Consumers Energy
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Date: June 7, 2018

To: Operating Record

From: Harold D. Register, Jr., P.E.

RE: Groundwater Monitoring System Certification, §257.91(f)
DE Karn Power Plant, Karn Lined Impoundment

Introduction

According to Title 40 Code of Federal Regulations (40 CFR) Part 257, Subpart D, §257.91(f); the owner or operator of a Coal Combustion Residual (CCR) management unit must obtain a certification from a qualified professional engineer stating that the groundwater monitoring system at the CCR management unit has been designed and constructed to meet the requirements of §257.91. Additionally, §257.91(a) details a performance standard requiring the system monitor the uppermost aquifer and include a minimum of at least one upgradient and three downgradient monitoring wells, and that if the uppermost aquifer monitoring system includes the minimum number of wells, the basis supporting use of only the minimum.

Groundwater Monitoring System

A groundwater monitoring system has been established for the Karn Lined Impoundment, which established the following locations for determining background groundwater quality and detection monitoring. The downgradient monitoring network accurately represents the quality of groundwater passing the waste boundary and ensures detection of groundwater contamination in the uppermost aquifer based on the upgradient groundwater mound and the limit of the practical length of the unit extending only 600 feet and acreage limited to less than one acre.

Background:

DEK-MW-15003

Downgradient:

OW-12 DEK-MW-18001 OW-10

Supplemental Data Analysis[1]:

OW-11

[1] OW-11 will be sampled to be potentially utilized in a future intra-well statistical evaluation program.

Provided herein, as required by §257.91(f), is certification from a qualified professional engineer that the groundwater monitoring system at Consumers Energy Karn Lined Impoundment meets the requirements of §257.91.

CERTIFICATION

Professional Engineer Certification Statement [40 CFR 257.91]

I hereby certify that, having reviewed the attached documentation and being familiar with the provisions of Title 40 of the Code of Federal Regulations §257.91 (40 CFR Part 257.91), I attest that this Groundwater Monitoring System has been designed and constructed to meet the requirements of 40 CFR 257.91. The report is accurate and has been prepared in accordance with good engineering practices, including the consideration of applicable industry standards, and with the requirements of 40 CFR Part 257.91.

Harold D. Register J.

Signature

June 7, 2018

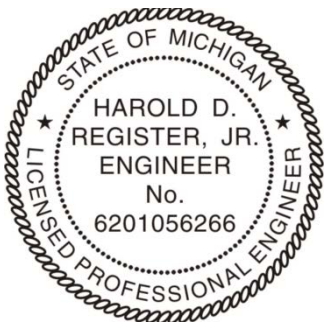
Date of Certification

Harold D. Register, Jr., P.E.

Name

6201056266

Professional Engineer Certification Number



06/07/2018

ENCLOSURES

TRC Environmental (2018). "*Groundwater Monitoring System Summary Report – Consumers Energy, DE Karn Lined Impoundment (KLI)*"

Technical Memorandum

Date:	June 5, 2018
To:	J.R. Register, CEC
From:	Darby Litz, TRC Graham Crockford, TRC
Project No.:	290804.0000 Phase 002, Task 005
Subject:	Groundwater Monitoring System Summary Report – Consumers Energy, DE Karn Lined Impoundment (KLI)

The United States Environmental Protection Agency (U.S. EPA) established a comprehensive set of requirements for management and disposal of coal combustion residuals (CCR) in landfills and surface impoundments in the Final Rule: Disposal of CCR from Electric Utilities (CCR Rule) on April 17, 2015. The Consumers Energy Company (CEC) DE Karn Lined Impoundment (KLI) is a new CCR unit is subject to the CCR Rule.

The objective of this report is to document and certify that the CCR Groundwater Monitoring System for the KLI has been designed and constructed to meet the requirements of Title 40 Code of Federal Regulations (CFR) §257.91 (a)(1) and (2) of the CCR Rule. TRC Environmental Corporation (TRC) was retained by CEC to provide this report documenting the construction of the CCR groundwater monitoring system for the KLI CCR Unit.

Site Overview

The DEK Power Plant site (the Site) is located north of the JC Weadock (JCW) Power Plant site (JCW Site), east of the Saginaw River, south and west of Saginaw Bay (Figure 1 of the SAP). A discharge channel runs along the majority of the southern perimeter of the site and separates the facility from the JCW Site to the south. The plant began generating electricity in 1959. Two power generating units (Units 1 & 2) are coal-fueled and two units (Units 3 & 4) are oil- and natural gas-fueled.

Description of CCR Unit

Previously, the DEK Bottom Ash Pond (existing DEK CCR unit) was used for wet ash dewatering and was the primary settling/detention structure for the NPDES treatment system prior to discharge. The existing DEK Bottom Ash Pond will be closed by removal of CCR in accordance with self-implementing requirements of the CCR Rule. In preparation for removal of the Bottom Ash Pond, a new lined impoundment CCR unit (KLI CCR unit) has been constructed. The liner system was

designed as a double composite liner system, with the primary and secondary composite liners each consisting of 60-mil High Density Polyethylene (HDPE) geomembrane (GM) overlaying 236-mil geosynthetic clay liner (GCL)[1]. The wet ash dewatering will be relocated to the new impoundment (KLI CCR unit), which is scheduled to begin receipt of CCR in June 2018.

Hydrogeology

The majority of KLI area is comprised of surficial CCR and sand fill. USGS topographic maps and aerial photographs dating back to 1938, in addition to field descriptions of subsurface soil at the site, indicate that the site was largely developed by reclaiming low-lands through construction of perimeter dikes and subsequent ash filling.

The surficial fill consists of a mixture of varying percentages of ash, sand, and clay-rich fill ranging from 5 to 15 feet thick. Below the surficial fill, native alluvium and lacustrine soils are present at varying depths. Generally, there is a well graded sand unit present to depths of 10-30 feet below ground surface (ft-bgs) overlying a clay till which is observed at depths ranging from 25 to 75 ft-bgs. A sandstone unit, which is part of the Saginaw formation, was generally encountered at 80-90 ft-bgs.

The site is bound by several surface water features (Figure 1 of the SAP): the Saginaw River to the west, Saginaw Bay (Lake Huron) to the north and east, and a discharge channel to the south. In general, shallow groundwater is encountered at a similar or slightly higher elevation relative to the surrounding surface water features. Groundwater flow in the upper aquifer is largely controlled by the surface water elevations of Saginaw River and Saginaw Bay. In the vicinity of the existing DEK Bottom Ash Pond and new KLI, the shallow groundwater flow is generally radial, flowing outward from the pond area toward the surrounding surface water bodies.

As Bottom Ash Pond closure activities commence, and dewatering begins, the local groundwater flow regime will be temporarily altered. Once the bottom ash removal activities are complete and groundwater elevations re-equilibrate, groundwater flow in the impoundment area will be driven by Saginaw Bay to the north and by the Saginaw river to the west in the absence of the hydraulic head from the former Bottom Ash Pond.

Groundwater Monitoring System

In accordance with 40 CFR 257.91, CEC has developed a groundwater monitoring system for the new KLI CCR unit. Because of the site hydrogeology and presence of affected groundwater due to the history of CCR-related operations throughout the DE Karn Site, an intra-well statistical approach is recommended for detection monitoring. However, there is currently insufficient data from wells in the KLI monitoring well system to support intra-well statistical methods, and based on hydrogeologic conditions, the frequency of sampling to collect data to support the intra-well methods will take

[1] Golder Associates Inc. 2018. *Bottom Ash Lined Impoundment Line System Design Certification Report, DE Karn Generating Facility, Essexville, Michigan.* April.

several years (see Section 3.2 of the SAP; TRC, 2018). Establishing background in a six-month time, per the CCR rule, does not allow for collection of sufficient statistically independent samples. Therefore, for an interim period, CEC will perform inter-well statistics using DEK-MW-15003 as the upgradient/background well until sufficient data are collected from the wells to support intra-well statistical procedures. The monitoring well network will consist of 5 wells located around the perimeter of the unit as discussed in the attached Sample and Analysis Plan (TRC, 2018) and Statistical Analysis Plan (TRC, 2018). These wells include:

Background:

DEK-MW-15003

Downgradient:

OW-12 DEK-MW-18001 OW-10

Supplemental Data Analysis[2]:

OW-11

The monitoring well locations are shown on Figure 2 of the SAP and Figure 1 of the Statistical Evaluation Plan. Relevant construction details are provided in Table 1 of the SAP. Soil boring logs and well construction diagrams are included in Appendix A of the SAP.

Background Data Collection and Detection Monitoring

In accordance with 40 CFR §257.94(b), for new CCR impoundments a minimum of eight independent samples for each background well must be collected and analyzed for the constituents listed in appendices III and IV to this part during the first six months of sampling. The detection monitoring program was established on June 1, 2018. Background sample collection for DEK-MW-15003 has been initiated and background will be established prior to the November 2018 detection monitoring sampling event, in accordance with the Stats Plan (TRC, 2018). In accordance with 40 CFR 257.94(b), groundwater samples will be collected and analyzed for Appendix III constituents on a semiannual frequency during the active life of the CCR unit and post-closure period. The KLI CCR unit monitoring well network will be initially sampled for Appendix III and Appendix IV constituents on a quarterly basis for two years to evaluate the potential for an intra-well statistical program for detection monitoring. Once sufficient sample data are collected from the five (5) KLI groundwater monitoring system wells for intra-well analysis, CEC will evaluate these data and determine alternative strategies for statistical evaluation of groundwater data.

Attachments

SAP; Stats Plan

[2] OW-11 will be sampled to be potentially utilized in a future intra-well statistical evaluation program.

Technical Memorandum

Sampling and Analysis Plan

Technical Memorandum

Sample and Analysis Plan

Sample and Analysis Plan

Electric Generation Facilities
RCRA CCR Detection Monitoring Program

DE Karn Power Plant Lined Impoundment
Essexville, Michigan

June 2018

Sample and Analysis Plan

Electric Generation Facilities
RCRA CCR Detection Monitoring Program

DE Karn Power Plant Lined Impoundment
Essexville, Michigan

June 2018

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Table of Contents

List of Tables

List of Figures

List of Appendices

Section 1
Introduction

On April 17, 2015, the United States Environmental Protection Agency (USEPA) issued the Coal Combustion Residual (CCR) Resource Conservation and Recovery Act (RCRA) Rule (40 CFR 257 Subpart D) ("CCR Rule") to regulate the solid waste management of CCRs generated at electrical generating facilities. The CCR Rule applies to existing and newly constructed CCR units.

Consumers Energy Company (CEC) operates a coal fired power generation facility at the DE Karn (DEK) site located in Essexville, Michigan (Figure 1). CEC is planning to remove CCRs and close their existing bottom ash basin in 2019. In order to manage future CCR bottom ash, DEK designed and constructed a lined bottom ash impoundment (Karn Lined Impoundment – KLI). The KLI is designed with a double composite liner system, with the primary and secondary composite liners consisting of HDPE overlying a geosynthetic clay liner. A secondary collection system collects liquids from between the primary and secondary liner systems. The KLI is scheduled to initiate receipt of bottom ash in June 2018.

New CCR units are required to have groundwater monitoring systems developed per the CCR Rule and a sampling and analysis plan developed to describe the means and methods of groundwater sample collection and analysis. TRC Environmental Corporation (TRC) has prepared this revised Groundwater Sampling and Analysis Plan (SAP) to evaluate groundwater quality for the newly constructed lined impoundment.

The collection of groundwater data will be completed to achieve compliance under the recently published 40 CFR Part 257, Subpart D – Standards for the Disposal of Coal Combustion Residuals (CCR) in Landfills and Surface Impoundments. The methodologies outlined in this SAP are consistent with the regulations, general federal and state guidance, TRC's and CEC's Standard Operating Procedures (SOPs), and industry standards.

This SAP is a revision to the SAP prepared for the Site by ARCADIS dated May 18, 2016, and has been modified to incorporate the monitoring well network established for the new KLI bottom ash impoundment constructed in 2018.

Section 2
Purpose and Objectives

The groundwater monitoring and corrective action compliance requirements for existing CCR units are set forth in 40 CFR 257.90 through 257.98. The groundwater sampling and analysis requirements are detailed in 40 CFR 257.93, and require the development of a Sampling and Analysis Plan (SAP) which details the sampling and analysis procedures that will be utilized to provide an accurate representation of groundwater quality at the background and downgradient wells. As per, 40 CFR 257.93(a) this SAP includes a description of the procedures and techniques that will be implemented for:

- Sample collection
- Sample preservation and shipment
- Analytical procedures
- Chain of custody control
- Quality assurance and quality control

Section 3
Implementation and Sampling Schedule

As set forth in 40 CFR 257.94(b), a minimum of eight (8) independent background samples must be collected within 6 months of initiating receipt of CCR in the KLI (a new CCR impoundment). CEC has established a groundwater monitoring system for the KLI and is in the process of collecting data in accordance with the CCR Rule. As stated previously, it is anticipated that the unit will likely initiate CCR receipt in June 2018. Therefore, the detection monitoring program was established on June 1, 2018, and the first semi-annual detection monitoring event will occur in November 2018.

3.1 Groundwater Monitoring System

In accordance with 40 CFR 257.91, CEC has developed a groundwater monitoring system for the new KLI CCR unit. Because of the site hydrogeology and presence of affected groundwater due to the history of CCR-related operations throughout the DE Karn Site, an intra-well statistical approach is recommended for detection monitoring. However, there is currently insufficient data from wells in the KLI monitoring well system to support intra-well statistical methods, and based on hydrogeologic conditions, the frequency of sampling to collect data to support the intra-well methods will take several years (see Section 3.2). Establishing background in a six-month time period, per the CCR rule, does not allow for collection of sufficient statistically independent samples. Therefore, for an interim period, CEC will perform inter-well statistics using DEK-MW-15003 as the upgradient/background well until sufficient data are collected from the wells to support intra-well statistical procedures. The groundwater monitoring system for the KLI unit consists of:

Background:

DEK-MW-15003

Downgradient:

OW-12 DEK-MW-18001 OW-10

Supplemental Data Analysis[1]:

OW-11

The monitoring well locations are shown on Figure 2 and relevant construction details are provided in Table 1. Soil boring logs and well construction diagrams are included in Appendix A.

[1] OW-11 will be sampled to be potentially utilized in a future intra-well statistical evaluation program.

3.2 Sampling Schedule and Frequency

Background sample collection for DEK-MW-15003 has been initiated and background will be established prior to the November 2018 detection monitoring sampling event, as described in the statistical evaluation plan (TRC 2018). In accordance with 40 CFR 257.94(b), groundwater samples will be collected and analyzed for Appendix III constituents on a semiannual frequency during the active life of the CCR unit and post-closure period. The KLI CCR unit monitoring well network will be initially sampled for Appendix III and Appendix IV constituents on a quarterly basis for two years to evaluate the potential for an intra-well statistical program for detection monitoring. Once sufficient sample data are collected from the five (5) KLI groundwater monitoring system wells for intra-well analysis, CEC will evaluate these data and determine alternative strategies for statistical evaluation of groundwater data.

Resampling of a well due to an anomalous result, either relative to data collected from other monitoring wells of similar type, or relative to other time-series data at an individual monitoring well, may be completed at any time. The timing of the resampling event and the reason for additional data collection will determine if events are statistically dependent and indicate the appropriate method for addressing interpretation or inclusion of data. Additional analytes may also be required pending the results of the monitoring events (in accordance with Section 257.94(e)). This document does not cover collection and analysis of such additional data.

Section 4
Sample Collection and Handling Procedures

The following sections address the methods and procedures associated with the collection and handling of groundwater samples at the Site. Five (5) monitoring wells (Table 1) are designated as KLI unit monitoring wells to assess the uppermost aquifer at the site.

Several other monitoring wells are present at the facility and are used for monitoring the DE Karn Landfill (non-CCR unit – Michigan Part 115) and the DE Karn Bottom Ash Pond (existing CCR unit) and some wells are utilized in multiple programs (Figure 2). Data from the other site wells will be utilized as needed to supplement the groundwater flow interpretation and/or nature and extent evaluations.

4.1 Groundwater Elevations

Groundwater level data will be collected from the five (5) monitoring wells in the KLI well network during each sampling event, prior to sampling. The monitoring well locations are depicted on Figure 2. Groundwater level monitoring will be conducted in accordance with Section 9.2 of the Low Stress (Low Flow) Purging and Sampling of Groundwater Monitoring Wells SOP presented in Appendix B.

Upon arrival at the site, monitoring wells will be opened and allowed to equilibrate with ambient air pressures prior to measuring the depths to water. Groundwater level measurements will then be made to the nearest 0.01 foot with an electronic water level indicator from the entire monitoring well network prior to sampling – monitoring wells that constitute a groundwater monitoring system for a CCR Unit shall be preferentially sampled in order to further minimize water level elevational changes relative to the CCR Unit. Monitoring wells shall be gauged on the same day to minimize temporal bias of measured groundwater elevation changes for the monitoring well network. Depth to water will be measured from established top of casing reference points as referenced in the record survey drawing. Groundwater levels, well conditions, and any pertinent observations will be recorded on the field log.

The measured hydraulic gradient will be used along with previously completed hydraulic conductivity testing to determine the apparent groundwater rate and direction during each sampling event.

4.2 Groundwater Sample Collection

Groundwater samples will be collected from the monitoring wells following Low-Flow (Minimal Drawdown) Groundwater Sampling Procedures (US EPA, 1996), as detailed in the Low Stress

(Low Flow) Purging and Sampling of Groundwater Monitoring Wells SOP (Appendix B). Low flow sampling will commence with the installation of either a peristaltic, stainless-steel 12-volt submersible impeller pump or bladder pump to a depth representing the middle of the saturated screen interval. An appropriate length of polyethylene tubing will be connected to the pump discharge prior to pump placement. The discharge line will be connected to a flow-cell and multi-meter to collect water quality indicator parameters (described below) during well purging to determine water quality stabilization.

The pump will be operated at a flow rate that ensures low volatilization and low well disturbance. Water quality indicator parameters and depth to water will be recorded at 3 to 5-minute intervals during the purging process and recorded on the sampling worksheet provided in Appendix C. Purging and sampling will proceed at a low pumping rate, expected to be between approximately 0.1 and 0.5 liters per minute or less, such that the water column in the well is not lowered more than 0.3 feet below the initial static depth to water measurement. The subject well will be considered ready to sample when three consecutive water quality measurements meet the stabilization criteria presented below.

PARAMETER	STABILIZATION CRITERIA
pH	3 readings within +/- 0.1 standard units (SU)
Specific Conductance	3 readings within +/- 3% millisiemens per centimeter (mS/cm)
Temperature	For Information Only
Turbidity	+/- 10% Nephelometric Turbidity Unit (NTU) variance between three consecutive readings and a turbidity less than 10 NTU
Oxygen Reduction Potential (ORP)	3 readings within +/- 10 millivolts (mV)
Dissolved Oxygen (DO)	3 readings within +/- 0.3 milligrams per liter (mg/L)

If the well is dry, no attempt at sampling will be conducted, as the aquifer is not considered to have sufficient quantity at that location. Additionally, if the well is pumped dry during low-flow monitoring activity, the well will be left overnight to accumulate water, then a sample collected assuming the NTU criteria can be met or, if necessary, filter the sample as laid out in Section 4.3 below. Prior to use, all equipment will be calibrated in accordance with the manufactures recommendations. Calibration information will be recorded in the field notes.

4.3 Sample Preservation and Shipment

Samples will be collected immediately following stabilization of field parameters as set forth in in the preceding section. Groundwater samples will be collected into the laboratory provided sample containers required for the analyses specified in the following section. The groundwater samples will be collected from the discharge tubing upstream of the water quality meter flow

cell. Care will be taken to allow for a non-turbulent filling of laboratory containers. Routine samples will not be filtered in the field to provide a measure of total recoverable metals that will include both the dissolved and particulate fractions of metals as per the CCR RCRA Rule.

If a more detailed understanding of the source of metals concentrations in groundwater is required for select monitoring wells, field filtered samples may be analyzed in addition to routine analysis. Field filtering may also be completed on highly turbid samples (greater than 10 NTU at stabilization). Field filtering will be completed using a 0.45-micron filter. If required, an attempt will be made to redevelop any monitoring wells that produce highly turbid prior to the subsequent sampling event. Where samples are filtered, a corresponding, unfiltered sample will also be collected.

The samples will be labelled, stored and transported to the laboratory according to the Chain-of-Custody, Handling, Packing and Shipping SOP presented in Appendix C. Following collection, samples will be immediately labelled, logged on the chain-of-custody, and placed in a cooler with ice. Sample coolers transported to the laboratory via overnight or next day air freight will be sealed with packing tape and a signed Chain-of-Custody seal. Sample coolers transported to the laboratory directly must be secured to ensure sample integrity is maintained. The samples will be packaged and shipped according to U. S. Department of Transportation and EPA regulations. The documentation of actual sample storage and transport will be by the use of chain-of-custody procedures. A laboratory provided chain-of-custody record will contain the dates and times of collection, receipt, and completion of all the analyses on a particular set of samples. The laboratory will return a copy of the chain-of-custody with the analytical report.

4.4 Quality Assurance/Quality Control (QA/QC)

Quality assurance/quality control (QA/QC) samples will be collected to ensure sample containers are free of analytes of interest, assess the variability of the sampling and laboratory methods, and monitor the effectiveness of decontamination protocols. The following QA/QC samples will be collected during each groundwater sampling event:

- Field duplicates will be collected at a frequency of one duplicate sample per 10 groundwater samples with at least one duplicate collected from each Unit. The field duplicates will be collected at the same time and in the same manner as the original sample. The duplicates will be labeled as a blind sample and noted on the sampling form of the designated well.
- Matrix spike/matrix spike duplicate (MS/MSD) samples will be collected at a frequency of one MS/MSD sample per 20 groundwater samples with at least one MS/MSD from each Unit. Duplicate and MS/MSD samples will be collected from different monitoring wells.
- Field blanks will be collected at a frequency of one field blank per 20 groundwater samples with at least one field blank collected from each Unit.

- Equipment blanks will be collected at a frequency of one equipment blank per 10 groundwater samples with at least one equipment blank collected from each Unit. The equipment blank will be collected by pouring distilled or deionized water over the decontaminated static water level meter or low flow pump and into the laboratory supplied containers.

The groundwater monitoring system at the DEK impoundment consists of 5 monitoring wells. Therefore, a total of 1 field duplicates, 1 MS/MSD, 1 field blank, and 1 equipment blanks will be collected during each groundwater sampling event. The QA/QC samples will be submitted to the laboratory for the routine analyses specified in Section 5 and in Appendix III and IV to Part 257. The laboratory should provide adequate documentation of laboratory reporting and QA/QC procedures.

4.5 Equipment Decontamination Procedures

All non-dedicated equipment will be decontaminated prior to use and between samples, following procedures presented in paragraph 9.6 of the SOP in Appendix B. Non-dedicated equipment will include a water level meter and low flow sampling pump (submersible) (if used). Each item will be cleaned using distilled or deionized water, and when necessary, and non-phosphate detergent wash followed by a distilled or deionized water rinse. When a peristaltic pump is used for low flow sampling, decontamination is not required, only replacement of the pump head tubing.

All dedicated equipment will be disposed of after each sampling point. Dedicated equipment will include polyethylene tubing and bladders if a bladder pump is used for low-flow sampling.

The flow-cell and water quality multi-meter (sonde) will be decontaminated at the completion of low-flow sampling. All sample collection will occur upstream of this device and therefore will not affect groundwater sample analytical results.

4.6 Investigation Derived Waste (IDW)

All waste created during monitoring well sampling will remain on site. All purge water from wells installed within the CCR Units will be discharged back onto the ground near the well it was purged from. All purge water from wells installed outside of a CCR Unit will be discharged to the ground in a manner that it doesn't directly enter a surface water or drain. All IDW will be handled according to details provided in paragraphs 9.3.8 and 9.4.10 of the SOP provided in Appendix B.

4.7 Field Documentation

All information pertinent to the field activities and sampling efforts will be recorded in a log or notebook, following the documentation procedures presented in section 5.4 of the SOP in

Appendix C. Example field logs are provided in the Attachments to Appendix B. At a minimum, entries in the sample logs will include the following:

- Property details and location
- Type of sample (for example, groundwater, surface water, waste)
- Number and volume of samples taken
- Sampling methodology
- Date and time of collection
- Sample identification number(s)
- Field observations including weather
- Any field measurements made (for example, pH, temperature, water depth and air monitoring data)
- Personnel present

Records shall contain sufficient information so that the sampling activity can be reconstructed without relying on the collector's memory. The sample logs will be preserved in electronic format.

Section 5
Analytical Suite and Procedures

As required for existing CCR units, all groundwater samples collected at the KLI Unit will be submitted to a laboratory for the analyses specified in Appendix III and IV to Part 257. The analytical methods and practical quantitation limits for each constituent are summarized below. If required, and in consultation with the laboratory, a comparable analytical method may be substituted for the analytical method recommended below. Analytical methods may also be modified to incorporate newer versions of the stated methods. All groundwater samples will be submitted to Consumers Energy Trail Street Laboratory. If any analyses are subsequently subcontracted to another accredited laboratory, the samples will be shipped using appropriate methods and COC documentation. All analyses will be performed within required hold times and consistent with the data quality objectives of this SAP.

Appendix III to Part 257—Constituents

CONSTITUENT	ANALYTICAL METHOD	PRESERVATION	HOLD TIME (DAYS)	REPORTING LIMIT (µG/L)
Boron	EPA 6020B	HNO_3, pH <2	180	20
Calcium	EPA 6020B	HNO_3, pH <2	180	1,000
Chloride	EPA 300.0	None, <6ºC	28	1,000
Fluoride[#]	EPA 300.0	None	28	1,000
pH	Stabilized field measurement	NA	NA	0.1 standard units
Sulfate	EPA 300.0	None, <6ºC	28	2,000
Total Dissolved Solids	SM 2540C	None, <6ºC	7	1,000

HNO_3 – Nitric acid
NA – Not applicable
[#] *Listed in both Appendix III and Appendix IV*

Appendix IV to Part 257—Constituents

CONSTITUENT	ANALYTICAL METHOD	PRESERVATION	HOLD TIME (DAYS)	REPORTING LIMIT (µG/L)
Antimony	EPA 6020B	HNO_3, pH <2	180	1
Arsenic	EPA 6020B	HNO_3, pH <2	180	1
Barium	EPA 6020B	HNO_3, pH <2	180	5
Beryllium	EPA 6020B	HNO_3, pH <2	180	1

Appendix IV to Part 257—Constituents

CONSTITUENT	ANALYTICAL METHOD	PRESERVATION	HOLD TIME (DAYS)	REPORTING LIMIT (µG/L)
Cadmium	EPA 6020B	HNO_3, pH <2	180	0.2
Chromium, total	EPA 6020B	HNO_3, pH <2	180	1
Cobalt	EPA 6020B	HNO_3, pH <2	180	15
Fluoride#	EPA 300	None, <6ºC	28	1,000
Lead	EPA 6020B	HNO_3, pH <2	180	1
Lithium	EPA 6020B	HNO_3, pH <2	180	10
Mercury	EPA 7470A	HNO_3, pH <2	28	0.2
Molybdenum	EPA 6020B	HNO_3, pH <2	180	5
Selenium	EPA 6020B	HNO_3, pH <2	180	1
Thallium	EPA 6020B	HNO_3, pH <2	180	2
Radium 226 and 228 combined^	EPA 903.1/904.0	HNO_3, pH <2	None	1 picocurie per liter (pCi/L)

Listed in both Appendix III and Appendix IV

^ *Requires a larger sample volume (minimum 2 liter)*

5.1 Optional Additional Analyses

To interpret groundwater monitoring data and determine the appropriate statistical methods for use in comparison of background and downgradient data sets, an understanding of aquifer connectivity and water types may be required. To determine if samples are collected from comparable aquifer units the predominant water type will be determined using Piper and Stiff diagrams.

Piper and Stiff diagrams are a graphical representation of the major anion and cation composition of a water sample and are useful in establishing if groundwater samples are from the same or a similar aquifer unit. To generate Piper and Stiff diagrams additional analytical data beyond that collected during routine sampling will be required. The additional analytical requirements are shown in the table below.

CONSTITUENT	ANALYTICAL METHOD	PRESERVATION	HOLD TIME (DAYS)	REPORTING LIMIT (µG/L)
Bicarbonate, carbonate and total alkalinity	ASM 2320B	None, 6ºC	14	10,000
Magnesium	EPA 6020B	HNO_3, pH <2	180	1,000
Sodium	EPA 6020B	HNO_3, pH <2	180	1,000
Potassium	EPA 6020B	HNO_3, pH <2	180	500

Section 6
Data Evaluation

In accordance with 40 CFR 257.93 data collected from eight samples from each background well will be used to calculate background concentrations for each constituent at each site. Background concentrations for each constituent will be calculated using an appropriate statistical method for each background well and constituent pair at the site, selected based on the distribution of the data in accordance with 40 CFR 257.93.

The data collected from background and downgradient monitoring wells will be compared using an appropriate statistical method, to be determined based on the distribution of data for each constituent, to assess if downgradient concentrations are consistent with background concentrations for each constituent. The statistical approach is detailed in the Groundwater Statistical Analysis Plan for the KLI Unit (TRC, 2018)[2].

[2] Groundwater Statistical Analysis Plan; DE Karn Power Plant Lined Impoundment; TRC; June 2018)

Table

Table 1
Monitoring Well Construction Summary
DE Karn Bottom Ash Impoundment – RCRA CCR Monitoring Program
Essexville, Michigan

Well Location	Ground Surface Elevation (ft)	TOC Elevation (ft)	Date Installed	Geologic Unit of Screen Interval	Well Construction	Screen Interval Depth (ft BGS)			Screen Interval Elevation (ft)			Borehole Terminus Depth (ft BGS)	Borehole Terminus Elevation (ft)
DEK Surface Impoundment													
DEK-MW-18001	TBD	TBD	5/21/2018	Sand	2" PVC, 10 Slot	11.5	to	16.5	TBD	to	TBD	18.0	TBD
DEK-MW-15003	599.9	602.79	10/12/2015	Sand	2" PVC, 10 Slot	21.0	to	25.0	578.9	to	574.9	29.0	570.9
OW-10	589.9	591.58	5/20/2010	Silty Sand and Silty Clay	2" PVC, 0.007 inch	13.9	to	18.9	576.0	to	571.0	20.0	569.5
OW-11	603.9	607.91	5/18/2010	Silt/Fly Ash	2" PVC, 0.007 inch	16.4	to	21.4	587.5	to	582.5	25.0	577.5
OW-12	TBD	603.10	5/19/2010	Silty Sand	2" PVC, 0.007 inch	TBD	to	TBD	584.2	to	579.2	TBD	579.2

Notes:

Survey for DEK-MW-15003, OW-10, and OW-11 conducted by Rowe Professional Services Company, November 2015.

Survey for OW-12 TOC was conducted in April 2018.

Survey for DEK-MW-18001 is pending.

Elevation in feet relative to North American Vertical Datum 1988 (NAVD 88).

TOC: Top of well casing.

ft BGS: Feet below ground surface.

TBD: To be determined pending updated survey information.

Figures

BASE MAP FROM USGS 7.5 MINUTE TOPOGRAPHIC QUADRANGLE SERIES.

N

1 " = 3,000 '
1:36,000

0 3,000 6,000 FEET

TRC
1540 Eisenhower Place
Ann Arbor, MI 48108-3284
Phone: 734.971.7080
TRC - GIS

PROJECT:

CONSUMERS ENERGY COMPANY
DE KARN AND JC WEADOCK POWER PLANTS
ESSEXVILLE, MICHIGAN

TITLE:

SITE LOCATION MAP

DRAWN BY:	J. PAPEZ
CHECKED BY:	D. LITZ
APPROVED BY:	G. CROCKFORD
DATE:	JUNE 2018
PROJ. NO.:	290804-001-002
FILE:	290804-001-002SLM.mxd

FIGURE 1

E:\ConsumersEnergy\CCR_GW\2017_269767\290804-001-002SLM.mxd -- Saved By: JPAPEZ on 6/5/2018, 16:08:30 PM

LEGEND

- DEK BOTTOM ASH POND MONITORING WELL
- DECOMMISSIONED WELL
- BOTTOM ASH POND & LINED IMPOUNDMENT MONITORING WELL
- DEK LINED IMPOUNDMENT MONITORING WELL
- MONITORING WELL
- EXTENT OF GEOSYNTHETICS

NOTES

1. BASE MAP IMAGERY FROM USDA – NATIONAL AGRICULTURE IMAGERY PROGRAM, 7/10/2016.
2. WELL LOCATIONS SURVEYED BY ROWE PROFESSIONAL SERVICES COMPANY ON 11/4/2015.
3. NOAA/NATIONAL OCEANIC SERVICE GREAT LAKES GAUGING STATION, ESSEXVILLE, MI (ID: 9075035).

0 200 400 Feet

1 " = 200 '
1:2,400

PROJECT:

CONSUMERS ENERGY COMPANY
DE KARN POWER PLANT
ESSEXVILLE, MICHIGAN

TITLE:

KARN LINED IMPOUNDMENT AREA

DRAWN BY:	S. MAJOR	PROJ NO.:	290804-001
CHECKED BY:	D. LITZ		
APPROVED BY:	G. CROCKFORD		**FIGURE 2**
DATE:	JUNE 2018		

TRC
1540 Eisenhower Place
Ann Arbor, MI 48108-3284
Phone: 734.971.7080
www.trcsolutions.com

FILE NO.: 290804-001-001.mxd

TRC - GIS
Coordinate System: NAD 1983 StatePlane Michigan South FIPS 2113 Feet Intl (Foot)
Map Rotation: 0
Plot Date: 6/5/2018, 16:10:34 PM by JPAPEZ -- LAYOUT: ANSI B(11"x17")
Path: E:\Consumers Energy\CCR_GW\2017_269767\290804-001-001.mxd

Appendix A
Soil Boring Logs and Well Construction Diagrams

LOG OF TEST BORING NO: PZ-2010-212 OW-10

Project Name: *D. E. Karn Barrier Wall Engineering*

Project Location: *Essexville, Michigan*

NTH Consultants, Ltd.
NTH Proj. No.: 62-100303-09
Checked By: ACE

SUBSURFACE PROFILE				SOIL SAMPLE DATA							
ELEV. (ft)	PRO-FILE	GROUND SURFACE ELEVATION: 589.5	DEPTH (ft)	SAMPLE TYPE/NO.	BLOWS / 6 inches	STD. PEN RESIST. (N)	REC (in)	HNu READING (ppm)	MOIST. CONTENT (%)	DRY DENSITY (pcf)	UNCONF. COMP ST (psf)
585		Loose Dark Brown SILTY SAND with Trace of Organic Matter (roots)		LS-1	1 2 3	5	10	--	25.1	97.5	--
		586.5 — 3.0		LS-2	1 WOH 1	1	13	--	72.6	52.4	--
			5	LS-3	WOH WOH 1	1	15	--	49.3	70.1	--
580				LS-4	WOH 2 4	6	16	--	28.8	97.2	--
		Loose to Very Loose Dark Gray SILTY FINE TO MEDIUM SAND Trace of Clay & Organic Matter (roots)	10								
575				LS-5	WOH WOH WOH	0	15	--	52.6	70.8	--
		572.0 — 17.5	15								
570		Hard Brown SILTY CLAY with Little to Some Sand & Trace of Gravel		LS-6	10 17 20	37	17	--	8.7	135.7	16140
		569.5 — 20.0	20								
		END OF BORING									
565			25								
560			30								
555			35								

Total Depth: *20 FT*
Drilling Date: *05-20-2010*
Inspector: *N. Emery*
Contractor: *Rau Drilling Co.*
Driller: *G. Compeau*
Drilling Method:
CME-750 ATV-mounted drill rig with 4-1/4" inside-diameter, hollow-stem augers to end of boring

Plugging Procedure:
Piezometer No. PZ-2010-212 installed in borehole with screen tip set at 18.5 ft bgs.

Water Level Observation:
Groundwater encountered at 9.0 ft bgs during drilling.

Notes:
*[1] * - Pocket Penetrometer Value*
[2] WOH - Weight of Hammer (= 0 blow count)
[3] Coordinates and elevation surveyed by Rowe PSC (datum = NAVD88).

Coordinates:
N: 782738 E: 13263728

Figure No.

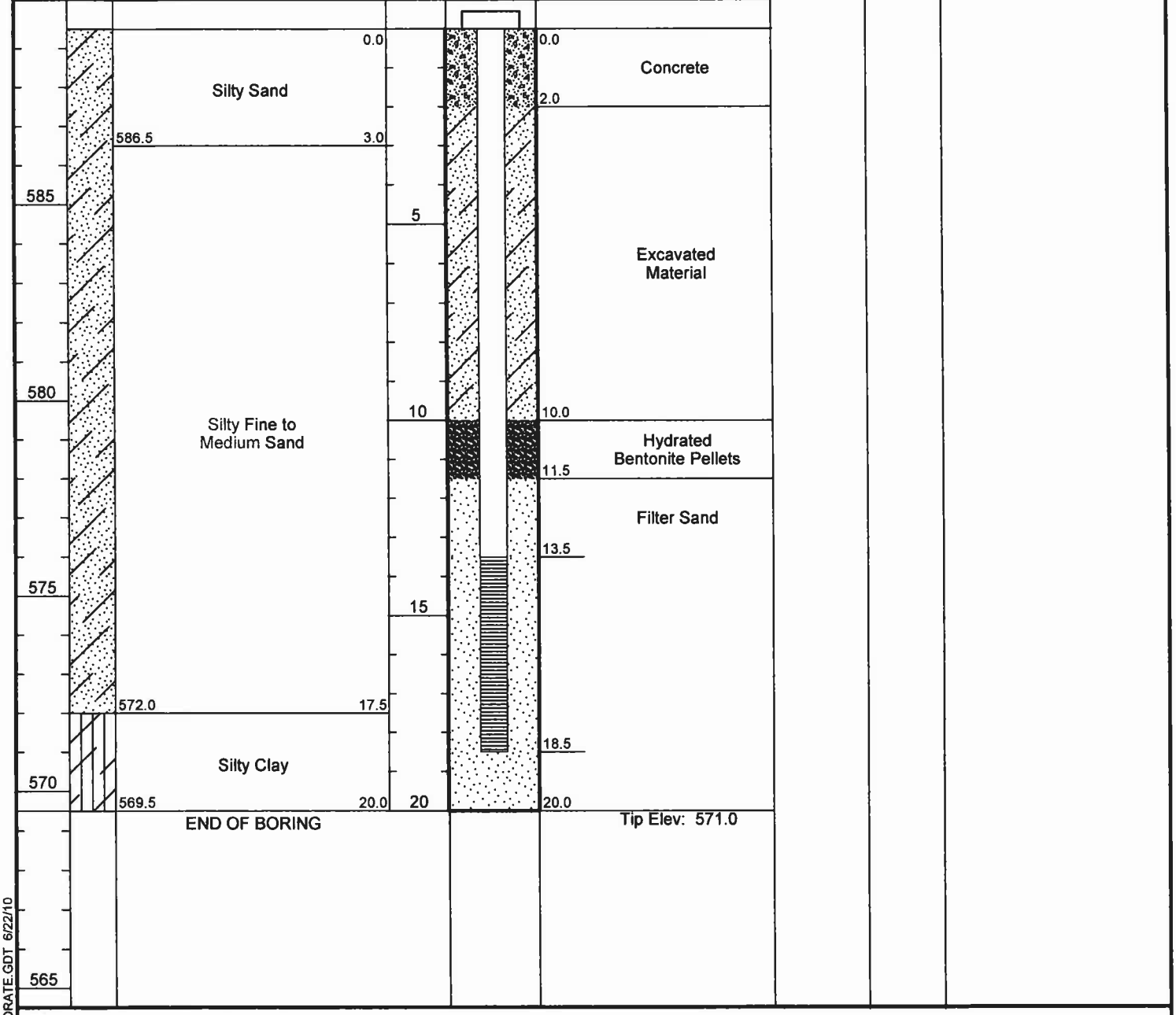
LOG OF TEST BORING 62-100303-09.GPJ NTH CORPORATE NEW.GDT 6/22/10

PIEZOMETER NO: PZ-2010-212 OW-10

Project Name: *D. E. Karn Barrier Wall Engineering*

Project Location: *Essexville, Michigan*

NTH Consultants, Ltd.
NTH Proj. No.: 62-100303-09
Checked By: ACE



Total Depth: *20.0 ft*
Drilling Date: *05-20-2010*
Inspector: *N. Emery*
Contractor: *Rau Drilling Co.*
Driller: *G. Compeau*
Equipment: *CME-750 ATV Drill Rig*

Casing Diameter: *2 in*
Casing Length: *15.5 ft*
Casing Type: *PVC*

Screen Diameter: *2 in*
Screen Length: *5 ft*
Screen Mesh: *0.007 in*
Screen Type: *PVC*

Protective Casing: *Steel*

Notes:

[1] For details of subsurface strata, see Log of Test Boring No. PZ-2010-212.
[2] Coordinates and elevation surveyed by Rowe PSC (datum = NAVD88).
[3] Well screen wrapped with filter fabric.

Coordinates: *N 782738 E 13263728*

FIGURE NO.

WELL LOG 62-100303-09.GPJ NTH CORPORATE.GDT 6/22/10

LOG OF TEST BORING NO: PZ-2010-208 OW-11

Project Name: *D. E. Karn Barrier Wall Engineering*

Project Location: *Essexville, Michigan*

NTH Consultants, Ltd.
NTH Proj. No.: 62-100303-09
Checked By: ACE

SUBSURFACE PROFILE

GROUND SURFACE ELEVATION: 602.5

ELEV. (ft)	PRO-FILE		DEPTH (ft)
600		FILL (Fly Ash): Medium Compact Dark Gray FINE SAND	
		599.5	3.0
595		FILL (Fly Ash): Loose to Very Loose Dark Gray SILTY FINE SAND	5
590		590.0	12.5
585		FILL (Fly Ash): Very Loose Gray SILT with Trace of Sand	15
		580.5	22.0
580		Medium Gray FINE TO MEDIUM SAND with Trace of Silt	20
		577.5	25.0
575		END OF BORING	25
			30
570			35

SOIL SAMPLE DATA

SAMPLE TYPE/NO.	BLOWS / 6 inches	STD. PEN RESIST. (N)	REC (in)	HNu READING (ppm)	MOIST. CONTENT (%)	DRY DENSITY (pcf)	UNCONF. COMP ST (psf)
LS-1	4 6 9	15	15	--	43.2	70.8	--
LS-2	3 3 3	6	17	--	43.8	72.7	--
LS-3	1 2 3	5	17	--	51.4	64.9	--
LS-4	WOH 1 1	2	17	--	48.5	66.4	--
LS-5	1 1 1	2	18	--	52.0	63.8	--
LS-6	WOH WOH 1	1	18	--	33.4	81.7	--
LS-7	3 6 7	13	17	--	23.3	101.0	--

Total Depth: *25 FT*
Drilling Date: *05-18-2010*
Inspector: *N. Emery*
Contractor: *Rau Drilling Co.*
Driller: *G. Compeau*
Drilling Method:
CME-750 ATV-mounted drill rig with 4-1/4" inside-diameter, hollow-stem augers to end of boring

Plugging Procedure:
Piezometer No. PZ-2010-208 installed in borehole with screen tip set at 20.0 ft bgs.

Water Level Observation:
Groundwater encountered at 12.5 ft bgs during drilling.

Notes:
*[1] * - Pocket Penetrometer Value*
[2] WOH - Weight of Hammer (= 0 blow count)
[3] Coordinates and elevation surveyed by Rowe PSC (datum = NAVD88).

Coordinates:
N: 783194 E: 13263582

Figure No.

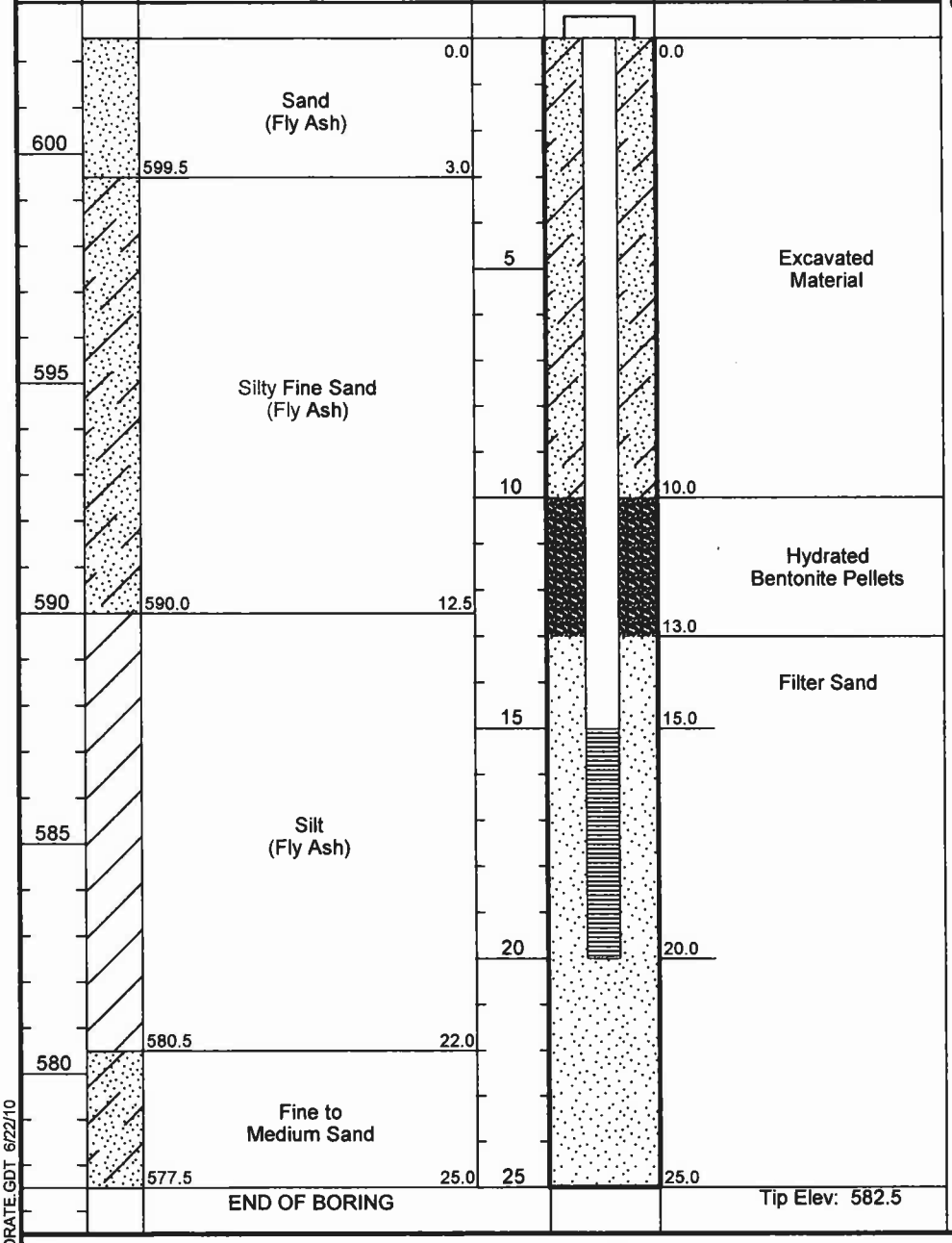
LOG OF TEST BORING 62-100303-09.GPJ NTH CORPORATE NEW.GDT 6/22/10

PIEZOMETER NO: PZ-2010-208 OW-11

Project Name: *D. E. Kam Barrier Wall Engineering*

Project Location: *Essexville, Michigan*

NTH Consultants, Ltd.
NTH Proj. No.: 62-100303-09
Checked By: ACE



GROUNDWATER DATA		
DATE	ELEV (FT)	COMMENTS
5/27/2010	588.67	
6/7/2010	589.32	

Total Depth: *25.0 ft*
Drilling Date: *05-18-2010*
Inspector: *N. Emery*
Contractor: *Rau Drilling Co.*
Driller: *G. Compeau*
Equipment: *CME-750 ATV Drill Rig*

Casing Diameter: *2 in*
Casing Length: *17 ft*
Casing Type: *PVC*

Screen Diameter: *2 in*
Screen Length: *5 ft*
Screen Mesh: *0.007 in*
Screen Type: *PVC*

Protective Casing: *4" dia. PVC extending 2 ft above ground*

Notes:

[1] For details of subsurface strata, see Log of Test Boring No. PZ-2010-208.
[2] Coordinates and elevation surveyed by Rowe PSC (datum = NAVD88).
[3] Well screen wrapped with filter fabric.

Coordinates: *N 783194 E 13263582*

FIGURE NO.

WELL LOG 62-100303-09.GPJ NTH CORPORATE.GDT 6/22/10

LOG OF TEST BORING NO: PZ-2010-206 OW-12

Project Name: *D. E. Karn Barrier Wall Engineering*

Project Location: *Essexville, Michigan*

NTH Consultants, Ltd.
NTH Proj. No.: 62-100303-09
Checked By: ACE

SUBSURFACE PROFILE

GROUND SURFACE ELEVATION: 591.7

ELEV. (ft)	PRO-FILE		DEPTH (ft)
590		FILL (Bottom Ash): Loose Gray SAND with Trace of Silt	
		588.7 — 3.0	
		FILL (Fly Ash): Medium Compact Gray SILTY SAND	5
		586.2 — 5.5	
585		Very Loose Gray SILTY SAND	
		583.7 — 8.0	
		Medium Compact Gray SILTY FINE SAND	10
580		579.2 — 12.5	
		END OF BORING	
			15
575			
			20
570			
			25
565			
			30
560			
			35

SOIL SAMPLE DATA

SAMPLE TYPE/NO.	BLOWS / 6 inches	STD. PEN RESIST. (N)	REC (in)	HNu READING (ppm)	MOIST. CONTENT (%)	DRY DENSITY (pcf)	UNCONF. COMP ST (psf)
LS-1	2 3 5	8	13	--	22.6	81.1	--
LS-2	5 6 6	12	12	--	12.6	115.7	--
LS-3	2 1 1	2	10	--	14.7	110.8	--
LS-4	4 5 6	11	12	--	43.4	74.4	--

Total Depth: *12.5 FT*
Drilling Date: *05-19-2010*
Inspector: *N. Emery*
Contractor: *Rau Drilling Co.*
Driller: *G. Compeau*
Drilling Method:
CME-750 ATV-mounted drill rig with 4-1/4" inside-diameter, hollow-stem augers to end of boring

Plugging Procedure:
Piezometer No. PZ-2010-206 installed in borehole with screen tip set at 12.5 ft bgs.

Water Level Observation:
Groundwater encountered at 7.0 ft bgs during drilling.

Notes:
*[1] * - Pocket Penetrometer Value*
[2] Coordinates and elevation surveyed by Rowe PSC (datum = NAVD88).

Coordinates:
N: 782858 E: 13263023

Figure No.

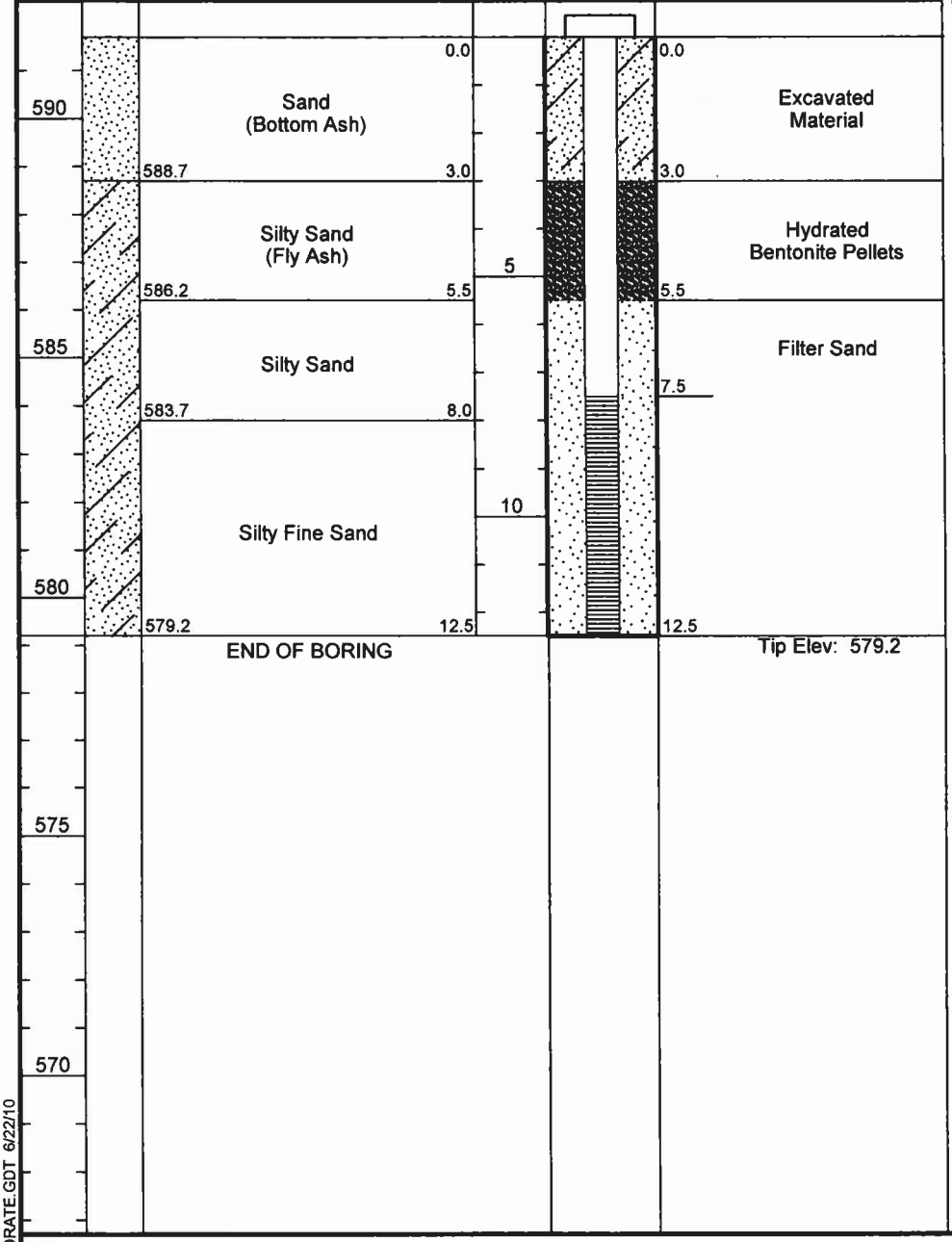
LOG OF TEST BORING 62-100303-09.GPJ NTH CORPORATE NEW.GDT 6/22/10

PIEZOMETER NO: PZ-2010-206 OW-12

Project Name: *D. E. Karn Barrier Wall Engineering*

Project Location: *Essexville, Michigan*

NTH Consultants, Ltd.
NTH Proj. No.: 62-100303-09
Checked By: ACE



GROUNDWATER DATA		
DATE	ELEV (FT)	COMMENTS
5/27/2010	587.79	
6/4/2010	588.05	

Total Depth: *12.5 ft*
Drilling Date: *05-19-2010*
Inspector: *N. Emery*
Contractor: *Rau Drilling Co.*
Driller: *G. Compeau*
Equipment: *CME-750 ATV Drill Rig*

Casing Diameter: *2 in*
Casing Length: *10 ft*
Casing Type: *PVC*

Screen Diameter: *2 in*
Screen Length: *5 ft*
Screen Mesh: *0.007 in*
Screen Type: *PVC*

Protective Casing: *4" dia. PVC extending 2 ft above ground*

Notes:

[1] For details of subsurface strata, see Log of Test Boring No. PZ-2010-206.
[2] Coordinates and elevation surveyed by Rowe PSC (datum = NAVD88).
[3] Well screen wrapped with filter fabric.

Coordinates: *N 782858 E 13263023*

FIGURE NO.

WELL LOG 62-100303-09.GPJ NTH CORPORATE.GDT 6/22/10

Date Start: 10/12/15
Date Finish: 10/12/15
Drilling Company: Stock Drilling
Driller's Name: Austin Goldsmith
Drilling Method: Hydrovac/Sonic
Sampling Method: Continuous
Rig Type: Sonic
Water Level Start (ft. bgs.): 7.0
Water Level Finish (ft. btoc.): 12.08

Northing: 783112.8
Easting: 13263202.1
Casing Elevation: 602.79

Borehole Depth (ft. bgs.): 29.0
Surface Elevation: 599.9

Descriptions By: L. Rogers

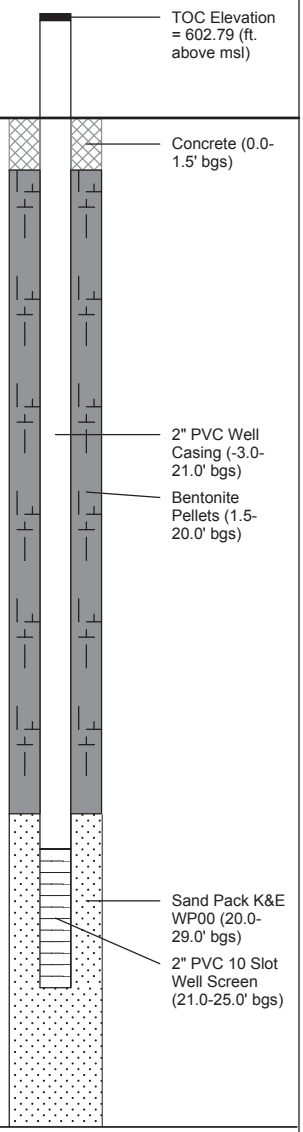
Well/Boring ID: DEK MW-15003

Client: Consumers Energy

Location: DE Karn Facility
2742 Weadock Highway
Essexville, MI 48732

Weather Conditions: 60 F Windy

DEPTH (feet bgs.) / ELEVATION	Sample Run Number	Sample/Int/Type	Recovery (feet)	PID Headspace (ppm)	Analytical Sample	Geologic Column	Stratigraphic Description	Water Level (ft. bgs.)
0 / 600								
	1	0.0-7.0'	0.0	NA			(0.0 - 7.0') Hydrovac; no lithology recorded.	
5 / 595								
	2	7.0-9.0'	2.0	NA			(7.0 - 8.0') Fly ASH; wet; black (10YR 2/1). NOTE: Fill material. (8.0 - 9.5') PEAT and ASH; little roots; little organics; wet; black (10YR 2/1).	
10 / 590							(9.5 - 19.5') ASH, mix of bottom and fly; wet; black (10YR 2/1). NOTE: Fill material.	
	3	9.0-19.0'	7.5	NA			NOTE: Trace clay from 16.0' to 19.5' bgs.	
15 / 585								
20 / 580							(19.5 - 21.0') SAND, very fine to fine; little silt and clay; trace medium sand; well sorted; moist to wet; dark olive gray (5Y 3/2).	
							(21.0 - 25.0') SAND, very fine to medium; trace coarse sand; trace silt; well sorted; moist to wet; dark gray (10YR 4/1).	
25 / 575	4	19.0-29.0'	10.3	NA			(25.0 - 29.0') CLAY, medium to low plasticity; little granule to large cobbles, subrounded to subangular; trace silt; dry; stiff to very stiff; brown (10YR 4/7). NOTE: Till.	
30 / 570							End of boring 29.0' bgs.	



Well/Boring Construction

ARCADIS Design & Consultancy for natural and built assets

Remarks: bgs = below ground surface btoc = below top of casing

Hydrovac to 7.0' bgs.
Groundwater encountered at 7.0' bgs during drilling.
Water level at development was 12.08' btoc.
No odor or staining observed.
Groundwater elevation measured on December 8, 2015 was 588.82 feet above mean sea level.

WELL CONSTRUCTION LOG

WELL NO. DEK-MW-18001

Facility/Project Name	Date Drilling Started	Date Drilling Completed	Project Number
Consumers Energy DE Karn CCR Monitoring	5/21/18	5/21/18	290804.0000

Drilling Firm	Drilling Method	Surface Elev. (ft)	TOC Elevation (ft)	Total Depth (ft bgs)	Borehole Dia. (in)
Stearns Drilling	Hollow Stem Auger	---	---	18.0	8.0

Boring Location: On the south side of the access road north of the substation, approximately 70 feet south and 30 feet west of decommissioned monitoring well DEK-MW-15001.

Personnel
Logged By - Jacob Krenz
Driller - Gary Geerligs

Drilling Equipment: CME LC 60

Civil Town/City/or Village	County	State
Essexville	Bay County	Michigan

Water Level Observations:
While Drilling: Date/Time 5/21/18 00:00 ▽ Depth (ft bgs) 7.0
After Drilling: Date/Time 5/22/18 07:08 ▼ Depth (ft bgs) 5.49

SAMPLE NUMBER AND TYPE	SAMPLE RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	WELL DIAGRAM	COMMENTS
1 SS	100	3 5 5 5	0–2	**TOPSOIL** black (10YR 2/1).				
				CLAY WITH SAND mostly clay, few to little fine to medium sand, trace fine gravel, low plasticity, yellowish brown (10YR 5/4), stiff, moist.	CL			
2 SS	100	4 5 6 7	2–4	**SAND** mostly medium sand, yellowish brown (10YR 5/6), dry, loose.	SP			
				CLAY WITH SAND mostly clay, few to little fine to medium sand, trace fine gravel, low plasticity, yellowish brown (10YR 5/4), stiff, moist.	CL			
				SAND mostly fine to medium sand, pale brown (10YR 6/3, dry, loose.	SP			
				CLAY WITH SAND mostly clay, few to little fine to medium sand, trace fine gravel, low plasticity, yellowish brown (10YR 5/4), stiff, moist.	CL			
3 SS	80	3 3 4 4	4–6	**SAND** mostly fine to medium sand, dark yellowish brown (10YR 4/4), moist, loose.	SP			
				▼ **CLAY WITH SAND** mostly clay, few to little fine to medium sand, trace fine gravel, low plasticity, yellowish brown (10YR 5/4), stiff, moist.	CL			
				SAND mostly fine to medium sand, dark yellowish brown (10YR 3/6), moist, loose.	SP			
4 SS	80	3 1 1 1	6–8	**CLAY** mostly clay, trace fine sand, trace silt, low to medium plasticity, gray (10YR 5/1), moist, medium stiff.	CL			
				▽ **SAND** mostly medium to coarse sand, very dark gray (10YR 3/1), saturated, loose.				
5 SS	80	0 1 2 4	8–9	Change to fine to medium sand, trace silt at 9.0 feet.	SP			

SOIL BORING WELL CONSTRUCTION LOG 290804P1T6.CEC.FLUORIDEASSESSMENT.GPJ TRC_CORP.GDT 290804.0000 6/4/18

Signature:

Firm: TRC Environmental
1540 Eisenhower Place Ann Arbor, MI 48108
734-971-7080
Fax 734-971-9022

WELL CONSTRUCTION LOG

WELL NO. DEK-MW-18001

SAMPLE NUMBER AND TYPE	RECOVERY (%)	BLOW COUNTS	DEPTH IN FEET	LITHOLOGIC DESCRIPTION	USCS	GRAPHIC LOG	WELL DIAGRAM	COMMENTS
6 SS	70	5 9 7 6	11	Change to mostly fine sand, trace ash at 11.0 feet.				
7 SS	60	4 6 9 7	12 13	Change to mostly medium sand, saturated, trace shell fragments, no ash at 13.0 feet.	SP			
8 SS	60	5 5 9 7	14 15					
9 SS	75	5 9 12 14	16 17	**CLAY** mostly clay, trace to few sand, trace gravel, low plasticity, gray (10YR 5/1), moist, very stiff.	CL			
			18	End of boring at 18.0 feet below ground surface.				
			19 20 21 22 23					

SOIL BORING WELL CONSTRUCTION LOG 290804P1T6.CEC.FLUORIDEASSESSMENT.GPJ TRC_CORP.GDT 290804.0000 6/4/18

WELL CONSTRUCTION DIAGRAM

PROJ. NAME:	CONSUMERS ENERGY DE KARN CCR MONITORING	WELL ID:	**DEK-MW-18001**
PROJ. NO:	290804.0000	DATE INSTALLED: 5/21/2018 INSTALLED BY: J.KRENZ	CHECKED BY: M. TAYLOR

ELEVATION (BENCHMARK: USGS)	DEPTH BELOW OR ABOVE GROUND SURFACE (FEET)	
TBD	3.0	TOP OF CASING
TBD	0.0	GROUND SURFACE
	1.5	CEMENT SURFACE PLUG
		GROUT/BACKFILL MATERIAL: NA
		GROUT/BACKFILL METHOD: NA
14.50		RISER PIPE LENGTH
	NA	GROUT
		BENTONITE SEAL MATERIAL: MEDIUM CHIPS
	9.5	BENTONITE SEAL
TBD	11.5	TOP OF SCREEN
5.00		SCREEN LENGTH
		FILTER PACK MATERIAL: MEDIUM, WASHED SAND
TBD	16.5	BOTTOM OF SCREEN
	16.5	BOTTOM OF FILTER PACK
	NA	BENTONITE PLUG
		BACKFILL MATERIAL: NATURAL COLLAPSE
TBD	18.0	HOLE BOTTOM

NOTES:

CASING AND SCREEN DETAILS

TYPE OF RISER: 2-INCH PVC

PIPE SCHEDULE: 40

PIPE JOINTS: THREADED O-RINGS

SCREEN TYPE: 2-INCH PVC

SCR. SLOT SIZE: 0.01-INCH

BOREHOLE DIAMETER: 8.00 IN. FROM 0 TO 16.5 FT.
2.00 IN. FROM 16.5 TO 18.0 FT.

SURF. CASING DIAMETER: ____ IN. FROM ____ TO ____ FT.
____ IN. FROM ____ TO ____ FT.

WELL DEVELOPMENT

DEVELOPMENT METHOD: SURGE AND PUMP

TIME DEVELOPING: 0.5 HOURS

WATER REMOVED: 67.5 GALLONS

WATER ADDED: 0 GALLONS

WATER CLARITY BEFORE / AFTER DEVELOPMENT

CLARITY BEFORE: VERY TURBID

COLOR BEFORE: LIGHT BROWN

CLARITY AFTER: CLEAR

COLOR AFTER: NONE

ODOR (IF PRESENT): NONE

WATER LEVEL SUMMARY

MEASUREMENT (FEET)			DATE	TIME
DTB BEFORE DEVELOPING:	19.71	T/PVC	5/22/2018	7:08
DTB AFTER DEVELOPING:	19.65	T/PVC	5/24/2018	15:53
SWL BEFORE DEVELOPING:	8.49	T/PVC	5/22/2018	7:08
SWL AFTER DEVELOPING:	8.35	T/PVC	5/24/2018	15:53
OTHER SWL:		T/PVC		
OTHER SWL:		T/PVC		

PROTECTIVE CASING DETAILS

PERMANENT, LEGIBLE WELL LABEL ADDED? ☑ YES ☐ NO

PROTECTIVE COVER AND LOCK INSTALLED? ☑ YES ☐ NO

LOCK KEY NUMBER: NEW LOCK NOT YET ADDED BY CEC

Appendix B
Low Stress (Low Flow) Purging and Sampling of Groundwater Monitoring Wells SOP (Procedure CHEM-2.7.06)

TITLE: LOW STRESS (LOW FLOW) PURGING AND SAMPLING OF GROUND WATER MONITORING WELLS

Written or Revised by Katharyn L Schlueter Date 08/07/09
Level I or Above

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TITLE: LOW STRESS (LOW FLOW) PURGING AND SAMPLING OF GROUND WATER MONITORING WELLS

1.0 SCOPE

1.1 This procedure is a general method for collecting low stress/low flow ground water samples from monitoring wells. Upon approval by the responsible party, this procedure may be used as a substitute for macro-purging techniques where 3 to 5 well volumes have traditionally been purged prior to sampling. The low stress/low flow method is the preferred technique for ground water monitoring wells located at the former Manufactured Gas Plant (MGP) sites of Consumers Energy.

1.2 The presented technique applies to monitoring wells that have an inner casing with a nominal diameter of at least 1.0 inch, and maximum-screened lengths of ten feet per interval.

1.3 The technique is appropriate for collection of ground water samples that will be analyzed for: volatile and semi-volatile organics including pesticides and polychlorinated biphenyls (PCBs), total and dissolved metals, and various other analytes such as sulfates, cyanides, and nitrates/nitrites.

1.4 The technique is also appropriate when the following conditions are desired: lower turbidity in the sample containers, significantly less purge water for disposal, and higher analyte repeatability.

2.0 APPLICABLE DOCUMENTS AND REFERENCES

2.1 CHEM-1.1.02, Chemistry Department Procedure Requirements.

2.2 Ground Water Issue, Low-Flow (Minimal Drawdown) Ground-Water Sampling Procedures, Puls and Barcelona, USEPA, Office of Research and Development, Office of Solid Waste and Emergency Response, EPA/540/S-95/504, April 1996.

2.3 Low Stress (Low Flow) Purging and Sampling Procedure for the Collection of Ground Water Samples From Monitoring Wells, USEPA Region 1, SOP No GW 0001, Revision 2, July 30, 1996.

2.4 Technical Guidance on Low-Flow Purging and Sampling and Passive Sampling, D M and G L Nielson, The Nielson Environmental Field School, NEFS-TG001-99, December 1999.

2.5 Manufacturer Operation Manual, as appropriate.

TITLE: LOW STRESS (LOW FLOW) PURGING AND SAMPLING OF GROUND WATER MONITORING WELLS

2.6 Standard Guide for Purging Methods for Wells Used for Ground-Water Quality Investigations, D6452-99, American Society for Testing and Materials.

2.7 MDEQ RRD Operational Memorandum 2, Attachment 5, Sampling and Analysis, October 2004, Revision.

2.8 Field worksheets (Attachments A-D).

3.0 DEFINITIONS

3.1 COC – Chain of Custody

3.2 NAPL – Non-aqueous Phase Liquids

3.3 LNAPL – Light Non-aqueous Phase Liquids

3.4 DNAPL – Dense Non-aqueous Phase Liquids

3.5 DTW – Depth-to-Groundwater

4.0 SUMMARY OF METHOD

4.1 Once depth-to-water is measured; a suitable pumping device is lowered to the target depth, generally mid-screen. Ground water is purged from the well casing at a slow rate, typically 100-500 mL/minute. While drawdown is measured and minimized, the purged water is diverted to a flow cell that contains several probes for indicating stabilization parameters, such as pH, conductively, etc. Once the parameters have stabilized within pre-determined limits, the purged water stream is diverted from the flow cell to sample containers for collection of proper test parameters.

5.0 PREREQUISITES

5.1 MEASURING AND TEST EQUIPMENT

5.1.1 Flow-cell, hand-held monitor, and sonde, containing in-line probes calibrated for at least dissolved oxygen and oxidation-reduction potential (ORP). If necessary, pH and conductivity may be monitored with external monitors, although in-line probes are recommended. Turbidity or other probes/monitors may be added as site-specific requirements dictate.

TITLE: LOW STRESS (LOW FLOW) PURGING AND SAMPLING OF GROUND WATER MONITORING WELLS

5.1.2 Adjustable rate groundwater pumping devices including: Peristaltic pump with pump head and electrical power source; bladder pump(s) with controller and a source of compressed air; gear pump (Keck or "bullet"), with controller and electrical power source. Gear and bladder pumps should be constructed of stainless steel or PTFE.

5.1.3 Tubing of the appropriate size, length, and material.

5.1.4 Interface probe for determining the presence or absence of NAPLs.

5.1.5 Water level measuring device with a minimum 0.01-foot accuracy.

5.1.6 Flow measurement supplies such as a rotometer or graduated cylinder with a stopwatch.

5.1.7 Portable PID meter, calibrated the same day as use.

5.1.8 Decontamination supplies, including deionized water, brushes, buckets, and commercially available 2-propanol soaked wipes.

5.1.9 Sample bottles with appropriate preservatives.

5.1.10 Field hazardous materials kit, including eyewash, sampling gloves, goggles, earplugs, etc.

5.1.11 Purge water collection device, such as a sturdy plastic bucket.

5.2 REAGENTS

5.2.1 Assorted standards as needed to fully calibrate the above system.

5.3 CALIBRATION REQUIREMENTS

5.3.1 All meters, probes, etc must be calibrated according to manufacturer's instructions. Periodic checks are recommended during or at the end of the day to ensure the calibration curves. Written documentation is required for all calibrations and periodic checks.

5.3.1.1 In general, daily recalibration will be required. In some cases where a periodic check indicates the calibration curves are still valid, no daily calibration may be necessary.

TITLE: LOW STRESS (LOW FLOW) PURGING AND SAMPLING OF GROUND WATER MONITORING WELLS

5.4 QUALITY CONTROL DOCUMENTS AND RECORDS

5.4.1 Historical documentation, including well construction data (eg, screen depth), well location map, and field data from a previous sampling event.

5.4.2 Material Safety Data Sheets (MSDSs) for all reagents taken to the job site.

5.4.3 A field log book or field worksheet must be kept at each sampling event (see Attachments A-D). The following should be documented:

5.4.3.1 Field instrumentation calibration data.

5.4.3.2 Monitoring well identification number and physical condition.

5.4.3.3 Monitoring well data such as casing material, casing diameter, and screen length.

5.4.3.4 Monitoring well depth and DTW, measurement technique, date and time of measurement.

5.4.3.5 Presence and thickness of NAPLs and detection method.

5.4.3.6 Sample tubing material, diameter, length, placement, and pump type.

5.4.3.7 Pumping rate, water level, water quality indicator values, date and time of measurements.

5.4.3.8 Identification of any unacceptable water quality indicator values.

5.4.3.9 Time and date of sample collection.

5.4.3.10 Sample ID and control number.

5.4.3.11 Field observations.

5.4.3.12 Sampler’s name or initials.

5.4.4 The COC must contain the analytical parameters requested, sample time and date, sampler’s name or initials, site location, sample ID, control number, preservatives added, and filtration status.

5.4.5 The sample labels must contain the sample ID, control number, sample time and date, sampler's initials, preservative, filtration status, and analytical parameter requested.

5.4.6 Field worksheets (Attachments A-D).

5.4.6.1 Monitoring Well Sampling Worksheet (Attachment A)

5.4.6.2 Monitoring Well Depth-To-Water Measurements Worksheet (Attachment B)

5.4.6.3 Flowcell/Sonde Calibration and Periodic Checks Worksheets (Attachment C)

5.4.6.4 Field Screening of Monitoring Wells Via PID (Attachment D)

5.5 PERSONNEL REQUIREMENTS

5.5.1 All tests and data reporting shall be performed by certified persons of Level I or above, in the appropriate discipline. (The project report shall be issued and reviewed by a certified person of Level II or above, in the appropriate discipline. The project report, if so indicated on the work request [or form similar in intent], may require approval from a certified person of Level III, in the appropriate discipline.)

5.6 ENVIRONMENTAL CONDITIONS

See Section 6.0.

6.0 PRECAUTIONS

6.1 The site-specific Health and Safety Plan is used to identify any physical or chemical precautions and actions to be taken to prevent injury. A pre-job briefing shall be conducted prior to initiating sampling.

6.2 Observe normal safety practices as specified in the latest online revision of the Environmental and Laboratory Services Accident Prevention Manual and the Consumers Energy Chemical Hygiene Plan in Lotus Notes.

TITLE: LOW STRESS (LOW FLOW) PURGING AND SAMPLING OF GROUND WATER MONITORING WELLS

7.0 LIMITATIONS AND ACTIONS

7.1 This technique is generally not suitable for very low-yield wells (<50 mL/minute with continued drawdown).

7.2 Even with pre-planning, a number of problems may be encountered which will challenge the sampler. These include: insufficient yield, failure of one or more key indicator parameters to stabilize, cascading, and equipment failure. Each of these problems will be addressed on a case-by-case basis and their impact can be minimized by consulting the references in Section 2.

7.3 This method does not address the collection of light or dense non-aqueous phase liquids (LNAPLs and DNAPLs). Collection of these sample types is both atypical and non-standardized and must therefore be addressed on an as-needed basis.

8.0 ACCEPTANCE CRITERIA

Refer to Section 9.3.9.3 in this procedure.

9.0 PROCEDURE

9.1 Orient the equipment and yourself upwind of the monitoring wells if possible.

9.2 DETERMINATION OF DEPTH-TO-GROUNDWATER (DTW)

9.2.1 Start at either the well known, or believed to have, the least contaminated groundwater and proceed systematically to the well known, or believed to have, the highest level of contamination.

9.2.2 Check the well casing protector, lock, locking cap, and well casing for obvious damage or evidence of tampering. Record any abnormal observations.

9.2.3 The sampler may desire to minimize contamination from the ground and provide a clean area for laying down equipment. This can be accomplished by cutting a section from a sheet of plastic and fitting it around the well casing protector.

9.2.4 Remove the well cap. At some sites, it may be necessary to remove all well caps first, then proceed to 9.2.5. This will be determined prior to any field events.

TITLE: LOW STRESS (LOW FLOW) PURGING AND SAMPLING OF GROUND WATER MONITORING WELLS

9.2.5 If the site has not been characterized yet, or there is insufficient history, it will be useful to determine the concentration of organic vapors in the heads case. Using a portable, calibrated, PID meter measure and record the organic vapor concentration as follows: (1) At the highest risk breathing zone elevation, defined here as the point located at roughly 6" above the center of the top of the well casing. (2) At 0-6" within the well casing.

9.2.6 If the well casing does not have a reference point, make one. The reference point is typically a V-cut or an indelible mark in the well casing.

9.2.7 Measure and record the DTW to 0.01 feet. Duplicate the reading. Hold the tape against the reference point when making the reading. Care should be taken to minimize disturbance of the water column.

9.2.8 Measure and record the thickness and depth of any NAPLs.

9.2.9 If desired or required by the site plan, measure the depth of the well. Care should be taken to minimize disturbance of the water column and any sediment that has accumulated.

9.2.10 Decontaminate the electronic tape and interface meter. Wipe dry using a clean Kaydry-type material. Rinse with DI water and wipe dry again. If organic contamination is suspected, the sampler must decontaminate accordingly before proceeding. One option is to use commercially prepared decontamination wipes that are saturated with 2-propanol.

9.2.11 If the monitoring well will be sampled the same day and will remain in visual range and/or without a reasonable risk of tampering, loosely recap the well and leave the well casing protector unlocked. Otherwise, secure the well as if not returning.

9.2.12 If a sheet of plastic has been fitted around the well casing protector, leave it in place if the well will be sampled the same day.

9.2.13 Continue with the determination of DTW on the rest of the monitoring wells. Continue with purging and sampling when appropriate (ie, large distance between wells).

TITLE: LOW STRESS (LOW FLOW) PURGING AND SAMPLING OF GROUND WATER MONITORING WELLS

9.3 PURGING

9.3.1 If not already determined at the laboratory or by prior sampling events, determine the type of pump to be used (operation of each pump type will not be covered here).

9.3.2 For ease of use and portability, a peristaltic pump may generally be used for any well where DTW plus casing height above grade does not exceed 15 feet.

9.3.3 Keck (gear or "bullet") and bladder pumps can be used in any instance where there is sufficient water in the casing to completely submerge the pump and intake screen at all times.

9.3.4 Use well installation and historical data to determine the length of tubing needed to place the pump intake or tubing at the desired sample depth, generally mid-screen. Attach the tubing to the pump and prepare to lower the tubing or tubing/pump down the well. To keep from introducing contamination into the monitoring well, never allow the tubing or tubing/pump to touch bare ground.

9.3.5 Install the tubing or pump/tubing. Slowly lower the pump, tubing, and any safety cable and electrical lines into the monitoring well. Final placement is generally at mid-screen. Typically, the intake must be kept at least 2 feet above the bottom of the well to prevent disturbance and resuspension of any sediment or NAPL present in the bottom of the well. Once the desired depth is reached, clamp or otherwise secure the tubing to prevent the pump/tubing from dropping any lower. Record the depth to which the pump was lowered.

9.3.6 Before starting the pump, wait a few minutes and measure the water level again. Record this level. This short waiting period allows for reduced turbidity and reequilibrium of the water level. Leave the electronic tape in the well for later use.

9.3.7 Attach the in-line flow cell. Start the pump and collect roughly 100 mL/minute. Start with a faster or slower pumping rate if historical data suggests to do so.

9.3.8 Collect all water for proper disposal.

9.3.9 Monitor and record the water quality parameters and water level every 3-5 minutes.

TITLE: LOW STRESS (LOW FLOW) PURGING AND SAMPLING OF GROUND WATER MONITORING WELLS

9.3.9.1 Ideally, a steady flow rate should be maintained that results in a stabilized water level. Pumping rates should be reduced or increased to ensure stabilization of the water level in the well. Avoid entrainment of air in the tubing.

9.3.9.2 Record the time of the readings and the pump rate.

9.3.9.3 The well is considered stabilized and ready for sample collection when the indicator parameters have stabilized for three consecutive readings as follows:

- ± 0.1 pH units
- ± 3% conductivity units (specific conductance)
- ± 10 mV for redox potential (Eh/ORP)
- ± 10% for DO and turbidity
- Temperature – For information only. Record only.

Dissolved oxygen and turbidity usually require the longest time to achieve stabilization. (Above criteria may not apply to very clean wells.)

9.4 SAMPLE COLLECTION

9.4.1 The pump must not be removed from the well between purging and sample collection. It is recommended that the pump not be turned off between purging and sample collection. Continue to collect excess groundwater for proper disposal.

9.4.2 Disconnect or bypass the flow cell.

9.4.3 Collect samples at the same flow rate as the purging rate. Minimize potential contamination from dust, rain, etc by shielding the open bottles as needed.

9.4.4 Samples will be collected directly into the sample containers. Minimize aeration by allowing the water to flow down the side of the container rather than splashing against the bottom of the bottle. Avoid placing the sample tubing below the liquid level of the sample being collected. Label the containers and chill immediately.

9.4.5 VOC samples must be collected first except as noted below for Low Level Mercury. Check for air bubbles in the container before proceeding to collecting the next parameter. Carbonacious waters will naturally produce bubbles in the containers, which cannot, and should not, be removed.

NOTE: A sample for low level mercury should be the first sample collected when multiple analyte containers will be filled. Low level mercury sample bottles should be pre-cleaned and individually stored in Ziploc®-style plastic bags. Use clean nitrile gloves for each sample collection point, immediately prior to handling any bagged sample bottles.

When collecting a sample from a monitoring well:

- Remove the sample bottle from the plastic bag and remove the cap.
- The bottle should be thoroughly rinsed with the sample stream, holding the sample tubing very close to, not within, the open bottle (approximately 1/8"). Never place the sample tubing within the bottle.
- Fill to approximately ¼" below the bottle threads, affix a label, cap the bottle, and return it to the plastic bag.
- Place the bagged bottle in a cooler designated only for low level mercury.

9.4.6 Semi-volatile samples must be collected next, followed by any other parameters that do not require filtration.

9.4.7 Samples that require only filtration with no additional preparation steps should be collected using in-line filters. Filtered samples are typically collected last One exception is collection for available cyanide, which must be collected last due to the potential for cross-contamination from the lead carbonate reagent.

9.4.8 Once all samples from the monitoring well are collected, remove the tubing or pump/tubing. Record the stop time, if required. In addition, the total volume purged can be calculated and recorded.

9.4.9 Cap and secure the monitoring well.

9.4.10 In general, the purged water is poured on to the ground next to the monitoring well. Whether to collect in a drum or to use another strategy will be determined prior to starting any field activities.

9.4.11 Continue with sampling all of the other monitoring wells.

9.5 FIELD QUALITY CONTROL (QC) SAMPLES

9.5.1 Field QC samples must be collected to determine if sample collection and handling procedures have adversely affected the quality of the ground water samples. All QC samples are treated the same as samples with regard to volume, bottle type, preservatives, and any pretreatment.

9.5.2 TYPES OF QC SAMPLES

9.5.2.1 Trip Blank – For VOCs only. Consists of DI water in a VOC vial (contains preservative) and is prepared at the lab prior to the field event. The vial is left capped and chilled while sampling. Used to determine if sample holding and transport has introduced contamination into the samples.

9.5.2.2 Field Blank – Consists of DI water in an appropriate bottle with the appropriate preservative. Obtained from the lab prior to the sampling event and can prepare for a variety of analytes. The bottle is uncapped while sampling to indicate contamination that may have occurred during the operation.

9.5.2.3 Equipment Blank – DI water is exposed to the sample path at any time decontamination needs to be verified. Collect for any suspect parameter and treat it exactly the same as if collecting a sample.

9.5.2.4 Sample Duplicate – One monitoring well per 20 will be selected for collection of a duplicate sample. This is simply an additional set of the sample collected in exactly the same manner as the original sample. The sample type is used to determine precision.

9.5.2.5 Matrix Spike and Matrix Spike Duplicate – One monitoring well per 20 will be selected. These are additional sets of samples collected in exactly the same manner as the sample is collected. This sample type is used to determine accuracy but can also indicate matrix bias.

9.6 DECONTAMINATION

9.6.1 **General Considerations**

9.6.1.1 All nondedicated sampling equipment that is to be reused must be decontaminated prior to its reuse.

9.6.1.2 All disposable tubing will be properly discarded and new tubing used in its place. No tubing will be reused.

9.6.1.3 All equipment washings/rinsates must be collected for proper disposal.

9.6.1.4 The flow cell may be cleaned using the procedure in Section 9.6.2.1 or a manufacturer recommended procedure. Special attention must be paid to care of the probes on the sonde portion of the unit.

9.6.1.5 To avoid cross-contamination, pumps that are contaminated with NAPLs will be isolated and decontaminated at the laboratory.

9.6.2 **Between Well and End-of-Day Decontamination Process**

9.6.2.1 Flow Cell

A. In the case of the flow cell when new tubing will be used, a double rinse at half volume using deionized water is typically adequate. Continue with sampling. If the sample location is historically not contaminated, this step may be omitted.

B. If NAPLs, odors, or colors are present and cannot be flushed out, assess if the probes are fouled by spot-checking the calibration curves. If the probes are not fouled, no further action is necessary since the flow cell does not contact the sample. Continue with sampling.

C. If the probes are fouled, contact the MGP sample coordinator at the laboratory for guidance.

D. At the end of the day, the in-line flow cell should be free of sediment and NAPLs. Fill the cell with tap water, insert the sonde, and store.

9.6.3 **Pumps**

9.6.3.1 Peristaltic pumps need to only have the pump head tubing and sample tubing replaced.

9.6.3.2 If the equipment, such as the peristaltic pump case, is contaminated with organic material, wipe down with commercially available wipes presaturated with 2-propanol. If the organic material does not dislodge, stop now, isolate for decontamination at the lab, and use different equipment for the next monitoring well.

9.6.4 **Specific Bladder and Keck (gear or bullet) Pump Decontamination Measures**

9.6.4.1 Pump pre-rinse – Operate the pump in a deep basin containing 1-5 gallons of deionized water and continue through several cycles.

9.6.4.2 Pump wash – Operate the pump in a deep basin containing 1-5 gallons of nonphosphate detergent solution, such as Alconox. Operate through several cycles.

9.6.4.3 Pump rinse – Operate the pump in a deep basin containing 1-5 gallons of DI water. Continue for several cycles.

9.6.4.4 Disassemble pump, if required, and continue with 9.6.4.5. If not required, go to 9.6.4.7.

9.6.4.5 Pre-rinse, wash, and rinse as above, scrubbing as needed at the wash stage.

9.6.4.6 Reassemble the pump.

9.6.4.7 Store the pump so as to keep it clean until needed.

10.0 CALCULATIONS

None

11.0 DATA REPORTING

Refer to Section 5.4 in this procedure. At a minimum the COC shall be stored in the project folder.

TITLE: LOW STRESS (LOW FLOW) PURGING AND SAMPLING OF GROUND WATER MONITORING WELLS

Sample

Consumers Energy Company
Chemistry Section – Laboratory Services Department
Monitoring Well Sampling Worksheet

MW_ID		**Today's Date**		**Control Number**	
Location					
MW Reference Name			**GPS Grid Reference**		
Top-of-Casing Elevation (ft)		**Depth-to-Screen Bottom (ft)**		**Depth-to-MidScreen (ft)**	
Screen Length (ft)		**Casing ID (in)**		**Typical Purge Volume**	
Protective Casing Mount					
Comments					

Field Measurements

Depth-to-Water (ft)		**HC Layer Detected**		**PID Reading (ppm)**					
Time	**pH**	**Temp**	**Sp Cond**	**DO**	**DO**	**ORP**	**Pump Rate Indicate**	**Water Level**	**Turbidity**
Hr : Min	Units	°C	µS/cm	ppm	% Sat	mV	mL/min gal/min	Draftdown (ft)	NTU
3-5 Min	± 0.1	na	± 3%	± 10%	± 10%	± 10%	See Notes	<0.33	± 10%
Completed By >>				**Total Pump Time >>**			**Total Purge Volume >>**		

Acceptance criteria are low-flow general acceptance. Pump rate should be <500 mL/min for low-flow and <1 gal/min for high-volume.

TITLE: LOW STRESS (LOW FLOW) PURGING AND SAMPLING OF GROUND WATER MONITORING WELLS

Monitoring Well Depth-to-Water Measurements

Site: _____

Analyst: _____

Date: _____

Project No: _____

Method: Electronic Tape

Tape ID: Solinst, Model 122, S/N 122001406-1

Sample

Well ID Number	Time of Measurement	Trial 1 DWL, ft	Trial 2 DWL, ft	Depth to Bottom of Screen, ft	Remarks

TITLE: LOW STRESS (LOW FLOW) PURGING AND SAMPLING OF GROUND WATER MONITORING WELLS

Project Sonde Check; As-Found Readings & Recalibration

I. *Site or Project Tracking*

Site or Project : _____ Chem. Control # : _____

II. *System Identifiers*

Monitor Brand, Model & S/N:	YSI 650MDS S/N 08C100135
Sonde Brand, Model & S/N:	YSI 6820V2 S/N 08C101426
Flow Cell Brand & Model:	YSI 6160
DO Probe Brand, Model & S/N:	YSI 6150 S/N 08C101539
Turbidity Probe Brand, Model & S/N:	YSI 6136 S/N 08C101363
pH With ORP Brand, Probe Model & Lot:	YSI 6565 Lot Number 08B*26
Conductivity & Temperature Probe Model & S/N:	YSI No additional information

Sample

III. *pH Check*

Standard vs As-found, pH Units	Standard Source	Catalog # & Lot #	Exp. Date
4.00			
7.00			
10.00			

Analyst Initials: _____ Date & Time: _____

As-Found Evaluation

Are the readings within +/- 0.10 of their calibration points? Yes No

If 'No' **and** you are at the start of a project, then recalibration is **required**.

If 'No' and you are **within, or at the end** of project, indicate whether recalibration has been performed. Yes No

Note: If recalibration was performed, the solutions listed above were used.

IV. *ORP Check With Zobell Solution*

Standard vs As-found, mV	Source	Catalog # & Lot #	Exp. Date
231			

Analyst Initials: _____ Date & Time: _____

As-Found Evaluation

Is the reading in the 221-241mV range? Yes No

If 'No' **and** you are at the start of a project, then recalibration is **required**.

If 'No' and you are **within, or at the end** of project, indicate whether recalibration has been performed. Yes No

Note: If recalibration was performed, the solution listed above was used.

V. *DO Check With DI Water; 100% Saturation*

As-Found: _____ Analyst Initials, Date & Time: _____

As-Found Evaluation

Is the reading in the 90-110 % saturation range? Yes No

If 'No' **and** you are at the start of a project, then recalibration is **required**.

If 'No' and you are **within, or at the end** of project, indicate whether recalibration has been performed. Yes No

Note: If recalibration was performed, lab DI water was used.

TITLE: LOW STRESS (LOW FLOW) PURGING AND SAMPLING OF GROUND WATER MONITORING WELLS

Project Sonde Check; As-Found Readings & Recalibration

Site or Project : _____ Chem. Control # : _____

VI. *Conductivity Check*

Standard vs As-Found, us	Source	Catalog # & Lot #	Exp. Date
0 (DI Water)	Lab DI System	- - - -	- - - -

Analyst Initials: _____ Date & Time: _____

As-Found Evaluation

Is the reading +/- 3% of the reference point? Yes No

If 'No' **and** you are at the start of a project, then recalibration is **required**.

If 'No' and you are **within, or at the end** of project, indicate whether recalibration has been performed. Yes No

Note: If recalibration was performed, the solutions listed above were used.

Linearity Check

Standard vs As-Found, us	Source	Catalog # & Lot #	Exp. Date

Analyst Initials: _____ Date & Time: _____

VII. *Turbidity Check*

Standard vs As-Found, NTU	Source	Catalog # & Lot #	Exp. Date
0 (DI Water)	Lab DI System	- - - -	- - - -

Analyst Initials: _____ Date & Time: _____

As-Found Evaluation

Is the reading +/- 10% of the reference point? Yes No

If 'No' **and** you are at the start of a project, then recalibration is **required**.

If 'No' and you are **within, or at the end** of project, indicate whether recalibration has been performed. Yes No

Note: If recalibration was performed, the solutions listed above were used.

Linearity Check

Standard vs As-Found, NTU	Source	Catalog # & Lot #	Exp. Date

Analyst Initials: _____ Date & Time: _____

Reviewed By _____ Date _____

TITLE: LOW STRESS (LOW FLOW) PURGING AND SAMPLING OF GROUND WATER MONITORING WELLS

Field Screening of Monitoring Wells Via PID

Project Information

Site: _____

Project No: _____

Date: _____

Sample

Instrument Information

Instrument ID and Serial Number: _____

Calibration (Span) Gas ID, Lot Number Concentration, etc: _____

Zero Gas ID, Lot Number, Concentration, etc: _____

Periodic Calibration Checks

Time	Analyst	Cal Gas Conc, ppm v/v	Display Conc, ppm v/v

Monitoring Well Screening

MW ID	Time	Analyst	Breathing Zone Display Conc	0-6" Within Casing Display Conc
Background Air				NA

Appendix C
Chain-of-Custody, Handling, Packing and Shipping SOP (Procedure CHEM-1.2.04)

TITLE: CHAIN OF CUSTODY REQUIREMENTS (CoC)

1.0 PURPOSE

To provide guidance for uniform preparation of a Chain-of-Custody document.

2.0 SCOPE

The Chain-of-Custody (CoC) document is required for all samples where the analysis results are used for environmental reporting. It may also be used as requested by the customer for other forms of reporting. This method provides guidance for the use of the CoC document.

3.0 DEFINITIONS

Chain-of-Custody (CoC) – A document that is a management tool used to verify sample identification information, sample inventory and sample possession from the time the sample is collected to the time the sample is received by a laboratory.

4.0 REFERENCE DOCUMENTS

4.1 Chapter 1 – SW-846, Test Method for Evaluating Solid Waste, USEPA

4.2 ASTM Method D 5283-92, Standard Practice for Generation of Environmental Data Related to Waste Management Activities: Quality Assurance and Quality Control Planning and Implementation

4.3 ASTM Method D 4840-95, Standard Guide for Sampling Chain-of-Custody Procedures

4.4 Chemistry Department Standard Operating Procedures, as applicable

4.5 Laboratory Services Quality Assurance (LSQA) Procedure Manual, as applicable

5.0 PROCEDURE

5.1 Prior to sampling, the sample team shall be provided with CoC forms. It shall be the responsibility of the on-site supervisor or designated representative to ensure that CoC requirements, sample collection protocol and proper sample handling protocol are initiated on-site.

TITLE: CHAIN OF CUSTODY REQUIREMENTS (CoC)

5.2 A sample is considered under custody if one or more of the following criteria are met:

- The sample is in the sampler's possession.
- The sample is within the sampler's view after being in possession.
- The sample was in the sampler's possession and then placed in a secure container to prevent tampering.
- It is in a designated secure area.

5.3 Each CoC shall identify basic site information and include the following:

- The sampling site name, project name or other site/project identification.
- The initials of the sampling teams.
- Project Leader or report distribution personnel.
- If a site sketch or other documents are to be found with the CoC.
- Necessary remarks as required.

5.4 Each sample entry into the CoC shall include the following:

- Date of sample collection.
- Time of sample collection.
- Type of sample matrix (soil, water, vapor, product, etc).
- Sample identification, name or description.
- Sample depth, if applicable.
- Number of sample containers.
- Specific analytical test parameters. In some cases the specific test parameters may not be known at the time of sample collection. However, the samples are collected in accordance with the protocol for a general group of analytes (e.g., dissolved metals, volatile organic compounds) and the specific test analytes are determined after the sampling event. In these cases, the entry for the analytical test parameter is not required.

5.5 The original of the CoC record shall accompany the samples and a copy should be maintained by the on-site supervisor.

5.6 When transferring the possession of samples, the individuals relinquishing and the individuals receiving the samples should sign, date and note the time on the CoC record.

5.7 In cases where the sample leaves the originator's immediate control, such as shipment to the laboratory by a common carrier (e.g., Federal Express or

TITLE: CHAIN OF CUSTODY REQUIREMENTS (CoC)

Consumers Energy's internal mail) a seal should be placed on the shipping container to detect unauthorized entry to the samples. Any shipping containers that arrive at the Laboratory with the seals damaged should be evaluated to ascertain if the contents have been in valid custody.

5.8 In the event samples requiring the CoC protocol arrive at the Laboratory without the CoC document, the Laboratory shall complete the CoC document upon sample login and under the supervision of the assigned Laboratory Project Leader or Area Coordinator. The person completing the CoC shall enter the statement "CoC completed by the Laboratory upon receipt of sample(s)" in the remarks section of the CoC and initial the entry.

5.9 A sample CoC form is attached (Attachment A).

5.10 Other CoC formats and forms may be used as long as the CoC meets the recommendations of this procedure.

5.11 The CoC shall be stored in the project folder and retained according to CHEM-1.1.7, Record Retention.

QA Review Katharyn L Schlueter Date 02/27/08
Chemistry Quality Assurance Coordinator

Administrative Approval Gordon L Cattell Date 02/27/08
Chemistry Department Supervisor

This electronically produced document has been reviewed and approved by the above-named individuals. The original document bearing the approval signatures is maintained on file by Consumers Energy, Laboratory Services.

TITLE: CHAIN OF CUSTODY FORM (CoC)

CHAIN OF CUSTODY

Consumers Energy

CONSUMERS ENERGY COMPANY – LABORATORY SERVICES

135 WEST TRAIL ST., JACKSON, MI 49201 • (517) 788-1251 • FAX (517) 788-2533

SAMPLING SITE:				PROJECT NUMBER:			ANALYSIS REQUESTED							PAGE ____ OF ____
SAMPLING TEAM:				DATE SHIPPED:	SITE SKETCH ATTACHED? CIRCLE ONE: YES NO									SEND REPORT TO: PHONE:
CE CONTROL #	SAMPLE DATE	SAMPLE TIME	SAMPLE MATRIX	SAMPLE DESCRIPTION / LOCATION	DEPTH	# OF CONTAINERS								REMARKS

RELINQUISHED BY: (SIGNATURE)	DATE / TIME	RECEIVED BY: (SIGNATURE)	COMMENTS
RELINQUISHED BY: (SIGNATURE)	DATE / TIME	RECEIVED BY: (SIGNATURE)	
RELINQUISHED BY: (SIGNATURE)	DATE / TIME	RECEIVED BY: (SIGNATURE)	ORIGINAL TO LAB COPY TO CUSTOMER