Hydrologic Monitoring System Plan (HMSP)
Black Hawk County Landfill
Waterloo, Iowa

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1.0 INTRODUCTION

This report presents the Hydrologic Monitoring System Plan (HMSP) for the Black Hawk County Landfill. The HMSP has been designed to comply with IAC 567-113.10(455B). The following sections comprise the report:

Section 1	Introduction
Section 2	Conceptual Site Models
Section 3	Theoretical Release Evaluation
Section 4	Groundwater Monitoring System
Section 5	Monthly Groundwater Level Measurement
Section 6	Groundwater Sampling and Analysis
Section 7	Detection Monitoring Program
Section 8	Assessment Monitoring Program
Section 9	Assessment of Corrective Measures
Section 10	Annual Groundwater Quality Reports
Section 11	Monitoring Well Maintenance and Performance Evaluation Plan
Section 12	SWPPP Sampling

1.1 BLACK HAWK COUNTY LANDFILL LOCATION

The Black Hawk County Landfill is located in rural Black Hawk County approximately 3 miles south of the City of Waterloo, Iowa, in Section 23, T. 88 N., R. 13 W (Figure 1-1). The street address is 1509 East Washburn Road, Waterloo, IA 50701. At the site, Area A, Area C, Area E, Cell X, Cell W1, Cell W2, Cell W3, Asbestos Cell No. 1, and Asbestos Cell No.2 are the waste disposal units regulated by the Iowa Department of Natural Resources (IDNR). Cell W3 and Asbestos Cell No. 2 are the two currently operating waste disposal units; all the other units are closed. The waste disposal areas are shown on Figure 1-2.

1.2 BLACK HAWK COUNTY LANDFILL HISTORY AND CONSTRUCTION

The Black Hawk County Landfill was initially developed and operated by Landfill Service Corporation in 1975. In 1984, the landfill was purchased by the Black Hawk County Solid Waste Management Commission. The landfill continued to be operated under contract by Landfill Service Corporation until 1987 when the operating contract was awarded to Denver Construction, Inc., who transferred the contract to Waste Tech, Inc., a division of Denver Construction, Inc.

At the Black Hawk County Landfill, the different cells and areas were constructed over time to different regulations, and hence there are differences in the underdrain, liner, leachate collection, and landfill gas systems. Area A, Area C, Area E, Cell X, Cell W1, Cell W2, Cell W3, Asbestos Cell No.1, and Asbestos Cell No.2 (Figure 1-2) are regulated by IDNR.

Waste was placed in Area A from 1975 to 1980, and Area A is now in post-closure. Area A was constructed without an underdrain, liner, or leachate collection system.

Waste was placed in Area C from 1986 to 1991, and Area C is also in post-closure. Area C was constructed without an underdrain, liner, or leachate collection system.

Waste was placed in Area E from 1991 to 1999, and Area E is in post-closure. Area E was constructed with an underdrain system, clay liner, 10- to 12-foot-deep perimeter groundwater drainage trench, and leachate collection system.

Construction of Cell X began in 1999, and waste was placed until 2008. Cell X is in post-closure. It was constructed with an underdrain system, clay liner, and leachate collection system.

Cell W1 was opened in 2007 and is closed. For Cell W1, Phase 1, Phase 2, Phase 3 and Phase 4 are constructed with an underdrain system, clay liner, and leachate collection system. Cell W2 construction began in 2013, and it is constructed with an underdrain system, composite liner, and leachate collection system. Cell W2 was closed in December 2022. Cell W3 construction began in 2020, and it is constructed with an underdrain system, composite liner, and leachate collection system. Cell W3 was opened in December 2021.

Asbestos Cell No. 1 was developed from 1992 to 2008 and is in post-closure. It was constructed with a clay liner but without an underdrain or leachate collection system.

Asbestos Cell No. 2 was opened in 2008 and is currently active. It was constructed above the water table and consequently without an underdrain system. It has a clay liner and leachate collection system.

Areas A, C, E, Cell X and Cell W1, and Cell W2 have passive landfill gas venting systems in-place. Cell W3, is currently active, and a passive landfill gas venting system is planned to be installed when the cell is closed. Landfill gas venting is not needed for Asbestos Trench No. 1 and Asbestos Trench No. 2.

1.3 BLACK HAWK COUNTY LANDFILL GEOLOGY AND SURFACE DRAINAGE

The Black Hawk County Landfill is underlain by a thick succession of Quaternary-age sediments that overlie Devonian-age bedrock. The total thickness of the Quaternary-age sediments varies from approximately 60 to 125 feet depending on differences in ground surface elevation and the buried bedrock topography.

Generally thin surficial sediments mantle the thick glacial sequence at the site. In the upland portions of the site area, the surficial deposits consist primarily of loess, a fine-grained eolian deposit (Ql). In drainageways lower in the landscape, the surficial deposits are colluvium and alluvium. In places, generally thin, fine-grained soil fill has been placed during landfill construction. All these thin surficial deposits mantle a sequence of fine-grained Pre-Illinoian-age glacial diamicton (till) units comprising the Wolf Creek Formation (QWT) and the older, underlying, Alburnett Formation (QAT). Infrequent, isolated, generally thin sand lenses of limited lateral extent occur within portions of the fine-grained glacial sequence.

Underlying the glacial deposits is bedrock composed of undifferentiated Devonian-age Cedar Valley Formation (Dcv) dolomite.

Groundwater is monitored in two water-bearing zones: (1) the shallow groundwater measured at the water table, and (2) the deep groundwater measured by the potentiometric surface in the Devonian-age Cedar Valley Formation. Based on existing shallow wells, the water table generally lies within 5 feet of the ground surface in either fine-grained loess, colluvium, alluvium or glacial diamicton (till), but may locally be as deep as 15 feet.

Area A, Area C, Area E, Cell X, Cell W1, Cell W2, Cell W3, Asbestos Cell No.1 and Asbestos Cell No.2 are in different locations of the site (Figure 1-3). Areas A and C were developed on a slope draining east to an unnamed tributary to Miller Creek, a tributary to the Cedar River; Area E, Cell X, and Asbestos Cell No. 1 and Asbestos Cell No. 2 were developed on slopes draining generally south and east to the same unnamed tributary. Cells W1, W2, W3 and W4 are located on a surface water drainage divide between the unnamed tributary on the east and a drainageway on the west side of the landfill that drains north to Sink Creek, another tributary to the Cedar River.

2.0 CONCEPTUAL SITE MODELS

Conceptual Site Models (CSMs) provide a representation for groundwater and contaminant flow beneath landfills. CSMs are based on consideration of site area topography, landfill construction, site geology (including geologic units beneath the landfill area and their thickness, extent, and properties), and site hydrogeology (including the water table in the uppermost sediments, and the piezometric surface in the uppermost bedrock aquifer).

The Black Hawk County Landfill consists of nine different cells or areas that are regulated by the Iowa DNR (Figure 2-1). These differ in topography, landfill construction, and water table relationships, and consequently, separate CSMs will be presented for these different settings. Conceptual Site Models are presented for closed landfills at Areas A and C, Area E, Cell X, Cell W1/W2 and Asbestos Cell No. 1, and active landfills at Cell W3 and Asbestos Cell No. 2.

Common to the different landfill cells and areas is the site geology, water table flow across the site, and the piezometric surface in the uppermost bedrock. The landfill cells and areas differ in topography, landfill construction, and local water table conditions.

The common geology, site water table, and bedrock piezometric surface conditions will be discussed first, then separate conceptual site models will be developed for the various areas and cells based on the differences in topography, landfill construction, and local water table conditions.

2.1 COMMON CONDITIONS ACROSS THE BLACK HAWK COUNTY LANDFILL

2.1.1 Site Geology and Hydrogeology

The subsurface geologic conditions encountered during installation of site wells at the Black Hawk County Landfill are included on the boring logs and monitoring well/piezometer documentation forms (Iowa DNR Form 542-1277) presented in Appendix A. Boring and well locations are shown on Figure 2-2. The site geology and hydrogeology of the Black Hawk County Landfill has been comprehensively investigated in several studies, including the *Black Hawk County Landfill Phase 1 Site Investigation and Monitoring Well Installation Program* (Brice, Petrides-Donohue, 1987), and the *Hydrologic Investigation Report for Landfill Expansion, Black Hawk County Landfill* (Rust Environment & Infrastructure, 1997), and will only be summarized here.

The Black Hawk County Landfill is situated in the Iowan Surface region of northeastern Iowa. The Iowan Surface (Prior, 1991) was glaciated several times during Pre-Illinoian-age glacial episodes leaving behind a sequence of glacial deposits that overlies bedrock. During the last glacial episode, the Wisconsin Episode, the Iowan Surface was subject to extensive erosion that has left a generally low-relief landscape with long, subtly stepped slopes.

In uplands, a relatively thin veneer of Wisconsin Episode loess and hillslope sediment mantles the Pre-Illinoian-age glacial sequence. In drainageways, Wisconsin episode and younger Holocene episode alluvium mantle the Pre-Illinoian-age glacial sequence. In borings completed at the Black Hawk County Landfill, the loess, hillslope, and alluvial sediments range from 0 to as much as 24 feet thick for the thickest alluvial deposits.

These surficial deposits overlie a thick sequence of Pre-Illinoian-age glacial deposits composed predominantly of fine-grained glacial diamictons (“tills”). At the Black Hawk County Landfill, the Pre-Illinoian-age glacial sequence includes deposits from three separate glacial advances. Deposits from the youngest Pre-Illinoian-age glacial advance are included in the Wolf Creek Formation and are designated as QWT at the site. The underlying deposits are from two older Pre-Illinoian-age glacial advances that are included in the Alburnett Formation and are designated QAT and the underlying QBT at the site.

The Wolf Creek Formation, QWT, occurs in the higher elevation summit areas at the landfill. Downslope, the Wolf Creek deposits are thin or are absent because of erosion during development of the Iowan Surface. At lower elevations of the site, the youngest Alburnett Formation deposits, QAT, locally form the surficial Pre-Illinoian-age glacial deposits because the Wolf Creek Formation deposits have been eroded away. The oldest Alburnett Formation deposits, QBT, occur only in the subsurface beneath QAT deposits.

The Pre-Illinoian-age glacial diamictons, QWT, QAT, and QBT, are all generally similar, fine-grained, low hydraulic conductivity deposits. Boundaries between the units at the Black Hawk County Landfill are marked by a variety of features including unconformities, weathering zone changes, and discontinuous meltwater deposits. Discontinuous lenses of meltwater deposits also occur infrequently within the diamictons of the three separate glacial advances. However, the limited occurrence and the isolated, discontinuous distribution of these meltwater deposits within the thick, fine-grained glacial sequence result in groundwater flow being controlled by the flow in the surrounding fine-grained Pre-Illinoian-age glacial diamictons.

Groundwater travel times in the glacial diamictons at Black Hawk County Landfill are low, on the order of feet/year. Hydrogeologic studies by Donohue (1989; 1990) calculated the groundwater flow velocity using hydraulic gradients from water elevations in site wells and hydraulic conductivity data from both laboratory tests of site samples and slug tests of site wells. The calculated groundwater flow velocity was 0.7 ft/yr.

A study of hydrogen isotopes (tritium) in site groundwater confirmed the low flow velocity. In shallow wells, a tritium isotope study indicated a velocity of 1.12 ft/yr, and in intermediate depth wells, the groundwater velocity was 0.92 ft/yr, both very similar to the calculated groundwater velocity of 0.7 ft/yr.

The bedrock surface beneath the Quaternary sediments at the Black Hawk County Landfill has low relief and undulates over a range of about 35 feet in elevation, with a north-south trending high near the center of the site (Figure 2-3). Top of bedrock elevations range from about 825 to 855 feet above MSL. The uppermost bedrock is thick Devonian-age Cedar Valley Group dolomite that ranges from about 120 to 160 feet thick at the site and forms the uppermost aquifer beneath the landfill.

The Cedar Valley Group at the site is underlain by an aquitard composed of sandy conglomeratic shales of the Kenwood Member of the Devonian-age Wapsipinicon Group. The Kenwood Member is reported to be between 18 to 29 feet thick in borings drilled at the site.

Underlying the Kenwood Member is a thick sequence of Silurian-age dolomite that is on the order of 120 to 135 feet thick. Below the Silurian-age dolomite in the deepest boring at the site, B-200, Ordovician-age Maquoketa Formation was encountered at a depth of over 420 feet.

2.1.2 Water Table

The water table at the Black Hawk County Landfill is shallow and occurs in the Quaternary-age sediments. Figure 2-4 presents the water table in 2024 which is representative of current water table conditions at the site. The water table attains its highest elevations both north and south of Cells W1, W2 and W3, with a groundwater divide occurring through Cells W1 and W3 with groundwater flow east and west of the groundwater divide.

Natural water table elevations range from a high of approximately 952 feet MSL at MW-319B along the south-central portion of the site to a low of 891 feet MSL at OW-118B east of the Co-Disposal Area. Water table elevations decline from the groundwater divide across the central part of the site just east of Cells W1 and W2 to approximately 891 feet along the drainageway in the southeastern portion of the site that is tributary to Miller Creek and to 920 feet in the northwestern corner of the site along a drainageway that is tributary to Sink Creek.

With the construction of underdrain systems beneath Area E, Cell X, Cell W1, Cell W2 and Cell W3, the water table is locally lowered artificially by groundwater drainage layers, and there are steep inward (downward) water table gradients to each of those groundwater underdrain systems.

2.1.3 Piezometric Surface in the Uppermost Bedrock

The piezometric surface in the Devonian Cedar Valley Group at the site in 2024 is shown on Figure 2-5 and is representative of the current piezometric surface in the uppermost bedrock. Groundwater flow in the Cedar Valley Group is east over most of the site, with a northerly component along part of the northern site boundary. The Cedar Valley Group dolomite is an aquifer, and piezometric surface elevations vary over a narrow range from about 837 to 827 feet. The distinct difference in elevations and flow directions between the water table in the Quaternary sediments (Figure 2-4) and the piezometric surface in the Cedar Valley Group dolomite (Figure 2-5) indicates that the vertical gradient through the Pre-Illinoian-age glacial diamicton is strongly downward toward the Cedar Valley Group.

2.2 AREA A AND AREA C SITE CONDITIONS

Area A and Area C are the two oldest municipal solid waste units at the Black Hawk County Landfill and are currently in post-closure. They were both constructed without an underdrain system, liner, or leachate collection system, and site conditions are similar for both areas.

2.2.1 Topography

Area A and Area C at the Black Hawk County Landfill were constructed in the eastern part of the landfill area where pre-construction slopes drained to a southeast trending drainageway. Figure 2-6 shows the topography of the site area on a USGS 7.5 Minute Topographic Map prior to landfill development, and Figure 2-7 shows the topography of the landfill site in 2019. Total relief of Area A and Area C prior to landfill construction varied from about 10 to 40 feet.

2.2.2 Landfill Construction

Area A was operated from 1975 to 1980 and Area C from 1988 to 1991. Both Area A and Area C were constructed without an underdrain system, liner, or leachate collection system.

The base grade for Area A is at an elevation of about 920 feet MSL (Figure 2-8) and required excavation depths ranging from about 20 to 40 feet.

The base grade for Area C slopes toward the drainageway to the east, and base grade elevations slope from about 900 feet above MSL on the west to about 876 feet above MSL on the east (Figure 2-9). Excavation depths ranged from about 30 to 60 feet.

Passive landfill gas vents have been installed in both Area A and Area C at the Black Hawk County Landfill.

2.2.3 Local Water Table Elevations in the Vicinity of Area A and Area C

The water table in the vicinity of Area A and Area C is shallow and occurs in the Quaternary-age sediments. Figure 2-4 presents the water table in 2024 which is representative of current water table conditions at the site. With later construction of groundwater underdrain systems beneath Area E to the north, Cell X to the east, and Cells W1, W2 and W3 to the west of Area A and Area C, the water table has been locally artificially lowered and there are steep inward (downward) water table gradients toward these underdrain systems.

Area A is located adjacent to a water table divide. Consequently, shallow water table flow east of the divide from Area A is east-northeast toward the Co-Disposal Area and Area C and then ultimately to the southeast trending drainageway in the eastern part of the site. On the western side of the water table divide, shallow groundwater flow is west toward the Cells W1, W2 and W3 underdrain system that is constructed below the Cell W1 base grades of 888 to 876 feet above MSL, Cell W2 base grades of 890 to 872 feet above MSL, and Cell W3 base grades of 954 to 872 feet above MSL, which are well below the base grade for Area A at 920 feet MSL.

Area C was constructed with base grades directing leachate flow to the east. Shallow water table flow from the eastern part of Area C is predominantly northeast and east toward the southeast trending drainageway in the eastern part of the site, but it appears that there is a minor component of shallow water table flow from the western portion of Area C toward the Cells W1, W2 and W3 underdrain system to the west.

2.2.4 Conceptual Site Model for Area A and Area C

The CSM for Area A and Area C is based on the site topography, landfill construction, site geology, local water table elevations, and the piezometric surface in the uppermost bedrock aquifer discussed in the above sections.

Most of the precipitation at the site is intercepted by the landfill caps and the surface water drainage system and routed to drainageways. A portion of the precipitation is lost to the atmosphere by evapotranspiration. A limited amount of precipitation infiltrates to the water table in the surficial loess and the underlying Pre-Illinoian-age glacial diamicton.

Both Area A and Area C have been constructed with base grades below the water table. Area A and Area C are constructed east of the water table divide at the site. East of the water table divide, shallow water table flow is east toward the southeast trending drainageway in the eastern part of the site. West of the water table divide, shallow water table flow is west toward the Cell W1 and Cell W2 underdrain system. The Pre-Illinoian-age glacial diamicton in which both Area A and Area C are constructed is fine grained, with low hydraulic conductivity, and is an aquitard. Because of high downward gradients, groundwater flow in the Pre-Illinoian glacial diamicton is predominantly downward toward the aquifer in the uppermost Cedar Valley Group bedrock.

The primary monitoring zones for Area A and Area C, therefore, are the shallow water table monitoring wells downgradient to the east and west and deeper in the Cedar Valley Group bedrock. Groundwater flow in the Cedar Valley Group dolomite is predominantly horizontal to the east.

2.3 AREA E SITE CONDITIONS

Area E is located in the northeastern portion of the Black Hawk County Landfill. It was operated from 1991 to 1999 and is now in the post-closure period. It was constructed with a perimeter groundwater drainage trench, underdrain system, liner, and leachate collection system.

2.3.1 Topography

Area E was constructed where pre-construction slopes in the northeastern part of the Black Hawk County Landfill drained south to the southeast trending drainageway. Figure 2-6 shows the topography of the site area on a USGS 7.5 Minute Topographic Map prior to landfill development, and Figure 2-7 shows the topography of the landfill site in 2019. Total relief of Area E prior to landfill construction was on the order of 20 feet.

2.3.2 Landfill Construction

Waste was placed in Area E from 1991 to 1999. Area E was constructed with a groundwater underdrain system, clay liner, a leachate collection system, and a 10- to 12-foot-deep perimeter groundwater drainage trench. Base grade elevations for Area E slope from an elevation of 892 feet MSL in the northwestern corner to 874 feet MSL at a sump in the southeastern corner (Figure 2-10). Construction of the landfill required excavation to depths of about 50 to 60 feet. Passive landfill gas vents have been installed in Area E.

2.3.3 Local Water Table Elevations in the Vicinity of Area E

The water table in the vicinity of Area E is shallow and occurs in the Quaternary-age sediments. Figure 2-4 presents the water table in 2024 which is representative of current water table conditions at the site. Around

Area E, the elevation of the water table is 934 to 911 feet above MSL. With the construction of the perimeter groundwater drainage trench and the underdrain system beneath Area E, the water table is artificially lowered to elevations ranging between 890 and 870 feet MSL across much of the Area E footprint. There are steep inward (downward) water table gradients to the underdrain system which is constructed below the base grade at elevations ranging between 892 and 874 feet MSL.

2.3.4 Conceptual Site Model for Area E

The CSM for Area E is based on the site topography, landfill construction, site geology, local water table elevations, and the piezometric surface in the uppermost bedrock aquifer discussed in the above sections.

Most of the precipitation at Area E is intercepted by the landfill cap and the surface water drainage system and routed to drainageways. A portion of the precipitation is lost to the atmosphere by evapotranspiration. A limited amount of precipitation infiltrates to the water table in the surficial loess and the underlying Pre-Illinoian-age glacial diamicton and is intercepted by the 10- to 12-foot-deep perimeter groundwater drainage trench. Area E was constructed with base grades well below the water table. Leachate is controlled by a liner and leachate collection system. Leachate not collected by the liner and leachate collection system is expected to be intercepted by the underdrain system. Should leachate seepage somehow bypass the underdrain system, seepage would be downward through the Pre-Illinoian-age glacial sequence because of its fine-grained nature and low hydraulic conductivity which results in high downward groundwater gradients in the diamicton. The seepage would then be to the aquifer in the uppermost Cedar Valley Group bedrock.

The primary monitoring zone for Area E is thus the underdrain outlet monitoring points, GUE-1 and GUE-2, the water table and then the deep Cedar Valley Group bedrock. Groundwater flow in the Cedar Valley Group dolomite is predominantly horizontal to the east (Figure 2-5).

2.4 CELL X SITE CONDITIONS

Cell X is located in the northeastern portion of the Black Hawk County Landfill. Construction of Cell X began in 1999 and waste was placed there until 2008. Cell X is now in the post-closure period. Cell X was constructed with a groundwater underdrain system, clay liner, and leachate collection system.

2.4.1 Topography

Cell X at the Black Hawk County Landfill was constructed in the northeastern part of the landfill area where pre-construction slopes drained south to the southeast trending drainageway. Figure 2-6 shows the topography of the site area on a USGS 7.5 Minute Topographic Map prior to landfill development, and Figure 2-7 shows the topography of the landfill site in 2019. Total relief in the Cell X area prior to landfill construction was on the order of 30 feet.

2.4.2 Landfill Construction

Construction of Cell X began in 1999, and waste was placed until 2008. Cell X was constructed with an underdrain system, clay liner, and leachate collection system. The base grade elevations for Cell X range from 880 to 872 feet MSL and drain to a sump in the south-central part of the cell (Figure 2-11). Construction of the landfill required excavation to depths of about 35 to 60 feet. Passive landfill gas vents have been installed in Cell X.

2.4.3 Local Water Table Elevations in the Vicinity of Cell X

The water table in the vicinity of Cell X is shallow and occurs in the Quaternary-age sediments. Figure 2-4 presents the water table in 2024 which is representative of current water table conditions at the site. Around Cell X the elevation of the water table in the northern, upland part of the landfill area is about 934 feet above MSL declining to about 900 feet above MSL downslope. With the construction of the underdrain system beneath Cell X, the water table is artificially lowered to elevations ranging between 880 and 870 feet MSL

across much of the Cell X footprint. There are steep inward (downward) water table gradients to the underdrain system constructed at elevations below the base grade elevations that range from 880 to 872 feet MSL.

2.4.4 Conceptual Site Model for Cell X

The CSM for Cell X is based on the site topography, landfill construction, site geology, local water table elevations, and the piezometric surface in the uppermost bedrock aquifer discussed in the above sections.

Most of the precipitation at Cell X is intercepted by the landfill cap and the surface water drainage system and routed to the drainageway trending southeast off site. A portion of the precipitation is lost to the atmosphere by evapotranspiration. A limited amount of precipitation infiltrates to the water table in the surficial loess and the underlying Pre-Illinoian-age glacial diamicton. Cell X has been constructed with base grades well below the water table, with groundwater being intercepted by the groundwater drainage layer and leachate is controlled by a liner and leachate collection system. Leachate not collected by the liner and leachate collection system is expected to be intercepted by the underdrain system. Should leachate seepage somehow bypass the underdrain system, seepage would be downward through the Pre-Illinoian-age glacial sequence because of its fine-grained nature and low hydraulic conductivity which results in high downward groundwater gradients in the diamicton. The seepage would then be to the aquifer in the uppermost Cedar Valley Group bedrock.

The primary monitoring zones for Cell X are thus the underdrain outlet monitoring point, GUX-1, the water table, and then the deep Cedar Valley Group bedrock. Groundwater flow in the Cedar Valley Group dolomite is predominantly horizontal to the east.

2.5 CELL W1 SITE CONDITIONS

Cell W1 is located in the western portion of the Black Hawk County Landfill and Phases I and II are currently closed. It was constructed with a groundwater underdrain system, liner, and leachate collection system.

2.5.1 Topography

Cell W1 at the Black Hawk County Landfill is constructed in the western part of the landfill area where pre-construction slopes were nearly level or drained west-northwest to a drainageway that is tributary to Sink Creek. Figure 2-6 shows the topography of the site area on a USGS 7.5 Minute Topographic Map prior to landfill development, and Figure 2-7 shows the topography of the landfill site in 2019. Total relief in the Cell W1 area prior to landfill construction was low, on the order of 5 to 10 feet.

2.5.2 Landfill Construction

Cell W1 was opened in 2007; waste was placed until 2014 and is now closed. For Cell W1, Phase 1, Phase 2 Phase 3 and Phase 4 are constructed with an underdrain system, clay liner, and leachate collection system; Phase 3 construction began in 2010. The base grade elevations for Cell W1 range from 888 to 876 feet MSL and drain to a sump in the northeastern part of the cell (Figure 2-12). Construction of the landfill required excavation to depths of about 65 to 75 feet. Passive landfill gas vents have been installed in Cell W1.

2.5.3 Local Water Table Elevations in the Vicinity of Cell W1

The water table in the vicinity of Cell W1 is shallow and occurs in the Quaternary-age sediments. Figure 2-4 presents the water table in 2024 which is representative of current water table conditions at the site. Around Cell W1 the elevation of the water table is about 946 to 937 feet above MSL. With the construction of the underdrain system beneath Cell W1, the water table is artificially lowered to elevations less than the 880 feet MSL in the center of Cell W1. There are steep inward (downward) water table gradients to the

underdrain system constructed at elevations below the base grade elevations which range from 888 to 876 feet MSL.

2.5.4 Conceptual Site Model for Cell W1

The CSM for Cell W1 is based on the site topography, landfill construction, site geology, local water table elevations, and the piezometric surface in the uppermost bedrock aquifer discussed in the above sections.

Cell W1 is currently closed, and most of the precipitation at Cell W1 is either drained by the leachate collection system or intercepted by the surface water drainage system and routed to the drainageways. A portion of the precipitation is lost to the atmosphere by evapotranspiration. A limited amount of precipitation in the uplands around the cell infiltrates to the water table in the surficial loess and the underlying Pre-Illinoian-age glacial diamictons. Cell W1 has been constructed with base grades well below the water table, with groundwater being intercepted by the groundwater drainage layer and leachate is controlled by a liner and leachate collection system. Leachate not collected by the liner and leachate collection system is expected to be intercepted by the underdrain system. Should leachate seepage somehow bypass the underdrain system, seepage would be downward through the Pre-Illinoian-age glacial sequence because of its fine-grained nature and low hydraulic conductivity which results in high downward groundwater gradients in the diamicton. The seepage would then be to the aquifer in the uppermost Cedar Valley Group bedrock.

The primary monitoring zone for Cell W1 is thus the underdrain outlet monitoring point, GUW1-1, the water table, and then the deep Cedar Valley Group bedrock. Groundwater flow in the Cedar Valley Group dolomite is predominantly horizontal to the east (Figure 2-5).

2.6 CELL W2 SITE CONDITIONS

Cell W2 is located in the western portion of the Black Hawk County Landfill and is closed. It was constructed with a groundwater underdrain system, liner, and leachate collection system.

2.6.1 Topography

Cell W2 at the Black Hawk County Landfill is constructed in the western part of the landfill area where pre-construction slopes were nearly level or drained west-northwest to a drainageway that is tributary to Sink Creek. Figure 2-6 shows the topography of the site area on a USGS 7.5-Minute Topographic Map prior to landfill development, and Figure 2-7 shows the topography of the landfill site in 2019. Total relief in the Cell W2 area prior to landfill construction was low, on the order of 5 to 10 feet.

2.6.2 Landfill Construction

Cell W2 was opened in 2014 and is now closed. Cell W2 is constructed with an underdrain system, clay liner and leachate collection system. The base grade elevations for Cell W2 range from 890 to 872 feet MSL and drain to a sump in the western part of the cell (Figure 2-12). Construction of the landfill required excavation to depths of about 60 to 70 feet.

2.6.3 Local Water Table Elevations in the Vicinity of Cell W2

The water table in the vicinity of Cell W2 is shallow and occurs in the Quaternary-age sediments. Figure 2-4 presents the water table in 2024 which is representative of current water table conditions at the site. Around Cell W2, the elevation of the water table is approximately 946 to 922 feet above MSL. With the construction of the underdrain system beneath Cell W2, the water table is artificially lowered to elevations less than the 880 feet MSL in the center of Cell W2. There are steep inward (downward) water table gradients to the underdrain system constructed at elevations below the base grade elevations which range from 890 to 872 feet MSL.

2.6.4 Conceptual Site Model for Cell W2

The CSM for Cell W2 is based on the site topography, landfill construction, site geology, local water table elevations, and the piezometric surface in the uppermost bedrock aquifer discussed in the above sections.

Cell W2 is closed, and most of the precipitation at Cell W2 is either drained by the leachate collection system or intercepted by the surface water drainage system and routed to the drainageways. A portion of the precipitation is lost to the atmosphere by evapotranspiration. A limited amount of precipitation in the uplands around the cell infiltrates to the water table in the surficial loess and the underlying Pre-Illinoian-age glacial diamictons. Cell W2 has been constructed with base grades well below the water table, and leachate is controlled by a liner and leachate collection system. Leachate not collected by the liner and leachate collection system is expected to be intercepted by the underdrain system. Should leachate seepage somehow bypass the underdrain system, seepage would be downward through the Pre-Illinoian-age glacial sequence because of its fine-grained nature and low hydraulic conductivity, which results in high downward groundwater gradients in the diamicton. The seepage would then be to the aquifer in the uppermost Cedar Valley Group bedrock.

The primary monitoring zone for Cell W2 is thus the underdrain outlet monitoring point, GUW2-1, water table, and then the deep Cedar Valley Group bedrock. Groundwater flow in the Cedar Valley Group dolomite is predominantly horizontal to the east (Figure 2-5).

2.7 CELL W3 SITE CONDITIONS

Cell W3 is located in the western portion of the Black Hawk County Landfill and is currently active. It was constructed with a groundwater underdrain system, liner, and leachate collection system.

2.7.1 Topography

Cell W3 at the Black Hawk County Landfill is constructed in the western part of the landfill area where pre-construction slopes were nearly level or drained west-northwest to a drainageway that is tributary to Sink Creek. Figure 2-6 shows the topography of the site area on a USGS 7.5-Minute Topographic Map prior to landfill development, and Figure 2-7 shows the topography of the landfill site in 2021. Total relief in the Cell W3 area prior to landfill construction was low, on the order of 5 to 10 feet.

2.7.2 Landfill Construction

Cell W3 was constructed in 2020 – 2021 and opened in December 2021. The base grade elevations for Cell W3 range from 890 to 872 feet MSL and drain to a sump in the eastern part of the cell (Figure 2-13). Construction of the landfill required excavation to depths of about 60 to 70 feet.

2.7.3 Local Water Table Elevations in the Vicinity of Cell W3

The water table in the vicinity of Cell W3 is shallow and occurs in the Quaternary-age sediments. Figure 2-4 presents the water table in 2024 which is representative of current water table conditions at the site. Around Cell W3, the elevation of the water table is approximately 937 to 928 feet above MSL. With the construction of the underdrain system beneath Cell W3, the water table is artificially lowered to elevations less than the 880 feet MSL in the center of Cell W3. There are steep inward (downward) water table gradients to the underdrain system constructed at elevations below the base grade elevations which range from 890 to 872 feet MSL.

2.7.4 Conceptual Site Model for Cell W3

The CSM for Cell W3 is based on the site topography, landfill construction, site geology, local water table elevations, and the piezometric surface in the uppermost bedrock aquifer discussed in the above sections.

Cell W3 is actively being filled, and most of the precipitation at Cell W3 is either drained by the leachate collection system or intercepted by the surface water drainage system and routed to the drainageways. A portion of the precipitation is lost to the atmosphere by evapotranspiration. A limited amount of precipitation in the uplands around the cell infiltrates to the water table in the surficial loess and the underlying Pre-Illinoian-age glacial diamictons. Cell W3 has been constructed with base grades well below the water table, and leachate is controlled by a liner and leachate collection system. Leachate not collected by the liner and leachate collection system is expected to be intercepted by the underdrain system. Should leachate seepage somehow bypass the underdrain system, seepage would be downward through the Pre-Illinoian-age glacial sequence because of its fine-grained nature and low hydraulic conductivity, which results in high downward groundwater gradients in the diamicton. The seepage would then be to the aquifer in the uppermost Cedar Valley Group bedrock.

The primary monitoring zone for Cell W3 is thus the underdrain outlet monitoring point, GUW3-1, water table, and then the deep Cedar Valley Group bedrock. Groundwater flow in the Cedar Valley Group dolomite is predominantly horizontal to the east (Figure 2-5).

2.8 ASBESTOS CELL NO. 1 SITE CONDITIONS

Asbestos Cell No. 1was developed from 1992 to 2008, and now is in post-closure. It has a clay liner but was constructed without an underdrain system or leachate collection system.

2.8.1 Topography

Asbestos Cell No. 1 at the Black Hawk County Landfill was constructed in the northern part of the landfill area where pre-construction slopes were low and drained to a southeast trending drainageway. Figure 2-6 shows the topography of the site area on a USGS 7.5 Minute Topographic Map prior to landfill development, and Figure 2-7 shows the topography of the landfill site in 2019. Total relief of Asbestos Cell No. 1 area prior to landfill construction was on the order of 5 to 10 feet.

2.8.2 Landfill Construction

Asbestos Cell No. 1 was developed from 1992 to 2008. It was constructed with a clay liner, but without an underdrain or leachate collection system because asbestos is relatively inert and immobile where buried.

The base grade for Asbestos Cell No. 1 slopes to the north from an elevation of about 920 feet MSL down to 914 feet MSL (Figure 2-14) and required excavation depths of about 20 to 30 feet.

2.8.3 Local Water Table Elevations in the Vicinity of Asbestos Cell No. 1

The water table in the vicinity of Asbestos Cell No. 1 is shallow and occurs in the Quaternary-age sediments. Figure 2-4 presents the water table in 2024 which is representative of current water table conditions at the site. Asbestos Cell No. 1 is located east of the local water table divide area, and water table elevations decline from about 937 feet above MSL to 925 feet MSL.

2.8.4 Conceptual Site Model for Asbestos Cell No. 1

The CSM for Asbestos Cell No. 1 is based on the site topography, landfill construction, site geology, local water table elevations, and the piezometric surface in the uppermost bedrock aquifer discussed in the above sections.

Most of the precipitation at the site is intercepted by the landfill cap and the surface water drainage system and routed to drainageways. A portion of the precipitation is lost to the atmosphere by evapotranspiration. A limited amount of precipitation infiltrates to the water table in the surficial loess and the underlying Pre-Illinoian-age glacial diamicton. Leachate in Asbestos Cell No. 1 is expected to be perched on the underlying clay liner. Any leachate seepage is expected to primarily seep downward through the Pre-Illinoian-age glacial diamicton because of its fine-grained nature and low hydraulic conductivity which result in high

downward groundwater gradients toward the aquifer in the uppermost Cedar Valley Group bedrock. For Asbestos Cell No. 1, the primary monitoring zones are the water table and the Cedar Valley Group bedrock. Groundwater flow in the Cedar Valley Group dolomite is predominantly horizontal to the northeast (Figure 2-5).

2.9 ASBESTOS CELL NO. 2 SITE CONDITIONS

Asbestos Cell No. 2 was opened in 2008 and is currently active. It was constructed above the water table and consequently without an underdrain system. It has a clay liner and leachate collection system.

2.9.1 Topography

Asbestos Cell No. 2 at the Black Hawk County Landfill was constructed in the northern part of the landfill area where pre-construction slopes were low and drained to a southeast trending drainageway. Figure 2-6 shows the topography of the site area on a USGS 7.5 Minute Topographic Map prior to landfill development, and Figure 2-7 shows the topography of the landfill site in 2019. Total relief of the Asbestos Cell No. 2 area prior to landfill construction was about 5 to 10 feet.

2.9.2 Landfill Construction

Asbestos Cell No. 2 was opened in 2008 and is currently active. It was constructed above the water table and consequently without an underdrain system. It has a clay liner and leachate collection system.

The base grade for Asbestos Cell No. 2 is at an elevation of about 936 to 932 feet MSL (Figure 2-14) and required excavation depths of about 4 to 8 feet.

2.9.3 Local Water Table Elevations Relative to Asbestos Cell No. 2

The water table in the vicinity of Asbestos Cell No. 2 is shallow and occurs in the Quaternary-age sediments. Figure 2-4 presents the water table in 2024 which is representative of current water table conditions at the site. Asbestos Cell No. 2 is located east of the water table divide, and water table elevations are on the order of 928 to 921 feet above MSL.

2.9.4 Conceptual Site Model for Asbestos Cell No. 2

The CSM for Asbestos Cell No. 2 is based on the site topography, landfill construction, site geology, local water table elevations, and the piezometric surface in the uppermost bedrock aquifer discussed in the above sections.

Asbestos Cell No. 2 is actively being filled, and most of the precipitation at Asbestos Cell No. 2 is either drained by the leachate collection system or intercepted by the surface water drainage system and routed to the drainageways. A portion of the precipitation is lost to the atmosphere by evapotranspiration. A limited amount of precipitation in uplands around Asbestos Cell No. 2 infiltrates to the water table in the surficial loess and the underlying Pre-Illinoian-age glacial diamicton.

Asbestos Cell No. 2 has been designed with base grades above the water table, and leachate is controlled by a liner and leachate collection system. Leachate not collected by the liner and leachate collection system is expected to seep downward to the water table. At the water table, flow would continue to be primarily downward through the Pre-Illinoian-age glacial diamicton because of its fine-grained nature and low hydraulic conductivity. High downward groundwater gradients in the Pre-Illinoian-age glacial diamicton direct flow toward the aquifer in the uppermost Cedar Valley Group bedrock.

For Asbestos Cell No. 2, the primary monitoring zones are the water table and the Cedar Valley Group bedrock. Groundwater flow in the Cedar Valley Group dolomite is predominantly horizontal to the northeast (Figure 2-5).

2.10 REFERENCES

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3.0 THEORETICAL RELEASE EVALUATION

The theoretical release evaluation for the Black Hawk County Landfill is based upon the landfill area conceptual site models (CSM) discussed in Sections 2.2 through 2.9 and is based on an understanding of landfill construction (base grades slope and direction, presence or absence of leachate collection systems, landfill cap, relationship to the water table), and site-specific geologic and hydrogeologic conditions.

Area A and Area C were both constructed without a groundwater underdrain system, liner, or leachate collection system, and the conceptual site model is similar for both areas. Both Area A and Area C have been constructed with base grades below the water table in an aquitard. Area A and Area C are constructed east of a water table divide at the site. East of the water table divide, shallow water table flow is toward the southeast trending drainageway in the eastern part of the site. In the Pre-Illinoian-age glacial diamicton aquitard in which both Area A and Area C are constructed, groundwater flow is predominantly downward toward the aquifer in the uppermost Cedar Valley Group bedrock because of downward vertical groundwater gradients from the aquitard towards the uppermost aquifer. Seepage within the Pre-Illinoian-age glacial sequence is estimated to be 1 foot per year vertically through the aquitard towards the aquifer in the uppermost Cedar Valley Group bedrock.

Area E, Area X, Cells W1, W2 and W3 are constructed with a groundwater underdrain system, clay liner, a leachate collection system, and a 10- to 12-foot-deep perimeter groundwater drainage trench around Area E. Area E, Area X, Cells W1, W2 and W3 are constructed with base grades well below the water table aquitard. Leachate is controlled by a liner and leachate collection system. A release of leachate not collected by the liner and leachate collection system is expected to be intercepted by the underdrain system. Should leachate seepage somehow bypass the underdrain system, seepage would be downward through the Pre-Illinoian-age glacial aquitard because of the downward vertical groundwater gradients in the diamicton. The seepage would then be to the aquifer in the uppermost Cedar Valley Group bedrock.

Asbestos Cell No. 1 was constructed with a clay liner, but without an underdrain or leachate collection system because asbestos is relatively inert and immobile where buried. Leachate in Asbestos Cell No. 1 is not expected on the underlying clay liner. Any seepage is expected to either follow the water table aquitard or seep downward because of high downward groundwater gradients in the Pre-Illinoian age glacial diamicton toward the aquifer in the uppermost Cedar Valley Group bedrock.

Asbestos Cell No. 2 was opened in 2008, is currently active, and has a clay liner and leachate collection system. Asbestos Cell No. 2 has been designed with base grades above the water table aquitard, and leachate is controlled by a liner and leachate collection system. A release of leachate not collected by the liner and leachate collection system is expected to seep downward to the water table and either follow the water table aquitard or seep downward toward the aquifer in the uppermost Cedar Valley Group bedrock because of high downward groundwater gradients in the Pre-Illinoian-age glacial diamicton.

The primary monitoring zones for Area A and Area C, therefore, are the shallow water table monitoring wells downgradient to the east, west and north and deeper in the Cedar Valley Group bedrock. The primary monitoring zone for Area E is the underdrain outlet monitoring points, GUE-1, and GUE-2, and then the deep Cedar Valley Group bedrock. The primary monitoring zones for Cell X is the underdrain outlet monitoring point, GUX-1, and then the deep Cedar Valley Group bedrock. The primary monitoring zone for Cells W1, W2 and W3 are the underdrain outlet monitoring points, GUW1-1, GUW2-1 and GUW3-1, and then the deep Cedar Valley Group bedrock. For Asbestos Cell No. 1, the primary monitoring zones are the water table and the Cedar Valley Group bedrock. For Asbestos Cell No. 2, the primary monitoring zones are the water table and the Cedar Valley Group bedrock. Shallow groundwater quality is monitored by downgradient water table wells. The groundwater monitoring points for the Black Hawk County Landfill (see Section 4) have been placed at approximately 300-foot spacings downgradient in accordance with the Conceptual Site Model and measured groundwater (water table) flow (see Section 2) to provide information on shallow groundwater head, horizontal flow, vertical gradients, and vertical flow from water table aquitard towards bedrock and will be monitored over time.

Flow in the Cedar Valley Group is east over most of the site with a northeast component along part of the northeast boundary of the site. Piezometric surface elevations indicate that the Cedar Valley Group dolomite is the uppermost aquifer beneath the site. The distinct difference in elevations and flow directions between the water table aquitard in the Quaternary sediments (Figure 2-4) and the piezometric surface in the Cedar Valley Group dolomite (Figure 2-5) indicates that these are different groundwater flow systems and that the vertical gradient through the Pre-Illinoian-age glacial diamicton is strongly downward toward the Cedar Valley Group. Downgradient bedrock aquifer wells are installed at approximately 600-foot spacings downgradient in accordance with the Conceptual Site Model and measured groundwater (bedrock) flow (see Section 2) to provide information on groundwater head, horizontal flow, vertical gradients, and vertical flow from water table aquitard towards bedrock and will be monitored over time.

3.1 THEORETICAL RELEASE MODEL

As part of the theoretical release modeling, groundwater flow was evaluated using GFLOW, a groundwater flow model. GFLOW was used to evaluate flow path lines from each of the five cells which comprise the Black Hawk County Landfill.

3.1.1 Groundwater Flow Model Construction

The conceptual model, numerical simulation code, and the numerical model construction details are described in this section.

3.1.1.1 Code Selection

A numerical groundwater flow model was selected as the method to simulate groundwater and surface water flow for the landfill area. The model is the mathematical representation of groundwater flow in an aquifer with water table discharge to surface water flow using a numerical analysis computer code. The computer code solves the governing systems of equations for groundwater flow.

The model, GFLOW (Haitijema, 2018) was chosen to simulate groundwater flow for the Black Hawk County Landfill theoretical release modeling. GFLOW uses an analytical element method to model groundwater flow. Analytic element methods use direct solutions to mathematical equations that represent hydrogeologic features in a groundwater flow model.

GFLOW was used to develop a regional-site model. GFLOW uses a stepwise approach that models steady-state groundwater flow in a single, heterogeneous aquifer. The GFLOW model was used for estimating aquifer parameters, setting boundary conditions, and provides theoretical release analyses.

3.1.1.2 GFLOW Regional Site Model

A binary base map derived from USGS digital line graphs (DLG) and site CAD maps were imported directly into the modeling software to serve as the geographic basis and reference for the model domain. The spatial units for the base map are in meters and geodetic reference is Universal Transverse Mercator (UTM) coordinate system, North American Datum (NAD), 1983, Zone 15. Units for groundwater modeling are in feet and days.

The GFLOW model domain (Figure 3-1) includes all major drainage basins in the vicinity of the project area, ranging from the unnamed tributary of Miller Creek on the southeast side of site, the Cedar River on east model boundary, and an unnamed tributary of the Sink Creek on west side of site. The geometry of the model layer includes a bottom elevation of 750 ft mean sea level (msl). The single layer represents a composite of the unconsolidated Quaternary sediments above the Devonian Cedar Valley Group dolomite.

The GFLOW model includes "far field" and "near field" line sinks. In the far field, streams and lakes are simulated with coarse line sinks having little or no leakage (resistance) between the surface water feature and the ground water system. The purpose of simulating the far field is to have the model explicitly define the regional groundwater flow in the vicinity of the area of interest. The near field represents the area of

interest and includes several of the streams adjacent to and including Sink Creek and Miller Creek. Near-field streams are simulated using slightly more detailed line sinks with streambed leakage (resistance) to control groundwater/surface water interaction. The line sinks representing streams were assigned stages based on site data and USGS 7.5-minute quadrangle maps. Near field line sinks were assigned stream widths (ranging from 5 to 100 feet) based on field measurements and stream order.

Other input parameters to the GFLOW model include recharge, transmissivity, drains, and pumping wells. The transmissivity and recharge zones extend over both the near field and far field of the model. There are no large capacity pumping wells within the model boundary. Table 3-1, GFLOW Model Parameters, presents the settings and boundary conditions applied to the GFLOW model.

TABLE 3-1
BLACK HAWK COUNTY GFLOW MODEL INPUT PARAMETERS

Aquifer Properties		
Base Elevation	750	feet MSL
Thickness	200	feet
Hydraulic Conductivity	1	feet/day
Porosity	0.4	[dimensionless]
Recharge	6	inches/year

3.1.1.3 Model Input Parameters

Aquifer Properties

The sediments above bedrock and weathered bedrock are the only geologic units in the groundwater model. Aquifer properties are based on field measurements collected during the site investigation for landfill permit. The aquifer properties required by GFLOW are aquifer thickness and hydraulic conductivity. Aquifer thickness was determined from boring logs presented in the hydrogeological investigation reports (Brice, Petrides-Donohue 1987; Rust E&I 1997) and from site geology and hydrogeology as described in Section 2. The aquifer thickness was set to 200 feet based on geologic cross-sections and the relief across the region.

Hydraulic conductivity measurements were collected during the hydrogeological investigation at wells screened in the sediments above bedrock and bedrock monitoring wells. Hydraulic conductivity measurements were estimated by the slug test method.

Hydraulic conductivities estimated from slug tests conducted in wells screened in the loess/till/alluvial deposits range from approximately $2.8x10^{-7}$ to $2.44x10^{-3}$ cm/sec ($7.91x10^{-4}$ to 6.92 ft/day) with a geometric mean $2.64x10^{-5}$ cm/sec (0.075 ft/day). For the model, the hydraulic conductivity was varied higher (faster) than the results of slug test analyses. The slug test method estimates hydraulic conductivity based on a small area surrounding the well, and studies indicate that slug tests are approximately one order of magnitude lower than pump tests conducted on the same aquifer.

Surface Water

Several surface water bodies were included in the groundwater model; the Cedar River, Sink Creek and Miller Creek. The rivers and creeks were modeled as streamline sinks with specified head and stream flow routing. Stream elevations were estimated based on USGS gauging stations and the staff gauges located at the site. Stream bed width and depths were based on USGS gauging stations, USGS topographic maps, and site data. Stream bed resistance is the thickness of the resistance layer between the surface water feature and the aquifer divided by the average vertical hydraulic conductivity of the resistance layer. Resistance values were calculated using site hydraulic conductivity data.

Recharge

Recharge is the portion of precipitation that does not become surface runoff, and percolates through the ground surface to the water table. The recharge was estimated using 6 inches/year (Rust E&I 1997).

Groundwater Drainage Layers

Landfill Cells X, W1/W2, and W3 were designed with groundwater drainage layers beneath the base of the landfill liner. The layers maintain a separation between the landfill cell and groundwater. The groundwater drainage layers were modeled using far-field line sinks which represented drainage to sump and then removed by pumping the underdrain groundwater to the force main.

3.2 MODEL RESULTS

3.2.1 Groundwater Elevations and Flow

The modeled water table is shown in Figure 3-1. In the site area, the groundwater flow system is closely approximated by the groundwater model. As measured at the site, there is a groundwater divide with groundwater flowing from the divide toward an unnamed tributary of the Sink Creek on the northwest and the Miller Creek on the southeast. Surface water flow discharges to an unnamed tributary of Sink Creek on the northwest and an unnamed tributary Miller Creek on the southeast.

3.2.2 Model Calibration

The groundwater flow model was calibrated using a manual calibration approach whereby the model hydraulic parameters were optimized to minimize the difference between the model-predicted heads and stream flows and actual field measured heads and stream flows. The initial model input consisted of hydraulic parameters, recharge rates, and boundary conditions. Hydraulic conductivity, resistance and recharge rates were the parameters varied during the calibration. Specified head boundary conditions were also revised to achieve calibration. Model verification was also performed by using the calibrated hydraulic parameters and boundary conditions to perform a simulation of the conditions observed in April 2021.

3.2.2.1 Calibration Procedure

The calibration was performed by repeatedly running the model while varying the hydraulic conductivity, resistance, and recharge between each run, until the difference in model-predicted heads and surface water flows and field measured heads and surface water flows (the “residuals”), were minimized. A calibration strategy using manual calibration was chosen because the high hydraulic gradients, thin saturated thicknesses, and high degree of variation in measured heads at the site. Use of an inverse model such as UCODE or Pest (automatic calibration) to check calibration and perform sensitivity analyses will be investigated during future modeling tasks.

Calibration parameter values were initially assigned to the model based on field measured values and, if measured values were not available, ranges of values for each hydrogeologic zone. These parameters were then adjusted between each model run to reduce the model residual. In many cases, physical constraints associated with the site determined the range over which calibration parameters could be varied.

3.2.2.2 Calibration Criteria

Due to the significant range of measured water table elevations, three statistical methods for analyzing the residuals were used, along with visual comparison of measured heads to model-predicted heads, to determine the calibration. The average error (AE), median error (ME), mean absolute error (MAE), the root mean square (RMS) error and sum of squared differences (SSD) were the statistical methods used to evaluate the model residual. The AE, which is the mean of all the residuals, indicates if the overall model response is high (a positive AE) or low (a negative AE) with respect to the measured values. The MAE,

which is the mean of the absolute value of all the residuals, indicates the absolute average error in the model. The RMS error, which is the square root of the mean of the squared residuals, is usually represented as a percentage of the total head difference in the hydrologic system. The total head difference in the system is defined as the range of values observed in the measured heads. As described by Anderson, Woessner and Hunt (2015), if the percent RMS error is small, the errors represent only a small part of the overall model response. The goal of the calibration was to reduce model AE to less than 5 feet, RMS error to less than 10 feet, and individual residuals at each well to less than 5 feet.

3.2.2.3 Calibration Data

The model was calibrated to the water levels measured in 63 monitoring wells at the site in April 2021. Calibration targets were randomly distributed across the model.

3.2.2.4 Calibration Results

Model calibration was performed until no significant reductions in the AE, ME, MAE, RMS, and SSD errors were being achieved with additional calibration simulations. Graphically, Figure 3-2 presents modeled head versus observed head. Targets aligning with the center 45-degree lines are those with no residual, i.e., exact calibration. Those targets falling above the centerline have simulated elevations greater than the target elevations. Those water levels falling below the centerline have simulated elevations less than the target elevations. In general, most of the targets for each layer plot along the 45-degree line which further demonstrates a reasonable calibration. A summary of the calibration statistics is tabulated in Table 3-2.

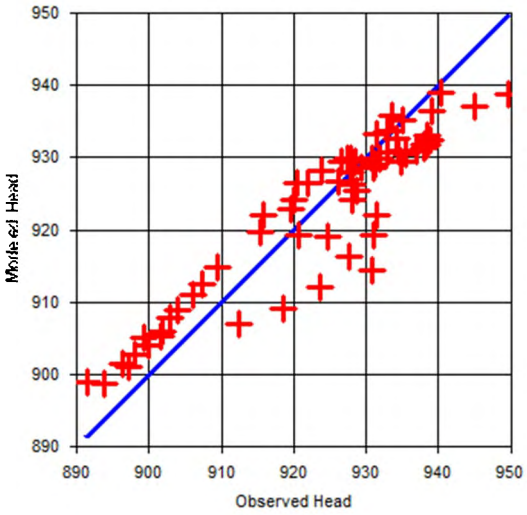

FIGURE 3-2: BLACK HAWK COUNTY LF
THEORETICAL RELEASE MODEL
MODELED HEAD VS. OBSERVED HEAD

TABLE 3-2
SUMMARY OF CALIBRATION STATISTICS FOR
BLACK HAWK COUNTY LANDFILL GROUNDWATER HEAD

Number of Observations:	63
Maximum Difference:	7.4 ft
Minimum Difference:	-16.4 ft
Average Difference (AD):	-1 ft
Median Difference (MAD):	0.1 ft
Mean Absolute Difference:	4.6 ft
RMS Difference:	5.6
Sum of Squared Differences:	1985.2

3.3 THEORETICAL RELEASE PARTICLE PATH LINES

As part of the theoretical release, particle tracking was conducted to assess the groundwater migration pathways and travel times under steady-state conditions at the site. Particles were tracked in steady-state flow domains, both forward and reverse, using April 2021 groundwater levels. Particles were introduced into the flow domain in 11 areas of the model: Area A, Area C, Area E, Cell X, Cells W1/W2/W3, Asbestos Cell 1, Asbestos Cell 2, Neutral Trench and Co-Disposal Area.

The particle tracking was conducted using GFLOW (Haitijema 2018). The GFLOW tracking timestep was set to 1 year with a maximum of 100 years (36,500 days) for forward tracking and 100 years for reverse tracking. Recharge was treated as a distributed source in GFLOW, and all particles were stopped when they entered strong internal sinks. Particles which encountered weak sinks passed through.

3.3.1 Theoretical Release: Area A

Figure 3-3 presents the results of the theoretical release from closed landfill Area A. Particles were placed within the footprint of Area A and at upgradient well locations corresponding to OW-114B, OW-410B, and OW-401B. The results of the particle path line modeling show the groundwater flow paths from Area A, prior to development and installation of Cells W1/W2 groundwater drainage layer. The flow paths show that Area A groundwater flows from a watershed and groundwater divide toward the east, and an unnamed tributary of Miller Creek east of the landfill. Area A is monitored by downgradient water table wells OW-105B, OW-411B and MW-501B, and by bedrock wells P-214C and P-215C.

Figure 3-4 presents the results of the theoretical release from closed landfill Area A with Cells W1/W2 groundwater drainage layer active. The flow paths show that Area A groundwater flows toward the Cells W1/W2 groundwater drainage layer. All modeled particles are captured by Cells W1/W2 groundwater drainage layer.

3.3.2 Theoretical Release: Area C

Figure 3-5 presents the results of the theoretical release from closed landfill Area C. Particles were placed within the footprint of Area C and at upgradient well locations corresponding to OW-402B, OW-413B and OW-414B. The results of the particle path line modeling show the groundwater flow paths from Area C, prior to development and installation of Cells W1/W2 groundwater drainage layer. The flow paths show that Area C groundwater flows from a watershed and groundwater divide toward the east, and an unnamed tributary of Miller Creek. Area C is monitored by downgradient water table wells OW-105B, OW-205B, OW-220B, OW-224B, OW-225B, OW-226B and OW-227B, and by bedrock wells P-214C and P-215C.

Figure 3-6 presents the results of the theoretical release from closed landfill Area C with Cells W1/W2 groundwater drainage layer active. The flow paths show that Area C groundwater flows toward the Cells W1/W2 groundwater drainage layer. A divide is inferred by the model whereby half of the modeled particles are captured by Cells W1/W2 groundwater drainage layer and the other half from the divide flows toward the east and an unnamed tributary of Miller Creek.

3.3.3 Theoretical Release: Area E

Figure 3-7 presents the results of the theoretical release from closed landfill Area E. Particles were placed within the footprint of Area E and at upgradient well locations corresponding to OW-218B, OW-219B, OW-213BR and MW-409B. The results of the particle path line modeling show the groundwater flow paths from Area E. The flow paths show that Area E groundwater flows from a watershed and groundwater divide toward the east, and an unnamed tributary of Miller Creek. Area E is monitored by downgradient water table wells OW-113B, OW-212B and OW-221B; by groundwater underdrains GUE-1 and GUE-2; and by bedrock wells P-214C, P-215C and P-216C.

Figure 3-8 presents the results of the theoretical release from closed landfill Area E with groundwater drainage layer active. The flow paths show that groundwater flows inward toward the Area E groundwater drainage layer.

3.3.4 Theoretical Release: Cell X

Figure 3-9 presents the results of the theoretical release from closed landfill Cell X. Particles were placed within the footprint of Cell X and at upgradient well locations corresponding to OW-213BR, OW-217B and OW-216B. The results of the particle path line modeling show the groundwater flow paths from Cell X. The flow paths show that Cell X groundwater flows from a watershed divide towards the south, and an unnamed tributary of Miller Creek. Cell X is monitored by downgradient water table wells OW-221B, OW-222B, OW-223B and OW-209B; by groundwater underdrain GUX-1; and by bedrock wells P-214C, P215C and P-216C.

Figure 3-10 presents the results of the theoretical release from closed landfill Cell X with groundwater drainage layer active. The flow paths show that groundwater flows inward toward the Cell X groundwater drainage layer.

3.3.5 Theoretical Release: Cell W1

Figure 3-11 presents the results of the theoretical release from active landfill Cell W1. Particles were placed within the footprint of Cell W1 and at upgradient well locations corresponding to OW-207B, OW-208B and MW-319B. The results of the particle path line modeling show the groundwater flow paths from Cell W1. The flow paths show that Cell W1 groundwater flows in two directions from a groundwater (watershed) divide. On the east side of the divide groundwater flows toward the east, and an unnamed tributary of Miller Creek. On the west side of the divide groundwater flows toward the west, and an unnamed tributary of Sink Creek. Cell W1 is monitored by downgradient water table wells OW-401B, OW-402B and OW-205B; by groundwater underdrain GUW1-1; and by upgradient well P-604C and downgradient bedrock wells P-214C, P215C and P-216C.

Figure 3-13 presents the results of the theoretical release from closed landfill Cells W1 and W2 with groundwater drainage layer active. The flow paths show that groundwater flows inward toward the Cells W1 and W2 groundwater drainage layer.

3.3.6 Theoretical Release: Cell W2

Figure 3-12 presents the results of the theoretical release from active landfill Cell W2. Particles were placed within the footprint of Cell W2 and at upgradient well locations corresponding to MW-606B, MW-318BR and MW-319B. The results of the particle path line modeling show the groundwater flow paths from Cell W2. The flow paths show that Cell W2 groundwater flows west from a groundwater (watershed) divide. On the

west side of the divide, groundwater flows toward the west, and an unnamed tributary of Sink Creek. Cell W2 is monitored by downgradient water table wells OW-602B, OW-603B, and OW-604B; by groundwater underdrain GUW2-1; and by upgradient well P-604C and downgradient bedrock wells P-214C, P215C and P-216C.

Figure 3-13 presents the results of the theoretical release from closed landfill Cells W1 and W2 with groundwater drainage layer active. The flow paths show that groundwater flows inward toward the Cells W1 and W2 groundwater drainage layer.

3.3.7 Theoretical Release: Asbestos Cell No. 1

Figure 3-14 presents the results of the theoretical release from closed landfill Asbestos Cell No.1. Particles were placed within the footprint of Asbestos Cell No.1 and at upgradient well locations corresponding to OW-101B, OW-102B and OW-103B. The results of the particle path line modeling show the groundwater flow paths from Asbestos Cell No.1. The flow paths show that Asbestos Cell No.1 groundwater flows from a watershed and groundwater divide toward the east, and an unnamed tributary of Miller Creek. Asbestos Cell No.1 is monitored by downgradient water table wells OW-102D, OW-113B, OW-212B, OW-219B and MW-409B, and by upgradient well P-604C and downgradient bedrock wells P-214C, P-215C and P-216C.

3.3.8 Theoretical Release: Asbestos Cell No. 2

Figure 3-15 presents the results of the theoretical release from closed landfill Asbestos Cell No. 2. Particles were placed within the footprint of Asbestos Cell No. 2 and at upgradient well locations corresponding to OW-102B, OW-102D and OW-103B. The results of the particle path line modeling show the groundwater flow paths from Asbestos Cell No. 2. The flow paths show that Asbestos Cell No. 2 groundwater flows from a watershed and groundwater divide toward the east, and an unnamed tributary of Miller Creek. Asbestos Cell No. 2 is monitored by downgradient water table wells OW-113B, MW-409B and OW-219B, and by upgradient well P-604C and downgradient bedrock wells P-214C, P-215C and P-216C.

3.3.9 Theoretical Release: EPA RCRA Neutral Trench

Figure 3-16 presents the results of the theoretical release from closed EPA RCRA Neutral Trench landfill. Particles were placed within the footprint of Neutral Trench and at upgradient well locations corresponding to OW-101B and MW-302B. The results of the particle path line modeling show the groundwater flow paths from Neutral Trench. The flow paths show that Neutral Trench groundwater flows from a watershed and groundwater divide toward the east, and an unnamed tributary of Miller Creek. Neutral Trench is monitored by downgradient water table wells OW-103B, OW-104B and OW-102B, intermediate wells OW-102D, P-102E, P-102A, P-103A and P-104A, and by upgradient well P-101C and downgradient bedrock wells P-102C, P-103C and P-104C.

3.3.10 Theoretical Release: EPA RCRA Co-Disposal Area

Figure 3-17 presents the results of the theoretical release from closed EPA RCRA Co-Disposal Area landfill. Particles were placed within the footprint of Co-Disposal Area and at upgradient well locations corresponding to OW-114B and MW-501B. The results of the particle path line modeling show the groundwater flow paths from Co-Disposal Area. The flow paths show that Co-Disposal Area groundwater flows from a watershed and groundwater divide toward the east, and an unnamed tributary of Miller Creek. Co-Disposal Area is monitored by downgradient water table wells OW-106B, OW-107BR, OW-108B, OW-109B, OW-110B and OW-111B; intermediate wells P-106AR, P-107A, P-108A, P-109A, P-110A and P-111A; and by upgradient well P-114C and downgradient bedrock wells P-106C, P-107C, P-108C, P-109C, P-110C and P-111C.

3.3.11 Theoretical Release: Cell W3

Figure 3-18 presents the results of the theoretical release from active landfill Cell W3. Particles were placed within the footprint of Cell W3 and at upgradient well locations corresponding to MW-709B and MW-710B.

The results of the particle path line modeling show the groundwater flow paths from Cell W3. The flow paths show that Cell W3 groundwater flows east and west from a groundwater (watershed) divide. On the west side of the divide, groundwater flows toward the west, and an unnamed tributary of Sink Creek. On the east side of the divide, groundwater flows toward the east, and an unnamed tributary of Miller Creek. Cell W3 is monitored by downgradient water table wells OW-101B, MW-711B and MW-712B; by groundwater underdrain GUW3-1; and by upgradient well P-703C and downgradient bedrock wells P-213C, P215C and P-216C.

Figure 3-19 presents the results of the theoretical release from closed landfill Cells W1 and W2 with groundwater drainage layer active. The flow paths show that groundwater flows inward toward the Cells W1 and W2 groundwater drainage layer.

3.4 References

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Rust Environment & Infrastructure, July 1997, Hydrogeologic Investigation Report for Landfill Expansion, Black Hawk County Landfill.

4.0 GROUNDWATER MONITORING SYSTEM

Groundwater monitoring at the Black Hawk County Landfill is based on the Conceptual Site Models (Section 2) and Theoretical Release Evaluation (Section 3) and includes monitoring of the water table aquitard in the surficial Quaternary-age sediments and the uppermost aquifer in the Devonian-age Cedar Valley Group dolomite bedrock.

4.1 WATER TABLE AND UNDERDRAIN MONITORING POINTS

The wells comprising the water-table and groundwater underdrain sampling program for the Black Hawk County Landfill are listed on Table 4-1 and include the following monitoring wells and underdrain sampling points shown on Figure 4-1.

Site-wide water table background monitoring includes:

Wells OW-101B, OW-114B, OW-213BR, OW-216BR, OW-217B, OW-218B, OW-219B, MW-304B, MW-308B, MW-319B, OW-403B, OW-405B, MW-701B, MW-702B, MW-703B, MW-704B, MW-705B, MW-706B, MW-707B, MW-708B, MW-709B and MW-710B serve as the shallow background monitoring points for Landfill Areas A, C and E, Cells X, W1, W2, W3 and W4; these wells are screened in Quaternary Loess and Pre-Illinoian glacial diamicton (till)..

Water table monitoring for closed Area A includes:

- Downgradient water table monitoring is completed in several wells that differ in the geology of their well screen intervals. These include water table wells: OW-401B completed in Quaternary loess and the underlying Pre-Illinoian age Wolf Creek Formation, MW-501B completed in Quaternary loess and the underlying Wolf Creek and Alburnett Formation glacial deposits, and assessment of corrective measures (ACM) wells OW-410B, OW-411B and OW-414B completed in Quaternary loess and the underlying Wolf Creek and Alburnett Formation glacial deposits.

Water table monitoring for closed Area C includes:

- Downgradient water table monitoring wells include several wells that differ in the geology of their well screen intervals. The water table wells include OW-105B completed in Pre-Illinoian-age Wolf Creek and Alburnett Formation glacial deposits, OW-205B completed in Wolf Creek and Alburnett Formation glacial deposits, OW-220B, OW-224B, OW-225B, OW-226B and OW-227B completed in Wolf Creek Formation glacial deposits and OW-402B and ACM wells OW-412B and OW-413B completed in Quaternary loess and the underlying Wolf Creek and Alburnett Formation glacial deposits.

Water table monitoring and the underdrain outlets for closed Area E and Cell X include:

- Downgradient water table monitoring wells include several wells that differ in the geology of their well screen intervals. The water table monitoring wells are OW-113B, OW-209B, OW-212B, OW-221B, OW-222B, OW-223B and MW-409B completed in Quaternary loess and the underlying Pre-Illinoian age Wolf Creek and Alburnett Formation glacial deposits.
- Water table measurement only wells include several upgradient wells that differ in their well screen geology. The wells include OW-101B, OW-102B, OW-102D, OW-103B, OW-104B, OW-214B, OW-215B, OW-217B, and OW-218B completed in Pre-Illinoian age Alburnett Formation deposits.

- Downgradient underdrain outlets GUE-2 and GUX-1.

Cell W1 is closed and is located on a watershed (surface water) and water table divide at the Black Hawk County Landfill. Cell W2 is closed and is located west of the watershed and water table divide at the Black Hawk County Landfill. Water table monitoring and the underdrain outlets for Cells W1 and W2 include:

- Downgradient table monitoring is completed in wells MW-602B, MW-603B and MW-604B completed in the Pre-Illinoian-age Wolf Creek Formation glacial deposits.

- Water table measurement only wells related to Cells W1/W2 include various wells that differ in the geology of their well screen interval. Upgradient water level measurement only wells include wells OW-407B and OW-408B where the well screens are set in the Pre-Illinoian-age Wolf Creek Formation and the underlying Alburnett Formation glacial deposits. Sidegradient water level measurement wells include MW-606B and MW-318BR completed in the Pre-Illinoian-age Wolf Creek Formation glacial deposits, and wells MW-320B and MW-701B completed in Pre-Illinoian-age Wolf Creek Formation and underlying Alburnett Formation glacial deposits.

- Downgradient underdrain outlets GUW1-1 and GUW2-1.

Cell W3 is currently operating (December 2021) and crosses the watershed and water table divide at the Black Hawk County Landfill. Water table monitoring and the underdrain outlets for Cell W3 include:

- Downgradient table monitoring is completed in wells OW-101B, MW-711B and MW-712B completed in the Pre-Illinoian-age Wolf Creek Formation glacial deposits.

- Water table measurement only wells related to Cells W3/W4 include various wells that differ in the geology of their well screen interval. Sidegradient water level measurement wells include MW-304B, MW-701B, MW-702B, MW-703B, MW-704B, MW-705B, MW-706B, MW-707B and MW-708B completed in the Pre-Illinoian-age Wolf Creek Formation glacial deposits.

- Downgradient underdrain outlet GUW3-1.

Water table monitoring for closed Asbestos Cell No. 1 includes:

- Water table measurement only wells include various wells that differ in the geology of their well screen interval. Upgradient water table wells include OW-101B and OW-102B completed in Pre-Illinoian age Alburnett Formation glacial deposits. Sidegradient water table wells include OW-103B and OW-104B completed in Pre-Illinoian age Alburnett Formation glacial deposits. Downgradient water table monitoring wells OW-113B, OW-212B, OW-219B, MW-409B and OW-221B completed in Quaternary loess and the underlying Pre-Illinoian age Wolf Creek Formation glacial deposits.

- Downgradient water table measurement only is completed in water table well OW-102D completed in Pre-Illinoian Alburnett Formation glacial deposits.

Asbestos Cell No. 2 is currently active. Water table monitoring for Asbestos Cell No. 2 includes:

- Water table measurement only wells include various wells that differ in the geology of their well screen intervals Upgradient water table measurement only wells include OW-101B, OW-102B, and OW-102D completed in the Pre-Illinoian age Alburnett Formation glacial deposits. Sidegradient water table measurement only wells include OW-103B and OW-104B completed in Pre-Illinoian Alburnett Formation glacial deposits. Downgradient water table monitoring wells OW-113B, MW-409B, OW-219B and OW-221B were completed in Quaternary loess and the underlying Pre-Illinoian age Wolf Creek Formation glacial deposits

4.2 BEDROCK MONITORING POINTS

The deep wells comprising the uppermost bedrock monitoring program for all waste disposal areas at the Black Hawk County Landfill are listed on Table 4-1 and include the following monitoring wells shown on Figure 4-2. All deep wells are completed in the uppermost bedrock beneath the facility, the Devonian-age Cedar Valley Group dolomite.

The six detection monitoring wells completed in the uppermost bedrock include:

- Deep monitoring wells P-604C and P-703C upgradient of the entire facility.
- Deep monitoring well P-213C sidegradient of Area E and upgradient Cell X.
- Deep monitoring wells P-214C, P-215C and P-216C downgradient of Areas A and C, Cells W1/W2/W3/W4, and Cell X.

The groundwater level measurement only wells completed in the uppermost Devonian-age Cedar Valley Group dolomite bedrock include:

- Deep well P-101C sidegradient of Cells W1/W2, upgradient RCRA Neutral Trench and upgradient of Asbestos Cell No.1.
- Deep well P-102C sidegradient of Cells W1/W2, downgradient RCRA Neutral Trench and downgradient Asbestos Cell No. 1
- Deep wells P-103C and P-104C sidegradient of Cells W1/W2, downgradient RCRA Neutral Trench, upgradient Area E and Cell X, downgradient Asbestos Cells No. 1, and upgradient Asbestos Cell No. 2.
- Deep wells P-105C, P-106C and P-107C downgradient of Cells W1/W2 and Area C, downgradient RCRA Co-Disposal Area and upgradient of Cell X.
- Deep wells P-108C and P-109C downgradient of Cells W1/W2, Area A and RCRA Co-Disposal Area.
- Deep wells P-110C and P-111C downgradient RCRA Co-Disposal Area.
- Deep well P-113C downgradient of Cells W1/W2, Area C and upgradient Cell X.
- Deep well P-114C upgradient RCRA Co-Disposal Area.
- Deep well P-402C downgradient Cells W1/W2 and upgradient Areas A and C.
- Deep well MW-318CR upgradient of the entire facility.

4.3 INTERMEDIATE MONITORING POINTS

The wells comprising the intermediate (inter-till) monitoring program for all the waste disposal areas at the Black Hawk County Landfill are listed on Table 4-1 and are shown on Figure 4-2. All the wells are completed in the Pre-Illinoian Alburnett Formation glacial deposits. A total of 18 intermediate wells are nested with water table and bedrock wells and used for estimating vertical gradients and groundwater flow between the shallow (water table) aquitard and the deep (bedrock) aquifer.

4.4 SURFACE WATER MONITORING POINTS

Surface water monitoring for all waste disposal areas at Black Hawk County Landfill are listed on Table 4-1 and are shown on Figure 4-2. Two surface water monitoring points will be used to monitor discharge of shallow groundwater to surface water drainage adjacent to Area C as part of the ACM monitoring. These monitoring points will be used to demonstrate concentrations are below applicable GWPSs at the property boundary.

5.0 SEMI-ANNUAL GROUNDWATER LEVEL MEASUREMENTS

Groundwater levels will be measured semi-annually in the Black Hawk County Landfill wells in compliance with Iowa Department of Natural Resources Permit No. 7-SDP-1-75P. Table 5-1 lists the wells that will be measured.

TABLE 5-1
WELLS INCLUDED IN SEMI-ANNUAL GROUNDWATER MEASUREMENT
BLACK HAWK COUNTY LANDFILL

Well Number	Gradient Position	Groundwater System	Screened Geologic Unit
OW-101B	Upgradient Asbestos Cells No. 1 and 2	Water Table	QAT
P-101C	Upgradient Asbestos Cells No. 1 and 2	Uppermost Bedrock	Dcv
OW-102B	Upgradient Asbestos Cell No. 2, Downgradient Asbestos Cell No. 1	Water Table	QAT
P-102C	Downgradient Asbestos Cells No. 1 and 2	Uppermost Bedrock	Dcv
OW-102D	Downgradient Asbestos Cell No. 2	Water Table	QAT
OW-103B	Sidegradient Asbestos Cell No. 2 Upgradient Area E	Water Table	QAT
P-103C	Downgradient Asbestos Cells No. 1 and 2	Uppermost Bedrock	Dcv
OW-104B	Sidegradient Asbestos Cell No. 2 Upgradient Area E	Water Table	QAT
P-104C	Upgradient Area E and Cell X Downgradient Cell W1	Uppermost Bedrock	Dcv
OW-105B	Downgradient Area C and Area E	Water Table	QAT
P-105C	Downgradient Area C Upgradient Cell X	Uppermost Bedrock	Dcv
OW-106B	Downgradient Area C, Area E, and Cell X	Water Table	QAT
P-106C	Downgradient Area C Upgradient Cell X	Uppermost Bedrock	Dcv
OW-107B	Downgradient Cell X	Water Table	QAT
P-107C	Downgradient Area A and Area C Upgradient Cell X	Uppermost Bedrock	Dcv
OW-108B	Downgradient Area C, Area E, and Cell X	Water Table	QWT/QAT
P-108C	Downgradient Area A	Uppermost Bedrock	Dcv
OW-109B	Downgradient Cell X	Water Table	QWT
P-109C	Downgradient Area A	Uppermost Bedrock	Dcv
OW-110B	Sidegradient Entire Facility	Water Table	QWT/QAT
P-110C	Sidegradient Entire Facility	Uppermost Bedrock	Dcv
OW-111B	Sidegradient Entire Facility	Water Table	QWT
P-111C	Sidegradient Entire Facility	Uppermost Bedrock	Dcv
OW-113B	Downgradient Area E	Water Table	QAT
P-113C	Downgradient Cell W1 and Area C Sidegradient Area E Upgradient Cell X	Uppermost Bedrock	Dcv
OW-114B	Upgradient Area A	Water Table	QWT
P-114C	Upgradient Area A	Uppermost Bedrock	Dcv
OW-115B	Downgradient Co-Disposal Area	Water Table	QWT/QAT
OW-116B	Downgradient Co-Disposal Area	Water Table	QWT/QAT
OW-117B	Downgradient Co-Disposal Area	Water Table	QWT/QAT

TABLE 5-1
WELLS INCLUDED IN SEMI-ANNUAL GROUNDWATER MEASUREMENT
BLACK HAWK COUNTY LANDFILL

Well Number	Gradient Position	Groundwater System	Screened Geologic Unit
OW-118B	Downgradient Co-Disposal Area	Water Table	QWT/QAT
OW-205B	Downgradient Cell W1 Upgradient Area E	Water Table	QWT/QAT
OW-207B	Sidegradient Entire Facility	Water Table	QWT/QAT
OW-208B	Sidegradient Entire Facility	Water Table	QWT/QAT
OW-209B	Downgradient Cell X	Water Table	QAT
OW-212B	Downgradient Cell W1 and Area C	Water Table	QAT
OW-213BR	Upgradient Area E	Water Table	QWT/QAT
P-213C	Upgradient Cell X	Uppermost Bedrock	Dcv
OW-214BR	Sidegradient Cell X	Water Table	QAT
P-214CR	Downgradient Cell W1, Area A, Area C, and Cell X	Uppermost Bedrock	Dcv
OW-215BR	Sidegradient Cell X	Water Table	QAT
P-215CR	Downgradient Area E and Cell X	Uppermost Bedrock	Dcv
OW-216BR	Upgradient Cell X	Water Table	QWT/QAT
P-216CR	Downgradient Area E and Cell X	Uppermost Bedrock	Dcv
OW-217B	Upgradient Cell X	Water Table	QWT/QAT
OW-218B	Upgradient Area E	Water Table	QWT/QAT
OW-219B	Upgradient Area E	Water Table	QWT/QAT
OW-220B	Downgradient Area C	Water Table	QWT/QAT
OW-221B	Downgradient Cell X	Water Table	QWT/QAT
OW-222B	Downgradient Cell X	Water Table	QWT/QAT
OW-223B	Downgradient Cell X	Water Table	QWT/QAT
OW-224B	Downgradient Area C	Water Table	QWT/QAT
OW-225B	Downgradient Area C	Water Table	QWT/QAT
OW-226B	Downgradient Area C	Water Table	QWT/QAT
OW-227B	Downgradient Area C	Water Table	QWT/QAT
MW-304B	Downgradient Cell W3/W4	Water Table	QWT
MW-318BR	Sidegradient Cell W1	Water Table	QWT/QAT
MW-318CR	Upgradient Entire Facility	Uppermost Bedrock	Dcv
MW-319B	Upgradient Cell W1, Area A, and Area C	Water Table	QWT
MW-320B	Sidegradient Entire Facility	Water Table	QWT/QAT
OW-401B	Downgradient Cell W1 Upgradient Area A	Water Table	Ql/QWT
OW-402B	Downgradient Cell W1 Upgradient Area C	Water Table	Ql/QWT/QAT
P-402A	Downgradient Cell W1 Upgradient Area C	Intermediate	QAT
P402C	Downgradient Cell W1 Upgradient Area C	Uppermost Bedrock	Dcv
OW-407B	Sidegradient Cell W1 Upgradient Area A	Water Table	QWT/QAT
OW-408B	Upgradient Cell W1	Water Table	QWT
MW-409B	Downgradient Asbestos Cells No. 1 and No. 2	Water Table	Ql/QWT

TABLE 5-1
WELLS INCLUDED IN SEMI-ANNUAL GROUNDWATER MEASUREMENT
BLACK HAWK COUNTY LANDFILL

Well Number	Gradient Position	Groundwater System	Screened Geologic Unit
OW-410B	Upgradient Cell W1 Downgradient Area A	Water Table	Ql/QWT/QAT
OW-411B	Upgradient Cell W1 Downgradient Area A	Water Table	Ql/QWT/QAT
OW-412B	Upgradient Cell W1 Downgradient Area C	Water Table	Ql/QWT/QAT
OW-413B	Upgradient Cell W1 Downgradient Area C	Water Table	Ql/QWT/QAT
OW-414B	Upgradient Cell W1 Downgradient Area A	Water Table	Ql/QWT/QAT
MW-501B	Downgradient Area A Upgradient Co-Disposal Area and Cell X	Water Table	QWT/QAT
MW-602B	Downgradient Cell W2	Water Table	QWT/QAT
MW-603B	Downgradient Cell W2	Water Table	QWT/QAT
MW-604B	Downgradient Cell W2	Water Table	QWT/QAT
MW-606B	Downgradient Cell W2	Water Table	QWT/QAT
P-604C	Upgradient Cell W2	Uppermost Bedrock	Dcv
MW-701B	Downgradient Cell W3/W4	Water Table	QWT/QAT
MW-702B	Downgradient Cell W3/W4	Water Table	QWT/QAT
MW-703B	Downgradient Cell W3/W4	Water Table	QWT/QAT
MW-704B	Downgradient Cell W3/W4	Water Table	QWT/QAT
P-703C	Upgradient Cell W3/W4	Uppermost Bedrock	Dcv
MW-705B	Downgradient Cell W3/W4	Water Table	QWT/QAT
MW-706B	Downgradient Cell W3/W4	Water Table	QWT/QAT
MW-707B	Downgradient Cell W3/W4	Water Table	QWT/QAT
MW-708B	Downgradient Cell W3/W4	Water Table	QWT/QAT
MW-709B	Upgradient Cell W3/W4	Water Table	QWT/QAT
MW-710B	Upgradient Cell W3/W4	Water Table	QWT/QAT
MW-711B	Downgradient Cell W3/W4	Water Table	QWT/QAT
MW-712B	Downgradient Cell W3/W4	Water Table	QWT/QAT

NOTES:1 Screened geologic unit symbols:
Ql = Quaternary loess
QWT = Quaternary Pre-Illinoian Till Unit – Wolf Creek Formation
QAT = Quaternary Pre-Illinoian Till Unit – Alburnett Formation Unit A
Dcv = Devonian, Cedar Valley Formation dolomite
NA = not applicable

For each semi-annual sampling event, field Water Elevation forms, such as the example in Appendix B, will be used to document:

- Well number
- Elevation of the top of the well casing
- Measured depth to water from the top of casing
- Measured depth to the bottom of the well

Two sets of groundwater level measurements will be collected from each well prior to groundwater sampling. The first groundwater level measurements will be collected as part of a full site-wide round, in which water levels will be collected from all permitted monitoring wells within a 24-hour time period for use in evaluating groundwater flow across the site. A second groundwater level measurement will be collected from each sampled well directly before groundwater sampling.

In preparation for collecting groundwater level and depth to bottom measurements, the groundwater sampling technician shall review the site-specific planning documents to obtain the following information:

- Identification number(s) of the well or wells to be monitored (found in sampling protocols presented in the HMSP).
- Locations of the wells as shown on a site map.
- Records listing the most recent water level measurements and constructed depth to bottoms for the well(s).
- Reference point information (e.g., top-of-casing elevation, state plane coordinates, marked location of measurement reference point).

Prior to collecting groundwater level measurements, the sampler will visually inspect the measuring tape/probe to ensure that it is not missing sections and the numbers are accurate. The sampler will then decontaminate the water-level indicator in its entirety, including the recessed chamber the probe sits in. Once decontaminated, the probe of the electronic water level indicator will be lowered into the riser casing until water is encountered, as indicated by the instrument signal. The instrument signals encountering top of water by illuminating a light on the side of the instrument and by sounding with a continuous beep. The water level will then be measured to the nearest 0.01 foot with respect to the marked “top-of-casing” reference point and entered on the field log. Measurement reference points have been clearly marked on the north side of the top-of-casing for each well. As part of the measurement process, additional consecutive water level measurements will be made by field personnel to verify the initial reading obtained.

The groundwater level measurement will be compared to the most recent water level obtained for the well (previous sampling event). If the measurements differ by more than 0.5 foot, the depth to water will be measured a second time for verification purposes. A remark will be made on the field form if a probable cause for the discrepancy is known (e.g., period of drought, rainfall event, or start-up of a nearby pumping well).

Field measurements of water levels for a given well shall be recorded on the field form, including the following information:

- The type of measurement device used.
- Date and time of the measurement.
- Any pertinent remarks concerning the well condition, instrument malfunction, variation of the measured depth versus the installed depth of the well, soft bottom, etc.

When groundwater-level measurements are taken at the same time as groundwater sampling, the static water level will be taken first; the depth to the bottom of the well will not be taken until after the completion of groundwater sampling to minimize any effects of any sediment in the well on groundwater turbidity and to avoid mixing of groundwater in the well casing prior to groundwater sample collection.

During the groundwater level measurements, other notes will be made about the well integrity and recorded on the Water Elevation form. These notes will include information about the status of the well

as locked and capped, and any notes about well integrity regarding cracks, obstructions, presence of sediment at bottom of well, or other observed features in the well and surface seal.

6.0 GROUNDWATER SAMPLING AND ANALYSIS

This section describes groundwater sampling and analysis at the Black Hawk County Landfill. The sampling and analysis are designed to comply with IAC 567-113.10(455B) (4) and are developed to ensure that monitoring results provide an accurate representation of groundwater quality at the wells at the Landfill.

6.1 SAMPLE COLLECTION AND PRESERVATION

Groundwater sample collection will be accomplished using low-flow sampling techniques.

Sample integrity will be maintained by decontaminating field equipment prior to sampling and in between wells, and adhering to the EPA sample collection, preservation, packaging and chain-of-custody protocols.

6.1.1 Low-Flow Sampling Techniques

For the semi-annual sampling events, low-flow sampling techniques will be used for groundwater sampling. The equipment to be used for this technique will consist of:

1. Pump Will be One of the Following: Low-Flow Sampling Pump and Controller (e.g., Impeller Type Pump) (i.e., Proactive Mega-Monsoon) with Back-Flow Check Valve, or a Dedicated or Non-Dedicated Bladder Pump (i.e., Geotech Portable Stainless-Steel Bladder Pump)
2. Disposable Tubing Made of Inert Materials for Low-Flow Sampling Pump
3. Disposable Bladders (if Non-Dedicated Bladder Pumps are Used)
4. For Wells Which Cannot be Continuously Pumped Without Well Going Dry, One of the Following:
   a. Try to dial flow rate back from 125 ml/min to 100 ml/min and allow 15-minutes for well recovery. If the water draws-down to the top of the screened interval again pause pumping and allow for 15-minutes recovery. *If two tubing volumes (including the volume of water in the pump and flow cell) have been removed during purging, then sampling can proceed next time the pump is turned on.*
   b. Purge Well Dry; Allow 24-Hr Recovery; Purge and Sample Well After Recovery
5. Electronic Water Level Indicator (Two-Wire Electrical Sounder), Equipped with a Sufficient Length of Water Level Tape to Reach the Deepest Anticipated Water Level (200 – 300 ft); the Water Level Tape should be Graduated Into 0.01-Foot Intervals
6. Extra Batteries for the Water Level Indicator
7. Disposable Nylon Rope
8. Liquinox or Other Non-Phosphate Detergent
9. Deionized Water
10. Pressurized Deionized Water Sprayer
11. Other Decontamination Equipment, as needed (e.g., Brush, Plastic Bucket, Clean Spray Bottles, Paper Towels, Clean Plastic Sheeting
12. Five-Gallon Graduated Bucket for Collecting Purge Volumes
13. Sample Containers (Provided with Appropriate Preservatives by Eurofins TestAmerica, Inc.)
14. Two Coolers for Shipment of Water Samples
15. Ice
16. For monitoring stabilization during purging, use one of the following:
    a. Myron Ultrameter II or Equivalent Combination Water Quality Meter (pH, Temperature, Conductivity) and LaMotte or Equivalent Turbidity Meter
    b. In-Situ Aqua Troll 500/600 Low-Flow System
17. Field Data Sheets
18. Sample Labels
19. Chain-of-Custody Forms
20. Personal Protective Equipment
21. Garbage Bags for PPE, Filters and Disposable Tubing

22. Keys for Locked Protective Casings
23. Tools (e.g., Wrenches), as Needed, to Enter Well Vault Boxes
24. Health and Safety Monitoring Equipment, as needed

6.1.2 Calibration of Field Equipment

Calibration of all field instruments used to measure and monitor pH, conductivity, turbidity, and temperature will be performed. Table 6-1 presents the analytical parameters being measured, equipment, calibration activity, maintenance, testing and inspection, frequency of calibration, acceptance criteria and corrective action, if necessary. Calibration data collected prior to groundwater sampling will be recorded on the Field Meter Instrument Calibration Log (see Appendix B).

The Myron Ultrameter II pH/Conductivity Meter will be calibrated at the beginning of each sampling day. The meter will be calibrated using the manufacturer's specifications. If instrument calibration indicates damage or sensor degradation over time, the instrument will be replaced.

The LaMotte turbidity meter will be calibrated at the beginning of each sampling day. The meter will be calibrated in the field office using the manufacturer's specifications. If instrument calibration indicates damage or sensor degradation over time, the instrument will be replaced.

The In-Situ Aqua Troll 500/600 Probe will be calibrated annually by the manufacturer prior to deployment. The meter will be maintained by the manufacturer using the manufacturer's specifications. A "*Quick Cal*," which calibrates the basic sensors simultaneously using a single "universal" calibration solution, will be performed daily. This will provide the field technician with information on stability of the sensor. If the instrument indicates damage or sensor degradation, the instrument will be replaced.

TABLE 6-1

FIELD EQUIPMENT/INSTRUMENT CALIBRATION, MAINTENANCE, TESTING, AND INSPECTION
BLACK HAWK COUNTY LANDFILL

Analytical Parameter	Field Equipment/Instrument	Calibration Activity	Maintenance & Testing/Inspection Activity	Frequency	Acceptance Criteria	Corrective Action
Temperature (sensor)	Myron Ultrameter II Mocels 6PFC^{E} & 4P	Annual check of endpoints of desired temperature range (0°C to 40°C) versus NIST thermometer	See manufacturer's manual	Annually	+/-0.1°C of true value at both endpoints	Remove from use if instrument doesn't pass calibration
pH (sensor)		Initial: two-point calibration bracketing expected range (using pH 7.0 and either pH 4.0 or pH 10.0 buffer); followed by one-point check with pH 7.0 buffer	See manufacturer's manual	Initial: beginning of each sampling day	Initial: two-point calibration done electronically; one-point check (using pH 7.0 buffer) +/-0.1 pH unit of true value	Recalibrate
Conductivity (sensor)		Initial: one-point calibration bracketing expected range (using KCl Conductivity Standard Solutions 1,409 µmho/cm)	See manufacturer's manual	Initial: beginning of each sampling day	Initial: one-point calibration bracketing expected range (using KCl Conductivity Standard Solutions 1,409 µmho/cm) +/-1% of reading	Recalibrate
Turbidity (sensor)	LaMotteTurbidity Meter Mocel 2020 e/i	Initial: three-point calibration bracketing expected range (using 1, 10, and 100 NTU Turbidity Calibration Standards, 60 ml (EPA))	See manufacturer's manual	Initial: beginning of each sampling day	+/-0.05 or +/- 2% of reading whichever is greater, below 100 NTU. +/- 3% of reacing whichever is greater, above 100 NTU	Recalibrate
Temperature (sensor)	In-Situ Multi-Parameter AQUA TROLL 500	Annual check of endpoints of desired temperature range (0°C to 40°C) versus NIST thermometer	See manufacturer's manual	Annually	+/-0.1°C of true value at both endpoints	Remove from use if instrument doesn't pass calibration
pH (sensor)		Initial: one-point calibration bracketing expected range (using Quick Cal Standard Solutions 7.0 pH)	See manufacturer's manual	Initial: beginning of each sampling day	Initial: one-point check (using pH 7.0 buffer) +/-0.1 pH unit of true value	Recalibrate
Conductivity (sensor)		Initial: one-point calibration bracketing expected range (using Quick Cal Standard Solutions 8,000 µmho/cm)	See manufacturer's manual	Initial: beginning of each sampling day	± 0.5% + 2 µS/cm between 150 µS/cm, and 112,000 µS/cm when calibrated in region of interest. From 70 to 150 µS/cm & 112,000 to 200,000 µS/cm ± 2% + 4 µS/cm typical.	Recalibrate
Turbidity (sensor)		Initial: one-point calibration bracketing expected range (using 10 NTU Turbidity Calibration Solution)	See manufacturer's manual	Initial: beginning of each sampling day	+/- 2 NTU or +/- 5% of reading, whichever is greater	Recalibrate

Notes:
Check calibration solutions expiration dates; discard open calibration solutions after 6 months
Calibration values are based on 25°C

6.1.3 Groundwater Sample Collection Procedures

Groundwater sampling will be conducted using "low-flow" or "low stress" sampling techniques recommended in the "Ground-Water Sampling Guidelines for Superfund and RCRA Project Managers" (EPA 2002) and "Standard Guide for Sampling Ground-Water Monitoring Wells" (ASTM 2013). The procedures that will be used are summarized below and will vary depending on if the well is a high-yield or low-yield well.

The groundwater sampling order will be from the least contaminated well to the most contaminated well. The order will be based on historical sample results and verified annually. A sampling order list will be provided to the sampling technician by the project hydrogeologist or chemist prior to the first day of sampling. The project hydrogeologist will provide depth to water and depth to bottom from prior groundwater level event. Prior field data sheets will be used to set the pump controller purge rate.

Prior to groundwater sampling, field meters will be calibrated according to procedures outlined in Section 6.1.2 and instrument manuals.

Purging and Sampling Procedures

Pre-sampling Tasks

1. As noted above, sampling locations must begin at the monitoring well with the least contamination, generally upgradient or furthest from the site or suspected source. Then proceed systematically to the monitoring wells with the most contaminated groundwater. The sampling order will be determined by the site hydrogeologist prior to groundwater sampling.
2. Check and record the condition of the monitoring well for damage or evidence of tampering. AECOM performs semi-annual groundwater levels and inspection of all monitoring wells and staff gauges prior to the sampling event.
3. Measure the depth to water (water level must be measured to nearest 0.01 feet), following procedures in Section 5, relative to a reference measuring point on the well casing with an electronic water level indicator and record on groundwater well purging and sampling collection form. If no reference point is found, measure relative to the top of the inner casing, then mark that reference point and note that location in the field logbook. Record information on depth to groundwater on well purging and sampling collection form. Measure the depth to water a second time to confirm initial measurement; measurement should agree within 0.01 feet or re-measure.
4. Check the available well information or field information from the groundwater levels for the total depth of the monitoring well. Use the information from the depth of water and the total depth of the monitoring well to calculate the volume of the water in the monitoring well or the volume of one casing. Record information on well purging and sampling collection form.
    a. Casing volume (2-in diameter well) = (D.T.B - D.T.W. x vol./ft. = PVC/well volume) = DTB-DTW)x 0.163 gal/ft = gal (x 617 ml/ft = _____ml)
    b. $\mathbf{h_s}$ = Stabilized/Max Drawdown Height = _____feet.
    c. **S** = Drawdown Volume (2" diameter well) = 0.163 gallons/ft x $\mathbf{h_s}$ = _____ gallons (x 617 ml/ft = _____ml)

Purging and Sampling Task

5. Place the pump and support equipment at the wellhead and slowly lower the pump and tubing down into the monitoring well until the location of the pump intake is set at a pre-determined location, such as mid-point of screened interval or midpoint of water column. Take care not to disturb any sediment in the bottom of the well. The tubing will be cut at a reasonable length to complete sampling, while minimizing groundwater exposure to sunlight and ambient air

temperatures. Sunlight and air may cause the groundwater to heat up and de-gas which is unacceptable for the collection of samples for VOC and dissolved gases analyses. The placement of the pump intake should be positioned by sounding with a weighted-tape. Refer to the available monitoring well information to determine the depth and length of the screen interval. Measure the depth of the pump intake while lowering the pump into location. Record pump location on well purging and sampling collection form.

6. Measure the water level (water level must be measured to nearest 0.01 feet) and record information on the well purging and sampling collection form, leave water level indicator probe in the monitoring well.
7. Connect the discharge line from the pump to a flow-through cell. The discharge line from the flow-through cell must be directed to a container to contain the purge water during the purging and sampling of the monitoring well.
8. Start pumping the well at a low flow rate (0.125 to 0.5 liter per minute) and slowly increase the speed. Check water level. Maintain a steady flow rate while maintaining a drawdown of less than 0.33 feet (Puls and Barcelona, 1996). Research suggests that purge rates less than 1L/min (0.25 gal/min) prevent excessive turbulence and produce more reproducible VOC/metals analytical results (ASTM 2013). The water levels will be checked frequently, and the pumping rate adjusted until the discharge rate matches the well's recharge rate indicated by little or no water level drawdown. If drawdown is greater than 0.33 feet lower the flow rate. The 0.33-feet is a goal to help guide with the flow rate adjustment. It should be noted that this goal may be difficult to achieve under some circumstances due to geologic heterogeneities within the screened interval and may require adjustment based on site-specific conditions and personal experience (Puls and Barcelona, 1996).
9. Measure the discharge rate of the pump with a graduated cylinder and a stopwatch. Also, measure the water level and record both flow rate and water level on the well purging and sampling collection form. Continue purging, monitor and record water level and pump rate every three to five minutes during purging. Pumping rates should be kept at minimal flow to ensure minimal drawdown in the monitoring well.
10. During the purging, a minimum of one tubing volume (including the volume of water in the pump and flow cell (130 ml)) must be purged prior to recording the water-quality indicator parameters. Then monitor and record the water-quality indicator parameters every three to five minutes using the AquaTroll. The water-quality indicator field parameters are turbidity, dissolved oxygen, specific electrical conductance, pH, redox-potential and temperature. The stabilization criterion is based on three successive readings of the water quality field parameters. Stabilization will be considered to have occurred when the parameters listed in Table 6-2 have stabilized on three successive readings within the listed criteria:
11. Once the criteria have been successfully met indicating that the water quality indicator parameters have stabilized, sample collection can take place. AquaTroll will notify when stabilization has occurred.

For Low-Permeability Formations which drawdown is >0.33 feet

12. Perform one of the following:

a. If a stabilized drawdown in the well can't be maintained at 0.33 feet or less and the water level is approaching the top of the screened interval, reduce the flow rate or pause the pump (for 15 minutes) and allow for recovery. Begin pumping at a lower flow rate, if the water draws-down to the top of the screened interval again pause pumping (for 15 minutes) and allow for recovery. <u>If two tubing volumes (including the volume of water in the pump and flow cell) have been removed during purging, then sampling can proceed</u>

next time the pump is turned on. This information should be noted on the well purging and sampling collection form.

b. **LOW-PERMEABILITY FORMATIONS**: Different procedures must be followed in the case of slow-recovery wells installed in low hydraulic conductivity aquifers (Yeskis and Zavala 2002) or aquitards which are present at Black Hawk county Landfill. The following procedures are not optimum but may be used to obtain a ground-water sample under less-than-ideal conditions. If a well has an open interval across the water table in a low permeability zone, there may be no way to avoid pumping a well dry (especially in those cases with four feet of water or less in the well and at a depth to water greater than 20 to 25 feet. In these cases, the well may be purged dry. The sample should be taken no sooner than two hours after purging and after a sufficient volume for a water-quality sample, or sufficient recovery (commonly 90%) is present (Herzog et al., 1988). For water table wells at Black Hawk County, complete recharge generally takes more than 4 hours. By allowing purged well to recharge overnight, the well will have adequate time to recharge and provide adequate volume for sampling. The sample will be collected within 24 hours, unless the rate of recovery of the well requires more time for adequate sample volume to collect in the well. Once there is sufficient volume of water to fill all the sample bottles, the sample will be collected. Field parameters will be recorded but will not need to be stabilized before collecting the sample. Every attempt will be made not to re-suspend sediment when repositioning the pump in the well screen. Turbidity will be used to monitor resuspension of any sediment.

13. Maintain the same pumping rate or reduce slightly for sampling (0.125 to 0.5 liter per minute) in order to minimize disturbance of the water column. Samples should be collected directly from the discharge port of the pump tubing prior to passing through the flow-through cell. Disconnect the pump's tubing from the flow-through-cell so that the samples are collected from the pump's discharge tubing. For samples collected for dissolved gases or Volatile Organic Compounds (VOCs) analyses, the pump's tubing needs to be completely full of ground water to prevent the ground water from being aerated as the ground water flows through the tubing. The sequence of the samples is immaterial unless filtered (dissolved) samples are collected and they must be collected last (Puls and Barcelona, 1996). All sample containers should be filled with minimal turbulence by allowing the ground water to flow from the tubing gently down the inside of the container. When filling the VOC samples a meniscus must be formed over the mouth of the vial to eliminate the formation of air bubbles and head space prior to capping.
14. Remove the pump from the monitoring well. Decontaminate the pump and dispose of the tubing.
15. Before locking the monitoring well, measure and record the well depth (to 0.1 feet). Measure the total depth a second time to confirm initial measurement; measurement should agree within 0.01 feet or re-measure.

TABLE 6-2
LOW-FLOW SAMPLING STABILIZATION PARAMETERS

Parameter	Stabilization Criteria	Reference
pH	±0.1	Puls and Barcelona, 1996; Wilde et al., 1998
Specific Electrical Conductance	±3%	Puls and Barcelona, 1996
Oxidation-Reduction Potential	±10 millivolts	Puls and Barcelona, 1996
Turbidity	±10% (When Turbidity is Greater Than 10 NTUs)	Puls and Barcelona, 1996; Wilde et al., 1998
Dissolved Oxygen	±0.3 mg/L	Wilde et al., 1998

Readings will be considered stabilized when they are within each other by ±10 percent for turbidity, ±10 percent for dissolved oxygen, ±10 mV for oxidation-reduction potential, ± 0.1 units for pH, ± 0.2 °C, and ± 3% µS/cm for specific conductance. In addition, when possible, especially when sampling for contaminants that may be biased by the presence of turbidity, the optimal turbidity reading is at a value below 10 Nephelometric Turbidity Units (<10 NTU) (EPA 2002). The flow-thru cell will be disconnected prior to collecting the sample.

6.1.4 Sample Containers

Sample bottles will be filled in order from most volatile to least volatile analytes being analyzed. In general, the sequence will be VOC, SVOC, Metals and dissolved metals. VOC bottles will be checked for bubbles, making sure there is no head space after bottles are filled.

Table 6-3 summarizes the sample containers and preservatives to be used. All samples will be stored in coolers containing ice in a secure area until custody is relinquished.

TABLE 6-3
BOTTLE AND PRESERVATION REQUIREMENTS

Test Parameters	Sample Container	Preservation	Holding Time
Total Organic Halogens	760 ml Amber Glass	$H2SO_4$ to pH<2	28 Days
Total Organic Carbon	500 ml Amber Glass	$H2SO_4$ to pH<2	28 Days
Total Chromium and Lead	250-ml HDPE	HNO_3 to pH<2	180 Days
Total Metals	250-ml HDPE	HNO_3 to pH<2	28 Days Mercury 180 Days All Others
Total Cyanide	500-ml HDPE	NaOH to pH>12	14 Days
Volatile Organic Compounds	3 50-ml Glass Vials	HCl to pH <2; cool to 4°C	14 Days
Base Neutral Semi-Volatile Organic Analytes	1,000-ml Amber Glass	--	7 Days
Acid Semi-Volatile Organic Analytes	1,000-ml Amber Glass	--	7 Days
PCB/Pesticide Analytes	1,000-ml Amber Glass	--	7 Days
Total Suspended Solids	1,000-ml HDPE	--	7 Days

6.1.5 Decontamination

Any non-dedicated sampling equipment (e.g., water level indicator, pump, stainless steel bailers) used will be decontaminated prior to sampling and in between wells using the following procedures:

1) Washing with Liquinox or similar detergent.

2) Spraying off detergent with deionized water to remove all the detergent solution.

The inner parts of non-dedicated impeller-type pumps will be decontaminated by pumping 2 – 3 gallons of deionized water through the pump using a 4-ft by 4-in. ID SCH 40 PVC casing section with bottom cap. The PVC casing will be filled with deionized water, the pump placed within in the water, and the pump turned on to run the clean water through.

Decontamination of a bladder-type pump will use the following procedures:

1. Remove the lower Teflon™ compression ring by pulling off the end of the internal center tube assembly.

2. Pull the lower end of the bladder toward the middle of the center tube assembly and remove O-ring from the lower end of the tube.

3. Release the upper Teflon™ compression ring and slide off the end of the center tube assembly.

4. Slide the bladder off the center tube assembly; at this point, the O-ring on the upper end can be replaced.

5. Decontaminate pump housing, pump ends, center tube assembly and Teflon compression ring by spraying with Liquinox, then deionized rinse.

6. Reassemble pump with new bladder and new O-rings.

Clean nitrile gloves will be used during decontamination of any equipment and rinsate water will be discharged to the 5-gal purge water bucket. The pump uses disposable tubing, which is replaced after each well. Rinsates will be discharged to a 5-gal water bucket and ultimately disposed of by discharging to the Landfill surface.

Personal Protective Equipment (PPE)

Personal protective equipment (PPE), dedicated sampling or decontamination equipment such as, disposable tubing, disposable bladders and disposable nylon rope, will be discarded after sampling and decontamination has been completed. PPE will include nitrile gloves, safety glasses, steel toe boots, PVC boot covers and poly-coated Tyvek, if necessary, to protect against dermal contact with groundwater.

Personal protective equipment (PPE) that is generated throughout investigation activities shall be placed in plastic garbage bags. All PPE should be disposed as non-hazardous waste in the designated on-site roll-off box at the municipal Landfill. Trash that is generated as part of field activities may be disposed of in the Landfill as long as the trash was not exposed to hazardous media.

Disposable Teflon bailers will not require decontamination.

6.1.6 Quality Control

In order to verify the quality of the sampling process, sample blanks and duplicates will be collected. One field (equipment or rinsate) blank will be collected for every 20 samples or a minimum of once per day for each group of analytes. The field blank will be collected after the decontamination process described in

Section 6.1.3 by collecting deionized water through the sampling device in the appropriate bottles listed in Table 6-3.

Field duplicates will be collected for every 10 or fewer samples. A field duplicate sample will be a second sample collected consecutively from a well using the sampling device.

In order to assess the degree and type of accidental contamination by volatile organics during the sample collection and shipment procedures, two 40-ml volatile trip blank samples per cooler will be filled completely with distilled water by the laboratory prior to mobilization to the site and stored with the sample volatile vials to be used during field sample collection.

Field documentation will undergo an internal QC review after the completion of field activities. Field forms will be reviewed by the AECOM QA Manager for completeness, accuracy and compliance with this document. Upon completion of the field sampling events, field documentation including field forms and Aqua Troll 500/600 low-flow sampling logs will be relinquished to the Project Manager.

6.1.7 Documentation

Data collected and observations made during groundwater sampling will be recorded on the Well Purging and Sample Collection Field Data Sheet (see Appendix A). Aqua Troll 500/600 low-flow sampling logs will be recorded and saved to project directory on AECOM server.

6.2 SAMPLE SHIPMENT

Samples will be collected from each monitoring point and submitted by AECOM personnel to Eurofins TestAmerica, Inc., at the end of each sampling day.

6.3 ANALYTICAL PROCEDURES

Measurements of pH, conductivity and temperature will be performed in the field using a pH/Conductivity Meter. Eurofins TestAmerica, Inc., will conduct all other analyses. Table 6-4 provides a list of all field and laboratory (IDNR Appendix I) analyses that will be performed along with method detection limits and reporting limits.

6.4 CHAIN-OF-CUSTODY CONTROL

The following sections summarize the sample handling and chain-of-custody procedures that will be used for this project and include an example Chain-of-Custody (Appendix A) form.

The Chain-of-Custody (COC) form is the written documented history of any sample and is initiated at the time of sampling. This form will be completed by AECOM sampling personnel and will accompany the samples to the laboratory where it will be received and stored under the laboratory's custody. The purpose of the COC form is to provide a legal written record of the handling of samples from the time of collection until they are received at the laboratory. It also serves as the primary written request for analyses from AECOM to the laboratory. The COC form also acts as a purchase order for analytical services when no other contractual agreement is in effect.

The information the AECOM sampler will provide at the time of sampling on the container label is:

- Sample Identification
- Date and Time
- Preservative

During the sampling process, the COC form will be completed and must be legible. This form will include the following information:

- Client Name, Address, Phone Number and Fax Number (If Available)
- Project Name and/or Number
- The Sample Identification
- Date, Time and Location of Sampling
- Sampling Plan, If Applicable
- Sample Collector's Name
- The Matrix Description
- The Container Description
- The Total Number of Each Type of Container
- Preservatives Used
- Analysis Requested
- Requested Turnaround Time (TAT)
- Any Special Instructions
- Purchase Order Number or Billing Information (e.g., Quote Number), If Available
- The Date and Time That Each Person Received or Relinquished the Sample(s), Including Their Signed Name

Samples will remain solely in the possession of the AECOM field technician until delivery to laboratory personnel. Samples are stored in a cooler with ice, as applicable. The sample collector will assure that each container is always in his/her physical possession/view or stored in such a place and manner to preclude tampering. The field technician will relinquish the samples in writing on the COC form to laboratory sample control personnel. Samples are only considered to be received by the lab when personnel at the laboratory have physical contact with the samples

TABLE 6-4
LIST OF APPENDIX I ANALYTICAL PARAMETERS AND DETECTION LIMITS

Compound	MDL, ug/L	RL, ug/L
Metals		
Antimony	2.73	6
Arsenic	0.6	1
Barium	0.64	10
Beryllium	0.051	1
Cadmium	0.12	0.5
Chromium	2.71	20
Cobalt	1.5	20
Copper	1.5	20
Lead	1	4
Nickel	2.6	50
Selenium	1.7	5
Silver	1.7	20
Thallium	0.84	2
Vanadium	2.1	50
Zinc	9.1	20
Volatile Organic Compounds		
1,1,1,2-Tetrachloroethane	0.21	1
1,1,1-Trichloroethane	0.23	1
1,1,2,2-Tetrachloroethane	0.28	1
1,1,2-Trichloroethane	0.22	1
1,1-Dichloroethane	0.22	1
1,1-Dichloroethylene	0.4	2
1,2,3-Trichloropropane	0.18	1
1,2-Dibromo-3-Chloropropane	0.5	10
1,2-Dibromoethane	0.25	10
1,2-Dichlorobenzene	0.22	1
1,2-Dichloroethane	0.31	1
1,2-Dichloropropane	0.19	1
1,4-Dichlorobenzene	0.27	1
2-Butanone	0.72	10
2-Hexanone	1.76	10
4-Methyl-2-Pentanone	0.31	10
Acetone	0.89	10
Acrylonitrile	0.58	10
Benzene	0.19	0.5
Bromochloromethane	0.32	5
Bromodichloromethane	0.24	1
Bromomethane	0.57	4
Carbon Disulfide	0.33	1
Carbon Tetrachloride	0.37	2
Chlorobenzene	0.19	1
Chloroethane	0.27	4
Chloromethane	0.18	3
cis-1,2-Dichloroethylene	0.33	1
cis-1,3-Dichloropropene	0.18	5
Compound	MDL, ug/l	RL, ug/l
Dibromochloromethane	0.2	5
Dibromomethane	0.42	1

TABLE 6-4
LIST OF APPENDIX I ANALYTICAL PARAMETERS AND DETECTION LIMITS
(Continued)

Compound	MDL, ug/L	RL, ug/L
Dichloromethane	0.26	5
Ethylbenzene	0.21	1
Iodomethane	0.4	10
Styrene	0.16	1
Tetrachloroethylene	0.27	1
Toluene	0.2	1
Trans-1,2-Dichloroethylene	0.37	1
Trans-1,3-Dichloropropene	0.26	5
Trans-1,4-Dichloro-2-butene	1.8	10
Tribromomethane	0.25	5
Trichloroethylene	0.26	1
Trichlorofluoromethane	0.23	4
Trichloromethane	0.28	1
Vinyl Acetate	1.36	2
Vinyl Chloride	0.24	1
Xylenes	0.41	3

Samples delivered to the laboratory must meet the following criteria:

1) Samples must be properly labeled.

   - Use durable labels (labels provided by Eurofins TestAmerica are preferred).
   - Include a unique identification number.
   - Include sampling date and time and sampler ID.
   - Include preservative used.
   - Use indelible ink.

2) Proper sample containers with adequate volume for the analysis and necessary QC are required for each analysis requested.

3) Samples must be preserved according to the requirements of the requested analytical method.

4) Most analytical methods require chilling samples to 4°C (exceptions would include samples submitted for metals analysis). For methods requiring temperature preservation to 4°C, the criteria are met if the samples are chilled to at or below 6°C and above freezing. For methods with other temperature criteria, the samples must arrive within ±2°C of the required temperature, or within the method specified range. Note: Samples that are hand-delivered to the laboratory immediately after collection may not have had time to cool sufficiently. In this case, the samples will be considered acceptable as long as there is evidence that the chilling process has begun (arrival on ice).

5) All samples submitted for Volatile Organic analyses should have a Trip Blank submitted with the samples. Eurofins TestAmerica will supply a Trip Blank, if requested, with all bottle orders containing Volatile Organic analyses.

6) The Eurofins TestAmerica project manager will be notified if any sample is received in damaged condition. Eurofins TestAmerica will then contact AECOM with the details of the sample condition upon receipt and request further instructions.

6.4.1 Sample Receipt

When samples arrive at the laboratory, designated sample-receiving personnel inspect the coolers and samples. The integrity of each sample must be determined by comparing sample labels or tags with the COC and by visual checks of the container for possible damage. Any non-conformance, irregularity or compromised sample receipt must be documented on the same form but on bright yellow paper and brought to the immediate attention of AECOM. The COC; shipping documents; documentation of any non-conformance, irregularity or compromised sample receipt; record of client contact and resulting instructions become part of the project record.

6.4.2 Sample Storage

In order to avoid deterioration, contamination or damage to a sample during storage and handling, from the time of receipt until all analyses are complete, samples are stored in refrigerators suitable for the sample matrix. In addition, samples to be analyzed for volatile organic parameters are stored in separate refrigerators designated for volatile organic parameters only. Samples are never to be stored with reagents, standards or materials that may create contamination.

To ensure the integrity of the samples during storage, refrigerator blanks are maintained in the volatile sample refrigerators and analyzed every two weeks.

Analysts and technicians retrieve the sample container allocated to their analysis from the designated refrigerator and place them on carts, analyze the sample, and return the remaining sample or empty container to the refrigerator from which it originally came. All unused portions of samples, including empty sample containers, are returned to the secure sample control area. All samples are kept in the refrigerators for 2 to 4 weeks after analysis, which meets or exceeds most sample holding times. Special arrangements may be made to store samples for longer periods of time. This extended holding period allows additional metal analyses to be performed on the archived sample and assists in dealing with legal matters or regulatory issues.

Access to the laboratory is controlled such that sample storage need not be locked at all times unless a project specifically demands it. Samples are accessible to laboratory personnel only. Visitors to the laboratory are prohibited from entering the refrigerator and laboratory areas unless accompanied by an employee of Eurofins TestAmerica.

6.5 QUALITY ASSURANCE AND QUALITY CONTROL

6.5.1 Field Quality Control

The field team will be responsible for inspecting sample containers before leaving for the field. Only new sealed sample containers accompanied by the manufacturer's certification of precleaning will be used. The sample containers will also be inspected for cracks, ill-fitting lids and other obvious defects before use and will be discarded if defects are found to be present.

The pH/Conductivity Meter will be calibrated at the beginning of each sampling day. The meter will be calibrated using the manufacturer's specifications. The calibration for the pH function will be at least a 2-point calibration (pH 7.0 and pH 4.0 solutions) and will occur in the office (except for the initial calibration check which will be done at the time of checkout). Calibration for the conductivity function will be performed with a potassium chloride (KCl) solution in the office. The meter does have temperature compensation; therefore, temperature differences between the sample and the calibration standards will not be an issue.

During water quality sampling, one equipment (rinsate) blank will be collected for every 20 or fewer groundwater samples when non-dedicated sampling equipment is used. Field duplicate samples will be at a frequency of 1 per 10 groundwater samples. A trip blank will be included in each shipment of samples collected for volatile organic compounds (VOCs).

Field quality control samples will be evaluated during data validation and the appropriate qualifiers assigned. For detections in blanks at concentrations below the reporting limit, the associated sample results that are less than the reporting will be qualified non-detect (U). For detections in the blanks that are greater than the reporting limit, associated sample concentrations within five times the blank concentration will be qualified non-detect.

Field equipment requiring testing, inspection and maintenance includes the pH/Conductivity Meter. This meter will be used to measure pH, temperature and conductivity for water samples while in the field. The manufacturer's operating manual for this instrument describes the procedures for testing and inspecting the meter. These procedures include a battery check, verification that the meter was successfully calibrated during its previous use and ensuring preventative maintenance has been completed per the manufacturer's recommendations.

An inspection checklist and initial calibration check will be completed by a field team member upon checkout of the meter. Calibration standards and commonly needed spare parts will also be obtained upon checkout. Any preventative or corrective maintenance done will be documented in the equipment log.

Other field equipment includes low-flow sampling pump and controller (e.g., Impeller Type Pump) (i.e., Proactive Mega-Monsoon) with Back-Flow Check Valve, or dedicated or non-dedicated bladder pump (i.e., Geotech Portable Stainless-Steel Bladder Pump). Any non-dedicated sampling equipment (e.g., water level indicator, pump, stainless steel bailers) used will be decontaminated prior to sampling and in between wells using the following procedures:

1) Washing with Liquinox or similar detergent.

2) Spraying off detergent with deionized water to remove all the detergent solution.

The inner parts of non-dedicated impeller-type pumps will be decontaminated by pumping 2 – 3 gallons of deionized water through the pump using a 4-ft by 4-in. ID SCH 40 PVC casing section with bottom cap. The PVC casing will be filled with deionized water, the pump placed within in the water, and the pump turned on to run the clean water through.

Decontamination of a bladder-type pump will use the following procedures:

1. Remove the lower Teflon™ compression ring by pulling off the end of the internal center tube assembly.

2. Pull the lower end of the bladder toward the middle of the center tube assembly and remove O-ring from the lower end of the tube.

3. Release the upper Teflon™ compression ring and slide off the end of the center tube assembly.

4. Slide the bladder off the center tube assembly; at this point, the O-ring on the upper end can be replaced.

5. Decontaminate pump housing, pump ends, center tube assembly, and Teflon compression ring, by spraying with Liquinox, then deionized rinse.

6. Reassemble pump with new bladder and new O-rings.

Clean nitrile gloves will be used during decontamination of any equipment, and rinsate water will be discharged to the 5-gal purge water bucket.

6.5.2 Laboratory Quality Control

Eurofins TestAmerica, Inc., procedures include reviewing the instrument log for any notations regarding problems experienced during the previous use and verifying the preventative maintenance has been completed per the manufacturer's recommendations. Any preventative or corrective maintenance done will be documented in the maintenance log. Spare parts are kept in the laboratory's supply room and are available when needed.

Eurofins TestAmerica, Inc., internal standards address the calibration for the laboratory instruments. Information regarding the standards used will be documented in the instrument log.

The Eurofins TestAmerica, Inc., analyst assigned to conduct the analysis will be responsible for inspecting equipment and supplies upon receipt. The manufacturer's specifications for product performance and purity will be used as the acceptance criteria.

6.6 REFERENCES

Puls, R.W., and M.J. Barcelona. 1996. Low flow (minimal drawdown) ground water sampling procedures. USEPA/ORD EPA/540/S-95/504. Washington, DC: US Environmental Protection Agency.

Wilde, F.D., D.B. Radtke, J. Gibs and R.T. Iwatsubo, eds., 1998, National Field Manual for the Collection of Water-Quality Data; U.S. Geological Survey Techniques of Water-Resources Investigations, Book 9, Handbooks for Water-Resources Investigations, variously paginated.

Yeskis, D. and Zavala, B. 2002. Ground-Water Sampling Guidelines for Superfund and RCRA Project Managers, EPA/542-S-02-001, 53 pp.

7.0 DETECTION MONITORING PROGRAM

The detection monitoring program for the Black Hawk County Landfill has been established in accordance with the IDNR regulations in 567-113.10(5).

7.1 MONITORING POINTS

The current detection monitoring system consists of 41 monitoring wells, including 35 shallow (water table aquitard) wells and six deeper wells in the uppermost bedrock aquifer. Table 7-1 present the shallow (water table aquitard) monitoring points and sampling schedule.

TABLE 7-1
SHALLOW (WATER TABLE AQUITARD) GROUNDWATER MONITORING POINTS

Shallow Monitoring Wells	Sampling Schedule
OW-101B	Semi-annual: Spring, Fall (2025 – 2028)
OW-105B	Semi-annual: Spring, Fall (2025 – 2028)
OW-113B	Semi-annual: Spring, Fall (2025 – 2028)
OW-114B	Semi-annual: Spring, Fall (2025 – 2028)
OW-205B	Annual: Spring (2025 – 2028)
OW-209B	Semi-annual: Spring, Fall (2025 – 2028)
OW-212B	Semi-annual: Spring, Fall (2025 – 2028)
OW-213BR	Semi-annual: Spring, Fall (2025 – 2028)
OW-216BR	Semi-annual: Spring, Fall (2025 – 2028)
OW-219B	Semi-annual: Spring, Fall (2025 – 2028)
OW-220B	Annual: Spring (2025 – 2028)
OW-221B	Semi-annual: Spring, Fall (2025 – 2028)
OW-222B	Semi-annual: Spring, Fall (2025 – 2028)
OW-223B	Semi-annual: Spring, Fall (2025 – 2028)
OW-224B	Annual: Spring (2025 – 2028)
OW-225B	Annual: Spring (2025 – 2028)
OW-226B	Annual: Spring (2025 – 2028)
OW-227B	Annual: Spring (2025 – 2028)
MW-319B	Semi-annual: Spring, Fall (2025 – 2028)
MW-409B	Semi-annual: Spring, Fall (2025 – 2028)
OW-401B	Annual: Spring (2025 – 2028)
OW-402B	Annual: Spring (2025 – 2028)
OW-410B	Annual: Spring (2025 – 2028)
OW-411B	Annual: Spring (2025 – 2028)
OW-412B	Annual: Spring (2025 – 2028)
OW-413B	Annual: Spring (2025 – 2028)2028
OW-414B	Annual: Spring (2025 – 2028)
MW-501B	Semi-annual: Spring, Fall (2025 – 2028)
MW-602B	Semi-annual: Spring, Fall (2025 – 2028)
MW-603B	Semi-annual: Spring, Fall (2025 – 2028)
MW-604B	Semi-annual: Spring, Fall (2025 – 2028)
MW-709B	Semi-annual: Spring, Fall (2025 – 2028)
MW-710B	Semi-annual: Spring, Fall (2025 – 2028)
MW-711B	Semi-annual: Spring, Fall (2025 – 2028)
MW-712B	Semi-annual: Spring, Fall (2025 – 2028)

Table 7-2 presents the deep (uppermost bedrock aquifer) monitoring points and sampling schedule.

TABLE 7-2
BEDROCK AQUIFER GROUNDWATER MONITORING POINTS

Monitoring Well	Sampling Schedule
P-213C	Semi-annual: Spring, Fall (2025 – 2028)
P-214CR	Semi-annual: Spring, Fall (2025 – 2028)
P-215CR	Semi-annual: Spring, Fall (2025 – 2028)
P-216CR	Semi-annual: Spring, Fall (2025 – 2028)
P-604C	Semi-annual: Spring, Fall (2025 – 2028)
P-703C	Semi-annual: Spring, Fall (2025 – 2028)

A summary of the hydrologic monitoring system is provided in Table 4-1. Locations of detection monitoring points are shown in Figure 2-2.

In addition to the shallow and deep monitoring wells, six groundwater underdrain outlets are also currently being monitored. Table 7-3 presents the groundwater underdrain monitoring points and sampling schedule.

TABLE 7-3
GROUNDWATER UNDERDRAIN MONITORING POINTS

Underdrain Monitoring Point	Sampling Schedule
GUW1-1	Semi-annual: Spring, Fall (2025 – 2028)
GUW2-1	Semi-annual: Spring, Fall (2025 – 2028)
GUW3-1	Semi-annual: Spring, Fall (2025 – 2028)

7.2 COMPARISON OF MONITORING POINTS

7.2.1 Shallow (Water Table Aquitard) Monitoring Points

Site-wide Background Monitoring Points

Wells OW-101B, OW-114B, OW-213BR, OW-216BR, OW-217B, OW-218B, OW-219B, MW-304B, MW-308B, MW-319B, OW-403B, OW-405B, MW-701B, MW-702B, MW-703B, MW-704B, MW-705B, MW-706B, MW-707B, MW-708B, MW-709B and MW-710B serve as the shallow background monitoring points for Landfill Areas A, C and E, Cells X, W1, W2, W3 and W4; these wells are screened in Quaternary Loess and Pre-Illinoian glacial diamicton (till). As a result of landfill cell design, the shallow water table wells installed around Area E and Cells X, W1, W2, W3 and W4 are vertically upgradient of the landfill base. Since these wells are upgradient of the Landfill base, interwell comparisons of groundwater quality at individual wells are the most appropriate types of statistical comparisons at these locations. Data from wells OW-101B, OW-114B, OW-213BR, OW-216BR, OW-217B, OW-218B, OW-219B, MW-304B, MW-308B, MW-319B, OW-403B, OW-405B, MW-701B, MW-702B, MW-703B, MW-704B, MW-705B, MW-706B, MW-707B, MW-708B, MW-709B and MW-710B will be pooled for interwell comparisons for all landfill cells.

Downgradient

The downgradient water table wells at the Landfill are generally screened in hydrostratigraphic units similar to those of the upgradient wells (Table 4-1). Because of this, interwell comparisons of groundwater quality can be performed at these locations. Moreover, it cannot be demonstrated that past data from these locations have not been affected by leakage from the landfill. Therefore, interwell comparisons of the

current year water quality with upgradient background data will be used at these locations. Table 4-1 presents the site-wide background and downgradient monitoring locations for each landfill cell.

7.2.2 Deep (Uppermost Bedrock Aquifer) Monitoring Points

Upgradient

Wells P-604C and P-703C serve as the deep upgradient detection monitoring points for the Landfill and are screened in the Devonian-age Cedar Valley Group. Because these wells are upgradient of the Landfill, interwell comparisons of groundwater quality at individual wells to the pooled upgradient background data are the most appropriate types of statistical comparisons at these locations.

Downgradient

Deep downgradient wells P-213C, P-214CR, P-215CR, and P-216CR, like the upgradient wells, are completed in the Devonian-age Cedar Valley Group. Because the upgradient and downgradient wells are screened in similar hydrostratigraphic units, interwell comparisons of the current year water quality with upgradient background data are the most appropriate type of statistical comparison at these wells. For the purpose of these comparisons, background data from upgradient wells MW-318CR, P-604C and P-703C will be pooled together.

7.3 STATISTICAL ANALYSIS

Statistical analysis for the detection monitoring program for Black Hawk County Landfill has been established in accordance with the IDNR regulations in 567-113.10(4).

Groundwater samples from the detection monitoring points will be sampled and analyzed semi-annually in Spring (March, April) and Fall (September, October) months for IDNR Appendix I parameters. The month sampling begins depends on weather and site access conditions. Statistical analyses will be completed within 45 days from the time that all data are received. A summary of monitoring data and statistical evaluations will be submitted to IDNR within the required 14 days (Subrules 113.10(5) and 113.10(6)) from the time statistical analyses are completed.

Prior to statistical analysis, the data will be examined to identify results that are artificially high or low (outliers), which may be due to potential field sampling, transportation, laboratory, or transcription errors.

Background levels of parameters detected in the current sampling year will be established by pooling all available historical data from the appropriate background data set through the end of the preceding year. For the detection monitoring program, current-year compliance data will be statistically tested against the background data using prediction limit methods. The procedure used to determine the appropriate prediction limit method will be as follows:

1) If background for a given parameter contains more than 50 percent non-detects (> 50% NDs), a nonparametric prediction limit (99 Percent Confidence Level) will be used to test the compliance data against background, and the reporting limit (RL) will be used for non-detect values to account for non-detects.

2) If background for a given parameter contains between 20 percent and 50 percent non-detects (20% ≤ NDs ≤ 50%, Cohen's adjustment or Kaplan-Meier method will be used to account for non-detect values.

3) If background for a given parameter contains less than 20 percent non-detects (NDs < 20%), the RL will be used to account for non-detect values.

4) If background for a given parameter contains less than 50 percent non-detects (NDs < 50%), the background data will be tested for lognormality and normality using the Shapiro-Wilk procedure and probability plots. If background for a given parameter is consistent with a either a lognormal or normal distribution (defined as a nonsignificant result for the Shapiro-Wilk method at a 95 percent confidence level) and contains less than 50 percent non-detects, a parametric prediction limit (USEPA Unified Guidance 99 percent Confidence One-Sided) will be used to test the compliance data against background.

5) If background data for a given parameter is not found to be lognormal or normal in statistical distribution (defined as a significant result for the Shapiro-Wilk procedure at a 95 percent confidence level), a distribution-free nonparametric prediction limit (99 percent confidence level) will be used to test the compliance well data against background.

A pass 1-of-2 verification resampling scheme will be utilized for wells which statistically exceed the background prediction limit and for wells which exceed a GWPS. For current year compliance data, an exceedance of the appropriate prediction limit for a given Appendix I inorganic constituent will trigger what amounts to a retest for that constituent. The retest will be completed within 90 days of determining an initial SSI has occurred. If the retest result also exceeds the prediction limit, a statistically significant increase (SSI) over background levels at that well will be considered to have occurred. If it cannot be demonstrated that a source other than a landfill unit caused the increased concentration or that the SSI resulted from error in sampling, analysis, statistical evaluation or natural variation in groundwater quality, the well will then enter assessment monitoring.

Because Appendix I organic constituents are anthropogenic, detection of a given organic constituent at or above the RL at a single detection monitoring well will trigger a retest for that constituent (DQR Rule). The retest will be completed within 90 days of determining an initial organic constituent has been detected. If the retest result also indicates a detection at or above the RL of that organic constituent, a confirmed SSI over background levels will be considered to have occurred. If it cannot be demonstrated that a source other than a landfill unit caused the change in concentration or that the SSI resulted from error in sampling, analysis, statistical evaluation or natural variation in groundwater quality, the well will then enter assessment monitoring.

7.3.1 Background Data

Background data is updated every two years. Analyses for updating background include analysis for trends, outliers, and comparing differences (or similarities) between the background pool and the recently collected 2-year monitoring data being considered for adding to background pool. Background updates were conducted in 2015, 2017, 2019, 2021 and 2023. Background will be evaluated again in 2026 and updated to include groundwater data from 2024 and 2025. The updated background values will be used for 2026 comparisons.

7.4 SITE-SPECIFIC GROUNDWATER PROTECTION STANDARDS

Site-specific groundwater protection standards have been developed for cobalt and nickel using USEPA guidance (EPA 2009). Background data for cobalt and nickel is based on upgradient shallow groundwater monitoring wells located outside the limits of waste and prior to waste placement. Monitoring wells included are: OW-101B, OW-114B, OW-213BR, OW-216B(R), OW-217B, OW-218B, OW-219B, MW-304B, MW-308B, MW-319B, OW-403B, OW-405B, MW-701B, MW-702B, MW-703B, MW-704B, MW-705B, MW-706B, MW-707B, MW-708B, MW-709B, MW-710B, MW-711B and MW-712B. Sample dates span from August 2014, when low-flow sampling began, through May 2024.

Sampling from these non-impacted monitoring points has indicated the measured background concentrations of cobalt and nickel are above the IDNR GWPS in wells screened in the shallow (water table) monitoring zone. This zone consists of loess and glacial till. As a result, development of a site-

specific background GWPS for cobalt and nickel is suitable. The paragraphs below provide a detailed discussion and justification for a background GWPS for cobalt and nickel for shallow (water table) wells at the Black Hawk County Landfill (BHCL). Documentation is be provided in the 2025 HMSP.

For BHCL IDNR permit, monitoring wells are sampled for Appendix I which includes total metals (Antimony (Sb), Arsenic (As), Barium (Ba), Beryllium (Be), Cadmium (Cd), Chromium (Cr), Cobalt (Co), Copper (Cu). Lead (Pb), Mercury (Hg), Nickel (Ni), Selenium (Se), Silver (Ag), Thallium (Tl), Vanadium (V), and Zinc (Zn)), low-flow field sampling parameters field pH, specific conductance, turbidity, and Total Suspended Solids (TSS). In addition, monitoring wells are sampled for Appendix I organic parameters. Alternate GWPS statistics were estimated for cobalt and nickel.

The process for estimating GWPS for annual sample results comparisons included analysis for trends, outliers, goodness-of-fit (GOF), and tolerance limits (TL). Currently, background for the facility includes data from Fall 2014 through Spring 2024. Each step in the process is described below.

First, detection monitoring data for each monitoring well used in site-specific GWPS are tallied for sample size (n), count of nondetects and calculated percentage of nondetects per well and parameter. For wells with small sample size (n≤ 5) and high percentage of nondetects (90 - 100% nondetect per parameter), no outliers, trends, or goodness of fit can be estimated.

Next, detection monitoring data for each monitoring well used in site-specific GWPS were analyzed for outliers using Rosner's or Dixon's methods depending on sample size. For the parameters, both raw (untransformed) and lognormal transformed data were tested for outliers. If there were significant outliers in the detection monitoring data which may be attributed to errors in field sampling, lab methods, changes in lab detection limits, or lab data recording, identified errors, which can be resolved, the data set is corrected, and outliers removed. If not, the outlier, would remain in the data set.

Next, the monitoring wells detection monitoring chemistry data were analyzed for trends using the Helsel (2012) NADA Akritas-Theil-Sen slope and Kendall's tau methods. If there are no significant trends within the past 10 years of detection monitoring data, the background data set was pooled to estimate the site-specific GWPS for each parameter.

Last, the pooled monitoring wells detection monitoring chemistry data were analyzed for statistical distribution using goodness-of-fit tests (GOF). Data will be tested for normal, lognormal and gamma distributions. Based on goodness-of-fit (distribution) tests, either parametric (normal) or nonparametric tolerance limits were estimated.

The analyses showed that the pooled data have few outliers. The GOF tests show the data are not normally distributed. Pooled data was natural log transformed and checked for outliers. Based on natural log transformed data, the pooled data show no outliers.

Goodness-of-fit (GOF) tests show the data is not normal, lognormal or gamma in statistical distribution. Given the GOF results, nonparametric tolerance limits were estimated for cobalt and nickel.

The nonparametric tolerance limit for cobalt is estimated to be 9.83 µg/L. While the nonparametric tolerance limit for nickel is estimated to be 722 µg/L. These tolerance limits be used as site-specific GWPS in place of the Iowa GWPS values of 2.1 µg/L for cobalt and 100 µg/L for nickel.

7.5 REFERENCES

EPA 530-R-09-007. 2009. Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities – Unified Guidance, 884 p.

8.0 ASSESSMENT MONITORING PROGRAM

Assessment monitoring at the Black Hawk County Landfill will be completed in accordance with IDNR regulations in 567-113.10(6).

8.1 SAMPLING PROGRAM

Within 90 days of being triggered into assessment monitoring, as described in Section 7 of this document, groundwater from the assessment monitoring point will be analyzed for IDNR Appendix II constituents. For any non-Appendix I constituent detected at or above the RL in the monitoring point as a result of the complete Appendix II analysis, a minimum of five quarterly samples from the point will be collected and analyzed to establish background for the constituents.

Wells that are in assessment monitoring will be analyzed every 5 years for all IDNR Appendix II parameters. After obtaining the sampling results, a notice will be placed in the operating record within 14 days identifying the Appendix II constituents that were detected and the IDNR will be notified that the notice has been placed in the operating record.

8.2 STATISTICAL ANALYSIS

At assessment monitoring points, comparisons of all constituents detected in the current monitoring year will be made to background levels as detailed in Sections 7.2 and 7.3 of this document.

In addition to comparisons to background, comparisons of all constituents detected in the current monitoring year to the appropriate statewide standards for a protected groundwater source will be performed using either a parametric or a nonparametric confidence interval as appropriate at a 99 percent confidence level ($\alpha = 0.01$). The current statewide groundwater protection standards (GPS) for a protected groundwater source used in the comparisons will be obtained from the following IDNR web site:

https://programs.iowadnr.gov/riskcalc/Home/statewidestandards

Prior to statistical analysis, the data will be examined to identify results that may be artificially high or low (outliers) which possibly could be attributed to field, transportation, laboratory or transcription errors.

Levels of parameters detected in the current sampling year will be established by pooling all available historical data collected since the fall of 2014. The procedure used to determine the appropriate prediction limit method will be as follows:

1) If background for a given parameter contains more than 50 percent nondetects (> 50% NDs), a nonparametric prediction limit (99 Percent Confidence Level) will be used to test the compliance data against the GPS, and the reporting limit (RL) will be used for nondetect values to account for nondetects.

2) If background for a given parameter contains between 20 percent and 50 percent nondetects (20% ≤ NDs ≤ 50%), Cohen's adjustment or Kaplan-Meier method will be used to account for nondetect values.

3) If background for a given parameter contains less than 20 percent nondetects (NDs < 20%), the RL will be used to account for nondetect values.

4) If background for a given parameter contains less than 50 percent nondetects (NDs < 50%), the background data will be tested for lognormality and normality using the Shapiro-Wilk procedure and probability plots. If background for a given parameter is consistent with a lognormal or normal distribution (defined as a nonsignificant result for the Shapiro-Wilk method at a 95 Percent

Confidence Level) and contains less than 50 percent nondetects, a parametric prediction limit (USEPA Unified Guidance 99 Percent Confidence One-Sided) will be used to test the compliance data against the GPS.

5) If background data for a given parameter is not found to be lognormal or normal in statistical distribution (defined as a significant result for the Shapiro-Wilk procedure at a 95 Percent Confidence Level), a distribution-free nonparametric prediction limit (99 Percent Confidence Level) will be used to test the compliance well data against the GWPS.

If the concentrations of all Appendix I and II constituents are statistically shown to be at or below background values for three consecutive sampling events, the IDNR will be notified of this finding and the monitoring point will return to detection monitoring.

If the concentrations of any Appendix II constituents are above background values (SSI), but all concentrations are statistically shown to be below the applicable GWPS, the monitoring point will continue in assessment monitoring.

If one or more Appendix II constituents are detected at statistically significant levels above the applicable GWPS in any sampling event, within 14 days of this finding a notice will be placed in the operating record identifying the Appendix II constituents that have exceeded the GWPS, and IDNR and all other appropriate local government officials will be notified that the notice has been placed in the operating record.

If one or more Appendix II constituents are detected at statistically significant levels above the applicable GWPS in any sampling event, an attempt will be made to determine whether a source other than a landfill unit caused the change in concentration, or whether the SSL resulted from error in sampling, analysis, statistical evaluation or natural variation in groundwater quality. If this is found to be the case, a report documenting this demonstration will be certified by a qualified groundwater scientist and submitted to IDNR for approval, and assessment monitoring will continue. If the concentrations of all Appendix II constituents are subsequently shown to be at or below background values for three consecutive sampling events, the IDNR will be notified of this finding and may return to detection monitoring.

If the contamination cannot be demonstrated to be unrelated to Landfill activities, the following actions will be taken within 90 days:

1) Characterize the nature and extent of the release by installing additional monitoring wells, as necessary, until the horizontal and vertical dimensions of the plume have been defined to background concentrations;

2) Install at least one additional monitoring well at the facility boundary in the direction of contaminant migration and sample this well to determine if contamination is migrating off site;

3) Notify all persons who own the land or reside on the land that directly overlies any part of the plume of contamination if contaminants have migrated off site when indicated by sampling of wells; and

4) Initiate an assessment of corrective measures.

Assessment of corrective measures is discussed in Section 9 of this document.

9.0 ASSESSMENT OF CORRECTIVE MEASURES

9.1 ASSESSMENT OF CORRECTIVE MEASURES

An assessment of possible corrective measures will be completed once it has been determined that any of the Appendix I or Appendix II constituents have been detected and confirmed at a statistically significant level (SSL) that exceeds the groundwater protection standards (GWPS). This assessment will be completed in accordance with the IDNR regulations in 567-113.10(7).

An assessment of corrective measures will be initiated within 90 days of finding that any of the constituents listed in Appendix I or Appendix II have been detected at a statistically significant level exceeding the groundwater protection standards. Within 180 days of the initial finding, an assessment will be completed and submitted to the IDNR for review and approval unless otherwise authorized or required by the IDNR. Monitoring will continue in accordance with the assessment monitoring program as outlined in Section 8.

The assessment will analyze the effectiveness of potential corrective measures in addressing the following:

1) The performance, reliability, ease of implementation and potential impacts of appropriate potential remedies, including safety impacts, cross-media impacts and control of exposure to any residual contamination;

2) The time required to begin and complete the remedy;

3) The costs of remedy implementation; and

4) The institutional requirements, such as state or local permit requirements or other environmental or public health requirements, that may substantially affect implementation of the remedy(ies).

Within 60 days of approval from the IDNR of the assessment of corrective measures, and prior to the selection of a remedy, a public meeting will be held with interested and affected parties to discuss the results of the corrective measures assessment. The IDNR may establish an alternative schedule for completing the public meeting requirement. Notice of the public meeting will be sent to all owners and occupiers of property adjacent to the permitted boundary of the facility, the IDNR and the appropriate IDNR field office. A copy of the minutes of this public meeting and the list of community concerns will be placed in the operating record and submitted to the IDNR.

9.2 SELECTION OF REMEDY

Based on the results of the corrective measures assessment described above, a remedy will be selected in accordance with the IDNR regulations in 567-113.10(8) within 60 days of holding the public meeting that, at a minimum, meets the following standards:

1) Be protective of human health and the environment;

2) Attain the groundwater protection standards described in Section 6 of this document;

3) Control the source(s) of releases so as to reduce or eliminate, to the maximum extent practicable, further releases of Appendix I or Appendix II constituents into the environment that may pose a threat to human health or the environment; and

4) Comply with standards for management of wastes that are protective of human health and the environment, and that comply with applicable RCRA, state and local requirements.

IDNR may establish an alternative schedule for selecting a remedy after holding the public meeting. Within 14 days of selecting a remedy, a report will be submitted to IDNR describing the selected remedy and explaining how the selected remedy meets the standards listed above.

In selecting a remedy, the following evaluation factors will be considered:

1) The long-term and short-term effectiveness and protectiveness of the potential remedy(ies), along with the degree of certainty that the remedy will prove successful.

2) The effectiveness of the remedy(ies) in controlling the source to reduce further releases.

3) The ease or difficulty of implementing a potential remedy(ies).

4) Practicable capability of the owner or operator, including a consideration of technical and economic capabilities.

5) The degree to which community concerns, including but not limited to the concerns identified at the public meeting, are addressed by a potential remedy(ies).

The selected remedy(ies) will include a schedule(s) for initiating and completing remedial activities. Such a schedule will require the initiation of remedial activities within a reasonable period of time. The following factors will be considered in determining the schedule of remedial activities:

1) Extent and nature of contamination;

2) Practical capabilities of remedial technologies in achieving compliance with groundwater protection standards, and other objectives of the remedy;

3) Availability of treatment or disposal capacity for wastes managed during implementation of the remedy;

4) Desirability of utilizing alternative or experimental technologies that are not widely available, but which may offer significant advantages over already available technologies in terms of effectiveness, reliability, safety, or ability to achieve remedial objectives;

5) Potential risks to human health and the environment from exposure to contamination prior to completion of the remedy;

5) Resource value of the aquifer;

6) Practicable capability of the owner or operator; and

7) Other relevant factors.

9.3 IMPLEMENTATION OF CORRECTIVE ACTION PLAN

Once the remedy has been selected, the corrective action plan will be implemented in accordance with the IDNR regulations in 567-113.10(9). Based on the schedule, the owner or operator will:

1) Establish and implement a corrective action groundwater monitoring program that meets the requirements of an assessment monitoring program, indicates the effectiveness of the corrective action remedy, and demonstrates compliance with groundwater protection standards;

2) Implement the selected corrective action remedy; and

3) Take any interim measures necessary to ensure the protection of human health and the environment. Interim measures will, to the greatest extent practicable, be consistent with the objectives of and contribute to the performance of any remedy that may be required. The following factors will be considered in determining whether interim measures are necessary:

   - Time period required to develop and implement a final remedy;
   - Actual or potential exposure of nearby populations or environmental receptors to hazardous constituents;
   - Actual or potential contamination of drinking water supplies or sensitive ecosystems;
   - Further degradation of the groundwater that may occur if remedial action is not initiated expeditiously;
   - Weather conditions that may cause hazardous constituents to migrate or be released;
   - Risk of fire or explosion, or potential for exposure to hazardous constituents as a result of an accident or the failure of a container or handling system; and
   - Other factors that may pose threats to human health and the environment.

After initiating the remedy, it may be determined that the selected remedy fails to achieve the goals of remediation. In this case, the owner or operator will notify the IDNR and implement other methods or techniques that could satisfy the goals, unless it is determined that achieving the goals cannot be practicably achieved with any currently available methods. The notification to IDNR will either explain how the proposed alternative methods or techniques will meet the goals, or else it will indicate that the goals cannot be practicably achieved with any currently available methods. Within 90 days of approval by the IDNR for the proposed alternative methods or techniques or the determination of impracticability, the owner or operator will implement the proposed alternative methods or techniques, or implement alternative measures.

In the case of a determination of impracticability, the owner or operator will:

1) Obtain certification of a qualified groundwater scientist and approval by the IDNR that compliance cannot be practicably achieved with any currently available methods;

2) Implement alternate measures to control exposure of humans or the environment to residual contamination, as necessary to protect human health and the environment;

3) Implement alternate measures for control of the sources of contamination, or for removal or decontamination of equipment, units, devices or structures that are technically practicable and consistent with the overall objective of the remedy; and

4) Notify the IDNR within 14 days that a report justifying the alternate measures prior to implementation has been placed in the operating record.

Remediation will be considered complete when:

1) The owner or operator complies with the groundwater protection standards at all points within the plume of contamination that lie beyond the groundwater monitoring well system.

2) Compliance with the groundwater protection standards has been achieved by demonstrating that concentrations of Appendix II constituents have not exceeded the groundwater protection standard(s) for a period of three consecutive years. The IDNR may specify an alternative length of time during which the owner or operator must demonstrate that concentrations of Appendix II constituents have not exceeded the groundwater protection standard(s).

3) All actions required by the IDNR to complete the remedy have been satisfied.

Upon completion of the remedy, the owner or operator must notify the department within 14 days that a certification has been placed in the operating record verifying that the remedy has been completed. The

certification must be signed by the owner or operator and by a qualified groundwater scientist and approved by the IDNR.

When, upon completion of the certification, the owner or operator determines that the corrective action remedy has been completed in accordance with IDNR regulations, the owner or operator will be released from the requirements for financial assurance for corrective action.

10.0 ANNUAL WATER QUALITY REPORTS

An annual report will be submitted to the IDNR in accordance with IDNR regulations in 567-113.10(10) detailing the water quality monitoring sampling locations and results, assessments, selection of remedies, implementation of corrective action, and the results of corrective action remedies to address SSIs, if any, during the previous year. The report will be due on January 31 of the current year for the previous monitoring year (i.e., January 31, 2025, for AWQR 2024).

The report will include:

- A site map delineating all monitoring points where water quality samples were taken.
- Map of contamination plumes, if any.
- A narrative explaining and interpreting all the data collected during the previous year.

Biennially, the report will also include monitoring well maintenance and performance evaluation information as detailed in Section 11.0. This was initiated with the 2013 AWQR. That information will include:

- Biennial evaluation of high and low water levels and their relationship to the well screen interval of individual wells.
- Biennial evaluation of Landfill operations and water level conditions to evaluate if there have been any changes to the hydrologic setting and resultant groundwater flow paths.
- Measurement of well depths to ensure that wells are physically intact and not filling with sediment.
- Biennial examination of well recharge rates and chemistry to determine if well deterioration is occurring.

11.0 MONITORING WELL MAINTENANCE AND PERFORMANCE EVALUATION PLAN

The monitoring well maintenance and evaluation plan for Black Hawk County Landfill is designed to comply with IAC 567-113.10(455B)(2)f to ensure that all monitoring wells remain reliable. The plan includes:

- Physical examination of the well, protective casing, and upper well seal for well integrity.
- Biennial evaluation of high and low water levels and their relationship to the well screen interval of individual wells.
- Biennial evaluation of landfill operations and water level conditions to evaluate if there have been any changes to the hydrologic setting and resultant groundwater flow paths.
- Measurement of well depths to ensure that wells are physically intact and not filling with sediment.
- Biennial examination of well recharge rates and chemistry to determine if well deterioration is occurring.

Monitoring well maintenance and evaluation will be reported in each year's Annual Water Quality Report as noted in Section 10.0.

11.1 MONITORING WELL MAINTENANCE AND PERFORMANCE EVALUATION REPORTING SCHEDULE

Annual reports will be made of:

- The physical integrity of the wells.
- For wells without a dedicated pump, the evaluation of well depth and any indications that wells are filling with sediment will be completed annually. For wells with a dedicated pump, the evaluation will be made every five years.

Biennial reports will be made of:

- High and low water levels and their relationship as either above or within the well screen interval.
- Landfill operation activities that may have changed the hydrologic setting and the resultant groundwater flow paths.
- Evaluation of well recharge rates and chemistry to determine if well deterioration is occurring.

11.2 PHYSICAL WELL EXAMINATION

The physical integrity of the wells will be evaluated semi-annually when water-level measurements are taken. Notes will be made regarding:

- Protective casing status as locked or unlocked.
- Well cap condition.
- Presence of any obstructions in the well casing.
- Well Casing Integrity: presence or absence of cracks.

- Upper Well Seal Integrity: intact or cracked.
- Any other items of note regarding well integrity.

Results of the physical well evaluation will be reported annually in the annual water quality report. If the integrity of any of the wells is in question, appropriate maintenance and rehabilitation procedures will be taken.

11.3 EVALUATION OF HIGH AND LOW WATER LEVELS AND THEIR RELATIONSHIP TO THE WELL SCREEN INTERVAL

The evaluation of water levels and their relationship to the well screen interval will be done to comply with IAC 567-113.10(455B)(2)f(1). Water levels will be measured to the nearest 1/100th of a foot as part of the monthly groundwater-level measurement program. The water-level depth will then be compared to the well screen depth to evaluate if well screens are placed appropriately in relationship to groundwater levels. Water table wells should have water levels within the well screen interval unless the water table is so high (near ground surface) that it occurs in the upper seal interval. Deep wells may have water levels above the well screen interval due to confining pressure. Results of the evaluation will be reported biennially in the AWQR for that year.

11.4 EVALUATION OF LANDFILL OPERATIONS ON GROUNDWATER LEVELS

To comply with IAC 567-113.10(455B)(2)f(2), landfill operations will be reviewed to determine if there have been any changes that would affect groundwater depth and flow. Such operational changes might include landfill excavation activities, installation of underdrain systems, etc. Results of the evaluation will be reported biennially in the Annual Water Quality Report for that year.

11.5 EVALUATION OF CHANGES TO THE MEASURED WELL BOTTOM DEPTH

Evaluation of changes to the measured well bottom depth will be done to comply with IAC 567-113.10(455B)(2)f(3). In wells that do not have dedicated sampling pumps, the depth to the bottom of the well will be measured monthly to the nearest 1/100th foot using a weighted tape. For wells with dedicated sampling pumps, measurement of the depth to the bottom of the well will be made every five years.

For each well, comparison of the depth to the bottom will be made over time to determine if sediment is building up in the well. If significant sediment build-up occurs, appropriate rehabilitation techniques, such as redevelopment by surging and bailing or other methodology, will be completed. The results of the evaluation of well depth changes will be reported biennially in the AWQR for that year.

11.6 EVALUATION OF WELL RECHARGE RATES AND GROUNDWATER CHEMISTRY

To comply with IAC 567-113.10(455B)(2)f(4), well recharge rates and groundwater chemistry will be evaluated to determine if well deterioration is occurring.

Well recharge rates will be determined biennially during one of the groundwater sampling events. To estimate the recharge (recovery) rate, at least one, and preferably several, time and depth to water (D.T.W.) measurements will be recorded after removal of the final purge volume to gauge recovery relative to the static water level. Recording the time, depth to water, and the volume removed during the purge and sampling cycle will provide for an estimate of well recharge (recovery) rates. If time permits, measurements will be taken until the well is fully recovered and the time that the well returned to static water level will be recorded. As an example:

- Depth to water (D.T.W.) is measured prior to purging/sampling (i.e., static water level) and is at 10 feet below ground surface.

- At the end of the purge/sample cycle, the measured D.T.W. = 12 feet below ground surface.

- 30 minutes later, D.T.W. = 10.5 feet below ground surface.

Therefore, the well recovered 1.5 feet in 30 minutes. Considering that the gallons of water per foot in a 2-inch diameter well is 0.16 gal/ft results in an estimated recharge rate of 0.008 gpm. Estimates calculated in this manner for each sampling event can be used to determine if well recovery rates are decreasing over time, indicating well deterioration is occurring because of infilling of the well with sediment, biofouling of the filter pack, etc.

In addition, wells, which are sampled semi-annually, may be analyzed using the slug test method once per 5 years. A slug test is an aquifer field test performed by groundwater hydrologists to estimate the hydraulic properties of aquifers and aquitards. The slug test is a method in which the water level in a monitoring well is caused to change suddenly (rise or fall), and the subsequent water-level response (displacement or change from static) is measured through time in the monitoring well. Other terms sometimes used instead of slug test include baildown test, slug-in test, and slug-out test.

The goal of a slug test is to estimate hydraulic properties of a monitoring well's formation and development of the well's filter pack. A change in the hydraulic properties of the monitoring well's formation, the filter pack or well screen may indicate that that well deterioration is occurring because of infilling of the well with sediment, biofouling of the filter pack, etc.

Groundwater chemistry changes over time will be evaluated to determine if there are any physical or chemical indicators affecting groundwater quality. Physical indicators include encrustation, biofouling, corrosion, and change in turbidity. Chemical indicators include changes in redox potential (Eh), pH, conductivity, and dissolved gases (such as oxygen, carbon dioxide, nitrogen, hydrogen sulfide, and methane) that may affect groundwater chemistry.

12.0 STORM WATER POLLUTION PREVENTION PLAN

This section describes storm water pollution prevention plan (SWPPP) sampling and analysis at the Black Hawk County Landfill. The sampling and analysis are designed to comply with IDNR National Pollutant Discharge Elimination System (NPDES) General Permit No. 1 (IDNR 2018) and are developed to ensure that storm water results provide an accurate representation of surface water quality at the Landfill.

SWPPP sampling will be conducted once per year following a 0.1-in or greater rainfall event. SWPPP sampling will be reported to NPDES section of IDNR. SWPP sampling will be conducted at four locations: SW-1, SW-2, SW-3 and SW-4. Figure 12-1 presents a location map for all SWPP sampling points.

12.1 SAMPLE COLLECTION AND PRESERVATION

Storm water sample collection will be accomplished using traditional environmental sampling techniques.

Sample integrity will be maintained by decontaminating field equipment prior to sampling and in between locations, and adhering to the EPA sample collection, preservation, packaging, and chain-of-custody protocols.

12.1.1 Storm Water Sampling Techniques

For the annual storm water sampling events, the sampling techniques will be as follows at each sampling location:

- A grab sample shall be taken during the first hour of storm discharge
    - Measurable (>0.1inch rainfall) storm water runoff in storm water channels built as part of landfill design to direct storm water flow
- Composite samples will be time-weighted:
    - Either a minimum of three sample aliquots taken each hour of discharge for entire storm water discharge event, or
    - For the first 3 hours of storm water discharge, with each aliquot being separated by a minimum of 15 minutes (the bottle in composite is marked to minimum fill point, but not the whole bottle),
        - i.e., for Black Hawk County Landfill, sample at surface water sample location SW-1 then drive over to surface water location SW-2, next to location SW-3 and next to location SW-4 and sample; repeat at each location until composite sample jug has enough storm water to fill composite sample bottles.

Two coolers, with ice, are required at each sampling location. Each cooler will have bottles in it for a grab sample and composite sample (and a large bottle to collect each aliquot for making a time weighted composite). The grab sample will be placed immediately on ice. Each sampling location composite jug will be in a cooler, on ice. After the composite sample jug has adequate volume (enough to fill all sample bottles), pour from the composite sample jug into composite sample bottles.

Sample gloves (nitrile) will be worn while collecting. Rubber boots (waders) so your feet don't get wet and to prevent slipping and falling. AECOM Health & Safety requires that you have a buddy in case you were to fall in, especially if you're wearing waders.

Ensure that there is no sediment in samples (i.e., do not scrape the bottom of channel). Using a sample collection beaker, measuring cup, or bottle, skim from top of water.
During sampling, collect field pH, specific conductance, turbidity, and temperature measurements from the surface water. This data will be collected using either both Myron and LaMotte meters or In-Situ Aqua

TROLL 500/600 multiparameter sonde. Ensure that the Myron and LaMotte meters are calibrated prior to sampling. A peristaltic pump and a filter will be required to sample for dissolved metals.

The following information needs to be recorded on the sample collection forms (Appendix B):

- Date and duration (in hours) of the storm event(s) sampled.
- Rainfall measurements or estimates (in inches) of the storm event generating the storm water sampled runoff.
- Duration between the storm event sampled and the end of previous measurable (greater than 0.1-inch rainfall) storm event.
- An estimate of the total volume (in gallons) of discharge sampled.

On the chain-of-custody (COC) form, enter sample date and times for grab and final composite. A log of composite times at each location is needed. Samples need to be cooled down to less than 6° C (< 6° C). Use two 10-lb bags of ice per cooler to cool samples down and keep samples cold. Then, repack with more ice in bags provided by lab. Transport to the analytical lab as soon as possible. Samples are required to be at lab within 24 hours due to analysis method hold times for some of the parameters. Table 12-1 presents the analytes, bottle type and sample type for the SWPPP sampling.

TABLE 12-1
SWPPP SAMPLING PARAMETERS

Analyte	Bottle Type	Sample Type	
		Grab	Composite
ammonia (mg/l)	plastic H2SO4	Yes	Yes
bicarbonate (mg/l)	plastic No Treatment	Yes	Yes
calcium (mg/l)	plastic HNO3	Yes	Yes
chloride (mg/l)	plastic No Treatment	Yes	Yes
total iron (mg/l)	plastic HNO3	Yes	Yes
magnesium (total) (mg/l)	plastic HNO3	Yes	Yes
magnesium (dissolved) (mg/l)	if Field Filtered - field filter plastic HNO3	Yes	Yes
nitrate plus nitrite nitrogen (mg/l)	plastic H2SO4	Yes	Yes
potassium (mg/l)	plastic HNO3	Yes	Yes
sodium (mg/l)	plastic HNO3	Yes	Yes
sulfate (mg/l)	plastic No Treatment	Yes	Yes
chemical oxygen demand (COD) (mg/l)	plastic H2SO4	Yes	Yes
total dissolved solids (TDS) (mg/l)	plastic No Treatment	Yes	Yes
total organic carbon (TOC) (mg/l)	plastic H2SO4 or 2-40 mL H2SO4 vials	Yes	Yes
oil and grease (mg/l)	Amber Glass H2SO4	Yes	No
pH	plastic No Treatment	Yes	No
total arsenic (As) (mg/l)	plastic HNO3	Yes	Yes
total barium (mg/l)	plastic HNO3	Yes	Yes
total cadmium (Cd) (mg/l)	plastic HNO3	Yes	Yes
total chromium (Cr) (mg/l)	plastic HNO3	Yes	Yes
total cyanide (mg/l)	plastic NaOH	Yes	No
total lead (Pb) (mg/l)	plastic HNO3	Yes	Yes
total mercury (mg/l)	plastic HNO3	Yes	Yes
total selenium (mg/l)	plastic HNO3	Yes	Yes
total silver (mg/l)	plastic HNO3	Yes	Yes

12.2 REFERENCES

IDNR 2018. IDNR NPDES General Permit No. 1, Storm Water Discharge Associated with Industrial Activity, 30 p. (https://www.iowadnr.gov/environmental-protection/water-quality/npdes-wastewater-permitting/npdes-general-permits)

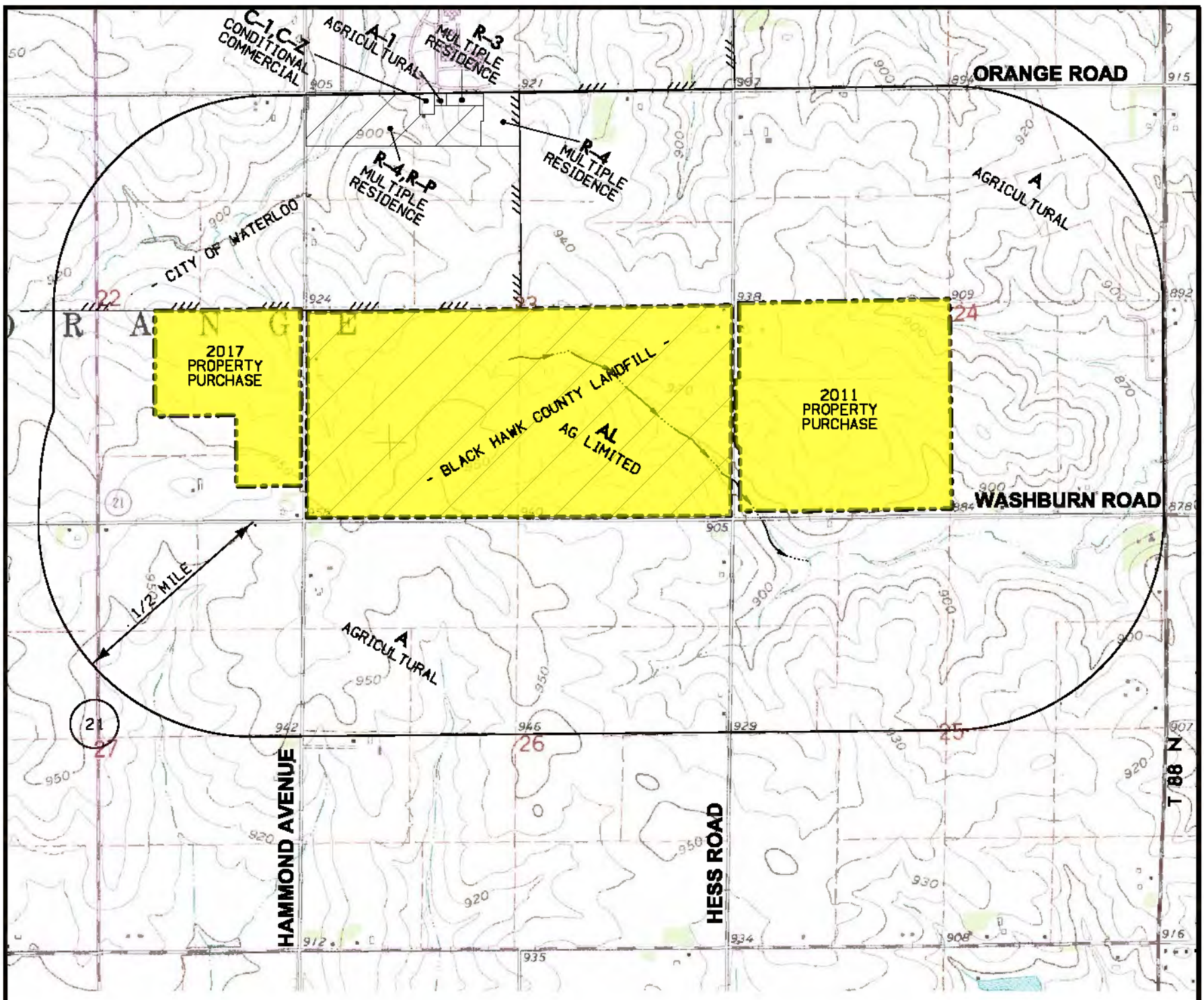
USEPA 1992. NPDES Storm Water Sampling Guidance Document. EPA 833-8-92-001. U.S. Environmental Protection Agency, Office of Water, Washington D.C.

USEPA 2008. NPDES Multi-Sector General Permit for Stormwater Discharges Associated with Industrial Activity (MSGP). U.S. Environmental Protection Agency, Washington D.C.

USEPA 2009. Industrial Stormwater Monitoring and Sampling Guide. EPA-832-B-09-003. March 2009. 51 p.

FIGURES

$$DATE$$



LEGEND

A AGRICULTURAL	ZONING DESIGNATION
21	STATE ROUTE
	MEDIUM DUTY ROAD
	LIGHT DUTY ROAD
	1/2 MILE RADIUS AROUND LANDFILL
	LANDFILL PROPERTY BOUNDARIES
	LANDFILL PERMITTED AREA
	DRAINAGEWAY
	CORPORATE LIMITS

SOURCE: U.S.G.S TOPOGRAPHIC MAP, 1963
PHOTO REVISED 1972.

N

0' 1000' 2000'
SCALE

PREPARED BY:

AECOM

501 SYCAMORE STREET SUITE 222 WATERLOO, IA. 50703-4544 1-319-232-6531

FIGURE 1-1

SITE LOCATION MAP
HYDROLOGIC MONITORING SYSTEM PLAN

BLACK HAWK COUNTY LANDFILL
WATERLOO, IOWA

JAN 2025

60746421

$$USER$$
$$PRF$$
$$DGN$$

RCRA NEUTRAL TRENCH 1988 (CLOSED)

ASBESTOS CELL I
2009 (CLOSED)

ASBESTOS CELL II
2008-PRESENT

TOPSOIL
STOCKPILE NO. 3
0 CY

TOPSOIL
CKPILE NO. 4
3,000 CY

FG PLANT
SITE

CELL W4
PHASE I
(FUTURE)

ROCK
STOCKPILE

CLAY BARRIER
STOCKPILE
NO. 9B
56,000 CY

CELL W3
PHASE I
(EXISTING)
2021–

AREA 'E'
1991–1999
(CLOSED)

CELL 'X'
1999–2008
(CLOSED)

TOPSOIL
STOCKPILE NO. 8
32,000 CY

MH AND PIPE
STOCKPILE AREA

CELL W4
PHASE II
(FUTURE)

CELL W4
PHASE III
(FUTURE)

CELL W3
PHASE II
(PROJECT AREA)

AREA 'C'
1986–1991
(CLOSED)

HAMMOND AVENUE

STOCKPILE NO. 2
949,000 CY

CELL W2
(EXISTING)
2014–

CELL W1
PHASE IV
(EXISTING)
2012–

CELL W1
PHASE III
(EXISTING)
(PARTIALLY
CLOSED)
2010–

CELL W1
PHASE II
(CLOSED)
2008–2018

CELL W1
PHASE I
(CLOSED)
2007–2014

AREA 'A'
(CLOSED)
1975–1980

HESS ROAD

SLURRY WALL

RCRA
CO–DISPOSAL AREA
1989 (CLOSED)
ORIGINAL AREA 'F'
1975–1986

STOCKPILE NO. 7
173,000 CY

TOPSOIL
STOCKPILE NO. 6
46,000 CY

CELL W5
(FUTURE)

SCALES AND
SCALE HOUSE

RUN-OFF
BASIN

SHOP

SMALL LOADS

YARD WASTE
COMPOST
FACILITY

SILTATION
BASIN

LANDFILL MAIN ENTRANCE

WASHBURN ROAD

N

0' 100' 200' 400'
SCALE

PREPARED BY:

AECOM

501 SYCAMORE STREET SUITE 222 WATERLOO, IA. 50703-4644 1-319-232-6531

FIGURE 1-2
LANDFILL AREAS / CELLS
HYDROLOGIC MONITORING SYSTEM PLAN
BLACK HAWK COUNTY LANDFILL
WATERLOO, IOWA

JAN 2025

60746421

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ORANGE ROAD

SINK CREEK

RCRA NEUTRAL TRENCH 1988 (CLOSED)

ASBESTOS CELL I
2009 (CLOSED)

ASBESTOS CELL II
2026-PRESENT

TOPSOIL STOCKPILE NO. 3
0 CY

TOPSOIL STOCKPILE NO. 4
53,000 CY

LFG PLANT SITE

CELL W4 PHASE I (FUTURE)

ROCK STOCKPILE

CLAY BARRIER STOCKPILE NO. 98
84,000 CY

CELL W4 PHASE II (FUTURE)

CELL W4 PHASE III (FUTURE)

CELL W3 PHASE I (EXISTING)
2021-

CELL W3 PHASE II (PROJECT AREA)

TOPSOIL STOCKPILE NO. 8
32,000 CY

MH AND PIPE STOCKPILE AREA

AREA 'E'
1991-1999
(CLOSED)

CELL 'X'
1999-2008
(CLOSED)

AREA 'C'
1986-1991
(CLOSED)

STOCKPILE NO. 1
882,000 CY

HWY 21

HAMMOND AVENUE

STOCKPILE NO. 2
949,000 CY

CELL W2 (EXISTING)
2014-

CELL W1 PHASE IV (EXISTING)
2012-

CELL W1 PHASE III (EXISTING) (PARTIALLY CLOSED)
2010-

CELL W1 PHASE II (CLOSED)
2008-2018

CELL W1 PHASE I (CLOSED)
2007-2014

AREA 'A'
(CLOSED)
1975-1980

RCRA CO-DISPOSAL AREA
1989 (CLOSED)
ORIGINAL AREA 'F'
1975-1986

STOCKPILE NO. 7
173,000 CY

CELL W5 (FUTURE)

TOPSOIL STOCKPILE NO. 6
46,000 CY

LANDFILL MAIN ENTRANCE

YARD WASTE COMPOST FACILITY

SCALES AND SCALEHOUSE

RUN-OFF BASIN

SHOP

SMALL LOADS

SLURRY WALL

SILTATION BASIN

WASHBURN ROAD

N

0' 250' 500' 1000'
SCALE

PREPARED BY:

AECOM

501 SYCAMORE STREET SUITE 222 WATERLOO, IA. 50703-4644 1-319-232-6531

FIGURE 1-3
SURFACE DRAINAGE
HYDROLOGIC MONITORING SYSTEM PLAN
BLACK HAWK COUNTY LANDFILL
WATERLOO, IOWA

JAN 2025

60746421

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RCRA NEUTRAL TRENCH 1988 (CLOSED)

ASBESTOS CELL I
2009 (CLOSED)

ASBESTOS CELL II
2008-PRESENT

TOPSOIL STOCKPILE NO. 3
0 CY

TOPSOIL
CKPILE NO. 4
3,000 CY

FG PLANT SITE

CELL W4
PHASE I
(FUTURE)

ROCK STOCKPILE

CLAY BARRIER STOCKPILE NO. 9B
56,000 CY

CELL W3
PHASE I
(EXISTING)
2021

AREA 'E'
1991–1999
(CLOSED)

CELL 'X'
1999–2008
(CLOSED)

TOPSOIL STOCKPILE NO. 8
32,000 CY

MH AND PIPE STOCKPILE AREA

CELL W4
PHASE II
(FUTURE)

CELL W4
PHASE III
(FUTURE)

CELL W3
PHASE II
(PROJECT AREA)

AREA 'C'
1986–1991
(CLOSED)

HAMMOND AVENUE

STOCKPILE NO. 2
949,000 CY

CELL W2
(EXISTING)
2014–

CELL W3
PHASE IV
(EXISTING)
2012–

CELL W1
PHASE III
(EXISTING)
(PARTIALLY CLOSED)
2010–

CELL W1
PHASE II
(CLOSED)
2008–2018

CELL W1
PHASE I
(CLOSED)
2007–2014

AREA 'A'
(CLOSED)
1975–1980

HESS ROAD

SLURRY WALL

RCRA
CO-DISPOSAL AREA
1989 (CLOSED)
ORIGINAL AREA 'F'
1975–1986

STOCKPILE NO. 7
173,000 CY

TOPSOIL
STOCKPILE NO. 6
46,000 CY

CELL W5
(FUTURE)

LANDFILL MAIN ENTRANCE

YARD WASTE
COMPOST
FACILITY

SCALES AND
SCALE HOUSE

RUN-OFF
BASIN

SHOP

SMALL LOADS

SILTATION
BASIN

WASHBURN ROAD

N

0' 100' 200' 400'
SCALE

PREPARED BY:

AECOM

501 SYCAMORE STREET SUITE 222 WATERLOO, IA. 50703-4644 1-319-232-6531

FIGURE 2-1
LANDFILL AREAS / CELLS
HYDROLOGIC MONITORING SYSTEM PLAN
BLACK HAWK COUNTY LANDFILL
WATERLOO, IOWA

JAN 2025

60746421

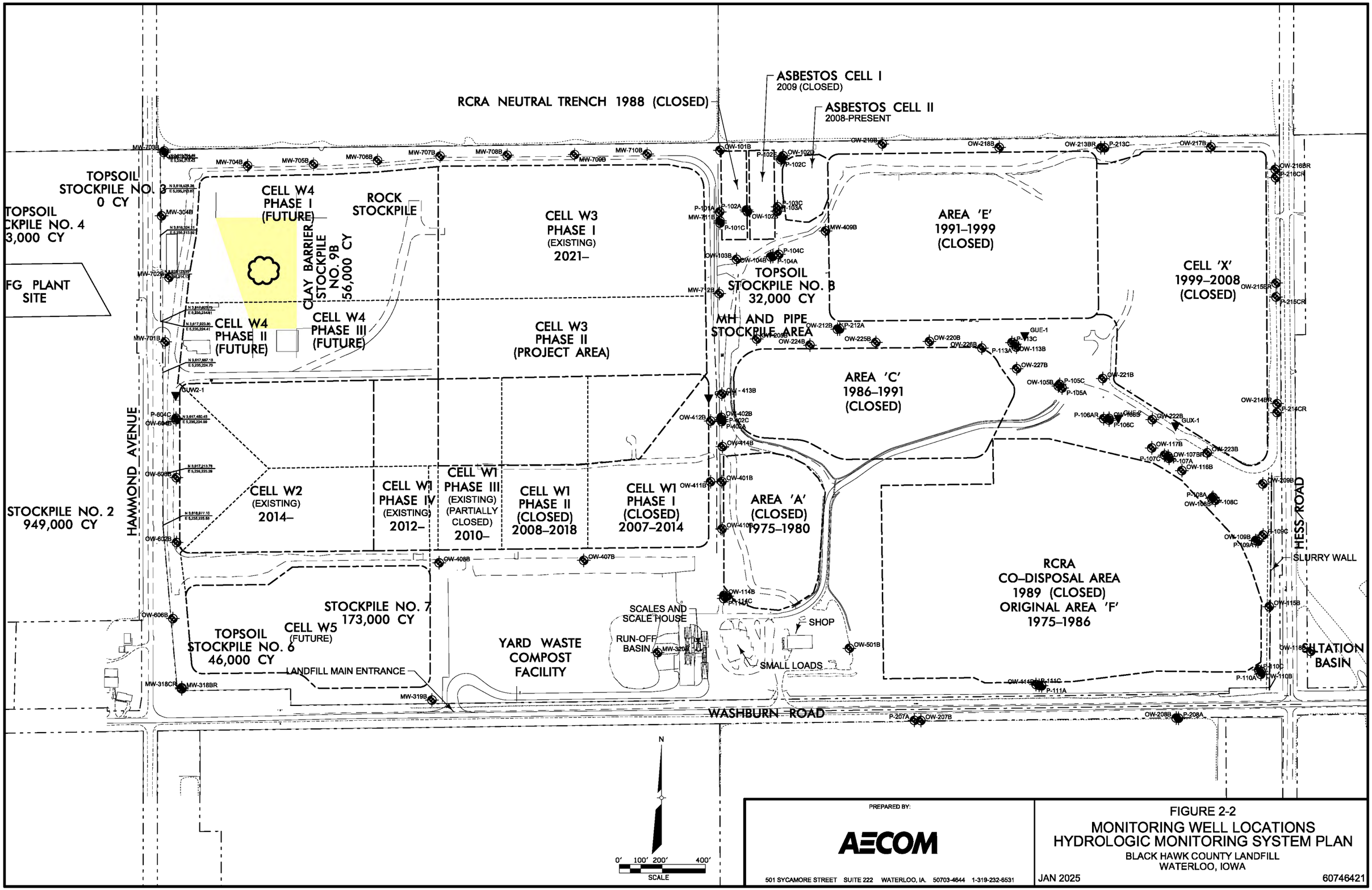

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FIGURE 2-2

MONITORING WELL LOCATIONS
HYDROLOGIC MONITORING SYSTEM PLAN

BLACK HAWK COUNTY LANDFILL
WATERLOO, IOWA

JAN 2025

60746421

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RCRA NEUTRAL TRENCH 1988 (CLOSED)

ASBESTOS CELL I
2009 (CLOSED)

ASBESTOS CELL II
2008-PRESENT

TOPSOIL
STOCKPILE NO. 3
0 CY

TOPSOIL
CKPILE NO. 4
3,000 CY

FG PLANT
SITE

CELL W4
PHASE I
(FUTURE)

ROCK
STOCKPILE

CLAY BARRIER
STOCKPILE
NO. 9B
56,000 CY

CELL W3
PHASE I
(EXISTING)
2021–

CELL W4
PHASE II
(FUTURE)

CELL W4
PHASE III
(FUTURE)

CELL W3
PHASE II
(PROJECT AREA)

TOPSOIL
STOCKPILE NO. 8
32,000 CY

MH AND PIPE
STOCKPILE AREA

AREA 'B'
1991–1999
(CLOSED)

CELL 'X'
1999–2008
(CLOSED)

AREA 'C'
1986–1991
(CLOSED)

HAMMOND AVENUE

STOCKPILE NO. 2
949,000 CY

CELL W2
(EXISTING)
2014–

CELL W1
PHASE IV
(EXISTING)
2012–

CELL W1
PHASE III
(EXISTING)
(PARTIALLY
CLOSED)
2010–

CELL W1
PHASE II
(CLOSED)
2008–2018

CELL W1
PHASE I
(CLOSED)
2007–2014

AREA 'A'
(CLOSED)
1975–1980

HESS ROAD

SLURRY WALL

RCRA
CO–DISPOSAL AREA
1989 (CLOSED)
ORIGINAL AREA 'F'
1975–1986

SILTATION
BASIN

STOCKPILE NO. 7
173,000 CY

TOPSOIL
STOCKPILE NO. 6
46,000 CY

CELL W5
(FUTURE)

SCALES AND
SCALE HOUSE

SHOP

RUN-OFF
BASIN

SMALL LOADS

YARD WASTE
COMPOST
FACILITY

LANDFILL MAIN ENTRANCE

WASHBURN ROAD

N

0′ 100′ 200′ 400′
SCALE

PREPARED BY:

AECOM

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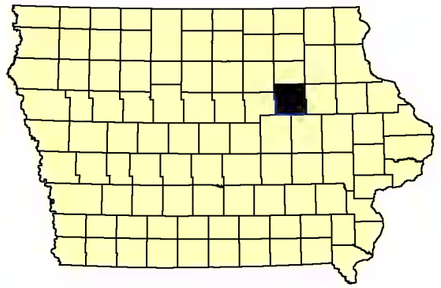
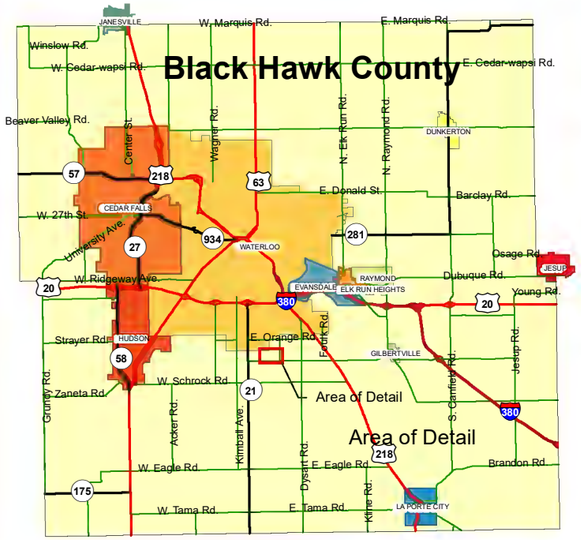
FIGURE 2-3
BEDROCK TOPOGRAPHY
HYDROLOGIC MONITORING SYSTEM PLAN
BLACK HAWK COUNTY LANDFILL
WATERLOO, IOWA

JAN 2025

60746421





Groundwater Contour

Flow Line

OW-207B 919.08 Monitoring Point with Water Elevation AMSL

Drainageway

N W E S

0 250 500 750 1,000

Feet

Contours based on March 2024 water elevations.
NM = Not measured

Basemap: Black Hawk County, IA Assessor, April 2021

Watershed Boundary

NEUTRAL TRENCH

ASBESTOS CELL NO. 1

ASBESTOS CELL NO. 2

CELL W4

CELL W3

CELL W2

CELL W1

AREA E

AREA C

AREA A

CELL X

CODISPOSAL AREA

Scale House

Hammond Avenue

Washburn Road

MW-703B 923.04
MW-704B 928.97
MW-705B 926.82
MW-706B 930.58
MW-707B 933.83
MW-708B 933.93
MW-709B 937.58
MW-710B 937.23
OW-101B 937.60
OW-102D 927.75
OW-102B 931.23
OW-103B 926.74
OW-104B 924.88
MW-304B 918.39
MW-702B 922.98
MW-712B 928.49
MW-711B 931.73
MW-409B 921.91
OW-218B 933.75
OW-219B 932.28
OW-213BR 932.19
OW-217B 927.54
OW-216BR 933.83
OW-215BR 926.08
OW-214BR 916.23
SG-1 920.41
MW-701B 920.73
OW-205B 931.27
OW-212B 925.05
OW-224B 928.42
OW-225B 924.67
OW-220B 916.26
OW-226B 912.50
OW-113B 911.05
OW-227B 910.14
SG-5 911.56
OW-105B 908.81
OW-221B 906.99
OW-106B 905.12
OW-222B 904.18
OW-117B 903.28
OW-223B 900.15
OW-116B 901.64
OW-107BR 902.61
OW-209B 900.57
OW-108B 898.22
OW-109B 896.22
SG-3 893.76
OW-115B 892.83
OW-118B 891.21
OW-110B 900.95
SG-2 898.50
OW-208B 918.59
OW-207B 928.51
MW-604B 922.48
MW-603B 928.85
OW-412B 938.23
OW-411B 933.84
OW-413B 937.38
OW-402B 938.33
OW-414B 938.55
OW-401B 938.05
OW-410B 938.65
MW-602B 932.47
OW-408B 946.20
OW-407B 942.25
OW-114B 934.06
MW-606B 940.58
MW-320B 933.87
MW-501B 928.64
MW-318BR 939.52
MW-319B 951.94
OW-111B 924.95

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FIGURE 2-4
WATER TABLE ELEVATIONS
HYDROLOGIC MONITORING SYSTEM PLAN
BLACK HAWK COUNTY LANDFILL
WATERLOO, IOWA

JAN 2025 60746421

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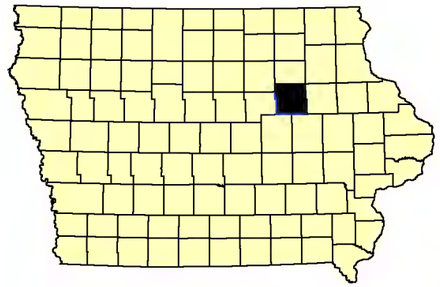

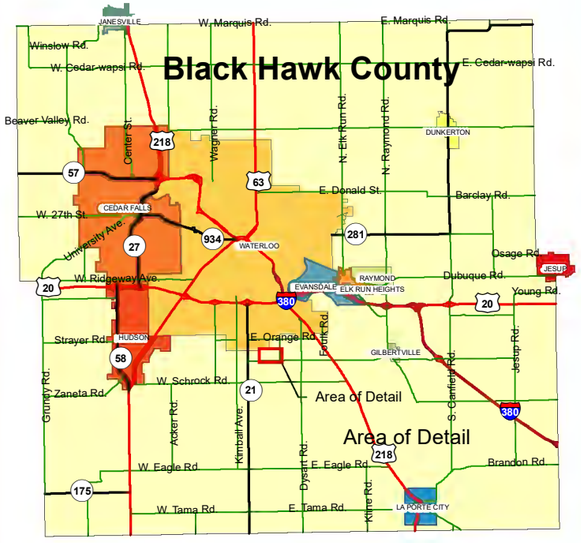

Groundwater Contours

Flow Line

OW-207B 919.08 — Monitoring Point with Water Elevation AMSL

0 250 500 750 1,000

Feet

N W E S

Contours based on March 2024 water elevations.
NM = Not Measured

Basemap: Black Hawk County, IA Assessor, Spring 2024

ASBESTOS CELL NO. 1

ASBESTOS CELL NO. 2

CELL W4

CELL W3

CELL W2

CELL W1

AREA E

AREA C

AREA A

CELL X

CODISPOSAL AREA

Scale House

Hammond Avenue

Hess Road

Washburn Road

P-703C 836.05

P-604C 836.73

MW-318CR 837.36

P-101C 834.89

P-102C 832.06

P-103C 833.31

P-104C 834.98

P-402C 835.77

P-113C 830.00

P-105C 830.09

P-106C 829.78

P-213C 828.92

P-216CR 827.41

P-215CR 827.20

P-214CR 827.35

P-107C 828.65

P-108C 828.27

P-109C 827.75

P-110C 828.38

P-111C 830.75

P-114C 835.57

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501 SYCAMORE STREET SUITE 222 WATERLOO, IA 50703-4644 1-319-232-6531

FIGURE 2-5
PIEZOMETRIC SURFACE - UPPERMOST BEDROCK
HYDROLOGIC MONITORING SYSTEM PLAN
BLACK HAWK COUNTY LANDFILL
WATERLOO, IOWA

JAN 2025

60746421

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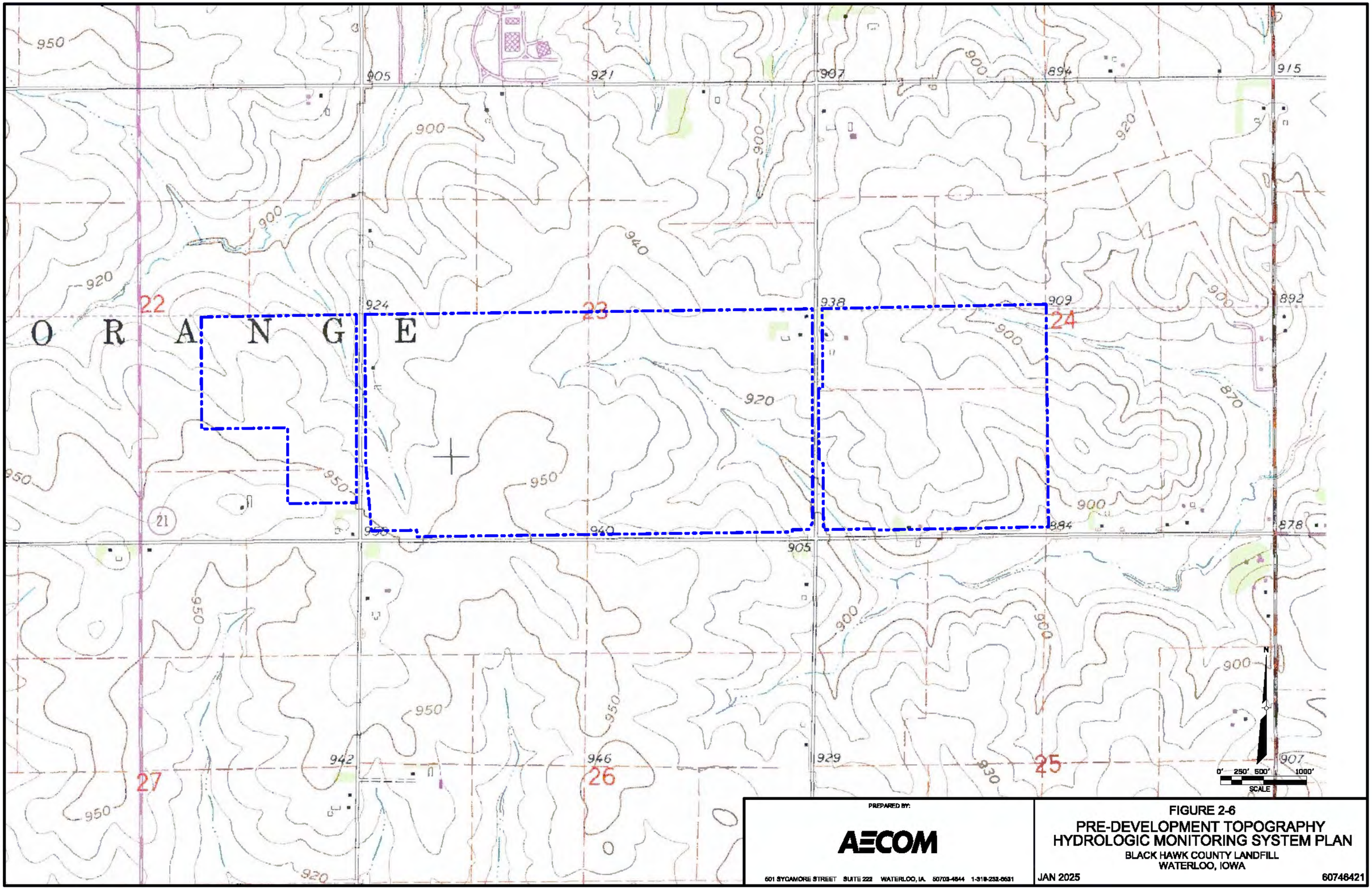

$$USER$$
$$SPRF$$
$$SDGN$$

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601 SYCAMORE STREET SUITE 222 WATERLOO, IA. 50703-4644 1-319-232-6531

FIGURE 2-6

PRE-DEVELOPMENT TOPOGRAPHY
HYDROLOGIC MONITORING SYSTEM PLAN

BLACK HAWK COUNTY LANDFILL
WATERLOO, IOWA

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RCRA NEUTRAL TRENCH 1988 (CLOSED)

ASBESTOS CELL I
2009 (CLOSED)

ASBESTOS CELL II
2008-PRESENT

TOPSOIL STOCKPILE NO 3
0 CY

TOPSOIL STOCKPILE NO 4
3,000 CY

FG PLANT SITE

CELL W4 PHASE I (FUTURE)

ROCK STOCKPILE

CLAY BARRIER STOCKPILE NO 2B
36,000 CY

CELL W3 PHASE I (EXISTING)
2021

CELL W4 PHASE II (FUTURE)

CELL W3 PHASE II (PROJECT AREA)

AREA E
1991-1999
(CLOSED)

CELL IX
1999-2008
(CLOSED)

TOPSOIL STOCKPILE NO 5
32,000 CY

MH AND PIPE STOCKPILE AREA

AREA C
1986-1991
(CLOSED)

STOCKPILE NO 1
949,000 CY

HAMMOND AVENUE

CELL W2
(EXISTING)
2014

CELL W2 PHASE IV
(EXISTING)
2012

CELL W1 PHASE III
(EXISTING)
(PARTIALLY CLOSED)
2010

CELL W1 PHASE II
(CLOSED)
2008-2018

CELL W1 PHASE I
(CLOSED)
2007-2014

AREA A
(CLOSED)
1975-1980

HESS ROAD

SLURRY WALL

RCRA
CO-DISPOSAL AREA
1989 (CLOSED)
ORIGINAL AREA F
1975-1986

STOCKPILE NO 7
178,000 CY

CELL W5 (FUTURE)

TOPSOIL STOCKPILE NO 6
46,000 CY

SCALES AND SCALE HOUSE

RUN-OFF BASIN

YARD WASTE COMPOST FACILITY

SHOP

SMALL LOADS

SILTATION BASIN

WASHBURN ROAD

N

0' 100' 200' 400'
SCALE

PREPARED BY:

AECOM

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FIGURE 2-7
CURRENT CONTOURS
HYDROLOGIC MONITORING SYSTEM PLAN
BLACK HAWK COUNTY LANDFILL
WATERLOO, IOWA

JAN 2025

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CELL W1
PHASE 1
(CLOSED)
2007–2014

AREA 'A'
(CLOSED)
1975–1980

950
940
930
920
910

SCALES AND
SCALE HOUSE

RUN-OFF
BASIN

SHOP

SIGN

N

0' 25' 50' 100'
SCALE

PREPARED BY:

AECOM

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FIGURE 2-8
AREA A BASE GRADES
HYDROLOGIC MONITORING SYSTEM PLAN
BLACK HAWK COUNTY LANDFILL
WATERLOO, IOWA

JAN 2025 60746421

MH AND PIPE STOCKPILE AREA

AREA 'C' 1986–1991 (CLOSED)

AREA 'A' (CLOSED) 1975–1980

N

0' 25' 50' 100'
SCALE

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FIGURE 2-9
AREA C BASE GRADES
HYDROLOGIC MONITORING SYSTEM PLAN
BLACK HAWK COUNTY LANDFILL
WATERLOO, IOWA

JAN 2025

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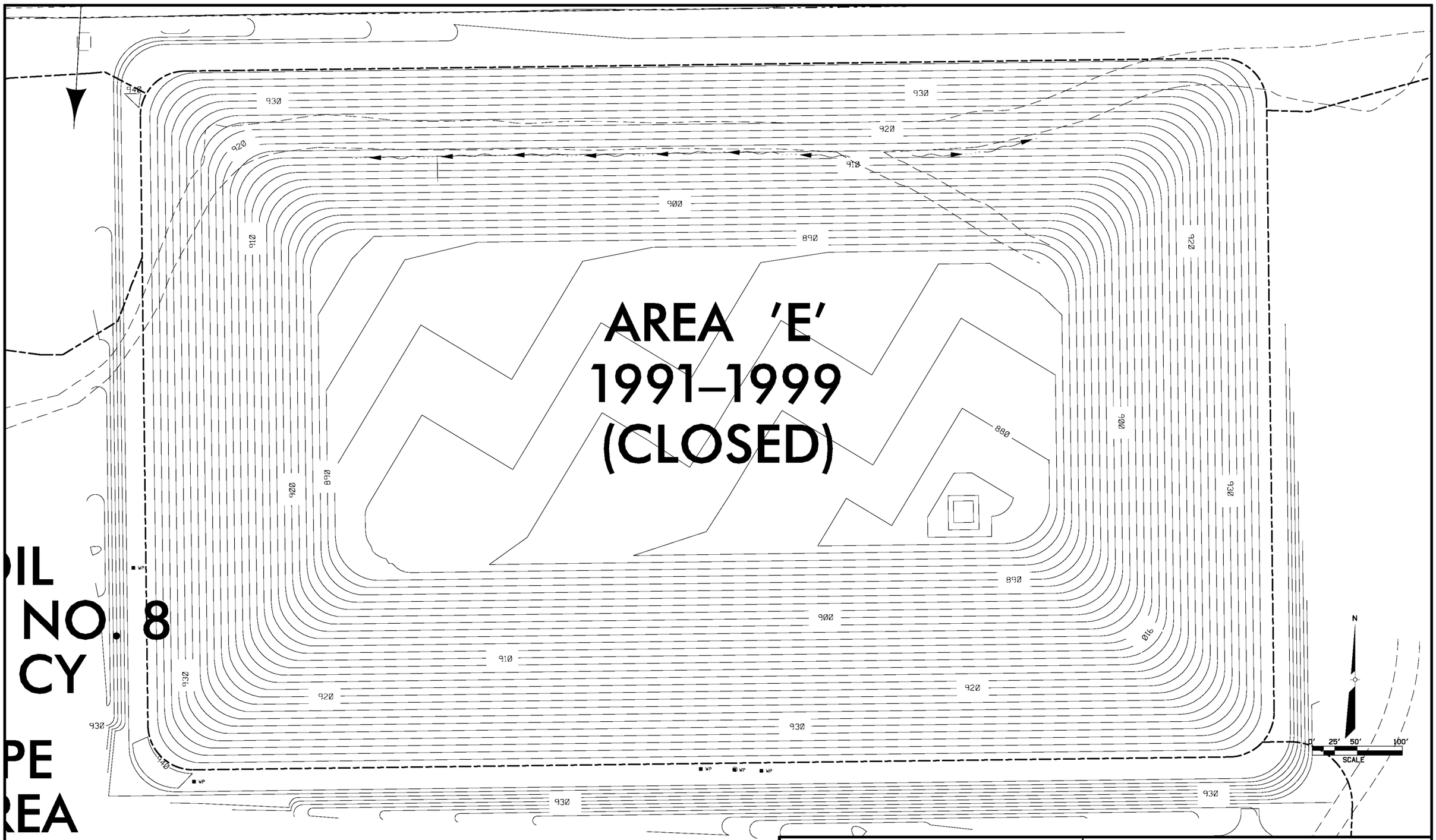
AREA 'E'
1991–1999
(CLOSED)



IL
NO. 8
CY
PE
REA

PREPARED BY:

AECOM

501 SYCAMORE STREET SUITE 222 WATERLOO, IA. 50703-4644 1-319-232-6531

FIGURE 2-10
AREA E BASE GRADES
HYDROLOGIC MONITORING SYSTEM PLAN
BLACK HAWK COUNTY LANDFILL
WATERLOO, IOWA

JAN 2025

60746421

II

AREA 'E'
1991–1999
(CLOSED)

CELL 'X'
1999–2008
(CLOSED)

AD

N

0′ 50′ 100′ 200′
SCALE

PREPARED BY:

AECOM

501 SYCAMORE STREET SUITE 222 WATERLOO, IA. 50703-4644 1-319-232-6531

FIGURE 2-11
CELL X BASE GRADES
HYDROLOGIC MONITORING SYSTEM PLAN
BLACK HAWK COUNTY LANDFILL
WATERLOO, IOWA

JAN 2025 60746421

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Design File

HAMMOND AVENUE

CLAY BARRIER
STOCKPILE
NO. 9B
56,000 CY

CELL W4
PHASE II
(FUTURE)

CELL W4
PHASE III
(FUTURE)

CELL W3
PHASE II
(PROJECT AREA)

PHASE I
(EXISTING)
2021–

TOPSO
STOCKPILE
32,000

MH AND P
STOCKPILE A

CELL W2
(EXISTING)
2014–

CELL W1
PHASE IV
(EXISTING)
2012–

CELL W1
PHASE III
(EXISTING)
(PARTIALLY
CLOSED)
2010–

CELL W1
PHASE II
(CLOSED)
2008–2018

CELL W1
PHASE I
(CLOSED)
2007–2014

AREA
(CLOSE
1975–19

STOCKPILE NO. 7
173,000 CY

CELL W5
(FUTURE)

TOPSOIL
STOCKPILE NO. 6
46,000 CY

LANDFILL MAIN ENTRANCE

SCALES AND
SCALE HOUSE

N

0' 50' 100' 200'
SCALE

PREPARED BY:

AECOM

501 SYCAMORE STREET SUITE 222 WATERLOO, IA. 50703-4644 1-319-232-6531

FIGURE 2-12
CELL W-1 & 2 BASE GRADES
HYDROLOGIC MONITORING SYSTEM PLAN
BLACK HAWK COUNTY LANDFILL
WATERLOO, IOWA

JAN 2025

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CELL W3
PHASE 1
(EXISTING)
2021–

N

0′ 25′ 50′ 100′
SCALE

PREPARED BY:

AECOM

501 SYCAMORE STREET SUITE 222 WATERLOO, IA. 50703-4644 1-319-232-6531

FIGURE 2-13
W-3 BASE GRADES
HYDROLOGIC MONITORING SYSTEM PLAN
BLACK HAWK COUNTY LANDFILL
WATERLOO, IOWA

60746421

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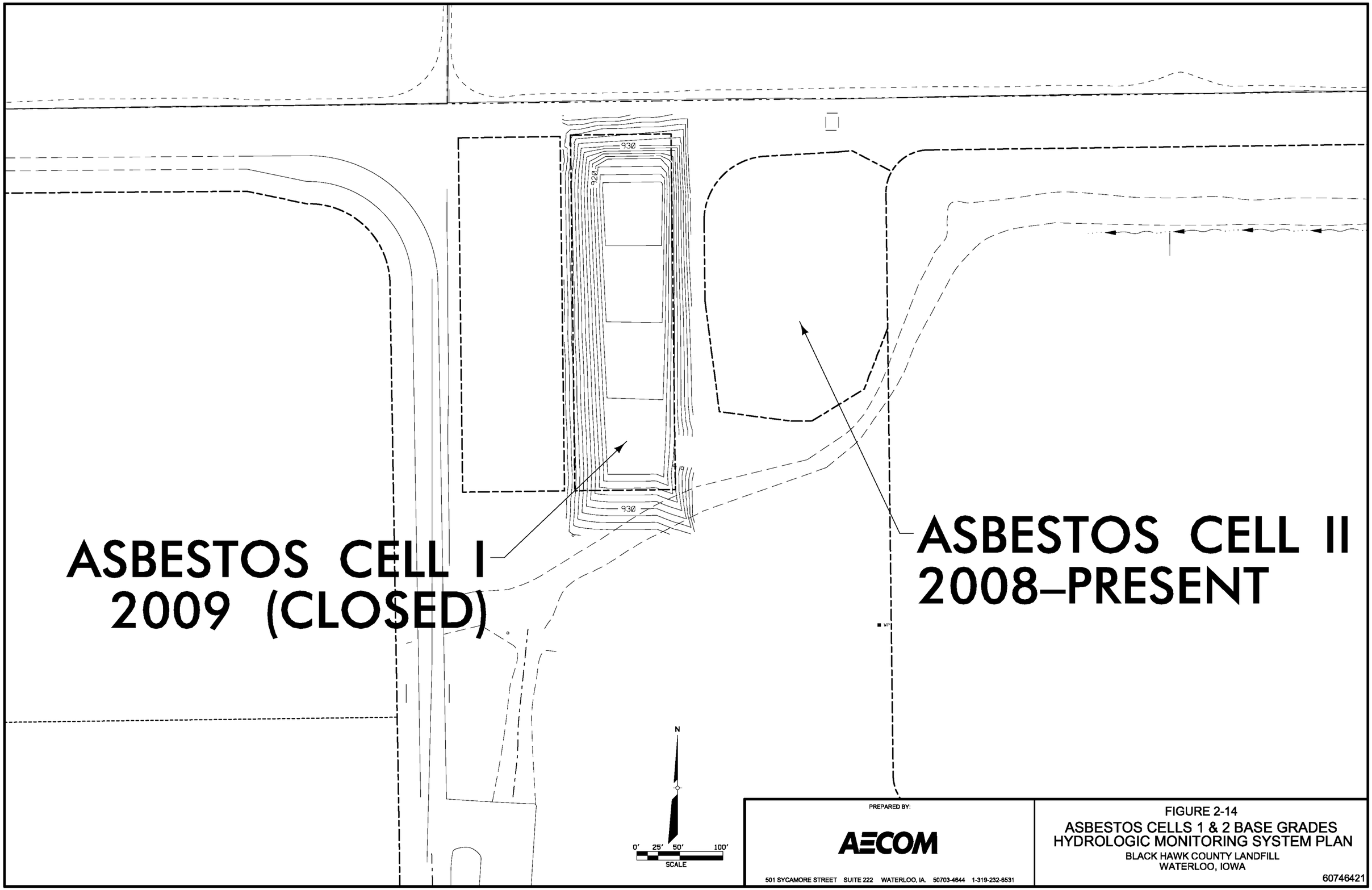
Printed from MicroStation V8i
Waterloo, Iowa



PREPARED BY:

AECOM

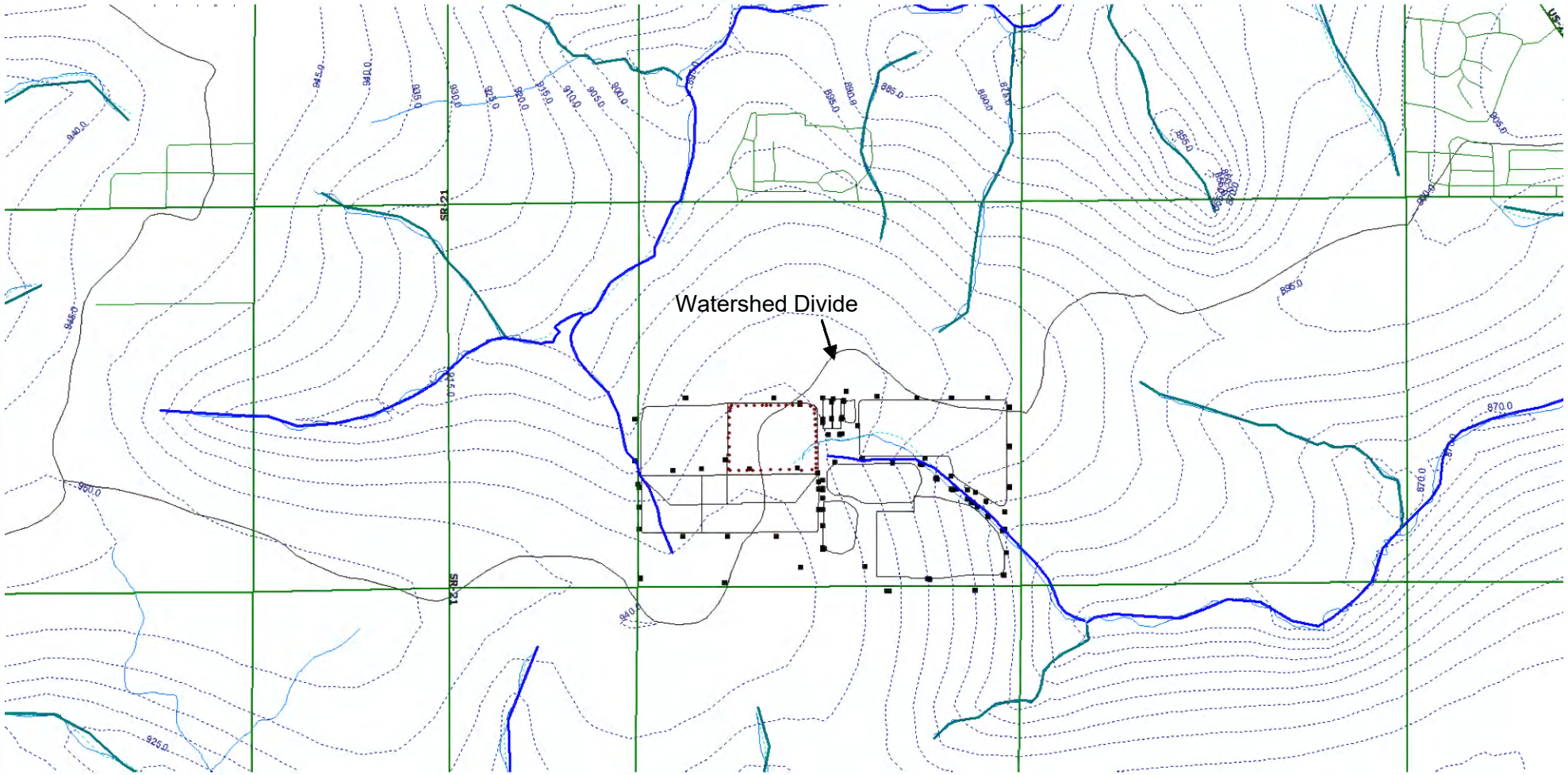
501 SYCAMORE STREET SUITE 222 WATERLOO, IA. 50703-4644 1-319-232-6531

FIGURE 2-14

ASBESTOS CELLS 1 & 2 BASE GRADES
HYDROLOGIC MONITORING SYSTEM PLAN

BLACK HAWK COUNTY LANDFILL
WATERLOO, IOWA

60746421



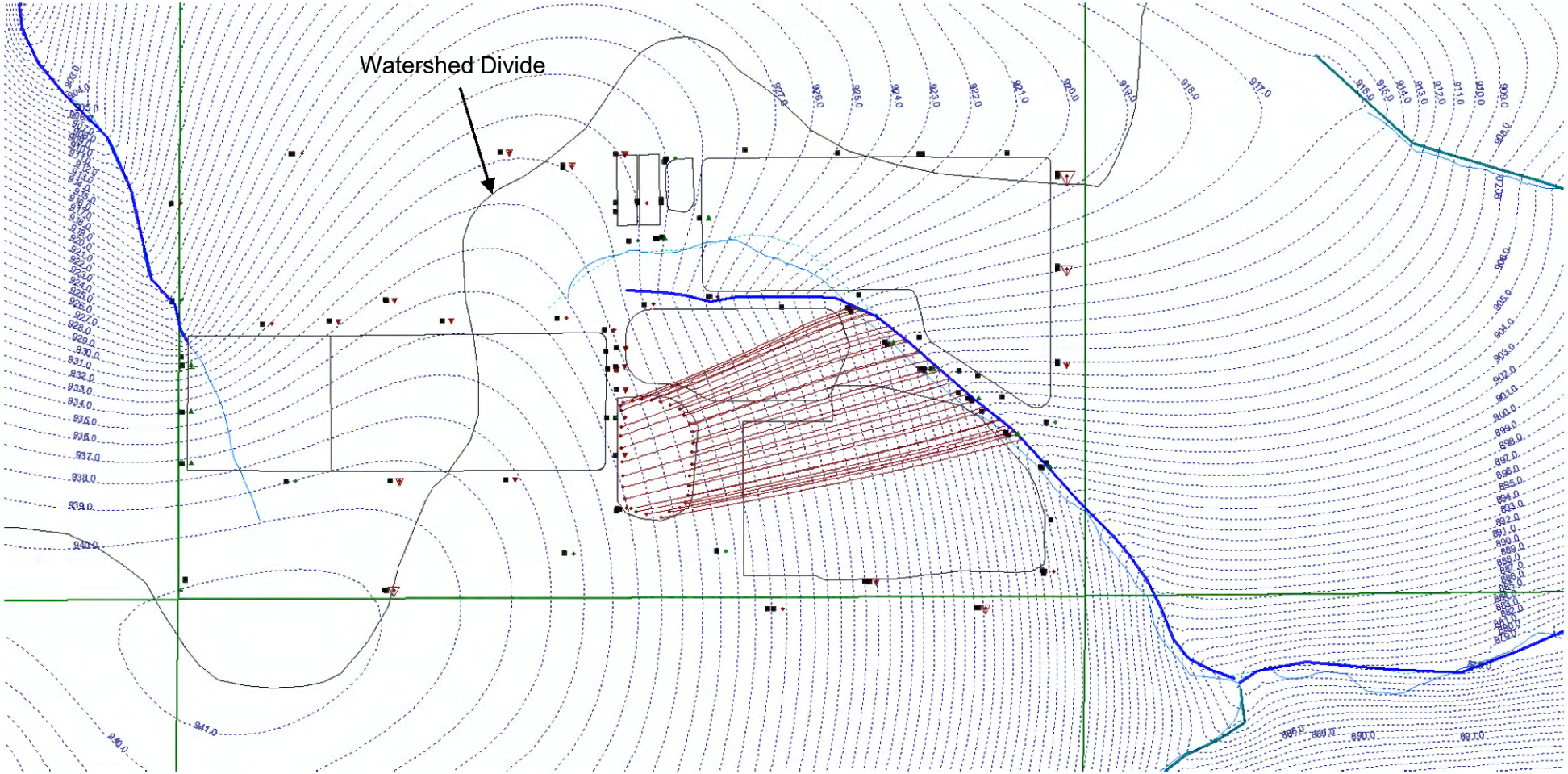
AECOM

FIGURE 3-1
Theoretical Release Model Domain

BLACK HAWK COUNTY LANDFILL
2023 HMSP

FEB 2023

60699034



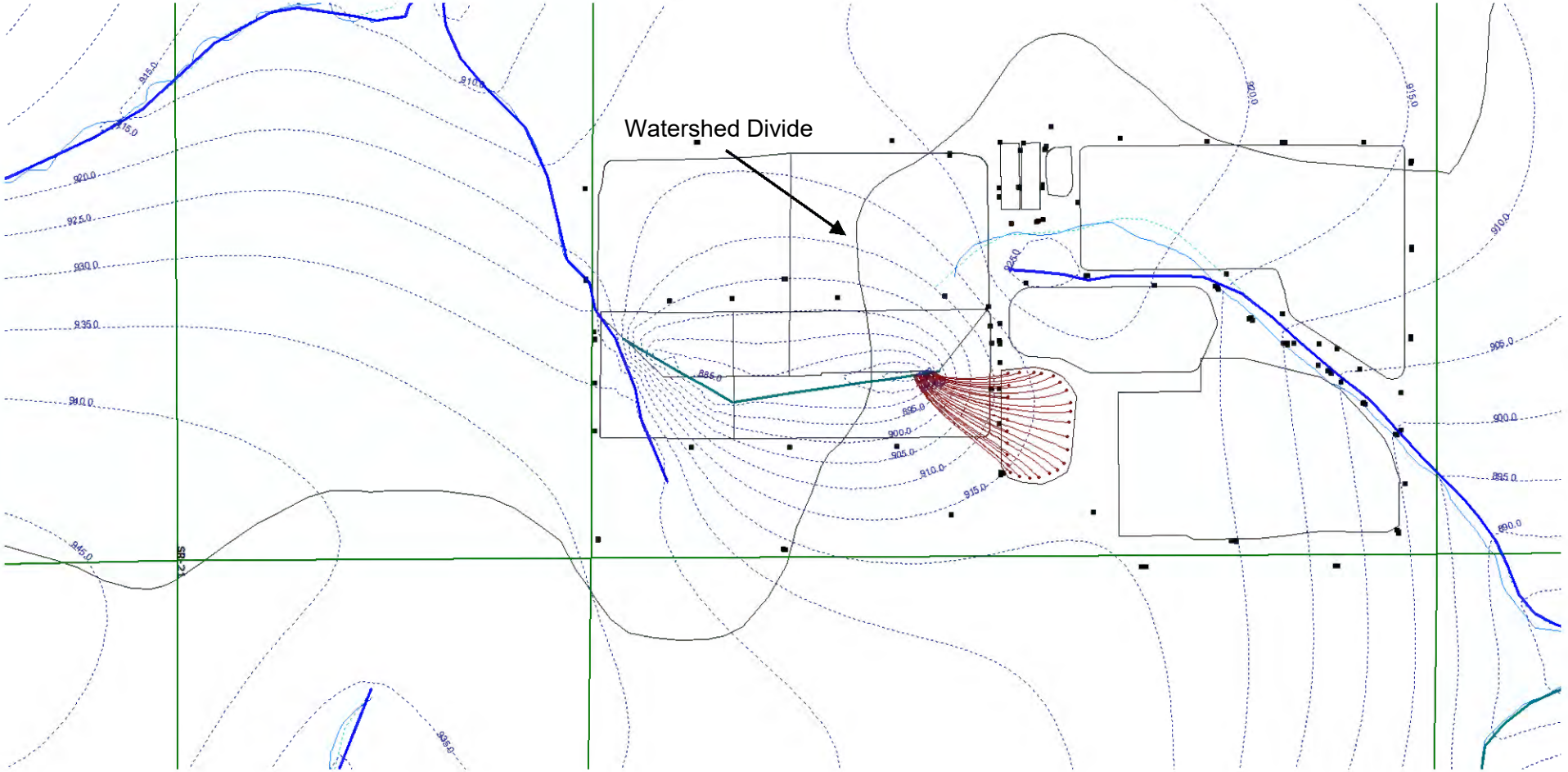
AECOM

FIGURE 3-3
Theoretical Release: Area A

BLACK HAWK COUNTY LANDFILL
2023 HMSP

FEB 2023

60699034



AECOM

FIGURE 3-4

Theoretical Release: Area A with Cells W1/W2 Groundwater Drainage Layer Active

BLACK HAWK COUNTY LANDFILL
2023 HMSP

FEB 2023

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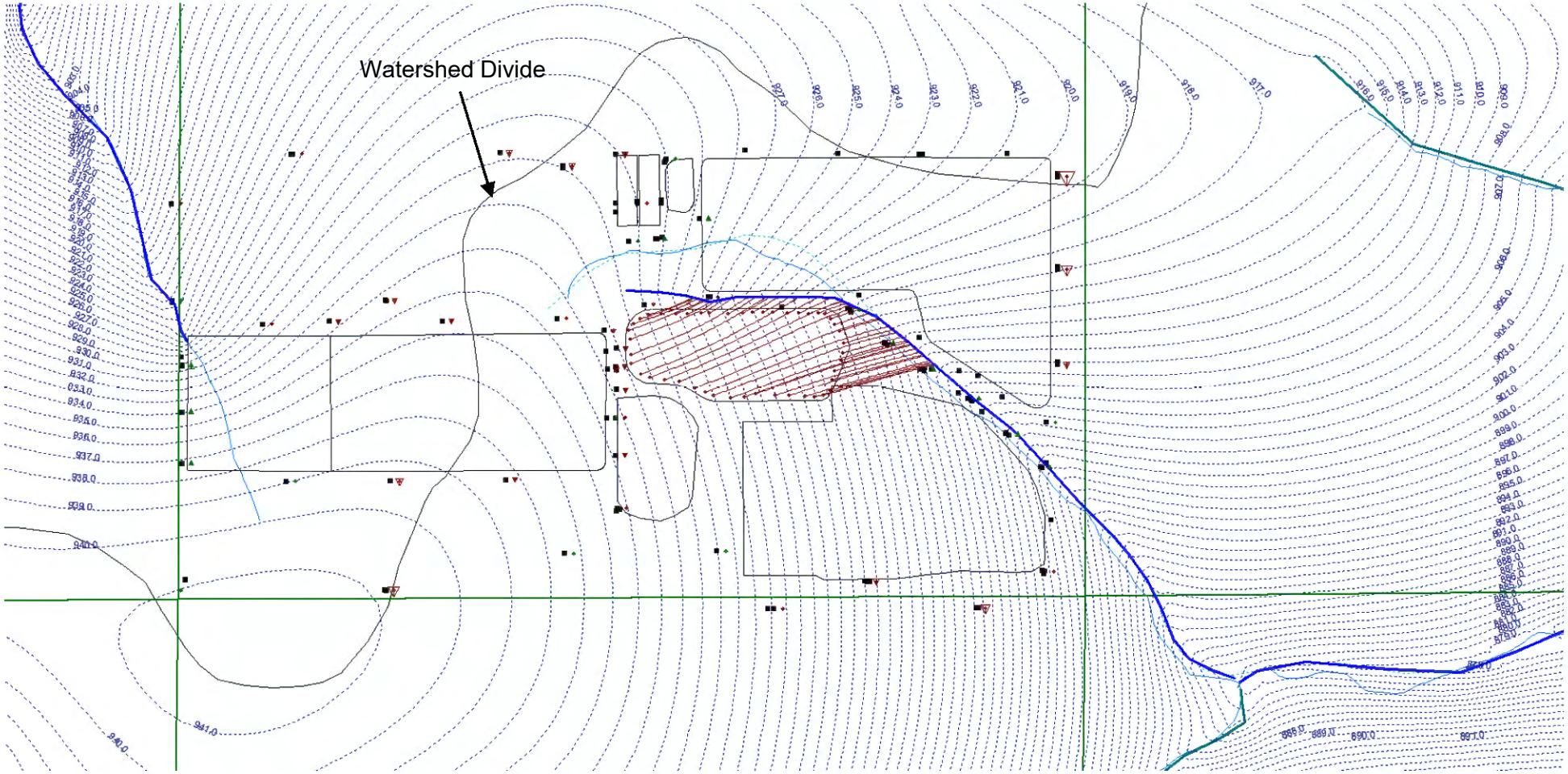
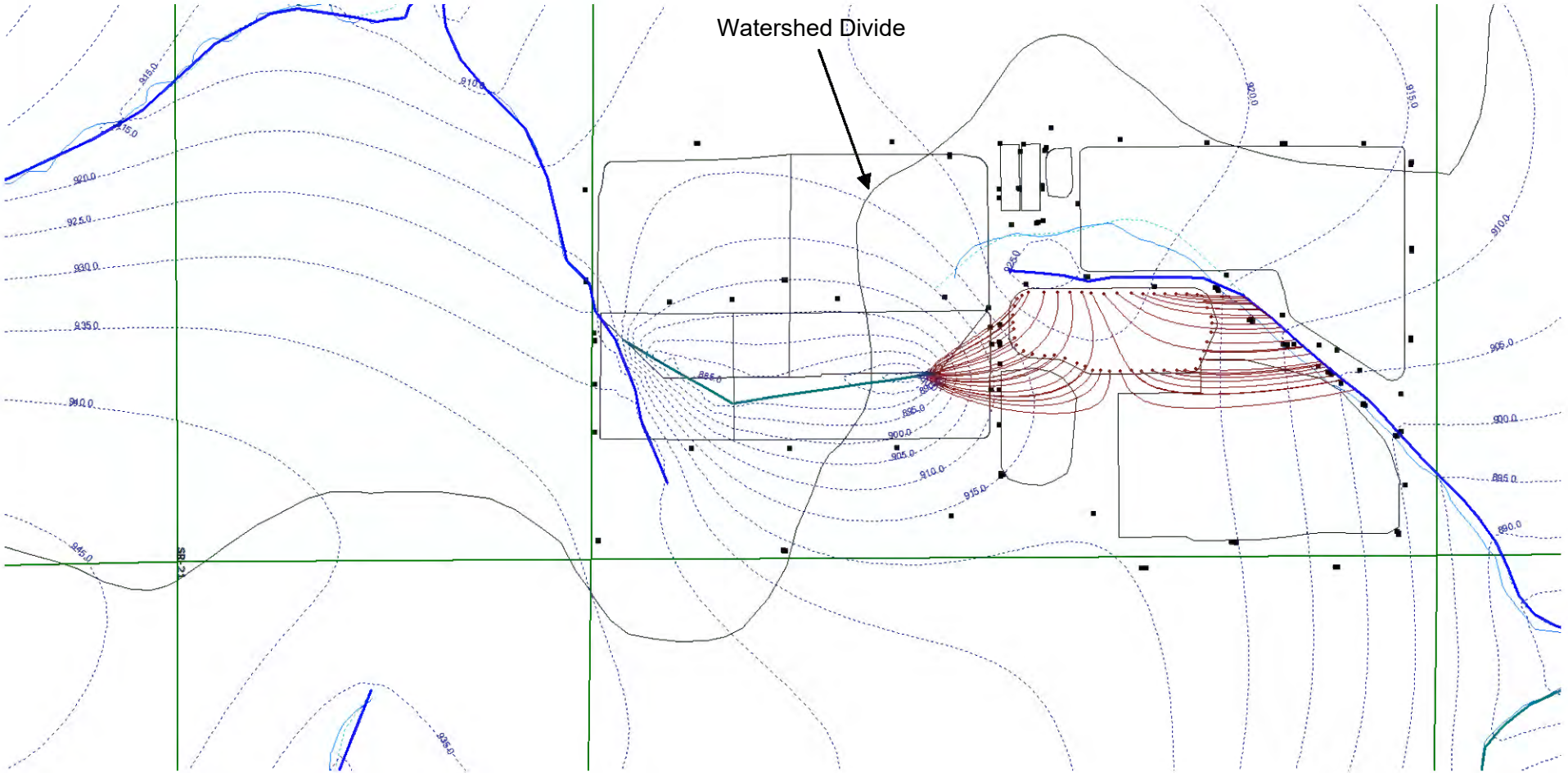


AECOM

FIGURE 3-5
Theoretical Release: Area C

BLACK HAWK COUNTY LANDFILL
2023 HMSP
FEB 2023
60699034



AECOM

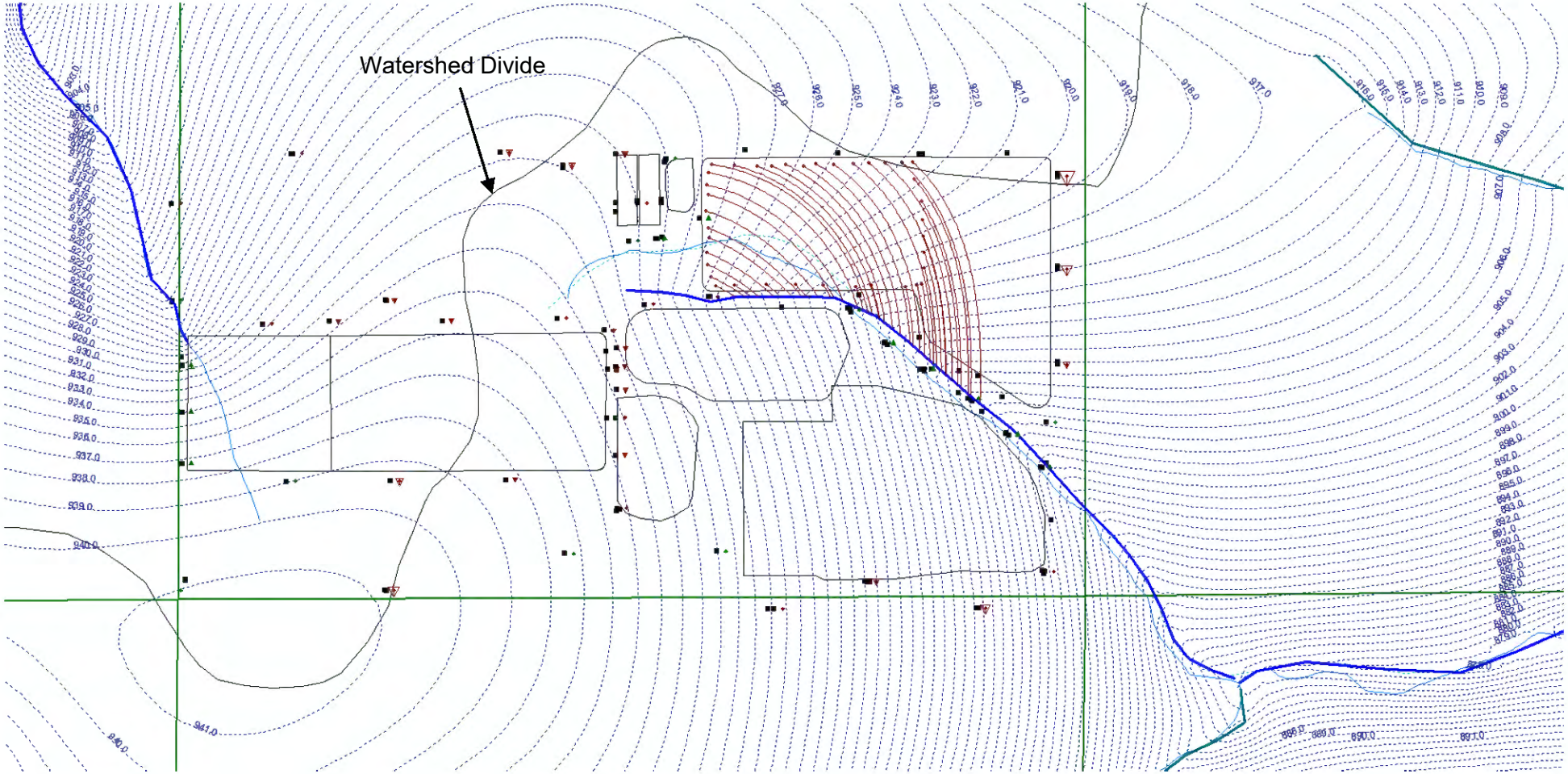
FIGURE 3-6

Theoretical Release: Area C and Cells W1/W2 Groundwater Drainage Layer Active

BLACK HAWK COUNTY LANDFILL
2023 HMSP

FEB 2023

60699034



AECOM

FIGURE 3-7
Theoretical Release: Area E

BLACK HAWK COUNTY LANDFILL
2023 HMSP

FEB 2023

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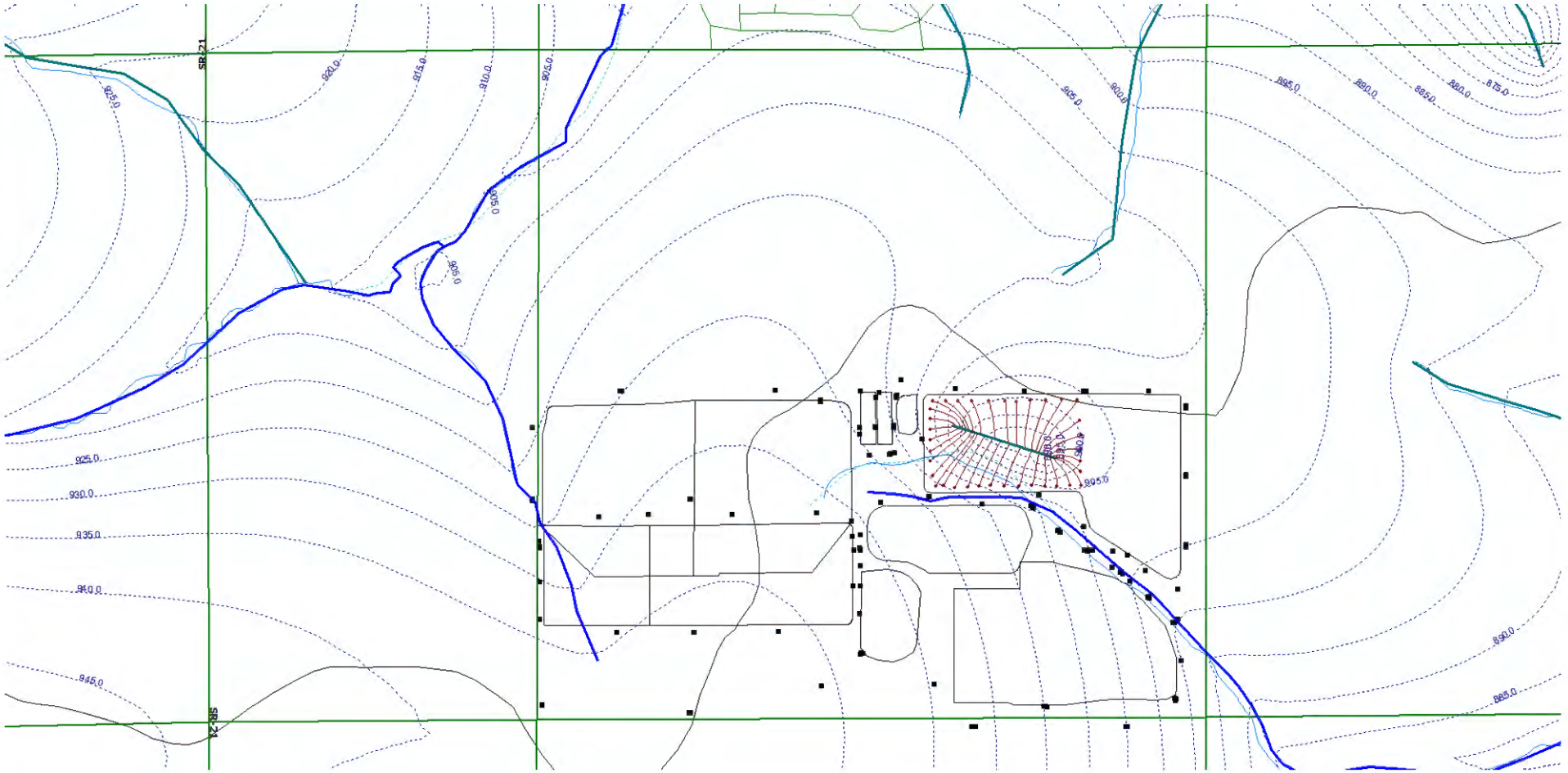

AECOM

FIGURE 3-8

Theoretical Release: Area E with Groundwater Underdrain Active

BLACK HAWK COUNTY LANDFILL
2023 HMSP

FEB 2023

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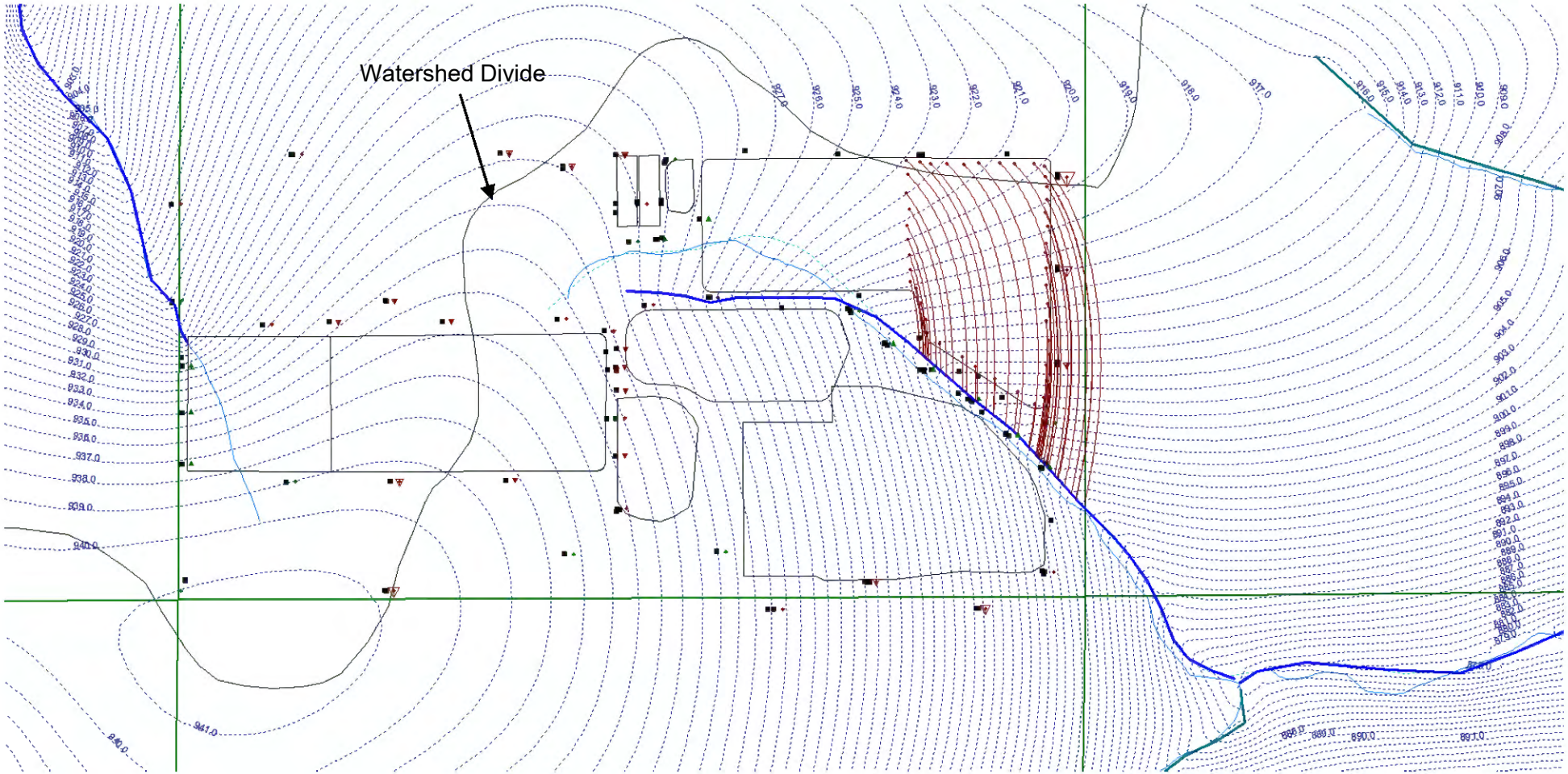

AECOM

FIGURE 3-9
Theoretical Release: Cell X

BLACK HAWK COUNTY LANDFILL
2023 HMSP

FEB 2023

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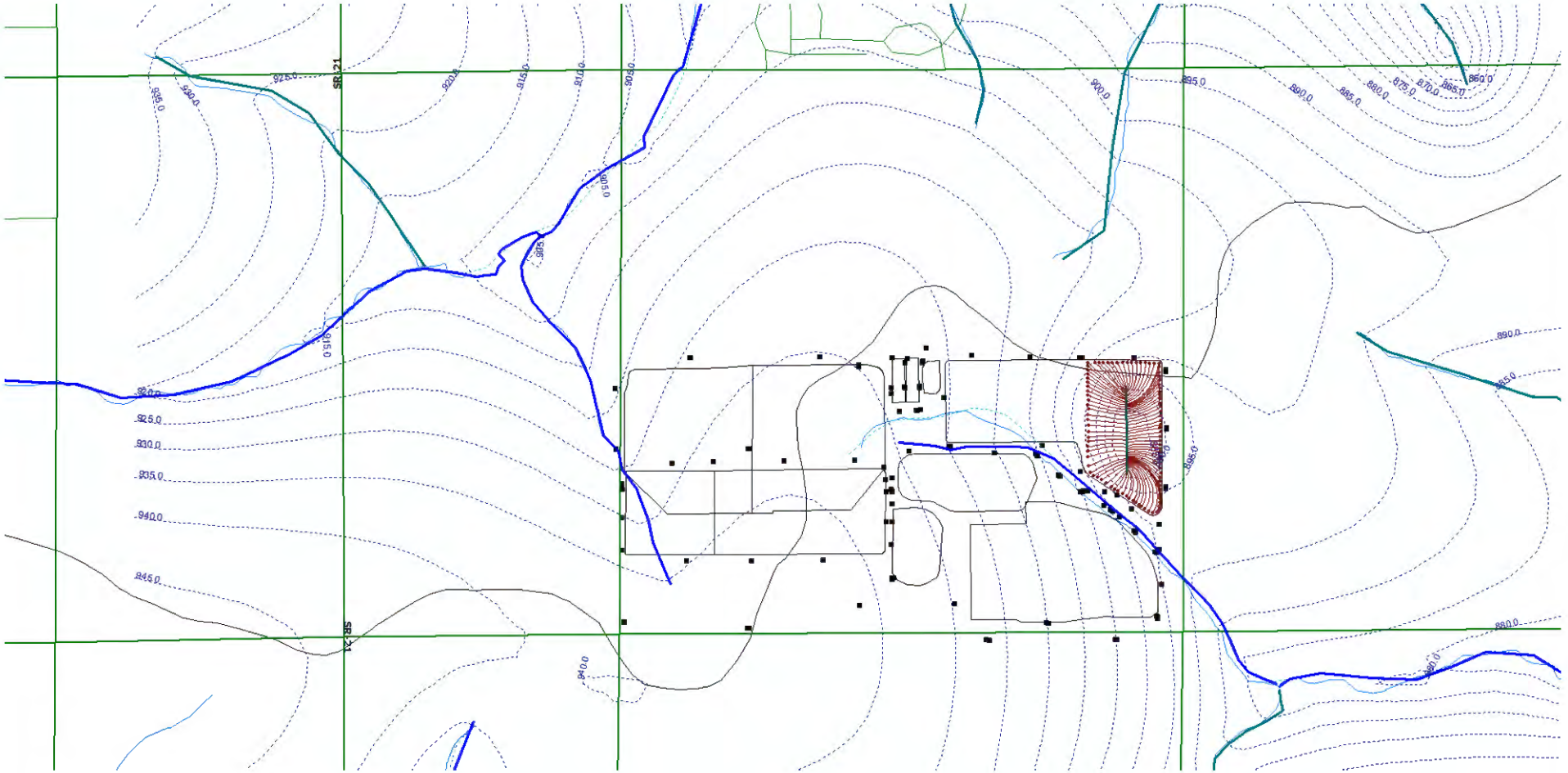

AECOM

FIGURE 3-10

Theoretical Release: Cell X with Groundwater Underdrain Active

BLACK HAWK COUNTY LANDFILL
2023 HMSP

FEB 2023

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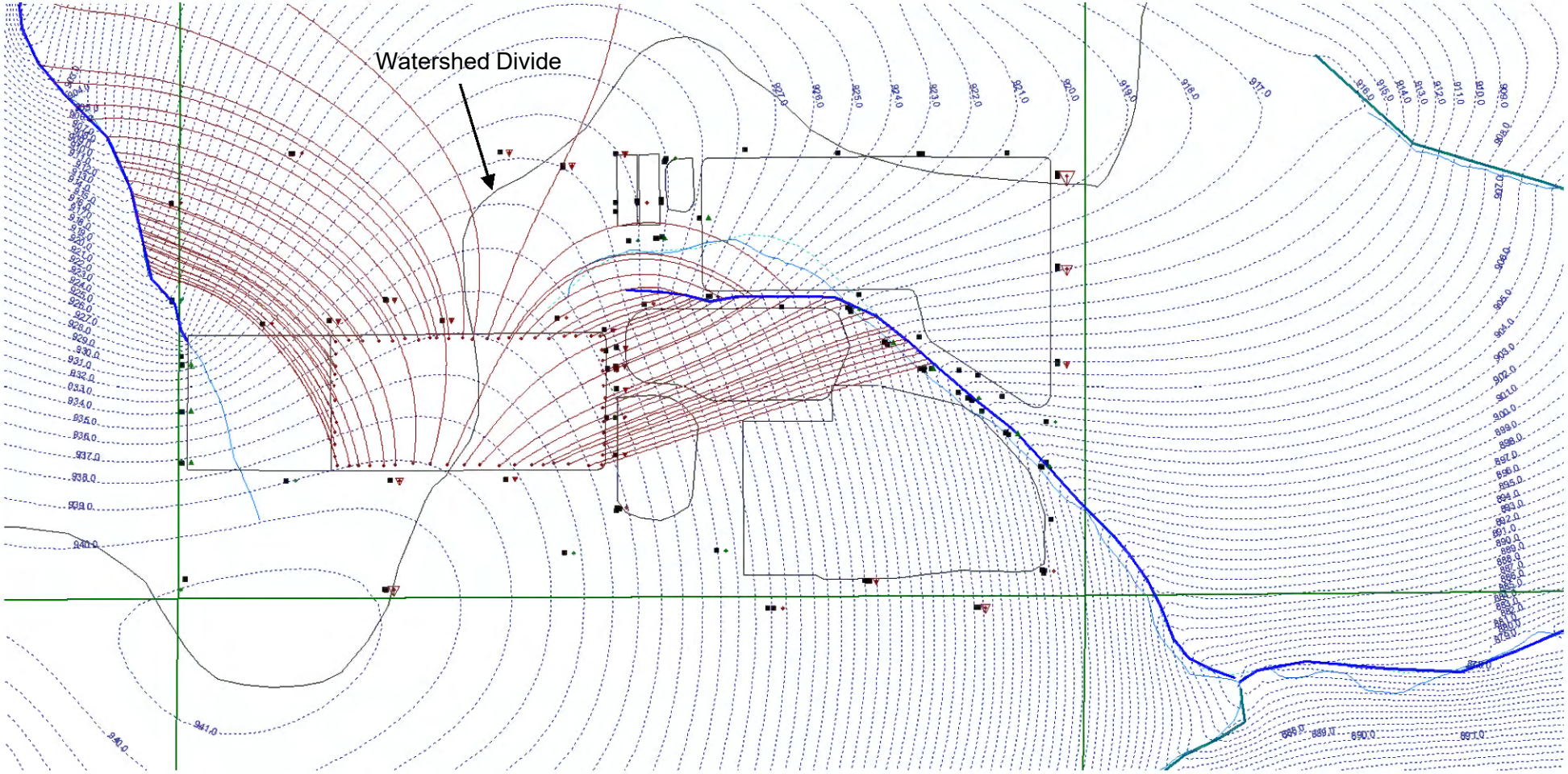

AECOM

FIGURE 3-11
Theoretical Release: Cell W1

BLACK HAWK COUNTY LANDFILL
2023 HMSP

FEB 2023

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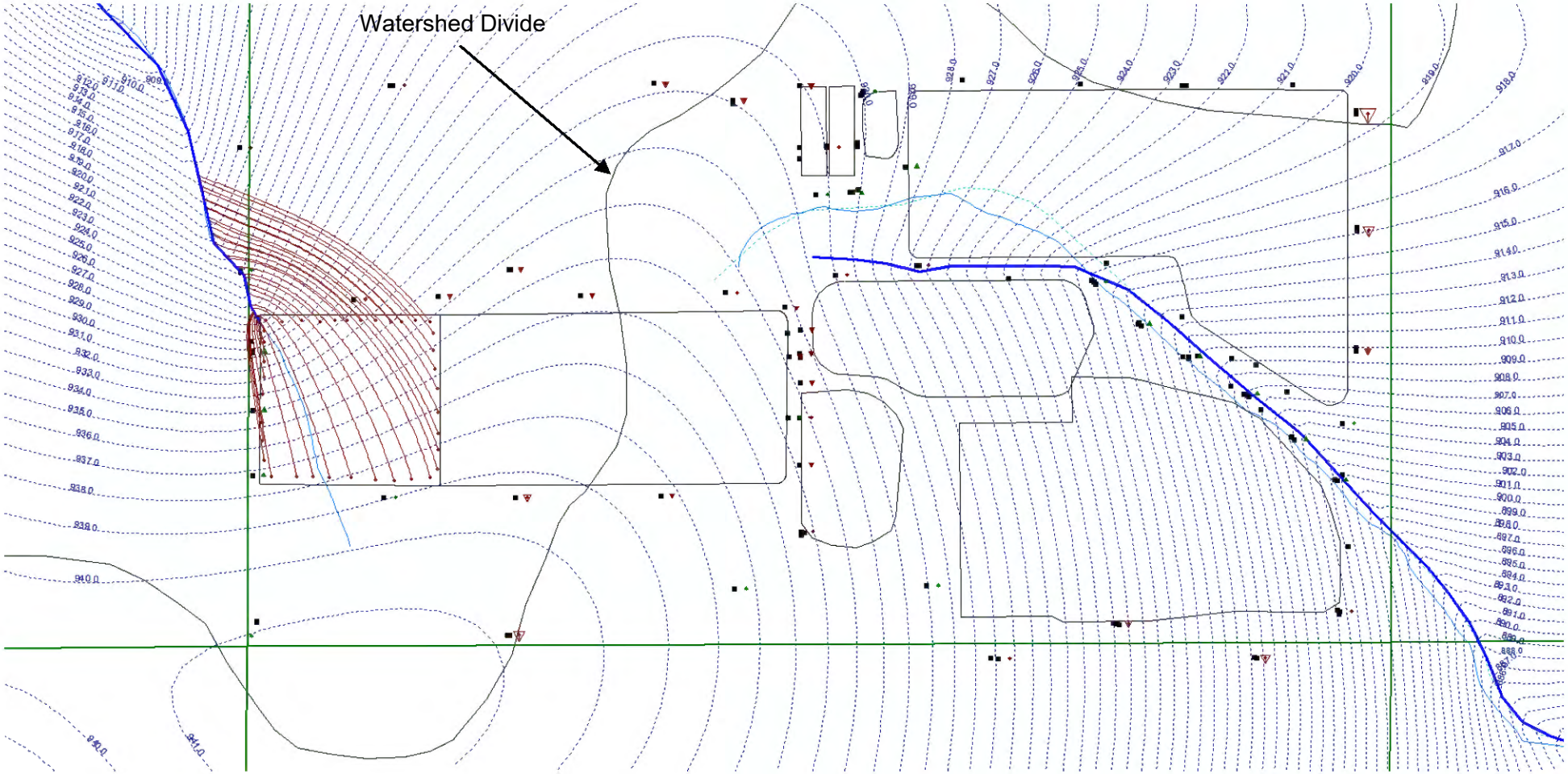

AECOM

FIGURE 3-12
Theoretical Release: Cell W2

BLACK HAWK COUNTY LANDFILL
2023 HMSP

FEB 2023

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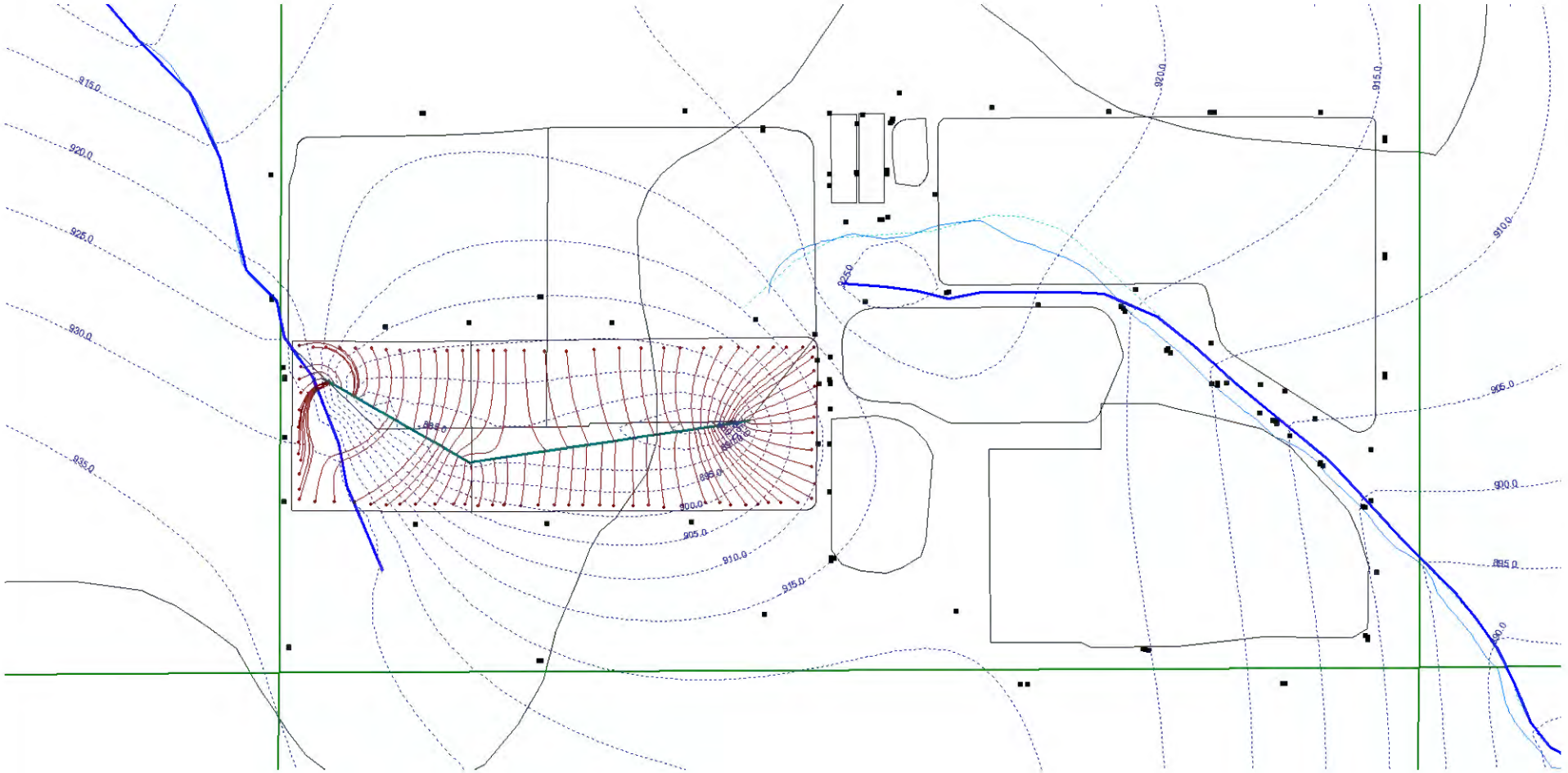


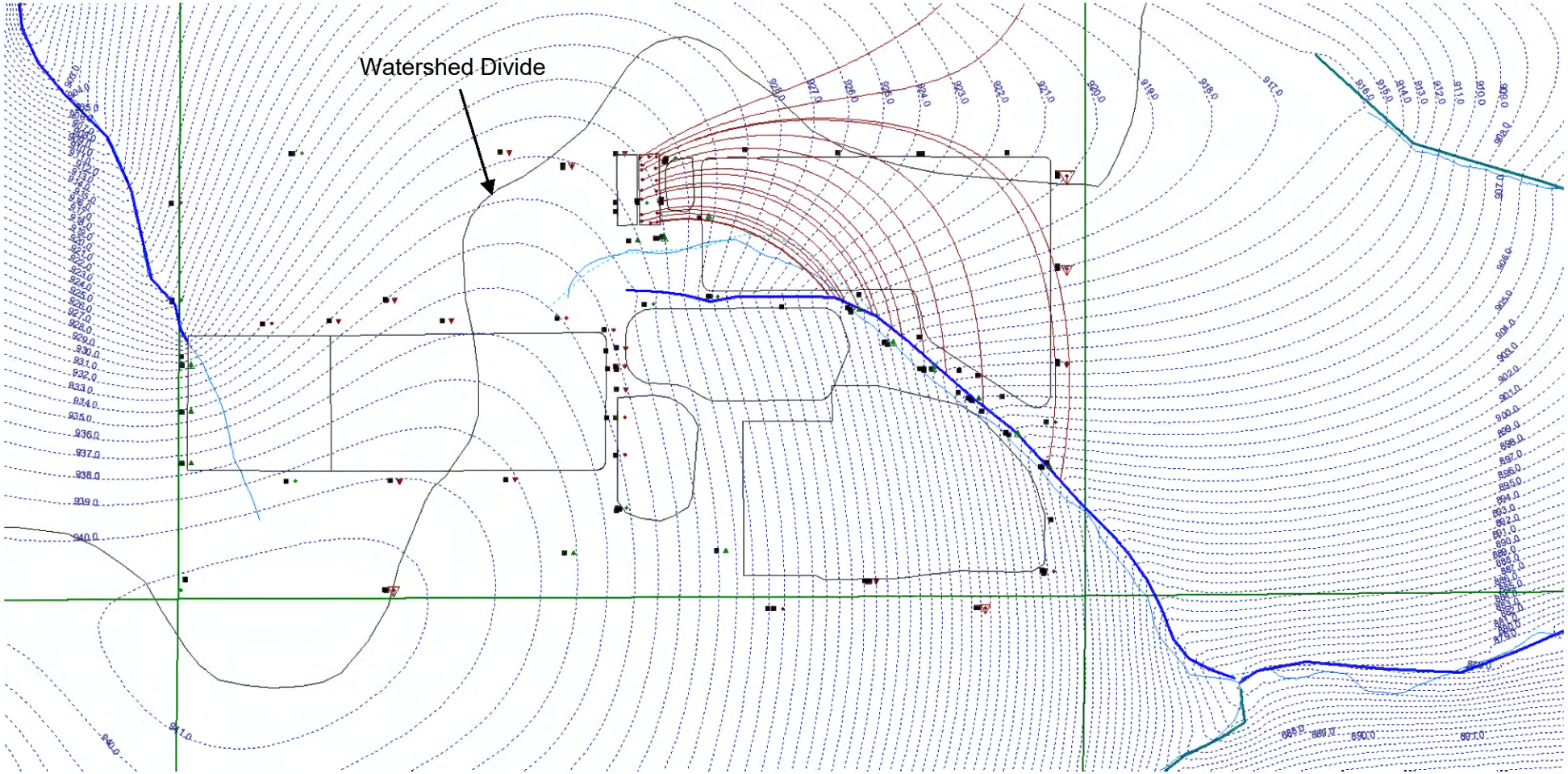
AECOM

FIGURE 3-13

Theoretical Release: Cells W1/W2 with Groundwater Drainage Layers Active

BLACK HAWK COUNTY LANDFILL
2023 HMSP

FEB 2023 60699034



AECOM

FIGURE 3-14
Theoretical Release: Asbestos Cell No. 1

BLACK HAWK COUNTY LANDFILL
2023 HMSP

FEB 2023

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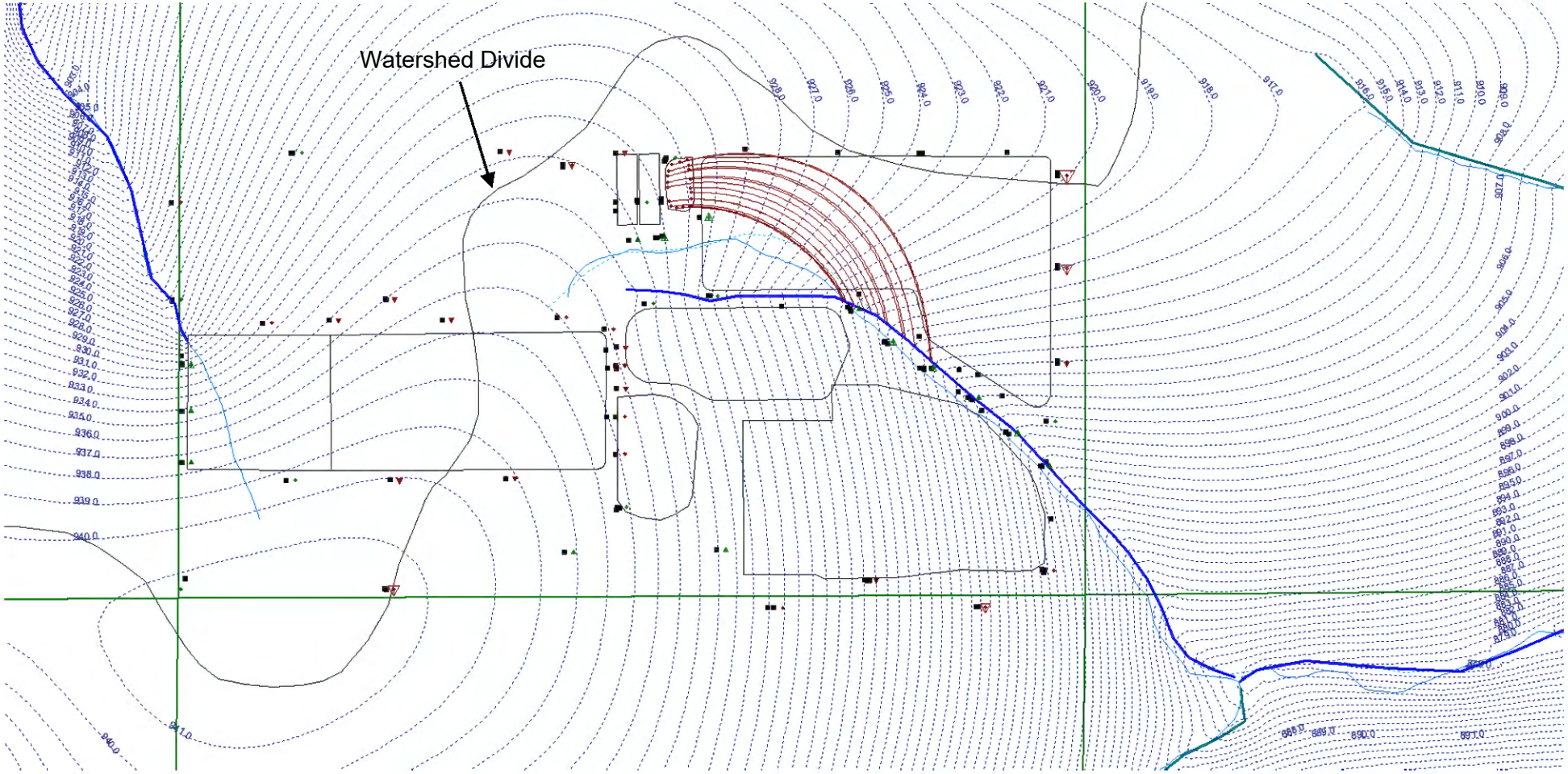

AECOM

FIGURE 3-15
Theoretical Release: Asbestos Cell No. 2

BLACK HAWK COUNTY LANDFILL
2023 HMSP

FEB 2023

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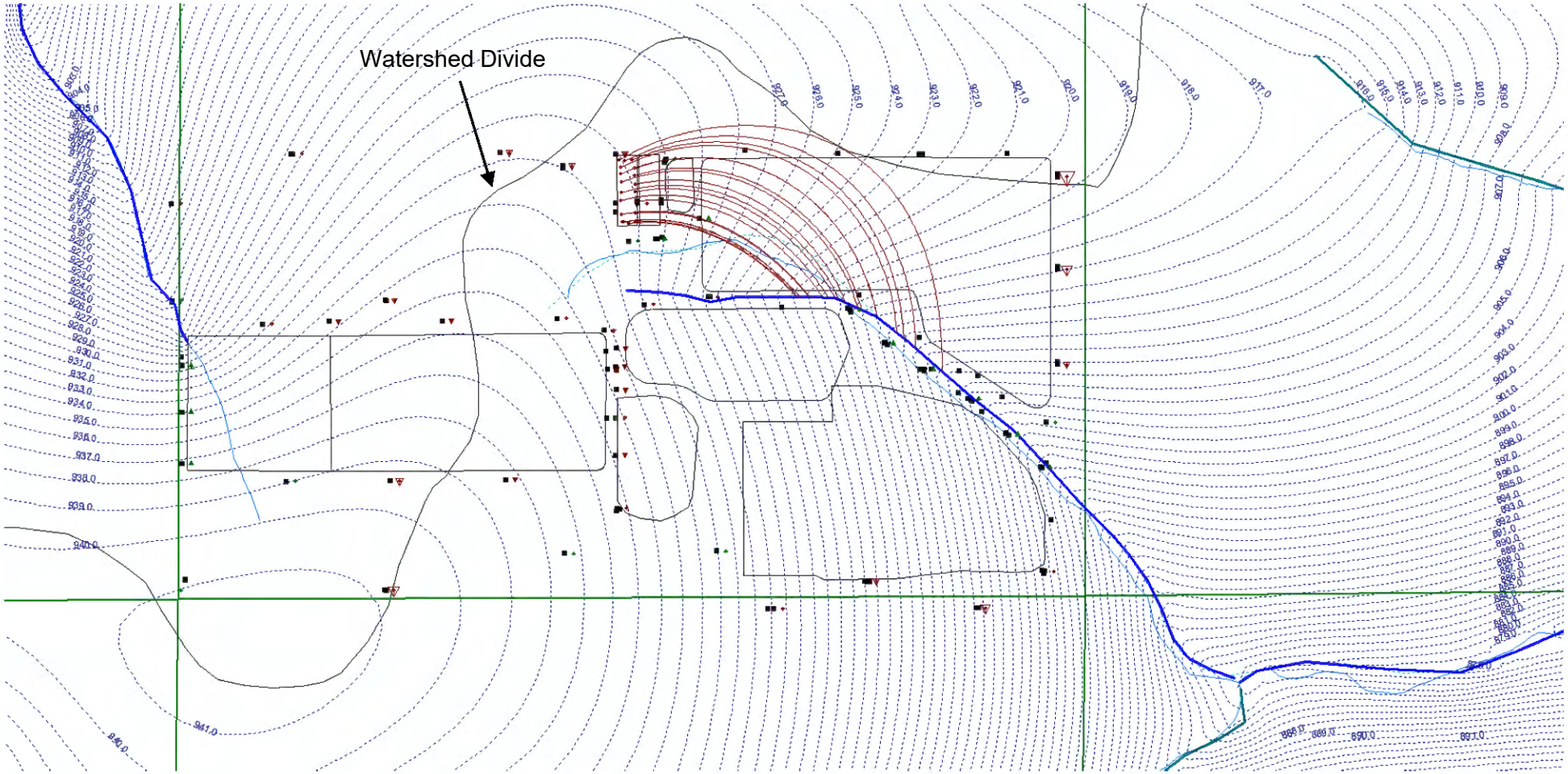


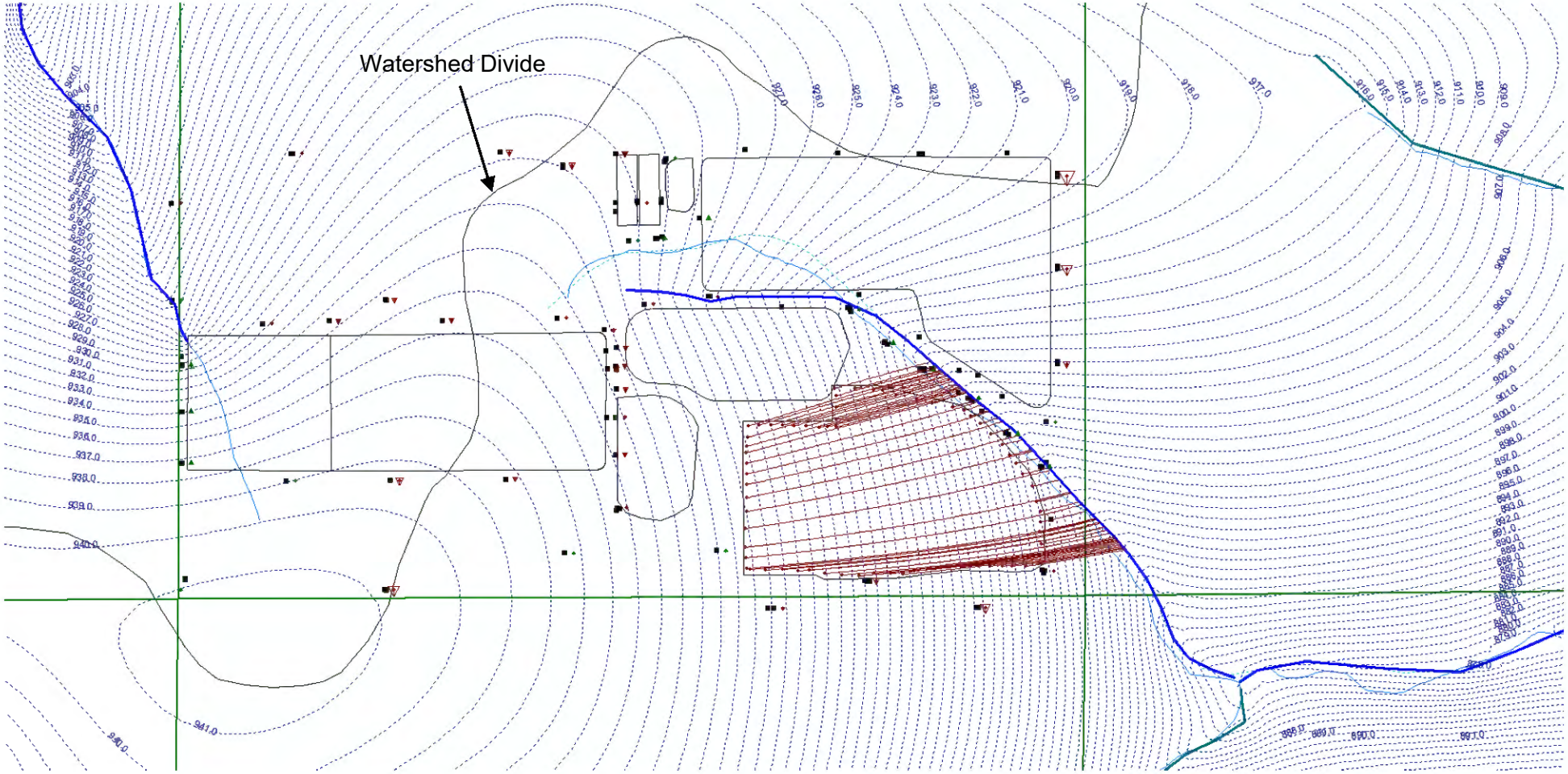
AECOM

FIGURE 3-16
Theoretical Release: Neutral Trench

BLACK HAWK COUNTY LANDFILL
2023 HMSP

FEB 2023

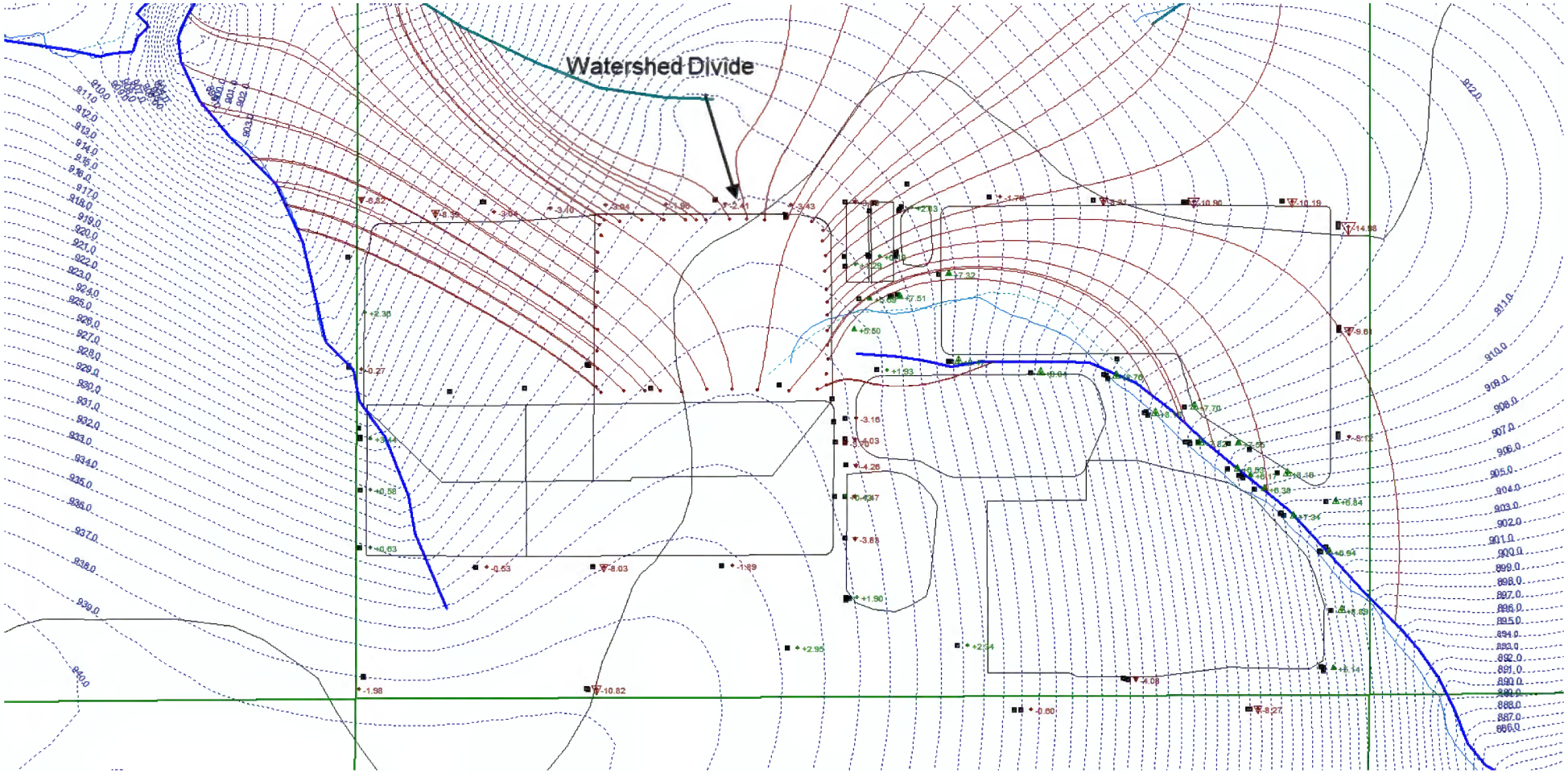
60699034



AECOM

FIGURE 3-17
Theoretical Release: Co-Disposal Area

BLACK HAWK COUNTY LANDFILL
2023 HMSP
FEB 2023
60699034



AECOM

FIGURE 3-18
Theoretical Release: Cell W3

BLACK HAWK COUNTY LANDFILL
2023 HMSP

FEB 2023

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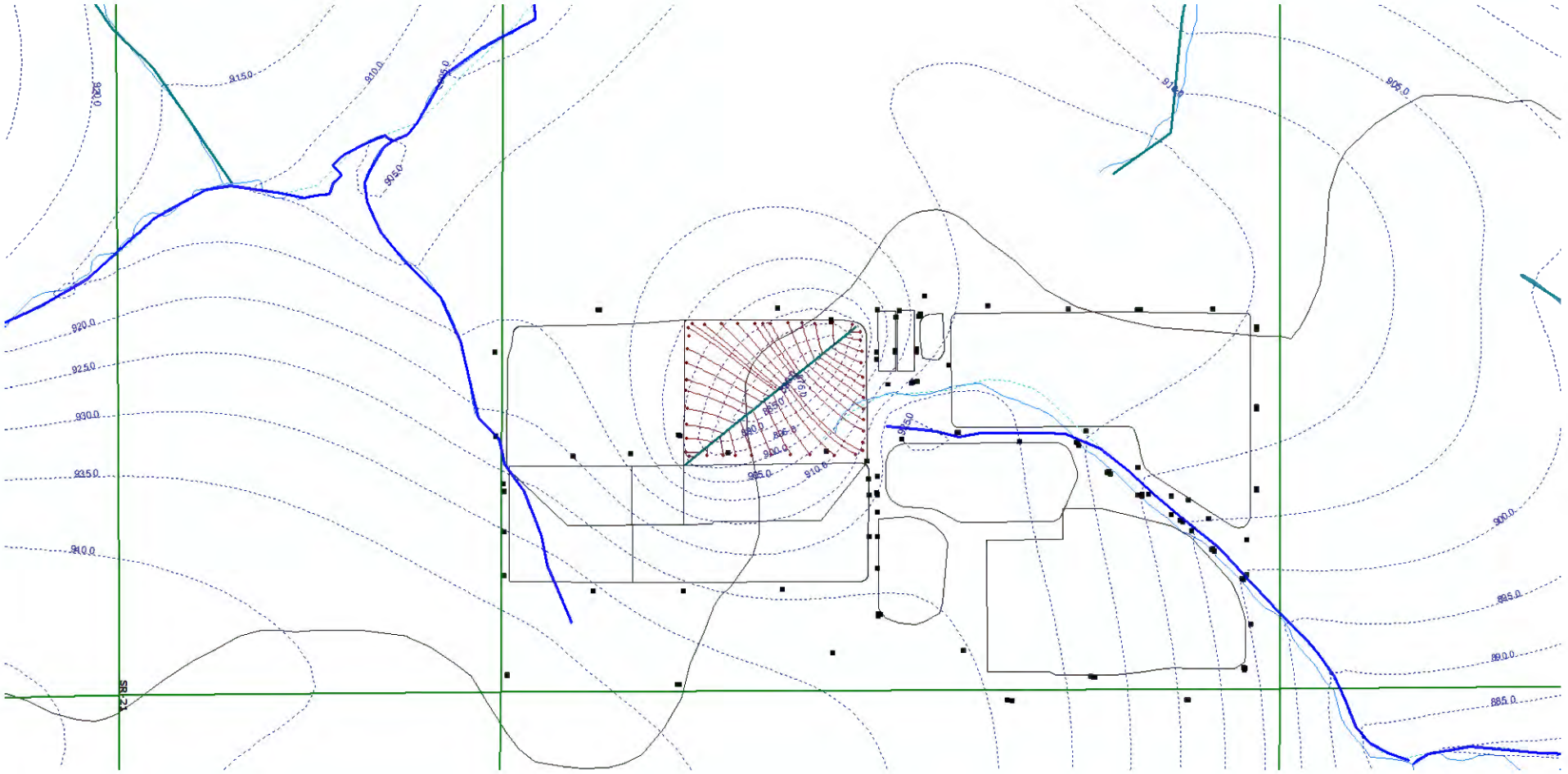
920.0
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960.0
965.0
970.0
975.0
980.0
985.0
990.0
995.0
1000.0
1005.0
1010.0
1015.0
1020.0
1025.0
1030.0
1035.0
1040.0
1045.0
1050.0
1055.0
1060.0
1065.0
1070.0
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1090.0
1095.0
1100.0
1105.0
1110.0
1115.0
1120.0

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RCRA NEUTRAL TRENCH 1988 (CLOSED)

ASBESTOS CELL I
2009 (CLOSED)

ASBESTOS CELL II
2008-PRESENT

TOPSOIL
STOCKPILE NO. 3
0 CY

TOPSOIL
CKPILE NO. 4
3,000 CY

FG PLANT
SITE

CELL W4
PHASE I
(FUTURE)

ROCK
STOCKPILE

CLAY BARRIER
STOCKPILE
NO. 9B
56,000 CY

CELL W3
PHASE I
(EXISTING)
2021–

CELL W4
PHASE II
(FUTURE)

CELL W4
PHASE III
(FUTURE)

CELL W3
PHASE II
(PROJECT AREA)

TOPSOIL
STOCKPILE NO. 8
32,000 CY

MH AND PIPE
STOCKPILE AREA

AREA 'E'
1991–1999
(CLOSED)

CELL 'X'
1999–2008
(CLOSED)

AREA 'C'
1986–1991
(CLOSED)

HAMMOND AVENUE

STOCKPILE NO. 2
949,000 CY

CELL W2
(EXISTING)
2014–

CELL W1
PHASE IV
(EXISTING)
2012–

CELL W1
PHASE III
(EXISTING)
(PARTIALLY
CLOSED)
2010–

CELL W1
PHASE II
(CLOSED)
2008–2018

CELL W1
PHASE I
(CLOSED)
2007–2014

AREA 'A'
(CLOSED)
1975–1980

HESS ROAD

SLURRY WALL

RCRA
CO–DISPOSAL AREA
1989 (CLOSED)
ORIGINAL AREA 'F'
1975–1986

STOCKPILE NO. 7
173,000 CY

TOPSOIL
STOCKPILE NO. 6
46,000 CY

CELL W5
(FUTURE)

SCALES AND
SCALE HOUSE

SHOP

RUN-OFF
BASIN

SMALL LOADS

YARD WASTE
COMPOST
FACILITY

LANDFILL MAIN ENTRANCE

SILTATION
BASIN

WASHBURN ROAD

MW-703B MW-704B MW-705B MW-706B MW-707B MW-708B MW-709B MW-710B MW-711B MW-712B MW-304B MW-702B MW-701B OW-604B OW-603B OW-602B OW-606B MW-318BR MW-319B MW-320B MW-409B OW-101B OW-102D OW-102B OW-103B OW-104B OW-212B OW-209B OW-224B OW-225B OW-220B OW-226B OW-113B OW-227B OW-105B OW-221B OW-214BR OW-106B OW-222B OW-117B OW-223B OW-107BR OW-116B OW-209B OW-106B OW-109B OW-115B OW-118B OW-110B OW-414B OW-207B OW-208B OW-501B OW-413B OW-412B OW-402B P-402A OW-414B OW-401B OW-411B OW-410B OW-408B OW-407B OW-114B OW-210B OW-218B OW-213BR OW-217B OW-216BR OW-215BR

N

0′ 100′ 200′ 400′
SCALE

PREPARED BY:

AECOM

501 SYCAMORE STREET SUITE 222 WATERLOO, IA. 50703-4644 1-319-232-6531

FIGURE 4-1
WATER TABLE AND UNDERDRAIN MON PTS
HYDROLOGIC MONITORING SYSTEM PLAN
BLACK HAWK COUNTY LANDFILL
WATERLOO, IOWA

JAN 2025 60746421

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Waterloo, Iowa
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RCRA NEUTRAL TRENCH 1988 (CLOSED)

ASBESTOS CELL I
2009 (CLOSED)

ASBESTOS CELL II
2008-PRESENT

MW-703C

TOPSOIL
STOCKPILE NO. 3
0 CY

TOPSOIL
CKPILE NO. 4
3,000 CY

FG PLANT
SITE

CELL W4
PHASE I
(FUTURE)

ROCK
STOCKPILE

CLAY BARRIER
STOCKPILE
NO. 9B
56,000 CY

CELL W3
PHASE I
(EXISTING)
2021–

P-213C

P-216CR

P-102C

P-103C

P-101C

P-104C

AREA 'E'
1991–1999
(CLOSED)

CELL 'X'
1999–2008
(CLOSED)

P-215CR

TOPSOIL
STOCKPILE NO. 8
32,000 CY

MH AND PIPE
STOCKPILE AREA

CELL W4
PHASE II
(FUTURE)

CELL W4
PHASE III
(FUTURE)

CELL W3
PHASE II
(PROJECT AREA)

P-113C

AREA 'C'
1986–1991
(CLOSED)

P-105C

P-214CR

P-604C

P-102C

P-106C

P-107C

HAMMOND AVENUE

CELL W2
(EXISTING)
2014–

CELL W1
PHASE IV
(EXISTING)
2012–

CELL W1
PHASE III
(EXISTING)
(PARTIALLY
CLOSED)
2010–

CELL W1
PHASE II
(CLOSED)
2008–2018

CELL W1
PHASE I
(CLOSED)
2007–2014

AREA 'A'
(CLOSED)
1975–1980

P-108C

HESS ROAD

P-109C

SLURRY WALL

STOCKPILE NO. 2
949,000 CY

STOCKPILE NO. 7
173,000 CY

TOPSOIL
STOCKPILE NO. 6
46,000 CY

CELL W5
(FUTURE)

LANDFILL MAIN ENTRANCE

YARD WASTE
COMPOST
FACILITY

SCALES AND
SCALE HOUSE

RUN-OFF
BASIN

P-114C

SHOP

SMALL LOADS

RCRA
CO–DISPOSAL AREA
1989 (CLOSED)
ORIGINAL AREA 'F'
1975–1986

P-111C

P-110C

SILTATION
BASIN

MW-318CR

WASHBURN ROAD

N

0' 100' 200' 400'
SCALE

PREPARED BY:

AECOM

501 SYCAMORE STREET SUITE 222 WATERLOO, IA. 50703-4644 1-319-232-6531

FIGURE 4-2
BEDROCK MONITORING POINTS
HYDROLOGIC MONITORING SYSTEM PLAN
BLACK HAWK COUNTY LANDFILL
WATERLOO, IOWA

JAN 2025

60746421



PREPARED BY:

AECOM

501 SYCAMORE STREET SUITE 222 WATERLOO, IA. 50703-4644 1-319-232-6531

FIGURE 12-1

STORM WATER SITE MAP
HYDROLOGIC MONITORING SYSTEM PLAN

BLACK HAWK COUNTY LANDFILL
WATERLOO, IOWA

JAN 2025 60746421

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Waterloo, Iowa
Printed from MicroStation V8i
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APPENDIX A

BORING LOGS AND IOWA DNR MONITORING WELL/PIEZOMETER CONSTRUCTION DOCUMENTATION FORMS (FORM 542-1277)

APPENDIX A-1
Boring Logs

LOG OF TEST BORING

JOB NO 4800 86-873 VERTICAL SCALE 1" = 4' BORING NO B 101

PROJECT BLACK HAWK COUNTY LANDFILL - WATERLOO, IOWA

DEPTH IN FEET	DESCRIPTION OF MATERIAL (SURFACE ELEVATION ____)	GEOLOGIC ORIGIN	R	WL	SAMPLE NO	SAMPLE TYPE	LABORATORY TESTS W	D	⌐	Qu
	ORGANIC CLAY, black to dark brown (OL)	TOPSOIL	---							
			48%		1	CS				
4	SILTY SAND AND A LITTLE GRAVEL, brown, a layer of Lean Clay at 4.8' (SM)	COARSE ALLUVIUM							*	MA
									*	MA
			46%	▽	2	CS				
9	SAND W/SILT AND W/GRAVEL, brown (SP-SM)									MA
10½	SANDY LEAN CLAY W/A LITTLE GRAVEL, brown and brown and gray mottled, some lenses of Sand (CL)	TILL							*	MA
			70%		3	CS			*	MA
			98%		4	CS			*	MA
20	LEAN CLAY W/SAND AND A LITTLE GRAVEL, gray (CL)		100%		5	CS	*	*	*	n/MA
			100%		6	CS				
28.9	a layer of Silty Sand									MA
			100%		7	CS				MA
30	Boring Continued Next Page									

SE-3 (77-B)-4

twin city testing corporation

LOG OF TEST BORING

JOB NO 4800 86-873 VERTICAL SCALE 1" = 4' BORING NO B 101 (Cont'd

PROJECT BLACK HAWK COUNTY LANDFILL - WATERLOO, IOWA

DEPTH IN FEET	DESCRIPTION OF MATERIAL (30')	GEOLOGIC ORIGIN	R	WL	SAMPLE NO	SAMPLE TYPE	LABORATORY TESTS W	D	⌐	Qu
	LEAN CLAY W/SAND AND A LITTLE GRAVEL (continued)	TILL (continued)	100%		8	CS				
			100%		9	CS				
			100%		10	CS				
			100%		11	CS				
			100%		12	CS				
			100%		13	CS				
60	Boring Continued Next Page									

SE-3 (77-B)-4

twin city testing corporation

LOG OF TEST BORING

JOB NO 4800 86-873 VERTICAL SCALE 1" = 4' BORING NO B 101 (Cont'd)
PROJECT BLACK HAWK COUNTY LANDFILL - WATERLOO, IOWA

DEPTH IN FEET	DESCRIPTION OF MATERIAL ~60'	GEOLOGIC ORIGIN	R	WL	SAMPLE NO	SAMPLE TYPE	LAB TESTS W	LAB TESTS D	LAB TESTS LL/PL	LAB TESTS Qu
	LEAN CLAY W/SAND AND A LITTLE GRAVEL (continued)	TILL (continued)	100%		14	CS			*	MA
	*-Boring advanced with 2 15/16" tricone		*							
	— a layer of Clayey Sand		93%		15	CS				MA
			100%		16	CS			*	MA
69	SAND W/SILT, fine to medium grained, gray (SP-SM)	COARSE ALLUVIUM								
			46%		17	CS				
			100%		18	CS				
76	SANDY LEAN CLAY W/A LITTLE GRAVEL, gray (CL)	TILL	87%		19	CS			*	MA
			100%		20	CS			*	MA
86	WEATHERED LIMESTONE, tan to buff	CEDAR VALLEY FORMATION	100%		21	CS				
88.4	END OF BORING									

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	BAILED DEPTHS	WATER LEVEL
9-8	11:30	9'	9'	-	to	7'
					to	
					to	
					to	

START 9-9-86 COMPLETE 9-10-86
METHOD @ 5:30
HSA 0-88.4'
CREW CHIEF Johnson

SE-2 (77-8) -4 twin city testing corporation

LOG OF TEST BORING

JOB NO 4800 86-873 VERTICAL SCALE 1" = 4' BORING NO P 101C
PROJECT BLACK HAWK COUNTY LANDFILL - WATERLOO, IOWA

DEPTH IN FEET	DESCRIPTION OF MATERIAL 85'	GEOLOGIC ORIGIN	R	WL	SAMPLE NO	SAMPLE TYPE	LAB TESTS W	LAB TESTS D	LAB TESTS LL/PL	LAB TESTS RQD
85.8	No Samples Taken (See #1)									
	LIMESTONE, tan to buff	CEDAR VALLEY FORMATION	93%		1	NQ				24%
			94%		2	NQ				64%
			100%		3	NQ				56%
			90%		4	NQ				48%
			96%		5	NQ				50%
110.4	END OF BORING									
	#1-boring put down inside 6" PVC									

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	BAILED DEPTHS	WATER LEVEL
10-16	5:00	110.4'	-	-	to	NMR
					to	
					to	
					to	

START 10-16-86 COMPLETE 10-16-86
METHOD @ 5:00
NRC 0-85.8'
NQ Core 85.8'-110.4'
CREW CHIEF Johnson

twin city testing

LOG OF TEST BORING

JOB NO 4800 86-873 VERTICAL SCALE 1" = 4' BORING NO B 102
PROJECT BLACK HAWK COUNTY LANDFILL - WATERLOO, IOWA

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	R or N	WL	SAMPLE NO	SAMPLE TYPE	LAB TESTS W	LAB TESTS D	LAB TESTS -200	LAB TESTS
	surface elevation not taken									
	FILL, mostly SANDY LEAN CLAY, gray and brown		97%		1	CS				
	Note: No sample recovered from 14'-24'		100%		2	CS				
			54%		3	CS				
			0%		4	CS				
			0%		5	CS				
24	SANDY LEAN CLAY W/A LITTLE GRAVEL, gray (may be FILL) (CL)	TILL (May be FILL)	17		6	SB				
27	SANDY LEAN CLAY W/A LITTLE GRAVEL, gray (CL)	TILL	100%		7	CS				
29	a layer of Sand, medium grained (SP)								*	K/MA
30	Boring Continued Next Page									

twin city testing corporation

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LOG OF TEST BORING

JOB NO. 4800 86-873 VERTICAL SCALE 1" = 4' BORING NO B 102 (Cont'd)
PROJECT BLACK HAWK COUNTY LANDFILL - WATERLOO, IOWA

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	R or N	WL	SAMPLE NO	SAMPLE TYPE	LAB TESTS W	LAB TESTS D	LAB TESTS -200	LAB TESTS
	30'									
31	SANDY LEAN CLAY (continued)	TILL	100%		8	CS			*	n/MA
			*							
			83%		9	CS				
			100%		10	CS			*	n/MA/K
			100%		11	CS				
			100%		12	CS				
50	Boring Continued on Next Page									
	*2 15/16" Tricone used to advance boring									

twin city testing corporation

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LOG OF TEST BORING

JOB NO 4800 86-873 VERTICAL SCALE 1" = 4' BORING NO B 102 (Cont'd)
PROJECT BLACK HAWK COUNTY LANDFILL - WATERLOO, IOWA

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	R	WL	SAMPLE NO	SAMPLE TYPE	LAB TESTS W	LAB TESTS D	LAB TESTS LL/PL
	50'								
	SANDY LEAN CLAY (continued)	TILL (continued)	100%		13	CS			
			20%		14	CS			
			100%		15	CS			
64.2	END OF BORING								

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	BAILED DEPTHS	WATER LEVEL
9-23	-	64.2'	-	-	to	NMR
					to	
					to	
					to	

START 9-17-86 COMPLETE 9-23-86
METHOD @ -
HSA 0-64.2'
CREW CHIEF Johnson

SE-2 (77-B)-4 twin city testing corporation

LOG OF TEST BORING

JOB NO 4800 86-873 VERTICAL SCALE 1" = 4' BORING NO P 102C
PROJECT BLACK HAWK COUNTY LANDFILL - WATERLOO, IOWA

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	R	WL	SAMPLE NO	SAMPLE TYPE	LAB TESTS W	LAB TESTS D	LAB TESTS LL/PL	RQD
	85'									
	No Samples Taken boring put down inside 6" PVC									
88.3	LIMESTONE, tan to buff	CEDAR VALLEY FORMATION	80%		1	NQ				20%
			100%		2	NQ				20%
			100%		3	NQ				34%
			86%		4	NQ				8%
			52%		5	NQ				0%
110.2	END OF BORING									

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	BAILED DEPTHS	WATER LEVEL
10-14	4:30	110.2'	-	-	to	NMR
					to	
					to	
					to	

START 10-14-86 COMPLETE 10-14-86
METHOD @ 4:30
NRC 0-88.3'
NQ Core 88.3'-110.2'
CREW CHIEF J. Fix

SE-2 (77-B)-4 twin city testing corporation

LOG OF TEST BORING

JOB NO 4800 86-873 VERTICAL SCALE 1" = 4' BORING NO B 103

PROJECT BLACK HAWK COUNTY LANDFILL - WATERLOO, IOWA

DEPTH IN FEET	DESCRIPTION OF MATERIAL (SURFACE ELEVATION)	GEOLOGIC ORIGIN	R or N	WL	SAMPLE NO	SAMPLE TYPE	LAB TESTS W	LAB TESTS D	LAB TESTS LL/PL	LAB TESTS Qu
	FILL, mostly LEAN CLAY and some Silty Clay, brown and grayish brown	FILL								
1½	ORGANIC CLAY, black (OL)	TOPSOIL	85%		1	CS				
3	LEAN CLAY, grayish brown to brown (CL)	FINE ALLUVIUM							*	MA
5	SANDY LEAN CLAY W/A LITTLE GRAVEL, brown to grayish brown, lenses of wet to waterbearing Sand (CL)	TILL	84%		2	CS			*	MA
									*	MA
									*	MA
8½	SAND, fine to medium grained, brown (SP)	COARSE ALLUVIUM							*	MA
10	SANDY LEAN CLAY W/A LITTLE GRAVEL, brown to grayish brown, a layer of Silty Sand at 10' (CL)	TILL	48%	▼	3	CS				K
13½	SANDY LEAN CLAY W/A LITTLE GRAVEL, gray (CL-SC)		100%		4	CS			*	n/MA
			100%		5	CS				
			100%		6	CS			*	n/MA
28½										K
29½	a layer of Sand, fine grained, gray, waterbearing (SP-SM)									
30	Boring Continued on Next Page									

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twin city testing corporation

LOG OF TEST BORING

JOB NO 4800 86-873 VERTICAL SCALE 1" = 4' BORING NO B 103 (Cont'd)

PROJECT BLACK HAWK COUNTY LANDFILL - WATERLOO, IOWA

DEPTH IN FEET	DESCRIPTION OF MATERIAL (30')	GEOLOGIC ORIGIN	R	WL	SAMPLE NO	SAMPLE TYPE	LAB TESTS W	LAB TESTS D	LAB TESTS LL/PL	LAB TESTS Qu
	SANDY LEAN CLAY (continued) (CL-SC)	TILL (continued)	100%		7	CS				
			100%		8	CS				
			100%		9	CS			*	n/MA
			100%		10	CS				
			100%		11	CS			*	n/MA
			100%		12	CS				
60	Boring Continued on Next Page									

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twin city testing corporation

LOG OF TEST BORING

JOB NO 4800 86-873 VERTICAL SCALE 1" = 4' BORING NO B 103 (Cont'd)

PROJECT BLACK HAWK COUNTY LANDFILL - WATERLOO, IOWA

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	R	WL	SAMPLE NO	SAMPLE TYPE	LAB W	LAB D	LAB LL/PL	
	60'									
	SANDY LEAN CLAY (continued)	TILL (continued)	100%		13	CS				
									*	n/MA
			100%		14	CS				
			96%		15	CS				
			100%		16	CS				
			100%		17	CS				
82½	WEATHERED LIMESTONE, brown	*								
83	END OF BORING	*CEDAR VALLEY FORMATION								

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	BAILED DEPTHS	WATER LEVEL
10-9	4:35	13.2'	-	-	to	13.0'
10-9	10:35	83.0'	-	-	to	20.4'
					to	
					to	

START 10-9-86 COMPLETE 10-10-86

METHOD HSA 0-83' @ 10:15

CREW CHIEF Johnson

SE 2 (77-B)-4

twin city testing corporation

LOG OF TEST BORING

JOB NO 4800 86-873 VERTICAL SCALE 1" = 4' BORING NO B-106

PROJECT BLACK HAWK COUNTY LANDFILL - WATERLOO, IOWA

DEPTH IN FEET	DESCRIPTION OF MATERIAL (SURFACE ELEVATION)	GEOLOGIC ORIGIN	R	WL	SAMPLE NO	SAMPLE TYPE	LAB TESTS W	D	LL/PL	Qu
	ORGANIC CLAY, black (OL)	TOPSOIL	77%		1	CS				
4	CLAYEY SAND, dark brown and brown (SC)	FINE ALLUVIUM		▼					*	n MA
5½	SANDY LEAN CLAY W/A LITTLE GRAVEL, gray and brown mottled (CL)	TILL	74%		2	CS			*	K/MA
7½	SAND W/SILT and A LITTLE GRAVEL, medium to fine grained, brown, wet to waterbearing (SP-SM)	COARSE ALLUVIUM								K
10½	SANDY LEAN CLAY W/A LITTLE GRAVEL, brownish gray to 14' then gray (CL)	TILL	74%		3	CS				
14	a layer of Clayey Sand		66%		4	CS			*	n/MA
			12%		5	CS				
			0%		6	NSR				
30	Boring Continued Next Page									

SE-3 (77-B)-4 twin city testing corporation

LOG OF TEST BORING

JOB NO 4800 86-873 VERTICAL SCALE 1" = 4' BORING NO. B 106 (Cont'd)

PROJECT BLACK HAWK COUNTY LANDFILL - WATERLOO, IOWA

DEPTH IN FEET	30' DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	R	WL	SAMPLE NO	SAMPLE TYPE	LAB TESTS W	D	LL/PL	Qu
	SANDY LEAN CLAY W/A LITTLE GRAVEL (continued)	TILL (continued)	94%		7	CS				
			100%		8	CS				
			100%		9	CS				
			100%		10	CS				
			100%		11	CS				
			100%		12	CS			*	n/MA/K
			100%		13	CS				
60	Boring Continued Next Page									

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LOG OF TEST BORING

JOB NO 4800 86-873 VERTICAL SCALE 1" = 4' BORING NO B 106 (Cont'd)
PROJECT BLACK HAWK COUNTY LANDFILL - WATERLOO, IOWA

DEPTH IN FEET	DESCRIPTION OF MATERIAL 60'	GEOLOGIC ORIGIN	R or N	WL	SAMPLE NO	SAMPLE TYPE	LAB TESTS W	D	LL/PL	Qu
	SANDY LEAN CLAY W/A LITTLE GRAVEL (continued)	TILL (continued)	100%		14	CS				
66½	WEATHERED LIMESTONE, brown, tan and buff, layers of Fat Clay	CEDAR VALLEY FORMATION	100%		15	CS			*	n/MA/K
			100%		16	CS				
70.4	OBSTRUCTION: End of Boring		100 / 0.1		17	NSR				

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	BAILED DEPTHS	WATER LEVEL
8-21	2:15	8.9'	8.9'	-	to	5.9'
8-21	9:00	44.0'	44.0'		to	32.5'
8-21	1:30	70.4'	69.7'		to	69.7'

START 8-20-86 COMPLETE 8-21-86
METHOD HSA 0-69.7' @ 11:15
2 15/16" Tricone 69.7'-70.4'
CREW CHIEF Johnson

SE 2 (77-B)-4 twin city testing corporation

LOG OF TEST BORING

JOB NO 4800 86-873 VERTICAL SCALE 1" = 4' BORING NO P 106 C
PROJECT BLACK HAWK COUNTY LANDFILL - WATERLOO, IOWA

DEPTH IN FEET	DESCRIPTION OF MATERIAL 80'	GEOLOGIC ORIGIN	R	WL	SAMPLE NO	SAMPLE TYPE	LAB TESTS W	D	LL/PL	RQD
	NO SAMPLES recovered.									
	Boring put down through 6" PVC.									
82.3	Rock first encountered at 82.0'.									
	LIMESTONE, tan to buff, fractured and broken	CEDAR VALLEY FORMATION	65%		1	NQ				17%
			32%		2	NQ				14%
89½	a layer of FAT CLAY									
90½	a layer of FAT CLAY									
			22%		3	NQ				0%
			20%		4	NQ				1[illegible]
			50%		5	NQ				0%
			83%		6	NQ				33%
			64%		7	NQ				0%
107.7	END OF BORING									

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	BAILED DEPTHS	WATER LEVEL
8-25	-	107.7'	-	-	to	NMR
					to	
					to	
					to	

START 8-24-86 COMPLETE 8-25-86
METHOD NRC 0-82.3' @ 4:4[illegible]
NQ Core 82.3'-107.7'
CREW CHIEF Johnson

SE 2 (77-B)-4 twin city testing corporation

AECOM **FIELD BORING LOG WITH ATMOSPHERIC MONITORING**

SITE: Black Hawk Co LF PROJECT NO.: 60284307 BORING NO.: B-106AR

WATER LEVEL READINGS

DATE/ TIME	WATER DEPTH	HOLE DEPTH	CASING DEPTH

DRILLING METHOD: 4 1/4-inch ID HSA w/2-inch dia by 2-foot long splitspoon sampler
LOG BY: Jeff Maletzke
FIRM/DRILLER: Braun Intertec/R. Hunt
PHYSICAL SETTING: Drainage swale by Co dep. / Area

GROUND SURFACE ELEV.:
COORDINATE TYPE:
NORTH:
EAST:
DATE/TIME START: 6/18/13 / 1017
DATE/TIME COMPLETE: 6/18/13 / 1245
ABANDONMENT DATE: NR
ABANDONMENT METHOD: NR
WELL INSTALLATION DATE:

DEPTH IN FEET	GRAPHIC LOG	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS	SAMPLING DATA B	N	A	R	Sample Type	Sample Interval	AIR MONITORING TIME	PID	Q2/ LEL	O2/ H2S
0		CL	Medium, 7.5YR, 4/1, dark gray, LEAN CLAY (CL) w/trace gravel, dry, low plasticity, cohesive, FILL	4				SS		1017	0	0	20.9 / 0
				4									
1				3									
				2	7								
2		CL	Medium, 10YR, 4/2, dark grayish brown to 10YR 4/3, Brown, LEAN CLAY w/	2									
			trace sand and gravel, dry, low to	3									
3			medium plasticity, cohesive, FILL	4									
				4	7					1025			
4		CL	Medium, 2.5Y, 2.5/1, black, LEAN CLAY w/trace sand, moist, low to	3									
			medium plasticity, cohesive, FILL	3									
5				5									
			slight 7 gravel sand? in top of spoon	6	8					1035	0	0	20.9 / 0
6		CL	Loose, black LEAN CLAY as above	2									
			to 7 feet bgs, transition to 2.5Y 4/2	2									
7			dark grayish brown LEAN CLAY w/ few	2									
		SP	sand, black POORLY GRADED SAND	3									
		CL	loose @ 7-7.5, wet	3	5								
8		CL	Medium, 2.5Y, 2.5/1, black LEAN CLAY w/ sand, moist, medium plasticity,	2									
			cohesive, LOESS	3									
9				2									
				3	5								

AECOM **FIELD BORING LOG WITH ATMOSPHERIC MONITORING**

SITE: Black Hawk Co. LF PROJECT NO.: 60284307 BORING NO.: B-106AR

DEPTH IN FEET	GRAPHIC LOG	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS	SAMPLING DATA B	N	A	R	Sample Type	Sample Interval	AIR MONITORING TIME	PID	Q2/ LEL
		CL	Medium, 2.5Y, 4/1, dark gray and 2.5Y, 4/3 olive brown, LEAN CLAY w/sand	2				SS				
			moist, medium plasticity, cohesive, LOESS	2								
11				3								
		SW	changes to 2.5Y, 5/3 lt. olive brown at 11.5 ft bgs with v. thin seam of gravel	3	5					1045	0	0 / 20.9 / 0
12			Medium, 2.5Y, 6/3 light yellowish	2								
			brown, SANDY LEAN CLAY, moist	2								
13			to wet, trace gravel / coarse sand,	3								
			low to med. plasticity, cohesive,	4	5							
			LOESS	3								
14			Very loose, 10YR 5/6, yellowish brown	2								
			WELL GRADED SAND (SW) @ ~ 15-15.5	2								
			ft bgs, wet, noncohesive, nonplastic, sharp	3								
15		SW	contact with 10YR 4/6 dark yellowish	2								
			brown SANDY LEAN CLAY between	2								
		CL	15.5-16, wet, low plasticity, cohesive,	3	4					1055	0	0 / 20.9 / 0
16			LOESS / EOLIAN SAND	4								
		CL	Stiff 10YR 4/1 dark gray LEAN	6								
			CLAY w/ SAND, (CL) moist to wet	7								
17			low plasticity, cohesive, Pre-Illinoian	10	13							
			glacial diamicton	3								
18		CL	Stiff dark gray LEAN CLAY	5								
			diamicton as above from 16-18	6								
19				6								
				6	11					1105		
20		CL	Stiff, dark gray LEAN CLAY	3								
			diamicton as above from 18 to 20	6								
21				6								
				9	12					1111	0	0 / 20.9 / 0
22				8								

Sheet 3 of 4

AECOM **FIELD BORING LOG WITH ATMOSPHERIC MONITORING**

SITE: Black Hawk Co. LF PROJECT NO.: 60284307 BORING NO.: B-106AR

DEPTH IN FEET	GRAPHIC LOG	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS	SAMPLING DATA B	N	A	R	Sample Type	Sample Interval	AIR MONITORING TIME	PID	Q2/ LEL	O2/ H2S
23		CL	Very stiff dark gray clay/silt (CL) as above from 20 to 22	8				SS					
				10									
				13	18					1120	0	0	20.9 0
24		CL	Very stiff dark gray clay/silt (CL) as above from 22-24	4									
				8									
25				10									
				14	18					1130	0	0	20.9 0
26		CL	Very stiff dark gray clay/silt (CL) as above from 24-26	6									
				8									
27				13									
				20	21								
28		CL	Very stiff, dark gray clay/silt (CL)	5									
		SP	sand (SP) lense @ 28.5 ft bgs (wet)	8									
29		CL		15									
				16	23					1145			
30		CL	Very stiff dark gray clay/silt (CL) as above from 26-28	6									
				8									
31				15									
				20	23					1155			
32		CL		12									
*			Hard, dark gray clay/silt (CL) as	17									
33			above from 30 32; v. thin sandy	20									
			clay seams between 32-32.5, wet	21	37					1205	0	0	20.9 0
34		CL	Very stiff dark gray clay/silt (CL)	8									
		SP	as above from 32.5-34 1/4-inch sand	10									
		CL	seam @ 34.5 (wet)										

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AECOM **FIELD BORING LOG WITH ATMOSPHERIC MONITORING**

SITE: Black Hawk Co LF PROJECT NO.: 60284307 BORING NO.: B-106AR

DEPTH IN FEET	GRAPHIC LOG	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS	SAMPLING DATA B	N	A	R	Sample Type	Sample Interval	AIR MONITORING TIME	PID	Q2/ LEL	O2/ H2S
		CL		14				SS					
35				16	24					1215			
		CL	Hard dark gray clay/silt (CL) as above from 34-36 color change	8									
			to 10YR 4/2 dark grayish brown at 34.5-35	14									
37				19									
				27	33					1225			
38		CL	Very stiff dark gray and dark grayish brown clay/silt (CL) as	8									
			above from 36-38	12									
39				17									
				24	29					1230	0	0	20.9 0
40		CL	Very stiff dark gray and dark grayish brown clay/silt (CL)	8									
			as above from 38-40	13									
41				17									
				21	30					1245			
42			EOB @ 40 ft bgs (553.42')										
			6/18/13 1245										
43													
44													
45													
46													
47													

Atmospheric Monitoring page 2.xlsx

LOG OF TEST BORING

JOB NO 4800 86-873 VERTICAL SCALE 1" = 4' BORING NO B 107

PROJECT BLACK HAWK COUNTY LANDFILL - WATERLOO, IOWA

DEPTH IN FEET	DESCRIPTION OF MATERIAL (SURFACE ELEVATION)	GEOLOGIC ORIGIN	R	WL	SAMPLE NO	SAMPLE TYPE	LAB TESTS W	LAB TESTS D	LAB TESTS LL/PL	LAB TESTS Qu
	ORGANIC CLAY, black, some roots (OL)	TOPSOIL	79%		1	CS				
3½	LEAN CLAY W/SAND, gray (CL)	FINE ALLUVIUM								
6	CLAYEY SAND W/A LITTLE GRAVEL, brownish gray (SC)	MIXED ALLUVIUM	90%	▼	2	CS			*	MA
7.5	a layer of Sandy Lean Clay								*	MA
									*	MA
9	SILTY SAND, fine grained, grayish brown to gray, wet to waterbearing (SM)	COARSE ALLUVIUM	90%		3	CS			*	MA
			0%		4	NSR				
11	SANDY LEAN CLAY W/A LITTLE GRAVEL, gray (CL)	TILL	0%		5	NSR				
			100%		6	CS				
			100%		7	CS				K
									*	n/MA
			100%		8	CS				
			100%		9	CS				
30	Boring Continued Next Page									

twin city testing corporation

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LOG OF TEST BORING

JOB NO 4800 86-873 VERTICAL SCALE 1" = 4' BORING NO B 107 (Cont'd

PROJECT BLACK HAWK COUNTY LANDFILL - WATERLOO, IOWA

DEPTH IN FEET	DESCRIPTION OF MATERIAL (30')	GEOLOGIC ORIGIN	R	WL	SAMPLE NO	SAMPLE TYPE	LAB TESTS W	LAB TESTS D	LAB TESTS LL/PL	LAB TESTS Qu
	SANDY LEAN CLAY W/A LITTLE GRAVEL (continued)	TILL (continued)	100%		10	CS				
			100%		11	CS			*	n/MA/K
			100%		12	CS				
			100%		13	CS				
			100%		14	CS				
			100%		15	CS				
60	Boring Continued Next Page									

twin city testing corporation

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LOG OF TEST BORING

JOB NO 4800 86-873 VERTICAL SCALE 1" = 4' BORING NO B 107 (Cont'd)
PROJECT BLACK HAWK COUNTY LANDFILL - WATERLOO, IOWA

DEPTH IN FEET	DESCRIPTION OF MATERIAL (60')	GEOLOGIC ORIGIN	R or N	WL	SAMPLE NO	SAMPLE TYPE	LAB W	LAB D	LAB LL/PL	LAB Qu
	SANDY LEAN CLAY W/A LITTLE GRAVEL (continued)	TILL (continued)	100%		16	CS				
62	LEAN CLAY W/SAND AND A LITTLE GRAVEL, reddish brown, gray and brown, some pieces of Limestone (CL)		100%		17	CS			*	MA
70½	WEATHERED LIMESTONE, tan to buff to gray, layers of Fat Clay and Sandy Lean Clay	CEDAR VALLEY FORMATION	88%		18	CS			*	n/MA
			87		19	SB				
			28		20	SB			*	K n/MA
84.6	END OF BORING									

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	BAILED DEPTHS	WATER LEVEL
8-19	10:00	8.7'	8.7'	-	to	6.9'
8-19	6:30	84.6'	73.7'	-	to	69.5'
8-20	8:05	84.6'	-	-	to	69.5'
					to	

START 8-19-86 COMPLETE 8-20-86
METHOD @ 8:30
HSA 0-73.7'
2 15/16" Tricone 73.7'-84.6'
CREW CHIEF Johnson

SE 2 (77-8) 4 twin city testing corporation

LOG OF TEST BORING

JOB NO 4800 86-873 VERTICAL SCALE 1" = 4' BORING NO P 107 C
PROJECT BLACK HAWK COUNTY LANDFILL - WATERLOO, IOWA

DEPTH IN FEET	DESCRIPTION OF MATERIAL (75')	GEOLOGIC ORIGIN	R	WL	SAMPLE NO	SAMPLE TYPE	LAB W	LAB D	LAB LL/PL	LAB RQD
	NO SAMPLES recovered. Boring put down through 6" PVC. Rock first encountered at 79.3'.									
79.5	LIMESTONE, tan to buff	CEDAR VALLEY FORMATION								
80½	Fat Clay, reddish brown									
81½			44%		1	NQ				18%
			54%		2	NQ				22%
			78%		3	NQ				35%
95½	a layer of Shale		94%		4	NQ				72%
			100%		5	NQ				68%
105.0	END OF BORING									

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	BAILED DEPTHS	WATER LEVEL
8-22	11:30	105'	-	-	to	NMR
					to	
					to	
					to	

START 8-22-86 COMPLETE 8-22-86
METHOD @ 11:
NRC 0-79.5'
NQ Core 79.5'-105.0'
CREW CHIEF Fix

SE 2 (77-8) 4 twin city testing corporation

Sheet __ of __

AECOM FIELD BORING LOG WITH ATMOSPHERIC MONITORING

SITE: Black Hawk Co. RCRA | PROJECT NO.: _____ | BORING NO.: B107BR

DRILLING METHOD: 4 1/4 HSA; 2-ft x 2-inch SS; continuous sampling

LOG BY: R. Henning

FIRM/DRILLER: Rob Hunt

PHYSICAL SETTING: bay Co-Disposal Area

WATER LEVEL READINGS

DATE/ TIME	WATER DEPTH	HOLE DEPTH	CASING DEPTH

ABANDONMENT DATE: _____

ABANDONMENT METHOD: _____

GROUND SURFACE ELEV.: _____

COORDINATE TYPE: _____

NORTH: _____

EAST: _____

DATE/TIME START: 6/12/2013 1500

DATE/TIME COMPLETE: _____

WELL INSTALLATION DATE: _____

DEPTH IN FEET	GRAPHIC LOG	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS	SAMPLING DATA B	N	A	R	Sample Type	Sample Interval	AIR MONITORING TIME	PID	Q2/ LEL	O2/ H2S
		CL	medium; dark yellowish brown (10YR 3/4); LEAN CLAY; moist; low plasticity, cohesive; thinly bedded, fill					SS		1515	0	0	20.9 0
2								SS					
4				1 2 3 4									
6			medium; very dark brown (10YR 2/2); LEAN CLAY; moist; low plasticity, cohesive, thinly bedded, loess	2 3 3 6	6								
8			medium; as above	2 2	4								
10			medium; as above;	2 2	4								
12			grayish brown (10YR 5/2); LEAN CLAY WITH SAND (CL); moist; low plasticity, cohesive	2 3									
13		CL	bedded; soft; brownish yellow (10YR 6/6) LEAN CLAY WITH SAND AND GRAVEL (CL)	WH WH									
14			moist, low plasticity, cohesive, bedded; dark gray (10YR 4/1) LEAN CLAY WITH SAND (CL)	2 2									
			medium; dark gray as above; loess	2 2	4								
16			; dark grayish brown (10YR 4/2); SANDY LEAN CLAY (CL); moist to wet; low	2 3									
		SP CL	plasticity, cohesive, bedded calcium carbonate	3									
			stiff; dark grayish brown (10YR 4/2); LEAN CLAY WITH SAND (CL); moist; low plasticity, cohesive, bedded, (TILL) diamicton	5 8 10	13								
18			EOB at 18.5 ft bgs										

Atmospheric Monitoring page 1.xls

Sheet 1 of 2

AECOM FIELD BORING LOG WITH ATMOSPHERIC MONITORING

SITE: Black Hawk Co. RCRA | PROJECT NO.: _____ | BORING NO.: B107BR

DRILLING METHOD: 4 1/4 HSA; 2-ft x 2-inch SS continuous sampling

LOG BY: R. Henning

FIRM/DRILLER: Rob Hunt

PHYSICAL SETTING: drainageway by Co-Disposal Area

WATER LEVEL READINGS

DATE/ TIME	WATER DEPTH	HOLE DEPTH	CASING DEPTH

ABANDONMENT DATE: N/A

ABANDONMENT METHOD: N/A

GROUND SURFACE ELEV.: _____

COORDINATE TYPE: _____

NORTH: _____

EAST: _____

DATE/TIME START: 6/12/2013 1500

DATE/TIME COMPLETE: 6/12/2013 1600

WELL INSTALLATION DATE: 6/13/13 0730

DEPTH IN FEET	GRAPHIC LOG	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS	SAMPLING DATA B	N	A	R	Sample Type	Sample Interval	AIR MONITORING TIME	PID	Q2/ LEL	O2/ H2S
			0-2 ft no sample recovered					SS		1515	0	0	20.9 0
1													
2			medium, dark yellowish brown (10YR 3/4) LEAN CLAY (CL); moist, medium to low plasticity, cohesive, bedded, fill										
3													
4			as above from 4.0-4.5 ft					SS					
5													
6			medium, very dark brown (10YR 2/2) LEAN CLAY (CL) moist, low plasticity, cohesive, thinly bedded, LOESS	2 3 3 .5	6			SS					
7													
8			as above from 8.0 to 10 ft	2 2 2 3	4			SS					
9													

Atmospheric Monitoring page 1.xls

AECOM **FIELD BORING LOG WITH ATMOSPHERIC MONITORING**

SITE: Black Hawk & RCRA PROJECT NO.: _____ BORING NO.: B107BR

DEPTH IN FEET	GRAPHIC LOG	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS	SAMPLING DATA B	N	A	R	Sample Type	Sample Interval	AIR MONITORING TIME	PID	Q2/ LEL
10			Medium; as above from 10.0 ft to 11.0 ft	2				SS				
				2	4							
				2								
				3								
11			Medium; grayish brown (10 yr 5/2) LEAN CLAY WITH SAND (CL); moist, low plasticity, cohesive									
			bedded, loess									
12			soft; brownish yellow (10 yr 6/6) LEAN CLAY WITH SAND AND GRAVEL (CL); moist, low plasticity	0				SS				
				0	2							
			cohesive, bedded, loess	2								
				2								
13			; dark gray (10 yr 4/1) LEAN CLAY WITH SAND (CL); moist, low plasticity, cohesive, bedded									
			loess									
14			medium; as above from 14.0 to 15.0 ft	2				SS				
				2	4							
				2								
				3								
15			; dark grayish brown (10 yr 4/2); SANDY LEAN CLAY (CL); moist to wet, low plasticity,									
			cohesive, bedded, loess									
16			loose dark grayish brown (10 yr 4/2) POORLY GRADED SAND (SP) wet, non cohesive, non plastic, coarse sand	3				SS				
				5	13							
			Stiff; dark grayish brown (10 yr 4/2) LEAN CLAY WITH SAND (CL); moist, low plasticity	8								
17				10								
			cohesive, bedded, dia micton, PRE-Illinoian Glacial Diamicton (QWT)									
18												
			EOB at 18.5 ft bgs; set well OW107BR in bore hole									
19												

LOG OF TEST BORING

JOB NO 4800 86-873 VERTICAL SCALE 1" = 4' BORING NO B 110

PROJECT BLACK HAWK COUNTY LANDFILL - WATERLOO, IOWA

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	R	WL	SAMPLE NO	SAMPLE TYPE	LABORATORY TESTS LL/PL	LABORATORY TESTS
	Surface Elevation							
	FILL, mostly LEAN CLAY and SANDY LEAN CLAY, brown to dark brown, a layer of brown Sandy Lean Clay at 2'	FILL	67%		1	CS		
3	SANDY LEAN CLAY W/A LITTLE GRAVEL, brown to brown and gray mottled (CL)	TILL	100%		2	CS	*	MA
9	CLAYEY SAND W/A LITTLE GRAVEL, gray (SC-CL)		100%		3	CS	*	MA
			100%		4	CS	*	MA
			100%		5	CS		
			64%		6	CS		
			62%		7	CS		
			100%		8	CS		
35	Boring Continued Next Page							

LOG OF TEST BORING

JOB NO 4800 86-873 VERTICAL SCALE 1" = 4' BORING NO B 110 (Cont'd)

PROJECT BLACK HAWK COUNTY LANDFILL - WATERLOO, IOWA

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	R	WL	SAMPLE NO	SAMPLE TYPE	LABORATORY TESTS W	LABORATORY TESTS D	LABORATORY TESTS LL/PL	LABORATORY TESTS
	35'									
	SANDY LEAN CLAY (continued)	TILL (continued)	100%		9	CS				
			100%		10	CS				
			100%		11	CS	*	*	*	K/MA n
			100%		12	CS				
			100%		13	CS				
			100%		14	CS			*	MA
65	Boring Continued Next Page									

LOG OF TEST BORING

JOB NO 4800 86-873 VERTICAL SCALE 1" = 4' BORING NO B 110 (Cont'd)
PROJECT BLACK HAWK COUNTY LANDFILL - WATERLOO, IOWA

DEPTH IN FEET	DESCRIPTION OF MATERIAL (65')	GEOLOGIC ORIGIN	R	WL	SAMPLE NO	SAMPLE TYPE	LAB TESTS W	LAB TESTS D	LAB TESTS LL/PL	
	SANDY LEAN CLAY (continued)	TILL (continued)	100%		15	CS	*	*	*	n/MA K
69	WEATHERED LIMESTONE, reddish brown to brown, slabs and pieces of limestone [Textural Classification: FAT CLAY W/SAND, some pieces of limestone (CH)	CEDAR VALLEY FORMATION	54%	▼	16	CS	*	*	*	K n/MA
			10%		17	CS				
			10%		18	CS				
			32%		19	CS				
	**Boring advanced below 69' with little resistance. Action of drilling equipment indicates solution cavity within limestone - partially filled with soft Fat Clay.		**							
100	Boring Continued Next Page									

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SE-3 (77-81-4

LOG OF TEST BORING

JOB NO 4800 86-873 VERTICAL SCALE 1" = 4' BORING NO B 110 (Cont'd)
PROJECT BLACK HAWK COUNTY LANDFILL - WATERLOO, IOWA

DEPTH IN FEET	DESCRIPTION OF MATERIAL (100')	GEOLOGIC ORIGIN	N	WL	SAMPLE NO	SAMPLE TYPE	LAB TESTS LL/PL
	WEATHERED LIMESTONE (continued)	CEDAR VALLEY FORMATION	11		20	SB	
			38		21	SB	
110	END OF BORING						

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	BAILED DEPTHS	WATER LEVEL
8-4	2:00	110'	-	-	to	74'
					to	
					to	
					to	

START 8-1-86 COMPLETE 8-4-86
METHOD @ 3:00
HSA 0-108';
2 15/16 Tri-Cone 108'-110'
CREW CHIEF Johnson

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SE 2 (77-8) 4

LOG OF TEST BORING

JOB NO 4800 86-873 VERTICAL SCALE 1" = 4' BORING NO B 111

PROJECT BLACK HAWK COUNTY LANDFILL - WATERLOO, IOWA

DEPTH IN FEET	DESCRIPTION OF MATERIAL (SURFACE ELEVATION)	GEOLOGIC ORIGIN	R	WL	SAMPLE NO	SAMPLE TYPE	LABORATORY TESTS W	D	⌐	
1	FILL, SANDY LEAN CLAY, brown to grayish brown	FILL								
	FILL, mostly ORGANIC CLAY and LEAN CLAY, dark brown to black, some roots and layers of Sandy Lean Clay		100%		1	CS				
			96%		2	CS				
7½	FILL, SANDY LEAN CLAY, brown									
8½	FILL, mostly ORGANIC CLAY, some SILTY SAND and SANDY LEAN CLAY		98%		3	CS				
11½	ORGANIC CLAY, dark brown to black, some Sandy Lean Clay lenses (OL)	TOPSOIL		▽						
13½	LEAN CLAY, grayish brown to brown (CL)	WEATHERED TILL					*	*	*	n/MA
15	SANDY LEAN CLAY W/A LITTLE GRAVEL, brown to brown and gray mottled, a layer of Sand at 15½' (CL)	TILL	100%		4	CS			*	K
							*	*	*	n/MA
										K
			84%		5	CS				MA
22	SANDY LEAN CLAY W/A LITTLE GRAVEL, gray to brownish gray (CL)								*	
			92%		6	CS				
			100%		7	CS				
32	lenses and layers of SAND and SILTY SAND, possible boulder at 32'									
33										
35	Boring Continued Next Page									

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SE-3 (77-8)-4

LOG OF TEST BORING

JOB NO 4800 86-873 VERTICAL SCALE 1" = 4' BORING NO B 111 (Cont'd)

PROJECT BLACK HAWK COUNTY LANDFILL - WATERLOO, IOWA

DEPTH IN FEET	DESCRIPTION OF MATERIAL (35' ...)	GEOLOGIC ORIGIN	R	WL	SAMPLE NO	SAMPLE TYPE	LABORATORY TESTS W	D	⌐	
	SANDY LEAN CLAY W/A LITTLE GRAVEL (continued)	TILL (continued)	94%		8	CS			*	MA
39	lenses of SAND and a cobble at 39½'									
40			68%		9	CS				
			97%		10	CS				
			91%		11	CS				
			100%		12	CS	*	*	*	n/K MA
59	SILTY SAND, gray, waterbearing, lenses of Silt and layers of Sand (SM)	COARSE ALLUVIUM							*	K/MA
			0%		13	NSR				
65	Boring Continued Next Page									

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LOG OF TEST BORING

JOB NO 4800 86-873 VERTICAL SCALE 1" = 4' BORING NO B 111 (Cont'd)
PROJECT BLACK HAWK COUNTY LANDFILL - WATERLOO, IOWA

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	N or R	WL	SAMPLE NO	SAMPLE TYPE	LAB TESTS W	LAB TESTS D	LAB TESTS LL/PL	
	⌐ 65'									
	SILTY SAND (continued)	COARSE ALLUVIUM (continued)	10**		14	SB				MA
			420**/0.5		15	SB			*	
			100%		16	CS				
			85%		17	CS				
73	LEAN CLAY W/SAND, gray, lenses of Silt, Silty Sand and Sand (CL)	FINE ALLUVIUM							*	MA
76	SANDY LEAN CLAY W/A LITTLE GRAVEL, gray (CL)	TILL	70%		18	CS			*	MA
									*	MA
			**		19	CS				
			**		20	CS				
	**-Sample disturbed due to cobble in tip of CS									
90	WEATHERED LIMESTONE, gray to tan	CEDAR VALLEY FORMATION	84%		21	CS			*	K
							*	*		MA
93.9			100%		22	CS				n
	END OF BORING									
	**-N value obtained with 3" SB sampler									

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	BAILED DEPTHS	WATER LEVEL
7-24	12:15	23½'	23½'	-	to	21½'
7-25	6:56	23½'	23½'	-	to	13'
7-29	1:30	61'	61'	-	to	15'
					to	

START 7-24-86 COMPLETE 7-30-86
METHOD @ 8:00
HSA 0-93.9'
CREW CHIEF K. Johnson

SE-2 (77-B)-4

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LOG OF TEST BORING

JOB NO 4800 86-873 VERTICAL SCALE 1" = 4' BORING NO P 111 C
PROJECT BLACK HAWK COUNTY LANDFILL - WATERLOO, IOWA

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	R	WL	SAMPLE NO	SAMPLE TYPE	LAB TESTS W	LAB TESTS D	LAB TESTS LL/PL	RQD
	⌐ 90' (no log 0-90')									
	No samples taken from 0-95.4'. Boring put down inside of 6" PVC casing. Limestone first encountered at 95.4'. Coring began at 96.4'									
95.4	LIMESTONE, tan to buff, fractured and weathered to about 120'	CEDAR VALLEY FORMATION	62%		1	NQ				17%
			98%		2	NQ				43%
			88%		3	NQ				19%
			62%		4	NQ				22%
115	Boring Continued Next Page									

SE-3 (77-B)-4

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LOG OF TEST BORING

JOB NO 4800 86-873 VERTICAL SCALE 1" = 4' BORING NO P 111 C (Cont'd)

PROJECT BLACK HAWK COUNTY LANDFILL - WATERLOO, IOWA

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	R	WL	SAMPLE NO	SAMPLE TYPE	LAB TESTS W	LAB TESTS D	LAB TESTS LL/PL	LAB TESTS RQD
	115'									
	LIMESTONE (continued)	CEDAR VALLEY FORMATION (continued)	76%		5	NQ				28%
			100%		6	NQ				62%
			96%		7	NQ				71%
130.2	END OF BORING									

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	BAILED DEPTHS	WATER LEVEL
8-7	4:30	130.2'	-	-	to	NMR
					to	
					to	
					to	

START 8-6-86 COMPLETE 8-7-86

METHOD NRC 0-110.2' @ 4:30

2 15/16" Tricone 95.4'-96.4'

NQ Core 96.4'-130.2'

CREW CHIEF Fix

SE-2 (77-8)-4

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LOG OF TEST BORING

JOB NO 4800 86-873 VERTICAL SCALE 1" = 4' BORING NO B 113

PROJECT BLACK HAWK COUNTY LANDFILL - WATERLOO, IOWA

DEPTH IN FEET	DESCRIPTION OF MATERIAL (SURFACE ELEVATION)	GEOLOGIC ORIGIN	R	WL	SAMPLE NO	SAMPLE TYPE	LAB TESTS W	LAB TESTS D	LAB TESTS LL/PL	LAB TESTS Qu
	FILL, mostly disturbed SANDY LEAN CLAY	FILL								
1	SANDY LEAN CLAY W/A LITTLE GRAVEL, gray (CL)	TILL	73%		1	CS				
			96%		2	CS				
			100%		3	CS			*	K n/MA
			100%		4	CS				
			0%		5	CS				
			100%		6	CS				
30	Boring Continued Next Page									

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twin city testing corporation

LOG OF TEST BORING

JOB NO 4800 86-873 VERTICAL SCALE 1" = 4' BORING NO B 113 (Cont'd)

PROJECT BLACK HAWK COUNTY LANDFILL - WATERLOO, IOWA

DEPTH IN FEET	DESCRIPTION OF MATERIAL (30')	GEOLOGIC ORIGIN	R or N	WL	SAMPLE NO	SAMPLE TYPE	LAB TESTS W	LAB TESTS D	LAB TESTS LL/PL	
	SANDY LEAN CLAY W/A LITTLE GRAVEL (continued)	TILL (continued)	100%		7	CS				
			100%		8	CS				
			100%		9	CS				
			100%		10	CS				
48			100%		11	CS				
49	lenses of SILTY SAND, medium grained		44		12	SB			*	MA
			100%		13	CS			*	MA
			100%		14	CS				
60	Boring Continued Next Page									

twin city testing corporation

LOG OF TEST BORING

JOB NO 4800 86-873 VERTICAL SCALE 1" = 4' BORING NO B 113 (Cont'd)
PROJECT BLACK HAWK COUNTY LANDFILL - WATERLOO, IOWA

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	R or N	WL	SAMPLE NO	SAMPLE TYPE	LAB TESTS W	LAB TESTS D	LAB TESTS LL/PL	LAB TESTS
	60'									
	WEATHERED LIMESTONE, tan to reddish, pieces of hard limestone	CEDAR VALLEY FORMATION	100%		15	CS				
	[Textural Classification: SANDY LEAN CLAY (CL)]								*	MA
	NOTE: Boring advanced from 68' to 72.3' with a 2 15/16" tricone.		100%		16	CS			*	MA
			150 / 0.0		17	SB				
72.3	END OF BORING									

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	BAILED DEPTHS	WATER LEVEL
8-27	3:15	72.3'	67.7'	-	to	NMR
					to	
					to	
					to	

START 8-25-86 COMPLETE 8-27-86
METHOD @ 3:15
HSA 0-67.7'
2 15/16" tricone 67.7'-72.3'
CREW CHIEF Johnson

SE 2 (77-8)-4

twin city testing corporation

LOG OF TEST BORING

JOB NO 4800 86-873 VERTICAL SCALE 1" = 4' BORING NO B 113 B
PROJECT BLACK HAWK COUNTY LANDFILL - WATERLOO, IOWA

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	R or N	WL	SAMPLE NO	SAMPLE TYPE	LAB TESTS W	LAB TESTS D	LAB TESTS LL/PL	LAB TESTS
	SURFACE ELEVATION not taken									
	ORGANIC CLAY, black (OL)	TOPSOIL	79%		1	CS				
3	(CL)	FINE ALLUVIUM		▼					*	MA
5	SANDY LEAN CLAY, brown and gray mottled (CL)	MIXED ALLUVIUM	62%		2	CS			*	MA
									*	MA
9	Poor Sample Recovery from 8' to 9'									
	Samples recovered indicate: SILTY SAND W/GRAVEL, gray, layers of Silt and Silty Clay		12%		3	CS				
			0%		4	NSR				
18	SANDY LEAN CLAY W/A LITTLE GRAVEL, gray (CL)	TILL	65		5	SB			*	n/MA/K
			100%		6	CS				
			100%		7	CS				
30	Boring Continued Next Page									

SE-3 (77-8)-4

twin city testing corporation

LOG OF TEST BORING

JOB NO 4800 86-873 VERTICAL SCALE 1" = 4' BORING NO B 113 B (Cont'd)
PROJECT BLACK HAWK COUNTY LANDFILL - WATERLOO, IOWA

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	R or N	WL	SAMPLE NO	SAMPLE TYPE	LAB TESTS W	D	LL/PL	Qu
30'										
	SANDY LEAN CLAY (continued)	TILL (continued)	100%		8	CS				
			100%		9	CS				
			100%		10	CS				
			100%		11	CS				
50	Boring Continued Next Page									

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twin city testing corporation

LOG OF TEST BORING

JOB NO 4800 86-873 VERTICAL SCALE 1" = 4' BORING NO B 113B (Cont'd)
PROJECT BLACK HAWK COUNTY LANDFILL - WATERLOO, IOWA

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	R or N	WL	SAMPLE NO	SAMPLE TYPE	LAB TESTS W	D	LL/PL	
50'										
	SANDY LEAN CLAY (continued)	TILL (continued)	100%		12	CS				
			100%		13	CS			*	K n/MA
58.6										
59.1	a layer of LEAN CLAY W/SAND								*	n/MA K
			100%		14	CS				
63½	WEATHERED LIMESTONE, brown	CEDAR VALLEY FORMATION	90%		15	CS				
	[Textural Classification: (See #1)		100							
65.1	OBSTRUCTION: End of Boring		0.1		16	SB				
	#1-FAT CLAY (CH)									

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	BAILED DEPTHS	WATER LEVEL
10-1	3:00	8.8'	8.8'	-	to	None
10-1	4:15	20.3'	-	-	to	4.1'
					to	
					to	

START 10-1-86 COMPLETE 10-1-86
METHOD @ 4:00
HSA 0-65.1'
CREW CHIEF Johnson

SE-2 (77-B)-4

twin city testing corporation

LOG OF TEST BORING

JOB NO 4800 86-873 VERTICAL SCALE 1" = 4' BORING NO B 113 B

PROJECT BLACK HAWK COUNTY LANDFILL - WATERLOO, IOWA

DEPTH IN FEET	DESCRIPTION OF MATERIAL (SURFACE ELEVATION not taken)	GEOLOGIC ORIGIN	R or N	WL	SAMPLE NO	SAMPLE TYPE	LAB TESTS W	D	LL	Qu
	ORGANIC CLAY, black (OL)	TOPSOIL	79%		1	CS				
3	(CL)	FINE ALLUVIUM		▼					*	MA
5	SANDY LEAN CLAY, brown and gray mottled (CL)	MIXED ALLUVIUM	62%		2	CS			*	MA
									*	MA
9	Poor Sample Recovery from 8' to 9'									
	Samples recovered indicate: SILTY SAND W/GRAVEL, gray, layers of Silt and Silty Clay		12%		3	CS				
			0%		4	NSR				
18	SANDY LEAN CLAY W/A LITTLE GRAVEL, gray (CL)	TILL	65		5	SB			*	n/MA/K
			100%		6	CS				
			100%		7	CS				
30	Boring Continued Next Page									

SE-3 (77-8)-4

twin city testing corporation

LOG OF TEST BORING

JOB NO 4800 86-873 VERTICAL SCALE 1" = 4' BORING NO B 113 B (Cont'd)

PROJECT BLACK HAWK COUNTY LANDFILL - WATERLOO, IOWA

DEPTH IN FEET	DESCRIPTION OF MATERIAL (30')	GEOLOGIC ORIGIN	R or N	WL	SAMPLE NO	SAMPLE TYPE	LAB TESTS W	D	LL	Qu
	SANDY LEAN CLAY (continued)	TILL (continued)	100%		8	CS				
			100%		9	CS				
			100%		10	CS				
			100%		11	CS				
50	Boring Continued Next Page									

twin city testing

LOG OF TEST BORING

JOB NO 4800 86-873 VERTICAL SCALE 1" = 4' BORING NO B 113B (Cont'd)
PROJECT BLACK HAWK COUNTY LANDFILL - WATERLOO, IOWA

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	R or N	WL	SAMPLE NO	SAMPLE TYPE	LABORATORY TESTS W	D	LL/PL	
	50' +									
	SANDY LEAN CLAY (continued)	TILL (continued)	100%		12	CS				
			100%		13	CS			*	K n/MA
58.6									*	n/MA
59.1	a layer of LEAN CLAY W/SAND									K
			100%		14	CS				
63½	WEATHERED LIMESTONE, brown	CEDAR VALLEY FORMATION	90%		15	CS				
65.1	[Textural Classification: (See #1)		100 0.1		16	SB				
	OBSTRUCTION: End of Boring									
	#1-FAT CLAY (CH)									

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	BAILED DEPTHS	WATER LEVEL
10-1	3:00	8.8'	8.8'	-	to	None
10-1	4:15	20.3'	-	-	to	4.1'
					to	
					to	

START 10-1-86 COMPLETE 10-1-86
METHOD @ 4:00
HSA 0-65.1'
CREW CHIEF Johnson

SE-2 (77-B) 4

twin city testing corporation

LOG OF TEST BORING

JOB NO 4800 86-873 VERTICAL SCALE 1" = 4' BORING NO B 114

PROJECT BLACK HAWK COUNTY LANDFILL - WATERLOO, IOWA

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	R	WL	SAMPLE NO	SAMPLE TYPE	LAB TESTS W	LAB TESTS D	LAB TESTS LL/PL	LAB TESTS
	Surface Elevation									
	ORGANIC CLAY, black (OL)	TOPSOIL							*	MA
1	SANDY LEAN CLAY W/A LITTLE GRAVEL, brown and grayish brown (CL)	TILL	88%		1	CS			*	MA
5				▼						
6	a layer of SILTY SAND		97%		2	CS			*	MA
									*	MA
			53%		3	CS				
										MA
14	SANDY LEAN CLAY W/A LITTLE GRAVEL, gray (CL)								*	
										MA
			51%		4	CS			*	
20	a layer of SAND and SILTY SAND								*	MA
21			98%		5	CS				
			100%		6	CS				
31	a lens of SAND		100%		7	CS				
			100%		8	CS				
35	Boring Continued Next Page									

SE-3 (77-81-4)

twin city testing corporation

LOG OF TEST BORING

JOB NO 4800 86-873 VERTICAL SCALE 1" = 4' BORING NO B 114 (Cont'd

PROJECT BLACK HAWK COUNTY LANDFILL - WATERLOO, IOWA

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	R	WL	SAMPLE NO	SAMPLE TYPE	LAB TESTS W	LAB TESTS D	LAB TESTS LL/PL	LAB TESTS
	35'									
	SANDY LEAN CLAY (continued)	TILL								
	a cobble	(continued)	100%		9	CS				
			100%		10	CS	*	*	*	MA Kn
			100%		11	CS				
			100%		12	CS				
54	a layer of SILTY SAND		100%		13	CS			*	MA
			62%		14	CS				
58½	a layer of SAND, medium grained									K
			98%		15	CS	*	*	*	n MA
			0%		16	NSR				
			88%		17	CS				
70	Boring Continued Next Page									

SE-3 (77-81-4)

twin city testing corporation

LOG OF TEST BORING

JOB NO 4800 86-873 VERTICAL SCALE 1" = 4' BORING NO B 114 (Cont'd)

PROJECT BLACK HAWK COUNTY LANDFILL - WATERLOO, IOWA

DEPTH IN FEET	DESCRIPTION OF MATERIAL (70')	GEOLOGIC ORIGIN	R	WL	SAMPLE NO	SAMPLE TYPE	LAB TESTS W	LAB TESTS D	LAB TESTS LL/PL
	SANDY LEAN CLAY (continued)	TILL (continued)							
71	SILTY CLAY, gray, lenses of Sand and Silty Sand (CL-ML)		100%		18	CS			
			100%		19	CS			
76.8	Note: No samples obtained from 76.8'-98' due to plugging of sampling equipment.		0%		20	NSR			
			0%		21	NSR			
			0%		22	NSR			
			0%		23	NSR			
95	Boring Continued Next Page								

SE 3 (77-B)-4

twin city testing corporation

LOG OF TEST BORING

JOB NO 4800 86-873 VERTICAL SCALE 1" = 4' BORING NO B 114 (Cont'd)

PROJECT BLACK HAWK COUNTY LANDFILL - WATERLOO, IOWA

DEPTH IN FEET	DESCRIPTION OF MATERIAL (95')	GEOLOGIC ORIGIN	R or N	WL	SAMPLE NO	SAMPLE TYPE	LAB TESTS W	LAB TESTS D	LAB TESTS LL/PL	
	No samples retrieved		0%		24	NSR				
98	SANDY LEAN CLAY W/A LITTLE GRAVEL, gray and brownish gray, pieces of weathered and hard limestone	TILL	79%		25	SB				
			100%		26	CS				
102	WEATHERED LIMESTONE, tan to brown	CEDAR VALLEY FORMATION	100%		27	CS	*	*	*	nVMA/K
103.6	END OF BORING									

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	BAILED DEPTHS	WATER LEVEL
8-6	12:20	19'	19'	-	to	8½'
8-6	12:20	19'	19'	-	to	15½'
8-7	7:45	68'	68'	-	to	5'
					to	

START 8-6-86 COMPLETE 8-7-86

METHOD HSA 0-103.6' @6:30

CREW CHIEF Johnson

SE 2 (77-B)-4

twin city testing corporation

LOG OF TEST BORING

JOB NO 4800 86-873 VERTICAL SCALE 1" = 4' BORING NO B 114

PROJECT BLACK HAWK COUNTY LANDFILL - WATERLOO, IOWA

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	R	WL	SAMPLE NO	SAMPLE TYPE	LAB TESTS W	LAB TESTS D	LAB TESTS LL/PL	
	Surface Elevation									
	ORGANIC CLAY, black (OL)	TOPSOIL							*	MA
1	SANDY LEAN CLAY W/A LITTLE GRAVEL, brown and grayish brown (CL)	TILL	88%		1	CS			*	MA
5				▼						
6	a layer of SILTY SAND		97%		2	CS			*	MA
									*	MA
			53%		3	CS				MA
14	SANDY LEAN CLAY W/A LITTLE GRAVEL, gray (CL)								*	
			51%		4	CS			*	MA
20	a layer of SAND and SILTY SAND								*	MA
21			98%		5	CS				
			100%		6	CS				
31	a lens of SAND		100%		7	CS				
			100%		8	CS				
35	Boring Continued Next Page									

SE 3 (77-8)-4

twin city testing corporation

LOG OF TEST BORING

JOB NO 4800 86-873 VERTICAL SCALE 1" = 4' BORING NO B 114 (Cont'd

PROJECT BLACK HAWK COUNTY LANDFILL - WATERLOO, IOWA

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	R	WL	SAMPLE NO	SAMPLE TYPE	LAB TESTS W	LAB TESTS D	LAB TESTS LL/PL	
	35'									
	SANDY LEAN CLAY (continued)	TILL (continued)								
	a cobble		100%		9	CS				
			100%		10	CS	*	*	*	MA Kn
			100%		11	CS				
			100%		12	CS				
54	a layer of SILTY SAND		100%		13	CS			*	MA
			62%		14	CS				
58½	a layer of SAND, medium grained									K
			98%		15	CS	*	*	*	n MA
			0%		16	NSR				
			88%		17	CS				
70	Boring Continued Next Page									

SE 3 (77-8)-4

twin city testing corporation

LOG OF TEST BORING

JOB NO 4800 86-873 VERTICAL SCALE 1" = 4' BORING NO B 114 (Cont'd)
PROJECT BLACK HAWK COUNTY LANDFILL - WATERLOO, IOWA

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	R	WL	SAMPLE NO	SAMPLE TYPE	LAB TESTS W	LAB TESTS D	LAB TESTS LL/PL
	70'								
	SANDY LEAN CLAY (continued)	TILL							
71	SILTY CLAY, gray, lenses of Sand and Silty Sand (CL-ML)	(continued)	100%		18	CS			
			100%		19	CS			
76.8	Note: No samples obtained from 76.8'-98' due to plugging of sampling equipment.		0%		20	NSR			
			0%		21	NSR			
			0%		22	NSR			
			0%		23	NSR			
95	Boring Continued Next Page								

SE 3 (77-B)-4 twin city testing corporation

LOG OF TEST BORING

JOB NO 4800 86-873 VERTICAL SCALE 1" = 4' BORING NO B 114 (Cont'd)
PROJECT BLACK HAWK COUNTY LANDFILL - WATERLOO, IOWA

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	R or N	WL	SAMPLE NO	SAMPLE TYPE	LAB TESTS W	LAB TESTS D	LAB TESTS LL/PL	
	95'									
	No samples retrieved		0%		24	NSR				
98	SANDY LEAN CLAY W/A LITTLE GRAVEL, gray and brownish gray, pieces of weathered and hard limestone	TILL	79%		25	SB				
			100%		26	CS				
102	WEATHERED LIMESTONE, tan to brown	CEDAR VALLEY FORMATION	100%		27	CS	*	*	*	n/MA/K
103.6	END OF BORING									

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	BAILED DEPTHS	WATER LEVEL
8-6	12:20	19'	19'	-	to	8½'
8-6	12:20	19'	19'	-	to	15½'
8-7	7:45	68'	68'	-	to	5'
					to	

START 8-6-86 COMPLETE 8-7-86
METHOD HSA 0-103.6' @6:30
CREW CHIEF Johnson

SE 2 (77-B)-4 twin city testing corporation

AECOM

FINAL SOIL BORING LOG

BORING NO. **B-115**

SITE: **Black Hawk County Landfill** PROJECT NO. **60562377** SHEET **1** OF **2**

SITE #: **7-SDP-1-75P**

PHYSICAL SETTING: **East of Co-Disposal Area adjacent to property fence along Hess Road**

LOG BY: **R. Henning**

FIRM/DRILLER: **Terracon/Ron Faulk**

DRILLING METHOD: **4.25-in HSA; 2-in by 2-ft SS**

WATER LEVEL READINGS

DATE	WATER DEPTH	HOLE DEPTH	CASING DEPTH
ABANDONMENT DATE: **NA**			
ABANDONMENT METHOD: **NA**			

GROUND SURFACE ELEV: **902.10**

IA State Plane LOCAL COORDINATES:

NORTHING: **3616599.6**

EASTING: **5240369.85**

DATE/TIME STARTED: **7/31/18 ; 10:00**

DATE/TIME COMPLETED: **7/31/18 ; 11:00**

WELL INSTALLATION: **7/31/2018**

Depth in Feet	SAMPLING DATA B	N	A	% Recovery	No.	T	Graphic Log	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS
0								NS	No sample. QUATERNARY ANTHROPOCENE FILL.
	3 5 6 10	11		90	1	SS		CL	QUATERNARY ANTHROPOCENE FILL. stiff; very dark brown (10YR 2/2); LEAN CLAY with SAND (CL); dry; low plasticity; cohesive; massive; fill.
	4 7 9 11	16		80	2	SS		CL	As above from 2.5 - 4.5 ft., but consistency change to very stiff.
5	3 6 7 6	13		85	3	SS		ML	LOESS stiff; black (10 YR 2/1); SILT with SAND (ML); moist; non-plastic; noncohesive; massive
	2 3 3 4	6		75	4	SS		ML	As above from 4.5 - 6.5 ft., but consistency change to medium.
	1 2 4 4	6		38	5	SS		CL	medium; dark gray (10YR 4/1); LEAN CLAY with SAND (CL); wet; low plasticity; cohesive; bedded.
10								SW	QUATERNARY ALLUVIUM (QAL). medium; dark gray (10 YR 4/1); WELL GRADED SAND (SW); wet; non-plastic; noncohesive; bedded; top of water table; GLACIOFLUVIAL
	2 3 3 2	6		50	6	SS		SW	As above from 10.5 - 12.5 ft., but density change to loose.
	2 2 2 3	4		50	7	SS		SW	very loose; yellowish brown (10 YR 5/8); WELL GRADED SAND (SW); wet, non-plastic; noncohesive; bedded; trace fine gravel; GLACIOFLUVIAL
15	2 3 3 2	6		60	8	SS		SW	As above from 14.5 - 16.5 ft., but density change to medium loose.
	2 2 2 4	4		20	9	SS		SW	As above from 16.5 - 18.5 ft., but density change to very loose.; poor sample recovery.
	8 17 12 11	29		50	10	SS		SW	As above from 18.5 - 20.5 ft., but density change to medium dense; SILT (ML) at bottom of spoon.

Continued Next Page

Tracking Codes: 60562377_BLACKHAWK.GPJ_ETSOIL: 11/29/18, 11:45

AECOM

FINAL SOIL BORING LOG

BORING NO. **B-115**

SITE: **Black Hawk County Landfill** PROJECT NO. **60562377** SHEET **2** OF **2**

Depth in Feet	SAMPLING DATA B	N	A	% Recovery	No.	T	Graphic Log	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS
20									
	7 11 17 17	28		50	11	SS		SW	medium dense; brownish yellow (10 YR 6/8); WELL GRADED SAND with GRAVEL (SW); wet; non-plastic; noncohesive; massive; some coarse gravel; gravel and cobbles at 19 ft; GLACIOFLUVIAL;
									End of boring at 22.5 ft; City of Cedar Falls water added to borehole to control heaving sand
25									
30									
35									
40									

Tracking Codes: 60562377_BLACKHAWK.GPJ_ETSOIL: 11/29/18, 11:45

AECOM

FINAL SOIL BORING LOG

BORING NO. **B-116**

SITE: **Black Hawk County Landfill** PROJECT NO. **60562377** SHEET **1** OF **2**

SITE #: **7-SDP-1-75P**

PHYSICAL SETTING: **East of Co-Disposal Area adjacent to OW-107BR along access road**

LOG BY: **R. Henning**

FIRM/DRILLER: **Terracon/Ron Faulk**

DRILLING METHOD: **4.25-in HSA; 2-in by 2-ft SS**

WATER LEVEL READINGS

DATE	WATER DEPTH	HOLE DEPTH	CASING DEPTH

ABANDONMENT DATE: **NA**

ABANDONMENT METHOD: **NA**

GROUND SURFACE ELEV: **908.00**

IA State Plane LOCAL COORDINATES:

NORTHING: **3617231.7**

EASTING: **5239963.12**

DATE/TIME STARTED: **7/31/18 ; 14:36**

DATE/TIME COMPLETED: **7/31/18 ; 15:36**

WELL INSTALLATION: **7/31/2018**

Depth in Feet	SAMPLING DATA B	N	A	% Recovery	No.	T	Graphic Log	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS
0								NS	No sample. QUATERNARY ANTHROPOCENE FILL.
	1 2 3 3	5		85	1	SS		CL	QUATERNARY ANTHROPOCENE FILL medium; very dark gray (10 YR 3/1); LEAN CLAY with SAND (CL); moist; low plasticity; cohesive; massive; little fine gravel
	WOH 1 2 2	3		85	2	SS		CL	As above from 2.5 - 4.5 ft., but consistency changes to soft.
	WOH 1 1 0	2		85	3	SS		CL	LOESS very soft; dark gray (10 YR 4/1); LEAN CLAY (CL); wet; low plasticity; cohesive; bedded.
5								SC	very soft; dark gray (10 YR 4/1); CLAYEY SAND (SC); wet; low placticity; cohesive; bedded; loess.
								ML	very soft; dark gray (10 YR 4/1); SILT (ML); wet; low placticity; cohesive; bedded; loess.
	WOH 2 2 3	4		85	4	SS		SC	soft; mottled olive (5 Y 4/4) to dark gray (2.5 Y 4/1); CLAYEY SAND (SC); wet; low plactitcty; cohesive, bedded; loess.
	WOH 1 1 1	2		85	5	SS		CL	very soft; mottled olive (5 Y 4/4); to dark gray (2.5 Y 4/1); SANDY LEAN CLAY (CL); wet; low plactitcty; cohesive, bedded; loess.
10	WOH WOH 1 2	1		100	6	SS		CL	As above from 10.5 - 12.5 ft., but color change to dark gray (10 YR 4/1).
	WOH 2 3 4	5		100	7	SS		CL	PRE-ILLINOIAN GLACIAL DIAMICTON (QWT). medium; mottled gray to brownish yellow (10 YR 5/1 to 6/8); LEAN CLAY (CL); wet; low plasticity; cohesive; massive; trace fine gravel; diamicton.
15	1 2 5 6	7		100	8	SS		CL	As above from 14.5 - 16.0 ft., but consistency changes to medium.
								CL	PRE-ILLINOIAN GLACIAL DIAMICTON (QAT). medium; very dark gray (10 YR 3/1); LEAN CLAY (CL); wet; low plasticity; cohesive; massive; diamicton
	3 5 9 10	14		100	9	SS		CL	As above from 16.5 - 18.5 ft., but consistency changes to stiff.
	4 7 10 12	17		100	10	SS		CL	As above from 18.5 - 20.5 ft., but consistency changes to very stiff.

Continued Next Page

Tracking Codes: 60562377_BLACKHAWK.GPJ_ETSOIL 11/29/18, 11:45

AECOM

FINAL SOIL BORING LOG

BORING NO. B-116

SITE: Black Hawk County Landfill PROJECT NO. 60562377 SHEET **2** OF **2**

Depth in Feet	SAMPLING DATA B	N	A	% Recovery	No.	T	Graphic Log	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS
20									End of boring at 20.5 ft.
25									
30									
35									
40									

Tracking Codes: 60562377_BLACKHAWK.GPJ_ETSOIL 11/29/18, 11:45

AECOM

FINAL SOIL BORING LOG

BORING NO. **B-117**

SITE: **Black Hawk County Landfill** PROJECT NO. **60562377** SHEET **1** OF **2**

SITE #: **7-SDP-1-75P**

PHYSICAL SETTING: **East of Co-Disposal Area adjacent to OW-107BR along access road**

LOG BY: **R. Henning**

FIRM/DRILLER: **Terracon/Ron Faulk**

DRILLING METHOD: **4.25-in HSA; 2-in by 2-ft SS**

WATER LEVEL READINGS	DATE	WATER DEPTH	HOLE DEPTH	CASING DEPTH

ABANDONMENT DATE: **NA**

ABANDONMENT METHOD: **NA**

GROUND SURFACE ELEV: **910.40**

IA State Plane LOCAL COORDINATES:

NORTHING: **3617337.5**

EASTING: **5239822.50**

DATE/TIME STARTED: **8/1/18 ; 09:00**

DATE/TIME COMPLETED: **8/1/18 ; 09:30**

WELL INSTALLATION: **8/1/2018**

Depth in Feet	SAMPLING DATA B	N	A	% Recovery	No.	T	Graphic Log	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS
0				25	0	SS		GW	No sample; QUATERNARY ANTHROPOCENE FILL; large clast gravel fill; unable to split spoon sample from 0 - 2.5 ft.
	1 2 3 4	5		65	1	SS		CL	QUATERNARY ANTHROPOCENE FILL medium, yellowish brown (10 YR 5/6); SANDY LEAN CLAY (CL); moist; low plasticity; cohesive; massive; fill.
5	2 3 4 5	7		85	2	SS		CL	medium; mottled black to bownish gray (10 YR 2/1 to 5/2); LEAN CLAY WITH SAND AND GRAVEL (CL); moist; low plasticity; cohesive; massive; fill.
	2 3 6 6	9		70	3	SS		ML	LOESS stiff; black (10 YR 2/1); SILT (ML); moist; low plasticity; cohesive; massive; buried A horizon of modern soil profile; loess.
	3 5 3 2	8		70	4	SS		SP	medium; dark gray (10 YR 4/1); POORLY GRADED SAND (SP); wet; non-plastic; noncohesive; bedded; grading to SILT (ML) at bottom; glaciofluvial.
10	WOH WOH 1 2	1		65	5	SS		CL	very soft; black (10 YR 2/1); LEAN CLAY (CL); wet; low plasticity; cohesive; massive; loess.
	1 2 2 2	4		70	6	SS		CL	PRE-ILLINOIAN GLACIAL DIAMICTON (QWT). soft; mottled gray to brownish yellow (10 YR 6/1 to 6/8); LEAN CLAY with SAND (CL); wet; low plasticity; cohesive; massive; sand seam at 13 ft; diamicton.
15	1 5 5 3	10		75	7	SS		ML	stiff; gray (10 YR 5/1); SILT (ML); wet; low plasticity; cohesive; bedded; very fine sand; trace fine gravel; some dolomite and shale clasts; diamicton.
								SW	stiff; gray (10 YR 5/1); WELL GRADED SAND (SW); wet; non-plastic; noncohesive; bedded; glaciofluvial.
	3 4 7 11	11		60	8	SS		CL	stiff; dark grayish brown (10 YR 4/2); SANDY LEAN CLAY (CL); wet; low plasticity; cohesive; bedded; diamicton.
								SW	stiff; dark grayish brown (10 YR 4/2); WELL GRADED SAND (SW); wet; non-plastic; noncohesive; bedded; glaciofluvial.
	5 6 7 11	13		65	9	SS		CL	PRE-ILLINOIAN GLACIAL DIAMICTON (QAT). stiff; grayish brown (10 YR 4/2); LEAN CLAY (CL); wet; low plasticity; cohesive; massive; diamicton.

Continued Next Page

Tracking Codes: 60562377_BLACKHAWK.GPJ, ETSOIL, 11/29/18, 11:45

AECOM

FINAL SOIL BORING LOG

BORING NO. B-117

SITE: **Black Hawk County Landfill** PROJECT NO. **60562377** SHEET **2** OF **2**

Depth in Feet	SAMPLING DATA B	N	A	% Recovery	No.	T	Graphic Log	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS
20									
	4 7 9 14	16		85	10	SS			very stiff; very dark gray (10 YR 3/1); LEAN CLAY (CL); wet; low plasticity; cohesive; massive; trace fine gravel; diamicton.
									End of boring at 22.5 ft.
25									
30									
35									
40									

Tracking Codes: 60562377_BLACKHAWK.GPJ, ETSOIL, 11/29/18, 11:45

LOG OF TEST BORING

JOB NO 7700 90-108 VERTICAL SCALE 1" = 4' BORING NO B-203

PROJECT SUPPLEMENTAL PHASE II, ADDITIONAL MONITORING WELLS, BLACK HAWK COUNTY LANDFILL, IOWA

DEPTH IN FEET	DESCRIPTION OF MATERIAL — SURFACE ELEVATION	GEOLOGIC ORIGIN	% R*	WL	SAMPLE NO	SAMPLE TYPE	LAB TESTS W	D	LL / PL	Qu
	ORGANIC CLAY, black (OL)	TOPSOIL								
2	SANDY LEAN CLAY, mottled grays (CL)	FINE ALLUVIUM	80			CS				
4	SILTY SAND W/A LITTLE GRAVEL, fine to medium grained, yellow-brown (SM)	MIXED ALLUVIUM	60			CS				
9	SANDY LEAN CLAY W/A LITTLE GRAVEL, mottled grays and browns (CL)	TILL	100			CS				
16	SANDY LEAN CLAY W/A LITTLE GRAVEL, dark gray (CL)		100	▼		CS				
	Lens of waterbearing Sand at 18½'		100			CS				
			100			CS				
	Lens of wet Sand at 32'		100			CS				
35	Boring Continued on Next Page									

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twin city testing corporation

LOG OF TEST BORING

JOB NO 7700 90-108 VERTICAL SCALE 1" = 4' BORING NO B-203 (CONT'D)

PROJECT SUPPLEMENTAL PHASE II, ADDITIONAL MONITORING WELLS, BLACK HAWK COUNTY LANDFILL, IOWA

DEPTH IN FEET	DESCRIPTION OF MATERIAL — 35'	GEOLOGIC ORIGIN	% R*	WL	SAMPLE NO	SAMPLE TYPE	LAB TESTS W	D	LL / PL	Qu
	SANDY LEAN CLAY W/A LITTLE GRAVEL, (Continued) (CL)	TILL (Continued)	50			CS				
			100			CS				
			100			CS				
			100			CS				
55	END OF BORING									

* = Percent Recovery

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	BAILED DEPTHS	WATER LEVEL
3-14	09:30	20'	20'	20'	to	19'
					to	
					to	
					to	

START 3-14-90 COMPLETE 3-15-90

METHOD @ 10:00

3¼" HSA 0-55'

CREW CHIEF A. Harris III

SE-2 (77-8)-4

twin city testing corporation

LOG OF TEST BORING

JOB NO 7700 90-55 VERTICAL SCALE 1" = 4' BORING NO B-207

PROJECT PHASE II, BLACK HAWK COUNTY LANDFILL, BLACK HAWK COUNTY, IOWA

DEPTH IN FEET	DESCRIPTION OF MATERIAL (SURFACE ELEVATION)	GEOLOGIC ORIGIN	R	WL	SAMPLE NO	SAMPLE TYPE	LAB TESTS W	D	LL/PL	Qu
	ORGANIC SILTY CLAY, dark brown (OL)	TOPSOIL								
2½	SANDY LEAN CLAY, light brown (CL)	MIXED ALLUVIUM	100%							
			60%							
10	SANDY LEAN CLAY W/A LITTLE GRAVEL, mottled gray and brown (CL)	TILL	100%							
15	SANDY LEAN CLAY W/A LITTLE GRAVEL, gray (CL)		100%							
			100%							
			100%							
35	Boring Continued on Next Page									

twin city testing
corporation

SE-3 (77-81-4

LOG OF TEST BORING

JOB NO 7700 90-55 VERTICAL SCALE 1" = 4' BORING NO B-207 (Cont'd)

PROJECT PHASE II, BLACK HAWK COUNTY LANDFILL, BLACK HAWK COUNTY, IOWA

DEPTH IN FEET	DESCRIPTION OF MATERIAL (35')	GEOLOGIC ORIGIN	R	WL	SAMPLE NO	SAMPLE TYPE	LAB TESTS W	D	LL/PL	Qu
	SANDY LEAN CLAY W/A LITTLE GRAVEL, (Continued) (CL)	TILL (Continued)	100%							
			100%							
			100%							
			100%							
			100%							
			100%							
65	END OF BORING									

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	BAILED DEPTHS	WATER LEVEL
12-6	14:40	65'	65'	65'		None

START 12-6-89 COMPLETE 12-6-89 @14:30

METHOD 3¼" HSA 0-65'

CREW CHIEF A. Harris III

twin city testing

LOG OF TEST BORING

JOB NO 7700 90-55 VERTICAL SCALE 1" = 4' BORING NO B-208

PROJECT PHASE II, BLACK HAWK COUNTY LANDFILL, BLACK HAWK COUNTY, IOWA

DEPTH IN FEET	DESCRIPTION OF MATERIAL (SURFACE ELEVATION)	GEOLOGIC ORIGIN	R	WL	SAMPLE NO	SAMPLE TYPE	LAB W	LAB D	LAB LL/PL	LAB Qu
	ORGANIC SILTY CLAY, dark brown (OL)	TOPSOIL								
2	SANDY LEAN CLAY, light brown (CL)	MIXED ALLUVIUM	100%							
			100%							
9	SANDY LEAN CLAY W/A LITTLE GRAVEL, mottled gray and brown (CL)	TILL		▼						
			100%							
14	SANDY LEAN CLAY W/A LITTLE GRAVEL, gray (CL)		100%							
18	SAND, fine to medium grained, brown, waterbearing (SP)									
21	SANDY LEAN CLAY W/A LITTLE GRAVEL, gray, scattered lenses of Sand (CL)		100%							
			100%							
			100%							
35	Boring Continued on Next Page									

twin city testing

LOG OF TEST BORING

JOB NO 7700 90-55 VERTICAL SCALE 1" = 4' BORING NO B-208 (Cont'

PROJECT PHASE II, BLACK HAWK COUNTY LANDFILL, BLACK HAWK COUNTY, IOWA

DEPTH IN FEET	DESCRIPTION OF MATERIAL (35')	GEOLOGIC ORIGIN	R	WL	SAMPLE NO	SAMPLE TYPE	LAB W	LAB D	LAB LL/PL	LAB Qu
	SANDY LEAN CLAY W/A LITTLE GRAVEL, (Continued) (CL)	TILL (Continued)	100%							
			100%							
46	SAND, fine grained, gray-brown, waterbearing (SP)	COARSE ALLUVIUM	100%							
51	SANDY LEAN CLAY W/A LITTLE GRAVEL, dark gray (CL)	TILL	100%							
53	SAND, fine grained, gray, waterbearing (SP)	COARSE ALLUVIUM								
55	END OF BORING									

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	BAILED DEPTHS	WATER LEVEL
12-8	9:00	20'	20'	20'	to	18'
12-13	10:00	44'	44'	43½'	to	10'
					to	
					to	

START 12-8-89 COMPLETE 12-13-89

METHOD @12:30

3¼" HSA 0-55'

CREW CHIEF A. Harris III

LOG OF BORING NO. P 212

OWNER: Black Hawk County Solid Waste Management Commission

SITE: AREA "E", Black Hawk County LandFill near Waterloo, Iowa

Sample No.	Type Sample	Sampling Distance	Recovery	Blows/ft.	Unconfined Compressive Strength-lbs./ft.²	Water Content - %	Dry Density - lbs./ft.³	Unified Classification Symbol	Depth, Feet	Description
								CL		TOPSOIL: SILTY CLAY TR. ORG., Dk.Brn.
1	CS	5	2½					SM		SILTY CLAY TR. SAND, Brn.Gray Mottled Silty Fine to Medium Sand @ 5'-5.5'
2	CS	5	2½					CL		SANDY SILTY CLAY TR. GRAVEL AND SAND SEAMS, Yellow Brown
3	CS	5	5					CL	10	SANDY SILTY CLAY TR. GRAVEL WITH OCCASIONAL THIN SAND SEAMS (TILL) Gray
4	CS	5	5					CL		
5	CS	5	1½					CL	20	Glacial erratic @ 21.5'
6	CS	5	4					SP CL		Fine to Coarse Sand Tr. Gravel @ 26.8'-28'
7	ST	1	1						30	
8	CS	4	4					CL		SANDY SILTY CLAY W/ GRAVEL (TILL) Gray
9	CS	5	5					CL		
10	CS	5	5					CL	40	
11	CS	5	4					CL		
12	CS	5	5					SP CL	50	Fine to Medium Sand @ 52.2'-52.5'
13	CS	5	5					CL		
14	ST	2	0						60	
										Bottom of Boring @ 62' Piezometer 212 A Installed

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES: IN-SITU THE TRANSITION MAY BE GRADUAL

WATER LEVEL OBSERVATIONS

W.L. 5' While Drilling
W.L.
W.L.

aquadrill

BORING STARTED 5-13-92
BORING COMPLETED 5-14-92
RIG B-57 ORV FOREMAN JLJ
APPROVED JLJ JOB # 92-041

LOG OF BORING NO. ~~OW 213B~~ P-213C

OWNER: Black Hawk County Solid Waste Management Commission

SITE: AREA "E", Black Hawk County Landfill near Waterloo, Iowa

Sample No.	Type Sample	Sampling Distance	Recovery	Blows/ft.	Unconfined Compressive Strength-lbs./ft.²	Water Content - %	Dry Density - lbs./ft.³	Unified Classification Symbol	Depth, Feet	Description
1	CS	5	5					CL		SANDY SILTY CLAY TR. GRAVEL, Yel.Brn.
										SILTY CLAY TR. SAND, Dark Gray
2	CS	5	5					CL		SANDY SILTY CLAY TR. GRAVEL (TILL) Yellow Brown Gray Mottled
3	CS	5	5					CL SM	10	Silty Fine to Medium Sand @ 12'-12.2'
4	CS	5	5					CL		SANDY SILTY CLAY TR. GRAVEL AND SAND SEAMS (TILL) Yellow Brown
5	CS	5	5					CL	20	SANDY SILTY CLAY TR. GRAVEL WITH SAND SEAMS (TILL) Gray
6	CS	5	5					CL		
7	CS	5	5					CL SM	30	Silty Fine to Medium Sand @ 33.5'-34'
8	CS	5	5					CL		SANDY SILTY CLAY TR. GRAVEL Gray
9	CS	5	5					CL	40	
10	CS	5	5					CL		
11	CS	5	5					CL	50	
12	CS	5	5					CL		
13	CS	5	5					CL	60	
										Continued on Page 2

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES IN-SITU THE TRANSITION MAY BE GRADUAL

WATER LEVEL OBSERVATIONS
W.L. 12' While Drilling
W.L. 105' @ 0 hr. AB
W.L.

aquadrill

BORING STARTED 5-20-92
BORING COMPLETED 5-27-92
RIG CME-75 FOREMAN JLJ
APPROVED JLJ JOB # 92-041

LOG OF BORING NO. ~~OW 213B~~ P-213C (Continued)

OWNER: Black Hawk County Solid Waste Management Commission

SITE: AREA "E", Black Hawk County Landfill near Waterloo, Iowa

Sample No.	Type Sample	Sampling Distance	Recovery	Blows/ft	Unconfined Compressive Strength-lbs./ft.²	Water Content - %	Dry Density - lbs./ft.³	Unified Classification Symbol	Depth, Feet	Description
										Continued from Page 1
14	CS	5	5						70	SANDY SILTY CLAY TR. GRAVEL (TILL) Gray
15	CS	5	5							
16	CS	5	5						80	
17	CS	5	5							
18	CS	5	5						90	
19	CS	5	5							SANDY SILTY CLAY TR. GRAVEL (TILL) Yellow Brown
20	CS	5	5						100	
21	CS	5	5							
22	CS	2½	2½						110	LIMESTONE BEDROCK W/ SHALE SEAMS AND SHALEY ZONES IN UPPER PORTION, HIGHLY TO MODERATELY WEATHERED Yellow Brown
									120	
									130	Bottom of Boring @ 130.5' Well 213 ~~B~~ C Installed

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL AND ROCK TYPES IN-SITU THE TRANSITION MAY BE GRADUAL

WATER LEVEL OBSERVATIONS
W.L. 12' While Drilling
W.L. 105' @ 0 hr. AB
W.L.

aquadrill

BORING STARTED 5-20-92
BORING COMPLETED 5-27-92
RIG CME-75 FOREMAN JLJ
APPROVED JLJ JOB # 92-041

AECOM

FINAL SOIL BORING LOG

BORING NO. **B-213R**

SITE: **Black Hawk County Landfill** PROJECT NO. **60562377** SHEET **1** OF **2**

SITE #: **7-SDP-1-75P**

PHYSICAL SETTING: **North of Area E adjacent to P-213C on landfill access road**

LOG BY: **R. Henning**

FIRM/DRILLER: **Terracon/Ron Faulk**

DRILLING METHOD: **4.25-in HSA; 2-in by 2-ft SS**

WATER LEVEL READINGS			
DATE	WATER DEPTH	HOLE DEPTH	CASING DEPTH

ABANDONMENT DATE: **NA**

ABANDONMENT METHOD: **NA**

GROUND SURFACE ELEV: **942.10**

IA State Plane LOCAL COORDINATES:

NORTHING: **3618730.9**

EASTING: **5239586.40**

DATE/TIME STARTED: **8/2/18 ; 08:00**

DATE/TIME COMPLETED: **8/2/18 ; 09:00**

WELL INSTALLATION: **8/2/2018**

Depth in Feet	SAMPLING DATA B	N	A	% Recovery	No.	T	Graphic Log	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS
0								NS	No sample. QUATERNARY ANTHROPOCENE FILL.
	1 3 5 8	**8**		85	1	SS		CL	QUATERNARY ANTHROPOCENE FILL. medium; very dark grayish brown (10 YR 3/2); LEAN CLAY with GRAVEL (CL); dry; low plasticity; cohesive; massive; fill.
	3 7 9 11	**16**		100	2	SS		CL	As above from 2.5 - 4.0 ft., but consistency change to very stiff.
5	3 5 7 9	**12**		80	3	SS		CL	LOESS. stiff; black (10 YR 2/1); LEAN CLAY (CL); dry; non-plastic; cohesive; bedded; buried A horizon of modern soil profile; loess.
	1 3 3 5	**6**		85	4	SS		CL	PRE-ILLINOIAN GLACIAL DIAMICTON (QWT). medium; mottled yellowish brown to gray (10 YR 5/8 to 5/1); LEAN CLAY with SAND and GRAVEL (CL); moist; low plasticity; cohesive; massive; diamicton.
	2 4 6 7	**10**		90	5	SS		CL	As above from 8.5 - 10.5 ft., but consistency change to stiff.
10	2 2 4 5	**6**		90	6	SS		CL	medium; gray (10 YR 6/1); SANDY LEAN CLAY (CL); moist; low plasticity; cohesive; massive; trace fine gravel; diamicton.
	2 8 15 18	**23**		100	7	SS		CL	very stiff; mottled gray to brownish yellow (10 YR 6/1 to 6/8); LEAN CLAY (CL); moist to wet; low plasticity; cohesive; massive; diamicton. Sand seam at 13.0 ft.
								SM	very stiff; mottled gray to brownish yellow (10 YR 6/1 to 6/8); SILTY SAND (SM); wet, non-plastic; noncohesive; glaciofluvial.
15	9 22 44 74	**>50**		100	8	SS		ML	hard; brownish yellow (10 YR 6/8); SILT (ML); wet; non-plastic; noncohesive; massive; glaciofluvial. Sand seam at 15.5 ft.
								SM	
	14 20 20 26	**40**		100	9	SS		SW	hard; brownish yellow (10 YR 6/8); SILTY SAND (SM); wet; non-plastic; noncohesive; massive; glaciofluvial. hard; brownish yellow (10 YR 6/8); WELL GRADED SAND (SW); wet; non-plastic; noncohesive; massive; glaciofluvial.
								CL	PRE-ILLINOIAN GLACIAL DIAMICTON (QAT). hard; brownish yellow (10 YR 6/8); SANDY LEAN CLAY (CL); wet; non-plastic; noncohesive; massive; diamicton.
	14 15 16 20	**31**		100	10	SS		CL	As above from 18.5 - 22.5 ft.

Continued Next Page

Tracking Codes: 60562377_BLACKHAWK.GPJ_ETSOIL 11/29/18, 11:45

AECOM

FINAL SOIL BORING LOG

BORING NO. B-213R

SITE: **Black Hawk County Landfill** PROJECT NO. **60562377** SHEET **2** OF **2**

Depth in Feet	SAMPLING DATA B	N	A	% Recovery	No.	T	Graphic Log	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS
20									
	6 14 15 20	**29**		100	11	SS			
	7 12 17 21	**29**		100	12	SS		CL	very stiff; dark gray (10 YR 4/1); LEAN CLAY with SAND and GRAVEL (CL); moist to wet; low plasticity; cohesive; massive; diamicton.
25									End of boring at 24.5 ft.
30									
35									
40									

Tracking Codes: 60562377_BLACKHAWK.GPJ_ETSOIL 11/29/18, 11:45

LOG OF TEST BORING

JOB NO. 9857768 VERTICAL SCALE 1" = 3' BORING NO. B214

PROJECT Black Hawk Landfill, Waterloo

DEPTH IN FEET	DESCRIPTION OF MATERIAL (SURFACE ELEVATION ____)	GEOLOGIC ORIGIN	SPT (N)	WL	SAMPLE NO.	SAMPLE TYPE	LAB TESTS MC	DD	LL	PI	Qp or (Qu)
	FILL mostly-silty clayey sand, light brown, moist	TOPSOIL				CSTS					
1.0	SILTY CLAY-very dark brown, buried topsoil (ML/CL)										
3.0	SANDY LEAN CLAY-light brown to brown, moist at 6', wet sand lense at 17.5'(SC)	GLACIAL TILL				CSTS					
						CSTS					
						CSTS					
17.5	CLAYEY SILT LAYER								31	18	
	SANDY LEAN CLAY-dark gray, trace of gravel (CL)										
	BORING CONT'D ON NEXT PAGE										

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	BAILED DEPTHS	WATER LEVEL

START 11-11-98 COMPLETE 11-12-98

METHOD 3.25 HSA

EAST: NORTH:

CREW CHIEF Mark Buenger

MAXIM TECHNOLOGIES INC

LOG OF TEST BORING

JOB NO. 9857768 VERTICAL SCALE 1" = 3' BORING NO. B214 CONTINUED

PROJECT Black Hawk Landfill, Waterloo

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	SPT (N)	WL	SAMPLE NO.	SAMPLE TYPE	LAB TESTS MC	DD	LL	PI	Qp or (Qu)
		GLACIAL TILL cont'd				ST					
	SAME AS ABOVE										
	wet					CSTS					
	gravel layer										
25.0						CSTS					
30.0						CSTS					
35.0						CSTS					
40.0						CSTS					
	wet										
	BORING CONT'D ON NEXT PAGE										

MAXIM TECHNOLOGIES INC

LOG OF TEST BORING

JOB NO. 9857768 VERTICAL SCALE 1" = 3' BORING NO. B214 CONTINUED

PROJECT Black Hawk Landfill, Waterloo

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	SPT (N)	WL	SAMPLE NO.	SAMPLE TYPE	LAB MC	LAB OD	LAB LL	LAB PI	LAB Qp or (Qu)
		GLACIAL TILL cont'd		▼							
45.0						CSTS			27	14	
46.5	CLAYEY SAND/GRAVEL (SC)										
48.5											
49.0	SAND LAYER (SP)										
	LEAN CLAY (CL)					CSTS					
51.5											
52.0	SAND-fine to medium grain, waterbearing (SP)	ALLUVIUM GLACIAL TILL									
	LEAN CLAY-trace of gravel, dark gray (CL)										
55.0						CSTS					
60.0						ST					
						CSTS					
	BORING CONT'D ON NEXT PAGE										
65.0											

MAXIM TECHNOLOGIES INC

LOG OF TEST BORING

JOB NO. 9857768 VERTICAL SCALE 1" = 3' BORING NO. B214 CONTINUED

PROJECT Black Hawk Landfill, Waterloo

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	SPT (N)	WL	SAMPLE NO.	SAMPLE TYPE	LAB MC	LAB OD	LAB LL	LAB PI	LAB Qp or (Qu)
		GALCIAL TILL cont'd				CSTS			31	18	
	SAME AS ABOVE										
70.0						CSTS					
74.0	LIMESTONE-weathered	CEDAR VALLEY FORMATION									
75.0	END OF BORING AUGER REFUSAL										

MAXIM TECHNOLOGIES INC

LOG OF TEST BORING

JOB NO. 9857768 VERTICAL SCALE 1" = 3' BORING NO. B215

PROJECT Black Hawk Landfill, Waterloo

DEPTH IN FEET	DESCRIPTION OF MATERIAL (SURFACE ELEVATION ____)	GEOLOGIC ORIGIN	SPT (N)	WL	SAMPLE NO.	SAMPLE TYPE	LAB TESTS MC	DD	LL	PI	Qp or (Qu)
	FILL-clay, brownish gray	TOPSOIL	11		1	SS					
2.0	CLAY-orange/brown (CL)	GLACIAL TILL	9		2	SS					
5.0	CLAY-orange/brown to yellow, wet (CL)					ST					
7.0	CLAY-sandy brown, wet (CL)		12		3	SS					
9.0	CLAY-silty,mottled brown with gray (CL)		12		4	SS					
12.0	CLAY-gray, with trace of gravel (CL)		33		5	SS					
15.0	"					CSTS					
	BORING CONT'D ON NEXT PAGE										

WATER LEVEL MEASUREMENTS

DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	BAILED DEPTHS	WATER LEVEL

START 11-12-98 COMPLETE 11-16-98 @

METHOD 3.25 HSA

EAST: NORTH:

CREW CHIEF Mark Buegner

MAXIM TECHNOLOGIES INC

LOG OF TEST BORING

JOB NO. 9857768 VERTICAL SCALE 1" = 3' BORING NO. B215 CONTINUED

PROJECT Black Hawk Landfill, Waterloo

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	SPT (N)	WL	SAMPLE NO.	SAMPLE TYPE	LAB TESTS MC	DD	LL	PI	Qp or (Qu)
	SAME AS ABOVE	GLACIAL TILL cont'd				CSTS					
25.0						CSTS					
30.0	LOST SAMPLE @ 30-35' AUGERS OFFSET BY BOULDER					CSTS					
35.0	SANDY LEAN CLAY-gray, trace of gravel (CL)		76		6	SS					
	"		78		7	SS					
			78		8	SS			27	15	
			72		9	SS					
	BORING CONT'D ON NEXT PAGE										

MAXIM TECHNOLOGIES INC

LOG OF TEST BORING

JOB NO. 9857768 VERTICAL SCALE 1" = 3' BORING NO. B215 CONTINUED

PROJECT Black Hawk Landfill, Waterloo

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	SPT (N)	WL	SAMPLE NO.	SAMPLE TYPE	LAB MC	LAB DD	LAB LL	LAB PI	LAB Qp or (Qu)
	SAME AS ABOVE	GLACIAL TILL cont'd	72		10	SS					
45.0			88		11	SS					
			85		12	SS					
			87		13	SS					
50.0			85		14	SS					
			85		15	SS					
54.0	SANDY LEAN CLAY-olive gray from 54-57', increase in gravel content @56.5' (CL)		85		16	SS			32	19	
57.0	SANDY LEAN CLAY-dark gray, trace of gravel (CL)		88		17	SS					
			95		18	SS					
60.0			101		19	SS					
			113		20	SS					
	BORING CONTINUED ON NEXT PAGE										
65.0											

MAXIM TECHNOLOGIES INC

LOG OF TEST BORING

JOB NO 9857768 VERTICAL SCALE 1" = 3' BORING NO. B215 CONTINUED

PROJECT Black Hawk Landfill, Waterloo

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	SPT (N)	WL	SAMPLE NO.	SAMPLE TYPE	LAB MC	LAB DD	LAB LL	LAB PI	LAB Qp or (Qu)
	SAME AS ABOVE	GLACIAL TILL cont'd	78		21	SS					
			105		22	SS					
			92		23	SS					
70.0									31	17	
			111		24	SS					
			113		25	SS					
75.0			101		26	SS					
77.0	LIMESTONE-weathered, sandy lean clay	CEDAR VALLEY FORMATION	91		27	SS					
79.0	END OF BORING AUGER REFUSAL										

MAXIM TECHNOLOGIES INC

LOG OF TEST BORING

JOB NO. 9857768 VERTICAL SCALE 1" = 3' BORING NO. B216 CONTINUED

PROJECT Black Hawk Landfill, Waterloo

DEPTH IN FEET	DESCRIPTION OF MATERIAL	GEOLOGIC ORIGIN	SPT (N)	WL	SAMPLE NO.	SAMPLE TYPE	LABORATORY TESTS MC	DD	LL	PI	Qp or (Qu)
66.0						CSTS					
	40% SAMPLE RECOVERY SAND-fine to medium grain, moist	ALLUVIUM									
67.0	estimated @66-67'(SP)	GLACIAL TILL									
	SANDY LEAN CLAY-dark gray (CL)										
70.0	NO SAMPLE 70-75' DRILLED TO 80' DUE TO SAND HEAVE PROBLEMS (DRILLING ACTION INDICATES SAME SANDY LEAN CLAY FROM 70-80' WITH POSSIBLE SAND SEAMS)					NSR					
75.0	NO SAMPLE 75-80'					NSR					
80.0	SANDY LEAN CLAY-dark gray (CL)					CSTS			30	17	
81.0	SANDY CLAY-olive brown, 2" sandseam (CL)								27	11	
82.0	LIMESTONE-weathered, with shale	CEDAR VALLEY FORMATION									
83.0	END OF BORING AUGER REFUSAL										

MAXIM TECHNOLOGIES INC

AECOM

FINAL SOIL BORING LOG

BORING NO. **B-217**

SITE: **Black Hawk County Landfill** PROJECT NO. **60562377** SHEET **1** OF **2**

SITE #: **7-SDP-1-75P**

PHYSICAL SETTING: **North of Area X, along landfill access road**

LOG BY: **R. Henning**

FIRM/DRILLER: **Terracon/Ron Faulk**

DRILLING METHOD: **4.25-in HSA; 2-in by 2-ft SS**

WATER LEVEL READINGS

DATE	WATER DEPTH	HOLE DEPTH	CASING DEPTH

ABANDONMENT DATE: **NA**

ABANDONMENT METHOD: **NA**

GROUND SURFACE ELEV: **939.90**

IA State Plane LOCAL COORDINATES:

NORTHING: **3618735.5**

EASTING: **5240098.85**

DATE/TIME STARTED: **8/1/18 ; 15:10**

DATE/TIME COMPLETED: **8/1/18 ; 16:00**

WELL INSTALLATION: **8/1/2018**

Depth in Feet	SAMPLING DATA B	N	A	% Recovery	No.	T	Graphic Log	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS
0								NS	No sample. QUATERNARY ANTHROPOCENE FILL.
	2 4 5 6	9		65	1	SS		CL	QUATERNARY ANTHROPOCENE FILL. stiff; light yellowish brown (2.5 Y 6/4); LEAN CLAY (CL); dry; low plasticity; cohesive; massive; fill.
	3 6 7 5	13		100	2	SS		CL	LOESS. stiff; black (10 YR 2/1); SANDY LEAN CLAY (CL); moist; low plasticity; cohesive; massive; buried A horizon of soil profile; loess.
5	3 5 7 8	12		70	3	SS		CL	As above from 4.5 - 5.5 ft.
								CL	PRE-ILLINOIAN GLACIAL DIAMICTON (QWT). dark gray (5 Y 4/1); LEAN CLAY with SAND (CL); moist; low plasticity; cohesive; massive; diamicton.
	1 3 3 6	6		75	4	SS		CL	medium; mottled dark gray to gray (5 Y 4/1 to 6/1); SANDY LEAN CLAY with GRAVEL (CL); moist; low plasticity; cohesive; massive; diamicton.
								SW	medium; mottled dark gray to gray (5 Y 4/1 to 6/1); WELL GRADED SAND (SW); moist; non-plastic, noncohesive; bedded; glaciofluvial.
	2 3 5 7	8		85	5	SS		CL	medium; mottled olive to gray (5 Y 4/3 to 5/1); SANDY LEAN CLAY (CL); moist to wet; low plasticity; cohesive; massive; diamicton.
10	3 4 3 5	7		80	6	SS		CL	medium; light olive brown (2.5 Y 5/4); LEAN CLAY with SAND and GRAVEL (CL); moist to wet; low plasticity; cohesive; massive; diamicton.
	4 6 10 19	16		90	7	SS		CL	very stiff; mottled brownish yellow to pale brown (10 YR 6/8 to 6/3); SANDY LEAN CLAY (CL); moist; low plasticitty; cohesive; massive; trace fine gravel; diamicton.
15	14 18 25 31	43		100	8	SS		ML	hard; brownish yellow (10 YR 6/6); SANDY SILT with GRAVEL (ML); moist; non-plastic, cohesive; massive; glaciofluvial.
	22 23 14 17	37		100	9	SS		ML	As above from 16.5 to 18.5 ft.
	4 9 14 24	23		100	10	SS		CL	very stiff; brownish yellow (10 YR 6/8); SANDY LEAN CLAY with GRAVEL (CL); moist; non-plastic; cohesive; massive; diamicton.

Continued Next Page

Tracking Codes: 60562377_BLACKHAWK.GPJ_ETSOIL 11/29/18, 1145

AECOM

FINAL SOIL BORING LOG

BORING NO. B-217

SITE: Black Hawk County Landfill PROJECT NO. 60562377 SHEET **2** OF **2**

Depth in Feet	SAMPLING DATA B	N	A	% Recovery	No.	T	Graphic Log	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS
20									
	12 16 14 20	30		100	11	SS		ML	very stiff; yellowish brown (10 YR 5/4); SILT with SAND (ML); moist; non-plastic; cohesive; bedded; glaciofluvial.
								CL	PRE-ILLINOIAN GLACIAL DIAMICTON (QAT). very stiff; dark gray (10 YR 4/1); LEAN CLAY with SAND and GRAVEL (CL); moist; low plasticity; cohesive; bedded; diamicton.
25									End of boring at 22.5 ft.
30									
35									
40									

Tracking Codes: 60562377_BLACKHAWK.GPJ_ETSOIL 11/29/18, 1145

AECOM

FINAL SOIL BORING LOG

BORING NO. **B-218**

SITE: **Black Hawk County Landfill** PROJECT NO. **60562377** SHEET **1** OF **2**

SITE #: **7-SDP-1-75P**

North of Area E, along new landfill

PHYSICAL SETTING: **access road**

LOG BY: **R. Henning**

FIRM/DRILLER: **Terracon/Ron Faulk**

DRILLING METHOD: **4.25-in HSA; 2-in by 2-ft SS**

WATER LEVEL READINGS

DATE	WATER DEPTH	HOLE DEPTH	CASING DEPTH

ABANDONMENT DATE: **NA**

ABANDONMENT METHOD: **NA**

GROUND SURFACE ELEV: **943.00**

IA State Plane LOCAL COORDINATES:

NORTHING: **3618733.3**

EASTING: **5239114.20**

DATE/TIME STARTED: **8/2/18 ; 10:15**

DATE/TIME COMPLETED: **8/2/18 ; 12:00**

WELL INSTALLATION: **8/2/2018**

Depth in Feet	SAMPLING DATA B	N	A	% Recovery	No.	T	Graphic Log	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS
0								NS	No sample. QUATERNARY ANTHROPOCENE FILL.
	2 2 3 4	5		80	1	SS		CL	QUATERNARY ANTHROPOCENE FILL. medium; brown (10 YR 4/3); SANDY LEAN CLAY (CL); moist; low plasticity; cohesive; massive; fill.
	4 5 8 9	13		95	2	SS		CL	stiff; dark grayish brown (10 YR 4/2); LEAN CLAY (CL); moist; low plasticity; cohesive; massive; fill.
								CL	LOESS.
5	3 4 9 7	13		70	3	SS		CL	stiff; black (10 YR 2/1); LEAN CLAY (CL); moist; low plasticity; cohesive; bedded; buried A horizon of soil profile; loess As above from 4.5 - 6.5 ft.
	2 4 5 6	9		95	4	SS		CL	PRE-ILLINOIAN GLACIAL DIAMICTON (QWT). stiff; mottled brownish yellow to gray (10 YR 6/8 to 6/1); LEAN CLAY (CL); moist; low plasticity; cohesive; massive; diamicton.
	2 4 7 10	11		100	5	SS		CL	stiff; mottled gray to brownish yellow (10 YR 6/1 to 6/8); SANDY LEAN CLAY (CL); wet; low plasticity; cohesive; massive; diamicton.
10								SP	stiff; mottled gray to brownish yellow (10 YR 6/1 to 6/8); POORLY GRADED SAND (SP); wet; non-plastic; noncohesive; bedded; glaciofluvial.
	1 3 5 6	8		95	6	SS		CL	medium; mottled gray to brownish yellow (10 YR 6/1 to 6/8); SANDY LEAN CLAY (CL); wet; low plasticity; cohesive; massive; diamicton.
	5 11 15 24	26		100	7	SS		CL	very stiff; brownish yellow (10 YR 6/8); SANDY LEAN CLAY (CL); moist; non-plastic; cohesive; massive; diamicton.
15	15 19 24 87	43		100	8	SS		CL	As above from 14.5 - 16.5 ft, but trace dolomite (clasts) gravel at end of split spoon sample; diamicton.
	54 46 39 44	>50		50	9	SS		SW	very dense; yellowish brown (10 YR 5/8); WELL GRADED SAND (SW); wet non-plastic; noncohesive; massive; glaciofluvial.
	16 27 24 29	>50		100	10	SS		SW	As above from 18.5 - 20.5.

Continued Next Page

Tracking Codes: 60562377_BLACKHAWK.GPJ_ETSOIL_11/29/18..1145

AECOM

FINAL SOIL BORING LOG

BORING NO. B-218

SITE: **Black Hawk County Landfill** PROJECT NO. **60562377** SHEET **2** OF **2**

Depth in Feet	SAMPLING DATA B	N	A	% Recovery	No.	T	Graphic Log	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS
20									
	2 14 24 36	38		100	11	SS		SW	As above from 20.5 - 22.5, but consistency changes to dense.
	13 13 14 37	27		100	12	SS		SW	As above from 22.5 - 23.0, but consistency changes to medium dense.
								CL	PRE-ILLINOIAN GLACIAL DIAMICTON (QAT). medium dense; black (10 YR 2/1); LEAN CLAY with SAND (CL); moist; low plasticity; cohesive; bedded; buried A horizon of soil profile; loess.
25	14 14 12 20	26		90	13	SS		ML	very stiff; brown (10 YR 4/3); SILT (ML); wet; non-plastic; cohesive; bedded; loess.
								CL	very stiff; mottled black to dark yellowish brown (10 YR 2/1 to 4/6); LEAN CLAY with SAND (CL); moist to wet; low plasticity; cohesive; bedded; diamicton.
30									End of boring at 26.5 ft.
35									
40									

Tracking Codes: 60562377_BLACKHAWK.GPJ_ETSOIL_11/29/18..1145

AECOM

FINAL SOIL BORING LOG

BORING NO. **B-219**

SHEET **1** OF **1**

SITE: **Black Hawk County Landfill** PROJECT NO. **60562377**

SITE #: **7-SDP-1-75P**

North of Area E, along new landfill

PHYSICAL SETTING: **access road**

LOG BY: **R. Henning**

FIRM/DRILLER: **Terracon/Ron Faulk**

DRILLING METHOD: **4.25-in HSA; 2-in by 2-ft SS**

WATER LEVEL READINGS

DATE	WATER DEPTH	HOLE DEPTH	CASING DEPTH

ABANDONMENT DATE: **NA**

ABANDONMENT METHOD: **NA**

GROUND SURFACE ELEV: **936.90**

IA State Plane LOCAL COORDINATES:

NORTHING: **3618749.2**

EASTING: **5238570.30**

DATE/TIME STARTED: **8/2/18 ; 13:20**

DATE/TIME COMPLETED: **8/2/18 ; 14:30**

WELL INSTALLATION: **8/2/2018**

Depth in Feet	SAMPLING DATA B	N	A	% Recovery	No.	T	Graphic Log	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS
0								NS	No sample. QUATERNARY ANTHROPOCENE FILL.
	1 2 2 5	**4**		100	1	SS		ML	QUATERNARY ANTHROPOCENE FILL. soft; black (10 YR 2/1); SILT (ML); dry; non-plastic; noncohesive; bedded; A horizon of soil profile; fill.
								CL	soft; black (10 YR 2/1); LEAN CLAY with SAND and GRAVEL (CL); dry; non-plastic; cohesive; bedded; fill.
	2 4 4 5	**8**		90	2	SS		CL	medium; mottled brownish yellow to gray (10 YR 6/8 to 6/1); LEAN CLAY with SAND and GRAVEL (CL); dry; low plasticity; cohesive; massive; fill.
5	1 2 2 3	**4**		70	3	SS		ML	LOESS. soft; black (10 YR 2/1); SILT (ML); moist; non-plastic; cohesive; bedded; buried A horizon of soil profile; wet at 5 ft; loess.
	WOH 1 1 2	**2**		45	4	SS		CL	PRE-ILLINOIAN GLACIAL DIAMICTON (QWT). very soft; mottled brownish yellow to olive (10 YR 6/8 to 5 Y 5/4); SANDY LEAN CLAY (CL); wet; low plasticity; cohesive; bedded; diamicton.
	2 2 4 5	**6**		85	5	SS		CL	medium; mottled brownish yellow to pale brown (10 YR 6/8 to 6/3); SANDY LEAN CLAY (CL); wet; low plasticity; cohesive; bedded; diamicton.
10	6 17 17 10	**34**		85	6	SS		CL	As above from 10.5 - 11.0 ft.
								SW	dense; brownish yellow (10 YR 6/8); WELL GRADED SAND (SW); wet; non-plastic; noncohesive; bedded; glaciofluvial.
	3 8 9 12	**17**		100	7	SS		CL	very stiff; mottled brownish yellow to pale brown (10 YR 6/8 to 6/3); LEAN CLAY (CL); wet; low plasticity; cohesive; massive; diamicton.
15	10 8 6 11	**14**		100	8	SS		SP	medium dense; grayish brown (10 YR 5/2); POORLY GRADED SAND (SP); wet; non-plastic; noncohesive; bedded; glaciofluvial.
								CL	stiff; grayish brown (10 YR 5/2); SANDY LEAN CLAY (CL); wet; low plasticity; cohesive; bedded; diamicton.
	5 8 11 14	**19**		100	9	SS		CL	PRE-ILLINOIAN GLACIAL DIAMICTON (QAT). very stiff; dark gray (10 YR 4/1) LEAN CLAY with SAND and GRAVEL (CL); wet; low plasticity; cohesive; massive; silt/sand seam at 18 ft; diamicton.
									End of boring at 18.5 ft.

Tracking Codes: 60562377_BLACKHAWK.GPJ_ETSOIL 11/29/18, 1145

AECOM

FINAL SOIL BORING LOG

BORING NO. **B-220**

SITE: **Black Hawk County Landfill** PROJECT NO. **60562377** SHEET **1** OF **1**

SITE #: **7-SDP-1-75P**

PHYSICAL SETTING: **South of Area E along access between Area E and Area C**

LOG BY: **R. Henning**

FIRM/DRILLER: **Terracon/Ron Faulk**

DRILLING METHOD: **4.25-in HSA; 2-in by 2-ft SS**

ABANDONMENT DATE: **8/1/2018**

ABANDONMENT METHOD: **3/8-in Holeplug by gravity to ground surface**

WATER LEVEL READINGS

DATE	WATER DEPTH	HOLE DEPTH	CASING DEPTH

GROUND SURFACE ELEV:

IA State Plane LOCAL COORDINATES:

NORTHING:

EASTING:

DATE/TIME STARTED: **8/1/18 ; 11:25**

DATE/TIME COMPLETED: **8/1/18 ; 12:10**

WELL INSTALLATION: **NA**

Depth in Feet	SAMPLING DATA B	N	A	% Recovery	No.	T	Graphic Log	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS
0								NS	No sample.
	1 2 3 2	**5**		100	1	SS		BLANK	medium;
	WOH 1 2 2	**3**		100	2	SS		BLANK	soft;
5	1 2 3 4	**5**		100	3	SS		BLANK	medium;
	2 2 3 3	**5**		100	4	SS		BLANK	medium;
	1 2 2 2	**4**		100	5	SS		BLANK	soft;
10	WOH WOH 1 2	**1**		100	6	SS		BLANK	very soft;
	1 3 5 15	**20**		100	7	SS		BLANK	very stiff;
15									End of boring at 14.5 ft. Appear to be on top of perimeter toe drain for Area E. Abandon borehole and move to adjacent location north of Area C.

Tracking Codes: 60562377_BLACKHAWK.GPJ_ETSOIL: 11/29/18, 1145

AECOM

FINAL SOIL BORING LOG

BORING NO. **B-220B**

SITE: **Black Hawk County Landfill** PROJECT NO. **60562377** SHEET **1** OF **2**

SITE #: **7-SDP-1-75P**

PHYSICAL SETTING: **South of Area E along access between Area E and Area C**

LOG BY: **R. Henning**

FIRM/DRILLER: **Terracon/Ron Faulk**

DRILLING METHOD: **4.25-in HSA; 2-in by 2-ft SS**

WATER LEVEL READINGS

DATE	WATER DEPTH	HOLE DEPTH	CASING DEPTH

ABANDONMENT DATE: **NA**

ABANDONMENT METHOD: **NA**

GROUND SURFACE ELEV: **928.00**

IA State Plane LOCAL COORDINATES:

NORTHING: **3617831.7**

EASTING: **5238789.55**

DATE/TIME STARTED: **8/1/18 ; 12:40**

DATE/TIME COMPLETED: **8/1/18 ; 13:40**

WELL INSTALLATION: **8/1/2018**

Depth in Feet	SAMPLING DATA B	N	A	% Recovery	No.	T	Graphic Log	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS
0								NS	No sample. QUATERNARY ANTHROPOCENE FILL.
	5 6 5 6	11		100	1	SS		CL	QUATERNARY ANTHROPOCENE FILL. stiff; gray (10 YR 4/1); SANDY LEAN CLAY (CL); dry; low plasticity; cohesive; massive; fill.
	5 6 10 11	16		100	2	SS		CL	very stiff; mottled gray to black (10 YR 2/1 to 5/1); LEAN CLAY with GRAVEL (CL); dry; low plasticity; cohesive; massive; some asphalt; fill.
5	3 3 5 4	8		100	3	SS		CL	medium; mottled olive yellow to dark gray (2.5 Y 6/6 to 4/1); LEAN CLAY with SAND (CL); dry; low plasticity; cohesive; massive; fill.
	3 3 5 5	8		85	4	SS		CL	As above from 6.5 - 7.5 ft.
								ML	LOESS. medium; black (10 YR 2/1); SILT (ML); moist; low plasticity; cohesive; massive; buried A horizon of soil profile; loess.
	2 4 5 6	9		85	5	SS		CL	PRE-ILLINOIAN GLACIAL DIAMICTON (QWT). stiff; mottled brownish yellow to brown (10 YR 6/8 to 4/3); LEAN CLAY (CL); moist; low plasticity; cohesive; bedded; diamicton.
10								SW	stiff; yellowish brown (10 YR 5/6); WELL GRADED SAND (SW); wet; non-plastic; noncohesive; bedded; glaciofluvial.
	2 2 3 3	5		85	6	SS		CL	medium; mottled yellowish brown to grayish brown (10 YR 5/8 to 5/2); LEAN CLAY (CL); wet; low plasticity; cohesive; massive; diamicton.
	WOH 1 1 2	2		85	7	SS		CL	very soft; mottled gray to yellowish brown (10 YR 5/1 to 5/8); LEAN CLAY (CL); wet; low plasticity; cohesive; massive; with POORLY GRADED SAND (SP) seams at 13, 13.5 ft; diamicton.
15	WOH 3 4 9	7		100	8	SS		CL	As above from 14.5 to 16.5 ft but consistency changes to medium; sand seams within interval.
	4 6 8 19	14		90	9	SS		CL	stiff; yellowish brown (10 YR 5/8); LEAN CLAY (CL); wet; low plasticity; cohesive; massive; trace fine gravel; trace coarse sand; diamicton.
	-- -- 8 10	8		60	10	SS		SW	medium dense; cobble from 18.5 to 19.5 ft, no sample or blow counts; dark gray (10 YR 4/1); WELL GRADED SAND (SW); wet; non-plastic; noncohesive; bedded; glaciofluvial.

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Tracking Codes: 60562377_BLACKHAWK.GPJ_ETSOIL 11/29/18, 11:45

AECOM

FINAL SOIL BORING LOG

BORING NO. B-220B

SITE: **Black Hawk County Landfill** PROJECT NO. **60562377** SHEET **2** OF **2**

Depth in Feet	SAMPLING DATA B	N	A	% Recovery	No.	T	Graphic Log	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS
20								CL	PRE-ILLINOIAN GLACIAL DIAMICTON (QAT).
	6 9 13 15	22		100	11	SS		CL	very stiff; dark gray (10 YR 4/1); lean CLAY with GRAVEL (CL); wet; low plasticity; cohesive; bedded; diamicton. As above from 20.5 - 22.5 ft.
	16 63 26 24	>50		100	12	SS		CL	hard; very dark gray (10 YR 3/1); LEAN CLAY with GRAVEL (CL); moist; low plasticity; cohesive; massive; trace cobbles; diamicton.
25									End of boring at 24.5 ft.
30									
35									
40									

Tracking Codes: 60562377_BLACKHAWK.GPJ_ETSOIL 11/29/18, 11:45

AECOM

FINAL SOIL BORING LOG

BORING NO. **B-221**

SITE: **Black Hawk County Landfill** PROJECT NO. **60562377** SHEET **1** OF **2**

SITE #: **7-SDP-1-75P**

Southwest of Area X along access

PHYSICAL SETTING: **road**

LOG BY: **R. Henning**

FIRM/DRILLER: **Terracon/Ron Faulk**

DRILLING METHOD: **4.25-in HSA; 2-in by 2-ft SS**

WATER LEVEL READINGS	DATE	WATER DEPTH	HOLE DEPTH	CASING DEPTH
ABANDONMENT DATE:	**NA**			
ABANDONMENT METHOD:	**NA**			

GROUND SURFACE ELEV: **921.20**

IA State Plane LOCAL COORDINATES:

NORTHING: **3617659.3**

EASTING: **5239595.28**

DATE/TIME STARTED: **7/31/18 ; 12:20**

DATE/TIME COMPLETED: **7/31/18 ; 13:20**

WELL INSTALLATION: **7/31/2018**

Depth in Feet	B	N	A	% Recovery	No.	T	Graphic Log	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS
0								NS	No sample. QUATERNARY ANTHROPOCENE FILL.
	4 6 7	**10**		65	1	SS		CL	QUATERNARY ANTHROPOCENE FILL. stiff; black to dark reddish brown (5 YR 2.5/1 to 3/4); LEAN CLAY (CL); dry; non-plastic; cohesive; bedded; trace fine gravel; fill.
	3 6 8 11	**14**		80	2	SS		CL	stiff; mottled olive (5 Y 4/4) to dark gray (10 YR 4/1); LEAN CLAY (CL); dry; non-plastic; cohesive; bedded; trace fine gravel; fill.
5	4 8 9 11	**17**		80	3	SS		CL	As above from 4.5 - 6.5 ft, but consistency change to very stiff.
	3 4 5 9	**9**		95	4	SS		CL	As above from 6.5 - 8.0 ft, but consistency change to stiff.
								ML	LOESS.
	3 5 7 10	**12**		75	5	SS		ML	stiff; very dark brown (10 YR 2/2); SILT (ML); dry; non-plastic; cohesive; bedded; trace fine gravel; buried A horizon of soil profile; roots; plants; eolian loess.
								SC-SW	As above from 8.5 - 9.0 ft.
10									stiff; brown (10 YR 4/3); WELL GRADED SAND with CLAY (SC-SW); dry; non-plastic; cohesive; bedded; fine sand with fine gravel; glaciofluvial.
	4 2 4 3	**6**		100	6	SS		CL	PRE-ILLINOIAN GLACIAL DIAMICTON (QWT). medium; mottled yellowish brown to gray (10 YR 5/6 to 5/1); LEAN CLAY with SAND and GRAVEL (CL); dry; low plasticity; cohesive; bedded; sand seams at 11.5 and 12.0 ft; wet at 12.0 ft; diamicton.
	2 3 4 3	**7**		65	7	SS		SM	medium; yellowish brown (10 YR 5/4); SILTY SAND (SM); wet; non-plastic; noncohesive; bedded; glaciofluvial.
								SC	medium; yellowish brown (10 YR 5/4); CLAYEY SAND (SC); wet; non-plastic; noncohesive; bedded; glaciofluvial.
15	6 6 3 4	**9**		100	8	SS		SP	loose; yellowish brown (10 YR 5/4); POORLY GRADED SAND with GRAVEL (SP); wet; non-plastic; noncohesive; bedded; glaciofluvial.
								SC	loose; yellowish brown (10 YR 5/4); CLAYEY SAND (SC); wet; non-plastic; noncohesive; bedded; glaciofluvial.
	4 4 8 9	**12**		100	9	SS		SC	As above from 16.5 - 17.0 ft.
								CL	PRE-ILLINOIAN GLACIAL DIAMICTON (QAT). stiff; mottled dark yellowish brown to dark gray (10 YR 4/6 to 4/1); LEAN CLAY with SAND (CL); wet; low plasticity; cohesive; bedded; diamicton.
	4 10 17 19	**27**		100	10	SS		CL	very stiff; very dark gray (10 YR 3/1); LEAN CLAY with GRAVEL (CL); moist; non-plastic; cohesive; massive; with trace dolomite gravel; diamicton.

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Tracking Codes: 60562377_BLACKHAWK.GPJ_ETSOIL 11/29/18, 11:45

AECOM

FINAL SOIL BORING LOG

BORING NO. B-221

SITE: Black Hawk County Landfill PROJECT NO. 60562377 SHEET **2** OF **2**

Depth in Feet	B	N	A	% Recovery	No.	T	Graphic Log	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS
20									
	6 8 10 13	**18**		100	11	SS		CL	As above from 20.5 - 22.5 ft.
									End of boring at 22.5 ft.
25									
30									
35									
40									

Tracking Codes: 60562377_BLACKHAWK.GPJ_ETSOIL 11/29/18, 11:45

AECOM

FINAL SOIL BORING LOG

BORING NO. **B-222**

SITE: **Black Hawk County Landfill** PROJECT NO. **60562377** SHEET **1** OF **2**

SITE #: **7-SDP-1-75P**

Southwest of Area X along access

PHYSICAL SETTING: **road**

LOG BY: **R. Henning**

FIRM/DRILLER: **Terracon/Ron Faulk**

DRILLING METHOD: **4.25-in HSA; 2-in by 2-ft SS**

WATER LEVEL READINGS

DATE	WATER DEPTH	HOLE DEPTH	CASING DEPTH

ABANDONMENT DATE: **NA**

ABANDONMENT METHOD: **NA**

GROUND SURFACE ELEV: **916.20**

IA State Plane LOCAL COORDINATES:

NORTHING: **3617468.0**

EASTING: **5239825.68**

DATE/TIME STARTED: **7/30/18 ; 14:00**

DATE/TIME COMPLETED: **7/30/18 ; 15:00**

WELL INSTALLATION: **7/30/2018**

Depth in Feet	SAMPLING DATA B	N	A	% Recovery	No.	T	Graphic Log	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS
0								NS	No sample. QUATERNARY ANTHROPOCENE FILL.
	3 5 5 3	**10**		40	1	SS		CL	QUATERNARY ANTHROPOCENE FILL. stiff; dark reddish brown (5 YR 3/2); LEAN CLAY (CL); dry; low plasticity; cohesive; bedded; little fine gravel; fill.
	3 4 4 6	**8**		50	2	SS		CL	medium; dark grayish brown (10 YR 4/2); LEAN CLAY (CL); dry; low plasticity; cohesive; massive; fill.
5	2 4 6 7	**10**		90	3	SS		CL	stiff; black (10 YR 2/1); LEAN CLAY (CL); dry; low plasticity; cohesive; massive; fill.
	3 6 6 7	**12**		85	4	SS		CL	stiff; very dark gray (10 YR 3/1); LEAN CLAY with SAND and GRAVEL (CL); moist; low plasticity; cohesive; massive; fill.
	2 4 6 6	**10**		80	5	SS		CL	LOESS. stiff; dark gray to black (10 YR 4/1 to 2/1); LEAN CLAY with SAND (CL); low plasticity; cohesive; massive; buried A horizon of soil profile; loess.
10	2 3 3 4	**6**		75	6	SS		ML	medium; black (10YR 2/1); SILT (ML); moist to wet; low plasticity; cohesive; massive; loess.
	2 1 3 2	**4**		65	7	SS		CL	PRE-ILLINOIAN GLACIAL DIAMICTON (QWT). soft; yellowish brown (10 YR 5/6) to black (10 YR 2/1); SANDY LEAN CLAY (CL); moist; low plasticity; cohesive; massive; diamicton.
15	1 1 3 3	**4**		100	8	SS		SC	soft; yellowsih brown (10 YR 5/6); CLAYEY SAND (SC); moist to wet; low plasticity; cohesive; fine sand; fine gravel with clay matrix; top of water table; diamicton.
	– – – –	**–**		90	9	SS		SC	dark yellowish brown (10 YR 4/4); CLAYEY SAND (SC); moist; low plasticity; cohesive; fine sand; fine gravel; diamicton.
	2 6 8 11	**14**		100	10	SS		CL	PRE-ILLINOIAN GLACIAL DIAMICTON ((QAT). stiff; very dark gray (10 YR 3/1); LEAN CLAY (CL); moist; low plasticity; cohesive; massive; with some sand and fine gravel; diamicton.

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Tracking Codes: 60562377_BLACKHAWK.GPJ_ETSOIL 11/29/18, 1145

AECOM

FINAL SOIL BORING LOG

BORING NO. **B-222**

SITE: **Black Hawk County Landfill** PROJECT NO. **60562377** SHEET **2** OF **2**

Depth in Feet	SAMPLING DATA B	N	A	% Recovery	No.	T	Graphic Log	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS
20									
	3 6 9 5	**15**		100	11	SS		CL	As above from 20.5 - 22.5 ft.
	– 8 10 15	**18**		100	12	SS		CL	As above from 22.5 - 24.5 ft, but consistency change to very stiff.
25									End of boring at 24.5 ft.
30									
35									
40									

Tracking Codes: 60562377_BLACKHAWK.GPJ_ETSOIL 11/29/18, 1145

AECOM

FINAL SOIL BORING LOG

BORING NO. **B-223**

SITE: **Black Hawk County Landfill** PROJECT NO. **60562377** SHEET **1** OF **2**

SITE #: **7-SDP-1-75P**

Southwest of Area X along access

PHYSICAL SETTING: **road**

LOG BY: **R. Henning**

FIRM/DRILLER: **Terracon/Ron Faulk**

DRILLING METHOD: **4.25-in HSA; 2-in by 2-ft SS**

WATER LEVEL READINGS

DATE	WATER DEPTH	HOLE DEPTH	CASING DEPTH

ABANDONMENT DATE: **NA**

ABANDONMENT METHOD: **NA**

GROUND SURFACE ELEV: **914.60**

IA State Plane LOCAL COORDINATES:

NORTHING: **3617313.9**

EASTING: **5240081.60**

DATE/TIME STARTED: **7/31/18 ; 07:30**

DATE/TIME COMPLETED: **7/31/18 ; 08:30**

WELL INSTALLATION: **7/31/2018**

Depth in Feet	SAMPLING DATA B	N	A	% Recovery	No.	T	Graphic Log	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS
0								NS	No sample. QUATERNARY ANTHROPOCENE FILL.
	4 3 3 4	6		75	1	SS		CL	QUATERNARY ANTHROPOCENE FILL. medium; dark brown (10 YR 3/3); SANDY LEAN CLAY (CL); dry; low plasticity; cohesive; massive; trace fine gravel; fill.
	2 3 3 4	6		60	2	SS		CL	medium; very dark brown (10 YR 3/2); SANDY LEAN CLAY (CL); moist; low plasticity; cohesive; massive; fine sand; fine gravel; fill.
5	2 2 4 6	6		90	3	SS		CL	medium; dark grayish brown (10 YR 4/2); SANDY LEAN CLAY (CL); moist; low plasticity; cohesive; massive; fine sand; fill.
	3 6 7 9	13		70	4	SS		CL	As above from 6.5 - 8.5 ft., but consistency change to stiff.
	3 6 9 11	15		75	5	SS		CL	As above from 8.5 - 10.5 ft., but consistency change to stiff.
10	2 3 4 6	7		75	6	SS		ML	LOESS. medium; black (10 YR 2/1);SILT with SAND (ML); moist; low plasticity; cohesive; massive; trace fine gravel; trace plat roots; buried A horizon of soil profile; loess.
	3 3 4 5	7		70	7	SS		CL	PRE-ILLINOIAN GLACIAL DIAMICTON (QWT). medium; mottled brownish yellow to gray (10 YR 6/8 to 6/1); SANDY LEAN CLAY (CL); moist; low plasticity; cohesive; massive; fine sand; fine gravel; sand seam at 13.5 ft.; diamicton.
15	1 3 3 5	6		80	8	SS		CL	As above from 14.5 - 16.5 ft.
	3 6 9 13	15		95	9	SS		CL	As above from 16.5 - 18.5 ft., but consistency change to stiff.
	3 9 13 16	22		100	10	SS		CL	PRE-ILLINOIAN GLACIAL DIAMICTON (QAT). very stiff; dark grayish brown (10 YR 4/2); LEAN CLAY with SAND (CL); moist; low plasticity; cohesive; massive; fine sand; fine gravel; diamicton.

Continued Next Page

Tracking Codes: 60562377_BLACKHAWK.GPJ_ETSOIL 11/29/18, 1145

AECOM

FINAL SOIL BORING LOG

BORING NO. **B-223**

SITE: **Black Hawk County Landfill** PROJECT NO. **60562377** SHEET **2** OF **2**

Depth in Feet	SAMPLING DATA B	N	A	% Recovery	No.	T	Graphic Log	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS
20									End of boring at 20.5 ft.
25									
30									
35									
40									

Tracking Codes: 60562377_BLACKHAWK.GPJ_ETSOIL 11/29/18, 1145

LOG OF BORING NO. 301

OWNER: BLACK HAWK COUNTY
ENGINEER: RUST ENVIRONMENT & INFRASTRUCTURE
SITE: WATERLOO, IOWA
PROJECT: BLACK HAWK COUNTY LANDFILL EXPANSION

GRAPHIC LOG	DESCRIPTION	DEPTH (FT.)	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, IN.	SAMPLES **SPT - N BLOWS / FT.	TESTS MOISTURE, %	TESTS DRY DENSITY PCF	TESTS UNCONFINED STRENGTH, PSF	LL, PL, PI
	Approx. Surface Elev.: 930.4 ft. NGVD										
	LEAN SILTY CLAY, TRACE SAND, Dark Brown		CL	1	CS	80					
	7 923.4	5	CL	2	CS	100					
	- Coarse sand seam @ 8 to 8.3 feet. ▽ - With iron striations & mottling @ 8-10 feet.										
	SANDY LEAN CLAY, TRACE GRAVEL (Glacial Till), Light Olive Brown	10	CL	3	CS	100					
	15 915.4										
	- Sand seam @ 17.5 feet.	15	CL	4	CS	100					
	SANDY LEAN CLAY, TRACE GRAVEL (Glacial Till) WITH NUMEROUS BROWN SAND SEAMS & LAYERS, Very Dark Gray	20	CL	5	CS	100					
	- Gray fine sand @ 26 to 27 feet.	25	CL	6	CS	100					
	27 903.4										
	SANDY LEAN CLAY, TRACE GRAVEL (Glacial Till), Very Dark Gray	30	CL	7	CS	100					27,12,15
	- Cobble @ 34 and 42.5 feet.	35	CL	8	CS	100					
		40	CL	9	ST	100		8.5	127		25, 9,16
			CL	10	CS	100					
	- Added H2O to reduce auger friction.	45	CL	11	CS	100					
	- Decreasing sand content @ 49 feet.										
	Continued Next Page	50									

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

Calibrated Hand Penetrometer*
CME 140 Lb. Auto. SPT Hammer **

WATER LEVEL OBSERVATIONS (FT.)				
WL	▽8	WS	▽ DRY	AB
WL	▽		▽	
WL				

Terracon

BORING STARTED	10-17-96		
BORING COMPLETED	10-18-96		
RIG	#37	FOREMAN	REF
APPROVED	TAS	JOB #	06968518

M3BLOG 68518 3/5/97

LOG OF BORING NO. 301

OWNER: BLACK HAWK COUNTY
ENGINEER: RUST ENVIRONMENT & INFRASTRUCTURE
SITE: WATERLOO, IOWA
PROJECT: BLACK HAWK COUNTY LANDFILL EXPANSION

GRAPHIC LOG	DESCRIPTION	DEPTH (FT.)	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, IN.	SAMPLES **SPT - N BLOWS / FT.	TESTS MOISTURE, %	TESTS DRY DENSITY PCF	TESTS UNCONFINED STRENGTH, PSF	LL, PL, PI
	- Change in color to dark olive gray @ 51 to 53 feet.		CL	12	CS	100					
	- Sand seam @ 52.5 feet, sandy clay @ 52.5 to 53 feet.	55	CL	13	CS	100					
		60		14	ST	0					
			CL	15	CS	100					
	SANDY LEAN CLAY, TRACE GRAVEL (Glacial Till), Very Dark Gray	65	CL	16	ST	100		11.5	125		
			CL	17	CS	100					
		70	CL	18	CS	100					
		75	CL	19	CS	100					
	- Less dense and moist @ 75 to 80 feet.	80	CL	20	ST	100		10.3	128		
			CL	21	CS	100					
		85	CL	22	CS	100					
		90	CL	23	CS	100					
	93.5 836.9										
	94.5 ***WEATHERED DOLOMITE, Light Brown 835.9										
	BOTTOM OF BORING										

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

Calibrated Hand Penetrometer*
CME 140 Lb. Auto. SPT Hammer **

WATER LEVEL OBSERVATIONS (FT.)				
WL	▽8	WS	▽ DRY	AB
WL	▽		▽	
WL				

Terracon

BORING STARTED	10-1		
BORING COMPLETED	10-18-96		
RIG	#37	FOREMAN	REF
APPROVED	TAS	JOB #	06968518

M3BLOG 68518 3/5/97

LOG OF BORING NO. 302

OWNER: BLACK HAWK COUNTY
ENGINEER: RUST ENVIRONMENT & INFRASTRUCTURE
SITE: WATERLOO, IOWA
PROJECT: BLACK HAWK COUNTY LANDFILL EXPANSION

DESCRIPTION	DEPTH (FT.)	USCS SYMBOL	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: RECOVERY, IN.	SAMPLES: **SPT - N BLOWS / FT.	TESTS: MOISTURE, %	TESTS: DRY DENSITY PCF	TESTS: UNCONFINED STRENGTH, PSF	TESTS: LL, PL, PI
Approx. Surface Elev.: 944.0 ft. NGVD										
2 SILT, TRACE SAND, Dark Gray Brown 942		ML	1	CS	50					
SANDY LEAN CLAY, TRACE GRAVEL (Glacial Till) & COBBLES, Light Olive Brown	5	CL	2	CS	100					
- With gray mottling.										
12 - Sand lens @ 10.5 feet. 932	10	CL	3	CS	80					
SANDY LEAN CLAY, TRACE GRAVEL (Glacial Till) & COBBLES, Olive Brown	15			HS						
		CL	4	CS	100					
(No Mottling) 23 921	20	CL	5	CS	100					
SANDY LEAN CLAY, TRACE GRAVEL (Glacial Till), Very Dark Gray	25	CL	6	CS	100					
	30	CL	7	CS	100		10.6	115	9600	27,15,12
- 2" Cobble @ 36 feet. 37 907	35	CL	8	CS	100					
39.5 FINE TO COARSE SAND, Gray (Moist) 904.5										
- Gray fine sand @ 41 to 42.5 feet.	40	CL	9	CS	90					
SANDY LEAN CLAY, TRACE GRAVEL (Glacial Till) WITH NUMEROUS SAND LAYERS, Very Dark Gray	45	CL	10	CS	100					
- 1" sand seam @ 46 feet.	50									
Continued Next Page										

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

Calibrated Hand Penetrometer*
CME 140 Lb. Auto. SPT Hammer **

WATER LEVEL OBSERVATIONS (FT.)				
WL	▽ 15	WS	▽ DRY	AB
WL	▽		▽	
WL				

Terracon

BORING STARTED	10-18-96		
BORING COMPLETED	10-18-96		
RIG	#37	FOREMAN	REF
APPROVED	TAS	JOB #	06968518

N3BLGE 68518 3/10/97

LOG OF BORING NO. 302

OWNER: BLACK HAWK COUNTY
ENGINEER: RUST ENVIRONMENT & INFRASTRUCTURE
SITE: WATERLOO, IOWA
PROJECT: BLACK HAWK COUNTY LANDFILL EXPANSION

DESCRIPTION	DEPTH (FT.)	USCS SYMBOL	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: RECOVERY, IN.	SAMPLES: **SPT - N BLOWS / FT.	TESTS: MOISTURE, %	TESTS: DRY DENSITY PCF	TESTS: UNCONFINED STRENGTH, PSF	TESTS: LL, PL, PI
SANDY LEAN CLAY, TRACE GRAVEL (Glacial Till) WITH NUMEROUS SAND LAYERS, Very Dark Gray		CL	11	CS	100					
- More dense @ 53 to 54 feet.	55	CL	12	CS	100					
60 - Silty clayey sand @ 54 to 54.5 feet. 884	60	CL	13	CS	100					
- Added H20 to reduce auger friction.										
- Cobble @ 60.5 feet.	65	CL	14	CS	100					
- Increasing gravel content.										
SANDY LEAN CLAY, TRACE GRAVEL (Glacial Till), Very Dark Gray (Dry)	70	CL	15	CS	100					
- Color change to dark olive gray @ 72 feet.	75	CL	16	CS	100					
- 1" sand lens @ 74 feet.										
- Added H20 to reduce auger friction.	80	CL	17	CS	100					
- Cobble @ 84.8 feet.	85	CL	18	CS	100					
- 1/4" sand seam @ 94.5 feet.	90	CL	19	CS	100					
- Trace dolomite chips. 95 849	95		20	CS	100					
96 ***WEATHERED DOLOMITE, Light Brown 848			21	SS	12	50/ 4.5"				
BOTTOM OF BORING										

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

Calibrated Hand Penetrometer*
CME 140 Lb. Auto. SPT Hammer **

WATER LEVEL OBSERVATIONS (FT.)				
WL	▽ 15	WS	▽ DRY	AB
WL	▽		▽	
WL				

Terracon

BORING STARTED	10-18		
BORING COMPLETED	10-18-96		
RIG	#37	FOREMAN	REF
APPROVED	TAS	JOB #	06968518

N3BLGE 68518 3/10/97

LOG OF BORING NO. 304

OWNER: BLACK HAWK COUNTY

ENGINEER: RUST ENVIRONMENT & INFRASTRUCTURE

SITE: WATERLOO, IOWA

PROJECT: BLACK HAWK COUNTY LANDFILL EXPANSION

GRAPHIC LOG	DESCRIPTION	DEPTH (FT.)	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, IN.	SAMPLES **SPT - N BLOWS / FT.	TESTS MOISTURE, %	TESTS DRY DENSITY PCF	TESTS UNCONFINED STRENGTH, PSF	LL, PL, PI
	Approx. Surface Elev.: 924.0 ft. NGVD										
	LEAN SILTY CLAY, TRACE SAND, Black	2.5	ML	1	CS	80					
	921.5										
	CLAYEY SILT, TRACE SAND, Very Dark Brown	6									
	918										
	3" sand seam @ 7.5 feet (Wet). ▽		CL	2	CS	80					
	SANDY LEAN CLAY, TRACE GRAVEL (Glacial Till) WITH SAND SEAMS, Light Olive Brown	10	CL	3	CS	100					
	(Mottled @ 10 to 12 feet).	13									
	911										
	1/4" Vertical sand seam @ 15 to 16 feet.	15	CL*	4	CS	100					
	SANDY LEAN CLAY, TRACE GRAVEL (Glacial Till) WITH SAND SEAMS, Gray	20	CL	5	CS	100					
	- Cobble @ 24.8 feet.	25									
	899										
	BOTTOM OF BORING										

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

Calibrated Hand Penetrometer*
CME 140 Lb. Auto. SPT Hammer **

WATER LEVEL OBSERVATIONS (FT.)			
WL	▽ 7.5	ws	▽
WL	▽		▽
WL			

Terracon

BORING STARTED	10-20-96		
BORING COMPLETED	10-20-96		
RIG	#37	FOREMAN	REF
APPROVED	TAS	JOB #	06968518

KIBLGE 68518 3/5/97

LOG OF BORING NO. 307

OWNER: BLACK HAWK COUNTY
SITE: WATERLOO, IOWA
ENGINEER: RUST ENVIRONMENT & INFRASTRUCTURE
PROJECT: BLACK HAWK COUNTY LANDFILL EXPANSION

GRAPHIC LOG	DESCRIPTION	DEPTH (FT.)	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, IN.	SAMPLES **SPT - N BLOWS / FT.	TESTS MOISTURE, %	TESTS DRY DENSITY PCF	TESTS UNCONFINED STRENGTH, PSF	LL, PL, PI
	Approx. Surface Elev.: 926.3 ft. NGVD										
	6" Topsoil - 6" to 12" Concrete Rubble		CL	1	CS	83					
	CLAYEY SILT, TRACE SAND, Very Dark Gray Brown		CL	2	CS	100					
5	921.3	5									
	SILTY LEAN CLAY, TRACE GRAVEL (Glacial Till), Very Dark Gray Brown		CL	3	CS	100					
11.5	914.8	10									
14	SANDY LEAN CLAY, TRACE GRAVEL (Glacial Till), Dark Gray Brown (Moist) 912.3		CL	4	CS	100					
	- Wet sand layer @ 18 to 18.2 feet.	15									
			CL	5	CS	75					
	- 1" fine sand seam @ 22 feet.	20	CL	6	CS	100					
	SANDY LEAN CLAY, TRACE GRAVEL (Glacial Till) WITH OCCASIONAL COBBLES @ 16 and 17.5 feet, Dark Gray	25	CL	7	CS	100					
		30	~~CL~~	~~8~~	~~ST~~	~~100~~		~~8.9~~	~~126~~		26,15,11
			CL	9	CS	88					
	- 1" sand seam @ 33 feet.	35	CL	10	CS	100		10.2			25,13,12
		40	CL	11	CS HS	100		8.5			25,14,11
	- Boulder obstruction @ 41 to 42 feet. (Drilled aside).		CL	12	CS	100					
		45	CL	13	CS	100					
	- More dense @ 48 to 50 feet.	50									

Continued Next Page

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

Calibrated Hand Penetrometer*
CME 140 Lb. Auto. SPT Hammer **

WATER LEVEL OBSERVATIONS (FT.)				
WL	▽ 18	WS	▽ 24	(10/17/96)
WL	▽		▽	
WL				

Terracon

BORING STARTED	10-16-96		
BORING COMPLETED	10-17-96		
RIG	#37	FOREMAN	REF
APPROVED	TAS	JOB #	06968518

N3BLGE 68518 3/10/97

LOG OF BORING NO. 307

OWNER: BLACK HAWK COUNTY
SITE: WATERLOO, IOWA
ENGINEER: RUST ENVIRONMENT & INFRASTRUCTURE
PROJECT: BLACK HAWK COUNTY LANDFILL EXPANSION

GRAPHIC LOG	DESCRIPTION	DEPTH (FT.)	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, IN.	SAMPLES **SPT - N BLOWS / FT.	TESTS MOISTURE, %	TESTS DRY DENSITY PCF	TESTS UNCONFINED STRENGTH, PSF	LL, PL, PI
		55	CL	14	CS	100					
			CL	15	ST	100		9.9	121		
			CL	16	CS	100					
	- Fine to medium sand (Wet) @ 58 to 59.5 feet. (Very Dark Gray)	60	SP								
			CL	17	CS	100					
	SANDY LEAN CLAY, TRACE GRAVEL (Glacial Till) WITH OCCASIONAL COBBLES, Dark Gray to Dark Olive Gray @ 59.5 feet.	65	CL	18	CS	100					
		70	CL	19	CS	100					
		75	CL	20	CS	100					
		80	CL	21	ST	100		12.3	126		
			CL	22	CS	100					
	- Fine clayey sand (Wet) @ 84 to 84.5 feet.	85	CL	23	CS	100					
87	839.3										
88.5	***WEATHERED DOLOMITE, Light Brown 837.8			24	SS	100	50/6"				
	BOTTOM OF BORING										

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

Calibrated Hand Penetrometer*
CME 140 Lb. Auto. SPT Hammer **

WATER LEVEL OBSERVATIONS (FT.)				
WL	▽ 18	WS	▽ 24	(10/17/96)
WL	▽		▽	
WL				

Terracon

BORING STARTED	10-16		
BORING COMPLETED	10-17-96		
RIG	#37	FOREMAN	REF
APPROVED	TAS	JOB #	06968518

N3BLGE 68518 3/5/97

LOG OF BORING NO. 308

OWNER: BLACK HAWK COUNTY
ENGINEER: RUST ENVIRONMENT & INFRASTRUCTURE
SITE: WATERLOO, IOWA
PROJECT: BLACK HAWK COUNTY LANDFILL EXPANSION

DESCRIPTION	DEPTH (FT.)	USCS SYMBOL	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: RECOVERY, IN.	SAMPLES: **SPT - N BLOWS / FT.	TESTS: MOISTURE, %	TESTS: DRY DENSITY PCF	TESTS: UNCONFINED STRENGTH, PSF	LL, PL, PI
Approx. Surface Elev.: 946.6 ft. NGVD										
12" Silty Clay (Topsoil), Dark Brown										
LEAN CLAY, TRACE SAND, Gray Brown	3.5	CL	1	CS	100					
943.1										
- Gravel lenses @ 7 & 9 feet.	5	ML	2	CS	100					
SANDY SILT, Yellow Brown										
12.5	10	ML	3	CS	100					
934.1										
- Sandy silt @ 19.5 feet.	15	CL	4	CS	100		12.1			34,15,19
SANDY LEAN CLAY, TRACE GRAVEL (Glacial Till) WITH SAND SEAMS, Olive-Brown	20			HS						
	25	CL	5	ST	100		13.1	125	16140	34,17,17
		CL	6	SS	100	41				
		CL	7	SS	100	44				
	30	CL	8	SS	100	51				
		CL	9	SS	100	59				
33										
913.6										
FINE TO COARSE SAND, TRACE GRAVEL, Gray Brown (Wet)	35			HS						
37.5 - Fine sand @ 36.5 feet.										
909.1										
SANDY LEAN CLAY, TRACE GRAVEL (Glacial Till), Dark Gray	40	CL	10	SS	100	44				
		CL	11	SS	100	58	12.9	123		31,13,18
	45	CL	12	SS	100	64				
		CL	13	SS	100	78				
		CL	14	SS	100	57				
	50									

Continued Next Page

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

Calibrated Hand Penetrometer*
CME 140 Lb. Auto. SPT Hammer **

WATER LEVEL OBSERVATIONS (FT.)			
WL	▽ 7.5	WS	▽ 24.9 (10/15/96)
WL	▽		▽
WL			

Terracon

BORING STARTED	10-14-96		
BORING COMPLETED	10-14-96		
RIG	#6	FOREMAN	SZ
APPROVED	TAS	JOB #	06968518

N3BLGE 68518 3/10/97

LOG OF BORING NO. 308

OWNER: BLACK HAWK COUNTY
ENGINEER: RUST ENVIRONMENT & INFRASTRUCTURE
SITE: WATERLOO, IOWA
PROJECT: BLACK HAWK COUNTY LANDFILL EXPANSION

DESCRIPTION	DEPTH (FT.)	USCS SYMBOL	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: RECOVERY, IN.	SAMPLES: **SPT - N BLOWS / FT.	TESTS: MOISTURE, %	TESTS: DRY DENSITY PCF	TESTS: UNCONFINED STRENGTH, PSF	LL, PL, PI
		CL	15	SS	100	36				
		CL	16	SS	100	53				
- Silty sand seam @ 54.5 feet.	55	CL	17	SS	100	97				
		CL	18	SS	100	59				
		CL	19	SS	100	58				
	60	CL	20	ST	100	40	8.5	129		
		CL	21	SS	100					
		CL	22	SS	100	55				
		CL	23	SS	100	61				
SANDY LEAN CLAY, TRACE GRAVEL (Glacial Till), Dark Gray	65	CL	24	SS	100	83				
		CL	25	SS	100	91				
	70	CL	26	SS	100	46				
		CL	27	SS	100	95				
		CL	28	SS	100	75				
- Silt layer @ 68.5 feet.	75	CL	29	SS	100	59				
		CL	30	SS	100	55				
	80	CL	31	ST	0	67				
			32	SS	100					
		CL	33	SS	100	88				
		CL	34	SS	100	57				
	85	CL	35	SS	100	109				
		CL	36	SS	100	57				
		CL	37	SS	100	80				
93.5	90	CL	38	SS	100	101				
853.1										
			39	SS	100	50/6"				
	95			RB						
			40	SS	100	50/5"				
***WEATHERED DOLOMITE WITH SILT & CLAY LAYERS, Light Brown				RB						
			41	SS	100	50/1"				
	100									

Continued Next Page

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

Calibrated Hand Penetrometer*
CME 140 Lb. Auto. SPT Hammer **

WATER LEVEL OBSERVATIONS (FT.)
WL ▽ 7.5 WS ▽ 24.9 (10/15/96)
WL ▽ ▽
WL

Terracon

BORING STARTED 10-14-96
BORING COMPLETED 10-14-96
RIG #6 FOREMAN SZ
APPROVED TAS JOB # 06968518

N3BLGE 68518 3/5/97

LOG OF BORING NO. 308

OWNER: BLACK HAWK COUNTY

ENGINEER: RUST ENVIRONMENT & INFRASTRUCTURE

SITE: WATERLOO, IOWA

PROJECT: BLACK HAWK COUNTY LANDFILL EXPANSION

GRAPHIC LOG	DESCRIPTION	DEPTH (FT.)	USCS SYMBOL	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: RECOVERY, IN.	SAMPLES: **SPT - N BLOWS / FT.	TESTS: MOISTURE, %	TESTS: DRY DENSITY PCF	TESTS: UNCONFINED STRENGTH, PSF	LL, PL, PI
	101.5 845.1				RB						
	BOTTOM OF BORING										

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

Calibrated Hand Penetrometer*
CME 140 Lb. Auto. SPT Hammer **

WATER LEVEL OBSERVATIONS (FT.)			
WL	▽ 7.5	WS	▽ 24.9 (10/15/96)
WL	▽		▽
WL			

Terracon

BORING STARTED	10-14-96		
BORING COMPLETED	10-14-96		
RIG	#6	FOREMAN	SZ
APPROVED	TAS	JOB #	06968518

N3BLGE 68518 3/5/97

LOG OF BORING NO. 312

OWNER: BLACK HAWK COUNTY

ENGINEER: RUST ENVIRONMENT & INFRASTRUCTURE

SITE: WATERLOO, IOWA

PROJECT: BLACK HAWK COUNTY LANDFILL EXPANSION

GRAPHIC LOG	DESCRIPTION	DEPTH (FT.)	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, IN.	SAMPLES **SPT - N BLOWS / FT.	TESTS MOISTURE, %	TESTS DRY DENSITY PCF	TESTS UNCONFINED STRENGTH, PSF	LL, PL, PI
	Approx. Surface Elev.: 943.5 ft. NGVD										
	13" Lean Clay (Topsoil), Dark Brown		CL	1	CS	100					
	SANDY LEAN CLAY, TRACE GRAVEL (Glacial Till) WITH SAND SEAMS, Gray Brown	5	CL	2	CS	100					
		10	CL	3	CS	100					
	13 930.5										
	- Sand layers from 15.5 to 17.5 feet. ▽	15	CL	4	CS	100					
	SANDY LEAN CLAY, TRACE GRAVEL (Glacial Till), Gray	20	CL	5	CS	100					
	25 918.5										
	BOTTOM OF BORING	25									

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

Calibrated Hand Penetrometer *
CME 140 Lb. Auto. SPT Hammer **

WATER LEVEL OBSERVATIONS (FT.)			
WL	▽ 15	WD	▽
WL	▽		▽
WL			

Terracon

BORING STARTED	10-19-96		
BORING COMPLETED	10-19-96		
RIG	#6	FOREMAN	SZ
APPROVED	TAS	JOB #	06968518

N3BLGE 68518 3/6/97

LOG OF BORING NO. 313

OWNER: BLACK HAWK COUNTY
ENGINEER: RUST ENVIRONMENT & INFRASTRUCTURE
SITE: WATERLOO, IOWA
PROJECT: BLACK HAWK COUNTY LANDFILL EXPANSION

GRAPHIC LOG	DESCRIPTION	DEPTH (FT.)	USCS SYMBOL	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: RECOVERY, IN.	SAMPLES: **SPT - N BLOWS / FT.	TESTS: MOISTURE, %	TESTS: DRY DENSITY PCF	TESTS: UNCONFINED STRENGTH, PSF	TESTS: LL, PL, PI
	Approx. Surface Elev.: 932.0 ft. NGVD										
	12" Silt (Topsoil), Dark Brown		CL	1	CS	90					
	SANDY LEAN CLAY, TRACE GRAVEL (Glacial Till), Olive-Yellow										
	Gray mottling to approx. 8 feet.	5	CL	2	CS	100					
7	- Cobble @ 4 feet. 925										
	SANDY LEAN CLAY, TRACE GRAVEL (Glacial Till), Olive Gray	10	CL	3	CS	100					
10	922										
	- Silty sand @ 15.5 to 17 feet, Olive-Brown	15	CL	4	CS	100					
	SANDY LEAN CLAY, TRACE GRAVEL (Glacial Till), Dark Olive Gray ▽	20	CL	5	CS	100					
		25	CL	6	CS	90					
	- Sand seams @ 22, 24.5, 26.5 to 27 feet. (Wet)	30	CL	7	CS	100					
		35	CL	8	CS	100					
	- Decreasing sand/gravel content @ 41 to 43 feet.	40	CL	9	CS	100					
	- Cobble @ 43.5 feet.	45	CL	10	CS	100					
		50									

Continued Next Page

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

Calibrated Hand Penetrometer*
CME 140 Lb. Auto. SPT Hammer **

WATER LEVEL OBSERVATIONS (FT.)			
WL	▽ 22	ws	▽
WL	▽		▽
WL			

Terracon

BORING STARTED	10-18-96		
BORING COMPLETED	10-19-96		
RIG	#37	FOREMAN	REF
APPROVED	TAS	JOB #	06968518

N38LGE 68518 3/6/97

LOG OF BORING NO. 313

OWNER: BLACK HAWK COUNTY
ENGINEER: RUST ENVIRONMENT & INFRASTRUCTURE
SITE: WATERLOO, IOWA
PROJECT: BLACK HAWK COUNTY LANDFILL EXPANSION

GRAPHIC LOG	DESCRIPTION	DEPTH (FT.)	USCS SYMBOL	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: RECOVERY, IN.	SAMPLES: **SPT - N BLOWS / FT.	TESTS: MOISTURE, %	TESTS: DRY DENSITY PCF	TESTS: UNCONFINED STRENGTH, PSF	TESTS: LL, PL, PI
			CL	11	CS	100					
	- Added H20 to reduce auger friction.	55	CL	12	CS	100					
		60	CL	13	ST	83		10.7	122		28,15,13
			CL	14	CS	100					
65	- 6" sand seam @ 64.5 feet. 867	65	CL	15	SS	100	51				
	SANDY CLAY, Olive		CL	16	CS	100					
	- Sand seam @ 68 feet.	70	CL	17	CS	100					
73	- Cobble @ 72 feet. 859										
	- Cobble @ 78 feet.	75	CL	18	CS	100					
		80	CL	19	ST	100		12.0	123		
	SANDY LEAN CLAY, TRACE GRAVEL (Glacial Till), Dark Olive Gray		CL	20	CS	100					
		85	CL	21	CS	100					
		90	CL	22	CS	100					
	- Increasing gravel content @ 99 feet.	95	CL	23	CS	100					
		100									

Continued Next Page

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

Calibrated Hand Penetrometer*
CME 140 Lb. Auto. SPT Hammer **

WATER LEVEL OBSERVATIONS (FT.)
WL ▽ 22 ws ▽
WL ▽ ▽
WL

Terracon

BORING STARTED 10-18-96
BORING COMPLETED 10-19-96
RIG #37 FOREMAN REF
APPROVED TAS JOB # 06968518

N38LGE 68518 3/6/97

LOG OF BORING NO. 313

OWNER: BLACK HAWK COUNTY

ENGINEER: RUST ENVIRONMENT & INFRASTRUCTURE

SITE: WATERLOO, IOWA

PROJECT: BLACK HAWK COUNTY LANDFILL EXPANSION

GRAPHIC LOG	DESCRIPTION	DEPTH (FT.)	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, IN.	SAMPLES **SPT - N BLOWS / FT.	TESTS MOISTURE, %	TESTS DRY DENSITY PCF	TESTS UNCONFINED STRENGTH, PSF	LL, PL, PI
	SANDY LEAN CLAY, TRACE GRAVEL (Glacial Till), Dark Olive Gray		CL	24	CS	100					
	- Sandy clay @ 106.5 - 107 feet.	105	CL	25	CS	100					
	109.5 822.5		CL	26	SS	50	106/6"				
	110 ***WEATHERED DOLOMITE, Light Brown 822	110									
	BOTTOM OF BORING										

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

Calibrated Hand Penetrometer*
CME 140 Lb. Auto. SPT Hammer **

WATER LEVEL OBSERVATIONS (FT.)			
WL	▽ 22	ws	▽
WL	▽		▽
WL			

Terracon

BORING STARTED			10-18-96
BORING COMPLETED			10-19-96
RIG	#37	FOREMAN	REF
APPROVED	TAS	JOB #	06968518

N:\BL\GE 68518 3/10/97

LOG OF BORING NO. 318

OWNER: BLACK HAWK COUNTY
ENGINEER: RUST ENVIRONMENT & INFRASTRUCTURE
SITE: WATERLOO, IOWA
PROJECT: BLACK HAWK COUNTY LANDFILL EXPANSION

GRAPHIC LOG	DESCRIPTION	DEPTH (FT.)	USCS SYMBOL	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: RECOVERY, IN.	SAMPLES: **SPT - N BLOWS / FT.	TESTS: MOISTURE, %	TESTS: DRY DENSITY PCF	TESTS: UNCONFINED STRENGTH, PSF	LL, PL, PI
	Approx. Surface Elev.: 954.7 ft. NGVD										
	10" Lean Clay (Topsoil), Dark Brown		CL	1	CS	75					
	SILT, TRACE SAND, Yellow-Brown										
	4.5 (Non-Plastic) 950.2										
	6.5 FINE SILTY SAND, Yellow-Brown 948.2	5	CL	2	CS	50					
	SANDY LEAN CLAY, TRACE GRAVEL (Glacial Till) WITH SAND SEAMS, Light Olive-Brown ▼										
	- Sand seam @ 11 feet. ▽	10	CL	3	CS	90					
	13.5 - Boulder @ 12 to 13 feet. (Drilled aside) 941.2				HS						
	16 FINE SILTY SAND, Olive-Yellow 938.7		CL	4	CS	100					
	- Blue gray & iron streaks @ 16 feet.	15		5	CS	100					
	SANDY LEAN CLAY, TRACE GRAVEL (Glacial Till), Dark Gray Brown	20	CL	6	CS	100		14.2			30,15,15
	- Silty sand @ 25 - 25.4 feet.	25	CL	7	HS CS	88					
	- Silt seam @ 27.5 feet.		CL	8	ST	90		11.3	123		29,12,17
		30	CL	9	CS	100					
	- Sand seam @ 32.5 feet.	35	CL	10	CS	100					
	- Sand seam @ 37 feet.										
	- Coarse sand layer @ 45.5 to 46 feet.	40	CL	11	CS	100					
	- Boulder @ 46 to 47.5 feet. (Tri-Cone through)	45	CL	12	CS	75					
	47.5 907.2				HS						
	SANDY LEAN CLAY, TRACE GRAVEL (Glacial Till), Gray		CL	13	RB SS	75	46				
	Continued Next Page	50									

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

Calibrated Hand Penetrometer*
CME 140 Lb. Auto. SPT Hammer **

WATER LEVEL OBSERVATIONS (FT.)				
WL	▽ 11	WS	▽ 8	(10/16/96)
WL	▽		▽	
WL				

Terracon

BORING STARTED	10-14-96		
BORING COMPLETED	10-16-96		
RIG	#37	FOREMAN	REF
APPROVED	TAS	JOB #	06968518

N3BLGE 68518 3/7/97

LOG OF BORING NO. 318

OWNER: BLACK HAWK COUNTY
ENGINEER: RUST ENVIRONMENT & INFRASTRUCTURE
SITE: WATERLOO, IOWA
PROJECT: BLACK HAWK COUNTY LANDFILL EXPANSION

GRAPHIC LOG	DESCRIPTION	DEPTH (FT.)	USCS SYMBOL	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: RECOVERY, IN.	SAMPLES: **SPT - N BLOWS / FT.	TESTS: MOISTURE, %	TESTS: DRY DENSITY PCF	TESTS: UNCONFINED STRENGTH, PSF	LL, PL, PI
			CL	14	SS	100	52				
	- Silt layer @ 53.8 feet.		CL	15	CS	100					
		55	CL	16	ST	100		13.2	124		29,15,14
	- Cobble @ 55.5 feet.		CL	17	CS	100					
		60	CL	18	CS	0					
		65	CL	19	CS	0					
	SANDY LEAN CLAY, TRACE GRAVEL (Glacial Till) WITH OCCASIONAL SAND SEAMS, Very Dark Gray	70			HS						
			CL	20	CS	100					
			CL	21	CS	100					
		75									
			CL	22	CS	100					
			CL	23	ST	100		9.0			
	- Sand seam @ 81 feet.	80	CL	24	CS	100					
		85	CL	25	CS	100					
	- Sand seam @ 88 feet.										
		90	CL	26	CS	100					
	- Silt @ 93 to 95.5 feet.										
	95.5 859.2	95	ML	27	CS	100					
	LEAN TO FAT CLAY, TRACE SAND, Gray										
	Continued Next Page	100									

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

Calibrated Hand Penetrometer*
CME 140 Lb. Auto. SPT Hammer **

WATER LEVEL OBSERVATIONS (FT.)				
WL	▽ 11	WS	▽ 8	(10/16/96)
WL	▽		▽	
WL				

Terracon

BORING STARTED	10-1(		
BORING COMPLETED	10-16-9(		
RIG	#37	FOREMAN	REF
APPROVED	TAS	JOB #	06968518

N3BLGE 68518 3/7/97

LOG OF BORING NO. 318

OWNER: BLACK HAWK COUNTY
ENGINEER: RUST ENVIRONMENT & INFRASTRUCTURE
SITE: WATERLOO, IOWA
PROJECT: BLACK HAWK COUNTY LANDFILL EXPANSION

GRAPHIC LOG	DESCRIPTION	DEPTH (FT.)	USCS SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES RECOVERY, IN.	SAMPLES **SPT - N BLOWS / FT.	TESTS MOISTURE, %	TESTS DRY DENSITY PCF	TESTS UNCONFINED STRENGTH, PSF	LL, PL, PI
	100.5 SANDY LEAN TO FAT CLAY, TRACE GRAVEL, Reddish Brown and Gray (Layered) 103.5 851.2		CL/CH	28	CS	100					
	SANDY LEAN CLAY, TRACE GRAVEL (Glacial Till), Dark Gray	105	CL	29	CS	100					
		110	CL	30	CS	100					
	- Sand seam @ 118.5 feet.	115	CL	31	CS	100					
	2" silty sand @ 119.5 feet.	120	CL	32	CS	100					
	125 829.7	125	CL	33	CS	100					
	126 ***WEATHERED DOLOMITE, Light Brown 828.7			34	SS	100	50/2"				
	BOTTOM OF BORING										

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

Calibrated Hand Penetrometer*
CME 140 Lb. Auto. SPT Hammer **

WATER LEVEL OBSERVATIONS (FT.)			
WL	▽ 11	WS	▽ 8 (10/16/96)
WL	▽		▽
WL			

Terracon

BORING STARTED	10-14-96		
BORING COMPLETED	10-16-96		
RIG	#37	FOREMAN	REF
APPROVED	TAS	JOB #	06968518

N3BLGE 68518 3/7/97

Sheet 1 Of ___

AECOM

FIELD BORING LOG

BORING NO. B38BR

SITE: Black Hawk Co. LF PROJECT NO: 60284307.17

DRILLING METHOD: 4¼ HSA. 2ft x 2in SS continuous sampling to EOB

LOG BY: R Henning

FIRM/DRILLER: Rob Hunt - Braun

PHYSICAL SETTING: Dry flat lying field by Hammond & Washburn

ABANDONMENT DATE: NA

ABANDONMENT METHOD: NA

WATER LEVEL READINGS

DATE/ TIME	WATER DEPTH	HOLE DEPTH	CASING DEPTH

GROUND SURFACE ELEV: ___

COORDINATE TYPE: ___

NORTH: ___

EAST: ___

DATE/TIME START: 7/16/2013 1630

DATE/TIME COMPLETE: 7/16/2013 1725

WELL INSTALLATION DATE: 7/16/2013

DEPTH IN FEET	SAMPLING DATA B	N	A	R	NO	T	GRAPHIC LOG	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS
0	2							ML	___; Very dark brown (10YR 2/2); SILT (ML), dry,
	4	8			1			CL	cohesive, bedded, LOESS (TOP SOIL)
	4								Grading to brown (10YR 4/3); LEAN CLAY (CL), dry;
2	5								cohesive, bedded
	3				2			CL	___; brownish yellow (10YR 6/6); LEAN CLAY WITH
	3	6							SAND (CL); moist, cohesive, bedded;
	3								----------
4	4								
	2				3				as above
	3	7							
	4								----------
6	2				4			CL	as above
	3	9							
V wet Sand	6							SP	brownish yellow (10YR 6/6) POORLY GRADED SAND (SP);
8	9							CL	WET, non cohesive, bedded, non plastic
	6				5				7.0 - 7.5; grading to LEAN CLAY WITH SAND (CL)
	7	18						SP	moist to wet, cohesive, bedded
	11							CL	
	12							SP	----------
10	5				6			CL	___; mottled yellowish brown (10YR 5/6) to light
	15	27							gray (10YR 7/1) SANDY LEAN CLAY (CL)
	12							GW	yellowish brown (10YR 5/4) WELL GRADED GRAVEL (GW);
12	10							CL	WET, non cohesive, bedded, non plastic, GLACIOFLUVIAL
	5				7				grading to SANDY LEAN CLAY (CL), moist-wet, cohesive,
	10	21							bedded, low plasticity, DIAMICTON
	11								as above
	16								----------
14	4				8			CL	___; dark gray (10YR 4/1); LEAN CLAY WITH
	8	16							SAND AND GRAVEL (CL); WET, cohesive, bedded, low
	8								plasticity, DIAMICTON
16	10								----------
	3				9			CL	as above
	5	13							
	8								----------
18	12								
	3				10			CL	as above
	7	17							
	10								----------
20	14								EOB at 19.1 ft bgs

AECOM

FIELD BORING LOG

Sheet 1 of 6

BORING NO B318CR

SITE: Black Hawk Co LF

PROJECT NO: 60284307.17

DRILLING METHOD: 4 1/4 HSA with 2-in x 2-ft SS to top of bedrock; 6-in tricone rotary bit to EOB

LOG BY: R Henning

FIRM/DRILLER: Rob Hunt - Braun

PHYSICAL SETTING: Flat lying field at Hammond &

WATER LEVEL READINGS

DATE/ TIME	WATER DEPTH	HOLE DEPTH	CASING DEPTH

ABANDONMENT DATE: NA

ABANDONMENT METHOD: NA

GROUND SURFACE ELEV:

COORDINATE TYPE:

NORTH:

EAST:

DATE/TIME START: 7/10/2013

DATE/TIME COMPLETE: 7/10/2013

WELL INSTALLATION DATE: 7/16/2013

DEPTH IN FEET	SAMPLING DATA B	N	A	R	NO	T	GRAPHIC LOG	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS
									No sample from 0-5 ft bgs; use 5 ft sample interval; 2-in x 2-ft SS. No information on density, moisture samples logged after boring complete
5			1.5/2.0 = 25%		1				QUATERNARY, LOESS, very dark grayish brown (10YR 3/2); LEAN CLAY (CL); cohesive, bedded; trace fine gravel; LOESS from 5.0-5.2
7									5.2-7.0 DIAMICTON, yellow (10YR 7/6) SANDY LEAN CLAY (CL); cohesive, bedded; trace gravel; trace coarse sand
10			0.9/2.0 = 75%		2				as above mottled yellow (10YR 7/8) to very pale brown (10YR 7/3)
12									
15			2.0/2.0 = 100%		3				as above mottled yellow (10YR 7/8) to light brownish gray (10YR 6/2) SANDY LEAN CLAY WITH GRAVEL (CL); cohesive, massive, DIAMICTON
17									
20									

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AECOM

FIELD BORING LOG

Sheet 2 of 6

B318CR

DEPTH IN FEET	GRAPHIC LOG	USCS	SOIL/ROCK DESCRIPTION AND DRILLING COMMENTS	SAMPLING DATA B	N	A	R	Sample Type	Sample Interval
20			light brownish gray (10YR 6/2) SANDY LEAN CLAY (CL) cohesive, massive, coarse to fine sand, DIAMICTON				1.9/2.0 = 95%	SS	4
22									
25			mottled brownish yellow (10YR 6/8) to gray (10YR 6/1) SANDY LEAN CLAY WITH GRAVEL (CL); cohesive, massive, DIAMICTON				1.6/2.0 = 80%		5
27									
30			gray (10YR 5/1) SANDY LEAN CLAY WITH GRAVEL (CL) cohesive, massive, DAMICTON				2.0/2.0 = 100%		6
32									
35			as above				2.0/2.0 = 100%		7
37									
40			as above				2.0/2.0 = 100%		8
42									
45									

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AECOM

FIELD BORING LOG

Sheet 3 of 6

B318CR

DEPTH IN FEET	GRAPHIC LOG	USCS	SOIL/ROCK DESCRIPTION AND DRILLING COMMENTS	SAMPLING DATA B	N	A	R	Sample Type	Sample Interval
45			as above				24/40 = 60%		9
47									
50			as above				20/40 = 100%		10
52									
55			gray (10YR 5/1); SANDY LEAN CLAY WITH GRAVEL (CL) cohesive, massive, gray dolomite gravel, diabase DIAMICTON				20/40 = 100%		11
57									
60			as above				20/20 = 100%		12
62									
65			as above				20/20 = 100%		13
67									
70									

AECOM

FIELD BORING LOG

Sheet 4 of 6

B318CR

DEPTH IN FEET	GRAPHIC LOG	USCS	SOIL/ROCK DESCRIPTION AND DRILLING COMMENTS	SAMPLING DATA B	N	A	R	Sample Type	Sample Interval
70			as above				20/40 = 100%		14
72									
75 80			as above				20/20 = 100%		15
77 82									
80 85			as above						16
82 87									
85 90			as above						17
87 92									
90 95		SM	dark grayish brown (2.5Y 4/2); SILTY SAND (SM), non cohesive, bedded, GLACIOFLUVIAL, wet						18
92 97		ML	dark gray (2.5Y 4/1), SILT (ML), cohesive, bedded, GLACIOFLUVIAL, wet						
95 100									

AECOM

FIELD BORING LOG

BORING NO B318CR

SITE: Black Hawk Co LF PROJECT NO: 60284307.17

DEPTH IN FEET	SAMPLING DATA B	N	A	R	NO	T	GRAPHIC LOG	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS
95 105						19			dark gray (2.5Y 4/1): LEAN CLAY WITH SAND AND GRAVEL (CL), cohesive, massive, DIAMICTON
97 106									
100 105						20			as above
102 107									
105 110						21			as above
107 112									
110 115						22			as above
112 117									
115 120						23			dark gray (2.5Y 4/1), LEAN CLAY WITH SAND (CL), cohesive, massive, DIAMICTON
117 122							SM CL		light brownish gray (2.5Y 6/2) SILTY SAND (SM), wet, calcareous, bedded, GLACIOLACUSTRINE: rounded to well rounded quartz sand, trace gravel, trace magnetite, LACUSTRINE(?) dark gray (10YR 4/1), LEAN CLAY (CH) TO SAND AND GRAVEL (CL) cohesive, massive, DIAMICTON
120 125									

AECOM

FIELD BORING LOG

BORING NO B318CR

SITE: Black Hawk Co LF PROJECT NO: 60284307.17

DEPTH IN FEET	SAMPLING DATA B	N	A	R	NO	T	GRAPHIC LOG	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS
120 125						24			as above
122 127									
125 130						25			as above
127									Top of Bedrock at 126 ft bgs; Set 6-in casing to top of rock
									LOAM ID; 6.625-in OD
130									

Sheet 1 of 2

FIELD ROCK CORE LOG

AECOM

SITE: Black Hawk Co LF

PROJECT NO.: 60284307.17

BORING NO.: B-318CR

WATER LEVEL READINGS

DATE	WATER	HOLE	CASING

DRILLING RIG: CME 55Ø

CORE BARREL/BIT: NQ wire barrel

CASING USED: 6-inch black steel

LOGGED BY: R. Henning

FIRM/DRILLER: Rob - Brown Interter

PHYSICAL SETTING: dry flat lying grassy field at corner

ABANDONMENT DATE: NA

ABANDONMENT METHOD: NA

GROUND SURFACE ELEV.:

COORDINATE TYPE:

NORTH:

EAST:

DATE/TIME START: 7/10/2013

DATE/TIME COMPLETE:

WELL INSTALLATION DATE:

DEPTH IN METER	METHOD	RUN NO	LENGTH	% RECOVERY	MPM	% WATER (GAIN/LOSS) (LITER)	% RQD	FRAC/M	GRAPHICS	ROCK TYPE CODE	ROCK DESCRIPTION	COMMENTS
127		1									Cedar Valley Dolomite; Dolomite; 10YR (7/4) very pale brown; fine grained; medium bedded; fresh; intensely fractured; conformable; 127-136 ft bgs; bedding plane fractures; unknown aperture, not healed; no infilling; smooth; wet; w/0.4 ft chert nodules	3.5'/8.0 = 0.44 = 44% Total Recovery 2.4/8.0 = 0.30 RQD %
128												
129												
130												
131												
132												
133												
134												
135												
136		2										

23/8.0 ft = 29%

250 gal H_2O used

RQD 30%

1 xls

Sheet 2 of 2

FIELD ROCK CORE LOG

AECOM

SITE: Black Hawk Co LF

PROJECT NO.: 60284307.17

BORING NO.: B318CR

DEPTH IN FEET	METHOD	RUN NO.	LENGTH	% RECOVERY	MPF	% WATER (GAIN/LOSS) (GAL)	% RQD	FRAC/FT	GRAPHICS	ROCK TYPE CODE	ROCK DESCRIPTION	COMMENTS
137											Cedar Valley Dolomite, Dolomite; 10YR (7/4) very pale brown; fine grained, medium bedded; fresh; intensely fractured, conformable; 136-142 ft bgs; bedding plane fractures; unknown aperture due to breakage; not healed, no infilling smooth, wet, secondary porosity; few vugs w/few chert nodules	
138												
139												
140												
141												
142											EOB at 142' bgs; overdrill from 127-142 ft bgs for piezometer installation	
143											7/15/2013	
144											EOB at 147' bgs with 6" tricone bit	
145												
146												
147												
148												

RQD

0.9'/6.0' = total

125 gal

22'/6.0' =

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LOG OF BORING NO. 319

OWNER: BLACK HAWK COUNTY
ENGINEER: RUST ENVIRONMENT & INFRASTRUCTURE
SITE: WATERLOO, IOWA
PROJECT: BLACK HAWK COUNTY LANDFILL EXPANSION

GRAPHIC LOG	DESCRIPTION	DEPTH (FT.)	USCS SYMBOL	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: RECOVERY, IN.	SAMPLES: **SPT - N BLOWS / FT.	TESTS: MOISTURE, %	TESTS: DRY DENSITY PCF	TESTS: UNCONFINED STRENGTH, PSF	LL, PL, PI
	Approx. Surface Elev.: 961.3 ft. NGVD										
	12" Lean Clay (Topsoil), Dark Brown		CL	1	CS	100					
	- Gravel lense @ 7.2 - 7.9 feet.	5	CL	2	CS	100					
	SANDY LEAN CLAY, TRACE GRAVEL (Glacial Till), Gray Brown	10	CL	3	CS	100					
		15	CL	4	CS	100					
		20	CL	5	CS	100					
	25 936.3										
	SANDY LEAN CLAY, TRACE GRAVEL (Glacial Till) WITH SAND SEAMS, Gray and Gray Brown	25			HS						
			CL	6	SS	100	122				
		30	CL	7	SS	100	108				
			CL	8	SS	100	71				
					HS						
	36.5 924.8	35	CL	9	CS	100					
	SANDY LEAN CLAY, TRACE GRAVEL (Glacial Till) WITH SAND SEAMS, Gray	40	CL	10	ST	100		11.8			28,15,13
			CL	11	CS	100					
	- Fine to coarse sand, trace gravel @ 47.5 to 48 feet.	45	CL	12	CS	100		11.7			
	48 913.3										
	SANDY LEAN CLAY, TRACE GRAVEL (Glacial Till), Gray	50									
	Continued Next Page										

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

Calibrated Hand Penetrometer*
CME 140 Lb. Auto. SPT Hammer **

WATER LEVEL OBSERVATIONS (FT.)			
WL	▽ NONE	ws	▽
WL	▽		▽
WL			

Terracon

BORING STARTED	10-16-96		
BORING COMPLETED	10-17-96		
RIG	#6	FOREMAN	SZ
APPROVED	TAS	JOB #	06968518

N3BLGE 68518 3/7/97

LOG OF BORING NO. 319

OWNER: BLACK HAWK COUNTY
ENGINEER: RUST ENVIRONMENT & INFRASTRUCTURE
SITE: WATERLOO, IOWA
PROJECT: BLACK HAWK COUNTY LANDFILL EXPANSION

GRAPHIC LOG	DESCRIPTION	DEPTH (FT.)	USCS SYMBOL	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: RECOVERY, IN.	SAMPLES: **SPT - N BLOWS / FT.	TESTS: MOISTURE, %	TESTS: DRY DENSITY PCF	TESTS: UNCONFINED STRENGTH, PSF	LL, PL, PI
		55	CL	13	ST	100		12.1	127		29,15,14
			CL	14	CS	100					
			CL	15	CS	100					
	SANDY LEAN CLAY, TRACE GRAVEL (Glacial Till), Gray	60	CL	16	CS	100					
	- Sand seam @ 64 - 65-1/2 feet.	65	CL	17	CS	100					
		70	CL	18	CS	100					
			CL	19	SS	100	66				
		75	CL	20	HS CS	100					
		80	CL	21	ST	100		9.9	128		
			CL	22	CS	100					
		85	CL	23	CS	100					
		90	CL	24	CS	100					
	95.5 865.8	95	SP	25	CS	100					
	FINE SAND WITH SILT & CLAY SEAMS, Brown Gray										
	100 861.3	100									
	BOTTOM OF BORING										

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

Calibrated Hand Penetrometer*
CME 140 Lb. Auto. SPT Hammer **

WATER LEVEL OBSERVATIONS (FT.)			
WL	▽ NONE	ws	▽
WL	▽		▽
WL			

Terracon

BORING STARTED	10-1[illegible]		
BORING COMPLETED	10-17-96		
RIG	#6	FOREMAN	SZ
APPROVED	TAS	JOB #	06968518

N3BLGE 68518 3/10/97

LOG OF BORING NO. 320

OWNER: BLACK HAWK COUNTY
ENGINEER: RUST ENVIRONMENT & INFRASTRUCTURE
SITE: WATERLOO, IOWA
PROJECT: BLACK HAWK COUNTY LANDFILL EXPANSION

DESCRIPTION (Approx. Surface Elev.: 937.7 ft. NGVD)	DEPTH (FT.)	USCS SYMBOL	SAMPLES: NUMBER	TYPE	RECOVERY, IN.	**SPT - N BLOWS / FT.	TESTS: MOISTURE, %	DRY DENSITY PCF	UNCONFINED STRENGTH, PSF	LL, PL, PI
LEAN CLAY, TRACE SAND, Dark Brown	2	CL	1	CS	100					
935.7										
SANDY LEAN CLAY, TRACE GRAVEL (Glacial Till), Gray Brown	5	CL	2	CS	100					
10.5 ▽927.2	10	CL	3	CS	100					
- Fine to coarse sand @ 10.5 to 11.5 feet.	15	CL	4	SS	100	63				
		CL	5	SS	100	47				
	20	CL	6	ST	100		10.3	128	13250	27,16,11
		CL	7	CS	100					
SANDY LEAN CLAY, TRACE GRAVEL (Glacial Till) WITH OCCASIONAL SAND SEAMS, Gray	25	CL	8	CS	100					
	30	CL	9	SS	100	70				
		CL	10	SS	100	54				
	35	CL	11	SS	100	25				
		CL	12	CS	100					
	40	CL	13	CS	100					
	45	CL	14	CS	100					
	50									

Continued Next Page

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

Calibrated Hand Penetrometer*
CME 140 Lb. Auto. SPT Hammer **

WATER LEVEL OBSERVATIONS (FT.)				
WL	▽10.5	WS	▽ 76	(10/19/96)
WL	▽		▽	
WL				

Terracon

BORING STARTED	10-18-96		
BORING COMPLETED	10-19-96		
RIG	#6	FOREMAN	SZ
APPROVED	TAS	JOB #	06968518

N3BLGE 68518 2/10/97

LOG OF BORING NO. 320

OWNER: BLACK HAWK COUNTY
ENGINEER: RUST ENVIRONMENT & INFRASTRUCTURE
SITE: WATERLOO, IOWA
PROJECT: BLACK HAWK COUNTY LANDFILL EXPANSION

DESCRIPTION	DEPTH (FT.)	USCS SYMBOL	SAMPLES: NUMBER	TYPE	RECOVERY, IN.	**SPT - N BLOWS / FT.	TESTS: MOISTURE, %	DRY DENSITY PCF	UNCONFINED STRENGTH, PSF	LL, PL, PI
SANDY LEAN CLAY, TRACE GRAVEL (Glacial Till) WITH OCCASIONAL SAND SEAMS, Gray	55	CL	15	CS	100					
		CL	16	CS	100					
61 876.7	60	CL	17	CS	100					
FINE TO MEDIUM SAND WITH SILT LAYERS, Gray										
64 873.7	65	CL	18	CS	100					
SANDY LEAN CLAY, TRACE GRAVEL (Glacial Till) WITH OCCASIONAL SAND SEAMS, Gray	70	CL	19	CS	100					
	75	CL	20	CS	100					
	80	CL	21	ST	100		11.6	127		
		CL	22	CS	100					
	85	CL	23	CS	100					
	90	CL	24	CS	100					
94.5 843.2	95	SP	25	CS	100					
96 FINE TO MEDIUM SAND, TRACE GRAVEL, Gray 841.7										
SANDY LEAN CLAY, TRACE GRAVEL (Glacial Till), Gray	100									

Continued Next Page

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

Calibrated Hand Penetrometer*
CME 140 Lb. Auto. SPT Hammer **

WATER LEVEL OBSERVATIONS (FT.)
WL ▽10.5 WS ▽ 76 (10/19/96)
WL ▽ ▽
WL

Terracon

BORING STARTED 10-18-96
BORING COMPLETED 10-19-96
RIG #6 FOREMAN SZ
APPROVED TAS JOB # 06968518

N3BLGE 68518 2/10/97

LOG OF BORING NO. 320

OWNER: BLACK HAWK COUNTY

ENGINEER: RUST ENVIRONMENT & INFRASTRUCTURE

SITE: WATERLOO, IOWA

PROJECT: BLACK HAWK COUNTY LANDFILL EXPANSION

GRAPHIC LOG	DESCRIPTION	DEPTH (FT.)	USCS SYMBOL	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: RECOVERY, IN.	SAMPLES: **SPT - N BLOWS / FT.	TESTS: MOISTURE, %	TESTS: DRY DENSITY PCF	TESTS: UNCONFINED STRENGTH, PSF	LL, PL, PI
	101.5 836.2		CL	26	SS	100	31				
	BOTTOM OF BORING										

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

Calibrated Hand Penetrometer*
CME 140 Lb. Auto. SPT Hammer **

WATER LEVEL OBSERVATIONS (FT.)				
WL	▽ 10.5	WS	▽ 76	(10/19/96)
WL	▽		▽	
WL				

Terracon

BORING STARTED			10-18-96
BORING COMPLETED			10-19-96
RIG	#6	FOREMAN	SZ
APPROVED	TAS	JOB #	06968518

N38LOG 68518 3/7/97

AECOM

FINAL SOIL BORING LOG

BORING NO B-401B

SITE: Black Hawk County Landfill PROJECT NO 60148396 SHEET 1 OF 2

SITE #:

	WATER LEVEL READINGS			
	DATE	WATER DEPTH	HOLE DEPTH	CASING DEPTH

GROUND SURFACE ELEV:

PHYSICAL SETTING: At base of berm near upland summit — LOCAL COORDINATES:

LOG BY: T. Kemmis — NORTHING:

FIRM/DRILLER: Terracon/M. White — EASTING:

DRILLING METHOD: 4 1/4 in. ID HSA with 2 in. dia. by 2 ft. long split spoon sampler, 140-lb. hammer — DATE/TIME STARTED: 5/6/10 ; 15:00

ABANDONMENT DATE: NA — DATE/TIME COMPLETED: 5/6/10 ; 16:15

ABANDONMENT METHOD: NA — WELL INSTALLATION: 05/06/10

Depth in Feet	SAMPLING DATA B	N	A	% Recovery	No	T	Graphic Log	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS
0	2 1 2 4	3		70	1	SS		CL	**QUATERNARY, FILL.** Soft, dark gray (10YR 4/1) SANDY LEAN CLAY (CL); moist; medium to low plasticity; cohesive; medium to thickly bedded; some sand, trace gravel; fill.
	2 3 4 4	7		85	2	SS			As above from 0.0 to 2.0 feet, but consistency changes to medium
	2 4 4 4	8		75	3	SS			As above from 2.0 to 4.0 feet.
5	2 5 5 4	10		75	4	SS			As above from 2.0 to 6.0 feet, but consistency changes to stiff.
	3 3 4 3	7		95	5	SS			As above from 6.0 to 8.0 feet, but consistency changes to medium
10	4 4 5 7	9		85	6	SS			As above from 8.0 to 10.0 feet, but consistency changes to stiff
								SP	Loose, pale yellow (2.5Y 7/3) POORLY GRADED SAND (SP); moist; nonplastic; noncohesive; massive; fine to medium sand; fill.
	2 6 8 7	14		85	7	SS		CL	Stiff, dark gray (10YR 4/1) and yellowish brown (10YR 5/6) LEAN CLAY (CL) and SANDY LEAN CLAY (CL); moist; medium to low plasticity; cohesive; thinly to medium bedded; few to some sand, trace gravel; fill.
	2 5 4 8	9		90	8	SS			As above from 12.0 to 14.0 feet.
15								CL	**LOESS.** Stiff, black (10YR 2/1) LEAN CLAY (CL); moist; medium plasticity; cohesive; massive; buried A horizon of modern soil profile; loess.
	2 2 3 3	5		65	9	SS		CL	As above from 15.5 to 16.0 feet, but consistency changes to medium.
									Medium, dark greenish gray (5GY 4/1) mottled with strong brown (7.5YR 4/6) LEAN CLAY (CL); moist; medium plasticity; cohesive; massive; buried B horizon of modern soil profile; loess.
	2 4 3 2	7		85	10	SS		CL	As above from 16.5 to 18.0 feet
20								ML	Medium, greenish gray (10YR 6/1) mottled with yellowish brown (10YR 5/8) LEAN CLAY (CL); moist; medium plasticity; cohesive; massive; MDL; loess.
	2 5 6 11	11		75	11	SS		SP	Medium, gray (10YR 6/1) SILT (ML); moist; low plasticity; cohesive; massive; trace yellowish brown (10YR 5/8) lamellae; MRL; loess. As above from 19.5 to 20.0 feet, but consistency changes to stiff.
	2 4 8 9	12		95	12	SS		CL	Medium dense, light yellowish brown (2.5Y 6/4) POORLY GRADED SAND (SP); moist; nonplastic; noncohesive; massive; fine sand; OL, eolian sand
									PRE-ILLINOIAN GLACIAL DIAMICTON (QWT).
	2 4	9		95	13	SS		CL	Stiff, yellowish brown (10YR 5/6) mottled with gray (10YR 6/1) SANDY LEAN CLAY (CL); moist; medium to low plasticity; cohesive; massive; some sand, trace gravel; MOU; diamicton.

Continued Next Page

Tracking Codes: 60148396 BLACK HAWK LDF2010 GPJ, ETSOIL 6/2/10, 19:24

AECOM

FINAL SOIL BORING LOG

BORING NO B-401B

SITE: Black Hawk County Landfill PROJECT NO 60148396 SHEET 2 OF 2

Depth in Feet	SAMPLING DATA B	N	A	% Recovery	No.	T	Graphic Log	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS
25	5 8								Stiff, gray (10YR 6/1) mottled with yellowish brown (10YR 5/6) SANDY LEAN CLAY (CL); moist; medium to low plasticity; cohesive; massive; some sand, trace grave ; MRU-OU; diamicton.
	5 8 9 12	17		95	14	SS		SP CL	As above from 23.4 to 24.0 feet As above from 23.4 to 26.0 feet, but consistency changes to very stiff
									Medium dense, yellowish brown (10YR 5/4) POORLY GRADED SAND (SP); wet; nonplastic; noncohesive; massive; medium sand; OU; poorly graded sand in Pre-Illinoian glacia diamicton
30									Very stiff, very dark gray (10YR 3/1) SANDY LEAN CLAY (CL); moist; medium to low plasticity; cohesive; massive; some sand, trace gravel; UU; diamicton.
									END OF BORING AT 28.0 FEET
35									
40									
45									
50									

Tracking Codes: 60148396 BLACK HAWK LDF2010 GPJ, ETSOIL 6/2/10, 19:24

AECOM

FINAL SOIL BORING LOG

BORING NO **B-402B**

SITE: Black Hawk County Landfill PROJECT NO **60148396** SHEET **1** OF **2**

SITE #: _____

	WATER LEVEL READINGS		
DATE	WATER DEPTH	HOLE DEPTH	CASING DEPTH

PHYSICAL SETTING: Berm adjacent to landfill access roads

LOG BY: T. Kemmis

FIRM/DRILLER: Terracon/M. White

DRILLING METHOD: 4 1/4 in. ID HSA with 2 in. dia. by 2 ft. long split spoon sampler, 140-lb. hammer

ABANDONMENT DATE: NA

ABANDONMENT METHOD: NA

GROUND SURFACE ELEV: _____

LOCAL COORDINATES:

NORTHING: _____

EASTING: _____

DATE/TIME STARTED: **5/6/10 ; 12:30**

DATE/TIME COMPLETED: **5/6/10 ; 13:15**

WELL INSTALLATION: **05/06/10**

Depth in Feet	SAMPLING DATA B	N	A	% Recovery	No	T	Graphic Log	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS
0	2 4 3 3	7		45	1	SS		CL	**QUATERNARY, FILL.** Medium, medium bedded black (10YR 2/1), dark gray (10YR 4/1), and yellowish brown (10YR 5/6) LEAN CLAY and LEAN CLAY WITH SAND (CL); moist; medium to low plasticity; cohesive; medium bedded; few to little sand; fill.
	3 3 4 4	7		70	2	SS			As above from 0 0 to 2.0 feet.
	4 3 3 4	6		55	3	SS			As above from 0 0 to 4.0 feet
5	0 3 4 5	7		70	4	SS			As above from 0 0 to 6 0 feet.
	3 3 3 5	6		70	5	SS			As above from 0.0 to 8.0 feet.
10	2 5 5 4	10		95	6	SS			As above from 0 0 to 10 0 feet, but consistency changes to stiff
	2 2 4 5	6		80	7	SS		CL	As above from 10 0 to 12 0 feet, but consistency changes to medium
								CL	**LOESS.** Medium, black (10YR 2/1) LEAN CLAY (CL); moist; medium plasticity; cohesive, massive, buried A horizon of modern soil profile, loess
	0 0 1 2	1		60	8	SS			Medium, gray (10YR 5/1) mottled with yellowish brown (10YR 5/8) LEAN CLAY (CL); moist; medium plasticity; cohesive; massive; buried B horizon of modern soil profile; loess. As above from 13 0 to 14 0 feet, but consistency changes to very soft
15	3 4 5 5	9		70	9	SS		CL	**PRE-ILLINOIAN GLACIAL DIAMICTON (QWT).** Stiff, yellowish brown (10YR 5/8) mottled with gray (10YR 5/1) SANDY LEAN CLAY (CL); moist; medium to low plasticity; cohesive; massive; some sand, trace gravel; MOJU; diamicton.
	4 7 11 17	18		85	10	SS		CL	**PRE-ILLINOIAN GLACIAL DIAMICTON (QAT).** Very stiff, brown (10YR 4/3) mottled with yellowish brown (10YR 5/8) SANDY LEAN CLAY (CL); moist; low plasticity; cohesive; massive; some sand, trace gravel; MOL; diamicton.
20	7 14 17 19	31		65	11	SS		SM	Medium dense, grayish brown (10YR 5/2) SILTY SAND (SM); moist to wet; nonplastic; noncohesive; massive; very fine sand; little to some silt; RL; silty sand in Pre-Illinoian glacial diamicton As above from 19.5 to 20.0 feet, but relative density changes to dense, and color changes to light olive brown (2.5Y 5/3) mottled with yellowish brown (10YR 5/8)
	4 7 7 9	14		80	12	SS		CL	Stiff, mottled yellowish brown (10YR 5/4 and 10YR 5/8) LEAN CLAY WITH SAND (CL); moist; low to medium plasticity; cohesive; massive; little sand, trace gravel; MOU; diamicton
								SP	Medium dense, yellowish brown (10YR 5/4) POORLY GRADED SAND (SP), moist; nonplastic, noncohesive, massive; very fine sand, OU, poorly

Continued Next Page

Tracking Codes: 60148396 BLACK HAWK LDF2010.GPJ, ETSOIL, 6/2/10, 19:24

AECOM

FINAL SOIL BORING LOG

BORING NO. **B-402B**

SITE: Black Hawk County Landfill PROJECT NO. **60148396** SHEET **2** OF **2**

Depth in Feet	SAMPLING DATA B	N	A	% Recovery	No	T	Graphic Log	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS
25									graded sand in Pre-Illinoian glacial diamicton. END OF BORING AT 24.0 FEET
30									
35									
40									
45									
50									

Tracking Codes: 60148396 BLACK HAWK LDF2010.GPJ, ETSOIL, 6/2/10, 19:24

AECOM

FINAL SOIL BORING LOG

BORING NO. **B-402C**

SITE: **Black Hawk County Landfill** PROJECT NO. **60482609** SHEET **1** OF **5**

SITE #:

PHYSICAL SETTING: **Area A, Adjacent to road and OW402B**

LOG BY: **Sarah Day**

FIRM/DRILLER: **Terracon/Ron Faulk**

DRILLING METHOD: **4.25 HSA from 0-36.5 ft., 36.5-102.0 ft. 6.0 in. tri-cone bit, mud rotary, 2.0 in. by 2.0 ft. SS**

WATER LEVEL READINGS	DATE	WATER DEPTH	HOLE DEPTH	CASING DEPTH

ABANDONMENT DATE: **NA**

ABANDONMENT METHOD: **NA**

GROUND SURFACE ELEV: **952.30**

IA State Plain LOCAL COORDINATES:

NORTHING: **3617467.90**

EASTING: **5237824.00**

DATE/TIME STARTED: **11/9/16 ; 15:25**

DATE/TIME COMPLETED: **11/15/16 ; 14:30**

WELL INSTALLATION: **11/16/16**

Depth in Feet	SAMPLING DATA B	N	A	% Recovery	No.	T	Graphic Log	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS
0								NS	No Sample. Blind drill to 20.5 feet. Reference soil boring log for B-402.
5									
10									
15									

Continued Next Page

Tracking Codes: 60482609_BLACKHAWK GPJ_ETSOIL_1/3/17_1103

AECOM

FINAL SOIL BORING LOG

BORING NO. **B-402C**

SITE: **Black Hawk County Landfill** PROJECT NO. **60482609** SHEET **2** OF **5**

Depth in Feet	SAMPLING DATA B	N	A	% Recovery	No.	T	Graphic Log	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS
20	7 9 8 10	17		90	1	SS		SP	PRE-ILLINOIAN GLACIAL DIAMICTON (QAT). Medium dense, yellowish brown (10YR 5/8), POORLY GRADED SAND (SP), wet, non-plastic, noncohesive, massive.
								CL	Very stiff, yellowish brown (10YR 5/8), SANDY LEAN CLAY (CL) moist, low plasticity, cohesive, massive, M, trace gravel.
	4 7 11 15	18		90	2	SS			As above from 22.5 to 23.5 feet, but color changes to light olive brown (2.5Y 5/6)
									As above from 23.5 to 24.5 feet, but color changes to dark grayish brown (10YR 4/2)
25	6 1 15 18	16		85	3	SS			As above from 24.5 to 28.5 feet, but color changes to very dark gray (10YR 3/1) and plasticity change to medium plasticity.
	4 9 14 23	23		100	4	SS			
	6 12 18 23	30		100	5	SS			As above from 28.5 to 30.5 feet, but moisture changes to dry.
30	6 11 15 24	26		100	6	SS			As above from 30.5 to 42.5 feet, but moisture changes to moist. Cobble at 42.5 feet.
	3 11 20 34	31		50	7	SS			
35	5 10 15 23	25		100	8	SS			
	7 15 27 43	42		100	9	SS			
	8 10 18 42	28		100	10	SS			
40	12 16 19 50/5.5	35		100	11	SS			
	22 21 32	43		75	12	SS		SP	Dense, grayish brown (10YR 5/2) POORLY GRADED SAND (SP) wet, non-plastic, noncohesive, massive, trace gravel and cobbles.

Continued Next Page

Tracking Codes: 60482609_BLACKHAWK GPJ_ETSOIL_1/3/17_1103

AECOM

FINAL SOIL BORING LOG

BORING NO. **B-402C**

SITE: **Black Hawk County Landfill** PROJECT NO. **60482609** SHEET **3** OF **5**

Depth in Feet	B	N	A	% Recovery	No.	T	Graphic Log	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS
44								CL	Hard, very dark gray (10YR 3/1) SANDY LEAN CLAY (CL) moist, medium plasticity, cohesive, massive, trace gravel.
45	10 18 30 40	48		100	13	SS			
	50 50/2	>50		35	14	SS		SP	Dense, grayish brown (10YR 5/2) POORLY GRADED SAND (SP) wet, non-plastic, noncohesive, massive, trace cobbles.
	80/6	>50		25	15	SS			As above from 48.5 to 50.7 feet.
50	20 20 25 30	45		100	16	SS		CL	Hard, very dark gray (10YR 3/1) SANDY LEAN CLAY (CL), moist, medium plasticity, cohesive, massive, trace gravel and cobbles.
	10 18 28 40	46		100	17	SS			As above from 52.5 to 56.5 feet.
	18 28 38 40	>50		0	18	SS			Cobble at 54.5 feet.
55	10 16 28 30	44		100	19	SS			As above from 56.5 to 60.5 feet.
	10 16 28 28	44		100	20	SS			
60	14 19 31 40	50		100	21	SS			As above from 60.5 to 62.5 feet. Cobble pushed from 60.5 along half of the split spoon sampler.
	13 24 34 36	>50		100	22	SS			As above from 62.5 to 68.5 feet.
65	18 25 35 45	>50		30	23	SS			
	12 18 25 30	43		100	24	SS			

Tracking Codes: 60482609_BLACKHAWK GPJ_ETSOIL_1/3/17, 1103

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AECOM

FINAL SOIL BORING LOG

BORING NO. **B-402C**

SITE: **Black Hawk County Landfill** PROJECT NO. **60482609** SHEET **4** OF **5**

Depth in Feet	B	N	A	% Recovery	No.	T	Graphic Log	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS
68									
70	11 22 22 40	44		100	25	SS			As above from 68.5 to 74.5, but with 0.01 foot sand seams.
	15 30 37 45	>50		100	26	SS			
	13 33 33 53	>50		100	27	SS			
75	13 23 33 53	>50		100	28	SS			As Above from 74.5 to 92.5 feet.
	10 20 30 50	50		100	29	SS			
80	13 24 34 44	>50		100	30	SS			
	15 30 40 60	>50		65	31	SS			
	12 24 36 60	>50		100	32	SS			
85	16 25 34 60	>50		100	33	SS			
	14 24 40 65	>50		50	34	SS			
	10 35 45 46	>50		100	35	SS			
90	20 20 40 45	>50		70	36	SS			

Tracking Codes: 60482609_BLACKHAWK GPJ_ETSOIL_1/3/17, 1103

Continued Next Page

AECOM

FINAL SOIL BORING LOG

BORING NO. **B-402C**

SITE: **Black Hawk County Landfill** PROJECT NO. **60482609** SHEET **5** OF **5**

Depth in Feet	SAMPLING DATA B	N	A	% Recovery	No.	T	Graphic Log	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS
92									
	10 25 35 40	>50		100	37	SS			As above from 92.5 to 97.2 feet.
95	10 20 40 42	>50		100	38	SS			
	25 70/6	>50		50	39	SS			As above from 97.2 to 98.5, but with weathered dolomite cobbles
	45 50 50/4	>50		70	40	SS		CL	Hard, pale yellow (5 Y 7/4) mottled with olive yelow (2.5 Y 6/8), LEAN CLAY (CL), moist, medium to high plasticity, cohesive, massive, M, few dolomite cobbles.
100	50/0.5	>50		3	41	SS		DL	Weathered Dolomite.
									Top of bedrock at 102 feet; End of boring at 102.5 feet below ground surface. Continues on Rock Core Log B-402C
105									
110									
115									

Tracking Codes: 60482609_BLACKHAWK.GPJ_ETSOIL, 1/3/17, 1103

AECOM

FINAL ROCK CORE LOG

BORING NO. **B-402C (Rock Core)**

SITE: **Black Hawk County Landfill** PROJECT NO. **60482609** SHEET **1** OF **2**

WATER LEVEL READINGS

	DATE	TIME	DEPTH	CASING
DRILLING METHOD: **4.25 HSA from 0-36.5 ft.,**	**11/15/16**		**109.20**	**102**
36.5 to 102.0 ft. 6.0 in. tri-cone bit, wash rotary,	**11/15/16**		**109.80**	**102**
NQ Rock Core 102.0 to 142.0 ft.	**11/16/16**		**102.26**	**102**

GROUND SURFACE ELEV: **952.3**

IA State Plain COORDINATES:

NORTHING: **3617467.9**

EASTING: **5237824.0**

LOG BY: **Russ Henning**

DATE STARTED: **11/15/16**

FIRM/DRILLER: **Terracon/Ron Faulk** ABANDONMENT DATE: **NA** DATE COMPLETED: **11/15/16**

PHYSICAL SETTING: **Area A, Adjacent to road and OW402B** ABANDONMENT METHOD: **NA** INSTALLATION: **11/16/16**

Depth in Feet	CORING DATA GRAPHICS	RUN NO	LENGTH	% RECOVERY	MPF	%WATER GAIN/LOSS	% RQD	FRACTURES	GRAPHIC LOG ROCK TYPE	ROCK TYPE CODE	ROCK DESCRIPTION
102		Run #1	3.0	18			0			DL	DEVONIAN CEDAR VALLEY FORMATION; DOLOMITE, strong, dark yellowish orange (10YR 6/6), microcrystalline, medium bedded, moderately decomposed, competent, slightly fractured, unconformable with glacial sediment overlying bedrock, some chert nodules.
105		Run #2	4.0	78			23			DL	DEVONIAN CEDAR VALLEY FORMATION; DOLOMITE, strong, grayish orange (10YR 7/4), microcrystalline, medium bedded, moderately decomposed, competent, slightly fractured, comformable.
110		Run #3	5.0	84			49			DL	DEVONIAN CEDAR VALLEY FORMATION; DOLOMITE, strong, grayish orange (10YR 7/4), microcrystalline, medium bedded, moderately to highly decomposed, moderately disintegrated with solutioning and hairline open fractures, intensely fractured, conformable, numerous solution fractures, horizontal, from 111 to 112 feet, 113 to 114 feet, clayey from 110 to 111 feet.
115		Run #4	5.0	92			67.5			DL	DEVONIAN CEDAR VALLEY FORMATION; DOLOMITE, strong, grayish orange (10YR 7/4), microcrystalline, medium bedded, moderately to highly decomposed, moderate disintegration, with solutioning and hairline fractures, moderately fractured, conformable, hareline solution fractures, clay filled fracture 114 to 115 feet, rock broken up at 117 feet, chert at 118 feet, with vugs and brachiopod at 119 feet.
120		Run #5	5.0	78			66			DL	DEVONIAN CEDAR VALLEY FORMATION; DOLOMITE, strong, grayish orange (10YR 7/4), microcrystalline, medium bedded, moderately to highly decomposed, moderately disintegrated, solutioning along horizontal fractures from 119 to 120 feet, some clay filled, vugs and solutioning from 120 to 121 feet, horisontal solution fractures from 123 to 124 feet.
122											

Continued Next Page

Tracking Codes: 60482609_BLACKHAWK.GPJ_ETROCK, 1/3/17, 1104

AECOM

FINAL ROCK CORE LOG

BORING NO. **B-402C (Rock Core)**

SITE: **Black Hawk County Landfill** PROJECT NO. **60482609** SHEET **2** OF **2**

Depth in Feet	CORING DATA: GRAPHICS	RUN NO	LENGTH	% RECOVERY	MPF	%WATER GAIN/LOSS	% RQD	FRACTURES	GRAPHIC LOG: ROCK TYPE	ROCK TYPE CODE	ROCK DESCRIPTION
122											
125		Run #6	5.0	62			7			DL	DEVONIAN CEDAR VALLEY FORMATION; DOLOMITE, strong, grayish orange (10YR 7/4), mircorcrystalline, medium bedded, moderately decomposed, moderately disintegrated, solutioning along horizontal (bedding plane) fractures from 125 to 126 feet, rock core very broken from 127 to 129 feet.
130		Run #7	5.0	49			23			DL	DEVONIAN CEDAR VALLEY FORMATION; DOLOMITE, strong, grayish orange (10YR 7/4) microcrystalline, medium bedded, moderately decomposed, moderately disintegrated, fractured with moderate reddish brown (10R 4/6) stained fractures.
135		Run #8	3.0	86		50	80			DL	DEVONIAN CEDAR VALLEY FORMATION; DOLOMITE, strong, pale yellowish brown (10YR 6/2), microcrystalline, medium bedded, moderately decomposed, moderately disintegrated, slightly fractured, competent, conformable. Large quartz lined vug at 133.5 feet.
140		Run #9	5.0	68			34			DL	DEVONIAN CEDAR VALLEY FORMATION; DOLOMITE, strong, pale yellowish brown (10YR 6/2), microcrystalline, medium bedded, slightly decomposed, slightly disintegrated, slightly fractured, many chert nodules from 138 to 140 feet.
146											End of boring at 142 feet below ground surface.

Tracking Codes: 60482609_BLACKHAWK.GPJ LETROCK 1/31/17 11:04

AECOM

FINAL SOIL BORING LOG

BORING NO. **B-403B**

SITE: Black Hawk County Landfill PROJECT NO. 60148396 SHEET 1 OF 1

SITE #:

		WATER LEVEL READINGS			
		DATE	WATER DEPTH	HOLE DEPTH	CASING DEPTH
PHYSICAL SETTING:	Excavated, nearly level upland				
LOG BY:	T. Kemmis				
FIRM/DRILLER:	Terracon/M. White				
DRILLING METHOD:	4 1/4 in. ID HSA with 2 in. dia. by 2 ft. long split spoon sampler, 140-lb. hammer				

ABANDONMENT DATE: NA

ABANDONMENT METHOD: NA

GROUND SURFACE ELEV:

LOCAL COORDINATES:

NORTHING:

EASTING:

DATE/TIME STARTED: 5/6/10 ; 07:20

DATE/TIME COMPLETED: 5/6/10 ; 08:15

WELL INSTALLATION: 05/06/10

Depth in Feet	SAMPLING DATA B	N	A	% Recovery	No	T	Graphic Log	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS
0	4 4 3 3	7		70	1	SS		CL	**QUATERNARY, FILL.** Medium, very dark gray (10YR 3/1) LEAN CLAY WITH SAND (CL); slightly moist to dry; medium to low plasticity; cohesive; massive to faintly stratified; little sand; fill.
	5 6 8 8	12		65	2	SS		CL	**LOESS.** Stiff, black (10YR 2/1) LEAN CLAY (CL); moist; medium plasticity; cohesive; massive; buried A horizon of modern soil profile; loess.
5	4 3 3 2	6		50	3	SS		CL	Medium, mottled brown (10YR 5/3) grayish brown (10YR 5/2) and yellowish brown (10YR 5/8) LEAN CLAY (CL); moist; medium plasticity; cohesive; massive; buried B horizon of modern soil profile; loess
	3 4 5 2	9		60	4	SS		CL	**PRE-ILLINOIAN GLACIAL DIAMICTON (QWT).** Stiff, yellowish brown (10YR 5/8) mottled with light gray (10YR 7/1) SANDY LEAN CLAY (CL); moist; medium to low plasticity; cohesive; massive; some sand, trace gravel; MOJU; diamicton Medium to coarse sand from 6.9 to 7.0 feet. As above from 6.0 to 8.0 feet.
	3 4 5 3	9		80	5	SS			
10	3 4 4 2	8		85	6	SS			As above from 6 0 to 10 0 feet, but consistency changes to medium.
								CL	Medium, dark gray (10YR 4/1) mottled with yellowish brown (10YR 5/8) SANDY LEAN CLAY (CL); moist; medium to low plasticity; cohesive; massive; some sand, trace gravel; MRU; diamicton
	10 11 10 21	21		75	7	SS		CL	Very stiff, very dark gray (10YR 3/1) SANDY LEAN CLAY (CL); moist; medium to low plasticity; cohesive; massive; some sand, trace gravel; UU; diamicton.
								SM	**PRE-ILLINOIAN GLACIAL DIAMICTON (QAT).** Medium dense, olive brown (2.5Y 4/3) SILTY SAND (SM); moist; nonplastic; noncohesive; massive; medium sand; little silt; RL; silty sand in Pre-Illinoian glacial diamicton. As above from 13.4 to 14.0 feet.
15	11 11 7 5	18		80	8	SS		CL	Very stiff, dark gray (10YR 4/1) mottled with strong brown (7.5YR 4/6) LEAN CLAY WITH SAND (CL); moist; medium plasticity; cohesive; massive to faintly stratified; few to little sand, trace gravel; MRL; diamicton As above from 15.0 to 16.0 feet. Medium to coarse sand from 16.9 to 17 3 feet
	8 7 10 16	17		30	9	SS			
	4 10 10 8	20		80	10	SS		CL	Very stiff, very dark gray (10YR 3/1) LEAN CLAY WITH SAND (CL); moist; low to medium plasticity; cohesive; massive; little sand, trace gravel; UU; diamicton
20									END OF BORING AT 20.0 FEET

Tracking Codes: 60148396 BLACK HAWK LDF2010.GPJ ETSOIL 6/2/10, 7:9:24

AECOM

FINAL SOIL BORING LOG

BORING NO. **B-405B**

SHEET 1 OF 1

SITE: Black Hawk County Landfill PROJECT NO. 60148396

SITE #:

	DATE	WATER LEVEL READINGS WATER DEPTH	HOLE DEPTH	CASING DEPTH

GROUND SURFACE ELEV:

PHYSICAL SETTING: Excavated, nearly level upland

LOG BY: T. Kemmis

FIRM/DRILLER: Terracon/M. White

DRILLING METHOD: 4 1/4 in. ID HSA with 2 in. dia. by 2 ft. long split spoon sampler, 140-lb. hammer

ABANDONMENT DATE: NA

ABANDONMENT METHOD: NA

LOCAL COORDINATES:

NORTHING:

CASTING:

DATE/TIME STARTED: 5/5/10 ; 16:10

DATE/TIME COMPLETED: 5/5/10 ; 17:00

WELL INSTALLATION: 05/05/10

Depth in Feet	SAMPLING DATA B	N	A	% Recovery	No	T	Graphic Log	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS
0	3 6 7 7	13		35	1	SS		CL	**QUATERNARY, FILL.** Stiff, medium bedded black (10YR 2/1) and yellowish brown (10YR 5/8) LEAN CLAY (CL) and SANDY LEAN CLAY (CL); dry; medium plasticity; cohesive; medium bedded; few to some sand; fill
	3 3 5 5	8		40	2	SS			As above from 0.0 to 2.0 feet, but consistency changes to medium.
5	2 3 4 4	7		65	3	SS		CL	**PRE-ILLINOIAN GLACIAL DIAMICTON (QWT).** Medium, yellowish brown (10YR 5/8) mottled with gray (10YR 6/1) SANDY LEAN CLAY (CL); moist; medium to low plasticity; cohesive; massive; some sand, trace gravel; MOJU; diamicton.
	3 3 6 7	9		60	4	SS			As above from 4.0 to 6.0 feet, but consistency changes to stiff Very fine sand lamination at 6.8 feet.
	3 3 3 8	6		60	5	SS			As above from 6.0 to 8.0 feet, but consistency changes to medium. Coarse sand from 8.1 to 8.3 feet. Very fine sand lamination at 8.9 feet.
10	3 6 8 8	14		60	6	SS			As above from 8.0 to 10.0 feet, but consistency changes to stiff.
								CL	Stiff, gray (10YR 5/1) mottled with yellowish brown (10YR 5/4) SANDY LEAN CLAY (CL); moist; medium to low plasticity; cohesive; massive; some sand, trace gravel; MRU; diamicton
	4 6 6 6	12		80	7	SS		CL	Stiff, very dark gray (10YR 3/1) SANDY LEAN CLAY (CL); moist; medium to low plasticity; cohesive; massive; some sand, trace gravel; UU; diamicton
15	4 7 7 7	14		80	8	SS		CL	Stiff, dark olive brown (2.5Y 3/3) mottled with very dark gray (10YR 3/1) and light gray (10YR 7/1) SANDY LEAN CLAY (CL); moist; medium to low plasticity; cohesive; massive; some sand, trace gravel; MRU-UU; diamicton. As above from 13.2 to 14.0 feet
	7 12 24 26	36		95	9	SS			As above from 13.2 to 16.0 feet, but consistency changes to hard
	13			60	10	SS		CL	**PRE-ILLINOIAN GLACIAL DIAMICTON (QAT).** Hard, dark yellowish brown (10YR 4/6) mottled with grayish brown (10YR 5/2) LEAN CLAY WITH SAND (CL); moist; low to medium plasticity; cohesive, massive, little to some sand, trace gravel; MOU; diamicton.
20									END OF BORING AT 18.5 FEET

Tracking Digital: 60148396 BLACK HAWK LDF2010.GPJ; ETSOIL 6/2/15 19:24

AECOM

FINAL SOIL BORING LOG

BORING NO **B-406B**

SITE: Black Hawk County Landfill PROJECT NO. 60148396 SHEET 1 OF 1

SITE #:

	DATE	WATER LEVEL READINGS WATER DEPTH	HOLE DEPTH	CASING DEPTH

GROUND SURFACE ELEV.:

PHYSICAL SETTING: Gentle slope to southwest

LOG BY: T. Kemmis

FIRM/DRILLER: Terracon/M. White

DRILLING METHOD: 4 1/4 in. ID HSA with 2 in. dia. by 2 ft. long split spoon sampler, 140-lb. hammer

ABANDONMENT DATE: NA

ABANDONMENT METHOD: NA

LOCAL COORDINATES:

NORTHING:

EASTING:

DATE/TIME STARTED: 5/5/10 ; 13:35

DATE/TIME COMPLETED: 5/5/10 ; 14:30

WELL INSTALLATION: 05/05/10

Depth in Feet	SAMPLING DATA B	N	A	% Recovery	No.	T	Graphic Log	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS
0	2 3 3 3	6		45	1	SS		CL	**QUATERNARY, LOESS.** Medium, black (10YR 2/1) LEAN CLAY (CL), moist; medium plasticity; cohesive; massive; A horizon of modern soil profile, loess.
								CL	**PRE-ILLINOIAN GLACIAL DIAMICTON (QWT).** Medium, yellowish brown (10YR 5/8) mottled with light brownish gray (10YR 6/2) SANDY LEAN CLAY (CL); moist; medium to low plasticity; cohesive; massive; some sand, trace gravel; MOJU; diamicton. As above from 1.0 to 2.0 feet.
	3 3 2 2	5		45	2	SS			
	2 3 4 3	7		85	3	SS			As above from 1.0 to 4.0 feet Very fine sand lamination at 5.1 feet.
5	2 4 4 3	8		85	4	SS			As above from 1.0 to 6.0 feet
	3 3 3 2	6		80	5	SS			As above from 1.0 to 8.0 feet
								CL	Medium, dark yellowish brown (10YR 4/4) mottled with gray (10YR 6/1) SANDY LEAN CLAY (CL); moist; medium to low plasticity; cohesive; massive; some sand, trace gravel; MOJU-RJU; diamicton.
10	3 3 3 3	6		80	6	SS			As above from 8.6 to 10.0 feet.
	4 16 16 10	32		100	7	SS			As above from 8.6 to 12.0 feet, but consistency changes to hard.
								CL	**PRE-ILLINOIAN GLACIAL DIAMICTON (QAT).** Hard, yellowish brown (10YR 5/8) LEAN CLAY WITH SAND (CL); moist; low to medium plasticity; cohesive; massive; little sand, trace gravel; OU; diamicton
	7 6 6 4	12		60	8	SS			As above from 12.7 to 14.0 feet, but consistency changes to stiff.
15									
	2 9 8 6	17		80	9	SS		CL	Very stiff, olive brown (2.5Y 5/3) mottled with yellowish brown (10YR 5/8) LEAN CLAY WITH SAND (CL); moist; low to medium plasticity; cohesive; massive; little sand, trace gravel; MRU; diamicton
								CL	Very stiff, very dark gray (10YR 3/1) LEAN CLAY WITH SAND (CL); moist; low to medium plasticity; cohesive; massive; little sand, trace gravel; UU; diamicton.
	4 9 8 7	17		85	10	SS			As above from 17.3 to 18.0 feet
20									END OF BORING AT 20.0 FEET

Tracking Codes: 60148396 BLACK HAWK.GPJ ETEOIL 6/2/10, 15:24

AECOM

FINAL SOIL BORING LOG

BORING NO **B-407B**

SITE: Black Hawk County Landfill PROJECT NO 60148396 SHEET 1 OF 1

SITE #:

		WATER LEVEL READINGS			
		DATE	WATER DEPTH	HOLE DEPTH	CASING DEPTH
PHYSICAL SETTING:	Excavated, nearly level upland				
LOG BY:	T. Kemmis				
FIRM/DRILLER:	Terracon/M. White				
DRILLING METHOD:	4 1/4 in. ID HSA with 2 in. dia. by 2 ft. long split spoon sampler, 140-lb. hammer				

ABANDONMENT DATE: NA

ABANDONMENT METHOD: NA

GROUND SURFACE ELEV:

LOCAL COORDINATES:

NORTHING:

EASTING:

DATE/TIME STARTED: 5/5/10 ; 11:15

DATE/TIME COMPLETED: 5/5/10 ; 12:25

WELL INSTALLATION: 05/05/10

Depth in Feet	SAMPLING DATA B	N	A	% Recovery	No.	T	Graphic Log	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS
0	3 4 3 2	7		50	1	SS		CL	**QUATERNARY, FILL.** Medium, black (10YR 2/1) LEAN CLAY (CL); moist; medium plasticity; cohesive; massive; topsoil fill
								CL	**PRE-ILLINOIAN GLACIAL DIAMICTON (QWT).** Medium, yellowish brown (10YR 5/8) mottled with gray (10YR 6/1) SANDY LEAN CLAY (CL); moist; medium to low plasticity; cohesive; massive; some sand, trace gravel; MOU; diamicton
	3 2 3 2	5		50	2	SS			As above from 1.0 to 2.0 feet.
5	2 2 3 3	5		65	3	SS			As above from 1.0 to 4.0 feet. Very fine sand laminations at 4.55 and 5.0 feet.
	2 5 6 3	11		70	4	SS			As above from 1.0 to 6 0 feet, but consistency changes to stiff. Very fine sand lamination at 6.55 feet. Coarse sand from 6.7 to 6.73 feet. Very fine sand laminations at 6.92, 7.2 and 7.4 feet.
	3 6 9 8	15		100	5	SS			As above from 6 0 to 8 0 feet.
								CL	Stiff, yellowish brown (10YR 5/8) mottled with dark grayish brown (10YR 4/2) SANDY LEAN CLAY (CL); moist; medium to low plasticity; cohesive; some sand, trace gravel; MOJU; diamicton.
10	7 16 8 12	24		85	6	SS			As above from 8.5 to 10.0 feet, but consistency changes to very stiff. Medium sand from 10.2 to 10.3 feet. Fine sand from 10.5 to 10.8 feet.
	4 7 8 6	15		70	7	SS		CL	Stiff, very dark gray (10YR 3/1) SANDY LEAN CLAY (CL); moist; medium to low plasticity; cohesive; massive; some sand, trace gravel; UU; diamicton
15	4 7 11 7	18		80	8	SS			As above from 12.0 to 14.0 feet, but consistency changes to very stiff.
	5 7 9 8	16		80	9	SS			As above from 14.0 to 16.0 feet.
								CL	**PRE-ILLINOIAN GLACIAL DIAMICTON (QAT).** Very stiff, grayish brown (10YR 5/2) SANDY LEAN CLAY (CL); slightly moist; medium to low plasticity; cohesive; massive; some sand; RL; diamicton
	6			100	10	SS			
									END OF BORING AT 18.5 FEET
20									

Tracking Codes: 60148396 BLACK HAWK LDF2010.GPJ ETSOIL, 6/2/10, 19:24

AECOM

FINAL SOIL BORING LOG

BORING NO. **B-408B**

SHEET 1 OF 1

SITE: Black Hawk County Landfill PROJECT NO 60148396

SITE #:

WATER LEVEL READINGS	DATE	WATER DEPTH	HOLE DEPTH	CASING DEPTH

GROUND SURFACE ELEV:

PHYSICAL SETTING: Excavated, nearly level upland

LOG BY: T. Kemmis

FIRM/DRILLER: Terracon/M. White

DRILLING METHOD: 4 1/4 in. ID HSA with 2 in. dia. by 2 ft. long split spoon sampler, 140-lb. hammer

ABANDONMENT DATE: NA

ABANDONMENT METHOD: NA

LOCAL COORDINATES:

NORTHING:

EASTING:

DATE/TIME STARTED: 5/6/10 ; 17:45

DATE/TIME COMPLETED: 5/6/10 ; 18:35

WELL INSTALLATION: 05/06/10

Depth in Feet	SAMPLING DATA B	N	A	% Recovery	No.	T	Graphic Log	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS
0	4 5 6 7	11		65	1	SS		CL	**QUATERNARY, FILL.** Stiff, black (10YR 2/1) LEAN CLAY (CL); moist; medium plasticity; cohesive, massive, topsoil fill.
								CL	**LOESS.** Stiff, olive brown (2.5Y 4/3) mottled with black (10YR 2/1) LEAN CLAY (CL); moist; medium plasticity; cohesive; massive; buried B horizon of modern soil profile; loess
	2 2 2 3	4		55	2	SS		CL	**PRE-ILLINOIAN GLACIAL DIAMICTON (QWT).** Soft, mottled yellowish brown (10YR 5/6 and 10YR 5/8) SANDY LEAN CLAY (CL); moist; medium to low plasticity; cohesive; massive; some sand, trace gravel, MOL, diamicton.
5	2 2 2 2	4		80	3	SS		CL	Soft, yellowish brown (10YR 5/8) mottled with light gray (10YR 7/1) and yellowish brown (10YR 5/6) SANDY LEAN CLAY (CL); moist; medium to low plasticity; cohesive; massive; some sand, trace gravel; MOJU; diamicton.
	2 2 3 2	5		80	4	SS			As above from 4 0 to 6.0 feet, but consistency changes to medium
	2 3 3 4	6		90	5	SS			As above from 6.0 to 8.0 feet.
10	2 3 4 4	7		80	6	SS			As above from 6.0 to 10.0 feet.
	6 10 8 11	18		90	7	SS			As above from 6.0 to 12.0 feet, but consistency changes to very stiff
	5 9 11 13	20		95	8	SS			As above from 12.0 to 14 0 feet. Very fine sand lamination at 14.55 feet. Medium sand lamination at 15.05 feet.
15	7 11 17 20	28		90	9	SS			Medium sand laminations at 15.5 feet and 15.8 feet As above from 12.0 to 16.0 feet. Medium sand from 16.5 to 16.6 feet Coarse sand from 17.1 to 17.4 feet.
	5 5 7 9	12		75	10	SS		CL	As above from 12.0 to 18.0 feet, but consistency changes to stiff. Stiff, very dark gray (10YR 3/1) mottled with olive brown (2 5Y 4/3) and dark gray (10YR 4/1) SANDY LEAN CLAY (CL); moist; medium to low plasticity; cohesive; massive; some sand, trace gravel; MUJU; diamicton.
20									END OF BORING AT 20.0 FEET

Tracking Codes: 60148396 BLACK HAWK LDF 2010.GPJ, ETSOIL, 6/2/10, 10:28

AECOM

FINAL SOIL BORING LOG

BORING NO. **B-409B**

SITE: Black Hawk County Landfill PROJECT NO. **60148396** SHEET 1 OF 2

SITE #:

WATER LEVEL READINGS

DATE	WATER DEPTH	HOLE DEPTH	CASING DEPTH

PHYSICAL SETTING: In ditch between Area E and landfill access road

LOG BY: T. Kemmis

FIRM/DRILLER: Terracon/M. White

DRILLING METHOD: 4 1/4 in. ID HSA with 2 in. dia. by 2 ft. long split spoon sampler, 140-lb. hammer

ABANDONMENT DATE: NA

ABANDONMENT METHOD: NA

GROUND SURFACE ELEV:

LOCAL COORDINATES:

NORTHING:

EASTING:

DATE/TIME STARTED: 5/6/10 ; 09:20

DATE/TIME COMPLETED: 5/6/10 ; 10:10

WELL INSTALLATION: 05/06/10

Depth in Feet	SAMPLING DATA B	N	A	% Recovery	No	T	Graphic Log	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS
0	0 0 1 1	1		60	1	SS		SM	**QUATERNARY, FILL.**
								CL	Very loose, brown (10YR 4/3) SILTY SAND (SM); moist; nonplastic; noncohesive; faintly stratified, fine to medium sand; some silt, fill
	3 3 3 3	6		60	2	SS			Very soft, dark gray (10YR 4/1) SANDY LEAN CLAY (CL); moist; medium to low plasticity; cohesive; massive to thickly bedded; some sand, trace gravel; fill As above from 0.5 to 2.0 feet, but consistency changes to medium
5	2 3 3 4	6		60	3	SS			As above from 2.0 to 4.0 feet.
	2 2 7 7	9		75	4	SS			As above from 2 0 to 6.0 feet, but consistency changes to stiff Mottled with yellowish brown (10YR 5/8) from 7.4 to 7.5 feet
	3 3 4 6	7		70	5	SS			As above from 6.0 to 8 0 feet, but consistency changes to medium. Mottled with yellowish brown (10YR 5/8) from 8.7 to 8.8 feet.
10	3 3 4 5	7		75	6	SS			As above from 8 0 to 10.0 feet.
	3 4 4 7	8		70	7	SS			As above from 8 0 to 12.0 feet.
								CL	**LOESS.** Medium, black (10YR 2/1) LEAN CLAY (CL); moist; medium plasticity; cohesive; massive; buried A horizon of modern soil profile; loess. As above from 13.0 to 14.0 feet, but consistency changes to stiff.
15	3 4 6 4	10		70	8	SS		CL	**PRE-ILLINOIAN GLACIAL DIAMICTON (QWT).** Stiff, dark gray (10YR 4/1) mottled with yellowish brown (10YR 5/8) SANDY LEAN CLAY (CL); moist; medium to low plasticity; cohesive; massive; some sand, trace gravel; buried B horizon of modern soil profile, diamicton
	4 4 2 1	6		90	9	SS		SP	Loose, yellowish brown (10YR 5/4) POORLY GRADED SAND (SP); moist; nonplastic; noncohesive; massive; fine sand; OU; poorly graded sand in Pre-Illinoian glacial diamicton
	0 2 2 2	4		75	10	SS		CL	Medium, yellowish brown (10YR 5/6) mottled with gray (10YR 6/1) SANDY LEAN CLAY (CL); moist; medium to low plasticity; cohesive; massive; some sand, trace gravel; MOJU; diamicton As above from 16 8 to 18 0 feet, but consistency changes to soft. Silt from 18 8 to 19 0 feet. As above from 18 0 to 20 0 feet, but consistency changes to stiff.
20	2 4 5 6	9		90	11	SS			
	3 4 5 7	9		85	12	SS		CL	Stiff, dark gray (10YR 4/1) mottled with brown (7.5YR 4/3) SANDY LEAN CLAY (CL); moist; medium to low plasticity; cohesive; massive; some sand, trace gravel; MRJU; diamicton.
								CL	Stiff, very dark gray (10YR 3/1) SANDY LEAN CLAY (CL); moist; medium to low plasticity; cohesive; massive; some sand, trace gravel; UJU; diamicton.

Continued Next Page

Tracking Codes: 60148396 BLACK HAWK LDF2010 GPJ, ETSOIL 6/3/10, 15:36

AECOM

FINAL SOIL BORING LOG

BORING NO **B-409B**

SITE: Black Hawk County Landfill PROJECT NO **60148396** SHEET 2 OF 2

Depth in Feet	SAMPLING DATA B	N	A	% Recovery	No.	T	Graphic Log	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS
25									END OF BORING 24.0 FEET
30									
35									
40									
45									
50									

Tracking Codes: 60148396 BLACK HAWK LDF2010 GPJ, ETSOIL 6/3/10, 15:36

FINAL SOIL BORING LOG

BORING NO. **B-410**

SITE: **Black Hawk County Landfill** PROJECT NO. **60482609** SHEET **1** OF **2**

SITE #: _____

WATER LEVEL READINGS			
DATE	WATER DEPTH	HOLE DEPTH	CASING DEPTH

PHYSICAL SETTING: **Adjacent to fence by Cell A**
LOG BY: **Sarah Day**
FIRM/DRILLER: **Terracon/Ron Faulk**
DRILLING METHOD: **4.25 HSA, 2.0 in. by 2.0 ft. SS**

ABANDONMENT DATE: **NA**
ABANDONMENT METHOD: **NA**

GROUND SURFACE ELEV: **948.00**
IA State Plain LOCAL COORDINATES:
NORTHING: **3616960.95**
EASTING: **5237824.52**
DATE/TIME STARTED: **11/9/16 ; 08:30**
DATE/TIME COMPLETED: **11/9/16 ; 10:00**
WELL INSTALLATION: **11/9/16**

Depth in Feet	SAMPLING DATA B	N	A	% Recovery	No.	T	Graphic Log	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS
0								NS	No Sample
	1 3 3 5	6		65	1	SS		CL	QUATERNARY, FILL. Medium, very dark grayish brown (10 YR 3/2) to very dark gray (10 YR 3/1), SANDY LEAN CLAY (CL), moist, medium plasticity, cohesive, massive, trace roots and gravel.
	1 3 2 7	5		90	2	SS			
								CL	Medium, light brownish gray (10YR 6/2) mottled with brownish yellow (10YR 6/6), SANDY LEAN CLAY (CL), moist, low plaicity, cohesive, masssive, M.
5	4 6 6 6	12		80	3	SS			
								CL	Stiff, grayish brown (10YR 5/2) LEAN CLAY (CL), moist, medium plaicity, cohesive, with 0.01 foot sand seams.
	3 3 4 6	7		100	4	SS		SP	Loose, grayish brown (10YR 5/2) POORLY GRADED SAND (SP), moist, non-plastic, noncohesive, massive.
								CL	Stiff, grayish brown (10YR 5/2) LEAN CLAY (CL), moist, medium plaicity, cohesive, with 0.01 foot sand seams.
	1 2 3 5	5		100	5	SS			LOESS. Medium, black (10YR 2/1) LEAN CLAY (CL), moist, medium to high plasticity, cohesive, massive. As above from 8.5 to 8.7, but color changes to lt olive brown (2.5Y 5/3). As above from 8.7 to 9.4, but color changes to black.
10								CL	PRE-ILLINOIAN GLACIAL DIAMICTON (QWT). Medium, olive brown (2.5 Y 4/4) LEAN CLAY (CL) moist, cohesive, medium plasticity, cohesive, massive.
	1 2 2 3	4		100	6	SS			
								SP	Very loose, light olive brown (2.5Y 5/1) POORLY GRADED SAND (SP) wet, non-plastic, noncohesive, massive.
								CL	Medium, gray (2.5 Y 5/1), SANDY LEAN CLAY (CL) mottled with light olive brown (2.5Y 5/6), moist, medium plasticity, cohesive, massive, M, trace gravel.
	2 3 4 6	7		100	7	SS			
15	5 6 8 11	14		100	8	SS			As above from 14.5 to 16 feet, but color changes to yellowish brown (10YR 5/8).
								CL	PRE-ILLINOIAN GLACIAL DIAMICTON (QAT). Very stiff, dark grayish brown (10YR 4/2) SANDY LEAN CLAY (CL), moist, medium plasticity, cohesive, massive, trace gravel.
	2 6 8 11	14		100	9	SS			
	3 6 12 33	18		100	10	SS			

Continued Next Page

Tracking Codes: 60482609_BLACKHAWK GPJ_ETSOIL_1/3/17, 1103

FINAL SOIL BORING LOG

BORING NO. **B-410**

SITE: **Black Hawk County Landfill** PROJECT NO. **60482609** SHEET **2** OF **2**

Depth in Feet	SAMPLING DATA B	N	A	% Recovery	No.	T	Graphic Log	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS
20								SP	Very dense, grayish brown (10YR 5/2), POORLY GRADED SAND (SP) moist, non-plastic, noncohesive, massive.
	17 31 45 50	>50		100	11	SS			
								CL	Hard, lt olive brown (2.5Y 5/3) SANDY LEAN CLAY (CL) moist, medium to low plasticity, cohesive, massive, trace gravel.
	8 28 50 50/3	>50		100	12	SS			As above from 23 to 24.5 feet, but color changes to olive yellow (2.5Y 6/6) and there are 0.01 foot silt seams.
25	8 11 13 16	24		90	13	SS			As above from 24.5 to 27 feet, but color changes to light olive brown (2.5Y 5/6).
	6 11 15 23	26		90	14	SS			As above from 27 to 28.5 feet, but color changes to very dark gray (10YR 3/1).
30									End of boring at 28.5 feet below ground surface.
35									
40									

Tracking Codes: 60482609_BLACKHAWK GPJ_ETSOIL_1/3/17, 1103

AECOM

FINAL SOIL BORING LOG

BORING NO. **B-411**

SITE: **Black Hawk County Landfill** PROJECT NO. **60482609** SHEET **1** OF **2**

SITE #: _____

	WATER LEVEL READINGS			
	DATE	WATER DEPTH	HOLE DEPTH	CASING DEPTH

PHYSICAL SETTING: **Side slope of Cell W-1**
LOG BY: **Sarah Day**
FIRM/DRILLER: **Terracon/Ron Faulk**
DRILLING METHOD: **4.25 HSA, 2.0 in. by 2.0 ft. SS**
ABANDONMENT DATE: **NA**
ABANDONMENT METHOD: **NA**

GROUND SURFACE ELEV: **964.00**
IA State Plain LOCAL COORDINATES:
NORTHING: **3617179.77**
EASTING: **5237772.33**
DATE/TIME STARTED: **11/8/16 ; 14:50**
DATE/TIME COMPLETED: **11/8/16 ;**
WELL INSTALLATION: **11/8/16**

Depth in Feet	SAMPLING DATA B	N	A	% Recovery	No.	T	Graphic Log	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS
0								NS	No Sample
	3 4 5 6	**9**		75	1	SS		CL	QUATERNARY FILL. Stiff, yellowish brown (10YR 5/6) mottled with dark gray (10YR 4/1), SANDY LEAN CLAY (CL), moist, low plasticity, cohesive, M, trace gravel.
	2 3 5 6	**8**		100	2	SS			
5	2 4 6 6	**10**		85	3	SS		CL	Stiff, dark brown (10YR 3/3) SANDY LEAN CLAY (CL), moist, medium plasticity, cohesive, massive, few gravel, 0.01 foot silty sand seams.
	3 3 5 4	**8**		90	4	SS			As above from 7.2 to 10.5, but color change to dark gray (10YR 4/1).
	1 3 5 6	**8**		100	5	SS			
10	2 6 6 8	**12**		100	6	SS			As above from 10.5 to 14.5.
	5 6 9 10	**15**		100	7	SS			
15	2 3 4 4	**7**		75	8	SS			As above from 14.5 to 19.6, but moisture changes to wet.
	WOH 2 3 5	**5**		100	9	SS			
	2 4 7 8	**11**		100	10	SS		CL	

Continued Next Page

Tracking Codes: 60482609_BLACKHAWK GPJ_ETSOIL_1/3/17, 1103

AECOM

FINAL SOIL BORING LOG

BORING NO. **B-411**

SITE: **Black Hawk County Landfill** PROJECT NO. **60482609** SHEET **2** OF **2**

Depth in Feet	SAMPLING DATA B	N	A	% Recovery	No.	T	Graphic Log	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS
20									PRE-ILLINOIAN GLACIAL DIAMICTON (QWT).
	2 3 5 7	**8**		90	11	SS		CL	Stiff, black (10YR 2/1) LEAN CLAY (CL), moist, medium to high plasticity, cohesive, massive, trace roots, burried topsoil.
									Medium, very dark grayish brown (10YR 3/2), LEAN CLAY (CL), moist, medium plasticity, cohesive, massive, trace gravel.
								SP	Loose, olive brown (2.5Y 4/4) POORLY GRADED SAND (SP), moist, non-plastic, noncohesive, massive, trace gravel and clay.
	2 3 5 5	**8**		100	12	SS		CL	Stiff, very dark brown (10YR 2/2), LEAN CLAY (CL), moist, medium plasticity, cohesive, massive.
									PRE-ILLINOIAN GLACIAL DIAMICTON (QAT).
25	3 5 6 6	**11**		100	13	SS			Very stiff, gray (10YR 6/1), LEAN CLAY (CL), moist, medium plasticity, cohesive, massive.
	2 3 5 7	**8**		100	14	SS			
	4 5 15 18	**20**		100	15	SS			As above from 29.5 to 30.5 feet, but color changes to very dark gray (10YR 3/1) mottled with dark brown (10YR 3/3).
30	7 11 15 20	**26**		100	16	SS			
	14 41 50/3	**>50**		60	17	SS		SM	Hard, gray (10YR 5/1) SILTY SAND (SM) wet, non-plastic, noncohesive, massive.
								CL	Hard, yellowish brownish (10YR 5/6) SANDY LEAN CLAY (CL) dry, low plasticity, cohesive, massive.
35	26 45 50 50/5	**>50**		80	18	SS			
									End of boring at 36.5 feet below ground surface.
40									

Tracking Codes: 60482609_BLACKHAWK GPJ_ETSOIL_1/3/17, 1103

FINAL SOIL BORING LOG

BORING NO. **B-412**

SITE: **Black Hawk County Landfill** PROJECT NO. **60482609** SHEET **1** OF **2**

SITE #: _____

		WATER LEVEL READINGS		
	DATE	WATER DEPTH	HOLE DEPTH	CASING DEPTH

GROUND SURFACE ELEV: **957.00**

PHYSICAL SETTING: **Side slope of Cell W-1**

LOG BY: **Sarah Day**

FIRM/DRILLER: **Terracon/Ron Faulk**

DRILLING METHOD: **4.25 HSA, 2.0 in. by 2.0 ft. SS**

ABANDONMENT DATE: **NA**

ABANDONMENT METHOD: **NA**

IA State Plain LOCAL COORDINATES:

NORTHING: **3617406.50**

EASTING: **5237772.33**

DATE/TIME STARTED: **11/7/16 ; 10:30**

DATE/TIME COMPLETED: **11/7/16 ; 12:30**

WELL INSTALLATION: **11/7/16**

Depth in Feet	SAMPLING DATA B	N	A	% Recovery	No.	T	Graphic Log	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS
0								NS	No Sample
	2 2 3 5	**5**			1	SS		SM	QUATERNARY, FILL.
								CL	Loose, dark yellowish brown (10YR 4/6), SILTY SAND (SM), dry, nonplastic, non-cohesive, massive.
									Medium, very dark brown (10YR 4/2), LEAN CLAY (CL), moist, medium plasticity, cohesive, massive, trace roots.
								SM	
	2 2 4 6	**6**			2	SS		CL	Loose, dark grayish brown (10YR 4/2), SILTY SAND (SM) dry, nonplastic, non-cohesive, massive.
									Medium, dark yellowish brown (10YR 4/6) to brownish yellow (10YR 6/6), dry LEAN CLAY (CL), low to medium plasticity, cohesive, light gray (10YR 7/2) silt seams throughout.
								CL	
5	6 6 5 5	**11**			3	SS			Stiff, very dark gray (10YR 3/1), LEAN CLAY (CL), dry, medium to low plasticity, cohesive, massive, few gravel and sand.
	2 4 6 7	**10**			4	SS			
	2 2 4 6	**6**			5	SS			
10	3 4 5 6	**9**			6	SS			As above from 10 to 14 feet but moisture changes to moist.
	3 4 7 9	**11**			7	SS			
								CL	LOESS.
15	3 4 5 7	**9**			8	SS			Stiff, black (10YR 2.5/1), LEAN CLAY (CL), moist, medium to low plasticity, cohesive, massive, few gravel and sand.
	2 3 4 4	**7**			9	SS		CL	PRE-ILLINOIAN GLACIAL DIAMICTON (QWT). Medium, olive grey (5Y 4/2) SANDY LEAN CLAY (CL), moist, medium plasticity, cohesive, massive, M.
	1 2 4 4	**6**			10	SS			

Continued Next Page

Tracking Codes: 60482609_BLACKHAWK GPJ_ETSOIL_1/3/17, 1103

FINAL SOIL BORING LOG

BORING NO. **B-412**

SITE: **Black Hawk County Landfill** PROJECT NO. **60482609** SHEET **2** OF **2**

Depth in Feet	SAMPLING DATA B	N	A	% Recovery	No.	T	Graphic Log	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS
20								SM	Medium dense, light olive brown (2.5 Y 5/6), silty sand (SM) moist, nonplastic, non-cohesive, massive.
	2 4 9 10	**13**			11	SS		CL	Medium, olive grey (5Y 4/2) SANDY LEAN CLAY (CL), moist, medium plasticity, cohesive, massive, mottled.
	3 5 7 11	**12**			12	SS		CL	PRE-ILLINOIAN GLACIAL DIAMICTON (QAT). Stiff, very dark grayish brown (10YR 3/2) to very dark gray (10YR 3/1), SANDY LEAN CLAY (CL), moist, low to medium plasticity, cohesive, massive, trace gravel.
25	6 13 20 28	**33**			13	SS			
	6 40 47 55	**>50**			14	SS		SP/SM	Very dense, grayish brown (10YR 5/2), POORLY GRADED SAND (SP) to SILTY SAND (SM), moist, nonplastic, non-cohesive, massive.
	12 12 14 15	**26**			15	SS		CL	Very stiff, olive gray (5Y 4/2), SANDY LEAN CLAY (CL), moist, low plasticity, cohesive, massive, with sand and silt seams throughout.
30	10 15 20 24	**35**			16	SS			
								CL	Very stiff, black (10YR 2.5/1), LEAN CLAY (CL), moist, low plasticity, cohesive, massive, little sand and trace gravel.
	10 9 8 12	**17**			17	SS			As above from 34 to 36.5 feet, but with silt seams.
35	9 9 30 31	**39**			18	SS			
									End of Boring at 36.5 feet below ground surface.
40									

Tracking Codes: 60482609_BLACKHAWK GPJ_ETSOIL_1/3/17, 1103

AECOM

FINAL SOIL BORING LOG

BORING NO. **B-413**

SITE: **Black Hawk County Landfill** PROJECT NO. **60482609** SHEET **1** OF **2**

SITE #: _____

Adjacent to fence and road by Cell

PHYSICAL SETTING: **A**

LOG BY: **Sarah Day**

FIRM/DRILLER: **Terracon/Ron Faulk**

DRILLING METHOD: **4.25 HSA, 2.0 in. by 2.0 ft. SS**

WATER LEVEL READINGS

DATE	WATER DEPTH	HOLE DEPTH	CASING DEPTH

ABANDONMENT DATE: **NA**

ABANDONMENT METHOD: **NA**

GROUND SURFACE ELEV: **946.00**

IA State Plain LOCAL COORDINATES:

NORTHING: **3617592.85**

EASTING: **5237824.52**

DATE/TIME STARTED: **11/7/16 ; 14:00**

DATE/TIME COMPLETED: **11/7/16 ; 15:00**

WELL INSTALLATION: **11/7/16**

Depth in Feet	SAMPLING DATA B	N	A	% Recovery	No.	T	Graphic Log	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS
0								NS	No Sample.
	2 4 5 6	9		80	1	SS		CL	QUATERNARY, FILL. Stiff, very dark brown (10YR 2.5/2), LEAN CLAY (CL), moist, medium plasticitiy, cohesive, massive.
								CL	Stiff, dark brown (10YR 3/2), LEAN CLAY (CL), moist, medium plasticity, cohesive, massive, trace gravel.
	2 4 6 6	10		75	2	SS			
	2 1 2 4	3		100	3	SS		SP	Soft, dark brown (10YR 3/2), POORLY GRADED SAND (SP) moist, non-plastic, noncohesive, massive.
5								CL	Soft, dark brown (10YR 3/2), LEAN CLAY (CL) moist, high plasticity, cohesive, massive.
	3 3 4 4	7		100	4	SS		CL	LOESS. Medium, black (10YR 2.5/1), LEAN CLAY (CL), moist, medium plasticity, cohesive, massive.
								CL	PRE-ILLINOIAN GLACIAL DIAMICTON (QWT). Medium, dark olive gray (5Y 3/2), SANDY LEAN CLAY (CL), moist, medium to low plasticity, cohesive, massive.
	2 4 6 6	10		80	5	SS		SP	Loose, olive gray (5Y 4/2), POORLY GRADED SAND (SP) wet, non-plastic, noncohesive, massive.
10	2 2 4 4	6		60	6	SS		CL	Medium, olive brown (2.5Y 4/3), LEAN CLAY (CL) wet, high plasticity, cohesive, massive, trace sand.
	2 2 4 5	6		80	7	SS		SP	Loose, olive gray (5Y 4/2), POORLY GRADED SAND (SP) wet, non-plastic, noncohesive, massive.
								CL	Medium, olive (5Y 4/3), LEAN CLAY (CL), wet, high plasticity, cohesive, massive, trace gravel.
15	2 3 4 5	7		100	8	SS		CL	PRE-ILLINOIAN GLACIAL DIAMICTON (QAT). Medium, grayish brown (10YR 5/2), SANDY LEAN CLAY (CL), moist, medium plasticity, cohesive, massive, trace gravel, with gray (10YR 6/1) silt seams throughout.
	10 15 30 30	45		100	9	SS		CL	Medium to very stiff, very dark grayish brown (10YR 3/2), SANDY LEAN CLAY (CL), dry, low plasticity, cohesive, massive, mottled, with gray (10YR 6/1) silt seams throughout. As above from 17.5 to 20.5, but color changes to olive gray (5Y 4/2).
	9 11 13 16	24		100	10	SS			

Continued Next Page

Tracking Codes: 60482609_BLACKHAWK GPJ_ETSOIL_1.0.17.1103

AECOM

FINAL SOIL BORING LOG

BORING NO. B-413

SITE: **Black Hawk County Landfill** PROJECT NO. **60482609** SHEET **2** OF **2**

Depth in Feet	SAMPLING DATA B	N	A	% Recovery	No.	T	Graphic Log	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS
20									
									End of Boring at 20.5 feet below ground surface.
25									
30									
35									
40									

Tracking Codes: 60482609_BLACKHAWK GPJ_ETSOIL_1.0.17.1103

AECOM

FINAL SOIL BORING LOG

BORING NO. **B-414**

SITE: **Black Hawk County Landfill** PROJECT NO. **60482609** SHEET **1** OF **2**

SITE #:

Adjacent to fence and road by Cell

PHYSICAL SETTING: **A**

LOG BY: **Sarah Day**

FIRM/DRILLER: **Terracon/Ron Faulk**

DRILLING METHOD: **4.25 HSA, 2.0 in. by 2.0 ft. SS**

WATER LEVEL READINGS

DATE	WATER DEPTH	HOLE DEPTH	CASING DEPTH

ABANDONMENT DATE: **NA**

ABANDONMENT METHOD: **NA**

GROUND SURFACE ELEV: **960.00**

IA State Plain LOCAL COORDINATES:

NORTHING: **3617328.34**

EASTING: **5237842.52**

DATE/TIME STARTED: **11/8/16 ; 09:34**

DATE/TIME COMPLETED: **11/8/16 ; 11:10**

WELL INSTALLATION: **11/8/16**

Depth in Feet	SAMPLING DATA B	N	A	% Recovery	No.	T	Graphic Log	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS
0								NS	No Sample
	1 1 3 6	**4**		70	1	SS		CL	QUATERNARY, FILL. Soft to medium, very dark gray (7.5YR 3/1) to dark brown (7.5YR 3/2), SANDY LEAN CLAY (CL), moist, medium plasticity, cohesive, massive, trace roots, trace gravel.
	2 4 5 6	**9**		75	2	SS			
5	1 3 5 6	**8**		75	3	SS			
	1 3 9 7	**12**		100	4	SS		SM	Loose, dark gray (7.5YR 4/1), SILTY SAND (SM), dry, non-plastic, noncohesive, massive.
								CL	PRE-ILLINOIAN GLACIAL DIAMICTON (QWT). Medium, dark brown (7.5YR 3/2), SANDY LEAN CLAY (CL), moist, medium to low plasticity, cohesive, massive, trace gravel.
	2 3 5 8	**8**		100	5	SS			
10	4 4 8 10	**12**		100	6	SS			
								CL	Stiff, olive brown (2.5Y 4/3), SANDY LEAN CLAY (CL), moist, medium plasticity, cohesive, massive, mottled, trace gravel.
	3 5 7 10	**12**		100	7	SS		CL	PRE-ILLINOIAN GLACIAL DIAMICTON (QAT). Stiff, dark gray (10YR 4/1), SANDY LEAN CLAY (CL) moist, low plasticity, cohesive, massive, trace gravel.
	4 6 7 10	**13**		100	8	SS			As above from 14.6 to 15 feet, but color changes to olive brown (2.5Y 4/3).
15								SM	Medium dense, light olive brown (2.5Y 5/6), SILTY SAND (SM), moist, non-plastic, noncohesive, massive.
								SP	
								CL	Medium dense, light olive brown (2.5Y 5/6), POORLY GRADED SAND (SP), wet, non-plastic, noncohesive, massive.
								CL	Stiff, yellowish brown (10YR 5/6), SANDY LEAN CLAY (CL), moist, low plasticity, cohesive, massive.
	3 5 7 7	**12**		100	9	SS			Stiff, black (10YR 2/1), LEAN CLAY (CL), moist, medium to high plasticity, cohesive, massive.
	3 4 6 6	**10**		100	10	SS		SP	Loose, olive brown (2.5Y 4/4), POORLY GRADED SAND (SP), moist, non-plastic, noncohesive, massive.
								CL	

Continued Next Page

Tracking Codes: 60482609_BLACKHAWK GPJ_ETSOIL_1/3/17, 1103

AECOM

FINAL SOIL BORING LOG

BORING NO. **B-414**

SITE: **Black Hawk County Landfill** PROJECT NO. **60482609** SHEET **2** OF **2**

Depth in Feet	SAMPLING DATA B	N	A	% Recovery	No.	T	Graphic Log	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS
20	1 2 4 4	**6**		100	11	SS			Medium, gray (10YR 5/1) mottled yellowish brown (10YR 5/6), LEAN CLAY (CL), moist, medium plasticity, cohesvie, massive, M, trace to little sand and gravel, with <0.1 foot poorly graded sand seams at 22.5 and 24.5 feet.
	2 3 3 4	**6**		100	12	SS			
25	2 3 5 19	**8**		100	13	SS			
								CL	Very stiff, gray (10YR 5/1), SANDY LEAN CLAY (CL), wet, lowplasticity, cohesvie, massive, little gravel.
	50 50/5	**>50**		50	14	SS		SP	Very dense, yellowish brown (10YR 5/6) POORLY GRADED SAND (SP), wet, non-plastic, noncohesive, trace gravel, Cobble at 27.5 feet.
	21 36 45 49	**>50**		100	15	SS		CL	Hard, light olive brown (2.5Y 5/4), SANDY LEAN CLAY (CL), moist, low plasticity, cohesive, massive, trace gravel.
30									End of boring at 30.5 feet below ground surface.
35									
40									

Tracking Codes: 60482609_BLACKHAWK GPJ_ETSOIL_1/3/17, 1103

AECOM **FIELD BORING LOG WITH ATMOSPHERIC MONITORING**

SITE: Black Hawk Co. LF | PROJECT NO.: 60284307 | BORING NO.: B-501B (new location)

DRILLING METHOD: 4¼-inch ID HSA w/2-inch dia by 2-foot long split spoon sampler

LOG BY: J. Malefeke

FIRM/DRILLER: Braun Intertec/R. Hunt

PHYSICAL SETTING: Directly east of SE corner of maintenance shop in gravel lot

WATER LEVEL READINGS

DATE/TIME	WATER DEPTH	HOLE DEPTH	CASING DEPTH

ABANDONMENT DATE: NA

ABANDONMENT METHOD: NA

GROUND SURFACE ELEV.:

COORDINATE TYPE:

NORTH:

EAST:

DATE/TIME START: 6/25/13 / 1155

DATE/TIME COMPLETE: 6/25/13 1310

WELL INSTALLATION DATE: 6/25/13

DEPTH IN FEET	GRAPHIC LOG	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS	SAMPLING DATA B	N	A	R	Sample Type	Sample Interval	AIR MONITORING TIME	PID	O2/LEL	O2 / H2S
0		CL	Medium, 2.5Y, 4/2 dark grayish brown LEAN CLAY w/sand and gravel, low plasticity, cohesive, FILL	5				SS		1155	0	0	20.9 0
				3									
1				4									
				4	7								
2		ML	Stiff, 2.5Y, 5/4 light olive brown ~~SILT~~, SILT w/ sand and gravel, nonplastic, noncohesive, dry, FILL	4						1210	0	0	20.9 0
				6									
3				9									
				12	15								
4		ML	Stiff, 2.5Y, 5/6 light olive brown SILT w/sand, nonplastic, noncohesive, dry, ~~LOESS~~ ~~FILL~~ LOESS	3									
				5									
5				10									
				12	15								
6		CL	Medium, 10YR 4/1, dark gray LEAN CLAY w/sand, medium plasticity, cohesive, moist, ~~LOESS~~ ~~FILL~~ LOESS	2						1215	0	0	20.9 0
				3									
7				5									
				7	8								
8		GL	Medium, 2.5Y, 4/3 olive brown and 2.5Y 4/1 dark gray, LEAN CLAY w/sand, medium plasticity, cohesive, ~~LOESS~~ ~~FILL~~ LOESS	2									
				3									
9				4									
				6	7								

AECOM **FIELD BORING LOG WITH ATMOSPHERIC MONITORING**

SITE: Black Hawk Co. LF | PROJECT NO.: 60284307 | BORING NO.: B-501B

DEPTH IN FEET	GRAPHIC LOG	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS	SAMPLING DATA B	N	A	R	Sample Type	Sample Interval	AIR MONITORING TIME	PID	O2/LEL	O2 / H2S
10		CL	Medium, olive brown and dark gray LEAN CLAY w/sand as above from 8 to 10 ft bgs, moist, ~~LOESS FILL~~ LOESS	2				SS		1220	0	0	20.9 0
				3									
11				5									
				5	8								
12		CL	Medium, 2.5Y, 6/4 ~~light~~ yellowish brown and 2.5Y 6/2 light brownish gray LEAN CLAY w/sand, trace gravel, medium plasticity, cohesive, moist, oxidized ~~FILL~~ LOESS	2									
				3									
13				3									
				5	6								
14		CL	Medium, 10YR 4/3 brown and light gray LEAN CLAY w/sand as above from 12 to 14 ft bgs; SP sand lense at ~ 15 ft bgs, moist, ~~LACUSTRINE~~	2									
		SP		3									
15		CL	~~FILL~~ LOESS	3									
				4	6								
16		CL	Stiff, 2.5Y, 4/3, olive brown LEAN CLAY w/sand, trace gravel, low to medium plasticity, cohesive, moist, ~~FILL~~ LOESS	3						1235	0	0	20.9 0
				5									
17				7									
				8	12								
18		CL	Stiff, 2.5Y, 4/1, dark gray LEAN CLAY w/sand, low plasticity, cohesive, moist, ~~DIAMICTON~~	3									
				5									
19				7									
				11	12					1246	0	0	20.9 0
20		CL	Very Stiff, dark gray LEAN CLAY w/sand as above from 18 to 20 ft bgs ~~DIAMICTON~~	6									
				8									
21				10									
				11	18								
22		CL	Very Stiff, dark gray LEAN CLAY w/sand as above from 20-22	4									

AECOM **FIELD BORING LOG WITH ATMOSPHERIC MONITORING**

SITE: Black Hawk Co. LF PROJECT NO.: 60284307 BORING NO.: B-501B

DEPTH IN FEET	GRAPHIC LOG	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS	SAMPLING DATA B	N	A	R	Sample Type	Sample Interval	AIR MONITORING TIME	PID	Q2/ LEL	O2/H2S
23		CL	DIAMICTON	9				SS					
				9									
				12	18					1245	0	0	20.9 0
24		CL	Stiff dark gray LEAN CLAY w/sand as above from 22-24 ft bgs,	3									
			DIAMICTON	5									
25				7									
				11	12					1255	0	0	20.9 0
26		CL	Very stiff dark LEAN CLAY w/sand, trace gravel, same as above from	9									
			24 to 26 ft bgs. DIAMICTON evidence of oxidation along vertical fractures	15									
27			in the till? (brown color)	13									
28				17	28								
		CL	Very stiff dark gray LEAN CLAY w/sand as above from 26 to 28 ft bgs,	4									
			DIAMICTON	9									
29				13									
				15	22					1310	0	0	20.9 0
30			EOB @ 30 ft bgs 6/25/2013 1310										
31													
32													

Sheet 1 of 1

AECOM FIELD BORING LOG WITH ATMOSPHERIC MONITORING

SITE: Black Hawk Co. LF PROJECT NO.: 60284307 BORING NO.: B-501B

DRILLING METHOD: 4¼-inch ID HSA w/2-inch dia by 2-foot long splitspoon sampler

LOG BY: J. Maletzke

FIRM/DRILLER: Braun Intertec/R Hunt

PHYSICAL SETTING: Along haul road between Area A & Co Disposal Area

WATER LEVEL READINGS

DATE/ TIME	WATER DEPTH	HOLE DEPTH	CASING DEPTH

ABANDONMENT DATE: 6/19/13

ABANDONMENT METHOD: Hydrated bentonite chips

GROUND SURFACE ELEV.:

COORDINATE TYPE:

NORTH:

EAST:

DATE/TIME START: 6/19/13/1125

DATE/TIME COMPLETE: 6/19/13/1155

WELL INSTALLATION DATE: N/A

DEPTH IN FEET	GRAPHIC LOG	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS	SAMPLING DATA B	N	A	R	Sample Type	Sample Interval	AIR MONITORING TIME	PID	Q2/ LEL	O2/ H2S
0		CL	Medium, 7.5YR, 3/1, Very Dark gray LEAN CLAY w/ sand, some gravel, dry	2				SS		1130	0	0	20.9/0
1			low plasticity, cohesive, FILL (upper 6 inches - topsoil/fill)	3									
				4									
2				4	7								
		CL	Stiff, 7.5YR, 3/1 Very dark gray LEAN CLAY w/ sand, dry, low	3									
			plasticity, cohesive, glacial diamicton	4									
3				5									
				6	9					1135	0	0	20.7/0
4		CL	Medium, 5Y, 4/2, olive gray and 5Y, 4/1, dark gray LEAN CLAY	2									
			w/ sand, dry, cohesive, low-med plasticity	4									
5				3									
				5	7					1140	0	0	20.9/0
6		CL	Medium, 10YR, 3/1, black and 5Y, 6/1 gray LEAN CLAY with some	2									
			debris/waste,	7									
7				5									
				6	7					1145	0	0	20.9/0
8		CL	As above from 6-8, wet, debris/waste, audible methane bubbling in the borehole										
9													
										1155	0.7	9	20.1/0

EOB @ 8 ft bgs (SS to 10 ft bgs)

Sheet 1 of 1

AECOM **FIELD BORING LOG WITH ATMOSPHERIC MONITORING**

SITE: Black Hawk Co. LF PROJECT NO.: 60284307 BORING NO.: B-502B

DRILLING METHOD: 4-1/4 inch ID HSA w/2-inch dia by 2-foot long splitspoon sampler

LOG BY: Jeff Maketzka

FIRM/DRILLER: Braun Intertec/R Hunt

PHYSICAL SETTING: Along haul road between Area A & Ce Disposal Area

WATER LEVEL READINGS

DATE/ TIME	WATER DEPTH	HOLE DEPTH	CASING DEPTH

ABANDONMENT DATE: 6/19/13

ABANDONMENT METHOD: NR Hydrated bentonite chips

GROUND SURFACE ELEV.:

COORDINATE TYPE:

NORTH:

EAST:

DATE/TIME START: 6/19/13/0945

DATE/TIME COMPLETE: 6/19/13/1110

WELL INSTALLATION DATE: NR

DEPTH IN FEET	GRAPHIC LOG	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS	SAMPLING DATA B	N	A	R	Sample Type	Sample Interval	AIR MONITORING TIME	PID	Q2/ LEL	O2/ H2S
0		CL	Medium, dark grayish brown 2.5Y 4/2 LEAN CLAY w/ sand and gravel, dry	3				SS		0950	0	0	20.9 0
			low plasticity, cohesive, TOPSOIL/FILL	3									
1				4									
				3	7								
2		CL	Stiff 10YR 3/1 very dark gray LEAN CLAY w/ some fine gravel	3									
			dry, low plasticity, cohesive, FILL	7									
3		FILL TILL	Contact w/ diamicton @ ~3.5'	9									
		CL		15	16					1000			
4		CL	Stiff, 10YR 4/1 dark gray LEAN CLAY w/ trace sand, dry,	14									
			low plasticity, cohesive, Pre-Illinoian glacial diamicton	7									
5				8									
				9	15					1005	0	0	20.9 0
6		CL	Stiff dark gray diamicton as above — used the fill as										
			cover/cap?										
7													
			Trash/garbage @ 7.5'										
8										1010	0.3 1.5	28 52	20.6 0
			E.O.B. @ 8 ft bgs (splitspoon to 8 ft bgs)										
9													

FINAL SOIL BORING LOG

BORING NO. **B-601B**

SITE: **Black Hawk County Landfill** PROJECT NO. **60313620** SHEET **1** OF **2**

SITE #: **Cell W-2**

WATER LEVEL READINGS	DATE	WATER DEPTH	HOLE DEPTH	CASING DEPTH

GROUND SURFACE ELEV: **942.30**

PHYSICAL SETTING: **South side of Cell W-2**

LOG BY: **Sarah Day**

FIRM/DRILLER: **Terracon/Ron Faulk**

DRILLING METHOD: **4.25 HSA, 2.0 in. by 2.0 ft. SS**

ABANDONMENT DATE: **NA**

ABANDONMENT METHOD: **NA**

LOCAL COORDINATES:

NORTHING: **3616798.20**

EASTING: **5235898.00**

DATE/TIME STARTED: **10/27/14 ; 15:00**

DATE/TIME COMPLETED: **10/27/14 ; 16:15**

WELL INSTALLATION: **10/27/14**

Depth in Feet	SAMPLING DATA B	N	A	% Recovery	No.	T	Graphic Log	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS
0								NS	No Sample
	3 3 3 3	6		50	1	SS		CL	QUATERNARY, FILL. Medium, dark yellowish brown (10 YR 4/4), LEAN CLAY (CL), moist, medium plasticity, cohesive, massive, medium-fine sand at 2.4 feet
	2 4 4 2	8		50	2	SS		CL	Medium, brown (10 YR 4/3), LEAN CLAY (CL), moist, medium plasticity, cohesive, massive, medium-fine sand seam at 2.7 feet, very dark grayish brown (10YR 3/2) medium sand seam from 4.3-4.5 feet.
5	WOH 2 3 3	5		100	3	SS		CL	PRE-ILLINOIAN GLACIAL DIAMICTON (QWT). Medium, brown (10 YR 4/3), LEAN CLAY (CL), moist, medium plasticity, cohesive, massive.
	5 8 10 10	18		85	4	SS		CL	Very stiff, strong brown (7.5 YR 4/6), LEAN CLAY (CL), moist, medium plasticity, cohesive, massive.
								SM	Medium dense, strong brown (7.5 YR 4/6) SILTY SAND (SM) moist, non-plastic, noncohesive, massive, well graded.
								CL	Very stiff strong brown (7.5 YR 4/6), LEAN CLAY (CL), moist, medium plasticity, cohesive, massive.
	7 9 10 11	19		85	5	SS		CL	Very stiff, brownish yellow (10 YR 6/6), LEAN CLAY (CL), moist, medium plasticity, cohesive, massive.
10	No Data	No Data		100	6	SS			As above from 10.5 to 12.5 feet.
	10 10 10 12	20		75	7	SS		CL	Very stiff yellowish brown (10 YR 5/4) LEAN CLAY (CL), moist, medium plasticity, cohesive, massive.
								CL	PRE-ILLINOIAN GLACIAL DIAMICTON (QAT). Very stiff, dark gray (10 YR 4/1) LEAN CLAY (CL) moist, medium plasticity, cohesive, massive.
15	6 9 12 16	21		85	8	SS		CL	Very stiff, dark grayish brown (10 YR 4/2) LEAN CLAY (CL), moist, medium to coarse sand and silt seams at 14.7 feet and 16.3 feet.
	9 62 82 34	144		85	9	SS		SM	Very dense, dark grayish brown (10YR 4/2), SILTY SAND (SM), moist with clay seams.
	9 18 22 25	40		75	10	SS			As above from 18.5 to 20.5 feet, dense, without clay seams.

Continued Next Page

Tracking Codes: 60313620.GPJ, ETSOIL, 11/24/14, 09:30

FINAL SOIL BORING LOG

BORING NO. **B-601B**

SITE: **Black Hawk County Landfill** PROJECT NO. **60313620** SHEET **2** OF **2**

Depth in Feet	SAMPLING DATA B	N	A	% Recovery	No.	T	Graphic Log	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS
20									
	6 12 12 12	24		75	11	SS		SM	Medium dense, dark grayish brown (10YR 4/2) SILTY SAND (SM) moist, non-plastic, noncohesive, massive.
								CL	Very stiff, dark grayish brown (10 YR 4/2) LEAN CLAY (CL) moist, low plasticity, cohesive, massive.
									End of Boring at 22.5 feet
25									
30									
35									
40									

Tracking Codes: 60313620.GPJ, ETSOIL, 11/24/14, 09:30

AECOM

FINAL SOIL BORING LOG

BORING NO. **B-602B**

SITE: **Black Hawk County Landfill** PROJECT NO. **60313620** SHEET **1** OF **2**

SITE #: **Cell W-2**

WATER LEVEL READINGS

DATE	WATER DEPTH	HOLE DEPTH	CASING DEPTH

PHYSICAL SETTING: **LF Berm West W-2**

LOG BY: **Sarah Day**

FIRM/DRILLER: **Terracon/Ron Faulk**

DRILLING METHOD: **4.25 HSA, 2.0 in. by 2.0 ft. SS**

ABANDONMENT DATE: **NA**

ABANDONMENT METHOD: **NA**

GROUND SURFACE ELEV: **942.36**

LOCAL COORDINATES:

NORTHING: **3616897.30**

EASTING: **5235288.80**

DATE/TIME STARTED: **10/27/14 ; 12:30**

DATE/TIME COMPLETED: **10/27/14 ; 14:00**

WELL INSTALLATION: **10/27/14**

Depth in Feet	SAMPLING DATA B	N	A	% Recovery	No.	T	Graphic Log	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS
0								NS	No Sample
	3 3 4 6	**7**		30	1	SS		CL	QUATERNARY, FILL. Medium, very dark grayish brown (10YR 3/2), LEAN CLAY (CL), dry, low plasticity, cohesive, massive
	5 6 7 7	**13**		60	2	SS		CL	Stiff, very dark gray (10YR 3/1), LEAN CLAY (CL), dry, low plasticity, cohesive, massive.
5	3 9 17 16	**26**		85	3	SS			As above from 4.5 to 5.5 feet, very stiff.
								SW	PRE-ILLINOIAN GLACIAL DIAMICTON (QWT). Loose, dark yellowish brown (10YR 4/6), WELL GRADED SAND (SW), moist, non-plastic, noncohesive, massive.
	3 4 4 5	**8**		75	4	SS			
								CL	Medium, yellowish brown (10YR 4/6), LEAN CLAY (CL), moist, medium plasticity, cohesive, massive.
	2 2 3 4	**5**		85	5	SS		CL	Medium, brownish yellow (10YR 6/6), LEAN CLAY (CL), moist, medium plasticity, cohesive, massive, fine to medium sand seam at 10.3-10.5 feet.
10	WOH 2 3 3	**5**		70	6	SS		CL	Medium, yellowish brown (10YR 5/4), LEAN CLAY (CL), moist, medium plasticity, cohesive, massive, pale brown (10YR 6/3), brownish yellow (10YR 6/6) fine to medium sand seam at 10.5 to 10.6 feet, fine to medium sand seam at 12.3 to 12.5 feet.
	2 3 6 7	**9**		75	7	SS		CL	Stiff, yellowish brown (10YR 5/4), LEAN CLAY (CL), moist, medium plasticity, cohesive, massive, with 3 silt seams, light brownish (10YR 6/2).
15	3 5 8 11	**13**		85	8	SS		CL	Stiff, yellowish brown (10YR 5/4), LEAN CLAY (CL), moist, low plasticity, cohesive, massive.
								CL	PRE-ILLINOIAN GLACIAL DIAMICTON (QAT). Stiff, dark grayish brown (10YR 4/2), LEAN CLAY (CL), moist, low plasticity, cohesive, massive.
	3 4 9 11	**13**		85	9	SS		CL	Stiff, very dark gray (10YR 3/1), LEAN CLAY (CL), dry, low plasticity, cohesive, massive.
	4 8 12 17	**20**		85	10	SS		CL	Very stiff, very dark grayish brown (10YR 3/2), LEAN CLAY (CL), moist, medium to low plasticity, cohesive, massive.

Continued Next Page

Tracking Codes: 60313620.GPJ, ETSOIL, 11/24/14, 09:30

AECOM

FINAL SOIL BORING LOG

BORING NO. B-602B

SITE: **Black Hawk County Landfill** PROJECT NO. **60313620** SHEET **2** OF **2**

Depth in Feet	SAMPLING DATA B	N	A	% Recovery	No.	T	Graphic Log	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS
20									
	4 9 12 13	**21**		100	11	SS			
	5 12 16 18	**28**		100	12	SS			As above from 22.5 to 30.5 feet.
25	8 12 16 24	**18**		100	13	SS			
	5 9 13 15	**22**		100	14	SS			
30	6 11 16 20	**27**		100	15	SS			
									End of Boring at 30.5 feet
35									
40									

Tracking Codes: 60313620.GPJ, ETSOIL, 11/24/14, 09:30

AECOM

FINAL SOIL BORING LOG

BORING NO. **B-603B**

SITE: **Black Hawk County Landfill** PROJECT NO. **60313620** SHEET **1** OF **2**

SITE #: **Cell W-2**

WATER LEVEL READINGS			
DATE	WATER DEPTH	HOLE DEPTH	CASING DEPTH

PHYSICAL SETTING: **LF Berm West W-2**

LOG BY: **Sarah Day**

FIRM/DRILLER: **Terracon/Ron Faulk**

DRILLING METHOD: **4.25 HSA, 2.0 in. by 2.0 ft. SS**

ABANDONMENT DATE: **NA**

ABANDONMENT METHOD: **NA**

GROUND SURFACE ELEV: **937.80**

LOCAL COORDINATES:

NORTHING: **3617198.50**

EASTING: **5235287.90**

DATE/TIME STARTED: **10/27/14 ; 09:15**

DATE/TIME COMPLETED: **10/27/14 ; 10:45**

WELL INSTALLATION: **10/27/14**

Depth in Feet	SAMPLING DATA B	N	A	% Recovery	No.	T	Graphic Log	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS
0								NS	No Sample
	2 9 8 7	**17**		25	1	SS		CL	QUATERNARY, FILL. Very stiff, very dark grayish brown (10YR 3/2), LEAN CLAY (CL), dry, low plasticity, cohesive, massive.
	4 9 10 10	**19**		50	2	SS		CL	Very stiff, very dark gray (10YR 3.1), LEAN CLAY (CL) dry, low plasticity, cohesive, massive.
								CL	PRE-ILLINOIAN GLACIAL DIAMICTON (QWT). Very stiff, very dark gray (10YR 3/1) LEAN CLAY (CL), dry, low plasticity, cohesive, massive.
5	4 6 8 6	**14**		75	3	SS		CL	Stiff, dark gray (10YR 4/1), LEAN CLAY (CL), dry, low plasticity, cohesive, massive.
	3 4 4 4	**8**		50	4	SS		CL	Medium, dark gray (10YR 4/1), LEAN CLAY (CL), moist, medium plasticity, cohesive, massive, color change at 7 feet to yellowish brown (10YR 5/6).
	2 3 3 5	**6**		85	5	SS		CL	Medium, yellowish brown (10YR 5/6), to (10YR 5/8), LEAN CLAY (CL), moist, medium plasticity, cohesive, massive, 2.0 inch silt seam at 9.0 feet.
10	2 2 3 4	**5**		75	6	SS		CL	Medium, yellowish brown (10YR 5/4), LEAN CLAY (CL), moist, medium plasticity, cohesive, massive with silt to fine sand seam, organic layer and pebbles.
	2 2 5 7	**7**		85	7	SS		CL	Medium, dark yellowish brown (10YR 4/6), LEAN CLAY (CL), moist, medium to low plasticity, cohesive, massive.
								CL	PRE-ILLINOIAN GLACIAL DIAMICTON (QAT). Medium, dark grayish brown (10YR 4/2), LEAN CLAY (CL), moist, medium to low plasticity, cohesive, massive.
15	3 4 6 9	**10**		85	8	SS		CL	Stiff, very dark dray (10YR 3/1), LEAN CLAY (CL), moist, medium to low plasticity, cohesive, massive.
	2 5 10 10	**15**		100	9	SS		CL	Stiff, very dark gray (10YR3/1), LEAN CLAY (CL), moist, low to medium plasticity, cohesive, massive.
	6 8 10 10	**18**		85	10	SS			As above from 18.5 to 20.5 feet, very stiff.

Continued Next Page

Tracking Codes: 60313620.GPJ, ETSOIL, 11/24/14, 09:30

AECOM

FINAL SOIL BORING LOG

BORING NO. **B-603B**

SITE: **Black Hawk County Landfill** PROJECT NO. **60313620** SHEET **2** OF **2**

Depth in Feet	SAMPLING DATA B	N	A	% Recovery	No.	T	Graphic Log	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS
20	8 9 13 15	**22**		50	11	SS		CL	Very stiff, very dark gray (10YR 3/1), LEAN CLAY (CL), moist, medium plasticity, cohesive, massive.
								SW	Medium dense, very dark gray (10YR 3/1), WELL GRADED SAND WITH GRAVEL (SW), wet, non-plastic, non cohesive, massive.
	7 7 9 9	**16**		85	12	SS		CL	Very stiff, dark gray (10YR 3/1), LEAN CLAY (CL), moist to wet, medium plasticity, cohesive, massive.
25	5 9 11 16	**20**		100	13	SS			As above from 24.5 to 26.5.
	12 20 39 12	**59**		75	14	SS		CL	Hard, dark grayish brown (10YR 4/2), LEAN CLAY (CL), moist, medium plasticity, cohesive, massive.
								SW	Very dense, WELL GRADED SAND WITH GRAVEL (SW) wet, non-plastic, noncohesive, massive.
30									End of Boring at 28.5 feet
35									
40									

Tracking Codes: 60313620.GPJ, ETSOIL, 11/24/14, 09:30

AECOM

FINAL SOIL BORING LOG

BORING NO. **B-604C**

SITE: **Black Hawk County Landfill** PROJECT NO. **60313620** SHEET **1** OF **5**

SITE #: **Cell W-2**

		WATER LEVEL READINGS		
	DATE	WATER DEPTH	HOLE DEPTH	CASING DEPTH
	11/4/14	92.8	124	124

PHYSICAL SETTING: **Left Berm West of Cell W2**
LOG BY: **Sarah Day**
FIRM/DRILLER: **Terracon/Ron Faulk**
DRILLING METHOD: **4.25 HSA from 0-26.5 ft., 26.5 to 101.0 ft. 6.0 in. tri-cone bit, mud rotary, 2.0 in. by 2.0 ft. SS**
ABANDONMENT DATE: **NA**
ABANDONMENT METHOD: **NA**

GROUND SURFACE ELEV: **932.00**
LOCAL COORDINATES:
NORTHING: **3617474.80**
EASTING: **5235286.40**
DATE/TIME STARTED: **10/30/14 ; 09:00**
DATE/TIME COMPLETED: **11/3/14 ; 09:51**
WELL INSTALLATION: **11/5/14**

Depth in Feet	SAMPLING DATA B	N	A	% Recovery	No.	T	Graphic Log	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS
0								NS	No Sample
	4 3 5 8	**8**		25	1	SS		CL	QUATERNARY, FILL. Medium, dark grayish brown (10YR 4/2), LEAN CLAY (CL), dry, low plasticity, cohesive, massive.
	3 5 5 9	**10**		25	2	SS		CL	Stiff, dark grayish brown (10YR 4/2), LEAN CLAY (CL), moist, low plasticity, cohesive, massive.
5	4 6 8 9	**14**		25	3	SS		CL	PRE-ILLINOIAN GLACIAL DIAMICTON (QWT). Stiff, dark grayish brown (10YR 4/2), LEAN CLAY (CL), moist, low plasticity, cohesive, massive.
	3 6 5 6	**11**		50	4	SS			As above from 6.5 to 8.5 feet.
	2 3 5 5	**8**		60	5	SS		CL	Medium, dark grayish brown (10YR 4/2) to brownish yellow (10YR 6/8), LEAN CLAY (CL), moist, medium plasticity, cohesive, massive.
10	2 2 8 9	**10**		50	6	SS		CL	Stiff, yellowish brown (10YR 5/6) LEAN CLAY (CL), moist, medium plasticity, cohesive, massive.
								SM	Loose, yellowish brown (10YR 5/6), SILTY SAND (SM), moist, non-plastic, noncohesive, massive.
	3 5 6 9	**11**		85	7	SS		CL	Top inch stiff, yellowish brown (10YR 5/4), SILTY SAND (SM) Yellowish brown (10YR 5/4) to brown (10YR 4/3), LEAN CLAY (CL), moist, low plasticity, cohesive, massive.
15	2 4 6 8	**10**		60	8	SS		CL	PRE-ILLINOIAN GLACIAL DIAMICTON (QAT). Stiff, yellowish brown (10YR 5/4) to brown (10YR 4/3), LEAN CLAY (CL), moist, low plasticity, cohesive, massive, with 1 in SILTY SAND (SM) at 12.5 feet.
	2 6 9 11	**15**		50	9	SS			As above 16.5 to 20.5.
	No Data	**No Data**		75	10	SS			

Continued Next Page

Tracking Codes: 60313620.GPJ, ETSOIL, 11/24/14, 09:30

AECOM

FINAL SOIL BORING LOG

BORING NO. **B-604C**

SITE: **Black Hawk County Landfill** PROJECT NO. **60313620** SHEET **2** OF **5**

Depth in Feet	SAMPLING DATA B	N	A	% Recovery	No.	T	Graphic Log	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS
20									
	4 7 19 22	**26**		50	11	SS			As above from 20.5 to 22.5 feet, but consistency changes to very stiff.
	8 15 33 40	**48**		75	12	SS		CL	Hard, dark gray (10YR 4/1), LEAN CLAY (CL), moist, medium plasticity, cohesive, massive.
								SW	Dense, brownish yellow (10YR 6/6), WELL GRADED SAND (SW), wet, non-plastic, noncohesive, massive.
25	10 16 21 26	**37**		100	13	SS		SW	Dense, brownish yellow (10 YR 6/6), WELL GRADED SAND (SW) wet, non-plastic, noncohesive, massive.
								CL	Hard, dark grayish brown (10YR 4/2), LEAN CLAY (CL), moist, low plasticity, cohesive, massive.
	10 66 38 33	**104**		85	14	SS		CL	Hard, dark gray (10YR 4/1), LEAN CLAY WITH SAND (CL), moist, low to medium plasticity, cohesive, massive.
30	5 10 17 25	**27**		100	15	SS		CL	Very stiff, dark gray (10YR 4/1), LEAN CLAY WITH SAND (CL), moist, low plasticity, cohesive, massive.
	13 17 21 32	**38**		25	16	SS		CL	Hard, dark gray (10YR 4/1), LEAN CLAY (CL), moist, low plasticity, cohesive, massive. At 32.5 feet, 3.0 inch SANDY LEAN CLAY WITH GRAVEL (CL) seam.
	8 13 20 32	**33**		85	17	SS		CL	Hard, dark gray (10YR 4/1) LEAN CLAY WITH SAND (CL), moist, cohesive, low plasticity, massive.
35	8 14 22 37	**36**		100	18	SS			As above 34.5 to 44.5 feet.
	9 16 25 37	**41**		85	19	SS			
	6 14 20 31	**34**		100	20	SS			
40	6 14 21 33	**35**		100	21	SS			
	9 19 28 41	**47**		85	22	SS			

Continued Next Page

Tracking Codes: 60313620.GPJ, ETSOIL, 11/24/14, 09:30

AECOM

FINAL SOIL BORING LOG

BORING NO. **B-604C**

SITE: **Black Hawk County Landfill** PROJECT NO. **60313620** SHEET **3** OF **5**

Depth in Feet	B	N	A	% Recovery	No.	T	Graphic Log	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS
44									
45	8 19 27 38	**46**		100	23	SS			As above 44.5 to 60.5 feet.
	9 15 26 46	**41**		85	24	SS			
	7 17 26 41	**43**		100	25	SS			
50	9 18 29 44	**47**		75	26	SS			
	14 13 22 44	**35**		100	27	SS			
	10 19 31 44	**50**		100	28	SS			
55	9 20 29 40	**49**		100	29	SS			
	5 15 25 31	**40**		100	30	SS			
60	5 15 20 50	**35**		100	31	SS			As above 60.5 to 61.5, struck a rock at 61.5 feet.
	10 22 31 45	**53**		50	32	SS			As above 62.5 to 66.5 feet.
	6 36 55 36	**91**		100	33	SS			
65	10 20 48 41	**68**		100	34	SS		CL	Hard, olive gray (5Y 4/2), LEAN CLAY WITH SAND (CL), moist, low plasticity, cohesive, massive.

Continued Next Page

Tracking Codes: 60313620.GPJ, ETSOIL, 11/24/14, 09:30

AECOM

FINAL SOIL BORING LOG

BORING NO. **B-604C**

SITE: **Black Hawk County Landfill** PROJECT NO. **60313620** SHEET **4** OF **5**

Depth in Feet	B	N	A	% Recovery	No.	T	Graphic Log	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS
68									
	18 19 21 31	**40**		100	35	SS			As above 68.5 to 70.5 feet.
70	8 17 24 36	**41**		100	36	SS		CL	Hard, gray (10YR 5/1), LEAN CLAY WITH SAND (CL), moist, low plasticity, cohesive, massive.
	5 14 20 29	**34**		100	37	SS			As above 72.5 to 92.5 feet.
75	6 12 19 26	**31**		100	38	SS			
	6 26 43 80	**69**		100	39	SS			
	7 16 26 33	**42**		100	40	SS			
80	5 12 22 28	**34**		25	41	SS			
	6 14 23 28	**37**		100	42	SS			
85	7 11 28 42	**39**		100	43	SS			
	6 17 23 42	**40**		50	44	SS			
	7 16 26 30	**42**		100	45	SS			
90	5 24 32 29	**56**		100	46	SS			

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Tracking Codes: 60313620.GPJ, ETSOIL, 11/24/14, 09:30

AECOM

FINAL SOIL BORING LOG

BORING NO. **B-604C**

SITE: **Black Hawk County Landfill** PROJECT NO. **60313620** SHEET **5** OF **5**

Depth in Feet	SAMPLING DATA B	N	A	% Recovery	No.	T	Graphic Log	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS
92									
	6 16 24 30	**40**		100	47	SS			As above 92.5 to 96.5 feet.
95	9 18 23 33	**41**		100	48	SS			
	7 19 28 31	**47**		85	49	SS		CL	Hard, gray (10YR 5/1), LEAN CLAY (CL), moist, low to medium plasticity, cohesive, massive.
	5 18 50 51	**68**		100	50	SS			As above 98.5 to 99.5 feet.
100								SM	Hard, pale olive (5Y 6/3), SILTY SAND (SM), moist, non-plastic, noncohesive, massive.
	20 55	**55**		35	51	SS			
									Top of bedrock at 102.5 feet Continues on Rock Core Log B-604C
105									
110									
115									

Tracking Codes: 60313620.GPJ, ETSOIL, 11/24/14, 09:30

AECOM

FINAL SOIL BORING LOG

BORING NO. **B-605B**

SITE: **Black Hawk County Landfill** PROJECT NO. **60313620** SHEET **1** OF **2**

SITE #: **Cell W-2**

	WATER LEVEL READINGS DATE	WATER DEPTH	HOLE DEPTH	CASING DEPTH
PHYSICAL SETTING: **LF North Access Road Cell W-2**				
LOG BY: **Sarah Day**				
FIRM/DRILLER: **Terracon/Ron Faulk**				
DRILLING METHOD: **4.25 HSA, 2.0 in. by 2.0 ft. SS**				
ABANDONMENT DATE: **NA**				
ABANDONMENT METHOD: **NA**				

GROUND SURFACE ELEV: **936.30**

LOCAL COORDINATES:

NORTHING: **3617714.80**

EASTING: **5235754.10**

DATE/TIME STARTED: **10/28/14 ; 08:45**

DATE/TIME COMPLETED: **10/28/14 ; 09:45**

WELL INSTALLATION: **10/28/14**

Depth in Feet	SAMPLING DATA B	N	A	% Recovery	No.	T	Graphic Log	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS
0								NS	No Sample
	5 4 3 4	**7**		25	1	SS		CL	QUATERNARY, FILL. Medium, grayish brown (10YR 5/2), LEAN CLAY (CL), dry, low plasticity, cohesive, massive
	3 4 5 6	**9**		50	2	SS		CL	Stiff, dark grayish brown (10YR 4/2), LEAN CLAY (CL), moist, medium to low plasticity, cohesive, massive, topsoil, plant roots.
5	2 2 2 4	**4**		60	3	SS		CL	PRE-ILLINOIAN GLACIAL DIAMICTON (QWT). Soft, dark gray (10YR4/1), LEAN CLAY (CL), moist, medium plasticity, cohesive, massive with 0.25 inch sand seams.
	3 3 3 4	**6**		75	4	SS		CL	Medium, light yellowish brown (10YR6/4), LEAN CLAY (CL), moist, medium plasticity, cohesive, massive, 2.0 to 3.0 inch sand seam at 6.6 feet.
	1 3 3 3	**6**		75	5	SS		CL SM CL	Medium, brownish yellow (10YR 6/6), LEAN CLAY (CL), moist, medium plasticity, cohesive, massive. Loose, brownish yellow (10YR 6/6) to gray (10YR 5/1) SILTY SAND (SM) moist, non-plastic, noncohesive, massive. Medium, brownish yellow 10YR 6/6) LEAN CLAY (CL) moist, medium plasticity, cohesive, massive.
10	2 5 6 9	**11**		85	6	SS		CL	PRE-ILLINOIAN GLACIAL DIAMICTON (QAT). Stiff, yellowish brown (10YR 5/4), LEAN CLAY (CL), dry, low plasticity, cohesive, massive with gravel.
	2 5 9 13	**14**		75	7	SS		CL	Stiff, dark gray (10YR 4/1), LEAN CLAY (CL), moist, low plasticity, cohesive, massive with gravel.
15	2 5 12 15	**17**		85	8	SS			As above 14.5 to 16.5 feet, very stiff.
	5 9 13 17	**22**		85	9	SS		CL SM CL	Very stiff, dark gray (10YR 4/1), LEAN CLAY (CL), moist, low plasticity, cohesive, massive with gravel. Medium dense, dark gray (10YR 4/1), SILTY SAND (SM), moist, non-plastic, non-cohesive, massive. Stiff, dark gray (10YR 4/1) LEAN CLAY (CL), moist, low plasticity, cohesive, massive with gravel.
	6 8 16 14	**24**		100	10	SS			As above 16.5 to 17 feet, very stiff.

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Tracking Codes: 60313620.GPJ, ETSOIL, 11/24/14, 09:30

AECOM

FINAL SOIL BORING LOG

BORING NO. **B-605B**

SITE: **Black Hawk County Landfill** PROJECT NO. **60313620** SHEET **2** OF **2**

Depth in Feet	SAMPLING DATA B	N	A	% Recovery	No.	T	Graphic Log	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS
20									
	6 9 12 10	**21**		100	11	SS		CL	Very stiff, dark gray (10YR 4/1), LEAN CLAY (CL), dry, low plasticity, cohesive, massive.
									End of Boring at 22.5 feet
25									
30									
35									
40									

Tracking Codes: 60313620.GPJ, ETSOIL, 11/24/14, 09:30

AECOM

FINAL ROCK CORE LOG

BORING NO. **B-604C**

SITE: **Black Hawk County Landfill** PROJECT NO. **60313620** SHEET **1** OF **2**

WATER LEVEL READINGS

DATE	TIME	DEPTH	CASING

DRILLING METHOD: **4.25 HSA from 0-26.5 ft., 26.5 to 101.0 ft. 6.0 in. tri-cone bit, wash rotary, NQ Rock Core 103.0 to 124.0 ft.**

LOG BY: **Sarah Day**

FIRM/DRILLER: **Terracon/Ron Faulk**

PHYSICAL SETTING: **Left Berm West of Cell W2**

ABANDONMENT DATE: **NA**

ABANDONMENT METHOD: **NA**

GROUND SURFACE ELEV: **932.0**

COORDINATES:

NORTHING: **3617474.8**

EASTING: **5235286.4**

DATE STARTED: **10/30/14**

DATE COMPLETED: **11/3/14**

INSTALLATION: **11/5/14**

Depth in Feet	CORING DATA: GRAPHICS	RUN NO	LENGTH	% RECOVERY	MPF	%WATER GAIN/LOSS	% RQD	FRACTURES	GRAPHIC LOG: ROCK TYPE	ROCK TYPE CODE	ROCK DESCRIPTION
103		Run #1	2.5	80			68			DL	DEVONIAN CEDAR VALLEY GROUP; DOLOMITE, moderate, yellowish gray (5Y 7/2), fresh to moderate yellow (5Y 6/4), weathered, fine-grained, massive, slightly decomposed, competent, moderately fractured; bedding plane joint, 0°, narrow to very narrow, not healed, staining, undulating, and joints, 45°-60°, very narrow, totally healed.
105		Run #2	5.0	94			60				Vuggy from 105.5-110.5 feet.
110		Run #3	3.0	50			17				Intensely fractured from 110.5-113.5 feet, mechanical break.
		Run #4	5.0	75		100	42			DL	DEVONIAN CEDAR VALLEY GROUP; DOLOMITE, moderate, dark yellowish orange (10YR 6/6), fresh to very pale orange (10YR8/2), weathered, fine-grained, massive, slightly decomposed, competent, intensely fractured; bedding plane joint, 0°, narrow to very narrow, not healed, staining, undulating, and joints, 45°-60°, very narrow, totally healed, vuggy, chert nodules at 115 feet.
115		Run #5	1.5	33			0				
120		Run #6	4.0	85			81			DL	DEVONIAN CEDAR VALLEY GROUP; DOLOMITE, moderate, yellowish gray (5Y 7/2), fine-grained, massive, slightly decomposed, competent, moderately fractured; bedding plane joint, 0°, narrow to very narrow, not healed, staining, undulating, and joints, 45°-60°, very narrow, totally healed, vuggy.
123											

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Tracking Codes: 60313620.GPJ ETROCK 11/7/14 09:31

AECOM

FINAL ROCK CORE LOG

BORING NO. **B-604C**

SITE: **Black Hawk County Landfill** PROJECT NO. **60313620** SHEET **2** OF **2**

Depth in Feet	CORING DATA: GRAPHICS	RUN NO	LENGTH	% RECOVERY	MPF	%WATER GAIN/LOSS	% RQD	FRACTURES	GRAPHIC LOG: ROCK TYPE	ROCK TYPE CODE	ROCK DESCRIPTION
123											End of Boring at 124.0 feet
147											

Tracking Codes: 60313620.GPJ ETROCK 11/7/14 09:31

AECOM

FINAL SOIL BORING LOG

BORING NO. **B-402C**

SITE: **Black Hawk County Landfill** PROJECT NO. **60482609** SHEET **1** OF **5**

SITE #:

PHYSICAL SETTING: **Area A, Adjacent to road and OW402B**

LOG BY: **Sarah Day**

FIRM/DRILLER: **Terracon/Ron Faulk**

DRILLING METHOD: **4.25 HSA from 0-36.5 ft., 36.5-102.0 ft. 6.0 in. tri-cone bit, mud rotary, 2.0 in. by 2.0 ft. SS**

WATER LEVEL READINGS	DATE	WATER DEPTH	HOLE DEPTH	CASING DEPTH

ABANDONMENT DATE: **NA**

ABANDONMENT METHOD: **NA**

GROUND SURFACE ELEV: **952.30**

IA State Plain LOCAL COORDINATES:

NORTHING: **3617467.90**

EASTING: **5237824.00**

DATE/TIME STARTED: **11/9/16 ; 15:25**

DATE/TIME COMPLETED: **11/15/16 ; 14:30**

WELL INSTALLATION: **11/16/16**

Depth in Feet	SAMPLING DATA B	N	A	% Recovery	No.	T	Graphic Log	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS
0								NS	No Sample. Blind drill to 20.5 feet. Reference soil boring log for B-402.
5									
10									
15									

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Tracking Codes: 60482609_BLACKHAWK GPJ_ETSOIL_1/3/17_1103

AECOM

FINAL SOIL BORING LOG

BORING NO. **B-402C**

SITE: **Black Hawk County Landfill** PROJECT NO. **60482609** SHEET **2** OF **5**

Depth in Feet	SAMPLING DATA B	N	A	% Recovery	No.	T	Graphic Log	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS
20	7 9 8 10	17		90	1	SS		SP	PRE-ILLINOIAN GLACIAL DIAMICTON (QAT). Medium dense, yellowish brown (10YR 5/8), POORLY GRADED SAND (SP), wet, non-plastic, noncohesive, massive.
								CL	Very stiff, yellowish brown (10YR 5/8), SANDY LEAN CLAY (CL) moist, low plasticity, cohesive, massive, M, trace gravel.
	4 7 11 15	18		90	2	SS			As above from 22.5 to 23.5 feet, but color changes to light olive brown (2.5Y 5/6)
									As above from 23.5 to 24.5 feet, but color changes to dark grayish brown (10YR 4/2)
25	6 1 15 18	16		85	3	SS			As above from 24.5 to 28.5 feet, but color changes to very dark gray (10YR 3/1) and plasticity change to medium plasticity.
	4 9 14 23	23		100	4	SS			
	6 12 18 23	30		100	5	SS			As above from 28.5 to 30.5 feet, but moisture changes to dry.
30	6 11 15 24	26		100	6	SS			As above from 30.5 to 42.5 feet, but moisture changes to moist. Cobble at 42.5 feet.
	3 11 20 34	31		50	7	SS			
35	5 10 15 23	25		100	8	SS			
	7 15 27 43	42		100	9	SS			
	8 10 18 42	28		100	10	SS			
40	12 16 19 50/5.5	35		100	11	SS			
	22 21 32	43		75	12	SS		SP	Dense, grayish brown (10YR 5/2) POORLY GRADED SAND (SP) wet, non-plastic, noncohesive, massive, trace gravel and cobbles.

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Tracking Codes: 60482609_BLACKHAWK GPJ_ETSOIL_1/3/17_1103

AECOM

FINAL SOIL BORING LOG

BORING NO. **B-402C**

SITE: **Black Hawk County Landfill** PROJECT NO. **60482609** SHEET **3** OF **5**

Depth in Feet	B	N	A	% Recovery	No.	T	Graphic Log	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS
44								CL	Hard, very dark gray (10YR 3/1) SANDY LEAN CLAY (CL) moist, medium plasticity, cohesive, massive, trace gravel.
45	10 18 30 40	48		100	13	SS			
	50 50/2	>50		35	14	SS		SP	Dense, grayish brown (10YR 5/2) POORLY GRADED SAND (SP) wet, non-plastic, noncohesive, massive, trace cobbles.
	80/6	>50		25	15	SS			As above from 48.5 to 50.7 feet.
50	20 20 25 30	45		100	16	SS		CL	Hard, very dark gray (10YR 3/1) SANDY LEAN CLAY (CL), moist, medium plasticity, cohesive, massive, trace gravel and cobbles.
	10 18 28 40	46		100	17	SS			As above from 52.5 to 56.5 feet.
	18 28 38 40	>50		0	18	SS			Cobble at 54.5 feet.
55	10 16 28 30	44		100	19	SS			As above from 56.5 to 60.5 feet.
	10 16 28 28	44		100	20	SS			
60	14 19 31 40	50		100	21	SS			As above from 60.5 to 62.5 feet. Cobble pushed from 60.5 along half of the split spoon sampler.
	13 24 34 36	>50		100	22	SS			As above from 62.5 to 68.5 feet.
65	18 25 35 45	>50		30	23	SS			
	12 18 25 30	43		100	24	SS			

Tracking Codes: 60482609_BLACKHAWK GPJ_ETSOIL_1/3/17, 1103

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AECOM

FINAL SOIL BORING LOG

BORING NO. **B-402C**

SITE: **Black Hawk County Landfill** PROJECT NO. **60482609** SHEET **4** OF **5**

Depth in Feet	B	N	A	% Recovery	No.	T	Graphic Log	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS
68									
70	11 22 22 40	44		100	25	SS			As above from 68.5 to 74.5, but with 0.01 foot sand seams.
	15 30 37 45	>50		100	26	SS			
	13 33 33 53	>50		100	27	SS			
75	13 23 33 53	>50		100	28	SS			As Above from 74.5 to 92.5 feet.
	10 20 30 50	50		100	29	SS			
80	13 24 34 44	>50		100	30	SS			
	15 30 40 60	>50		65	31	SS			
	12 24 36 60	>50		100	32	SS			
85	16 25 34 60	>50		100	33	SS			
	14 24 40 65	>50		50	34	SS			
	10 35 45 46	>50		100	35	SS			
90	20 20 40 45	>50		70	36	SS			

Tracking Codes: 60482609_BLACKHAWK GPJ_ETSOIL_1/3/17, 1103

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AECOM

FINAL SOIL BORING LOG

BORING NO. **B-402C**

SITE: **Black Hawk County Landfill** PROJECT NO. **60482609** SHEET **5** OF **5**

Depth in Feet	SAMPLING DATA B	N	A	% Recovery	No.	T	Graphic Log	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS
92									
	10 25 35 40	>50		100	37	SS			As above from 92.5 to 97.2 feet.
95	10 20 40 42	>50		100	38	SS			
	25 70/6	>50		50	39	SS			As above from 97.2 to 98.5, but with weathered dolomite cobbles
	45 50 50/4	>50		70	40	SS		CL	Hard, pale yellow (5 Y 7/4) mottled with olive yelow (2.5 Y 6/8), LEAN CLAY (CL), moist, medium to high plasticity, cohesive, massive, M, few dolomite cobbles.
100	50/0.5	>50		3	41	SS		DL	Weathered Dolomite.
									Top of bedrock at 102 feet; End of boring at 102.5 feet below ground surface. Continues on Rock Core Log B-402C
105									
110									
115									

Tracking Codes: 60482609_BLACKHAWK.GPJ_ETSOIL, 1/3/17, 1103

AECOM

FINAL ROCK CORE LOG

BORING NO. **B-402C (Rock Core)**

SITE: **Black Hawk County Landfill** PROJECT NO. **60482609** SHEET **1** OF **2**

WATER LEVEL READINGS

	DATE	TIME	DEPTH	CASING
DRILLING METHOD: **4.25 HSA from 0-36.5 ft.,**	**11/15/16**		**109.20**	**102**
36.5 to 102.0 ft. 6.0 in. tri-cone bit, wash rotary,	**11/15/16**		**109.80**	**102**
NQ Rock Core 102.0 to 142.0 ft.	**11/16/16**		**102.26**	**102**

GROUND SURFACE ELEV: **952.3**

IA State Plain COORDINATES:

NORTHING: **3617467.9**

EASTING: **5237824.0**

LOG BY: **Russ Henning**

DATE STARTED: **11/15/16**

FIRM/DRILLER: **Terracon/Ron Faulk** ABANDONMENT DATE: **NA** DATE COMPLETED: **11/15/16**

PHYSICAL SETTING: **Area A, Adjacent to road and OW402B** ABANDONMENT METHOD: **NA** INSTALLATION: **11/16/16**

Depth in Feet	CORING DATA GRAPHICS	RUN NO	LENGTH	% RECOVERY	MPF	%WATER GAIN/LOSS	% RQD	FRACTURES	GRAPHIC LOG ROCK TYPE	ROCK TYPE CODE	ROCK DESCRIPTION
102		Run #1	3.0	18			0			DL	DEVONIAN CEDAR VALLEY FORMATION; DOLOMITE, strong, dark yellowish orange (10YR 6/6), microcrystalline, medium bedded, moderately decomposed, competent, slightly fractured, unconformable with glacial sediment overlying bedrock, some chert nodules.
105		Run #2	4.0	78			23			DL	DEVONIAN CEDAR VALLEY FORMATION; DOLOMITE, strong, grayish orange (10YR 7/4), microcrystalline, medium bedded, moderately decomposed, competent, slightly fractured, comformable.
110		Run #3	5.0	84			49			DL	DEVONIAN CEDAR VALLEY FORMATION; DOLOMITE, strong, grayish orange (10YR 7/4), microcrystalline, medium bedded, moderately to highly decomposed, moderately disintegrated with solutioning and hairline open fractures, intensely fractured, conformable, numerous solution fractures, horizontal, from 111 to 112 feet, 113 to 114 feet, clayey from 110 to 111 feet.
115		Run #4	5.0	92			67.5			DL	DEVONIAN CEDAR VALLEY FORMATION; DOLOMITE, strong, grayish orange (10YR 7/4), microcrystalline, medium bedded, moderately to highly decomposed, moderate disintegration, with solutioning and hairline fractures, moderately fractured, conformable, hareline solution fractures, clay filled fracture 114 to 115 feet, rock broken up at 117 feet, chert at 118 feet, with vugs and brachiopod at 119 feet.
120		Run #5	5.0	78			66			DL	DEVONIAN CEDAR VALLEY FORMATION; DOLOMITE, strong, grayish orange (10YR 7/4), microcrystalline, medium bedded, moderately to highly decomposed, moderately disintegrated, solutioning along horizontal fractures from 119 to 120 feet, some clay filled, vugs and solutioning from 120 to 121 feet, horisontal solution fractures from 123 to 124 feet.
122											

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Tracking Codes: 60482609_BLACKHAWK.GPJ_ETROCK, 1/3/17, 1104

AECOM

FINAL ROCK CORE LOG

BORING NO. **B-402C (Rock Core)**

SITE: **Black Hawk County Landfill** PROJECT NO. **60482609** SHEET **2** OF **2**

Depth in Feet	CORING DATA: GRAPHICS	RUN NO	LENGTH	% RECOVERY	MPF	%WATER GAIN/LOSS	% RQD	FRACTURES	GRAPHIC LOG: ROCK TYPE	ROCK TYPE CODE	ROCK DESCRIPTION
122											
125		Run #6	5.0	62			7			DL	DEVONIAN CEDAR VALLEY FORMATION; DOLOMITE, strong, grayish orange (10YR 7/4), mircorcrystalline, medium bedded, moderately decomposed, moderately disintegrated, solutioning along horizontal (bedding plane) fractures from 125 to 126 feet, rock core very broken from 127 to 129 feet.
130		Run #7	5.0	49			23			DL	DEVONIAN CEDAR VALLEY FORMATION; DOLOMITE, strong, grayish orange (10YR 7/4) microcrystalline, medium bedded, moderately decomposed, moderately disintegrated, fractured with moderate reddish brown (10R 4/6) stained fractures.
135		Run #8	3.0	86		50	80			DL	DEVONIAN CEDAR VALLEY FORMATION; DOLOMITE, strong, pale yellowish brown (10YR 6/2), microcrystalline, medium bedded, moderately decomposed, moderately disintegrated, slightly fractured, competent, conformable. Large quartz lined vug at 133.5 feet.
140		Run #9	5.0	68			34			DL	DEVONIAN CEDAR VALLEY FORMATION; DOLOMITE, strong, pale yellowish brown (10YR 6/2), microcrystalline, medium bedded, slightly decomposed, slightly disintegrated, slightly fractured, many chert nodules from 138 to 140 feet.
146											End of boring at 142 feet below ground surface.

Tracking Codes: 60482609_BLACKHAWK.GPJ_ETROCK_1/3/17_11:04

AECOM

FINAL SOIL BORING LOG

BORING NO. **B-410**

SITE: **Black Hawk County Landfill** PROJECT NO. **60482609** SHEET **1** OF **2**

SITE #: _____

WATER LEVEL READINGS	DATE	WATER DEPTH	HOLE DEPTH	CASING DEPTH

PHYSICAL SETTING: **Adjacent to fence by Cell A**

LOG BY: **Sarah Day**

FIRM/DRILLER: **Terracon/Ron Faulk**

DRILLING METHOD: **4.25 HSA, 2.0 in. by 2.0 ft. SS**

ABANDONMENT DATE: **NA**

ABANDONMENT METHOD: **NA**

GROUND SURFACE ELEV: **948.00**

IA State Plain LOCAL COORDINATES:

NORTHING: **3616960.95**

EASTING: **5237824.52**

DATE/TIME STARTED: **11/9/16 ; 08:30**

DATE/TIME COMPLETED: **11/9/16 ; 10:00**

WELL INSTALLATION: **11/9/16**

Depth in Feet	SAMPLING DATA: B	N	A	% Recovery	No.	T	Graphic Log	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS
0								NS	No Sample
	1 3 3 5	6		65	1	SS		CL	QUATERNARY, FILL. Medium, very dark grayish brown (10 YR 3/2) to very dark gray (10 YR 3/1), SANDY LEAN CLAY (CL), moist, medium plasticity, cohesive, massive, trace roots and gravel.
	1 3 2 7	5		90	2	SS		CL	Medium, light brownish gray (10YR 6/2) mottled with brownish yellow (10YR 6/6), SANDY LEAN CLAY (CL), moist, low platicity, cohesive, masssive, M.
5	4 6 6 6	12		80	3	SS		CL	Stiff, grayish brown (10YR 5/2) LEAN CLAY (CL), moist, medium platicity, cohesive, with 0.01 foot sand seams.
	3 3 4 6	7		100	4	SS		SP CL	Loose, grayish brown (10YR 5/2) POORLY GRADED SAND (SP), moist, non-plastic, noncohesive, massive. Stiff, grayish brown (10YR 5/2) LEAN CLAY (CL), moist, medium platicity, cohesive, with 0.01 foot sand seams.
	1 2 3 5	5		100	5	SS		CL	LOESS. Medium, black (10YR 2/1) LEAN CLAY (CL), moist, medium to high plasticity, cohesive, massive. As above from 8.5 to 8.7, but color changes to lt olive brown (2.5Y 5/3). As above from 8.7 to 9.4, but color changes to black.
10	1 2 2 3	4		100	6	SS			PRE-ILLINOIAN GLACIAL DIAMICTON (QWT). Medium, olive brown (2.5 Y 4/4) LEAN CLAY (CL) moist, cohesive, medium plasticity, cohesive, massive.
	2 3 4 6	7		100	7	SS		SP CL	Very loose, light olive brown (2.5Y 5/1) POORLY GRADED SAND (SP) wet, non-plastic, noncohesive, massive. Medium, gray (2.5 Y 5/1), SANDY LEAN CLAY (CL) mottled with light olive brown (2.5Y 5/6), moist, medium plasticity, cohesive, massive, M, trace gravel.
15	5 6 8 11	14		100	8	SS			As above from 14.5 to 16 feet, but color changes to yellowish brown (10YR 5/8).
	2 6 8 11	14		100	9	SS		CL	PRE-ILLINOIAN GLACIAL DIAMICTON (QAT). Very stiff, dark grayish brown (10YR 4/2) SANDY LEAN CLAY (CL), moist, medium plasticity, cohesive, massive, trace gravel.
	3 6 12 33	18		100	10	SS			

Tracking Codes: 60482609_BLACKHAWK.GPJ_ETSOIL_1/3/17_11:03

Continued Next Page

AECOM

FINAL SOIL BORING LOG

BORING NO. **B-410**

SITE: **Black Hawk County Landfill** PROJECT NO. **60482609** SHEET **2** OF **2**

Depth in Feet	SAMPLING DATA B	N	A	% Recovery	No.	T	Graphic Log	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS
20								SP	Very dense, grayish brown (10YR 5/2), POORLY GRADED SAND (SP) moist, non-plastic, noncohesive, massive.
	17 31 45 50	>50		100	11	SS			
	8 28 50 50/3	>50		100	12	SS		CL	Hard, lt olive brown (2.5Y 5/3) SANDY LEAN CLAY (CL) moist, medium to low plasticity, cohesive, massive, trace gravel. As above from 23 to 24.5 feet, but color changes to olive yellow (2.5Y 6/6) and there are 0.01 foot silt seams.
25	8 11 13 16	24		90	13	SS			As above from 24.5 to 27 feet, but color changes to light olive brown (2.5Y 5/6).
	6 11 15 23	26		90	14	SS			As above from 27 to 28.5 feet, but color changes to very dark gray (10YR 3/1).
30									End of boring at 28.5 feet below ground surface.
35									
40									

Tracking Codes: 60482609_BLACKHAWK GPJ_ETSOIL_1/3/17, 1103

AECOM

FINAL SOIL BORING LOG

BORING NO. **B-411**

SITE: **Black Hawk County Landfill** PROJECT NO. **60482609** SHEET **1** OF **2**

SITE #:

WATER LEVEL READINGS	DATE	WATER DEPTH	HOLE DEPTH	CASING DEPTH

PHYSICAL SETTING: **Side slope of Cell W-1**
LOG BY: **Sarah Day**
FIRM/DRILLER: **Terracon/Ron Faulk**
DRILLING METHOD: **4.25 HSA, 2.0 in. by 2.0 ft. SS**
ABANDONMENT DATE: **NA**
ABANDONMENT METHOD: **NA**

GROUND SURFACE ELEV: **964.00**
IA State Plain LOCAL COORDINATES:
NORTHING: **3617179.77**
EASTING: **5237772.33**
DATE/TIME STARTED: **11/8/16 ; 14:50**
DATE/TIME COMPLETED: **11/8/16 ;**
WELL INSTALLATION: **11/8/16**

Depth in Feet	SAMPLING DATA B	N	A	% Recovery	No.	T	Graphic Log	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS
0								NS	No Sample
	3 4 5 6	9		75	1	SS		CL	QUATERNARY FILL. Stiff, yellowish brown (10YR 5/6) mottled with dark gray (10YR 4/1), SANDY LEAN CLAY (CL), moist, low plasticity, cohesive, M, trace gravel.
	2 3 5 6	8		100	2	SS			
5	2 4 6 6	10		85	3	SS		CL	Stiff, dark brown (10YR 3/3) SANDY LEAN CLAY (CL), moist, medium plasticity, cohesive, massive, few gravel, 0.01 foot silty sand seams.
	3 3 5 4	8		90	4	SS			As above from 7.2 to 10.5, but color change to dark gray (10YR 4/1).
	1 3 5 6	8		100	5	SS			
10	2 6 6 8	12		100	6	SS			As above from 10.5 to 14.5.
	5 6 9 10	15		100	7	SS			
15	2 3 4 4	7		75	8	SS			As above from 14.5 to 19.6, but moisture changes to wet.
	WOH 2 3 5	5		100	9	SS			
	2 4 7 8	11		100	10	SS			
								CL	

Continued Next Page

Tracking Codes: 60482609_BLACKHAWK GPJ_ETSOIL_1/3/17, 1103

AECOM

FINAL SOIL BORING LOG

BORING NO. **B-411**

SITE: **Black Hawk County Landfill** PROJECT NO. **60482609** SHEET **2** OF **2**

Depth in Feet	SAMPLING DATA B	N	A	% Recovery	No.	T	Graphic Log	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS
20									PRE-ILLINOIAN GLACIAL DIAMICTON (QWT).
	2 3 5 7	**8**		90	11	SS		CL	Stiff, black (10YR 2/1) LEAN CLAY (CL), moist, medium to high plasticity, cohesive, massive, trace roots, burried topsoil.
									Medium, very dark grayish brown (10YR 3/2), LEAN CLAY (CL), moist, medium plasticity, cohesive, massive, trace gravel.
								SP	Loose, olive brown (2.5Y 4/4) POORLY GRADED SAND (SP), moist, non-plastic, noncohesive, massive, trace gravel and clay.
	2 3 5 5	**8**		100	12	SS		CL	Stiff, very dark brown (10YR 2/2), LEAN CLAY (CL), moist, medium plasticity, cohesive, massive.
									PRE-ILLINOIAN GLACIAL DIAMICTON (QAT).
	3 5 6 6	**11**		100	13	SS			Very stiff, gray (10YR 6/1), LEAN CLAY (CL), moist, medium plasticity, cohesive, massive.
25	2 3 5 7	**8**		100	14	SS			
	4 5 15 18	**20**		100	15	SS			As above from 29.5 to 30.5 feet, but color changes to very dark gray (10YR 3/1) mottled with dark brown (10YR 3/3).
30	7 11 15 20	**26**		100	16	SS			
	14 41 50/3	**>50**		60	17	SS		SM	Hard, gray (10YR 5/1) SILTY SAND (SM) wet, non-plastic, noncohesive, massive.
								CL	Hard, yellowish brownish (10YR 5/6) SANDY LEAN CLAY (CL) dry, low plasticity, cohesive, massive.
35	26 45 50 50/5	**>50**		80	18	SS			
									End of boring at 36.5 feet below ground surface.
40									

Tracking Codes: 60482609_BLACKHAWK GPJ_ETSOIL_1/3/17, 1103

AECOM

FINAL SOIL BORING LOG

BORING NO. **B-412**

SITE: **Black Hawk County Landfill** PROJECT NO. **60482609** SHEET **1** OF **2**

SITE #:

WATER LEVEL READINGS	DATE	WATER DEPTH	HOLE DEPTH	CASING DEPTH

PHYSICAL SETTING: **Side slope of Cell W-1**
LOG BY: **Sarah Day**
FIRM/DRILLER: **Terracon/Ron Faulk**
DRILLING METHOD: **4.25 HSA, 2.0 in. by 2.0 ft. SS**
ABANDONMENT DATE: **NA**
ABANDONMENT METHOD: **NA**

GROUND SURFACE ELEV: **957.00**
IA State Plain LOCAL COORDINATES:
NORTHING: **3617406.50**
EASTING: **5237772.33**
DATE/TIME STARTED: **11/7/16 ; 10:30**
DATE/TIME COMPLETED: **11/7/16 ; 12:30**
WELL INSTALLATION: **11/7/16**

Depth in Feet	SAMPLING DATA B	N	A	% Recovery	No.	T	Graphic Log	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS
0								NS	No Sample
	2 2 3 5	**5**			1	SS		SM	QUATERNARY, FILL.
								CL	Loose, dark yellowish brown (10YR 4/6), SILTY SAND (SM), dry, nonplastic, non-cohesive, massive.
									Medium, very dark brown (10YR 4/2), LEAN CLAY (CL), moist, medium plasticity, cohesive, massive, trace roots.
								SM	
	2 2 4 6	**6**			2	SS		CL	Loose, dark grayish brown (10YR 4/2), SILTY SAND (SM) dry, nonplastic, non-cohesive, massive.
									Medium, dark yellowish brown (10YR 4/6) to brownish yellow (10YR 6/6), dry LEAN CLAY (CL), low to medium plasticity, cohesive, light gray (10YR 7/2) silt seams throughout.
								CL	
5	6 6 5 5	**11**			3	SS			Stiff, very dark gray (10YR 3/1), LEAN CLAY (CL), dry, medium to low plasticity, cohesive, massive, few gravel and sand.
	2 4 6 7	**10**			4	SS			
	2 2 4 6	**6**			5	SS			
10	3 4 5 6	**9**			6	SS			As above from 10 to 14 feet but moisture changes to moist.
	3 4 7 9	**11**			7	SS			
								CL	LOESS.
15	3 4 5 7	**9**			8	SS			Stiff, black (10YR 2.5/1), LEAN CLAY (CL), moist, medium to low plasticity, cohesive, massive, few gravel and sand.
	2 3 4 4	**7**			9	SS		CL	PRE-ILLINOIAN GLACIAL DIAMICTON (QWT). Medium, olive grey (5Y 4/2) SANDY LEAN CLAY (CL), moist, medium plasticity, cohesive, massive, M.
	1 2 4 4	**6**			10	SS			

Continued Next Page

Tracking Codes: 60482609_BLACKHAWK GPJ_ETSOIL_1/3/17, 1103

AECOM

FINAL SOIL BORING LOG

BORING NO. **B-412**

SITE: **Black Hawk County Landfill** PROJECT NO. **60482609** SHEET **2** OF **2**

Depth in Feet	B	N	A	% Recovery	No.	T	Graphic Log	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS
20								SM	Medium dense, light olive brown (2.5 Y 5/6), silty sand (SM) moist, nonplastic, non-cohesive, massive.
	2 4 9 10	**13**			11	SS		CL	Medium, olive grey (5Y 4/2) SANDY LEAN CLAY (CL), moist, medium plasticity, cohesive, massive, mottled.
	3 5 7 11	**12**			12	SS		CL	PRE-ILLINOIAN GLACIAL DIAMICTON (QAT). Stiff, very dark grayish brown (10YR 3/2) to very dark gray (10YR 3/1), SANDY LEAN CLAY (CL), moist, low to medium plasticity, cohesive, massive, trace gravel.
25	6 13 20 28	**33**			13	SS			
	6 40 47 55	**>50**			14	SS		SP/SM	Very dense, grayish brown (10YR 5/2), POORLY GRADED SAND (SP) to SILTY SAND (SM), moist, nonplastic, non-cohesive, massive.
	12 12 14 15	**26**			15	SS		CL	Very stiff, olive gray (5Y 4/2), SANDY LEAN CLAY (CL), moist, low plasticity, cohesive, massive, with sand and silt seams throughout.
30	10 15 20 24	**35**			16	SS			
	10 9 8 12	**17**			17	SS		CL	Very stiff, black (10YR 2.5/1), LEAN CLAY (CL), moist, low plasticity, cohesive, massive, little sand and trace gravel. As above from 34 to 36.5 feet, but with silt seams.
35	9 9 30 31	**39**			18	SS			
40									End of Boring at 36.5 feet below ground surface.

Tracking Codes: 60482609_BLACKHAWK GPJ_ETSOIL_1/3/17_1103

AECOM

FINAL SOIL BORING LOG

BORING NO. **B-413**

SITE: **Black Hawk County Landfill** PROJECT NO. **60482609** SHEET **1** OF **2**

SITE #:

Adjacent to fence and road by Cell

PHYSICAL SETTING: **A**

LOG BY: **Sarah Day**

FIRM/DRILLER: **Terracon/Ron Faulk**

DRILLING METHOD: **4.25 HSA, 2.0 in. by 2.0 ft. SS**

WATER LEVEL READINGS

DATE	WATER DEPTH	HOLE DEPTH	CASING DEPTH

ABANDONMENT DATE: **NA**

ABANDONMENT METHOD: **NA**

GROUND SURFACE ELEV: **946.00**

IA State Plain LOCAL COORDINATES:

NORTHING: **3617592.85**

EASTING: **5237824.52**

DATE/TIME STARTED: **11/7/16 ; 14:00**

DATE/TIME COMPLETED: **11/7/16 ; 15:00**

WELL INSTALLATION: **11/7/16**

Depth in Feet	B	N	A	% Recovery	No.	T	Graphic Log	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS
0								NS	No Sample.
	2 4 5 6	**9**		80	1	SS		CL	QUATERNARY, FILL.
								CL	Stiff, very dark brown (10YR 2.5/2), LEAN CLAY (CL), moist, medium plasticitiy, cohesive, massive.
	2 4 6 6	**10**		75	2	SS			Stiff, dark brown (10YR 3/2), LEAN CLAY (CL), moist, medium plasticity, cohesive, massive, trace gravel.
5	2 1 2 4	**3**		100	3	SS		SP	Soft, dark brown (10YR 3/2), POORLY GRADED SAND (SP) moist, non-plastic, noncohesive, massive.
								CL	Soft, dark brown (10YR 3/2), LEAN CLAY (CL) moist, high plasticity, cohesive, massive.
	3 3 4 4	**7**		100	4	SS		CL	LOESS. Medium, black (10YR 2.5/1), LEAN CLAY (CL), moist, medium plasticity, cohesive, massive.
								CL	PRE-ILLINOIAN GLACIAL DIAMICTON (QWT). Medium, dark olive gray (5Y 3/2), SANDY LEAN CLAY (CL), moist, medium to low plasticity, cohesive, massive.
	2 4 6 6	**10**		80	5	SS		SP	Loose, olive gray (5Y 4/2), POORLY GRADED SAND (SP) wet, non-plastic, noncohesive, massive.
10	2 2 4 4	**6**		60	6	SS		CL	Medium, olive brown (2.5Y 4/3), LEAN CLAY (CL) wet, high plasticity, cohesive, massive, trace sand.
	2 2 4 5	**6**		80	7	SS		SP	Loose, olive gray (5Y 4/2), POORLY GRADED SAND (SP) wet, non-plastic, noncohesive, massive.
								CL	Medium, olive (5Y 4/3), LEAN CLAY (CL), wet, high plasticity, cohesive, massive, trace gravel.
15	2 3 4 5	**7**		100	8	SS		CL	PRE-ILLINOIAN GLACIAL DIAMICTON (QAT). Medium, grayish brown (10YR 5/2), SANDY LEAN CLAY (CL), moist, medium plasticity, cohesive, massive, trace gravel, with gray (10YR 6/1) silt seams throughout.
	10 15 30 30	**45**		100	9	SS		CL	Medium to very stiff, very dark grayish brown (10YR 3/2), SANDY LEAN CLAY (CL), dry, low plasticity, cohesive, massive, mottled, with gray (10YR 6/1) silt seams throughout. As above from 17.5 to 20.5, but color changes to olive gray (5Y 4/2).
	9 11 13 16	**24**		100	10	SS			

Continued Next Page

Tracking Codes: 60482609_BLACKHAWK GPJ_ETSOIL_1/3/17_1103

AECOM

FINAL SOIL BORING LOG

BORING NO. **B-413**

SITE: **Black Hawk County Landfill** PROJECT NO. **60482609** SHEET **2** OF **2**

Depth in Feet	SAMPLING DATA B	N	A	% Recovery	No.	T	Graphic Log	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS
20									End of Boring at 20.5 feet below ground surface.
25									
30									
35									
40									

Tracking Codes: 60482609_BLACKHAWK GPJ_ETSOIL_1/3/17, 1103

AECOM

FINAL SOIL BORING LOG

BORING NO. **B-414**

SITE: **Black Hawk County Landfill** PROJECT NO. **60482609** SHEET **1** OF **2**

SITE #: _____

Adjacent to fence and road by Cell

PHYSICAL SETTING: **A**

LOG BY: **Sarah Day**

FIRM/DRILLER: **Terracon/Ron Faulk**

DRILLING METHOD: **4.25 HSA, 2.0 in. by 2.0 ft. SS**

WATER LEVEL READINGS

DATE	WATER DEPTH	HOLE DEPTH	CASING DEPTH

ABANDONMENT DATE: **NA**

ABANDONMENT METHOD: **NA**

GROUND SURFACE ELEV: **960.00**

IA State Plain LOCAL COORDINATES:

NORTHING: **3617328.34**

EASTING: **5237842.52**

DATE/TIME STARTED: **11/8/16 ; 09:34**

DATE/TIME COMPLETED: **11/8/16 ; 11:10**

WELL INSTALLATION: **11/8/16**

Depth in Feet	SAMPLING DATA B	N	A	% Recovery	No.	T	Graphic Log	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS
0								NS	No Sample
	1 1 3 6	**4**		70	1	SS		CL	QUATERNARY, FILL. Soft to medium, very dark gray (7.5YR 3/1) to dark brown (7.5YR 3/2), SANDY LEAN CLAY (CL), moist, medium plasticity, cohesive, massive, trace roots, trace gravel.
	2 4 5 6	**9**		75	2	SS			
5	1 3 5 6	**8**		75	3	SS			
	1 3 9 7	**12**		100	4	SS		SM	Loose, dark gray (7.5YR 4/1), SILTY SAND (SM), dry, non-plastic, noncohesive, massive.
								CL	PRE-ILLINOIAN GLACIAL DIAMICTON (QWT). Medium, dark brown (7.5YR 3/2), SANDY LEAN CLAY (CL), moist, medium to low plasticity, cohesive, massive, trace gravel.
	2 3 5 8	**8**		100	5	SS			
10	4 4 8 10	**12**		100	6	SS		CL	Stiff, olive brown (2.5Y 4/3), SANDY LEAN CLAY (CL), moist, medium plasticity, cohesive, massive, mottled, trace gravel.
								CL	PRE-ILLINOIAN GLACIAL DIAMICTON (QAT). Stiff, dark gray (10YR 4/1), SANDY LEAN CLAY (CL) moist, low plasticity, cohesive, massive, trace gravel.
	3 5 7 10	**12**		100	7	SS			
	4 6 7 10	**13**		100	8	SS			As above from 14.6 to 15 feet, but color changes to olive brown (2.5Y 4/3).
15								SM	Medium dense, light olive brown (2.5Y 5/6), SILTY SAND (SM), moist, non-plastic, noncohesive, massive.
								SP	
								CL	Medium dense, light olive brown (2.5Y 5/6), POORLY GRADED SAND (SP), wet, non-plastic, noncohesive, massive.
								CL	Stiff, yellowish brown (10YR 5/6), SANDY LEAN CLAY (CL), moist, low plasticity, cohesive, massive.
	3 5 7 7	**12**		100	9	SS			Stiff, black (10YR 2/1), LEAN CLAY (CL), moist, medium to high plasticity, cohesive, massive.
	3 4 6 6	**10**		100	10	SS		SP	Loose, olive brown (2.5Y 4/4), POORLY GRADED SAND (SP), moist, non-plastic, noncohesive, massive.
								CL	

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Tracking Codes: 60482609_BLACKHAWK GPJ_ETSOIL_1/3/17, 1103

AECOM

FINAL SOIL BORING LOG

BORING NO. **B-414**

SITE: **Black Hawk County Landfill** PROJECT NO. **60482609** SHEET **2** OF **2**

Depth in Feet	SAMPLING DATA B	N	A	% Recovery	No.	T	Graphic Log	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS
20									Medium, gray (10YR 5/1) mottled yellowish brown (10YR 5/6), LEAN CLAY (CL), moist, medium plasticity, cohesvie, massive, M, trace to little sand and gravel, with <0.1 foot poorly graded sand seams at 22.5 and 24.5 feet.
	1 2 4 4	6		100	11	SS			
	2 3 3 4	6		100	12	SS			
25	2 3 5 19	8		100	13	SS			
								CL	Very stiff, gray (10YR 5/1), SANDY LEAN CLAY (CL), wet, lowplasticity, cohesvie, massive, little gravel.
	50 50/5	>50		50	14	SS		SP	Very dense, yellowish brown (10YR 5/6) POORLY GRADED SAND (SP), wet, non-plastic, noncohesive, trace gravel, Cobble at 27.5 feet.
	21 36 45 49	>50		100	15	SS		CL	Hard, light olive brown (2.5Y 5/4), SANDY LEAN CLAY (CL), moist, low plasticity, cohesive, massive, trace gravel.
30									End of boring at 30.5 feet below ground surface.
35									
40									

Tracking Codes: 60482609_BLACKHAWK.GPJ, ETSOIL, 1/3/17, 1103

AECOM

FINAL ROCK CORE LOG

BORING NO. **B-703 (ROCK)**

SITE: **Black Hawk County LF** PROJECT NO. **60649127.14** SHEET **1** OF **2**

WATER LEVEL READINGS

	DATE	TIME	DEPTH	CASING
	9/17/2021		**93**	**92**

GROUND SURFACE ELEV: **927.5**

IA State Plane COORDINATES:

NORTHING: **3618709.6**

EASTING: **5235229.8**

DATE STARTED: **09/14/21**

DATE COMPLETED: **09/17/21**

INSTALLATION: **9/17/2021**

DRILLING METHOD: **3-1/4 HSA; 3-in x 5-ft CT; 2-in x 2-ft SS to top of bedrock; NQ2 rock core to EOB**

LOG BY: **R. Henning**

FIRM/DRILLER: **Terracon/S. Zeien**

ABANDONMENT DATE: **NA**

ABANDONMENT METHOD: **NA**

PHYSICAL SETTING: **Northwest side of property adjacent to Hammond Rd.**

Depth in Feet	CORING DATA: GRAPHICS	RUN NO	LENGTH	% RECOVERY	MPF	%WATER GAIN/LOSS	% RQD	FRACTURES	GRAPHIC LOG: ROCK TYPE	ROCK TYPE CODE	ROCK DESCRIPTION
88.1										DL	88.1 - 92.0 ft. Reamed to 92 ft to install 6-in ID SCH 80 PVC outer casing.
90											
		1	2.8	65		0	0			DL	DEVONIAN CEDAR VALLEY GROUP DOLOMITE. DOLOMITE (DL); moderate; light olive gray (5 Y 6/1); microcrystalline; massive; slightly decomposed; slightly disintegrated; intensely fractured; unconformable; numerous bedding plane fractures; interval very broken up by weathering and coring.
95		2	7.3	88		0	35			DL	DOLOMITE (DL); moderate; light olive gray (5 Y 6/1); microcrystalline; massive; slightly decomposed; moderately disintegrated; intensely fractured; conformable; numerous bedding plane fractures; interval very broken up by weathering and coring.
100											large chert nodule at 101-ft
		3	7.2	91		0	47			DL	DOLOMITE (DL); moderate; light gray (N 7/0) with dark yellowish orange (10 YR 6/6) staining on fractures; microcrystalline; massive; slightly decomposed; moderately disintegrated; intensely fractured; conformable; numerous bedding plane fractures; large dolomite crystal and chert at top of core.
105											
108.1											

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Tracking Codes: 60649127_BLACKHAWK.GPJ_ETROCK_12/02/21_10:13

AECOM

FINAL ROCK CORE LOG

BORING NO. **B-703 (ROCK)**

SITE: **Black Hawk County LF** PROJECT NO. **60649127.14** SHEET **2** OF **2**

Depth in Feet	CORING DATA: GRAPHICS	RUN NO	LENGTH	% RECOVERY	MPF	%WATER GAIN/LOSS	% RQD	FRACTURES	GRAPHIC LOG: ROCK TYPE	ROCK TYPE CODE	ROCK DESCRIPTION
108.1											
		4	6.9	61		-20	36			DL	DOLOMITE (DL); moderate; pale yellowish orange (10 YR 8/6) with dark yellowish orange (10 YR 6/6) staining on fractures; microcrystalline; massive; slightly decomposed; moderately disintegrated; intensely fractured; conformable; numerous bedding plane fractures; few chert nodules.
110											
115											
		5	2.0	40		-20	17			DL	very poor recovery; as above from 116.2 - 118.2 ft.
		6	2.2	100		-20	46			DL	DOLOMITE (DL); moderate; pale yellowish brown (10 YR 6/2) with dark yellowish orange (10 YR 6/6) staining on fractures; microcrystalline; massive; moderately decomposed; moderately disintegrated; intensely fractured; conformable; numerous bedding plane fractures; many pores (appears porous); most pores filled.
120											
											EOB at 120.4 ft bgs. Ream borehole to 6-in; install piezometer P-703C in borehole.
132.1											

Tracking Codes: 60649127 BLACKHAWK GPJ ETROCK 12/02/21 10:13

AECOM

FINAL SOIL BORING LOG

BORING NO. **B-701**

SITE: **Black Hawk County LF** PROJECT NO. **60649127.14** SHEET **1** OF **1**

SITE #: **7-SDP-1-75P**

PHYSICAL SETTING: **West side of property adjacent to Hammond Rd.**

LOG BY: **R. Henning**

FIRM/DRILLER: **Terracon/S. Zeien**

DRILLING METHOD: **4-1/4 HSA; 3-in x 5-ft CT to EOB**

ABANDONMENT DATE: **NA**

ABANDONMENT METHOD: **NA**

WATER LEVEL READINGS

DATE	WATER DEPTH	HOLE DEPTH	CASING DEPTH

GROUND SURFACE ELEV: **925.80**

IA State Plane LOCAL COORDINATES:

NORTHING: **3617829.7**

EASTING: **5235253.75**

DATE/TIME STARTED: **09/15/21 ; 0815**

DATE/TIME COMPLETED: **09/15/21 ; 0945**

WELL INSTALLATION: **9/15/2021**

Depth in Feet	SAMPLING DATA B	N	A	% Recovery	No.	T	Graphic Log	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS
0		15		40	1	CT		ML	QUATERNARY WISCONSINAN EPISODE LOESS. stiff; black (10 YR 2/1); SILT (ML); dry; non-plastic, noncohesive, massive; UU; LOESS
5		12		93	2	CT		CL	PRE-ILLINOIN GLACIAL DIAMICTON (QWT). stiff; brownish yellow (10 YR 6/8); LEAN CLAY WITH SAND (CL); wet; low plasticity; cohesive; massive; OU; DIAMICTON
								CL	medium plasticity; top of water table ▽ 7-ft
10		23		100	3	CT		CL	very stiff; strong brown (7.5 YR 5/6); LEAN CLAY WITH SAND AND GRAVEL (CL); wet; low plasticity; cohesive; massive; OU; few gravel pebbles; QWT - DIAMICTON
15		>30		10	4	CT		CL	PRE-ILLINOIN GLACIAL DIAMICTON (QAT). hard; mottled very dark gray (7.5 YR 3/1) to strong brown (7.5 YR 5/6); LEAN CLAY WITH SAND AND GRAVEL (CL); moist; low plasticity; cohesive; massive; MOU; DIAMICTON
									EOB at 18-ft bgs; Install monitoring well MW-701B in borehole.

Tracking Codes: 60649127_BLACKHAWK.GPJ, ETSOIL, 12/02/21, 10:14

AECOM

FINAL SOIL BORING LOG

BORING NO. **B-702**

SITE: **Black Hawk County LF** PROJECT NO. **60649127.14** SHEET **1** OF **1**

SITE #: **7-SDP-1-75P**

PHYSICAL SETTING: **West side of property adjacent to Hammond Rd.**

LOG BY: **R. Henning**

FIRM/DRILLER: **Terracon/S. Zeien**

DRILLING METHOD: **4-1/4 HSA; 3-in x 5-ft CT; 2-in x 2-ft SS to EOB**

WATER LEVEL READINGS			
DATE	WATER DEPTH	HOLE DEPTH	CASING DEPTH

ABANDONMENT DATE: **NA**

ABANDONMENT METHOD: **NA**

GROUND SURFACE ELEV: **925.99**

IA State Plane LOCAL COORDINATES:

NORTHING: **3618128.3**

EASTING: **5235253.47**

DATE/TIME STARTED: **09/15/21 ; 0645**

DATE/TIME COMPLETED: **09/15/21 ; 0810**

WELL INSTALLATION: **9/15/2021**

Depth in Feet	SAMPLING DATA B	N	A	% Recovery	No.	T	Graphic Log	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS
0		23		65	1	CT		ML	QUATERNARY WISCONSINAN EPISODE LOESS. very stiff; very dark grayish brown (10 YR 5/2); SILT (ML); dry; non-plastic; noncohesive; bedded; top soil; LOESS
5		6		42	2	CT		CL	PRE-ILLINOIAN GLACIAL DIAMICTON (QWT). hard; brownish yellow (10 YR 6/8); LEAN CLAY WITH SAND (CL); dry to moist; low plasticity; cohesive; bedded.
								SW	soft; brownish yellow (10 YR 6/8); WELL GRADED SAND (SW); dry to moist; non-plastic; noncohesive; bedded; glaciofluvial
10		>30		100	3	CT		CL	hard; mottled gray (10 YR 5/1) to brownish yellow (10 YR 6/8); moist; LEAN CLAY WITH SAND AND GRAVEL (CL); low plasticity; cohesive; massive; MOU; few fine gravel
15		>30		13	4	CT		CL	PRE-ILLINOIAN GLACIAL DIAMICTON (QAT). hard; very dark gray (10 YR 3/1); LEAN CLAY WITH SAND (CL); moist; low plsticity; cohesive; massive; UU; little fine gravel; with few brownish yellow (10 YR 6/8) fractures; oxidized.
	50/3	>30		9	5	SS			
									EOP at 18-ft bgs; install monitoring well MW-702B in borehole.

Tracking Codes: 60649127_BLACKHAWK.GPJ, ETSOIL, 12/02/21, 10:14

AECOM

FINAL SOIL BORING LOG

BORING NO. **B-703**

SITE: **Black Hawk County LF** PROJECT NO. **60649127.14** SHEET **1** OF **4**

SITE #: **7-SDP-1-75P**

PHYSICAL SETTING: **Northwest side of property adjacent to Hammond Rd.**

LOG BY: **R. Henning**

FIRM/DRILLER: **Terracon/S. Zeien**

DRILLING METHOD: **3-1/4 HSA; 3-in x 5-ft CT; 2-in x 2-ft SS to top of bedrock; NQ2 rock core to EOB**

WATER LEVEL READINGS

DATE	WATER DEPTH	HOLE DEPTH	CASING DEPTH
9/17/2021	**93**	**120**	**92**

ABANDONMENT DATE: **NA**

ABANDONMENT METHOD: **NA**

GROUND SURFACE ELEV: **927.52**

IA State Plane LOCAL COORDINATES:

NORTHING: **3618709.6**

EASTING: **5235229.84**

DATE/TIME STARTED: **09/14/21 ; 0730**

DATE/TIME COMPLETED: **09/17/21 ; 1330**

WELL INSTALLATION: **9/17/2021**

Depth in Feet	SAMPLING DATA B	N	A	% Recovery	No.	T	Graphic Log	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS
0		8		22	1	CT		ML	QUATERNARY WISCONSINAN EPISODE LOESS. medium; very dark brown (10 YR 2/2); SILT (ML); dry; non-plastic; noncohesive; bedded; UU; top soil; loess
5		10		100	2	CT		ML	stiff; brownish yellow (10 YR 6/8); SILT (ML); moist to wet; non-plastic; noncohesive; bedded; OU; loess
								CL	PRE-ILLINOIAN GLACIAL DIAMICTON (QWT). stiff; mottled brownish yellow (10 YR 6/8) to gray (10 YR 6/1); GRAVELLY LEAN CLAY (CL); moist; low plasticity; cohesive; thickly bedded; diamicton.
								SW	stiff; brownish yellow (10 YR 6/8); WELL GRADED SAND (SW); wet; non-pastic; noncohesive; bedded; glaciofluvial; top of water table ▽ 7-ft.
								CL	stiff; mottled brownish yellow (10 YR 6/8) to gray (10 YR 6/1); GRAVELLY LEAN CLAY (CL); wet; low plasticity; cohesive; thickly bedded; diamicton.
10		>30		97	3	CT		CL	hard; mottled dark gray (10 YR 4/1) to yellowish brown (10 YR 5/8); GRAVELLY LEAN CLAY (CL); moist; low plasticity; cohesive; massive; few fine gravel (dolomite); oxidized on fractures.
15		>30		44	4	CT		CL	as above from 15 - 16.5 ft.
	28 28 22 28	>30		59	5	SS		CL	hit rock at 16.5-ft bgs; split spoon and auger through interval; Cedar Valley Dolomite cobble.
	29 12 20 23	>30		95	6	SS		CL	hard; as above from 18.5 - 20.5 ft.

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Tracking Codes: 60649127_BLACKHAWK.GPJ, ETSOIL, 12/02/21, 10:14

AECOM

FINAL SOIL BORING LOG

BORING NO. **B-703**

SITE: **Black Hawk County LF** PROJECT NO. **60649127.14**

Depth in Feet	SAMPLING DATA B	N	A	% Recovery	No.	T	Graphic Log	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS
20									
		>30		80	7	CT		CL	PRE-ILLINOIAN GLACIAL DIAMICTON (QAT). hard; dark gray (10 YR 4/1); GRAVELLY LEAN CLAY (CL); moist; low plasticity; cohesive; massive; little coarse sand with fine gravel; diamicton.
25		>30		30	8	CT			
	24 20 22 24	>30		63	9	SS		CL	hard; as above from 26 - 29.5 ft.; hit dolomite cobble; few dolomite pebbles in SANDY LEAN CLAY (CL) matrix.
		>30		30	10	CT			
30		>30		100	11	CT		CL	as above from 29.5 - 34.5 ft.
35		>30		100	12	CT		CL	as above from 34.5 - 39.5 ft.
		>30		40	13	CT		CL	hard; dark gray (10 YR 4/1); GRAVELLY LEAN CLAY (CL); moist; low plasticity; cohesive; massive; little coarse sand and fine dolomite gravel; diamicton.
40	16 18 30 37	>30		75	14	SS		CL	as above from 41.5 - 43.5 ft.
	9	>30		92	15	SS		CL	as above from 43.5 - 45.5 ft.

Tracking Codes: 60649127_BLACKHAWK.GPJ, ETSOIL, 12/02/21, 10:14

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AECOM

FINAL SOIL BORING LOG

BORING NO. **B-703**

SITE: **Black Hawk County LF** PROJECT NO. **60649127.14** SHEET **3** OF **4**

Depth in Feet	SAMPLING DATA B	N	A	% Recovery	No.	T	Graphic Log	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS
44	24 27 36								
45		>30		50	16	CT		CL	as above from 45.5 - 48 ft.
	13 19 23	>30		70	17	SS		CL	as above from 48 - 49.5 ft.
		>30		100	18	CT		CL	as above from 49.5 - 54.5 ft.
50									
55		>30		100	19	CT		CL	as above from 54.5 - 59.5 ft.
		>30		20	20	CT		CL	as above from 59.5 - 60.5 ft.
60	24 17 18	>30		63	21	SS		SW	hard; grayish brown (10 YR 5/2); WELL GRADED SAND (SW); wet; non-plastic; noncohesive; bedded; UU; glaciofluvial; fine quartz sand.
								CL	PRE-ILLINOIAN GLACIAL DIAMICTON (QBT).
	12 20 26 46	>30		100	22	SS			hard; dark gray (10 YR 4/1); LEAN CLAY WITH SAND AND GRAVEL (CL); moist; low plasticity; massive; UU; few fine gravel; coarse grained sand.
	16 22 29 48	>30		100	23	SS		CL	as above from 64 - 66 ft.
65		>30		70	24	CT		CL	as above from 66 - 69.5 ft.

Tracking Codes: 60649127_BLACKHAWK.GPJ, ETSOIL, 12/02/21, 10:14

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AECOM

FINAL SOIL BORING LOG

BORING NO. **B-703**

SITE: **Black Hawk County LF** PROJECT NO. **60649127.14** SHEET **4** OF **4**

Depth in Feet	SAMPLING DATA B	N	A	% Recovery	No.	T	Graphic Log	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS
68									
70		>30		100	25	CT		CL	as above from 69.5 - 74.5 ft.
75		>30		100	26	CT		CL	as above from 74.5 - 79.5 ft.
80		>30		100	27	CT		CL	as above from 79.5 - 84 ft.
								SW	hard; dark gray (10 YR 4/1); WELL GRADED SAND (SW); wet; non-plastic; noncohesive; bedded; UU; fine quartz sand; glaciofluvial.
85		>30		65	28	CT		CL	hard; dark gray (10 YR 4/1); SANDY LEAN CLAY WITH GRAVEL (CL); moist; low plasticity; cohesive; massive; UU; dolomite gravel pebbles; diamicton.
	50/3	>30		9	29	SS		DL	DEVONIAN CEDAR VALLEY GROUP DOLOMITE. Top of bedrock; refusal of augers and samplers.
90									EOB soil boring at top of bedrock. Install 6-in ID SCH 80 PVC casing to top of bedrock. Advance borehole in bedrock with NQ2 rock core.

Tracking Codes: 60649127_BLACKHAWK.GPJ, ETSOIL, 12/02/21, 10:14

AECOM

FINAL SOIL BORING LOG

BORING NO. **B-703B**

SITE: **Black Hawk County LF** PROJECT NO. **60649127.14** SHEET **1** OF **1**

SITE #: **7-SDP-1-75P**

PHYSICAL SETTING: **Northwest side of property adjacent to Hammond Rd.**

LOG BY: **R. Henning**

FIRM/DRILLER: **Terracon/S. Zeien**

DRILLING METHOD: **4-1/4 HSA; 3-in x 5-ft CT; 2-in x 2-ft SS to EOB**

WATER LEVEL READINGS

DATE	WATER DEPTH	HOLE DEPTH	CASING DEPTH

ABANDONMENT DATE: **NA**

ABANDONMENT METHOD: **NA**

GROUND SURFACE ELEV: **927.51**

IA State Plane LOCAL COORDINATES:

NORTHING: **3618716.7**

EASTING: **5235231.33**

DATE/TIME STARTED: **09/14/21 ; 1530**

DATE/TIME COMPLETED: **09/14/21 ; 1630**

WELL INSTALLATION: **9/14/2021**

Depth in Feet	SAMPLING DATA B	N	A	% Recovery	No.	T	Graphic Log	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS
0					1	NR		AU	Blind drill from 0 - 20 ft. bgs. Refer to B-703 soil boring log. Install monitoring well MW-703B in borehole.
5									
10									
15									

Tracking Codes: 60649127_BLACKHAWK.GPJ, ETSOIL, 12/02/21, 10:14

AECOM

FINAL SOIL BORING LOG

BORING NO. **B-704**

SITE: **Black Hawk County LF** PROJECT NO. **60649127.14** SHEET **1** OF **2**

SITE #: **7-SDP-1-75P**

PHYSICAL SETTING: **Northwest side of property on top of berm**

LOG BY: **R. Henning**

FIRM/DRILLER: **Terracon/S. Zeien**

DRILLING METHOD: **4-1/4 HSA; 3-in x 5-ft CT; 2-in x 2-ft SS to EOB**

WATER LEVEL READINGS

DATE	WATER DEPTH	HOLE DEPTH	CASING DEPTH

ABANDONMENT DATE: **NA**

ABANDONMENT METHOD: **NA**

GROUND SURFACE ELEV: **950.89**

IA State Plane LOCAL COORDINATES:

NORTHING: **3618648.4**

EASTING: **5235619.47**

DATE/TIME STARTED: **09/15/21 ; 1000**

DATE/TIME COMPLETED: **09/15/21 ; 1130**

WELL INSTALLATION: **9/15/2021**

Depth in Feet	SAMPLING DATA B	N	A	% Recovery	No.	T	Graphic Log	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS
0		>30		83	1	CT		CL	QUATERNARY ANTHROPOCENE FILL. hard; dark brown (7.5 YR 3/3); LEAN CLAY WITH SAND AND GRAVEL (CL); dry; low plasticity; cohesive; massive; berm made of fill.
5		23		93	2	CT		CL	very stiff; very dark grayish brown (10 YR 3/2); LEAN CLAY WITH SAND AND GRAVEL (CL); moist to wet; low plasticity; cohesive; massive; fill.
10		23		98	3	CT		CL	as above from 10 - 15 ft bgs.
15		30		93	4	CT		ML	QUATERNARY WISCONSINAN EPISODE LOESS. very stiff; dark gray (10 YR 4/1); SILT (ML); non-plastic; cohesive; moist; bedded; buried top soil.
								CL	PRE-ILLINOIAN GLACIAL DIAMICTON (QWT). very stiff; brown (10 YR 4/3); LEAN CLAY WITH SAND (CL); moist; low plasticity; cohesive; bedded; diamicton.

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Tracking Codes: 60649127_BLACKHAWK.GPJ, ETSOIL, 12/02/21, 10:14

AECOM

FINAL SOIL BORING LOG

BORING NO. **B-704**

SITE: **Black Hawk County LF** PROJECT NO. **60649127.14** SHEET **2** OF **2**

Depth in Feet	SAMPLING DATA B	N	A	% Recovery	No.	T	Graphic Log	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS
20		7		83	5	CT		CL	medium; mottled gray to brownish yellow (10 YR 5/1 to 6/8); LEAN CLAY WITH SAND AND GRAVEL (CL); wet; medium plasticity; cohesive; massive; diamicton. Water table ▼ approximately 20-ft bgs.
25		>30		100	6	CT		CL	hard; as above from 25 - 27 ft bgs.
								CL	PRE-ILLINOIAN GLACIAL DIAMICTON (QAT). hard; dark yellowish brown (10 YR 4/2); GRAVELLY LEAN CLAY (CL); moist; low plasticity; cohesive; massive; some coarse gravel to pebbles; very dense and stony; diamicton.
30		>30		100	7	CT		CL	hard; as above from 30 - 35 ft bgs.
35									EOB at 35-ft bgs; install monitoring well MW-704B in borehole.
40									

Tracking Codes: 60649127_BLACKHAWK.GPJ, ETSOIL, 12/02/21, 10:14

AECOM

FINAL SOIL BORING LOG

BORING NO. **B-705**

SITE: **Black Hawk County LF** PROJECT NO. **60649127.14** SHEET **1** OF **2**

SITE #: **7-SDP-1-75P**

PHYSICAL SETTING: **Northwest side of property on top of berm**

LOG BY: **R. Henning**

FIRM/DRILLER: **Terracon/S. Zeien**

DRILLING METHOD: **4-1/4 HSA; 3-in x 5-ft CT; 2-in x 2-ft SS to EOB**

WATER LEVEL READINGS

DATE	WATER DEPTH	HOLE DEPTH	CASING DEPTH

ABANDONMENT DATE: **NA**

ABANDONMENT METHOD: **NA**

GROUND SURFACE ELEV: **949.01**

IA State Plane LOCAL COORDINATES:

NORTHING: **3618655.0**

EASTING: **5235926.05**

DATE/TIME STARTED: **09/15/21 ; 1130**

DATE/TIME COMPLETED: **09/15/21 ; 1300**

WELL INSTALLATION: **9/15/2021**

Depth in Feet	SAMPLING DATA B	N	A	% Recovery	No.	T	Graphic Log	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS
0		>30		90	1	CT		CL	QUATERNARY ANTHROPOCENE FILL. hard; mottled dark grayish brown (10 YR 6/2) to brownish yellow (10 YR 6/6); LEAN CLAY WITH SAND AND GRAVEL (CL); dry; low plasticity; cohesive; massive; fill.
5		>30		97	2	CT		CL	stiff; very dark gray (10 YR 3/1); LEAN CLAY WITH SAND AND GRAVEL (CL); dry; low plasticity; cohesive; massive; fill.
10		>30		77	3	CT		CL	hard; as above from 10 - 15 ft.
15		>30		80	4	CT		CL	hard; as above from 15 - 20 ft.

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Tracking Codes: 60649127_BLACKHAWK.GPJ, ETSOIL, 12/02/21, 10:14

AECOM

FINAL SOIL BORING LOG

BORING NO. **B-705**

SITE: **Black Hawk County LF** PROJECT NO. **60649127.14** SHEET **2** OF **2**

Depth in Feet	SAMPLING DATA B	N	A	% Recovery	No.	T	Graphic Log	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS
20		>30		10	5	CT		ML	QUATERNARY WISCONSINAN EPISODE LOESS. hard; black (10 YR 2/1); SILT (ML); moist; non-plastic; noncohesive; bedded; UU, buried top soil, loess.
								LDRCBBL	missing sample due to cobble blocking continuous sampler.
25	4 5 5 6	10		79	6	SS		CL	PRE-ILLINOIAN GLACIAL DIAMICTON (QWT). stiff; strong brown (7.5 YR 5/8); LEAN CLAY WITH SAND AND GRAVEL (CL); moist; low plasticity; cohesive; bedded; OU; diamicton.
		25		100	7	CT		CL	very stiff; mottled gray to strong brown (7.5 YR 5/1 to 5/6); LEAN CLAY WITH SAND AND GRAVEL (CL); moist to wet; low plasticity; cohesive; bedded; MOU; diamicton.
30		23		100	8	CT		CL	PRE-ILLINOIAN GLACIAL DIAMICTON (QAT). very stiff; mottled very dark gray (7.5 YR 3/1) to strong brown (7.5 YR 5/6); LEAN CLAY (CL); moist to wet; low plasticity; cohesive; massive MOU; diamicton.
35		>30		98	9	CT		CL	as above from 35 - 39 ft.
									EOB at 39-ft bgs; install monitoring well MW-705B in borehole.
40									

Tracking Codes: 60649127_BLACKHAWK.GPJ, ETSOIL, 12/02/21, 10:14

AECOM

FINAL SOIL BORING LOG

BORING NO. **B-706**

SITE: **Black Hawk County LF** PROJECT NO. **60649127.14** SHEET **1** OF **2**

SITE #: **7-SDP-1-75P**

PHYSICAL SETTING: **Northwest side of property on top of berm**

LOG BY: **R. Henning**

FIRM/DRILLER: **Terracon/S. Zeien**

DRILLING METHOD: **4-1/4 HSA; 3-in x 5-ft CT; 2-in x 2-ft SS to EOB**

WATER LEVEL READINGS

DATE	WATER DEPTH	HOLE DEPTH	CASING DEPTH

ABANDONMENT DATE: **NA**

ABANDONMENT METHOD: **NA**

GROUND SURFACE ELEV: **950.25**

IA State Plane LOCAL COORDINATES:

NORTHING: **3618672.3**

EASTING: **5236223.67**

DATE/TIME STARTED: **09/15/21 ; 1310**

DATE/TIME COMPLETED: **09/15/21 ; 1500**

WELL INSTALLATION: **9/15/2021**

Depth in Feet	SAMPLING DATA B	N	A	% Recovery	No.	T	Graphic Log	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS
0		>30		93	1	CT		CL	QUATERNARY ANTHROPOCENE FILL. hard; brown (10 YR 4/3) LEAN CLAY WITH SAND AND GRAVEL (CL); dry non-plastic; cohesive; massive; MOU; fill.
5		>30		82	2	CT		CL	very stiff; as above from 5 - 10 ft.; mottled gray to olive yellow (2.5 Y 5/1 to 6/6).
10		16		73	3	CT		CL	as above from 10 - 15 ft.
15		16		78	4	CT		ML	QUATERNARY WISCONSINAN EPISODE LOESS. very stiff; black (2.5 Y 2.5/1); SILT (ML); moist; non-plastic; noncohesive; bedded; UU; buried topsoil under berm; loess.
								SW	very stiff; brownish yellow (10 YR 6/6); WELL GRADED SAND (SW); wet; non-plastic; noncohesive; bedded; OU; glaciofluvial; fine quartz sand; oxidized; water table; lost bottom 2-ft of sample when retrieving continous sampler.

Tracking Codes: 60649127_BLACKHAWK.GPJ, ETSOIL, 12/02/21, 10:14

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AECOM

FINAL SOIL BORING LOG

BORING NO. **B-706**

SITE: **Black Hawk County LF** PROJECT NO. **60649127.14** SHEET **2** OF **2**

Depth in Feet	SAMPLING DATA B	N	A	% Recovery	No.	T	Graphic Log	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS
20		15		62	5	CT		CL	PRE-ILLINOIAN GLACIAL DIAMICTON (QWT). stiff; mottled gray to brownish yellow (10 YR 5/1 to 6/6); SANDY LEAN CLAY (CL); wet; low plasticity; cohesive; bedded; MOU; diamicton.
								SW	WELL GRADED SAND (SW) seam; little fine gravel.
								CL	hard; as above from 21.1 - 26 ft.
25		>30		80	6	CT			
								CL	PRE-ILLINOIAN GLACIAL DIAMICTON (QAT). hard; very dark gray (10 YR 3/1); LEAN CLAY WITH SAND AND GRAVEL (CL); moist; low plasticity; cohesive; massive; UU; little fine gravel; diamicton.
30									EOB at 30 ft. bgs. Install monitoring well MW-706B in borehole.
35									
40									

Tracking Codes: 60649127_BLACKHAWK.GPJ, ETSOIL, 12/02/21, 10:14

AECOM

FINAL SOIL BORING LOG

BORING NO. **B-707**

SITE: **Black Hawk County LF** PROJECT NO. **60649127.14** SHEET **1** OF **2**

SITE #: **7-SDP-1-75P**

PHYSICAL SETTING: **Northwest side of property on top of berm**

LOG BY: **R. Henning**

FIRM/DRILLER: **Terracon/S. Zeien**

DRILLING METHOD: **4-1/4 HSA; 3-in x 5-ft CT; 2-in x 2-ft SS to EOB**

ABANDONMENT DATE: **NA**

ABANDONMENT METHOD: **NA**

WATER LEVEL READINGS

DATE	WATER DEPTH	HOLE DEPTH	CASING DEPTH

GROUND SURFACE ELEV: **948.67**

IA State Plane LOCAL COORDINATES:

NORTHING: **3618692.8**

EASTING: **5236514.51**

DATE/TIME STARTED: **09/16/21 ; 0850**

DATE/TIME COMPLETED: **09/16/21 ; 1018**

WELL INSTALLATION: **9/16/2021**

Depth in Feet	SAMPLING DATA B	N	A	% Recovery	No.	T	Graphic Log	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS
0		>30		87	1	CT		CL	QUATERNARY ANTHROPOCENE FILL. hard; mottled dark gray to brownish yellow (10 YR 4/1 to 6/8); LEAN CLAY WITH GRAVEL (CL); dry; low plasticity; cohesive; massive; MOU; fill.
5		30		70	2	CT		CL	very stiff; as above from 5 - 10 ft.
								ML	QUATERNARY WISCONSINAN EPISODE LOESS. very stiff; black; (10 YR 2/1); SILT (ML); moist; non-plastic; noncohesive; buried top soil under berm; loess.
								CL	PRE-ILLINOIAN GLACIAL DIAMICTON (QWT). very stiff; yellowish brown (10 YR 5/6); LEAN CLAY WITH SAND AND GRAVEL (CL); moist to wet; low plasticity; cohesive; bedded; OU; diamicton.
10		23		77	3	CT		CL	very stiff; as above from 10 - 12 ft.
								SC	very stiff; brownish yellow (10 YR 6/8); CLAYEY SAND (SC); wet; non-plastic; noncohesive; bedded; glaciofluvial; top of water table.
								CL	very stiff; mottled brownish yellow (10 YR 6/8) to gray (10 YR 5/1); LEAN CLAY WITH SAND AND GRAVEL (CL); moist; low plasticity; cohesive; massive; coarse grained sand; few fine gravel; MOU; diamicton
15		25		100	4	CT		CL	very stiff; grayish brown (10 YR 5/2); SANDY LEAN CLAY (CL); moist; low plasticity; cohesive; massive; diamicton.
								CL	PRE-ILLINOIAN GLACIAL DIAMICTON (QAT). very stiff; gray (10 YR 6/1); LEAN CLAY (CL); moist; low plasticity; cohesive;

Continued Next Page

Tracking Codes: 60649127_BLACKHAWK.GPJ, ETSOIL, 12/02/21, 10:14

AECOM

FINAL SOIL BORING LOG

BORING NO. **B-707**

SITE: **Black Hawk County LF** PROJECT NO. **60649127.14** SHEET **2** OF **2**

Depth in Feet	SAMPLING DATA B	N	A	% Recovery	No.	T	Graphic Log	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS
20		>30		100	5	CT		CL	massive; little pebbles and fine sand; diamicton. hard; jointed; mottled; dark gray (10 YR 4/1) to brownish yellow (10 YR 6/8); SANDY LEAN CLAY WITH GRAVEL (CL); moist; low plasticity; cohesive; massive; ; joints yellowish red staining (5 YR 4/6); diamicton.
								CL	as above from 24 - 25 ft.
25									EOB at 25 ft. bgs. Install monitoring well MW-707B in borehole.
30									
35									
40									

Tracking Codes: 60649127_BLACKHAWK.GPJ, ETSOIL, 12/02/21, 10:14

AECOM

FINAL SOIL BORING LOG

BORING NO. **B-708**

SITE: **Black Hawk County LF** PROJECT NO. **60649127.14** SHEET **1** OF **2**

SITE #: **7-SDP-1-75P**

PHYSICAL SETTING: **Northwest side of property on top of berm**

LOG BY: **R. Henning**

FIRM/DRILLER: **Terracon/S. Zeien**

DRILLING METHOD: **4-1/4 HSA; 3-in x 5-ft CT; 2-in x 2-ft SS to EOB**

WATER LEVEL READINGS

DATE	WATER DEPTH	HOLE DEPTH	CASING DEPTH

ABANDONMENT DATE: **NA**

ABANDONMENT METHOD: **NA**

GROUND SURFACE ELEV: **951.13**

IA State Plane LOCAL COORDINATES:

NORTHING: **3618696.5**

EASTING: **5236826.11**

DATE/TIME STARTED: **09/16/21 ; 0700**

DATE/TIME COMPLETED: **09/16/21 ; 0810**

WELL INSTALLATION: **9/16/2021**

Depth in Feet	SAMPLING DATA B	N	A	% Recovery	No.	T	Graphic Log	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS
0		>30		93	1	CT		CL	QUATERNARY ANTHROPOCENE FILL. hard; mottled brownish yellow to dark gray (10 YR 6/8 to 4/1); LEAN CLAY WITH SAND AND GRAVEL (CL); dry; non-plastic; cohesive; massive; fill.
5		12		25	2	CT		CL	stiff; as above from 5 - 10 ft.
10		23		25	3	CT		CL	very stiff; as above from 10 - 11 ft.
								CL	PRE-ILLINOIAN GLACIAL DIAMICTON (QWT). very stiff; mottled brownish yellow to dark gray (10 YR 6/8 to 4/1); GRAVELLY LEAN CLAY (CL); moist; non-plastic; cohesive; massive; plants and wood bark from original top soil surface; diamicton.
15	2 3 3 4	6		79	4	SS		CL	medium; brownish yellow (10 YR 6/8) LEAN CLAY WITH SAND (CL); wet; low plasticity; cohesive; bedded; OU; few fine gravel; diamicton.
		15		100	5	CT		CL	stiff; brown (10 YR 5/3); LEAN CLAY WITH SAND AND GRAVEL (CL); wet; low plasticity; cohesive; massive; RU; diamicton.

Continued Next Page

Tracking Codes: 60649127_BLACKHAWK.GPJ, ETSOIL, 12/02/21, 10:14

AECOM

FINAL SOIL BORING LOG

BORING NO. **B-708**

SITE: **Black Hawk County LF** PROJECT NO. **60649127.14** SHEET **2** OF **2**

Depth in Feet	SAMPLING DATA B	N	A	% Recovery	No.	T	Graphic Log	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS
20		15		95	6	CT		CL	stiff; grayish brown (10 YR 5/2); LEAN CLAY WITH SAND AND GRAVEL (CL); wet; low plasticity; cohesive; massive; diamicton.
								SW	stiff; grayish brown (10 YR 5/2); WELL GRADED SAND (SW); wet; non-plastic; noncohesive; bedded; glaciofluvial.
								CL	stiff; mottled brownish yellow (10 YR 6/8) to pale brown (10 YR 6/3); LEAN CLAY WITH SAND AND GRAVEL (CL); moist to wet; low plasticity; cohesive; massive; diamicton.
								SW	stiff; mottled brownish yellow (10 YR 6/8) to pale brown (10 YR 6/3); WELL GRADED SAND (SW); wet; non-plastic; noncohesive; bedded; glaciofluvial.
25		23		68	7	CT		CL	PRE-ILLINOIAN GLACIAL DIAMICTON (QAT). very stiff; very dark gray (10 YR 3/1) LEAN CLAY (CL); moist to wet; low plasticity; cohesive; massive; diamicton.
30									EOB at 30 ft bgs. Install monitoring well MW-708B in borehole.
35									
40									

Tracking Codes: 60649127_BLACKHAWK.GPJ, ETSOIL, 12/02/21, 10:14

AECOM

FINAL SOIL BORING LOG

BORING NO. **B-709**

SITE: **Black Hawk County LF** PROJECT NO. **60649127.14** SHEET **1** OF **2**

SITE #: **7-SDP-1-75P**

PHYSICAL SETTING: **Northwest side of property on top of berm**

LOG BY: **R. Henning**

FIRM/DRILLER: **Terracon/S. Zeien**

DRILLING METHOD: **4-1/4 HSA; 3-in x 5-ft CT; 2-in x 2-ft SS to EOB**

WATER LEVEL READINGS

DATE	WATER DEPTH	HOLE DEPTH	CASING DEPTH

ABANDONMENT DATE: **NA**

ABANDONMENT METHOD: **NA**

GROUND SURFACE ELEV: **954.32**

IA State Plane LOCAL COORDINATES:

NORTHING: **3618699.4**

EASTING: **5237139.81**

DATE/TIME STARTED: **09/16/21 ; 1445**

DATE/TIME COMPLETED: **09/16/21 ; 1630**

WELL INSTALLATION: **9/16/2021**

Depth in Feet	SAMPLING DATA B	N	A	% Recovery	No.	T	Graphic Log	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS
0		>30		60	1	CT		CL	QUATERNARY ANTHROPOCENE FILL. hard; dark gray (10 YR 4/1); LEAN CLAY WITH SAND AND GRAVEL (CL); dry; low plasticity; cohesive; massive.
5		18		73	2	CT		CL	very stiff; mottled gray to yellowish brown (10 YR 5/1 to 5/8); LEAN CLAY WITH SAND AND GRAVEL (CL); moist; low plasticity; cohesive; massive; fill.
10		>30		85	3	CT		CL	hard; as above from 10 - 11 ft.
								CL	PRE-ILLINOIAN GLACIAL DIAMICTON (QWT). hard; mottled yellowish brown (10 YR 5/6) to gray (10 YR 6/1) LEAN CLAY WITH SAND AND GRAVEL (CL); moist; low plasticity; cohesive; some plants and roots; original top soil before berm fill; diamicton.
15		4		38	4	CT		SW	soft; bownish yellow (10 YR 6/8); WELL GRADED SAND (SW); wet; non-plastic; noncohesive; bedded; medium to coarse sand composed of quartz and feldspar; glaciofluvial. no sample 17 - 20 ft bgs, bottom of continous sampler became plugged.

Tracking Codes: 60649127_BLACKHAWK.GPJ, ETSOIL, 12/02/21, 10:14

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AECOM

FINAL SOIL BORING LOG

BORING NO. **B-709**

SITE: **Black Hawk County LF** PROJECT NO. **60649127.14** SHEET **2** OF **2**

Depth in Feet	SAMPLING DATA B	N	A	% Recovery	No.	T	Graphic Log	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS
20		28		93	5	CT		CL	very stiff; brownish yellow (10 YR 6/8); SANDY LEAN CLAY (CL); moist to wet; non-plastic; cohesive; massive; diamicton.
25		>30		100	6	CT		CL	PRE-ILLINOIAN GLACIAL DIAMICTON (QAT). hard; mottled gray to very dark gray (10 YR 5/1 to 3/1); LEAN CLAY WITH SAND AND GRAVEL (CL); moist; low plasticity; cohesive; massive; diamicton.
30									EOB at 30 ft bgs. Install monitoring well MW-709B in borehole.
35									
40									

Tracking Codes: 60649127_BLACKHAWK.GPJ, ETSOIL, 12/02/21, 10:14

AECOM

FINAL SOIL BORING LOG

BORING NO. **B-710**

SITE: **Black Hawk County LF** PROJECT NO. **60649127.14** SHEET **1** OF **2**

SITE #: **7-SDP-1-75P**

PHYSICAL SETTING: **Northwest side of property on top of berm**

LOG BY: **R. Henning**

FIRM/DRILLER: **Terracon/S. Zeien**

DRILLING METHOD: **4-1/4 HSA; 3-in x 5-ft CT; 2-in x 2-ft SS to EOB**

WATER LEVEL READINGS

DATE	WATER DEPTH	HOLE DEPTH	CASING DEPTH

ABANDONMENT DATE: **NA**

ABANDONMENT METHOD: **NA**

GROUND SURFACE ELEV: **952.15**

IA State Plane LOCAL COORDINATES:

NORTHING: **3618702.5**

EASTING: **5237477.63**

DATE/TIME STARTED: **09/16/21 ; 1045**

DATE/TIME COMPLETED: **09/16/21 ; 1150**

WELL INSTALLATION: **9/16/2021**

Depth in Feet	SAMPLING DATA B	N	A	% Recovery	No.	T	Graphic Log	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS
0		>30		33	1	CT		CL	QUATERNARY ANTHROPOCENE FILL. hard; grayish brown (10 YR 5/2); LEAN CLAY WITH SAND AND GRAVEL (CL); dry; non-plastic; cohesive; massive; fine sand and fine gravel; fill.
5		23		55	2	CT		CL	very stiff; mottled brownish yellow (10 YR 6/8) to light brownish gray (10 YR 6/2); moist; LEAN CLAY WITH SAND AND GRAVEL (CL); low plasticity; cohesive; massive; fill.
10		12		68	3	CT		CL	stiff; as above from 10 - 14 ft bgs.
								ML	QUATERNARY WISCONSINAN EPISODE LOESS. stiff; black (10 YR 2/1); SILT (ML); moist; non-plastic; noncohesive; bedded; buried top soil; loess.
15		18		95	4	CT		CL	PRE-ILLINOIAN GLACIAL DIAMICTON (QWT). very stiff; mottled brownish yellow to gray (10 YR 6/8 to 6/1); SANDY LEAN CLAY (CL); moist to wet; low plsaticity; cohesive; massive; diamicton.
								SW	very stiff; brownish yellow (10 YR 6/8); WELL GRADED SAND (SW); wet; non-plastic; noncohesive; bedded; glaciofluvial.

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Tracking Codes: 60649127_BLACKHAWK.GPJ, ETSOIL, 12/02/21, 10:14

AECOM

FINAL SOIL BORING LOG

BORING NO. **B-710**

SITE: **Black Hawk County LF** PROJECT NO. **60649127.14** SHEET **2** OF **2**

Depth in Feet	SAMPLING DATA B	N	A	% Recovery	No.	T	Graphic Log	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS
20		12		65	5	CT		SP	stiff; mottled brownish yellow to gray (10 YR 6/8 to 6/1); POORLY GRADED SAND (SP); very fine grained sand; angular; wet; non-plastic; noncohesive; massive; glaciofluvial.
								CL	stiff; very pale brown (10 YR 7/3); LEAN CLAY WITH SAND AND GRAVEL (CL); moist to wet; low plasticity; cohesive; bedded; diamicton.
25									EOB at 25 ft. bgs. Install monitoring well MW-710B in borehole.
30									
35									
40									

Tracking Codes: 60649127_BLACKHAWK.GPJ, ETSOIL, 12/02/21, 10:14

AECOM

FINAL SOIL BORING LOG

BORING NO. **B-711**

SITE: **Black Hawk County LF** PROJECT NO. **60649127.14** SHEET **1** OF **2**

SITE #: **7-SDP-1-75P**

PHYSICAL SETTING: **East side Cell W3, west Neutral Trench adjacent to P101C and P101A**

LOG BY: **R. Henning**

FIRM/DRILLER: **Terracon/S. Zeien**

DRILLING METHOD: **4-1/4 HSA; 3-in x 5-ft CT; 2-in x 2-ft SS to EOB**

WATER LEVEL READINGS

DATE	WATER DEPTH	HOLE DEPTH	CASING DEPTH

ABANDONMENT DATE: **NA**

ABANDONMENT METHOD: **NA**

GROUND SURFACE ELEV: **940.10**

IA State Plane LOCAL COORDINATES:

NORTHING: **3618391.8**

EASTING: **5237815.65**

DATE/TIME STARTED: **09/16/21 ; 1200**

DATE/TIME COMPLETED: **09/16/21 ; 1325**

WELL INSTALLATION: **9/16/2021**

Depth in Feet	SAMPLING DATA B	N	A	% Recovery	No.	T	Graphic Log	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS
0		20		45	1	CT		ML	QUATERNARY ANTHROPOCENE FILL. very stiff; black (10 YR 2/1); SILT (ML); moist; non-plastic; noncohesive; bedded; fill composed of re-worked top soil as part of CELL 3 development on east side by NEUTRAL TRENCH wells P-101A and P-101C.
5		20		77	2	CT		ML	QUATERNARY WISCONSINAN EPISODE LOESS. very stiff; black (10 YR 2/1); SILT ((ML); moist; non-plastic; noncohesive; bedded; buried top soil; loess. 8 - 9 ft bgs; mottled; gray to yellowish brown (10 YR 6/1 to 6/6); SILT (ML); low plasticity; cohesive; bedded; MRU; loess
								SW	very stiff; mottled gray to yellowish brown (10 YR 6/1 to 6/6); WELL GRADED SAND (SW); wet; non-plastic; noncohesive; bedded; glaciofluvial; top of water table.
10		7		83	3	CT		CL	PRE-ILLINOIAN GLACIAL DIAMICTON (QWT). medium; mottled gray to yellowish brown (10 YR 6/1 to 6/6); LEAN CLAY WITH SAND (CL); wet; low plasticity; cohesive; massive; diamicton.
15		>30		55	4	CT		SW	hard; yellowish brown (10 YR 5/8); WELL GRADED SAND (SW); wet; non-plastic; noncohesive; bedded; glaciofluvial.
								CL	PRE-ILLINOIAN GLACIAL DIAMICTON (QAT). hard; dark gray (10 YR 4/1); LEAN CLAY WITH SAND AND GRAVEL (CL); wet; low plasticity; cohesive; massive; diamicton.

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Tracking Codes: 60649127_BLACKHAWK.GPJ, ETSOIL, 12/02/21, 10:14

AECOM

FINAL SOIL BORING LOG

BORING NO. **B-711**

SITE: **Black Hawk County LF** PROJECT NO. **60649127.14** SHEET **2** OF **2**

Depth in Feet	SAMPLING DATA							Graphic Log	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS
	B	N	A	% Recovery		No.	T			
20										EOB at 20 ft bgs. Install monitoring well MW-711B in borehole.
25										
30										
35										
40										

Tracking Codes: 60649127_BLACKHAWK.GPJ, ETSOIL, 12/02/21, 10:14

AECOM

FINAL SOIL BORING LOG

BORING NO. **B-712**

SITE: **Black Hawk County LF** PROJECT NO. **60649127.14** SHEET **1** OF **2**

SITE #: **7-SDP-1-75P**

PHYSICAL SETTING: **East side Cell W3 adjacent to litter fence**

LOG BY: **R. Henning**

FIRM/DRILLER: **Terracon/S. Zeien**

DRILLING METHOD: **4-1/4 HSA; 3-in x 5-ft CT; 2-in x 2-ft SS to EOB**

WATER LEVEL READINGS

DATE	WATER DEPTH	HOLE DEPTH	CASING DEPTH

ABANDONMENT DATE: **NA**

ABANDONMENT METHOD: **NA**

GROUND SURFACE ELEV: **940.41**

IA State Plane LOCAL COORDINATES:

NORTHING: **3618053.7**

EASTING: **5237812.77**

DATE/TIME STARTED: **09/16/21 ; 1330**

DATE/TIME COMPLETED: **09/16/21 ; 1440**

WELL INSTALLATION: **9/16/2021**

Depth in Feet	SAMPLING DATA B	N	A	% Recovery	No.	T	Graphic Log	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS
0		>30		88	1	CT		CL	QUATERNARY ANTHROPOCENE FILL. hard; dark grayish brown (10 YR 4/2); LEAN CLAY WITH SAND AND GRAVEL (CL); dry; non-plastic; noncohesive; massive; fill.
5		>30		48	2	CT		CL	hard; dark gray (10 YR 4/1); LEAN CLAY WITH GRAVEL (CL); moist; low plasticity; cohesive; massive; fill.
10		22		62	3	CT		ML	QUATERNARY WISCONSINAN EPISODE LOESS. very stiff; black (10 YR 2/1); SILT (ML); moist; non-plastic; cohesive; massive; buried top soil prior to landfill construction; loess. from 12 - 15 ft; mottled gray to yellowish brown (10 YR 6/1 to 5/8); SILT (ML); wet; low plasticity; cohesive; massive; loess; top of water table.
15		>30		88	4	CT		SW	medium; yellowish brown (10 YR 5/6); WELL GRADED SAND (SW); wet; non-plastic; noncohesive; glaciofluvial.
								CL	PRE-ILLINOIAN GLACIAL DIAMICTON (QWT). medium; brownish yellow (10 YR 6/8); LEAN CLAY WITH SAND AND GRAVEL (CL); wet; low plasticity; cohesive; massive; diamicton.
								CL	PRE-ILLINOIAN GLACIAL DIAMICTON (QAT). hard; very dark gray (10 YR 3/1); LEAN CLAY WITH SAND (CL); wet; low plasticity; cohesive; massive; diamicton.

Tracking Codes: 60649127_BLACKHAWK.GPJ, ETSOIL, 12/02/21, 10:14

AECOM

FINAL SOIL BORING LOG

BORING NO. **B-712**

SITE: **Black Hawk County LF** PROJECT NO. **60649127.14** SHEET **2** OF **2**

Depth in Feet	SAMPLING DATA							Graphic Log	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS
	B	N	A	% Recovery		No.	T			
20										EOB at 20 ft. bgs. Install monitoring well MW-712B in borehole.
25										
30										
35										
40										

Tracking Codes: 60649127_BLACKHAWK.GPJ, ETSOIL, 12/02/21, 10:14

Sheet ___ Of ___

AECOM

FIELD BORING LOG

BORING NO B214CR

SITE: BLACK HAWK CO LF PROJECT NO: 60674663.14

WATER LEVEL READINGS

DATE/ TIME	WATER DEPTH	HOLE DEPTH	CASING DEPTH

DRILLING METHOD: 3¼ HSA to top of bedrock

LOG BY: R. Henning

FIRM/DRILLER: Terracon - Scott Fein

PHYSICAL SETTING: East side cell X adjacent to OW214BR

ABANDONMENT DATE: ____

ABANDONMENT METHOD: ____

GROUND SURFACE ELEV: ____

COORDINATE TYPE: ____

NORTH: ____

EAST: ____

DATE/TIME START: 12/14/22 0800

DATE/TIME COMPLETE: ____

WELL INSTALLATION DATE: ____

DEPTH IN FEET	SAMPLING DATA (B N A R NO T)	GRAPHIC LOG	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS
				Blind drill from 0 — 84.5 ft bgs
				Install 6-in outer casing for rock core to top of bedrock
				Top of bedrock at 84.5 ft bgs
				Refer to B214 boring log for lithology above bedrock
70				
80				
90				

715 WAS A Bar
white ranch
before HWY 21

Sheet 1 of ___

FIELD ROCK CORE LOG

AECOM

SITE: BLACK HAWK CO LF

PROJECT NO.: 60674663.14

BORING NO.: B214CR

WATER LEVEL READINGS

DATE	WATER	HOLE	CASING
12:54	86.04	106.5	110

DRILLING RIG: CME

CORE BARREL/BIT: NQ2

CASING USED: 6-in SCH40 PVC top of rock

LOGGED BY: R. Henning

FIRM/DRILLER: Terracon - Scott Zein

PHYSICAL SETTING: East Cell X, adjacent to OW214BR

ABANDONMENT DATE:

ABANDONMENT METHOD:

GROUND SURFACE ELEV.:

COORDINATE TYPE:

NORTH:

EAST:

DATE/TIME START: 12/14/22 0800

DATE/TIME COMPLETE: 12/16/22 1230

WELL INSTALLATION DATE: 12/16/22

DEPTH IN METER	METHOD	RUN NO.	LENGTH	% RECOVERY	FPM	% WATER GAIN/LOSS (LITER)	% ROD	FRAC./FT	GRAPHICS	ROCK TYPE CODE	ROCK DESCRIPTION	COMMENTS
80											Blind drill 0-84.5 ft; set 6-in SCH 40 PVC casing for rock coring. Refer to B214 log (MAXIM 1998) for glacial sediment above bedrock	
84.5	NQ2	NO. 1	5.5 ft	94%	0.25 ft/min	Lost water at 88 ft bgs	71.2%			DL	DEVONIAN CEDAR VALLEY GROUP: DOLOMITE; mottled very pale orange (10YR 8/2) to dark yellowish orange (10YR 6/6); weathered/stained; strong; microcrystalline; massive; moderately decomposed; moderately disintegrated; moderately fractured; conformable; pitted; some infilled vugs fossiliferous w/ shell fragments replaced by quartz	RUN #1 84.5-90 ft 5.5 ft run 5.15/5.5 = 94% 1.75+0.7+0.15+0.8+0.6+0.8 = 4.8/5.5 = 87.3% 5+11+8+6+7+10 = 47 47/66 = 71.2%
90	NQ2	NO. 2	6.5 ft	91%	0.25 ft/min	no water return	74.4%			DL	DOLOMITE; very pale orange (10YR 8/2) to dark yellowish orange (10YR 6/6) on solution/fractures staining; strong; microcrystalline, massive; slightly decomposed; slightly disintegrated; moderately fractured; conformable; some chert;	RUN #2 90-96.5 6.5 ft run 5.9/6.5 = 91% 1.6+0.9+0.7+0.35+0.6+0.5+0.5+0.4 = 5.55 = 85.4% 5+6+5+11+8+7+6+5+5 = 58/78 = 74.4%
95	NQ2	NO 3	10 ft	97%	0.25 ft/min	no return				DL	DOLOMITE; very pale orange (10YR 8/2) to dark yellowish orange (10YR 6/6) on fractures staining; strong; microcrystalline; massive; slightly decomposed; slightly disintegrated; moderately fractured; conformable	RUN #3 96.5-106.5 10 ft run 5.8+1.9+2 = 9.7/10 97% 1.75+1.55+1.9+1.5+1.95 = 8.65/10 87%
00												

FIELD ROCK CORE LOG

AECOM

SITE: Black Hawk Co LF PROJECT NO.: 60674663.14 BORING NO.: BD14CR

DEPTH IN FEET	CORING DATA: METHOD	RUN NO.	LENGTH	% RECOVERY	MPF	% WATER GAIN/LOSS (GAL)	% ROD	FRAC./FT	GRAPHICS	ROCK TYPE CODE	ROCK DESCRIPTION	COMMENTS
100										DL		Run #3 96.5 - 106.5
												7.5+4+6.5+4.5+4+
												4+15+4.5+5.5+4+6+
												+5+11 = 81.5/120
												= 68%
	NQ2											
	No. 3										Large chert nodules at 103' and 104 ft bgs	
		10 ft	97%	0.25 gpm/min	all water lost	68%						
105												
106.5												
110											EOB at 106.5 ft bgs; ream borehole w/ 6-in tricone bit for well BD14CR	
115												

AECOM

PIEZOMETER INSTALLATION DIAGRAM

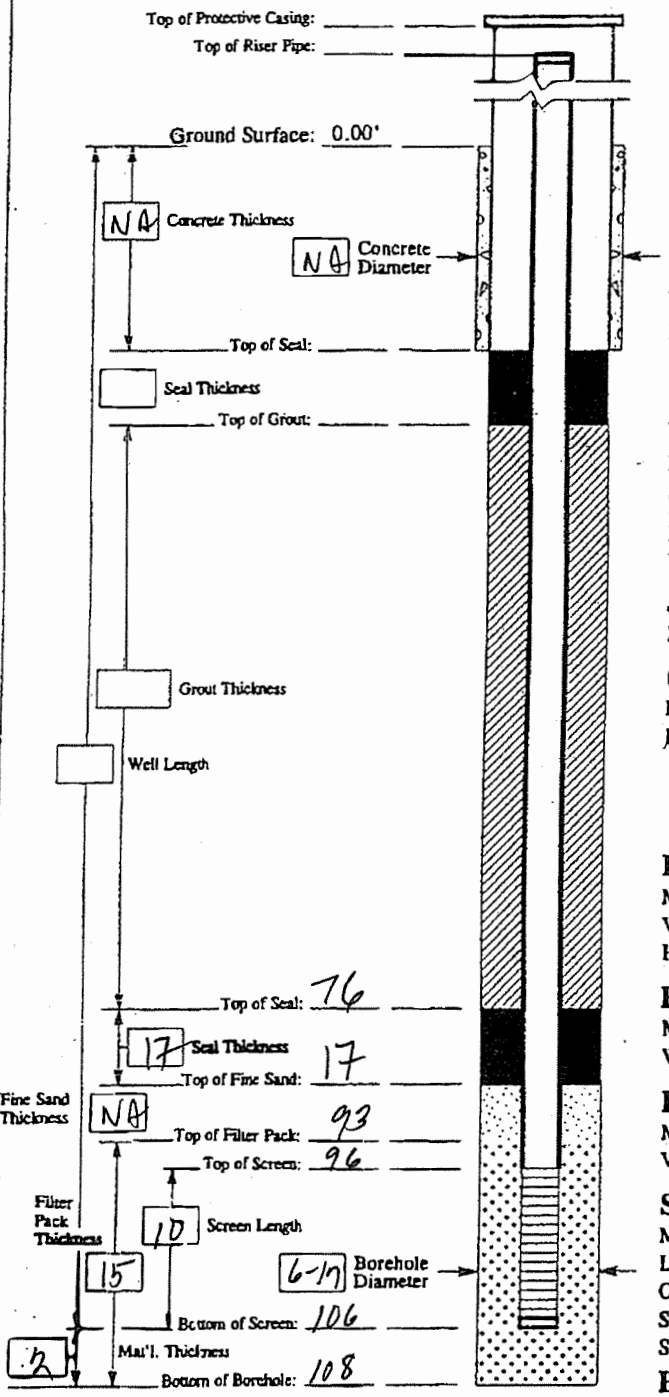
Site Name: BLACK HAWK CO. LF Project No. 60674663.14 Well No. P214CR

Northing: _____ Easting: _____ Surf.Elev. _____ Ref. Boring No. B214CR

Drilling Contractor: Terracon Drilling Dates: 12/14/22 - 12/16/22

Driller: Scott Zein Inspected By: R. Henning Well Completion Date: 12/16/22

Drilling Method: 3 1/4 HSA to bedrock; NQ Core; 6-in tricone EOB Drilling Fluids (type): City water



Protective Casing
Type: Black Coated Steel Vented (Y/N): _____
Dia.(in): 4-in sq. Locked (Y/N): _____
Length: 7-ft Key No.: _____

Cap or Plug Type: PVC J-plug Vented (Y/N): _____

Concrete Collar
Manufacturer: NA
Volumes: _____ Lbs. of Cement
+ _____ Gal. of Water
= _____ Gal. total Volume

Upper Seal Type: 3/8" Hole plug
Manufacturer: _____
Volume (Gal.) _____
Hydration: Volume Water: _____ Time: _____

Well Casing Type: PVC
Manufacturer: Johnson Well
Schedule: 80
Length per Section: 10 Casing O.D./I.D. _____
No. of Sections: 10 Total Length: _____

Joints Flush Threaded ☒ Taped ☐ Welded ☐ O-Ring ☒
Manufacturer: Johnson Well

Grout Type: _____
Manufacturer: _____
Final Volumes: _____ Lbs. of _____
+ _____ Lbs. of _____
+ _____ Gal. of Water
= _____ Gal. total Volume

Lower Seal Type: 3/8-in Hole plug
Manufacturer: BAROID
Volume (Gal.) _____
Hydration: Volume Water _____ Time: _____

Fine Sand Type: NA
Manufacturer: _____
Volume (Gal.) _____

Filter Pack Type: Coarse Sand
Manufacturer: BMC Aggregates
Volume (Gal.) _____

Screen Type: PVC Sch: 80
Manufacturer: Johnson Well
Length/Sec. 10-ft No of Sec. 1
O.D. _____ I.D. _____
Slot Size: No. 10 No. Slots/ft. _____
Slotted Length: 10-ft

Bottom Cap or Plug Type: PVC Length: 0.3 ft

Water Source City of Cedar Falls, IA

NOTES: Borehole reamed to 6-in diameter to 108 ft bgs

Tracking Codes: &prjid&, PIEZOFF, 12/15/97, 10:42

Sheet 1 Of ____

AECOM

FIELD BORING LOG

BORING NO B215CR

SITE: BLACK HAWK CO LF PROJECT NO: 60674663.14

WATER LEVEL READINGS

DATE/ TIME	WATER DEPTH	HOLE DEPTH	CASING DEPTH
12/16/22 0825	104.03	121	120 (SCH 80 PVC)

DRILLING METHOD: 3 1/4 HSA to top of competent bedrock

LOG BY: R. Henning

FIRM/DRILLER: Terracon - Scott Zein

PHYSICAL SETTING: ____

ABANDONMENT DATE: ____

ABANDONMENT METHOD: ____

GROUND SURFACE ELEV: ____

COORDINATE TYPE: ____

NORTH: ____

EAST: ____

DATE/TIME START: 12/13/22 1150

DATE/TIME COMPLETE: 12/16/22 0800

WELL INSTALLATION DATE: 12/16/22

DEPTH IN FEET	SAMPLING DATA B	N	A	R	NO	T	GRAPHIC LOG	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS
									Blind drill from 0 - 90.5 ft
									Top of weathered bedrock 89 ft bgs
									Top of competent bedrock 90.5 ft bgs
									Refer to MAXIM B215 boring log for description of glacial sediments above bedrock
20									
40									
60									
80									

FIELD ROCK CORE LOG

AECOM

SITE: BLACK HAWK CO LF PROJECT NO.: 60674663.14 BORING NO.: B215CR

WATER LEVEL READINGS

	DATE	WATER	HOLE	CASING

GROUND SURFACE ELEV.: ___
COORDINATE TYPE: ___
NORTH: ___
EAST: ___

DRILLING RIG: CME
CORE BARREL/BIT: NQ2
CASING USED: 6-in PVC top of bedrock
LOGGED BY: R. Henning
FIRM/DRILLER: Terracon - Schlein
PHYSICAL SETTING: East of Cell X adjacent to OW215BR
ABANDONMENT DATE: ___
ABANDONMENT METHOD: ___
DATE/TIME START: 12/13/22 1150
DATE/TIME COMPLETE: ___
WELL INSTALLATION DATE: ___

DEPTH IN METER	CORING DATA: METHOD	RUN NO.	LENGTH	% RECOVERY	FPM	% WATER GAIN/LOSS (LITER)	% ROD	FRAC./FT	GRAPHICS	ROCK TYPE CODE	ROCK DESCRIPTION	COMMENTS
90											DEVONIAN CEDAR VALLEY GROUP	RUN #1 – 5 ft
90.5	NQ2	No. 1	5ft	52%		Water return	19.2%				DOLOMITE; very pale orange (10YR 8/2) with dark yellowish orange (10YR 6/6) staining on fractures; strong; micro crystalline, massive; slightly decomposed; moderately disintegrated; intensely fractured; conformable	90.5 – 95.5 ft 2.6/5 = 52% 1.65/5 = 33% 11.5/60 = 19.2%
95												
95.5	NQ2	No. 2	5ft	66%			22%				DOLOMITE w/CHERT; very pale orange (10YR 8/2); staining on fractures (10YR 6/6) dark yellowish orange; strong, micro crystalline massive, slightly decomposed moderately disintegrated; intensely fractured conformable vugs within filled dolomite crystals, chert nodules; appears to have solution features	RUN #2 – 5 ft 95.5 – 100.5 ft 33/5 = 66% 2.4/5 = 48% 13/60 = 22%
00												
05	NQ2	No. 3	10ft	94%		Water return	80%				DOLOMITE w/chert; filled vugs, pitted; very pale orange (10YR 8/2); staining on fractures; dark yellowish orange (10YR 6/6); ~~stain~~ strong; micro crystalline; massive, slightly decomposed; moderately disintegrated; intensely fractured conformable; fractures with clay infilling	RUN #3 – 10 ft 100.5 – 110.5 ft 3.9+1.85+1.85+0.55+1.45 = 8.6/10 = 86% 1.3+1.6+0.85+0.5+1.25 +0.3+0.85+0.3+0.4+0.7 +0.4+0.95 = 9.4/10 = 94% 5+9+18+10.5+7+15+ 7+8+5+11.5 = 96/120 = 80%
10												

FIELD ROCK CORE LOG

AECOM

SITE: BLACK HAWK CO LF PROJECT NO.: 60674663.14 BORING NO.: B215CR

DEPTH IN FEET	CORING DATA: METHOD	RUN NO.	LENGTH	% RECOVERY	MPF	% WATER GAIN/LOSS (GAL)	% ROD	FRAC./FT	GRAPHICS	ROCK TYPE CODE	ROCK DESCRIPTION	COMMENTS
110												
											DOLOMITE; very pale orange (10YR 8/2) with dark yellowish orange staining (10YR 6/6) on fractures; strong; micro crystalline; massive; moderately decomposed; moderately disintegrated; intensely fractured; anfracmable; pitted; extremely narrow fractures; partly healed; some clay infilling	RUN #4 - 110.5 - 120.5 6.8/10 = 68% 1.5+1.3+1.9+1.1 = 5.8/10 = 58% 6.5+11.5+5.5+6+9+4.5+6 = 49/120 = 41%
115	NQ2	10 ft	10.4	68%		no water loss	41%					
120											EOB at 120.5 ft bgs; ream borehole with 6-in rotary tricone bit for piezometer installation	
25												
30												

Old top of sand 105 ft Ott 22

DTW 104.05 from GS
DTB 122.28 from GS

933.05 - 929.75 = 3.3 Δ GS
121.3

AECOM

PIEZOMETER INSTALLATION DIAGRAM

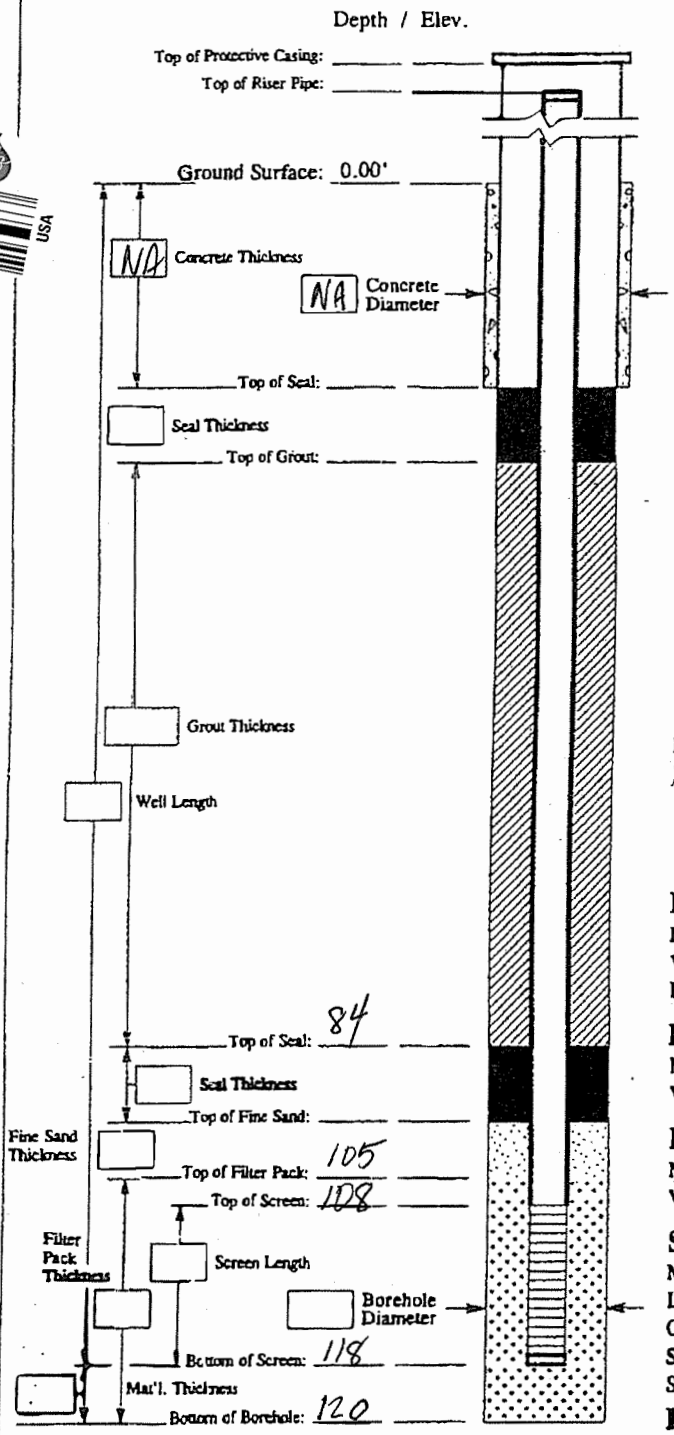
Site Name: BLACK HAWK CO LF Project No. 60674663.14 Well No. P215CR

Northing: _____ Easting: _____ Surf.Elev. _____ Ref. Boring No. B215CR

Drilling Contractor: Terracon Drilling Dates: 12/13/22 - 12/15/22

Driller: Scott Zein Inspected By: R. Henning Well Completion Date: _____

Drilling Method: 3 1/4 HSA to bedrock; NQ2 core; 6-in tricone Drilling Fluids (type): City water



Protective Casing

Type: Black coated Steel Vented (Y/N): _____

Dia.(in): 4-in sq. Locked (Y/N): _____

Length: 7-ft Key No.: _____

Cap or Plug

Type: PVC J-plug Vented (Y/N): _____

Concrete Collar

Manufacturer: _____

Volumes: NA Lbs. of Cement

\+ _____ Gal. of Water

= _____ Gal. total Volume

Upper Seal

Type: _____

Manufacturer: _____

Volume (Gal.) _____

Hydration: Volume Water: _____ Time: _____

Well Casing

Type: _____

Manufacturer: _____

Schedule: _____

Length per Section: _____ Casing O.D./I.D. _____

No. of Sections: _____ Total Length: _____

Joints

Flush Threaded ☐ Taped ☐ Welded ☐ O-Ring ☐

Manufacturer: _____

Grout

Type: _____

Manufacturer: _____

Final Volumes: _____ Lbs. of _____

\+ _____ Lbs. of _____

\+ _____ Gal. of Water

= _____ Gal. total Volume

Lower Seal

Type: _____

Manufacturer: _____

Volume (Gal.) _____

Hydration: Volume Water _____ Time: _____

Fine Sand

Type: _____

Manufacturer: _____

Volume (Gal.) _____

Filter Pack

Type: _____

Manufacturer: _____

Volume (Gal.) _____

Screen

Type: _____ Sch: _____

Manufacturer: _____

Length/Sec. _____ No of Sec. _____

O.D. _____ I.D. _____

Slot Size: _____ No. Slots/ft. _____

Slotted Length: _____

Bottom Cap or Plug

Type: _____ Length: _____

Water Source

NOTES: DTW 104.03 12/16/22 0825 in well casing before finishing well
sealed bentonite into 6-in PVC outer casing

Tracking Codes: &prjid&, PIEZOFF, 12/15/97, 16:42

4128 USA

Sheet ___ Of ___

AECOM

FIELD BORING LOG

BORING NO B216CR

SITE: BLACK HAWK CO LF PROJECT NO: 60674663.14

WATER LEVEL READINGS

DATE/ TIME	WATER DEPTH	HOLE DEPTH	CASING DEPTH

DRILLING METHOD: 3 1/4 HSA to top of bedrock

LOG BY: R. Henning

FIRM/DRILLER: Terracon - Scott Zein

PHYSICAL SETTING: East of Cell X adjacent to OW216BR

GROUND SURFACE ELEV: ___

COORDINATE TYPE: ___

NORTH: ___

EAST: ___

DATE/TIME START: 12/12/22 1040

DATE/TIME COMPLETE: 12/12/22 1040

ABANDONMENT DATE: ___

ABANDONMENT METHOD: ___

WELL INSTALLATION DATE: ___

DEPTH IN FEET	SAMPLING DATA B	N	A	R	NO	T	GRAPHIC LOG	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS
									Blind drill to top of bedrock; refer to B216 boring log for lithology to top of bedrock
20									
40									
60									Top of bedrock at 108.5 ft bgs
80									

FIELD ROCK CORE LOG

AECOM

SITE: BLACK HAWK CO. LF

PROJECT NO.: 60674663.14

BORING NO.: B216CR

WATER LEVEL READINGS 133.7

DATE	WATER	HOLE	CASING
12/15/22	110.8	133.7	108.5

DRILLING RIG: CME

CORE BARREL/BIT: NQ2

CASING USED: 6-in PVC SCH40

LOGGED BY: R. Henning

FIRM/DRILLER: Terracon - Scott Zein

PHYSICAL SETTING: East of Cell X adjacent to OW216BR

ABANDONMENT DATE: NA

ABANDONMENT METHOD: NA

GROUND SURFACE ELEV.:

COORDINATE TYPE:

NORTH:

EAST:

DATE/TIME START: 12/12/2022 1045

DATE/TIME COMPLETE: 12/14/2022 1630

WELL INSTALLATION DATE: 12/15/2022

DEPTH IN ~~METER~~ Feet	CORING DATA: METHOD	RUN NO.	LENGTH	% RECOVERY	MPI or RQD	% WATER GAIN/LOSS (LITER)	% ROD	FRAC. or FT	GRAPHICS	ROCK TYPE CODE	ROCK DESCRIPTION	COMMENTS
0											Blind drill 0-108.5 ft to top of bedrock; 6-in SCH40 PVC installed/grouted in borehole above bedrock	
5	NQ2	1	5ft 4.6/5.0 ft			all water to formation	59.2%			DL	Very pale orange (10YR 8/2) DEVONIAN CEDAR VALLEY GROUP: DOLOMITE; strong; microcrystalline; massive; slightly decomposed; moderately disintegrated, pitted w/ some chert infilling intensely fractured; conformable, some mineralization (chert);	RUN #1 - 5 ft 3.85/5.0 = 0.77 ~ 77% 0.4 + 1 + 1.5 + 4.5 + 1 + 8 + 4.5 + 4.5 + 4 = 35.5/60 = 59.2%
10												
15	NQ2	2	6ft 5.8/6.0 ft			Bearing @ 10 gpm	71.3%			DL	very pale orange (10YR 8/2) DOLOMITE; strong; microcrystalline massive; slightly decomposed; moderately disintegrated, fractured intensely; conformable; some mineralization; dolomite crystal infilled 3-in void; vug. dark yellowish orange (10YR 6/6) staining on fractures	RUN #2 - 6 ft 4.8/72 = 80% 4.5 + 6 + 5 + 5 + 8 + 5 + 4 + 4 + 9.5 = 51.3/72 = 71.3%
20												
25	NQ2	3	8.2 ft 7.7/8.2 ft = 94%				50%			DL	very pale orange (10 YR/8/2) DOLOMITE w/ chert nodules; strong, micro crystalline; massive; slightly decomposed; moderately disintegrated, intensely fractured; conformable. some mineralization - chert nodules, dark yellowish orange (10 YR 6/6) staining on fractures; some vugs	RUN #3 8.2 ft 5.8/8.2 = 70% 5 + 7 + 5 + 5 + 5.5 + 4.5 + 10 + 6.5 = 48.5/98.4 = 50%

FIELD ROCK CORE LOG

AECOM

SITE: Black Hawk CO LF PROJECT NO.: 60674663.14 BORING NO.: B216CR

DEPTH IN FEET	CORING DATA: METHOD	RUN NO.	LENGTH	% RECOVERY	MPF	WATER GAIN/LOSS (GAL)	% ROD	FRAC./FT	GRAPHICS	ROCK TYPE CODE	ROCK DESCRIPTION	COMMENTS
125												
127.7						no return all day						
	NQ2	4		94%			31.3%			DL	very pale orange (10YR 8/2); DOLOMITE; STRONG; microcrystalline, massive, moderately decomposed; intensely disintegrated very intensely fractured; comfortable; mineralization with chert nodules; some very disintegrated sections; porous; dark yellowish orange (10YR 6/6) staining on fractures / distinctive features	RUN #4 3.2 ft 3.0/3.2 = 94% 1.5/3.2 = 47% 4+8 = 12 12/38.4 = 31.3%
130												
	NQ2	5		93%			12%					RUN #5 2.8 ft bottom = 133.7 ft bgs 2.6/2.8 ft = 93% 1.5/2.8 ft = 54% 4/33.6 = 12%
133.7											EOB at 133.7 ft bgs: ream bore hole with 6-in tricone bit to install piezometer P216CR in bore hole	
135												

AECOM

PIEZOMETER INSTALLATION DIAGRAM

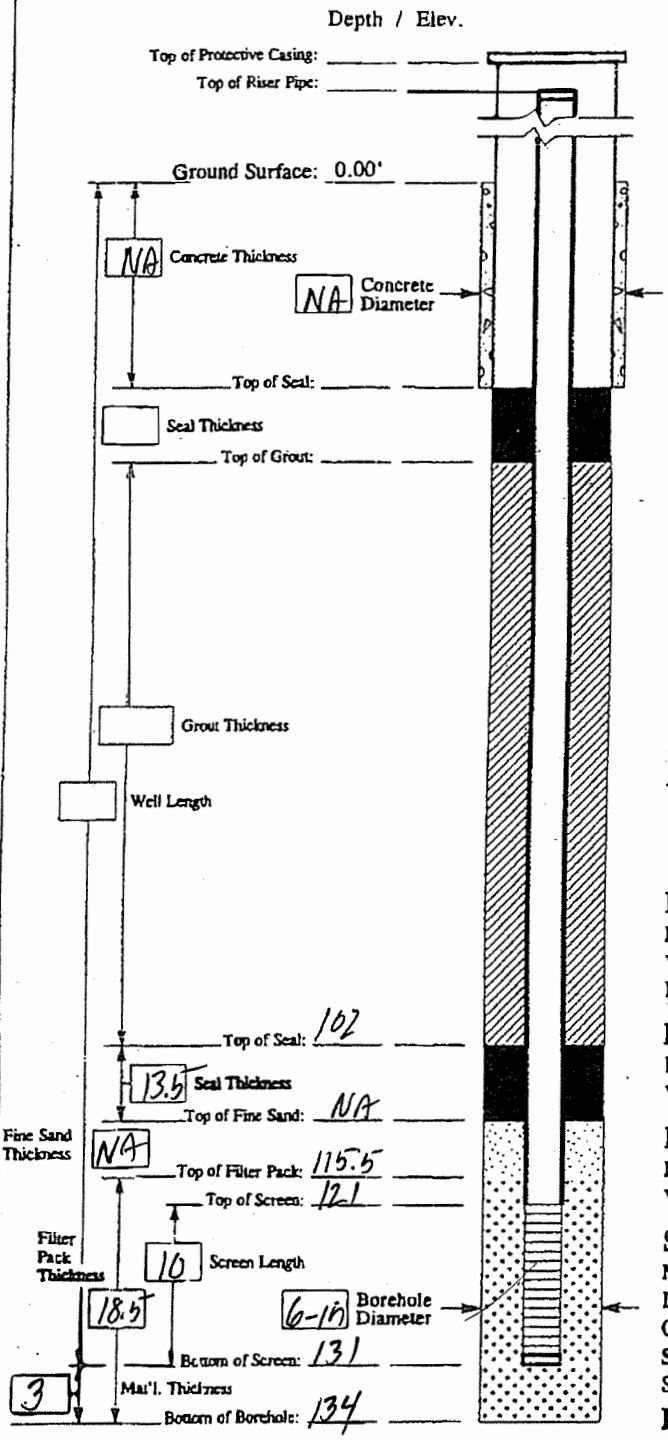
Site Name: BLACK HAWK CO LF Project No. 60674663.14 Well No. P216CR

Northing: _____ Easting: _____ Surf.Elev. _____ Ref. Boring No. B216CR

Drilling Contractor: Terracon Drilling Dates: 12/12/22 - 12/15/22

Driller: Terracon - Scott Inspected By: R. Henning Well Completion Date: 12/15/22

Drilling Method: 3 1/4 HSA to top of bedrock; NQ core, 6-in tricone Drilling Fluids (type): City Water



Protective Casing
Type: Black Steel Vented (Y/N): _____
Dia.(in): 4-in Sq. Locked (Y/N): _____
Length: 7-ft Key No.: _____

Cap or Plug Type: PVC J-plug Vented (Y/N): _____

Concrete Collar
Manufacturer: NA
Volumes: _____ Lbs. of Cement
+ _____ Gal. of Water
= _____ Gal. total Volume

Upper Seal Type: 3/8-in Hole plug
Manufacturer: Baroid
Volume (Gal.) NA
Hydration: Volume Water: _____ Time: _____

Well Casing Type: PVC
Manufacturer: Johnson Screen
Schedule: 80
Length per Section: 10-ft Casing O.D./I.D. _____
No. of Sections: _____ Total Length: _____

Joints Flush Threaded ☒ Taped ☐ Welded ☐ O-Ring ☒
Manufacturer: Johnson Well

Grout Type: _____
Manufacturer: _____
Final Volumes: _____ Lbs. of _____
+ _____ Lbs. of _____
+ _____ Gal. of Water
= _____ Gal. total Volume

Lower Seal Type: 3/8-in Hole plug
Manufacturer: Baroid
Volume (Gal.) _____
Hydration: Volume Water _____ Time: _____

Fine Sand Type: _____
Manufacturer: NA
Volume (Gal.) _____

Filter Pack Type: Industrial SAND Coarse Grade
Manufacturer: BMC Aggregates
Volume (Gal.) _____

Screen Type: PVC Sch: 80
Manufacturer: Johnson Well
Length/Sec. 10 ft No of Sec. 1
O.D. _____ I.D. _____
Slot Size: No. 10 No. Slots/ft. _____
Slotted Length: 10 ft

Bottom Cap or Plug Type: _____ Length: _____

Water Source _____

NOTES: 12/15/2022 10:00 start well construction; bore hole reamed to 6-in with tri-cone bit and wash rotary

Tracking Codes: &pfjids, PIEZOFF, 12/15/97, 16:42

Sheet ___ Of ___

AECOM

FIELD BORING LOG

BORING NO B-214BR

SITE: BLACK HAWK CO LF PROJECT NO: 60674663

WATER LEVEL READINGS

DATE/ TIME	WATER DEPTH	HOLE DEPTH	CASING DEPTH

DRILLING METHOD: 4 1/4 HSA; 2-in x 2-ft SS continuous to EOB

LOG BY: R. Henning

FIRM/DRILLER: Scott Zein

PHYSICAL SETTING: offset from OW-214B on east side of Cell X

ABANDONMENT DATE:

ABANDONMENT METHOD:

GROUND SURFACE ELEV:

COORDINATE TYPE:

NORTH:

EAST:

DATE/TIME START: 11/2/22 0820

DATE/TIME COMPLETE: 11/2/22 0900

WELL INSTALLATION DATE: 11/2/22

DEPTH IN FEET	SAMPLING DATA B	N	A	R	NO	T	GRAPHIC LOG	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS	
	3				1	SS		CL	STIFF; yellowish brown (10YR 5/6); LEAN CLAY (CL) dry; Nonplastic, cohesive, FILL; bedded	1.6/2
	4	10								
	6									
	7									
2	7				2	SS		CL	VERY STIFF; brown (10YR 4/3); LEAN CLAY (CL) with gravel; dry, nonplastic, cohesive, bedded FILL	1.6/2
	6	23								
	17									
4	12									
	3				3	SS		CL	MEDIUM; brownish yellow (10YR 6/8) LEAN CLAY with sand and gravel (CL); moist, low plasticity, cohesive, massive, diamicton (QWT)	2.0/2
	4	8								
	4									
	5									
6	3				4	SS		CL	MEDIUM; yellowish brown (10YR 5/6) LEAN CLAY (CL) with POORLY GRADED SAND (SP) seams; moist to wet, low plasticity, cohesive, ~~massive~~ bedded, diamicton (QWT)	2.0/2
	3	6								
	3									
8	4									
	3				5	SS		CL	STIFF; yellowish brown (10YR 5/6); GRAVELLY LEAN CLAY (CL); moist to wet; low plasticity, cohesive, massive, diamicton (QWT)	2.0/2
	4	10								
	6									
	7									
10	8				6	SS		CL	VERY STIFF; mottled yellowish brown (10YR 6/8) to gray (10YR 6/1); SANDY LEAN CLAY (CL) moist to wet, low plasticity, cohesive, massive, diamicton (QWT)	2.0/2
	10	20								
	10									
12	14									
	5				7	SS		CL	VERY STIFF; as above with sand and silt seams	2.0/2
	9	20								
	11									
14	16									
	5				8	SS		CL	VERY STIFF; mottled yellowish brown (10YR 6/8) to gray	2.0/2
	11	26						SW	SANDY LEAN CLAY (CL) with WELL GRADED SAND (SW)	
15	15							SC	and CLAYEY SAND (SC) seams, wet, low plasticity	
	16							CL	cohesive, bedded diamicton (QWT)	
16	7				9	SS		CL	VERY STIFF; dark gray (10YR 4/1); GRAVELLY LEAN CLAY (CL) moist to wet, low plasticity, cohesive,	2.0/2
	12	24								
	12								massive, diamicton (QAT) QAT; jointed, small	
18	18								gravel clasts.	
	8				10	SS		CL	HARD; as above with joints yellowish brown (10YR 5/8), diamicton (QAT)	2.0/2
	13	33								
	20									
20	22									

EOB at 20 ft bgs; install OW-214BR

AECOM

PIEZOMETER INSTALLATION DIAGRAM

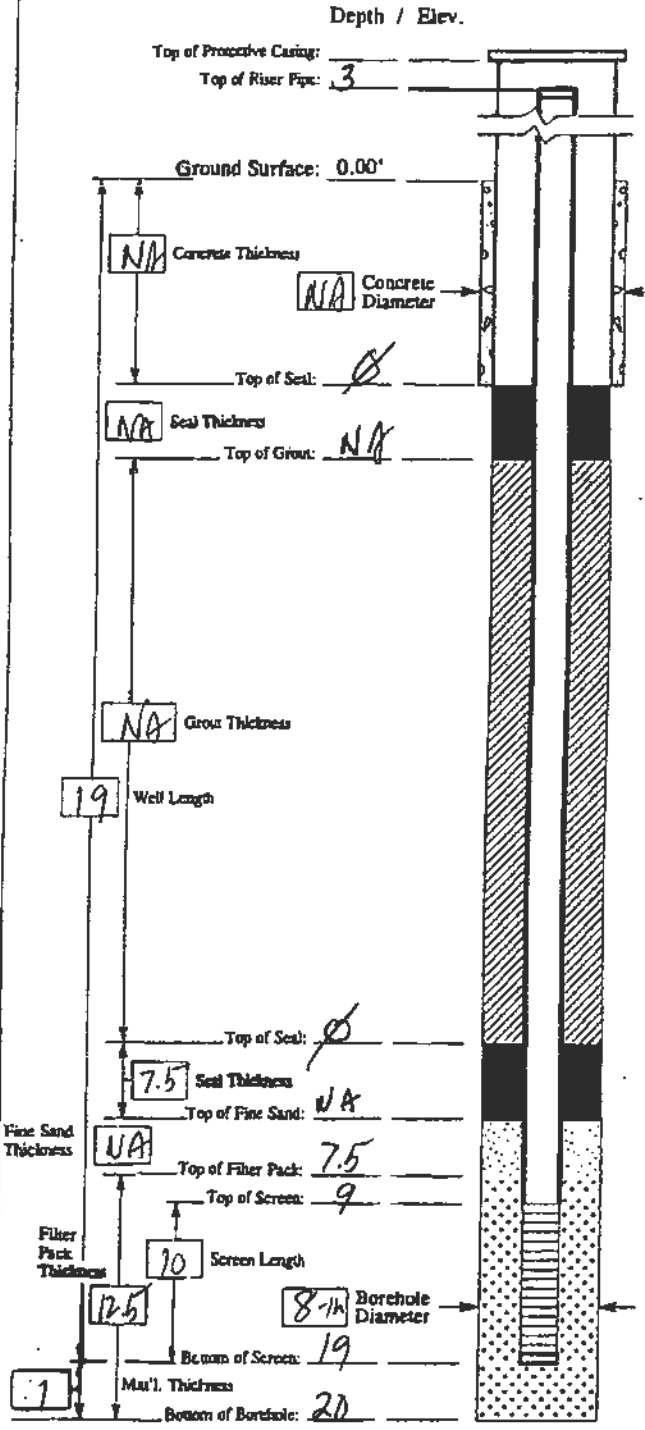
Site Name: BLACK HAWK CO. LF Project No. 60674663 Well No. OW214BR

Northing: _____ Easting: _____ Surf.Elev. _____ Ref. Boring No. B214BR

Drilling Contractor: TERRACON Drilling Dates: 11/2/2022

Driller: Scott Zein Inspected By: R. Henning Well Completion Date: 11/2/2022 0920

Drilling Method: 4 1/4 HSA; 2-in x 2-ft SS to EOB Drilling Fluids (type): NONE



Protective Casing
Type: Steel; black paint Vented (Y/N): _____
Dia.(in): 4-in sq. Locked (Y/N): _____
Length: 7-ft Key No.: _____

Cap or Plug Type: PVC J-plug Vented (Y/N): _____

Concrete Collar
Manufacturer: NA
Volumes: _____ Lbs. of Cement
+ _____ Gal. of Water
= _____ Gal. total Volume

Upper Seal Type: _____
Manufacturer: AS BELOW
Volume (Gal.) _____
Hydration: Volume Water: _____ Time: _____

Well Casing Type: PVC
Manufacturer: _____
Schedule: 40
Length per Section: 10-ft Casing O.D./I.D. _____
No. of Sections: _____ Total Length: 13-ft

Joints Flush Threaded ☒ Taped ☐ Welded ☐ O-Ring ☒
Manufacturer: JOHNSON SCREEN

Grout Type: _____
Manufacturer: NA
Final Volumes: _____ Lbs. of _____
+ _____ Lbs. of _____
+ _____ Gal. of Water
= _____ Gal. total Volume

Lower Seal Type: 3/8-in HOLEPLUG
Manufacturer: BAROID
Volume (Gal.) _____
Hydration: Volume Water _____ Time: _____

Fine Sand Type: _____
Manufacturer: NA
Volume (Gal.) _____

Filter Pack Type: COARSE SAND
Manufacturer: BMC Aggregates
Volume (Gal.) _____

Screen Type: PVC Sch: 40
Manufacturer: JOHNSON SCREEN
Length/Sec. 10-ft No of Sec. 1
O.D. _____ I.D. _____
Slot Size: 10 No. Slots/ft. _____
Slotted Length: _____

Bottom Cap or Plug Type: PVC Length: 0.3-ft

Water Source NONE

NOTES: _____

Tracking Codes: &pr.jsb, PIEZOFF, 12/15/97, 10:42

Sheet 1 Of 1

AECOM

FIELD BORING LOG

BORING NO B-215BR

SITE: BLACK HAWK CO LF

PROJECT NO: 60674663

DRILLING METHOD: 4 1/4 HSA; 2-in x 2-ft SS continuous to EOB

LOG BY: R. Henning

FIRM/DRILLER: Scott Zein - Terracon

PHYSICAL SETTING: Adjacent

ABANDONMENT DATE: NA

ABANDONMENT METHOD: NA

WATER LEVEL READINGS

DATE/ TIME	WATER DEPTH	HOLE DEPTH	CASING DEPTH

GROUND SURFACE ELEV:

COORDINATE TYPE:

NORTH:

EAST:

DATE/TIME START: 11/2/2022 09

DATE/TIME COMPLETE: 11/2/2022 11

WELL INSTALLATION DATE: 11/2/2022

DEPTH IN FEET	SAMPLING DATA B	N	A	R	NO	T	GRAPHIC LOG	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS	
	5				1	SS		CL	STIFF; dark grayish brown (10 YR 4/2); LEAN CLAY (CL); dry, non plastic, cohesive, bedded; FILL with few gravel	1.5/2
	7	15								
	8									
2	7									
	5				2	SS		CL	STIFF; as above, FILL	2.0/2.
	6	11								
	5									
4	6									
	4				3	SS		CL	STIFF; as above 4-5 ft; black (10 YR 2/1); SILT (ML); moist, low plasticity, cohesive, bedded	2.0/2
	5	11								
	6							ML	LOESS; trace quartz sand	
6	6									
	3				4	SS			MEDIUM; as above 6-7 ft; mottled brownish yellow (10 YR 6/8) to light olive brown (2.5 Y 5/4); moist to wet; clayey	1.3/2.
	4	8								
	4							SC	SANDY (SC); low plasticity, cohesive, fine to coarse sand diamicton (QWT)	
8	4									
	4				5	SS		CL	STIFF; brownish yellow (10 YR 6/8), GRAVELLY LEAN CLAY (CL); moist to wet; low plasticity, cohesive small rounded gravel clasts; diamicton (QWT)	2.0/2.
	5	10								
	5									
10	5									
	3				6	SS		CL	STIFF; mottled brownish yellow (10 YR 6/8) to gray (10 YR 6/1); LEAN CLAY (CL) with sand and gravel; wet; low plasticity, cohesive, massive, diamicton (QWT)	2.0/2.
	4	9								
	5									
12	5									
	3				7	SS		CL	STIFF; as above 12-14	2.0/2.
	4	9								
	5									
14	6									
	3				8	SS		CL	STIFF; dark gray (10 YR 4/1) WITH brownish yellow (10 YR 5/8); rinting (weathering); LEAN CLAY (CL) WITH GRAVEL (limestone clasts); moist to wet; low plasticity, cohesive diamicton (QAT)	
	6	15								
	9									
16	10									
	4				9	SS		CL	VERY STIFF; dark gray (10 YR 4/1); GRAVELLY LEAN CLAY (CL); moist to wet low plasticity, cohesive massive, diamicton (QAT)	
	7	17								
	10									
18	15									
	5				10	SS		CL	VERY STIFF; as above from 18-20 ft,	
	10	22								
	12									
	13									

K:\PROJECTS\60482809 - Black Hawk County Landfill\Forms\2 - FIELD BORING LOG page 1.xls

EOB at 20-ft bgs; intstale well OW215BR

AECOM

PIEZOMETER INSTALLATION DIAGRAM

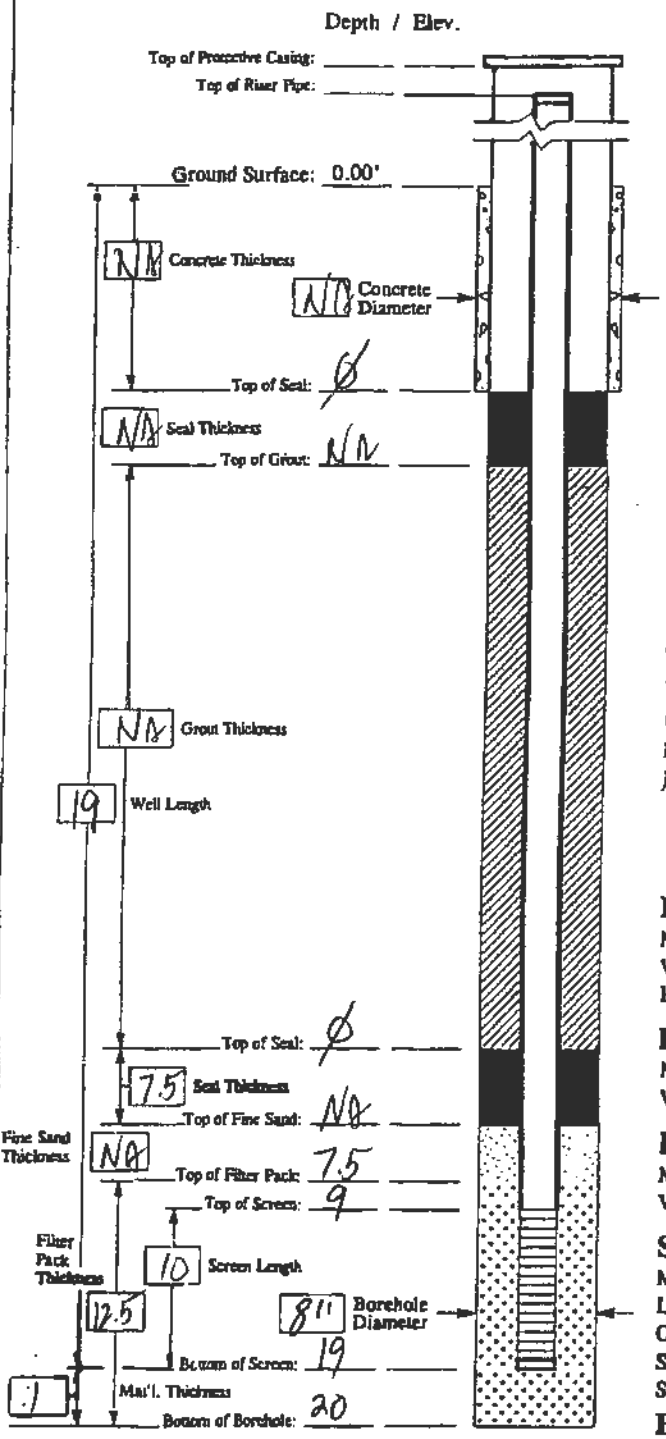
Site Name: BLACK HAWK CO LF Project No. 60674663 Well No. OW215BR

Northing: _____ Easting: _____ Surf.Elev. _____ Ref. Boring No. B215BR

Drilling Contractor: TERRACON Drilling Dates: 11/2/22

Driller: Scott Zein Inspected By: R Henning Well Completion Date: 11/2/22

Drilling Method: 4 1/4 HSA; 2 in x 2 ft SS to EOB Drilling Fluids (type): NONE



Protective Casing
Type: Steel; blade painted Vented (Y/N): _____
Dia.(in): 4-in Sq. Locked (Y/N): _____
Length: 7-ft Key No.: _____

Cap or Plug Type: PVC J-plug Vented (Y/N): _____

Concrete Collar
Manufacturer: NA
Volumes: _____ Lbs. of Cement
+ _____ Gal. of Water
= _____ Gal. total Volume

Upper Seal Type: _____
Manufacturer: As below
Volume (Gal.) _____
Hydration: Volume Water: _____ Time: _____

Well Casing Type: PVC
Manufacturer: JOHNSON WELL
Schedule: 40
Length per Section: 10-ft Casing O.D./I.D. _____
No. of Sections: _____ Total Length: 13

Joints Flush Threaded ☒ Taped ☐ Welded ☐ O-Ring ☒
Manufacturer: JOHNSON WELL

Grout Type: _____
Manufacturer: _____
Final Volumes: NA Lbs. of _____
+ _____ Lbs. of _____
+ _____ Gal. of Water
= _____ Gal. total Volume

Lower Seal Type: 3/8-in Hole plug
Manufacturer: BAROID
Volume (Gal.) _____
Hydration: Volume Water _____ Time: _____

Fine Sand Type: NA
Manufacturer: _____
Volume (Gal.) _____

Filter Pack Type: Coarse Sand
Manufacturer: BMC Aggregates
Volume (Gal.) _____

Screen Type: PVC Sch: 40
Manufacturer: JOHNSON WELL
Length/Sec. 10-ft No of Sec. 1
O.D. _____ I.D. _____
Slot Size: 10 No. Slots/ft. _____
Slotted Length: _____

Bottom Cap or Plug Type: PVC Length: 0.3 ft

Water Source none

NOTES: 3 yellow bollards per well

Tracking Codes: Sprjids, PIEZOFF, 12/15/97, 16:42

Sheet 1 Of ____

AECOM

FIELD BORING LOG

BORING NO B216BR

SITE: BLACK HAWK CO. LF

PROJECT NO: 60674663

DRILLING METHOD: 4 1/4 HSA; 2-in X 2-ft SS continuous to EOB

LOG BY: R. Henning

FIRM/DRILLER: Terracon - Scott Zein

PHYSICAL SETTING: Adjacent to P216C, east of Cell X

ABANDONMENT DATE: NA

ABANDONMENT METHOD: NA

WATER LEVEL READINGS

DATE/ TIME	WATER DEPTH	HOLE DEPTH	CASING DEPTH

GROUND SURFACE ELEV:

COORDINATE TYPE:

NORTH:

EAST:

DATE/TIME START: 11/2/2022 1055

DATE/TIME COMPLETE: 11/2/2022 1300

WELL INSTALLATION DATE: 11/2/2022

DEPTH IN FEET	B	N	A	R	NO	T	GRAPHIC LOG	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS	
	2				1	SS		ML	MEDIUM; very dark grayish brown (10YR 3/2) SILT (ML); dry, non plastic, cohesive, topsoil with plant roots, LOESS, bedded	1.4/2
	4	8								
	4									
	5									
2	5				2	SS		CL	STIFF; brown (10YR 4/3); LEAN CLAY (CL); dry; non plastic, cohesive, bedded, diamicton (QWT)	1.7/2
	5	10								
	6									
	5									
4	2				3	SS		SM	SOFT; brownish yellow (10YR 6/8); SILTY SAND (SM) dry to moist; non plastic, non cohesive, glacial fluvial	~~5.6/2~~ 1.5/2
	2	4								
	2							CL	Mottled brownish yellow to gray (10YR 6/8) to (10YR 6/1) LEAN CLAY (CL); grading to ~~[illegible]~~ POORLY GRADED SAND (SP) moist	
	1							SP		
6	3				4	SS		SP ~~SM~~	MEDIUM; light gray (10YR 7/1); POORLY GRADED SAND (SP); wet non plastic, non cohesive, fine grained quartz	2.0/2
	4	8								
	4							CL ~~CL~~	brownish yellow (10YR 6/8) LEAN CLAY WITH GRAVEL (CL)	
	4							~~SP~~	wet, non plastic, cohesive, bedded, diamicton (QWT)	~~SP~~
8	3				5	SS		CL	~~MEDIUM~~ STIFF; mottled brownish yellow (10YR 6/8) to gray (10YR 6/1); SANDY LEAN CLAY (CL) with gravel wet; low plasticity, cohesive, massive, diamicton (QWT)	~~2.0~~ 1.8/2
	4	8	9							
	4									
	5									
10	3				6	SS		CL	STIFF; gray (10YR 5/1); GRAVELLY LEAN CLAY (CL) moist; low plasticity, cohesive, massive, diamicton ~~(QAT)~~ (QWT)	2.0/2
	4	9	18							
	5									
	7									
12	7				7	SS		CL	VERY STIFF; mottled; jointed yellowish brown (10YR 6/8) to gray (10YR 6/1); GRAVELLY LEAN CLAY (CL) moist to wet; low plasticity, cohesive, massive diamicton ~~(QAT)~~ (QWT)	2.0/2
	9	18	16							
	9									
	16									
14	5				8	SS		CL	~~VERY~~ STIFF/HARD; pale brown (10YR 6/3); SANDY LEAN CLAY (CL); moist to wet, low plasticity, cohesive, massive, diamicton (QWT)	2.0/2
	7	16	57							
	9									
	12									
16	13				9	SS		CL	HARD; as above	2.0/2
	27	51	38							
	29									
	33									
18	20				10	SS		CL	~~HARD~~ VERY STIFF; mottled brownish yellow (10YR) to dark gray (10YR 4/1); GRAVELLY LEAN CLAY (CL), moist to wet; low plasticity, cohesive massive, diamicton (QAT) QAT	2.0/2
	20	38	16							
	18									
	16									
20										

Shaft blow counts; drillers helper was off on log

VERY STIFF

End of Field Log. Install OW216BR

AECOM

PIEZOMETER INSTALLATION DIAGRAM

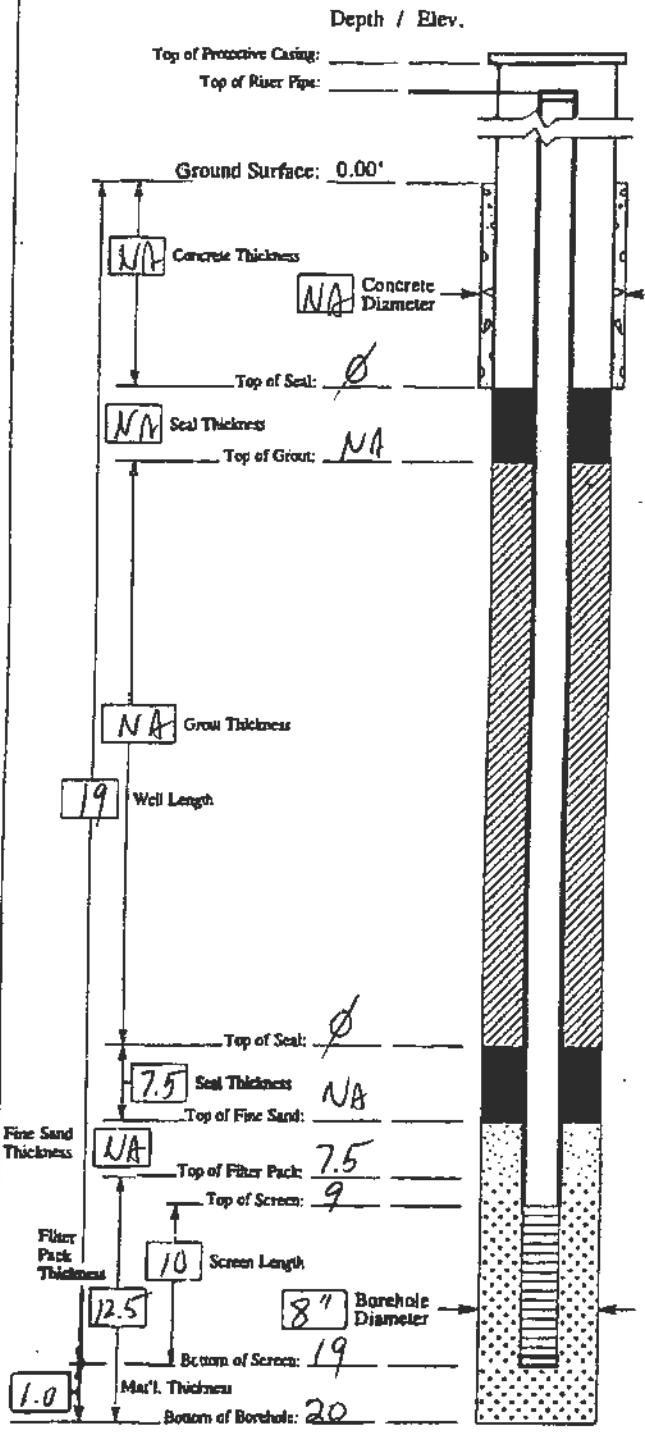
Site Name: BLACK HAWK CO LF Project No. 60674663 Well No. OW216BR

Northing: _____ Easting: _____ Surf.Elev. _____ Ref. Boring No. B216BR

Drilling Contractor: Terracon Drilling Dates: 11/2/2022

Driller: Scott Zein Inspected By: R. Henning Well Completion Date: 11/2/2022

Drilling Method: 4 1/4 HSA; 2-in x 2-ft SS to EOB Drilling Fluids (type): NONE



Protective Casing
Type: Steel, black paint Vented (Y/N): _____
Dia.(in): 4-in Sq. Locked (Y/N): _____
Length: 7-ft Key No.: _____

Cap or Plug Type: PVC J-plug Vented (Y/N): _____

Concrete Collar
Manufacturer: NA
Volumes: _____ Lbs. of Cement
+ _____ Gal. of Water
= _____ Gal. total Volume

Upper Seal Type: as below
Manufacturer: NA
Volume (Gal.)
Hydration: Volume Water: _____ Time: _____

Well Casing Type: PVC
Manufacturer: JOHNSON WELL
Schedule: 40
Length per Section: 10-ft Casing O.D./I.D. _____
No. of Sections: _____ Total Length: 13

Joints Flush Threaded ☒ Taped ☐ Welded ☐ O-Ring ☒
Manufacturer: JOHNSON WELL

Grout Type: NA
Manufacturer:
Final Volumes: _____ Lbs. of _____
+ _____ Lbs. of _____
+ _____ Gal. of Water
= _____ Gal. total Volume

Lower Seal Type: 3/8-in Hole plug
Manufacturer: BAROID
Volume (Gal.) _____ 50# bags
Hydration: Volume Water _____ Time: _____

Fine Sand Type: NA
Manufacturer:
Volume (Gal.)

Filter Pack Type: Coarse Sand
Manufacturer: BMC Aggregate
Volume (Gal.)

Screen Type: PVC Sch: 40
Manufacturer: JOHNSON SCREEN
Length/Sec. 10-ft No of Sec. 1
O.D. _____ I.D. _____
Slot Size: 10 No. Slots/ft. _____
Slotted Length: _____

Bottom Cap or Plug Type: PVC Length: 0.3 ft

Water Source NONE

NOTES: 3 yellow bollards per well

Tracking Codes: Eprilds, PIEZOFF, 12/15/97, 16:42

Sheet 1 Of ____

AECOM

FIELD BORING LOG

BORING NO B-224

SITE: BLACK HAWK CO

PROJECT NO: 60674663.14

WATER LEVEL READINGS

DATE/ TIME	WATER DEPTH	HOLE DEPTH	CASING DEPTH

DRILLING METHOD: 4 1/4 HSA; 2-in x 2-ft SS TO EOB

LOG BY: R. Henning

FIRM/DRILLER: Terracon - Scott

PHYSICAL SETTING: Dry area along north side AREA C access

ABANDONMENT DATE: 11/1/2022

ABANDONMENT METHOD: Hole plug

GROUND SURFACE ELEV:

COORDINATE TYPE:

NORTH:

EAST:

DATE/TIME START: 11/1/22 0845

DATE/TIME COMPLETE: 11/1/22 0920

WELL INSTALLATION DATE: NA

DEPTH IN FEET	SAMPLING DATA B	N	A	R	NO	T	GRAPHIC LOG	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS	
	3				1	SS		CL	VERY STIFF; YELLOWISH BROWN (10YR 5/8) LEAN CLAY (CL) w/ SAND AND GRAVEL; dry; non-plastic, cohesive, thickly bedded; oxidized; FILL	1.6/2.
	7	16								
	9									
	10									
2	7				2	SS		CL	VERY STIFF; dark grayish brown (10YR 4/2) LEAN CLAY (CL); moist; non plastic, cohesive, thickly bedded, FILL	2.0/2.0
	9	18								
	9									
	12									
4	7				3	SS		ML	VERY STIFF, black (10YR 2/1); SILT (ML) WITH SAND SEAMS (SW); moist to wet; non plastic, cohesive bedded FILL	
	10	19								
	9									1.7/2.
	6									▽
6	9				4	SS		FILL	Poor recovery; wood plugged spoon tip; STIFF; FILL	0.2/2.
	8	12								
	4									
	4									
8	4				5	SS			no recovery; paper and plastic plugged tip; STIFF, FILL	0.0/2.
	7	14								
	7									
	5									
10	4				6	SS			no recovery; wood, fill; in refuse; abandon borehole; offset	0.0/2.0
	4	8								
	4									
	7									
12									EOB at 12-ft bgs. Abandon boring due to waste encountered during drilling; move north approximately 15 ft	
14										
16										
18										

AECOM

PIEZOMETER INSTALLATION DIAGRAM

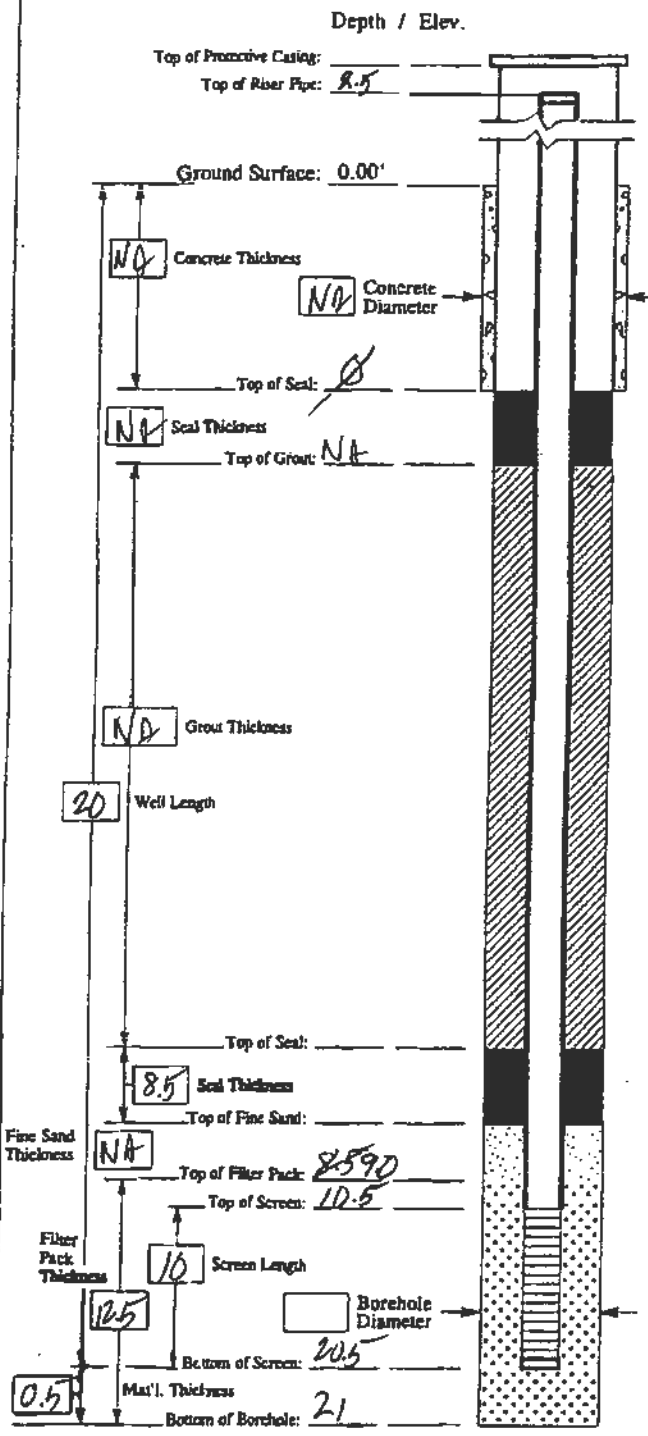
Site Name: BLACK HAWK CO LF Project No. 60674663.14 Well No. OW224B

Northing: _____ Easting: _____ Surf.Elev. _____ Ref. Boring No. B-224A

Drilling Contractor: Terracon Drilling Dates: 11/1/2022

Driller: Scott Zion Inspected By: R. Henning Well Completion Date: 11/1/2022

Drilling Method: 4 1/4 HSA; 2-ft x 2-in SS to EOB Drilling Fluids (type): NONE



Protective Casing

Type: _____ Vented (Y/N): _____
Dia.(in): _____ Locked (Y/N): _____
Length: _____ Key No.: _____

Cap or Plug

Type: _____ Vented (Y/N): _____

Concrete Collar

Manufacturer: _____
Volumes: _____ Lbs. of Cement
+ _____ Gal. of Water
= _____ Gal. total Volume

Upper Seal

Type: _____
Manufacturer: _____
Volume (Gal.) _____
Hydration: Volume Water: _____ Time: _____

Well Casing

Type: PVC
Manufacturer: ENVIRONMENTAL MANUFACTURING
Schedule: 40
Length per Section: 10 Casing O.D./I.D. _____
No. of Sections: 2 Total Length: 13 ft

Joints

Flush Threaded ☒ Taped ☐ Welded ☐ O-Ring ☒
Manufacturer: ENVIRONMENTAL MANUFACTURING

Grout

Type: NA
Manufacturer: _____
Final Volumes: _____ Lbs. of _____
+ _____ Lbs. of _____
+ _____ Gal. of Water
= _____ Gal. total Volume

Lower Seal

Type: 3/8-in Holeplug
Manufacturer: BAROID
Volume (Gal.) _____
Hydration: Volume Water _____ Time: _____

Fine Sand

Type: NA
Manufacturer: _____
Volume (Gal.) _____

Filter Pack

Type: Coarse Filter SAND
Manufacturer: BMC Aggregates
Volume (Gal.) _____

Screen

Type: PVC Sch: 40
Manufacturer: JOHNSON
Length/Sec. 10-ft No of Sec. 1
O.D. _____ I.D. _____
Slot Size: 10 No. Slots/ft. _____
Slotted Length: _____

Bottom Cap or Plug

Type: PVC Length: 0.3-ft

Water Source

none

NOTES: Well pushed down during protective casing set by 0.5 ft

Tracking Codes: &prj.id&, PIEZOFF, 12/15/97, 16:42

AECOM

FIELD BORING LOG

BORING NO B-225

SITE: Black Hawk Co. LF PROJECT NO: 60674663

DRILLING METHOD: 4 1/4 HSA; 2-in x 2-ft SS continuous to EOB

LOG BY: R. Henning

FIRM/DRILLER: Terracon / Scott

PHYSICAL SETTING: Dry slope north of BOEAC, west of OUTZOB

WATER LEVEL READINGS

DATE/ TIME	WATER DEPTH	HOLE DEPTH	CASING DEPTH

ABANDONMENT DATE: NA

ABANDONMENT METHOD: NA

GROUND SURFACE ELEV:

COORDINATE TYPE:

NORTH:

EAST:

DATE/TIME START: 11/1/2022; 150

DATE/TIME COMPLETE: 11/1/2022 15

WELL INSTALLATION DATE: 11/1/2022

DEPTH IN FEET	SAMPLING DATA B	N	A	R	NO	T	GRAPHIC LOG	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS	
	1				1	SS		CL	STIFF; brownish yellow (10YR 6/6); LEAN CLAY (CL); dry, non plastic cohesive, bedded, FILL	1.0/2
	3	10								
	7									
	7									
2	4				2	SS		CL	MEDIUM; very dark grayish brown (10YR 3/2); LEAN CLAY (CL); dry, non plastic, cohesive, massive, FILL	2.0/2.
	4	8								
	4									
	4									
4	1				3	SS		CL	MEDIUM; as above from 4-6 ft	1.6/2.
	3	6								
	3									
	6									
6	3				4	SS		ML	MEDIUM; black (10YR 2/1); SILT (ML), moist; low plasticity, cohesive, bedded; buried A horizon of soil profile; plants, wood, roots LOESS	1.5/2.
	3	8								
	5									
	7									
8	3				5	SS		ML	MEDIUM; as above, SILT (ML) with SAND, LOESS	1.0/2.
	2	5								
	3									
	2									
10	3				6	SS		CL	MEDIUM; olive (5Y 4/3) LEAN CLAY (CL) with sand; low plasticity, cohesive, bedded (QWT)	2.0/2
	3	7								
▽	4							SM	light gray (10YR 7/2); SILTY SAND (SM), wet, very fine sand; non plastic, non cohesive, glacio fluvial	
	4									
12	2				7	SS		CL	MEDIUM; mottled brownish yellow (10YR 6/8) to gray (10YR 6/1); alternating beds of LEAN CLAY (CL) and	2.0/2.0
	2	5						SW	WELL GRADED SAND (SW), wet, low plasticity,	
	3							CL	cohesive, bedded; diamicton (QWT), glacio fluvial	
	4							SW		
14	3				8	SS		CL	STIFF; brownish yellow (10YR 6/8) LEAN CLAY (CL) with sand and gravel; wet, low plasticity,	2.0/2.
	5	11								
	6								cohesive, massive, diamicton (QWT)	
	8									
16	6				9	SS		CL	VERY STIFF; mottled brownish yellow (10YR 6/8) to gray (10YR 6/1); wet; low plasticity, cohesive, with	2.0/2.0 oxidized
	9	18							oxidized joints; diamicton (QWT)	joints
	11									
	16									
18	5				10	SS		CL	VERY STIFF; dark gray (10YR 4/1); LEAN CLAY (CL); moist to wet, low plasticity, cohesive,	2.0/2.
	6	16							massive, diamicton (QWT)	
	10									
20	12									

ACCOM

FIELD BORING LOG

BORING NO B225

SITE: BLACK HAWK CO LF PROJECT NO: 60674663

DEPTH IN FEET	SAMPLING DATA B	N	A	R	NO	T	GRAPHIC LOG	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS
	8				11	SS		CL	VERY STIFF; dark gray (10YR 4/1); LEAN CLAY 2.0/2
	10	21							(CL) with sand and gravel; moist, low plasticity,
	11								cohesive, moraine, diamicton (QAT)
	13								
22									EOB at 22 ft bgs; Install OW225R
									in borehole
24									

AECOM

PIEZOMETER INSTALLATION DIAGRAM

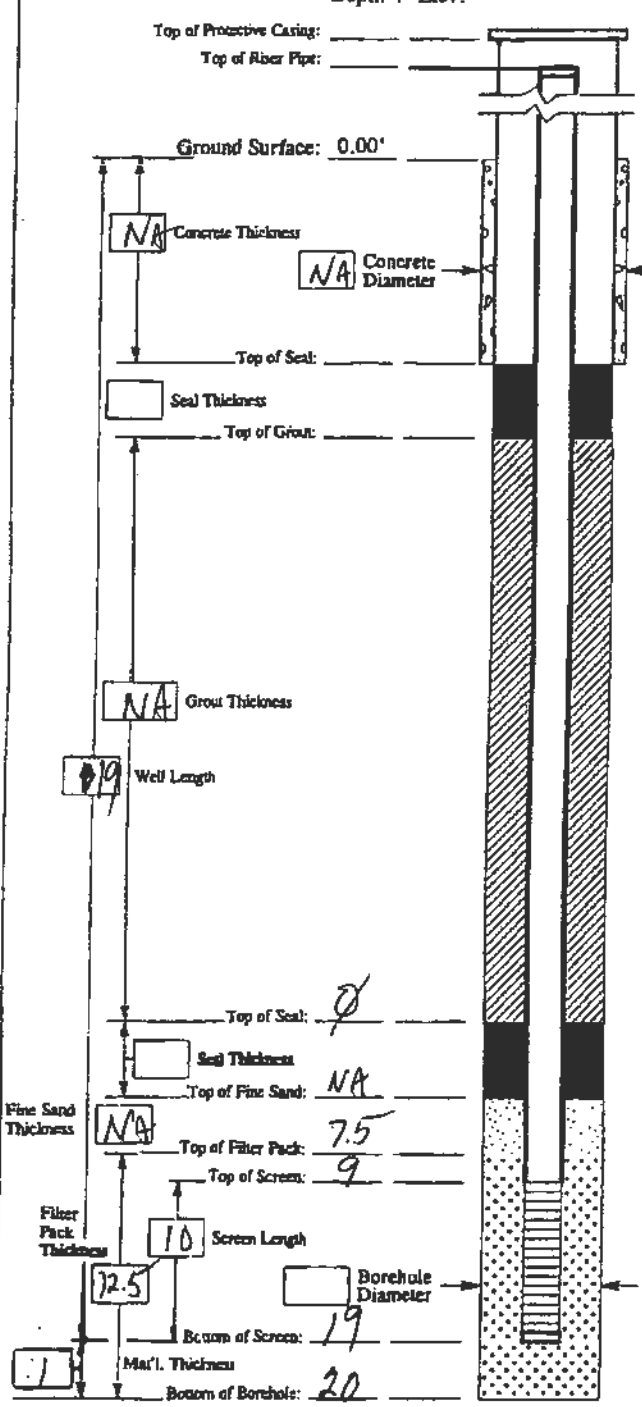
Site Name: BLACK HAWK CO LF Project No. 60674663 Well No. 04/225B

Northing: _____ Easting: _____ Surf.Elev. _____ Ref Boring No. B-225

Drilling Contractor: Terracon Drilling Dates: 11/1/2022

Driller: Scott Zion Inspected By: R. Henning Well Completion Date: 11/1/2022

Drilling Method: 4 1/4 HSA, 2-in x 2-ft SS to EOB Drilling Fluids (type): NONE



Protective Casing
Type: Blad. Steel Vented (Y/N): _____
Dia.(in): 4-in Sq. Locked (Y/N): _____
Length: 7-ft Key No.: _____

Cap or Plug Type: PVC J-plug Vented (Y/N): _____

Concrete Collar
Manufacturer: NA
Volumes: _____ Lbs. of Cement
\+ _____ Gal. of Water
= _____ Gal. total Volume

Upper Seal Type: As below
Manufacturer: _____
Volume (Gal.) _____
Hydration: Volume Water: _____ Time: _____

Well Casing Type: PVC
Manufacturer: JOHNSON WELL
Schedule: 40
Length per Section: 10-ft Casing O.D./I.D. _____
No. of Sections: _____ Total Length: _____

Joints Flush Threaded ☒ Taped ☐ Welded ☐ O-Ring ☒
Manufacturer: JOHNSON SCREEN WELL

Grout Type: NA
Manufacturer: _____
Final Volumes: _____ Lbs. of _____
\+ _____ Lbs. of _____
\+ _____ Gal. of Water
= _____ Gal. total Volume

Lower Seal Type: 3/8-in HOLEPLUG
Manufacturer: BAROID
Volume (Gal.) _____
Hydration: Volume Water _____ Time: _____

Fine Sand Type: NA
Manufacturer: _____
Volume (Gal.) _____

Filter Pack Type: Coarse Filter Sand
Manufacturer: BMC Aggregates
Volume (Gal.) _____

Screen Type: PVC Sch: 40
Manufacturer: JOHNSON WELL
Length/Sec. 10-ft No of Sec. 1
O.D. _____ I.D. _____
Slot Size: 10 No. Slots/ft. _____
Slotted Length: _____

Bottom Cap or Plug Type: PVC Length: 0.3-ft

Water Source NONE

NOTES: Concrete collar not used; grout not used; 3/8" HOLEPLUG to surface for seal

Tracking Codes: Boriolds, PIEZOFF, 12/15/97, 16:42

Sheet 1 Of ____

AECOM

FIELD BORING LOG

BORING NO B-226

SITE: BLACK HAWK CO LF PROJECT NO: 60674663

WATER LEVEL READINGS

DATE/ TIME	WATER DEPTH	HOLE DEPTH	CASING DEPTH

GROUND SURFACE ELEV: ____

COORDINATE TYPE: ____

NORTH: ____

EAST: ____

DRILLING METHOD: 4 1/4 HSA · 2-in x 2-ft SS continuous to EOB

LOG BY: R. Henning

FIRM/DRILLER: Terracon - Scott Z.

PHYSICAL SETTING: dry slope

ABANDONMENT DATE: 11/1/2022 1320

ABANDONMENT METHOD: 3/8" Hole plug

DATE/TIME START: 11/1/22 1245

DATE/TIME COMPLETE: ~~AFA~~ 11/1/22 1320

WELL INSTALLATION DATE: NA

DEPTH IN FEET	SAMPLING DATA B	N	A	R	NO	T	GRAPHIC LOG	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS	
	3				1	SS		CL	MEDIUM; mottled dark brown (10YR 6/3) to brownish yellow (10YR 6/8); LEAN CLAY (CL) with sand and gravel, dry; non plastic, cohesive, FILL	1.4/2.0
	3	8								
	5									
	3									
2	3				2	SS		CL	MEDIUM; mottled brownish yellow (10YR 6/8) to dark gray (10YR 4/1); LEAN CLAY (CL) jointed; dry, non plastic, cohesive, FILL	2.0/2
	4	8								
	4									
	6									
4	5				3	SS		ML	STIFF; black (10YR 2/1); SILT (ML), dry, non plastic cohesive, LOESS(?); gradual to	1.7/2.0
	5	11								
	6								WELL GRADED SAND (SW), MOIST, non plastic,	LOESS
	11							SW	non cohesive, glacial outwash fluvial	
6	2				4	SS		SP	MEDIUM; black (10YR 2/1) POORLY GRADED SAND (SP), wet, non plastic, non cohesive, glacial fluvial (?)	1.9/2.0
	4	8								
	4									
	5									
8	3				5	SS		SP	MEDIUM; as above black stained (10YR 2/1) glacial fluvial (?) or FILL (?)	2.0/2
	3	6								
	3									
	3									
10	2				6	SS		SP	SOFT; black (10YR 2/1); POORLY GRADED SAND (SP) stained black; wet, non plastic, non cohesive, bedded, FILL (?)	1.6/2.0
	2	4								
	2									
	3									
12	2				7	SS		SP	VERY SOFT; black (10YR 2/1); as above from 12-14; SANDY LEAN CLAY (CL); wet; non plastic, cohesive	1.6/2.0
	1	2								
	1							CL	diamicton (QUT)	
	2									
14	2				8	SS			ENCOUNTERED WASTE; PLASTIC; some HARD DENSE PLASTIC, STIFF	0.1/2.0
	4	11								
	7									
	19								ABANDON BORE HOLE; MOVE NORTH TOWARDS	
16					9	SS			DRAINAGE	
18					10	SS				

▽

Sheet 1 Of 1

AECOM

FIELD BORING LOG

BORING NO B-226 B

SITE: BLACK HAWK CO LF

PROJECT NO: 60674663.14

DRILLING METHOD: 4 1/4 HSA; 2-ft x 2-in SS continuous to EOB

LOG BY: R. Henning

FIRM/DRILLER: Terracon - Scott F.

PHYSICAL SETTING: 10-ft North of B226 by AREA C

ABANDONMENT DATE:

ABANDONMENT METHOD:

WATER LEVEL READINGS

DATE/ TIME	WATER DEPTH	HOLE DEPTH	CASING DEPTH

GROUND SURFACE ELEV:

COORDINATE TYPE:

NORTH:

EAST:

DATE/TIME START: 11/1/2022 1330

DATE/TIME COMPLETE: 11/1/2022 1495

WELL INSTALLATION DATE: 11/1/2022

DEPTH IN FEET	SAMPLING DATA B	N	A	R	NO	T	GRAPHIC LOG	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS	
	1				1	SS		CL	MEDIUM; mottled yellow (10YR 7/8) to olive yellow	1.0/2.
	2	5							(2.5Y 6/6); dry - nonplastic, cohesive, bedded,	
	3								FILL, LEAN CLAY (CL) W/ GRAVEL AND SAND	
2	5				~~2~~	~~SS~~				
2	5				2	SS		CL	STIFF; very dark grayish brown (10YR 3/2); LEAN	1.4/2.
	7	15							CLAY (CL) with sand and gravel; dry, nonplastic	
	8								cohesive, massive, FILL	
4	10				~~3~~	~~SS~~				
4	5				3	SS		CL	STIFF; as above from 4-6 ft	2.0/2.
	5	11								
	6									
	8									
6	4				4	SS			MEDIUM; as above 6-7 ft; black (10YR 2/1);	2.0/2.
	4	8							SILT (ML), moist; nonplastic, cohesive, bedded	
	4							ML	LOESS	
	6									
8	2				5	SS		CL	MEDIUM; very dark grayish brown (10YR 3/2)	1.3/2.
	3	8							LEAN CLAY (CL) moist; low plasticity, cohesive,	
	5								bedded, diamicton (QWT)	
	6									
10	3				6	SS			STIFF; as above to 11 ft; gray (10YR 6/1);	1.2/2.
	5	11							WELL GRADED SAND (SW); wet, saturated, nonplastic	
	6							SW	non cohesive, bedded, glaciofluvial, mainly quartz	
	6								with some hornblende; microcline	
12	4				7	SS			MEDIUM; as above	1.5/2.
	3	5								
	2									
	1									
14	1				8	SS		SC	VERY SOFT; dark yellowish brown (10YR 4/6),	1.8/2.0
	1	2							CLAYEY SAND (SC), wet, nonplastic, cohesive,	
	1								bedded, diamicton (QWT)	
	2									
16	6				9	SS		GW	VERY STIFF; dark yellowish brown (10YR 4/6)	1.0/2.
	10	18							WELL GRADED GRAVEL (GW) with sand and clay;	
	8								wet, nonplastic, cohesive, bedded, glaciofluvial	
	8									
18	2				10	SS		CL	MEDIUM; grayish brown (10YR 5/2) LEAN CLAY	1.8/2.2
	2	5							WITH SAND and GRAVEL (CL) wet, nonplastic	
	3								bedded, cohesive; diamicton (QAT)	
20	5									

2 OB at 20 ft has install OW226B

AECOM

PIEZOMETER INSTALLATION DIAGRAM

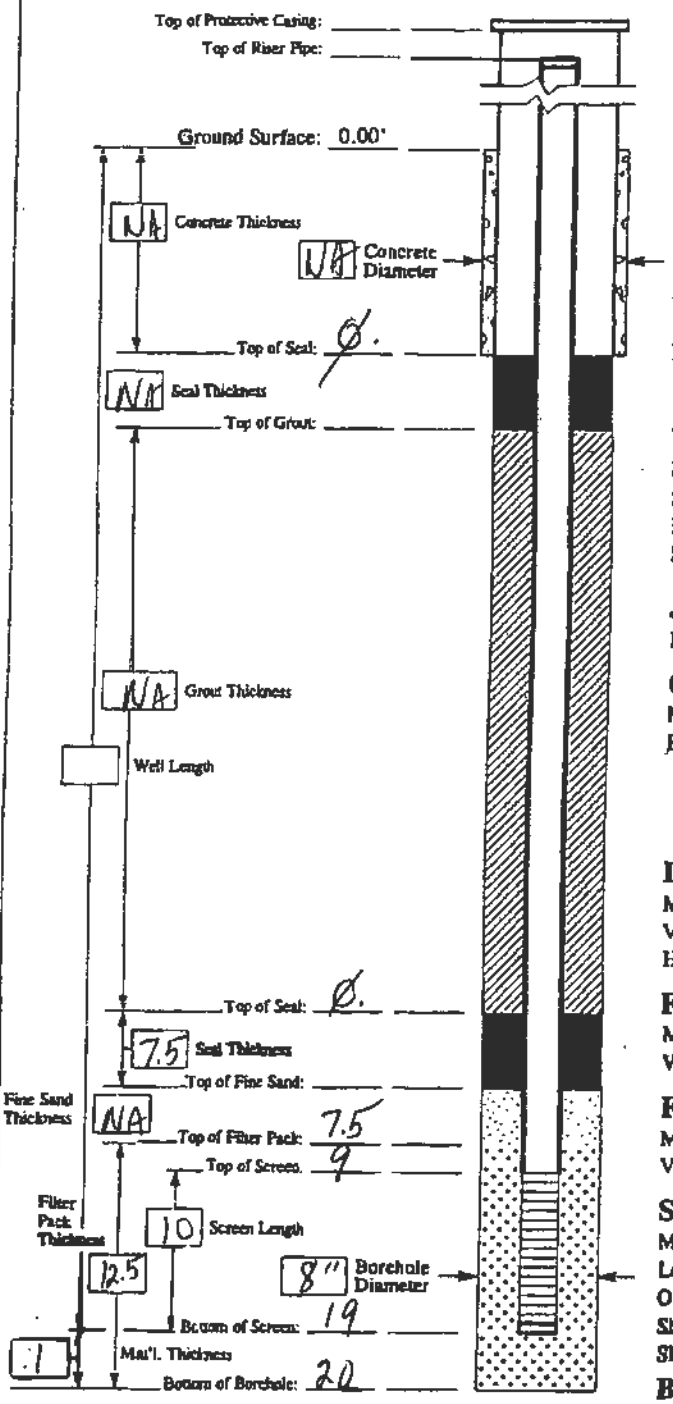
Site Name: BLACK HAWK CO. LF Project No. 60674663.14 Well No. OW226B

Northing: _____ Easting: _____ Surf.Elev. _____ Ref. Boring No. B226B

Drilling Contractor: Terracon Drilling Dates: 11/1/2022

Driller: Scott Zion Inspected By: R. Henning Well Completion Date: 11/1/2022

Drilling Method: 4 1/4 HSA; 2" x 2-ft SS to EOB Drilling Fluids (type): None



Protective Casing
Type: Black Steel Vented (Y/N): _____
Dia.(in): 4-in Sq. Locked (Y/N): _____
Length: 7-ft Key No.: _____

Cap or Plug Type: PVC J-plug Vented (Y/N): _____

Concrete Collar
Manufacturer: _____
Volumes: NA Lbs. of Cement
+ _____ Gal. of Water
= _____ Gal. total Volume

Upper Seal Type: _____
Manufacturer: _____
Volume (Gal.) NA
Hydration: Volume Water: _____ Time: _____

Well Casing Type: _____
Manufacturer: _____
Schedule: _____
Length per Section: _____ Casing O.D./I.D. _____
No. of Sections: _____ Total Length: _____

Joints Flush Threaded ☒ Taped ☐ Welded ☐ O-Ring ☒
Manufacturer: JOHNSON WELL

Grout Type: _____
Manufacturer: NA
Final Volumes: _____ Lbs. of _____
+ _____ Lbs. of _____
+ _____ Gal. of Water
= _____ Gal. total Volume

Lower Seal Type: 3/8" HOLE PLUG
Manufacturer: BAROID
Volume (Gal.) _____
Hydration: Volume Water _____ Time: _____

Fine Sand Type: _____
Manufacturer: NA
Volume (Gal.) _____

Filter Pack Type: Coarse Filter Sand
Manufacturer: BMC Aggregates
Volume (Gal.) _____

Screen Type: PVC Sch: 40
Manufacturer: JOHNSON WELL
Length/Sec. 10-ft No of Sec. 1
O.D. _____ I.D. _____
Slot Size: 10 No. Slots/ft. _____
Slotted Length: _____

Bottom Cap or Plug Type: PVC Length: 0.3-ft

Water Source NONE

NOTES: 3- bollards per well

Tracking Codes: Sprj.id8, PIEZOFF, 12/15/97, 18:42

Sheet 1 Of ____

AECOM

FIELD BORING LOG

BORING NO B-227

SITE: BLACK HAWK CO. LF PROJECT NO: 60674663.14

WATER LEVEL READINGS

DATE/ TIME	WATER DEPTH	HOLE DEPTH	CASING DEPTH

DRILLING METHOD: 4 1/4 HSA; 2-in X 2 ft Continuous to 20' EOB

LOG BY: ____

FIRM/DRILLER: Terracon - Scott

PHYSICAL SETTING: Dry gentle slope NE side AREA C by drainage

ABANDONMENT DATE: NA

ABANDONMENT METHOD: NA

GROUND SURFACE ELEV: ____

COORDINATE TYPE: ____

NORTH: ____

EAST: ____

DATE/TIME START: 11/1/22 11:24

DATE/TIME COMPLETE: 11/1/22 1200

WELL INSTALLATION DATE: 11/1/22

DEPTH IN FEET	SAMPLING DATA B	N	A	R	NO	T	GRAPHIC LOG	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS	
	3				1	SS		CL	VERY STIFF; dark grayish brown (10YR 4/2); LEAN CLAY (CL); dry; non plastic, cohesive, massive, w/some gravel FILL	1.8/2.
	8	18								
	10									
	10									
2	8				2	SS		CL	VERY STIFF; dark gray (10YR 4/1); LEAN CLAY (CL) w/some gravel, sand, dry; non plastic, cohesive, massive FILL	2.0/2
	10	20								
	10									
	13									
4	3				3	SS		ML	MEDIUM; as above to 5 ft; very dark gray (10YR 3/1) SILT (ML); dry; non plastic, cohesive, massive, LOESS	2.0/2
	4	8								
	4									
	8									
6	3				4	SS		ML	MEDIUM; black (10YR 2/1); SILT (ML); MOIST non plastic, cohesive, massive, LOESS; wet at bottom of spoon	1.6/2.
	3	7								
	4									
	8									
8 ▽	2				5	SS		ML	MEDIUM; black (10YR 2/1); SILT WITH SAND (ML); wet; low plasticity, cohesive, massive LOESS;	1.5/2
	3	7								
	4								well GRADED SAND (SW) at bottom	
wet ▽ 10	5									
	3				6	SS		SW	MEDIUM; mottled brownish yellow (10YR 6/8) to gray (10YR 6/1); well GRADED SAND (SW) thin wet at top;	1.4/2.
	3	5						CL	grading to LEAN CLAY (CL) with sand and gravel, non-plastic, cohesive bulked, diameter (QWT)	
	2									
12	2									
	1				7	SS		CL	MEDIUM; mottled brownish yellow (10YR 6/8) to grayish brown (10YR 5/2); LEAN CLAY (CL), moist to wet, low plasticity, cohesive, massive, diameter (QWT)	2.0/2.0
	2	5								
	3									
	6									
14	1				8	SS		CL	MEDIUM; dark grayish brown (10YR 4/2) LEAN CLAY with sand and gravel (CL) wet, low plasticity, cohesive,	2.0/2.
	4	8								
	4								massive, diameter (QWT)	
	9									
16	6				9	SS		CL	STIFF; as above from 16-18	2.0/2
	7	15								
	8									
18	8									
	4				10	SS		CL	STIFF; as above from 18-20	2.0/2.
	6	15								
	9									
20	10								EOB at 20 ft, installed well OW22FB	

AECOM

PIEZOMETER INSTALLATION DIAGRAM

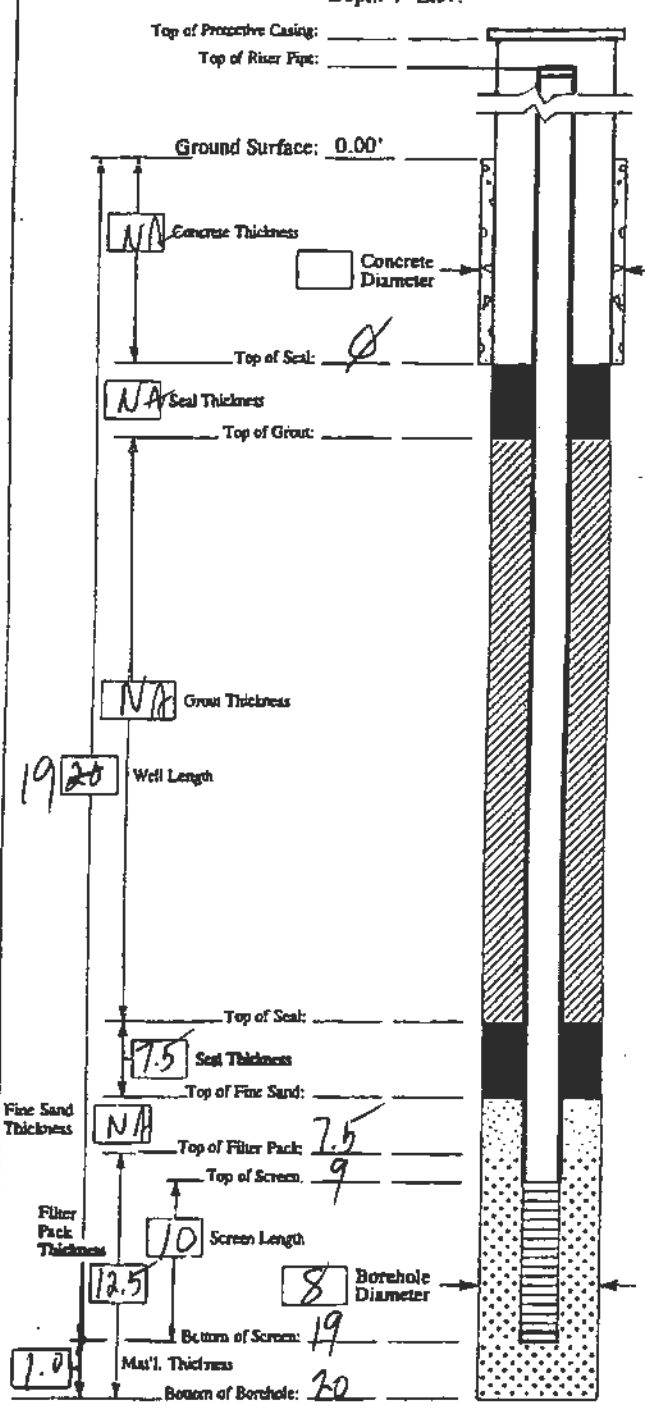
Site Name: BLACK HAWK CO LF Project No. 6067 4663 Well No. OW 227 B

Northing: _____ Easting: _____ Surf.Elev. _____ Ref. Boring No. B-227

Drilling Contractor: Terracon Drilling Dates: 11/1/22

Driller: Scott Zion Inspected By: R. Henning Well Completion Date: 11/1/22

Drilling Method: 4 1/4 HSA; 2"x2 ft SS to EOB Drilling Fluids (type): None



Protective Casing
Type: blad steel Vented (Y/N): _____
Dia.(in): 4-in SG Locked (Y/N): _____
Length: 7-ft Key No.: _____

Cap or Plug Type: PVC J-plug Vented (Y/N): _____

Concrete Collar
Manufacturer: NA
Volumes: _____ Lbs. of Cement
+ _____ Gal. of Water
= _____ Gal. total Volume

Upper Seal Type: _____
Manufacturer: As below
Volume (Gal.) _____
Hydration: Volume Water: _____ Time: _____

Well Casing Type: PVC
Manufacturer: JOHNSON WELL
Schedule: 40
Length per Section: 10-ft Casing O.D./I.D. _____
No. of Sections: _____ Total Length: _____

Joints Flush Threaded ☒ Taped ☐ Welded ☐ O-Ring ☒
Manufacturer: JOHNSON WELL

Grout Type: _____
Manufacturer: NA
Final Volumes: _____ Lbs. of _____
+ _____ Lbs. of _____
+ _____ Gal. of Water
= _____ Gal. total Volume

Lower Seal Type: 3/8-in Holeplug
Manufacturer: BAROID
Volume (Gal.) _____
Hydration: Volume Water _____ Time: _____

Fine Sand Type: _____
Manufacturer: NA
Volume (Gal.) _____

Filter Pack Type: Coarse filter sand
Manufacturer: BMC Aggregates
Volume (Gal.) _____

Screen Type: PVC Sch: 40
Manufacturer: JOHNSON WELL
Length/Sec. 10-ft No of Sec. 1
O.D. _____ I.D. _____
Slot Size: 10 No. Slots/ft. _____
Slotted Length: _____

Bottom Cap or Plug Type: PVC Length: 0.3 ft

Water Source NONE

NOTES: _____

Tracking Codes: Sprjid8, PIEZOFF, 12/15/97, 10:42

Sheet 1 Of ____

AECOM

FIELD BORING LOG

BORING NO B-606

SITE: BLACK HAWK CO. LF PROJECT NO: 60674663

WATER LEVEL READINGS

DATE/ TIME	WATER DEPTH	HOLE DEPTH	CASING DEPTH

GROUND SURFACE ELEV:
COORDINATE TYPE:
NORTH:
EAST:

DRILLING METHOD: 4 1/4 HSA; 2-in x 2ft SS continuous to EOB

LOG BY: R. Henning

FIRM/DRILLER: Terracon - Scott Z.

PHYSICAL SETTING: dry, grassy area next to fence and Hammond Rd

ABANDONMENT DATE: NA

ABANDONMENT METHOD: NA

DATE/TIME START: 11/2/22 1325

DATE/TIME COMPLETE: 11/2/22 1500

WELL INSTALLATION DATE: 11/2/2022

DEPTH IN FEET	SAMPLING DATA B	N	A	R	NO	T	GRAPHIC LOG	USCS	SOIL DESCRIPTION AND DRILLING COMMENTS	
	3				1	SS		ML	MEDIUM; black (10YR 2/1); SILT (ML); dry, non plastic, cohesive, TOPSOIL/w roots; plant matter LOESS	1.6/2
	4	8								
	4									
	4									
2	4				2	SS		ML	STIFF; as above	13/2.
	5	9								
	4									
	4									
4	3				3	SS		ML	Medium, as above, very poor recovery; tip blocked	0.1/2.0
	4	8								
	4									
	3									
6	3				4	SS		CL	STIFF; mottled yellowish brown (10YR 6/8) to gray (10YR GRAVELLY LEAN CLAY WITH SAND (CL); moist to wet, low plasticity, cohesive, massive, small gravel clasts diamicton (QWT) oxidized	2.0,
	4	9								
	5									
	5									
8	2				5	SS		CL	MEDIUM; dark gray (10YR 4/1); LEAN CLAY WITH SAND (CL); moist to wet, low plasticity, cohesive massive, reduced; diamicton (QWT)	2.0/2.
	3	6								
	3									
	4									
10	3				6	SS		CL	STIFF; gray (10YR 5/1); SANDY LEAN CLAY (CL) moist to wet low plasticity, cohesive, massive, diamicton (QWT)	2.0/2
	6	15								
	9									
	15									
12	7				7	SS		SP	HARD; light olive gray (5Y 6/2); POORLY GRADED SAND (SP); wet, saturated, non plastic noncohesive	1.8/.
	19	45								
	26							SW	bedded, quartz sand grading to WELL GRADED SAND (SW); glaciofluvial	
	26									
14	6				8	SS		~~SP~~ SW	as above from 14-15.5; light olive brown (2.5Y 5/6); LEAN CLAY (CL) wet low plasticity,	1.0/2.
	9	18								
	9							~~SW~~ CL	cohesive, bedded, diamicton (QWT)	
	13									
16	13				9	SS		CL	VERY STIFF; mottled, jointed yellowish brown (10YR 6/8) to gray (10YR 6/1); wet, ~~LEA~~ LEAN CLAY (CL) with sand, bedded, low plasticity, cohesive, diamicton (QWT)	1.7/2.
	13	21								
	8									
	14									
18	7				10	SS		CL	HARD, brown (7.5YR 4/4) SANDY LEAN CLAY (CL) wet low plasticity, cohesive bedded, diamicton (QWT)	2.0/2.
	14	30								
	16							ML	SILT (ML); gray (10YR 6/1) wet, non plastic, cohesive, jointed, diamicton (QWT)	
	24									
20										

∇

6

[illegible] MW606R

AECOM

PIEZOMETER INSTALLATION DIAGRAM

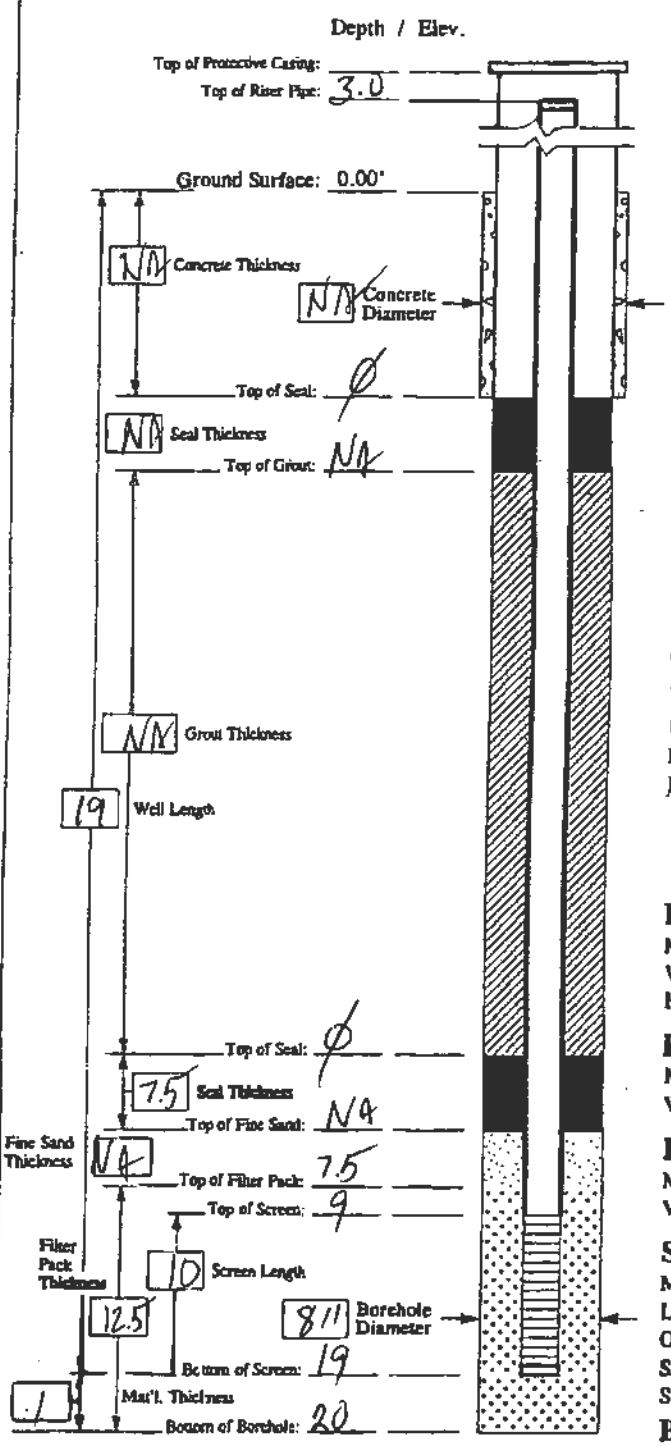
Site Name: BLACK HAWK CO LF Project No. 60674663 Well No. MW606B

Northing: _____ Easting: _____ Surf.Elev. _____ Ref. Boring No. B606--

Drilling Contractor: Terracon Drilling Dates: 11/2/2022

Driller: Scott Zein Inspected By: R. Henning Well Completion Date: 11/2/2022

Drilling Method: 4 1/4 HSA; 2-in x 2-ft SS to EOB Drilling Fluids (type): NONE



Protective Casing
Type: Steel, black painted Vented (Y/N): _____
Dia.(in): 4-in SG Locked (Y/N): _____
Length: 7-ft Key No.: _____

Cap or Plug Type: PVC J plug Vented (Y/N): _____

Concrete Collar
Manufacturer: _____
Volumes: NA Lbs. of Cement
+ _____ Gal. of Water
= _____ Gal. total Volume

Upper Seal Type: _____
Manufacturer: NA / GAS below
Volume (Gal.) _____
Hydration: Volume Water: _____ Time: _____

Well Casing Type: PVC
Manufacturer: JOHNSON WELL
Schedule: 40
Length per Section: 10-ft Casing O.D./I.D. _____
No. of Sections: _____ Total Length: 13 ft

Joints Flush Threaded ☒ Taped ☐ Welded ☐ O-Ring ☒
Manufacturer: JOHNSON WELL

Grout Type: _____
Manufacturer: NA
Final Volumes: _____ Lbs. of _____
+ _____ Lbs. of _____
+ _____ Gal. of Water
= _____ Gal. total Volume

Lower Seal Type: 3/8-in Aoleplug
Manufacturer: BAROID
Volume (Gal.) _____
Hydration: Volume Water _____ Time: _____

Fine Sand Type: _____
Manufacturer: NA
Volume (Gal.) _____

Filter Pack Type: Coarse Sand
Manufacturer: BMC Aggregates
Volume (Gal.) _____

Screen Type: PVC Sch: 40
Manufacturer: JOHNSON WELL
Length/Sec. 10-ft No of Sec. 1
O.D. _____ I.D. _____
Slot Size: 10 No. Slots/ft. _____
Slotted Length: _____

Bottom Cap or Plug Type: PVC Length: 0.3-ft

Water Source NONE

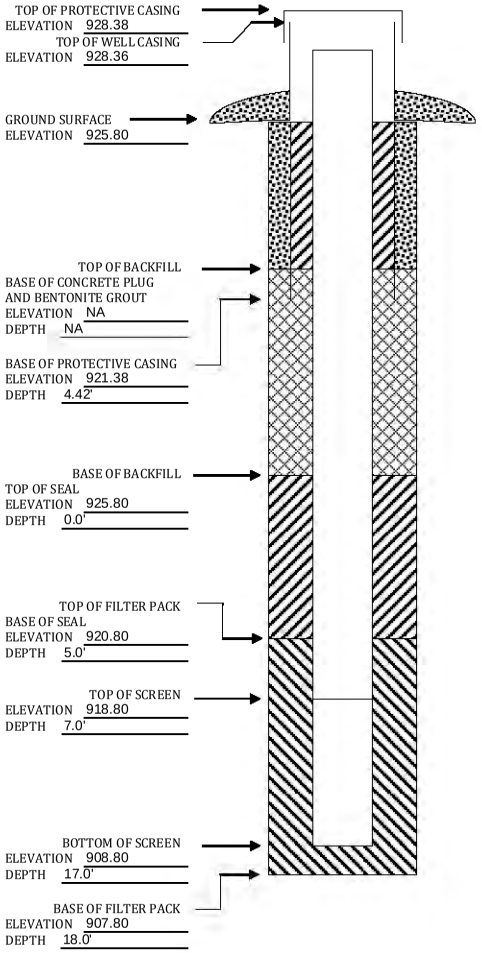
NOTES: 3 yellow bollards per well

Tracking Codes: Eprj.ldS, PIEZOFF, 12/15/97, 16:42

APPENDIX A-2
Monitoring Well/Piezometer
Construction Documentation Forms

ELEVATIONS: ± 0.01 ft MSL
DEPTHS: ± 0.1 ft FROM GROUND SURFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL.)



Print Form

IOWA DEPARTMENT OF NATURAL RESOURCES

MONITORING WELL/PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name: Black Hawk Co Landfill Permit No.: 7-SDP-1-75P

Well or Piezometer No: MW-701B

Dates Started: 09/15/2021 Date Completed: 09/15/2021

A. SURVEYED LOCATIONS AND ELEVATIONS

Locations (± 0.5 ft): N 3617829.70 E 5235235.75

Specify corner of site: IA State Plane

Distance & direction along boundary:

Distance & direction from boundary to wall:

Elevations (± 0.01 ft MSL):

Ground Surface: 925.80

Top of protective casing: 928.38

Top of well casing: 928.36

Benchmark elevation:

Benchmark description:

B. SOIL BORING INFORMATION

Name & Address of Construction Company:
Terracon
6612 Chancellor Drive Suite 102
Cedar Falls IA 50613

Name of Driller: Scott Zeien

Drilling Method: 4 1/4" HSA

Drilling Fluid: NA

Bore Hole Diameter: 8.25"

Soil Sampling Method: 2' by 2" split spoon

Depth of Boring: 18.0'

C. MONITORING WELL INSTALLATION

Casing material: SCH 40 PVC

Length of casing: 9.56'

Outside casing diameter: 2.375"

Inside casing diameter: 2.067"

Casing joint type: flush threaded

Casing/screen joint type: flush threaded

Screen material: SCH 40 PVC

Screen opening size: 0.010"

Screen length: 10'

Depth of well: 18'

Filter Pack:

Material: Filter Pack Sand

Grain size: 0.007-0.250"

Volume: 33 gal.

Seal (minimum 3 ft length above filter pack):

Material: Bentonite Chips 3/8" hole plug

Placement method: direct pour

Volume: 13 gal.

Backfill (if different from seal):

Material:

Placement method:

Volume:

Surface seal design:

Material of protective casing: Steel

Material of grout between protective casing and well casing: 3/8" hole plug

Protective cap:

Material: Steel

Vented: ☐ Yes ☐ No Locking: ☒ Yes ☐ No

Well Cap:

Material: PVC

Vented: ☐ Yes ☒ No

D. GROUNDWATER MEASURMENT (± 0.01 ft below top of inner well casing)

Water level: 8.66 ft Stabilization Time: 24-hr

Well development method: Bailed and Pumped

Average depth of frostline:

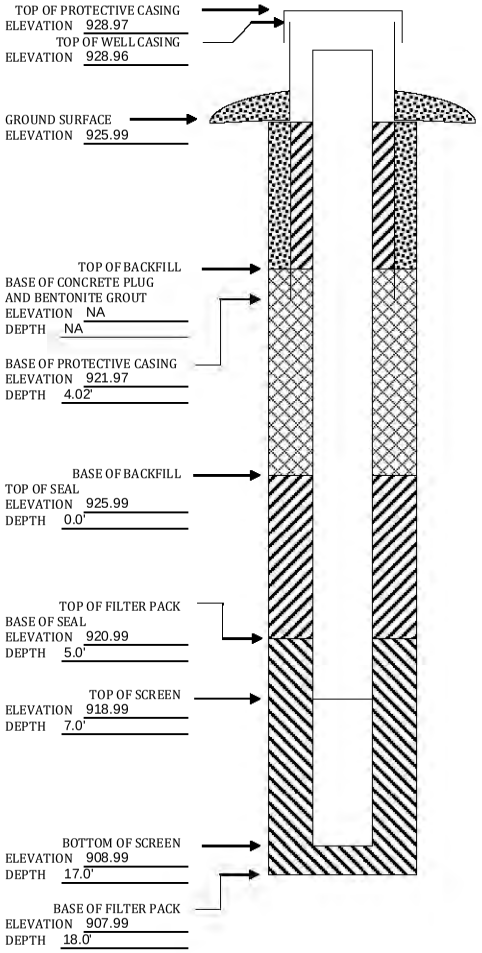
Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½x11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed for to: Iowa Department of Natural Resources, Land Quality Bureau, 502 E 9th St, Des Moines IA 50319-0034.

Questions? Call or Email: Nina Koger, Environmental Engineer Sr., 515-281-8986, Nina.Koger@dnr.iowa.gov

ELEVATIONS: ± 0.01 ft MSL
DEPTHS: ± 0.1 ft FROM GROUND SURFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL.)



Print Form

IOWA DEPARTMENT OF NATURAL RESOURCES

MONITORING WELL/PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name: Black Hawk Co Landfill Permit No.: 7-SDP-1-75P

Well or Piezometer No: MW-702B

Dates Started: 09/15/2021 Date Completed: 09/15/2021

A. SURVEYED LOCATIONS AND ELEVATIONS

Locations (± 0.5 ft): N 3618128.33 E 5235253.47

Specify corner of site: IA State Plane

Distance & direction along boundary:

Distance & direction from boundary to wall:

Elevations (± 0.01 ft MSL):

Ground Surface: 925.99

Top of protective casing: 928.97

Top of well casing: 928.96

Benchmark elevation:

Benchmark description:

B. SOIL BORING INFORMATION

Name & Address of Construction Company:
Terracon
6612 Chancellor Drive Suite 102
Cedar Falls IA 50613

Name of Driller: Scott Zeien

Drilling Method: 4 1/4" HSA

Drilling Fluid: NA

Bore Hole Diameter: 8.25"

Soil Sampling Method: 2' by 2" split spoon

Depth of Boring: 18.0'

C. MONITORING WELL INSTALLATION

Casing material: SCH 40 PVC

Length of casing: 9.97'

Outside casing diameter: 2.375"

Inside casing diameter: 2.067"

Casing joint type: flush threaded

Casing/screen joint type: flush threaded

Screen material: SCH 40 PVC

Screen opening size: 0.010"

Screen length: 10'

Depth of well: 17'

Filter Pack:

Material: Filter Pack Sand

Grain size: 0.007-0.250"

Volume: 33 gal.

Seal (minimum 3 ft length above filter pack):

Material: Bentonite Chips 3/8" hole plug

Placement method: direct pour

Volume: 13 gal.

Backfill (if different from seal):

Material:

Placement method:

Volume:

Surface seal design:

Material of protective casing: Steel

Material of grout between protective casing and well casing: 3/8" hole plug

Protective cap:

Material: Steel

Vented: ☐ Yes ☐ No Locking: ☒ Yes ☐ No

Well Cap:

Material: PVC

Vented: ☐ Yes ☒ No

D. GROUNDWATER MEASURMENT (± 0.01 ft below top of inner well casing)

Water level: 13.23 ft Stabilization Time: 24-hr

Well development method: Bailed and Pumped

Average depth of frostline:

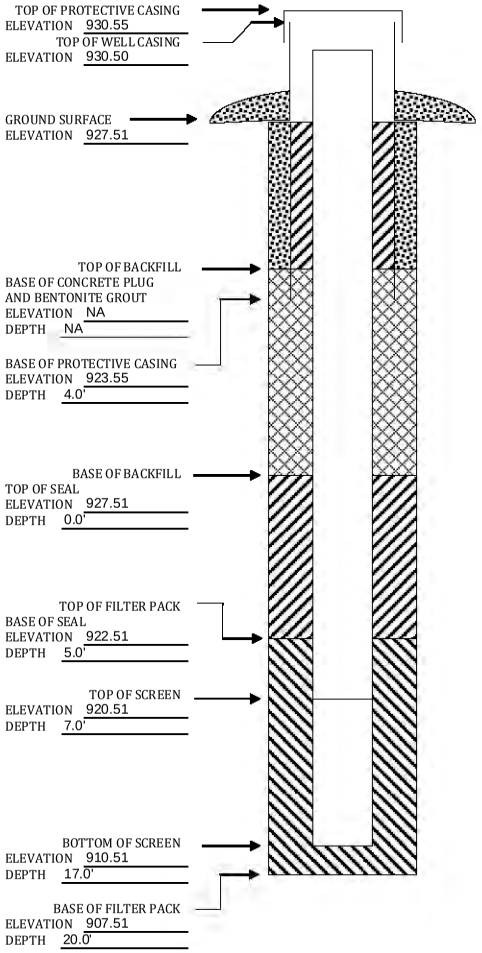
Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½x11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed for to: Iowa Department of Natural Resources, Land Quality Bureau, 502 E 9th St, Des Moines IA 50319-0034.

Questions? Call or Email: Nina Koger, Environmental Engineer Sr., 515-281-8986, Nina.Koger@dnr.iowa.gov

ELEVATIONS: ± 0.01 ft MSL
DEPTHS: ± 0.1 ft FROM GROUND SURFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL.)



06/2011 cmz

DNR Form 542-1277

Print Form

IOWA DEPARTMENT OF NATURAL RESOURCES

MONITORING WELL/PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name: Black Hawk Co Landfill Permit No.: 7-SDP-1-75P

Well or Piezometer No: MW-703B

Dates Started: 09/14/2021 Date Completed: 09/14/2021

A. SURVEYED LOCATIONS AND ELEVATIONS

Locations (± 0.5 ft): N 3618716.73 E 5235231.33

Specify corner of site: IA State Plane

Distance & direction along boundary:

Distance & direction from boundary to wall:

Elevations (± 0.01 ft MSL):

Ground Surface: 927.51

Top of protective casing: 930.55

Top of well casing: 930.50

Benchmark elevation:

Benchmark description:

B. SOIL BORING INFORMATION

Name & Address of Construction Company:
Terracon
6612 Chancellor Drive Suite 102
Cedar Falls IA 50613

Name of Driller: Scott Zeien

Drilling Method: 4 1/4" HSA

Drilling Fluid: NA

Bore Hole Diameter: 8.25"

Soil Sampling Method: 2' by 2" split spoon

Depth of Boring: 20.0'

C. MONITORING WELL INSTALLATION

Casing material: SCH 40 PVC

Length of casing: 9.97'

Outside casing diameter: 2.375"

Inside casing diameter: 2.067"

Casing joint type: flush threaded

Casing/screen joint type: flush threaded

Screen material: SCH 40 PVC

Screen opening size: 0.010"

Screen length: 10'

Depth of well: 17'

Filter Pack:

Material: Filter Pack Sand

Grain size: 0.007-0.250"

Volume: 38 gal.

Seal (minimum 3 ft length above filter pack):

Material: Bentonite Chips 3/8" hole plug

Placement method: direct pour

Volume: 13 gal.

Backfill (if different from seal):

Material:

Placement method:

Volume:

Surface seal design:

Material of protective casing: Steel

Material of grout between protective casing and well casing: 3/8" hole plug

Protective cap:

Material: Steel

Vented: ☐ Yes ☐ No Locking: ☒ Yes ☐ No

Well Cap:

Material: PVC

Vented: ☐ Yes ☒ No

D. GROUNDWATER MEASURMENT (± 0.01 ft below top of inner well casing)

Water level: 9.86 ft Stabilization Time: 24-hr

Well development method: Bailed and Pumped

Average depth of frostline:

Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½x11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed for to: Iowa Department of Natural Resources, Land Quality Bureau, 502 E 9th St, Des Moines IA 50319-0034.

Questions? Call or Email: Nina Koger, Environmental Engineer Sr., 515-281-8986, Nina.Koger@dnr.iowa.gov

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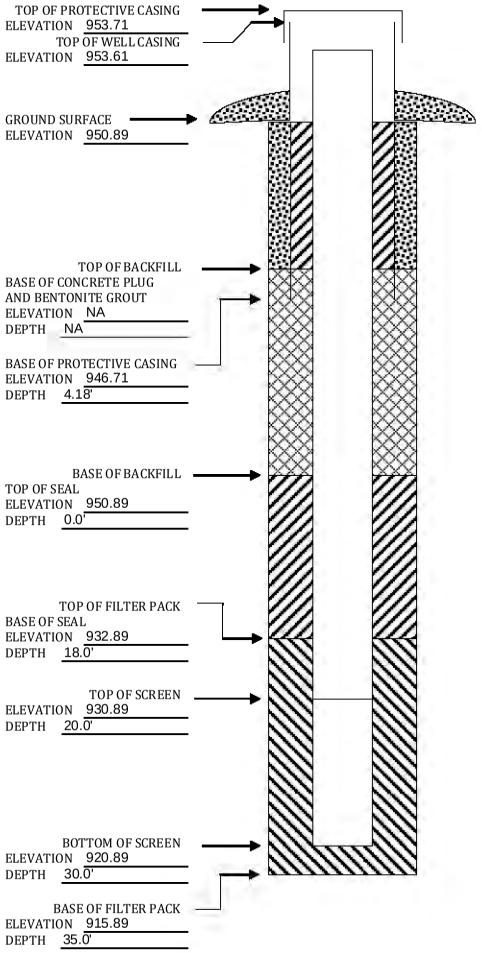
ELEVATIONS: ± 0.01 ft MSL
DEPTHS: ± 0.1 ft FROM GROUND SURFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL.)



Print Form

IOWA DEPARTMENT OF NATURAL RESOURCES

MONITORING WELL/PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name: Black Hawk Co Landfill Permit No.: 7-SDP-1-75P

Well or Piezometer No: MW-704B

Dates Started: 09/15/2021 Date Completed: 09/15/2021

A. SURVEYED LOCATIONS AND ELEVATIONS

Locations (± 0.5 ft): N 3618648.41 E 5235619.47

Specify corner of site: IA State Plane

Distance & direction along boundary:

Distance & direction from boundary to wall:

Elevations (± 0.01 ft MSL):

Ground Surface: 950.89

Top of protective casing: 953.71

Top of well casing: 953.61

Benchmark elevation:

Benchmark description:

B. SOIL BORING INFORMATION

Name & Address of Construction Company:
Terracon
6612 Chancellor Drive Suite 102
Cedar Falls IA 50613

Name of Driller: Scott Zeien

Drilling Method: 4 1/4" HSA

Drilling Fluid: NA

Bore Hole Diameter: 8.25"

Soil Sampling Method: 2' by 2" split spoon

Depth of Boring: 35.0'

C. MONITORING WELL INSTALLATION

Casing material: SCH 40 PVC

Length of casing: 22.72'

Outside casing diameter: 2.375"

Inside casing diameter: 2.067"

Casing joint type: flush threaded

Casing/screen joint type: flush threaded

Screen material: SCH 40 PVC

Screen opening size: 0.010"

Screen length: 10'

Depth of well: 30'

Filter Pack:

Material: Filter Pack Sand

Grain size: 0.007-0.250"

Volume: 44 gal.

Seal (minimum 3 ft length above filter pack):

Material: Bentonite Chips 3/8" hole plug

Placement method: direct pour

Volume: 46 gal.

Backfill (if different from seal):

Material:

Placement method:

Volume:

Surface seal design:

Material of protective casing: Steel

Material of grout between protective casing and well casing: 3/8" hole plug

Protective cap:

Material: Steel

Vented: ☐ Yes ☐ No Locking: ☒ Yes ☐ No

Well Cap:

Material: PVC

Vented: ☐ Yes ☒ No

D. GROUNDWATER MEASURMENT (± 0.01 ft below top of inner well casing)

Water level: 25.56 ft Stabilization Time: 24-hr

Well development method: Bailed and Pumped

Average depth of frostline:

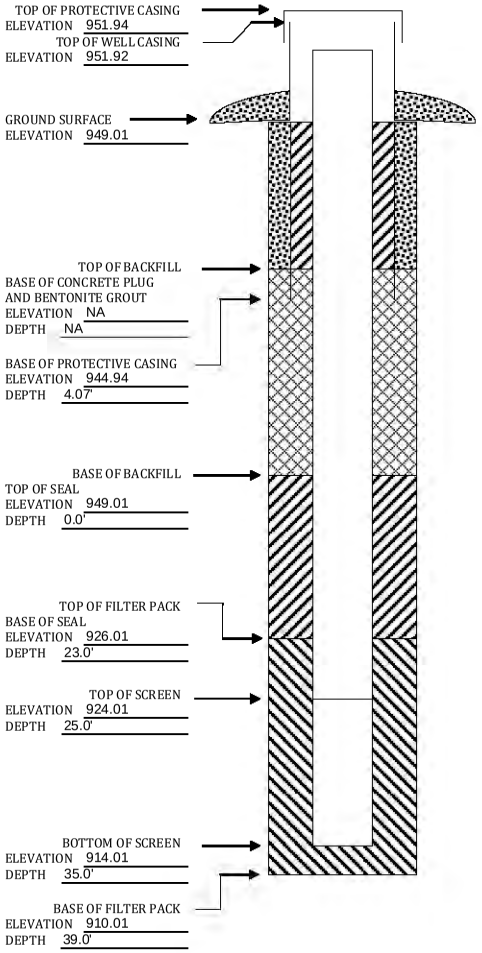
Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½x11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed for to: Iowa Department of Natural Resources, Land Quality Bureau, 502 E 9th St, Des Moines IA 50319-0034.

Questions? Call or Email: Nina Koger, Environmental Engineer Sr., 515-281-8986, Nina.Koger@dnr.iowa.gov

ELEVATIONS: ± 0.01 ft MSL
DEPTHS: ± 0.1 ft FROM GROUND SURFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL.)



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IOWA DEPARTMENT OF NATURAL RESOURCES

MONITORING WELL/PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name: Black Hawk Co Landfill Permit No.: 7-SDP-1-75P

Well or Piezometer No: MW-705B

Dates Started: 09/15/2021 Date Completed: 09/15/2021

A. SURVEYED LOCATIONS AND ELEVATIONS

Locations (± 0.5 ft): N 3618654.99 E 5235926.05

Specify corner of site: IA State Plane

Distance & direction along boundary:

Distance & direction from boundary to wall:

Elevations (± 0.01 ft MSL):

Ground Surface: 949.01

Top of protective casing: 951.94

Top of well casing: 957.92

Benchmark elevation:

Benchmark description:

B. SOIL BORING INFORMATION

Name & Address of Construction Company:
Terracon
6612 Chancellor Drive Suite 102
Cedar Falls IA 50613

Name of Driller: Scott Zeien

Drilling Method: 4 1/4" HSA

Drilling Fluid: NA

Bore Hole Diameter: 8.25"

Soil Sampling Method: 5' by 3" continuous sampler

Depth of Boring: 39.0'

C. MONITORING WELL INSTALLATION

Casing material: SCH 40 PVC

Length of casing: 27.91'

Outside casing diameter: 2.375"

Inside casing diameter: 2.067"

Casing joint type: flush threaded

Casing/screen joint type: flush threaded

Screen material: SCH 40 PVC

Screen opening size: 0.010"

Screen length: 10'

Depth of well: 35'

Filter Pack:

Material: Filter Pack Sand

Grain size: 0.007-0.250"

Volume: 41 gal.

Seal (minimum 3 ft length above filter pack):

Material: Bentonite Chips 3/8" hole plug

Placement method: direct pour

Volume: 59 gal.

Backfill (if different from seal):

Material:

Placement method:

Volume:

Surface seal design:

Material of protective casing: Steel

Material of grout between protective casing and well casing: 3/8" hole plug

Protective cap:

Material: Steel

Vented: ☐ Yes ☐ No Locking: ☒ Yes ☐ No

Well Cap:

Material: PVC

Vented: ☐ Yes ☒ No

D. GROUNDWATER MEASURMENT (± 0.01 ft below top of inner well casing)

Water level: 25.65 ft Stabilization Time: 24-hr

Well development method: Bailed and Pumped

Average depth of frostline:

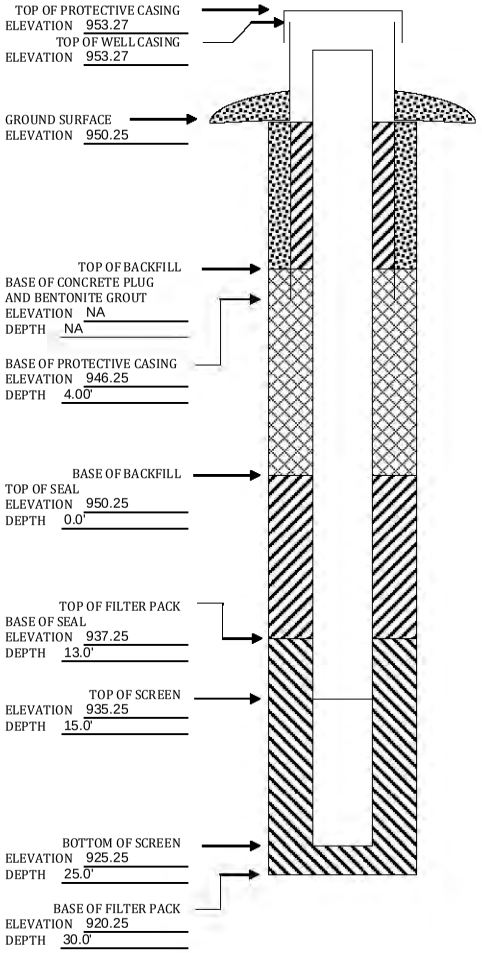
Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½x11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed for to: Iowa Department of Natural Resources, Land Quality Bureau, 502 E 9th St, Des Moines IA 50319-0034.

Questions? Call or Email: Nina Koger, Environmental Engineer Sr., 515-281-8986, Nina.Koger@dnr.iowa.gov

ELEVATIONS: ± 0.01 ft MSL
DEPTHS: ± 0.1 ft FROM GROUND SURFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL.)



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DNR Form 542-1277

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IOWA DEPARTMENT OF NATURAL RESOURCES

MONITORING WELL/PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name: Black Hawk Co Landfill Permit No.: 7-SDP-1-75P

Well or Piezometer No: MW-706B

Dates Started: 09/15/2021 Date Completed: 09/15/2021

A. SURVEYED LOCATIONS AND ELEVATIONS

Locations (± 0.5 ft): N 3618672.27 E 5236223.67

Specify corner of site: IA State Plane

Distance & direction along boundary:

Distance & direction from boundary to wall:

Elevations (± 0.01 ft MSL):

Ground Surface: 950.25

Top of protective casing: 953.27

Top of well casing: 953.27

Benchmark elevation:

Benchmark description:

B. SOIL BORING INFORMATION

Name & Address of Construction Company:
Terracon
6612 Chancellor Drive Suite 102
Cedar Falls IA 50613

Name of Driller: Scott Zeien

Drilling Method: 4 1/4" HSA

Drilling Fluid: NA

Bore Hole Diameter: 8.25"

Soil Sampling Method: 5' by 3" continuous sampler

Depth of Boring: 30.0'

C. MONITORING WELL INSTALLATION

Casing material: SCH 40 PVC

Length of casing: 18.0'

Outside casing diameter: 2.375"

Inside casing diameter: 2.067"

Casing joint type: flush threaded

Casing/screen joint type: flush threaded

Screen material: SCH 40 PVC

Screen opening size: 0.010"

Screen length: 10'

Depth of well: 25'

Filter Pack:

Material: Filter Pack Sand

Grain size: 0.007-0.250"

Volume: 44 gal.

Seal (minimum 3 ft length above filter pack):

Material: Bentonite Chips 3/8" hole plug

Placement method: direct pour

Volume: 33 gal.

Backfill (if different from seal):

Material:

Placement method:

Volume:

Surface seal design:

Material of protective casing: Steel

Material of grout between protective casing and well casing: 3/8" hole plug

Protective cap:

Material: Steel

Vented: ☐ Yes ☐ No Locking: ☒ Yes ☐ No

Well Cap:

Material: PVC

Vented: ☐ Yes ☒ No

D. GROUNDWATER MEASURMENT (± 0.01 ft below top of inner well casing)

Water level: 23.95 ft Stabilization Time: 24-hr

Well development method: Bailed and Pumped

Average depth of frostline:

Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½x11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed for to: Iowa Department of Natural Resources, Land Quality Bureau, 502 E 9th St, Des Moines IA 50319-0034.

Questions? Call or Email: Nina Koger, Environmental Engineer Sr., 515-281-8986, Nina.Koger@dnr.iowa.gov

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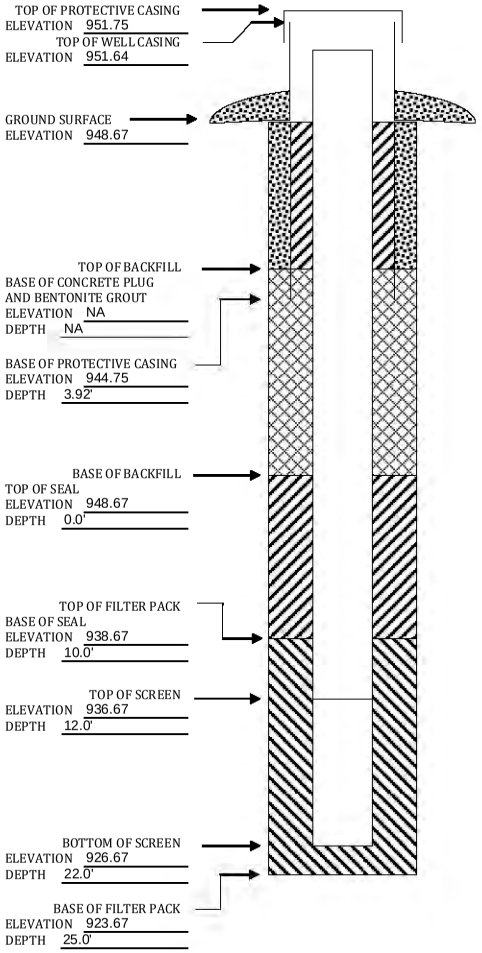
DNR Form 542-1277

ELEVATIONS: ± 0.01 ft MSL
DEPTHS: ± 0.1 ft FROM GROUND SURFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL.)



Print Form

IOWA DEPARTMENT OF NATURAL RESOURCES

MONITORING WELL/PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name: Black Hawk Co Landfill Permit No.: 7-SDP-1-75P

Well or Piezometer No: MW-707B

Dates Started: 09/16/2021 Date Completed: 09/16/2021

A. SURVEYED LOCATIONS AND ELEVATIONS

Locations (± 0.5 ft): N 3618692.84 E 5236574.51

Specify corner of site: IA State Plane

Distance & direction along boundary:

Distance & direction from boundary to wall:

Elevations (± 0.01 ft MSL):

Ground Surface: 948.67

Top of protective casing: 951.75

Top of well casing: 951.64

Benchmark elevation:

Benchmark description:

B. SOIL BORING INFORMATION

Name & Address of Construction Company:
Terracon
6612 Chancellor Drive Suite 102
Cedar Falls IA 50613

Name of Driller: Scott Zeien

Drilling Method: 4 1/4" HSA

Drilling Fluid: NA

Bore Hole Diameter: 8.25"

Soil Sampling Method: 5' by 3" continuous sampler

Depth of Boring: 25.0'

C. MONITORING WELL INSTALLATION

Casing material: SCH 40 PVC

Length of casing: 14.97'

Outside casing diameter: 2.375"

Inside casing diameter: 2.067"

Casing joint type: flush threaded

Casing/screen joint type: flush threaded

Screen material: SCH 40 PVC

Screen opening size: 0.010"

Screen length: 10'

Depth of well: 22'

Filter Pack:

Material: Filter Pack Sand

Grain size: 0.007-0.250"

Volume: 39 gal.

Seal (minimum 3 ft length above filter pack):

Material: Bentonite Chips 3/8" hole plug

Placement method: direct pour

Volume: 26 gal.

Backfill (if different from seal):

Material:

Placement method:

Volume:

Surface seal design:

Material of protective casing: Steel

Material of grout between protective casing and well casing: 3/8" hole plug

Protective cap:

Material: Steel

Vented: ☐ Yes ☐ No Locking: ☒ Yes ☐ No

Well Cap:

Material: PVC

Vented: ☐ Yes ☒ No

D. GROUNDWATER MEASURMENT (± 0.01 ft below top of inner well casing)

Water level: 19.84 ft Stabilization Time: 24-hr

Well development method: Bailed and Pumped

Average depth of frostline:

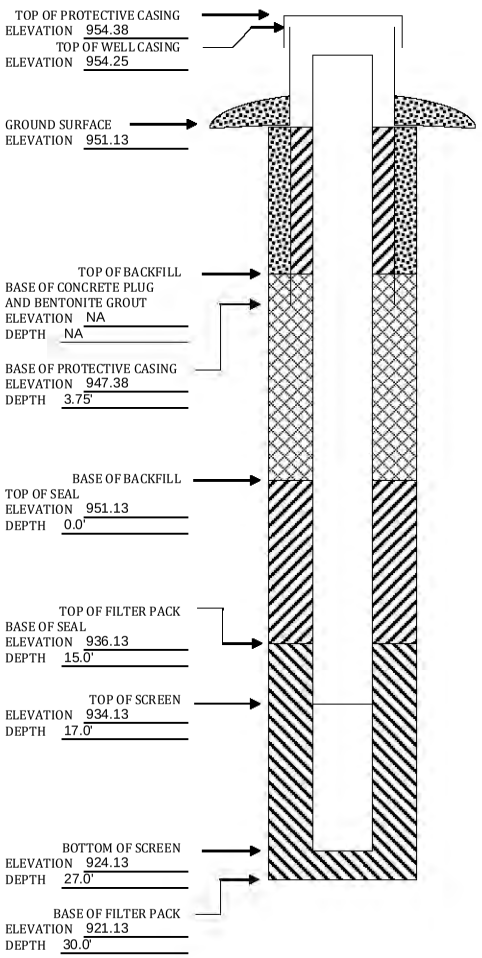
Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½x11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed for to: Iowa Department of Natural Resources, Land Quality Bureau, 502 E 9th St, Des Moines IA 50319-0034.

Questions? Call or Email: Nina Koger, Environmental Engineer Sr., 515-281-8986, Nina.Koger@dnr.iowa.gov

ELEVATIONS: ± 0.01 ft MSL
DEPTHS: ± 0.1 ft FROM GROUND SURFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL.)



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DNR Form 542-1277

Print Form

IOWA DEPARTMENT OF NATURAL RESOURCES

MONITORING WELL/PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name: Black Hawk Co Landfill Permit No.: 7-SDP-1-75P

Well or Piezometer No: MW-708B

Dates Started: 09/16/2021 Date Completed: 09/16/2021

A. SURVEYED LOCATIONS AND ELEVATIONS

Locations (± 0.5 ft): N 3618696.54 E 5236826.11

Specify corner of site: IA State Plane

Distance & direction along boundary:

Distance & direction from boundary to wall:

Elevations (± 0.01 ft MSL):

Ground Surface: 951.13

Top of protective casing: 954.38

Top of well casing: 954.25

Benchmark elevation:

Benchmark description:

B. SOIL BORING INFORMATION

Name & Address of Construction Company:
Terracon
6612 Chancellor Drive Suite 102
Cedar Falls IA 50613

Name of Driller: Scott Zeien

Drilling Method: 4 1/4" HSA

Drilling Fluid: NA

Bore Hole Diameter: 8.25"

Soil Sampling Method: 5' by 3" continuous sampler

Depth of Boring: 30.0'

C. MONITORING WELL INSTALLATION

Casing material: SCH 40 PVC

Length of casing: 20.12'

Outside casing diameter: 2.375"

Inside casing diameter: 2.067"

Casing joint type: flush threaded

Casing/screen joint type: flush threaded

Screen material: SCH 40 PVC

Screen opening size: 0.010"

Screen length: 10'

Depth of well: 27'

Filter Pack:

Material: Filter Pack Sand

Grain size: 0.007-0.250"

Volume: 39 gal.

Seal (minimum 3 ft length above filter pack):

Material: Bentonite Chips 3/8" hole plug

Placement method: direct pour

Volume: 39 gal.

Backfill (if different from seal):

Material:

Placement method:

Volume:

Surface seal design:

Material of protective casing: Steel

Material of grout between protective casing and well casing: 3/8" hole plug

Protective cap:

Material: Steel

Vented: ☐ Yes ☐ No Locking: ☒ Yes ☐ No

Well Cap:

Material: PVC

Vented: ☐ Yes ☒ No

D. GROUNDWATER MEASURMENT (± 0.01 ft below top of inner well casing)

Water level: 21.36 ft Stabilization Time: 24-hr

Well development method: Bailed and Pumped

Average depth of frostline:

Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½x11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed for to: Iowa Department of Natural Resources, Land Quality Bureau, 502 E 9th St, Des Moines IA 50319-0034.

Questions? Call or Email: Nina Koger, Environmental Engineer Sr., 515-281-8986, Nina.Koger@dnr.iowa.gov

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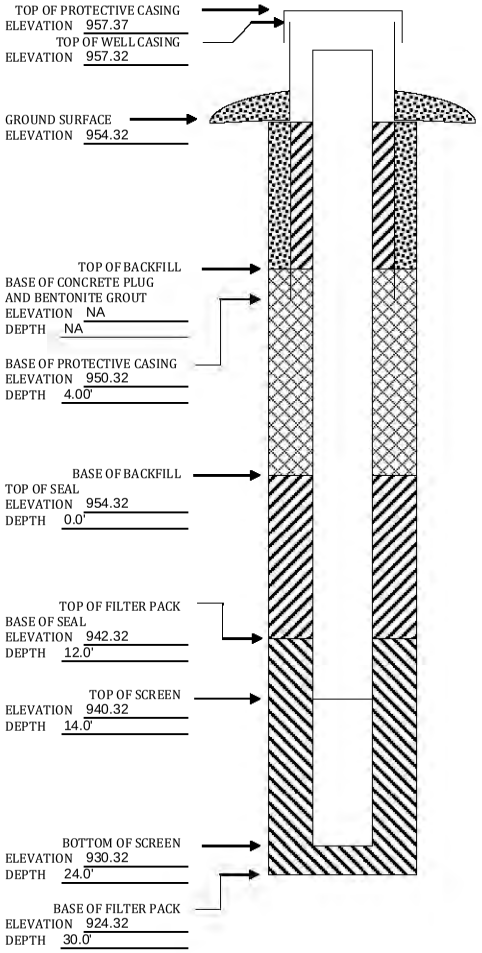
DNR Form 542-1277

ELEVATIONS: ± 0.01 ft MSL
DEPTHS: ± 0.1 ft FROM GROUND SURFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL.)



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DNR Form 542-1277

Print Form

IOWA DEPARTMENT OF NATURAL RESOURCES

MONITORING WELL/PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name: Black Hawk Co Landfill Permit No.: 7-SDP-1-75P

Well or Piezometer No: MW-709B

Dates Started: 09/16/2021 Date Completed: 09/16/2021

A. SURVEYED LOCATIONS AND ELEVATIONS

Locations (± 0.5 ft): N 3618699.41 E 5237139.81

Specify corner of site: IA State Plane

Distance & direction along boundary:

Distance & direction from boundary to wall:

Elevations (± 0.01 ft MSL):

Ground Surface: 954.32

Top of protective casing: 957.37

Top of well casing: 957.32

Benchmark elevation:

Benchmark description:

B. SOIL BORING INFORMATION

Name & Address of Construction Company:
Terracon
6612 Chancellor Drive Suite 102
Cedar Falls IA 50613

Name of Driller: Scott Zeien

Drilling Method: 4 1/4" HSA

Drilling Fluid: NA

Bore Hole Diameter: 8.25"

Soil Sampling Method: 5' by 3" continuous sampler

Depth of Boring: 30.0'

C. MONITORING WELL INSTALLATION

Casing material: SCH 40 PVC

Length of casing: 17.0'

Outside casing diameter: 2.375"

Inside casing diameter: 2.067"

Casing joint type: flush threaded

Casing/screen joint type: flush threaded

Screen material: SCH 40 PVC

Screen opening size: 0.010"

Screen length: 10'

Depth of well: 24'

Filter Pack:

Material: Filter Pack Sand

Grain size: 0.007-0.250"

Volume: 46 gal.

Seal (minimum 3 ft length above filter pack):

Material: Bentonite Chips 3/8" hole plug

Placement method: direct pour

Volume: 31 gal.

Backfill (if different from seal):

Material:

Placement method:

Volume:

Surface seal design:

Material of protective casing: Steel

Material of grout between protective casing and well casing: 3/8" hole plug

Protective cap:

Material: Steel

Vented: ☐ Yes ☐ No Locking: ☒ Yes ☐ No

Well Cap:

Material: PVC

Vented: ☐ Yes ☒ No

D. GROUNDWATER MEASURMENT (± 0.01 ft below top of inner well casing)

Water level: 22.91 ft Stabilization Time: 24-hr

Well development method: Bailed and Pumped

Average depth of frostline:

Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½x11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed for to: Iowa Department of Natural Resources, Land Quality Bureau, 502 E 9th St, Des Moines IA 50319-0034.

Questions? Call or Email: Nina Koger, Environmental Engineer Sr., 515-281-8986, Nina.Koger@dnr.iowa.gov

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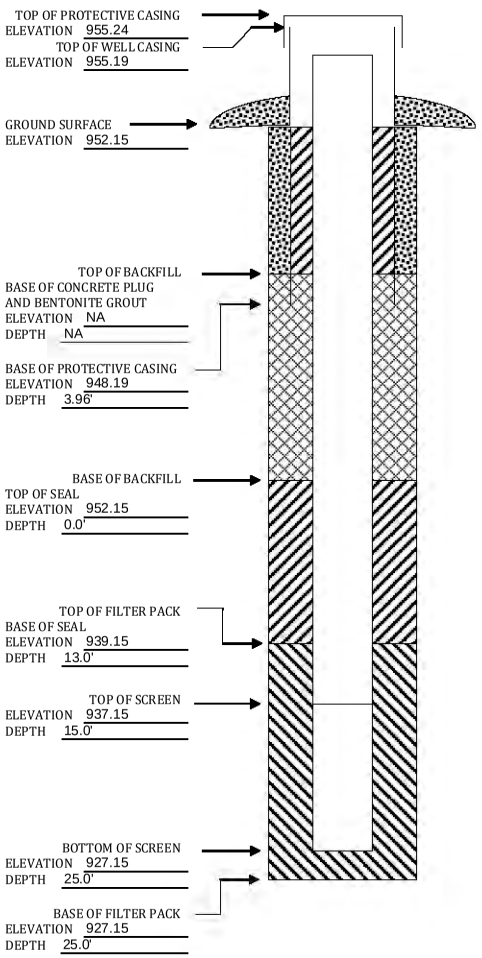
DNR Form 542-1277

ELEVATIONS: ± 0.01 ft MSL
DEPTHS: ± 0.1 ft FROM GROUND SURFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL.)



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DNR Form 542-1277

Print Form

IOWA DEPARTMENT OF NATURAL RESOURCES

MONITORING WELL/PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name: Black Hawk Co Landfill Permit No.: 7-SDP-1-75P

Well or Piezometer No: MW-710B

Dates Started: 09/16/2021 Date Completed: 09/16/2021

A. SURVEYED LOCATIONS AND ELEVATIONS

Locations (± 0.5 ft): N 3618702.50 E 5237477.63

Specify corner of site: IA State Plane

Distance & direction along boundary:

Distance & direction from boundary to wall:

Elevations (± 0.01 ft MSL):

Ground Surface: 952.15

Top of protective casing: 955.24

Top of well casing: 955.19

Benchmark elevation:

Benchmark description:

B. SOIL BORING INFORMATION

Name & Address of Construction Company:
Terracon
6612 Chancellor Drive Suite 102
Cedar Falls IA 50613

Name of Driller: Scott Zeien

Drilling Method: 4 1/4" HSA

Drilling Fluid: NA

Bore Hole Diameter: 8.25"

Soil Sampling Method: 5' by 3" continuous sampler

Depth of Boring: 25.0'

C. MONITORING WELL INSTALLATION

Casing material: SCH 40 PVC

Length of casing: 18.04'

Outside casing diameter: 2.375"

Inside casing diameter: 2.067"

Casing joint type: flush threaded

Casing/screen joint type: flush threaded

Screen material: SCH 40 PVC

Screen opening size: 0.010"

Screen length: 10'

Depth of well: 25'

Filter Pack:

Material: Filter Pack Sand

Grain size: 0.007-0.250"

Volume: 31 gal.

Seal (minimum 3 ft length above filter pack):

Material: Bentonite Chips 3/8" hole plug

Placement method: direct pour

Volume: 38 gal.

Backfill (if different from seal):

Material:

Placement method:

Volume:

Surface seal design:

Material of protective casing: Steel

Material of grout between protective casing and well casing: 3/8" hole plug

Protective cap:

Material: Steel

Vented: ☐ Yes ☐ No Locking: ☒ Yes ☐ No

Well Cap:

Material: PVC

Vented: ☐ Yes ☒ No

D. GROUNDWATER MEASURMENT (± 0.01 ft below top of inner well casing)

Water level: 19.78 ft Stabilization Time: 24-hr

Well development method: Bailed and Pumped

Average depth of frostline:

Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½x11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed for to: Iowa Department of Natural Resources, Land Quality Bureau, 502 E 9th St, Des Moines IA 50319-0034.

Questions? Call or Email: Nina Koger, Environmental Engineer Sr., 515-281-8986, Nina.Koger@dnr.iowa.gov

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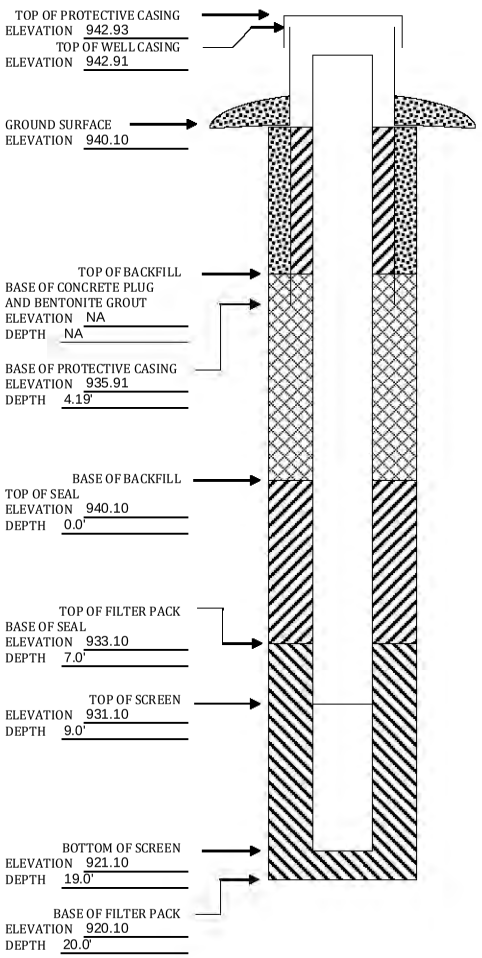
DNR Form 542-1277

ELEVATIONS: ± 0.01 ft MSL
DEPTHS: ± 0.1 ft FROM GROUND SURFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL.)



Print Form

IOWA DEPARTMENT OF NATURAL RESOURCES

MONITORING WELL/PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name: Black Hawk Co Landfill Permit No.: 7-SDP-1-75P

Well or Piezometer No: MW-711B

Dates Started: 09/16/2021 Date Completed: 09/16/2021

A. SURVEYED LOCATIONS AND ELEVATIONS

Locations (± 0.5 ft): N 3618391.76 E 5237815.65

Specify corner of site: IA State Plane

Distance & direction along boundary:

Distance & direction from boundary to wall:

Elevations (± 0.01 ft MSL):

Ground Surface: 940.10

Top of protective casing: 942.93

Top of well casing: 942.91

Benchmark elevation:

Benchmark description:

B. SOIL BORING INFORMATION

Name & Address of Construction Company:
Terracon
6612 Chancellor Drive Suite 102
Cedar Falls IA 50613

Name of Driller: Scott Zeien

Drilling Method: 4 1/4" HSA

Drilling Fluid: NA

Bore Hole Diameter: 8.25"

Soil Sampling Method: 5' by 3" continuous sampler

Depth of Boring: 20.0'

C. MONITORING WELL INSTALLATION

Casing material: SCH 40 PVC

Length of casing: 11.81'

Outside casing diameter: 2.375"

Inside casing diameter: 2.067"

Casing joint type: flush threaded

Casing/screen joint type: flush threaded

Screen material: SCH 40 PVC

Screen opening size: 0.010"

Screen length: 10'

Depth of well: 19'

Filter Pack:

Material: Filter Pack Sand

Grain size: 0.007-0.250"

Volume: 41 gal.

Seal (minimum 3 ft length above filter pack):

Material: Bentonite Chips 3/8" hole plug

Placement method: direct pour

Volume: 21 gal.

Backfill (if different from seal):

Material:

Placement method:

Volume:

Surface seal design:

Material of protective casing: Steel

Material of grout between protective casing and well casing: 3/8" hole plug

Protective cap:

Material: Steel

Vented: ☐ Yes ☐ No Locking: ☒ Yes ☐ No

Well Cap:

Material: PVC

Vented: ☐ Yes ☒ No

D. GROUNDWATER MEASURMENT (± 0.01 ft below top of inner well casing)

Water level: 12.10 ft Stabilization Time: 24-hr

Well development method: Bailed and Pumped

Average depth of frostline:

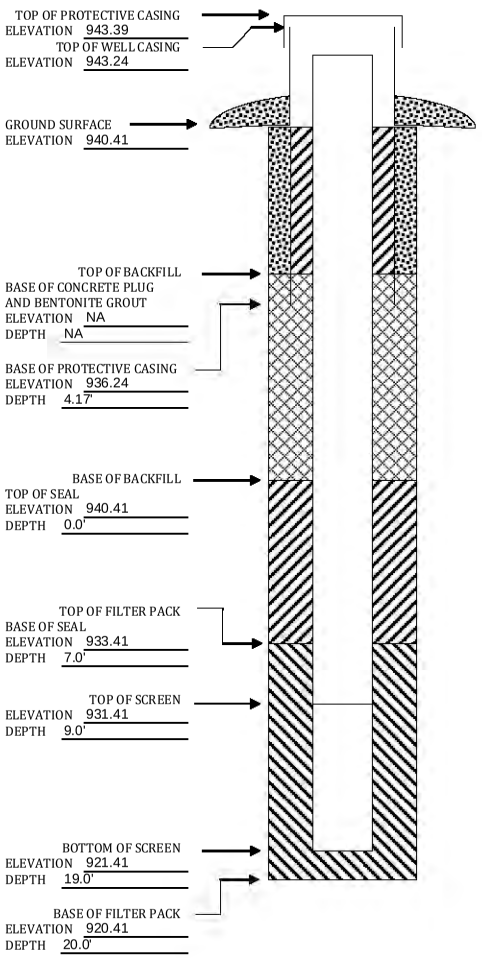
Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½x11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed for to: Iowa Department of Natural Resources, Land Quality Bureau, 502 E 9th St, Des Moines IA 50319-0034.

Questions? Call or Email: Nina Koger, Environmental Engineer Sr., 515-281-8986, Nina.Koger@dnr.iowa.gov

ELEVATIONS: ± 0.01 ft MSL
DEPTHS: ± 0.1 ft FROM GROUND SURFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL.)



Print Form

IOWA DEPARTMENT OF NATURAL RESOURCES

MONITORING WELL/PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name: Black Hawk Co Landfill Permit No.: 7-SDP-1-75P

Well or Piezometer No: MW-712B

Dates Started: 09/16/2021 Date Completed: 09/16/2021

A. SURVEYED LOCATIONS AND ELEVATIONS

Locations (± 0.5 ft): N 3618053.73 E 5237812.77

Specify corner of site: IA State Plane

Distance & direction along boundary:

Distance & direction from boundary to wall:

Elevations (± 0.01 ft MSL):

Ground Surface: 940.41

Top of protective casing: 943.39

Top of well casing: 943.24

Benchmark elevation:

Benchmark description:

B. SOIL BORING INFORMATION

Name & Address of Construction Company:
Terracon
6612 Chancellor Drive Suite 102
Cedar Falls IA 50613

Name of Driller: Scott Zeien

Drilling Method: 4 1/4" HSA

Drilling Fluid: NA

Bore Hole Diameter: 8.25"

Soil Sampling Method: 5' by 3" continuous sampler

Depth of Boring: 20.0'

C. MONITORING WELL INSTALLATION

Casing material: SCH 40 PVC

Length of casing: 11.83'

Outside casing diameter: 2.375"

Inside casing diameter: 2.067"

Casing joint type: flush threaded

Casing/screen joint type: flush threaded

Screen material: SCH 40 PVC

Screen opening size: 0.010"

Screen length: 10'

Depth of well: 19'

Filter Pack:

Material: Filter Pack Sand

Grain size: 0.007-0.250"

Volume: 52 gal.

Seal (minimum 3 ft length above filter pack):

Material: Bentonite Chips 3/8" hole plug

Placement method: direct pour

Volume: 21 gal.

Backfill (if different from seal):

Material:

Placement method:

Volume:

Surface seal design:

Material of protective casing: Steel

Material of grout between protective casing and well casing: 3/8" hole plug

Protective cap:

Material: Steel

Vented: ☐ Yes ☐ No Locking: ☒ Yes ☐ No

Well Cap:

Material: PVC

Vented: ☐ Yes ☒ No

D. GROUNDWATER MEASURMENT (± 0.01 ft below top of inner well casing)

Water level: 15.43 ft Stabilization Time: 24-hr

Well development method: Bailed and Pumped

Average depth of frostline:

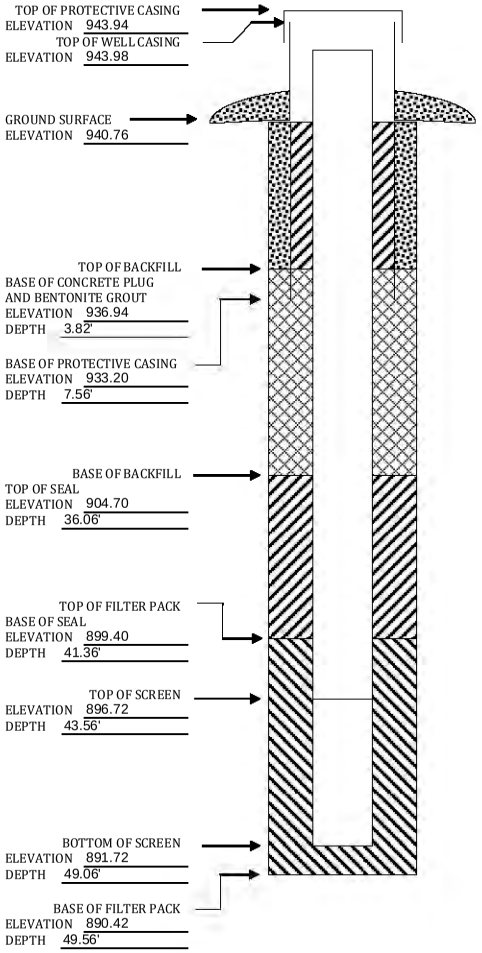
Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½x11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed for to: Iowa Department of Natural Resources, Land Quality Bureau, 502 E 9th St, Des Moines IA 50319-0034.

Questions? Call or Email: Nina Koger, Environmental Engineer Sr., 515-281-8986, Nina.Koger@dnr.iowa.gov

ELEVATIONS: ± 0.01 ft MSL
DEPTHS: ± 0.1 ft FROM GROUND SURFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL.)



Print Form

IOWA DEPARTMENT OF NATURAL RESOURCES

MONITORING WELL/PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name: Black Hawk Co Landfill Permit No.: 7-SDP-1-75P

Well or Piezometer No: P-101A

Dates Started: 10/20/1986 Date Completed: 10/20/1986

A. SURVEYED LOCATIONS AND ELEVATIONS

Locations (± 0.5 ft): N 3618433.56 E 5237814.22

Specify corner of site: IA State Plane

Distance & direction along boundary:

Distance & direction from boundary to wall:

Elevations (± 0.01 ft MSL):

Ground Surface: 940.76

Top of protective casing: 943.94

Top of well casing: 943.98

Benchmark elevation:

Benchmark description:

B. SOIL BORING INFORMATION

Name & Address of Construction Company: Twin City Testing Corp.

Name of Driller:

Drilling Method:

Drilling Fluid:

Bore Hole Diameter: 6.5-inch

Soil Sampling Method:

Depth of Boring: 49.56

C. MONITORING WELL INSTALLATION

Casing material: STAINLESS STEEL

Length of casing: 44.06'

Outside casing diameter: 2.375"

Inside casing diameter: 2.067"

Casing joint type: flush threaded, o-ring

Casing/screen joint type: flush threaded, o-ring

Screen material: STAINLESS STEEL

Screen opening size: 0.010"

Screen length: 5.0'

Depth of well: 49.06'

Filter Pack:

Material: Silica Sand

Grain size: #10

Volume:

Seal (minimum 3 ft length above filter pack):

Material: Bentonite pellet

Placement method:

Volume:

Backfill (if different from seal):

Material: VOLCLAY Grout

Placement method:

Volume:

Surface seal design: 3/8-in Hole Plug bentonite

Material of protective casing: Steel

Material of grout between protective casing and well casing: 3/8" hole plug

Protective cap:

Material: Steel

Vented: ☐ Yes ☐ No Locking: ☒ Yes ☐ No

Well Cap:

Material: PVC

Vented: ☒ Yes ☐ No

D. GROUNDWATER MEASURMENT (± 0.01 ft below top of inner well casing)

Water level: 22.15 ft Stabilization Time: 24-hr

Well development method:

Average depth of frostline:

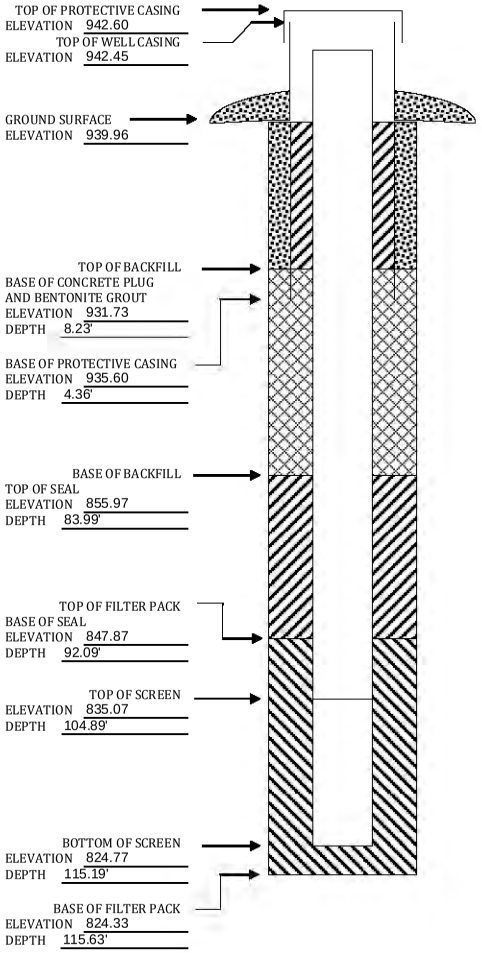
Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½x11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed for to: Iowa Department of Natural Resources, Land Quality Bureau, 502 E 9th St, Des Moines IA 50319-0034.

Questions? Call or Email: Nina Koger, Environmental Engineer Sr., 515-281-8986, Nina.Koger@dnr.iowa.gov

ELEVATIONS: ± 0.01 ft MSL
DEPTHS: ± 0.1 ft FROM GROUND SURFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL.)



Print Form

IOWA DEPARTMENT OF NATURAL RESOURCES

MONITORING WELL/PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name: Black Hawk Co Landfill Permit No.: 7-SDP-1-75P

Well or Piezometer No: P-101C

Dates Started: 10/23/1986 Date Completed: 10/23/1986

A. SURVEYED LOCATIONS AND ELEVATIONS

Locations (± 0.5 ft): N 3618381.56 E 5237815.73

Specify corner of site: IA State Plane

Distance & direction along boundary:

Distance & direction from boundary to wall:

Elevations (± 0.01 ft MSL):

Ground Surface: 939.96

Top of protective casing: 942.60

Top of well casing: 942.45

Benchmark elevation:

Benchmark description:

B. SOIL BORING INFORMATION

Name & Address of Construction Company:
Twin City Testing Corp.

Name of Driller:

Drilling Method:

Drilling Fluid:

Bore Hole Diameter: 6.0"

Soil Sampling Method:

Depth of Boring: 115.63'

C. MONITORING WELL INSTALLATION

Casing material: STAINLESS STEEL

Length of casing: 111.96'

Outside casing diameter: 2.375"

Inside casing diameter: 2.067"

Casing joint type: flush threaded, o-ring

Casing/screen joint type: flush threaded, o-ring

Screen material: STAINLESS STEEL

Screen opening size: 0.010"

Screen length: 10.3'

Depth of well: 118.03'

Filter Pack:

Material: Silica Sand

Grain size: #10

Volume:

Seal (minimum 3 ft length above filter pack):

Material: Bentonite/2 - 6"x10" rubber packers

Placement method:

Volume:

Backfill (if different from seal):

Material: VOLCLAY Grout

Placement method:

Volume:

Surface seal design: 3/8-in Hole Plug bentonite

Material of protective casing: Steel

Material of grout between protective casing and well casing: 3/8" hole plug

Protective cap:

Material: Steel

Vented: ☐ Yes ☐ No Locking: ☑ Yes ☐ No

Well Cap:

Material: PVC

Vented: ☑ Yes ☐ No

D. GROUNDWATER MEASURMENT (± 0.01 ft below top of inner well casing)

Water level: 107.17 ft Stabilization Time: 24-hr

Well development method:

Average depth of frostline:

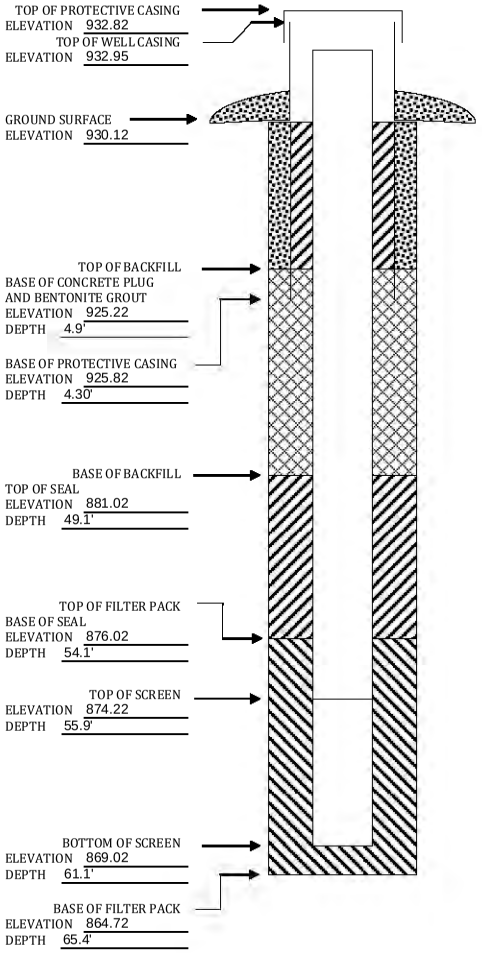
Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½x11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed for to: Iowa Department of Natural Resources, Land Quality Bureau, 502 E 9th St, Des Moines IA 50319-0034.

Questions? Call or Email: Nina Koger, Environmental Engineer Sr., 515-281-8986, Nina.Koger@dnr.iowa.gov

ELEVATIONS: ± 0.01 ft MSL
DEPTHS: ± 0.1 ft FROM GROUND SURFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL.)



Print Form

IOWA DEPARTMENT OF NATURAL RESOURCES

MONITORING WELL/PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name: Black Hawk Co Landfill Permit No.: 7-SDP-1-75P

Well or Piezometer No: P-101A

Dates Started: 1/15/1990 Date Completed: 1/15/1990

A. SURVEYED LOCATIONS AND ELEVATIONS

Locations (± 0.5 ft): N 3618226.13 E 5238062.10

Specify corner of site: IA State Plane

Distance & direction along boundary:

Distance & direction from boundary to wall:

Elevations (± 0.01 ft MSL):

Ground Surface: 930.12

Top of protective casing: 932.82

Top of well casing: 932.95

Benchmark elevation:

Benchmark description:

B. SOIL BORING INFORMATION

Name & Address of Construction Company: Twin City Testing Corp.

Name of Driller:

Drilling Method:

Drilling Fluid:

Bore Hole Diameter: 7-inch

Soil Sampling Method:

Depth of Boring: 65.4 ft bgs

C. MONITORING WELL INSTALLATION

Casing material: STAINLESS STEEL

Length of casing: 58.73'

Outside casing diameter: 2.375"

Inside casing diameter: 2.067"

Casing joint type: flush threaded, o-ring

Casing/screen joint type: flush threaded, o-ring

Screen material: STAINLESS STEEL

Screen opening size: 0.010"

Screen length: 5.2'

Depth of well: 61.1'

Filter Pack:

Material: BADGER BB #1 WELL PACK

Grain size:

Volume:

Seal (minimum 3 ft length above filter pack):

Material: 1/4-inch Bentonite pellet

Placement method:

Volume:

Backfill (if different from seal):

Material: AMERICAN COLLOID PURE GOLD Grout

Placement method:

Volume:

Surface seal design: 3/8-in Hole Plug bentonite

Material of protective casing: Steel

Material of grout between protective casing and well casing: 3/8" hole plug

Protective cap:

Material: Steel

Vented: ☐ Yes ☐ No Locking: ☑ Yes ☐ No

Well Cap:

Material: PVC

Vented: ☑ Yes ☐ No

D. GROUNDWATER MEASURMENT (± 0.01 ft below top of inner well casing)

Water level: 51.99 ft Stabilization Time: 24-hr

Well development method:

Average depth of frostline:

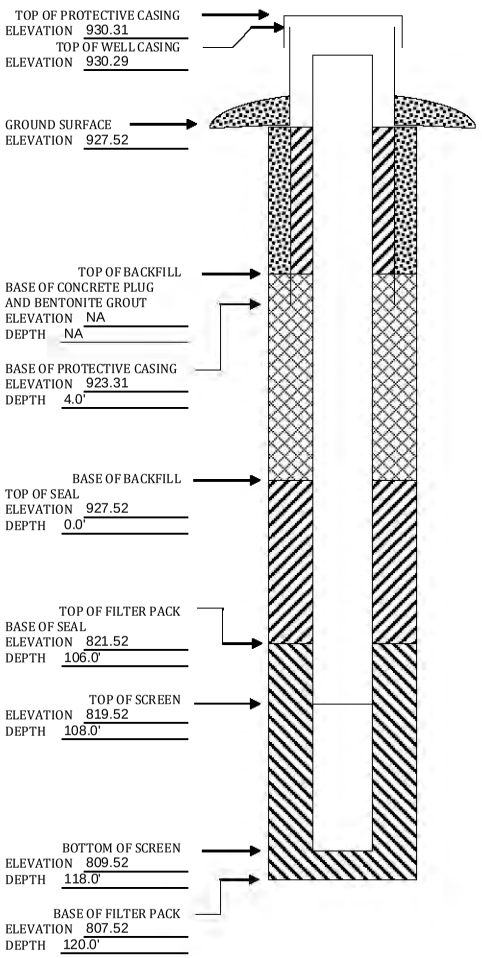
Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½x11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed for to: Iowa Department of Natural Resources, Land Quality Bureau, 502 E 9th St, Des Moines IA 50319-0034.

Questions? Call or Email: Nina Koger, Environmental Engineer Sr., 515-281-8986, Nina.Koger@dnr.iowa.gov

ELEVATIONS: ± 0.01 ft MSL
DEPTHS: ± 0.1 ft FROM GROUND SURFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL.)



06/2011 cmz

DNR Form 542-1277

Print Form

IOWA DEPARTMENT OF NATURAL RESOURCES

MONITORING WELL/PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name: Black Hawk Co Landfill Permit No.: 7-SDP-1-75P

Well or Piezometer No: P-703C

Dates Started: 09/14/2021 Date Completed: 09/17/2021

A. SURVEYED LOCATIONS AND ELEVATIONS

Locations (± 0.5 ft): N 3618709.58 E 5235229.84

Specify corner of site: IA State Plane

Distance & direction along boundary:

Distance & direction from boundary to wall:

Elevations (± 0.01 ft MSL):

Ground Surface: 927.52

Top of protective casing: 930.31

Top of well casing: 930.29

Benchmark elevation:

Benchmark description:

B. SOIL BORING INFORMATION

Name & Address of Construction Company:
Terracon
6612 Chancellor Drive Suite 102
Cedar Falls IA 50613

Name of Driller: Scott Zeien

Drilling Method: 3 1/4" HSA

Drilling Fluid: NA

Bore Hole Diameter: 7.25"

Soil Sampling Method: 5' by 3" continuous sampler

Depth of Boring: 120.4'

C. MONITORING WELL INSTALLATION

Casing material: SCH 80 PVC

Length of casing: 111'

Outside casing diameter: 2.375"

Inside casing diameter: 1.939"

Casing joint type: flush threaded

Casing/screen joint type: flush threaded

Screen material: SCH 80 PVC

Screen opening size: 0.010''

Screen length: 10'

Depth of well: 118'

Filter Pack:

Material: Filter Pack Sand

Grain size: 0.007-0.250"

Volume: 36 gal.

Seal (minimum 3 ft length above filter pack):

Material: Bentonite Chips 3/8" hole plug

Placement method: direct pour

Volume: 13 gal.

Backfill (if different from seal):

Material: Baroid Quik-Grout

Placement method: 1-in ID tremie pipe to ground surface

Volume: 250 gal.

Surface seal design:

Material of protective casing: Steel

Material of grout between protective casing and well casing: 3/8" hole plug

Protective cap:

Material: Steel

Vented: ☐ Yes ☐ No Locking: ☒ Yes ☐ No

Well Cap:

Material: PVC

Vented: ☐ Yes ☒ No

D. GROUNDWATER MEASURMENT (± 0.01 ft below top of inner well casing)

Water level: 93.92 ft Stabilization Time: 24-hr

Well development method: Bailed and Pumped

Average depth of frostline:

Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½x11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed for to: Iowa Department of Natural Resources, Land Quality Bureau, 502 E 9th St, Des Moines IA 50319-0034.

Questions? Call or Email: Nina Koger, Environmental Engineer Sr., 515-281-8986, Nina.Koger@dnr.iowa.gov

06/2011 cmz

DNR Form 542-1277

MONITORING WELL / PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name BLACK HAWK COUNTY LANDFILL	**Permit No.** 07-SDP-01-75P
Well or Piezometer No. MW-301A	
Dates Started	**Date Completed** 10-21-96

A. SURVEYED LOCATIONS AND ELEVATIONS	**B. SOIL BORING INFORMATION**
Locations (± 0.5 ft.): N 3618709.01 E 5235922.14	**Name & address of construction company**
Specify corner of site	TERRACON
Distance & direction along boundary	
Distance & direction from boundary to well	
Elevations (± 0.01 ft. MSL):	**Name of driller**
Ground Surface 932.36	**Drilling method**
Top of protective casing	**Drilling fluid**
Top of well casing 931.76	**Bore Hole diameter** 10 inch
Benchmark elevation	**Soil sampling method**
Benchmark description	**Depth of boring** 55.5 ft BGS

C. MONITORING WELL INSTALLATION	
Casing material 10 ft STAINLESS STEEL RISER, WITH SCH. 40 BLACK IRON RISER	**Placement method**
Length of casing	**Volume**
Outside casing diameter	**Backfill (if different from seal):**
Inside casing diameter 2.0 inch	**Material** ENVIROPLUG GROUT
Casing joint type	**Placement method**
Casing/screen joint type	**Volume**
Screen material 304 STAINLESS STEEL	**Surface seal design:**
Screen opening size 0.010 inches	**Material of protective casing:** CADIUM PLATED STEEL
Screen length 5.0 ft	**Material of grout between protective casing and well casing:** CONCRETE
Depth of Well 55.0 ft BGS	**Protective cap:**
Filter Pack:	**Material** CADIUM PLATED STEEL
Material MORIE SILICA #0	**Vented?: Y/N** Y **Locking?: Y/N** Y
Grain Size	**Well cap:**
Volume	**Material** LOCKING EXPANSION
Seal (minimum 3 ft. length above filter pack):	**Vented?: Y/N** Y
Material 1/2 inch BENTONITE PELLETS	

D. GROUNDWATER MEASUREMENT (± 0.01 foot below top of inner well casing)	
Water level	**Stabilization time**
Well development method	
Average depth of frostline	

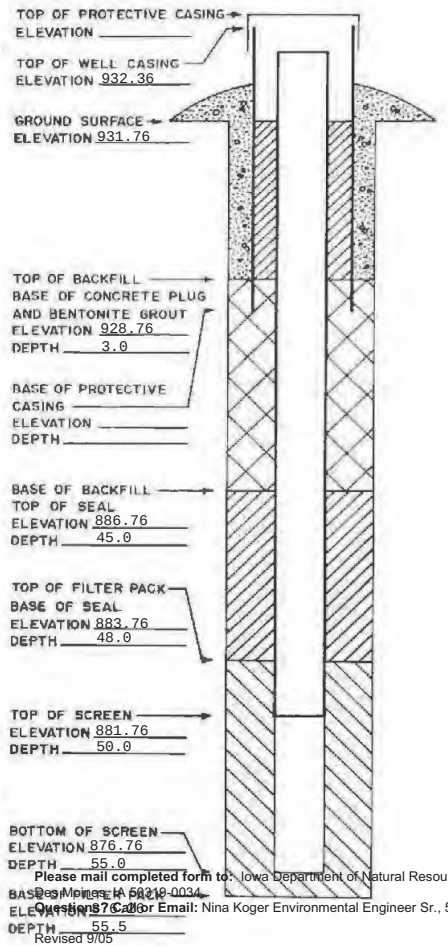
Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½ inch x 11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed form to: Iowa Department of Natural Resources, Energy and Waste Management Bureau, 502 E. 9th Street, Des Moines, IA 50319-0034.
Questions? Call or Email: Nina Koger Environmental Engineer Sr., 515-281-8986, nina.koger@dnr.state.ia.us

ELEVATIONS: ± 0.01 FT. MSL
DEPTHS: ± 0.1 FT. FROM GROUND SERFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL).

MW-301A



Please mail completed form to: Iowa Department of Natural Resources, Energy and Waste Management Bureau, 502 E. 9th Street, Des Moines, IA 50319-0034.
Questions? Call or Email: Nina Koger Environmental Engineer Sr., 515-281-8986, nina.koger@dnr.state.ia.us

Revised 9/05 Form # 542-1277

MONITORING WELL / PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name BLACK HAWK COUNTY LANDFILL	**Permit No.** 07-SDP-01-75P
Well or Piezometer No. MW-301B	
Dates Started	**Date Completed** 10-20-96

A. SURVEYED LOCATIONS AND ELEVATIONS	B. SOIL BORING INFORMATION
Locations (± 0.5 ft.): N 3618708.96 E 5235927.46	**Name & address of construction company**
Specify corner of site	TERRACON
Distance & direction along boundary	
Distance & direction from boundary to well	
Elevations (± 0.01 ft. MSL):	**Name of driller**
Ground Surface 931.50, 929.25 CONCRETE PAD	**Drilling method**
Top of protective casing	**Drilling fluid**
Top of well casing 932.10	**Bore Hole diameter** 10 inch
Benchmark elevation	**Soil sampling method**
Benchmark description	**Depth of boring** 17.0 ft BGS

C. MONITORING WELL INSTALLATION	
Casing material 10 ft STAINLESS STEEL RISER	**Placement method**
Length of casing	**Volume**
Outside casing diameter	**Backfill (if different from seal):**
Inside casing diameter 2.0 inch	**Material**
Casing joint type	**Placement method**
Casing/screen joint type	**Volume**
Screen material 304 STAINLESS STEEL	**Surface seal design:**
Screen opening size 0.010 inches	**Material of protective casing:** CADIUM PLATED STEEL
Screen length 10.0 ft	**Material of grout between protective casing and well casing:** CONCRETE
Depth of Well 16.0 ft BGS	**Protective cap:**
Filter Pack:	**Material** CADIUM PLATED STEEL
Material MORIE SILICA #0	**Vented?: Y/N** Y **Locking?: Y/N** Y
Grain Size	**Well cap:**
Volume	**Material** LOCKING EXPANSION
Seal (minimum 3 ft. length above filter pack):	**Vented?: Y/N** Y
Material 1/2 inch BENTONITE PELLETS	

D. GROUNDWATER MEASUREMENT (± 0.01 foot below top of inner well casing)	
Water level	**Stabilization time**
Well development method	
Average depth of frostline	

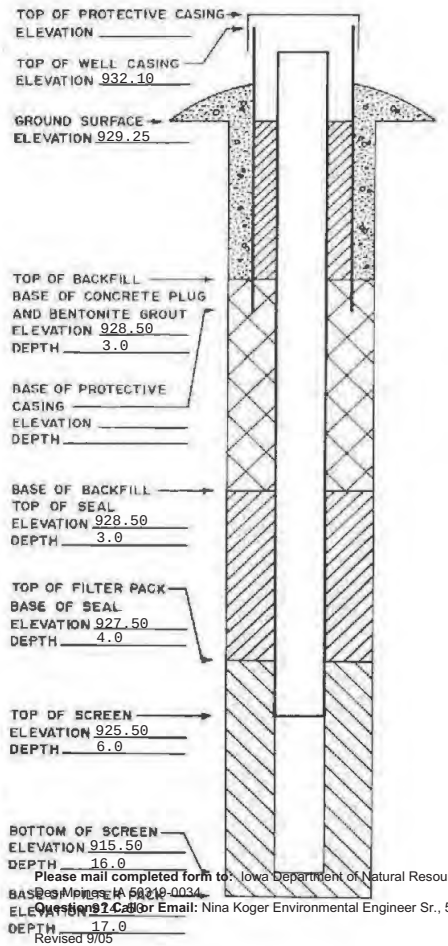
Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½ inch x 11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed form to: Iowa Department of Natural Resources, Energy and Waste Management Bureau, 502 E. 9th Street, Des Moines, IA 50319-0034.
Questions? Call or Email: Nina Koger Environmental Engineer Sr., 515-281-8986, nina.koger@dnr.state.ia.us

ELEVATIONS: ± 0.01 FT. MSL
DEPTHS: ± 0.1 FT. FROM GROUND SERFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL).

MW-301B



Please mail completed form to: Iowa Department of Natural Resources, Energy and Waste Management Bureau, 502 E. 9th Street, Des Moines, IA 50319-0034.
Questions? Call or Email: Nina Koger Environmental Engineer Sr., 515-281-8986, nina.koger@dnr.state.ia.us

MONITORING WELL / PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name BLACK HAWK COUNTY LANDFILL	**Permit No.** 07-SDP-01-75P
Well or Piezometer No. MW-301E	
Dates Started	**Date Completed** 10-28-96

A. SURVEYED LOCATIONS AND ELEVATIONS	B. SOIL BORING INFORMATION
Locations (± 0.5 ft.): N 3618708.95 E 5235917.33	**Name & address of construction company**
Specify corner of site	TERRACON
Distance & direction along boundary	
Distance & direction from boundary to well	
Elevations (± 0.01 ft. MSL):	**Name of driller**
Ground Surface 932.15	**Drilling method**
Top of protective casing	**Drilling fluid**
Top of well casing 932.75	**Bore Hole diameter** 10 inch
Benchmark elevation	**Soil sampling method**
Benchmark description	**Depth of boring** 76.5 ft BGS

C. MONITORING WELL INSTALLATION	
Casing material 10 ft STAINLESS STEEL WITH Sch. 40 BLACK IRON RISER	**Placement method**
Length of casing	**Volume**
Outside casing diameter	**Backfill (if different from seal):**
Inside casing diameter 2.0 inch	**Material** ENVIROPLUG GROUT
Casing joint type	**Placement method**
Casing/screen joint type	**Volume**
Screen material 304 STAINLESS STEEL	**Surface seal design:**
Screen opening size 0.010 inches	**Material of protective casing:** CADIUM PLATED STEEL
Screen length 5.0 ft	**Material of grout between protective casing and well casing:** CONCRETE
Depth of Well 76.0 ft BGS	**Protective cap:**
Filter Pack:	**Material** CADIUM PLATED STEEL
Material MORIE SILICA #0	**Vented?: Y/N** Y **Locking?: Y/N** Y
Grain Size	**Well cap:**
Volume	**Material** LOCKING EXPANSION
Seal (minimum 3 ft. length above filter pack):	**Vented?: Y/N** Y
Material 1/2 inch BENTONITE PELLETS	

D. GROUNDWATER MEASUREMENT (± 0.01 foot below top of inner well casing)	
Water level	**Stabilization time**
Well development method	
Average depth of frostline	

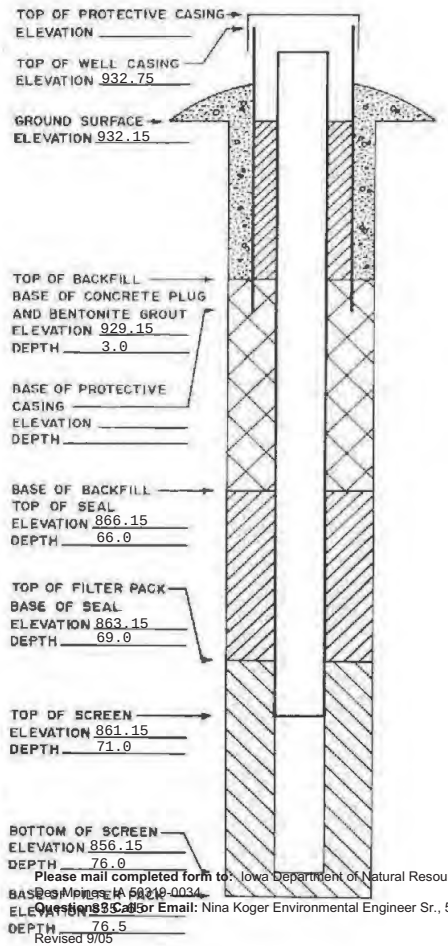
Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½ inch x 11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed form to: Iowa Department of Natural Resources, Energy and Waste Management Bureau, 502 E. 9th Street, Des Moines, IA 50319-0034.
Questions? Call or Email: Nina Koger Environmental Engineer Sr., 515-281-8986, nina.koger@dnr.state.ia.us

ELEVATIONS: ± 0.01 FT. MSL
DEPTHS: ± 0.1 FT. FROM GROUND SERFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL).

MW-301E



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Revised 9/05 Form # 542-1277

MONITORING WELL / PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name BLACK HAWK COUNTY LANDFILL	**Permit No.** 07-SDP-01-75P
Well or Piezometer No. MW-302B	
Dates Started	**Date Completed** 10-20-96

A. SURVEYED LOCATIONS AND ELEVATIONS	B. SOIL BORING INFORMATION
Locations (± 0.5 ft.): N 3618724.57 E 5237140.48	**Name & address of construction company**
Specify corner of site	TERRACON
Distance & direction along boundary	
Distance & direction from boundary to well	
Elevations (± 0.01 ft. MSL):	**Name of driller**
Ground Surface 943.75	**Drilling method**
Top of protective casing	**Drilling fluid**
Top of well casing 946.05	**Bore Hole diameter** 10 inch
Benchmark elevation	**Soil sampling method**
Benchmark description	**Depth of boring** 18.0 ft BGS

C. MONITORING WELL INSTALLATION	
Casing material 10 ft STAINLESS STEEL WITH Sch. 40 BLACK IRON RISER	**Placement method**
Length of casing	**Volume**
Outside casing diameter	**Backfill (if different from seal):**
Inside casing diameter 2.0 inch	**Material** ENVIROPLUG GROUT
Casing joint type	**Placement method**
Casing/screen joint type	**Volume**
Screen material 304 STAINLESS STEEL	**Surface seal design:**
Screen opening size 0.010 inches	**Material of protective casing:** CADIUM PLATED STEEL
Screen length 10.0 ft	**Material of grout between protective casing and well casing:** CONCRETE
Depth of Well 17.0 ft BGS	**Protective cap:**
Filter Pack:	**Material** CADIUM PLATED STEEL
Material MORIE SILICA #0	**Vented?: Y/N** Y **Locking?: Y/N** Y
Grain Size	**Well cap:**
Volume	**Material** LOCKING EXPANSION
Seal (minimum 3 ft. length above filter pack):	**Vented?: Y/N** Y
Material 1/2 inch BENTONITE PELLETS	

D. GROUNDWATER MEASUREMENT (± 0.01 foot below top of inner well casing)	
Water level	**Stabilization time**
Well development method	
Average depth of frostline	

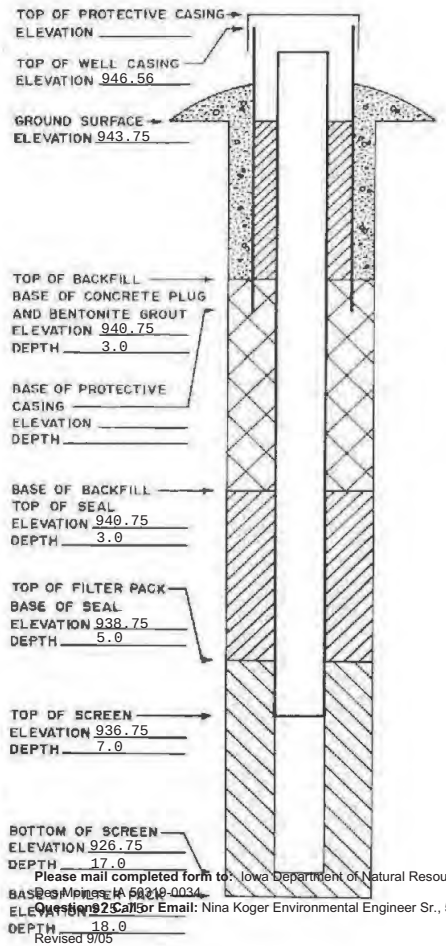
Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½ inch x 11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed form to: Iowa Department of Natural Resources, Energy and Waste Management Bureau, 502 E. 9th Street, Des Moines, IA 50319-0034.
Questions? Call or Email: Nina Koger Environmental Engineer Sr., 515-281-8986, nina.koger@dnr.state.ia.us

ELEVATIONS: ± 0.01 FT. MSL
DEPTHS: ± 0.1 FT. FROM GROUND SERFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL).

MW-302B



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MONITORING WELL / PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name BLACK HAWK COUNTY LANDFILL	**Permit No.** 07-SDP-01-75P
Well or Piezometer No. MW-304B - 2009 UPPER 4' WAS REPLACED	
Dates Started	**Date Completed** 10-20-96

A. SURVEYED LOCATIONS AND ELEVATIONS	B. SOIL BORING INFORMATION
Locations (± 0.5 ft.): N 3618415.07 E 5235219.45	**Name & address of construction company**
Specify corner of site	TERRACON
Distance & direction along boundary	
Distance & direction from boundary to well	
Elevations (± 0.01 ft. MSL):	**Name of driller**
Ground Surface 923.48	**Drilling method**
Top of protective casing	**Drilling fluid**
Top of well casing 926.72	**Bore Hole diameter** 10 inch
Benchmark elevation	**Soil sampling method**
Benchmark description	**Depth of boring** 17.0 ft BGS

C. MONITORING WELL INSTALLATION	
Casing material 10 ft STAINLESS STEEL RISER	**Placement method**
Length of casing	**Volume**
Outside casing diameter	**Backfill (if different from seal):**
Inside casing diameter 2.0 inch	**Material**
Casing joint type	**Placement method**
Casing/screen joint type	**Volume**
Screen material 304 STAINLESS STEEL	**Surface seal design:**
Screen opening size 0.010 inches	**Material of protective casing:** CADIUM PLATED STEEL
Screen length 10.0 ft	**Material of grout between protective casing and well casing:** CONCRETE
Depth of Well 16.0 ft BGS	**Protective cap:**
Filter Pack:	**Material** CADIUM PLATED STEEL
Material MORIE SILICA #0	**Vented?: Y/N** Y **Locking?: Y/N** Y
Grain Size	**Well cap:**
Volume	**Material** LOCKING EXPANSION
Seal (minimum 3 ft. length above filter pack):	**Vented?: Y/N** Y
Material 1/2 inch BENTONITE PELLETS	

D. GROUNDWATER MEASUREMENT (± 0.01 foot below top of inner well casing)	
Water level	**Stabilization time**
Well development method	
Average depth of frostline	

Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½ inch x 11 inch map showing locations of all monitoring wells and piezometers.

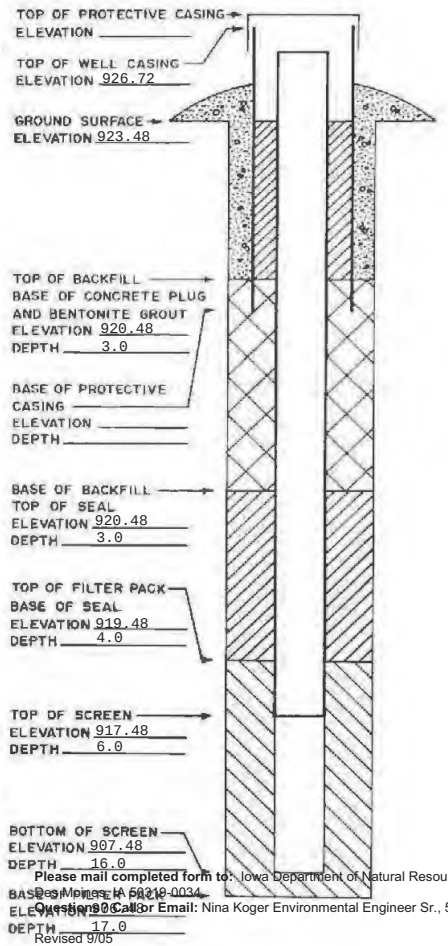
Please mail completed form to: Iowa Department of Natural Resources, Energy and Waste Management Bureau, 502 E. 9th Street, Des Moines, IA 50319-0034.
Questions? Call or Email: Nina Koger Environmental Engineer Sr., 515-281-8986, nina.koger@dnr.state.ia.us

ELEVATIONS: ± 0.01 FT. MSL
DEPTHS: ± 0.1 FT. FROM GROUND SERFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL).

2009 UPPER 4' WAS REPLACED

MW-304B



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Revised 9/05 Form # 542-1277

MONITORING WELL / PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name BLACK HAWK COUNTY LANDFILL	**Permit No.** 07-SDP-01-75P
Well or Piezometer No. MW-307A	
Dates Started	**Date Completed** 10-21-96

A. SURVEYED LOCATIONS AND ELEVATIONS	B. SOIL BORING INFORMATION
Locations (± 0.5 ft.): N 3617844.33 E 5235226.18	**Name & address of construction company**
Specify corner of site	TERRACON
Distance & direction along boundary	
Distance & direction from boundary to well	
Elevations (± 0.01 ft. MSL):	**Name of driller**
Ground Surface 925.82	**Drilling method**
Top of protective casing	**Drilling fluid**
Top of well casing 927.67	**Bore Hole diameter** 10 inch
Benchmark elevation	**Soil sampling method**
Benchmark description	**Depth of boring** 35.5 ft BGS

C. MONITORING WELL INSTALLATION	
Casing material 10 ft STAINLESS STEEL WITH Sch. 40 BLACK IRON RISER	**Placement method**
Length of casing	**Volume**
Outside casing diameter	**Backfill (if different from seal):**
Inside casing diameter 2.0 inch	**Material** ENVIROPLUG GROUT
Casing joint type	**Placement method**
Casing/screen joint type	**Volume**
Screen material 304 STAINLESS STEEL	**Surface seal design:**
Screen opening size 0.010 inches	**Material of protective casing:** CADIUM PLATED STEEL
Screen length 5.0 ft	**Material of grout between protective casing and well casing:** CONCRETE
Depth of Well 35.0 ft BGS	**Protective cap:**
Filter Pack:	**Material** CADIUM PLATED STEEL
Material MORIE SILICA #0	**Vented?: Y/N** Y **Locking?: Y/N** Y
Grain Size	**Well cap:**
Volume	**Material** LOCKING EXPANSION
Seal (minimum 3 ft. length above filter pack):	**Vented?: Y/N** Y
Material 1/2 inch BENTONITE PELLETS	

D. GROUNDWATER MEASUREMENT (± 0.01 foot below top of inner well casing)	
Water level	**Stabilization time**
Well development method	
Average depth of frostline	

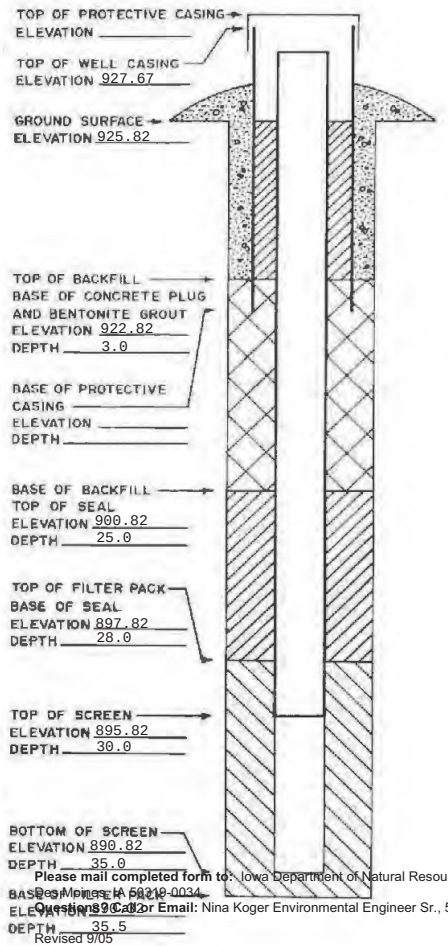
Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½ inch x 11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed form to: Iowa Department of Natural Resources, Energy and Waste Management Bureau, 502 E. 9th Street, Des Moines, IA 50319-0034.
Questions? Call or Email: Nina Koger Environmental Engineer Sr., 515-281-8986, nina.koger@dnr.state.ia.us

ELEVATIONS: ± 0.01 FT. MSL
DEPTHS: ± 0.1 FT. FROM GROUND SERFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL).

MW-307A



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MONITORING WELL / PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name BLACK HAWK COUNTY LANDFILL	**Permit No.** 07-SDP-01-75P
Well or Piezometer No. MW-307B	
Dates Started	**Date Completed** 10-21-96

A. SURVEYED LOCATIONS AND ELEVATIONS	B. SOIL BORING INFORMATION
Locations (± 0.5 ft.): N 3617849.02 E 5235226.10	**Name & address of construction company**
Specify corner of site	TERRACON
Distance & direction along boundary	
Distance & direction from boundary to well	
Elevations (± 0.01 ft. MSL):	**Name of driller**
Ground Surface 925.84	**Drilling method**
Top of protective casing	**Drilling fluid**
Top of well casing 927.81	**Bore Hole diameter** 10 inch
Benchmark elevation	**Soil sampling method**
Benchmark description	**Depth of boring** 17.0 ft BGS

C. MONITORING WELL INSTALLATION	
Casing material 10 ft STAINLESS STEEL RISER	**Placement method**
Length of casing	**Volume**
Outside casing diameter	**Backfill (if different from seal):**
Inside casing diameter 2.0 inch	**Material**
Casing joint type	**Placement method**
Casing/screen joint type	**Volume**
Screen material 304 STAINLESS STEEL	**Surface seal design:**
Screen opening size 0.010 inches	**Material of protective casing:** CADIUM PLATED STEEL
Screen length 10.0 ft	**Material of grout between protective casing and well casing:** CONCRETE
Depth of Well 16.0 ft BGS	**Protective cap:**
Filter Pack:	**Material** CADIUM PLATED STEEL
Material MORIE SILICA #0	**Vented?: Y/N** Y **Locking?: Y/N** Y
Grain Size	**Well cap:**
Volume	**Material** LOCKING EXPANSION
Seal (minimum 3 ft. length above filter pack):	**Vented?: Y/N** Y
Material 1/2 inch BENTONITE PELLETS	

D. GROUNDWATER MEASUREMENT (± 0.01 foot below top of inner well casing)	
Water level	**Stabilization time**
Well development method	
Average depth of frostline	

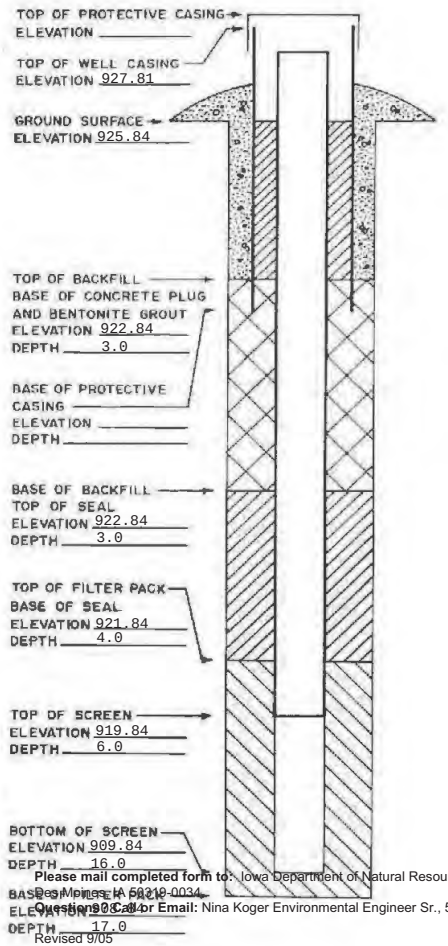
Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½ inch x 11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed form to: Iowa Department of Natural Resources, Energy and Waste Management Bureau, 502 E. 9th Street, Des Moines, IA 50319-0034.
Questions? Call or Email: Nina Koger Environmental Engineer Sr., 515-281-8986, nina.koger@dnr.state.ia.us

ELEVATIONS: ± 0.01 FT. MSL
DEPTHS: ± 0.1 FT. FROM GROUND SERFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL).

MW-307B



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Questions? Call or Email: Nina Koger Environmental Engineer Sr., 515-281-8986, nina.koger@dnr.state.ia.us

Revised 9/05 Form # 542-1277

MONITORING WELL / PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name BLACK HAWK COUNTY LANDFILL	**Permit No.** 07-SDP-01-75P
Well or Piezometer No. MW-307E	
Dates Started	**Date Completed** 10-29-96

A. SURVEYED LOCATIONS AND ELEVATIONS	B. SOIL BORING INFORMATION
Locations (± 0.5 ft.): N 3617839.93 E 5235226.83	**Name & address of construction company**
Specify corner of site	TERRACON
Distance & direction along boundary	
Distance & direction from boundary to well	
Elevations (± 0.01 ft. MSL):	**Name of driller**
Ground Surface 925.80	**Drilling method**
Top of protective casing	**Drilling fluid**
Top of well casing 928.15	**Bore Hole diameter** 10 inch
Benchmark elevation	**Soil sampling method**
Benchmark description	**Depth of boring** 60.5 ft BGS

C. MONITORING WELL INSTALLATION	
Casing material 10 ft STAINLESS STEEL WITH Sch. 40 BLACK IRON RISER	**Placement method**
Length of casing	**Volume**
Outside casing diameter	**Backfill (if different from seal):**
Inside casing diameter 2.0 inch	**Material** ENVIROPLUG GROUT
Casing joint type	**Placement method**
Casing/screen joint type	**Volume**
Screen material 304 STAINLESS STEEL	**Surface seal design:**
Screen opening size 0.010 inches	**Material of protective casing:** CADIUM PLATED STEEL
Screen length 5.0 ft	**Material of grout between protective casing and well casing:** CONCRETE
Depth of Well 60.0 ft BGS	**Protective cap:**
Filter Pack:	**Material** CADIUM PLATED STEEL
Material MORIE SILICA #0	**Vented?: Y/N** Y **Locking?: Y/N** Y
Grain Size	**Well cap:**
Volume	**Material** LOCKING EXPANSION
Seal (minimum 3 ft. length above filter pack):	**Vented?: Y/N** Y
Material 1/2 inch BENTONITE PELLETS	

D. GROUNDWATER MEASUREMENT (± 0.01 foot below top of inner well casing)	
Water level	**Stabilization time**
Well development method	
Average depth of frostline	

Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½ inch x 11 inch map showing locations of all monitoring wells and piezometers.

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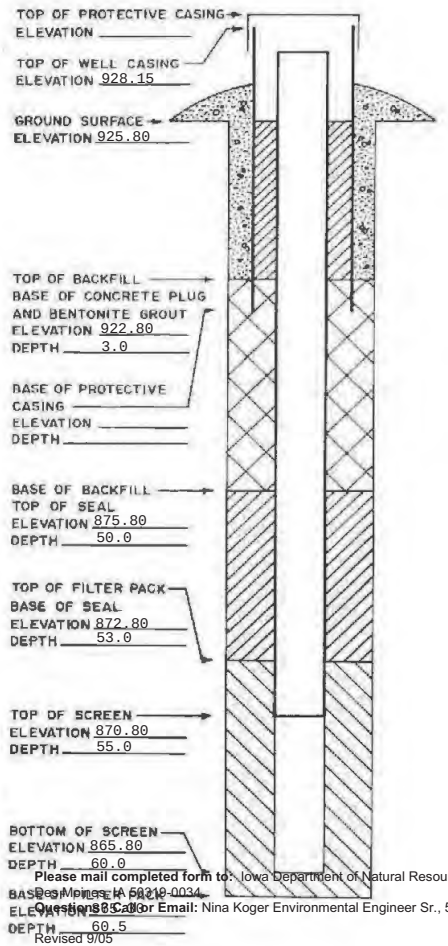
Questions? Call or Email: Nina Koger Environmental Engineer Sr., 515-281-8986, nina.koger@dnr.state.ia.us

ELEVATIONS: ± 0.01 FT. MSL
DEPTHS: ± 0.1 FT. FROM GROUND SERFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL).

MW-307E



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Revised 9/05 Form # 542-1277

MONITORING WELL / PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name BLACK HAWK COUNTY LANDFILL	**Permit No.** 07-SDP-01-75P
Well or Piezometer No. MW-308A	
Dates Started	**Date Completed** 10-23-96

A. SURVEYED LOCATIONS AND ELEVATIONS	B. SOIL BORING INFORMATION
Locations (± 0.5 ft.): N 3617857.62 E 5236479.97	**Name & address of construction company**
Specify corner of site	TERRACON
Distance & direction along boundary	
Distance & direction from boundary to well	
Elevations (± 0.01 ft. MSL):	**Name of driller**
Ground Surface 946.53	**Drilling method**
Top of protective casing	**Drilling fluid**
Top of well casing 948.43	**Bore Hole diameter** 10 inch
Benchmark elevation	**Soil sampling method**
Benchmark description	**Depth of boring** 55.5 BGS

C. MONITORING WELL INSTALLATION	
Casing material 10 ft STAINLESS STEEL WITH Sch. 40 BLACK IRON RISER	**Placement method**
Length of casing	**Volume**
Outside casing diameter	**Backfill (if different from seal):**
Inside casing diameter 2.0 inch	**Material** ENVIROPLUG GROUT
Casing joint type	**Placement method**
Casing/screen joint type	**Volume**
Screen material 304 STAINLESS STEEL	**Surface seal design:**
Screen opening size 0.010 inches	**Material of protective casing:** CADIUM PLATED STEEL
Screen length 5.0 ft	**Material of grout between protective casing and well casing:** CONCRETE
Depth of Well 55.0 ft BGS	**Protective cap:**
Filter Pack:	**Material** CADIUM PLATED STEEL
Material MORIE SILICA #0	**Vented?: Y/N** Y **Locking?: Y/N** Y
Grain Size	**Well cap:**
Volume	**Material** LOCKING EXPANSION
Seal (minimum 3 ft. length above filter pack):	**Vented?: Y/N** Y
Material 1/2 inch BENTONITE PELLETS	

D. GROUNDWATER MEASUREMENT (± 0.01 foot below top of inner well casing)	
Water level	**Stabilization time**
Well development method	
Average depth of frostline	

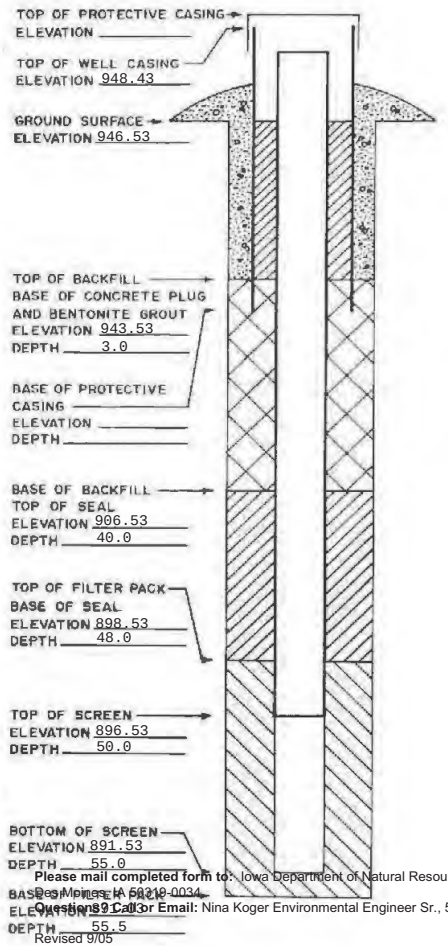
Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½ inch x 11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed form to: Iowa Department of Natural Resources, Energy and Waste Management Bureau, 502 E. 9th Street, Des Moines, IA 50319-0034.
Questions? Call or Email: Nina Koger Environmental Engineer Sr., 515-281-8986, nina.koger@dnr.state.ia.us

ELEVATIONS: ± 0.01 FT. MSL
DEPTHS: ± 0.1 FT. FROM GROUND SERFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL).

MW-308A



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Revised 9/05 Form # 542-1277

MONITORING WELL / PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name BLACK HAWK COUNTY LANDFILL	**Permit No.** 07-SDP-01-75P
Well or Piezometer No. MW-308B - 2007 UPPER 4' WAS REPLACED BY CJ MOYNA	
Dates Started	**Date Completed** 10-20-96

A. SURVEYED LOCATIONS AND ELEVATIONS	B. SOIL BORING INFORMATION
Locations (± 0.5 ft.): N 3617858.17 E 5236472.11	**Name & address of construction company**
Specify corner of site	TERRACON
Distance & direction along boundary	
Distance & direction from boundary to well	
Elevations (± 0.01 ft. MSL):	**Name of driller**
Ground Surface 946.67	**Drilling method**
Top of protective casing	**Drilling fluid**
Top of well casing 948.94	**Bore Hole diameter** 10 inch
Benchmark elevation	**Soil sampling method**
Benchmark description	**Depth of boring** 17.0 ft BGS

C. MONITORING WELL INSTALLATION	
Casing material STAINLESS STEEL	**Placement method**
Length of casing	**Volume**
Outside casing diameter	**Backfill (if different from seal):**
Inside casing diameter 2.0 inch	**Material**
Casing joint type	**Placement method**
Casing/screen joint type	**Volume**
Screen material STAINLESS STEEL	**Surface seal design:**
Screen opening size 0.010 inches	**Material of protective casing:** STEEL
Screen length 10.0 ft	**Material of grout between protective casing and well casing:** CONCRETE
Depth of Well 16.0 ft BGS	**Protective cap:**
Filter Pack:	**Material** STEEL
Material MORIE SILICA 0#	**Vented?: Y/N** Y **Locking?: Y/N** Y
Grain Size	**Well cap:**
Volume	**Material** LOCKING EXPANSION
Seal (minimum 3 ft. length above filter pack):	**Vented?: Y/N** Y
Material 1/2 inch BENTONITE PELLETS	

D. GROUNDWATER MEASUREMENT (± 0.01 foot below top of inner well casing)	
Water level	**Stabilization time**
Well development method	
Average depth of frostline	

Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½ inch x 11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed form to: Iowa Department of Natural Resources, Energy and Waste Management Bureau, 502 E. 9th Street, Des Moines, IA 50319-0034.
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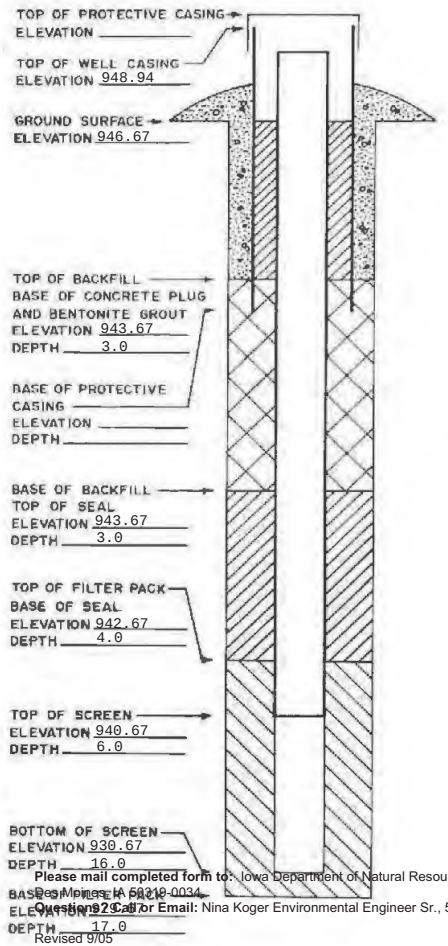
ELEVATIONS: ± 0.01 FT. MSL
DEPTHS: ± 0.1 FT. FROM GROUND SERFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL).

2007 UPPER 4' WAS REPLACED BY CJ MOYNA, NO EXACT LENGTH WAS RECORDED

MW-308B



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MONITORING WELL / PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name BLACK HAWK COUNTY LANDFILL	**Permit No.** 07-SDP-01-75P
Well or Piezometer No. MW-312B - 2008 WELL WAS EXTENDED 4.88'	
Dates Started	**Date Completed** 10-21-96

A. SURVEYED LOCATIONS AND ELEVATIONS	B. SOIL BORING INFORMATION
Locations (± 0.5 ft.): N 3617690.80 E 5237752.36	**Name & address of construction company**
Specify corner of site	TERRACON
Distance & direction along boundary	
Distance & direction from boundary to well	
Elevations (± 0.01 ft. MSL):	**Name of driller**
Ground Surface 944.30	**Drilling method**
Top of protective casing	**Drilling fluid**
Top of well casing 949.94	**Bore Hole diameter** 10 inch
Benchmark elevation	**Soil sampling method**
Benchmark description	**Depth of boring**

C. MONITORING WELL INSTALLATION	
Casing material 10 ft STAINLESS STEEL RISER	**Placement method**
Length of casing	**Volume**
Outside casing diameter	**Backfill (if different from seal):**
Inside casing diameter 2.0 inch	**Material**
Casing joint type	**Placement method**
Casing/screen joint type	**Volume**
Screen material 304 STAINLESS STEEL	**Surface seal design:**
Screen opening size 0.010 inches	**Material of protective casing:** CADIUM PLATED STEEL
Screen length 10.0 ft	**Material of grout between protective casing and well casing:** CONCRETE
Depth of Well	**Protective cap:**
Filter Pack:	**Material** CADIUM PLATED STEEL
Material MORIE SILICA #0	**Vented?: Y/N** Y **Locking?: Y/N** Y
Grain Size	**Well cap:**
Volume	**Material** LOCKING EXPANSION
Seal (minimum 3 ft. length above filter pack):	**Vented?: Y/N** Y
Material 1/2 inch BENTONITE PELLETS	

D. GROUNDWATER MEASUREMENT (± 0.01 foot below top of inner well casing)	
Water level	**Stabilization time**
Well development method	
Average depth of frostline	

Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½ inch x 11 inch map showing locations of all monitoring wells and piezometers.

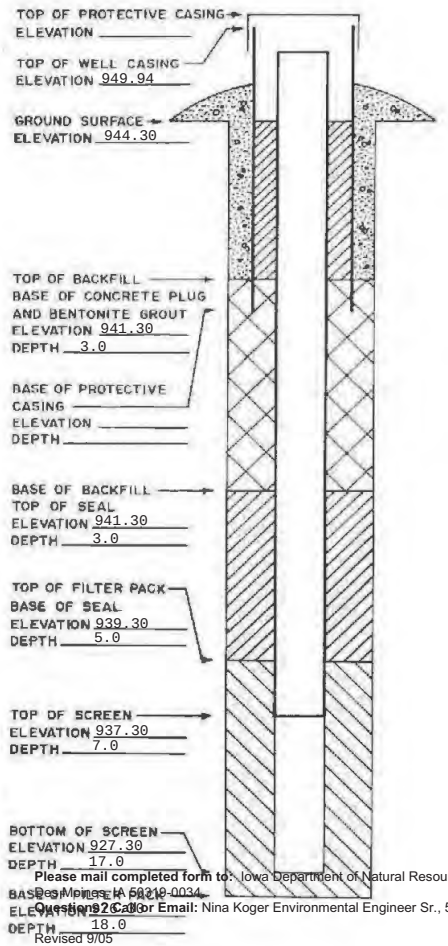
Please mail completed form to: Iowa Department of Natural Resources, Energy and Waste Management Bureau, 502 E. 9th Street, Des Moines, IA 50319-0034.
Questions? Call or Email: Nina Koger Environmental Engineer Sr., 515-281-8986, nina.koger@dnr.state.ia.us

ELEVATIONS: ± 0.01 FT. MSL
DEPTHS: ± 0.1 FT. FROM GROUND SERFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL).

2008 WELL WAS EXTENDED 4.88'

MW-312B



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Revised 9/05 Form # 542-1277

Print Form

IOWA DEPARTMENT OF NATURAL RESOURCES

MONITORING WELL/PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name: Black Hawk County Landfill Permit No.: 99-TV-054R2

Well or Piezometer No: MW-318BR

Dates Started: 07/16/2013 Date Completed: 07/16/2013

A. SURVEYED LOCATIONS AND ELEVATIONS

Locations (± 0.5 ft): N - 3616217.6, E - 5235313.1

Specify corner of site:

Distance & direction along boundary:

Distance & direction from boundary to wall:

Elevations (± 0.01 ft MSL):

Ground Surface: 950.50

Top of protective casing:

Top of well casing: 952.77

Benchmark elevation:

Benchmark description:

B. SOIL BORING INFORMATION

Name & Address of Construction Company:
Braun Intertec
5915 4th Street SW
Cedar Rapids, IA 52404

Name of Driller: Rob Hunt

Drilling Method: 4 1/4" HSA

Drilling Fluid: None

Bore Hole Diameter: 8"

Soil Sampling Method: 2' split spoon

Depth of Boring: 18.0' bgs

C. MONITORING WELL INSTALLATION

Casing material: stainless steel

Length of casing: 9.7'

Outside casing diameter: 2.375"

Inside casing diameter: 2.067"

Casing joint type: flush threaded, o-ring

Casing/screen joint type: flush threaded, o-ring

Screen material: stainless steel

Screen opening size: 0.010"

Screen length: 10'

Depth of well: 17.4' bgs

Filter Pack:

Material: Red Flint Sand and Gravel

Grain size: #10 coarse sand

Volume: 3.8 cu. ft.

Seal (minimum 3 ft length above filter pack):

Material: 3/8" Sodium Bentonite Chips (Baroid)

Placement method: direct pour

Volume: 1.9 cu. ft.

Backfill (if different from seal):

Material: same as seal

Placement method:

Volume:

Surface seal design:

Material of protective casing: stainless steel

Material of grout between protective casing and well casing: 3/8" bentonite chips

Protective cap:

Material: stainless steel

Vented: ☐ Yes ☐ No Locking: ☑ Yes ☐ No

Well Cap:

Material: Protop with gasket seal

Vented: ☐ Yes ☑ No

D. GROUNDWATER MEASURMENT (± 0.01 ft below top of inner well casing)

Water level: Stabilization Time:

Well development method:

Average depth of frostline:

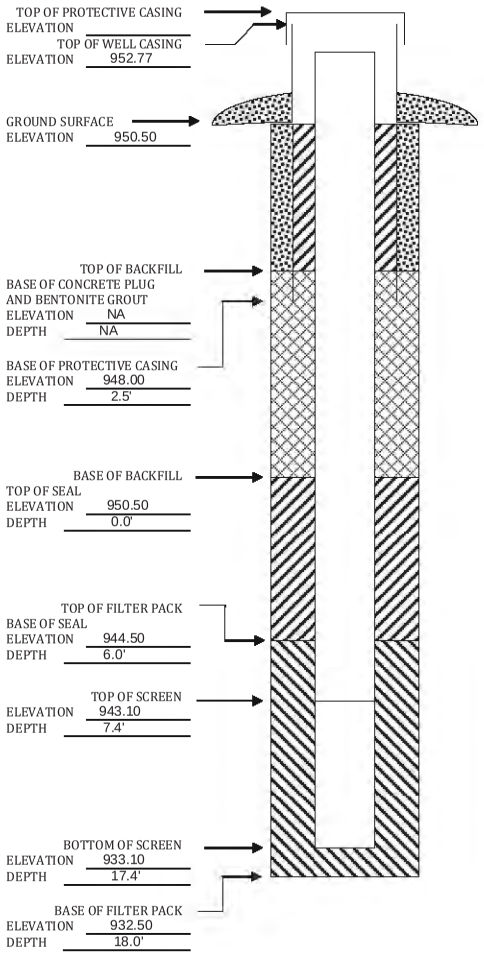
Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½x11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed for to: Iowa Department of Natural Resources, Land Quality Bureau, 502 E 9th St, Des Moines IA 50319-0034.

Questions? Call or Email: Nina Koger, Environmental Engineer Sr., 515-281-8986, Nina.Koger@dnr.iowa.gov

ELEVATIONS: ± 0.01 ft MSL
DEPTHS: ± 0.1 ft FROM GROUND SURFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL.)



06/2011 cmz DNR Form 542-1277

Print Form

IOWA DEPARTMENT OF NATURAL RESOURCES

MONITORING WELL/PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name: Black Hawk County Landfill Permit No.: 99-TV-054R2

Well or Piezometer No: MW-318CR

Dates Started: 07/10/2013 Date Completed: 07/16/2013

A. SURVEYED LOCATIONS AND ELEVATIONS

Locations (± 0.5 ft): N - 3616222.8, E - 5235312.6

Specify corner of site:

Distance & direction along boundary:

Distance & direction from boundary to wall:

Elevations (± 0.01 ft MSL):

Ground Surface: 950.43

Top of protective casing:

Top of well casing: 952.82

Benchmark elevation:

Benchmark description:

B. SOIL BORING INFORMATION

Name & Address of Construction Company:
Braun Intertec
5915 4th Street SW
Cedar Rapids, IA 52404

Name of Driller: Rob Hunt

Drilling Method: 4 1/4" HSA to rock, 6" tricone rotary in rock

Drilling Fluid: water

Bore Hole Diameter: 8"

Soil Sampling Method: 2' split spoon

Depth of Boring: 147.0' bgs

C. MONITORING WELL INSTALLATION

Casing material: stainless steel

Length of casing: 138.4'

Outside casing diameter: 2.375"

Inside casing diameter: 2.067"

Casing joint type: flush threaded, o-ring

Casing/screen joint type: flush threaded, o-ring

Screen material: stainless steel

Screen opening size: 0.010"

Screen length: 5'

Depth of well: 141' bgs

Filter Pack:

Material: Red Flint Sand and Gravel

Grain size: #10 coarse sand

Volume: 4 cu. ft.

Seal (minimum 3 ft length above filter pack):

Material: 3/8" Sodium Bentonite Chips (Baroid)

Placement method: direct pour

Volume: 0.7 cu. ft.

Backfill (if different from seal):

Material: 20% solids bentonite (Baroid Quik-Gel)

Placement method: tremie pipe

Volume: 150 gallons

Surface seal design:

Material of protective casing: stainless steel

Material of grout between protective casing and well casing: 3/8" bentonite chips

Protective cap:

Material: stainless steel

Vented: ☐ Yes ☐ No Locking: ☑ Yes ☐ No

Well Cap:

Material: Protop with gasket seal

Vented: ☐ Yes ☑ No

D. GROUNDWATER MEASURMENT (± 0.01 ft below top of inner well casing)

Water level: Stabilization Time:

Well development method:

Average depth of frostline:

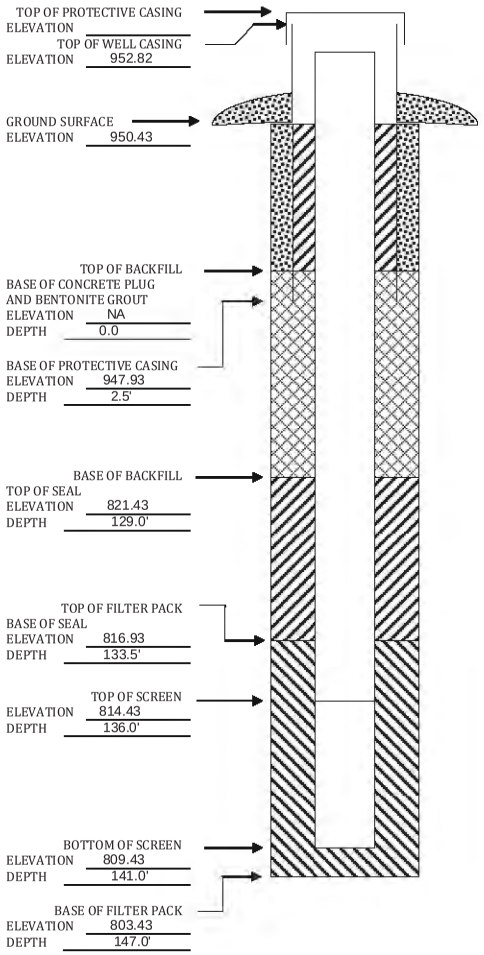
Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½x11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed for to: Iowa Department of Natural Resources, Land Quality Bureau, 502 E 9th St, Des Moines IA 50319-0034.

Questions? Call or Email: Nina Koger, Environmental Engineer Sr., 515-281-8986, Nina.Koger@dnr.iowa.gov

ELEVATIONS: ± 0.01 ft MSL
DEPTHS: ± 0.1 ft FROM GROUND SURFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL.)



06/2011 cmz DNR Form 542-1277

MONITORING WELL / PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name BLACK HAWK COUNTY LANDFILL	**Permit No.** 07-SDP-01-75P
Well or Piezometer No. MW-319A	
Dates Started	**Date Completed** 10-28-96

A. SURVEYED LOCATIONS AND ELEVATIONS	B. SOIL BORING INFORMATION
Locations (± 0.5 ft.): N 3616164.92 E 5236491.17	**Name & address of construction company**
Specify corner of site	TERRACON
Distance & direction along boundary	
Distance & direction from boundary to well	
Elevations (± 0.01 ft. MSL):	**Name of driller**
Ground Surface 960.79	**Drilling method**
Top of protective casing	**Drilling fluid**
Top of well casing 962.95	**Bore Hole diameter** 10 inch
Benchmark elevation	**Soil sampling method**
Benchmark description	**Depth of boring** 68.5 ft BGS

C. MONITORING WELL INSTALLATION	
Casing material 10 ft STAINLESS STEEL WITH Sch. 40 BLACK IRON RISER	**Placement method**
Length of casing	**Volume**
Outside casing diameter	**Backfill (if different from seal):**
Inside casing diameter 2.0 inch	**Material** ENVIROPLUG GROUT
Casing joint type	**Placement method**
Casing/screen joint type	**Volume**
Screen material 304 STAINLESS STEEL	**Surface seal design:**
Screen opening size 0.010 inches	**Material of protective casing:** CADIUM PLATED STEEL
Screen length 10.0 ft	**Material of grout between protective casing and well casing:** CONCRETE
Depth of Well 68.0 ft BGS	**Protective cap:**
Filter Pack:	**Material** CADIUM PLATED STEEL
Material MORIE SILICA #0	**Vented?: Y/N** Y **Locking?: Y/N** Y
Grain Size	**Well cap:**
Volume	**Material** LOCKING EXPANSION
Seal (minimum 3 ft. length above filter pack):	**Vented?: Y/N** Y
Material 1/2 inch BENTONITE PELLETS	

D. GROUNDWATER MEASUREMENT (± 0.01 foot below top of inner well casing)	
Water level	**Stabilization time**
Well development method	
Average depth of frostline	

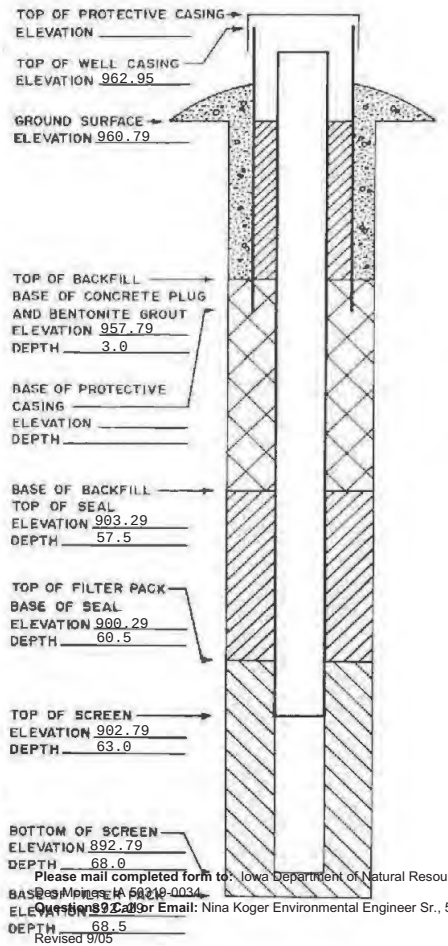
Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½ inch x 11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed form to: Iowa Department of Natural Resources, Energy and Waste Management Bureau, 502 E. 9th Street, Des Moines, IA 50319-0034.
Questions? Call or Email: Nina Koger Environmental Engineer Sr., 515-281-8986, nina.koger@dnr.state.ia.us

ELEVATIONS: ± 0.01 FT. MSL
DEPTHS: ± 0.1 FT. FROM GROUND SERFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL).

MW-319A



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Questions? Call or Email: Nina Koger Environmental Engineer Sr., 515-281-8986, nina.koger@dnr.state.ia.us

Revised 9/05 Form # 542-1277

MONITORING WELL / PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name BLACK HAWK COUNTY LANDFILL	**Permit No.** 07-SDP-01-75P
Well or Piezometer No. MW-319B	
Dates Started	**Date Completed** 10-21-96

A. SURVEYED LOCATIONS AND ELEVATIONS	B. SOIL BORING INFORMATION
Locations (± 0.5 ft.): N 3616165.32 E 5236476.34	**Name & address of construction company**
Specify corner of site	TERRACON
Distance & direction along boundary	
Distance & direction from boundary to well	
Elevations (± 0.01 ft. MSL):	**Name of driller**
Ground Surface 960.71	**Drilling method**
Top of protective casing	**Drilling fluid**
Top of well casing 963.01	**Bore Hole diameter** 10 inch
Benchmark elevation	**Soil sampling method**
Benchmark description	**Depth of boring** 18.0 ft BGS

C. MONITORING WELL INSTALLATION	
Casing material 10 ft STAINLESS STEEL RISER	**Placement method**
Length of casing	**Volume**
Outside casing diameter	**Backfill (if different from seal):**
Inside casing diameter 2.0 inch	**Material** ENVIROPLUG GROUT
Casing joint type	**Placement method**
Casing/screen joint type	**Volume**
Screen material 304 STAINLESS STEEL	**Surface seal design:**
Screen opening size 0.010 inches	**Material of protective casing:** CADIUM PLATED STEEL
Screen length 10.0 ft	**Material of grout between protective casing and well casing:** CONCRETE
Depth of Well 17.0 ft BGS	**Protective cap:**
Filter Pack:	**Material** CADIUM PLATED STEEL
Material MORIE SILICA #0	**Vented?: Y/N** Y **Locking?: Y/N** Y
Grain Size	**Well cap:**
Volume	**Material** LOCKING EXPANSION
Seal (minimum 3 ft. length above filter pack):	**Vented?: Y/N** Y
Material 1/2 inch BENTONITE PELLETS	

D. GROUNDWATER MEASUREMENT (± 0.01 foot below top of inner well casing)	
Water level	**Stabilization time**
Well development method	
Average depth of frostline	

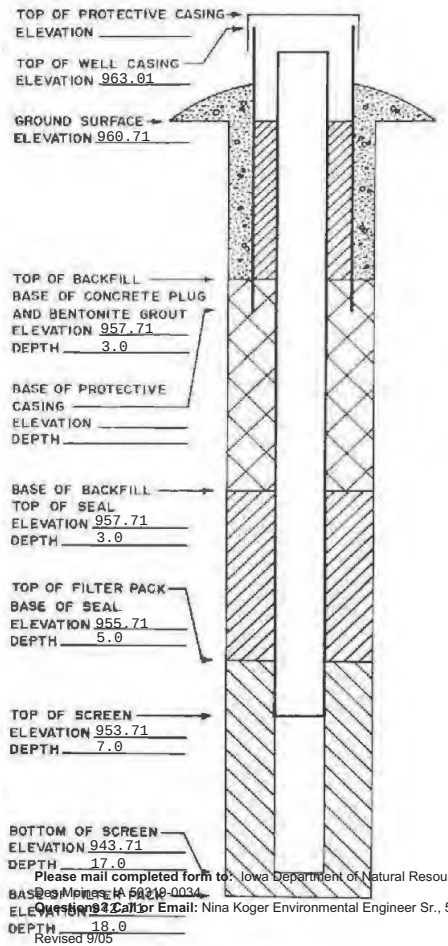
Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½ inch x 11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed form to: Iowa Department of Natural Resources, Energy and Waste Management Bureau, 502 E. 9th Street, Des Moines, IA 50319-0034.
Questions? Call or Email: Nina Koger Environmental Engineer Sr., 515-281-8986, nina.koger@dnr.state.ia.us

ELEVATIONS: ± 0.01 FT. MSL
DEPTHS: ± 0.1 FT. FROM GROUND SERFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL).

MW-319B



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Questions? Call or Email: Nina Koger Environmental Engineer Sr., 515-281-8986, nina.koger@dnr.state.ia.us

Revised 9/05 Form # 542-1277

MONITORING WELL / PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name BLACK HAWK COUNTY LANDFILL	**Permit No.** 07-SDP-01-75P
Well or Piezometer No. MW-319E	
Dates Started	**Date Completed** 10-30-96

A. SURVEYED LOCATIONS AND ELEVATIONS	B. SOIL BORING INFORMATION
Locations (± 0.5 ft.): N 3616164.79 E 5236487.94	**Name & address of construction company**
Specify corner of site	TERRACON
Distance & direction along boundary	
Distance & direction from boundary to well	
Elevations (± 0.01 ft. MSL):	**Name of driller**
Ground Surface 960.97	**Drilling method**
Top of protective casing	**Drilling fluid**
Top of well casing 963.39	**Bore Hole diameter** 10 inch
Benchmark elevation	**Soil sampling method**
Benchmark description	**Depth of boring** 98.5 ft BGS

C. MONITORING WELL INSTALLATION	
Casing material 10 ft STAINLESS STEEL WITH Sch. 40 BLACK IRON RISER	**Placement method**
Length of casing	**Volume**
Outside casing diameter	**Backfill (if different from seal):**
Inside casing diameter 2.0 inch	**Material** ENVIROPLUG GROUT
Casing joint type	**Placement method**
Casing/screen joint type	**Volume**
Screen material 304 STAINLESS STEEL	**Surface seal design:**
Screen opening size 0.010 inches	**Material of protective casing:** CADIUM PLATED STEEL
Screen length 5.0 ft	**Material of grout between protective casing and well casing:** CONCRETE
Depth of Well 98.0 ft BGS	**Protective cap:**
Filter Pack:	**Material** CADIUM PLATED STEEL
Material MORIE SILICA #0	**Vented?: Y/N** Y **Locking?: Y/N** Y
Grain Size	**Well cap:**
Volume	**Material** LOCKING EXPANSION
Seal (minimum 3 ft. length above filter pack):	**Vented?: Y/N** Y
Material 1/2 inch BENTONITE PELLETS	

D. GROUNDWATER MEASUREMENT (± 0.01 foot below top of inner well casing)	
Water level	**Stabilization time**
Well development method	
Average depth of frostline	

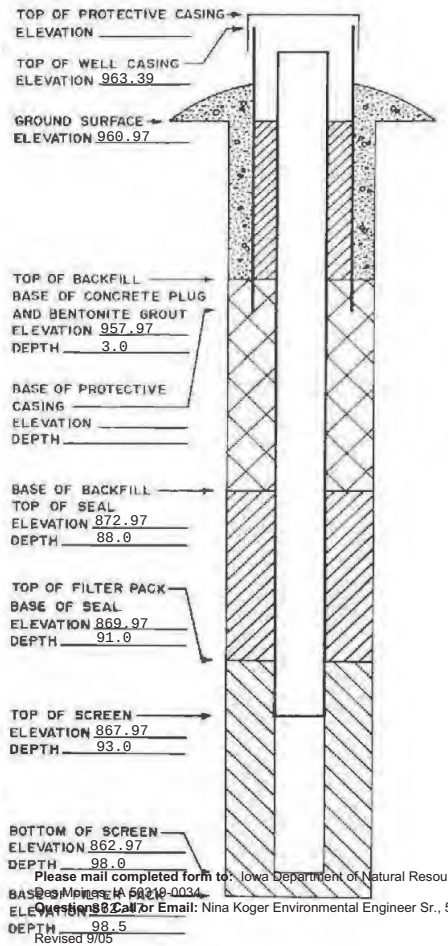
Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½ inch x 11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed form to: Iowa Department of Natural Resources, Energy and Waste Management Bureau, 502 E. 9th Street, Des Moines, IA 50319-0034.
Questions? Call or Email: Nina Koger Environmental Engineer Sr., 515-281-8986, nina.koger@dnr.state.ia.us

ELEVATIONS: ± 0.01 FT. MSL
DEPTHS: ± 0.1 FT. FROM GROUND SERFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL).

MW-319E



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Revised 9/05 Form # 542-1277

MONITORING WELL / PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name BLACK HAWK COUNTY LANDFILL	**Permit No.** 07-SDP-01-75P
Well or Piezometer No. MW-320B	
Dates Started	**Date Completed** 10-21-96

A. SURVEYED LOCATIONS AND ELEVATIONS	B. SOIL BORING INFORMATION
Locations (± 0.5 ft.): N 3616385.90 E 5237525.92	**Name & address of construction company**
Specify corner of site	TERRACON
Distance & direction along boundary	
Distance & direction from boundary to well	
Elevations (± 0.01 ft. MSL):	**Name of driller**
Ground Surface 937.41	**Drilling method**
Top of protective casing	**Drilling fluid**
Top of well casing 939.78	**Bore Hole diameter** 10 inch
Benchmark elevation	**Soil sampling method**
Benchmark description	**Depth of boring** 18.0 ft BGS

C. MONITORING WELL INSTALLATION	
Casing material 10 ft STAINLESS STEEL RISER	**Placement method**
Length of casing	**Volume**
Outside casing diameter	**Backfill (if different from seal):**
Inside casing diameter 2.0 inch	**Material**
Casing joint type	**Placement method**
Casing/screen joint type	**Volume**
Screen material 304 STAINLESS STEEL	**Surface seal design:**
Screen opening size 0.010 inches	**Material of protective casing:** CADIUM PLATED STEEL
Screen length 10.0 ft	**Material of grout between protective casing and well casing:** CONCRETE
Depth of Well 17.0 ft BGS	**Protective cap:**
Filter Pack:	**Material** CADIUM PLATED STEEL
Material MORIE SILICA #0	**Vented?: Y/N** Y **Locking?: Y/N** Y
Grain Size	**Well cap:**
Volume	**Material** LOCKING EXPANSION
Seal (minimum 3 ft. length above filter pack):	**Vented?: Y/N** Y
Material 1/2 inch BENTONITE PELLETS	

D. GROUNDWATER MEASUREMENT (± 0.01 foot below top of inner well casing)	
Water level	**Stabilization time**
Well development method	
Average depth of frostline	

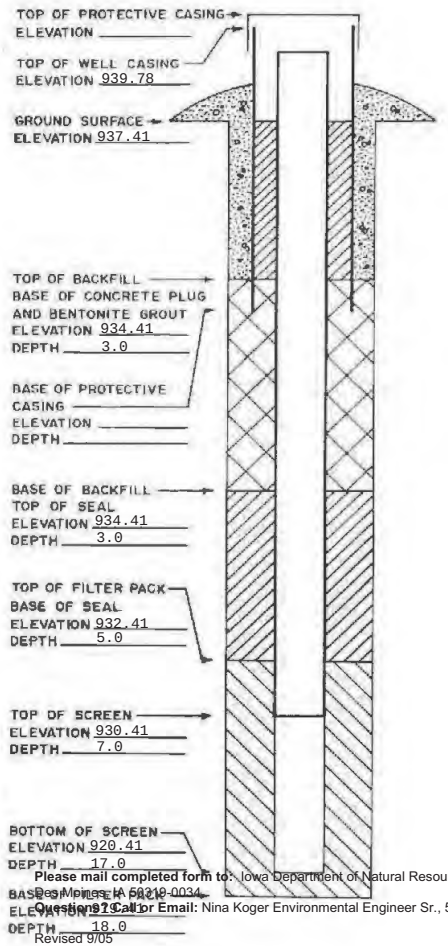
Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½ inch x 11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed form to: Iowa Department of Natural Resources, Energy and Waste Management Bureau, 502 E. 9th Street, Des Moines, IA 50319-0034.
Questions? Call or Email: Nina Koger Environmental Engineer Sr., 515-281-8986, nina.koger@dnr.state.ia.us

ELEVATIONS: ± 0.01 FT. MSL
DEPTHS: ± 0.1 FT. FROM GROUND SERFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL).

MW-320B



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Questions? Call or Email: Nina Koger Environmental Engineer Sr., 515-281-8986, nina.koger@dnr.state.ia.us

Revised 9/05 Form # 542-1277

MONITORING WELL / PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name BLACK HAWK COUNTY LANDFILL	**Permit No.** 07-SDP-01-75P
Well or Piezometer No. MW-409B	
Dates Started 5-6-2010	**Date Completed** 5-6-2010

A. SURVEYED LOCATIONS AND ELEVATIONS	B. SOIL BORING INFORMATION
Locations (± 0.5 ft.): N3618345.05 E 5238306.68	**Name & address of construction company**
Specify corner of site	TERRACON
Distance & direction along boundary	
Distance & direction from boundary to well	
Elevations (± 0.01 ft. MSL):	**Name of driller** MATT WHITE
Ground Surface 940.16	**Drilling method** 4 1/4-INCH HSA
Top of protective casing	**Drilling fluid** NONE
Top of well casing 942.80	**Bore Hole diameter** 8 inch
Benchmark elevation	**Soil sampling method** 2-INCH SPLIT SPOON
Benchmark description	**Depth of boring** 24.0 ft BGS

C. MONITORING WELL INSTALLATION	
Casing material TYPE 304 STAINLESS STEEL	**Placement method** GRAVITY
Length of casing 15.5 ft	**Volume** 4 1/2 - 50 lb bags
Outside casing diameter 2.375 inch	**Backfill (if different from seal):** SAME AS SEAL
Inside casing diameter 2.067 inch	**Material**
Casing joint type FLUSH THREADED	**Placement method**
Casing/screen joint type FLUSH THREADED	**Volume**
Screen material TYPE 304 STAINLESS STEEL	**Surface seal design:**
Screen opening size 0.010 inches	**Material of protective casing:** STEEL
Screen length 10.0 ft	**Material of grout between protective casing and well casing:** SAME AS SEAL
Depth of Well 23.0 ft BGS	**Protective cap:**
Filter Pack:	**Material** STEEL
Material COARSE SAND	**Vented?: Y/N** Y **Locking?: Y/N** Y
Grain Size SEE GRAIN SIZE CURVE	**Well cap:**
Volume 8 - 50 lb bags	**Material** PROTOP (PLASTIC W/ GASKET SEAL)
Seal (minimum 3 ft. length above filter pack):	**Vented?: Y/N** N
Material 3/8 inch SODIUM BENTONITE HOLE PLUG	

D. GROUNDWATER MEASUREMENT (± 0.01 foot below top of inner well casing)	
Water level	**Stabilization time**
Well development method	
Average depth of frostline	

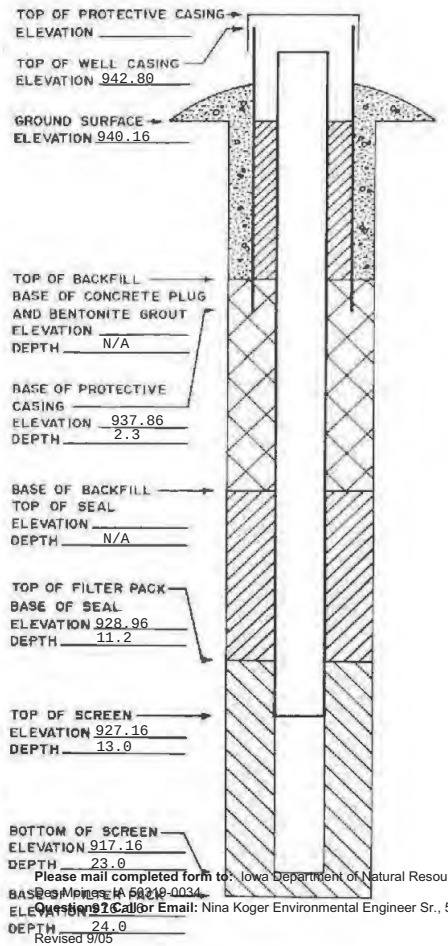
Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½ inch x 11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed form to: Iowa Department of Natural Resources, Energy and Waste Management Bureau, 502 E. 9th Street, Des Moines, IA 50319-0034.
Questions? Call or Email: Nina Koger Environmental Engineer Sr., 515-281-8986, nina.koger@dnr.state.ia.us

ELEVATIONS: ± 0.01 FT. MSL
DEPTHS: ± 0.1 FT. FROM GROUND SERFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL).

MW-409B



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Questions? Call or Email: Nina Koger Environmental Engineer Sr., 515-281-8986, nina.koger@dnr.state.ia.us

Revised 9/05 Form # 542-1277

Print Form

IOWA DEPARTMENT OF NATURAL RESOURCES

MONITORING WELL/PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name: Black Hawk County Landfill Permit No.: 99-TV-054R2

Well or Piezometer No: MW-501B

Dates Started: 06/25/2013 Date Completed: 06/25/2013

A. SURVEYED LOCATIONS AND ELEVATIONS

Locations (± 0.5 ft): N - 3616406.0, E - 5238417.5

Specify corner of site:

Distance & direction along boundary:

Distance & direction from boundary to wall:

Elevations (± 0.01 ft MSL):

Ground Surface: 935.87

Top of protective casing:

Top of well casing: 938.10

Benchmark elevation:

Benchmark description:

B. SOIL BORING INFORMATION

Name & Address of Construction Company:
Braun Intertec
5915 4th Street SW
Cedar Rapids, IA 52404

Name of Driller: Rob Hunt

Drilling Method: 4 1/4" HSA

Drilling Fluid: None

Bore Hole Diameter: 8"

Soil Sampling Method: 2' split spoon

Depth of Boring: 30.0' bgs

C. MONITORING WELL INSTALLATION

Casing material: stainless steel

Length of casing: 21.5'

Outside casing diameter: 2.375"

Inside casing diameter: 2.067"

Casing joint type: flush threaded, o-ring

Casing/screen joint type: flush threaded, o-ring

Screen material: stainless steel

Screen opening size: 0.010"

Screen length: 10'

Depth of well: 29.0' bgs

Filter Pack:

Material: Red Flint Sand and Gravel

Grain size: #10 coarse sand

Volume: 4 cu. ft.

Seal (minimum 3 ft length above filter pack):

Material: 3/8" Sodium Bentonite Chips (Baroid)

Placement method: direct pour

Volume: 1 cu. ft.

Backfill (if different from seal):

Material: 20% Solids Bentonite (Baroid Quik-Gel)

Placement method: tremie pipe

Volume: 25 gallons

Surface seal design:

Material of protective casing: stainless steel

Material of grout between protective casing and well casing: 3/8" bentonite chips

Protective cap:

Material: stainless steel

Vented: ☐ Yes ☐ No Locking: ☑ Yes ☐ No

Well Cap:

Material: Protop with gasket seal

Vented: ☐ Yes ☑ No

D. GROUNDWATER MEASURMENT (± 0.01 ft below top of inner well casing)

Water level: Stabilization Time:

Well development method:

Average depth of frostline:

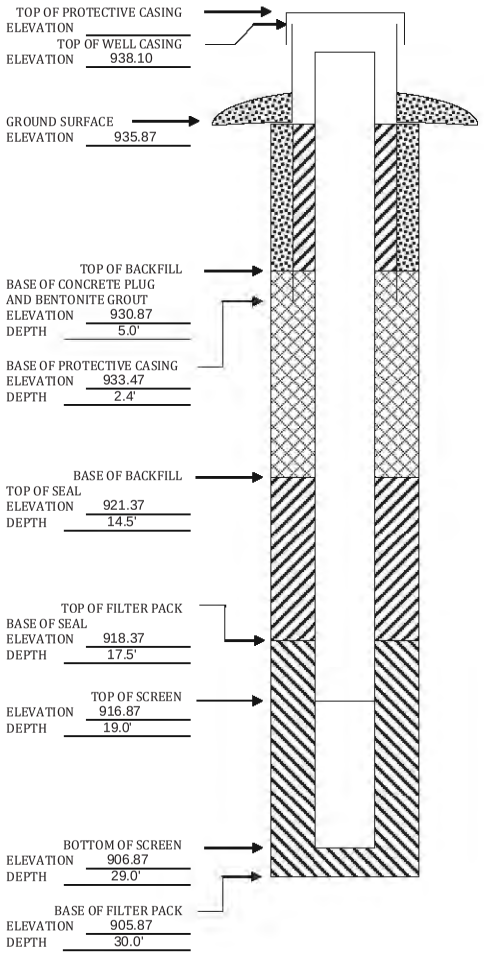
Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½x11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed for to: Iowa Department of Natural Resources, Land Quality Bureau, 502 E 9th St, Des Moines IA 50319-0034.

Questions? Call or Email: Nina Koger, Environmental Engineer Sr., 515-281-8986, Nina.Koger@dnr.iowa.gov

ELEVATIONS: ± 0.01 ft MSL
DEPTHS: ± 0.1 ft FROM GROUND SURFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL.)



06/2011 cmz DNR Form 542-1277

Print Form

IOWA DEPARTMENT OF NATURAL RESOURCES

MONITORING WELL/PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name: Black Hawk Co Land Fill Permit No.: 7-SDP-1-75P

Well or Piezometer No: MW-601B

Dates Started: 10/27/2014 Date Completed: 10/27/2014

A. SURVEYED LOCATIONS AND ELEVATIONS

Locations (± 0.5 ft): N - 3616798.2, E - 5235898.0

Specify corner of site:

Distance & direction along boundary:

Distance & direction from boundary to wall:

Elevations (± 0.01 ft MSL):

Ground Surface: 941.90

Top of protective casing: 944.73

Top of well casing: 944.38

Benchmark elevation:

Benchmark description:

B. SOIL BORING INFORMATION

Name & Address of Construction Company:
Terracon
6612 Chancellor Drive Suite 102
Cedar Falls IA 50613

Name of Driller: Ron Faulk

Drilling Method: 4 1/4" HSA

Drilling Fluid: NA

Bore Hole Diameter: 8"

Soil Sampling Method: 2 ft split spoon

Depth of Boring: 20.5 ft bgs

C. MONITORING WELL INSTALLATION

Casing material: Stainless Steel

Length of casing: 12.48 ft

Outside casing diameter: 2 1/4 in

Inside casing diameter: 2 in

Casing joint type: flush threaded

Casing/screen joint type: flush threaded

Screen material: Stainless Steel

Screen opening size: No. 10 Slot

Screen length: 10 ft

Depth of well: 20 ft bgs

Filter Pack:

Material: Coarse Sand

Grain size: see attached grain size curve

Volume: 4.14 cu. ft

Seal (minimum 3 ft length above filter pack):

Material: Bentonite Chips 3/8" hole plug

Placement method: direct pour

Volume: 2.92 cu. ft

Backfill (if different from seal):

Material:

Placement method:

Volume:

Surface seal design:

Material of protective casing: Steel

Material of grout between protective casing and well casing: 3/8" Bentonite Chips

Protective cap:

Material: Steel

Vented: ☐ Yes ☐ No Locking: ☑ Yes ☐ No

Well Cap:

Material: PVC

Vented: ☐ Yes ☑ No

D. GROUNDWATER MEASURMENT (± 0.01 ft below top of inner well casing)

Water level: 9.90 ft Stabilization Time:

Well development method: Bailed and Pumped

Average depth of frostline:

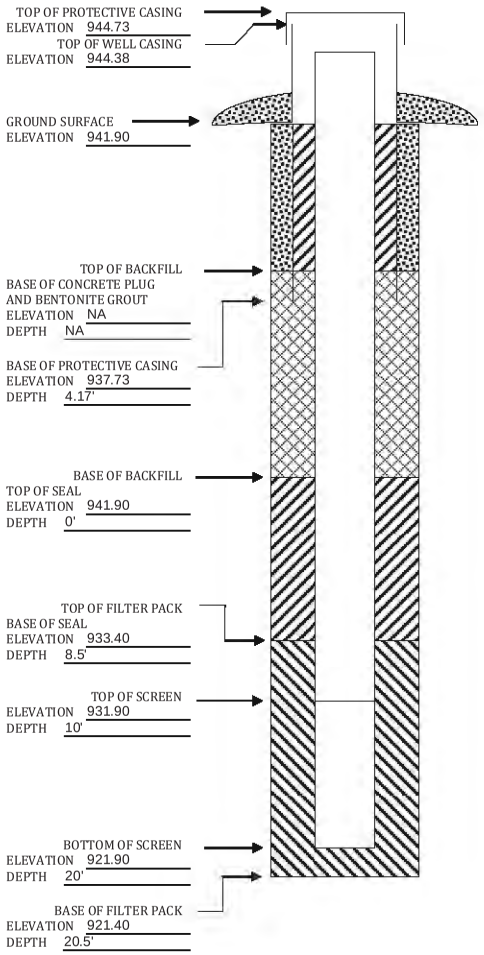
Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½x11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed for to: Iowa Department of Natural Resources, Land Quality Bureau, 502 E 9th St, Des Moines IA 50319-0034.

Questions? Call or Email: Nina Koger, Environmental Engineer Sr., 515-281-8986, Nina.Koger@dnr.iowa.gov

ELEVATIONS: ± 0.01 ft MSL
DEPTHS: ± 0.1 ft FROM GROUND SURFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL.)



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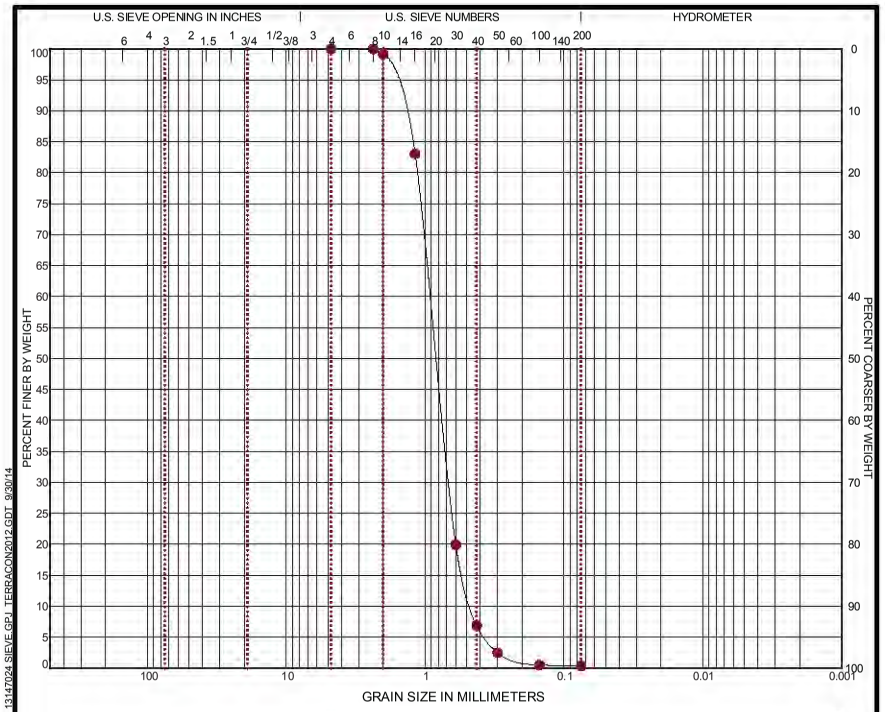
GRAIN SIZE DISTRIBUTION

ASTM D422



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

BORING ID	DEPTH	% COBBLES	% GRAVEL	% SAND	% SILT	% FINES	% CLAY	USCS
1	0	0.0	0.0	99.6		0.4		SP

GRAIN SIZE	
D_{60}	0.922
D_{30}	0.668
D_{10}	0.461
COEFFICIENTS	
C_C	1.05
C_U	2.00

SIEVE (size)	PERCENT FINER

SOIL DESCRIPTION
BMC Coarse

REMARKS

PROJECT: Black Hawk County Landfill

SITE:

Terracon
6612 Chancellor Drive, Suite 102
Cedar Falls, Iowa

PROJECT NUMBER: 13147024

CLIENT:

EXHIBIT: B-1

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE - USCS 1 13147024 SIEVE.GPJ TERRACON2012.GDT 9/30/14

Print Form

IOWA DEPARTMENT OF NATURAL RESOURCES

MONITORING WELL/PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name: Black Hawk Co Land Fill Permit No.: 7-SDP-1-75P

Well or Piezometer No: MW-602B

Dates Started: 10/27/2014 Date Completed: 10/27/2014

A. SURVEYED LOCATIONS AND ELEVATIONS

Locations (± 0.5 ft): N - 3616897.3, E - 5235288.8

Specify corner of site:

Distance & direction along boundary:

Distance & direction from boundary to wall:

Elevations (± 0.01 ft MSL):

Ground Surface: 942.30

Top of protective casing: 945.30

Top of well casing: 944.95

Benchmark elevation:

Benchmark description:

B. SOIL BORING INFORMATION

Name & Address of Construction Company:
Terracon
6612 Chancellor Drive Suite 102
Cedar Falls IA 50613

Name of Driller: Ron Faulk

Drilling Method: 4 1/4 HSA

Drilling Fluid: NA

Bore Hole Diameter: 8"

Soil Sampling Method: 2 ft split spoon

Depth of Boring: 28.5 ft bgs

C. MONITORING WELL INSTALLATION

Casing material: Stainless Steel

Length of casing: 12.65 ft

Outside casing diameter: 2 1/4 in

Inside casing diameter: 2 in

Casing joint type: flush threaded

Casing/screen joint type: flush threaded

Screen material: Stainless Steel

Screen opening size: No. 10 Slot

Screen length: 10 ft

Depth of well: 20 ft bgs

Filter Pack:

Material: Coarse Sand

Grain size: see attached grain size curve

Volume: 7.11 cu. ft

Seal (minimum 3 ft length above filter pack):

Material: Bentonite Chips 3/8" hole plug

Placement method: direct pour

Volume: 2.92 cu. ft

Backfill (if different from seal):

Material:

Placement method:

Volume:

Surface seal design:

Material of protective casing: Steel

Material of grout between protective casing and well casing: 3/8" Bentonite chips

Protective cap:

Material: Steel

Vented: ☐ Yes ☐ No Locking: ☑ Yes ☐ No

Well Cap:

Material: PVC

Vented: ☐ Yes ☑ No

D. GROUNDWATER MEASURMENT (± 0.01 ft below top of inner well casing)

Water level: 12.95 ft Stabilization Time:

Well development method: Bailed and Pumped

Average depth of frostline:

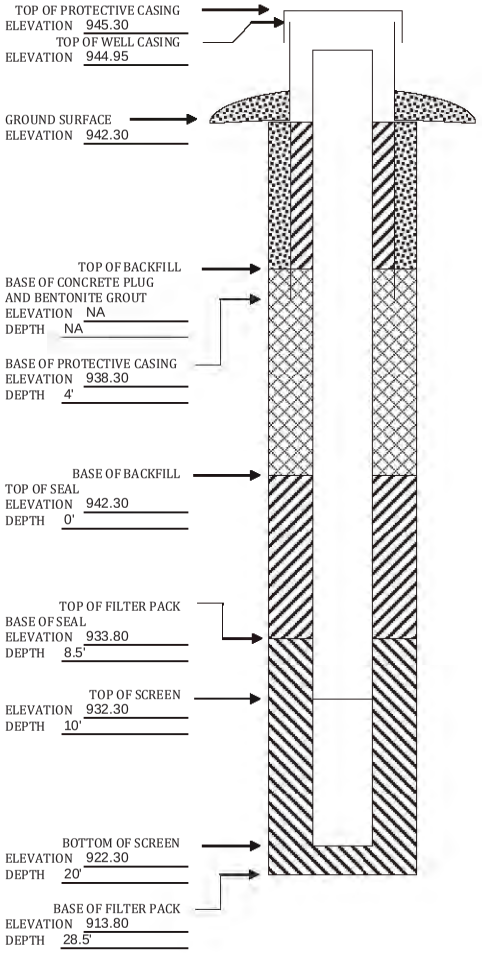
Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½x11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed for to: Iowa Department of Natural Resources, Land Quality Bureau, 502 E 9th St, Des Moines IA 50319-0034.

Questions? Call or Email: Nina Koger, Environmental Engineer Sr., 515-281-8986, Nina.Koger@dnr.iowa.gov

ELEVATIONS: ± 0.01 ft MSL
DEPTHS: ± 0.1 ft FROM GROUND SURFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL.)



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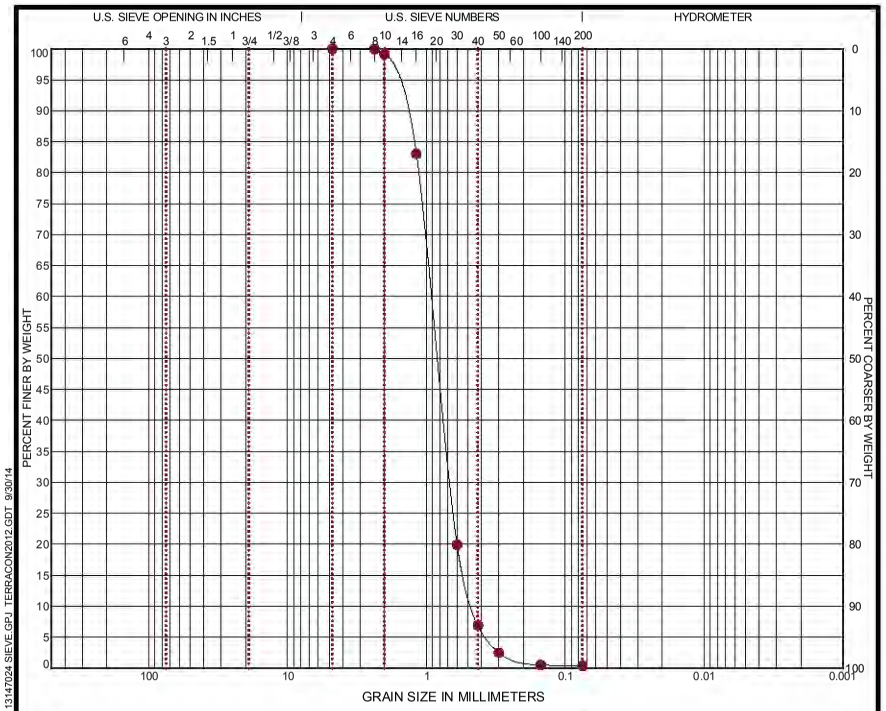
DNR Form 542-1277

GRAIN SIZE DISTRIBUTION

ASTM D422



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

BORING ID	DEPTH	% COBBLES	% GRAVEL	% SAND	% SILT	% FINES	% CLAY	USCS
1	0	0.0	0.0	99.6		0.4		SP

GRAIN SIZE	
D_{60}	0.922
D_{30}	0.668
D_{10}	0.461
COEFFICIENTS	
C_C	1.05
C_U	2.00

SIEVE (size)	PERCENT FINER

SOIL DESCRIPTION
BMC Coarse

REMARKS

PROJECT: Black Hawk County Landfill

SITE:

Terracon
6612 Chancellor Drive, Suite 102
Cedar Falls, Iowa

PROJECT NUMBER: 13147024

CLIENT:

EXHIBIT: B-1

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS 1 13147024 SIEVE.GPJ TERRACON2012.GDT 9/30/14

Print Form

IOWA DEPARTMENT OF NATURAL RESOURCES

MONITORING WELL/PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name: Black Hawk Co Land Fill Permit No.: 7-SDP-1-75P

Well or Piezometer No: MW-603B

Dates Started: 10/27/2014 Date Completed: 10/27/2014

A. SURVEYED LOCATIONS AND ELEVATIONS

Locations (± 0.5 ft): N - 3617198.5, E - 5235287.9

Specify corner of site:

Distance & direction along boundary:

Distance & direction from boundary to wall:

Elevations (± 0.01 ft MSL):

Ground Surface: 937.80

Top of protective casing: 940.80

Top of well casing: 940.42

Benchmark elevation:

Benchmark description:

B. SOIL BORING INFORMATION

Name & Address of Construction Company:
Terracon
6612 Chancellor Drive Suite 102
Cedar Falls IA 50613

Name of Driller: Ron Faulk

Drilling Method: 4 1/4 HSA

Drilling Fluid: NA

Bore Hole Diameter: 8"

Soil Sampling Method: 2 ft split spoon

Depth of Boring: 27 ft bgs

C. MONITORING WELL INSTALLATION

Casing material: Stainless Steel

Length of casing: 19.62 ft

Outside casing diameter: 2 1/4 in

Inside casing diameter: 2 in

Casing joint type: flush threaded

Casing/screen joint type: flush threaded

Screen material: Stainless Steel

Screen opening size: No. 10 Slot

Screen length: 10'

Depth of well: 27 ft

Filter Pack:

Material: Coarse Sand

Grain size: see attached grain size curve

Volume: 3.95 cu. ft

Seal (minimum 3 ft length above filter pack):

Material: Bentonite Chips 3/8" hole plug

Placement method: direct pour

Volume: 5.33 cu. ft

Backfill (if different from seal):

Material:

Placement method:

Volume:

Surface seal design:

Material of protective casing: Steel

Material of grout between protective casing and well casing: 3/8" Bentonite chips

Protective cap:

Material: Steel

Vented: ☐ Yes ☐ No Locking: ☑ Yes ☐ No

Well Cap:

Material: PVC

Vented: ☐ Yes ☑ No

D. GROUNDWATER MEASURMENT (± 0.01 ft below top of inner well casing)

Water level: 15.38 ft Stabilization Time:

Well development method: Bailed and Pumped

Average depth of frostline:

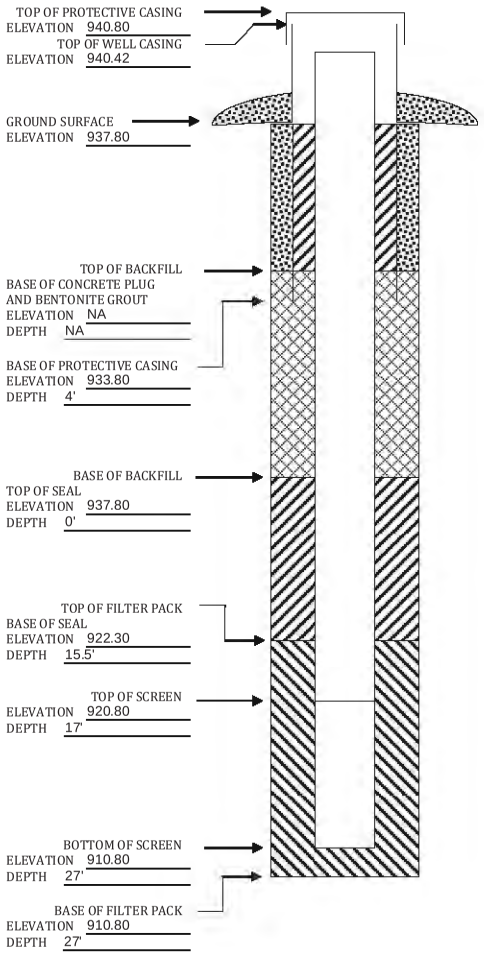
Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½x11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed for to: Iowa Department of Natural Resources, Land Quality Bureau, 502 E 9th St, Des Moines IA 50319-0034.

Questions? Call or Email: Nina Koger, Environmental Engineer Sr., 515-281-8986, Nina.Koger@dnr.iowa.gov

ELEVATIONS: ± 0.01 ft MSL
DEPTHS: ± 0.1 ft FROM GROUND SURFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL.)



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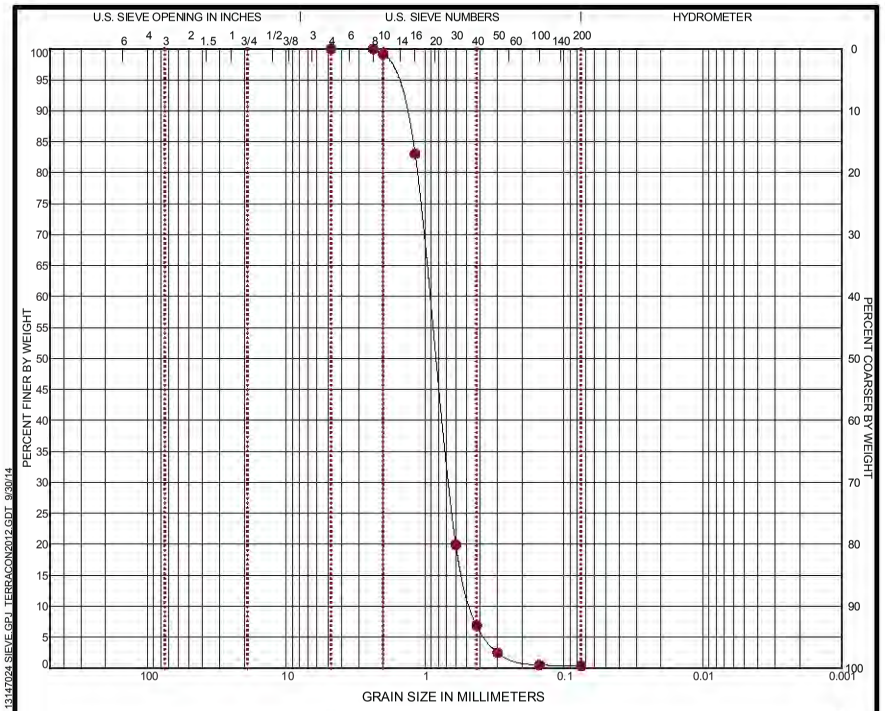
GRAIN SIZE DISTRIBUTION

ASTM D422



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

BORING ID	DEPTH	% COBBLES	% GRAVEL	% SAND	% SILT	% FINES	% CLAY	USCS
1	0	0.0	0.0	99.6		0.4		SP

GRAIN SIZE	
D_{60}	0.922
D_{30}	0.668
D_{10}	0.461
COEFFICIENTS	
C_C	1.05
C_U	2.00

SIEVE (size)	PERCENT FINER

SOIL DESCRIPTION
BMC Coarse

REMARKS

PROJECT: Black Hawk County Landfill

SITE:

Terracon
6612 Chancellor Drive, Suite 102
Cedar Falls, Iowa

PROJECT NUMBER: 13147024

CLIENT:

EXHIBIT: B-1

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE - USCS 1 13147024 SIEVE.GPJ TERRACON2012.GDT 9/30/14

Print Form

IOWA DEPARTMENT OF NATURAL RESOURCES

MONITORING WELL/PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name: Black Hawk Co Land Fill Permit No.: 7-SDP-1-75P

Well or Piezometer No: MW-604B

Dates Started: 11/5/2014 Date Completed: 11/5/2014

A. SURVEYED LOCATIONS AND ELEVATIONS

Locations (± 0.5 ft): N - 3617467.8, E - 5235286.8

Specify corner of site:

Distance & direction along boundary:

Distance & direction from boundary to wall:

Elevations (± 0.01 ft MSL):

Ground Surface: 932.20

Top of protective casing: 935.20

Top of well casing: 934.80

Benchmark elevation:

Benchmark description:

B. SOIL BORING INFORMATION

Name & Address of Construction Company:
Terracon
6612 Chancellor Drive Suite 102
Cedar Falls IA 50613

Name of Driller: Ron Faulk

Drilling Method: 4 1/4 HSA

Drilling Fluid: NA

Bore Hole Diameter: 8"

Soil Sampling Method: 2 ft split spoon

Depth of Boring: 26 ft bgs

C. MONITORING WELL INSTALLATION

Casing material: Stainless Steel

Length of casing: 17.6 ft

Outside casing diameter: 2 1/4 in

Inside casing diameter: 2 in

Casing joint type: flush threaded

Casing/screen joint type: flush threaded

Screen material: Stainless Steel

Screen opening size: No. 10 Slot

Screen length: 10 ft

Depth of well: 25 ft bgs

Filter Pack:

Material: Coarse Sand

Grain size: see attached grain size curve

Volume: 4.49 cu. ft

Seal (minimum 3 ft length above filter pack):

Material: Bentonite Chips 3/8" hole plug

Placement method: direct pour

Volume: 4.47 cu. ft

Backfill (if different from seal):

Material:

Placement method:

Volume:

Surface seal design:

Material of protective casing: Steel

Material of grout between protective casing and well casing: 3/8" Bentonite chips

Protective cap:

Material: Steel

Vented: ☐ Yes ☐ No Locking: ☑ Yes ☐ No

Well Cap:

Material: PVC

Vented: ☐ Yes ☑ No

D. GROUNDWATER MEASURMENT (± 0.01 ft below top of inner well casing)

Water level: 19.44 ft Stabilization Time:

Well development method: Bailed and Pumped

Average depth of frostline:

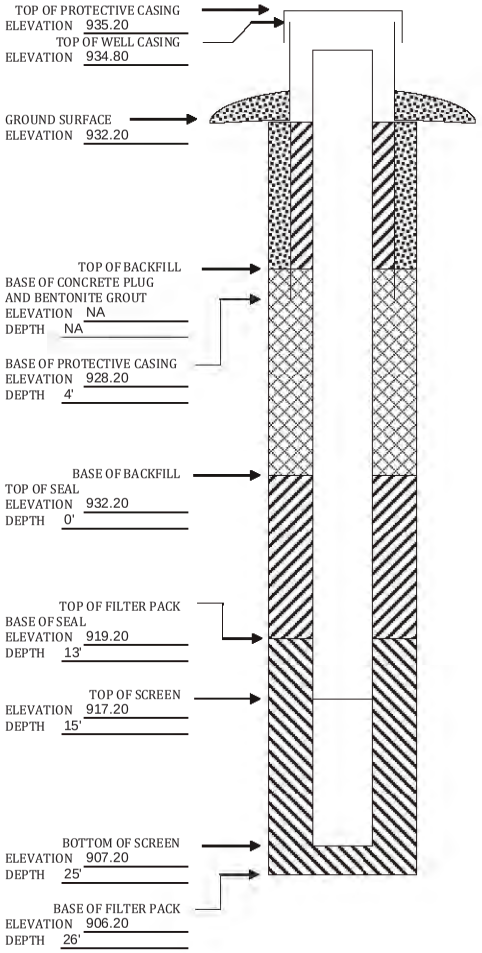
Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½x11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed for to: Iowa Department of Natural Resources, Land Quality Bureau, 502 E 9th St, Des Moines IA 50319-0034.

Questions? Call or Email: Nina Koger, Environmental Engineer Sr., 515-281-8986, Nina.Koger@dnr.iowa.gov

ELEVATIONS: ± 0.01 ft MSL
DEPTHS: ± 0.1 ft FROM GROUND SURFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL.)



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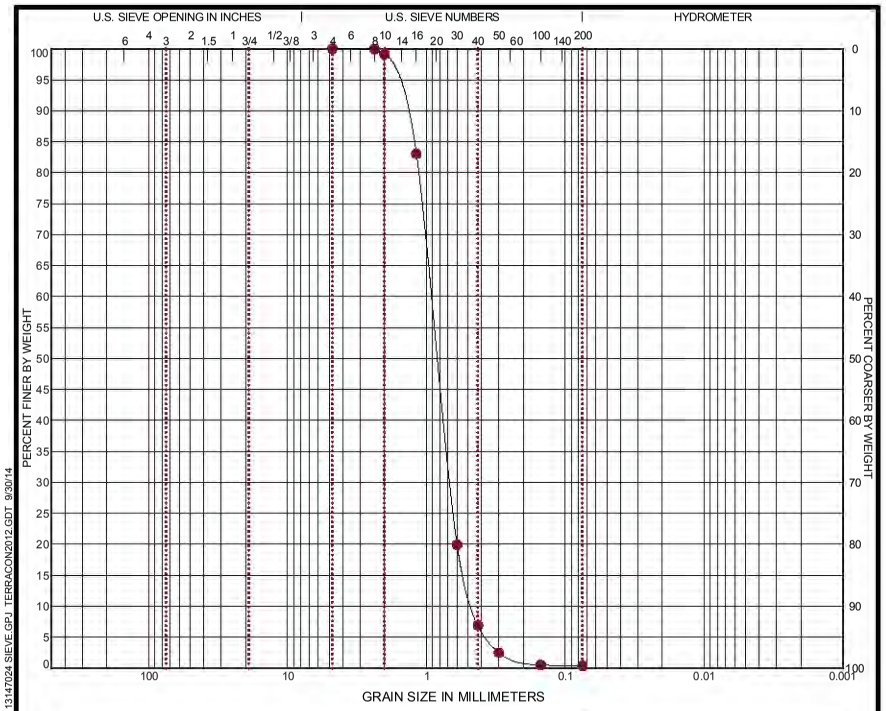
DNR Form 542-1277

GRAIN SIZE DISTRIBUTION

ASTM D422



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

BORING ID	DEPTH	% COBBLES	% GRAVEL	% SAND	% SILT	% FINES	% CLAY	USCS
1	0	0.0	0.0	99.6		0.4		SP

GRAIN SIZE	
D_{60}	0.922
D_{30}	0.668
D_{10}	0.461
COEFFICIENTS	
C_C	1.05
C_U	2.00

SIEVE (size)	PERCENT FINER

SOIL DESCRIPTION
BMC Coarse

REMARKS

PROJECT: Black Hawk County Landfill

SITE:

Terracon
6612 Chancellor Drive, Suite 102
Cedar Falls, Iowa

PROJECT NUMBER: 13147024

CLIENT:

EXHIBIT: B-1

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS 1 13147024 SIEVE.GPJ TERRACON2012.GDT 9/30/14

Print Form

IOWA DEPARTMENT OF NATURAL RESOURCES

MONITORING WELL/PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name: Black Hawk Co Land Fill Permit No.: 7-SDP-1-75P

Well or Piezometer No: MW-605B

Dates Started: 10/28/2014 Date Completed: 10/28/2014

A. SURVEYED LOCATIONS AND ELEVATIONS

Locations (± 0.5 ft): N - 3617714.8, E - 5235754.1

Specify corner of site:

Distance & direction along boundary:

Distance & direction from boundary to wall:

Elevations (± 0.01 ft MSL):

Ground Surface: 936.30

Top of protective casing: 939.14

Top of well casing: 938.82

Benchmark elevation:

Benchmark description:

B. SOIL BORING INFORMATION

Name & Address of Construction Company:
Terracon
6612 Chancellor Drive Suite 102
Cedar Falls IA 50613

Name of Driller: Ron Faulk

Drilling Method: 4 1/4 HSA

Drilling Fluid: NA

Bore Hole Diameter: 8 in

Soil Sampling Method: 2 ft split spoon

Depth of Boring: 20.5 ft bgs

C. MONITORING WELL INSTALLATION

Casing material: Stainless Steel

Length of casing: 11.52 ft

Outside casing diameter: 2 1/4 in

Inside casing diameter: 2 in

Casing joint type: flush threaded

Casing/screen joint type: flush threaded

Screen material: Stainless Steel

Screen opening size: No. 10 Slot

Screen length: 10 ft

Depth of well: 19 ft bgs

Filter Pack:

Material: Coarse Sand

Grain size: see attached grain size curve

Volume: 4.51 cu. ft

Seal (minimum 3 ft length above filter pack):

Material: Bentonite Chips 3/8" hole plug

Placement method: direct pour

Volume: 2.58 cu. ft

Backfill (if different from seal):

Material:

Placement method:

Volume:

Surface seal design:

Material of protective casing: Steel

Material of grout between protective casing and well casing: 3/8" Bentonite chips

Protective cap:

Material: Steel

Vented: ☐ Yes ☐ No Locking: ☑ Yes ☐ No

Well Cap:

Material: PVC

Vented: ☐ Yes ☑ No

D. GROUNDWATER MEASURMENT (± 0.01 ft below top of inner well casing)

Water level: 5.26 ft Stabilization Time:

Well development method: Bailed and Pumped

Average depth of frostline:

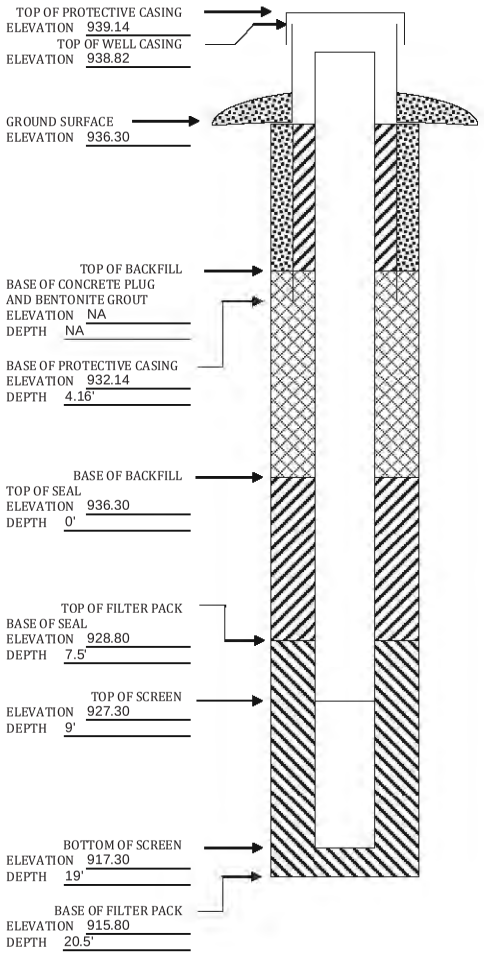
Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½x11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed for to: Iowa Department of Natural Resources, Land Quality Bureau, 502 E 9th St, Des Moines IA 50319-0034.

Questions? Call or Email: Nina Koger, Environmental Engineer Sr., 515-281-8986, Nina.Koger@dnr.iowa.gov

ELEVATIONS: ± 0.01 ft MSL
DEPTHS: ± 0.1 ft FROM GROUND SURFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL.)



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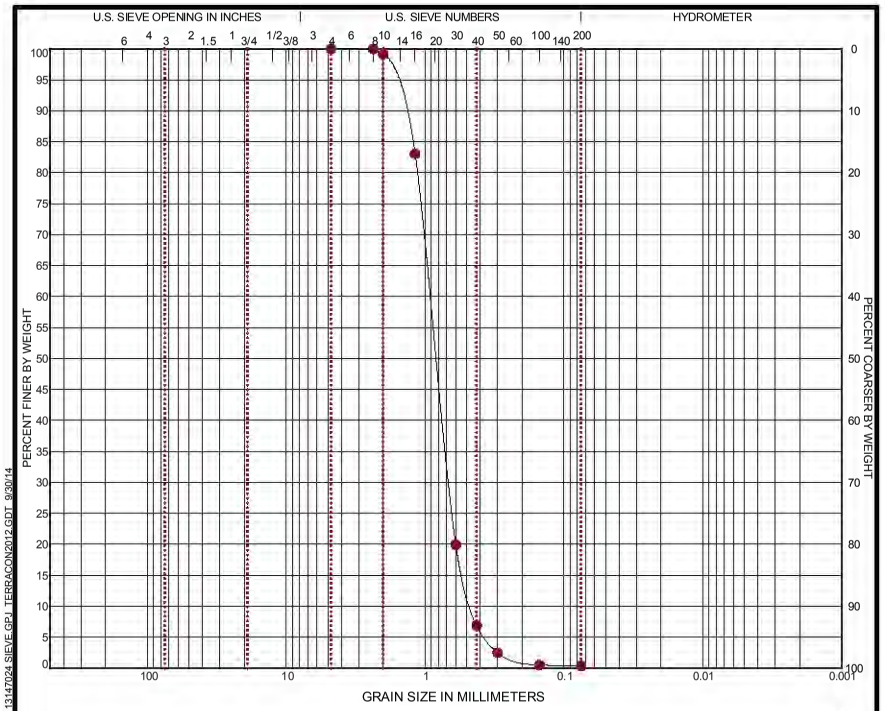
GRAIN SIZE DISTRIBUTION

ASTM D422



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

BORING ID	DEPTH	% COBBLES	% GRAVEL	% SAND	% SILT	% FINES	% CLAY	USCS
1	0	0.0	0.0	99.6		0.4		SP

GRAIN SIZE	
D_{60}	0.922
D_{30}	0.668
D_{10}	0.461
COEFFICIENTS	
C_C	1.05
C_U	2.00

SIEVE (size)	PERCENT FINER

SOIL DESCRIPTION
BMC Coarse

REMARKS

PROJECT: Black Hawk County Landfill

SITE:

Terracon
6612 Chancellor Drive, Suite 102
Cedar Falls, Iowa

PROJECT NUMBER: 13147024

CLIENT:

EXHIBIT: B-1

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS 1 13147024 SIEVE.GPJ TERRACON2012.GDT 9/30/14

MONITORING WELL / PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name BLACK HAWK COUNTY LANDFILL	**Permit No.** 07-SDP-01-75P
Well or Piezometer No. OW-101B	
Dates Started 10-20-86	**Date Completed** 10-20-86

A. SURVEYED LOCATIONS AND ELEVATIONS	B. SOIL BORING INFORMATION
Locations (± 0.5 ft.): N 3618719.61 E 5237815.81	**Name & address of construction company**
Specify corner of site	TWIN CITY TESTING CORP.
Distance & direction along boundary	
Distance & direction from boundary to well	
Elevations (± 0.01 ft. MSL):	**Name of driller**
Ground Surface 943.62	**Drilling method**
Top of protective casing	**Drilling fluid**
Top of well casing 946.51	**Bore Hole diameter** 10 inch
Benchmark elevation	**Soil sampling method**
Benchmark description	**Depth of boring** 29.4 ft BGS

C. MONITORING WELL INSTALLATION	
Casing material STAINLESS STEEL	**Placement method**
Length of casing	**Volume**
Outside casing diameter	**Backfill (if different from seal):**
Inside casing diameter 2 inch	**Material**
Casing joint type FLUSH THREADED, O-RING	**Placement method**
Casing/screen joint type FLUSH THREADED, O-RING	**Volume**
Screen material STAILNLESS STEEL	**Surface seal design:** CONCRETE PAD
Screen opening size #10 SLOT	**Material of protective casing:** STEEL
Screen length 10.2 ft	**Material of grout between protective casing and well casing:** CONCRETE
Depth of Well 30.1 ft BGS	**Protective cap:**
Filter Pack:	**Material** STAINLESS STEEL
Material SILICA SAND	**Vented?: Y/N** YES **Locking?: Y/N** YES
Grain Size #10	**Well cap:**
Volume	**Material** PVC
Seal (minimum 3 ft. length above filter pack):	**Vented?: Y/N** NO
Material BENTONITE PELLET SEAL	

D. GROUNDWATER MEASUREMENT (± 0.01 foot below top of inner well casing)	
Water level	**Stabilization time**
Well development method	
Average depth of frostline	

Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½ inch x 11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed form to: Iowa Department of Natural Resources, Energy and Waste Management Bureau, 502 E. 9th Street, Des Moines, IA 50319-0034.
Questions? Call or Email: Nina Koger Environmental Engineer Sr., 515-281-8986, nina.koger@dnr.state.ia.us

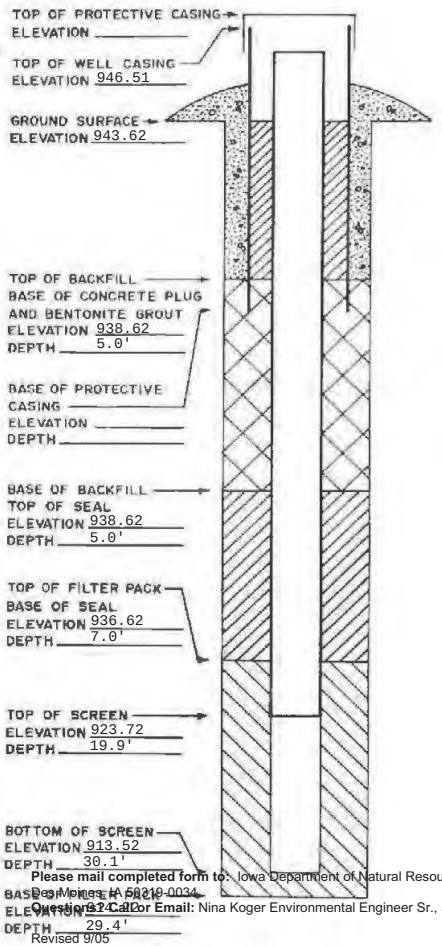
Revised 9/05

Form # 542-1277

ELEVATIONS: ± 0.01 FT. MSL
DEPTHS: ± 0.1 FT. FROM GROUND SERFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL).

OW-101B



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REVISED 1/23/14

MONITORING WELL / PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name BLACK HAWK COUNTY LANDFILL	**Permit No.** 07-SDP-01-75P
Well or Piezometer No. OW-102B - 2009 EXTENDED APPROX. 5.5', See Note Page 2	
Dates Started 10-15-86	**Date Completed** 10-15-86

A. SURVEYED LOCATIONS AND ELEVATIONS	**B. SOIL BORING INFORMATION**
Locations (± 0.5 ft.): N 3618434.57 E 5237943.14	**Name & address of construction company**
Specify corner of site	TWIN CITY TESTING CORP.
Distance & direction along boundary	
Distance & direction from boundary to well	
Elevations (± 0.01 ft. MSL):	**Name of driller**
Ground Surface 948.71 CURRENT	**Drilling method**
Top of protective casing	**Drilling fluid**
Top of well casing 951.32	**Bore Hole diameter** 7 inch
Benchmark elevation	**Soil sampling method**
Benchmark description	**Depth of boring** 35.0 ft BGS

C. MONITORING WELL INSTALLATION	
Casing material STAINLESS STEEL	**Placement method**
Length of casing	**Volume**
Outside casing diameter	**Backfill (if different from seal):**
Inside casing diameter 2.0 inch	**Material**
Casing joint type FLUSH THREADED; O-RING	**Placement method**
Casing/screen joint type FLUSH THREADED; O-RING	**Volume**
Screen material STAINLESS STEEL	**Surface seal design:** CONCRETE PAD
Screen opening size #10 SLOT	**Material of protective casing:** STEEL
Screen length 10.2 ft	**Material of grout between protective casing and well casing:** CONCRETE
Depth of Well 35.2 ft	**Protective cap:**
Filter Pack:	**Material** STEEL
Material SILICA SAND	**Vented?: Y/N** YES **Locking?: Y/N** YES
Grain Size #10	**Well cap:**
Volume	**Material** PVC
Seal (minimum 3 ft. length above filter pack):	**Vented?: Y/N** YES
Material BENTONITE PELLETS	

D. GROUNDWATER MEASUREMENT (± 0.01 foot below top of inner well casing)	
Water level	**Stabilization time**
Well development method	
Average depth of frostline	

Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½ inch x 11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed form to: Iowa Department of Natural Resources, Energy and Waste Management Bureau, 502 E. 9th Street, Des Moines, IA 50319-0034.
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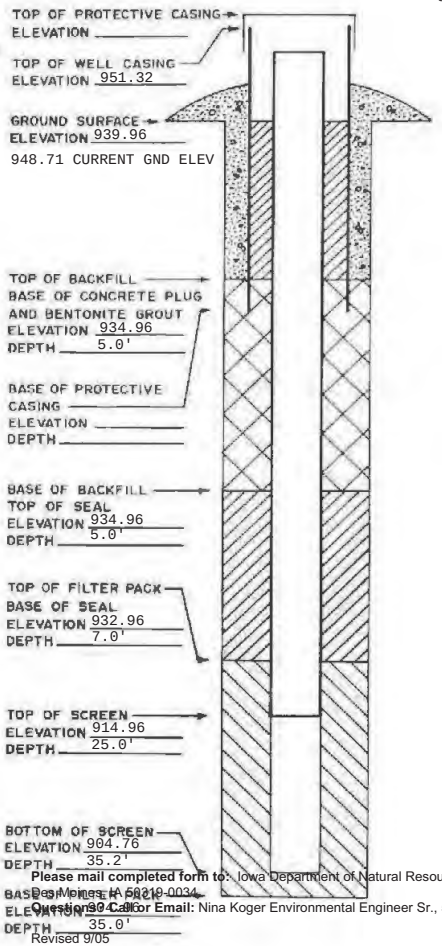
ELEVATIONS: ± 0.01 FT. MSL
DEPTHS: ± 0.1 FT. FROM GROUND SERFACE

OW-102B



SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL).

2009 well was raised approximately 5.5'. Concrete pad was left intact. Depths are calculated from original ground elevation at concrete pad. Current ground elevation is 948.71. The well has been raised once before, Top of Well Casing was 945.84.

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Questions? Call or Email: Nina Koger Environmental Engineer Sr., 515-281-8986, nina.koger@dnr.state.ia.us

MONITORING WELL / PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name BLACK HAWK COUNTY LANDFILL	**Permit No.** 07-SDP-01-75P
Well or Piezometer No. OW-102D	
Dates Started	**Date Completed** 12-27-89

A. SURVEYED LOCATIONS AND ELEVATIONS	**B. SOIL BORING INFORMATION**
Locations (± 0.5 ft.): N 3618693.88 E 5238109.26	**Name & address of construction company**
Specify corner of site	TWIN CITY TESTING CORPORATION
Distance & direction along boundary	
Distance & direction from boundary to well	
Elevations (± 0.01 ft. MSL):	**Name of driller**
Ground Surface 938.34	**Drilling method**
Top of protective casing	**Drilling fluid**
Top of well casing 941.23	**Bore Hole diameter** 10 inch
Benchmark elevation	**Soil sampling method**
Benchmark description	**Depth of boring** 30.0 ft BGS

C. MONITORING WELL INSTALLATION	
Casing material STAINLESS STEEL	**Placement method**
Length of casing	**Volume**
Outside casing diameter	**Backfill (if different from seal):**
Inside casing diameter 2.0 inch	**Material**
Casing joint type	**Placement method**
Casing/screen joint type	**Volume**
Screen material STAINLESS STEEL	**Surface seal design:**
Screen opening size 0.010 inches	**Material of protective casing:** STEEL
Screen length 10 ft	**Material of grout between protective casing and well casing:** CONCRETE
Depth of Well 29.80 ft BGS	**Protective cap:**
Filter Pack:	**Material** STEEL
Material SILICA SAND	**Vented?: Y/N** **Locking?: Y/N**
Grain Size	**Well cap:**
Volume	**Material**
Seal (minimum 3 ft. length above filter pack):	**Vented?: Y/N**
Material 1/4 inch BENTONITE PELLETS	

D. GROUNDWATER MEASUREMENT (± 0.01 foot below top of inner well casing)	
Water level	**Stabilization time**
Well development method	
Average depth of frostline	

Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½ inch x 11 inch map showing locations of all monitoring wells and piezometers.

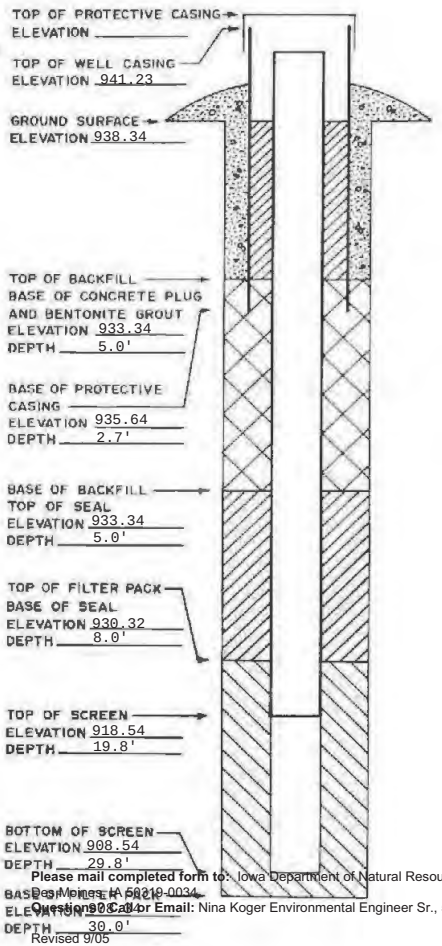
Please mail completed form to: Iowa Department of Natural Resources, Energy and Waste Management Bureau, 502 E. 9th Street, Des Moines, IA 50319-0034.
Questions? Call or Email: Nina Koger Environmental Engineer Sr., 515-281-8986, nina.koger@dnr.state.ia.us

Revised 9/05 Form # 542-1277

ELEVATIONS: ± 0.01 FT. MSL
DEPTHS: ± 0.1 FT. FROM GROUND SERFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL).

OW-102D



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Questions? Call or Email: Nina Koger Environmental Engineer Sr., 515-281-8986, nina.koger@dnr.state.ia.us

MONITORING WELL / PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name BLACK HAWK COUNTY LANDFILL	**Permit No.** 07-SDP-01-75P
Well or Piezometer No. OW-103B	
Dates Started 10/15/86	**Date Completed** 10-15-86

A. SURVEYED LOCATIONS AND ELEVATIONS	**B. SOIL BORING INFORMATION**
Locations (± 0.5 ft.): N 3618213.25 E 5237892.83	**Name & address of construction company**
Specify corner of site	TWIN CITY TESTING CORPORATION
Distance & direction along boundary	
Distance & direction from boundary to well	
Elevations (± 0.01 ft. MSL):	**Name of driller**
Ground Surface 934.90	**Drilling method**
Top of protective casing	**Drilling fluid**
Top of well casing 937.46	**Bore Hole diameter** 10 inch
Benchmark elevation	**Soil sampling method**
Benchmark description	**Depth of boring** 26.0 ft BGS

C. MONITORING WELL INSTALLATION	
Casing material STAINLESS STEEL	**Placement method**
Length of casing	**Volume**
Outside casing diameter	**Backfill (if different from seal):**
Inside casing diameter 2.0 inch	**Material**
Casing joint type FLUSH THREADED; O-RING	**Placement method**
Casing/screen joint type FLUSH THREADED; O-RING	**Volume**
Screen material STAINLESS STEEL	**Surface seal design:** CONCRETE PAD
Screen opening size #10 SLOT	**Material of protective casing:** STEEL
Screen length 10.2 ft	**Material of grout between protective casing and well casing:** CONCRETE
Depth of Well 29.8 ft BGS	**Protective cap:**
Filter Pack:	**Material** STEEL
Material SILICA SAND	**Vented?: Y/N** YES **Locking?: Y/N** YES
Grain Size #10	**Well cap:**
Volume	**Material** PVC
Seal (minimum 3 ft. length above filter pack):	**Vented?: Y/N** YES
Material BENTONITE PELLET	

D. GROUNDWATER MEASUREMENT (± 0.01 foot below top of inner well casing)	
Water level	**Stabilization time**
Well development method	
Average depth of frostline	

Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½ inch x 11 inch map showing locations of all monitoring wells and piezometers.

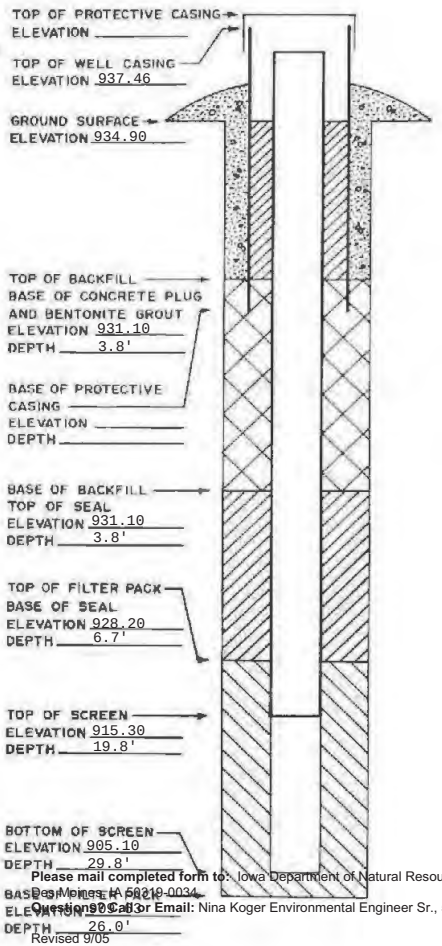
Please mail completed form to: Iowa Department of Natural Resources, Energy and Waste Management Bureau, 502 E. 9th Street, Des Moines, IA 50319-0034.
Questions? Call or Email: Nina Koger Environmental Engineer Sr., 515-281-8986, nina.koger@dnr.state.ia.us

Revised 9/05 Form # 542-1277

ELEVATIONS: ± 0.01 FT. MSL
DEPTHS: ± 0.1 FT. FROM GROUND SERFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL).

OW-103B



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Questions? Call or Email: Nina Koger Environmental Engineer Sr., 515-281-8986, nina.koger@dnr.state.ia.us

MONITORING WELL / PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name BLACK HAWK COUNTY LANDFILL	**Permit No.** 07-SDP-01-75P
Well or Piezometer No. OW-104B	
Dates Started 10/15/86	**Date Completed** 10-15-86

A. SURVEYED LOCATIONS AND ELEVATIONS	**B. SOIL BORING INFORMATION**
Locations (± 0.5 ft.): N 3618224.96 E 5238051.60	**Name & address of construction company**
Specify corner of site	TWIN CITY TESTING CORPORATION
Distance & direction along boundary	
Distance & direction from boundary to well	
Elevations (± 0.01 ft. MSL):	**Name of driller**
Ground Surface 930.72(R) 929.57(O)	**Drilling method**
Top of protective casing	**Drilling fluid**
Top of well casing 933.23(R) 932.27(O)	**Bore Hole diameter** 10 inch
Benchmark elevation	**Soil sampling method**
Benchmark description	**Depth of boring** 25.4 ft BGS

C. MONITORING WELL INSTALLATION	
Casing material STAINLESS STEEL	**Placement method**
Length of casing	**Volume**
Outside casing diameter	**Backfill (if different from seal):**
Inside casing diameter 2.0 inch	**Material**
Casing joint type FLUSH THREADED; O-RING	**Placement method**
Casing/screen joint type FLUSH THREADED; O-RING	**Volume**
Screen material STAINLESS STEEL	**Surface seal design:** CONCRETE PAD
Screen opening size #10 SLOT	**Material of protective casing:** STEEL
Screen length 10.2 ft	**Material of grout between protective casing and well casing:** CONCRETE
Depth of Well 27.15 ft(R) 26.0 ft(O) BGS	**Protective cap:**
Filter Pack:	**Material** STEEL
Material SILICA SAND	**Vented?: Y/N** YES **Locking?: Y/N** YES
Grain Size #10	**Well cap:**
Volume	**Material** PVC
Seal (minimum 3 ft. length above filter pack):	**Vented?: Y/N** YES
Material BENTONITE PELLET	

D. GROUNDWATER MEASUREMENT (± 0.01 foot below top of inner well casing)	
Water level	**Stabilization time**
Well development method	
Average depth of frostline	

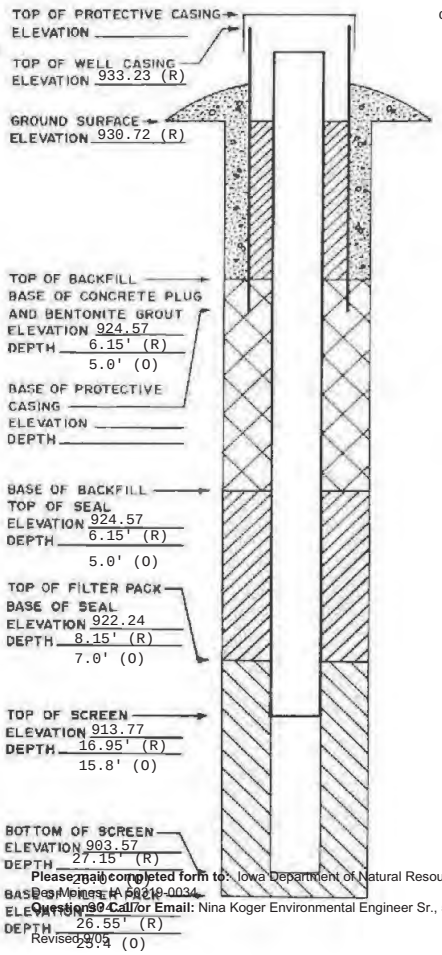
Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½ inch x 11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed form to: Iowa Department of Natural Resources, Energy and Waste Management Bureau, 502 E. 9th Street, Des Moines, IA 50319-0034.
Questions? Call or Email: Nina Koger Environmental Engineer Sr., 515-281-8986, nina.koger@dnr.state.ia.us

Revised 9/05 Form # 542-1277

ELEVATIONS: ± 0.01 FT. MSL
DEPTHS: ± 0.1 FT. FROM GROUND SERFACE

OW-104B



SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL).

Monitoring well was hit in 2006. It was repaired and raised approximately 1 foot. A new concrete pad was also installed at this time, raising the ground surface elevation. The Depths below ground surface(BGS) have been revised from new top of concrete pad.

Please mail completed form to: Iowa Department of Natural Resources, Energy and Waste Management Bureau, 502 E. 9th Street, Des Moines, IA 50319-0034.
Questions? Call or Email: Nina Koger Environmental Engineer Sr., 515-281-8986, nina.koger@dnr.state.ia.us

MONITORING WELL / PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name BLACK HAWK COUNTY LANDFILL	**Permit No.** 07-SDP-01-75P
Well or Piezometer No. OW-105B	
Dates Started 9-11-86	**Date Completed** 09-11-86

A. SURVEYED LOCATIONS AND ELEVATIONS	**B. SOIL BORING INFORMATION**
Locations (± 0.5 ft.): N 3617624.69 E 5239389.10	**Name & address of construction company**
Specify corner of site	TWIN CITY TESTING CORPORATION
Distance & direction along boundary	
Distance & direction from boundary to well	
Elevations (± 0.01 ft. MSL):	**Name of driller**
Ground Surface 910.90 (O) 922.57 (C)	**Drilling method**
Top of protective casing	**Drilling fluid**
Top of well casing 913.72 (O) 925.73 (C)	**Bore Hole diameter** 10"
Benchmark elevation	**Soil sampling method**
Benchmark description	**Depth of boring** 19.6'

C. MONITORING WELL INSTALLATION	
Casing material STAINLESS STEEL	**Placement method**
Length of casing	**Volume**
Outside casing diameter	**Backfill (if different from seal):**
Inside casing diameter 2.0 inch	**Material**
Casing joint type FLUSH THREADED; O-RING	**Placement method**
Casing/screen joint type FLUSH THREADED; O-RING	**Volume**
Screen material STAINLESS STEEL	**Surface seal design:** CONCRETE PAD
Screen opening size #10 SLOT	**Material of protective casing:** STEEL
Screen length 10.2 ft	**Material of grout between protective casing and well casing:** CONCRETE
Depth of Well	**Protective cap:**
Filter Pack:	**Material** STEEL
Material SILICA SAND	**Vented?: Y/N** YES **Locking?: Y/N** YES
Grain Size #10	**Well cap:**
Volume	**Material** PVC
Seal (minimum 3 ft. length above filter pack):	**Vented?: Y/N** YES
Material BENTONITE PELLET	

D. GROUNDWATER MEASUREMENT (± 0.01 foot below top of inner well casing)	
Water level	**Stabilization time**
Well development method	
Average depth of frostline	

Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½ inch x 11 inch map showing locations of all monitoring wells and piezometers.

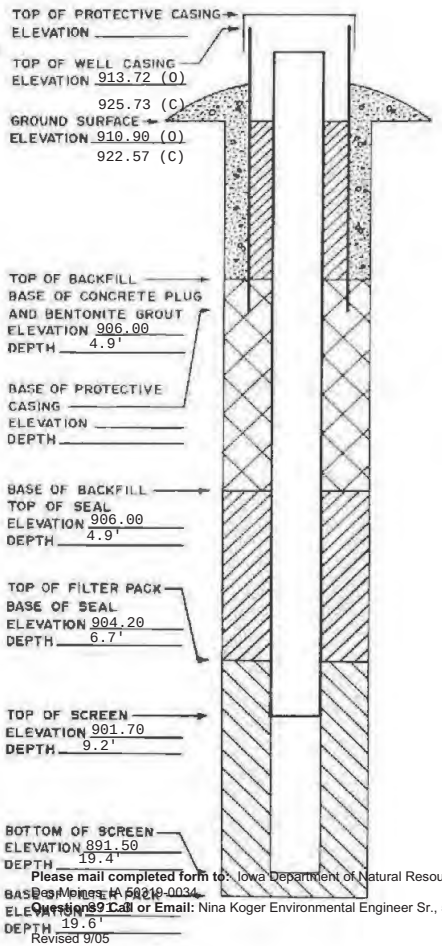
Please mail completed form to: Iowa Department of Natural Resources, Energy and Waste Management Bureau, 502 E. 9th Street, Des Moines, IA 50319-0034.
Questions? Call or Email: Nina Koger Environmental Engineer Sr., 515-281-8986, nina.koger@dnr.state.ia.us

ELEVATIONS: ± 0.01 FT. MSL
DEPTHS: ± 0.1 FT. FROM GROUND SERFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL).

Monitoring Well OW-105B has been raised since installation.

OW-105B



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Questions? Call or Email: Nina Koger Environmental Engineer Sr., 515-281-8986, nina.koger@dnr.state.ia.us

Revised 9/05 Form # 542-1277

MONITORING WELL / PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name BLACK HAWK COUNTY LANDFILL	**Permit No.** 07-SDP-01-75P
Well or Piezometer No. OW-106B	
Dates Started 9/11/86	**Date Completed** 9/11/86

A. SURVEYED LOCATIONS AND ELEVATIONS	**B. SOIL BORING INFORMATION**
Locations (± 0.5 ft.): N 3617474.13 E 5239624.71	**Name & address of construction company**
Specify corner of site	TWIN CITY TESTING CORPORATION
Distance & direction along boundary	
Distance & direction from boundary to well	
Elevations (± 0.01 ft. MSL):	**Name of driller**
Ground Surface 908.35 (O) 911.36 (C)	**Drilling method**
Top of protective casing	**Drilling fluid**
Top of well casing 910.85 (O) 914.65 (C)	**Bore Hole diameter** 10 inch
Benchmark elevation	**Soil sampling method**
Benchmark description	**Depth of boring** 19.5 ft BGS

C. MONITORING WELL INSTALLATION	
Casing material STAINLESS STEEL	**Placement method**
Length of casing	**Volume**
Outside casing diameter	**Backfill (if different from seal):**
Inside casing diameter 2.0 inch	**Material**
Casing joint type Flush thread,O-ring	**Placement method**
Casing/screen joint type Flush thread,O-ring	**Volume**
Screen material STAINLESS STEEL	**Surface seal design:** CONCRETE PAD
Screen opening size #10 SLOT	**Material of protective casing:** STEEL
Screen length 10.2 ft	**Material of grout between protective casing and well casing:** CONCRETE
Depth of Well 22.31' (O) 26.11' (C)	**Protective cap:**
Filter Pack:	**Material** STEEL
Material SILICA SAND	**Vented?: Y/N** Y **Locking?: Y/N** Y
Grain Size UNIMIN SIZE #10	**Well cap:**
Volume	**Material** PVC
Seal (minimum 3 ft. length above filter pack):	**Vented?: Y/N** Y
Material BENTONITE PELLETS	

D. GROUNDWATER MEASUREMENT (± 0.01 foot below top of inner well casing)	
Water level	**Stabilization time**
Well development method	
Average depth of frostline	

Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½ inch x 11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed form to: Iowa Department of Natural Resources, Energy and Waste Management Bureau, 502 E. 9th Street, Des Moines, IA 50319-0034.
Questions? Call or Email: Nina Koger Environmental Engineer Sr., 515-281-8986, nina.koger@dnr.state.ia.us

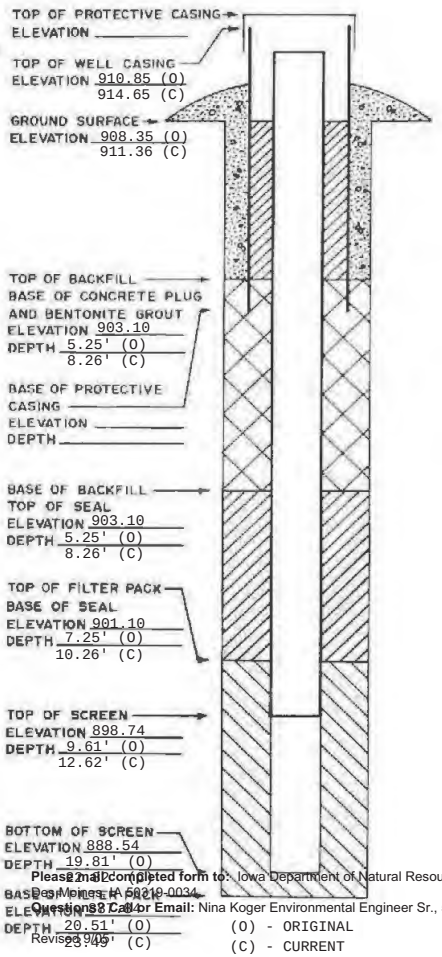
Revised 9/05 Form # 542-1277

ELEVATIONS: ± 0.01 FT. MSL
DEPTHS: ± 0.1 FT. FROM GROUND SERFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL).

Monitoring Well OW-106B has been raised since installation.

OW-106B



(O) - ORIGINAL
(C) - CURRENT

Please mail completed form to: Iowa Department of Natural Resources, Energy and Waste Management Bureau, 502 E. 9th Street, Des Moines, IA 50319-0034.

Questions? Call or Email: Nina Koger Environmental Engineer Sr., 515-281-8986, nina.koger@dnr.state.ia.us

Revised 2005

Form # 542-1277

Print Form

IOWA DEPARTMENT OF NATURAL RESOURCES

MONITORING WELL/PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name: Black Hawk County Landfill Permit No.: 99-TV-054R2

Well or Piezometer No: OW-107BR

Dates Started: 06/12/2013 Date Completed: 06/13/2013

A. SURVEYED LOCATIONS AND ELEVATIONS

Locations (± 0.5 ft): N - 3617288.7, E - 5239903.7

Specify corner of site:

Distance & direction along boundary:

Distance & direction from boundary to wall:

Elevations (± 0.01 ft MSL):

Ground Surface: 908.10

Top of protective casing:

Top of well casing: 911.00

Benchmark elevation:

Benchmark description:

B. SOIL BORING INFORMATION

Name & Address of Construction Company:
Braun Intertec
5915 4th Street SW
Cedar Rapids, IA 52404

Name of Driller: Rob Hunt

Drilling Method: 4 1/4" HSA

Drilling Fluid: None

Bore Hole Diameter: 8"

Soil Sampling Method: 2' split spoon

Depth of Boring: 18.6' bgs

C. MONITORING WELL INSTALLATION

Casing material: stainless steel

Length of casing: 10'

Outside casing diameter: 2.375"

Inside casing diameter: 2.067"

Casing joint type: flush threaded, o-ring

Casing/screen joint type: flush threaded, o-ring

Screen material: stainless steel

Screen opening size: 0.010"

Screen length: 10'

Depth of well: 17.6' bgs

Filter Pack:

Material: Red Flint Sand and Gravel

Grain size: #10 coarse sand

Volume: 3.9 cu. ft.

Seal (minimum 3 ft length above filter pack):

Material: 3/8" Sodium Bentonite Chips (Baroid)

Placement method: direct pour

Volume: 1.9 cu. ft.

Backfill (if different from seal):

Material: same as seal

Placement method:

Volume:

Surface seal design:

Material of protective casing: stainless steel

Material of grout between protective casing and well casing: 3/8" bentonite chips

Protective cap:

Material: stainless steel

Vented: ☐ Yes ☐ No Locking: ☑ Yes ☐ No

Well Cap:

Material: Protop with gasket seal

Vented: ☐ Yes ☑ No

D. GROUNDWATER MEASURMENT (± 0.01 ft below top of inner well casing)

Water level: Stabilization Time:

Well development method:

Average depth of frostline:

Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½x11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed for to: Iowa Department of Natural Resources, Land Quality Bureau, 502 E 9th St, Des Moines IA 50319-0034.

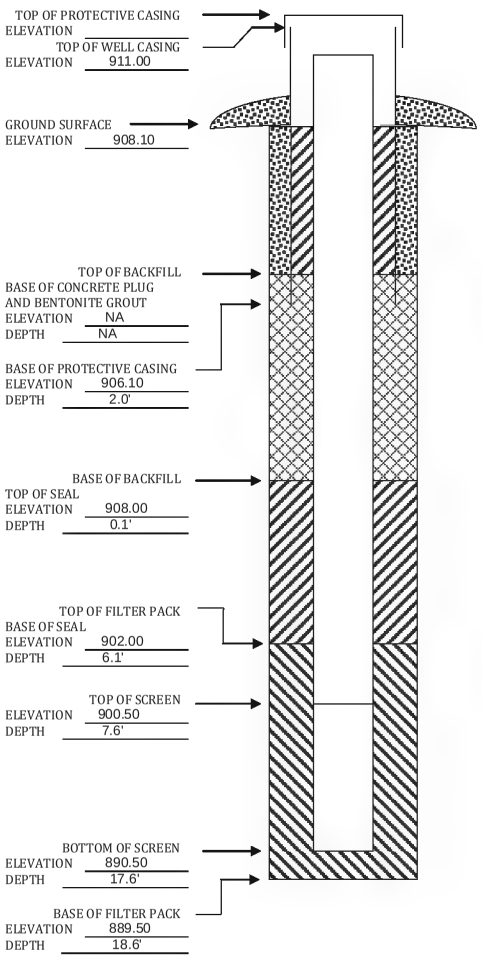
Questions? Call or Email: Nina Koger, Environmental Engineer Sr., 515-281-8986, Nina.Koger@dnr.iowa.gov

06/2011 cmz

DNR Form 542-1277

ELEVATIONS: ± 0.01 ft MSL
DEPTHS: ± 0.1 ft FROM GROUND SURFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL.)



06/2011 cmz

DNR Form 542-1277

MONITORING WELL / PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name BLACK HAWK COUNTY LANDFILL	**Permit No.** 07-SDP-01-75P
Well or Piezometer No. OW-108B	
Dates Started 9-05-86	**Date Completed** 9-05-86

A. SURVEYED LOCATIONS AND ELEVATIONS	**B. SOIL BORING INFORMATION**
Locations (± 0.5 ft.): N3617093.51 E5240118.15	**Name & address of construction company**
Specify corner of site	TWIN CITY TESTING CORPORATION
Distance & direction along boundary	
Distance & direction from boundary to well	
Elevations (± 0.01 ft. MSL):	**Name of driller**
Ground Surface 900.74 (O) 905.50 (C)	**Drilling method**
Top of protective casing	**Drilling fluid**
Top of well casing 903.24 (O) 908.03 (C)	**Bore Hole diameter** 10 inch
Benchmark elevation	**Soil sampling method**
Benchmark description	**Depth of boring** 18.2 ft BGS

C. MONITORING WELL INSTALLATION	
Casing material STAINLESS STEEL	**Placement method**
Length of casing	**Volume**
Outside casing diameter	**Backfill (if different from seal):**
Inside casing diameter 2.0 inch	**Material**
Casing joint type Flush thread,O-ring	**Placement method**
Casing/screen joint type Flush thread,O-ring	**Volume**
Screen material STAINLESS STEEL	**Surface seal design:** CONCRETE PAD
Screen opening size 10 SLOT	**Material of protective casing:** STEEL
Screen length 10.25 ft	**Material of grout between protective casing and well casing:** CONCRETE
Depth of Well 21.85' (O) 26.60' (C)	**Protective cap:**
Filter Pack:	**Material** STEEL
Material SILICA SAND	**Vented?: Y/N** Y **Locking?: Y/N** Y
Grain Size UNIMIN SIZE 10	**Well cap:**
Volume	**Material** PVC
Seal (minimum 3 ft. length above filter pack):	**Vented?: Y/N** YES
Material BENTONITE PELLETS	

D. GROUNDWATER MEASUREMENT (± 0.01 foot below top of inner well casing)	
Water level	**Stabilization time**
Well development method	
Average depth of frostline	

Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½ inch x 11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed form to: Iowa Department of Natural Resources, Energy and Waste Management Bureau, 502 E. 9th Street, Des Moines, IA 50319-0034.
Questions? Call or Email: Nina Koger Environmental Engineer Sr., 515-281-8986, nina.koger@dnr.state.ia.us

Revised 9/05

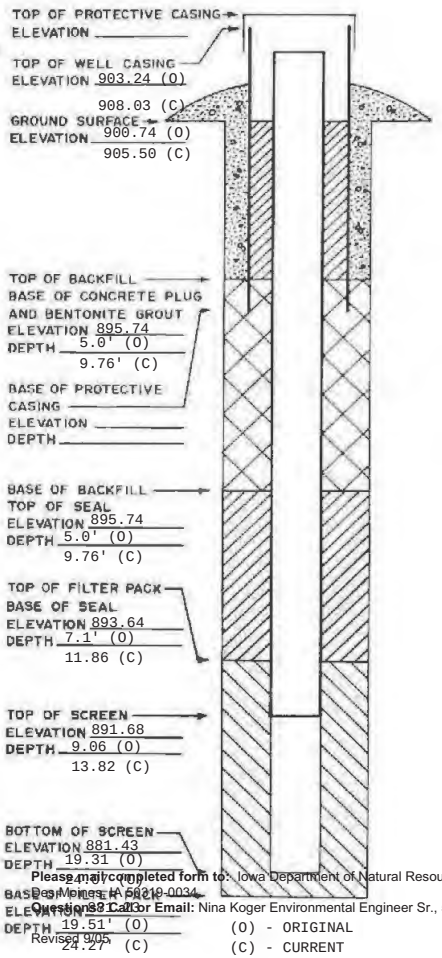
Form # 542-1277

ELEVATIONS: ± 0.01 FT. MSL
DEPTHS: ± 0.1 FT. FROM GROUND SERFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL).

Monitoring Well OW-108B has been raised since installation.

OW-108B



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(O) - ORIGINAL
(C) - CURRENT

MONITORING WELL / PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name BLACK HAWK COUNTY LANDFILL	**Permit No.** 07-SDP-01-75P
Well or Piezometer No. OW-109B	
Dates Started 9-05-86	**Date Completed** 9-05-86

A. SURVEYED LOCATIONS AND ELEVATIONS	**B. SOIL BORING INFORMATION**
Locations (± 0.5 ft.): N3616906.62 E5240306.02	**Name & address of construction company**
Specify corner of site	TWIN CITY TESTING CORPORATION
Distance & direction along boundary	
Distance & direction from boundary to well	
Elevations (± 0.01 ft. MSL):	**Name of driller**
Ground Surface 899.49 (O) 900.03 (C)	**Drilling method**
Top of protective casing	**Drilling fluid**
Top of well casing 901.99 (O) 902.76 (C)	**Bore Hole diameter** 10 inch
Benchmark elevation	**Soil sampling method**
Benchmark description	**Depth of boring** 18.0 ft BGS

C. MONITORING WELL INSTALLATION	
Casing material STAINLESS STEEL	**Placement method**
Length of casing	**Volume**
Outside casing diameter	**Backfill (if different from seal):**
Inside casing diameter 2.0 inch	**Material**
Casing joint type FLUSH THREADED; O-RING	**Placement method**
Casing/screen joint type FLUSH THREADED; O-RING	**Volume**
Screen material STAINLESS STEEL	**Surface seal design:** CONCRETE PAD
Screen opening size #10 SLOT	**Material of protective casing:** STEEL
Screen length 10.2 ft	**Material of grout between protective casing and well casing:** CONCRETE
Depth of Well 21.56 ft BGS	**Protective cap:**
Filter Pack:	**Material** STEEL
Material SILICA SAND	**Vented?: Y/N** YES **Locking?: Y/N** YES
Grain Size UNIMIN SIZE #10	**Well cap:**
Volume	**Material** PVC
Seal (minimum 3 ft. length above filter pack):	**Vented?: Y/N** YES
Material BENTONITE PELLET	

D. GROUNDWATER MEASUREMENT (± 0.01 foot below top of inner well casing)	
Water level	**Stabilization time**
Well development method	
Average depth of frostline	

Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½ inch x 11 inch map showing locations of all monitoring wells and piezometers.

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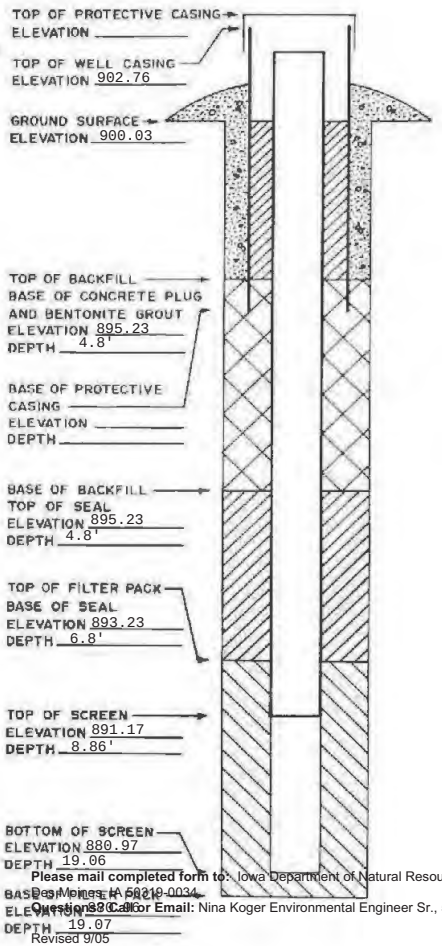
Revised 9/05 Form # 542-1277

ELEVATIONS: ± 0.01 FT. MSL
DEPTHS: ± 0.1 FT. FROM GROUND SERFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL).

OW-109B



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Revised 9/05 Form # 542-1277

(O) - ORIGINAL
(C) - CURRENT

MONITORING WELL / PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name BLACK HAWK COUNTY LANDFILL	**Permit No.** 07-SDP-01-75P
Well or Piezometer No. OW-110B	
Dates Started 9-11-86	**Date Completed** 09-11-86

A. SURVEYED LOCATIONS AND ELEVATIONS	**B. SOIL BORING INFORMATION**
Locations (± 0.5 ft.): N3616298.74 E5240332.85	**Name & address of construction company**
Specify corner of site	TWIN CITY TESTING CORPORATION
Distance & direction along boundary	
Distance & direction from boundary to well	
Elevations (± 0.01 ft. MSL):	**Name of driller**
Ground Surface 905.78	**Drilling method**
Top of protective casing	**Drilling fluid**
Top of well casing 908.58	**Bore Hole diameter** 10 inch
Benchmark elevation	**Soil sampling method**
Benchmark description	**Depth of boring** 25.30 ft BGS

C. MONITORING WELL INSTALLATION	
Casing material STAINLESS STEEL	**Placement method**
Length of casing	**Volume**
Outside casing diameter	**Backfill (if different from seal):**
Inside casing diameter 2.0 inch	**Material**
Casing joint type FLUSH THREADED; O-RING	**Placement method**
Casing/screen joint type FLUSH THREADED; O-RING	**Volume**
Screen material STAINLESS STEEL	**Surface seal design:** CONCRETE PAD
Screen opening size #10 SLOT	**Material of protective casing:** STEEL
Screen length 10.2 ft	**Material of grout between protective casing and well casing:** CONCRETE
Depth of Well 28.7 ft BGS	**Protective cap:**
Filter Pack:	**Material** STEEL
Material SILICA SAND	**Vented?: Y/N** YES **Locking?: Y/N** YES
Grain Size UNIMIN SIZE #10	**Well cap:**
Volume	**Material** PVC
Seal (minimum 3 ft. length above filter pack):	**Vented?: Y/N** YES
Material BENTONITE PELLET	

D. GROUNDWATER MEASUREMENT (± 0.01 foot below top of inner well casing)	
Water level	**Stabilization time**
Well development method	
Average depth of frostline	

Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½ inch x 11 inch map showing locations of all monitoring wells and piezometers.

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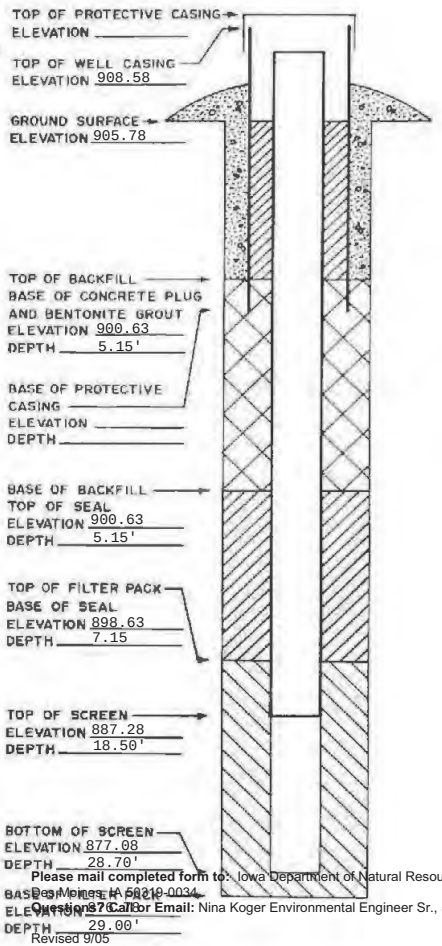
Revised 9/05 Form # 542-1277

ELEVATIONS: ± 0.01 FT. MSL
DEPTHS: ± 0.1 FT. FROM GROUND SERFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL).

OW-110B



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MONITORING WELL / PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name BLACK HAWK COUNTY LANDFILL	**Permit No.** 07-SDP-01-75P
Well or Piezometer No. OW-111B	
Dates Started 8-27-86	**Date Completed** 08-27-86

A. SURVEYED LOCATIONS AND ELEVATIONS	**B. SOIL BORING INFORMATION**
Locations (± 0.5 ft.): N3616233.55 E5239299.18	**Name & address of construction company**
Specify corner of site	TWIN CITY TESTING CORPORATION
Distance & direction along boundary	
Distance & direction from boundary to well	
Elevations (± 0.01 ft. MSL):	**Name of driller**
Ground Surface 942.64	**Drilling method**
Top of protective casing	**Drilling fluid**
Top of well casing 945.54	**Bore Hole diameter** 7.5 inch
Benchmark elevation	**Soil sampling method**
Benchmark description	**Depth of boring** 25.0 ft BGS

C. MONITORING WELL INSTALLATION	
Casing material STAINLESS STEEL	**Placement method**
Length of casing	**Volume**
Outside casing diameter	**Backfill (if different from seal):**
Inside casing diameter 2.0 inch	**Material**
Casing joint type FLUSH THREADED; O-RING	**Placement method**
Casing/screen joint type FLUSH THREADED; O-RING	**Volume**
Screen material STAINLESS STEEL	**Surface seal design:** CONCRETE PAD
Screen opening size #10 SLOT	**Material of protective casing:** STEEL
Screen length 10.2 ft	**Material of grout between protective casing and well casing:** CONCRETE
Depth of Well 25.5 ft BGS	**Protective cap:**
Filter Pack:	**Material** STEEL
Material SILICA SAND	**Vented?: Y/N** YES **Locking?: Y/N** YES
Grain Size UNIMIN SIZE #10	**Well cap:**
Volume	**Material** PVC
Seal (minimum 3 ft. length above filter pack):	**Vented?: Y/N** YES
Material BENTONITE PELLET	

D. GROUNDWATER MEASUREMENT (± 0.01 foot below top of inner well casing)	
Water level	**Stabilization time**
Well development method	
Average depth of frostline	

Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½ inch x 11 inch map showing locations of all monitoring wells and piezometers.

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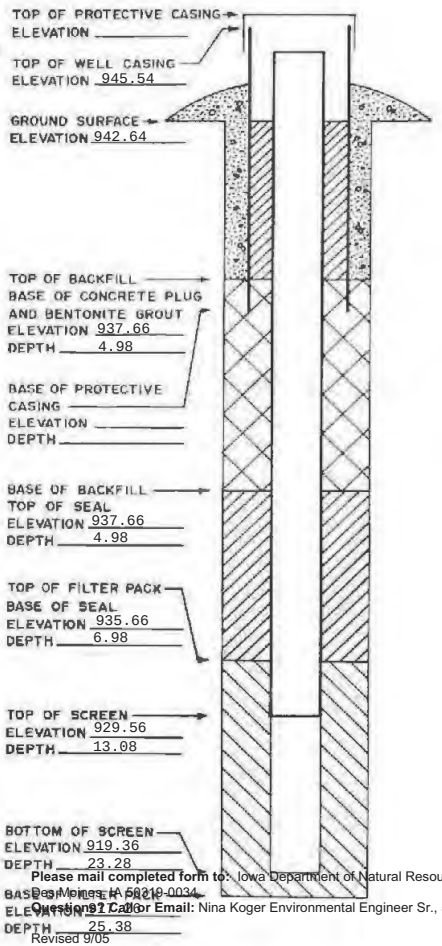
Revised 9/05 Form # 542-1277

ELEVATIONS: ± 0.01 FT. MSL
DEPTHS: ± 0.1 FT. FROM GROUND SERFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL).

OW-111B



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MONITORING WELL / PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name BLACK HAWK COUNTY LANDFILL	**Permit No.** 07-SDP-01-75P
Well or Piezometer No. OW-113B	
Dates Started 10/20/86	**Date Completed** 10/20/86

A. SURVEYED LOCATIONS AND ELEVATIONS	**B. SOIL BORING INFORMATION**
Locations (± 0.5 ft.): N3617819.18 E5239186.61	**Name & address of construction company**
Specify corner of site	TWIN CITY TESTING CORPORATION
Distance & direction along boundary	
Distance & direction from boundary to well	
Elevations (± 0.01 ft. MSL):	**Name of driller**
Ground Surface 916.07	**Drilling method**
Top of protective casing	**Drilling fluid**
Top of well casing 918.41	**Bore Hole diameter** 10 inch
Benchmark elevation	**Soil sampling method**
Benchmark description	**Depth of boring** 20.50 ft BGS

C. MONITORING WELL INSTALLATION	
Casing material STAINLESS STEEL	**Placement method**
Length of casing	**Volume**
Outside casing diameter	**Backfill (if different from seal):**
Inside casing diameter 2.0 inch	**Material**
Casing joint type FLUSH THREADED; O-RING	**Placement method**
Casing/screen joint type FLUSH THREADED; O-RING	**Volume**
Screen material STAINLESS STEEL	**Surface seal design:** CONCRETE PAD
Screen opening size 10 SLOT	**Material of protective casing:** STEEL
Screen length 10.2 ft	**Material of grout between protective casing and well casing:** CONCRETE
Depth of Well 20.80' ft BGS	**Protective cap:**
Filter Pack:	**Material** STEEL
Material SILICA SAND	**Vented?: Y/N** YES **Locking?: Y/N** YES
Grain Size UNIMIN SIZE 10	**Well cap:**
Volume	**Material** PVC
Seal (minimum 3 ft. length above filter pack):	**Vented?: Y/N** YES
Material BENTONITE PELLETS	

D. GROUNDWATER MEASUREMENT (± 0.01 foot below top of inner well casing)	
Water level	**Stabilization time**
Well development method	
Average depth of frostline	

Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½ inch x 11 inch map showing locations of all monitoring wells and piezometers.

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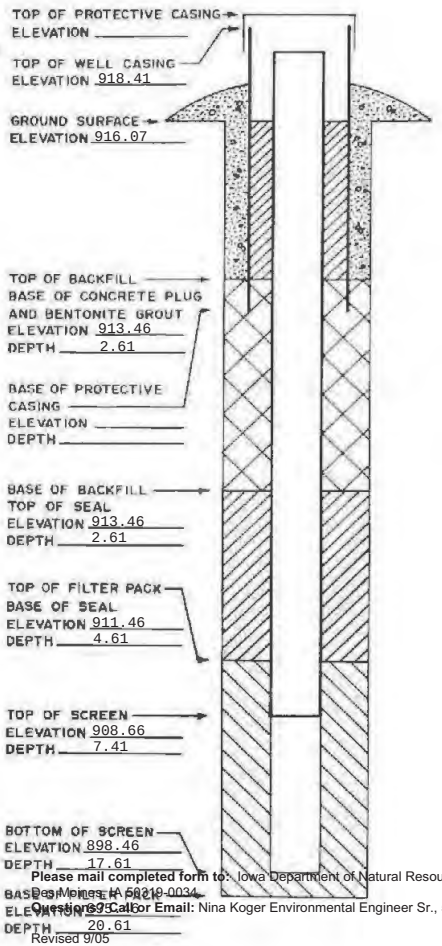
Revised 9/05 Form # 542-1277

ELEVATIONS: ± 0.01 FT. MSL
DEPTHS: ± 0.1 FT. FROM GROUND SERFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL).

OW-113B



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MONITORING WELL / PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name BLACK HAWK COUNTY LANDFILL	**Permit No.** 07-SDP-01-75P
Well or Piezometer No. OW-114B	
Dates Started 9-11-86	**Date Completed** 09-11-86

A. SURVEYED LOCATIONS AND ELEVATIONS	**B. SOIL BORING INFORMATION**
Locations (± 0.5 ft.): N3616651.65 E5237834.14	**Name & address of construction company**
Specify corner of site	TWIN CITY TESTING CORPORATION
Distance & direction along boundary	
Distance & direction from boundary to well	
Elevations (± 0.01 ft. MSL):	**Name of driller**
Ground Surface 940.39	**Drilling method**
Top of protective casing	**Drilling fluid**
Top of well casing 943.24	**Bore Hole diameter** 10 inch
Benchmark elevation	**Soil sampling method**
Benchmark description	**Depth of boring** 19.50 ft BGS

C. MONITORING WELL INSTALLATION	
Casing material STAINLESS STEEL	**Placement method**
Length of casing	**Volume**
Outside casing diameter	**Backfill (if different from seal):**
Inside casing diameter 2.0 inch	**Material**
Casing joint type FLUSH THREADED; O-RING	**Placement method**
Casing/screen joint type FLUSH THREADED; O-RING	**Volume**
Screen material STAINLESS STEEL	**Surface seal design:** CONCRETE PAD
Screen opening size #10 SLOT	**Material of protective casing:** STEEL
Screen length 10.2 ft	**Material of grout between protective casing and well casing:** CONCRETE
Depth of Well 22.7 ft BGS	**Protective cap:**
Filter Pack:	**Material** STEEL
Material SILICA SAND	**Vented?: Y/N** YES **Locking?: Y/N** YES
Grain Size UNIMIN SIZE #10	**Well cap:**
Volume	**Material** PVC
Seal (minimum 3 ft. length above filter pack):	**Vented?: Y/N** YES
Material BENTONITE PELLET	

D. GROUNDWATER MEASUREMENT (± 0.01 foot below top of inner well casing)	
Water level	**Stabilization time**
Well development method	
Average depth of frostline	

Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½ inch x 11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed form to: Iowa Department of Natural Resources, Energy and Waste Management Bureau, 502 E. 9th Street, Des Moines, IA 50319-0034.
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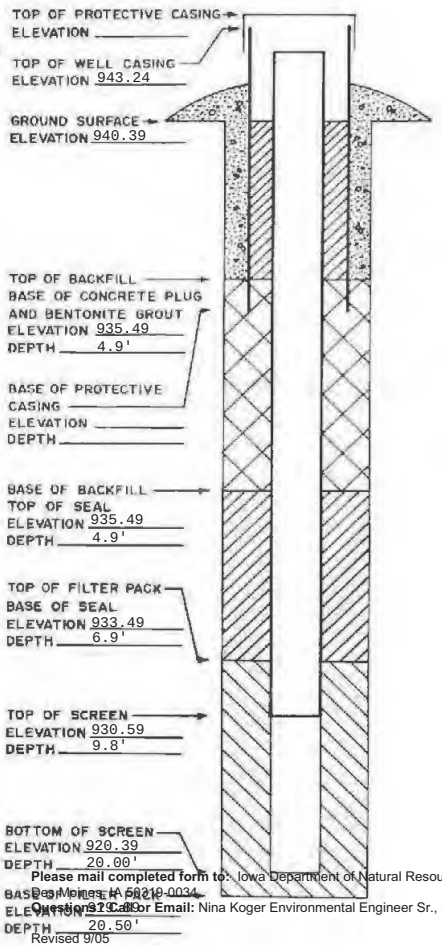
Revised 9/05 Form # 542-1277

ELEVATIONS: ± 0.01 FT. MSL
DEPTHS: ± 0.1 FT. FROM GROUND SERFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL).

OW-114B



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MONITORING WELL / PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name BLACK HAWK COUNTY LANDFILL	**Permit No.** 07-SDP-01-75P
Well or Piezometer No. OW-203B	
Dates Started 3-15-90	**Date Completed** 03-15-90

A. SURVEYED LOCATIONS AND ELEVATIONS	**B. SOIL BORING INFORMATION**
Locations (± 0.5 ft.): N3618649.09 E5237504.19	**Name & address of construction company**
Specify corner of site	TWIN CITY TESTING
Distance & direction along boundary	
Distance & direction from boundary to well	
Elevations (± 0.01 ft. MSL):	**Name of driller**
Ground Surface 941.08	**Drilling method**
Top of protective casing	**Drilling fluid**
Top of well casing 943.11	**Bore Hole diameter** 7 inch
Benchmark elevation	**Soil sampling method**
Benchmark description	**Depth of boring** 23.5 ft BGS

C. MONITORING WELL INSTALLATION	
Casing material 316 STAINLESS STEEL	**Placement method**
Length of casing	**Volume**
Outside casing diameter 2.375 inch	**Backfill (if different from seal):**
Inside casing diameter 2.0 inch	**Material** SILICA SAND
Casing joint type FLUSH THREADED; O-RING	**Placement method**
Casing/screen joint type FLUSH THREADED; O-RING	**Volume** 450 lbs.
Screen material 316 STAINLESS STEEL	**Surface seal design:** CONCRETE
Screen opening size 0.010 inches	**Material of protective casing:** STEEL
Screen length 10.2 ft	**Material of grout between protective casing and well casing:** CONCRETE
Depth of Well 25.33 ft BGS	**Protective cap:**
Filter Pack:	**Material** STEEL
Material SILICA SAND	**Vented?: Y/N** Y **Locking?: Y/N** Y
Grain Size	**Well cap:**
Volume 4.5 100 POUND BAGS	**Material** PVC
Seal (minimum 3 ft. length above filter pack):	**Vented?: Y/N** Y
Material 1/4 inch B-K GEO PELLETS	

D. GROUNDWATER MEASUREMENT (± 0.01 foot below top of inner well casing)	
Water level	**Stabilization time**
Well development method	
Average depth of frostline	

Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½ inch x 11 inch map showing locations of all monitoring wells and piezometers.

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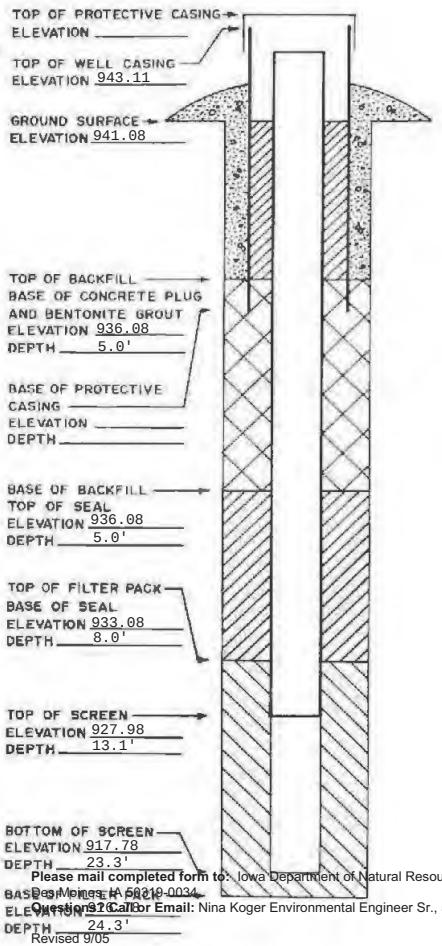
Revised 9/05 Form # 542-1277

ELEVATIONS: ± 0.01 FT. MSL
DEPTHS: ± 0.1 FT. FROM GROUND SERFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL).

OW-203B



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MONITORING WELL / PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name BLACK HAWK COUNTY LANDFILL	**Permit No.** 07-SDP-01-75P
Well or Piezometer No. OW-205B	
Dates Started	**Date Completed** 12-19-86

A. SURVEYED LOCATIONS AND ELEVATIONS	**B. SOIL BORING INFORMATION**
Locations (± 0.5 ft.): 3617842.60 N 5237986.69 E	**Name & address of construction company**
Specify corner of site	TWIN CITY TESTING CORPORATION
Distance & direction along boundary	
Distance & direction from boundary to well	
Elevations (± 0.01 ft. MSL):	**Name of driller**
Ground Surface 937.38	**Drilling method**
Top of protective casing	**Drilling fluid**
Top of well casing 940.13	**Bore Hole diameter** 10 inch
Benchmark elevation	**Soil sampling method**
Benchmark description	**Depth of boring** 21.02 ft BGS

C. MONITORING WELL INSTALLATION	
Casing material STAINLESS STEEL	**Placement method**
Length of casing	**Volume**
Outside casing diameter	**Backfill (if different from seal):**
Inside casing diameter 2.0 inch	**Material**
Casing joint type FLUSH THREADED; O-RING	**Placement method**
Casing/screen joint type	**Volume**
Screen material STAINLESS STEEL	**Surface seal design:**
Screen opening size 0.010 inch	**Material of protective casing:** STEEL
Screen length 10.0 ft	**Material of grout between protective casing and well casing:** CONCRETE
Depth of Well 20.32 ft BGS	**Protective cap:**
Filter Pack:	**Material** STEEL
Material SILICA SAND	**Vented?: Y/N** **Locking?: Y/N**
Grain Size UNIMIN SIZE #10	**Well cap:**
Volume	**Material** PVC
Seal (minimum 3 ft. length above filter pack):	**Vented?: Y/N**
Material 1/4 inch BENTONITE PELLETS	

D. GROUNDWATER MEASUREMENT (± 0.01 foot below top of inner well casing)	
Water level	**Stabilization time**
Well development method	
Average depth of frostline	

Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½ inch x 11 inch map showing locations of all monitoring wells and piezometers.

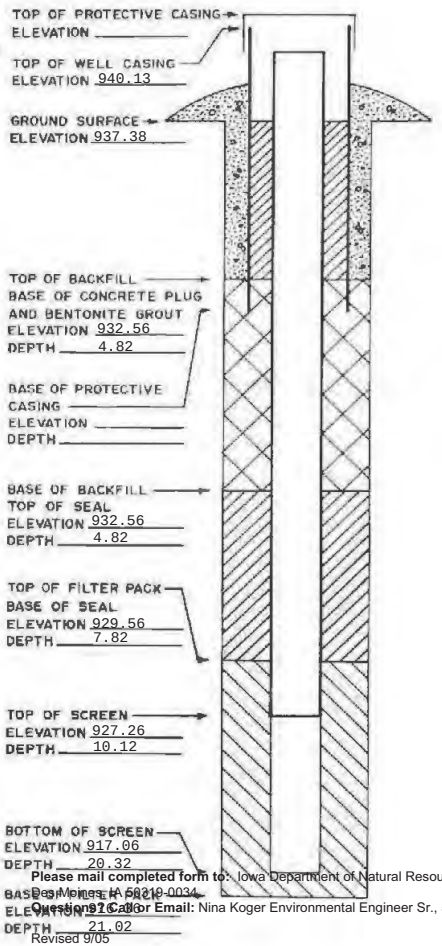
Please mail completed form to: Iowa Department of Natural Resources, Energy and Waste Management Bureau, 502 E. 9th Street, Des Moines, IA 50319-0034.
Questions? Call or Email: Nina Koger Environmental Engineer Sr., 515-281-8986, nina.koger@dnr.state.ia.us

Revised 9/05 Form # 542-1277

ELEVATIONS: ± 0.01 FT. MSL
DEPTHS: ± 0.1 FT. FROM GROUND SERFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL).

OW-205B



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Questions? Call or Email: Nina Koger Environmental Engineer Sr., 515-281-8986, nina.koger@dnr.state.ia.us

MONITORING WELL / PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name BLACK HAWK COUNTY LANDFILL	**Permit No.** 07-SDP-01-75P
Well or Piezometer No. OW-206B	
Dates Started	**Date Completed** 03-23-90

A. SURVEYED LOCATIONS AND ELEVATIONS	**B. SOIL BORING INFORMATION**
Locations (± 0.5 ft.):	**Name & address of construction company**
Specify corner of site	TWIN CITY TESTING
Distance & direction along boundary	
Distance & direction from boundary to well	
Elevations (± 0.01 ft. MSL):	**Name of driller**
Ground Surface 953.65	**Drilling method**
Top of protective casing	**Drilling fluid**
Top of well casing 950.65	**Bore Hole diameter** 7 inch
Benchmark elevation	**Soil sampling method**
Benchmark description	**Depth of boring** 30.8 ft BGS

C. MONITORING WELL INSTALLATION	
Casing material 316 STAINLESS STEEL	**Placement method**
Length of casing	**Volume** 5 GALLONS
Outside casing diameter 2.375 inch	**Backfill (if different from seal):**
Inside casing diameter 2.0 inch	**Material** SILICA SAND #12-40
Casing joint type	**Placement method**
Casing/screen joint type	**Volume** 400 lbs.
Screen material 316 STAINLESS STEEL	**Surface seal design:**
Screen opening size 0.010 inches	**Material of protective casing:** STEEL
Screen length 10.0 ft	**Material of grout between protective casing and well casing:** CONCRETE
Depth of Well 30.8 ft BGS	**Protective cap:**
Filter Pack:	**Material** STEEL
Material SAND	**Vented?: Y/N** Y **Locking?: Y/N** Y
Grain Size	**Well cap:**
Volume	**Material** LOCKING EXPANSION
Seal (minimum 3 ft. length above filter pack):	**Vented?: Y/N** Y
Material 1/4 inch B-K GEO PELLETS	

D. GROUNDWATER MEASUREMENT (± 0.01 foot below top of inner well casing)	
Water level	**Stabilization time**
Well development method	
Average depth of frostline	

Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½ inch x 11 inch map showing locations of all monitoring wells and piezometers.

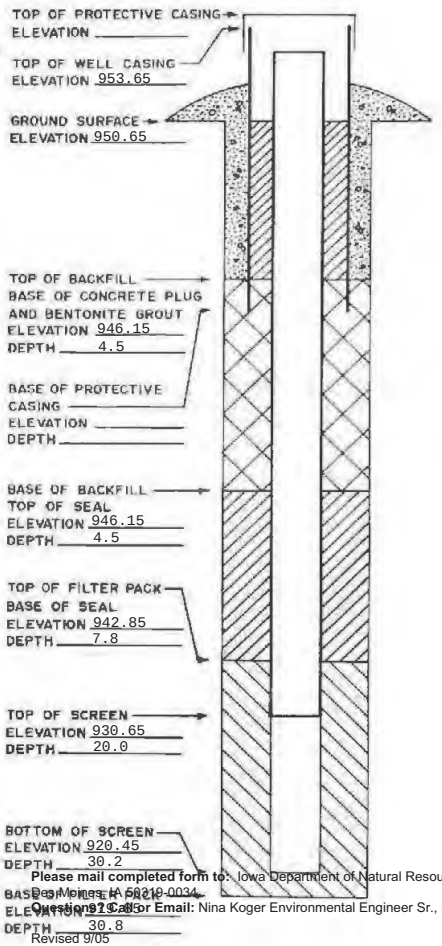
Please mail completed form to: Iowa Department of Natural Resources, Energy and Waste Management Bureau, 502 E. 9th Street, Des Moines, IA 50319-0034.
Questions? Call or Email: Nina Koger Environmental Engineer Sr., 515-281-8986, nina.koger@dnr.state.ia.us

Revised 9/05 Form # 542-1277

ELEVATIONS: ± 0.01 FT. MSL
DEPTHS: ± 0.1 FT. FROM GROUND SERFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL).

OW-206B



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Questions? Call or Email: Nina Koger Environmental Engineer Sr., 515-281-8986, nina.koger@dnr.state.ia.us

MONITORING WELL / PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name BLACK HAWK COUNTY LANDFILL	**Permit No.** 07-SDP-01-75P
Well or Piezometer No. OW-207B	
Dates Started	**Date Completed** 12-20-89

A. SURVEYED LOCATIONS AND ELEVATIONS	**B. SOIL BORING INFORMATION**
Locations (± 0.5 ft.): 3616070.11 N 5238749.85 E	**Name & address of construction company**
Specify corner of site	TWIN CITY TESTING CORPORATION
Distance & direction along boundary	
Distance & direction from boundary to well	
Elevations (± 0.01 ft. MSL):	**Name of driller**
Ground Surface 933.39	**Drilling method**
Top of protective casing	**Drilling fluid**
Top of well casing 936.46	**Bore Hole diameter** 10 inch
Benchmark elevation	**Soil sampling method**
Benchmark description	**Depth of boring** 25.45 ft BGS

C. MONITORING WELL INSTALLATION	
Casing material STAINLESS STEEL	**Placement method**
Length of casing	**Volume**
Outside casing diameter	**Backfill (if different from seal):**
Inside casing diameter 2.0 inch	**Material**
Casing joint type FLUSH THREADED; O-RING	**Placement method**
Casing/screen joint type	**Volume**
Screen material STAINLESS STEEL	**Surface seal design:**
Screen opening size 0.010 inch	**Material of protective casing:** STEEL
Screen length 10.2 ft	**Material of grout between protective casing and well casing:** CONCRETE
Depth of Well 24.75 ft BGS	**Protective cap:**
Filter Pack:	**Material** STEEL
Material BADGER BB #1 WELL PACK	**Vented?: Y/N** **Locking?: Y/N**
Grain Size	**Well cap:**
Volume	**Material** PVC
Seal (minimum 3 ft. length above filter pack):	**Vented?: Y/N**
Material 1/4 inch BENTONITE PELLET	

D. GROUNDWATER MEASUREMENT (± 0.01 foot below top of inner well casing)	
Water level	**Stabilization time**
Well development method	
Average depth of frostline	

Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½ inch x 11 inch map showing locations of all monitoring wells and piezometers.

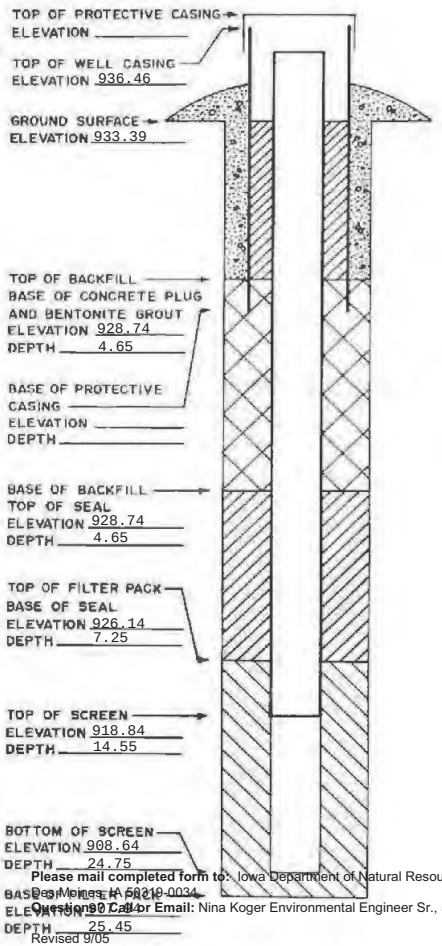
Please mail completed form to: Iowa Department of Natural Resources, Energy and Waste Management Bureau, 502 E. 9th Street, Des Moines, IA 50319-0034.
Questions? Call or Email: Nina Koger Environmental Engineer Sr., 515-281-8986, nina.koger@dnr.state.ia.us

Revised 9/05 Form # 542-1277

ELEVATIONS: ± 0.01 FT. MSL
DEPTHS: ± 0.1 FT. FROM GROUND SERFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL).

OW-207B



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MONITORING WELL / PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name BLACK HAWK COUNTY LANDFILL	**Permit No.** 07-SDP-01-75P
Well or Piezometer No. OW-208B	
Dates Started	**Date Completed** 12-29-89

A. SURVEYED LOCATIONS AND ELEVATIONS	**B. SOIL BORING INFORMATION**
Locations (± 0.5 ft.): N 3616082.02 E 5239936.90	**Name & address of construction company**
Specify corner of site	TWIN CITY TESTING CORPORATION
Distance & direction along boundary	
Distance & direction from boundary to well	
Elevations (± 0.01 ft. MSL):	**Name of driller**
Ground Surface 926.60	**Drilling method**
Top of protective casing	**Drilling fluid**
Top of well casing 929.11	**Bore Hole diameter** 10 inch
Benchmark elevation	**Soil sampling method**
Benchmark description	**Depth of boring** 22.85 ft BGS

C. MONITORING WELL INSTALLATION	
Casing material STAINLESS STEEL	**Placement method**
Length of casing	**Volume**
Outside casing diameter	**Backfill (if different from seal):**
Inside casing diameter 2.0 inch	**Material**
Casing joint type	**Placement method**
Casing/screen joint type	**Volume**
Screen material STAINLESS STEEL	**Surface seal design:**
Screen opening size 0.010 inches	**Material of protective casing:** STEEL
Screen length 10.2 ft	**Material of grout between protective casing and well casing:** CONCRETE
Depth of Well 22.15 ft BGS	**Protective cap:**
Filter Pack:	**Material** STEEL
Material BADGER BB #1 WELL PACK	**Vented?: Y/N** **Locking?: Y/N**
Grain Size	**Well cap:**
Volume	**Material**
Seal (minimum 3 ft. length above filter pack):	**Vented?: Y/N** Y
Material 1/4 inch BENTONITE PELLET	

D. GROUNDWATER MEASUREMENT (± 0.01 foot below top of inner well casing)	
Water level	**Stabilization time**
Well development method	
Average depth of frostline	

Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½ inch x 11 inch map showing locations of all monitoring wells and piezometers.

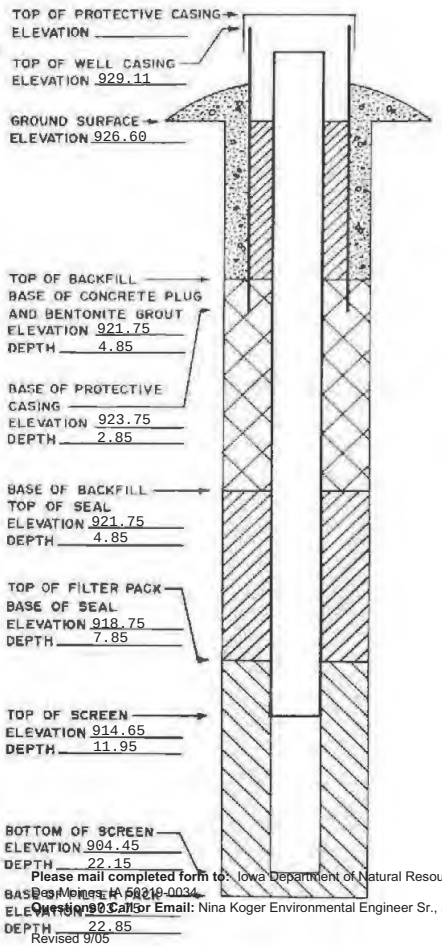
Please mail completed form to: Iowa Department of Natural Resources, Energy and Waste Management Bureau, 502 E. 9th Street, Des Moines, IA 50319-0034.
Questions? Call or Email: Nina Koger Environmental Engineer Sr., 515-281-8986, nina.koger@dnr.state.ia.us

Revised 9/05 Form # 542-1277

ELEVATIONS: ± 0.01 FT. MSL
DEPTHS: ± 0.1 FT. FROM GROUND SERFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL).

OW-208B



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Questions? Call or Email: Nina Koger Environmental Engineer Sr., 515-281-8986, nina.koger@dnr.state.ia.us

MONITORING WELL / PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name BLACK HAWK COUNTY LANDFILL	**Permit No.** 07-SDP-01-75P
Well or Piezometer No. OW-209B	
Dates Started	**Date Completed** 12-18-89

A. SURVEYED LOCATIONS AND ELEVATIONS	**B. SOIL BORING INFORMATION**
Locations (± 0.5 ft.): N 3617169.34 E 5240339.89	**Name & address of construction company**
Specify corner of site	
Distance & direction along boundary	
Distance & direction from boundary to well	
Elevations (± 0.01 ft. MSL):	**Name of driller**
Ground Surface 908.21	**Drilling method**
Top of protective casing	**Drilling fluid**
Top of well casing 910.99	**Bore Hole diameter** 10 inch
Benchmark elevation	**Soil sampling method**
Benchmark description	**Depth of boring** 24.29 ft BGS

C. MONITORING WELL INSTALLATION	
Casing material STAINLESS STEEL	**Placement method**
Length of casing	**Volume**
Outside casing diameter	**Backfill (if different from seal):**
Inside casing diameter 2 inch	**Material** CEMENT
Casing joint type	**Placement method**
Casing/screen joint type	**Volume**
Screen material STAINLESS STEEL	**Surface seal design:**
Screen opening size 0.010 inch	**Material of protective casing:** STEEL
Screen length 10.2 ft	**Material of grout between protective casing and well casing:**
Depth of Well 23.59 ft BGS	**Protective cap:**
Filter Pack:	**Material** STEEL
Material BADGER BB	**Vented?: Y/N** **Locking?: Y/N**
Grain Size #1 WELL PACK	**Well cap:**
Volume	**Material**
Seal (minimum 3 ft. length above filter pack):	**Vented?: Y/N** Y
Material 1/4 inch BENTONITE PELLETS	

D. GROUNDWATER MEASUREMENT (± 0.01 foot below top of inner well casing)	
Water level	**Stabilization time**
Well development method	
Average depth of frostline	

Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½ inch x 11 inch map showing locations of all monitoring wells and piezometers.

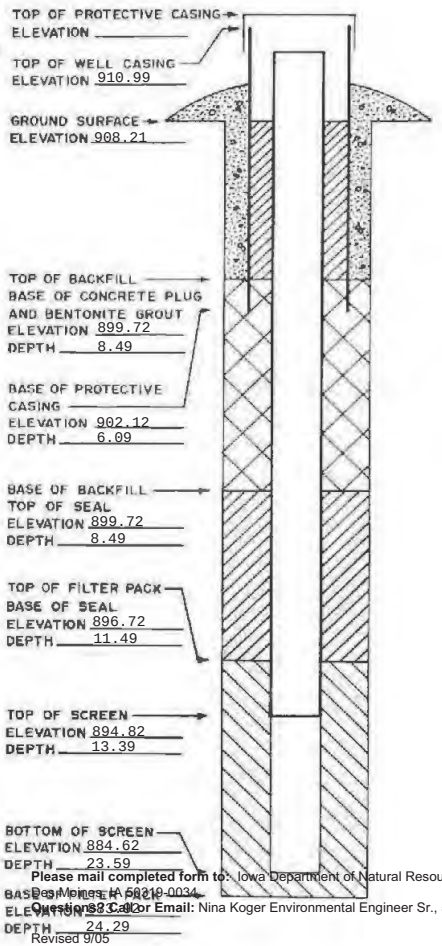
Please mail completed form to: Iowa Department of Natural Resources, Energy and Waste Management Bureau, 502 E. 9th Street, Des Moines, IA 50319-0034.
Questions? Call or Email: Nina Koger Environmental Engineer Sr., 515-281-8986, nina.koger@dnr.state.ia.us

Revised 9/05 Form # 542-1277

ELEVATIONS: ± 0.01 FT. MSL
DEPTHS: ± 0.1 FT. FROM GROUND SERFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL).

OW-209B



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Questions? Call or Email: Nina Koger Environmental Engineer Sr., 515-281-8986, nina.koger@dnr.state.ia.us

MONITORING WELL / PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name BLACK HAWK COUNTY LANDFILL	**Permit No.** 07-SDP-01-75P
Well or Piezometer No. OW-212B	
Dates Started	**Date Completed** 05-15-92

A. SURVEYED LOCATIONS AND ELEVATIONS	**B. SOIL BORING INFORMATION**
Locations (± 0.5 ft.): N 3617888.43 E 5238361.55 E	**Name & address of construction company**
Specify corner of site	AQUADRILL, INC.
Distance & direction along boundary	717 EAST 2ND AVE.
Distance & direction from boundary to well	CORALVILLE, IA 52241
Elevations (± 0.01 ft. MSL):	**Name of driller** JEFF JOSLYN
Ground Surface 931.94	**Drilling method** 6-5/8 inch I.D. HSA
Top of protective casing	**Drilling fluid** NONE
Top of well casing 935.24	**Bore Hole diameter** 11 inch
Benchmark elevation	**Soil sampling method** NONE
Benchmark description	**Depth of boring** 18.0 ft BGS

C. MONITORING WELL INSTALLATION	
Casing material TYPE 316 STAINLESS	**Placement method** FREE FALL
Length of casing 10.5 ft	**Volume** 0.8 CF
Outside casing diameter 2.375 inch	**Backfill (if different from seal):**
Inside casing diameter 2.067 inch	**Material**
Casing joint type O-RING & THREADS	**Placement method**
Casing/screen joint type O-RING & THREADS	**Volume**
Screen material TYPE 316 STAINLESS	**Surface seal design:**
Screen opening size 0.010 inches	**Material of protective casing:**
Screen length 10.0 ft	**Material of grout between protective casing and well casing:**
Depth of Well 18.0 ft BGS	**Protective cap:**
Filter Pack:	**Material**
Material SIEVED SAND	**Vented?: Y/N** **Locking?: Y/N**
Grain Size NORTHERN #0(COARSE)	**Well cap:**
Volume 6.2 CF	**Material**
Seal (minimum 3 ft. length above filter pack):	**Vented?: Y/N**
Material BENTONITE CHIPS	

D. GROUNDWATER MEASUREMENT (± 0.01 foot below top of inner well casing)	
Water level	**Stabilization time**
Well development method	
Average depth of frostline	

Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½ inch x 11 inch map showing locations of all monitoring wells and piezometers.

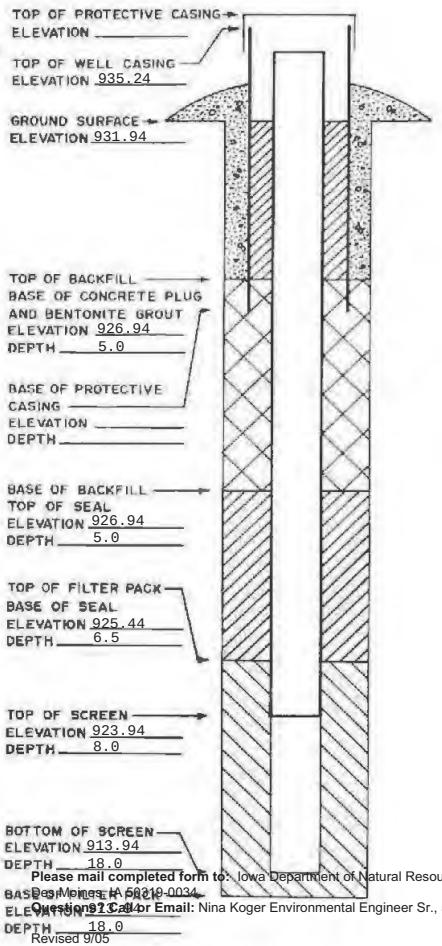
Please mail completed form to: Iowa Department of Natural Resources, Energy and Waste Management Bureau, 502 E. 9th Street, Des Moines, IA 50319-0034.
Questions? Call or Email: Nina Koger Environmental Engineer Sr., 515-281-8986, nina.koger@dnr.state.ia.us

Revised 9/05 Form # 542-1277

ELEVATIONS: ± 0.01 FT. MSL
DEPTHS: ± 0.1 FT. FROM GROUND SERFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL).

OW-212B



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Questions? Call or Email: Nina Koger Environmental Engineer Sr., 515-281-8986, nina.koger@dnr.state.ia.us

MONITORING WELL / PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name BLACK HAWK COUNTY LANDFILL	**Permit No.** 07-SDP-01-75P
Well or Piezometer No. OW-214B	
Dates Started	**Date Completed** 10-23-96

A. SURVEYED LOCATIONS AND ELEVATIONS	**B. SOIL BORING INFORMATION**
Locations (± 0.5 ft.): N 3617506.11 E 5240402.58	**Name & address of construction company**
Specify corner of site	TERRACON
Distance & direction along boundary	
Distance & direction from boundary to well	
Elevations (± 0.01 ft. MSL):	**Name of driller**
Ground Surface 922.81	**Drilling method**
Top of protective casing	**Drilling fluid**
Top of well casing 924.86	**Bore Hole diameter** 10 inch
Benchmark elevation	**Soil sampling method**
Benchmark description	**Depth of boring** 22.71 ft BGS

C. MONITORING WELL INSTALLATION	
Casing material 10 ft STAINLESS STEEL WITH Sch. 40 BLACK IRON RISER	**Placement method**
Length of casing	**Volume** 2 X 50 LB. BAGS
Outside casing diameter	**Backfill (if different from seal):**
Inside casing diameter 2.0 inch	**Material**
Casing joint type	**Placement method**
Casing/screen joint type	**Volume**
Screen material Sch. 40 STAINLESS STEEL	**Surface seal design:**
Screen opening size 0.010 inches	**Material of protective casing:** STEEL
Screen length 10.0 ft	**Material of grout between protective casing and well casing:** CONCRETE
Depth of Well 21.31 ft BGS	**Protective cap:**
Filter Pack:	**Material** STEEL
Material SILICA SAND	**Vented?: Y/N** Y **Locking?: Y/N** Y
Grain Size T .35-.45	**Well cap:**
Volume 11 X 50 LB. BAGS	**Material** PVC
Seal (minimum 3 ft. length above filter pack):	**Vented?: Y/N** Y
Material BENTONITE PELLETS	

D. GROUNDWATER MEASUREMENT (± 0.01 foot below top of inner well casing)	
Water level	**Stabilization time**
Well development method	
Average depth of frostline	

Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½ inch x 11 inch map showing locations of all monitoring wells and piezometers.

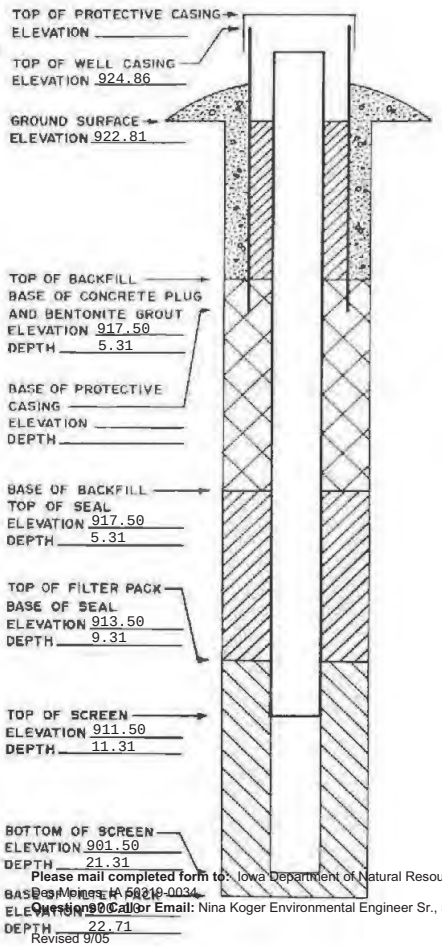
Please mail completed form to: Iowa Department of Natural Resources, Energy and Waste Management Bureau, 502 E. 9th Street, Des Moines, IA 50319-0034.
Questions? Call or Email: Nina Koger Environmental Engineer Sr., 515-281-8986, nina.koger@dnr.state.ia.us

Revised 9/05 Form # 542-1277

ELEVATIONS: ± 0.01 FT. MSL
DEPTHS: ± 0.1 FT. FROM GROUND SERFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL).

OW-214B



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Questions? Call or Email: Nina Koger Environmental Engineer Sr., 515-281-8986, nina.koger@dnr.state.ia.us

MONITORING WELL / PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name BLACK HAWK COUNTY LANDFILL	**Permit No.** 07-SDP-01-75P
Well or Piezometer No. OW-215B	
Dates Started	**Date Completed** 12-21-98

A. SURVEYED LOCATIONS AND ELEVATIONS	**B. SOIL BORING INFORMATION**
Locations (± 0.5 ft.): N 3618062.86 E 5240401.60	**Name & address of construction company**
Specify corner of site	MAXIM TECHNOLOGIES, INC.
Distance & direction along boundary	
Distance & direction from boundary to well	
Elevations (± 0.01 ft. MSL):	**Name of driller** TROY NIEDERT
Ground Surface 932.74	**Drilling method**
Top of protective casing	**Drilling fluid**
Top of well casing 935.04	**Bore Hole diameter** 10 inch
Benchmark elevation	**Soil sampling method**
Benchmark description	**Depth of boring**

C. MONITORING WELL INSTALLATION	
Casing material Sch. 40 STAINLESS STEEl	**Placement method**
Length of casing	**Volume** 2.5 X 50lb. BAGS
Outside casing diameter 2.375 inch	**Backfill (if different from seal):**
Inside casing diameter 2.0 inch	**Material**
Casing joint type	**Placement method**
Casing/screen joint type	**Volume**
Screen material Sch. 40 STAINLESS STEEL	**Surface seal design:**
Screen opening size #10 SLOT	**Material of protective casing:** STEEL
Screen length 5.0 ft	**Material of grout between protective casing and well casing:** CONCRETE
Depth of Well	**Protective cap:**
Filter Pack:	**Material** STEEL
Material PURE SILICA SAND	**Vented?: Y/N** Y **Locking?: Y/N** Y
Grain Size T.35-.45	**Well cap:**
Volume 13 X 50lb. BAGS	**Material** PVC
Seal (minimum 3 ft. length above filter pack):	**Vented?: Y/N** Y
Material COLLOID ENVIRONMENTAL TECH. PELLETS	

D. GROUNDWATER MEASUREMENT (± 0.01 foot below top of inner well casing)	
Water level	**Stabilization time**
Well development method	
Average depth of frostline	

Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½ inch x 11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed form to: Iowa Department of Natural Resources, Energy and Waste Management Bureau, 502 E. 9th Street, Des Moines, IA 50319-0034.
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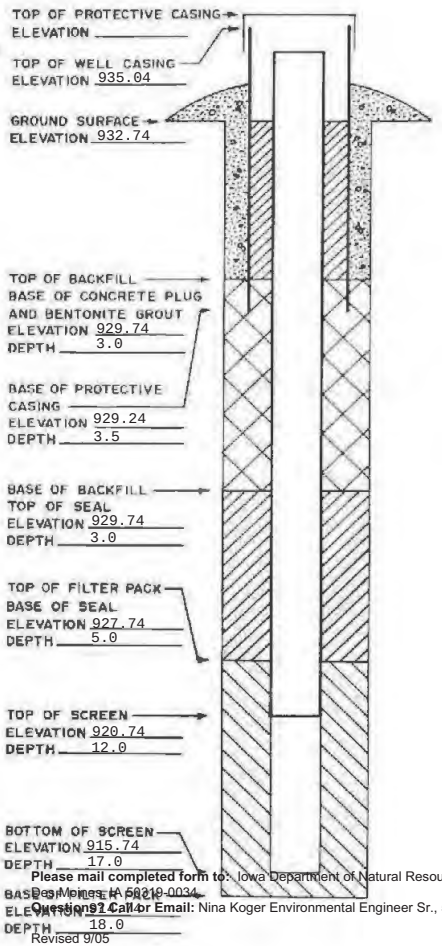
ELEVATIONS: ± 0.01 FT. MSL
DEPTHS: ± 0.1 FT. FROM GROUND SERFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL).

OW-215B



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Questions? Call or Email: Nina Koger Environmental Engineer Sr., 515-281-8986, nina.koger@dnr.state.ia.us

MONITORING WELL / PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name BLACK HAWK COUNTY LANDFILL	**Permit No.** 07-SDP-01-75P
Well or Piezometer No. OW-216B	
Dates Started	**Date Completed** 12-04-98

A. SURVEYED LOCATIONS AND ELEVATIONS	**B. SOIL BORING INFORMATION**
Locations (± 0.5 ft.): N 3618604.37 E 5240395.77	**Name & address of construction company**
Specify corner of site	MAXIM TECHNOLOGIES, INC
Distance & direction along boundary	
Distance & direction from boundary to well	
Elevations (± 0.01 ft. MSL):	**Name of driller** TROY NIEDERT
Ground Surface 941.03	**Drilling method**
Top of protective casing	**Drilling fluid**
Top of well casing 942.83	**Bore Hole diameter** 10 inch
Benchmark elevation	**Soil sampling method**
Benchmark description	**Depth of boring** 17.5 ft BGS

C. MONITORING WELL INSTALLATION	
Casing material STAINLESS STEEL	**Placement method**
Length of casing	**Volume** 2 X 50 lbs BAGS
Outside casing diameter 2.375 inch	**Backfill (if different from seal):**
Inside casing diameter 2.0 inch	**Material**
Casing joint type FLUSH THREADED; O-RING	**Placement method**
Casing/screen joint type	**Volume**
Screen material STAINLESS STEEL	**Surface seal design:**
Screen opening size #10 SLOT	**Material of protective casing:** STEEL
Screen length 10.0 ft	**Material of grout between protective casing and well casing:** CONCRETE
Depth of Well 17.0 ft BGS	**Protective cap:**
Filter Pack:	**Material** STEEL
Material PURE SILICA SAND	**Vented?: Y/N** Y **Locking?: Y/N** Y
Grain Size T .35-.45	**Well cap:**
Volume 8 X 50 lbs BAGS	**Material** STEEL
Seal (minimum 3 ft. length above filter pack):	**Vented?: Y/N** Y
Material COLLOID ENVIRONMENTAL TECH. PELLETS	

D. GROUNDWATER MEASUREMENT (± 0.01 foot below top of inner well casing)	
Water level	**Stabilization time**
Well development method	
Average depth of frostline	

Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½ inch x 11 inch map showing locations of all monitoring wells and piezometers.

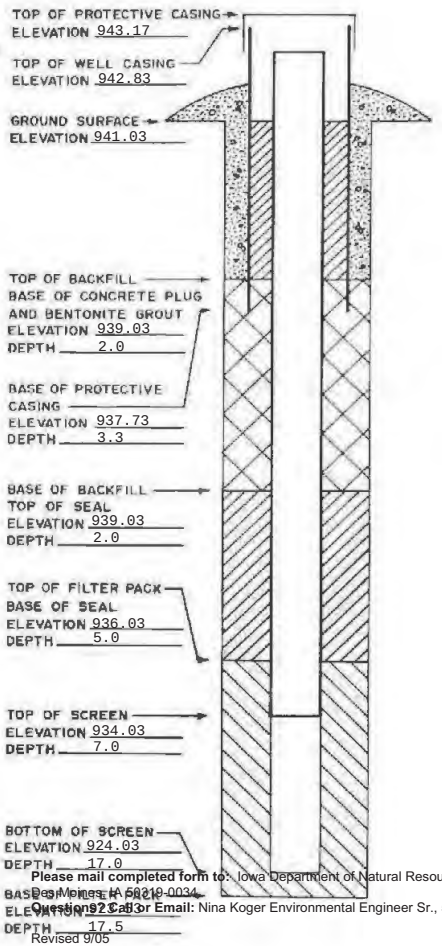
Please mail completed form to: Iowa Department of Natural Resources, Energy and Waste Management Bureau, 502 E. 9th Street, Des Moines, IA 50319-0034.
Questions? Call or Email: Nina Koger Environmental Engineer Sr., 515-281-8986, nina.koger@dnr.state.ia.us

Revised 9/05 Form # 542-1277

ELEVATIONS: ± 0.01 FT. MSL
DEPTHS: ± 0.1 FT. FROM GROUND SERFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL).

OW-216B



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MONITORING WELL / PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name BLACK HAWK COUNTY LANDFILL	**Permit No.** 07-SDP-01-75P
Well or Piezometer No. OW-401B	
Dates Started 5-6-2010	**Date Completed** 5-6-2010

A. SURVEYED LOCATIONS AND ELEVATIONS	**B. SOIL BORING INFORMATION**
Locations (± 0.5 ft.): N 3617180.26 E 5237824.52	**Name & address of construction company**
Specify corner of site	TERRACON
Distance & direction along boundary	
Distance & direction from boundary to well	
Elevations (± 0.01 ft. MSL):	**Name of driller** MATT WHITE
Ground Surface 960.56	**Drilling method** 4 1/4-INCH HSA
Top of protective casing	**Drilling fluid** NONE
Top of well casing 963.10	**Bore Hole diameter** 8 inch
Benchmark elevation	**Soil sampling method** 2-INCH SPLIT SPOON
Benchmark description	**Depth of boring** 28.5 ft BGS

C. MONITORING WELL INSTALLATION	
Casing material TYPE 304 STAINLESS STEEL	**Placement method** GRAVITY
Length of casing 20.0 ft	**Volume** 7 1/2 - 50 lb bags
Outside casing diameter 2.375 inch	**Backfill (if different from seal):** SAME AS SEAL
Inside casing diameter 2.067 inch	**Material**
Casing joint type FLUSH THREADED	**Placement method**
Casing/screen joint type FLUSH THREADED	**Volume**
Screen material TYPE 304 STAINLESS STEEL	**Surface seal design:**
Screen opening size 0.010 inches	**Material of protective casing:** STEEL
Screen length 10.0 ft	**Material of grout between protective casing and well casing:** SAME AS SEAL
Depth of Well 27.5 ft BGS	**Protective cap:**
Filter Pack:	**Material** STEEL
Material COARSE SAND	**Vented?: Y/N** Y **Locking?: Y/N** Y
Grain Size SEE GRAIN SIZE CURVE	**Well cap:**
Volume 8 1/4 - 50 lb bags	**Material** STAINLESS STEEL
Seal (minimum 3 ft. length above filter pack):	**Vented?: Y/N** N
Material 3/8 inch SODIUM BENTONITE HOLE PLUG	

D. GROUNDWATER MEASUREMENT (± 0.01 foot below top of inner well casing)	
Water level	**Stabilization time**
Well development method	
Average depth of frostline	

Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½ inch x 11 inch map showing locations of all monitoring wells and piezometers.

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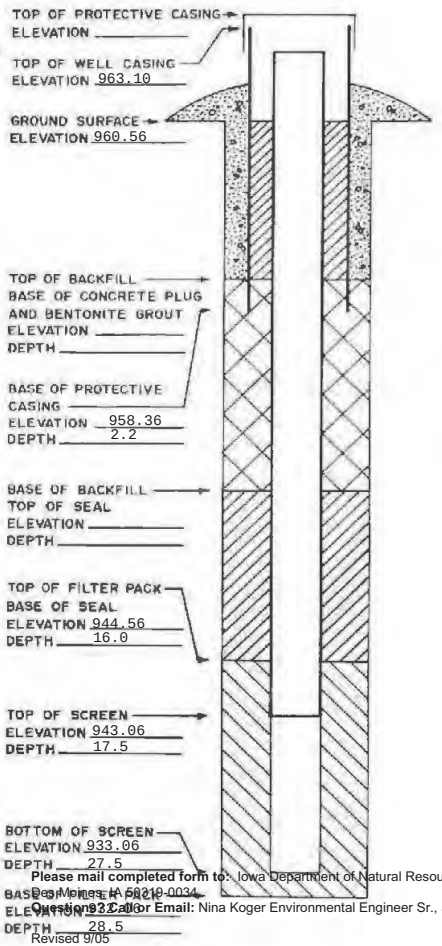
Revised 9/05 Form # 542-1277

ELEVATIONS: ± 0.01 FT. MSL
DEPTHS: ± 0.1 FT. FROM GROUND SERFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL).

OW-401B



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MONITORING WELL / PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name BLACK HAWK COUNTY LANDFILL	**Permit No.** 07-SDP-01-75P
Well or Piezometer No. OW-402B	
Dates Started 5-6-2010	**Date Completed** 5-6-2010

A. SURVEYED LOCATIONS AND ELEVATIONS	**B. SOIL BORING INFORMATION**
Locations (± 0.5 ft.): N 3617479.15 E 5237821.85	**Name & address of construction company**
Specify corner of site	TERRACON
Distance & direction along boundary	
Distance & direction from boundary to well	
Elevations (± 0.01 ft. MSL):	**Name of driller** MATT WHITE
Ground Surface 952.64	**Drilling method** 4 1/4-INCH HSA
Top of protective casing	**Drilling fluid** NONE
Top of well casing 954.89	**Bore Hole diameter** 8 inch
Benchmark elevation	**Soil sampling method** 2-INCH SPLIT SPOON
Benchmark description	**Depth of boring** 24.0 ft BGS

C. MONITORING WELL INSTALLATION	
Casing material TYPE 304 STAINLESS STEEL	**Placement method** GRAVITY
Length of casing 15.5 ft	**Volume** 4 1/2 - 50 lb bags
Outside casing diameter 2.375 inch	**Backfill (if different from seal):** SAME AS SEAL
Inside casing diameter 2.067 inch	**Material**
Casing joint type FLUSH THREADED	**Placement method**
Casing/screen joint type FLUSH THREADED	**Volume**
Screen material TYPE 304 STAINLESS STEEL	**Surface seal design:**
Screen opening size 0.010 inches	**Material of protective casing:** STEEL
Screen length 10.0 ft	**Material of grout between protective casing and well casing:** SAME AS SEAL
Depth of Well 23.0 ft BGS	**Protective cap:**
Filter Pack:	**Material** STEEL
Material COARSE SAND	**Vented?: Y/N** N **Locking?: Y/N** Y
Grain Size SEE GRAIN SIZE CURVE	**Well cap:**
Volume 7 - 50 lb bags	**Material** PROTOP (PLASTIC W/ GASKET SEAL)
Seal (minimum 3 ft. length above filter pack):	**Vented?: Y/N** N
Material 3/8 inch SODIUM BENTONITE HOLE PLUG	

D. GROUNDWATER MEASUREMENT (± 0.01 foot below top of inner well casing)	
Water level	**Stabilization time**
Well development method	
Average depth of frostline	

Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½ inch x 11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed form to: Iowa Department of Natural Resources, Energy and Waste Management Bureau, 502 E. 9th Street, Des Moines, IA 50319-0034.
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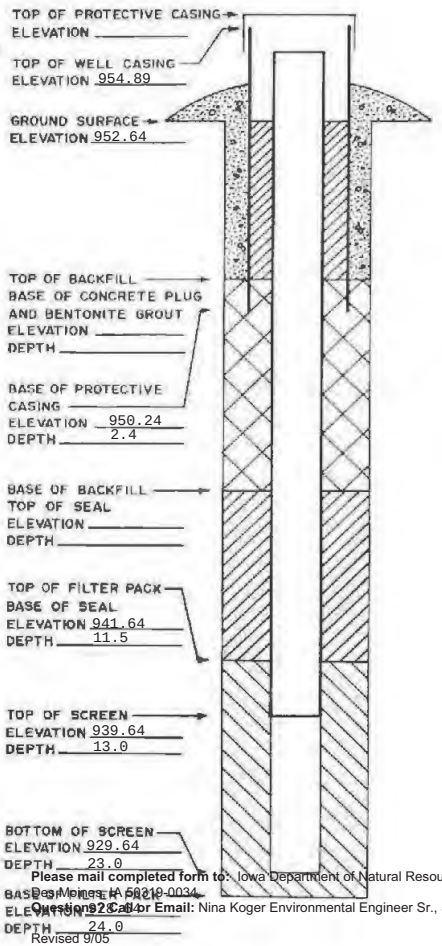
Revised 9/05 Form # 542-1277

ELEVATIONS: ± 0.01 FT. MSL
DEPTHS: ± 0.1 FT. FROM GROUND SERFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL).

OW-402B



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MONITORING WELL / PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name BLACK HAWK COUNTY LANDFILL	**Permit No.** 07-SDP-01-75P
Well or Piezometer No. OW-403B	
Dates Started 5-6-2010	**Date Completed** 5-6-2010

A. SURVEYED LOCATIONS AND ELEVATIONS	**B. SOIL BORING INFORMATION**
Locations (± 0.5 ft.): N 3617757.68 E 5237476.05	**Name & address of construction company**
Specify corner of site	TERRACON
Distance & direction along boundary	
Distance & direction from boundary to well	
Elevations (± 0.01 ft. MSL):	**Name of driller** MATT WHITE
Ground Surface 944.33	**Drilling method** 4 1/4-INCH HSA
Top of protective casing	**Drilling fluid** NONE
Top of well casing 947.15	**Bore Hole diameter** 8 inch
Benchmark elevation	**Soil sampling method** 2-INCH SPLIT SPOON
Benchmark description	**Depth of boring** 18.5 ft BGS

C. MONITORING WELL INSTALLATION	
Casing material TYPE 304 STAINLESS STEEL	**Placement method** GRAVITY
Length of casing 10.0 ft	**Volume** 3 - 50 lb bags
Outside casing diameter 2.375 inch	**Backfill (if different from seal):** SAME AS SEAL
Inside casing diameter 2.067 inch	**Material**
Casing joint type FLUSH THREADED	**Placement method**
Casing/screen joint type FLUSH THREADED	**Volume**
Screen material TYPE 304 STAINLESS STEEL	**Surface seal design:**
Screen opening size 0.010 inches	**Material of protective casing:** STEEL
Screen length 10.0 ft	**Material of grout between protective casing and well casing:** SAME AS SEAL
Depth of Well 17.3 ft BGS	**Protective cap:**
Filter Pack:	**Material** STEEL
Material COARSE SAND	**Vented?: Y/N** N **Locking?: Y/N** Y
Grain Size SEE GRAIN SIZE CURVE	**Well cap:**
Volume 7 1/2 - 50 lb bags	**Material** STAINLESS STEEL
Seal (minimum 3 ft. length above filter pack):	**Vented?: Y/N** N
Material 3/8 inch SODIUM BENTONITE HOLE PLUG	

D. GROUNDWATER MEASUREMENT (± 0.01 foot below top of inner well casing)	
Water level	**Stabilization time**
Well development method	
Average depth of frostline	

Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½ inch x 11 inch map showing locations of all monitoring wells and piezometers.

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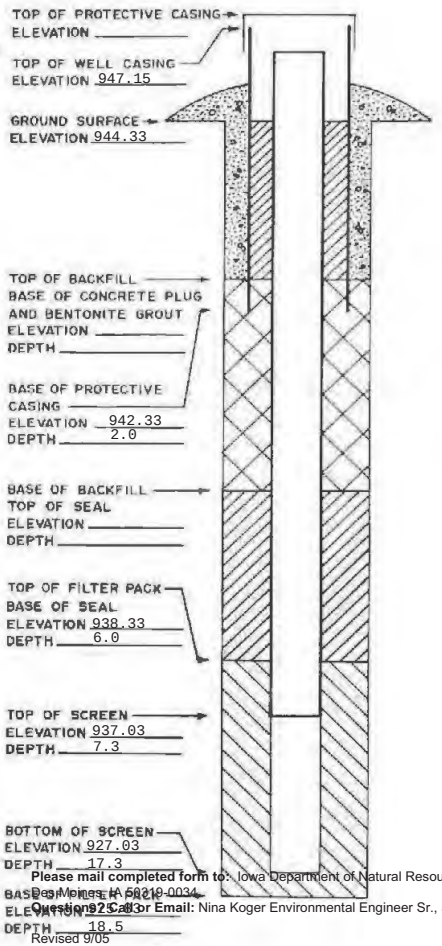
Revised 9/05 Form # 542-1277

ELEVATIONS: ± 0.01 FT. MSL
DEPTHS: ± 0.1 FT. FROM GROUND SERFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL).

OW-403B



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MONITORING WELL / PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name BLACK HAWK COUNTY LANDFILL	**Permit No.** 07-SDP-01-75P
Well or Piezometer No. OW-405B	
Dates Started 5-5-2010	**Date Completed** 5-5-2010

A. SURVEYED LOCATIONS AND ELEVATIONS	**B. SOIL BORING INFORMATION**
Locations (± 0.5 ft.): N 3617739.72 E 5236807.01	**Name & address of construction company**
Specify corner of site	TERRACON
Distance & direction along boundary	
Distance & direction from boundary to well	
Elevations (± 0.01 ft. MSL):	**Name of driller** MATT WHITE
Ground Surface 947.24	**Drilling method** 4 1/4-INCH HSA
Top of protective casing	**Drilling fluid** NONE
Top of well casing 949.34	**Bore Hole diameter** 8 inch
Benchmark elevation	**Soil sampling method** 2-INCH SPLIT SPOON
Benchmark description	**Depth of boring** 18.5 ft BGS

C. MONITORING WELL INSTALLATION	
Casing material TYPE 304 STAINLESS STEEL	**Placement method** GRAVITY
Length of casing 10.0 ft	**Volume** 2 3/4 - 50 lb bags
Outside casing diameter 2.375 inch	**Backfill (if different from seal):** SAME AS SEAL
Inside casing diameter 2.067 inch	**Material**
Casing joint type FLUSH THREADED	**Placement method**
Casing/screen joint type FLUSH THREADED	**Volume**
Screen material TYPE 304 STAINLESS STEEL	**Surface seal design:**
Screen opening size 0.010 inches	**Material of protective casing:** STEEL
Screen length 10.0 ft	**Material of grout between protective casing and well casing:** SAME AS SEAL
Depth of Well 17.6 ft BGS	**Protective cap:**
Filter Pack:	**Material** STEEL
Material COARSE SAND	**Vented?: Y/N** N **Locking?: Y/N** Y
Grain Size SEE GRAIN SIZE CURVE	**Well cap:**
Volume 7 1/4 - 50 lb bags	**Material** STAINLESS STEEL
Seal (minimum 3 ft. length above filter pack):	**Vented?: Y/N** N
Material 3/8 inch SODIUM BENTONITE HOLE PLUG	

D. GROUNDWATER MEASUREMENT (± 0.01 foot below top of inner well casing)	
Water level	**Stabilization time**
Well development method	
Average depth of frostline	

Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½ inch x 11 inch map showing locations of all monitoring wells and piezometers.

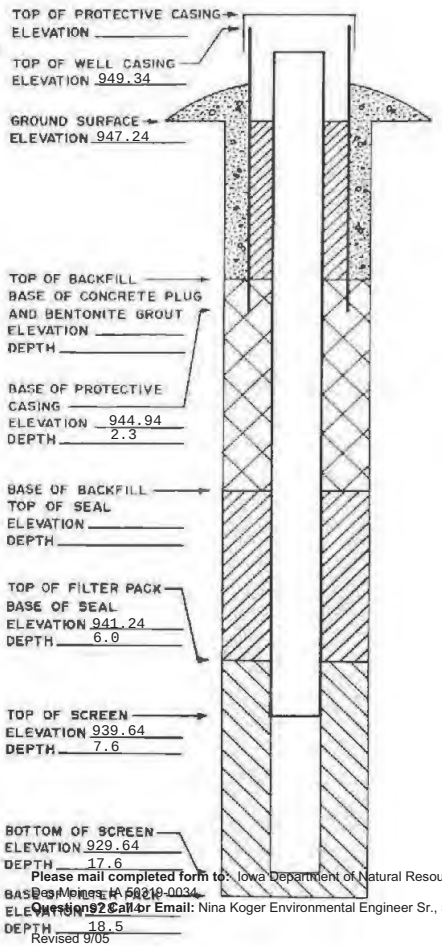
Please mail completed form to: Iowa Department of Natural Resources, Energy and Waste Management Bureau, 502 E. 9th Street, Des Moines, IA 50319-0034.
Questions? Call or Email: Nina Koger Environmental Engineer Sr., 515-281-8986, nina.koger@dnr.state.ia.us

Revised 9/05 Form # 542-1277

ELEVATIONS: ± 0.01 FT. MSL
DEPTHS: ± 0.1 FT. FROM GROUND SERFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL).

OW-405B



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MONITORING WELL / PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name BLACK HAWK COUNTY LANDFILL	**Permit No.** 07-SDP-01-75P
Well or Piezometer No. OW-406B	
Dates Started 5-5-2010	**Date Completed** 5-5-2010

A. SURVEYED LOCATIONS AND ELEVATIONS	**B. SOIL BORING INFORMATION**
Locations (± 0.5 ft.): N 3617733.1 E 5236144.16	**Name & address of construction company**
Specify corner of site	TERRACON
Distance & direction along boundary	
Distance & direction from boundary to well	
Elevations (± 0.01 ft. MSL):	**Name of driller** MATT WHITE
Ground Surface 942.47	**Drilling method** 4 1/4-INCH HSA
Top of protective casing	**Drilling fluid** NONE
Top of well casing 945.40	**Bore Hole diameter** 8 inch
Benchmark elevation	**Soil sampling method** 2-INCH SPLIT SPOON
Benchmark description	**Depth of boring** 18.5 ft BGS

C. MONITORING WELL INSTALLATION	
Casing material TYPE 304 STAINLESS STEEL	**Placement method** GRAVITY
Length of casing 10.0 ft	**Volume** 2 1/4 - 50 lb bags
Outside casing diameter 2.375 inch	**Backfill (if different from seal):** SAME AS SEAL
Inside casing diameter 2.067 inch	**Material**
Casing joint type FLUSH THREADED	**Placement method**
Casing/screen joint type FLUSH THREADED	**Volume**
Screen material TYPE 304 STAINLESS STEEL	**Surface seal design:**
Screen opening size 0.010 inches	**Material of protective casing:** STEEL
Screen length 10.0 ft	**Material of grout between protective casing and well casing:** SAME AS SEAL
Depth of Well 17.0 ft BGS	**Protective cap:**
Filter Pack:	**Material** STEEL
Material COARSE SAND	**Vented?: Y/N** N **Locking?: Y/N** Y
Grain Size SEE GRAIN SIZE CURVE	**Well cap:**
Volume 8 1/4 - 50 lb bags	**Material** STAINLESS STEEL
Seal (minimum 3 ft. length above filter pack):	**Vented?: Y/N** N
Material 3/8 inch SODIUM BENTONITE HOLE PLUG	

D. GROUNDWATER MEASUREMENT (± 0.01 foot below top of inner well casing)	
Water level	**Stabilization time**
Well development method	
Average depth of frostline	

Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½ inch x 11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed form to: Iowa Department of Natural Resources, Energy and Waste Management Bureau, 502 E. 9th Street, Des Moines, IA 50319-0034.
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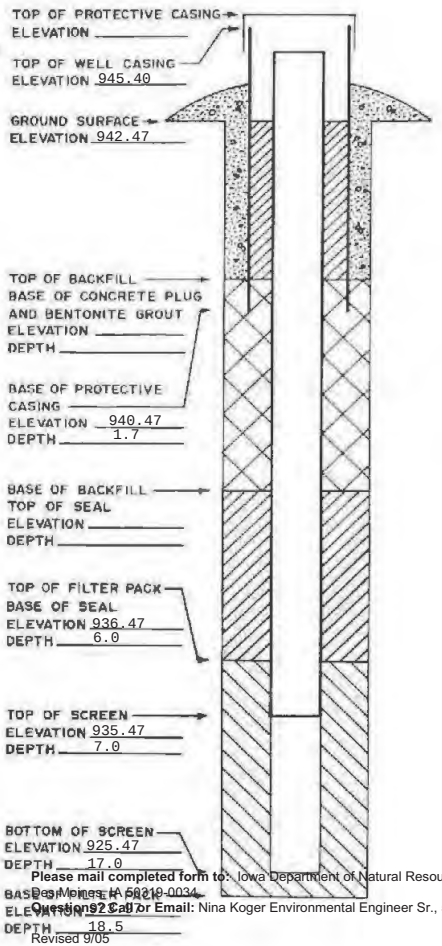
Revised 9/05 Form # 542-1277

ELEVATIONS: ± 0.01 FT. MSL
DEPTHS: ± 0.1 FT. FROM GROUND SERFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL).

OW-406B



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Revised 9/05 Form # 542-1277

MONITORING WELL / PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name BLACK HAWK COUNTY LANDFILL	**Permit No.** 07-SDP-01-75P
Well or Piezometer No. OW-407B	
Dates Started 5-5-2010	**Date Completed** 5-5-2010

A. SURVEYED LOCATIONS AND ELEVATIONS	**B. SOIL BORING INFORMATION**
Locations (± 0.5 ft.): N 3616814.39 E 5237182.48	**Name & address of construction company**
Specify corner of site	TERRACON
Distance & direction along boundary	
Distance & direction from boundary to well	
Elevations (± 0.01 ft. MSL):	**Name of driller** MATT WHITE
Ground Surface 948.23	**Drilling method** 4 1/4-INCH HSA
Top of protective casing	**Drilling fluid** NONE
Top of well casing 950.69	**Bore Hole diameter** 8 inch
Benchmark elevation	**Soil sampling method** 2-INCH SPLIT SPOON
Benchmark description	**Depth of boring** 18.5 ft BGS

C. MONITORING WELL INSTALLATION	
Casing material TYPE 304 STAINLESS STEEL	**Placement method** GRAVITY
Length of casing 10.0 ft	**Volume** 2 1/2 - 50 lb bags
Outside casing diameter 2.375 inch	**Backfill (if different from seal):** SAME AS SEAL
Inside casing diameter 2.067 inch	**Material**
Casing joint type FLUSH THREADED	**Placement method**
Casing/screen joint type FLUSH THREADED	**Volume**
Screen material TYPE 304 STAINLESS STEEL	**Surface seal design:**
Screen opening size 0.010 inches	**Material of protective casing:** STEEL
Screen length 10.0 ft	**Material of grout between protective casing and well casing:** SAME AS SEAL
Depth of Well 17.5 ft BGS	**Protective cap:**
Filter Pack:	**Material** STEEL
Material COARSE SAND	**Vented?: Y/N** N **Locking?: Y/N** Y
Grain Size SEE GRAIN SIZE CURVE	**Well cap:**
Volume 7 3/4 - 50 lb bags	**Material** PROTOP (PLASTIC W/ GASKET SEAL)
Seal (minimum 3 ft. length above filter pack):	**Vented?: Y/N** N
Material 3/8 inch SODIUM BENTONITE HOLE PLUG	

D. GROUNDWATER MEASUREMENT (± 0.01 foot below top of inner well casing)	
Water level	**Stabilization time**
Well development method	
Average depth of frostline	

Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½ inch x 11 inch map showing locations of all monitoring wells and piezometers.

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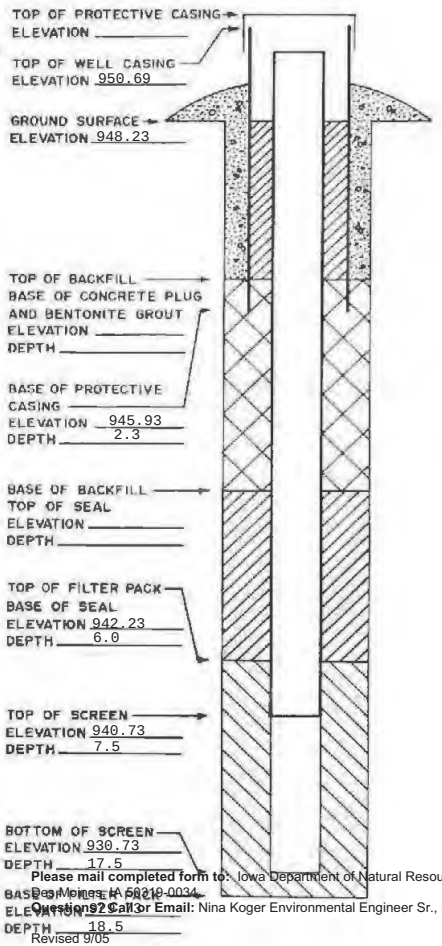
Revised 9/05 Form # 542-1277

ELEVATIONS: ± 0.01 FT. MSL
DEPTHS: ± 0.1 FT. FROM GROUND SERFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL).

OW-407B



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MONITORING WELL / PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name BLACK HAWK COUNTY LANDFILL	**Permit No.** 07-SDP-01-75P
Well or Piezometer No. OW-408B	
Dates Started 5-6-2010	**Date Completed** 5-6-2010

A. SURVEYED LOCATIONS AND ELEVATIONS	**B. SOIL BORING INFORMATION**
Locations (± 0.5 ft.): N 3616803.12 E 5236509.88	**Name & address of construction company**
Specify corner of site	TERRACON
Distance & direction along boundary	
Distance & direction from boundary to well	
Elevations (± 0.01 ft. MSL):	**Name of driller** MATT WHITE
Ground Surface 952.24	**Drilling method** 4 1/4-INCH HSA
Top of protective casing	**Drilling fluid** NONE
Top of well casing 954.34	**Bore Hole diameter** 8 inch
Benchmark elevation	**Soil sampling method** 2-INCH SPLIT SPOON
Benchmark description	**Depth of boring** 20.0 ft BGS

C. MONITORING WELL INSTALLATION	
Casing material TYPE 304 STAINLESS STEEL	**Placement method** GRAVITY
Length of casing 11.5 ft	**Volume** 3 - 50 lb bags
Outside casing diameter 2.375 inch	**Backfill (if different from seal):** SAME AS SEAL
Inside casing diameter 2.067 inch	**Material**
Casing joint type FLUSH THREADED	**Placement method**
Casing/screen joint type FLUSH THREADED	**Volume**
Screen material TYPE 304 STAINLESS STEEL	**Surface seal design:**
Screen opening size 0.010 inches	**Material of protective casing:** STEEL
Screen length 10.0 ft	**Material of grout between protective casing and well casing:** SAME AS SEAL
Depth of Well 19.0 ft BGS	**Protective cap:**
Filter Pack:	**Material** STEEL
Material COARSE SAND	**Vented?: Y/N** N **Locking?: Y/N** Y
Grain Size SEE GRAIN SIZE CURVE	**Well cap:**
Volume 8 - 50 lb bags	**Material** PROTOP (PLASTIC W/ GASKET SEAL)
Seal (minimum 3 ft. length above filter pack):	**Vented?: Y/N** N
Material 3/8 inch SODIUM BENTONITE HOLE PLUG	

D. GROUNDWATER MEASUREMENT (± 0.01 foot below top of inner well casing)	
Water level	**Stabilization time**
Well development method	
Average depth of frostline	

Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½ inch x 11 inch map showing locations of all monitoring wells and piezometers.

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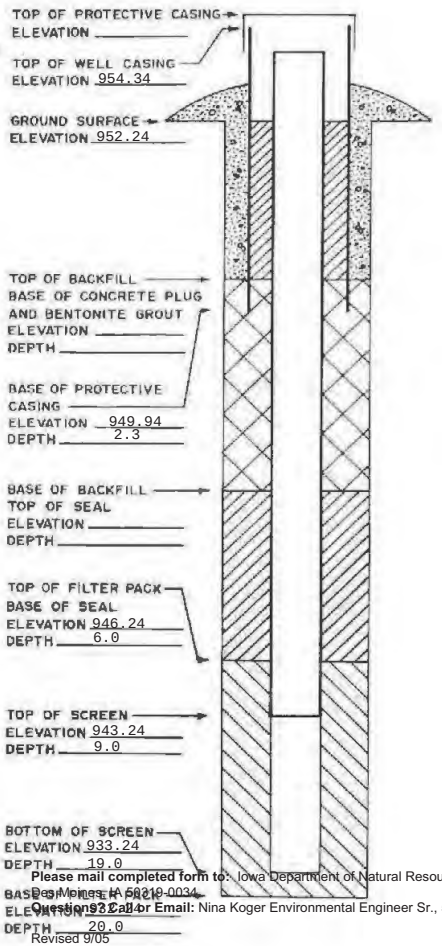
Revised 9/05 Form # 542-1277

ELEVATIONS: ± 0.01 FT. MSL
DEPTHS: ± 0.1 FT. FROM GROUND SERFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL).

OW-408B



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Revised 9/05

Form # 542-1277

IOWA DEPARTMENT OF NATURAL RESOURCES

MONITORING WELL/PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name: Black Hawk Co Land Fill Permit No.: 7-SDP-1-75P

Well or Piezometer No: OW-410B

Dates Started: 11/9/2016 Date Completed: 11/9/2016

A. SURVEYED LOCATIONS AND ELEVATIONS

Locations (± 0.5 ft): N - 3616960.5, E - 5237825.5

Specify corner of site:

Distance & direction along boundary:

Distance & direction from boundary to wall:

Elevations (± 0.01 ft MSL):

Ground Surface: 949.9

Top of protective casing:

Top of well casing: 952.85

Benchmark elevation:

Benchmark description:

B. SOIL BORING INFORMATION

Name & Address of Construction Company:
Terracon
6612 Chancellor Drive Suite 102
Cedar Falls IA 50613

Name of Driller: Ron Faulk

Drilling Method: 4 1/4" HSA

Drilling Fluid: NA

Bore Hole Diameter: 8.25"

Soil Sampling Method: 2' split spoon

Depth of Boring: 26.5'

C. MONITORING WELL INSTALLATION

Casing material: Type 304 Stainless Steel

Length of casing: 14.9'

Outside casing diameter: 2.375"

Inside casing diameter: 2.157"

Casing joint type: flush threaded

Casing/screen joint type: flush threaded

Screen material: Type 304 Stainless Steel

Screen opening size: 0.010"

Screen length: 10'

Depth of well: 22'

Filter Pack:

Material: Filter Pack Sand

Grain size: 0.007-0.250"

Volume: 40 gal

Seal (minimum 3 ft length above filter pack): 10'

Material: Bentonite Chips 3/8" hole plug

Placement method: direct pour

Volume: 25 gal

Backfill (if different from seal):

Material:

Placement method:

Volume:

Surface seal design: 3/8" hole plug

Material of protective casing: Steel

Material of grout between protective casing and well casing: 3/8" hole plug

Protective cap:

Material: Steel

Vented: ☐ Yes ☐ No Locking: ☒ Yes ☐ No

Well Cap:

Material: PVC

Vented: ☐ Yes ☒ No

D. GROUNDWATER MEASURMENT (± 0.01 ft below top of inner well casing)

Water level: 13.80 ft Stabilization Time:

Well development method: Bailed and Pumped

Average depth of frostline:

Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½x11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed for to: Iowa Department of Natural Resources, Land Quality Bureau, 502 E 9th St, Des Moines IA 50319-0034.

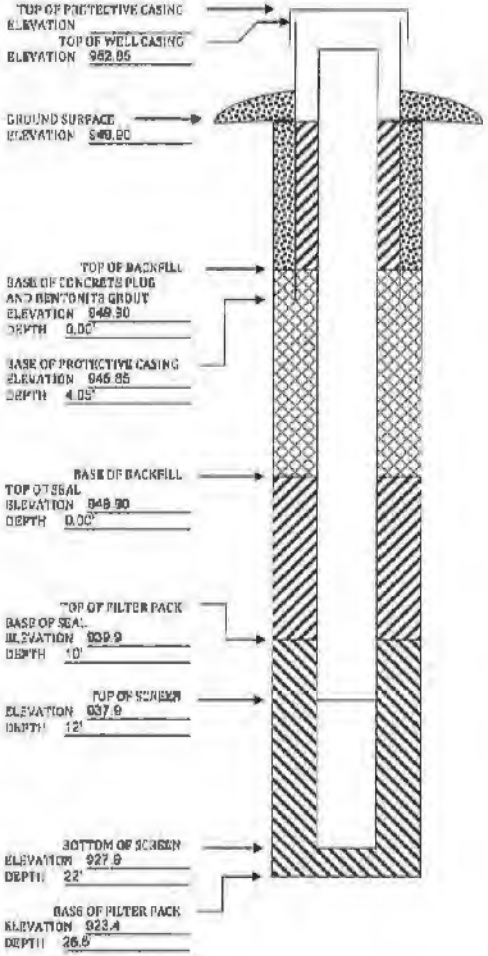
Questions? Call or Email: Nina Koger, Environmental Engineer Sr., 515-281-8986, Nina.Koger@dnr.iowa.gov

06/2011 cmz

DNR Form 542-1277

ELEVATIONS: ± 0.01 ft MSL
DEPTHS: ± 0.1 ft FROM GROUND SURFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL.)



IOWA DEPARTMENT OF NATURAL RESOURCES

MONITORING WELL/PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name: Black Hawk Co Land Fill Permit No.: 7-SDP-1-75P

Well or Piezometer No: OW-411B

Dates Started: 11/8/2016 Date Completed: 11/8/2016

A. SURVEYED LOCATIONS AND ELEVATIONS

Locations (± 0.5 ft): N - 3617179.6 E - 5237771.9

Specify corner of site:

Distance & direction along boundary:

Distance & direction from boundary to wall:

Elevations (± 0.01 ft MSL):

Ground Surface: 964.40

Top of protective casing:

Top of well casing: 967.30

Benchmark elevation:

Benchmark description:

B. SOIL BORING INFORMATION

Name & Address of Construction Company:
Terracon
6612 Chancellor Drive Suite 102
Cedar Falls IA 50613

Name of Driller: Ron Faulk

Drilling Method: 4 1/4" HSA

Drilling Fluid: NA

Bore Hole Diameter: 8.25"

Soil Sampling Method: 2' split spoon

Depth of Boring: 34.5'

C. MONITORING WELL INSTALLATION

Casing material: Type 304 Stainless Steel

Length of casing: 17.04'

Outside casing diameter: 2.375"

Inside casing diameter: 2.157"

Casing joint type: flush threaded

Casing/screen joint type: flush threaded

Screen material: Type 304 Stainless Steel

Screen opening size: 0.010"

Screen length: 10'

Depth of well: 34'

Filter Pack:

Material: Filter Pack Sand

Grain size: 0.007-0.250"

Volume: 31 gal.

Seal (minimum 3 ft length above filter pack): 22'

Material: Bentonite Chips 3/8" hole plug

Placement method: direct pour

Volume: 54 gal.

Backfill (if different from seal):

Material:

Placement method:

Volume:

Surface seal design: 3/8" hole plug

Material of protective casing: Steel

Material of grout between protective casing and well casing: 3/8" hole plug

Protective cap:

Material: Steel

Vented: ☐ Yes ☐ No Locking: ☑ Yes ☐ No

Well Cap:

Material: PVC

Vented: ☐ Yes ☑ No

D. GROUNDWATER MEASURMENT (± 0.01 ft below top of inner well casing)

Water level: 33.01 ft Stabilization Time:

Well development method: Bailed

Average depth of frostline:

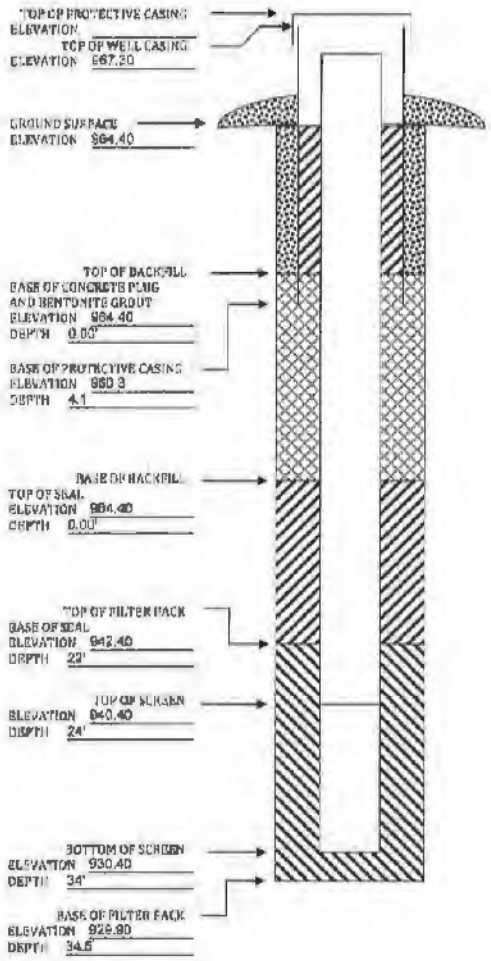
Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½x11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed for to: Iowa Department of Natural Resources, Land Quality Bureau, 502 E 9th St, Des Moines IA 50319-0034.

Questions? Call or Email: Nina Koger, Environmental Engineer Sr., 515-281-8985, Nina.Koger@dnr.iowa.gov

ELEVATIONS: ± 0.01 ft MSL
DEPTHS: ± 0.1 ft FROM GROUND SURFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL.)



IOWA DEPARTMENT OF NATURAL RESOURCES

MONITORING WELL/PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name: Black Hawk Co Land Fill Permit No.: 7-SDP-1-75P

Well or Piezometer No: OW-412B

Dates Started: 11/8/2016 Date Completed: 11/8/2016

A. SURVEYED LOCATIONS AND ELEVATIONS

Locations (± 0.5 ft): N - 3617461.7, E - 6237772.5

Specify corner of site:

Distance & direction along boundary:

Distance & direction from boundary to wall:

Elevations (± 0.01 ft MSL):

Ground Surface: 956.40

Top of protective casing:

Top of well casing: 959.45

Benchmark elevation:

Benchmark description:

B. SOIL BORING INFORMATION

Name & Address of Construction Company:
Terracon
6612 Chancellor Drive Suite 102
Cedar Falls IA 50613

Name of Driller: Ron Faulk

Drilling Method: 4 1/4" HSA

Drilling Fluid: NA

Bore Hole Diameter: 8.25"

Soil Sampling Method: 2' split spoon

Depth of Boring: 34.5'

C. MONITORING WELL INSTALLATION

Casing material: Type 304 Stainless Steel

Length of casing: 22.79'

Outside casing diameter: 2.375"

Inside casing diameter: 2.157"

Casing joint type: flush threaded

Casing/screen joint type: flush threaded

Screen material: Type 304 Stainless Steel

Screen opening size: 0.010"

Screen length: 10'

Depth of well: 34'

Filter Pack:

Material: Filter Pack Sand

Grain size: 0.007-0.250"

Volume: 41 gal.

Seal (minimum 3 ft length above filter pack): 18'

Material: Bentonite Chips 3/8" hole plug

Placement method: direct pour

Volume: 44 gal.

Backfill (if different from seal):

Material:

Placement method:

Volume:

Surface seal design: 3/8" hole plug

Material of protective casing: Steel

Material of grout between protective casing and well casing: 3/8" hole plug

Protective cap:

Material: Steel

Vented: ☐ Yes ☐ No Locking: ☒ Yes ☐ No

Well Cap:

Material: PVC

Vented: ☐ Yes ☒ No

D. GROUNDWATER MEASURMENT (± 0.01 ft below top of inner well casing)

Water level: 21.15 ft Stabilization Time:

Well development method: Bailed and Pumped

Average depth of frostline:

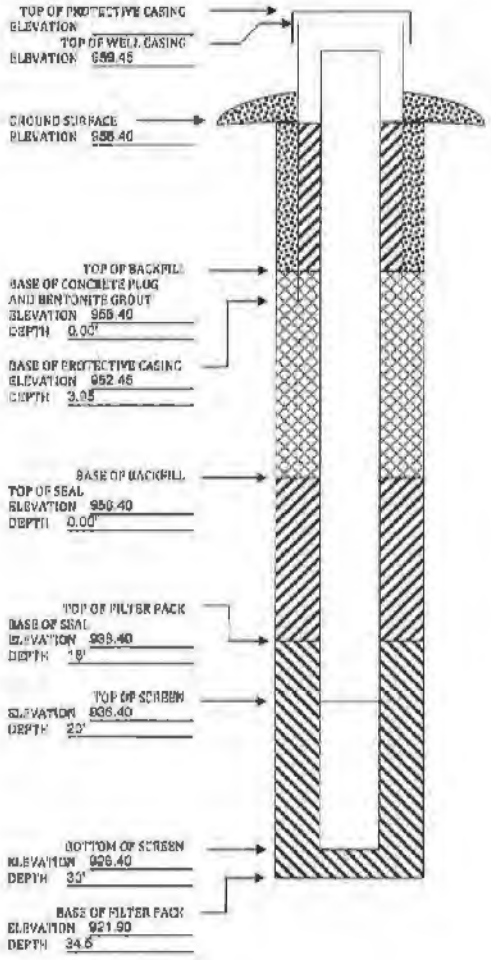
Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½x11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed for to: Iowa Department of Natural Resources, Land Quality Bureau, 502 E 9th St, Des Moines IA 50319-0034.

Questions? Call or Email: Nina Koger, Environmental Engineer Sr., 515-281-8986, Nina.Koger@dnr.iowa.gov

ELEVATIONS: ± 0.01 ft MSL
DEPTHS: ± 0.1 ft FROM GROUND SURFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL)



IOWA DEPARTMENT OF NATURAL RESOURCES

MONITORING WELL/PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name: Black Hawk Co Land Fill Permit No.: 7-SDP-1-75P

Well or Piezometer No: OW-413B

Dates Started: 11/7/2016 Date Completed: 11/7/2016

A. SURVEYED LOCATIONS AND ELEVATIONS

Locations (± 0.5 ft): N - 3617586.9, E - 5237824.0

Specify corner of site:

Distance & direction along boundary:

Distance & direction from boundary to wall:

Elevations (± 0.01 ft MSL):

Ground Surface: 946.00

Top of protective casing:

Top of well casing: 948.60

Benchmark elevation:

Benchmark description:

B. SOIL BORING INFORMATION

Name & Address of Construction Company:
Terracon
6612 Chancellor Drive Suite 102
Cedar Falls IA 50613

Name of Driller: Ron Faulk

Drilling Method: 4 1/4" HSA

Drilling Fluid: NA

Bore Hole Diameter: 8.25"

Soil Sampling Method: 2' split spoon

Depth of Boring: 20.0'

C. MONITORING WELL INSTALLATION

Casing material: Type 304 Stainless Steel

Length of casing: 11.4'

Outside casing diameter: 2.375"

Inside casing diameter: 2.157"

Casing joint type: flush threaded

Casing/screen joint type: flush threaded

Screen material: Type 304 Stainless Steel

Screen opening size: 0.010"

Screen length: 10'

Depth of well: 19'

Filter Pack:

Material: Filter Pack Sand

Grain size: 0.007-0.250"

Volume:

Seal (minimum 3 ft length above filter pack): 7'

Material: Bentonite Chips 3/8" hole plug

Placement method: direct pour

Volume: 19 gal.

Backfill (if different from seal):

Material:

Placement method:

Volume:

Surface seal design: 3/8" hole plug

Material of protective casing: Steel

Material of grout between protective casing and well casing: 3/8" hole plug

Protective cap:

Material: Steel

Vented: ☐ Yes ☐ No Locking: ☒ Yes ☐ No

Well Cap:

Material: PVC

Vented: ☐ Yes ☒ No

D. GROUNDWATER MEASURMENT (± 0.01 ft below top of inner well casing)

Water level: 11.15 ft Stabilization Time:

Well development method: Bailed and Pumped

Average depth of frostline:

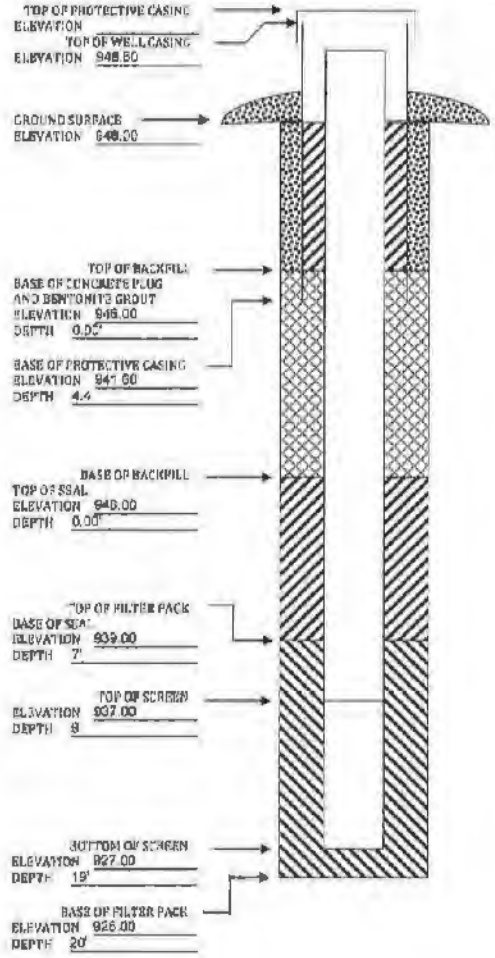
Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½x11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed for to: Iowa Department of Natural Resources, Land Quality Bureau, 502 E 9th St, Des Moines IA 50319-0034.

Questions? Call or Email: Nina Koger, Environmental Engineer Sr, 515-281-8986, Nina.Koger@dnr.iowa.gov

ELEVATIONS: ± 0.01 ft MSL
DEPTHS: ± 0.1 ft FROM GROUND SURFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL.)



IOWA DEPARTMENT OF NATURAL RESOURCES

MONITORING WELL/PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name: Black Hawk Co Land Fill — Permit No.: 7-SDP-1-78P

Well or Piezometer No: OW-414B

Dates Started: 11/8/2016 — Date Completed: 11/8/2016

A. SURVEYED LOCATIONS AND ELEVATIONS

Locations (± 0.5 ft): N - 3617342.9, E - 6237827.2

Specify corner of site:

Distance & direction along boundary:

Distance & direction from boundary to wall:

Elevations (± 0.01 ft MSL):

Ground Surface: 959.40

Top of protective casing:

Top of well casing: 962.40

Benchmark elevation:

Benchmark description:

B. SOIL BORING INFORMATION

Name & Address of Construction Company:
Terracon
6612 Chancellor Drive Suite 102
Cedar Falls IA 50613

Name of Driller: Ron Faulk

Drilling Method: 4 1/4" HSA

Drilling Fluid: NA

Bore Hole Diameter: 8.25"

Soil Sampling Method: 2' split spoon

Depth of Boring: 30.5'

C. MONITORING WELL INSTALLATION

Casing material: Type 304 Stainless Steel

Length of casing: 11.4'

Outside casing diameter: 2.375"

Inside casing diameter: 2.157"

Casing joint type: flush threaded

Casing/screen joint type: flush threaded

Screen material: Type 304 Stainless Steel

Screen opening size: 0.010"

Screen length: 10'

Depth of well: 30.5'

Filter Pack:

Material: Filter Pack Sand

Grain size: 0.007-0.250"

Volume: 52 gal.

Seal (minimum 3 ft length above filter pack): 17'

Material: Bentonite Chips 3/8" hole plug

Placement method: direct pour

Volume: 42 gal.

Backfill (if different from seal):

Material:

Placement method:

Volume:

Surface seal design: 3/8" hole plug

Material of protective casing: Steel

Material of grout between protective casing and well casing: 3/8" hole plug

Protective cap:

Material: Steel

Vented: ☐ Yes ☐ No Locking: ☒ Yes ☐ No

Well Cap:

Material: PVC

Vented: ☐ Yes ☒ No

D. GROUNDWATER MEASURMENT (± 0.01 ft below top of inner well casing)

Water level: 23.64 ft — Stabilization Time:

Well development method: Bailed and Pumped

Average depth of frostline:

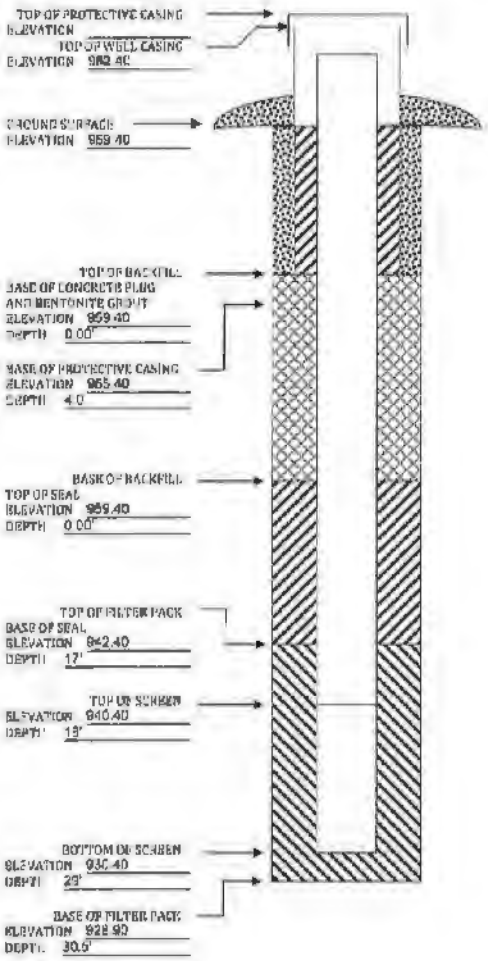
Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½x11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed for to: Iowa Department of Natural Resources, Land Quality Bureau, 502 E 9th St, Des Moines IA 50319-0034.

Questions? Call or Email: Nina Koger, Environmental Engineer Sr., 515-281-8986, Nina.Koger@dnr.iowa.gov

ELEVATIONS: ± 0.01 ft MSL
DEPTHS: ± 0.1 ft FROM GROUND SURFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL)



05/2011 cmz

DNR Form 542-1277

MONITORING WELL / PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name BLACK HAWK COUNTY LANDFILL	**Permit No.** 07-SDP-01-75P
Well or Piezometer No. P-101A	
Dates Started 10-20-86	**Date Completed** 10-20-86

A. SURVEYED LOCATIONS AND ELEVATIONS	B. SOIL BORING INFORMATION
Locations (± 0.5 ft.): N 3618433.60 E 5237814.56	**Name & address of construction company**
Specify corner of site	TWIN CITY TESTING CORPORATION
Distance & direction along boundary	
Distance & direction from boundary to well	
Elevations (± 0.01 ft. MSL):	**Name of driller**
Ground Surface 937.20	**Drilling method**
Top of protective casing	**Drilling fluid**
Top of well casing 940.04	**Bore Hole diameter** 6.5 inch
Benchmark elevation	**Soil sampling method**
Benchmark description	**Depth of boring** 46.0 ft BGS

C. MONITORING WELL INSTALLATION	
Casing material STAINLESS STEEL	**Placement method**
Length of casing	**Volume**
Outside casing diameter	**Backfill (if different from seal):**
Inside casing diameter 2 inch	**Material** VOLCLAY GROUT
Casing joint type FLUSH THREADED, O-RING	**Placement method**
Casing/screen joint type FLUSH THREADED, O-RING	**Volume**
Screen material STAINLESS STEEL	**Surface seal design:**
Screen opening size #10 SLOT	**Material of protective casing:** STAINLESS STEEL
Screen length 5.0 ft	**Material of grout between protective casing and well casing:** CONCRETE
Depth of Well 45.50'	**Protective cap:**
Filter Pack:	**Material** STAINLESS STEEL
Material SILICA SAND	**Vented?: Y/N** YES **Locking?: Y/N** YES
Grain Size #10	**Well cap:**
Volume	**Material** PVC
Seal (minimum 3 ft. length above filter pack):	**Vented?: Y/N** YES
Material BENTONITE PELLET	

D. GROUNDWATER MEASUREMENT (± 0.01 foot below top of inner well casing)	
Water level	**Stabilization time**
Well development method	
Average depth of frostline	

Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½ inch x 11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed form to: Iowa Department of Natural Resources, Energy and Waste Management Bureau, 502 E. 9th Street, Des Moines, IA 50319-0034.
Questions? Call or Email: Nina Koger Environmental Engineer Sr., 515-281-8986, nina.koger@dnr.state.ia.us

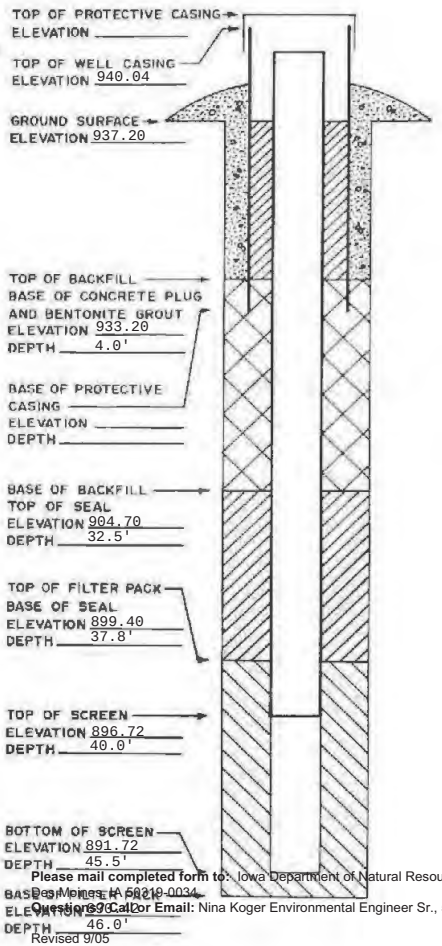
Revised 9/05

Form # 542-1277

ELEVATIONS: ± 0.01 FT. MSL
DEPTHS: ± 0.1 FT. FROM GROUND SERFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL).

P-101A



Please mail completed form to: Iowa Department of Natural Resources, Energy and Waste Management Bureau, 502 E. 9th Street, Des Moines, IA 50319-0034.
Questions? Call or Email: Nina Koger Environmental Engineer Sr., 515-281-8986, nina.koger@dnr.state.ia.us

MONITORING WELL / PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name BLACK HAWK COUNTY LANDFILL	**Permit No.** 07-SDP-01-75P
Well or Piezometer No. P-101C	
Dates Started 10-23-86	**Date Completed** 10-23-86

A. SURVEYED LOCATIONS AND ELEVATIONS	**B. SOIL BORING INFORMATION**
Locations (± 0.5 ft.): N 3618381.36 E 5237816.01	**Name & address of construction company**
Specify corner of site	TWIN CITY TESTING CORP
Distance & direction along boundary	
Distance & direction from boundary to well	
Elevations (± 0.01 ft. MSL):	**Name of driller**
Ground Surface 935.73	**Drilling method**
Top of protective casing	**Drilling fluid**
Top of well casing 938.57	**Bore Hole diameter** 6"
Benchmark elevation	**Soil sampling method**
Benchmark description	**Depth of boring** 111.4 ft

C. MONITORING WELL INSTALLATION	
Casing material STAINLESS STEEL	**Placement method**
Length of casing	**Volume**
Outside casing diameter	**Backfill (if different from seal):**
Inside casing diameter 2 inch	**Material** VOLCLAY GROUT
Casing joint type FLUSH THREADED, O-RING	**Placement method**
Casing/screen joint type FLUSH THREADED, O-RING	**Volume**
Screen material STAINLESS STEEL	**Surface seal design:** CONCRETE PAD
Screen opening size SLOT #10	**Material of protective casing:** STEEL
Screen length 10.3 ft	**Material of grout between protective casing and well casing:** CONCRETE
Depth of Well 113.8'	**Protective cap:**
Filter Pack:	**Material** STEEL
Material SILICA SAND	**Vented?: Y/N** YES **Locking?: Y/N** YES
Grain Size #10	**Well cap:**
Volume	**Material** PVC
Seal (minimum 3 ft. length above filter pack):	**Vented?: Y/N** YES
Material BENTONITE/2 - 6"x10" RUBBER PACKERS	

D. GROUNDWATER MEASUREMENT (± 0.01 foot below top of inner well casing)	
Water level	**Stabilization time**
Well development method	
Average depth of frostline	

Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½ inch x 11 inch map showing locations of all monitoring wells and piezometers.

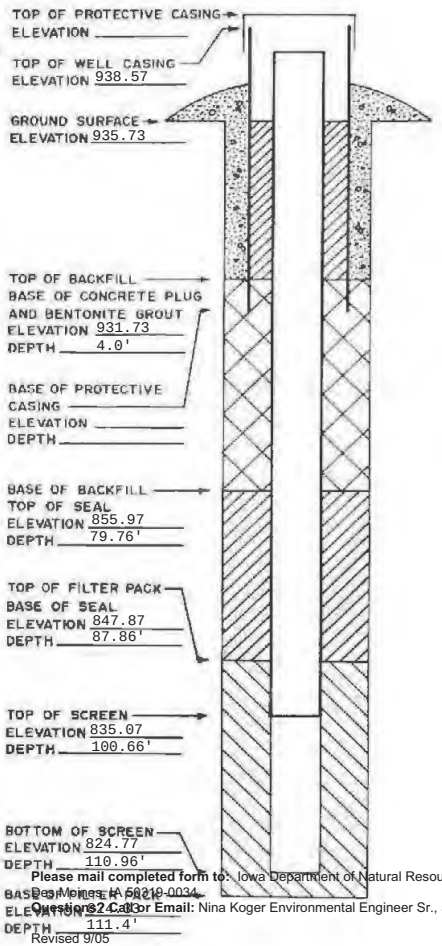
Please mail completed form to: Iowa Department of Natural Resources, Energy and Waste Management Bureau, 502 E. 9th Street, Des Moines, IA 50319-0034.
Questions? Call or Email: Nina Koger Environmental Engineer Sr., 515-281-8986, nina.koger@dnr.state.ia.us

Revised 9/05 Form # 542-1277

ELEVATIONS: ± 0.01 FT. MSL
DEPTHS: ± 0.1 FT. FROM GROUND SERFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL).

P-101C



Please mail completed form to: Iowa Department of Natural Resources, Energy and Waste Management Bureau, 502 E. 9th Street, Des Moines, IA 50319-0034.
Questions? Call or Email: Nina Koger Environmental Engineer Sr., 515-281-8986, nina.koger@dnr.state.ia.us

MONITORING WELL / PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name BLACK HAWK COUNTY LANDFILL	**Permit No.** 07-SDP-01-75P
Well or Piezometer No. P-102A - 2009 EXTENDED APPROX. 5.0', SEE NOTE PAGE 2	
Dates Started 10/15/86	**Date Completed** 10-15-86

A. SURVEYED LOCATIONS AND ELEVATIONS	**B. SOIL BORING INFORMATION**
Locations (± 0.5 ft.): N 3618442.47 E 5237938.89	**Name & address of construction company**
Specify corner of site	TWIN CITY TESTING CORPORATION
Distance & direction along boundary	
Distance & direction from boundary to well	
Elevations (± 0.01 ft. MSL):	**Name of driller**
Ground Surface 947.85 CURRENT	**Drilling method** EX HSA
Top of protective casing	**Drilling fluid**
Top of well casing 950.79	**Bore Hole diameter** 6.25 inch
Benchmark elevation	**Soil sampling method**
Benchmark description	**Depth of boring** 64.0 ft BGS

C. MONITORING WELL INSTALLATION	
Casing material STAINLESS STEEL	**Placement method**
Length of casing	**Volume**
Outside casing diameter	**Backfill (if different from seal):**
Inside casing diameter 2.0 inch	**Material** VOLCLAY GROUT
Casing joint type FLUSH THREADED; O-RING	**Placement method**
Casing/screen joint type FLUSH THREADED; O-RING	**Volume**
Screen material STAINLESS STEEL	**Surface seal design:** CONCRETE PAD
Screen opening size #10 SLOT	**Material of protective casing:** STEEL
Screen length 5.3 ft	**Material of grout between protective casing and well casing:** CONCRETE
Depth of Well 60.3'	**Protective cap:**
Filter Pack:	**Material** STEEL
Material SILICA SAND	**Vented?: Y/N** YES **Locking?: Y/N** YES
Grain Size #10	**Well cap:**
Volume	**Material** PVC
Seal (minimum 3 ft. length above filter pack):	**Vented?: Y/N** YES
Material BENTONITE PELLET	

D. GROUNDWATER MEASUREMENT (± 0.01 foot below top of inner well casing)	
Water level	**Stabilization time**
Well development method	
Average depth of frostline	

Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½ inch x 11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed form to: Iowa Department of Natural Resources, Energy and Waste Management Bureau, 502 E. 9th Street, Des Moines, IA 50319-0034.
Questions? Call or Email: Nina Koger Environmental Engineer Sr., 515-281-8986, nina.koger@dnr.state.ia.us

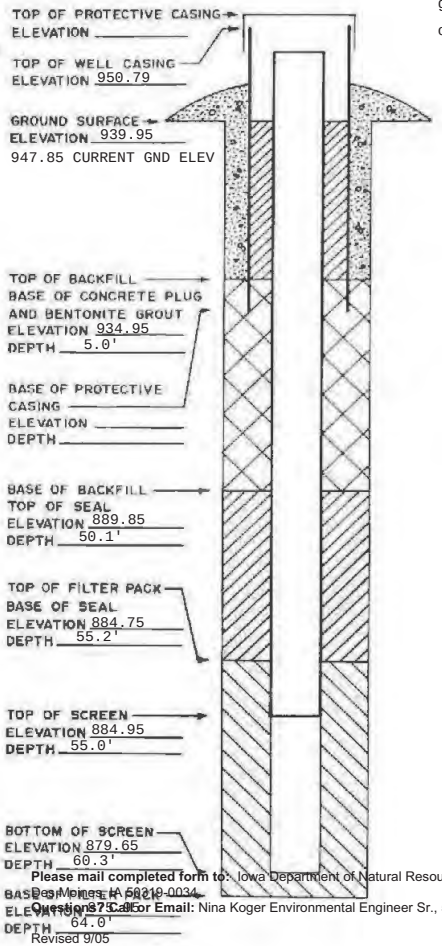
Revised 9/05 Form # 542-1277

ELEVATIONS: ± 0.01 FT. MSL
DEPTHS: ± 0.1 FT. FROM GROUND SERFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL).

2009 well was raised approximately 5.0'. Concrete pad was left intact and depths are calculated from original ground elevation at concrete pad. Current ground elevation is 947.85. Well has been raised once before, Top of Well Casing was 945.80.

P-102A



Please mail completed form to: Iowa Department of Natural Resources, Energy and Waste Management Bureau, 502 E. 9th Street, Des Moines, IA 50319-0034.
Questions? Call or Email: Nina Koger Environmental Engineer Sr., 515-281-8986, nina.koger@dnr.state.ia.us

MONITORING WELL / PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name BLACK HAWK COUNTY LANDFILL	**Permit No.** 07-SDP-01-75P
Well or Piezometer No. P-102C	
Dates Started 10-23-86	**Date Completed** 10-23-86

A. SURVEYED LOCATIONS AND ELEVATIONS	**B. SOIL BORING INFORMATION**
Locations (± 0.5 ft.): N 3618675.88 E 5238099.10	**Name & address of construction company**
Specify corner of site	TWIN CITY TESTING CORPORATION
Distance & direction along boundary	
Distance & direction from boundary to well	
Elevations (± 0.01 ft. MSL):	**Name of driller**
Ground Surface 937.00	**Drilling method**
Top of protective casing	**Drilling fluid**
Top of well casing 940.53	**Bore Hole diameter** 6"
Benchmark elevation	**Soil sampling method**
Benchmark description	**Depth of boring** 111.0 ft BGS

C. MONITORING WELL INSTALLATION	
Casing material STAINLESS STEEL	**Placement method**
Length of casing	**Volume**
Outside casing diameter	**Backfill (if different from seal):**
Inside casing diameter 2.0 inch	**Material** VOLCALY/CEMENT-BENTONITE GROUT
Casing joint type FLUSH THREADED; O-RING	**Placement method**
Casing/screen joint type FLUSH THREADED; O-RING	**Volume**
Screen material STAINLESS STEEL	**Surface seal design:** CONCRETE PAD
Screen opening size #10 SLOT	**Material of protective casing:** STEEL
Screen length 10.3 ft	**Material of grout between protective casing and well casing:** CONCRETE
Depth of Well 110.10 ft BGS	**Protective cap:**
Filter Pack:	**Material** STEEL
Material SILICA SAND	**Vented?: Y/N** YES **Locking?: Y/N** YES
Grain Size #10	**Well cap:**
Volume	**Material** PVC
Seal (minimum 3 ft. length above filter pack):	**Vented?: Y/N** YES
Material BENTONITE\2 - 6"x10" RUBBER PACKERS	

D. GROUNDWATER MEASUREMENT (± 0.01 foot below top of inner well casing)	
Water level	**Stabilization time**
Well development method	
Average depth of frostline	

Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½ inch x 11 inch map showing locations of all monitoring wells and piezometers.

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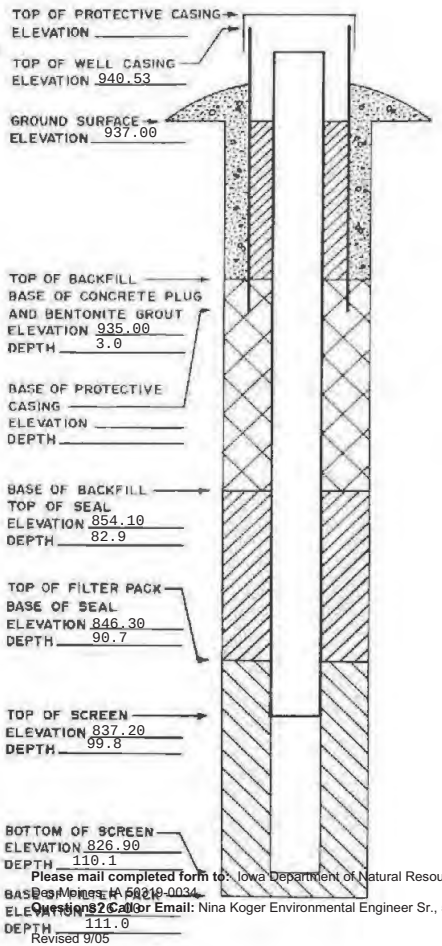
Revised 9/05 Form # 542-1277

ELEVATIONS: ± 0.01 FT. MSL
DEPTHS: ± 0.1 FT. FROM GROUND SERFACE

P-102C



SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL).

Ground surface was surveyed at elevation 938.18, after survey was complete the concrete pad was uncovered approximately 1.0' below surveyed elevation. New elevation is 937.00.

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MONITORING WELL / PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name BLACK HAWK COUNTY LANDFILL	**Permit No.** 07-SDP-01-75P
Well or Piezometer No. P-102E	
Dates Started	**Date Completed** 12-28-89

A. SURVEYED LOCATIONS AND ELEVATIONS	**B. SOIL BORING INFORMATION**
Locations (± 0.5 ft.): N 3618582.94 E 5238103.16	**Name & address of construction company**
Specify corner of site	TWIN CITY TESTING CORPORATION
Distance & direction along boundary	
Distance & direction from boundary to well	
Elevations (± 0.01 ft. MSL):	**Name of driller**
Ground Surface 938.05	**Drilling method**
Top of protective casing	**Drilling fluid**
Top of well casing 940.60	**Bore Hole diameter**
Benchmark elevation	**Soil sampling method**
Benchmark description	**Depth of boring** 58.2 ft BGS

C. MONITORING WELL INSTALLATION	
Casing material STAINLESS STEEL	**Placement method**
Length of casing	**Volume**
Outside casing diameter	**Backfill (if different from seal):**
Inside casing diameter 2.0 inch	**Material** BAROID QUICKGEL BENTONITE GROUT
Casing joint type	**Placement method**
Casing/screen joint type	**Volume**
Screen material STAINLESS STEEL	**Surface seal design:**
Screen opening size 0.010 inch	**Material of protective casing:** STEEL
Screen length 5 ft	**Material of grout between protective casing and well casing:** CONCRETE
Depth of Well 58.2 ft BGS	**Protective cap:**
Filter Pack:	**Material** STEEL
Material SILICA SAND	**Vented?: Y/N** **Locking?: Y/N**
Grain Size	**Well cap:**
Volume	**Material**
Seal (minimum 3 ft. length above filter pack):	**Vented?: Y/N**
Material BENTONITE PELLETS	

D. GROUNDWATER MEASUREMENT (± 0.01 foot below top of inner well casing)	
Water level	**Stabilization time**
Well development method	
Average depth of frostline	

Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½ inch x 11 inch map showing locations of all monitoring wells and piezometers.

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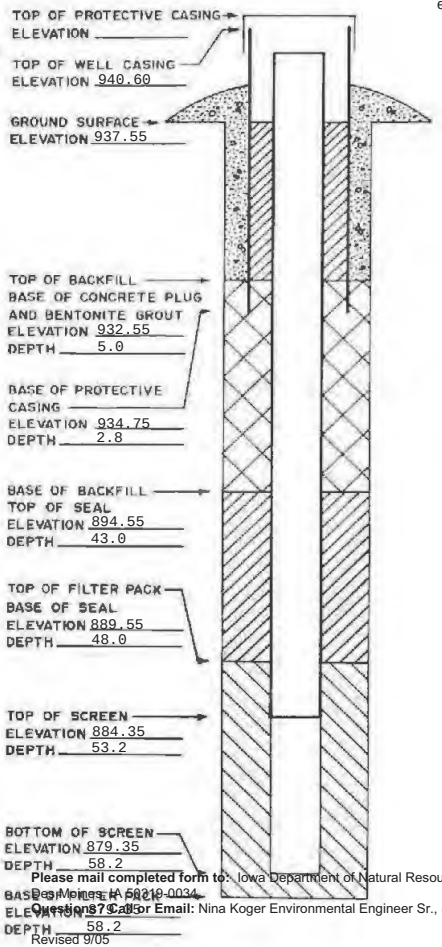
Revised 9/05 Form # 542-1277

ELEVATIONS: ± 0.01 FT. MSL
DEPTHS: ± 0.1 FT. FROM GROUND SERFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL).

Ground surface was surveyed at elevation 938.05, after the survey was complete the concrete pad was uncovered approximately 0.5' below surveyed elevation. New elevation is 937.55.

P-102E



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MONITORING WELL / PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name BLACK HAWK COUNTY LANDFILL	**Permit No.** 07-SDP-01-75P
Well or Piezometer No. P-103A	
Dates Started 10-20-86	**Date Completed** 10-20-08

A. SURVEYED LOCATIONS AND ELEVATIONS	**B. SOIL BORING INFORMATION**
Locations (± 0.5 ft.): N 3618435.96 E 5238082.13	**Name & address of construction company**
Specify corner of site	TWIN CITY TESTING CORPORATION
Distance & direction along boundary	
Distance & direction from boundary to well	
Elevations (± 0.01 ft. MSL):	**Name of driller**
Ground Surface 936.11 CURRENT	**Drilling method**
Top of protective casing	**Drilling fluid**
Top of well casing 938.91'	**Bore Hole diameter** 6.5 inch
Benchmark elevation	**Soil sampling method**
Benchmark description	**Depth of boring** 50.4 ft BGS

C. MONITORING WELL INSTALLATION	
Casing material STAINLESS STEEL	**Placement method**
Length of casing	**Volume**
Outside casing diameter	**Backfill (if different from seal):**
Inside casing diameter 2.0 inch	**Material** VOLCLAY GROUT
Casing joint type FLUSH THREADED; O-RING	**Placement method**
Casing/screen joint type FLUSH THREADED; O-RING	**Volume**
Screen material STAINLESS STEEL	**Surface seal design:** CONCRETE PAD
Screen opening size #10 SLOT	**Material of protective casing:** STEEL
Screen length 5.0 ft	**Material of grout between protective casing and well casing:** CONCRETE
Depth of Well 52.9'	**Protective cap:**
Filter Pack:	**Material** STEEL
Material SILICA SAND	**Vented?: Y/N** YES **Locking?: Y/N** YES
Grain Size #10	**Well cap:**
Volume	**Material** PVC
Seal (minimum 3 ft. length above filter pack):	**Vented?: Y/N** YES
Material BENTONITE PELLET	

D. GROUNDWATER MEASUREMENT (± 0.01 foot below top of inner well casing)	
Water level	**Stabilization time**
Well development method	
Average depth of frostline	

Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½ inch x 11 inch map showing locations of all monitoring wells and piezometers.

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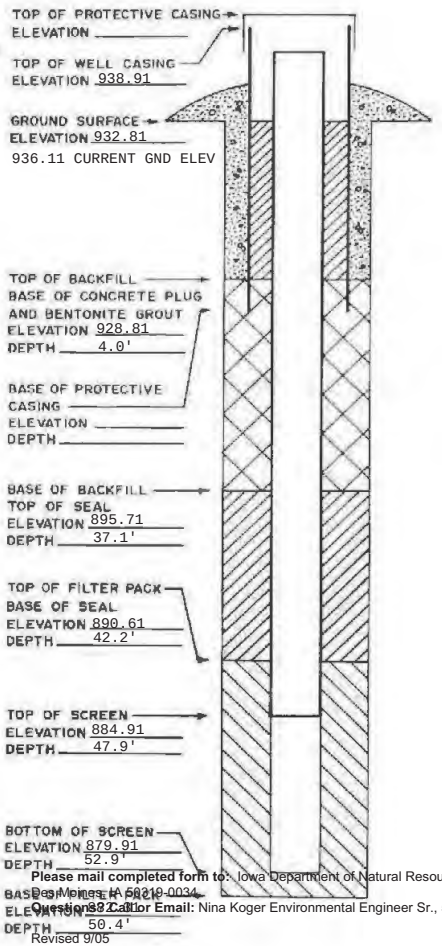
Revised 9/05 Form # 542-1277

ELEVATIONS: ± 0.01 FT. MSL
DEPTHS: ± 0.1 FT. FROM GROUND SERFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL).

2009 well was raised approximately 3.0'. Concrete pad was left intact and depths are calculated from original ground elevation at concrete pad. Current ground elevation is 936.11.

P-103A



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MONITORING WELL / PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name BLACK HAWK COUNTY LANDFILL	**Permit No.** 07-SDP-01-75P
Well or Piezometer No. P-103C	
Dates Started 10-23-86	**Date Completed** 10-23-86

A. SURVEYED LOCATIONS AND ELEVATIONS	**B. SOIL BORING INFORMATION**
Locations (± 0.5 ft.): N 3618457.09 E 5238083.90	**Name & address of construction company**
Specify corner of site	TWIN CITY TESTING CORPORATION
Distance & direction along boundary	
Distance & direction from boundary to well	
Elevations (± 0.01 ft. MSL):	**Name of driller**
Ground Surface 936.24 CURRENT	**Drilling method**
Top of protective casing	**Drilling fluid**
Top of well casing 939.29	**Bore Hole diameter** 6"
Benchmark elevation	**Soil sampling method**
Benchmark description	**Depth of boring** 106.3'

C. MONITORING WELL INSTALLATION	
Casing material STAINLESS STEEL	**Placement method**
Length of casing	**Volume**
Outside casing diameter	**Backfill (if different from seal):**
Inside casing diameter 2.0 inch	**Material** VOLCLAY GROUT\CEMENT-BENTONITE GROUT
Casing joint type FLUSH THREADED; O-RING	**Placement method**
Casing/screen joint type FLUSH THREADED; O-RING	**Volume**
Screen material STAINLESS STEEL	**Surface seal design:** CONCRETE PAD
Screen opening size #10 SLOT	**Material of protective casing:** STEEL
Screen length 10.3 ft	**Material of grout between protective casing and well casing:** CONCRETE
Depth of Well 105.95'	**Protective cap:**
Filter Pack:	**Material** STEEL
Material EXAMPLE SILICA SAND	**Vented?: Y/N** Y **Locking?: Y/N** Y
Grain Size #10	**Well cap:**
Volume	**Material** PVC
Seal (minimum 3 ft. length above filter pack):	**Vented?: Y/N** Y
Material BENTONITE\2 - 6"x10" RUBBER PACKERS	

D. GROUNDWATER MEASUREMENT (± 0.01 foot below top of inner well casing)	
Water level	**Stabilization time**
Well development method	
Average depth of frostline	

Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½ inch x 11 inch map showing locations of all monitoring wells and piezometers.

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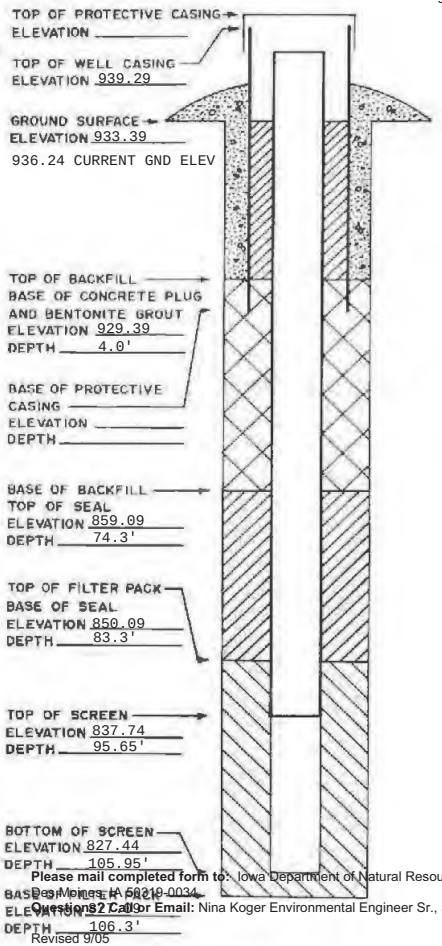
Revised 9/05 Form # 542-1277

ELEVATIONS: ± 0.01 FT. MSL
DEPTHS: ± 0.1 FT. FROM GROUND SERFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL).

2009 well was raised approximately 3.0'. Concrete pad was left intact and depths are calculated from original ground elevation at concrete pad. Current ground elevation is 936.24.

P-103C



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MONITORING WELL / PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name BLACK HAWK COUNTY LANDFILL	**Permit No.** 07-SDP-01-75P
Well or Piezometer No. P-104A	
Dates Started	**Date Completed** 1-15-90

A. SURVEYED LOCATIONS AND ELEVATIONS	**B. SOIL BORING INFORMATION**
Locations (± 0.5 ft.): N 3618226.59 E 5238061.46	**Name & address of construction company**
Specify corner of site	TWIN CITY TESTING CORPORATION
Distance & direction along boundary	
Distance & direction from boundary to well	
Elevations (± 0.01 ft. MSL):	**Name of driller**
Ground Surface 930.22	**Drilling method**
Top of protective casing	**Drilling fluid**
Top of well casing 932.59	**Bore Hole diameter** 7" inch
Benchmark elevation	**Soil sampling method**
Benchmark description	**Depth of boring** 65.5 ft BGS

C. MONITORING WELL INSTALLATION	
Casing material STAINLESS STEEL	**Placement method**
Length of casing	**Volume**
Outside casing diameter	**Backfill (if different from seal):**
Inside casing diameter 2.0 inch	**Material** AMERICAN COLLOID PURE GOLD GROUT
Casing joint type	**Placement method**
Casing/screen joint type	**Volume**
Screen material STAINLESS STEEL	**Surface seal design:**
Screen opening size 0.010 inches	**Material of protective casing:** STEEL
Screen length 5.2 ft	**Material of grout between protective casing and well casing:** CONCRETE
Depth of Well 61.2 ft BGS	**Protective cap:**
Filter Pack:	**Material** STEEL
Material BADGER BB #1 WELL PACK	**Vented?: Y/N** **Locking?: Y/N**
Grain Size	**Well cap:**
Volume	**Material**
Seal (minimum 3 ft. length above filter pack):	**Vented?: Y/N** Y
Material 1/4 inch BENTONITE PELLET	

D. GROUNDWATER MEASUREMENT (± 0.01 foot below top of inner well casing)	
Water level	**Stabilization time**
Well development method	
Average depth of frostline	

Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½ inch x 11 inch map showing locations of all monitoring wells and piezometers.

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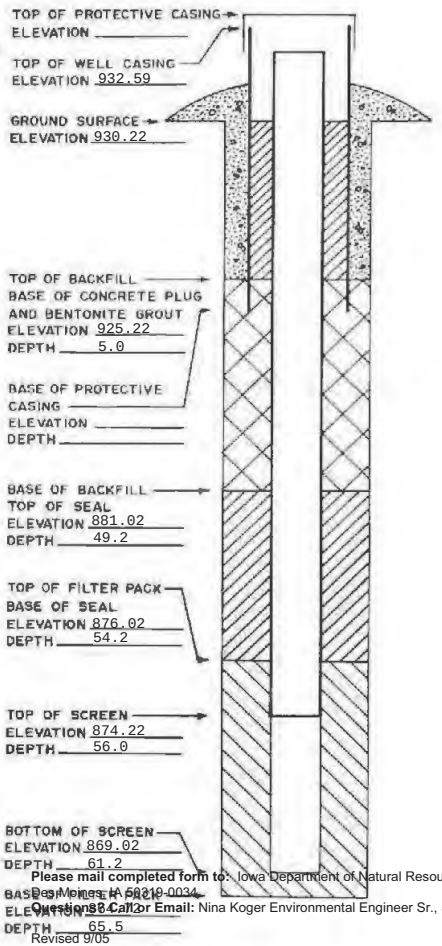
Revised 9/05 Form # 542-1277

ELEVATIONS: ± 0.01 FT. MSL
DEPTHS: ± 0.1 FT. FROM GROUND SERFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL).

P-104A



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MONITORING WELL / PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name BLACK HAWK COUNTY LANDFILL	**Permit No.** 07-SDP-01-75P
Well or Piezometer No. P-104C	
Dates Started	**Date Completed** 10-15-86

A. SURVEYED LOCATIONS AND ELEVATIONS	**B. SOIL BORING INFORMATION**
Locations (± 0.5 ft.): N 3618236.01 E 5238089.37	**Name & address of construction company**
Specify corner of site	TWIN CITY TESTING CORPORATION
Distance & direction along boundary	
Distance & direction from boundary to well	
Elevations (± 0.01 ft. MSL):	**Name of driller**
Ground Surface 930.60	**Drilling method**
Top of protective casing	**Drilling fluid**
Top of well casing 932.35	**Bore Hole diameter**
Benchmark elevation	**Soil sampling method**
Benchmark description	**Depth of boring** 106 ft BGS

C. MONITORING WELL INSTALLATION	
Casing material STAINLESS STEEL	**Placement method**
Length of casing	**Volume**
Outside casing diameter	**Backfill (if different from seal):**
Inside casing diameter 2.0 inch	**Material** VOLCLAY GROUT
Casing joint type FLUSH THREADED; O-RING	**Placement method**
Casing/screen joint type	**Volume**
Screen material STAINLESS STEEL	**Surface seal design:**
Screen opening size #10 SLOT	**Material of protective casing:** STEEL
Screen length 10.3 ft	**Material of grout between protective casing and well casing:** CONCRETE
Depth of Well 105 ft BGS	**Protective cap:**
Filter Pack:	**Material** STEEL
Material EXAMPLE SILICA SAND	**Vented?: Y/N** **Locking?: Y/N**
Grain Size #10	**Well cap:**
Volume	**Material** PVC
Seal (minimum 3 ft. length above filter pack):	**Vented?: Y/N**
Material BENTONITE PELLET	

D. GROUNDWATER MEASUREMENT (± 0.01 foot below top of inner well casing)	
Water level	**Stabilization time**
Well development method	
Average depth of frostline	

Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½ inch x 11 inch map showing locations of all monitoring wells and piezometers.

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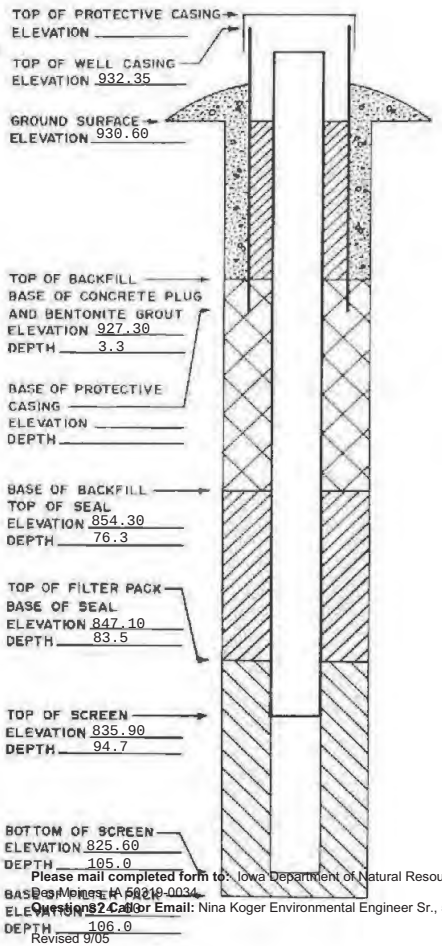
ELEVATIONS: ± 0.01 FT. MSL
DEPTHS: ± 0.1 FT. FROM GROUND SERFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL).

P-104C



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MONITORING WELL / PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name BLACK HAWK COUNTY LANDFILL	**Permit No.** 07-SDP-01-75P
Well or Piezometer No. P-105A - WELL WAS RAISED APPROX. 12.0', SEE NOTE PAGE 2	
Dates Started 9-24-86	**Date Completed** 9-24-86

A. SURVEYED LOCATIONS AND ELEVATIONS	**B. SOIL BORING INFORMATION**
Locations (± 0.5 ft.): N 3617615.55 E 5239406.42	**Name & address of construction company**
Specify corner of site	TWIN CITY TESTING CORPORATION
Distance & direction along boundary	
Distance & direction from boundary to well	
Elevations (± 0.01 ft. MSL):	**Name of driller**
Ground Surface 911.18 923.96(R)	**Drilling method**
Top of protective casing	**Drilling fluid**
Top of well casing 914.74 926.83(R)	**Bore Hole diameter** 10 inch
Benchmark elevation	**Soil sampling method**
Benchmark description	**Depth of boring** 32.5 ft BGS

C. MONITORING WELL INSTALLATION	
Casing material STAINLESS STEEL	**Placement method**
Length of casing	**Volume**
Outside casing diameter	**Backfill (if different from seal):**
Inside casing diameter 2.0 inch	**Material** VOLCLAY GROUT
Casing joint type FLUSH THREADED; O-RING	**Placement method**
Casing/screen joint type FLUSH THREADED; O-RING	**Volume**
Screen material STAINLESS STEEL	**Surface seal design:** CONCRETE PAD
Screen opening size #10 SLOT	**Material of protective casing:** STEEL
Screen length 5.0 ft	**Material of grout between protective casing and well casing:** CONCRETE
Depth of Well 32.5 ft BGS	**Protective cap:**
Filter Pack:	**Material** STEEL
Material SILICA SAND	**Vented?: Y/N** YES **Locking?: Y/N** YES
Grain Size #10	**Well cap:**
Volume	**Material** PVC
Seal (minimum 3 ft. length above filter pack):	**Vented?: Y/N** YES
Material BENTONITE PELLET	

D. GROUNDWATER MEASUREMENT (± 0.01 foot below top of inner well casing)	
Water level	**Stabilization time**
Well development method	
Average depth of frostline	

Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½ inch x 11 inch map showing locations of all monitoring wells and piezometers.

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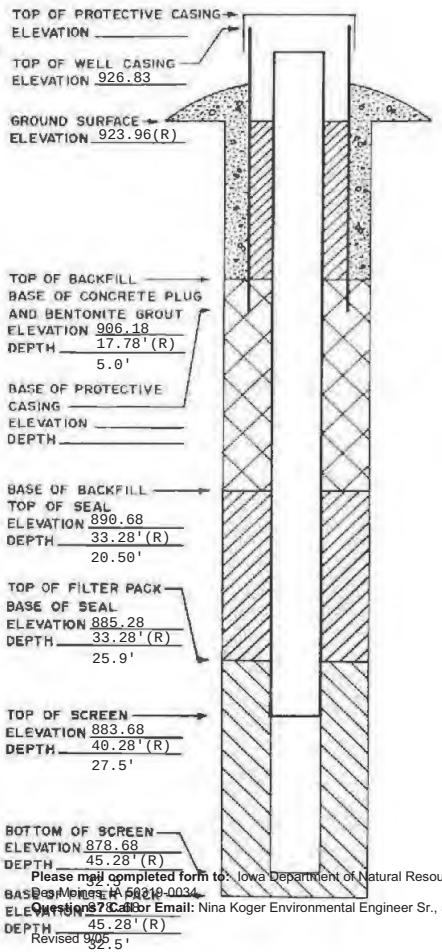
Revised 9/05 Form # 542-1277

ELEVATIONS: ± 0.01 FT. MSL
DEPTHS: ± 0.1 FT. FROM GROUND SERFACE

P-105A

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL).

Well was raised approximately 12.0'. New concrete pad was installed. Depths are revised, elevations were held.



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MONITORING WELL / PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name BLACK HAWK COUNTY LANDFILL	**Permit No.** 07-SDP-01-75P
Well or Piezometer No. P-105C - WELL WAS RAISED APPROX. 10.0', SEE NOTE PAGE 2	
Dates Started 9-24-86	**Date Completed** 9-24-86

A. SURVEYED LOCATIONS AND ELEVATIONS	**B. SOIL BORING INFORMATION**
Locations (± 0.5 ft.): N 3617632.01 E 5239395.15	**Name & address of construction company**
Specify corner of site	TWIN CITY TESTING CORPORATION
Distance & direction along boundary	
Distance & direction from boundary to well	
Elevations (± 0.01 ft. MSL):	**Name of driller**
Ground Surface 911.85 922.82(R)	**Drilling method**
Top of protective casing	**Drilling fluid**
Top of well casing 914.70 925.05(R)	**Bore Hole diameter** 6"
Benchmark elevation	**Soil sampling method**
Benchmark description	**Depth of boring** 112.0 ft BGS

C. MONITORING WELL INSTALLATION	
Casing material STAINLESS STEEL	**Placement method**
Length of casing	**Volume**
Outside casing diameter	**Backfill (if different from seal):**
Inside casing diameter 2.0 inch	**Material** VOLCLAY GROUT\CEMENT-BENTONITE GROUT
Casing joint type FLUSH THREADED; O-RING	**Placement method**
Casing/screen joint type FLUSH THREADED; O-RING	**Volume**
Screen material STAINLESS STEEL	**Surface seal design:** CONCRETE PAD
Screen opening size #10 SLOT	**Material of protective casing:** STEEL
Screen length 10.2'	**Material of grout between protective casing and well casing:** CONCRETE
Depth of Well 110.9 ft BGS	**Protective cap:**
Filter Pack:	**Material** STEEL
Material SILICA SAND	**Vented?: Y/N** YES **Locking?: Y/N** YES
Grain Size #10	**Well cap:**
Volume	**Material** PVC
Seal (minimum 3 ft. length above filter pack):	**Vented?: Y/N** YES
Material BENTONITE\2 - 6"X10" RUBBER PACKERS	

D. GROUNDWATER MEASUREMENT (± 0.01 foot below top of inner well casing)	
Water level	**Stabilization time**
Well development method	
Average depth of frostline	

Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½ inch x 11 inch map showing locations of all monitoring wells and piezometers.

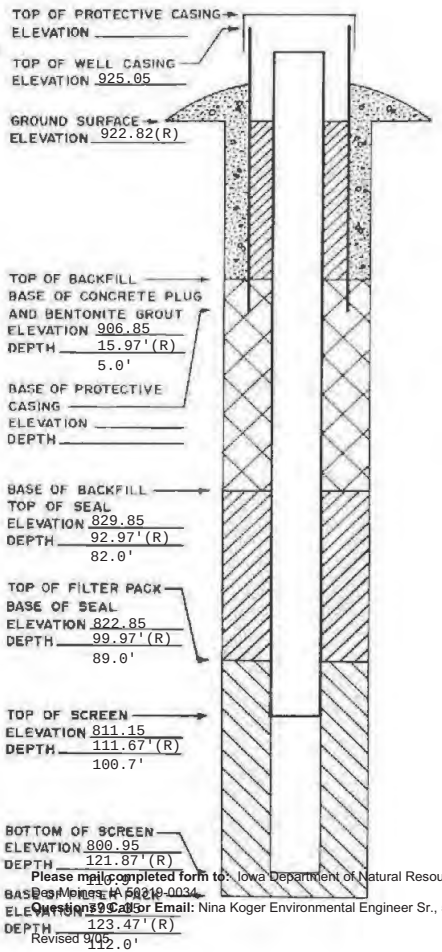
Please mail completed form to: Iowa Department of Natural Resources, Energy and Waste Management Bureau, 502 E. 9th Street, Des Moines, IA 50319-0034.
Questions? Call or Email: Nina Koger Environmental Engineer Sr., 515-281-8986, nina.koger@dnr.state.ia.us

ELEVATIONS: ± 0.01 FT. MSL
DEPTHS: ± 0.1 FT. FROM GROUND SERFACE

P-105C

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL).

Well was raised approximately 10.0'. New concrete pad was installed. Depths are revised, elevations were held.



Please mail completed form to: Iowa Department of Natural Resources, Energy and Waste Management Bureau, 502 E. 9th Street, Des Moines, IA 50319-0034.

Questions? Call or Email: Nina Koger Environmental Engineer Sr., 515-281-8986, nina.koger@dnr.state.ia.us

Revised 9/05

Form # 542-1277

Print Form

IOWA DEPARTMENT OF NATURAL RESOURCES

MONITORING WELL/PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name: Black Hawk County Landfill Permit No.: 99-TV-054R2

Well or Piezometer No: P-106AR

Dates Started: 06/18/2013 Date Completed: 06/19/2013

A. SURVEYED LOCATIONS AND ELEVATIONS

Locations (± 0.5 ft): N - 3617472.8, E - 5239599.6

Specify corner of site:

Distance & direction along boundary:

Distance & direction from boundary to wall:

Elevations (± 0.01 ft MSL):

Ground Surface: 913.80

Top of protective casing:

Top of well casing: 916.30

Benchmark elevation:

Benchmark description:

B. SOIL BORING INFORMATION

Name & Address of Construction Company:
Braun Intertec
5915 4th Street SW
Cedar Rapids, IA 52404

Name of Driller: Rob Hunt

Drilling Method: 4 1/4" HSA

Drilling Fluid: None

Bore Hole Diameter: 8"

Soil Sampling Method: 2' split spoon

Depth of Boring: 40.0' bgs

C. MONITORING WELL INSTALLATION

Casing material: stainless steel

Length of casing: 36.0'

Outside casing diameter: 2.375"

Inside casing diameter: 2.067"

Casing joint type: flush threaded, o-ring

Casing/screen joint type: flush threaded, o-ring

Screen material: stainless steel

Screen opening size: 0.010"

Screen length: 5'

Depth of well: 38.5' bgs

Filter Pack:

Material: Red Flint Sand and Gravel

Grain size: #10 coarse sand

Volume: 2 cu. ft.

Seal (minimum 3 ft length above filter pack):

Material: 3/8" Sodium Bentonite Chips (Baroid)

Placement method: direct pour with water to avoid bridging

Volume: 0.7 cu. ft.

Backfill (if different from seal):

Material: 20% Solids Bentonite (Baroid Quik-Gel)

Placement method: tremie pipe

Volume: 40 gallons

Surface seal design:

Material of protective casing: stainless steel

Material of grout between protective casing and well casing: 3/8" bentonite chips

Protective cap:

Material: stainless steel

Vented: ☐ Yes ☐ No Locking: ☒ Yes ☐ No

Well Cap:

Material: Protop with gasket seal

Vented: ☐ Yes ☒ No

D. GROUNDWATER MEASURMENT (± 0.01 ft below top of inner well casing)

Water level: Stabilization Time:

Well development method:

Average depth of frostline:

Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½x11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed for to: Iowa Department of Natural Resources, Land Quality Bureau, 502 E 9th St, Des Moines IA 50319-0034.

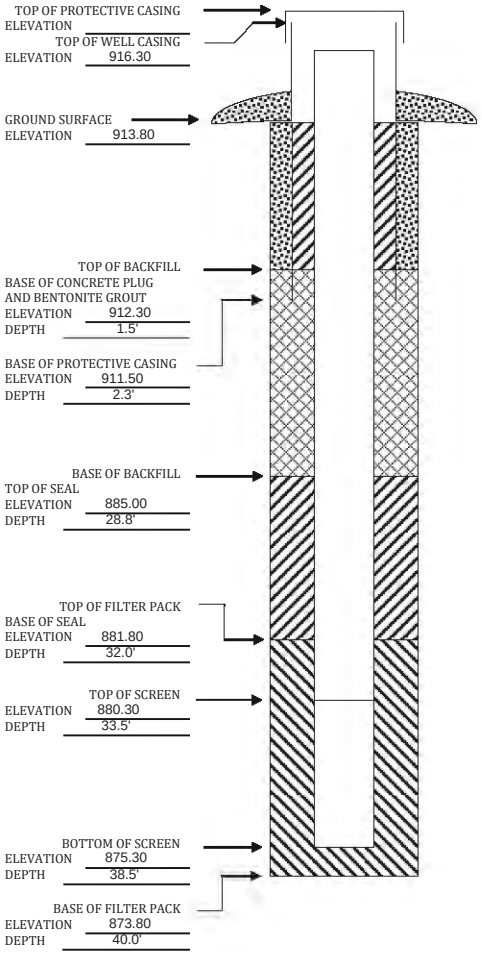
Questions? Call or Email: Nina Koger, Environmental Engineer Sr., 515-281-8986, Nina.Koger@dnr.iowa.gov

06/2011 cmz

DNR Form 542-1277

ELEVATIONS: ± 0.01 ft MSL
DEPTHS: ± 0.1 ft FROM GROUND SURFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL.)



Print Form

IOWA DEPARTMENT OF NATURAL RESOURCES

MONITORING WELL/PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name: Black Hawk County Landfill Permit No.: 99-TV-054R2

Well or Piezometer No: P-106C

Dates Started: Installed 09/24/86 Date Completed: Repaired 06/17/2013

A. SURVEYED LOCATIONS AND ELEVATIONS

Locations (± 0.5 ft): N - 3617466.1, E - 5239625.2

Specify corner of site:

Distance & direction along boundary:

Distance & direction from boundary to wall:

Elevations (± 0.01 ft MSL):

Ground Surface: 910.60

Top of protective casing:

Top of well casing: 914.40

Benchmark elevation:

Benchmark description:

B. SOIL BORING INFORMATION

Name & Address of Construction Company:
Braun Intertec
5915 4th Street SW
Cedar Rapids, IA 52404

Name of Driller: Rob Hunt

Drilling Method: 4 1/4" HSA

Drilling Fluid: None

Bore Hole Diameter: 8"

Soil Sampling Method: 2' split spoon

Depth of Boring: 110.6' bgs

C. MONITORING WELL INSTALLATION

Casing material: stainless steel

Length of casing: 113.9'

Outside casing diameter:

Inside casing diameter: 2.0"

Casing joint type: flush threaded, o-ring

Casing/screen joint type: flush threaded, o-ring

Screen material: stainless steel

Screen opening size: 0.010"

Screen length: 10.2'

Depth of well: 111.29' bgs

Filter Pack:

Material: silica sand

Grain size: unimin size #10

Volume:

Seal (minimum 3 ft length above filter pack):

Material: bentonite pellet

Placement method:

Volume:

Backfill (if different from seal):

Material: Volclay grout

Placement method:

Volume:

Surface seal design:

Material of protective casing: aluminum

Material of grout between protective casing and well casing: 3/8" bentonite chips

Protective cap:

Material: aluminum

Vented: ☐ Yes ☐ No Locking: ☒ Yes ☐ No

Well Cap:

Material: Protop with gasket seal

Vented: ☐ Yes ☒ No

D. GROUNDWATER MEASURMENT (± 0.01 ft below top of inner well casing)

Water level: Stabilization Time:

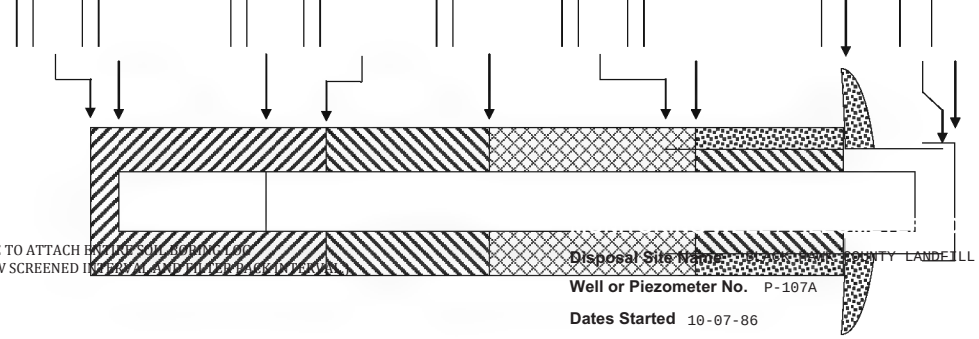
Well development method:

Average depth of frostline:

Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½x11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed for to: Iowa Department of Natural Resources, Land Quality Bureau, 502 E 9th St, Des Moines IA 50319-0034.

Questions? Call or Email: Nina Koger, Environmental Engineer Sr., 515-281-8986, Nina.Koger@dnr.iowa.gov



ELEVATIONS: ± 0.01 ft MSL
DEPTHS: ± 0.1 ft FROM GROUND SURFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL)

TOP OF PROTECTIVE CASING
ELEVATION
TOP OF WELL CASING
ELEVATION 914.40

GROUND SURFACE
ELEVATION 910.60

TOP OF BACKFILL
BASE OF CONCRETE PLUG
AND BENTONITE GROUT
ELEVATION 902.61
DEPTH 7.99'

BASE OF PROTECTIVE CASING
ELEVATION
DEPTH

BASE OF BACKFILL
TOP OF SEAL
ELEVATION 829.81
DEPTH 80.79'

TOP OF FILTER PACK
BASE OF SEAL
ELEVATION 823.00
DEPTH 88.79'

TOP OF SCREEN
ELEVATION 809.51
DEPTH 101.09'

BOTTOM OF SCREEN
ELEVATION 799.31
DEPTH 111.29'

BASE OF FILTER PACK
ELEVATION 798.81
DEPTH 111.79'

Disposal Site Name BLACK HAWK COUNTY LANDFILL **Permit No.** 07-SDP-01-75P

Well or Piezometer No. P-107A

Dates Started 10-07-86 **Date Completed** 10-07-86

Locations (± 0.5 ft.): N3617297.99 E5239899.64
Specify corner of site
Distance & direction along boundary
Distance & direction from boundary to well

Name & address of construction company
TWIN CITY TESTING CORPORATION

Elevations (± 0.01 ft. MSL):
Ground Surface 902.74 (O) 907.69 (C)
Top of protective casing
Top of well casing 905.98 (O) 910.63 (C)
Benchmark elevation
Benchmark description

Name of driller
Drilling method
Drilling fluid
Bore Hole diameter 6.5 inch
Soil sampling method
Depth of boring 66.4 ft BGS

Casing material STAINLESS STEEL
Length of casing
Outside casing diameter
Inside casing diameter 2.0 inch
Casing joint type FLUSH THREADED; O-RING
Casing/screen joint type FLUSH THREADED; O-RING
Screen material STAINLESS STEEL
Screen opening size #10 SLOT
Screen length 5.3 ft
Depth of Well 68.74' (O) 73.39' (C)
Filter Pack:
Material SILICA SAND
Grain size UNIMIN SIZE #10
Volume
Seal (minimum 3 ft. length above filter pack):
Material BENTONITE PELLET

Placement method
Volume
Backfill (if different from seal):
Material VOLCLAY GROUT
Placement method
Volume
Surface seal design: CONCRETE PAD
Material of protective casing: STEEL
Material of grout between protective casing and well casing: CONCRETE
Protective cap:
Material STEEL
Vented?: Y/N Y **Locking?: Y/N** Y
Well cap:
Material PVC
Vented?: Y/N Y

OUNT [illegible] URE [illegible] 0.01 foot [illegible] of in

Water level
Well development method
Average depth of frostline

Stabilization time

Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½ inch x 11 inch map showing locations of all monitoring wells and piezometers.

Please [illegible] completed form to: Iowa Department of Natural Resources, Energy and Waste Management Bureau, 502 E. 9th Street, Des Moines, IA 50319-0034.
Questions? Call or Email: Nina Koger Environmental Engineer Sr., 515-281-8[illegible] nina.koger@dnr.state.ia.us

Revised [illegible]

Form # 542-1277

06/2011 cmz

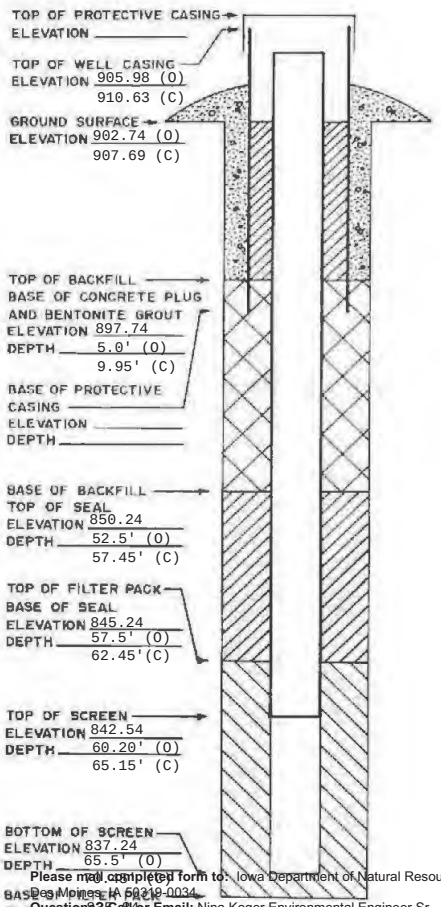
DNR Form 542-1277

ELEVATIONS: ± 0.01 FT. MSL
DEPTHS: ± 0.1 FT. FROM GROUND SERFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL).

Monitoring Well P-107A has been raised since installation.

P-107A



(O) - ORIGINAL
(C) - CURRENT

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Questions? Call or Email: Nina Koger Environmental Engineer Sr., 515-281-8986, nina.koger@dnr.state.ia.us

MONITORING WELL / PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name BLACK HAWK COUNTY LANDFILL	**Permit No.** 07-SDP-01-75P
Well or Piezometer No. P-107C	
Dates Started 10-07-86	**Date Completed** 10-07-86

A. SURVEYED LOCATIONS AND ELEVATIONS	**B. SOIL BORING INFORMATION**
Locations (± 0.5 ft.): N 3617303.17 E 5239883.44	**Name & address of construction company**
Specify corner of site	TWIN CITY TESTING CORPORATION
Distance & direction along boundary	
Distance & direction from boundary to well	
Elevations (± 0.01 ft. MSL):	**Name of driller**
Ground Surface 903.03 (O) 908.32 (C)	**Drilling method**
Top of protective casing	**Drilling fluid**
Top of well casing 905.93 (O) 910.73 (C)	**Bore Hole diameter** 6"
Benchmark elevation	**Soil sampling method**
Benchmark description	**Depth of boring** 106.0'

C. MONITORING WELL INSTALLATION	
Casing material STAINLESS STEEL	**Placement method**
Length of casing	**Volume**
Outside casing diameter	**Backfill (if different from seal):**
Inside casing diameter 2.0 inch	**Material** VOLCLAY GROUT\CEMENT-BENTONITE GROUT
Casing joint type FLUSH THREADED; O-RING	**Placement method**
Casing/screen joint type FLUSH THREADED; O-RING	**Volume**
Screen material STAINLESS STEEL	**Surface seal design:** CONCRETE PAD
Screen opening size #10 SLOT	**Material of protective casing:** STEEL
Screen length 10.2 ft	**Material of grout between protective casing and well casing:** CONCRETE
Depth of Well 105.8' (O) 110.6' (C)	**Protective cap:**
Filter Pack:	**Material** STEEL
Material SILICA SAND	**Vented?: Y/N** Y **Locking?: Y/N** Y
Grain Size UNIMIN SIZE #10	**Well cap:**
Volume	**Material** PVC
Seal (minimum 3 ft. length above filter pack):	**Vented?: Y/N** Y
Material BENTONITE\2 - 6"x10" RUBBER PACKERS	

D. GROUNDWATER MEASUREMENT (± 0.01 foot below top of inner well casing)	
Water level	**Stabilization time**
Well development method	
Average depth of frostline	

Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½ inch x 11 inch map showing locations of all monitoring wells and piezometers.

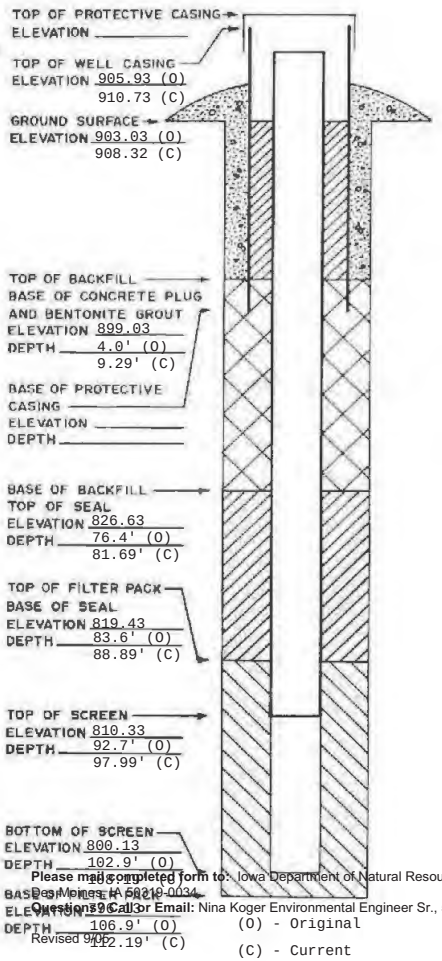
Please mail completed form to: Iowa Department of Natural Resources, Energy and Waste Management Bureau, 502 E. 9th Street, Des Moines, IA 50319-0034.
Questions? Call or Email: Nina Koger Environmental Engineer Sr., 515-281-8986, nina.koger@dnr.state.ia.us

ELEVATIONS: ± 0.01 FT. MSL
DEPTHS: ± 0.1 FT. FROM GROUND SERFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL).

Monitoring Well P-107C has been raised since installation.

P-107C



(O) - Original
(C) - Current

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Questions? Call or Email: Nina Koger Environmental Engineer Sr., 515-281-8986, nina.koger@dnr.state.ia.us

MONITORING WELL / PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name BLACK HAWK COUNTY LANDFILL	**Permit No.** 07-SDP-01-75P
Well or Piezometer No. P-108A	
Dates Started 9-05-86	**Date Completed** 9-05-86

A. SURVEYED LOCATIONS AND ELEVATIONS	**B. SOIL BORING INFORMATION**
Locations (± 0.5 ft.): N 3617102.41 E 5240102.94	**Name & address of construction company**
Specify corner of site	TWIN CITY TESTING CORPORATION
Distance & direction along boundary	
Distance & direction from boundary to well	
Elevations (± 0.01 ft. MSL):	**Name of driller**
Ground Surface 900.23 (O) 906.54(C)	**Drilling method**
Top of protective casing	**Drilling fluid**
Top of well casing 903.37 (O) 909.11(C)	**Bore Hole diameter** 9-1/4 inch
Benchmark elevation	**Soil sampling method**
Benchmark description	**Depth of boring** 35.2 ft BGS

C. MONITORING WELL INSTALLATION	
Casing material STAINLESS STEEL	**Placement method**
Length of casing	**Volume**
Outside casing diameter	**Backfill (if different from seal):**
Inside casing diameter 2.0 inch	**Material** VOLCLAY GROUT
Casing joint type FLUSH THREADED; O-RING	**Placement method**
Casing/screen joint type FLUSH THREADED; O-RING	**Volume**
Screen material STAINLESS STEEL	**Surface seal design:** CONCRETE PAD
Screen opening size #10 SLOT	**Material of protective casing:** STEEL
Screen length 5.0 ft	**Material of grout between protective casing and well casing:** CONCRETE
Depth of Well 38.64' (O) 44.38' (C)	**Protective cap:**
Filter Pack:	**Material** STEEL
Material SILICA SAND	**Vented?: Y/N** Y **Locking?: Y/N** Y
Grain Size UNIMIN SIZE #10	**Well cap:**
Volume	**Material** PVC
Seal (minimum 3 ft. length above filter pack):	**Vented?: Y/N** Y
Material BENTONITE PELLET	

D. GROUNDWATER MEASUREMENT (± 0.01 foot below top of inner well casing)	
Water level	**Stabilization time**
Well development method	
Average depth of frostline	

Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½ inch x 11 inch map showing locations of all monitoring wells and piezometers.

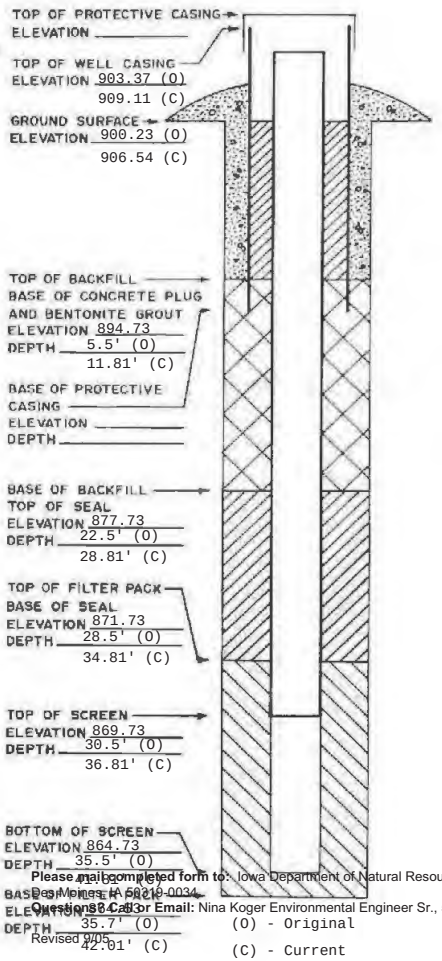
Please mail completed form to: Iowa Department of Natural Resources, Energy and Waste Management Bureau, 502 E. 9th Street, Des Moines, IA 50319-0034.
Questions? Call or Email: Nina Koger Environmental Engineer Sr., 515-281-8986, nina.koger@dnr.state.ia.us

ELEVATIONS: ± 0.01 FT. MSL
DEPTHS: ± 0.1 FT. FROM GROUND SERFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL).

Monitoring Well P-108A was been raised since installation.

P-108A



(O) - Original
(C) - Current

Please mail completed form to: Iowa Department of Natural Resources, Energy and Waste Management Bureau, 502 E. 9th Street, Des Moines, IA 50319-0034.
Questions? Call or Email: Nina Koger Environmental Engineer Sr., 515-281-8986, nina.koger@dnr.state.ia.us

MONITORING WELL / PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name BLACK HAWK COUNTY LANDFILL	**Permit No.** 07-SDP-01-75P
Well or Piezometer No. P-108C	
Dates Started 09-24-86	**Date Completed** 09-24-86

A. SURVEYED LOCATIONS AND ELEVATIONS	**B. SOIL BORING INFORMATION**
Locations (± 0.5 ft.): N 3617107.44 E 5240107.87	**Name & address of construction company**
Specify corner of site	TWIN CITY TESTING CORPORATION
Distance & direction along boundary	
Distance & direction from boundary to well	
Elevations (± 0.01 ft. MSL):	**Name of driller**
Ground Surface 905.99	**Drilling method**
Top of protective casing	**Drilling fluid**
Top of well casing 908.49	**Bore Hole diameter** 6"
Benchmark elevation	**Soil sampling method**
Benchmark description	**Depth of boring** 93.7'

C. MONITORING WELL INSTALLATION	
Casing material STAINLESS STEEL	**Placement method**
Length of casing	**Volume**
Outside casing diameter	**Backfill (if different from seal):**
Inside casing diameter 2.0 inch	**Material** VOLCLAY GROUT\CEMENT-BENTONITE GROUT
Casing joint type FLUSH THREADED; O-RING	**Placement method**
Casing/screen joint type FLUSH THREADED; O-RING	**Volume**
Screen material STAINLESS STEEL	**Surface seal design:** CONCRETE PAD
Screen opening size #10 SLOT	**Material of protective casing:** STEEL
Screen length 10.2'	**Material of grout between protective casing and well casing:** CONCRETE
Depth of Well 97.10'	**Protective cap:**
Filter Pack:	**Material** STEEL
Material SILICA SAND	**Vented?: Y/N** YES **Locking?: Y/N** YES
Grain Size UNIMIN SIZE #10	**Well cap:**
Volume	**Material** PVC
Seal (minimum 3 ft. length above filter pack):	**Vented?: Y/N** YES
Material BENTONITE\2 - 6"x10" RUBBER PACKERS	

D. GROUNDWATER MEASUREMENT (± 0.01 foot below top of inner well casing)	
Water level	**Stabilization time**
Well development method	
Average depth of frostline	

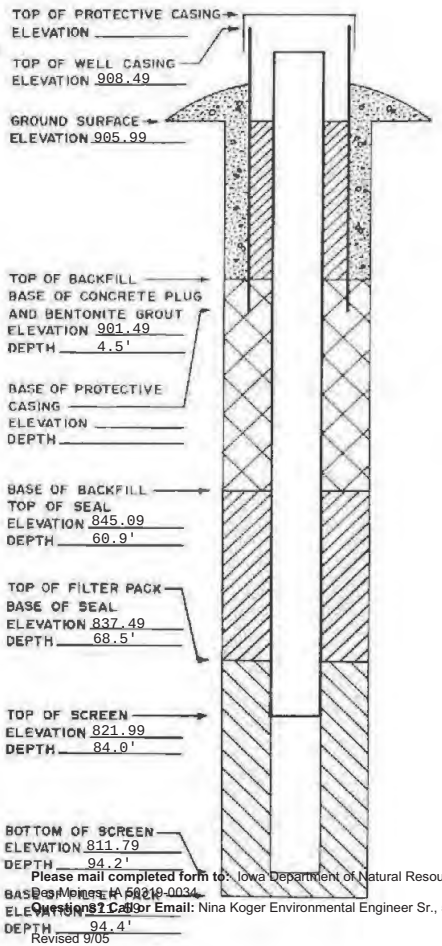
Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½ inch x 11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed form to: Iowa Department of Natural Resources, Energy and Waste Management Bureau, 502 E. 9th Street, Des Moines, IA 50319-0034.
Questions? Call or Email: Nina Koger Environmental Engineer Sr., 515-281-8986, nina.koger@dnr.state.ia.us

ELEVATIONS: ± 0.01 FT. MSL
DEPTHS: ± 0.1 FT. FROM GROUND SERFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL).

P-108C



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Questions? Call or Email: Nina Koger Environmental Engineer Sr., 515-281-8986, nina.koger@dnr.state.ia.us

MONITORING WELL / PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name BLACK HAWK COUNTY LANDFILL	**Permit No.** 07-SDP-01-75P
Well or Piezometer No. P-109A	
Dates Started 9-05-89	**Date Completed** 09-05-86

A. SURVEYED LOCATIONS AND ELEVATIONS	**B. SOIL BORING INFORMATION**
Locations (± 0.5 ft.): N 3616902.60 E 5240317.16	**Name & address of construction company**
Specify corner of site	TWIN CITY TESTING CORPORATION
Distance & direction along boundary	
Distance & direction from boundary to well	
Elevations (± 0.01 ft. MSL):	**Name of driller**
Ground Surface 899.93	**Drilling method**
Top of protective casing	**Drilling fluid**
Top of well casing 903.32	**Bore Hole diameter** 10 inch
Benchmark elevation	**Soil sampling method**
Benchmark description	**Depth of boring** 35.1 ft BGS

C. MONITORING WELL INSTALLATION	
Casing material STAINLESS STEEL	**Placement method**
Length of casing	**Volume**
Outside casing diameter	**Backfill (if different from seal):**
Inside casing diameter 2.0 inch	**Material** VOLCLAY GROUT
Casing joint type FLUSH THREADED; O-RING	**Placement method**
Casing/screen joint type FLUSH THREADED; O-RING	**Volume**
Screen material STAINLESS STEEL	**Surface seal design:** CONCRETE PAD
Screen opening size #10 SLOT	**Material of protective casing:** STEEL
Screen length 5.0 ft	**Material of grout between protective casing and well casing:** CONCRETE
Depth of Well 35 ft BGS	**Protective cap:**
Filter Pack:	**Material** STEEL
Material SILICA SAND	**Vented?: Y/N** Y **Locking?: Y/N** Y
Grain Size UNIMIN SIZE #10	**Well cap:**
Volume	**Material** PVC
Seal (minimum 3 ft. length above filter pack):	**Vented?: Y/N** Y
Material BENTONITE PELLET	

D. GROUNDWATER MEASUREMENT (± 0.01 foot below top of inner well casing)	
Water level	**Stabilization time**
Well development method	
Average depth of frostline	

Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½ inch x 11 inch map showing locations of all monitoring wells and piezometers.

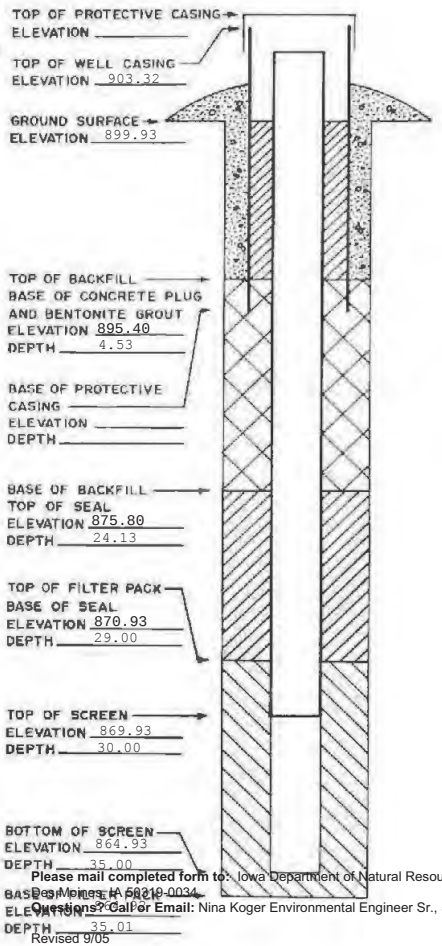
Please mail completed form to: Iowa Department of Natural Resources, Energy and Waste Management Bureau, 502 E. 9th Street, Des Moines, IA 50319-0034.
Questions? Call or Email: Nina Koger Environmental Engineer Sr., 515-281-8986, nina.koger@dnr.state.ia.us

Revised 9/05 Form # 542-1277

ELEVATIONS: ± 0.01 FT. MSL
DEPTHS: ± 0.1 FT. FROM GROUND SERFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL).

P-109A



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Questions? Call or Email: Nina Koger Environmental Engineer Sr., 515-281-8986, nina.koger@dnr.state.ia.us

MONITORING WELL / PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name BLACK HAWK COUNTY LANDFILL	**Permit No.** 07-SDP-01-75P
Well or Piezometer No. P-109C	
Dates Started	**Date Completed** 09-05-86

A. SURVEYED LOCATIONS AND ELEVATIONS	**B. SOIL BORING INFORMATION**
Locations (± 0.5 ft.): N 3616932.17 E 5240341.56	**Name & address of construction company**
Specify corner of site	TWIN CITY TESTING CORPORATION
Distance & direction along boundary	
Distance & direction from boundary to well	
Elevations (± 0.01 ft. MSL):	**Name of driller**
Ground Surface 901.10	**Drilling method**
Top of protective casing	**Drilling fluid**
Top of well casing 903.75	**Bore Hole diameter** 10 inch
Benchmark elevation	**Soil sampling method**
Benchmark description	**Depth of boring** 18.0 ft BGS

C. MONITORING WELL INSTALLATION	
Casing material STAINLESS STEEL	**Placement method**
Length of casing	**Volume**
Outside casing diameter	**Backfill (if different from seal):**
Inside casing diameter 2.0 inch	**Material** VOLCLAY GROUT
Casing joint type FLUSH THREADED; O-RING	**Placement method**
Casing/screen joint type	**Volume**
Screen material STAINLESS STEEL	**Surface seal design:**
Screen opening size #10 SLOT	**Material of protective casing:** STEEL
Screen length 10.2 ft	**Material of grout between protective casing and well casing:** CONCRETE
Depth of Well 90.1 ft BGS	**Protective cap:**
Filter Pack:	**Material** STEEL
Material EXAMPLE SILICA SAND	**Vented?: Y/N** **Locking?: Y/N**
Grain Size UNIMIN SIZE #10	**Well cap:**
Volume	**Material** PVC
Seal (minimum 3 ft. length above filter pack):	**Vented?: Y/N**
Material BENTONITE PELLET	

D. GROUNDWATER MEASUREMENT (± 0.01 foot below top of inner well casing)	
Water level	**Stabilization time**
Well development method	
Average depth of frostline	

Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½ inch x 11 inch map showing locations of all monitoring wells and piezometers.

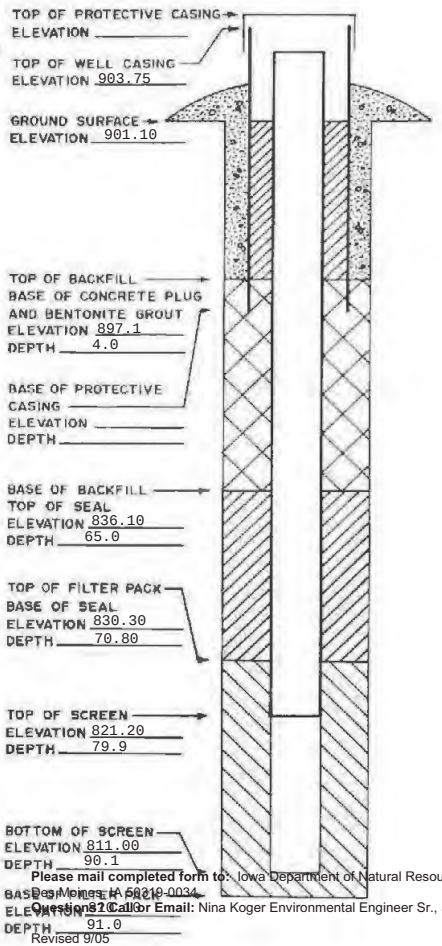
Please mail completed form to: Iowa Department of Natural Resources, Energy and Waste Management Bureau, 502 E. 9th Street, Des Moines, IA 50319-0034.
Questions? Call or Email: Nina Koger Environmental Engineer Sr., 515-281-8986, nina.koger@dnr.state.ia.us

Revised 9/05 Form # 542-1277

ELEVATIONS: ± 0.01 FT. MSL
DEPTHS: ± 0.1 FT. FROM GROUND SERFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL).

P-109C



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MONITORING WELL / PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name BLACK HAWK COUNTY LANDFILL	**Permit No.** 07-SDP-01-75P
Well or Piezometer No. P-110A	
Dates Started 10-20-86	**Date Completed** 10-20-86

A. SURVEYED LOCATIONS AND ELEVATIONS	**B. SOIL BORING INFORMATION**
Locations (± 0.5 ft.): N 3616285.18 E 5240330.47	**Name & address of construction company**
Specify corner of site	TWIN CITY TESTING CORPORATION
Distance & direction along boundary	
Distance & direction from boundary to well	
Elevations (± 0.01 ft. MSL):	**Name of driller**
Ground Surface 906.01	**Drilling method**
Top of protective casing	**Drilling fluid**
Top of well casing 908.89	**Bore Hole diameter** 6.5 inch
Benchmark elevation	**Soil sampling method**
Benchmark description	**Depth of boring** 60.5 ft BGS

C. MONITORING WELL INSTALLATION	
Casing material STAINLESS STEEL	**Placement method**
Length of casing	**Volume**
Outside casing diameter	**Backfill (if different from seal):**
Inside casing diameter 2.0 inch	**Material** VOLCLAY GROUT
Casing joint type FLUSH THREADED; O-RING	**Placement method**
Casing/screen joint type FLUSH THREADED; O-RING	**Volume**
Screen material STAINLESS STEEL	**Surface seal design:** CONCRETE PAD
Screen opening size #10 SLOT	**Material of protective casing:** STEEL
Screen length 5.0 ft	**Material of grout between protective casing and well casing:** CONCRETE
Depth of Well 55.54 ft	**Protective cap:**
Filter Pack:	**Material** STEEL
Material SILICA SAND	**Vented?: Y/N** Y **Locking?: Y/N** Y
Grain Size UNIMIN SIZE #10	**Well cap:**
Volume	**Material** PVC
Seal (minimum 3 ft. length above filter pack):	**Vented?: Y/N** Y
Material BENTONITE PELLET	

D. GROUNDWATER MEASUREMENT (± 0.01 foot below top of inner well casing)	
Water level	**Stabilization time**
Well development method	
Average depth of frostline	

Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½ inch x 11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed form to: Iowa Department of Natural Resources, Energy and Waste Management Bureau, 502 E. 9th Street, Des Moines, IA 50319-0034.
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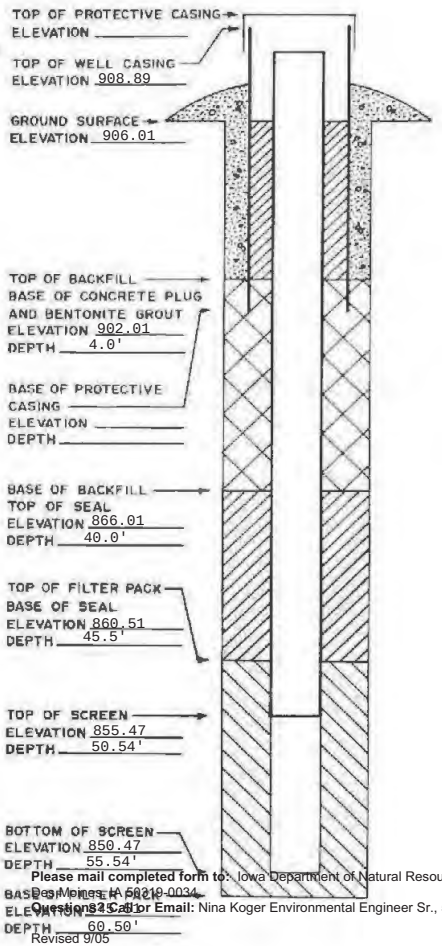
Revised 9/05 Form # 542-1277

ELEVATIONS: ± 0.01 FT. MSL
DEPTHS: ± 0.1 FT. FROM GROUND SERFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL).

P-110A



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MONITORING WELL / PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name BLACK HAWK COUNTY LANDFILL	**Permit No.** 07-SDP-01-75P
Well or Piezometer No. P-110C	
Dates Started 10-20-86	**Date Completed** 10-20-86

A. SURVEYED LOCATIONS AND ELEVATIONS	**B. SOIL BORING INFORMATION**
Locations (± 0.5 ft.): N 3616305.23 E 5240320.45	**Name & address of construction company**
Specify corner of site	TWIN CITY TESTING CORPORATION
Distance & direction along boundary	
Distance & direction from boundary to well	
Elevations (± 0.01 ft. MSL):	**Name of driller**
Ground Surface 906.05	**Drilling method**
Top of protective casing	**Drilling fluid**
Top of well casing 908.90	**Bore Hole diameter** 6"
Benchmark elevation	**Soil sampling method**
Benchmark description	**Depth of boring** 87.0'

C. MONITORING WELL INSTALLATION	
Casing material STAINLESS STEEL	**Placement method**
Length of casing	**Volume**
Outside casing diameter	**Backfill (if different from seal):**
Inside casing diameter 2.0 inch	**Material** VOLCLAY GROUT\CEMENT-BENTONITE GROUT
Casing joint type FLUSH THREADED; O-RING	**Placement method**
Casing/screen joint type FLUSH THREADED; O-RING	**Volume**
Screen material STAINLESS STEEL	**Surface seal design:** CONCRETE PAD
Screen opening size #10 SLOT	**Material of protective casing:** STEEL
Screen length 10.3'	**Material of grout between protective casing and well casing:** CONCRETE
Depth of Well 89.7'	**Protective cap:**
Filter Pack:	**Material** STEEL
Material SILICA SAND	**Vented?: Y/N** YES **Locking?: Y/N** YES
Grain Size UNIMIN SIZE #10	**Well cap:**
Volume	**Material** PVC
Seal (minimum 3 ft. length above filter pack):	**Vented?: Y/N** YES
Material BENTONITE\2 - 6"x10" RUBBER PACKERS	

D. GROUNDWATER MEASUREMENT (± 0.01 foot below top of inner well casing)	
Water level	**Stabilization time**
Well development method	
Average depth of frostline	

Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½ inch x 11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed form to: Iowa Department of Natural Resources, Energy and Waste Management Bureau, 502 E. 9th Street, Des Moines, IA 50319-0034.
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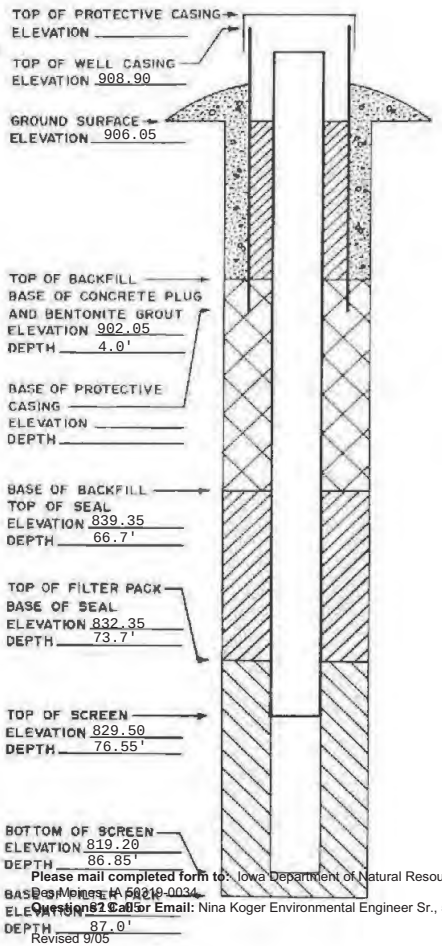
Revised 9/05 Form # 542-1277

ELEVATIONS: ± 0.01 FT. MSL
DEPTHS: ± 0.1 FT. FROM GROUND SERFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL).

P-110C



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MONITORING WELL / PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name BLACK HAWK COUNTY LANDFILL	**Permit No.** 07-SDP-01-75P
Well or Piezometer No. P-111A	
Dates Started 8-27-86	**Date Completed** 8-27-86

A. SURVEYED LOCATIONS AND ELEVATIONS	**B. SOIL BORING INFORMATION**
Locations (± 0.5 ft.): N 3616231.73 E 5239311.61	**Name & address of construction company**
Specify corner of site	TWIN CITY TESTING CORPORATION
Distance & direction along boundary	
Distance & direction from boundary to well	
Elevations (± 0.01 ft. MSL):	**Name of driller**
Ground Surface 942.19	**Drilling method**
Top of protective casing	**Drilling fluid**
Top of well casing 945.10	**Bore Hole diameter** 10 inch
Benchmark elevation	**Soil sampling method**
Benchmark description	**Depth of boring** 75.09 ft BGS

C. MONITORING WELL INSTALLATION	
Casing material STAINLESS STEEL	**Placement method**
Length of casing	**Volume**
Outside casing diameter	**Backfill (if different from seal):**
Inside casing diameter 2.0 inch	**Material** VOLCLAY GROUT
Casing joint type FLUSH THREADED; O-RING	**Placement method**
Casing/screen joint type FLUSH THREADED; O-RING	**Volume**
Screen material STAINLESS STEEL	**Surface seal design:** CONCRETE PAD
Screen opening size #10 SLOT	**Material of protective casing:** STEEL
Screen length 5.3 ft	**Material of grout between protective casing and well casing:** CONCRETE
Depth of Well 72.8 ft	**Protective cap:**
Filter Pack:	**Material** STEEL
Material SILICA SAND	**Vented?: Y/N** Y **Locking?: Y/N** Y
Grain Size UNIMIN SIZE #10	**Well cap:**
Volume	**Material** PVC
Seal (minimum 3 ft. length above filter pack):	**Vented?: Y/N** Y
Material BENTONITE PELLET	

D. GROUNDWATER MEASUREMENT (± 0.01 foot below top of inner well casing)	
Water level	**Stabilization time**
Well development method	
Average depth of frostline	

Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½ inch x 11 inch map showing locations of all monitoring wells and piezometers.

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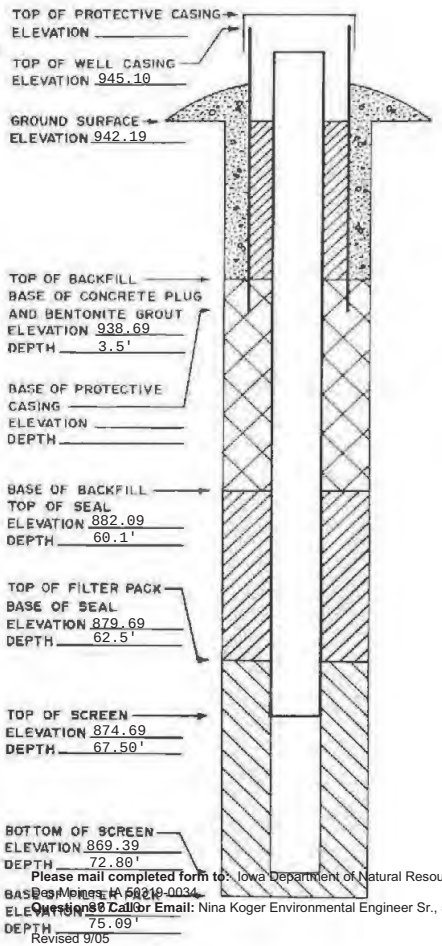
Revised 9/05 Form # 542-1277

ELEVATIONS: ± 0.01 FT. MSL
DEPTHS: ± 0.1 FT. FROM GROUND SERFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL).

P-111A



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MONITORING WELL / PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name BLACK HAWK COUNTY LANDFILL	**Permit No.** 07-SDP-01-75P
Well or Piezometer No. P-111C	
Dates Started 08-27-86	**Date Completed** 08-27-86

A. SURVEYED LOCATIONS AND ELEVATIONS	**B. SOIL BORING INFORMATION**
Locations (± 0.5 ft.): N 3616237.64 E 5239285.21	**Name & address of construction company**
Specify corner of site	TWIN CITY TESTING CORPORATION
Distance & direction along boundary	
Distance & direction from boundary to well	
Elevations (± 0.01 ft. MSL):	**Name of driller**
Ground Surface 943.21	**Drilling method**
Top of protective casing	**Drilling fluid**
Top of well casing 946.09	**Bore Hole diameter** 6"
Benchmark elevation	**Soil sampling method**
Benchmark description	**Depth of boring** 130.2'

C. MONITORING WELL INSTALLATION	
Casing material STAINLESS STEEL	**Placement method**
Length of casing	**Volume**
Outside casing diameter	**Backfill (if different from seal):**
Inside casing diameter 2.0 inch	**Material** VOLCLAY GROUT\CEMENT-BENTONITE GROUT
Casing joint type FLUSH THREADED; O-RING	**Placement method**
Casing/screen joint type FLUSH THREADED; O-RING	**Volume**
Screen material STAINLESS STEEL	**Surface seal design:** CONCRETE PAD
Screen opening size #10 SLOT	**Material of protective casing:** STEEL
Screen length 10.3'	**Material of grout between protective casing and well casing:** CONCRETE
Depth of Well 124.8'	**Protective cap:**
Filter Pack:	**Material** STEEL
Material SILICA SAND	**Vented?: Y/N** YES **Locking?: Y/N** YES
Grain Size UNIMIN SIZE #10	**Well cap:**
Volume	**Material** PVC
Seal (minimum 3 ft. length above filter pack):	**Vented?: Y/N** YES
Material BENTONITE\2 - 6"x10" RUBBER PACKERS	

D. GROUNDWATER MEASUREMENT (± 0.01 foot below top of inner well casing)	
Water level	**Stabilization time**
Well development method	
Average depth of frostline	

Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½ inch x 11 inch map showing locations of all monitoring wells and piezometers.

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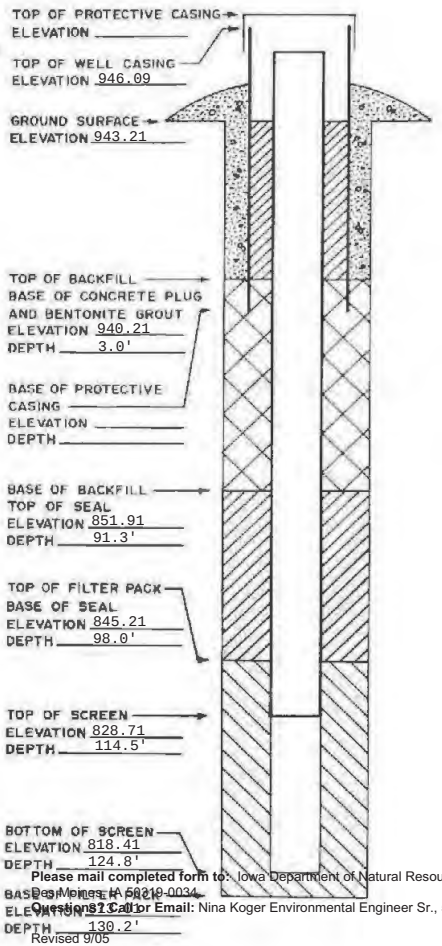
Revised 9/05 Form # 542-1277

ELEVATIONS: ± 0.01 FT. MSL
DEPTHS: ± 0.1 FT. FROM GROUND SERFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL).

P-111C



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MONITORING WELL / PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name BLACK HAWK COUNTY LANDFILL	**Permit No.** 07-SDP-01-75P
Well or Piezometer No. P-113A	
Dates Started 10-20-86	**Date Completed** 10-20-86

A. SURVEYED LOCATIONS AND ELEVATIONS	**B. SOIL BORING INFORMATION**
Locations (± 0.5 ft.): N 3617805.50 E 5239194.00	**Name & address of construction company**
Specify corner of site	TWIN CITY TESTING CORPORATION
Distance & direction along boundary	
Distance & direction from boundary to well	
Elevations (± 0.01 ft. MSL):	**Name of driller**
Ground Surface 915.12	**Drilling method**
Top of protective casing	**Drilling fluid**
Top of well casing 917.69	**Bore Hole diameter** 6.5 inch
Benchmark elevation	**Soil sampling method**
Benchmark description	**Depth of boring** 30.5 ft

C. MONITORING WELL INSTALLATION	
Casing material STAINLESS STEEL	**Placement method**
Length of casing	**Volume**
Outside casing diameter	**Backfill (if different from seal):**
Inside casing diameter 2.0 inch	**Material** VOLCLAY GROUT
Casing joint type FLUSH THREADED; O-RING	**Placement method**
Casing/screen joint type FLUSH THREADED; O-RING	**Volume**
Screen material STAINLESS STEEL	**Surface seal design:** CONCRETE PAD
Screen opening size #10 SLOT	**Material of protective casing:** STEEL
Screen length 5.0 ft	**Material of grout between protective casing and well casing:** CONCRETE
Depth of Well 30.35' BGS	**Protective cap:**
Filter Pack:	**Material** STEEL
Material SILICA SAND	**Vented?: Y/N** Y **Locking?: Y/N** Y
Grain Size UNIMIN SIZE #10	**Well cap:**
Volume	**Material** PVC
Seal (minimum 3 ft. length above filter pack):	**Vented?: Y/N** Y
Material BENTONITE PELLET	

D. GROUNDWATER MEASUREMENT (± 0.01 foot below top of inner well casing)	
Water level	**Stabilization time**
Well development method	
Average depth of frostline	

Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½ inch x 11 inch map showing locations of all monitoring wells and piezometers.

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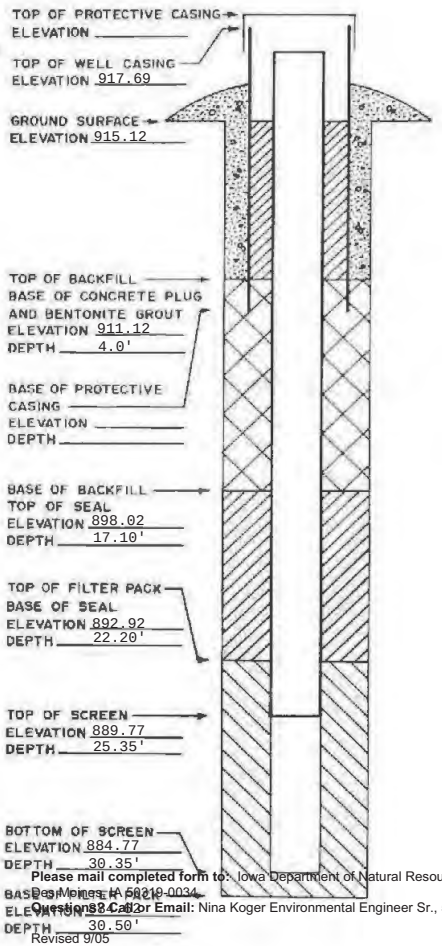
Revised 9/05 Form # 542-1277

ELEVATIONS: ± 0.01 FT. MSL
DEPTHS: ± 0.1 FT. FROM GROUND SERFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL).

The original well log shows a well depth of 32.7 feet from the top of casing. The measured well depth is 32.92 feet. The measured well depth was used for this diagram.

P-113A



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MONITORING WELL / PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name BLACK HAWK COUNTY LANDFILL	**Permit No.** 07-SDP-01-75P
Well or Piezometer No. P-113C	
Dates Started	**Date Completed** 10-20-86

A. SURVEYED LOCATIONS AND ELEVATIONS	**B. SOIL BORING INFORMATION**
Locations (± 0.5 ft.): N 3617826.65 E 5239173.37	**Name & address of construction company**
Specify corner of site	TWIN CITY TESTING CORPORATION
Distance & direction along boundary	
Distance & direction from boundary to well	
Elevations (± 0.01 ft. MSL):	**Name of driller**
Ground Surface 916.33	**Drilling method**
Top of protective casing	**Drilling fluid**
Top of well casing 918.56	**Bore Hole diameter**
Benchmark elevation	**Soil sampling method**
Benchmark description	**Depth of boring** 106.41 ft BGS

C. MONITORING WELL INSTALLATION	
Casing material STAINLESS STEEL	**Placement method**
Length of casing	**Volume**
Outside casing diameter	**Backfill (if different from seal):**
Inside casing diameter 2.0 inch	**Material** VOLCLAY GROUT
Casing joint type FLUSH THREADED; O-RING	**Placement method**
Casing/screen joint type	**Volume**
Screen material STAINLESS STEEL	**Surface seal design:**
Screen opening size #10 SLOT	**Material of protective casing:** STEEL
Screen length 10.0 ft	**Material of grout between protective casing and well casing:** CONCRETE
Depth of Well 105.41 ft BGS	**Protective cap:**
Filter Pack:	**Material** STEEL
Material SILICA SAND	**Vented?: Y/N** **Locking?: Y/N**
Grain Size UNIMIN SIZE #10	**Well cap:**
Volume	**Material** PVC
Seal (minimum 3 ft. length above filter pack):	**Vented?: Y/N**
Material BENTONITE PELLET	

D. GROUNDWATER MEASUREMENT (± 0.01 foot below top of inner well casing)	
Water level	**Stabilization time**
Well development method	
Average depth of frostline	

Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½ inch x 11 inch map showing locations of all monitoring wells and piezometers.

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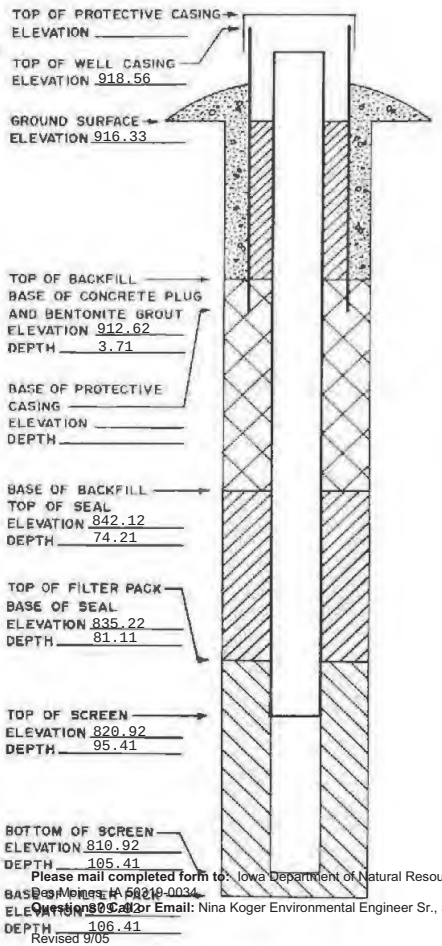
ELEVATIONS: ± 0.01 FT. MSL
DEPTHS: ± 0.1 FT. FROM GROUND SERFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL).

P-113C



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MONITORING WELL / PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name BLACK HAWK COUNTY LANDFILL	**Permit No.** 07-SDP-01-75P
Well or Piezometer No. P-114A	
Dates Started 10-07-86	**Date Completed** 10-07-86

A. SURVEYED LOCATIONS AND ELEVATIONS	**B. SOIL BORING INFORMATION**
Locations (± 0.5 ft.): N 3616637.44 E 5237833.19	**Name & address of construction company**
Specify corner of site	TWIN CITY TESTING CORPORATION
Distance & direction along boundary	
Distance & direction from boundary to well	
Elevations (± 0.01 ft. MSL):	**Name of driller**
Ground Surface 940.21	**Drilling method**
Top of protective casing	**Drilling fluid**
Top of well casing 942.71	**Bore Hole diameter** 6.5 inch
Benchmark elevation	**Soil sampling method**
Benchmark description	**Depth of boring** 47.1 ft

C. MONITORING WELL INSTALLATION	
Casing material STAINLESS STEEL	**Placement method**
Length of casing	**Volume**
Outside casing diameter	**Backfill (if different from seal):**
Inside casing diameter 2.0 inch	**Material** VOLCLAY GROUT
Casing joint type FLUSH THREADED; O-RING	**Placement method**
Casing/screen joint type FLUSH THREADED; O-RING	**Volume**
Screen material STAINLESS STEEL	**Surface seal design:** CONCRETE PAD
Screen opening size #10 SLOT	**Material of protective casing:** STEEL
Screen length 5.0 ft	**Material of grout between protective casing and well casing:** CONCRETE
Depth of Well 46.39'	**Protective cap:**
Filter Pack:	**Material** STEEL
Material SILICA SAND	**Vented?: Y/N** YES **Locking?: Y/N** YES
Grain Size UNIMIN SIZE #10	**Well cap:**
Volume	**Material** PVC
Seal (minimum 3 ft. length above filter pack):	**Vented?: Y/N** YES
Material BENTONITE PELLET	

D. GROUNDWATER MEASUREMENT (± 0.01 foot below top of inner well casing)	
Water level	**Stabilization time**
Well development method	
Average depth of frostline	

Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½ inch x 11 inch map showing locations of all monitoring wells and piezometers.

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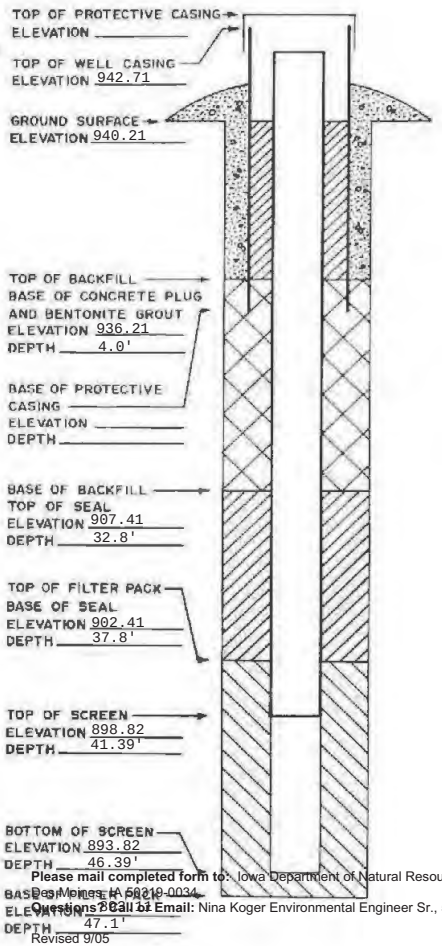
Revised 9/05 Form # 542-1277

ELEVATIONS: ± 0.01 FT. MSL
DEPTHS: ± 0.1 FT. FROM GROUND SERFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL).

P-114A



Please mail completed form to: Iowa Department of Natural Resources, Energy and Waste Management Bureau, 502 E. 9th Street, Des Moines, IA 50319-0034.
Questions? Call or Email: Nina Koger Environmental Engineer Sr., 515-281-8986, nina.koger@dnr.state.ia.us

Revised 9/05 Form # 542-1277

MONITORING WELL / PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name BLACK HAWK COUNTY LANDFILL	**Permit No.** 07-SDP-01-75P
Well or Piezometer No. P-114C	
Dates Started 10-7-86	**Date Completed** 10-7-86

A. SURVEYED LOCATIONS AND ELEVATIONS	**B. SOIL BORING INFORMATION**
Locations (± 0.5 ft.): N 3616648.42 E 5237849.66	**Name & address of construction company**
Specify corner of site	TWIN CITY TESTING CORPORATION
Distance & direction along boundary	
Distance & direction from boundary to well	
Elevations (± 0.01 ft. MSL):	**Name of driller**
Ground Surface 939.90	**Drilling method**
Top of protective casing	**Drilling fluid**
Top of well casing 942.28	**Bore Hole diameter** 6"
Benchmark elevation	**Soil sampling method**
Benchmark description	**Depth of boring** 136.0'

C. MONITORING WELL INSTALLATION	
Casing material STAINLESS STEEL	**Placement method**
Length of casing	**Volume**
Outside casing diameter	**Backfill (if different from seal):**
Inside casing diameter 2.0 inch	**Material** VOLCLAY GROUT\CEMENT-BENTONITE GROUT
Casing joint type FLUSH THREADED; O-RING	**Placement method**
Casing/screen joint type FLUSH THREADED; O-RING	**Volume**
Screen material STAINLESS STEEL	**Surface seal design:** CONCRETE PAD
Screen opening size #10 SLOT	**Material of protective casing:** STEEL
Screen length 10.2'	**Material of grout between protective casing and well casing:** CONCRETE
Depth of Well 137.50'	**Protective cap:**
Filter Pack:	**Material** STEEL
Material SILICA SAND	**Vented?: Y/N** YES **Locking?: Y/N** YES
Grain Size UNIMIN SIZE #10	**Well cap:**
Volume	**Material** PVC
Seal (minimum 3 ft. length above filter pack):	**Vented?: Y/N** YES
Material BENTONITE/2 - 6"x10" RUBBER PACKERS	

D. GROUNDWATER MEASUREMENT (± 0.01 foot below top of inner well casing)	
Water level	**Stabilization time**
Well development method	
Average depth of frostline	

Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½ inch x 11 inch map showing locations of all monitoring wells and piezometers.

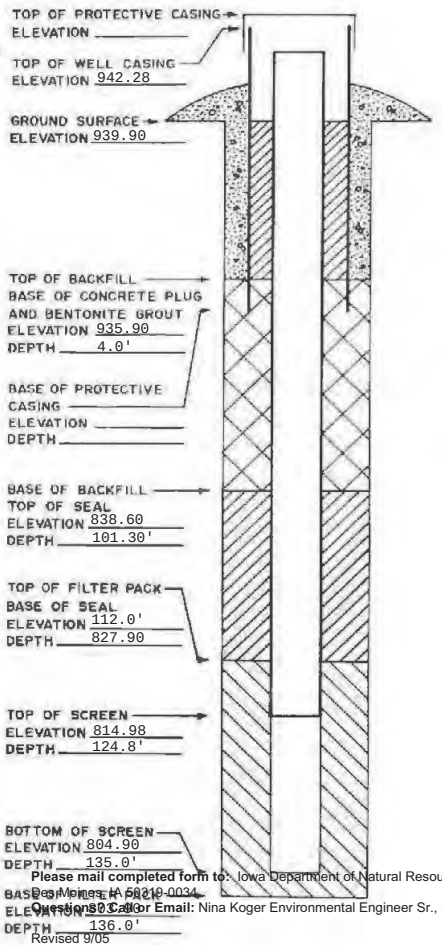
Please mail completed form to: Iowa Department of Natural Resources, Energy and Waste Management Bureau, 502 E. 9th Street, Des Moines, IA 50319-0034.
Questions? Call or Email: Nina Koger Environmental Engineer Sr., 515-281-8986, nina.koger@dnr.state.ia.us

Revised 9/05 Form # 542-1277

ELEVATIONS: ± 0.01 FT. MSL
DEPTHS: ± 0.1 FT. FROM GROUND SERFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL).

P-114C



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MONITORING WELL / PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name BLACK HAWK COUNTY LANDFILL	**Permit No.** 07-SDP-01-75P
Well or Piezometer No. P-203A	
Dates Started 3-16-90	**Date Completed** 3-16-90

A. SURVEYED LOCATIONS AND ELEVATIONS	**B. SOIL BORING INFORMATION**
Locations (± 0.5 ft.): N 3618635.45 E 5237505.66	**Name & address of construction company**
Specify corner of site	TWIN CITY TESTING CORPORATION
Distance & direction along boundary	
Distance & direction from boundary to well	
Elevations (± 0.01 ft. MSL):	**Name of driller**
Ground Surface 940.92	**Drilling method**
Top of protective casing	**Drilling fluid**
Top of well casing 943.26	**Bore Hole diameter** 7"
Benchmark elevation	**Soil sampling method**
Benchmark description	**Depth of boring** 38.00'

C. MONITORING WELL INSTALLATION	
Casing material STAINLESS STEEL	**Placement method**
Length of casing	**Volume**
Outside casing diameter 2.375"	**Backfill (if different from seal):**
Inside casing diameter 2"	**Material** VOLCLAY GROUT
Casing joint type FLUSH THREADED; O-RING	**Placement method**
Casing/screen joint type FLUSH THREADED; O-RING	**Volume**
Screen material STAINLESS STEEL	**Surface seal design:** CONCRETE PAD
Screen opening size 0.010 inch	**Material of protective casing:** STEEL
Screen length 5.0'	**Material of grout between protective casing and well casing:** CONCRETE
Depth of Well 38.00'	**Protective cap:**
Filter Pack:	**Material** STEEL
Material 12-40 SILICA SAND	**Vented?: Y/N** YES **Locking?: Y/N** YES
Grain Size	**Well cap:**
Volume 2 - 100 POUND BAGS	**Material** PVC
Seal (minimum 3 ft. length above filter pack):	**Vented?: Y/N** YES
Material BENTONITE PELLETS	

D. GROUNDWATER MEASUREMENT (± 0.01 foot below top of inner well casing)	
Water level	**Stabilization time**
Well development method	
Average depth of frostline	

Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½ inch x 11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed form to: Iowa Department of Natural Resources, Energy and Waste Management Bureau, 502 E. 9th Street, Des Moines, IA 50319-0034.
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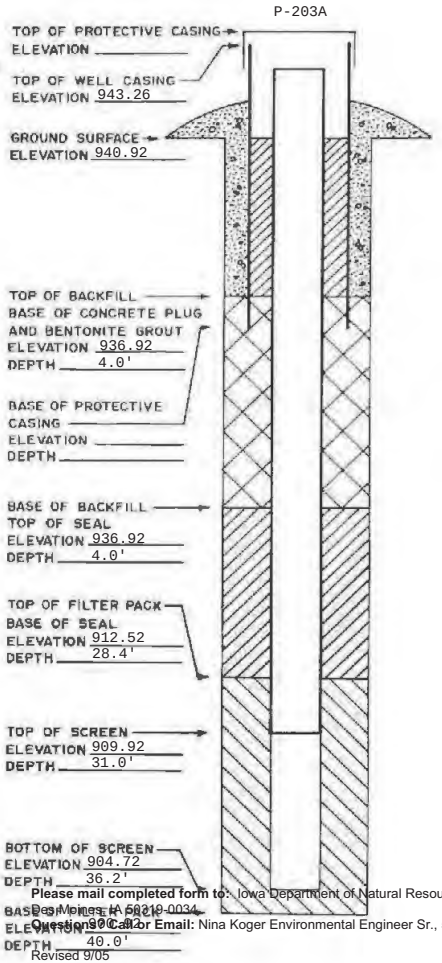
Revised 9/05 Form # 542-1277

ELEVATIONS: ± 0.01 FT. MSL
DEPTHS: ± 0.1 FT. FROM GROUND SERFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL).



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MONITORING WELL / PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name BLACK HAWK COUNTY LANDFILL	**Permit No.** 07-SDP-01-75P
Well or Piezometer No. P-206A	
Dates Started	**Date Completed** 03-23-90

A. SURVEYED LOCATIONS AND ELEVATIONS	**B. SOIL BORING INFORMATION**
Locations (± 0.5 ft.):	**Name & address of construction company**
Specify corner of site	TWIN CITY TESTING
Distance & direction along boundary	
Distance & direction from boundary to well	
Elevations (± 0.01 ft. MSL):	**Name of driller**
Ground Surface 950.45	**Drilling method**
Top of protective casing	**Drilling fluid**
Top of well casing 953.45	**Bore Hole diameter** 7 inch
Benchmark elevation	**Soil sampling method**
Benchmark description	**Depth of boring** 47.0 ft BGS

C. MONITORING WELL INSTALLATION	
Casing material 316 STAINLESS STEEL	**Placement method**
Length of casing	**Volume** 8 GALLONS
Outside casing diameter 2.375 inch	**Backfill (if different from seal):**
Inside casing diameter 2.0 inch	**Material** PURE GOLD BENTONITE GROUT
Casing joint type FLUSH THREADED; O-RING	**Placement method**
Casing/screen joint type FLUSH THREADED; O-RING	**Volume** 150 lbs.
Screen material 316 STAINLESS STEEL	**Surface seal design:**
Screen opening size SLOT 0.010 inches	**Material of protective casing:** STEEL
Screen length 5.0 ft	**Material of grout between protective casing and well casing:** CONCRETE
Depth of Well 46.0 ft BGS	**Protective cap:**
Filter Pack:	**Material** STEEL
Material 12-40 SILICA SAND	**Vented?: Y/N** Y **Locking?: Y/N**
Grain Size	**Well cap:**
Volume	**Material** PVC
Seal (minimum 3 ft. length above filter pack):	**Vented?: Y/N** Y
Material PELLETS	

D. GROUNDWATER MEASUREMENT (± 0.01 foot below top of inner well casing)	
Water level	**Stabilization time**
Well development method	
Average depth of frostline	

Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½ inch x 11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed form to: Iowa Department of Natural Resources, Energy and Waste Management Bureau, 502 E. 9th Street, Des Moines, IA 50319-0034.
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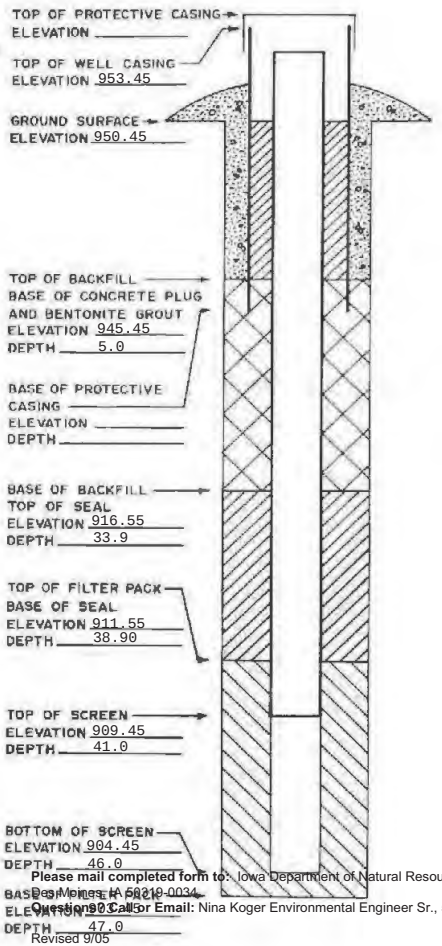
Revised 9/05 Form # 542-1277

ELEVATIONS: ± 0.01 FT. MSL
DEPTHS: ± 0.1 FT. FROM GROUND SERFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL).

P-206A



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MONITORING WELL / PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name BLACK HAWK COUNTY LANDFILL	**Permit No.** 07-SDP-01-75P
Well or Piezometer No. P-207A	
Dates Started	**Date Completed** 01-12-90

A. SURVEYED LOCATIONS AND ELEVATIONS	**B. SOIL BORING INFORMATION**
Locations (± 0.5 ft.):	**Name & address of construction company**
Specify corner of site	TWIN CITY TESTING CORPORATION
Distance & direction along boundary	
Distance & direction from boundary to well	
Elevations (± 0.01 ft. MSL):	**Name of driller**
Ground Surface 933.00	**Drilling method**
Top of protective casing	**Drilling fluid**
Top of well casing 936.71	**Bore Hole diameter** 7 inch
Benchmark elevation	**Soil sampling method**
Benchmark description	**Depth of boring** 71.87 ft BGS

C. MONITORING WELL INSTALLATION	
Casing material STAINLESS STEEL	**Placement method**
Length of casing	**Volume**
Outside casing diameter	**Backfill (if different from seal):**
Inside casing diameter 2.0 inch	**Material** AMERCIAN COLLOID PURE GOLD GROUT
Casing joint type FLUSH THREADED; O-RING	**Placement method**
Casing/screen joint type	**Volume**
Screen material STAINLESS STEEL	**Surface seal design:**
Screen opening size 0.010 inch	**Material of protective casing:** STEEL
Screen length 5.2 ft	**Material of grout between protective casing and well casing:** CONCRETE
Depth of Well 64.57 ft BGS	**Protective cap:**
Filter Pack:	**Material** STEEL
Material SILICA SAND	**Vented?: Y/N** Y **Locking?: Y/N**
Grain Size UNIMIN SIZE #10	**Well cap:**
Volume	**Material** PVC
Seal (minimum 3 ft. length above filter pack):	**Vented?: Y/N** Y
Material BENTONITE PELLET	

D. GROUNDWATER MEASUREMENT (± 0.01 foot below top of inner well casing)	
Water level	**Stabilization time**
Well development method	
Average depth of frostline	

Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½ inch x 11 inch map showing locations of all monitoring wells and piezometers.

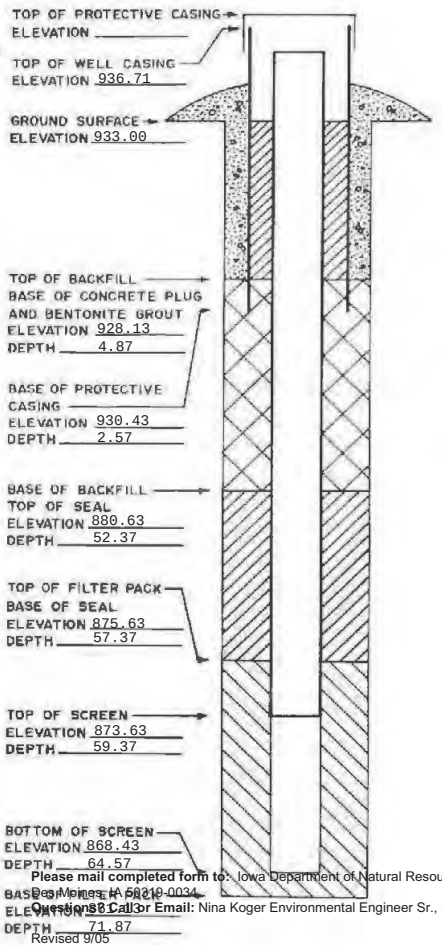
Please mail completed form to: Iowa Department of Natural Resources, Energy and Waste Management Bureau, 502 E. 9th Street, Des Moines, IA 50319-0034.
Questions? Call or Email: Nina Koger Environmental Engineer Sr., 515-281-8986, nina.koger@dnr.state.ia.us

Revised 9/05 Form # 542-1277

ELEVATIONS: ± 0.01 FT. MSL
DEPTHS: ± 0.1 FT. FROM GROUND SERFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL).

P-207A



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MONITORING WELL / PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name BLACK HAWK COUNTY LANDFILL	**Permit No.** 07-SDP-01-75P
Well or Piezometer No. P-208A	
Dates Started	**Date Completed** 10-20-86

A. SURVEYED LOCATIONS AND ELEVATIONS	**B. SOIL BORING INFORMATION**
Locations (± 0.5 ft.):	**Name & address of construction company**
Specify corner of site	TWIN CITY TESTING CORPORATION
Distance & direction along boundary	
Distance & direction from boundary to well	
Elevations (± 0.01 ft. MSL):	**Name of driller**
Ground Surface 926.40	**Drilling method**
Top of protective casing	**Drilling fluid**
Top of well casing 929.09	**Bore Hole diameter** 10 inch
Benchmark elevation	**Soil sampling method**
Benchmark description	**Depth of boring** 53.58 ft BGS

C. MONITORING WELL INSTALLATION	
Casing material STAINLESS STEEL	**Placement method**
Length of casing	**Volume**
Outside casing diameter	**Backfill (if different from seal):**
Inside casing diameter 2.0 inch	**Material** BAROID AQUA-GEL GOLD SEAL BENTONITE GROUT
Casing joint type	**Placement method**
Casing/screen joint type	**Volume**
Screen material STAINLESS STEEL	**Surface seal design:**
Screen opening size 0.010 inches	**Material of protective casing:** STEEL
Screen length 5.2 ft	**Material of grout between protective casing and well casing:** CONCRETE
Depth of Well 52.58 ft BGS	**Protective cap:**
Filter Pack:	**Material** STEEL
Material BADGER BB #1 WELL PACK	**Vented?: Y/N** Y **Locking?: Y/N**
Grain Size	**Well cap:**
Volume	**Material** PVC
Seal (minimum 3 ft. length above filter pack):	**Vented?: Y/N** Y
Material 1/4 inch BENTONITE PELLET	

D. GROUNDWATER MEASUREMENT (± 0.01 foot below top of inner well casing)	
Water level	**Stabilization time**
Well development method	
Average depth of frostline	

Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½ inch x 11 inch map showing locations of all monitoring wells and piezometers.

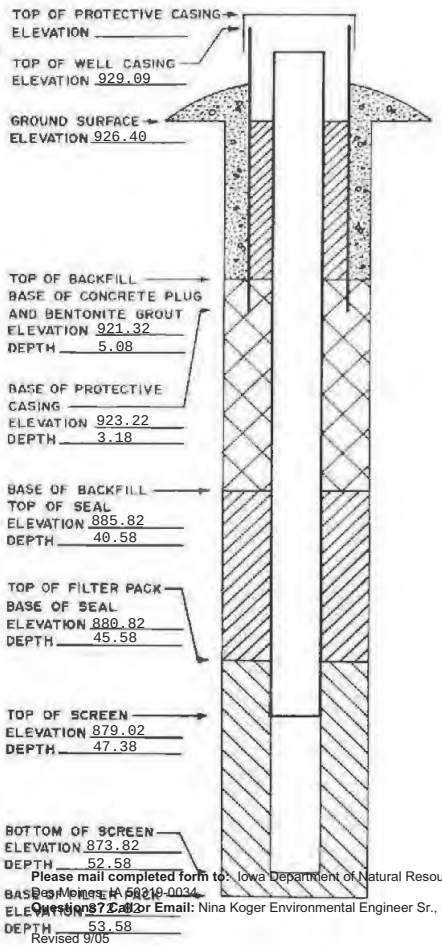
Please mail completed form to: Iowa Department of Natural Resources, Energy and Waste Management Bureau, 502 E. 9th Street, Des Moines, IA 50319-0034.
Questions? Call or Email: Nina Koger Environmental Engineer Sr., 515-281-8986, nina.koger@dnr.state.ia.us

Revised 9/05 Form # 542-1277

ELEVATIONS: ± 0.01 FT. MSL
DEPTHS: ± 0.1 FT. FROM GROUND SERFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL).

P-208A



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Questions? Call or Email: Nina Koger Environmental Engineer Sr., 515-281-8986, nina.koger@dnr.state.ia.us

MONITORING WELL / PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name BLACK HAWK COUNTY LANDFILL	**Permit No.** 07-SDP-01-75P
Well or Piezometer No. P-212A	
Dates Started	**Date Completed** 05-14-92

A. SURVEYED LOCATIONS AND ELEVATIONS	**B. SOIL BORING INFORMATION**
Locations (± 0.5 ft.):	**Name & address of construction company**
Specify corner of site	AQUADRILL, INC.
Distance & direction along boundary	717 EAST 2ND AVE.
Distance & direction from boundary to well	CORALVILLE, IA 52241
Elevations (± 0.01 ft. MSL):	**Name of driller** JEFF JOSLYN
Ground Surface 932.43	**Drilling method** 6-5/8 inch I.D. HSA
Top of protective casing	**Drilling fluid** NONE
Top of well casing 935.36	**Bore Hole diameter** 11 inch
Benchmark elevation	**Soil sampling method** LASKEY SAMPLER
Benchmark description	**Depth of boring** 60 ft BGS

C. MONITORING WELL INSTALLATION	
Casing material TYPE 316 STAINLESS	**Placement method** FREE FALL
Length of casing 52.5 ft	**Volume** 1.6 CF
Outside casing diameter 2.375 inch	**Backfill (if different from seal):**
Inside casing diameter 2.067 inch	**Material** BENTONITE GROUT
Casing joint type O-RING & THREADS	**Placement method** TREMIE TUBE
Casing/screen joint type O-RING & THREADS	**Volume** 20.2 CF
Screen material TYPE 316 STAINLESS	**Surface seal design:**
Screen opening size 0.010 inches	**Material of protective casing:** STEEL
Screen length 5.0 ft	**Material of grout between protective casing and well casing:** CONCRETE
Depth of Well 55.0 ft BGS	**Protective cap:**
Filter Pack:	**Material** STEEL
Material SIEVED SAND	**Vented?: Y/N** **Locking?: Y/N**
Grain Size NORTHERN #0(COARSE)	**Well cap:**
Volume 4 CF	**Material** PVC
Seal (minimum 3 ft. length above filter pack):	**Vented?: Y/N**
Material BENTONITE CHIPS	

D. GROUNDWATER MEASUREMENT (± 0.01 foot below top of inner well casing)	
Water level	**Stabilization time**
Well development method	
Average depth of frostline	

Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½ inch x 11 inch map showing locations of all monitoring wells and piezometers.

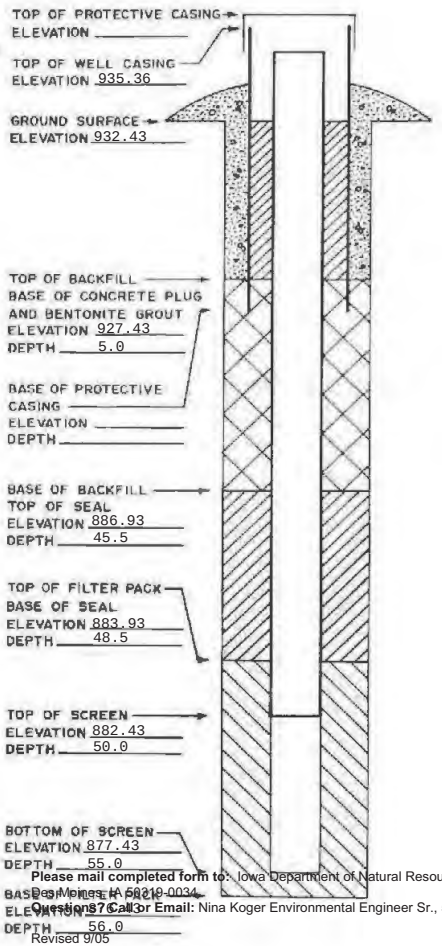
Please mail completed form to: Iowa Department of Natural Resources, Energy and Waste Management Bureau, 502 E. 9th Street, Des Moines, IA 50319-0034.
Questions? Call or Email: Nina Koger Environmental Engineer Sr., 515-281-8986, nina.koger@dnr.state.ia.us

Revised 9/05 Form # 542-1277

ELEVATIONS: ± 0.01 FT. MSL
DEPTHS: ± 0.1 FT. FROM GROUND SERFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL).

P-212A



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MONITORING WELL / PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name BLACK HAWK COUNTY LANDFILL	**Permit No.** 07-SDP-01-75P
Well or Piezometer No. P-213C	
Dates Started	**Date Completed** 05-27-92

A. SURVEYED LOCATIONS AND ELEVATIONS	**B. SOIL BORING INFORMATION**
Locations (± 0.5 ft.): N 3618731.33 E 5239604.25	**Name & address of construction company**
Specify corner of site	AQUADRILL, INC.
Distance & direction along boundary	717 EAST 2ND AVE.
Distance & direction from boundary to well	CORALVILLE, IA 52241
Elevations (± 0.01 ft. MSL):	**Name of driller** JEFF JOSLYN
Ground Surface 941.36	**Drilling method** HSA & ROTARY(9-7/8 inch)
Top of protective casing	**Drilling fluid** POTABLE WATER
Top of well casing 943.29	**Bore Hole diameter** 10 inch
Benchmark elevation	**Soil sampling method** LASKEY SAMPLER
Benchmark description	**Depth of boring** 130.5 ft BGS

C. MONITORING WELL INSTALLATION	
Casing material TYPE 316 STAINLESS	**Placement method** TREMIE TUBE
Length of casing 120.0 ft	**Volume** 23.0 CF
Outside casing diameter 2.375 inch	**Backfill (if different from seal):**
Inside casing diameter 2.067 inch	**Material** BENTONITE GROUT(INSIDE CASING)
Casing joint type O-RING & THREADS	**Placement method** TREMIE TUBE
Casing/screen joint type O-RING & THREADS	**Volume** INCLUDED IN ABOVE
Screen material TYPE 316 STAINLESS	**Surface seal design:**
Screen opening size 0.010 inches	**Material of protective casing:**
Screen length 10.0 ft	**Material of grout between protective casing and well casing:**
Depth of Well 127.5 ft BGS	**Protective cap:**
Filter Pack:	**Material**
Material SIEVED SAND	**Vented?: Y/N** **Locking?: Y/N**
Grain Size NORTHERN #0(COARSE)	**Well cap:**
Volume 3.1 CF	**Material**
Seal (minimum 3 ft. length above filter pack):	**Vented?: Y/N**
Material BENTONITE GROUT(INSIDE CASING)	

D. GROUNDWATER MEASUREMENT (± 0.01 foot below top of inner well casing)	
Water level	**Stabilization time**
Well development method	
Average depth of frostline	

Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½ inch x 11 inch map showing locations of all monitoring wells and piezometers.

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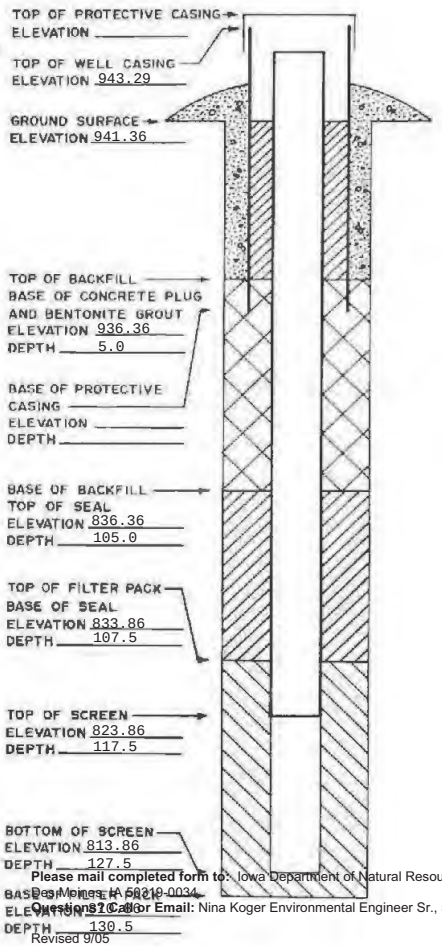
Revised 9/05 Form # 542-1277

ELEVATIONS: ± 0.01 FT. MSL
DEPTHS: ± 0.1 FT. FROM GROUND SERFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL).

P-213C



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MONITORING WELL / PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name BLACK HAWK COUNTY LANDFILL	**Permit No.** 07-SDP-01-75P
Well or Piezometer No. P-214A	
Dates Started	**Date Completed** 12-03-98

A. SURVEYED LOCATIONS AND ELEVATIONS	**B. SOIL BORING INFORMATION**
Locations (± 0.5 ft.): N 3617512.37 E 5240402.17	**Name & address of construction company**
Specify corner of site	MAXIM TECHNOLOGIES, INC.
Distance & direction along boundary	
Distance & direction from boundary to well	
Elevations (± 0.01 ft. MSL):	**Name of driller** TROY NIEDERT
Ground Surface 923.14	**Drilling method**
Top of protective casing	**Drilling fluid**
Top of well casing 925.24	**Bore Hole diameter** 10 inch
Benchmark elevation	**Soil sampling method**
Benchmark description	**Depth of boring** 53.44 ft BGS

C. MONITORING WELL INSTALLATION	
Casing material Sch. 40 STAINLESS STEEL	**Placement method**
Length of casing	**Volume** 1.5 X 50lb. BAGS
Outside casing diameter 2.375 inch	**Backfill (if different from seal):**
Inside casing diameter 2.0 inch	**Material**
Casing joint type FLUSH THREADED; O-RING	**Placement method**
Casing/screen joint type FLUSH THREADED; O-RING	**Volume**
Screen material Sch. 40 STAINLESS STEEL	**Surface seal design:**
Screen opening size #10 SLOT	**Material of protective casing:** STEEL
Screen length 5.0 ft	**Material of grout between protective casing and well casing:** CONCRETE
Depth of Well 51.44 ft BGS	**Protective cap:**
Filter Pack:	**Material** STEEL
Material PURE SILICA SAND	**Vented?: Y/N** Y **Locking?: Y/N** Y
Grain Size T.35-.45	**Well cap:**
Volume 7 X 50lb. BAGS	**Material** PVC
Seal (minimum 3 ft. length above filter pack):	**Vented?: Y/N** Y
Material COLLOID ENVIRONMENTAL TECH. PELLETS	

D. GROUNDWATER MEASUREMENT (± 0.01 foot below top of inner well casing)	
Water level	**Stabilization time**
Well development method	
Average depth of frostline	

Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½ inch x 11 inch map showing locations of all monitoring wells and piezometers.

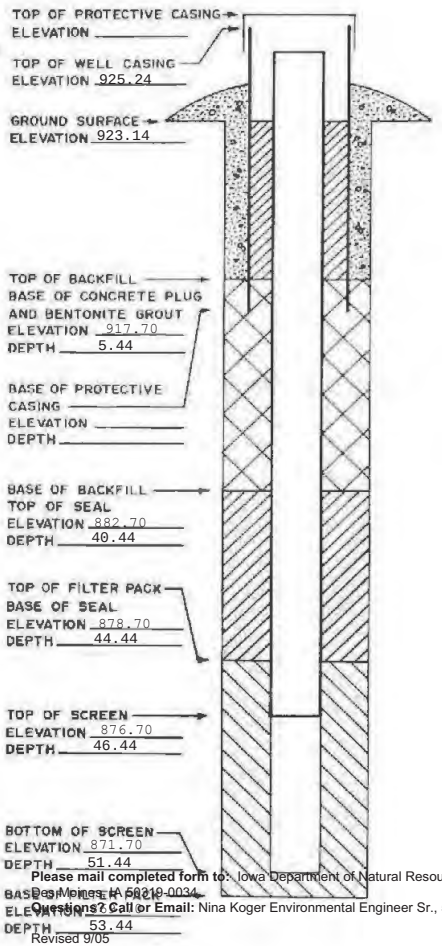
Please mail completed form to: Iowa Department of Natural Resources, Energy and Waste Management Bureau, 502 E. 9th Street, Des Moines, IA 50319-0034.
Questions? Call or Email: Nina Koger Environmental Engineer Sr., 515-281-8986, nina.koger@dnr.state.ia.us

Revised 9/05 Form # 542-1277

ELEVATIONS: ± 0.01 FT. MSL
DEPTHS: ± 0.1 FT. FROM GROUND SERFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL).

P-214A



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Questions? Call or Email: Nina Koger Environmental Engineer Sr., 515-281-8986, nina.koger@dnr.state.ia.us

MONITORING WELL / PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name BLACK HAWK COUNTY LANDFILL	**Permit No.** 07-SDP-01-75P
Well or Piezometer No. P-214C	
Dates Started	**Date Completed** 12-02-98

A. SURVEYED LOCATIONS AND ELEVATIONS	**B. SOIL BORING INFORMATION**
Locations (± 0.5 ft.): N 3617520.17 E 5240401.87	**Name & address of construction company**
Specify corner of site	MAXIM TECHNOLOGIES, INC.
Distance & direction along boundary	
Distance & direction from boundary to well	
Elevations (± 0.01 ft. MSL):	**Name of driller** TROY NIEDERT
Ground Surface 923.20	**Drilling method**
Top of protective casing	**Drilling fluid**
Top of well casing 925.32	**Bore Hole diameter** 6 inch
Benchmark elevation	**Soil sampling method**
Benchmark description	**Depth of boring** 00.0 ft BGS

C. MONITORING WELL INSTALLATION	
Casing material Sch. 40 STAINLESS STEEl	**Placement method**
Length of casing	**Volume** 2.5 X 50lb. BAGS
Outside casing diameter 2.375 inch	**Backfill (if different from seal):**
Inside casing diameter 2.0 inch	**Material**
Casing joint type FLUSH THREADED; O-RING	**Placement method**
Casing/screen joint type FLUSH THREADED; O-RING	**Volume**
Screen material Sch. 40 STAINLESS STEEL	**Surface seal design:**
Screen opening size #10 SLOT	**Material of protective casing:** STEEL
Screen length 10.0 ft	**Material of grout between protective casing and well casing:** CONCRETE
Depth of Well 00.0 ft BGS	**Protective cap:**
Filter Pack:	**Material** STEEL
Material PURE SILICA SAND	**Vented?: Y/N** Y **Locking?: Y/N** Y
Grain Size T.35-.45	**Well cap:**
Volume 7 X 50lb. BAGS	**Material** PVC
Seal (minimum 3 ft. length above filter pack):	**Vented?: Y/N** Y
Material COLLOID ENVIRONMENTAL TECH. PELLETS	

D. GROUNDWATER MEASUREMENT (± 0.01 foot below top of inner well casing)	
Water level	**Stabilization time**
Well development method	
Average depth of frostline	

Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½ inch x 11 inch map showing locations of all monitoring wells and piezometers.

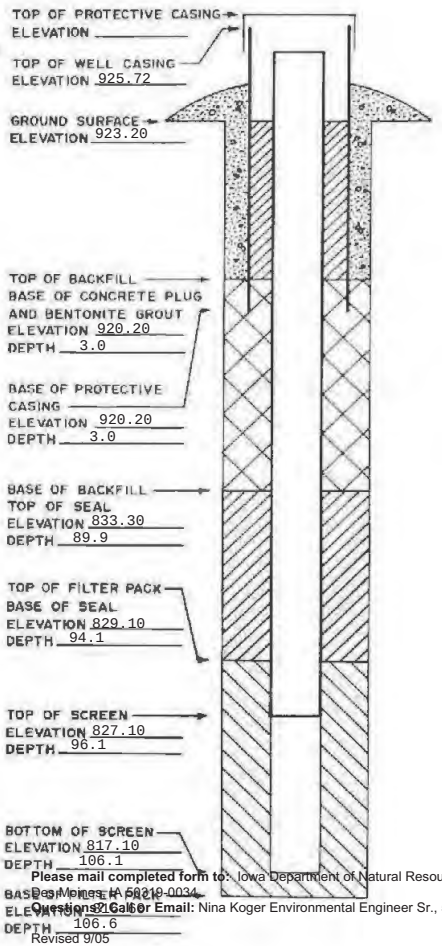
Please mail completed form to: Iowa Department of Natural Resources, Energy and Waste Management Bureau, 502 E. 9th Street, Des Moines, IA 50319-0034.
Questions? Call or Email: Nina Koger Environmental Engineer Sr., 515-281-8986, nina.koger@dnr.state.ia.us

Revised 9/05 Form # 542-1277

ELEVATIONS: ± 0.01 FT. MSL
DEPTHS: ± 0.1 FT. FROM GROUND SERFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL).

P-214C



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Questions? Call or Email: Nina Koger Environmental Engineer Sr., 515-281-8986, nina.koger@dnr.state.ia.us

Revised 9/05

Form # 542-1277

MONITORING WELL / PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name BLACK HAWK COUNTY LANDFILL	**Permit No.** 07-SDP-01-75P
Well or Piezometer No. P-215A	
Dates Started	**Date Completed** 12-21-98

A. SURVEYED LOCATIONS AND ELEVATIONS	**B. SOIL BORING INFORMATION**
Locations (± 0.5 ft.): N 3618070.13 E 5240402.02	**Name & address of construction company**
Specify corner of site	MAXIM TECHNOLOGIES, INC.
Distance & direction along boundary	
Distance & direction from boundary to well	
Elevations (± 0.01 ft. MSL):	**Name of driller** TROY NIEDERT
Ground Surface 932.82	**Drilling method**
Top of protective casing	**Drilling fluid**
Top of well casing 935.07	**Bore Hole diameter** 10 inch
Benchmark elevation	**Soil sampling method**
Benchmark description	**Depth of boring**

C. MONITORING WELL INSTALLATION	
Casing material Sch. 40 STAINLESS STEEl	**Placement method**
Length of casing	**Volume** 2 X 50lb. BAGS
Outside casing diameter 2.375 inch	**Backfill (if different from seal):**
Inside casing diameter 2.0 inch	**Material** BAROID AQUAQUAD BENTONITE GROUT
Casing joint type	**Placement method**
Casing/screen joint type	**Volume** 175lbs.
Screen material Sch. 40 STAINLESS STEEL	**Surface seal design:**
Screen opening size #10 SLOT	**Material of protective casing:** STEEL
Screen length 5.0 ft	**Material of grout between protective casing and well casing:** CONCRETE
Depth of Well	**Protective cap:**
Filter Pack:	**Material** STEEL
Material PURE SILICA SAND	**Vented?: Y/N** Y **Locking?: Y/N** Y
Grain Size T.35-.45	**Well cap:**
Volume 7 X 50lb. BAGS	**Material** PVC
Seal (minimum 3 ft. length above filter pack):	**Vented?: Y/N** Y
Material COLLOID ENVIRONMENTAL TECH. PELLETS	

D. GROUNDWATER MEASUREMENT (± 0.01 foot below top of inner well casing)	
Water level	**Stabilization time**
Well development method	
Average depth of frostline	

Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½ inch x 11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed form to: Iowa Department of Natural Resources, Energy and Waste Management Bureau, 502 E. 9th Street, Des Moines, IA 50319-0034.
Questions? Call or Email: Nina Koger Environmental Engineer Sr., 515-281-8986, nina.koger@dnr.state.ia.us

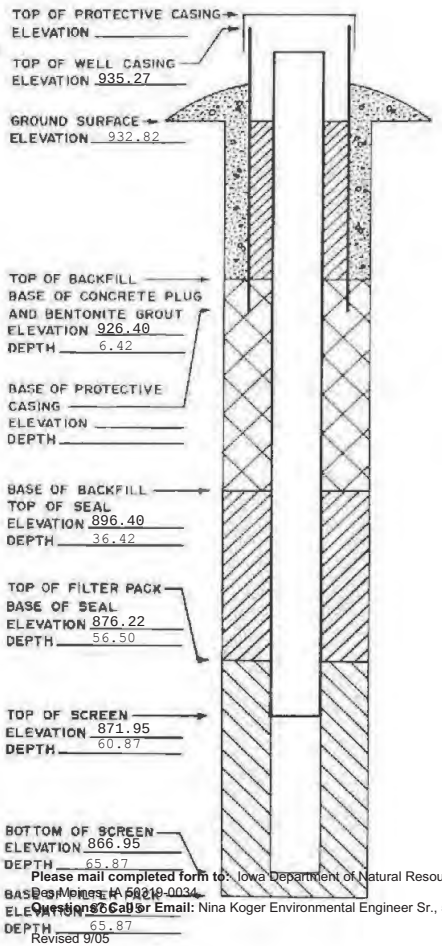
Revised 9/05

Form # 542-1277

ELEVATIONS: ± 0.01 FT. MSL
DEPTHS: ± 0.1 FT. FROM GROUND SERFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL).

P-215A



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Questions? Call or Email: Nina Koger Environmental Engineer Sr., 515-281-8986, nina.koger@dnr.state.ia.us

MONITORING WELL / PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name BLACK HAWK COUNTY LANDFILL	**Permit No.** 07-SDP-01-75P
Well or Piezometer No. P-215C	
Dates Started	**Date Completed** 12-21-98

A. SURVEYED LOCATIONS AND ELEVATIONS	**B. SOIL BORING INFORMATION**
Locations (± 0.5 ft.): N 3618077.58 E 5240402.14	**Name & address of construction company**
Specify corner of site	MAXIM TECHNOLOGIES, INC.
Distance & direction along boundary	
Distance & direction from boundary to well	
Elevations (± 0.01 ft. MSL):	**Name of driller** TROY NIEDERT
Ground Surface 933.05	**Drilling method**
Top of protective casing	**Drilling fluid**
Top of well casing 935.57	**Bore Hole diameter** 6 inch
Benchmark elevation	**Soil sampling method**
Benchmark description	**Depth of boring**

C. MONITORING WELL INSTALLATION	
Casing material Sch. 40 STAINLESS STEEl	**Placement method**
Length of casing	**Volume** 1 X 50lb. BAGS
Outside casing diameter 2.375 inch	**Backfill (if different from seal):**
Inside casing diameter 2.0 inch	**Material** BAROID AQUAQUAD BENTONITE GROUT
Casing joint type	**Placement method**
Casing/screen joint type	**Volume** 175lbs.
Screen material Sch. 40 STAINLESS STEEL	**Surface seal design:**
Screen opening size #10 SLOT	**Material of protective casing:** STEEL
Screen length 10.0 ft	**Material of grout between protective casing and well casing:** CONCRETE
Depth of Well	**Protective cap:**
Filter Pack:	**Material** STEEL
Material PURE SILICA SAND	**Vented?: Y/N** Y **Locking?: Y/N** Y
Grain Size T.35-.45	**Well cap:**
Volume 5 X 50lb. BAGS	**Material** PVC
Seal (minimum 3 ft. length above filter pack):	**Vented?: Y/N** Y
Material COLLOID ENVIRONMENTAL TECH. PELLETS	

D. GROUNDWATER MEASUREMENT (± 0.01 foot below top of inner well casing)	
Water level	**Stabilization time**
Well development method	
Average depth of frostline	

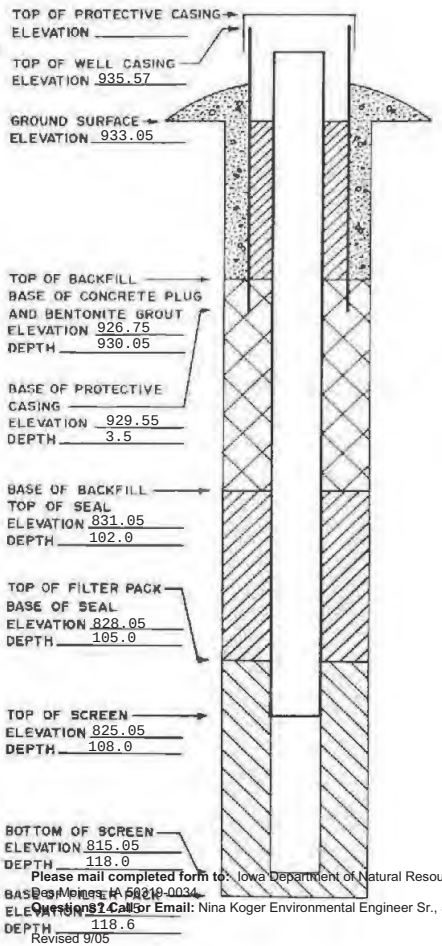
Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½ inch x 11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed form to: Iowa Department of Natural Resources, Energy and Waste Management Bureau, 502 E. 9th Street, Des Moines, IA 50319-0034.
Questions? Call or Email: Nina Koger Environmental Engineer Sr., 515-281-8986, nina.koger@dnr.state.ia.us

ELEVATIONS: ± 0.01 FT. MSL
DEPTHS: ± 0.1 FT. FROM GROUND SERFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL).

P-215C



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MONITORING WELL / PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name BLACK HAWK COUNTY LANDFILL	**Permit No.** 07-SDP-01-75P
Well or Piezometer No. P-216A	
Dates Started	**Date Completed** 12-04-98

A. SURVEYED LOCATIONS AND ELEVATIONS	**B. SOIL BORING INFORMATION**
Locations (± 0.5 ft.): N 3618611.72 E 5240395.73	**Name & address of construction company**
Specify corner of site	MAXIM TECHNOLOGIES, INC
Distance & direction along boundary	
Distance & direction from boundary to well	
Elevations (± 0.01 ft. MSL):	**Name of driller** TROY NIEDERT
Ground Surface 940.55	**Drilling method**
Top of protective casing	**Drilling fluid**
Top of well casing 942.70	**Bore Hole diameter** 10 inch
Benchmark elevation	**Soil sampling method**
Benchmark description	**Depth of boring** 65.0 ft BGS

C. MONITORING WELL INSTALLATION	
Casing material STAINLESS STEEL	**Placement method**
Length of casing	**Volume** 1.5 X 50 lbs BAGS
Outside casing diameter 2.375 inch	**Backfill (if different from seal):**
Inside casing diameter 2.0 inch	**Material** BAROID AQUAQUAD BENTONITE GROUT
Casing joint type FLUSH THREADED; O-RING	**Placement method**
Casing/screen joint type	**Volume** 400 lbs
Screen material STAINLESS STEEL	**Surface seal design:**
Screen opening size #10 SLOT	**Material of protective casing:** STEEL
Screen length 5.0 ft	**Material of grout between protective casing and well casing:** CONCRETE
Depth of Well 65.0 ft BGS	**Protective cap:**
Filter Pack:	**Material** STEEL
Material PURE SILICA SAND	**Vented?: Y/N** Y **Locking?: Y/N** Y
Grain Size T .35-.45	**Well cap:**
Volume 5 X 50 lbs BAGS	**Material** STEEL
Seal (minimum 3 ft. length above filter pack):	**Vented?: Y/N** Y
Material COLLOID ENVIRONMENTAL TECH. PELLETS	

D. GROUNDWATER MEASUREMENT (± 0.01 foot below top of inner well casing)	
Water level	**Stabilization time**
Well development method	
Average depth of frostline	

Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½ inch x 11 inch map showing locations of all monitoring wells and piezometers.

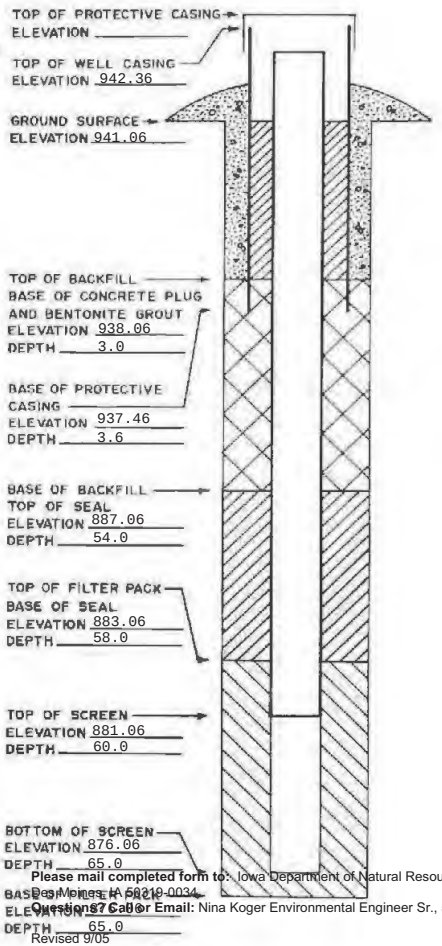
Please mail completed form to: Iowa Department of Natural Resources, Energy and Waste Management Bureau, 502 E. 9th Street, Des Moines, IA 50319-0034.
Questions? Call or Email: Nina Koger Environmental Engineer Sr., 515-281-8986, nina.koger@dnr.state.ia.us

Revised 9/05 Form # 542-1277

ELEVATIONS: ± 0.01 FT. MSL
DEPTHS: ± 0.1 FT. FROM GROUND SERFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL).

P-216A



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Questions? Call or Email: Nina Koger Environmental Engineer Sr., 515-281-8986, nina.koger@dnr.state.ia.us

MONITORING WELL / PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name BLACK HAWK COUNTY LANDFILL	**Permit No.** 07-SDP-01-75P
Well or Piezometer No. P-216C	
Dates Started	**Date Completed** 12-17-98

A. SURVEYED LOCATIONS AND ELEVATIONS	**B. SOIL BORING INFORMATION**
Locations (± 0.5 ft.): N 618619.09 E 5240396.25	**Name & address of construction company**
Specify corner of site	MAXIM TECHNOLOGIES, INC
Distance & direction along boundary	
Distance & direction from boundary to well	
Elevations (± 0.01 ft. MSL):	**Name of driller** TROY NIEDERT
Ground Surface 941.10	**Drilling method**
Top of protective casing	**Drilling fluid**
Top of well casing 943.10	**Bore Hole diameter** 6 inch
Benchmark elevation	**Soil sampling method**
Benchmark description	**Depth of boring** EX ft BGS

C. MONITORING WELL INSTALLATION	
Casing material STAINLESS STEEL	**Placement method**
Length of casing	**Volume** 1 X 50 lbs BAGS
Outside casing diameter 2.375 inch	**Backfill (if different from seal):**
Inside casing diameter 2.0 inch	**Material** BAROID AQUAQUAD BENTONITE GROUT
Casing joint type FLUSH THREADED; O-RING	**Placement method**
Casing/screen joint type	**Volume** 350 lbs
Screen material STAINLESS STEEL	**Surface seal design:**
Screen opening size #10 SLOT	**Material of protective casing:** STEEL
Screen length 10.0 ft	**Material of grout between protective casing and well casing:** CONCRETE
Depth of Well 134.20 ft BGS	**Protective cap:**
Filter Pack:	**Material** STEEL
Material PURE SILICA SAND	**Vented?: Y/N** Y **Locking?: Y/N** Y
Grain Size T .35-.45	**Well cap:**
Volume 5.5 X 50 lbs BAGS	**Material** STEEL
Seal (minimum 3 ft. length above filter pack):	**Vented?: Y/N** Y
Material COLLOID ENVIRONMENTAL TECH. PELLETS	

D. GROUNDWATER MEASUREMENT (± 0.01 foot below top of inner well casing)	
Water level	**Stabilization time**
Well development method	
Average depth of frostline	

Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½ inch x 11 inch map showing locations of all monitoring wells and piezometers.

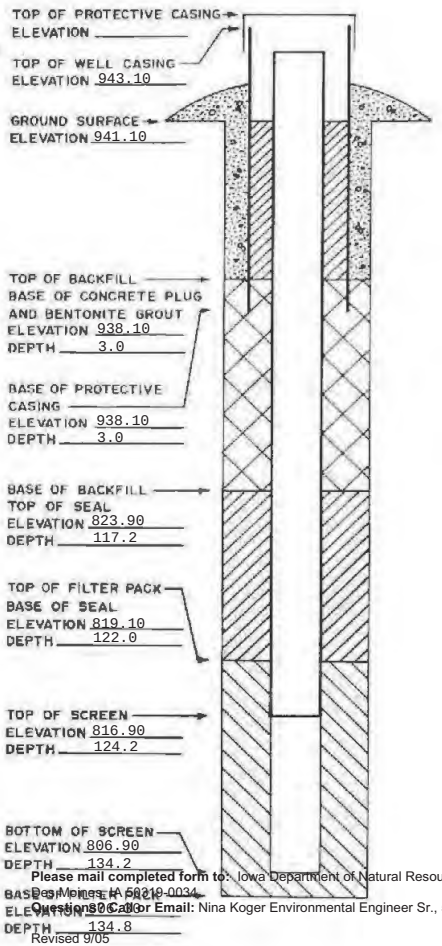
Please mail completed form to: Iowa Department of Natural Resources, Energy and Waste Management Bureau, 502 E. 9th Street, Des Moines, IA 50319-0034.
Questions? Call or Email: Nina Koger Environmental Engineer Sr., 515-281-8986, nina.koger@dnr.state.ia.us

Revised 9/05 Form # 542-1277

ELEVATIONS: ± 0.01 FT. MSL
DEPTHS: ± 0.1 FT. FROM GROUND SERFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL).

P-216C



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Questions? Call or Email: Nina Koger Environmental Engineer Sr., 515-281-8986, nina.koger@dnr.state.ia.us

Revised 9/05

Form # 542-1277

IOWA DEPARTMENT OF NATURAL RESOURCES

MONITORING WELL/PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name: Black Hawk Co Land Fill Permit No.: 7-SDP-1-75P

Well or Piezometer No: P-402A

Dates Started: 11/16/2016 Date Completed: 11/16/2016

A. SURVEYED LOCATIONS AND ELEVATIONS

Locations (± 0.5 ft): N - 3617459.5, E - 5237824.2
Specify corner of site:
Distance & direction along boundary:
Distance & direction from boundary to wall:
Elevations (± 0.01 ft MSL):
Ground Surface: 952.80
Top of protective casing:
Top of well casing: 955.27
Benchmark elevation:
Benchmark description:

B. SOIL BORING INFORMATION

Name & Address of Construction Company:
Terracon
6612 Chancellor Drive Suite 102
Cedar Falls IA 50613
Name of Driller: Ron Faulk
Drilling Methnd: 4 1/4" HSA
Drilling Fluid: City of Cedar Falls Water
Bore Hole Diameter: 8.25"
Soil Sampling Method: 2' split spoon
Depth of Boring: 52'

C. MONITORING WELL INSTALLATION

Casing material: Type 304 Stainless Steel
Length of casing: 49.3'
Outside casing diameter: 2.375"
Inside casing diameter: 2.157"
Casing joint type: flush threaded
Casing/screen joint type: flush threaded
Screen material: Type 304 Stainless Steel
Screen opening size: 0.010"
Screen length: 10'
Depth of well: 51'
Filter Pack:
Material: Filter Pack Sand
Grain size: 0.007-0.250"
Volume:
Seal (minimum 3 ft length above filter pack): 3.5'
Material: Bentonite Chips 3/8" hole plug

Placement method: direct pour
Volume: 5 gal
Backfill (if different from seal):
Material: Quick Grout
Placement method: Tremie pipe
Volume: 63 gal.
Surface seal design: 3/8" hole plug
Material of protective casing: Steel
Material of grout between protective casing and well casing: 3/8" hole plug
Protective cap:
Material: Steel
Vented: ☐ Yes ☐ No Locking: ☑ Yes ☐ No
Well Cap:
Material: PVC
Vented: ☐ Yes ☑ No

D. GROUNDWATER MEASURMENT (± 0.01 ft below top of inner well casing)

Water level: 32.58 ft Stabilization Time:
Well development method: Bailed and Pumped
Average depth of frostline:

Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½x11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed for to: Iowa Department of Natural Resources, Land Quality Bureau, 502 E 9th St, Des Moines IA 50319-0034.

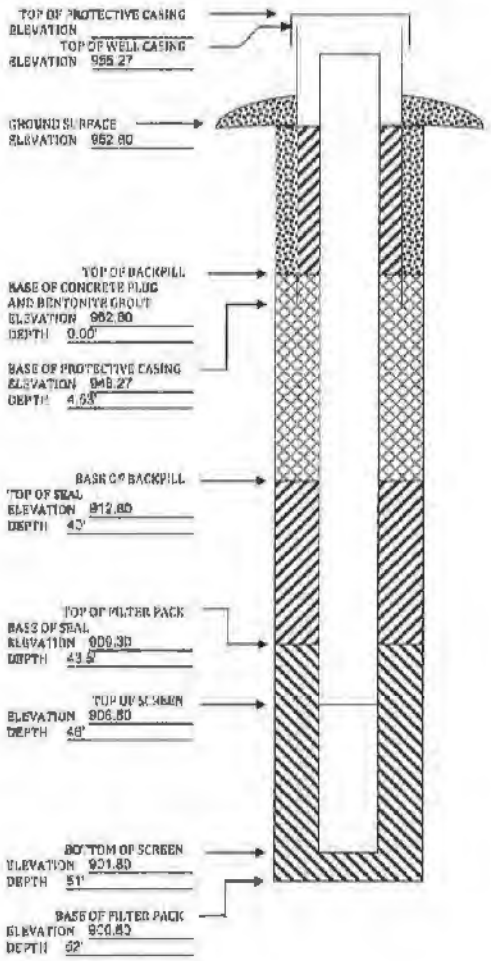
Questions? Call or Email: Nina Koger, Environmental Engineer Sr., 515-281-8986, Nina.Koger@dnr.iowa.gov

06/2011 cmz

DNR Form 542-1277

ELEVATIONS: ± 0.01 ft MSL
DEPTHS: ± 0.1 ft FROM GROUND SURFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL.)



IOWA DEPARTMENT OF NATURAL RESOURCES

MONITORING WELL/PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name: Black Hawk Co Land Fill Permit No.: 7-SDP-1-78P

Well or Piezometer No: P-402C

Dates Started: 11/9/2016 Date Completed: 11/16/2016

A. SURVEYED LOCATIONS AND ELEVATIONS

Locations (± 0.5 ft): N - 3617467.9, E - 5237824.0

Specify corner of site:

Distance & direction along boundary:

Distance & direction from boundary to wall:

Elevations (± 0.01 ft MSL):

Ground Surface: 952.30

Top of protective casing:

Top of well casing: 955.25

Benchmark elevation:

Benchmark description:

B. SOIL BORING INFORMATION

Name & Address of Construction Company:
Terracon
6612 Chancellor Drive Suite 102
Cedar Falls IA 50613

Name of Driller: Ron Faulk

Drilling Method: 4 1/4" HSA; 8" tricone; NQ rock core

Drilling Fluid: City of Cedar Falls Water

Bore Hole Diameter: 8.25"

Soil Sampling Method: 2' split spoon; rock core

Depth of Boring: 133'

C. MONITORING WELL INSTALLATION

Casing material: Type 304 Stainless Steel

Length of casing: 123.7'

Outside casing diameter: 2.375"

Inside casing diameter: 2.157"

Casing joint: type: flush threaded

Casing/screen joint type: flush threaded

Screen material: Type 304 Stainless Steel

Screen opening size: 0.010"

Screen length: 10'

Depth of well: 51'

Filter Pack:

Material: Filter Pack Sand

Grain size: 0.007-0.250"

Volume: 18 gal

Seal (minimum 3 ft length above filter pack): 3.5

Material: Bentonite Chips 3/8" hole plug

Placement method: direct pour

Volume: 5 gal

Backfill (if different from seal):

Material: Quick Grout

Placement method: Tremie pipe

Volume: 150 gal

Surface seal design: 3/8" hole plug

Material of protective casing: Steel

Material of grout between protective casing and well casing: 3/8" hole plug

Protective cap:

Material: Steel

Vented: ☐ Yes ☐ No Locking: ☒ Yes ☐ No

Well Cap:

Material: PVC

Vented: ☐ Yes ☒ No

D. GROUNDWATER MEASURMENT (± 0.01 ft below top of inner well casing)

Water level: 113.64 ft Stabilization Time:

Well development method: Bailed and Pumped

Average depth of frostline:

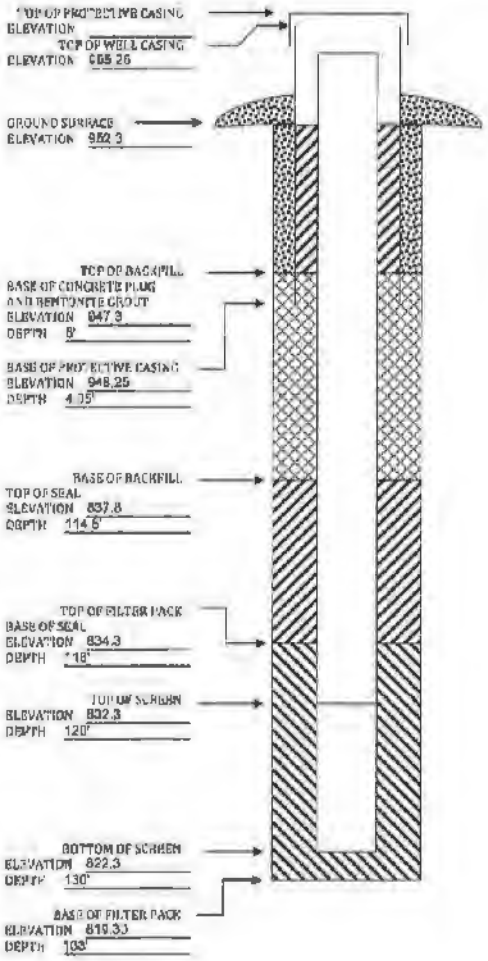
Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½x11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed for to: Iowa Department of Natural Resources, Land Quality Bureau, 502 E 9th St, Des Moines IA 50319-0034.

Questions? Call or Email: Nina Koger, Environmental Engineer Sr., 515-281-8986, Nina.Koger@dnr.iowa.gov

ELEVATIONS: ± 0.01 ft MSL
DEPTHS: ± 0.1 ft FROM GROUND SURFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL.)



Print Form

IOWA DEPARTMENT OF NATURAL RESOURCES

MONITORING WELL/PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name: Black Hawk Co Land Fill Permit No.: 7-SDP-1-75P

Well or Piezometer No: P-604C

Dates Started: 10/30/2014 Date Completed: 11/5/2014

A. SURVEYED LOCATIONS AND ELEVATIONS

Locations (± 0.5 ft): N - 3617474.8, E - 5235286.4

Specify corner of site:

Distance & direction along boundary:

Distance & direction from boundary to wall:

Elevations (± 0.01 ft MSL):

Ground Surface: 932.00

Top of protective casing: 935.10

Top of well casing: 934.71

Benchmark elevation:

Benchmark description:

B. SOIL BORING INFORMATION

Name & Address of Construction Company:
Terracon
6612 Chancellor Drive Suite 102
Cedar Falls IA 50613

Name of Driller: Ron Faulk

Drilling Method: 6 1/4 HSA to 35', 6" tricone to 121.5'

Drilling Fluid: NA with HSA, Water with tricone

Bore Hole Diameter: 9.5" to 35', 6" 35'-121.5'

Soil Sampling Method: 2 ft split spoon

Depth of Boring: 121.5 ft bgs

C. MONITORING WELL INSTALLATION

Casing material: Stainless Steel

Length of casing: 116.71 ft

Outside casing diameter: 2 1/4 in

Inside casing diameter: 2 in

Casing joint type: flush threaded

Casing/screen joint type: flush threaded

Screen material: Stainless Steel

Screen opening size: No. 10 Slot

Screen length: 5 ft

Depth of well: 119 ft bgs

Filter Pack:

Material: Coarse Sand

Grain size: see attached grain size curve

Volume: 1.83 cu. ft

Seal (minimum 3 ft length above filter pack):

Material: Bentonite Chips 3/8" hole plug

Placement method: direct pour

Volume: 1.48 cu. ft

Backfill (if different from seal):

Material: Quick Grout

Placement method: Tremie pipe

Volume: 29.61 cu. ft

Surface seal design:

Material of protective casing: Steel

Material of grout between protective casing and well casing: 3/8" Bentonite chips

Protective cap:

Material: Steel

Vented: ☐ Yes ☐ No Locking: ☒ Yes ☐ No

Well Cap:

Material: PVC

Vented: ☐ Yes ☒ No

D. GROUNDWATER MEASURMENT (± 0.01 ft below top of inner well casing)

Water level: 95.54 ft Stabilization Time:

Well development method: Bailed and Pumped

Average depth of frostline:

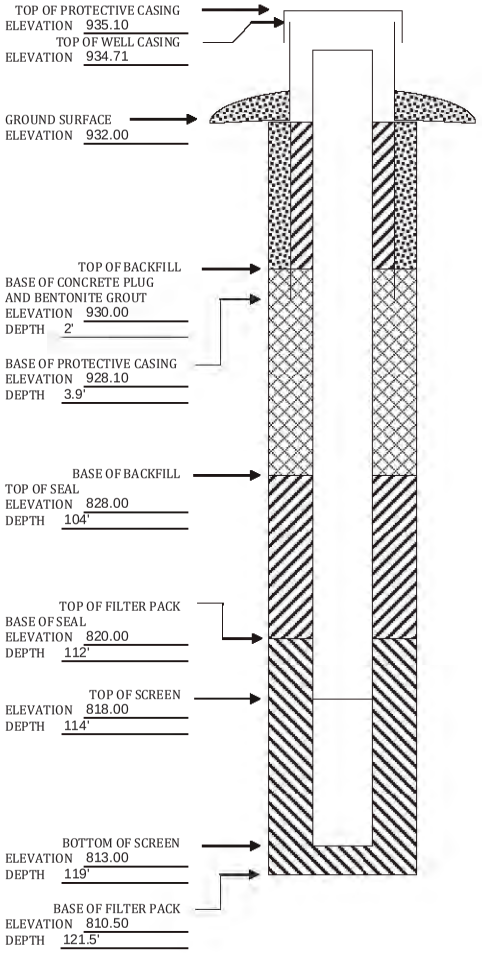
Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½x11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed for to: Iowa Department of Natural Resources, Land Quality Bureau, 502 E 9th St, Des Moines IA 50319-0034.

Questions? Call or Email: Nina Koger, Environmental Engineer Sr., 515-281-8986, Nina.Koger@dnr.iowa.gov

ELEVATIONS: ± 0.01 ft MSL
DEPTHS: ± 0.1 ft FROM GROUND SURFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL.)

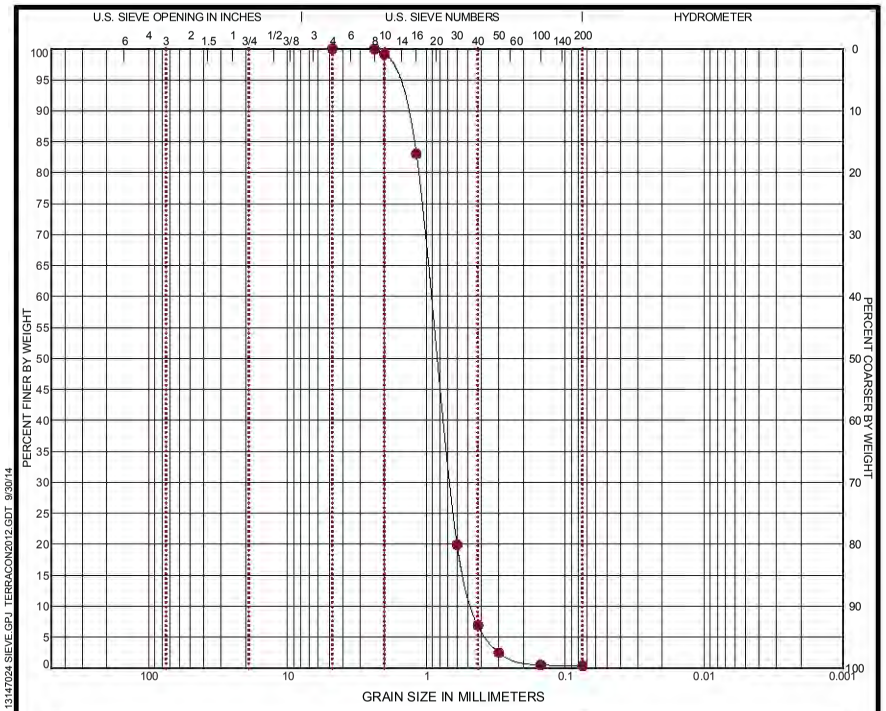


06/2011 cmz

DNR Form 542-1277

GRAIN SIZE DISTRIBUTION

ASTM D422



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

BORING ID	DEPTH	% COBBLES	% GRAVEL	% SAND	% SILT	% FINES	% CLAY	USCS
1	0	0.0	0.0	99.6		0.4		SP

GRAIN SIZE	
D_{60}	0.922
D_{30}	0.668
D_{10}	0.461
COEFFICIENTS	
C_C	1.05
C_U	2.00

SIEVE (size)	PERCENT FINER

SOIL DESCRIPTION
BMC Coarse

REMARKS

PROJECT: Black Hawk County Landfill

SITE:

Terracon
6612 Chancellor Drive, Suite 102
Cedar Falls, Iowa

PROJECT NUMBER: 13147024

CLIENT:

EXHIBIT: B-1

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS 1 13147024 SIEVE.GPJ TERRACON2012.GDT 9/30/14

IOWA DEPARTMENT OF NATURAL RESOURCES

MONITORING WELL/PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name: Black Hawk Co Land Fill Permit No.: 7-SDP-1-75P

Well or Piezometer No: OW-410B

Dates Started: 11/9/2016 Date Completed: 11/9/2016

A. SURVEYED LOCATIONS AND ELEVATIONS

Locations (± 0.5 ft): N - 3616980.5, E - 5237825.5

Specify corner of site:

Distance & direction along boundary:

Distance & direction from boundary to well:

Elevations (± 0.01 ft MSL):

Ground Surface: 949.9

Top of protective casing:

Top of well casing: 952.85

Benchmark elevation:

Benchmark description:

B. SOIL BORING INFORMATION

Name & Address of Construction Company:
Terracon
6612 Chancellor Drive Suite 102
Cedar Falls IA 50613

Name of Driller: Ron Faulk

Drilling Method: 4 1/4" HSA

Drilling Fluid: NA

Bore Hole Diameter: 8.25"

Soil Sampling Method: 2' split spoon

Depth of Boring: 26.5'

C. MONITORING WELL INSTALLATION

Casing material: Type 304 Stainless Steel

Length of casing: 14.9'

Outside casing diameter: 2.375"

Inside casing diameter: 2.157"

Casing joint type: flush threaded

Casing/screen joint type: flush threaded

Screen material: Type 304 Stainless Steel

Screen opening size: 0.010"

Screen length: 10'

Depth of well: 22'

Filter Pack:

Material: Filter Pack Sand

Grain size: 0.007-0.250"

Volume: 40 gal

Seal (minimum 3 ft length above filter pack): 10'

Material: Bentonite Chips 3/8" hole plug

Placement method: direct pour

Volume: 25 gal

Backfill (if different from seal):

Material:

Placement method:

Volume:

Surface seal design: 3/8" hole plug

Material of protective casing: Steel

Material of grout between protective casing and well casing: 3/8" hole plug

Protective cap:

Material: Steel

Vented: ☐ Yes ☐ No Locking: ☑ Yes ☐ No

Well Cap:

Material: PVC

Vented: ☐ Yes ☑ No

D. GROUNDWATER MEASURMENT (± 0.01 ft below top of inner well casing)

Water level: 13.80 ft Stabilization Time:

Well development method: Bailed and Pumped

Average depth of frostline:

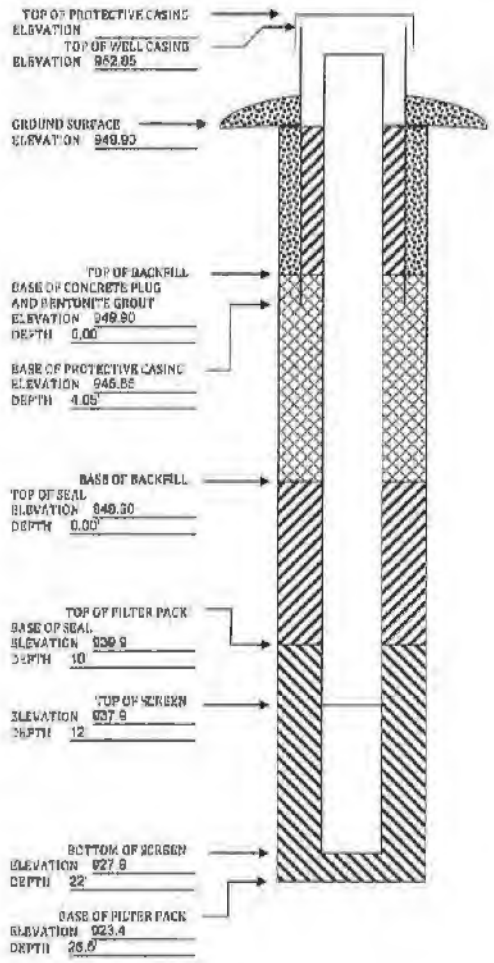
Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½x11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed for to: Iowa Department of Natural Resources, Land Quality Bureau, 502 E 9th St, Des Moines IA 50319-0034.

Questions? Call or Email: Nina Koger, Environmental Engineer Sr., 515-281-8986, Nina.Koger@dnr.iowa.gov

ELEVATIONS: ± 0.01 ft MSL
DEPTHS: ± 0.1 ft FROM GROUND SURFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL)



IOWA DEPARTMENT OF NATURAL RESOURCES

MONITORING WELL/PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name: Black Hawk Co Land Fill Permit No.: 7-SDP-1-75P

Well or Piezometer No: OW-411B

Dates Started: 11/8/2016 Date Completed: 11/8/2016

A. SURVEYED LOCATIONS AND ELEVATIONS

Locations (± 0.5 ft): N - 3617179.6, E - 5237771.9

Specify corner of site:

Distance & direction along boundary:

Distance & direction from boundary to well:

Elevations (± 0.01 ft MSL):

Ground Surface: 964.40

Top of protective casing:

Top of well casing: 967.30

Benchmark elevation:

Benchmark description:

B. SOIL BORING INFORMATION

Name & Address of Construction Company:
Terracon
6612 Chancellor Drive Suite 102
Cedar Falls IA 50613

Name of Driller: Ron Faulk

Drilling Method: 4 1/4" HSA

Drilling Fluid: NA

Bore Hole Diameter: 8.25"

Soil Sampling Method: 2' split spoon

Depth of Boring: 34.5'

C. MONITORING WELL INSTALLATION

Casing material: Type 304 Stainless Steel

Length of casing: 17.04'

Outside casing diameter: 2.375"

Inside casing diameter: 2.157"

Casing joint type: flush threaded

Casing/screen joint type: flush threaded

Screen material: Type 304 Stainless Steel

Screen opening size: 0.010"

Screen length: 10'

Depth of well: 34'

Filter Pack:

Material: Filter Pack Sand

Grain size: 0.007-0.250"

Volume: 31 gal.

Seal (minimum 3 ft length above filter pack): 22'

Material: Bentonite Chips 3/8" hole plug

Placement method: direct pour

Volume: 54 gal.

Backfill (if different from seal):

Material:

Placement method:

Volume:

Surface seal design: 3/8" hole plug

Material of protective casing: Steel

Material of grout between protective casing and well casing: 3/8" hole plug

Protective cap:

Material: Steel

Vented: ☐ Yes ☐ No Locking: ☒ Yes ☐ No

Well Cap:

Material: PVC

Vented: ☐ Yes ☒ No

D. GROUNDWATER MEASUREMENT (± 0.01 ft below top of inner well casing)

Water level: 33.01 ft Stabilization Time:

Well development method: Bailed

Average depth of frostline:

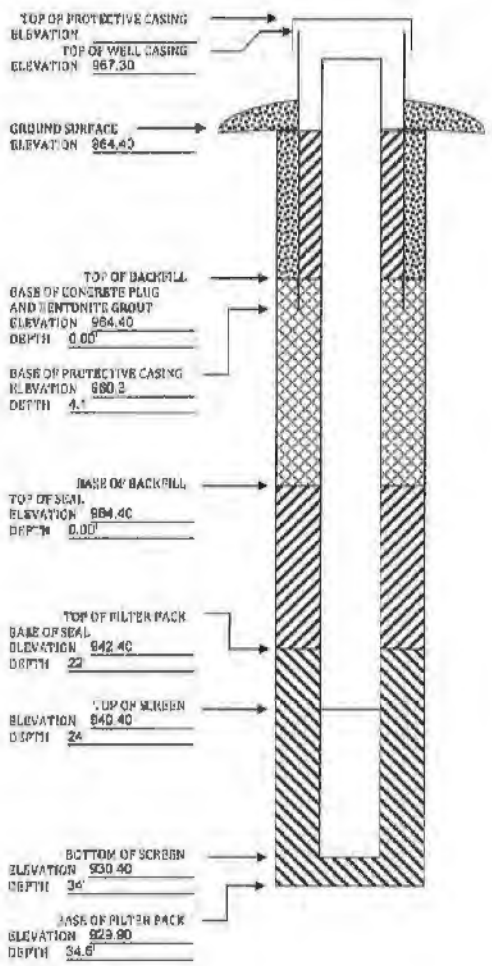
Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½x11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed for to: Iowa Department of Natural Resources, Land Quality Bureau, 502 E 9th St, Des Moines IA 50319-0034.

Questions? Call or Email: Nina Koger, Environmental Engineer Sr, 515-281-6986, Nina.Koger@dnr.iowa.gov

ELEVATIONS: ± 0.01 ft MSL
DEPTHS: ± 0.1 ft FROM GROUND SURFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL)



06/2011.cmz DNR Form 542-1277

IOWA DEPARTMENT OF NATURAL RESOURCES
MONITORING WELL/PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name: Black Hawk Co Land Fill Permit No.: 7-SDP-1-75P

Well or Piezometer No: OW-412B

Dates Started: 11/8/2016 Date Completed: 11/8/2016

A. SURVEYED LOCATIONS AND ELEVATIONS

Locations (± 0.5 ft): N - 3617481.7, E - 6237772.5

Specify corner of site:

Distance & direction along boundary:

Distance & direction from boundary to well:

Elevations (± 0.01 ft MSL):

Ground Surface: 956.40

Top of protective casing:

Top of well casing: 959.45

Benchmark elevation:

Benchmark description:

B. SOIL BORING INFORMATION

Name & Address of Construction Company:
Terracon
6612 Chancellor Drive Suite 102
Cedar Falls IA 50613

Name of Driller: Ron Faulk

Drilling Method: 4 1/4" HSA

Drilling Fluid: NA

Bore Hole Diameter: 8.25"

Soil Sampling Method: 2' split spoon

Depth of Boring: 34.5'

C. MONITORING WELL INSTALLATION

Casing material: Type 304 Stainless Steel

Length of casing: 22.79'

Outside casing diameter: 2.376"

Inside casing diameter: 2.157"

Casing joint type: flush threaded

Casing/screen joint type: flush threaded

Screen material: Type 304 Stainless Steel

Screen opening size: 0.010"

Screen length: 10'

Depth of well: 34'

Filter Pack:

Material: Filter Pack Sand

Grain size: 0.007-0.250"

Volume: 41 gal.

Seal (minimum 3 ft length above filter pack): 18'

Material: Bentonite Chips 3/8" hole plug

Placement method: direct pour

Volume: 44 gal.

Backfill (if different from seal):

Material:

Placement method:

Volume:

Surface seal design: 3/8" hole plug

Material of protective casing: Steel

Material of grout between protective casing and well casing: 3/8" hole plug

Protective cap:

Material: Steel

Vented: ☐ Yes ☐ No Locking: ☒ Yes ☐ No

Well Cap:

Material: PVC

Vented: ☐ Yes ☒ No

D. GROUNDWATER MEASURMENT (± 0.01 ft below top of inner well casing)

Water level: 21.15 ft Stabilization Time:

Well development method: Bailed and Pumped

Average depth of frostline:

Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½x11 inch map showing locations of all monitoring wells and piezometers.

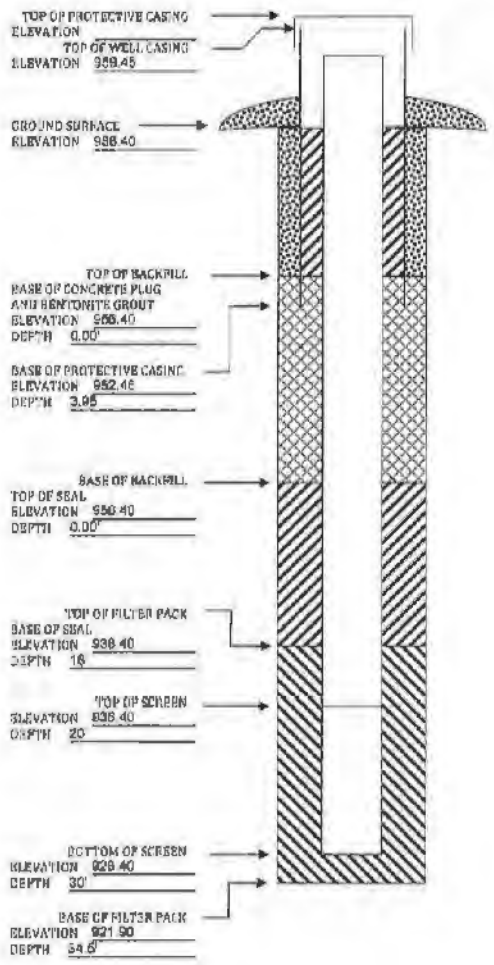
Please mail completed for to: Iowa Department of Natural Resources, Land Quality Bureau, 502 E 9th St, Des Moines IA 50319-0034.

Questions? Call or Email: Nina Koger, Environmental Engineer Sr., 515-281-8986, Nina.Koger@dnr.iowa.gov

05/2011 cmz DNR Form 542-1277

ELEVATIONS: ± 0.01 ft MSL
DEPTHS: ± 0.1 ft FROM GROUND SURFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL.)



05/2011 cmz DNR Form 542-1277

IOWA DEPARTMENT OF NATURAL RESOURCES

MONITORING WELL/PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name: Black Hawk Co Land Fill Permit No.: 7-SDP-1-75P

Well or Piezometer No: OW-413B

Dates Started: 11/7/2016 Date Completed: 11/7/2016

A. SURVEYED LOCATIONS AND ELEVATIONS

Locations (± 0.5 ft): N - 3617586.9, E - 6237824.0

Specify corner of site:

Distance & direction along boundary:

Distance & direction from boundary to well:

Elevations (± 0.01 ft MSL):

Ground Surface: 946.00

Top of protective casing:

Top of well casing: 948.60

Benchmark elevation:

Benchmark description:

B. SOIL BORING INFORMATION

Name & Address of Construction Company:
Terracon
6612 Chancellor Drive Suite 102
Cedar Falls IA 50613

Name of Driller: Ron Faulk

Drilling Method: 4 1/4" HSA

Drilling Fluid: NA

Bore Hole Diameter: 8.25'

Soil Sampling Method: 2' split spoon

Depth of Boring: 20.0'

C. MONITORING WELL INSTALLATION

Casing material: Type 304 Stainless Stee

Length of casing: 11.4'

Outside casing diameter: 2.375"

Inside casing diameter: 2.157"

Casing joint type: flush threaded

Casing/screen joint type: flush threaded

Screen material: Type 304 Stainless Steel

Screen opening size: 0.010'

Screen length: 10'

Depth of well: 19'

Filter Pack:

Material: Filter Pack Sand

Grain size: 0.007-0.250"

Volume:

Seal (minimum 3 ft length above filter pack): 7'

Material: Bentonite Chips 3/8" hole plug

Placement method: direct pour

Volume: 19 gal.

Backfill (if different from seal):

Material:

Placement method:

Volume:

Surface seal design: 3/8" hole plug

Material of protective casing: Steel

Material of grout between protective casing and well casing: 3/8" hole plug

Protective cap:

Material: Steel

Vented: ☐ Yes ☐ No Locking: ☒ Yes ☐ No

Well Cap:

Material: PVC

Vented: ☐ Yes ☒ No

D. GROUNDWATER MEASURMENT (± 0.01 ft below top of inner well casing)

Water level: 11.15 ft Stabilization Time:

Well development method: Bailed and Pumped

Average depth of frostline:

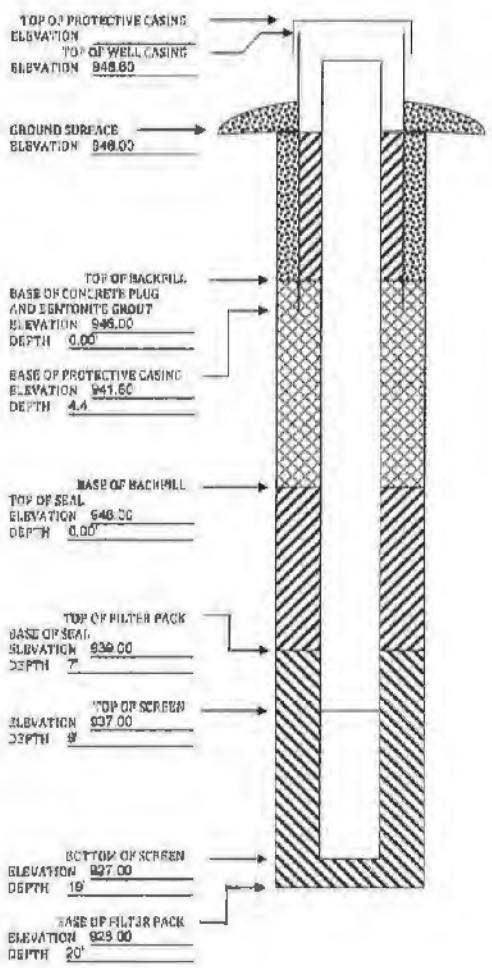
Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½x11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed for to: Iowa Department of Natural Resources, Land Quality Bureau, 502 E 9th St, Des Moines IA 50319-0034.

Questions? Call or Email: Nina Koger, Environmental Engineer Sr., 515-281-8986, Nina.Koger@dnr.iowa.gov

ELEVATIONS: ± 0.01 ft MSL
DEPTHS: ± 0.1 ft FROM GROUND SURFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL)



IOWA DEPARTMENT OF NATURAL RESOURCES

MONITORING WELL/PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name: Black Hawk Co Land Fill Permit No.: 7-SDP-1-75P

Well or Piezometer No: QW-414B

Dates Started: 11/8/2016 Date Completed: 11/8/2016

A. SURVEYED LOCATIONS AND ELEVATIONS

Locations (± 0.5 ft): N - 3617342.9, E - 6237827.2

Specify corner of site:

Distance & direction along boundary:

Distance & direction from boundary to well:

Elevations (± 0.01 ft MSL):

Ground Surface: 959.40

Top of protective casing:

Top of well casing: 962.40

Benchmark elevation:

Benchmark description:

B. SOIL BORING INFORMATION

Name & Address of Construction Company:
Terracon
6612 Chancellor Drive Suite 102
Cedar Falls IA 50613

Name of Driller: Ron Faulk

Drilling Method: 4 1/4" HSA

Drilling Fluid: NA

Bore Hole Diameter: 8.25'

Soil Sampling Method: 2' split spoon

Depth of Boring: 30.5'

C. MONITORING WELL INSTALLATION

Casing material: Type 304 Stainless Stee

Length of casing: 11.4'

Outside casing diameter: 2.375"

Inside casing diameter: 2.157"

Casing joint type: flush threaded

Casing/screen joint type: flush threaded

Screen material: Type 304 Stainless Steel

Screen opening size: 0.010"

Screen length: 10'

Depth of well: 30.5'

Filter Pack:

Material: Filter Pack Sand

Grain size: 0.007-0.250'

Volume: 52 gal.

Seal (minimum 3 ft length above filter pack): 17'

Material: Bentonite Chips 3/8" hole plug

Placement method: direct pour

Volume: 42 gal.

Backfill (if different from seal):

Material:

Placement method:

Volume:

Surface seal design: 3/8" hole plug

Material of protective casing: Steel

Material of grout between protective casing and well casing: 3/8" hole plug

Protective cap:

Material: Steel

Vented: ☐ Yes ☐ No Locking: ☑ Yes ☐ No

Well Cap:

Material: PVC

Vented: ☐ Yes ☑ No

D. GROUNDWATER MEASURMENT (± 0.01 ft below top of inner well casing)

Water level: 28.64 ft Stabilization Time:

Well development method: Bailed and Pumped

Average depth of frostline:

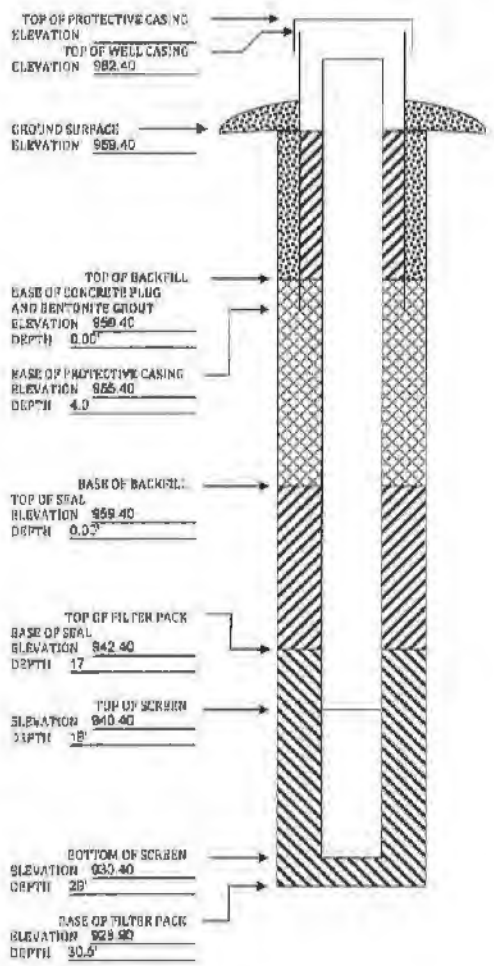
Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½x11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed for to: Iowa Department of Natural Resources, Land Quality Bureau, 502 E 9th St, Des Moines IA 50319-0034.

Questions? Call or Email: Nina Koger, Environmental Engineer Sr., 515-281-8986, Nina.Koger@dnr.iowa.gov

ELEVATIONS: ± 0.01 ft MSL
DEPTHS: ± 0.1 ft FROM GROUND SURFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL.)



IOWA DEPARTMENT OF NATURAL RESOURCES
MONITORING WELL/PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name: Black Hawk Co Land Fill Permit No.: 7-SDP-1-75P

Well or Piezometer No: P-402A

Dates Started: 11/16/2016 Date Completed: 11/16/2016

A. SURVEYED LOCATIONS AND ELEVATIONS

Locations (± 0.5 ft): N - 3617459.6, E - 6237824.2

Specify corner of site:

Distance & direction along boundary:

Distance & direction from boundary to well:

Elevations (± 0.01 ft MSL):

Ground Surface: 952.80

Top of protective casing:

Top of well casing: 955.27

Benchmark elevation:

Benchmark description:

B. SOIL BORING INFORMATION

Name & Address of Construction Company:
Terracon
6612 Chancellor Drive Suite 102
Cedar Falls IA 50613

Name of Driller: Ron Faulk

Drilling Method: 4 1/4" HSA

Drilling Fluid: City of Cedar Falls Water

Bore Hole Diameter: 8.25"

Soil Sampling Method: 2' split spoon

Depth of Boring: 52'

C. MONITORING WELL INSTALLATION

Casing material: Type 304 Stainless Steel

Length of casing: 49.3'

Outside casing diameter: 2.375"

Inside casing diameter: 2.157"

Casing joint type: flush threaded

Casing/screen joint type: flush threaded

Screen material: Type 304 Stainless Steel

Screen opening size: 0.010"

Screen length: 10'

Depth of well: 51'

Filter Pack:

Material: Filter Pack Sand

Grain size: 0.007-0.250"

Volume:

Seal (minimum 3 ft length above filter pack): 3.5'

Material: Bentonite Chips 3/8" hole plug

Placement method: direct pour

Volume: 5 gal

Backfill (if different from seal):

Material: Quick Grout

Placement method: Tremie pipe

Volume: 53 gal

Surface seal design: 3/8" hole plug

Material of protective casing: Steel

Material of grout between protective casing and well casing: 3/8" hole plug

Protective cap:

Material: Steel

Vented: ☐ Yes ☐ No Locking: ☒ Yes ☐ No

Well Cap:

Material: PVC

Vented: ☐ Yes ☒ No

D. GROUNDWATER MEASUREMENT (± 0.01 ft below top of inner well casing)

Water level: 32.58 ft Stabilization Time:

Well development method: Bailed and Pumped

Average depth of frostline:

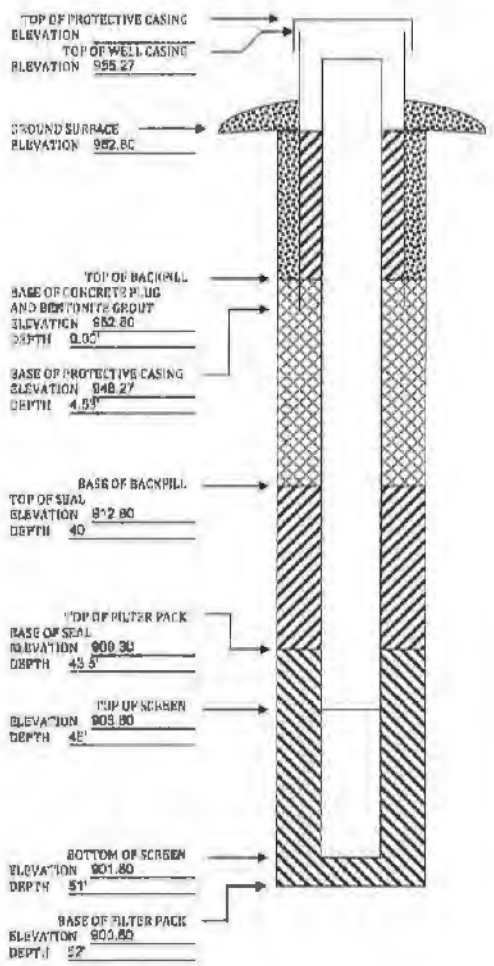
Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½x11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed for to: Iowa Department of Natural Resources, Land Quality Bureau, 502 E 9th St, Des Moines IA 50319-0034.

Questions? Call or Email: Nina Koger, Environmental Engineer Sr., 515-281-8986, Nina.Koger@dnr.iowa.gov

ELEVATIONS: ± 0.01 ft MSL
DEPTHS: ± 0.1 ft FROM GROUND SURFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL.)



06/2011 cmz DNR Form 542-1277

IOWA DEPARTMENT OF NATURAL RESOURCES
MONITORING WELL/PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name: Black Hawk Co Land Fill Permit No.: 7-SDP-1-75P

Well or Piezometer No: P-402C

Dates Started: 11/9/2016 Date Completed: 11/18/2016

A. SURVEYED LOCATIONS AND ELEVATIONS

Locations (± 0.5 ft): N - 3617487.9, E - 5237824.0

Specify corner of site:

Distance & direction along boundary:

Distance & direction from boundary to well:

Elevations (± 0.01 ft MSL):

Ground Surface: 952.30

Top of protective casing:

Top of well casing: 955.25

Benchmark elevation:

Benchmark description:

B. SOIL BORING INFORMATION

Name & Address of Construction Company:
Terracon
6812 Chancellor Drive Suite 102
Cedar Falls IA 50613

Name of Driller: Ron Faulk

Drilling Method: 4 1/4" HSA; 6" tricone; NQ rock core

Drilling Fluid: City of Cedar Falls Water

Bore Hole Diameter: 8.25"

Soil Sampling Method: 2' split spoon; rock core

Depth of Boring: 133'

C. MONITORING WELL INSTALLATION

Casing material: Type 304 Stainless Steel

Length of casing: 123.7'

Outside casing diameter: 2.375"

Inside casing diameter: 2.157"

Casing joint type: flush threaded

Casing/screen joint type: flush threaded

Screen material: Type 304 Stainless Stee

Screen opening size: 0.010"

Screen length: 10'

Depth of well: 51'

Filter Pack:

Material: Filter Pack Sand

Grain size: 0.007-0.250"

Volume: 18 gal

Seal (minimum 3 ft length above filter pack): 3.5'

Material: Bentonite Chips 3/8" hole plug

Placement method: direct pour

Volume: 5 gal

Backfill (if different from seal):

Material: Quick Grout

Placement method: Tremie pipe

Volume: 150 gal

Surface seal design: 3/8" hole plug

Material of protective casing: Steel

Material of grout between protective casing and well casing: 3/8" hole plug

Protective cap:

Material: Steel

Vented: ☐ Yes ☐ No Locking: ☑ Yes ☐ No

Well Cap:

Material: PVC

Vented: ☐ Yes ☑ No

D. GROUNDWATER MEASURMENT (± 0.01 ft below top of inner well casing)

Water level: 113.64 ft Stabilization Time:

Well development method: Bailed and Pumped

Average depth of frostline:

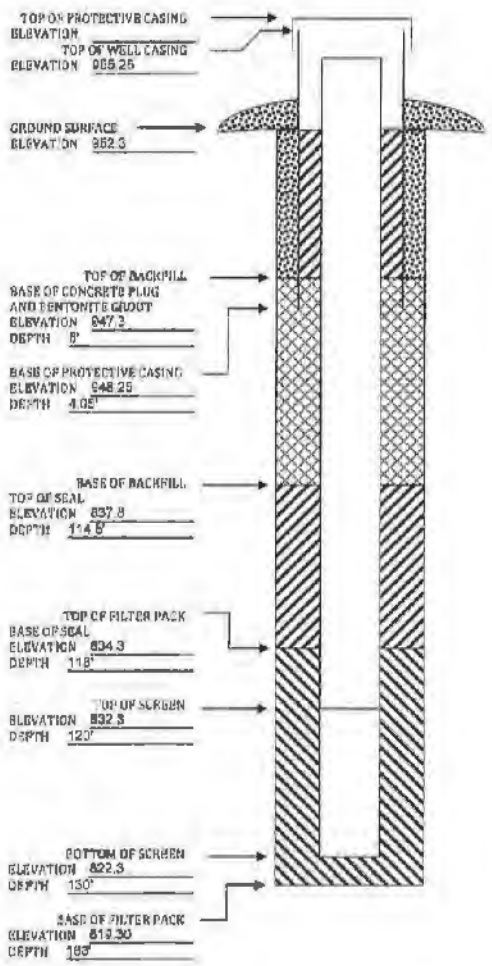
Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½x11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed for to: Iowa Department of Natural Resources, Land Quality Bureau, 502 E 9th St, Des Moines IA 50319-0034.

Questions? Call or Email: Nina Koger, Environmental Engineer Sr, 515-281-8986, Nina.Koger@dnr.iowa.gov

ELEVATIONS: ± 0.01 ft MSL
DEPTHS: ± 0.1 ft FROM GROUND SURFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL)



Print Form

IOWA DEPARTMENT OF NATURAL RESOURCES

MONITORING WELL/PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name: Black Hawk Co Landfill Permit No.: 7-SDP-1-75P

Well or Piezometer No: OW-116B

Dates Started: 07/31/2018 Date Completed: 07/31/2018

A. SURVEYED LOCATIONS AND ELEVATIONS

Locations (± 0.5 ft): N 3617231.68 E 5239963.12

Specify corner of site: IA State Plane

Distance & direction along boundary:

Distance & direction from boundary to wall:

Elevations (± 0.01 ft MSL):

Ground Surface: 908.0

Top of protective casing: 911.36

Top of well casing: 911.06

Benchmark elevation:

Benchmark description:

B. SOIL BORING INFORMATION

Name & Address of Construction Company:
Terracon
6612 Chancellor Drive Suite 102
Cedar Falls IA 50613

Name of Driller: Ron Faulk

Drilling Method: 4 1/4" HSA

Drilling Fluid: NA

Bore Hole Diameter: 8.25"

Soil Sampling Method: 2' by 2" split spoon

Depth of Boring: 19.0'

C. MONITORING WELL INSTALLATION

Casing material: Stainless Steel

Length of casing: 10.0'

Outside casing diameter: 2.375"

Inside casing diameter: 2.157"

Casing joint type: flush threaded

Casing/screen joint type: flush threaded

Screen material: Stainless Steel

Screen opening size: 0.010"

Screen length: 10'

Depth of well: 17'

Filter Pack:

Material: Filter Pack Sand

Grain size: 0.007-0.250"

Volume: 33 gal.

Seal (minimum 3 ft length above filter pack):

Material: Bentonite Chips 3/8" hole plug

Placement method: direct pour

Volume: 12 gal.

Backfill (if different from seal):

Material:

Placement method:

Volume:

Surface seal design:

Material of protective casing: Steel

Material of grout between protective casing and well casing: 3/8" hole plug

Protective cap:

Material: Steel

Vented: ☐ Yes ☐ No Locking: ☑ Yes ☐ No

Well Cap:

Material: PVC

Vented: ☐ Yes ☑ No

D. GROUNDWATER MEASURMENT (± 0.01 ft below top of inner well casing)

Water level: 12.02 ft Stabilization Time:

Well development method: Bailed and Pumped

Average depth of frostline:

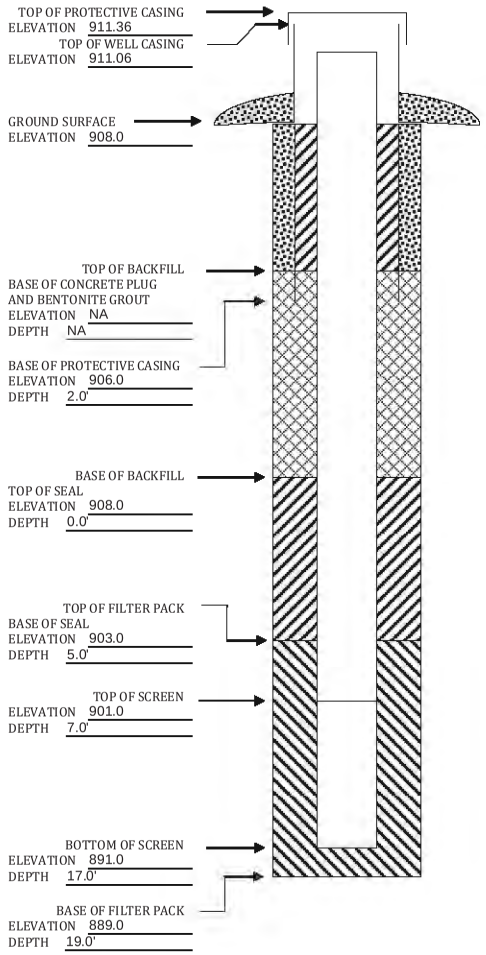
Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½x11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed for to: Iowa Department of Natural Resources, Land Quality Bureau, 502 E 9th St, Des Moines IA 50319-0034.

Questions? Call or Email: Nina Koger, Environmental Engineer Sr., 515-281-8986, Nina.Koger@dnr.iowa.gov

ELEVATIONS: ± 0.01 ft MSL
DEPTHS: ± 0.1 ft FROM GROUND SURFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL.)



06/2011 cmz DNR Form 542-1277

IOWA DEPARTMENT OF NATURAL RESOURCES
MONITORING WELL/PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name: Black Hawk Co Land Fill Permit No.: 7-SDP-1-75P

Well or Piezometer No: OW-410B

Dates Started: 11/9/2016 Date Completed: 11/9/2016

A. SURVEYED LOCATIONS AND ELEVATIONS

Locations (± 0.5 ft): N - 3616960.5, E - 6237825.5

Specify corner of site:

Distance & direction along boundary:

Distance & direction from boundary to well:

Elevations (± 0.01 ft MSL):

Ground Surface: 949.9

Top of protective casing:

Top of well casing: 952.85

Benchmark elevation:

Benchmark description:

B. SOIL BORING INFORMATION

Name & Address of Construction Company:
Terracon
6612 Chancellor Drive Suite 102
Cedar Falls IA 50613

Name of Driller: Ron Faulk

Drilling Method: 4 1/4" HSA

Drilling Fluid: NA

Bore Hole Diameter: 8.25"

Soil Sampling Method: 2' split spoon

Depth of Boring: 26.5'

C. MONITORING WELL INSTALLATION

Casing material: Type 304 Stainless Steel

Length of casing: 14.9'

Outside casing diameter: 2.375"

Inside casing diameter: 2.157"

Casing joint type: flush threaded

Casing/screen joint type: flush threaded

Screen material: Type 304 Stainless Steel

Screen opening size: 0.010"

Screen length: 10'

Depth of well: 22'

Filter Pack:

Material: Filter Pack Sand

Grain size: 0.007-0.250"

Volume: 40 gal

Seal (minimum 3 ft length above filter pack): 10'

Material: Bentonite Chips 3/8" hole plug

Placement method: direct pour

Volume: 25 gal.

Backfill (if different from seal):

Material:

Placement method:

Volume:

Surface seal design: 3/8" hole plug

Material of protective casing: Steel

Material of grout between protective casing and well casing: 3/8" hole plug

Protective cap:

Material: Steel

Vented: ☐ Yes ☐ No Locking: ☒ Yes ☐ No

Well Cap:

Material: PVC

Vented: ☐ Yes ☒ No

D. GROUNDWATER MEASURMENT (± 0.01 ft below top of inner well casing)

Water level: 13.80 ft Stabilization Time:

Well development method: Bailed and Pumped

Average depth of frostline:

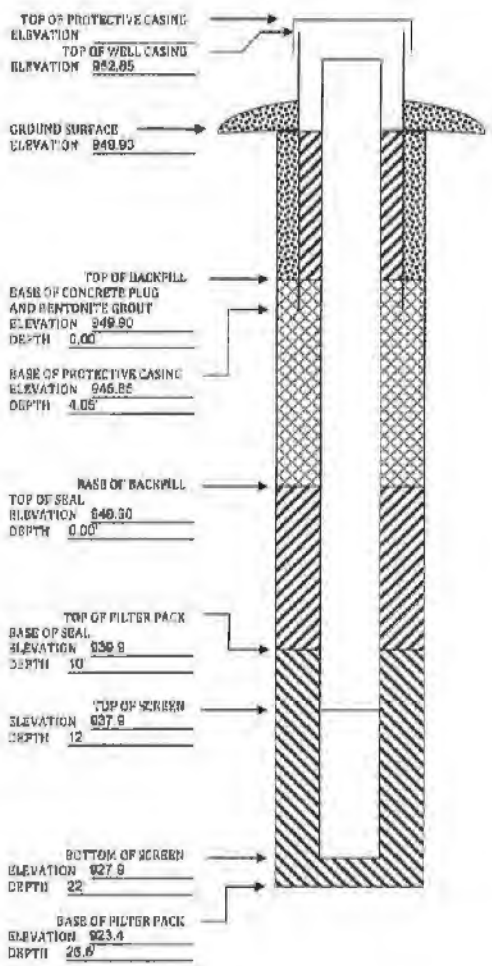
Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½x11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed for to: Iowa Department of Natural Resources, Land Quality Bureau, 502 E 9th St, Des Moines IA 50319-0034.

Questions? Call or Email: Nina Koger, Environmental Engineer Sr., 515-281-8986, Nina.Koger@dnr.iowa.gov

ELEVATIONS: ± 0.01 ft MSL
DEPTHS: ± 0.1 ft FROM GROUND SURFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL)



IOWA DEPARTMENT OF NATURAL RESOURCES

MONITORING WELL/PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name: Black Hawk Co Land Fill Permit No.: 7-SDP-1-75P

Well or Piezometer No: OW-411B

Dates Started: 11/8/2016 Date Completed: 11/8/2016

A. SURVEYED LOCATIONS AND ELEVATIONS

Locations (± 0.5 ft): N - 3617179.6, E - 6237771.9

Specify corner of site:

Distance & direction along boundary:

Distance & direction from boundary to well:

Elevations (± 0.01 ft MSL):

Ground Surface: 964.40

Top of protective casing:

Top of well casing: 967.30

Benchmark elevation:

Benchmark description:

B. SOIL BORING INFORMATION

Name & Address of Construction Company:
Terracon
6612 Chancellor Drive Suite 102
Cedar Falls IA 50613

Name of Driller: Ron Faulk

Drilling Method: 4 1/4" HSA

Drilling Fluid: NA

Bore Hole Diameter: 8.25'

Soil Sampling Method: 2' split spoon

Depth of Boring: 34.5'

C. MONITORING WELL INSTALLATION

Casing material: Type 304 Stainless Steel

Length of casing: 17.04

Outside casing diameter: 2.375"

Inside casing diameter: 2.157"

Casing joint type: flush threaded

Casing/screen joint type: flush threaded

Screen material: Type 304 Stainless Steel

Screen opening size: 0.010"

Screen length: 10'

Depth of well: 34'

Filter Pack:

Material: Filter Pack Sand

Grain size: 0.007-0.250"

Volume: 31 gal.

Seal (minimum 3 ft length above filter pack): 22'

Material: Bentonite Chips 3/8" hole plug

Placement method: direct pour

Volume: 54 gal.

Backfill (if different from seal):

Material:

Placement method:

Volume:

Surface seal design: 3/8" hole plug

Material of protective casing: Steel

Material of grout between protective casing and well casing: 3/8" hole plug

Protective cap:

Material: Steel

Vented: ☐ Yes ☐ No Locking: ☒ Yes ☐ No

Well Cap:

Material: PVC

Vented: ☐ Yes ☒ No

D. GROUNDWATER MEASURMENT (± 0.01 ft below top of inner well casing)

Water level: 33.01 ft Stabilization Time:

Well development method: Bailed

Average depth of frostline:

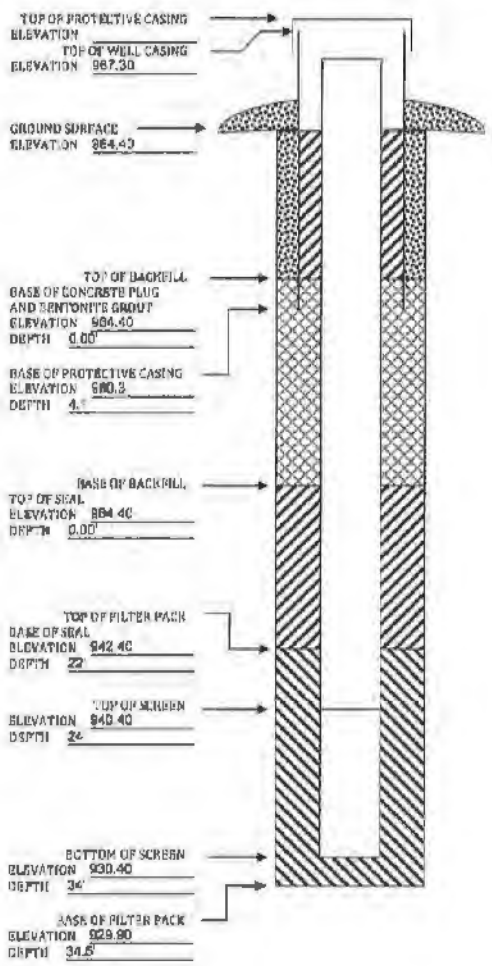
Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½x11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed for to: Iowa Department of Natural Resources, Land Quality Bureau, 502 E 9th St, Des Moines IA 50319-0034.

Questions? Call or Email: Nina Koger, Environmental Engineer Sr., 515-281-6986, Nina.Koger@dnr.iowa.gov

ELEVATIONS: ± 0.01 ft MSL
DEPTHS: ± 0.1 ft FROM GROUND SURFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL)



06/2011 cmz DNR Form 542-1277

IOWA DEPARTMENT OF NATURAL RESOURCES
MONITORING WELL/PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name: Black Hawk Co Land Fill Permit No.: 7-SDP-1-78P

Well or Piezometer No: OW-412B

Dates Started: 11/8/2016 Date Completed: 11/8/2016

A. SURVEYED LOCATIONS AND ELEVATIONS

Locations (± 0.5 ft): N - 3617481.7, E - 6237772.5

Specify corner of site:

Distance & direction along boundary:

Distance & direction from boundary to well:

Elevations (± 0.01 ft MSL):

Ground Surface: 956.40

Top of protective casing:

Top of well casing: 959.45

Benchmark elevation:

Benchmark description:

B. SOIL BORING INFORMATION

Name & Address of Construction Company:
Terracon
6612 Chancellor Drive Suite 102
Cedar Falls IA 50613

Name of Driller: Ron Faulk

Drilling Method: 4 1/4" HSA

Drilling Fluid: NA

Bore Hole Diameter: 8.25"

Soil Sampling Method: 2' split spoon

Depth of Boring: 34.5'

C. MONITORING WELL INSTALLATION

Casing material: Type 304 Stainless Steel

Length of casing: 22.79'

Outside casing diameter: 2.375"

Inside casing diameter: 2.157"

Casing joint type: flush threaded

Casing/screen joint type: flush threaded

Screen material: Type 304 Stainless Steel

Screen opening size: 0.010"

Screen length: 10'

Depth of well: 34'

Filter Pack:

Material: Filter Pack Sand

Grain size: 0.007-0.250"

Volume: 41 gal.

Seal (minimum 3 ft length above filter pack): 18'

Material: Bentonite Chips 3/8" hole plug

Placement method: direct pour

Volume: 44 gal.

Backfill (if different from seal):

Material:

Placement method:

Volume:

Surface seal design: 3/8" hole plug

Material of protective casing: Steel

Material of grout between protective casing and well casing: 3/8" hole plug

Protective cap:

Material: Steel

Vented: ☐ Yes ☐ No Locking: ☒ Yes ☐ No

Well Cap:

Material: PVC

Vented: ☐ Yes ☒ No

D. GROUNDWATER MEASURMENT (± 0.01 ft below top of inner well casing)

Water level: 21.15 ft Stabilization Time:

Well development method: Bailed and Pumped

Average depth of frostline:

Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½x11 inch map showing locations of all monitoring wells and piezometers.

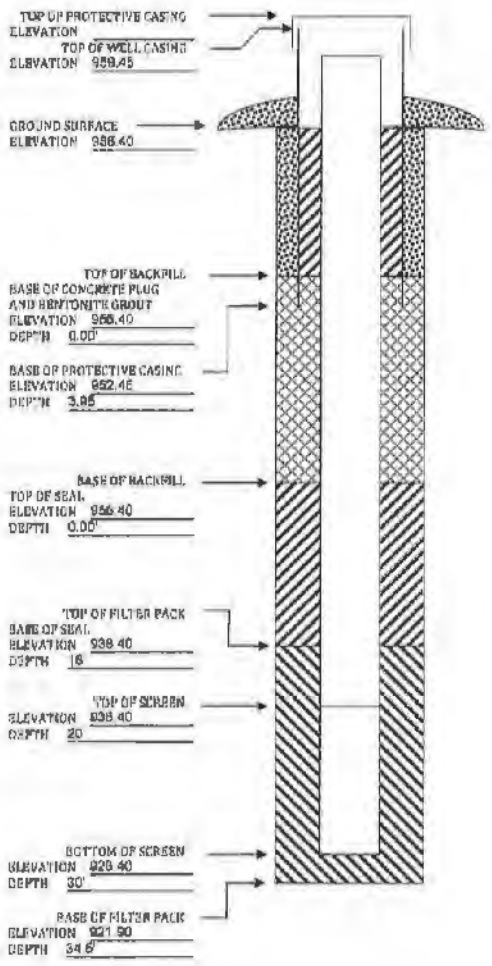
Please mail completed for to: Iowa Department of Natural Resources, Land Quality Bureau, 502 E 9th St, Des Moines IA 50319-0034.

Questions? Call or Email: Nina Koger, Environmental Engineer Sr., 515-281-8986, Nina.Koger@dnr.iowa.gov

05/2011 cmz DNR Form 542-1277

ELEVATIONS: ± 0.01 ft MSL
DEPTHS: ± 0.1 ft FROM GROUND SURFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL)



05/2011 cmz DNR Form 542-1277

IOWA DEPARTMENT OF NATURAL RESOURCES

MONITORING WELL/PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name: Black Hawk Co Land Fill Permit No.: 7-SDP-1-75P

Well or Piezometer No: OW-413B

Dates Started: 11/7/2016 Date Completed: 11/7/2016

A. SURVEYED LOCATIONS AND ELEVATIONS

Locations (± 0.5 ft): N - 3617586.9, E - 6237824.0

Specify corner of site:

Distance & direction along boundary:

Distance & direction from boundary to well:

Elevations (± 0.01 ft MSL):

Ground Surface: 946.00

Top of protective casing:

Top of well casing: 948.60

Benchmark elevation:

Benchmark description:

B. SOIL BORING INFORMATION

Name & Address of Construction Company:
Terracon
6612 Chancellor Drive Suite 102
Cedar Falls IA 50613

Name of Driller: Ron Faulk

Drilling Method: 4 1/4" HSA

Drilling Fluid: NA

Bore Hole Diameter: 8.25'

Soil Sampling Method: 2' split spoon

Depth of Boring: 20.0'

C. MONITORING WELL INSTALLATION

Casing material: Type 304 Stainless Stee

Length of casing: 11.4'

Outside casing diameter: 2.375"

Inside casing diameter: 2.157"

Casing joint type: flush threaded

Casing/screen joint type: flush threaded

Screen material: Type 304 Stainless Steel

Screen opening size: 0.010'

Screen length: 10'

Depth of well: 19'

Filter Pack:

Material: Filter Pack Sand

Grain size: 0.007-0.250"

Volume:

Seal (minimum 3 ft length above filter pack): 7'

Material: Bentonite Chips 3/8" hole plug

Placement method: direct pour

Volume: 19 gal.

Backfill (if different from seal):

Material:

Placement method:

Volume:

Surface seal design: 3/8" hole plug

Material of protective casing: Steel

Material of grout between protective casing and well casing: 3/8" hole plug

Protective cap:

Material: Steel

Vented: ☐ Yes ☐ No Locking: ☒ Yes ☐ No

Well Cap:

Material: PVC

Vented: ☐ Yes ☒ No

D. GROUNDWATER MEASURMENT (± 0.01 ft below top of inner well casing)

Water level: 11.15 ft Stabilization Time:

Well development method: Bailed and Pumped

Average depth of frostline:

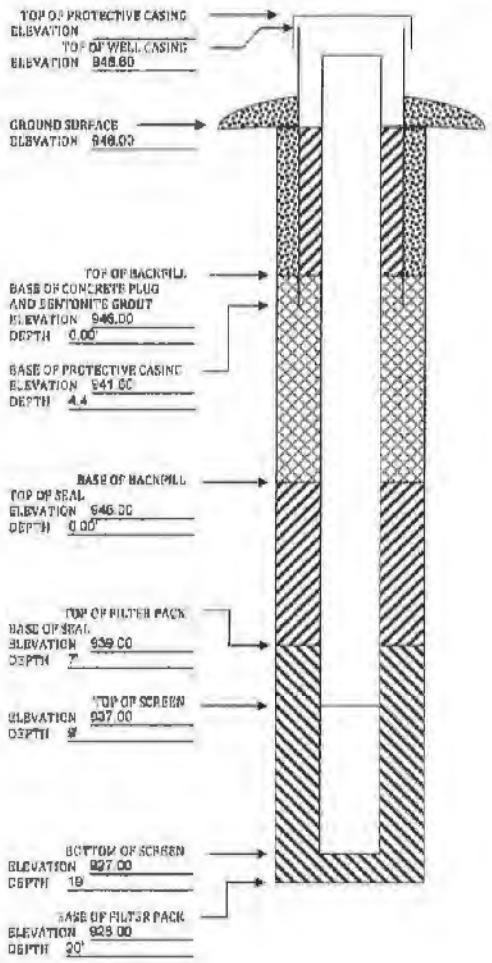
Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½x11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed for to: Iowa Department of Natural Resources, Land Quality Bureau, 502 E 9th St, Des Moines IA 50319-0034.

Questions? Call or Email: Nina Koger, Environmental Engineer Sr., 515-281-8986, Nina.Koger@dnr.iowa.gov

ELEVATIONS: ± 0.01 ft MSL
DEPTHS: ± 0.1 ft FROM GROUND SURFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL)



IOWA DEPARTMENT OF NATURAL RESOURCES

MONITORING WELL/PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name: Black Hawk Co Land Fill Permit No.: 7-SDP-1-75P

Well or Piezometer No: QW-414B

Dates Started: 11/8/2016 Date Completed: 11/8/2016

A. SURVEYED LOCATIONS AND ELEVATIONS

Locations (± 0.5 ft): N - 3617342.9, E - 6237827.2

Specify corner of site:

Distance & direction along boundary:

Distance & direction from boundary to well:

Elevations (± 0.01 ft MSL):

Ground Surface: 959.40

Top of protective casing:

Top of well casing: 962.40

Benchmark elevation:

Benchmark description:

B. SOIL BORING INFORMATION

Name & Address of Construction Company:
Terracon
6612 Chancellor Drive Suite 102
Cedar Falls IA 50613

Name of Driller: Ron Faulk

Drilling Method: 4 1/4" HSA

Drilling Fluid: NA

Bore Hole Diameter: 8.25'

Soil Sampling Method: 2' split spoon

Depth of Boring: 30.5'

C. MONITORING WELL INSTALLATION

Casing material: Type 304 Stainless Stee

Length of casing: 11.4'

Outside casing diameter: 2.375"

Inside casing diameter: 2.157"

Casing joint type: flush threaded

Casing/screen joint type: flush threaded

Screen material: Type 304 Stainless Steel

Screen opening size: 0.010"

Screen length: 10'

Depth of well: 30.5'

Filter Pack:

Material: Filter Pack Sand

Grain size: 0.007-0.250'

Volume: 52 gal.

Seal (minimum 3 ft length above filter pack): 17'

Material: Bentonite Chips 3/8" hole plug

Placement method: direct pour

Volume: 42 gal.

Backfill (if different from seal):

Material:

Placement method:

Volume:

Surface seal design: 3/8" hole plug

Material of protective casing: Steel

Material of grout between protective casing and well casing: 3/8" hole plug

Protective cap:

Material: Steel

Vented: ☐ Yes ☐ No Locking: ☒ Yes ☐ No

Well Cap:

Material: PVC

Vented: ☐ Yes ☒ No

D. GROUNDWATER MEASURMENT (± 0.01 ft below top of inner well casing)

Water level: 28.64 ft Stabilization Time:

Well development method: Bailed and Pumped

Average depth of frostline:

Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½x11 inch map showing locations of all monitoring wells and piezometers.

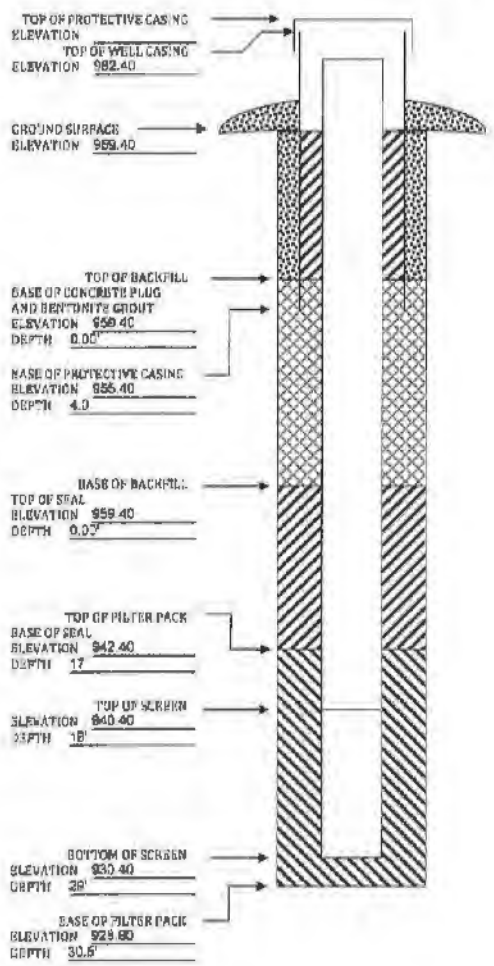
Please mail completed for to: Iowa Department of Natural Resources, Land Quality Bureau, 502 E 9th St, Des Moines IA 50319-0034.

Questions? Call or Email: Nina Koger, Environmental Engineer Sr., 515-281-8986, Nina.Koger@dnr.iowa.gov

08/2011.com DNR Form 542-1277

ELEVATIONS: ± 0.01 ft MSL
DEPTHS: ± 0.1 ft FROM GROUND SURFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREEN INTERVAL AND FILTER PACK INTERVAL.)



08/2011.com DNR Form 542-1277

IOWA DEPARTMENT OF NATURAL RESOURCES
MONITORING WELL/PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name: Black Hawk Co Land Fill Permit No.: 7-SDP-1-75P

Well or Piezometer No: P-402A

Dates Started: 11/16/2016 Date Completed: 11/16/2016

A. SURVEYED LOCATIONS AND ELEVATIONS

Locations (± 0.5 ft): N - 3617459.6, E - 6237824.2

Specify corner of site:

Distance & direction along boundary:

Distance & direction from boundary to well:

Elevations (± 0.01 ft MSL):

Ground Surface: 952.80

Top of protective casing:

Top of well casing: 955.27

Benchmark elevation:

Benchmark description:

B. SOIL BORING INFORMATION

Name & Address of Construction Company:
Terracon
6612 Chancellor Drive Suite 102
Cedar Falls IA 50613

Name of Driller: Ron Faulk

Drilling Method: 4 1/4" HSA

Drilling Fluid: City of Cedar Falls Water

Bore Hole Diameter: 8.25'

Soil Sampling Method: 2' split spoon

Depth of Boring: 52'

C. MONITORING WELL INSTALLATION

Casing material: Type 304 Stainless Steel

Length of casing: 49.3'

Outside casing diameter: 2.375"

Inside casing diameter: 2.157"

Casing joint type: flush threaded

Casing/screen joint type: flush threaded

Screen material: Type 304 Stainless Steel

Screen opening size: 0.010"

Screen length: 10'

Depth of well: 51'

Filter Pack:

Material: Filter Pack Sand

Grain size: 0.007-0.250"

Volume:

Seal [minimum 3 ft length above filter pack]: 3.5'

Material: Bentonite Chips 3/8" hole plug

Placement method: direct pour

Volume: 5 gal

Backfill (if different from seal):

Material: Quick Grout

Placement method: Tremie pipe

Volume: 53 gal.

Surface seal design: 3/8" hole plug

Material of protective casing: Steel

Material of grout between protective casing and well casing: 3/8" hole plug

Protective cap:

Material: Steel

Vented: ☐ Yes ☐ No Locking: ☒ Yes ☐ No

Well Cap:

Material: PVC

Vented: ☐ Yes ☒ No

D. GROUNDWATER MEASUREMENT (± 0.01 ft below top of inner well casing)

Water level: 32.58 ft Stabilization Time:

Well development method: Bailed and Pumped

Average depth of frostline:

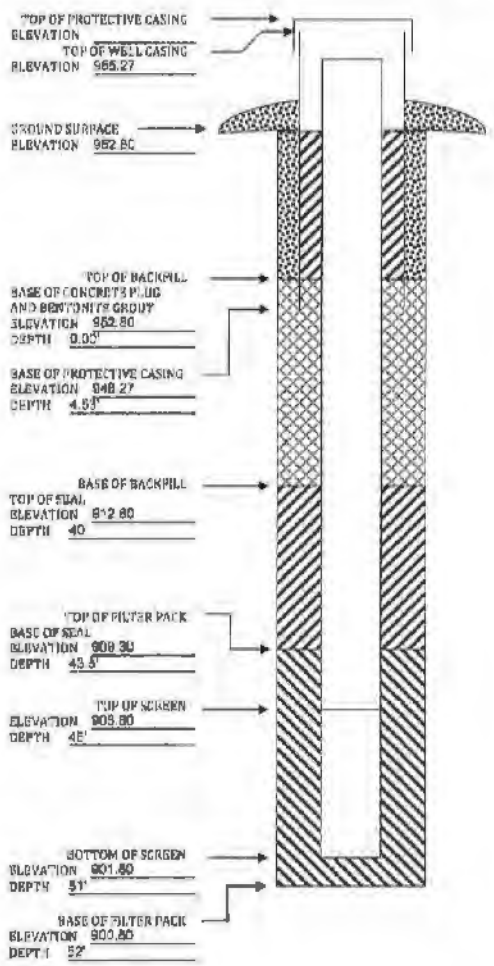
Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½x11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed for to: Iowa Department of Natural Resources, Land Quality Bureau, 502 E 9th St, Des Moines IA 50319-0034.

Questions? Call or Email: Nina Koger, Environmental Engineer Sr., 515-281-6986, Nina.Koger@dnr.iowa.gov

ELEVATIONS: ± 0.01 ft MSL
DEPTHS: ± 0.1 ft FROM GROUND SURFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL)



06/2011 cmz DNR Form 542-1277

IOWA DEPARTMENT OF NATURAL RESOURCES

MONITORING WELL/PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name: Black Hawk Co Land Fill Permit No.: 7-SDP-1-75P

Well or Piezometer No: P-402C

Dates Started: 11/9/2016 Date Completed: 11/16/2016

A. SURVEYED LOCATIONS AND ELEVATIONS

Locations (± 0.5 ft): N - 3617467.9, E - 5237824.0

Specify corner of site:

Distance & direction along boundary:

Distance & direction from boundary to wall:

Elevations (± 0.01 ft MSL):

Ground Surface: 952.30

Top of protective casing:

Top of well casing: 955.25

Benchmark elevation:

Benchmark description:

B. SOIL BORING INFORMATION

Name & Address of Construction Company:
Terracon
6612 Chancellor Drive Suite 102
Cedar Falls IA 50613

Name of Driller: Ron Faulk

Drilling Method: 4 1/4" HSA; 8" tricone; NQ rock core

Drilling Fluid: City of Cedar Falls Water

Bore Hole Diameter: 8.25"

Soil Sampling Method: 2' split spoon; rock core

Depth of Boring: 133'

C. MONITORING WELL INSTALLATION

Casing material: Type 304 Stainless Steel

Length of casing: 123.7'

Outside casing diameter: 2.375"

Inside casing diameter: 2.157"

Casing joint type: flush threaded

Casing/screen joint type: flush threaded

Screen material: Type 304 Stainless Stee

Screen opening size: 0.010"

Screen length: 10'

Depth of well: 51'

Filter Pack:

Material: Filter Pack Sand

Grain size: 0.007-0.250"

Volume: 18 gal

Seal (minimum 3 ft length above filter pack): 3.5'

Material: Bentonite Chips 3/8" hole plug

Placement method: direct pour

Volume: 5 gal

Backfill (if different from seal):

Material: Quick Grout

Placement method: Tremie pipe

Volume: 150 gal

Surface seal design: 3/8" hole plug

Material of protective casing: Steel

Material of grout between protective casing and well casing: 3/8" hole plug

Protective cap:

Material: Steel

Vented: ☐ Yes ☐ No Locking: ☒ Yes ☐ No

Well Cap:

Material: PVC

Vented: ☐ Yes ☒ No

D. GROUNDWATER MEASURMENT (± 0.01 ft below top of inner well casing)

Water level: 113.64 ft Stabilization Time:

Well development method: Bailed and Pumped

Average depth of frostline:

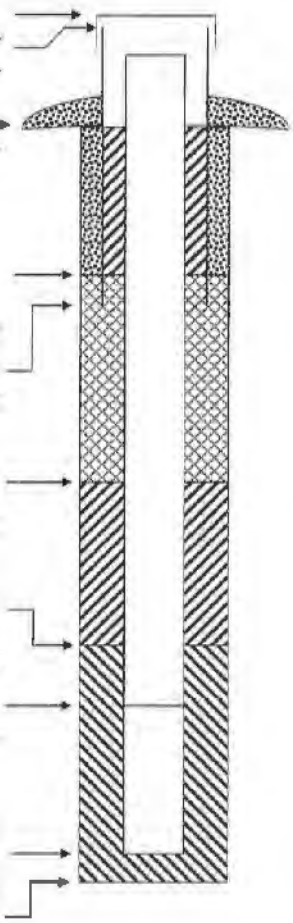
Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½x11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed for to: Iowa Department of Natural Resources, Land Quality Bureau, 502 E 9th St, Des Moines IA 50319-0034.

Questions? Call or Email: Nina Koger, Environmental Engineer Sr., 515-281-8986, Nina.Koger@dnr.iowa.gov

ELEVATIONS: ± 0.01 ft MSL
DEPTHS: ± 0.1 ft FROM GROUND SURFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL)



Print Form

IOWA DEPARTMENT OF NATURAL RESOURCES

MONITORING WELL/PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name: Black Hawk Co Land Fill Permit No.: 7-SDP-1-75P

Well or Piezometer No: MW 601B

Dates Started: 10/27/2014 Date Completed: 10/27/2014

A. SURVEYED LOCATIONS AND ELEVATIONS

Locations (± 0.5 ft): N - 3616798.2, E - 5235898.0

Specify corner of site:

Distance & direction along boundary:

Distance & direction from boundary to wall:

Elevations (± 0.01 ft MSL):

Ground Surface: 941.90

Top of protective casing: 944.73

Top of well casing: 944.38

Benchmark elevation:

Benchmark description:

B. SOIL BORING INFORMATION

Name & Address of Construction Company:
Terracon
6612 Chancellor Drive Suite 102
Cedar Falls IA 50613

Name of Driller: Ron Faulk

Drilling Method: 4 1/4" HSA

Drilling Fluid: NA

Bore Hole Diameter: 8.25"

Soil Sampling Method: 2' split spoon

Depth of Boring: 22.5'

C. MONITORING WELL INSTALLATION

Casing material: Stainless Steel

Length of casing: 12.95'

Outside casing diameter: 2.25"

Inside casing diameter: 2"

Casing joint type: flush threaded

Casing/screen joint type: flush threaded

Screen material: Stainless Steel

Screen opening size: 0.010"

Screen length: 10'

Depth of well: 20'

Filter Pack:

Material: Coarse Sand

Grain size: see grain size curve

Volume: 4.14 cu. ft

Seal (minimum 3 ft length above filter pack):

Material: Bentonite Chips 3/8 in hole plug

Placement method: direct pour

Volume: 2.92 cu. ft

Backfill (if different from seal):

Material:

Placement method:

Volume:

Surface seal design:

Material of protective casing: Steel

Material of grout between protective casing and well casing: Bentonite Chips 3/8in

Protective cap:

Material: Steel

Vented: ☐ Yes ☐ No Locking: ☑ Yes ☐ No

Well Cap:

Material: PVC

Vented: ☐ Yes ☑ No

D. GROUNDWATER MEASURMENT (± 0.01 ft below top of inner well casing)

Water level: 9.90 ft Stabilization Time:

Well development method: Bailed and Pumped

Average depth of frostline:

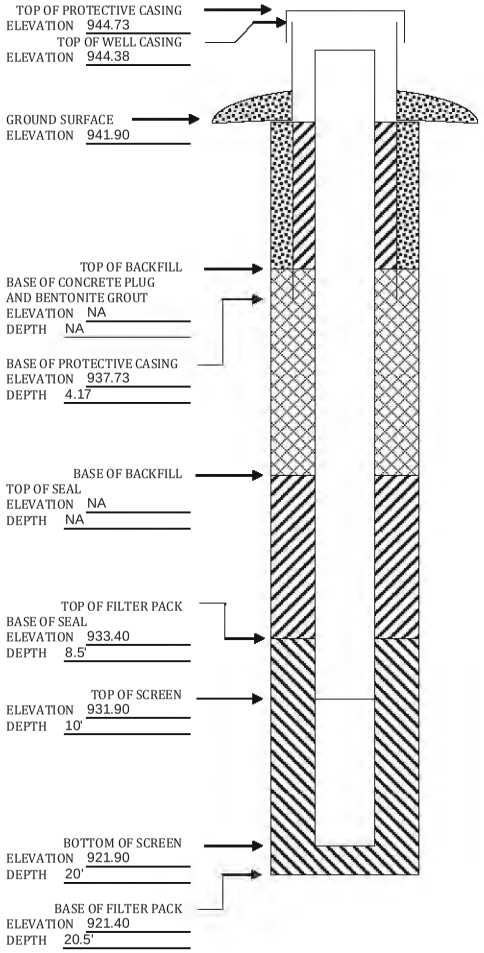
Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½x11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed for to: Iowa Department of Natural Resources, Land Quality Bureau, 502 E 9th St, Des Moines IA 50319-0034.

Questions? Call or Email: Nina Koger, Environmental Engineer Sr., 515-281-8986, Nina.Koger@dnr.iowa.gov

ELEVATIONS: ± 0.01 ft MSL
DEPTHS: ± 0.1 ft FROM GROUND SURFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL.)



06/2011 cmz DNR Form 542-1277

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IOWA DEPARTMENT OF NATURAL RESOURCES

MONITORING WELL/PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name: Black Hawk Co Land Fill Permit No.: 7-SDP-1-75P

Well or Piezometer No: MW 602B

Dates Started: 10/27/2014 Date Completed: 10/27/2014

A. SURVEYED LOCATIONS AND ELEVATIONS

Locations (± 0.5 ft): N - 3616897.3, E - 5235288.8

Specify corner of site:

Distance & direction along boundary:

Distance & direction from boundary to wall:

Elevations (± 0.01 ft MSL):

Ground Surface: 942.30

Top of protective casing: 945.30

Top of well casing: 944.95

Benchmark elevation:

Benchmark description:

B. SOIL BORING INFORMATION

Name & Address of Construction Company:
Terracon
6612 Chancellor Drive Suite 102
Cedar Falls IA 50613

Name of Driller: Ron Faulk

Drilling Method: 4 1/4 HSA

Drilling Fluid: NA

Bore Hole Diameter: 8 in

Soil Sampling Method: Continuous 2 ft split spoon

Depth of Boring: 28.5 ft

C. MONITORING WELL INSTALLATION

Casing material: Stainless Steel

Length of casing: ft

Outside casing diameter: 2 1/4 in

Inside casing diameter: 2 in

Casing joint type: 304

Casing/screen joint type: 304

Screen material: Stainless Steel

Screen opening size: No. 10 Slot

Screen length: 10 ft

Depth of well: 20 ft

Filter Pack:

Material: Coarse Sand

Grain size: see grain size curve

Volume: 7.11 cu. ft

Seal (minimum 3 ft length above filter pack):

Material: Bentonite Chips 3/8 in hole plug

Placement method: direct pour

Volume: 2.92 cu. ft

Backfill (if different from seal):

Material:

Placement method:

Volume:

Surface seal design:

Material of protective casing: Steel

Material of grout between protective casing and well casing: Sand

Protective cap:

Material: Steel

Vented: ☐ Yes ☐ No Locking: ☑ Yes ☐ No

Well Cap:

Material: PVC

Vented: ☐ Yes ☑ No

D. GROUNDWATER MEASURMENT (± 0.01 ft below top of inner well casing)

Water level: 12.95 ft Stabilization Time:

Well development method: Bailed and Pumped

Average depth of frostline:

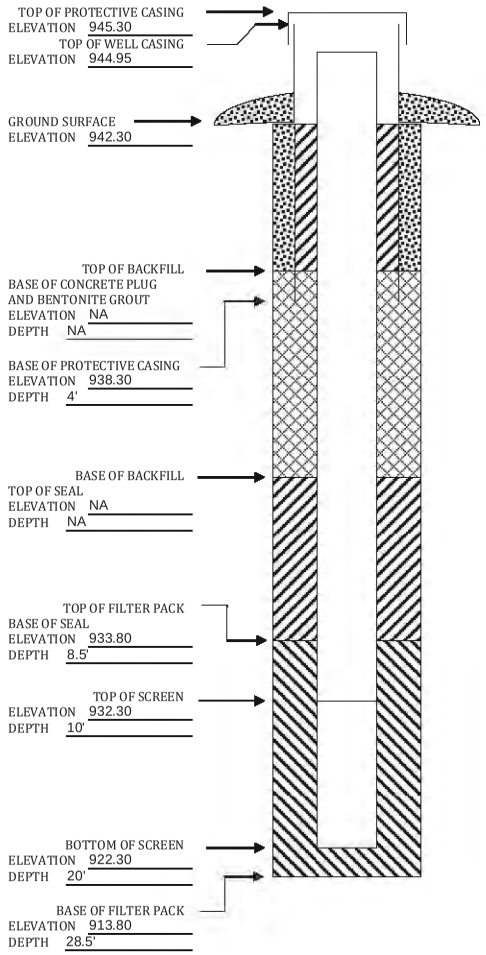
Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½x11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed for to: Iowa Department of Natural Resources, Land Quality Bureau, 502 E 9th St, Des Moines IA 50319-0034.

Questions? Call or Email: Nina Koger, Environmental Engineer Sr., 515-281-8986, Nina.Koger@dnr.iowa.gov

ELEVATIONS: ± 0.01 ft MSL
DEPTHS: ± 0.1 ft FROM GROUND SURFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL.)



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IOWA DEPARTMENT OF NATURAL RESOURCES

MONITORING WELL/PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name: Black Hawk Co Land Fill Permit No.: 7-SDP-1-75P

Well or Piezometer No: MW 603B

Dates Started: 10/27/2014 Date Completed: 10/27/2014

A. SURVEYED LOCATIONS AND ELEVATIONS

Locations (± 0.5 ft):

Specify corner of site:

Distance & direction along boundary:

Distance & direction from boundary to wall:

Elevations (± 0.01 ft MSL):

Ground Surface:

Top of protective casing:

Top of well casing:

Benchmark elevation:

Benchmark description:

B. SOIL BORING INFORMATION

Name & Address of Construction Company:
Terracon
6612 Chancellor Drive Suite 102
Cedar Falls IA 50613

Name of Driller: Ron Faulk

Drilling Method: 4 1/4 HSA

Drilling Fluid: NA

Bore Hole Diameter: 8 in

Soil Sampling Method: Continuous 2 ft split spoon

Depth of Boring: 27 ft

C. MONITORING WELL INSTALLATION

Casing material: Stainless Steel

Length of casing: ft

Outside casing diameter: 2 1/4 in

Inside casing diameter: 2 in

Casing joint type: 304

Casing/screen joint type: 304

Screen material: Stainless Steel

Screen opening size: No. 10 Slot

Screen length: 10 ft

Depth of well: 27 ft

Filter Pack:

Material: Coarse Sand

Grain size: see grain size curve

Volume: 3.95 cu. ft

Seal (minimum 3 ft length above filter pack):

Material: Bentonite Chips 3/8 in hole plug

Placement method: direct pour

Volume: 5.33 cu. ft

Backfill (if different from seal):

Material:

Placement method:

Volume:

Surface seal design:

Material of protective casing: Steel

Material of grout between protective casing and well casing: Sand

Protective cap:

Material: Steel

Vented: ☐ Yes ☐ No Locking: ☑ Yes ☐ No

Well Cap:

Material: PVC

Vented: ☐ Yes ☑ No

D. GROUNDWATER MEASURMENT (± 0.01 ft below top of inner well casing)

Water level: 15.38 ft Stabilization Time:

Well development method: Bailed and Pumped

Average depth of frostline:

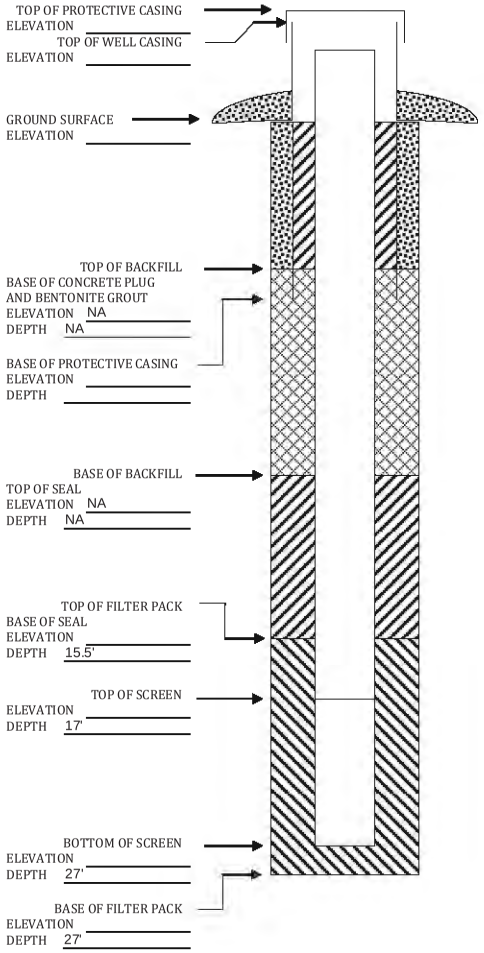
Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½x11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed for to: Iowa Department of Natural Resources, Land Quality Bureau, 502 E 9th St, Des Moines IA 50319-0034.

Questions? Call or Email: Nina Koger, Environmental Engineer Sr., 515-281-8986, Nina.Koger@dnr.iowa.gov

ELEVATIONS: ± 0.01 ft MSL
DEPTHS: ± 0.1 ft FROM GROUND SURFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL.)



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IOWA DEPARTMENT OF NATURAL RESOURCES

MONITORING WELL/PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name: Black Hawk Co Land Fill Permit No.: 7-SDP-1-75P

Well or Piezometer No: MW 604B

Dates Started: 11/5/2014 Date Completed: 11/5/2014

A. SURVEYED LOCATIONS AND ELEVATIONS

Locations (± 0.5 ft): N - 3617467.8, E - 5235286.8

Specify corner of site:

Distance & direction along boundary:

Distance & direction from boundary to wall:

Elevations (± 0.01 ft MSL):

Ground Surface: 932.20

Top of protective casing: 935.20

Top of well casing: 934.80

Benchmark elevation:

Benchmark description:

B. SOIL BORING INFORMATION

Name & Address of Construction Company:
Terracon
6612 Chancellor Drive Suite 102
Cedar Falls IA 50613

Name of Driller: Ron Faulk

Drilling Method: 4 1/4 HSA

Drilling Fluid: NA

Bore Hole Diameter: 8 in

Soil Sampling Method: Continuous 2 ft split spoon

Depth of Boring: 26 ft

C. MONITORING WELL INSTALLATION

Casing material: Stainless Steel

Length of casing: ft

Outside casing diameter: 2 1/4 in

Inside casing diameter: 2 in

Casing joint type: 304

Casing/screen joint type: 304

Screen material: Stainless Steel

Screen opening size: No. 10 Slot

Screen length: 10 ft

Depth of well: 25 ft

Filter Pack:

Material: Coarse Sand

Grain size: see grain size curve

Volume: 4.49 cu. ft

Seal (minimum 3 ft length above filter pack):

Material: Bentonite Chips 3/8 in hole plug

Placement method: direct pour

Volume: 4.47 cu. ft

Backfill (if different from seal):

Material:

Placement method:

Volume:

Surface seal design:

Material of protective casing: Steel

Material of grout between protective casing and well casing: Sand

Protective cap:

Material: Steel

Vented: ☐ Yes ☐ No Locking: ☑ Yes ☐ No

Well Cap:

Material: PVC

Vented: ☐ Yes ☑ No

D. GROUNDWATER MEASURMENT (± 0.01 ft below top of inner well casing)

Water level: 19.44 ft Stabilization Time:

Well development method: Bailed and Pumped

Average depth of frostline:

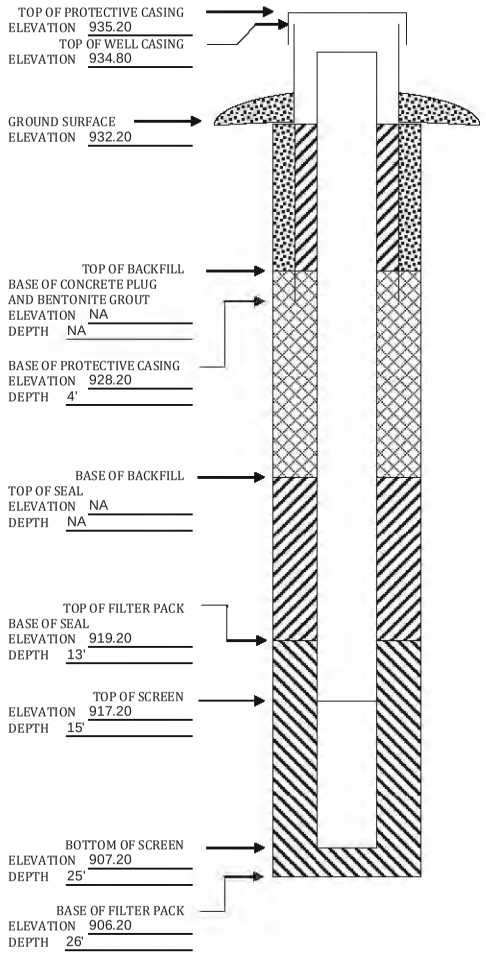
Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½x11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed for to: Iowa Department of Natural Resources, Land Quality Bureau, 502 E 9th St, Des Moines IA 50319-0034.

Questions? Call or Email: Nina Koger, Environmental Engineer Sr., 515-281-8986, Nina.Koger@dnr.iowa.gov

ELEVATIONS: ± 0.01 ft MSL
DEPTHS: ± 0.1 ft FROM GROUND SURFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL.)



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IOWA DEPARTMENT OF NATURAL RESOURCES

MONITORING WELL/PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name: Black Hawk Co Land Fill Permit No.: 7-SDP-1-75P

Well or Piezometer No: MW 605C

Dates Started: 10/28/2014 Date Completed: 10/28/2014

A. SURVEYED LOCATIONS AND ELEVATIONS

Locations (± 0.5 ft): N - 3617714.8, E - 5235754.1

Specify corner of site:

Distance & direction along boundary:

Distance & direction from boundary to wall:

Elevations (± 0.01 ft MSL):

Ground Surface: 936.30

Top of protective casing: 939.14

Top of well casing: 938.82

Benchmark elevation:

Benchmark description:

B. SOIL BORING INFORMATION

Name & Address of Construction Company:
Terracon
6612 Chancellor Drive Suite 102
Cedar Falls IA 50613

Name of Driller: Ron Faulk

Drilling Method: 4 1/4 HSA

Drilling Fluid: NA

Bore Hole Diameter: 8 in

Soil Sampling Method: Continuous 2 ft split spoon

Depth of Boring: 20.5 ft

C. MONITORING WELL INSTALLATION

Casing material: Stainless Steel

Length of casing: ft

Outside casing diameter: 2 1/4 in

Inside casing diameter: 2 in

Casing joint type: 304

Casing/screen joint type: 304

Screen material: Stainless Steel

Screen opening size: No. 10 Slot

Screen length: 10 ft

Depth of well: 19 ft

Filter Pack:

Material: Coarse Sand

Grain size: see grain size curve

Volume: 4.51 cu. ft

Seal (minimum 3 ft length above filter pack):

Material: Bentonite Chips 3/8 in hole plug

Placement method: direct pour

Volume: 2.58 cu. ft

Backfill (if different from seal):

Material:

Placement method:

Volume:

Surface seal design:

Material of protective casing: Steel

Material of grout between protective casing and well casing: Sand

Protective cap:

Material: Steel

Vented: ☐ Yes ☐ No Locking: ☑ Yes ☐ No

Well Cap:

Material: PVC

Vented: ☐ Yes ☑ No

D. GROUNDWATER MEASURMENT (± 0.01 ft below top of inner well casing)

Water level: 5.26 ft Stabilization Time:

Well development method: Bailed and Pumped

Average depth of frostline:

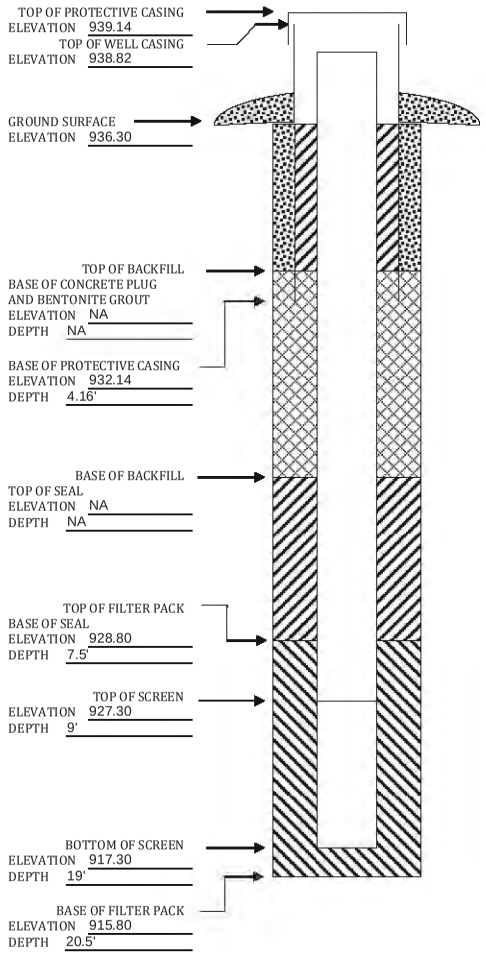
Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½x11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed for to: Iowa Department of Natural Resources, Land Quality Bureau, 502 E 9th St, Des Moines IA 50319-0034.

Questions? Call or Email: Nina Koger, Environmental Engineer Sr., 515-281-8986, Nina.Koger@dnr.iowa.gov

ELEVATIONS: ± 0.01 ft MSL
DEPTHS: ± 0.1 ft FROM GROUND SURFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL.)



06/2011 cmz DNR Form 542-1277

Print Form

IOWA DEPARTMENT OF NATURAL RESOURCES

MONITORING WELL/PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name: Black Hawk Co Landfill Permit No.: 7-SDP-1-75P

Well or Piezometer No: OW-115B

Dates Started: 07/31/2018 Date Completed: 07/31/2018

A. SURVEYED LOCATIONS AND ELEVATIONS

Locations (± 0.5 ft): N 3616599.63 E 5240369.85

Specify corner of site: IA State Plane

Distance & direction along boundary:

Distance & direction from boundary to wall:

Elevations (± 0.01 ft MSL):

Ground Surface: 902.1

Top of protective casing: 905.03

Top of well casing: 904.72

Benchmark elevation:

Benchmark description:

B. SOIL BORING INFORMATION

Name & Address of Construction Company:
Terracon
6612 Chancellor Drive Suite 102
Cedar Falls IA 50613

Name of Driller: Ron Faulk

Drilling Method: 4 1/4" HSA

Drilling Fluid: NA

Bore Hole Diameter: 8.25"

Soil Sampling Method: 2' by 2" split spoon

Depth of Boring: 20.0'

C. MONITORING WELL INSTALLATION

Casing material: Stainless Steel

Length of casing: 13.0'

Outside casing diameter: 2.375"

Inside casing diameter: 2.157"

Casing joint type: flush threaded

Casing/screen joint type: flush threaded

Screen material: Stainless Steel

Screen opening size: 0.010"

Screen length: 10'

Depth of well: 20'

Filter Pack:

Material: Filter Pack Sand

Grain size: 0.007-0.250"

Volume: 31 gal.

Seal (minimum 3 ft length above filter pack):

Material: Bentonite Chips 3/8" hole plug

Placement method: direct pour

Volume: 17 gal.

Backfill (if different from seal):

Material:

Placement method:

Volume:

Surface seal design:

Material of protective casing: Steel

Material of grout between protective casing and well casing: 3/8" hole plug

Protective cap:

Material: Steel

Vented: ☐ Yes ☐ No Locking: ☑ Yes ☐ No

Well Cap:

Material: PVC

Vented: ☐ Yes ☑ No

D. GROUNDWATER MEASURMENT (± 0.01 ft below top of inner well casing)

Water level: 10.58 ft Stabilization Time:

Well development method: Bailed and Pumped

Average depth of frostline:

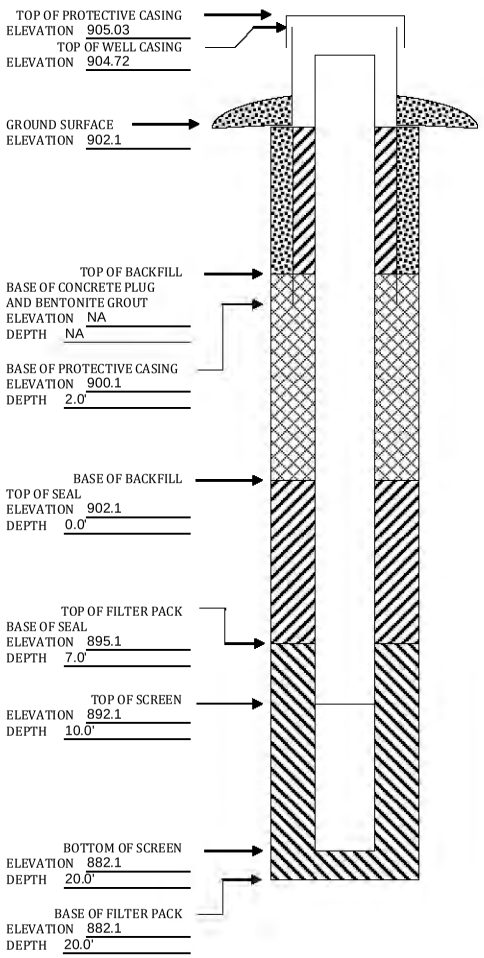
Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½x11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed for to: Iowa Department of Natural Resources, Land Quality Bureau, 502 E 9th St, Des Moines IA 50319-0034.

Questions? Call or Email: Nina Koger, Environmental Engineer Sr., 515-281-8986, Nina.Koger@dnr.iowa.gov

ELEVATIONS: ± 0.01 ft MSL
DEPTHS: ± 0.1 ft FROM GROUND SURFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL.)



06/2011 cmz DNR Form 542-1277

Print Form

IOWA DEPARTMENT OF NATURAL RESOURCES

MONITORING WELL/PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name: Black Hawk Co Landfill Permit No.: 7-SDP-1-75P

Well or Piezometer No: OW-116B

Dates Started: 07/31/2018 Date Completed: 07/31/2018

A. SURVEYED LOCATIONS AND ELEVATIONS

Locations (± 0.5 ft): N 3617231.68 E 5239963.12

Specify corner of site: IA State Plane

Distance & direction along boundary:

Distance & direction from boundary to wall:

Elevations (± 0.01 ft MSL):

Ground Surface: 908.0

Top of protective casing: 911.36

Top of well casing: 911.06

Benchmark elevation:

Benchmark description:

B. SOIL BORING INFORMATION

Name & Address of Construction Company:
Terracon
6612 Chancellor Drive Suite 102
Cedar Falls IA 50613

Name of Driller: Ron Faulk

Drilling Method: 4 1/4" HSA

Drilling Fluid: NA

Bore Hole Diameter: 8.25"

Soil Sampling Method: 2' by 2" split spoon

Depth of Boring: 19.0'

C. MONITORING WELL INSTALLATION

Casing material: Stainless Steel

Length of casing: 10.0'

Outside casing diameter: 2.375"

Inside casing diameter: 2.157"

Casing joint type: flush threaded

Casing/screen joint type: flush threaded

Screen material: Stainless Steel

Screen opening size: 0.010"

Screen length: 10'

Depth of well: 17'

Filter Pack:

Material: Filter Pack Sand

Grain size: 0.007-0.250"

Volume: 33 gal.

Seal (minimum 3 ft length above filter pack):

Material: Bentonite Chips 3/8" hole plug

Placement method: direct pour

Volume: 12 gal.

Backfill (if different from seal):

Material:

Placement method:

Volume:

Surface seal design:

Material of protective casing: Steel

Material of grout between protective casing and well casing: 3/8" hole plug

Protective cap:

Material: Steel

Vented: ☐ Yes ☐ No Locking: ☑ Yes ☐ No

Well Cap:

Material: PVC

Vented: ☐ Yes ☑ No

D. GROUNDWATER MEASURMENT (± 0.01 ft below top of inner well casing)

Water level: 12.02 ft Stabilization Time:

Well development method: Bailed and Pumped

Average depth of frostline:

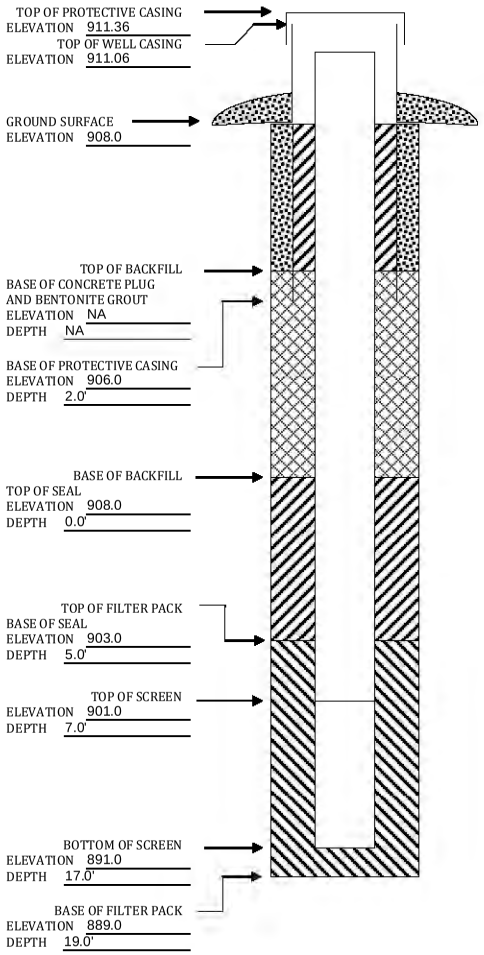
Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½x11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed for to: Iowa Department of Natural Resources, Land Quality Bureau, 502 E 9th St, Des Moines IA 50319-0034.

Questions? Call or Email: Nina Koger, Environmental Engineer Sr., 515-281-8986, Nina.Koger@dnr.iowa.gov

ELEVATIONS: ± 0.01 ft MSL
DEPTHS: ± 0.1 ft FROM GROUND SURFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL.)



06/2011 cmz DNR Form 542-1277

Print Form

IOWA DEPARTMENT OF NATURAL RESOURCES

MONITORING WELL/PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name: Black Hawk Co Landfill Permit No.: 7-SDP-1-75P

Well or Piezometer No: OW-117B

Dates Started: 08/01/2018 Date Completed: 08/01/2018

A. SURVEYED LOCATIONS AND ELEVATIONS

Locations (± 0.5 ft): N 3617337.50 E 5239822.50

Specify corner of site: IA State Plane

Distance & direction along boundary:

Distance & direction from boundary to wall:

Elevations (± 0.01 ft MSL):

Ground Surface: 910.4

Top of protective casing: 913.84

Top of well casing: 913.51

Benchmark elevation:

Benchmark description:

B. SOIL BORING INFORMATION

Name & Address of Construction Company:
Terracon
6612 Chancellor Drive Suite 102
Cedar Falls IA 50613

Name of Driller: Ron Faulk

Drilling Method: 4 1/4" HSA

Drilling Fluid: NA

Bore Hole Diameter: 8.25"

Soil Sampling Method: 2' by 2" split spoon

Depth of Boring: 20.5'

C. MONITORING WELL INSTALLATION

Casing material: Stainless Steel

Length of casing: 13.0'

Outside casing diameter: 2.375"

Inside casing diameter: 2.157"

Casing joint type: flush threaded

Casing/screen joint type: flush threaded

Screen material: Stainless Steel

Screen opening size: 0.010"

Screen length: 10'

Depth of well: 20'

Filter Pack:

Material: Filter Pack Sand

Grain size: 0.007-0.250"

Volume: 31 gal.

Seal (minimum 3 ft length above filter pack):

Material: Bentonite Chips 3/8" hole plug

Placement method: direct pour

Volume: 18 gal.

Backfill (if different from seal):

Material:

Placement method:

Volume:

Surface seal design:

Material of protective casing: Steel

Material of grout between protective casing and well casing: 3/8" hole plug

Protective cap:

Material: Steel

Vented: ☐ Yes ☐ No Locking: ☑ Yes ☐ No

Well Cap:

Material: PVC

Vented: ☐ Yes ☑ No

D. GROUNDWATER MEASURMENT (± 0.01 ft below top of inner well casing)

Water level: 10.94 ft Stabilization Time:

Well development method: Bailed and Pumped

Average depth of frostline:

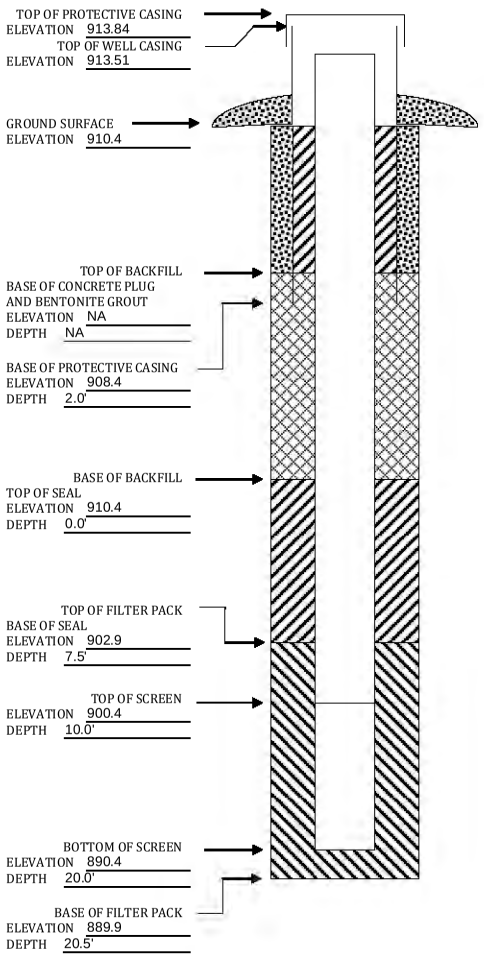
Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½x11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed for to: Iowa Department of Natural Resources, Land Quality Bureau, 502 E 9th St, Des Moines IA 50319-0034.

Questions? Call or Email: Nina Koger, Environmental Engineer Sr., 515-281-8986, Nina.Koger@dnr.iowa.gov

ELEVATIONS: ± 0.01 ft MSL
DEPTHS: ± 0.1 ft FROM GROUND SURFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL.)



06/2011 cmz DNR Form 542-1277

MONITORING WELL / PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name BLACK HAWK COUNTY LANDFILL	**Permit No.** 07-SDP-01-75P
Well or Piezometer No. OW-209B	
Dates Started	**Date Completed** 12-18-89

A. SURVEYED LOCATIONS AND ELEVATIONS	B. SOIL BORING INFORMATION
Locations (± 0.5 ft.):	**Name & address of construction company**
Specify corner of site	
Distance & direction along boundary	
Distance & direction from boundary to well	
Elevations (± 0.01 ft. MSL):	**Name of driller**
Ground Surface	**Drilling method**
Top of protective casing	**Drilling fluid**
Top of well casing	**Bore Hole diameter** 10 inch
Benchmark elevation	**Soil sampling method**
Benchmark description	**Depth of boring** 20.96 ft BGS

C. MONITORING WELL INSTALLATION	
Casing material STAINLESS STEEL	**Placement method**
Length of casing	**Volume**
Outside casing diameter	**Backfill (if different from seal):**
Inside casing diameter 2 inch	**Material** CEMENT
Casing joint type	**Placement method**
Casing/screen joint type	**Volume**
Screen material STAINLESS STEEL	**Surface seal design:**
Screen opening size 0.010 inch	**Material of protective casing:** STEEL
Screen length 10.2 ft	**Material of grout between protective casing and well casing:**
Depth of Well 20.26 ft BGS	**Protective cap:**
Filter Pack:	**Material** STEEL
Material BADGER BB	**Vented?:** Y/N **Locking?:** Y/N
Grain Size #1 WELL PACK	**Well cap:**
Volume	**Material**
Seal (minimum 3 ft. length above filter pack):	**Vented?:** Y/N Y
Material 1/4 inch BENTONITE PELLETS	

D. GROUNDWATER MEASUREMENT (± 0.01 foot below top of inner well casing)	
Water level	**Stabilization time**
Well development method	
Average depth of frostline	

Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½ inch x 11 inch map showing locations of all monitoring wells and piezometers.

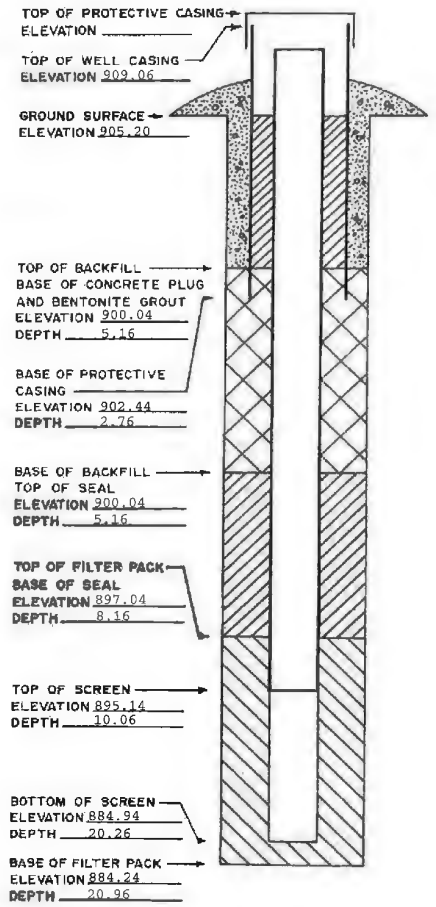
Please mail completed form to: Iowa Department of Natural Resources, Energy and Waste Management Bureau, 502 E. 9th Street, Des Moines, IA 50319-0034.
Questions? Call or Email: Nina Koger Environmental Engineer Sr., 515-281-8986, nina.koger@dnr.state.ia.us

Revised 9/05 Form # 542-1277

ELEVATIONS: ± 0.01 FT. MSL
DEPTHS: ± 0.1 FT. FROM GROUND SERFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL).

OW-209B



Print Form

IOWA DEPARTMENT OF NATURAL RESOURCES

MONITORING WELL/PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name: Black Hawk Co Landfill Permit No.: 7-SDP-1-75P

Well or Piezometer No: OW-213BR

Dates Started: 08/02/2018 Date Completed: 08/02/2018

A. SURVEYED LOCATIONS AND ELEVATIONS

Locations (± 0.5 ft): N 3618730.93 E 5239586.40

Specify corner of site: IA State Plane

Distance & direction along boundary:

Distance & direction from boundary to wall:

Elevations (± 0.01 ft MSL):

Ground Surface: 942.1

Top of protective casing: 945.66

Top of well casing: 945.32

Benchmark elevation:

Benchmark description:

B. SOIL BORING INFORMATION

Name & Address of Construction Company:
Terracon
6612 Chancellor Drive Suite 102
Cedar Falls IA 50613

Name of Driller: Ron Faulk

Drilling Method: 4 1/4" HSA

Drilling Fluid: NA

Bore Hole Diameter: 8.25"

Soil Sampling Method: 2' by 2" split spoon

Depth of Boring: 22.5'

C. MONITORING WELL INSTALLATION

Casing material: Stainless Steel

Length of casing: 13.0'

Outside casing diameter: 2.375"

Inside casing diameter: 2.157"

Casing joint type: flush threaded

Casing/screen joint type: flush threaded

Screen material: Stainless Steel

Screen opening size: 0.010"

Screen length: 10'

Depth of well: 20'

Filter Pack:

Material: Filter Pack Sand

Grain size: 0.007-0.250"

Volume: 35 gal.

Seal (minimum 3 ft length above filter pack):

Material: Bentonite Chips 3/8" hole plug

Placement method: direct pour

Volume: 19 gal.

Backfill (if different from seal):

Material:

Placement method:

Volume:

Surface seal design:

Material of protective casing: Steel

Material of grout between protective casing and well casing: 3/8" hole plug

Protective cap:

Material: Steel

Vented: ☐ Yes ☐ No Locking: ☑ Yes ☐ No

Well Cap:

Material: PVC

Vented: ☐ Yes ☑ No

D. GROUNDWATER MEASURMENT (± 0.01 ft below top of inner well casing)

Water level: 9.95 ft Stabilization Time:

Well development method: Bailed and Pumped

Average depth of frostline:

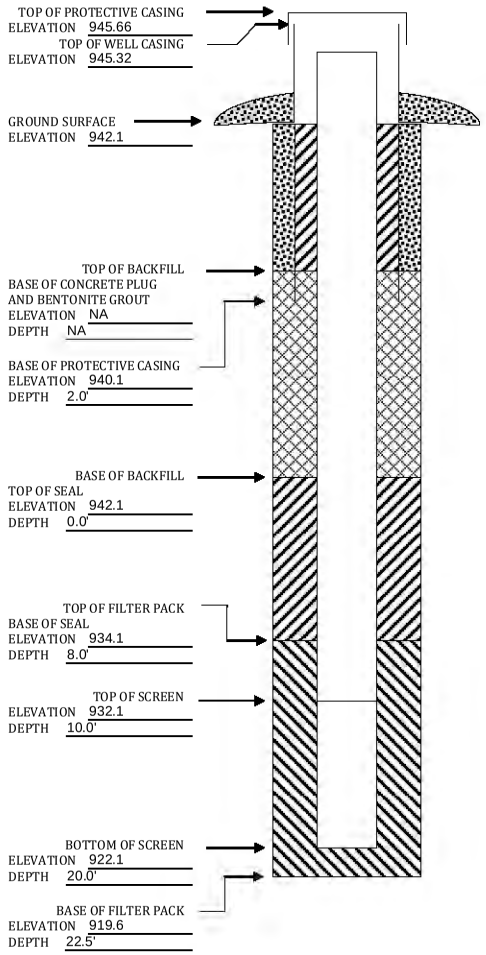
Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½x11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed for to: Iowa Department of Natural Resources, Land Quality Bureau, 502 E 9th St, Des Moines IA 50319-0034.

Questions? Call or Email: Nina Koger, Environmental Engineer Sr., 515-281-8986, Nina.Koger@dnr.iowa.gov

ELEVATIONS: ± 0.01 ft MSL
DEPTHS: ± 0.1 ft FROM GROUND SURFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL.)



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Print Form

IOWA DEPARTMENT OF NATURAL RESOURCES

MONITORING WELL/PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name: Black Hawk Co Landfill Permit No.: 7-SDP-1-75P

Well or Piezometer No: OW-217B

Dates Started: 08/01/2018 Date Completed: 08/01/2018

A. SURVEYED LOCATIONS AND ELEVATIONS

Locations (± 0.5 ft): N 3618735.48 E 5240098.85

Specify corner of site: IA State Plane

Distance & direction along boundary:

Distance & direction from boundary to wall:

Elevations (± 0.01 ft MSL):

Ground Surface: 939.9

Top of protective casing: 942.74

Top of well casing: 942.44

Benchmark elevation:

Benchmark description:

B. SOIL BORING INFORMATION

Name & Address of Construction Company:
Terracon
6612 Chancellor Drive Suite 102
Cedar Falls IA 50613

Name of Driller: Ron Faulk

Drilling Method: 4 1/4" HSA

Drilling Fluid: NA

Bore Hole Diameter: 8.25"

Soil Sampling Method: 2' by 2" split spoon

Depth of Boring: 21.0'

C. MONITORING WELL INSTALLATION

Casing material: Stainless Steel

Length of casing: 13.0'

Outside casing diameter: 2.375"

Inside casing diameter: 2.157"

Casing joint type: flush threaded

Casing/screen joint type: flush threaded

Screen material: Stainless Steel

Screen opening size: 0.010"

Screen length: 10'

Depth of well: 20'

Filter Pack:

Material: Filter Pack Sand

Grain size: 0.007-0.250"

Volume: 32 gal.

Seal (minimum 3 ft length above filter pack):

Material: Bentonite Chips 3/8" hole plug

Placement method: direct pour

Volume: 19 gal.

Backfill (if different from seal):

Material:

Placement method:

Volume:

Surface seal design:

Material of protective casing: Steel

Material of grout between protective casing and well casing: 3/8" hole plug

Protective cap:

Material: Steel

Vented: ☐ Yes ☐ No Locking: ☑ Yes ☐ No

Well Cap:

Material: PVC

Vented: ☐ Yes ☑ No

D. GROUNDWATER MEASURMENT (± 0.01 ft below top of inner well casing)

Water level: 9.07 ft Stabilization Time:

Well development method: Bailed and Pumped

Average depth of frostline:

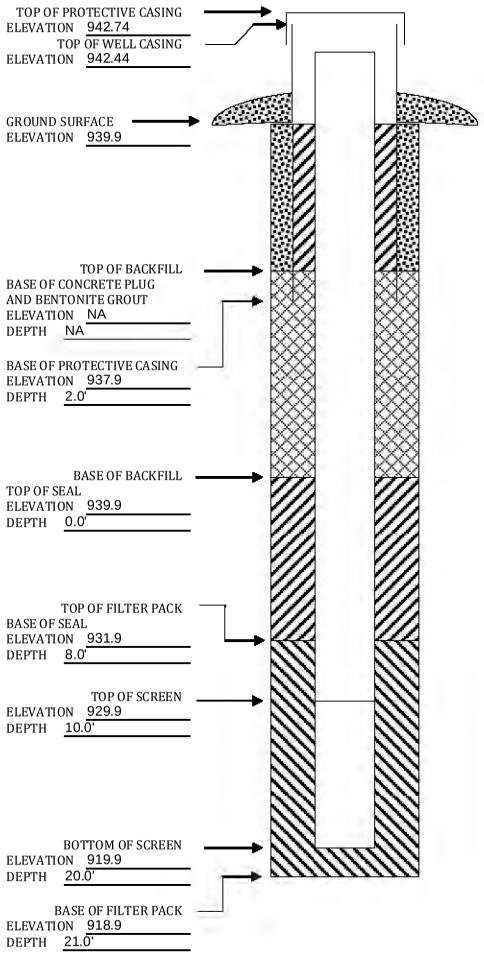
Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½x11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed for to: Iowa Department of Natural Resources, Land Quality Bureau, 502 E 9th St, Des Moines IA 50319-0034.

Questions? Call or Email: Nina Koger, Environmental Engineer Sr., 515-281-8986, Nina.Koger@dnr.iowa.gov

ELEVATIONS: ± 0.01 ft MSL
DEPTHS: ± 0.1 ft FROM GROUND SURFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL.)



06/2011 cmz DNR Form 542-1277

Print Form

IOWA DEPARTMENT OF NATURAL RESOURCES

MONITORING WELL/PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name: Black Hawk Co Landfill Permit No.: 7-SDP-1-75P

Well or Piezometer No: OW-218B

Dates Started: 08/02/2018 Date Completed: 08/02/2018

A. SURVEYED LOCATIONS AND ELEVATIONS

Locations (± 0.5 ft): N 3618733.31 E 5239114.220

Specify corner of site: IA State Plane

Distance & direction along boundary:

Distance & direction from boundary to wall:

Elevations (± 0.01 ft MSL):

Ground Surface: 943.0

Top of protective casing: 946.76

Top of well casing: 946.37

Benchmark elevation:

Benchmark description:

B. SOIL BORING INFORMATION

Name & Address of Construction Company:
Terracon
6612 Chancellor Drive Suite 102
Cedar Falls IA 50613

Name of Driller: Ron Faulk

Drilling Method: 4 1/4" HSA

Drilling Fluid: NA

Bore Hole Diameter: 8.25"

Soil Sampling Method: 2' by 2" split spoon

Depth of Boring: 24.5'

C. MONITORING WELL INSTALLATION

Casing material: Stainless Steel

Length of casing: 16.0'

Outside casing diameter: 2.375"

Inside casing diameter: 2.157"

Casing joint type: flush threaded

Casing/screen joint type: flush threaded

Screen material: Stainless Steel

Screen opening size: 0.010"

Screen length: 10'

Depth of well: 23'

Filter Pack:

Material: Filter Pack Sand

Grain size: 0.007-0.250"

Volume: 35 gal.

Seal (minimum 3 ft length above filter pack):

Material: Bentonite Chips 3/8" hole plug

Placement method: direct pour

Volume: 24 gal.

Backfill (if different from seal):

Material:

Placement method:

Volume:

Surface seal design:

Material of protective casing: Steel

Material of grout between protective casing and well casing: 3/8" hole plug

Protective cap:

Material: Steel

Vented: ☐ Yes ☐ No Locking: ☑ Yes ☐ No

Well Cap:

Material: PVC

Vented: ☐ Yes ☑ No

D. GROUNDWATER MEASURMENT (± 0.01 ft below top of inner well casing)

Water level: 10.73 ft Stabilization Time:

Well development method: Bailed and Pumped

Average depth of frostline:

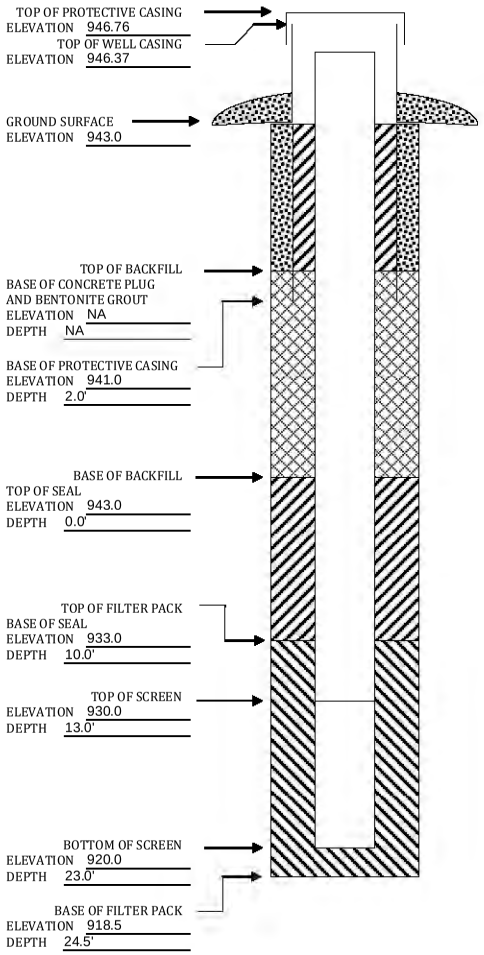
Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½x11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed for to: Iowa Department of Natural Resources, Land Quality Bureau, 502 E 9th St, Des Moines IA 50319-0034.

Questions? Call or Email: Nina Koger, Environmental Engineer Sr., 515-281-8986, Nina.Koger@dnr.iowa.gov

ELEVATIONS: ± 0.01 ft MSL
DEPTHS: ± 0.1 ft FROM GROUND SURFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL.)



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Print Form

IOWA DEPARTMENT OF NATURAL RESOURCES

MONITORING WELL/PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name: Black Hawk Co Landfill Permit No.: 7-SDP-1-75P

Well or Piezometer No: OW-219B

Dates Started: 08/02/2018 Date Completed: 08/02/2018

A. SURVEYED LOCATIONS AND ELEVATIONS

Locations (± 0.5 ft): N 3618749.15 E 5238570.30

Specify corner of site: IA State Plane

Distance & direction along boundary:

Distance & direction from boundary to wall:

Elevations (± 0.01 ft MSL):

Ground Surface: 936.9

Top of protective casing: 940.14

Top of well casing: 939.90

Benchmark elevation:

Benchmark description:

B. SOIL BORING INFORMATION

Name & Address of Construction Company:
Terracon
6612 Chancellor Drive Suite 102
Cedar Falls IA 50613

Name of Driller: Ron Faulk

Drilling Method: 4 1/4" HSA

Drilling Fluid: NA

Bore Hole Diameter: 8.25"

Soil Sampling Method: 2' by 2" split spoon

Depth of Boring: 18.5'

C. MONITORING WELL INSTALLATION

Casing material: Stainless Steel

Length of casing: 10.0'

Outside casing diameter: 2.375"

Inside casing diameter: 2.157"

Casing joint type: flush threaded

Casing/screen joint type: flush threaded

Screen material: Stainless Steel

Screen opening size: 0.010"

Screen length: 10'

Depth of well: 17'

Filter Pack:

Material: Filter Pack Sand

Grain size: 0.007-0.250"

Volume: 32 gal.

Seal (minimum 3 ft length above filter pack):

Material: Bentonite Chips 3/8" hole plug

Placement method: direct pour

Volume: 12 gal.

Backfill (if different from seal):

Material:

Placement method:

Volume:

Surface seal design:

Material of protective casing: Steel

Material of grout between protective casing and well casing: 3/8" hole plug

Protective cap:

Material: Steel

Vented: ☐ Yes ☐ No Locking: ☑ Yes ☐ No

Well Cap:

Material: PVC

Vented: ☐ Yes ☑ No

D. GROUNDWATER MEASURMENT (± 0.01 ft below top of inner well casing)

Water level: 6.54 ft Stabilization Time:

Well development method: Bailed and Pumped

Average depth of frostline:

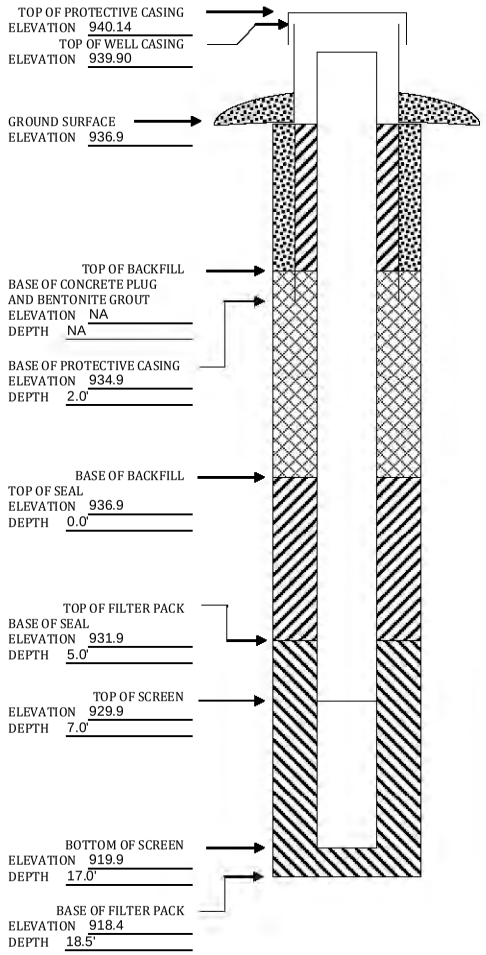
Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½x11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed for to: Iowa Department of Natural Resources, Land Quality Bureau, 502 E 9th St, Des Moines IA 50319-0034.

Questions? Call or Email: Nina Koger, Environmental Engineer Sr., 515-281-8986, Nina.Koger@dnr.iowa.gov

ELEVATIONS: ± 0.01 ft MSL
DEPTHS: ± 0.1 ft FROM GROUND SURFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL.)



06/2011 cmz DNR Form 542-1277

Print Form

IOWA DEPARTMENT OF NATURAL RESOURCES

MONITORING WELL/PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name: Black Hawk Co Landfill Permit No.: 7-SDP-1-75P

Well or Piezometer No: OW-220B

Dates Started: 08/01/2018 Date Completed: 08/01/2018

A. SURVEYED LOCATIONS AND ELEVATIONS

Locations (± 0.5 ft): N 3617831.65 E 5238789.55

Specify corner of site: IA State Plane

Distance & direction along boundary:

Distance & direction from boundary to wall:

Elevations (± 0.01 ft MSL):

Ground Surface: 928.0

Top of protective casing: 931.42

Top of well casing: 931.15

Benchmark elevation:

Benchmark description:

B. SOIL BORING INFORMATION

Name & Address of Construction Company:
Terracon
6612 Chancellor Drive Suite 102
Cedar Falls IA 50613

Name of Driller: Ron Faulk

Drilling Method: 4 1/4" HSA

Drilling Fluid: NA

Bore Hole Diameter: 8.25"

Soil Sampling Method: 2' by 2" split spoon

Depth of Boring: 22.5'

C. MONITORING WELL INSTALLATION

Casing material: Stainless Steel

Length of casing: 13.0'

Outside casing diameter: 2.375"

Inside casing diameter: 2.157"

Casing joint type: flush threaded

Casing/screen joint type: flush threaded

Screen material: Stainless Steel

Screen opening size: 0.010"

Screen length: 10'

Depth of well: 20'

Filter Pack:

Material: Filter Pack Sand

Grain size: 0.007-0.250"

Volume: 35 gal.

Seal (minimum 3 ft length above filter pack):

Material: Bentonite Chips 3/8" hole plug

Placement method: direct pour

Volume: 19 gal.

Backfill (if different from seal):

Material:

Placement method:

Volume:

Surface seal design:

Material of protective casing: Steel

Material of grout between protective casing and well casing: 3/8" hole plug

Protective cap:

Material: Steel

Vented: ☐ Yes ☐ No Locking: ☑ Yes ☐ No

Well Cap:

Material: PVC

Vented: ☐ Yes ☑ No

D. GROUNDWATER MEASURMENT (± 0.01 ft below top of inner well casing)

Water level: 14.47 ft Stabilization Time:

Well development method: Bailed and Pumped

Average depth of frostline:

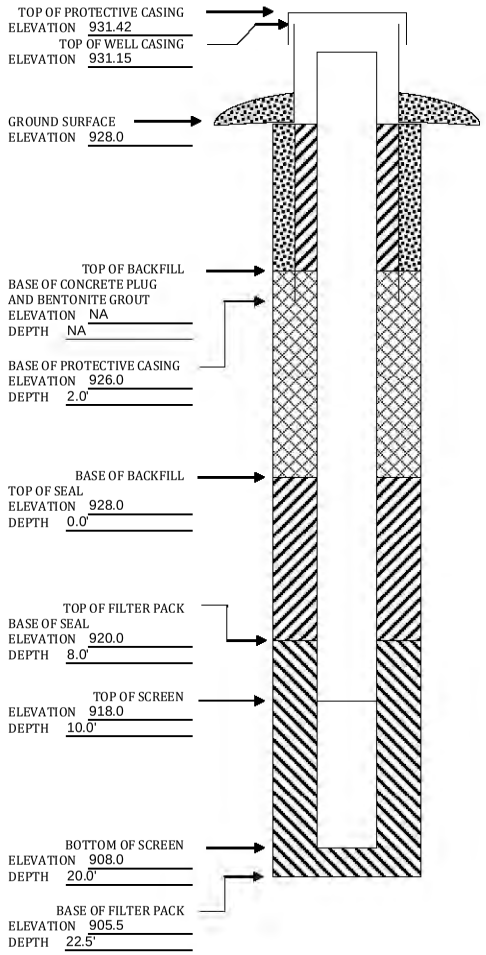
Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½x11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed for to: Iowa Department of Natural Resources, Land Quality Bureau, 502 E 9th St, Des Moines IA 50319-0034.

Questions? Call or Email: Nina Koger, Environmental Engineer Sr., 515-281-8986, Nina.Koger@dnr.iowa.gov

ELEVATIONS: ± 0.01 ft MSL
DEPTHS: ± 0.1 ft FROM GROUND SURFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL.)



06/2011 cmz DNR Form 542-1277

Print Form

IOWA DEPARTMENT OF NATURAL RESOURCES

MONITORING WELL/PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name: Black Hawk Co Landfill Permit No.: 7-SDP-1-75P

Well or Piezometer No: OW-221B

Dates Started: 07/31/2018 Date Completed: 07/31/2018

A. SURVEYED LOCATIONS AND ELEVATIONS

Locations (± 0.5 ft): N 3617659.33 E 5239595.28

Specify corner of site: IA State Plane

Distance & direction along boundary:

Distance & direction from boundary to wall:

Elevations (± 0.01 ft MSL):

Ground Surface: 921.2

Top of protective casing: 924.49

Top of well casing: 924.15

Benchmark elevation:

Benchmark description:

B. SOIL BORING INFORMATION

Name & Address of Construction Company:
Terracon
6612 Chancellor Drive Suite 102
Cedar Falls IA 50613

Name of Driller: Ron Faulk

Drilling Method: 4 1/4" HSA

Drilling Fluid: NA

Bore Hole Diameter: 8.25"

Soil Sampling Method: 2' by 2" split spoon

Depth of Boring: 20.5'

C. MONITORING WELL INSTALLATION

Casing material: Stainless Steel

Length of casing: 13.0'

Outside casing diameter: 2.375"

Inside casing diameter: 2.157"

Casing joint type: flush threaded

Casing/screen joint type: flush threaded

Screen material: Stainless Steel

Screen opening size: 0.010"

Screen length: 10'

Depth of well: 20'

Filter Pack:

Material: Filter Pack Sand

Grain size: 0.007-0.250"

Volume: 30 gal.

Seal (minimum 3 ft length above filter pack):

Material: Bentonite Chips 3/8" hole plug

Placement method: direct pour

Volume: 19 gal.

Backfill (if different from seal):

Material:

Placement method:

Volume:

Surface seal design:

Material of protective casing: Steel

Material of grout between protective casing and well casing: 3/8" hole plug

Protective cap:

Material: Steel

Vented: ☐ Yes ☐ No Locking: ☑ Yes ☐ No

Well Cap:

Material: PVC

Vented: ☐ Yes ☑ No

D. GROUNDWATER MEASURMENT (± 0.01 ft below top of inner well casing)

Water level: 18.09 ft Stabilization Time:

Well development method: Bailed and Pumped

Average depth of frostline:

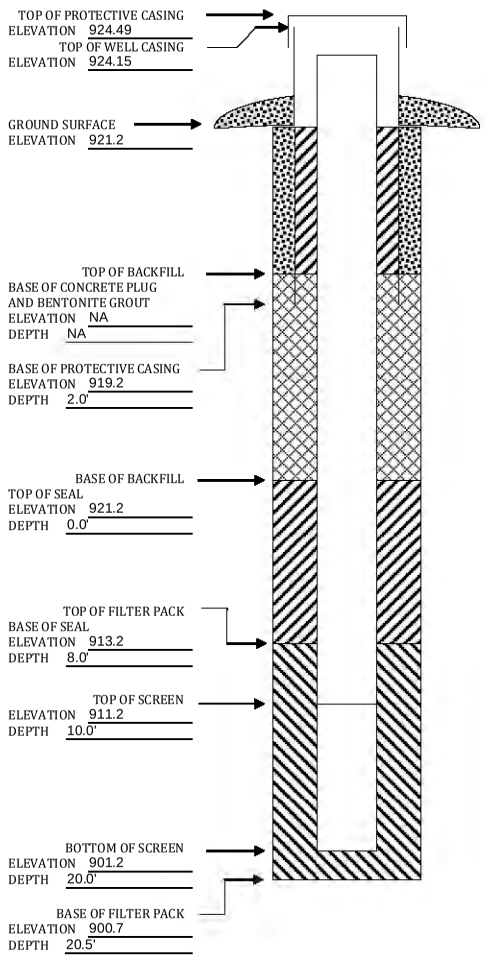
Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½x11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed for to: Iowa Department of Natural Resources, Land Quality Bureau, 502 E 9th St, Des Moines IA 50319-0034.

Questions? Call or Email: Nina Koger, Environmental Engineer Sr., 515-281-8986, Nina.Koger@dnr.iowa.gov

ELEVATIONS: ± 0.01 ft MSL
DEPTHS: ± 0.1 ft FROM GROUND SURFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL.)



06/2011 cmz DNR Form 542-1277

Print Form

IOWA DEPARTMENT OF NATURAL RESOURCES

MONITORING WELL/PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name: Black Hawk Co Landfill Permit No.: 7-SDP-1-75P

Well or Piezometer No: OW-222B

Dates Started: 07/30/2018 Date Completed: 07/30/2018

A. SURVEYED LOCATIONS AND ELEVATIONS

Locations (± 0.5 ft): N 3617468.03 E 5239825.68

Specify corner of site: IA State Plane

Distance & direction along boundary:

Distance & direction from boundary to wall:

Elevations (± 0.01 ft MSL):

Ground Surface: 916.2

Top of protective casing: 919.65

Top of well casing: 919.37

Benchmark elevation:

Benchmark description:

B. SOIL BORING INFORMATION

Name & Address of Construction Company:
Terracon
6612 Chancellor Drive Suite 102
Cedar Falls IA 50613

Name of Driller: Ron Faulk

Drilling Method: 4 1/4" HSA

Drilling Fluid: NA

Bore Hole Diameter: 8.25"

Soil Sampling Method: 2' by 2" split spoon

Depth of Boring: 22.5'

C. MONITORING WELL INSTALLATION

Casing material: Stainless Steel

Length of casing: 10.0'

Outside casing diameter: 2.375"

Inside casing diameter: 2.157"

Casing joint type: flush threaded

Casing/screen joint type: flush threaded

Screen material: Stainless Steel

Screen opening size: 0.010"

Screen length: 10'

Depth of well: 17'

Filter Pack:

Material: Filter Pack Sand

Grain size: 0.007-0.250"

Volume: 42 gal.

Seal (minimum 3 ft length above filter pack):

Material: Bentonite Chips 3/8" hole plug

Placement method: direct pour

Volume: 12 gal.

Backfill (if different from seal):

Material:

Placement method:

Volume:

Surface seal design:

Material of protective casing: Steel

Material of grout between protective casing and well casing: 3/8" hole plug

Protective cap:

Material: Steel

Vented: ☐ Yes ☐ No Locking: ☑ Yes ☐ No

Well Cap:

Material: PVC

Vented: ☐ Yes ☑ No

D. GROUNDWATER MEASURMENT (± 0.01 ft below top of inner well casing)

Water level: dry Stabilization Time:

Well development method: Bailed and Pumped

Average depth of frostline:

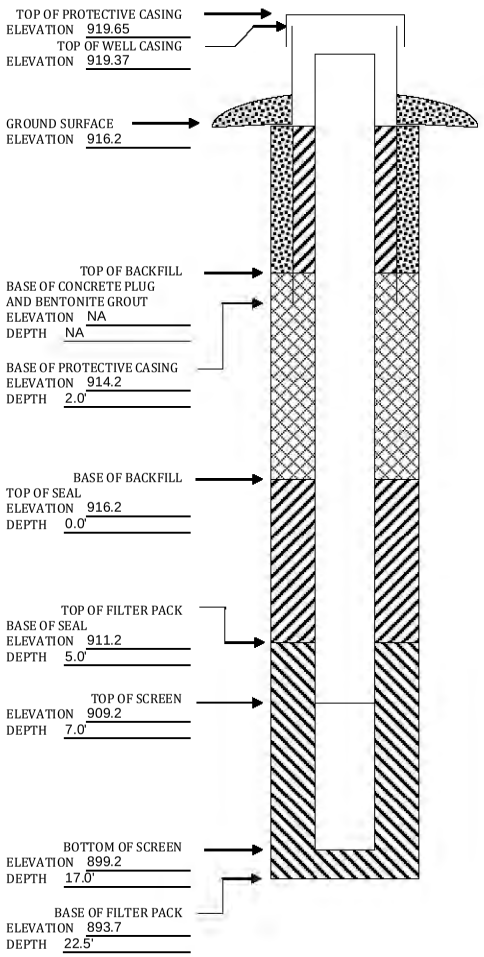
Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½x11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed for to: Iowa Department of Natural Resources, Land Quality Bureau, 502 E 9th St, Des Moines IA 50319-0034.

Questions? Call or Email: Nina Koger, Environmental Engineer Sr., 515-281-8986, Nina.Koger@dnr.iowa.gov

ELEVATIONS: ± 0.01 ft MSL
DEPTHS: ± 0.1 ft FROM GROUND SURFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL.)



06/2011 cmz DNR Form 542-1277

Print Form

IOWA DEPARTMENT OF NATURAL RESOURCES

MONITORING WELL/PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name: Black Hawk Co Landfill Permit No.: 7-SDP-1-75P

Well or Piezometer No: OW-223B

Dates Started: 07/31/2018 Date Completed: 07/31/2018

A. SURVEYED LOCATIONS AND ELEVATIONS

Locations (± 0.5 ft): N 3617313.92 E 5240081.60

Specify corner of site: IA State Plane

Distance & direction along boundary:

Distance & direction from boundary to wall:

Elevations (± 0.01 ft MSL):

Ground Surface: 914.6

Top of protective casing: 917.74

Top of well casing: 917.45

Benchmark elevation:

Benchmark description:

B. SOIL BORING INFORMATION

Name & Address of Construction Company:
Terracon
6612 Chancellor Drive Suite 102
Cedar Falls IA 50613

Name of Driller: Ron Faulk

Drilling Method: 4 1/4" HSA

Drilling Fluid: NA

Bore Hole Diameter: 8.25"

Soil Sampling Method: 2' by 2" split spoon

Depth of Boring: 18.5'

C. MONITORING WELL INSTALLATION

Casing material: Stainless Steel

Length of casing: 10.0'

Outside casing diameter: 2.375"

Inside casing diameter: 2.157"

Casing joint type: flush threaded

Casing/screen joint type: flush threaded

Screen material: Stainless Steel

Screen opening size: 0.010"

Screen length: 10'

Depth of well: 17'

Filter Pack:

Material: Filter Pack Sand

Grain size: 0.007-0.250"

Volume: 32 gal.

Seal (minimum 3 ft length above filter pack):

Material: Bentonite Chips 3/8" hole plug

Placement method: direct pour

Volume: 12 gal.

Backfill (if different from seal):

Material:

Placement method:

Volume:

Surface seal design:

Material of protective casing: Steel

Material of grout between protective casing and well casing: 3/8" hole plug

Protective cap:

Material: Steel

Vented: ☐ Yes ☐ No Locking: ☑ Yes ☐ No

Well Cap:

Material: PVC

Vented: ☐ Yes ☑ No

D. GROUNDWATER MEASURMENT (± 0.01 ft below top of inner well casing)

Water level: dry Stabilization Time:

Well development method: Bailed and Pumped

Average depth of frostline:

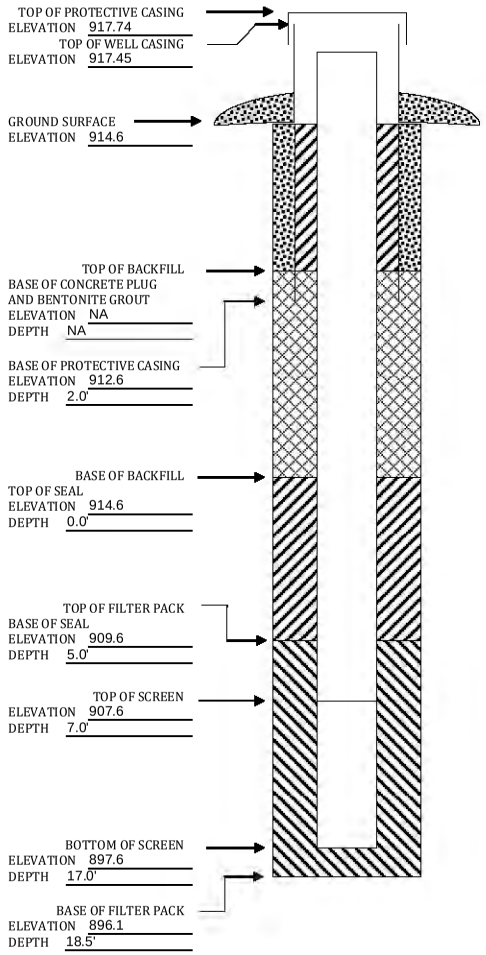
Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½x11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed for to: Iowa Department of Natural Resources, Land Quality Bureau, 502 E 9th St, Des Moines IA 50319-0034.

Questions? Call or Email: Nina Koger, Environmental Engineer Sr., 515-281-8986, Nina.Koger@dnr.iowa.gov

ELEVATIONS: ± 0.01 ft MSL
DEPTHS: ± 0.1 ft FROM GROUND SURFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL.)



06/2011 cmz DNR Form 542-1277

Print Form

IOWA DEPARTMENT OF NATURAL RESOURCES

MONITORING WELL/PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name: Black Hawk Co Land Fill Permit No.: 7-SDP-1-75P

Well or Piezometer No: P 604C

Dates Started: 10/30/2014 Date Completed: 11/5/2014

A. SURVEYED LOCATIONS AND ELEVATIONS

Locations (± 0.5 ft): N - 3617474.8, E - 5235286.4

Specify corner of site:

Distance & direction along boundary:

Distance & direction from boundary to wall:

Elevations (± 0.01 ft MSL):

Ground Surface: 932.00

Top of protective casing: 935.10

Top of well casing: 934.71

Benchmark elevation:

Benchmark description:

B. SOIL BORING INFORMATION

Name & Address of Construction Company:
Terracon
6612 Chancellor Drive Suite 102
Cedar Falls IA 50613

Name of Driller: Ron Faulk

Drilling Method: 4 1/4 HSA

Drilling Fluid: NA

Bore Hole Diameter: 6 in

Soil Sampling Method: Continuous 2 ft split spoon

Depth of Boring: 121.5 ft

C. MONITORING WELL INSTALLATION

Casing material: Stainless Steel

Length of casing: ft

Outside casing diameter: 2 1/4 in

Inside casing diameter: 2 in

Casing joint type: 304

Casing/screen joint type: 304

Screen material: Stainless Steel

Screen opening size: No. 10 Slot

Screen length: 5 ft

Depth of well: 119 ft

Filter Pack:

Material: Coarse Sand

Grain size: see grain size curve

Volume: 1.83 cu. ft

Seal (minimum 3 ft length above filter pack):

Material: Bentonite Chips 3/8 in hole plug

Placement method: direct pour

Volume: 1.48 cu. ft

Backfill (if different from seal):

Material: Quick Grout

Placement method: Tremie pipe

Volume: 29.61 cu. ft

Surface seal design:

Material of protective casing: Steel

Material of grout between protective casing and well casing: Sand

Protective cap:

Material: Steel

Vented: ☐ Yes ☐ No Locking: ☑ Yes ☐ No

Well Cap:

Material: PVC

Vented: ☐ Yes ☑ No

D. GROUNDWATER MEASURMENT (± 0.01 ft below top of inner well casing)

Water level: 95.54 ft Stabilization Time:

Well development method: Bailed and Pumped

Average depth of frostline:

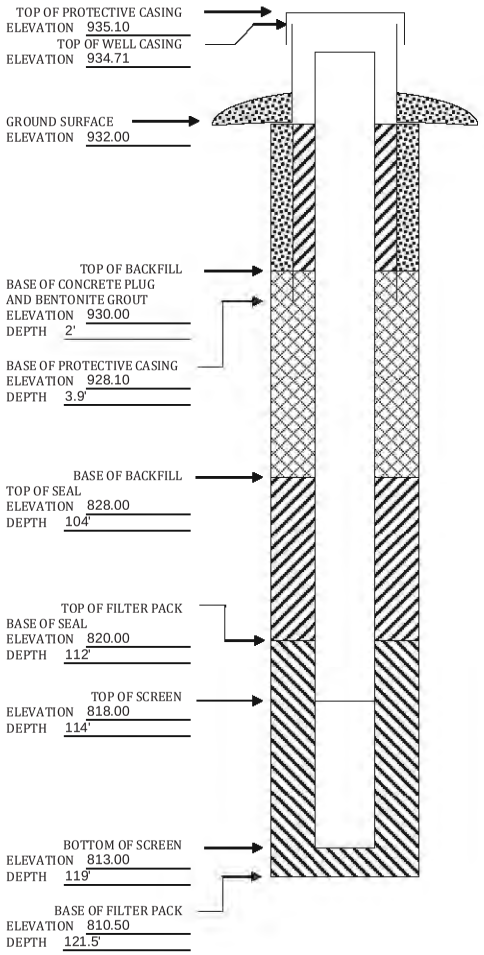
Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½x11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed for to: Iowa Department of Natural Resources, Land Quality Bureau, 502 E 9th St, Des Moines IA 50319-0034.

Questions? Call or Email: Nina Koger, Environmental Engineer Sr., 515-281-8986, Nina.Koger@dnr.iowa.gov

ELEVATIONS: ± 0.01 ft MSL
DEPTHS: ± 0.1 ft FROM GROUND SURFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL.)



06/2011 cmz DNR Form 542-1277

Print Form

IOWA DEPARTMENT OF NATURAL RESOURCES

MONITORING WELL/PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name: Black Hawk Co Landfill Permit No.: 7-SDP-1-75P

Well or Piezometer No: MW-606B

Dates Started: 11/02/2022 Date Completed: 11/02/2022

A. SURVEYED LOCATIONS AND ELEVATIONS

Locations (± 0.5 ft): N 3616543.81 E 5235271.97

Specify corner of site: IA State Plane

Distance & direction along boundary:

Distance & direction from boundary to wall:

Elevations (± 0.01 ft MSL):

Ground Surface: 944.71

Top of protective casing: 947.31

Top of well casing: 947.18

Benchmark elevation:

Benchmark description:

B. SOIL BORING INFORMATION

Name & Address of Construction Company:
Terracon
6612 Chancellor Drive Suite 102
Cedar Falls IA 50613

Name of Driller: Scott Zein

Drilling Method: 4 1/4" HSA

Drilling Fluid: NA

Bore Hole Diameter: 8.25"

Soil Sampling Method: 2' by 2" split spoon

Depth of Boring: 20.0'

C. MONITORING WELL INSTALLATION

Casing material: SCH 40 PVC

Length of casing: 11.47'

Outside casing diameter: 2.375"

Inside casing diameter: 2.067"

Casing joint type: flush threaded

Casing/screen joint type: flush threaded

Screen material: SCH 40 PVC

Screen opening size: 0.010"

Screen length: 10'

Depth of well: 19'

Filter Pack:

Material: Filter Pack Sand

Grain size: 0.007-0.250"

Volume: 31 gal.

Seal (minimum 3 ft length above filter pack):

Material: Bentonite Chips 3/8" hole plug

Placement method: direct pour

Volume: 18 gal.

Backfill (if different from seal):

Material:

Placement method:

Volume:

Surface seal design:

Material of protective casing: 4-in sq. by 7-ft long Steel

Material of grout between protective casing and well casing: 3/8" hole plug

Protective cap:

Material: Steel

Vented: ☐ Yes ☐ No Locking: ☑ Yes ☐ No

Well Cap:

Material: PVC J-Plug

Vented: ☐ Yes ☑ No

D. GROUNDWATER MEASURMENT (± 0.01 ft below top of inner well casing)

Water level: 7.29 ft Stabilization Time: 24-hr

Well development method: Bailed and Pumped

Average depth of frostline:

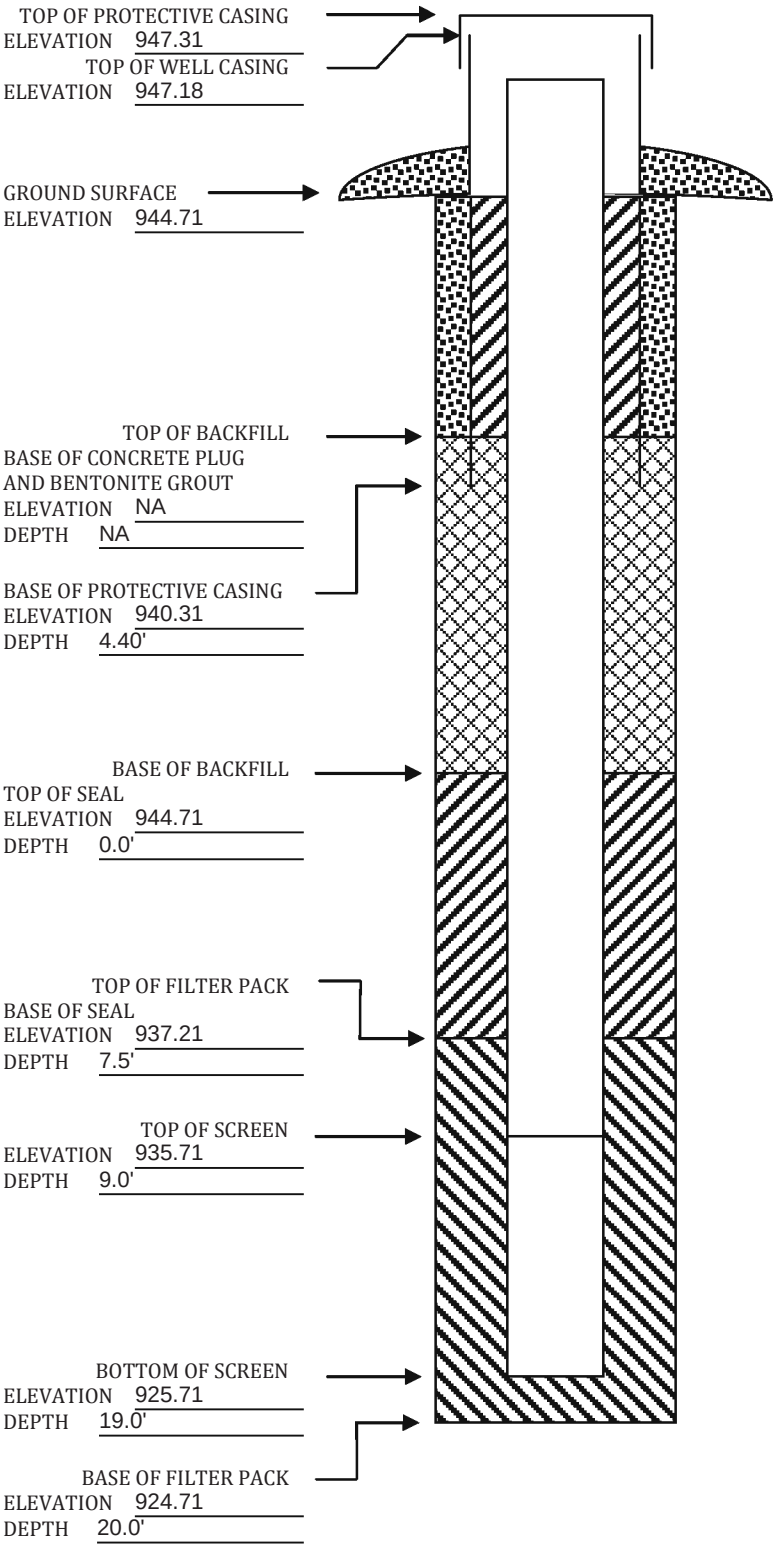
Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½x11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed for to: Iowa Department of Natural Resources, Land Quality Bureau, 502 E 9th St, Des Moines IA 50319-0034.

Questions? Call or Email: Nina Koger, Environmental Engineer Sr., 515-281-8986, Nina.Koger@dnr.iowa.gov

ELEVATIONS: ± 0.01 ft MSL
DEPTHS: ± 0.1 ft FROM GROUND SURFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL.)



Print Form

IOWA DEPARTMENT OF NATURAL RESOURCES

MONITORING WELL/PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name: Black Hawk Co Landfill Permit No.: 7-SDP-1-75P

Well or Piezometer No: OW-214BR

Dates Started: 11/02/2022 Date Completed: 11/02/2022

A. SURVEYED LOCATIONS AND ELEVATIONS

Locations (± 0.5 ft): N 3617542.42 E 5240405.93

Specify corner of site: IA State Plane

Distance & direction along boundary:

Distance & direction from boundary to wall:

Elevations (± 0.01 ft MSL):

Ground Surface: 922.89

Top of protective casing: 925.53

Top of well casing: 925.36

Benchmark elevation:

Benchmark description:

B. SOIL BORING INFORMATION

Name & Address of Construction Company:
Terracon
6612 Chancellor Drive Suite 102
Cedar Falls IA 50613

Name of Driller: Scott Zein

Drilling Method: 4 1/4" HSA

Drilling Fluid: NA

Bore Hole Diameter: 8.25"

Soil Sampling Method: 2' by 2" split spoon

Depth of Boring: 20.0'

C. MONITORING WELL INSTALLATION

Casing material: SCH 40 PVC

Length of casing: 11.47'

Outside casing diameter: 2.375"

Inside casing diameter: 2.067"

Casing joint type: flush threaded

Casing/screen joint type: flush threaded

Screen material: SCH 40 PVC

Screen opening size: 0.010"

Screen length: 10'

Depth of well: 19'

Filter Pack:

Material: Filter Pack Sand

Grain size: 0.007-0.250"

Volume: 31 gal.

Seal (minimum 3 ft length above filter pack):

Material: Bentonite Chips 3/8" hole plug

Placement method: direct pour

Volume: 18 gal.

Backfill (if different from seal):

Material:

Placement method:

Volume:

Surface seal design:

Material of protective casing: 4-in sq. by 7-ft long Steel

Material of grout between protective casing and well casing: 3/8" hole plug

Protective cap:

Material: Steel

Vented: ☐ Yes ☐ No Locking: ☑ Yes ☐ No

Well Cap:

Material: PVC J-Plug

Vented: ☐ Yes ☑ No

D. GROUNDWATER MEASURMENT (± 0.01 ft below top of inner well casing)

Water level: 11.65 ft Stabilization Time: 24-hr

Well development method: Bailed and Pumped

Average depth of frostline:

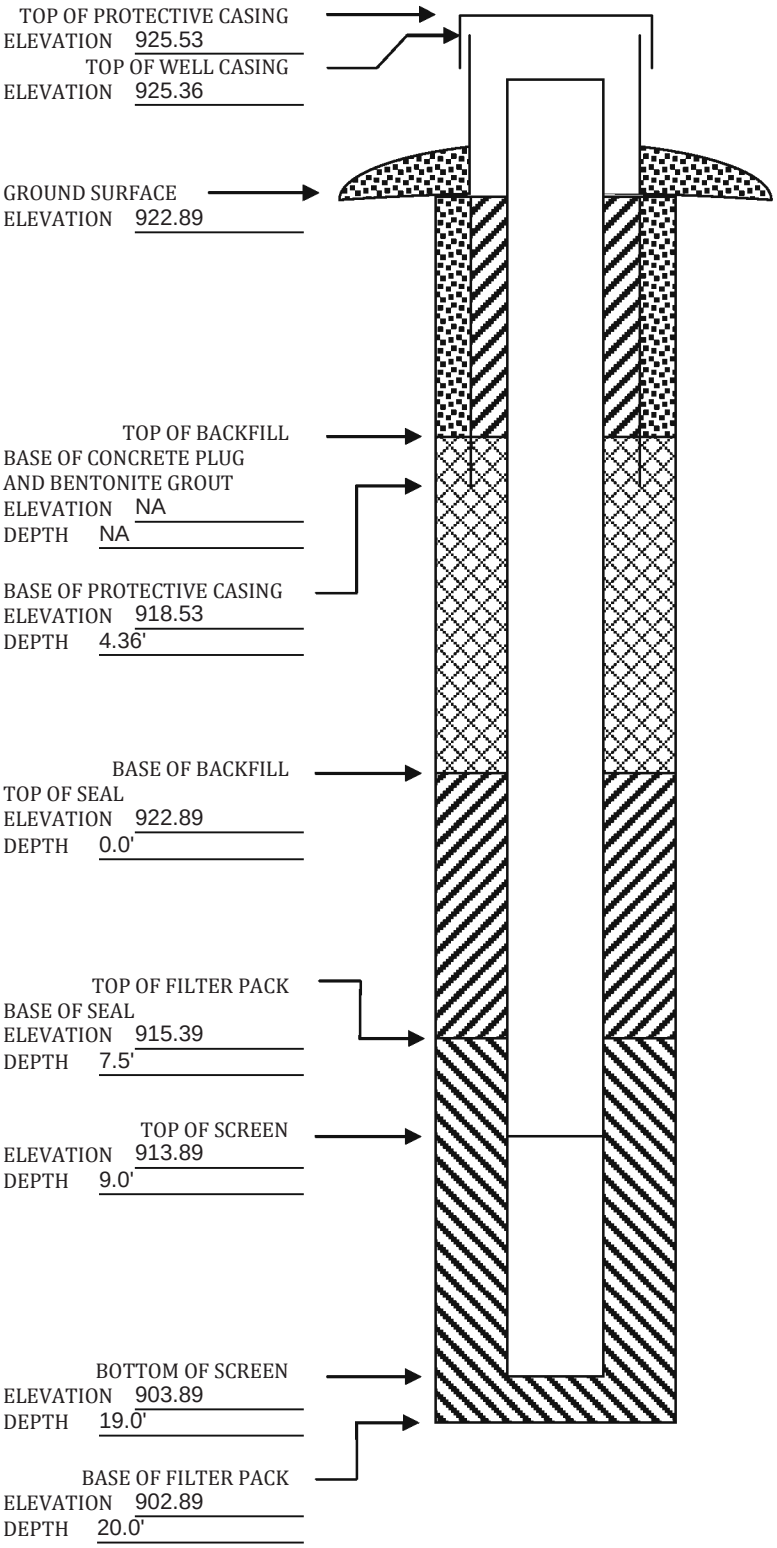
Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½x11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed for to: Iowa Department of Natural Resources, Land Quality Bureau, 502 E 9th St, Des Moines IA 50319-0034.

Questions? Call or Email: Nina Koger, Environmental Engineer Sr., 515-281-8986, Nina.Koger@dnr.iowa.gov

ELEVATIONS: ± 0.01 ft MSL
DEPTHS: ± 0.1 ft FROM GROUND SURFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL.)



Print Form

IOWA DEPARTMENT OF NATURAL RESOURCES

MONITORING WELL/PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name: Black Hawk Co Landfill Permit No.: 7-SDP-1-75P

Well or Piezometer No: OW-215BR

Dates Started: 11/02/2022 Date Completed: 11/02/2022

A. SURVEYED LOCATIONS AND ELEVATIONS

Locations (± 0.5 ft): N 3618102.44 E 5240401.53

Specify corner of site: IA State Plane

Distance & direction along boundary:

Distance & direction from boundary to wall:

Elevations (± 0.01 ft MSL):

Ground Surface: 933.13

Top of protective casing: 935.82

Top of well casing: 935.64

Benchmark elevation:

Benchmark description:

B. SOIL BORING INFORMATION

Name & Address of Construction Company:
Terracon
6612 Chancellor Drive Suite 102
Cedar Falls IA 50613

Name of Driller: Scott Zein

Drilling Method: 4 1/4" HSA

Drilling Fluid: NA

Bore Hole Diameter: 8.25"

Soil Sampling Method: 2' by 2" split spoon

Depth of Boring: 20.0'

C. MONITORING WELL INSTALLATION

Casing material: SCH 40 PVC

Length of casing: 11.51'

Outside casing diameter: 2.375"

Inside casing diameter: 2.067"

Casing joint type: flush threaded

Casing/screen joint type: flush threaded

Screen material: SCH 40 PVC

Screen opening size: 0.010"

Screen length: 10'

Depth of well: 19'

Filter Pack:

Material: Filter Pack Sand

Grain size: 0.007-0.250"

Volume: 31 gal.

Seal (minimum 3 ft length above filter pack):

Material: Bentonite Chips 3/8" hole plug

Placement method: direct pour

Volume: 18 gal.

Backfill (if different from seal):

Material:

Placement method:

Volume:

Surface seal design:

Material of protective casing: 4-in sq. by 7-ft long Steel

Material of grout between protective casing and well casing: 3/8" hole plug

Protective cap:

Material: Steel

Vented: ☐ Yes ☐ No Locking: ☑ Yes ☐ No

Well Cap:

Material: PVC J-Plug

Vented: ☐ Yes ☑ No

D. GROUNDWATER MEASURMENT (± 0.01 ft below top of inner well casing)

Water level: Dry; DTB 21.80 ft Stabilization Time: 24-hr

Well development method: Bailed and Pumped

Average depth of frostline:

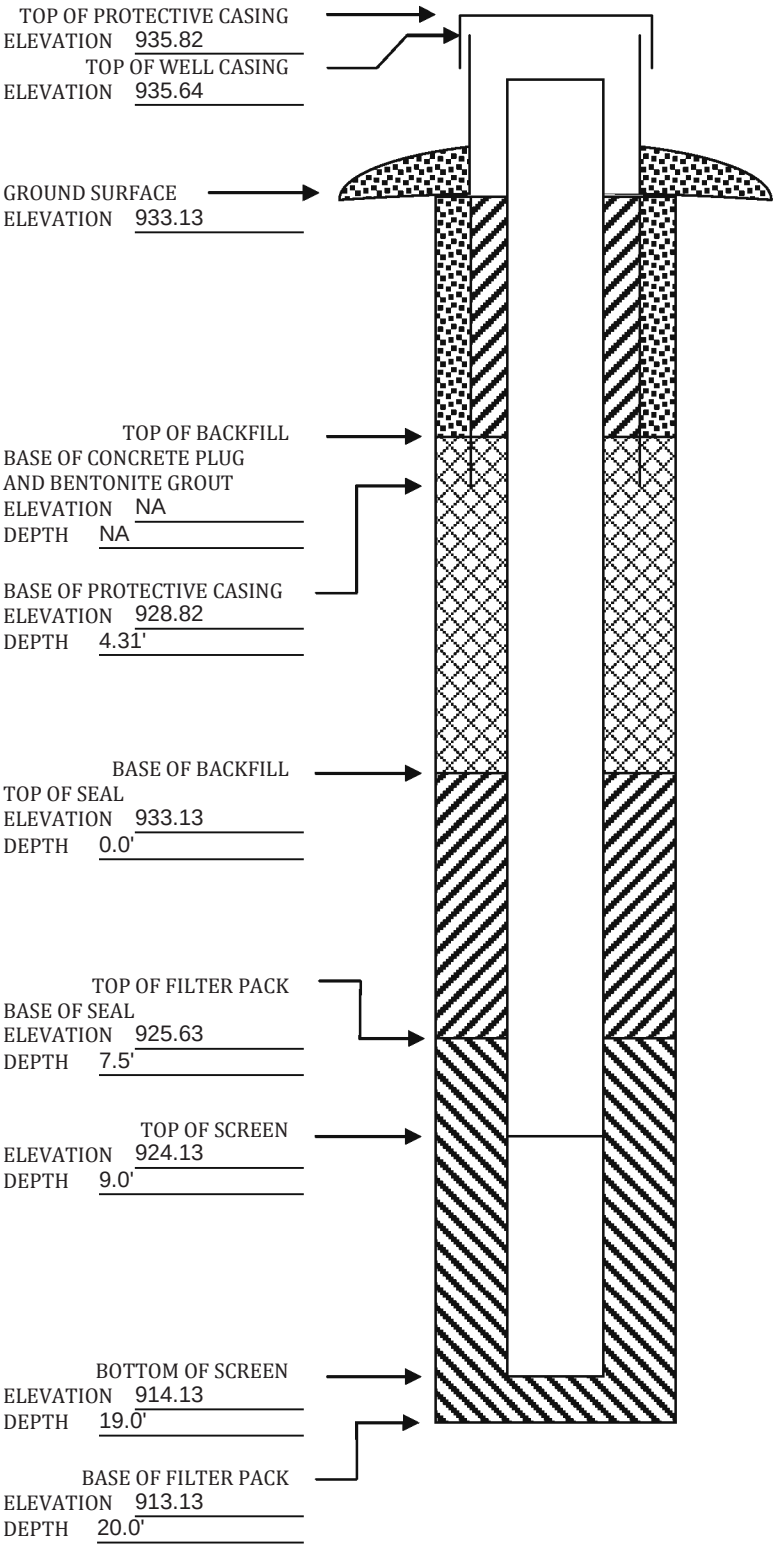
Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½x11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed for to: Iowa Department of Natural Resources, Land Quality Bureau, 502 E 9th St, Des Moines IA 50319-0034.

Questions? Call or Email: Nina Koger, Environmental Engineer Sr., 515-281-8986, Nina.Koger@dnr.iowa.gov

ELEVATIONS: ± 0.01 ft MSL
DEPTHS: ± 0.1 ft FROM GROUND SURFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL.)



Print Form

IOWA DEPARTMENT OF NATURAL RESOURCES

MONITORING WELL/PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name: Black Hawk Co Landfill Permit No.: 7-SDP-1-75P

Well or Piezometer No: OW-216BR

Dates Started: 11/02/2022 Date Completed: 11/02/2022

A. SURVEYED LOCATIONS AND ELEVATIONS

Locations (± 0.5 ft): N 3618630.93 E 5240397.51

Specify corner of site: IA State Plane

Distance & direction along boundary:

Distance & direction from boundary to wall:

Elevations (± 0.01 ft MSL):

Ground Surface: 940.66

Top of protective casing: 943.25

Top of well casing: 943.03

Benchmark elevation:

Benchmark description:

B. SOIL BORING INFORMATION

Name & Address of Construction Company:
Terracon
6612 Chancellor Drive Suite 102
Cedar Falls IA 50613

Name of Driller: Scott Zein

Drilling Method: 4 1/4" HSA

Drilling Fluid: NA

Bore Hole Diameter: 8.25"

Soil Sampling Method: 2' by 2" split spoon

Depth of Boring: 20.0'

C. MONITORING WELL INSTALLATION

Casing material: SCH 40 PVC

Length of casing: 11.37'

Outside casing diameter: 2.375"

Inside casing diameter: 2.067"

Casing joint type: flush threaded

Casing/screen joint type: flush threaded

Screen material: SCH 40 PVC

Screen opening size: 0.010"

Screen length: 10'

Depth of well: 19'

Filter Pack:

Material: Filter Pack Sand

Grain size: 0.007-0.250"

Volume: 31 gal.

Seal (minimum 3 ft length above filter pack):

Material: Bentonite Chips 3/8" hole plug

Placement method: direct pour

Volume: 18 gal.

Backfill (if different from seal):

Material:

Placement method:

Volume:

Surface seal design:

Material of protective casing: 4-in sq. by 7-ft long Steel

Material of grout between protective casing and well casing: 3/8" hole plug

Protective cap:

Material: Steel

Vented: ☐ Yes ☐ No Locking: ☑ Yes ☐ No

Well Cap:

Material: PVC J-Plug

Vented: ☐ Yes ☑ No

D. GROUNDWATER MEASURMENT (± 0.01 ft below top of inner well casing)

Water level: 19.23 ft Stabilization Time: 24-hr

Well development method: Bailed and Pumped

Average depth of frostline:

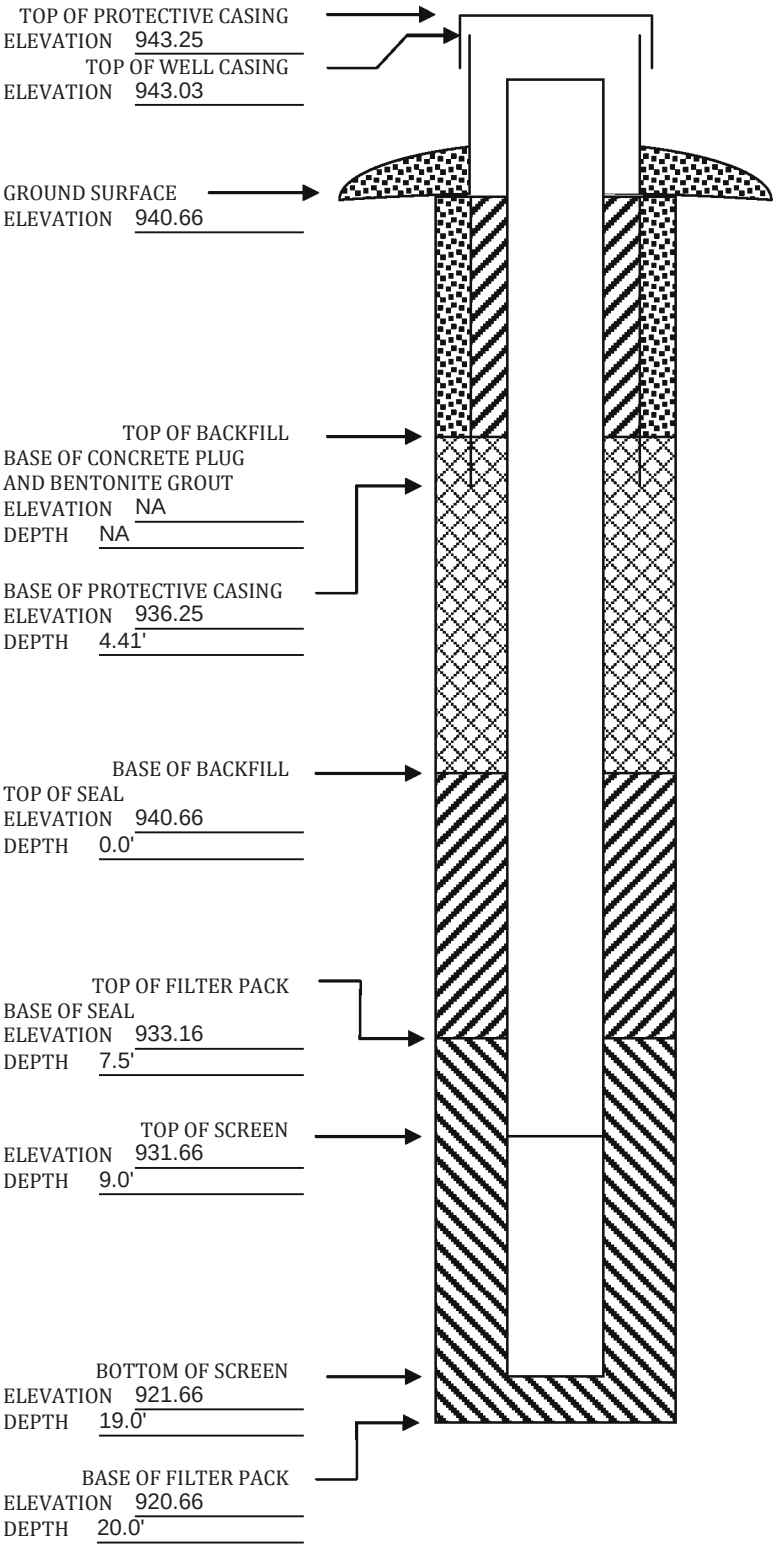
Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½x11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed for to: Iowa Department of Natural Resources, Land Quality Bureau, 502 E 9th St, Des Moines IA 50319-0034.

Questions? Call or Email: Nina Koger, Environmental Engineer Sr., 515-281-8986, Nina.Koger@dnr.iowa.gov

ELEVATIONS: ± 0.01 ft MSL
DEPTHS: ± 0.1 ft FROM GROUND SURFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL.)



Print Form

IOWA DEPARTMENT OF NATURAL RESOURCES

MONITORING WELL/PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name: Black Hawk Co Landfill Permit No.: 7-SDP-1-75P

Well or Piezometer No: OW-224B

Dates Started: 11/01/2022 Date Completed: 11/01/2022

A. SURVEYED LOCATIONS AND ELEVATIONS

Locations (± 0.5 ft): N 3617814.51 E 5238234.23

Specify corner of site: IA State Plane

Distance & direction along boundary:

Distance & direction from boundary to wall:

Elevations (± 0.01 ft MSL):

Ground Surface: 939.54

Top of protective casing: 941.54

Top of well casing: 941.29

Benchmark elevation:

Benchmark description:

B. SOIL BORING INFORMATION

Name & Address of Construction Company:
Terracon
6612 Chancellor Drive Suite 102
Cedar Falls IA 50613

Name of Driller: Scott Zein

Drilling Method: 4 1/4" HSA

Drilling Fluid: NA

Bore Hole Diameter: 8.25"

Soil Sampling Method: 2' by 2" split spoon

Depth of Boring: 21.0'

C. MONITORING WELL INSTALLATION

Casing material: SCH 40 PVC

Length of casing: 12.25'

Outside casing diameter: 2.375"

Inside casing diameter: 2.067"

Casing joint type: flush threaded

Casing/screen joint type: flush threaded

Screen material: SCH 40 PVC

Screen opening size: 0.010"

Screen length: 10'

Depth of well: 20.5'

Filter Pack:

Material: Filter Pack Sand

Grain size: 0.007-0.250"

Volume: 30 gal.

Seal (minimum 3 ft length above filter pack):

Material: Bentonite Chips 3/8" hole plug

Placement method: direct pour

Volume: 22 gal.

Backfill (if different from seal):

Material:

Placement method:

Volume:

Surface seal design:

Material of protective casing: 4-in sq. by 7-ft long Steel

Material of grout between protective casing and well casing: 3/8" hole plug

Protective cap:

Material: Steel

Vented: ☐ Yes ☐ No Locking: ☑ Yes ☐ No

Well Cap:

Material: PVC J-Plug

Vented: ☐ Yes ☑ No

D. GROUNDWATER MEASURMENT (± 0.01 ft below top of inner well casing)

Water level: 12.95 ft Stabilization Time: 24-hr

Well development method: Bailed and Pumped

Average depth of frostline:

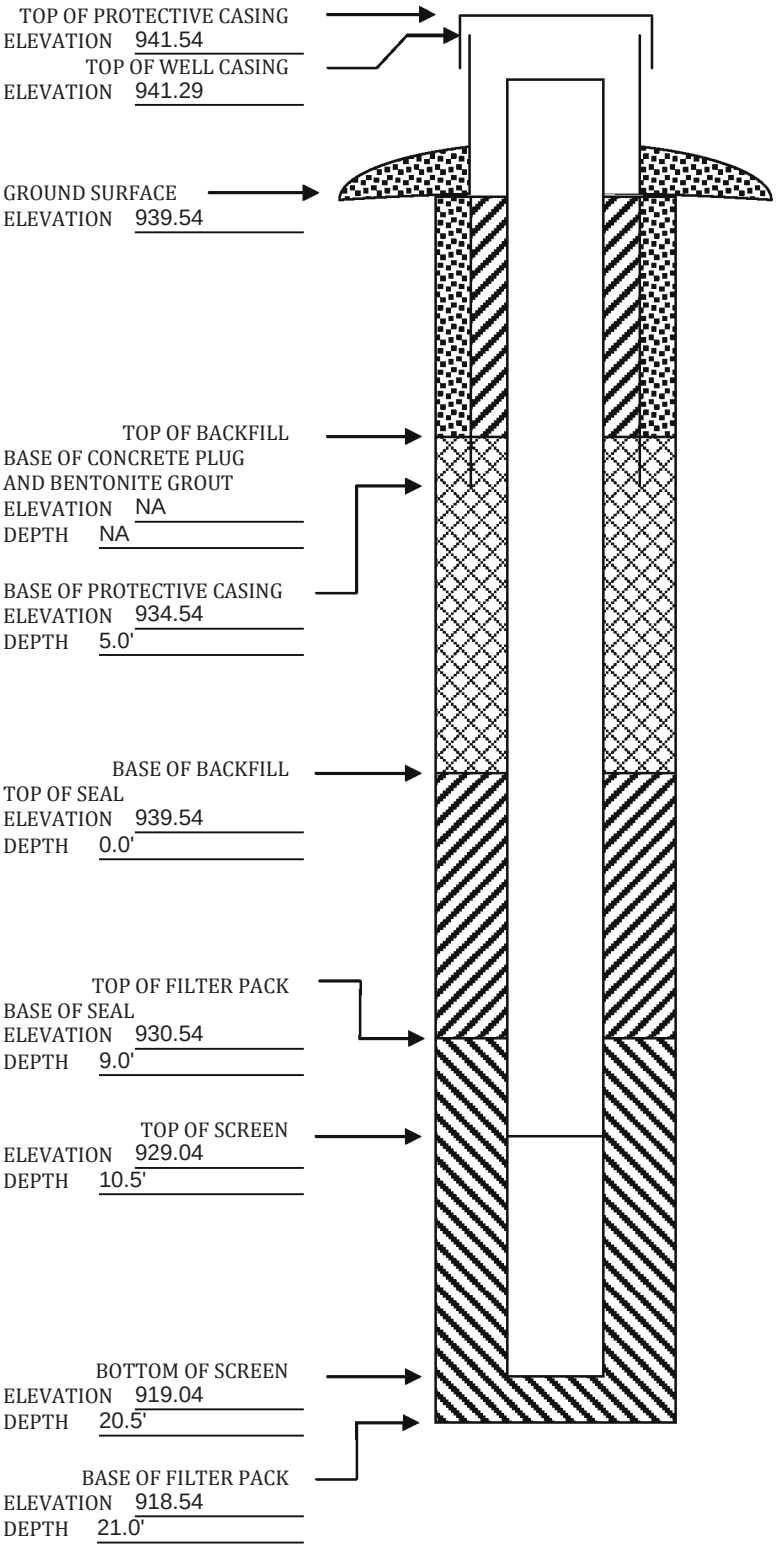
Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½x11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed for to: Iowa Department of Natural Resources, Land Quality Bureau, 502 E 9th St, Des Moines IA 50319-0034.

Questions? Call or Email: Nina Koger, Environmental Engineer Sr., 515-281-8986, Nina.Koger@dnr.iowa.gov

ELEVATIONS: ± 0.01 ft MSL
DEPTHS: ± 0.1 ft FROM GROUND SURFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL.)



Print Form

IOWA DEPARTMENT OF NATURAL RESOURCES

MONITORING WELL/PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name: Black Hawk Co Landfill Permit No.: 7-SDP-1-75P

Well or Piezometer No: OW-225B

Dates Started: 11/01/2022 Date Completed: 11/01/2022

A. SURVEYED LOCATIONS AND ELEVATIONS

Locations (± 0.5 ft): N 3617826.98 E 5238540.53

Specify corner of site: IA State Plane

Distance & direction along boundary:

Distance & direction from boundary to wall:

Elevations (± 0.01 ft MSL):

Ground Surface: 933.93

Top of protective casing: 936.64

Top of well casing: 936.36

Benchmark elevation:

Benchmark description:

B. SOIL BORING INFORMATION

Name & Address of Construction Company:
Terracon
6612 Chancellor Drive Suite 102
Cedar Falls IA 50613

Name of Driller: Scott Zein

Drilling Method: 4 1/4" HSA

Drilling Fluid: NA

Bore Hole Diameter: 8.25"

Soil Sampling Method: 2' by 2" split spoon

Depth of Boring: 20.0'

C. MONITORING WELL INSTALLATION

Casing material: SCH 40 PVC

Length of casing: 11.43'

Outside casing diameter: 2.375"

Inside casing diameter: 2.067"

Casing joint type: flush threaded

Casing/screen joint type: flush threaded

Screen material: SCH 40 PVC

Screen opening size: 0.010"

Screen length: 10'

Depth of well: 19.0'

Filter Pack:

Material: Filter Pack Sand

Grain size: 0.007-0.250"

Volume: 30 gal.

Seal (minimum 3 ft length above filter pack):

Material: Bentonite Chips 3/8" hole plug

Placement method: direct pour

Volume: 18 gal.

Backfill (if different from seal):

Material:

Placement method:

Volume:

Surface seal design:

Material of protective casing: 4-in sq. by 7-ft long Steel

Material of grout between protective casing and well casing: 3/8" hole plug

Protective cap:

Material: Steel

Vented: ☐ Yes ☐ No Locking: ☑ Yes ☐ No

Well Cap:

Material: PVC J-Plug

Vented: ☐ Yes ☑ No

D. GROUNDWATER MEASURMENT (± 0.01 ft below top of inner well casing)

Water level: 12.67 ft Stabilization Time: 24-hr

Well development method: Bailed and Pumped

Average depth of frostline:

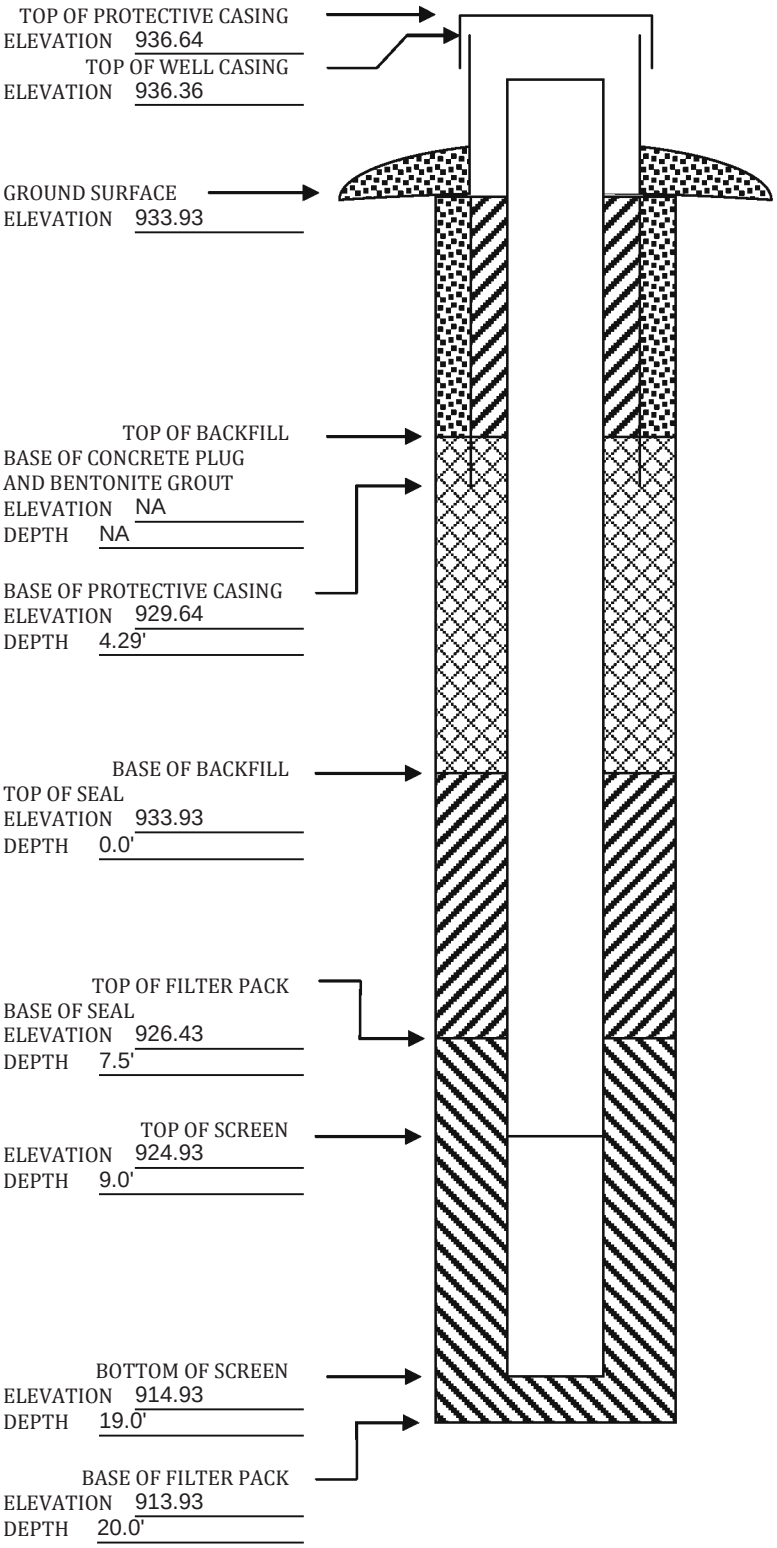
Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½x11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed for to: Iowa Department of Natural Resources, Land Quality Bureau, 502 E 9th St, Des Moines IA 50319-0034.

Questions? Call or Email: Nina Koger, Environmental Engineer Sr., 515-281-8986, Nina.Koger@dnr.iowa.gov

ELEVATIONS: ± 0.01 ft MSL
DEPTHS: ± 0.1 ft FROM GROUND SURFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL.)



Print Form

IOWA DEPARTMENT OF NATURAL RESOURCES

MONITORING WELL/PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name: Black Hawk Co Landfill Permit No.: 7-SDP-1-75P

Well or Piezometer No: OW-226B

Dates Started: 11/01/2022 Date Completed: 11/01/2022

A. SURVEYED LOCATIONS AND ELEVATIONS

Locations (± 0.5 ft): N 3617800.80 E 5239033.29

Specify corner of site: IA State Plane

Distance & direction along boundary:

Distance & direction from boundary to wall:

Elevations (± 0.01 ft MSL):

Ground Surface: 922.41

Top of protective casing: 925.20

Top of well casing: 924.97

Benchmark elevation:

Benchmark description:

B. SOIL BORING INFORMATION

Name & Address of Construction Company:
Terracon
6612 Chancellor Drive Suite 102
Cedar Falls IA 50613

Name of Driller: Scott Zein

Drilling Method: 4 1/4" HSA

Drilling Fluid: NA

Bore Hole Diameter: 8.25"

Soil Sampling Method: 2' by 2" split spoon

Depth of Boring: 20.0'

C. MONITORING WELL INSTALLATION

Casing material: SCH 40 PVC

Length of casing: 11.56'

Outside casing diameter: 2.375"

Inside casing diameter: 2.067"

Casing joint type: flush threaded

Casing/screen joint type: flush threaded

Screen material: SCH 40 PVC

Screen opening size: 0.010"

Screen length: 10'

Depth of well: 19.0'

Filter Pack:

Material: Filter Pack Sand

Grain size: 0.007-0.250"

Volume: 30 gal.

Seal (minimum 3 ft length above filter pack):

Material: Bentonite Chips 3/8" hole plug

Placement method: direct pour

Volume: 18 gal.

Backfill (if different from seal):

Material:

Placement method:

Volume:

Surface seal design:

Material of protective casing: 4-in sq. by 7-ft long Steel

Material of grout between protective casing and well casing: 3/8" hole plug

Protective cap:

Material: Steel

Vented: ☐ Yes ☐ No Locking: ☑ Yes ☐ No

Well Cap:

Material: PVC J-Plug

Vented: ☐ Yes ☑ No

D. GROUNDWATER MEASURMENT (± 0.01 ft below top of inner well casing)

Water level: 12.80 ft Stabilization Time: 24-hr

Well development method: Bailed and Pumped

Average depth of frostline:

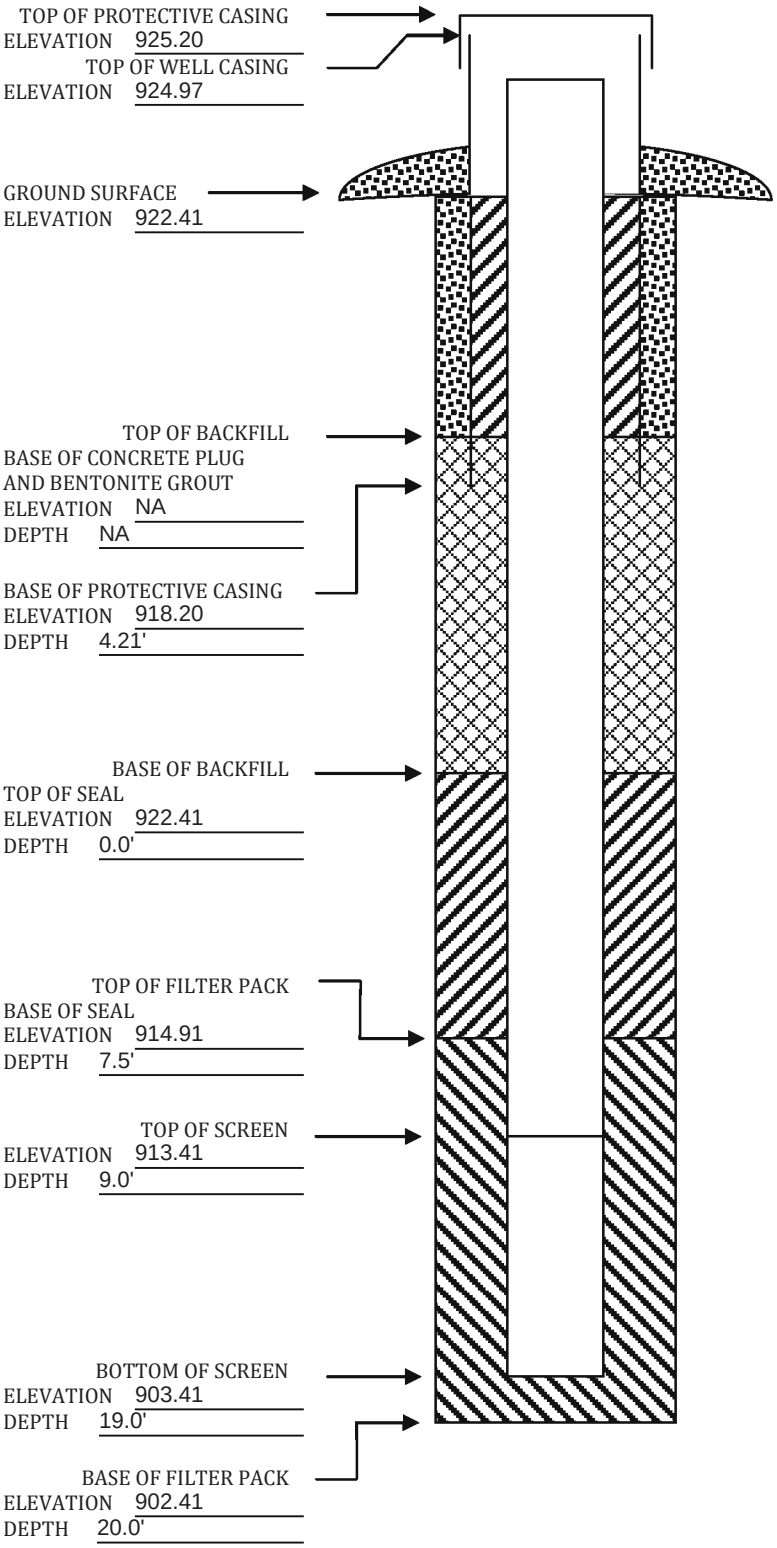
Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½x11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed for to: Iowa Department of Natural Resources, Land Quality Bureau, 502 E 9th St, Des Moines IA 50319-0034.

Questions? Call or Email: Nina Koger, Environmental Engineer Sr., 515-281-8986, Nina.Koger@dnr.iowa.gov

ELEVATIONS: ± 0.01 ft MSL
DEPTHS: ± 0.1 ft FROM GROUND SURFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL.)



Print Form

IOWA DEPARTMENT OF NATURAL RESOURCES

MONITORING WELL/PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name: Black Hawk Co Landfill Permit No.: 7-SDP-1-75P

Well or Piezometer No: OW-227B

Dates Started: 11/01/2022 Date Completed: 11/01/2022

A. SURVEYED LOCATIONS AND ELEVATIONS

Locations (± 0.5 ft): N 3617704.81 E 5239195.46

Specify corner of site: IA State Plane

Distance & direction along boundary:

Distance & direction from boundary to wall:

Elevations (± 0.01 ft MSL):

Ground Surface: 917.44

Top of protective casing: 920.28

Top of well casing: 919.96

Benchmark elevation:

Benchmark description:

B. SOIL BORING INFORMATION

Name & Address of Construction Company:
Terracon
6612 Chancellor Drive Suite 102
Cedar Falls IA 50613

Name of Driller: Scott Zein

Drilling Method: 4 1/4" HSA

Drilling Fluid: NA

Bore Hole Diameter: 8.25"

Soil Sampling Method: 2' by 2" split spoon

Depth of Boring: 20.0'

C. MONITORING WELL INSTALLATION

Casing material: SCH 40 PVC

Length of casing: 11.52'

Outside casing diameter: 2.375"

Inside casing diameter: 2.067"

Casing joint type: flush threaded

Casing/screen joint type: flush threaded

Screen material: SCH 40 PVC

Screen opening size: 0.010"

Screen length: 10'

Depth of well: 19.0'

Filter Pack:

Material: Filter Pack Sand

Grain size: 0.007-0.250"

Volume: 30 gal.

Seal (minimum 3 ft length above filter pack):

Material: Bentonite Chips 3/8" hole plug

Placement method: direct pour

Volume: 18 gal.

Backfill (if different from seal):

Material:

Placement method:

Volume:

Surface seal design:

Material of protective casing: 4-in sq. by 7-ft long Steel

Material of grout between protective casing and well casing: 3/8" hole plug

Protective cap:

Material: Steel

Vented: ☐ Yes ☐ No Locking: ☑ Yes ☐ No

Well Cap:

Material: PVC J-Plug

Vented: ☐ Yes ☑ No

D. GROUNDWATER MEASURMENT (± 0.01 ft below top of inner well casing)

Water level: 10.17 ft Stabilization Time: 24-hr

Well development method: Bailed and Pumped

Average depth of frostline:

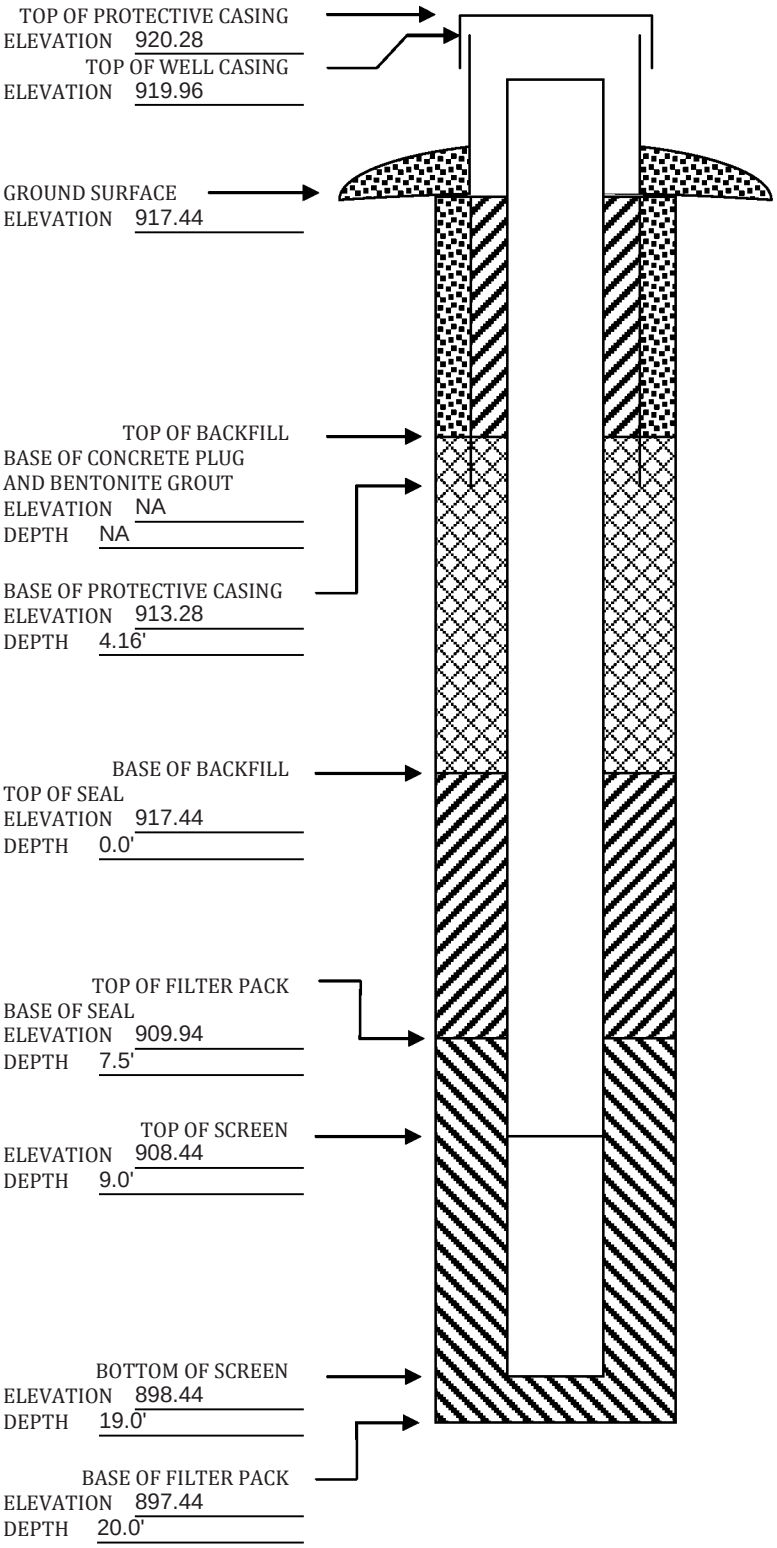
Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½x11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed for to: Iowa Department of Natural Resources, Land Quality Bureau, 502 E 9th St, Des Moines IA 50319-0034.

Questions? Call or Email: Nina Koger, Environmental Engineer Sr., 515-281-8986, Nina.Koger@dnr.iowa.gov

ELEVATIONS: ± 0.01 ft MSL
DEPTHS: ± 0.1 ft FROM GROUND SURFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL.)



Print Form

IOWA DEPARTMENT OF NATURAL RESOURCES

MONITORING WELL/PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name: Black Hawk Co Landfill Permit No.: 7-SDP-1-75P

Well or Piezometer No: P-214CR

Dates Started: 12/14/2022 Date Completed: 12/16/2022

A. SURVEYED LOCATIONS AND ELEVATIONS

Locations (± 0.5 ft): N 3617501.09 E 5240406.26

Specify corner of site: IA State Plane

Distance & direction along boundary:

Distance & direction from boundary to wall:

Elevations (± 0.01 ft MSL):

Ground Surface: 922.17

Top of protective casing: 924.62

Top of well casing: 924.65

Benchmark elevation:

Benchmark description:

B. SOIL BORING INFORMATION

Name & Address of Construction Company:
Terracon
6612 Chancellor Drive Suite 102
Cedar Falls IA 50613

Name of Driller: Scott Zein

Drilling Method: 3 1/4" HSA

Drilling Fluid: NA

Bore Hole Diameter: 6"

Soil Sampling Method: 2' by 2" split spoon

Depth of Boring: 108.0'

C. MONITORING WELL INSTALLATION

Casing material: SCH 80 PVC

Length of casing: 98.48'

Outside casing diameter: 2.375"

Inside casing diameter: 1.913"

Casing joint type: flush threaded

Casing/screen joint type: flush threaded

Screen material: SCH 80 PVC

Screen opening size: 0.010"

Screen length: 10'

Depth of well: 106'

Filter Pack:

Material: Filter Pack Sand

Grain size: 0.007-0.250"

Volume: 20 gal.

Seal (minimum 3 ft length above filter pack):

Material: Bentonite Chips 3/8" hole plug

Placement method: direct pour

Volume: 42 gal.

Backfill (if different from seal):

Material: Baroid Quik-Grout

Placement method: 1-in PVC tremie pipe to ground surface

Volume: 94 gal.

Surface seal design:

Material of protective casing: 4-in sq. by 7-ft long Steel

Material of grout between protective casing and well casing: 3/8" hole plug

Protective cap:

Material: Steel

Vented: ☐ Yes ☐ No Locking: ☑ Yes ☐ No

Well Cap:

Material: PVC J-Plug

Vented: ☐ Yes ☑ No

D. GROUNDWATER MEASURMENT (± 0.01 ft below top of inner well casing)

Water level: 95.16 ft Stabilization Time: 24-hr

Well development method: Bailed and Pumped

Average depth of frostline:

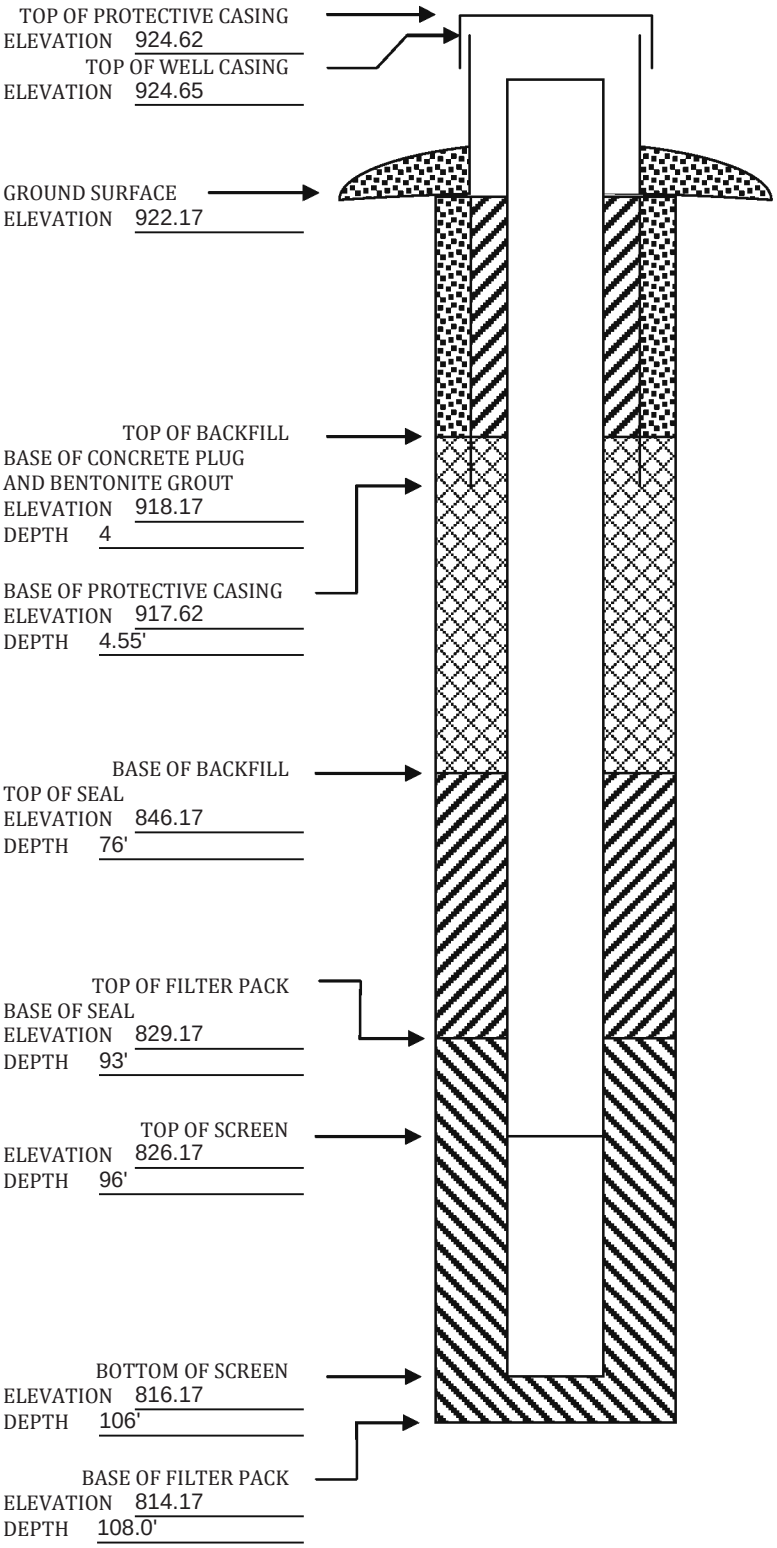
Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½x11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed for to: Iowa Department of Natural Resources, Land Quality Bureau, 502 E 9th St, Des Moines IA 50319-0034.

Questions? Call or Email: Nina Koger, Environmental Engineer Sr., 515-281-8986, Nina.Koger@dnr.iowa.gov

ELEVATIONS: ± 0.01 ft MSL
DEPTHS: ± 0.1 ft FROM GROUND SURFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL.)



Print Form

IOWA DEPARTMENT OF NATURAL RESOURCES

MONITORING WELL/PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name: Black Hawk Co Landfill Permit No.: 7-SDP-1-75P

Well or Piezometer No: P-215CR

Dates Started: 12/13/2022 Date Completed: 12/16/2022

A. SURVEYED LOCATIONS AND ELEVATIONS

Locations (± 0.5 ft): N 3618038.43 E 5240401.16

Specify corner of site: IA State Plane

Distance & direction along boundary:

Distance & direction from boundary to wall:

Elevations (± 0.01 ft MSL):

Ground Surface: 932.26

Top of protective casing: 934.51

Top of well casing: 934.53

Benchmark elevation:

Benchmark description:

B. SOIL BORING INFORMATION

Name & Address of Construction Company:
Terracon
6612 Chancellor Drive Suite 102
Cedar Falls IA 50613

Name of Driller: Scott Zein

Drilling Method: 3 1/4" HSA

Drilling Fluid: NA

Bore Hole Diameter: 6"

Soil Sampling Method: 2' by 2" split spoon

Depth of Boring: 120.0'

C. MONITORING WELL INSTALLATION

Casing material: SCH 80 PVC

Length of casing: 110.27'

Outside casing diameter: 2.375"

Inside casing diameter: 1.913"

Casing joint type: flush threaded

Casing/screen joint type: flush threaded

Screen material: SCH 80 PVC

Screen opening size: 0.010"

Screen length: 10'

Depth of well: 118'

Filter Pack:

Material: Filter Pack Sand

Grain size: 0.007-0.250"

Volume: 20 gal.

Seal (minimum 3 ft length above filter pack):

Material: Bentonite Chips 3/8" hole plug

Placement method: direct pour

Volume: 51 gal.

Backfill (if different from seal):

Material: Baroid Quik-Grout

Placement method: 1-in PVC tremie pipe to ground surface

Volume: 105 gal.

Surface seal design:

Material of protective casing: 4-in sq. by 7-ft long Steel

Material of grout between protective casing and well casing: 3/8" hole plug

Protective cap:

Material: Steel

Vented: ☐ Yes ☐ No Locking: ☑ Yes ☐ No

Well Cap:

Material: PVC J-Plug

Vented: ☐ Yes ☑ No

D. GROUNDWATER MEASURMENT (± 0.01 ft below top of inner well casing)

Water level: 105.22 ft Stabilization Time: 24-hr

Well development method: Bailed and Pumped

Average depth of frostline:

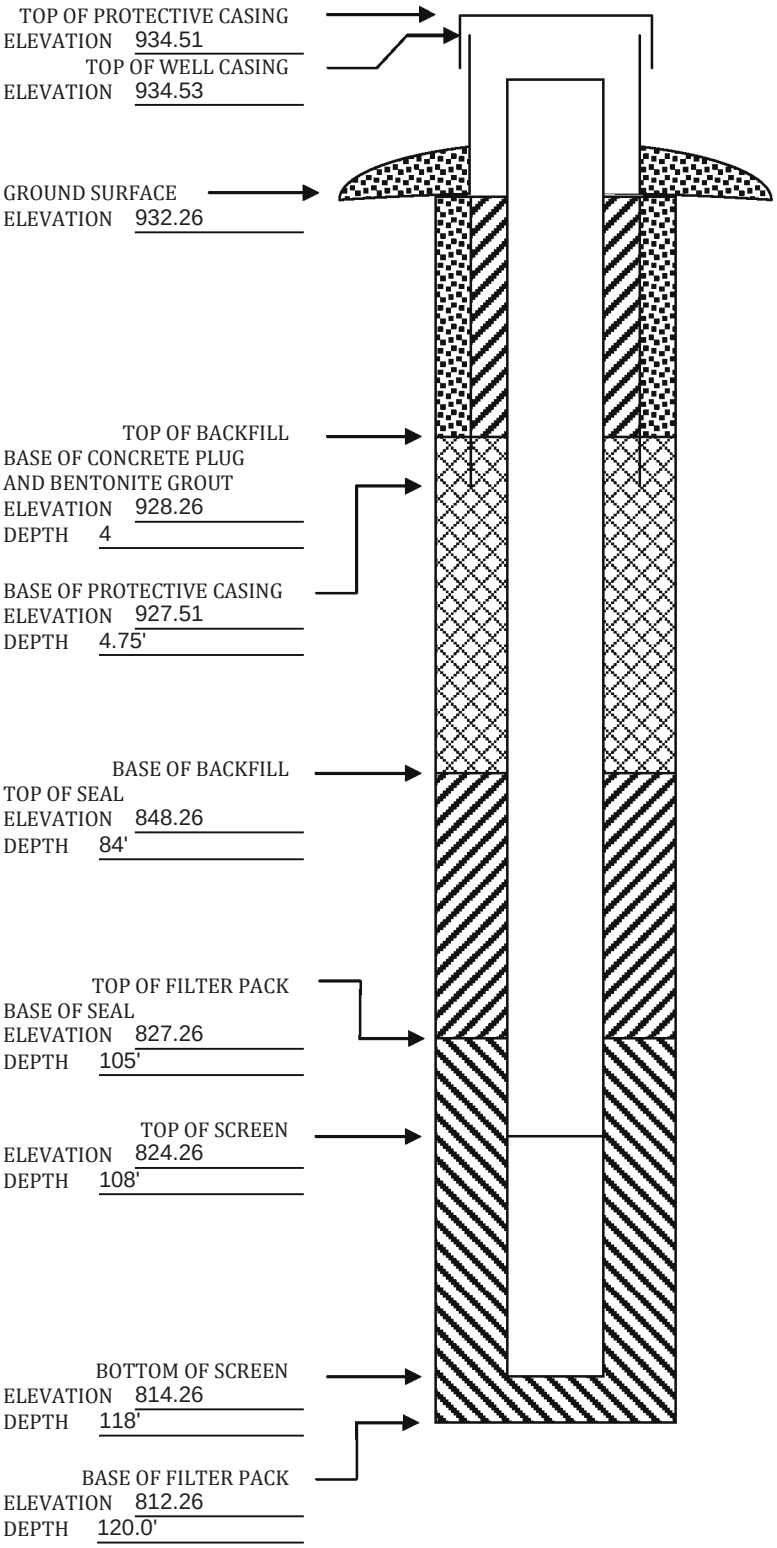
Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½x11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed for to: Iowa Department of Natural Resources, Land Quality Bureau, 502 E 9th St, Des Moines IA 50319-0034.

Questions? Call or Email: Nina Koger, Environmental Engineer Sr., 515-281-8986, Nina.Koger@dnr.iowa.gov

ELEVATIONS: ± 0.01 ft MSL
DEPTHS: ± 0.1 ft FROM GROUND SURFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL.)



Print Form

IOWA DEPARTMENT OF NATURAL RESOURCES

MONITORING WELL/PIEZOMETER CONSTRUCTION DOCUMENTATION FORM

Disposal Site Name: Black Hawk Co Landfill Permit No.: 7-SDP-1-75P

Well or Piezometer No: P-216CR

Dates Started: 12/12/2022 Date Completed: 12/15/2022

A. SURVEYED LOCATIONS AND ELEVATIONS

Locations (± 0.5 ft): N 3618592.39 E 5240399.69

Specify corner of site: IA State Plane

Distance & direction along boundary:

Distance & direction from boundary to wall:

Elevations (± 0.01 ft MSL):

Ground Surface: 941.13

Top of protective casing: 943.31

Top of well casing: 943.28

Benchmark elevation:

Benchmark description:

B. SOIL BORING INFORMATION

Name & Address of Construction Company:
Terracon
6612 Chancellor Drive Suite 102
Cedar Falls IA 50613

Name of Driller: Scott Zein

Drilling Method: 3 1/4" HSA

Drilling Fluid: NA

Bore Hole Diameter: 6"

Soil Sampling Method: 2' by 2" split spoon

Depth of Boring: 134.0'

C. MONITORING WELL INSTALLATION

Casing material: SCH 80 PVC

Length of casing: 123.15'

Outside casing diameter: 2.375"

Inside casing diameter: 1.913"

Casing joint type: flush threaded

Casing/screen joint type: flush threaded

Screen material: SCH 80 PVC

Screen opening size: 0.010"

Screen length: 10'

Depth of well: 131'

Filter Pack:

Material: Filter Pack Sand

Grain size: 0.007-0.250"

Volume: 24 gal.

Seal (minimum 3 ft length above filter pack):

Material: Bentonite Chips 3/8" hole plug

Placement method: direct pour

Volume: 33 gal.

Backfill (if different from seal):

Material: Baroid Quik-Grout

Placement method: 1-in PVC tremie pipe to ground surface

Volume: 128 gal.

Surface seal design:

Material of protective casing: 4-in sq. by 7-ft long Steel

Material of grout between protective casing and well casing: 3/8" hole plug

Protective cap:

Material: Steel

Vented: ☐ Yes ☐ No Locking: ☑ Yes ☐ No

Well Cap:

Material: PVC J-Plug

Vented: ☐ Yes ☑ No

D. GROUNDWATER MEASURMENT (± 0.01 ft below top of inner well casing)

Water level: 113.75 ft Stabilization Time: 24-hr

Well development method: Bailed and Pumped

Average depth of frostline:

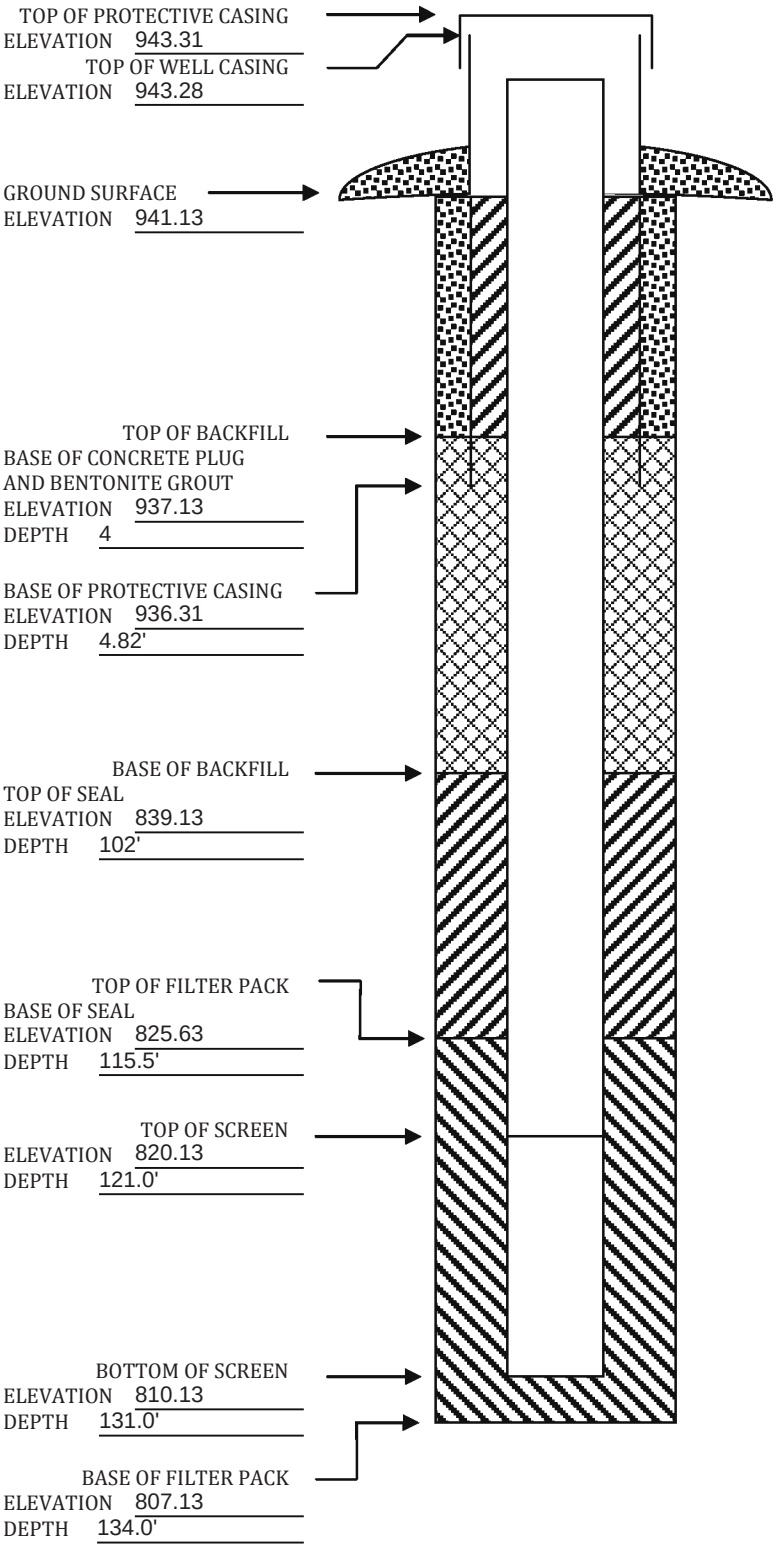
Attachments: Driller's log. Pipe schedules and grouting schedules. 8 ½x11 inch map showing locations of all monitoring wells and piezometers.

Please mail completed for to: Iowa Department of Natural Resources, Land Quality Bureau, 502 E 9th St, Des Moines IA 50319-0034.

Questions? Call or Email: Nina Koger, Environmental Engineer Sr., 515-281-8986, Nina.Koger@dnr.iowa.gov

ELEVATIONS: ± 0.01 ft MSL
DEPTHS: ± 0.1 ft FROM GROUND SURFACE

SPACE TO ATTACH ENTIRE SOIL BORING LOG
(SHOW SCREENED INTERVAL AND FILTER PACK INTERVAL.)



APPENDIX A-3
Abandoned Water Well Plugging Record
(Form 542-1226)

3105 Capital Way
Cedar Falls, IA 50613
P (319) 277-4016
F (319) 277-4320
Terracon.com

Date: November 4, 2022

Black Hawk County Solid Waste Management Commission
PO Box 208
Waterloo, Iowa 50704

Attention: John Foster

Re: Black Hawk County Landfill

Job No.: 13227055

We are transmitting ☒ herewith ☐ under separate cover

Item	Date	Description
1	10/31/22	Monitoring Well Abandonment Forms
2		AECOM 2022 Monitoring Well Location Map

Remarks:

If you have any questions regarding this information, please contact our office.

Yours truly,

Terracon Consultants, Inc.

By:

Dave Cleary

Copies to: Address (email)
Russ Henning, AECOM, (email)
Chris Oelkers, AECOM, (email)

IOWA DEPARTMENT OF NATURAL RESOURCES

Abandoned Water Well Plugging Record

1. Owner:

Name: Black Hawk County Solid Waste Management Commission Phone: 319-234-8115

Address: PO Box 208

City: Waterloo State: Iowa Zip: 50704

If this was a Public Water Supply Well, please provide:

PWSID Name: _____ PWSID Number: _____

2. Location of Well (Cistern):

SE ¼ of, NE ¼ of, SE ¼ of, Section 23 , T 88N N, R 13 ☐ East ☒ West

County: Black Hawk Describe well location on property: See attached AECOM MW Location Map

GPS Well Location: Latitude: 42.418010 Longitude: 92.317973

3. Well Description:

Well depth: 55.15 ft

Depth to water 23.95 ft.

Casing depth: 55.15 ft. Casing Material: ☒ Steel ☐ Plastic ☐ Concrete ☐ Clay ☐ Brick ☐ Stone

Casing diameter: 2 in.

Year or decade constructed: 1998 Type of Construction: ☒ Drilled ☐ Driven ☐ Bored ☐ Augured ☐ Dug

Is this a Monitoring Well? ☒ Yes ☐ No Well ID: 214A

Check if Cistern ☐ Depth: _____ ft. Diameter: _____ ft.

I certify this well has been plugged as required by rule 567-39.8 of the Iowa Administrative Code (IAC). I agree to provide any additional information the county or department may need concerning this well.

Signature of Owner _____ Date Plugged: 10/31/22

If plugged by certified well contractor, complete this box:

I have plugged this well as required by rule 567-39.8 of the Iowa Administrative Code (IAC).

Signature of Contractor: _____ Cert No: 9351

OR, If plugged by well owner, complete this box:

The property owner has plugged this well following requirements in rule 567-39.8 of the Iowa Administrative Code (IAC) with the oversight and assistance of the designated county agent.

Signature of County Agent: _____ Date Approved: _____

Eligible for Grants-to-Counties cost share: ☐ Yes ☐ No (Determined by County Agent)

Complete one form for each well plugged and submit within 30 days to the local county agent:

OR, only if no county agent is available, to:

Water Supply Section
Iowa Department of Natural Resources
502 E 9th St
Des Moines IA 50319-0034

IOWA DEPARTMENT OF NATURAL RESOURCES

Abandoned Water Well Plugging Record

1. **Owner:**

Name: Black Hawk County Solid Waste Management Commission Phone: 319-234-8115

Address: PO Box 208

City: Waterloo State: Iowa Zip: 50704

If this was a Public Water Supply Well, please provide:

PWSID Name: _____ PWSID Number: _____

2. **Location of Well (Cistern):**

SE ¼ of, NE ¼ of, SE ¼ of, Section 23 , T 88N N, R 13 ☐ East ☒ West

County: Black Hawk Describe well location on property: See attached AECOM MW Location Map

GPS Well Location: Latitude: 42.418010 Longitude: 92.317973

3. **Well Description:**

Well depth: 23.36 ft

Depth to water 12.73 ft.

Casing depth: 23.36 ft. Casing Material: ☒ Steel ☐ Plastic ☐ Concrete ☐ Clay ☐ Brick ☐ Stone

Casing diameter: 2 in.

Year or decade constructed: 1998 Type of Construction: ☒ Drilled ☐ Driven ☐ Bored ☐ Augured ☐ Dug

Is this a Monitoring Well? ☒ Yes ☐ No Well ID: 214B

Check if Cistern ☐ Depth: _____ ft. Diameter: _____ ft.

I certify this well has been plugged as required by rule 567-39.8 of the Iowa Administrative Code (IAC). I agree to provide any additional information the county or department may need concerning this well.

Signature of Owner _____ Date Plugged: 10/31/22

If plugged by certified well contractor, complete this box:

I have plugged this well as required by rule 567-39.8 of the Iowa Administrative Code (IAC).

Signature of Contractor: _____ Cert No: 9351

OR, If plugged by well owner, complete this box:

The property owner has plugged this well following requirements in rule 567-39.8 of the Iowa Administrative Code (IAC) with the oversight and assistance of the designated county agent.

Signature of County Agent: _____ Date Approved: _____

Eligible for Grants-to-Counties cost share: ☐ Yes ☐ No (Determined by County Agent)

Complete one form for each well plugged and submit within 30 days to the local county agent:

OR, only if no county agent is available, to:

Water Supply Section
Iowa Department of Natural Resources
502 E 9th St
Des Moines IA 50319-0034

IOWA DEPARTMENT OF NATURAL RESOURCES

Abandoned Water Well
Plugging Record

1. Owner:

Name: Black Hawk County Solid Waste Management Commission Phone: 319-234-8115

Address: PO Box 208

City: Waterloo State: Iowa Zip: 50704

If this was a Public Water Supply Well, please provide:

PWSID Name: _____ PWSID Number: _____

2. Location of Well (Cistern):

____ ¼ of, ____ ¼ of, ____ ¼ of, Section 23 , T 88N N, R 13 ☐ East ☒ West

County: Black Hawk Describe well location on property: See attached AECOM MW Location Map

GPS Well Location: Latitude: 42.418010 Longitude: 92.317973

3. Well Description:

Well depth: 110.12 ft

Depth to water 95.93 ft.

Casing depth: 110.12 ft. Casing Material: ☒ Steel ☐ Plastic ☐ Concrete ☐ Clay ☐ Brick ☐ Stone

Casing diameter: 2 in.

Year or decade constructed: 1998 Type of Construction: ☒ Drilled ☐ Driven ☐ Bored ☐ Augured ☐ Dug

Is this a Monitoring Well? ☒ Yes ☐ No Well ID: 214C

Check if Cistern ☐ Depth: _____ ft. Diameter: _____ ft.

I certify this well has been plugged as required by rule 567-39.8 of the Iowa Administrative Code (IAC). I agree to provide any additional information the county or department may need concerning this well.

Signature of Owner _____ Date Plugged: 10/31/22

If plugged by certified well contractor, complete this box:

I have plugged this well as required by rule 567-39.8 of the Iowa Administrative Code (IAC).

Signature of Contractor: _____ Cert No: 9351

OR, If plugged by well owner, complete this box:

The property owner has plugged this well following requirements in rule 567-39.8 of the Iowa Administrative Code (IAC) with the oversight and assistance of the designated county agent.

Signature of County Agent: _____ Date Approved: _____

Eligible for Grants-to-Counties cost share: ☐ Yes ☐ No (Determined by County Agent)

Complete one form for each well plugged and submit within 30 days to the local county agent:

OR, only if no county agent is available, to:

Water Supply Section
Iowa Department of Natural Resources
502 E 9th St
Des Moines IA 50319-0034

IOWA DEPARTMENT OF NATURAL RESOURCES

Abandoned Water Well Plugging Record

1. Owner:

Name: Black Hawk County Solid Waste Management Commission Phone: 319-234-8115

Address: PO Box 208

City: Waterloo State: Iowa Zip: 50704

If this was a Public Water Supply Well, please provide:

PWSID Name: _____ PWSID Number: _____

2. Location of Well (Cistern):

NE ¼ of, NE ¼ of, SE ¼ of, Section 23 , T 88N N, R 13 ☐ East ☒ West

County: Black Hawk Describe well location on property: See attached AECOM MW Location Map

GPS Well Location: Latitude: 42.419429 Longitude: -92.317960

3. Well Description:

Well depth: 65.22 ft

Depth to water 27.62 ft.

Casing depth: 65.22 ft. Casing Material: ☒ Steel ☐ Plastic ☐ Concrete ☐ Clay ☐ Brick ☐ Stone

Casing diameter: 2 in.

Year or decade constructed: 1998 Type of Construction: ☒ Drilled ☐ Driven ☐ Bored ☐ Augured ☐ Dug

Is this a Monitoring Well? ☒ Yes ☐ No Well ID: 215A

Check if Cistern ☐ Depth: _____ ft. Diameter: _____ ft.

I certify this well has been plugged as required by rule 567-39.8 of the Iowa Administrative Code (IAC). I agree to provide any additional information the county or department may need concerning this well.

Signature of Owner _____ Date Plugged: 10/31/22

If plugged by certified well contractor, complete this box:

I have plugged this well as required by rule 567-39.8 of the Iowa Administrative Code (IAC).

Signature of Contractor: _____ Cert No: 9351

OR, If plugged by well owner, complete this box:

The property owner has plugged this well following requirements in rule 567-39.8 of the Iowa Administrative Code (IAC) with the oversight and assistance of the designated county agent.

Signature of County Agent: _____ Date Approved: _____

Eligible for Grants-to-Counties cost share: ☐ Yes ☐ No (Determined by County Agent)

Complete one form for each well plugged and submit within 30 days to the local county agent:

OR, only if no county agent is available, to:

Water Supply Section
Iowa Department of Natural Resources
502 E 9th St
Des Moines IA 50319-0034

IOWA DEPARTMENT OF NATURAL RESOURCES

Abandoned Water Well Plugging Record

1. **Owner:**

Name: Black Hawk County Solid Waste Management Commission Phone: 319-234-8115

Address: PO Box 208

City: Waterloo State: Iowa Zip: 50704

If this was a Public Water Supply Well, please provide:

PWSID Name: _____ PWSID Number: _____

2. **Location of Well (Cistern):**

NE ¼ of, NE ¼ of, SE ¼ of, Section 23 , T 88N N, R 13 ☐ East ☒ West

County: Black Hawk Describe well location on property: See attached AECOM MW Location Map

GPS Well Location: Latitude: 42.419429 Longitude: -92.317960

3. **Well Description:**

Well depth: 23.90 ft

Depth to water 12.02 ft.

Casing depth: 23.90 ft. Casing Material: ☒ Steel ☐ Plastic ☐ Concrete ☐ Clay ☐ Brick ☐ Stone

Casing diameter: 2 in.

Year or decade constructed: 1998 Type of Construction: ☒ Drilled ☐ Driven ☐ Bored ☐ Augured ☐ Dug

Is this a Monitoring Well? ☒ Yes ☐ No Well ID: 215B

Check if Cistern ☐ Depth: _____ ft. Diameter: _____ ft.

I certify this well has been plugged as required by rule 567-39.8 of the Iowa Administrative Code (IAC). I agree to provide any additional information the county or department may need concerning this well.

Signature of Owner _____ Date Plugged: 10/31/22

If plugged by certified well contractor, complete this box:

I have plugged this well as required by rule 567-39.8 of the Iowa Administrative Code (IAC).

Signature of Contractor: _____ Cert No: 9351

OR, If plugged by well owner, complete this box:

The property owner has plugged this well following requirements in rule 567-39.8 of the Iowa Administrative Code (IAC) with the oversight and assistance of the designated county agent.

Signature of County Agent: _____ Date Approved: _____

Eligible for Grants-to-Counties cost share: ☐ Yes ☐ No (Determined by County Agent)

Complete one form for each well plugged and submit within 30 days to the local county agent:

OR, only if no county agent is available, to:

Water Supply Section
Iowa Department of Natural Resources
502 E 9th St
Des Moines IA 50319-0034

IOWA DEPARTMENT OF NATURAL RESOURCES

Abandoned Water Well Plugging Record

1. Owner:

Name: Black Hawk County Solid Waste Management Commission Phone: 319-234-8115

Address: PO Box 208

City: Waterloo State: Iowa Zip: 50704

If this was a Public Water Supply Well, please provide:

PWSID Name: _____ PWSID Number: _____

2. Location of Well (Cistern):

NE ¼ of, NE ¼ of, SE ¼ of, Section 23 , T 88N N, R 13 ☐ East ☒ West

County: Black Hawk Describe well location on property: See attached AECOM MW Location Map

GPS Well Location: Latitude: 42.419429 Longitude: -92.317960

3. Well Description:

Well depth: 124.8 ft

Depth to water 105.57 ft.

Casing depth: 124.8 ft. Casing Material: ☒ Steel ☐ Plastic ☐ Concrete ☐ Clay ☐ Brick ☐ Stone

Casing diameter: 2 in.

Year or decade constructed: 1998 Type of Construction: ☒ Drilled ☐ Driven ☐ Bored ☐ Augured ☐ Dug

Is this a Monitoring Well? ☒ Yes ☐ No Well ID: 215C

Check if Cistern ☐ Depth: _____ ft. Diameter: _____ ft.

I certify this well has been plugged as required by rule 567-39.8 of the Iowa Administrative Code (IAC). I agree to provide any additional information the county or department may need concerning this well.

Signature of Owner _____ Date Plugged: 10/31/22

If plugged by certified well contractor, complete this box:

I have plugged this well as required by rule 567-39.8 of the Iowa Administrative Code (IAC).

Signature of Contractor: _____ Cert No: 9351

OR, If plugged by well owner, complete this box:

The property owner has plugged this well following requirements in rule 567-39.8 of the Iowa Administrative Code (IAC) with the oversight and assistance of the designated county agent.

Signature of County Agent: _____ Date Approved: _____

Eligible for Grants-to-Counties cost share: ☐ Yes ☐ No (Determined by County Agent)

Complete one form for each well plugged and submit within 30 days to the local county agent:

OR, only if no county agent is available, to:

Water Supply Section
Iowa Department of Natural Resources
502 E 9th St
Des Moines IA 50319-0034

IOWA DEPARTMENT OF NATURAL RESOURCES

Abandoned Water Well Plugging Record

1. **Owner:**

Name: Black Hawk County Solid Waste Management Commission Phone: 319-234-8115

Address: PO Box 208

City: Waterloo State: Iowa Zip: 50704

If this was a Public Water Supply Well, please provide:

PWSID Name: _____ PWSID Number: _____

2. **Location of Well (Cistern):**

NE ¼ of, NE ¼ of, SE ¼ of, Section 23 , T 88N N, R 13 ☐ East ☒ West

County: Black Hawk Describe well location on property: See attached AECOM MW Location Map

GPS Well Location: Latitude: 42.420880 Longitude: -92.317978

3. **Well Description:**

Well depth: 66.96 ft

Depth to water 55.91 ft.

Casing depth: 66.96 ft. Casing Material: ☒ Steel ☐ Plastic ☐ Concrete ☐ Clay ☐ Brick ☐ Stone

Casing diameter: 2 in.

Year or decade constructed: 1998 Type of Construction: ☒ Drilled ☐ Driven ☐ Bored ☐ Augured ☐ Dug

Is this a Monitoring Well? ☒ Yes ☐ No Well ID: 216A

Check if Cistern ☐ Depth: _____ ft. Diameter: _____ ft.

I certify this well has been plugged as required by rule 567-39.8 of the Iowa Administrative Code (IAC). I agree to provide any additional information the county or department may need concerning this well.

Signature of Owner _____ Date Plugged: 10/31/22

If plugged by certified well contractor, complete this box:

I have plugged this well as required by rule 567-39.8 of the Iowa Administrative Code (IAC).

Signature of Contractor: _____ Cert No: 9351

OR, If plugged by well owner, complete this box:

The property owner has plugged this well following requirements in rule 567-39.8 of the Iowa Administrative Code (IAC) with the oversight and assistance of the designated county agent.

Signature of County Agent: _____ Date Approved: _____

Eligible for Grants-to-Counties cost share: ☐ Yes ☐ No (Determined by County Agent)

Complete one form for each well plugged and submit within 30 days to the local county agent:

OR, only if no county agent is available, to:

Water Supply Section
Iowa Department of Natural Resources
502 E 9th St
Des Moines IA 50319-0034

IOWA DEPARTMENT OF NATURAL RESOURCES

Abandoned Water Well Plugging Record

1. **Owner:**

Name: Black Hawk County Solid Waste Management Commission Phone: 319-234-8115

Address: PO Box 208

City: Waterloo State: Iowa Zip: 50704

If this was a Public Water Supply Well, please provide:

PWSID Name: _____ PWSID Number: _____

2. **Location of Well (Cistern):**

NE ¼ of, NE ¼ of, SE ¼ of, Section 23, T 88N N, R 13 ☐ East ☒ West

County: Black Hawk Describe well location on property: See attached AECOM MW Location Map

GPS Well Location: Latitude: 42.420880 Longitude: -92.317978

3. **Well Description:**

Well depth: 26.20 ft

Depth to water 14.18 ft.

Casing depth: 26.20 ft. Casing Material: ☒ Steel ☐ Plastic ☐ Concrete ☐ Clay ☐ Brick ☐ Stone

Casing diameter: 2 in.

Year or decade constructed: 1998 Type of Construction: ☒ Drilled ☐ Driven ☐ Bored ☐ Augured ☐ Dug

Is this a Monitoring Well? ☒ Yes ☐ No Well ID: 216B

Check if Cistern ☐ Depth: _____ ft. Diameter: _____ ft.

I certify this well has been plugged as required by rule 567-39.8 of the Iowa Administrative Code (IAC). I agree to provide any additional information the county or department may need concerning this well.

Signature of Owner _____ Date Plugged: 10/31/22

If plugged by certified well contractor, complete this box:

I have plugged this well as required by rule 567-39.8 of the Iowa Administrative Code (IAC).

Signature of Contractor: _____ Cert No: 9351

OR, If plugged by well owner, complete this box:

The property owner has plugged this well following requirements in rule 567-39.8 of the Iowa Administrative Code (IAC) with the oversight and assistance of the designated county agent.

Signature of County Agent: _____ Date Approved: _____

Eligible for Grants-to-Counties cost share: ☐ Yes ☐ No (Determined by County Agent)

Complete one form for each well plugged and submit within 30 days to the local county agent:

OR, only if no county agent is available, to:

Water Supply Section
Iowa Department of Natural Resources
502 E 9th St
Des Moines IA 50319-0034

IOWA DEPARTMENT OF NATURAL RESOURCES

Abandoned Water Well Plugging Record

1. Owner:

Name: Black Hawk County Solid Waste Management Commission Phone: 319-234-8115

Address: PO Box 208

City: Waterloo State: Iowa Zip: 50704

If this was a Public Water Supply Well, please provide:

PWSID Name: _____ PWSID Number: _____

2. Location of Well (Cistern):

NE ¼ of, NE ¼ of, SE ¼ of, Section 23 , T 88N N, R 13 ☐ East ☒ West

County: Black Hawk Describe well location on property: See attached AECOM MW Location Map

GPS Well Location: Latitude: 42.420880 Longitude: -92.317978

3. Well Description:

Well depth: 137.72 ft

Depth to water 113.82 ft.

Casing depth: 137.72 ft. Casing Material: ☒ Steel ☐ Plastic ☐ Concrete ☐ Clay ☐ Brick ☐ Stone

Casing diameter: 2 in.

Year or decade constructed: 1998 Type of Construction: ☒ Drilled ☐ Driven ☐ Bored ☐ Augured ☐ Dug

Is this a Monitoring Well? ☒ Yes ☐ No Well ID: 216C

Check if Cistern ☐ Depth: _____ ft. Diameter: _____ ft.

I certify this well has been plugged as required by rule 567-39.8 of the Iowa Administrative Code (IAC). I agree to provide any additional information the county or department may need concerning this well.

Signature of Owner _____ Date Plugged: 10/31/22

If plugged by certified well contractor, complete this box:

I have plugged this well as required by rule 567-39.8 of the Iowa Administrative Code (IAC).

Signature of Contractor: _____ Cert No: 9351

OR, If plugged by well owner, complete this box:

The property owner has plugged this well following requirements in rule 567-39.8 of the Iowa Administrative Code (IAC) with the oversight and assistance of the designated county agent.

Signature of County Agent: _____ Date Approved: _____

Eligible for Grants-to-Counties cost share: ☐ Yes ☐ No (Determined by County Agent)

Complete one form for each well plugged and submit within 30 days to the local county agent:

OR, only if no county agent is available, to:

Water Supply Section
Iowa Department of Natural Resources
502 E 9th St
Des Moines IA 50319-0034

IOWA DEPARTMENT OF NATURAL RESOURCES

Abandoned Water Well
Plugging Record

1. **Owner:**

Name: Black Hawk County Solid Waste Management Commission Phone: 319-234-8115

Address: PO Box 208

City: Waterloo State: Iowa Zip: 50704

If this was a Public Water Supply Well, please provide:

PWSID Name: _____ PWSID Number: _____

2. **Location of Well (Cistern):**

SE ¼ of, SE ¼ of, SW ¼ of, Section 23 , T 88N N, R 13 ☐ East ☒ West

County: Black Hawk Describe well location on property: See attached AECOM MW Location Map

GPS Well Location: Latitude: 42.414211 Longitude: -92.332500

3. **Well Description:**

Well depth: 70.67 ft

Depth to water 15.70 ft.

Casing depth: 70.67 ft. Casing Material: ☒ Steel ☐ Plastic ☐ Concrete ☐ Clay ☐ Brick ☐ Stone

Casing diameter: 2 in.

Year or decade constructed: 1990s Type of Construction: ☒ Drilled ☐ Driven ☐ Bored ☐ Augured ☐ Dug

Is this a Monitoring Well? ☒ Yes ☐ No Well ID: 319A

Check if Cistern ☐ Depth: _____ ft. Diameter: _____ ft.

I certify this well has been plugged as required by rule 567-39.8 of the Iowa Administrative Code (IAC). I agree to provide any additional information the county or department may need concerning this well.

Signature of Owner _____ Date Plugged: 10/31/22

If plugged by certified well contractor, complete this box:

I have plugged this well as required by rule 567-39.8 of the Iowa Administrative Code (IAC).

Signature of Contractor: _____ Cert No: 9351

OR, If plugged by well owner, complete this box:

The property owner has plugged this well following requirements in rule 567-39.8 of the Iowa Administrative Code (IAC) with the oversight and assistance of the designated county agent.

Signature of County Agent: _____ Date Approved: _____

Eligible for Grants-to-Counties cost share: ☐ Yes ☐ No (Determined by County Agent)

Complete one form for each well plugged and submit within 30 days to the local county agent:

OR, only if no county agent is available, to:

Water Supply Section
Iowa Department of Natural Resources
502 E 9th St
Des Moines IA 50319-0034

IOWA DEPARTMENT OF NATURAL RESOURCES

Abandoned Water Well Plugging Record

1. **Owner:**

Name: Black Hawk County Solid Waste Management Commission Phone: 319-234-8115

Address: PO Box 208

City: Waterloo State: Iowa Zip: 50704

If this was a Public Water Supply Well, please provide:

PWSID Name: _____ PWSID Number: _____

2. **Location of Well (Cistern):**

SE ¼ of, SE ¼ of, SW ¼ of, Section 23 , T 88N N, R 13 ☐ East ☒ West

County: Black Hawk Describe well location on property: See attached AECOM MW Location Map

GPS Well Location: Latitude: 42.414211 Longitude: -92.332500

3. **Well Description:**

Well depth: 101.23 ft

Depth to water 87.62 ft.

Casing depth: 101.23 ft. Casing Material: ☒ Steel ☐ Plastic ☐ Concrete ☐ Clay ☐ Brick ☐ Stone

Casing diameter: 2 in.

Year or decade constructed: 1990s Type of Construction: ☒ Drilled ☐ Driven ☐ Bored ☐ Augured ☐ Dug

Is this a Monitoring Well? ☒ Yes ☐ No Well ID: 319E

Check if Cistern ☐ Depth: _____ ft. Diameter: _____ ft.

I certify this well has been plugged as required by rule 567-39.8 of the Iowa Administrative Code (IAC). I agree to provide any additional information the county or department may need concerning this well.

Signature of Owner _____ Date Plugged: 10/31/22

If plugged by certified well contractor, complete this box:

I have plugged this well as required by rule 567-39.8 of the Iowa Administrative Code (IAC).

Signature of Contractor: _____ Cert No: 9351

OR, If plugged by well owner, complete this box:

The property owner has plugged this well following requirements in rule 567-39.8 of the Iowa Administrative Code (IAC) with the oversight and assistance of the designated county agent.

Signature of County Agent: _____ Date Approved: _____

Eligible for Grants-to-Counties cost share: ☐ Yes ☐ No (Determined by County Agent)

Complete one form for each well plugged and submit within 30 days to the local county agent:	OR, only if no county agent is available, to:
	Water Supply Section **Iowa Department of Natural Resources** **502 E 9th St** **Des Moines IA 50319-0034**

IOWA DEPARTMENT OF NATURAL RESOURCES

Abandoned Water Well Plugging Record

1. **Owner:**

Name: Black Hawk County Solid Waste Management Commission Phone: 319-234-8115

Address: PO Box 208

City: Waterloo State: Iowa Zip: 50704

If this was a Public Water Supply Well, please provide:

PWSID Name: _____ PWSID Number: _____

2. **Location of Well (Cistern):**

NE ¼ of, SW ¼ of, SW ¼ of, Section 23, T 88N N, R 13 ☐ East ☒ West

County: Black Hawk Describe well location on property: See attached AECOM MW Location Map

GPS Well Location: Latitude: 42.415920 Longitude: -92.335123

3. **Well Description:**

Well depth: 23 ft

Depth to water 9.37 ft.

Casing depth: 23 ft. Casing Material: ☒ Steel ☐ Plastic ☐ Concrete ☐ Clay ☐ Brick ☐ Stone

Casing diameter: 2 in.

Year or decade constructed: 2014 Type of Construction: ☒ Drilled ☐ Driven ☐ Bored ☐ Augured ☐ Dug

Is this a Monitoring Well? ☒ Yes ☐ No Well ID: 601B

Check if Cistern ☐ Depth: _____ ft. Diameter: _____ ft.

I certify this well has been plugged as required by rule 567-39.8 of the Iowa Administrative Code (IAC). I agree to provide any additional information the county or department may need concerning this well.

Signature of Owner _____ Date Plugged: 10/31/22

If plugged by certified well contractor, complete this box:

I have plugged this well as required by rule 567-39.8 of the Iowa Administrative Code (IAC).

Signature of Contractor: _____ Cert No: 9351

OR, If plugged by well owner, complete this box:

The property owner has plugged this well following requirements in rule 567-39.8 of the Iowa Administrative Code (IAC) with the oversight and assistance of the designated county agent.

Signature of County Agent: _____ Date Approved: _____

Eligible for Grants-to-Counties cost share: ☐ Yes ☐ No (Determined by County Agent)

Complete one form for each well plugged and submit within 30 days to the local county agent:	OR, only if no county agent is available, to:
	Water Supply Section **Iowa Department of Natural Resources** **502 E 9th St** **Des Moines IA 50319-0034**

Plotted: 1/8/2021, 9:21:28 AM

ASBESTOS CELL I
2009 (CLOSED)

ASBESTOS CELL II
2008-PRESENT

RCRA NEUTRAL TRENCH 1988 (CLOSED)

TOPSOIL
STOCKPILE NO. 3
18,300 CY

DAILY COVER
STOCKPILE NO. 9
245,000 CY

CELL W4
PHASE I
(FUTURE)

CELL W3
PHASE I
UNDER CONSTRUCTION
(2021)

AREA 'E'
1991–1999
(CLOSED)

Abandon/replace P-216C;
OW-216B; Abandon P-216A

OPSOIL
KPILE NO. 4
0,750 CY

CELL W4
PHASE II
(FUTURE)

CELL W4
PHASE III
(FUTURE)

CELL W3
PHASE III
(FUTURE)

CELL W3
PHASE II
(FUTURE)

TOPSOIL
STOCKPILE NO. 8

MH AND PIPE
STOCKPILE AREA

CELL 'X'
1999–2008
(CLOSED)

Abandon/replace P-215C;
OW-215B; Abandon P-215A

B-224

B-225

B-226

B-227

AREA 'C'
1986–1991
(CLOSED)

Abandon/replace P-214C;
OW-214B; Abandon P-214A

HAMMOND AVENUE

STOCKPILE NO. 2
625,000 CY

CELL W2
(EXISTING)
2014–

CELL W1
PHASE IV
(EXISTING)
2012–

CELL W1
PHASE III
(EXISTING)
(PARTIALLY
CLOSED)
2010–

CELL W1
PHASE II
(CLOSED)
2008–2018

CELL W1
PHASE I
(CLOSED)
2007–2014

AREA 'A'
(CLOSED)
1975–1980

RCRA
CO-DISPOSAL AREA
1989 (CLOSED)
ORIGINAL AREA 'F'
1975–1986

Abandon MW-601B

STOCKPILE NO. 7

CELL W5
(FUTURE)

TOPSOIL
STOCKPILE NO. 6

SCALES AND
SCALE HOUSE

SHOP

RUN-OFF
BASIN

SMALL LOADS

YARD WASTE
COMPOST
FACILITY

LANDFILL MAIN ENTRANCE

Abandon MW-319A; MW-319E

HESS ROAD

SILTATION
BASIN

WASHBURN ROAD

N

0' 100' 200' 400'
SCALE

PREPARED BY:

AECOM

501 SYCAMORE STREET SUITE 222 WATERLOO, IA. 50703-4644 1-319-232-6531

FIGURE 2-2
MONITORING WELL LOCATIONS
HYDROLOGIC MONITORING SYSTEM PLAN
BLACK HAWK COUNTY LANDFILL
WATERLOO, IOWA

JAN 2021

60649127

Waterloo, Iowa
Printed from MicroStation V8i
Design File P:\60649127\900-CAD-GIS\00-HMSP\HMSP Figures.Dsn, Model Figure 2-2

APPENDIX B

EXAMPLE FIELD FORMS

AECOM

Water Elevation

Project No.: _____ Site: _____

Well Number	Elevation of Top of Pipe	Depth to Water	Water Elevation	Depth to Bottom	Well Integrity				Comments
					Locked	Capped	Cracked	Obstruct	

Description of Site: _____

Soil Conditions: _____

Weather: _____ Temperature: _____

Entered on Computer: _____ Signature: _____ Date: _____

AECOM

Field Meter Instrument Calibration Log

Project No.: _____ Site: _____ Date: _____

Name / Signature of personnel conducting calibration: _____

INSTRUMENT	BRAND	MODEL #	SERIAL #	LAST SERVICED
Water Level Indicator				

INSTRUMENT	BRAND	MODEL #	SERIAL #	CALIBRATED
DO Meter				
Air Temperature ° C		Calibrated Air (mg/L)		Reading Air (mg/L)

INSTRUMENT	**BRAND**	**MODEL #**	**SERIAL #**	**CALIBRATED**
Turbidity Meter				
True Value of Standard:		Actual Reading:		Corrected to:

INSTRUMENT	BRAND	MODEL #	SERIAL #	CALIBRATED
pH/Cond./ORP Meter	Miron L Company Ultra Meter 6P			
CONDUCTIVITY (µs)				
True Value of Standard:		Actual Reading:		Corrected to:
pH				
True Value of Standard:		Actual Reading:		Corrected to:
7				
4				

INSTRUMENT	BRAND	MODEL #	SERIAL #	CALIBRATED
pH/Cond./Turbidity Meter	In-Situ	Aqua Troll 500		
CONDUCTIVITY (µs)				
True Value of Standard:		Actual Reading:		Corrected to:
pH				
True Value of Standard:		Actual Reading:		Corrected to:
7				
4				

AIR QUALITY				
INSTRUMENT	**BRAND**	**MODEL #**	**SERIAL #**	**CALIBRATED**
Multigas Meter				

True Value of Gas	Actual Reading:	Corrected to:
Open Air		
Isobutylene 100 PPM		
O^2/CO/LEL/H_2S		

Comments: _____

Rev. 12/2019

F523/Earth.Sci

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AECOM

Daily Time Log

Date: _____/_____/_____

Sat. Sun. Mon. Tues. Weds. Thurs. Fri.

Site: _____ Project No.: _____

Weather: _____

Task/Equipment: _____

Firm/Contractor's Personnel: _____ Hrs On-Site: _____

AECOM Personnel: _____ Hrs On-Site: _____

Site Visitor: _____

Time Log indicating work in progress, remarks:

0600-0630 _____

0630-0700 _____

0700-0730 _____

0730-0800 _____

0800-0830 _____

0830-0900 _____

0900-0930 _____

0930-1000 _____

1000-1030 _____

1030-1100 _____

1100-1130 _____

1130-1200 _____

1200-1230 _____

1230-1300 _____

1300-1330 _____

1330-1400 _____

1400-1430 _____

1430-1500 _____

1500-1530 _____

1530-1600 _____

1600-1630 _____

1630-1700 _____

1700-1730 _____

1730-1800 _____

Items requiring follow up: _____

K:\PROJECTS\60595251 Black Hawk LF\400-Technical\455_Environmental\HMSP 2019\Appendix B\15 - Daily Time Log.doc

Rev.

AECOM

Well Purging and Sampling Collection

Site: _____ Well ID: _____ Date: _____
Depth to Top of Screen: _____feet (TOC) Depth to Bottom of screen: _____feet (TOC)

Weather Conditions: _____ Project No.:_____

Sample Method (circle one): Pumped Other: _____

Pump Type: (circle one) 0.85" dia. SS Bladder PVC Mega-Monsoon 0.675" dia. SS Bladder Other:_____

Day 1 (for wells with <0.33 drawdown)

Pre-Purge DTW: _____feet(TOC) Time: _____
Pump Intake (ft. below DTW): _____feet (TOC)
Post-Purge DTW: _____feet (TOC) Time: _____
From AquaTroll 500:
Total Purge Volume (actual): _____ ml
(At least 1x the total tubing and flow thru cell volume calculated below needs to be removed prior to recording)

Day 2 (for wells pumped/bailed dry) Date:_____

Pre-Purge DTW: _____feet (TOC) Time: _____
Pump Intake (ft. below DTW): _____feet (TOC)
Post-Purge DTW: _____ feet (TOC) Time:_____
From AquaTroll 500:
Total Purge Volume: _____ ml
(At least 1x the total tubing and flow thru cell volume calculated below needs to be removed)

Total Purge Volume Calculation:
h_s = Stabilized/Max Drawdown Height = _____feet h_t = Length of Tubing in Well = _____feet
S = Drawdown Volume (2" diameter well) = 0.163 gallons/ft x h_s = _____ gallons (x 617 ml/ft = _____ml)
P = Bladder Pump (3/16" diameter) Tubing + Flow Cell Volume (Gallons) = 0.0014 gallons/ft x h_t + 0.033 gal + 0.004 gal = _____gal. (5.4297 ml/ft x h_t + 130 ml + 15 ml = _____ ml).
Or
P = SS Submersible Pump (3/8" diameter) Tubing + Flow Cell Volume (Gallons) = 0.006 gallons/ft x h_t + **0.033 gal**= _____gal. (21.72 ml/ft x h_t + 130 ml = _____ ml).
T = Total Tubing and Flow Cell Purge Volume (Gallons) = **P** = _____ gallons or =_____ml
Time to purge tubing plus flow cell volume = T/ pump purge rate = _____ minutes

Depth to Bottom: _____ feet (TOC) Time: _____ (measure after sample has been collected)

Field parameters will also be recorded by the low flow sampling system.

Time (24 HR)	DTW (ft)	Pump Dial[1]	Purge Rate (ml/min)	Cum. Volume Removed (ml.)	pH	Spec. Cond.[2] µS/cm	Temp. °C	Turbidity NTU	DO[3] Mg/L	ORP[4] mv
Stabilization Criteria:					+/- 0.1	3%	3%	10%	10%	+/- 10 mv

Comments:

Duplicate - Sample ID.:_____ Time: _____

Field Blank - Sample ID.:_____ Time: _____

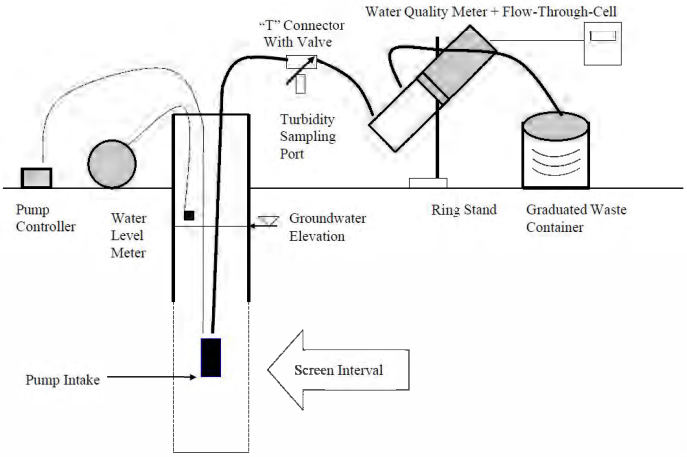
(If no quality control samples were collected cross-out, initial, and date)

Signature: Date:

Notes:

[1] Pump dial setting (for example: hertz, cycles/min, etc.)
[2] µSiemens per cm (same as µmhos/cm) at 25°C
[3] DO = dissolved oxygen
[4] ORP = oxidation reduction potential
DTW = depth to water from TOC

Low-Flow Setup Diagram



Procedure for wells with <0.33 ft drawdown during purging

1. Place the pump and support equipment at the wellhead and slowly lower the pump and tubing down into the monitoring well until the location of the pump intake is set at a pre-determined location within the screen interval. The placement of the pump intake should be positioned by a sounded with a weighted-tape. Refer to the available monitoring well information to determine the depth and length of the screen interval. Measure the depth of the pump intake while lowering the pump into location. Record pump location on field groundwater sampling log.
2. Measure the water level (water level must be measured to nearest 0.01 feet) and record information on the groundwater sampling log, leave water level indicator probe in the monitoring well.
3. Connect the discharge line from the pump to a flow-through cell. The discharge line from the flow-through cell must be directed to a container to contain the purge water during the purging and sampling of the monitoring well.
4. Start pumping the well at a low flow rate (0.125 to 0.5 liter per minute) and slowly increase the speed. Check water level. Maintain a steady flow rate while maintaining a drawdown of less than 0.33 feet (Puls and Barcelona, 1996). If drawdown is greater than 0.33 feet lower the flow rate. The 0.33 feet is a goal to help guide with the flow rate adjustment. It should be noted that this goal may be difficult to achieve under some circumstances due to geologic heterogeneities within the screened interval, and may require adjustment based on site-specific conditions and personal experience (Puls and Barcelona, 1996).
5. Measure the discharge rate of the pump with a graduated cylinder and a stop watch. Also, measure the water level and record both flow rate and water level on the groundwater sampling log. Continue purging, monitor and record water level and pump rate every three to five minutes during purging. Pumping rates should be kept at minimal flow to ensure minimal drawdown in the monitoring well.
6. During the purging, a minimum of one tubing volume (including the volume of water in the pump and flow cell) must be purged prior to recording the water-quality indicator parameters. Then monitor and record the water-quality indicator parameters every three to five minutes. Once the criteria have been successfully met indicating that the water quality indicator parameters have stabilized, then sample collection can take place.
7. If a stabilized drawdown in the well can't be maintained at 0.33 feet and the water level is approaching the top of the screened interval, reduce the flow rate or turn the pump off (for 15 minutes) and allow for recovery. It should be noted whether or not the pump has a check valve. A check valve is required if the pump is shut off. Begin pumping at a lower flow rate, if the water draws-down to the top of the screened interval again turn pump off and allow for recovery. If two tubing volumes (including the volume of water in the pump and flow cell) have been removed during purging then sampling can proceed next time the pump is turned on. This information should be noted in the field notebook or groundwater sampling log with a recommendation for a different purging and sampling procedure.
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Eurofins TestAmerica, Cedar Falls
704 Enterprise Drive
Cedar Falls, IA 50613
phone 319.277.2401 fax 319.277.2425

Chain of Custody Record

eurofins | Environment Testing TestAmerica

Client Contact

AECOM
501 Sycamore St., Suite 222
Waterloo, IA 50703
(319)222-6531 Phone
(319)232-0221 FAX
Project Name: Groundwater Monitoring
Site: Black Hawk County Landfill
P O #

Project Manager: Christopher Oelkers
Tel/Fax: (319)222-6531(319)222-0221
Email: Christopher.Oelkers@aecom.com

Analysis Turnaround Time
☐ CALENDAR DAYS ☐ WORKING DAYS
☐ TAT if different from Below
☐ 2 weeks
☐ 1 week
☐ 2 days
☐ 1 day

Regulatory Program: ☐ DW ☐ NPDES ☐ RCRA ☐ Other: ☐ Iowa DNR

TestAmerica Laboratories, Inc. d/b/a Eurofins TestAmerica

COC No: ____ of ____ COCs
Sampler: **For Lab Use Only:** Walk-in Client: Lab Sampling:
Job / SDG No.:

Sample Identification	Sample Date	Sample Time	Sample Type (C=Comp, G=Grab)	Matrix	# of Cont.	Filtered Sample (Y / N)	Perform MS / MSD (Y / N)	Total Cobalt	Benzene	Total Chromium	Appendix I Metals and VOCs	Total Antimony	Sample Specific Notes:
OW-113B			G	GW		N		X					
MW-312B			G	GW		N			X				
P-214C			G	GW		N				X			
GUW1-1			G	GW		N					X		
P-402A			G	GW		N						X	

Preservation Used: 1= Ice, 2= HCl; 3= H2SO4; 4=HNO3; 5=NaOH; 6= Other

Possible Hazard Identification:
Are any samples from a listed EPA Hazardous Waste? Please List any EPA Waste Codes for the sample in the Comments Section if the lab is to dispose of the sample.
☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ Return to Client ☐ Disposal by Lab ☐ Archive for ____ Months

Special Instructions/QC Requirements & Comments:

Custody Seals Intact: ☐ Yes ☐ No	Custody Seal No.:	Cooler Temp. (°C): Obs'd:	Corr'd:	Therm ID No.:
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received in Laboratory by:	Company:	Date/Time:

Form No. CA-C-WI-002, Rev. 4.23, dated 4/16/2019

MSGP Quarterly Visual Assessment Form

(Complete a separate form for each outfall you assess)

Name of Facility:	Permit No.:	
Street Address:	City:	State: Zip Code:
Outfall Number:	"Substantially Identical Outfall"? ☐ No ☐ Yes (identify substantially identical outfalls):	
Quarter/Year:	Substitute Sample?: ☐ No ☐ Yes (identify quarter/year when sample was originally scheduled to be collected):	
Person(s)/Title(s) collecting sample:		
Person(s)/Title(s) examining sample:		
Date & Time Storm or Snowmelt Began:	Date & Time Sample Collected: _____	Date & Time Sample Examined: _____
Nature of Discharge: ☐ Rainfall	☐ Snowmelt	
Rainfall Amount: inches	Previous Storm Ended > 72 hours Before Start of This Storm? ☐ Yes ☐ No* (explain):	

Parameter		
Color	☐ None ☐ Other (describe):	
Odor	☐ None ☐ Musty ☐ Sewage ☐ Sulfur ☐ Sour ☐ Petroleum/Gas ☐ Solvents ☐ Other (describe):	
Clarity	☐ Clear ☐ Slightly Cloudy ☐ Cloudy ☐ Opaque ☐ Other (describe):	
Floating Solids	☐ No ☐ Yes (describe):	
Settled Solids**	☐ No ☐ Yes (describe):	
Suspended Solids	☐ No ☐ Yes (describe):	
Oil Sheen	☐ None ☐ Flecks ☐ Globs ☐ Sheen ☐ Slick ☐ Other (describe):	
Foam (gently shake sample)	☐ No ☐ Yes (describe):	
Other Obvious Indicators of Storm Water Pollution	☐ No ☐ Yes (describe):	

* The 72-hour interval can be waived when the previous storm did not yield a measurable discharge or if you are able to document (attach applicable documentation) that less than a 72-hour interval is representative of local storm events during the sampling period.

** Observe for settled solids after allowing the sample to sit for approximately one-half hour.

Sampling not performed due to adverse conditions: ☐ No ☐ Yes (explain): _____

Sampling not performed due to no measurable storm event occurring that resulted in a discharge during the monitoring quarter: ☐ No ☐ Yes (explain): _____

Detail any concerns, additional comments, descriptions of pictures taken, and any corrective actions taken below (attach additional sheets as necessary).

Certification by Facility Responsible Official (Refer to MSGP Subpart 11 Appendix B for Signatory Requirements)

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

A. Name _____ B. Title _____

C. Signature _____ D. Date Signed _____

MSGP Industrial Stormwater/Snowmelt Discharge Collection Form

Name of Facility:

Address:

Person(s)/Title(s) collecting sample:

Permit Tracking Number:

Outfall Numbers/Sample Locations:

Discharge Information

Nature of Discharge (circle one): Rainfall or Snowmelt

Rainfall Amount (inches):

Date of Discharge Sampling:
Date & Time Storm Began:
Date & Time Storm Ended:
Date & Time of Previous Measurable Storm Event:

Preservative (Y/N)

Number of Containers

Type of Analyses Required

Sample Collection Information

Date & Time Sample Collection Began:

Date & Time Sample Collection Ended (if different):

Shaded area for laboratory use only

Date	Time	Sample Identification/Outfall	Collection Method	Laboratory Log Number

Sampled by: (*signature*)	Date/Time:	Relinquished by: (*signature*)	Date/Time:	Received by: (*signature*)	Date/Time:
Received by: (*signature*)	Date/Time:	Received by: (*signature*)	Date/Time:	Received by: (*signature*)	Date/Time:

The 72-hour interval can be waived when the previous storm did not yield a measurable discharge or if you are able to document (attach applicable documentation) that less than a 72-hour interval is representative of local storm events during the sampling period.

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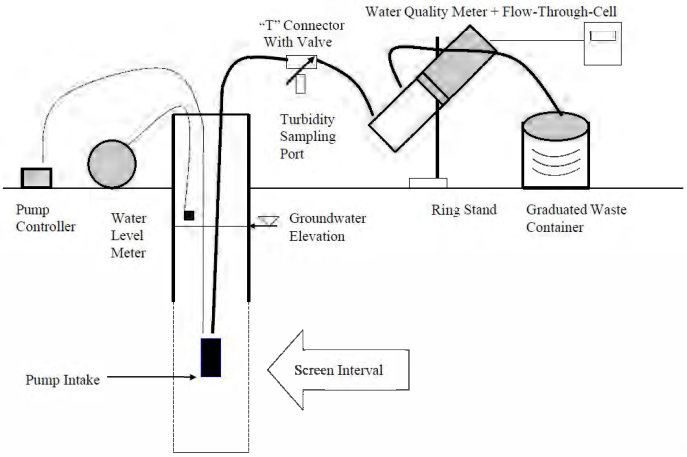
A. Name_____ B. Title_____

C. Signature_____ C. Date Signed_____

Notes:

[1] Pump dial setting (for example: hertz, cycles/min, etc.)
[2] µSiemens per cm (same as µmhos/cm) at 25°C
[3] DO = dissolved oxygen
[4] ORP = oxidation reduction potential
DTW = depth to water from TOC

Low-Flow Setup Diagram



Procedure for wells with <0.33 ft drawdown during purging

1. Place the pump and support equipment at the wellhead and slowly lower the pump and tubing down into the monitoring well until the location of the pump intake is set at a pre-determined location within the screen interval. The placement of the pump intake should be positioned by a sounded with a weighted-tape. Refer to the available monitoring well information to determine the depth and length of the screen interval. Measure the depth of the pump intake while lowering the pump into location. Record pump location on field groundwater sampling log.
2. Measure the water level (water level must be measured to nearest 0.01 feet) and record information on the groundwater sampling log, leave water level indicator probe in the monitoring well.
3. Connect the discharge line from the pump to a flow-through cell. The discharge line from the flow-through cell must be directed to a container to contain the purge water during the purging and sampling of the monitoring well.
4. Start pumping the well at a low flow rate (0.125 to 0.5 liter per minute) and slowly increase the speed. Check water level. Maintain a steady flow rate while maintaining a drawdown of less than 0.33 feet (Puls and Barcelona, 1996). If drawdown is greater than 0.33 feet lower the flow rate. The 0.33 feet is a goal to help guide with the flow rate adjustment. It should be noted that this goal may be difficult to achieve under some circumstances due to geologic heterogeneities within the screened interval, and may require adjustment based on site-specific conditions and personal experience (Puls and Barcelona, 1996).
5. Measure the discharge rate of the pump with a graduated cylinder and a stop watch. Also, measure the water level and record both flow rate and water level on the groundwater sampling log. Continue purging, monitor and record water level and pump rate every three to five minutes during purging. Pumping rates should be kept at minimal flow to ensure minimal drawdown in the monitoring well.
6. During the purging, a minimum of one tubing volume (including the volume of water in the pump and flow cell) must be purged prior to recording the water-quality indicator parameters. Then monitor and record the water-quality indicator parameters every three to five minutes. Once the criteria have been successfully met indicating that the water quality indicator parameters have stabilized, then sample collection can take place.
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AECOM

Well Purging and Sampling Collection

Site: _____ Well ID: _____ Date: _____
Depth to Top of Screen: _____feet (TOC) Depth to Bottom of screen: _____feet (TOC)

Weather Conditions: _____ Project No.:_____

Sample Method (circle one): Pumped Other: _____

Pump Type: (circle one) 0.85" dia. SS Bladder PVC Mega-Monsoon 0.675" dia. SS Bladder Other:_____

Day 1 (for wells with <0.33 drawdown)

Pre-Purge DTW: _____feet(TOC) Time: _____
Pump Intake (ft. below DTW): _____feet (TOC)
Post-Purge DTW: _____feet (TOC) Time: _____
From AquaTroll 500:
Total Purge Volume (actual): _____ ml
(At least 1x the total tubing and flow thru cell volume calculated below needs to be removed prior to recording)

Day 2 (for wells pumped/bailed dry) Date:_____

Pre-Purge DTW: _____feet (TOC) Time: _____
Pump Intake (ft. below DTW): _____feet (TOC)
Post-Purge DTW: _____ feet (TOC) Time:_____
From AquaTroll 500:
Total Purge Volume: _____ ml
(At least 1x the total tubing and flow thru cell volume calculated below needs to be removed)

Total Purge Volume Calculation:
h_s = Stabilized/Max Drawdown Height = _____feet h_t = Length of Tubing in Well = _____feet
S = Drawdown Volume (2" diameter well) = 0.163 gallons/ft x h_s = _____ gallons (x 617 ml/ft = _____ml)
P = Bladder Pump (3/16" diameter) Tubing + Flow Cell Volume (Gallons) = 0.0014 gallons/ft x h_t + 0.033 gal + 0.004 gal = _____gal. (5.4297 ml/ft x h_t + 130 ml + 15 ml = _____ ml).
Or
P = SS Submersible Pump (3/8" diameter) Tubing + Flow Cell Volume (Gallons) = 0.006 gallons/ft x h_t + **0.033 gal**= _____gal. (21.72 ml/ft x h_t + 130 ml = _____ ml).
T = Total Tubing and Flow Cell Purge Volume (Gallons) = **P** = _____ gallons or =_____ml
Time to purge tubing plus flow cell volume = T/ pump purge rate = _____ minutes

Depth to Bottom: _____ feet (TOC) Time: _____ (measure after sample has been collected)

Field parameters will also be recorded by the low flow sampling system.

Time (24 HR)	DTW (ft)	Pump Dial[1]	Purge Rate (ml/min)	Cum. Volume Removed (ml.)	pH	Spec. Cond.[2] µS/cm	Temp. °C	Turbidity NTU	DO[3] Mg/L	ORP[4] mv
Stabilization Criteria:					+/- 0.1	3%	3%	10%	10%	+/- 10 mv

Comments:

Duplicate - Sample ID.:_____ Time: _____

Field Blank - Sample ID.:_____ Time: _____

(If no quality control samples were collected cross-out, initial, and date)

Signature: Date: