Independent Testing Technologies, Inc.

OCTOBER 26, 2010

PROJECT 10-304
REPORT OF GEOTECHNICAL EXPLORATIONS

For

WESTERN SEWER INTERCEPTOR
WILLMAR, MINNESOTA

Prepared For:

DONOHUE & ASSOCIATES

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Independent Testing Technologies, Inc.

October 26, 2010

Mr. Josh Halvorson, PE
Donohue & Associates
2320 East Highway 12, Suite 5
Willmar, MN 56201

RE: 10-304 Report of Geotechnical Exploration
Western Sewer Interceptor
Willmar, Minnesota

Dear Mr. Halvorson:

Independent Testing Technologies, Inc. is pleased to submit the results of our subsurface investigation program for this project in Willmar, Minnesota. This report represents our work for this project as authorized by you. It includes our recommendations regarding earthwork, fill and compaction, utility installation, foundation treatment, backfill, street subgrade preparation and pavement design. Five copies are enclosed.

The soils on this site are fairly well suited for the proposed utility and lift station construction. The soils encountered generally consisted of some fill and organic soils over native, sandy lean clay (CL). Some very deep, poorly graded sands (SP) were also encountered. Groundwater was observed at varying depths of 1.5 to 7.0 feet during drilling, which will have an impact on construction. Soil samples obtained during our investigation will be stored at our office for thirty days after the date of this report. After that time, they will be disposed of unless you advise otherwise.

Mr. Halvorson, it has been our pleasure to work with you on this project. Please contact us if you have any questions or need additional services.

Sincerely,

Patrick A. Johnson, P.E.
MN Registration #22037

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CERTIFICATION

I hereby certify that this report was prepared by me or under my direct supervision and that I am a duly Registered Engineer under the laws of the State of Minnesota.

Patrick A. Johnson

Patrick A. Johnson

Date: 10/26/10 **Registration No.:** 22037

October 26, 2010 22037

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WESTERN SEWER INTERCEPTOR
WILLMAR, MINNESOTA
PROJECT 10-304

A. Introduction

This report is being prepared for use by our client on this specific project. We intend to present this report and our findings in the same logical manner that led us to arrive at our recommendations. This report is based on some general assumptions regarding the anticipated construction based on experience with similar projects. These assumptions and the entire report should be reviewed immediately upon receipt.

Purpose:

The purpose of our investigation was to evaluate the existing soil and water conditions on this site for the purpose of constructing a sanitary sewer interceptor around the west side of Willmar. The line will run from the existing MH 140 at 30th Avenue SW and 30th Street SW, north along 30th Street under C.S.A.H. 15/ 19th Street SW, then continuing north along the west side of 30th Street to 15th Avenue SW. From there, the sewer line will run north through the old airport, with a jog to the west at a future extension of Trott Avenue, and then due north to US Highway 12 at a future intersection with an extension of 33rd Street NW.

Construction is expected to consist of some combination of directional boring and open cut trenching for the sewer line installation. Manholes will be installed intermittently along the alignment using open cut methods. In accordance with your written authorization, we have conducted a subsurface exploration program for the proposed project.

Scope of Services:

Our authorized scope of services included the following:

1. To investigate the subsurface soil and water conditions encountered at eleven (11) split-spoon soil boring locations along the alignment. The boring depths were planned to between 30 and 45 feet deep, with the deepest being at the south end of the alignment and shallowest at the north end. The approximate boring locations are shown on the boring location plan in Appendix 1.
2. To perform laboratory testing and analysis on the soil samples including visual classification, moisture, unconfined compressive strengths, sieve analysis and other testing needed to characterize the materials and their engineering properties.
3. To provide a report of our findings including the results of our subsurface investigation and recommendations regarding excavation requirements, backfill and compaction, utility installation, foundation treatment, design criteria for temporary excavations and potential construction problems.

General Site Conditions:

The site of the sewer collector is primarily in the ditches adjacent to 30th Street SW and through open fields around the old airport. The area is mostly agricultural land. The area is on the western edge of the city and is adjacent to some large tract commercial/ industrial properties and older residential property. Areas that are currently incorporated into the city are zoned as government/ institution or general industrial. According to the City of Willmar Comprehensive Plan, the future use of the agricultural land may be mixed commercial/ light industrial transitioning to mixed residential. The sites are relatively flat with slopes of 0-6 %.

Available Subsurface Information:

According to the Geologic Map of Minnesota, Quaternary Geology, prepared by Howard C. Hobbs and Joseph E. Goebel (1982, Minnesota Geological Survey), this site lies within a ground moraine of the Altamont Moraine Association. It is associated with the Des Moines Lobe glaciation of Pleistocene, Late Wisconsinan age. The glacial till consists of grey, calcareous drift with clasts of shale and limestone common. The drift is derived from parent material in Manitoba and eastern North Dakota.

According to the Soil Survey of Kandiyohi County prepared by the Soil Conservation Service, this site lies within the Harps- Okoboji- Seaforth Soils Association, which consists of nearly level and undulating, poorly drained, very poorly drained and moderately well drained, loamy and silty soils that formed in glacial till and lacustrine sediments on till plains. The individual soils mapped on this site are predominantly sand loams and silt and clay loam soils that are rated fair to poor for shallow excavations due to shallow groundwater, ponding and weak cutbanks.

A copy of the soils map from the Web Soil Survey, prepared by the Natural Resources Conservation Service is included in Appendix 2. The map shows the soil types and the ratings for shallow excavations and trenches less than 5 or 6 feet. The areas colored red are very limited and yellow are somewhat limited for shallow excavations. Note that this is a guide. Actual conditions may vary.

B. Exploration Program

Eleven (11) split-spoon soil borings were conducted on this project. The borings were advanced to depths of 30 to 45 feet deep using a 3 1/4 inch I.D. hollow stem auger. Samples were obtained every 2 1/2 feet for the first 10 feet and every 5 feet, thereafter, using a 2-inch O.D. split-spoon sampler in accordance with the American Society for Testing and Materials (ASTM D1586). Standard penetration values (N-values) were obtained at each sample interval by driving the sampler into the soil using a 140-pound hammer falling 30 inches.

After an initial set of 6 inches, the number of blows required to drive the sampler 12 inches is known as the standard penetration resistance or N-value. Where the sampler can not be driven at least 6 inches by 50 blows of the hammer, the total number of blows as well as the distance driven is reported on the boring logs.

Groundwater levels were noted during drilling and immediately after completion. Where possible, the holes were left open for at least 24 hours to allow time for groundwater levels to stabilize. The holes were sealed with bentonite grout and the auger cuttings. Some settlement of the bore holes may be expected. All of the borings were conducted with a truck mounted rig. The boring locations were staked by your survey crew and the borings were conducted within 2 feet of the staked location unless otherwise stated on the boring log.

Exploration Results:

Boring B-1 was conducted on the gravel surface of 30th Street SW and encountered 8 inches of aggregate surfacing material. Below the aggregate, boring B-1 encountered sand (SP-SM) fill to 1.5 feet, followed by native silt (ML) to 7.0 feet, poorly graded sand and sand with silt (SP-SM) to 17.0 feet, silty sand (SM) to 20.0 feet, sandy lean clay (CL) to 41.5 feet and water bearing, poorly graded sand (SP) to termination at 45 feet.

Boring B-2 was conducted on a bituminous paved portion of 30th Street near the intersection with 19th Avenue SW and encountered 10 inches of bituminous pavement over 8 inches of aggregate base. Below the pavement, boring B-1 encountered dark brown to black clayey sand (SC) fill to a depth of 3.5 feet, followed by silty lean clay (CL-ML) to 9.0 feet, sandy lean clay (CL) to 37.0 feet and water bearing sand (SP) to termination at 40 feet.

Borings B-3, B-4 and B-5 were conducted west of 30th Street (C.S.A.H.5) between 19th Avenue and 15th Avenue. Boring B-3 encountered black, organic peat (PT) to a depth of 2.0 feet, followed by soft silty lean clay (CL-ML) to 4.0 feet and then sandy lean clay (CL) to termination at 35.0 feet. Boring B-4 encountered topsoil material consisting of black clayey sand (SC) to 2.0 feet followed by soft, silty clay (CL-ML) to 6.5 feet, highly plastic clay (CH) to 13.5 feet, sandy lean clay (CL) to 37.5 feet and then water bearing sand (SP) to termination at 40.0 feet. Boring B-5 encountered topsoil material consisting of black

clayey sand (SC) to 2.0 feet, followed by sandy lean clay (CL) to 37.5 feet and water bearing sand (SP) to termination at 40.0 feet.

Borings B-6 and B-7 were conducted on the old airport site and encountered 12 to 18 inches of silty sand (SM) fill at the surface. Below the silty sand (SM) fill, boring B-6 encountered silty clay (CL-ML) fill to 4.5 feet, followed by a thin layer of remnant topsoil (CL-ML) to 5.0 feet and then native, sandy lean clay (CL) to termination at 35.0 feet. Below the silty sand (SM) fill, boring B-7 encountered sandy clay (CL) fill to 5.0 feet, followed by a layer of remnant topsoil (SC) to 6.5 feet and then native, sandy lean clay (CL) to 34.0 feet and water bearing sand (SP) to termination at 35.0 feet.

Boring B-8 was conducted in a field north of the old airport and encountered topsoil material consisting of clayey sand (SC) to 2.5 feet, followed by soft, silty clay (CL-ML) to 4.0 feet and then native, sandy lean clay (CL) to termination at 35.0 feet. Boring B-9 was conducted in a field north of the old airport near a county ditch and encountered black, clayey sand (SC) fill to 5.0 feet, followed by native, sandy lean clay (CL) to 28.0 feet and water bearing sand (SP) to termination at 30.0 feet.

Boring B-10 was conduced in the ditch in the south side of US Highway 12 and encountered topsoil material consisting of black, organic silt (OL) to 13 inches. Below the topsoil, boring B-10 encountered silt (ML) to 8.0 feet, followed by water bearing sand (SP) to 11.5 feet sandy lean clay (CL) to 27.0 feet and water bearing sand (SP) to termination at 30.0 feet. Boring B-11 was conducted just north of the railroad tracks, north of US Highway 12 and encountered mixed silty sand (SM) fill to 10.0 feet. Below the fill, boring B-11 encountered native, clayey sand (SC) to13.5 feet, silty sand (SM) to 16.0 feet, water bearing sand (SP) to 22.0 feet and then sandy lean clay (CL) to termination at 30.0 feet.

Penetration Test Results:

The standard penetration blow counts in the native sandy lean clay soils ranged from 2 to 15, which are low to moderate, indicating that they are in a very soft to firm condition. The standard penetration blow counts in the soft silty clay soils encountered in borings B-2, B-3, B-4 and B-8 ranged from 0 to 3, which are very low, indicating that they are in a very soft condition. The standard penetration blow counts in the native sand soils ranged from 2 to 15, which are low to high, indicating that they are in a very loose to dense condition.

The standard penetration blow counts in the fill soils in borings B-6, B-7 and B-11 ranged from 4 to 8, which are moderate, indicating that they are in a firm condition. The standard penetration blow counts in the black clayey sand fill soils in boring B-9 ranged from 1 to 2, which are very low, indicating that they are in a very loose condition. Refusal of the spoon did occur on a rock in the bottom of boring B-3. However, refusal of the spoon or auger did not occur in any of the other borings and the drilling was relatively easy in all of the borings.

Water Level Observations:

Observations of the subsurface water conditions were made during drilling operations. The boreholes were left open for at least 24 hours to allow the water levels to stabilize. Groundwater was encountered in all of the borings at depths of 1.5 to 7.0 feet during drilling. The following table shows the depth to water at each boring location:

Boring	Water Depth	Boring	Water Depth	Boring	Water Depth
B-1	4.5 feet	B-5	3.0 feet	B-9	7.0 feet
B-2	5.5 feet	B-6	5.0 feet	B-10	7.5 feet
B-3	3.0 feet	B-7	5.0 feet	B-11	7.0 feet
B-4	1.5 feet	B-8	2.5 feet		

It is our opinion that the water levels observed during our investigation represent a perched water condition on this site. Perched water is water trapped above an impervious layer. In this case, the native clay soils on the site prevent surface water from precipitation from infiltrating into the ground. We did observe that the clean, poorly graded sands below the clay soils at depth in most of the borings were water bearing.

It should be noted that fluctuations in the level of the groundwater can occur due to variations in rainfall, temperature, spring thaw and other factors not evident at the time of our investigation. Mottled soils were observed. Mottled native soils are a historical indication of a temporarily or seasonally saturated soil condition. Grey soils were also observed. Grey native soils are an indication of a permanently saturated soil condition.

Laboratory Testing

Moisture Content Tests- Moisture content tests were performed on various samples in accordance with ASTM method D2216; *Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass.* Individual test results are shown on the boring logs adjacent to the sample that was tested.

Percent Passing #200 Sieve- Grain size analyses of samples were conducted to determine the percent passing a number 200 sieve in accordance with ASTM method C117; *Standard Test Method for Materials Finer than 75-μm (No.200) Sieve in Mineral Aggregates by Washing.* The percent passing the number 200 sieve is the parameter that defines clays, silts and sands under the Unified Soil Classification System. Sols with less than 50% passing a number 200 sieve are classified as sands, and soils with more than 50% passing are classified as silts or clays. Individual test results are shown on the boring logs adjacent to the sample that was tested.

Pocket Penetrometer Tests- The unconfined compressive strengths of the lean clay and clayey sand samples were estimated using a pocket penetrometer. The pocket penetrometer consists of a ¼-inch diameter, spring-loaded rod pushed into the soil a distance of ¼ inch. Compression of the spring is correlated to the shear strength and is read directly from the gauge. Individual test results are shown on the boring logs adjacent to the sample tested.

C. Engineering Review

Discussion:

Based on our findings, this site appears to be fairly well suited for the proposed utility installation. The native soils at anticipated pipe invert elevation on this site all appear suitable for support of the sewer pipe, manholes and any miscellaneous structures. The soils are predominately clays that may be difficult to compact. The upper portions of the soil strata within the top four to six feet will likely be very soft and unstable. Use of scrapers or other heavy wheeled vehicles will be very limited.

Dewatering for deep utility installation will be difficult. It appears that most of the pipe inverts will be in cohesive clay (CL) or clayey sand (SC) soils. Dewatering will likely consist of a sump with a pump in theses clay soils. However, some water bearing, poorly graded sands (SP) were encountered at depths of 27 to 37 feet in several borings. While pipe inverts are not anticipated to be that deep, dewatering in those sands would best be accomplished with a series of well points.

We understand that the sewer depths will range from 20 to 35 feet below grade. This would mean that all pipes and manhole foundations will bear in firm, native, sandy lean clays, which are suitable for support. We recommend all manhole foundations be placed on a bed of clean, crushed rock or compacted granular foundation material.

D. Recommendations

The following recommendations are based on our understanding of the proposed project. If our understanding of the project is not accurate or if changes are made to the project scope, please inform us so that our recommendations can be amended, if necessary. We have included recommendations regarding earthwork and construction that may help in cost estimates and aid in design. We should be allowed to review the proposed construction plans to provide further detailed recommendations, if necessary. Without the opportunity to review the final construction plans, the recommendations made in this report may no longer be valid.

Utility Installation:

We recommend that all utility pipes lay in non-organic mineral soils capable of supporting the pipes. Excessive over-excavation beneath the pipes should be avoided. We recommend that 2 to 6 inches of granular bedding material be placed and compacted around the pipe to aid in aligning the sanitary sewer pipe for line and grade. The native soils will not meet the requirements of granular bedding material. All granular bedding material will need to be imported. Compaction should be done very carefully by hand to prevent the pipe from shifting. We recommend that the backfill be compacted with a static sheep's foot roller after the backfill is 2 feet above the top of the pipe. The organic soils should not be used as backfill in the utility trenches.

The clay (CL) soils identified on the site are cohesive soils. Based on the penetrometer results, it appears that the cohesive soils have unconfined compressive strengths in excess of 0.5 tons per square foot. Therefore, the on-site soils should be considered "Type B" soils for purposes of trench excavation safety. We recommend that excavations slope at a minimum of 1:1 (horizontal: vertical) ratio from the bottom of the excavation to the surface in Type B soils.

The sand (SP) soils identified on the site are non-cohesive soils. These soils will be saturated and should be considered "Type C" soils for purposes of trench excavation safety. We recommend that excavations slope at a minimum of 1.5:1 (horizontal: vertical) ratio from the bottom of the excavation to the surface in Type C soils. Some deep, water bearing sands were encountered beneath the clays at depths of 30 to 35 feet, Where Type B soils overlie Type C soils, the most conservative sloping should be used.

Stockpiled material should be kept at least 2 feet from the edge of the excavation. This is the minimum required by OSHA. We recommend all construction vehicles be kept at least 5 feet from the edge of the excavation. An escape ladder should be provided at all times while workers are in the excavation. All excavations must meet OSHA standards (29 CFR1926).

Construction Dewatering:

Dewatering will be needed for deep utility installation below the water levels on this site. It appears that a sump with a pump would be best suited for dewatering utility trenches in the native clay soils on this site.

Some water bearing, poorly graded sands (SP) were encountered at depths of 32.0 to 41.5 feet in borings B-1, B-2, B-4, B-6 and B-7. Pipe inverts are not anticipated to be that deep through these areas. Water bearing, poorly graded sands (SP) were also encountered at depths of 27.0 to 28.0 feet in borings B-9 and B-10 and at 16.0 to 22.0 feet in boring B-11. Trench excavations are anticipated to intersect the water bearing sands through these areas. We recommend dewatering the water bearing sands on the north end of the project using a series of well points prior to utility installation.

We recommend that any standing water be removed from the utility trenches prior to backfilling. In addition, we recommend that any utility trench backfill material placed below standing water consist of clean sands with less than 5% passing the number 200 sieve.

Earthwork:

We recommend that all topsoil material be removed from the construction areas prior to beginning grading. The topsoil should be stockpiled and used for landscaping and restoration.

Shallow groundwater was encountered in much of the low lying area of the site. There was some fill observed on the existing roadways. The fill we observed was all suitable for roadway and pavement support. However, it is possible that some unsuitable material is mixed with the fill on top of the organic soils or buried in the roadway. We recommend that the area be observed carefully during construction to verify that no buried topsoil, debris, organic peat or other unsuitable material is present.

For design purposes, we recommend using a shrinkage rate of 10% for the native sand soils on the site. That would be a factor of 0.9 from in-place or excavated volume (EV) to compacted volume (CV).

Structural Fill:

The onsite soils consisting of sandy lean clays (CL) are considered poor material for use as structural fill. These soils are difficult to work with, especially in wet areas. The wet, soft clays present at this location are considered poor material for use as fill. The clay soils will be wet and will require moisture conditioning to reach optimum moisture for compaction.

We recommend that any imported fill and utility trench backfill material consist of mineral soils meeting the requirements specified below. No organic soils, roots, stumps, logs, brush, etc. should be used as structural fill below any utility structure or pavement section. We recommend that all fill and utility trench backfill material be free of soft, wet or frozen soils, highly expansive soils, rubble, debris and rocks in excess of 6 inches in diameter. The fill and utility trench backfill material should be as uniform as possible both in composition and moisture content.

We recommend that all fill and utility trench backfill material placed beneath future roadways be placed in 12-inch loose lifts and compacted to a minimum of 95% of standard proctor maximum density (ASTM D698). Any fill placed in the top 3 feet of the road subgrade should be compacted to at least 100% of standard proctor maximum density. Any backfill placed on green areas should be placed in 12-inch loose lifts and compacted to a minimum of 90% of standard proctor maximum density (ASTM D698) to avoid excessive settlement. All fill and utility trench backfill material should be compacted at a moisture content within plus 3% or minus 2% of the optimum moisture as determined by a standard proctor. We recommend compaction tests be taken at a minimum rate of one test per two feet of fill per 200 linear feet of the utility trench backfill, roadway subgrade, and aggregate base material.

E. Closing

Our work was performed for geotechnical purposes only and not to document the presence or extent of any contamination on the site. We can note that our crew did not detect any obvious contamination by sight or smell during drilling operations. However, human senses are limited in terms of contamination detection and, therefore, the lack of detection through human sensing does not preclude the possibility of the presence of contamination of the site.

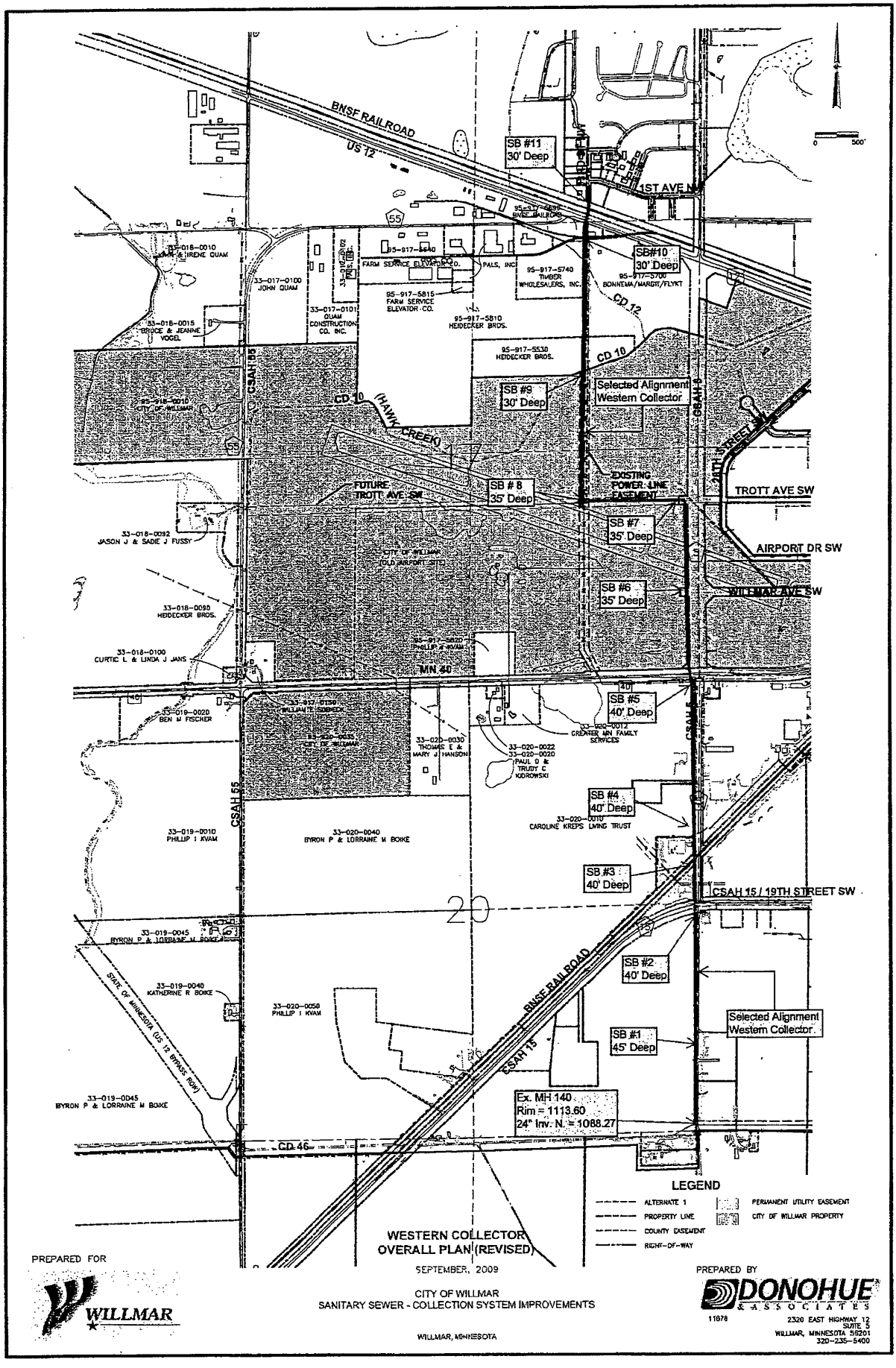
This report represents the result of our subsurface investigation and is based on information gathered at specific locations. Subsurface conditions can change a great deal over short horizontal distances. Also, the actual interface between strata will likely be a gradual transition rather than an abrupt change as represented on the boring logs.

Geotechnical engineering is based extensively on opinion. Therefore, the data contained in this report should be used as a guide, and we recommend that construction monitoring be performed by a qualified geotechnical engineer or technician. Any changes in the subsurface conditions from those found during this geotechnical exploration should be brought to the attention of a soils engineer.

c:b10304-rpt

APPENDIX 1

BORING LOCATION PLAN



WESTERN COLLECTOR
OVERALL PLAN (REVISED)

SEPTEMBER, 2009

PREPARED FOR

WILLMAR

CITY OF WILLMAR
SANITARY SEWER - COLLECTION SYSTEM IMPROVEMENTS

WILLMAR, MINNESOTA

PREPARED BY

DONOHUE & ASSOCIATES

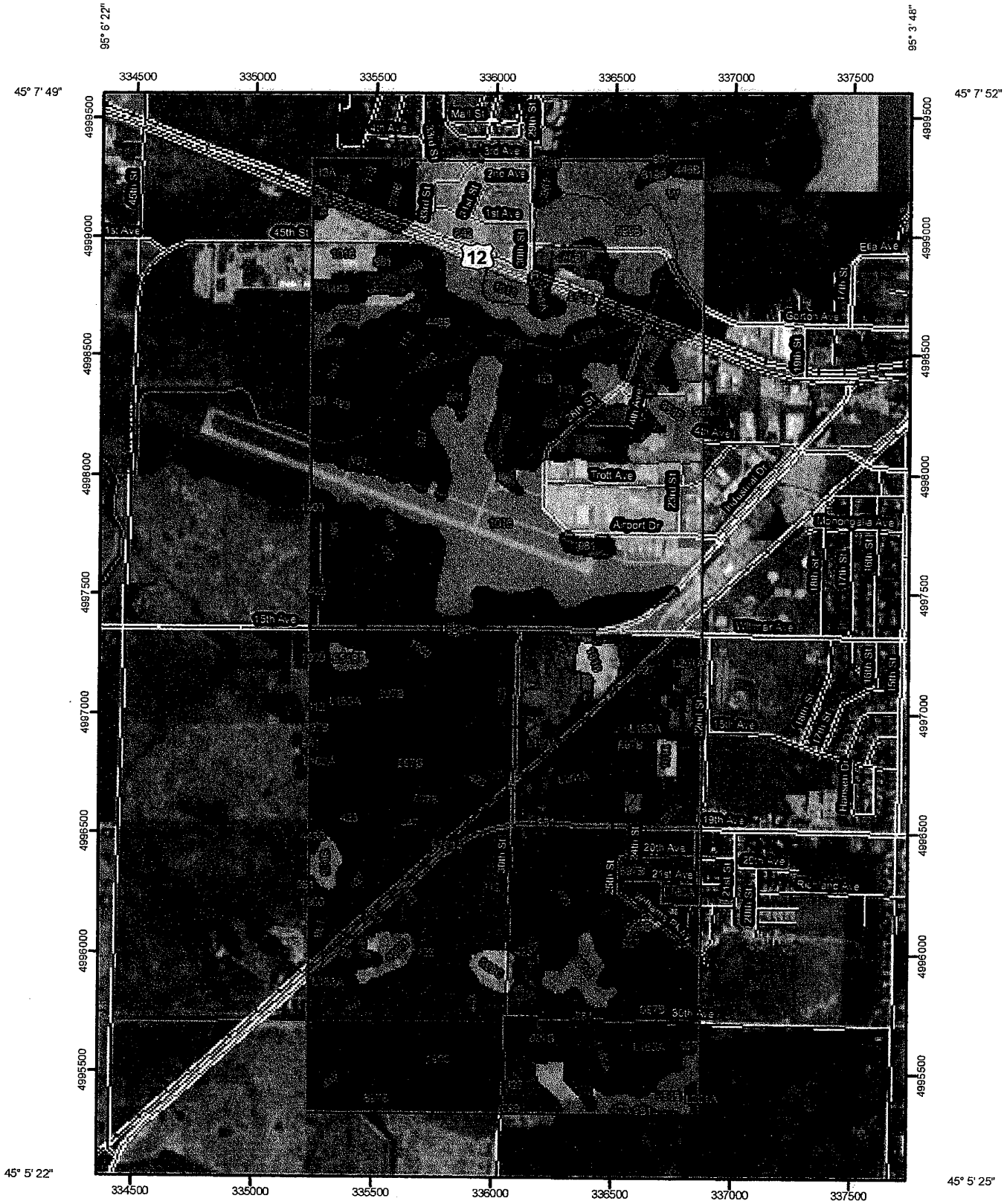
11878

2320 EAST HIGHWAY 12
SUITE 5
WILLMAR, MINNESOTA 56201
320-235-5400

APPENDIX 2

WEB SOIL SURVEY

Shallow Excavations—Kandiyohi County, Minnesota
(Willmar Western Sewer Collector- South)



Map Scale: 1:21,700 if printed on A size (8.5" x 11") sheet.

N

Meters
0 200 400 800 1,200

Feet
0 500 1,000 2,000 3,000

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Units

Soil Ratings
- Very limited
- Somewhat limited
- Not limited
- Not rated or not available

Political Features
- Cities

Water Features
- Oceans
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

MAP INFORMATION

Map Scale: 1:21,700 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at 1:20,000.

Please rely on the bar scale on each map sheet for accurate map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 15N NAD83

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Kandiyohi County, Minnesota
Survey Area Data: Version 10, Feb 25, 2010

Date(s) aerial images were photographed: 7/2/2003

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Shallow Excavations

Shallow Excavations— Summary by Map Unit — Kandiyohi County, Minnesota						
Map unit symbol	Map unit name	Rating	Component name (percent)	Rating reasons (numeric values)	Acres in AOI	Percent of AOI
41A	Estherville coarse sandy loam, 0 to 3 percent slopes	Very limited	Estherville (90%)	Cutbanks cave (1.00)	5.5	0.3%
112	Harps clay loam	Very limited	Harps (90%)	Depth to saturated zone (1.00)	17.9	1.1%
				Cutbanks cave (0.10)		
113	Webster silty clay loam	Very limited	Webster (90%)	Depth to saturated zone (1.00)	2.4	0.1%
				Cutbanks cave (0.10)		
413	Osakis sandy loam	Very limited	Osakis (90%)	Depth to saturated zone (1.00)	5.8	0.4%
				Cutbanks cave (1.00)		
423	Seaforth loam	Very limited	Seaforth (85%)	Depth to saturated zone (0.99)	129.5	8.0%
				Cutbanks cave (0.10)		
446B	Normania loam, 2 to 5 percent slopes	Very limited	Normania (90%)	Depth to saturated zone (0.99)	42.9	2.7%
				Cutbanks cave (0.10)		
447	Harpster silty clay loam	Very limited	Harpster (90%)	Depth to saturated zone (1.00)	57.9	3.6%
				Cutbanks cave (0.10)		
810	Coriff-Fieldon complex	Very limited	Coriff (45%)	Depth to saturated zone (1.00)	0.2	0.0%
				Cutbanks cave (1.00)		
			Fieldon (45%)	Depth to saturated zone (1.00)		
				Cutbanks cave (1.00)		

Shallow Excavations— Summary by Map Unit — Kandiyohi County, Minnesota						
Map unit symbol	Map unit name	Rating	Component name (percent)	Rating reasons (numeric values)	Acres in AOI	Percent of AOI
819B	Regal-Hawick complex, 0 to 4 percent slopes	Very limited	Regal (55%)	Depth to saturated zone (1.00)	2.1	0.1%
				Cutbanks cave (1.00)		
			Hawick (35%)	Cutbanks cave (1.00)		
842	Urban land-Udorthents complex	Not rated	Urban land (50%)		54.7	3.4%
875B	Estherville-Hawick complex, 2 to 6 percent slopes	Very limited	Estherville (60%)	Cutbanks cave (1.00)	10.6	0.7%
			Hawick (25%)	Cutbanks cave (1.00)		
897B	Seaforth-Swanlake loams, 2 to 6 percent slopes	Very limited	Seaforth (60%)	Depth to saturated zone (0.99)	39.7	2.5%
				Cutbanks cave (0.10)		
899	Harps-Okoboji complex	Very limited	Harps (60%)	Depth to saturated zone (1.00)	24.4	1.5%
				Cutbanks cave (0.10)		
			Okoboji (35%)	Depth to saturated zone (1.00)		
				Ponding (1.00)		
				Cutbanks cave (0.10)		
927	Harps-Seaforth-Okoboji complex	Very limited	Harps (35%)	Depth to saturated zone (1.00)	296.3	18.3%
				Cutbanks cave (0.10)		
			Seaforth (25%)	Depth to saturated zone (0.99)		
				Cutbanks cave (0.10)		
			Okoboji (25%)	Depth to saturated zone (1.00)		
				Ponding (1.00)		
				Cutbanks cave (0.10)		

Shallow Excavations— Summary by Map Unit — Kandiyohi County, Minnesota						
Map unit symbol	Map unit name	Rating	Component name (percent)	Rating reasons (numeric values)	Acres in AOI	Percent of AOI
954B	Ves-Swanlake loams, 2 to 6 percent slopes	Somewhat limited	Ves (65%)	Depth to saturated zone (0.78)	87.7	5.4%
				Cutbanks cave (0.10)		
			Swanlake (25%)	Depth to saturated zone (0.78)		
				Cutbanks cave (0.10)		
981	Canisteo-Harps loams	Very limited	Canisteo (45%)	Depth to saturated zone (1.00)	287.6	17.8%
				Cutbanks cave (0.10)		
			Harps (40%)	Depth to saturated zone (1.00)		
				Cutbanks cave (0.10)		
999B	Ves-Swanlake-Hawick complex, 2 to 6 percent slopes	Somewhat limited	Ves (40%)	Depth to saturated zone (0.78)	55.4	3.4%
				Cutbanks cave (0.10)		
			Swanlake (30%)	Depth to saturated zone (0.78)		
				Cutbanks cave (0.10)		
999C	Swanlake-Ves-Hawick complex, 6 to 12 percent slopes	Somewhat limited	Swanlake (40%)	Cutbanks cave (0.10)	6.8	0.4%
				Slope (0.04)		
			Ves (25%)	Cutbanks cave (0.10)		
				Slope (0.04)		
1016	Udorthents, loamy	Somewhat limited	Udorthents, loamy (100%)	Cutbanks cave (0.10)	235.7	14.6%

Shallow Excavations— Summary by Map Unit — Kandiyohi County, Minnesota						
Map unit symbol	Map unit name	Rating	Component name (percent)	Rating reasons (numeric values)	Acres in AOI	Percent of AOI
1900	Okoboji-Canisteo silty clay loams, depressional	Very limited	Okoboji, depressional (55%)	Depth to saturated zone (1.00)	107.5	6.6%
				Ponding (1.00)		
				Cutbanks cave (0.10)		
			Canisteo, depressional (30%)	Depth to saturated zone (1.00)		
				Ponding (1.00)		
				Cutbanks cave (0.10)		
L13A	Klossner muck, depressional, 0 to 1 percent slopes	Very limited	Klossner, drained (80%)	Depth to saturated zone (1.00)	1.9	0.1%
				Ponding (1.00)		
				Organic matter content (1.00)		
				Cutbanks cave (0.10)		
			Mineral soil, drained (15%)	Depth to saturated zone (1.00)		
				Ponding (1.00)		
				Cutbanks cave (0.10)		
			Houghton, drained (5%)	Depth to saturated zone (1.00)		
				Organic matter content (1.00)		
				Ponding (1.00)		

Shallow Excavations— Summary by Map Unit — Kandiyohi County, Minnesota						
Map unit symbol	Map unit name	Rating	Component name (percent)	Rating reasons (numeric values)	Acres in AOI	Percent of AOI
W	Water	Not rated	Water (100%)		34.2	2.1%
Totals for Area of Interest					**1,618.2**	**100.0%**

Shallow Excavations— Summary by Rating Value		
Rating	Acres in AOI	Percent of AOI
Very limited	1,143.6	70.7%
Somewhat limited	385.6	23.8%
Null or Not Rated	89.0	5.5%
Totals for Area of Interest	**1,618.2**	**100.0%**

Description

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for graves, utility lines, open ditches, or other purposes. The ratings are based on the soil properties that influence the ease of digging and the resistance to sloughing. Depth to bedrock or a cemented pan, hardness of bedrock or a cemented pan, the amount of large stones, and dense layers influence the ease of digging, filling, and compacting. Depth to the seasonal high water table, flooding, and ponding may restrict the period when excavations can be made. Slope influences the ease of using machinery. Soil texture, depth to the water table, and linear extensibility (shrink-swell potential) influence the resistance to sloughing.

The ratings are both verbal and numerical. Rating class terms indicate the extent to which the soils are limited by all of the soil features that affect the specified use. "Not limited" indicates that the soil has features that are very favorable for the specified use. Good performance and very low maintenance can be expected. "Somewhat limited" indicates that the soil has features that are moderately favorable for the specified use. The limitations can be overcome or minimized by special planning, design, or installation. Fair performance and moderate maintenance can be expected. "Very limited" indicates that the soil has one or more features that are unfavorable for the specified use. The limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor performance and high maintenance can be expected.

Numerical ratings indicate the severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.01 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the use (1.00) and the point at which the soil feature is not a limitation (0.00).

The map unit components listed for each map unit in the accompanying Summary by Map Unit table in Web Soil Survey or the Aggregation Report in Soil Data Viewer are determined by the aggregation method chosen. An aggregated rating class is shown for each map unit. The components listed for each map unit are only those that have the same rating class as listed for the map unit. The percent composition of each component in a particular map unit is presented to help the user better understand the percentage of each map unit that has the rating presented.

Other components with different ratings may be present in each map unit. The ratings for all components, regardless of the map unit aggregated rating, can be viewed by generating the equivalent report from the Soil Reports tab in Web Soil Survey or from the Soil Data Mart site. Onsite investigation may be needed to validate these interpretations and to confirm the identity of the soil on a given site.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: *None Specified*

Tie-break Rule: Higher

APPENDIX 3

SOIL BORING LOGS

INDEPENDENT TESTING TECHNOLOGIES, INC. LOG OF SOIL BORING

PROJECT: 10-304 DONOHUE & ASSOCIATES
WESTERN INTERCEPTOR SEWER
DONOHUE PROJECT 11678
WILLMAR, MINNESOTA

DATE: 10/7/10 BORING #: B-1
START TIME: 12:17 END TIME: 2:00

METHOD: 3 1/4" I.D. Hollow Stem Auger
CREW: RB / VB
ELEVATION: N/A

LOCATION: 30th Street SW- See Boring Location Plan

Depth (Feet)	ASTM Symbol	Soil Description	Sample #	N Value	Water Table	Notes
8"		8 inches Aggregate Base				
1.5	SP-SM	POORLY GRADED SAND with SILT, fine to medium grained, with a trace of GRAVEL, brown, FILL.				
	ML	SILT, brown, mottled.		2		
5.0				2	V	Water encountered at 4.5 feet during drilling. q_u= 0.75 t.s.f.
7.0	SP	POORLY GRADED SAND, fine grained, with a trace of GRAVEL, brown.		7		
9.0						
10.0	SP-SM	POORLY GRADED SAND with SILT, fine grained, with a trace of GRAVEL, brown.		6		
15.0				13		
17.0	SM	SILTY SAND, fine grained, grey.		7		
20.0						
	CL	SANDY LEAN CLAY, with fine grained SAND, grey.				
25.0				3		q_u= 0.75 t.s.f. m.c.= 19.0 %,#200= 54.0%
30.0				3		

(continued)

INDEPENDENT TESTING TECHNOLOGIES, INC. LOG OF SOIL BORING

PROJECT: 10-304 DONAHUE & ASSOCIATES
WESTERN INTERCEPTOR SEWER
DONOHUE PROJECT 11678
WILLMAR, MINNESOTA

DATE: 10/7/10 BORING #: B-1
START TIME: 12:17 END TIME: 2:00
METHOD: 3 1/4" I.D. Hollow Stem Auger
CREW: RB / VB
ELEVATION: N/A

LOCATION: 30th Street SW- See Boring Location Plan

Depth (Feet)	ASTM Symbol	Soil Description	Sample #	N Value	Water Table	Notes
		(CONTINUED FROM PAGE 1)				
	CL	SANDY LEAN CLAY, with fine grained SAND, grey.				
				5		
35.0						
				4		
40.0						
41.5	SP	POORLY GRADED SAND, fine grained, with a trace of GRAVEL, grey, water bearing.				
				2		
45.0		Boring Complete to 45.0 feet. Water encountered at 4.5 feet during drilling. Borehole sealed with bentonite grout. No water level reading after completion.				

INDEPENDENT TESTING TECHNOLOGIES, INC. LOG OF SOIL BORING

PROJECT: 10-304 DONOHUE & ASSOCIATES
WESTERN INTERCEPTOR SEWER
DONOHUE PROJECT 11678
WILLMAR, MINNESOTA

DATE: 10/7/10 BORING #: B-2
START TIME: 2:20 END TIME: 3:37
METHOD: 3 1/4" I.D. Hollow Stem Auger
CREW: RB / VB
ELEVATION: N/A

LOCATION: 30th Street SW- See Boring Location Plan

Depth (Feet)	ASTM Symbol	Soil Description	Sample #	N Value	Water Table	Notes
		10 inches Bituminous, 8 inches Aggregate Base				
18"	SC	CLAYEY SAND, fine grained, dark brown to black, FILL.		4		
3.5	CL-ML	SILTY LEAN CLAY, brown, mottled, soft.		3	V	q_u= 1.5 t.s.f. m.c.= 34.0% %<#200= 63.5% Water encountered at 5.5 feet during drilling.
5.0						
6.0	ML	SILT, brown, mottled.		4		q_u= 1.5 t.s.f. m.c.= 44.3% %<#200= 96.3%
9.0	CL	SANDY LEAN CLAY, with fine grained SAND, brown, mottled.		8		
10.0		changes to grey at 13.5 feet.		4		q_u= 1.25 t.s.f.
15.0				6		q_u= 1.5 t.s.f.
20.0				6		q_u= 2.25 t.s.f.
25.0				5		q_u= 1.75 t.s.f.
30.0						

(continued)

INDEPENDENT TESTING TECHNOLOGIES, INC. LOG OF SOIL BORING

PROJECT: 10-304 **DONAHUE & ASSOCIATES**
WESTERN INTERCEPTOR SEWER
DONOHUE PROJECT 11678
WILLMAR, MINNESOTA

DATE: 10/7/10 BORING #: B-2
START TIME: 2:20 END TIME: 3:37

METHOD: 3 1/4" I.D. Hollow Stem Auger
CREW: RB /VB
ELEVATION: N/A

LOCATION: 30th Street SW- See Boring Location Plan

Depth (Feet)	ASTM Symbol	Soil Description	Sample #	N Value	Water Table	Notes
		(CONTINUED FROM PAGE 1)				
	CL	SANDY LEAN CLAY, with fine grained SAND, grey.				
				7		q_u= 2.0 t.s.f.
35.0						
37.0	SP	POORLY GRADED SAND, fine grained, with a trace of GRAVEL, grey, water bearing.				
				3		
40.0		Boring Complete to 40.0 feet. Water encountered at 5.5 feet during drilling. Borehole sealed with bentonite grout. No water level reading after completion.				

INDEPENDENT TESTING TECHNOLOGIES, INC. LOG OF SOIL BORING

PROJECT: 10-304 **DONOHUE & ASSOCIATES**
WESTERN INTERCEPTOR SEWER
DONOHUE PROJECT 11678
WILLMAR, MINNESOTA

DATE: 10/7/10 BORING #: B-3
START TIME: 3:47 END TIME: 5:05

METHOD: 3 1/4" I.D. Hollow Stem Auger
CREW: RB / VB
ELEVATION: N/A

LOCATION: West of 30th Street SW- See Boring Location Plan

Depth (Feet)	ASTM Symbol	Soil Description	Sample #	N Value	Water Table	Notes
	PT	Peat, black, organic.				
2.0						
	CL-ML	SILTY LEAN CLAY, brown, mottled, soft.		0*	V	*Weight of Hammer Water measured at 3.0 feet on 10-13-10
4.0						
	CL	SANDY LEAN CLAY, with fine grained SAND, brown, mottled.		3		
5.0						
				6		
				6		m.c.= 15.4%
10.0						
				6		m.c.= 15.0%
15.0						
		changes to grey at 18 feet		8		m.c.= 17.4%
20.0						
				9		m.c.= 13.5%
25.0						
				9		
30.0						

(continued)

INDEPENDENT TESTING TECHNOLOGIES, INC. LOG OF SOIL BORING

PROJECT: 10-304 DONAHUE & ASSOCIATES
WESTERN INTERCEPTOR SEWER
DONOHUE PROJECT 11678
WILLMAR, MINNESOTA

DATE: 10/7/10 BORING #: B-3
START TIME: 3:47 END TIME: 5:05

METHOD: 3 1/4" I.D. Hollow Stem Auger
CREW: RB /VB
ELEVATION: N/A

LOCATION: West of 30th Street SW- See Boring Location Plan

Depth (Feet)	ASTM Symbol	Soil Description	Sample #	N Value	Water Table	Notes
		(CONTINUED FROM PAGE 1)				
	CL	SANDY LEAN CLAY, with fine grained SAND, grey.				
				54*		*54 for 6 inches, on rock.
35.0		Boring Complete to 35.0 feet. Water encountered 5.0 feet during drilling. Water measured at 3.0 feet on 10-13-10. Borehole sealed with bentonite grout.				

INDEPENDENT TESTING TECHNOLOGIES, INC. LOG OF SOIL BORING

PROJECT: 10-304 **DONOHUE & ASSOCIATES**
WESTERN INTERCEPTOR SEWER
DONOHUE PROJECT 11678
WILLMAR, MINNESOTA

DATE: 10/8/10 BORING #: B-4
START TIME: 10:10 END TIME: 11:20

METHOD: 3 1/4" I.D. Hollow Stem Auger
CREW: RB / VB
ELEVATION: N/A

LOCATION: West of 30th Street SW- See Boring Location Plan

Depth (Feet)	ASTM Symbol	Soil Description	Sample #	N Value	Water Table	Notes
	SC	CLAYEY SAND, black, TOPSOIL			V	Water measured at 1.5 feet on 10-13-10
2.0						
	CL-ML	SILTY LEAN CLAY, brown, mottled, soft.		0*		*Weight of Hammer
4.0						
5.0	CL	SANDY LEAN CLAY, with fine grained SAND, brown, mottled.		1		
6.5						
	CH	HIGHLY PLASTIC CLAY, brown, grey, mottled.		2		
				3		
10.0						
13.5						
	CL	SANDY LEAN CLAY, with fine grained SAND, grey.		6		
15.0						
				6		q_u= 1.5 t.s.f.
20.0						
				8		q_u= 1.5 t.s.f.
25.0						
				8		
30.0						

(continued)

INDEPENDENT TESTING TECHNOLOGIES, INC. LOG OF SOIL BORING

PROJECT: 10-304 DONAHUE & ASSOCIATES
WESTERN INTERCEPTOR SEWER
DONOHUE PROJECT 11678
WILLMAR, MINNESOTA

DATE: 10/8/10 BORING #: B-4
START TIME: 10:10 END TIME: 11:20

METHOD: 3 1/4" I.D. Hollow Stem Auger
CREW: RB /VB
ELEVATION: N/A

LOCATION: West of 30th Street SW- See Boring Location Plan

Depth (Feet)	ASTM Symbol	Soil Description	Sample #	N Value	Water Table	Notes
		(CONTINUED FROM PAGE 1)				
	CL	SANDY LEAN CLAY, with fine grained SAND, grey.		9		
37.5						
	SP	POORLY GRADED SAND, fine grained, with a trace of GRAVEL, gery, water bearing.		4		
40.0						
		Boring Complete to 40.0 feet. Water encountered at 2.5 feet during drilling. Water measured at 1.5 feet on 10-13-10. Borehole sealed with bentonite grout.				

INDEPENDENT TESTING TECHNOLOGIES, INC. LOG OF SOIL BORING

PROJECT: 10-304 DONOHUE & ASSOCIATES
WESTERN INTERCEPTOR SEWER
DONOHUE PROJECT 11678
WILLMAR, MINNESOTA

DATE: 10/8/10 BORING #: B-5
START TIME: 12:03 END TIME: 1:11

METHOD: 3 1/4" I.D. Hollow Stem Auger
CREW: RB / VB
ELEVATION: N/A

LOCATION: West of 30th Street SW- See Boring Location Plan

Depth (Feet)	ASTM Symbol	Soil Description	Sample #	N Value	Water Table	Notes
	SC	CLAYEY SAND, black, TOPSOIL				
18"						
	CL	SANDY LEAN CLAY, with fine grained SAND, brown, mottled.		2	V	q_u= 0.75 t.s.f. Water measured at 3.0 feet on 10-13-10
				4		q_u= 0.75 t.s.f. m.c.= 16.6
5.0						
				8		q_u= 2.25 t.s.f. m.c.= 14.2%
				9		q_u= 3.0 t.s.f. m.c.= 16.6%
10.0						
		changes to grey a 13.5 feet		6		
15.0						
				9		
20.0						
				4		
25.0						
				6		
30.0						

(continued)

INDEPENDENT TESTING TECHNOLOGIES, INC. LOG OF SOIL BORING

PROJECT: 10-304 DONAHUE & ASSOCIATES
WESTERN INTERCEPTOR SEWER
DONOHUE PROJECT 11678
WILLMAR, MINNESOTA

DATE: 10/8/10 BORING #: B-5
START TIME: 12:03 END TIME: 1:11

METHOD: 3 1/4" I.D. Hollow Stem Auger
CREW: RB /VB
ELEVATION: N/A

LOCATION: West of 30th Street SW- See Boring Location Plan

Depth (Feet)	ASTM Symbol	Soil Description	Sample #	N Value	Water Table	Notes
		(CONTINUED FROM PAGE 1)				
	CL	SANDY LEAN CLAY, with fine grained SAND, grey.		15		
				17		
40.0		Boring Complete to 40.0 feet. Water encountered at 14 feet during drilling. Water measured at 3.0 feet on 10-13-10. Borehole sealed with bentonite grout.				

INDEPENDENT TESTING TECHNOLOGIES, INC. LOG OF SOIL BORING

PROJECT: 10-304 DONOHUE & ASSOCIATES
WESTERN INTERCEPTOR SEWER
DONOHUE PROJECT 11678
WILLMAR, MINNESOTA

DATE: 10/11/10 BORING #: B-6
START TIME: 8:37 END TIME: 9:31
METHOD: 3 1/4" I.D. Hollow Stem Auger
CREW: RB / CKA
ELEVATION: N/A

LOCATION: South of Old Airport Runway- See Boring Location Plan

Depth (Feet)	ASTM Symbol	Soil Description	Sample #	N Value	Water Table	Notes
	SM	SILTY SAND, fine to medium grained, with a trace of GRAVEL, brown, FILL.				
18"						
	CL-ML	SILTY LEAN CLAY, with lenses of silt, brown, FILL.		5		
4.5						
5.0	CL-ML	SILTY LEAN CLAY, dark grey, remnant TOPSOIL.		6	V	Water measured at 5.0 feet on 10-13-10
	CL	SANDY LEAN CLAY, with fine grained SAND, brown, mottled.		5		
				6		
10.0						
		changes to grey at 12.5 feet.		6		
15.0						
				6		
20.0						
				8		
25.0						
				6		
30.0						

(continued)

INDEPENDENT TESTING TECHNOLOGIES, INC. LOG OF SOIL BORING

PROJECT: 10-304 DONAHUE & ASSOCIATES
WESTERN INTERCEPTOR SEWER
DONOHUE PROJECT 11678
WILLMAR, MINNESOTA

DATE: 10/11/10 BORING #: B-6
START TIME: 8:37 END TIME: 9:31

METHOD: 3 1/4" I.D. Hollow Stem Auger
CREW: RB /CKA
ELEVATION: N/A

LOCATION: South of Old Airport Runway- See Boring Location Plan

Depth (Feet)	ASTM Symbol	Soil Description	Sample #	N Value	Water Table	Notes
	CL	(CONTINUED FROM PAGE 1) SANDY LEAN CLAY, with fine grained SAND, grey.				
32.0	SP	POORLY GRADED SAND, fine to medium grained, with a trace of GRAVEL, grey, water bearing.		15		
35.0		Boring Complete to 35.0 feet. Water encountered at 32 feet during drilling. Water measured at 5.0 feet on 10-13-10. Borehole sealed with bentonite grout.				

INDEPENDENT TESTING TECHNOLOGIES, INC. LOG OF SOIL BORING

PROJECT: 10-304 **DONOHUE & ASSOCIATES**
WESTERN INTERCEPTOR SEWER
DONOHUE PROJECT 11678
WILLMAR, MINNESOTA

DATE: 10/11/10 BORING #: B-7
START TIME: 9:43 END TIME: 10:47

METHOD: 3 1/4" I.D. Hollow Stem Auger
CREW: RB / CKA
ELEVATION: N/A

LOCATION: In Old Airport- See Boring Location Plan

Depth (Feet)	ASTM Symbol	Soil Description	Sample #	N Value	Water Table	Notes
12"	SM	SILTY SAND, fine to medium grained, with a trace of GRAVEL, brown, FILL.				
	CL	SANDY LEAN CLAY, with fine grained SAND, grey, brown, FILL		6		m.c.= 13.8
5.0				7	V	q_u= 1.75 t.s.f. m.c.= 22.8% Water measured at 5.0 feet on 10-13-10
6.5	SC	CLAYEY SAND, dark brown to black, TOPSOIL.				
	CL	SANDY LEAN CLAY, with fine grained SAND, brown, mottled.		4		q_u= 0.75 t.s.f. m.c.= 19.8%
10.0				4		
15.0				8		
20.0				8		
		changes to grey at 22 feet.				
25.0				6		
30.0				6		

(continued)

INDEPENDENT TESTING TECHNOLOGIES, INC. LOG OF SOIL BORING

PROJECT: **10-304** **DONAHUE & ASSOCIATES**
WESTERN INTERCEPTOR SEWER
DONOHUE PROJECT 11678
WILLMAR, MINNESOTA

LOCATION: **In Old Airport- See Boring Location Plan**

DATE: **10/11/10** *BORING #:* **B-7**
START TIME: **9:43** *END TIME:* **10:37**

METHOD: **3 1/4" I.D. Hollow Stem Auger**
CREW: **RB /CKA**
ELEVATION: **N/A**

Depth (Feet)	ASTM Symbol	Soil Description	Sample #	N Value	Water Table	Notes
		(CONTINUED FROM PAGE 1)				
	CL	SANDY LEAN CLAY, with fine grained SAND, grey.				
34.0						
	SP	POORLY GRADED SAND, fine to medium grained, with a trace of GRAVEL, grey, water bearing.		15		
35.0		Boring Complete to 35.0 feet. Water encountered at 18 feet during drilling. Water measured at 5.0 feet on 10-13-10. Borehole sealed with bentonite grout.				

INDEPENDENT TESTING TECHNOLOGIES, INC. LOG OF SOIL BORING

PROJECT: 10-304 DONOHUE & ASSOCIATES
WESTERN INTERCEPTOR SEWER
DONOHUE PROJECT 11678
WILLMAR, MINNESOTA

DATE: 10/11/10 BORING #: B-8
START TIME: 10:59 END TIME: 12:03

METHOD: 3 1/4" I.D. Hollow Stem Auger
CREW: RB / CKA
ELEVATION: N/A

LOCATION: See Boring Location Plan

Depth (Feet)	ASTM Symbol	Soil Description	Sample #	N Value	Water Table	Notes
	SC	CLAYEY SAND, black, TOPSOIL				
				1	V	Water measured at 2.5 feet on 10-13-10
2.5	CL-ML	SILTY LEAN CLAY, brown, mottled, soft.				
4.0	CL	SANDY LEAN CLAY, with fine grained SAND, brown, mottled.		3		
5.0				5		
				4		
10.0						
				10		
15.0		changes to grey at 17 feet				
				5		
20.0						
				6		
25.0						
				5		
30.0						

(continued)

INDEPENDENT TESTING TECHNOLOGIES, INC. LOG OF SOIL BORING

PROJECT: 10-304 DONAHUE & ASSOCIATES
WESTERN INTERCEPTOR SEWER
DONOHUE PROJECT 11678
WILLMAR, MINNESOTA

DATE: 10/11/10 BORING #: B-8
START TIME: 10:59 END TIME: 12:03

METHOD: 3 1/4" I.D. Hollow Stem Auger
CREW: RB /CKA
ELEVATION: N/A

LOCATION: In Old Airport- See Boring Location Plan

Depth (Feet)	ASTM Symbol	Soil Description	Sample #	N Value	Water Table	Notes
		(CONTINUED FROM PAGE 1)				
	CL	SANDY LEAN CLAY, with fine grained SAND, grey.				
34.0				2		
35.0		Boring Complete to 35.0 feet. Water encountered at 7 feet during drilling. Water measured at 2.5 feet on 10-13-10. Borehole sealed with bentonite grout.				

INDEPENDENT TESTING TECHNOLOGIES, INC. LOG OF SOIL BORING

PROJECT: 10-304 **DONOHUE & ASSOCIATES**
WESTERN INTERCEPTOR SEWER
DONOHUE PROJECT 11678
WILLMAR, MINNESOTA

DATE: 10/11/10 *BORING #:* B-9
START TIME: 12:55 *END TIME:* 1:41

METHOD: 3 1/4" I.D. Hollow Stem Auger
CREW: RB / CKA
ELEVATION: N/A

LOCATION: See Boring Location Plan

Depth (Feet)	ASTM Symbol	Soil Description	Sample #	N Value	Water Table	Notes
	CL	SANDY LEAN CLAY, with fine to medium grained SAND, black, FILL.				
				1		
5.0				2		
	CL	SANDY LEAN CLAY, with fine grained SAND, brown, mottled.				
				4	V	Water measured at 7.0 feet on 10-13-10.
				5		q_u= 0.75 t.s.f.
10.0						
		changes to grey at 12 feet.				
				6		q_u= 1.75 t.s.f.
15.0						
				7		q_u= 1.25 t.s.f.
20.0		layer of SAND at 20 feet.				
				5		
25.0						
28.0						
	SP	POORLY GRADED SAND, fine to medium grained, with a trace of GRAVEL, grey.		2		
30.0						
		Boring Complete to 30.0 feet. Water encountered at 7.0 feet during drilling. Water measured at 7.0 feet on 10-13-10.				Borehole sealed with bentonite grout.

INDEPENDENT TESTING TECHNOLOGIES, INC. LOG OF SOIL BORING

PROJECT: 10-304 DONOHUE & ASSOCIATES
WESTERN INTERCEPTOR SEWER
DONOHUE PROJECT 11678
WILLMAR, MINNESOTA

DATE: 10/13/10 BORING #: B-10
START TIME: 7:40 END TIME: 8:30

METHOD: 3 1/4" I.D. Hollow Stem Auger
CREW: RB / CKA
ELEVATION: N/A

LOCATION: See Boring Location Plan

Depth (Feet)	ASTM Symbol	Soil Description	Sample #	N Value	Water Table	Notes
13"	OL	ORGANIC SILT, black, TOPSOIL.				
	ML	SILT, brown, mottled.				
		with layers of SAND.		4		
5.0				6		
				9	V	Water measured at 7.5 feet on 10-13-10.
8.0	SP	POORLY GRADED SAND, fine to medium grained, with a trace of GRAVEL, brown, mottled.		13		
10.0						
11.5	CL	SANDY LEAN CLAY, with fine grained SAND, grey.		7		q_u= 1.25 t.s.f.
15.0						
				6		q_u= 0.5 t.s.f.
20.0						
				4		q_u= 0.5 t.s.f.
25.0						
27.0	SP	POORLY GRADED SAND, fine to coarse grained, with a trace of GRAVEL, grey.				
				15		
30.0		Boring Complete to 30.0 feet. Water encountered at 7.5 feet during drilling. Water measured at 7.5 feet on 10-13-10.				Borehole sealed with bentonite grout.

INDEPENDENT TESTING TECHNOLOGIES, INC. LOG OF SOIL BORING

PROJECT: 10-304 DONOHUE & ASSOCIATES
WESTERN INTERCEPTOR SEWER
DONOHUE PROJECT 11678
WILLMAR, MINNESOTA

DATE: 10/13/10 BORING #: B-11
START TIME: 8:45 END TIME: 9:37

METHOD: 3 1/4" I.D. Hollow Stem Auger
CREW: RB / CKA
ELEVATION: N/A

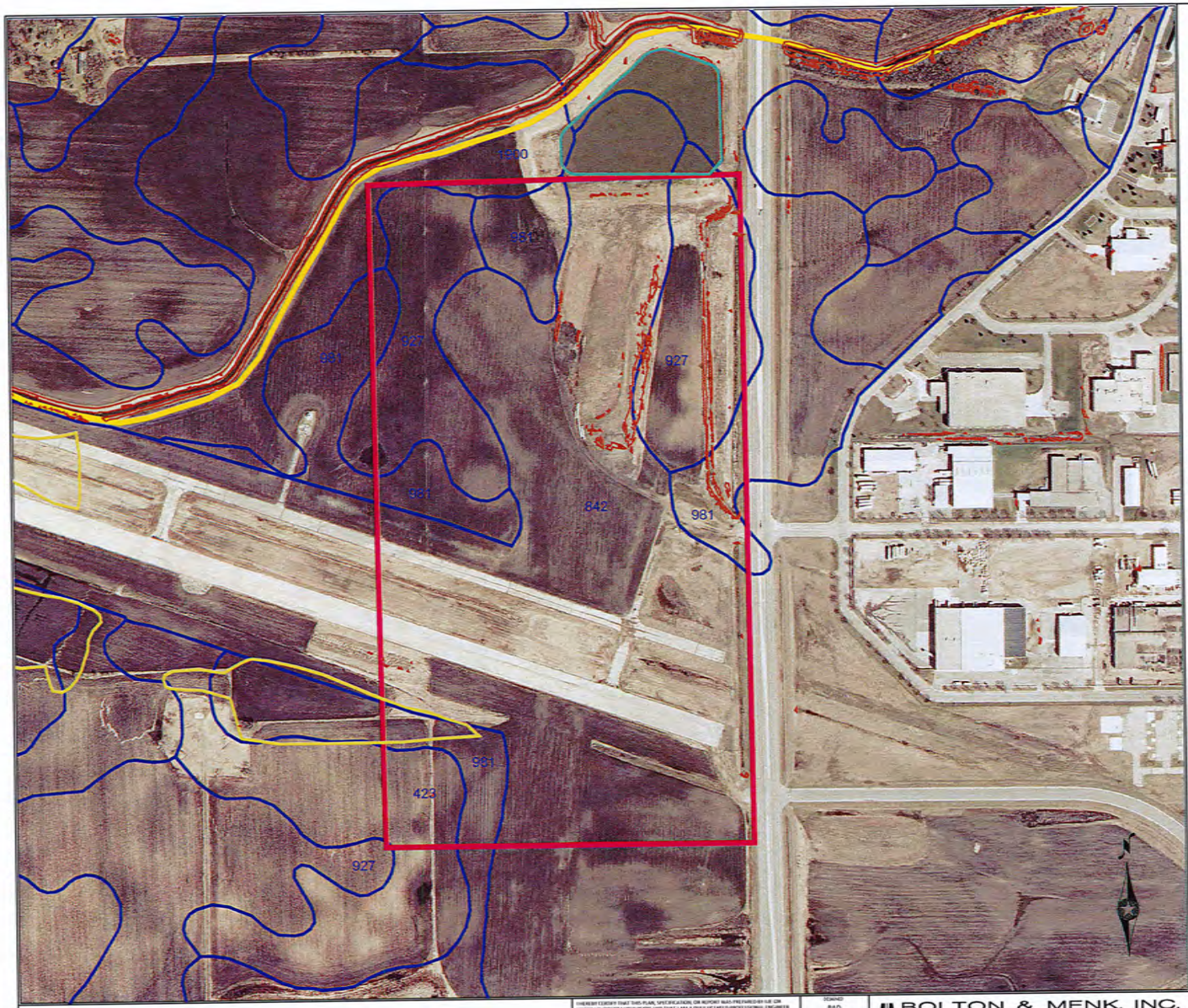
LOCATION: See Boring Location Plan

Depth (Feet)	ASTM Symbol	Soil Description	Sample #	N Value	Water Table	Notes
	SM	SILTY SAND, fine to medium grained, dark brown, FILL				
				8		
5.0				4		
				5		
10.0				4		
	SC	CLAYEY SAND, fine grained, with a trace of GRAVEL, brown, mottled.				
13.5						
	SM	SILTY SAND, fine grained, brown, mottled.		11	V	Water encountered at 14.0 feet during drilling.
15.0						
16.0						
	SP	POORLY GRADED SAND, fine to medium grained, with a trace of GRAVEL, brown.				
				11		
20.0						
22.0						
	CL	SANDY LEAN CLAY, with fine grained SAND, grey.				
				1		
25.0						
				4		
30.0						
		Boring Complete to 30.0 feet. Water encountered at 14.0 feet during drilling. No water measured to cave-in at 11.0 feet on 10-13-10.				Borehole sealed with bentonite grout.

Unified Soil Classification (USC) System (from ASTM D 2487)

Major Divisions			Group Symbol	Typical Names
Course-Grained Soils More than 50% retained on the 0.075 mm (No. 200) sieve	**Gravels** 50% or more of course fraction retained on the 4.75 mm (No. 4) sieve	Clean Gravels	GW	Well-graded gravels and gravel-sand mixtures, little or no fines
			GP	Poorly graded gravels and gravel-sand mixtures, little or no fines
		Gravels with Fines	GM	Silty gravels, gravel-sand-silt mixtures
			GC	Clayey gravels, gravel-sand-clay mixtures
	Sands 50% or more of course fraction passes the 4.75 (No. 4) sieve	Clean Sands	SW	Well-graded sands and gravelly sands, little or no fines
			SP	Poorly graded sands and gravelly sands, little or no fines
		Sands with Fines	SM	Silty sands, sand-silt mixtures
			SC	Clayey sands, sand-clay mixtures
Fine-Grained Soils More than 50% passes the 0.075 mm (No. 200) sieve	**Silts and Clays** Liquid Limit 50% or less		ML	Inorganic silts, very fine sands, rock four, silty or clayey fine sands
			CL	Inorganic clays of low to medium plasticity, gravelly/sandy/silty/lean clays
			OL	Organic silts and organic silty clays of low plasticity
	Silts and Clays Liquid Limit greater than 50%		MH	Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts
			CH	Inorganic clays or high plasticity, fat clays
			OH	Organic clays of medium to high plasticity
Highly Organic Soils			PT	Peat, muck, and other highly organic soils

Prefix: G = Gravel, S = Sand, M = Silt, C = Clay, O = Organic
Suffix: W = Well Graded, P = Poorly Graded, M = Silty, L = Clay, LL < 50%, H = Clay, LL > 50%



LEGEND

- PROJECT BOUNDARY
- SOIL TYPE
- IMPAIRED, SPECIAL OR PROTECTED WATERS
- NATIONAL WETLANDS INVENTORY
- STEEP SLOPES (>33.3%)
- WETLAND BUFFER
- EXISTING STORMWATER POND

SOIL TYPE SUMMARY

Map Unit Symbol	Soil Name	Hyd. Soil Group	Erodibility
MUSYM	MUNAME	HYDGRP	MUHELCL
1900	OKOBOJI-CANISTEO SILTY CLAY LOAMS, DEPRESSIONAL	C/D	PHEL
423	SEAFORTH LOAM	C	PHEL
842	URBAN LAND-UDORTHENTS COMPLEX	C	PHEL
927	HARPS-SEAFORTH-OKOBOJI COMPLEX	B/D	PHEL
981	CANISTEO-HARPS LOAMS	B/D	PHEL

NHEL - Not Highly Erodible Land
PHEL - Potentially Highly Erodible Land
HEL - Highley Erodible Land

0 200 400
SCALE FEET

P:\WILLI\W181078\427\CAD\181784COMPPP_SOILS MAP.dwg

I HEREBY CERTIFY THAT THIS PLAN, SPECIFICATION, OR REPORT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MINNESOTA.

JARED A. VOGE, P.E.
LIC. NO. 45063 DATE XX/XX/XXXX

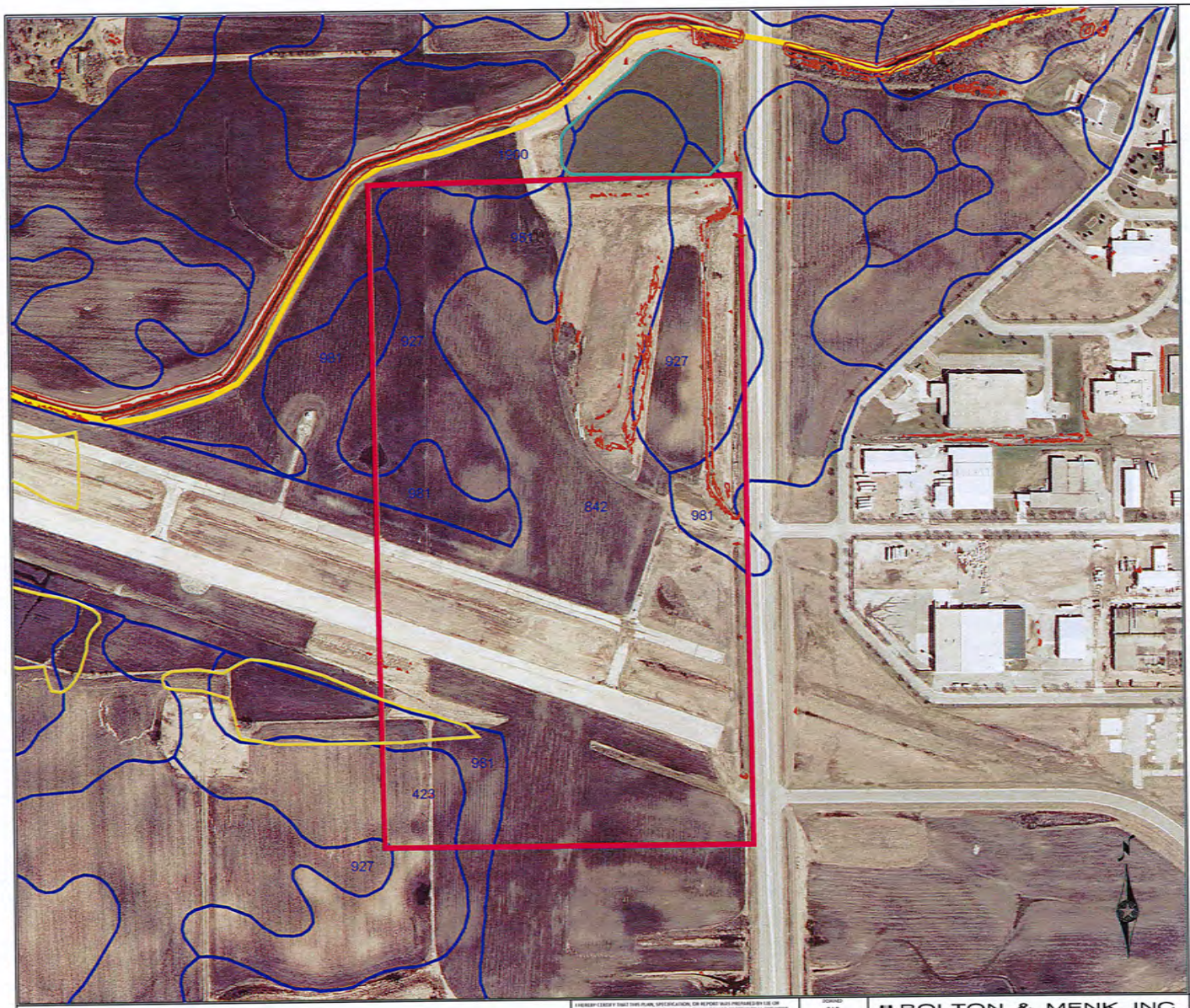
DESIGNED PAD
DRAWN EPA
CHECKED NDH

BOLTON & MENK, INC.
Consulting Engineers & Surveyors
MANKATO, MN FAIRMONT, MN SLEEPY EYE, MN BURNSVILLE, MN WILLMAR, MN
CHASKA, MN RAMSEY, MN MAPLEWOOD, MN BAXTER, MN ROCHESTER, MN
AMES, IA SPENCER, IA DES MOINES, IA FARGO, ND

REV.	BY	DATE

CITY OF WILLMAR, MINNESOTA
INDUSTRIAL PARK 4TH ADDITION
STORM WATER POLLUTION PREVENTION PLAN
SITE AND SOILS MAP

SHEET 8.3



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