" = 2000'

AECOM

750 Corporate Woods Parkway
Vernon Hills, IL 60061
847.279.2500
www.aecom.com

Copyright © 2009, By: AECOM

Site Location on USGS Topographic Map
Site No. 9 - McHenry Township
Harrison-Benwell - McCullom Lake Rd.
Observation Well Network
McHenry County, Illinois

Drawn :	CJH	04/01/2009
Checked:	GMB	04/15/2009
Approved:	CSR	04/24/2009
PROJECT NUMBER	09000-460	
FIGURE NUMBER	Folio_9 #2	

Z:\Projects\200804080\CityWide\D-09000-460-8000_TopoMaps_v02.dwg; 4/20/2009 10:04:06 AM; BRAUN, GARY; STS_BLACK_040102.ctb

500 0 500 1000

1" = 500'

AECOM

750 Corporate Woods Parkway
Vernon Hills, IL 60061
847.279.2500
www.aecom.com
Copyright © 2009, By: AECOM

2005 USGS High Resolution Orthophoto
Site No. 9 - McHenry Township
Harrison-Benwell Park - McCullom Lake Rd.
Observation Well Network
McHenry County, Illinois

Drawn :	CJH	04/01/2009
Checked:	GMB	04/15/2009
Approved:	CSR	04/24/2009
PROJECT NUMBER	09000-460	
FIGURE NUMBER	Folio_9 #3	

Z:\Projects\200804080\CtyWide\D-09000-460-8000_AerialsMap_004.dwg; 4/21/2009 1:01:57 PM; BRAUN, GARY; STS_BLACK_040102.ctb

Boring and Well Construction Details

DRILLING LOG

DIVISION	USACE
INSTALLATION	Chicago District
SHEET	1 OF 9 SHEETS
1. PROJECT	McHenry County Observation Wells
2. LOCATION (Coordinates or Station)	McHenry County, Illinois N 2,083,060.00 E 984,550.00
3. DRILLING AGENCY	WDC Exploration & Wells
4. HOLE NO. *(As shown on drawing title and file number)*	9-McHENRY
5. NAME OF DRILLER	Dan Tonnancour
6. DIRECTION OF HOLE	☒ VERTICAL ☐ INCLINED --- DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN	208.5
8. DEPTH DRILLED INTO ROCK	1.5
9. TOTAL DEPTH OF HOLE	210.0
10. SIZE AND TYPE OF BIT	3 7/8" Carbide Bit / 5 7/8" Casing
11. DATUM FOR ELEVATION SHOWN *(TBM or MSL)*	NAVD 88
12. MANUFACTURER'S DESIGNATION OF DRILL	Super Sonic II
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN	DISTURBED 23 / UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES	N/A
15. ELEVATION GROUND WATER	808.7
16. DATE HOLE	STARTED 10/1/2008 / COMPLETED 10/2/2008
17. ELEVATION TOP OF HOLE	+863.2
18. TOTAL CORE RECOVERY FOR BORING	98 %
19. GEOLOGIST	Gary Braun, LPG IL

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS *(Drilling time, water loss, depth weathering, etc., if significant)* g
+863.2	0.0		Topsoil: OL, Black organic clayey silt	100	1 0.0 5.0	
+862.2	1.0		CL, Reddish brown silty clay, little fine gravel, occasional fine black laminations, damp			Sample No. 1 from 2.0' - 3.0'
+859.7	3.5		SC, Brown gravelly-clayey sand, little silt, trace organics, medium dense, moist to wet below 8.0'			
				100	2 5.0 15.0	Qp = 1.5 TSF @9.0'
			Note: Stiffness increases slightly with depth			Sample No. 2 from 12.0' to 13.0' Qp = 1.75 TSF @12.0'
				100	3 15.0 25.0	
+844.2	19.0		GW, Brown sandy fine to coarse gravel, loose, wet			

DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE 863.2

Hole No. 9-McHENRY

PROJECT: McHenry County Observation Wells

INSTALLATION: Chicago District

SHEET 2 OF 9 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
			GW, Brown sandy fine to coarse gravel, loose, wet *(continued)*			Sample No. 3 from 21.0' - 22.0'
+839.7	23.5					
			SP, Brown medium sand, trace fine gravel, loose, wet			% Gravel/% Sand/% Fines = 37/62/2 from 24.0' to 25.0'
				100	4 25.0 35.0	
+834.2	29.0					
			ML, Brown sandy silt, little gravel/clay, stiff, moist to wet, not plastic			Sample No. 4 from 30.0' to 31.0' Qp = 0.5 to 0.0 TSF @31.0'
+830.2	33.0					
			SC, Gray clayey sand, little fine to coarse gravel and silt, medium dense to soft, moist			
+827.7	35.5			100	5 35.0 45.0	
			CL-ML, Gray clayey silt, trace fine gravel, stiff to medium dense, moist, low plasticity			Qp = 1.5 TSF @37.0' Qp = 0.0 TSF @38.0' (silt) Qp = 1.25 TSF @40.0' Qp = 1.75 TSF @42.0' Qp = 0.25 TSF @44.0' Sample No. 5 from 44.0' to 45.0'
+818.2	45.0					
				100	6 45.0	

DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE 863.2

Hole No. 9-McHENRY

PROJECT: McHenry County Observation Wells

INSTALLATION: Chicago District

SHEET 3 OF 9 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
			CL, Gray silty clay, trace coarse sand and fine gravel (occasional silt partings), stiff to hard, moist *(continued)*		55.0	Qp = 2.5 TSF @46.0'
						Qp = 3.0 TSF @47.0'
						Qp = 4.0 TSF @49.0'
						Qp = 2.5 TSF @51.0'
						Qp = 4.5+ TSF @53.0'
			Note: 10/2/08 - 0700, water level 54.5 ft. bgs ~15 hours after borehole completion			Sample No. 6 from 54.0' to 55.0' Qp = 3.5 TSF @55.0'
				100	7 55.0 65.0	
						QP = 2.5 TSF @58.0'
						Qp = 4.5 TSF @61.0'
						Qp = 2.0 TSF @63.0'
						Sample No. 7 from 64.0' to 65.0'
				95	8 65.0 75.0	
						Qp = 1.75 TSF @68.0'
						Qp = 1.5 TSF @71.0'

DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE 863.2

Hole No. 9-McHENRY

PROJECT: McHenry County Observation Wells

INSTALLATION: Chicago District

SHEET 4 OF 9 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
			CL, Gray silty clay, trace coarse sand and fine gravel (occasional silt partings), stiff to hard, moist *(continued)*			Sample No. 8 from 71.0' to 72.0'
			Note: Silt with gravel encountered from 73.0' to 74.0'			
+789.2	74.0		CL, Reddish brown silty clay, little fine to medium gravel, trace coarse sand, hard to extremely hard, damp			
				95	9 75.0 85.0	
						Qp = 4.5+ TSF @80.0'
						Sample No. 9 from 82.0' to 83.0'
				95	10 85.0 95.0	
						Qp = 4.0 TSF @88.0'
						Qp = >4.5 TSF @92.0' Sample No. 10 from 92.0' to 93.0'
						Qp = >4.5 TSF @94.0'
				100	11 95.0 105.0	
						Qp = 3.0 TSF @96.0'

DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE 863.2

Hole No. 9-McHENRY

PROJECT: McHenry County Observation Wells

INSTALLATION: Chicago District

SHEET 5 OF 9 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
			CL, Reddish brown silty clay, little fine to medium gravel, trace coarse sand, hard to extremely hard, damp *(continued)*			
						Qp = 3.5 TSF @99.0'
						Qp = 4.0 TSF @102.0'
						Sample No. 11 from 104.0' to 105.0' Qp = 3.5 TSF @105.0'
				100	12 105.0 115.0	
						Qp = 4.5 TSF @107.0'
						Qp = 4.5 TSF @112.0'
						Sample No. 12 from 114.0' to 115.0'
				100	13 115.0 125.0	
						Qp = 3.25 TSF @117.0'
						Qp = 4.5 TSF @119.0'

DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE 863.2

Hole No. 9-McHENRY

PROJECT: McHenry County Observation Wells

INSTALLATION: Chicago District

SHEET 6 OF 9 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
			CL, Reddish brown silty clay, little fine to medium gravel, trace coarse sand, hard to extremely hard, damp *(continued)* Note: 1" thick sand seam encountered at 123.5'			Qp = 2.5 TSF @123.0'
						Sample No. 13 from 124.0' to 125.0'
				119	14 125.0 133.0	
						Qp = >4.5 TSF @130.0'
						Sample No. 14 from 131.0' to 132.0' QP = >4.5 TSF at 132.0'
				129	15 133.0 140.0	
				160	16 140.0 145.0	Qp = 4.5+ TSF @ 140.0'
						Qp = 3.0 TSF @143.0'
						Sample No. 15 from 144.0' to 145.0'
			Note: 10/2/08 - 0700, water level measured to be 17.10 ft. bgs when borehole was opent to 145.0'	100	17 145.0 155.0	QP = 3.5 TSF @146.0'

DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE 863.2

Hole No. 9-McHENRY

PROJECT: McHenry County Observation Wells

INSTALLATION: Chicago District

SHEET 7 OF 9 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
			CL, Reddish brown silty clay, little fine to medium gravel, trace coarse sand, hard to extremely hard, damp *(continued)*			Qp = 2.5 TSF @150.0'
+710.2	153.0					
+709.7	153.5		SC, Clayey sand contact over 0.4'			
			SP, Gray medium sand, little coarse sand and gravel, moderately dense, wet			Sample No. 16 from 154.0' to 155.0'
				100	18 155.0 165.0	
+707.2	156.0					
			ML, Gray silt, dense, not cohesive, no plasticity, wet with black bedding planes on 0.05 to 0.1' intervals Note: Clay seam encountered from 158.4' to 158.6'			
+703.2	160.0					
+702.2	161.0		CL, Gray silty clay, stiff, moist			
			SP, Gray medium sand, trace fine to coarse sand, dense, wet			Sample No. 17 from 164.0' to 165.0'
				75	19 165.0 175.0	

DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE 863.2

Hole No. 9-McHENRY

PROJECT: McHenry County Observation Wells

INSTALLATION: Chicago District

SHEET 8 OF 9 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
			SP, Gray medium sand, trace fine to coarse sand, dense, wet *(continued)*			Sample No. 18 from 174.0' to 175.0'
				90	20 175.0 185.0	% Gravel/% Sand/% Fines = 2/81/17 from 176.0' to 177.0'
+682.2	181.0					
			OL, Gray, brown, and black layered and mottled organic silt, soft, moist			Sample No. 19 from 181.0' to 182.0'
+680.2	183.0					
			SP, Brown coarse sand, little medium sand, loose, wet			Sample No. 20 from 184.0' to 185.0'
			Note: Turns gray with depth	100	21 185.0 195.0	
+676.2	187.0					
			CL, Brownish gray clayey silt, little coarse sand and fine gravel, stiff to very stiff (187.0' t 189.0'); hard to extremely hard (189.0' to 195.0')			Qp = >4.5 TSF @191.0'
						Qp = >4.5 TSF @194.0' Sample No. 21 from 194.0' to 195.0'
				100	22 195.0 202.0	
						Qp = >4.5 TSF @198.0'

DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE 863.2

Hole No. 9-McHENRY

PROJECT: McHenry County Observation Wells

INSTALLATION: Chicago District

SHEET 9 OF 9 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
			CL, Brownish gray clayey silt, little coarse sand and fine gravel, stiff to very stiff (187.0' t 189.0'); hard to extremely hard (189.0' to 195.0') *(continued)*			Qp = >4.5 TSF @198.0' Sample No. 22 from 201.0' to 202.0'
				100	23 202.0 203.0	
				100	24 203.0 205.5	
+657.7	205.5					
			ML, Gray cobbly, gravelly silt, little sand, trace clay, extremely hard, dry, not plastic	100	25 205.5 210.0	Qp = >4.5 TSF @207.0' Sample No. 23 from 207.0' to 208.0'
+654.7	208.5					
			Gray Dolomite Bedrock			
+653.2	210.0					
			END OF BORING - 210.0' BGS			AECOM Project No. 60095270

Hole No. 9-McHenry Twp

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 1 OF 14 SHEETS

1. PROJECT: McHenry Cty Wells
2. LOCATION (Coordinates or Station): N2,083,060 E984,550 ILST PI-E
3. DRILLING AGENCY: WOC Exploration
4. HOLE NO. (As shown on drawing title and title number): 9-McH.
5. NAME OF DRILLER: DAN TONNANCOUR
6. DIRECTION OF HOLE: [X] VERTICAL [ ] INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 208.5'
8. DEPTH DRILLED INTO ROCK: 1.5'
9. TOTAL DEPTH OF HOLE: 210'
10. SIZE AND TYPE OF BIT: 3 7/8" / 5 7/8" CASING (RotoSonic)
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): NAVD88
12. MANUFACTURERS DESIGNATION OF DRILL: Super Sonic II
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 23; UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES: —
15. ELEVATION GROUND WATER: 808.7' 15hr AB
16. DATE HOLE: STARTED 10/1/08; COMPLETED 10/2/08
17. ELEVATION TOP OF HOLE: 863.2 FT MSL
18. TOTAL CORE RECOVERY FOR BORING: 205'/210' = 98%
19. SIGNATURE OF INSPECTOR: Gary M. Brown ZPG IL

10/3/08 0700 Water Level 54.5 ft bgs ~15 hrs After borehole completion & prior to deep well installation.

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
863.2	0		Top soil - Black Organic Clayey SILT (OL)		Bag 1	Run 1 (0-5') Rec/Run = 5'/5' = 100%
	1		Reddish Brown Silty CLAY, little fine gravel, occasional fine black laminations, damp (CL)	Rec 100%	S1 Bag 2	
	2					
	3					
	4		Brown, Gravelly-Clayey SAND, little silt Med. dense to stiff moist to wet below 8' (SC) Not Plastic to GC DIAMICTON trace blk organics but w/ some stiffness wet Gravelly seam			
	5					
	6					Run 2 (5-15') Rec/Run = 10'/10' = 100%
	7				Bag 3	
	8					
	9			Rec 100%		1.5 tsf
853.2	10					
	11					
	12				Bag 4	↓ stiffness increases slightly w/ depth
	13				S2	1.75 tsf
	14					
	15					

0700 ↓ set-up
0759 push R1
well site Rt. of drive 50' w/ of Harrison - Boswell Park
0805
0810
0825

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT: McHenry Cty We | HOLE NO. #9-McHenry Twp

Hole No. 9 - McHenry Twp

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 2 OF 14 SHEETS

1. PROJECT: McHenry Cty Wells
2. LOCATION (Coordinates or Station):
3. DRILLING AGENCY: WDC
4. HOLE NO. (As shown on drawing title and title number): 9-McH
5. NAME OF DRILLER: Dan Tonnacour
6. DIRECTION OF HOLE: ☑ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 208.5'
8. DEPTH DRILLED INTO ROCK: 1.5
9. TOTAL DEPTH OF HOLE: 210'
10. SIZE AND TYPE OF BIT: 4"/6" Carbide
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): NAVD 88
12. MANUFACTURERS DESIGNATION OF DRILL: Super Sonic II
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 23; UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES: 0
15. ELEVATION GROUND WATER: 808.7' 15 hr AB
16. DATE HOLE: STARTED 10/1/09; COMPLETED 10/2/09
17. ELEVATION TOP OF HOLE: 863.2 FT MSL
18. TOTAL CORE RECOVERY FOR BORING: 205/210' = 98%
19. SIGNATURE OF INSPECTOR: Gary M. Brown LPG IL

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	15		cont. Brown Gravelly-Clayey SAND Diamicton (SC/GC)		Bag 5	Run 3 (15-25') Rec/Run = 10'/10'
	16					
	17					
	18			Rec 100%	Bag 6	
	19		Gradational over 0.8 ft			
843.2	20		Brown Sandy GRAVEL (fine to coarse), loose, wet (GW)			
	21					
	22				S3 Bag 7	
	23		Abrupt Gradation			
	24		Brown Medium SAND, trace fine gravel, loose, wet (SP)			
	25				Bag 8	Run 4 (25-35) Rec/Run = 10'/10' = 100%
	26					
	27					
	28			Rec 100%	Bag 9	
	29					
833.2	30		SEE DESCRIPTION ON NEXT PAGE			

0830

0845 7 5/8" Long Casing
0915 over 5 1/2" inner casing

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT: McHenry Cty Wells — HOLE NO. 9 - McHenry Twp

Hole No. 9 - McHenry Twp

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 3 OF 14 SHEETS

1. PROJECT McHenry Cty Wells	10. SIZE AND TYPE OF BIT 4" X 6" carbide (Sonic)
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) NAVD 88
3. DRILLING AGENCY WDC	12. MANUFACTURERS DESIGNATION OF DRILL SuperSonic II
4. HOLE NO. (As shown on drawing title and title number) 9-McH	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 23; UNDISTURBED 0
5. NAME OF DRILLER DAN TONNANCOUR	14. TOTAL NUMBER CORE BOXES Ø
6. DIRECTION OF HOLE ☑ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.	15. ELEVATION GROUND WATER 808.7 15 ft AB
	16. DATE HOLE: STARTED 10/1/08; COMPLETED 10/2/08
7. THICKNESS OF OVERBURDEN 208.5'	17. ELEVATION TOP OF HOLE 863.2 ft MSL
8. DEPTH DRILLED INTO ROCK 1.5'	18. TOTAL CORE RECOVERY FOR BORING 98%
9. TOTAL DEPTH OF HOLE 210'	19. SIGNATURE OF INSPECTOR Barry M. Brown LPG IL

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
833.2	30		Brown sandy SILT, little gravel/clay stiff, not plastic moist to wet (ML) Diamicton	cont. Rec 100%	S4	Run 4 (25-35) 0.5 tsf to Ø cont.
	31					
	32				Bag 10	
	33		Gray Clayey SAND, little Fine-Coarse gravel & silt, Med. Dense to soft, moist (SC)			
	34					
	35					0925 Extract Samples 0935 Break
	36		Gray Clayey SILT, trace fine gravel, stiff to Med Dense & No to Low Plasticity due to CL content, moist (CL-ML)		Bag 11	Run 5 (35-45) Rec = 10' Run 10'
	37					1.5 tsf (CL-ML)
	38			Rec 100%	Bag 12	0 tsf (SILT)
	39					
823.2	40					1.25 tsf
	41		Silty CLAY Layer			ML-CL
	42					1.75 tsf
	43		Broke on 0.1-0.2 ft bedding planes		Bag 13	
	44					0.25 tsf
	45				S5	Extract Samples 1010

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT McHenry Cty Well — HOLE NO. 9 - McHenry Twp

Hole No. 9 - McHenry Twp

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 4 OF 14 SHEETS

1. PROJECT McHenry Cty Wells	10. SIZE AND TYPE OF BIT 4" x 6" Carbide (Sonic)
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) NAVD 88
3. DRILLING AGENCY WDC	12. MANUFACTURERS DESIGNATION OF DRILL Super Sonic II
4. HOLE NO. (As shown on drawing title and title number) 9-McH	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN — DISTURBED 23 — UNDISTURBED 0
5. NAME OF DRILLER Dan Tonnancour	14. TOTAL NUMBER CORE BOXES 0
6. DIRECTION OF HOLE ☑ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.	15. ELEVATION GROUND WATER 808.7 15 hr. AB
	16. DATE HOLE — STARTED 10/1/08 — COMPLETED 10/2/08
	17. ELEVATION TOP OF HOLE 863.2 ft msl
7. THICKNESS OF OVERBURDEN 208.5'	18. TOTAL CORE RECOVERY FOR BORING 98%
8. DEPTH DRILLED INTO ROCK 1.5'	19. SIGNATURE OF INSPECTOR Gary M. Burgener LPG IL
9. TOTAL DEPTH OF HOLE 210.0'	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g	
	45		Gray Silty CLAY, trace Coarse Sand & fine gravel, stiff to hard, moist (CL)		Bag 14	RUN 6 (45-55)	~1015
	46					25 tsf Rec 10' / Run 10' = 100%	
	47					3.0 tsf	
	48		TILL		Bag 15		
	49		Low to Medium Plasticity ocassional silty partings, but generally very uniform	Rec 100%		4.0 tsf	
813.2	50						
	51					2.5 tsf	
	52				Bag 16		
	53					4.5+ tsf	
	54						
					56	3.5 tsf	1024 Extract
	55				Bag 17	RUN 7 (55-65')	1032 start 4" 1033 stop 4" RUN 1037 stop 6" CASING ADVANCE
	56					20 Rec 10' / Run 10' = 100%	
	57						
	58			Rec 100%	Bag 18	2.5 tsf	
	59						
803.2	60						

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT McHenry Cty Wells — HOLE NO. 9 - McHenry Twp

Hole No. 9 - McHenry Twp

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 5 OF 14 SHEETS

1. PROJECT McHenry Cty Wells	10. SIZE AND TYPE OF BIT 4" x 6" Carbide (Sonic)
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) NAVD 88
3. DRILLING AGENCY WDC	12. MANUFACTURERS DESIGNATION OF DRILL Super Sonic II
4. HOLE NO. (As shown on drawing title and title number) 9-McH	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 23, UNDISTURBED 0
5. NAME OF DRILLER DAN TONWANCONR	14. TOTAL NUMBER CORE BOXES 0
6. DIRECTION OF HOLE ☑ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.	15. ELEVATION GROUND WATER 808.7' 15 hr AB
	16. DATE HOLE STARTED 10/1/08 COMPLETED 10/2/08
	17. ELEVATION TOP OF HOLE 863.2 FT MSL
7. THICKNESS OF OVERBURDEN 208.5'	18. TOTAL CORE RECOVERY FOR BORING 98%
8. DEPTH DRILLED INTO ROCK 1.5'	19. SIGNATURE OF INSPECTOR [signature] LPG IL
9. TOTAL DEPTH OF HOLE 210.0'	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
803.2	60		Cont. uniform silty CLAY, gray TILL		18	Cont. Run 7 (55-65')
	61					4.5 tsf
	62			Rec 100%	Bag 19	
	63					2.0 tsf
	64				S7	
	65					1044 Extract
						1050 start 4" sampler
	66					Run 8 (65-75') Rec 9.5 / Run 10' = 95%
	67				Bag 20	
	68					1.75 tsf
	69			Rec. 95%		
793.2	70					
	71				S8	1.5 tsf
	72				Bag 21	
	73		grades to clayey gray silt w/ gravel (73-74')			
start contact	74		sharp contact between gray silt & reddish brown hard silty CLAY			
	75		E. HARD CLAY! TISKILWA			1105 Extract Sample

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT McHenry Cty Wells | HOLE NO. 9 - McHenry Twp

Hole No. 9 - McHenry Twp

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 6 OF 14 SHEETS

1. PROJECT: McHenry Cty Wells
2. LOCATION (Coordinates or Station):
3. DRILLING AGENCY: WDC
4. HOLE NO. (As shown on drawing title and title number): 9-McH
5. NAME OF DRILLER: DAN TONNANCOUR
6. DIRECTION OF HOLE: [✓] VERTICAL [ ] INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 208.5'
8. DEPTH DRILLED INTO ROCK: 1.5'
9. TOTAL DEPTH OF HOLE: 210.0'
10. SIZE AND TYPE OF BIT: 4" x 6" Carbide
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): NAVD 88
12. MANUFACTURERS DESIGNATION OF DRILL: Super Sonic II
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 23; UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES: 0
15. ELEVATION GROUND WATER: 808.7 15hr AB
16. DATE HOLE: STARTED 10/1/08; COMPLETED 10/2/08
17. ELEVATION TOP OF HOLE: 863.2 FTMSL
18. TOTAL CORE RECOVERY FOR BORING:
19. SIGNATURE OF INSPECTOR: Jamy M Bra LPGIL

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g	
	75		cont. from 74' Reddish Brown Silty CLAY, little Fine to Medium gravel, trace coarse sand, hard to extreme hard, damp (CL)			Run 9 (75-85) Rec/Run = 9.5/10' = 95%	1110 start 4" sampler
	76						1116 stop
	77				Bag 22		
	78						>5x's longer than in softer materials higher in hole
	79			Rec 95%			
783.2	80		"Pinkish" Tiskilwa Till			+4.5tsf	
	81					Hard Drilling over 10' run but 83-85' seems especially hard	
	82				Bag 23		
	83		>4.5tsf	59			
	84						1125 stop 6" casing
	85					Run 10 (85-95') Rec/Run = 9.5/10' = 95%	1140 start 1150 stop 4" drive
	86				Bag 24		
	87					cont. Difficult Drilling	
	88			Rec 95%		4.0 tsf	
	89				Bag 25		
773.2	90						

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT: McHenry Cty Wells | HOLE NO.: 9-McHenry Twp

Hole No. 9 - McHenry Twp

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 7 OF 14 SHEETS

1. PROJECT McHenry Cty Wells	10. SIZE AND TYPE OF BIT 4" X 6" Carbide
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) NAVD 88
3. DRILLING AGENCY WDC	12. MANUFACTURERS DESIGNATION OF DRILL SuperSonic
4. HOLE NO. (As shown on drawing title and title number) 9-McH	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 23, UNDISTURBED 0
5. NAME OF DRILLER DAN TONNANCOUR	14. TOTAL NUMBER CORE BOXES 0
6. DIRECTION OF HOLE ☑ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.	15. ELEVATION GROUND WATER 808.7 Ft. 15hr AG
	16. DATE HOLE: STARTED 10/1/08, COMPLETED 10/2/08
	17. ELEVATION TOP OF HOLE 863.2 Ft MSL
7. THICKNESS OF OVERBURDEN 208.5'	18. TOTAL CORE RECOVERY FOR BORING 98%
8. DEPTH DRILLED INTO ROCK 1.5'	19. SIGNATURE OF INSPECTOR Gary M. Brown LPG IL
9. TOTAL DEPTH OF HOLE 210.0'	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
773.2	90		cont. Reddish Brown - Hard, Silty CLAY.		Bag 25 cont.	RUN 10 (85-95) cont.
	91			Rec ~95%		> 4.5
	92				Bag 26	5/10
	93					
	94					> 4.5 tsf
	95					1135 Extract sample LUNCH
	96		3.0 tsf		Bag 27	RUN 11 (95-105) Rec/Run = 10'/10' = 100%
	97					
	98					cont. difficult drilling / sampling
	99		3.5 tsf	Rec 100%		
763.2	100				Bag 28	
	101					
	102		4.0 tsf			Extremely Hard
	103				Bag 29	1255
	104					
	105		3.5 tsf		511	1259 Stop 4" sampler; 1312 Stop 6"

1245 start 4" sampler 6" casing 1300

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT McHenry Cty Wells — HOLE NO. 9 - McHenry Twp

Hole No. 9 - McHenry Twp

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 8 OF 14 SHEETS

1. PROJECT McHenry Cty Wells	10. SIZE AND TYPE OF BIT 4" x 6"
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) NAVD 88
3. DRILLING AGENCY WOC Exploration	12. MANUFACTURERS DESIGNATION OF DRILL Super Sonic II
4. HOLE NO. (As shown on drawing title and title number) 9-McH	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 23, UNDISTURBED 0
5. NAME OF DRILLER DAN TONNANCOUR	14. TOTAL NUMBER CORE BOXES 6
6. DIRECTION OF HOLE ☑ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER 808.7' 15hr AB
	16. DATE HOLE: STARTED 10/1/08, COMPLETED 10/2/08
	17. ELEVATION TOP OF HOLE 863.2 Ft MSL
7. THICKNESS OF OVERBURDEN 208.5'	18. TOTAL CORE RECOVERY FOR BORING 98%
8. DEPTH DRILLED INTO ROCK 1.5'	19. SIGNATURE OF INSPECTOR Gary M. Brown LPG IL
9. TOTAL DEPTH OF HOLE 210.0'	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX/OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g	
	105		cont.			Run 12 (105-115)	1320 start 4" sampler
	106		Very stiff silty CLAY (cl)		Bag 30	Rec./Run = 10'/10' = 100%	
	107					>4.5 tsf	
	108					continue Very Difficult Drilling	
	109			Rec. 100%	Bag 31	4.0 tsf	
753.2	110						
	111						
	112				Bag 32	4.5 tsf	
	113						
	114				S12		1346 stop 4" sampler
	115					Run 13 (115-125)	
	116				Bag 33	Rec./Run 10'/10' = 100%	1416 4" sampler ↓ 1426
	117					3.25 tsf	1428 ↓ 6" casing 1438
	118			Rec. 100%		continue difficult drilling	
	119				Bag 34	>4.5 tsf	
743.2	120						

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT McHenry Cty Wells — HOLE NO. 9-McHenry Twp

Hole No. 9 - McHenry Twp

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 9 OF 14 SHEETS

1. PROJECT McHenry Cty Wells	10. SIZE AND TYPE OF BIT 4" x 6" Carbide
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) NAVD 88
3. DRILLING AGENCY WDC Exploration	12. MANUFACTURERS DESIGNATION OF DRILL Super Sonic II
4. HOLE NO. (As shown on drawing title and title number) 9-McH	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN — DISTURBED 23 — UNDISTURBED 0
5. NAME OF DRILLER DAN TONNANCOUR	14. TOTAL NUMBER CORE BOXES 0
6. DIRECTION OF HOLE ☑ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.	15. ELEVATION GROUND WATER 808.7 ft 15 hr AB
	16. DATE HOLE — STARTED 10/1/08 — COMPLETED 10/2/08
	17. ELEVATION TOP OF HOLE 863.2 ft MSL
7. THICKNESS OF OVERBURDEN 208.5'	18. TOTAL CORE RECOVERY FOR BORING 98%
8. DEPTH DRILLED INTO ROCK 1.5'	19. SIGNATURE OF INSPECTOR Gary M. Brown LPG IL
9. TOTAL DEPTH OF HOLE 210.0'	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g	
743.2	120		cont.	cont.	Bag 34 cont.	Run 13 (115-125') cont.	
	121		Till	Rec 100%			
	122				Bag 35		
	123		← 1" thick Med. Sand seam			2.5 tsf	
	124				S13	2.5 tsf	1445 Extract Samples
	125					Run 14 (125-133')	— Empty Water Truck ↓ Helper Goes to Huemann
	126				Bag 36	Rec/Run = 9.5/8.0 = >100%	
	127					clay smearing because of constant vibration due to difficult drilling. Clay filled the sampler ∴ Run was 2' short	1553 start 4" sampler
	128						1604 @ 8'
	129			Rec 100%	Bag 37		↓ pull rods
733.2	130		> 4.5 tsf				1614 Extract Sample
	131				Bag 38		
	132		> 4.5 tsf		S14		
	133					Run 15 (133-140')	1625
	134			Rec 100%	Bag 39	Rec/Run 9/7 = 100%	
	135						

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT McHenry Cty Wells — HOLE NO. 9 - McHenry Twp

Hole No. 9 - McHenry Twp

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 10 OF 14 SHEETS

1. PROJECT: McHenry Cty Wells
2. LOCATION (Coordinates or Station):
3. DRILLING AGENCY: WDC
4. HOLE NO. (As shown on drawing title and title number): 9-McH
5. NAME OF DRILLER: Dan Tonnancour
6. DIRECTION OF HOLE: ☑ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 208.5'
8. DEPTH DRILLED INTO ROCK: 1.5'
9. TOTAL DEPTH OF HOLE: 210.0'
10. SIZE AND TYPE OF BIT: 4" x 6" Carbide
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): NAVD 88
12. MANUFACTURERS DESIGNATION OF DRILL: Super Sonic II
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 23 UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES: 0
15. ELEVATION GROUND WATER: 808.7' 15 hr AB
16. DATE HOLE: STARTED 10/1/08 COMPLETED 10/2/08
17. ELEVATION TOP OF HOLE: 863.2 ft MSL
18. TOTAL CORE RECOVERY FOR BORING: 98%
19. SIGNATURE OF INSPECTOR: [signature] LPG

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g	
	135		cont. TILL	cont.	cont. 39	RUN 15 (133-140) cont.	1625 start 4" sampler
	136		same as ABOVE	Rec. 100%			1626:30 At 10'
	137				Bag 40		Drop 6" casing
	138						1628 Start
	139						1634 Done
723.2	140		4.5+ tsf				
	141				Bag 41	RUN 16 (140-145) Rec/Run = 8'/5.0 = 100%	1640
	142			Rec 100%			
	143		3.0 tsf		Bag 42	(clay stretching under constant vibration)	
	144				515		End day 10/1/08
	145						1705
	146				Bag 43	RUN 17 (145-155) Rec/Run = 10'/10' = 100%	Start 10/2/08
	147		3.5 tsf			10/2/08 0700 Water level measured to be 17.10 ft bgs at 145'	0734 0748 > 4" sampler
	148			Rec 100%			0757 finish setting 6" casing
	149				Bag 44		
713.2	150		2.5 tsf				

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT: McHenry Cty Wells | HOLE NO. 9 - McHenry Twp

Hole No. 9 - McHenry Twp

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 11 OF 14 SHEETS

1. PROJECT: McHenry Cty Wells
2. LOCATION (Coordinates or Station):
3. DRILLING AGENCY: WDC Exploration
4. HOLE NO. (As shown on drawing title and title number): #9-McH
5. NAME OF DRILLER: Dan Townsencour
6. DIRECTION OF HOLE: [x] VERTICAL [ ] INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 208.5'
8. DEPTH DRILLED INTO ROCK: 1.5'
9. TOTAL DEPTH OF HOLE: 210.0'
10. SIZE AND TYPE OF BIT: 4" x 6" Carbide
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): NAVD 88
12. MANUFACTURERS DESIGNATION OF DRILL: SuperSonic II
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 23; UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES: —
15. ELEVATION GROUND WATER: 208.7' 15hr
16. DATE HOLE: STARTED 10/1/08; COMPLETED 10/2/08
17. ELEVATION TOP OF HOLE: 863.2 ft MSL
18. TOTAL CORE RECOVERY FOR BORING: 98%
19. SIGNATURE OF INSPECTOR: Jay M. Brown LPGIL

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
713.2	150		Cont Silty CLAY TILL	Cont	Bag 44	Run 17 (145-155) Cont.
	151					
	152			Rec. 100%		continue difficult drilling until bottom of run.
	153		Clayey SAND contact (SC) over 0.4'		Bag 45	
	154		Gray Medium SAND, moderately dense, wet (SP) little coarse sand & gravel fining upward		s16	815 Extract Sample
	155					
	156		Gray SILT, dense, not cohesive, no plasticity, wet w/ common black bedding planes on 0.05 to 0.1' intervals (ML) clay seam 158.4-158.6'		Bag 46	Run 18 (155-165) Rec/Run = 10'/10' = 100% 0831 0833 > 10' run of 4" sampler. Considerably easier drilling than in Till
	157					
	158					0836 start 6" casing drive
	159			Rec. 100%		0840 stop
703.2	160		Gray Silty CLAY, stiff, moist (CL)		Bag 47	
	161		Gray Medium SAND, trace fine-coarse sand, ~~occasional~~ rare clay stringer, ~~moderately~~ dense, wet (SP)			
	162					
	163		clay		Bag 48	
	164					
	165				s17	0852 Extract Sample

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT: McHenry Cty Wells — HOLE NO. 9 - McHenry Twp

Hole No. 9 - McHenry Twp

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 12 OF 14 SHEETS

1. PROJECT McHenry Cty Wells	10. SIZE AND TYPE OF BIT 4" x 6" Carbide
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) NAVD88
3. DRILLING AGENCY WOC Exploration	12. MANUFACTURERS DESIGNATION OF DRILL Super Sonic II
4. HOLE NO. (As shown on drawing title and title number) #9-McH	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 23; UNDISTURBED 0
5. NAME OF DRILLER Dan TONNANCOUR	14. TOTAL NUMBER CORE BOXES 0
6. DIRECTION OF HOLE ☑ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.	15. ELEVATION GROUND WATER 808.7' 15hr AB
	16. DATE HOLE: STARTED 10/1/08; COMPLETED 10/2/08
	17. ELEVATION TOP OF HOLE 863.2 FT MSL
7. THICKNESS OF OVERBURDEN 208.5'	18. TOTAL CORE RECOVERY FOR BORING 98%
8. DEPTH DRILLED INTO ROCK 1.5'	19. SIGNATURE OF INSPECTOR Gary M. Brown LPG IL
9. TOTAL DEPTH OF HOLE 210.0'	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	165		cont.			Run 19 (165-175) 0932 start 4" sampler
	166		Gray Med. SAND			Rec/Run = ~7.5'/10' = 75%
	167		occassional Fine sand beds			
	168					
	169			Rec 75%	Bag 49	
693.2	170		Fine sand Grayish Brown			
	171					
	172					
	173					
	174				S18	0948 Extract Sample
	175					Run 20 (175-185) 1000 start 4" sampler
	176		continued Med. SAND		Bag 50	Rec/Run = ~9'/10' = 90%
	177			Rec 90%		
	178					
	179				Bag 51	
683.2	180					

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT McHenry Cty Wells | HOLE NO. 9 - McHenry Twp

Hole No. 9 - McHenry Twp

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 13 OF 14 SHEETS

1. PROJECT: McHenry County Wells
2. LOCATION (Coordinates or Station):
3. DRILLING AGENCY: WDC Exploration
4. HOLE NO. (As shown on drawing title and title number): 9-MCH
5. NAME OF DRILLER: DAN TONNANCOUR
6. DIRECTION OF HOLE: ☑ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 208.5'
8. DEPTH DRILLED INTO ROCK: 1.5'
9. TOTAL DEPTH OF HOLE: 210.0'
10. SIZE AND TYPE OF BIT: 4"x6" Carbide
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): NAVD 88
12. MANUFACTURERS DESIGNATION OF DRILL: Super Sonic II
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 23; UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES: 0
15. ELEVATION GROUND WATER: 808.7' 15 hr AB
16. DATE HOLE: STARTED 10/1/08; COMPLETED 10/2/08
17. ELEVATION TOP OF HOLE: 863.2 Est MSL
18. TOTAL CORE RECOVERY FOR BORING: 78%
19. SIGNATURE OF INSPECTOR: Gary M. Brown LPG IL

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
683.2	180		Gray Sandy GRAVEL at base. Fining upwards	cont.	51 cont.	RUN 20 (175-185) continued
	181					
	182		Gray, Brown, Black layered & mottled Organic SILT, soft, moist (OL) fibrous material common	90%	19	organic odor from Bag 52
	183				Bag 52	
	184		Brown coarse SAND, little med. sand, loose, wet (SP)		520	
	185		↓ Turns gray w/ depth			RUN 21 (185-195)
	186		Fine to Medium Gravel at base fines upward at abrupt contact			Rec/Run = 10'/10' = 100%
	187				Bag 53	
	188		Brownish Gray Clayey SILT, little coarse sand & fine gravel stiff to very stiff (187-189'); hard to extremely hard (189-195')			
	189					start Difficult Drilling
673.2	190			Rec 100%	Bag 54	↓
	191		"Hard Pan"			> 4.5 tsf
	192					
	193				Bag 55	
	194					
	195				521	> 4.5 tsf

Drive 6" casing
Pull rods
1020 Extract Samples
1053 push 4"
1054 @ 190'
1056 @ 193'
1102 @ 195'
1130 Extract Samples

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT: McHenry Cty Wells | HOLE NO. 9 - McHenry Twp

Hole No. 9- McHenry Twp

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 14 OF 14 SHEETS

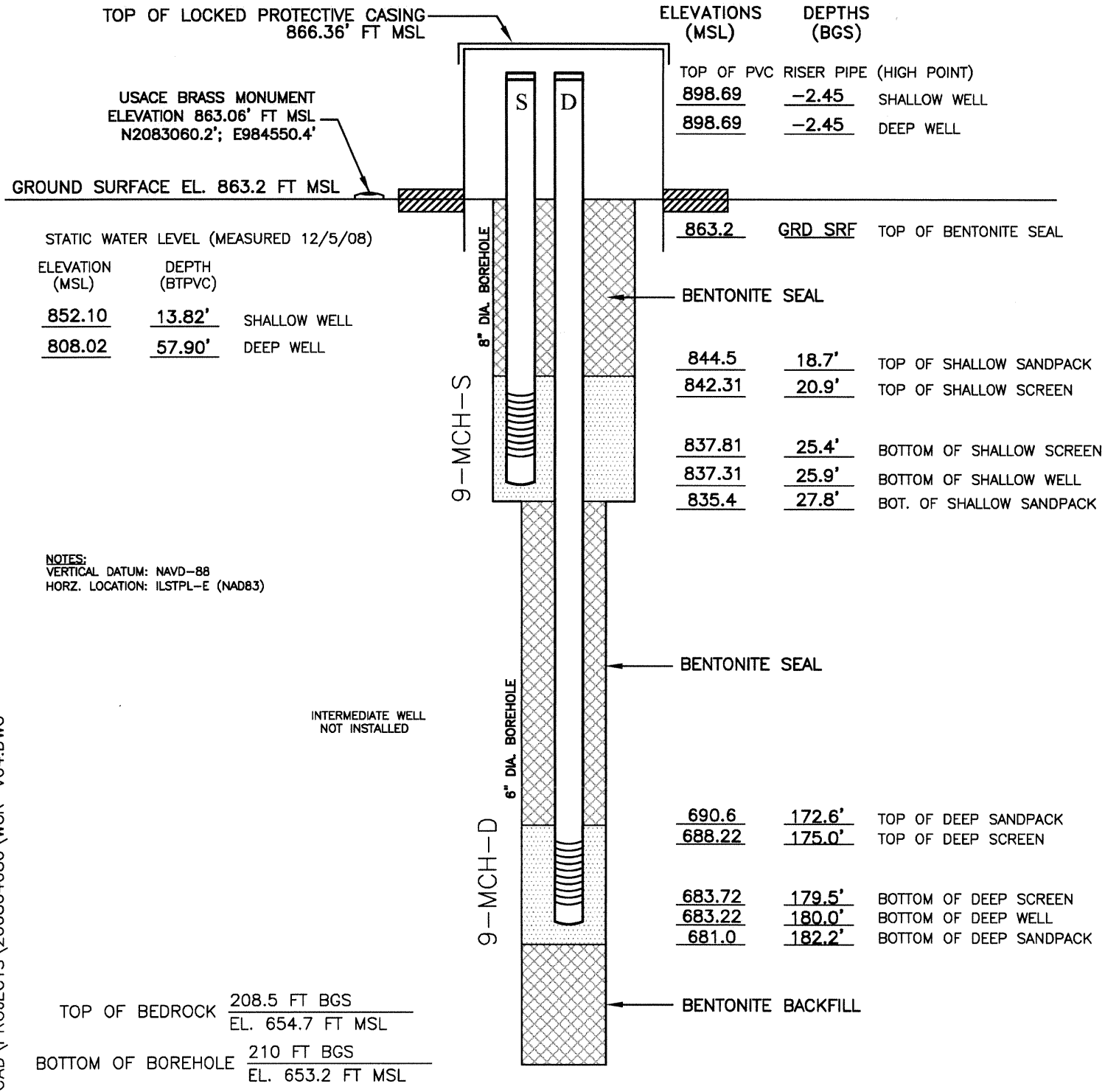
1. PROJECT McHenry Cty Wells	10. SIZE AND TYPE OF BIT 4" x 6" Carbide
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) NAVD 88
3. DRILLING AGENCY WDC Exploration	12. MANUFACTURERS DESIGNATION OF DRILL SuperSonic II
4. HOLE NO. (As shown on drawing title and title number) #9-MCH	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 23, UNDISTURBED 0
5. NAME OF DRILLER Dan Tonnancour	14. TOTAL NUMBER CORE BOXES 0
6. DIRECTION OF HOLE ☑ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER 808.7 - 15hr AB
	16. DATE HOLE: STARTED 10/1/08, COMPLETED 10/2/08
7. THICKNESS OF OVERBURDEN 208.5 ft	17. ELEVATION TOP OF HOLE 863.2 ft MSL
8. DEPTH DRILLED INTO ROCK 1.5 ft	18. TOTAL CORE RECOVERY FOR BORING 98%
9. TOTAL DEPTH OF HOLE 210 ft	19. SIGNATURE OF INSPECTOR Gary M. Brown LPG IL

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g	
	195		cont.			RUN 22 (195-202)	1143 start 4" sampler
	196		Extremely Hard Clayey SILT		Bag 56	Rec/Run = 7'/7' = 100%	
	197					- continue difficult drilling	
	198			100%		> 4.5 tsf	
	199						
663.2	200				Bag 57		1153 @ ≈200' 1207 Extract Samples
	201					> 4.5 tsf	
	202		Till appears to be fractured and discolored (buff to light gray) due to weathering. Suspect close to bedrock. (> 4.5 tsf)		S22	Refusal lead to shorter run length	1215 Bk for lunch ↓ 1245 Resume
				Rec 100%	Bag 58	RUN 23 (202-203)	1219
	203					RUN 24 (203-205.5)	↓ RUN 23
	204		Till broke at semi-regular bedding planes during sample recovery ↑ sharp contact	Rec 100%	Bag 59	Rec/Run = 2.5'/2.5' = 100% • Driller reports cobble/boulder @ 203.5 ft	1226 end Very Difficult Drilling
	205						↓
	206		Gray Cobbly-Gravelly-SILT, little sand, trace clay, extremely hard, not plastic, essentially dry (ML)			RUN 25 (205.5-210)	7 ft total feet in 3 hours drilling
	207				Bag 60	Rec/Run = 4.5'/4.5' = 100%	
	208			Rec 100%	S23	> 4.5 tsf Cont. Extremely difficult drilling	
	209		Gray DOLOMITE Bedrock (poor recovery - powdered)		Bag 61	Essentially Auger refusal	
653.2	210		210' END OF BOREHOLE				1530 Extract Sample

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT McHenry Cty Wells | HOLE NO. 9- McHenry Twp

PROJECT McHENRY COUNTY OBSERVATION WELL NETWORK INSTALLATION (#09000-460)	WELL NO. 9-MCH-S & 9-MCH-D
LOCATION McHENRY TOWNSHIP – McHENRY COUNTY, ILLINOIS	
CLIENT U.S. ARMY CORPS OF ENGINEERS / McHENRY COUNTY	
GEOLOGIST GARY BRAUN, P.G. (AECOM)	INSTALLATION DATE OCT. 3, 2008
DRILLER WDC EXPLORATION AND WELLS, INC. (DAN TONNANCOUR)	DRILLING METHOD ROTO-SONIC



ELEVATIONS (MSL)	DEPTHS (BGS)	
TOP OF PVC RISER PIPE (HIGH POINT)		
898.69	-2.45	SHALLOW WELL
898.69	-2.45	DEEP WELL
863.2	GRD SRF	TOP OF BENTONITE SEAL
844.5	18.7'	TOP OF SHALLOW SANDPACK
842.31	20.9'	TOP OF SHALLOW SCREEN
837.81	25.4'	BOTTOM OF SHALLOW SCREEN
837.31	25.9'	BOTTOM OF SHALLOW WELL
835.4	27.8'	BOT. OF SHALLOW SANDPACK
690.6	172.6'	TOP OF DEEP SANDPACK
688.22	175.0'	TOP OF DEEP SCREEN
683.72	179.5'	BOTTOM OF DEEP SCREEN
683.22	180.0'	BOTTOM OF DEEP WELL
681.0	182.2'	BOTTOM OF DEEP SANDPACK

STATIC WATER LEVEL (MEASURED 12/5/08)

ELEVATION (MSL)	DEPTH (BTPVC)	
852.10	13.82'	SHALLOW WELL
808.02	57.90'	DEEP WELL

NOTES:
VERTICAL DATUM: NAVD-88
HORZ. LOCATION: ILSTPL-E (NAD83)

INTERMEDIATE WELL NOT INSTALLED

TOP OF BEDROCK 208.5 FT BGS / EL. 654.7 FT MSL

BOTTOM OF BOREHOLE 210 FT BGS / EL. 653.2 FT MSL

NOT TO SCALE

WELL CONSTRUCTION MATERIALS*

PROTECTIVE CASING	5' L X 8" DIA. ALUMINUM CASING W/ LOCKING CAP
RISER PIPE ABOVE W.T.	SCHEDULE 40 PVC (2.07" I.D./ 2.38" O.D.)
RISER PIPE BELOW W.T.	SCHEDULE 40 PVC (2.07" I.D./ 2.38" O.D.)
SCREEN	2" I.D. SCHEDULE 40 PVC W/ 0.010" SCREEN SLOT SIZE
TYPE OF BENTONITE SEAL	BLACK HILLS BENTONITE – 3/8" CHIPS (HOLE PLUG)
TYPE OF SAND PACK	R.W. SIDLEY CO. – NO. 5 FILTER PACK SAND

CASING MEASUREMENTS

BOTTOM OF SCREEN TO END CAP (FT)*		0.50
SCREEN LENGTH (1ST SLOT TO LAST SLOT) (FT)*		4.50
TOTAL LENGTH OF CASING (FT):	SHALLOW WELL	28.61
	DEEP WELL	182.70

* MEASUREMENT REFERS TO ALL WELLS

USMWK2FP001\05CAD\PROJECTS\20080408O\WCR-V04.DWG

WELL SITE DATA SUMMARY AND COMMENTARY

Well Site #9 – McHenry Township
Harrison-Benwell Park on McCullom Lake Rd

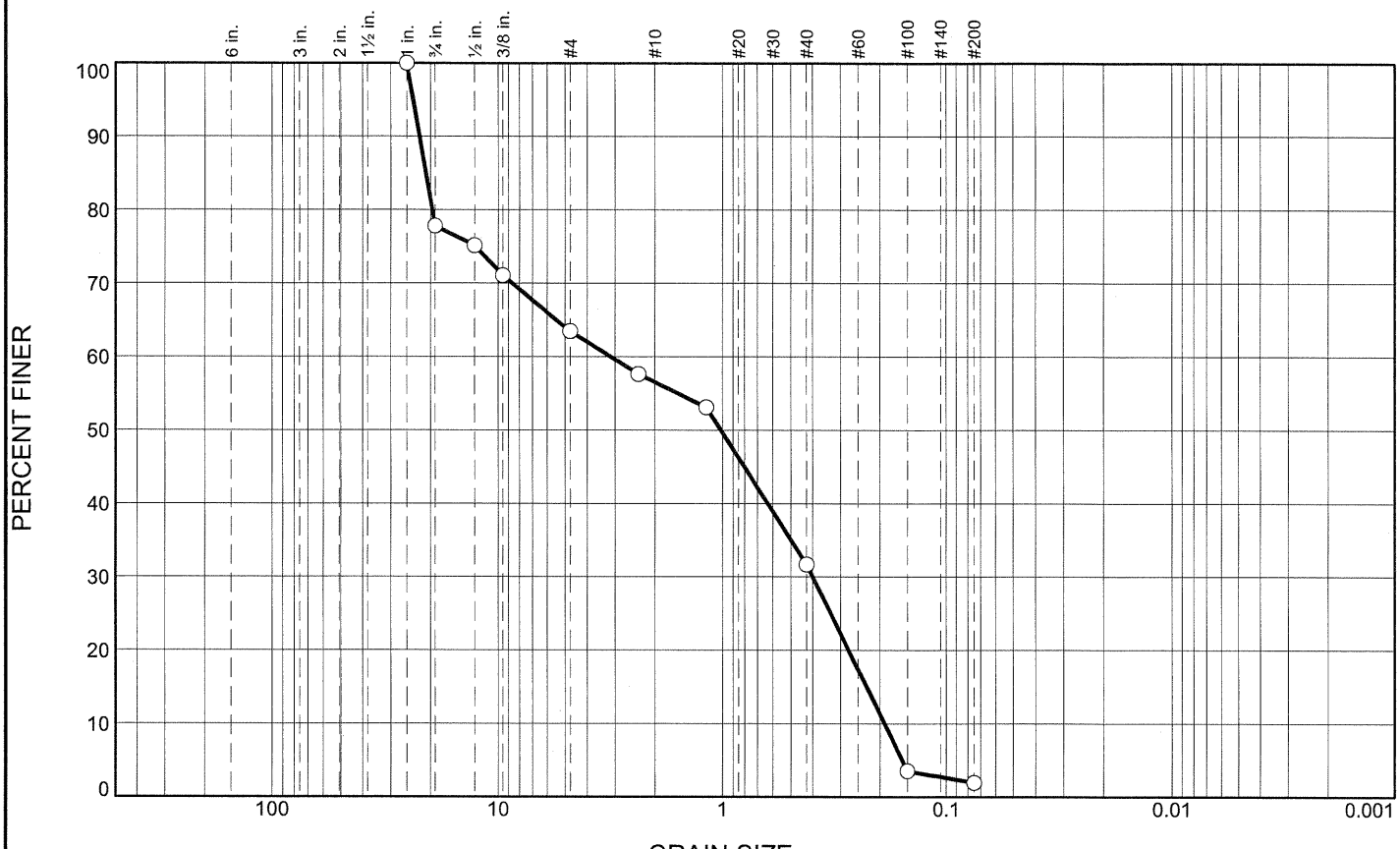
Two wells were installed at the McHenry Township well site in sand units that were separated by a thick till sequence that is believed to be the main diamicton unit of the of the Tiskilwa Formation between 29 and 153 feet below ground surface. A very thin intratill silt seam was observed between 73 and 74 ft, but was deemed relatively insignificant and not worthy of a separate monitoring installation. The McHenry Township well site was one of the most difficult boreholes to advance using the roto-sonic drilling method. Unconfined compressive strength measurements taken in the field were frequently greater than 4.5 tons per square foot (tsf) throughout the very hard till. Another noteworthy occurrence in the samples was an organic silt layer that was observed near the bottom of the hole between 181-183 ft bgs. It is suspected that the organic-rich silt represents windblown deposits and the former soil horizon of the Morton-Robein-Berry Clay complex. The organic-rich silt is a marker bed for the Sangamon Episode where climate conditions were similar to those of today (Curry et al, 1997).

The deep well is set immediately overlying the paleosol between 175 and 180 ft bgs, in a 34 foot thick sand aquifer. If the paleosol is part of the Sangamon Episode, then the deep hydrostatic zone is likely the Pearl/Ashmore aquifer. According to the well construction report obtained for the Harrison School located next to the site, the deep well is likely screened in the same unit as the school's well.

Groundwater quality results at the shallow well indicated elevated levels of sodium and chloride. These results were interpreted to be anthropogenic results of road salt runoff.

Well Site Testing Results

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	22.2	14.3	6.9	24.9	29.7	2.0	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.0	100.0		
.75	77.8		
.5	75.1		
.375	71.1		
#4	63.5		
#8	57.6		
#16	53.1		
#40	31.7		
#100	3.6		
#200	2.0		

* (no specification provided)

Material Description

F-C Sand and Gravel Trace Silt

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 22.3121 D_{85}= 20.9120 D_{60}= 3.1353
D_{50}= 1.0169 D_{30}= 0.3994 D_{15}= 0.2292
D_{10}= 0.1905 C_u= 16.46 C_c= 0.27

Classification

USCS= SP AASHTO=

Remarks

Source of Sample: 9-MCH-S **Depth:** 24.0-25.0

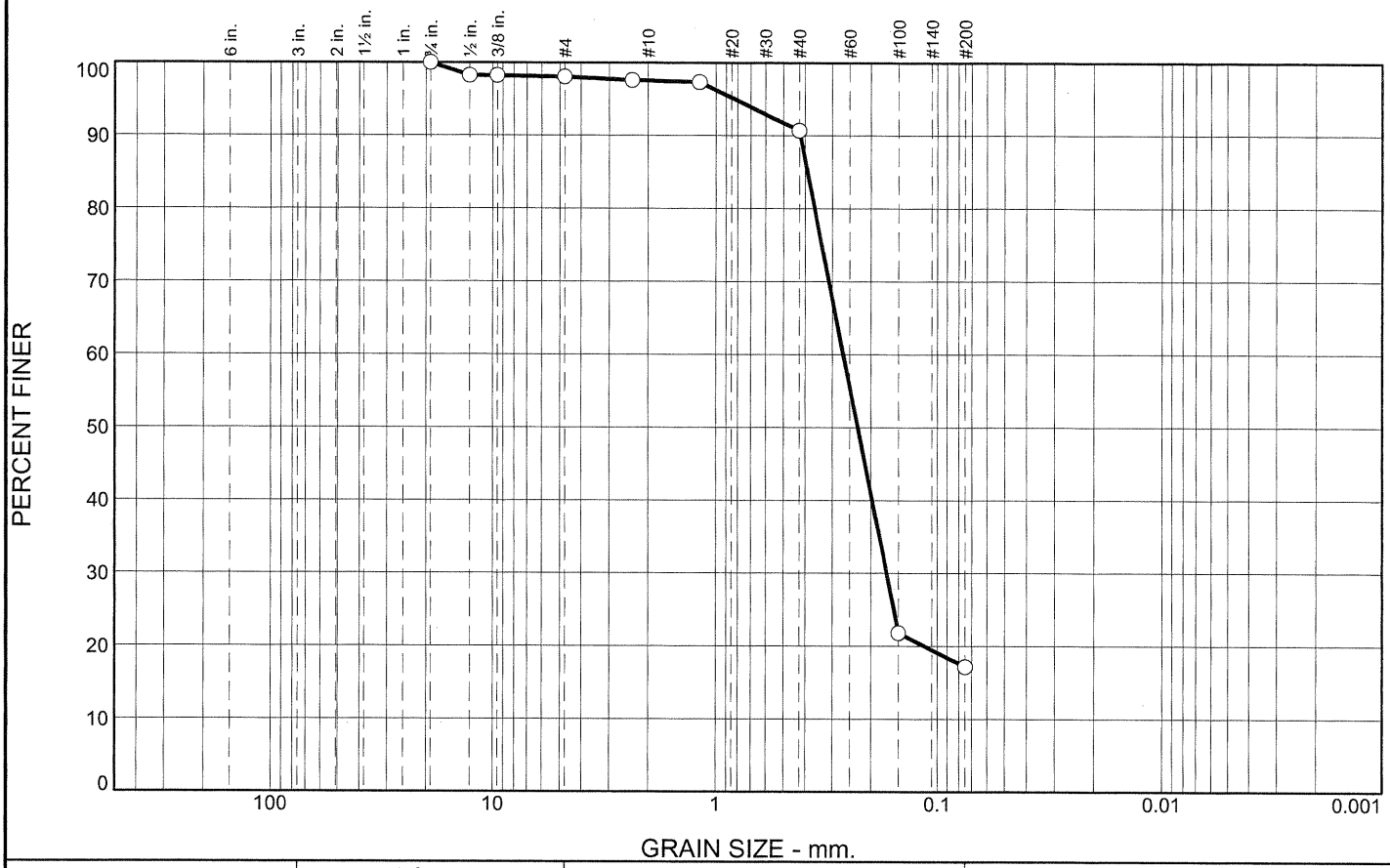
Date: 12/05/08

STS | AECOM

Client: USACE
Project: McHenry County Wells
Project No: 200804080 **Figure**

Tested By: JRT

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	2.0	0.5	6.8	73.5	17.2	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.75	100.0		
.5	98.2		
.375	98.2		
#4	98.0		
#8	97.6		
#16	97.3		
#40	90.7		
#100	21.8		
#200	17.2		

* (no specification provided)

Material Description

F-M Sand Trace Fine Gravel Little Silt

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.4205 D_{85}= 0.3899 D_{60}= 0.2672
D_{50}= 0.2297 D_{30}= 0.1698 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= AASHTO=

Remarks

Source of Sample: 9-MCH-D **Depth:** 176.0-177.0

Date: 12/05/08

STS | AECOM

Client: USACE
Project: McHenry County Wells
Project No: 200804080 **Figure**

Tested By: JRT

Groundwater Level Measurements

McHenry County Monitoring Well Installations
AECOM Project 09000-460

Site Number	9	
Township Name	McHenry	
Well Number	9-MCH-S	9-MCH-D
Ground Surface Elevation (ft msl)	863.18	863.18
Top of PVC Casing Elevation (ft)	865.92	865.92
Location of PVC Casing within Wellhead	North Well	South Well
Well Depth (Feet from TOC)[A]	28.61	182.70

Date	Depth to GW from TOC (ft)	GW Elevation (ft msl)	Depth to GW from TOC (ft)	GW Elevation (ft msl)
Sep. 26, 2008				
Oct. 09, 2008	13.13	852.79	57.9	808.02
Oct. 14, 2008				
Oct. 16, 2008				
Oct. 21, 2008				
Oct. 22, 2008				
Oct. 24, 2008				
Oct. 28, 2008				
Oct. 29, 2008				
Oct. 30, 2008				
Nov. 07, 2008				
Nov. 13, 2008				
Dec. 05, 2008	13.82	852.10	57.74	808.18
Dec. 08, 2008				
Dec. 09, 2008				
Dec. 12, 2008	13.84	852.08		
Dec. 15, 2008				
Dec. 16, 2008				
Dec. 17, 2008				
Dec. 18, 2008				
Dec. 19, 2008				
Dec. 22, 2008				
Dec. 23, 2008				
Dec. 29, 2008			57.89	808.03
Dec. 30, 2008				
Jan. 05, 2009				
Jan. 06, 2009				
Jan. 07, 2009				
Jan. 08, 2009				
Jan. 09, 2009				
Jan. 10, 2009				
Jan. 12, 2009	12.33	853.59	57.31	808.61
Feb. 24, 2009	12.43	853.49	57.51	808.41
Mar. 20, 2009				
end				

Notes:

ft msl = Elevation referenced to feet above mea

TOC = Top of PVC Casing

ft = feet

[A] = as measured inside well

NI = Not Installed

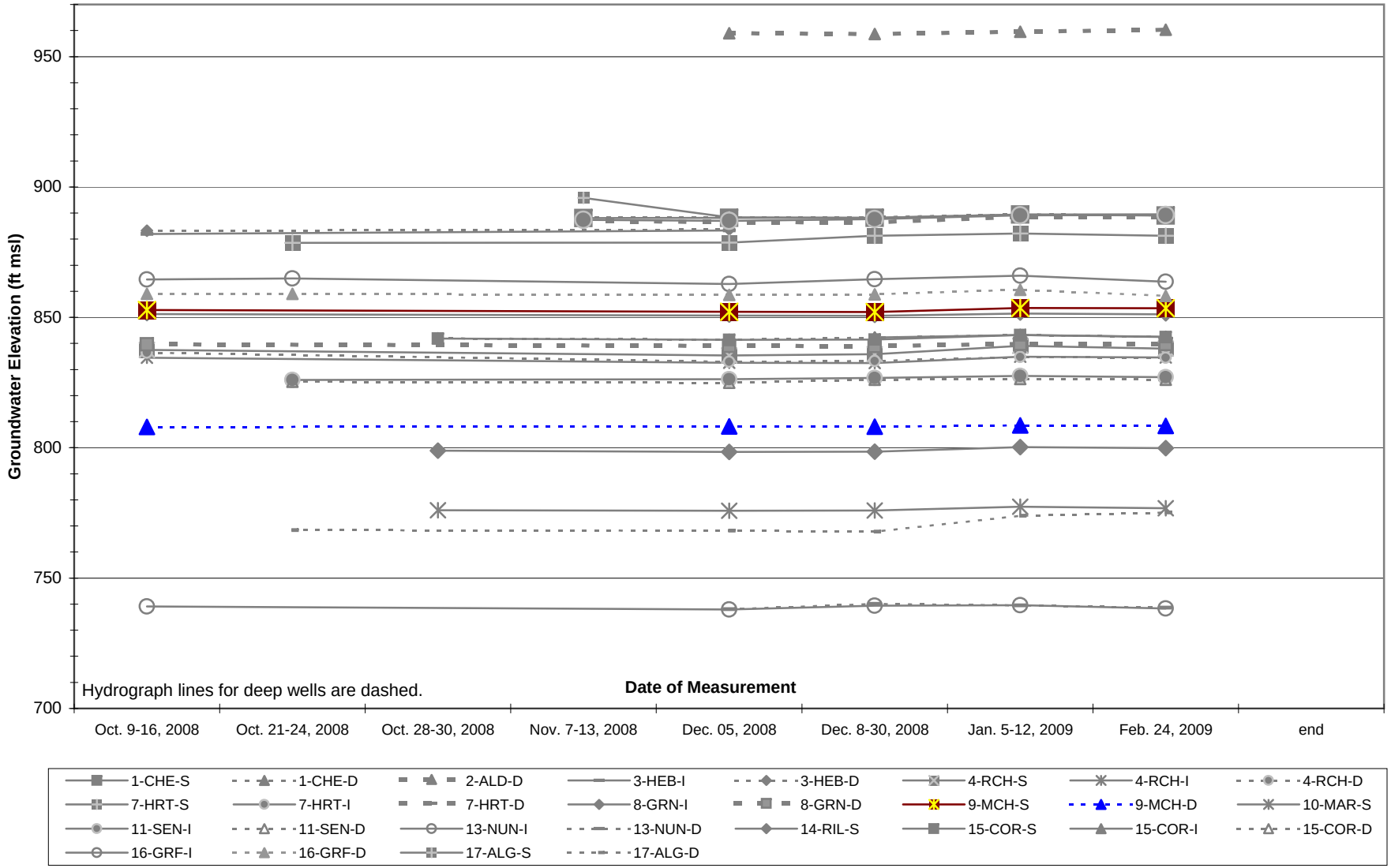
--- No Elevation

Well 17-Alg-S was frozen or partially frozen fror

Site 9 Groundwater Level Hydrograph
(includes ALL AECOM INSTALLED WELLS)

McHenry County Obervation Well Network

AECOM Project 09000-460

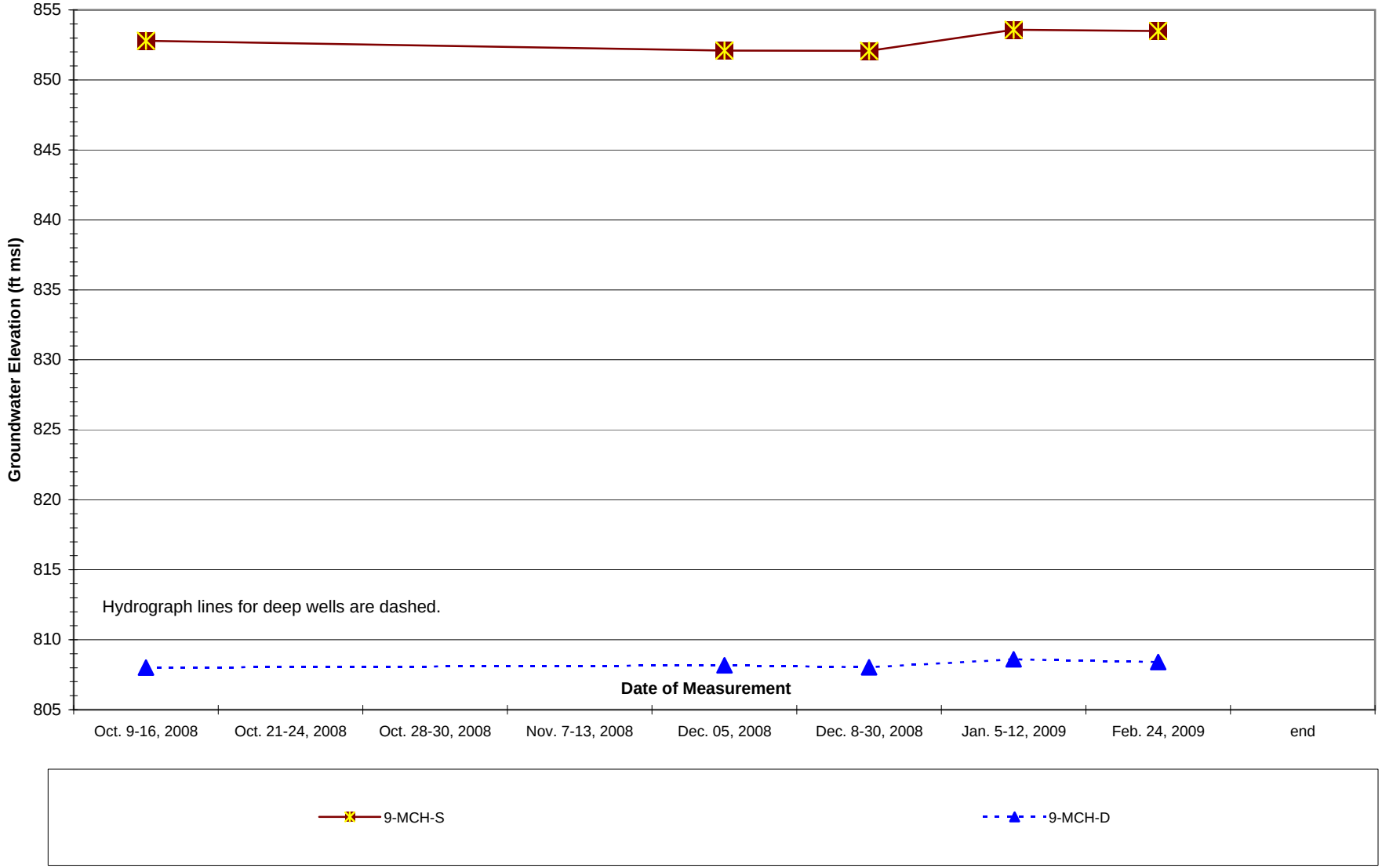


K:\PROJECTS\200804080\In_Progress\STS-McHenry Cty_WLs IN PROGRESS - figs for each site.xls

Site 9 Groundwater Level Hydrograph

McHenry County Obervation Well Network

AECOM Project 09000-460



K:\PROJECTS\200804080\In_Progress\STS-McHenry Cty_WLs IN PROGRESS - figs for each site.xls

Well Development Record

STS Consultants, Ltd.
11425 West Lake Park Drive
Milwaukee, Wisconsin 53224

Site Name: McHenry Co. Well ID Number: 9-MC4-5

Date of Completion: 12/12/08 STS Job Number: 200804080

Start Time: 9:20 End Time: 11:50

Water color at start of development: Brown Water color at end of development: Clear

Amount of water removed during development:

Contained water? ☐ Yes ☒ No

If not contained, where water disposed? Ground

Well Development Methods:

- ☐ Surged with bailer and bailed
- ☐ Surged with block and bailed
- ☐ Surged with block, bailed & pumped
- ☐ Bailed only
- ☐ Pumped slowly
- ☒ Surged with bailer and pumped
- ☐ Surged with block and pumped
- ☐ Compressed Air
- ☐ Pumped only
- ☐ Other

Equipment Used

- ☐ PVC bailer
- ☐ Well wizard
- ☐ Bean or Moino pump (on drill rig)
- ☐ Surge block
- ☒ Whale pumps
- (x) Stainless Steel Bailer

Notes: Surge Start: 9:20

End: 9:35

Purge Start: 9:45

End: 11:50

WL: 13.84

WELL DEVELOPMENT FIELD RECORD

Job Name: McHenry County Job No.: 200804080 Well No.: 9-MC4-S'

Developed By: Brian Schmidt Date of Install.: _____ Sheet ____ of ____

Started Devel.: 12/12/08 / _____ (DATE / TIME) Completed Devel.: 12/12/08 / _____ (DATE / TIME)

W.L. Before Devel.: _____ / _____ / _____ (DATE / TIME / DEPTH) After Devel.: _____ / _____ / _____ (DATE / TIME / DEPTH)

Well Depth: Before Devel. _____ After Devel. _____ Well Dia. (in.) _____

Standing Water Column (ft.) _____ Standing Well Volume _____ gal.

Screen Length: 5' Drilling Water Loss _____ gal.

DATE / TIME	VOLUME REMOVED (Gallons)	FIELD PARAMETERS SPEC. COND. (umhos/cm)	TEMP. (C°)	pH (s.u.)	TURB ~~Other~~	ORP	REMARKS
12/12/08 CAL	—	4530	10.6	4.02	0	—	
9:50	5 Gal/min	2000	10.8	5.61	999	—	
10:00	"	1920	12.1	6.95	810	—	
10:10	"	1900	12.0	7.11	999	—	
10:20	"	1920	12.2	7.16	999	—	
10:30	"	1900	12.2	7.20	595	—	
10:40	"	1890	12.3	7.22	169	—	
10:50	"	1770	12.1	7.26	999	—	RESURGED
11:00	"	1840	12.4	7.24	427	—	RESURGED
11:10	"	1820	12.5	7.24	999	—	
11:20	"	1810	12.4	7.25	999	—	RESURGED
11:30	"	1840	12.5	7.23	66	—	
11:40	"	1830	12.6	7.24	63	—	
11:50	"	1830	12.9	7.26	60	—	
		= TOTAL VOLUME REMOVED (Gallons)					

Development Method: _____

Notes:

Well Development Record

STS Consultants, Ltd.
11425 West Lake Park Drive
Milwaukee, Wisconsin 53224

Site Name: McHenry County

Well ID Number: 9-MCH-D

Date of Completion: 12/29/08

STS Job Number: 200804080

Start Time: 1100

End Time: 1405

Water color at start of development: Brown

Water color at end of development: Milky Clear

Amount of water removed during development:

Contained water? ☐ Yes ☒ No

If not contained, where water disposed? Ground

Well Development Methods:

- ☐ Surged with bailer and bailed
- ☐ Surged with block and bailed
- ☐ Surged with block, bailed & pumped
- ☐ Bailed only
- ☐ Pumped slowly
- ☐ Surged with bailer and pumped
- ☐ Surged with block and pumped
- ☐ Compressed Air
- ☒ Pumped only
- ☐ Other

Equipment Used

- ☐ PVC bailer
- ☐ Well wizard
- ☐ Bean or Moino pump (on drill rig)
- ☐ Surge block
- ☐ Whale pumps
- ☒ Waterra Pump w/ Block

Notes:

Purge St: 1100

Purge End: 1405

WL St: 57.89

WL End: 58.45

Purging Delayed Due To Leaky Pump Valve

WELL DEVELOPMENT FIELD RECORD

Job Name McHenry County Job No. 20080480 Well No. 9-MCH-D

Developed By Brian Schmidt Date of Install. _____ Sheet ____ of ____

Started Devel. 12/29/08 / DATE / TIME Completed Devel. 12/29/08 / DATE / TIME

W.L. Before Devel. ____ / DATE / TIME / DEPTH After Devel. ____ / DATE / TIME / DEPTH

Well Depth: Before Devel. _____ After Devel. _____ Well Dia. (in.) _____

Standing Water Column (ft.) _____ Standing Well Volume _____ gal.

Screen Length 5' Drilling Water Loss _____ gal.

DATE / TIME	VOLUME REMOVED (Gallons)	FIELD PARAMETERS SPEC. COND. (umhos/cm)	TEMP. (C°)	pH (s.u.)	TURB ~~Other~~	ORP	REMARKS
12/29/08 CAL	—	4520	10.4	3.96	0	—	
1115	2 GAL/MIN	1330	10.6	5.69	999	—	
1130	"	1070	10.5	7.23	999	—	
1145	"	871	10.3	7.37	999	—	
1200	"	794	10.3	7.44	903	—	
1215	"	723	10.3	7.45	999	—	
1230	"	687	10.0	7.46	999	—	
1250	"	648	10.3	7.44	999	—	
1305	"	633	10.2	7.44	912	—	
1320	"	614	10.4	7.42	566	—	
1340	"	591	10.4	7.44	467	—	
1405	"	574	10.3	7.42	398	—	
		= TOTAL VOLUME REMOVED (Gallons)					

Development Method: _____

Notes:

First Environmental Laboratories, Inc.

IL ELAP / NELAC Accreditation # 100292

1600 Shore Road • Naperville, Illinois 60563 • Phone (630) 778-1200 • Fax (630) 778-1233

Analytical Report

Client: AECOM ENVIRONMENT
Project ID: McHenry County 200804080
Sample ID: 9-MCH-S
Sample No: 9-0115-004

Date Collected: 01/12/09
Time Collected: 13:00
Date Received: 01/13/09
Date Reported: 01/20/09

Analyte		Result	R.L.	Units	Flags
Total Metals	**Method: 6020A**		**Preparation Method 3010A**		
Analysis Date: 01/16/09			Preparation Date: 01/15/09		
Calcium		140	0.1	mg/L	
Iron		1.03	0.01	mg/L	
Magnesium		69.6	0.1	mg/L	
Potassium		3.0	0.1	mg/L	
Sodium		102	0.1	mg/L	
Alkalinity, Bicarbonate (CaCO3)	**Method: 2320B**				
Analysis Date: 01/15/09 13:30					
Alkalinity, Bicarbonate (CaCO3)		410	5	mg/L	
Alkalinity, Carbonate (CaCO3)	**Method: 2320B**				
Analysis Date: 01/15/09 13:30					
Alkalinity, Carbonate (CaCO3)		< 5	5	mg/L	
Chloride	**Method: 4500Cl, E**				
Analysis Date: 01/14/09					
Chloride		266	5	mg/L	
Sulfate	**Method: 375.2R2.0**				
Analysis Date: 01/15/09					
Sulfate		54	15	mg/L	

First Environmental Laboratories, Inc.

IL ELAP / NELAC Accreditation # 100292

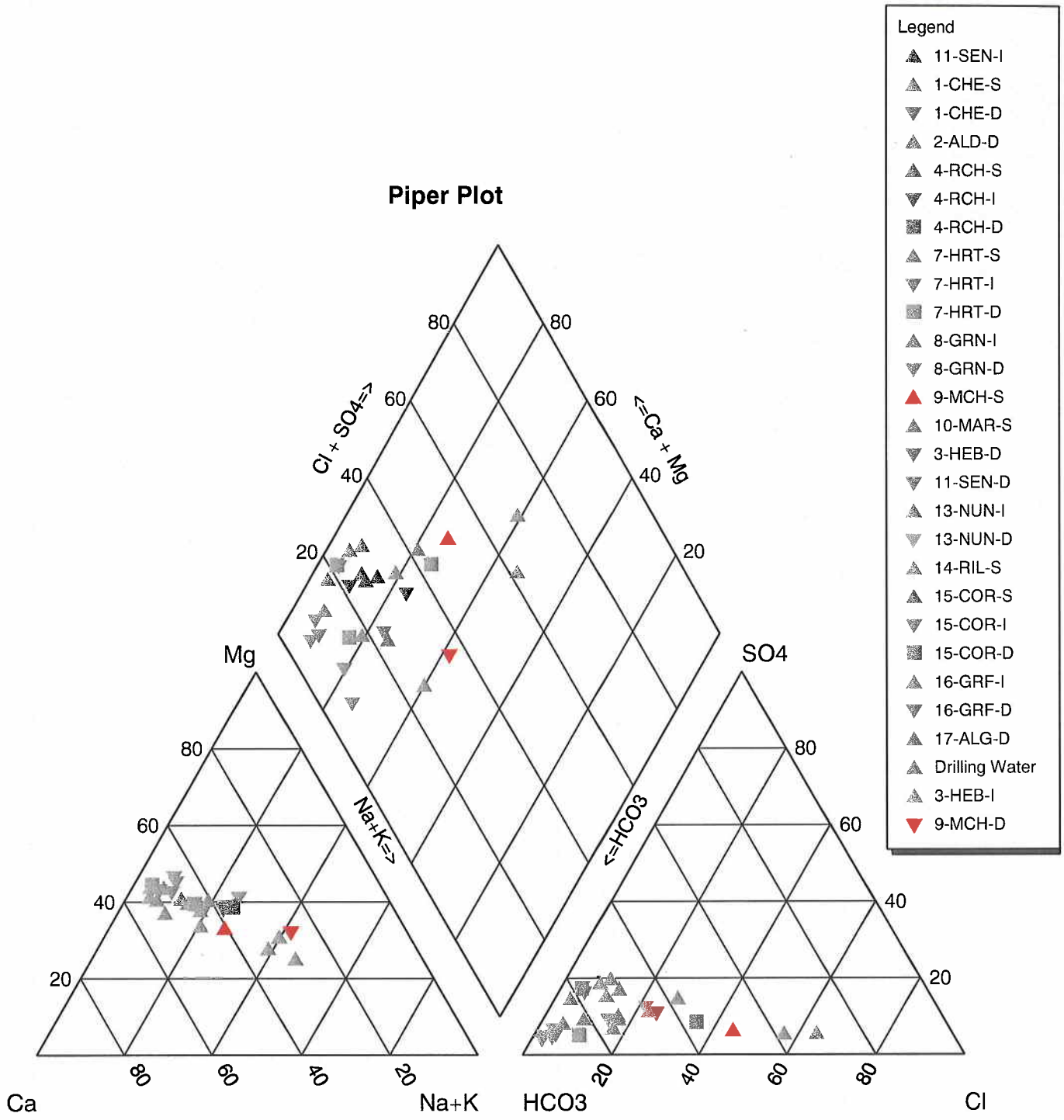
1600 Shore Road • Naperville, Illinois 60563 • Phone (630) 778-1200 • Fax (630) 778-1233

Analytical Report

Client: AECOM ENVIRONMENT
Project ID: McHenry County 200804080
Sample ID: 9-MCH-D
Sample No: 9-0115-003

Date Collected: 01/12/09
Time Collected: 12:55
Date Received: 01/13/09
Date Reported: 01/20/09

Analyte		Result	R.L.	Units	Flags
Total Metals	**Method: 6020A**		**Preparation Method 3010A**		
Analysis Date: 01/16/09			Preparation Date: 01/15/09		
Calcium		44.5	0.1	mg/L	
Iron		0.51	0.01	mg/L	
Magnesium		33.2	0.1	mg/L	
Potassium		2.9	0.1	mg/L	
Sodium		79.0	0.1	mg/L	
Alkalinity, Bicarbonate (CaCO3)	**Method: 2320B**				
Analysis Date: 01/15/09 13:30					
Alkalinity, Bicarbonate (CaCO3)		320	5	mg/L	
Alkalinity, Carbonate (CaCO3)	**Method: 2320B**				
Analysis Date: 01/15/09 13:30					
Alkalinity, Carbonate (CaCO3)		< 5	5	mg/L	
Chloride	**Method: 4500Cl, E**				
Analysis Date: 01/14/09					
Chloride		88	5	mg/L	
Sulfate	**Method: 375.2R2.0**				
Analysis Date: 01/15/09					
Sulfate		54	15	mg/L	



DESCRIPTION: Piper Linear Diagram - Well Site #9

AECOM	PROJECT: McHenry County	PROJECT NO: 09000460
	CLIENT: Army Corps of Engineers	DATE: 7/30/2009

Field Well Sampling Sheet

Fill out the entire form. If it does not apply, mark N/A.

Project Name: McHenry County STS Job No. 20080478 0

Location: McHenry Tester: Brian Schmidt

Well Number: 9-MCH-S Date Sampled: 1/12/09

Previous Well Sampled: 8-GRN-D

GENERAL CONDITIONS:

						If Missing Replaced?
Surface Seal:	X Ok		Damaged		Missing:	Yes No
Protector Pipe:	X Ok		Damaged		Missing:	Yes No
Well Cap:	X Ok		Damaged		Missing:	Yes No
Ambient Temperature: 20 °F			Clear	Cloudy	Rain	

WELL DATA:

Measuring Device: Solinist Water Level Meter

Stick Up or Down: Up (from Ground Surface)

Depth to Water: 12.33 (from TPVC)

Depth to Bottom: 25 (from TPVC)

Length of Water:

Free Product Observed: [ ] Yes [X] No Thickness: N/A

PURGING/SAMPLING:

Well Purging Calculations: Amount to purge = 0.163 gallons/foot times height of water column in feet for one well volume

Purging Device: Bladder Pump Sampling Device: Bladder Pump

Volume Required: [X] See back of page for field readings during purge

Volume Purged:

Could Well Bail Dry? [ ] Yes [X] No

Purging - Time Start: 12:00 Time Ended: 1305

Decon Method: Alconox

IN-SITU TESTING:

Turbidity: [ ] Turbid [ ] Opaque

Odor:

Color

pH @ degrees C

Uncorrected Conductivity X

Water Temp. (from Cond.)

Comments: STI 1300

SAMPLES COLLECTED

Vocs -		Cyanide	
Metals -		Hexchrome	
SVOC		Alkalinity	
TOC		Chloride	
Sulfide		Ammonia	
Phenolics		COD	

Well Purging Log

Date 1/12/09

9-MCH-S

Time	Temp	pH	Conductivity	~~ORP~~ TURB	~~DO~~ RATE
1/12/09 12:10	8.8	7.14	1880	500	250 ML/MIN
1220	9.5	7.22	1850	153	"
1230	10.3	7.20	1830	120	"
1240	10.6	7.18	1840	52	"
1250	8.9	7.23	1860	28	"
1300	9.0	7.19	1870	30	"
ST: 1300					

Field Well Sampling Sheet

Fill out the entire form. If it does not apply, mark N/A.

Project Name: McHenry County STS Job No. 200804080

Location: McHenry Tester: Brian Schmidt

Well Number: 9-MC4-D Date Sampled: 1/12/09

Previous Well Sampled: 8-GRN-D

GENERAL CONDITIONS:

					If Missing Replaced?
Surface Seal:	X Ok		Damaged		Missing: Yes No
Protector Pipe:	X Ok		Damaged		Missing: Yes No
Well Cap:	X Ok		Damaged		Missing: Yes No
Ambient Temperature: 20 °F			Clear	X Cloudy	Rain

WELL DATA:

Measuring Device: Solinst Water Level Meter

Stick Up or Down: UP (from Ground Surface)

Depth to Water: 57.31 (from TPVC)

Depth to Bottom: 180 (from TPVC)

Length of Water:

Free Product Observed: ☐ Yes ☒ No Thickness: N/A

PURGING/SAMPLING:

Well Purging Calculations: Amount to purge = 0.163 gallons/foot times height of water column in feet for one well volume

Purging Device: Grundfos Pump Sampling Device: Grundfos Pump

Volume Required: ☒ See back of page for field readings during purge

Volume Purged:

Could Well Bail Dry? ☐ Yes ☒ No

Purging - Time Start: 11:55 Time Ended: 1300

Decon Method: Alconox

IN-SITU TESTING:

Turbidity: ☐ Turbid ☐ Opaque

Odor:

Color

pH @ degrees C

Uncorrected Conductivity X

Water Temp. (from Cond.)

Comments: STI 1255

SAMPLES COLLECTED

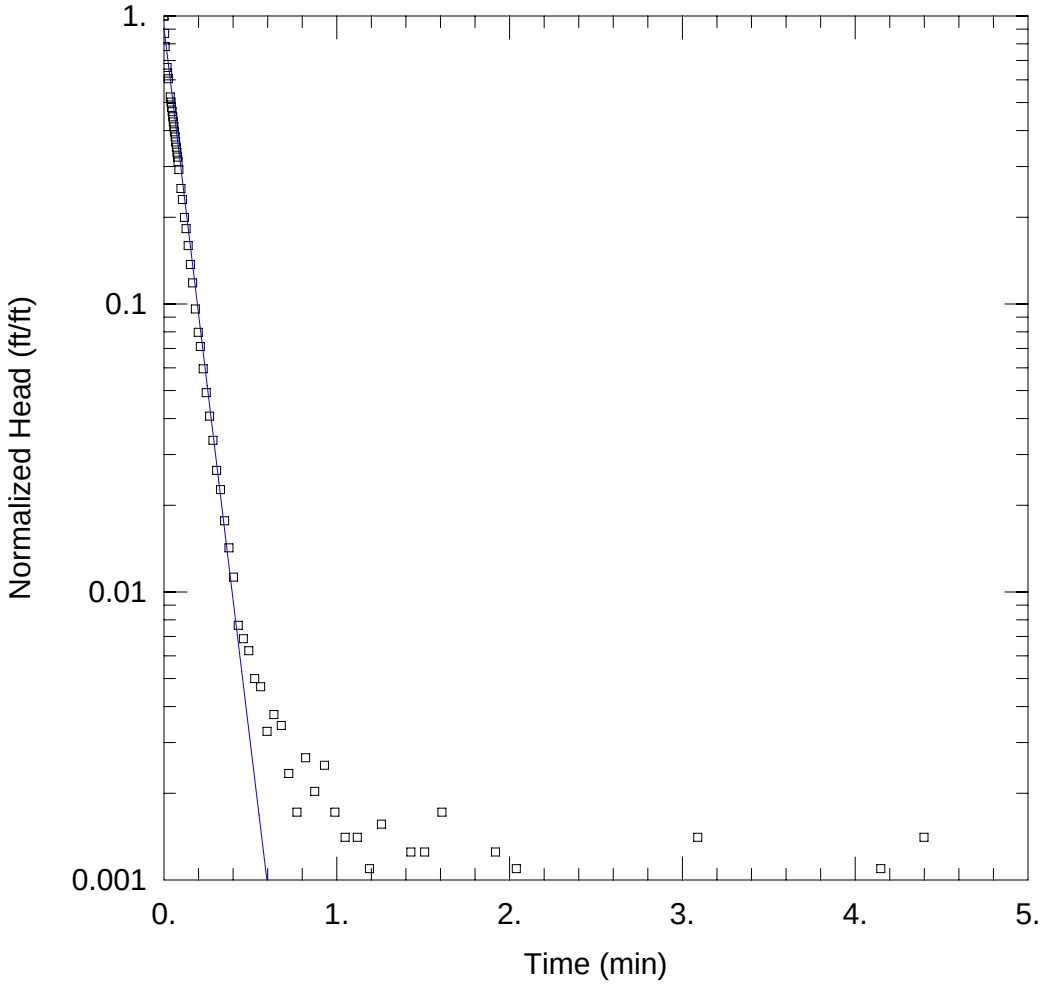
Vocs -		Cyanide	
Metals -		Hexchrome	
SVOC		Alkalinity	
TOC		Chloride	
Sulfide		Ammonia	
Phenolics		COD	

Well Purging Log

Date 1/12/09

9-MCH-D

Time	Temp	pH	Conductivity	~~ORP~~ TURB	~~DO~~ RATE
1/12/09 12:05	11.8	7.63	1070	17	1000 ML/MIN
12:15	11.7	7.45	815	101	"
1225	11.5	7.62	704	40	"
1235	11.5	7.61	684	33	"
1245	10.6	7.86	682	24	"
1255	GRUNDFOS UNDER CURRENT FAULT				
		SAMPLED W/ BAILER			
ST: 1255					



WELL TEST ANALYSIS

Data Set: K:\PROJECTS\200804080\In_Progress\Troll-files\AQTESOLV-files\9-McH-S_001_B&R.aqt
Date: 04/05/09 Time: 12:22:16

PROJECT INFORMATION

Company: AECOM
Client: USACE / McHenry Cty
Project: 09000-460 (h200804080)
Location: McHenry County, IL
Test Date: Feb. 22, 2009

AQUIFER DATA

Saturated Thickness: 10. ft
Anisotropy Ratio (Kz/Kr): 0.33

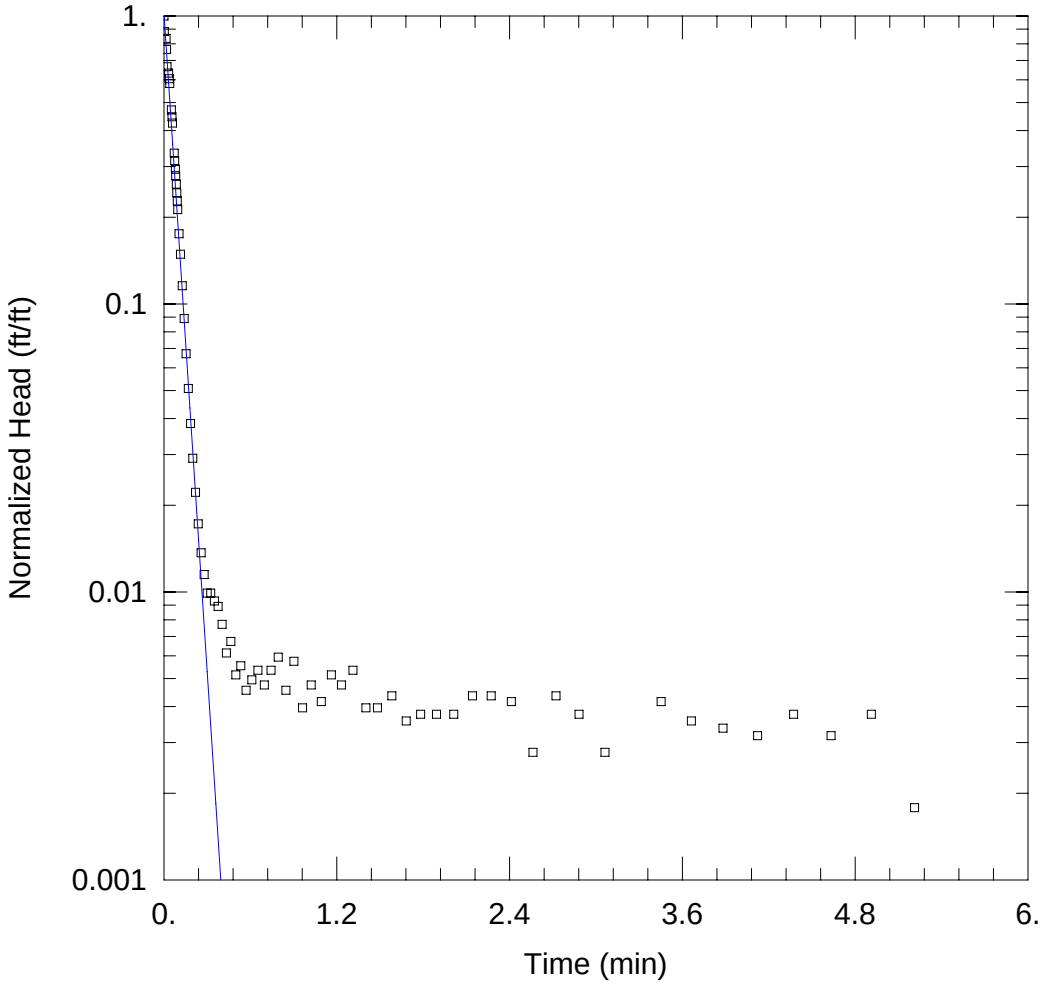
WELL DATA (9-McH-S)

Initial Displacement: 6.4 ft
Total Well Penetration Depth: 6.4 ft
Casing Radius: 0.083 ft
Static Water Column Height: 14.8 ft
Screen Length: 4.5 ft
Well Radius: 0.25 ft
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 0.01083 cm/sec
y0 = 5.822 ft



WELL TEST ANALYSIS

Data Set: K:\PROJECTS\200804080\In_Progress\Troll-files\AQTESOLV-files\9-McH-D_001_B&R.aqt
Date: 04/05/09 Time: 12:21:51

PROJECT INFORMATION

Company: AECOM
Client: USACE / McHenry Cty
Project: 09000-460 (h200804080)
Location: McHenry County, IL
Test Date: Feb. 22, 2009

AQUIFER DATA

Saturated Thickness: 34. ft
Anisotropy Ratio (Kz/Kr): 0.33

WELL DATA (9-McH-D)

Initial Displacement: 5.05 ft
Total Well Penetration Depth: 26.5 ft
Casing Radius: 0.083 ft
Static Water Column Height: 125. ft
Screen Length: 4.5 ft
Well Radius: 0.25 ft
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 0.02003 cm/sec
y0 = 5.205 ft

Additional Well Site Information

In-Situ Inc.

9-McH-S

Calibration Report

Report Number: 20090120174259-140444

221 East Lincoln Avenue, Fort Collins, CO 80524 USA
1-970-498-1500, 1-800-446-7488, FAX: 1-970-498-1598
Visit us at www.in-situ.com

Instrument Details:

Instrument Model:	**Level TROLL 500**
Full Scale Pressure Range	**103.42 KPa (15 PSI) vented**
Serial Number:	**140444**

Calibration Details:

Calibration Result:	**PASS**
Calibration Date:	2009-01-20 17:42:59 (UTC)
Nominal Range of Applied Temperature:	-5 C to +50 C
Temperature Accuracy Specification:	+/- 0.1 C From 0 C to +50 C
Nominal Range of Applied Pressure:	0 KPa to 103.4 KPa (0.0 PSI to 15.0 PSI)
Pressure Accuracy Specification:	+/- 0.1 %FS from -5 C to +50 C, +/- 0.05 %FS at +15 C

Post-Calibration Check:

Parameter	Applied	Reported	Deviation
Pressure	15.0001	14.9979	-0.0151
Pressure	0.0004	-0.0011	-0.0100
Temperature	19.8990	19.9218	0.0228

Calibration Procedures and Equipment Used:

Automated calibration procedures used.
Manu Agilent Model 34970A SerialNo MY44015965
Manu Instrulab Model 3312A-14-15-24 SerialNo 31103-(41012)
Manu Instrulab Model 406X-0031-01 SerialNo 2-31138
Manu MENSOR Model 600 SerialNo 621436
Manu Agilent Model 53131A SerialNo MY47000169
Manu MENSOR Model 600 SerialNo 621385

Notes:

1. Standards used in this calibration are traceable to the National Institute of Standards and Technology.
2. This calibration report shall not be reproduced, except in full, without the written approval of In-Situ, Inc.
3. A calibration interval of 12 to 18 months is recommended.
4. The post-calibration data is collected at nominal +20 C.
5. 1.0 PSI = 6.894757 KPa

Performed By: JBO

Copyright © 2006 In-Situ, Inc.

In-Situ Inc.

9-MeH-D

Calibration Report

Report Number: 2009012318333-140950

221 East Lincoln Avenue, Fort Collins, CO 80524 USA
1-970-498-1500, 1-800-446-7488, FAX: 1-970-498-1598
Visit us at www.in-situ.com

Instrument Details:

Instrument Model:	**Level TROLL 500**
Full Scale Pressure Range	**206.84 KPa (30 PSI) vented**
Serial Number:	**140950**

Calibration Details:

Calibration Result:	**PASS**
Calibration Date:	2009-01-23 18:3:33 (UTC)
Nominal Range of Applied Temperature:	-5 C to +50 C
Temperature Accuracy Specification:	+/- 0.1 C From 0 C to +50 C
Nominal Range of Applied Pressure:	0 KPa to 206.8 KPa (0.0 PSI to 30.0 PSI)
Pressure Accuracy Specification:	+/- 0.1 %FS from -5 C to +50 C, +/- 0.05 %FS at +15 C

Post-Calibration Check:

Parameter	Applied	Reported	Deviation
Pressure	30.0002	30.0095	0.0308
Pressure	0.0012	0.0052	0.0133
Temperature	19.9810	19.9888	0.0078

Calibration Procedures and Equipment Used:

Automated calibration procedures used.
Manu Agilent Model 34970A SerialNo MY41012474
Manu Instrulab Model 3312A-14-15-24 SerialNo 31102-(41037)
Manu Instrulab Model 406X-0031-01 SerialNo 31128-1
Manu MENSOR Model 600 SerialNo 621218
Manu Agilent Model 53131A SerialNo MY47000169
Manu MENSOR Model 600 SerialNo 621385

Notes:

1. Standards used in this calibration are traceable to the National Institute of Standards and Technology.
2. This calibration report shall not be reproduced, except in full, without the written approval of In-Situ, Inc.
3. A calibration interval of 12 to 18 months is recommended.
4. The post-calibration data is collected at nominal +20 C.
5. 1.0 PSI = 6.894757 KPa

Performed By: JBO

Copyright © 2006 In-Situ, Inc.

McHenry Township Well Site – Staked Location

McHenry Township Subsurface Samples

McHenry Township Subsurface Samples

McHenry Township Well Site

McHenry Township Well Site Entrance (Well in Center of Photo)

McHenry Township Well Site

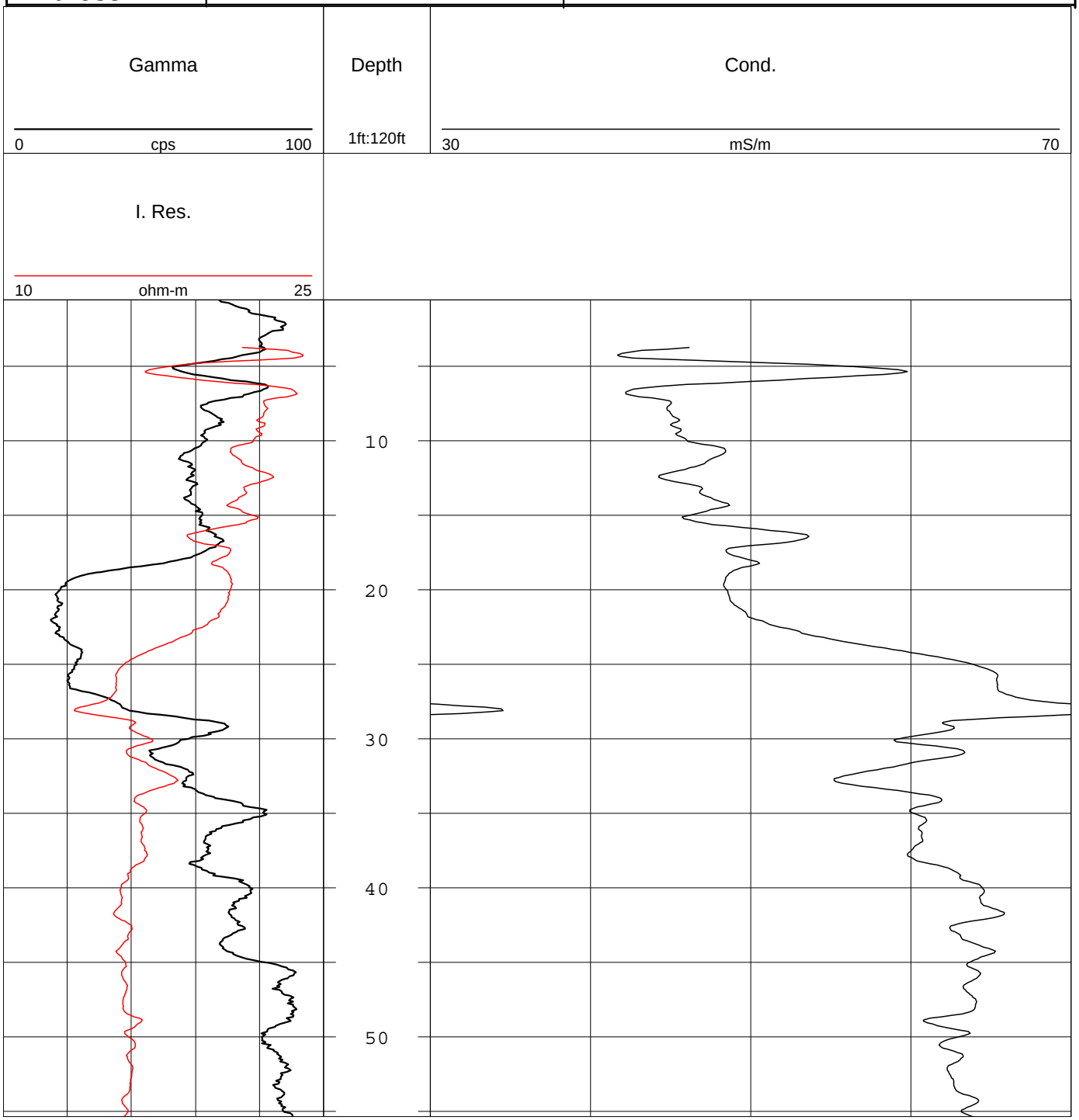
McHenry Township Well Site – Casing & Monument

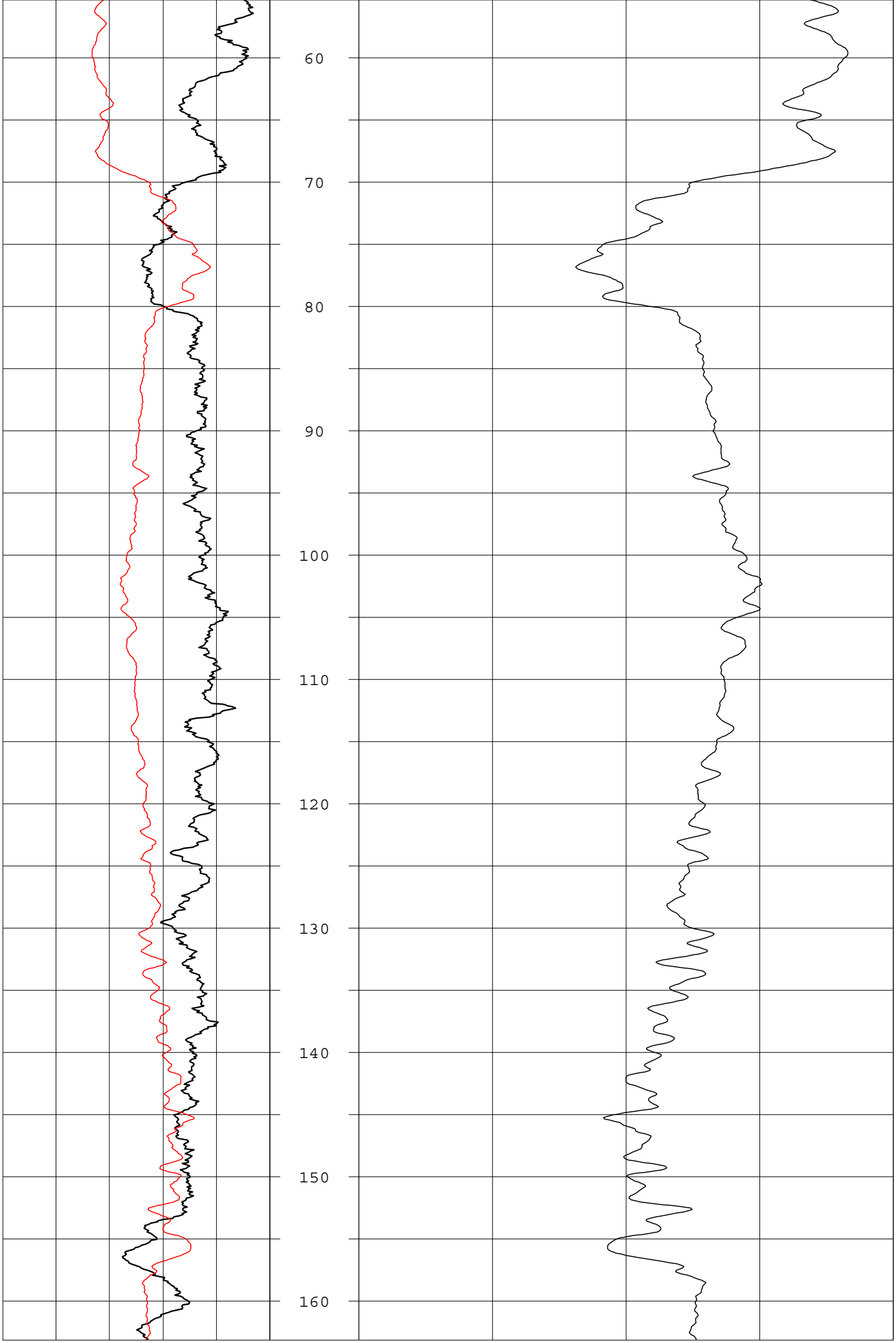
McHenry Township Well Site – Inside Casing

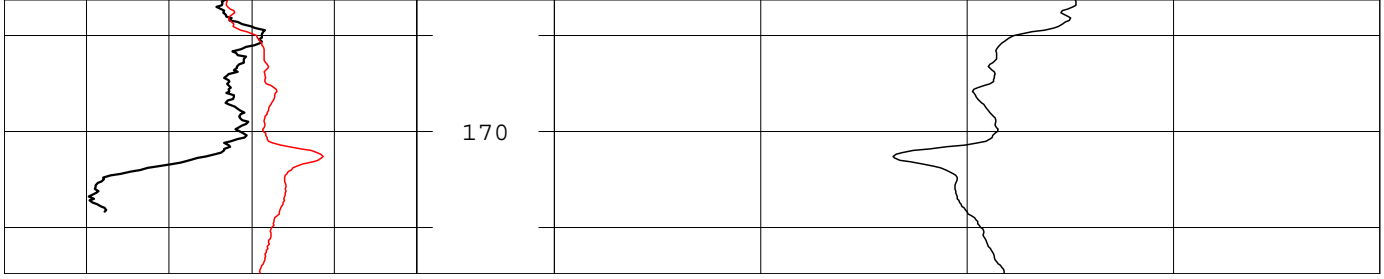
COMPANY:	McHenry County & US Corp of Engineers
Location:	

Well	#9 MCHENRY TWNSHP		
Date	10/22/08	BH Fluid	Formation
Casing	2" PVC +2.8 to -180' bgs		
File Name	MCHTH9-08EMGAM		
Depth Driller	202' bgs		
Depth Logger	179.8' bgs		
Logged by:	T. YOUNG		
Witness:	NOT WITNESSED		

OTHER SERVICES




60
70
80
90
100
110
120
130
140
150
160


170

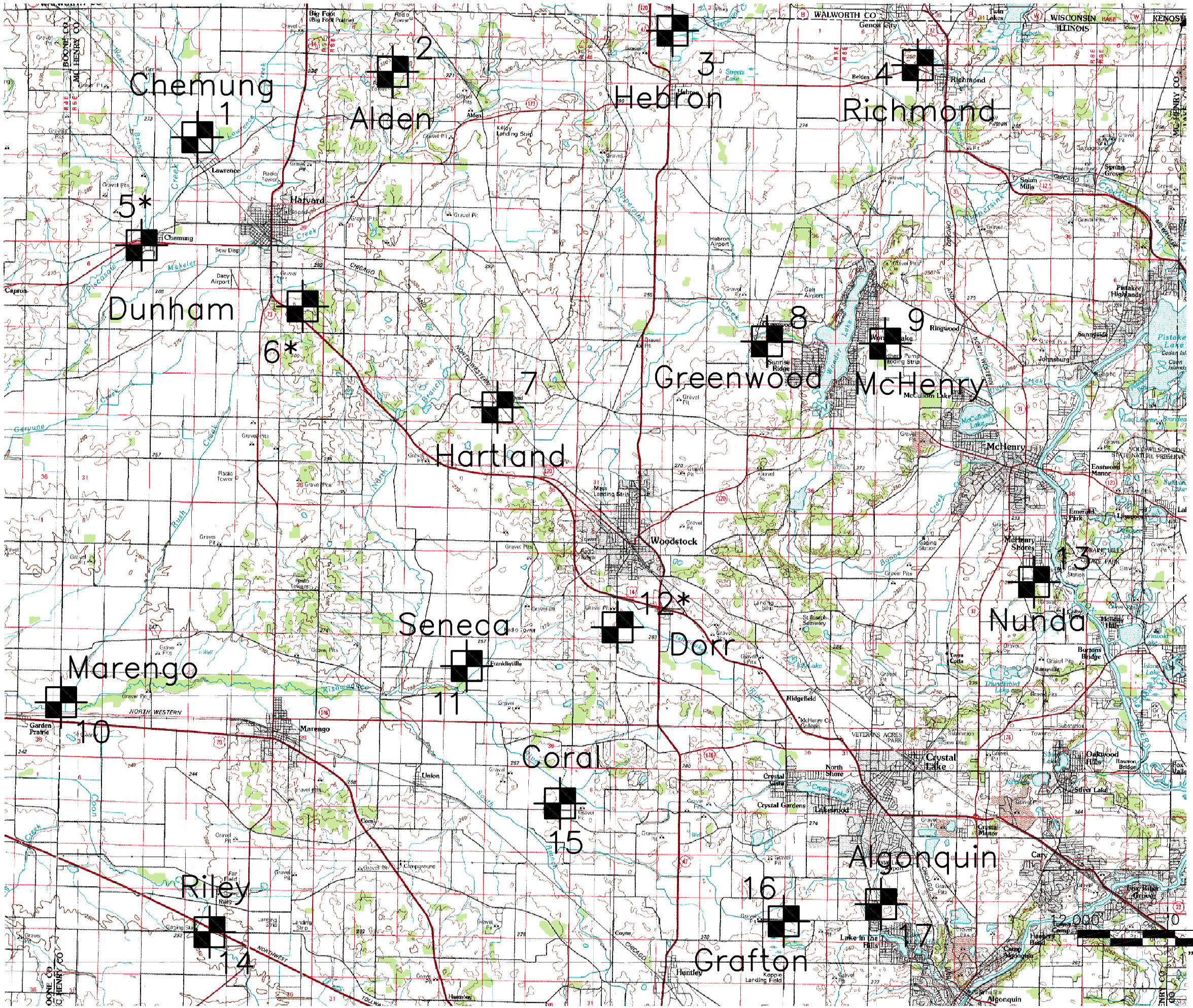
A-10: Folio for Well Site #10 – Marengo Township

Table of Contents

I.) Site Location Map – Location in County
II.) Site Location Map – Location on USGS Topographic Map
III.) Site Location Map – Location on USGS High Resolution Orthophoto
IV.) Site Boring Log
V.) Well Construction Diagram
VI.) Well Site Summary and Commentary
VII.) Particle Size Distribution Report
VIII.) Table of Water Level Measurements
IX.) Well Development Field Log
X.) Water Quality Analysis Results
XI.) Groundwater Sampling Field Log
XII.) Hydraulic Conductivity Testing Results
XIII.) In-Situ LevelTroll™ Calibration Report
XIV.) Site Photographs
XV.) Downhole Geophysical Testing

Well Site Location Maps

Z:\Projects\200804080\CtyWide\D-09000-460-8000_CtyOverviewMap_004.dwg; 4/20/2009 5:33:59 PM; BRAUN, GARY



LEGEND:

AECOM Well Installation Site

McHenry 9

Well Installations By Others

Dunham 6*

0 12,000 24,000'

" = 12,000'

AECOM

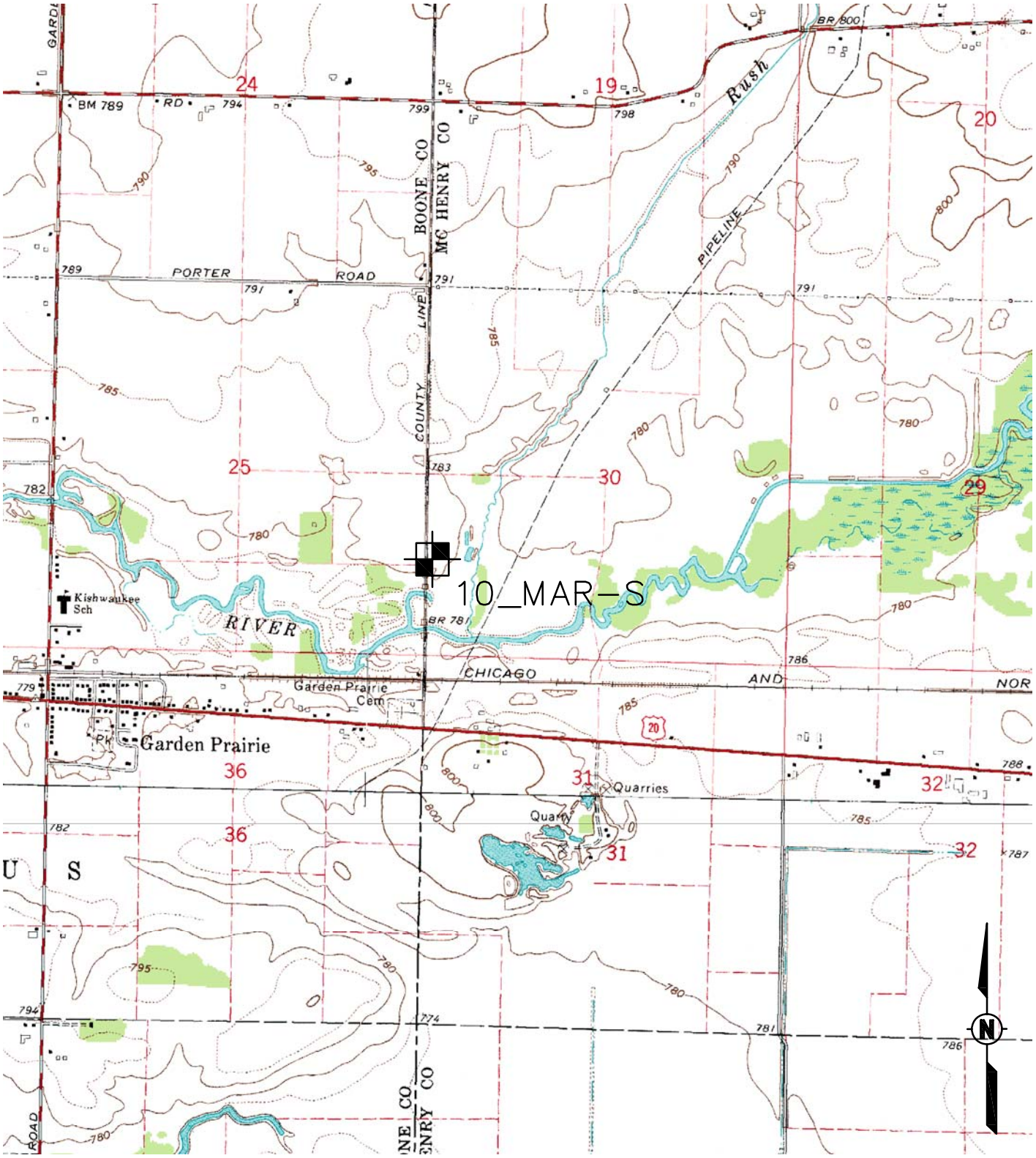
750 Corporate Woods Pkwy
Vernon Hills, IL 60061
847-279-2500
www.aecom.com

Copyright © By: STS Consultants, Ltd.

LOCATION MAP OF WELL SITES

Observation Well Network for Glacial Aquifers
McHenry County, Illinois

Drawn :	CJH	3/11/2009
Checked:	GMB	4/18/2009
Approved:	CSR	4/27/2009
PROJECT NUMBER	09000-460	
FIGURE NUMBER	1	



2000 0 2000 4000

1" = 2000'

AECOM

750 Corporate Woods Parkway
Vernon Hills, IL 60061
847.279.2500
www.aecom.com

Copyright © 2009, By: AECOM

Site Location on USGS Topographic Map
Site No. 10 - Marengo Township
MCCD Land - County Line Rd.
Observation Well Network
McHenry County, Illinois

Drawn :	CJH	04/01/2009
Checked:	GMB	04/15/2009
Approved:	CSR	04/24/2009
PROJECT NUMBER	09000-460	
FIGURE NUMBER	Folio_10 #2	

Z:\Projects\200804080\CtyWide\D-09000-460-8000_TopoMaps_v02.dwg; 4/20/2009 10:05:02 AM; BRAUN, GARY; STS_BLACK_040102.ctb

500 0 500 1000

1" = 500'

AECOM

750 Corporate Woods Parkway
Vernon Hills, IL 60061
847.279.2500
www.aecom.com

Copyright © 2009, By: AECOM

2005 USGS High Resolution Orthophoto
Site No. 10 - Riley Township
MCCD Land - County Line Rd.
Observation Well Network
McHenry County, Illinois

Drawn :	CJH	04/01/2009
Checked:	GMB	04/15/2009
Approved:	CSR	04/24/2009
PROJECT NUMBER	09000-460	
FIGURE NUMBER	Folio_10 #3	

Z:\Projects\200804080\CtyWide\D-09000-460-8000_AerialsMap_004.dwg; 4/21/2009 1:23:27 PM; BRAUN, GARY; STS_BLACK_040102.ctb

Boring and Well Construction Details

DRILLING LOG

DIVISION	USACE
INSTALLATION	Chicago District
SHEET	1 OF 3 SHEETS
1. PROJECT	McHenry County Observation Wells
2. LOCATION (Coordinates or Station)	McHenry County, Illinois N 2,037,239.00 E 883,606.00
3. DRILLING AGENCY	WDC Exploration & Wells
4. HOLE NO. *(As shown on drawing title and file number)*	10-MARENGO
5. NAME OF DRILLER	Bill Zakow
6. DIRECTION OF HOLE	☒ VERTICAL ☐ INCLINED --- DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN	42.0
8. DEPTH DRILLED INTO ROCK	8.0
9. TOTAL DEPTH OF HOLE	50.0
10. SIZE AND TYPE OF BIT	3 7/8" Carbide Bit / 5 7/8" Casing
11. DATUM FOR ELEVATION SHOWN *(TBM or MSL)*	NAVD 88
12. MANUFACTURER'S DESIGNATION OF DRILL	Super Sonic II
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN	DISTURBED 8 / UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES	N/A
15. ELEVATION GROUND WATER	776.1
16. DATE HOLE	STARTED 10/29/2008 / COMPLETED 10/29/2008
17. ELEVATION TOP OF HOLE	+780.9
18. TOTAL CORE RECOVERY FOR BORING	97 %
19. GEOLOGIST	Gary Braun, LPG IL

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
+780.9	0.0		Topsoil: OL, Dark brown clayey organic silt, little sand, fine gravel, hard, dry	90	1 0.0 5.0	
+779.9	1.0		SC, Brown to dark brown sandy clay to clayey sand (sand content increases with depth), stiff to very dense, moist			Sample No. 1 from 2.0' - 3.0' Qp = 2.75 - 3.25 TSF @2.0'
+776.9	4.0		SP, Brown fine sand, trace fine gravel (content increases with depth), dense, wet			
				90	2 5.0 15.0	Sample No. 2 from 8.0' - 9.0'
+770.9	10.0		SP, Gray medium sand, trace to little coarse sand and fine gravel, trace fine sand (varies with bedding), loose, wet			Sample No. 3 from 14.0' - 15.0'
				100	3 15.0 25.0	Sample No. 4 from 18.5' - 19.5'
						% Gravel/% Sand/% Fines = 16/83/1 from 18.0' to 19.0'

DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE 780.9

Hole No. 10-MARENGO

PROJECT: McHenry County Observation Wells

INSTALLATION: Chicago District

SHEET 2 OF 3 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
+759.9	21.0					
			SP, Brownish gray fine sand, some clayey content with depth, dense, wet			Sample No. 5 from 24.5' - 25.0'
+754.9	26.0			100	4 25.0 35.0	
			CL, Gray sandy silty clay, trace fine to coarse gravel, stiff to very stiff, low plasticity, massive matrix supported till			Qp = 2.5 TSF @27.0' Qp = >4.5 TSF @30.0' Qp = 3.5 TSF @33.0' Sample No. 6 from 34.0' - 35.0'
				100	5 35.0 45.0	Qp = 3.75 TSF @39.0' Sample No. 7 from 41.9' to 42.1'
+738.9	42.0					
			Dark grayish green shale, soft Ordovician System, Maquoketa Group, Brainard Formation			
				90	6 45.0	

DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE 780.9

Hole No. 10-MARENGO

PROJECT: McHenry County Observation Wells

INSTALLATION: Chicago District

SHEET 3 OF 3 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS *(Drilling time, water loss, depth weathering, etc., if significant)* g
			Dark grayish green shale, soft Ordovician System, Maquoketa Group, Brainard Formation *(continued)*		50.0	
						Sample No. 8 from 48.0' to 49.0'
+730.9	50.0					
			END OF BORING - 50.0' BGS			AECOM Project No. 60095270

Hole No. 10 - MARENGO TWP

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 1 OF 4 SHEETS

1. PROJECT: McHenry Cty Wells
2. LOCATION (Coordinates or Station): N2,037,239 E 883,606
3. DRILLING AGENCY: WDC Exploration & Wells
4. HOLE NO. (As shown on drawing title and title number): 10-MAR
5. NAME OF DRILLER: ~~Dan Tondnard Corp~~ BILL ZAMON
6. DIRECTION OF HOLE: [x] VERTICAL [ ] INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 42'
8. DEPTH DRILLED INTO ROCK: 8'
9. TOTAL DEPTH OF HOLE: 50'
10. SIZE AND TYPE OF BIT: 3 7/8" Carbide Sampler
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): NAVD 88
12. MANUFACTURERS DESIGNATION OF DRILL: Super Sonic II
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 8; UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES: —
15. ELEVATION GROUND WATER: 776.1' 10/29
16. DATE HOLE: STARTED 10-29-08; COMPLETED 10-29-08
17. ELEVATION TOP OF HOLE: 780.9 FT MSL
18. TOTAL CORE RECOVERY FOR BORING: 48.5'/50' = 97%
19. SIGNATURE OF INSPECTOR: Gary M. Brown LPGIL

IL ST PL-E

5 7/8" Casing v Roto-Sonic

Boring located 75' NE of Cty Line Access Rd Sign.

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g	
780.9	0		Topsoil: Dark Brown Clay SILT, little SA, Fgrvl, hard, dry (OL)			Run 1 (0-5) Rec/Run = 4.5/5' = 90%	0850 ↓ 4" run 0851
	1		Brown to Dark Brown Sandy CLAY to Clayey SAND (Sand content increases w/ depth) stiff to very dense, moist (SC)	Rec 90%	Bag 1 S1	2.75 tsf – 3.25 tsf	
	2						
	3						
	4		Brown FINE SAND, dense, wet (SP) fine gravel content increases w/ depth (None to very little w 15% gravel)			wet below 4ft ±	
	5						
	6				Bag 2	Run 2 (5-15) Rec/Run = 9'/10' = 90%	0855 ↓ 4" run 0857
	7						Drive 6" Casing ↓ 0913
	8				S2		
	9						
770.9	10		Approx. Grades over 0.5ft	Rec. 90%			
	11		Gray Medium SAND, trace to little Coarse SAND & Fine gravel, trace Fine sand (varies w/ bedding), loose, wet mainly SP w/ SW beds		Bag 3		
	12						
	13						
	14						Extract Samples 0914
	15				S3		

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT: McHenry Cty Wells | HOLE NO. 10 - MARENGO TWP

Hole No. 10 - MARENGO TWP

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 2 OF 4 SHEETS

1. PROJECT McHenry Cty Wells	10. SIZE AND TYPE OF BIT 3 7/8" Carbide Sampler
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) NAVD 88
3. DRILLING AGENCY WDC Exploration & Wells	12. MANUFACTURERS DESIGNATION OF DRILL Super Sonic II
4. HOLE NO. (As shown on drawing title and title number) 10-MAR	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 8; UNDISTURBED 0
5. NAME OF DRILLER DAN TONNANCOUR	14. TOTAL NUMBER CORE BOXES —
6. DIRECTION OF HOLE ☑ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.	15. ELEVATION GROUND WATER 776.1 10/29/08
	16. DATE HOLE: STARTED 10-29-08; COMPLETED 10-29-08
7. THICKNESS OF OVERBURDEN 42'	17. ELEVATION TOP OF HOLE 780.9 Ft MSL
8. DEPTH DRILLED INTO ROCK 8'	18. TOTAL CORE RECOVERY FOR BORING 97%
9. TOTAL DEPTH OF HOLE 50'	19. SIGNATURE OF INSPECTOR Gary M Brown LPG IL

5 7/8" Casing
Roto-Sonic

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	15		SW zone cont.			Run 3 (15-25) Rec/Run = 10'/10'
	16		SAND		Bag 4	
	17					
Shallow well 15'–20'	18		SW zone			
	19			Rec 100%	S4	Grain Size Sample Also taken from 18-19' (upper portion of Bag 5)
760.9	20				Bag 5	
	21		Abrupt			
	22		Brownish Gray FINE SAND, dense, wet (SP), some clay content w/ depth			
	23				Bag 6	
	24					
	25				S5	
	26		Approx 1 ft gradation			Run 4 (25-35) Rec./Run = 10'/10' = 100%
	27		Gray Sandy Silty CLAY, trace F.-C. gravel stiff to very stiff, low plasticity, massive matrix supported TILL (Dwinton)	Rec. 100%	Bag 7	2.5 tsf
	28					
	29				Bag 8	
750.9	30					> 4.5 tsf

0921 ↓ 4" run 0923
0925 ↓ Drive 6" Casing 0928
Extract Samples 0931
0936 ↓ Drive 4" core barrel 0938
942 ↓ Drive 6" 945

ENG FORM 1836
MAR 71
PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT McHenry Cty Wells | HOLE NO. 10 - MARENGO TWP

Hole No. 10 - MARENGO TWP

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 3 OF 4 SHEETS

1. PROJECT McHenry Cty Wells	10. SIZE AND TYPE OF BIT 3 7/8" Carbide Sampler
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) NAVD 88
3. DRILLING AGENCY WDC Exploration & Wells	12. MANUFACTURERS DESIGNATION OF DRILL Super Sonic II
4. HOLE NO. (As shown on drawing title and title number) 10-MAR	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 8; UNDISTURBED 0
5. NAME OF DRILLER DAN TONNANCOUR	14. TOTAL NUMBER CORE BOXES —
6. DIRECTION OF HOLE ☑ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.	15. ELEVATION GROUND WATER 776.1' 10-29
	16. DATE HOLE: STARTED 10-29-08; COMPLETED 10-29-08
7. THICKNESS OF OVERBURDEN 42'	17. ELEVATION TOP OF HOLE 780.9 Ft MSL
8. DEPTH DRILLED INTO ROCK 8'	18. TOTAL CORE RECOVERY FOR BORING 97%
9. TOTAL DEPTH OF HOLE 50'	19. SIGNATURE OF INSPECTOR Amy M. Brown LPG IL

5 7/8" Casing
Roto-Sonic

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
750.9	30		cont.	cont.	cont. Bag 8	RUN 4 (25-35) cont.
	31		TILL			
	32			Rec. 100%		
	33				Bag 9	3.5+tsf
	34					
					sb	Extract Samples 0950
	35					RUN 5 (35-45)
	36					Rec/Run = 10'/10' = 100%
					Bag 10	0954 ↓ 1002
	37					3.5+tsf
	38					Drive 6" Casing ↓ 1009
	39			Rec 100%		3.75+tsf Drilling hard below 40ft - Especially hard 43-45ft
740.9	40				Bag 11	
	41					• JASON THOMASON from 1565 onsite 1000 - 1145
	42		4.25 tsf ↓ Sharp Gradation	At Contact 41.9-42.1	sb	• Inspects core also.
Weathered BR (clay)	43		ORDOVICIAN SYSTEM - Maquoketa Group BRAINARD FORMATION		Bag 12	• Paleo sol (?) or Shale Bedrock (Maquoketa ?) → Collect another 5 ft.
	44		Dark Grayish Green SHALE, soft			Extract Samples 1014
	45		continued next pg.			

Hole No. 10-MARENGO TWP

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 4 OF 4 SHEETS

1. PROJECT: McHenry Cty Wells
2. LOCATION (Coordinates or Station):
3. DRILLING AGENCY: WDC Exploration & Wells
4. HOLE NO. (As shown on drawing title and title number): 10-MAR
5. NAME OF DRILLER: DAN TONNANCOUR
6. DIRECTION OF HOLE: [x] VERTICAL [ ] INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 42'
8. DEPTH DRILLED INTO ROCK: 8'
9. TOTAL DEPTH OF HOLE: 50'
10. SIZE AND TYPE OF BIT: 3 7/8" Carbide Sampler — 5 7/8" Casing
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): NAVD 88
12. MANUFACTURERS DESIGNATION OF DRILL: Super Sonic II
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 8; UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES: —
15. ELEVATION GROUND WATER: 776.1' 10-29
16. DATE HOLE: STARTED 10-29-08; COMPLETED 10-29-08
17. ELEVATION TOP OF HOLE: 780.9 FT MSL
18. TOTAL CORE RECOVERY FOR BORING: 97%
19. SIGNATURE OF INSPECTOR: Gary M Brown LPG IL

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	45		cont.			RUN 6 (45-50')
	46		weathered differentially → 42-43 ft nearly completely weathered while other sound, unaltered bedrock also present. laminated. > 2 Wet fracture zones observed. (Mechanically induced?)		Bag 13	Rec/Run = 5'/5' = 100%
	47			Rec 100%		• Drilling easier than Dolomite.
	48				Bag 14	• Pieces of dry shale evident in recovery
	49				38	
730.9	50		END OF BORING 50 feet below ground surface (bgs)			
	51		10-29-08 set 1 well	10-MARENGO-S		Screened 15-20 ft bgs
	52					
	53					
	54					
	55					
	56					
	57					
	58					
	59					
	60					

1048 Drive 4" Core barrel 1054

~1056 Extract Run

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT: McHenry Cty Wells — HOLE NO. 10-MARENGO TWP

PROJECT McHENRY COUNTY OBSERVATION WELL NETWORK INSTALLATION (#09000-460)

LOCATION MARENGO TOWNSHIP – McHENRY COUNTY, ILLINOIS

CLIENT U.S. ARMY CORPS OF ENGINEERS / McHENRY COUNTY

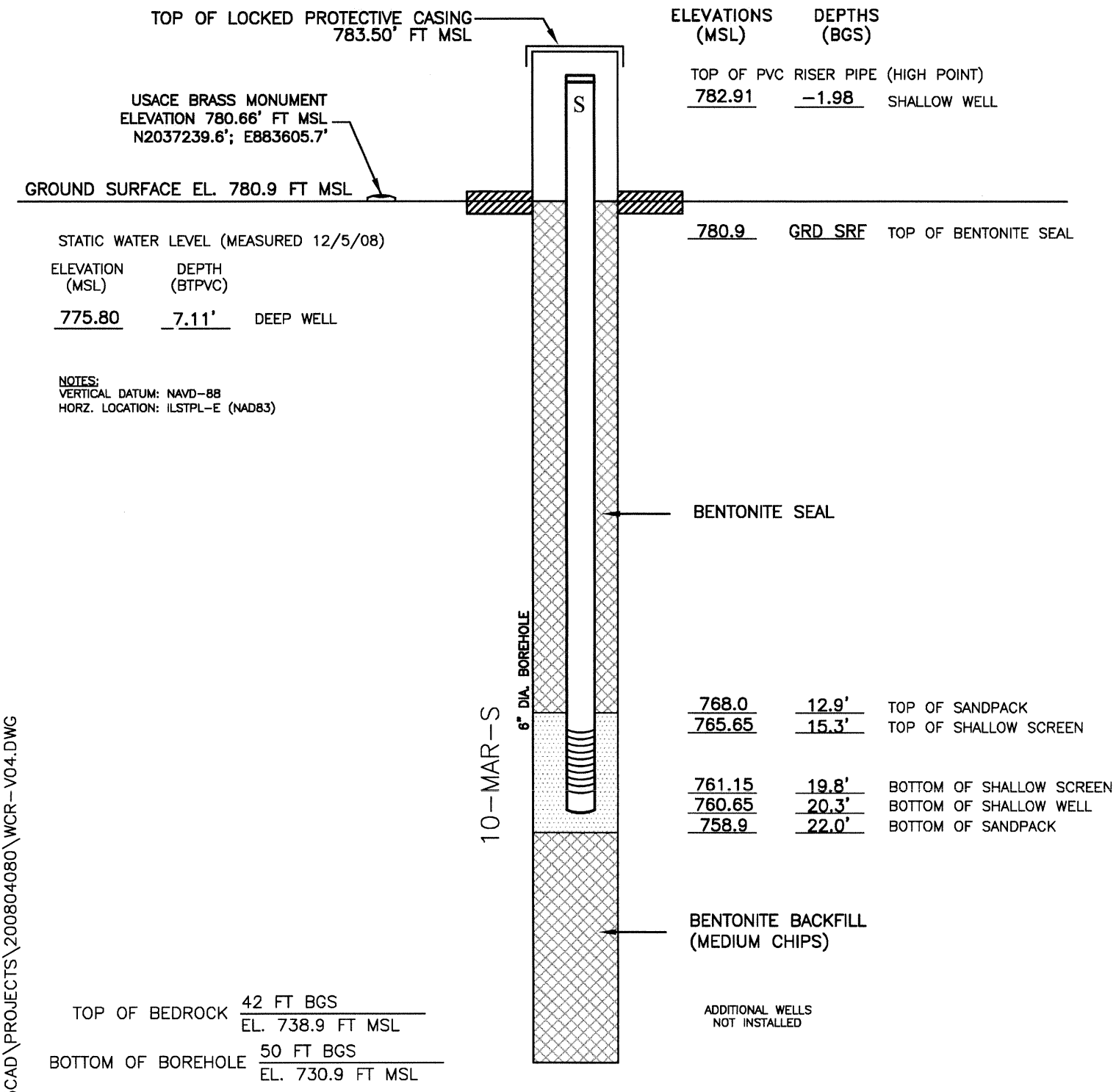
GEOLOGIST GARY BRAUN, P.G. (AECOM)

DRILLER WDC EXPLORATION AND WELLS, INC. (BILL ZAKOW)

WELL NO. 10-MAR-S

INSTALLATION DATE OCT. 29, 2008

DRILLING METHOD ROTO-SONIC



ELEVATIONS (MSL)	DEPTHS (BGS)	
TOP OF PVC RISER PIPE (HIGH POINT)		
782.91	–1.98	SHALLOW WELL
780.9	GRD SRF	TOP OF BENTONITE SEAL
768.0	12.9'	TOP OF SANDPACK
765.65	15.3'	TOP OF SHALLOW SCREEN
761.15	19.8'	BOTTOM OF SHALLOW SCREEN
760.65	20.3'	BOTTOM OF SHALLOW WELL
758.9	22.0'	BOTTOM OF SANDPACK

STATIC WATER LEVEL (MEASURED 12/5/08)

ELEVATION (MSL)	DEPTH (BTPVC)	
775.80	7.11'	DEEP WELL

NOTES:
VERTICAL DATUM: NAVD-88
HORZ. LOCATION: ILSTPL-E (NAD83)

TOP OF BEDROCK 42 FT BGS / EL. 738.9 FT MSL

BOTTOM OF BOREHOLE 50 FT BGS / EL. 730.9 FT MSL

ADDITIONAL WELLS NOT INSTALLED

NOT TO SCALE

WELL CONSTRUCTION MATERIALS*

PROTECTIVE CASING	5' L X 6" DIA. STEEL CASING W/ LOCKING CAP
RISER PIPE ABOVE W.T.	SCHEDULE 40 PVC (2.07" I.D./ 2.38" O.D.)
RISER PIPE BELOW W.T.	SCHEDULE 40 PVC (2.07" I.D./ 2.38" O.D.)
SCREEN	2" I.D. SCHEDULE 40 PVC W/ 0.010" SCREEN SLOT SIZE
TYPE OF BENTONITE SEAL	BLACK HILLS BENTONITE – 3/8" CHIPS (HOLE PLUG)
TYPE OF SAND PACK	R.W. SIDLEY CO. – NO. 5 FILTER PACK SAND

CASING MEASUREMENTS

BOTTOM OF SCREEN TO END CAP (FT)*	0.50
SCREEN LENGTH (1ST SLOT TO LAST SLOT) (FT)*	4.50
TOTAL LENGTH OF CASING (FT): SHALLOW WELL	22.26

* MEASUREMENT REFERS TO ALL WELLS

USMWK2FP001\05CAD\PROJECTS\20080408O\WCR-V04.DWG

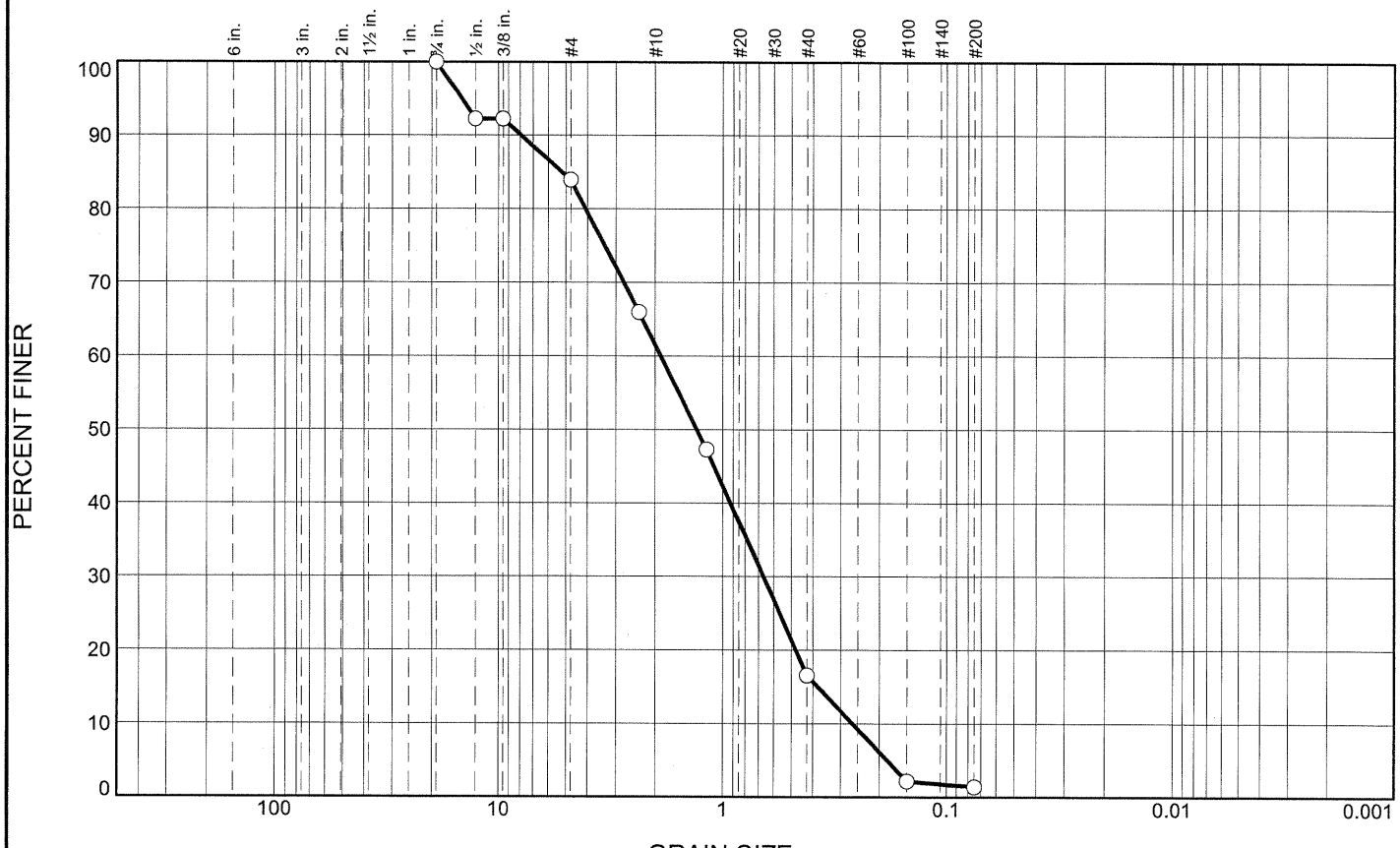
WELL SITE DATA SUMMARY AND COMMENTARY

Well Site #10 – Marengo Township
MCCD Land on County Line Rd

The western-most well in County, the Marengo site is located south and west of Wisconsin-aged deposits. The site is located in the flat outwash plain of the Kishwaukee River valley. The sand deposits at the surface are 26 feet and are underlain by a 16 foot till sequence. The till overlies weathered Ordovician Maquoketa Group bedrock. The well site is located in close proximity to Rush Creek and the Kishwaukee River. Because of the high water table in the sand (~776 ft msl) and river (~773 ft msl), it is recommended that the surface water bodies (i.e. the Kishwaukee River and Rush Creek) be monitored for stage and flow to obtain data on the local surface and ground water interactions and water budget.

Well Site Testing Results

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	16.1	22.4	44.9	15.2	1.4	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.75	100.0		
.5	92.3		
.375	92.3		
#4	83.9		
#8	66.0		
#16	47.3		
#40	16.6		
#100	2.2		
#200	1.4		

* (no specification provided)

Material Description

F-C Sand Little Fine Gravel Trace Silt

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 7.8858 D_{85}= 5.1903 D_{60}= 1.8912
D_{50}= 1.3045 D_{30}= 0.6642 D_{15}= 0.3796
D_{10}= 0.2643 C_u= 7.16 C_c= 0.88

Classification

USCS= SP AASHTO=

Remarks

Sample Number: 10-Marengo-S **Depth:** 18.0-19.0

Date: 12/05/08

STS AECOM

Client: USACE
Project: McHenry County Wells
Project No: 200804080 **Figure**

Tested By: JRT

Groundwater Level Measurements

McHenry County Monitoring Well Installations
AECOM Project 09000-460

Site Number	10
Township Name	Marengo
Well Number	10-MAR-S
Ground Surface Elevation (ft msl)	780.93
Top of PVC Casing Elevation (ft)	782.91
Location of PVC Casing within Wellhead	Single Well
Well Depth (Feet from TOC)[A]	22.26

Date	Depth to GW from TOC (ft)	GW Elevation (ft msl)
Sep. 26, 2008		
Oct. 09, 2008		
Oct. 14, 2008		
Oct. 16, 2008		
Oct. 21, 2008		
Oct. 22, 2008		
Oct. 24, 2008		
Oct. 28, 2008		
Oct. 29, 2008	6.85	776.06
Oct. 30, 2008		
Nov. 07, 2008		
Nov. 13, 2008		
Dec. 05, 2008	7.11	775.80
Dec. 08, 2008		
Dec. 09, 2008	6.99	775.92
Dec. 12, 2008		
Dec. 15, 2008		
Dec. 16, 2008		
Dec. 17, 2008		
Dec. 18, 2008		
Dec. 19, 2008		
Dec. 22, 2008		
Dec. 23, 2008		
Dec. 29, 2008		
Dec. 30, 2008		
Jan. 05, 2009		
Jan. 06, 2009		
Jan. 07, 2009	5.51	777.40
Jan. 08, 2009		
Jan. 09, 2009		
Jan. 10, 2009		
Jan. 12, 2009		
Feb. 24, 2009	6.12	776.79
Mar. 20, 2009		
end		

Notes:

ft msl = Elevation referenced to feet above mea

TOC = Top of PVC Casing

ft = feet

[A] = as measured inside well

NI = Not Installed

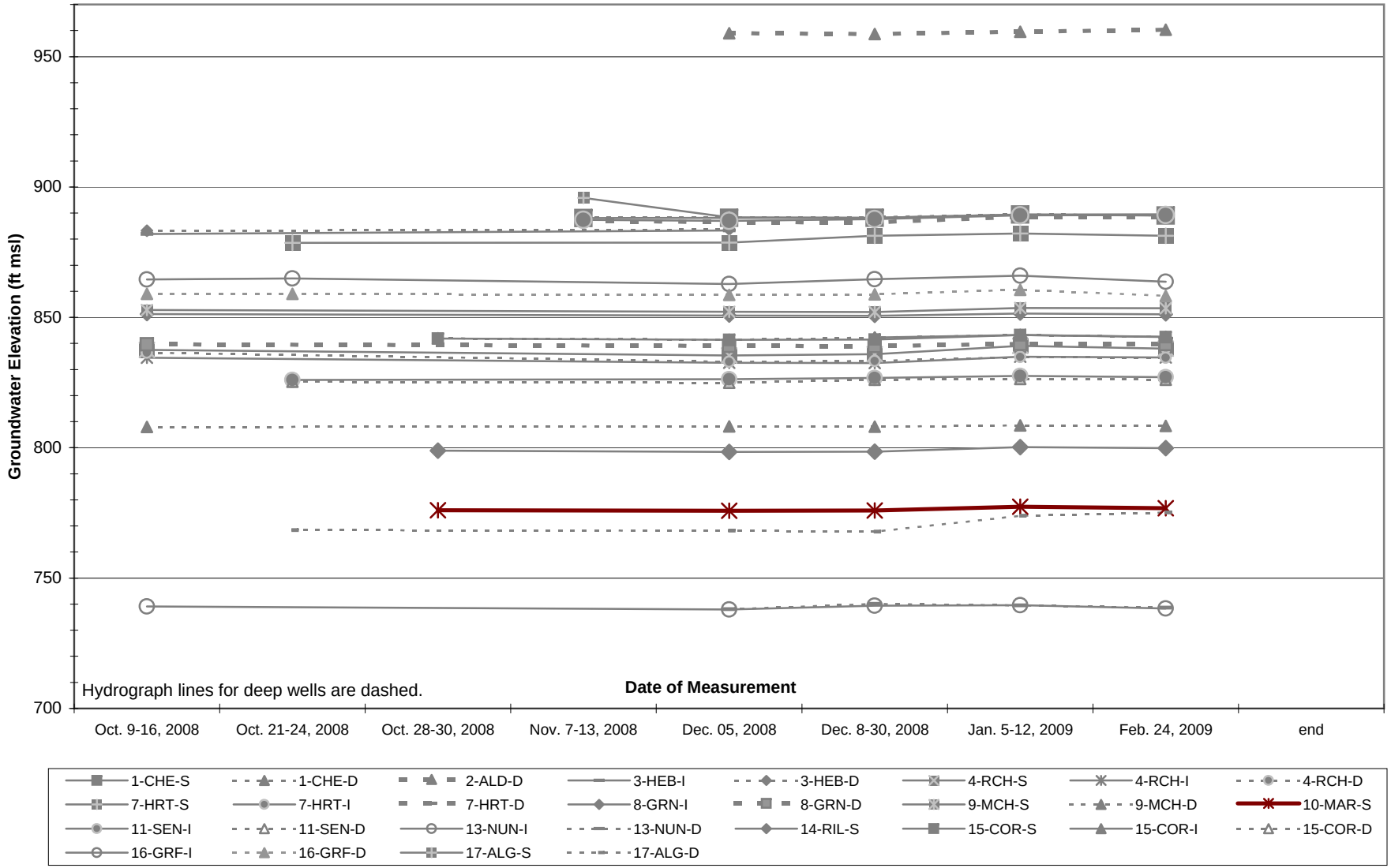
--- No Elevation

Well 17-Alg-S was frozen or partially frozen fror

Site 10 Groundwater Level Hydrograph
(includes ALL AECOM INSTALLED WELLS)

McHenry County Obervation Well Network

AECOM Project 09000-460

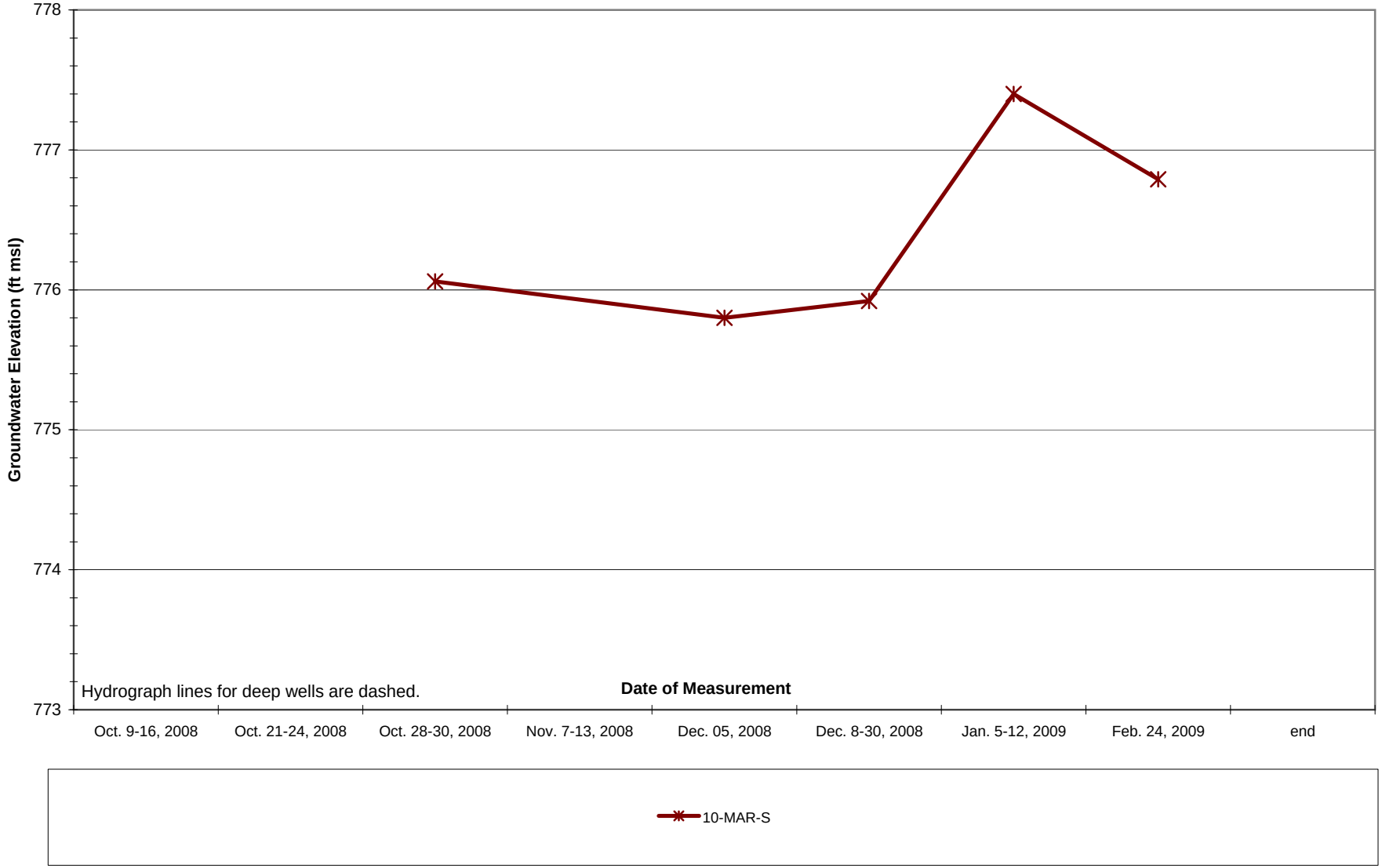


K:\PROJECTS\200804080\In_Progress\STS-McHenry Cty_WLs IN PROGRESS - figs for each site.xls

Site 10 Groundwater Level Hydrograph

McHenry County Obervation Well Network

AECOM Project 09000-460



K:\PROJECTS\200804080\In_Progress\STS-McHenry Cty_WLs IN PROGRESS - figs for each site.xls

Well Development Record

STS Consultants, Ltd.
11425 West Lake Park Drive
Milwaukee, Wisconsin 53224

Site Name: McHenry County Well ID Number: 10-MAR-S

Date of Completion: 12/9/08 STS Job Number: 200804080 pH. 4000

Start Time: 9:05 End Time: 11:05

Water color at start of development: Brown Water color at end of development: Clean

Amount of water removed during development:

Contained water? ☐ Yes ☒ No

If not contained, where water disposed? Ground

Well Development Methods:

- ☐ Surged with bailer and bailed
- ☐ Surged with block and bailed
- ☐ Surged with block, bailed & pumped
- ☐ Bailed only
- ☐ Pumped slowly
- ☒ Surged with bailer and pumped
- ☐ Surged with block and pumped
- ☐ Compressed Air
- ☐ Pumped only
- ☐ Other

Equipment Used

- ☐ PVC bailer
- ☐ Well wizard
- ☐ Bean or Moino pump (on drill rig)
- ☐ Surge block
- ☒ Whale pumps
- ☒ Stainless Steel Bailer

Notes: Surge Start: 9:05

End: 9:20

Purge Start: 9:25

End: 11:05

WL: 6.99

WELL DEVELOPMENT FIELD RECORD

Job Name: McHenry County Job No. 20080408O Well No. 10-MW-S

Developed By: Brian Schmidt Date of Install. _____ Sheet ____ of ____

Started Devel. 12/9/08 DATE / TIME Completed Devel. 12/9/08 DATE / TIME

W.L. Before Devel. DATE / TIME / DEPTH After Devel. DATE / TIME / DEPTH

Well Depth: Before Devel. _____ After Devel. _____ Well Dia. (in.) _____

Standing Water Column (ft.) _____ Standing Well Volume _____ gal.

Screen Length 5' Drilling Water Loss _____ gal.

DATE / TIME	VOLUME REMOVED (Gallons)	FIELD PARAMETERS SPEC. COND. (umhos/cm)	TEMP. (C°)	pH (s.u.)	TURB ~~Other~~	ORP	REMARKS
12/9/08 CAL	—	4530	10.4	3.96	0	—	
9:35	5 GAL/min	1060	10.1	6.21	999	—	
9:45	"	1030	10.1	6.80	999	—	
9:55	"	1030	9.9	6.93	999	—	
10:05	"	1040	10.1	6.95	355	—	
10:15	"	1030	10.0	6.96	51	—	
10:25	"	1030	10.1	6.97	39	—	
10:35	"	1030	10.3	6.97	34	—	
10:45	"	1030	10.4	6.99	823	—	RESURGED
10:55	"	1030	10.5	6.97	23	—	
11:05	"	1030	10.4	6.98	23	—	
		= TOTAL VOLUME REMOVED (Gallons)					

Development Method: _____

Notes:

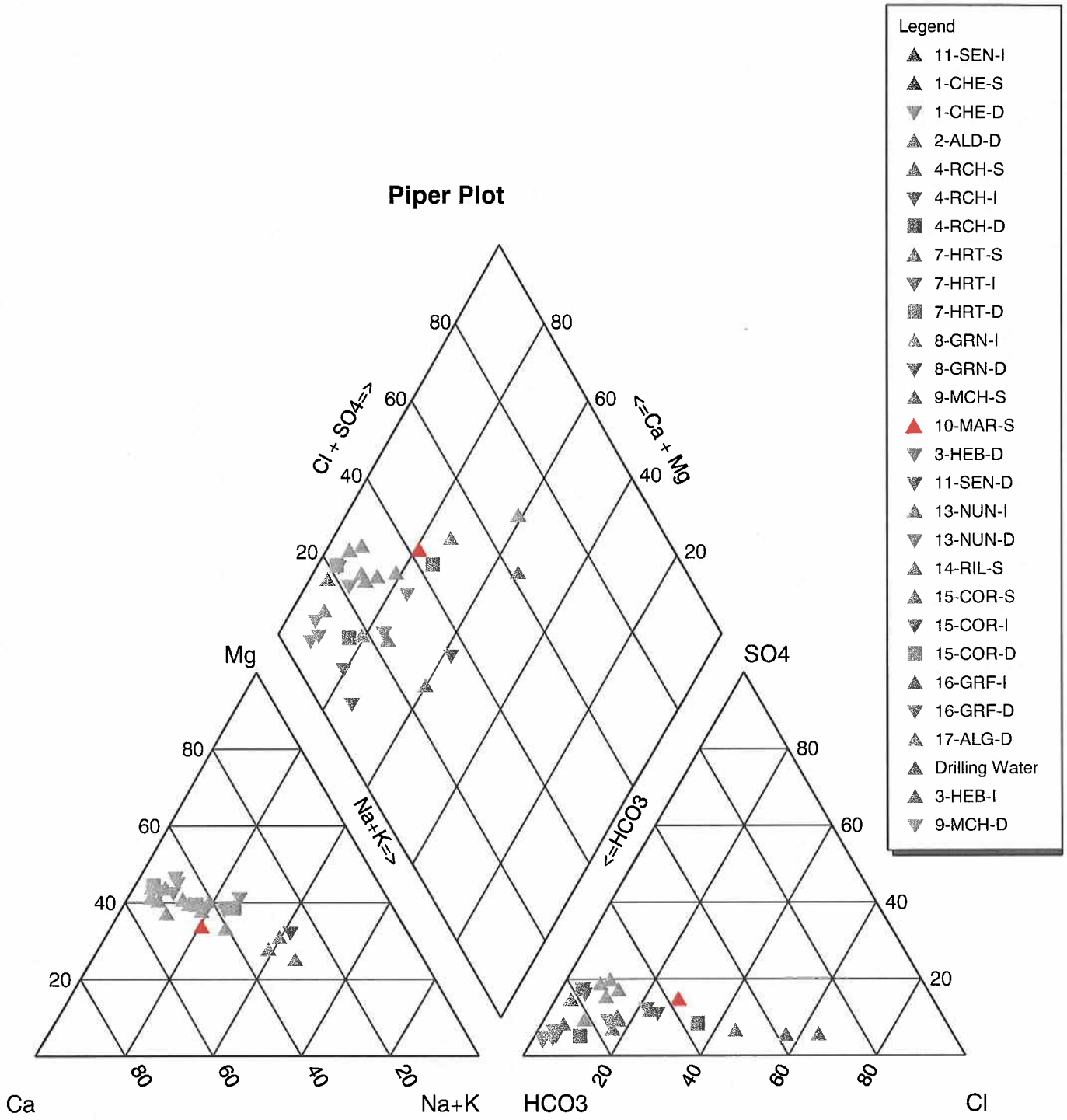
First Environmental Laboratories, Inc.
IL ELAP / NELAC Accreditation # 100292
1600 Shore Road • Naperville, Illinois 60563 • Phone (630) 778-1200 • Fax (630) 778-1233

Analytical Report

Client: STS CONSULTANTS (VERN)
Project ID: McHenry County 200804080
Sample ID: 10-MAR-S
Sample No: 9-0115-016

Date Collected: 01/07/09
Time Collected: 15:55
Date Received: 01/13/09
Date Reported: 01/20/09

Analyte		Result	R.L.	Units	Flags
Total Metals	**Method: 6020A**		**Preparation Method 3010A**		
Analysis Date: 01/16/09			Preparation Date: 01/15/09		
Calcium		96.0	0.1	mg/L	
Iron		2.00	0.01	mg/L	
Magnesium		43.1	0.1	mg/L	
Potassium		3.3	0.1	mg/L	
Sodium		47.5	0.1	mg/L	
Alkalinity, Bicarbonate (CaCO3)	**Method: 2320B**				
Analysis Date: 01/15/09 13:30					
Alkalinity, Bicarbonate (CaCO3)		290	5	mg/L	
Alkalinity, Carbonate (CaCO3)	**Method: 2320B**				
Analysis Date: 01/15/09 13:30					
Alkalinity, Carbonate (CaCO3)		< 5	5	mg/L	
Chloride	**Method: 4500Cl, E**				
Analysis Date: 01/14/09					
Chloride		121	5	mg/L	
Sulfate	**Method: 375.2R2.0**				
Analysis Date: 01/15/09					
Sulfate		88	15	mg/L	



DESCRIPTION: Piper Linear Diagram - Well Site #10

AECOM	PROJECT: McHenry County	PROJECT NO: 09000460
	CLIENT: Army Corps of Engineers	DATE: 7/30/2009

Field Well Sampling Sheet

Fill out the entire form. If it does not apply, mark N/A.

Project Name: McHenry County
STS Job No. 200804080
Location: Marengo
Tester: Brian Schmidt
Well Number: 10-MAR-S
Date Sampled: 1/7/09
Previous Well Sampled: 4-RCH-D

GENERAL CONDITIONS:

						If Missing Replaced?
Surface Seal:	☒ Ok	☐ Damaged	☐ Missing:	Yes	No
Protector Pipe:	☒ Ok	☐ Damaged	☐ Missing:	Yes	No
Well Cap:	☒ Ok	☐ Damaged	☐ Missing:	Yes	No

Ambient Temperature: 20 °F ☐ Clear ☒ Cloudy ☐ Rain

WELL DATA:

Measuring Device: Solinist Water Level Meter
Stick Up or Down: Up
Depth to Water: 5.51 (from Ground Surface)
Depth to Bottom: 20 (from TPVC)
Length of Water: (from TPVC)

Free Product Observed: ☐ Yes ☒ No Thickness: N/A

PURGING/SAMPLING:

Well Purging Calculations: Amount to purge = 0.163 gallons/foot times height of water column in feet for one well volume

Purging Device: Bladder Pump
Sampling Device: Bladder Pump
Volume Required:
☒ See back of page for field readings during purge
Volume Purged:
Could Well Bail Dry? ☐ Yes ☒ No
Purging - Time Start: 14:55
Time Ended: 1600
Decon Method: Alconox

IN-SITU TESTING:

Turbidity: ☐ Turbid ☐ Opaque
Odor:
Color
pH @ degrees C
Uncorrected Conductivity X
Water Temp. (from Cond.)
Comments: ST: 1555

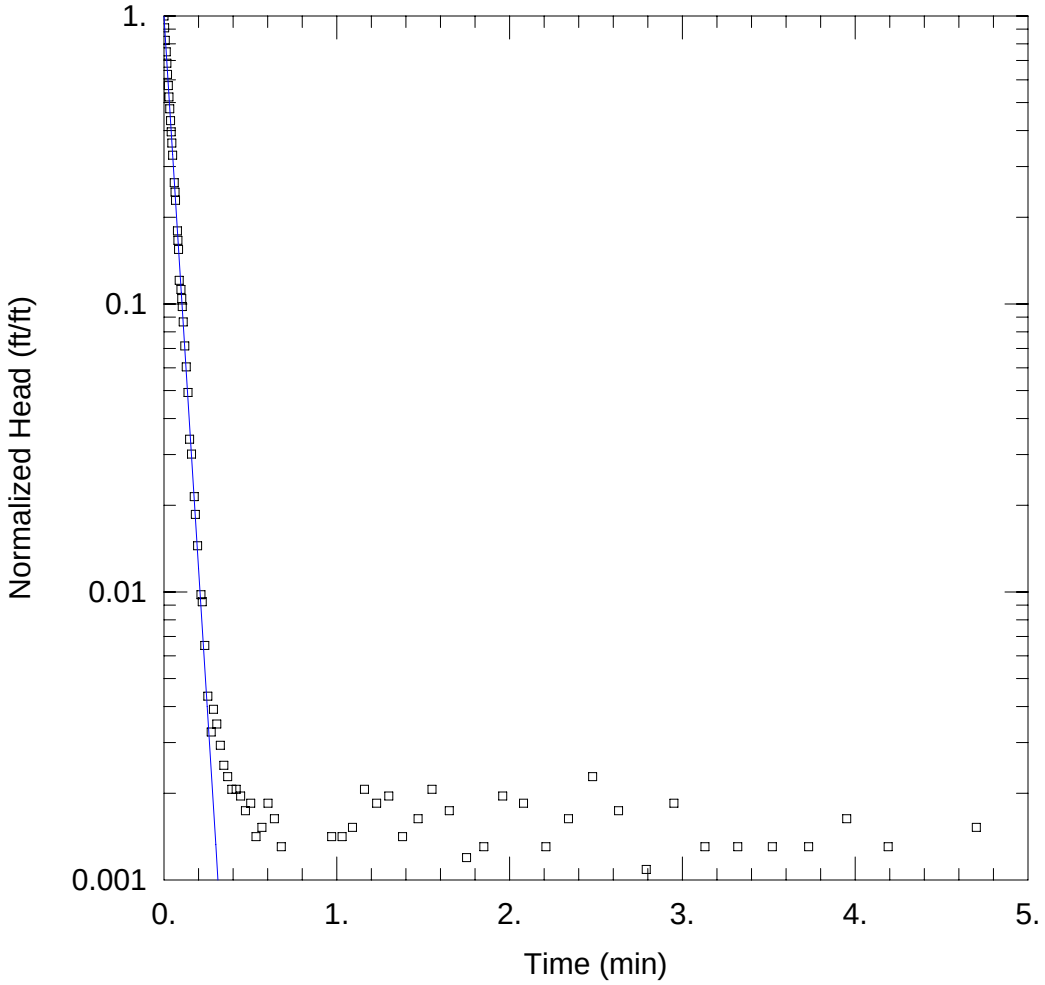
SAMPLES COLLECTED

Vocs -	☐	Cyanide	☐
Metals -	☐	Hexchrome	☐
SVOC	☐	Alkalinity	☐
TOC	☐	Chloride	☐
Sulfide	☐	Ammonia	☐
Phenolics	☐	COD	☐

Well Purging Log

Date 1/7/09

Time		Temp	pH	Conductivity	~~ORP~~ TURB	~~DO~~ RATE
1/7/09	15:05	1.9	7.90	1260	999	250 ml/min
	15:10	3.0	7.66	1240	999	"
	15:15	4.0	7.62	1210	340	"
	15:20	2.9	7.59	1210	248	"
	15:25	2.5	7.62	1210	150	"
	15:30	3.2	7.58	1200	136	"
	15:35	3.9	7.57	1180	100	"
	1540	4.1	7.58	1180	81	"
	1545	4.1	7.59	1180	66	"
	1550	3.9	7.60	1180	55	"
	1555	3.8	7.60	1180	50	"
	ST: 1555					



WELL TEST ANALYSIS

Data Set: K:\...\10-MAR-S_001_cB&R.aqt
Date: 04/05/09 Time: 12:21:16

PROJECT INFORMATION

Company: AECOM
Client: USACE / McHenry Cty
Project: 09000-460 (h200804080)
Location: McHenry County, IL
Test Date: Feb. 22, 2009

AQUIFER DATA

Saturated Thickness: 21. ft
Anisotropy Ratio (Kz/Kr): 0.33

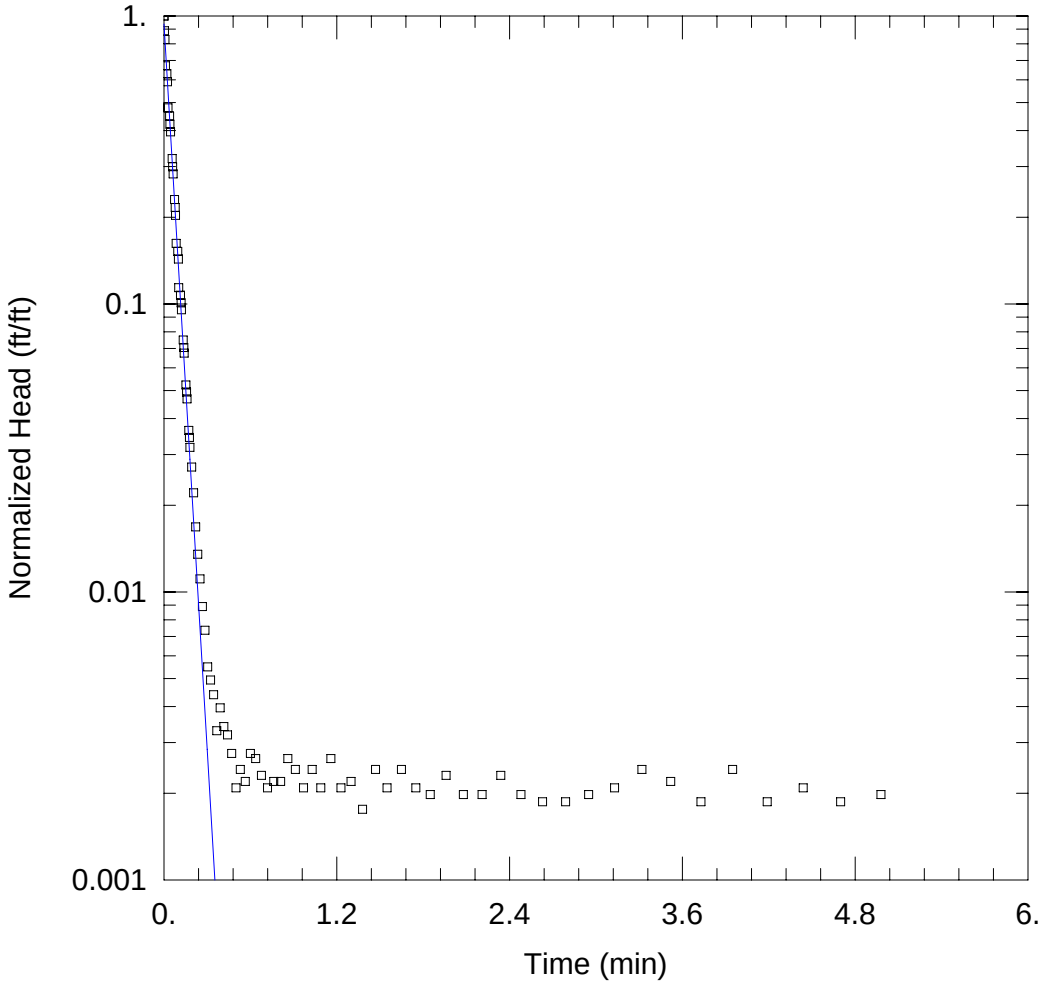
WELL DATA (10-MAR-S)

Initial Displacement: 9.2 ft
Total Well Penetration Depth: 14.5 ft
Casing Radius: 0.083 ft
Static Water Column Height: 15. ft
Screen Length: 4.5 ft
Well Radius: 0.25 ft
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 0.08004 cm/sec
y0 = 9.16 ft



WELL TEST ANALYSIS

Data Set: K:\...\10-MAR-S_002_cB&R.aqt
Date: 04/05/09 Time: 12:20:54

PROJECT INFORMATION

Company: AECOM
Client: USACE / McHenry Cty
Project: 09000-460 (h200804080)
Location: McHenry County, IL
Test Date: Feb. 22, 2009

AQUIFER DATA

Saturated Thickness: 21. ft
Anisotropy Ratio (Kz/Kr): 0.33

WELL DATA (10-MAR-S)

Initial Displacement: 9.1 ft
Total Well Penetration Depth: 14.5 ft
Casing Radius: 0.083 ft
Static Water Column Height: 15. ft
Screen Length: 4.5 ft
Well Radius: 0.25 ft
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 0.0701 cm/sec
y0 = 8.535 ft

Additional Well Site Information

In-Situ Inc.

10-MAR-S

Calibration Report

Report Number: 200901201605-140527

221 East Lincoln Avenue, Fort Collins, CO 80524 USA
1-970-498-1500, 1-800-446-7488, FAX: 1-970-498-1598
Visit us at www.in-situ.com

Instrument Details:

Instrument Model:	**Level TROLL 500**
Full Scale Pressure Range	**103.42 KPa (15 PSI) vented**
Serial Number:	**140527**

Calibration Details:

Calibration Result:	**PASS**
Calibration Date:	2009-01-20 16:0:5 (UTC)
Nominal Range of Applied Temperature:	-5 C to +50 C
Temperature Accuracy Specification:	+/- 0.1 C From 0 C to +50 C
Nominal Range of Applied Pressure:	0 KPa to 103.4 KPa (0.0 PSI to 15.0 PSI)
Pressure Accuracy Specification:	+/- 0.1 %FS from -5 C to +50 C, +/- 0.05 %FS at +15 C

Post-Calibration Check:

Parameter	Applied	Reported	Deviation
Pressure	15.0000	14.9980	-0.0133
Pressure	0.0000	-0.0015	-0.0098
Temperature	20.0230	20.0305	0.0075

Calibration Procedures and Equipment Used:

Automated calibration procedures used.
Manu Agilent Model 34970A SerialNo MY41012474
Manu Instrulab Model 3312A-14-15-24 SerialNo 31102-(41037)
Manu Instrulab Model 406X-0031-01 SerialNo 31128-1
Manu MENSOR Model 600 SerialNo 621219
Manu Agilent Model 53131A SerialNo MY47000169
Manu MENSOR Model 600 SerialNo 621385

Notes:

1. Standards used in this calibration are traceable to the National Institute of Standards and Technology.
2. This calibration report shall not be reproduced, except in full, without the written approval of In-Situ, Inc.
3. A calibration interval of 12 to 18 months is recommended.
4. The post-calibration data is collected at nominal +20 C.
5. 1.0 PSI = 6.894757 KPa

Performed By: JBO

Copyright © 2006 In-Situ, Inc.

Marengo Township Well Site

Marengo Township Subsurface Samples

Marengo Township Subsurface Samples

Marengo Township Well Site Entrance (well is right of center)

Marengo Township Well Site

Marengo Township Well Site – Casing and Monument

Marengo Township Well Site – Inside Casing

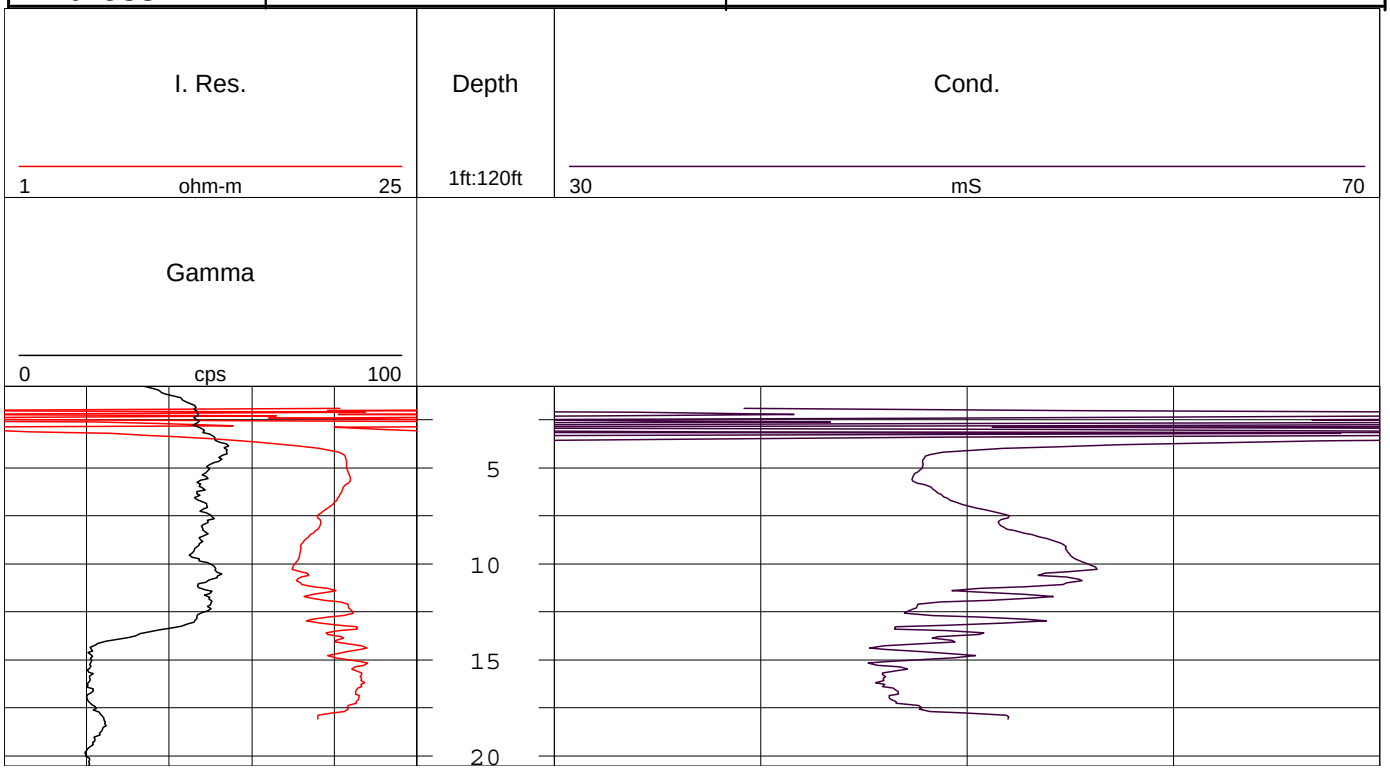
Marengo Township Well Site – Well Label

COMPANY:	MCHENRY CO. & USACE
Location:	MARENGO TWP - COUNTY LINE

Well	MARENGO TWP #10		
Date	1/21/2009	BH Fluid	FORMATION
Casing	2" PVC 2.0' AGS - 21'BGS		
File Name	MCHTH10-09EM		
Depth Driller	50' BGS		
Depth Logger	20.53' BGS		
Logged by:	T. YOUNG		
Witness:	NOT WITNESSED		

OTHER SERVICES

H2O LEVEL & GPS



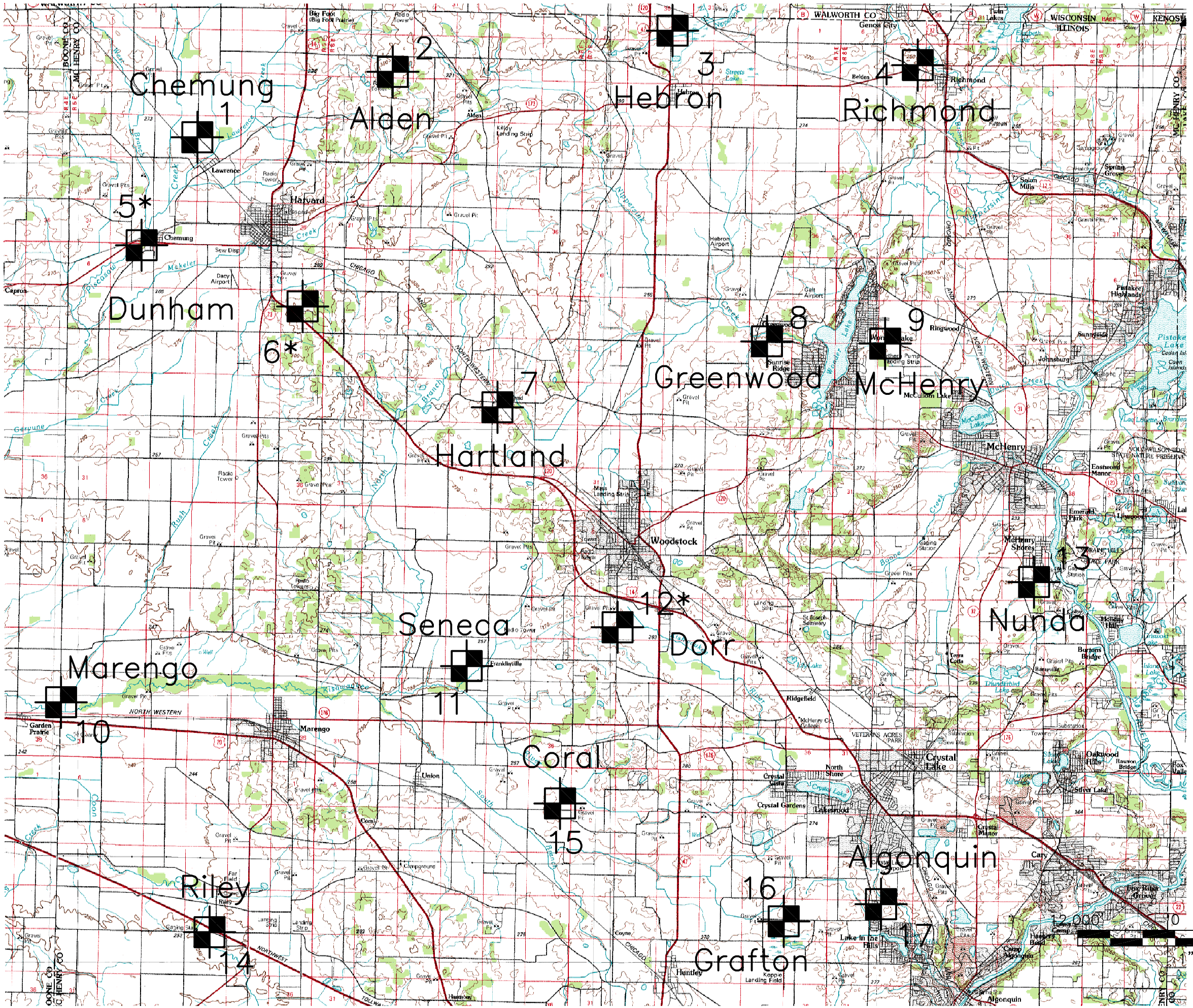
A-11: Folio for Well Site #11 – Seneca Township

Table of Contents

I.) Site Location Map – Location in County
II.) Site Location Map – Location on USGS Topographic Map
III.) Site Location Map – Location on USGS High Resolution Orthophoto
IV.) Site Boring Log
V.) Well Construction Diagram
VI.) Well Site Summary and Commentary
VII.) Particle Size Distribution Report
VIII.) Table of Water Level Measurements
IX.) Well Development Field Log
X.) Water Quality Analysis Results
XI.) Groundwater Sampling Field Log
XII.) Hydraulic Conductivity Testing Results
XIII.) In-Situ LevelTroll™ Calibration Report
XIV.) Site Photographs
XV.) Downhole Geophysical Testing

Well Site Location Maps

Z:\Projects\200804080\CtyWide\D-09000-460-8000_CtyOverviewMap_004.dwg; 4/20/2009 5:33:59 PM; BRAUN, GARY



LEGEND:

AECOM Well Installation Site

McHenry 9

Well Installations By Others

Dunham 6*

0 12,000 24,000'

" = 12,000'

AECOM

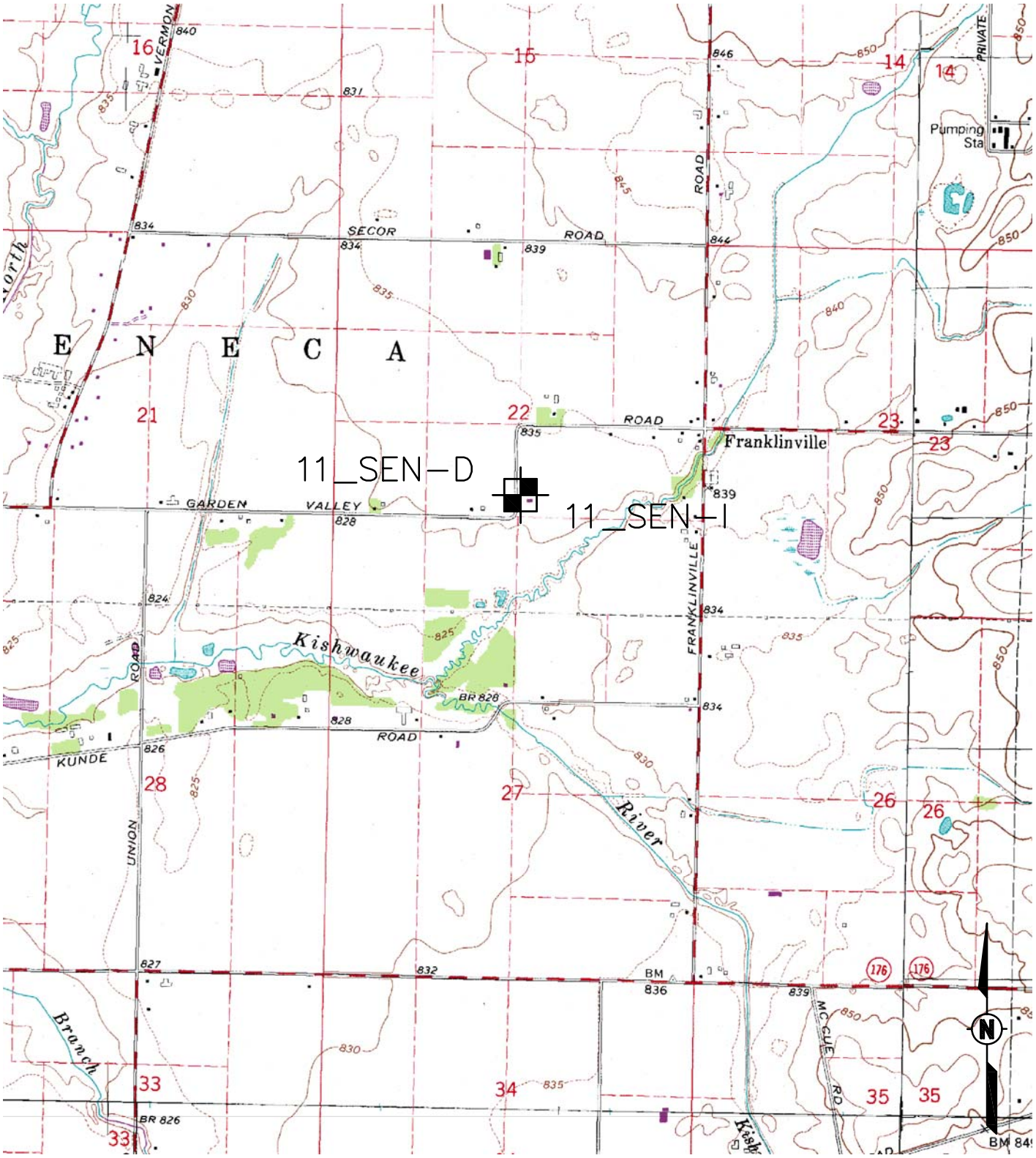
750 Corporate Woods Pkwy
Vernon Hills, IL 60061
847-279-2500
www.aecom.com

Copyright © By: STS Consultants, Ltd.

LOCATION MAP OF WELL SITES

Observation Well Network for Glacial Aquifers
McHenry County, Illinois

Drawn :	CJH	3/11/2009
Checked:	GMB	4/18/2009
Approved:	CSR	4/27/2009
PROJECT NUMBER	09000-460	
FIGURE NUMBER	1	



2000 0 2000 4000

1" = 2000'

AECOM

750 Corporate Woods Parkway
Vernon Hills, IL 60061
847.279.2500
www.aecom.com

Copyright © 2009, By: AECOM

Site Location on USGS Topographic Map
Site No. 11 - Seneca Township
Seneca Town Hall - Garden Valley Rd.
Observation Well Network
McHenry County, Illinois

Drawn :	CJH	04/01/2009
Checked:	GMB	04/15/2009
Approved:	CSR	04/24/2009
PROJECT NUMBER	09000-460	
FIGURE NUMBER	Folio_11 #2	

Z:\Projects\200804080\CtyWide\D-09000-460-8000_TopoMaps_v02.dwg; 4/20/2009 10:06:14 AM; BRAUN, GARY; STS_BLACK_040102.ctb

AECOM

750 Corporate Woods Parkway
Vernon Hills, IL 60061
847.279.2500
www.aecom.com
Copyright © 2009, By: AECOM

2005 USGS High Resolution Orthophoto
Site No. 11 - Seneca Township
Seneca Town Hall - Garden Valley Rd.
Observation Well Network
McHenry County, Illinois

Drawn :	CJH	04/01/2009
Checked:	GMB	04/15/2009
Approved:	CSR	04/24/2009
PROJECT NUMBER	09000-460	
FIGURE NUMBER	Folio_11 #3	

Z:\Projects\200804080\CityWide\D-09000-460-8000_AerialsMap_004.dwg; 4/21/2009 2:03:01 PM; BRAUN, GARY; STS_BLACK_040102.ctb

Boring and Well Construction Details

DRILLING LOG

DIVISION	USACE
INSTALLATION	Chicago District
SHEET	1 OF 7 SHEETS
1. PROJECT	McHenry County Observation Wells
2. LOCATION (Coordinates or Station)	McHenry County, Illinois N 2,042,491.00 E 933,561.00
3. DRILLING AGENCY	WDC Exploration & Wells
4. HOLE NO. *(As shown on drawing title and file number)*	11-SENECA
5. NAME OF DRILLER	Dan Tonnancour
6. DIRECTION OF HOLE	☒ VERTICAL ☐ INCLINED --- DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN	154.0
8. DEPTH DRILLED INTO ROCK	1.0
9. TOTAL DEPTH OF HOLE	155.0
10. SIZE AND TYPE OF BIT	3 7/8" Carbide Bit / 5 7/8" Casing
11. DATUM FOR ELEVATION SHOWN *(TBM or MSL)*	NAVD 88
12. MANUFACTURER'S DESIGNATION OF DRILL	Super Sonic II
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN	DISTURBED 19 / UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES	N/A
15. ELEVATION GROUND WATER	827.1
16. DATE HOLE	STARTED 10/22/2008 / COMPLETED 10/23/2008
17. ELEVATION TOP OF HOLE	+830.6
18. TOTAL CORE RECOVERY FOR BORING	94 %
19. GEOLOGIST	Gary Braun, LPG IL

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS *(Drilling time, water loss, depth weathering, etc., if significant)* g
+830.6	0.0		Topsoil: CL, Brown with black mottling, sandy clay, little organics, very stiff	84	1 0.0 5.0	
+829.1	1.5		SC, Dark brown clayey sand, trace fine gravel, trace orange/black mottles, very dense			
+827.6	3.0		SP, Brown medium sand, little coarse sand, trace fine sand, dense, moist to wet			
				100	2 5.0 15.0	
+823.6	7.0		SP, Brown fine sand, dense, wet			Sample No. 1 from 7.0' - 8.0'
+821.1	9.5		SP, Light grayish brown, medium sand, loose, wet			Sample No. 2 from 14.0' - 15.0'
				85	3 15.0 25.0	

DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE 830.6

Hole No. 11-SENECA

PROJECT: McHenry County Observation Wells

INSTALLATION: Chicago District

SHEET 2 OF 7 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
			SP, Light grayish brown, medium sand, loose, wet *(continued)*			
+806.6	24.0					
			SP, Gray medium sand, little coarse sand, trace fine sand, trace fine gravel, loose, wet			Sample No. 3 from 24.0' - 25.0'
				100	4 25.0 35.0	
						Sample No. 4 from 34.0' - 35.0'
				100	5 35.0 45.0	
+788.6	42.0					
			GP, Gray fine gravel, little coarse sand, loose, wet			Sample No. 5 from 42.0' to 43.0'
+787.1	43.5					
			SP, Gray fine sand, medium dense, wet			
+786.1	44.5					
			SP, Gray coarse sand, little fine to coarse gravel and medium sand, loose, wet			
				80	6 45.0	

DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE 830.6

Hole No. 11-SENECA

PROJECT: McHenry County Observation Wells

INSTALLATION: Chicago District

SHEET 3 OF 7 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
			SP, Gray coarse sand, little fine to coarse gravel and medium sand, loose, wet *(continued)*		55.0	
+778.6	52.0					
			GW, Gray fine gravel to coarse sandy fine gravel, some medium to coarse gravel, loose, wet			Sample No. 6 from 52.0' to 53.0'
				95	7 55.0 65.0	
+770.6	60.0					
			CL-ML, Grayish brown clayey silt, soft, little to no plasticity, damp			Sample No. 7 from 62.0' to 63.0'
+766.6	64.0					
			GP, Gray sandy medium gravel, lttle fine gravel, loose, wet			
				60	8 65.0 75.0	
+762.6	68.0					
			GW, Gray fine to coarse gravel, very loose, clean, very productive wet			

DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE 830.6

Hole No. 11-SENECA

PROJECT: McHenry County Observation Wells

INSTALLATION: Chicago District

SHEET 4 OF 7 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
+755.6	75.0		GW, Gray fine to coarse gravel, very loose, clean, very productive wet *(continued)*			Sample No. 8 from 73.0' to 74.0' % Gravel/% Sand/% Fines = 86/11/2 from 73.0' to 74.0'
+751.6	79.0		SP, Grayish brown medium sand, loose, wet	100	9 75.0 85.0	Second attempt to collect Run 8; casing at 75.0'; water level at 515' bgs
+739.1	91.5		GW, Gray sandy fine gravel, little medium gravel, trace coarse gravel, very loose, wet			Sample No. 9 from 84.0' to 85.0'
				100	10 85.0 95.0	
+737.1	93.5		ML, Dark brown clayey silt, little sand and gravel, hard diamicton, not plastic			Sample No. 10 from 92.0' to 93.0'
+735.6	95.0		GP, Gray fine to coarse gravel, loose, wet			
			SP, Brownish gray fine sand, dense, wet, very well graded with sharp gradations	100	11 95.0 105.0	Sample No. 11 from 95.0' to 96.0'

DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE 830.6

Hole No. 11-SENECA

PROJECT: McHenry County Observation Wells

INSTALLATION: Chicago District

SHEET 5 OF 7 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
+733.1	97.5					
			CH, Dark grayish brown fat clay, soft, moist, highly plastic no intraclasts, massive with only traces of fine sand pockets (usually only 1" long and <1/6" thick), no distinguishable bedding observed			Qp = 0.5 TSF @100.5' Qp = 0.75 TSF @102.5' Sample No. 12 from 104.0' to 105.0' Qp = 0.75 TSF @104.5'
				100	12 105.0 115.0	
+723.1	107.5					
			ML, Grayish brown silt, very dense, not cohesive/not plastic, very well sorted, moist			Sample No. 13 from 114.0' to 115.0'
+715.6	115.0					
			SP, Gray very fine sand, desne, wet, well sorted	100	13 115.0 125.0	Sample No. 14 from 119.0' to 120.0'

DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE 830.6

Hole No. 11-SENECA

PROJECT: McHenry County Observation Wells

INSTALLATION: Chicago District

SHEET 6 OF 7 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
+707.6	123.0		CL, Gray fat clay, stiff, damp, clean - no clasts, high plasticity			Qp = 3.75 TSF @123.5' Qp = 3.5 TSF @124.5'
				90	14 125.0 135.0	
+704.6	126.0					
			CL-ML, Gray (with black laminations) clayey silt, soft, little plasticity Note: Black bedding only in upper 2.0'			Sample No. 15 from 127.0' to 128.0'
+701.1	129.5					
			CL, Dark gray silty clay, stiff, well sorted			
+699.6	131.0					
			SP, Brownish gray fine sand, medium dense, wet			
+698.1	132.5					
			SP, Grayish brown medium sand, little coarse sand, trace fine gravel, medium dense			
+696.6	134.0					
			CL, Brownish gray silty clay, little fine gravel and coarse sand, stiff diamicton			Sample No. 16 from 134.0' to 135.0'
				100	15 135.0 145.0	
						Qp = 3.5 TSF @137.0' Qp = 3.0 TSF @138.5'
+691.6	139.0					
			SP, Grayish brown fine sand, trace fine garvel, medium dense			
+689.6	141.0					
			SP, Gray gravelly coarse sand, trace medium gravel, loose			Sample No. 17 from 144.0' to 145.0'
				90	16 145.0 155.0	

DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE 830.6

Hole No. 11-SENECA

PROJECT: McHenry County Observation Wells

INSTALLATION: Chicago District

SHEET 7 OF 7 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS *(Drilling time, water loss, depth weathering, etc., if significant)* g
			SP, Gray gravelly coarse sand, trace medium gravel, loose *(continued)*			% Gravel/% Sand/% Fines = 65/33/2 from 151.0' to 152.0'
+676.6	154.0					
			Dolomite, gray argillaceous, vuggy			Sample No. 19 from 154.0' to 155.0'
+675.6	155.0					
			END OF BORING - 155.0' BGS			AECOM Project No. 60095270

Hole No. 11 - SENECA TWP

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 1 OF 11 SHEETS

1. PROJECT McHenry Cty Wells	10. SIZE AND TYPE OF BIT 3 7/8" Carbide Sampler
2. LOCATION (Coordinates or Station) N2042,491 E 933,561 IL ST PL-E	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) NAVD 88
3. DRILLING AGENCY WDC Exploration & Wells	12. MANUFACTURERS DESIGNATION OF DRILL Super Sonic II
4. HOLE NO. (As shown on drawing title and title number) 11 - SEN	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 19; UNDISTURBED 0
5. NAME OF DRILLER Dan Tonnancour	14. TOTAL NUMBER CORE BOXES —
6. DIRECTION OF HOLE ☑ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER 827.1' 10/24/08
	16. DATE HOLE: STARTED 10-22-08; COMPLETED 10-23-08
7. THICKNESS OF OVERBURDEN 154'	17. ELEVATION TOP OF HOLE 830.6 Ft MSL
8. DEPTH DRILLED INTO ROCK 1'	18. TOTAL CORE RECOVERY FOR BORING 145.2/155 = 94%
9. TOTAL DEPTH OF HOLE 155'	19. SIGNATURE OF INSPECTOR Gary M. Brown LPG IL

5 7/8" V Casing RotoSonic

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
830.6	0	GRASS	Topsoil: Brown w/ Black Mottling, Sandy CLAY, little organics, Very stiff (CL)			Run 1 (0-5) Rec/Run = 4.2'/5' = 84%
	1					
	2		Dark Brown Clayey SAND, trace f. gravel, trace Orange/Blk mottles, Very Dense (SC)	Rec 84%	Bag 1	
	3		Brown Med. SAND, little coarse sand, trace fine sand, dense, moist to wet (SP to SW)			
	4					
	5		grades to having only trace F. & C. SA. (SP)			Run 2 (5-15) Rec/Run = 10'/10' = 100%
	6					
	7		grades over 0.25'		Bag 2	
	8		Brown FINE SAND, dense, wet (SP)		s1	
	9		somewhat abrupt	Rec 100%	Bag 3	
820.6	10		Light Grayish Brown MEDIUM SAND, loose, wet (SP)			
	11					
	12					
	13				Bag 4	
	14					
	15				s2	

1330 Start Run

Extract Sample 1338

Drive 8" Casing for 1401

1402:20 (4" core barrel)

1406 Drive 6" Casing

1416

1422 Extract Sample

Hole No. 11 - SENECA TWP

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 2 OF 11 SHEETS

1. PROJECT McHenry Cty Wells	10. SIZE AND TYPE OF BIT 3 7/8" Carbide Sampler
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) NAVD 88
3. DRILLING AGENCY WDC Exploration & Wells	12. MANUFACTURERS DESIGNATION OF DRILL Super Sonic II
4. HOLE NO. (As shown on drawing title and title number) 11-SEN	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 19; UNDISTURBED 0
5. NAME OF DRILLER Dan Tonnancour	14. TOTAL NUMBER CORE BOXES —
6. DIRECTION OF HOLE ☑ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER 827.1' (10/24)
	16. DATE HOLE: STARTED 10-22-08; COMPLETED 10-23-08
7. THICKNESS OF OVERBURDEN 154'	17. ELEVATION TOP OF HOLE 830.6 FT MSL
8. DEPTH DRILLED INTO ROCK 1'	18. TOTAL CORE RECOVERY FOR BORING 94%
9. TOTAL DEPTH OF HOLE 155'	19. SIGNATURE OF INSPECTOR Gary M. Brown LPG IL

5 7/8" Casing Roto-Sonic

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	15		cont.			Run 3 (15-25) Rec/Run = 8.5'/10' = 85%
	16					
	17				Bag 5	
	18					
	19			Rec 85%		
810.6	20					
	21					
	22				Bag 6	
	23					
	24		gradation over ±1ft			
	25		Gray Medium SAND, little C. Sand, trace f. Sand, loose, wet (SP) to trace (SP/SW) fine gravel		S3	
	26				Bag 7	Run 4 (25-35) Rec/Run = 10'/10' = 100%
	27			Rec 100%		
	28					
	29				Bag 8	
800.6	30					

1431 — 4" core barrel — 1433
1436 — 6" Casing — 1438
Extract Samples 1444
1452 — 4" core barrel — 1452:50 — 2/min
1455 — Drive Casing — 1458

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT McHenry Cty Wells | HOLE NO. 11 - SENECA TWP

Hole No. 11 - SENECA TWP

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 3 OF 11 SHEETS

1. PROJECT McHenry Cty Wells	10. SIZE AND TYPE OF BIT 3 7/8" Carbide Sampler
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) NAVD 88
3. DRILLING AGENCY WDC Exploration & Wells	12. MANUFACTURERS DESIGNATION OF DRILL Super Sonic II
4. HOLE NO. (As shown on drawing title and title number) 11-SEN	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 19; UNDISTURBED 0
5. NAME OF DRILLER Dan Tonnancour	14. TOTAL NUMBER CORE BOXES —
6. DIRECTION OF HOLE ☑ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.	15. ELEVATION GROUND WATER 827.1' 10/24
	16. DATE HOLE: STARTED 10-22-08; COMPLETED 10-23-08
7. THICKNESS OF OVERBURDEN 154'	17. ELEVATION TOP OF HOLE 830.6 Ft MSL
8. DEPTH DRILLED INTO ROCK 1'	18. TOTAL CORE RECOVERY FOR BORING 94%
9. TOTAL DEPTH OF HOLE 155'	19. SIGNATURE OF INSPECTOR Gary M. Brown LPG IL

5 7/8" Casing Roto-Sonic

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
800.6	30		cont.	cont.	Bag 8	Run 4 (25-35) cont.
	31		Gray SAND			
	32			Rec 100%		
	33				Bag 9	1503 Extract Samples
	34				S4	
	35					Run 5 (35-45)
	36				Bag 10	Rec/Run = 10'/10' = 100% 1512 ↓ 4" Casing 1513:30
	37					1516 ↓ 6" Casing 1519
	38		38-39.5' Med. SAND (SP) Very Well Sorted			
	39			Rec 100%	Bag 11	
790.6	40					
	41					
	42		Fining Upwards Sequence over 1/2 ft.			
	43		Gray Fine GRAVEL, little coarse sand, loose, wet (GP)		S5 Bag 12	1524 Extract Samples
	44		Gray Fine SAND, Med. dense, wet (SP)			
	45		see next pg.			

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT McHenry Cty Wells | HOLE NO. 11-SENECA TWP

Hole No. 11 - SENECA TWP

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 4 OF 11 SHEETS

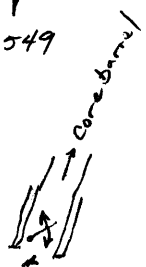
1. PROJECT McHenry Cty Wells	10. SIZE AND TYPE OF BIT 3 7/8" Carbide Sampler
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) NAVD 88
3. DRILLING AGENCY WDC Exploration & Wells	12. MANUFACTURERS DESIGNATION OF DRILL Super Sonic II
4. HOLE NO. (As shown on drawing title and title number) 11-SEN	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN — DISTURBED 19 — UNDISTURBED 0
5. NAME OF DRILLER DAN TONNANCOUR	14. TOTAL NUMBER CORE BOXES
6. DIRECTION OF HOLE ☑ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.	15. ELEVATION GROUND WATER 827.1' 10-24-08
	16. DATE HOLE — STARTED 10-22-08 — COMPLETED 10-23-08
7. THICKNESS OF OVERBURDEN 154'	17. ELEVATION TOP OF HOLE 830.6 FT MSL
8. DEPTH DRILLED INTO ROCK 1'	18. TOTAL CORE RECOVERY FOR BORING 94%
9. TOTAL DEPTH OF HOLE 155'	19. SIGNATURE OF INSPECTOR Gary M. Brown LPG IL

5 1/8" Casing Roto-Sonic

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	45		Gray Coarse Sand, little f.-c. gravel & med. sand, loose, wet (SP) (although may be SW locally)		Bag 13	Run 6 (45-55) Rec* / Run = 8' / 10' = 80%
	46					
	47				Bag 14	
	48					
	49			Rec 80%		
780.6	50				Bag 15	*Only ~2 ft of recovery from initial extraction due to clean Medium sized gravel. Attempted to recover samples w/in casing w/ flapper bit & recovered an additional 6' but broke flapper bit due to clean coarse gravel
	51					
	52		grades over 1 ft.			
	53		Gray fine GRAVEL to Coarse Sandy fine GRAVEL, some M.-C. gravel, loose wet (GW)		SB	• Must continue without flapper bit
	54					
	55		Some coarsening upwards sequences			
	56				Bag 16	Run 7 (55-65) Rec / Run = 9.5 / 10' = 95 %
	57					
	58			Rec 95%	Bag 17	
	59					
770.6	60		Abrupt Contact			

1542.45 — 4" CORE BARREL — 1543.30

DRIVE 6" CASING 1547 — 1549



Extract Samples 1552 — Clear remainder of sand out of 6" casing

1621 — 4" core barrel — 1623

1625 — Drive 6" CASING — 1629

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT McHenry Cty Wells — HOLE NO. 11-SENECA TWP

Hole No. 11-SENECA TWP

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 5 OF 11 SHEETS

1. PROJECT McHenry Cty Wells	10. SIZE AND TYPE OF BIT 3 7/8" Carbide Sampler
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) NAVD 88
3. DRILLING AGENCY WDC Exploration & Wells	12. MANUFACTURERS DESIGNATION OF DRILL Super Sonic II
4. HOLE NO. (As shown on drawing title and title number) 11-SEN	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 19; UNDISTURBED 0
5. NAME OF DRILLER DAN TONWANCOUR	14. TOTAL NUMBER CORE BOXES —
6. DIRECTION OF HOLE ☑ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER 827.1' 10-24-08
	16. DATE HOLE: STARTED 10-22-08; COMPLETED 10-23-08
7. THICKNESS OF OVERBURDEN 154'	17. ELEVATION TOP OF HOLE 830.6 FT MSL
8. DEPTH DRILLED INTO ROCK 1'	18. TOTAL CORE RECOVERY FOR BORING 94%
9. TOTAL DEPTH OF HOLE 155'	19. SIGNATURE OF INSPECTOR Gary M. Braun LPG IL

5 7/8" Casing Roto-Sonic

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
770.6	60		Grayish Brown, Clayey SILT, soft, little to no plasticity, well sorted (No intra-clasts) (CL-ML)	cont.	17	Run 7 (55-65) Cont.
	61			Rec 95%		
	62				s7 Bag 18	
	63					Extract Samples 1634
	64		Gray Sandy Med. GRAVEL, little fine gravel, loose wet (GP) to (SP-GP)			
	65					Run 8 (65-75) 1645
	66					Rec/Run = ___ % → SEE P. 6 ↓ Drive 4" Core Barrel 1649
	67				Bag 19	(Based on total recovery from 63-95) * 6'/10' = 60% 1649
	68		Gray Fine to Coarse GRAVEL, very loose, clean, very productively wet (GW)			* Lost recovery during first extraction. Drop rods again for collection. ↓ Drive 6" CASING 1652
	69					
760.6	70			*Rec 60%		• 2nd Attempt also failed. • Since sample is still in casing will attempt to run 20ft w/ 20ft core barrel. (Hoping for any cohesive layer that will samples in core barrel)
	71					
	72				Bag 20 s8	
	73		Intermediate Grain Size Sample			Add 10 Ft additional core barrel
	74					End of Day 10/22 1725
	75					

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT McHenry Cty Wells | HOLE NO. 11-SENECA TWP

Hole No. 11 - SENECA TWP

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 6 OF 11 SHEETS

1. PROJECT McHenry Cty Wells	10. SIZE AND TYPE OF BIT 3 7/8" Carbide Sampler
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) NAVD 88
3. DRILLING AGENCY WDC Exploration & Wells	12. MANUFACTURERS DESIGNATION OF DRILL Super Sonic II
4. HOLE NO. (As shown on drawing title and title number) 11 - SEN	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 19 / UNDISTURBED 0
5. NAME OF DRILLER Dan Tennancour	14. TOTAL NUMBER CORE BOXES —
6. DIRECTION OF HOLE ☑ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.	15. ELEVATION GROUND WATER 827.1' 10/24
	16. DATE HOLE: STARTED 10-22-08 / COMPLETED 10-23-08
7. THICKNESS OF OVERBURDEN 154'	17. ELEVATION TOP OF HOLE 830.6 FT MSL
8. DEPTH DRILLED INTO ROCK 1'	18. TOTAL CORE RECOVERY FOR BORING 94%
9. TOTAL DEPTH OF HOLE 155'	19. SIGNATURE OF INSPECTOR Gary M Brown LPG IL

5 7/8" CASING ROTO-SONIC

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	75		Grayish Brown Medium SAND, loose, wet (SP)		Bag 21	Run 9 (75-85) (2nd ~~part of~~ Attempt to collect Run 8)
	76					0720 WL = 5.15 ft bgs (casing at 75 ft)
	77		Glacio fluvial Geo (Beach Sand)			
	78				Bag 22	• Recovered Approx. 6 ft from Run 8.
	79		Gray Sandy FINE GRAVEL, little Med. gravel, trace Course gravel, very loose, wet (GW)	Rec 100%		• Remainder of samples still in casing. Will continue to sample with 20' core barrel using 10 ft runs to try to hold cuttings in core barrel.
750.6	80					
	81				Bag 23	
	82					
	83					• Recovery was clean medium gravel some f./c. gravel, little sand.
	84				59	
	85				Bag 24	
	86					Run 10 (85-95) Recovered 20 ft in Run 10. Cohesive layer 91.5-93.5' was able to hold the remaining S&G above it in core barrel. It also was able to hold gravel below it b/c lower water pressure
	87					
	88			Rec 100%	Bag 25	
	89					
740.6	90					

THURSDAY Begin 10/23/08

Drive 4" core barrel from 75-85'
0731
0732:20
Drive 6" Casing to 85'
0736
0738:20
Extract @ 0746
Drive 4" Core Barrel from 85→95'
0755 first 10'
0756:30
Georgette Arrives 0804
0806:30

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT McHenry Cty Wells — HOLE NO. 11 - SENECA TWP

Hole No. #11 - SENECA TWP

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 7 OF 11 SHEETS

1. PROJECT McHenry Cty Wells	10. SIZE AND TYPE OF BIT 3 7/8" Carbide Samples
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) NAVD88
3. DRILLING AGENCY WDC Exploration & Wells	12. MANUFACTURERS DESIGNATION OF DRILL Super Sonic II
4. HOLE NO. (As shown on drawing title and title number) 11-SEN	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 19; UNDISTURBED 0
5. NAME OF DRILLER DAN TENNANCOUR	14. TOTAL NUMBER CORE BOXES —
6. DIRECTION OF HOLE ☑ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER 827.1' 10/24
	16. DATE HOLE: STARTED 10-22-08; COMPLETED 10-23-08
7. THICKNESS OF OVERBURDEN 154'	17. ELEVATION TOP OF HOLE 830.6 FT MSL
8. DEPTH DRILLED INTO ROCK 1'	18. TOTAL CORE RECOVERY FOR BORING 94%
9. TOTAL DEPTH OF HOLE 155'	19. SIGNATURE OF INSPECTOR Gary M. Brown LPG/L

5 7/8" Casing Roto-Sonic

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
740.6	90		cont. from p.6	cont.	cont. Bag 25	Run 10 cont. (85-95)
	91		sharp contact			
	92		Dark Brown Clayey SILT, little sand & gravel, hard (ML) Diamicton Not Plastic & Abrupt Gradation	REC 100%	Bag 26	
	93				s10	
	94		Gray Fine to Coarse GRAVEL, fining upward, loose, wet (GP) Abrupt Gradation			
	95		Brownish Gray FINE SAND, dense wet (SP) — Very well graded with sharp top & bott. gradations		s11 Bag 27	Run 11 (95-105) Rec/Run = 10'/10' = 100%
	96					
	97					
	98		Dark Grayish Brown ~~Fat~~ CLAY, soft, moist (CH) Highly Plastic, No intraclasts, Massive - with only traces of fine SAND pockets (usually only 1" long & < 1/16" thick)			
	99					
730.6	100			REC. 100%	Bag 28	0.5 tsf
	101					
	102					0.75 tsf
	103		No distinguishable bedding observed - Quiet Water - Glaciofluvial		Bag 29	
	104					
	105				s12	0.75 tsf

0839 ↓ 4" 0841

Drive 6" Casing 0843 ↓ 0849

Extract Samples 0858

Hole No. 11 - SENECA TWP

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 8 OF 11 SHEETS

1. PROJECT McHenry Cty Wells	10. SIZE AND TYPE OF BIT 3 7/8" Carbide Jampler
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) NAVD 88
3. DRILLING AGENCY WDC Exploration & Wells	12. MANUFACTURERS DESIGNATION OF DRILL Super Sonic II
4. HOLE NO. (As shown on drawing title and title number) 11 - SEN	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 19; UNDISTURBED 0
5. NAME OF DRILLER Dan Tonnancour	14. TOTAL NUMBER CORE BOXES —
6. DIRECTION OF HOLE ☑ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER 827.1' 10-24
	16. DATE HOLE: STARTED 10-22-08; COMPLETED 10-23-08
7. THICKNESS OF OVERBURDEN 154'	17. ELEVATION TOP OF HOLE 820.6 FT MSL
8. DEPTH DRILLED INTO ROCK 1'	18. TOTAL CORE RECOVERY FOR BORING 94%
9. TOTAL DEPTH OF HOLE 155'	19. SIGNATURE OF INSPECTOR Gary M Brown LPG IL

5 7/8" Casing Roto-Sonic

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	105		Cont.			Run 12 (105-115)
	106		Same as Above			Rec/Run = 10'/10' = 100%
					Bag 30	
	107		↓ Gradual Transition over ~0.5 ft			
	108		Grayish Brown Silt, very dense, not cohesive / not plastic, very well sorted, moist (ML)			
	109			Rec. 100%		
720.6	110				Bag 31	
	111					
	112					
	113				Bag 32	
	114					
	115		↓ Grades to SA. over 1/2'		S13	
	116		Gray Very Fine Sand, dense, wet (SP) well sorted			Rec 13 (115-125)
						Rec./Run = 10'/10' = 100%
	117				Bag 33	
	118			Rec 100%		
	119				Bag 34	
710.6	120				S14	

0909 ↓ 4" Casing 0912

0916 ↓ 6" Casing 0922

0929 Extract Samples
Water Truck Run 0930

Advance 4" core barrel
1000 ↓ 1001
Wait for H_2O truck
1029 ↓ 6" Casing 1034

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT McHenry Cty Wells | HOLE NO. 11 - SENECA TWP

Hole No. 11-SENECA TWP

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 9 OF 11 SHEETS

1. PROJECT McHenry Cty Wells	10. SIZE AND TYPE OF BIT 3 7/8" Carbide Sampler
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) NAVD 88
3. DRILLING AGENCY WDC Exploration & Wells	12. MANUFACTURERS DESIGNATION OF DRILL Super Sonic II
4. HOLE NO. (As shown on drawing title and title number) 11-SEN	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 19; UNDISTURBED 0
5. NAME OF DRILLER DAN TONNANCOUR	14. TOTAL NUMBER CORE BOXES —
6. DIRECTION OF HOLE ☑ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER 827.1' 10-24
	16. DATE HOLE: STARTED 10-22-08; COMPLETED 10-23-08
7. THICKNESS OF OVERBURDEN 154'	17. ELEVATION TOP OF HOLE 830.6 Ft MSL
8. DEPTH DRILLED INTO ROCK 1'	18. TOTAL CORE RECOVERY FOR BORING 94%
9. TOTAL DEPTH OF HOLE 155'	19. SIGNATURE OF INSPECTOR Gary M. Brown LPG IL

5 7/8" Casing Roto-Sonic

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
710.6	120		cont. Very Fine SAND	cont	cont. Bag 34	Run 13 (115-125) cont.
	121					
	122			Rec. 100%		
	123		Gradation over 0.4' Gray Fat CLAY, stiff, damp (CL) clean - no clasts High Plasticity		Bag 35	3.75 tsf
	124					
	125					3.5 tsf
	126		grades quickly over 0.10 ft			Run 14 (125-135) Rec/Run = 9'/10' = 90%
	127		Gray w/ Black layers Clayey SILT, soft, little plasticity (CL-ML)		Bag 36	s15
	128		(Black Bedding only in upper 2 ft)			
	129		Grades over 0.25 ft			
700.6	130		Dark Gray Silty CLAY, stiff (CL) (well sorted)	Rec 90%		
	131		Brownish Gray FINE SAND, Mod. Dense, wet (SP) Fining Upward			
	132				Bag 37	
	133		Grayish Brown Med. SAND little C. SA, tr. fi gravel, Mod Dense (SP)			
	134		Brownish Gray Silty CLAY (SEE NEXT PAGE)		s16	
	135					

Extract Samples 1042

Drive 4" core barrel 1050 ↓ 1052

Drive 6" Casing

Hole No. 11 - SENECA TWP

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 10 OF 11 SHEETS

1. PROJECT McHenry Cty Wells	10. SIZE AND TYPE OF BIT 3 7/8" Carbide Sampler
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) NAVD 88
3. DRILLING AGENCY WBC Exploration & Wells	12. MANUFACTURERS DESIGNATION OF DRILL Super Sonic II
4. HOLE NO. (As shown on drawing title and title number) 11-SEN	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN — DISTURBED 19 — UNDISTURBED 0
5. NAME OF DRILLER Dan Tonnancour	14. TOTAL NUMBER CORE BOXES —
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.	15. ELEVATION GROUND WATER 827.1' 10/24
	16. DATE HOLE — STARTED 10-22-08 — COMPLETED 10-23-08
7. THICKNESS OF OVERBURDEN 154'	17. ELEVATION TOP OF HOLE 830.6 Ft MSL
8. DEPTH DRILLED INTO ROCK 1'	18. TOTAL CORE RECOVERY FOR BORING 94%
9. TOTAL DEPTH OF HOLE 155'	19. SIGNATURE OF INSPECTOR Henry M. Brown LPG IL

5 7/8" Casing Roto-Sonic

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	135		Brownish Gray Silty CLAY, little fine gravel & C. SAND, stiff DIAMICTON (CL)		Bag 38	Run 15 (135-145') Rec/Run = 10'/10' = 100% 3.5 tsf
	136					
	137					
	138					3.0 tsf
	139		Grayish Brown fine SAND, trace fine Gravel, Med. Dense (SP)	Rec. 100%	Bag 39	
690.6	140					
	141		Gray Gravelly (fine gravel) COARSE SAND, trace medium gravel, loose (GP-SP)			
	142					
	143				Bag 40	
	144				S17	Extract Samples 1140
	145		SAND ONLY SEAM			Run 16 (145-155) Rec/Run = 9'/10 = 90%
	146					
	147		SAND ONLY	Rec. 90%	Bag 41	
	148					
Deep Well	149					
680.6	150					

1117 ↓ 4" 1119
1122 ↓ 6" 1127
4" core barrel 1152 ↓ 1154
6" 1156 ↓ 1204
Extract Samples 1212

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT McHenry Cty Wells — HOLE NO. 11-SENECA TWP

Hole No. 11 - SENECA TWP

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 11 OF 11 SHEETS

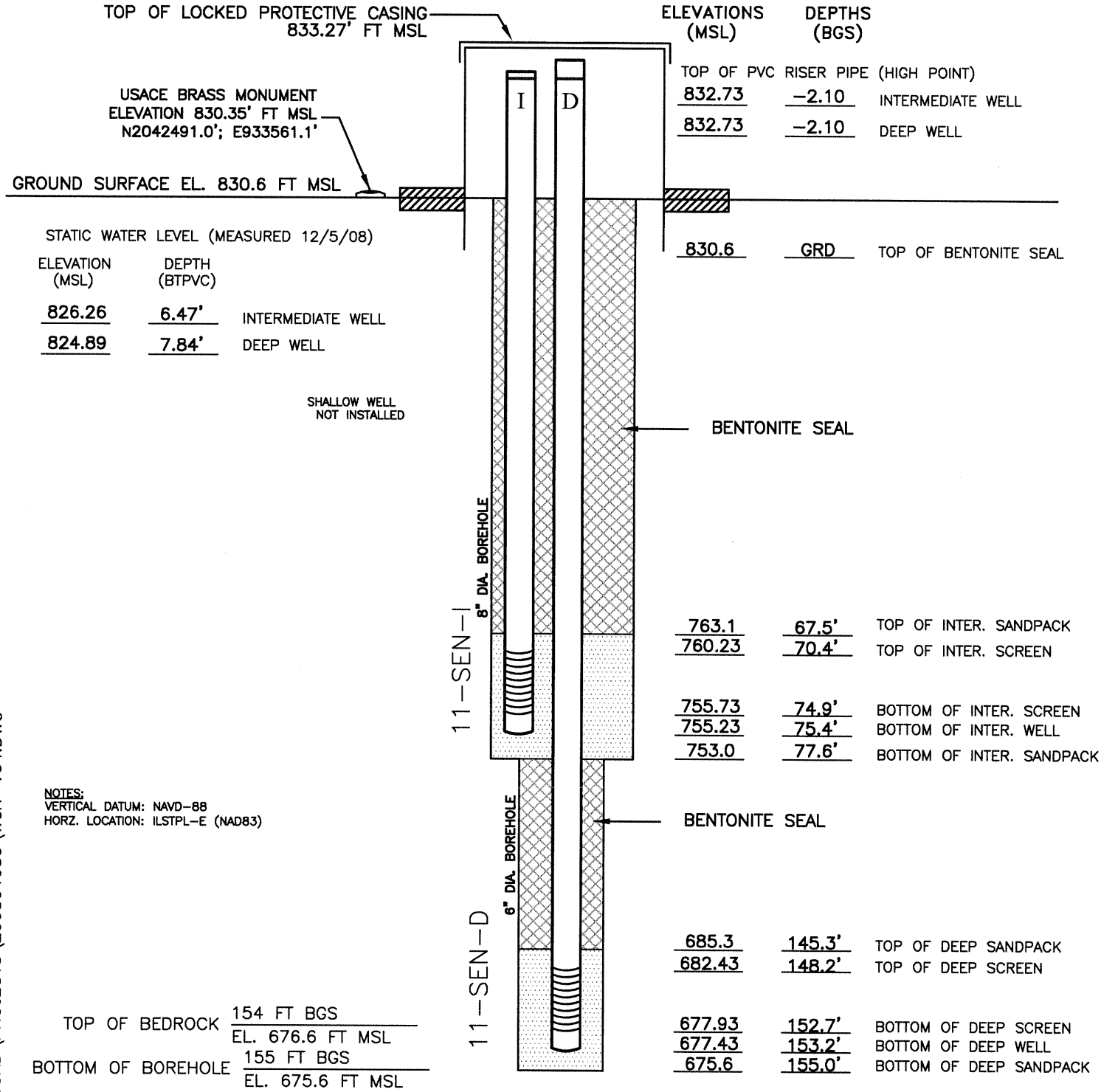
1. PROJECT: McHenry Cty Wells
2. LOCATION (Coordinates or Station):
3. DRILLING AGENCY: WDC Exploration & Wells
4. HOLE NO. (As shown on drawing title and title number): 11-SEN
5. NAME OF DRILLER: Dan Tonnancour
6. DIRECTION OF HOLE: ☑ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 154'
8. DEPTH DRILLED INTO ROCK: 1'
9. TOTAL DEPTH OF HOLE: 155'
10. SIZE AND TYPE OF BIT: 3 7/8" Carbide Sampler — 5 7/8" Casing Roto-Sonic
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): NAVD 88
12. MANUFACTURERS DESIGNATION OF DRILL: Super Sonic II
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 19 / UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES: —
15. ELEVATION GROUND WATER: 827.1' 10/24
16. DATE HOLE: STARTED 10-22-08 / COMPLETED 10-23-08
17. ELEVATION TOP OF HOLE: 830.6 FT MSL
18. TOTAL CORE RECOVERY FOR BORING: 94%
19. SIGNATURE OF INSPECTOR: Gary M Brown LPG IL

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
680.6	150		CONT.	cont		CONT.
	151		5 18 ¼ Grain Size Samples (151 - 152)			RUN 16 (145-155)
Deep Well ↑	152			Rec 90%	Bag 42	
	153					
	154		Gray Vuggy Argillaceous DOLOMITE		s19	
675.6	155		END OF BORING	155	A bgs	10-23-09 1215
	156					
	157					
	158					
	159					
	160					
	161					
	162					
	163					
	164					
	165					

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT: McHenry Cty Wells | HOLE NO. 11-SENECA TWP

PROJECT McHENRY COUNTY OBSERVATION WELL NETWORK INSTALLATION (#09000-460)	WELL NO. 11-SEN-I & 11-SEN-D
LOCATION SENECA TOWNSHIP – McHENRY COUNTY, ILLINOIS	
CLIENT U.S. ARMY CORPS OF ENGINEERS / McHENRY COUNTY	
GEOLOGIST GARY BRAUN, P.G. (AECOM)	INSTALLATION DATE OCT. 23, 2008
DRILLER WDC EXPLORATION AND WELLS, INC. (DAN TONNANCOUR)	DRILLING METHOD ROTO-SONIC



ELEVATIONS (MSL)	DEPTHS (BGS)	
TOP OF PVC RISER PIPE (HIGH POINT)		
832.73	-2.10	INTERMEDIATE WELL
832.73	-2.10	DEEP WELL
830.6	GRD	TOP OF BENTONITE SEAL
763.1	67.5'	TOP OF INTER. SANDPACK
760.23	70.4'	TOP OF INTER. SCREEN
755.73	74.9'	BOTTOM OF INTER. SCREEN
755.23	75.4'	BOTTOM OF INTER. WELL
753.0	77.6'	BOTTOM OF INTER. SANDPACK
685.3	145.3'	TOP OF DEEP SANDPACK
682.43	148.2'	TOP OF DEEP SCREEN
677.93	152.7'	BOTTOM OF DEEP SCREEN
677.43	153.2'	BOTTOM OF DEEP WELL
675.6	155.0'	BOTTOM OF DEEP SANDPACK

STATIC WATER LEVEL (MEASURED 12/5/08)

ELEVATION (MSL)	DEPTH (BTPVC)	
826.26	6.47'	INTERMEDIATE WELL
824.89	7.84'	DEEP WELL

SHALLOW WELL NOT INSTALLED

NOTES:
VERTICAL DATUM: NAVD-88
HORZ. LOCATION: ILSTPL-E (NAD83)

TOP OF BEDROCK 154 FT BGS / EL. 676.6 FT MSL

BOTTOM OF BOREHOLE 155 FT BGS / EL. 675.6 FT MSL

NOT TO SCALE

WELL CONSTRUCTION MATERIALS*

PROTECTIVE CASING	5' L X 8" DIA. ALUMINUM CASING W/ LOCKING CAP
RISER PIPE ABOVE W.T.	SCHEDULE 40 PVC (2.07" I.D./ 2.38" O.D.)
RISER PIPE BELOW W.T.	SCHEDULE 40 PVC (2.07" I.D./ 2.38" O.D.)
SCREEN	2" I.D. SCHEDULE 40 PVC W/ 0.010" SCREEN SLOT SIZE
TYPE OF BENTONITE SEAL	BLACK HILLS BENTONITE – 3/8" CHIPS (HOLE PLUG)
TYPE OF SAND PACK	R.W. SIDLEY CO. – NO. 5 FILTER PACK SAND

CASING MEASUREMENTS

BOTTOM OF SCREEN TO END CAP (FT)*		0.50
SCREEN LENGTH (1ST SLOT TO LAST SLOT) (FT)*		4.50
TOTAL LENGTH OF CASING (FT):	INTERMEDIATE WELL	77.50
	DEEP WELL	155.30

* MEASUREMENT REFERS TO ALL WELLS

USMWK2FP001\05CAD\PROJECTS\200804080\WCR-V04.DWG

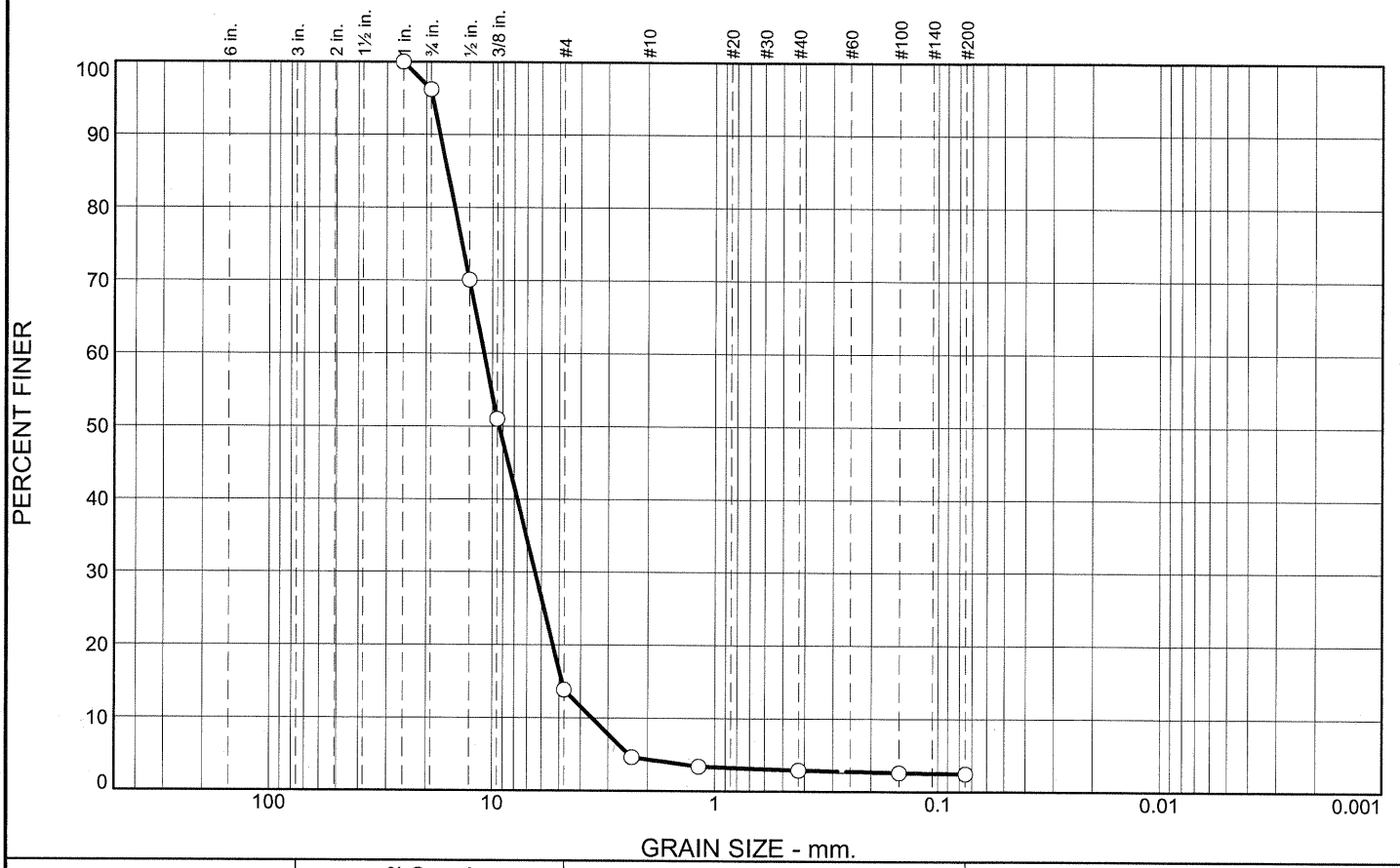
WELL SITE DATA SUMMARY AND COMMENTARY

Well Site #11 – SenecaTownship
Seneca Town Hall on Garden Valley Rd

The Seneca Township well site is located in one of the most prolific aquifers in the County. Located between the Marengo Moraine to the west and the Woodstock Moraine to the west, the Seneca well site has thick coarse sand and gravel deposits of the Henry Formation. Both of the wells installed at the site were characterized by high hydraulic conductivity and elevated hydrostatic head. The site it is characterized by a slight upward gradient, which suggests that groundwater is discharging to the nearby Kishwaukee River.

Well Site Testing Results

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	3.8	82.3	9.6	1.4	0.4	2.5	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1	100.0		
.75	96.2		
.5	70.1		
.375	51.0		
#4	13.9		
#8	4.6		
#16	3.4		
#40	2.9		
#100	2.6		
#200	2.5		

* (no specification provided)

Material Description

F-C Gravel Some Sand Trace Silt

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 17.2996 D_{85}= 16.0070 D_{60}= 10.9071
D_{50}= 9.3466 D_{30}= 6.4251 D_{15}= 4.8506
D_{10}= 3.5412 C_u= 3.08 C_c= 1.07

Classification

USCS= GP AASHTO=

Remarks

Source of Sample: 11-Sen-I **Depth:** 73.0-74.0

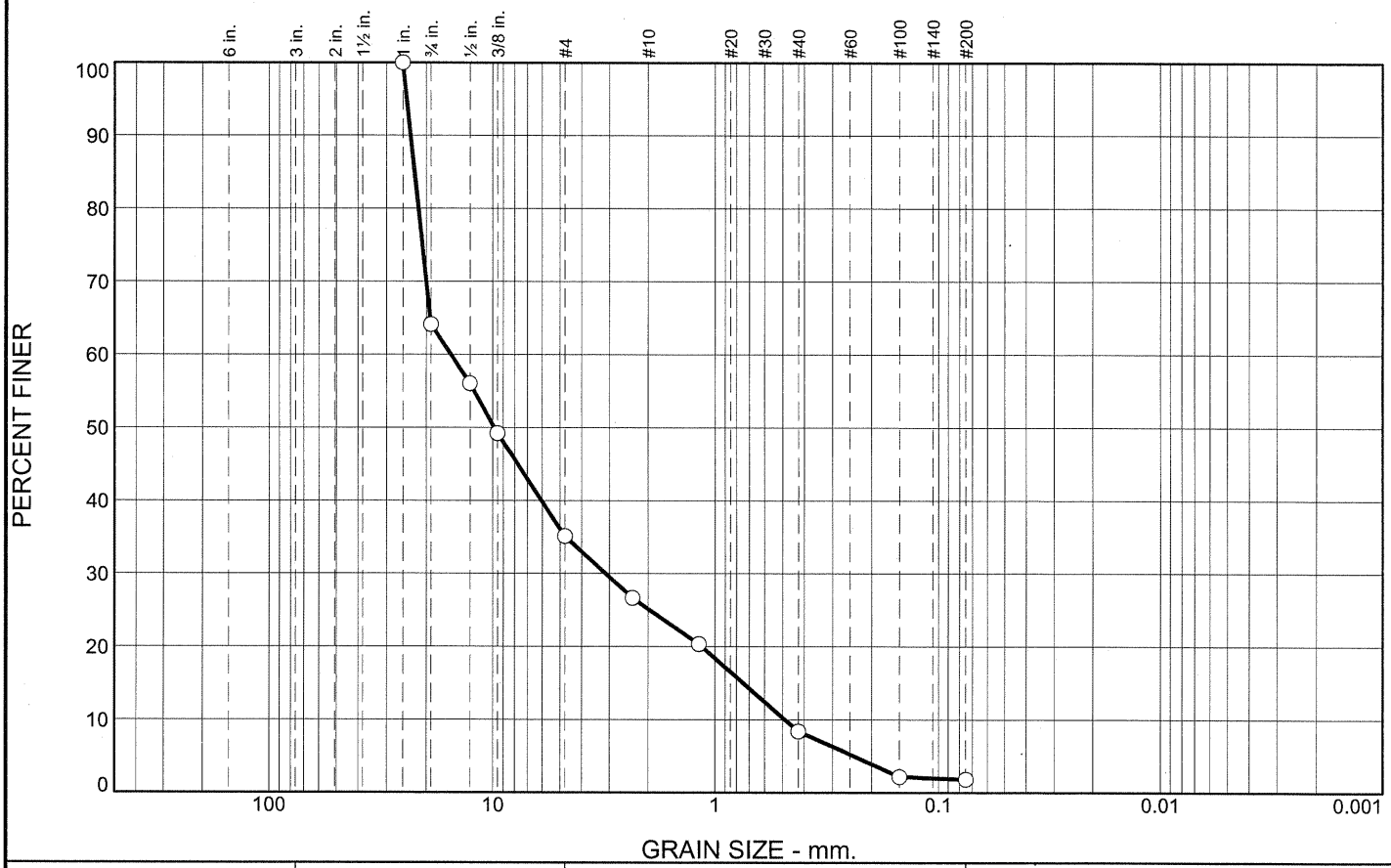
Date: 12/04/08

STS | AECOM

Client: USACE
Project: McHenry County Wells
Project No: 200804080 **Figure**

Tested By: JRT

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	35.9	29.0	9.9	16.8	6.6	1.8	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1	100.0		
.75	64.1		
.5	56.0		
.375	49.2		
#4	35.1		
#8	26.7		
#16	20.4		
#40	8.4		
#100	2.2		
#200	1.8		

* (no specification provided)

Material Description

F-C Sand and Gravel Trace Silt

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 23.4421 D_{85}= 22.5205 D_{60}= 15.4876
D_{50}= 9.8430 D_{30}= 3.1109 D_{15}= 0.7460
D_{10}= 0.4864 C_u= 31.84 C_c= 1.28

Classification

USCS= GW AASHTO=

Remarks

Source of Sample: 11-Sen-D **Depth:** 151.0-152.0

Date: 12/05/08

STS | AECOM

Client: USACE
Project: McHenry County Wells
Project No: 200804080 **Figure**

Tested By: JRT

Groundwater Level Measurements

McHenry County Monitoring Well Installations
AECOM Project 09000-460

Site Number	11			
Township Name	Seneca			
Well Number	11-SEN-I		11-SEN-D	
Ground Surface Elevation (ft msl)	830.63		830.63	
Top of PVC Casing Elevation (ft)	832.73		832.73	
Location of PVC Casing within Wellhead	SE Well		NW Well	
Well Depth (Feet from TOC)[A]	77.50		155.30	
Date	Depth to GW from TOC (ft)	GW Elevation (ft msl)	Depth to GW from TOC (ft)	GW Elevation (ft msl)
Sep. 26, 2008				
Oct. 09, 2008				
Oct. 14, 2008				
Oct. 16, 2008				
Oct. 21, 2008				
Oct. 22, 2008				
Oct. 24, 2008	6.74	825.99	7.41	825.32
Oct. 28, 2008				
Oct. 29, 2008				
Oct. 30, 2008				
Nov. 07, 2008				
Nov. 13, 2008				
Dec. 05, 2008	6.47	826.26	7.84	824.89
Dec. 08, 2008				
Dec. 09, 2008				
Dec. 12, 2008				
Dec. 15, 2008				
Dec. 16, 2008				
Dec. 17, 2008				
Dec. 18, 2008				
Dec. 19, 2008				
Dec. 22, 2008				
Dec. 23, 2008	5.99	826.74	6.66	826.07
Dec. 29, 2008				
Dec. 30, 2008				
Jan. 05, 2009				
Jan. 06, 2009				
Jan. 07, 2009				
Jan. 08, 2009				
Jan. 09, 2009	5.23	827.50	6.32	826.41
Jan. 10, 2009				
Jan. 12, 2009				
Feb. 24, 2009	5.65	827.08	6.67	826.06
Mar. 20, 2009				
end				

Notes:

ft msl = Elevation referenced to feet above mea

TOC = Top of PVC Casing

ft = feet

[A] = as measured inside well

NI = Not Installed

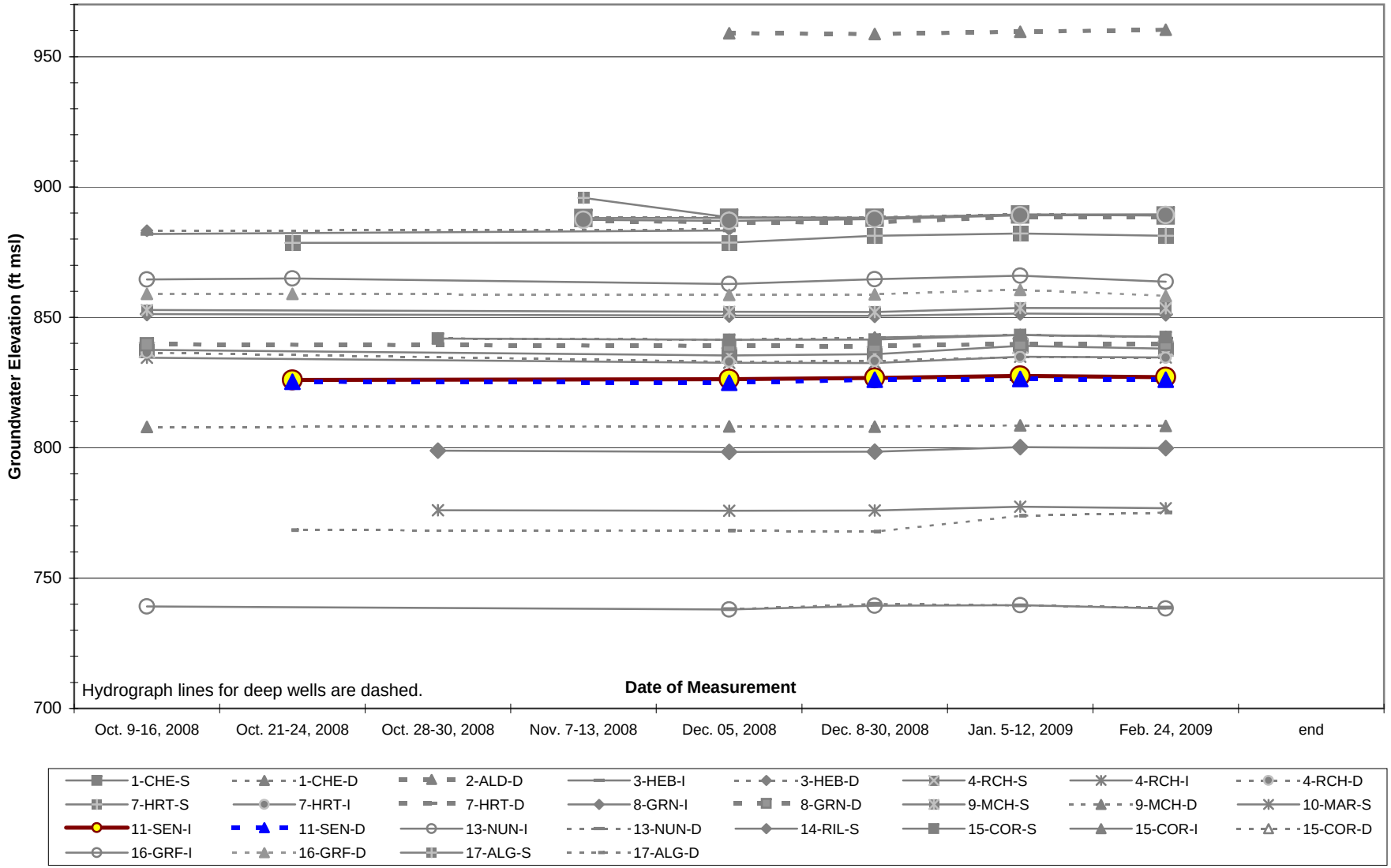
--- No Elevation

Well 17-Alg-S was frozen or partially frozen fror

Site 11 Groundwater Level Hydrograph
(includes ALL AECOM INSTALLED WELLS)

McHenry County Obervation Well Network

AECOM Project 09000-460

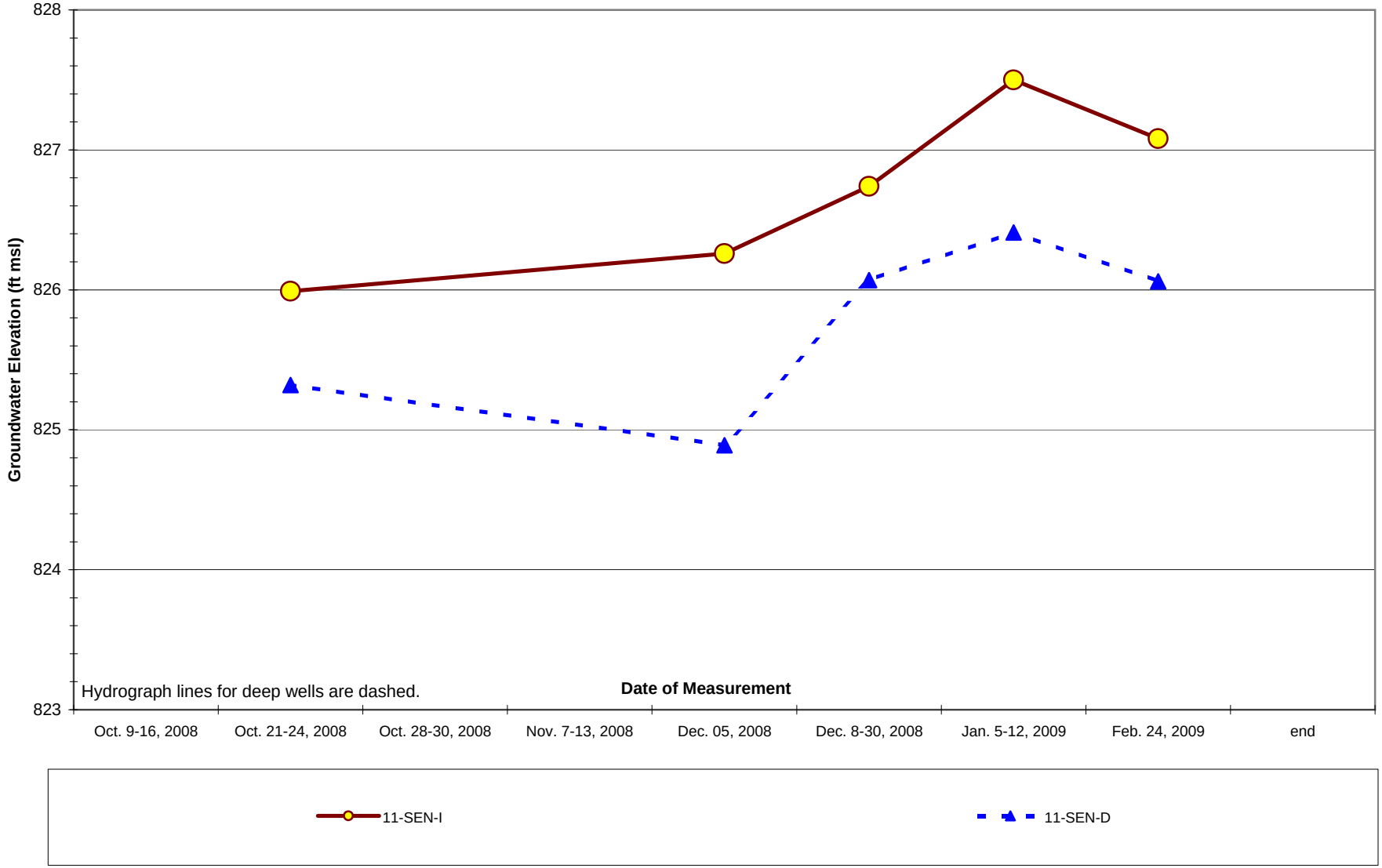


K:\PROJECTS\200804080\In_Progress\STS-McHenry Cty_WLs IN PROGRESS - figs for each site.xls

Site 11 Groundwater Level Hydrograph

McHenry County Obervation Well Network

AECOM Project 09000-460



K:\PROJECTS\200804080\In_Progress\STS-McHenry Cty_WLs IN PROGRESS - figs for each site.xls

Well Development Record

STS Consultants, Ltd.
11425 West Lake Park Drive
Milwaukee, Wisconsin 53224

Site Name: McHenry County

Well ID Number: 11-SEN-I

Date of Completion: 12/23/08

STS Job Number: 200804080

Start Time: 10:40

End Time: 11:50

Water color at start of development: Brown

Water color at end of development: CLEAR

Amount of water removed during development:

Contained water? ☐ Yes ☒ No

If not contained, where water disposed? GROUND

Well Development Methods:

- ☐ Surged with bailer and bailed
- ☐ Surged with block and bailed
- ☐ Surged with block, bailed & pumped
- ☐ Bailed only
- ☐ Pumped slowly
- ☐ Surged with bailer and pumped
- ☐ Surged with block and pumped
- ☐ Compressed Air
- ☒ Pumped only
- ☐ Other

Equipment Used

- ☐ PVC bailer
- ☐ Well wizard
- ☐ Bean or Moino pump (on drill rig)
- ☐ Surge block
- ☐ Whale pumps
- ☒ WATERRA PUMP W/ BLOCK

Notes: PURGE START: 10:40

END: 11:50

WL START: 5.99

END: 6.01

WELL DEVELOPMENT FIELD RECORD

Job Name: McHenry County Job No. 20080408.0 Well No. 11-SGW-I

Developed By: Brian Sommiot Date of Install. _____ Sheet ____ of ____

Started Devel. 12/23/08 / _____ (DATE / TIME) Completed Devel. 12/23/08 / _____ (DATE / TIME)

W.L. Before Devel. _____ / _____ / _____ (DATE / TIME / DEPTH) After Devel. _____ / _____ / _____ (DATE / TIME / DEPTH)

Well Depth: Before Devel. _____ After Devel. _____ Well Dia. (in.) _____

Standing Water Column (ft.) _____ Standing Well Volume _____ gal.

Screen Length 5' Drilling Water Loss _____ gal.

DATE / TIME	VOLUME REMOVED (Gallons)	FIELD PARAMETERS SPEC. COND. (umhos/cm)	TEMP. (C°)	pH (s.u.)	TURB ~~Other~~	ORP	REMARKS
12/23/08 1050	2 Gal/min	661	7.7	6.98	999	✓	
1110	"	618	7.9	7.14	322	–	
1130	"	616	7.7	7.18	123	–	
1150	"	614	7.9	7.29	23	–	
		= TOTAL VOLUME REMOVED (Gallons)					

Development Method: _____

Notes:

Well Development Record

STS Consultants, Ltd.
11425 West Lake Park Drive
Milwaukee, Wisconsin 53224

Site Name: McHenry County

Well ID Number: 11-STNP D

Date of Completion: 12/13/08

STS Job Number: 208804080

Start Time: 9:25

End Time: 10:40

Water color at start of development: Brown

Water color at end of development: CLEAR

Amount of water removed during development:

Contained water? ☐ Yes ☒ No

If not contained, where water disposed? Ground

Well Development Methods:

- ☐ Surged with bailer and bailed
- ☐ Surged with block and bailed
- ☐ Surged with block, bailed & pumped
- ☐ Bailed only
- ☐ Pumped slowly
- ☐ Surged with bailer and pumped
- ☐ Surged with block and pumped
- ☐ Compressed Air
- ☒ Pumped only
- ☐ Other

Equipment Used

- ☐ PVC bailer
- ☐ Well wizard
- ☐ Bean or Moino pump (on drill rig)
- ☐ Surge block
- ☐ Whale pumps
- ☒ WATERRA Pump w/ Block

Notes: PURGE START: 9:25

END: 10:40

WL ST: 6.66

WL END: 7.34

WELL DEVELOPMENT FIELD RECORD

Job Name McHenry County Job No. 20080408 Well No. 11-SGW-D

Developed By Brian Schmidt Date of Install. _____ Sheet ____ of ____

Started Devel. 12/23/08 / _____ (DATE / TIME) Completed Devel. 12/23/08 / _____ (DATE / TIME)

W.L. Before Devel. _____ / _____ / _____ (DATE / TIME / DEPTH) After Devel. _____ / _____ / _____ (DATE / TIME / DEPTH)

Well Depth: Before Devel. _____ After Devel. _____ Well Dia. (in.) _____

Standing Water Column (ft.) _____ Standing Well Volume _____ gal.

Screen Length 5' Drilling Water Loss _____ gal.

DATE / TIME	VOLUME REMOVED (Gallons)	FIELD PARAMETERS SPEC. COND. (umhos/cm)	TEMP. (C°)	pH (s.u.)	TURB ~~Other~~	ORP	REMARKS
12/23/08 CAL	[illegible]	4500	14.1	3.95	0	–	
940	2 GAL/MIN	649	10.6	5.73	940	–	
1000	"	595	9.6	6.59	186	–	
1020	"	577	9.4	6.78	111	–	
1040	"	587	9.5	6.92	341	–	
		= TOTAL VOLUME REMOVED (Gallons)					

Development Method: _____

Notes:

First Environmental Laboratories, Inc.

IL ELAP / NELAC Accreditation # 100292

1600 Shore Road • Naperville, Illinois 60563 • Phone (630) 778-1200 • Fax (630) 778-1233

Analytical Report

Client: STS CONSULTANTS (VERN)
Project ID: McHenry County 200804080
Sample ID: 11-SEN-I
Sample No: 9-0115-009

Date Collected: 01/09/09
Time Collected: 14:45
Date Received: 01/13/09
Date Reported: 01/20/09

Analyte		Result	R.L.	Units	Flags
Total Metals	**Method: 6020A**		**Preparation Method 3010A**		
Analysis Date: 01/16/09			Preparation Date: 01/15/09		
Calcium		84.6	0.1	mg/L	
Iron		3.60	0.01	mg/L	
Magnesium		43.4	0.1	mg/L	
Potassium		1.8	0.1	mg/L	
Sodium		6.3	0.1	mg/L	
Alkalinity, Bicarbonate (CaCO3)	**Method: 2320B**				
Analysis Date: 01/15/09 13:30					
Alkalinity, Bicarbonate (CaCO3)		330	5	mg/L	
Alkalinity, Carbonate (CaCO3)	**Method: 2320B**				
Analysis Date: 01/15/09 13:30					
Alkalinity, Carbonate (CaCO3)		< 5	5	mg/L	
Chloride	**Method: 4500Cl, E**				
Analysis Date: 01/14/09					
Chloride		10	5	mg/L	
Sulfate	**Method: 375.2R2.0**				
Analysis Date: 01/15/09					
Sulfate		57	15	mg/L	

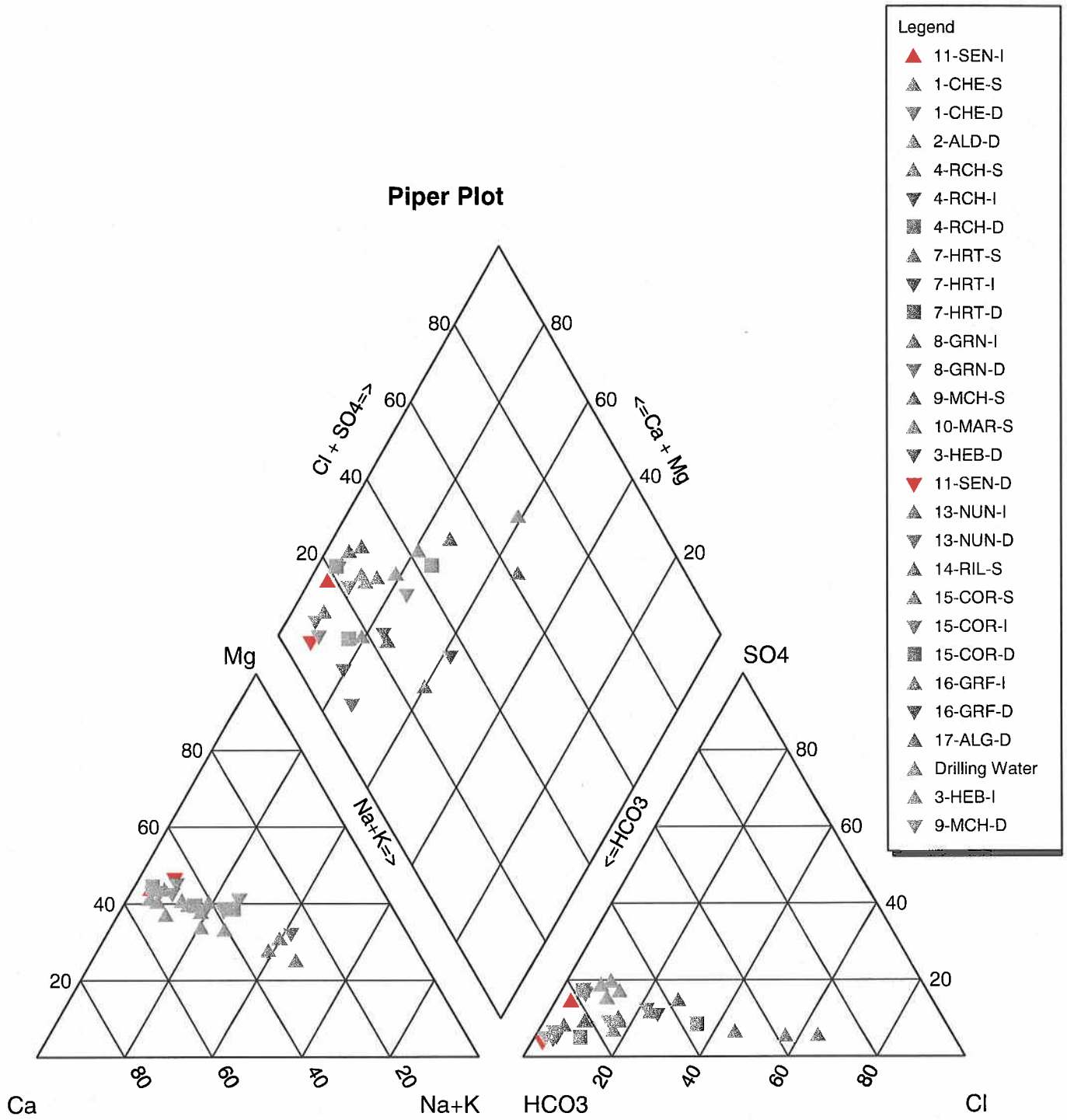
First Environmental Laboratories, Inc.
IL ELAP / NELAC Accreditation # 100292
1600 Shore Road • Naperville, Illinois 60563 • Phone (630) 778-1200 • Fax (630) 778-1233

Analytical Report

Client: STS CONSULTANTS (VERN)
Project ID: McHenry County 200804080
Sample ID: 11-SEN-D
Sample No: 9-0115-008

Date Collected: 01/09/09
Time Collected: 15:30
Date Received: 01/13/09
Date Reported: 01/20/09

Analyte		Result	R.L.	Units	Flags
Total Metals	**Method: 6020A**		**Preparation Method 3010A**		
Analysis Date: 01/16/09			Preparation Date: 01/15/09		
Calcium		67.8	0.1	mg/L	
Iron		1.02	0.01	mg/L	
Magnesium		42.4	0.1	mg/L	
Potassium		1.6	0.1	mg/L	
Sodium		12.9	0.1	mg/L	
Alkalinity, Bicarbonate (CaCO3)	**Method: 2320B**				
Analysis Date: 01/15/09 13:30					
Alkalinity, Bicarbonate (CaCO3)		350	5	mg/L	
Alkalinity, Carbonate (CaCO3)	**Method: 2320B**				
Analysis Date: 01/15/09 13:30					
Alkalinity, Carbonate (CaCO3)		< 5	5	mg/L	
Chloride	**Method: 4500Cl, E**				
Analysis Date: 01/14/09					
Chloride		6	5	mg/L	
Sulfate	**Method: 375.2R2.0**				
Analysis Date: 01/15/09					
Sulfate		< 15	15	mg/L	



DESCRIPTION: Piper Linear Diagram - Well Site #11

AECOM	PROJECT: McHenry County	PROJECT NO: 09000460
	CLIENT: Army Corps of Engineers	DATE: 7/30/2009

Field Well Sampling Sheet

Fill out the entire form. If it does not apply, mark N/A.

Project Name: McHenry
STS Job No. 200804080
Location: Seneca
Tester: Brian Scamiot
Well Number: 11-1 Sen-I
Date Sampled: 1/9/09
Previous Well Sampled: 1-CHE-D

GENERAL CONDITIONS:

						If Missing Replaced?	
Surface Seal:	X Ok		Damaged		Missing:	Yes	No
Protector Pipe:	X Ok		Damaged		Missing:	Yes	No
Well Cap:	X Ok		Damaged		Missing:	Yes	No
Ambient Temperature: 20 °F			Clear	X Cloudy	Rain		

WELL DATA:

Measuring Device: Solinist Water Level Meter
Stick Up or Down: Up (from Ground Surface)
Depth to Water: 5.23 (from TPVC)
Depth to Bottom: 75 (from TPVC)
Length of Water:
Free Product Observed: [ ] Yes [X] No Thickness: N/A

PURGING/SAMPLING:

Well Purging Calculations: Amount to purge = 0.163 gallons/foot times height of water column in feet for one well volume

Purging Device: Bladder Pump
Sampling Device: Bladder Pump
Volume Required:
[X] See back of page for field readings during purge
Volume Purged:
Could Well Bail Dry? [ ] Yes [X] No
Purging - Time Start: 14:10
Time Ended: 1450
Decon Method: Alconox

IN-SITU TESTING:

Turbidity: [ ] Turbid [ ] Opaque
Odor:
Color
pH @ degrees C
Uncorrected Conductivity X
Water Temp. (from Cond.)
Comments: ST: 1445

SAMPLES COLLECTED

Vocs -		Cyanide	
Metals -		Hexchrome	
SVOC		Alkalinity	
TOC		Chloride	
Sulfide		Ammonia	
Phenolics		COD	

Well Purging Log

Date 1/9/09

Time		Temp	pH	Conductivity	~~ORP~~ TURB	~~DO~~ RATE
1/9/09	14:15	7.6	7.55	820	999	250 ml/min
	14:20	9.2	7.43	775	958	"
	14:25	9.1	7.57	778	124	"
	14:30	9.5	7.55	762	66	"
	14:35	9.5	7.55	759	47	"
	14:40	9.5	7.58	758	48	"
	14:45	9.5	7.61	756	47	"
		ST:1445				

Field Well Sampling Sheet

Fill out the entire form. If it does not apply, mark N/A.

Project Name: McHenry County STS Job No. 2008 04080

Location: Seneca Tester: Brian Schmidt

Well Number: 11-SEN-D Date Sampled: 1/9/09

Previous Well Sampled: 11-SEN-I

GENERAL CONDITIONS:

						If Missing Replaced?
Surface Seal:	[x] Ok	[ ] Damaged	[ ] Missing:	Yes	No
Protector Pipe:	[x] Ok	[ ] Damaged	[ ] Missing:	Yes	No
Well Cap:	[x] Ok	[ ] Damaged	[ ] Missing:	Yes	No

Ambient Temperature: 20 °F [ ] Clear [x] Cloudy [ ] Rain

WELL DATA:

Measuring Device: Solinist Water Level Meter

Stick Up or Down: Up (from Ground Surface)

Depth to Water: 6.32 (from TPVC)

Depth to Bottom: 153 (from TPVC)

Length of Water:

Free Product Observed: [ ] Yes [x] No Thickness: N/A

PURGING/SAMPLING:

Well Purging Calculations: Amount to purge = 0.163 gallons/foot times height of water column in feet for one well volume

Purging Device: Bladder Pump Sampling Device: Bladder Pump

Volume Required: [x] See back of page for field readings during purge

Volume Purged:

Could Well Bail Dry? [ ] Yes [x] No

Purging - Time Start: 1450 Time Ended: 1535

Decon Method: Alconox

IN-SITU TESTING:

Turbidity: [ ] Turbid [ ] Opaque

Odor:

Color

pH @ degrees C

Uncorrected Conductivity X

Water Temp. (from Cond.)

Comments: ST: 1530

SAMPLES COLLECTED

Vocs -	[ ]	Cyanide	[ ]
Metals -	[ ]	Hexchrome	[ ]
SVOC	[ ]	Alkalinity	[ ]
TOC	[ ]	Chloride	[ ]
Sulfide	[ ]	Ammonia	[ ]
Phenolics	[ ]	COD	[ ]

Well Purging Log

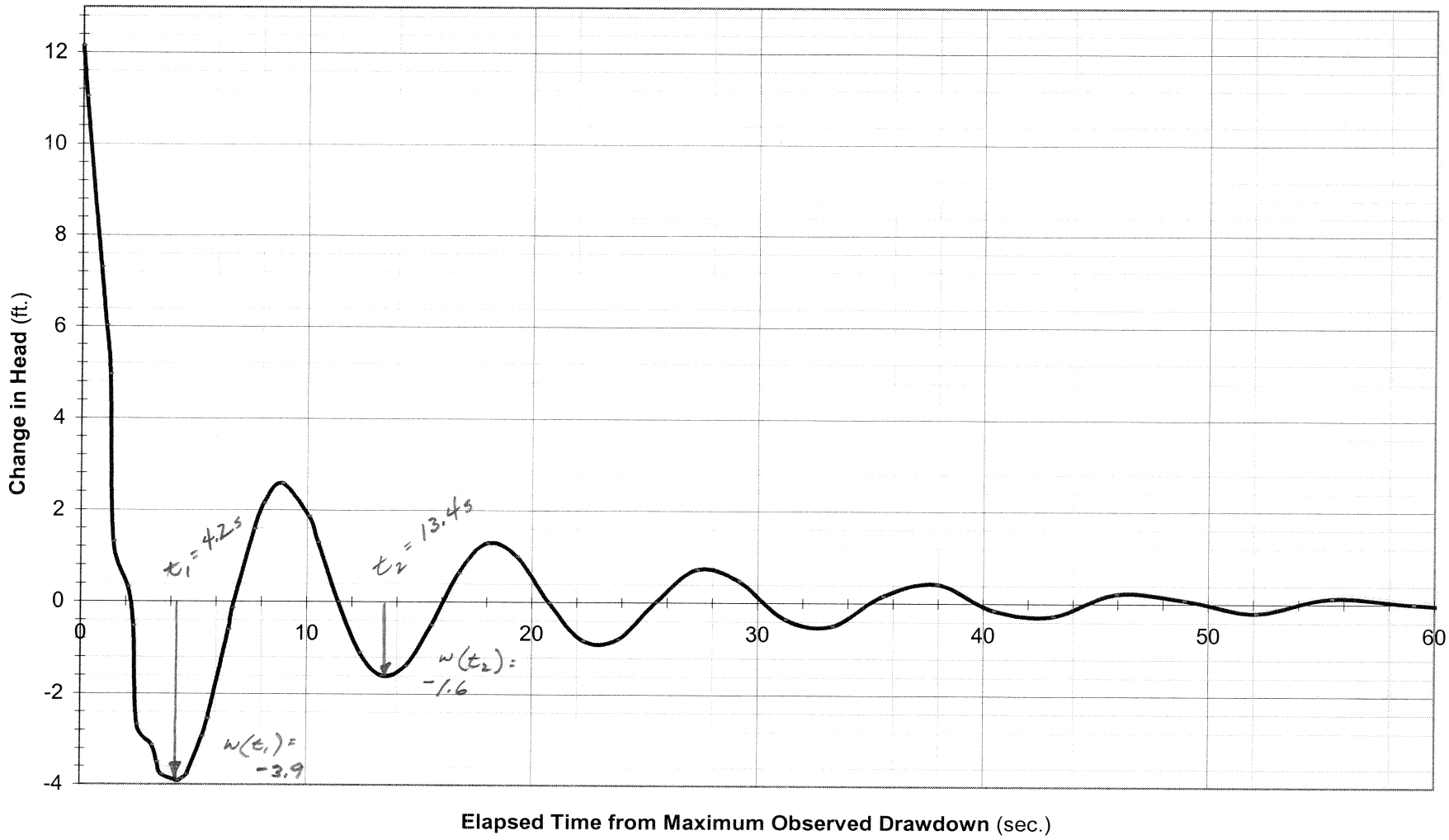
Date 1/9/09

Time		Temp	pH	Conductivity	~~ORP~~ TURB	~~DO~~ RATE
1/9/09	1500	6.3	7.53	715	38	250 ML/MIN
	1505	7.4	7.46	717	23	"
	1510	8.0	7.44	718	14	"
	1515	8.0	7.48	719	9	"
	1520	8.0	7.53	718	10	"
	1525	7.9	7.54	718	12	"
	1530	8.0	7.55	718	17	"
	ST:	1530				

Underdamped Response to Sudden Change in Water Level

Hydraulic Conductivity Test Result

Seneca Township #11 - Intermediate Well (Test #1)



Calculation of Transmissivity of Underdamped Well Response to Slug Test

Seneca Township - Intermediate Well (Test #1)
McHenry County Monitoring Well Network Installation
AECOM Environment Project No. 09000-460

Expression		Value	Units
$w(t_1)$	=	-3.9	ft.
$w(t_2)$	=	-1.6	ft.
t_1	=	4.2	sec.
t_2	=	13.4	sec.
R_c	=	0.083	ft.
R_s	=	0.083	ft.
L_c	=	66.1	ft.
L_s	=	5	ft.
τ	=	9.2	sec.
ϖ	=	0.6830	s^{-1}
γ	=	0.09684	s^{-1}
T	=	b+a lnT	
$(g/L)^{1/2}$	=	0.6898	
d	=	0.1404	
a	=	0.00423	ft^2/sec
Assume S	=	1.0E-05	
b	=	0.072	ft^2/sec
T_1	=	$b+a \ln T_0$	
Assume T_0	≈	b_1	
T_1	=	0.0612	ft^2/sec
T_2	=	0.0605	ft^2/sec
T	=	5229	ft^2/day
Aquifer Thickness	=	33.5	ft.
Hydraulic Conductivity	**=**	**156**	**ft/day**
		5.51E-02	**cm/sec**

Reference:
ASTM D5785-95 - (Analytical Procedure) for Determining Transmissivity of Confined Nonleaky Aquifers by Underdamped Well Response to Instantaneous Change in Head (Slug Test)

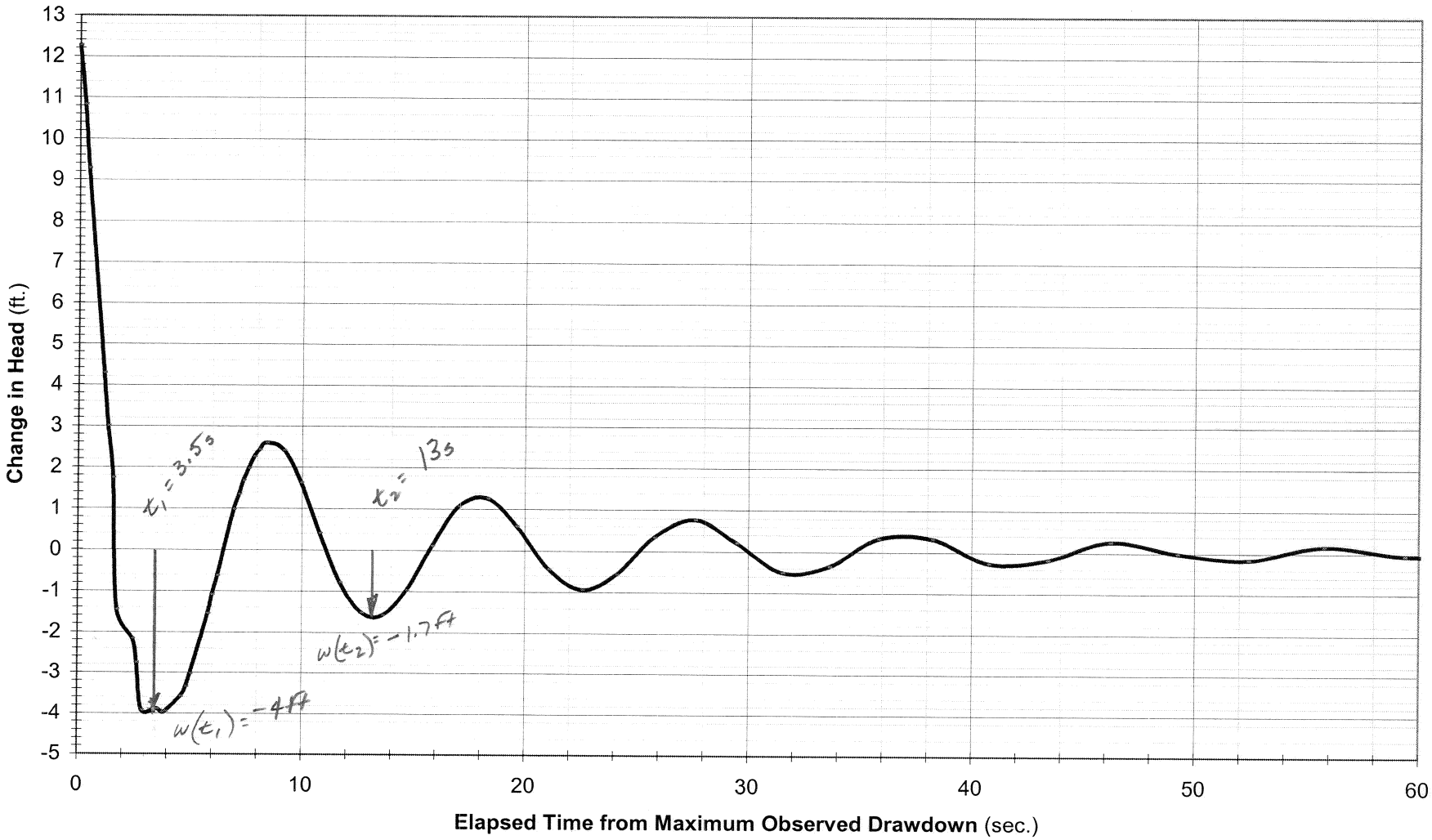
Check the results:

L	=	67.3 ft	1.3	2.0%	less than 20%?	**YES**
L	=	68.6 ft				
α	=	7.89E-04	less than 0.1?	**YES**		
d	=	0.1404	less than 0.7?	**YES**		

Underdamped Response to Sudden Change in Water Level

Hydraulic Conductivity Test Result

Seneca Township #11 - Intermediate Well (Test #2)



Calculation of Transmissivity of Underdamped Well Response to Slug Test

Seneca Township - Intermediate Well (Test #2)
McHenry County Monitoring Well Network Installation
AECOM Environment Project No. 09000-460

Expression		Value	Units
$w(t_1)$	=	-4.0	ft.
$w(t_2)$	=	-1.7	ft.
t_1	=	3.5	sec.
t_2	=	13.0	sec.
R_c	=	0.083	ft.
R_s	=	0.083	ft.
L_c	=	66.1	ft.
L_s	=	5	ft.
τ	=	9.5	sec.
ϖ	=	0.6614	s^{-1}
γ	=	0.09007	s^{-1}
T	=	b+a lnT	
$(g/L)^{1/2}$	=	0.6675	
d	=	0.1349	
a	=	0.00426	ft^2/sec
Assume S	=	1.0E-05	
b	=	0.073	ft^2/sec
T_1	=	$b+a \ln T_0$	
Assume T_0	≈	b_1	
T_1	=	0.0618	ft^2/sec
T_2	=	0.0611	ft^2/sec
T	=	5280	ft^2/day
Aquifer Thickness	=	33.5	ft.
Hydraulic Conductivity	**=**	**158**	**ft/day**
		5.56E-02	**cm/sec**

Reference:
ASTM D5785-95 - (Analytical Procedure) for Determining Transmissivity of Confined Nonleaky Aquifers by Underdamped Well Response to Instantaneous Change in Head (Slug Test)

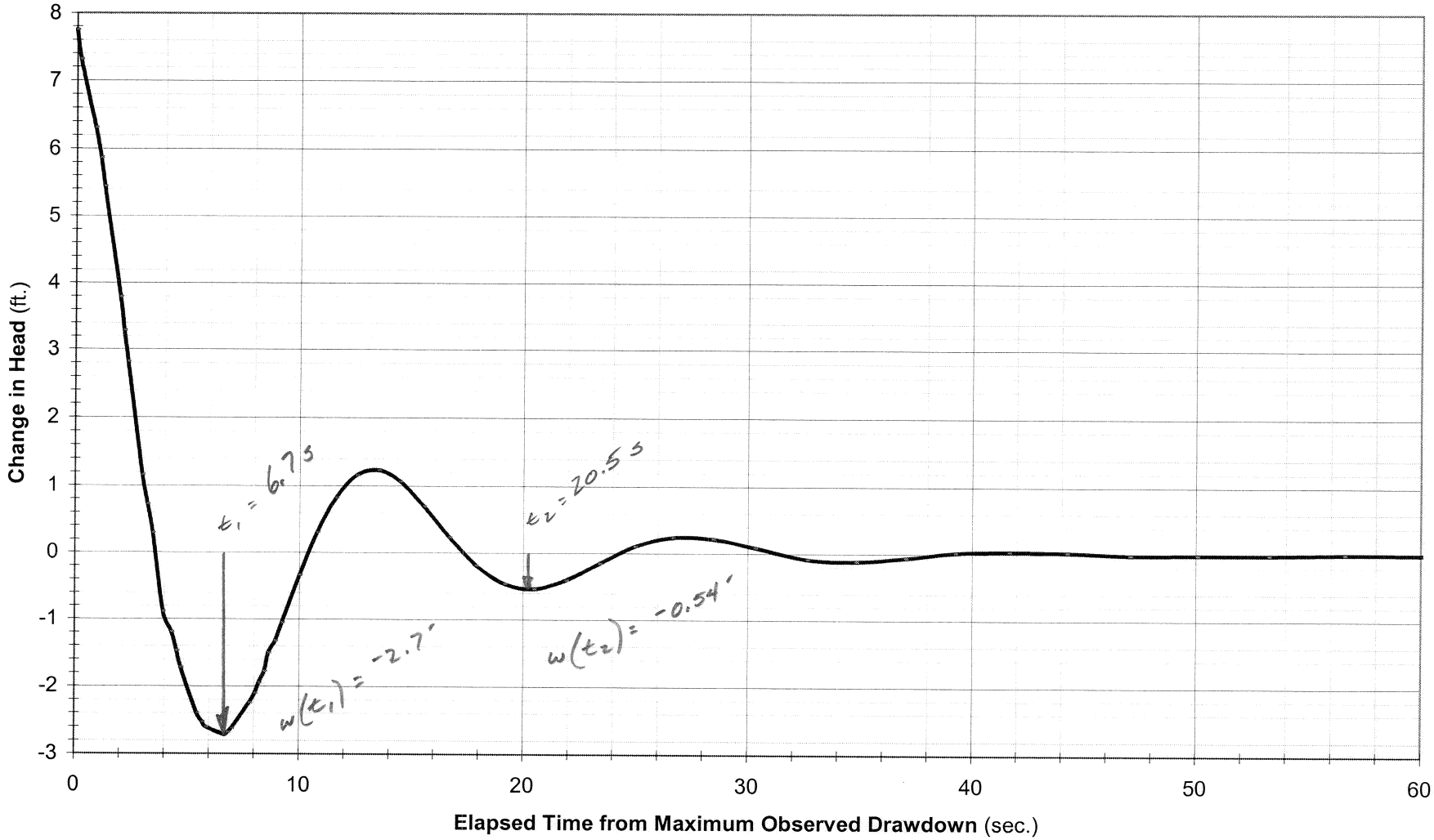
Check the results:

L	=	71.8 ft	-3.2	-4.5%	less than 20%?	**YES**
L	=	68.6 ft				
α	=	7.72E-04	less than 0.1?	**YES**		
d	=	0.1349	less than 0.7?	**YES**		

Underdamped Response to Sudden Change in Water Level

Hydraulic Conductivity Test Result

Seneca Township #11 - Deep Well (Test #1)



Calculation of Transmissivity of Underdamped Well Response to Slug Test

Seneca Township - Deep Well (Test #1)
McHenry County Monitoring Well Network Installation
AECOM Environment Project No. 09000-460

Expression		Value	Units
$w(t_1)$	=	-2.7	ft.
$w(t_2)$	=	-0.5	ft.
t_1	=	6.7	sec.
t_2	=	20.5	sec.
R_c	=	0.083	ft.
R_s	=	0.083	ft.
L_c	=	142.5	ft.
L_s	=	5	ft.
τ	=	13.8	sec.
ϖ	=	0.4553	s^{-1}
γ	=	0.11663	s^{-1}
T	=	b+a lnT	
$(g/L)^{1/2}$	=	0.4700	
d	=	0.2481	
a	=	0.00163	ft^2/sec
Assume S	=	1.0E-05	
b	=	0.029	ft^2/sec
T_1	=	b+a $\ln T_0$	
Assume T_0	≈	b_1	
T_1	=	0.0227	ft^2/sec
T_2	=	0.0223	ft^2/sec
T	=	1930	ft^2/day
Aquifer Thickness	=	15	ft.
Hydraulic Conductivity	**=**	**129**	**ft/day**
		4.54E-02	**cm/sec**

Reference:
ASTM D5785-95 - (Analytical Procedure) for Determining Transmissivity of Confined Nonleaky Aquifers by Underdamped Well Response to Instantaneous Change in Head (Slug Test)

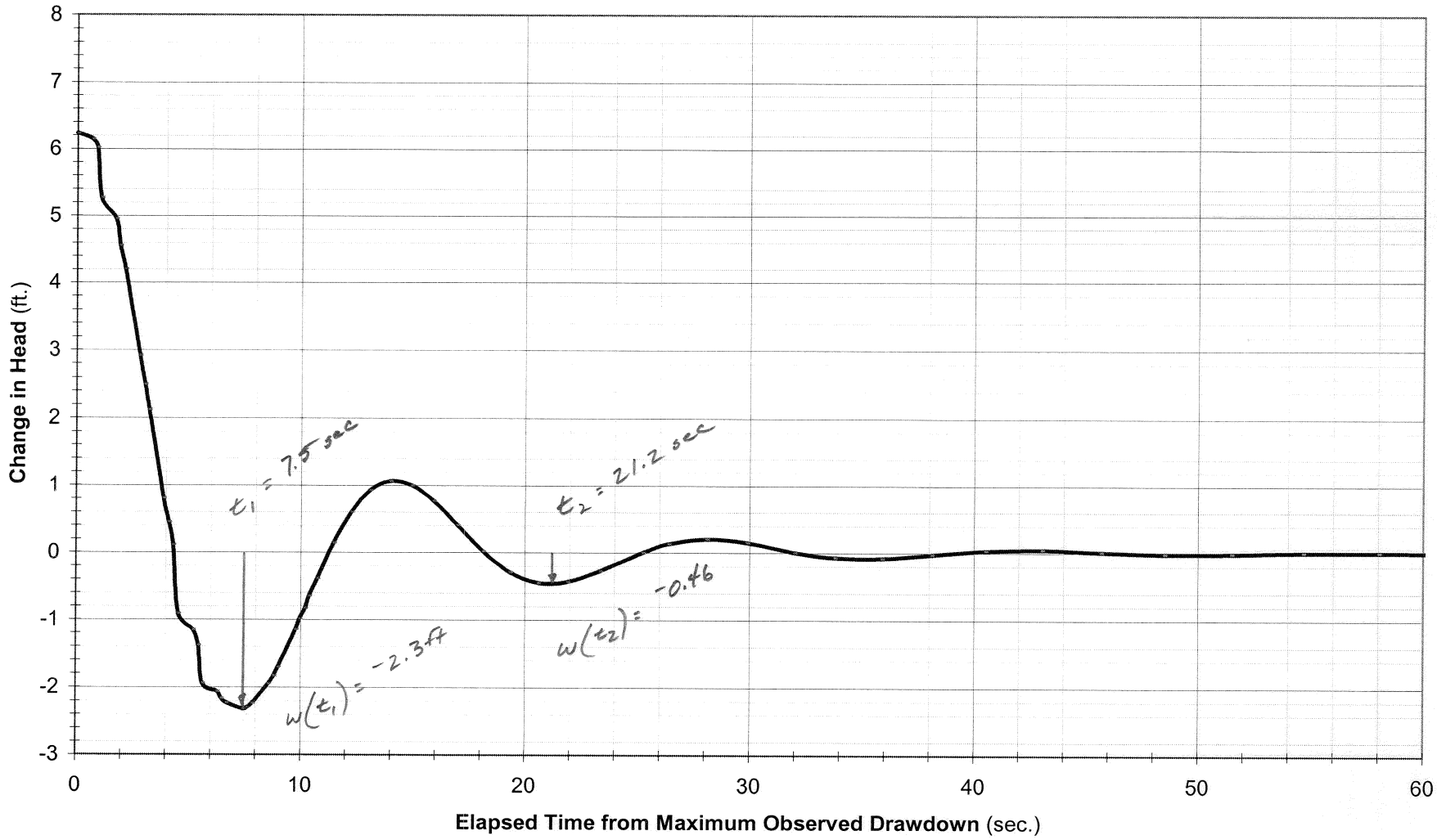
Check the results:

L	=	144.9 ft	0.1	0.1%	less than 20%?	**YES**
L	=	145 ft				
α	=	1.07E-03	less than 0.1?	**YES**		
d	=	0.2481	less than 0.7?	**YES**		

Underdamped Response to Sudden Change in Water Level

Hydraulic Conductivity Test Result

Seneca Township #11 - Deep Well (Test #2)



Calculation of Transmissivity of Underdamped Well Response to Slug Test

Seneca Township - Deep Well (Test #2)
McHenry County Monitoring Well Network Installation
AECOM Environment Project No. 09000-460

Expression		Value	Units
$w(t_1)$	=	-2.3	ft.
$w(t_2)$	=	-0.5	ft.
t_1	=	7.5	sec.
t_2	=	21.2	sec.
R_c	=	0.083	ft.
R_s	=	0.083	ft.
L_c	=	142.5	ft.
L_s	=	5	ft.
τ	=	13.7	sec.
ϖ	=	0.4586	s^{-1}
γ	=	0.11748	s^{-1}
T	=	b+a lnT	
$(g/L)^{1/2}$	=	0.4734	
d	=	0.2481	
a	=	0.00164	ft^2/sec
Assume S	=	1.0E-05	
b	=	0.029	ft^2/sec
T_1	=	b+a $\ln T_0$	
Assume T_0	≈	b_1	
T_1	=	0.0229	ft^2/sec
T_2	=	0.0225	ft^2/sec
T	=	1944	ft^2/day
Aquifer Thickness	=	15	ft.
Hydraulic Conductivity	**=**	**130**	**ft/day**
		4.57E-02	**cm/sec**

Reference:
ASTM D5785-95 - (Analytical Procedure) for Determining Transmissivity of Confined Nonleaky Aquifers by Underdamped Well Response to Instantaneous Change in Head (Slug Test)

Check the results:

L	=	142.8 ft	2.2	1.6%	less than 20%?	**YES**
L	=	145 ft				
α	=	1.07E-03	less than 0.1?	**YES**		
d	=	0.2481	less than 0.7?	**YES**		

Additional Well Site Information

In-Situ Inc.

Calibration Report

Report Number: 20090109142227-140448

221 East Lincoln Avenue, Fort Collins, CO 80524 USA
1-970-498-1500, 1-800-446-7488, FAX: 1-970-498-1598
Visit us at www.in-situ.com

11-SEN-I

Instrument Details:

Instrument Model:	**Level TROLL 500**
Full Scale Pressure Range	**206.84 KPa (30 PSI) vented**
Serial Number:	**140448**

Calibration Details:

Calibration Result:	**PASS**
Calibration Date:	2009-01-09 14:22:27 (UTC)
Nominal Range of Applied Temperature:	-5 C to +50 C
Temperature Accuracy Specification:	+/- 0.1 C From 0 C to +50 C
Nominal Range of Applied Pressure:	0 KPa to 206.8 KPa (0.0 PSI to 30.0 PSI)
Pressure Accuracy Specification:	+/- 0.1 %FS from -5 C to +50 C, +/- 0.05 %FS at +15 C

Post-Calibration Check:

Parameter	Applied	Reported	Deviation
Pressure	30.0002	29.9988	-0.0046
Pressure	0.0004	0.0001	-0.0011
Temperature	19.9960	20.0026	0.0066

Calibration Procedures and Equipment Used:

Automated calibration procedures used.
Manu Agilent Model 34970A SerialNo MY44038788
Manu Instrulab Model 3312A-14-15-24 SerialNo 31138
Manu Instrulab Model 406X-0031-01 SerialNo 1-31118
Manu MENSOR Model 600 SerialNo 622742
Manu Agilent Model 53131A SerialNo MY47000169
Manu MENSOR Model 600 SerialNo 621385

Notes:

1. Standards used in this calibration are traceable to the National Institute of Standards and Technology.
2. This calibration report shall not be reproduced, except in full, without the written approval of In-Situ, Inc.
3. A calibration interval of 12 to 18 months is recommended.
4. The post-calibration data is collected at nominal +20 C.
5. 1.0 PSI = 6.894757 KPa

Performed By: NJH

Copyright © 2006 In-Situ, Inc.

In-Situ Inc.

Calibration Report

Report Number: 20090109182153-140462

221 East Lincoln Avenue, Fort Collins, CO 80524 USA
1-970-498-1500, 1-800-446-7488, FAX: 1-970-498-1598
Visit us at www.in-situ.com

11-SEN-D

Instrument Details:

Instrument Model:	**Level TROLL 500**
Full Scale Pressure Range	**206.84 KPa (30 PSI) vented**
Serial Number:	**140462**

Calibration Details:

Calibration Result:	**PASS**
Calibration Date:	2009-01-09 18:21:53 (UTC)
Nominal Range of Applied Temperature:	-5 C to +50 C
Temperature Accuracy Specification:	+/- 0.1 C From 0 C to +50 C
Nominal Range of Applied Pressure:	0 KPa to 206.8 KPa (0.0 PSI to 30.0 PSI)
Pressure Accuracy Specification:	+/- 0.1 %FS from -5 C to +50 C, +/- 0.05 %FS at +15 C

Post-Calibration Check:

Parameter	Applied	Reported	Deviation
Pressure	30.0000	29.9955	-0.0151
Pressure	0.0005	-0.0025	-0.0100
Temperature	20.0220	20.0330	0.0110

Calibration Procedures and Equipment Used:

Automated calibration procedures used.
Manu Agilent Model 34970A SerialNo MY41012474
Manu Instrulab Model 3312A-14-15-24 SerialNo 31102-(41037)
Manu Instrulab Model 406X-0031-01 SerialNo 31128-1
Manu MENSOR Model 600 SerialNo 621218
Manu Agilent Model 53131A SerialNo MY47000169
Manu MENSOR Model 600 SerialNo 621385

Notes:

1. Standards used in this calibration are traceable to the National Institute of Standards and Technology.
2. This calibration report shall not be reproduced, except in full, without the written approval of In-Situ, Inc.
3. A calibration interval of 12 to 18 months is recommended.
4. The post-calibration data is collected at nominal +20 C.
5. 1.0 PSI = 6.894757 KPa

Performed By: NJH

Copyright © 2006 In-Situ, Inc.

Seneca Township Well Site – Staked Location

Seneca Township Well Site – Set of on Hole

Seneca Township Subsurface Samples

Seneca Township Subsurface Samples

Seneca Township Subsurface Samples

Seneca Township Well Site – After Rig Pulled Off

Seneca Township Well Site

Seneca Township Well Site

Seneca Township Well Site - Monument

Seneca Township Well Site – view west

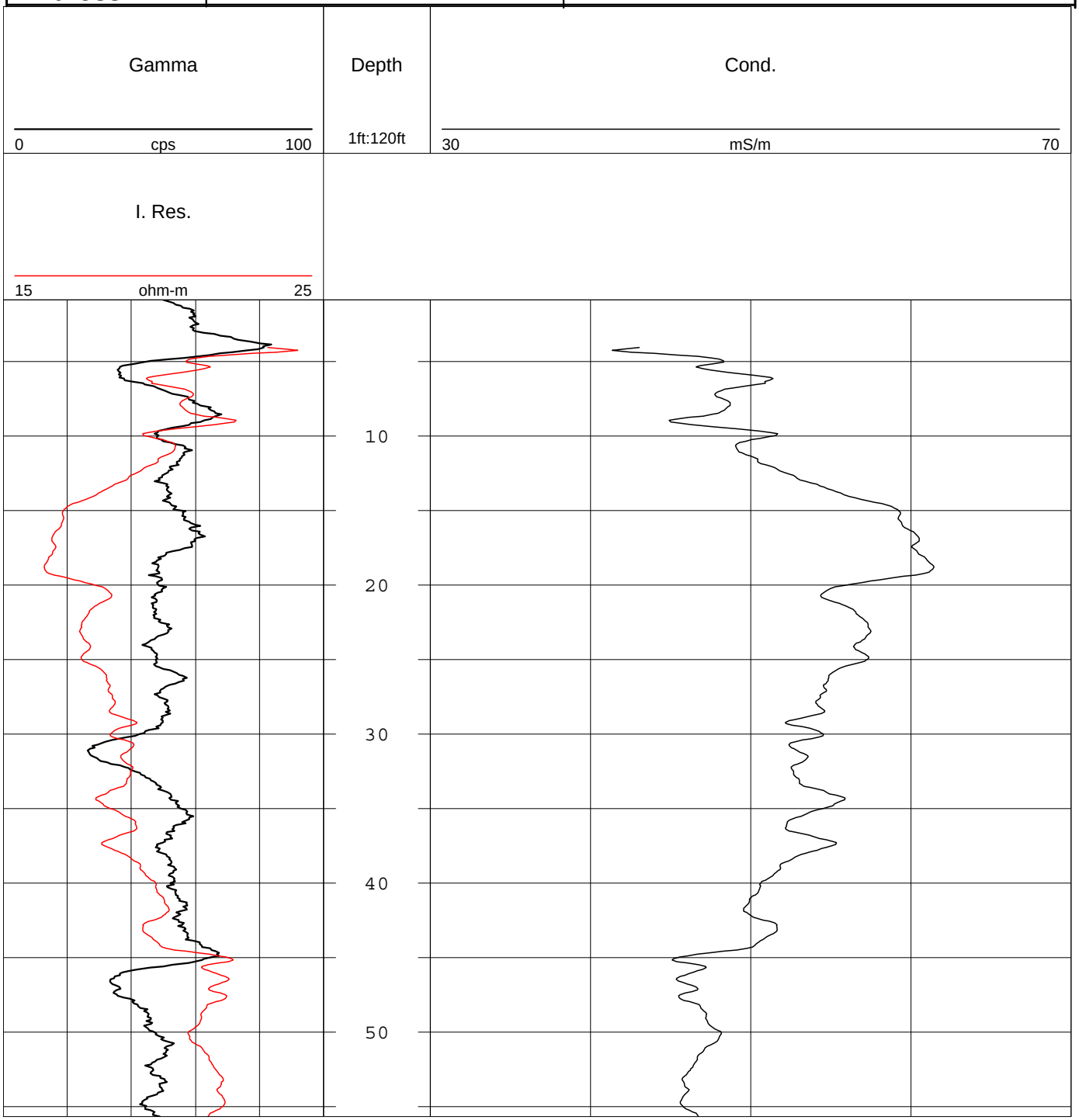
Seneca Township Well Site – Inside Casing

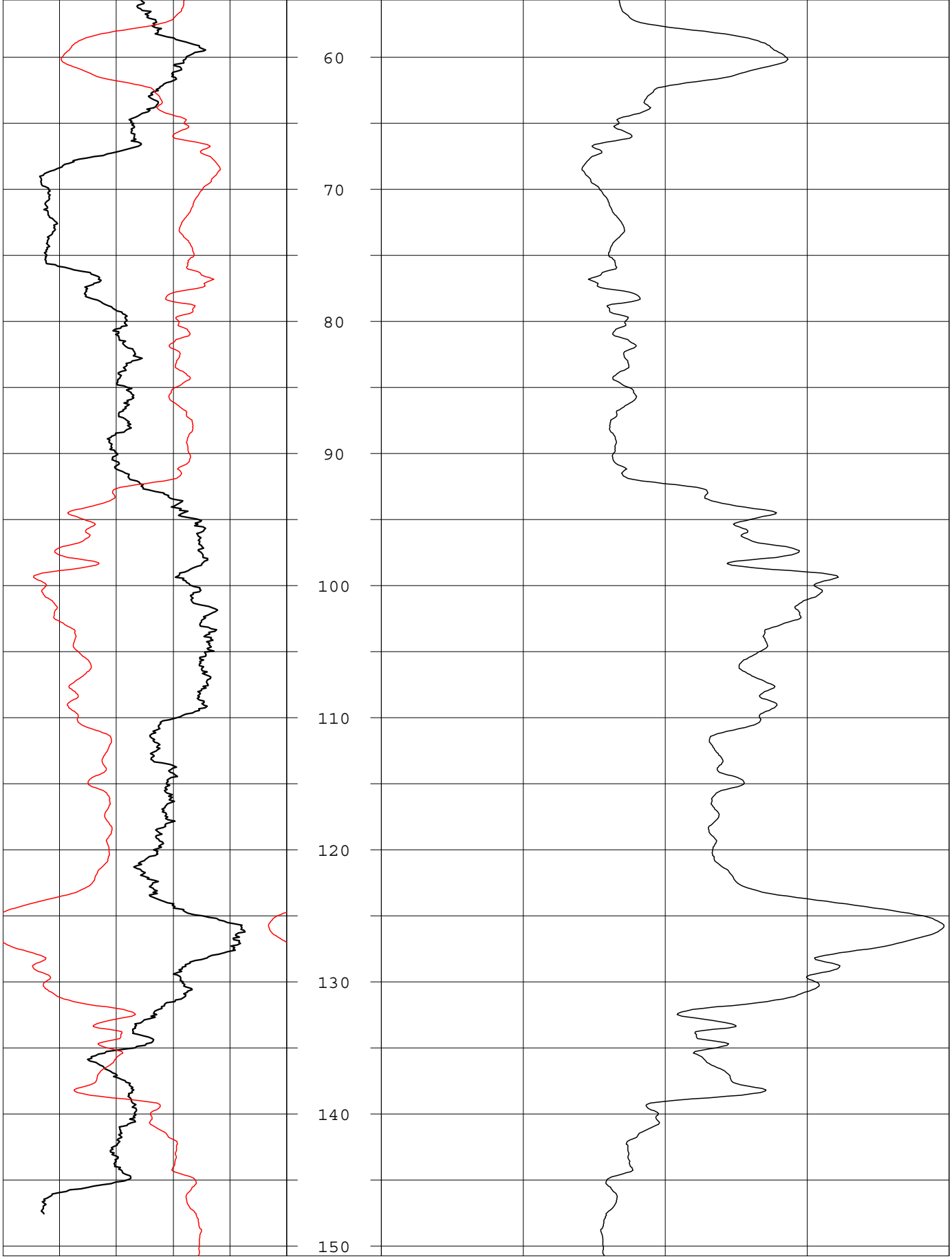
COMPANY:	MCHENRY CO. & USACE
Location:	SENECA TWP

Well	SENECA TWP #11		
Date	1/21/2009	BH Fluid	FORMATION
Casing	2" PVC 2.1' AGS - 153 'BGS		
File Name	MCHTH11-09EMGAM		
Depth Driller	155.0' BGS		
Depth Logger	153.13' BGS		
Logged by:	T. YOUNG		
Witness:	NOT WITNESSED		

OTHER SERVICES

H2O LEVEL & GPS




60
70
80
90
100
110
120
130
140
150

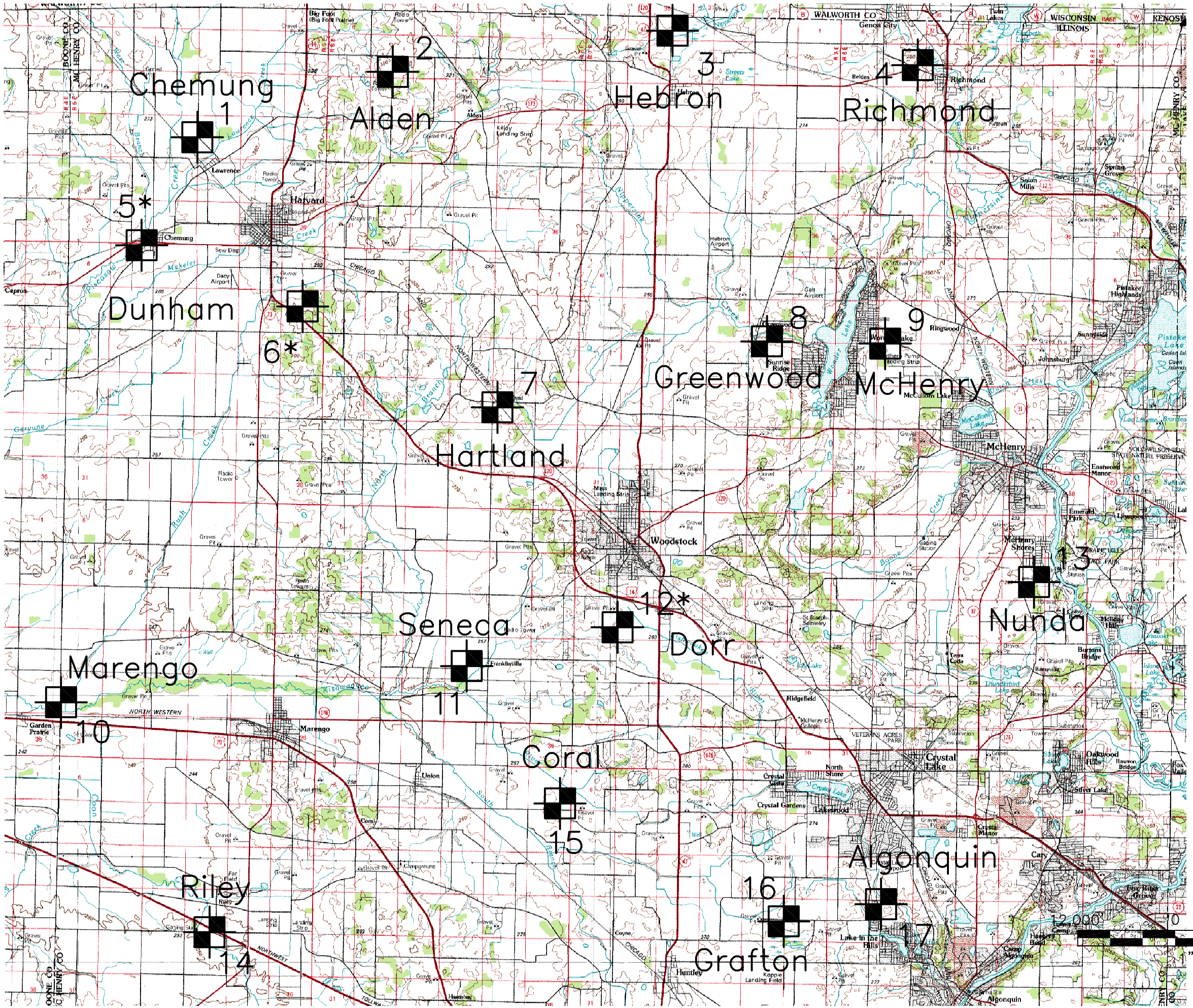
A-13: Folio for Well Site #13 – Nunda Township

Table of Contents

I.) Site Location Map – Location in County
II.) Site Location Map – Location on USGS Topographic Map
III.) Site Location Map – Location on USGS High Resolution Orthophoto
IV.) Site Boring Log
V.) Well Construction Diagram
VI.) Well Site Summary and Commentary
VII.) Particle Size Distribution Report
VIII.) Table of Water Level Measurements
IX.) Well Development Field Log
X.) Water Quality Analysis Results
XI.) Groundwater Sampling Field Log
XII.) Hydraulic Conductivity Testing Results
XIII.) In-Situ LevelTroll™ Calibration Report
XIV.) Site Photographs
XV.) Downhole Geophysical Testing

Well Site Location Maps

Z:\Projects\200804080\CtyWide\D-09000-460-8000_CtyOverviewMap_004.dwg; 4/20/2009 5:33:59 PM; BRAUN, GARY



LEGEND:

AECOM Well Installation Site

McHenry 9

Well Installations By Others

Dunham 6*

0 12,000 24,000'

" = 12,000'

AECOM

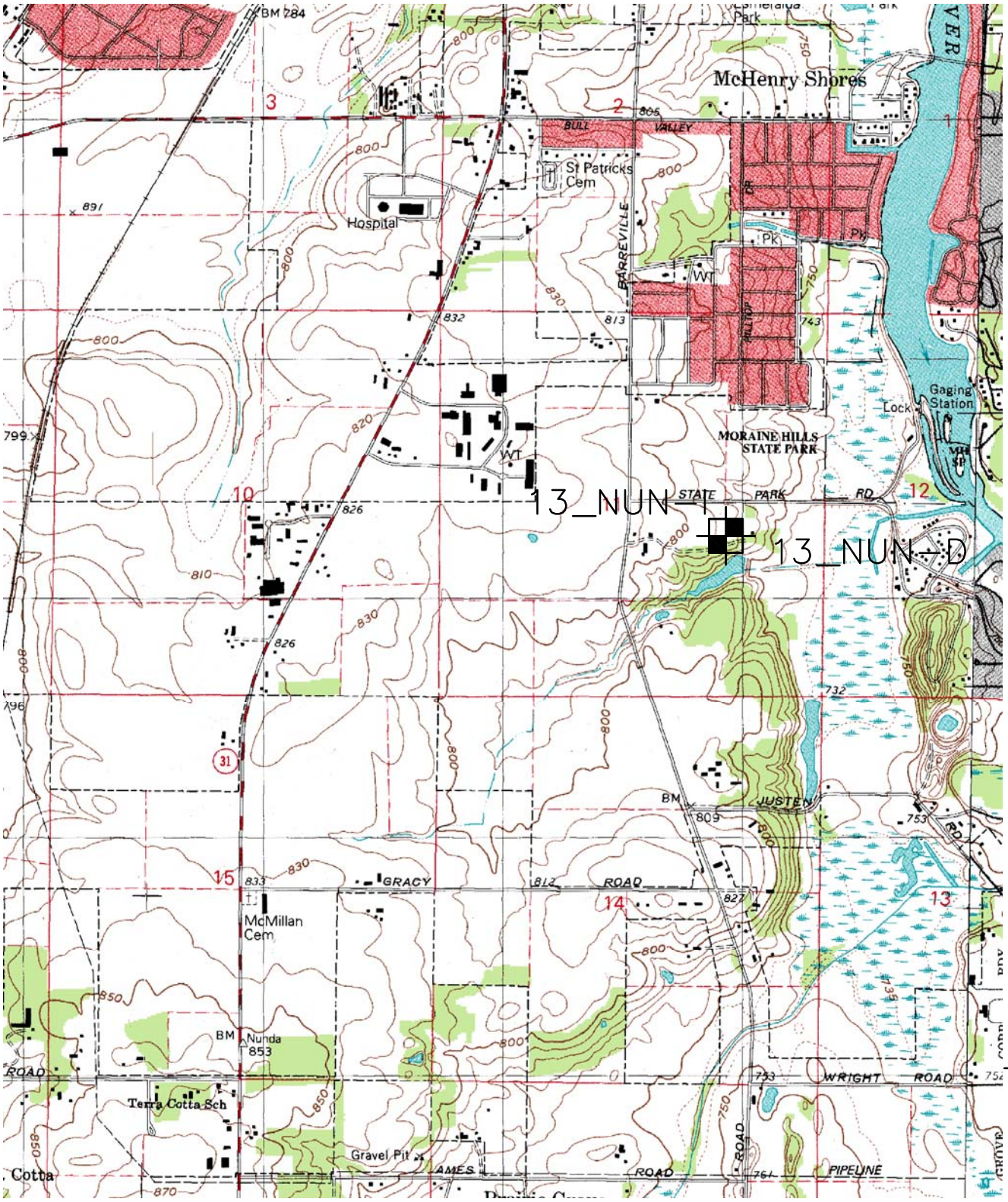
750 Corporate Woods Pkwy
Vernon Hills, IL 60061
847-279-2500
www.aecom.com

Copyright © By: STS Consultants, Ltd.

LOCATION MAP OF WELL SITES

Observation Well Network for Glacial Aquifers
McHenry County, Illinois

Drawn :	CJH	3/11/2009
Checked:	GMB	4/18/2009
Approved:	CSR	4/27/2009
PROJECT NUMBER	09000-460	
FIGURE NUMBER	1	



2000 0 2000 4000

1" = 2000'

AECOM

750 Corporate Woods Parkway
Vernon Hills, IL 60061
847.279.2500
www.aecom.com

Copyright © 2009, By: AECOM

Site Location on USGS Topographic Map
Site No. 13 - Nunda Township
Stickney Run - State Park Rd.
Observation Well Network
McHenry County, Illinois

Drawn :	CJH	04/01/2009
Checked:	GMB	04/15/2009
Approved:	CSR	04/24/2009
PROJECT NUMBER	09000-460	
FIGURE NUMBER	Folio_13 #2	

Z:\Projects\200804080\CityWide\D-09000-460-8000_TopoMaps_v02.dwg; 4/24/2009 12:51:27 PM; BRAUN, GARY; STS_BLACK_040102.ctb

AECOM

750 Corporate Woods Parkway
Vernon Hills, IL 60061
847.279.2500
www.aecom.com
Copyright © 2009, By: AECOM

2005 USGS High Resolution Orthophoto
Site No. 13 - Nunda Township
Stickney Run - State Park Rd.
Observation Well Network
McHenry County, Illinois

Drawn :	CJH	04/01/2009
Checked:	GMB	04/15/2009
Approved:	CSR	04/24/2009
PROJECT NUMBER	09000-460	
FIGURE NUMBER	Folio_13 #3	

Z:\Projects\200804080\CtyWide\D-09000-460-8000_AerialsMap_004.dwg; 4/21/2009 2:04:59 PM; BRAUN, GARY; STS_BLACK_040102.ctb

Boring and Well Construction Details

DRILLING LOG

DIVISION	USACE
INSTALLATION	Chicago District
SHEET	1 OF 7 SHEETS
1. PROJECT	McHenry County Observation Wells
2. LOCATION (Coordinates or Station)	McHenry County, Illinois N 2,053,939.00 E 1,000,377.00
3. DRILLING AGENCY	WDC Exploration & Wells
4. HOLE NO. *(As shown on drawing title and file number)*	13-NUNDA
5. NAME OF DRILLER	Dan Tonnancour
6. DIRECTION OF HOLE	☒ VERTICAL ☐ INCLINED --- DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN	150.0
8. DEPTH DRILLED INTO ROCK	3.0
9. TOTAL DEPTH OF HOLE	153.0
10. SIZE AND TYPE OF BIT	3 7/8" Carbide Bit / 5 7/8" Casing
11. DATUM FOR ELEVATION SHOWN *(TBM or MSL)*	NAVD 88
12. MANUFACTURER'S DESIGNATION OF DRILL	Super Sonic II
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN	DISTURBED 20 / UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES	N/A
15. ELEVATION GROUND WATER	739.3
16. DATE HOLE	STARTED 10/9/2008 / COMPLETED 10/10/2008
17. ELEVATION TOP OF HOLE	+785.3
18. TOTAL CORE RECOVERY FOR BORING	95 %
19. GEOLOGIST	Gary Braun, LPG IL

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
+785.3	0.0		Topsoil: OL, Black dense organic silt	90	1 0.0 5.0	
+784.3	1.0					
+782.8	2.5		CL, Dark brown silty clay, little sand and organics, stiff, damp			
			CL, Brown/light brown mottled sitly clay, little fine gravel, trace organics and sand, stiff, moist Note: Trace black mottles, weathered till			Sample No. 1 from 4.0' - 5.0'
				90	2 5.0 15.0	QP = 1.75 TSF @5.5'
+777.3	8.0					
			CL, Olive brown to brown silty clay, little coarse sand and fine gravel, trace medium gravel, very stiff to hard, moist			Sample No. 2 from 14.0' - 15.0'
+769.8	15.5			85	3 15.0 25.0	
			SP, Grayish brown fine sand, moderately dense, wet			Sample No. 3 from 16.0' - 17.0'
+768.3	17.0					
			GC, Brownish gray sandy-gravelly clay, little silt, very stiff with occasional medium dense spots, damp			

DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE 785.3

Hole No. 13-NUNDA

PROJECT: McHenry County Observation Wells

INSTALLATION: Chicago District

SHEET 2 OF 7 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
			GC, Brownish gray sandy-gravelly clay, little silt, very stiff with occasional medium dense spots, damp *(continued)*			Sample No. 4 from 20.0' - 21.0'
+762.8	22.5		GW, Gray sandy fine to medium gravel, loose, moist to wet			Sample No. 5 from 23.0' to 24.0' Sample No. 6 from 24.0' to 25.0' Qp = >4.5 TSF @25.0'
+761.3	24.0		CL, Dark pinkish brown silty clay, little coarse sand and fine to medium gravel, very hard, damp Note: Gravelly seams noted between 26.0' and 27.0'	100	4 25.0 35.0	
						Sample No. 7 from 34.0' to 35.0' Qp = >4.5 TSF @35.0'
				100	5 35.0 45.0	
						Qp = 4.5+ TSF @40.0'
						Sample No. 8 from 44.0' to 45.0' Qp = 4.5+ TSF @45.0'
				100	6 45.0	

DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE 785.3

Hole No. 13-NUNDA

PROJECT: McHenry County Observation Wells

INSTALLATION: Chicago District

SHEET 3 OF 7 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
			CL, Dark pinkish brown silty clay, little coarse sand and fine to medium gravel, very hard, damp Note: Gravelly seams noted between 26.0' and 27.0' *(continued)*		55.0	Qp = >4.5 TSF @47.0' Qp = >4.5 TSF @50.0' Qp = 4.5 TSF @53.5' Sample No. 9 from 54.0' to 55.0'
				85	7 55.0 65.0	Qp = >4.5 TSF @56.5' Qp = >4.5 TSF @59.5' Qp = >4.5 TSF @61.0' Sample No. 10 from 62.5' to 63.5' Qp = >4.5 TSF @63.0'
				100	8 65.0 75.0	Qp = >4.5 TSF @66.5' Qp = >4.5 TSF @70.0'

DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE 785.3

Hole No. 13-NUNDA

PROJECT: McHenry County Observation Wells

INSTALLATION: Chicago District

SHEET 4 OF 7 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
			CL, Dark pinkish brown silty clay, little coarse sand and fine to medium gravel, very hard, damp Note: Gravelly seams noted between 26.0' and 27.0' *(continued)*			Qp = >4.5 TSF @72.0' Sample No. 11 from 74.0' to 75.0' Qp = >4.5 TSF @74.0'
				100	9 75.0 85.0	Qp = 4.5 TSF @76.0' Qp = 4.0 TSF @79.5' Qp = >4.5 TSF @82.0' Sample No. 12 from 84.0' to 85.0' Qp = >4.5 TSF @85.0'
				100	10 85.0 92.0	Qp = >4.5 TSF @87.0' Qp = >4.5 TSF @89.0'
				100	11 92.0 95.0	
+690.8	94.5		SW, Brownish gray medium to coarse sand with fine to medium gravel, trace to little silt, trace coarse gravel and cobbles, moderately dense, wet	100	12 95.0 105.0	Sample No. 13 from 95.0' to 96.0'

DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE 785.3

Hole No. 13-NUNDA

PROJECT: McHenry County Observation Wells

INSTALLATION: Chicago District

SHEET 5 OF 7 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
			SW, Brownish gray medium to coarse sand with fine to medium gravel, trace to little silt, trace coarse gravel and cobbles, moderately dense, wet *(continued)*			Sample No. 14 from 104.0' to 105.0'
				95	13 105.0 115.0	
+678.3	107.0		GW, Gray medium to coarse sandy gravel, trace cobbles, loose, wet			% Gravel/% Sand/% Fines = 68/29/3 from 108.0' to 109.0' Sample No. 15 from 110.0' to 111.0'
				100	14 115.0 125.0	Sample No. 16 from 119.0' to 120.0'
+664.3	121.0		CL-ML, Gray silty clay to clayey silt, trace fine gravel, stiff to very stiff (with dense pockets), damp, medium plasticity, but reduces with increasing silt content			Qp = 3.5 TSF @122.0'

DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE 785.3

Hole No. 13-NUNDA

PROJECT: McHenry County Observation Wells

INSTALLATION: Chicago District

SHEET 6 OF 7 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
			CL-ML, Gray silty clay to clayey silt, trace fine gravel, stiff to very stiff (with dense pockets), damp, medium plasticity, but reduces with increasing silt content *(continued)*			Sample No. 17 from 124.0' to 125.0' Qp = 3.5 TSF @124.0'
				100	15 125.0 135.0	
+658.3	127.0		CL, Gray silty clay, trace fine gravel, very stiff, damp, medium plasticity			Qp = 4.5 TSF @127.0'
						Qp = >4.5 TSF @130.0'
						Qp = >4.5 TSF @133.5' Sample No. 18 from 134.0' to 135.0'
				75	16 135.0 145.0	
+641.9	143.4		GM, Gray gravelly silt, some sand, very hard, damp Note: Occasional granular layer, frequent dolomite clasts; hardpan (not plastic)			Sample No. 19 from 144.0' to 154.0'
				73	17 145.0 150.5	% Gravel/% Sand/% Fines = 31/40/30 from 145.0' to 146.0'
						Qp = >4.5 TSF at 146.5'
			Note: Drill chatter noticed at approximately 147.0' to 148.0', caused by bedrock clasts and rounded cobbles			Sample No. 20 from 148.0' to 149.0'

DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE 785.3

Hole No. 13-NUNDA

PROJECT: McHenry County Observation Wells

INSTALLATION: Chicago District

SHEET 7 OF 7 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
+635.3	150.0					
			Dolomitic Bedrock, gray fine grained, moderately hard, trace faint blue discoloration, few vugs	100	18 150.5 153.0	
+632.3	153.0					
			END OF BORING - 153.0' BGS			AECOM Project No. 60095270

Hole No. 13 - Nunda Twp

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 1 OF 11 SHEETS

1. PROJECT: McHenry Cty Wells
2. LOCATION (Coordinates or Station): N 2,053,939 E 1,000,377 IL 3T PLE
3. DRILLING AGENCY: WOC Exploration & Wells
4. HOLE NO. (As shown on drawing title and title number): 13 - Nunda
5. NAME OF DRILLER: DAN TONNANCOUR
6. DIRECTION OF HOLE: ☑ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 150'
8. DEPTH DRILLED INTO ROCK: 3'
9. TOTAL DEPTH OF HOLE: 153'
10. SIZE AND TYPE OF BIT: 3 7/8" Carbide Sampler Bit & 5 7/8" CASING
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): NAVD 88
12. MANUFACTURERS DESIGNATION OF DRILL: Super Sonic II
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 20; UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES: —
15. ELEVATION GROUND WATER: 739.3' (Deep 10/14)
16. DATE HOLE: STARTED 10/9/08; COMPLETED 10/10/08
17. ELEVATION TOP OF HOLE: 785.3 Ft MSL
18. TOTAL CORE RECOVERY FOR BORING: 145.5/153 = 95%
19. SIGNATURE OF INSPECTOR: Jon M. Brown LPG IL

LOCATION: west side of gravel parking lot of Stickney Run CD located on State Park Rd.

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
785.3	0		Topsoil - Black dense organic SILT (OL)			Run 1 (0-5') Rec/Run = 4.5'/5' = 90% — 1245 4" Sampler Begins Sampling
	1		Dark Brown Silty CLAY, little sand and organics, stiff, damp (CL-OL)	Rec 90%	Bag 1	
	2					
	3		Brown / Light Brown mottled Silty CLAY, little fine gravel, trace organics & sand, stiff, moist (CL) (Trace black mottles) 1.75 tsf Weathered Till			
	4				S1	
	5					Start Run 1257 — Run 2 (5-15') Rec/Run = 9'/10 = 90%
	6					
	7				Bag 2	
	8		Olive Brown to Brown Silty CLAY, little coarse sand & fine gravel, trace medium gravel, very stiff to hard, moist (CL) Diamicton Till			
	9			Rec 90%		
775.3	10					
	11					
	12				Bag 3	
	13					
	14					
	15				S2	1309

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT: McHenry Cty Wells — HOLE NO. 13 - NUNDA TWP

Hole No. 13 - NUNDA TWP

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 2 OF 11 SHEETS

1. PROJECT: McHenry Cty Wells
2. LOCATION (Coordinates or Station):
3. DRILLING AGENCY: WDC Exploration & Wells
4. HOLE NO. (As shown on drawing title and title number): 13-NUN
5. NAME OF DRILLER: DAN TONNANCOUR
6. DIRECTION OF HOLE: ☑ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 150'
8. DEPTH DRILLED INTO ROCK: 3'
9. TOTAL DEPTH OF HOLE: 153'
10. SIZE AND TYPE OF BIT: 3 7/8" Carbide Sampler & 5 7/8" Roto-Sonic Casing
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): NAVD 88
12. MANUFACTURERS DESIGNATION OF DRILL: Super Sonic II
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 20 / UNDISTURBED —
14. TOTAL NUMBER CORE BOXES: 0
15. ELEVATION GROUND WATER: 739.3' Deep 10/4
16. DATE HOLE: STARTED 10/9/08 COMPLETED 10/10/08
17. ELEVATION TOP OF HOLE: 785.3 Ft MSL
18. TOTAL CORE RECOVERY FOR BORING: 95%
19. SIGNATURE OF INSPECTOR: [signature] LPG IL

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	15		SAME AS ABOVE			RUN 3 (15-25')
	16		Grayish Brown Fine SAND, moderately dense, wet (SP)	Bag 4	S3	Rec/Run = 10'/10' = 100%
	17		Brownish Gray Sandy-Gravelly CLAY, little silt, very stiff with occassional med. dense spots, damp (GC/SC)	Rec 100% Bag 5	S4	
765.3	20					
	21					
	22		Gradational over 0.25'			
	23		Gray sandy Fine/med. GRAVEL, loose, moist to wet (GW)	Bag 6	S5	
stratigraphic contact	24		Abrupt Contact			Extract Samples
	25		Dark Pinkish Brown Silty CLAY, little coarse sand and fine to medium gravel, very hard, damp (CL)		S6	>4.5 tsf 1320
	26		(gravelly seams)		Bag 7	RUN 4 (25-35') 1330 Drive 4" Casing 1340 Rec/Run = 10/10 = 100%
	27		Tiskilwa Till	Rec 100%		
	28					Difficult Drilling
	29				Bag 8	
755.3	30					

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT: McHenry Cty Wells — HOLE NO. 13-Nunda Twp

Hole No. 13 - NUNDA TWP

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 3 OF 11 SHEETS

1. PROJECT: McHenry Cty Wells
2. LOCATION (Coordinates or Station):
3. DRILLING AGENCY: WOC Exploration & Wells
4. HOLE NO. (As shown on drawing title and title number): 13 - NUN
5. NAME OF DRILLER: DAN TONNANCOUR
6. DIRECTION OF HOLE: [x] VERTICAL [ ] INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 150'
8. DEPTH DRILLED INTO ROCK: 3'
9. TOTAL DEPTH OF HOLE: 153'
10. SIZE AND TYPE OF BIT: 3 7/8" Carbide Sampler & 5 7/8" Roto-Sonic Casing
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): NAVD 88
12. MANUFACTURERS DESIGNATION OF DRILL: Super Sonic II
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 20 UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES: 0
15. ELEVATION GROUND WATER: 739.3' Deep (10/14)
16. DATE HOLE: STARTED 10/9/08 COMPLETED 10/10/08
17. ELEVATION TOP OF HOLE: 785.3 FT MSL
18. TOTAL CORE RECOVERY FOR BORING: 95%
19. SIGNATURE OF INSPECTOR: Gary M. Brown EPG IL

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g	
755.3	30		cont.	Bag 8 cont.	cont.	Run 4 (25-35')	1342
	31		Very hard Silty CLAY till			cont.	Drive 6" Casing
	32			Bag 9	Rec 100%		1352
	33						
	34				S7	>4.5 tsf	Extract Samples 1357
	35					Run 5 (35-45')	Start 4" Sampler at 1403
	36			Bag 10		Rec/Run = 10'/10'	1413 at 45'
	37					4.5 tsf	6" CASING AT 45 @ 1423
	38						
	39			Bag 11	Rec 100%	4.5 tsf +	
745.3	40						
	41						
	42						
	43			Bag 12			Extract Samples @ 1433
	44						
	45				S8	4.5 tsf +	

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT: McHenry Cty Wells HOLE NO. 13 - NUNDA TWP

Hole No. 13 - NUNDA TWP

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 4 OF 11 SHEETS

1. PROJECT: McHenry Cty Wells
2. LOCATION (Coordinates or Station):
3. DRILLING AGENCY: WDC Exploration
4. HOLE NO. (As shown on drawing title and title number): 13-Nunda
5. NAME OF DRILLER: DAN TONNANCOUR
6. DIRECTION OF HOLE: ☑ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 150'
8. DEPTH DRILLED INTO ROCK: 3'
9. TOTAL DEPTH OF HOLE: 153'
10. SIZE AND TYPE OF BIT: 3 7/8" Carbide Sampler & 5 7/8" ROTO-SONIC CASING
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): NAVD 88
12. MANUFACTURERS DESIGNATION OF DRILL: Super Sonic II
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 20; UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES: 0
15. ELEVATION GROUND WATER: 739.3' Deep (10/14)
16. DATE HOLE: STARTED 10/9/08; COMPLETED 10/10/08
17. ELEVATION TOP OF HOLE: 785.3 FT MSL
18. TOTAL CORE RECOVERY FOR BORING: 95%
19. SIGNATURE OF INSPECTOR: Gary M Brown LPG IL

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	45		cont.			Run 6 (45-55')
	46		very hard silty CLAY till		Bag 13	Rec/Run = 10'/10' = 100%
	47		>4.5 tsf			
	48					
	49				Bag 14	
735.3	50		>4.5 tsf	Rec 100%		
	51					
	52				Bag 15	
	53		>4.5 tsf	Undisturbed 3.5' long sample!		
	54				59	
	55					65
	56		>4.5 tsf		Bag 16	Run 7 (55-63.5) Rec/Run = 8.5'/10' = 85%
	57			Rec 85%		cont. difficult drilling
	58					
	59				Bag 17	
725.3	60		>4.5 tsf			

1439 Start 4"
1448 @ 55'
Drive 6" Casing 1449 ↓ 1459
Extract Samples 1505
1517 Start 4" sampler
1529 @ 65'

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT: McHenry Cty Wells | HOLE NO. 13-NUNDA TWP

Hole No. 13-NUNDA TWP

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 5 OF 11 SHEETS

1. PROJECT McHenry Cty Wells	10. SIZE AND TYPE OF BIT 3 7/8" Carbide Sampler & 5 7/8" Roto-Sonic Casing
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) NAVD88
3. DRILLING AGENCY WOC Exploration & Wells	12. MANUFACTURERS DESIGNATION OF DRILL SuperSonic II
4. HOLE NO. (As shown on drawing title and title number) 13-Nunda	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 20; UNDISTURBED 0
5. NAME OF DRILLER DAN TONNAN COUR	14. TOTAL NUMBER CORE BOXES 0
6. DIRECTION OF HOLE ☑ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER 739.3 - Deep (10/14)
	16. DATE HOLE: STARTED 10/9/08; COMPLETED 10/10/08
	17. ELEVATION TOP OF HOLE 785.3 Ft MSL
7. THICKNESS OF OVERBURDEN 150'	18. TOTAL CORE RECOVERY FOR BORING 95%
8. DEPTH DRILLED INTO ROCK 3'	19. SIGNATURE OF INSPECTOR Gary McBride LPG IL
9. TOTAL DEPTH OF HOLE 153'	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
725.3	60		cont. Hard Till		17	RUN 7 (55-65) cont.
	61		>4.5+sf			
	62				Bag 18	Recovery 1.5 ft short because of cobble stuck in drill bit
	63		>4.5+sf		s10	1537 Extract Samples
	64			No Recovery 63.5-65'	NR	
	65				Bag 19	RUN 8 (65-75) 1545 Start Run
	66		>4.5+sf			Rec/Run = 10'/10' = 100%
	67					
	68				Bag 20	Note: Penetrometer barely makes intend at 4.5+ tons!
	69					
715.3	70		>4.5+sf	Rec 100%		Core recovery resembles concrete cylinders - very hard; rigid & up to 2 ft long pieces
	71					
	72		>4.5+sf			
	73				Bag 21	
	74		>4.5+sf			
	75				s11	1625 Extract

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT McHenry Twp Wells | HOLE NO. 13-NUNDA

Hole No. 13-NUNDA TWP

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 6 OF 11 SHEETS

1. PROJECT: McHenry Cty Wells
2. LOCATION (Coordinates or Station):
3. DRILLING AGENCY: WDC Exploration & Wells
4. HOLE NO. (As shown on drawing title and title number): 13-NUN
5. NAME OF DRILLER: DAN TONNANCOUR
6. DIRECTION OF HOLE: ☑ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 150'
8. DEPTH DRILLED INTO ROCK: 3'
9. TOTAL DEPTH OF HOLE: 153'
10. SIZE AND TYPE OF BIT: 3 7/8" Carbide Sampler & 5 7/8" Roto-Sonic Casing
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): NAVD 88
12. MANUFACTURERS DESIGNATION OF DRILL: Super Sonic II
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 20 UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES: 0
15. ELEVATION GROUND WATER: 739.3' (Deep 10/14)
16. DATE HOLE: STARTED 10/9/08 COMPLETED 10/10/08
17. ELEVATION TOP OF HOLE: 785.3 FT MSL
18. TOTAL CORE RECOVERY FOR BORING: 95%
19. SIGNATURE OF INSPECTOR: Gary M. Braun LPGIL

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	75				Bag 22	RUN 9 (75-85) Rec/Run = 10'/10' = 100%
	76		4.5 tsf			
	77					
	78				Bag 23	
	79		4.0 tsf	Rec 100%		
705.3	80					
	81				Bag 24	
	82		> 4.5 tsf			
	83				Bag 25	
	84				S12	
	85		> 4.5 tsf			
	86					RUN 10 (85-92)
	87		> 4.5 tsf		Bag 26	Rec/Run = 7'/7.0 = 100%
	88			Rec 100%		• Water level ~5.5' below ground surf. Suspect tight clay held drilling water overnight.
	89		> 4.5 tsf		Bag 27	
695.3	90					

1635

1700 End of Day 10/9

Drop rods 0741 start 4" Sampler 0751 at 92' Extract

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT: McHenry Cty Wells | HOLE NO. 13-NUNDA TWP

Hole No. 13-NUNDA Twp

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 7 OF 11 SHEETS

1. PROJECT: McHenry Cty Wells
2. LOCATION (Coordinates or Station):
3. DRILLING AGENCY: WOC Exploration & Wells
4. HOLE NO. (As shown on drawing title and title number): 13-NUN
5. NAME OF DRILLER: DAN TONNANCOUR
6. DIRECTION OF HOLE: ☑ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 150'
8. DEPTH DRILLED INTO ROCK: 3'
9. TOTAL DEPTH OF HOLE: 153'
10. SIZE AND TYPE OF BIT: 3 7/8" Carbide Sampler & 5 7/8" Dia Roto Sonic Casing
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): NAVD 88
12. MANUFACTURERS DESIGNATION OF DRILL: Super Sonic II
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 20; UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES: 0
15. ELEVATION GROUND WATER: 739.3' Deep (10/14)
16. DATE HOLE: STARTED 10/9/08; COMPLETED 10/10/08
17. ELEVATION TOP OF HOLE: 785.3 Ft MSL
18. TOTAL CORE RECOVERY FOR BORING: 95%
19. SIGNATURE OF INSPECTOR: Gary M. Brown LPG IL

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
695.3	90		cont.	cont. 100%	Bag 27 cont	Run 10 (85-92) cont. 4" sampler full Run 3' short of 10'
	91		Hard Till			
	92					Run 11 (92-95) Rec/Run = 3'/3' = 100%
	93			Rec 100%	Bag 28	0806 ↓ 4" 0809 Drive 6" Casing from 85 to 95' 0819 6" at 95' Extract Run 11 0826
	94		0.05' of wet fine gravel at base			
	94.5'		Brownish Gray Medium to Coarse SAND with fine to Medium Gravel, trace to little silt & Coarse to cobbles gravel, Moderately dense, wet (SW to SW/GW) PROGLACIAL OUTWASH			
	95				s13	Run 12 (95-105) Rec/Run = 10'/10' = 100%
	96				Bag 29	start 4" sampler 0832 0840 ↓ WATER TRUCK REFILL
	97					
	98					
	99			Rec. 100%	Bag 30	
685.3	100					
	101					
	102		> well sorted medium sand layer			
	103				Bag 31	
	104					Advance 6" Casing Extract Samples 1010
	105				s14	

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT: McHenry Cty Wells | HOLE NO. 13-NUNDA Twp

Hole No. 13 - NUNDA TWP

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 8 OF 11 SHEETS

1. PROJECT: McHenry Cty Wells
2. LOCATION (Coordinates or Station):
3. DRILLING AGENCY: WDC Exploration & Wells
4. HOLE NO. (As shown on drawing title and title number): 13 - NUNDA
5. NAME OF DRILLER: DAN TONNANCOUR
6. DIRECTION OF HOLE: ☑ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 150'
8. DEPTH DRILLED INTO ROCK: 3'
9. TOTAL DEPTH OF HOLE: 153'
10. SIZE AND TYPE OF BIT: 3 7/8" Carbide Sampler & 5 7/8" Casing RotoSonic
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): NAVD88
12. MANUFACTURERS DESIGNATION OF DRILL: SuperSonic II
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 20 UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES: 0
15. ELEVATION GROUND WATER: 739.3' Deep (10/14)
16. DATE HOLE: STARTED 10/9/08 COMPLETED 10/10/08
17. ELEVATION TOP OF HOLE: 785.3 Ft MSL
18. TOTAL CORE RECOVERY FOR BORING: 95%
19. SIGNATURE OF INSPECTOR: Gary M. Brown LPG IL

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	105		Fine to coarse GRAVEL		Bag 32	Run 13 (105-115) Rec/Run = 9.5'/10' = 95%
	106		Coarse SAND — Fining upward deposition sequence			
	107		Gray med. to coarse Sandy (M.-C.) GRAVEL (F.-C. gravel) trace cobbles, loose, wet (GW)			
	108				GRAIN SIZE SAMPLE (108-109)	
	109			Rec 95%	Bag 33	
675.3	110		PROGLACIAL OUTWASH		S15	
	111					
	112					
	113				Bag 34	
	114					
	115					Run 14 (115-125) Rec/Run = 10'/10' = 100%
	116		Dense lens w/ silt matrix		Bag 35	
	117					
	118		Medium SAND lens	Rec 100%	Bag 36	
	119					
665.3	120				S16	

107 ← Planned Screen Interval → 112

1020 Advance 4" Sampler 1022

1032 6" Casing Advanced to 115'

1043 Extract Samples

1100 4" Sampler 1105

Drive 6" Casing 1112 at 125'

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT: McHenry Cty Wells HOLE NO. 13-NUNDA

Hole No. 13-NUNDA Twp

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 9 OF 11 SHEETS

1. PROJECT: McHenry Cty Wells
2. LOCATION (Coordinates or Station):
3. DRILLING AGENCY: WOC Exploration & Wells
4. HOLE NO. (As shown on drawing title and title number): 13-NUN
5. NAME OF DRILLER: DAN TONNANCOUR
6. DIRECTION OF HOLE: ☑ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 150'
8. DEPTH DRILLED INTO ROCK: 3'
9. TOTAL DEPTH OF HOLE: 153'
10. SIZE AND TYPE OF BIT: 3 7/8" Carbide Sampler & 5 7/8" ROTOSONIC CASING
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): NAVD 88
12. MANUFACTURERS DESIGNATION OF DRILL: Super Sonic II
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 20 UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES: 0
15. ELEVATION GROUND WATER: 793.9' Deep (10/14)
16. DATE HOLE: STARTED 10/9/08 COMPLETED 10/10/08
17. ELEVATION TOP OF HOLE: 785.3 Ft MSL
18. TOTAL CORE RECOVERY FOR BORING: 95%
19. SIGNATURE OF INSPECTOR: LPG + L

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
665.3	120		cont. Sandy GRAVEL	Cont.	Bag 36	Run 14 (115-125) cont.
	121		Gray Silty CLAY to Clayey SILT, trace fine gravel, stiff to very stiff, (w/ dense pockets) damp (CL - CL/ML) Med. plasticity, but reduces w/ increasing silt content. • Distinguishable from overlying till b/c less gravel content. grades to silty CLAY primarily DIAMICTON (Till) (CL) over a ± 2 ft interval (125-127)	Rec 100%		
	122				Bag 37	3.5 tsf
	123					
	124				s17	3.5 tsf
	125					Run 15 (125-135) Rec/Run = 10'/10' = 100%
	126				Bag 38	
	127					4.5 tsf
	128					
	129			Rec 100%	Bag 39	
655.3	130					>4.5 tsf
	131					
	132					
	133				Bag 40	>4.5 tsf
	134				s18	
	135					

Extract Samples 1122, 1137, 4" Sampler 1144, 1204 Extract Samples

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT: McHenry Cty Wells | HOLE NO. 13-NUNDA Twp

Hole No. 13-NUNDA TWP

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 10 OF 11 SHEETS

1. PROJECT McHenry Cty Wells	10. SIZE AND TYPE OF BIT 3 7/8" Carbide Sampler & 5 7/8" Roto-Sonic Casing
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) NAVD 88
3. DRILLING AGENCY WDC Exploration & Wells	12. MANUFACTURERS DESIGNATION OF DRILL Super Sonic II
4. HOLE NO. (As shown on drawing title and title number) 13-NUN	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 20; UNDISTURBED 0
5. NAME OF DRILLER Dan Tonnancour	14. TOTAL NUMBER CORE BOXES 0
6. DIRECTION OF HOLE ☑ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER 739.3' Deep (10/14)
	16. DATE HOLE: STARTED 10/9/08; COMPLETED 10/10/08
7. THICKNESS OF OVERBURDEN 150'	17. ELEVATION TOP OF HOLE 785.3 Ft MSL
8. DEPTH DRILLED INTO ROCK 3'	18. TOTAL CORE RECOVERY FOR BORING 95%
9. TOTAL DEPTH OF HOLE 153'	19. SIGNATURE OF INSPECTOR Sam M. Brown LPG IL

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	135		Till cont.			Run 16 (135-145)
	136					Rec/Run = 7.5'/10' = 75%
	137				Bag 41	
	138			Rec 75%		
	139		4.5 tsf			
645.3	140					
	141					
	142		> 4.5 tsf		Bag 42	
	143					
	144		Silty Gravelly Zone both > 4.5 tsf; Large fractured Cobble or bedrock fragment		S19	
	145					Run 17 (145-150.5')
	146		(143.4 - 150) Gray Gravelly SILT, some sand, very hard, damp, ocassional granular layer, frequent dolomite clasts (GM)	145.8-146.2 GRAIN SIZE SAMPLE; Rec 73%		Rec./Run = 4'/5.5' = 73%
>4.5 tsf	147				Bag 43	Drill Chatter noticed (1332-BH) ~147-148 depth range (Caused by bedrock clasts & rounded cobbles)
wet sand & gravel seams	148				S20	
that are thin ≤0.05' in thickness	149					
635.3	150		HARDPAN (not Plastic)			

1301 → 4" sampler
1309 → Drive 6" Casing
1316
1326 Extract Samples
1336 start run → 4" sampler
1400

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT McHenry Cty Wells — HOLE NO. 13-NUNDA TWP

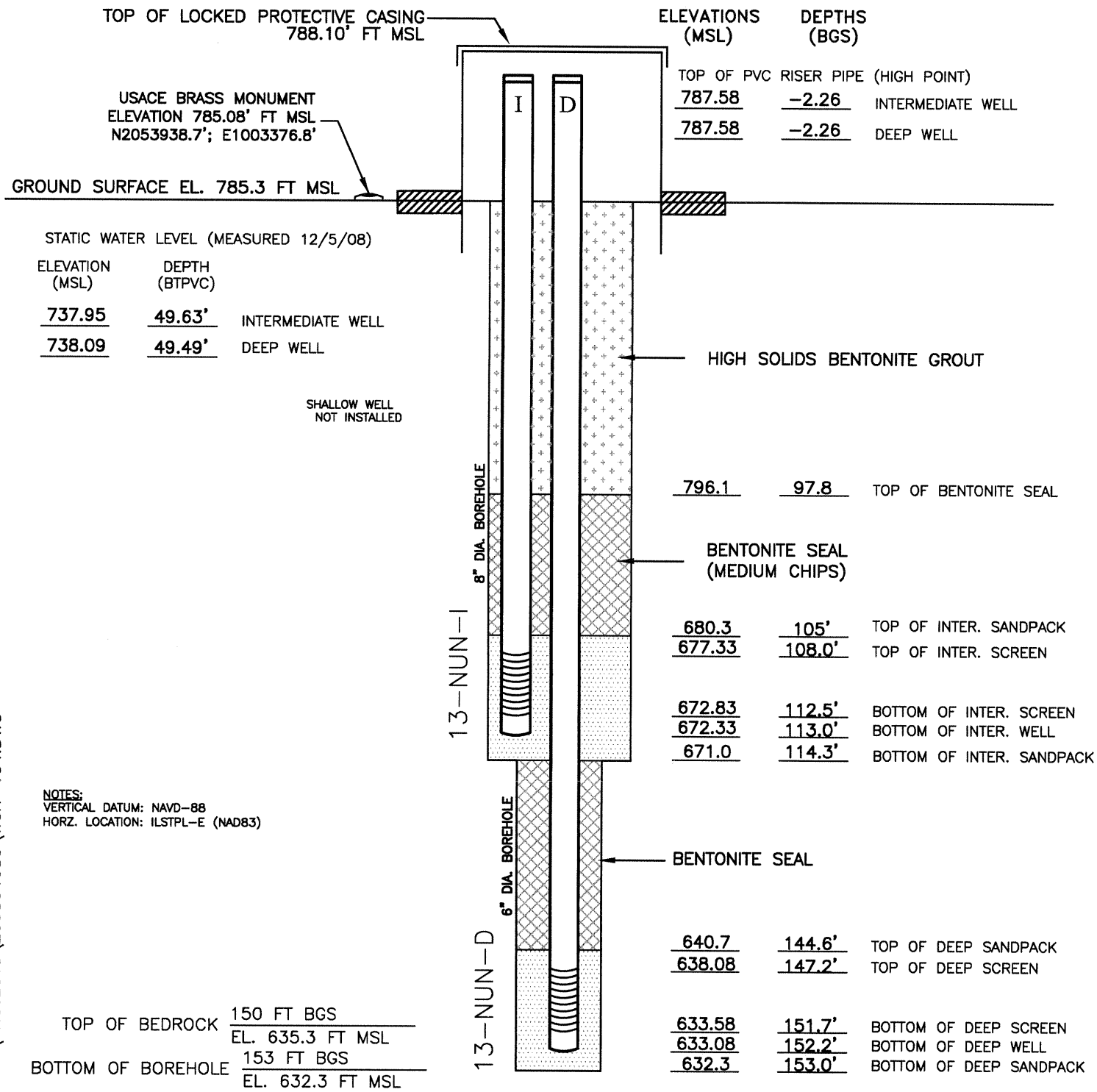
Hole No. 13 - NUNDA TWP

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 11 OF 11 SHEETS

1. PROJECT McHenry Cty Wells	10. SIZE AND TYPE OF BIT 3 7/8" Carbide Sampler & 5 7/8"
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) NAVD 88
3. DRILLING AGENCY WDC Exploration & Wells	12. MANUFACTURERS DESIGNATION OF DRILL Super Sonic II
4. HOLE NO. (As shown on drawing title and title number) 13-NUN	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN — DISTURBED 20 — UNDISTURBED 0
5. NAME OF DRILLER DAN TONNANCOUR	14. TOTAL NUMBER CORE BOXES 0
6. DIRECTION OF HOLE ☑ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.	15. ELEVATION GROUND WATER 739.3' Deep (10/14)
	16. DATE HOLE — STARTED 10/9/08 — COMPLETED 10/10/08
	17. ELEVATION TOP OF HOLE 785.3 Ft MSL
7. THICKNESS OF OVERBURDEN 150'	18. TOTAL CORE RECOVERY FOR BORING 95%
8. DEPTH DRILLED INTO ROCK 3'	19. SIGNATURE OF INSPECTOR Gary M. Brown LPG IL
9. TOTAL DEPTH OF HOLE 153'	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g	
635.3	150		DOLOMITIC BEDROCK, gray, fine grained, mod. hard, trace faint blue discoloration, few vugs			END RUN 17 AT 150.5	
	151			REC 100%	Bag 44	RUN 18 (150.5-153) REC/RUN = 2.5'/2.5' = 100% 10/13/08 WL = 42.6' bgs Open Borehole Rdg	1426
	152						
632.3	153		END OF BOREHOLE 10/10/08			1500	1436
	154						
	155						
	156						
	157						
	158						
	159						
	160						
	161						
	162						
	163						
	164						
	165						

PROJECT McHENRY COUNTY OBSERVATION WELL NETWORK INSTALLATION (#09000-460)	WELL NO. 13-NUN-I & 13-NUN-D
LOCATION NUNDA TOWNSHIP – McHENRY COUNTY, ILLINOIS	
CLIENT U.S. ARMY CORPS OF ENGINEERS / McHENRY COUNTY	
GEOLOGIST GARY BRAUN, P.G. (AECOM)	INSTALLATION DATE OCT. 10, 2008
DRILLER WDC EXPLORATION AND WELLS, INC. (DAN TONNANCOUR)	DRILLING METHOD ROTO-SONIC



NOT TO SCALE

WELL CONSTRUCTION MATERIALS*

PROTECTIVE CASING	5' L X 8" DIA. ALUMINUM CASING W/ LOCKING CAP
RISER PIPE ABOVE W.T.	SCHEDULE 40 PVC (2.07" I.D./ 2.38" O.D.)
RISER PIPE BELOW W.T.	SCHEDULE 40 PVC (2.07" I.D./ 2.38" O.D.)
SCREEN	2" I.D. SCHEDULE 40 PVC W/ 0.010" SCREEN SLOT SIZE
TYPE OF BENTONITE SEAL	BLACK HILLS BENTONITE – 3/8" CHIPS (HOLE PLUG)
TYPE OF SAND PACK	R.W. SIDLEY CO. – NO. 5 FILTER PACK SAND

CASING MEASUREMENTS

BOTTOM OF SCREEN TO END CAP (FT)*	0.50
SCREEN LENGTH (1ST SLOT TO LAST SLOT) (FT)*	4.50
TOTAL LENGTH OF CASING (FT): INTERMEDIATE WELL	115.25
DEEP WELL	154.50

* MEASUREMENT REFERS TO ALL WELLS

USMWK2FP001\05CAD\PROJECTS\200804080\WCR-V04.DWG

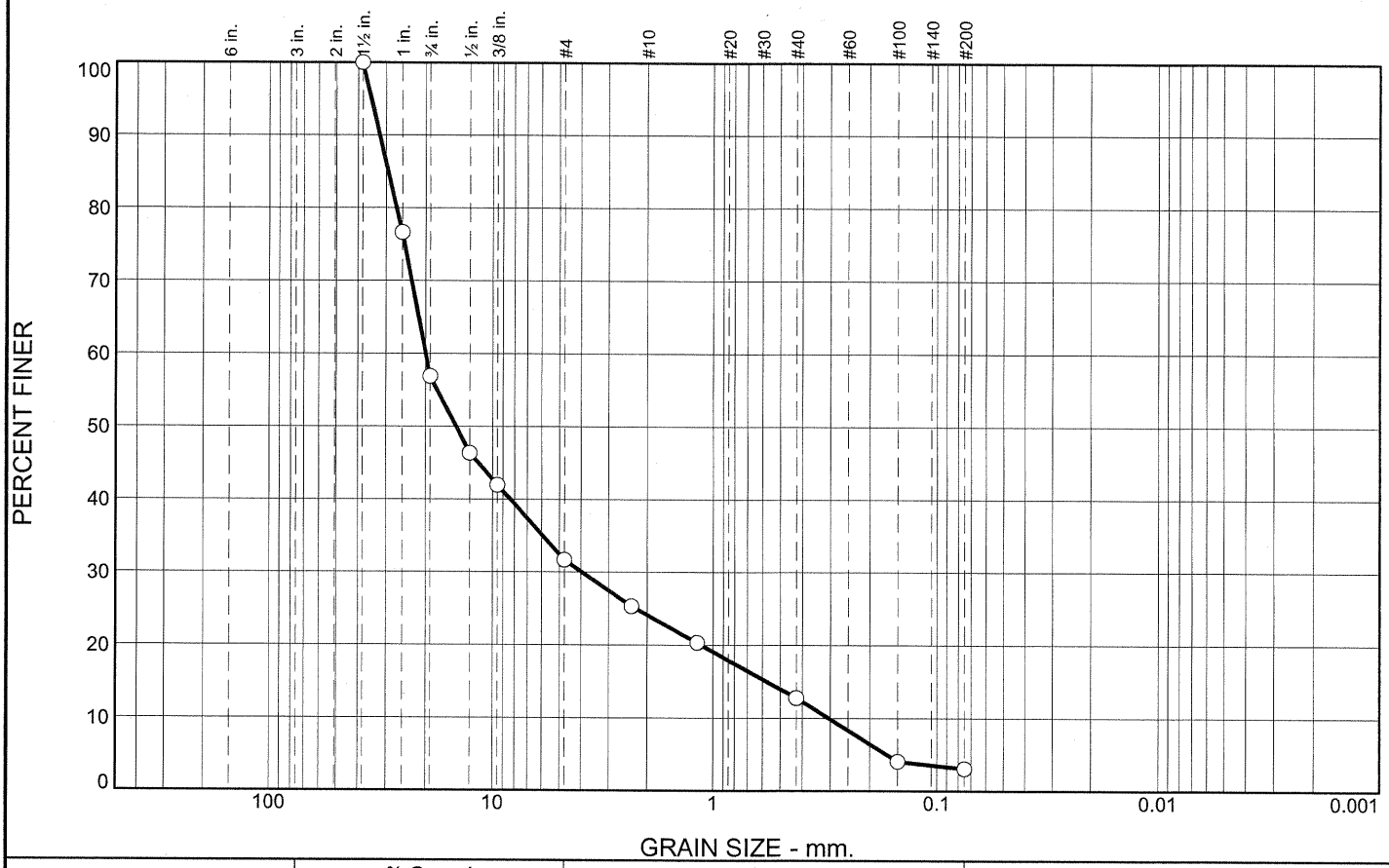
WELL SITE DATA SUMMARY AND COMMENTARY

Well Site #13 – Nunda Township
Stickney Run Park (north entrance) on State Park Rd.

The Nunda Township well site is located close to the Fox River, which acts the regional discharge for the quaternary aquifers. As a result, groundwater elevations in the well are the lowest observed among the new observation wells. Discharge conditions are suggested by the slight upward gradients observed between the shallow and deep wells. Similar to the McHenry Township site located at Harrison-Benwell Park, the Nunda site also consisted of very hard till. The difficult drilling at the two sites is believed to be related to similar depositional environments of the Tiskwila Till. However, a shallow well was installed in McHenry, whereas the surficial aquifer at the Nunda site was not instrumented with a monitoring well. Had been installed, Nunda shallow well would have been targeted for sand and/or gravel deposits between 16 and 24 feet below grade. Instead, an intermediate and a deep well were installed. The intermediate well was installed within a relatively coarse sand and gravel aquifer that was 26 feet thick (between 95 and 121 ft bgs). The deep well was installed at the bedrock interface. Limited granular units were found overlying the bedrock surface.

Well Site Testing Results

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	43.1	25.2	7.6	11.3	9.7	3.1	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.5	100.0		
1	76.7		
.75	56.9		
.5	46.3		
.375	42.0		
#4	31.7		
#8	25.3		
#16	20.3		
#40	12.8		
#100	4.1		
#200	3.1		

* (no specification provided)

Material Description

F-C Gravel Some F-C Sand Trace Silt

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 32.0230 D_{85}= 29.3583 D_{60}= 19.9301
D_{50}= 14.6172 D_{30}= 3.9438 D_{15}= 0.5726
D_{10}= 0.3044 C_u= 65.48 C_c= 2.56

Classification

USCS= GW AASHTO=

Remarks

Source of Sample: 13-Nun-S **Depth:** 108.0-109.0

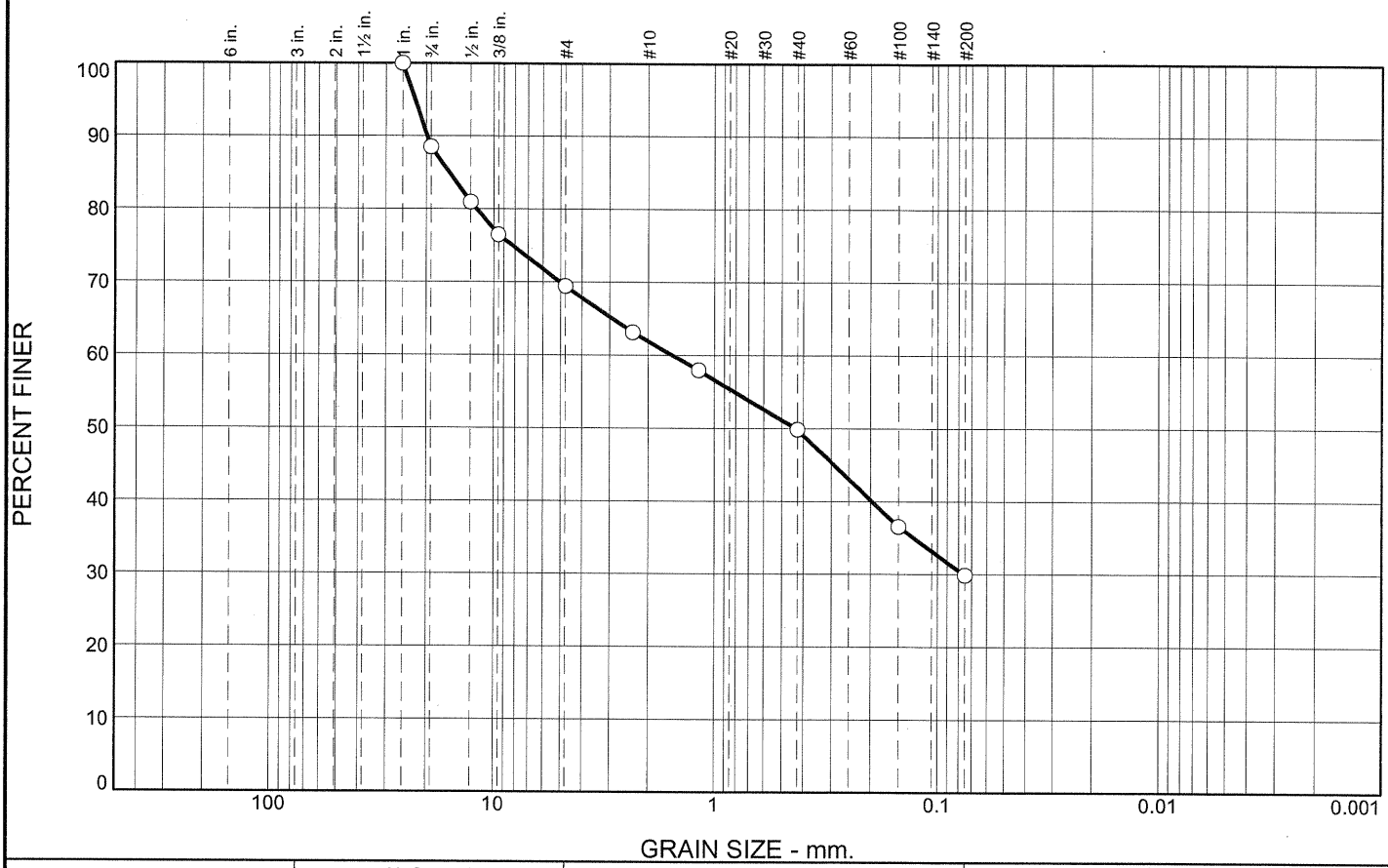
Date: 12/05/08

STS AECOM

Client: USACE
Project: McHenry County Wells
Project No: 200804080 **Figure**

Tested By: JRT

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	11.5	19.1	7.5	12.1	19.9	29.9	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1	100.0		
.75	88.5		
.5	80.9		
.375	76.5		
#4	69.4		
#8	63.1		
#16	58.0		
#40	49.8		
#100	36.5		
#200	29.9		

* (no specification provided)

Material Description

F-C Sand and Gravel Some Silt

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D_{90}= 19.7734 D_{85}= 15.7860 D_{60}= 1.5501
D_{50}= 0.4334 D_{30}= 0.0760 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO= A-2-4(0)

Remarks

Source of Sample: 13-Nun-D **Depth:** 145.8-146.2

Date: 12/05/08

STS | AECOM

Client: USACE
Project: McHenry County Wells
Project No: 200804080 **Figure**

Tested By: JRT

Groundwater Level Measurements

McHenry County Monitoring Well Installations
AECOM Project 09000-460

Site Number	13			
Township Name	Nunda			
Well Number	13-NUN-I		13-NUN-D	
Ground Surface Elevation (ft msl)	785.32		785.32	
Top of PVC Casing Elevation (ft)	787.58		787.58	
Location of PVC Casing within Wellhead	NW Well		SE Well	
Well Depth (Feet from TOC)[A]	115.25		154.50	
Date	Depth to GW from TOC (ft)	GW Elevation (ft msl)	Depth to GW from TOC (ft)	GW Elevation (ft msl)
Sep. 26, 2008				
Oct. 09, 2008				
Oct. 14, 2008	48.5	739.08	48.29	739.29
Oct. 16, 2008				
Oct. 21, 2008				
Oct. 22, 2008				
Oct. 24, 2008				
Oct. 28, 2008				
Oct. 29, 2008				
Oct. 30, 2008				
Nov. 07, 2008				
Nov. 13, 2008				
Dec. 05, 2008	49.63	737.95	49.49	738.09
Dec. 08, 2008				
Dec. 09, 2008				
Dec. 12, 2008				
Dec. 15, 2008				
Dec. 16, 2008				
Dec. 17, 2008				
Dec. 18, 2008				
Dec. 19, 2008				
Dec. 22, 2008				
Dec. 23, 2008				
Dec. 29, 2008	48.19	739.39		
Dec. 30, 2008			47.48	740.10
Jan. 05, 2009				
Jan. 06, 2009				
Jan. 07, 2009				
Jan. 08, 2009				
Jan. 09, 2009				
Jan. 10, 2009	47.99	739.59	48.06	739.52
Jan. 12, 2009				
Feb. 24, 2009	49.2	738.38	48.97	738.61
Mar. 20, 2009				
end				

Notes:

ft msl = Elevation referenced to feet above mea

TOC = Top of PVC Casing

ft = feet

[A] = as measured inside well

NI = Not Installed

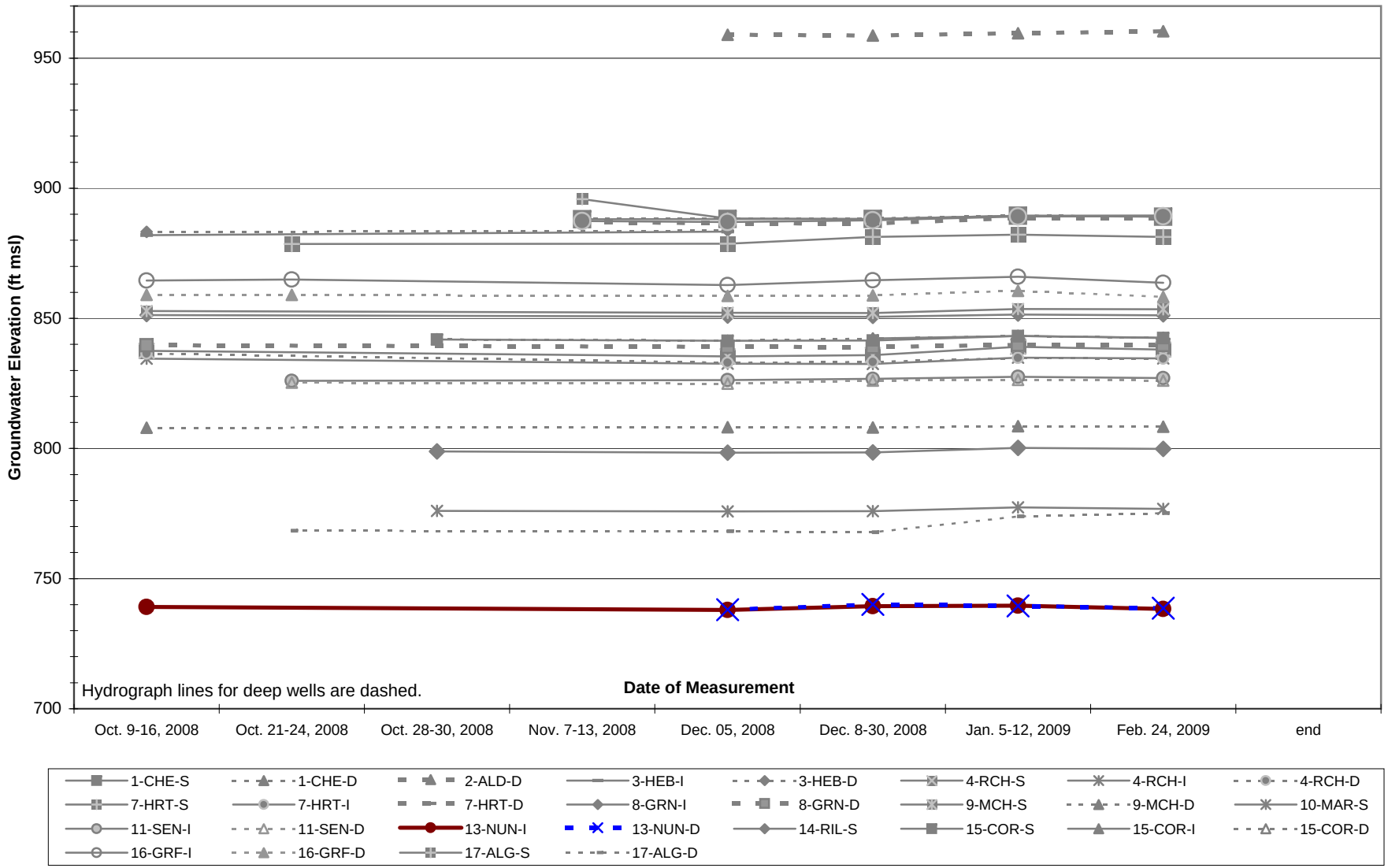
--- No Elevation

Well 17-Alg-S was frozen or partially frozen fror

Site 13 Groundwater Level Hydrograph
(includes ALL AECOM INSTALLED WELLS)

McHenry County Obervation Well Network

AECOM Project 09000-460

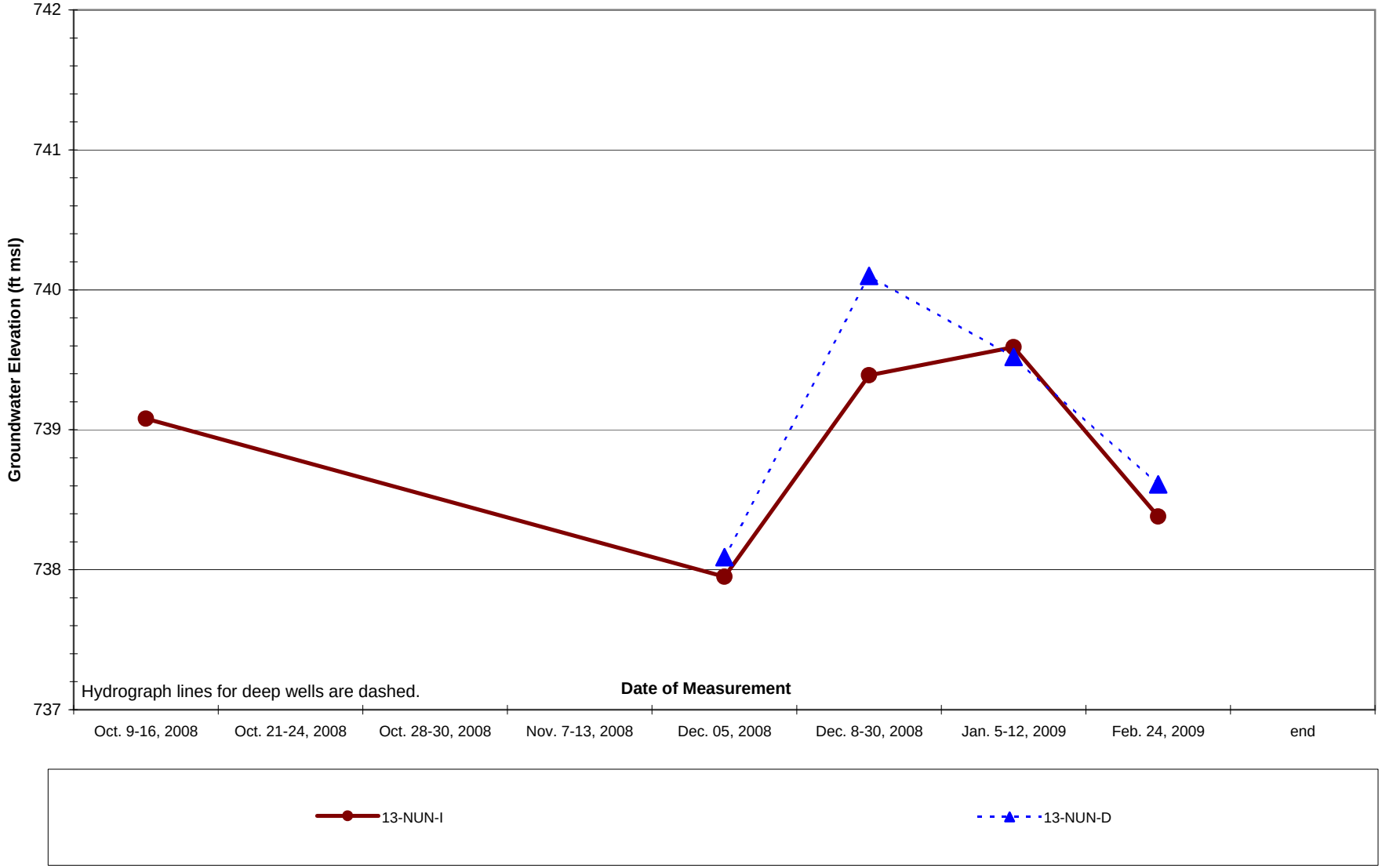


K:\PROJECTS\200804080\In_Progress\STS-McHenry Cty_WLs IN PROGRESS - figs for each site.xls

Site 13 Groundwater Level Hydrograph

McHenry County Obervation Well Network

AECOM Project 09000-460



K:\PROJECTS\200804080\In_Progress\STS-McHenry Cty_WLs IN PROGRESS - figs for each site.xls

Well Development Record

STS Consultants, Ltd.
11425 West Lake Park Drive
Milwaukee, Wisconsin 53224

Site Name: McHenry County Well ID Number: 13-NW-I

Date of Completion: 12/29/08 STS Job Number: 20080408O

Start Time: 15:10 End Time: 16:50

Water color at start of development: Brown Water color at end of development: CLEAR

Amount of water removed during development: _____

Contained water? ☐ Yes ☒ No

If not contained, where water disposed? Ground

Well Development Methods:

- ☐ Surged with bailer and bailed
- ☐ Surged with block and bailed
- ☐ Surged with block, bailed & pumped
- ☐ Bailed only
- ☐ Pumped slowly
- ☐ Surged with bailer and pumped
- ☐ Surged with block and pumped
- ☐ Compressed Air
- ☒ Pumped only
- ☐ Other _____

Equipment Used

- ☐ PVC bailer
- ☐ Well wizard
- ☐ Bean or Moino pump (on drill rig)
- ☐ Surge block
- ☐ Whale pumps
- ☒ WATERRA Pump w/ Block

Notes: Purge St: 15:10

End: 16:50

WL St: 48.19

End: 49.40

WELL DEVELOPMENT FIELD RECORD

Job Name: McHenry County Job No. 200804080 Well No. 13-NUN-I

Developed By: Brian Schmidt Date of Install. _____ Sheet ____ of ____

Started Devel. 12/29/08 / _____ (DATE / TIME) Completed Devel. 12/29/08 / _____ (DATE / TIME)

W.L. Before Devel. _____ / _____ / _____ (DATE / TIME / DEPTH) After Devel. _____ / _____ / _____ (DATE / TIME / DEPTH)

Well Depth: Before Devel. _____ After Devel. _____ Well Dia. (in.) _____

Standing Water Column (ft.) _____ Standing Well Volume _____ gal.

Screen Length 5' Drilling Water Loss _____ gal.

DATE / TIME	VOLUME REMOVED (Gallons)	FIELD PARAMETERS SPEC. COND. (umhos/cm)	TEMP. (C°)	pH (s.u.)	TURB ~~Other~~	ORP	REMARKS
12/29/08 1530	1 GAL/MIN	653	10.2	7.61	999	—	
1550	"	598	9.3	7.32	999	—	
1610	"	598	9.4	7.27	999	—	
1630	"	590	9.1	7.35	368	—	
1640	"	589	9.5	7.30	268	—	
1650	"	588	9.3	7.37	199	—	
		= TOTAL VOLUME REMOVED (Gallons)					

Development Method: _____

Notes:

Well Development Record

STS Consultants, Ltd.
11425 West Lake Park Drive
Milwaukee, Wisconsin 53224

Site Name: McHenry County

Well ID Number: 13-NVN-D

Date of Completion: 12/30/08

STS Job Number: 200804080

Start Time: 10:55

End Time: 12:50

Water color at start of development: Brown

Water color at end of development: Milky Clear

Amount of water removed during development:

Contained water? ☐ Yes ☒ No

If not contained, where water disposed? Ground

Well Development Methods:

- ☐ Surged with bailer and bailed
- ☐ Surged with block and bailed
- ☐ Surged with block, bailed & pumped
- ☐ Bailed only
- ☐ Pumped slowly
- ☐ Surged with bailer and pumped
- ☐ Surged with block and pumped
- ☐ Compressed Air
- ☒ Pumped only
- ☐ Other

Equipment Used

- ☐ PVC bailer
- ☐ Well wizard
- ☐ Bean or Moino pump (on drill rig)
- ☐ Surge block
- ☐ Whale pumps
- ☒ Waterra Pump w/ Block

Notes: Purge Start: 10:55

Purge End: 12:50

WL St: 47.48'

WL End: 50.90

WELL DEVELOPMENT FIELD RECORD

Job Name McHenry County Job No. 20080480 Well No. 13-NJ-D

Developed By Brian Schmidt Date of Install. _____ Sheet ____ of ____

Started Devel. 12/30/08 / DATE / TIME Completed Devel. 12/30/08 / DATE / TIME

W.L. Before Devel. ____ / DATE / TIME / DEPTH After Devel. ____ / DATE / TIME / DEPTH

Well Depth: Before Devel. _____ After Devel. _____ Well Dia. (in.) _____

Standing Water Column (ft.) _____ Standing Well Volume _____ gal.

Screen Length 5' Drilling Water Loss _____ gal.

DATE / TIME	VOLUME REMOVED (Gallons)	FIELD PARAMETERS SPEC. COND. (umhos/cm)	TEMP. (C°)	pH (s.u.)	TURB ~~Other~~	ORP	REMARKS
12/30/08 CAL	–	4540	9.2	3.96	0	–	
1110	1 GAL/MIN	1120	9.3	5.42	988	–	
1130	"	771	9.7	7.01	999	–	
1150	"	727	9.5	7.23	999	–	
1210	"	729	9.7	7.29	714	–	
1230	"	710	9.6	7.29	442	–	
1250	"	708	9.3	7.30	350	–	
		= TOTAL VOLUME REMOVED (Gallons)					

Development Method: _____

Notes:

First Environmental Laboratories, Inc.
IL ELAP / NELAC Accreditation # 100292
1600 Shore Road • Naperville, Illinois 60563 • Phone (630) 778-1200 • Fax (630) 778-1233

Analytical Report

Client: STS CONSULTANTS (VERN)
Project ID: McHenry County 200804080
Sample ID: 13-NUN-I
Sample No: 9-0115-007

Date Collected: 01/10/09
Time Collected: 13:50
Date Received: 01/13/09
Date Reported: 01/20/09

Analyte		Result	R.L.	Units	Flags
Total Metals	**Method: 6020A**		**Preparation Method 3010A**		
Analysis Date: 01/16/09			Preparation Date: 01/15/09		
Calcium		75.8	0.1	mg/L	
Iron		3.37	0.01	mg/L	
Magnesium		45.9	0.1	mg/L	
Potassium		4.8	0.1	mg/L	
Sodium		37.9	0.1	mg/L	
Alkalinity, Bicarbonate (CaCO3)	**Method: 2320B**				
Analysis Date: 01/15/09 13:30					
Alkalinity, Bicarbonate (CaCO3)		350	5	mg/L	
Alkalinity, Carbonate (CaCO3)	**Method: 2320B**				
Analysis Date: 01/15/09 13:30					
Alkalinity, Carbonate (CaCO3)		< 5	5	mg/L	
Chloride	**Method: 4500Cl, E**				
Analysis Date: 01/14/09					
Chloride		28	5	mg/L	
Sulfate	**Method: 375.2R2.0**				
Analysis Date: 01/15/09					
Sulfate		39	15	mg/L	

First Environmental Laboratories, Inc.

IL ELAP / NELAC Accreditation # 100292

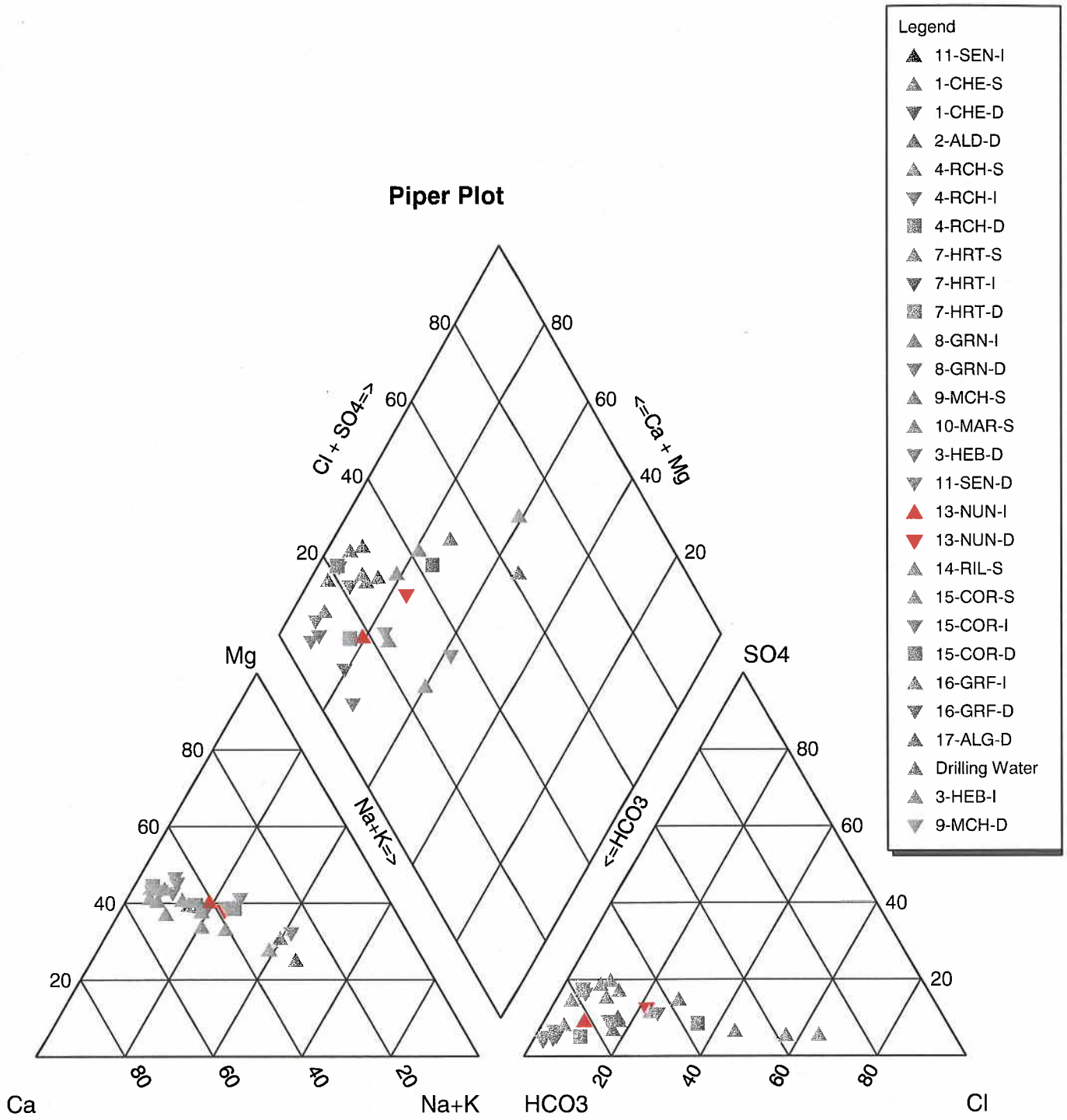
1600 Shore Road • Naperville, Illinois 60563 • Phone (630) 778-1200 • Fax (630) 778-1233

Analytical Report

Client: AECOM ENVIRONMENT
Project ID: McHenry County 200804080
Sample ID: 13-NUN-D
Sample No: 9-0115-001

Date Collected: 01/12/09
Time Collected: 15:45
Date Received: 01/13/09
Date Reported: 01/20/09

Analyte		Result	R.L.	Units	Flags
Total Metals	**Method: 6020A**		**Preparation Method 3010A**		
Analysis Date: 01/16/09			Preparation Date: 01/15/09		
Calcium		81.4	0.1	mg/L	
Iron		0.38	0.01	mg/L	
Magnesium		49.3	0.1	mg/L	
Potassium		2.2	0.1	mg/L	
Sodium		56.2	0.1	mg/L	
Alkalinity, Bicarbonate (CaCO3)	**Method: 2320B**				
Analysis Date: 01/15/09 13:30					
Alkalinity, Bicarbonate (CaCO3)		360	5	mg/L	
Alkalinity, Carbonate (CaCO3)	**Method: 2320B**				
Analysis Date: 01/15/09 13:30					
Alkalinity, Carbonate (CaCO3)		< 5	5	mg/L	
Chloride	**Method: 4500Cl, E**				
Analysis Date: 01/14/09					
Chloride		84	5	mg/L	
Sulfate	**Method: 375.2R2.0**				
Analysis Date: 01/15/09					
Sulfate		66	15	mg/L	



DESCRIPTION: Piper Linear Diagram - Well Site #13

AECOM	PROJECT: McHenry County	PROJECT NO: 09000460
	CLIENT: Army Corps of Engineers	DATE: 7/30/2009

Field Well Sampling Sheet

Fill out the entire form. If it does not apply, mark N/A.

Project Name: McHenry County
STS Job No. 200804080
Location: Nunda
Tester: Brian Schmidt
Well Number: 13-NUN-I
Date Sampled: 1/10/09
Previous Well Sampled: 11-SEN-D

GENERAL CONDITIONS:

						If Missing Replaced?
Surface Seal:	✓ Ok	☐ Damaged	☐	Missing:	Yes	No
Protector Pipe:	✓ Ok	☐ Damaged	☐	Missing:	Yes	No
Well Cap:	✓ Ok	☐ Damaged	☐	Missing:	Yes	No
Ambient Temperature: 25 °F		☐ Clear ☒ Cloudy	☐	Rain		

WELL DATA:

Measuring Device: Solinist Water Level Meter
Stick Up or Down: Up
Depth to Water: 47.99 (from Ground Surface)
Depth to Bottom: 112 (from TPVC)
Length of Water: (from TPVC)
Free Product Observed: ☐ Yes ☒ No Thickness: N/A

PURGING/SAMPLING:

Well Purging Calculations: Amount to purge = 0.163 gallons/foot times height of water column in feet for one well volume

Purging Device: Bladder Pump
Sampling Device: Bladder Pump
Volume Required:
☒ See back of page for field readings during purge
Volume Purged:
Could Well Bail Dry? ☐ Yes ☒ No
Purging - Time Start: 1250
Time Ended: 1355
Decon Method: Alconox

IN-SITU TESTING:

Turbidity: ☐ Turbid ☐ Opaque
Odor:
Color
pH @ degrees C
Uncorrected Conductivity X
Water Temp. (from Cond.)

SAMPLES COLLECTED

Vocs -	☐	Cyanide	☐
Metals -	☐	Hexchrome	☐
SVOC	☐	Alkalinity	☐
TOC	☐	Chloride	☐
Sulfide	☐	Ammonia	☐
Phenolics	☐	COD	☐

Comments: Line failure from 1130-1250
ST: 1350

Well Purging Log

Date 1/10/09

Time	Temp	pH	Conductivity	~~ORP~~ TURB	~~DO~~ RATE
1/10/09 CAL	8.3	3.97	4560	0	—
1305	5.4	6.18	1000	999	250 ml/min
1310	8.1	6.54	970	999	"
1315	9.6	6.96	970	940	"
1320	8.9	7.08	960	609	"
1325	8.5	7.31	930	355	"
1330	8.4	7.38	910	271	"
1335	8.5	7.47	868	188	"
1340	8.3	7.45	866	185	"
1345	8.4	7.52	853	156	"
1350	8.7	7.54	852	139	"
ST:	1350				

Field Well Sampling Sheet

Fill out the entire form. If it does not apply, mark N/A.

Project Name: McHenry County
STS Job No. 20080408 0
Location: Nunda
Tester: Brian Schmidt
Well Number: 13-NUN-O
Date Sampled: 1/10/09 + 1/12/09
Previous Well Sampled: 13-NUN-I

GENERAL CONDITIONS:

						If Missing Replaced?
Surface Seal:	X Ok		Damaged		Missing:	Yes No
Protector Pipe:	X Ok		Damaged		Missing:	Yes No
Well Cap:	X Ok		Damaged		Missing:	Yes No
Ambient Temperature: 25 °F			Clear	X Cloudy	Rain	

WELL DATA:

Measuring Device: Solinist Water Level Meter
Stick Up or Down: Up (from Ground Surface)
Depth to Water: 48.06 (from TPVC)
Depth to Bottom: 152 (from TPVC)
Length of Water:
Free Product Observed: [ ] Yes [X] No Thickness: N/A

PURGING/SAMPLING:

Well Purging Calculations: Amount to purge = 0.163 gallons/foot times height of water column in feet for one well volume

Purging Device: Bladder Pump
Sampling Device: Bladder Pump
Volume Required:
[X] See back of page for field readings during purge
Volume Purged:
Could Well Bail Dry? [ ] Yes [X] No
Purging - Time Start: 1400
Time Ended:
Decon Method: Alconox

IN-SITU TESTING:

Turbidity: [ ] Turbid [ ] Opaque
Odor:
Color
pH @ degrees C
Uncorrected Conductivity X
Water Temp. (from Cond.)
Comments: ST: 1545

SAMPLES COLLECTED

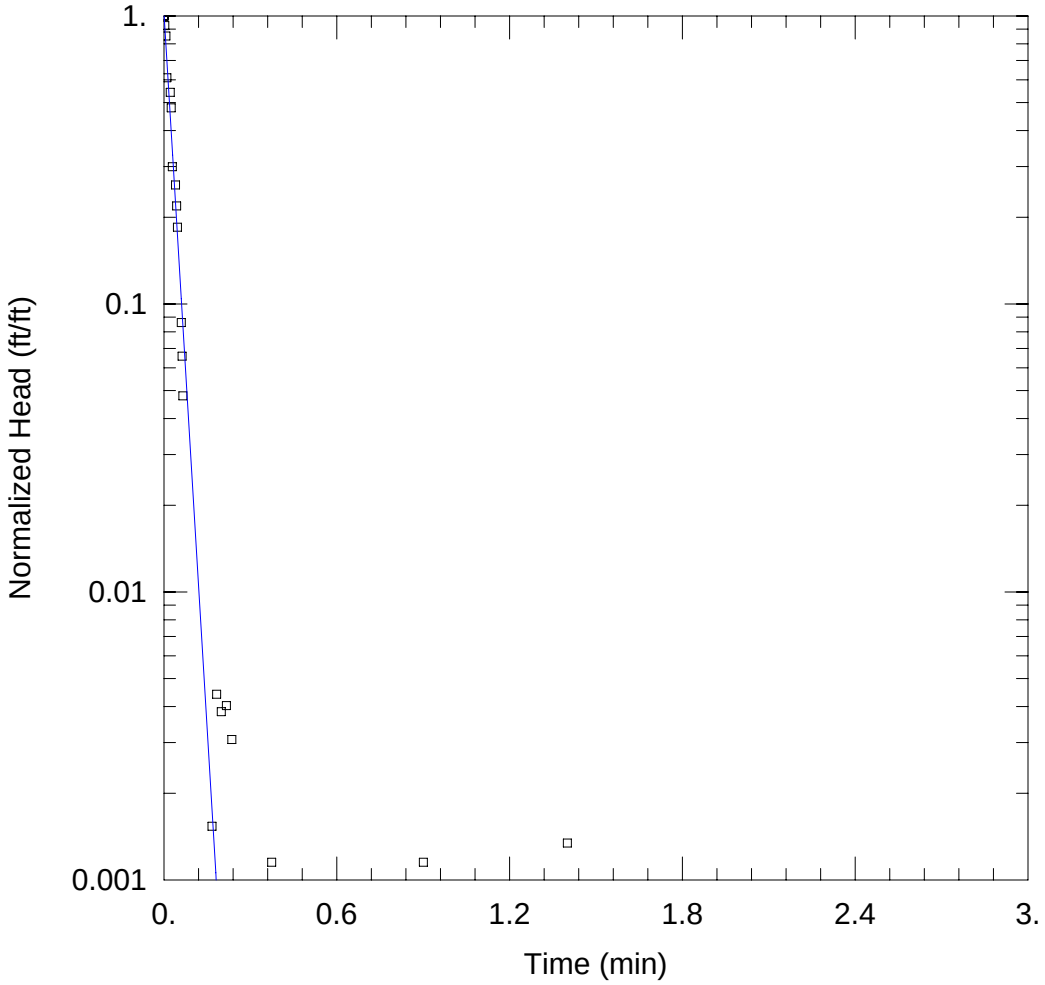
Vocs -		Cyanide	
Metals -		Hexchrome	
SVOC		Alkalinity	
TOC		Chloride	
Sulfide		Ammonia	
Phenolics		COD	

Line Pressure Problems @ 152' Pulled Pump To ~100' To Pump

Well Purging Log

Date 1/10/09 - 1/12/09

Time	Temp	pH	Conductivity	~~ORP~~ TURB	~~DO~~ RATE
1/10/09 1455	5.0	7.64	1270	999	250 mL/min
1500	4.7	7.64	1230	999	"
SAMPLING STOPPED AIR COMPRESSOR BLOWN					
RESTART ON 1/12/09 @ 1430					
1505	9.9	7.72	1140	8	250 mL/min
1530	8.3	7.66	1130	9	"
1535	8.6	7.67	1130	8	"
1540	8.6	7.67	1120	7	"
1545	8.6	7.67	1120	7	"
ST: 1545					



WELL TEST ANALYSIS

Data Set: C:\...\13-NUN-I_001_B&R.aqt
Date: 04/07/09 Time: 11:44:18

PROJECT INFORMATION

Company: AECOM
Client: USACE / McHenry Cty
Project: 09000-460 (h200804080)
Location: McHenry County, IL
Test Date: Feb. 22, 2009

AQUIFER DATA

Saturated Thickness: 26.5 ft
Anisotropy Ratio (Kz/Kr): 0.33

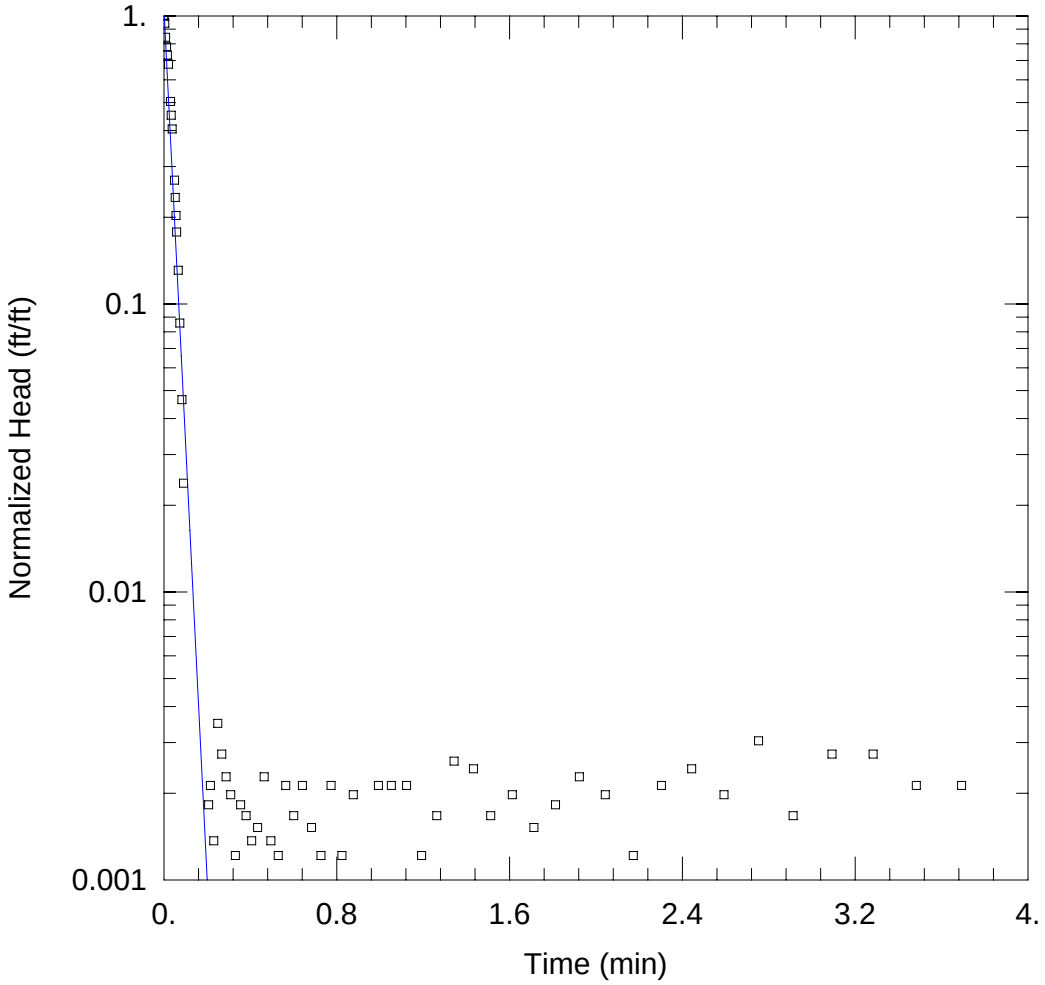
WELL DATA (13-NUN-I)

Initial Displacement: 5.21 ft
Total Well Penetration Depth: 18. ft
Casing Radius: 0.083 ft
Static Water Column Height: 65.6 ft
Screen Length: 4.5 ft
Well Radius: 0.25 ft
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 0.04135 cm/sec
y0 = 5.394 ft



WELL TEST ANALYSIS

Data Set: C:\...\13-NUN-I_002_B&R.aqt
Date: 04/07/09 Time: 11:43:55

PROJECT INFORMATION

Company: AECOM
Client: USACE / McHenry Cty
Project: 09000-460 (h200804080)
Location: McHenry County, IL
Test Date: Feb. 22, 2009

AQUIFER DATA

Saturated Thickness: 26.5 ft
Anisotropy Ratio (Kz/Kr): 0.33

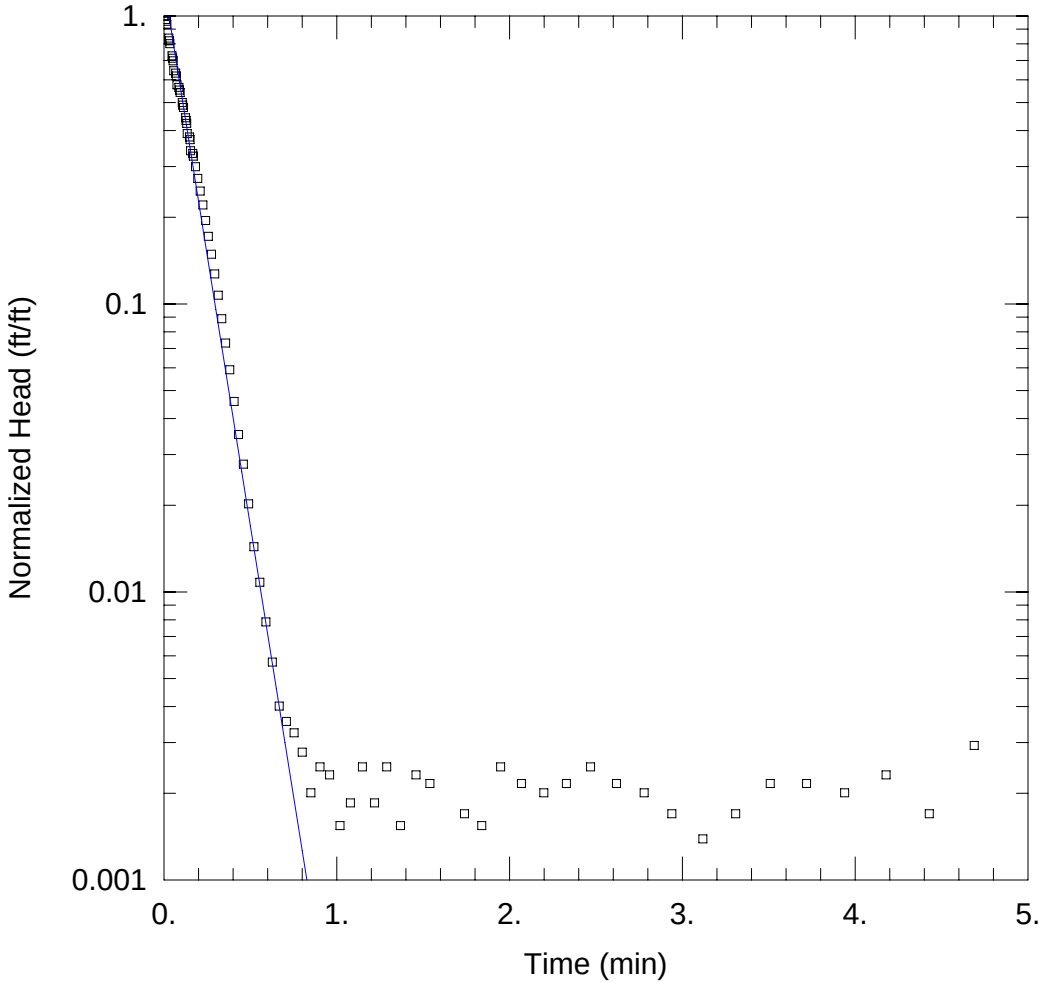
WELL DATA (13-NUN-I)

Initial Displacement: 6.58 ft
Total Well Penetration Depth: 18. ft
Casing Radius: 0.083 ft
Static Water Column Height: 65.6 ft
Screen Length: 4.5 ft
Well Radius: 0.25 ft
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 0.03773 cm/sec
y0 = 7.074 ft



WELL TEST ANALYSIS

Data Set: K:\PROJECTS\200804080\In_Progress\Troll-files\AQTESOLV-files\13-NUN-D_001_B&R.aqt
Date: 04/05/09 Time: 11:13:41

PROJECT INFORMATION

Company: AECOM
Client: USACE / McHenry Cty
Project: 09000-460 (h200804080)
Location: McHenry County, IL
Test Date: Feb. 22, 2009

AQUIFER DATA

Saturated Thickness: 8. ft
Anisotropy Ratio (Kz/Kr): 0.33

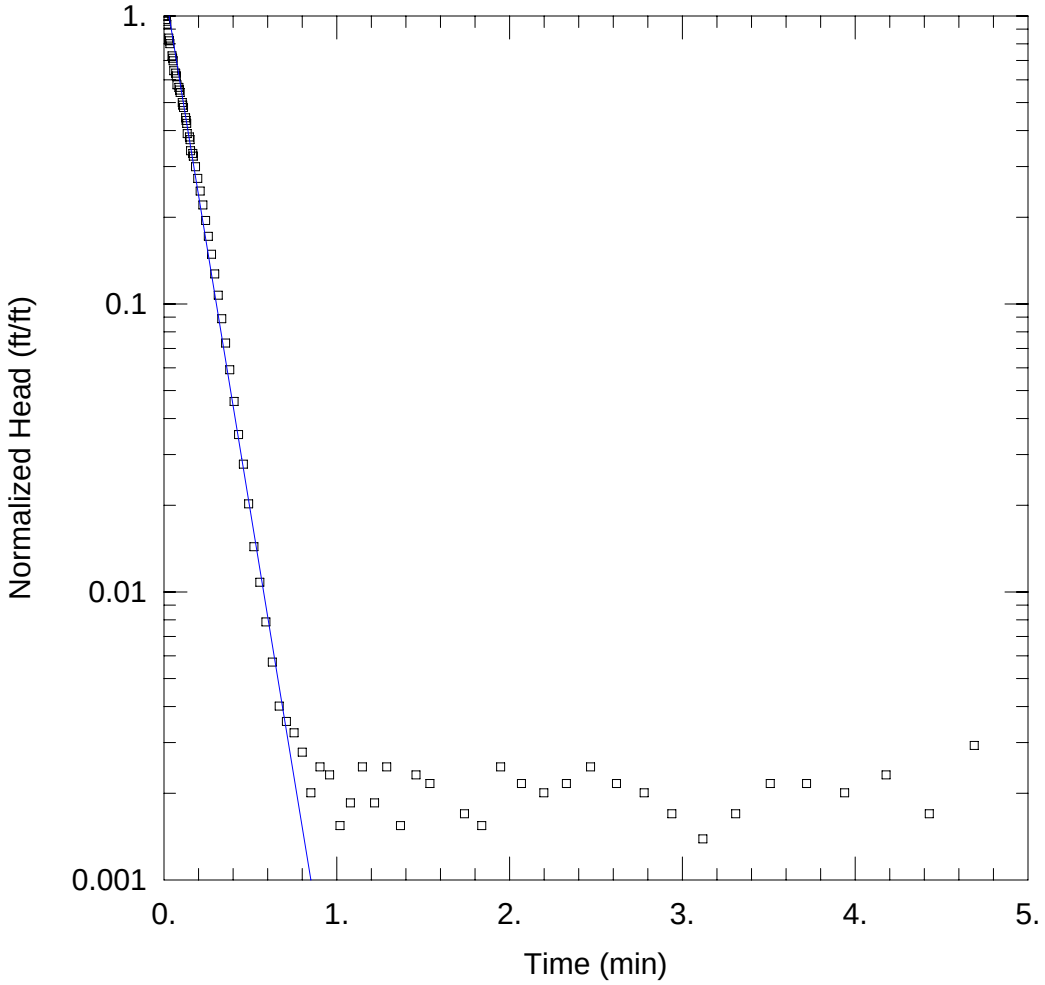
WELL DATA (13-NUN-D)

Initial Displacement: 6.48 ft
Total Well Penetration Depth: 6.5 ft
Casing Radius: 0.083 ft
Static Water Column Height: 105. ft
Screen Length: 4.5 ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 0.008453 cm/sec
y0 = 8.317 ft



WELL TEST ANALYSIS

Data Set: K:\...\13-NUN-D_001_cB&R_150ft.aqt
Date: 04/05/09 Time: 11:42:55

PROJECT INFORMATION

Company: AECOM
Client: USACE / McHenry Cty
Project: 09000-460 (h200804080)
Location: McHenry County, IL
Test Date: Feb. 22, 2009

AQUIFER DATA

Saturated Thickness: 150. ft
Anisotropy Ratio (Kz/Kr): 0.33

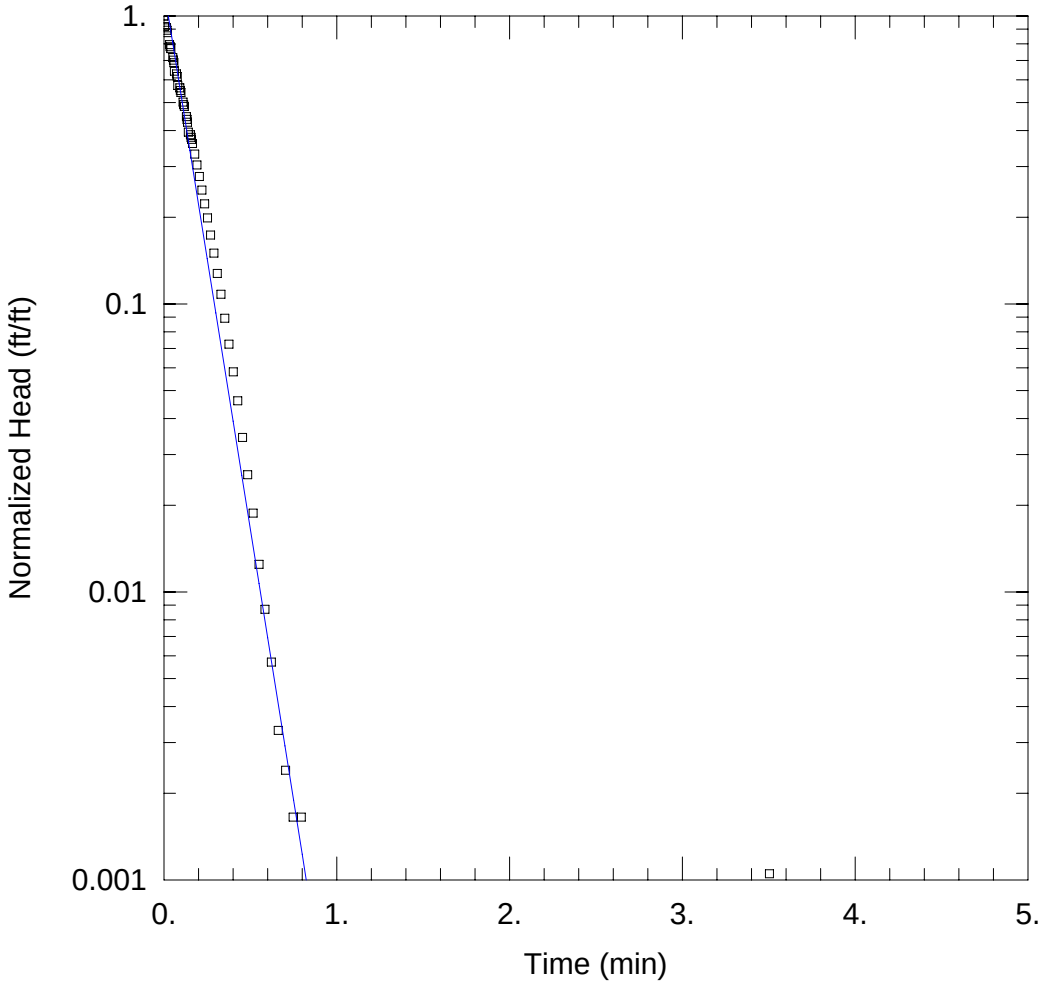
WELL DATA (13-NUN-D)

Initial Displacement: 6.48 ft
Total Well Penetration Depth: 6.5 ft
Casing Radius: 0.083 ft
Static Water Column Height: 105. ft
Screen Length: 4.5 ft
Well Radius: 0.25 ft
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 0.007353 cm/sec
y0 = 8.317 ft



WELL TEST ANALYSIS

Data Set: K:\...\13-NUN-D_002_cB&R.aqt
Date: 04/05/09 Time: 11:45:22

PROJECT INFORMATION

Company: AECOM
Client: USACE / McHenry Cty
Project: 09000-460 (h200804080)
Location: McHenry County, IL
Test Date: Feb. 22, 2009

AQUIFER DATA

Saturated Thickness: 8. ft
Anisotropy Ratio (Kz/Kr): 0.33

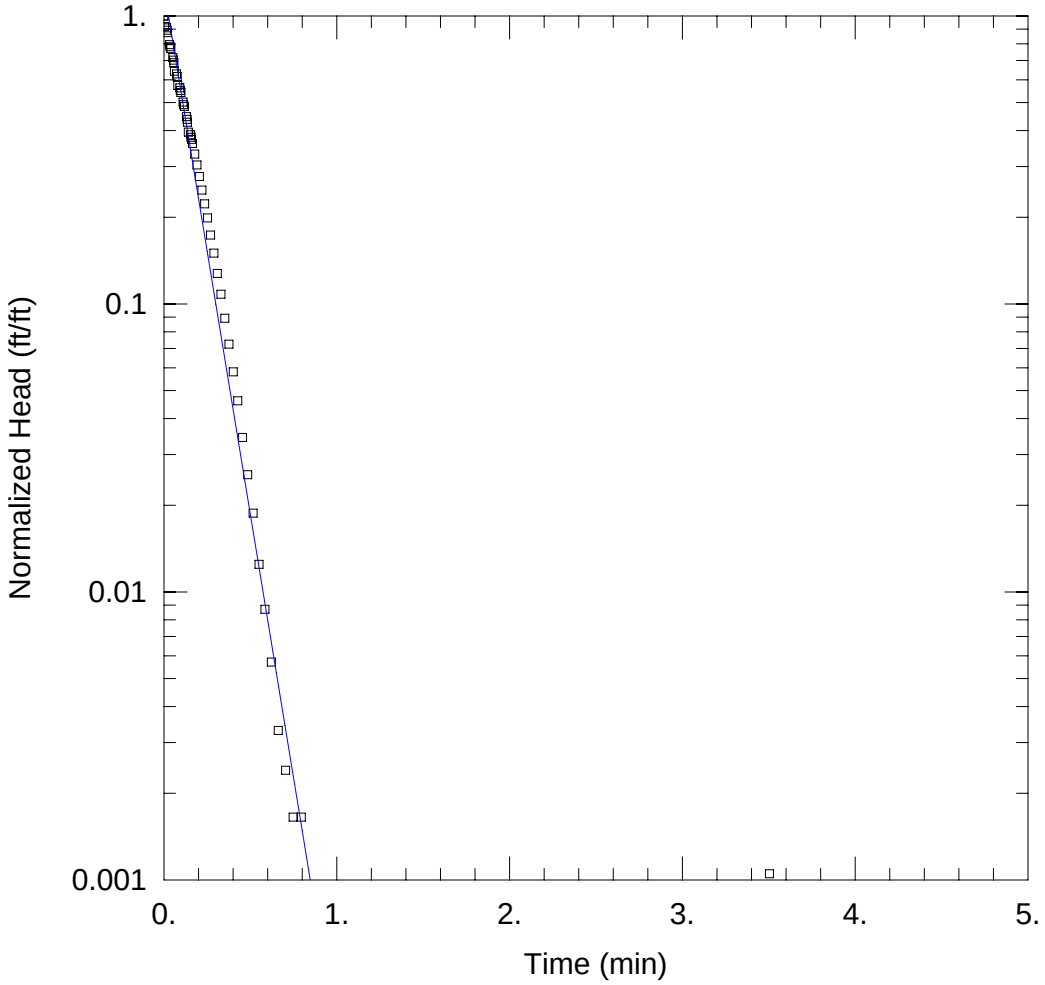
WELL DATA (13-NUN-D)

Initial Displacement: 6.66 ft
Total Well Penetration Depth: 6.5 ft
Casing Radius: 0.083 ft
Static Water Column Height: 105. ft
Screen Length: 4.5 ft
Well Radius: 0.25 ft
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 0.008453 cm/sec
y0 = 8.317 ft



WELL TEST ANALYSIS

Data Set: K:\...\13-NUN-D_002_cB&R_150ft.aqt
Date: 04/05/09 Time: 11:46:24

PROJECT INFORMATION

Company: AECOM
Client: USACE / McHenry Cty
Project: 09000-460 (h200804080)
Location: McHenry County, IL
Test Date: Feb. 22, 2009

AQUIFER DATA

Saturated Thickness: 150. ft
Anisotropy Ratio (Kz/Kr): 0.33

WELL DATA (13-NUN-D)

Initial Displacement: 6.66 ft
Total Well Penetration Depth: 6.5 ft
Casing Radius: 0.083 ft
Static Water Column Height: 105. ft
Screen Length: 4.5 ft
Well Radius: 0.25 ft
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 0.007353 cm/sec
y0 = 8.317 ft

Additional Well Site Information

In-Situ Inc.

13-Nun-I

Calibration Report

Report Number: 20090126144841-140971

221 East Lincoln Avenue, Fort Collins, CO 80524 USA
1-970-498-1500, 1-800-446-7488, FAX: 1-970-498-1598
Visit us at www.in-situ.com

Instrument Details:

Instrument Model:	**Level TROLL 500**
Full Scale Pressure Range	**206.84 KPa (30 PSI) vented**
Serial Number:	**140971**

Calibration Details:

Calibration Result:	**PASS**
Calibration Date:	2009-01-26 14:48:41 (UTC)
Nominal Range of Applied Temperature:	-5 C to +50 C
Temperature Accuracy Specification:	+/- 0.1 C From 0 C to +50 C
Nominal Range of Applied Pressure:	0 KPa to 206.8 KPa (0.0 PSI to 30.0 PSI)
Pressure Accuracy Specification:	+/- 0.1 %FS from -5 C to +50 C, +/- 0.05 %FS at +15 C

Post-Calibration Check:

Parameter	Applied	Reported	Deviation
Pressure	30.0003	29.9974	-0.0096
Pressure	0.0009	-0.0025	-0.0115
Temperature	19.8960	19.9146	0.0186

Calibration Procedures and Equipment Used:

Automated calibration procedures used.
Manu Agilent Model 34970A SerialNo MY44015965
Manu Instrulab Model 3312A-14-15-24 SerialNo 31103-(41012)
Manu Instrulab Model 406X-0031-01 SerialNo 2-31138
Manu MENSOR Model 600 SerialNo 621435
Manu Agilent Model 53131A SerialNo MY47000169
Manu MENSOR Model 600 SerialNo 621385

Notes:

1. Standards used in this calibration are traceable to the National Institute of Standards and Technology.
2. This calibration report shall not be reproduced, except in full, without the written approval of In-Situ, Inc.
3. A calibration interval of 12 to 18 months is recommended.
4. The post-calibration data is collected at nominal +20 C.
5. 1.0 PSI = 6.894757 KPa

Performed By: JBO

Copyright © 2006 In-Situ, Inc.

In-Situ Inc.

13-NUN-D

Calibration Report

Report Number: 20081224211846-140207

221 East Lincoln Avenue, Fort Collins, CO 80524 USA
1-970-498-1500, 1-800-446-7488, FAX: 1-970-498-1598
Visit us at www.in-situ.com

Instrument Details:

Instrument Model:	**Level TROLL 500**
Full Scale Pressure Range	**206.84 KPa (30 PSI) vented**
Serial Number:	**140207**

Calibration Details:

Calibration Result:	**PASS**
Calibration Date:	2008-12-24 21:18:46 (UTC)
Nominal Range of Applied Temperature:	-5 C to +50 C
Temperature Accuracy Specification:	+/- 0.1 C From 0 C to +50 C
Nominal Range of Applied Pressure:	0 KPa to 206.8 KPa (0.0 PSI to 30.0 PSI)
Pressure Accuracy Specification:	+/- 0.1 %FS from -5 C to +50 C, +/- 0.05 %FS at +15 C

Post-Calibration Check:

Parameter	Applied	Reported	Deviation
Pressure	30.0002	29.9982	-0.0067
Pressure	0.0002	-0.0012	-0.0047
Temperature	19.9950	20.0172	0.0222

Calibration Procedures and Equipment Used:

Automated calibration procedures used.
Manu Agilent Model 34970A SerialNo MY44038788
Manu Instrulab Model 3312A-14-15-24 SerialNo 31138
Manu Instrulab Model 406X-0031-01 SerialNo 1-31118
Manu MENSOR Model 600 SerialNo 622742
Manu Agilent Model 53131A SerialNo MY47000169
Manu MENSOR Model 600 SerialNo 621385

Notes:

1. Standards used in this calibration are traceable to the National Institute of Standards and Technology.
2. This calibration report shall not be reproduced, except in full, without the written approval of In-Situ, Inc.
3. A calibration interval of 12 to 18 months is recommended.
4. The post-calibration data is collected at nominal +20 C.
5. 1.0 PSI = 6.894757 KPa

Performed By: CB

Copyright © 2006 In-Situ, Inc.

Nunda Township Well Site – Staked Location

Nunda Township Well Site – Set Up on Hole

Nunda Township Well Site – Temporary Casing

Nunda Township Well Site – Protective Casing

Nunda Township Well Site

Nunda Township Well Site – Well Casing & Monument

Nunda Township Well Site – Inside Casing

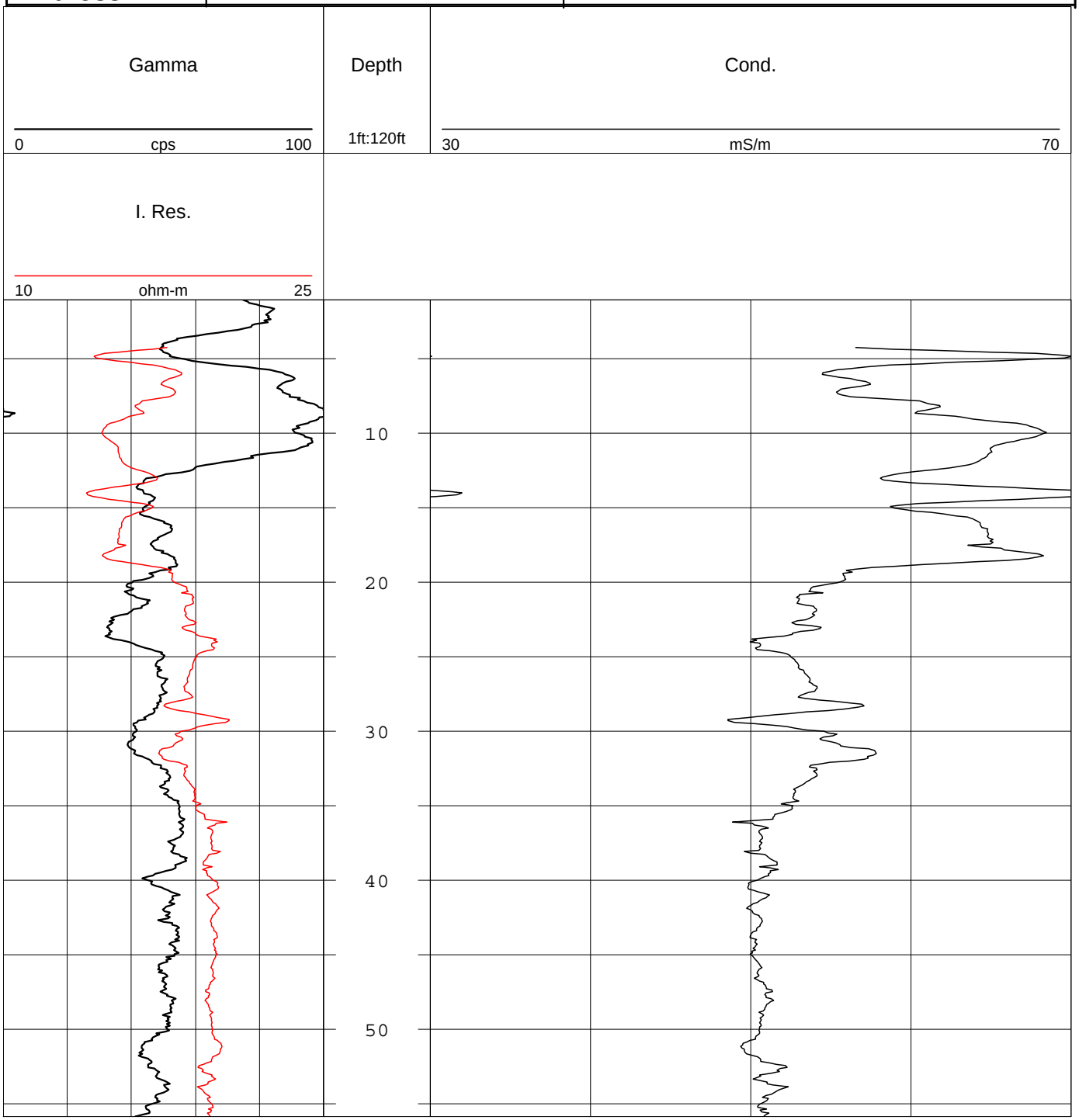
Nunda Township Well Site

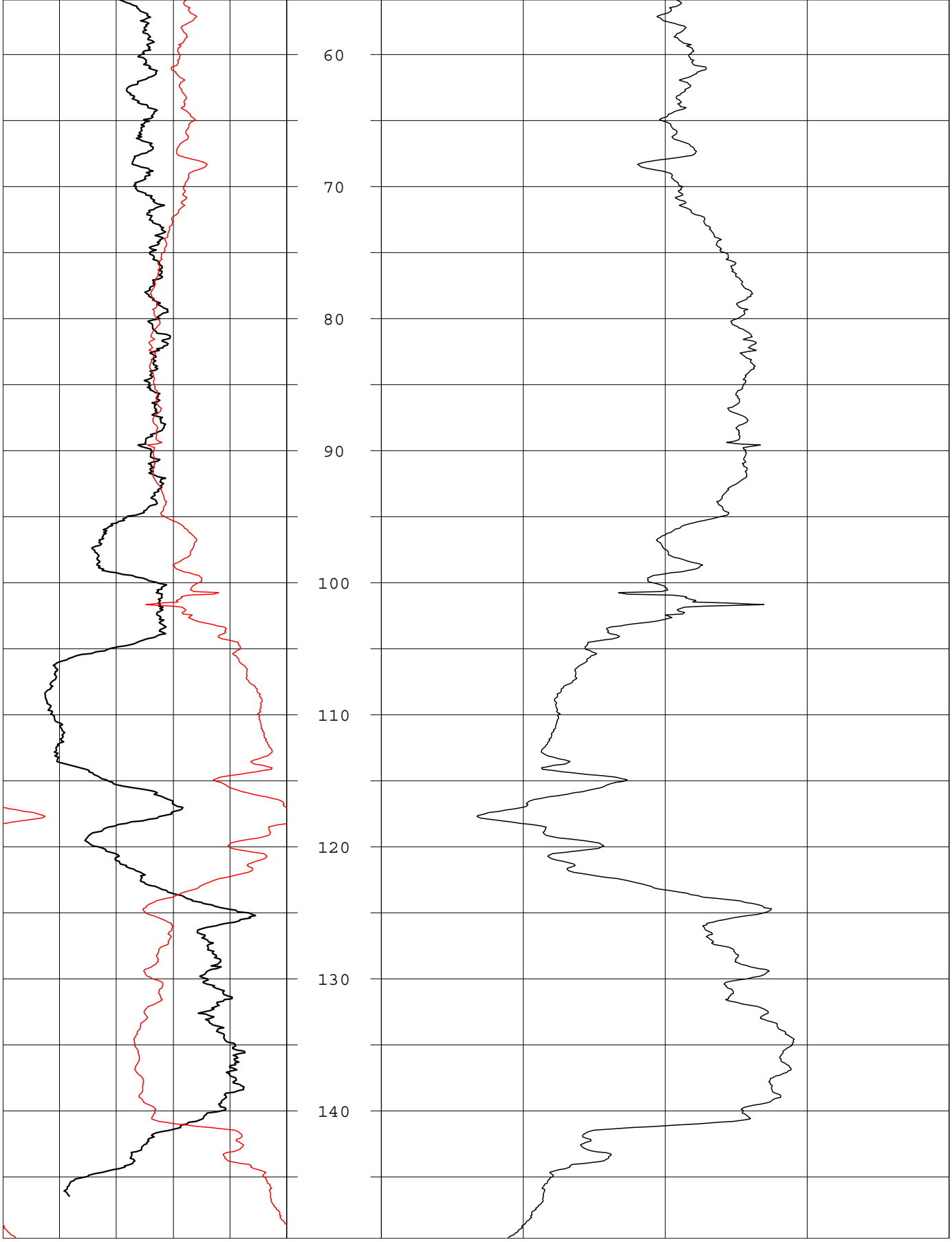
COMPANY:	McHenry County & US Corp of Engineers
Location:	STICKNEY RUN PARK

Well	#13 MCH NUNDA TWN		
Date	10/22/08	BH Fluid	Formation
Casing	2" PVC +2.4 to -152' bgs		
File Name	MCHTH13-08EMGAM		
Depth Driller	153' bgs		
Depth Logger	152.0' bgs		
Logged by:	T. YOUNG		
Witness:	NOT WITNESSED		

OTHER SERVICES

48.15' BTC




60
70
80
90
100
110
120
130
140

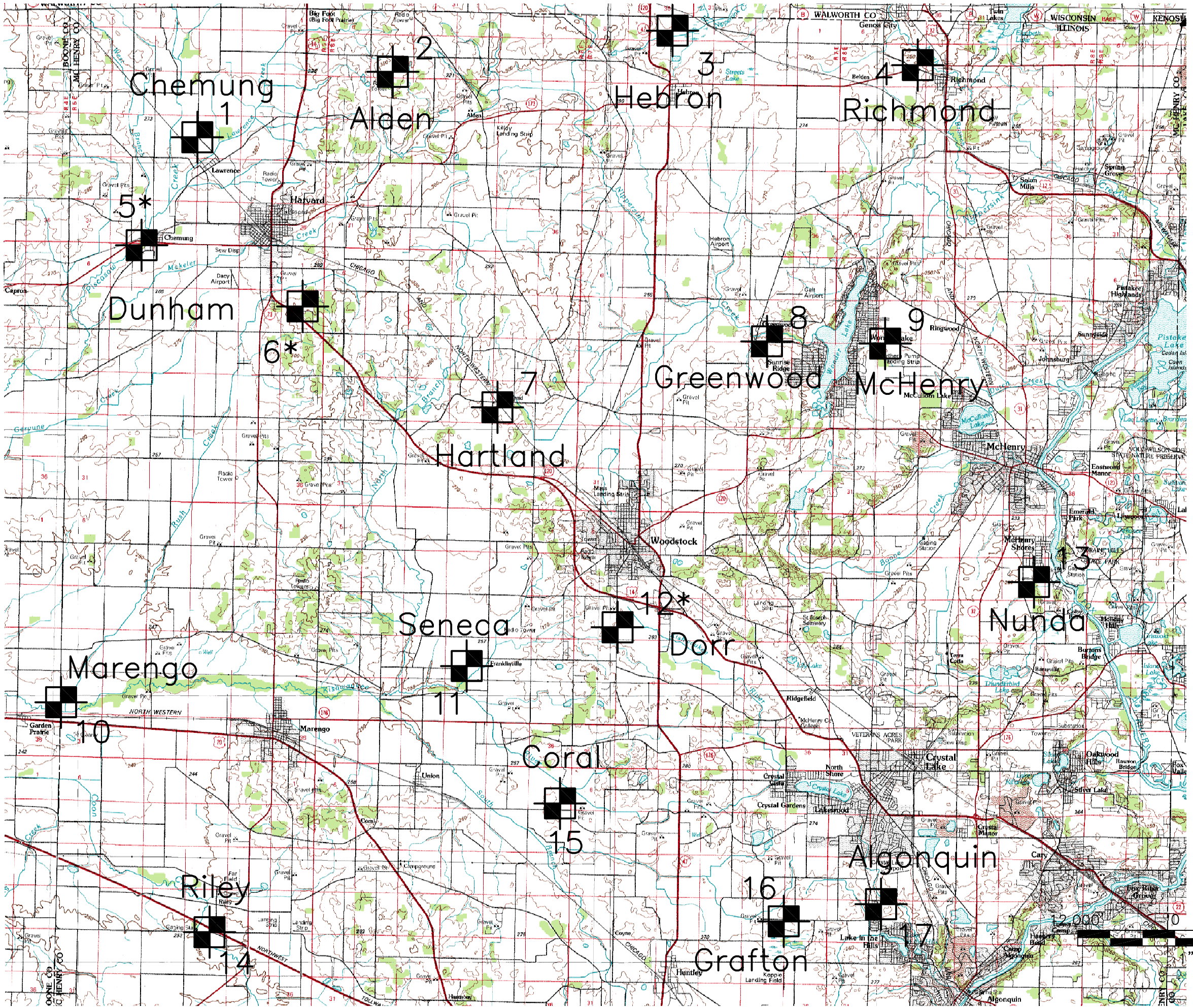
A-14: Folio for Well Site #14 – Riley Township

Table of Contents

I.) Site Location Map – Location in County
II.) Site Location Map – Location on USGS Topographic Map
III.) Site Location Map – Location on USGS High Resolution Orthophoto
IV.) Site Boring Log
V.) Well Construction Diagram
VI.) Well Site Summary and Commentary
VII.) Particle Size Distribution Report
VIII.) Table of Water Level Measurements
IX.) Well Development Field Log
X.) Water Quality Analysis Results
XI.) Groundwater Sampling Field Log
XII.) Hydraulic Conductivity Testing Results
XIII.) In-Situ LevelTroll™ Calibration Report
XIV.) Site Photographs
XV.) Downhole Geophysical Testing

Well Site Location Maps

Z:\Projects\200804080\CtyWide\D-09000-460-8000_CtyOverviewMap_004.dwg; 4/20/2009 5:33:59 PM; BRAUN, GARY



LEGEND:

AECOM Well Installation Site

McHenry 9

Well Installations By Others

Dunham 6*

0 12,000 24,000'

" = 12,000'

AECOM

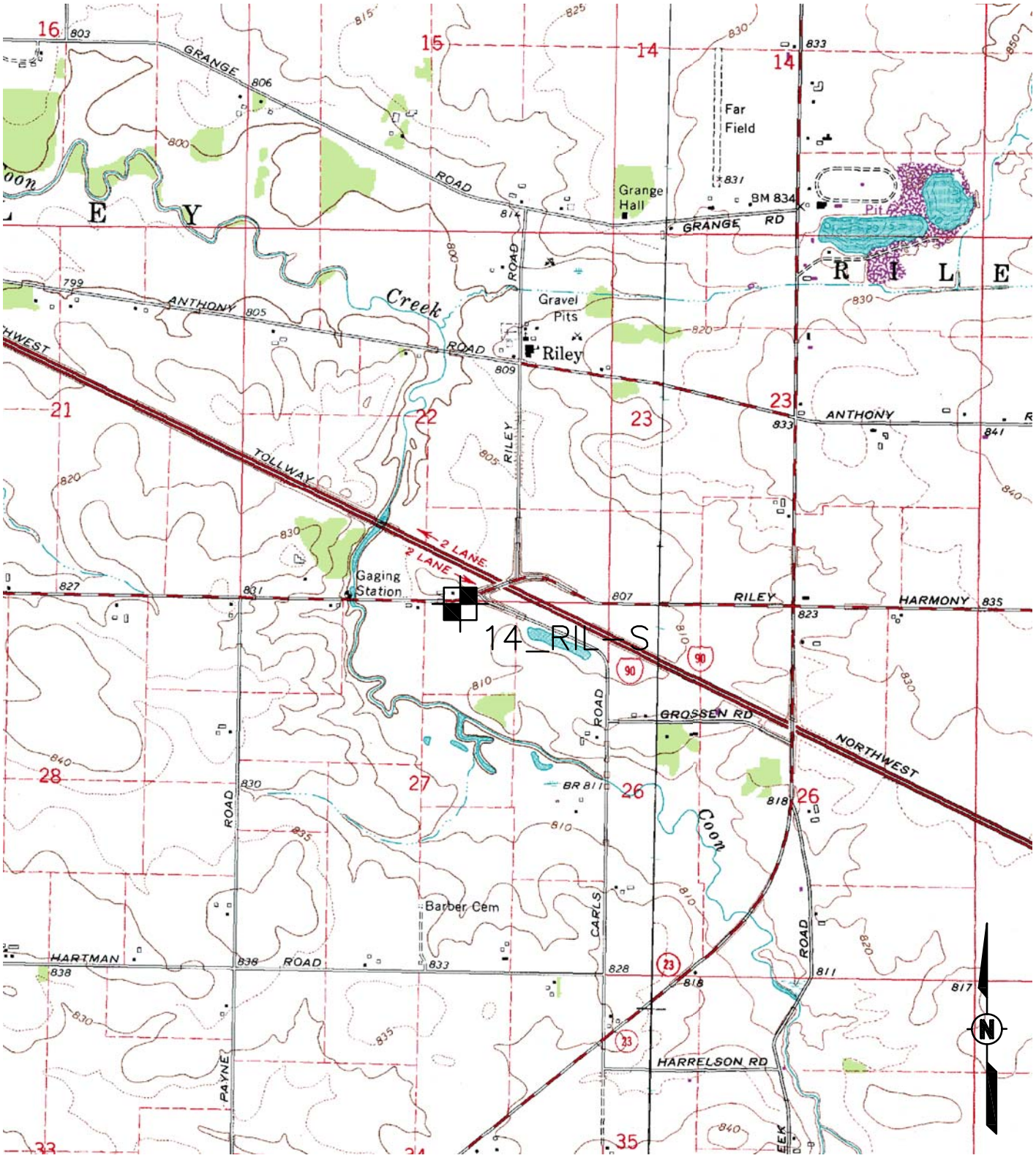
750 Corporate Woods Pkwy
Vernon Hills, IL 60061
847-279-2500
www.aecom.com

Copyright © By: STS Consultants, Ltd.

LOCATION MAP OF WELL SITES

Observation Well Network for Glacial Aquifers
McHenry County, Illinois

Drawn :	CJH	3/11/2009
Checked:	GMB	4/18/2009
Approved:	CSR	4/27/2009
PROJECT NUMBER	09000-460	
FIGURE NUMBER	1	



2000 0 2000 4000

1" = 2000'

AECOM

750 Corporate Woods Parkway
Vernon Hills, IL 60061
847.279.2500
www.aecom.com

Copyright © 2009, By: AECOM

Site Location on USGS Topographic Map
Site No. 14 - Riley Township
RWIS - Harmony Rd.
Observation Well Network
McHenry County, Illinois

Drawn :	CJH	04/01/2009
Checked:	GMB	04/15/2009
Approved:	CSR	04/24/2009
PROJECT NUMBER	09000-460	
FIGURE NUMBER	Folio_14 #2	

Z:\Projects\200804080\CtyWide\D-09000-460-8000_TopoMaps_v02.dwg; 4/20/2009 11:17:59 AM; BRAUN, GARY; STS_BLACK_040102.ctb

AECOM

750 Corporate Woods Parkway
Vernon Hills, IL 60061
847.279.2500
www.aecom.com
Copyright © 2009, By: AECOM

2005 USGS High Resolution Orthophoto
Site No. 14 - Riley Township
RWIS - Harmony Rd.
Observation Well Network
McHenry County, Illinois

Drawn :	CJH	04/01/2009
Checked:	GMB	04/15/2009
Approved:	CSR	04/24/2009
PROJECT NUMBER	09000-460	
FIGURE NUMBER	Folio_14 #3	

Z:\Projects\200804080\CtyWide\D-09000-460-8000_AerialsMap_004.dwg; 4/21/2009 2:32:05 PM; BRAUN, GARY; STS_BLACK_040102.ctb

Boring and Well Construction Details

DRILLING LOG

DIVISION	USACE
INSTALLATION	Chicago District
SHEET	1 OF 2 SHEETS
1. PROJECT	McHenry County Observation Wells
2. LOCATION (Coordinates or Station)	McHenry County, Illinois N 2,009,182.00 E 902,363.00
3. DRILLING AGENCY	WDC Exploration & Wells
4. HOLE NO. *(As shown on drawing title and file number)*	14-RILEY
5. NAME OF DRILLER	Bill Zakow
6. DIRECTION OF HOLE	☒ VERTICAL ☐ INCLINED --- DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN	29.0
8. DEPTH DRILLED INTO ROCK	2.0
9. TOTAL DEPTH OF HOLE	31.0
10. SIZE AND TYPE OF BIT	3 7/8" Carbide Bit / 5 7/8" Casing
11. DATUM FOR ELEVATION SHOWN *(TBM or MSL)*	NAVD 88
12. MANUFACTURER'S DESIGNATION OF DRILL	Super Sonic II
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN	DISTURBED 7 / UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES	N/A
15. ELEVATION GROUND WATER	799.0
16. DATE HOLE	STARTED 10/30/2008 / COMPLETED 10/30/2008
17. ELEVATION TOP OF HOLE	+806.8
18. TOTAL CORE RECOVERY FOR BORING	85 %
19. GEOLOGIST	Gary Braun, LPG IL

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS *(Drilling time, water loss, depth weathering, etc., if significant)* g
+806.8	0.0		Topsoil: OL, Black-dark brown organic clayey silt, little sand, dense	70	1 0.0 5.0	
+805.3	1.5		SC, Dark brown silty sandy clay, little gravel, trace organics, soft with black and brown mottling, damp			Sample No. 1 from 4.0' - 5.0'
+800.3	6.5			95	2 5.0 15.0	
+797.8	9.0		SW, Brown fine to coarse sand, trace fine gravel and silt, loose, wet			Sample No. 2 from 7.0' - 8.0'
+791.8	15.0		SP, Brown coarse sand, trace to little fine to medium sand and fine gravel, loose, wet			Sample No. 3 from 14.0' - 15.0'
			SP, Brownish gray coarse sand, little fine to medium sand and fine gravel, very loose, wet Note: 4" to 5" cobble noted between 21.5' and 22.0'; large cobble plugged bit and limited recovery at 22.0'	75	3 15.0 25.0	Sample No. 4 from 18.0' - 19.0' % Gravel/% Sand/% Fines = 35/64/1 from 18.0' to 19.0'

DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE 806.8

Hole No. 14-RILEY

PROJECT: McHenry County Observation Wells

INSTALLATION: Chicago District

SHEET 2 OF 2 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
+784.8	22.0					
+780.8	26.0		SP, Medium gray sand, little clay, trace fine gravel, dense, wet	100	4 25.0 31.0	Sample No. 5 from 25.0' - 26.0'
+777.8	29.0		CL, Brownish gray sitly clay, little fine to coarse gravel, trace sand, stiff to hard, damp			Sample No. 6 from 27.0' - 28.0' Qp = 3.5 TSF @27.0' Qp = 4.0 TSF @28.0'
+775.8	31.0		Green and gray shaley dolomite, medium hard Maquoketa Group, Brainard Formation Note: Drilling difficult at 29.0'			Sample No. 7 from 30.0' to 31.0'
			END OF BORING - 31.0' BGS			AECOM Project No. 60095270

Hole No. 14 - RILEY TWP

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 1 OF 3 SHEETS

1. PROJECT McHenry City Wells	10. SIZE AND TYPE OF BIT 3 7/8" Carbide Sampler
2. LOCATION (Coordinates or Station) N 2,009,182 E 902,363 IL St Pl-E	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) NAVD 88
3. DRILLING AGENCY WDC Exploration & Wells	12. MANUFACTURERS DESIGNATION OF DRILL Super Sonic II
4. HOLE NO. (As shown on drawing title and title number) 14-RIL	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN — DISTURBED 7 — UNDISTURBED —
5. NAME OF DRILLER BILL ZAKOW ~~Dan Tennant Corp~~	14. TOTAL NUMBER CORE BOXES —
6. DIRECTION OF HOLE ☑ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.	15. ELEVATION GROUND WATER 798.9' 10/30
	16. DATE HOLE — STARTED 10-30-08 — COMPLETED 10-30-08
7. THICKNESS OF OVERBURDEN 29'	17. ELEVATION TOP OF HOLE 806.75 ft MSL
8. DEPTH DRILLED INTO ROCK 2'	18. TOTAL CORE RECOVERY FOR BORING 26.5/31 = 85%
9. TOTAL DEPTH OF HOLE 31'	19. SIGNATURE OF INSPECTOR Gary M. Brown LPG IL

5 7/8" Casing

HARMONY RD SITE

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	0–1		TOPSOIL: Black-Dark Brown Organic Clayey SILT, little sand, dense (OL)			Run 1 (0-5) Rec/Run = 3.5/5.0 = 70%
	2–6		Dark Brown Silty Sandy CLAY, little gravel, trace organics, soft (SC) with black & brown mottling, damp	Rec 70%	Bag 1; S1	
	6–8		Brown Fine to Coarse SAND, trace fine gravel & silt, loose, wet (SW)		Bag 2; S2; Bag 3	Run 2 (5-15') Rec/Run = 9.5'/10' = 95%
	9–15		Brown COARSE SAND, trace F.-M. Sand & to little F. gravel, loose wet (SP)	Rec 95%	Bag 4; S3	

0836 ↓ 4" CORE BARREL 0837

Extract Samples 0839

0842 ↓ 4" CORE BARREL 0844

Drive 6" Casing 0-15' 0847 ↓ 0849

Extract Samples 0853

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT McHenry City Wells — HOLE NO. 14-RILEY TWP

Hole No. 14-RILEY TWP

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 2 OF 3 SHEETS

1. PROJECT McHenry Cty Wells	10. SIZE AND TYPE OF BIT 3 7/8" Carbide Sampler
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) NAVD88
3. DRILLING AGENCY WDC Exploration & Wells	12. MANUFACTURERS DESIGNATION OF DRILL Super Sonic II
4. HOLE NO. (As shown on drawing title and title number) 14-RIL	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN — DISTURBED 7 — UNDISTURBED —
5. NAME OF DRILLER BILL ZAKON	14. TOTAL NUMBER CORE BOXES —
6. DIRECTION OF HOLE ☑ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER 798.7' 10/30
	16. DATE HOLE — STARTED 10-30-08 — COMPLETED 10-30-08
7. THICKNESS OF OVERBURDEN 29'	17. ELEVATION TOP OF HOLE 806.8 ft MSL
8. DEPTH DRILLED INTO ROCK 2'	18. TOTAL CORE RECOVERY FOR BORING 85%
9. TOTAL DEPTH OF HOLE 31'	19. SIGNATURE OF INSPECTOR Gary M Brown LPGIL

5 3/4" Casing
Roto Sonic

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
SHALLOW WELL	15		Brownish Gray COARSE SAND, little F.-M. Sand & fine gravel, very loose, wet (SP-SW)		Bag 5	RUN 3 (15-25') 0856 ↓ 4" coring
	16					Rec/Run = 7.5'/10' = 75% 0857:30
	17		Varies on bedding			
	18		Coarse zone		s4	Grain size sample also taken 0901 ↓ Drive 6" 0902:30
	19				Bag 6	
	20			REC 75%		
	21		trace clay			
	22		4"-5" Cobble			Large Cobble plugged bit limited recovery
	23		Medium Gray SAND, little clay, tr. F. gravel, dense, wet (SP)		NR	
	24					Extract Samples 0906
	25		grades over 0.25 feet		s5	RUN 4 (25-31) 0910
	26		Brownish Gray Silty CLAY, little F.-C. gravel, trace SA, stiff to hard, damp (CL) TILL		Bag 7	Rec/Run = 6'/6' = 100% ↓ 4" coring 0916
	27			REC 100%		3.5 tsf
	28				s6 8	4.0 tsf • Drilling difficult at 29 ft. (My Estimate)
	29		MAQUOKETA GROUP BRAINARD FORMATION		9	• Driller reports easy drilling first foot, then more difficult 26-29 before bedrock 0919 Extract Samples
	30					

ENG FORM 1836
MAR 71

PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT McHenry Cty Wells | HOLE NO. 14-RILEY TWP

Hole No. 14-RILEY TWP

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 3 OF 3 SHEETS

1. PROJECT: McHenry Cty Wells
2. LOCATION (Coordinates or Station):
3. DRILLING AGENCY: WDC Exploration & Wells
4. HOLE NO. (As shown on drawing title and title number): 14-RIL
5. NAME OF DRILLER: DAN TONNANCOUR
6. DIRECTION OF HOLE: ☑ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 29'
8. DEPTH DRILLED INTO ROCK: 2'
9. TOTAL DEPTH OF HOLE: 31'
10. SIZE AND TYPE OF BIT: 3 7/8" Carbide Sampler 5 7/8" CASING
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): NAVD 88
12. MANUFACTURERS DESIGNATION OF DRILL: SuperSonic II
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 7 UNDISTURBED —
14. TOTAL NUMBER CORE BOXES: —
15. ELEVATION GROUND WATER: 798.9 10/30
16. DATE HOLE: STARTED 10-30-08 COMPLETED 10-30-08
17. ELEVATION TOP OF HOLE: 806.75 Ft MSL
18. TOTAL CORE RECOVERY FOR BORING: 85%
19. SIGNATURE OF INSPECTOR: Gary M. Brown LPG IL

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	30		cont. MAQUOKETA Green & Gray SHALEY DOLOMITE, Mod. Hard Fresh.	100% cont.	Bag 9 cont.	Run 4 (25-31) cont. Drilled More Difficult than #10
END OF BORING	31					
	32					
	33					
	34					
	35					
	36					
	37					
	38					
	39					
	40					
	41					
	42					
	43					
	44					
	45					

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT: McHenry Cty Wells HOLE NO. 14-RILEY TWP

PROJECT McHENRY COUNTY OBSERVATION WELL NETWORK INSTALLATION (#09000-460)	WELL NO. 14-RIL-S
LOCATION RILEY TOWNSHIP – McHENRY COUNTY, ILLINOIS	
CLIENT U.S. ARMY CORPS OF ENGINEERS / McHENRY COUNTY	
GEOLOGIST GARY BRAUN, P.G. (AECOM)	INSTALLATION DATE OCT. 30, 2008
DRILLER WDC EXPLORATION AND WELLS, INC. (BILL ZAKOW)	DRILLING METHOD ROTO-SONIC

TOP OF LOCKED PROTECTIVE CASING
809.73' FT MSL

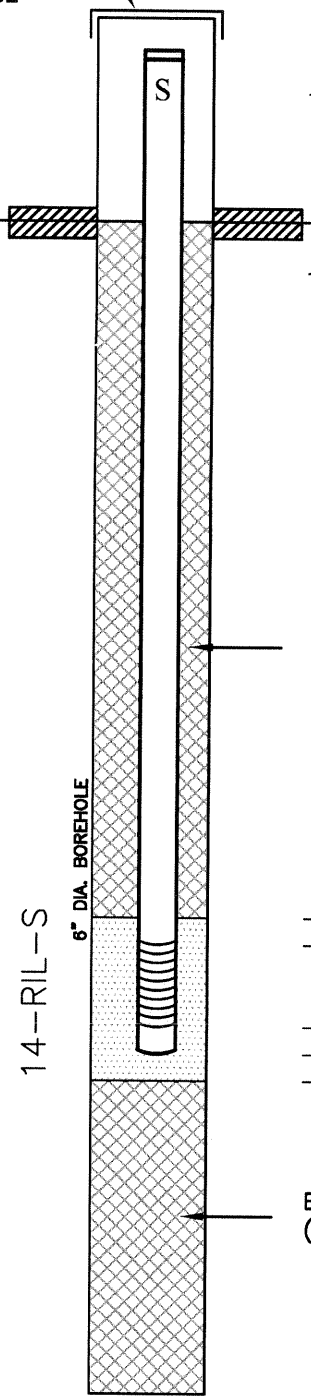
USACE BRASS MONUMENT
ELEVATION 806.88' FT MSL
N2009182.3'; E902363.0'

GROUND SURFACE EL. 806.8 FT MSL

STATIC WATER LEVEL (MEASURED 12/5/08)

ELEVATION (MSL)	DEPTH (BTPVC)	
798.44	10.69'	DEEP WELL

NOTES:
VERTICAL DATUM: NAVD-88
HORZ. LOCATION: ILSTPL-E (NAD83)



ELEVATIONS (MSL)	DEPTHS (BGS)	
TOP OF PVC RISER PIPE (HIGH POINT)		
809.13	-2.38	SHALLOW WELL
806.8	GRD SRF	TOP OF BENTONITE SEAL
		BENTONITE SEAL
793.6	13.2'	TOP OF SANDPACK
791.36	15.4'	TOP OF SHALLOW SCREEN
786.86	19.9'	BOTTOM OF SHALLOW SCREEN
786.36	20.4'	BOTTOM OF SHALLOW WELL
784.8	22.0'	BOTTOM OF SANDPACK
		BENTONITE BACKFILL (MEDIUM CHIPS)

ADDITIONAL WELLS NOT INSTALLED

TOP OF BEDROCK 29 FT BGS / EL. 777.8 FT MSL

BOTTOM OF BOREHOLE 31 FT BGS / EL. 775.8 FT MSL

NOT TO SCALE

WELL CONSTRUCTION MATERIALS*

PROTECTIVE CASING	5' L X 6" DIA. STEEL CASING W/ LOCKING CAP
RISER PIPE ABOVE W.T.	SCHEDULE 40 PVC (2.07" I.D./ 2.38" O.D.)
RISER PIPE BELOW W.T.	SCHEDULE 40 PVC (2.07" I.D./ 2.38" O.D.)
SCREEN	2" I.D. SCHEDULE 40 PVC W/ 0.010" SCREEN SLOT SIZE
TYPE OF BENTONITE SEAL	BLACK HILLS BENTONITE – 3/8" CHIPS (HOLE PLUG)
TYPE OF SAND PACK	R.W. SIDLEY CO. – NO. 5 FILTER PACK SAND

CASING MEASUREMENTS

BOTTOM OF SCREEN TO END CAP (FT)*	0.50
SCREEN LENGTH (1ST SLOT TO LAST SLOT) (FT)*	4.50
TOTAL LENGTH OF CASING (FT): SHALLOW WELL	22.77

* MEASUREMENT REFERS TO ALL WELLS

USMWK2FP001\05CAD\PROJECTS\20080408O\WCR-V04.DWG

WELL SITE DATA SUMMARY AND COMMENTARY

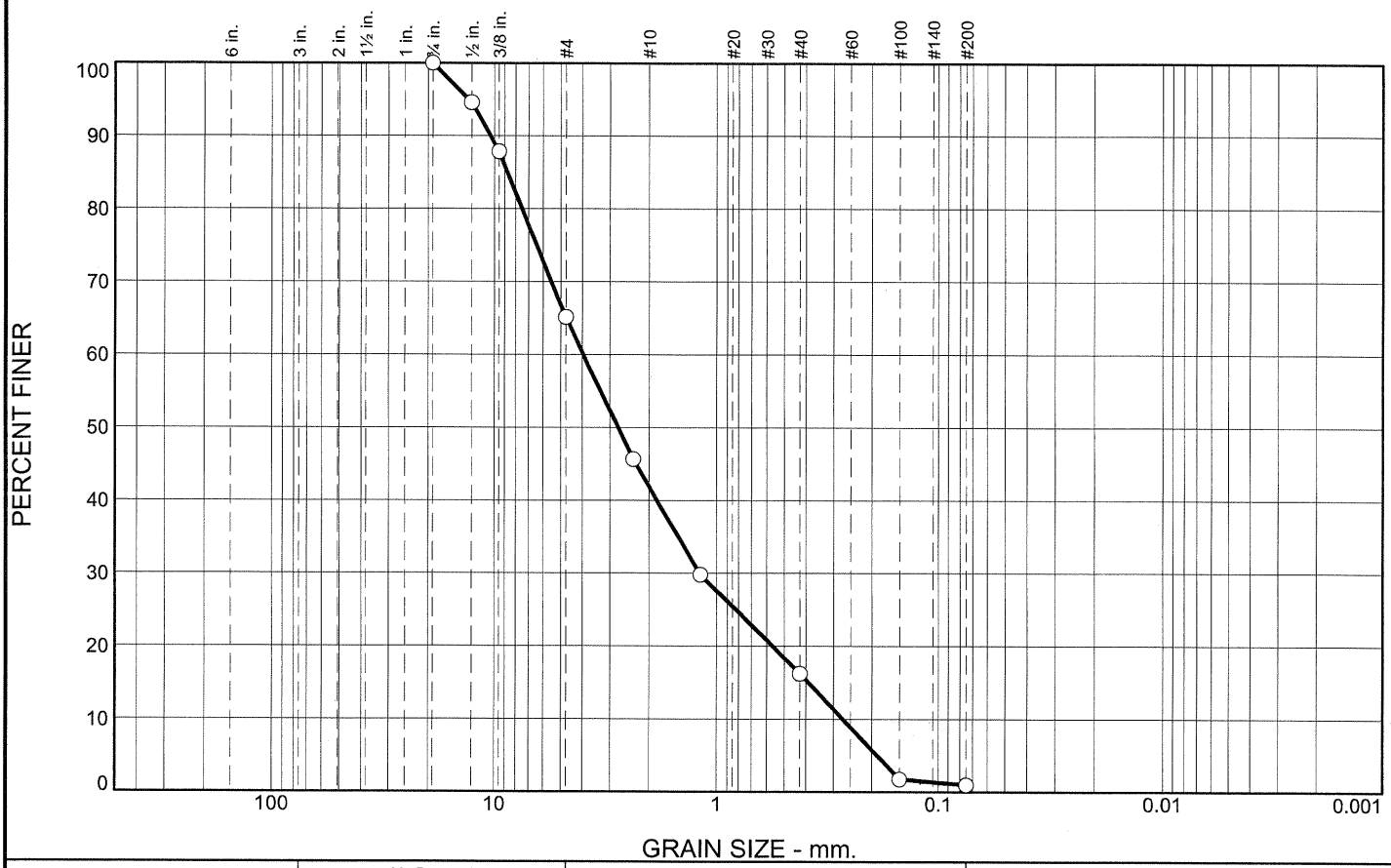
Well Site #14 – Riley Township
Right-of-way embankment at Harmony Road bridge over I-90

The Riley Township site is located west of the Marengo Moraine and has limited thickness of materials overlying bedrock. Only 29 feet of unconsolidated glacial drift is present at the well, which consists of about 15 feet of saturated sand. Although this observation well provides little direct information on the primary Quaternary aquifer, it will be useful for the overall water budget of the County. The unconfined near-surface sand deposits are very conductive and are located in close proximity to Coon Creek. The Riley Township well was calculated to have the highest conductivity of all the site wells (i.e. 1.3×10^{-1} cm/s), which can be used to assume that groundwater has a strong hydraulic connection to the nearby creek. Coon Creek is a tributary to the Kishwaukee River. The Riley Township site is also valuable since other information such as atmospheric data and surface water data are collected nearby. A weather station is located on the Harmony Rd bridge and a gauging station is located on Harmony Rd where Coon Creek crosses.

The well is installed in a right-of-way embankment along the Harmony Road Bridge over Interstate 90. The de-icing activities on the Interstate and bridge are believed to have an impact on the shallow groundwater quality. Groundwater quality results indicate elevated levels of sodium and chloride at this location. The high conductivity of the shallow materials indicates this area is particularly susceptible to anthropogenic impacts.

Well Site Testing Results

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	34.8	23.3	25.7	15.2	1.0	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.75	100.0		
.5	94.6		
.375	87.9		
#4	65.2		
#8	45.7		
#16	29.8		
#40	16.2		
#100	1.8		
#200	1.0		

* (no specification provided)

Material Description

F-C Sand Some Fine Gravel Trace Silt

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 10.4387 D_{85}= 8.7257 D_{60}= 3.9464
D_{50}= 2.7571 D_{30}= 1.1901 D_{15}= 0.3885
D_{10}= 0.2711 C_u= 14.55 C_c= 1.32

Classification

USCS= SW AASHTO=

Remarks

Source of Sample: 14-Riley-S **Depth:** 18.0-19.0

Date: 12/04/08

STS | AECOM

Client: USACE
Project: McHenry County Wells
Project No: 200804080 **Figure**

Tested By: JRT

Groundwater Level Measurements

McHenry County Monitoring Well Installations
AECOM Project 09000-460

Site Number	14
Township Name	Riley
Well Number	14-RIL-S
Ground Surface Elevation (ft msl)	806.75
Top of PVC Casing Elevation (ft)	809.13
Location of PVC Casing within Wellhead	Single Well
Well Depth (Feet from TOC)[A]	22.77

Date	Depth to GW from TOC (ft)	GW Elevation (ft msl)
Sep. 26, 2008		
Oct. 09, 2008		
Oct. 14, 2008		
Oct. 16, 2008		
Oct. 21, 2008		
Oct. 22, 2008		
Oct. 24, 2008		
Oct. 28, 2008		
Oct. 29, 2008		
Oct. 30, 2008	10.23	798.90
Nov. 07, 2008		
Nov. 13, 2008		
Dec. 05, 2008	10.69	798.44
Dec. 08, 2008		
Dec. 09, 2008	10.68	798.45
Dec. 12, 2008		
Dec. 15, 2008		
Dec. 16, 2008		
Dec. 17, 2008		
Dec. 18, 2008		
Dec. 19, 2008		
Dec. 22, 2008		
Dec. 23, 2008		
Dec. 29, 2008		
Dec. 30, 2008		
Jan. 05, 2009		
Jan. 06, 2009		
Jan. 07, 2009		
Jan. 08, 2009	8.85	800.28
Jan. 09, 2009		
Jan. 10, 2009		
Jan. 12, 2009		
Feb. 24, 2009	9.26	799.87
Mar. 20, 2009		
end		

Notes:

ft msl = Elevation referenced to feet above mea

TOC = Top of PVC Casing

ft = feet

[A] = as measured inside well

NI = Not Installed

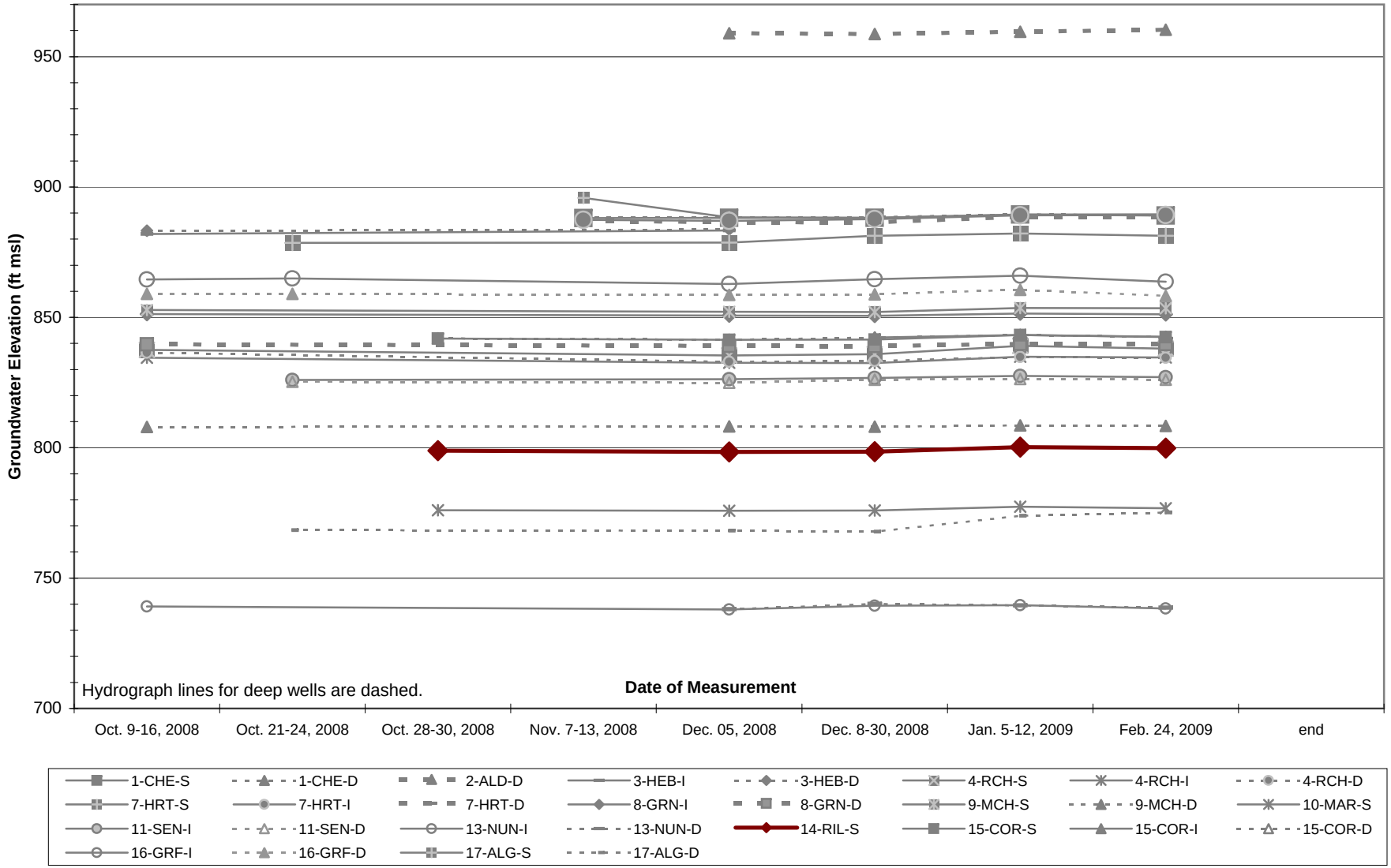
--- No Elevation

Well 17-Alg-S was frozen or partially frozen fror

Site 14 Groundwater Level Hydrograph
(includes ALL AECOM INSTALLED WELLS)

McHenry County Obervation Well Network

AECOM Project 09000-460

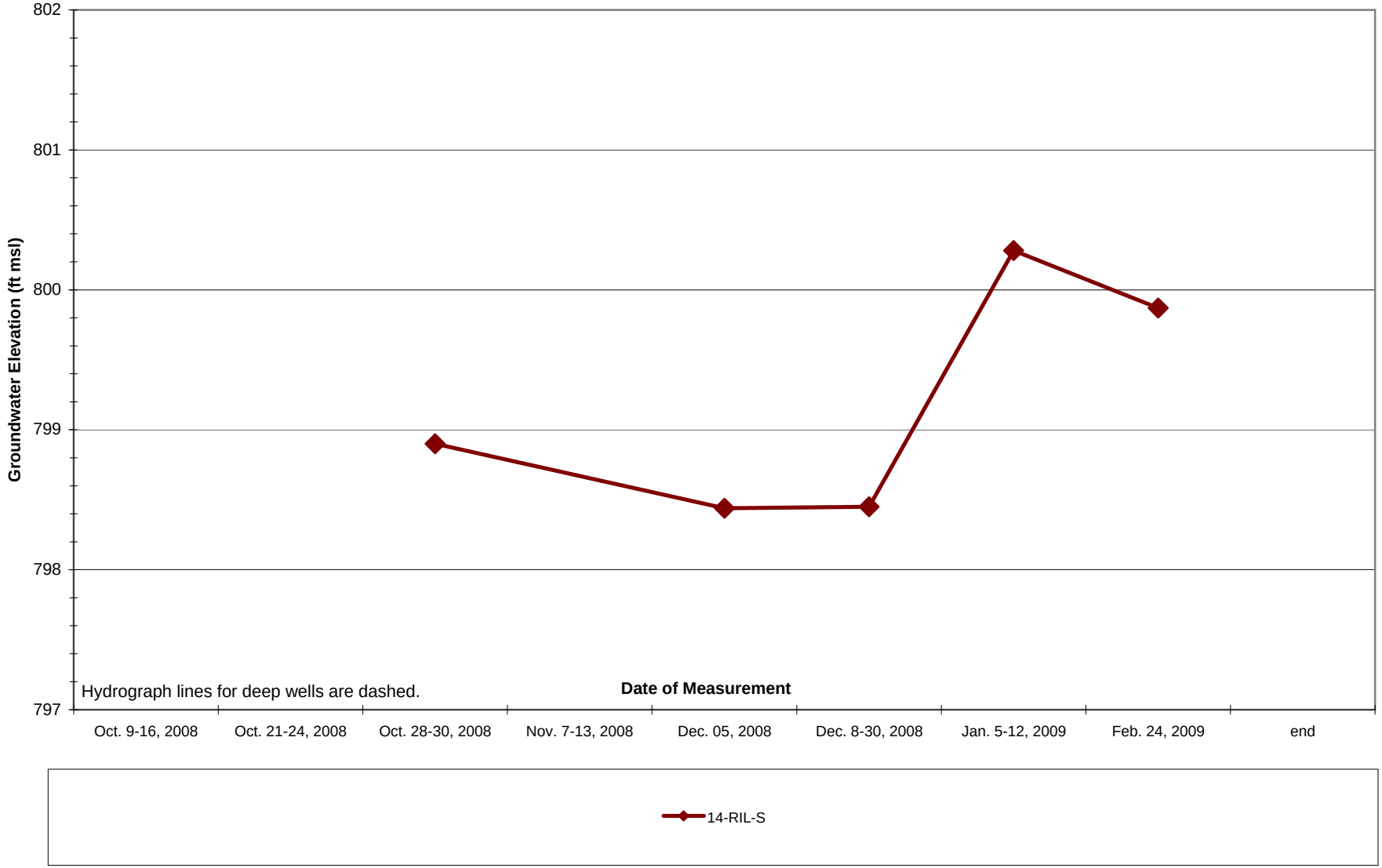


K:\PROJECTS\200804080\In_Progress\STS-McHenry Cty_WLs IN PROGRESS - figs for each site.xls

Site 14 Groundwater Level Hydrograph

McHenry County Obervation Well Network

AECOM Project 09000-460



K:\PROJECTS\200804080\In_Progress\STS-McHenry Cty_WLs IN PROGRESS - figs for each site.xls

Well Development Record

STS Consultants, Ltd.
11425 West Lake Park Drive
Milwaukee, Wisconsin 53224

Site Name: McHenry County

Well ID Number: 14-RIL-5

Date of Completion: 12/9/08

STS Job Number: 20080408 0 PH. 4000

Start Time: 11:40

End Time: 13:50

Water color at start of development: Brown

Water color at end of development: CLEAR

Amount of water removed during development:

Contained water? ☐ Yes – ☒ No

If not contained, where water disposed? Ground

Well Development Methods:

- ☐ Surged with bailer and bailed
- ☐ Surged with block and bailed
- ☐ Surged with block, bailed & pumped
- ☐ Bailed only
- ☐ Pumped slowly
- ☒ Surged with bailer and pumped
- ☐ Surged with block and pumped
- ☐ Compressed Air
- ☐ Pumped only
- ☐ Other

Equipment Used

- ☐ PVC bailer
- ☐ Well wizard
- ☐ Bean or Moino pump (on drill rig)
- ☐ Surge block
- ☒ Whale pumps
- ☒ Stainless Steel Bailer

Notes: WL: 10.68

Surge Start: 11:40

End: 11:55

Purge Start: 12:00

End: 13:50

WELL DEVELOPMENT FIELD RECORD

Job Name McHenry County Job No. 20080408O Well No. 14-RIL-S

Developed By Brian Schmidt Date of Install. 12/9/08 Sheet ____ of ____

Started Devel. ____ / ____ (DATE / TIME) Completed Devel. ____ / ____ (DATE / TIME)

W.L. Before Devel. ____ / ____ / ____ (DATE / TIME / DEPTH) After Devel. ____ / ____ / ____ (DATE / TIME / DEPTH)

Well Depth: Before Devel. ____ After Devel. ____ Well Dia. (in.) ____

Standing Water Column (ft.) ____ Standing Well Volume ____ gal.

Screen Length 5' Drilling Water Loss ____ gal.

DATE / TIME	VOLUME REMOVED (Gallons)	FIELD PARAMETERS SPEC. COND. (umhos/cm)	TEMP. (C°)	pH (s.u.)	TURB ~~Other~~	ORP	REMARKS
12/9/08 12:00	5 GAL/min	1630	10.4	7.30	999	—	
12:10	"	1570	10.8	7.16	890	—	
12:20	"	1540	10.9	7.15	999	—	
12:30	"	1550	10.8	7.13	999	—	
12:40	"	1560	11.0	7.11	449	—	
12:50	"	1560	10.8	7.11	291	—	
13:00	"	1480	11.0	7.12	999	—	RESURGED
13:10	"	1560	10.9	7.11	583	—	RESURGED
13:20	"	1550	11.0	7.11	164	—	RESURGED
13:30	"	1540	11.0	7.11	103	—	
13:40	"	1550	11.1	7.11	56	—	
13:50	"	1550	11.0	7.10	62	—	
		= TOTAL VOLUME REMOVED (Gallons)					

Development Method: ____

Notes:

First Environmental Laboratories, Inc.

IL ELAP / NELAC Accreditation # 100292

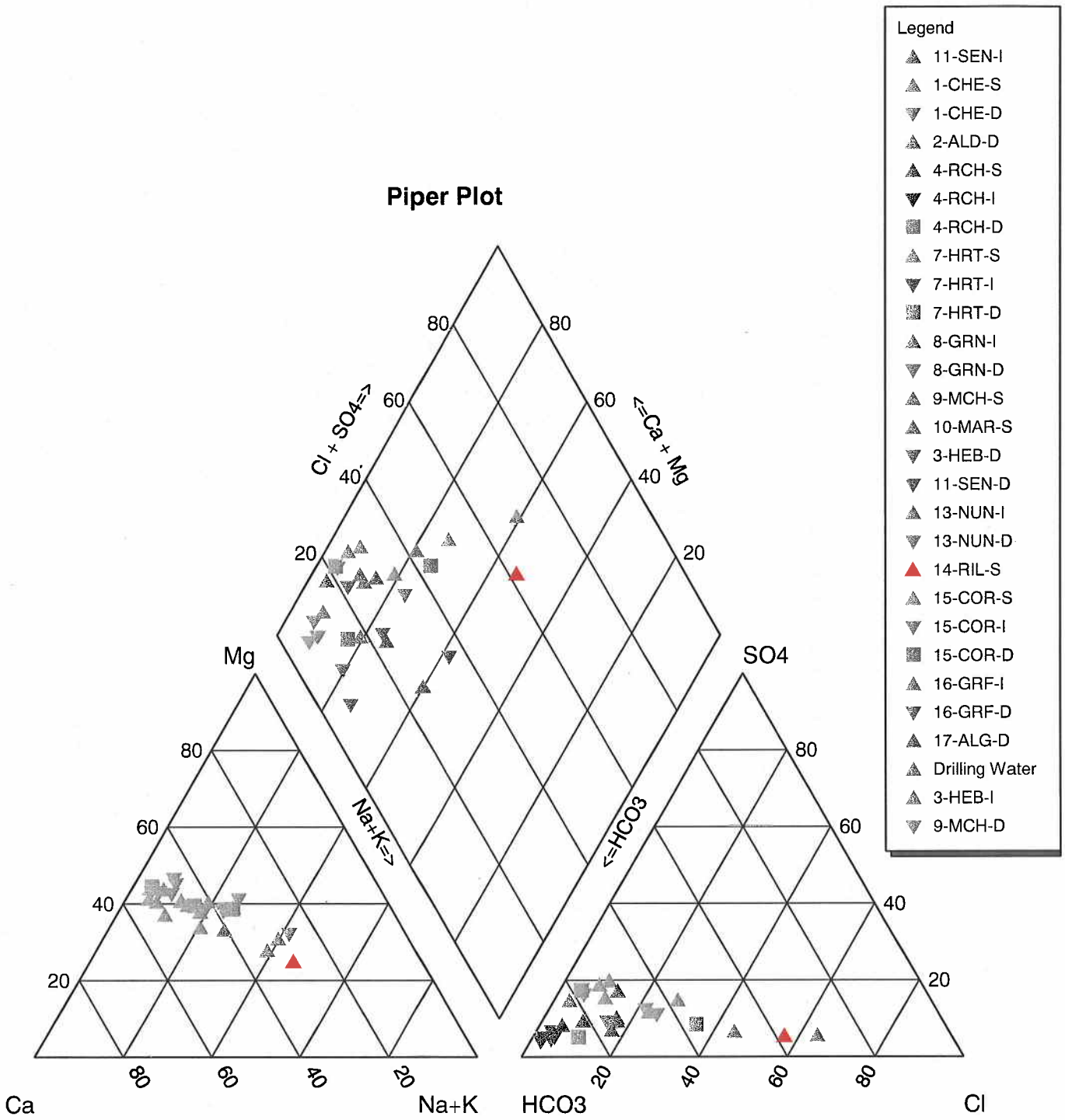
1600 Shore Road • Naperville, Illinois 60563 • Phone (630) 778-1200 • Fax (630) 778-1233

Analytical Report

Client: STS CONSULTANTS (VERN)
Project ID: McHenry County 200804080
Sample ID: 14-RIL-S
Sample No: 9-0115-012

Date Collected: 01/08/09
Time Collected: 16:45
Date Received: 01/13/09
Date Reported: 01/20/09

Analyte		Result	R.L.	Units	Flags
Total Metals	**Method: 6020A**		**Preparation Method 3010A**		
Analysis Date: 01/16/09			Preparation Date: 01/15/09		
Calcium		102	0.1	mg/L	
Iron		0.69	0.01	mg/L	
Magnesium		54.3	0.1	mg/L	
Potassium		2.5	0.1	mg/L	
Sodium		186	0.1	mg/L	
Alkalinity, Bicarbonate (CaCO3)	**Method: 2320B**				
Analysis Date: 01/15/09 13:30					
Alkalinity, Bicarbonate (CaCO3)		330	5	mg/L	
Alkalinity, Carbonate (CaCO3)	**Method: 2320B**				
Analysis Date: 01/15/09 13:30					
Alkalinity, Carbonate (CaCO3)		< 5	5	mg/L	
Chloride	**Method: 4500Cl, E**				
Analysis Date: 01/14/09					
Chloride		350	5	mg/L	
Sulfate	**Method: 375.2R2.0**				
Analysis Date: 01/15/09					
Sulfate		47	15	mg/L	



DESCRIPTION: Piper Linear Diagram - Well Site #14

AECOM	PROJECT: McHenry County	PROJECT NO: 09000460
	CLIENT: Army Corps of Engineers	DATE: 7/30/2009

Field Well Sampling Sheet

Fill out the entire form. If it does not apply, mark N/A.

Project Name: McHenry County
STS Job No. 200804080
Location: Riley
Tester: Brian Schmidt
Well Number: 14-RIL-S
Date Sampled: 1/8/09
Previous Well Sampled: 7-HRT-D

GENERAL CONDITIONS:

						If Missing Replaced?
Surface Seal:	X Ok		Damaged		Missing:	Yes No
Protector Pipe:	X Ok		Damaged		Missing:	Yes No
Well Cap:	X Ok		Damaged		Missing:	Yes No
Ambient Temperature: 20 °F		X Clear		Cloudy	Rain	

WELL DATA:

Measuring Device: Solinst Water Level Meter
Stick Up or Down: Up
Depth to Water: 8.85 (from Ground Surface)
Depth to Bottom: 20 (from TPVC)
Length of Water: (from TPVC)
Free Product Observed: [ ] Yes [X] No Thickness: N/A

PURGING/SAMPLING:

Well Purging Calculations: Amount to purge = 0.163 gallons/foot times height of water column in feet for one well volume

Purging Device: Bladder Pump
Sampling Device: Bladder Pump
Volume Required:
[X] See back of page for field readings during purge
Volume Purged:
Could Well Bail Dry? [ ] Yes [X] No
Purging - Time Start: 15:50
Time Ended: 1650
Decon Method: Alconox

IN-SITU TESTING:

Turbidity: [ ] Turbid [ ] Opaque
Odor:
Color
pH @ degrees C
Uncorrected Conductivity X
Water Temp. (from Cond.)
Comments: ST: 1645

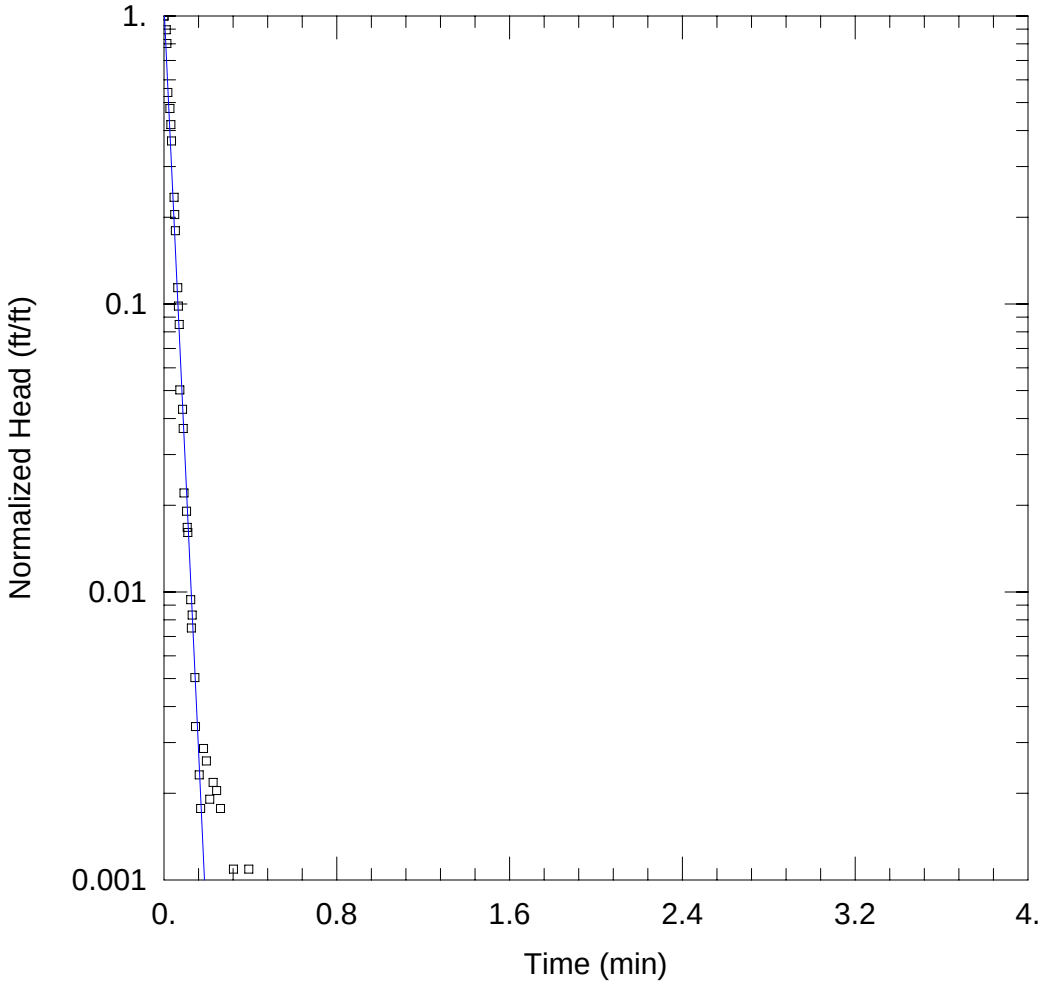
SAMPLES COLLECTED

Vocs -		Cyanide	
Metals -		Hexchrome	
SVOC		Alkalinity	
TOC		Chloride	
Sulfide		Ammonia	
Phenolics		COD	

Well Purging Log

Date 1/8/09

Time	Temp	pH	Conductivity	~~ORP~~ TURB	~~DO~~ RATE
1/8/09 16:05	7.7	7.96	1970	999	250 ml/min
16:10	7.6	7.86	1970	999	"
16:15	7.1	7.71	1980	999	"
16:20	7.0	7.70	2010	452	"
16:25	7.7	7.54	2000	172	"
16:30	8.5	7.52	1980	42	"
16:35	8.9	7.51	1970	27	"
16:40	8.7	7.50	1970	14	"
16:45	8.3	7.51	1980	12	"
	ST: 1645				



WELL TEST ANALYSIS

Data Set: K:\PROJECTS\200804080\In_Progress\Troll-files\AQTESOLV-files\14-RIL-S_001_B&R.aqt
Date: 04/05/09 Time: 12:24:16

PROJECT INFORMATION

Company: AECOM
Client: USACE / McHenry Cty
Project: 09000-460 (h200804080)
Location: McHenry County, IL
Test Date: Feb. 22, 2009

AQUIFER DATA

Saturated Thickness: 18. ft
Anisotropy Ratio (Kz/Kr): 0.33

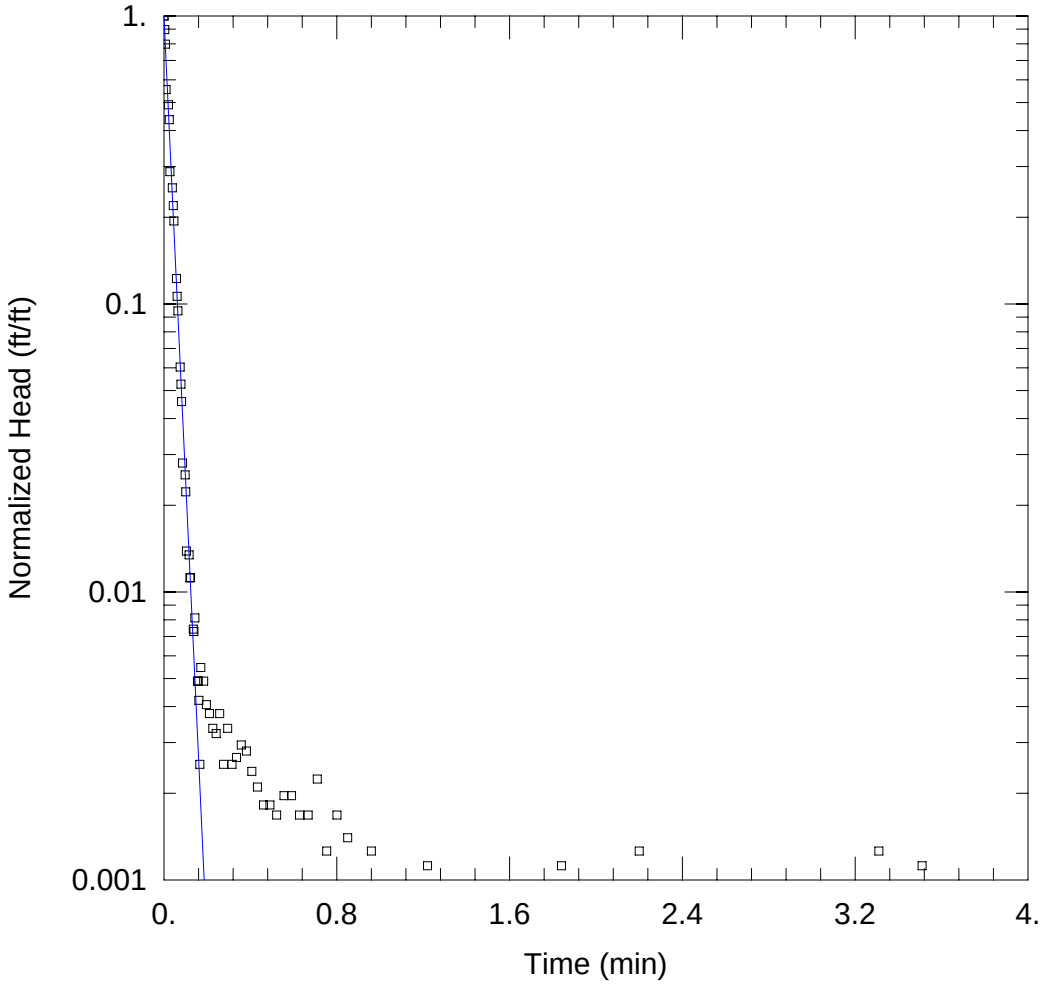
WELL DATA (14-RIL-S)

Initial Displacement: 7.34 ft
Total Well Penetration Depth: 11.5 ft
Casing Radius: 0.083 ft
Static Water Column Height: 12. ft
Screen Length: 4.5 ft
Well Radius: 0.25 ft
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 0.131 cm/sec
y0 = 8.122 ft



WELL TEST ANALYSIS

Data Set: C:\...\14-RIL-S_002_B&R.aqt
Date: 04/07/09 Time: 11:52:05

PROJECT INFORMATION

Company: AECOM
Client: USACE / McHenry Cty
Project: 09000-460 (h200804080)
Location: McHenry County, IL
Test Date: Feb. 22, 2009

AQUIFER DATA

Saturated Thickness: 18. ft
Anisotropy Ratio (Kz/Kr): 0.33

WELL DATA (14-RIL-S)

Initial Displacement: 7.14 ft
Total Well Penetration Depth: 11.5 ft
Casing Radius: 0.083 ft
Static Water Column Height: 12. ft
Screen Length: 4.5 ft
Well Radius: 0.25 ft
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 0.1298 cm/sec
y0 = 7.081 ft

Additional Well Site Information

In-Situ Inc.

14-RIL-5

Calibration Report

Report Number: 20090121201115-140871

221 East Lincoln Avenue, Fort Collins, CO 80524 USA
1-970-498-1500, 1-800-446-7488, FAX: 1-970-498-1598
Visit us at www.in-situ.com

Instrument Details:

Instrument Model:	**Level TROLL 500**
Full Scale Pressure Range	**103.42 KPa (15 PSI) vented**
Serial Number:	**140871**

Calibration Details:

Calibration Result:	**PASS**
Calibration Date:	2009-01-21 20:11:15 (UTC)
Nominal Range of Applied Temperature:	-5 C to +50 C
Temperature Accuracy Specification:	+/- 0.1 C From 0 C to +50 C
Nominal Range of Applied Pressure:	0 KPa to 103.4 KPa (0.0 PSI to 15.0 PSI)
Pressure Accuracy Specification:	+/- 0.1 %FS from -5 C to +50 C, +/- 0.05 %FS at +15 C

Post-Calibration Check:

Parameter	Applied	Reported	Deviation
Pressure	15.0001	14.9994	-0.0046
Pressure	0.0004	-0.0008	-0.0082
Temperature	19.9070	19.9233	0.0163

Calibration Procedures and Equipment Used:

Automated calibration procedures used.
Manu Agilent Model 34970A SerialNo MY44015965
Manu Instrulab Model 3312A-14-15-24 SerialNo 31103-(41012)
Manu Instrulab Model 406X-0031-01 SerialNo 2-31138
Manu MENSOR Model 600 SerialNo 621436
Manu Agilent Model 53131A SerialNo MY47000169
Manu MENSOR Model 600 SerialNo 621385

Notes:

1. Standards used in this calibration are traceable to the National Institute of Standards and Technology.
2. This calibration report shall not be reproduced, except in full, without the written approval of In-Situ, Inc.
3. A calibration interval of 12 to 18 months is recommended.
4. The post-calibration data is collected at nominal +20 C.
5. 1.0 PSI = 6.894757 KPa

Performed By: JBO

Copyright © 2006 In-Situ, Inc.

Riley Township Well Site

Riley Township Well Site

Riley Township Well Site – Set Up on Hole

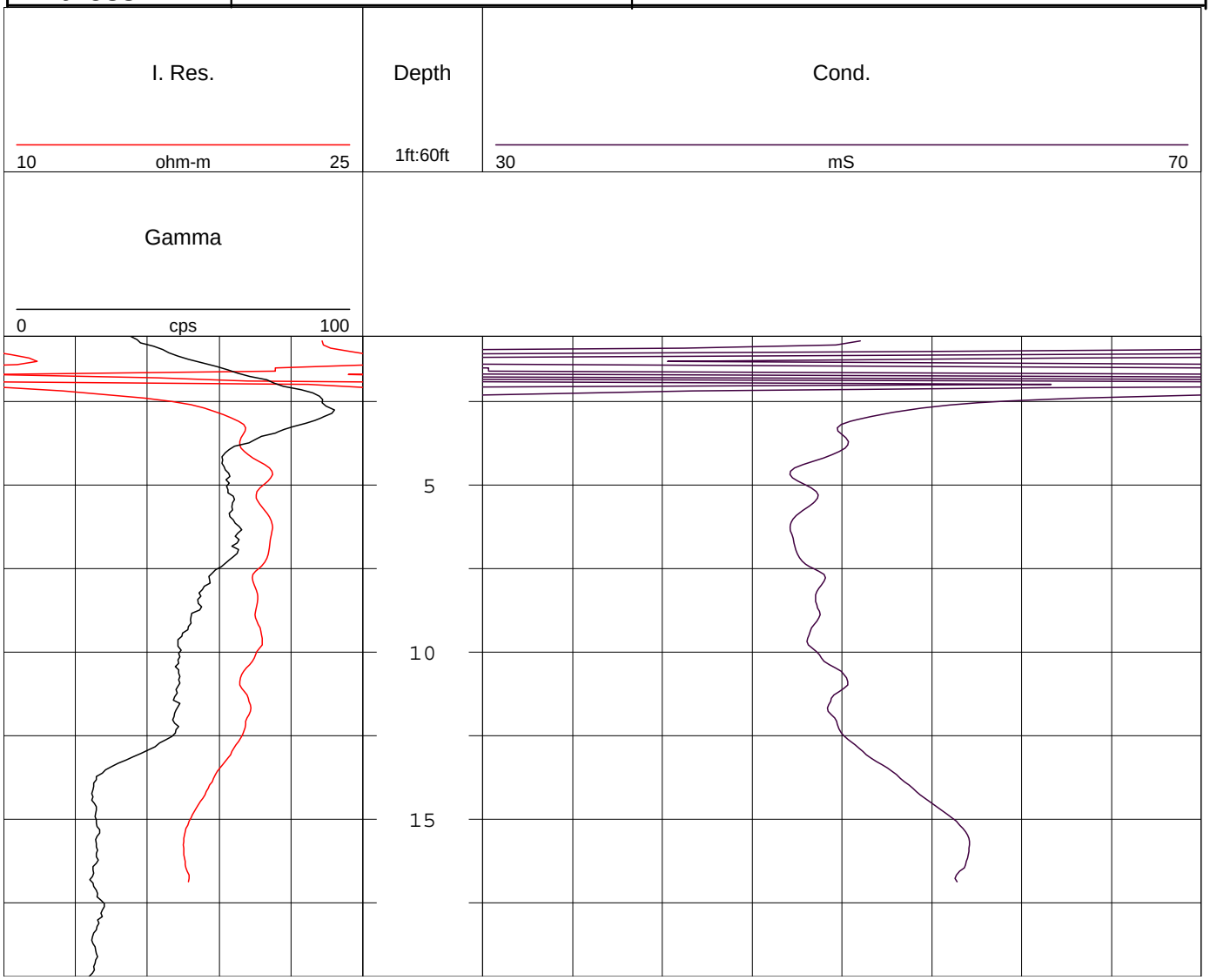
Riley Township Well Site

COMPANY:	MCHENRY CO. & USACE
Location:	RILEY TWP

Well	RILEY TWP #14		
Date	1/21/2009	BH Fluid	FORMATION
Casing	2" PVC 2.4' AGS - 20'BGS		
File Name	MCHTH14-09EM		
Depth Driller	31' BGS		
Depth Logger	19.27' BGS		
Logged by:	T. YOUNG		
Witness:	NOT WITNESSED		

OTHER SERVICES

H2O LEVEL & GPS



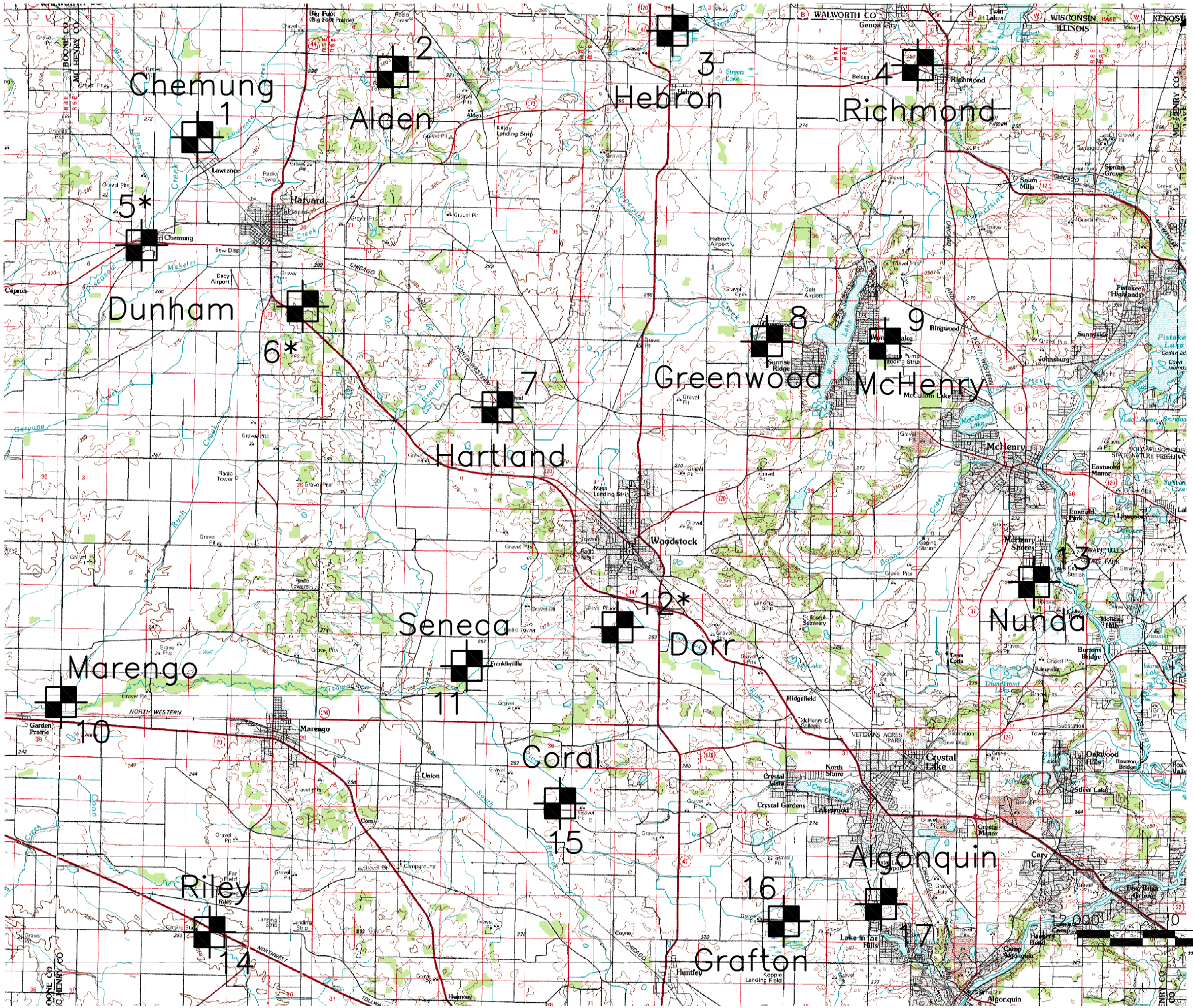
A-15: Folio for Well Site #15 – Coral Township

Table of Contents

I.) Site Location Map – Location in County
II.) Site Location Map – Location on USGS Topographic Map
III.) Site Location Map – Location on USGS High Resolution Orthophoto
IV.) Site Boring Log
V.) Well Construction Diagram
VI.) Well Site Summary and Commentary
VII.) Particle Size Distribution Report
VIII.) Table of Water Level Measurements
IX.) Well Development Field Log
X.) Water Quality Analysis Results
XI.) Groundwater Sampling Field Log
XII.) Hydraulic Conductivity Testing Results
XIII.) In-Situ LevelTroll™ Calibration Report
XIV.) Site Photographs
XV.) Downhole Geophysical Testing

Well Site Location Maps

Z:\Projects\200804080\CtyWide\D-09000-460-8000_CtyOverviewMap_004.dwg; 4/20/2009 5:33:59 PM; BRAUN, GARY



LEGEND:

AECOM Well Installation Site

McHenry 9

Well Installations By Others

Dunham 6*

0 12,000 24,000'

" = 12,000'

AECOM

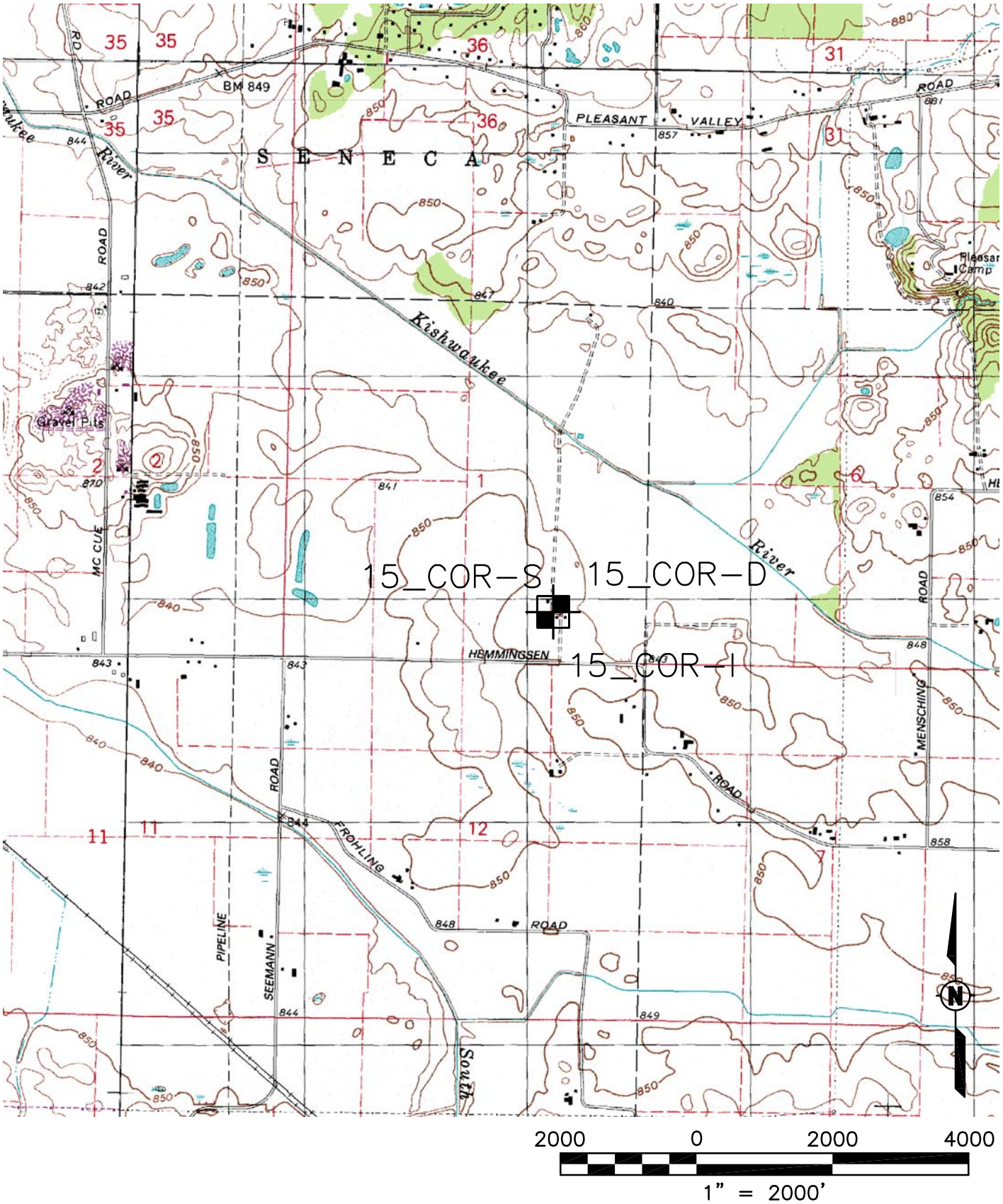
750 Corporate Woods Pkwy
Vernon Hills, IL 60061
847-279-2500
www.aecom.com

Copyright © By: STS Consultants, Ltd.

LOCATION MAP OF WELL SITES

Observation Well Network for Glacial Aquifers
McHenry County, Illinois

Drawn :	CJH	3/11/2009
Checked:	GMB	4/18/2009
Approved:	CSR	4/27/2009
PROJECT NUMBER	09000-460	
FIGURE NUMBER	1	



AECOM

750 Corporate Woods Parkway
Vernon Hills, IL 60061
847.279.2500
www.aecom.com

Copyright © 2009, By: AECOM

Site Location on USGS Topographic Map
Site No. 15 - Coral Township
MCCD Pleasant Valley Facility - Hemmingson Rd.
Observation Well Network
McHenry County, Illinois

Drawn :	CJH	04/01/2009
Checked:	GMB	04/15/2009
Approved:	CSR	04/24/2009
PROJECT NUMBER	09000-460	
FIGURE NUMBER	Folio_15 #2	

Z:\Projects\200804080\CityWide\D-09000-460-8000_TopoMaps_v02.dwg; 4/20/2009 11:18:57 AM; BRAUN, GARY; STS_BLACK_040102.ctb

500 0 500 1000

1" = 500'

AECOM

750 Corporate Woods Parkway
Vernon Hills, IL 60061
847.279.2500
www.aecom.com
Copyright © 2009, By: AECOM

2005 USGS High Resolution Orthophoto
Site No. 15 - Coral Township
MCCD Pleasant Valley Facility - Hemmingson Rd.
Observation Well Network
McHenry County, Illinois

Drawn :	CJH	04/01/2009
Checked:	GMB	04/15/2009
Approved:	CSR	04/24/2009
PROJECT NUMBER	09000-460	
FIGURE NUMBER	Folio_15 #2	

Z:\Projects\200804080\CtyWide\D-09000-460-8000_AerialsMap_004.dwg; 4/21/2009 2:32:56 PM; BRAUN, GARY; STS_BLACK_040102.ctb

Boring and Well Construction Details

DRILLING LOG

DIVISION	USACE
INSTALLATION	Chicago District
SHEET	1 OF 6 SHEETS
1. PROJECT	McHenry County Observation Wells
2. LOCATION (Coordinates or Station)	McHenry County, Illinois N 2,025,727.00 E 945,338.00
3. DRILLING AGENCY	WDC Exploration & Wells
4. HOLE NO. *(As shown on drawing title and file number)*	15-CORAL
5. NAME OF DRILLER	Dan Tonnancour
6. DIRECTION OF HOLE	☒ VERTICAL ☐ INCLINED --- DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN	122.5
8. DEPTH DRILLED INTO ROCK	2.5
9. TOTAL DEPTH OF HOLE	125.0
10. SIZE AND TYPE OF BIT	3 7/8" Carbide Bit / 5 7/8" Casing
11. DATUM FOR ELEVATION SHOWN *(TBM or MSL)*	NAVD 88
12. MANUFACTURER'S DESIGNATION OF DRILL	Super Sonic II
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN	DISTURBED 16 / UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES	N/A
15. ELEVATION GROUND WATER	842.0
16. DATE HOLE	STARTED 10/27/2008 / COMPLETED 10/27/2008
17. ELEVATION TOP OF HOLE	+851.2
18. TOTAL CORE RECOVERY FOR BORING	NA %
19. GEOLOGIST	Gary Braun, LPG IL

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS *(Drilling time, water loss, depth weathering, etc., if significant)* g
+851.2	0.0		Topsoil: OL, Black organic sandy silt, trace gravel	60	1 0.0 5.0	
+850.2	1.0		GW, Brown/dark brown mottled gravelly sand, little silt, loose, moist to wet below 7.0'			Sample No. 1 from 4.0' - 5.0'
				100	2 5.0 15.0	
+843.2	8.0		CH, Gray fat clay, trace coarse sand and fine gravel, soft, moist, highly plastic, massive, matrix support diamicton			Sample No. 2 from 14.0' - 15.0'
				90	3 15.0 25.0	

DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE 851.2

Hole No. 15-CORAL

PROJECT: McHenry County Observation Wells

INSTALLATION: Chicago District

SHEET 2 OF 6 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
			CH, Gray fat clay, trace coarse sand and fine gravel, soft, moist, highly plastic, massive, matrix support diamicton *(continued)*			
						Sample No. 3 from 24.0' - 25.0'
				95	4 25.0 35.0	
						Qp = 1.5 TSF @28.0'
						Sample No. 4 from 33.0' to 34.0'
				50	5 35.0 45.0	
+812.2	39.0					
			GP, Fine gravel, some sand, trace medium to coarse gravel, very loose, wet			
						No recovery from 40.0' to 45.0'
						Sample No. 5 from 44.0' to 45.0'
				100	6 45.0	

DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE 851.2

Hole No. 15-CORAL

PROJECT: McHenry County Observation Wells

INSTALLATION: Chicago District

SHEET 3 OF 6 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
			GP, Fine gravel, some sand, trace medium to coarse gravel, very loose, wet *(continued)*		55.0	
+796.2	55.0					Sample No. 6 from 54.0' to 55.0' % Gravel/% Sand/% Fines = 59/39/2 from 54.0' to 55.0'
			SP, Gray gravelly coarse sand, very loose, wet	65	7 55.0 65.0	
						Sample No. 7 from 64.0' to 65.0'
				100	8 65.0 75.0	

DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE 851.2

Hole No. 15-CORAL

PROJECT: McHenry County Observation Wells

INSTALLATION: Chicago District

SHEET 4 OF 6 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
+777.2	74.0		SP, Gray gravelly coarse sand, very loose, wet *(continued)*			
			SP, Gray fine sand, moderately dense, wet			Sample No. 8 from 74.0' to 75.0'
				100	9 75.0 85.0	
						Sample No. 9 from 84.0' to 85.0'
				80	10 85.0 95.0	
+760.2	91.0					
			SP, Brownish gray medium sand, trace fine gravel, loose, wet			
						Sample No. 10 from 94.0' to 95.0'
				75	11 95.0 105.0	

DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE 851.2

Hole No. 15-CORAL

PROJECT: McHenry County Observation Wells

INSTALLATION: Chicago District

SHEET 5 OF 6 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
			SP, Brownish gray medium sand, trace fine gravel, loose, wet *(continued)*			
+750.7	100.5					
			SW, Gray gravelly medium sand, loose, wet			
						Sample No. 11 from 104.0' to 105.0' % Gravel/% Sand/% Fines = 41/57/2 from 104.0' to 105.0'
				100	12 105.0 115.0	
+745.2	106.0					
			SP, Gray medium sand, moderately dense, well sorted, wet			
						Sample No. 12 from 107.0' to 108.0'
+743.2	108.0					
			OL, Very dark brown organic silt, with brown and black layering and mottling, dense, not plastic or cohesive			Sample No. 13 from 108.0' to 109.0'
			Note: Fine gravel lens from 110.0' to 110.3'			
+740.9	110.3					
			SP, Gray medium sand, trace gravel, moderately dense, wet			
						Sample No. 14 from 114.0' to 115.0' % Gravel/% Sand/% Fines = 15/80/6 from 114.0' to 115.0'
				100	13 115.0 125.0	
+734.7	116.5					
			CL, Brownish gray clayey silt, little sand and gravel, hard, damp			
			Note: Drilling more difficult 2.0' into run and much higher pitch vibration and drill chatter last 1.5' of run			
						Sample No. 15 from 120.0' to 121.0'
+729.7	121.5					
			Weathered Bedrock			
+728.7	122.5					
			Dolomitic Bedrock			

DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE 851.2

Hole No. 15-CORAL

PROJECT: McHenry County Observation Wells

INSTALLATION: Chicago District

SHEET 6 OF 6 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS *(Drilling time, water loss, depth weathering, etc., if significant)* g
			Dolomitic Bedrock *(continued)*			
						Sample No. 16 from 124.0' to 125.0'
+726.2	125.0					
			END OF BORING - 125.0' BGS			AECOM Project No. 60095270

Hole No. 15 - CORAL TWP

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 1 OF 9 SHEETS

1. PROJECT McHenry City Wells	10. SIZE AND TYPE OF BIT 3 7/8" Carbide Sampler
2. LOCATION (Coordinates or Station) N 2,025,727.4 E 945,338 IL 34 P/E	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) NAVD 88
3. DRILLING AGENCY WDC Exploration & Wells	12. MANUFACTURERS DESIGNATION OF DRILL SuperSonic II
4. HOLE NO. (As shown on drawing title and title number) 15-COR	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN — DISTURBED 16 — UNDISTURBED —
5. NAME OF DRILLER DAN TONNANCOUR	14. TOTAL NUMBER CORE BOXES —
6. DIRECTION OF HOLE ☑ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.	15. ELEVATION GROUND WATER 842' (10/28)
	16. DATE HOLE — STARTED 10-27-08 — COMPLETED 10-27-08
7. THICKNESS OF OVERBURDEN 122.5 ft	17. ELEVATION TOP OF HOLE 851.2 ft MSL
8. DEPTH DRILLED INTO ROCK 2.5 ft	18. TOTAL CORE RECOVERY FOR BORING 108"/125' = 87%
9. TOTAL DEPTH OF HOLE 125 ft	19. SIGNATURE OF INSPECTOR Gary M. Brown LPG IL

5 5/8" Casing

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
851.2	0		Topsoil: Black Sandy SILT, organic tr. gravel (OL)			Run 1 (0-5') Rec/Run = 3'/5' = 60%
	1		Brown / Dark Brown Mottled Gravelly SAND, little silt, loose moist - wet below 7' (SW-SW)	Rec 60%	Bag 1	
	2					
	3					
	4				S1	
	5				Bag 2	Run 2 (5-15) Rec/Run = 10'/10' = 100%
	6					
	7				Bag 3	
	8		0.5 ft Gradation			
	9		Gray Fat CLAY, trace C. sand & fine gravel, soft, moist (CH) - highly plastic, massive, matrix supported diamicton	Rec 100%		
841.2	10				Bag 4	
	11					
	12					
	13		TILL			
	14				Bag 5	
	15				S2	

0938 ↓ Sample 0940

0945 ↓ Run 4" 0947 Core barrel

Drive 6" Casing

Extract Samples 0955

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT McHenry City Wells — HOLE NO. 15 - CORAL TWP

Hole No. 15-CORAL TWP

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 2 OF SHEETS

1. PROJECT McHenry City Wells	10. SIZE AND TYPE OF BIT 3 7/8" Carbide Sampler
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) NAVD 88
3. DRILLING AGENCY WDC Exploration & Wells	12. MANUFACTURERS DESIGNATION OF DRILL Super Sonic II
4. HOLE NO. (As shown on drawing title and title number) 15-COR	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 16; UNDISTURBED 0
5. NAME OF DRILLER Dan Tonnancour	14. TOTAL NUMBER CORE BOXES —
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.	15. ELEVATION GROUND WATER 842' (10/28)
	16. DATE HOLE: STARTED 10-27-08; COMPLETED 10-27-08
7. THICKNESS OF OVERBURDEN 122.5'	17. ELEVATION TOP OF HOLE 951.2 FT MSL
8. DEPTH DRILLED INTO ROCK 2.5'	18. TOTAL CORE RECOVERY FOR BORING 108/125 = 87%
9. TOTAL DEPTH OF HOLE 125'	19. SIGNATURE OF INSPECTOR Harry M. Brown LPG IL

5 7/8" Casing

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g	
	15		cont.			Run 3 (15-25)	0859
	16		Diamicton		Bag 6	Rec/Run = 9'/10' = 90%	↓ 4" Coring 0901
	17						Drive 6" Casing
	18						0906
	19			Rec 90%	Bag 7		
931.2	20						
	21						
	22						
	23				Bag 8		
	24						Extract Samples
					S3		0910
	25					Run 4 (25-35)	0915
	26					Rec/Run = 9.5'/10' = 95%	↓ 4" Coring 0917
	27						
	28		1.5 tsf	Rec 95%	Bag 9		Drive 6" Casing 0924
	29						
821.2	30						

ENG FORM 1836
MAR 71

PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT McHenry City Wells | HOLE NO. 15-CORAL TWP

Hole No. 15 - CORAL TWP

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 3 OF 9 SHEETS

1. PROJECT McHenry City Wells	10. SIZE AND TYPE OF BIT 3 7/8" Carbide Sampler (5 7/8" Casing)
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) NAVD 88
3. DRILLING AGENCY WDC Exploration & Wells	12. MANUFACTURERS DESIGNATION OF DRILL Super Sonic II
4. HOLE NO. (As shown on drawing title and title number) 15 - COR	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN — DISTURBED 16 — UNDISTURBED —
5. NAME OF DRILLER DAN TONNANCOWE	14. TOTAL NUMBER CORE BOXES —
6. DIRECTION OF HOLE ☑ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.	15. ELEVATION GROUND WATER 842 (10/28)
	16. DATE HOLE — STARTED 10-24-08 — COMPLETED 10-27-08
7. THICKNESS OF OVERBURDEN 122.5'	17. ELEVATION TOP OF HOLE 951.2 FT MSL
8. DEPTH DRILLED INTO ROCK 2.5'	18. TOTAL CORE RECOVERY FOR BORING 108/125 = 87%
9. TOTAL DEPTH OF HOLE 125'	19. SIGNATURE OF INSPECTOR Henry M. Brown LPG IL

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
821.2	30		DIAMICTON cont.	cont.		RUN 4 (25-35') cont.
	31					
	32			REC 95%	Bag 10	
	33					
	34		> SILT SEAM		S4	Extract Sample 0932
	35		> SAND & GRAVEL SEAM			RUN 5 (35-45) 0938
	36					Rec/Run = 5/10 = 50 % ↓ Drive 4" core barrel 0940
	37				Bag 11	
	38					↓ Drive 6" Casing 0945
	39					
811.2	40		Gray FINE GRAVEL, some sand, trace Medium - Coarse gravel, very loose, wet (GP)	REC 50%		• Lack of recovery believed to be caused by loose gravel. Assumed 2nd half of Run5 is same as Run6. ½ Bottom of Bag11 (i.e. f gravel)
	41					
	42		OUTWASH			
	43				NR 40-45	Extract Sample 0949
	44					Brk.
	45				S5	

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT McHenry City Wells — HOLE NO. 15 - CORAL TWP

Hole No. 15-CORAL TWP

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 4 OF SHEETS

1. PROJECT McHenry Cty Wells	10. SIZE AND TYPE OF BIT 3 7/8" Carbide Sampler
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) NAVD88
3. DRILLING AGENCY WDC Exploration & Wells	12. MANUFACTURERS DESIGNATION OF DRILL Super Sonic II
4. HOLE NO. (As shown on drawing title and title number) 15-COR	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN — DISTURBED 16 — UNDISTURBED 0
5. NAME OF DRILLER DAN TONNANCOUR	14. TOTAL NUMBER CORE BOXES —
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.	15. ELEVATION GROUND WATER 842' (10-28)
	16. DATE HOLE — STARTED 10-27-08 — COMPLETED 10-27-08
7. THICKNESS OF OVERBURDEN 122.5'	17. ELEVATION TOP OF HOLE 851.2 FMSL
8. DEPTH DRILLED INTO ROCK 2.5'	18. TOTAL CORE RECOVERY FOR BORING 108/125 = 87%
9. TOTAL DEPTH OF HOLE 125'	19. SIGNATURE OF INSPECTOR Gary M Braun LPG IL

5 7/8" Casing
Roto-Sonic

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	45		cont.			Run 6 (45-55)
	46		OUTWASH			Rec/Run = 10/10' = 100%
	47		sandy lens		Bag 12	
	48					
	49			Rec. 100%		
801.2	50					
	51					
	52				Bag 13	
	53					
	54				36	(Grain size sample also taken)
	55		Grades over 1-2ft			
	56		Gray Gravelly Coarse Sand, very loose, wet (SP)			Run 7 (55-65)
	57				Bag 14	Rec/Run = 6.5'/10' = 65%
	58			Rec. 65%		
	59				Bag 15	
791.2	60					

1021 ↓ Drive 4" Core Barrel 1022
Drive 6" Casing ↓ 1027
1047 ↓ Drive 4" Core barrel 1048
Drive 6" Casing 1051 ↓ 1055

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT McHenry Cty Wells — HOLE NO. 15-CORAL TWP

Hole No. 15-CORAL TWP

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 5 OF SHEETS

1. PROJECT McHenry Cty Wells	10. SIZE AND TYPE OF BIT 3 7/8" Carbide Sampler 5 7/8" CAS
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) NAVD 88
3. DRILLING AGENCY WDC Exploration & Wells	12. MANUFACTURERS DESIGNATION OF DRILL Super Sonic II
4. HOLE NO. (As shown on drawing title and title number) 15-COR	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 16; UNDISTURBED 0
5. NAME OF DRILLER PAN TONNANCOUR	14. TOTAL NUMBER CORE BOXES —
6. DIRECTION OF HOLE ☑ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER 842 (10/28')
	16. DATE HOLE: STARTED 10-27-08; COMPLETED 10-27-08
7. THICKNESS OF OVERBURDEN 122.5'	17. ELEVATION TOP OF HOLE 851.2 Ft MSL
8. DEPTH DRILLED INTO ROCK 2.5'	18. TOTAL CORE RECOVERY FOR BORING 108/125 = 89%
9. TOTAL DEPTH OF HOLE 125'	19. SIGNATURE OF INSPECTOR Gary M Baran LPG IL

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
791.2	60		cont.	cont.		Run 7 CONT. (55-65)
	61		C. SAND (SP)	REC 65%	Bag 15	
	62					
	63					
	64				S7	Extract Samples 1058
	65					
	66				Bag 16	Run 8 (65-75) 1108
	67		Gravelly Seam			Rec/Run = 10'/10' = 100% 1109
	68					
	69				Bag 17	
781.2	70			REC 100%		
	71					
	72					
	73		Abrupt Contact		Bag 18	
	74		Gray FINE SAND, Moderately dense, wet (SP)		S8	1120 Extract Samples
	75					

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT McHenry Cty Wells | HOLE NO. 15-CORAL TWP

Hole No. 15-CORAL TWP

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 6 OF SHEETS

1. PROJECT McHenry Cty Wells	10. SIZE AND TYPE OF BIT 3 7/8" Carbide Sampler
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) NAVD 88
3. DRILLING AGENCY WDC Exploration & Wells	12. MANUFACTURERS DESIGNATION OF DRILL Super Sonic II
4. HOLE NO. (As shown on drawing title and title number) 15-COR	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN — DISTURBED 16 — UNDISTURBED 0
5. NAME OF DRILLER DAN TONNANCOUR	14. TOTAL NUMBER CORE BOXES —
6. DIRECTION OF HOLE ☑ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.	15. ELEVATION GROUND WATER 842 (10-28-08)
	16. DATE HOLE — STARTED 10-27-08 — COMPLETED 10-27-08
7. THICKNESS OF OVERBURDEN 122.5'	17. ELEVATION TOP OF HOLE 851.2 Ft MSL
8. DEPTH DRILLED INTO ROCK 2.5'	18. TOTAL CORE RECOVERY FOR BORING 109/125 = 87%
9. TOTAL DEPTH OF HOLE 125'	19. SIGNATURE OF INSPECTOR Gary M. Brown LPG IL

5 7/8" Casing

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	75		cont.			Run 9 (75-85)
	76		FINE SAND		Bag 19	Rec/Run = 10'/10' = 100%
	77					
	78					
	79					
771.2	80			Rec 100%	Bag 20	
	81					
	82					
	83				Bag 21	
	84					
	85				59	
	86				Bag 22	Run 10 (85-95) Rec/Run = 8/10' = 80%
	87					
	88			Rec 80%		
	89				Bag 23	
761.2	90					

1132 ↓ 4" Sampling 1134

1145 Extract Samples

1201 Drive ↓ 4" core barrel 1202

6" Casing ↓ to 95' 1206

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT McHenry Cty Wells — HOLE NO. 15-CORAL TWP

Hole No. 15-CORAL TWP

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 7 OF 9 SHEETS

1. PROJECT McHenry Cty Wells	10. SIZE AND TYPE OF BIT 3 7/8" Carbide Sampler
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) NAVD 88
3. DRILLING AGENCY WDC Exploration & Wells	12. MANUFACTURERS DESIGNATION OF DRILL Super Sonic II
4. HOLE NO. (As shown on drawing title and title number) 15-COR	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN — DISTURBED 16 — UNDISTURBED 0
5. NAME OF DRILLER PAN TONNANCOUR	14. TOTAL NUMBER CORE BOXES —
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.	15. ELEVATION GROUND WATER 842 (10/28)
	16. DATE HOLE — STARTED 10-27-08 — COMPLETED 10-27-08
7. THICKNESS OF OVERBURDEN 122.5'	17. ELEVATION TOP OF HOLE 851.2 ft MSL
8. DEPTH DRILLED INTO ROCK 2.5'	18. TOTAL CORE RECOVERY FOR BORING 108/125 = 87%
9. TOTAL DEPTH OF HOLE 125'	19. SIGNATURE OF INSPECTOR Gary M. Brown UPGIL

5 7/8" CASING

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
761.2	90		Same As Above a brupt	Cont.		Run 10 cont. (85-95)
	91		Brownish Gray Medium SAND, trace fine gravel, loose, wet (SP) Gravelly Zone			
	92			Rec 80%	Bag 23	
	93					Extract Samples 1213
	94				s10	
	95					Run 11 (95-105)
	96					Rec/Run = 7.5'/10' = 75%
	97					
	98					
	99				Bag 24	
751.2	100			Rec 75%		
	101		Gray Gravelly Med. SAND, loose, wet (SW)			
	102					
	103					
	104					Extract Sample @ 1341
	105				s11	

1326 ↓ 4" 1328

6" ↓ 1336

Hole No. 15-CORAL TWP

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 8 OF 9 SHEETS

1. PROJECT McHenry Cty Wells	10. SIZE AND TYPE OF BIT 3 7/8" Carbide Sampler 5 7/8" Casing
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) NAVD88
3. DRILLING AGENCY WDC Exploration & Wells	12. MANUFACTURERS DESIGNATION OF DRILL Super Sonic II
4. HOLE NO. (As shown on drawing title and title number) 15-COR	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN — DISTURBED 16 — UNDISTURBED 0
5. NAME OF DRILLER Dan Tonwancour	14. TOTAL NUMBER CORE BOXES —
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.	15. ELEVATION GROUND WATER 842 (10/28)
	16. DATE HOLE — STARTED 10-27-08 — COMPLETED 10-27-08
7. THICKNESS OF OVERBURDEN 122.5'	17. ELEVATION TOP OF HOLE 851.2 ft MSL
8. DEPTH DRILLED INTO ROCK 2.5'	18. TOTAL CORE RECOVERY FOR BORING 109/125 = 87%
9. TOTAL DEPTH OF HOLE 125'	19. SIGNATURE OF INSPECTOR Gary M. Brown LPG IL

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g	
	105		Same Gravelly SAND as above			Run 12 (105-115)	1351
	106		Gray MEDIUM SAND Mod. Dense, well sorted, wet (SP)		Bag 25	Rec/Run = 10'/10' = 100%	4" Sampler 1353
	107		Very Abrupt Contact		s12		Drive 6" Casing 1359-1402
	108		Very Dark Brown ORGANIC SILT, w/ brown & black layering & mottling, dense, not plastic or cohesive (CL)		s13		
	109			Rec. 100%	Bag 26		
741.2	110						
	111		(110-110.3) fine gravel lens				
	112		Gray MEDIUM SAND, trace gravel, mod. dense, wet (SP) (well graded)				Extract Sample @ 1410
	113				Bag 27		
	114				s14	{Grain Size Sample Also Collected}	
	115		Gravel content decreases w/ elevation (fining upwards sequence)		Bag 28	Run 13 (115-125)	1422
	116					Rec/Run = 10'/10' = 100%	4" barrel 1426
	117		Brownish Gray CLAYEY SILT, little sand & gravel, hard, damp (CL)				1429
	118				Bag 29	Drilling more difficult 2 ft into run & much higher pitch vibration & drill chatter last 1.5 ft of run.	Drive 6" Casing 1434
	119		DIAMICTON Basal Till Unit				
731.2	120						

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT McHenry Cty Wells — HOLE NO. 15-SENECA TWP

Hole No. 15 - CORAL TWP

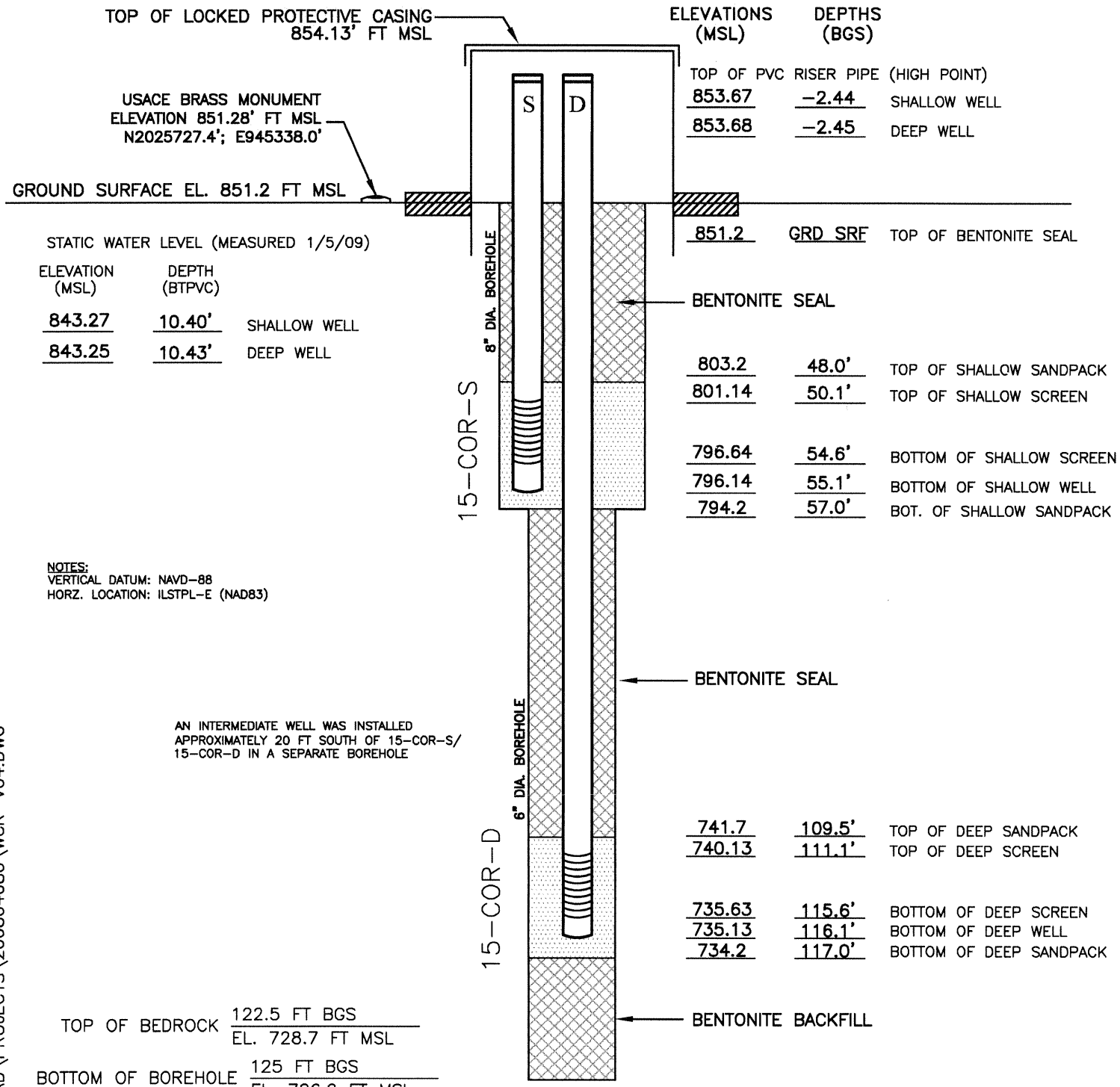
DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 9 OF 9 SHEETS

1. PROJECT: McHenry Cty Wells
2. LOCATION (Coordinates or Station):
3. DRILLING AGENCY: WDC Exploration & Wells
4. HOLE NO. (As shown on drawing title and title number): 15-COR
5. NAME OF DRILLER: DAN TONNANCOUR
6. DIRECTION OF HOLE: ☑ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 122.5'
8. DEPTH DRILLED INTO ROCK: 2.5'
9. TOTAL DEPTH OF HOLE: 125.0'
10. SIZE AND TYPE OF BIT: 3 7/8" Carbide Sampler 5 7/8" Casing
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): NAVD 88
12. MANUFACTURERS DESIGNATION OF DRILL: Super Sonic II
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 16 UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES: 0
15. ELEVATION GROUND WATER: 842 (10/28/08)
16. DATE HOLE: STARTED 10-27-08 COMPLETED 10-27-08
17. ELEVATION TOP OF HOLE: 851.2 FT MSL
18. TOTAL CORE RECOVERY FOR BORING: 108/125 = 87%
19. SIGNATURE OF INSPECTOR: Gary M Brown LPG/L

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
731.2	120		cont. BASAL TILL UNIT	cont.	s15	RUN 13 (115-125) CONT.
	121				Bag 30	
	122		WEATHERED wet BEDROCK/TILL INTERFACE	100%		
	123		WEATHERED BEDROCK Dry			
	124				Bag 31 s16	Extract Samples 1445
726.2	125		END OF BOREHOLE	10/27/08		
	126					
	127					
	128					
	129					
	130					
	131					
	132					
	133					
	134					
	135					

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT) PROJECT: McHenry Cty Wells HOLE NO. 15 - CORAL TWP

PROJECT McHENRY COUNTY OBSERVATION WELL NETWORK INSTALLATION (#09000-460)	WELL NO. 15-COR-S & 15-COR-D
LOCATION CORAL TOWNSHIP – McHENRY COUNTY, ILLINOIS	
CLIENT U.S. ARMY CORPS OF ENGINEERS / McHENRY COUNTY	
GEOLOGIST GARY BRAUN, P.G. (AECOM)	INSTALLATION DATE OCT. 28, 2008
DRILLER WDC EXPLORATION AND WELLS, INC. (BILL ZAKOW)	DRILLING METHOD ROTO-SONIC



ELEVATIONS (MSL)	DEPTHS (BGS)	
TOP OF PVC RISER PIPE (HIGH POINT)		
853.67	−2.44	SHALLOW WELL
853.68	−2.45	DEEP WELL
851.2	GRD SRF	TOP OF BENTONITE SEAL
803.2	48.0'	TOP OF SHALLOW SANDPACK
801.14	50.1'	TOP OF SHALLOW SCREEN
796.64	54.6'	BOTTOM OF SHALLOW SCREEN
796.14	55.1'	BOTTOM OF SHALLOW WELL
794.2	57.0'	BOT. OF SHALLOW SANDPACK
741.7	109.5'	TOP OF DEEP SANDPACK
740.13	111.1'	TOP OF DEEP SCREEN
735.63	115.6'	BOTTOM OF DEEP SCREEN
735.13	116.1'	BOTTOM OF DEEP WELL
734.2	117.0'	BOTTOM OF DEEP SANDPACK

STATIC WATER LEVEL (MEASURED 1/5/09)

ELEVATION (MSL)	DEPTH (BTPVC)	
843.27	10.40'	SHALLOW WELL
843.25	10.43'	DEEP WELL

NOTES:
VERTICAL DATUM: NAVD-88
HORZ. LOCATION: ILSTPL-E (NAD83)

AN INTERMEDIATE WELL WAS INSTALLED APPROXIMATELY 20 FT SOUTH OF 15-COR-S/ 15-COR-D IN A SEPARATE BOREHOLE

TOP OF BEDROCK 122.5 FT BGS / EL. 728.7 FT MSL

BOTTOM OF BOREHOLE 125 FT BGS / EL. 726.2 FT MSL

NOT TO SCALE

WELL CONSTRUCTION MATERIALS*

PROTECTIVE CASING	5' L X 8" DIA. ALUMINUM CASING W/ LOCKING CAP
RISER PIPE ABOVE W.T.	SCHEDULE 40 PVC (2.07" I.D./ 2.38" O.D.)
RISER PIPE BELOW W.T.	SCHEDULE 40 PVC (2.07" I.D./ 2.38" O.D.)
SCREEN	2" I.D. SCHEDULE 40 PVC W/ 0.010" SCREEN SLOT SIZE
TYPE OF BENTONITE SEAL	BLACK HILLS BENTONITE – 3/8" CHIPS (HOLE PLUG)
TYPE OF SAND PACK	R.W. SIDLEY CO. – NO. 5 FILTER PACK SAND

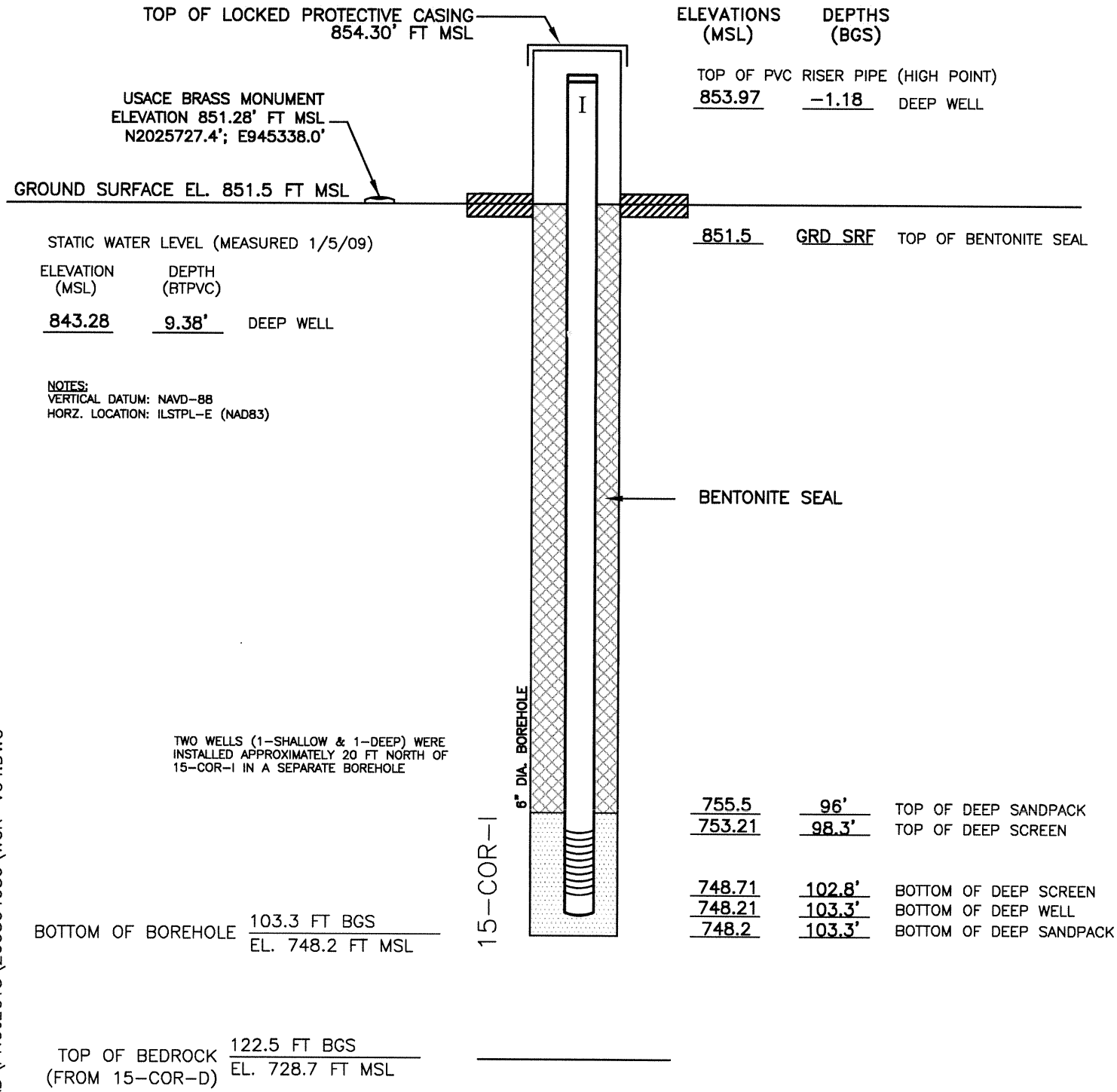
CASING MEASUREMENTS

BOTTOM OF SCREEN TO END CAP (FT)*		0.50
SCREEN LENGTH (1ST SLOT TO LAST SLOT) (FT)*		4.50
TOTAL LENGTH OF CASING (FT):	SHALLOW WELL	57.53
	DEEP WELL	118.55

* MEASUREMENT REFERS TO ALL WELLS

USMWK2FP001\05CAD\PROJECTS\200804080\WCR-V04.DWG

PROJECT McHENRY COUNTY OBSERVATION WELL NETWORK INSTALLATION (#09000-460)	WELL NO. 15-COR-I
LOCATION CORAL TOWNSHIP – McHENRY COUNTY, ILLINOIS	
CLIENT U.S. ARMY CORPS OF ENGINEERS / McHENRY COUNTY	
GEOLOGIST GARY BRAUN, P.G. (AECOM)	INSTALLATION DATE DEC. 16, 2008
DRILLER SUBSURFACE EXPLORATION, INC. (SEI – BILL McCARTNEY)	DRILLING METHOD ROTO-SONIC



NOT TO SCALE

WELL CONSTRUCTION MATERIALS*

PROTECTIVE CASING	5' L X 6" DIA. STEEL CASING W/ LOCKING CAP
RISER PIPE ABOVE W.T.	SCHEDULE 40 PVC (2.07" I.D./ 2.38" O.D.)
RISER PIPE BELOW W.T.	SCHEDULE 40 PVC (2.07" I.D./ 2.38" O.D.)
SCREEN	2" I.D. SCHEDULE 40 PVC W/ 0.010" SCREEN SLOT SIZE
TYPE OF BENTONITE SEAL	BLACK HILLS BENTONITE – 3/8" CHIPS (HOLE PLUG)
TYPE OF SAND PACK	R.W. SIDLEY CO. – NO. 5 FILTER PACK SAND

CASING MEASUREMENTS

BOTTOM OF SCREEN TO END CAP (FT)*	0.50
SCREEN LENGTH (1ST SLOT TO LAST SLOT) (FT)*	4.50
TOTAL LENGTH OF CASING (FT): INTERMEDIATE WELL	104.45

* MEASUREMENT REFERS TO ALL WELLS

USMWK2FP001\05CAD\PROJECTS\200804080\WCR-V04.DWG

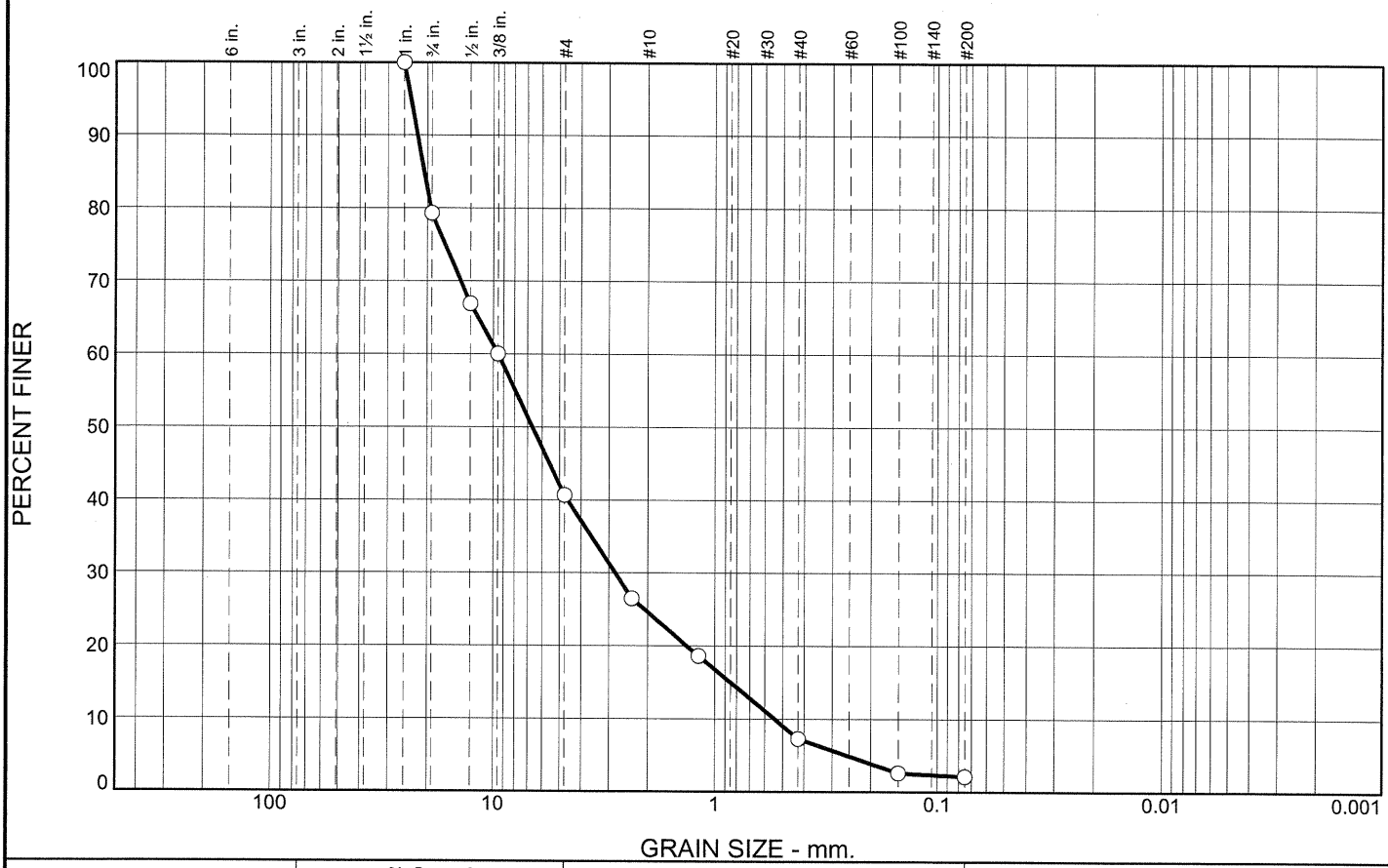
WELL SITE DATA SUMMARY AND COMMENTARY

Well Site #15 – Coral Township
MCCD Pleasant Valley Property on Hemmingsen Rd.

The Coral Township well site is located in a similar physiographic area as the Seneca Township, which is located approximately 6 miles to the northwest. However, unlike Seneca Township, the Coral Township site is located in a hummocky topographic area which is believed to be low-lying remnants of either the Barlina or Huntley Moraine (Curry et al, 1997). The Coral site had a relatively thick sequence of sand and gravel deposits that were overlaid by a 30 foot thick diamicton unit. The sand and gravel aquifer was observed from 39 to 108 feet below grade. A thin organic silt deposit (which may be a Sangamon episode paleosol) separates the upper hydrostatic unit, with another 6-foot thick hydrostatic unit between 110 and 116 feet. These units are hydraulically similar, however, since conductivities, heads and chemistry are comparable.

Well Site Testing Results

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	20.7	38.6	16.1	17.3	5.2	2.1	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1	100.0		
.75	79.3		
.5	66.9		
.375	60.1		
#4	40.7		
#8	26.5		
#16	18.6		
#40	7.3		
#100	2.6		
#200	2.1		

* (no specification provided)

Material Description

F-C Sand and Gravel Trace silt

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 22.1008 D_{85}= 20.6155 D_{60}= 9.5072
D_{50}= 6.6422 D_{30}= 2.8083 D_{15}= 0.8503
D_{10}= 0.5426 C_u= 17.52 C_c= 1.53

Classification

USCS= GW AASHTO=

Remarks

Source of Sample: 15-Coral-S **Depth:** 54.0-55.0

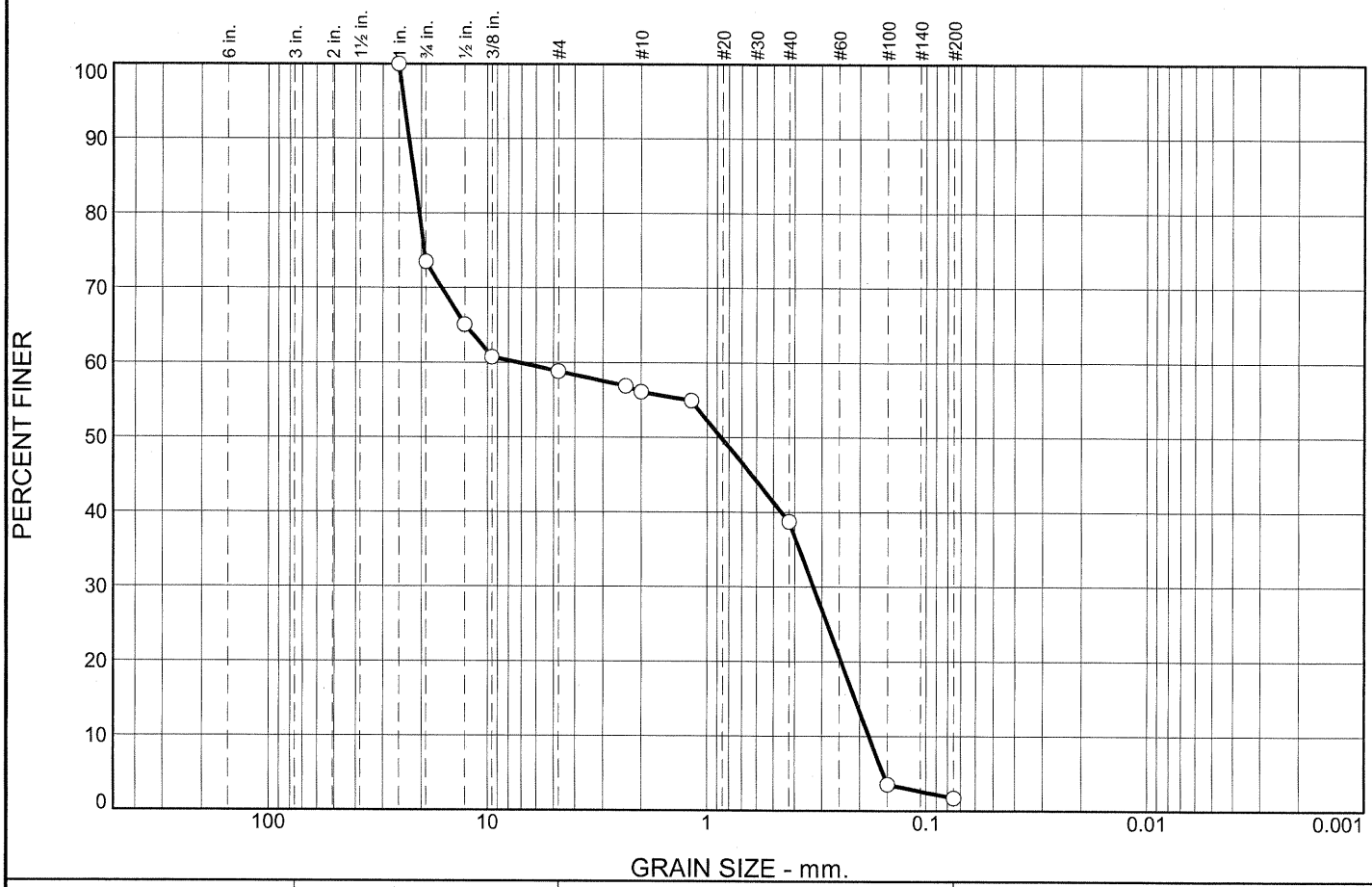
Date: 12/04/08

STS | AECOM

Client: USACE
Project: McHenry County Wells
Project No: 200804080 **Figure**

Tested By: JRT

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	26.5	14.7	2.7	17.4	37.0	1.7	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1	100.0		
.75	73.5		
.5	65.1		
.375	60.8		
#4	58.8		
#8	56.9		
#10	56.1		
#16	54.9		
#40	38.7		
#100	3.5		
#200	1.7		

* (no specification provided)

Material Description

F-C Sand and Gravel Trace Silt

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 22.7880 D_{85}= 21.5845 D_{60}= 7.2300
D_{50}= 0.8647 D_{30}= 0.3282 D_{15}= 0.2106
D_{10}= 0.1817 C_u= 39.80 C_c= 0.08

Classification

USCS= SP AASHTO=

Remarks

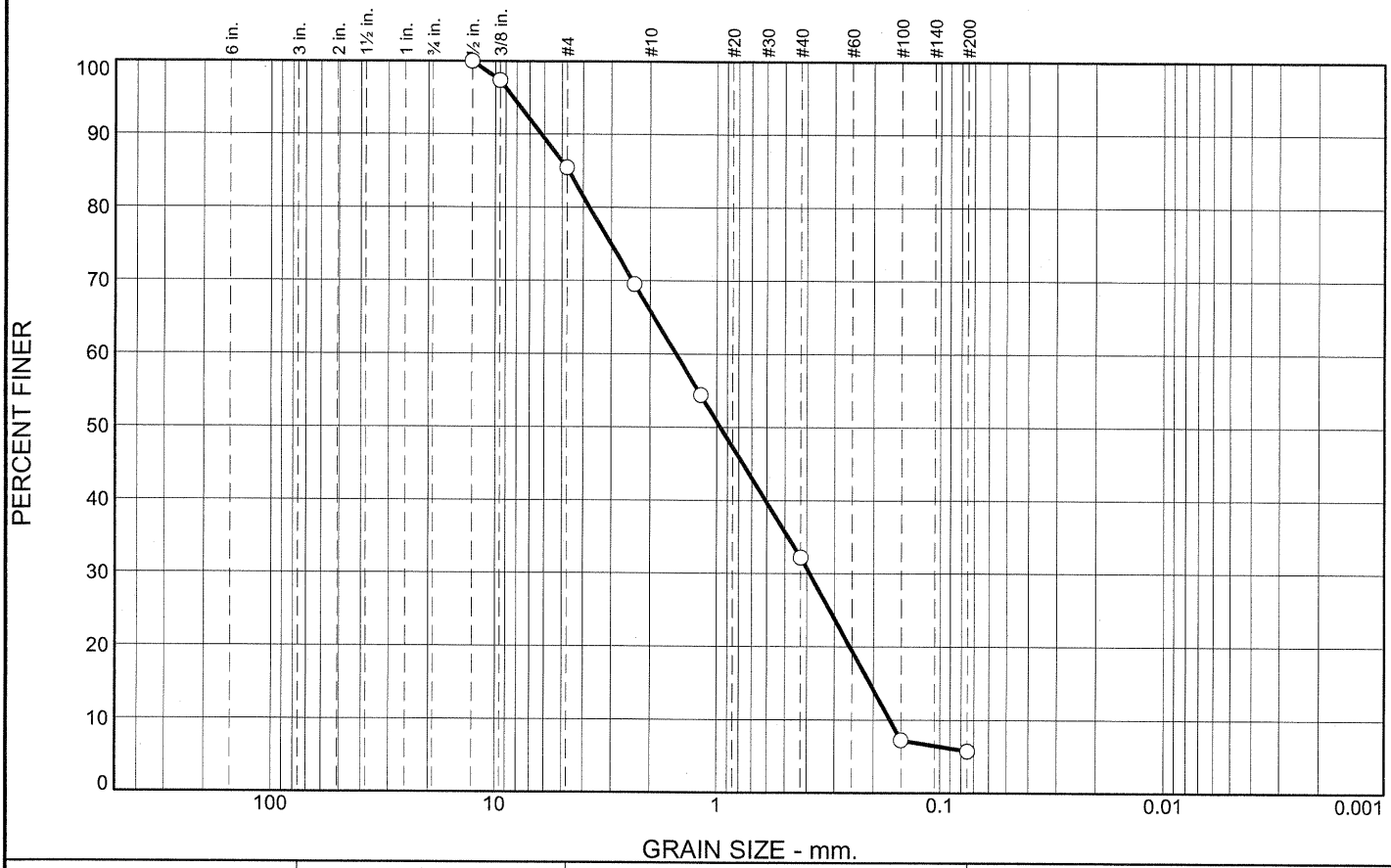
Source of Sample: 15-Coral-I **Depth:** 104.0-105.0

Date: 01/15/09

STS | AECOM

Client: USACE
Project: McHenry County Wells
Project No: 200804080 **Figure**

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	14.5	19.6	33.7	26.5	5.7	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.5	100.0		
.375	97.4		
#4	85.5		
#8	69.5		
#16	54.4		
#40	32.2		
#100	7.2		
#200	5.7		

* (no specification provided)

Material Description

F-C Sand Little Fine Gravel Trace Silt

Atterberg Limits

PL= np LL= nv PI=

Coefficients

D_{90}= 6.1941 D_{85}= 4.6541 D_{60}= 1.5260
D_{50}= 0.9640 D_{30}= 0.3877 D_{15}= 0.2074
D_{10}= 0.1683 C_u= 9.07 C_c= 0.59

Classification

USCS= SP-SM AASHTO= A-1-b

Remarks

Source of Sample: 15-Coral-D **Depth:** 114.0-115.0

Date: 12/04/08

STS | AECOM

Client: USACE
Project: McHenry County Wells
Project No: 200804080 **Figure**

Tested By: JRT

Groundwater Level Measurements

McHenry County Monitoring Well Installations
AECOM Project 09000-460

Site Number	15					
Township Name	Coral					
Well Number	15-COR-S		15-COR-I		15-COR-D	
Ground Surface Elevation (ft msl)	851.23		851.48		851.23	
Top of PVC Casing Elevation (ft)	853.67		852.66		853.68	
Location of PVC Casing within Wellhead	NW Well		Single Well		SE Well	
Well Depth (Feet from TOC)[A]	57.53		104.45		118.55	
Date	Depth to GW from TOC (ft)	GW Elevation (ft msl)	Depth to GW from TOC (ft)	GW Elevation (ft msl)	Depth to GW from TOC (ft)	GW Elevation (ft msl)
Sep. 26, 2008						
Oct. 09, 2008						
Oct. 14, 2008						
Oct. 16, 2008						
Oct. 21, 2008						
Oct. 22, 2008						
Oct. 24, 2008						
Oct. 28, 2008	11.78	841.89			11.7	841.98
Oct. 29, 2008						
Oct. 30, 2008						
Nov. 07, 2008						
Nov. 13, 2008						
Dec. 05, 2008	12.24	841.43	NI		12.25	841.43
Dec. 08, 2008						
Dec. 09, 2008	12.15	841.52				
Dec. 12, 2008						
Dec. 15, 2008						
Dec. 16, 2008						
Dec. 17, 2008						
Dec. 18, 2008						
Dec. 19, 2008						
Dec. 22, 2008						
Dec. 23, 2008			10.35	842.31	11.44	842.24
Dec. 29, 2008						
Dec. 30, 2008						
Jan. 05, 2009	10.4	843.27	9.38	843.28	10.43	843.25
Jan. 06, 2009						
Jan. 07, 2009						
Jan. 08, 2009						
Jan. 09, 2009						
Jan. 10, 2009						
Jan. 12, 2009						
Feb. 24, 2009	11.17	842.50	10.11	842.55	11.19	842.49
Mar. 20, 2009						
end						

Notes:

ft msl = Elevation referenced to feet above mea

TOC = Top of PVC Casing

ft = feet

[A] = as measured inside well

NI = Not Installed

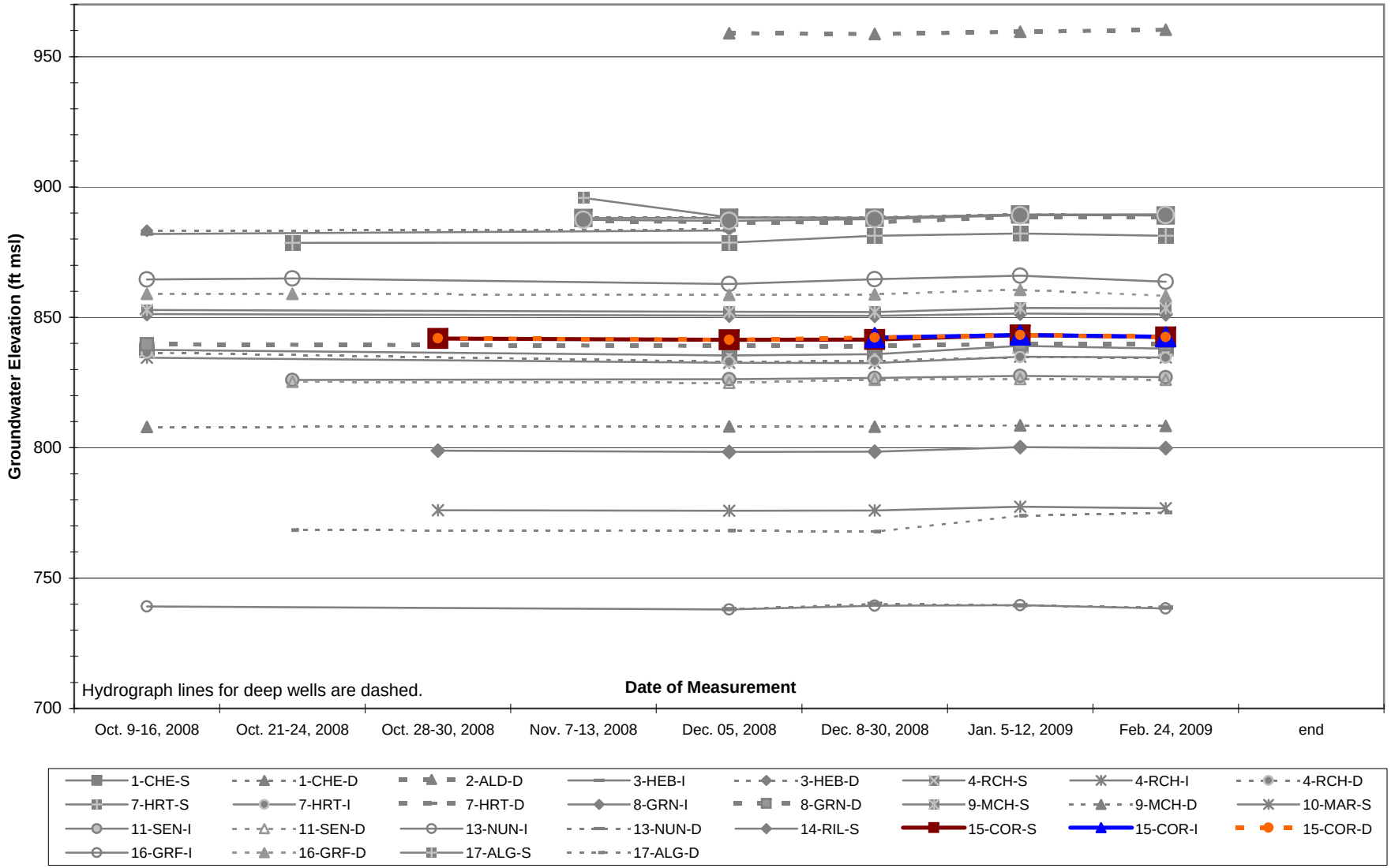
--- No Elevation

Well 17-Alg-S was frozen or partially frozen fror

Site 15 Groundwater Level Hydrograph
(includes ALL AECOM INSTALLED WELLS)

McHenry County Obervation Well Network

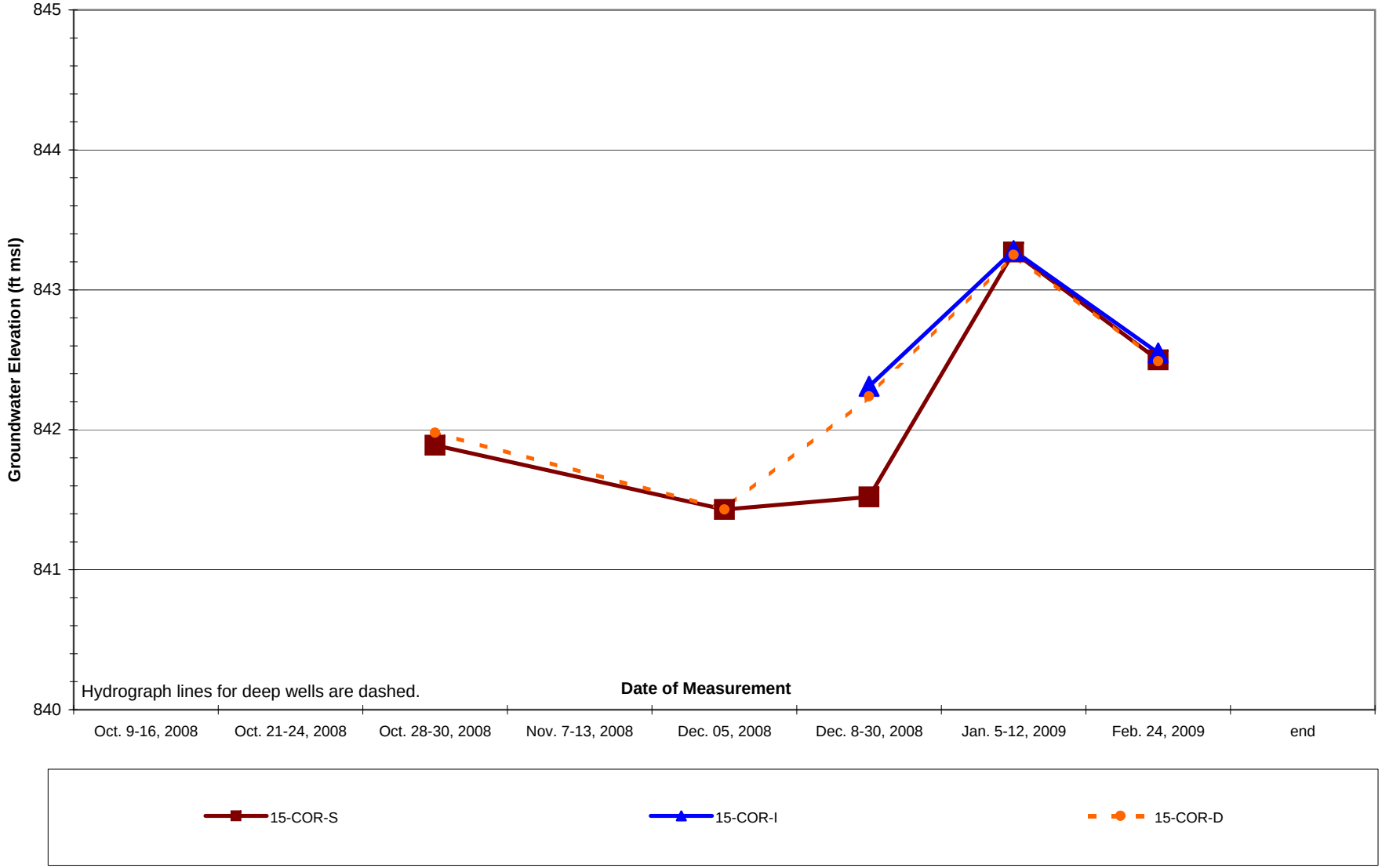
AECOM Project 09000-460



Site 15 Groundwater Level Hydrograph

McHenry County Obervation Well Network

AECOM Project 09000-460



K:\PROJECTS\200804080\In_Progress\STS-McHenry Cty_WLs IN PROGRESS - figs for each site.xls

Well Development Record

STS Consultants, Ltd.
11425 West Lake Park Drive
Milwaukee, Wisconsin 53224

Site Name: McHenry Co. Well ID Number: 15-COR-S

Date of Completion: 12/9/08 STS Job Number: 200804080 pg 4000

Start Time: 14:30 End Time: 16:15

Water color at start of development: Brown Water color at end of development: CLEAR

Amount of water removed during development:

Contained water? ☐ Yes ☒ No

If not contained, where water disposed? GROUND

Well Development Methods:

- ☐ Surged with bailer and bailed
- ☐ Surged with block and bailed
- ☐ Surged with block, bailed & pumped
- ☐ Bailed only
- ☐ Pumped slowly
- ☐ Surged with bailer and pumped
- ☐ Surged with block and pumped
- ☐ Compressed Air
- ☒ Pumped only
- ☐ Other

Equipment Used

- ☐ PVC bailer
- ☐ Well wizard
- ☐ Bean or Moino pump (on drill rig)
- ☐ Surge block
- ☒ Whale pumps

Notes: PURGE START: 14:30

END: 16:15

WL: 12.15

PUMPED ONLY DUE TO TIME CONSTRAINTS

WELL DEVELOPMENT FIELD RECORD

Job Name: McHenry County Job No.: 20080408 0 Well No.: 15-COK-5'

Developed By: Brian Schmidt Date of Install.: _____ Sheet ____ of ____

Started Devel.: 12/9/08 / _____ (DATE / TIME) Completed Devel.: 12/9/08 / _____ (DATE / TIME)

W.L. Before Devel.: _____ / _____ / _____ (DATE / TIME / DEPTH) After Devel.: _____ / _____ / _____ (DATE / TIME / DEPTH)

Well Depth: Before Devel. _____ After Devel. _____ Well Dia. (in.) _____

Standing Water Column (ft.) _____ Standing Well Volume _____ gal.

Screen Length: 5' Drilling Water Loss _____ gal.

DATE / TIME	VOLUME REMOVED (Gallons)	FIELD PARAMETERS SPEC. COND. (umhos/cm)	TEMP. (C°)	pH (s.u.)	TURB ~~Other~~	ORP	REMARKS
12/9/08 14:35	6 Gal/min	864	8.7	7.53	999	–	Resurged
14:45	"	794	9.3	7.20	864	–	" "
14:55	"	788	9.5	7.17	999	–	" "
15:05	"	784	9.6	7.14	999	–	" "
15:15	"	781	9.5	7.16	999	–	" "
15:25	"	781	9.4	7.13	337	–	Resurged
15:35	"	776	9.5	7.14	999	–	Resurged
15:45	"	772	8.0	7.15	999	–	
15:55	"	775	9.1	7.12	335	–	
16:05	"	775	9.5	7.11	66	–	
16:15	"	776	9.2	7.10	34	–	
		= TOTAL VOLUME REMOVED (Gallons)					

Development Method: Surged While Pumping

Notes:

Well Development Record

STS Consultants, Ltd.
11425 West Lake Park Drive
Milwaukee, Wisconsin 53224

Site Name: McHenry County

Well ID Number: 15-COR-I

Date of Completion: 12/23/08

STS Job Number: 200804080

Start Time: 14:20

End Time: 16:10

Water color at start of development: GRAY

Water color at end of development: CLEAR

Amount of water removed during development:

Contained water? ☐ Yes ☒ No

If not contained, where water disposed? GROUND

Well Development Methods:

- ☐ Surged with bailer and bailed
- ☐ Surged with block and bailed
- ☐ Surged with block, bailed & pumped
- ☐ Bailed only
- ☐ Pumped slowly
- ☐ Surged with bailer and pumped
- ☐ Surged with block and pumped
- ☐ Compressed Air
- ☒ Pumped only
- ☐ Other

Equipment Used

- ☐ PVC bailer
- ☐ Well wizard
- ☐ Bean or Moino pump (on drill rig)
- ☐ Surge block
- ☐ Whale pumps
- ☒ WATERRA PUMP W/ BLOCK

Notes:

PURGE START: 14:20

PURGE END: 16:10

WL ST: 10.35

WL END: 10.37

WELL DEVELOPMENT FIELD RECORD

Job Name McHenry County Job No. 200804080 Well No. 15-COR-I

Developed By Brian Schmidt Date of Install. _____ Sheet ____ of ____

Started Devel. 12/23/08 / _____ (DATE / TIME) Completed Devel. 12/23/08 / _____ (DATE / TIME)

W.L. Before Devel. ___ / ___ / ___ (DATE / TIME / DEPTH) After Devel. ___ / ___ / ___ (DATE / TIME / DEPTH)

Well Depth: Before Devel. _____ After Devel. _____ Well Dia. (in.) _____

Standing Water Column (ft.) _____ Standing Well Volume _____ gal.

Screen Length 5' Drilling Water Loss _____ gal.

DATE / TIME	VOLUME REMOVED (Gallons)	FIELD PARAMETERS SPEC. COND. (umhos/cm)	TEMP. (C°)	pH (s.u.)	TURB ~~Other~~	ORP	REMARKS
12/23/08 1430	2 GAL/min	722	8.1	7.40	999	–	
1450	"	749	8.7	7.33	969	–	
1510	"	745	8.8	7.31	488	–	
1530	"	746	8.8	7.30	342	–	
1550	"	746	8.9	7.31	285	–	
1610	"	744	8.5	7.41	198	–	
		= TOTAL VOLUME REMOVED (Gallons)					

Development Method: _____

Notes:

Well Development Record

STS Consultants, Ltd.
11425 West Lake Park Drive
Milwaukee, Wisconsin 53224

Site Name: McHenry County

Well ID Number: 15-COR-D

Date of Completion: 12/23/08

STS Job Number: 200804080

Start Time: 1300

End Time: 14:10

Water color at start of development: Brown

Water color at end of development: CLEAR

Amount of water removed during development:

Contained water? ☐ Yes ☒ No

If not contained, where water disposed? Ground

Well Development Methods:

- ☐ Surged with bailer and bailed
- ☐ Surged with block and bailed
- ☐ Surged with block, bailed & pumped
- ☐ Bailed only
- ☐ Pumped slowly
- ☐ Surged with bailer and pumped
- ☐ Surged with block and pumped
- ☐ Compressed Air
- ☒ Pumped only
- ☐ Other

Equipment Used

- ☐ PVC bailer
- ☐ Well wizard
- ☐ Bean or Moino pump (on drill rig)
- ☐ Surge block
- ☐ Whale pumps
- ☒ WATERRA Pump w/ Block

Notes: Purge Start: 1300

Purge End: 14:10

WL St: 11.44

WL End: 11.43

WELL DEVELOPMENT FIELD RECORD

Job Name McHenry County Job No. 20080408 Well No. 15-COR-D

Developed By Brian Schmidt Date of Install. _____ Sheet ____ of ____

Started Devel. ____ / ____ (DATE / TIME) Completed Devel. ____ / ____ (DATE / TIME)

W.L. Before Devel. 12/23/08 / ____ / ____ (DATE / TIME / DEPTH) After Devel. 12/23/08 / ____ / ____ (DATE / TIME / DEPTH)

Well Depth: Before Devel. _____ After Devel. _____ Well Dia. (in.) _____

Standing Water Column (ft.) _____ Standing Well Volume _____ gal.

Screen Length 5' Drilling Water Loss _____ gal.

DATE / TIME	VOLUME REMOVED (Gallons)	FIELD PARAMETERS SPEC. COND. (umhos/cm)	TEMP. (C°)	pH (s.u.)	TURB ~~Other~~	ORP	REMARKS
12/23/08 13:10	2 GAL/min	737	8.2	8.02	999	—	
13:30	"	744	8.7	7.34	131	—	
13:50	"	730	9.2	7.36	69	—	
14:10	"	734	8.9	7.40	56	—	
		= TOTAL VOLUME REMOVED (Gallons)					

Development Method: _____

Notes:

First Environmental Laboratories, Inc.
IL ELAP / NELAC Accreditation # 100292
1600 Shore Road • Naperville, Illinois 60563 • Phone (630) 778-1200 • Fax (630) 778-1233

Analytical Report

Client: STS CONSULTANTS (VERN)
Project ID: McHenry County 200804080
Sample ID: 15-COR-S
Sample No: 9-0115-024

Date Collected: 01/05/09
Time Collected: 12:00
Date Received: 01/13/09
Date Reported: 01/20/09

Analyte		Result	R.L.	Units	Flags
Total Metals	**Method: 6020A**		**Preparation Method 3010A**		
Analysis Date: 01/16/09			Preparation Date: 01/16/09		
Calcium		107	0.1	mg/L	
Iron		3.97	0.01	mg/L	
Magnesium		50.0	0.1	mg/L	
Potassium		1.6	0.1	mg/L	
Sodium		10.6	0.1	mg/L	
Alkalinity, Bicarbonate (CaCO3)	**Method: 2320B**				
Analysis Date: 01/15/09 13:30					
Alkalinity, Bicarbonate (CaCO3)		340	5	mg/L	
Alkalinity, Carbonate (CaCO3)	**Method: 2320B**				
Analysis Date: 01/15/09 13:30					
Alkalinity, Carbonate (CaCO3)		< 5	5	mg/L	
Chloride	**Method: 4500Cl, E**				
Analysis Date: 01/14/09					
Chloride		27	5	mg/L	
Sulfate	**Method: 375.2R2.0**				
Analysis Date: 01/15/09					
Sulfate		84	15	mg/L	

First Environmental Laboratories, Inc.
IL ELAP / NELAC Accreditation # 100292
1600 Shore Road • Naperville, Illinois 60563 • Phone (630) 778-1200 • Fax (630) 778-1233

Analytical Report

Client: STS CONSULTANTS (VERN)
Project ID: McHenry County 200804080
Sample ID: 15-COR-I
Sample No: 9-0115-023

Date Collected: 01/06/09
Time Collected: 10:15
Date Received: 01/13/09
Date Reported: 01/20/09

Analyte		Result	R.L.	Units	Flags
Total Metals	**Method: 6020A**		**Preparation Method 3010A**		
Analysis Date: 01/16/09			Preparation Date: 01/16/09		
Calcium		103	0.1	mg/L	
Iron		1.93	0.01	mg/L	
Magnesium		51.8	0.1	mg/L	
Potassium		1.8	0.1	mg/L	
Sodium		9.6	0.1	mg/L	
Alkalinity, Bicarbonate (CaCO3)	**Method: 2320B**				
Analysis Date: 01/15/09 13:30					
Alkalinity, Bicarbonate (CaCO3)		350	5	mg/L	
Alkalinity, Carbonate (CaCO3)	**Method: 2320B**				
Analysis Date: 01/15/09 13:30					
Alkalinity, Carbonate (CaCO3)		< 5	5	mg/L	
Chloride	**Method: 4500Cl, E**				
Analysis Date: 01/14/09					
Chloride		15	5	mg/L	
Sulfate	**Method: 375.2R2.0**				
Analysis Date: 01/15/09					
Sulfate		77	15	mg/L	

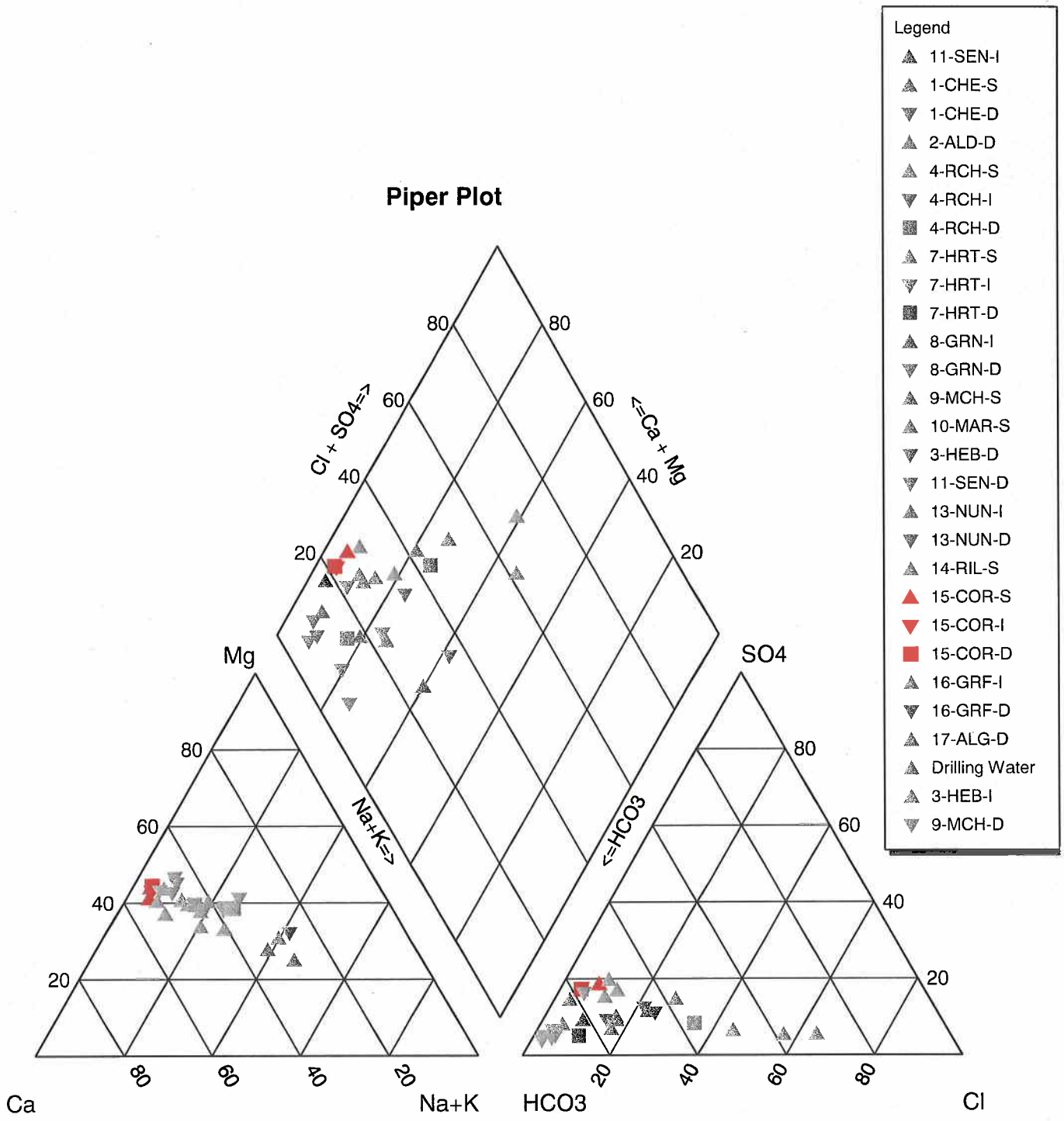
First Environmental Laboratories, Inc.
IL ELAP / NELAC Accreditation # 100292
1600 Shore Road • Naperville, Illinois 60563 • Phone (630) 778-1200 • Fax (630) 778-1233

Analytical Report

Client: STS CONSULTANTS (VERN)
Project ID: McHenry County 200804080
Sample ID: 15-COR-D
Sample No: 9-0115-025

Date Collected: 01/05/09
Time Collected: 13:35
Date Received: 01/13/09
Date Reported: 01/20/09

Analyte		Result	R.L.	Units	Flags
Total Metals	**Method: 6020A**		**Preparation Method 3010A**		
Analysis Date: 01/16/09			Preparation Date: 01/16/09		
Calcium		102	0.1	mg/L	
Iron		2.89	0.01	mg/L	
Magnesium		53.3	0.1	mg/L	
Potassium		1.3	0.1	mg/L	
Sodium		8.8	0.1	mg/L	
Alkalinity, Bicarbonate (CaCO3)	**Method: 2320B**				
Analysis Date: 01/15/09 13:30					
Alkalinity, Bicarbonate (CaCO3)		340	5	mg/L	
Alkalinity, Carbonate (CaCO3)	**Method: 2320B**				
Analysis Date: 01/15/09 13:30					
Alkalinity, Carbonate (CaCO3)		< 5	5	mg/L	
Chloride	**Method: 4500Cl, E**				
Analysis Date: 01/14/09					
Chloride		15	5	mg/L	
Sulfate	**Method: 375.2R2.0**				
Analysis Date: 01/15/09					
Sulfate		72	15	mg/L	



DESCRIPTION: Piper Linear Diagram - Well Site #15

AECOM	PROJECT: McHenry County	PROJECT NO: 09000460
	CLIENT: Army Corps of Engineers	DATE: 7/30/2009

Field Well Sampling Sheet

Fill out the entire form. If it does not apply, mark N/A.

Project Name: McHenry County
STS Job No. 200804080
Location: Coral
Tester: Brian Schmidt
Well Number: 15-Cor-S
Date Sampled: 1/5/09
Previous Well Sampled: N/A

GENERAL CONDITIONS:

						If Missing Replaced?	
Surface Seal:	X Ok		Damaged		Missing:	Yes	No
Protector Pipe:	X Ok		Damaged		Missing:	Yes	No
Well Cap:	X Ok		Damaged		Missing:	Yes	No

Ambient Temperature: 20 °F X Clear Cloudy Rain

WELL DATA:

Measuring Device: Solinst Water Level Meter
Stick Up or Down: Up
Depth to Water: 10.40 (from Ground Surface)
Depth to Bottom: 48 (from TPVC)
Length of Water: (from TPVC)
Free Product Observed: Yes X No Thickness: N/A

PURGING/SAMPLING:

Well Purging Calculations: Amount to purge = 0.163 gallons/foot times height of water column in feet for one well volume

Purging Device: Bladder Pump Sampling Device: Bladder Pump
Volume Required: X See back of page for field readings during purge
Volume Purged:
Could Well Bail Dry? Yes X No
Purging - Time Start: 1035 Time Ended: 1210
Decon Method: Alconox

IN-SITU TESTING:

Turbidity: Turbid Opaque
Odor:
Color
pH @ degrees C
Uncorrected Conductivity X
Water Temp. (from Cond.)
Comments: ST: 1200

SAMPLES COLLECTED

Vocs -		Cyanide	
Metals -		Hexchrome	
SVOC		Alkalinity	
TOC		Chloride	
Sulfide		Ammonia	
Phenolics		COD	

Well Purging Log

Date 1/5/09

Time	Temp	pH	Conductivity	~~ORP~~ TURB	~~DO~~ RATE
1/5/09 CAL	18.1	3.98	4480	0	250 mL/min
1120	2.0	5.38	847	861	
1130	2.6	6.22	813	483	
1135	1.7	6.32	802	356	
1140	0.5	6.32	790	98	
1145	0.3	6.37	794	61	
1150	0.2	6.47	793	35	
1155	0.3	6.54	790	30	
1200	0.3	6.60	789	24	
ST: 1200					

Field Well Sampling Sheet

Fill out the entire form. If it does not apply, mark N/A.

Project Name: McHenry County
STS Job No. 200804080
Location: Coral
Tester: Brian Sounist
Well Number: 15-COR-I
Date Sampled: 1/5/09 + 1/6/09
Previous Well Sampled: 15-COR-D

GENERAL CONDITIONS:

						If Missing Replaced?
Surface Seal:	X Ok		Damaged		Missing:	Yes No
Protector Pipe:	X Ok		Damaged		Missing:	Yes No
Well Cap:	X Ok		Damaged		Missing:	Yes No
Ambient Temperature: 20 °F		X Clear		Cloudy	Rain	

WELL DATA:

Measuring Device: Solinist Water Level Meter
Stick Up or Down: Up (from Ground Surface)
Depth to Water: 9.38 (from TPVC)
Depth to Bottom: (from TPVC)
Length of Water:
Free Product Observed: [ ] Yes [X] No Thickness: N/A

PURGING/SAMPLING:

Well Purging Calculations: Amount to purge = 0.163 gallons/foot times height of water column in feet for one well volume

Purging Device: Bladder Pump
Sampling Device: Bladder Pump
Volume Required:
[X] See back of page for field readings during purge
Volume Purged:
Could Well Bail Dry? [ ] Yes [X] No
Purging - Time Start: 13:45 (1/5/09) Time Ended: 10:20 (1/6/09)
Decon Method: Alconox

IN-SITU TESTING:

Turbidity: [ ] Turbid [ ] Opaque
Odor:
Color
pH @ degrees C
Uncorrected Conductivity X
Water Temp. (from Cond.)
Comments: ST: 10:15

SAMPLES COLLECTED

Vocs -		Cyanide	
Metals -		Hexchrome	
SVOC		Alkalinity	
TOC		Chloride	
Sulfide		Ammonia	
Phenolics		COD	

Well Purging Log

Date 1/5/09

Time	Temp	pH	Conductivity	~~ORP~~ TURB	~~DO~~ RATE
1/5/08 14:25	2.0	7.39	729	999	250 ML/MIN
14:35	3.4	7.43	728	999	"
LINE FROZE @ 1435					
1/6/08 WL: 9.42'					
PURGE START: 910		SLOW DUE TO FROZEN LINE			
CAL	9.1	3.97	4550	0	
9:45	17.0	6.57	858	40	250 ML/MIN
9:50	11.2	7.11	861	999	"
9:55	10.4	7.24	867	785	"
10:00	10.3	7.16	871	112	"
10:05	9.7	7.27	898	19	"
10:10	9.4	7.19	896	19	"
10:15	9.3	7.18	895	14	"
ST: 1015					

Field Well Sampling Sheet

Fill out the entire form. If it does not apply, mark N/A.

Project Name: McHenry County
STS Job No. 200804080
Location: Coral
Tester: Blake Schmidt
Well Number: 15-COR-D
Date Sampled: 1/5/09
Previous Well Sampled: 15-COR-S

GENERAL CONDITIONS:

					If Missing Replaced?
Surface Seal:	☒ Ok	☐ Damaged	☐	Missing:	Yes No
Protector Pipe:	☒ Ok	☐ Damaged	☐	Missing:	Yes No
Well Cap:	☒ Ok	☐ Damaged	☐	Missing:	Yes No

Ambient Temperature: 20 °F ☒ Clear ☐ Cloudy ☐ Rain

WELL DATA:

Measuring Device: Solinst Water Level Meter
Stick Up or Down: Up (from Ground Surface)
Depth to Water: 10.43 (from TPVC)
Depth to Bottom: 109.5 (from TPVC)
Length of Water:
Free Product Observed: ☐ Yes ☒ No Thickness: N/A

PURGING/SAMPLING:

Well Purging Calculations: Amount to purge = 0.163 gallons/foot times height of water column in feet for one well volume

Purging Device: Bladder Pump
Sampling Device: Bladder Pump
Volume Required:
☒ See back of page for field readings during purge
Volume Purged:
Could Well Bail Dry? ☐ Yes ☒ No
Purging - Time Start: 12:15
Time Ended: 1340
Decon Method: Alconox

IN-SITU TESTING:

Turbidity: ☐ Turbid ☐ Opaque
Odor:
Color
pH @ degrees C
Uncorrected Conductivity X
Water Temp. (from Cond.)
Comments: ST: 1735

SAMPLES COLLECTED

Vocs -	☐	Cyanide	☐
Metals -	☐	Hexchrome	☐
SVOC	☐	Alkalinity	☐
TOC	☐	Chloride	☐
Sulfide	☐	Ammonia	☐
Phenolics	☐	COD	☐

Well Purging Log

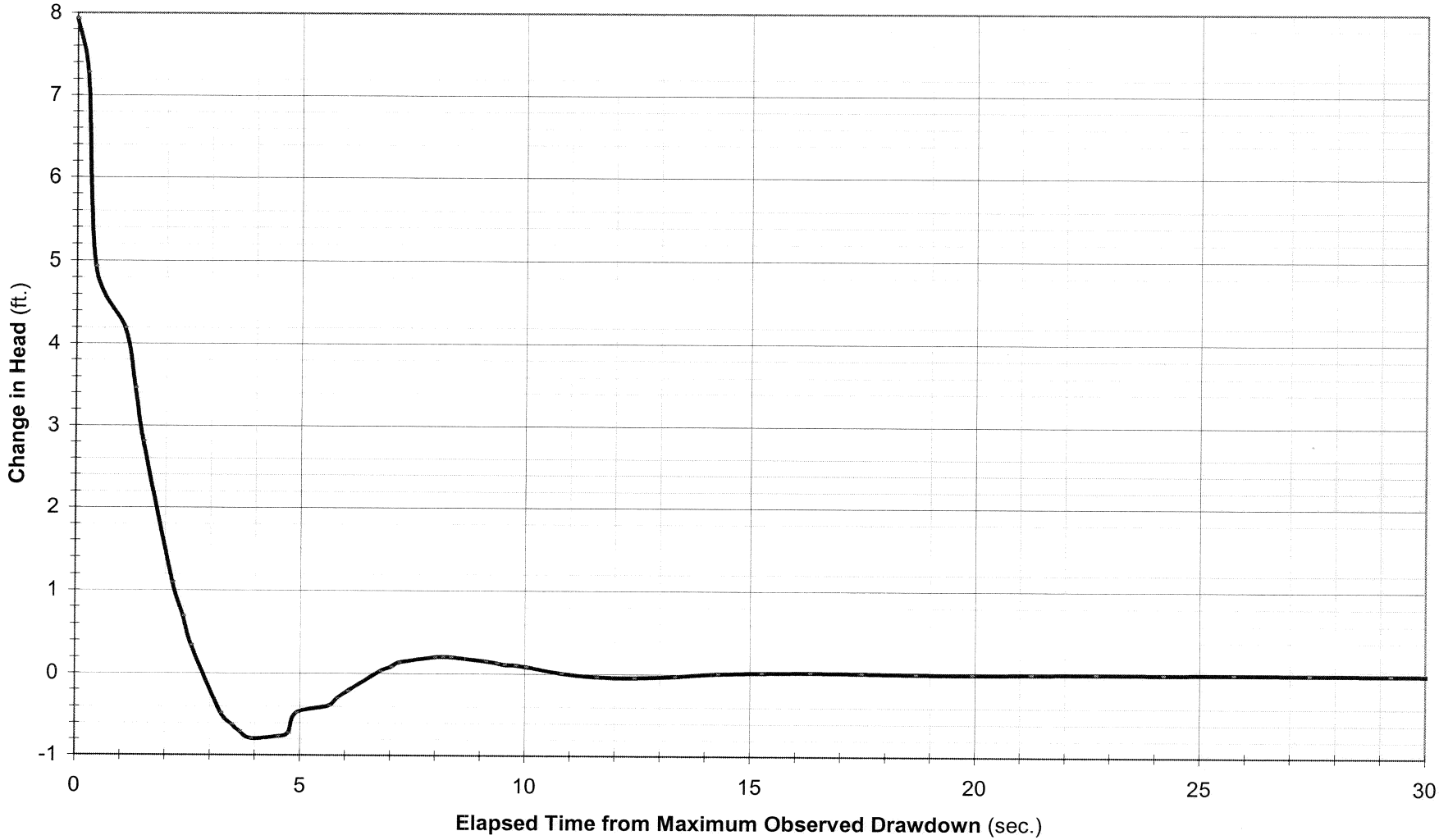
Date 1/5/09

Time	Temp	pH	Conductivity	~~ORP~~ TURB	~~DO~~ RATE
1/5/09 12:45	1.3	6.84	761	4	250 mL/min
12:55	1.6	6.74	753	999	"
13:05	1.6	6.77	751	693	"
13:10	1.7	7.33	744	29	"
13:25	1.6	7.19	744	7	"
13:30	1.7	7.21	740	8	"
13:35	1.7	7.22	741	7	"
ST: 1335					

Underdamped Response to Sudden Change in Water Level

Hydraulic Conductivity Test Result

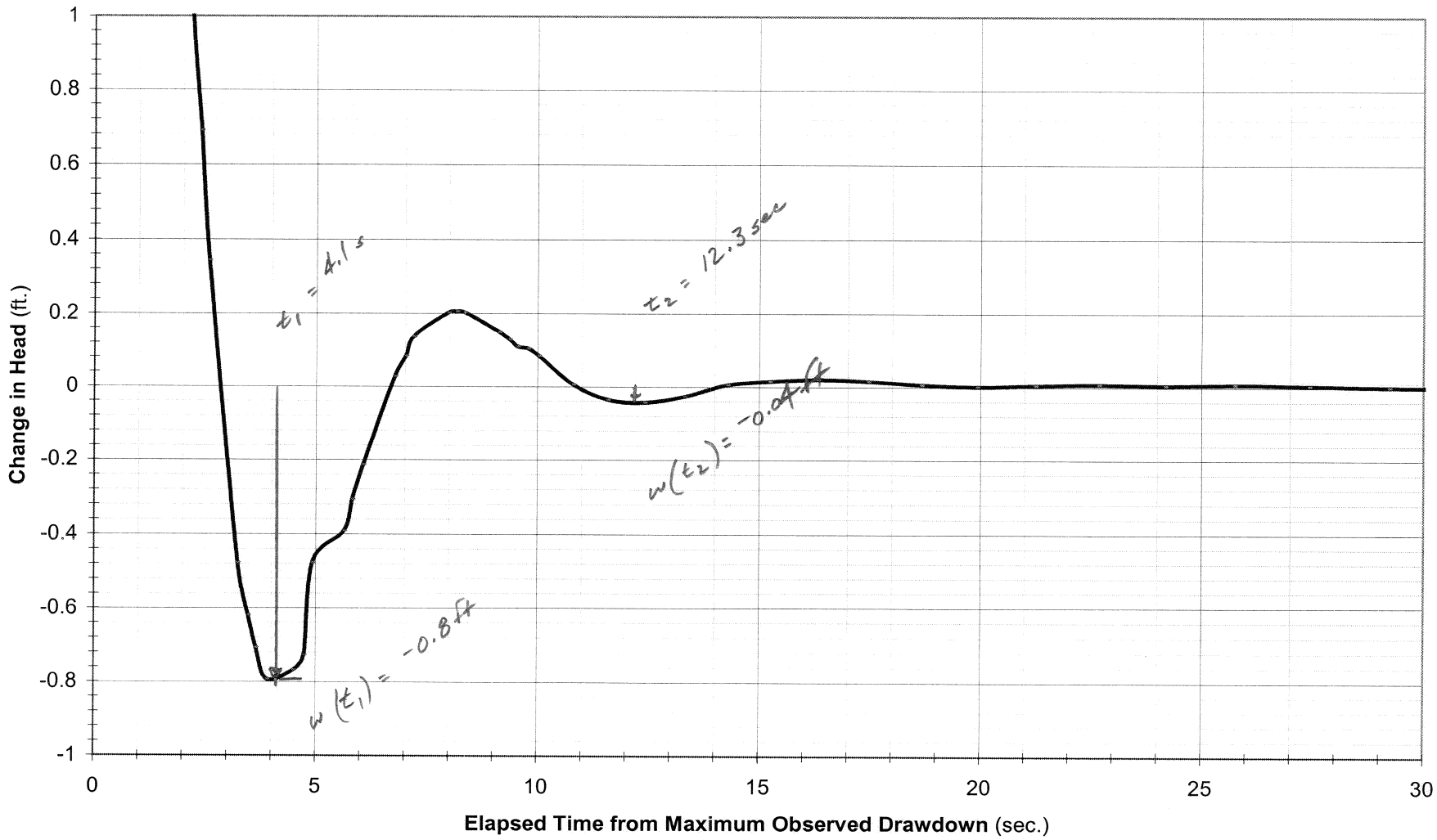
Coral Township #15 - Shallow Well (Test #1)



Underdamped Response to Sudden Change in Water Level

Hydraulic Conductivity Test Result

Coral Township #15 - Shallow Well (Test #1)



Calculation of Transmissivity of Underdamped Well Response to Slug Test

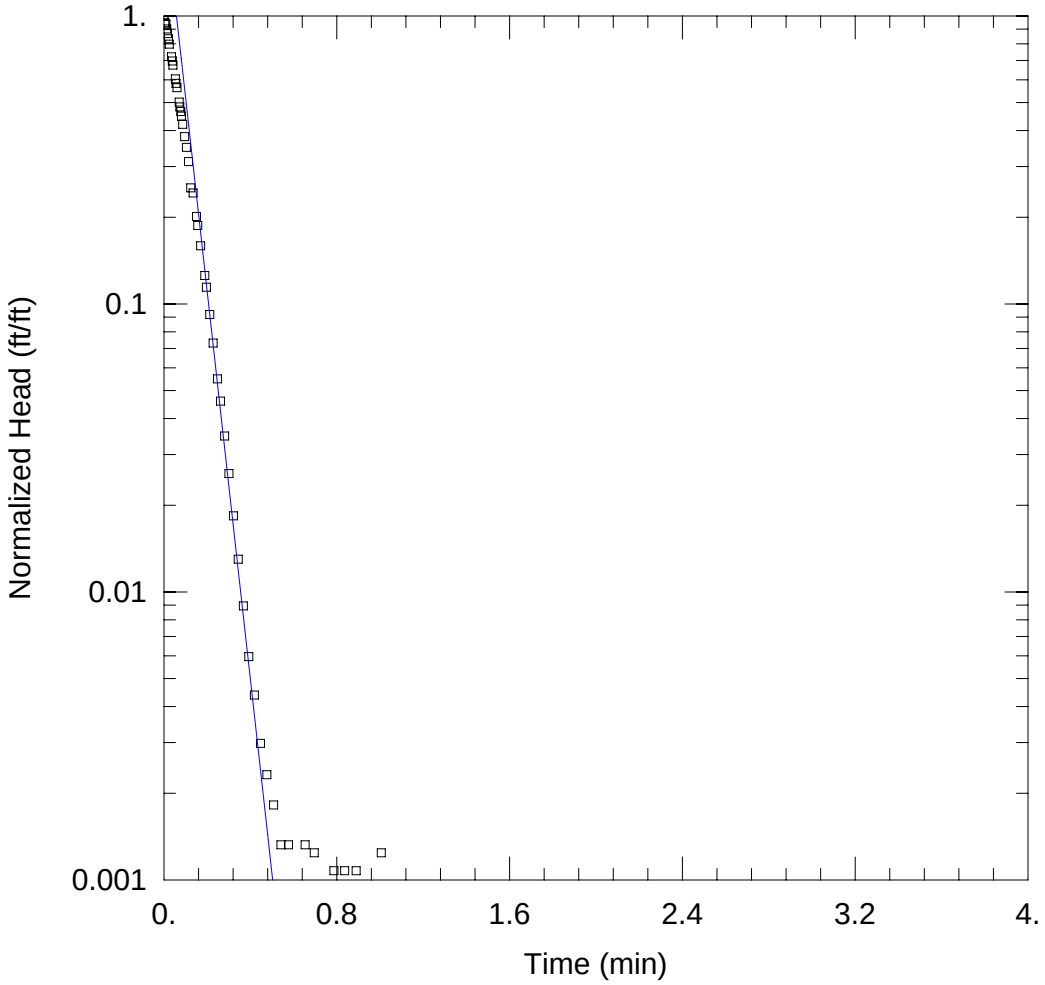
Coral Township - Shallow Well
McHenry County Monitoring Well Network Installation
AECOM Environment Project No. 09000-460

Expression		Value	Units
$w(t_1)$	=	-0.8	ft.
$w(t_2)$	=	-0.04	ft.
t_1	=	4.1	sec.
t_2	=	12.3	sec.
R_c	=	0.083	ft.
R_s	=	0.083	ft.
L_c	=	42.2	ft.
L_s	=	5	ft.
τ	=	8.2	sec.
ϖ	=	0.7662	s^{-1}
γ	=	0.36533	s^{-1}
T	=	b+a lnT	
$(g/L)^{1/2}$	=	0.8489	
d	=	0.4304	
a	=	0.00170	ft^2/sec
Assume S	=	1.0E-05	
b	=	0.029	ft^2/sec
T_1	=	$b+a \ln T_0$	
Assume T_0	≈	b_1	
T_1	=	0.0227	ft^2/sec
T_2	=	0.0223	ft^2/sec
T	=	1923	ft^2/day
Aquifer Thickness	=	69	ft.
Hydraulic Conductivity	**=**	**28**	**ft/day**
		9.83E-03	**cm/sec**

Reference:
ASTM D5785-95 - (Analytical Procedure) for Determining Transmissivity of Confined Nonleaky Aquifers by Underdamped Well Response to Instantaneous Change in Head (Slug Test)

Check the results:

L	=	44.4 ft	0.3	0.7%	less than 20%?	**YES**
L	=	44.7 ft				
α	=	1.44E-03	less than 0.1?	**YES**		
d	=	0.4304	less than 0.7?	**YES**		



WELL TEST ANALYSIS

Data Set: C:\...\15-COR-I_001_B&R.aqt
Date: 04/07/09 Time: 14:59:09

PROJECT INFORMATION

Company: AECOM
Client: USACE / McHenry Cty
Project: 09000-460 (h200804080)
Location: McHenry County, IL
Test Date: Feb. 22, 2009

AQUIFER DATA

Saturated Thickness: 69. ft
Anisotropy Ratio (Kz/Kr): 0.33

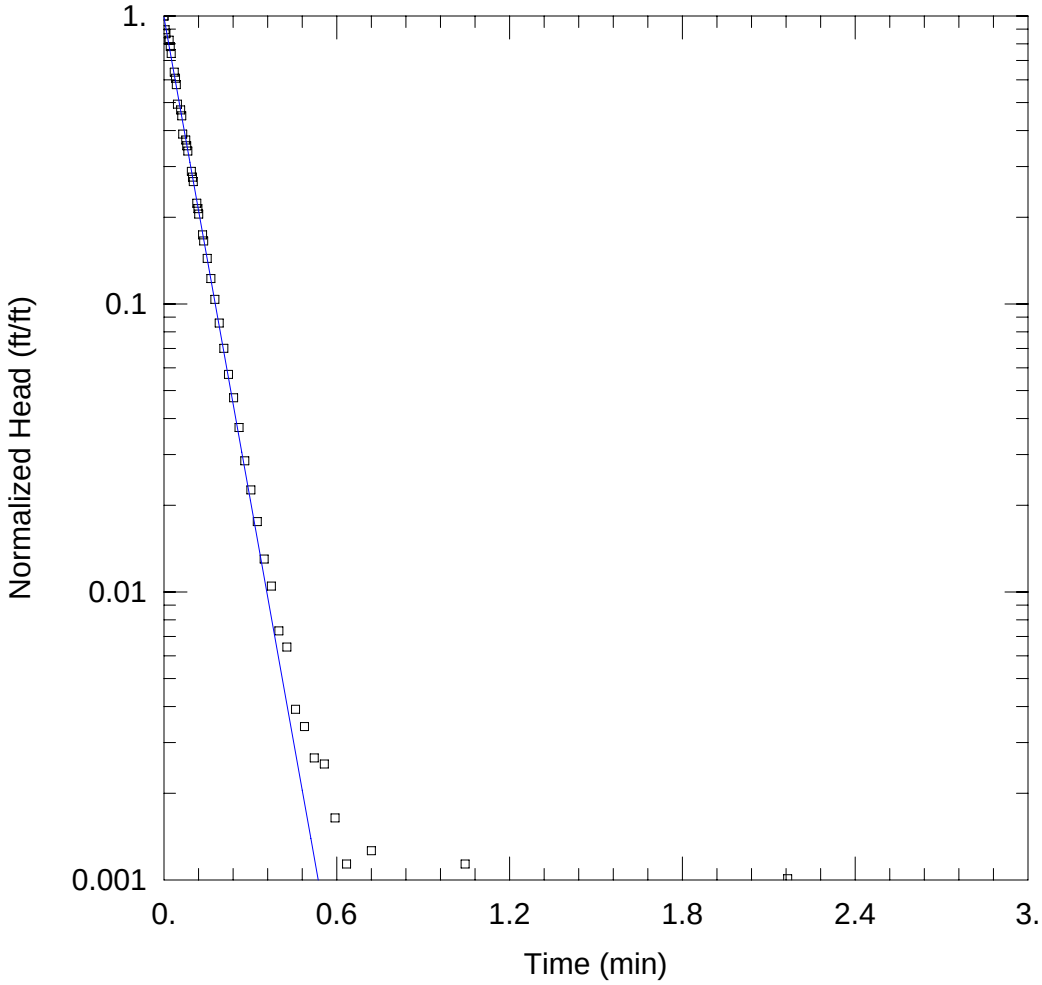
WELL DATA (15-COR-I)

Initial Displacement: 12.08 ft
Total Well Penetration Depth: 63.8 ft
Casing Radius: 0.083 ft
Static Water Column Height: 95.4 ft
Screen Length: 4.5 ft
Well Radius: 0.25 ft
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 0.0197 cm/sec
y0 = 29.68 ft



WELL TEST ANALYSIS

Data Set: C:\...\15-COR-I_002_B&R.aqt
Date: 04/07/09 Time: 15:05:14

PROJECT INFORMATION

Company: AECOM
Client: USACE / McHenry Cty
Project: 09000-460 (h200804080)
Location: McHenry County, IL
Test Date: Feb. 22, 2009

AQUIFER DATA

Saturated Thickness: 69. ft
Anisotropy Ratio (Kz/Kr): 0.33

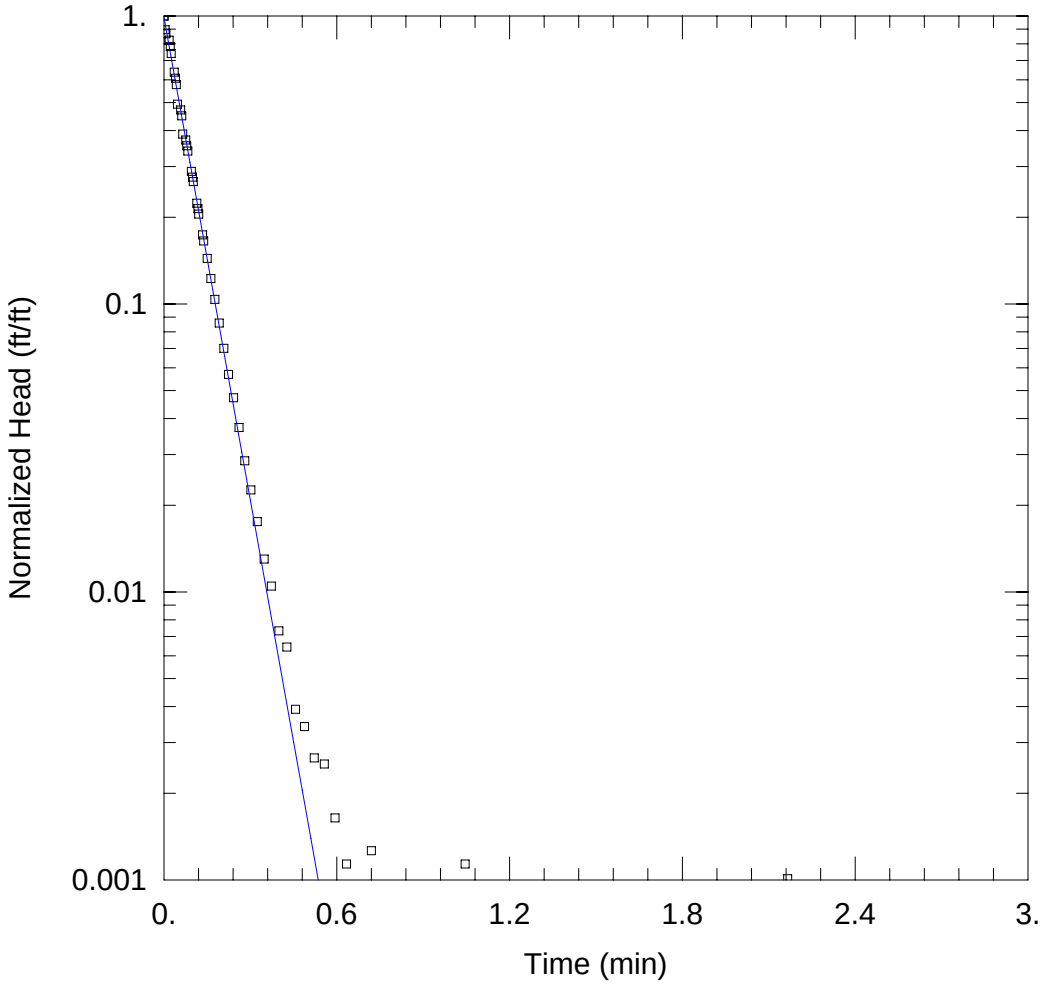
WELL DATA (15-COR-I)

Initial Displacement: 7.92 ft
Total Well Penetration Depth: 63.8 ft
Casing Radius: 0.083 ft
Static Water Column Height: 95.4 ft
Screen Length: 4.5 ft
Well Radius: 0.25 ft
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 0.01635 cm/sec
y0 = 7.826 ft



WELL TEST ANALYSIS

Data Set: C:\...\15-COR-D_001_B&R.aqt
Date: 04/07/09 Time: 15:06:57

PROJECT INFORMATION

Company: AECOM
Client: USACE / McHenry Cty
Project: 09000-460 (h200804080)
Location: McHenry County, IL
Test Date: Feb. 22, 2009

AQUIFER DATA

Saturated Thickness: 7. ft
Anisotropy Ratio (Kz/Kr): 0.33

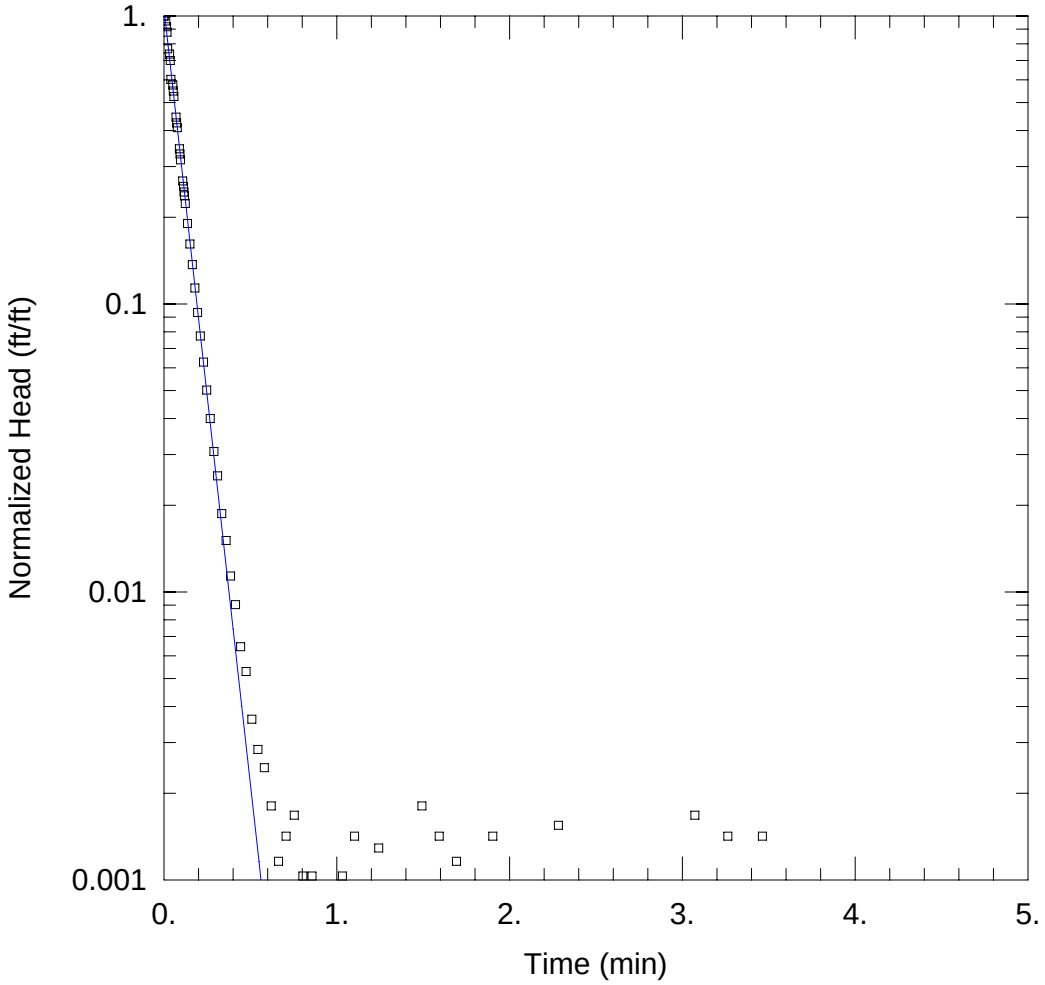
WELL DATA (15-COR-D)

Initial Displacement: 7.92 ft
Total Well Penetration Depth: 6.1 ft
Casing Radius: 0.083 ft
Static Water Column Height: 108. ft
Screen Length: 4.5 ft
Well Radius: 0.25 ft
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 0.01262 cm/sec
y0 = 7.826 ft



WELL TEST ANALYSIS

Data Set: C:\...\15-COR-D_002_B&R.aqt
Date: 04/07/09 Time: 15:08:42

PROJECT INFORMATION

Company: AECOM
Client: USACE / McHenry Cty
Project: 09000-460 (h200804080)
Location: McHenry County, IL
Test Date: Feb. 22, 2009

AQUIFER DATA

Saturated Thickness: 7. ft
Anisotropy Ratio (Kz/Kr): 0.33

WELL DATA (15-COR-D)

Initial Displacement: 7.75 ft
Total Well Penetration Depth: 6.1 ft
Casing Radius: 0.083 ft
Static Water Column Height: 108. ft
Screen Length: 4.5 ft
Well Radius: 0.25 ft
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 0.01217 cm/sec
y0 = 8.233 ft

Additional Well Site Information

In-Situ Inc.

15-COR-S

Calibration Report

Report Number: 20090108234738-140348

221 East Lincoln Avenue, Fort Collins, CO 80524 USA
1-970-498-1500, 1-800-446-7488, FAX: 1-970-498-1598
Visit us at www.in-situ.com

Instrument Details:

Instrument Model:	**Level TROLL 500**
Full Scale Pressure Range	**206.84 KPa (30 PSI) vented**
Serial Number:	**140348**

Calibration Details:

Calibration Result:	**PASS**
Calibration Date:	2009-01-08 23:47:38 (UTC)
Nominal Range of Applied Temperature:	-5 C to +50 C
Temperature Accuracy Specification:	+/- 0.1 C From 0 C to +50 C
Nominal Range of Applied Pressure:	0 KPa to 206.8 KPa (0.0 PSI to 30.0 PSI)
Pressure Accuracy Specification:	+/- 0.1 %FS from -5 C to +50 C, +/- 0.05 %FS at +15 C

Post-Calibration Check:

Parameter	Applied	Reported	Deviation
Pressure	30.0001	29.9968	-0.0111
Pressure	0.0000	-0.0017	-0.0055
Temperature	20.0140	20.0270	0.0130

Calibration Procedures and Equipment Used:

Automated calibration procedures used.
Manu Agilent Model 34970A SerialNo MY41012474
Manu Instrulab Model 3312A-14-15-24 SerialNo 31102-(41037)
Manu Instrulab Model 406X-0031-01 SerialNo 31128-1
Manu MENSOR Model 600 SerialNo 621218
Manu Agilent Model 53131A SerialNo MY47000169
Manu MENSOR Model 600 SerialNo 621385

Notes:

1. Standards used in this calibration are traceable to the National Institute of Standards and Technology.
2. This calibration report shall not be reproduced, except in full, without the written approval of In-Situ, Inc.
3. A calibration interval of 12 to 18 months is recommended.
4. The post-calibration data is collected at nominal +20 C.
5. 1.0 PSI = 6.894757 KPa

Performed By: CB

Copyright © 2006 In-Situ, Inc.

In-Situ Inc.

15-COR-I

Calibration Report

Report Number: 20090112144643-140467

221 East Lincoln Avenue, Fort Collins, CO 80524 USA
1-970-498-1500, 1-800-446-7488, FAX: 1-970-498-1598
Visit us at www.in-situ.com

Instrument Details:

Instrument Model:	**Level TROLL 500**
Full Scale Pressure Range	**206.84 KPa (30 PSI) vented**
Serial Number:	**140467**

Calibration Details:

Calibration Result:	**PASS**
Calibration Date:	2009-01-12 14:46:43 (UTC)
Nominal Range of Applied Temperature:	-5 C to +50 C
Temperature Accuracy Specification:	+/- 0.1 C From 0 C to +50 C
Nominal Range of Applied Pressure:	0 KPa to 206.8 KPa (0.0 PSI to 30.0 PSI)
Pressure Accuracy Specification:	+/- 0.1 %FS from -5 C to +50 C, +/- 0.05 %FS at +15 C

Post-Calibration Check:

Parameter	Applied	Reported	Deviation
Pressure	30.0000	29.9920	-0.0266
Pressure	-0.0002	-0.0020	-0.0060
Temperature	20.0080	19.9976	-0.0104

Calibration Procedures and Equipment Used:

Automated calibration procedures used.
Manu Agilent Model 34970A SerialNo MY41012474
Manu Instrulab Model 3312A-14-15-24 SerialNo 31102-(41037)
Manu Instrulab Model 406X-0031-01 SerialNo 31128-1
Manu MENSOR Model 600 SerialNo 621218
Manu Agilent Model 53131A SerialNo MY47000169
Manu MENSOR Model 600 SerialNo 621385

Notes:

1. Standards used in this calibration are traceable to the National Institute of Standards and Technology.
2. This calibration report shall not be reproduced, except in full, without the written approval of In-Situ, Inc.
3. A calibration interval of 12 to 18 months is recommended.
4. The post-calibration data is collected at nominal +20 C.
5. 1.0 PSI = 6.894757 KPa

Performed By: JBO

Copyright © 2006 In-Situ, Inc.

In-Situ Inc.

15-COE-D

Calibration Report

Report Number: 20090126142155-140959

221 East Lincoln Avenue, Fort Collins, CO 80524 USA
1-970-498-1500, 1-800-446-7488, FAX: 1-970-498-1598
Visit us at www.in-situ.com

Instrument Details:

Instrument Model:	**Level TROLL 500**
Full Scale Pressure Range	**206.84 KPa (30 PSI) vented**
Serial Number:	**140959**

Calibration Details:

Calibration Result:	**PASS**
Calibration Date:	2009-01-26 14:21:55 (UTC)
Nominal Range of Applied Temperature:	-5 C to +50 C
Temperature Accuracy Specification:	+/- 0.1 C From 0 C to +50 C
Nominal Range of Applied Pressure:	0 KPa to 206.8 KPa (0.0 PSI to 30.0 PSI)
Pressure Accuracy Specification:	+/- 0.1 %FS from -5 C to +50 C, +/- 0.05 %FS at +15 C

Post-Calibration Check:

Parameter	Applied	Reported	Deviation
Pressure	30.0001	29.9951	-0.0166
Pressure	0.0000	-0.0025	-0.0085
Temperature	19.9940	20.0092	0.0152

Calibration Procedures and Equipment Used:

Automated calibration procedures used.
Manu Agilent Model 34970A SerialNo MY44038788
Manu Instrulab Model 3312A-14-15-24 SerialNo 31138
Manu Instrulab Model 406X-0031-01 SerialNo 1-31118
Manu MENSOR Model 600 SerialNo 622742
Manu Agilent Model 53131A SerialNo MY47000169
Manu MENSOR Model 600 SerialNo 621385

Notes:

1. Standards used in this calibration are traceable to the National Institute of Standards and Technology.
2. This calibration report shall not be reproduced, except in full, without the written approval of In-Situ, Inc.
3. A calibration interval of 12 to 18 months is recommended.
4. The post-calibration data is collected at nominal +20 C.
5. 1.0 PSI = 6.894757 KPa

Performed By: JBO

Copyright © 2006 In-Situ, Inc.

Coral Township Well Site – Set Up on Hole

Coral Township Well Site Entrance

Coral Township Well Site

Coral Township Well Site

Coral Township Well Site – 15I

Coral Township Well Site – 15S and 15D

Coral Township Well Site

Coral Township Well Site – 15I and Monument

Coral Township Well Site

Coral Township Well Site – Brass COE Monument

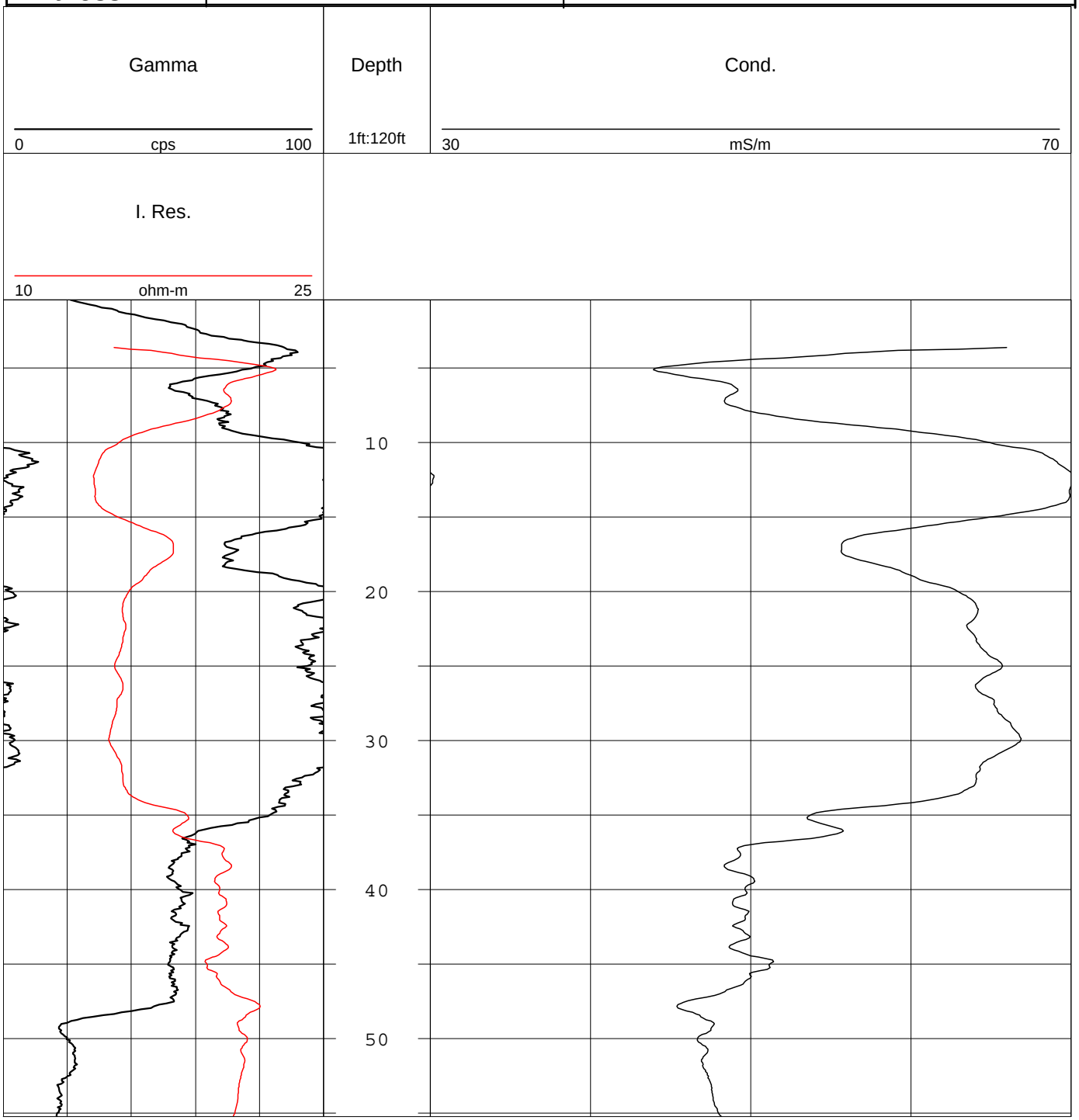
Coral Township Well Site – Inside Casing

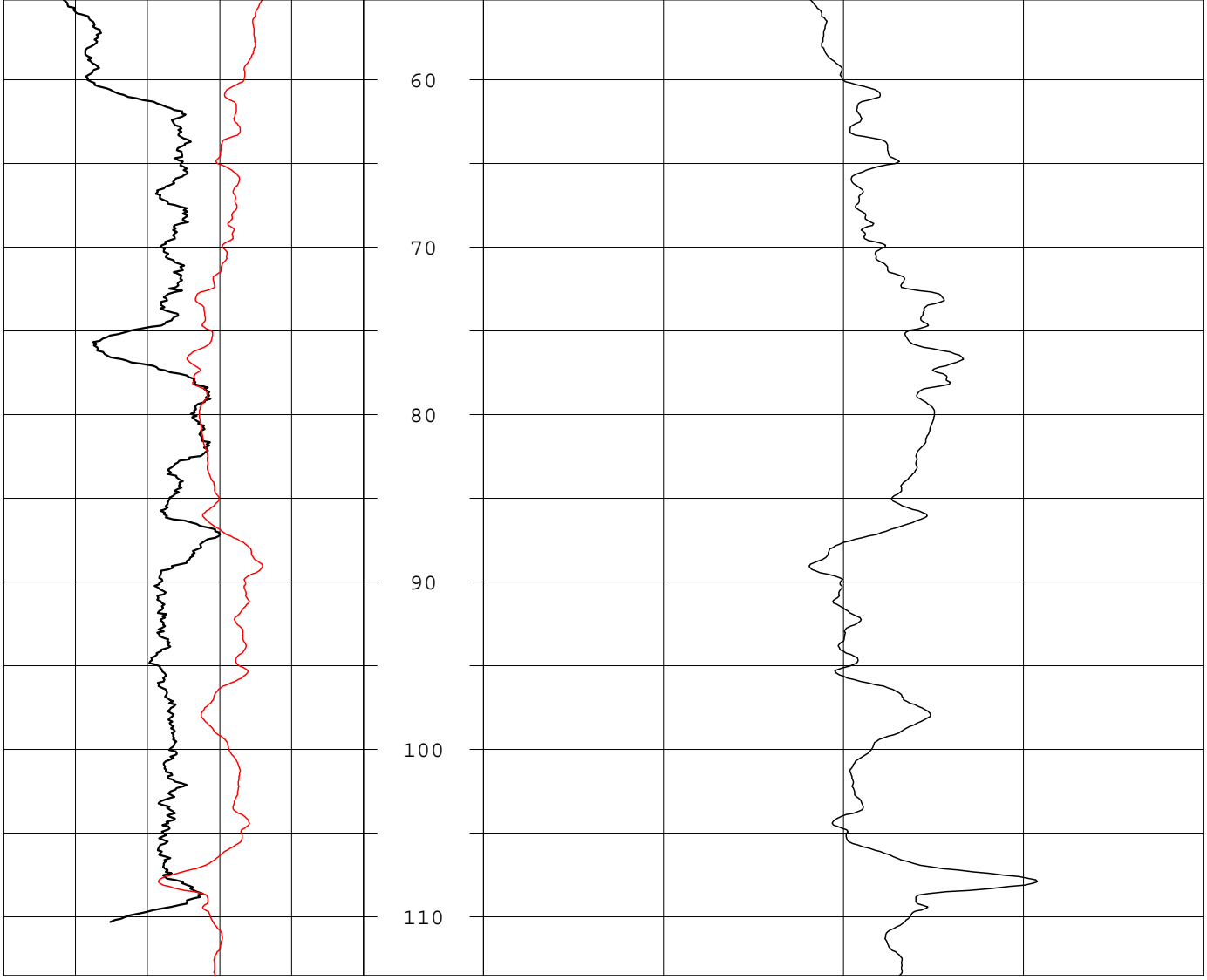
COMPANY:	MCHENRY CO. & USACE
Location:	CORAL TWP

Well	CORAL TWP #15		
Date	1/21/2009	BH Fluid	FORMATION
Casing	2" PVC 2.3' AGS - 116 'BGS		
File Name	MCHTH15-09EMGAM		
Depth Driller	125' BGS		
Depth Logger	115.91' BGS		
Logged by:	T. YOUNG		
Witness:	NOT WITNESSED		

OTHER SERVICES

H2O LEVEL & GPS




60
70
80
90
100
110

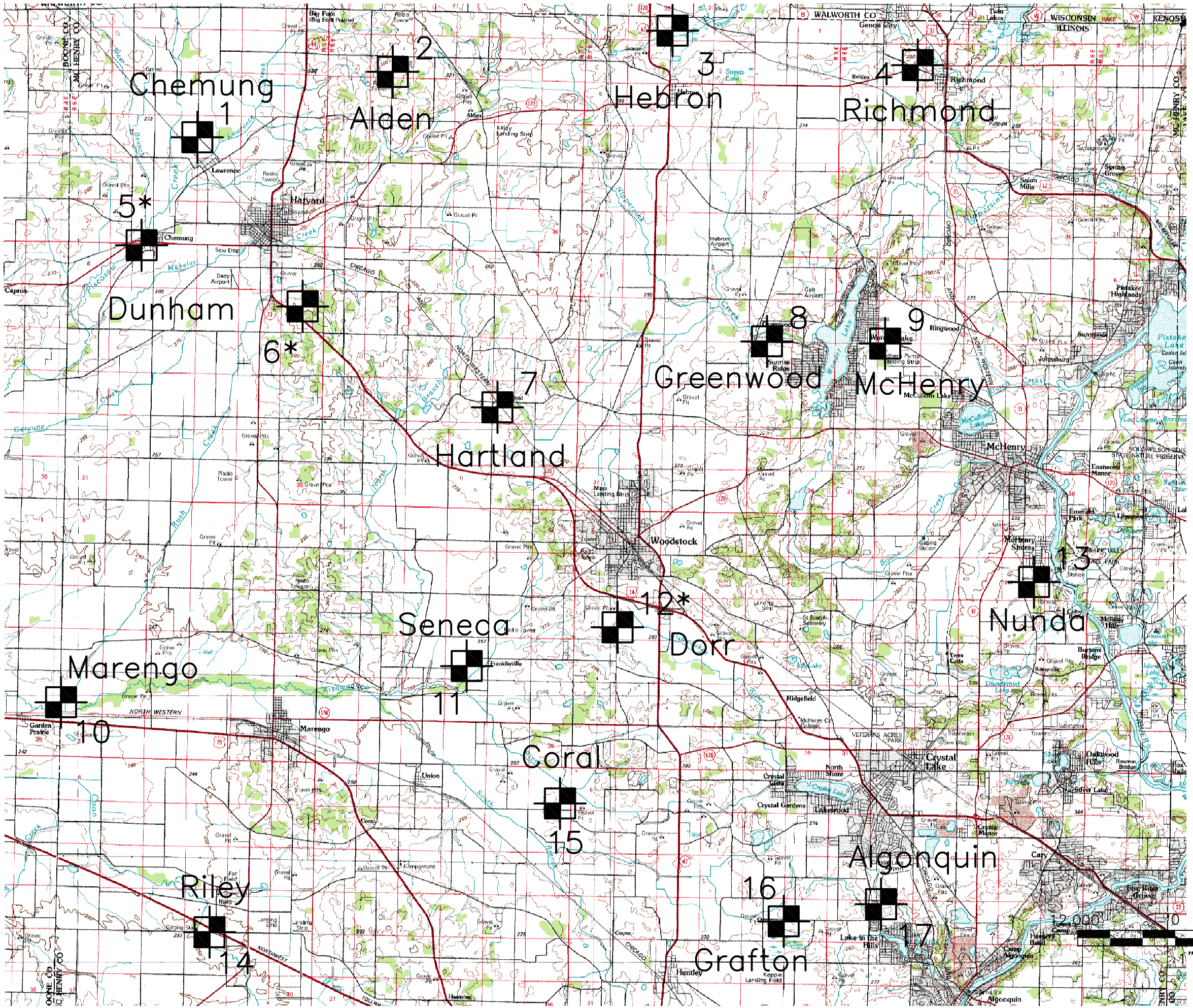
A-16: Folio for Well Site #16 – Grafton Township

Table of Contents

I.) Site Location Map – Location in County
II.) Site Location Map – Location on USGS Topographic Map
III.) Site Location Map – Location on USGS High Resolution Orthophoto
IV.) Site Boring Log
V.) Well Construction Diagram
VI.) Well Site Summary and Commentary
VII.) Particle Size Distribution Report
VIII.) Table of Water Level Measurements
IX.) Well Development Field Log
X.) Water Quality Analysis Results
XI.) Groundwater Sampling Field Log
XII.) Hydraulic Conductivity Testing Results
XIII.) In-Situ LevelTroll™ Calibration Report
XIV.) Site Photographs
XV.) Downhole Geophysical Testing

Well Site Location Maps

Z:\Projects\200804080\CtyWide\D-09000-460-8000_CtyOverviewMap_004.dwg; 4/20/2009 5:33:59 PM; BRAUN, GARY



LEGEND:

AECOM Well Installation Site

McHenry 9

Well Installations By Others

Dunham 6*

0 12,000 24,000'

" = 12,000'

AECOM

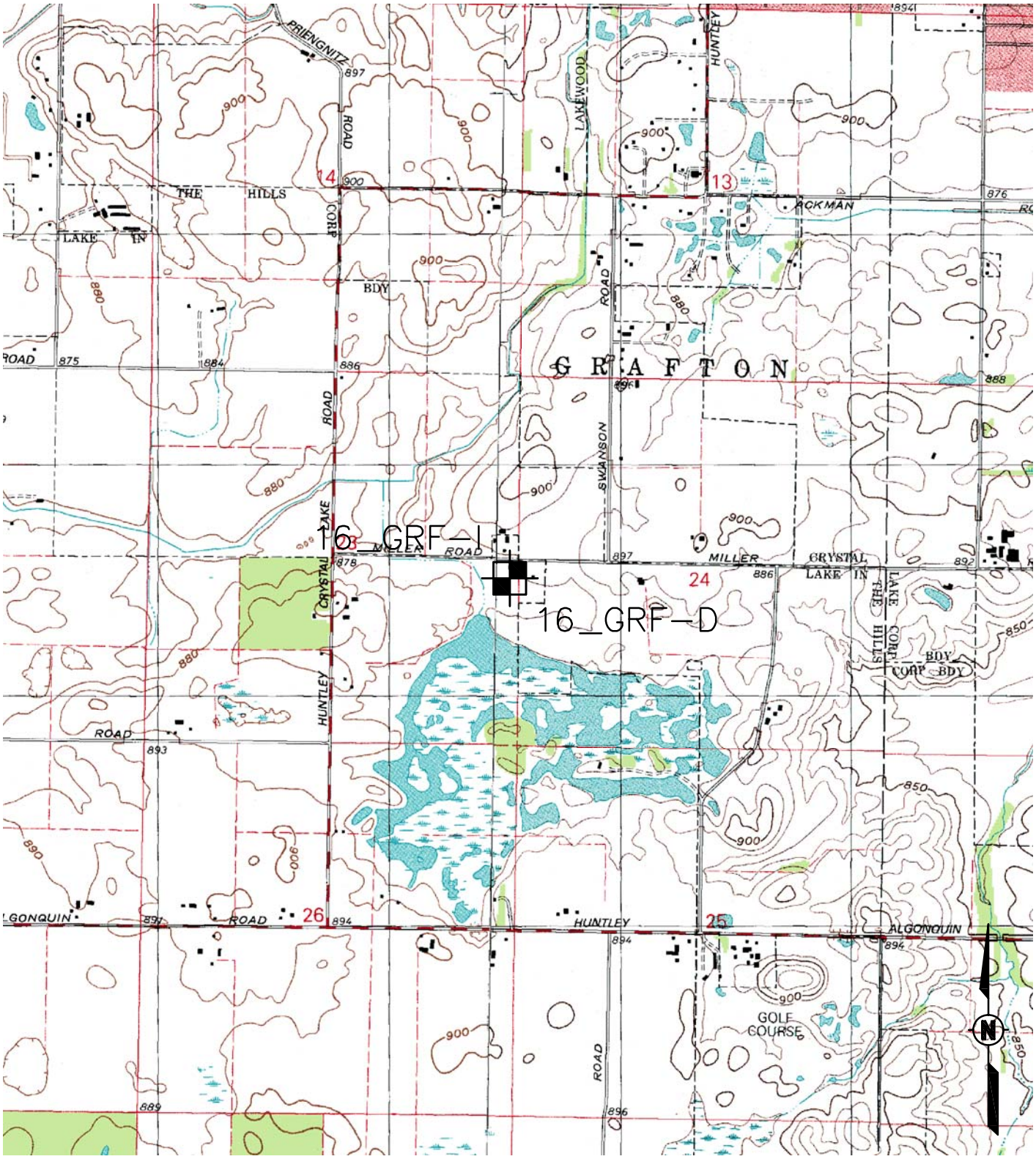
750 Corporate Woods Pkwy
Vernon Hills, IL 60061
847-279-2500
www.aecom.com

Copyright © By: STS Consultants, Ltd.

LOCATION MAP OF WELL SITES

Observation Well Network for Glacial Aquifers
McHenry County, Illinois

Drawn :	CJH	3/11/2009
Checked:	GMB	4/18/2009
Approved:	CSR	4/27/2009
PROJECT NUMBER	09000-460	
FIGURE NUMBER	1	



2000 0 2000 4000

1" = 2000'

AECOM

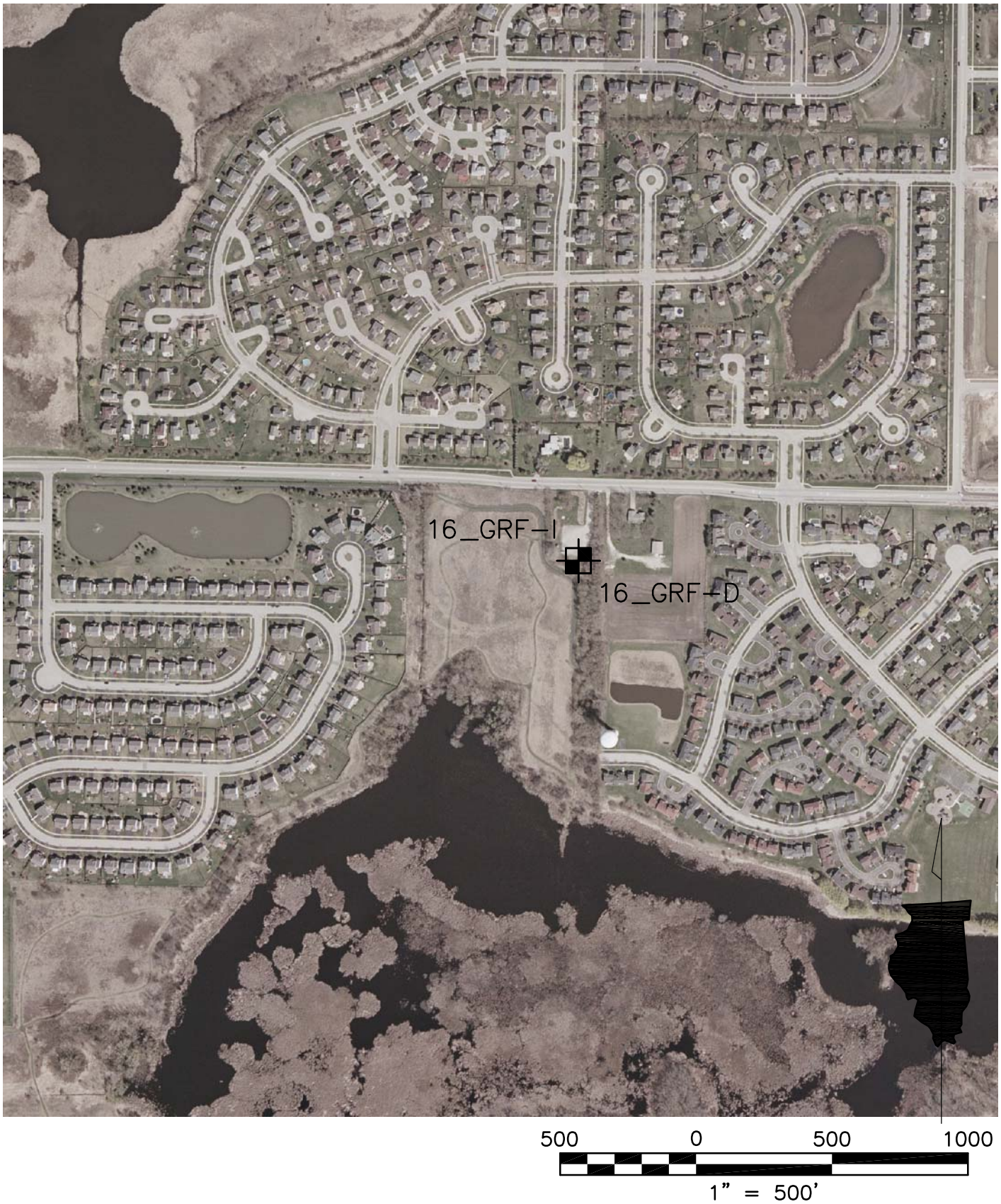
750 Corporate Woods Parkway
Vernon Hills, IL 60061
847.279.2500
www.aecom.com

Copyright © 2009, By: AECOM

Site Location on USGS Topographic Map
Site No. 16 - Grafton Township
Exner Marsh - Miller Rd.
Observation Well Network
McHenry County, Illinois

Drawn :	CJH	04/01/2009
Checked:	GMB	04/15/2009
Approved:	CSR	04/24/2009
PROJECT NUMBER	09000-460	
FIGURE NUMBER	Folio_16 #2	

Z:\Projects\200804080\CtyWide\D-09000-460-8000_TopoMaps_v02.dwg; 4/20/2009 11:19:57 AM; BRAUN, GARY; STS_BLACK_040102.ctb



AECOM

750 Corporate Woods Parkway
Vernon Hills, IL 60061
847.279.2500
www.aecom.com
Copyright © 2009, By: AECOM

2005 USGS High Resolution Orthophoto
Site No. 16 - Grafton Township
Exner Marsh - Miller Rd.
Observation Well Network
McHenry County, Illinois

Drawn :	CJH	04/01/2009
Checked:	GMB	04/15/2009
Approved:	CSR	04/24/2009
PROJECT NUMBER	09000-460	
FIGURE NUMBER	Folio_16 #3	

Z:\Projects\200804080\CtyWide\D-09000-460-8000_AerialsMap_004.dwg; 4/21/2009 2:33:47 PM; BRAUN, GARY; STS_BLACK_040102.ctb

Boring and Well Construction Details

DRILLING LOG

DIVISION	USACE
INSTALLATION	Chicago District
SHEET	1 OF 7 SHEETS
1. PROJECT	McHenry County Observation Wells
2. LOCATION (Coordinates or Station)	McHenry County, Illinois N 2,011,623.00 E 973,157.00
3. DRILLING AGENCY	WDC Exploration & Wells
4. HOLE NO. *(As shown on drawing title and file number)*	16-GRAFTON
5. NAME OF DRILLER	Dan Tonnancour
6. DIRECTION OF HOLE	☒ VERTICAL ☐ INCLINED --- DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN	170.0
8. DEPTH DRILLED INTO ROCK	1.0
9. TOTAL DEPTH OF HOLE	171.0
10. SIZE AND TYPE OF BIT	3 7/8" Carbide Bit / 5 7/8" Casing
11. DATUM FOR ELEVATION SHOWN *(TBM or MSL)*	NAVD 88
12. MANUFACTURER'S DESIGNATION OF DRILL	Super Sonic II
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN	DISTURBED 22 / UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES	N/A
15. ELEVATION GROUND WATER	859.0
16. DATE HOLE	STARTED 10/14/2008 / COMPLETED 10/15/2008
17. ELEVATION TOP OF HOLE	+879.5
18. TOTAL CORE RECOVERY FOR BORING	88 %
19. GEOLOGIST	Gary Braun, LPG IL

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS *(Drilling time, water loss, depth weathering, etc., if significant)* g
+879.5	0.0		Topsoil: OL, Light to dark brown clayey organic silt, trace sand and gravel, stiff	70	1 0.0 5.0	
+878.0	1.5		Fill: Light brown medium gravel, moderately dense, dry			
+875.5	4.0		OL, Black clayey organic silt, soft, damp			
+874.5	5.0		GP, Gray medium gravel, loose, moist	90	2 5.0 15.0	
+873.5	6.0		CL, Brown and black mottled silty clay with medium gravel, little sand, moderately stiff, moist			
+870.5	9.0		CL, Brownish gray silty clay, little coarse sand, trace fine to coarse gravel, stiff, damp Note: Matrix supported Massive Diamicton Till			Sample No. 1 from 11.0' - 12.0'
				75	3 15.0 25.0	
+860.5	19.0		SP, Gray medium sand, trace coarse sand and gravel, loose, wet			
+859.5	20.0					

DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE 879.5

Hole No. 16-GRAFTON

PROJECT: McHenry County Observation Wells

INSTALLATION: Chicago District

SHEET 2 OF 7 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
			SP, Gray coarse sand, little fine to medium gravel, very loose, wet Note: No bedding/grading identified			Sample No. 2 from 22.0' - 23.0'
+855.0	24.5					
			SC, Grayish brown sandy clay, little silt and gravel, very soft, moist, low plasticity Note: Matrix Supported Diamicton Till	95	4 25.0 35.0	Qp = 0.0 TSF @25.0' Qp = 0.0 TSF @27.0' Qp = <0.5 TSF @30.0'
+848.5	31.0					
			CL-ML, Grayish brown clayey silt, soft, low to medium plasticity, moist			Sample No. 3 from 34.0' to 35.0'
				100	5 35.0 45.0	Sample No. 4 from 41.0' to 42.0'
			Note: Occasional thin (<1/4" thick) medium sand seams from 43.0' to 44.0'			
+834.5	45.0					
				25	6 45.0	Sample No. 5 from 45.0' to 55.0'

DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE 879.5

Hole No. 16-GRAFTON

PROJECT: McHenry County Observation Wells

INSTALLATION: Chicago District

SHEET 3 OF 7 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
			SC, Grayish brown sandy clay, little gravel, trace cobbles, stiff to very stiff, moist, little to no plasticity Note: Matrix Supported Massive Diamicton *(continued)* Note: Large cobble stick in bit limited recover on Run 6		55.0	
						Qp = 2.75 TSF @50.0'
				100	7 55.0 65.0	
						Sample No. 6 from 58.0' to 59.0' Qp = 4.5+ TSF @58.0'
						QP = 4.5+ TSF @61.0'
						Sample No. 7 from 64.0' to 65.0' Qp = 4.5+ TSF @64.0'
				100	8 65.0 75.0	
						Qp = >4.5 TSF @67.0'
						Qp = >4.5 TSF @71.0'

DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE 879.5

Hole No. 16-GRAFTON

PROJECT: McHenry County Observation Wells

INSTALLATION: Chicago District

SHEET 4 OF 7 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
			SC, Grayish brown sandy clay, little gravel, trace cobbles, stiff to very stiff, moist, little to no plasticity Note: Matrix Supported Massive Diamicton *(continued)*			Sample No. 8 from 74.0' to 75.0' Qp = >4.5 TSF @74.0'
				90	9 75.0 85.0	
+800.0	79.5					
			SW, Brownish gray fine gravelly fine to coarse sand, loose, wet			Sample No. 9 from 80.0' to 81.0'
+797.0	82.5					
			SW, Brownish gray medium to coarse sand, loose, wet			Sample No. 10 from 84.0' to 85.0'
				80	10 85.0 95.0	
+790.5	89.0					
			GP, Gray sandy fine gravel, loose, wet			Sample No. 11 from 91.0' to 92.0'
+787.5	92.0					
			SW, Gray gravelly fine to coarse sand, loose, wet			
+786.5	93.0					
			GW, Gray fine to coarse gravel, medium to coarse sand, loose, wet, outwash			
+784.5	95.0					
			GP, Clean, gray fine to medium gravel, trace coarse gravel, very loose, wet, outwash	100	11 95.0 105.0	% Gravel/% Sand/% Fines = 63/36/1 from 96.0' to 97.0'

DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE 879.5

Hole No. 16-GRAFTON

PROJECT: McHenry County Observation Wells

INSTALLATION: Chicago District

SHEET 5 OF 7 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
			GP, Clean, gray fine to medium gravel, trace coarse gravel, very loose, wet, outwash *(continued)*			Grainsize analysis sample taken from 97.0' to 98.0' Sample No. 12 from 98.0' to 99.0'
+779.5	100.0					
			CL, Brownish gray silty clay, trace to little fine to coarse gravel and sand, very stiff to hard, damp, medium plasticity Note: Matrix Supported Massive Diamicton Till; more difficult drilling last half of Run No. 11			Qp = 4.25 TSF @101.0' Qp = 4.5 TSF @103.0' Sample No. 13 from 104.0' to 105.0'
				100	12 105.0 114.0	
						Qp = 4.5 TSF @107.0' Qp = 4.0 TSF @110.5' Sample No. 14 from 113.0' to 114.0' Qp = 4.5 TSF @113.0'
+765.5	114.0					
+765.0	114.5		CL, Brownish gray sandy clay, some fine to coarse gravel, stiff, damp, not plastic	100	13 114.0 122.5	
			SC, Gray intra-till clayey sand with fine to medium gravel			
+763.0	116.5					
			CL, Brownish gray sandy clay, some fine to coarse gravel, stiff to hard, damp, not plastic, matrix supported thinly to medium bedded diamicton with frequent fine sand partings and occassional black mottling at bedding planes			Sample No. 15 from 121.0' to 122.0'
				100	14	

DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE 879.5

Hole No. 16-GRAFTON

PROJECT: McHenry County Observation Wells

INSTALLATION: Chicago District

SHEET 6 OF 7 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
			CL, Brownish gray sandy clay, some fine to coarse gravel, stiff to hard, damp, not plastic, matrix supported thinly to medium bedded diamicton with frequent fine sand partings and occassional black mottling at bedding planes *(continued)*		122.5 128.5	Qp = >4.5 TSF @125.0'
+752.3	127.2					
+751.5	128.0		GP, Brownish gray very fine gravel seam, some clay			Sample No. 16 from 127.0' to 128.0' Qp = >4.5 TSF at 127.0' where not granular
			Note: Difficult drilling			
			CL, Brownish gray sandy clay, some fine to coarse gravel, hard, damp	100	15 128.5 135.0	Qp = >4.5 TSF @130.5' Sample No. 17 from 134.0' to 135.0' Qp = >4.5 TSF @134.0'
+744.5	135.0					
			GW, Brownish gray fine to coarse gravel, little sand, trace silt/clay, loose, wet	70	16 135.0 145.0	Sample No. 18 from 136.0' to 137.0' % Gravel/% Sand/% Fines = 41/55/5 from 137.0' to 138.0'
+741.5	138.0					
			CL, Brownish gray sandy clay, some fine to coarse gravel, stiff, damp with occasional sand partings, very hard			Qp = >4.5 TSF @138.0' Qp = >4.5 TSF @140.0' Qp = >4.5 TSF @142.0' Sample No. 19 from 143.0' to 144.0'
			Note: Brownish gray clayey sand encountered from 143.0' to 144.0'			
				100	17 145.0 152.0	

DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE 879.5

Hole No. 16-GRAFTON

PROJECT: McHenry County Observation Wells

INSTALLATION: Chicago District

SHEET 7 OF 7 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
			CL, Brownish gray sandy clay, some fine to coarse gravel, stiff, damp with occasional sand partings, very hard *(continued)*			Sample No. 20 from 151.0' to 152.0' QP >4.5 TSF @151.0'
				100	18 152.0 159.0	QP >4.5 TSF @153.0' QP >4.5 TSF @155.0'
			Note: Trace fine sand seams (~1" thick) encountered between 158.0' to 159.0'			QP >4.5 TSF @155.0'
				100	19 159.0 165.0	Sample No. 21 from 160.0' to 161.0' QP >4.5 TSF @160.0' QP >4.5 TSF @162.0' QP >4.5 TSF @164.0'
				83	20 165.0 171.0	Sample No. 22 from 166.0' to 167.0'
			Note: Gravelly zone encountered from 167.2' to 168.0'			
+709.5	170.0					
+708.5	171.0		Dolomite Bedrock			
			END OF BORING - 171.0' BGS			AECOM Project No. 60095270

Hole No. 16 - GRAFTON TWP

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 1 OF 12 SHEETS

1. PROJECT McHenry City Wells	10. SIZE AND TYPE OF BIT 3 7/8" Carbide Sampler
2. LOCATION (Coordinates or Station) N 2,011,623 E 973,157 IL St Pl-E	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) NAVD 88
3. DRILLING AGENCY WDC Exploration & Wells	12. MANUFACTURERS DESIGNATION OF DRILL Super Sonic II
4. HOLE NO. (As shown on drawing title and title number) 16-GRF	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN — DISTURBED 22 — UNDISTURBED 0
5. NAME OF DRILLER Dan Tenhancowk	14. TOTAL NUMBER CORE BOXES 0
6. DIRECTION OF HOLE ☑ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER 859' Deep Well (10/16)
	16. DATE HOLE — STARTED 10/14/08 — COMPLETED 10/15/08
7. THICKNESS OF OVERBURDEN 170'	17. ELEVATION TOP OF HOLE 879.5 ft MSL
8. DEPTH DRILLED INTO ROCK 1'	18. TOTAL CORE RECOVERY FOR BORING 151/171 = 88%
9. TOTAL DEPTH OF HOLE 171'	19. SIGNATURE OF INSPECTOR Gary M. Brown LPG IL

5 7/8" Casing V Roto-Sonic

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
879.5	0		Light to Dark Br. Clayey ORGANIC SILT, trace Sand & gravel, stiff (OL) TOPSOIL			Run 1 (0-5') Rec/Run = 3.5'/5' = 70%
	1					
	2		Light Brown Medium GRAVEL FILL. Dry, Mod. Dense (Fill likely for Parking)	Rec 70%	Bag #1	
	3					
	4		Black Clayey ORGANIC SILT, soft, damp (OL)			
	5		Gray Medium GRAVEL Loose, Moist (GP) ↕ subtle			Run 2 (5-15') Rec/Run = 9'/10' = 90%
	6		Brown & Black Mottled Silty CLAY w/ Med. Gravel, little Sand, Mod. Stiff, moist (CL to GC) Top of Clay @ > Gravel Content			
	7					
	8				Bag #2	
	9					
869.5	10		Brownish Gray Silty CLAY, little coarse sand, trace fine to coarse gravel, stiff, damp (CL)	Rec 90%		
	11				S1	
	12		Matrix Supported Massive Diamicton TILL		Bag #3	
	13					
	14					
	15					

1247 SE Corner of Exner Marsh Parking Lot off Miller Rd.

1255 End Run

1301 Start Run

Extract Samples 1318

Hole No. 16 - GRAFTON TWP

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 2 OF 12 SHEETS

1. PROJECT McHenry Cty Wells	10. SIZE AND TYPE OF BIT 3 7/8" Carbide Sampler
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) NAVD 88
3. DRILLING AGENCY WDC Exploration & Wells	12. MANUFACTURERS DESIGNATION OF DRILL Super Sonic II
4. HOLE NO. (As shown on drawing title and title number) 16-GRF	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN — DISTURBED 22 — UNDISTURBED 0
5. NAME OF DRILLER Dan Tennant Cowie	14. TOTAL NUMBER CORE BOXES Ø
6. DIRECTION OF HOLE ☑ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.	15. ELEVATION GROUND WATER 859' Deepwell (10/16
	16. DATE HOLE — STARTED 10/14/08 — COMPLETED 10/15/08
7. THICKNESS OF OVERBURDEN 170'	17. ELEVATION TOP OF HOLE 879.5 FT MSL
8. DEPTH DRILLED INTO ROCK 1'	18. TOTAL CORE RECOVERY FOR BORING 88%
9. TOTAL DEPTH OF HOLE 171'	19. SIGNATURE OF INSPECTOR Gary M. Brown LPG IL

5 7/8" Casing
↓
Roto-Sonic

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	15		Cont.			Run 3 (15-25)
	16		Br. Gray TILL			Rec/Run = 7.5'/10' = 75%
	17			Rec. 75%		
	18					· Approx. 1ft of sand lost when sampling bag split.
	19		Abrupt Contacts		Bag 4	· Suspected to be from (20-21')
859.5	20		Gray Med. SAND, tr. C. Sand & Gravel loose, wet (SP)			
	21		Gray Coarse SAND, little f.-Med. Gravel, very loose, wet (SP)			
	22		· no bedding/grading identified		S2	
	23					
	24		Abrupt Gradation			
	25		Grayish Brown Sandy CLAY, little silt & gravel, very soft, moist (SC) Low Plasticity Matrix supported DIAMICTON TILL			0.0 tsf
	26				Bag 5	Run 4 (25-35) Rec/Run = 9.5'/10' = 95%
	27					0.0 tsf
	28			Rec 95%		
	29				Bag 6	
849.5	30		Thin Med. Sand seam 3/8" thick			<0.5 tsf

1321

1342 Start 4" sampler
1343 Stop
Drive 6" Casing
↓
1348

ENG FORM 1836
MAR 71

PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT McHenry Cty Wells

HOLE NO. 16-GRAFTON TWP

Hole No. 16 - GRAFTON TWP

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 3 OF 12 SHEETS

1. PROJECT McHenry Cty Wells	10. SIZE AND TYPE OF BIT 3 7/8" Carbide Sampler
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) NAVD 88
3. DRILLING AGENCY WDC Exploration & Wells	12. MANUFACTURERS DESIGNATION OF DRILL Super Sonic II
4. HOLE NO. (As shown on drawing title and title number) 16-GRF	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 22; UNDISTURBED 0
5. NAME OF DRILLER DAN TONNANCOUR	14. TOTAL NUMBER CORE BOXES 0
6. DIRECTION OF HOLE ☑ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.	15. ELEVATION GROUND WATER 859' 10/16 (Deep Well)
	16. DATE HOLE: STARTED 10/14/08; COMPLETED 10/15/08
7. THICKNESS OF OVERBURDEN 170'	17. ELEVATION TOP OF HOLE 879.5 FT MSL
8. DEPTH DRILLED INTO ROCK 1'	18. TOTAL CORE RECOVERY FOR BORING 151/171 = 88%
9. TOTAL DEPTH OF HOLE 171'	19. SIGNATURE OF INSPECTOR Gary M Brown LPG 1L

5 7/8" Casing

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
~~849.5~~	30		cont. Grades to over 1 ft Grayish Brown Clayey SILT, soft, low to medium plasticity, moist (CL-ML) Massive w/ Poss. deformations (clasts poor) DIAMICTIC	Rec. 95% cont.	Bag 6 cont.	Run 4 (25-35) cont.
	31					
	32				Bag 7	
	33					
	34				S3	Extract Samples 1354
	35					Run 5 (35-45) Rec/Run = 10'/10' = 100% 1359 ↓ 1400
	36				Bag 8	
	37					
	38					
	39			Rec 100%	Bag 9	
839.5	40					
	41				S4	
	42					
	43		1.0 - 1.5 Gradation thin (<1/4" thick) Med. Sand seams		Bag 10	
	44					Extract Samples 1411
	45		SEE DESCRIPTION NEXT PAGE			

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT McHenry Cty Wells | HOLE NO. 16-GRAFTON TWP.

Hole No. 16 - GRAFTON TWP

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 4 OF 12 SHEETS

1. PROJECT McHenry Cty Wells	10. SIZE AND TYPE OF BIT 3 7/8" Carbide Sampler
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) NAVD 88
3. DRILLING AGENCY WDC Exploration & Wells	12. MANUFACTURERS DESIGNATION OF DRILL Super Sonic II
4. HOLE NO. (As shown on drawing title and title number) 16-GRF	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN — DISTURBED 22 — UNDISTURBED 0
5. NAME OF DRILLER Dan Tonnancour	14. TOTAL NUMBER CORE BOXES 0
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.	15. ELEVATION GROUND WATER 10/16 = 859' DryWell
	16. DATE HOLE — STARTED 10/14/08 — COMPLETED 10/15/08
7. THICKNESS OF OVERBURDEN 170'	17. ELEVATION TOP OF HOLE 879.5 FMSL
8. DEPTH DRILLED INTO ROCK —	18. TOTAL CORE RECOVERY FOR BORING 151/171 = 88%
9. TOTAL DEPTH OF HOLE 171'	19. SIGNATURE OF INSPECTOR Gary M. Brown LPG IL

5 7/8" CASING

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	45		Grayish Brown SANDY CLAY, little gravel, trace cobbles, stiff to very stiff, moist (SC) little to no plasticity, matrix supported massive - DIAMICTON		S5	Run 6 (45-55') Rec/Run = 2.5'/10' = 25% • Large Cobble stuck in bit which limited recovery on run (4" × 6")
	46					
	47					
	48			Rec 25%	Bag 11	
	49					
829.5	50					2.75 tsf
	51		Pinkish Hue (Tiskilwa Till)			
	52					
	53					
	54					
	55					
	56				Bag 11½	Run 7 (55-65') Rec/Run = 10'/10' = 100%
	57					
	58			Rec 100%	Bag 12	4.5+ tsf
	59				S6	
819.5	60					

1417
4" Sampler
1422
Extract Samples
1432
1440 Start
4" Sampler
1448
Drive 6" Casing
1457

ENG FORM 1836
MAR 71

PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT McHenry Cty Wells | HOLE NO. 16 - GRAFTON TWP

Hole No. 16 - GRAFTON TWP

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 5 OF 12 SHEETS

1. PROJECT McHenry Cty Wells	10. SIZE AND TYPE OF BIT 3 7/8" Carbide Sampler 5 7/8" Casing
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) NAVD 88
3. DRILLING AGENCY WDC Exploration & Wells	12. MANUFACTURERS DESIGNATION OF DRILL Super Sonic II
4. HOLE NO. (As shown on drawing title and title number) 16-GRF	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 22; UNDISTURBED 0
5. NAME OF DRILLER DAN TONNANCOUR	14. TOTAL NUMBER CORE BOXES 0
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.	15. ELEVATION GROUND WATER 859' Deep (10/16)
	16. DATE HOLE: STARTED 10/14/08; COMPLETED 10/15/08
7. THICKNESS OF OVERBURDEN 170'	17. ELEVATION TOP OF HOLE 899.5 ft MSL
8. DEPTH DRILLED INTO ROCK 1'	18. TOTAL CORE RECOVERY FOR BORING 151/171 = 88%
9. TOTAL DEPTH OF HOLE 171'	19. SIGNATURE OF INSPECTOR Gary M. Brown LPG IL

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
819.5	60		cont. V. Stiff Br. Gray Sandy CLAY DIAMICTON	cont.		Run 7 (55-65) cont.
	61					4.5+ tsf
	62			Rec 100%	Bag 13	
	63					
	64					
					S7	4.5+ tsf
	65					
	66					Run 8 (65-75) Rec/Run = 10'/10' = 100%
	67				Bag 14	>4.5 tsf
	68					
	69			Rec 100%		
809.5	70				Bag 15	
	71					>4.5 tsf
	72					
	73				Bag 16	
	74					
	75				S8	>4.5 tsf

Extract Samples 1500

1517 Start 4" Sampler 1520

Drive 6" Casing 1528

Extract Samples 1533

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT McHenry Cty Wells — HOLE NO. 16-GRAFTON TWP

Hole No. 16- GRAFTON TWP

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 6 OF 12 SHEETS

1. PROJECT McHenry Cty Wells	10. SIZE AND TYPE OF BIT 3 7/8" Carbide Sampler
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) NAVD 88
3. DRILLING AGENCY WDC Exploration & Wells	12. MANUFACTURERS DESIGNATION OF DRILL Super Sonic II
4. HOLE NO. (As shown on drawing title and title number) 16-GRF	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 22; UNDISTURBED Ø
5. NAME OF DRILLER Dan Tonwancour	14. TOTAL NUMBER CORE BOXES Ø
6. DIRECTION OF HOLE ☑ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER 859 ft (Deep well)
	16. DATE HOLE: STARTED 10/14/08; COMPLETED 10/15/08
7. THICKNESS OF OVERBURDEN 170'	17. ELEVATION TOP OF HOLE 979.5 ft MSL
8. DEPTH DRILLED INTO ROCK 1'	18. TOTAL CORE RECOVERY FOR BORING 151'/171 = 88%
9. TOTAL DEPTH OF HOLE 171'	19. SIGNATURE OF INSPECTOR Gary M. Brown LPG IL

5 7/8" CASING
V
ROTO-SONIC

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	75		cont.			Run 9 (75-85)
	76		Sandy CLAY TILL		Bag 17	Rec./Run = 9'/10' = 90%
	77					
	78					
	79		Abrupt Gradation	Rec 100%		
799.5	80		Brownish Gray Fine Gravelly F.-C. SAND, loose, wet (GP-SW)		S9	
	81				Bag 18	
	82		OUTWASH w/ occassional clay stringers (1/2 to 3/4" thick)			
	83		Brownish Gray Med. to COARSE SAND, loose, wet (SW) OUTWASH cont.			
	84				S10	
	85		clean sands			Run 10 (85-95)
	86					Rec/Run = 8'/10' = 80%
	87			Rec 80%		(missing recovery from sands in bag 19 85-89)
	88				Bag 19	
	89					
789.5	90		Gray Sandy F. GRAVEL loose wet (GP)			

1540 — 4" sampler — 1542
1543 — Drive 6" Casing — 1550
Extract Samples — 1554
1559 — 4" Sampler — 1600
1603 — 6" CASING — 1605

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT McHenry Cty Wells | HOLE NO. 16- GRAFTON TWP

Hole No. 16 - GRAFTON TWP

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 7 OF 12 SHEETS

1. PROJECT McHenry Cty Wells	10. SIZE AND TYPE OF BIT 3 7/8" Carbide Sampler
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) NAVD88
3. DRILLING AGENCY WDC Exploration & Wells	12. MANUFACTURERS DESIGNATION OF DRILL Super Sonic II
4. HOLE NO. (As shown on drawing title and title number) 16-GRF	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN — DISTURBED 22 — UNDISTURBED 0
5. NAME OF DRILLER DAN TONNANCOUR	14. TOTAL NUMBER CORE BOXES 0
6. DIRECTION OF HOLE ☑ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.	15. ELEVATION GROUND WATER 859' Deep (10/16)
	16. DATE HOLE — STARTED 10/14/08 — COMPLETED 10/15/08
7. THICKNESS OF OVERBURDEN 170'	17. ELEVATION TOP OF HOLE 879.5 ft MSL
8. DEPTH DRILLED INTO ROCK 1'	18. TOTAL CORE RECOVERY FOR BORING 151/171 = 88%
9. TOTAL DEPTH OF HOLE 171'	19. SIGNATURE OF INSPECTOR Barry M Brown LPG IL

5 7/8" Casing
Roto-Sonic

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
789.5	90		cont. Sandy F. GRAVEL	cont.		Run 10 (85-95) cont.
	91				s11	
	92		Gray Gravelly F.-C. SAND, loose, wet (SW)	Rec 80%	Bag 20	
	93		stratified fine SAND Bed			
	94		Gray Fine to Coarse GRAVEL, Med.-C. Sand, loose, wet (GW) OUTWASH			1610 Extract Samples
	95		grades to			Run 11 (95-105)
	96		Clean, Gray fine to Med. GRAVEL, trace Coarse Gravel Very loose, wet (GP) OUTWASH			Rec/Run = 10'/10' = 100% — Had to blow out sand from w/in casing
	97				Bag 21	1623 4" sampler advance
	98				GRAIN SIZE ANALYSIS SAMPLE TAKEN	1626
	99				s12	Drive 6" Casing
779.5	100		Abrupt Contact	Rec 100%		
	101		Brownish Gray Silty CLAY, trace to little fine to coarse gravel & sand, very stiff to hard, damp (CL) Medium Plasticity - Matrix Supported Massive DIAMICTON TILL		Bag 22	4.5 tsf
	102					
	103				Bag 23	4.5 tsf — More difficult drilling last 1/2 of run — 1644 Extract Samples
	104					
	105				s13	

INTERMEDIATE SCREEN

Tiskilwa Till cont.

Hole No. 16-GRAFTON TWP

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 8 OF 12 SHEETS

1. PROJECT McHenry Cty Wells	10. SIZE AND TYPE OF BIT 3 7/8" Carbide Sampler
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) NAVD 88
3. DRILLING AGENCY WDC Exploration & Wells	12. MANUFACTURERS DESIGNATION OF DRILL Super Sonic II
4. HOLE NO. (As shown on drawing title and title number) 16-GRF	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN — DISTURBED 22 — UNDISTURBED 0
5. NAME OF DRILLER DAN TONNANCOUR	14. TOTAL NUMBER CORE BOXES 0
6. DIRECTION OF HOLE ☑ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.	15. ELEVATION GROUND WATER 859 ft MSL 10/16 in Deep Well
	16. DATE HOLE — STARTED 10/14/08 — COMPLETED 10/15/08
7. THICKNESS OF OVERBURDEN 170'	17. ELEVATION TOP OF HOLE 879.5 ft MSL
8. DEPTH DRILLED INTO ROCK 1'	18. TOTAL CORE RECOVERY FOR BORING 151/171' = 88%
9. TOTAL DEPTH OF HOLE 171'	19. SIGNATURE OF INSPECTOR Ken M. Brown LPG IL

5 7/8" Casing

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	105		Cont.			Run 12 (105-114)
	106		Massive Silty CLAY, TILL		Bag 24	Rec/Run = 9'+/9' = 100%
	107					4.5 tsf
	108					
	109			Rec. 100%	Bag 25	
769.5	110					4.0 tsf
	111					
	112				Bag 26	
	113					4.5 tsf
					s14	
	114		See Description (Below 116.5)			Run 13 (114-122.5)
	115		Gray Intra-Till Clayey SAND w/ fine to med gravel, loose (SC-GC)		Bag 27	Rec/Run = 8.5'/8.5' = 100%
	116					
	117		Brownish Gray Sandy CLAY, some fine to coarse gravel, stiff, damp, not plastic, matrix supported thinly to medium → (refer to pg)	Rec 100%		
	118				Bag 28	
	119					
759.5	120					

1655 4" SAMPLER
1707 Pull Sample
Extract Samples 1705
Drop casing
0740 10-15-08 Begin Run 13

Hole No. 16 - GRAFTON TWP

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 9 OF 12 SHEETS

1. PROJECT McHenry Cty Wells	10. SIZE AND TYPE OF BIT 3 7/8" Carbide Sampler
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) NAVD 88
3. DRILLING AGENCY WDC Exploration & Wells	12. MANUFACTURERS DESIGNATION OF DRILL Super Sonic II
4. HOLE NO. (As shown on drawing title and title number) 16-GRF	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN — DISTURBED 22 — UNDISTURBED 0
5. NAME OF DRILLER DAN TONNANCOUR	14. TOTAL NUMBER CORE BOXES 0
	15. ELEVATION GROUND WATER 859 ft 10/16 DEEP
6. DIRECTION OF HOLE ☑ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.	16. DATE HOLE — STARTED 10-14-08 — COMPLETED 10/15/08
7. THICKNESS OF OVERBURDEN 170'	17. ELEVATION TOP OF HOLE 879.5 ft MSL
8. DEPTH DRILLED INTO ROCK 1'	18. TOTAL CORE RECOVERY FOR BORING 151/171 (88%)
9. TOTAL DEPTH OF HOLE 171'	19. SIGNATURE OF INSPECTOR Gary M. Brown LPG IL

5 7/8" Casing
Roto-Sonic

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
759.5	120		cont. description from Page 8: bedded Dimicton w/ frequent fine sand partings & occassional black mottling at bedding planes Very hard	cont.		cont. Run 13
	121			100%	Bag 29 s15	Extract Samples 0820
	122					
	123				Bag 30	Run 14 (122.5 - 128.5) Rec/Run = 6+'/6.0' = 100% Start 4" Sampler 0831 ↓ 0840
	124					
	125			Rec 100%	Bag 31	> 4.5 tsf Drive 6" Casing • 0843-0845 • 0930-0940 Water Run 0845-0930
	126					
	127		(127.2-128) Very well sorted / poorly graded very fine gravel seam some clay (GP)		Bag 32 s16	Difficult Drilling > 4.5 tsf where not granular
	128					0950 Extract samples
	129				32A	Run 15 (128.5-135) Rec/Run = 6.5'+/6.5 = 100% 1003 Start 4" Sampler
749.5	130				Bag 33	1007 stop > 4.5 tsf Drive 6" Casing
	131					1022 @ End of Run
	132			Rec 100%		> 4.5 tsf
	133				Bag 34	
	134					> 4.5 tsf
	135				s17	Extract Samples 1030-1032

Hole No. 16-GRAFTON TWP

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 10 OF 12 SHEETS

1. PROJECT McHenry Cty Wells	10. SIZE AND TYPE OF BIT 3 7/8" Carbide Sampler
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) NAVD 88
3. DRILLING AGENCY WDC Exploration & Wells	12. MANUFACTURERS DESIGNATION OF DRILL Super Sonic II
4. HOLE NO. (As shown on drawing title and title number) 16-GRF	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN — DISTURBED 22 — UNDISTURBED 0
5. NAME OF DRILLER DAN TONNANCOUR	14. TOTAL NUMBER CORE BOXES 0
6. DIRECTION OF HOLE ☑ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER 859' Deep Well 10/16
	16. DATE HOLE — STARTED 10-14-08 — COMPLETED 10-15-08
7. THICKNESS OF OVERBURDEN 170'	17. ELEVATION TOP OF HOLE 879.5 Ft MSL
8. DEPTH DRILLED INTO ROCK 1'	18. TOTAL CORE RECOVERY FOR BORING 151/171 = 88%
9. TOTAL DEPTH OF HOLE 171'	19. SIGNATURE OF INSPECTOR Gary M. Brown LPG IL

5 7/8" Casing
V
Roto-Sonic

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	135		Brownish Gray fine to coarse GRAVEL, little sand, trace silt/clay, loose, wet (GW) Inter-Till Gravel		S18 Bag 35	Run 16 (135-145) Rec/Run = 7'/10' = 70%
	136					
	137					
	138		same bedded Diameton as above very hard			> 4.5 tsf
	139			Rec 100%		
739.5	140					> 4.5 tsf
	141					
	142				Bag 36	> 4.5 tsf
	143		Brownish Gray Clayey SAND, Med dense (SC)		S19	
	144					
	145		SAME DIAMETON AS ABOVE, but gets harder w/ depth & has thicker bedding planes			Run 17 (145-152) Rec/Run = 7.0/7.0' = 100%
	146				Bag 39	
	147					
	148					
	149				Bag 38	
729.5	150					

Proposed Deep Zone w/ Surface

139

1039 Start 4" Sampler
1043 6" casing
1052 At Bot of Run (145')
Extract Samples
1102
1112 4" Sampler
1117 Refusal By Driller
1118 Retry Again Refusal
1129-1139 Extract Samples

ENG FORM 1836
MAR 71
PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT McHenry Cty Wells | HOLE NO. 16-GRAFTON TWP

Hole No. 16 - GRAFTON TWP

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 11 OF 12 SHEETS

1. PROJECT McHenry Cty Wells	10. SIZE AND TYPE OF BIT 3 7/8" Carbide Sampler
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) NAVD 88
3. DRILLING AGENCY WDC Exploration & Wells	12. MANUFACTURERS DESIGNATION OF DRILL Super Sonic II
4. HOLE NO. (As shown on drawing title and title number) 16-GRF	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 22, UNDISTURBED 0
5. NAME OF DRILLER Dan Tonwancour	14. TOTAL NUMBER CORE BOXES 0
6. DIRECTION OF HOLE ☑ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER 859' (10/16) Deep Well
	16. DATE HOLE: STARTED 10-14-08, COMPLETED 10-15-08
7. THICKNESS OF OVERBURDEN 170'	17. ELEVATION TOP OF HOLE 879.5 ft MSL
8. DEPTH DRILLED INTO ROCK 1'	18. TOTAL CORE RECOVERY FOR BORING 151/171 = 88%
9. TOTAL DEPTH OF HOLE 171'	19. SIGNATURE OF INSPECTOR Gary M Brown LPG IL

5 7/8" Casing
Roto-Sonic

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
729.5	150		cont.	cont. Rec 100%	Bag 39	Run 17 (145-152) cont.
	151		Hard Diamicton		520	>4.5 tsf
	152					
	153			Rec 100%	Bag 40	Run 18 (152-159) Rec/Run 7'+/7' = 100%
	154					>4.5 tsf
	155				Bag 41	> 4.5 tsf
	156					
	157				Bag 42	>4.5 tsf
	158					
	159		2 one inch thick sand seams 158-159			
719.5	160			Rec 100%	Bag 43	Run 19 (159-165) Rec/Run 6'+/6' = 100%
	161				521	>4.5 tsf
	162				Bag 44	>4.5 tsf
	163					
	164				Bag 45	>4.5 tsf
	165					

1140 Start 4" Sampler
1142
6" Casing
1158
1207 Extract Samples
Lunch 1219-1245
1253 4"
1258
6" Casing to Depth
1314
Extract Samples
1321

ENG FORM 1836
MAR 71
PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT McHenry Cty Wells | HOLE NO. 16-GRAFTON

Hole No. 16-GRAFTON TWP

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 12 OF 12 SHEETS

1. PROJECT McHenry Cty Wells	10. SIZE AND TYPE OF BIT 3 7/8" Carbide Sampler
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) NAVD 88
3. DRILLING AGENCY WDC Exploration & Wells	12. MANUFACTURERS DESIGNATION OF DRILL Super Sonic II
4. HOLE NO. (As shown on drawing title and title number) 16-GRF	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 22; UNDISTURBED 0
5. NAME OF DRILLER Dan Tonnancour	14. TOTAL NUMBER CORE BOXES 0
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.	15. ELEVATION GROUND WATER 859' Deep Well 10/16
	16. DATE HOLE: STARTED 10-14-08; COMPLETED 10-15-08
7. THICKNESS OF OVERBURDEN 170'	17. ELEVATION TOP OF HOLE 879.5 Ft MSL
8. DEPTH DRILLED INTO ROCK 1'	18. TOTAL CORE RECOVERY FOR BORING 151/171 = 88%
9. TOTAL DEPTH OF HOLE 171'	19. SIGNATURE OF INSPECTOR Henry M. Brown LPG IL

5 7/8" Casing V Roto-Sonic

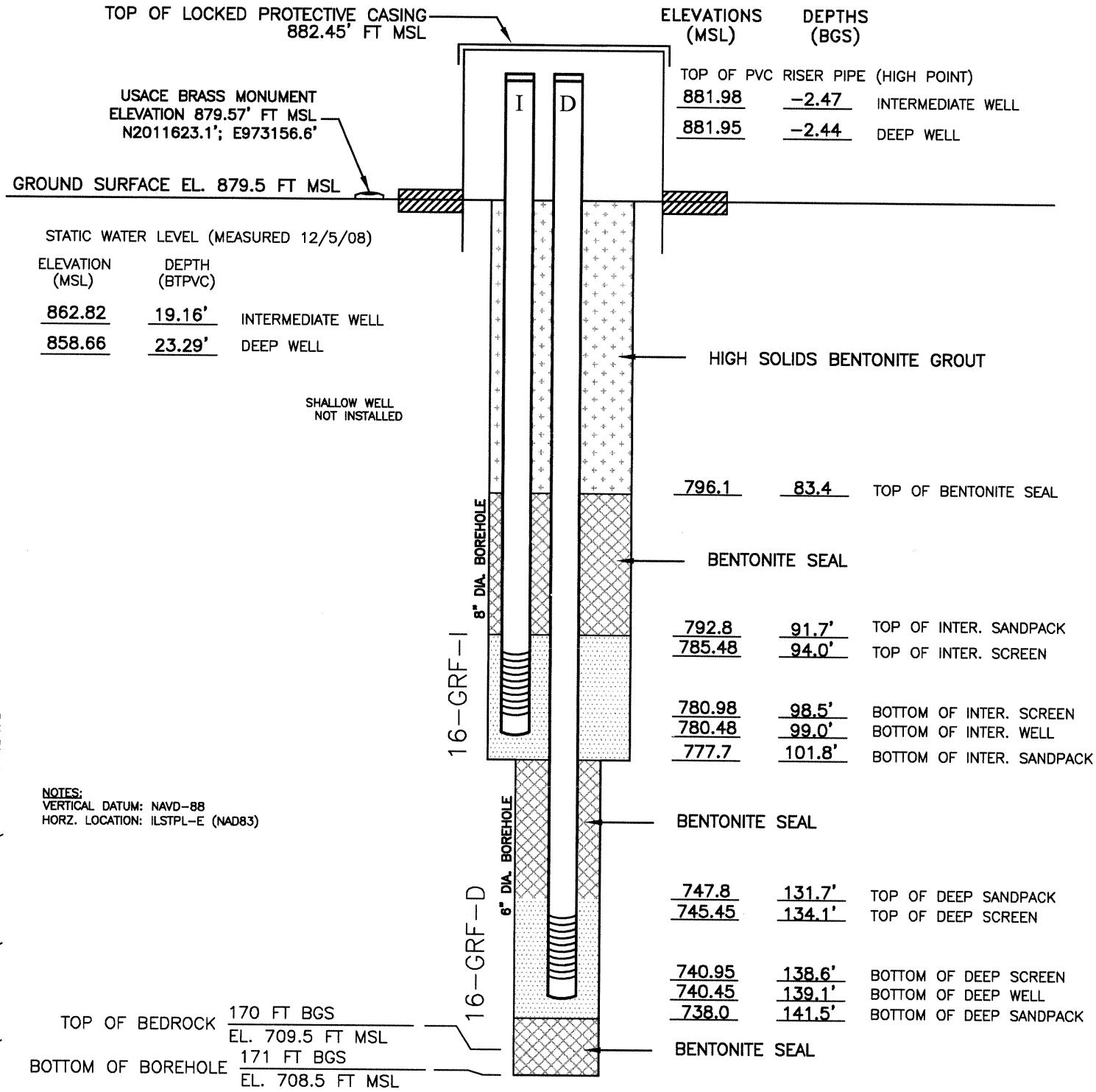
ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	165		cont.			Run 20 (165-171)
	166		Very Hard Lodgement Till		Bag 46	Rec 5'/6' = 83%
	167			Rec 83%	522	Run
	168		~0.75 ft thick fine to coarse GRAVEL zone w/ sand & clay. Grades to Sandy Clay in ~0.1			
	169				Bag 47	
709.5	170		DOLOMITE BEDROCK			
708.5	171		END OF BORING 171 ft bgs			
	172					
	173					
	174					
	175					
	176					
	177					
	178					
	179					
	180					

1333 4" casing 1338

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT McHenry Cty Wells — HOLE NO. 16-GRAFTON TWP

PROJECT McHENRY COUNTY OBSERVATION WELL NETWORK INSTALLATION (#09000-460)	WELL NO. 16-GRF-I & 16-GRF-D
LOCATION GRAFTON TOWNSHIP – McHENRY COUNTY, ILLINOIS	
CLIENT U.S. ARMY CORPS OF ENGINEERS / McHENRY COUNTY	
GEOLOGIST GARY BRAUN, P.G. (AECOM)	INSTALLATION DATE OCT. 16, 2008
DRILLER WDC EXPLORATION AND WELLS, INC. (DAN TONNANCOUR)	DRILLING METHOD ROTO-SONIC



NOT TO SCALE

WELL CONSTRUCTION MATERIALS*

PROTECTIVE CASING	5' L X 8" DIA. ALUMINUM CASING W/ LOCKING CAP
RISER PIPE ABOVE W.T.	SCHEDULE 40 PVC (2.07" I.D./ 2.38" O.D.)
RISER PIPE BELOW W.T.	SCHEDULE 40 PVC (2.07" I.D./ 2.38" O.D.)
SCREEN	2" I.D. SCHEDULE 40 PVC W/ 0.010" SCREEN SLOT SIZE
TYPE OF BENTONITE SEAL	BLACK HILLS BENTONITE – 3/8" CHIPS (HOLE PLUG)
TYPE OF SAND PACK	R.W. SIDLEY CO. – NO. 5 FILTER PACK SAND

CASING MEASUREMENTS

BOTTOM OF SCREEN TO END CAP (FT)*		0.50
SCREEN LENGTH (1ST SLOT TO LAST SLOT) (FT)*		4.50
TOTAL LENGTH OF CASING (FT):	INTERMEDIATE WELL	101.50
	DEEP WELL	141.50

* MEASUREMENT REFERS TO ALL WELLS

USMWK2FP001\05CAD\PROJECTS\20080408O\WCR-V04.DWG

WELL SITE DATA SUMMARY AND COMMENTARY

Well Site #16 – Grafton Township
MCCD Exner Marsh on Miller Rd

The Exner Marsh site in Lake in the Hills is a low-lying area in south-central McHenry County. The lowland which is located south of the wells includes a large wetland and surface water bodies that appear to be in a localized depression along the surface water divide between the Fox and Kishwaukee River drainage areas. Only an intermittent flowing ditch allows for surface water to discharge northward towards the South Branch of the Kishwaukee River. A small intermittent outlet such a large wetland area suggests that the lowland may act as a groundwater recharge source. Downward gradients observed between the intermediate and deep wells at the site also suggest that the site is a recharge area for the quaternary aquifers.

The well site is located in a newly developed residential area that is indicative of the suburban-sprawl common along the Randall Road corridor between Crystal Lake and Joliet. As such, groundwater supplies in the area are critical because of the high demand for potable water resources. Interpretation of the site's boring record indicated that three distinct hydrostatic zones were present. The uppermost hydrostatic zone within the overburden was observed at a depth of 20 to 24 feet below grade. The saturated sand deposits at these depths represented the uppermost hydrostatic zone (or water table materials) that are likely in close hydraulic communication with the surficial wetland and water bodies of the Exner Marsh. However, because of the shallow nature of the sand seam and the likely surface water interaction within the unit, a well was not installed in the shallow unit. Instead, two wells within the intermediate and deep hydrostatic units were installed at the site.

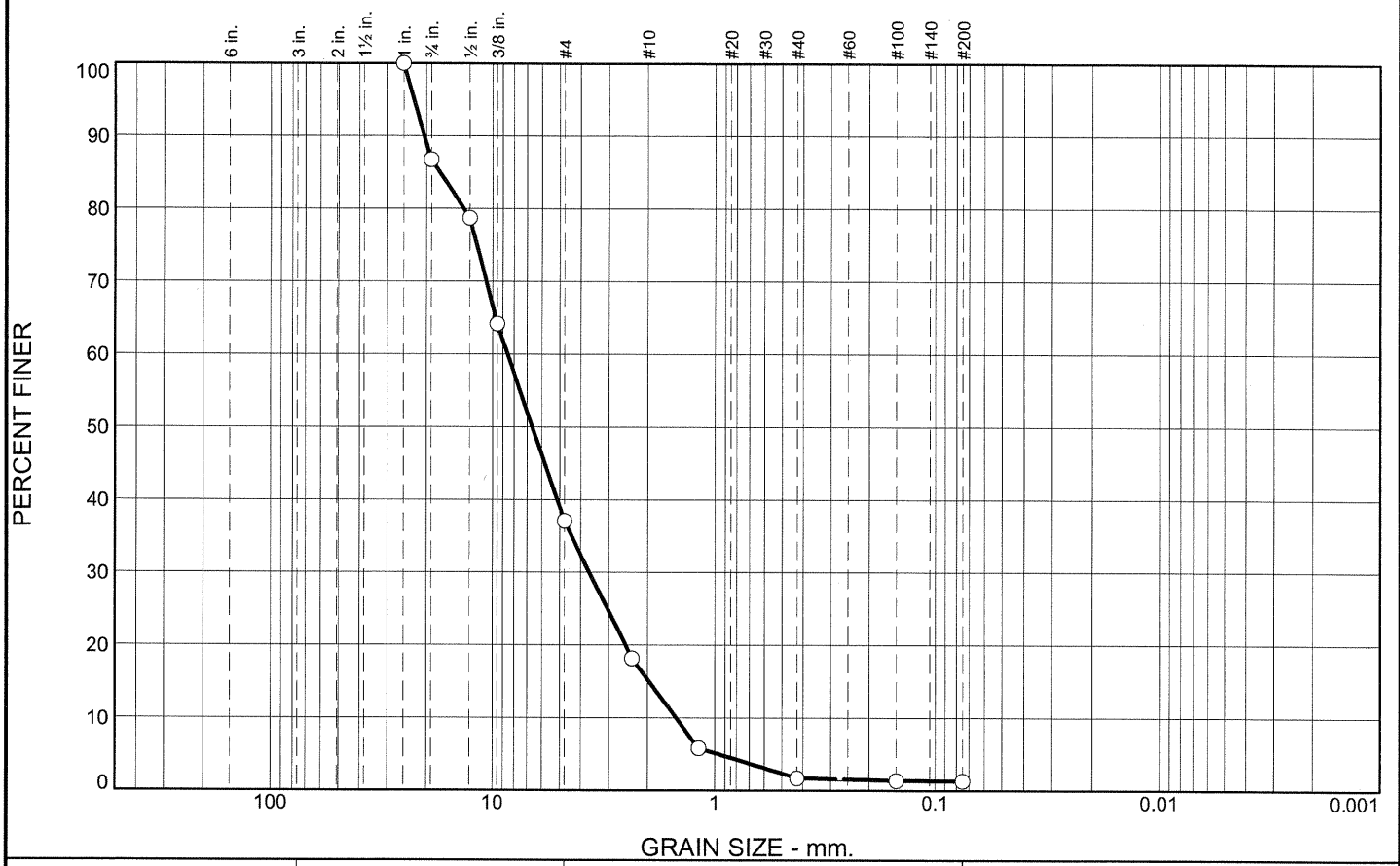
The intermediate well is screened from 94 to 99 feet below ground surface in an approximate 20.5 foot thick aquifer. The intermediate aquifer was found between 79.5 and 100 feet below ground surface. This unit was found to have one of the highest hydraulic conductivities within the County. Conductivities for the intermediate well averaged over $5.8e10^{-2}$ cm/sec.

The deep hydrostatic unit was located 35 feet below the intermediate unit, approximately 31 feet above the top of bedrock. The relatively thin unit (i.e. only 3 feet thick from 135 to 138 ft bgs), was the only feasible hydrostatic unit between the intermediate sand unit and bedrock. A very hard diamicton unit was found below the deep hydrostatic unit which directly overlied bedrock. Potentiometric levels within the bedrock aquifer would be useful to be monitored simultaneously at this location. This information could be used to evaluate gradients and flow patterns across the bedrock interface.

It should be noted that the upper four feet of the borehole consisted of coarse grained granular fill material. It is our interpretation that fill was used to construct at least a portion of the existing parking lot.

Well Site Testing Results

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	13.3	49.6	21.9	13.5	0.4	1.3	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1	100.0		
.75	86.7		
.5	78.7		
.375	64.1		
#4	37.1		
#8	18.2		
#16	5.8		
#40	1.7		
#100	1.4		
#200	1.3		

* (no specification provided)

Material Description

F-C Sand and Gravel Trace Silt

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 20.4473 D_{85}= 17.4440 D_{60}= 8.5634
D_{50}= 6.6229 D_{30}= 3.6572 D_{15}= 1.9750
D_{10}= 1.4907 C_u= 5.74 C_c= 1.05

Classification

USCS= GW AASHTO=

Remarks

Source of Sample: 16-GRF-I **Depth:** 96.0-97.0

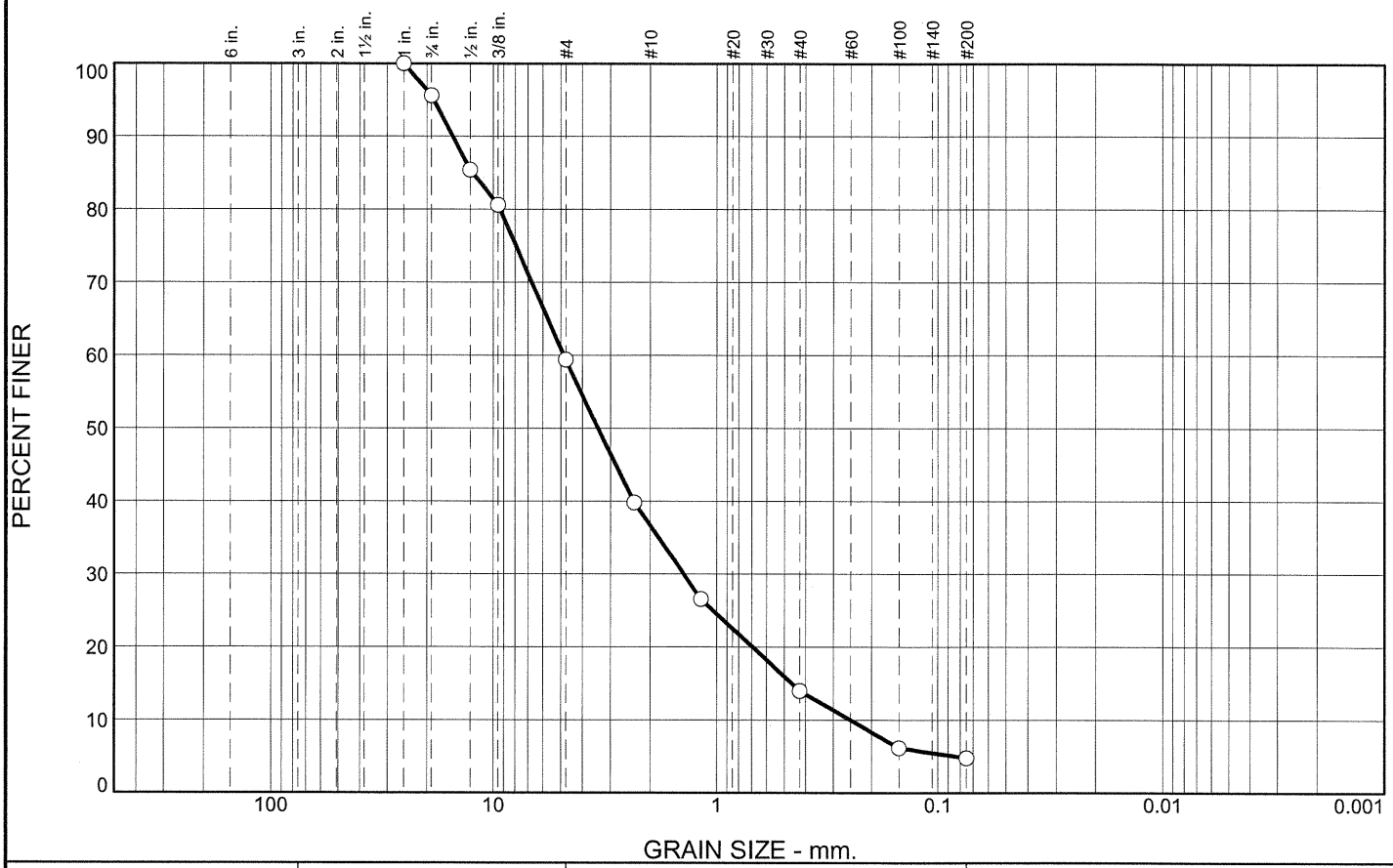
Date: 12/04/08

STS | AECOM

Client: USACE
Project: McHenry County Wells
Project No: 200804080 **Figure**

Tested By: JRT

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	4.4	36.2	22.8	22.6	9.2	4.8	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1	100.0		
.75	95.6		
.5	85.4		
.375	80.6		
#4	59.4		
#8	39.8		
#16	26.6		
#40	14.0		
#100	6.2		
#200	4.8		

* (no specification provided)

Material Description

F-C Sand and Gravel Trace Silt

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 15.2340 D_{85}= 12.3726 D_{60}= 4.8482
D_{50}= 3.3979 D_{30}= 1.4127 D_{15}= 0.4619
D_{10}= 0.2497 C_u= 19.41 C_c= 1.65

Classification

USCS= SW AASHTO=

Remarks

Source of Sample: 16-GRF-D **Depth:** 137.0-138.0

Date: 12/04/08

STS | AECOM

Client: USACE
Project: McHenry County Wells
Project No: 200804080 **Figure**

Tested By: JRT

Groundwater Level Measurements

McHenry County Monitoring Well Installations
AECOM Project 09000-460

Site Number	16			
Township Name	Grafton			
Well Number	16-GRF-I		16-GRF-D	
Ground Surface Elevation (ft msl)	879.51		879.51	
Top of PVC Casing Elevation (ft)	881.98		881.95	
Location of PVC Casing within Wellhead	NW Well		SE Well	
Well Depth (Feet from TOC)[A]	101.50		141.50	
Date	Depth to GW from TOC (ft)	GW Elevation (ft msl)	Depth to GW from TOC (ft)	GW Elevation (ft msl)
Sep. 26, 2008				
Oct. 09, 2008				
Oct. 14, 2008				
Oct. 16, 2008	17.42	864.56	22.96	858.99
Oct. 21, 2008	17.07	864.91	22.92	859.03
Oct. 22, 2008				
Oct. 24, 2008				
Oct. 28, 2008				
Oct. 29, 2008				
Oct. 30, 2008				
Nov. 07, 2008				
Nov. 13, 2008				
Dec. 05, 2008	19.16	862.82	23.29	858.66
Dec. 08, 2008				
Dec. 09, 2008				
Dec. 12, 2008				
Dec. 15, 2008				
Dec. 16, 2008	17.38	864.60	23.13	858.82
Dec. 17, 2008				
Dec. 18, 2008				
Dec. 19, 2008				
Dec. 22, 2008				
Dec. 23, 2008				
Dec. 29, 2008				
Dec. 30, 2008				
Jan. 05, 2009				
Jan. 06, 2009	15.97	866.01	21.36	860.59
Jan. 07, 2009				
Jan. 08, 2009				
Jan. 09, 2009				
Jan. 10, 2009				
Jan. 12, 2009				
Feb. 24, 2009	18.33	863.65	23.72	858.23
Mar. 20, 2009				
end				

Notes:

ft msl = Elevation referenced to feet above mea

TOC = Top of PVC Casing

ft = feet

[A] = as measured inside well

NI = Not Installed

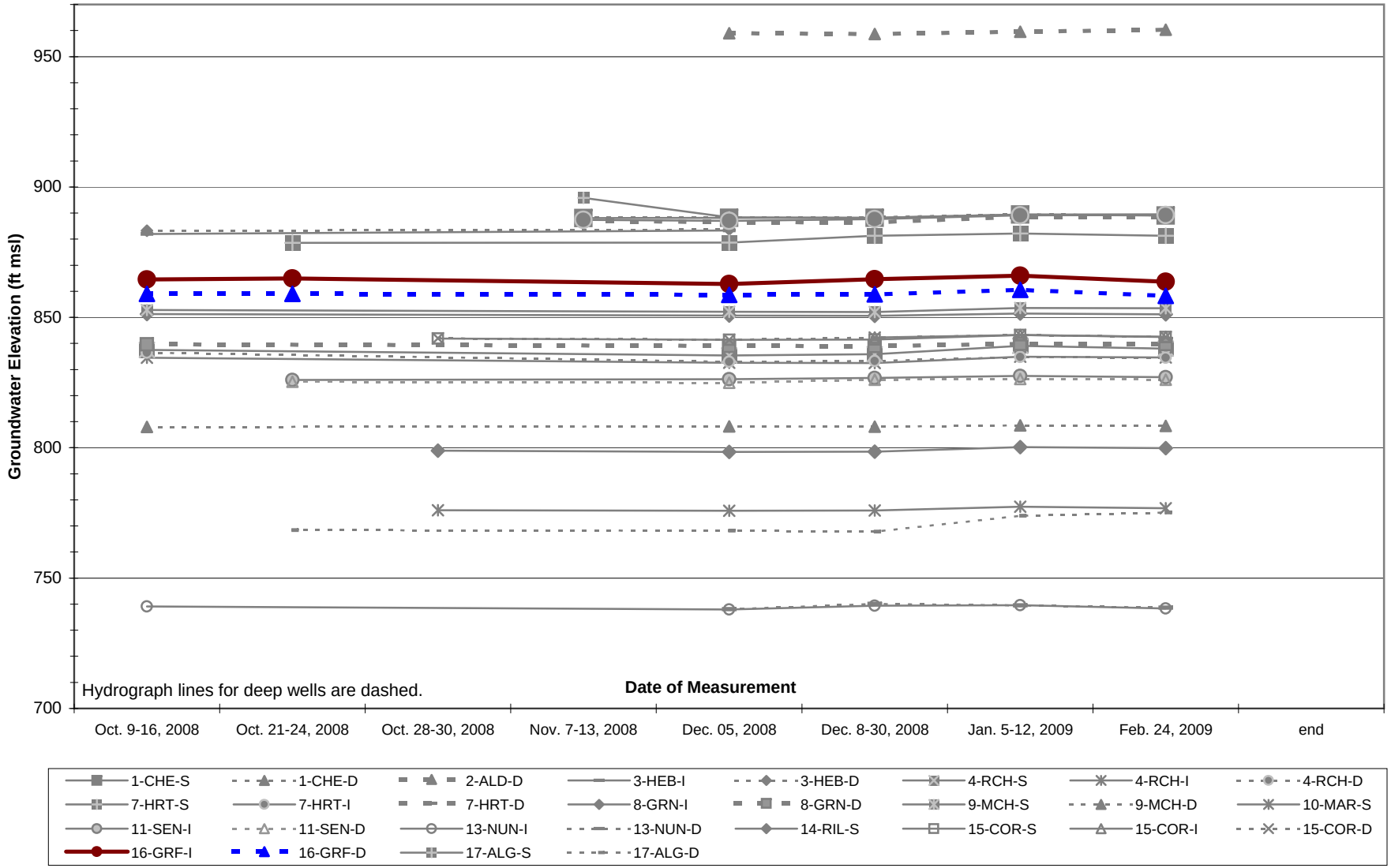
--- No Elevation

Well 17-Alg-S was frozen or partially frozen fror

Site 16 Groundwater Level Hydrograph
(includes ALL AECOM INSTALLED WELLS)

McHenry County Obervation Well Network

AECOM Project 09000-460

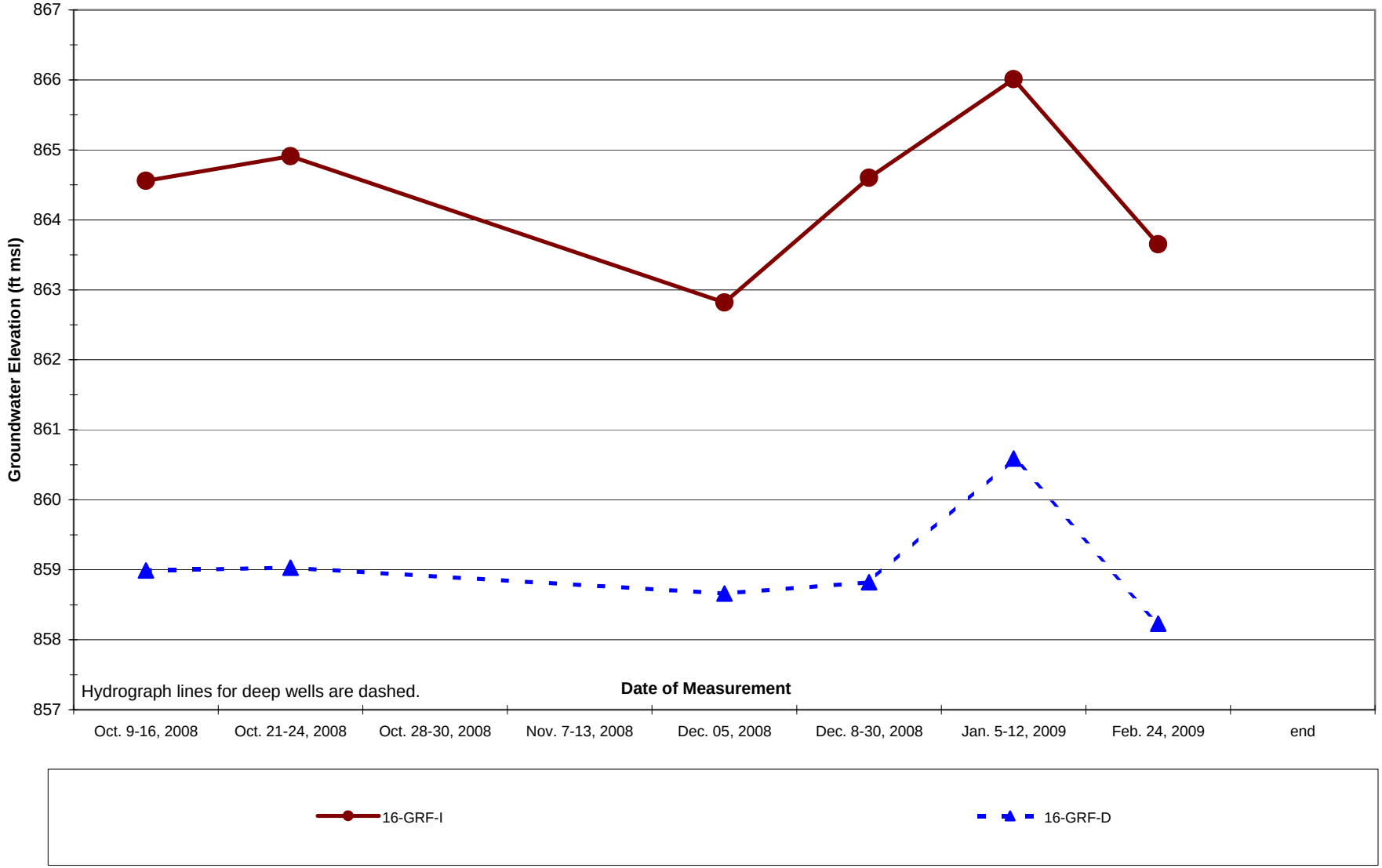


K:\PROJECTS\200804080\In_Progress\STS-McHenry Cty_WLs IN PROGRESS - figs for each site.xls

Site 16 Groundwater Level Hydrograph

McHenry County Obervation Well Network

AECOM Project 09000-460



K:\PROJECTS\200804080\In_Progress\STS-McHenry Cty_WLs IN PROGRESS - figs for each site.xls

Well Development Record

STS Consultants, Ltd.
11425 West Lake Park Drive
Milwaukee, Wisconsin 53224

Site Name: McHenry County

Well ID Number: 16-GRF-I

Date of Completion: 12/16/08

STS Job Number: 20080480

Start Time: 1430

End Time: 1640

Water color at start of development: Brown

Water color at end of development: CLEAR

Amount of water removed during development:

Contained water? ☐ Yes ☒ No

If not contained, where water disposed? GROUND

Well Development Methods:

- ☐ Surged with bailer and bailed
- ☐ Surged with block and bailed
- ☐ Surged with block, bailed & pumped
- ☐ Bailed only
- ☐ Pumped slowly
- ☐ Surged with bailer and pumped
- ☒ Surged with block and pumped
- ☐ Compressed Air
- ☐ Pumped only
- ☐ Other

Equipment Used

- ☐ PVC bailer
- ☐ Well wizard
- ☐ Bean or Moino pump (on drill rig)
- ☒ Surge block
- ☒ Whale pumps

Notes: SURGE START: 14:05

END: 14:20

PURGE START: 14:30

END: 1640

WL: 17.38

WELL DEVELOPMENT FIELD RECORD

Job Name McHenry County Job No. 20080480 Well No. 16-GRF-I

Developed By Brian Schmidt Date of Install. _____ Sheet ____ of ____

Started Devel. 12/16/08 / DATE / TIME Completed Devel. 12/16/08 / DATE / TIME

W.L. Before Devel. ____ / DATE / TIME / DEPTH After Devel. ____ / DATE / TIME / DEPTH

Well Depth: Before Devel. _____ After Devel. _____ Well Dia. (in.) _____

Standing Water Column (ft.) _____ Standing Well Volume _____ gal.

Screen Length 5' Drilling Water Loss _____ gal.

DATE / TIME	VOLUME REMOVED (Gallons)	FIELD PARAMETERS SPEC. COND. (umhos/cm)	TEMP. (C°)	pH (s.u.)	TURB ~~Other~~	ORP	REMARKS
12/16/08 14:40	5 GAL/MIN	860	10.1	8.50	188	—	
15:00	"	815	10.5	8.56	92	—	
15:20		807	10.4	8.58	47	—	
15:40		803	10.5	8.60	24	—	
1600		796	10.5	8.61	47	—	
1620		787	10.5	8.61	32	—	
1640		783	10.5	8.61	6	—	
		= TOTAL VOLUME REMOVED (Gallons)					

Development Method: _____

Notes:

Well Development Record

STS Consultants, Ltd.
11425 West Lake Park Drive
Milwaukee, Wisconsin 53224

Site Name: McHenry County

Well ID Number: 16-GRF-D

Date of Completion: 12/16/08 + 12/17/08

STS Job Number: 200804080

Start Time: 1535

End Time: 1725

Water color at start of development: Brown

Water color at end of development: Milky Clear

Amount of water removed during development:

Contained water? ☐ Yes ☒ No

If not contained, where water disposed? Ground

Well Development Methods:

- ☐ Surged with bailer and bailed
- ☐ Surged with block and bailed
- ☐ Surged with block, bailed & pumped
- ☐ Bailed only
- ☐ Pumped slowly
- ☐ Surged with bailer and pumped
- ☒ Surged with block and pumped
- ☐ Compressed Air
- ☐ Pumped only
- ☐ Other

Equipment Used

- ☐ PVC bailer
- ☐ Well wizard
- ☐ Bean or Moino pump (on drill rig)
- ☒ Surge block
- ☐ Whale pumps

Notes:

Surge Start: 1424

End: 1439

Purge Start: 15:35

End: 17:25

WL: 23.13

WELL DEVELOPMENT FIELD RECORD

Job Name McHenry County Job No. 200804080 Well No. 16-GRF-D

Developed By Brian Sammiot Date of Install. _____ Sheet ____ of ____

Started Devel. 12/16/08 / DATE / TIME Completed Devel. 12/17/08 / DATE / TIME

W.L. Before Devel. ____ / DATE / TIME / DEPTH After Devel. ____ / DATE / TIME / DEPTH

Well Depth: Before Devel. _____ After Devel. _____ Well Dia. (in.) _____

Standing Water Column (ft.) _____ Standing Well Volume _____ gal.

Screen Length 5' Drilling Water Loss _____ gal.

DATE / TIME	VOLUME REMOVED (Gallons)	FIELD PARAMETERS SPEC. COND. (umhos/cm)	TEMP. (C°)	pH (s.u.)	TURB ~~Other~~	ORP	REMARKS
12/17/08 15:40	2 GAL/min	480	8.8	7.67	547	–	
16:00	"	484	8.5	7.44	999	–	
16:20	"	489	8.9	7.43	999	–	
16:40	"	513	9.2	7.38	921	–	
17:00	"	527	9.3	7.37	618	–	
17:25	"	551	9.1	7.44	537	–	
		= TOTAL VOLUME REMOVED (Gallons)					

Development Method: _____

Notes:

First Environmental Laboratories, Inc.
IL ELAP / NELAC Accreditation # 100292
1600 Shore Road • Naperville, Illinois 60563 • Phone (630) 778-1200 • Fax (630) 778-1233

Analytical Report

Client: STS CONSULTANTS (VERN)
Project ID: McHenry County 200804080
Sample ID: 16-GRF-I
Sample No: 9-0115-021

Date Collected: 01/06/09
Time Collected: 14:45
Date Received: 01/13/09
Date Reported: 01/20/09

Analyte		Result	R.L.	Units	Flags
Total Metals	**Method: 6020A**		**Preparation Method 3010A**		
Analysis Date: 01/16/09			Preparation Date: 01/16/09		
Calcium		94.9	0.1	mg/L	
Iron		1.45	0.01	mg/L	
Magnesium		50.5	0.1	mg/L	
Potassium		2.3	0.1	mg/L	
Sodium		28.3	0.1	mg/L	
Alkalinity, Bicarbonate (CaCO3)	**Method: 2320B**				
Analysis Date: 01/15/09 13:30					
Alkalinity, Bicarbonate (CaCO3)		380	5	mg/L	
Alkalinity, Carbonate (CaCO3)	**Method: 2320B**				
Analysis Date: 01/15/09 13:30					
Alkalinity, Carbonate (CaCO3)		< 5	5	mg/L	
Chloride	**Method: 4500Cl, E**				
Analysis Date: 01/14/09					
Chloride		60	5	mg/L	
Sulfate	**Method: 375.2R2.0**				
Analysis Date: 01/15/09					
Sulfate		51	15	mg/L	

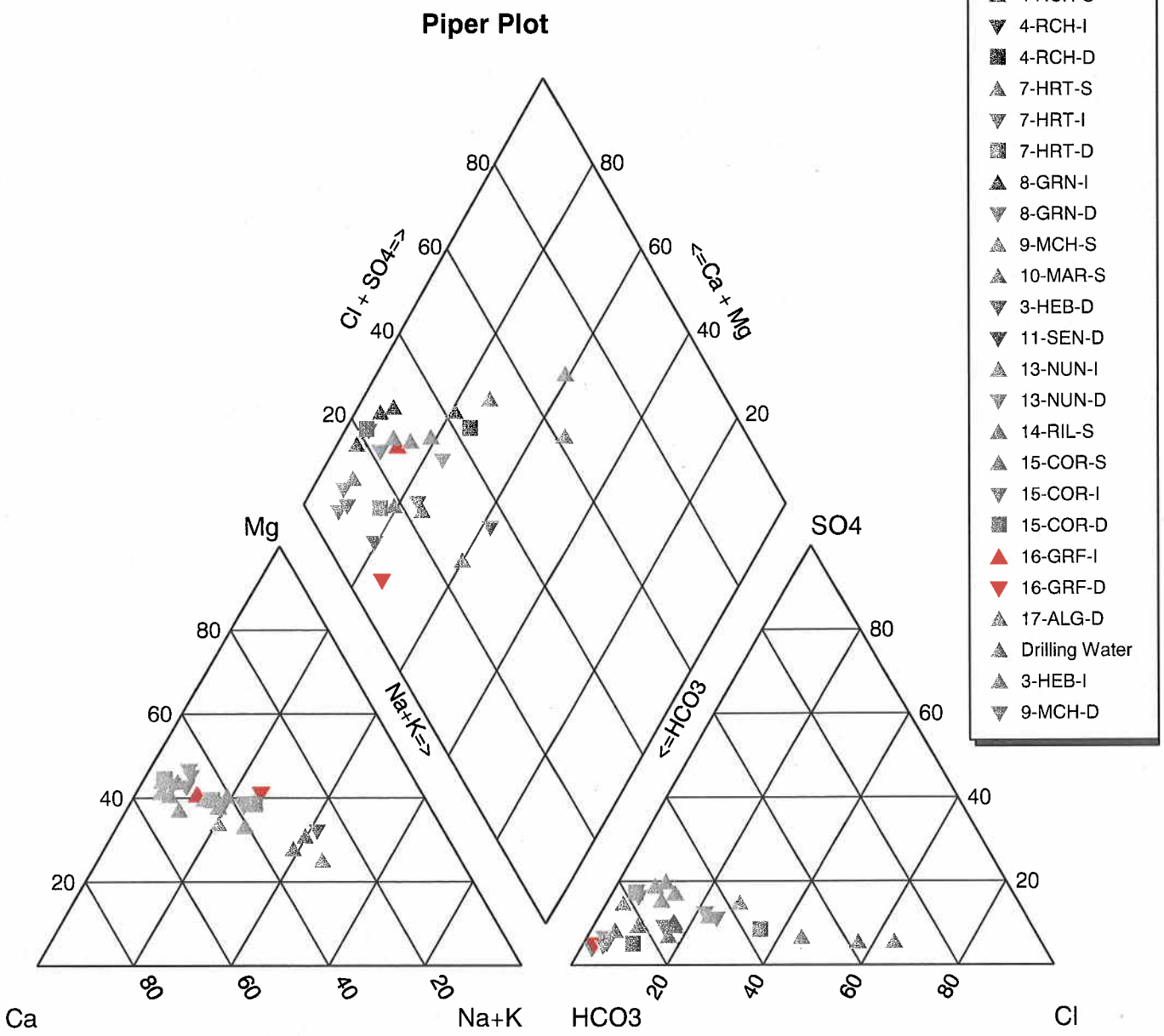
First Environmental Laboratories, Inc.
IL ELAP / NELAC Accreditation # 100292
1600 Shore Road • Naperville, Illinois 60563 • Phone (630) 778-1200 • Fax (630) 778-1233

Analytical Report

Client: STS CONSULTANTS (VERN)
Project ID: McHenry County 200804080
Sample ID: 16-GRF-D
Sample No: 9-0115-020

Date Collected: 01/06/09
Time Collected: 15:50
Date Received: 01/13/09
Date Reported: 01/20/09

Analyte		Result	R.L.	Units	Flags
Total Metals	**Method: 6020A**		**Preparation Method 3010A**		
Analysis Date: 01/16/09			Preparation Date: 01/15/09		
Calcium		40.0	0.1	mg/L	
Iron		0.64	0.01	mg/L	
Magnesium		30.0	0.1	mg/L	
Potassium		1.5	0.1	mg/L	
Sodium		34.2	0.1	mg/L	
Alkalinity, Bicarbonate (CaCO3)	**Method: 2320B**				
Analysis Date: 01/15/09 13:30					
Alkalinity, Bicarbonate (CaCO3)		280	5	mg/L	
Alkalinity, Carbonate (CaCO3)	**Method: 2320B**				
Analysis Date: 01/15/09 13:30					
Alkalinity, Carbonate (CaCO3)		< 5	5	mg/L	
Chloride	**Method: 4500Cl, E**				
Analysis Date: 01/14/09					
Chloride		< 5	5	mg/L	
Sulfate	**Method: 375.2R2.0**				
Analysis Date: 01/15/09					
Sulfate		< 15	15	mg/L	



DESCRIPTION: Piper Linear Diagram - Well Site #16

AECOM	PROJECT: McHenry County	PROJECT NO: 09000460
	CLIENT: Army Corps of Engineers	DATE: 7/30/2009

Field Well Sampling Sheet

Fill out the entire form. If it does not apply, mark N/A.

Project Name: McHenry County
STS Job No. 20080480
Location: Grafton
Tester: Brian Sammot
Well Number: 16-GRF-I
Date Sampled: 1/6/09
Previous Well Sampled: 17-ALG-D

GENERAL CONDITIONS:

						If Missing Replaced?	
Surface Seal:	X Ok		Damaged		Missing:	Yes	No
Protector Pipe:	α Ok		Damaged		Missing:	Yes	No
Well Cap:	α Ok		Damaged		Missing:	Yes	No
Ambient Temperature: 20 °F			Clear	α Cloudy	Rain		

WELL DATA:

Measuring Device: Solinist Water Level Meter
Stick Up or Down: UP
Depth to Water: 15.97 (from Ground Surface)
Depth to Bottom: 99 (from TPVC)
Length of Water: (from TPVC)
Free Product Observed: ☐ Yes ☒ No Thickness: N/A

PURGING/SAMPLING:

Well Purging Calculations: Amount to purge = 0.163 gallons/foot times height of water column in feet for one well volume

Purging Device: Bladder Pump
Sampling Device: Bladder Pump
Volume Required:
☒ See back of page for field readings during purge
Volume Purged:
Could Well Bail Dry? ☐ Yes ☐ No
Purging - Time Start: 1330
Time Ended: 14:55
Decon Method: Alconox

IN-SITU TESTING:

Turbidity: ☐ Turbid ☐ Opaque
Odor:
Color
pH @ degrees C
Uncorrected Conductivity X
Water Temp. (from Cond.)
Comments: ST: 1445

SAMPLES COLLECTED

Vocs -		Cyanide	
Metals -		Hexchrome	
SVOC		Alkalinity	
TOC		Chloride	
Sulfide		Ammonia	
Phenolics		COD	

Well Purging Log

Date 1/6/09

Time	Temp	pH	Conductivity	~~ORP~~ TURB	~~DO~~ RATE
1/6/09 13:50	2.7	7.98	1140	999	250 ml/min
13:55	2.4	7.85	1090	348	"
14:00	2.2	7.75	1090	232	"
14:05	2.0	7.70	1100	181	"
14:15	2.3	7.67	1060	97	"
14:20	2.3	7.64	1060	94	"
14:25	2.5	7.73	1040	68	"
14:35	2.6	7.64	1040	56	"
1440	2.5	7.66	1040	48	"
1445	2.6	7.67	1040	46	"
ST: 1445					

Field Well Sampling Sheet

Fill out the entire form. If it does not apply, mark N/A.

Project Name: McHenry County
STS Job No. 20080408 0
Location: Grafton
Tester: Brian Schmidt
Well Number: 16-GRF-D
Date Sampled: 1/6/09
Previous Well Sampled: 16-GRF-I

GENERAL CONDITIONS:

					If Missing Replaced?
Surface Seal:	X Ok	Damaged		Missing:	Yes No
Protector Pipe:	X Ok	Damaged		Missing:	Yes No
Well Cap:	X Ok	Damaged		Missing:	Yes No
Ambient Temperature: 20 °F		Clear	X Cloudy	Rain	

WELL DATA:

Measuring Device: Solinist Water Level Meter
Stick Up or Down: Up (from Ground Surface)
Depth to Water: 21.36 (from TPVC)
Depth to Bottom: 139 (from TPVC)
Length of Water:
Free Product Observed: ☐ Yes ☒ No Thickness: N/A

PURGING/SAMPLING:

Well Purging Calculations: Amount to purge = 0.163 gallons/foot times height of water column in feet for one well volume

Purging Device: Bladder Pump
Sampling Device: Bladder Pump
Volume Required:
☒ See back of page for field readings during purge
Volume Purged:
Could Well Bail Dry? ☐ Yes ☒ No
Purging - Time Start: 1300
Time Ended: 1600
Decon Method: Alconox

IN-SITU TESTING:

Turbidity: ☐ Turbid ☐ Opaque
Odor:
Color
pH @ degrees C
Uncorrected Conductivity X
Water Temp. (from Cond.)
Comments: ST: 1550

SAMPLES COLLECTED

Vocs -		Cyanide	
Metals -		Hexchrome	
SVOC		Alkalinity	
TOC		Chloride	
Sulfide		Ammonia	
Phenolics		COD	

Well Purging Log

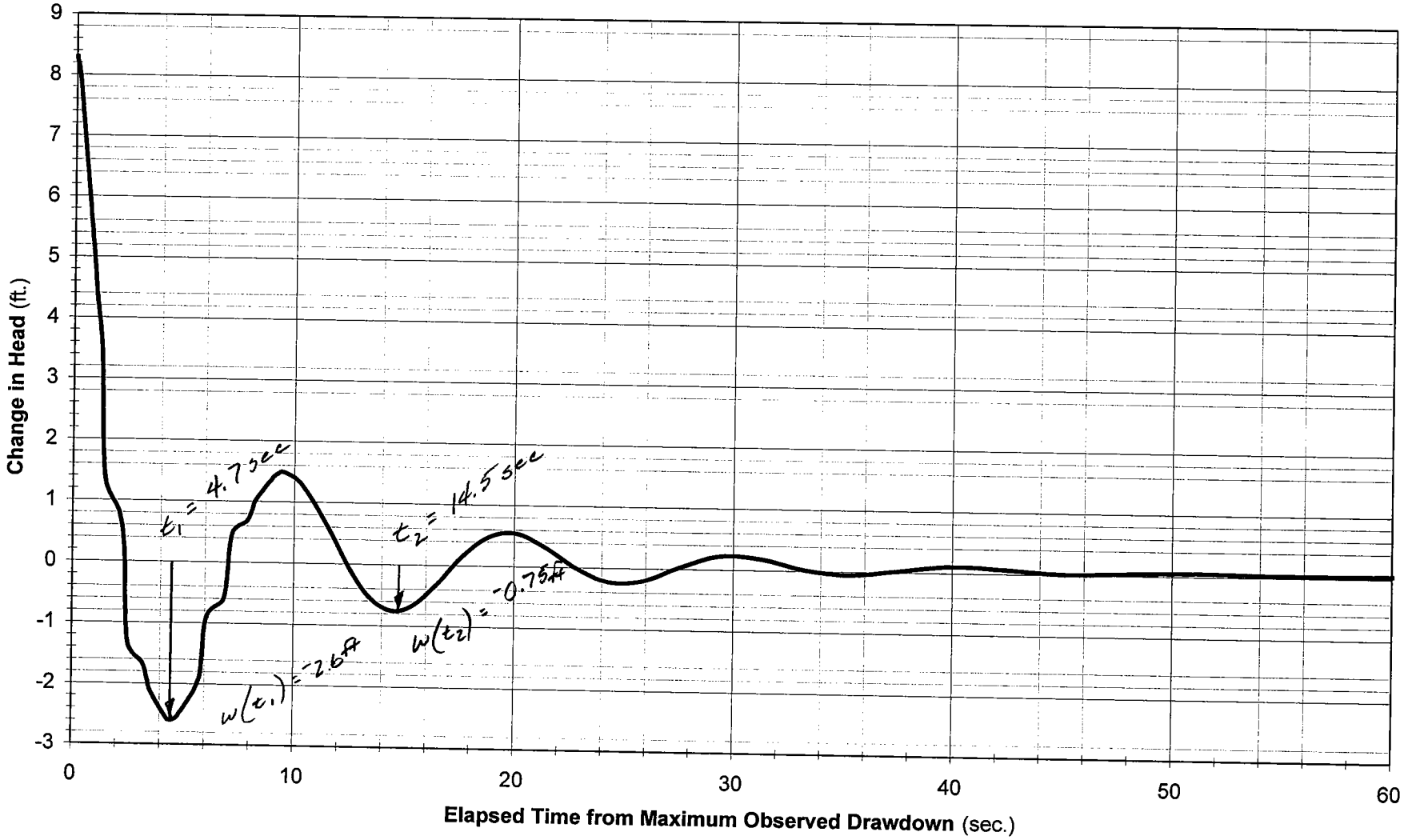
Date 1/6/09

Time	Temp	pH	Conductivity	~~ORP~~ TURB	~~DO~~ RATE
1/6/09 15:15	2.0	7.99	576	9	250 ML/MIN
15:25	2.0	7.88	573	7	"
15:30	1.8	7.89	575	5	"
15:35	1.6	7.91	578	8	"
15:40	1.6	7.94	577	7	"
15:45	1.6	7.96	573	6	"
15:50	1.6	7.97	572	3	"
ST:	15:50				

Underdamped Response to Sudden Change in Water Level

Hydraulic Conductivity Test Result

Grafton Township #16 - Intermediate Well (Test #1)



HyCond_Underdamped-Well-Graphs.xls

16_GRF-I t1

Calculation of Transmissivity of Underdamped Well Response to Slug Test

Grafton Township - Intermediate Well (Test #1)
McHenry County Monitoring Well Network Installation
AECOM Environment Project No. 09000-460

Expression		Value	Units
$w(t_1)$	=	-2.6	ft.
$w(t_2)$	=	-0.75	ft.
t_1	=	4.7	sec.
t_2	=	14.5	sec.
R_c	=	0.083	ft.
R_s	=	0.083	ft.
L_c	=	77.3	ft.
L_s	=	5	ft.
τ	=	9.8	sec.
ϖ	=	0.6411	s^{-1}
γ	=	0.12686	s^{-1}
T	=	b+a lnT	
$(g/L)^{1/2}$	=	0.6536	
d	=	0.1941	
a	=	0.00290	ft^2/sec
Assume S	=	1.0E-05	
b	=	0.050	ft^2/sec
T_1	=	$b+a \ln T_0$	
Assume T_0	≈	b_1	
T_1	=	0.0410	ft^2/sec
T_2	=	0.0405	ft^2/sec
T	=	3497	ft^2/day
Aquifer Thickness	=	20.5	ft.
Hydraulic Conductivity	**=**	**171**	**ft/day**
		6.02E-02	**cm/sec**

Reference:
ASTM D5785-95 - (Analytical Procedure) for Determining Transmissivity of Confined Nonleaky Aquifers by Underdamped Well Response to Instantaneous Change in Head (Slug Test)

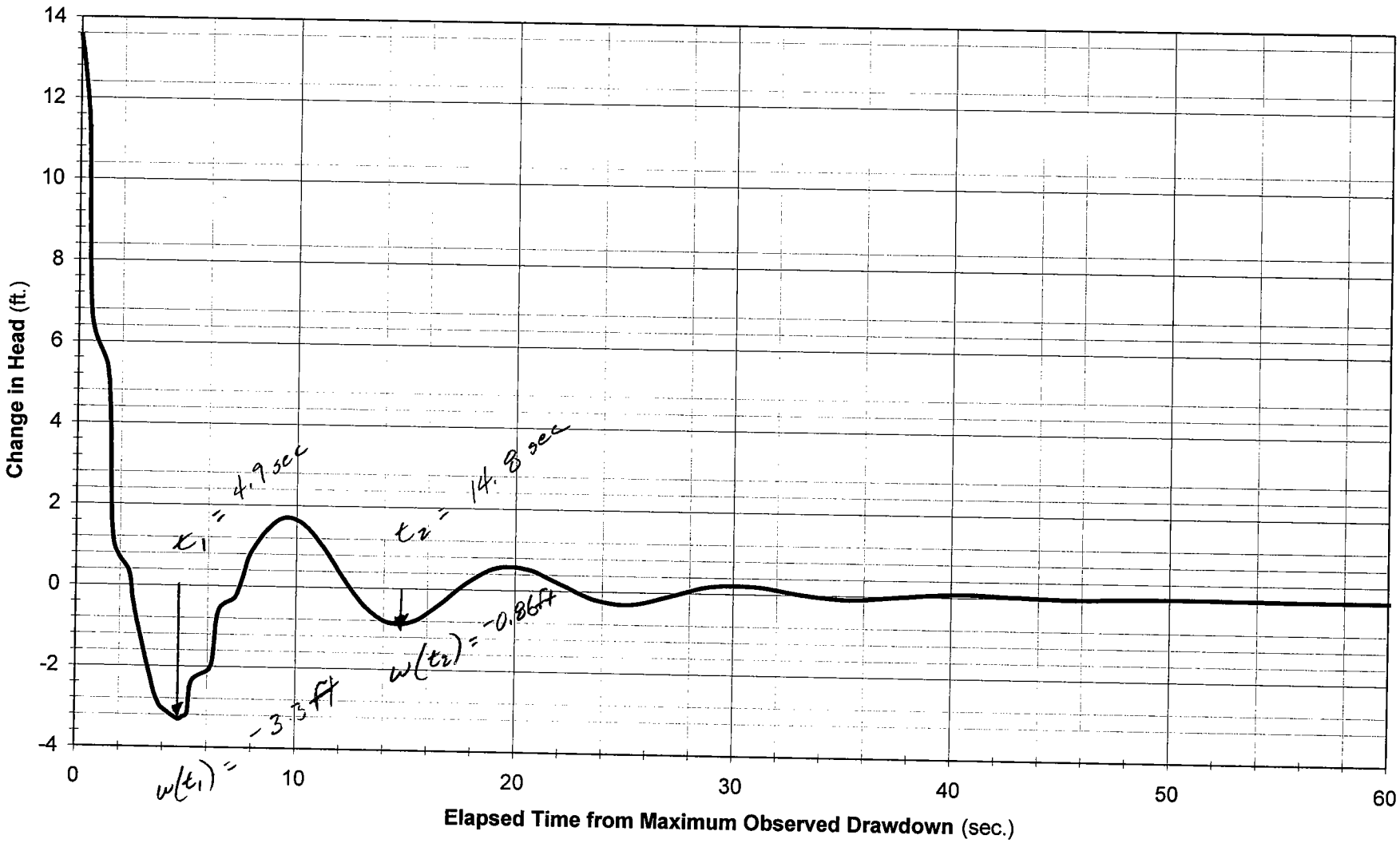
Check the results:

L	=	74.9 ft	4.9	6.5%	less than 20%?	**YES**
L	=	79.8 ft				
α	=	9.39E-04	less than 0.1?	**YES**		
d	=	0.1941	less than 0.7?	**YES**		

Underdamped Response to Sudden Change in Water Level

Hydraulic Conductivity Test Result

Grafton Township #16 - Intermediate Well (Test #2)



HyCond_Underdamped-Well-Graphs.xls

16_GRF-I t2

Calculation of Transmissivity of Underdamped Well Response to Slug Test

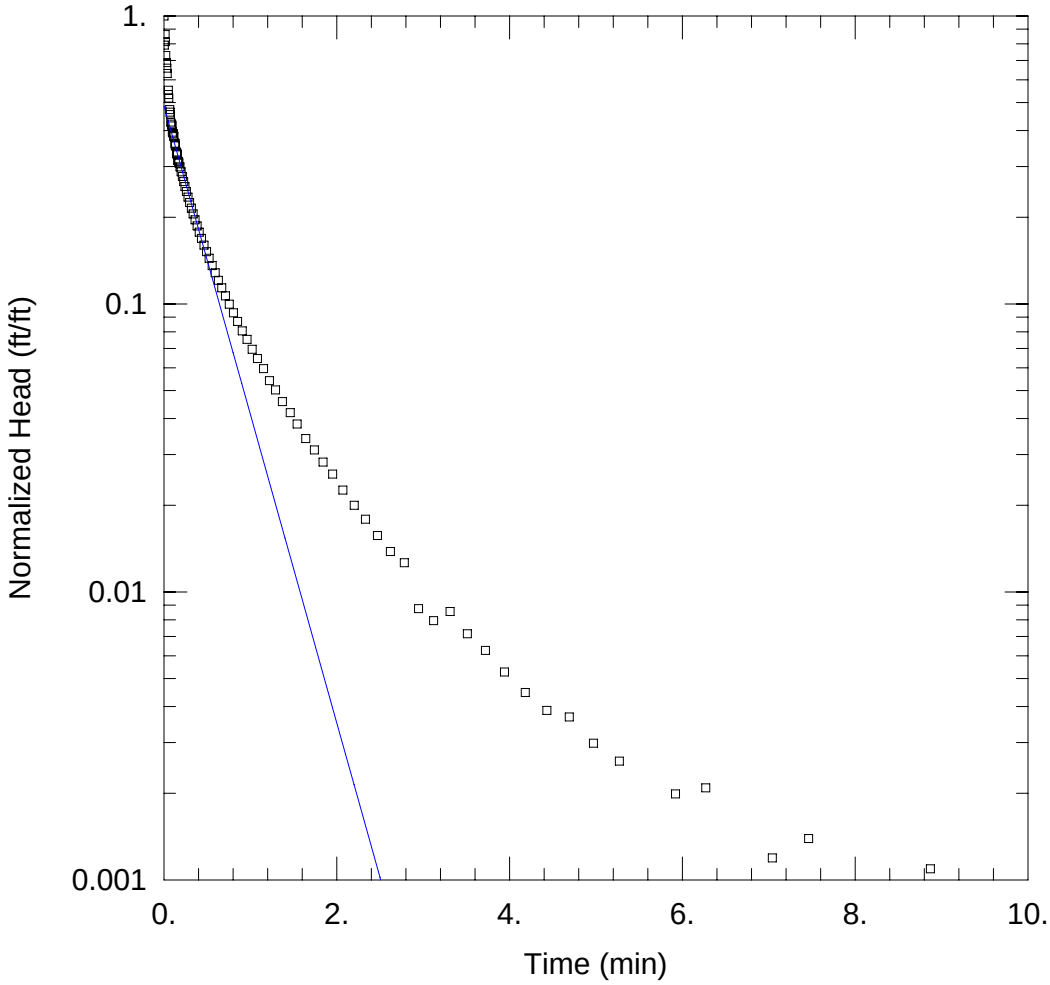
Grafton Township - Intermediate Well (Test #2)
McHenry County Monitoring Well Network Installation
AECOM Environment Project No. 09000-460

Expression		Value	Units
$w(t_1)$	=	-3.3	ft.
$w(t_2)$	=	-0.86	ft.
t_1	=	4.9	sec.
t_2	=	14.8	sec.
R_c	=	0.083	ft.
R_s	=	0.083	ft.
L_c	=	77.3	ft.
L_s	=	5	ft.
τ	=	9.94	sec.
ϖ	=	0.6321	s^{-1}
γ	=	0.13375	s^{-1}
T	=	b+a lnT	
$(g/L)^{1/2}$	=	0.6461	
d	=	0.2070	
a	=	0.00269	ft^2/sec
Assume S	=	1.0E-05	
b	=	0.046	ft^2/sec
T_1	=	b+a $\ln T_0$	
Assume T_0	≈	b_1	
T_1	=	0.0379	ft^2/sec
T_2	=	0.0373	ft^2/sec
T	=	3225	ft^2/day
Aquifer Thickness	=	20.5	ft.
Hydraulic Conductivity	**=**	**157**	**ft/day**
		5.55E-02	**cm/sec**

Reference:
ASTM D5785-95 - (Analytical Procedure) for Determining Transmissivity of Confined Nonleaky Aquifers by Underdamped Well Response to Instantaneous Change in Head (Slug Test)

Check the results:

L	=	76.7 ft	3.1	4.1%	less than 20%?	**YES**
L	=	79.8 ft				
α	=	9.72E-04	less than 0.1?	**YES**		
d	=	0.2070	less than 0.7?	**YES**		



WELL TEST ANALYSIS

Data Set: C:\...\16-GRF-D_001_B&R.aqt
Date: 04/07/09 Time: 15:32:06

PROJECT INFORMATION

Company: AECOM
Client: USACE / McHenry Cty
Project: 09000-460 (h200804080)
Location: McHenry County, IL
Test Date: Feb. 22, 2009

AQUIFER DATA

Saturated Thickness: 4.5 ft
Anisotropy Ratio (Kz/Kr): 0.33

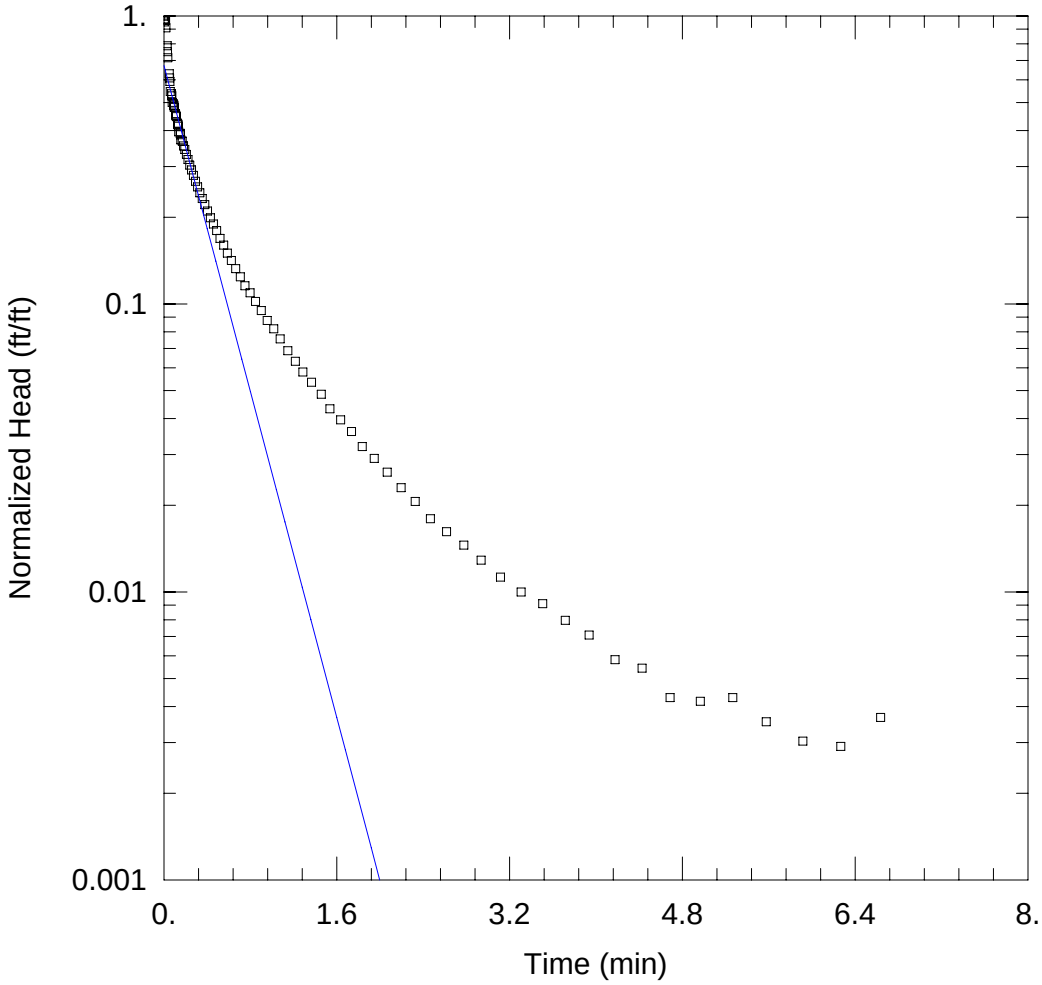
WELL DATA (16-GRF-D)

Initial Displacement: 10.06 ft
Total Well Penetration Depth: 4.5 ft
Casing Radius: 0.083 ft
Static Water Column Height: 118.2 ft
Screen Length: 4.5 ft
Well Radius: 0.25 ft
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 0.002044 cm/sec
y0 = 4.901 ft



WELL TEST ANALYSIS

Data Set: C:\...\16-GRF-D_002_B&R.aqt
Date: 04/07/09 Time: 15:31:29

PROJECT INFORMATION

Company: AECOM
Client: USACE / McHenry Cty
Project: 09000-460 (h200804080)
Location: McHenry County, IL
Test Date: Feb. 22, 2009

AQUIFER DATA

Saturated Thickness: 4.5 ft
Anisotropy Ratio (Kz/Kr): 0.33

WELL DATA (16-GRF-D)

Initial Displacement: 7.91 ft
Total Well Penetration Depth: 4.5 ft
Casing Radius: 0.083 ft
Static Water Column Height: 118.2 ft
Screen Length: 4.5 ft
Well Radius: 0.25 ft
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 0.002699 cm/sec
y0 = 5.317 ft

Additional Well Site Information

In-Situ Inc.

16-GRF-I

Calibration Report

Report Number: 20090109171410-140459

221 East Lincoln Avenue, Fort Collins, CO 80524 USA
1-970-498-1500, 1-800-446-7488, FAX: 1-970-498-1598
Visit us at www.in-situ.com

Instrument Details:

Instrument Model:	**Level TROLL 500**
Full Scale Pressure Range	**206.84 KPa (30 PSI) vented**
Serial Number:	**140459**

Calibration Details:

Calibration Result:	**PASS**
Calibration Date:	2009-01-09 17:14:10 (UTC)
Nominal Range of Applied Temperature:	-5 C to +50 C
Temperature Accuracy Specification:	+/- 0.1 C From 0 C to +50 C
Nominal Range of Applied Pressure:	0 KPa to 206.8 KPa (0.0 PSI to 30.0 PSI)
Pressure Accuracy Specification:	+/- 0.1 %FS from -5 C to +50 C, +/- 0.05 %FS at +15 C

Post-Calibration Check:

Parameter	Applied	Reported	Deviation
Pressure	30.0000	29.9963	-0.0124
Pressure	0.0000	-0.0015	-0.0049
Temperature	19.8140	19.8201	0.0061

Calibration Procedures and Equipment Used:

Automated calibration procedures used.
Manu Agilent Model 34970A SerialNo MY44002404
Manu Instrulab Model 3312A-14-15-24 SerialNo 31127
Manu Instrulab Model 406X-0031-01 SerialNo 31128-2
Manu MENSOR Model 600 SerialNo 620225
Manu Agilent Model 53131A SerialNo MY47000169
Manu MENSOR Model 600 SerialNo 621385

Notes:

1. Standards used in this calibration are traceable to the National Institute of Standards and Technology.
2. This calibration report shall not be reproduced, except in full, without the written approval of In-Situ, Inc.
3. A calibration interval of 12 to 18 months is recommended.
4. The post-calibration data is collected at nominal +20 C.
5. 1.0 PSI = 6.894757 KPa

Performed By: NJH

Copyright © 2006 In-Situ, Inc.

In-Situ Inc.

16-GRF-D

Calibration Report

Report Number: 20090109191441-140464
221 East Lincoln Avenue, Fort Collins, CO 80524 USA
1-970-498-1500, 1-800-446-7488, FAX: 1-970-498-1598
Visit us at www.in-situ.com

Instrument Details:

Instrument Model:	**Level TROLL 500**
Full Scale Pressure Range	**206.84 KPa (30 PSI) vented**
Serial Number:	**140464**

Calibration Details:

Calibration Result:	**PASS**
Calibration Date:	2009-01-09 19:14:41 (UTC)
Nominal Range of Applied Temperature:	-5 C to +50 C
Temperature Accuracy Specification:	+/- 0.1 C From 0 C to +50 C
Nominal Range of Applied Pressure:	0 KPa to 206.8 KPa (0.0 PSI to 30.0 PSI)
Pressure Accuracy Specification:	+/- 0.1 %FS from -5 C to +50 C, +/- 0.05 %FS at +15 C

Post-Calibration Check:

Parameter	Applied	Reported	Deviation
Pressure	30.0001	29.9986	-0.0048
Pressure	0.0003	-0.0014	-0.0057
Temperature	19.9940	20.0065	0.0125

Calibration Procedures and Equipment Used:

Automated calibration procedures used.
Manu Agilent Model 34970A SerialNo MY44038788
Manu Instrulab Model 3312A-14-15-24 SerialNo 31138
Manu Instrulab Model 406X-0031-01 SerialNo 1-31118
Manu MENSOR Model 600 SerialNo 622742
Manu Agilent Model 53131A SerialNo MY47000169
Manu MENSOR Model 600 SerialNo 621385

Notes:

1. Standards used in this calibration are traceable to the National Institute of Standards and Technology.
2. This calibration report shall not be reproduced, except in full, without the written approval of In-Situ, Inc.
3. A calibration interval of 12 to 18 months is recommended.
4. The post-calibration data is collected at nominal +20 C.
5. 1.0 PSI = 6.894757 KPa

Performed By: NJH

Copyright © 2006 In-Situ, Inc.

Grafton Township Well Site – Set-Up on Well

Grafton Township Subsurface Samples

Grafton Township Well Site

Grafton Township Well Site

Grafton Township Well Site - South-side of Parking Lot

Grafton Township Well Site

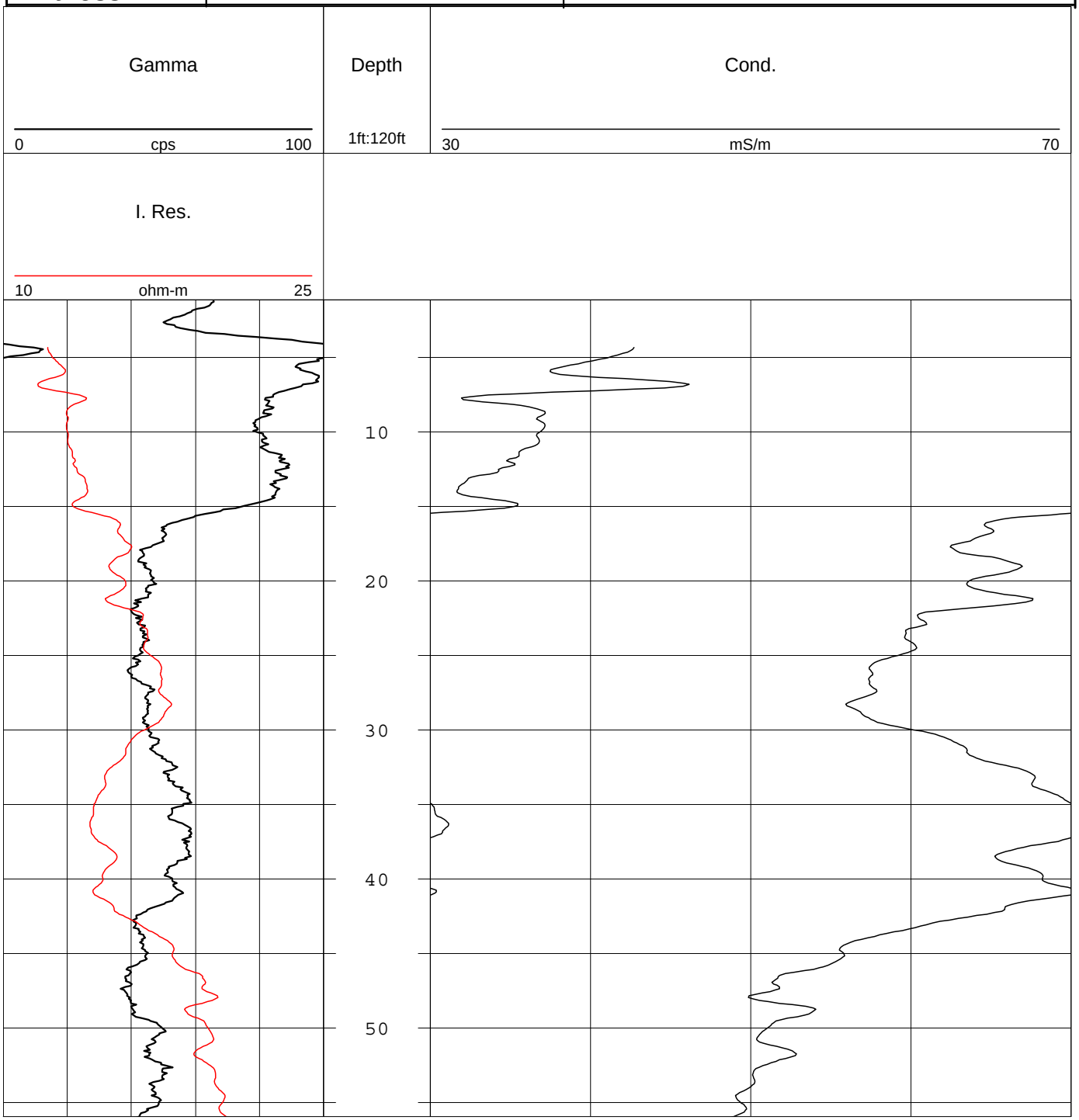
Grafton Township Well Site – Wells & Monument

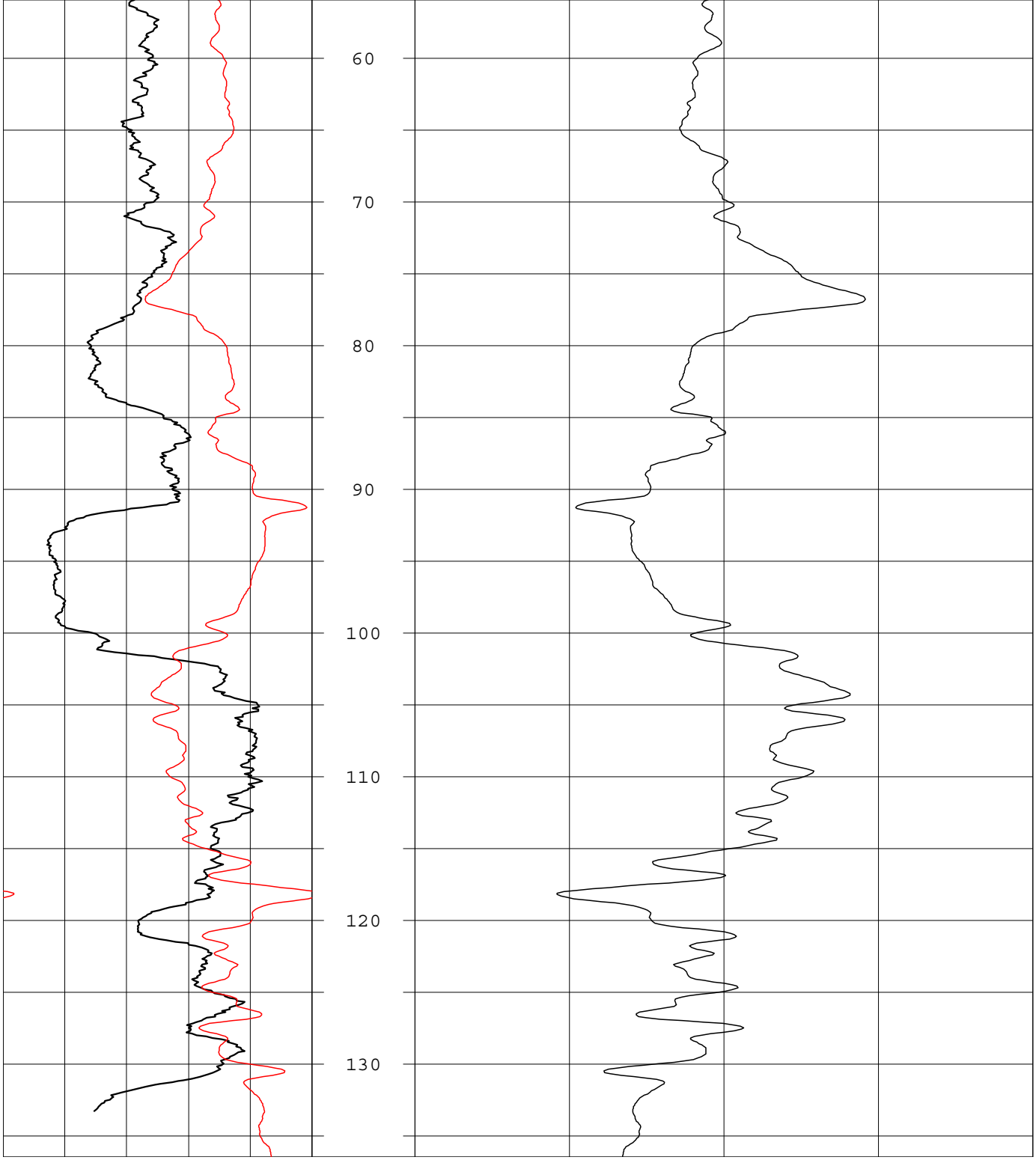
Grafton Township Well Site – Inside Well Casing

COMPANY:	McHenry County & US Corp of Engineers
Location:	EXNER MARSH

Well	# MCH GRAFTON TWN		
Date	10/22/08	BH Fluid	Formation ' BTC
Casing	2" PVC +2.3 to -139' bgs		
File Name	MCHTH16-08EMGAM		
Depth Driller	171' bgs		
Depth Logger	138.9' bgs		
Logged by:	T. YOUNG		
Witness:	NOT WITNESSED		

OTHER SERVICES




60
70
80
90
100
110
120
130

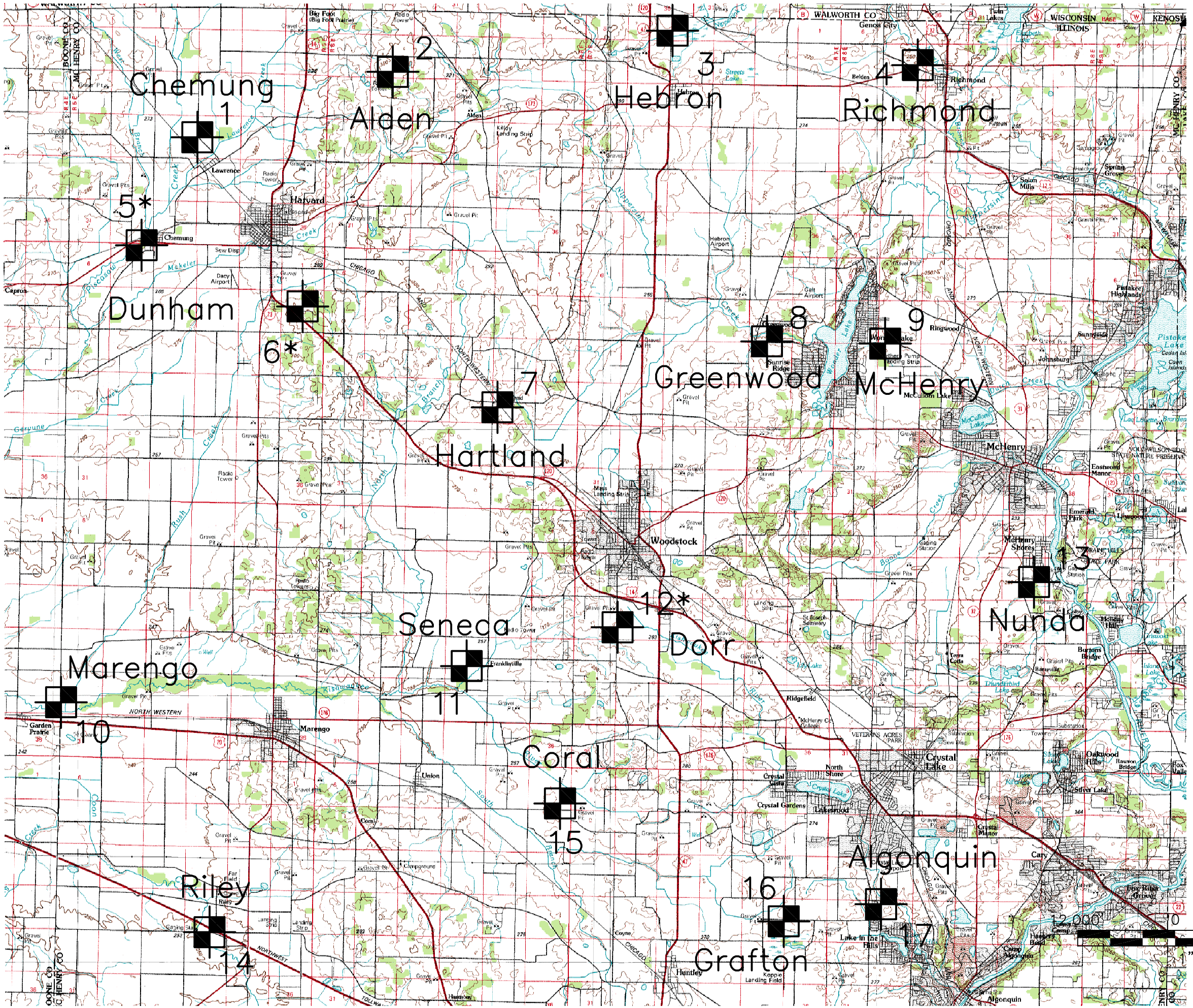
A-17: Folio for Well Site #17 – Algonquin Township

Table of Contents

I.) Site Location Map – Location in County
II.) Site Location Map – Location on USGS Topographic Map
III.) Site Location Map – Location on USGS High Resolution Orthophoto
IV.) Site Boring Log
V.) Well Construction Diagram
VI.) Well Site Summary and Commentary
VII.) Particle Size Distribution Report
VIII.) Table of Water Level Measurements
IX.) Well Development Field Log
X.) Water Quality Analysis Results
XI.) Groundwater Sampling Field Log
XII.) Hydraulic Conductivity Testing Results
XIII.) In-Situ LevelTroll™ Calibration Report
XIV.) Site Photographs
XV.) Downhole Geophysical Testing

Well Site Location Maps

Z:\Projects\200804080\CtyWide\D-09000-460-8000_CtyOverviewMap_004.dwg; 4/20/2009 5:33:59 PM; BRAUN, GARY



LEGEND:

AECOM Well Installation Site

McHenry 9

Well Installations By Others

Dunham 6*

0 12,000 24,000'

" = 12,000'

AECOM

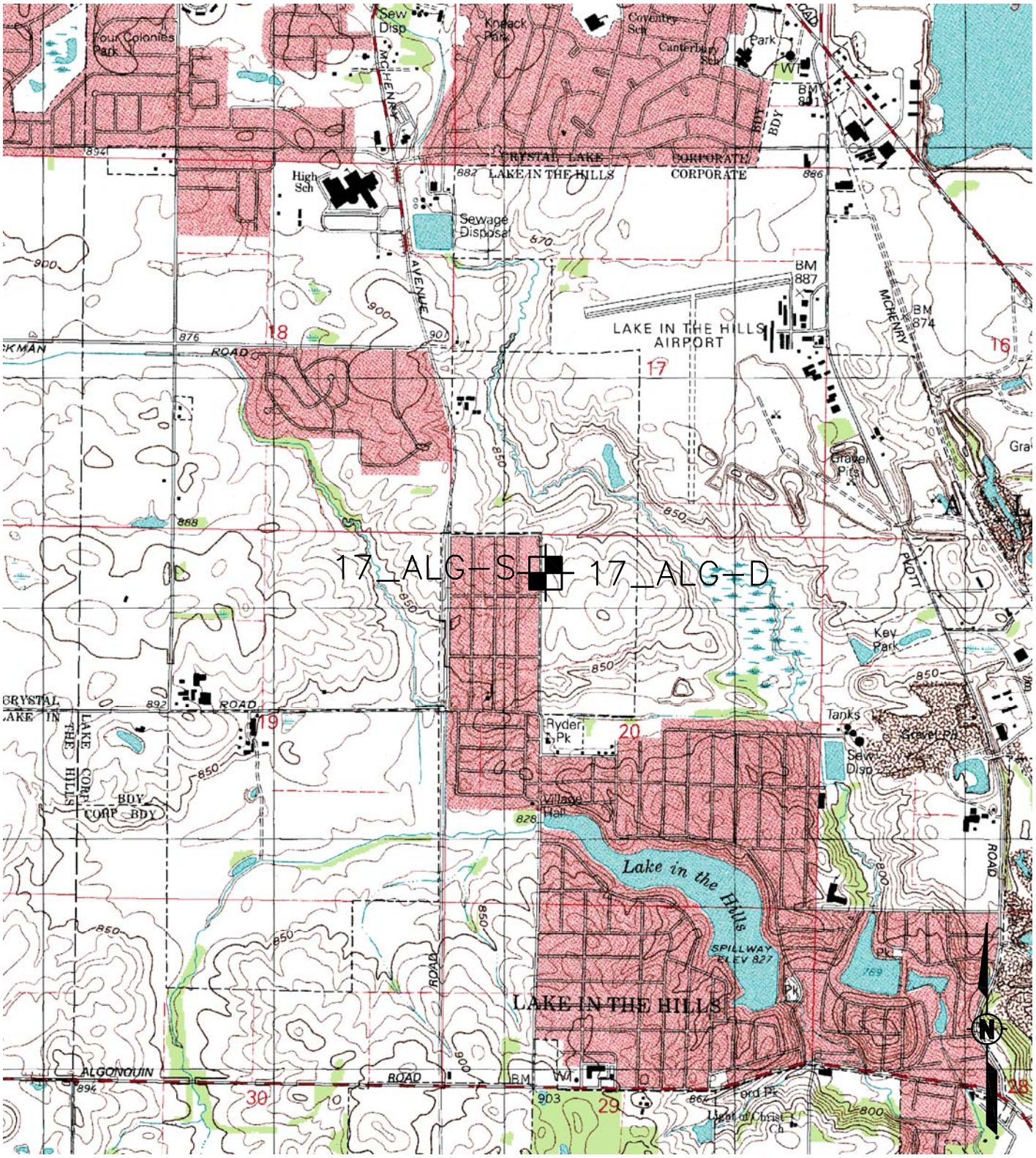
750 Corporate Woods Pkwy
Vernon Hills, IL 60061
847-279-2500
www.aecom.com

Copyright © By: STS Consultants, Ltd.

LOCATION MAP OF WELL SITES

Observation Well Network for Glacial Aquifers
McHenry County, Illinois

Drawn :	CJH	3/11/2009
Checked:	GMB	4/18/2009
Approved:	CSR	4/27/2009
PROJECT NUMBER	09000-460	
FIGURE NUMBER	1	



AECOM

750 Corporate Woods Parkway
Vernon Hills, IL 60061
847.279.2500
www.aecom.com

Copyright © 2009, By: AECOM

Site Location on USGS Topographic Map
Site No. 17 - Algonquin Township
Rothschild Parcel - Jefferson St.
Observation Well Network
McHenry County, Illinois

Drawn :	CJH	04/01/2009
Checked:	GMB	04/15/2009
Approved:	CSR	04/24/2009
PROJECT NUMBER	09000-460	
FIGURE NUMBER	Folio_17#2	

Z:\Projects\200804080\CityWide\D-09000-460-8000_TopoMaps_v02.dwg; 4/20/2009 11:24:18 AM; BRAUN, GARY; STS_BLACK_040102.ctb

500 0 500 1000

1" = 500'

AECOM

750 Corporate Woods Parkway
Vernon Hills, IL 60061
847.279.2500
www.aecom.com

Copyright © 2009, By: AECOM

2005 USGS High Resolution Orthophoto
Site No. 17 - Algonquin Township
Rothschild Parcel - Jefferson St.
Observation Well Network
McHenry County, Illinois

Drawn :	CJH	04/01/2009
Checked:	GMB	04/15/2009
Approved:	CSR	04/24/2009
PROJECT NUMBER	09000-460	
FIGURE NUMBER	Folio_17 #3	

Z:\Projects\200804080\CtyWide\D-09000-460-8000_AerialsMap_004.dwg; 4/21/2009 2:35:16 PM; BRAUN, GARY; STS_BLACK_040102.ctb

Boring and Well Construction Details

DRILLING LOG

DIVISION	USACE
INSTALLATION	Chicago District
SHEET	1 OF 8 SHEETS
1. PROJECT	McHenry County Observation Wells
2. LOCATION (Coordinates or Station)	McHenry County, Illinois N 2,011,623.00 E 973,157.00
3. DRILLING AGENCY	WDC Exploration & Wells
4. HOLE NO. *(As shown on drawing title and file number)*	17-ALGONQUIN
5. NAME OF DRILLER	Dan Tonnancour
6. DIRECTION OF HOLE	☒ VERTICAL ☐ INCLINED --- DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN	185.0
8. DEPTH DRILLED INTO ROCK	4.0
9. TOTAL DEPTH OF HOLE	189.0
10. SIZE AND TYPE OF BIT	3 7/8" Carbide Bit / 5 7/8" Casing
11. DATUM FOR ELEVATION SHOWN *(TBM or MSL)*	NAVD 88
12. MANUFACTURER'S DESIGNATION OF DRILL	Super Sonic II
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN	DISTURBED 22 / UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES	N/A
15. ELEVATION GROUND WATER	768.3
16. DATE HOLE	STARTED 10/17/2008 / COMPLETED 10/20/2008
17. ELEVATION TOP OF HOLE	+879.5
18. TOTAL CORE RECOVERY FOR BORING	94 %
19. GEOLOGIST	Gary Braun, LPG IL

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS *(Drilling time, water loss, depth weathering, etc., if significant)* g
+879.5	0.0		Topsoil: OL, Black organic clayey silt, trace sand and gravel, hard	70	1 0.0 5.0	
+878.0	1.5		CL, Brown/black mottled silty clay, very stiff, little sand and gravel			Qp = 3.0 TSF @4.0'
+873.5	6.0		CL, Olive gray silty clay, trace coarse sand and fine to medium gravel, stiff, damp, trace orange and black mottles Note: Matrix Supported Diamicton Till	60	2 5.0 15.0	Qp = >4.5 TSF @9.0' Qp = >4.5 TSF @11.0' Sample No. 1 from 14.0' - 15.0'
+864.5	15.0		CL, Reddish brown silty clay, little sand and gravel, stiff, damp Note: Diamicton	90	3 15.0 25.0	Qp = 2.0 TSF @17.5' Sample No. 2 from 18.0' - 19.0'

DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE 879.5

Hole No. 17-ALGONQUIN

PROJECT: McHenry County Observation Wells

INSTALLATION: Chicago District

SHEET 2 OF 8 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
+858.5	21.0					Qp = 1.25 TSF @20.0'
+856.0	23.5		GW, Gray sandy gravel, loose, wet			Sample No. 3 from 22.0' to 23.0'
			CL, Brownish gray sandy silty clay, little coarse sand to fine gravel, trace medium gravel, stiff, moist, medium plasticity Note: Matrix Supported Diamicton			Qp = 1.25 TSF @24.0'
				100	4 25.0 35.0	
						Qp = 1.6 TSF @27.0'
						Qp = 1.7 TSF @30.0'
						Qp = 0.75 TSF @33.0'
						Sample No. 4 from 34.0' to 35.0'
				95	5 35.0 45.0	
						Qp = 2.5 TSF @37.0'
						Qp = 3.0 TSF @40.0'
+837.5	42.0					
+834.5	45.0		SP, Grayish brown medium sand, little fine gravel, trace coarse sand, loose, wet			Sample No. 5 from 44.0' to 45.0'
			GP, Brownish gray fine gravel, little coarse sand, loose, wet	100	6 45.0	

DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE 879.5

Hole No. 17-ALGONQUIN

PROJECT: McHenry County Observation Wells

INSTALLATION: Chicago District

SHEET 3 OF 8 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
			GP, Brownish gray fine gravel, little coarse sand, loose, wet *(continued)*		55.0	Sample No. 6 from 46.0' to 47.0' % Gravel/% Sand/% Fines = 56/41/3 from 46.0' to 47.0'
+832.5	47.0		GW, Brownish gray gravelly sand, loose, wet			
+831.5	48.0		SC, Grayish-pinkish brown silty sandy clay, little fine to coarse gravel, stiff to very stiff, damp Note: Matrix Supported (Massive) Diamicton			Qp = 2.25 - 2.5 TSF @50.0' Qp = 1.5 - 2.5 TSF @53.0' Sample No. 7 from 54.0' to 55.0'
				100	7 55.0 65.0	
+823.0	56.5		CL, Grayish-pinkish brown silty clay, little sand and gravel, very stiff to hard, damp, medium plasticity Note: Matrix Supported (Massive) Diamicton			QP = >4.5+ TSF @63.0' Sample No. 8 from 64.0' to 65.0'
				100	8 65.0 75.0	Qp = 2.5 - 4.0 TSF @70.0'

DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE 879.5

Hole No. 17-ALGONQUIN

PROJECT: McHenry County Observation Wells

INSTALLATION: Chicago District

SHEET 4 OF 8 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
			CL, Grayish-pinkish brown silty clay, little sand and gravel, very stiff to hard, damp, medium plasticity Note: Matrix Supported (Massive) Diamicton *(continued)*			Qp = 2.0 TSF @73.0' Sample No. 9 from 74.0' to 75.0'
				100	9 75.0 85.0	Qp = 3.25 TSF @77.0' Qp = >4.5 TSF @80.0' Qp = 2.0 - 3.0 TSF @83.0' Sample No. 10 from 84.0' to 85.0'
				100	10 85.0 95.0	Qp = 4.0 TSF @90.0' Qp = 4.5 TSF @93.0' Sample No. 11 from 94.0' to 95.0'
				90	11 95.0 105.0	

DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE 879.5

Hole No. 17-ALGONQUIN

PROJECT: McHenry County Observation Wells

INSTALLATION: Chicago District

SHEET 5 OF 8 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
			CL, Grayish-pinkish brown silty clay, little sand and gravel, very stiff to hard, damp, medium plasticity Note: Matrix Supported (Massive) Diamicton *(continued)* Note: Difficult drilling through cobble from 102.0' to 103.0'			Qp = 1.75 - 2.0 TSF @97.0'
+776.5	103.0					
			SP, Brown fine sand, moderately dense, wet			Sample No. 12 from 104.0' to 105.0'
+774.5	105.0					
			CL, Reddish-grayish brown, silty clay, little sand and fine to medium gravel, very stiff, damp, medium to low plasticity Note: Matrix Supported Diamicton; water level taken in open borehole at 105.0' was 29.5' bgs	100	12 105.0 115.0	Qp = 2.75 TSF @107.0' Qp = 2.5 TSF @111.0' Sample No. 14 from 114.0' to 115.0' Qp = 2.75 - 3.0 TSF @114.0'
+763.5	116.0			65	13 115.0 125.0	
			SC, Dark reddish brown sandy clay, little fine gravel, trace coarse gravel, soft, moist			Qp = 0.5 TSF @119.0'
+759.5	120.0					
			CL, Dark brown to dark grayish brown silty clay, little sand and fine to medium gravel, very stiff, damp, low to medium plasticity Note: Matrix Supported (Massive) Diamicton			

DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE 879.5

Hole No. 17-ALGONQUIN

PROJECT: McHenry County Observation Wells

INSTALLATION: Chicago District

SHEET 6 OF 8 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
			CL, Dark brown to dark grayish brown silty clay, little sand and fine to medium gravel, very stiff, damp, low to medium plasticity Note: Matrix Supported (Massive) Diamicton *(continued)*			Qp = 4.5 TSF @123.0' Sample No. 14 from 124.0' to 125.0'
				100	14 125.0 135.0	
						Qp = >4.5 TSF @128.0'
						Qp = >4.5 TSF at 133.0' Sample No. 15 from 134.0' to 135.0'
				100	15 135.0 145.0	
						Qp = >4.5 TSF @143.0' Sample No. 16 from 144.0' to 145.0'
				100	16 145.0 155.0	

DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE 879.5

Hole No. 17-ALGONQUIN

PROJECT: McHenry County Observation Wells

INSTALLATION: Chicago District

SHEET 7 OF 8 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
			CL, Dark brown to dark grayish brown silty clay, little sand and fine to medium gravel, very stiff, damp, low to medium plasticity Note: Matrix Supported (Massive) Diamicton *(continued)*			Qp = >4.5 TSF @149.0' Sample No. 17 from 154.0' to 155.0'
				100	17 155.0 165.0	
						QP = 4.0 - 4.5 TSF @159.0' Qp = 4.5 TSF @163.0' Sample No. 18 from 164.0' to 165.0'
				100	18 165.0 175.0	
						QP >4.5 TSF @170.0' QP >4.5 TSF @173.0'

DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE 879.5

Hole No. 17-ALGONQUIN

PROJECT: McHenry County Observation Wells

INSTALLATION: Chicago District

SHEET 8 OF 8 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
						Sample No. 19 from 174.0' to 175.0'
+704.0	175.5			100	19 175.0 180.0	
			ML, Light gray silt, little fine to medium gravel, trace clay, extremely hard, dry			Sample No. 20 from 177.0' to 178.0' QP >4.5 TSF @178.0'
+700.5	179.0					
			ML, Gray weathered dolomite clasts in hard silt matrix, trace weathering zones (black/green mottling) Note: Difficult drilling at 182.0'; open borehole water level 45.5' bgs	100	20 180.0 185.0	Sample No. 21 from 181.0' to 182.0'
+694.5	185.0					
			Gray dolomite, hard, fresh micro-crystalline, thinly bedded	163	21 185.0 189.0	Sample No. 22 frp, 188.0' to 189.0'
+690.5	189.0					
			END OF BORING - 189.0' BGS			AECOM Project No. 60095270

Hole No. 17 - ALGONQUIN TWP

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 1 OF 13 SHEETS

1. PROJECT: McHenry City Wells
2. LOCATION (Coordinates or Station): N2,011,623 E973,157 1st Pl-E
3. DRILLING AGENCY: WDC Exploration & Wells
4. HOLE NO. (As shown on drawing title and title number): 17 - ALG
5. NAME OF DRILLER: Dan Tonnancour
6. DIRECTION OF HOLE: ☑ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 185'
8. DEPTH DRILLED INTO ROCK: 4'
9. TOTAL DEPTH OF HOLE: 189'
10. SIZE AND TYPE OF BIT: 3 7/8" Carbide Sampler 5 7/8" Casing Roto-Sonic
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): NAVD 88
12. MANUFACTURERS DESIGNATION OF DRILL: Super Sonic II
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 22 UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES: —
15. ELEVATION GROUND WATER: 768.3' Deep Well (10/22)
16. DATE HOLE: STARTED 10-17-08 COMPLETED 10-20-08
17. ELEVATION TOP OF HOLE: 879.5 FT MSL
18. TOTAL CORE RECOVERY FOR BORING: 94% (177/189)
19. SIGNATURE OF INSPECTOR: Harry M. Brown LPG IL

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
			PRAIRIE AT SURFACE			
880	0		Black Organic (OL) Clayey SILT, tr. sand & gravel, hard (TOPSOIL)			RUN 1 (0-5) Rec/Run = 3.5'/5' = 70%
	1					
	2		Brown / Black Mottled Silty CLAY, very stiff, little sand & gravel (CL)	Rec 70%	Bag 1	
	3					
	4					3.0 tsf
	5					RUN 2 (5-15) Rec/Run = 6'/10' = 60%
	6		Olive Gray Silty CLAY, trace Coarse sand & fine to Medium gravel, stiff, damp, trace Orange & black mottles (CL) Matrix Supported DIAMICTON			
	7				NR	
	8					
	9					
870	10			Rec 60%	Bag 2	
	11					>4.5 tsf
	12		TILL			
	13				Bag 3	
	14					
	15				S1	> tsf

SITE LOCATION: Rothschild Parcel Lake In The Hills, IL Jefferson St. North of Miller Rd. Across from 1509 Jefferson Access across from McKinley Rd.

0805

0810 Start Run ~0815

0830

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT: McHenry City Wells HOLE NO. 17 - ALGONQUIN TWP

Hole No. 17 - ALGONQUIN TWP

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 2 OF 13 SHEETS

1. PROJECT McHenry Cty Wells	10. SIZE AND TYPE OF BIT 3 7/8" Carbide Sampler
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) NAVD 88
3. DRILLING AGENCY WDC Exploration & Wells	12. MANUFACTURERS DESIGNATION OF DRILL Super Sonic II
4. HOLE NO. (As shown on drawing title and title number) 17-ALQ	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN — DISTURBED 22 — UNDISTURBED 0
5. NAME OF DRILLER DAN TONNANCOUR	14. TOTAL NUMBER CORE BOXES —
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.	15. ELEVATION GROUND WATER 768.3' Deep (10/22)
	16. DATE HOLE — STARTED 10-17-08 — COMPLETED 10-20-08
7. THICKNESS OF OVERBURDEN 185'	17. ELEVATION TOP OF HOLE 879.5 Ft MSL
8. DEPTH DRILLED INTO ROCK 4'	18. TOTAL CORE RECOVERY FOR BORING 177'/189'
9. TOTAL DEPTH OF HOLE 189'	19. SIGNATURE OF INSPECTOR Gary M Brown LPG IL

5 7/8" Casing
v
Roto Sonic

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g	
	15		Reddish Brown Silty CLAY, little sand & gravel, stiff, damp (CL) DIAMICTON			RUN 3 (15-25)	0835
	16				Bag 4	Rec/Run = 9'/10' = 90%	
	17						
	18				32	2.0 tsf	
	19			Rec 90%	Bag 5		
860	20					1.25 tsf	
	21		Gray Sandy GRAVEL, loose wet (GW) (intra-till gravel)				
	22				53	clay interbedded w/ gravel and sand at main contact	
	23				Bag 6		
	24		Brownish Gray Sandy Silty CLAY little Coarse Sand to fine gravel, trace Medium gravel, stiff, moist (CL). Medium Plasticity, Matrix Supported DIAMICTON			1.25 tsf	0850
	25						0855
	26					RUN 4 (25-35) Rec/Run = 10'/10' = 100%	
	27				Bag 7	1.6 tsf	
	28			Rec 100%			
	29				Bag 8		
850	30		TILL (Tiskilwa)			1.7 tsf	

ENG FORM 1836
MAR 71

PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT McHenry Cty Wells | HOLE NO. 17-Algonquin Twp

Hole No. 17-ALGONQUIN TWP

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 3 OF 13 SHEETS

1. PROJECT McHenry Cty Wells	10. SIZE AND TYPE OF BIT 3 7/8" Carbide Sampler
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) NAVD 88
3. DRILLING AGENCY WDC Exploration & Wells	12. MANUFACTURERS DESIGNATION OF DRILL Super Sonic II
4. HOLE NO. (As shown on drawing title and title number) 17-ALG	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 22, UNDISTURBED 0
5. NAME OF DRILLER DAN TONNANCOUR	14. TOTAL NUMBER CORE BOXES —
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.	15. ELEVATION GROUND WATER 768.3 Deep (10/22)
	16. DATE HOLE: STARTED 10-17-08, COMPLETED 10-20-08
7. THICKNESS OF OVERBURDEN 185'	17. ELEVATION TOP OF HOLE 879.5 ft MSL
8. DEPTH DRILLED INTO ROCK 4'	18. TOTAL CORE RECOVERY FOR BORING 177/189 = 94%
9. TOTAL DEPTH OF HOLE 189'	19. SIGNATURE OF INSPECTOR Gary M. Brown LPG IL

5 7/8" Casing
Roto-Sonic

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
850	30		cont.	cont.	cont.	Run 4 (25-35)
	31		Till		Bag 8	CONT.
	32			Rec 100%		
	33				Bag 9	0.75 tsf
	34				S4	0910
	35					0920
	36				Bag 10	Run 5 (35-45) Rec/Run = 9.5'/10' = 95%
	37					2.5 tsf
	38					
	39				Bag 11	
840	40			Rec 95%		3.0 tsf
	41					
	42		Grades over 0.25 ft			
	43		Grayish Brown Medium SAND, little fine gravel, trace C. SAND, loose, wet		Bag 12	
	44		> clay stringer (SP)			
	45				S5	(Sand) 0950

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT McHenry Cty Wells | HOLE NO. 17-ALGONQUIN TWP

Hole No. 17 - ALGONQUIN TWP

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 4 OF 13 SHEETS

1. PROJECT McHenry Cty Wells	10. SIZE AND TYPE OF BIT 3 7/8" Carbide Sampler
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) NAVD 88
3. DRILLING AGENCY WDC Exploration & Wells	12. MANUFACTURERS DESIGNATION OF DRILL Super Sonic II
4. HOLE NO. (As shown on drawing title and title number) 17-ALG	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 22, UNDISTURBED 0
5. NAME OF DRILLER DAN TONNANCOUR	14. TOTAL NUMBER CORE BOXES —
6. DIRECTION OF HOLE ☑ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.	15. ELEVATION GROUND WATER 768.3 DEEP (10/22/08)
	16. DATE HOLE: STARTED 10-17-08, COMPLETED 10-20-08
7. THICKNESS OF OVERBURDEN 185'	17. ELEVATION TOP OF HOLE 879.5 ft MSL
8. DEPTH DRILLED INTO ROCK 4'	18. TOTAL CORE RECOVERY FOR BORING 177/189 = 94%
9. TOTAL DEPTH OF HOLE 189'	19. SIGNATURE OF INSPECTOR Jon M. Braun LPG IL

5 7/8" CASING V ROTO-SONIC

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	45		Brownish Gray fine GRAVEL, little coarse sand, loose, wet (GP)			RUN 6 (45-55) Rec/Run = 10'/10' = 100%
	46				Bag 13 s6	
	47		↓ Grades over 0.2'			
			Brownish Gray Gravelly SAND, loose, wet (GW-SP) ← Abrupt			
	48					
			Grayish Pinkish Brown Silty Sandy CLAY, little fine to coarse gravel, stiff to very stiff, damp (SC)	Rec 100%		
	49					
830	50				Bag 14	2.25-4.25 tsf
	51					
			Matrix Supported DIAMICTON (Massive) TILL (Medium Plasticity)			
	52					
	53				Bag 15	1.5-2.5 tsf
	54		Tiskilwa Till			
					s7	
	55					
			Grades Gradually to			RUN 7 (55-65) Rec/Run = 10'/10' = 100%
	56					
	57		Grayish-Pinkish Brown Silty CLAY, little sand & gravel, very stiff to hard, damp (CL) (cont. next page)	Rec 100%	Bag 16	
	58					
	59				Bag 17	>4.5 ~~tsf~~
820	60					

1005

End Run 1040

Break

Start 4" Sampler 1134

Stop (at 65') 1138

Drive 6" Casing

1146

Hole No. 17 - ALGONQUIN TWP

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 5 OF 13 SHEETS

1. PROJECT: McHenry Cty Wells
2. LOCATION (Coordinates or Station):
3. DRILLING AGENCY: WDC Exploration & Wells
4. HOLE NO. (As shown on drawing title and title number): 17-ALG
5. NAME OF DRILLER: Dan Tonnancour
6. DIRECTION OF HOLE: ☑ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 185'
8. DEPTH DRILLED INTO ROCK: 4'
9. TOTAL DEPTH OF HOLE: 189'
10. SIZE AND TYPE OF BIT: 3 7/8" Carbide Sampler — 5 7/8" Casing
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): NAVD 88
12. MANUFACTURERS DESIGNATION OF DRILL: Super Sonic II
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 22; UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES: —
15. ELEVATION GROUND WATER: 768.3' Deep (10/28)
16. DATE HOLE: STARTED 10-17-08; COMPLETED 10-20-08
17. ELEVATION TOP OF HOLE: 879.5 ft MSL
18. TOTAL CORE RECOVERY FOR BORING: 177/189 = 94%
19. SIGNATURE OF INSPECTOR: [signature] LPG IL

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g	
820	60		cont. (Tiskilwa) (Till) Medium Plasticity, Matrix Supported Massive Diamicton	cont	cont. Bag 19	Run 7 (55-65) cont. 4.5	
	61						
	62						
	63				Bag 18	>4.5	
	64				58		Extract Samples @ 1150
	65					Run 8 (65-75) Rec/Run = 10'/10' = 100%	Start Sampler 1155 ↓ 1200
	66				Bag 19		
	67						Drive 6" Casing ↓ 1207
	68						
	69						
810	70			Rec 100%	Bag 20	2.5-4.0 tsf	
	71						
	72						
	73				Bag 21	2.0 tsf	
	74						
	75				59		1213 Extract Samples

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT: McHenry Cty Wells | HOLE NO.: 17-ALGONQUIN TWP

Hole No. 17 - ALGONQUIN TWP

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 6 OF 13 SHEETS

1. PROJECT McHenry Cty Wells	10. SIZE AND TYPE OF BIT 3 3/8" Carbide Sampler
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) NAVD 88
3. DRILLING AGENCY WDC Exploration & Wells	12. MANUFACTURERS DESIGNATION OF DRILL Super Sonic II
4. HOLE NO. (As shown on drawing title and title number) 17-ALG	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 22; UNDISTURBED 0
5. NAME OF DRILLER DAN TENNANCOUR	14. TOTAL NUMBER CORE BOXES —
6. DIRECTION OF HOLE ☑ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.	15. ELEVATION GROUND WATER 768.3 Deep (10/28)
	16. DATE HOLE: STARTED 10-17-08; COMPLETED 10-20-08
7. THICKNESS OF OVERBURDEN 185'	17. ELEVATION TOP OF HOLE 879.5 FT MSL
8. DEPTH DRILLED INTO ROCK 4'	18. TOTAL CORE RECOVERY FOR BORING 177/189 = 94%
9. TOTAL DEPTH OF HOLE 189'	19. SIGNATURE OF INSPECTOR Gary M Brown LPG IL

5 7/8" CASING
V
ROTOSONIC

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g	
	75		cont. (Till)			Run 9 (75-85)	1224
	76		Massive, Matrix Supported Diamicton		Bag 22	Rec/Run = 10'/10' = 100%	Drive Sampler 1230
	77					3.25 tsf	Drive 6" Casing 1238
	78						
	79			Rec 100%	Bag 23	> 4.5 tsf	
800	80						
	81						
	82						
	83				Bag 24	2-3.0 tsf	Extract Samples 1255
	84						
	85				5/0		
	86					Run 10 (85-95)	1335
	87				Bag 25	Rec/Run = 10'/10' = 100%	1342
	88			Rec 100%			Drive 6" Casing 1348
	89				Bag 26	4.0 tsf	
790	90						

ENG FORM 1836
MAR 71

PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT McHenry Cty Wells | HOLE NO. 17-ALGONQUIN TWP

Hole No. 17 - ALGONQUIN TWP

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 7 OF 13 SHEETS

1. PROJECT McHenry Cty Wells	10. SIZE AND TYPE OF BIT 3 7/8" Carbide Sampler
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) NAVD 88
3. DRILLING AGENCY WDC Exploration & Wells	12. MANUFACTURERS DESIGNATION OF DRILL Super Sonic II
4. HOLE NO. (As shown on drawing title and title number) 17-ALG	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 22; UNDISTURBED 0
5. NAME OF DRILLER DAN TONNANCOUR	14. TOTAL NUMBER CORE BOXES —
6. DIRECTION OF HOLE ☑ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER 768.3' (10/29)
	16. DATE HOLE: STARTED 10-17-08; COMPLETED 10-20-08
7. THICKNESS OF OVERBURDEN 185'	17. ELEVATION TOP OF HOLE 879.5 ft MSL
8. DEPTH DRILLED INTO ROCK 4'	18. TOTAL CORE RECOVERY FOR BORING 177/189 = 94%
9. TOTAL DEPTH OF HOLE 189'	19. SIGNATURE OF INSPECTOR Gary M. Brown LPG IL

5 7/8" CASING
ROTO-SONIC

DEEP WELL

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
790	90		Cont.	cont	Bag 26 (cont)	Run 10 (85-95) cont.
	91		(Till)			
	92			Rec. 100%		
	93				Bag 27	4.5 tsf
	94					
					S11	
	95					
	96					Run 11 (95-105) Rec/Run = 9'/10' = 90%
	97				Bag 28	1.75-2.0 tsf
	98					
	99					
780	100			Rec	Bag 29	>4.5 tsf
	101					
	102		Cored partially through Medium Cobble → Appears to be larger base			Difficult drilling through cobble
	103		Brown FINE SAND, Moderately dense, wet (SP)		Bag 30	Driller lost water pressure at end of run driving 6" casing.
	104					
	105		INTRA-Till SAND		S12	

1356 Extract samples
1404 ↓ 4" Sampler
1416
Drive 6" Casing ↓
1423
1436 Extract Samples
1445 → WATER
END OF DAY 10-17-08

Hole No. 17 - ALGONQUIN TWP

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 8 OF 13 SHEETS

1. PROJECT McHenry Cty Wells	10. SIZE AND TYPE OF BIT 3 7/8" Carbide Sampler
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) NAVD 88
3. DRILLING AGENCY WDC Exploration & Wells	12. MANUFACTURERS DESIGNATION OF DRILL Super Sonic II
4. HOLE NO. (As shown on drawing title and title number) 17-ALG	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 22, UNDISTURBED 0
5. NAME OF DRILLER DAN TONNANCOUR	14. TOTAL NUMBER CORE BOXES —
6. DIRECTION OF HOLE ☑ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER 768.3' (10/28) Deep Well
	16. DATE HOLE: STARTED 10-17-08, COMPLETED 10-20-08
7. THICKNESS OF OVERBURDEN 185'	17. ELEVATION TOP OF HOLE 879.5 ft MSL
8. DEPTH DRILLED INTO ROCK 4'	18. TOTAL CORE RECOVERY FOR BORING 177/189 = 94%
9. TOTAL DEPTH OF HOLE 189'	19. SIGNATURE OF INSPECTOR Gary M. Brown LPG IL

5 7/8" Casing
ROTO SONIC

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	105		Reddish-Grayish Brown, Silty CLAY, little sand & fine to medium gravel, very stiff, damp (CL) Medium to low Plasticity, Matrix Supported DIAMICTON			RUN 12 (105-115) Start 10-20-08 740 ↓ 4" core barrel
	106				Bag 30	Rec/Run = 10'/10' = 100%
	107					← 2.75 tsf
	109					☆ Note: water level taken before run in open borehole which was left to equilibrate over the weekend was 29.4 ft below grd surf. (No blow-in over weekend) 744-750 • Actual 10" run duration 0753 drive 6" casing ↓ 0759
	109			Rec 100%		
770	110				Bag 31	2.5 tsf
	111					
	112					
	113		TILL			
	114				Bag 32 S13	2.75-3.0 tsf 0809
	115					RUN 13 (115-125) 0820 ↓ drive 4" core barrel 0830
	116		Dark Reddish Brown SANDY CLAY, little fine gravel, trace coarse gravel, soft, moist (SC) DIAMICTON (fine gravel layer @ 117.6'-117.7')			Rec/Run = 6.5'/10' = 65%
	117			Rec 65%	Bag 33	Drive 6" Casing ↓ to 0839
	118					
	119					0.5 tsf
760	120					

Hole No. 17-Algonquin Twp

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 9 OF 13 SHEETS

1. PROJECT McHenry Cty Wells	10. SIZE AND TYPE OF BIT 3 7/8" Carbide Sampler 5 7/8" Casing
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) NAVD 88
3. DRILLING AGENCY WDC Exploration & Wells	12. MANUFACTURERS DESIGNATION OF DRILL Super Sonic II
4. HOLE NO. (As shown on drawing title and title number) 17-ALG	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 22; UNDISTURBED 0
5. NAME OF DRILLER Dan Tonwancour	14. TOTAL NUMBER CORE BOXES 0
6. DIRECTION OF HOLE ☑ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER 768.3 ft MSL
	16. DATE HOLE: STARTED 10-17-08; COMPLETED 10-20-08
	17. ELEVATION TOP OF HOLE 879.5 ft MSL
7. THICKNESS OF OVERBURDEN 185'	18. TOTAL CORE RECOVERY FOR BORING 177/186 = 94%
8. DEPTH DRILLED INTO ROCK 4'	19. SIGNATURE OF INSPECTOR Jim M. Brown LPG IL
9. TOTAL DEPTH OF HOLE 187'	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g	
760	120		Dark Brown to Dark Grayish Brown Silty Clay, little sand & fine to medium gravel, very stiff clay (CL) - low to medium plasticity, matrix supported massive Diamicton	Cont.		Run 13 (115-125) cont.	
	121			Rec 65%			
	122				Bag 34	4.5 tsf	
	123						
	124				S14		0847 Extract Samples
	125					Run 14 (125-135)	0856
	126				Bag 35	Rec 10' / Run 10' = 100%	4" core barrel 0905
	127		Cont.				Drive 6" Casing
	128		Tiskilwa Till			>4.5 tsf	0912
	129						
750	130			Rec 100%	Bag 36		
	131						
	132						
	133				Bag 37	>4.5 tsf	0920 Extract Samples
	134						
	135				S15		

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT McHenry Cty Wells | HOLE NO. 17-Algonquin Twp

Hole No. 17-Algonquin Twp

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 10 OF 13 SHEETS

1. PROJECT: McHenry Cty Wells
2. LOCATION (Coordinates or Station):
3. DRILLING AGENCY: WDC Exploration & Wells
4. HOLE NO. (As shown on drawing title and title number): 17-ALG
5. NAME OF DRILLER: DAN TONNANCOUR
6. DIRECTION OF HOLE: ☑ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 185'
8. DEPTH DRILLED INTO ROCK: 4'
9. TOTAL DEPTH OF HOLE: 189'
10. SIZE AND TYPE OF BIT: 3 7/8" Carbide Sampler — 5 7/8" Casing
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): NAVD88
12. MANUFACTURERS DESIGNATION OF DRILL: Super Sonic II
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 22 / UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES: —
15. ELEVATION GROUND WATER: 768.3' (10/22) Deep Well
16. DATE HOLE: STARTED 10-17-08 / COMPLETED 10-20-08
17. ELEVATION TOP OF HOLE: 879.5 Fr MSL
18. TOTAL CORE RECOVERY FOR BORING: 177/189 = 94%
19. SIGNATURE OF INSPECTOR: Gary M. Brown LPG IL

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g	
	135		SAME TILL AS ABOVE			RUN 15 (135-145)	0942
	136				Bag 38	Rec/Run = 10'/10' = 100%	↓ 4" barrel 0950.
	137						Drive 6" Casing
	138						
	139			Rec 100%	Bag 39		
740	140						
	141						
	142						
	143				Bag 40	>4.5 tsf	
	144				5/6		
	145						
	146				Bag 41	RUN 16 (145-155) Rec/Run = 10'/10' = 100%	1024 ↓ 4" 1031
	147						
	148			Rec 100%			
	149				Bag 42	>4.5 tsf	
730	150						

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT: McHenry Cty Wells — HOLE NO. 17-ALGONQUIN TWP

Hole No. 17- ALGONQUIN TWP

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET // OF 13 SHEETS

1. PROJECT: McHenry Cty Wells
2. LOCATION (Coordinates or Station):
3. DRILLING AGENCY: WDC Exploration & Wells
4. HOLE NO. (As shown on drawing title and title number): 17-ALG
5. NAME OF DRILLER: DAN TONNANCOUR
6. DIRECTION OF HOLE: [x] VERTICAL [ ] INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 185'
8. DEPTH DRILLED INTO ROCK: 4'
9. TOTAL DEPTH OF HOLE: 189'
10. SIZE AND TYPE OF BIT: 3 7/8" Carbide Sampler — 5 7/8" Casing v Roto Sonic
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): NAVD 88
12. MANUFACTURERS DESIGNATION OF DRILL: Super Sonic II
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 22 / UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES: —
15. ELEVATION GROUND WATER: 768.3 (Deep) on 10/22/08
16. DATE HOLE: STARTED 10-17-08 / COMPLETED 10-20-08
17. ELEVATION TOP OF HOLE: 879.5 FMSL
18. TOTAL CORE RECOVERY FOR BORING: 177/189 = 94%
19. SIGNATURE OF INSPECTOR: Gary M Brown LPG IL

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
730	150		SAME TILL AS ABOVE	cont.	Bag 42	RUN 16 (145-155) Cont
	151					
	152			Rec 100%		
	153				Bag 43	> 4.5 tsf
	154				517	
	155					RUN 17 (155-165)
	156					Rec/Run = 10'/10' = 100%
	157				Bag 44	
	158					
	159					4.0-4.5 tsf
720	160			Rec 100%	Bag 45	
	161					
	162					
	163				Bag 46	4.5 tsf
	164				518	
	165					

1108
1118
Drive 6" Casing
1124
Extract Samples
1135
EARLY LUNCH B/c HEAVY RAIN

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT: McHenry Cty Wells | HOLE NO. 17- ALGONQUIN TWP

Hole No. 17 - ALGONQUIN TWP

DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 12 OF 13 SHEETS

1. PROJECT McHenry Cty Wells	10. SIZE AND TYPE OF BIT 3 3/8" Carbide Sampler
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) NAVD 88
3. DRILLING AGENCY WDC Exploration & Wells	12. MANUFACTURERS DESIGNATION OF DRILL Super Sonic II
4. HOLE NO. (As shown on drawing title and title number) 17-ALG	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 22, UNDISTURBED 0
5. NAME OF DRILLER DAN TONNANCOUR	14. TOTAL NUMBER CORE BOXES —
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER 768.3' Deep 10/22
	16. DATE HOLE: STARTED 10-17-08, COMPLETED 10-20-08
	17. ELEVATION TOP OF HOLE 879.5 ft MSL
7. THICKNESS OF OVERBURDEN 185'	18. TOTAL CORE RECOVERY FOR BORING 177/189 = 94%
8. DEPTH DRILLED INTO ROCK 4'	19. SIGNATURE OF INSPECTOR Gary M. Brown LPG IL
9. TOTAL DEPTH OF HOLE 189'	

5 7/8" Casing
Roto Sonic

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	165		cont.			RUN 18 (165-175)
	166		Dark Grayish Brown Silty Clay little sand & gravel, very stiff to hard (CL)		Bag 47	Rec/Run = 10'/10' = 100%
	167					
	168					
	169		"SAME TILL AS ABOVE	Rec 100%		
710	170				Bag 48	> 4.5 tsf
	171					
	172					
	173				Bag 49	> 4.5 tsf
	174					
	175		Gradation over 0.2'		S19	
	176		Light Gray SILT, little fine to medium gravel, trace clay, extremely hard, dry (burned by sampler) hardpan		Bag 50	RUN 19 (175-180) Rec/Run = 5'/5' = 100%
	177			Rec 100%	Bag 51	S20 (177-178)
	178					> 4.5 tsf
	179				Bag 52	
700	180		Weathered Bedrock (see next page)			

1306 → 4" → 1314
Drive 6" → 1326
1349 → 1355
1412 Extract Samples

ENG FORM 1836
MAR 71
PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT McHenry Cty Wells | HOLE NO. 17 - ALGONQUIN TWP

Hole No. 17 - ALGONQUIN TWP

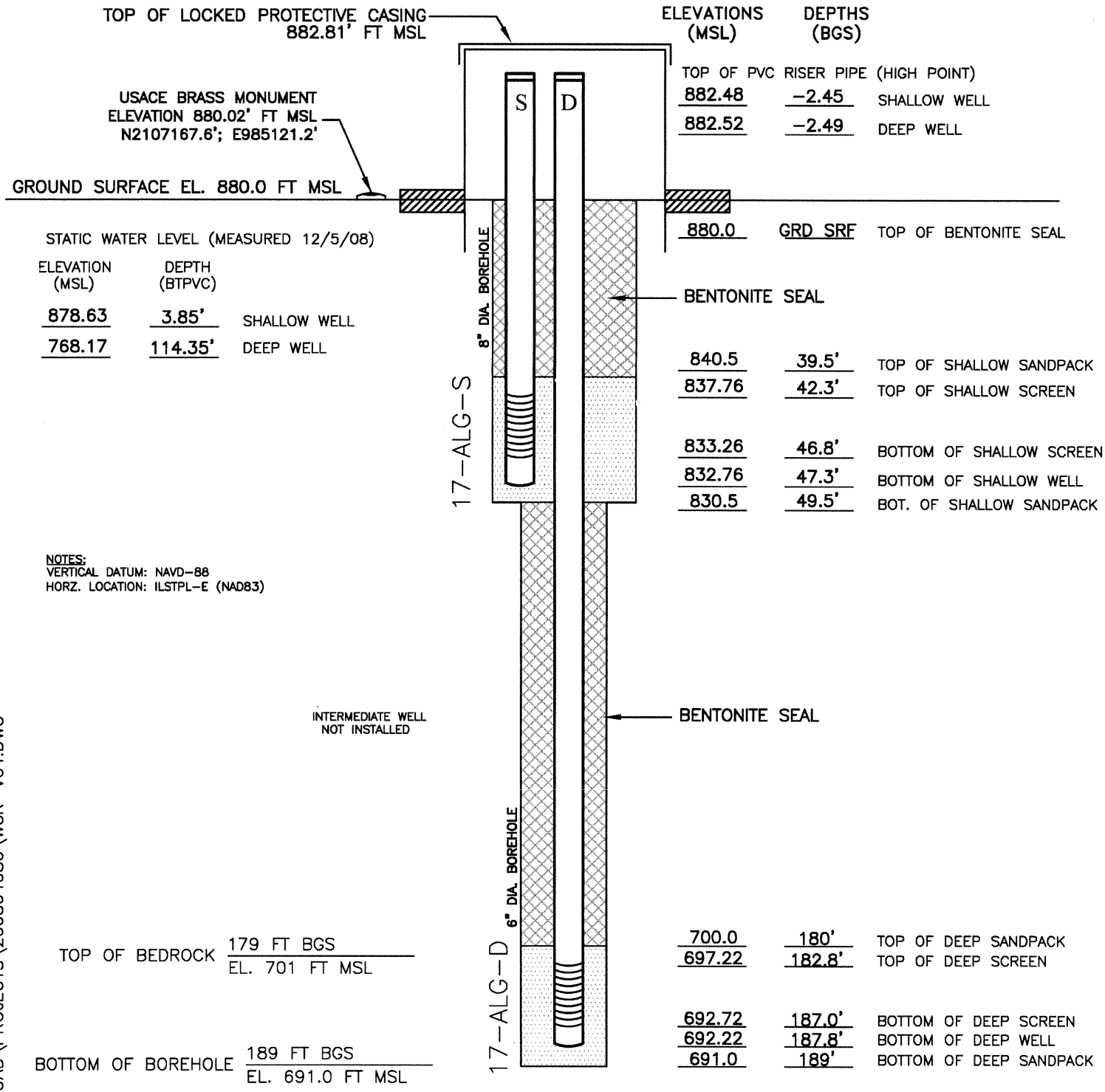
DRILLING LOG	DIVISION Chicago	INSTALLATION —	SHEET 13 OF 13 SHEETS

1. PROJECT: McHenry Cty Wells
2. LOCATION (Coordinates or Station):
3. DRILLING AGENCY: WDC Exploration & Wells
4. HOLE NO. (As shown on drawing title and title number): 17-ALG
5. NAME OF DRILLER: DAN TONNMANCOUR
6. DIRECTION OF HOLE: ☑ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 179 ft
8. DEPTH DRILLED INTO ROCK: 10 ft
9. TOTAL DEPTH OF HOLE: 189 ft
10. SIZE AND TYPE OF BIT: 3 7/8" Carbide Sampler
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): NAVD 88
12. MANUFACTURERS DESIGNATION OF DRILL: Super Sonic II
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 22; UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES: —
15. ELEVATION GROUND WATER: 768.3 ft 10/22 Deep
16. DATE HOLE: STARTED 10-17-08; COMPLETED 10-20-08
17. ELEVATION TOP OF HOLE: 879.5 ft MSL
18. TOTAL CORE RECOVERY FOR BORING: 177/189 = 94%
19. SIGNATURE OF INSPECTOR: Ann M. Brown LPG IL

5 7/8" Casing
↓
ROTO-SONIC

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) (from 179')	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g	
700	180		Gray Weathered DOLOMITE; dolomite clasts in hard SILT matrix; trace weathering zones (black/green mottling)	Rec 100%	Bag 53, S21	RUN 20 (180-185) Rec/Run = 5'/5' = 100%	1424 ↓ 4" core barrel 1435
	181						
	182					Difficult drilling water level rose 10 ft bgs during water re-fill break	Drive 6" Casing 175 1438 ↓ 185'
	183				Bag 54		1520
	184						
	185		Estimated due to change in sampling method				
	186		Gray DOLOMITE, hard, fresh micro-crystalline, thinly bedded	Rec 87.5%	Bag 55	RUN 21 (185-189) Rec/Run = 3.5/4 = 87.5% 2nd run drill with water. No water used in previous runs.	1549
	187						
	188				S22		
691	189		END OF BORING	189 ft bgs		10-20-08 1615 grab	1558
	190						
	191						
	192						
	193						
	194						
	195						

PROJECT McHENRY COUNTY OBSERVATION WELL NETWORK INSTALLATION (#09000-460)	WELL NO. 17-ALG-S & 17-ALG-D
LOCATION ALGONQUIN TOWNSHIP – McHENRY COUNTY, ILLINOIS	
CLIENT U.S. ARMY CORPS OF ENGINEERS / McHENRY COUNTY	
GEOLOGIST GARY BRAUN, P.G. (AECOM)	INSTALLATION DATE OCT. 21, 2008
DRILLER WDC EXPLORATION AND WELLS, INC. (DAN TONNANCOUR)	DRILLING METHOD ROTO-SONIC



NOT TO SCALE

WELL CONSTRUCTION MATERIALS*

PROTECTIVE CASING	5' L X 8" DIA. STEEL CASING W/ LOCKING CAP
RISER PIPE ABOVE W.T.	SCHEDULE 40 PVC (2.07" I.D./ 2.38" O.D.)
RISER PIPE BELOW W.T.	SCHEDULE 40 PVC (2.07" I.D./ 2.38" O.D.)
SCREEN	2" I.D. SCHEDULE 40 PVC W/ 0.010" SCREEN SLOT SIZE
TYPE OF BENTONITE SEAL	BLACK HILLS BENTONITE – 3/8" CHIPS (HOLE PLUG)
TYPE OF SAND PACK	R.W. SIDLEY CO. – NO. 5 FILTER PACK SAND

CASING MEASUREMENTS

BOTTOM OF SCREEN TO END CAP (FT)*		0.50
SCREEN LENGTH (1ST SLOT TO LAST SLOT) (FT)*		4.50
TOTAL LENGTH OF CASING (FT):	SHALLOW WELL	49.72
	DEEP WELL	190.30

* MEASUREMENT REFERS TO ALL WELLS

USMWK2FP001\05CAD\PROJECTS\200804080\WCR-V04.DWG

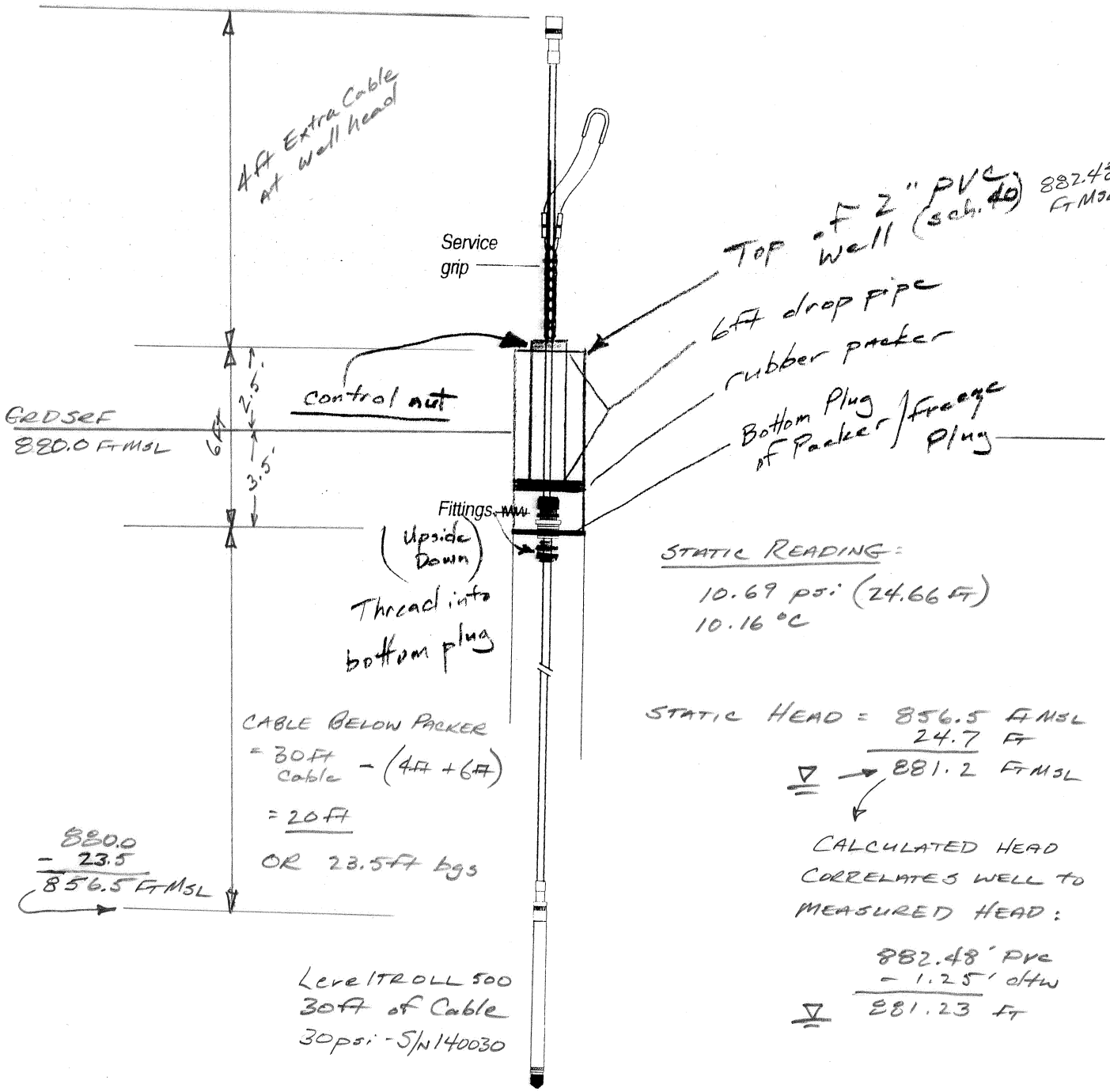
STS | AECOM

Calculation Sheet

Project				Subject		
McHenry Cty Wells				Level TROLL Position in Well		
Originated By	Date	Checked By	Date	STS Job No.	Scale	Sheet No.
gnb	4/20/09			09000-460	NTS	1 Of 1

Level TROLL Positioning through Artesian Packer

SITE: 17 - ALGONQUIN TOWNSHIP
SHALLOW WELL



WELL SITE DATA SUMMARY AND COMMENTARY

Well Site #17 – Algonquin Township
MCCD Rothschild Parcel on Jefferson St.

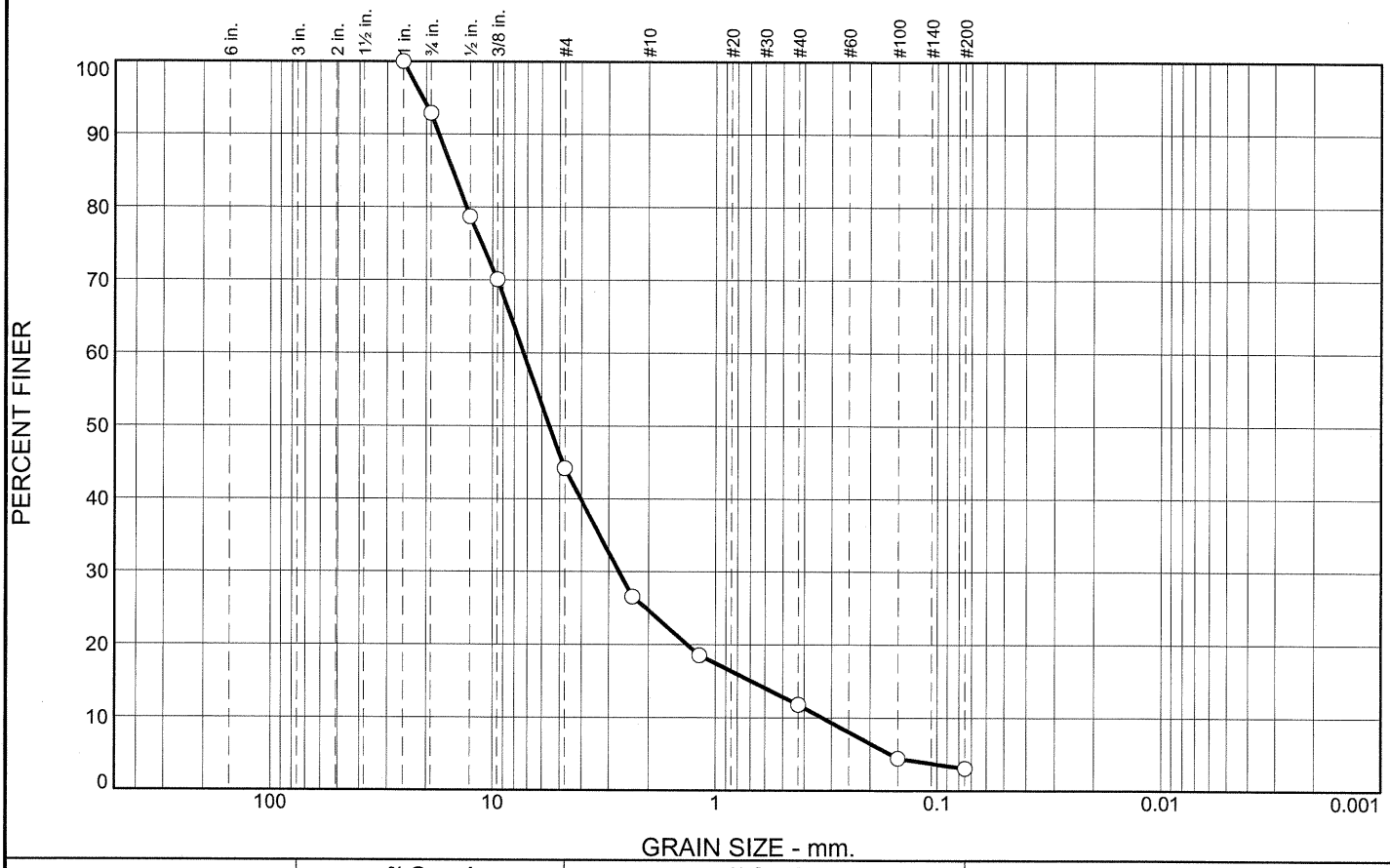
The Algonquin Township well site is located north of Miller Road and east of Randall Road approximately 2½ miles east of the Grafton Township site. It is believed that the Algonquin site is located on the Barlina Moraine which trends northwest-southeast from Woodstock to Lake-in-the-Hills, IL (Curry, 2005). The upper diamicton deposits (that are likely part of the Yorkville member of the Lemont Formation) overlie the upper hydrostatic unit which was observed to be from 42 to 45 feet below ground surface. As previously discussed, groundwater levels within the upper sand and gravel hydrostatic unit were at or above ground surface for each of the groundwater level monitoring events. The sand and gravel deposits are likely members of the Henry Formation (Curry, 2005) which thicken towards the east. Underlying the upper hydrostatic unit, a thick sequence of Tiskilwa Formation diamicton was found between 48 and 179 feet below ground surface. No proglacial outwash was observed overlying bedrock at this location.

The artesian conditions within the Algonquin shallow well are not easily explained. The site appears to be at a topographic high location along the Barlina Moraine, so the source of the high groundwater head is not immediately apparent. In addition, the sand and gravel deposits of the artesian upper hydrostatic unit thicken towards the east and are believed to discharge at the Lake in the Hills Fen. This means that heads within the sand and gravel seam shouldn't build-up since the discharge area is not confined. Based on the USGS topo map for the Algonquin Site (see Appendix A-17), there are limited areas where the ground surface elevations are greater than at the well (880 ft msl). These areas are limited to the northwest of the site near the intersection of Randall Road and Ackman Road. This location is the topographic high between two tributaries that flow to Goose Lake and the Lake in the Hills to the east and west, respectively. Thus recharge is likely occurring in the sand and gravel seam at some distance upgradient (northwest) of the well.

However, regardless of the cause of the artesian conditions observed in the well, since water is above ground surface and freezes in the winter-time, the shallow Algonquin well also required a packer. A 6-ft long stainless steel pipe with an expandable rubber packer was installed in the well to seal water below the frost line. A detailed schematic of the packer assembly is included in Appendix A-17.

Well Site Testing Results

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	7.1	48.7	19.5	12.9	8.7	3.1	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1	100.0		
.75	92.9		
.5	78.7		
.375	70.1		
#4	44.2		
#8	26.6		
#16	18.5		
#40	11.8		
#100	4.5		
#200	3.1		

* (no specification provided)

Material Description

F-C Sand and Gravel Trace Silt

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 17.5350 D_{85}= 15.1952 D_{60}= 7.2672
D_{50}= 5.5548 D_{30}= 2.7020 D_{15}= 0.6899
D_{10}= 0.3294 C_u= 22.06 C_c= 3.05

Classification

USCS= GP AASHTO=

Remarks

Source of Sample: 17-ALG-S **Depth:** 46-47

Date: 12/04/08

STS | AECOM

Client: USACE
Project: McHenry County Wells
Project No: 200804080 **Figure**

Tested By: JRT

Groundwater Level Measurements

McHenry County Monitoring Well Installations
AECOM Project 09000-460

Site Number	17	
Township Name	Algonquin	
Well Number	17-ALG-S	17-ALG-D
Ground Surface Elevation (ft msl)	880.03	880.03
Top of PVC Casing Elevation (ft)	882.48	882.52
Location of PVC Casing within Wellhead	W Well	E Well
Well Depth (Feet from TOC)[A]	49.72	190.30

Date	Depth to GW from TOC (ft)	GW Elevation (ft msl)	Depth to GW from TOC (ft)	GW Elevation (ft msl)
Sep. 26, 2008				
Oct. 09, 2008				
Oct. 14, 2008				
Oct. 16, 2008				
Oct. 21, 2008				
Oct. 22, 2008	3.89	878.59	114.19	768.33
Oct. 24, 2008				
Oct. 28, 2008				
Oct. 29, 2008				
Oct. 30, 2008				
Nov. 07, 2008				
Nov. 13, 2008				
Dec. 05, 2008	3.85	878.63	114.35	768.17
Dec. 08, 2008				
Dec. 09, 2008				
Dec. 12, 2008				
Dec. 15, 2008	1.9	880.58		
Dec. 16, 2008				
Dec. 17, 2008	1.2	881.28	114.69	767.83
Dec. 18, 2008				
Dec. 19, 2008				
Dec. 22, 2008				
Dec. 23, 2008				
Dec. 29, 2008				
Dec. 30, 2008			111.91	770.61
Jan. 05, 2009				
Jan. 06, 2009	0.3	882.18	108.67	773.85
Jan. 07, 2009				
Jan. 08, 2009				
Jan. 09, 2009				
Jan. 10, 2009				
Jan. 12, 2009				
Feb. 24, 2009	1.2	881.28	107.38	775.14
Mar. 20, 2009				
end				

Notes:

ft msl = Elevation referenced to feet above mea

TOC = Top of PVC Casing

ft = feet

[A] = as measured inside well

NI = Not Installed

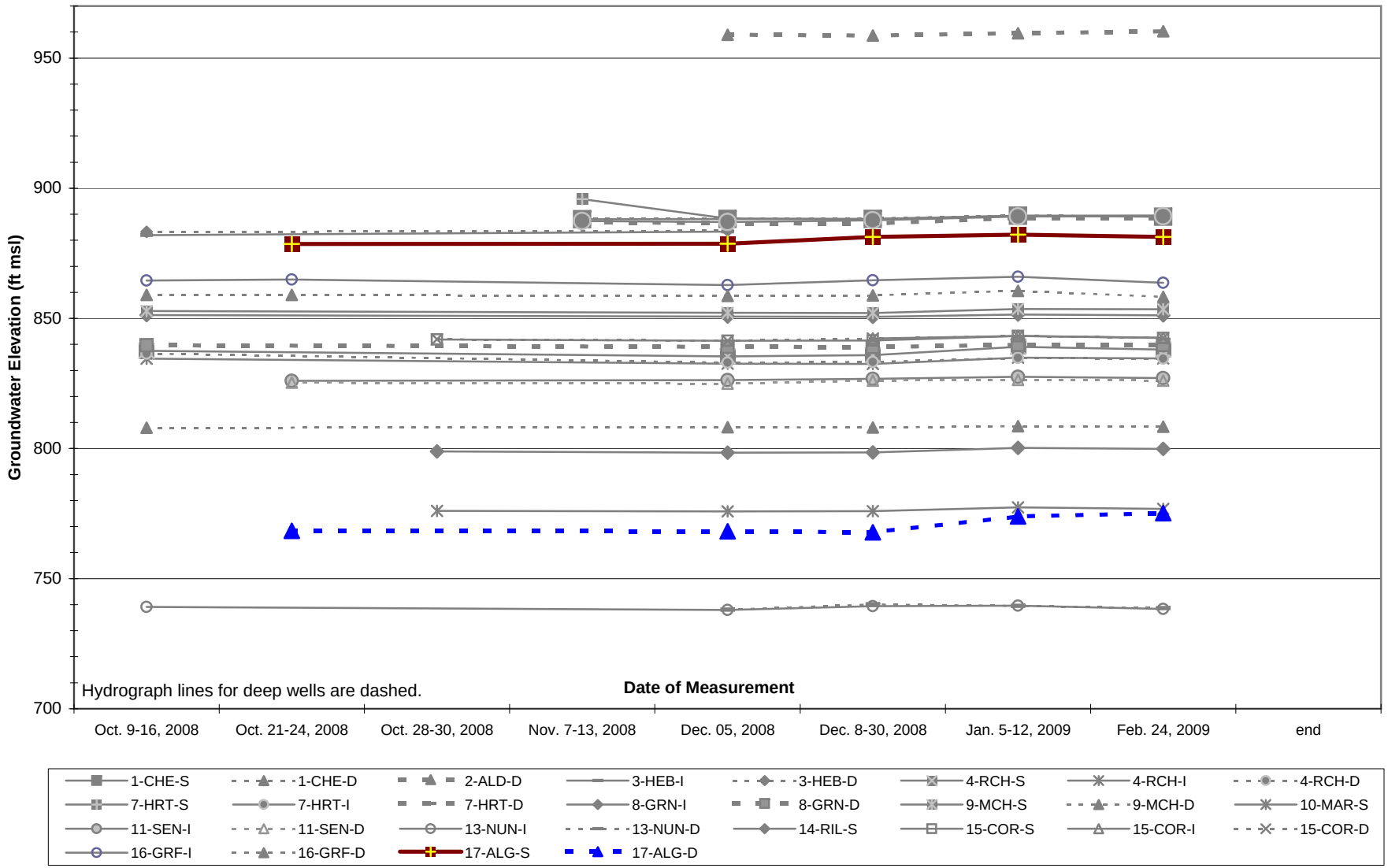
--- No Elevation

Well 17-Alg-S was frozen or partially frozen fror

Site 17 Groundwater Level Hydrograph
(includes ALL AECOM INSTALLED WELLS)

McHenry County Obervation Well Network

AECOM Project 09000-460

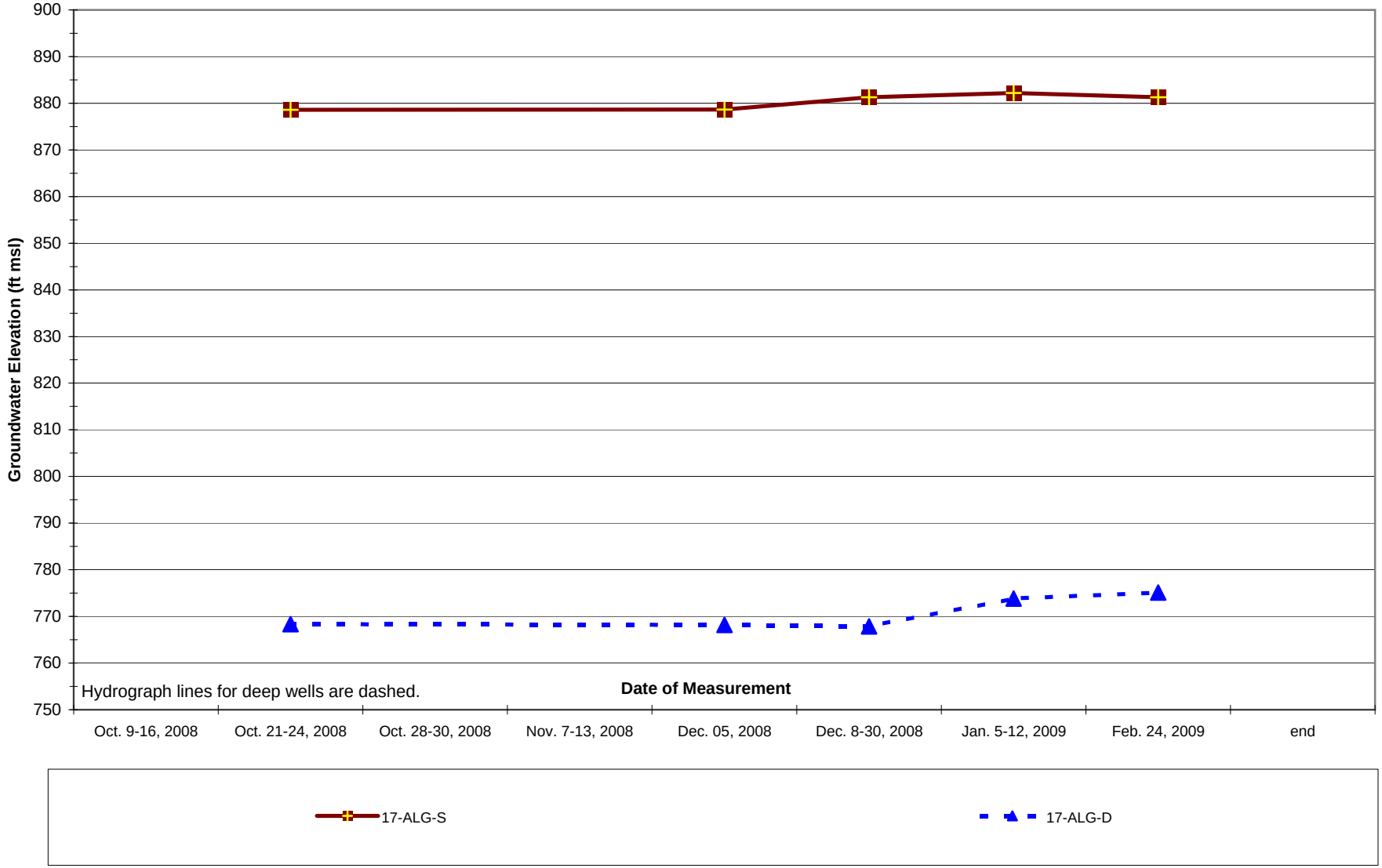


K:\PROJECTS\200804080\In_Progress\STS-McHenry Cty_WLs IN PROGRESS - figs for each site.xls

Site 17 Groundwater Level Hydrograph

McHenry County Obervation Well Network

AECOM Project 09000-460



K:\PROJECTS\200804080\In_Progress\STS-McHenry Cty_WLs IN PROGRESS - figs for each site.xls

Well Development Record

STS Consultants, Ltd.
11425 West Lake Park Drive
Milwaukee, Wisconsin 53224

Site Name: McHenry County

Well ID Number: 17-A2G-S

Date of Completion: 12/15/08

STS Job Number: 20080408O

Start Time: 14:10

End Time: 1550

Water color at start of development: Brown

Water color at end of development: Milky Clear

Amount of water removed during development:

Contained water? ☐ Yes ☒ No

If not contained, where water disposed? Ground

Well Development Methods:

- ☐ Surged with bailer and bailed
- ☐ Surged with block and bailed
- ☐ Surged with block, bailed & pumped
- ☐ Bailed only
- ☐ Pumped slowly
- ☐ Surged with bailer and pumped
- ☒ Surged with block and pumped
- ☐ Compressed Air
- ☐ Pumped only
- ☐ Other

Equipment Used

- ☐ PVC bailer
- ☐ Well wizard
- ☐ Bean or Moino pump (on drill rig)
- ☒ Surge block
- ☐ Whale pumps

Notes: Purge Start: 14:10

End: 1550

WL: 1.90'

Surge Start: 12:45

End: 13:00

WELL DEVELOPMENT FIELD RECORD

Job Name: McHenry County Job No. 20080408 0 Well No. 17-ALG-5

Developed By: Brian Schmidt Date of Install. _____ Sheet ____ of ____

Started Devel. 12/15/08 / _____ (DATE / TIME) Completed Devel. 12/15/08 / _____ (DATE / TIME)

W.L. Before Devel. _____ / _____ / _____ (DATE / TIME / DEPTH) After Devel. _____ / _____ / _____ (DATE / TIME / DEPTH)

Well Depth: Before Devel. _____ After Devel. _____ Well Dia. (in.) _____

Standing Water Column (ft.) _____ Standing Well Volume _____ gal.

Screen Length 5' Drilling Water Loss _____ gal.

DATE / TIME	VOLUME REMOVED (Gallons)	FIELD PARAMETERS SPEC. COND. (umhos/cm)	TEMP. (C°)	pH (s.u.)	TURB ~~Other~~	ORP	REMARKS
12/15/08 CAL	—	4630	4.6	4.05	0	—	
14:30	1GAL/MIN	786	3.6	7.52	999	—	
14:40	"	785	3.8	7.54	999	—	
14:50	"	779	4.6	7.80	999	—	
15:00	"	802	4.8	7.95	731	—	
15:10	"	803	5.6	8.01	485	—	
15:20	"	817	5.1	8.08	321	—	
15:30	"	816	5.4	8.16	225	—	
15:50	"	829	5.4	8.20	248	—	
		= TOTAL VOLUME REMOVED (Gallons)					

Development Method: Pump Stopped @ 1405
Tubing Broke

Notes:

Well Development Record

STS Consultants, Ltd.
11425 West Lake Park Drive
Milwaukee, Wisconsin 53224

Site Name: McHenry County

Well ID Number: 17-MW-5

Date of Completion: 12/16/08

STS Job Number: 200804080

Start Time: 1055

End Time: 1325

Water color at start of development: Brown

Water color at end of development: Milky Clear

Amount of water removed during development:

Contained water? ☐ Yes ☑ No

If not contained, where water disposed? Ground

Well Development Methods:

- ☐ Surged with bailer and bailed
- ☐ Surged with block and bailed
- ☐ Surged with block, bailed & pumped
- ☐ Bailed only
- ☐ Pumped slowly
- ☐ Surged with bailer and pumped
- ☑ Surged with block and pumped
- ☐ Compressed Air
- ☐ Pumped only
- ☐ Other

Equipment Used

- ☐ PVC bailer
- ☐ Well wizard
- ☐ Bean or Moino pump (on drill rig)
- ☑ Surge block
- ☐ Whale pumps

Notes:

WELL DEVELOPMENT FIELD RECORD

Job Name McHenry County Job No. 200804080 Well No. 17-AL6-5

Developed By Matt Hoole Date of Install. _____ Sheet ____ of ____

Started Devel. 12/16/08 / DATE / TIME Completed Devel. 12/16/08 / DATE / TIME

W.L. Before Devel. ____ / DATE / TIME / DEPTH After Devel. ____ / DATE / TIME / DEPTH

Well Depth: Before Devel. _____ After Devel. _____ Well Dia. (in.) _____

Standing Water Column (ft.) _____ Standing Well Volume _____ gal.

Screen Length 5' Drilling Water Loss _____ gal.

DATE / TIME	VOLUME REMOVED (Gallons)	FIELD PARAMETERS SPEC. COND. (umhos/cm)	TEMP. (C°)	pH (s.u.)	TURB ~~Other~~	ORP	REMARKS
12/16/08 Cal	-						
1055	1gal/min	.845	10.6	8.89	999		
1105		.827	10.4	8.66	999		
1115		.836	9.7	8.68	999		- Empty Flow Cell
1125		.840	9.6	8.61	999		
1135		.838	10.9	8.63	999		
1145		.824	11.4	8.62	999		- Empty Flow cell
1155		.833	11.0	8.51	713		
1205		.842	11.9	8.58	500		
1215		.833	11.6	8.55	387		
1225		.844	11.7	8.56	290		
1235		.870	9.1	8.57	192		- Speed up pump
1245		.828	11.6	8.55	630		
1255		.839	10.2	8.59	506		
		= TOTAL VOLUME REMOVED (Gallons)					

Development Method: - Start @ 0945
- Tube Froze @ 1005
- Start Pumping again @ 1045

Notes:

Time	Spec. Cond	Temp	pH	Turb
1305	.845	9.3	8.56	388
1315	.836	9.6	8.56	427
1325	.835	10.8	8.54	370

- started to slow

Well Development Record

STS Consultants, Ltd.
11425 West Lake Park Drive
Milwaukee, Wisconsin 53224

Site Name: McHenry County

Well ID Number: 17-AG-S

Date of Completion: 12/17/20

STS Job Number: 20020408O

Start Time: 1120

End Time: 1450

Water color at start of development: Brown

Water color at end of development: Milky Clear

Amount of water removed during development:

Contained water? ☐ Yes ☒ No

If not contained, where water disposed? Ground

Well Development Methods:

- ☐ Surged with bailer and bailed
- ☐ Surged with block and bailed
- ☐ Surged with block, bailed & pumped
- ☐ Bailed only
- ☐ Pumped slowly
- ☐ Surged with bailer and pumped
- ☐ Surged with block and pumped
- ☐ Compressed Air
- ☒ Pumped only
- ☐ Other

Equipment Used

- ☐ PVC bailer
- ☐ Well wizard
- ☐ Bean or Moino pump (on drill rig)
- ☐ Surge block
- ☒ Whale pumps

Notes: Purge Start: 1120

End: 1450

WL: 1.20'

WELL DEVELOPMENT FIELD RECORD

Job Name: McHenry County Job No.: 200804080 Well No.: 17-ALG-S

Developed By: Brian Schmidt Date of Install. _____ Sheet ____ of ____

Started Devel.: 12/17/08 / _____ (DATE / TIME) Completed Devel.: 12/17/08 / _____ (DATE / TIME)

W.L. Before Devel.: _____ / _____ / _____ (DATE / TIME / DEPTH) After Devel.: _____ / _____ / _____ (DATE / TIME / DEPTH)

Well Depth: Before Devel. _____ After Devel. _____ Well Dia. (in.) _____

Standing Water Column (ft.) _____ Standing Well Volume _____ gal.

Screen Length: 5' Drilling Water Loss _____ gal.

DATE / TIME	VOLUME REMOVED (Gallons)	FIELD PARAMETERS SPEC. COND. (umhos/cm)	TEMP. (C°)	pH (s.u.)	TURB ~~Other~~	ORP	REMARKS
12/17/08	CAL	4420	5.1	3.95	3	–	
1120	5gal/min	841	9.4	6.26	252	–	
1130	"	832	9.0	6.78	146	–	
1140	"	837	8.4	6.89	108	–	
1220	"	856	8.6	6.91	702	–	
1230	"	856	8.0	6.89	471	–	
1300	"	867	8.3	6.92	331	–	
1310	"	864	8.6	6.88	266	–	
1320	"	869	8.5	6.84	230	–	
1330	"	865	8.0	6.88	195	–	
1430	"	895	9.9	7.02	372	–	
1440	"	878	9.3	6.97	443	–	
1450	"	879	8.1	7.00	362	–	
		= TOTAL VOLUME REMOVED (Gallons)					

Development Method: Pump stopped @ 11:40 to let recharge, restart @ 12:15
Pump stopped @ 12:35 to let recharge, restart @ 13:00
Pump stopped @ 13:30 to let recharge, restart @ 1430
Pump stopped @ 1450

Notes:

Well Development Record

STS Consultants, Ltd.
11425 West Lake Park Drive
Milwaukee, Wisconsin 53224

Site Name: McHenry County

Well ID Number: 17-AL6-D

Date of Completion: 12/17/08

STS Job Number: 20080408O

Start Time: 1230

End Time: 1500

Water color at start of development: Gray

Water color at end of development: Milky Gray

Amount of water removed during development:

Contained water? ☐ Yes ☒ No

If not contained, where water disposed? Ground

Well Development Methods:

- ☐ Surged with bailer and bailed
- ☐ Surged with block and bailed
- ☐ Surged with block, bailed & pumped
- ☐ Bailed only
- ☐ Pumped slowly
- ☐ Surged with bailer and pumped
- ☐ Surged with block and pumped
- ☐ Compressed Air
- ☒ Pumped only
- ☐ Other

Equipment Used

- ☐ PVC bailer
- ☐ Well wizard
- ☐ Bean or Moino pump (on drill rig)
- ☐ Surge block
- ☐ Whale pumps
- ☒ Water Pump w/ Surge Block

Notes: Purge Start: 9:50, 1230

End: 1500

WL: 114.69'

WELL DEVELOPMENT FIELD RECORD

Job Name McHenry County Job No. 200804080 Well No. 17-AGG-D

Developed By Matt Hogle Date of Install. _____ Sheet ____ of ____

Started Devel. 12/17/08 / TIME Completed Devel. 12/17/08 / TIME

W.L. Before Devel. ____ / TIME / DEPTH After Devel. ____ / TIME / DEPTH

Well Depth: Before Devel. _____ After Devel. _____ Well Dia. (in.) _____

Standing Water Column (ft.) _____ Standing Well Volume _____ gal.

Screen Length 5' Drilling Water Loss _____ gal.

DATE / TIME	VOLUME REMOVED (Gallons)	FIELD PARAMETERS SPEC. COND. (umhos/cm)	TEMP. (C°)	pH (s.u.)	TURB ~~Other~~	ORP	REMARKS
12/17/08 1005	CAL	4610	5.1	3.95	3		
1330	~0.5 gal/min	697	9.7	7.15	999		
1340		687	10.0	7.33	999		
1350		669	9.5	7.38	999		
1400		664	9.8	7.35	999		
1410		660	10.0	7.33	999		
1420		660	9.9	7.35	999		
1430	~1 gal/min	657	10.3	7.53	999		
1450		657	9.8	7.19	999		
1500		657	9.7	7.32	999		
		= TOTAL VOLUME REMOVED (Gallons)					

Development Method: _____

Notes:

Well Development Record

STS Consultants, Ltd.
11425 West Lake Park Drive
Milwaukee, Wisconsin 53224

Site Name: McHenry County

Well ID Number: 17-ALG-D

Date of Completion: 12/30/08

STS Job Number: 208804080

Start Time: 14:00

End Time: 14:00

Water color at start of development:

Water color at end of development:

Amount of water removed during development: 0

Contained water? ☐ Yes ☒ No

If not contained, where water disposed? Ground

Well Development Methods:

- ☐ Surged with bailer and bailed
- ☐ Surged with block and bailed
- ☐ Surged with block, bailed & pumped
- ☐ Bailed only
- ☐ Pumped slowly
- ☐ Surged with bailer and pumped
- ☐ Surged with block and pumped
- ☐ Compressed Air
- ☒ Pumped only
- ☐ Other

Equipment Used

- ☐ PVC bailer
- ☐ Well wizard
- ☐ Bean or Moino pump (on drill rig)
- ☐ Surge block
- ☐ Whale pumps
- (x) WATERRA PUMP W/BLOCK

Notes:

PURGE START: 1400

END: 1445

WL ST: 111.91

WL END: SAME

WATERRA PUMP WOULDN'T PRODUCE

WELL DEVELOPMENT FIELD RECORD

Job Name _____ Job No. _____ Well No. _____

Developed By _____ Date of Install. _____ Sheet _____ of _____

Started Devel. _____ / _____ (DATE / TIME) Completed Devel. _____ / _____ (DATE / TIME)

W.L. Before Devel. _____ / _____ / _____ (DATE / TIME / DEPTH) After Devel. _____ / _____ / _____ (DATE / TIME / DEPTH)

Well Depth: Before Devel. _____ After Devel. _____ Well Dia. (in.) _____

Standing Water Column (ft.) _____ Standing Well Volume _____ gal.

Screen Length _____ Drilling Water Loss _____ gal.

DATE / TIME	VOLUME REMOVED (Gallons)	FIELD PARAMETERS SPEC. COND. (umhos/cm)	TEMP. (C°)	pH (s.u.)	TURB ~~Other~~	ORP	REMARKS
		= TOTAL VOLUME REMOVED (Gallons)					

Development Method: _____

Notes:

First Environmental Laboratories, Inc.

IL ELAP / NELAC Accreditation # 100292

1600 Shore Road • Naperville, Illinois 60563 • Phone (630) 778-1200 • Fax (630) 778-1233

Analytical Report

Client: AECOM ENVIRONMENT
Project ID: McHenry City (09000-460) # 2073737
Sample ID: 17-ALG-S
Sample No: 9-1394-003

Date Collected: 04/15/09
Time Collected: 14:35
Date Received: 04/17/09
Date Reported: 04/27/09

Analyte		Result	R.L.	Units	Flags
Total Metals	**Method: 6010B**		**Preparation Method 3010A**		
Analysis Date: 04/22/09			Preparation Date: 04/20/09		
Calcium		92.5	0.1	mg/L	
Iron		0.58	0.01	mg/L	
Magnesium		50.5	0.1	mg/L	
Potassium		2.0	0.1	mg/L	
Sodium		28.7	0.1	mg/L	
Chloride	**Method: 4500Cl, E**				
Analysis Date: 04/17/09					
Chloride		52	5	mg/L	
Alkalinity, Bicarbonate (CaCO3)	**Method: 2320B**				
Analysis Date: 04/21/09					
Alkalinity, Bicarbonate (CaCO3)		380	5	mg/L	
Alkalinity, Carbonate (CaCO3)	**Method: 2320B**				
Analysis Date: 04/21/09					
Alkalinity, Carbonate (CaCO3)		< 5	5	mg/L	
Sulfate	**Method: 4500S04,E**				
Analysis Date: 04/24/09					
Sulfate		53	15	mg/L	

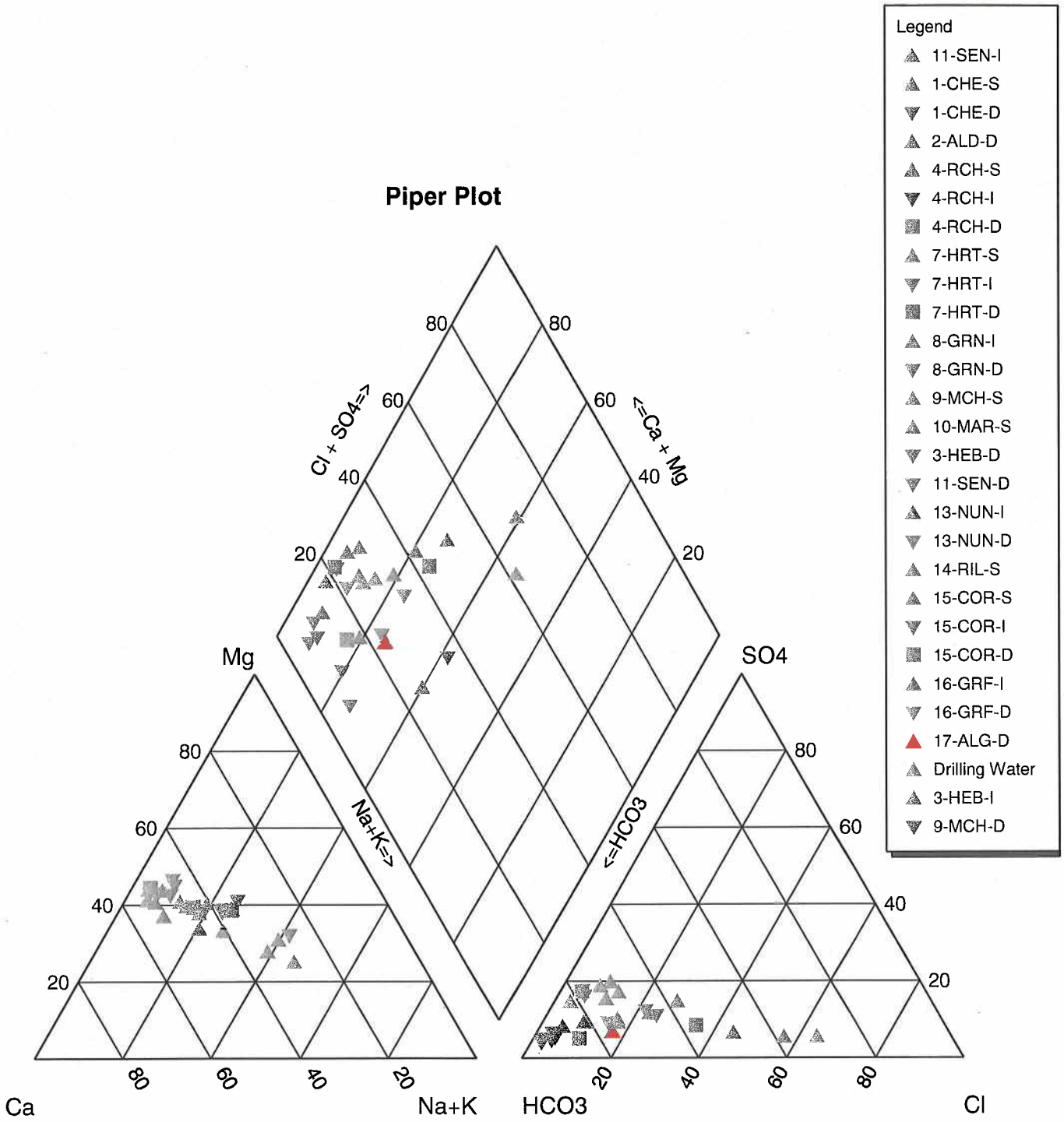
First Environmental Laboratories, Inc.
IL ELAP / NELAC Accreditation # 100292
1600 Shore Road • Naperville, Illinois 60563 • Phone (630) 778-1200 • Fax (630) 778-1233

Analytical Report

Client: STS CONSULTANTS (VERN)
Project ID: McHenry County 200804080
Sample ID: 17-ALG-D
Sample No: 9-0115-022

Date Collected: 01/06/09
Time Collected: 12:30
Date Received: 01/13/09
Date Reported: 01/20/09

Analyte		Result	R.L.	Units	Flags
Total Metals	**Method: 6020A**		**Preparation Method 3010A**		
Analysis Date: 01/16/09			Preparation Date: 01/16/09		
Calcium		69.6	0.1	mg/L	
Iron		0.42	0.01	mg/L	
Magnesium		46.1	0.1	mg/L	
Potassium		2.0	0.1	mg/L	
Sodium		55.6	0.1	mg/L	
Alkalinity, Bicarbonate (CaCO3)	**Method: 2320B**				
Analysis Date: 01/15/09 13:30					
Alkalinity, Bicarbonate (CaCO3)		350	5	mg/L	
Alkalinity, Carbonate (CaCO3)	**Method: 2320B**				
Analysis Date: 01/15/09 13:30					
Alkalinity, Carbonate (CaCO3)		< 5	5	mg/L	
Chloride	**Method: 4500Cl, E**				
Analysis Date: 01/14/09					
Chloride		55	5	mg/L	
Sulfate	**Method: 375.2R2.0**				
Analysis Date: 01/15/09					
Sulfate		31	15	mg/L	



DESCRIPTION: Piper Linear Diagram - Well Site #17

AECOM	PROJECT: McHenry County	PROJECT NO: 09000460
	CLIENT: Army Corps of Engineers	DATE: 7/30/2009

Field Well Sampling Sheet

Fill out the entire form. If it does not apply, mark N/A.

Project Name: McHenry City Wells STS Job No. 200304090 (09000 - 460)

Location: Algonquin Twp Tester: gmb

Well Number: 17-ALG-5 Date Sampled: 4/15/09

Previous Well Sampled: 3-HEB-I

GENERAL CONDITIONS:

					If Missing Replaced?
Surface Seal:	✓ Ok	☐ Damaged	☐ Missing:	Yes	No
Protector Pipe:	✓ Ok	☐ Damaged	☐ Missing:	Yes	No
Well Cap:	✓ Ok	☐ Damaged	☐ Missing:	Yes	No
Ambient Temperature: ___ °F		☐ Clear ☐ Cloudy	☐ Rain		

Depth to Water: 1.25 ft (from TPVC)

Depth to Bottom: 49.72' (from TPVC)

Length of Water: 48.5'

Free Product Observed: ☐ Yes ✓ No Thickness: —

PURGING/SAMPLING:

Well Purging Calculations: Amount to purge = 0.163 gallons/foot times height of water column in feet for one well volume

Purging Device: Solinst Bladder Sampling Device: Solinst Bladder

Volume Required: 24 gals ☐ See back of page for field readings during purge

Volume Purged: 8 gals (micro-purged)

Could Well Bail Dry? ☐ Yes ☐ No ?

Purging - Time Start: 1335 Time Ended: ___

Decon Method: Alconox Wash, Rinse, D.I Rinse

IN-SITU TESTING:

Not Turbid Turbidity: ☐ Turbid ☐ Opaque

Odor: —

Color Colorless

pH @ degrees C

Uncorrected Conductivity X

Water Temp. (from Cond.)

Comments:

SAMPLES COLLECTED

Vocs -	☐	Cyanide	☐
Metals -	✓	Hexchrome	☐
SVOC	☐	Alkalinity	✓
TOC	☐	Chloride	✓
Sulfide	☐	Ammonia	☐
Phenolics	☐	COD	☐

Well Purging Log

Date 4-15-09

Time	Temp (°C)	pH (s.u.)	Conductivity (umhos/cm)	Turbidity ~~ORP~~ (NTU)	Depth ~~DO~~ to GW (ft toc)	Pumping Rate (L/min)
1335 →	Start Purging					
1340	10.4	7.41	814	16	3.20 ft	0.5 L/min
1345	10.6	7.36	812	14	4.05 "	
1350	10.6	7.35	812	23	4.70 "	
1355	10.7	7.33	815	103	5.45 "	
1400	10.9	7.33	819	310	5.75 "	
1405	10.9	7.33	818	105	6.10 "	
1430	11.0	7.33	820	80	6.1 "	
1435 →	SAMPLE					
	11.0	7.33	820	65	6.1 "	

Field Well Sampling Sheet

Fill out the entire form. If it does not apply, mark N/A.

Project Name: McHenry County
STS Job No. 200804080
Location: Algonquin
Tester: Brian Schmidt
Well Number: 17-ALG-D
Date Sampled: 1/6/09
Previous Well Sampled: 15-COR-I

GENERAL CONDITIONS:

					If Missing Replaced?
Surface Seal:	X Ok		Damaged		Missing: Yes No
Protector Pipe:	X Ok		Damaged		Missing: Yes No
Well Cap:	X Ok		Damaged		Missing: Yes No
Ambient Temperature: 20 °F			Clear	X Cloudy	Rain

WELL DATA:

Measuring Device: Solinist Water Level Meter
Stick Up or Down: UP (from Ground Surface)
Depth to Water: 108.67 (from TPVC)
Depth to Bottom: 158 (from TPVC)
Length of Water:
Free Product Observed: ☐ Yes ☒ No Thickness: N/A

PURGING/SAMPLING:

Well Purging Calculations: Amount to purge = 0.163 gallons/foot times height of water column in feet for one well volume

Purging Device: Bladder Pump
Sampling Device: Bladder Pump
Volume Required:
☒ See back of page for field readings during purge
Volume Purged:
Could Well Bail Dry? ☐ Yes ☐ No
Purging - Time Start: 11:20
Time Ended: 12:35
Decon Method: Alconox

IN-SITU TESTING:

Turbidity: ☐ Turbid ☐ Opaque
Odor:
Color
pH @ degrees C
Uncorrected Conductivity X
Water Temp. (from Cond.)
Comments: ST: 1230

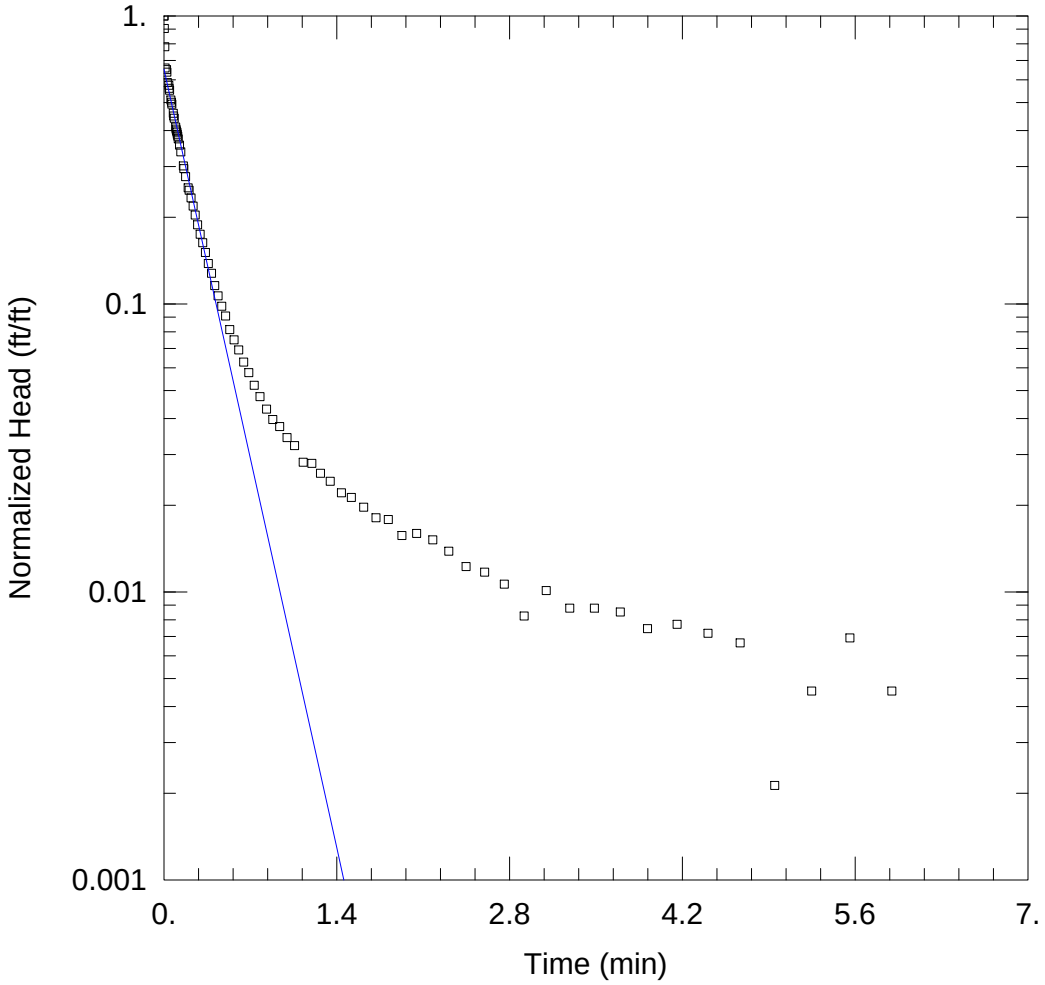
SAMPLES COLLECTED

Vocs -		Cyanide	
Metals -		Hexchrome	
SVOC		Alkalinity	
TOC		Chloride	
Sulfide		Ammonia	
Phenolics		COD	

Well Purging Log

Date 1/6/09

Time	Temp	pH	Conductivity	~~ORP~~ TURB	~~DO~~ RATE
1/6/09 1200	5.8	7.60	916	8	250 ml/min
1205	5.5	7.60	919	8	"
1210	5.3	7.59	918	7	"
1215	5.2	7.60	918	7	"
1220	5.1	7.60	917	7	"
1225	5.0	7.60	919	7	"
1230	5.0	7.61	919	7	"
ST: 1230					



WELL TEST ANALYSIS

Data Set: K:\PROJECTS\200804080\In_Progress\Troll-files\AQTESOLV-files\17-ALG-S_001_B&R.aqt
Date: 08/05/09 Time: 09:35:48

PROJECT INFORMATION

Company: AECOM
Client: USACE / McHenry Cty
Project: 09000-460 (h200804080)
Location: McHenry County, IL
Test Date: Feb. 22, 2009

AQUIFER DATA

Saturated Thickness: 6. ft
Anisotropy Ratio (Kz/Kr): 0.33

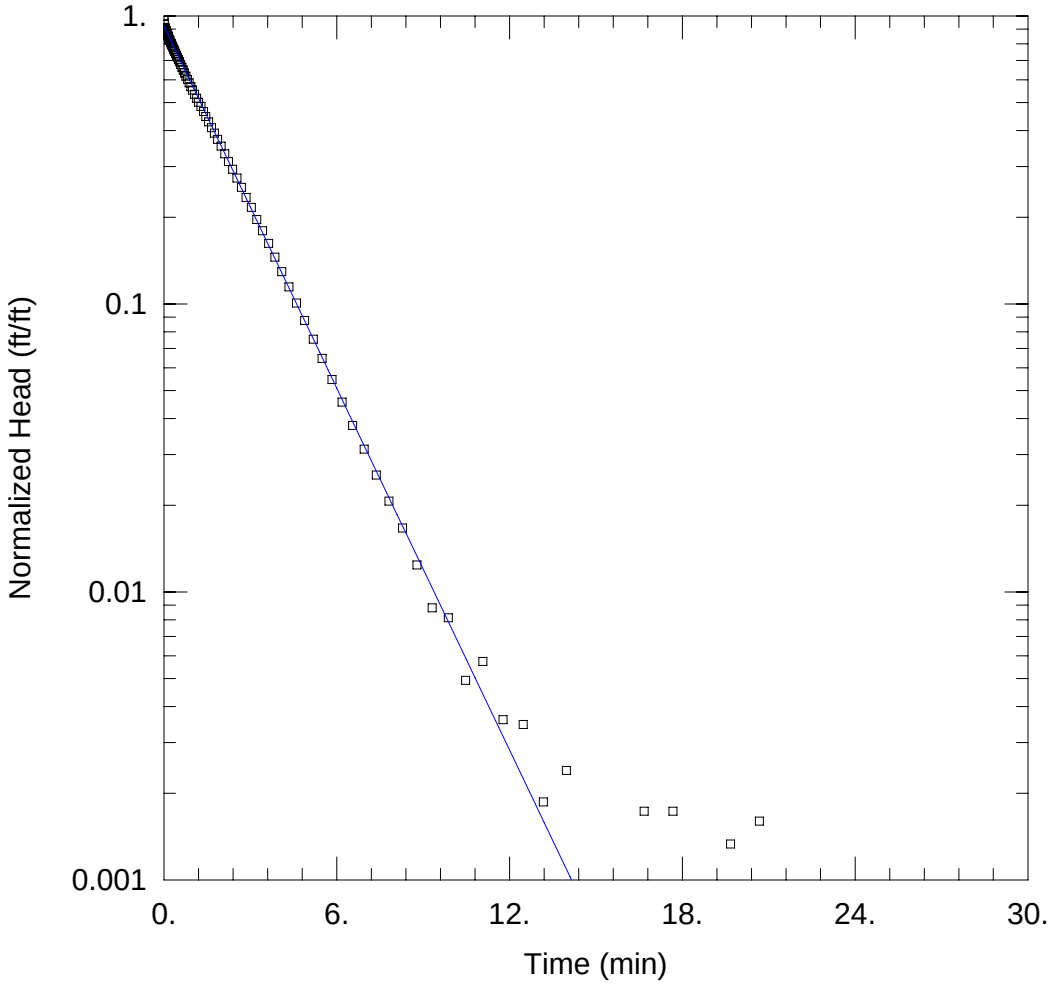
WELL DATA (17-ALG-S)

Initial Displacement: 3.757 ft
Total Well Penetration Depth: 48.5 ft
Casing Radius: 0.083 ft
Static Water Column Height: 49.2 ft
Screen Length: 5. ft
Well Radius: 0.25 ft

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 0.006223 cm/sec
y0 = 2.451 ft



WELL TEST ANALYSIS

Data Set: C:\...\17-ALG-D_001_B&R.aqt
Date: 04/07/09 Time: 15:55:00

PROJECT INFORMATION

Company: AECOM
Client: USACE / McHenry Cty
Project: 09000-460 (h200804080)
Location: McHenry County, IL
Test Date: Feb. 22, 2009

AQUIFER DATA

Saturated Thickness: 150. ft
Anisotropy Ratio (Kz/Kr): 0.33

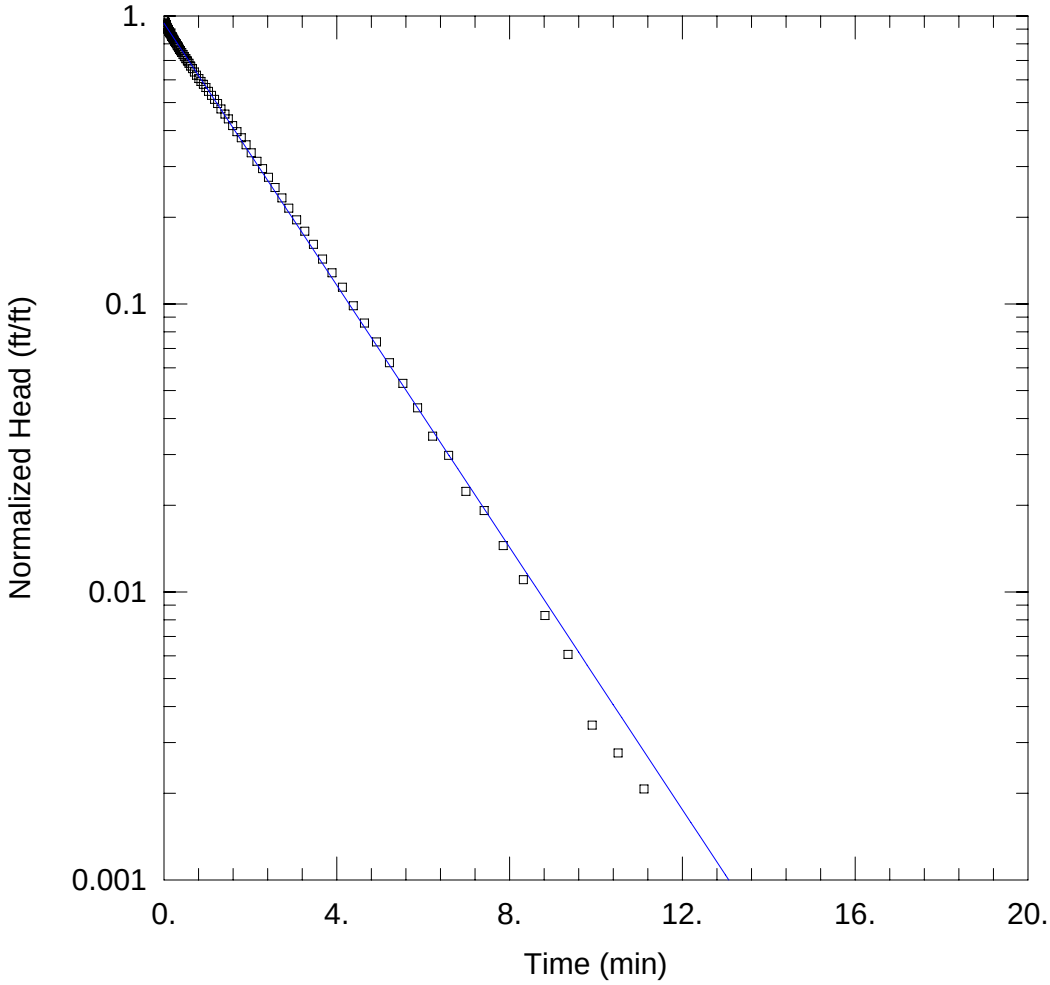
WELL DATA (17-ALG-D)

Initial Displacement: 7.5 ft
Total Well Penetration Depth: 8.5 ft
Casing Radius: 0.083 ft
Static Water Column Height: 76. ft
Screen Length: 4.5 ft
Well Radius: 0.25 ft
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 0.0004399 cm/sec
y0 = 6.912 ft



WELL TEST ANALYSIS

Data Set: C:\...\17-ALG-D_002_B&R.aqt
Date: 04/07/09 Time: 15:59:07

PROJECT INFORMATION

Company: AECOM
Client: USACE / McHenry Cty
Project: 09000-460 (h200804080)
Location: McHenry County, IL
Test Date: Feb. 22, 2009

AQUIFER DATA

Saturated Thickness: 150. ft
Anisotropy Ratio (Kz/Kr): 0.33

WELL DATA (17-ALG-D)

Initial Displacement: 7.25 ft
Total Well Penetration Depth: 8.5 ft
Casing Radius: 0.083 ft
Static Water Column Height: 76. ft
Screen Length: 4.5 ft
Well Radius: 0.25 ft
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Confined
Solution Method: Bouwer-Rice

K = 0.0004777 cm/sec
y0 = 6.84 ft

Additional Well Site Information

In-Situ Inc.

Calibration Report

Report Number: 20081217044917-140030

221 East Lincoln Avenue, Fort Collins, CO 80524 USA
1-970-498-1500, 1-800-446-7488, FAX: 1-970-498-1598
Visit us at www.in-situ.com

17-AUG-5

Instrument Details:

Instrument Model:	**Level TROLL 500**
Full Scale Pressure Range	**206.84 KPa (30 PSI) vented**
Serial Number:	**140030**

Calibration Details:

Calibration Result:	**PASS**
Calibration Date:	2008-12-17 04:49:17 (UTC)
Nominal Range of Applied Temperature:	-5 C to +50 C
Temperature Accuracy Specification:	+/- 0.1 C From 0 C to +50 C
Nominal Range of Applied Pressure:	0 KPa to 206.8 KPa (0.0 PSI to 30.0 PSI)
Pressure Accuracy Specification:	+/- 0.1 %FS from -5 C to +50 C, +/- 0.05 %FS at +15 C

Post-Calibration Check:

Parameter	Applied	Reported	Deviation
Pressure	30.0001	29.9991	-0.0033
Pressure	0.0007	-0.0010	-0.0054
Temperature	19.8110	19.8336	0.0226

Calibration Procedures and Equipment Used:

Automated calibration procedures used.
Manu Agilent Model 34970A SerialNo MY44002404
Manu Instrulab Model 3312A-14-15-24 SerialNo 31127
Manu Instrulab Model 406X-0031-01 SerialNo 31128-2
Manu MENSOR Model 600 SerialNo 620225
Manu Agilent Model 53131A SerialNo MY47000169
Manu MENSOR Model 600 SerialNo 621385

Notes:

1. Standards used in this calibration are traceable to the National Institute of Standards and Technology.
2. This calibration report shall not be reproduced, except in full, without the written approval of In-Situ, Inc.
3. A calibration interval of 12 to 18 months is recommended.
4. The post-calibration data is collected at nominal +20 C.
5. 1.0 PSI = 6.894757 KPa

Performed By: CB

Copyright © 2006 In-Situ, Inc.

In-Situ Inc.

Calibration Report

Report Number: 20090126144419-140972

221 East Lincoln Avenue, Fort Collins, CO 80524 USA
1-970-498-1500, 1-800-446-7488, FAX: 1-970-498-1598
Visit us at www.in-situ.com

17-AUG-D

Instrument Details:

Instrument Model:	**Level TROLL 500**
Full Scale Pressure Range	**206.84 KPa (30 PSI) vented**
Serial Number:	**140972**

Calibration Details:

Calibration Result:	**PASS**
Calibration Date:	2009-01-26 14:44:19 (UTC)
Nominal Range of Applied Temperature:	-5 C to +50 C
Temperature Accuracy Specification:	+/- 0.1 C From 0 C to +50 C
Nominal Range of Applied Pressure:	0 KPa to 206.8 KPa (0.0 PSI to 30.0 PSI)
Pressure Accuracy Specification:	+/- 0.1 %FS from -5 C to +50 C, +/- 0.05 %FS at +15 C

Post-Calibration Check:

Parameter	Applied	Reported	Deviation
Pressure	30.0001	30.0017	0.0052
Pressure	-0.0002	0.0019	0.0069
Temperature	19.9580	19.9642	0.0062

Calibration Procedures and Equipment Used:

Automated calibration procedures used.
Manu Agilent Model 34970A SerialNo MY41012474
Manu Instrulab Model 3312A-14-15-24 SerialNo 31102-(41037)
Manu Instrulab Model 406X-0031-01 SerialNo 31128-1
Manu MENSOR Model 600 SerialNo 621218
Manu Agilent Model 53131A SerialNo MY47000169
Manu MENSOR Model 600 SerialNo 621385

Notes:

1. Standards used in this calibration are traceable to the National Institute of Standards and Technology.
2. This calibration report shall not be reproduced, except in full, without the written approval of In-Situ, Inc.
3. A calibration interval of 12 to 18 months is recommended.
4. The post-calibration data is collected at nominal +20 C.
5. 1.0 PSI = 6.894757 KPa

Performed By: JBO

Copyright © 2006 In-Situ, Inc.

Algonquin Township Well Site (view south)

Algonquin Township Well Site

Algonquin Township Well Site

Algonquin Township Well Site

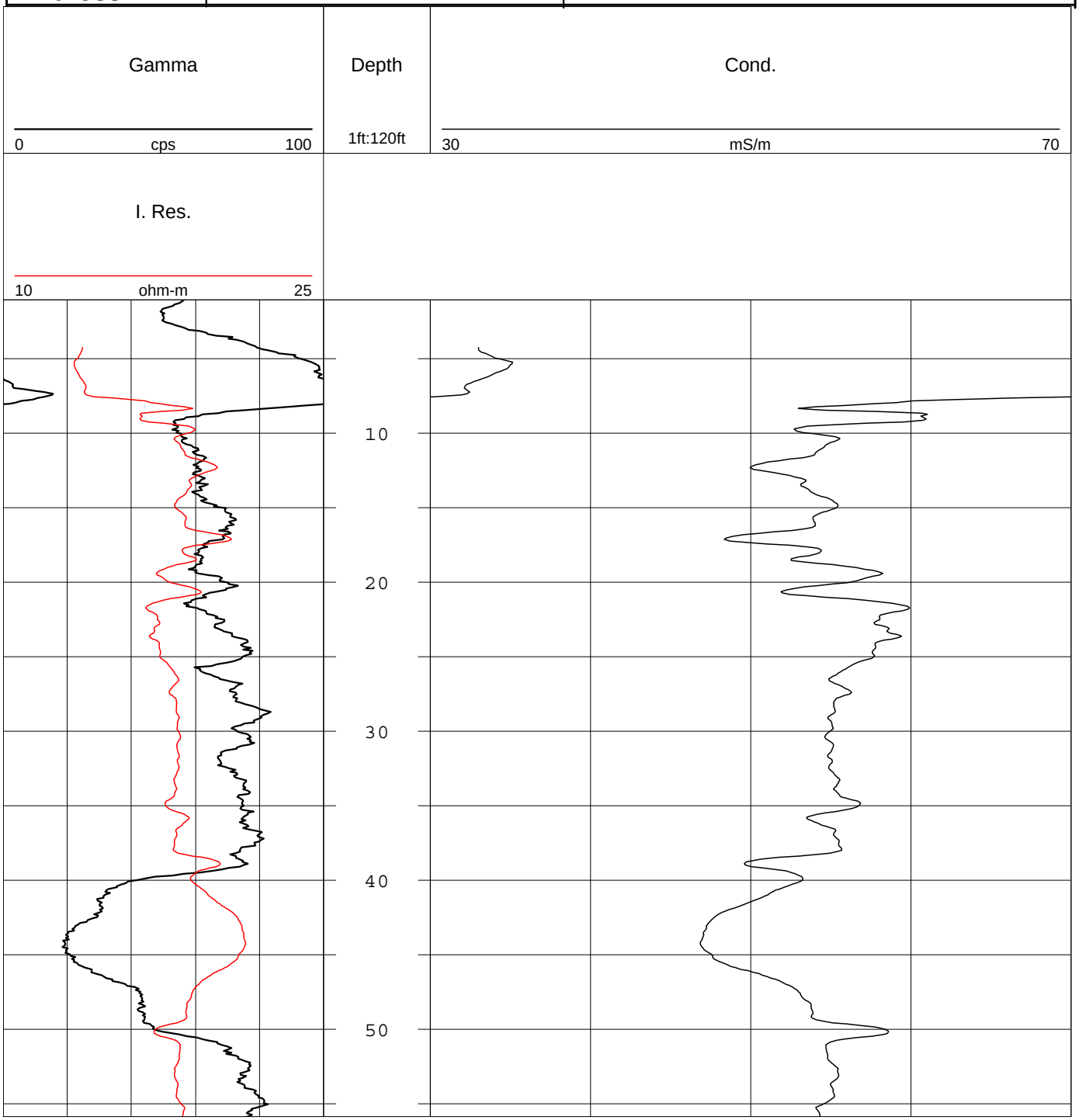
Algonquin Township Well Site

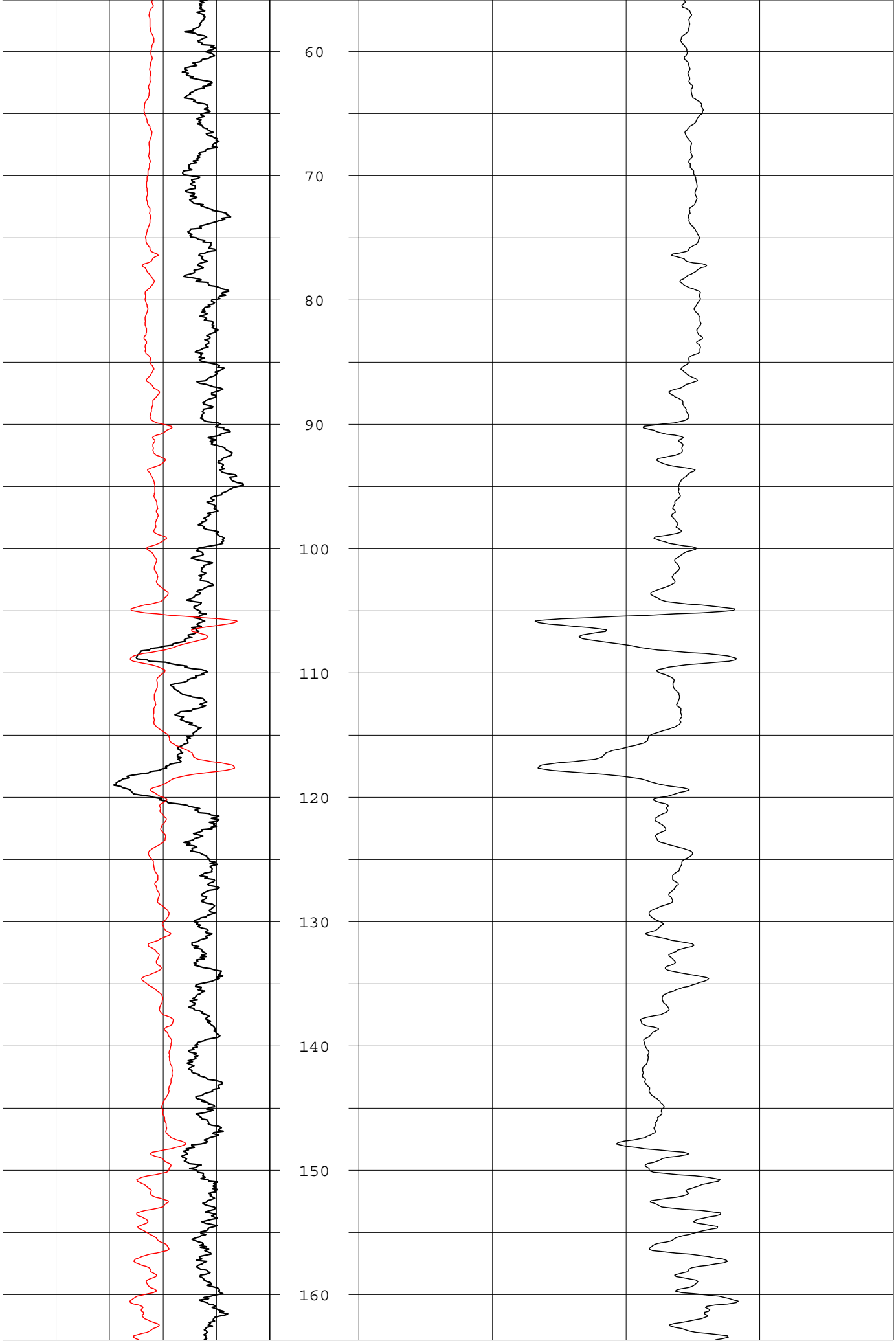
Algonquin Township Well Site

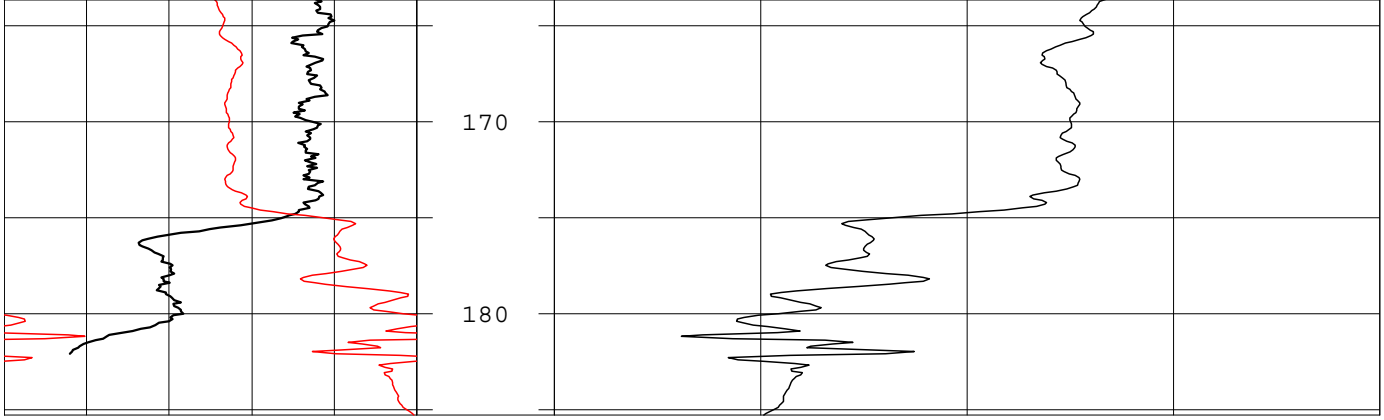
Algonquin Township Well Site

COMPANY:	McHenry County & US Corp of Engineers
Location:	ROTHSCHILD PARCEL

Well	#17 MCH ALGONQUIN TWN			OTHER SERVICES
Date	10/22/08	BH Fluid	Formation	113.92' BTC
Casing	2" PVC +2.5 to -187.6' bgs			
File Name	MCHTH17-08EMGAM			
Depth Driller	187.6' bgs			
Depth Logger	187.66' bgs			
Logged by:	T. YOUNG			
Witness:	NOT WITNESSED			




60
70
80
90
100
110
120
130
140
150
160


170
180

Appendix B

Equipment Procurement Documentation

Solinst™ Integra Bladder Pump Data Sheet

In-Situ™ Documentation

Solinst™ Integra Bladder Pump Data Sheet

Integra Bladder Pump

Model 407 Data Sheet

Bladder Pump

Model 407

The Solinst Integra® Bladder Pump allows consistent, high quality samples in all types of applications. It offers excellent performance and reliability. With Integra Bladder Pumps there is the assurance that there is no air/water contact during sampling. It meets the most rigorous US EPA standards for VOC groundwater monitoring.

The bladder ensures that drive air or gas does not contact the sample, thus avoiding degassing or contamination of the sample. Integra Pumps are rugged and long lasting. Teflon® bladders have a 10-year warranty, while less expensive polyethylene bladders are available for those that prefer to change bladders after each use. Both bladders and intake filters are easily replaced in the field in just a few minutes. No special tools required.

Excellent for either regular flow or low flow sampling, the stainless steel pumps can lift from depths up to 500 ft (150 m) below grade. The PVC Integra operates up to 100 ft (30 m) below grade.

Low Flow Purge and Sampling

Low flow sampling offers excellent quality samples by reducing turbulence. It also reduces purge volumes, and thus sampling time and disposal costs. When using the Solinst Model 466 Electronic Pump Control Unit, the Solinst Integra Bladder Pump can be adjusted to provide continuous output of 100 ml/min. or less.

Use of a Flow-Through Cell System during low flow sampling, allows the continuous analysis of purge water, in-line, as it flows, so that sampling can begin as soon as the readings stabilize.

Packers are also available to further reduce purge volumes and to speed sampling times.

Features

Stainless Steel or Low Cost PVC: 1.66" Ø (42 mm) and 1" Ø (25 mm) in 316 stainless steel. 1.66" Ø (42 mm) in PVC.

Non-Vertical Applications: Pumps operate effectively at almost any angle and can be placed under landfills, tailings, storage tanks or contaminant plumes.

Zero-Submergence Capability: Pumps can sample from low yield wells and allow complete emptying of the well.

Leachate/Product Pumping: Pneumatic drive pumps are well suited for pumping contaminant liquids. Strong solvents and corrosive chemicals can be easily and economically pumped.

Survives Dry Pumping, Dirty Air and Sand: Integra bladders are not damaged by operation in sediment laden water, or in dry pumping conditions.

Freeze Protection Kit: Optional accessory available to prevent freezing in the sample line.

Benefits

High Quality Samples: Consistently accurate samples with excellent VOC sample integrity.

Simplicity: The controller, air compressor and flow-through cell can be easily transported by one person to any site. Hookup to the pump is by compression fittings. Low purge volumes ensure rapid sampling.

Cost Savings: Reduced need for repeat sampling and shorter time required for each sampling round.

Bladders: Teflon Bladders are guaranteed for 10 years. Inexpensive polyethylene is also available.

® *Solinst and Integra are registered trademarks of Solinst Canada Ltd.*

® *Teflon is a registered trademark of Dupont Corp.*

The Integra Bladder Pump

Integras are manufactured from 316 stainless steel and have Teflon check balls. The bladder most frequently used is Teflon, however polyethylene bladders are also available. This is the ideal sampling pump for most types of municipal, industrial and general environmental applications, especially where VOC analysis of the sample is important.

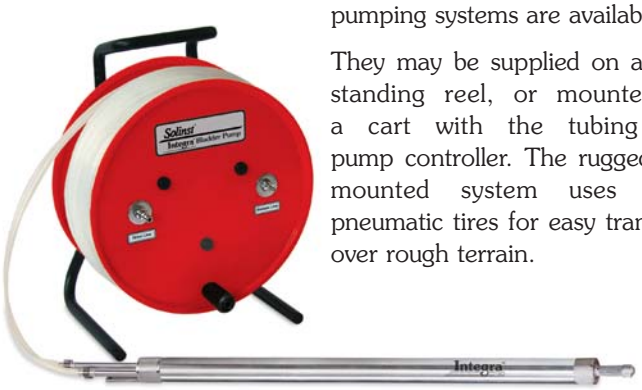
For metals analysis and situations with highly corrosive liquids, the PVC Integra is more suitable. It has Teflon check balls, a porous polyethylene screen and may have either a Teflon or a polyethylene bladder. The low cost of the PVC pump also makes this a perfect choice for situations where there is a limited budget, but dedicated bladder pumps would be preferred.

The pump body of the standard Integra is a convenient 1.66" dia. (42 mm) and comes in lengths of 2 ft and 4 ft (0.6 m and 1.2 m). 1" dia. (25 mm) bladder pumps are also available for narrower applications and for use in the Waterloo Multilevel System. (See Model 401 Data Sheet.)

Portable Integra Pumps

For less frequent sampling, and to allow access to multiple monitoring wells, even in remote locations, portable Integra pumping systems are available.

They may be supplied on a free-standing reel, or mounted on a cart with the tubing and pump controller. The rugged cart mounted system uses large pneumatic tires for easy transport over rough terrain.



Bladder Pump Stainless Steel 1" (25 mm) on Free-standing Reel

Converts Easily to Pneumatic DVP

The 1.66" dia. (42 mm) by 2 ft (0.6 m) Stainless Steel Integra Bladder Pump (42 x 610 mm) utilizes most of the same parts as the pneumatic drive Solinst 1.66" Double Valve Pump (DVP). The DVP can operate from greater depths and provide higher flow rates. Conversion from an Integra Bladder Pump to a DVP and back again is quick and easy (approx. 2 min.) and requires no tools.

Integra Bladder Pumps available in Stainless Steel 1" and 1.66" (25 mm and 42 mm) or PVC 1.66" (42 mm)

Dedicated Systems

For long term monitoring it is always best to dedicate Integra Pumps. This avoids cross-contamination and saves time without the need to decontaminate between sampling events. There is the assurance of no air/water contact during sampling, and the confidence that no cross-contamination will occur from the use of portable equipment.

Integra well caps are designed for ease of use. The vented PVC caps have a quick-connect attachment for the controller unit/air supply. Fittings are provided for both 1/4" OD (6 mm) and 3/8" OD (9 mm) tubing. Each cap comes with a 3 ft (0.9 m) length of discharge line, which is easily replaced, as required.

For water level monitoring there is an access hole to fit a Solinst Model 101 Water Level Meter. An eyebolt is provided for a pump support cable or for suspension of a Solinst Levelogger, (see Model 3001 Data Sheet) or other device.

Dedicated Well Caps

The caps slip easily onto 2" dia. (50 mm) wells. Adaptors to fit 4" dia. (100 mm) or other well sizes are also available. The cap seals in place with an o-ring, and comes with a wire connected protective cover. Low profile wellheads are also available for flush mount casing applications.

Dedicated Well Caps 2" and 4" (50 mm and 100 mm)

Pump Controllers

The Electronic Control Unit uses 8 AA batteries that provide up to 30 hours of continuous use. It is fully automatic with preset sample modes to give a variety of useful drive and vent cycles. These can be further adjusted manually to optimize the flow. It allows faster purge rates and precise low flow control to ensure a representative sample at 100 ml/min or less when sampling for VOCs. The standard Model 466 gives up to 160 psi and the 466 HP offers up to 250 psi output.

These convenient boxes are rugged, dependable and suitable for all environments. Quick-connect fittings allow instant attachment to dedicated well caps, portable reel units and through an in-line dryer to an air compressor or compressed gas source.

12V Oil-Less Air Compressor

The Solinst 12 Volt Compressor is lightweight 21 lbs (9.5 kg), compact, and ideal for field use, especially low flow applications of less than 100 ft (30 m) depths.

The compressor operates using 12 volt DC power source, such as a car or truck vehicle battery, and comes with alligator clips. The compressor operates at up to 125 psi and is equipped with a 2 US gallon (7.6 L) air tank which is rated to 150 psi.

12V Compressor

Easy Decon or Disposable Polyethylene

Integra Bladder Pumps are easy to decontaminate. Everything is very accessible. The tubing may simply be flushed or it is easily replaced.

The pump is quick to disassemble and the bladders and screens are simple to replace in the field. No tools required. Inexpensive polyethylene bladders can be quickly replaced to suit regulatory requirements.

Electronic Control Unit
Model 466

Tubing

The standard tubing is 1/4" (6 mm) single line or 1/4" (6 mm) OD dual skip-bonded LDPE. Teflon-lined LDPE and other tubing sizes are also available.

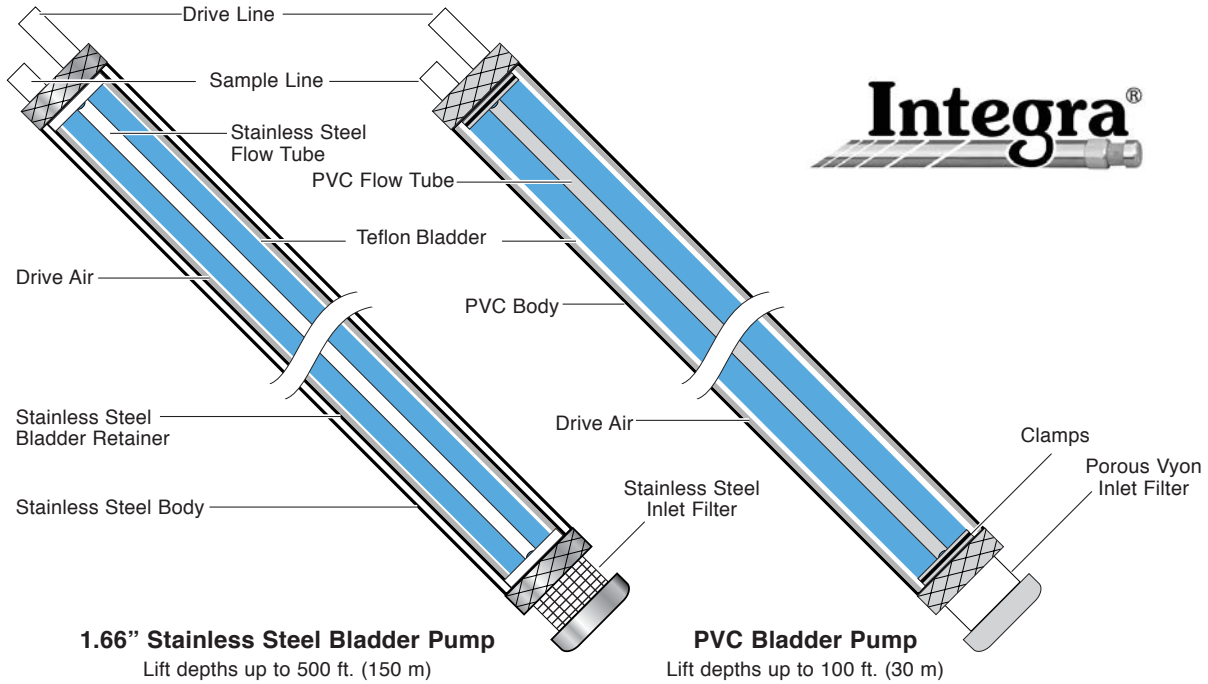
Solinst provides dedicated systems with individual drive and sample lines so that the cost of replacing the sample line is minimized. Dedicated systems can come pre-assembled to the length you need, at no extra charge. Portable systems are provided with 1/4" (6 mm) dual skip-bonded tubing for ease of operation.

Filters and Packers

Integra Stainless Steel Bladder Pumps come complete with a 50 mesh intake filter over the sample inlet. These filters are very easy to replace. If required, Solinst also supplies disposable in-line filters which are used on the sample discharge tube. They are adaptable to fit many sizes of tubing.

Model 800 Low-Pressure Packers can be used with Integra Pumps to minimize purge times by reducing purge volumes. This reduces the cost of water disposal and labour. Packers are available in single point or straddle packer designs, and in sizes to fit 2" (50 mm) to 5" (127 mm) dia. wells. (See Model 800 Data Sheet.)

Model 800 Packers
3.7" and 1.8" (94 mm and 46 mm)



Bladder Pump Operation

When an Integra Bladder Pump is lowered into a well, hydraulic pressure allows formation water to enter the central Teflon chamber (the bladder) through the inlet filter.

When compressed air or gas is applied to the drive line it pressurizes the space around the bladder, causing it to collapse and pushes the water up into the sample line.

Check valves ensure that no water flows back down through the pump or into the formation.

When compressed air or gas is vented (released), more formation water enters the bladder. When the pressure is reapplied, the fresh formation water is pushed up towards the surface.

The pressure/vent cycles are repeated, providing a steady flow of water up the sample line, without any stripping of volatiles from the sample. Turbidity is minimized due to the low flow rates and the gentle pumping action.

Thus a high quality VOC groundwater sample is obtained.

Higher Flow Rates

When larger purge volumes are required, Solinst Integra Bladder Pumps can deliver flow rates up to 2 L/min.

Alternatively a simple conversion kit can be used to quickly turn a stainless steel Integra Bladder Pump into a Solinst Double Valve Pump (DVP). These pneumatic drive DVPs can provide higher flow rates and sample from greater depths than most bladder pumps.

Flow rates vary with depth of pump below surface, depth below water level, size of drive and sample tubing, drive and vent cycle times, gas pressure applied and aquifer recharge.

Flow rates of the Integra Bladder Pump and the DVP compare favourably with published data for similar types and sizes of pumps, under similar conditions. For example:

1.66" x 2 ft (42 mm x 610 mm) Bladder Pump at 100 psi, with 1/4" OD drive line and 3/8" OD sample line; 50 ft (15 m) below grade with 25 ft (7.5 m) below water level gives 2 L/min.

Printed in Canada
August 13, 2007

For further information contact: Solinst Canada Ltd.
Fax: +1 (905) 873-1992; (800) 516-9081 Tel: +1 (905) 873-2255; (800) 661-2023
35 Todd Road, Georgetown, Ontario, Canada L7G 4R8
Web Site: www.solinst.com E-mail: instruments@solinst.com

In-Situ™ Documentation

Quick Start Guides

Software License Certificates

Artesian Well Cable Information Sheet

Material Safety Data Sheet – Activated Dessicant

Cable Calibration Reports

Level TROLL® 300 500 700
QUICK START GUIDE

1 **Install Win-Situ® 5** to your local hard drive from the In-Situ software CD or the In-Situ website. Optional: Install the desktop component of Win-Situ® Mobile to the same computer. Then use the In-Situ Software Manager to install it on the RuggedReader® at your next ActiveSync® connection.

Tip: If using a USB TROLL Com, be sure to select the option "Install USB TROLL Com Drivers" when installing Win-Situ.

2 **Attach** a TROLL Com to the Level TROLL or to its cable.

Tip: Mating the cable connectors is easy after you do it once. See the steps and photos on the back of this Quick Start Guide.

3 **Plug** the TROLL Com into a USB or serial port on a desktop/laptop PC, or into the serial port on a RuggedReader handheld PDA.

After plugging in a USB TROLL Com, follow the prompts to install the drivers. Then use Windows® Device Manager to determine which COM port the USB TROLL Com is using.

4 **Launch** the software:

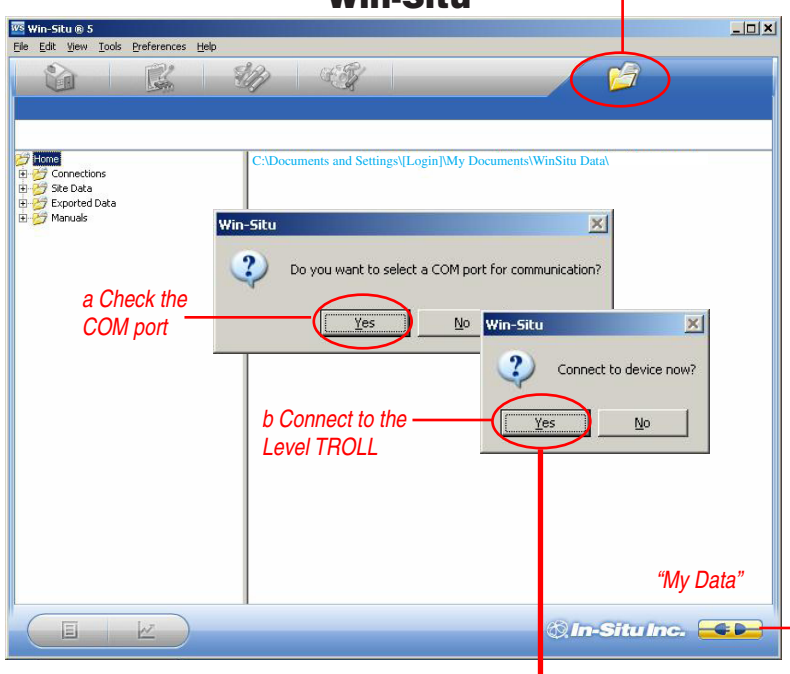
Win-Situ: Double-click the desktop shortcut

Win-Situ Mobile: Tap the Start menu, tap Win-Situ Mobile

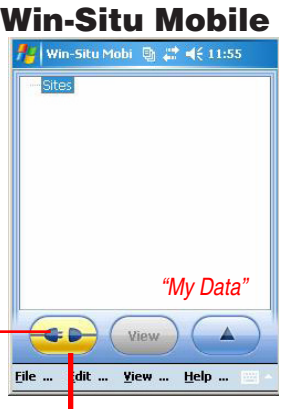
5 **Win-Situ** launches. The screen shows the My Data tab. **a.** On first connection, be sure to select the correct COM port for a USB connection. **b.** Then connect to the device.

Win-Situ Mobile launches at the My Data tab. Tap the Connect Button to connect to the Level TROLL.

Win-Situ



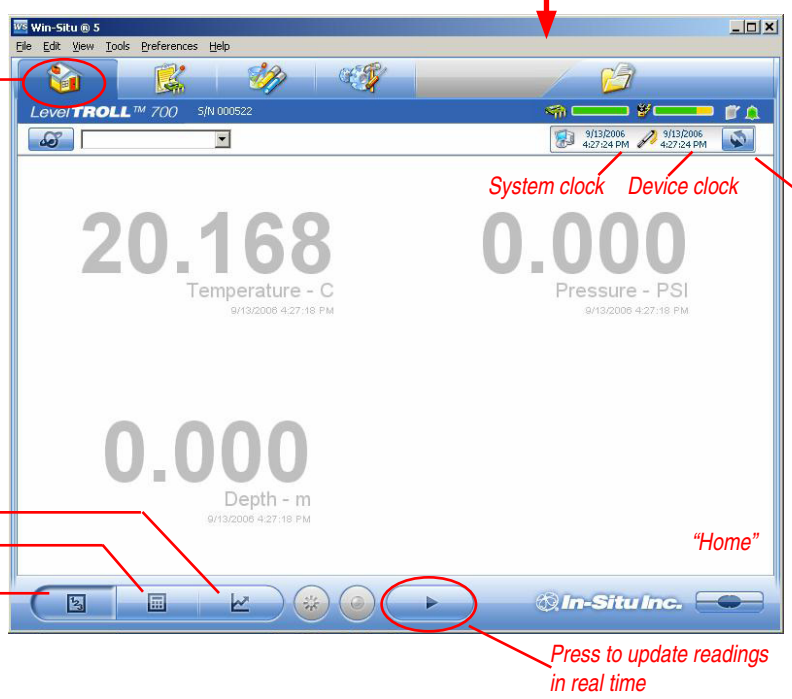
Win-Situ Mobile

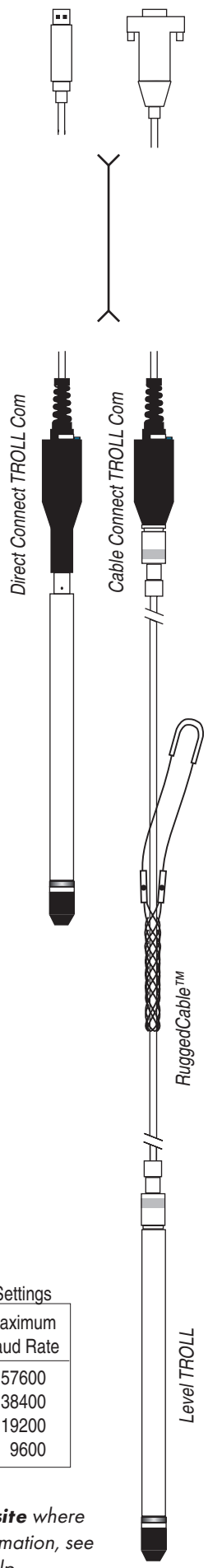


Not connected

Connected

When connected, focus shifts to the Home tab. Readings are shown in "meter" view. Values in gray are not being updated in real time.

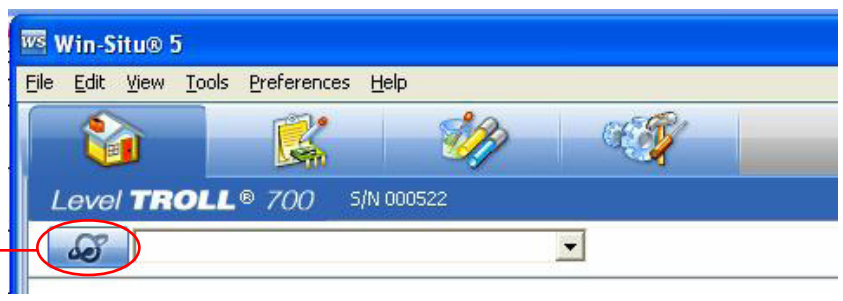




Recommended Baud Settings

Cable Length		Maximum
Meters	Feet	Baud Rate
300	1000	57600
450	1500	38400
1200	4000	19200
>1200	>4000	9600

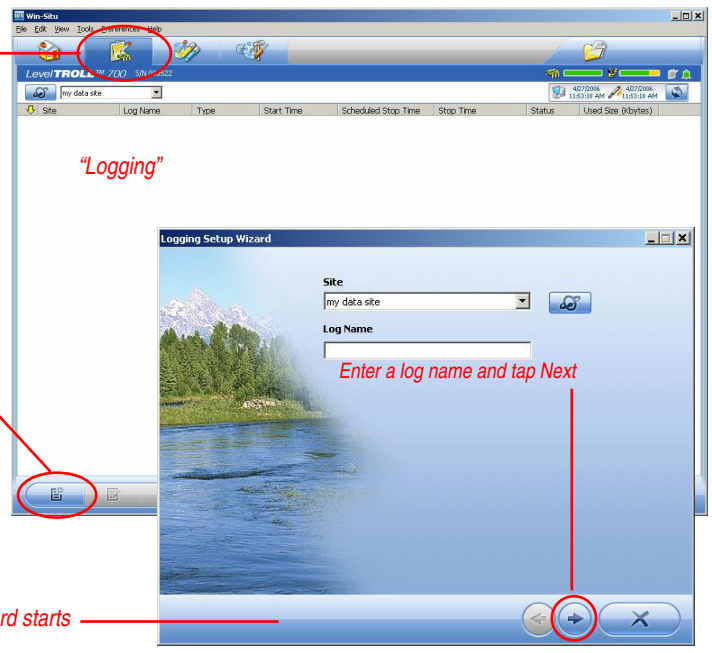
6 **Set up a Site:** Click the Site Button , select the Default Site or click the New button to set up a custom site. The site name can have up to 32 characters. Location coordinates are optional.



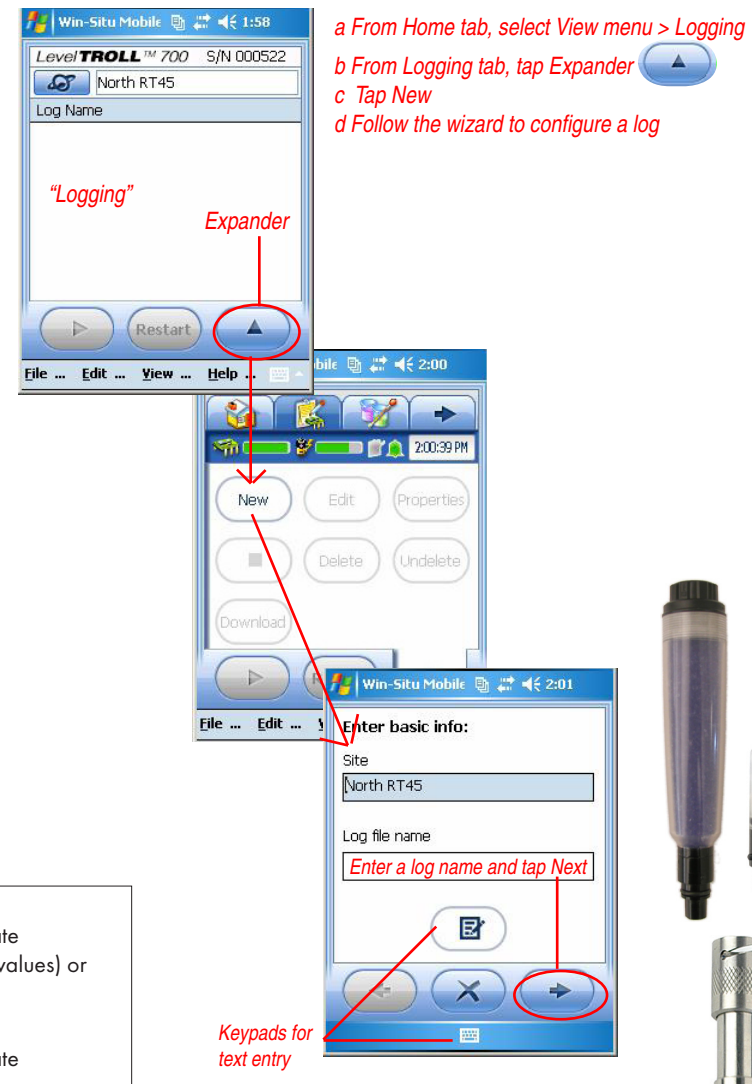
*All data logs are associated with the **site** where the data were logged. For more information, see Win-Situ Help, or Win-Situ Mobile Help.*

7 To set up a data log, follow the steps in the Logging Setup Wizard.

Win-Situ



Win-Situ Mobile



For help, see the Help menu in Win-Situ or Win-Situ Mobile. The complete Level TROLL operator's manual is available on the In-Situ software CD and website.

Typical Level Settings

AQUIFER TESTING deployment on cable or wire	Level Output Specific Gravity Reference	Depth to Water (DTW)/Drawdown Choose fresh, brackish, or salt water as appropriate Set first logged reading to: zero (log shows delta values) or with probe installed, enter measured DTW
SURFACE-WATER PROFILING deployment on cable	Level Output Specific Gravity	Depth of Probe Choose fresh, brackish, or salt water as appropriate
LONG-TERM MONITORING deployment on cable or wire	Level Output Specific Gravity Reference	Elevation or Gauge Height Choose fresh, brackish, or salt water as appropriate Set first logged reading to: measured elevation or gauge height, or with probe installed, enter elevation or gauge height

8 When you are finished programming, disconnect the TROLL Com and reattach the desiccant—or attach a Twist-Lock Hanger and suspension cable for a non-vented instrument—and install the Level TROLL in its monitoring location.

If logged data from an In-Situ BaroTROLL® will be used to post-correct LevelTROLL data logs, the BaroTROLL log should start near the time the Level TROLL log starts. Be sure both devices' clocks are synchronized.

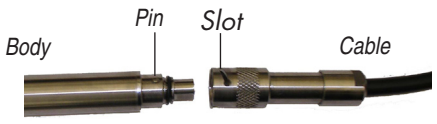
Twist-Lock Connectors

Mating the Twist-Lock connectors is easy after you do it once to get a feel for the process.

Note that each connector has a flat side.

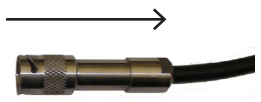
Level TROLL, Cable Connect TROLL Com — *Cable*

Note the pins on the body connector (one on each side) and the slots on the cable connector (one on each side).



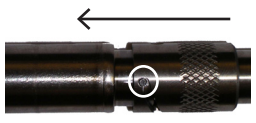
To mate the connectors:

1 Slide back the sleeve on the cable connector.



2 Orient the "flats" so they will mate up, and insert the body connector firmly into the cable connector.

3 Slide the sleeve on the cable connector toward the body until the pin on the body pops into the round hole in the slot on the cable connector.



4 Grasp the cable connector in one hand and the Level TROLL in the other. Push and twist firmly so that the pin slides along the slot and snaps securely into the hole at the other end.

Non-Vented Level TROLL

Range	Effective Range*		Usable Depth	
PSIA	PSIA	kPa	Meters	Feet
30	15.5	106.9	0-10.9	0-35.8
100	85.5	589.5	0-60.1	0-197.3
300	285.5	1968	0-200.7	0-658.7
500	485.5	3347	0-341.3	0-1120

** At sea level (14.5 PSI atmospheric pressure).*

Vented Level TROLL

Range		Usable Depth	
PSIG	kPa	Meters	Feet
5	34.5	0-3.5	0-11.5
15	103.4	0-11	0-35
30	206.8	0-21	0-69
100	689.5	0-70	0-231
300	2068	0-210	0-692
500	3447	0-351	0-1153

Guidelines & Precautions: If the holes in the nose cone are plugged, swish the Level TROLL in a bucket of water. In severe cases, remove the nose cone to rinse out the holes. Or try soaking overnight in a mild acidic solution, such as household vinegar. *Don't dig or scrape in the pressure sensor opening!* The sensitive pressure sensor diaphragm is vulnerable when exposed.

Damage caused by digging or scraping in the pressure sensor opening to remove debris is not covered by the warranty.

Nose cone

1 800 446 7488
(toll-free, US and Canada) or 970 498 1500 **www.in-situ.com**

Due to continuing product development this information is subject to change without notice. In-Situ and the In-Situ logo, Win-Situ, TROLL, BaroTROLL, RuggedReader, and RuggedCable are trademarks or registered trademarks of In-Situ Inc. Microsoft, Windows, Excel, Internet Explorer, and ActiveSync are trademarks or registered trademarks of Microsoft Corporation. Copyright © 2005 – 2008 by In-Situ Inc. All rights reserved.

0051120 rev. 005 4/08

In-Situ Inc.

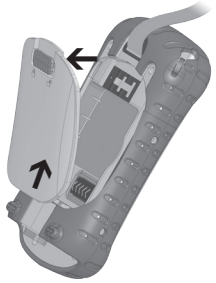
RuggedReader®
QUICK START GUIDE

Step One: Install the Battery Pack

1a Slowly unhook and lift up the bottom latch of the hand strap. CAUTION: Do not let the hand strap hook hit the display.

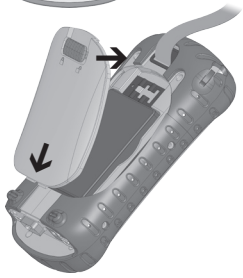
1b Press on the battery door about ¼" below the door latch and slide the latch to the right.

1c Remove the battery door.



1d Insert the battery pack so that the battery contacts mate with the RuggedReader contacts.

1e Insert the tabs on the battery door into the slots. Make sure the door latch is all the way to the right and properly aligned. Then close the battery door.

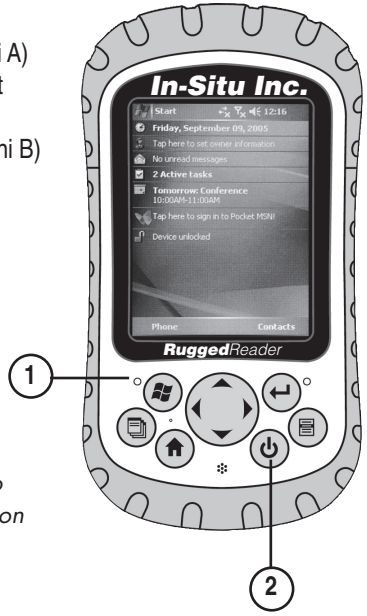


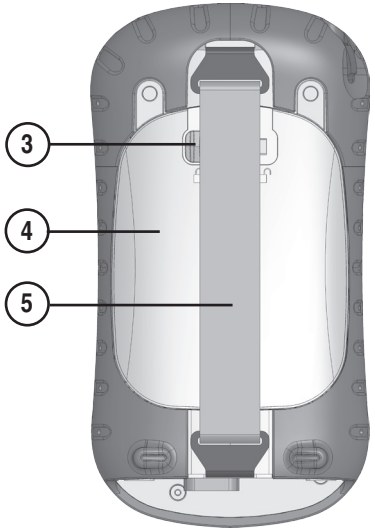
1f Press very firmly on the battery door and slide the latch to the left to lock it. Reattach the hand strap.

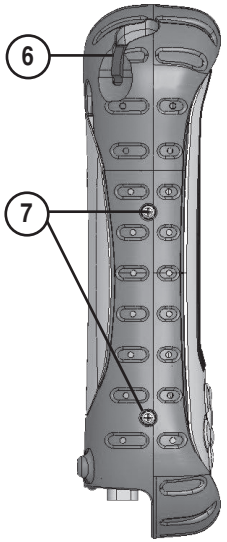
(turn over for next steps)

Anatomy of the RuggedReader

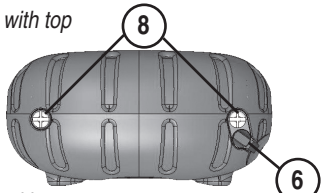
1 Charge LED (red)
2 Power button
3 Battery door latch
4 Battery door
5 Hand strap
6 Stylus
7 Main screws (DO NOT REMOVE)
8 Top cap screws (captive)
9 Slot for future accessory
10 Compact Flash (CF) card slot
11 Secure Digital (SD) I/O card slot
12 USB Host (mini A)
13 9-pin serial port
14 12V DC jack
15 USB Client (mini B)



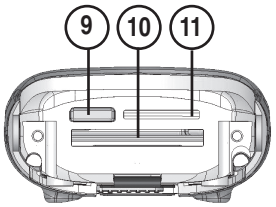




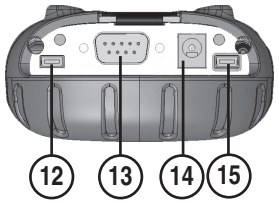
Top view with top cap



Top view without top cap



Communications module



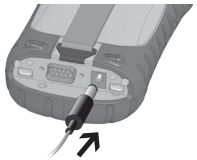
TIP: *For a complete description of the device and its functions, please refer to the RuggedReader operator's manual on the In-Situ software/resource CD.*

Step Two: Charge the Battery Pack

2a Mount the plug to the wall charger* (if not already assembled) and plug the wall charger into an outlet.

*Use only the charger shipped with your RuggedReader. Damage caused by other devices is not covered by warranty.

2b Plug the other end of the wall charger into the DC jack on the RuggedReader. *The device turns on after a few seconds.*



2c A red light begins flashing to signal the device is charging. Let it charge 4-6 hours. *After a few minutes the RuggedReader suspends and the flashing light disappears, but the device keeps charging.*

Step Three: Calibrate the Touchscreen

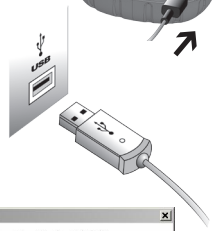
3a Apply a screen protector.
3b Using the stylus, follow the instructions on the display.

Step Four: Create an ActiveSync® Connection

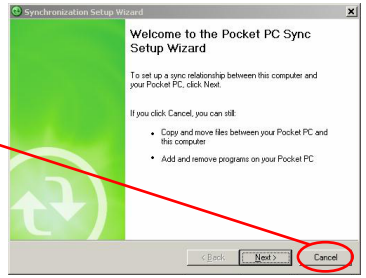
4a Insert the Microsoft® Getting Started CD into the desktop computer and follow the screen directions for installing ActiveSync. Be sure to install Active Sync ***before*** attaching the USB cable to the desktop PC or RuggedReader (next steps).

4b When the ActiveSync instructions direct you to, plug the USB Client (mini B) end of the USB communications cable into your RuggedReader.

4c Plug the USB host (full size A) end of the USB cable into your desktop computer.



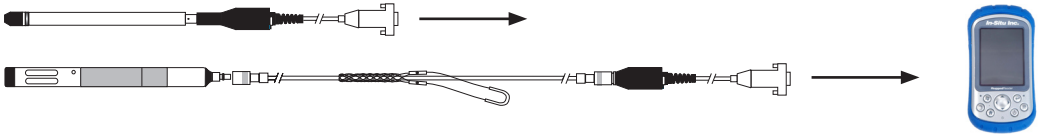
4d The Pocket PC Sync Setup Wizard starts. We recommend you establish a Guest connection by clicking Cancel at the first screen.



Step Five: Connect an In-Situ Instrument to the Serial Port

Refer to the diagrams for cable connections:

Level TROLL®, Aqua TROLL®, or TROLL® 9500

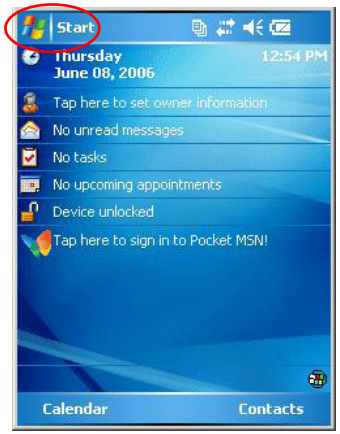


miniTROLL® or TROLL® 9000

Step Six: Launch the In-Situ Software

Power on the RuggedReader by pressing the power button ⏻.
Tap Start to display the Start menu. Tap Programs in the Start menu.
Select the program for your In-Situ device:

- Level TROLL or Aqua TROLL – Win-Situ® Mobile
- TROLL 9500, miniTROLL,TROLL 9000 – Pocket-Situ 4



TIP: The default timeout in the Microsoft operating system is 3 minutes. This may be inconvenient when calibrating, profiling, or downloading data. To change this, tap Start > Settings > System tab > Power > Advanced.

TIP: After direct exposure to salt water, mud, or debris, rinse the RuggedReader in clean running water, shake or wipe to remove moisture, especially from the connectors. Note that the battery door may trap water or dirt. Complete care recommendations are in Section 7 of the RuggedReader operator's manual on the In-Situ CD.

1 800 446 7488
(toll-free, US and Canada) or 970 498 1500
www.in-situ.com

Due to continuing product development this information is subject to change without notice. In-Situ and the In-Situ logo, Win-Situ, TROLL, BaroTROLL, miniTROLL, RuggedReader, and RuggedCable are trademarks or registered trademarks of In-Situ Inc. Microsoft, Windows, Excel, Internet Explorer, and ActiveSync are trademarks or registered trademarks of Microsoft Corporation. Copyright © 2006, 2007 by In-Situ Inc. All rights reserved.

0057520 rev. 001 08/07

In-Situ Inc.

Win-Situ® Mobile
QUICK START GUIDE

Win-Situ Mobile software is pre-installed, licensed, and activated on your new RuggedReader®—a handheld PDA running Microsoft® Windows Mobile® operating system. If you downloaded Win-Situ Mobile software and wish to use it beyond the 15-day demo period, call Technical Support to obtain a license key and an activation code.

1 Connect the device to the RuggedReader, set the RuggedReader clock
See the RuggedReader Quick Start for details.

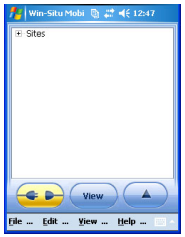
2 Launch Win-Situ Mobile
Tap Programs → Win-Situ Mobile.
Win-Situ Mobile launches and displays the functional area called "My Data".

TIP: For additional information about Win-Situ Mobile Software, including calibration and communications, open the online help file by tapping Help → Help.

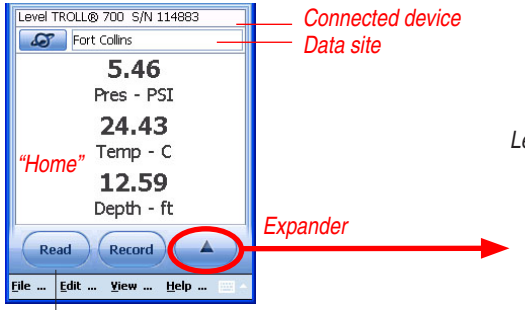
3 Connect to the device
Tap the Connect button.

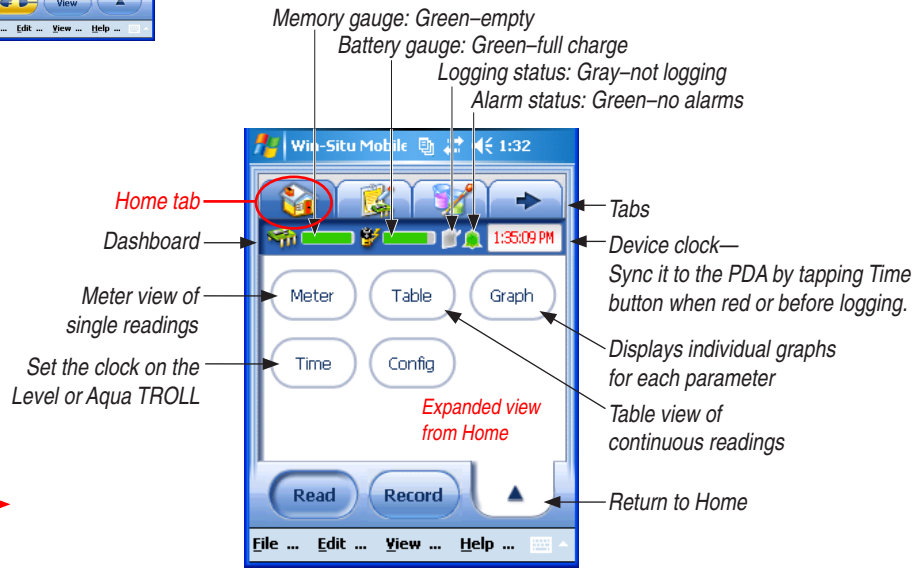
= Device is not connected

= Device is connected



4 Get acquainted with Win-Situ Mobile
When connected, the "Home" screen appears. Real-time readings of all supported parameters are displayed and updated automatically. Note the Expander button. It expands your view of the functions in all tabs.





5 Add a data site
All Win-Situ Mobile data logs are organized and filed by the **Site** where the data were collected.
Enter a site as shown below *before* setting up a data log:

A File menu → New Site, New button.
B Follow the on-screen instructions.

TIP: There are two keypads you can use to enter text: 1) cellphone-type keypad and 2) standard keypad.

TIP: The Update Rate shows how frequently data on the home screen are updated (not related to how often data are saved in the log).

C When the new site is shown again, tap OK ✓.
D The Home tab returns to the screen with your new site shown. You can now set up a log.

TABS

Home: Display real-time readings

Logging: Configure, start, stop, download, delete data logs

Sensors: Zero pressure, configure level, select units, adjust reference, calibrate conductivity, view sensor details

Setup: View device details, firmware, alarms, Analog (4-20 mA) & SDI-12 setup

My Data: View downloaded data logs

Alternatively, select these options from the View menu.

Recording on-screen data: From the data polling screen (step 4), press **Read** (make sure that the values are black, not gray). Press **Record**. Enter a file name, folder, type, and location for the saved data. Press **Save**. On-screen data are recorded as they are polled. **Note:** If you leave the data polling screen, data recording will pause. Return to the polling screen and press **Read** to resume. Press **Record** again to permanently stop recording on-screen data.

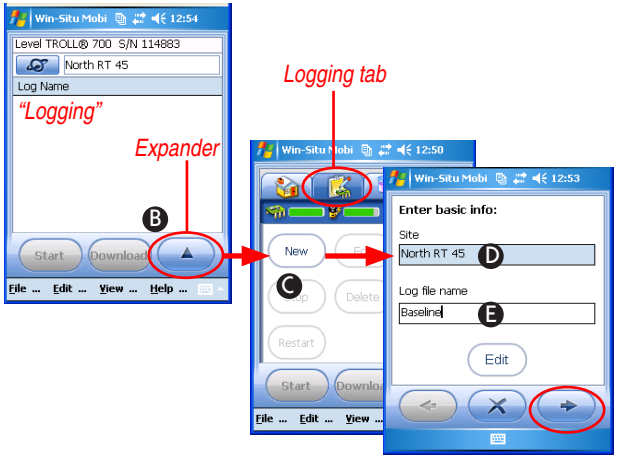
6 Set up a data log

A Tap View menu → Logging to go to the Logging tab.
B Tap the Expander button.
C Tap the New button.

TIP: Only one log can be "active" (ready to run, running, or pending) at a time.

D The data site you entered in step 5 is pre-selected.
E Enter a name for the log (32 char. max). Tap Next to continue.
F Follow the on-screen instructions to complete the log set-up. For more information, refer to the help files.

TIP: For a non-vented device that will be deployed on wire, select a Scheduled start. You will not be able to communicate with it when deployed.



BUTTONS

- Expander
- Connect
- Device is connected
- OK
- Cancel
- Next, continue
- Previous, go back
- Site selection
- Increment down
- Increment up

THE LOG STATUS SYMBOLS (shown for each log in Logging tab)

- *Ready: Log is ready. Press Start.
- *Pending: Log will start at scheduled time (or press Start at any time)
- *Running: Device is actively logging data
- *Suspended: Log has been paused (stopped temporarily)
- Stopped: Log has been stopped, either manually or on schedule
- Deleted: Log is flagged and will be deleted from device when memory is needed (software manages this automatically), or delete it yourself by tapping Delete again

** These logs are considered "active". A device can have only one active log at a time.*

7 Start the log

A Scheduled log will start automatically at its programmed time. To start a Manual log: go to the Logging tab, tap the log, tap Start.

8 View the log/Download the log to the RuggedReader

The log can be downloaded and viewed while it is running or after it stops.

A To download: On the Logging tab, tap the log, tap the Expander button, tap Download, tap your preferred download option (which will create a new file). Tap OK.
B To view the data, select Yes when asked. Focus shifts to My Data tab.
C In My Data tab, tap View. Use the View and Date pull-down menus to select which data and the date it was logged.

9 Stop logging

To permanently stop a log that has no scheduled stop time, go to the Logging tab, select the log, tap the Expander button, then tap Stop.

TIP: Be sure to download again after stopping the log.

TIP: To exit Win-Situ Mobile, go to File menu → Exit.

10 Transfer files to desktop/laptop PC

A First, install on your desktop/laptop PC (if not already installed):
- Microsoft® ActiveSync® (or Windows® Mobile Media Center for Vista®): See the RuggedReader Quick Start.
- Win-Situ 5 (desktop version of Win-Situ Mobile, located on the In-Situ Software/Resource CD)
- Win-Situ Sync (located on the In-Situ Software/Resource CD)

B Establish an ActiveSync or Mobile Media Center connection.
C Use Win-Situ Sync or ActiveSync to transfer files. For more information, refer to the help files.

After the Transfer (either method): To view the log, launch Win-Situ 5 on the desktop (device connection is not needed).

1 800 446 7488
(toll-free, US and Canada) or 970 498 1500

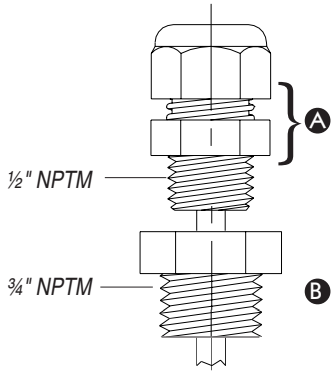
www.in-situ.com

Information is subject to change without notice. In-Situ and the In-Situ logo, Win-Situ, TROLL, BaroTROLL, RuggedReader, RDO, and RuggedCable are trademarks or registered trademarks of In-Situ Inc. Microsoft, Windows, Windows Mobile, Excel, Internet Explorer, and ActiveSync are trademarks or registered trademarks of Microsoft Corporation. Copyright © 2007, 2009 by In-Situ Inc. All rights reserved.

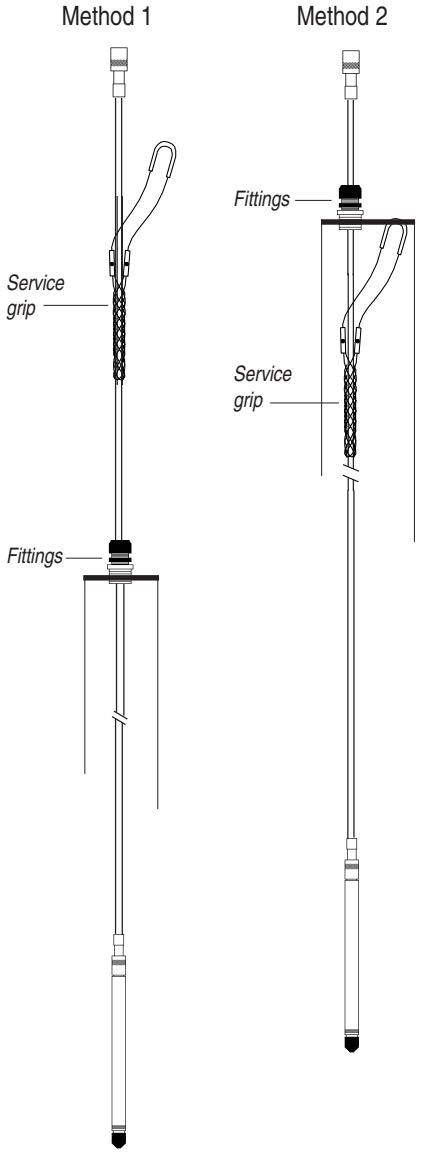
0055650 rev. 004 1/22/09

In-Situ Inc.

Information Sheet



ARTESIAN WELL CABLE OPTION
(SEALED WELL APPLICATIONS)



APPLICATION

Permits installation of a Level TROLL® or miniTROLL® into a sealed well where the seal is made around the cable. Allows easy removal from a ¾" NPT application. Includes a black dome compression fitting that makes a water- and air-tight seal around the cable.

Components are factory-installed on the Level TROLL RuggedCable™ or miniTROLL Quick-Connect cable

COMPONENTS

A Black two-piece dome connector with ½" male threads (NPTM)

B White PVC adapter that accepts connector A (interior threads are ½" female, NPTF) and mates with ¾" NPT threads

INSTALLATION

1. Loosen halves of connector A and slide to desired position on cable.
2. Tighten the compression fitting firmly around the cable and screw into PVC adapter B for installation into ¾" NPT fitting.

Additional adapter(s) may be added for installation into 1" or other size NPT fitting.

TIP: *Cable may be ordered with the sealing fittings* ***below*** *the service grip (Method 1) or* ***above*** *the service grip (Method 2), depending on well configuration.*

1 800 446 7488
(toll-free, US and Canada) or 970 498 1500 **www.in-situ.com**

Due to continuing product development this information is subject to change without notice. In-Situ and the In-Situ logo, Win-Situ, TROLL, miniTROLL, BaroTROLL, RuggedReader, RuggedCable, and RDO are trademarks or registered trademarks of In-Situ Inc. Copyright © 2000 – 2007 by In-Situ Inc. All rights reserved.

0027772 rev. 002 07/07

Material Safety Data Sheet

SECTION I - Material Identity

Item Name.....DESSICANT, ACTIVATED
Part Number/Trade Name.....DAVISON BLUE INDICATING GEL
National Stock Number.....6850002900042
CAGE Code.....16210
Part Number Indicator.....A
MSDS Number.....187833
HAZ Code.....A

SECTION II - Manufacturer's Information

Manufacturer Name.....W R GRACE & CO. DAVISON CHEMICAL DIVISION
P.O. Box.....2117
Street.....10 E BALTIMORE STREET
City.....BALTIMORE
State.....MD
Country.....US
Zip Code.....21202-1630
Emergency Phone.....301-659-9000;301-874-2009
Information Phone.....301-659-9000;301-659-9058

MSDS Preparer's Information

Date MSDS Prepared/Revised.....01OCT92
Date of Technical Review.....25NOV96
Active Indicator.....Y
Item Manager.....CX

Alternate Vendors

Vendor #1 Name.....HUMIDIAL CORP (714-825-1793)
Vendor #1 CAGE.....00334
Vendor #5 CAGE.....CCHSV

SECTION III - Physical/Chemical Characteristics

Specification Number.....N/K
Specification Type/Grade/Class.....N/K
Hazard Storage Compatibility Code.....N1
NRC License Number.....N/K
Net Propellant Weight (Ammo).....N/K
Appearance/Odor.....CLEAR BLUE GRANULES
Boiling Point.....N/A
Melting Point.....N/K
Vapor Pressure.....N/K
Vapor Density.....N/K
Specific Gravity.....2.1
Decomposition Temperature.....N/K
Evaporation Rate.....N/K
Solubility in Water.....INSOLUBLE (GEL)
Percent Volatiles by Volume.....N/K

Chemical pH.....6.5-7
Corrosion Rate.....N/K
Container Pressure Code.....4
Temperature Code.....8
Product State Code.....U

SECTION IV - Fire and Explosion Hazard Data

Flash Point Method.....UNK
Lower Explosion Limit.....N/A
Upper Explosion Limit.....N/A
Extinguishing Media.....NONE SPECIFIED BY MANUFACTURER.
Special Fire Fighting Procedures.....NON-FLAMMABLE.
Unusual Fire/Explosion Hazards.....NON-FLAMMABLE.

SECTION V - Reactivity Data

Stability.....YES
Stability Conditions to Avoid.....REACTS WITH HYDROFLUORIC ACID
Materials to Avoid.....NONE SPECIFIED BY MANUFACTURER.
Hazardous Decomposition Products.....NONE SPECIFIED BY MANUFACTURER.
Hazardous Polymerization.....NO
Polymerization Conditions to Avoid.....NONE SPECIFIED BY MANUFACTURER.
LD50 - LD50 Mixture.....ORAL-31,000 MG/KG: DERMAL-2000 MG/KG

SECTION VI - Health Hazard Data

Route of Entry: Skin.....NO
Route of Entry: Ingestion.....NO
Route of Entry: Inhalation.....YES
Health Hazards - Acute and Chronic.....COLBALT CHLORIDE CAN CAUSE DERMATITIS AND IRRITATION OF NASAL PASSAGES AND LUNGS. SILICA GEL CAN, IN ITSACTIVATED FORM, CAN CAUSE DRYING OF THE SKIN AND MUCOUS MEMBRANES OF THE NOSE AND THROAT IN CASES OF SEVERE EXPOSURE. CONSIDERED AN OCCULAR IRRITANT.
Carcinogenity: NTP.....NO
Carcinogenity: IARC.....NO
Carcinogenity: OSHA.....NO
Explanation of Carcinogenity.....THIS PRODUCT AND ITS COMPONENTS ARE NOT LISTED ON THE IARC, NTP OR OSHA CARCINOGENS LISTS.
Symptoms of Overexposure.....IRRITATION OF THE MUCOUS MEMBRANES OF THE NOSE AND THROAT AND IRRITATION OF THE SKIN.
Medical Cond. Aggrevated by Exposure....DAVISON LNOWNS OF NO MEDICAL CONDITIONS ABNORMALLY AGGRAVATED BY EXPOSURE TO THIS PRODUCT.
Emergency/First Aid Procedures.....EYES-IMMEDIATELY WASH FROM EYES WITH LARGE AMOUNTS OF WATER, OCCASIONALLY LIFTING THE UPPER & LOWER EYE LIDS. IF IRRITATION PERSISTS, SEEK MEDICAL ATTENTION. SKIN-WASH WITH SOAP AND WATER. INGESTION-MATERIAL WILL PASS THROUGH THE BODY NORMALLY. INHALATION-REMOVE TO FRESH AIR.

SECTION VII - Precautions for Safe Handling and Use

Steps if Material Released/Spilled.....SWEEP OR VACUUM UP.
Neutralizing Agent.....NONE SPECIFIED BY MANUFACTURER.
Waste Disposal Method.....DISPOSE IN AN APPROVED LANDFILL ACCORDING TO FEDERAL, STATE AND LOCAL REGULATIONS. COVER PROMPTLY TO AVOID BLOWING OF DUST.
Handling and Storage Precautions.....KEEP TIGHTLY SEALED TO PROTECT QUALITY.
Other Precautions.....MOT KNOWN TO HAVE ANY ENVIRONMENTAL EFFECTS ON THE AQUATIC ENVIRONMENT. THE SILICA BASE IN INSOLUBLE AND NONTOXIC. COBALT CHLORIDE MAY LEACH AWAY IF CONTACTED WITH WATER.

SECTION VIII - Control Measures

Respiratory Protection.....IF DUSTY CONDITIONS PREVAIL, WEAR A PROPERLY FITTED NIOSH-APPROVED RESPIRATOR.
Ventilation.....USE IF PEL IS GREATER THAN OSHA 6 MG/M3 FOR SILICA GEL
Protective Gloves.....CLOSE-WEAVE COTTON GLOVES
Eye Protection.....WEAR GOGGLES FOR DUST.
Other Protective Equipment.....IF ITS USE REQUIRES MANUAL HANDLING, WEAR LONG SLEAVES CLOSEWEAVE COTTON SHIRT
Work Hygenic Practices.....MINIMIZE BREATHING DUST. CLEANSE SKIN THOROUGHLY AFTER CONTACT, BEFORE BREAKS AND MEALS, AND AT THE END OF WORK PERIODS.
Supplemental Health/Safety Data.....WHEN POURING INTO A CONTAINER OF FLAMMABLE LIQUID, GROUND BOTH CONTAINERS ELECTRICALLY TO PREVENT A STATIC ELECTRIC SPARK.

SECTION IX - Label Data

Protect Eye.....NO
Protect Skin.....NO
Protect Respiratory.....NO
Chronic Indicator.....UNKNOWN
Contact Code.....UNKNOWN
Fire Code.....UNKNOWN
Health Code.....UNKNOWN
React Code.....UNKNOWN

SECTION X - Transportation Data

SECTION XI - Site Specific/Reporting Information

SECTION XII - Ingredients/Identity Information

Ingredient #.....1
Ingredient Name.....SILICA GEL
CAS Number.....63231674
NIOSH Number.....VV7322000
Proprietary.....NO
Percent.....UNKNOWN
OSHA PEL.....80 MG/M3 / % SIO2
ACGIH TLV.....10 MG/M3
Recommended Limit.....NONE RECOMMENDED
Ingredient #.....2
Ingredient Name.....COBALT CHLORIDE
CAS Number.....7646799
NIOSH Number.....GF9800000
Proprietary.....NO
Percent.....UNKNOWN
OSHA PEL.....NOT ESTABLISHED
ACGIH TLV.....NOT ESTABLISHED
Recommended Limit.....NONE RECOMMENDED

NOTICE: For additional information, contact BIO ENGR AT 7-7555

Summary of LevelTroll Rugged Cable Serial Numbers

Observation Well Network Installation
McHenry County, Illinois
AECOM Project No. 09000-460 (200804080)

Well Designation			In-Situ™ Rugged Cable Length	In-Situ™ Rugged Cable Serial Number
Site No.	Township	Name		
1	Chemung	1-CHE-S	40	220375
		1-CHE-D	60	220355
2	Alden	2-ALD-D	275	220381
3	Hebron	3-HEB-I	20	220360
		3-HEB-D	20	220362
4	Richmond	4-RCH-S	30	220374
		4-RCH-I	65	220365
		4-RCH-D	65	220368
7	Hartland	7-HRT-S	60	220354
		7-HRT-I	90	220359
		7-HRT-D	90	220358
8	Greenwood	8-GRN-I	60	220351
		8-GRN-D	75	220367
9	McHenry	9-MCH-S	30	220373
		9-MCH-D	100	220377
10	Marengo	10-MAR-S	20	220369
11	Seneca	11-SEN-I	60	220356
		11-SEN-D	60	220357
13	Nunda	13-NUN-I	100	220378
		13-NUN-D	100	220376
14	Riley	14-RIL-S	20	220370
15	Coral	15-COR-S	50	220366
		15-COR-I	60	220352
		15-COR-D	60	220353
16	Grafton	16-GRF-I	75	220364
		16-GRF-D	75	220363
17	Algonquin	17-ALG-S	30	220361
		17-ALG-D	160	220380
12	Dorr	12-Dorr-D	135	220379

K:\PROJECTS\200804080\In_Progress\Report\LevelTroll Cable Serial Numbers.xls

In-Situ Inc.

221 East Lincoln Avenue • Fort Collins, CO 80524 USA
1 800 446 7488 • 1 970 498 1500 (Tel)
1 970 498 1598 (Fax)

WWW.IN-SITU.COM

Station Number: 1

Serial Number: 220381

Test Results: PASS

Operator Initials: MG

Sales Order: 20048385

Length(feet): 275.0

Length(meters): 83.8

Cable Type: Vented / Lemo

Conductor Test Results: PASS

Vent Test Results: PASS: Vent OK.

In-Situ Inc.

221 East Lincoln Avenue • Fort Collins, CO 80524 USA
1 800 446 7488 • 1 970 498 1500 (Tel)
1 970 498 1598 (Fax)

WWW.IN-SITU.COM

Station Number: 1

Serial Number: 220380

Test Results: PASS

Operator Initials: MG

Sales Order: 20048385

Length(feet): 165.0

Length(meters): 50.3

Cable Type: Vented / Lemo

Conductor Test Results: PASS

Vent Test Results: PASS: Vent OK.

In-Situ Inc.

221 East Lincoln Avenue • Fort Collins, CO 80524 USA
1 800 446 7488 • 1 970 498 1500 (Tel)
1 970 498 1598 (Fax)

WWW.IN-SITU.COM

Station Number: 1

Serial Number: 220378

Test Results: PASS

Operator Initials: MG

Sales Order: 20048385

Length(feet): 100.0

Length(meters): 30.5

Cable Type: Vented / Lemo

Conductor Test Results: PASS

Vent Test Results: PASS: Vent OK.

In-Situ Inc.

221 East Lincoln Avenue • Fort Collins, CO 80524 USA
1 800 446 7488 • 1 970 498 1500 (Tel)
1 970 498 1598 (Fax)

WWW.IN-SITU.COM

Station Number: 1

Serial Number: 220377

Test Results: PASS

Operator Initials: MG

Sales Order: 20048385

Length(feet): 100.0

Length(meters): 30.5

Cable Type: Vented / Lemo

Conductor Test Results: PASS

Vent Test Results: PASS: Vent OK.

In-Situ Inc.

221 East Lincoln Avenue • Fort Collins, CO 80524 USA
1 800 446 7488 • 1 970 498 1500 (Tel)
1 970 498 1598 (Fax)

WWW.IN-SITU.COM

Station Number: 1

Serial Number: 220376

Test Results: PASS

Operator Initials: MG

Sales Order: 20048385

Length(feet): 100.0

Length(meters): 30.5

Cable Type: Vented / Lemo

Conductor Test Results: PASS

Vent Test Results: PASS: Vent OK.

In-Situ Inc.

221 East Lincoln Avenue • Fort Collins, CO 80524 USA
1 800 446 7488 • 1 970 498 1500 (Tel)
1 970 498 1598 (Fax)

WWW.IN-SITU.COM

Station Number: 1

Serial Number: 220374

Test Results: PASS

Operator Initials: MG

Sales Order: 2048385

Length(feet): 30.0

Length(meters): 9.1

Cable Type: Vented / Lemo

Conductor Test Results: PASS

Vent Test Results: PASS: Vent OK.

In-Situ Inc.

221 East Lincoln Avenue • Fort Collins, CO 80524 USA
1 800 446 7488 • 1 970 498 1500 (Tel)
1 970 498 1598 (Fax)

WWW.IN-SITU.COM

Station Number: 1

Serial Number: 220373

Test Results: PASS

Operator Initials: MG

Sales Order: 20048385

Length(feet): 30.0

Length(meters): 9.1

Cable Type: Vented / Lemo

Conductor Test Results: PASS

Vent Test Results: PASS: Vent OK.

In-Situ Inc.

221 East Lincoln Avenue • Fort Collins, CO 80524 USA
1 800 446 7488 • 1 970 498 1500 (Tel)
1 970 498 1598 (Fax)

WWW.IN-SITU.COM

Station Number: 1

Serial Number: 220375

Test Results: PASS

Operator Initials: MG

Sales Order: 20048385

Length(feet): 40.0

Length(meters): 12.2

Cable Type: Vented / Lemo

Conductor Test Results: PASS

Vent Test Results: PASS: Vent OK.

In-Situ Inc.

221 East Lincoln Avenue • Fort Collins, CO 80524 USA
1 800 446 7488 • 1 970 498 1500 (Tel)
1 970 498 1598 (Fax)

WWW.IN-SITU.COM

Station Number: 1

Serial Number: 220370

Test Results: PASS

Operator Initials: MG

Sales Order: 20048385

Length(feet): 20.0

Length(meters): 6.1

Cable Type: Vented / Lemo

Conductor Test Results: PASS

Vent Test Results: PASS: Vent OK.

In-Situ Inc.

221 East Lincoln Avenue • Fort Collins, CO 80524 USA
1 800 446 7488 • 1 970 498 1500 (Tel)
1 970 498 1598 (Fax)

WWW.IN-SITU.COM

Station Number: 1

Serial Number: 220369

Test Results: PASS

Operator Initials: MG

Sales Order: 20048385

Length(feet): 20.0

Length(meters): 6.1

Cable Type: Vented / Lemo

Conductor Test Results: PASS

Vent Test Results: PASS: Vent OK.

In-Situ Inc.

221 East Lincoln Avenue • Fort Collins, CO 80524 USA
1 800 446 7488 • 1 970 498 1500 (Tel)
1 970 498 1598 (Fax)

WWW.IN-SITU.COM

Station Number: 1

Serial Number: 220368

Test Results: PASS

Operator Initials: MG

Sales Order: 20048385

Length(feet): 65.0

Length(meters): 19.8

Cable Type: Vented / Lemo

Conductor Test Results: PASS

Vent Test Results: PASS: Vent OK.

In-Situ Inc.

221 East Lincoln Avenue • Fort Collins, CO 80524 USA
1 800 446 7488 • 1 970 498 1500 (Tel)
1 970 498 1598 (Fax)

WWW.IN-SITU.COM

Station Number: 1

Serial Number: 220367

Test Results: PASS

Operator Initials: MG

Sales Order: 20048385

Length(feet): 75.0

Length(meters): 22.9

Cable Type: Vented / Lemo

Conductor Test Results: PASS

Vent Test Results: PASS: Vent OK.

In-Situ Inc.

221 East Lincoln Avenue • Fort Collins, CO 80524 USA
1 800 446 7488 • 1 970 498 1500 (Tel)
1 970 498 1598 (Fax)

WWW.IN-SITU.COM

Station Number: 1

Serial Number: 220361

Test Results: PASS

Operator Initials: CG

Sales Order: 20048385

Length(feet): 30.0

Length(meters): 9.1

Cable Type: Vented / Lemo

Conductor Test Results: PASS

Vent Test Results: PASS: Vent OK.

In-Situ Inc.

221 East Lincoln Avenue • Fort Collins, CO 80524 USA
1 800 446 7488 • 1 970 498 1500 (Tel)
1 970 498 1598 (Fax)

WWW.IN-SITU.COM

Station Number: 1

Serial Number: 220360

Test Results: PASS

Operator Initials: CG

Sales Order: 20048385

Length(feet): 20.0

Length(meters): 6.1

Cable Type: Vented / Lemo

Conductor Test Results: PASS

Vent Test Results: PASS: Vent OK.

In-Situ Inc.

221 East Lincoln Avenue • Fort Collins, CO 80524 USA
1 800 446 7488 • 1 970 498 1500 (Tel)
1 970 498 1598 (Fax)

WWW.IN-SITU.COM

Station Number: 1

Serial Number: 220379

Test Results: PASS

Operator Initials: MG

Sales Order: 20048385

Length(feet): 135.0

Length(meters): 41.1

Cable Type: Vented / Lemo

Conductor Test Results: PASS

Vent Test Results: PASS: Vent OK.

In-Situ Inc.

221 East Lincoln Avenue • Fort Collins, CO 80524 USA
1 800 446 7488 • 1 970 498 1500 (Tel)
1 970 498 1598 (Fax)

WWW.IN-SITU.COM

Station Number: 1

Serial Number: 220365

Test Results: PASS

Operator Initials: MG

Sales Order: 20048385

Length(feet): 65.0

Length(meters): 19.8

Cable Type: Vented / Lemo

Conductor Test Results: PASS

Vent Test Results: PASS: Vent OK.

In-Situ Inc.

221 East Lincoln Avenue • Fort Collins, CO 80524 USA
1 800 446 7488 • 1 970 498 1500 (Tel)
1 970 498 1598 (Fax)

WWW.IN-SITU.COM

Station Number: 1

Serial Number: 220364

Test Results: PASS

Operator Initials: CG

Sales Order: 20048385

Length(feet): 75.0

Length(meters): 22.9

Cable Type: Vented / Lemo

Conductor Test Results: PASS

Vent Test Results: PASS: Vent OK.

In-Situ Inc.

221 East Lincoln Avenue • Fort Collins, CO 80524 USA
1 800 446 7488 • 1 970 498 1500 (Tel)
1 970 498 1598 (Fax)

WWW.IN-SITU.COM

Station Number: 1

Serial Number: 220362

Test Results: PASS

Operator Initials: CG

Sales Order: 20048385

Length(feet): 20.0

Length(meters): 6.1

Cable Type: Vented / Lemo

Conductor Test Results: PASS

Vent Test Results: PASS: Vent OK.

In-Situ Inc.

221 East Lincoln Avenue • Fort Collins, CO 80524 USA
1 800 446 7488 • 1 970 498 1500 (Tel)
1 970 498 1598 (Fax)

WWW.IN-SITU.COM

Station Number: 1

Serial Number: 220359

Test Results: PASS

Operator Initials: MG

Sales Order: 20048385

Length(feet): 90.0

Length(meters): 27.4

Cable Type: Vented / Lemo

Conductor Test Results: PASS

Vent Test Results: PASS: Vent OK.

In-Situ Inc.

221 East Lincoln Avenue • Fort Collins, CO 80524 USA
1 800 446 7488 • 1 970 498 1500 (Tel)
1 970 498 1598 (Fax)

WWW.IN-SITU.COM

Station Number: 1

Serial Number: 220363

Test Results: PASS

Operator Initials: CG

Sales Order: 20048385

Length(feet): 75.0

Length(meters): 22.9

Cable Type: Vented / Lemo

Conductor Test Results: PASS

Vent Test Results: PASS: Vent OK.

In-Situ Inc.

221 East Lincoln Avenue • Fort Collins, CO 80524 USA
1 800 446 7488 • 1 970 498 1500 (Tel)
1 970 498 1598 (Fax)

WWW.IN-SITU.COM

Station Number: 1

Serial Number: 220358

Test Results: PASS

Operator Initials: MG

Sales Order: 20048385

Length(feet): 90.0

Length(meters): 27.4

Cable Type: Vented / Lemo

Conductor Test Results: PASS

Vent Test Results: PASS: Vent OK.

In-Situ Inc.

221 East Lincoln Avenue • Fort Collins, CO 80524 USA
1 800 446 7488 • 1 970 498 1500 (Tel)
1 970 498 1598 (Fax)

WWW.IN-SITU.COM

Station Number: 1

Serial Number: 220357

Test Results: PASS

Operator Initials: MG

Sales Order: 20048385

Length(feet): 60.0

Length(meters): 18.3

Cable Type: Vented / Lemo

Conductor Test Results: PASS

Vent Test Results: PASS: Vent OK.

In-Situ Inc.

221 East Lincoln Avenue • Fort Collins, CO 80524 USA
1 800 446 7488 • 1 970 498 1500 (Tel)
1 970 498 1598 (Fax)

WWW.IN-SITU.COM

Station Number: 1

Serial Number: 220351

Test Results: PASS

Operator Initials: MG

Sales Order: 20048385

Length(feet): 60.0

Length(meters): 18.3

Cable Type: Vented / Lemo

Conductor Test Results: PASS

Vent Test Results: PASS: Vent OK.

In-Situ Inc.

221 East Lincoln Avenue • Fort Collins, CO 80524 USA
1 800 446 7488 • 1 970 498 1500 (Tel)
1 970 498 1598 (Fax)

WWW.IN-SITU.COM

Station Number: 1

Serial Number: 220356

Test Results: PASS

Operator Initials: MG

Sales Order: 20048385

Length(feet): 60.0

Length(meters): 18.3

Cable Type: Vented / Lemo

Conductor Test Results: PASS

Vent Test Results: PASS: Vent OK.

In-Situ Inc.

221 East Lincoln Avenue • Fort Collins, CO 80524 USA
1 800 446 7488 • 1 970 498 1500 (Tel)
1 970 498 1598 (Fax)

WWW.IN-SITU.COM

Station Number: 1

Serial Number: 220355

Test Results: PASS

Operator Initials: MG

Sales Order: 20048385

Length(feet): 60.0

Length(meters): 18.3

Cable Type: Vented / Lemo

Conductor Test Results: PASS

Vent Test Results: PASS: Vent OK.

In-Situ Inc.

221 East Lincoln Avenue • Fort Collins, CO 80524 USA
1 800 446 7488 • 1 970 498 1500 (Tel)
1 970 498 1598 (Fax)

WWW.IN-SITU.COM

Station Number: 1

Serial Number: 220354

Test Results: PASS

Operator Initials: MG

Sales Order: 20048385

Length(feet): 60.0

Length(meters): 18.3

Cable Type: Vented / Lemo

Conductor Test Results: PASS

Vent Test Results: PASS: Vent OK.

In-Situ Inc.

221 East Lincoln Avenue • Fort Collins, CO 80524 USA
1 800 446 7488 • 1 970 498 1500 (Tel)
1 970 498 1598 (Fax)

WWW.IN-SITU.COM

Station Number: 1

Serial Number: 220353

Test Results: PASS

Operator Initials: MG

Sales Order: 20048385

Length(feet): 60.0

Length(meters): 18.3

Cable Type: Vented / Lemo

Conductor Test Results: PASS

Vent Test Results: PASS: Vent OK.

In-Situ Inc.

221 East Lincoln Avenue • Fort Collins, CO 80524 USA
1 800 446 7488 • 1 970 498 1500 (Tel)
1 970 498 1598 (Fax)
WWW.IN-SITU.COM

Station Number: 1

Serial Number: 220366

Test Results: PASS

Operator Initials: MG

Sales Order: 20048385

Length(feet): 50.0

Length(meters): 15.2

Cable Type: Vented / Lemo

Conductor Test Results: PASS

Vent Test Results: PASS: Vent OK.

In-Situ Inc.

221 East Lincoln Avenue • Fort Collins, CO 80524 USA
1 800 446 7488 • 1 970 498 1500 (Tel)
1 970 498 1598 (Fax)

WWW.IN-SITU.COM

Station Number: 1

Serial Number: 220352

Test Results: PASS

Operator Initials: MG

Sales Order: 20048385

Length(feet): 60.0

Length(meters): 18.3

Cable Type: Vented / Lemo

Conductor Test Results: PASS

Vent Test Results: PASS: Vent OK.

Appendix C

Hydraulic Conductivity Testing Information

ASTM D5785-95 Reference for Underdamped Well Response

Spreadsheet Calculation of D5785-95 Example

Hvorslev Equations Referenced in Cedergren (1977)

ASTM D5785-95 Reference for Underdamped Well Response

Designation: D 5785 – 95

AMERICAN SOCIETY FOR TESTING AND MATERIALS
100 Barr Harbor Dr., West Conshohocken, PA 19428
Reprinted from the Annual Book of ASTM Standards. Copyright ASTM
If not listed in the current combined index, will appear in the next edition.

Standard Test Method for (Analytical Procedure) for Determining Transmissivity of Confined Nonleaky Aquifers by Underdamped Well Response to Instantaneous Change in Head (Slug Test)[1]

This standard is issued under the fixed designation D 5785; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This test method covers determination of transmissivity from the measurement of the damped oscillation about the equilibrium water level of a well-aquifer system to a sudden change of water level in a well. Underdamped response of water level in a well to a sudden change in water level is characterized by oscillatory fluctuation about the static water level with a decrease in the magnitude of fluctuation and recovery to initial water level. Underdamped response may occur in wells tapping highly transmissive confined aquifers and in deep wells having long water columns.

1.2 This analytical procedure is used in conjunction with the field procedure Test Method D 4044 for collection of test data.

1.3 *Limitations*—Slug tests are considered to provide an estimate of transmissivity of a confined aquifer. This test method requires that the storage coefficient be known. Assumptions of this test method prescribe a fully penetrating well (a well open through the full thickness of the aquifer), but the slug test method is commonly conducted using a partially penetrating well. Such a practice may be acceptable for application under conditions in which the aquifer is stratified and horizontal hydraulic conductivity is much greater than vertical hydraulic conductivity. In such a case the test would be considered to be representative of the average hydraulic conductivity of the portion of the aquifer adjacent to the open interval of the well. The method assumes laminar flow and is applicable for a slug test in which the initial water-level displacement is less than 0.1 or 0.2 of the length of the static water column.

1.4 This test method of analysis presented here is derived by van der Kamp **(1)**[2] based on an approximation of the underdamped response to that of an exponentially damped sinusoid. A more rigorous analysis of the response of wells to a sudden change in water level by Kipp **(2)** indicates that the method presented by van der Kamp **(1)** matches the solution of Kipp **(2)** when the damping parameter values are less than about 0.2 and time greater than that of the first peak of the oscillation **(2)**.

1.5 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*

D 653 Terminology Relating to Soil, Rock, and Contained Fluids[3]

D 4043 Guide for Selection of Aquifer-Test Method in Determining of Hydraulic Properties by Well-Techniques[3]

D 4044 Test Method for (Field Procedure for) Instantaneous Change in Head (Slug Test) for Determining Hydraulic Properties of Aquifers[3]

D 4750 Test Method for Determining Subsurface Liquid Levels in a Borehole or Monitoring Well (Observation Well)[3]

3. Terminology

3.1 *Definitions:*

3.1.1 *aquifer, confined*—an aquifer bounded above and below by confining beds and in which the static head is above the top of the aquifer.

3.1.2 *confining bed*—a hydrogeologic unit of less permeable material bounding one or more aquifers.

3.1.3 *control well*—well by which the aquifer is stressed, for example, by pumping, injection, or change in head.

3.1.4 *head, static*—the height above a standard datum of the surface of a column of water (or other liquid) that can be supported by the static pressure at a given point.

3.1.5 *observation well*—a well open to all or part of an aquifer.

3.1.6 *overdamped well response*—characterized by the water level returning to the static level in an approximately exponential manner following a sudden change in water level. (See for comparison *underdamped well response*.)

3.1.7 *slug*—a volume of water or solid object used to induce a sudden change of head in a well.

3.1.8 *storage coefficient*—the volume of water an aquifer releases from or takes into storage per unit surface area of the aquifer per unit change in head. For a confined aquifer, the storage coefficient is equal to the product of specific storage and aquifer thickness. For an unconfined aquifer, the storage coefficient is approximately equal to the specific yield.

[1] This test method is under the jurisdiction of ASTM Committee D-18 on Soil and Rock and is the direct responsibility of Subcommittee D18.21 on Ground Water and Vadose Zone Investigations.

Current edition approved Sept. 10, 1995. Published November 1995.

[2] The boldface numbers given in parentheses refer to a list of references at the end of the text.

[3] *Annual Book of ASTM Standards*, Vol 04.08.

3.1.9 *transmissivity*—the volume of water at the existing kinematic viscosity that will move in a unit time under a unit hydraulic gradient through a unit width of the aquifer.

3.1.10 *underdamped well response*—response characterized by the water level oscillating about the static water level following a sudden change in water level (See for comparison *overdamped well response.*)

3.1.11 For definitions of other terms used in this test method, see Terminology D 653.

3.2 *Symbols and Dimensions:*

3.2.1 T—transmissivity $[L^2T^{-1}]$.

3.2.2 S—storage coefficient $[nd]$.

3.2.3 L—effective length of water column, equal to $L_c + (r_c^2/r_s^2)$ (m/2).

3.2.3.1 *Discussion*—This expression for the effective length is given by Kipp (2). The expression for the effective length of the water column from Cooper et al (3) is given as $L_c + 3/8L_s$ and assumes that the well screen and well casing have the same diameter.

3.2.4 L_c—length of water column within casing $[L]$.

3.2.5 L_s—length of water column within well screen $[L]$.

3.2.6 g—acceleration of gravity $[LT^{-2}]$.

3.2.7 h—hydraulic head in the aquifer $[L]$.

3.2.8 h_o—initial hydraulic head in the aquifer $[L]$.

3.2.9 h_s—hydraulic head in the well screen $[L]$.

3.2.10 r_c—radius of well casing $[L]$.

3.2.11 r_s—radius of well screen $[L]$.

3.2.12 t—time $[T]$.

3.2.13 w—water level displacement from the initial static level $[L]$.

3.2.14 w_o—initial water level displacement $[L]$.

3.2.15 γ—damping constant $[T^{-1}]$.

3.2.16 τ—wavelength $[T]$.

3.2.17 ω—angular frequency $[T^{-1}]$.

3.2.18 m—aquifer thickness, $[L]$.

4. Summary of Test Method

4.1 This test method describes the analytical procedure for analyzing data collected during an instantaneous head (slug) test using a well in which the response is underdamped. The field procedures in conducting a slug test are given in Test Method D 4044. The analytical procedure consists of analyzing the response of water level in the well following the change in water level induced in the well.

4.2 *Theory*—The equations that govern the response of well to an instantaneous change in head are treated at length by Kipp (2). The flow in the aquifer is governed by the following equation for cylindrical flow:

$$\frac{S}{T}\frac{dh}{dt} = \frac{1}{r}\frac{d}{dr}\left(r\frac{dh}{dr}\right) \tag{1}$$

where:

h = hydraulic head,

T = aquifer transmissivity, and

S = storage coefficient.

4.2.1 The initial condition is at $t = 0$ and $h = h_o$, and the outer boundary condition is as $r \rightarrow \infty$ and $h \rightarrow h_o$.

4.3 The flow rate balance on the well bore relates the displacement of the water level in the well-riser to the flow into the well:

$$\pi r_c^2 \frac{dw}{dt} = 2\pi r_s T \frac{\partial h}{\partial r}\bigg|_{r=r_s} \tag{2}$$

where:

r_c = radius of the well casing, and

w = displacement of the water level in the well from its initial position.

4.3.1 The third equation describing the system, relating h_s and w, comes from a momentum balance of Bird et al (4) as referenced in Kipp (2).

$$\frac{d}{dt}\int_{-m}^{0} \pi r_s^2 \rho v_d z = [-\rho v_2^2 + p_1 - p_2 - \rho g m]\pi r_s^2 \tag{3}$$

where:

v = velocity in the well screen interval,

m = aquifer thickness,

p = pressure,

ρ = fluid density,

g = gravitational acceleration, and

r_s = well screen radius. Well and aquifer geometry are shown in Fig. 1.

Atmospheric pressure is taken as zero.

5. Solution

5.1 The method of van der Kamp (1) assumes the water level response to a sudden change for the underdamped case, except near critical damping conditions, can be approximately described as an exponentially damped cyclic fluctuation that decays exponentially. The water-level fluctuation would then be given by:

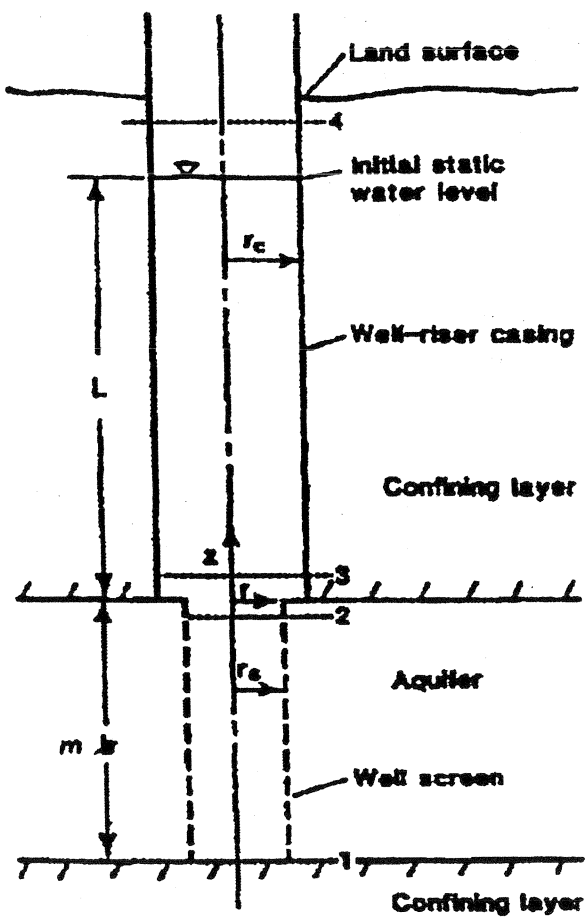


FIG. 1 Well and Aquifer Geometry

$$w(t) = w_o e^{-\gamma t} \cos \omega t \quad (4)$$

5.1.1 The following solution is given by van der Kamp (1).

$$d = \frac{-r_c^2 (g/L)^{1/2} \ln[0.79 r_s^2 (S/T)(g/L)^{1/2}]}{8T} \quad (5)$$

that may be written as:

$$T = b + a \ln T \quad (6)$$

where:

$$b = -a \ln[0.79\, r_s^2 S (g/L)^{1/2}] \quad (7)$$

$$a = \frac{r_c^2 (g/L)^{1/2}}{8d} \quad (8)$$

$$d = \gamma/(g/L)^{1/2} \quad (9)$$

and

$$L = g/(\omega^2 + \gamma^2) \quad (10)$$

NOTE 1—Other analytical solutions are proposed by Kipp (2), Krauss (5), Uffink (6) and Kabala, Pinder, and Milly (7).

6. Significance and Use

6.1 The assumptions of the physical system are given as follows:

6.1.1 The aquifer is of uniform thickness and confined by impermeable beds above and below.

6.1.2 The aquifer is of constant homogeneous porosity and matrix compressibility and of homogeneous and isotropic hydraulic conductivity.

6.1.3 The origin of the cylindrical coordinate system is taken to be on the well-bore axis at the top of the aquifer.

6.1.4 The aquifer is fully screened.

6.2 The assumptions made in defining the momentum balance are as follows:

6.2.1 The average water velocity in the well is approximately constant over the well-bore section.

6.2.2 Flow is laminar and frictional head losses from flow across the well screen are negligible.

6.2.3 Flow through the well screen is uniformly distributed over the entire aquifer thickness.

6.2.4 Change in momentum from the water velocity changing from radial flow through the screen to vertical flow in the well are negligible.

6.2.5 The system response is an exponentially decaying sinusoidal function.

7. Procedure

7.1 The overall procedure consists of:

7.1.1 Conducting the slug test field procedure (see Test Method D 4044), and

7.1.2 Analyzing the field data, that is addressed in this test method.

NOTE 2—The initial displacement of water level should not exceed 0.1 or 0.2 of the length of the static water column in the well, because of considerations for calculating L_c. Practically, the displacement should be small, a few times larger than the well radius, to minimize frictional losses. The measurement of displacement should be within 1 % of the initial water-level displacement. The water-level displacement needs to be calculated independently for comparison to the observed initial displacement.

8. Calculation and Interpretation of Test Data

8.1 Plot the water-level response in the well to the sudden change in head, as in Fig. 2.

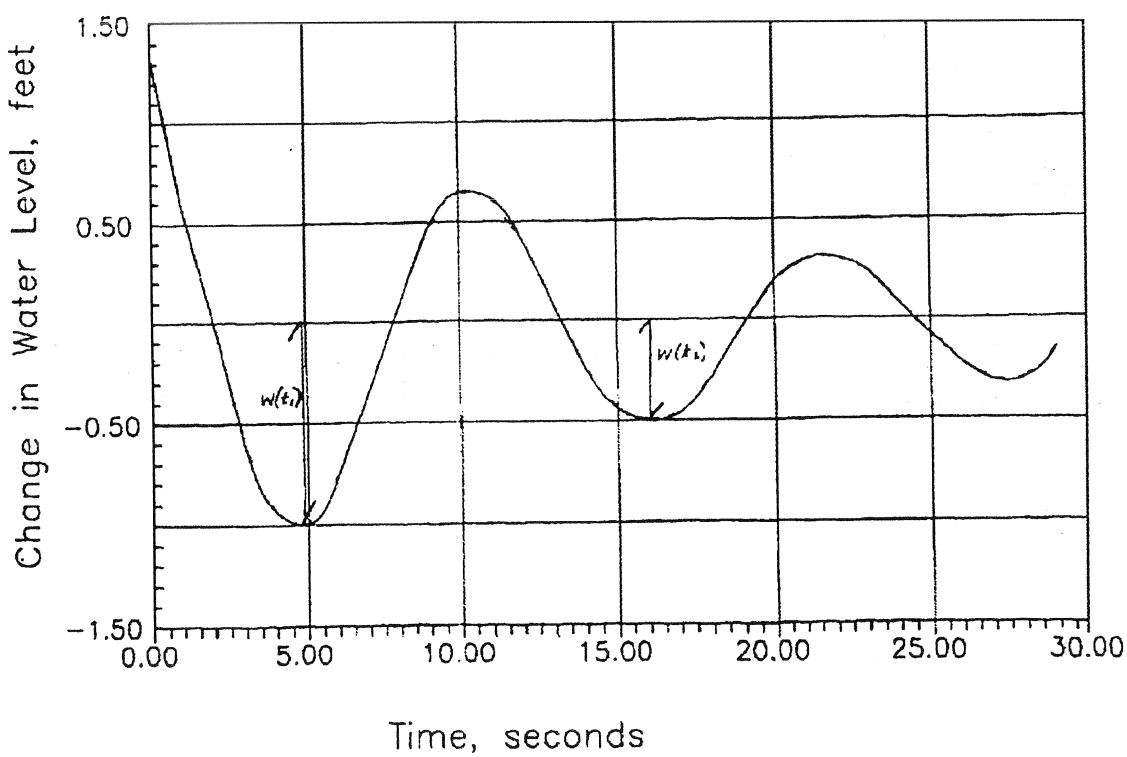


FIG. 2 Underdamped Response of Water Level to a Sudden Change in Head

8.2 Calculate the angular frequency, ω:

$$\omega = 2\pi/\tau \quad (11)$$

where:
$\tau = t_1 - t_2$, and t_1 and t_2 are times of successive maxima or minima of the oscillatory wave.

8.3 Calculate the damping factor, γ:

$$\gamma = \ln[w(t_1)/w(t_2)]/t_2 - t_1 \quad (12)$$

where:
$w(t_1)$ and $w(t_2)$ are the water-level displacements at times t_1 and t_2, respectively.

8.4 Determine transmissivity, T,

$$T = b + a \ln T \quad (13)$$

where:

$$a = [r_c^2 (g/L)^{1/2}]/8d \quad (14)$$

$$d = \gamma/(g/L)^{1/2} \quad (15)$$

$$L = g/(\omega^2 + \gamma^2) \quad (16)$$

and:

$$b = -a \ln[0] \quad (17)$$

8.4.1 Solve for transmissivity iteratively using an initial estimate value for transmissivity, T, and a known or estimated value of storage coefficient, S.

8.4 Check the results.

8.4.1 Compare the effective length of the water column, L, calculated by the following two relationships:

$$L = g/(\omega^2 + \gamma^2) \quad (18)$$

and:

$$L = L_c + (r_c^2/r_s^2)m/2 \quad (19)$$

The values of L should agree within 20 %.

8.4.2 Check to see that the value of $\alpha \ll 0.1$, where:

$$\alpha = 0.89(S/T)^{1/2} (\omega^2 + \gamma^2)^{1/4} r_s < 0.1 \quad (20)$$

8.4.3 Check to see that the value of $d \ll 0.7$, where:

$$d = \gamma/(g/L)^{1/2} \quad (21)$$

8.4.4 *Example*—The following data are taken from the underdamped response to a slug test shown in Fig. 2:

$w(t_1)$ = −1.0 ft
$w(t_2)$ = −0.5 ft
t_1 = 4.9 s
t_2 = 16.9 s
r_c = 0.25 ft
r_s = 0.25 ft
L_c = 95 ft
L_s = 55 ft
τ = $t_2 - t_1$ = 16.9 − 4.9 = 12 s
ω = $2\pi/\tau$ = 2* 3.1416/12.0 = 0.5236 s^{-1}
γ = $\ln(w(t_1)/w(t_2))/\tau$ = $\ln(-1.0/-0.5)/12$ = 0.6931/12 = 0.05776 s^{-1}
T = $b + a \ln T$
$(g/L)^{1/2}$ = $(\omega^2 + \gamma^2)^{1/2}$ = $((0.5236)^2 + (0.05776)^2)^{1/2}$ = $((0.2742) + (0.0033362))^{1/2}$ = $(0.2775)^{1/2}$ = 0.5268
d = $\gamma/(g/L)^{1/2}$ = 0.05776/0.5268 = 0.1096
a = $(r_c^2(g/L)^{1/2})/8d$ = $(0.25)^2(0.5268)/8(0.1096)$ = 0.03755 ft^2/s

Assume $S = 1.5 \times 10^{-5}$

b = $-a \ln(0.79\, r_s^2 S(g/L)^{1/2})$
= $(-0.03755)\ln(0.79(0.25)^2\,(0.000015)(0.5268)$ = 0.5541 ft^2/s
T_1 = $b + a \ln T_0$

Assume $T_0 \cong b$,

T_1 = 0.5541 + (0.03755)ln(0.5541) = 0.5319 ft^2/s
T_2 = 0.5541 + (0.03755)ln(0.5319) = 0.5304 ft^2/s
T = 0.5304 ft^2/s * 86 400 s/day = 45 826 ft^2/day

Check the results:

L = $g/(\omega^2 + \gamma^2)$ = 32/(0.2775) = 115.3 ft
L = $L_c + (r_c^2/r_s^2)m/2$ = 95 + 27.5 = 122.5
122.5 − 115.3 = 7.2, 7.2/115.3 = 6.2 < 20 %
α = $0.89(S/T)^{1/2} (\omega^2 + \gamma^2)^{1/4} r_s < 0.1$
= 0.89 (0.005318)(0.7258) 0.25 = 0.000859 < 0.1
d = 0.1096 < 0.7

9. Report

9.1 Report the following information described as follows. The final report of the analytical procedure will include information from the report on test method selection, Guide D 4043, and the field testing procedure, Test Method D 4044.

9.1.1 *Introduction*—The introductory section is intended to present the scope and purpose of the slug test method for determining transmissivity and storativity. Summarize the field hydrogeologic conditions, the field equipment and instrumentation including the construction of the control well, the method of measurement of head, and the method of effecting the change in head. Discuss the rationale for selecting this test method.

9.1.2 *Hydrogeologic Setting*—Review information available on the hydrogeology of the site; interpret and describe the hydrogeology of the site as it pertains to the method selected for conducting and analyzing an aquifer test. Compare hydrogeologic characteristics of the site as it conforms and differs from assumptions made in the solution to the aquifer test method.

9.1.3 *Equipment*—Report the field installation and equipment for the aquifer test. Include in the report, well construction information, diameter, depth, and open interval to the aquifer, and location of control well and pumping equipment. The construction, diameter, depth, and open interval of observation wells should be recorded.

9.1.3.1 Report the techniques used for observing water levels, and other environmental conditions pertinent to the test. Include a list of measuring devices used during the test; the manufacturers name, model number, and basic specifications for each major item; and the name and date of the last calibration, if applicable.

9.1.4 *Testing Procedures*—Report the steps taken in conducting the pretest and test phases. Include the frequency of head measurements made in the control well, and other environmental data recorded before and during the testing procedure.

9.1.5 *Presentation and Interpretation of Test Results:*

9.1.5.1 *Data*—Present tables of data collected during the test.

9.1.5.2 *Data Plots*—Present data plots used in analysis of the data.

9.1.5.3 Show calculation of transmissivity and coefficient of storage.

9.1.5.4 Evaluate the overall quality of the test on the basis of the adequacy of instrumentation and observations of stress and response and the conformance of the hydro-

geologic conditions and the performance of the test to the assumptions (see 5.1).

10. Precision and Bias

10.1 It is not practicable to specify the precision of this test method because the response of aquifer systems during aquifer tests is dependent upon ambient system stresses. No statement can be made about bias because no true reference values exist.

11. Keywords

11.1 aquifers; aquifer tests; control wells; ground water; hydraulic conductivity; slug test; storage coefficient; transmissivity

REFERENCES

(1) van der Kamp, Garth, "Determining Aquifer Transmissivity by Means of Well Response Tests: The Underdamped Case," *Water Resources Research*, Vol 12, No. 1, 1976, pp. 71–77.

(2) Kipp, K. L., Jr., "Type Curve Analysis of Inertial Effects in the Response of a Well to a Slug Test," *Water Resources Research*, Vol 21, No. 9, 1985, pp. 1397–1408.

(3) Cooper, H. H., Jr., Bredehoeft, J. D., and Papadopulos, I. S., "Response of a Finite-Diameter Well to an Instantaneous Charge of Water," *Water Resources Research*, Vol 3, No. 1, 1967, pp. 263–269.

(4) Bird, R. B., Stewart, W. E., and Lightfoot, E. N., *Transport Phenomena*, John Wiley, New York, 1960.

(5) Krauss, I., "Determination of the Transmissibility from the Free Water Level Oscillation in Well-Aquifer Systems," *Surface and Subsurface Hydrology, Proceedings of the Third International Hydrology Symposium*, Colorado State University, 1977, pp. 179–268.

(6) Kruseman and de Ridder, "Analysis and Evaluation of Pumping Test Data," *Publication 47, International Institute for Land and Reclamation and Improvement*, Wageningen, The Netherlands, 1991.

(7) Kabala, Z. J., Pinder, G. F., and Milly, P. C. D., "Analysis of Well-Aquifer Response to a Slug Test," *Water Resources Research*, Vol 21, No. 9, 1985, pp. 1433–1436.

The American Society for Testing and Materials takes no position respecting the validity of any patent rights asserted in connection with any item mentioned in this standard. Users of this standard are expressly advised that determination of the validity of any such patent rights, and the risk of infringement of such rights, are entirely their own responsibility.

This standard is subject to revision at any time by the responsible technical committee and must be reviewed every five years and if not revised, either reapproved or withdrawn. Your comments are invited either for revision of this standard or for additional standards and should be addressed to ASTM Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend. If you feel that your comments have not received a fair hearing you should make your views known to the ASTM Committee on Standards, 1916 Race St., Philadelphia, PA 19103.

Spreadsheet Calculation of D5785-95 Example

Calculation of Transmissivity of Underdamped Well Response to Slug Test

Spreadsheet Calculation Check using ASTM D5785 Example (Refer to Section 8.4.4)
McHenry County Monitoring Well Network Installation
AECOM Environment Project No. 09000-460

Expression		Value	Units
$w(t_1)$	=	-1.0	ft.
$w(t_2)$	=	-0.5	ft.
t_1	=	4.9	sec.
t_2	=	16.9	sec.
R_c	=	0.25	ft.
R_s	=	0.25	ft.
L_c	=	95	ft.
L_s	=	55	ft.
τ	=	12	sec.
ϖ	=	0.5236	s^{-1}
γ	=	0.05776	s^{-1}
T	=	b+a lnT	
$(g/L)^{1/2}$	=	0.5268	
d	=	0.1097	
a	=	0.03753	ft^2/sec
Assume S	=	1.5E-05	
b	=	0.554	ft^2/sec
T_1	=	$b+a \ln T_0$	
Assume T_0	≈	b_1	
T_1	=	0.5317	ft^2/sec
T_2	=	0.5301	ft^2/sec
T	=	45804	ft^2/day
From ASTM Example: T	=	45826	ft^2/day

Percent Deviation Calc Sheet is from Example:
< 0.05%

Check the results:

L	=	115.3	ft	7.2	6.2%	less than 20%? **YES**
L	=	122.5	ft			
α	=	8.59E-04		less than 0.1?	**YES**	
d	=	0.1097		less than 0.7?	**YES**	

Reference:
ASTM D5785-95: (Analytical Procedure) for Determining Transmissivity of Confined Nonleaky Aquifers by Underdamped Well Response to Instantaneous Change in Head (Slug Test)

Calculation of Transmissivity of Underdamped Well Response to Slug Test
(Check Sheet Showing Steps in Transmissivity Calculation)

Spreadsheet Calculation Check using ASTM D5785 Example (Refer to Section 8.4.4)
McHenry County Monitoring Well Network Installation
AECOM Environment Project No. 09000-460

Expression		Value	Units	Calculation Steps Cell #	Formula
$w(t_1)$	=	-1.0	ft.	F10	from graph
$w(t_2)$	=	-0.5	ft.	F11	from graph
t_1	=	4.9	sec.	F12	from graph
t_2	=	16.9	sec.	F13	from graph
R_c	=	0.25	ft.	F14	from as-built
R_s	=	0.25	ft.	F15	from as-built
L_c	=	95	ft.	F16	from test
L_s	=	55	ft.	F17	from test
τ	=	12	sec.	F18	=F13-F12
ϖ	=	0.5236	s^{-1}	F19	=2*(3.1416)/F18
γ	=	0.05776	s^{-1}	F20	=LN((F10/F11))/F18
T	=	b+a lnT		F21	given
$(g/L)^{1/2}$	=	0.5268		F22	=((F19^2)+(F20^2))^(1/2)
d	=	0.1097		F23	=F20/F22
a	=	0.03753	ft^2/sec	F24	=((F14^2)*(F22))/(8*F23)
Assume S	=	1.5E-05		F25	assumption
b	=	0.554	ft^2/sec	F26	=(-F24)*(LN((0.79)*(F15^2)*(F25)*(F22)))
T_1	=	b+a lnT_0		F27	given
Assume T_0	≈	b_1		F28	assumption
T_1	=	0.5317	ft^2/sec	F29	=F26+((F24)*(LN(F26)))
T_2	=	0.5301	ft^2/sec	F30	=F26+((F24)*(LN(F29)))
T	=	45804	ft^2/day	F31	=F30*86400
From ASTM Example: T	=	45826	ft^2/day		

Percent Deviation Calc Sheet is from Example:

Check the results:

				<	0.05%	
L	=	115.3 ft	7.2	6.2%	less than 20%?	**YES**
L	=	122.5 ft				
α	=	8.59E-04	less than 0.1?	**YES**		
d	=	0.1097	less than 0.7?	**YES**		

Reference:
ASTM D5785-95: (Analytical Procedure) for Determining Transmissivity of Confined Nonleaky Aquifers by Underdamped Well Response to Instantaneous Change in Head (Slug Test)

Hvorslev Equations Referenced in Cedergren (1977)

The volume of flow required to equalize the pressure difference h is $V = Ah$. Hvorslev (1951) defines the *basic time lag* T as the time required for equalization of this pressure difference when the original rate of flow $q = Fkh$ is maintained. It then follows that

$$T = \frac{V}{q} = \frac{Ah}{Fkh} = \frac{A}{Fk} \tag{2.30}$$

Equation 2.29 may be rewritten

$$\frac{dy}{z - y} = \frac{dt}{T} \tag{2.31}$$

Equation 2.31 is the basic differential equation for the hydrostatic time lag.

In the field the basic time lag is determined by raising or depressing the head in a standpipe or other pressure measuring device and

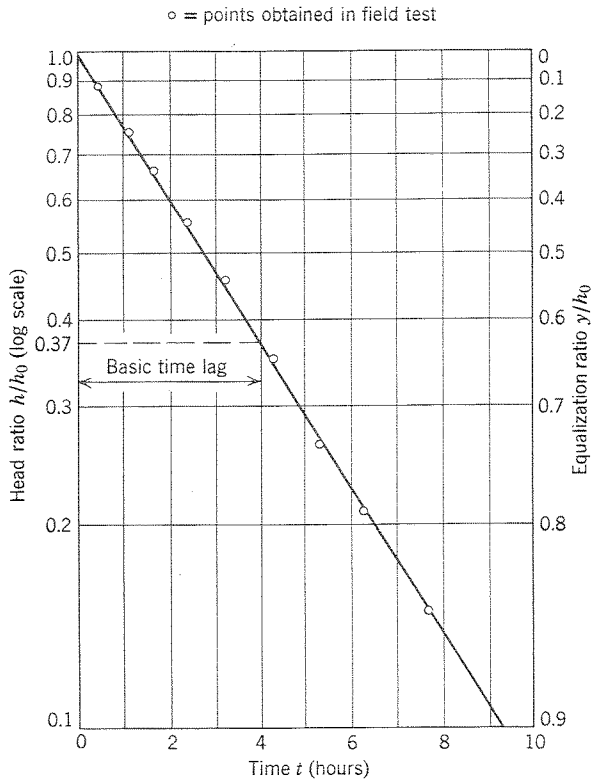


FIG. 2.19 Plot used for basic time lag determination.

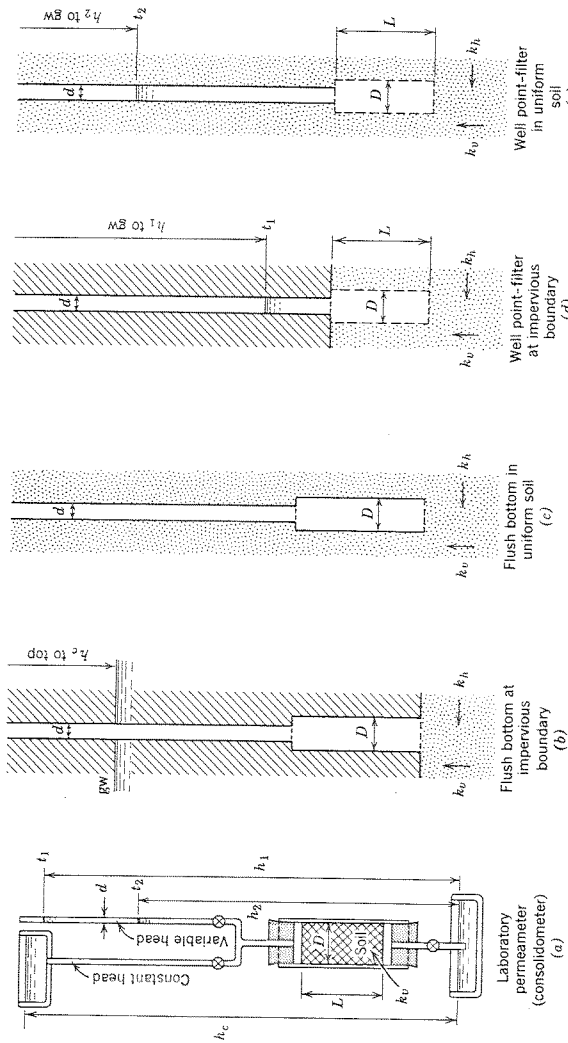


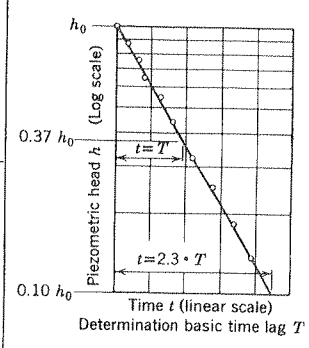
FIG. 2.20 Formulas for determination of permeability. (After Hvorslev, U.S. Corps of Engineers, W.E.S.)

Case	Constant head	Variable head	Basic time lag
a	$k_v = \dfrac{4 \cdot q \cdot L}{\pi \cdot D^2 \cdot h_c}$	$k_v = \dfrac{d^2 \cdot L}{D^2 \cdot (t_2 - t_1)} \ln \dfrac{h_1}{h_2}$ $k_v = \dfrac{L}{t_2 - t_1} \ln \dfrac{h_1}{h_2}$ for $d = D$	$k_v = \dfrac{d^2 \cdot L}{D^2 \cdot T}$ $k_v = \dfrac{L}{T}$ for $d = D$
b	$k_m = \dfrac{q}{2 \cdot D \cdot h_c}$	$k_m = \dfrac{\pi \cdot d^2}{8 \cdot D \cdot (t_2 - t_1)} \ln \dfrac{h_1}{h_2}$ $k_m = \dfrac{\pi \cdot D}{8 \cdot (t_2 - t_1)} \ln \dfrac{h_1}{h_2}$ for $d = D$	$k_m = \dfrac{\pi \cdot d^2}{8 \cdot D \cdot T}$ $k_m = \dfrac{\pi \cdot D}{8 \cdot T}$ for $d = D$
c	$k_m = \dfrac{q}{2.75 \cdot D \cdot h_c}$	$k_m = \dfrac{\pi \cdot d^2}{11 \cdot D \cdot (t_2 - t_1)} \ln \dfrac{h_1}{h_2}$ $k_m = \dfrac{\pi \cdot D}{11 \cdot (t_2 - t_1)} \ln \dfrac{h_1}{h_2}$ for $d = D$	$k_m = \dfrac{\pi \cdot d^2}{11 \cdot D \cdot T}$ $k_m = \dfrac{\pi \cdot D}{11 \cdot T}$ for $d = D$

Notation

D = diam. intake, sample, cm
d = diameter, standpipe, cm
L = length, intake, sample, cm
h_c = constant piez. head, cm
h_1 = piez. head for $t = t_1$, cm
h_2 = piez. head for $t = t_2$, cm
q = flow of water, cm^3/sec
t = time, sec
T = basic time lag, sec
k_v = vert. perm. ground, cm/sec
k_v' = vert. perm. casing, cm/sec
k_h = horz. perm. ground, cm/sec
k_m = mean coeff. perm. cm/sec
m = transformation ratio
$k_m = \sqrt{k_h \cdot k_v} \quad m = \sqrt{k_h / k_v}$
$\ln = \log_e = 2.3 \log_{10}$

d	$k_h = \dfrac{q \cdot \ln\left[\dfrac{2mL}{D} + \sqrt{1 + \left(\dfrac{2mL}{D}\right)^2}\right]}{2 \cdot \pi \cdot L \cdot h_c}$	$k_h = \dfrac{d^2 \cdot \ln\left[\dfrac{2mL}{D} + \sqrt{1 + \left(\dfrac{2mL}{D}\right)^2}\right]}{8 \cdot L \cdot (t_2 - t_1)} \ln \dfrac{h_1}{h_2}$ $k_h = \dfrac{d^2 \cdot \ln\left(\dfrac{4mL}{D}\right)}{8 \cdot L \cdot (t_2 - t_1)} \ln \dfrac{h_1}{h_2}$ for $\dfrac{2mL}{D} > 4$	$k_h = \dfrac{d^2 \cdot \ln\left[\dfrac{2mL}{D} + \sqrt{1 + \left(\dfrac{2mL}{D}\right)^2}\right]}{8 \cdot L \cdot T}$ $k_h = \dfrac{d^2 \cdot \ln\left(\dfrac{4mL}{D}\right)}{8 \cdot L \cdot T}$ for $\dfrac{2mL}{D} > 4$
e	$k_h = \dfrac{q \cdot \ln\left[\dfrac{mL}{D} + \sqrt{1 + \left(\dfrac{mL}{D}\right)^2}\right]}{2 \cdot \pi \cdot L \cdot h_c}$	$k_h = \dfrac{d^2 \cdot \ln\left[\dfrac{mL}{D} + \sqrt{1 + \left(\dfrac{mL}{D}\right)^2}\right]}{8 \cdot L \cdot (t_2 - t_1)} \ln \dfrac{h_1}{h_2}$ $k_h = \dfrac{d^2 \cdot \ln\left(\dfrac{2mL}{D}\right)}{8 \cdot L \cdot (t_2 - t_1)} \ln \dfrac{h_1}{h_2}$ for $\dfrac{mL}{D} > 4$	$k_h = \dfrac{d^2 \cdot \ln\left[\dfrac{mL}{D} + \sqrt{1 + \left(\dfrac{mL}{D}\right)^2}\right]}{8 \cdot L \cdot T}$ $k_h = \dfrac{d^2 \cdot \ln\left(\dfrac{2mL}{D}\right)}{8 \cdot L \cdot T}$ for $\dfrac{mL}{D} > 4$



Determination basic time lag T

Assumptions: Soil at intake, infinite depth and directional isotropy (k_v and k_h constant); no disturbance, segregation, swelling or consolidation of soil; no sedimentation or leakage; no air or gas in soil, well point, or pipe; hydraulic losses in pipes, well point or filter negligible. (After Hvorslev, U.S. Corps of Engineers, W.E.S.)

FIG. 2.20 (Continued).

Appendix D

ITR Comments and QA/QC Checklist

Appendix D-1 ITR Comments

Appendix D-2 QA/QC Checklist

Appendix D-1 ITR Comments

horizontal conductivity was assumed to be much greater than vertical conductivity. For the purpose of these analyses, it was assumed that the horizontal conductivity (K_h) was 3 times greater than vertical hydraulic conductivity (K_v). Thus the anisotropy ratio (K_v/K_h) of 0.33 was used. This assumption is similar to reported values of K_v/K_h ranging between 0.1 and 0.5 for alluvium by Todd (1980).

78. Sixteen out of the twenty-eight wells had conductivities greater than $1x10^{-2}$ cm/sec. Only the Riley Township well ($1.3x10^{-1}$) was found to have a conductivity higher than $1x10^{-1}$ cm/sec. The lowest conductivities (i.e. < $5x10^{-4}$ cm/sec) were found in wells that were screened entirely within the upper portion of bedrock. These wells (1-CHE-D, 17-ALG-D and the bedrock solution at 7-HRT-D) were completed in bedrock because there was no appropriate place to screen the wells within the overburden. The deep well in Hartland Township was screened across the bedrock interface and displayed recovery curves for both the bedrock and the sand overlying it. These wells had reduced conductivities because the boreholes were only advanced a short distance (< 10ft) into rock to maintain representative head conditions at the top of rock interface. As a result, there was little opportunity to intersect fractures within the bedrock.

79. Besides the deep well in Hartland Township, the deep well at the Nunda Township Site (13-NUN-D) was the only other well to show a dual conductivity response indicative of the a well being screened across an interface. The water level recovery curve at the Nunda well was much more subtle than the Hartland well because the conductivity of the sand and the bedrock were more similar. In fact, the conductivity results for both the sand and bedrock were averaged to determine the deep well's conductivity.

80. For the artesian wells, the assumption that the hydraulic conductivity could be calculated using constant head test injection methods appears to be acceptable. The injection test calculations for the Hebron wells 3-HEB-I and 3-HEB-D yielded conductivity values (i.e. $9.0x10^{-3}$ cm/sec and $3.3e^{-3}$ cm/sec for I & D, respectively) that were within the range of other well sites. It should be noted that when the stainless steel packers were installed on April 15th, the pressures and flows were measured and similar readings were found. The results of the pressure readings are provided in the water level monitoring sheet in the Folio #3 of Appendix A.

3.4 Water Level Monitoring Results

81. A hydrograph of all of the manual water levels taken at the new observation wells is shown in Figure 3. Groundwater levels vary considerably throughout the County. The highest elevation (960.29 ft msl) was observed at the Alden well on Feb. 24, 2009, while the lowest elevation (737.95 ft msl) was recorded at the intermediate well at the Nunda site on Dec. 5, 2008. The Alden Township well is located in the highest point in the County close to the regional recharge area for the glacial aquifers. Conversely, the Nunda Township site is closest site to the Fox River which acts as the regional discharge for the glacial aquifers.

82. Perhaps the most interesting water level was observed at the shallow well in Algonquin Township. The shallow well is installed in a sand and gravel seam between 42 and 45 ft bgs, but the water levels are continually above ground surface. Water levels were frequently measured to be about a foot below the top of casing (Refer to water level table in Appendix A-17). This is interesting considering the well is located at an elevated location compared its surrounding area. Based on the USGS topo map for the Algonquin Site (see Appendix A-17), there are limited areas where the ground surface elevations are greater than at the well (882.5 ft msl). Since water in this well is above ground surface and freezes in winter, it also required a packer that sealed the well off below the frost line. A detailed schematic of the packer assembly is included in Appendix A-17.

83. Gradients between nested observation wells varied throughout the County based on the location of the wells in relation to recharge and discharge areas. Downward gradients (i.e. sites that had decreasing groundwater heads with deeper wells) were typically observed in areas where deeper aquifers were being recharged. Upward gradients (i.e. higher heads in deeper wells) indicated lower portions of the aquifer were flowing to surface discharge areas. Water level results at individual well sites are described in section 4.0.

Comment [A3]: Gary, I think it may be useful for the reader to have a summary in final summery of range and average cond. For the shallow, the intermediate and the deep aquifers with a not that they include the cond. of the artesian aquifers.

Comment [b4]: The shallow, intermediate and deep well nomenclature was developed to keep track of hydrostatic units at each individual site. So averaging data from site to site would be arbitrary and would not necessarily correlate hydrostratigraphic units properly. Therefore, a summary of conductivity results based on well names was not completed to avoid confusion and erroneous usage.

Deleted: sink

Comment [A5]: Gary, you will need to reword this. I think you mean that the surrounding surface elevation is greater than the top of well and this may be the reason for the artesian conditions??

Comment [b6]: The text was revised to reflect the commenter's suggestion.

Deleted: the next

Well Site #8 – Greenwood Township
MCCD Property at Barber Fen on Wondermere Rd

105. The Greenwood Township site is located on the property of an abandoned farm house. Some former buildings can be seen in the aerial photo of the site in Appendix A-8. Demolition debris from the house or out-buildings could be seen at the surface during site inspections, but were especially evident during installation of the protective bollards in the upper 4-feet of the soil. Below the surficial fill, a 20 foot thick till sequence overlies the uppermost water bearing unit. This unit is approximately 15 feet thick and consists of gravelly coarse sands that grade to fine sands below 34 feet. Although a shallow well was not installed at this depth, this shallow unit is likely critical to the Barber Fen because it likely discharges along the banks of Nippersink Creek. The base of the upper water bearing unit is at an elevation of 820 ft msl, while the elevation of the creek is approximately 815 ft msl at the site. Since fens are typically fed by cool, mineralized groundwater that supports the unique flora and fauna, an additional well screened within the upper water bearing unit (roughly between 25 and 33 ft bgs) may be of interest of the MCCD for resource protection purposes.

106. The intermediate hydrostatic zone appears to also discharge to Nippersink Creek, but the discharge would occur upward along the creek and not along the stream bank. However, the intermediate hydrostatic zone at the Greenwood site appears to be very productive. The intermediate aquifer is approximately 20 feet thick and consists of nearly 70% gravel based on the particle size test results. The conductivity test also showed that this interval was very permeable.

107. The deepest well at the site was installed in a thicker aquifer (48ft aquifer between 120 and 168 ft bgs), but had a slower conductivity. Based on the water level monitoring data, it appears this unit is utilized by nearby residents as a potable water source because of its "choppy" appearance which is indicative of nearby pumping wells.

Well Site #9 – McHenry Township
Harrison-Benwell Park on McCullom Lake Rd

108. Two wells were installed at the McHenry Township well site in sand units that were separated by a thick till sequence that is believed to be the main diamicton unit of the of the Tiskilwa Formation between 29 and 153 feet below ground surface. A very thin intratill silt seam was observed between 73 and 74 ft, but was deemed unworthy to monitor. The McHenry Township well site was one of the most difficult boreholes to advance using the roto-sonic drilling method. Unconfined compressive strength measurements taken in the field were frequently greater than 4.5 tons per square foot (tsf) throughout the very hard till. Another noteworthy occurrence in the samples was an organic silt layer that was observed near the bottom of the hole between 181-183 ft bgs. It is suspected that the organic-rich silt represents windblown deposits and the former soil horizon of the Morton-Robein-Berry Clay complex. The organic-rich silt is a marker bed for the Sangamon Episode where climate conditions were similar to those of today (Curry et al, 1997).

109. The deep well is set immediately overlying the paleosol between 175 and 180 ft bgs, in a 34 foot thick sand aquifer. If the paleosol is part of the Sangamon Episode, then the deep hydrostatic zone is likely the Pearl/Ashmore aquifer. According to the well construction report obtained for the Harrison School located next to the site, the deep well is likely screened in the same unit as the school's well.

Comment [A9]: Comment on elevated chloride??

Comment [b10]: A sentence was added to address the high chloride detection.

Well Site #10 – Marengo Township
MCCD Land on County Line Rd

110. The western-most well in County, the Marengo site is located south and west of Wisconsin-aged deposits. The site is located in the flat outwash plain of the Kishwaukee River valley. The sand deposits at the surface are 26 feet and are underlain by a 16 foot till sequence. The till overlies weathered Ordovician Maquoketa Group bedrock. The well site is located in close proximity to Rush Creek and the Kishwaukee River. Because of the high water table in the sand (~776 ft msl) and river (~773 ft msl), it is recommended that

4.0 WELL SITE DATA SUMMARY AND COMMENTARY

84. This section provides a narrative summary for the subsurface conditions observed at each observation well site. The summary includes much of the following information:

- Location of the major permeable zones,
- Depths at which the wells were installed,
- Thicknesses of aquifer(s) found onsite,
- Description of noteworthy features and their significance,
- Water level information (i.e. depth, gradients, etc),
- Possible significance of water quality & hydraulic conductivity test results, and
- Operation and Maintenance Issues.

Well Site #1 - Chemung Township
Meyer Material Property on Lawrence Rd

Comment [A7]: Gary, we may want to consider cutting each well summary and making it the first page of each folio in addition to leaving the summaries in this section as well.

Comment [b8]: The summary write-up for each well site has been provided in the well folios.

85. The Chemung Township is located west of the Marengo Moraine margin, which indicates that the area received alluvial pro-glacial deposits in front of Wisconsin Episode advances (Curry et al, 1997). Stratified sand and gravel outwash deposits (that are likely Henry Formation deposits) were found between 6 feet and 54 feet below ground surface. A shallow well was installed in a medium gravel zone with some cobbles that were recovered. The particle size distribution of the well screen interval is likely biased low because the 3½" ID core barrel would limit the recovery of the cobble-size pieces. The shallow well was the only occurrence where an unconfined well had an under-damped response from slug testing. However, the confined assumption of the van der Kamp (1977) solution was considered valid since K_h is likely several orders of magnitude greater than K_v due to the poorly graded gravelly sequence where the well was screened. The shallow hydrostatic zone consists of an approximate 47 foot thick aquifer and is underlain by 49 feet of clay-rich diamicton.

86. No intermediate well was installed at this location. The one possible zone where a possible well could be installed is through granular deposits that were found at a depth of 81 to 83 feet. It was determined that these thin medium sand seams were not considered significant enough to justify an additional well at the site.

87. The deep well was installed in bedrock that was encountered at 103 ft bgs. No sand or gravel deposits were found below 83 feet. A possible buried soil horizon consisting of mottled dark brown and black organic silt was observed at a depth of 96 to 97 ft bgs. The possible paleosol was deposited overlying the basal till unit. The borehole was advanced to a depth of roughly 111 ft and the well was set entirely within rock. The deep well appeared to produce an adequate volume of water since a high head in the well was observed shortly after installation (i.e. static water level was < 8 ft bgs). A slight upward gradient between the deep and shallow well was also observed. However, based on the conductivity testing, the deep well had the lowest permeability of all the wells.

88. The well site is located in an area of flat outwash deposits that provide good recharge conditions to the shallow aquifer. However, the site does not appear to be located in a deeply incised tributary to the Troy Bedrock Valley which is located northwest of the site. These tributaries have been suggested as targets for potential groundwater resource exploration by Curry and others (1997).

the surface water bodies (i.e. the Kishwaukee River and Rush Creek) be monitored for stage and flow to obtain data on the local surface and ground water interactions and water budget.

Well Site #11 – SenecaTownship
Seneca Town Hall on Garden Valley Rd

111. The Seneca Township well site is located in one of the most prolific aquifers in the County. Located between the Marengo Moraine to the west and the Woodstock Moraine to the west, the Seneca well site has thick coarse sand and gravel deposits of the Henry Formation. Both of the wells installed at the site have high conductivities and have high heads. The site has a slight upward gradient, which suggests that groundwater is discharging to the nearby Kishwaukee River.

Well Site #13 – Nunda Township
Stickney Run Park (north entrance) on State Park Rd.

112. The Nunda Township well site is located close to the Fox River, which acts the regional discharge for the quaternary aquifers. As a result, groundwater elevations in the well are the lowest observed amoung the new observation wells. The discharge conditions are suggested by the slight upward gradients observed between the shallow and deep wells. Similar to the McHenry Township site located at Harrison-Benwell Park, the Nunda site also consisted of very hard till. The difficult drilling at the two sites is believed to be related to similar depositional environments of the Tiskwila Till. However, a shallow well was installed in McHenry, whereas the surficial aquifer at the Nunda site was not installed. The Nunda shallow well would have been targeted for sand and/or gravel deposits between 16 and 24 feet below grade. Instead, an intermediate and a deep well was installed. The intermediate well was installed within a relatively coarse sand and gravel aquifer that was 26 feet thick (between 95 and 121 ft bgs). The deep well was installed at the bedrock interface. Limited granular units were found overlying the bedrock surface.

Well Site #14 – Riley Township
Right-of-way embankment at Harmony Road bridge over I-90

113. The Riley Township site is located west of the Marengo Moraine and has limited thickness of materials overlying bedrock. Only 29 feet of overburden is present at the well, which consists of about 15 feet of saturated sand. Although this observation well will have little direct information on a primary Quaternary aquifer, it will be useful for the overall water budget of the County. The unconfined near-surface sand deposits are very conductive and are located in close proximity to Coon Creek. The Riley Township well was calculated to have the highest conductivity of all the site wells (i.e. 1.3×10^{-1} cm/s), which can be used to assume that groundwater has a strong interaction with the nearby creek. Coon Creek is a tributary to the Kishwaukee River. The Riley Township site is also valuable since other information such as atmospheric data and surface water data are collected nearby. A weather station is located on the Harmony Rd bridge and a gauging station is located on Harmony Rd where Coon Creek crosses.

Comment [A10]: Elevated CL levels???

114. The well is installed in a right-of-way embankment along the Harmony Road Bridge over Interstate 90. The de-icing activities on the Interstate and bridge are believed to have an impact on the shallow groundwater quality. Groundwater quality results indicate elevated levels of sodium and chloride at this location. The high conductivity of the shallow materials indicates this area is particularly susceptible to anthropogenic impacts.

Comment [b11]: An additional paragraph was added to address the elevated Cl levels observed at the Riley site.

Well Site #15 – Coral Township

MCCD Pleasant Valley Property on Hemmingsen Rd.

115. The Coral Township well site is located in a similar physiographic area as the Seneca Township, which is located approximately 6 miles to the northwest. However, unlike Seneca Township, the Coral Township site is located in a hummocky topographic area which is believed to be low-lying remnants of either the Barlina or Huntley Moraine (Curry et al, 1997). The Coral site had a relatively thick sequence of sand and gravel deposits that were overlaid by a 30 foot thick diamicton unit. The sand and gravel aquifer was observed from 39 to 108 feet below grade. A thin organic silt deposit (which may be a Sangamon episode paleosol) separates the upper hydrostatic unit, with another 6-foot hydrostatic unit between 110 and 116 feet. However, it can be argued that these units are hydraulically similar since conductivities, heads and chemistry are similar. Data will be available to further evaluate this issue considering all three wells were screened within the same sequence of sand and gravel.

Formatted: Bullets and Numbering

Comment [A13]: From where and from whom???

Comment [b14]: This sentence was eliminated from the text.

Appendix D-2 QA/QC Checklist

Quality Control Plan
For
McHenry County
Monitoring Well Installation
McHenry County, Illinois
August 20, 2008
W912P6-06-D-0001

Quality Control Check List:

- √ Were monitoring well locations cleared with utilities?
- √ Were the wells drilled at the required locations?
- √ Were the wells drilled within the provided real estate?
- √ Were the wells drilled to the required depth?
- √ Were the representative samples collected from each well screened area?
- √ Were the screens installed at or near the bottom of the aquifer?
- √ Were the wells properly developed?
- √ Were water quality samples collected and analyzed for each of the 35 new monitoring wells?
- √ Was each site properly restored?
- √ Were all cuttings removed from the site and properly disposed of?
- √ Were the wells chlorinated in accordance with the Scope of work?
- √ Are the boring logs on the Corps Form?
- √ Was the water depth recorded on the boring logs?
- √ Was the soil stratigraphy logged in accordance with ASTM D 5434?
- √ Were each of the wells locations and surface elevation surveyed, to the reference datum?
- √ Are the "as-drilled" locations of the wells shown on the location map?
- √ Are there photographs of the drilling, well installation, and other operations included in the report?
- √ Were the grain size analysis laboratory tests conducted?
- √ Are the lab test results sheets included in the report?
- √ Were the lab test conducted in accordance with the proper ASTMs?
- √ Were the well logs modified to reflect the lab test results?
- √ Was the in-situ hydraulic conductivity testing completed in accordance with ASTM D5785, for each well?
- ☐ Was the Well Telemetry system installed as described in the Scope of Work? **N/A**

- ☐ Were the Corps and County representatives trained in operation of the telemetry system? **N/A**
- √ Were O&M manuals for the LevelTrolls provided to the owners?
- √ Is there a well folio for each well in the final report?
- √ Are all of the well logs included in the final report?
- √ Are well completion diagrams, for each well included in the report?
- √ Does the final report meet the outline contained in the Scope of Work?
- √ Does the final report include a CD with all of the electronic files?
- √ Does the final report contain the ITR comments and their resolution?
- √ Is the final report signed?