AECOM

Subsurface Exploration and Geotechnical Engineering Evaluation

Rueping-Macy Force Main
Fond du Lac, Wisconsin

AECOM Technical Services, Inc.
1210 Fourier Drive, Suite 100
Madison, Wisconsin 53717

May 26, 2009
AECOM USA Inc. Project No. 60098468

Prepared by:
Douglas S. Dettmers
Senior Project Engineer
AECOM USA, Inc.
414-577-1379

AECOM

AECOM
11425 W. Lake Park Drive, Suite 100, Milwaukee, WI 53224
P 414.359.3030 F 414.359.0822

May 26, 2009

Ms. Caroline Burger, P.E.
AECOM Technical Services, Inc.
1210 Fourier Drive, Suite 100
Madison, Wisconsin 53717

RE: Subsurface Exploration and Geotechnical Engineering Analysis for the New Force Main Construction in Fond du Lac, Wisconsin – AECOM USA, Inc. Project No. 60098468

Dear Ms. Burger:

The subsurface exploration and geotechnical engineering analysis for the above referenced project has been completed. The attached report contains the logs of six soil borings and an evaluation of the conditions encountered by the borings. It also includes our preliminary recommendations regarding suitable foundation types, support of slabs on grade, site seismic classification, below grade wall design, dewatering, conceptual earth retention, suitability of on-site soil for use as structural fill, as well as other geotechnical-related design and construction considerations.

We appreciate the opportunity to be of service to you. If you have questions with regard to the attached report, or if we can be of further assistance, please feel free to call.

Respectfully,

Douglas S. Dettmers, P.E.
Senior Project Engineer

Paul A. Tarvin, P.E.
Vice President

© AECOM 2009, ALL RIGHTS RESERVED

Table of Contents

1.0 Project Overview 1
1.1 Project Description 1
1.2 Project Scope 1
2.0 Field Exploration Procedures 3
2.1 Boring Layout and Survey Procedures 3
2.2 Drilling and Sampling Procedures 3
2.3 Groundwater Measurements and Borehole Abandonment ... 3
2.4 Laboratory Testing Procedures 3
2.5 Boring Log Procedures and Qualifications 4
3.0 Field Exploration Procedures 5
3.1 Site Conditions 5
3.2 Soil Conditions 5
3.3 Groundwater Conditions 6
4.0 Analysis and Recommendations 8
4.1 Discussion 8
4.2 Site Preparation – Force Main Construction 8
4.3 Foundation Recommendations 9
4.4 Base Slabs 11
4.5 Below Grade Walls 12
4.6 Site Seismic Classification 13
4.7 Conceptual Excavation Retention 13
4.8 Dewatering Considerations 15
4.9 Construction Considerations 15

Drawings

Drawing D.1 – Depiction of Former River Channel

Figures

Figure 1 – Site Location Diagram

Figure 2 – Soil Boring Location Diagram

Appendices

Appendix A – AECOM Standard Boring Log Procedures

Appendix B – AECOM General Boring Log Notes

Appendix C – Soil Boring Logs (6),

Appendix D – WDNR Borehole Abandonment Forms (6)

Appendix E – AECOM Field and Laboratory Procedures

- Subsurface Exploration Procedures
- Sampling Procedures
- Laboratory Procedures

Appendix F – AECOM Soil Classification System

Appendix G – AECOM Earthwork Guideline

Appendix H – AECOM General Qualifications

Appendix I – AECOM Changed Conditions Clause

1.0 Project Overview

1.1 Project Description

The City of Fond du Lac is planning the construction of a new force main line along the north side of the east branch of the Fond du Lac River. The proposed force main will extend from approximately 500 feet west of Doty Street to the east, across Doty Street to Macy Street. We understand the force main pipe will be constructed approximately 6 feet below the existing grades. Actual design elevations and force main invert elevations were not available at the time this report was issued. Figure 1 in the Appendix shows the approximate area of construction.

At the west end of the proposed force main, an addition to the existing lift station building is planned. Based on the plans and elevations provided, the first floor elevation of the existing lift station is 755.57 feet (10.17 feet City of Fond du Lac datum). The above grade walls are generally masonry block construction with a brick veneer. The below grade walls are 1 foot 6 inch thick reinforced concrete extending to elevation 728.57 feet (-16.83 feet City of Fond du Lac datum), approximately 25 feet below the existing grades. The structure is supported by 2 foot thick concrete mat/slab. The actual dimensions of the addition were not available at the time of this report, but we understand the maximum size will be about one-half of the existing building footprint. Currently, the new construction is planned to match the elevations of the existing building. No information is currently available as to the design of the existing structure to resist uplift pressures.

1.2 Project Scope

Our services were completed in general accordance with the project scope outlined in AECOM Intercompany Sub-Consultancy Agreement authorized by AECOM Technical Services, Inc. on April 7, 2009. Our completed scope of work included the following tasks:

- Reviewed the logs of previous soil borings completed in 2008 by another consultant.
- Obtained clearance of public utilities at the site through Digger's Hotline.
- The City of Fond du Lac provided layout of the borings and ground surface elevations.
- Mobilized a truck mounted drill rig to the site to drill four borings, each to a planned depth of 20 feet. Due to wet gravel layer encountered, boring SB-2 was offset twice before it could be drilled to the planned depth. The borings were advanced using a combination of solid stem flight augers, rotary wash boring techniques and hollow stem augers and abandoned in accordance with Wisconsin Administrative Code NR812 after completion.

- Obtained representative soil samples at 2.5-foot intervals in the upper 10 feet and at 5-foot intervals thereafter. Soil samples were obtained using split-barrel sampling techniques in general accordance with ASTM Specification D1586.

- Performed routine strength and classification tests on representative soil samples obtained from the borings. The testing of representative samples included moisture content and unconfined compressive strength as estimated by a calibrated penetrometer. The samples were classified in general accordance with the Unified Soil Classification System.

- Prepared this Geotechnical Engineering report under the direction of a registered Professional Engineer. This geotechnical report describes the subsurface exploration program and provides geologic characterizations of the soil and groundwater conditions encountered in the borings and those expected during construction. The geotechnical report also includes preliminary recommendations for the following:

    - Foundation design and construction for the expansion of the existing Southwest Lift Station,
    - Design depths for frost avoidance,
    - Temporary construction dewatering considerations,
    - Lateral earth pressure parameters,
    - Subgrade preparation procedures, and
    - Backfill materials, including placement and compaction requirements.

During our field explorations, AECOM Technical Services' personnel were on site to perform environmental screening of the samples collected. As directed by these personnel, AECOM USA, Inc. representatives cleaned split spoon samples and drilling augers as well as placed spoil in drums for future disposal. The future disposal of the drummed material will be coordinated by AECOM Technical Services.

2.0 Field Exploration Procedures

2.1 Boring Layout and Survey Procedures

Six soil borings were drilled at the approximate locations depicted on the Soil Boring Location Diagram (Figure 2) included in the Appendix. The locations of the borings were selected by representatives of AECOM Technical Services, Inc. and were marked in the field by the City of Fond du Lac. The ground surface elevation at each boring location was provided to AECOM USA by the City of Fond du Lac. We understand that the elevations are referenced to USGS datum.

2.2 Drilling and Sampling Procedures

The borings were drilled using a truck mounted CME-55 drill rig operated by a two person crew. The borings were advanced to their termination depths using a combination of hollow stem augers, solid-stem augers, and rotary wash boring techniques utilizing drilling fluid and various rotating cutting bits. More detailed descriptions of these drilling procedures are included in the Appendix. Specific drilling methods, depths, casing usage, drill rig type, foreman and other drilling information are documented on the boring logs.

Soil sampling was generally performed at 2.5-foot intervals to a depth of 10 feet, and at 5-foot intervals thereafter to the boring termination depths. Representative samples of soil were obtained using a split-barrel sampler. The split-barrel sampler was driven into the ground during Standard Penetration Tests in general accordance with American Society of Testing and Materials (ASTM) D-1586, “Standard Method of Penetration Test and Split-Barrel Sampling of Soils”. Additional explanations of typical AECOM drilling and sampling procedures are presented in Standard Field and Laboratory Procedures in the Appendix of this report.

Recovered samples were described on field logs, containerized, sealed, labeled and then transported to our laboratory for further examination and testing. The field logs also documented sample intervals, test data and observations of drilling resistance, groundwater occurrence and other pertinent conditions.

2.3 Groundwater Measurements and Borehole Abandonment

The drill crew checked for the presence of obvious groundwater inflows or standing water in the boreholes while drilling and sampling, and immediately after boring completion. These observations and measurements are noted on the lower left-hand corner of the boring logs. The drill crew backfilled and abandoned the boreholes in accordance with WDNR NR812 regulations. Borehole abandonment documentation forms were completed as required and are included in the Appendix.

2.4 Laboratory Testing Procedures

The penetration test split-spoon (SS) samples were visually examined by a AECOM representative to estimate the distribution of grain sizes, plasticity, consistency, moisture condition, color, presence of lenses and seams,

and apparent geologic origin. The soils were classified according to type using the Unified Soil Classification System (USCS). A chart describing this classification system is contained in the Appendix.

The unconfined compressive strengths of relatively undisturbed portions of cohesive soils were estimated using a calibrated penetrometer. In addition, moisture content tests were performed on selected cohesive soils. An explanation of typical laboratory procedures is presented in the Appendix of this report.

2.5 Boring Log Procedures and Qualifications

The results of the field and laboratory observations and tests are printed on the boring logs. Similar soils were grouped into strata which are shown on the logs. The corresponding estimated USCS classification symbols were also added. Note that the stratification lines between soil types were estimated by our geotechnical engineer based on the available data. In-situ, the transition between soil types may be less distinct. Subsurface conditions and water levels at locations between borings may differ from the conditions encountered at the boring locations. Furthermore, the subsurface conditions may change over time. These variables need proper assessment when utilizing the information presented on the boring logs. Additional comments on boring log preparation procedures and qualifications are contained in an Appendix sheet entitled “AECOM Standard Boring Log Procedures.”

3.0 Field Exploration Procedures

3.1 Site Conditions

The site of the proposed force main construction is located along the north side of the East Branch of the Fond du Lac River with the west boundary being approximately 500 feet west of Doty Street and the east boundary at Macy Street. An existing bike path with associated landscaping approximately parallels the river and the proposed route of the force main. An existing building with asphalt pavement and drives is located north of the area of proposed construction located west of Doty Street. The area north of the proposed forced main construction located east of Doty Street is a vacant grass field, planned to be converted into a storm water quality pond.

Based on our site observations and elevations provided, the topography of the site is relatively flat with a slight incline in each direction toward Doty Street. Based on information provided by the City of Fond du Lac, the elevations at our boring locations range from 753.7 feet (SB-1) to 756.1 feet (SB-2).

AECOM Technical Services provided historical information related to the area of the proposed construction that indicates the East Branch of the Fond du Lac River was straightened and the channel relocated further to the south sometime prior to 1918. It is likely that at least portions of the currently proposed construction will extend through or cross the former river channel.

AECOM USA also reviewed the Geotechnical Exploration report prepared by River Valley Testing (RVT #N08-113, dated March 20, 2008) for the proposed detention pond east of Doty Street and north of the Fond du Lac River. The borings performed by RVT did not fall within the alignment of the proposed force main and the closest borings (3-08 and 4-08) were terminated within material described as fill or possible fill.

3.2 Soil Conditions

Based on the soil borings completed by AECOM as a part of this exploration, the soil profile generally consisted of heterogeneous fill deposits overlying natural silty clay soils. With the exception of borings SB-1 and SB-2B, clayey topsoil fill was encountered at the surface of the borings and was about 0.2 to 1 foot thick. Below the topsoil or at the surface of the remainder of the borings, existing fill/possible fill material was encountered. The fill/possible fill material consisted of varying soil types ranging in texture from gravel, sand, silty sand, clayey sand, and silty clay. The consistency of the cohesive soil fill material encountered ranged from very soft to very stiff. The relative density of the granular fill material was in the very loose to dense range based on SPT blow counts. A summary of the fill thicknesses encountered are presented below in Table 1. Three attempts were made to advance boring B-2 to the planned termination depth of 20 feet. Borings SB-2 and SB-2A were terminated within the fill material and could not be extended into underlying native soils due to caving of the borehole within a gravel layer encountered below the water table.

Table 1 – Summary of Soil Profile

Boring No.	Ground Surface Elevation (feet)	Fill/Possible Fill Thickness (feet)
SB-1	753.7	17
SB-2	756.1	18.5+*
SB-2A	756.1	15+*
SB-2B	756.1	17
SB-3	755.7	12
SB-4	754.9	7

* - Boring terminated within the existing fill material.

It is important to note that these fill thickness observations were made in small diameter boreholes. Therefore, it should be understood that thicker or thinner deposits are likely to be encountered. Furthermore, the estimation of topsoil or fill thickness at a particular location can differ from person to person due to the indistinct transition between the soil types.

Deposits of natural cohesive soils were encountered below the fill/possible fill in the borings. The natural cohesive soils included silty clay possible former river deposits and silty clay glacial till. The possible former river deposits were encountered from 7.5 to 13 feet in boring SB-4. The consistency of the possible river deposits was typically stiff and moisture contents ranged from 24 to 40 percent. The silty clay glacial till material was encountered below the possible former river deposits in SB-4 and below the fill/possible fill material in borings SB-1, SB-2B, and SB-3. The consistency of the silty clay glacial till ranged from very stiff to hard and moisture content of the sample tested was 22 percent.

The generalized profile summarized above is described in greater detail on the individual boring logs in the Appendix. Variations from the generalized profile may exist and should be assessed from the boring logs and the normal geologic character of the deposits.

3.3 Groundwater Conditions

Groundwater observations were made in the open boreholes while sampling and at the completion of drilling. The following Table 2 is a summary of the water level measurements encountered during and immediately after the completion of drilling.

Table 2 – Summary of Highest Water Level Measurements During Drilling and Sampling

Boring No.	Ground Surface Elevation (feet, site datum)	Water Depth From Ground Surface (feet)	Elevation to Top of Water (feet, site datum)
SB-1	753.7	16.0	737.7
SB-2	756.1	8.2	747.9
SB-2A	756.1	7.5	748.6
SB-2B	756.1	13.0	743.1
SB-3	755.7	10.6	745.1
SB-4	754.9	12.0	742.9

Based on information provided by AECOM Technical Services, the ordinary high water mark for the adjacent Fond du Lac River is 747.85 feet and the 100 year flood elevation is 754 feet. We would expect that the long term position of the water table is at, or slightly above, the level of the adjacent river. Longer term monitoring through installation of a temporary observation well would be needed to establish the ground water elevation in the project area.

Groundwater level fluctuations may occur with time and seasonal change due to variations in precipitation, evaporation, surface water runoff, local dewatering and especially the level of the adjacent River. Perched water pockets and a higher water table level may also be encountered during wet weather periods, particularly in more permeable silt and sand seams or fill material overlying less permeable clays.

4.0 Analysis and Recommendations

4.1 Discussion

The bottom of the base of the slab for the proposed addition to the lift station is planned to match the existing structure at elevation 726.57 feet. The ground surface elevation of boring SB-1, adjacent to the existing lift station, is 753.7 feet. The proposed design elevation information for the lift station structure was not available prior to, or at the time of our geotechnical drilling, and our project scope limited the boring depths to 20 feet below existing grade, or elevation 733.7. Boring SB-1 encountered native soils at a depth of about 17 feet, but we are uncertain as to the strength and composition of the native soils below the drilled depth of 20 feet, or roughly 7 feet above the base of the existing lift station. With the understanding that the base of the lift station expansion will be constructed at the same elevation as the existing structure, we believe it to be prudent to obtain additional deeper geotechnical information to design the addition, to anticipate the extent of construction dewatering, and design the type(s) of earth retention needed for the lift station addition. If needed, we also install a temporary observation well at the same time to establish the ground water elevation in the area of the lift station addition.

4.2 Site Preparation – Force Main Construction

Based on the project information currently available, we understand the force main will be constructed approximately 6 feet below the existing grades. The soils encountered at this depth consisted of sandy and clayey fill material and groundwater encountered while on site was at depths greater than 7 feet. Based on the information provided, the existing grades at the boring locations are approximately 6 to 8 feet above the high water level for the adjacent river. Assuming construction is performed during a time of low to normal water levels, the general subsurface conditions should allow for excavation and construction of the force main at the proposed 6 foot depth with possible localized groundwater pumping required to control perched water.

Various soil types are expected to be encountered during excavation, including differing types of fill material or very soft to soft silty clay. Some additional excavation and replacement at the base of the force main trench may be required in areas to provide a suitable base for placement of the bedding material.

We are also assuming the force main construction will utilize trench box shoring. Sloughing of the soils into the excavation from the sidewalls will likely occur and it may be difficult in areas to maintain the stability long enough to set the trench box shoring. To help provide safe construction of the force main, the overall excavation and installation and use of trench box shoring should be performed under the direction of a competent person designated by the project contractor. Additionally, although the buried wet gravel layer in borings SB-2 and SB-2A was encountered deeper than the proposed construction depth, the force main contractor should be prepared to excavate in this material because conditions may vary between the boring locations.

The force main should be installed as per the recommendations provided in the Standard Specifications for Sewer and Water Construction in Wisconsin, 6th Edition (2003). If soft or wet soils are encountered at the base, the excavation should be extended an additional 3 inches (minimum) and backfilled with a crushed stone material meeting the gradation requirements of section 8.43.6. The additional excavation and crushed stone placement should be performed under the observation of a member of the project design team. Bedding material placed below and adjacent to the force main pipe should conform to the requirements of section 8.43.2 of the above specification. Cover material (fill placed over the sewer pipe and above the bedding material) should conform to section 8.43.3. Excavated material could be used to backfill the remainder of the trench above the cover material, provided all deleterious materials are removed prior to placement and the fill is placed as per the requirements of section 8.43.5. It should be noted that there can be an increased risk of consolidation of cohesive backfill when compared to granular material, post placement, if proper compaction methods are not used. We recommend that the backfill be consolidated in accordance with section 2.6.14(b) (Mechanical compaction) rather than by flooding (section 2.6.14(a)).

Existing fill was encountered in all of the borings performed. No information related to the placement methods of the existing fill was available at the time of this report. Constructing utilities or other structures over undocumented fill may result in consolidation of the fill material as a result of any new loading and an increased risk of excessive total or differential settlement. Additionally, excessive consolidation of the fill material and related settlement is more likely in areas where new loading is imposed on the existing material. If it is determined that new loading is anticipated, additional evaluation of potential settlement of the force main or relevant structure should be performed.

We recommend that the fills be placed within -2 to +4 percent of the optimum moisture content as determined by the modified Proctor test. Compaction of cohesive soils should be performed using a sufficiently large vibratory sheepsfoot roller to confirm that the soils are adequately mixed and compacted. Compaction of granular soils should be performed using a sufficiently large vibratory roller or plate compactor.

We recommend that a geotechnical engineer or a qualified representative of the engineer be present during the filling operations. This is to confirm that only approved fill materials are used, as well as to confirm that the soils have been placed in accordance with the project specifications. This would allow confirmation that the existing subgrade is undisturbed and that the site is prepared according to the intent of this report. AECOM would be pleased to perform these services for an additional fee at your request. Refer to the “AECOM Earthwork Guideline” below for additional information regarding site preparation.

4.3 Foundation Recommendations

As stated previously, information related to the design of the proposed lift station addition was not available at the time of our exploration. As a result, our boring SB-1 was terminated above the base of the proposed lift station.

Additional deeper geotechnical information is recommended to provide more specific foundation recommendations.

Assuming the native soils at and below the base of the proposed lift station addition are consistent with the native, inorganic very stiff to hard silty clay encountered at the termination of our boring SB-1, the proposed structure can be supported on conventional spread foundations. Recommendations for a design net allowable soil bearing pressure require additional geotechnical information at and below the proposed bearing elevation; however, assuming the strength and consistency of the native soils is similar to that encountered above, a minimum net allowable soil bearing pressure of 3,000 psf could be used for design of structure foundations. The net allowable soil bearing pressure refers to the pressure that can be transmitted to the bearing soils in excess of the final minimum adjacent overburden pressure.

The lift station addition will be subject to uplift pressures from hydrostatic forces. Resistance to uplift can be provided by the dead weight of the structure empty, plus the weight of soil above the foundation extending outward on a 30 degree angle from the edge of the footing or mat. Additional information related to uplift pressures is included in the Base Slabs section of this report.

Care should be exercised so that the soils at the base of the foundation excavations are not disturbed. Water should not be allowed to pond on the surface of the bearing soils, as this could cause a softening of the subgrade, particularly when subjected to construction traffic. Field testing should be performed to confirm that the excavations extend through any unsuitable materials to an underlying competent bearing stratum. It is critical that the soils at the base of the foundation excavations be observed and tested by an AECOM geotechnical engineer or a qualified AECOM representative to observe and check that the foundation subgrade soils are similar in type and consistency to those encountered in the borings and are suitable for support of the foundations. This observation program is also an important check that the subgrade soils have not been unduly disturbed as a result of construction activities. Field checks should be performed just prior to concrete placement to confirm that the bearing soils are of adequate strength to support footings proportioned using the design bearing pressure. If the excavation will be left open for significant periods, consideration should be made to pouring a lean concrete mud mat on the exposed bearing soils as soon as they have been tested to further protect them from disturbance or degradation from the elements.

If unsuitable or disturbed soils are encountered at the footing subgrade, the material should be excavated and replaced with suitable fill. The overexcavations can be backfilled over an acceptable subgrade using either compacted structural soil fill or flowable cementious fill. If the overexcavations are backfilled using structural soil fill, the fill should consist of a reasonably well-graded select granular material containing less than 5 percent by weight passing the No. 200 sieve. The overexcavations should extend a minimum of 1-foot horizontally from each edge of the footing for each foot of fill required below the footing base. The structural soil fill should be

placed in 9- to 12-inch loose lifts and compacted to a minimum of 95 percent of the maximum dry density as determined by the modified Proctor test (ASTM D-1557). Horizontal overexcavation is unnecessary if a lean concrete is used to backfill the overexcavated area. The lean concrete should have a minimum 7 day unconfined compressive strength of 500 pounds per square inch (psi).

Exterior footings in heated buildings should be supported at a minimum depth of 4 feet below final grade to provide adequate protection against frost heave. Similarly, exterior footings in unheated areas should be supported at a minimum depth of 5 feet below final grade. Interior column footings that are within heated portions of buildings can be supported at shallower elevations provided they are founded on competent native inorganic soils or compacted structural soil fill as described above. We also recommend that the minimum width of continuous footings be 18 inches, and that the minimum dimension of individual spread footings be no less than 30 inches. These minimum recommended widths are given to prevent disproportionately small footing sizes.

4.4 Base Slabs

As stated previously, information related to the design of the proposed lift station addition was not available at the time of our field exploration. As a result, our boring SB-1 was terminated at a depth above the base of the proposed lift station. Additional deeper geotechnical information is recommended to provide more specific base slab recommendations.

Assuming the native soils at and below the base of the proposed lift station addition are consistent with the native very stiff to hard silty clay encountered at the termination of our boring SB-1, the proposed structure can be supported on this material. The area should be adequately dewatered to at least 2 feet below the maximum depth of excavation so as to minimize the potential for basal heave.

Given the water levels encountered in the exploration and based on the proposed bottom of lift station slab elevations, it will be necessary to design the base slabs to resist hydrostatic and uplift forces. Resistance to uplift pressures will be provided by the weight of the slab or mat, and the soil above the base slab/mat foundation if it extends beyond the footprint of the structure. Tie down anchors could also be incorporated to resist the uplift loads, if desired. Uplift resistance should be calculated assuming the lift station is empty, if it will be necessary to dewater it at some time for maintenance or other purposes. The joints between the base slab and the walls should be supplied with waterstops.

If the base slabs are to be pressure relieved, then we recommend that they be underlain by a drainage blanket consisting of at least 12-inches of clean sand containing less than 5 percent by weight of material passing the No. 200 sieve that acts as a filter to prevent upward migration of fines from the natural subgrade soils. A material such as ASTM Specification C33 Size 67 washed concrete aggregate would prove satisfactory in this regard. Alternatively, a geotextile separator fabric could be used between the drainage fill material below the base slab

and underlying native soils. The recommendations for the drainage blanket or geotextile fabric should be confirmed if an additional deeper boring is performed. The exterior walls and base slab should be waterproofed, and waterstops provided at all joints.

A more thorough evaluation of the impact of the water levels should be performed when final design elevations are determined. The evaluation of the water table may require temporary groundwater observation wells or piezometers to determine the water levels within the existing fill and within the native silty clay. Depending on the final design, cutoff walls or other measures may be required to reduce the effective hydrostatic head if a pressure relief system is used or tie down anchors could be used if a pressure relief system is not practical. Additionally, we recommend that the existing structure should be evaluated to determine if it is designed with a pressure relief system or tie down anchors.

The base slabs should be at least nominally reinforced with steel wire mesh to help reduce cracking and maintain the structural integrity of the slab. Slab reinforcement and concrete design should be performed by a qualified professional with consideration of expected loading and environment, drainage, and subgrade conditions.

4.5 Below Grade Walls

The below-grade walls of the lift station structure should be designed to resist both lateral earth pressures and hydrostatic pressures assuming the level of the static water table could rise to the 100 year flood elevation. A unit weight of 62.4 pounds per cubic foot and a lateral coefficient equal to 1.0 should be used to compute the hydrostatic pressure. Lateral earth pressures should be estimated using the values provided in Table 3 below assuming the structure will be backfilled with a granular material such as sand or sand with gravel. The recommended parameters should be considered preliminary and should be confirmed for the final design.

Table 3 – Recommended Below Grade Wall Design Parameters

Total Unit Weight of Backfill (γ)	140 pcf
Angle of Internal Friction (Φ)	32º
At-Rest Pressure Coefficient, (K_o)	0.47
Active Earth Pressure Coefficient, (K_a)	0.31
Mobilized Passive Earth Pressure Coefficient, (K_p)*	1.63
Coefficient of friction between concrete and soil**	0.35

*Reduced by a factor of 2.0 to correspond to normal small movements
**Corresponds to mass concrete on native silty clay

Surcharge loads extending from a zone of 1 horizontal to 1 vertical from the base of the wall should also be included in the design. Typical temporary surcharge loads would include construction equipment and vehicular traffic along the adjacent roads. Permanent loads would include those induced by adjacent buildings or

structures. The magnitude of the surcharge load should be multiplied by the appropriate lateral earth pressure coefficient to determine the equivalent lateral load on the wall. The top of the wall should be braced prior to placement of backfill material, and the size of compactor limited to that of less than 500 pounds total weight to minimize stresses on the wall.

We recommend that the walls of the below-grade structures be waterproofed to reduce the migration of water through the walls due to an unbalanced hydrostatic head. Waterstops should be installed in all construction and expansion joints. Sufficient measures should be undertaken to ensure that the walls remain water tight. The outside face of the walls in the upper 5 feet should be backfilled with free draining material as described above to minimize the potential for frost pressures acting on the wall. This material should be placed behind the wall and extend at least 2 feet from the face.

A minimum 2 foot thick clay cap or other relatively impermeable barrier should be placed above the granular backfill around each of the below-grade structures to minimize surface water infiltration into the free-draining backfill. The clay material should be placed and compacted as recommended in the site preparation section and in the Earthwork Guideline specifications in the Appendix. The cap should extend from final grade to a depth of at least 2 feet. The clay cap should slope away from the structure at a minimum 2 percent grade. Bituminous or Portland cement concrete (i.e. walkways and drives) could also serve to reduce surface water infiltration.

4.6 Site Seismic Classification

For seismic design purposes, we have classified the site in general accordance with Section 1615.1.5.1, of the 2002 Wisconsin Enrolled Commercial Building Code. We have assumed that, for purposes of seismic design, the soil strength characteristics beyond the maximum depths explored are similar to, or better than, the average of those native soils encountered in the borings. Given the native soils encountered in this exploration and based on this assumption, the project site should be classified as Site Classification D.

4.7 Conceptual Excavation Retention

We understand that the proposed lift station addition will likely be 25 feet below grade. We assume it is not possible to construct an adequately sloped excavation because of the proximity to adjacent structures and that an earth retention will be required to facilitate construction. Additional deeper geotechnical information is necessary to provide a more detailed evaluation of the type of earth retention system required.

Assuming the native soils at and below the proposed lift station addition consist of native very stiff to hard silty clay encountered at the termination of our borings, driven sheeting would be technically feasible for temporary excavation support. Because of the depth of excavation, the sheeting will likely need a single or multiple rows of anchors, or be internally braced. Some difficulty may be encountered during installation if potential obstructions are encountered within the existing fill or if cobbles and boulders are present in the native soils. We recommend

that a contingency be set up to account for the additional costs and delays associated with obstructions or difficult conditions encountered during installation.

We recommend that an excavation retention method be capable of resisting a combination of earth and hydrostatic pressures. It may be prudent to extend the sheeting a sufficient depth so as to increase the gradient and reduce the potential for basal heave. The sheeting could be left in place permanently to form a cut off wall and reduce the temporary and permanent dewatering requirements. It is traditional for the engineer designing the earth retention system to select appropriate lateral earth pressures and other parameters necessary with which to base the design. Temporary and permanent surcharge loads, such as concrete trucks or other construction equipment, as well as the existing lift station, located between the outside face (retained-soil side) of the wall and a plane extending upward at a 45-degree angle from the bottom of the wall should also be included in the design.

It should be recognized that, while providing a safe working environment for workmen, the installation of a properly designed and installed temporary excavation retention system will not prevent lateral movements from occurring behind the system. The amount of tolerable lateral and vertical movement behind the system should be considered in the design. Lateral movements can occur to a distance of as much as 1 to 2 times the height of the temporary excavation system. The magnitude of movement will be a function of the stiffness of the wall and the construction methods utilized. If there are critical structures located within the zone of influence of the excavation retention system that cannot tolerate the estimated lateral or vertical movements, consideration should be given to adding more rigid bracing to the temporary excavation system, using a more rigid wall system, or underpinning these structures. The selection of lateral earth design pressures for design of temporary retention systems is a function of the desired wall stiffness and therefore should be completed in conjunction with the retention system designer.

The final design of the earth retention system may need to account for temporary dewatering requirements. If the earth retention system is made the responsibility of a design build contractor, we recommend the contractor have demonstrated experience with the type of earth retention system proposed.

Another issue related to the selection of a ground-support system may be magnitude of vibrations associated with the installation of the system. This issue should be examined prior to selection of an appropriate ground support system. Particular care should be taken so as to not adversely impact the existing lift station. Prior to any deep excavation and installation of earth retention, we recommend that a pre- and post-construction survey should be performed of all structures, including roadways and utilities, located within the zone of influence of the temporary excavation support system. The purpose of this survey is to protect both the Owner and the Contractor from unwarranted claims of damage to facilities due to construction. The survey should be performed by a qualified civil or structural engineer. The survey should document any existing cracks or other defects which may be present prior to construction and the formation of any new cracks or other signs of distress after construction.

4.8 Dewatering Considerations

Prior to excavation of the lift station addition, we recommend that the area of proposed expansion be temporarily dewatered to facilitate construction. Excavations should not proceed until the groundwater table has been lowered a minimum of 2 to 3 feet below the maximum depth of excavation, particularly if there is a water bearing granular layer at or slightly below the level of the base slab. If these areas are not adequately dewatered, upward hydraulic gradients will be encountered at the base of excavations which could cause a temporary loss of support from the base soils. If steel sheeting is used as excavation retention, it may be possible to reduce the dewatering requirements by pumping from within the confines of the sheeting. The effects of dewatering on adjacent structures should also be thoroughly analyzed.

The dewatering system should be determined by the grain size and the hydraulic conductivity of the soils to be dewatered and should incorporate, or be designed in conjunction with, the temporary earth retention system.

4.9 Construction Considerations

We recommend that earthwork and foundation work for this project be observed and tested by AECOM to determine if the soil and groundwater conditions encountered are consistent with those anticipated in this report. Foundation subgrade should be tested to check for adequate bearing conditions. Subgrade for slabs and new structural fill should be proofrolled and unsuitable areas improved. New fill and backfill material should be tested for conformance to specified requirements. Fill placement should be monitored and tested to ensure that the resulting material conforms to specified density, strength or compressibility requirements. Structural materials should also be tested for conformance to specifications. AECOM USA, Inc. can provide the monitoring and testing services that are recommended.

Occupational Safety and Health Act (OSHA) has instituted strict standards for temporary construction excavations. These standards are outlined in 29 CFR Part 1926 Subpart P. Excavations within unstable soil conditions or extending five feet or more in depth should be adequately sloped or braced according to these standards. Excavation safety is the responsibility of the contractor. Based on the soil boring data, we expect that the majority of excavations will be completed within fill soils. Material stockpiles or heavy equipment should not be placed near the edge of the excavation slopes. The actual stable slope angle should be determined during construction and will depend upon the loading, soil, and groundwater conditions encountered.

Drawings

Drawing D.1Depiction of Former River Channel

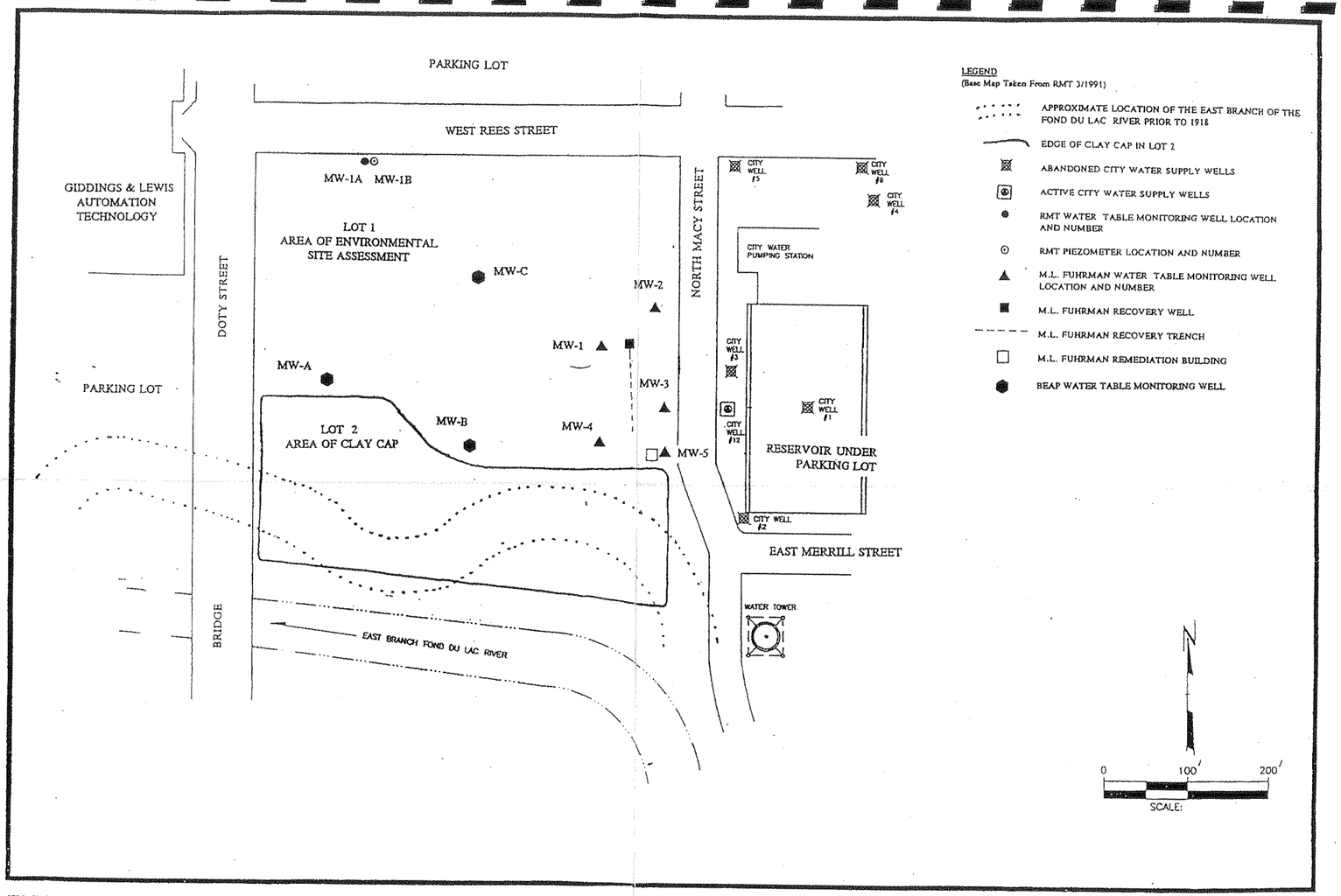
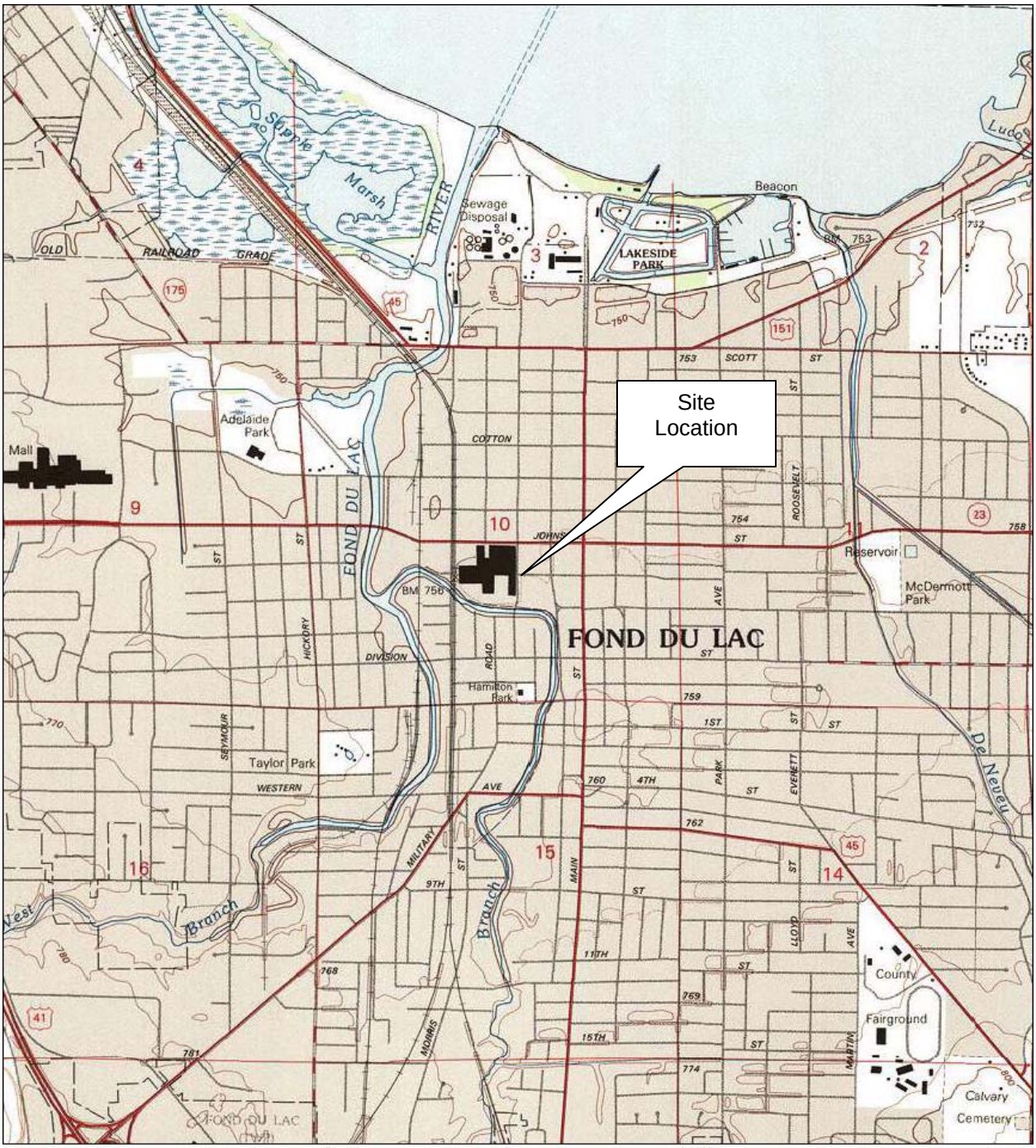


FIGURE 2 GENERAL SITE FEATURES

Figures

Figure 1 – Site Location Diagram

Figure 2 – Soil Boring Location Diagram



AECOM

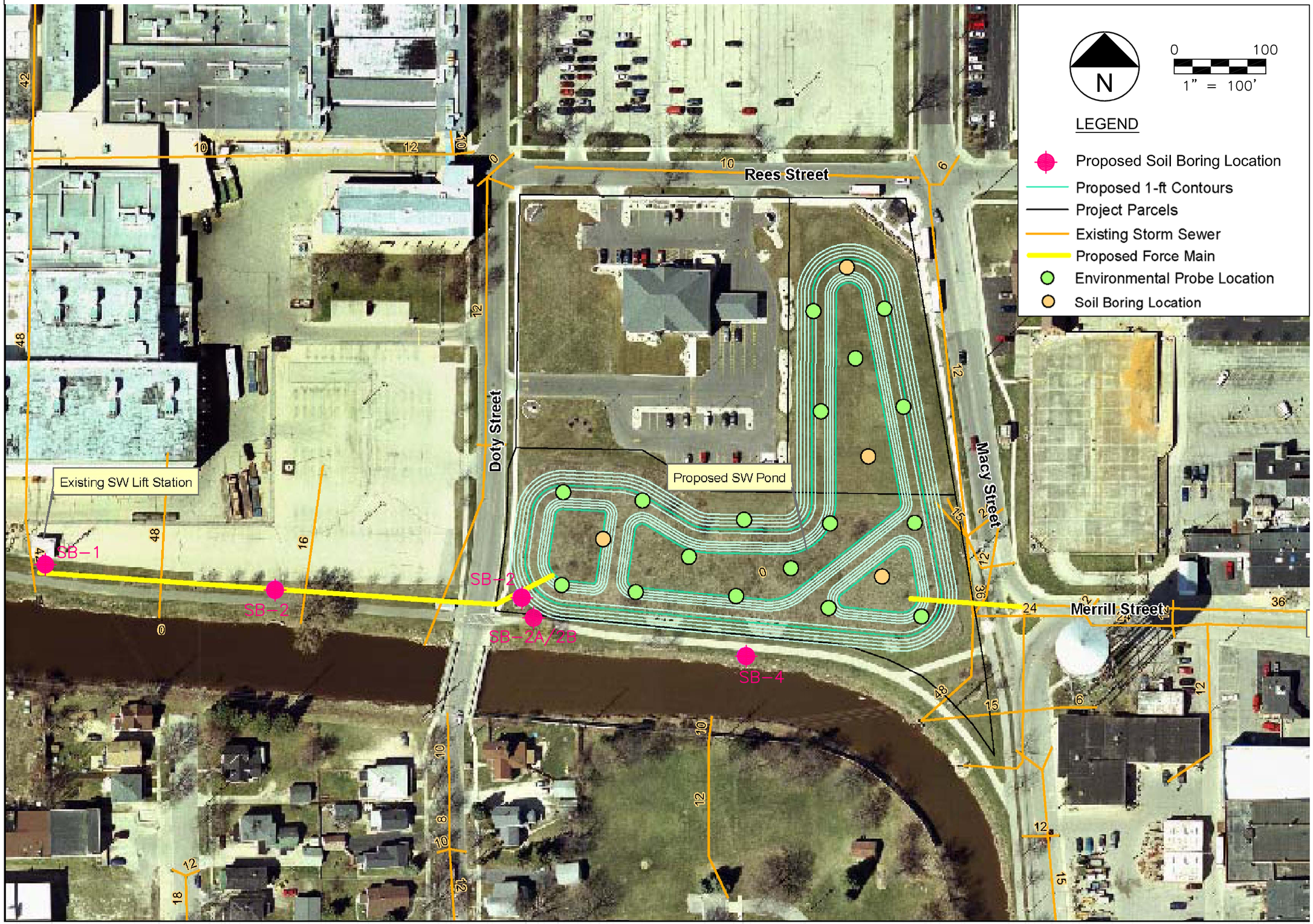
11425 W. Lake Park Drive
Suite 100, Milwaukee, WI 53224
T 414.359.3030
www.aecom.com

Copyright©2009, By: AECOM

Site Location Diagram

Rueping – Macy Force Main
Fond du Lac, Wisconsin

Drawn:	CAS	5/21/2009
Checked:	DSD	5/21/2009
Approved:	PAT	5/21/2009
PROJECT NUMBER	60098468	
FIGURE NUMBER	1	



AECOM

11425 West Lake Park Drive
Milwaukee, WI 53224
414.359.3030
www.aecom.com
Copyright © 2009, By: AECOM USA, Inc.

SOIL BORING LOCATION DIAGRAM
REUPING-MACY FORCE MAIN
FON DU LAC, WISCONSIN

Drawn :	CJH	5/20/2009
Checked:	D1D	5/20/2009
Approved:	D1D	5/20/2009
PROJECT NUMBER	60098468	
FIGURE NUMBER	2	

X:\Projects\60098468\dwg\G60098468-BORE.dwg; 5/20/2009 3:45:20 PM; HEINTZ, CHARLES; STS.stb

Appendices

Appendix A – AECOM Standard Boring Log Procedures

Appendix B – AECOM General Boring Log Notes

Appendix C – Soil Boring Logs (6),

Appendix D – WDNR Borehole Abandonment Forms (6)

Appendix E – AECOM Field and Laboratory Procedures

- Subsurface Exploration Procedures
- Sampling Procedures
- Laboratory Procedures

Appendix F – AECOM Soil Classification System

Appendix G – AECOM Earthwork Guideline

Appendix H – AECOM General Qualifications

Appendix I – AECOM Changed Conditions Clause

Appendix A

AECOM Standard Boring Log Procedures

AECOM Standard Boring Log Procedures

In the process of obtaining and testing samples and preparing this report, standard procedures are followed regarding field logs, laboratory data sheets and samples.

Field logs are prepared during performance of the drilling and sampling operations and are intended to essentially portray field occurrences, sampling locations and procedures.

Samples obtained in the field are frequently subjected to additional testing and reclassification in the laboratory by experienced geotechnical engineers, and as such, differences between the field logs and the final logs may exist. The engineer preparing the report reviews the field logs, laboratory test data and classifications, and using judgment and experience in interpreting this data, may make further changes. It is common practice in the geotechnical engineering profession not to include field logs and laboratory data sheets in engineering reports, because they do not represent the engineer's final opinions as to appropriate descriptions for conditions encountered in the exploration and testing work. Results of laboratory tests are generally shown on the boring logs or are described in the text of the report, as appropriate.

Samples taken in the field, some of which are later subjected to laboratory tests, are retained in our laboratory for sixty days and are then discarded unless special disposition is requested by our client. Samples retained over a long period of time, even in sealed jars, are subject to moisture loss which changes the apparent strength of cohesive soil, generally increasing the strength from what was originally encountered in the field. Since they are then no longer representative of the moisture conditions initially encountered, observers of these samples should recognize this factor.

Appendix B

AECOM General Boring Log Notes

AECOM General Notes

Drilling and Sampling Symbols:

SS : Split Spoon - 1-3/8" I.D. 2" O.D. (Unless otherwise noted)	HS : Hollow Stem Auger
ST : Shelby Tube-2" O.D. (Unless otherwise noted)	WS : Wash Sample
PA : Power Auger	FT : Fish Tail
DB : Diamond Bit-NX, BX, AX	RB : Rock Bit
AS : Auger Sample	BS : Bulk Sample
JS : Jar Sample	PM : Pressuremeter Test
VS : Vane Shear	GS : Giddings Sampler
OS : Osterberg Sampler	

Standard "N" Penetration: Blows per foot of a 140 pound hammer falling 30 inches on a 2 inch O.D. split spoon sampler, except where otherwise noted.

Water Level Measurement Symbols:

WL : Water Level	WCI : Wet Cave In
WS : While Sampling	DCI : Dry Cave In
WD : While Drilling	BCR : Before Casing Removal
AB : After Boring	ACR : After Casing Removal

Water levels indicated on the boring logs are the levels measured in the boring at the time indicated. In pervious soils, the indicated elevations are considered reliable groundwater levels. In impervious soils, the accurate determination of groundwater elevations may not be possible, even after several days of observations; additional evidence of groundwater elevations must be sought.

Gradation Description and Terminology:

Coarse grained or granular soils have more than 50% of their dry weight retained on a #200 sieve; they are described as boulders, cobbles, gravel or sand. Fine grained soils have less than 50% of their dry weight retained on a #200 sieve; they are described as clay or clayey silt if they are cohesive and silt if they are non-cohesive. In addition to gradation, granular soils are defined on the basis of their relative in-place density and fine grained soils on the basis of their strength or consistency and their plasticity.

Major Component of Sample	Size Range	Description of Other Components Present in Sample	Percent Dry Weight
Boulders	Over 8 in. (200 mm)	Trace	1-9
Cobbles	8 inches to 3 inches (200 mm to 75 mm)	Little	10-19
Gravel	3 inches to #4 sieve (75 mm to 4.76 mm)	Some	20-34
Sand	#4 to #200 sieve (4.76 mm to 0.074 mm)	And	35-50
Silt	Passing #200 sieve (0.074 mm to 0.005 mm)		
Clay	Smaller than 0.005 mm		

Consistency of Cohesive Soils:

Unconfined Compressive Strength, Qu, tsf	Consistency
<0.25	Very Soft
0.25 - 0.49	Soft
0.50 - 0.99	Medium (firm)
1.00 - 1.99	Stiff
2.00 - 3.99	Very Stiff
4.00 - 8.00	Hard
>8.00	Very Hard

Relative Density of Granular Soils:

N-Blows per foot	Relative Density
0 - 3	Very Loose
4 - 9	Loose
10 - 29	Medium Dense
30 - 49	Dense
50 - 80	Very Dense
>80	Extremely Dense

Appendix C

Soil Boring Logs (6),

AECOM	OWNER: City of Fond du Lac	LOG OF BORING NUMBER: SB-1
	PROJECT NAME: Rueping-Macy Force Main	ARCHITECT-ENGINEER: AECOM Technical Services, Inc.

SITE LOCATION: Doty Street, Fond du Lac, WI

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2} (1, 2, 3, 4, 5)

PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT % (10, 20, 30, 40, 50)

STANDARD PENETRATION BLOWS/FT. (10, 20, 30, 40, 50)

DEPTH(FT)	ELEVATION(FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL	Unit Dry Wt. LBS./FT.^{3}	STANDARD PENETRATION BLOWS/FT.
						SURFACE ELEVATION 753.7'		
		1	SS			Fill: Fine to Coarse Sand, little to some silt, mixed brown and dark brown silty clay, trace gravel - loose to medium dense (Fill: SM)		11
2.5		2	SS					14
5.0		3	SS					6
7.5		4	SS					7
10.0		5	SS					6
12.5		6	SS					8
15.0		7	SS					6
					17.0			
17.5		8	SS			Silty Clay, trace sand and gravel - reddish brown - moist - very stiff (CL)		17 *
20.0					20.0			
						End of Boring. Boring advanced to 20.0 ft. by solid stem auger. Standard Penetration Tests performed with automatic hammer. Boring backfilled with 3/8" holeplug.	* Calibrated Penetrometer	

The stratification lines represent the approximate boundary lines between soil types: in situ, the transition may be gradual.

WL 16' WS	BORING STARTED 4/16/09	AECOM OFFICE	11425 West Lake Park Drive Milwaukee, WI 53224
WL	BORING COMPLETED 4/16/09	ENTERED BY CAS	SHEET NO. 1 OF 1
WL	RIG/FOREMAN CME-55/JD	APP'D BY DSD	AECOM JOB NO. 60098468

AECOM	OWNER: City of Fond du Lac	LOG OF BORING NUMBER: SB-2
	PROJECT NAME: Rueping-Macy Force Main	ARCHITECT-ENGINEER: AECOM Technical Services, Inc.

SITE LOCATION: Doty Street, Fond du Lac, WI

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2} (1, 2, 3, 4, 5)

PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT % (10, 20, 30, 40, 50)

STANDARD PENETRATION BLOWS/FT. (10, 20, 30, 40, 50)

DEPTH(FT)	ELEVATION(FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL	Unit Dry Wt. LBS./FT.^{3}	Standard Penetration Blows/Ft.
						SURFACE ELEVATION 756.1'		
		1	SS			0.2 Topsoil Fill: Silty Clay - dark brown - moist (Topsoil Fill: CL) Fill: Silty Fine to Medium Sand - light brown - moist - medium dense (Fill: SM) 2.0		17
2.5		2	SS			Fill: Silty Fine to Coarse Sand, little to some gravel - light brown - moist - loose to medium dense (Fill: SM)		10
5.0		3	SS					9
7.5		4	SS					6
10.0						10.0		
		5	SS			Fill: Fine Gravel - brown - wet - loose (Fill: GP) 11.5		5
12.5 15.0 17.5						Could not sample below 11.5 ft. because of wet gravel encountered. Extended auger to 18.5 ft. to attempt to determine bottom of gravel. Bottom of gravel could not be confirmed, abandoned borehole, offset and redrilled. 18.5		
						End of Boring. Boring advanced to 18.5 ft. by solid stem auger. Standard Penetration Tests performed with automatic hammer. Boring backfilled with 3/8" holeplug.	* Calibrated Penetrometer	

The stratification lines represent the approximate boundary lines between soil types: in situ, the transition may be gradual.

WL 10' WS	BORING STARTED 4/15/09	AECOM OFFICE	11425 West Lake Park Drive Milwaukee, WI 53224
WL 8.2' (cave in) AB	BORING COMPLETED 4/15/09	ENTERED BY CAS	SHEET NO. 1 OF 1
WL	RIG/FOREMAN CME-55/JD	APP'D BY DSD	AECOM JOB NO. 60098468

AECOM	OWNER: City of Fond du Lac	LOG OF BORING NUMBER: SB-2A
	PROJECT NAME: Rueping-Macy Force Main	ARCHITECT-ENGINEER: AECOM Technical Services, Inc.

SITE LOCATION: Doty Street, Fond du Lac, WI

DEPTH(FT)	ELEVATION(FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL	Unit Dry Wt. LBS./FT.³	UNCONFINED COMPRESSIVE STRENGTH TONS/FT.² (1 2 3 4 5) / PLASTIC LIMIT % / WATER CONTENT % / LIQUID LIMIT % (10 20 30 40 50) / STANDARD PENETRATION BLOWS/FT. (10 20 30 40 50)
						SURFACE ELEVATION 756.1' (assumed)		
		1	SS			0.2 Topsoil Fill: Silty Clay - dark brown (Topsoil Fill: CL) Fill: Silty Clay - reddish brown - moist - very stiff (Fill: CL)		14 *
						2.0		
2.5		2	SS			Fill: Silty Fine to Medium Sand, trace gravel, trace cobbles, possible brick pieces - moist - very loose to medium dense (Fill: SM)		18
5.0		3	SS			6.0		2
		3A	SS			Fill: Silty Clay, little sand - reddish brown - moist - very soft to soft (Fill: CL)		
						7.0		
7.5		4	SS			Fill: Clayey Fine to Medium Sand - dark brown - wet - dense (Fill: SC)		33
						9.0		
10.0		5	SS			Fill: Fine Gravel with Sand and Cobbles - brown - wet - medium dense (Fill: GP)		16
12.5								
15.0						15.0		

End of Boring.
Boring advanced to 15.0 ft. by solid stem auger.
Standard Penetration Tests performed with automatic hammer.
Boring backfilled with 3/8" holeplug.

Boring could not be extended beyond 15.0 ft. due to wet gravel.
Driller's elected to abandon borehole, offset and redrill with hollow stem augers.

SB-2A is offset ~25' southeast of SB-2

* Calibrated Penetrometer

The stratification lines represent the approximate boundary lines between soil types: in situ, the transition may be gradual.

WL 7.5' WS	BORING STARTED 4/15/09	AECOM OFFICE 11425 West Lake Park Drive Milwaukee, WI 53224	
WL	BORING COMPLETED 4/15/09	ENTERED BY CAS	SHEET NO. 1 OF 1
WL	RIG/FOREMAN CME-55/JD	APP'D BY DSD	AECOM JOB NO. 60098468

AECOM	OWNER: City of Fond du Lac	LOG OF BORING NUMBER: SB-2B
	PROJECT NAME: Rueping-Macy Force Main	ARCHITECT-ENGINEER: AECOM Technical Services, Inc.

SITE LOCATION: Doty Street, Fond du Lac, WI

DEPTH(FT)	ELEVATION(FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL	Unit Dry Wt. LBS./FT.³	UNCONFINED COMPRESSIVE STRENGTH TONS/FT.² (1 2 3 4 5)	PLASTIC LIMIT % / WATER CONTENT % / LIQUID LIMIT % (10 20 30 40 50)	STANDARD PENETRATION BLOWS/FT. (10 20 30 40 50)
						SURFACE ELEVATION 756.1' (assumed)				
						Fill: Silty Fine to Medium Sand, trace clay, trace wood and brick pieces - very loose (Fill: SM)				
2.5										
5.0						See log SB-2 and SB-2A for additional soil classification				
		1	SS					2		
7.5										
10.0										
12.5										
15.0						15.0				
		2	SS			Fill: Clayey Fine to Coarse Sand, little gravel - brown - wet - loose (Fill: SC)		6		
						17.0				
17.5						Silty Clay, trace sand and gravel - reddish brown - moist - very stiff (CL)				
		3	SS						25 *	
20.0						20.0				
						End of Boring. Boring advanced to 20.0 ft. by 3-1/4" hollow stem auger. Standard Penetration Tests performed with automatic hammer. Boring backfilled with 3/8" holeplug. SB-2B is offset 3' east of SB-2A	* Calibrated Penetrometer			

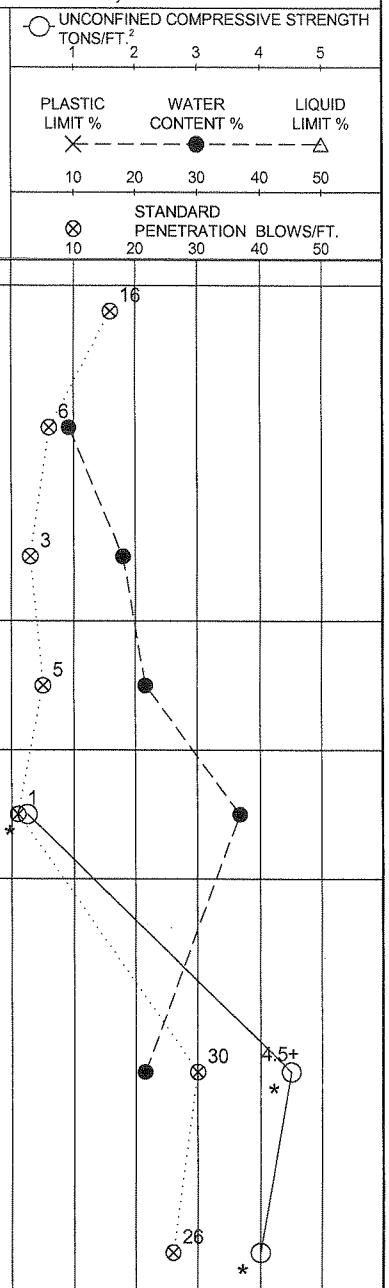
The stratification lines represent the approximate boundary lines between soil types: in situ, the transition may be gradual.

WL 13' AB	BORING STARTED 4/16/09	AECOM OFFICE	11425 West Lake Park Drive Milwaukee, WI 53224
WL	BORING COMPLETED 4/16/09	ENTERED BY CAS	SHEET NO. 1 OF 1
WL	RIG/FOREMAN CME-55/JD	APP'D BY DSD	AECOM JOB NO. 60098468

AECOM	OWNER: City of Fond du Lac	LOG OF BORING NUMBER: SB-3
	PROJECT NAME: Rueping-Macy Force Main	ARCHITECT-ENGINEER: AECOM Technical Services, Inc.

SITE LOCATION: Doty Street, Fond du Lac, WI

DEPTH(FT)	ELEVATION(FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL	Unit Dry Wt. LBS./FT.³
						SURFACE ELEVATION 755.7'	
		1	SS			0.5 Topsoil Fill: Silty Clay - dark brown to black - moist (Topsoil Fill: CL)	
		1A	SS			Fill: Clayey Fine to Coarse Sand, trace gravel, possible slag in Samples 1A & 2 - dark brown to black - moist - very loose to medium dense (Fill: SC)	
2.5		2	SS				
5.0		3	SS			7.0	
7.5		4	SS			Possible Fill: Silty Clay, trace gravel, roots present, possible shells - brown to dark brown - moist - soft to medium (Possible Fill: CL) 9.5	
10.0		5	SS			Possible Fill: Silty Clay, roots present, possible shells - brown to dark brown - moist - very soft to soft (Possible Fill: CL) 12.0	
12.5						Silty Clay, trace sand and gravel - reddish brown - moist - hard (CL)	
15.0		6	SS				
17.5		7	SS				
20.0						20.0	
						End of Boring. Boring advanced to 20.0 ft. by solid stem auger. Standard Penetration Tests performed with automatic hammer. Boring backfilled with 3/8" holeplug.	



* Calibrated Penetrometer

The stratification lines represent the approximate boundary lines between soil types: in situ, the transition may be gradual.

WL	BORING STARTED	AECOM OFFICE	
10.6' AB	4/15/09	11425 West Lake Park Drive Milwaukee, WI 53224	
WL	BORING COMPLETED 4/15/09	ENTERED BY CAS	SHEET NO. 1 OF 1
WL	RIG/FOREMAN CME-55/JD	APP'D BY DSD	AECOM JOB NO. 60098468

AECOM	OWNER: City of Fond du Lac	LOG OF BORING NUMBER: SB-4
	PROJECT NAME: Rueping-Macy Force Main	ARCHITECT-ENGINEER: AECOM Technical Services, Inc.

SITE LOCATION: Doty Street, Fond du Lac, WI

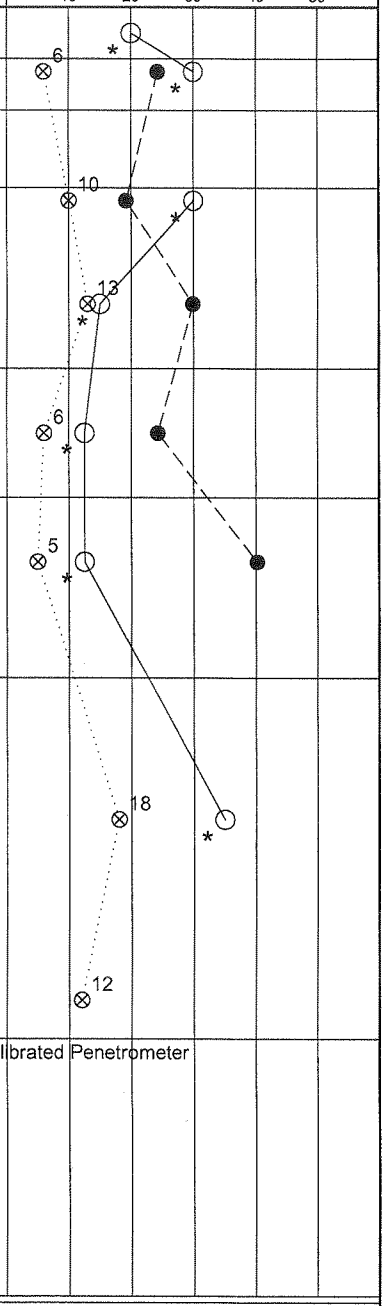
UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2} (1, 2, 3, 4, 5)

PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT % (10, 20, 30, 40, 50)

STANDARD PENETRATION BLOWS/FT. (10, 20, 30, 40, 50)

DEPTH(FT)	ELEVATION(FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL	Unit Dry Wt. LBS./FT.^{3}
						SURFACE ELEVATION 754.9'	
		1	SS			Topsoil Fill: Silty Clay, trace sand - dark brown - moist - very stiff (Topsoil Fill: CL)	
		1A	SS			Fill: Silty Clay - reddish brown - moist - very stiff (Fill: CL)	
2.5		2	SS			Fill: Silty and Clayey Fine to Coarse Sand, trace gravel - brown - moist - medium dense (Fill: SM/SC)	
		2A	SS			Fill: Silty Clay, trace to little sand and gravel - reddish brown to dark brown - moist - stiff to very stiff (Fill: CL)	
5.0		3	SS				
7.5		4	SS			Silty Clay, trace to little sand - reddish brown - moist - stiff (CL)	
10.0		5	SS			Silty Clay, trace wood or roots - dark brown - moist - stiff (CL)	
12.5							
15.0		6	SS			Silty Clay, trace sand and gravel - reddish brown - moist - very stiff (CL)	
17.5							
20.0		7	SS				

1.0 — 2.0 — 3.5 — 7.0 — 9.5 — 13.0 — 20.0



End of Boring.
Boring advanced to 20.0 ft. by solid stem auger.
Standard Penetration Tests performed with automatic hammer.
Boring backfilled with 3/8" holeplug.

* Calibrated Penetrometer

The stratification lines represent the approximate boundary lines between soil types: in situ, the transition may be gradual.

WL	BORING STARTED	AECOM OFFICE	
12' AB	4/15/09	11425 West Lake Park Drive Milwaukee, WI 53224	
WL	BORING COMPLETED 4/15/09	ENTERED BY CAS	SHEET NO. 1 OF 1
WL	RIG/FOREMAN CME-55/JD	APP'D BY DSD	AECOM JOB NO. 60098468

Appendix D

WDNR Borehole Abandonment Forms (6)

State of Wisconsin
Department of Natural Resources

WELL/DRILLHOLE/BOREHOLE ABANDONMENT

Form 3300-5 2/2000

Notice: Please complete Form 3300-5 and return it to the appropriate DNR office and bureau. Completion of this report is required by chs. 160, 281, 283, 289, 291, 292, 293, 295, and 299, Wis. Stats., and ch. NR 141, Wis. Adm. Code. In accordance with chs. 281, 289, 291, 292, 293, 295, and 299, Wis. Stats., failure to file this form may result in a forfeiture of between $10 and $25,000, or imprisonment for up to one year, depending on the program and conduct involved. Personally identifiable information on this form is not intended to be used for any other purpose. NOTE: See the instructions for more information.

Route to: ☐ Drinking Water ☐ Watershed/Wastewater ☐ Waste Management ☐ Remediation/Redevelopment ☐ Other 60098468

(1) GENERAL INFORMATION

WI Unique Well No. | DNR Well ID No. | County

Common Well Name _____ _____ Gov't Lot (if applicable)

Grid Location ____ 1/4 of ____ 1/4 of Sec. ____ ; T. ____ N; R. ____ ☐ E ☐ W

____ ft. ☐ N. ☐ S., ____ ft. ☐ E. ☐ W.

Local Grid Origin ☐ (estimated: ☐) or Well Location ☐

Lat ___ ° ___ ' ___ " Long ___ ° ___ ' ___ " or

State Plane ____ ft. N. ____ ft. E. ☐ S ☐ C ☐ N Zone

Reason For Abandonment: Sample only

WI Unique Well No. of Replacement Well

(2) FACILITY /OWNER INFORMATION

Facility Name: Rueping Mary Force Main

Facility ID: SB-1

License/Permit/Monitoring No.

Street Address of Well

City, Village, or Town

Present Well Owner: Same

Original Owner: Same

Street Address or Route of Owner

City, State, Zip Code

(3) WELL/DRILLHOLE/BOREHOLE INFORMATION

Original Construction Date: 4-16-09

☐ Monitoring Well
☐ Water Well
☒ Drillhole / Borehole

If a Well Construction Report is available, please attach.

Construction Type:
☒ Drilled ☐ Driven (Sandpoint) ☐ Dug
☐ Other (Specify) _____

Formation Type:
☒ Unconsolidated Formation ☐ Bedrock

Total Well Depth (ft) (From ground surface): 20'

Casing Diameter (in.): —

Casing Depth (ft.): —

Lower Drillhole Diameter (in.): 4"

Was Well Annular Space Grouted? ☐ Yes ☒ No ☐ Unknown

If Yes, To What Depth? _____ Feet

Depth to Water (Feet): moist @ 16'

(4) PUMP, LINER, SCREEN, CASING, & SEALING MATERIAL

Pump & Piping Removed?	☐ Yes	☐ No	☒ Not Applicable
Liner(s) Removed?	☐ Yes	☐ No	☒ Not Applicable
Screen Removed?	☐ Yes	☐ No	☒ Not Applicable
Casing Left in Place?	☐ Yes	☒ No	
Was Casing Cut Off Below Surface?	☐ Yes	☒ No	
Did Sealing Material Rise to Surface?	☒ Yes	☐ No	
Did Material Settle After 24 Hours?	☐ Yes	☒ No	
If Yes, Was Hole Retopped?	☐ Yes	☒ No	

Required Method of Placing Sealing Material
☐ Conductor Pipe - Gravity ☐ Conductor Pipe - Pumped
☒ Screened & Poured (Bentonite Chips) ☐ Other (Explain)

Sealing Materials
☐ Neat Cement Grout
☐ Sand-Cement (Concrete) Grout
☐ Concrete
☐ Clay-Sand Slurry
☐ Bentonite-Sand Slurry
☒ Chipped Bentonite

For monitoring wells and monitoring well boreholes only
☐ Bentonite Chips
☐ Granular Bentonite
☐ Bentonite-Cement Grout
☐ Bentonite - Sand Slurry

(5) Sealing Material Used	From (Ft.)	To (Ft.)		Mix Ratio or Mud Weight
Hole plug	Surface	20'	3 Bags	3/8 chip

(6) Comments _____

(7) Name of Person or Firm Doing Sealing Work: AECOM

Date of Abandonment: 4-16-09

Signature of Person Doing Work: [signature]

Date Signed: 4-16-09

Street or Route: 1035 Kepler Drive

Telephone Number: 920-468-1978

City, State, Zip Code: Green Bay, Wisconsin 54311-8320

FOR DNR OR COUNTY USE ONLY

Date Received | Noted By

Comments

BCG 34930

State of Wisconsin
Department of Natural Resources

WELL/DRILLHOLE/BOREHOLE ABANDONMENT

Form 3300-5 2/2000

Notice: Please complete Form 3300-5 and return it to the appropriate DNR office and bureau. Completion of this report is required by chs. 160, 281, 283, 289, 291, 292, 293, 295, and 299, Wis. Stats., and ch. NR 141, Wis. Adm. Code. In accordance with chs. 281, 289, 291, 292, 293, 295, and 299, Wis. Stats., failure to file this form may result in a forfeiture of between $10 and $25,000, or imprisonment for up to one year, depending on the program and conduct involved. Personally identifiable information on this form is not intended to be used for any other purpose. NOTE: See the instructions for more information.

Route to: ☐ Drinking Water ☐ Watershed/Wastewater ☐ Waste Management ☐ Remediation/Redevelopment ☐ Other 60098468

(1) GENERAL INFORMATION

WI Unique Well No. | DNR Well ID No. | County

Common Well Name _____ Gov't Lot (if applicable) _____

Grid Location ____ 1/4 of ____ 1/4 of Sec. ____ ; T. ____ N; R. ____ ☐ E ☐ W

____ ft. ☐ N. ☐ S., ____ ft. ☐ E. ☐ W.

Local Grid Origin ☐ (estimated: ☐) or Well Location ☐

Lat ___ ° ___ ' ___ " Long ___ ° ___ ' ___ " or

State Plane ____ ft. N. ____ ft. E. ☐ S ☐ C ☐ N Zone

Reason For Abandonment: Sample only

WI Unique Well No. of Replacement Well

(2) FACILITY /OWNER INFORMATION

Facility Name: Rueping Macy Force Main

Facility ID: SB-2

License/Permit/Monitoring No.

Street Address of Well

City, Village, or Town

Present Well Owner: Same

Original Owner: Same

Street Address or Route of Owner

City, State, Zip Code

(3) WELL/DRILLHOLE/BOREHOLE INFORMATION

Original Construction Date: 4-15-09

☐ Monitoring Well
☐ Water Well
☒ Drillhole / Borehole

If a Well Construction Report is available, please attach.

Construction Type:
☒ Drilled ☐ Driven (Sandpoint) ☐ Dug
☐ Other (Specify) _____

Formation Type:
☒ Unconsolidated Formation ☐ Bedrock

Total Well Depth (ft) (From ground surface): 18.5

Casing Diameter (in.): —

Casing Depth (ft.): —

Lower Drillhole Diameter (in.): 4

Was Well Annular Space Grouted? ☐ Yes ☒ No ☐ Unknown

If Yes, To What Depth? _____ Feet

Depth to Water (Feet): 8.0

(4) PUMP, LINER, SCREEN, CASING, & SEALING MATERIAL

Pump & Piping Removed?	☐ Yes	☐ No	☒ Not Applicable
Liner(s) Removed?	☐ Yes	☐ No	☒ Not Applicable
Screen Removed?	☐ Yes	☐ No	☒ Not Applicable
Casing Left in Place?	☐ Yes	☒ No	
Was Casing Cut Off Below Surface?	☐ Yes	☒ No	
Did Sealing Material Rise to Surface?	☒ Yes	☐ No	
Did Material Settle After 24 Hours?	☐ Yes	☒ No	
If Yes, Was Hole Retopped?	☐ Yes	☒ No	

Required Method of Placing Sealing Material
☐ Conductor Pipe - Gravity ☐ Conductor Pipe - Pumped
☒ Screened & Poured (Bentonite Chips) ☐ Other (Explain)

Sealing Materials
☐ Neat Cement Grout
☐ Sand-Cement (Concrete) Grout
☐ Concrete
☐ Clay-Sand Slurry
☐ Bentonite-Sand Slurry
☒ Chipped Bentonite

For monitoring wells and monitoring well boreholes only
☐ Bentonite Chips
☐ Granular Bentonite
☐ Bentonite-Cement Grout
☐ Bentonite - Sand Slurry

(5) Sealing Material Used	From (Ft.)	To (Ft.)		Mix Ratio or Mud Weight
Hole plug	Surface	18.5	3 Bags	3/8 chip

(6) Comments _____

(7) Name of Person or Firm Doing Sealing Work: AECOM

Date of Abandonment: 4-15-09

Signature of Person Doing Work: [signature]

Date Signed: 4-15-09

Street or Route: 1035 Kepler Drive

Telephone Number: 920-468-1978

City, State, Zip Code: Green Bay, Wisconsin 54311-8320

FOR DNR OR COUNTY USE ONLY

Date Received | Noted By

Comments

BCG 34930

State of Wisconsin
Department of Natural Resources

WELL/DRILLHOLE/BOREHOLE ABANDONMENT
Form 3300-5 2/2000

Notice: Please complete Form 3300-5 and return it to the appropriate DNR office and bureau. Completion of this report is required by chs. 160, 281, 283, 289, 291, 292, 293, 295, and 299, Wis. Stats., and ch. NR 141, Wis. Adm. Code. In accordance with chs. 281, 289, 291, 292, 293, 295, and 299, Wis. Stats., failure to file this form may result in a forfeiture of between $10 and $25,000, or imprisonment for up to one year, depending on the program and conduct involved. Personally identifiable information on this form is not intended to be used for any other purpose. NOTE: See the instructions for more information.

Route to: ☐ Drinking Water ☐ Watershed/Wastewater ☐ Waste Management ☐ Remediation/Redevelopment ☐ Other 60098468

(1) GENERAL INFORMATION

WI Unique Well No. | DNR Well ID No. | County

Common Well Name _____ _____ Gov't Lot (if applicable)

Grid Location ____ 1/4 of ____ 1/4 of Sec. ____ ; T. ____ N; R. ____ ☐ E ☐ W

____ ft. ☐ N. ☐ S., ____ ft. ☐ E. ☐ W.

Local Grid Origin ☐ (estimated: ☐) or Well Location ☐

Lat ___ ° ___ ' ___ " Long ___ ° ___ ' ___ " or

State Plane ____ ft. N. ____ ft. E. S C N Zone

Reason For Abandonment: sample auth

WI Unique Well No. of Replacement Well

(2) FACILITY /OWNER INFORMATION

Facility Name: Rudfine Mercy Force Main

Facility ID: SB-24 License/Permit/Monitoring No.

Street Address of Well

City, Village, or Town

Present Well Owner: Same | Original Owner: Same

Street Address or Route of Owner

City, State, Zip Code

(3) WELL/DRILLHOLE/BOREHOLE INFORMATION

Original Construction Date: 4-15-09

☐ Monitoring Well
☐ Water Well
☒ Drillhole / Borehole

If a Well Construction Report is available, please attach.

Construction Type:
☒ Drilled ☐ Driven (Sandpoint) ☐ Dug
☐ Other (Specify) _____

Formation Type:
☒ Unconsolidated Formation ☐ Bedrock

Total Well Depth (ft) (From ground surface): 15' Casing Diameter (in.): — Casing Depth (ft.): —

Lower Drillhole Diameter (in.): 4

Was Well Annular Space Grouted? ☐ Yes ☒ No ☐ Unknown

If Yes, To What Depth? _____ Feet

Depth to Water (Feet) _____

(4) PUMP, LINER, SCREEN, CASING, & SEALING MATERIAL

Pump & Piping Removed?	☐ Yes	☐ No	☒ Not Applicable
Liner(s) Removed?	☐ Yes	☐ No	☒ Not Applicable
Screen Removed?	☐ Yes	☐ No	☒ Not Applicable
Casing Left in Place?	☐ Yes	☒ No	
Was Casing Cut Off Below Surface?	☐ Yes	☒ No	
Did Sealing Material Rise to Surface?	☒ Yes	☐ No	
Did Material Settle After 24 Hours?	☐ Yes	☒ No	
If Yes, Was Hole Retopped?	☐ Yes	☒ No	

Required Method of Placing Sealing Material
☐ Conductor Pipe - Gravity ☐ Conductor Pipe - Pumped
☒ Screened & Poured (Bentonite Chips) ☐ Other (Explain)

Sealing Materials
☐ Neat Cement Grout
☐ Sand-Cement (Concrete) Grout
☐ Concrete
☐ Clay-Sand Slurry
☐ Bentonite-Sand Slurry
☒ Chipped Bentonite

For monitoring wells and monitoring well boreholes only
☐ Bentonite Chips
☐ Granular Bentonite
☐ Bentonite-Cement Grout
☐ Bentonite - Sand Slurry

(5) Sealing Material Used	From (Ft.)	To (Ft.)		Mix Ratio or Mud Weight
Hole plug	Surface	15'	2 Bags	3/8 chip

(6) Comments _____

(7) Name of Person or Firm Doing Sealing Work: AECOM | Date of Abandonment: 4-15-09

Signature of Person Doing Work: [signature] | Date Signed: 4-15-09

Street or Route: 1035 Kepler Drive | Telephone Number: 920-468-1978

City, State, Zip Code: Green Bay, Wisconsin 54311-8320

FOR DNR OR COUNTY USE ONLY
Date Received | Noted By
Comments

BCG 34930

State of Wisconsin
Department of Natural Resources

WELL/DRILLHOLE/BOREHOLE ABANDONMENT
Form 3300-5 2/2000

Notice: Please complete Form 3300-5 and return it to the appropriate DNR office and bureau. Completion of this report is required by chs. 160, 281, 283, 289, 291, 292, 293, 295, and 299, Wis. Stats., and ch. NR 141, Wis. Adm. Code. In accordance with chs. 281, 289, 291, 292, 293, 295, and 299, Wis. Stats., failure to file this form may result in a forfeiture of between $10 and $25,000, or imprisonment for up to one year, depending on the program and conduct involved. Personally identifiable information on this form is not intended to be used for any other purpose. NOTE: See the instructions for more information.

Route to: ☐ Drinking Water ☐ Watershed/Wastewater ☐ Waste Management ☐ Remediation/Redevelopment ☐ Other 60098468

(1) GENERAL INFORMATION

WI Unique Well No. | DNR Well ID No. | County

Common Well Name _____ _____ Gov't Lot (if applicable)

Grid Location ____ 1/4 of ____ 1/4 of Sec. ____ ; T. ____ N; R. ____ ☐ E ☐ W

____ ft. ☐ N. ☐ S., ____ ft. ☐ E. ☐ W.

Local Grid Origin ☐ (estimated: ☐) or Well Location ☐

Lat ___ ° ___ ' ___ " Long ___ ° ___ ' ___ " or

State Plane ____ ft. N. ____ ft. E. ☐ S ☐ C ☐ N Zone

Reason For Abandonment: Sample Only

WI Unique Well No. of Replacement Well

(2) FACILITY /OWNER INFORMATION

Facility Name: Rugging Mary Force Main

Facility ID: SB-26

License/Permit/Monitoring No.

Street Address of Well

City, Village, or Town

Present Well Owner: Same

Original Owner: Same

Street Address or Route of Owner

City, State, Zip Code

(3) WELL/DRILLHOLE/BOREHOLE INFORMATION

Original Construction Date: 4-16-09

☐ Monitoring Well
☐ Water Well
☒ Drillhole / Borehole

If a Well Construction Report is available, please attach.

Construction Type:
☒ Drilled ☐ Driven (Sandpoint) ☐ Dug
☐ Other (Specify) _____

Formation Type:
☒ Unconsolidated Formation ☐ Bedrock

Total Well Depth (ft) (From ground surface): 20'

Casing Diameter (in.): —

Casing Depth (ft.): —

Lower Drillhole Diameter (in.): 6"

Was Well Annular Space Grouted? ☐ Yes ☒ No ☐ Unknown

If Yes, To What Depth? _____ Feet

Depth to Water (Feet): 13'

(4) PUMP, LINER, SCREEN, CASING, & SEALING MATERIAL

Pump & Piping Removed?	☐ Yes	☐ No	☒ Not Applicable
Liner(s) Removed?	☐ Yes	☐ No	☒ Not Applicable
Screen Removed?	☐ Yes	☐ No	☒ Not Applicable
Casing Left in Place?	☐ Yes	☒ No	
Was Casing Cut Off Below Surface?	☐ Yes	☒ No	
Did Sealing Material Rise to Surface?	☒ Yes	☐ No	
Did Material Settle After 24 Hours?	☐ Yes	☒ No	
If Yes, Was Hole Retopped?	☐ Yes	☐ No	

Required Method of Placing Sealing Material
☐ Conductor Pipe - Gravity ☐ Conductor Pipe - Pumped
☒ Screened & Poured (Bentonite Chips) ☐ Other (Explain)

Sealing Materials
☐ Neat Cement Grout
☐ Sand-Cement (Concrete) Grout
☐ Concrete
☐ Clay-Sand Slurry
☐ Bentonite-Sand Slurry
☐ Chipped Bentonite

For monitoring wells and monitoring well boreholes only
☐ Bentonite Chips
☐ Granular Bentonite
☐ Bentonite-Cement Grout
☐ Bentonite - Sand Slurry

(5) Sealing Material Used	From (Ft.)	To (Ft.)		Mix Ratio or Mud Weight
Hole plug	Surface	20'	5 Bags	3/8 chip

(6) Comments _____

(7) Name of Person or Firm Doing Sealing Work: AECOM

Date of Abandonment: 4-16-09

Signature of Person Doing Work: [signature]

Date Signed: 4-16-09

Street or Route: 1035 Kepler Drive

Telephone Number: 920-468-1978

City, State, Zip Code: Green Bay, Wisconsin 54311-8320

FOR DNR OR COUNTY USE ONLY
Date Received | Noted By
Comments

BCG 34930

State of Wisconsin
Department of Natural Resources

WELL/DRILLHOLE/BOREHOLE ABANDONMENT

Form 3300-5 2/2000

Notice: Please complete Form 3300-5 and return it to the appropriate DNR office and bureau. Completion of this report is required by chs. 160, 281, 283, 289, 291, 292, 293, 295, and 299, Wis. Stats., and ch. NR 141, Wis. Adm. Code. In accordance with chs. 281, 289, 291, 292, 293, 295, and 299, Wis. Stats., failure to file this form may result in a forfeiture of between $10 and $25,000, or imprisonment for up to one year, depending on the program and conduct involved. Personally identifiable information on this form is not intended to be used for any other purpose. NOTE: See the instructions for more information.

Route to: ☐ Drinking Water ☐ Watershed/Wastewater ☐ Waste Management ☐ Remediation/Redevelopment ☐ Other 60098468

(1) GENERAL INFORMATION

WI Unique Well No. | DNR Well ID No. | County

Common Well Name _____ _____ Gov't Lot (if applicable)

Grid Location ____ 1/4 of ____ 1/4 of Sec. ____ ; T. ____ N; R. ____ ☐ E ☐ W

____ ft. ☐ N. ☐ S., ____ ft. ☐ E. ☐ W.

Local Grid Origin ☐ (estimated: ☐) or Well Location ☐

Lat ___ ° ___ ' ___ " Long ___ ° ___ ' ___ " or

State Plane ____ ft. N. ____ ft. E. ☐ S ☐ C ☐ N Zone

Reason For Abandonment: Sample only

WI Unique Well No. of Replacement Well

(2) FACILITY /OWNER INFORMATION

Facility Name: Ruefing Lacy Force Main

Facility ID: SB-3

License/Permit/Monitoring No.

Street Address of Well

City, Village, or Town

Present Well Owner: Same

Original Owner: Same

Street Address or Route of Owner

City, State, Zip Code

(3) WELL/DRILLHOLE/BOREHOLE INFORMATION

Original Construction Date: 4-15-09

☐ Monitoring Well
☐ Water Well
☒ Drillhole / Borehole

If a Well Construction Report is available, please attach.

Construction Type:
☒ Drilled ☐ Driven (Sandpoint) ☐ Dug
☐ Other (Specify) _____

Formation Type:
☒ Unconsolidated Formation ☐ Bedrock

Total Well Depth (ft) (From ground surface): 20

Casing Diameter (in.): ~

Casing Depth (ft.): ~

Lower Drillhole Diameter (in.): 4

Was Well Annular Space Grouted? ☐ Yes ☒ No ☐ Unknown

If Yes, To What Depth? _____ Feet

Depth to Water (Feet): 10.6

(4) PUMP, LINER, SCREEN, CASING, & SEALING MATERIAL

Pump & Piping Removed?	☐ Yes	☐ No	☒ Not Applicable
Liner(s) Removed?	☐ Yes	☐ No	☒ Not Applicable
Screen Removed?	☐ Yes	☐ No	☒ Not Applicable
Casing Left in Place?	☐ Yes	☒ No	
Was Casing Cut Off Below Surface?	☐ Yes	☒ No	
Did Sealing Material Rise to Surface?	☒ Yes	☐ No	
Did Material Settle After 24 Hours?	☐ Yes	☒ No	
If Yes, Was Hole Retopped?	☐ Yes	☒ No	

Required Method of Placing Sealing Material
☐ Conductor Pipe - Gravity ☐ Conductor Pipe - Pumped
☒ Screened & Poured (Bentonite Chips) ☐ Other (Explain)

Sealing Materials
☐ Neat Cement Grout
☐ Sand-Cement (Concrete) Grout
☐ Concrete
☐ Clay-Sand Slurry
☐ Bentonite-Sand Slurry
☒ Chipped Bentonite

For monitoring wells and monitoring well boreholes only
☐ Bentonite Chips
☐ Granular Bentonite
☐ Bentonite-Cement Grout
☐ Bentonite - Sand Slurry

(5) Sealing Material Used	From (Ft.)	To (Ft.)		Mix Ratio or Mud Weight
Hole Plug	Surface	20'	3 Bags	3/8 chip

(6) Comments _____

(7) Name of Person or Firm Doing Sealing Work: AECOM

Date of Abandonment: 4-15-09

Signature of Person Doing Work: [signature]

Date Signed: 4-15-09

Street or Route: 1035 Kepler Drive

Telephone Number: 920-468-1978

City, State, Zip Code: Green Bay, Wisconsin 54311-8320

FOR DNR OR COUNTY USE ONLY

Date Received | Noted By

Comments

BCG 34930

State of Wisconsin
Department of Natural Resources

WELL/DRILLHOLE/BOREHOLE ABANDONMENT

Form 3300-5 2/2000

Notice: Please complete Form 3300-5 and return it to the appropriate DNR office and bureau. Completion of this report is required by chs. 160, 281, 283, 289, 291, 292, 293, 295, and 299, Wis. Stats., and ch. NR 141, Wis. Adm. Code. In accordance with chs. 281, 289, 291, 292, 293, 295, and 299, Wis. Stats., failure to file this form may result in a forfeiture of between $10 and $25,000, or imprisonment for up to one year, depending on the program and conduct involved. Personally identifiable information on this form is not intended to be used for any other purpose. NOTE: See the instructions for more information.

Route to: ☐ Drinking Water ☐ Watershed/Wastewater ☐ Waste Management ☐ Remediation/Redevelopment ☐ Other 60098468

(1) GENERAL INFORMATION

WI Unique Well No. | DNR Well ID No. | County

Common Well Name _____ _____ Gov't Lot (if applicable)

Grid Location: ____ 1/4 of ____ 1/4 of Sec. ____ ; T. ____ N; R. ____ ☐ E ☐ W

____ ft. ☐ N. ☐ S., ____ ft. ☐ E. ☐ W.

Local Grid Origin ☐ (estimated: ☐) or Well Location ☐

Lat ___ ° ___ ' ___ " Long ___ ° ___ ' ___ " or

State Plane ____ ft. N. ____ ft. E. S ☐ C ☐ N ☐ Zone

Reason For Abandonment: Sample only

WI Unique Well No. of Replacement Well

(2) FACILITY /OWNER INFORMATION

Facility Name: Rueffin Macy Force Main

Facility ID: SB-4 | License/Permit/Monitoring No.

Street Address of Well

City, Village, or Town

Present Well Owner: Same | Original Owner: Same

Street Address or Route of Owner

City, State, Zip Code

(3) WELL/DRILLHOLE/BOREHOLE INFORMATION

Original Construction Date: 4-15-09

☐ Monitoring Well
☐ Water Well
☒ Drillhole / Borehole

If a Well Construction Report is available, please attach.

Construction Type:
☒ Drilled ☐ Driven (Sandpoint) ☐ Dug
☐ Other (Specify) _____

Formation Type:
☒ Unconsolidated Formation ☐ Bedrock

Total Well Depth (ft) (From ground surface): 20' Casing Diameter (in.) _____

Casing Depth (ft.) _____

Lower Drillhole Diameter (in.): 4

Was Well Annular Space Grouted? ☐ Yes ☒ No ☐ Unknown

If Yes, To What Depth? _____ Feet

Depth to Water (Feet): 12'

(4) PUMP, LINER, SCREEN, CASING, & SEALING MATERIAL

Pump & Piping Removed?	☐ Yes	☐ No	☒ Not Applicable
Liner(s) Removed?	☐ Yes	☐ No	☒ Not Applicable
Screen Removed?	☐ Yes	☐ No	☒ Not Applicable
Casing Left in Place?	☐ Yes	☒ No	
Was Casing Cut Off Below Surface?	☐ Yes	☒ No	
Did Sealing Material Rise to Surface?	☒ Yes	☐ No	
Did Material Settle After 24 Hours?	☐ Yes	☒ No	
If Yes, Was Hole Retopped?	☐ Yes	☒ No	

Required Method of Placing Sealing Material
☐ Conductor Pipe - Gravity ☐ Conductor Pipe - Pumped
☒ Screened & Poured (Bentonite Chips) ☐ Other (Explain)

Sealing Materials
☐ Neat Cement Grout
☐ Sand-Cement (Concrete) Grout
☐ Concrete
☐ Clay-Sand Slurry
☐ Bentonite-Sand Slurry
☒ Chipped Bentonite

For monitoring wells and monitoring well boreholes only
☐ Bentonite Chips
☐ Granular Bentonite
☐ Bentonite-Cement Grout
☐ Bentonite - Sand Slurry

(5) Sealing Material Used	From (Ft.)	To (Ft.)		Mix Ratio or Mud Weight
Hole Plug	Surface	20'	3 Bags	3/8 chip

(6) Comments _____

(7) Name of Person or Firm Doing Sealing Work: AECOM | Date of Abandonment: 4-15-09

Signature of Person Doing Work: [signature] | Date Signed: 4-15-09

Street or Route: 1035 Kepler Drive | Telephone Number: 920-468-1978

City, State, Zip Code: Green Bay, Wisconsin 54311-8320

FOR DNR OR COUNTY USE ONLY
Date Received | Noted By
Comments

BCG 34930

Appendix E

AECOM Field and Laboratory Procedures

- Subsurface Exploration Procedures
- Sampling Procedures
- Laboratory Procedures

AECOM Field and Laboratory Procedures

Subsurface Exploration Procedures

Hand-Auger Drilling (HA)

In this procedure, a sampling device is driven into the soil by repeated blows of a sledge hammer or a drop hammer. When the sampler is driven to the desired sample depth, the soil sample is retrieved. The hole is then advanced by manually turning the hand auger until the next sampling depth increment is reached. The hand auger drilling between sampling intervals also helps to clean and enlarge the borehole in preparation for obtaining the next sample.

Power Auger Drilling (PA)

In this type of drilling procedure, continuous flight augers are used to advance the boreholes. They are turned and hydraulically advanced by a truck, trailer or track-mounted unit as site accessibility dictates. In auger drilling, casing and drilling mud are not required to maintain open boreholes.

Hollow Stem Auger Drilling (HS)

In this drilling procedure, continuous flight augers having open stems are used to advance the boreholes. The open stem allows the sampling tool to be used without removing the augers from the borehole. Hollow stem augers thus provide support to the sides of the borehole during the sampling operations.

Rotary Drilling (RB)

In employing rotary drilling methods, various cutting bits are used to advance the boreholes. In this process, surface casing and/or drilling fluids are used to maintain open boreholes.

Diamond Core Drilling (DB)

Diamond core drilling is used to sample cemented formations. In this procedure, a double tube (or triple tube) core barrel with a diamond bit cuts an annular space around a cylindrical prism of the material sampled. The sample is retrieved by a catcher just above the bit. Samples recovered by this procedure are placed in sturdy containers in sequential order.

AECOM Field and Laboratory Procedures

Field Sampling Procedures

Auger Sampling (AS)

In this procedure, soil samples are collected from cuttings off of the auger flights as they are removed from the ground. Such samples provide a general indication of subsurface conditions; however, they do not provide undisturbed samples, nor do they provide samples from discrete depths.

Split-Barrel Sampling (SS) - (ASTM Standard D-1586-99)

In the split-barrel sampling procedure, a 2-inch O.D. split barrel sampler is driven into the soil a distance of 18 inches by means of a 140-pound hammer falling 30 inches. The value of the Standard Penetration Resistance is obtained by counting the number of blows of the hammer over the final 12 inches of driving. This value provides a qualitative indication of the in-place relative density of cohesionless soils. The indication is qualitative only, however, since many factors can significantly affect the Standard Penetration Resistance Value, and direct correlation of results obtained by drill crews using different rigs, drilling procedures, and hammer-rod-spoon assemblies should not be made. A portion of the recovered sample is placed in a sample jar and returned to the laboratory for further analysis and testing.

Shelby Tube Sampling Procedure (ST) - ASTM Standard D-1587-94

In the Shelby tube sampling procedure, a thin-walled steel seamless tube with a sharp cutting edge is pushed hydraulically into the soil and a relatively undisturbed sample is obtained. This procedure is generally employed in cohesive soils. The tubes are identified, sealed and carefully handled in the field to avoid excessive disturbance and are returned to the laboratory for extrusion and further analysis and testing.

Giddings Sampler (GS)

This type of sampling device consists of 5-foot sections of thin-wall tubing which are capable of retrieving continuous columns of soil in 5-foot maximum increments. Because of a continuous slot in the sampling tubes, the sampler allows field determination of stratification boundaries and containerization of soil samples from any sampling depth within the 5-foot interval.

AECOM Laboratory Procedures

Water Content (Wc)

The water content of a soil is the ratio of the weight of water in a given soil mass to the weight of the dry soil. Water content is generally expressed as a percentage.

Hand Penetrometer (Qp)

In the hand penetrometer test, the unconfined compressive strength of a soil is determined, to a maximum value of 4.5 tons per square foot (tsf) or 7.0 tsf depending on the testing device utilized, by measuring the resistance of the soil sample to penetration by a small, spring-calibrated cylinder. The hand penetrometer test has been carefully correlated with unconfined compressive strength tests, and thereby provides a useful and a relatively simple testing procedure in which soil strength can be quickly and easily estimated.

Unconfined Compression Tests (Qu)

In the unconfined compression strength test, an undisturbed prism of soil is loaded axially until failure or until 20% strain has been reached, whichever occurs first.

Dry Density (γd)

The dry density is a measure of the amount of solids in a unit volume of soil. Use of this value is often made when measuring the degree of compaction of a soil.

Classification of Samples

In conjunction with the sample testing program, all soil samples are examined in our laboratory and visually classified on the basis of their texture and plasticity in accordance with the STS Soil Classification System which is described on a separate sheet. The soil descriptions on the boring logs are derived from this system as well as the component gradation terminology, consistency of cohesive soils and relative density of granular soils as described on a separate sheet entitled "STS General Notes". The estimated group symbols included in parentheses following the soil descriptions on the boring logs are in general conformance with the Unified Soil Classification System (USCS) which serves as the basis of the STS Soil Classification System.

Appendix F

AECOM Soil Classification System

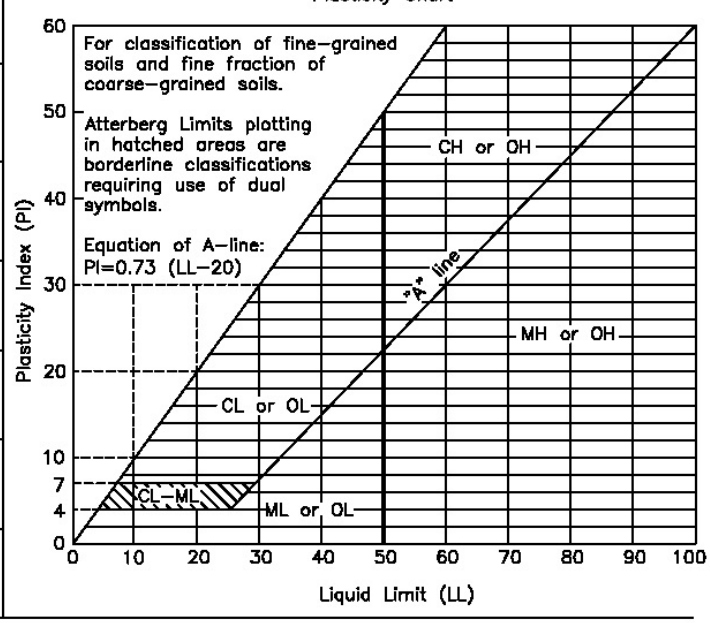
AECOM Soil Classification System [1]

Major Divisions		Group Symbols	Typical Names	Laboratory Classification Criteria
Coarse-grained soils (More than half of material is *larger* than No. 200 sieve size)	Gravel (More than half of coarse fraction is larger than No. 4 sieve size) — Clean gravel (Little or no fines)	GW	Well-graded, gravel, gravel-sand mixtures, little or no fines	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 & 3
		GP	Poorly graded gravel, gravel-sand mixtures, little or no fines	Not meeting all gradation requirements for GW
	Gravel with fines (Appreciable amount of fines)	GM	Silty gravel, gravel-sand-silt mixtures	Atterberg limits below "A" line or PI less than 4 — Above "A" line with PI between 4 and 7 are *borderline* cases requiring use of dual symbols
		GC	Clayey gravel, gravel-sand-clay mixtures	Atterberg limits above "A" line or PI greater than 7
	Sand (More than half of coarse fraction is smaller than No. 4 sieve size) — Clean sand (Little or no fines)	SW	Well-graded sand, gravelly sand, little or no fines	$C_u = \frac{D_{60}}{D_{10}}$ greater than 6; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 & 3
		SP	Poorly graded sand, gravelly sand, little or no fines	Not meeting all gradation requirements for SW
	Sand with fines (Appreciable amount of fines)	SM	Silty sand, sand-silt mixtures	Atterberg limits below "A" line or PI less than 4 — Limits plotting in hatched zone with PI between 4 and 7 are *borderline* cases requiring use of dual symbols
		SC	Clayey sand, sand-clay mixtures	Atterberg limits above "A" line or PI greater than 7
Fine-grained soils (More than half of material is *smaller* than No. 200 sieve size)	Silt and clay (Liquid limit less than 50)	ML	Inorganic silt and very fine sand, rock flour, silty or clayey fine sand or clayey silt with slight plasticity	
		CL	Inorganic clay of low to medium plasticity, gravelly clay, sandy clay, silty clay, lean clay	
		OL	Organic silt and organic silty clay of low plasticity	
	Silt and clay (Liquid limit greater than 50)	MH	Inorganic silt, micaceous or diatomaceous fine sandy or silty soils, elastic silt	
		CH	Inorganic clay of high plasticity, fat clay	
		OH	Organic clay of medium to high plasticity, organic silt	
	Highly organic soils	PT	Peat and other highly organic soil	

Determine percentages of sand and gravel from grain-size curve. Depending on percentage of fines (fraction smaller than No. 200 sieve size), coarse-grained soils are classified as follows:

Less than 5 percent . . . . . GW, GP, SW, SP
More than 12 percent . . . . GM, GC, SM, SC
5 to 12 percent . . . . . Borderline cases *requiring* dual symbols[3]

Plasticity Chart [2]



1. See AECOM General Notes for component gradation terminology, consistency of cohesive soils and relative density of granular soils.
2. Reference: Unified Soil Classification Systems
3. Borderline classifications, used for soils possessing characteristics of two groups, are designated by combinations of group symbols. For example: GW-GC, well-graded gravel-sand mixture with clay binder.

Appendix G

AECOM Earthwork Guideline

AECOM Earthwork Guidelines

Fill or backfill required on the project should consist of a non-frozen, non-organic granular material, aggregate or natural soil that is free of debris and particles larger than 25 percent of the loose lift thickness. The natural water content of cohesive fill soil at the time of compaction should generally be within -2 to +4 percent of the optimum water content determined by the proctor test. Difficulty in obtaining the desired degree of compaction is expected for soil that is too dry or too wet. The water content should be adjusted by sprinkling if too dry or by scarifying and aerating if too wet. Blending with an additive such as fly ash or drier soil may also help produce an acceptable water content.

Fill or backfill which is relatively uniform should be used on the project. Non-uniform materials or mixing two or more materials will reduce the degree of certainty in the test results and will tend to cause variable compressibility of the fill.

Fill or backfill should be placed on a firm, checked subgrade in horizontal lifts with a loose thickness not greater than 12 inches for granular material and 9 inches for cohesive soil. It should then be compacted with equipment that is suited to the soil type and compaction requirements. Normally, vibratory roller or plate compactors are better suited for granular soils, while a sheepsfoot or other "kneading" type of compactors are more effective in cohesive soils. Lighter, hand-propelled compactors should generally be utilized to compact backfill within 5 feet of structures unless the structure is designed to resist expected lateral pressures from use of heavier compactors. When using lighter, hand-propelled compactors, a maximum loose lift thickness of 8 inches should be used for granular material and 6 inches for cohesive soil.

Unless stated otherwise in the report text, fill or backfill that supports foundations, floor slabs that are loaded in excess of 400 psf, and roadway pavement that is subjected to concentrated automobile or truck traffic should be compacted to a dry density of 95% or more of the maximum dry density determined by modified Proctor tests (ASTM D-1557) on representative samples of the fill material. Fill or backfill that supports lightly loaded floor slabs, sidewalks or pavement that is subjected to dispersed automobile traffic should be compacted to a dry density of 90% or more of the maximum dry density determined by modified Proctor tests on representative samples of the fill material. Compaction tests may be considered satisfactory if the average of five consecutive tests on similarly compacted material exceeds the required compaction and no individual test is more than 2% below the required percentage of compaction.

Proper compaction is generally difficult to achieve near the edge of a slope or embankment fill due to lack of confinement. For this reason, we recommend that the compacted fill or backfill zone extend horizontally beyond the edge of foundations a minimum of 1 foot at the subgrade level and then with depth at a minimum slope of 1 horizontal to 1 vertical.

Fill material acceptability, subgrade preparation and testing for suitability, fill placement and fill compaction should be monitored continuously or at least regularly by a qualified soils technician whom reports to the geotechnical engineer for the project. Compaction density for structural fill should be tested at a minimum frequency of once per 5000 ft^2 of fill area or once per 200 yd^3 of compacted material placed unless stated otherwise in our report. In non-structural fill areas, testing frequencies may be reduced in half.

Appendix H

AECOM General Qualifications

AECOM General Qualifications

Underground Engineering

This report has been prepared in general accordance with normally accepted geotechnical engineering practices to aid in the evaluation of this site and to assist our Client in the design of this project. We have prepared this report for the purpose intended by our Client, and reliance on its contents by anyone other than our Client is done at the sole risk of the user. No other warranty, either expressed or implied, is made. The scope is limited to the specific project and location described herein, and our description of the project represents our understanding of the significant aspects relevant to the geotechnical characteristics. In the event that any changes in the design or location of the facilities as outlined in this report are planned, we should be informed so that the changes can be reviewed and the conclusions of this report modified as necessary in writing by the geotechnical engineer. As a check, we recommend that we be authorized to review the project plans and specifications to confirm that the recommendations contained in this report have been interpreted in accordance with our intent. Without this review, we will not be responsible for the misinterpretation of our data, our analysis, and/or our recommendations, nor how these are incorporated into the final design.

The analysis and recommendations submitted in this report are based on the data obtained from the soil borings performed at the locations indicated on the location diagram and from the information discussed in this report. This report does not reflect any variations which may occur between the borings. In the performance of subsurface explorations, specific information is obtained at specific locations at specific times. However, it is a well-known fact that variations in soil and rock conditions exist on most sites between boring locations and that seasonal and annual fluctuations in groundwater levels will likely occur. The nature and extent of variations may not become evident until the course of construction. If variations then appear evident, it will be necessary for a re-evaluation of the recommendations contained in this report after performing on-site observations during the construction period and noting the characteristics of the variations.

The geotechnical engineer of record is the professional engineer who authored the geotechnical report. It is recommended that all construction operations dealing with earthwork and foundations be observed by the geotechnical engineer of record or the geotechnical engineer's appointed representative to confirm that the design requirements are fulfilled in the actual construction. For some projects, this may be required by the governing building code.

The scope of services for this project does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, bacteria, viruses, and the byproducts of such organisms) assessment of the site, or identification of or prevention of pollutants, hazardous materials or conditions. Other studies beyond the scope of this project would be required to evaluate the potential of such contamination or pollution.

Appendix I

AECOM Changed Conditions Clause

AECOM

AECOM Changed Conditions Clause

Differing Site Conditions

The owner had a subsurface exploration and testing program performed by a geotechnical consultant. The results of this program are contained in the consultant's report. The consultant's report presents conclusions on the subsurface conditions based on their interpretation of the data obtained in the exploration. The contractor acknowledges that they have reviewed the consultant's report and any addenda thereto, and that their bid for earthwork operations is based on the subsurface conditions, as described in that report. The contract parties recognize that a subsurface exploration does not disclose all conditions as they actually exist and further, conditions may change, particularly groundwater conditions, between the time of subsurface exploration and the time of subsurface construction operations. In recognition of these facts, this clause is made part of the contract and provides a means of equitable additional compensation to the contractor if adverse unanticipated conditions are encountered and found to be materially different than reasonable expected as represented in the contract documents.

If at any time during earthwork, paving, foundation, and underground construction operations, the contractor encounters conditions that they consider to be materially different than those anticipated by the geotechnical consultant's report, contractor shall promptly and before such conditions are disturbed notify the owner's representative in writing of the condition and shall explain: (1) how subsurface or latent physical conditions at the site differ materially from those indicated in the contract, or, (2) what unknown physical conditions were encountered that are of an unusual nature and differ materially from those ordinarily encountered and generally recognized as inherent in work of the character provided for in this contract. The owner's representative will promptly initiate an investigation of the alleged differing site conditions. The contractor will provide access to the conditions and fully cooperate with the investigation. Upon completion, the owner’s representative will issue a findings report with a recommendation on merit. Conversely, if owner’s representative observes subsurface conditions which are different than those anticipated by the foundation consultant's report, he will also promptly notify the contractor. If a differing site condition claim has been found to have merit, negotiations will commence between the owner and the contractor to arrive at an equitable change in contract price for the necessary additional work or for reduction in work because of the unanticipated conditions. The contractor agrees that unit prices listed in the bid are applicable in computing equitable adjustments for additional or reduced work under the contract. For changed conditions for which unit prices are not listed, the additional work will be paid for on a time and material basis.