STRUCTURE GEOTECHNICAL REPORT
MAIN STREET OVER I & M CANAL TRIBUTARY
CULVERT 1 AT STATION 16+73.00
PR SN 016-0924, SECTION 2020-142-C&DR
LEMONT, COOK COUNTY, ILLINOIS

For
Mott MacDonald
10 South LaSalle Street, Suite 2520
Chicago, IL 60603

Submitted by
Wang Engineering, Inc.
1145 North Main Street
Lombard, IL 60148

Original Report: December 17, 2021
Revised Report: March 15, 2023

Technical Report Documentation Page

1. Title and Subtitle Structure Geotechnical Report, Culvert at Station 16+73.00 Main Street from Wheeler Road to Illinois 83 (Archer Avenue)		**2. Original Date:** December 17, 2021 **Revised Date:** March 15, 2023 **3. Report Type** ☒ SGR ☐ RGR ☐ Draft ☒ Final ☒ Revised
4. Route / Section / County/ District/ Region FA3587/ 2020-142-C &DR/ Cook/ 1/ 1		**5. IDOT Job / Contract** D-91-449-20 / 62L30
6. PTB / Item No. 196/006	**7. Existing Structure Number(s)** 016-0924	**8. Proposed Structure Number(s)** 016-0924
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11. Abstract

The existing structure that carries Main Street over I&M Canal Tributary will be replaced. The proposed culvert will be a cast-in-place double-cell box culvert with an interior opening of 8-foot wide and 5-foot high. The culvert will have a length of 51.0 feet, a total width of 18.3 feet, and up to 8.5 feet of embankment fill on the top.

Beneath the surface and up to 3.2 feet of fill, the soil is made up of very soft to medium stiff silty clay to silty clay loam or very loose very dense sandy gravel interbedded with very soft to stiff silty clay loam extending to sound bedrock. The sound dolostone bedrock is present at elevation of 580.3 feet or at 3.0 to 4.2 feet below the proposed invert elevations. Additionally, sampler refusal was noted in downstream end boring at elevation of 585.2 feet (5.5 bgs) indicating possible cobble or weathered bedrock. Groundwater was encountered while drilling at elevations of 586 to 591 feet (0.0 to 16.3 feet bgs) and was measured at elevations of 582 to 591 feet (0.0 to 20.0 feet bgs) upon completion of drilling.

At the culvert base, we recommend removing very soft to stiff silty clay loam to an elevation of 584.5 feet at the upstream half and elevation of 584.0 feet at the downstream half. The replacement material could be IDOT CA-6 or IDOT District One "Aggregate Subgrade Improvement" materials.

Since the proposed culvert will be a cast-in-place culvert, horizontal cantilever and L-type walls typically are considered. T-type wall and flexible walls such as sheet pile wall and soldier pile and lagging walls could also be considered. Since installation of sheet pile walls will be difficult due the presence of dense to very dense granular soils at the embedment depths, we do not recommend the use of sheet pile wall or driven solider pile and lagging wall. We have provided geotechnical parameters for potential wall types.

Since the groundwater encountered up to 4 feet above culvert base slab elevations, the contractor should be prepared for special dewatering measures. For the replacement of culvert and to maintain the traffic along Main Street, temporary soil retention system will be required. The TSRS can be included as Pay Item.

12. Path to archived file

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Wang Engineering

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MAIN STREET OVER I & M CANAL TRIBUTARY
CULVERT AT STATION 16+73.00
PR SN 016-0917, SECTION 2020-142-C&DR
LEMONT, COOK COUNTY, ILLINOIS
FOR
MOTT MACDONALD

1.0 INTRODUCTION

This report presents the results of our subsurface investigation, laboratory testing, geotechnical evaluations, and recommendations to support the design and construction of replacement of culvert for Main Street over I & M Canal Tributary at Station 16+73.00 in the Village of Lemont, Cook County, Illinois. On the USGS *Sag Bridge Quadrangle 7.5 Minute Series* map, the project site is generally located at SW¼ of Section 21, Township 37N, Range 11E of the Third Principal Meridian. A *Site Location Map* is presented as Exhibit 1.

The purpose of this investigation was to characterize the site soil and groundwater conditions, perform geotechnical analyses, and provide recommendations for the design and construction of the proposed culvert.

1.1 Proposed Structure

Based on *General Plan and Elevation (GPE) sheets* (Appendix D) provided on March 9, 2023 prepared by Lochner, Wang Engineering, Inc. (Wang) understands the existing structure will be removed and replaced with a cast-in-place double-cell box culvert with an interior opening of 8-foot wide and 5-foot high. The culvert has proposed invert elevations of 587.27 and 586.00 feet at the upstream and downstream ends, respectively. The culvert will have a length of 51.0 feet and total width of 18.3 feet with up to 8.5 feet of embankment fill on the top. The proposed wingwalls type will be drilled soldier pile wingwalls at the upstream and downstream ends. The structure replacement will be done on staged construction to maintain traffic on Main Street.

1.2 Existing Structure and Land Use

The existing structure was constructed circa 1900 and widened circa 1980. The structure consists of a simple span reinforced concrete slab, measuring 17 feet between face-to-face abutments and 48.5 feet out-to-out width. Original bridge abutments supported stacked-and-mortared limestone block walls and widened portion supported reinforced wall-type abutment. The existing structure will be completely removed. The surrounding land of the structure is generally wooded area with railway tracks and canal on the north side.

2.0 METHODS OF INVESTIGATION

The following sections outline the field and laboratory investigations performed by Wang.

2.1 Field Investigation

The field investigation consisted of three structure borings, designated as CUL-01-01 through CUL-01-03 drilled by Wang from October 6 to October 12, 2021. The as-drilled northings and eastings were obtained with a mapping-grade GPS unit. Elevations, station and offsets were provided by Mott MacDonald. As-drilled boring locations are presented in the *Boring Logs* (Appendix A) and are shown in the *Boring Location Plan* (Exhibit 2).

A truck-mounted drilling rig, equipped with hollow stem augers, was used to advance and maintain open boreholes. Soil sampling was performed according to AASHTO T206, *"Penetration Test and Split Barrel Sampling of Soils."* The soil in the Borings CUL-01-02 and CUL-01-03 was sampled at 2.5-foot intervals to the boring termination depths or top of bedrock whereas the soil in Boring CUL-01-01 was sampled continuously to the sampler refusal using geoprobe sampler. Bedrock cores were obtained in Borings CUL-01-02 and CUL-01-03 in 10-foot runs with an NW4-sized core barrel. Soil samples collected from each sampling interval were placed in sealed jars and transported to the laboratory for further examination and laboratory testing. Additionally, a bulk sample was collected in Boring CUL-01-01 for further hydraulic analysis.

Field boring logs, prepared and maintained by Wang geologists, include lithological descriptions, visual-manual soil (IDH Textural) classifications, results of Rimac and pocket penetrometer unconfined compressive strength tests, and results of Standard Penetration Tests (SPT) recorded as blows per 6 inches of penetration.

Groundwater levels were measured while drilling and at completion of each boring. Each borehole was backfilled upon completion with lean grout and bentonite chips. The pavement surface was restored as close as possible to its original condition.

2.2 Laboratory Testing

The soil samples were tested in the laboratory for moisture content (AASHTO T265). Atterberg limits (AASHTO T89 and T90) and particle size analyses (AASHTO T88) were performed on a selected SPT and bulk samples. An unconfined compressive strength test (AASHTO T22) was performed one selected intact bedrock core. Tested samples were classified according to the IDH classification system. Field visual descriptions of the soil samples were verified in the laboratory. Laboratory test results are shown in the *Boring Logs* (Appendix A) and in the *Laboratory Test Results* (Appendix B). Additionally, a bulk sample was tested for scour analysis.

3.0 INVESTIGATION RESULTS

Detailed descriptions of the soil conditions encountered during the subsurface investigation are presented in the attached *Boring Logs* (Appendix A) and in the *Soil Profile* (Exhibit 3). Please note that strata contact lines represent approximate boundaries between soil types. The actual transition between soil types in the field may be gradual in horizontal and vertical directions.

3.1 Lithological Profile

Boring CUL-01-01, drilled at the downstream end, encountered 5 inches of sandy gravel at the surface. Borings CUL-01-02, drilled on the Main Street encountered pavement consisting of 10 inches of asphalt overlying 8 inches of concrete followed by 1.7-feet thick sandy gravel. Boring CUL-01-03, drilled on the Main Street shoulder encountered 13-inch thick asphalt over 5-inch thick sandy gravel. In descending order, the general lithologic succession encountered beneath the surface includes: 1) man-made ground (fill); 2) very soft to medium stiff silty clay loam; 3) very loose to very dense sandy gravel; and 3) dolostone bedrock.

1) Man-made ground (fill)

Beneath the pavement, Borings CUL-01-02 and CUL-01-03 encountered 1.0 to 3.2 feet of medium stiff to very stiff, brown clay loam to silty clay loam fill with unconfined compressive strength (Q_u) values of 0.5 and 1.0 tsf and a moisture content value of 32%.

2) Very soft to medium stiff silty clay loam

Beneath the surface, Boring CUL-01-01 encountered 5.0 feet of very soft to medium stiff, gray and black silty clay loam with Q_u values of less than 0.25 to 0.5 tsf and moisture content values of 22 to 40%.

3) Very loose to very dense sandy gravel

At elevations of 595.8 to 599.8 feet, the borings encountered very loose to very dense, brown and gray to gray, damp to saturated sandy gravel interbedded with very soft to stiff silty clay loam to silty loam. The unit has SPT-N values of 3 blows to over 50 blows for 1 to 11 inches of sampler penetration. The interbedded cohesive soils have Q_u values of less than 0.25 to 1.0 tsf with moisture content values of 25 and 48%. Boring CUL-01-01 encountered sampler refusal at an elevation of 585.2 feet, indicating possible cobble or weathered bedrock. Hard drilling conditions were noted within this unit.

4) Dolostone bedrock

At an elevation of 580.3 feet (22 feet bgs), Borings CUL-01-02 and CUL-01-03 encountered very strong and poor to fair quality dolostone bedrock. The dolostone is slightly to moderately weathered with horizontal and oblique joints. The rock quality designation (RQD) values range from 49 to 62%, classifying the bedrock as poor to fair. Laboratory testing on an intact rock core specimen showed a uniaxial compressive strength of 11,485 psi. *Bedrock Core Photographs* are attached in Appendix C.

3.2 Groundwater Conditions

Groundwater was encountered while drilling at elevations of 586 to 591 feet (0.0 to 16.3 feet bgs) and was measured in open boreholes at elevations of 582 to 591 feet (0.0 to 20.0 feet bgs) upon completion of drilling. We estimate the long-term groundwater elevation at 586 feet.

4.0 ANALYSES AND RECOMMENDATIONS

In the following sections, we present the results of our analyses and recommendations for the proposed culvert and wingwalls.

4.1 Scour Considerations

The design scour elevation should be taken at the bottom of the cutoff wall (IDOT 2012). For horizontal cantilever wingwalls, the cutoff walls are established 3.0 feet below the culvert invert elevations. To prevent local erosion, we recommend placing stone riprap or a concrete apron at the

ends of the culvert. This will also prevent sediments from entering and accumulating in the culvert, minimize long term maintenance, and provide protection to the stream bed at the interface.

4.2 Culvert Foundations

Based on the subsurface investigation, the soils at the base of culvert barrel are expected to be medium dense sandy gravel or very soft silty clay loam. Prior to culvert barrel construction, we recommend removing very soft to stiff silty clay loam to an elevation of 584.5 feet at the upstream half of the culvert and to an elevation of 584.0 feet at the downstream of the culvert. The replacement material could be IDOT CA-6 or IDOT District One "*Aggregate Subgrade Improvement*" materials. The removal and replacement material should extend a minimum of two foot beyond the edge of the box. The actual extent of the removal should be determined in the field by a geotechnical soil inspector at the time of construction. It should be noted that the groundwater table can be as high as 591 feet elevation, thus water control will be needed during construction.

We estimate the foundation soils will experience long-term settlement of 0.5 inches or less with a differential settlement of 0.5 inches or less. Based on our geotechnical analysis both precast or cast-in-place culverts are feasible at this site.

4.3 Wingwalls

Based on the GPE, we understand drilled soldier pile and lagging walls are proposed at the upstream and downstream ends. The proposed wingwalls will have a maximum retained height of 15 feet. We do not recommend driven sheet pile or soldier pile and lagging walls due to very dense sandy gravel and shallow bedrock. Other wingwall types such as horizontal cantilever wingwalls or T-type walls could also be considered for the cast-in-place culvert.

The horizontal cantilever wingwalls are supported by the culvert box rather than the foundation soils. Horizontal cantilever wingwalls should be designed based on the guidelines provided in Section 4.2 of the IDOT *Culvert Manual* (2017).

For the cast-in-place T-type walls, the footings should be established at a depth such that they would be at least 4 feet below culvert barrel invert elevation. Footing will be established at elevation of 583.3 feet. Based on the Boring CUL-01-03, saturated very dense sandy gravel is expected to be encountered at T-type wall footing. The T-type walls could be designed based on a maximum factored resistance of 4,000 psf, determined with a bearing resistance factor of 0.45

(AASHTO 2020). The wingwalls should be sized and designed based on the information and typical sections shown in Section 4.4 of the IDOT *Culvert Manual* (IDOT 2017).

The drilled soldier pile and lagging wingwalls should be designed for both lateral earth pressure and lateral deformation. The embedment depth in moment equilibrium for the wingwalls should be designed in accordance with LRFD guidelines (AASHTO 2020) using long-term (drained) soil parameters in Tables 1 and 2 for the upstream end and downstream wingwalls, respectively. The design of the wall should ignore 3 feet of soil in front of the wall measured from finished ground surface elevation in providing passive pressure due to the frost-heave condition. Drainage behind the wall and underdrain should be as per IDOT Bridge Manual (IDOT 2012). The water pressure should be added to the earth pressure if drainage is not provided. The design of walls should consider the groundwater elevation as high as 591 feet.

Table 1: Geotechnical Parameters for Design of Soldier Pile Wingwalls at Upstream End

Reference Boring: CUL-01-03

Soil Description Elevation	Unit Weight, γ (pcf)	Drained Shear Strength Properties		Earth Pressure Coefficients	
		Cohesion (psf)	Friction Angle (°)	Active Pressure (Straight)	Passive Pressure (Straight)
M Stiff CLAY LOAM FILL Surface to EL 599.8 feet	120	0	29	0.35	2.88
Loose to M Dense SANDY GRAVEL EL 599.8 to 594.3 feet	120	0	30	0.33	3.00
Stiff SILTY CLAY LOAM EL 594.3 to 591.8 feet	120	100	30	0.33	3.00
Loose to M Dense SANDY GRAVEL EL 591.8 to 586.0 feet	58 (submerged)	0	30	0.33	3.00
V Soft SILTY CLAY LOAM EL 586.0 to 584.3 feet	48 (submerged)	0	28	0.36	2.77
V Dense SANDY GRAVEL EL 584.3 to 580.3 feet (BR)	58 (submerged)	0	35	0.27	3.69

Table 2: Geotechnical Parameters for Design of Soldier Pile Wingwalls at Downstream End
Reference Borings: CUL-01-01 and CUL-01-02

Soil Description / Elevation	Unit Weight, γ (pcf)	Drained Shear Strength Properties		Earth Pressure Coefficients	
		Cohesion (psf)	Friction Angle (°)	Active Pressure (Straight)	Passive Pressure (Straight)
M Stiff to Stiff SILTY CLAY LOAM FILL Surface to EL 595.8 feet	120	0	29	0.35	2.88
V Loose to V Dense SANDY GRAVEL EL 595.8 to 584.8 feet	58 (submerged)	0	30	0.33	3.00
Stiff SILTY CLAY LOAM to SILTY LOAM EL 584.8 to 581.8 feet	58 (submerged)	100	30	0.33	3.00
WEATHERED BEDROCK EL 581.8 to 580.3 feet (BR)	58 (submerged)	0	35	0.27	3.69

Design considerations should also establish deflection control at the top of drilled soldier pile wall. The estimated soil and rock parameters that may be used to analyze deflection of the wall using COMP 624P, LPILE or any other programs are presented in Tables 3 to 5.

Table 3: Recommended Soil Parameters for Lateral Load Analysis of Soldier Pile Wingwalls at Upstream
Reference Boring: CUL-01-03

Soil Description / Elevation Range (feet)	Unit Weight, γ (pcf)	Undrained Shear Strength, c_u (psf)	Estimated Friction Angle, Φ (°)	Estimated Lateral Soil Modulus Parameter, k (pci)	Estimated Soil Strain Parameter, ε_{50} (%)
M Stiff CLAY LOAM FILL Surface to EL 599.8 feet	115	500	0	100	0.7
Loose to M Dense SANDY GRAVEL EL 599.8 to 594.3 feet	120	0	30	30	--
Stiff SILTY CLAY LOAM EL 594.3 to 591.8 feet	120	1800	0	500	0.5

Soil Description Elevation Range (feet)	Unit Weight, γ (pcf)	Undrained Shear Strength, c_u (psf)	Estimated Friction Angle, Φ (°)	Estimated Lateral Soil Modulus Parameter, k (pci)	Estimated Soil Strain Parameter, ε_{50} (%)
Loose to M Dense SANDY GRAVEL EL 591.8 to 586.0 feet	58 (submerged)	0	30	50	--
V Soft SILTY CLAY LOAM EL 586.0 to 584.3 feet	48 (submerged)	500	0	100	0.7
V Dense SANDY GRAVEL EL 584.3 to 580.3 feet (BR)	58 (submerged)	0	35	125	--

Table 4: Recommended Soil Parameters for Lateral Load Analysis of Soldier Pile Wingwalls at Downstream Reference Borings: CUL-01-01 and CUL-01-02

Soil Description Elevation Range (feet)	Unit Weight, γ (pcf)	Undrained Shear Strength, c_u (psf)	Estimated Friction Angle, Φ (°)	Estimated Lateral Soil Modulus Parameter, k (pci)	Estimated Soil Strain Parameter, ε_{50} (%)
M Stiff to Stiff SILTY CLAY LOAM FILL Surface to EL 595.8 feet	120	700	0	100	0.7
V Loose to V Dense SANDY GRAVEL EL 595.8 to 584.8 feet	58 (submerged)	0	30	30	--
Stiff SILTY CLAY LOAM to SILTY LOAM EL 584.8 to 581.8 feet	58 (submerged)	1000	0	500	0.5
WEATHERED BEDROCK EL 581.8 to 580.3 feet (BR)	58 (submerged)	0	35	125	--

Table 5: Recommended Bedrock Parameters for Lateral Load Analysis of Soldier Pile Wingwalls
Reference Boring: CUL-01-03

Bedrock	Total Unit Weight, γ (pcf)	Modulus of Rock Mass (ksi)	Uniaxial Compressive Strength (psi)	RQD (%)	Strain Factor
Dolostone	140	300	10,000 (Estimated)	49	0.0005

4.4 Global Stability

Since the horizontal cantilever walls are proposed at the downstream end, we do not anticipate global instability concerns for wingwalls. For the T-type wall, global stability analysis will be performed when cross-section drawing becomes available.

5.0 CONSTRUCTION CONSIDERATIONS

5.1 Site Preparation

The existing vegetation, surface topsoil, pavement, and debris should be cleared and stripped where the foundations will be placed.

5.2 Excavation, Dewatering, and Utilities

Excavations should be performed in accordance with local, state, and federal regulations. The potential effect of ground movements upon nearby roadways and utilities should be considered during construction. Any excavation that cannot be sloped 1:2.5 (V:H) should be properly shored Temporary Soil Retention Systems (TSRS). The TSRS can be included as *Pay Item*. Due to the very dense weathered bedrock followed by sound bedrock, temporary sheet piling design is not feasible using IDOT *Design Guide 3.3.13* (IDOT 2012).

The groundwater was observed at elevations 586 to 591 feet in borings that is up to 4 feet above the proposed culvert base slab. The contractor should be prepared for special dewatering measures. Depending upon prevailing climate conditions and the time of the year when wingwalls construction taken place, control runoff and maintenance of existing flows may require temporary water diversion and control. Any water that accumulates in open excavations by seepage or runoff should be immediately removed by sump pump.

T-type wall will also require special dewatering measures. For the drilled soldier pile installation, the contractor should be prepared to use temporary casing to top of bedrock.

Unstable or unsuitable materials exposed during excavation should be removed and replaced with fill material as described in Section 4.2. Geotechnical and field engineer may extend or reduce the limits of excavation based on soil condition encountered during construction. The following note should be included:

The limits and quantities of removal and replacement shown are based on the boring data and may be modified by the District Geotechnical and Field Engineers for variable subsurface conditions encountered in the field.

In case, below the box culvert where dewatering and compaction is not possible, rockfill shall be used and the following note should be added:

The Rockfill shall be capped with 6 inches of CA7 and satisfy the Standard Specifications unless otherwise indicated in the Special Provisions. The cost of the capping material shall be included in the pay item for Rockfill.

5.3 Filling and Backfilling

Fill used as embankment material and for replacement of any unstable or unsuitable soils encountered during construction should be pre-approved by the Engineer. The material used to backfill around and to a level at least 1 foot over the top of the culvert box, should be porous granular material conforming to the requirements specified in the IDOT 2022 Standard Specifications (IDOT 2022).

5.4 Drilled Soldier Pile Construction

Drilled soldier pile should be constructed in accordance with IDOT 2022 *Standard Specifications* Section 522, *Retaining Wall* (IDOT 2022).

5.5 Earthwork Operations

The required earthwork can be accomplished with conventional construction equipment. Moisture and traffic will cause deterioration of exposed subgrade soils. Precautions should be taken by the Contractor to prevent water erosion of the exposed subgrade. A compacted subgrade will minimize water runoff erosion.

Earth moving operations should be scheduled to not coincide with excessive cold or wet weather (early spring, late fall or winter). Any soil allowed to freeze or soften due to the standing water should be removed. Wet weather can cause problems with subgrade compaction.

It is recommended that an experienced geotechnical engineer be retained to inspect the exposed subgrade, monitor earthwork operations, and provide material inspection services during the construction phase of this project.

6.0 QUALIFICATIONS

The analysis and recommendations submitted in this report are based upon the data obtained from the borings drilled at the locations shown on the boring logs and in Exhibit 2. This report does not reflect any variations that may occur between the borings or elsewhere on the site, variations whose nature and extent may not become evident until the course of construction. If changes are planned to the proposed improvements as described in this report, we should be timely informed so that our recommendations can be adjusted accordingly.

It has been a pleasure to assist Mott MacDonald and the Illinois Department of Transportation and Highways on this project. Please call if there are any questions, or if we can be of further service.

Respectfully Submitted,

WANG ENGINEERING, INC.

Metin W. Seyhun, P.E
Project Manager

Nesam S. Balakumaran, P.Eng.
Project Geotechnical Engineer

Corina T. Farez, P.E., P.G.
QA/QC Reviewer

REFERENCES

IDOT (2017) *Culvert Manual.* Illinois Department of Transportation.

IDOT (2022) *Standard Specifications for Road and Bridge Construction.* Illinois Department of Transportation. 1098 pp.

IDOT (2020) *Geotechnical Manual*, Illinois Department of Transportation.

IDOT (2020) *Supplemental Specifications and Recurring Special Provisions*

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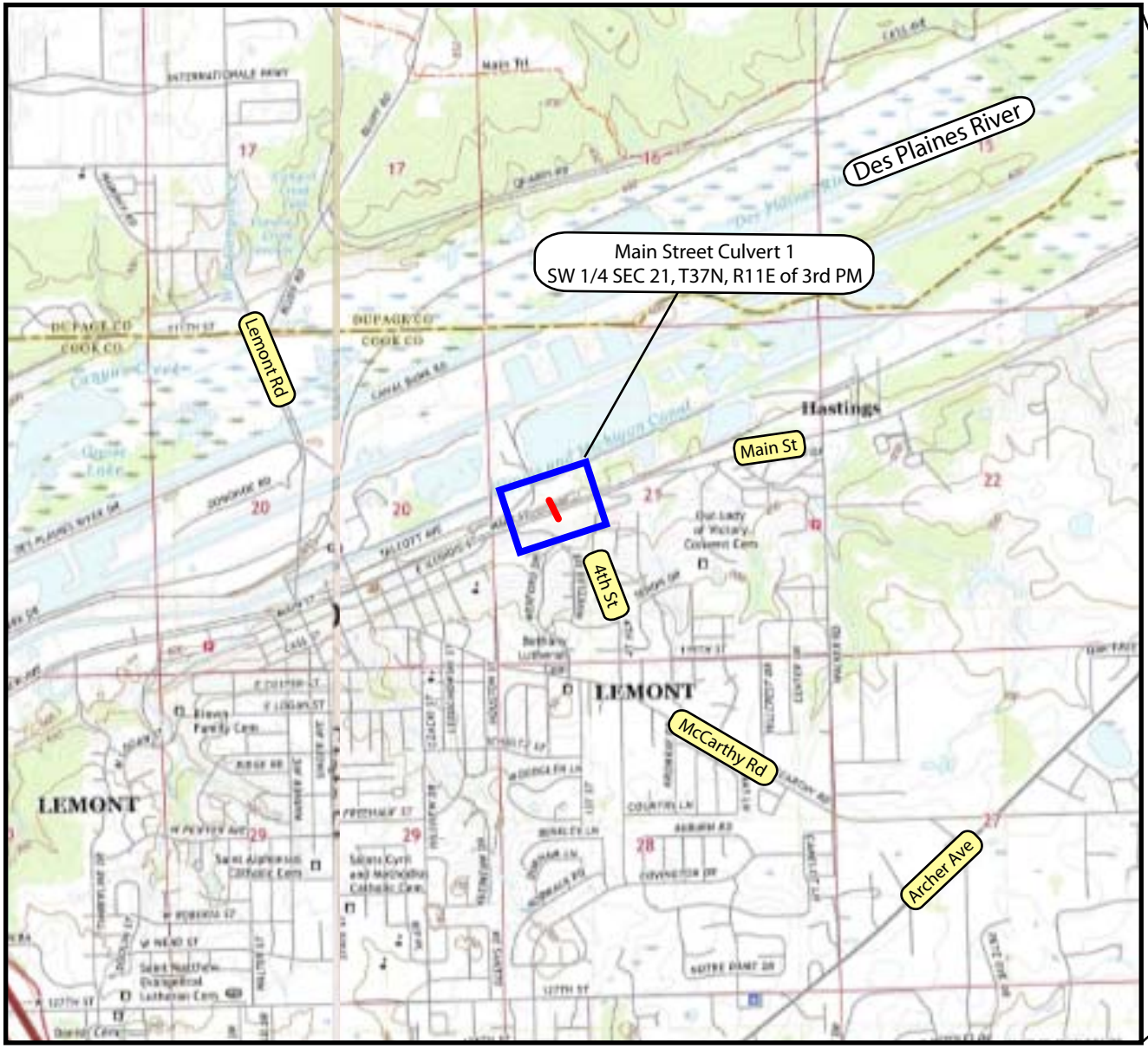
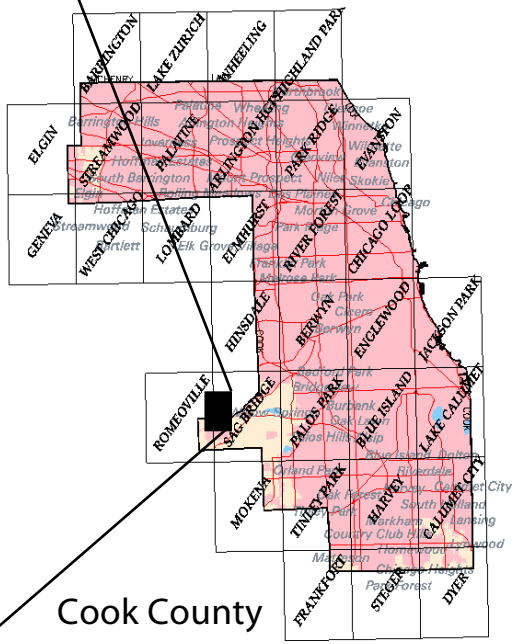
EXHIBITS





SITE LOCATION MAP: MAIN STREET CULVERT 1; CONTRACT D-91-449-20, PTB 196-006, COOK COUNTY, ILLINOIS

SCALE: GRAPHICAL	EXHIBIT 1	DRAWN BY: J. Bensen CHECKED BY: M. Seyhun

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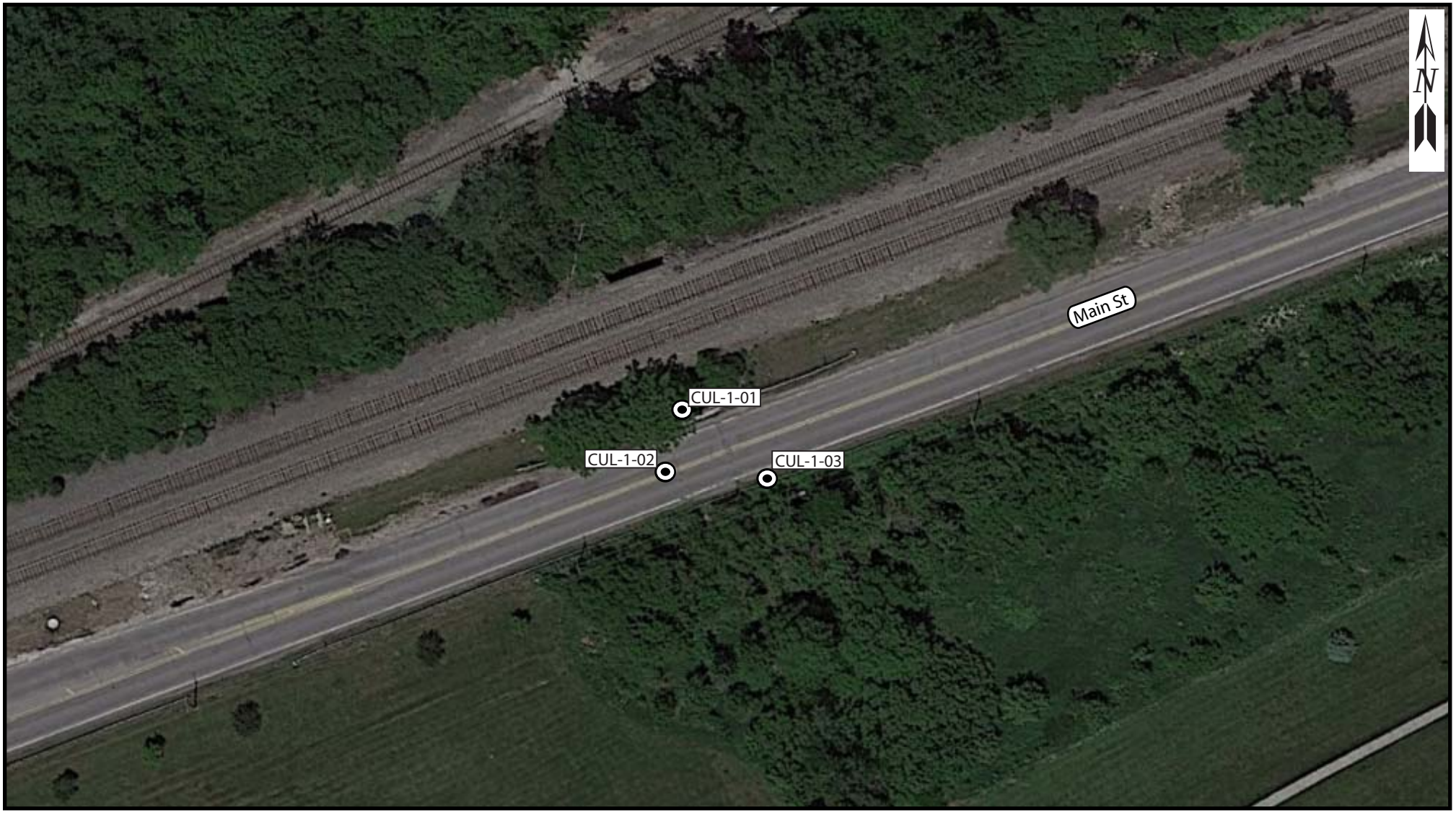
FOR MOTT MCDONALD	269-02-01



0 100 200 Feet

Legend

Boring Location

BORING LOCATION PLAN: MAIN STREET CULVERT 1; CONTRACT D-91-449-20, PTB 196-006, COOK COUNTY, ILLINOIS

SCALE: GRAPHICAL	EXHIBIT 2	DRAWN BY: J. Bensen CHECKED BY: M. Seyhun

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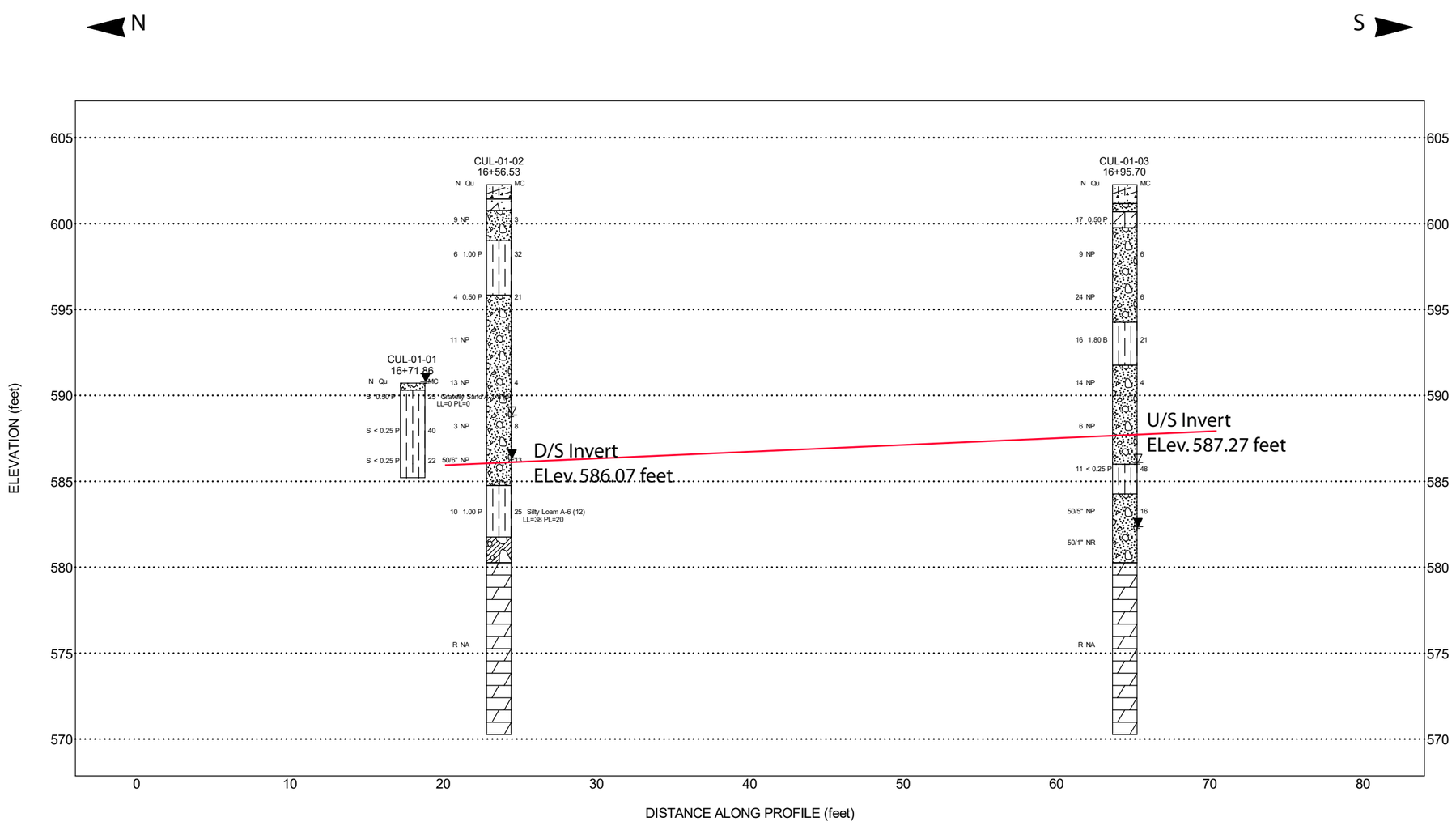
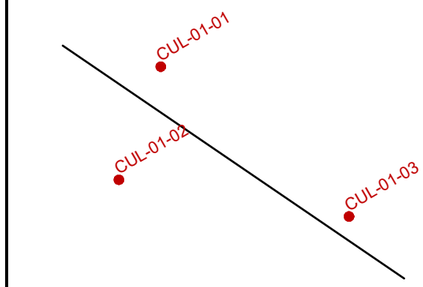
FOR MOTT MCDONALD | 269-02-01



Lithology Graphics

- Gravelly sand, sandy gravel
- IDH Silty Clay, Silty Clay Loam
- Pavement
- Concrete
- Weathered bedrock
- Dolomite or Dolomitic Limestone
- IDH Clay Loam



Site Map Scale 1 inch equals 30 feet

Explanation:

CUL-01-01
16+71.86 — Borehole Number
Station

Borehole Lithology

N--N-value, (blw/12 in)
Qu--UC Strength, (tsf)
MC--Moisture Content, (%)

Water Level Reading at time of drilling.

Water Level Reading 24-hr after drilling or at end of drilling

0 8

Horizontal Scale (feet)

Vertical Exaggeration: 1x

Wang Engineering, Inc.
1145 N. Main Street
Lombard/IL/60148

Soil Profile
Main Street over Tributary to I&M Canal
SN xxx-xxxx

Main Street Lemont from Wheeler RD to IL 83
Cook County, IL

JOB NUMBER	PLATE NUMBER
269-02-01	EXHIBIT 3

WEI 11X17 2690201.GPJ WANGENG.GDT 12/8/21

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APPENDIX A

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BORING LOG CUL-01-01

WEI Job No.: 269-02-01

Client: **Mott MacDonald**
Project: **Main Street Lemont from Wheeler RD to IL 83**
Location: **Cook County, IL**

Datum: NAVD 88
Elevation: 590.72 ft
North: 1825433.24 ft
East: 1078829.34 ft
Station: 16+71.86
Offset: 26.71' LT

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
	590.3	5-inch thick, gray SANDY GRAVEL; saturated						
		Very soft to medium stiff, gray and black SILTY CLAY LOAM, trace to little gravel; moist to wet			1	PUSH	0.50 P	25
		--trace organic matter--			2	PUSH	< 0.25 P	40
		--black--	5		3	PUSH	< 0.25 P	22
	585.2	--REFUSAL--						
		Boring terminated at 5.50 ft	10					
			15					
			20					

GENERAL NOTES

Begin Drilling: **10-12-2021** Complete Drilling: **10-12-2021**
Drilling Contractor: **Wang Testing Services** Drill Rig: **Geoprobe HA**
Driller: **R&A** Logger: **M. Sadowski** Checked by: **C. Marin**
Drilling Method: **1" ID HSA; boring backfilled upon completion**

WATER LEVEL DATA

While Drilling: **0.00 ft**
At Completion of Drilling: **0.00 ft**
Time After Drilling: **NA**
Depth to Water: **NA**

The stratification lines represent the approximate boundary between soil types; the actual transition may be gradual.

WANGENGINC 2690201.GPJ WANGENG.GDT 12/11/21

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Fax: 6309539938

BORING LOG CUL-01-02

WEI Job No.: 269-02-01

Client: **Mott MacDonald**
Project: **Main Street Lemont from Wheeler RD to IL 83**
Location: **Cook County, IL**

Datum: NAVD 88
Elevation: 602.26 ft
North: 1825411.34 ft
East: 1078821.23 ft
Station: 16+56.53
Offset: 9.09' LT

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
	601.4	10-inch thick ASPHALT --PAVEMENT--						
	600.8	8-inch thick CONCRETE --PAVEMENT--						
		Loose, gray and brown SANDY GRAVEL; damp --FILL--			1	6 5 4	NP	3
	599.0	Medium stiff to stiff, brown SILTY CLAY LOAM, little gravel; damp --FILL-- --RDR 2--	5		2	3 3 3	1.00 P	32
	595.8	Very loose to very dense, brown and tan to gray SANDY GRAVEL; dry to saturated --RDR 2-4--			3	3 2 2	0.50 P	21
			10		4	4 4 7	NP	
		--rig chatter-- --possible cobbles--			5	12 7 6	NP	4
			15		6	7 1 2	NP	8
					7	50/6"	NP	13
	584.8	Stiff, gray and black SILTY CLAY LOAM to SILTY LOAM, trace gravel; moist --RDR 2-- --trace organic matter-- --L_L(%)=38, P_L(%)=20--	20		8	1 2 8	1.00 P	25

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
	581.8	--%Gravel=5.0-- --%Sand=19.8-- --%Silt=57.4-- --%Clay=17.8-- --A-6 (12)--						
	580.3	--hard drilling from 20.5 to 22.0 feet-- --Weathered BEDROCK--						
		Very strong, light bluish gray, fair quality, DOLOSTONE; Closely spaced, moderately weathered, horizontal joints, with <0.05 inch opening, slightly rough walls, and <0.2 inch thick sand infill. --Run 1: 22.0 to 32.0 feet-- --Recovery: 100%-- --RQD: 62%-- --Drilling rate: 3 min/foot	25		9	CORE		
			30					
	570.3	Boring terminated at 32.00 ft	35					
			40					

GENERAL NOTES

Begin Drilling: **10-08-2021** Complete Drilling: **10-08-2021**
Drilling Contractor: **Wang Testing Services** Drill Rig: **20CME55T[81%]**
Driller: **R&A** Logger: **M. Sadowski** Checked by: **C. Marin**
Drilling Method: **3.25" ID HSA; boring backfilled upon completion**

WATER LEVEL DATA

While Drilling: **13.50 ft**
At Completion of Drilling: **16.00 ft**
Time After Drilling: **NA**
Depth to Water: **NA**

The stratification lines represent the approximate boundary between soil types; the actual transition may be gradual.

WANGENGINC 2690201.GPJ WANGENG.GDT 12/11/21

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BORING LOG CUL-01-03

WEI Job No.: 269-02-01

Client: **Mott MacDonald**
Project: **Main Street Lemont from Wheeler RD to IL 83**
Location: **Cook County, IL**

Datum: NAVD 88
Elevation: 602.26 ft
North: 1825404.23 ft
East: 1078865.79 ft
Station: 16+95.70
Offset: 13.32' RT

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
	601.2	13-inch thick ASPHALT --PAVEMENT--						
	600.7	Brown and gray SANDY GRAVEL; damp --AGGREGATE BASE--			1	7 5 12	0.50 P	
	599.8	Medium stiff, gray and light gray CLAY LOAM, little gravel; damp --FILL-- --RDR 2--			2	5 4 5	NP	6
		Loose to medium dense, brown and gray SANDY GRAVEL; damp --RDR 2 to 3--	5		3	9 15 9	NP	6
	594.3	Medium stiff, brown SILTY CLAY LOAM, little gravel; damp --RDR 2 to 3--	10		4	4 7 9	1.80 B	21
	591.8	Loose to medium dense, gray SANDY GRAVEL; damp to saturated --cobble fragments-- --RDR 3 to 4-- --some to frequent rig chatter, 15.0 to 16.0 feet-- --possible cobbles--	15		5	3 6 8	NP	4
					6	13 3 3	NP	
	586.0	Very soft, gray SILTY CLAY LOAM, little gravel; wet --RDR 1 to 2--			7	4 3 8	< 0.25 P	48
	584.3	Very dense, gray SANDY GRAVEL; saturated --RDR 3--	20		8	6 6 50/5"	NP	16

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
		--possible cobbles--			9	50/1"	NR	
	580.3	Very strong, light gray, poor rock mass quality DOLOSTONE; slightly weathered rock and joints, closely spaced horizontal and oblique joints, with less than 0.2-inch joint opening, hard joint wall, slightly rough joint wall surface, soft infill strength, and less than 0.2-inch infill thickness. --Run 1: 22.0 to 32.0 feet-- --Recovery = 100%-- --RQD = 49%-- --Drilling rate: 3.5 min/foot--	25		10	C O R E		
	570.3	Boring terminated at 32.00 ft	30					
			35					
			40					

GENERAL NOTES

Begin Drilling: **10-06-2021** Complete Drilling: **10-06-2021**
Drilling Contractor: **Wang Testing Services** Drill Rig: **20CME55T[81%]**
Driller: **R&H** Logger: **F. Bozga** Checked by: **C. Marin**
Drilling Method: **3.25" ID HSA; boring backfilled upon completion**

WATER LEVEL DATA

While Drilling: **16.25 ft**
At Completion of Drilling: **20.00 ft**
Time After Drilling: **NA**
Depth to Water: **NA**

The stratification lines represent the approximate boundary between soil types; the actual transition may be gradual.

WANGENGINC 2690201.GPJ WANGENG.GDT 12/11/21

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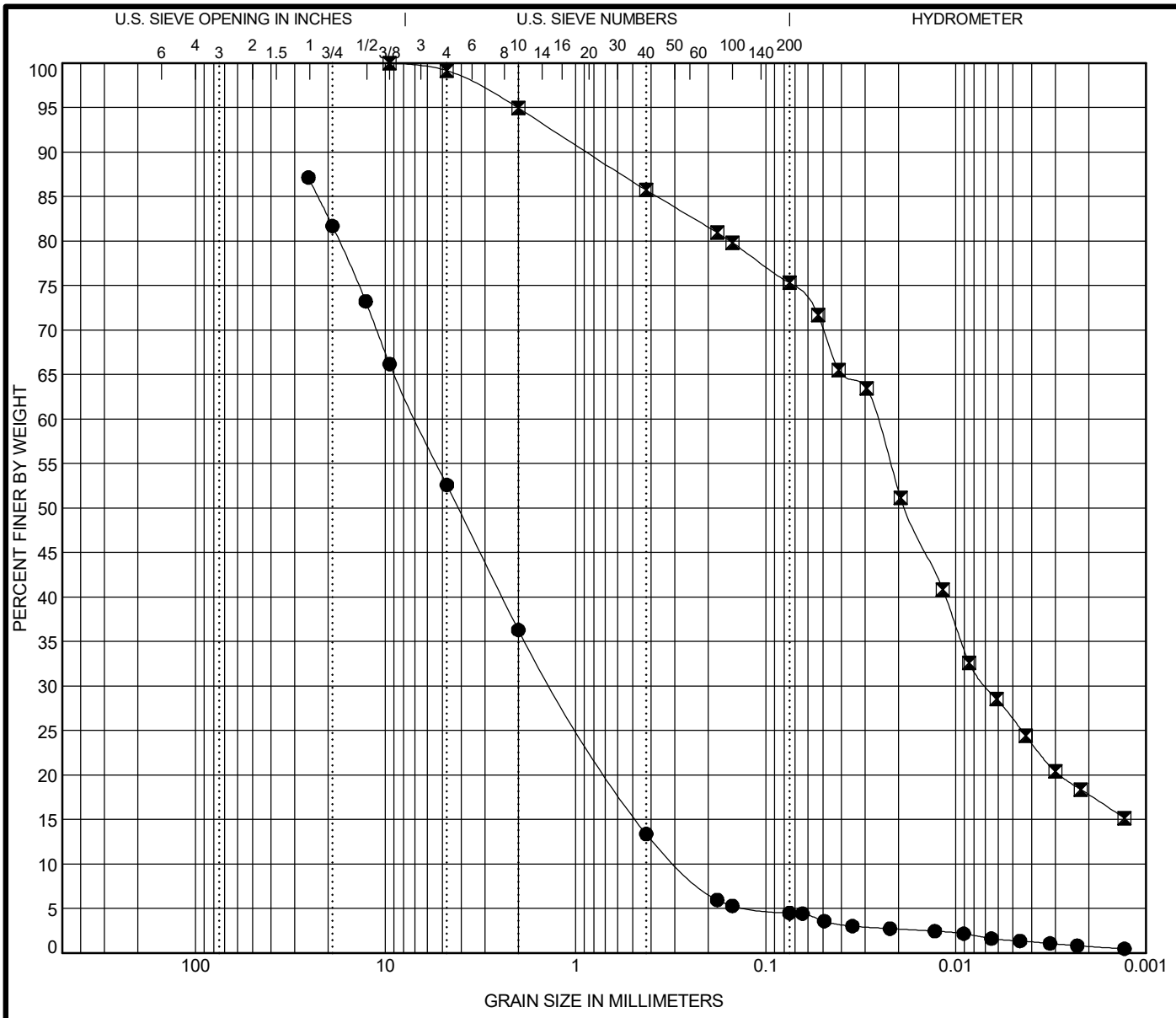
APPENDIX B



COBBLES	GRAVEL	SAND		SILT AND CLAY
		coarse	fine	

	Specimen Identification		IDH Classification	LL	PL	PI	Cc	Cu
●	CUL-01-01#1	0.0 ft	**Gravelly Sand**	**NP**	**NP**	**NP**	**0.86**	**24.11**
⊠	CUL-01-02#8	18.5 ft	**Silty Loam**	**38**	**20**	**18**		

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	CUL-01-01#1	0.0 ft	**25.4**	**6.928**	**1.307**	**0.287**	**63.7**	**31.8**	**3.8**	**0.7**
⊠	CUL-01-02#8	18.5 ft	**9.5**	**0.026**	**0.007**		**5.0**	**19.8**	**57.4**	**17.8**

WEI SINCE 1982

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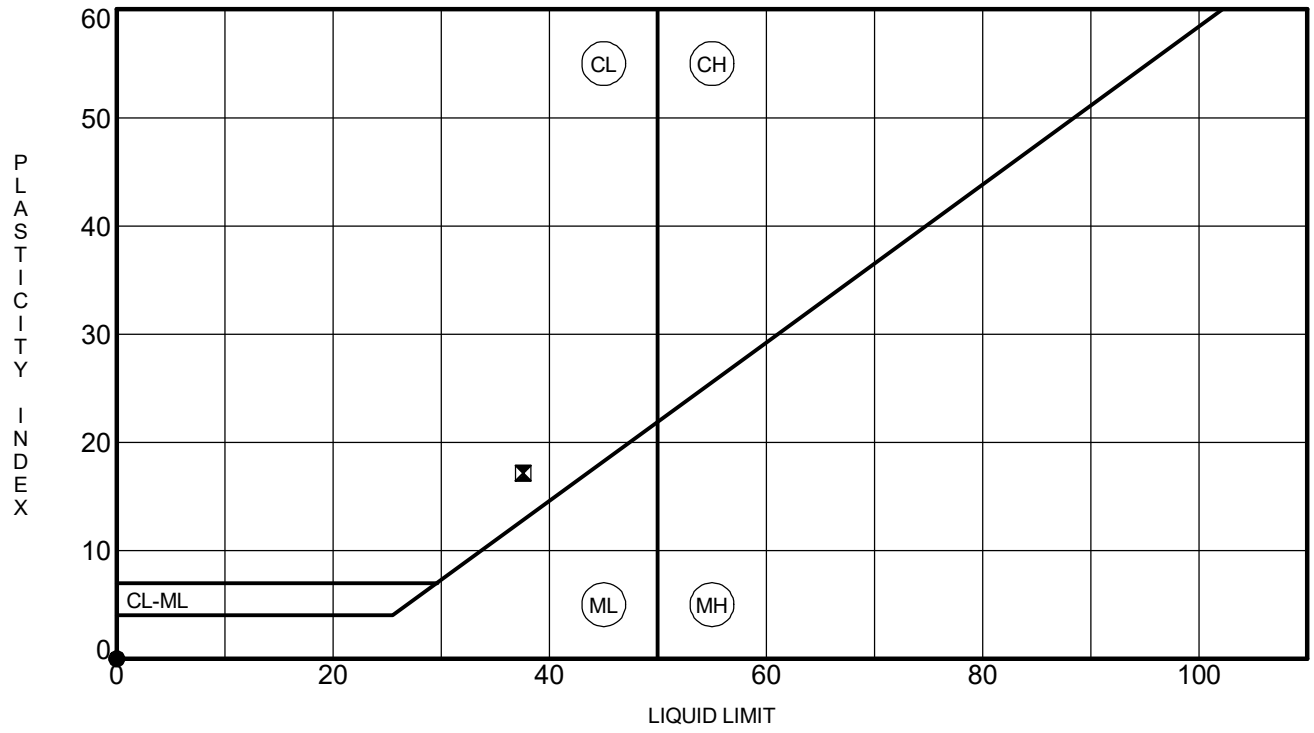
GRAIN SIZE DISTRIBUTION

Project: Main Street Lemont from Wheeler RD to IL 83

Location: Cook County, IL

Number: 269-02-01



Specimen Identification		LL	PL	PI	Fines	IDH Classification
● CUL-01-01#1	0.0 ft	NP	NP	NP	5	Gravelly Sand
⊠ CUL-01-02#8	18.5 ft	38	20	18	75	Silty Loam

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ATTERBERG LIMITS' RESULTS

Project: Main Street Lemont from Wheeler RD to IL 83

Location: Cook County, IL

Number: 269-02-01

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Lombard, Illinois 60148
Phone (630) 953-9928
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APPENDIX C

Run #1

0 6 inches

Boring CUL-01-02:
Run #1, 22.0 to 32.0 feet, RECOVERY=100%, RQD=62%

BEDROCK CORE: MAIN STREET CULVERT 1; CONTRACT D-91-449-20, PTB 196-006, COOK COUNTY, ILLINOIS

SCALE: GRAPHICAL	APPENDIX C-1	DRAWN BY: J. Bensen CHECKED BY: M. Seyhun

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FOR MOTT MCDONALD | 269-02-01

Run #1

Boring CUL-01-03:
Run #1, 22.0 to 32.0 feet, RECOVERY=100%, RQD=49%

BEDROCK CORE: MAIN STREET CULVERT 1; CONTRACT D-91-449-20, PTB 196-006, COOK COUNTY, ILLINOIS

SCALE: GRAPHICAL	APPENDIX C-2	DRAWN BY: J. Bensen CHECKED BY: M. Seyhun

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FOR MOTT MCDONALD | 269-02-01

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APPENDIX D

Benchmark: C.P. #2 – Rebar with HLR cap. Sta. 18+07, o/s 21' LT, Elev. 601.96.

Existing Structure: S.N. 016-0924 appears to have been constructed circa 1900 and widened circa 1980. Plans for the original construction or widening are not available. Superstructure consists of a simple-span R.C. slab, measuring 17'-0" face-to-face of abutments and 48'-6"± out-to-out. Original substructure consists of stacked-and-mortared limestone block walls and an R.C. wall-type abutment for the widened south portion. Structure to be completely removed and replaced with 8'x5' two-barrel box culvert.

No salvage.

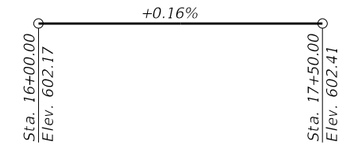
Precast alternative is not allowed.

WATERWAY INFORMATION

Drainage Area = 0.6 sq. mi.

Existing Overtopping Elev. = 602.1 at Sta. 14+00
Proposed Overtopping Elev. = 602.4 at Sta. 16+00

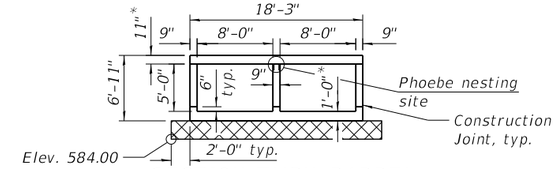
Flood	Freq. Yr.	Q C.F.S.	Opening Ft² Exist.	Opening Ft² Prop.	Nat. H.W.E.	Head – Ft. Exist.	Head – Ft. Prop.	Headwater El. Exist.	Headwater El. Prop.
	10	111	47	34	590.2	0	0	589.4	590.1
Design	50	261	86	61	591.9	0	0	591.1	591.5
Base	100	340	101	59	592.6	0	0	591.8	592.3
Overtop. Exist.		1282						602.1	
Overtop. Prop.		1282							602.4



PROFILE GRADE
(along ℄ roadway)

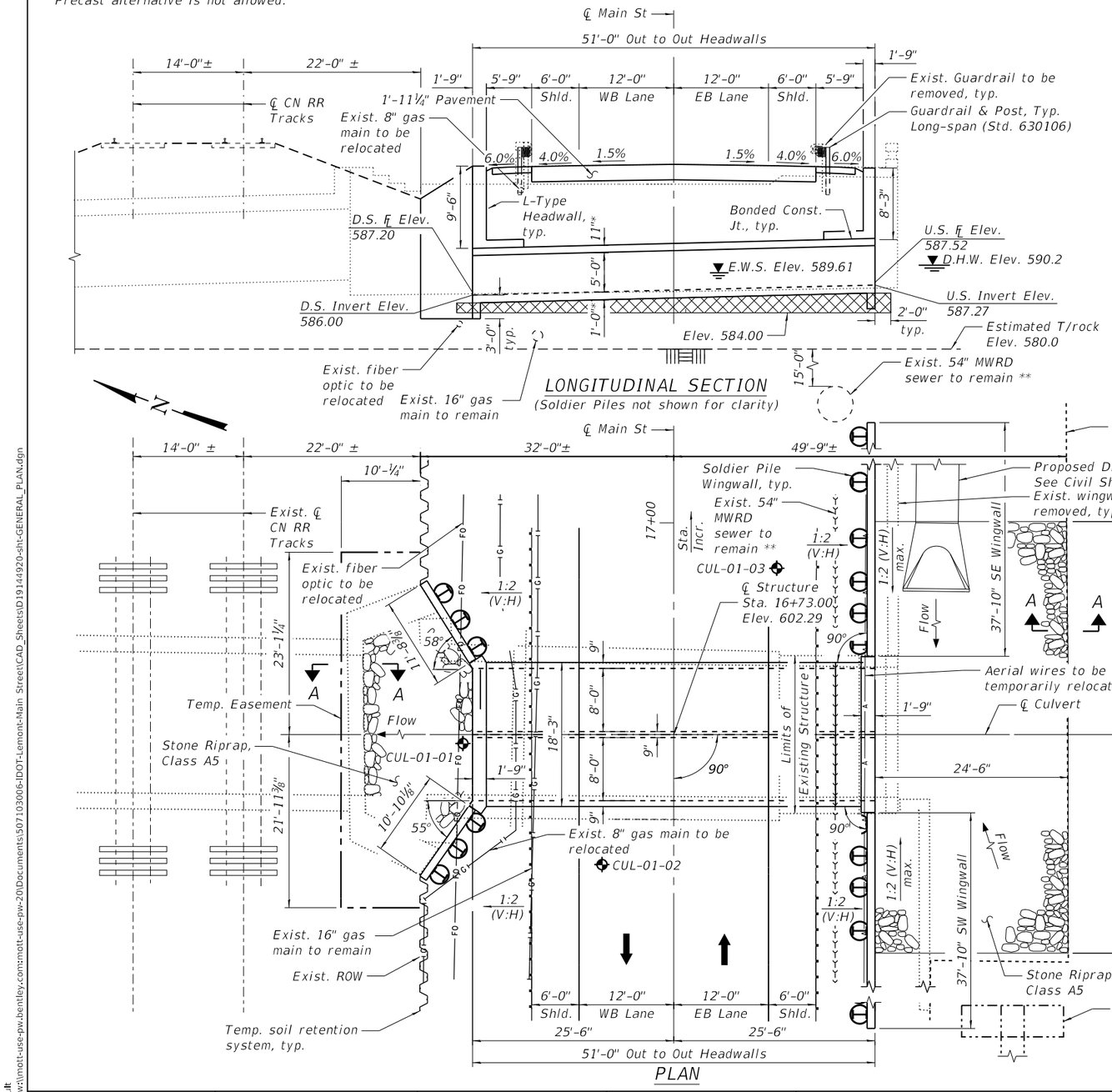
LEGEND

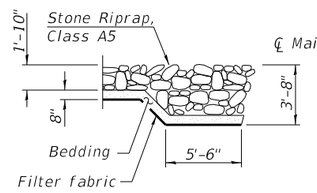
- Soil boring location
- Remove and replace unsuitable material
- Existing retaining wall removal
- Existing underground gas main
- Existing underground fiber optic
- Existing underground sanitary sewer



SECTION THRU BARREL

* Slab thickness may be refined in final design





SECTION A-A

LOADING HL-93

Allow 50#/sq. ft. for future wearing surface.

DESIGN SPECIFICATIONS

2020 AASHTO LRFD Bridge Design Specifications, 9th Edition

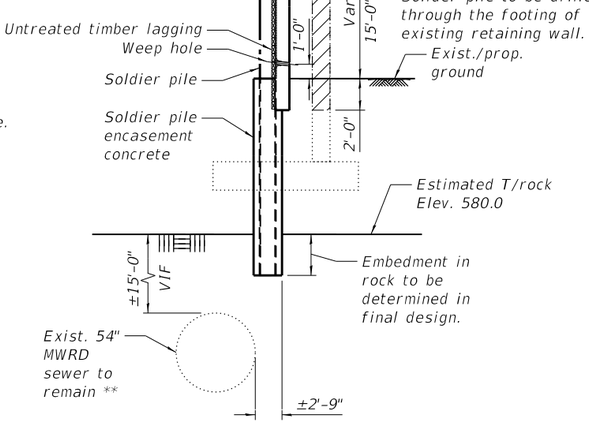
DESIGN STRESSES

FIELD UNITS

f'c = 3,500 psi
fy = 60,000 psi (Reinforcement)

HIGHWAY CLASSIFICATION

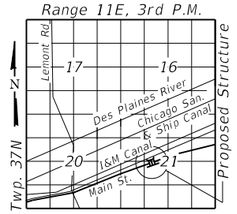
Rte. F.A.U. 3587 – Main St.
Functional Class: Minor Arterial
ADT: 4,400 (2018); 11,300 (2030)
ADTT: 528 (2018); 1,356 (2030)
DHV: 1,130 (2030)
Design Speed: 50 m.p.h.
Posted Speed: 40 m.p.h.



SECTION THRU SOUTH WINGWALLS

(North wingwall similar)

** Contractor to verify the location of the 54" MWRD sewer before soldier pile installation



LOCATION SKETCH

GENERAL PLAN & ELEVATION
MAIN STREET OVER
TRIBUTARY TO I&M CANAL
F.A. RTE. 3587 – SEC. 2020-142-C & DR
COOK COUNTY
STATION 16+73.00
STRUCTURE NO. 016-0924.

MODEL: Default
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3/15/2023 9:13:00 AM

LOCHNER	USER NAME =	DESIGNED -	REVISED -	STATE OF ILLINOIS DEPARTMENT OF TRANSPORTATION	SHEET $GP01 OF $SB01 SHEETS
H. W. LOCHNER, INC. 225 WEST WASHINGTON STREET 12 TH FLOOR CHICAGO, ILLINOIS 60606		CHECKED -	REVISED -		
	PLOT SCALE =	DRAWN -	REVISED -		
	PLOT DATE =	CHECKED -	REVISED -		

F.A.U. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
3587	2020-142-C&DR	COOK		
		CONTRACT NO. 62L30		
		ILLINOIS FED. AID PROJECT		