Figures

Central Lake County Joint Action Water Agency (CLCJAWA) Water System Expansion

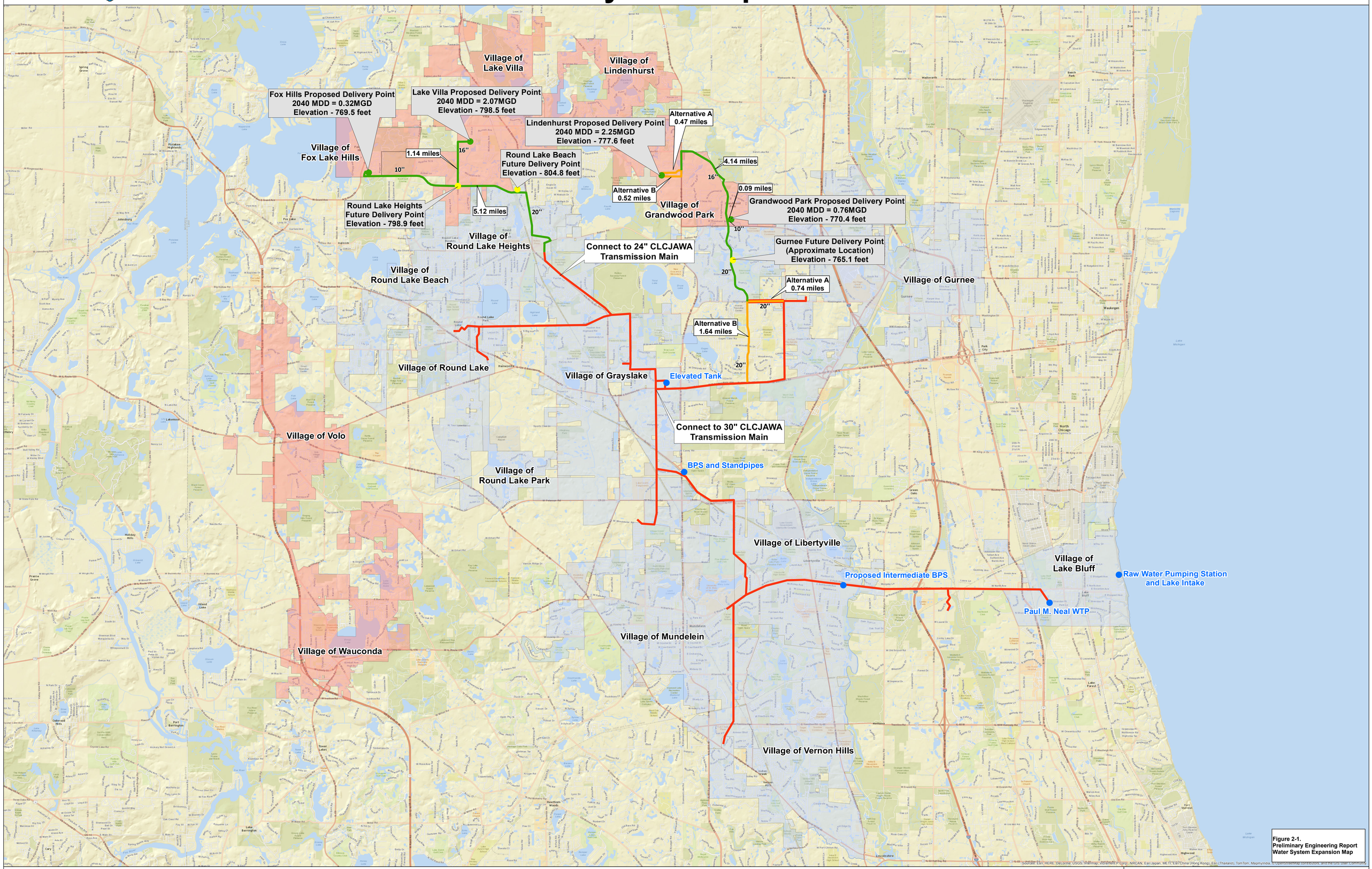

Figure 2-1.
Preliminary Engineering Report
Water System Expansion Map

N

0 1.25 2.5 5 Miles

Legend

- Proposed Route
- Proposed Route Alternatives
- Existing
- CLCJAWA Facilities
- Proposed Delivery Point
- Future Delivery Point
- Existing CLCJAWA Members
- Prospective Members

Elevation Source - Lake County Digital Terrian Model (2014)

CLCJAWA
Water System Expansion

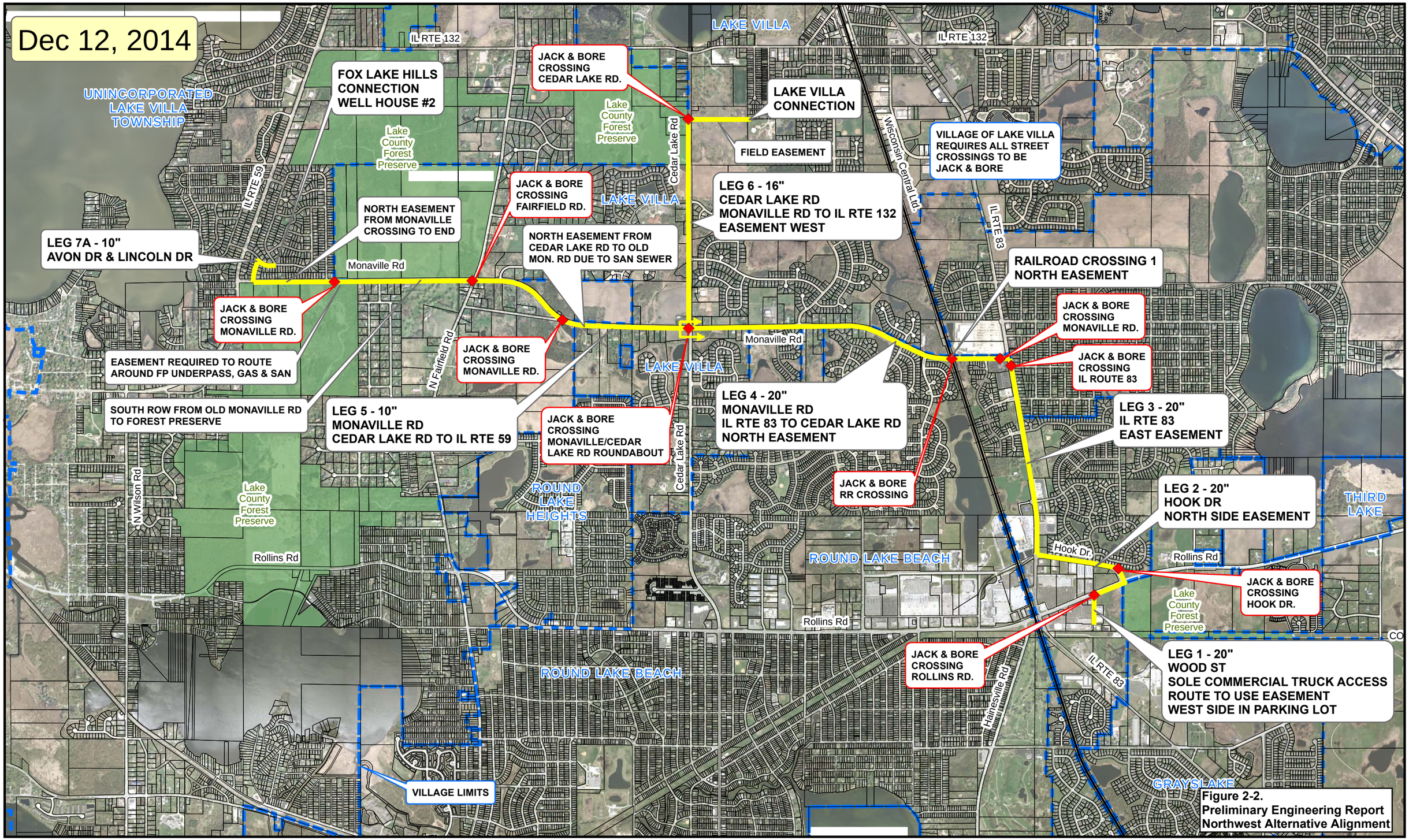

Figure 2-2.
Preliminary Engineering Report
Northwest Alternative Alignment

JACK & BORE LOCATIONS APPROXIMATE; TO BE REFINED IN FINAL DESIGN

CDM Smith

Applied Technologies
Engineers - Architects

NW ROUTE NOTES

ROUTE 4NW
NORTHWEST PIPELINE
North Group Route Study - CLCJAWA Water System Expansion

J:\5353\GRAPHICS\GIS\Route Study Maps\FIGURE 4NW - NORTHWEST ALT 4 MOD 1.MXD

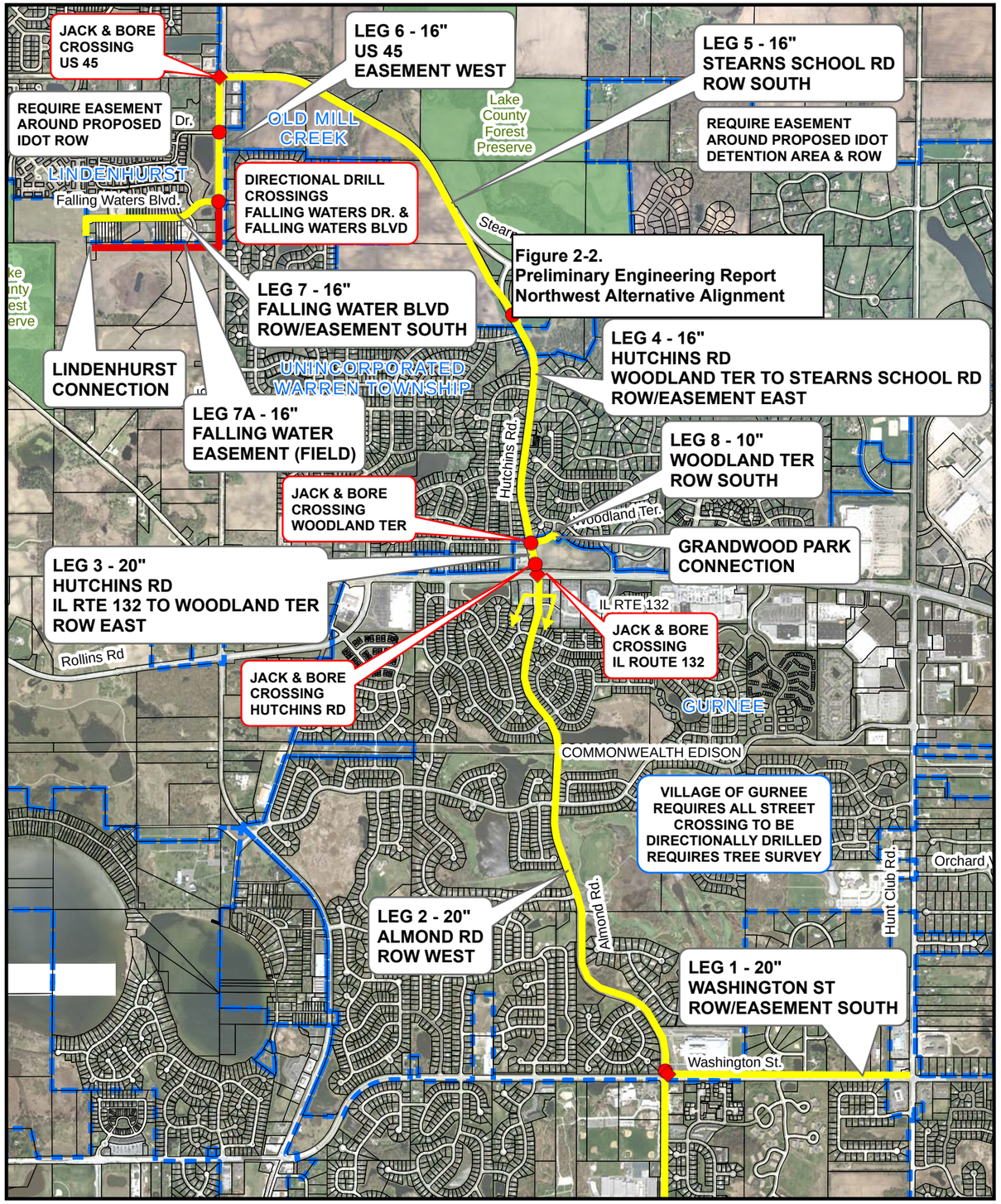

Figure 2-2.
Preliminary Engineering Report
Northwest Alternative Alignment

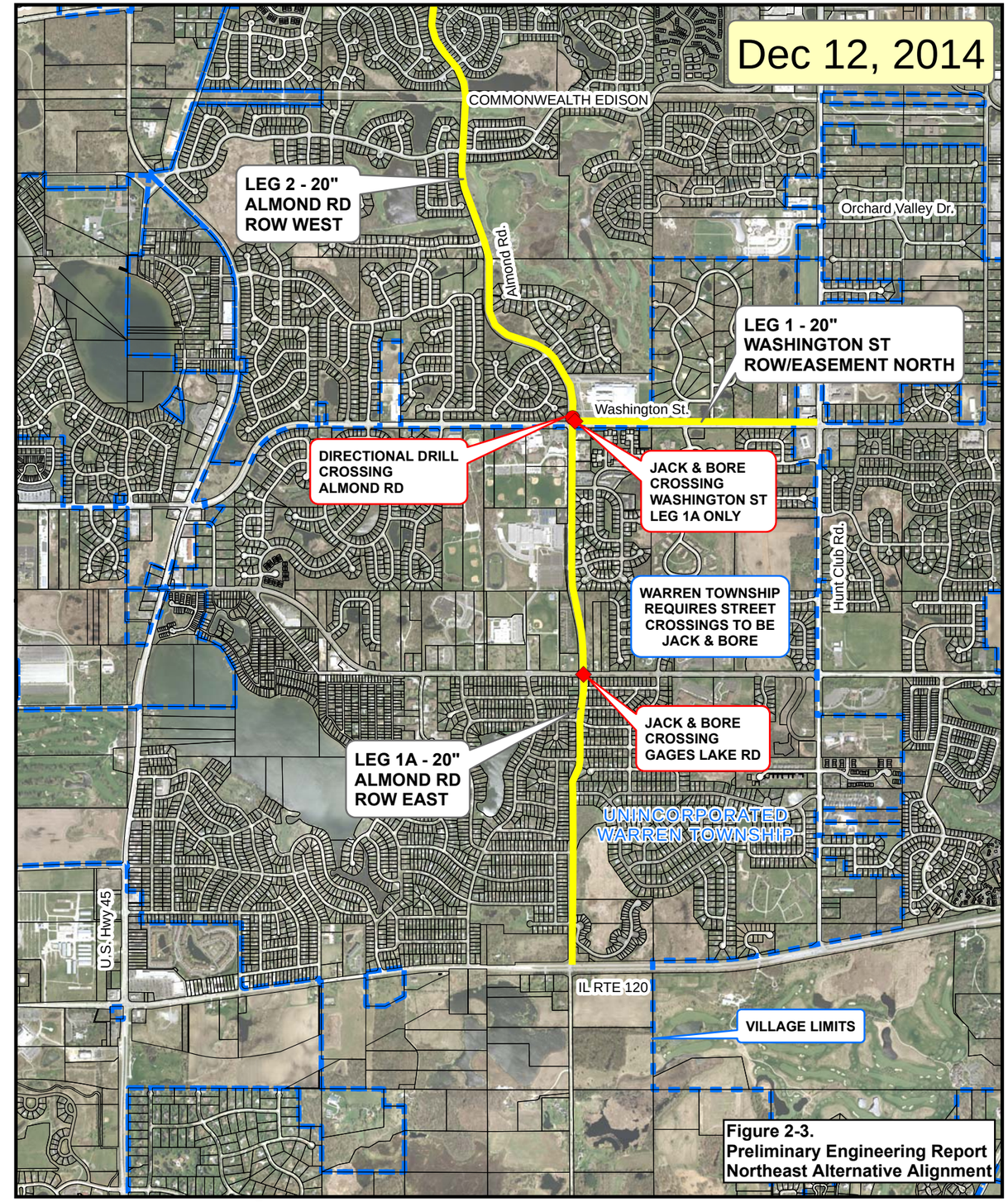

Figure 2-3.
Preliminary Engineering Report
Northeast Alternative Alignment

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Engineers - Architects

N W E S

0 1,000 2,000 4,000 6,000 8,000 Feet

NE ROUTE NOTES

JACK & BORE LOCATIONS APPROXIMATE;
TO BE REFINED IN FINAL DESIGN

ROUTE 4NE
NORTHEAST PIPELINE
North Group Route Study - CLCJAWA Water System Expansion

J:\5353\GRAPHICS\GIS\Route Study Maps\FIGURE 4NE - NORTHEAST ALT 4.MXD

Figure 4-1 - 2040 Max Day Demand Hydraulic Profile

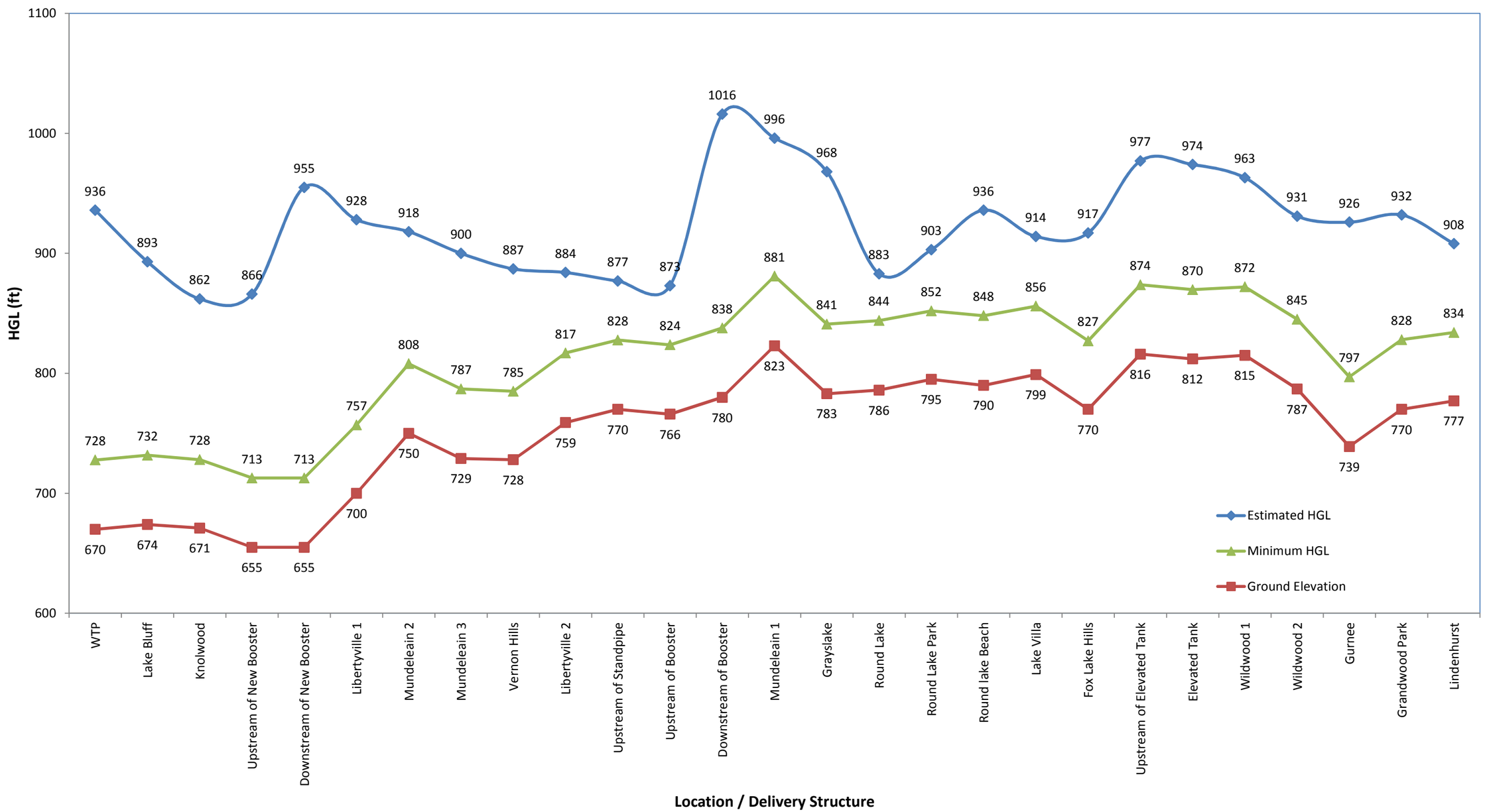
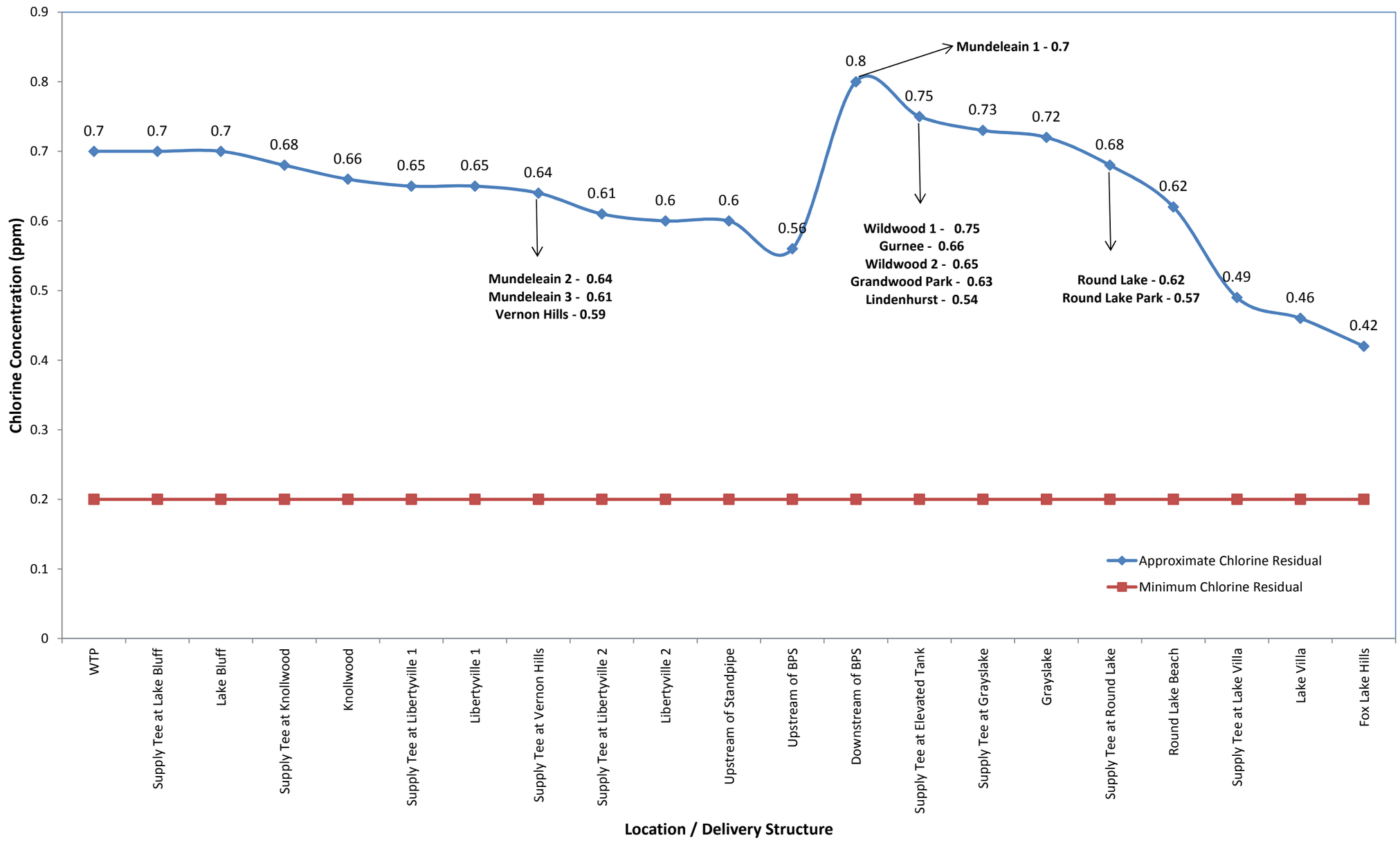


Figure 4-2 - Chlorine Decay Plot at Current Low Flow Conditions



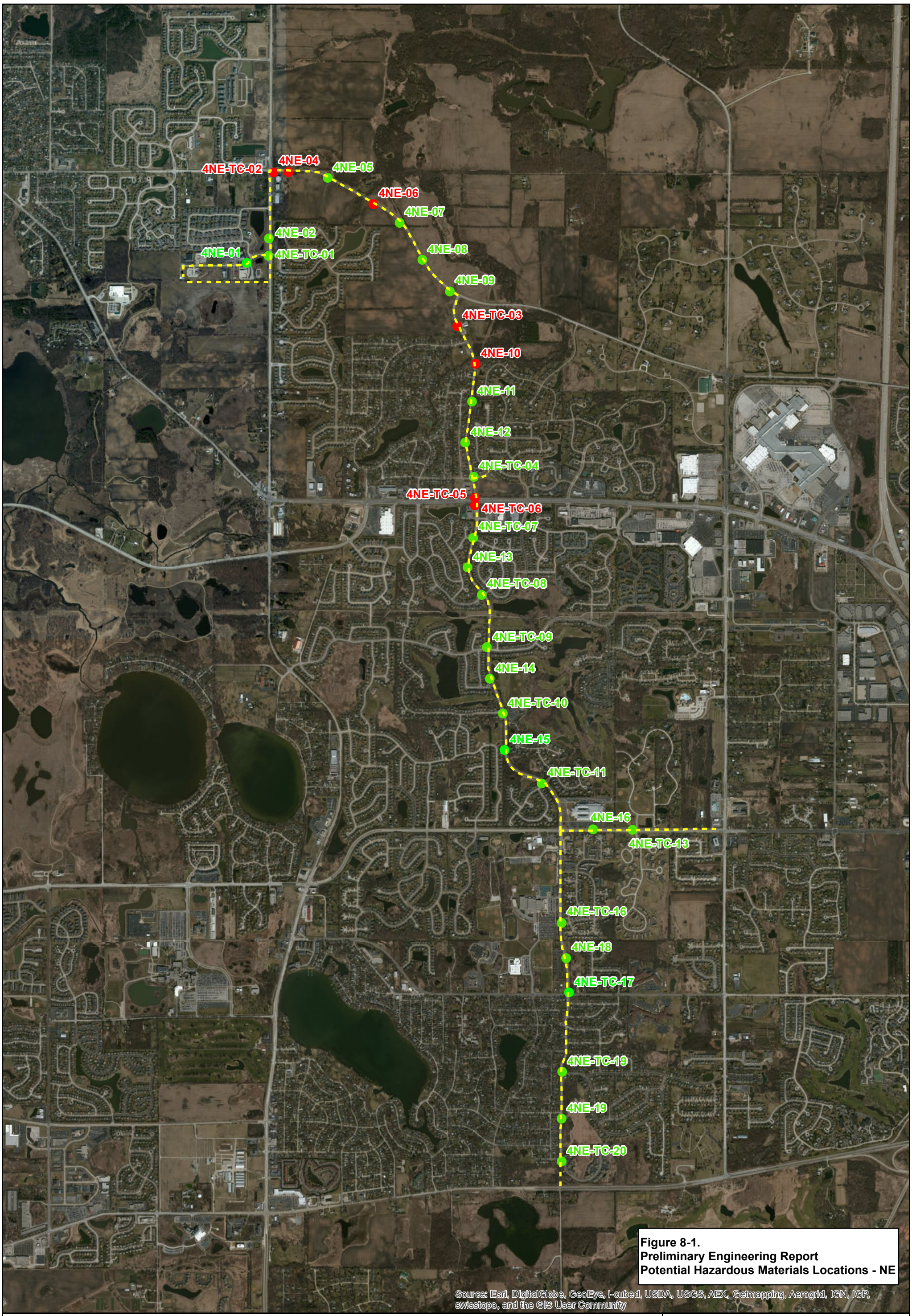


Figure 8-1.
Preliminary Engineering Report
Potential Hazardous Materials Locations - NE

CDM Smith®

N

0 0.25 0.5 Miles

Proposed Alignment

Exceeds MAC Standards (Subtitle D landfill disposal)

Meets MAC Standards (CCDD disposal)

CLCJAWA North Group Pipeline
Northeast Pipeline Alignment
Environmental Sample Report Summary
Phase 1 Geotechnical Program

November 7, 2014

Figure 8-2.
Preliminary Engineering Report
Potential Hazardous Materials Locations - NW

CDM Smith®

N

0 0.25 0.5 1 Miles

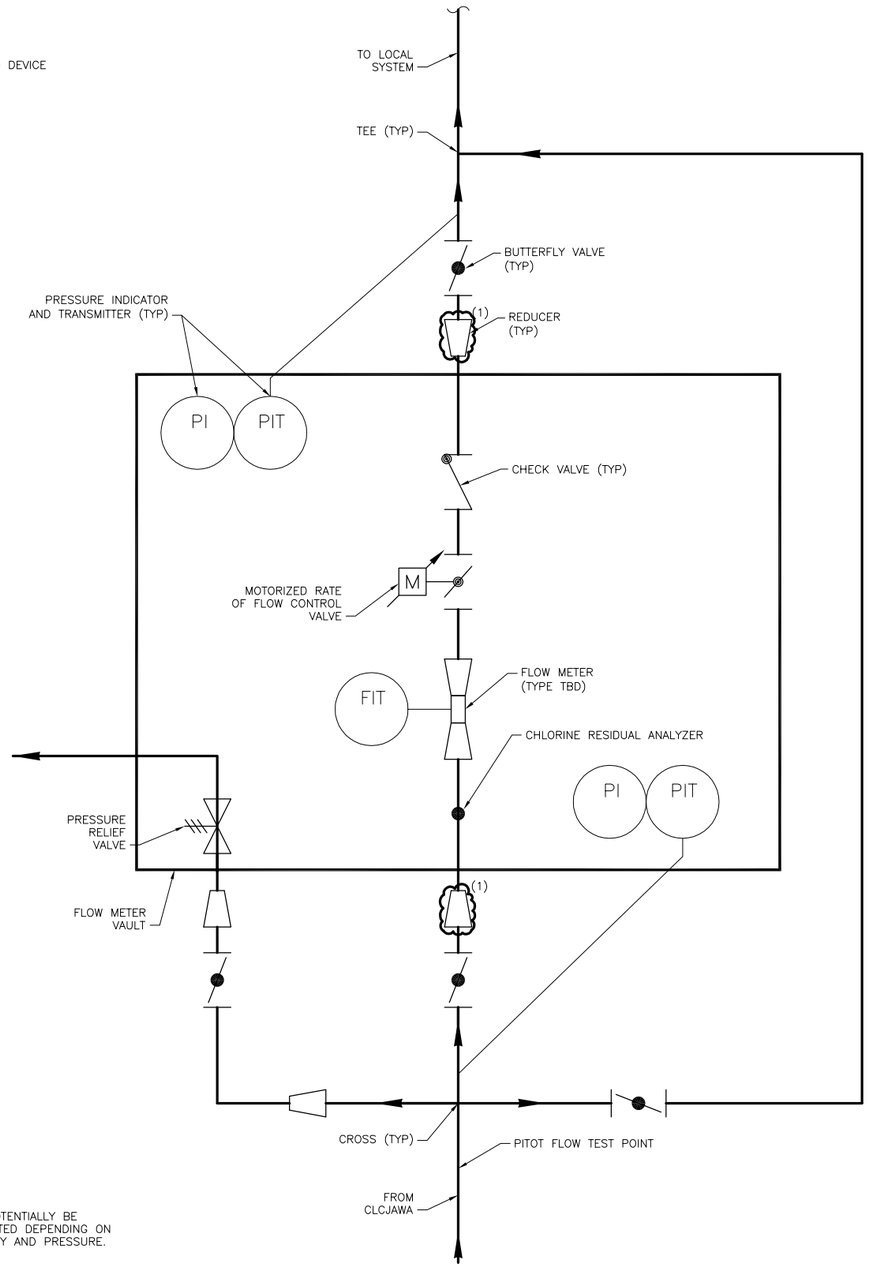
Proposed Alignment

Exceeds MAC Standards (Subtitle D landfill disposal)

Meets MAC Standards (CCDD disposal)

CLCJAWA North Group Pipeline
Northwest Pipeline Alignment
Environmental Sample Report Summary
Phase 1 Geotechnical Program

November 7, 2014



NOTES:

1. CAN POTENTIALLY BE ELIMINATED DEPENDING ON VELOCITY AND PRESSURE.

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REV. NO.	DATE	DRWN	CHKD	REMARKS

DESIGNED BY: A. ATASSI
DRAWN BY: J. WENDORF
SHEET CHK'D BY: A. ATASSI
CROSS CHK'D BY: X
APPROVED BY: X
DATE: DEC 2014

CDM Smith
125 South Wacker Drive, Suite 600
Chicago, IL 60606
Tel: (312) 346-5000
IL COA No. 184-001297

AppliedTechnologies
Engineers-Architects

CENTRAL LAKE COUNTY JOINT ACTION WATER AGENCY

NORTH GROUP WATER SYSTEM EXPANSION
NORTHEAST PIPELINE - BID PACKAGE #1

FIGURE 9-1
UPDATED TYPICAL DELIVERY STRUCTURE
PROCESS AND INSTRUMENTATION DIAGRAM

PROJECT NO. 1047-104376
FILE NAME: M002BP1DI.DWG
SHEET NO.
M-2

30% SUBMITTAL - DRAFT

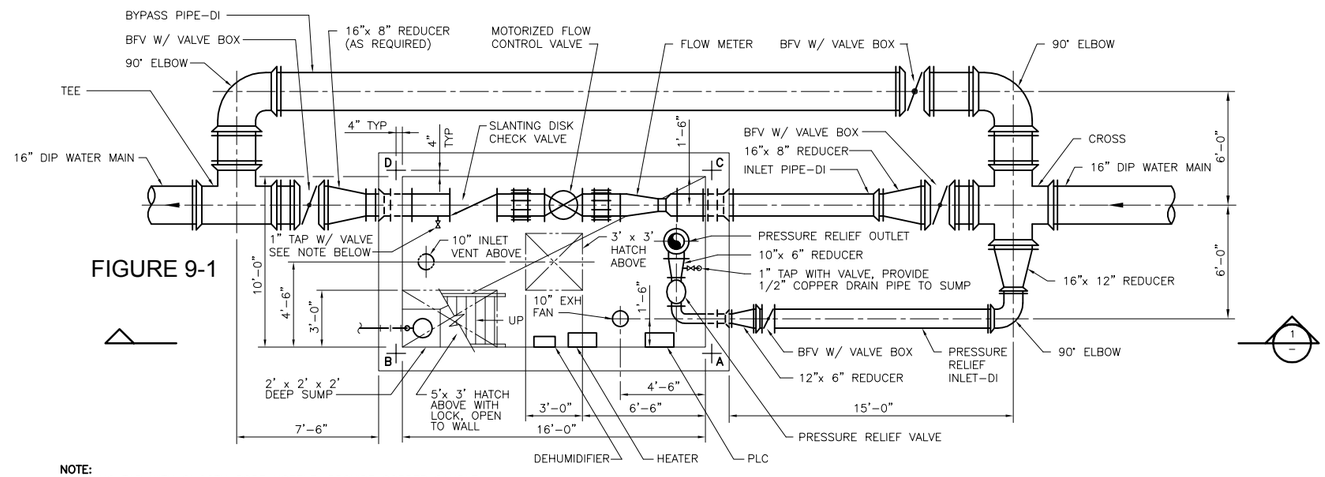


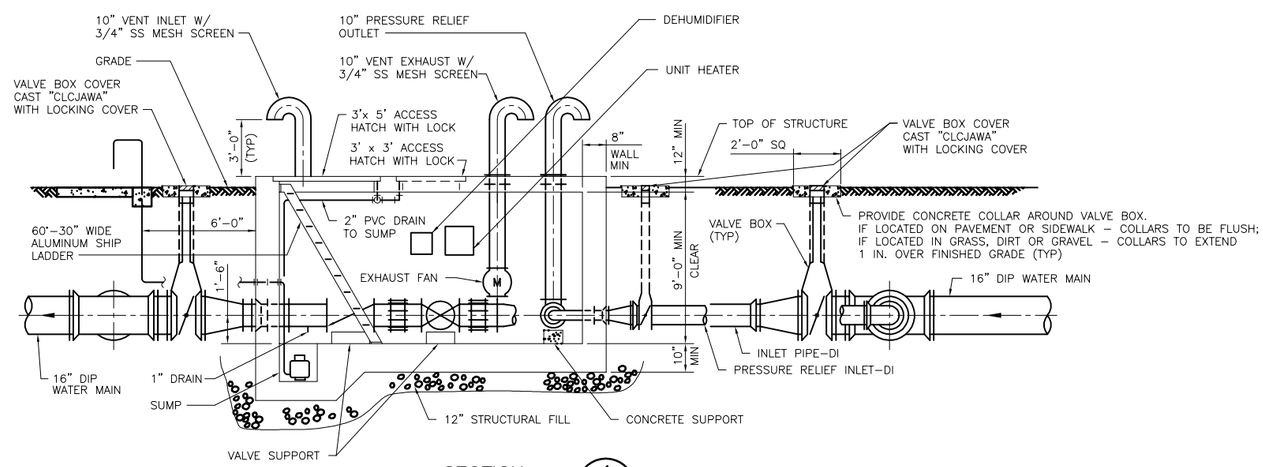
FIGURE 9-1

NOTE:
SAMPLING TAP WITH SMOOTH BORE NOZZLE. PROVIDE COPPER SAMPLE LINE WITH BREAK FOR SAMPLING BOTTLE. USE FUNNEL RECEIVING FLAIR AT START OF DRAIN.

CLCJAWA DELIVERY STRUCTURE PIPING

PLAN

1/4" = 1'-0"



SECTION 1 –

1/4" = 1'-0"

NOTES:

1. REDUCER/INCREASER CAN POTENTIALLY BE ELIMINATED DEPENDING ON VELOCITY AND PRESSURE.

REV. NO.	DATE	DRWN	CHKD	REMARKS

DESIGNED BY: A. ATASSI
DRAWN BY: J. WENDORF
SHEET CHK'D BY: A. ATASSI
CROSS CHK'D BY: X
APPROVED BY: X
DATE: DEC 2014

CDM Smith
125 South Wacker Drive, Suite 600
Chicago, IL 60606
Tel: (312) 346-5000
IL COA No. 184-001297

AppliedTechnologies Engineers-Architects

CENTRAL LAKE COUNTY JOINT ACTION WATER AGENCY

NORTH GROUP WATER SYSTEM EXPANSION
NORTHEAST PIPELINE - BID PACKAGE #1

FIGURE 9-2
UPDATED TYPICAL DELIVERY STRUCTURE PLAN AND SECTION

PROJECT NO. 1047-104376
FILE NAME: M003BP1DI.DWG
SHEET NO. M-3

30% SUBMITTAL - DRAFT

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Central Lake County Joint Action Water Agency
Task Order B - Water System Expansion, North Group Detailed Design

Figure 11-1. Project Schedule through Construction

Thu 12/11/14

ID	Task Name	Duration	Start	Finish
1	Permitting Agencies Review of the PER	4 wks	Mon 2/2/15	Fri 2/27/15
2	**Detailed Design**	**41.4 wks**	**Thu 2/12/15**	**Fri 11/27/15**
3	**60% Contract Documents**	**18.4 wks**	**Thu 2/12/15**	**Fri 6/19/15**
4	Design Team 60% Kick-off Meeting	0 wks	Thu 2/12/15	Thu 2/12/15
5	**Additional Site Investigations**	**8 wks**	**Mon 3/2/15**	**Fri 4/24/15**
6	Phase II Geotechnical Investigation	8 wks	Mon 3/2/15	Fri 4/24/15
7	Supplemental Survey	8 wks	Mon 3/2/15	Fri 4/24/15
8	**Specifications**	**12 wks**	**Mon 2/16/15**	**Fri 5/8/15**
9	Specification Development	8 wks	Mon 2/16/15	Fri 4/10/15
10	Internal (TRC) Review	2 wks	Mon 4/13/15	Fri 4/24/15
11	Incorporate Review Comments/Finalize Specifications	2 wks	Mon 4/27/15	Fri 5/8/15
12	**Delivery Structures**	**9 wks**	**Mon 2/16/15**	**Fri 4/17/15**
13	Radio Path Study	2 wks	Mon 2/16/15	Fri 2/27/15
14	Drawing Set Development	4 wks	Mon 2/23/15	Fri 3/20/15
15	Internal (TRC) Review	2 wks	Mon 3/23/15	Fri 4/3/15
16	Incorporate Review Comments/Finalize Drawing Set	2 wks	Mon 4/6/15	Fri 4/17/15
17	Production Standards Meeting	0 wks	Mon 3/2/15	Mon 3/2/15
18	**Bid Package #1**	**12 wks**	**Mon 3/2/15**	**Fri 5/22/15**
19	BP#1: Drawing Set Development	6 wks	Mon 3/2/15	Fri 4/10/15
20	BP#1: Internal (ATI & TRC) Review	2 wks	Mon 4/13/15	Fri 4/24/15
21	BP#1: Incorporate Review Comments/Finalize Drawing Set	2 wks	Mon 4/27/15	Fri 5/8/15
22	BP#1: Client Review	2 wks	Mon 5/11/15	Fri 5/22/15
23	**BP#1: Cost Estimate Development**	**4 wks**	**Mon 4/13/15**	**Fri 5/8/15**
24	Prepare OPCC	2 wks	Mon 4/13/15	Fri 4/24/15
25	Internal QA/QC of Draft OPCC	1 wk	Mon 4/27/15	Fri 5/1/15
26	Prepare Final OPCC	1 wk	Mon 5/4/15	Fri 5/8/15
27	BP#1 60% Client Workshop	0 wks	Fri 5/22/15	Fri 5/22/15
28	**Bid Package #2**	**12 wks**	**Mon 3/30/15**	**Fri 6/19/15**
29	BP#2: Drawing Set Development	6 wks	Mon 3/30/15	Fri 5/8/15
30	BP#2: Unique Specifications & Delivery Structure Details	2 wks	Mon 4/13/15	Fri 4/24/15
31	BP#2: Internal (ATI & TRC) Review	2 wks	Mon 5/11/15	Fri 5/22/15
32	BP#2: Incorporate Review Comments/Finalize Drawing Set	2 wks	Mon 5/25/15	Fri 6/5/15
33	BP#2: Client Review	2 wks	Mon 6/8/15	Fri 6/19/15
34	**BP#2: Cost Estimate Development**	**4 wks**	**Mon 5/11/15**	**Fri 6/5/15**
35	Prepare OPCC	2 wks	Mon 5/11/15	Fri 5/22/15
36	Internal QA/QC of Draft OPCC	1 wk	Mon 5/25/15	Fri 5/29/15
37	Prepare Final OPCC	1 wk	Mon 6/1/15	Fri 6/5/15
38	BP#2 60% Client Workshop	0 wks	Fri 6/19/15	Fri 6/19/15
39	**Bid Package #3**	**12 wks**	**Mon 3/2/15**	**Fri 5/22/15**

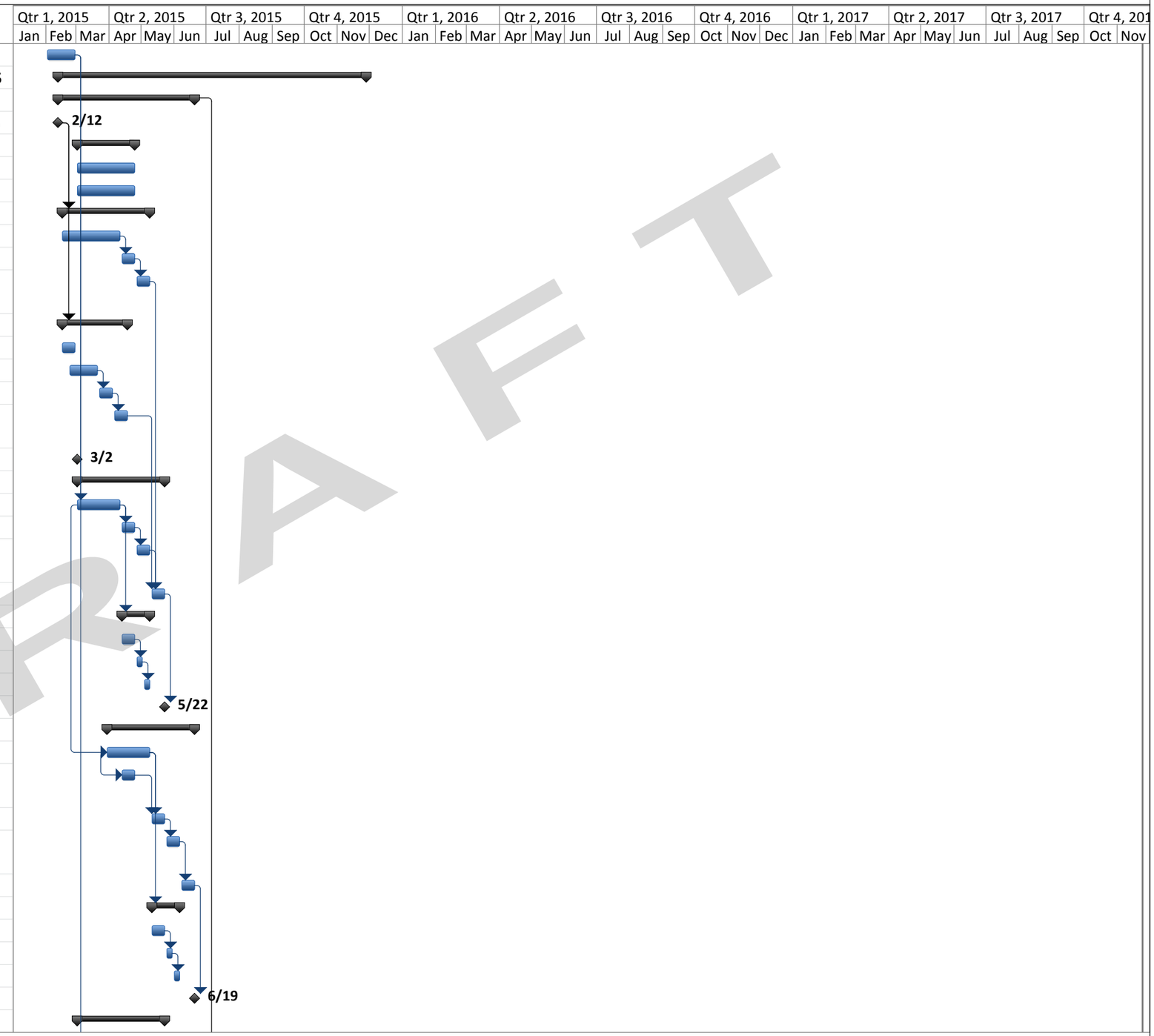

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Figure 11-1. Project Schedule through Construction

ID	Task Name	Duration	Start	Finish
40	BP#3: Drawing Set Development	6 wks	Mon 3/2/15	Fri 4/10/15
41	BP#3: Unique Specifications & Delivery Structure Details	2 wks	Mon 3/30/15	Fri 4/10/15
42	BP#3: Internal (CDMS & TRC) Review	2 wks	Mon 4/13/15	Fri 4/24/15
43	BP#3: Incorporate Review Comments/Finalize Drawing Set	2 wks	Mon 4/27/15	Fri 5/8/15
44	BP#3: Client Review	2 wks	Mon 5/11/15	Fri 5/22/15
45	**BP#3: Cost Estimate Development**	**4 wks**	**Mon 4/13/15**	**Fri 5/8/15**
46	Prepare OPCC	2 wks	Mon 4/13/15	Fri 4/24/15
47	Internal QA/QC of Draft OPCC	1 wk	Mon 4/27/15	Fri 5/1/15
48	Prepare Final OPCC	1 wk	Mon 5/4/15	Fri 5/8/15
49	BP#3 60% Client Workshop	0 wks	Fri 5/22/15	Fri 5/22/15
50	**Bid Package #4**	**12 wks**	**Mon 3/30/15**	**Fri 6/19/15**
51	BP#4: Drawing Set Development	6 wks	Mon 3/30/15	Fri 5/8/15
52	BP#4: Unique Specifications & Delivery Structure Details	2 wks	Mon 4/27/15	Fri 5/8/15
53	BP#4: Internal (CDMS & TRC) Review	2 wks	Mon 5/11/15	Fri 5/22/15
54	BP#4: Incorporate Review Comments/Finalize Drawing Set	2 wks	Mon 5/25/15	Fri 6/5/15
55	BP#4: Client Review	2 wks	Mon 6/8/15	Fri 6/19/15
56	**BP#4: Cost Estimate Development**	**4 wks**	**Mon 5/11/15**	**Fri 6/5/15**
57	Prepare OPCC	2 wks	Mon 5/11/15	Fri 5/22/15
58	Internal QA/QC of Draft OPCC	1 wk	Mon 5/25/15	Fri 5/29/15
59	Prepare Final OPCC	1 wk	Mon 6/1/15	Fri 6/5/15
60	BP#4 60% Client Workshop	0 wks	Fri 6/19/15	Fri 6/19/15
61	**90% Contract Documents**	**11 wks**	**Fri 7/10/15**	**Fri 9/25/15**
62	Design Team 90% Kick-off Meeting	0 wks	Fri 7/10/15	Fri 7/10/15
63	**Specifications**	**7 wks**	**Mon 7/13/15**	**Fri 8/28/15**
64	Specification Development	4 wks	Mon 7/13/15	Fri 8/7/15
65	Internal (TRC) Review	2 wks	Mon 8/10/15	Fri 8/21/15
66	Incorporate Review Comments/Finalize Specifications	1 wk	Mon 8/24/15	Fri 8/28/15
67	**Delivery Structures**	**7 wks**	**Mon 7/13/15**	**Fri 8/28/15**
68	Drawing Set Development	4 wks	Mon 7/13/15	Fri 8/7/15
69	Internal (TRC) Review	2 wks	Mon 8/10/15	Fri 8/21/15
70	Incorporate Review Comments/Finalize Drawing Set	1 wk	Mon 8/24/15	Fri 8/28/15
71	**Bid Package #1**	**9 wks**	**Mon 7/13/15**	**Fri 9/11/15**
72	BP#1: Drawing Set Development	4 wks	Mon 7/13/15	Fri 8/7/15
73	BP#1: Internal (ATI & TRC) Review	2 wks	Mon 8/10/15	Fri 8/21/15
74	BP#1: Incorporate Review Comments/Finalize Drawing Set	1 wk	Mon 8/24/15	Fri 8/28/15
75	BP#1: Client Review	2 wks	Mon 8/31/15	Fri 9/11/15
76	**BP#1: Cost Estimate Development**	**4 wks**	**Mon 8/10/15**	**Fri 9/4/15**

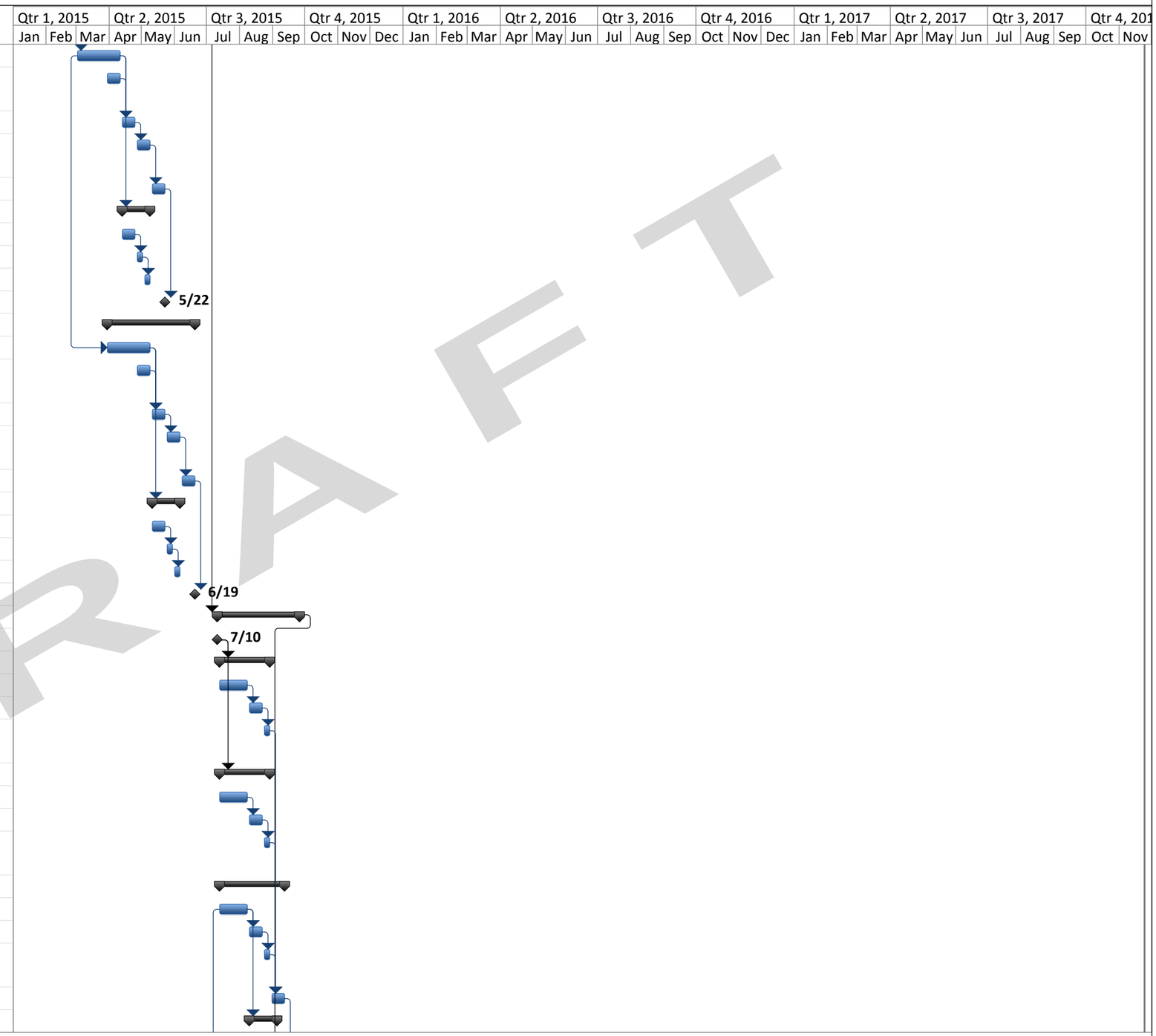

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Figure 11-1. Project Schedule through Construction

ID	Task Name	Duration	Start	Finish
77	Prepare OPCC	2 wks	Mon 8/10/15	Fri 8/21/15
78	Internal QA/QC of Draft OPCC	1 wk	Mon 8/24/15	Fri 8/28/15
79	Prepare Final OPCC	1 wk	Mon 8/31/15	Fri 9/4/15
80	BP#1 90% Client Workshop	0 wks	Fri 9/11/15	Fri 9/11/15
81	**Bid Package #2**	**9 wks**	**Mon 7/27/15**	**Fri 9/25/15**
82	BP#2: Drawing Set Development	4 wks	Mon 7/27/15	Fri 8/21/15
83	BP#2: Unique Specifications & Delivery Structure Details	2 wks	Mon 8/10/15	Fri 8/21/15
84	BP#2: Internal (ATI & TRC) Review	2 wks	Mon 8/24/15	Fri 9/4/15
85	BP#2: Incorporate Review Comments/Finalize Drawing Set	1 wk	Mon 9/7/15	Fri 9/11/15
86	BP#2: Client Review	2 wks	Mon 9/14/15	Fri 9/25/15
87	**BP#2: Cost Estimate Development**	**4 wks**	**Mon 8/24/15**	**Fri 9/18/15**
88	Prepare OPCC	2 wks	Mon 8/24/15	Fri 9/4/15
89	Internal QA/QC of Draft OPCC	1 wk	Mon 9/7/15	Fri 9/11/15
90	Prepare Final OPCC	1 wk	Mon 9/14/15	Fri 9/18/15
91	BP#2 90% Client Workshop	0 wks	Fri 9/25/15	Fri 9/25/15
92	**Bid Package #3**	**9 wks**	**Mon 7/13/15**	**Fri 9/11/15**
93	BP#3: Drawing Set Development	4 wks	Mon 7/13/15	Fri 8/7/15
94	BP#3: Unique Specifications & Delivery Structure Details	2 wks	Mon 7/27/15	Fri 8/7/15
95	BP#3: Internal (CDMS & TRC) Review	2 wks	Mon 8/10/15	Fri 8/21/15
96	BP#3: Incorporate Review Comments/Finalize Drawing Set	1 wk	Mon 8/24/15	Fri 8/28/15
97	BP#3: Client Review	2 wks	Mon 8/31/15	Fri 9/11/15
98	**BP#3: Cost Estimate Development**	**4 wks**	**Mon 8/10/15**	**Fri 9/4/15**
99	Prepare OPCC	2 wks	Mon 8/10/15	Fri 8/21/15
100	Internal QA/QC of Draft OPCC	1 wk	Mon 8/24/15	Fri 8/28/15
101	Prepare Final OPCC	1 wk	Mon 8/31/15	Fri 9/4/15
102	BP#3 90% Client Workshop	0 wks	Fri 9/11/15	Fri 9/11/15
103	**Bid Package #4**	**9 wks**	**Mon 7/27/15**	**Fri 9/25/15**
104	BP#4: Drawing Set Development	4 wks	Mon 7/27/15	Fri 8/21/15
105	BP#4: Unique Specifications & Delivery Structure Details	2 wks	Mon 8/10/15	Fri 8/21/15
106	BP#4: Internal (CDMS & TRC) Review	2 wks	Mon 8/24/15	Fri 9/4/15
107	BP#4: Incorporate Review Comments/Finalize Drawing Set	1 wk	Mon 9/7/15	Fri 9/11/15
108	BP#4: Client Review	2 wks	Mon 9/14/15	Fri 9/25/15
109	**BP#4: Cost Estimate Development**	**4 wks**	**Mon 8/24/15**	**Fri 9/18/15**
110	Prepare OPCC	2 wks	Mon 8/24/15	Fri 9/4/15
111	Internal QA/QC of Draft OPCC	1 wk	Mon 9/7/15	Fri 9/11/15
112	Prepare Final OPCC	1 wk	Mon 9/14/15	Fri 9/18/15
113	BP#4 90% Client Workshop	0 wks	Fri 9/25/15	Fri 9/25/15

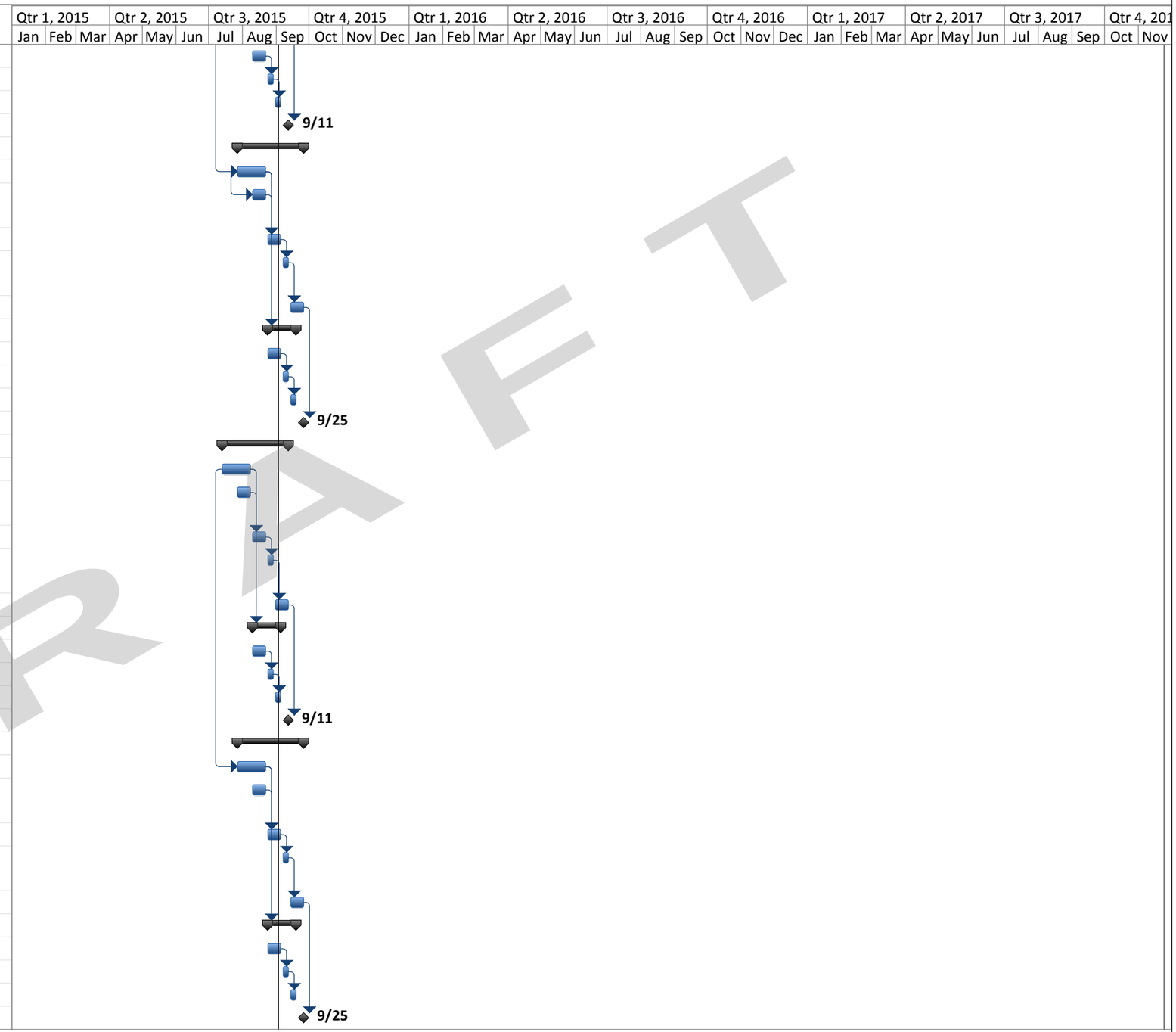

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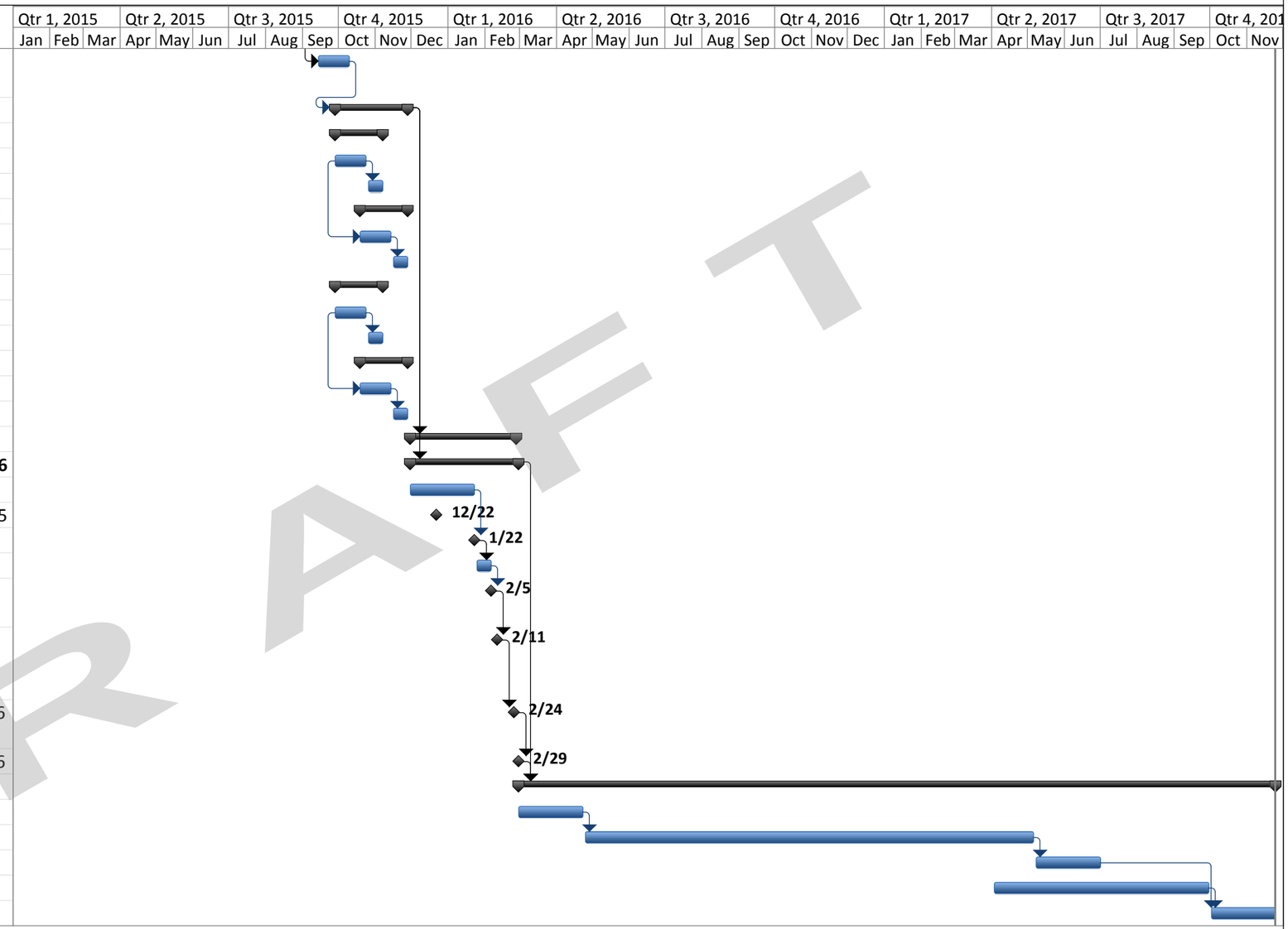
Figure 11-1. Project Schedule through Construction

ID	Task Name	Duration	Start	Finish
114	Permitting Agencies Review of the 90% Contract Documents	4 wks	Mon 9/14/15	Fri 10/9/15
115	**100% Contract Documents (bidding)**	**9 wks**	**Mon 9/28/15**	**Fri 11/27/15**
116	**Bid Package #1**	**6 wks**	**Mon 9/28/15**	**Fri 11/6/15**
117	BP#1: Develop Bidding Documents	4 wks	Mon 9/28/15	Fri 10/23/15
118	BP#1: Bid Document Production	2 wks	Mon 10/26/15	Fri 11/6/15
119	**Bid Package #2**	**6 wks**	**Mon 10/19/1**	**Fri 11/27/15**
120	BP#2: Develop Bidding Documents	4 wks	Mon 10/19/15	Fri 11/13/15
121	BP#2: Bid Document Production	2 wks	Mon 11/16/15	Fri 11/27/15
122	**Bid Package #3**	**6 wks**	**Mon 9/28/15**	**Fri 11/6/15**
123	BP#3: Develop Bidding Documents	4 wks	Mon 9/28/15	Fri 10/23/15
124	BP#3: Bid Document Production	2 wks	Mon 10/26/15	Fri 11/6/15
125	**Bid Package #4**	**6 wks**	**Mon 10/19/1**	**Fri 11/27/15**
126	BP#4: Develop Bidding Documents	4 wks	Mon 10/19/15	Fri 11/13/15
127	BP#4: Bid Document Production	2 wks	Mon 11/16/15	Fri 11/27/15
128	**Permitting & IEPA SRF Approval**	**13 wks**	**Mon 11/30/1**	**Fri 2/26/16**
130	**Bidding**	**13 wks**	**Mon 11/30/1**	**Mon 2/29/16**
131	Advertisement	8 wks	Mon 11/30/15	Fri 1/22/16
132	Pre-Bid Meeting	0 days	Tue 12/22/15	Tue 12/22/15
133	Bid Opening	0 days	Fri 1/22/16	Fri 1/22/16
134	Bid Reviews	2 wks	Mon 1/25/16	Fri 2/5/16
135	Recommendation of Award to the Technical Committee	0 days	Fri 2/5/16	Fri 2/5/16
136	Technical Commettee Recommendation of Award to the Board of Directors	0 wks	Thu 2/11/16	Thu 2/11/16
137	Approval by the Board of Directors	0 wks	Wed 2/24/16	Wed 2/24/16
138	Notice of Award	0 days	Mon 2/29/16	Mon 2/29/16
139	**Construction**	**91 wks**	**Mon 2/29/16**	**Fri 11/24/17**
140	Mobilization	8 wks	Mon 2/29/16	Fri 4/22/16
141	Installation	54 wks	Mon 4/25/16	Fri 5/5/17
142	Testing & Startup	8 wks	Mon 5/8/17	Fri 6/30/17
143	Restoration	26 wks	Mon 4/3/17	Fri 9/29/17
144	Closeout	8 wks	Mon 10/2/17	Fri 11/24/17



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Appendix A

List of Permits

NE/NW WATER SYSTEM EXPANSION PROJECT
PERMIT DATABASE
CENTRAL LAKE COUNTY JOINT ACTION WATER AGENCY

Authority/Municipality/ Utility	Permit Information and Fees					Notes/Comments
	Permit Name	Fee Information	Pipeline "Legs" Permit Applies to	Approximate Total Fee	Meetings/Discussion Log	
			Northwest Pipeline Alignment			
State/Federal Authorities						
IDOT	Utility Construction Permit Utility Bond	Based on IDOT Review of Plans Contractor to complete permit and bond	3 and 7			
IDNR	Inter Agency Wetland Policy Act	NA				
IEPA	Construction Permit Schedule B: Water Main Construction	Permit fees exempt				
USACE (Corps of Engineers)	RP7 RP8-401		2, 4, 5, 6, and 7			
County Authorities						
Lake County Forest Preserve	Easement Botanic Survey Wetland Report	Market Value of Property Tree Compensation Fee Additional Consideration	5 and 6			
Lake County Division of Transportation	Watermain Construction Permit Performance Guarantee & Insurance (from General Contractor)	Per LCDOT roadway: $150 application fee $700 permit fee (> 1/4 mile); $500 (< 1/4 mile) $350 (one time inspection fee for all of NW) Permit estimate $2,700 $200 (additional if reinspection required) Contractor Bond - $20,000 per County Roadway crossing - 7 crossings = Bond Estimate $140,000	1, 4, 5, and 6			
Lake County Department of Public Works	NA	NA	5 and 7A			
Lake County GIS	NA	NA				
Lake County Stormwater Management Commission	Watershed Development Ordiance Permit WDO Section I - standard review fee WDO Section II - Preliminary Jurisdictional Determination (PJD) ACOE - Boundary Verification WDO Section III - Other fees WDO Section IV - Inspection fees Designated Erosion Control Inspector for Construction	WDO Sec I - $375 + fee determined by LCSMC WDO Sec II - PJD $720 for First Wetland + $180 for each additional Boundary Verification $480 for first Wetland + $180 for each additional WDO Sec III - resubmittal, etc: fee by LCSMC WDO Sec IV - Inspection fees by LCSMC Fee Schedule is attached for LCSMC stormwater review and permits.	1, 2, 3, 4, 5, 6 and 7A	The combined PJD fee for the NW and NE alignments is $5,940. The boundry verification fee for the NW alignmet is $1,200. The NE fee will be calculated after the PJD for the NE is issued (contingent upon payment of the PJD).	Does the permit required also include dewatering water discharge? - Under LCSMC's review of the project SWPPP they will require any dewatering water to be treated to remove sedimations prior to discharge.	Does the permit required also include dewatering water discharge? LCSMC will require any dewatering water to be treated to remove sedimations prior to discharge.
Local Authorities						
Avon Township	NA	NA				
Lake Villa Township	NA	NA	5 and 7			
Warren Township	NA	NA				
Village of Grays Lake	NA	NA				
Village of Gurnee	NA	NA				
Village of Lake Villa	NA	NA	4, 5, and 6			
Village of Lindenhurst	NA	NA				
Village of Old Mill Creek	NA	NA				
Village of Round Lake Beach	Department of Economic Development Permit	Reimbursement of Fees are attached	1, 2, 3, and 4			

NE/NW WATER SYSTEM EXPANSION PROJECT
PERMIT DATABASE
CENTRAL LAKE COUNTY JOINT ACTION WATER AGENCY

Authority/Municipality/ Utility	Permit Information and Fees					Notes/Comments
	Permit Name	Fee Information	Pipeline "Legs" Permit Applies to	Approximate Total Fee	Meetings/Discussion Log	
Railroad						
Canadian National Railroad (Metra)	Licence Agreement	$750 - Permit Prep Fee $4,800 - Water License Fee $250 Cable Locate $1,300/Day - Flagman Fee CLC MUST Carry Insurance Contractor MUST Carry Insurance	4			

NE/NW WATER SYSTEM EXPANSION PROJECT
PERMIT DATABASE
CENTRAL LAKE COUNTY JOINT ACTION WATER AGENCY

Authority/Municipality/ Utility	Permit Information and Fees					Notes/Comments
	Permit Name	Fee Information	Pipeline "Legs" Permit Applies to	Approximate Total Fee	Meetings/Discussion Log	
			Northeast Pipeline Alignment			
State/Federal Authorities						
IDOT	Utility Construction Permit	Based on IDOT Review of Plans Contractor to complete permit and bond	1A, 6			
IDNR	Inter Agency Wetland Policy Act	NA				
IEPA	Construction Permit Schedule B: Water Main Construction	Permit fees exempt				
USACE (Corps of Engineers)	RP7 RP8-401		1, 1A, 3, 4, 5, 6, 7 or 7A			
County Authorities						
Lake County Forest Preserve	NA					
Lake County Division of Transportation	Watermain Construction Permit Performance Guarantee & Insurance (from General Contractor)	Per LCDOT roadway: $150 application fee $700 permit fee (> 1/4 mile) $350 (one time inspection fee for all of NE) Permit estimate $4,600 $200 (additional if reinspection required) Contractor Bond - $20,000 per County Roadway crossing - 7 crossings = Bond Estimate $140,000	1, 1A, 3, 4, and 5			
Lake County Department of Public Works	NA					
Lake County GIS	NA					
Lake County Stormwater Management Commission	Wetland Permit Preliminary Jurisdictional Determination (JD) $720 for First Wetland + $180 for each additional Boundary Verification $480 for first Wetland + $180 for each additional Designated Erosion Control Inspector for Construction	Preliminary Jurisdictional Determination $720 for First Wetland + $180 for each additional Boundary Verification $480 for first Wetland + $180 for each additional Fee Schedule is attached for LCSMC stormwater review & permits	1, 1A, 2, 3, 4, 5, 6, 7 or 7A			Does the permit required also include dewatering water discharge? LCSMC will require any dewtering water to be treated to remove sedimations prior to discharge.
Local Authorities						
Avon Township	NA					
Lake Villa Township	NA					
Newport Township	NA					
Warren Township	NA					
Village of Grays Lake	NA					
Village of Gurnee	Intergovernmental Agreement for restoration and tree impacts + listed on Contractor's Certificate of Insurance as also insured	Depends on agreement	2			
Village of Lake Villa	NA					
Village of Lindenhurst	NA					
Village of Old Mill Creek	NA					
Village of Round Lake Beach	NA					
Railroad						
Canadian National Railroad (Metra)	NA					

Notes:
NA - Not applicable. No permit identified in Section 7 or the Appendix of the Route Study Report dated April, 2014.

Appendix B

Proposed Permanent Easements

CDM Smith

Memorandum

To: *Darrell Blenniss; CLCJAWA Executive Director*

From: *Jon Meyer, CDM Smith*

Date: *October 16, 2014*

Subject: ***Anticipated Number of Permanent Easements Required for Pipeline Project***
CLCJAWA – North Group Preliminary Engineering Report

CDM Smith Inc. (CDMS), Applied Technologies, Inc. (ATI), and Manhard Consulting LtD (Manhard) evaluated the proposed Northwest (NW) and Northeast (NE) pipeline alignments for the North Group to estimate the number of permanent easements required for each alignment. This memorandum provides an initial approximation of the number of permanent easements required for the pipeline.

The following assumptions were made in generating the proposed number of permanent easements:

- Central Lake County Joint Action Water Agency (CLCJAWA) prefers to locate the pipeline in permanent easements wherever possible.
- Permanent easements will be a minimum of 10-feet wide either side of the pipe centerline, and a maximum of 20-feet total width.
- A re-evaluation will be performed during detailed design to determine if the alignment needs to be adjusted, and thus, additional permanent easements may be required.
- It is assumed that an equal number of the properties requiring permanent easements will also require temporary construction easements if the ground surface is disturbed in these areas.

Northwest Alignment

It is assumed that the NW pipeline alignment will require approximately 100 permanent easements. The properties that may require permanent easements are identified in Figure 1.

The alignment that proceeds northbound on Cedar Lake Road will only require one-half of the proposed permanent easement width (i.e. 10-feet) as the pipe will be located along the far western perimeter of the right-of-way. The remainder of the permanent easements are assumed to be the full width (20-foot).

There are twenty-five proposed permanent easements along IL Rte 83. ATI has identified that the Illinois Department of Transportation is planning to expand the width of this roadway. Therefore, it is recommended that the entire pipeline be placed in easements along IL Rte 83.

It should be noted that the railroad crossing will not require a permanent easement, but will instead require a license agreement. Therefore, it is not considered in the approximate number of permanent easements for this alignment.

Northeast Alignment

It is assumed that the NE pipeline alignment will require approximately 60 permanent easements. The properties that may require permanent easements are identified in Figure 2.

Leg 7 was included in this preliminary number to consider the worst –case-scenario known at this time. Leg 7 contains a total of 20 permanent easements located along Falling Waters Boulevard whereas Leg 7A only contains 3.

Summary

A total of approximately 160 permanent easements are assumed for the North Group water transmission main.

cc: FILE
Amrou Atassi – CDMS
Bill Soucie – CLCJAWA
Frank Tiefert – ATI
Tim Murphy – Manhard

Attachments:
Figure 1 - Approximate Number and Location of Permanent Easements for the Northwest Alignment
Figure 2 - Approximate Number and Location of Permanent Easements for the Northeast Alignment

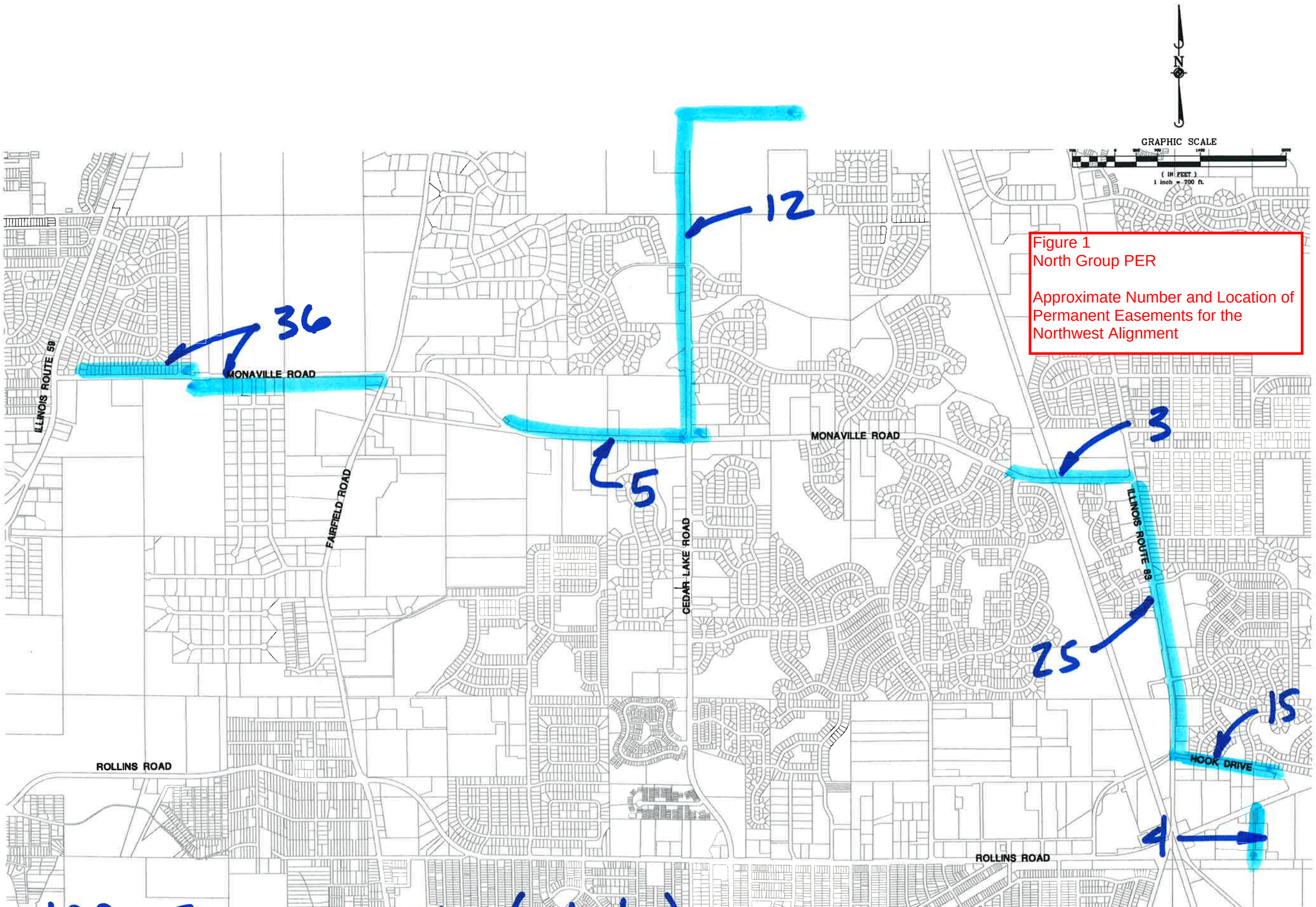


Figure 1
North Group PER

Approximate Number and Location of Permanent Easements for the Northwest Alignment

100 EASEMENTS (10/15/14)

Manhard CONSULTING LTD

CLCJAWA SYSTEM EXPANSION PROJECT
LAKE COUNTY, ILLINOIS
NORTHWEST ROUTE MAP

SHEET 1 OF 1

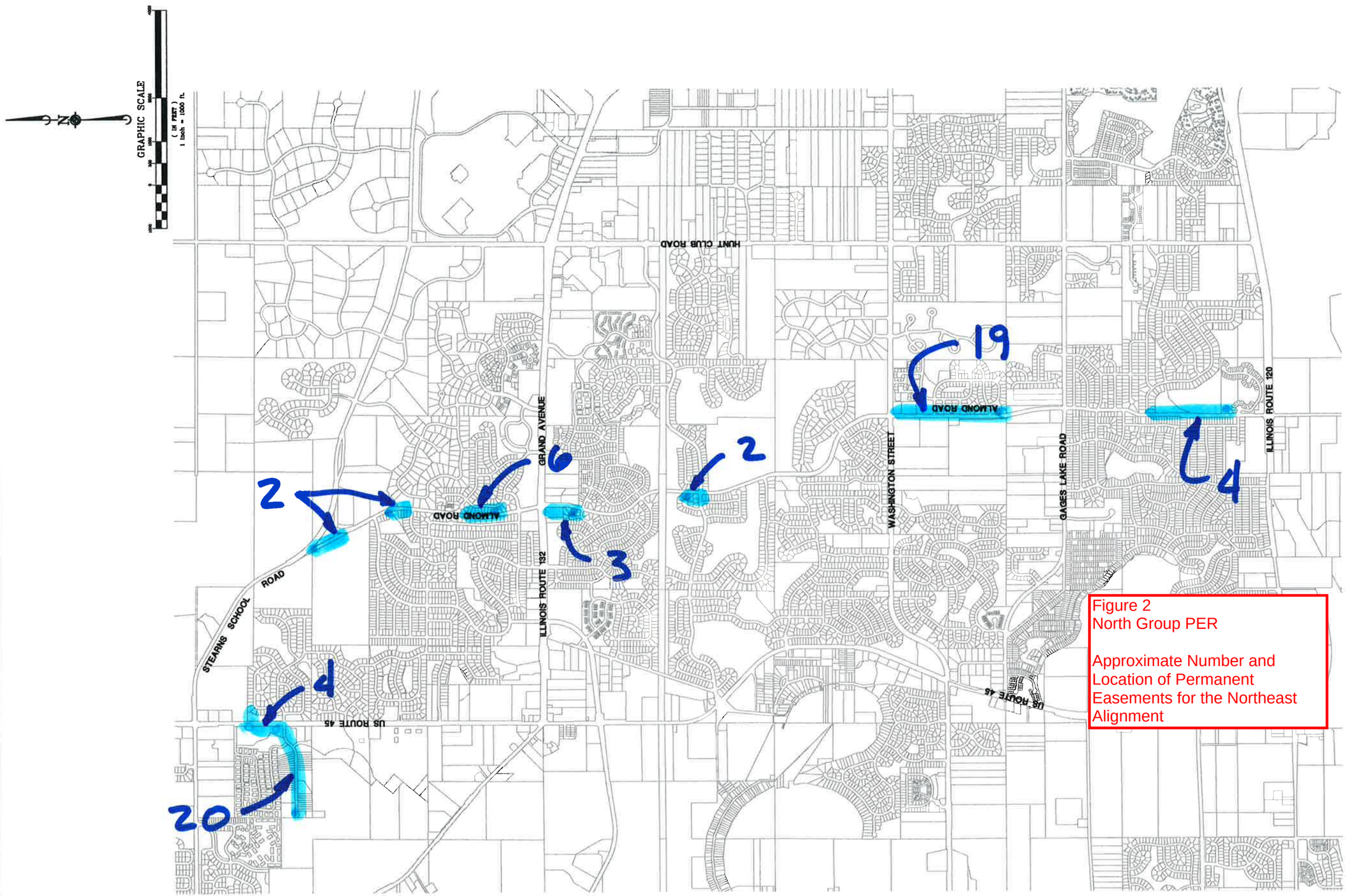


Figure 2
North Group PER

Approximate Number and Location of Permanent Easements for the Northeast Alignment

60 EASEMENTS (10/15/14)

Manhard CONSULTING LTD

CLCJAWA SYSTEM EXPANSION PROJECT

LAKE COUNTY, ILLINOIS

NORTHEAST ROUTE MAP

SHEET 1 OF 1

140008

Appendix C

Hydraulic Analysis Results

CDM Smith

Memorandum

To: *CLCJAWA North Group Expansion Technical Committee*

From: *CDM Smith*

Date: *October 27, 2014*

Subject: *CLCJAWA North Group Preliminary Engineering Report*
Updated Hydraulic Analysis Results

Introduction and Background

The Central Lake County Joint Action Water Agency (CLCJAWA) has been providing its nine members, serving 12 communities, with potable Lake Michigan water with a high degree of quality and reliability for over twenty years. Over the past several years, a number of Lake County communities approached the Agency for membership to access Lake Michigan as their water supply source.

Four communities (Lake Villa, Lindenhurst, Grandwood Park, and Fox Lake Hills) formed one of the prospective member groups designated by the Agency as the North Group. The North Group began discussions to obtain Lake Michigan water from the Agency, and a water supply agreement was reached in 2013. In accorance with the agreement, the Agency will supply Lake Michigan water to the North Group, and the North Group will fund the expansion of the Agency's finished water transmission main system, and other associated improvements. Two of the North Group members, Fox Lake Hills and Grandwood Park, are unincorporated communities with public water systems that are owned and operated by the Lake County Department of Public Works. Lake County is a current member of the Agency. The agreement includes provisions for expanding the Lake County water service area to include these two communities. The other two North Group members, Lake Villa and Lindenhurst, are incorporated villages. Each of these villages has a public water system. The agreement includes adding Lake Villa and Lindenhurst to the Agency as new members.

A North Group Membership Expansion Technical Committee was formed to review and present recommendations to the Agency's Board of Directors during the design and construction of finished water transmission main system improvements. The new committee consists of representation from the North Group, Agency staff, and an Executive Committee member.

In 2011 and 2012, CDM Smith completed several hydraulic modeling studies to evaluate serving the four new communities (in addition to serving the communities of Wauconda and Volo) using the Agency's calibrated hydraulic model. Initially the hydraulic analysis was based on the 2030 IDNR water demand allocations and a peaking factor of 1.69, and then later revised to the 2040 CMAP water demand

projections using a lower peaking factor of 1.65. The 2012 revised hydraulic analysis confirmed that the Agency can serve the new communities with a combination of pumping and transmission pipeline improvements. The analysis also identified the preliminary sizing of transmission piping needed to serve the new communities. The pipe size analysis was based on a preliminary desktop routing of the proposed pipelines.

In 2013, the North Group Technical Committee commissioned a Route Study to identify and evaluate pipeline routes to serve the new communities. Although the final pipeline routes serving the new communities defer from the 2012 desktop routes, the pipeline lengths did not change substantially.

The purpose of this memorandum is to provide the following information to the Technical Committee:

- Confirm pipeline sizing for the proposed pipelines serving the new communities while maintaining the Agency's system operating criteria;
- Provide residual pressure results to the existing and new members at current and future flow conditions; and
- Provide water age and chlorine residual information to the current and new members at current low flow conditions.

Basis of Modeling and Assumptions

The Agency's existing calibrated hydraulic model was used as the base for the new model development. This existing model was created in WaterGEMS V8i (SELECT series 4) software Version 8.11. The existing model included the Agency's water transmission system and facilities (elevated tank, standpipes, reservoir, high service and booster pumps) and also delivery structures for Lake Bluff, Vernon Hills, Libertyville, Mundelein, Libertyville, Round Lake Park, Grayslake, Round Lake, Gurnee, and Round Lake Beach. The new model development included addition of new transmission mains and delivery structures for Fox Lake Hills, Grandwood Park, Lake Villa, Lindenhurst, Volo, and Wauconda. Although the communities of Wauconda and Volo are not included in this phase of the project, it is important to simulate their water demands and assess that impact on overall system operation. All modeling simulations and results presented below include the water demands of Wauconda and Volo.

Transmission pipes and delivery structures of the new communities were added to the existing hydraulic model from the GIS database. The **attached map** shows the locations of the new community delivery structures and Agency transmission pipelines to those delivery structures. Proposed pipe sizes for the new transmission pipelines are also shown. The pipe sizes are consistent with the 2012 Capacity Expansion Assessment.

The following inputs were developed for the model development:

- New Delivery Structure Elevations - Elevations for the delivery structures were extracted from the Lake County Digital Terrain Model (DTM).

- New Transmission Pipe Lengths Size – The transmission pipeline lengths were extracted from the Route Study and latest revisions using GIS mapping. The initial pipeline sizing was based on the 2012 CDM Smith Study (Capacity Expansion Assessment dated August 14, 2012).

- Pipe Friction Factors (C-value) - The Hazen-Williams C-value is a relative measure of the hydraulic capacity of a water main. The C-value for the new transmission mains was assumed to be 110. This is consistent with the 2012 analysis. Although previous model calibration efforts confirmed a C-value of 130, it is important to account for C-value degradation over the life of the pipeline and this why the 110 C-value was used in the analysis.

- Demand Data and Allocations - The 2040 average day demands for the existing and new communities were taken from the 2012 Water Demand Projection Assessment. Current water demands for the new members were as provided in 2012 Capacity Expansion Assessment. Current water demands for the existing members were estimated from recent water demands provided by the Agency. Current and 2040 Maximum Day Demands were developed using a peaking factor of 1.65 times the average day demands. **Table 1** provides a summary of water demands for the new members used in the hydraulic analysis.

Table 1 - Current and 2040 Water Demands for the North Group

Community	Current Average Demand (MGD)	Current Maximum Demand (MGD)	2040 Average Demand (MGD)	2040 Maximum Demand (MGD)
Fox Lake Hills	0.18	0.30	0.20	0.33
Grandwood Park	0.44	0.73	0.46	0.76
Lake Villa	0.68	1.12	1.26	2.08
Lindenhurst	1.02	1.68	1.37	2.26

- Demand Patterns – Demand patterns for the Extended Period Simulations (EPS) were assumed to be consistent over the 24-hour period during average and maximum day demand conditions. This is consistent with the Agency's historical desired operation of maintaining constant flow over the course of the day since the Agency is not responsible for diurnal flow changes (such as peak hour flows) as well as fire flows.

The proposed transmission main sizes were evaluated for the current and 2040 demand conditions. The evaluation was based on the following established criteria:

- Velocities not to exceed 7 feet per second (fps) and ideally less than 5 fps for the new pipelines;
- Head losses not to exceed 6 feet/1,000 feet;
- Pressures not to exceed 135 psi in the system; and
- Minimum pressure of 25 psi at each delivery structure.

The model results assume Alternative B is selected for the Northeast connection point to the Agency's existing system. The hydraulic comparison between the two alternatives is later discussed in this memorandum.

Table 2 summarizes the basis of hydraulic and water quality analysis, as well as the design criteria for the system.

Table 2 – Summary Basis of Analysis and Design Criteria

Parameter	***Value***	***Notes/Comments***
Number of Delivery Structures Per Community	*One*	-
Minimum Delivery Pressure	*25 psi*	*Pressure will vary depending on water demands and system conditions/operation*
Design Flows	*Maximum Day Demand Only (per CMAP 2040 flows at 1.65 peaking factor)*	*Fire flows and peak hour flows are the responsibility of the communities via adequate existing or new storage*
CLCJAWA Demand Responsibility	*Allocated Percentage of Plant Production Capacity*	-
Minimum Delivery Chlorine Residual	*0.2 ppm*	*Each community will be responsible for booster chlorination beyond the delivery point*
Corrosion Control and Flushing	*Agency will provide non-corrosive water with an ortho-phosphate*	*Each community is responsible for flushing of existing distribution system to address hydraulic and water quality changes in the system during the transition to Lake Michigan water*
Pipeline C-Value	*110*	*C-value is a measure of the roughness of the pipe and is a critical parameter in sizing transmission main piping.*
Maximum Allowable System Pressure	*135 psi*	-
Maximum Design Velocity	*<7 feet per second*	

(1) Members cannot assume 100% continuous water service from the Agency 100% of the time.
(2) *An emergency response plan for existing and new members is being developed by the individual member communities.*

Hydraulic Model Results

The hydraulic model results are broken into the following:

- Current average day and maximum day residual pressure results
- Future (2040) average day and maximum day residual pressure results
- Water age and chlorine residual results simulated during a current low flow condition (worse case water age condition).

For the residual pressure results where the hydraulic model was simulated under current and future average and maximum demand conditions, it is important to understand the limitations and assumptions:

- WTP (Water Treatment Plant) high service pumps are operational using a combination of pumps maintaining the desired flow condition and maintaining discharge pressure of less than 135 psi.
- The new intermediate booster pump station is assumed to be operational when simulating the 2040 maximum day flow conditions. This pump station is on the finished water transmission main, located along Route 176 near the east border of Libertyville.
- The analysis assumes that the existing and new members' water demands are consistent and peak (at the peaking factor of 1.65) simultaneously.
- The existing elevated tank continues to float on the system at all times to provide the surge protection needed (continued to operate below the overflow elevation of 1000-feet and above the minimum level of approximately 960-feet). Given the hydraulic impact of the elevated tank on the system, the model was simulated with and without the elevated tank in service. The model assumed an initial elevated tank level of 974-feet.
- The standpipes water level will vary to provide the Agency with the flexibility to operate the system efficiently and stay below the standpipe overflow elevation of approximately 896-feet.
- The existing standpipes and booster pumping station are operational using a combination of pumps required to maintain the hydraulic grade line to float the elevated tank on the system. A future fourth booster pump will be required for the 2040 maximum flow conditions.
- The available pressures provided in this memorandum are estimated based on normal operational scenarios and should not be used by the communities for designing their internal distribution system improvements. The North Group should design all internal improvements assuming a delivery pressure of 25 psi and chlorine residual of 0.2 ppm.

Current Average Day Demand Results

The water model was simulated for the current average day demand conditions. The total demand in the system for this scenario is 25.3 MGD. The available residual pressures for the current average day demand conditions are summarized in **Table 3**. Please note that these pressures are estimated based on normal operational scenarios. The Agency will optimize its system operation to delivery 25 psi at the control point, which can change depending on the flow conditions.

Table 3 – Residual Pressure for Current Average Day Demand Conditions	
Community	Residual Pressure (PSI) with Elevated Tank in Service (1)
Fox Lake Hills	25 – 83 (+/-)
Grandwood Park	25 – 83 (+/-)
Lake Villa	25 – 71 (+/-)
Lindenhurst	25 – 78 (+/-)

(1) The residual pressure when the tank is out of service depends on the number of booster pumps in operation and the water demands for the existing members. The estimate pressure ranges between 25 and 40 psi for the new communities.

Current Maximum Day Demand Results

The water model was simulated for the current maximum day demand conditions. A peaking factor of 1.65 was applied to the average day demands. The total demand in the system for this scenario is 41.8 MGD. The available residual pressures for the current maximum day demand conditions are summarized in **Table 4**.

Table 4 – Residual Pressure for Current Maximum Day Demand Conditions		
Community	Pressures (PSI) with Elevated Tank in Service	Pressures (PSI) with Elevated Tank Out of Service
Fox Lake Hills	25 – 75 (+/-)	25 – 37 (+/-)
Grandwood Park	25 – 75 (+/-)	25 – 37 (+/-)
Lake Villa	25 – 63 (+/-)	25 (+/-)
Lindenhurst	25 – 66 (+/-)	25 – 28 (+/-)

Appendix A.1 includes a summary of flows and residual pressures for the current and future communities under current water demand conditions.

2040 Average Day Demand Results

The water model was simulated for the 2040 average day demand conditions. The total demand in the system for this scenario is 30.9 MGD. The available residual pressures for the 2040 average day demand conditions are summarized in **Table 5**.

Table 5 – Residual Pressure for 2040 Average Day Demand Conditions	
Community	Pressures (PSI) with Elevated Tank in Service (1)
Fox Lake Hills	25 - 79 (+/-)
Grandwood Park	25 - 81 (+/-)
Lake Villa	25 - 65 (+/-)
Lindenhurst	25 - 74 (+/-)

(1) The residual pressure when the tank is out of service depends on the number of booster pumps in operation and the water demands for the existing members. The estimate pressure ranges between 25 and 40 psi for the new communities.

2040 Maximum Day Demand Results

The water model was simulated for the 2040 maximum day demand conditions. A peaking factor of 1.65 was applied to the average day demand. The total demand in the system for this scenario is 51.0 MGD. The available residual pressures for the 2040 maximum day demand conditions are summarized in **Table 6**.

Table 6 – Residual Pressures for 2040 Maximum Day Demand Conditions

Community	Pressures (PSI) with Elevated Tank in Service	Pressures (PSI) with Elevated Tank Out of Service
Fox Lake Hills	25 – 64 (+/-)	25 – 47 (+/-)
Grandwood Park	25 - 70 (+/-)	25 - 53 (+/-)
Lake Villa	25 - 50 (+/-)	25 - 33 (+/-)
Lindenhurst	25 - 57 (+/-)	25 - 40 (+/-)

This scenario assumes the operation of the new intermediate booster pumping station, WTP improvements to provide the 51 MGD flow, and the addition of a fourth pump at the existing Booster Pumping Station. The new intermediate booster pumping station is needed when flows from the WTP approach 46 MGD. This is based on a C-value in the pipe of 110.

Figure 1 provides a hydraulic profile at the 2040 maximum day demand conditions (design condition). Appendix A.2 includes a summary of flows and residual pressures for the current and future communities under 2040 maximum day water demand conditions.

Water Quality Analysis – Water Age and Chlorine Residual

Water age is a measure of the water turnover in the distribution system (i.e. how long has the water been in the distribution system since its original source at the water treatment plant). Long water age (distribution system residence time) may lead to loss of chlorine residual in the system, potential formation of disinfection-by-products, and formation of biofilm.

An extended period simulation (EPS) of the model was performed for ten days under a current minimum day demand of 13 MGD to determine if the system has water age problems. Minimum day demand was estimated using a peaking factor of 0.5 over the current average day demand. Water age is a function primarily of water demand, system operation, and system design. Generally, water age decreases as the demand in the system increases, operation of booster pumps or smaller pipe sizes. The water age under the low demand flow condition for the new communities is summarized in **Table 7**.

Table 7 - Water Age During Minimum Day Demand Conditions (13 MGD)

Community	Water Age (hours)
Fox Lake Hills	66 (+/-)
Grandwood Park	42 (+/-)
Lake Villa	58 (+/-)
Lindenhurst	50 (+/-)

Analysis for residual chlorine is dependent on the following parameters. These parameters were based from the 2002 Water Quality Modeling Study where the reaction rates were simulated based on actual field conditions for the Agency's system.

- Bulk reaction rate of 0.22/day – The bulk reaction rate or decay factor was developed based on August 2002 chlorine residual testing where the water temperature ranged between 20 and 23 degrees Celsius. This will produce more conservative results since most low flow conditions occur in the winter where chlorine decay is lower.
- Wall reaction rate of 0.080 feet/day
- Diffusivity (of chlorine in water) is 1.208 x 10^{-9} ft^2/sec

For this scenario a chlorine residual of 0.7 mg/L was simulated leaving the water treatment plant and a residual of 0.8 mg/L at the existing booster pumping station. An extended period simulation (EPS) of the model was performed for ten days under a current minimum day demand of 13 MGD to identify the available chlorine residual in the system. Minimum chlorine residual at the delivery structure of the newer communities are summarized in **Table 8**.

Table 8 - Chlorine Residual Results During Minimum Day Demand Conditions (13 MGD)

Community	Chlorine Residual (ppm)
Fox Lake Hills	0.2 - 0.42 (+/-)
Grandwood Park	0.2 - 0.63 (+/-)
Lake Villa	0.2 - 0.46 (+/-)
Lindenhurst	0.2 - 0.54 (+/-)

Figure 2 provides a chlorine decay curve from the WTP to Fox Lake Hills. Appendix A.3 includes a summary of flows, water age, and chlorine residual for the current and future communities.

Northeast Route - Alternative A Route vs Alternative B Route

As shown in the attached map, for the Northeast pipeline serving the communities of Grandwood Park and Lindenhurst, two alternatives are currently being evaluated to where the proposed pipeline will tie into the existing Agency's transmission system. Alternative A is a proposed 20-inch along Washington Street running in parallel to an existing 12-inch pipeline. The proposed 20-inch ties to the existing 30-inch along Hunt Club Road. Alternative B is a proposed 20-inch along Almond Road. Both alternatives are currently being included in the Preliminary Engineering Report and will be surveyed.

The hydraulic model was simulated to determine the hydraulic impact for both alternatives under the 2040 maximum day demand conditions. **Table 9** summarizes the comparison between the two alternative routes. Based on the hydraulic results and the additional headloss through the existing 30-inch pipeline on Hunt Club Road, Alternative B along Almond Road is recommended.

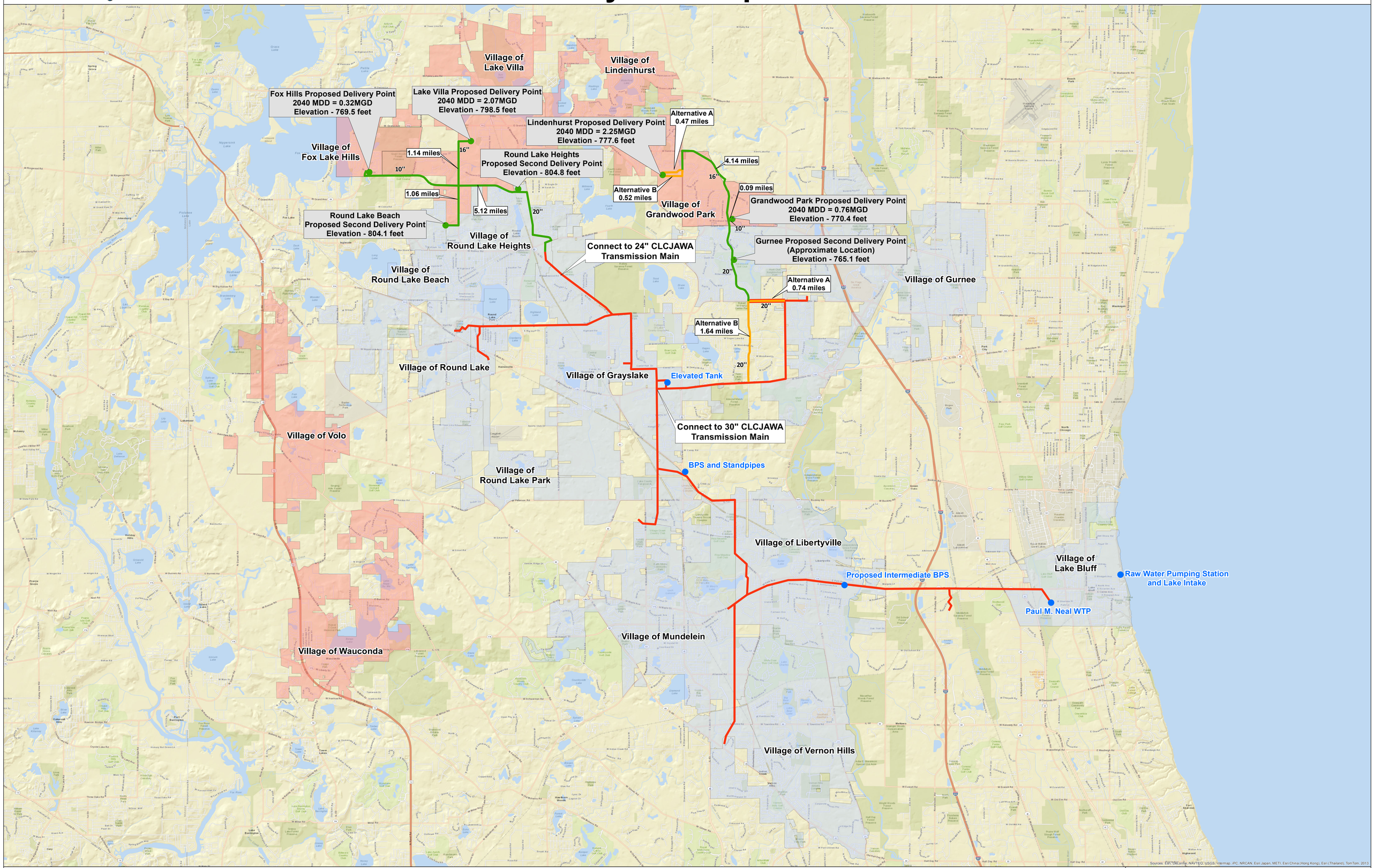
Table 9 – Comparison of Hydraulic Results for Northeast Connection Point to Agency's System		
Parameter	Alternative A	Alternative B
Pressure (PSI) at Grandwood Park Delivery Point	59 (+/-)	67 (+/-)
Pressure (PSI) at Gurnee Delivery Point	74 (+/-)	78 (+/-)
Pressure (PSI) at Lindenhurst Delivery Point	45 (+/-)	54 (+/-)

Conclusions and Recommendations

The following conclusions and recommendations were developed based on the above hydraulic and water quality modeling results:

- The pipeline sizes previously developed to serve the new communities are confirmed and are summarized in the **attached map**.
- The new intermediate booster pump station is needed when the discharge pressure out of the WTP high service pumps approaches 135 psi, which equates to a total system demand of 46 MGD.
- The Agency's water system and proposed improvements will allow the Agency to meet the new members current and future water demands while maintaining a minimum delivery pressure of 25 psi. Higher residual pressure at the delivery points depends on the operation/level of the elevated tank, distribution of demands in the system, and the optimization of pumping operation at the WTP and booster pumping stations.
- The expansion of the Agency's system will result in higher water age to the new members. The higher water age will reduce chlorine residual in the system to the new members. Based upon the results, all four new communities should plan on booster chlorination.
- In comparing Alternative A versus Alternative B for connecting to the Agency's existing transmission system, Alternative B (Almond Road) is recommended due to the decrease in headloss and the improved reliability of the system.

Central Lake County Joint Action Water Agency (CLCJAWA)
Water System Expansion



N

0 1.25 2.5 5 Miles

Legend

- Proposed Route
- Proposed Route Alternatives
- Existing
- CLCJAWA Facilities
- Proposed Delivery Point
- Existing CLCJAWA Members
- Prospective Members

Elevation Source - Lake County Digital Terrian Model (2014)

CLCJAWA
Water System Expansion

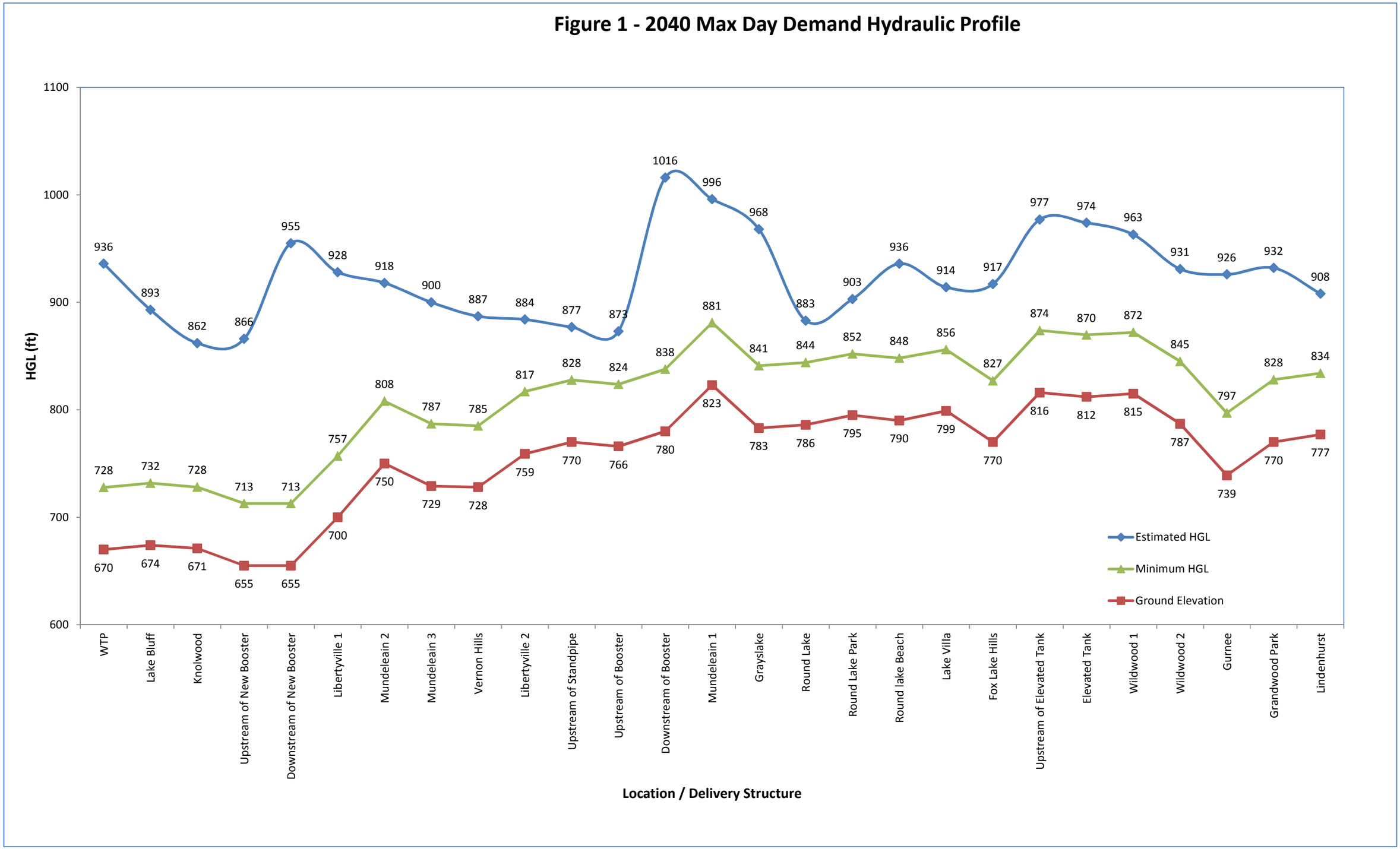
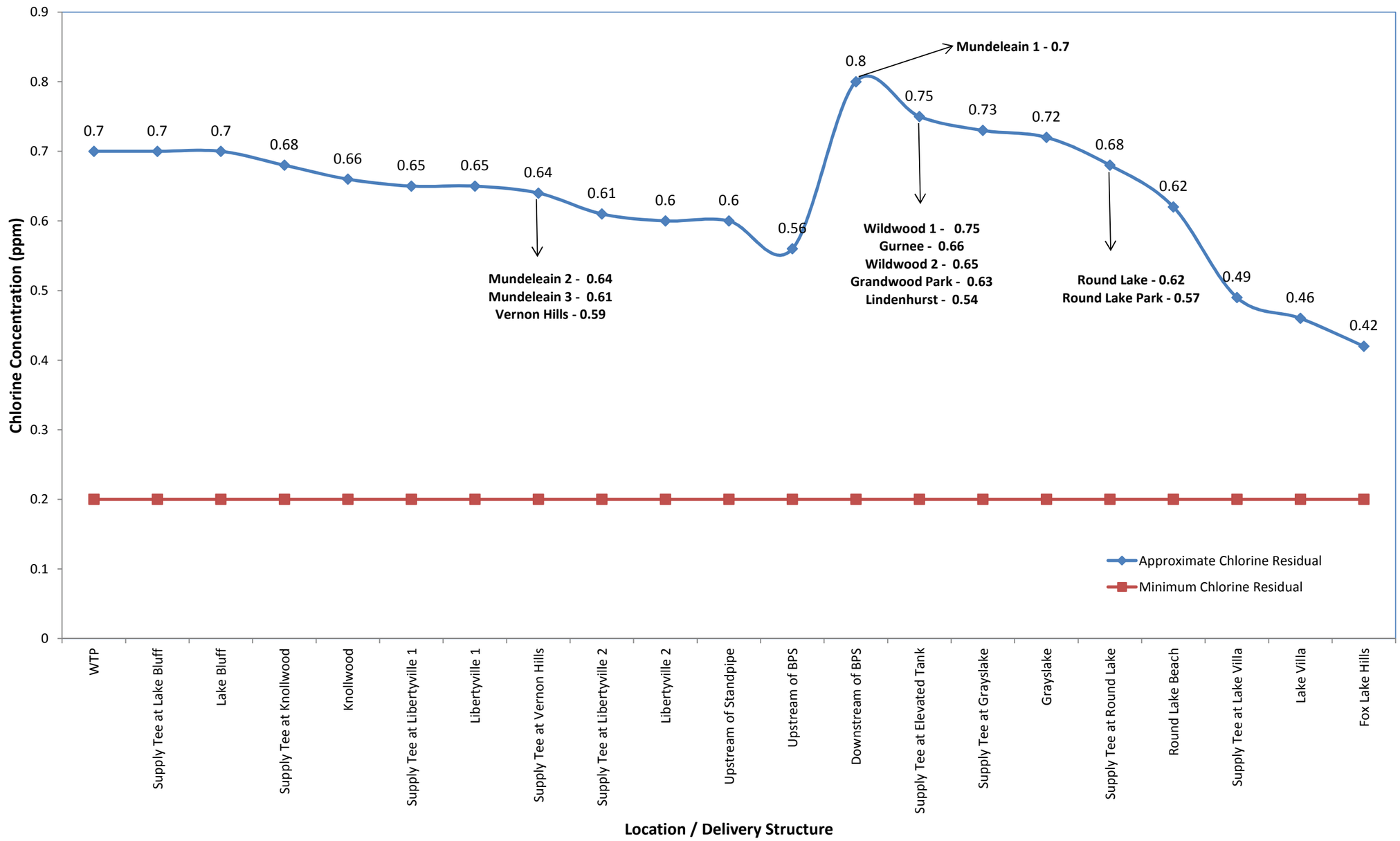


Figure 1 - 2040 Max Day Demand Hydraulic Profile
HGL (ft)
1100
1000
900
800
700
600
936
893
862
866
955
928
918
900
887
884
877
873
1016
996
968
883
903
936
914
917
977
974
963
931
926
932
908
728
732
728
713
713
757
808
787
785
817
828
824
838
881
841
844
852
848
856
827
874
870
872
845
797
828
834
670
674
671
655
655
700
750
729
728
759
770
766
780
823
783
786
795
790
799
770
816
812
815
787
739
770
777
Estimated HGL
Minimum HGL
Ground Elevation
WTP
Lake Bluff
Knolwood
Upstream of New Booster
Downstream of New Booster
Libertyville 1
Mundeleain 2
Mundeleain 3
Vernon Hills
Libertyville 2
Upstream of Standpipe
Upstream of Booster
Downstream of Booster
Mundeleain 1
Grayslake
Round Lake
Round Lake Park
Round lake Beach
Lake Villa
Fox Lake Hills
Upstream of Elevated Tank
Elevated Tank
Wildwood 1
Wildwood 2
Gurnee
Grandwood Park
Lindenhurst
Location / Delivery Structure

Figure 2 - Chlorine Decay Plot at Current Low Flow Conditions



Appendix A.1 - Current Water Demand Conditions/Results

Delivery Point	Elevation (ft)	Average Day Demand (MGD)	Pressure with Elevated Tank In Service (psi)	Max Day Demand (MGD)	Pressure with Elevated Tank in Service (psi)	Pressure with Elevated Tank Out-of-Service (psi)
Gurnee	739	4.26	95 +/-	7.03	85 +/-	47 +/-
Vernon Hills	728	3.10	65 +/-	5.12	66 +/-	66 +/-
Round Lake	786	1.35	76 +/-	2.23	68 +/-	30 +/-
Round Lake Beach	790	2.20	76 +/-	3.63	70 +/-	32 +/-
Grayslake	783	1.71	82 +/-	2.82	81 +/-	42 +/-
Libertyville -1	700	1.48	84 +/-	2.43	95 +/-	95 +/-
Libertyville -2	759	1.48	52 +/-	2.43	53 +/-	53 +/-
Mundelein-3	729	0.92	67 +/-	1.52	71 +/-	71 +/-
Mundelein-1	823	0.92	66 +/-	1.52	63 +/-	29 +/-
Mundelein-2	750	0.92	61 +/-	1.52	70 +/-	70 +/-
Lake Bluff	674	0.90	103 +/-	1.49	128 +/-	128 +/-
Knollwood	671	0.66	101 +/-	1.09	119 +/-	119 +/-
Wildwood - 1	815	0.60	67 +/-	0.99	65 +/-	26 +/-
Wildwood - 2	787	0.60	75 +/-	0.99	66 +/-	28 +/-
Round Lake Park	795	0.37	73 +/-	0.61	66 +/-	28 +/-
Lake Villa	799	0.68	71 +/-	1.12	63 +/-	25 +/-
Lindenhurst	777	1.02	78 +/-	1.68	66 +/-	28 +/-
Grandwood Park	770	0.44	83 +/-	0.73	75 +/-	37 +/-
Fox Lake Hills	770	0.18	83 +/-	0.30	75 +/-	37 +/-

Appendix A.2 - 2040 Water Demand Conditions/Results

Delivery Point	Elevation (ft)	Average Day Demand (MGD)	Max Day Demand (MGD)	Pressure with Elevated Tank in Service (psi)	Pressure with Elevated Tank Out of Service (psi)
Gurnee	739	4.95	8.17	81 +/-	64 +/-
Vernon Hills	728	3.18	5.25	69 +/-	69 +/-
Round Lake	786	2.73	4.50	42 +/-	25 +/-
Round Lake Beach	790	2.48	4.09	63 +/-	46 +/-
Grayslake	783	1.92	3.17	80 +/-	63 +/-
Libertyville -1	700	1.49	2.46	99 +/-	99 +/-
Libertyville -2	759	1.49	2.46	54 +/-	54 +/-
Mundelein-3	729	1.05	1.73	74 +/-	74 +/-
Mundelein-1	823	1.05	1.73	75 +/-	53 +/-
Mundelein-2	750	1.05	1.73	73 +/-	73 +/-
Lake Bluff	674	0.85	1.40	95 +/-	95 +/-
Knollwood	671	0.81	1.34	83 +/-	83 +/-
Wildwood - 1	815	0.64	1.06	64 +/-	47 +/-
Wildwood - 2	787	0.64	1.06	62 +/-	46 +/-
Round Lake Park	795	0.57	0.94	47 +/-	30 +/-
Lake Villa	799	1.26	2.08	50 +/-	33 +/-
Lindenhurst	777	1.37	2.26	57 +/-	40 +/-
Grandwood Park	770	0.46	0.76	70 +/-	53 +/-
Fox Lake Hills	770	0.2	0.33	64 +/-	47 +/-

Appendix A.3 - Water Age and Chlorine Residual Results at Current Minimum Flow Conditions

Delivery Point	Demand (MGD)	Max Water Age (Hours)	Anticipated Chlorine Residual (ppm)
Gurnee	2.13	38 +/-	0.66 +/-
Vernon Hills	1.55	14 +/-	0.59 +/-
Round Lake	0.68	42 +/-	0.62 +/-
Round Lake Beach	1.10	38 +/-	0.66 +/-
Grayslake	0.86	32 +/-	0.72 +/-
Libertyville -1	0.74	8 +/-	0.65 +/-
Libertyville -2	0.74	14 +/-	0.60 +/-
Mundelein-3	0.46	12 +/-	0.61 +/-
Mundelein-1	0.46	30 +/-	0.70 +/-
Mundelein-2	0.46	10 +/-	0.64 +/-
Lake Bluff	0.45	1 +/-	0.70 +/-
Knollwood	0.33	5 +/-	0.66 +/-
Wildwood - 1	0.30	31 +/-	0.75 +/-
Wildwood - 2	0.30	38 +/-	0.65 +/-
Round Lake Park	0.19	47 +/-	0.57 +/-
Lake Villa	0.34	58 +/-	0.46 +/-
Lindenhurst	0.51	50 +/-	0.54 +/-
Grandwood Park	0.22	42 +/-	0.63 +/-
Fox Lake Hills	0.09	66 +/-	0.42 +/-

Appendix D

Wang Geotechnical Report

CDM Smith

GEOTECHNICAL DATA REPORT
CENTRAL LAKE COUNTY JOINT ACTION WATER AGENCY NORTH GROUP SYSTEM EXPANSION
NORTHEAST AND NORTHWEST MAINS
LAKE COUNTY, ILLINOIS

For

CDM Smith, Inc.

125 South Wacker Drive, Suite 600

Chicago, IL 60606

(312) 346-5000

Submitted by

Wang Engineering, Inc.

1145 North Main Street

Lombard, IL 60148

(630) 953-9928

December 16, 2014

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1145 North Main Street
Lombard, Illinois 60148
Phone (630) 953-9928
www.wangeng.com

GEOTECHNICAL DATA REPORT
CENTRAL LAKE COUNTY JOINT ACTION WATER AGENCY
NORTH GROUP SYSTEM EXPANSION
NORTHEAST AND NORTHWEST TRANSMISSION MAINS
LAKE COUNTY, ILLINOIS
FOR
CDM SMITH, INC.

1.0 INTRODUCTION

This report presents the results of our Phase I geotechnical subsurface investigation and laboratory testing in support of the Central Lake County Joint Action Water Agency (CLCJAWA) North Group System Expansion in Lake County, Illinois. The system expansion will include the installation of two new transmission mains, designated as the 4 Northwest (4NW) and 4 Northeast (4NE) lines. A *Site Location Map* is presented as Exhibit 1.

Wang Engineering, Inc. (Wang) understands the new mains will have diameters ranging from 10 to 20 inches and will be installed approximately 5 feet below grade. The 4NW route has a total length of approximately 7.4 miles, whereas the 4NE Route has a total length of approximately 7.1 miles. The majority will be constructed in cut-and-cover trenches; however, at major roadway, rail, and waterway crossings, as well as crossings mandated by local agencies, the mains will require trenchless construction technologies. These trenchless crossings require deeper geotechnical investigations by way of longer soil boring logs to support the design and construction. The mains will be either polyvinyl chloride (PVC) or ductile iron pipe (DIP).

The purpose of the subsurface investigation and laboratory testing program was to provide Phase I characterization of the site soil and groundwater conditions along the 4NW and 4NE Mainline Routes.

1.1 4 Northwest Route

The 4NW Route begins at the Fox Lake Hills Well House #2 near the corner of Avon Drive and Monaville Road, runs east along the north easement of Monaville Road to Illinois Route 83, turns south along IL 83 and terminates near the intersection of Rollins Road and Wood Street (see Route 4NW map for specific details). The 4NW Route has 9 locations identified as requiring trenchless technologies and these locations are summarized in Section 3.1.

1.2 4 Northeast Route

The 4NE Route begins at the Lindenhurst Connection near Falling Water Boulevard and US Route 45. It jogs north along US 45 to Stearns School Road and takes a southern route along Stearns School Road, Hutchins Road, and Almond Road to the corner of Almond Road and Washington Street. At Washington Street two alternatives will be investigated, one running along Washington Street to Hunt Club Road and second continuing south along Almond Road to Illinois Route 120 (see Route 4NE map for specific details). The 4NE Route may have up to 19 locations identified as requiring trenchless technologies and these locations are summarized in Section 3.1.

2.0 GEOLOGIC SETTING

The following review of published geological, with emphasis on factors that might influence the design and construction of proposed engineering works, is meant to place the project area within a physiographic and geological framework. The goal is to confirm the dependability and consistency of the subsurface investigation results. For the study of the regional geologic framework, Wang considered the northeastern Illinois area in general and central Lake County in particular.

2.1 Physiography

Lake County is part of Wheaton Morainal Country, which is characterized by a series of broad parallel morainic ridges with intervening stretches of relatively flat or gently undulatory groundmoraine. The topography consists of elongated hills, mounds, basins, sags, and valleys parallel to the Lake Michigan Shoreline (Leighton et al. 1948). The surface elevations have relatively significant variation, with the 4NW Alignment ranging from a high elevation of approximately 820 feet (NAVD88) to a low elevation of approximately 755 feet. The 4 NE section ranges in elevation for about 790 feet to a low of about 720 feet.

2.2 Surficial Cover

The glacigenic deposits were placed during short-lived advances or still-stands of the retreating glacier responsible for the formation of end moraines and associated low-relief till and lake plains. Today, glacial drift up to 200 feet thick overlies the bedrock. The moraine deposits consist primarily of diamicton attributed to the Wadsworth Formation. This formation contains relatively homogeneous, massive, gray till with clay to silty clay matrix, a high content of black shale clasts, and occasional silt and sand lenses (Branhardt 2005, Hansel and Johnson 1996, Willman et al. 1975). From an

engineering viewpoint, the Wadsworth diamicton in central Lake County has relatively low plasticity with medium to low water content, poor permeability, and low compressibility (Bauer et al. 1991).

Sorted drift includes outwash deposits of the Henry Formation and lacustrine deposits of the Equality Formation. The Henry Formation consists of evenly-bedded and generally well-sorted sand and gravel. The Equality Formation consists of clay and fine grained silt and sand.
Post glacial deposits include modern stream sediment attributed to Cahokia Alluvium and muck or peat of Grayslake Peat.

2.3 Bedrock

The uppermost section of bedrock that underlies Lake County consists of Silurian-age dolostones (Willman et al. 1975). The bedrock is about 150 to 200 feet deep, with top of bedrock at an elevation of about 500 to 550 feet (Herzog et al., 1994). No major, active faults have been identified in the area. Structurally, the bedrock dips gently eastward at a pace of 10 to 15 feet per mile (Willman 1971).

3.0 METHODS OF INVESTIGATION

3.1 Subsurface Investigation

The complete subsurface investigation consists of 74 soil borings drilled by Wang between August and November, 2014. The 4NW Alignment contains 40 soil borings and the 4NE Alignment contains 34 soil borings. The borings were advanced to depths of 12 and 36 feet bgs; the borings in areas proposed for cut-and-cover construction were advanced 12 feet, whereas the proposed trenchless crossing locations were advanced to 36 feet bgs. A summary of the soil borings drilled along each alignment, as well as the range of ground surface elevations and boring termination depths, is provided below in Tables 1 (4NW) and 2 (4NE). In addition, a summary of trenchless crossing locations and the associated soil borings is provided in Table 3. Northings, eastings, and elevations were provided by CDM Smith. Boring location data is shown in the *Boring Logs* (Appendix A) and in the *Boring Location Plans* (Exhibit 2).

Table 1: 4NW Soil Boring IDs, Locations, As-drilled Elevations, and Termination Depths

Route Leg ID	Location	Boring ID	As-Drilled Elevation Range (feet)	Termination Depth Range (feet)
4NW Leg 1	Wood Street/ Rollins Road	4NW-24 4NW-TC-10		12 to 36
4NW Leg 2	Hook Drive	4NW-23 4NW-TC-09		12 to 36
4NW Leg 3	IL Route 83	4NW-19 thru 4NW-22 4NW-TC-08		12 to 36
4NW Leg 4	Monaville Road, IL 83 to CLR	4NW-14 thru 4NW-18 4NW-TC-04, 06, 07		12 to 36
4NW Leg 5	Monaville Road, CLR to Avon Drive	4NW-01 thru 4NW-08 4NW-TC-01, 02, 03		12 to 36
4NW Leg 6	Cedar Lake Road (CLR)	4NW-09 thru 4NW-13 4NW-TC-05		12 to 36

Table 2: 4 NE Soil Boring IDs, Locations, As-drilled Elevations, and Termination Depths

Route Leg ID	Location	Boring ID	As-Drilled Elevation Range (feet)	Termination Depth Range (feet)
4NE Leg 1A	Almond Road, IL 120 to Washington	4NE-18 and 4NE-19 4NE-TC-15 thru 4NE-TC-20		12 to 36
4NE Leg 1	Washington Street, Almond to Hunt Club Road	4NE-16 and 4NE-17 4NE-TC-13 and 4NE-TC-14		12 to 36
4NE Leg 2	Almond Road, Washington to IL 132	4NE-13 thru 4NE-15 4NE-TC-06 thru 4NE-TC-12		12 to 36

4NE Leg 3	Hutchins Road, IL 132 to Woodland Terrace	4NE-TC-05	36
4NE Leg 4	Hutchins Road, Woodland Terrace to Stearns School	4NE-10 thru 4NE-12 4NE-TC-03 and 4NE-TC-04	12 to 36
4NE Leg 5	Stearns School Road, Hutchins to US Route 45	4NE-04 thru 4NE-09 4NE-TC-02	12 to 36
4NE Leg 6	US Route 45, Stearns School to Falling Waters	4NE-02 and 4NE-03 4NE-TC-01	12 to 36
4NE Leg 7/7A	Falling Waters Boulevard	4NE-01 and 4NE-01A	12 to 36

Table 3: Summary of Trenchless Crossing Borings

Boring ID	Route ID	Crossing ID
4NW-TC-01	Monaville Road, 4NW Leg 5	Grant Woods Trail Underpass
4NW-TC-02	Monaville Road, 4NW Leg 5	North Fairfield Road
4NW-TC-03	Monaville Road, 4NW Leg 5	Old Monaville Road Crossover
4NW-TC-04	Monaville Road, 4NW Leg 4	Cedar Lake Road
4NW-TC-05	Cedar Lake Road, 4NW Leg 6	Drainage Ditch Culvert
4NW-TC-06	Monaville Road, 4NW Leg 4	Wisconsin Central Railroad
4NW-TC-07	Monaville Road, 4NW Leg 4	IL Route 83, west
4NW-TC-08	IL Route 83, 4NW Leg 3	Monaville Road, east
4NW-TC-09	Hook Drive, 4NW Leg 2	Crossover
4NW-TC-10	Rollins Road, 4NW Leg 1	Wood Street
4NE-TC-01	US Route 45, 4NE Leg 6	Falling Waters Boulevard
4NE-TC-02	Stearns School Road, 4NE Leg 5	US Route 45
4NE-TC-03	Hutchins Road, 4NE Leg 4	Crossover

4NE-TC-04	Hutchins Road, 4NE Leg 4	Woodland Terrace
4NE-TC-05	Hutchins Road, 4NE Leg 3	IL Route 132, north
4NE-TC-06	Almond Road, 4NE Leg 2	IL Route 132, south
4NE-TC-07	Almond Road, 4NE Leg 2	Clem Drive
4NE-TC-08	Almond Road, 4NE Leg 2	Almaden Lane
4NE-TC-09	Almond Road, 4NE Leg 2	Dada Drive
4NE-TC-10	Almond Road, 4NE Leg 2	Bittersweet Drive
4NE-TC-11	Almond Road, 4NE Leg 2	Aberdare Lane
4NE-TC-12	Almond Road, 4NE Leg 2	Washington Street
4NE-TC-13	Washington Street, 4NE Leg 1	White Oak Lane
4NE-TC-14	Washington Street, 4NE Leg 1	Hunt Club Road, east project limit
4NE-TC-15	Almond Road, 4NE Leg 1A	Homestead Road
4NE-TC-16	Almond Road, 4NE Leg 1A	Julie Lane
4NE-TC-17	Almond Road, 4NE Leg 1A	Gages Lake Road
4NE-TC-18	Almond Road, 4NE Leg 1A	Winnebago Drive
4NE-TC-19	Almond Road, 4NE Leg 1A	Dartmore Drive
4NE-TC-20	Almond Road, 4NE Leg 1A	Fairfield Lane, south project limt

Truck and ATV-mounted drilling rigs, equipped with rotary drilling equipment and hollow stem augers, were used to advance and maintain open boreholes. Soil sampling was performed according to ASTM D 1586, "*Penetration Test and Split Barrel Sampling of Soils*." The soil was continuously sampled to the termination depths of the borings. Samples collected from each interval were placed in sealed jars for further examination and laboratory testing. Undisturbed Shelby tube samples of foundation soils were collected in Boring RW-17 in accordance with ASTM D 1587, "*Thin-Walled Tube Sampling of Soils.*"

Field boring logs, prepared and maintained by a Wang geologist, include lithological descriptions, visual-manual soil classifications (USCS, ASTM D 2488), results of Rimac and pocket penetrometer field unconfined compressive strength tests, and results of Standard Penetration Tests (SPT), recorded as blows per 6 inches of penetration.

Groundwater observations were made in each boring during and at the completion of drilling operations. During the investigation, 10 groundwater monitoring wells were installed along the project alignments and a summary the locations is provided in Table 4. The borings were backfilled with bentonite or grout after completion, and the surface condition was restored as close as possible to its original condition.

3.2 Laboratory Testing

The soil samples were tested in the laboratory for moisture content (ASTM D 2216). Atterberg limits (ASTM D 4318) and particle size (ASTM D 422) analyses were performed to classify selected samples. Field visual descriptions of the soil samples were verified in the laboratory and soil samples were classified according to the USCS (ASTM D 2487). Laboratory test results are shown in the *Boring Logs* (Appendix A) and in the *Laboratory Test Results* (Appendix B).

4.0 RESULTS OF FIELD AND LABORATORY INVESTIGATIONS

Detailed descriptions of the soil conditions encountered during the subsurface investigation are presented in the attached Boring Logs (Appendix A) and in the *Soil Profiles* (Exhibit 3). The Boring Logs have descriptions in both the USCS and Burmister soil classification systems. 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.

4.1 Soil Conditions

The soil conditions along both alignments are predominantly clayey and silty materials. The borings encountered lean clay and lean clay with sand, with the occasional interbeds of fine sand and silty sand; in the Burmister System, these soils classify almost exclusively as silty clay and clay & silt with minor trace to some fractions of fine sand and traces of fine gravel. The 4NW alignment revealed soils with slightly higher clay fractions, generally in the range of 45 to 65%; whereas the 4NE alignment measured higher percentages of silt and fine sand. Thus, the 4NW soils classify primarily as lean clay (USCS) and silty clay (Burmister), while the 4NE soils range more to the lean clay with sand (USCS) and clay & sand (Burmister).

The clayey diamicton has a highly uniform consistency, predominantly in the stiff to very stiff range, with SPT values of 8 to 30 blows per foot of penetration. The field unconfined compressive strength

(Q_u) values showed a higher degree of inconsistency, ranging from about 1.0 to 5.0 tsf and averaging 2.7 tsf. The soil moisture content was also highly uniform, ranging from about 15 to 25% and averaging 19%; the moisture content rarely exceeded 30%. Charts of the SPT, Q_u, and moisture content values are included in Appendix B, divided into each of the individual alignment legs along the 4NW and 4NE Routes. A summary of the laboratory testing results, including Atterberg limits, particle size analyses, and organic content tests, is included in Appendix B.

The notable exception to the descriptions listed above is along Cedar Lake Road in Boring 4NW-11 (4NW Leg 6), where a deposit of peat soil was encountered between approximately 9 and 15 feet bgs. The peat has moisture content values ranging from about 200% along the top to over 500% at the center; the organic content by loss on ignition measures 84%.

4.2 Groundwater Conditions

Groundwater was encountered while and at the completion of drilling within the sandy outwash interbeds within the massive diamicton. The groundwater was recorded between elevations of 760 and 720 feet along the 4NE alignment and between elevations of 800 and 750 feet along the 4NE alignment. Groundwater monitoring wells were installed in the 10 locations summarized in Table 4.

Table 4: Summary of Groundwater Monitoring Wells

Boring ID	Groundwater Elevation (feet)	Screened Depth Interval (feet)
4NW-02	748.4	5 to 15
4NW-09	776.0	10 to 20
4NW-TC-05	774.1	15 to 25
4NW-TC-06	797.3	5 to 15
4NW-TC-09	769.4	25 to 35
4NE-14	756.7	23 to 33
4NE-TC-02	719.0	10 to 20
4NE-TC-03	727.4	13 to 23
4NE-TC-08	730.8	25 to 35
4NE-TC-20	726.5	25 to 35

5.0 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. In the event that any changes in the design and/or location of the improvements are planned, we should be timely informed so that our recommendations can be adjusted accordingly.

It has been a pleasure to assist CDM Smith Inc. and the Central Lake County Joint Action Water Agency on this phase of the project. Please call if there are any questions, or if we can be of further service.

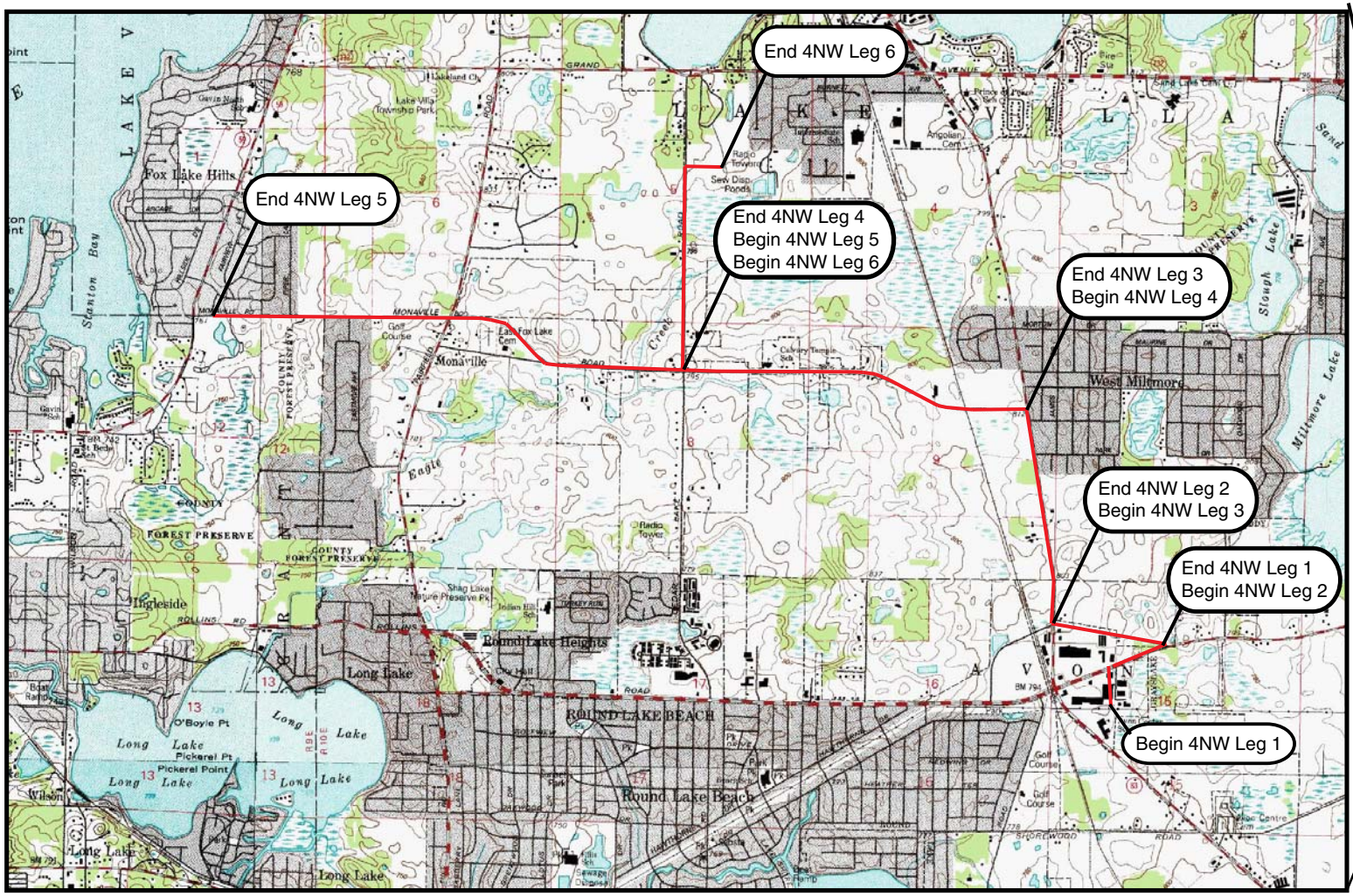
Respectfully Submitted,

WANG ENGINEERING, INC.

Mickey L. Snider, P.E.
Senior Geotechnical Engineer

Corina T. Farez, P.G., P.E.
Vice President

EXHIBITS



SITE LOCATION MAP: CENTRAL LAKE COUNTY JOINT ACTION WATER AGENCY SYSTEM IMPROVEMENTS, 4NW ALIGNMENT

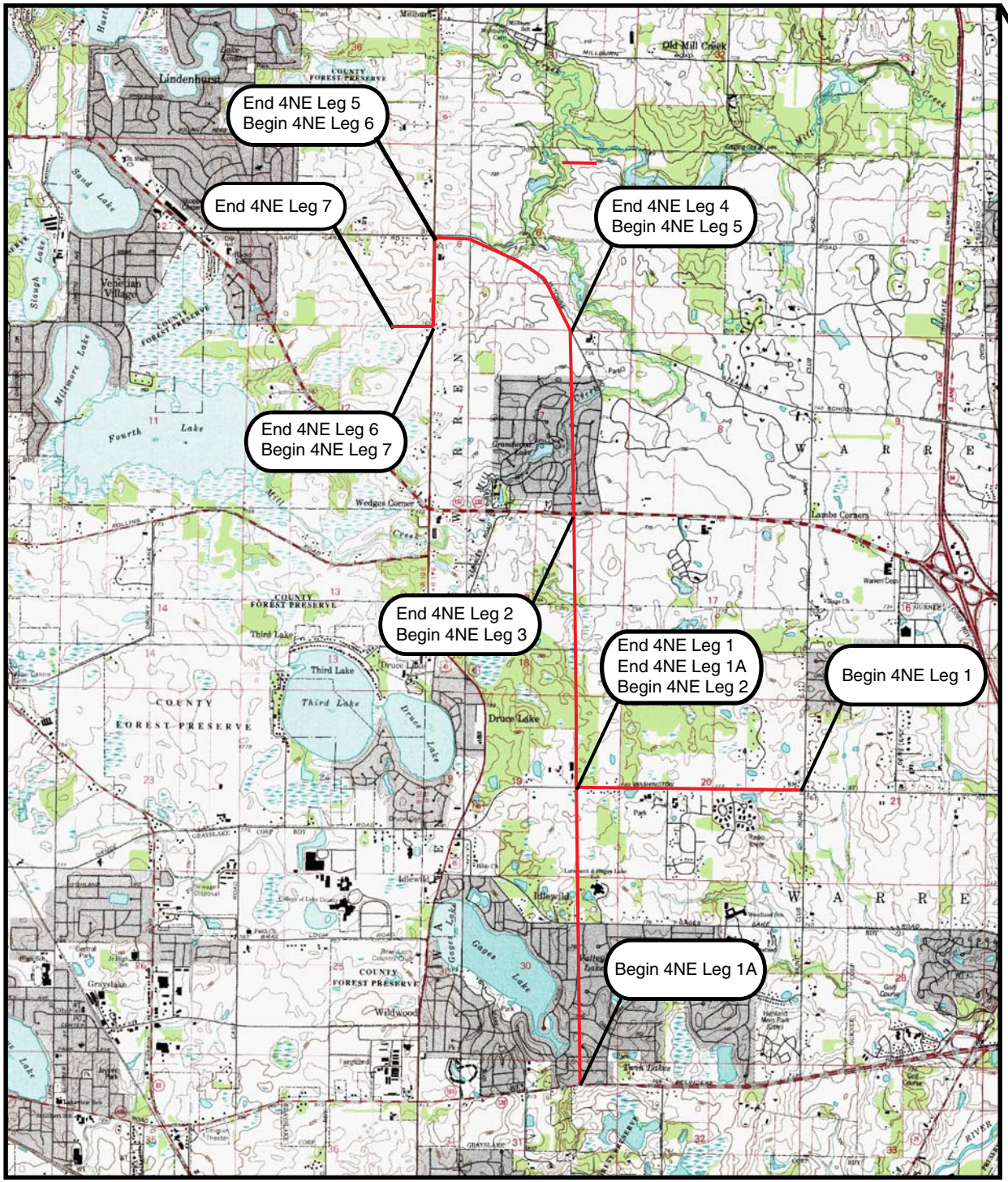
SCALE: GRAPHICAL	EXHIBIT 1-1	DRAWN BY: E. Datz CHECKED BY: M. Snider

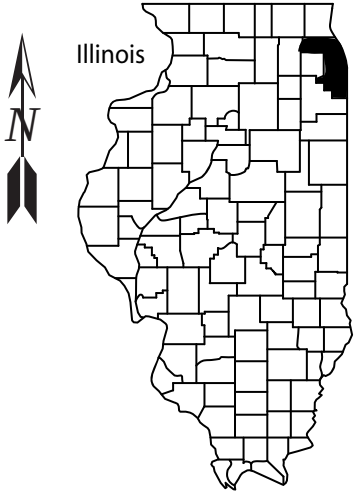
Wang Engineering

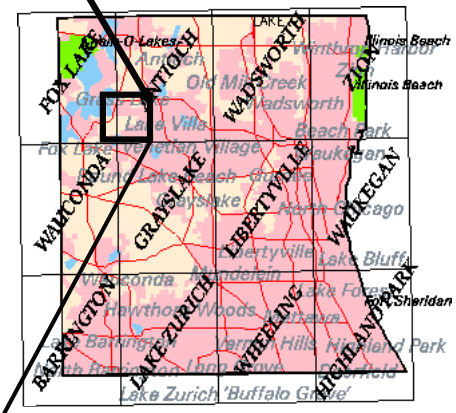
1145 N. Main Street
Lombard, IL 60148
www.wangeng.com

FOR CDM SMITH, INC.

786-40-01







Lake County

0 2 4 6 8 Miles

SITE LOCATION MAP: CENTRAL LAKE COUNTY JOINT ACTION WATER AGENCY SYSTEM IMPROVEMENTS, 4NE ALIGNMENT

SCALE: GRAPHICAL	EXHIBIT 1-2	DRAWN BY: E. Datz CHECKED BY: M. Snider

Wang Engineering

1145 N. Main Street
Lombard, IL 60148
www.wangeng.com

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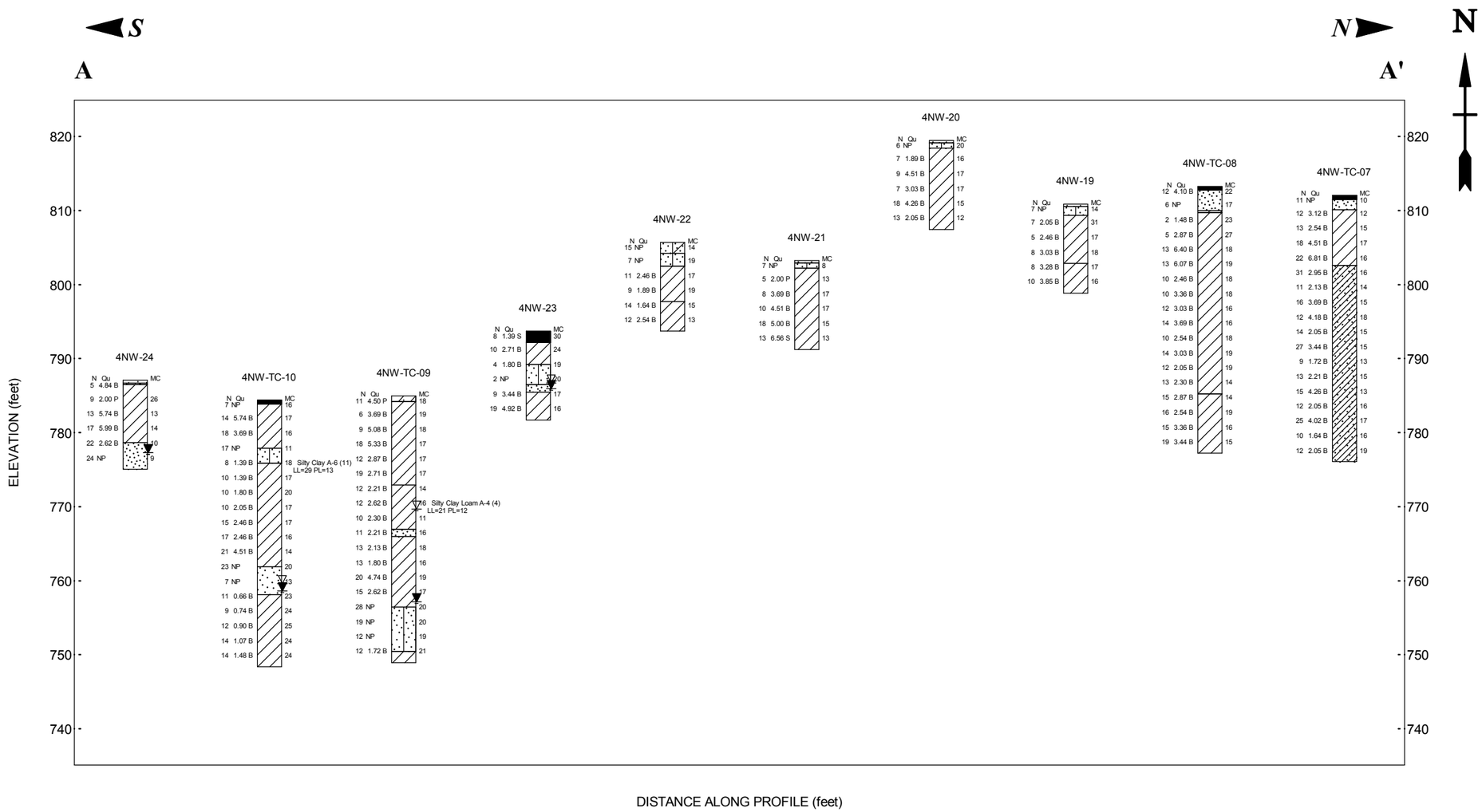
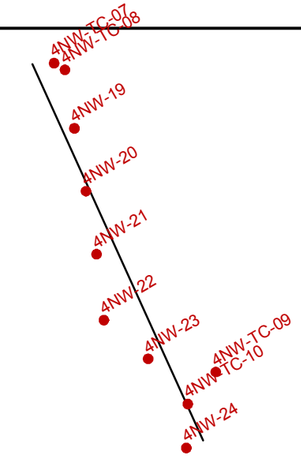


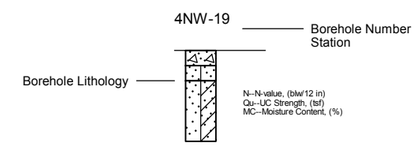
Lithology Graphics

- Crushed stone
- Topsoil
- USCS Low Plasticity Silty Clay
- USCS Poorly-graded Sand with Silt
- USCS Well-graded Sand
- USCS Poorly-graded Sand
- USCS Low Plasticity Clay
- Pavement
- USCS Poorly-graded Sand with Clay
- USCS Low Plasticity Sandy Clay



Site Map Scale 1 inch equals 2,385 feet

Explanation:



Water Level Reading at time of drilling.

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

0 650

Horizontal Scale (feet)

Vertical Exaggeration: 40x

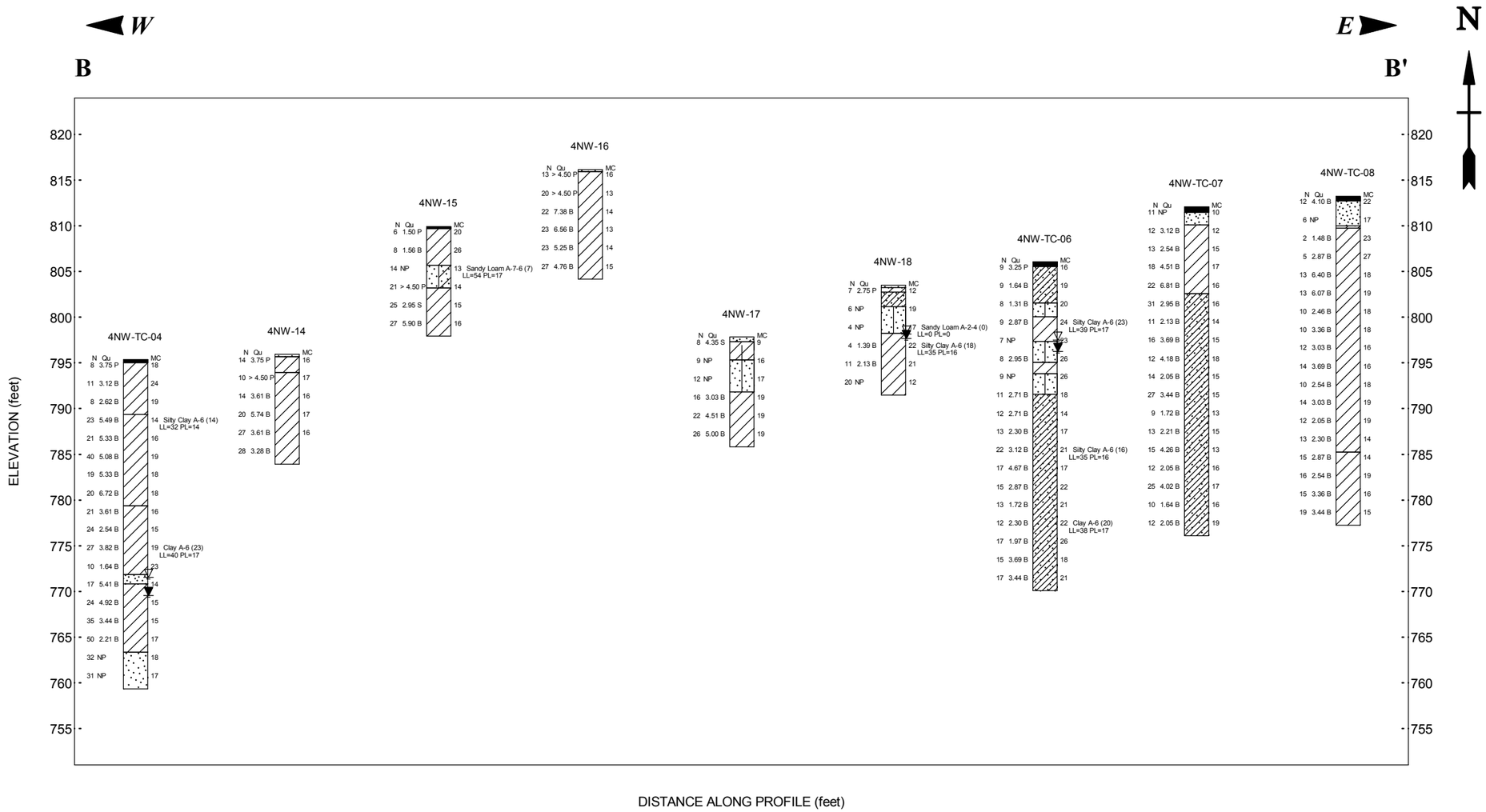
Wang Engineering, Inc.
1145 N Main Street
Lombard, IL 60148

Soil Profile A-A'
4NW Alignment Legs 1, 2, and 3

CLCJAWA System Expansion
Lake County, Illinois

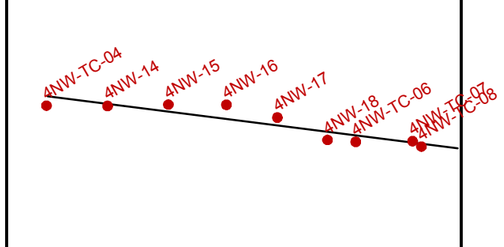
JOB NUMBER	PLATE NUMBER
786-40-01	EXHIBIT 3-1

WEI 11X17 7864001.GPJ WANGENG.GDT 12/15/14



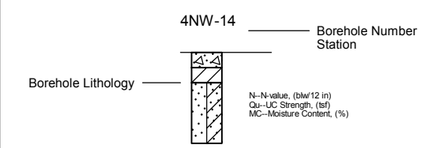
Lithology Graphics

- Crushed stone
- USCS Low Plasticity Clay
- Topsoil
- USCS Poorly-graded Sand with Clay
- USCS Low Plasticity Silty Clay
- USCS Poorly-graded Sand with Silt
- USCS Low Plasticity Sandy Clay
- USCS Well-graded Sand
- USCS Poorly-graded Sand



Site Map Scale 1 inch equals 2,935 feet

Explanation:



Water Level Reading at time of drilling.

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

0 800

Horizontal Scale (feet)

Vertical Exaggeration: 60.5x

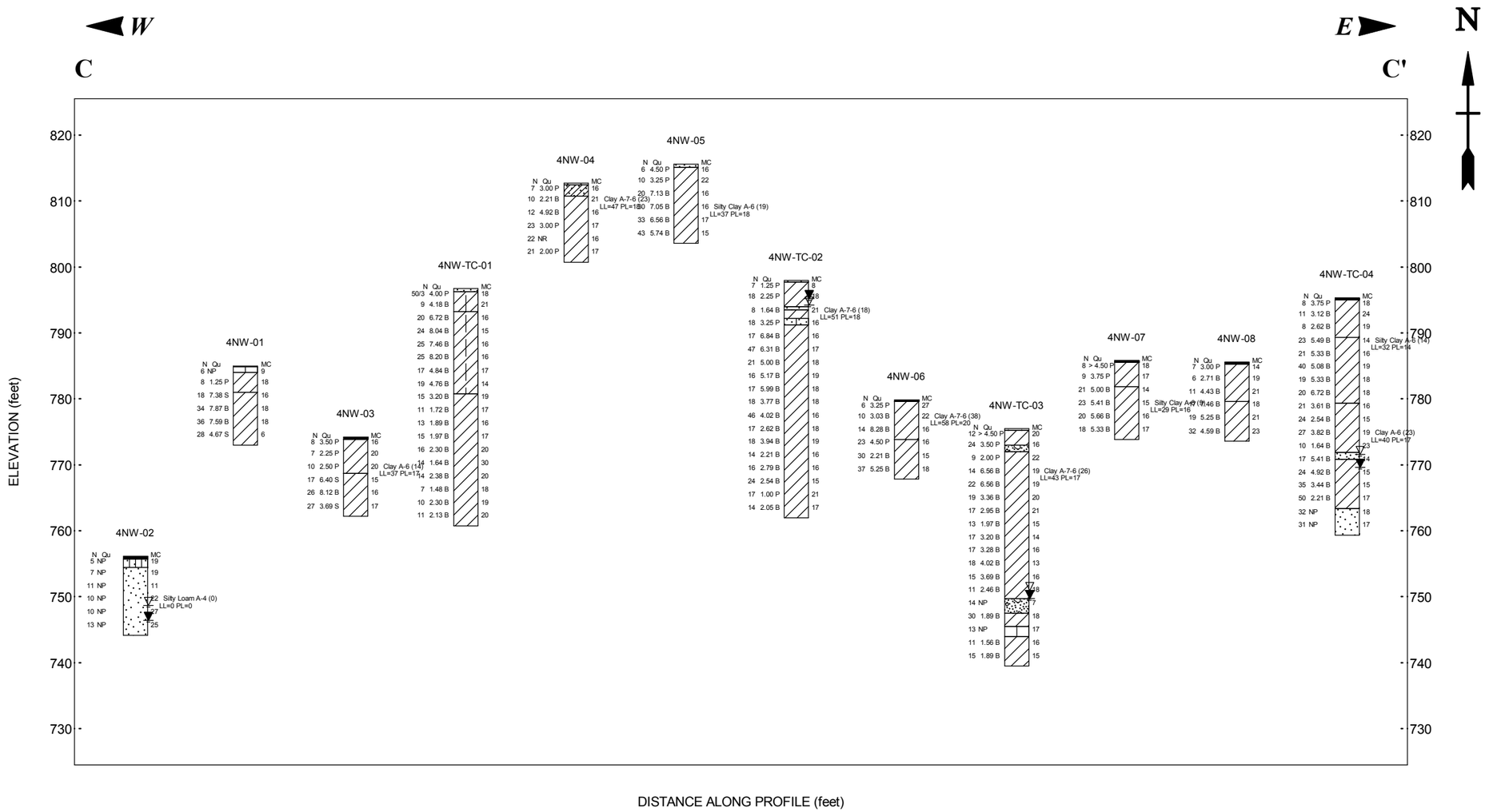
Wang Engineering, Inc.
1145 N Main Street
Lombard, IL 60148

Soil Profile B-B'
4NW Alignment Leg 4

CLCJAWA System Expansion
Lake County, Illinois

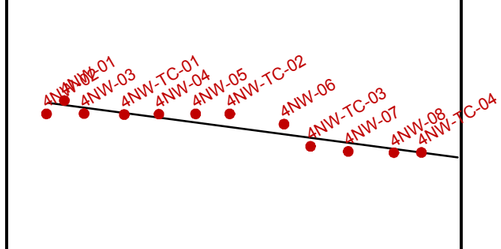
JOB NUMBER	PLATE NUMBER
786-40-01	EXHIBIT 3-2

WEI 11X17 7864001.GPJ WANGENG.GDT 12/15/14



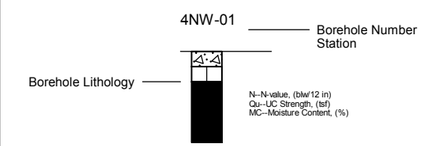
Lithology Graphics

- Crushed stone
- USCS Silt
- USCS Low Plasticity Clay
- Topsoil
- USCS Sandy Silt
- USCS Poorly-graded Sand
- USCS Low Plasticity Sandy Clay
- USCS Well-graded Sand
- USCS Low Plasticity Silty Clay
- USCS Poorly-graded Sand with Silt
- Gravelly sand, sandy gravel



Site Map Scale 1 inch equals 4,035 feet

Explanation:



Water Level Reading at time of drilling.

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

0 — 1100

Horizontal Scale (feet)

Vertical Exaggeration: 60x

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

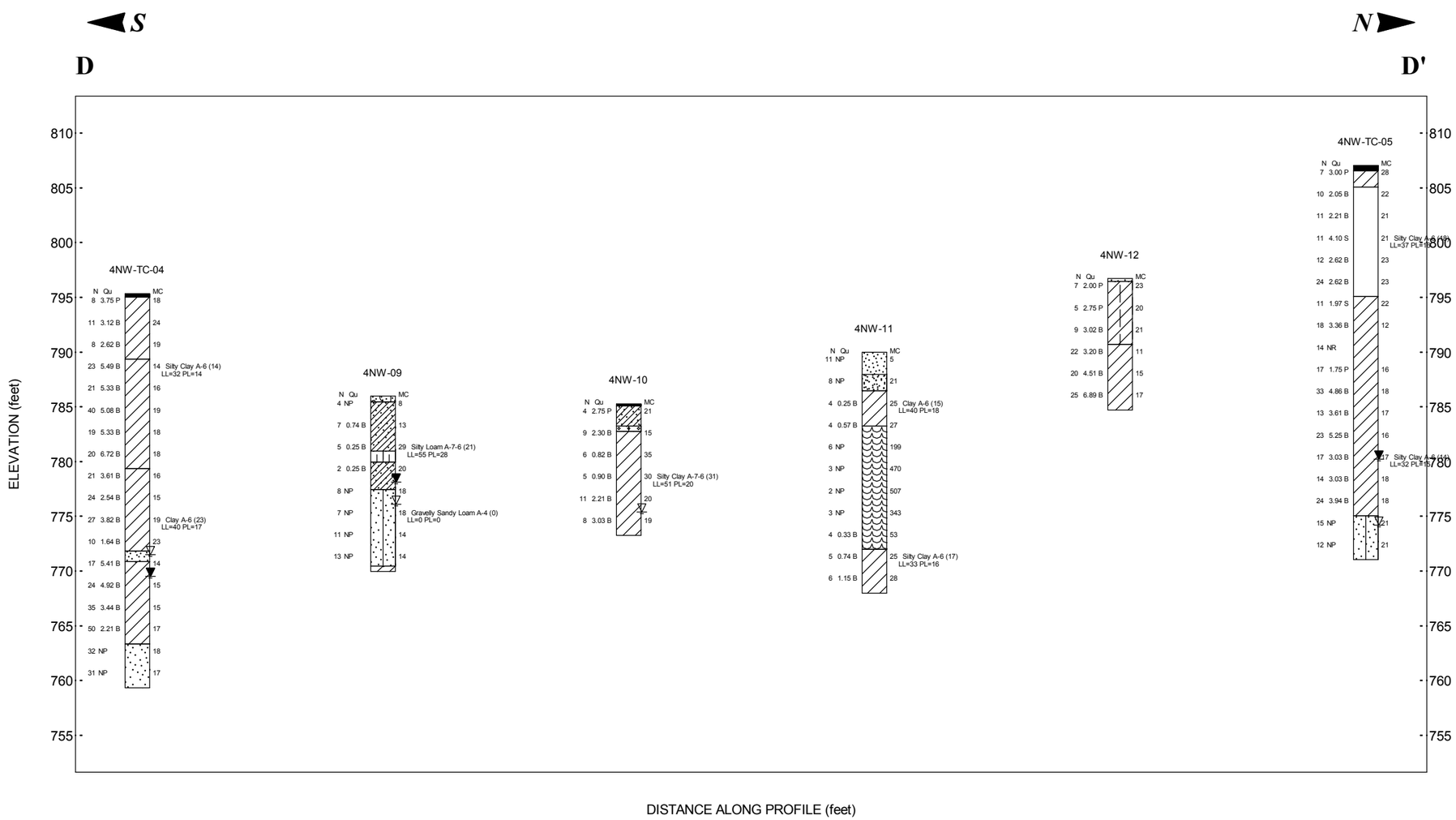
Soil Profile C-C'
4NW Alignment Leg 5

WEI SINCE 1982

CLCJAWA System Expansion
Lake County, Illinois

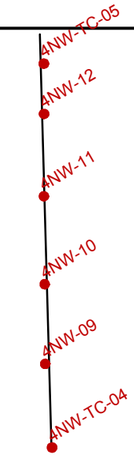
JOB NUMBER	PLATE NUMBER
786-40-01	EXHIBIT 3-3

WEI 11X17 7864001.GPJ WANGENG.GDT 12/15/14



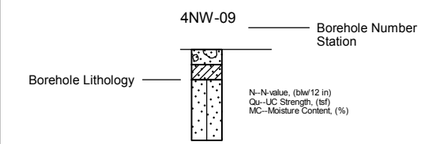
Lithology Graphics

- USCS Well-graded Gravel
- USCS Low Plasticity Sandy Clay
- USCS Low Plasticity Organic silt or clay
- USCS Poorly-graded Sand with Silt
- USCS Low Plasticity Clay
- Topsoil
- USCS Well-graded Sand with Silt
- USCS Well-graded Sand
- USCS Peat
- Crushed stone
- USCS Low Plasticity Silty Clay
- USCS Poorly-graded Sand



Site Map Scale 1 inch equals 1,835 feet

Explanation:



Water Level Reading at time of drilling.

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

0 500

Horizontal Scale (feet)

Vertical Exaggeration: 44.5x

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

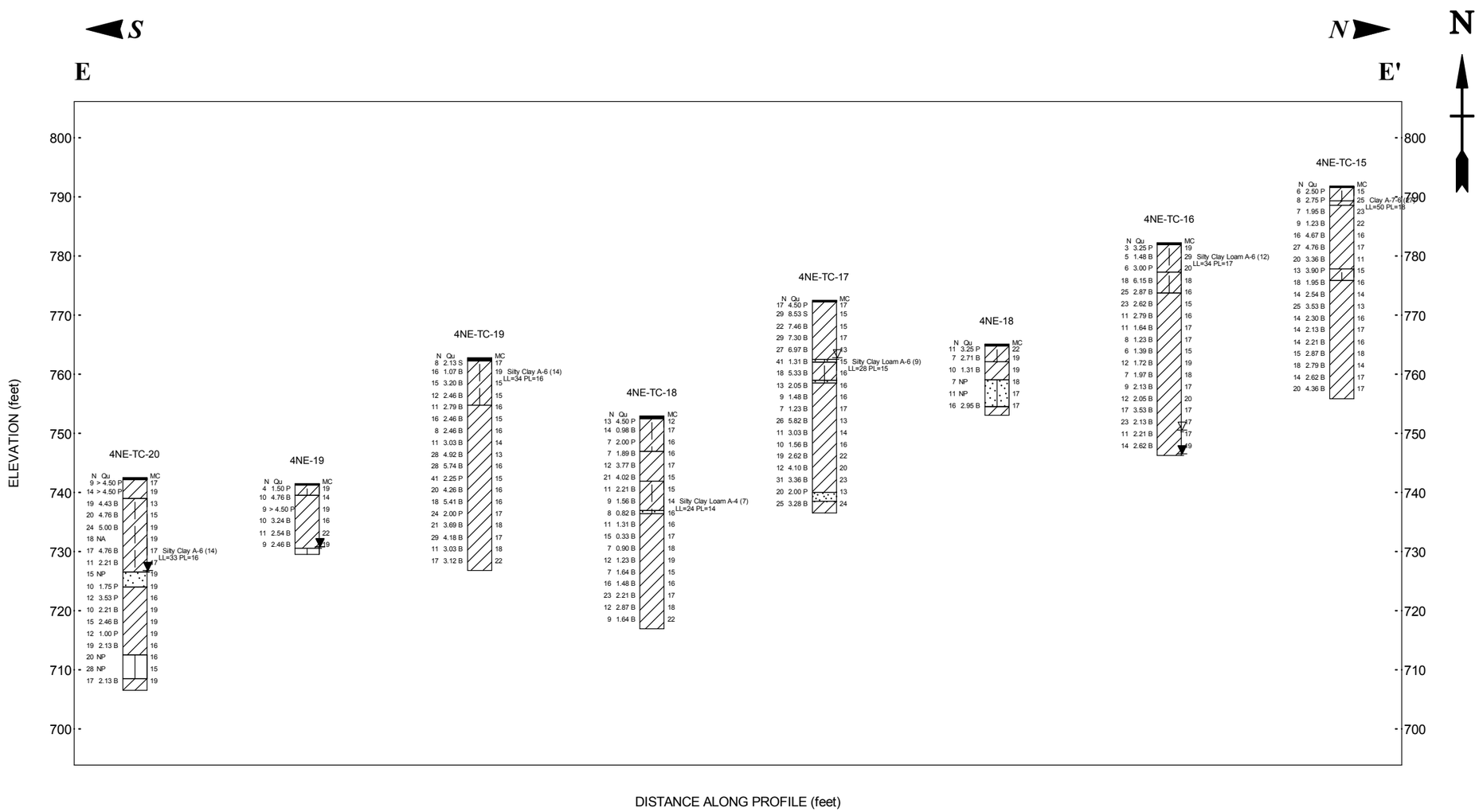
Soil Profile D-D'
4NW Alignment Leg 6

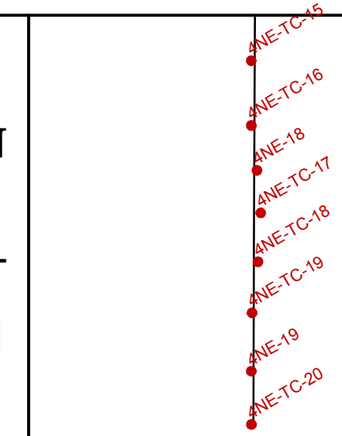
WEI SINCE 1982

CLCJAWA System Expansion
Lake County, Illinois

JOB NUMBER	PLATE NUMBER
786-40-01	EXHIBIT 3-4

WEI 11X17 786400I.GPJ WANGENG.GDT 12/15/14



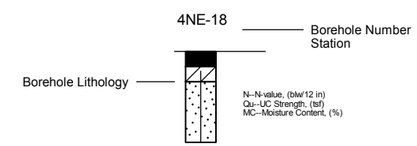


Site Map Scale 1 inch equals 2,935 feet

Lithology Graphics

- Topsoil
- USCS Silt
- USCS Low Plasticity Silty Clay
- USCS Poorly-graded Sand with Silt
- USCS Low Plasticity Clay
- USCS Well-graded Sand
- USCS Silty Sand
- USCS Poorly-graded Sand

Explanation:



Water Level Reading at time of drilling.

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

0 800

Horizontal Scale (feet)

Vertical Exaggeration: 39x

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

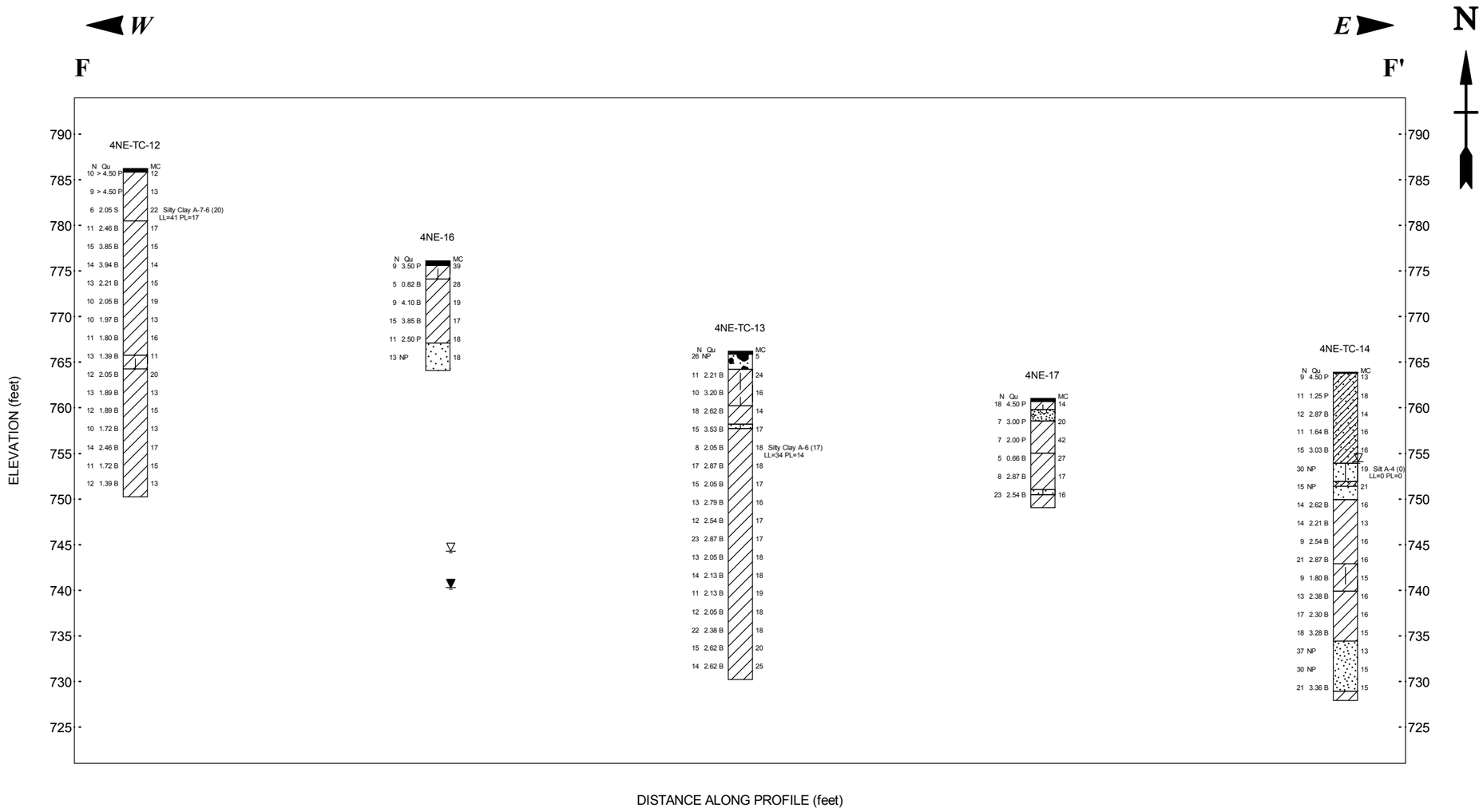
Soil Profile E-E'
4NE Alignment Leg 1A

WEI SINCE 1982

CLCJAWA System Expansion
Lake County, Illinois

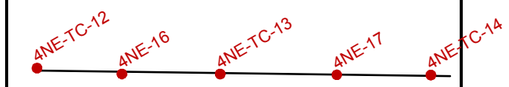
JOB NUMBER	PLATE NUMBER
786-40-01	EXHIBIT 3-5

WEI 11X17 7864001.GPJ WANGENG.GDT 12/15/14



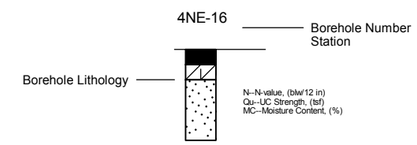
Lithology Graphics

- Topsoil
- Gravelly sand, sandy gravel
- USCS Well-graded Sand
- USCS Low Plasticity Silty Clay
- USCS Poorly-graded Sand with Silt
- USCS Low Plasticity Clay
- USCS Poorly-graded Gravel
- USCS Poorly-graded Sand
- USCS Low Plasticity Sandy Clay



Site Map Scale 1 inch equals 1,465 feet

Explanation:



Water Level Reading at time of drilling.

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

0 400

Horizontal Scale (feet)

Vertical Exaggeration: 30x

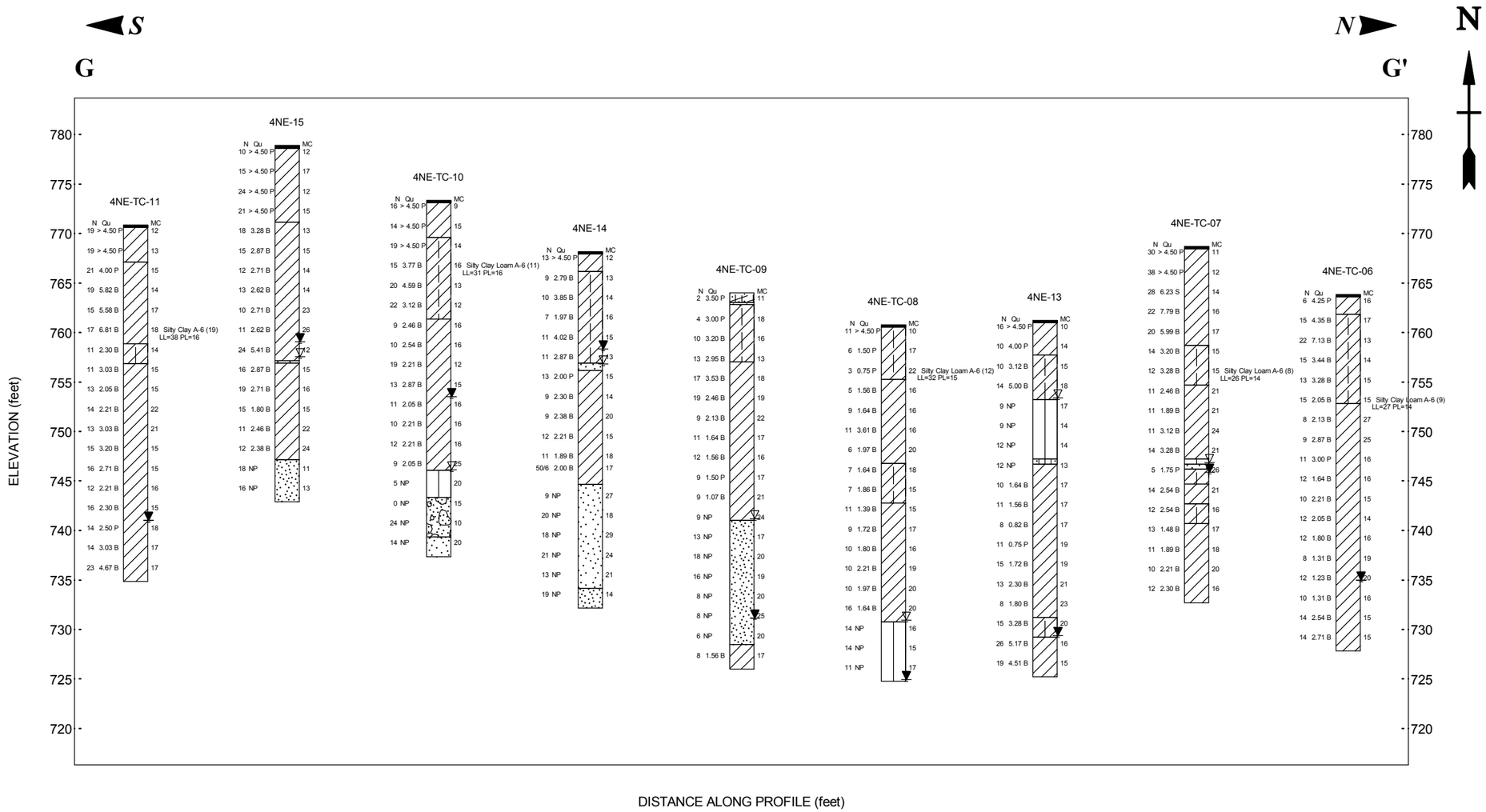
Wang Engineering, Inc.
1145 N Main Street
Lombard, IL 60148

Soil Profile F-F'
4NE Alignment Leg 1

CLCJAWA System Expansion
Lake County, Illinois

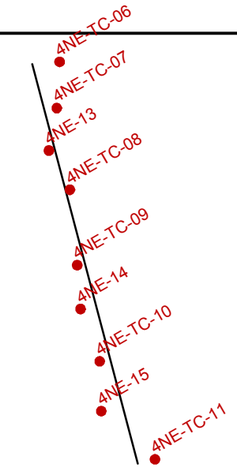
JOB NUMBER	PLATE NUMBER
786-40-01	EXHIBIT 3-6

WEI 11X17 786-40-01.GPJ WANGENG.GDT 12/15/14



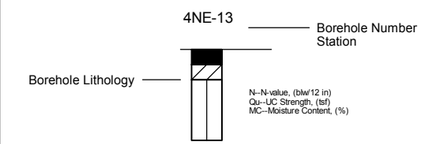
Lithology Graphics

- Topsoil
- USCS Low Plasticity Clay
- USCS Low Plasticity Silty Clay
- USCS Silt
- USCS Sandy Silt
- USCS Poorly-graded Sand
- USCS Well-graded Sand
- Pavement
- Crushed stone
- USCS Well-graded Gravel



Site Map Scale 1 inch equals 2,565 feet

Explanation:



Water Level Reading at time of drilling.

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

0 700

Horizontal Scale (feet)

Vertical Exaggeration: 57x

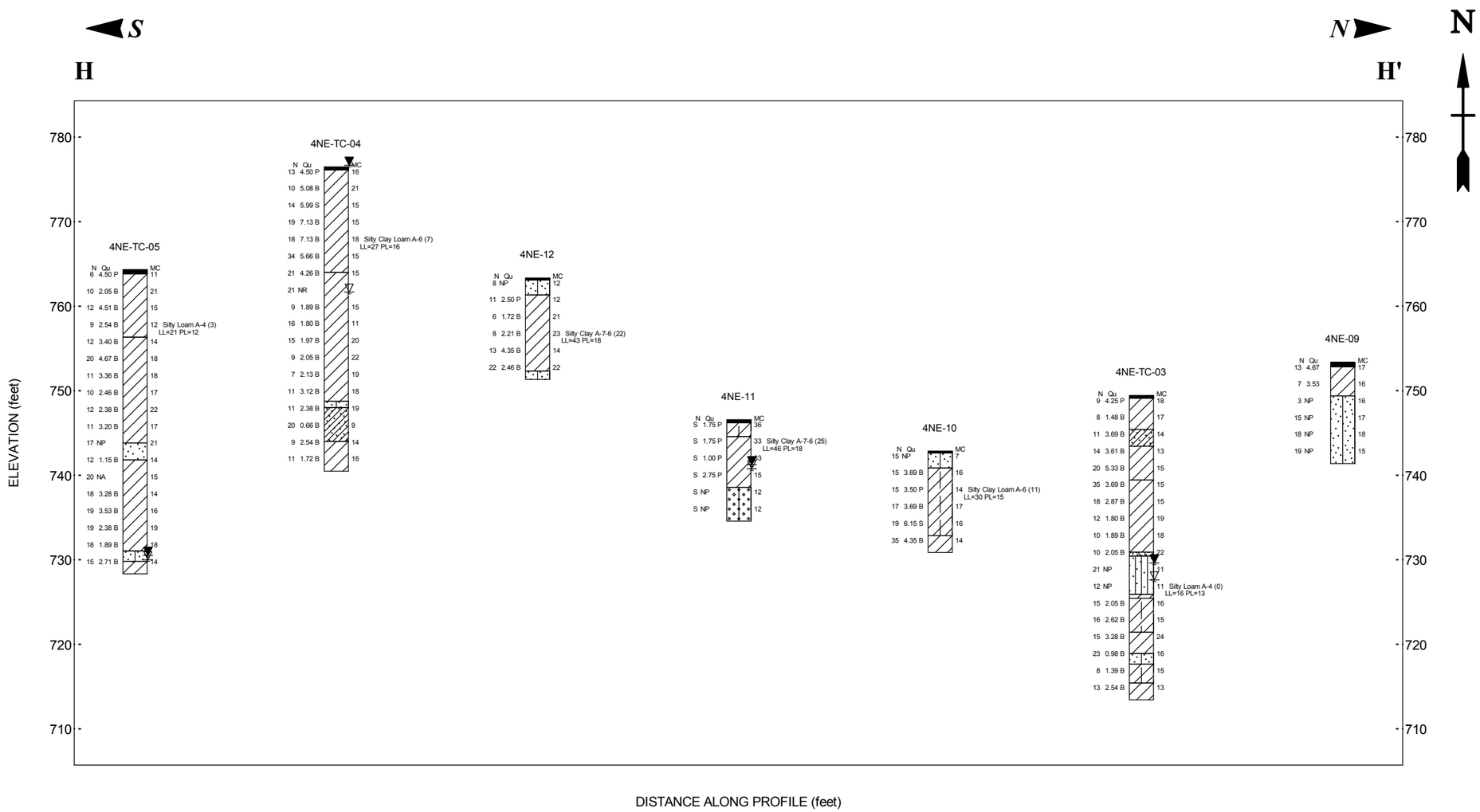
Wang Engineering, Inc.
1145 N Main Street
Lombard, IL 60148

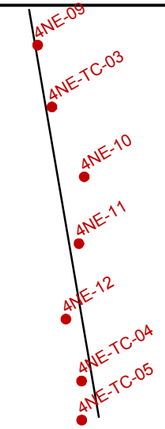
Soil Profile G-G'
4NE Alignment Leg 2

CLCJAWA System Expansion
Lake County, Illinois

JOB NUMBER	PLATE NUMBER
786-40-01	EXHIBIT 3-7

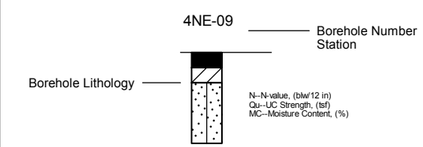
WEI 11X17 7864001.GPJ WANGENG.GDT 12/15/14





Site Map Scale 1 inch equals 2,015 feet

Explanation:



Water Level Reading at time of drilling.

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

Horizontal Scale (feet)

Vertical Exaggeration: 38.5x

Lithology Graphics

- Topsoil
- USCS Low Plasticity Clay
- USCS Poorly-graded Sand with Silt
- USCS Silty Sand
- USCS Low Plasticity Silty Clay
- USCS Well-graded Sand with Silt
- USCS Low Plasticity Sandy Clay
- Gravelly sand, sandy gravel
- USCS Sandy Silt
- USCS Poorly-graded Sand

Wang Engineering, Inc.
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Lombard, IL 60148

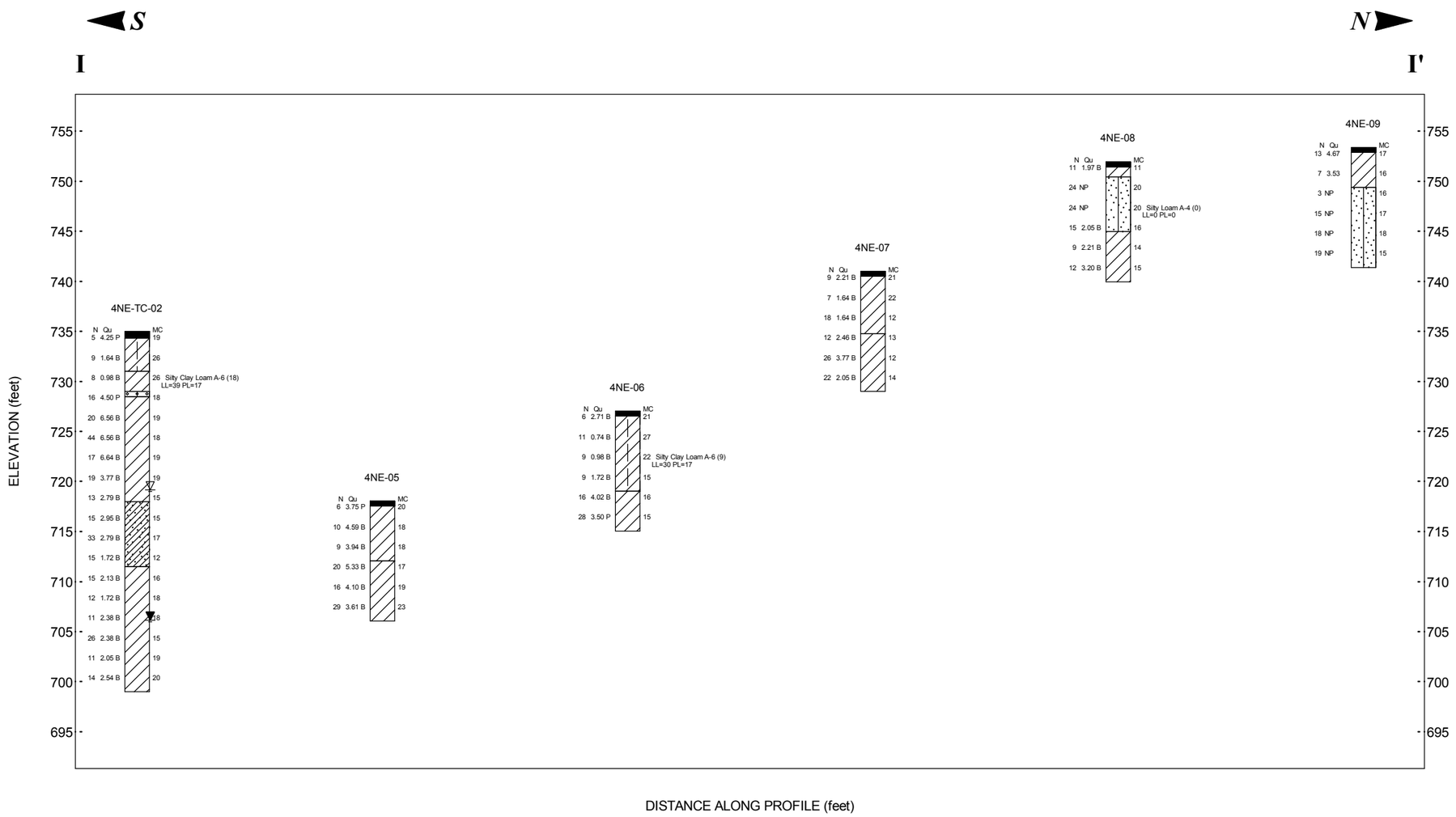
Soil Profile H-H'
4NE Alignment Legs 3 and 4

WEI SINCE 1982

CLCJAWA System Expansion
Lake County, Illinois

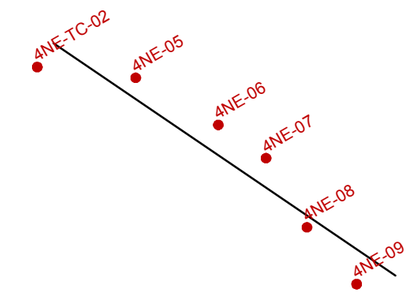
JOB NUMBER	PLATE NUMBER
786-40-01	EXHIBIT 3-8

WEI 11X17 786400I.GPJ WANGENG.GDT 12/15/14



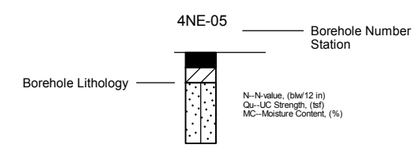
Lithology Graphics

- Topsoil
- USCS Low Plasticity Clay
- USCS Low Plasticity Silty Clay
- USCS Poorly-graded Sand with Silt
- USCS Well-graded Sand with Silt
- USCS Low Plasticity Sandy Clay



Site Map Scale 1 inch equals 2,015 feet

Explanation:



Water Level Reading at time of drilling.

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

0 550

Horizontal Scale (feet)

Vertical Exaggeration: 45x

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

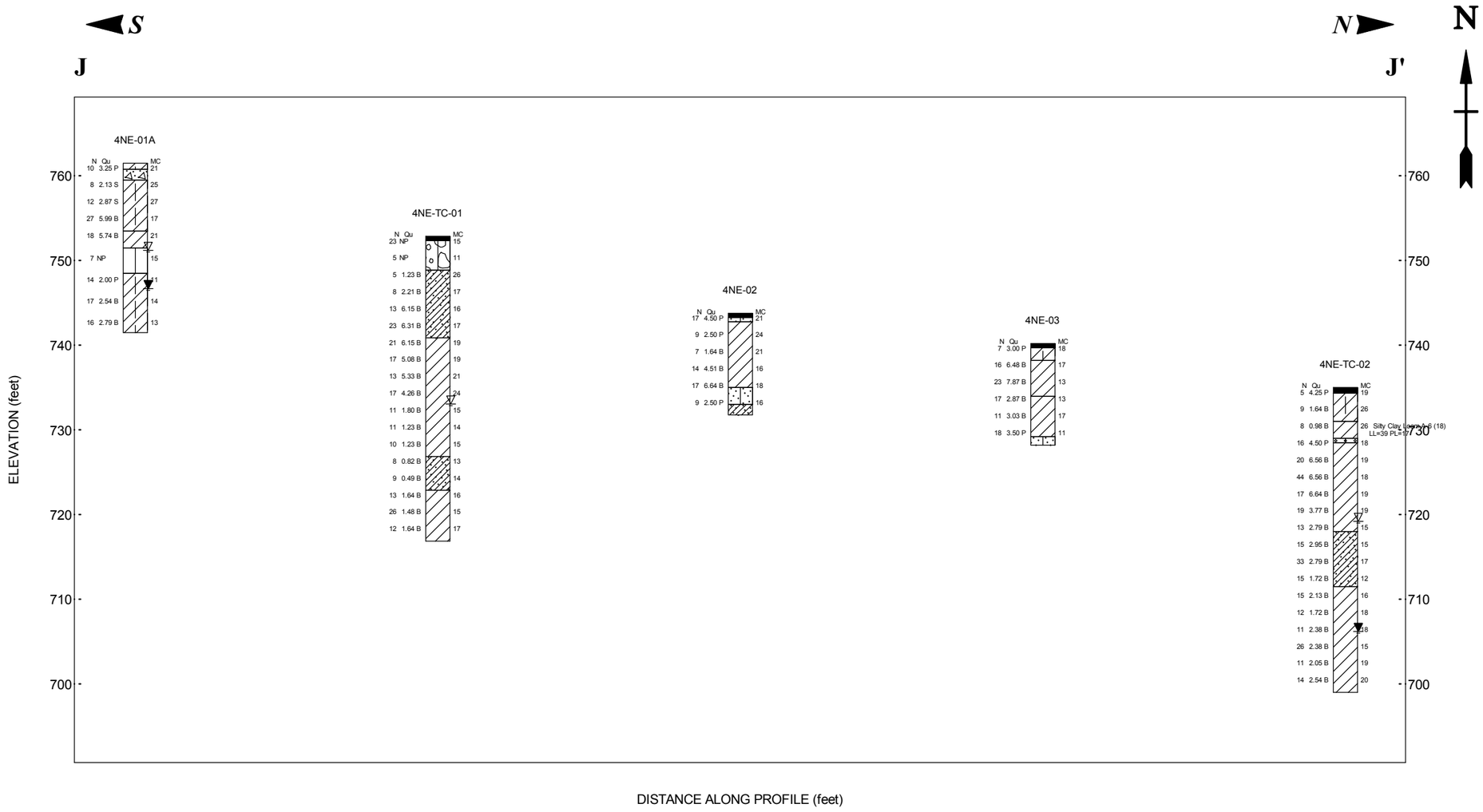
Soil Profile I-I'
4NE Alignment Leg 5

WEI SINCE 1982

CLCJAWA System Expansion
Lake County, Illinois

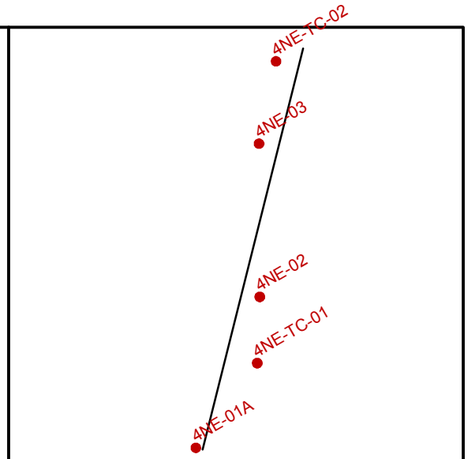
JOB NUMBER	PLATE NUMBER
786-40-01	EXHIBIT 3-9

WEI 11X17 7864001.GPJ WANGENG.GDT 12/15/14



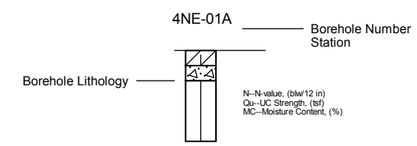
Lithology Graphics

- USCS Low Plasticity Silty Clay
- Crushed stone
- USCS Low Plasticity Clay
- USCS Silt
- Topsoil
- USCS Poorly-graded Sand with Silt
- USCS Low Plasticity Sandy Clay
- USCS Well-graded Gravel with Silt
- USCS Well-graded Sand with Silt



Site Map Scale 1 inch equals 1,025 feet

Explanation:



Water Level Reading at time of drilling.

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

0 280

Horizontal Scale (feet)

Vertical Exaggeration: 19.5x

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

Soil Profile J-J'
4NE Alignment Legs 6 and 7

WEI SINCE 1982

CLCJAWA System Expansion
Lake County, Illinois

JOB NUMBER	PLATE NUMBER
786-40-01	EXHIBIT 3-10

WEI 11X17 786-40-01.GPJ WANGENG.GDT 12/15/14

APPENDIX A

Wang Engineering
wangeng@wangeng.com
1145 N Main Street
Lombard, IL 60148
Telephone: 630 953-9928
Fax: 630 953-9938

BORING LOG 4NE-01

WEI Job No.: 786-40-01

Client: **CDM Smith, Inc.**
Project: **CLCJAWA System Expansion**
Location: **Lake County, Illinois**

Datum: NAVD88
Elevation: 758.77 ft
North: 2089213.69 ft
East: 1072647.68 ft
Station:
Offset:

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
	758.3	6-inch thick, black CLAY & SILT (Cy$); topsoil (CL-ML)						
		Stiff to very stiff, brown and gray SILTY CLAY ($yC), trace fine to medium gravel; fill, (CL)			1	2 3 6 7	4.00 P	
		--PID= 0.4ppm--						
		--same--			2	4 5 8 8	4.50 P	
		--PID = 0.4 ppm--						
		--same--						
		--PID = 0.9 ppm (LS)--	5		3	8 8 13 16	3.26 B	
		--same, with fine sand--						
		--PID= 0.5ppm--			4	5 9 11 14	2.05 S	
		--same--						
		--PID= 0.3ppm--			5	8 12 16 20	5.58 B	
			10					
		--same--						
		--PID= 0.2ppm--			6	6 11 12 14	6.31 B	
	746.8							
		Boring terminated at 12.00 ft						
			15					
			20					

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)

GENERAL NOTES

Begin Drilling: **09-22-2014** Complete Drilling: **09-22-2014**
Drilling Contractor: **Wang Testing Service** Drill Rig: **CME-55**
Driller: **R&J** Logger: **A. Happel** Checked by: **MdIR**
Drilling Method: **2.25 IDA HSA, 140 lb auto, 30" drop, 2" DIA SS;**
Backfilled with soil cuttings and bentonite; PID Bkgrd 0.3 ppm

WATER LEVEL DATA

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

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

Wang Engineering
wangeng@wangeng.com
1145 N Main Street
Lombard, IL 60148
Telephone: 630 953-9928
Fax: 630 953-9938

BORING LOG 4NE-01A

WEI Job No.: 786-40-01

Client: **CDM Smith, Inc.**
Project: **CLCJAWA System Expansion**
Location: **Lake County, Illinois**

Datum: NAVD88
Elevation: 761.49 ft
North: 2088760.04 ft
East: 1072745.16 ft
Station:
Offset:

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
	760.7	Stiff, brown CLAY & SILT(C&$), trace fine gravel; fill, (CL-ML)			1	3 4 6 4	3.25 P	21
	759.5	Medium dense, gray CRUSHED STONE(G); fill, dry, (CA-6) --PID = 0.3 ppm--						
		Stiff to very stiff, brown CLAY & SILT(C&$), trace fine gravel and roots;(CL-ML) --PID = 0.1 ppm--			2	2 4 4 8	2.13 S	25
		--same, no roots-- --PID = 0.0 ppm--	5		3	4 6 6 7	2.87 S	27
		--same, no roots-- --PID = 0.6 ppm--			4	5 12 15 20	5.99 B	17
	753.5	Very stiff, brown SILTY CLAY($yC), trace fine gravel; (CL) --PID= 0.0 ppm--	10		5	4 7 11 14	5.74 B	21
	751.5	Loose, gray SILT($), trace fine gravel and clay; (CL)			6	3 4 3	NP	15
	748.5	Stiff, gray CLAY & SILT(C&$), trace fine gravel, interbedded with silt; (CL-ML)	15		7	5 6 8	2.00 P	11
		--same, no silt--			8	5 7 10	2.54 B	14
		--same, no silt--			9	4 7 9	2.79 B	13
	741.5	Boring terminated at 20.00 ft	20					

GENERAL NOTES

Begin Drilling: **11-05-2014** Complete Drilling: **11-05-2014**
Drilling Contractor: **Wang Testing Service** Drill Rig: **CME-55**
Driller: **R&J** Logger: **D. Kolpacki** Checked by: **MdIR**
Drilling Method: **3.25 IDA HSA, 140 lb auto, 30" drop, 2" DIA SS;**
Backfilled with soil cuttings and bentonite; PID Bkgrd 0.4 ppm

WATER LEVEL DATA

While Drilling: **10.50 ft**
At Completion of Drilling: **15.00 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.

Wang Engineering
wangeng@wangeng.com
1145 N Main Street
Lombard, IL 60148
Telephone: 630 953-9928
Fax: 630 953-9938

BORING LOG 4NE-02

WEI Job No.: 786-40-01

Client: **CDM Smith, Inc.**
Project: **CLCJAWA System Expansion**
Location: **Lake County, Illinois**

Datum: NAVD88
Elevation: 743.75 ft
North: 2089783.04 ft
East: 1073178.55 ft
Station:
Offset:

Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
743.3	6-inch thick, black CLAY & SILT (Cy$); topsoil (CL-ML)					
742.8	6-inch thick, black SAND (S), and fine silt, little fine gravel; dry, fill (SP-SM)		1	7 12 5 4	4.50 P	21
	Medium stiff to stiff, brown and gray SILTY CLAY ($yC), little fine sand, trace fine gravel; fill, (CL) --PID = 0.7 ppm--		2	2 3 6 7	2.50 P	24
	--same-- --PID = 0.7 ppm-- --same-- --PID = 0.7 ppm--	5	3	2 3 4 4	1.64 B	21
	--same, fine sand seams-- --PID = 0.5ppm--		4	4 5 9 11	4.51 B	16
735.0	Loose to medium dense, brown SAND (S), and fine silt, trace fine gravel; dry (SP-SM) --PID = 0.7 ppm--	10	5	2 7 10 11	6.64 B	18
733.0	Stiff, brown SILTY CLAY ($yC), and fine sand, trace fine gravel; (CLS) --PID = 1.1 ppm (LS)--		6	3 3 6 7	2.50 P	16
731.8	Boring terminated at 12.00 ft	15				
		20				

GENERAL NOTES

Begin Drilling: **09-22-2014** Complete Drilling: **09-22-2014**
Drilling Contractor: **Wang Testing Service** Drill Rig: **CME-55**
Driller: **R&J** Logger: **A. Happel** Checked by: **MdIR**
Drilling Method: **2.25 IDA HSA, 140 lb auto, 30" drop, 2" DIA SS;**
Backfilled with soil cuttings and bentonite; PID Bkgrd 0.3 ppm

WATER LEVEL DATA

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

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

Wang Engineering
wangeng@wangeng.com
1145 N Main Street
Lombard, IL 60148
Telephone: 630 953-9928
Fax: 630 953-9938

BORING LOG 4NE-03

WEI Job No.: 786-40-01

Client: **CDM Smith, Inc.**
Project: **CLCJAWA System Expansion**
Location: **Lake County, Illinois**

Datum: NAVD88
Elevation: 740.21 ft
North: 2090820.69 ft
East: 1073173.20 ft
Station:
Offset:

Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
739.7	6-inch thick, black CLAY & SILT (Cy$); topsoil (CL-ML)						
	Medium stiff, brown and gray CLAY & SILT (C&$), trace fine gravel; fill (CL-ML)			1	2 3 4 7	3.00 P	18
738.2	--PID = 0.1 ppm--						
	Very stiff, brown and gray SILTY CLAY ($yC), trace fine to medium gravel; fill, (CL)			2	3 5 11 11	6.48 B	17
	--PID = 0.1 ppm (LS)--						
	--same--						
	--PID = 0.0 ppm--	5		3	6 9 14 13	7.87 B	13
734.0							
	Stiff to very stiff, gray SILTY CLAY ($yC), with fine sand, trace fine to medium gravel; fill, (CL)			4	7 7 10 11	2.87 B	13
	--PID = 0.0 ppm--						
	--same--						
	--PID = 0.0 ppm--			5	3 4 7 9	3.03 B	17
		10					
729.2							
	Medium dense, gray, fine SAND (S), and silt, trace fine to medium gravel; dry (SP-SM)			6	3 8 10 12	3.50 P	11
728.2	--PID = 0.0 ppm--						
	Boring terminated at 12.00 ft						
		15					
		20					

GENERAL NOTES

Begin Drilling: **09-22-2014** Complete Drilling: **09-22-2014**
Drilling Contractor: **Wang Testing Service** Drill Rig: **CME-55**
Driller: **R&J** Logger: **A. Happel** Checked by: **MdIR**
Drilling Method: **2.25 IDA HSA, 140 lb auto, 30" drop, 2" DIA SS;**
Backfilled with soil cuttings and bentonite; PID Bkgrd 0.3 ppm

WATER LEVEL DATA

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

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

Wang Engineering
wangeng@wangeng.com
1145 N Main Street
Lombard, IL 60148
Telephone: 630 953-9928
Fax: 630 953-9938

BORING LOG 4NE-04

WEI Job No.: 786-40-01

Client: **CDM Smith, Inc.**
Project: **CLCJAWA System Expansion**
Location: **Lake County, Illinois**

Datum: NAVD88
Elevation: 725.85 ft
North: 2091390.52 ft
East: 1073649.83 ft
Station:
Offset:

Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
725.2	8-inch thick, black SILTY CLAY ($yC); organic matter, topsoil (CL)			1	4 4 4 4	2.75 P	16
	Stiff, brown and gray SILTY CLAY ($yC), trace fine gravel; fill (CL)						
	--PID = 3.4 ppm--			2	4 4 5 6	2.50 S	25
	--same--						
	--PID = 18.5 ppm (LS)--						
	--same, with wood fragments--						
	--PID = 4.1 ppm--	5		3	3 3 3 5	1.31 B	23
	--same, soft--						
	--PID = 15.8 ppm--			4	1 1 2 2	0.16 B	54
718.4	Medium stiff, gray SILTY CLAY ($yC), trace fine gravel; organic matter, (CL)						
716.9	--PID = 16.5 ppm--			5	2 2 4 9	0.82 B	17
715.9	Stiff, brown and gray SILT ($), and fine sand; moist (ML)	10					
	Medium dense, brown, medium SAND (S), some medium gravel; moist (SP)			6	5 7 7 12	NP	12
	--PID = 13.7 ppm--						
713.9	Boring terminated at 12.00 ft						
		15					
		20					

GENERAL NOTES

Begin Drilling: **08-25-2014** Complete Drilling: **08-25-2014**
Drilling Contractor: **Wang Testing Services** Drill Rig: **D-50 ATV**
Driller: **K&K** Logger: **A. Happel** Checked by: **BW**
Drilling Method: **3.25 IDA HSA, 140 lb auto, 30" drop, 2" DIA SS;**
Backfilled with soil cuttings and bentonite; PID Bkgrd 0.0 ppm

WATER LEVEL DATA

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

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Wang Engineering
wangeng@wangeng.com
1145 N Main Street
Lombard, IL 60148
Telephone: 630 953-9928
Fax: 630 953-9938

BORING LOG 4NE-05

WEI Job No.: 786-40-01

Client: **CDM Smith, Inc.**
Project: **CLCJAWA System Expansion**
Location: **Lake County, Illinois**

Datum: NAVD88
Elevation: 718.08 ft
North: 2091235.95 ft
East: 1074598.43 ft
Station:
Offset:

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
	717.6	6-inch thick, black SILTY CLAY ($yC); topsoil (CL)						
		Medium stiff to stiff, brown and gray SILTY CLAY ($yC), trace fine gravel; fill (CL)			1	2 2 4 9	3.75 P	20
		--PID = 25.3 ppm--						
		--same--			2	4 5 5 4	4.59 B	18
		--PID = 27.6 ppm--						
		--same--						
		--PID = 27.6 ppm (LS)--	5		3	5 4 5 12	3.94 B	18
	712.1							
		Very stiff, brown and gray SILTY CLAY ($yC), trace fine gravel; (CL)			4	5 8 12 15	5.33 B	17
		--PID = 25.1 ppm--						
		--same--						
		--PID = 24.2 ppm--			5	5 7 9 13	4.10 B	19
			10					
		--same--						
		--PID = 29.4 ppm--			6	14 14 15 15	3.61 B	23
	706.1							
		Boring terminated at 12.00 ft						
			15					
			20					

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)

GENERAL NOTES

Begin Drilling: **08-25-2014** Complete Drilling: **08-25-2014**
Drilling Contractor: **Wang Testing Services** Drill Rig: **D-50 ATV**
Driller: **K&K** Logger: **A. Happel** Checked by: **BW**
Drilling Method: **3.25 IDA HSA, 140 lb auto, 30" drop, 2" DIA SS;**
Backfilled with soil cuttings and bentonite; PID Bkgrd 25.0 ppm

WATER LEVEL DATA

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

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Wang Engineering
wangeng@wangeng.com
1145 N Main Street
Lombard, IL 60148
Telephone: 630 953-9928
Fax: 630 953-9938

BORING LOG 4NE-06

WEI Job No.: 786-40-01

Client: **CDM Smith, Inc.**
Project: **CLCJAWA System Expansion**
Location: **Lake County, Illinois**

Datum: NAVD88
Elevation: 727.06 ft
North: 2090609.09 ft
East: 1075698.28 ft
Station:
Offset:

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
	726.6	6-inch thick, black SILTY CLAY ($yC); topsoil (CL)						
		Medium stiff to stiff, brown and gray CLAY & SILT (C&$), trace fine gravel, trace medium sand; fill (CL)			1	2 3 3 5	2.71 B	21
		--PID = 27.2 ppm (LS)--			2	3 4 7 8	0.74 B	27
		--same-- --PID = 19.7 ppm--						
		--same-- --PID = 25.5 ppm--	5		3	3 5 4 4	0.98 B	22
		--same-- --PID = 25.5 ppm--			4	4 4 5 10	1.72 B	15
	719.1	Very stiff, brown SILTY CLAY ($yC), trace fine gravel; (CL)						
		--PID = 23.6 ppm--	10		5	4 7 9 14	4.02 B	16
		--same-- --PID = 14.5 ppm--			6	17 14 14 18	3.50 P	15
	715.1	Boring terminated at 12.00 ft						
			15					
			20					

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)

GENERAL NOTES

Begin Drilling: **08-25-2014** Complete Drilling: **08-25-2014**
Drilling Contractor: **Wang Testing Services** Drill Rig: **D-50 ATV**
Driller: **K&K** Logger: **A. Happel** Checked by: **BW**
Drilling Method: **3.25 IDA HSA, 140 lb auto, 30" drop, 2" DIA SS;**
Backfilled with soil cuttings and bentonite; PID Bkgrd 25.0 ppm

WATER LEVEL DATA

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

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Wang Engineering
wangeng@wangeng.com
1145 N Main Street
Lombard, IL 60148
Telephone: 630 953-9928
Fax: 630 953-9938

BORING LOG 4NE-07

WEI Job No.: 786-40-01

Client: **CDM Smith, Inc.**
Project: **CLCJAWA System Expansion**
Location: **Lake County, Illinois**

Datum: NAVD88
Elevation: 741.00 ft
North: 2090167.16 ft
East: 1076333.62 ft
Station:
Offset:

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
	740.5	6-inch thick, black SILTY CLAY ($yC); topsoil (CL)						
		Stiff, brown and black SILTY CLAY ($yC), trace medium sand; trace gravel, fill (CL)			1	2 4 5 5	2.21 B	21
		--PID = 1.3 ppm--						
		--same--			2	3 3 4 8	1.64 B	22
		--PID = 12.3 ppm (LS)--						
		--same, very stiff--						
		--PID = 5.9 ppm--	5		3	3 8 10 11	1.64 B	12
	734.8							
		Stiff to very stiff, gray SILTY CLAY ($yC), trace gravel; (CL)			4	5 5 7 10	2.46 B	13
		--PID = 9.3 ppm--						
		--same--						
		--PID = 9.3 ppm--			5	5 12 14 8	3.77 B	12
			10					
		--same--						
		--PID = 9.3 ppm--			6	9 10 12 13	2.05 B	14
	729.0							
		Boring terminated at 12.00 ft						
			15					
			20					

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)

GENERAL NOTES

Begin Drilling: **08-26-2014** Complete Drilling: **08-26-2014**
Drilling Contractor: **Wang Testing Services** Drill Rig: **D-50 ATV**
Driller: **K&K** Logger: **A. Happel** Checked by: **BW**
Drilling Method: **3.25 IDA HSA, 140 lb auto, 30" drop, 2" DIA SS;**
Backfilled with soil cuttings and bentonite; PID Bkgrd 10.0 ppm

WATER LEVEL DATA

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

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Wang Engineering
wangeng@wangeng.com
1145 N Main Street
Lombard, IL 60148
Telephone: 630 953-9928
Fax: 630 953-9938

BORING LOG 4NE-08

WEI Job No.: 786-40-01

Client: **CDM Smith, Inc.**
Project: **CLCJAWA System Expansion**
Location: **Lake County, Illinois**

Datum: NAVD88
Elevation: 751.94 ft
North: 2089246.04 ft
East: 1076878.05 ft
Station:
Offset:

Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
751.4	6-inch thick, black, SILT ($), with fine sand; dry, topsoil (ML)			1	3 3 8 11	1.97 B	11
750.4	Very stiff, black and brown, SILTY CLAY ($yC), trace fine sand, trace fine gravel; fill (CL) --PID = 13.4 ppm--						
	Medium dense, brown, fine SAND (S), with silt; dry, fill (SP-SM)			2	19 11 13 16	NP	20
	--same, moist-- --PID = 14.2 ppm (LS)--	5		3	9 11 13 14	NP	20
	--same, moist-- --PID = 9.6 ppm--						
744.9	Stiff, gray SILTY CLAY ($yC), trace gravel; (CL) --PID = 8.2 ppm--			4	8 8 7 7	2.05 B	16
	--same-- --PID = 5.0 ppm--			5	3 3 6 10	2.21 B	14
	--same-- --PID = 4.5 ppm--	10		6	10 6 6 14	3.20 B	15
739.9	Boring terminated at 12.00 ft						
		15					
		20					

GENERAL NOTES

Begin Drilling: **09-02-2014** Complete Drilling: **09-02-2014**
Drilling Contractor: **Wang Testing Services** Drill Rig: **D-50 ATV**
Driller: **K&K** Logger: **A. Happel** Checked by: **MdIR**
Drilling Method: **2.25 IDA HSA, 140 lb auto, 30" drop, 2" DIA SS;**
Backfilled with soil cuttings and bentonite; PID Bkgrd 0.0 ppm

WATER LEVEL DATA

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

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Wang Engineering
wangeng@wangeng.com
1145 N Main Street
Lombard, IL 60148
Telephone: 630 953-9928
Fax: 630 953-9938

BORING LOG 4NE-09

WEI Job No.: 786-40-01

Client: **CDM Smith, Inc.**
Project: **CLCJAWA System Expansion**
Location: **Lake County, Illinois**

Datum: NAVD88
Elevation: 753.38 ft
North: 2088490.98 ft
East: 1077539.13 ft
Station:
Offset:

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
	752.9	6-inch thick, black, SILT ($), with fine sand; dry, topsoil (ML)						
		Medium stiff to stiff, black and brown, SILTY CLAY ($yC), trace fine sand, trace fine gravel; fill (CL)			1	4 6 7 8	4.67	17
		--PID = 10.2 ppm (LS)--			2	4 3 4 3	3.53	16
		--same--						
		--PID = 8.0 ppm--						
	749.4							
		Loose to medium dense, brown, fine SAND (S), with fine silt, trace fine gravel and roots; moist, fill (SP-SM)	5		3	2 1 2 3	NP	16
		--PID = 8.0 ppm--						
		--same, no roots--						
		--PID = 9.2 ppm--			4	5 6 9 13	NP	17
		--same, no roots--			5	4 8 10 13	NP	18
		--PID = 5.0 ppm--	10					
		--same, no roots--						
		--PID = 3.7 ppm--			6	9 9 10 10	NP	15
	741.4							
		Boring terminated at 12.00 ft						
			15					
			20					

GENERAL NOTES

Begin Drilling: **09-02-2014** Complete Drilling: **09-02-2014**
Drilling Contractor: **Wang Testing Services** Drill Rig: **D-50 ATV**
Driller: **K&K** Logger: **A. Happel** Checked by: **MdIR**
Drilling Method: **2.25 IDA HSA, 140 lb auto, 30" drop, 2" DIA SS;**
Backfilled with soil cuttings and bentonite; PID Bkgrd 0.0 ppm

WATER LEVEL DATA

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

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Wang Engineering
wangeng@wangeng.com
1145 N Main Street
Lombard, IL 60148
Telephone: 630 953-9928
Fax: 630 953-9938

BORING LOG 4NE-10

WEI Job No.: 786-40-01

Client: **CDM Smith, Inc.**
Project: **CLCJAWA System Expansion**
Location: **Lake County, Illinois**

Datum: NAVD88
Elevation: 742.85 ft
North: 2086737.78 ft
East: 1078159.27 ft
Station:
Offset:

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
	742.6	3-inch thick, black SILT ($), little fine gravel; topsoil (ML)						
		Medium dense, brown and gray, fine SAND (S), with fine silt,little fine gravel; dry, fill (SW-SM)			1	9 10 5 6	NP	7
	740.9	--PID= 22.2 ppm--						
		Very stiff, black and gray, CLAY & SILT (C&$), little fine sand, trace fine gravel; fill (CLS)			2	7 7 8 12	3.69 B	16
		--PID= 23.2 ppm (LS)--						
		--same--						
		--PID= 19.2 ppm--	5		3	5 8 7 10	3.50 P	14
		--same--						
		--PID= 10.5 ppm--			4	7 8 9 11	3.69 B	17
		--same--						
		--PID= 1.4 ppm--			5	4 8 11 19	6.15 S	16
	732.9		10					
		Hard, gray SILTY CLAY, trace gravel and fine seams of sand; (CL)			6	14 17 18 18	4.35 B	14
		--PID= 4.5 ppm--						
	730.9							
		Boring terminated at 12.00 ft						
			15					
			20					

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)

GENERAL NOTES

Begin Drilling: **09-02-2014** Complete Drilling: **09-02-2014**
Drilling Contractor: **Wang Testing Services** Drill Rig: **D-50 ATV**
Driller: **K&K** Logger: **A. Happel** Checked by: **MdIR**
Drilling Method: **2.25 IDA HSA, 140 lb auto, 30" drop, 2" DIA SS;**
Backfilled with soil cuttings and bentonite; PID Bkgrd 0.0 ppm

WATER LEVEL DATA

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

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Wang Engineering
wangeng@wangeng.com
1145 N Main Street
Lombard, IL 60148
Telephone: 630 953-9928
Fax: 630 953-9938

BORING LOG 4NE-11

WEI Job No.: 786-40-01

Client: **CDM Smith, Inc.**
Project: **CLCJAWA System Expansion**
Location: **Lake County, Illinois**

Datum: NAVD88
Elevation: 746.56 ft
North: 2085848.91 ft
East: 1078088.44 ft
Station:
Offset:

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
	746.2	4-inch thick, black CLAY & SILT (C&$); topsoil, dry (CL-ML)						
		Stiff, brown and gray CLAY & SILT (C&$), trace gravel and roots; dry (CL-ML)			1	PUSH	1.75 P	36
	744.6	--PID= 11.6 ppm--						
		Stiff, brown and gray SILTY CLAY ($yC), trace fine gravel, seams of medium sand; moist (CLS)			2	PUSH	1.75 P	33
		--PID = 8.1 ppm--						
		--same--	5		3	PUSH	1.00 P	33
		--PID = 24.3 ppm--						
		--same, with 3 inch fine sand seam--			4	PUSH	2.75 P	15
		--PID = 10.2 ppm--						
	738.6							
		Brown fine SAND (S), little fine silt, little fine gravel; moist (SW-SM)			5	PUSH	NP	12
		--PID = 35.7 ppm (LS)--	10					
		--same, wet--			6	PUSH	NP	12
		--PID = 4.9 ppm--						
	734.6							
		Boring terminated at 12.00 ft						
			15					
			20					

GENERAL NOTES

Begin Drilling: **09-03-2014** Complete Drilling: **09-03-2014**
Drilling Contractor: **Wang Testing Services** Drill Rig: **Hand Auger**
Driller: **K&K** Logger: **A. Happel** Checked by: **MdIR**
Drilling Method: **Pneumatic-drive Geoprobe sampler due to access restriction;Backfilled with soil cuttings and bentonite; PID**

WATER LEVEL DATA

While Drilling: **6.00 ft**
At Completion of Drilling: **5.50 ft**
Time After Drilling: **NA**
Depth to Water: **NA**

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Wang Engineering
wangeng@wangeng.com
1145 N Main Street
Lombard, IL 60148
Telephone: 630 953-9928
Fax: 630 953-9938

BORING LOG 4NE-12

WEI Job No.: 786-40-01

Client: **CDM Smith, Inc.**
Project: **CLCJAWA System Expansion**
Location: **Lake County, Illinois**

Datum: NAVD88
Elevation: 763.33 ft
North: 2084843.60 ft
East: 1077915.55 ft
Station:
Offset:

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
	763.1	3-inch thick, black SILT ($), trace fine gravel and roots; topsoil (ML)						
		Medium dense, brown and gray, fine SAND (S), with silt, trace fine gravel; dry, fill (SP-SM)			1	5 4 4 6	NP	12
	761.3	--PID = 8.5 ppm (LS)--						
		Medium to very stiff, brown and gray SILTY CLAY ($yC), trace fine sand, trace fine gravel; fill (CL)			2	6 6 5 6	2.50 P	12
		--PID = 3.8 ppm--						
		--same--	5		3	2 2 4 5	1.72 B	21
		--PID = 4.3 ppm--						
		--same--						
		--PID = 5.2 ppm--			4	4 4 4 6	2.21 B	23
		--same--						
		--PID = 2.4 ppm--			5	2 5 8 12	4.35 B	14
			10					
	752.3							
		Medium dense, brown, fine SAND (S), with silt, trace fine gravel; moist (SP-SM)			6	11 11 11 12	2.46 B	22
	751.3	--PID = 1.9 ppm--						
		Boring terminated at 12.00 ft						
			15					
			20					

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)

GENERAL NOTES

Begin Drilling: **09-02-2014** Complete Drilling: **09-02-2014**
Drilling Contractor: **Wang Testing Services** Drill Rig: **D-50 ATV**
Driller: **K&K** Logger: **A. Happel** Checked by: **MdIR**
Drilling Method: **2.25 IDA HSA, 140 lb auto, 30" drop, 2" DIA SS;**
Backfilled with soil cuttings and bentonite; PID Bkgrd 0.0 ppm

WATER LEVEL DATA

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

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Wang Engineering
wangeng@wangeng.com
1145 N Main Street
Lombard, IL 60148
Telephone: 630 953-9928
Fax: 630 953-9938

BORING LOG 4NE-13

WEI Job No.: 786-40-01

Client: **CDM Smith, Inc.**
Project: **CLCJAWA System Expansion**
Location: **Lake County, Illinois**

Datum: NAVD88
Elevation: 761.21 ft
North: 2081830.84 ft
East: 1077966.18 ft
Station:
Offset:

Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
761.0	3-inch thick, dark brown SILT ($); organic matter, topsoil (ML)						
	Stiff, brown SILTY CLAY ($yC), trace fine gravel; fill (CL)			1	5 7 9 11	> 4.50 P	10
	--PID = 17.3 ppm--						
	--same--			2	5 6 4 4	4.00 P	14
	--PID = 17.3 ppm--						
757.7	Stiff, brown CLAY & SILT (C&$), little fine to medium sand, trace fine gravel; (CL)						
	--PID = 17.5 ppm--	5		3	4 5 5 7	3.12 B	15
	--same--						
	--PID = 17.2 ppm--			4	3 6 8 8	5.00 B	18
753.2	Stiff, gray SILT ($); saturated (ML)						
	--PID = 16.7 ppm--			5	3 4 5 6	NP	17
		10					
	--same, interbedded fine sand--						
	--PID = 17.3 ppm--			6	3 4 5 7	NP	14
	--same--			7	3 6 6 8	NP	14
747.2							
746.7	Gray SILT ($), with fine sand; saturated (MLS)						
	Stiff, gray SILTY CLAY ($yC), trace fine gravel; (CL)	15		8	3 6 6 8	NP	13
	--same--			9	3 4 6 7	1.64 B	17
	--same--			10	3 5 6 7	1.56 B	17
		20					
	--same--			11	3 4 4 6	0.82 B	17
	--same--			12	3 4 7 8	0.75 P	19
	--same--	25		13	4 6 9 10	1.72 B	19
	--same--			14	3 6 7 8	2.30 B	21
	--same, interbedded fine sand--			15	6 4 4 4	1.80 B	23
731.2		30					
	Stiff, gray CLAY & SILT (C&$), trace fine gravel; (CL-ML)			16	4 7 8 15	3.28 B	20
729.2	Very stiff, gray SILTY CLAY ($yC), trace fine gravel; (CL)			17	4 11 15 15	5.17 B	16
		35		18	3 6 13 19	4.51 B	15
725.2	Boring terminated at 36.00 ft						
		40					

GENERAL NOTES

Begin Drilling: **08-14-2014** Complete Drilling: **08-14-2014**
Drilling Contractor: **Wang Testing Service** Drill Rig: **CME-55**
Driller: **R&J** Logger: **D. Kolpacki** Checked by: **M. Snider**
Drilling Method: **3.25 IDA HSA, 140 lb auto, 30" drop, 2" DIA SS;**
Backfilled with soil cuttings and bentonite; PID Bkgrd 0.0 ppm

WATER LEVEL DATA

While Drilling: **8.00 ft**
At Completion of Drilling: **32.00 ft**
Time After Drilling: **NA**
Depth to Water: **NA**

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Wang Engineering
wangeng@wangeng.com
1145 N Main Street
Lombard, IL 60148
Telephone: 630 953-9928
Fax: 630 953-9938

BORING LOG 4NE-14

WEI Job No.: 786-40-01

Client: **CDM Smith, Inc.**
Project: **CLCJAWA System Expansion**
Location: **Lake County, Illinois**

Datum: NAVD88
Elevation: 768.16 ft
North: 2079147.63 ft
East: 1078502.34 ft
Station:
Offset:

Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
767.9	2-inch thick, dark brown SILT ($); organic matter, topsoil (ML)						
	Stiff, brown SILTY CLAY ($yC); fill (CL)			1	3 6 7 10	> 4.50 P	12
766.2	--PID = 13.3 ppm--						
	Stiff, brown CLAY & SILT (C&$), trace fine gravel; (CL) --PID = 12.6 ppm--			2	3 4 5 5	2.79 B	13
	--same-- --PID = 12.7 ppm--	5		3	3 5 5 5	3.85 B	14
	--same, gray, medium stiff-- --PID = 11.8 ppm--			4	3 3 4 5	1.97 B	16
	--same, gray-- --PID = 10.5 ppm--	10		5	3 4 7 8	4.02 B	15
	--same, gray-- --PID = 11.3 ppm--			6	3 5 6 7	2.87 B	13
756.9	Medium dense, dark brown, coarse SAND (S); wet (SP)						
756.2	Stiff, gray SILTY CLAY ($yC), trace fine gravel; (CL)			7	3 6 7 8	2.00 P	15
	--same--	15		8	3 4 5 6	2.30 B	14
	--same--			9	3 4 5 7	2.38 B	20
	--same--	20		10	4 5 7 8	2.21 B	15
	--same--			11	3 5 6 19	1.89 B	18
	--same-- --spoon refusal, 22.5'-- --cobble or coarse gravel--			12	50/6	2.00 B	17
744.7	Medium dense, gray, fine SAND (S); wet (SP)						
		25		13	4 4 5 5	NP	27
	--same--			14	7 9 11 12	NP	18
	--same--	30		15	7 9 9 10	NP	29
	--same--			16	6 9 12 10	NP	24
	--same--			17	4 7 6 8	NP	21
734.2	Medium dense, gray, fine to coarse SAND (S), trace fine gravel; wet (SW)	35		18	3 8 11 14	NP	14
732.2	Boring terminated at 36.00 ft	40					

GENERAL NOTES

Begin Drilling: **08-15-2014** Complete Drilling: **08-15-2014**
Drilling Contractor: **Wang Testing Service** Drill Rig: **CME-55**
Driller: **R&J** Logger: **D. Kolpacki** Checked by: **M. Snider**
Drilling Method: **3.25 IDA HSA, 140 lb auto, 30" drop, 2" DIA SS;**
Backfilled with soil cuttings and bentonite; PID Bkgrd 0.0 ppm

WATER LEVEL DATA

While Drilling: **11.50 ft**
At Completion of Drilling: **10.00 ft**
Time After Drilling: **NA**
Depth to Water: **NA**

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Wang Engineering
wangeng@wangeng.com
1145 N Main Street
Lombard, IL 60148
Telephone: 630 953-9928
Fax: 630 953-9938

BORING LOG 4NE-15

WEI Job No.: 786-40-01

Client: **CDM Smith, Inc.**
Project: **CLCJAWA System Expansion**
Location: **Lake County, Illinois**

Datum: NAVD88
Elevation: 778.89 ft
North: 2077418.07 ft
East: 1078853.01 ft
Station:
Offset:

Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
778.6	4-inch thick, dark brown SILT ($); organic matter, topsoil (ML)						
	Stiff to very stiff, brown SILTY CLAY ($yC), trace fine gravel; fill (CL)			1	2 3 7 8	> 4.50 P	12
	--PID = 24.5 ppm--						
	--same--			2	6 6 9 10	> 4.50 P	17
	--PID = 27.6 ppm--						
	--same--						
	--PID = 24.7 ppm--	5		3	7 12 12 16	> 4.50 P	12
	--same--						
	--PID = 25.2 ppm--			4	7 10 11 15	> 4.50 P	15
771.1	Stiff to very stiff, brown SILTY CLAY ($yC), trace fine gravel; (CL)						
	--PID = 24.2 ppm--			5	5 8 10 12	3.28 B	13
		10					
	--same--						
	--PID = 25.3 ppm--			6	5 7 8 8	2.87 B	15
	--same, gray--			7	3 5 7 11	2.71 B	14
	--same, gray--						
		15		8	3 6 7 8	2.62 B	14
	--same, gray--			9	3 4 6 8	2.71 B	23
	--same, gray--						
		20		10	3 5 6 8	2.62 B	26

Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
	--same, gray--			11	9 9 15 12	5.41 B	12
757.1							
756.9	3-inch thick, gray, coarse SAND (S); wet (SP)						
	Very stiff, gray SILTY CLAY ($yC), trace fine gravel; (CL)			12	5 7 9 9	2.87 B	15
	--same--						
		25		13	6 8 11 12	2.71 B	16
	--same--			14	5 6 9 10	1.80 B	15
	--same, stiff--			15	3 5 6 20	2.46 B	22
		30					
	--same--			16	3 5 7 10	2.38 B	24
747.1	Medium dense, gray, fine to coarse SAND (S), trace fine gravel; wet (SW)			17	4 8 10 8	NP	11
	--same--						
		35		18	9 8 8 9	NP	13
742.9	Boring terminated at 36.00 ft						
		40					

GENERAL NOTES

Begin Drilling: **08-15-2014** Complete Drilling: **08-15-2014**
Drilling Contractor: **Wang Testing Service** Drill Rig: **CME-55**
Driller: **R&J** Logger: **D. Kolpacki** Checked by: **M. Snider**
Drilling Method: **3.25 IDA HSA, 140 lb auto, 30" drop, 2" DIA SS;**
Backfilled with soil cuttings and bentonite; PID Bkgrd 0.0 ppm

WATER LEVEL DATA

While Drilling: **21.50 ft**
At Completion of Drilling: **20.00 ft**
Time After Drilling: **NA**
Depth to Water: **NA**

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Wang Engineering
wangeng@wangeng.com
1145 N Main Street
Lombard, IL 60148
Telephone: 630 953-9928
Fax: 630 953-9938

BORING LOG 4NE-16

WEI Job No.: 786-40-01

Client: **CDM Smith, Inc.**
Project: **CLCJAWA System Expansion**
Location: **Lake County, Illinois**

Datum: NAVD88
Elevation: 776.11 ft
North: 2075494.97 ft
East: 1081002.42 ft
Station:
Offset:

Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
775.6	6-inch thick, black CLAY & SILT (C&$); topsoil, dry (CL-ML)						
	Stiff, black and brown, CLAY & SILT (C&$), with fine sand and gravel; fill (CLS)			1	2 5 4 5	3.50 P	39
774.1	--PID = 0.5 ppm--						
	Medium stiff to stiff, gray and brown SILTY CLAY ($yC), trace fine sand, trace fine gravel; moist (CL)			2	3 2 3 5	0.82 B	28
	--PID = 0.9 ppm (LS)--						
	--same--	5		3	2 3 6 7	4.10 B	19
	--PID = 0.7 ppm--						
	--same--						
	--PID = 0.7 ppm--			4	4 6 9 12	3.85 B	17
767.1							
	Medium dense, brown and gray, fine SAND (S), with fine to medium gravel; wet (SP)	10		5	5 6 5 7	2.50 P	18
	--PID = 0.7 ppm--						
	--same--			6	5 7 6 8	NP	18
	--PID = 0.6 ppm--						
764.1							
	Boring terminated at 12.00 ft						
		15					
		20					
		25					
		30					
		35					
		40					

GENERAL NOTES

Begin Drilling: **09-05-2014** Complete Drilling: **09-05-2014**
Drilling Contractor: **Wang Testing Services** Drill Rig: **D-50 ATV**
Driller: **K&K** Logger: **A. Happel** Checked by: **MdIR**
Drilling Method: **3.25 IDA HSA, 140 lb auto, 30" drop, 2" DIA SS;**
Backfilled with soil cuttings and bentonite; PID Bkgrd 0.6 ppm

WATER LEVEL DATA

While Drilling: **32.00 ft**
At Completion of Drilling: **36.00 ft**
Time After Drilling: **NA**
Depth to Water: **NA**

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Wang Engineering
wangeng@wangeng.com
1145 N Main Street
Lombard, IL 60148
Telephone: 630 953-9928
Fax: 630 953-9938

BORING LOG 4NE-17

WEI Job No.: 786-40-01

Client: **CDM Smith, Inc.**
Project: **CLCJAWA System Expansion**
Location: **Lake County, Illinois**

Datum: NAVD88
Elevation: 761.04 ft
North: 2075486.60 ft
East: 1083082.07 ft
Station:
Offset:

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
	760.74	4-inch thick, black CLAY & SILT (C&$); topsoil, dry (CL-ML)						
	759.8	Stiff, black and brown CLAY & SILT (C&$), with fine sand and gravel; fill (CLS)			1	8 7 11 5	4.50 P	14
	758.5	--PID = 0.8 ppm--						
		Loose, black and gray SAND and GRAVEL (S); fill, moist (SWG)			2	2 3 4 5	3.00 P	20
		Medium stiff, gray and black SILTY CLAY ($yC), trace fine to coarse gravel; organic matter, fill (CL)	5		3	2 3 4 6	2.00 P	42
		--PID = 1.0 ppm (LS)--						
	755.0	--same, with roots--						
		--PID = 0.7 ppm--						
		Medium stiff, brown and gray SILTY CLAY ($yC), trace fine sand, trace fine to medium gravel; fill, dry (CL)			4	2 2 3 4	0.66 B	27
		--PID = 0.7 ppm--						
		--same--			5	3 3 5 8	2.87 B	17
		--PID = 0.6 ppm--						
	751.0		10					
	750.5	Medium dense, brown and gray, fine SAND (S), with silt; moist (SP-SM)			6	4 13 10 11	2.54 B	16
	749.0	Very stiff, brown and gray SILTY CLAY ($yC), with fine sand, trace fine gravel; fill (CL)						
		--PID = 0.8ppm--						
		Boring terminated at 12.00 ft						
			15					
			20					

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)

GENERAL NOTES

Begin Drilling: **09-04-2014** Complete Drilling: **09-04-2014**
Drilling Contractor: **Wang Testing Services** Drill Rig: **D-50 ATV**
Driller: **K&K** Logger: **A. Happel** Checked by: **MdIR**
Drilling Method: **3.25 IDA HSA, 140 lb auto, 30" drop, 2" DIA SS;**
Backfilled with soil cuttings; PID Bkgrd 0.6 ppm

WATER LEVEL DATA

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

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Wang Engineering
wangeng@wangeng.com
1145 N Main Street
Lombard, IL 60148
Telephone: 630 953-9928
Fax: 630 953-9938

BORING LOG 4NE-18

WEI Job No.: 786-40-01

Client: **CDM Smith, Inc.**
Project: **CLCJAWA System Expansion**
Location: **Lake County, Illinois**

Datum: NAVD88
Elevation: 765.08 ft
North: 2072383.62 ft
East: 1080352.40 ft
Station:
Offset:

Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
764.8	4-inch thick, black CLAY & SILT (C&$); topsoil, dry (CL-ML)					
	Stiff, gray and brown CLAY & SILT (C&$), little fine sand, little fine gravel; fill (CLS) --PID = 0.6 ppm--		1	2 5 6 8	3.25 P	22
762.1	--same-- --PID = 0.7 ppm (LS)--		2	3 3 4 5	2.71 B	19
	Medium stiff, brown and gray SILTY CLAY ($yC), trace fine sand, trace fine gravel; (CL) --PID = 0.1 ppm--	5	3	4 5 5 7	1.31 B	19
759.1	Loose to medium dense, brown and gray, fine SAND (S), some silt, trace fine gravel; dry (SM) --PID = 0.2 ppm--		4	2 3 4 4	NP	18
	--same, moist-- --PID = 0.3 ppm--	10	5	4 5 6 6	NP	17
754.6	Very stiff, gray SILTY CLAY ($yC), some fine sand, trace fine to medium gravel; (CL) --PID = 0.2 ppm--		6	6 7 9 10	2.95 B	17
753.1	Boring terminated at 12.00 ft	15				
		20				

GENERAL NOTES

Begin Drilling: **09-05-2014** Complete Drilling: **09-05-2014**
Drilling Contractor: **Wang Testing Services** Drill Rig: **D-50 ATV**
Driller: **K&K** Logger: **A. Happel** Checked by: **MdIR**
Drilling Method: **3.25 IDA HSA, 140 lb auto, 30" drop, 2" DIA SS;**
Backfilled with soil cuttings and bentonite; PID Bkgrd 0.1 ppm

WATER LEVEL DATA

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

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Wang Engineering
wangeng@wangeng.com
1145 N Main Street
Lombard, IL 60148
Telephone: 630 953-9928
Fax: 630 953-9938

BORING LOG 4NE-19

WEI Job No.: 786-40-01

Client: **CDM Smith, Inc.**
Project: **CLCJAWA System Expansion**
Location: **Lake County, Illinois**

Datum: NAVD88
Elevation: 741.53 ft
North: 2068495.96 ft
East: 1080243.26 ft
Station:
Offset:

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
	741.3	3-inch thick, black SILT ($); organic matter, topsoil (OL)						
		Soft, brown CLAY & SILT (C&$), trace fine gravel; fill (CL-ML) --PID = 4.8 ppm--			1	1 2 2 3	1.50 P	19
	739.5	Stiff to very stiff, brown SILTY CLAY, trace fine gravel; (CL) --PID = 6.1 ppm--			2	2 4 6 10	4.76 B	14
		--same-- --PID = 5.9 ppm--	5		3	4 4 5 8	> 4.50 P	19
		--same-- --PID = 9.9 ppm (LS)--			4	3 5 5 7	3.24 B	16
		--same-- --PID = 6.4 ppm--	10		5	4 5 6 7	2.54 B	22
	730.5	--same-- --PID = 6.7 ppm--			6	2 4 5 7	2.46 B	19
	729.5	Medium stiff, brown SILT ($); saturated (ML)						
		Boring terminated at 12.00 ft	15					
			20					

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)

GENERAL NOTES

Begin Drilling: **09-05-2014** Complete Drilling: **09-05-2014**
Drilling Contractor: **Wang Testing Services** Drill Rig: **D-50 ATV**
Driller: **R&J** Logger: **D. Kolpacki** Checked by: **MdIR**
Drilling Method: **3.25 IDA HSA, 140 lb auto, 30" drop, 2" DIA SS;**
Backfilled with soil cuttings and bentonite; PID Bkgrd 0.1 ppm

WATER LEVEL DATA

While Drilling: **11.00 ft**
At Completion of Drilling: **11.00 ft**
Time After Drilling: **NA**
Depth to Water: **NA**

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Wang Engineering
wangeng@wangeng.com
1145 N Main Street
Lombard, IL 60148
Telephone: 630 953-9928
Fax: 630 953-9938

BORING LOG 4NE-TC-01

WEI Job No.: 786-40-01

Client: **CDM Smith, Inc.**
Project: **CLCJAWA System Expansion**
Location: **Lake County, Illinois**

Datum: NAVD88
Elevation: 752.87 ft
North: 2089334.34 ft
East: 1073160.68 ft
Station:
Offset:

Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
752.4	6-inch thick, black CLAY & SILT (C&$); topsoil (CL-ML)						
	Medium dense, black, fine to medium GRAVEL (G), and fine sand, and silt; fill, dry (GW-GM)			1	0 16 7 5	NP	15
	--PID = 0.5 ppm--						
	--same--			2	4 2 3 3	NP	11
	--PID = 0.0 ppm--						
748.9	Medium stiff to stiff, brown and black SILTY CLAY ($yC), some fine sand, trace fine gravel; fill (CLS)	5		3	3 2 3 4	1.23 B	26
	--PID= 0.3 ppm--						
	--same--			4	2 3 5 7	2.21 B	17
	--PID= 0.4 ppm--						
	--same--			5	2 4 9 11	6.15 B	16
	--PID= 0.6 ppm--	10					
	--same, very stiff--			6	9 10 13 17	6.31 B	17
	--PID= 0.8 ppm (LS)--						
740.9	Stiff to very stiff, gray SILTY CLAY ($yC), trace fine to medium gravel; (CL)			7	5 9 12 10	6.15 B	19
	--PID= 0.3 ppm--						
	--same--	15		8	3 7 10 13	5.08 B	19
	--same, fine sand seams--			9	2 5 8 10	5.33 B	21
	--same--	20		10	4 9 8 16	4.26 B	24
	--same, some fine sand--			11	4 4 7 8	1.80 B	15
	--same, some fine sand--			12	3 4 7 8	1.23 B	14
	--same, some fine sand--	25		13	3 4 6 13	1.23 B	15
726.9	Stiff, gray SILTY CLAY ($yC), and fine sand, trace fine gravel; (CLS)			14	3 3 5 7	0.82 B	13
	--same--			15	3 4 5 6	0.49 B	14
722.9	Stiff to very stiff, gray SILTY CLAY ($yC), trace fine to medium gravel; (CL)	30		16	4 5 8 10	1.64 B	16
	--same--			17	5 11 15 13	1.48 B	15
	--same--	35		18	3 5 7 10	1.64 B	17
716.9	Boring terminated at 36.00 ft	40					

GENERAL NOTES

Begin Drilling: **09-22-2014** Complete Drilling: **09-22-2014**
Drilling Contractor: **Wang Testing Service** Drill Rig: **CME-55**
Driller: **R&J** Logger: **A. Happel** Checked by: **MdIR**
Drilling Method: **2.25 IDA HSA, 140 lb auto, 30" drop, 2" DIA SS;**
Backfilled with soil cuttings and bentonite; PID Bkgrd 0.3 ppm

WATER LEVEL DATA

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

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Wang Engineering
wangeng@wangeng.com
1145 N Main Street
Lombard, IL 60148
Telephone: 630 953-9928
Fax: 630 953-9938

BORING LOG 4NE-TC-02

WEI Job No.: 786-40-01

Client: **CDM Smith, Inc.**
Project: **CLCJAWA System Expansion**
Location: **Lake County, Illinois**

Datum: NAVD88
Elevation: 734.98 ft
North: 2091378.55 ft
East: 1073288.45 ft
Station:
Offset:

Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
734.3	8-inch thick CLAY & SILT (C&$), with sand; dry, topsoil (CL-ML)						
	Stiff, gray and brown CLAY & SILT (C&$), trace fine gravel; (CL-ML)			1	1 3 2 4	4.25 P	19
	--PID = 15.1 ppm--						
	--same, trace organic matter--			2	4 5 4 5	1.64 B	26
	--PID = 16.6 ppm (LS) --						
731.0	Stiff, brown and gray SILTY CLAY ($yC), trace fine gravel; (CL)	5		3	3 3 5 5	0.98 B	26
	--PID = 15.5 ppm--						
729.0							
728.5	Loose, brown, fine to coarse SAND (S), and silt; moist (SW-SM)			4	3 7 9 14	4.50 P	18
	Very stiff, brown and gray SILTY CLAY ($yC), trace fine gravel; (CL)						
	--PID = 13.7 ppm--			5	4 9 11 18	6.56 B	19
	--same--						
	--PID = 14.5 ppm	10					
	--same, hard--			6	20 22 22 25	6.56 B	18
	--PID = 10.6 ppm--						
	--same--			7	4 6 11 15	6.64 B	19
	--same--	15		8	6 8 11 14	3.77 B	19
	--same, stiff--						
	--6 inch sand seam, wet--			9	7 6 7 11	2.79 B	15
718.0	Very stiff, gray SILTY CLAY ($yC), and fine sand, trace fine gravel; moist (CLS)						
				10	7 8 7 9	2.95 B	15
		20					

Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
	--same, hard--			11	14 16 17 15	2.79 B	17
	--same--			12	3 5 10 14	1.72 B	12
711.5	Stiff to very stiff, gray SILTY CLAY ($yC), trace fine gravel; (CL)						
		25		13	4 7 8 11	2.13 B	16
				14	5 5 7 8	1.72 B	18
				15	4 5 6 13	2.38 B	18
		30					
				16	11 12 14 14	2.38 B	15
				17	5 5 6 9	2.05 B	19
		35		18	5 6 8 11	2.54 B	20
699.0	Boring terminated at 36.00 ft						
		40					

GENERAL NOTES

Begin Drilling: **08-25-2014** Complete Drilling: **08-25-2014**
Drilling Contractor: **Wang Testing Service** Drill Rig: **D-25 ATV**
Driller: **K&K** Logger: **A. Happel** Checked by: **MdIR**
Drilling Method: **2.25 IDA HSA, 140 lb auto, 30" drop, 2" DIA SS;**
Backfilled with soil cuttings and bentonite; PID Bkgrd 10.0 ppm

WATER LEVEL DATA

While Drilling: **16.00 ft**
At Completion of Drilling: **29.00 ft**
Time After Drilling: **NA**
Depth to Water: **NA**

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Wang Engineering
wangeng@wangeng.com
1145 N Main Street
Lombard, IL 60148
Telephone: 630 953-9928
Fax: 630 953-9938

BORING LOG 4NE-TC-03

WEI Job No.: 786-40-01

Client: **CDM Smith, Inc.**
Project: **CLCJAWA System Expansion**
Location: **Lake County, Illinois**

Datum: NAVD88
Elevation: 749.42 ft
North: 2087666.91 ft
East: 1077729.11 ft
Station:
Offset:

Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
749.1	4-Inch thick, black SILT & CLAY ($&C); topsoil, dry (CLS)						
	Stiff, brown and black SILTY CLAY ($yC), trace fine sand, trace fine gravel; fill (CL)			1	5 6 3 4	4.25 P	18
	--PID = 5.4 ppm--						
	--same--			2	3 3 5 5	1.48 B	17
	--PID = 4.5 ppm--						
745.4	Stiff, brown and gray SILTY CLAY ($yC), some fine sand, trace fine gravel; fill (CLS)	5		3	5 5 6 8	3.69 B	14
	--PID = 6.7 ppm (LS)--						
743.4	Stiff to very stiff, brown and gray SILTY CLAY ($yC), trace fine sand, trace fine gravel; fill (CL)			4	4 6 8 12	3.61 B	13
	--PID = 2.6 ppm--						
	--same--			5	4 9 11 13	5.33 B	15
	--PID = 2.1 ppm--						
739.4		10					
	Stiff to very stiff, gray SILTY CLAY ($yC), trace fine gravel; (CL)			6	15 17 18 20	3.69 B	15
	--PID = 2.2 ppm--						
	--same--			7	4 8 10 10	2.87 B	15
	--same--	15		8	2 5 7 9	1.80 B	19
	--same--			9	4 4 6 9	1.89 B	18
	--same--						
730.9							
730.4	Gray coarse SAND and GRAVEL (S); saturated (SWG)			10	2 3 7 9	2.05 B	22
	Very stiff, gray CLAYEY SILT	20					
	(Cy$), some fine sand, trace fine gravel; dry (MLS)				15 10 11 12	NP	11
	--same, saturated--			11			
	--same, stiff, wet--			12	4 5 7 14	NP	11
725.9							
725.4	Gray SILTY CLAY ($yC), trace fine gravel; (CL)						
	Very stiff, gray CLAY & SILT (C&$), trace fine gravel; moist (CL-ML)	25		13	4 7 8 9	2.05 B	16
	-- same--			14	4 6 10 12	2.62 B	15
721.4							
	Very stiff, gray SILTY CLAY ($yC), trace fine gravel; (CL)			15	4 6 9 13	3.28 B	24
		30					
718.9							
	Very stiff, gray SILT ($), and fine sand, trace fine gravel; dry (SP-SM)			16	14 11 12 11	0.98 B	16
717.7							
	Stiff, gray CLAY & SILT (C&$), trace gravel; (CL-ML)			17	3 4 4 5	1.39 B	15
715.4							
	Stiff, gray SILTY CLAY ($yC), trace gravel; (CL)	35		18	4 6 7 9	2.54 B	13
713.4							
	Boring terminated at 36.00 ft						
		40					

GENERAL NOTES

Begin Drilling: **09-02-2014** Complete Drilling: **09-02-2014**
Drilling Contractor: **Wang Testing Services** Drill Rig: **D-50 ATV**
Driller: **K&K** Logger: **A. Happel** Checked by: **MdIR**
Drilling Method: **2.25 IDA HSA, 140 lb auto, 30" drop, 2" DIA SS;**
Backfilled with soil cuttings and bentonite; PID Bkgrd 0.0 ppm

WATER LEVEL DATA

While Drilling: **22.00 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.

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Wang Engineering
wangeng@wangeng.com
1145 N Main Street
Lombard, IL 60148
Telephone: 630 953-9928
Fax: 630 953-9938

BORING LOG 4NE-TC-04

WEI Job No.: 786-40-01

Client: **CDM Smith, Inc.**
Project: **CLCJAWA System Expansion**
Location: **Lake County, Illinois**

Datum: NAVD88
Elevation: 776.49 ft
North: 2084019.85 ft
East: 1078123.68 ft
Station:
Offset:

Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
776.24	4-inch thick, black CLAY & SILT (Cy$); topsoil, dry (CL-ML)						
	Stiff to very stiff, brown and gray CLAY & SILT (C&$), some fine sand, trace fine gravel; fill (CL)			1	4 4 9 11	4.50 P	16
	--PID = 8.5 ppm (LS)--						
	--same--			2	5 4 6 8	5.08 B	21
	--PID = 1.5 ppm--						
	--same--						
	--PID = 1.9 ppm--	5		3	4 6 8 10	5.99 S	15
	--same--						
	--PID = 0.7 ppm--			4	7 8 11 13	7.13 B	15
	--same--						
	--PID = 2.7 ppm--			5	5 8 10 13	7.13 B	18
	--same--	10					
	--PID = 3.5 ppm--			6	15 16 18 19	5.66 B	15
764.0							
	Stiff to very stiff, gray SILTY CLAY ($yC), trace fine gravel; (CL)			7	4 9 12 11	4.26 B	15
	--no recovery--						
	--wet spoon--	15		8	9 9 12 13	NR	
	--same--			9	3 4 5 8	1.89 B	15
	--same, fine sand seams--			10	5 6 10 11	1.80 B	11
		20					

Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
	--same			11	7 7 8 9	1.97 B	20
	--same, fine sand seams--			12	3 3 6 8	2.05 B	22
	--same, fine sand seams--	25		13	3 4 3 8	2.13 B	19
	--same, fine sand seams--			14	4 5 6 9	3.12 B	18
748.7							
748.0	Loose, brown, fine SAND (S), and silt; (SP-SM)						
	Stiff to very stiff, gray SILTY CLAY ($yC), and fine sand, trace fine gravel; (CLS)			15	4 5 6 7	2.38 B	19
	--same--	30		16	8 9 11 10	0.66 B	9
744.0							
	Stiff, gray SILTY CLAY ($yC), trace fine gravel; (CL)			17	3 3 6 9	2.54 B	14
		35		18	3 5 6 7	1.72 B	16
740.5							
	Boring terminated at 36.00 ft						
		40					

GENERAL NOTES

Begin Drilling: **09-03-2014** Complete Drilling: **09-03-2014**
Drilling Contractor: **Wang Testing Services** Drill Rig: **D-50 ATV**
Driller: **K&K** Logger: **A. Happel** Checked by: **MdIR**
Drilling Method: **2.25 IDA HSA, 140 lb auto, 30" drop, 2" DIA SS;**
Backfilled with soil cuttings and bentonite; PID Bkgrd 0.5 ppm

WATER LEVEL DATA

While Drilling: **15.00 ft**
At Completion of Drilling: **0.00 ft**
Time After Drilling: **NA**
Depth to Water: **NA**

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Wang Engineering
wangeng@wangeng.com
1145 N Main Street
Lombard, IL 60148
Telephone: 630 953-9928
Fax: 630 953-9938

BORING LOG 4NE-TC-05

WEI Job No.: 786-40-01

Client: **CDM Smith, Inc.**
Project: **CLCJAWA System Expansion**
Location: **Lake County, Illinois**

Datum: NAVD88
Elevation: 764.31 ft
North: 2083499.71 ft
East: 1078126.27 ft
Station:
Offset:

Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
763.8	4-inch thick, black CLAY & SILT (Cy$); topsoil, dry (CL-ML)						
	Stiff, brown and black, SILTY CLAY (CLS), some fine sand, trace fine gravel; fill (CLS)			1	5 3 3 5	4.50 P	11
	--PID = 36.1 ppm--						
	--same--			2	5 4 6 7	2.05 B	21
	--PID = 56.1 ppm (LS)--						
	--same--						
	--PID = 55.4 ppm--	5		3	4 5 7 10	4.51 B	15
	--same--						
	--PID = 36.3 ppm--			4	4 4 5 9	2.54 B	12
756.3							
	Very stiff, gray SILTY CLAY ($yC), trace fine gravel; (CL)						
	--PID = 24.2 ppm--			5	3 5 7 9	3.40 B	14
		10					
	--same--						
	--PID = 28.6 ppm--			6	9 9 11 11	4.67 B	18
	--same-			7	3 6 5 9	3.36 B	18
	--same-						
		15		8	2 3 7 8	2.46 B	17
	--same-			9	5 5 7 8	2.38 B	22
	--same-			10	3 5 6 9	3.20 B	17
		20					

Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
743.8	--same-						
	Medium dense, gray, fine SAND (S), trace clay, trace fine gravel; moist (SP)			11	6 8 9 8	NP	21
741.8							
	Stiff to very stiff, gray SILTY CLAY ($yC), trace fine sand, trace fine gravel; (CL)			12	2 4 8 9	1.15 B	14
	--same--						
		25		13	6 9 11 18	NA	15
	--same--			14	5 7 11 13	3.28 B	14
	--same--			15	10 10 9 11	3.53 B	16
		30					
	--same, no fine sand--			16	6 8 11 12	2.38 B	19
	--same, no fine sand--			17	6 8 10 9	1.89 B	18
731.1							
	Loose, brown, fine SAND (S), and silt, trace fine gravel; wet (SP-SM)						
729.8							
	Very stiff, gray SILTY CLAY ($yC), trace fine sand, trace fine gravel; (CL)	35		18	4 6 9 14	2.71 B	14
728.3							
	Boring terminated at 36.00 ft						
		40					

GENERAL NOTES

Begin Drilling: **09-03-2014** Complete Drilling: **09-03-2014**
Drilling Contractor: **Wang Testing Services** Drill Rig: **D-50 ATV**
Driller: **K&K** Logger: **A. Happel** Checked by: **MdIR**
Drilling Method: **2.25 IDA HSA, 140 lb auto, 30" drop, 2" DIA SS;**
Backfilled with soil cuttings and bentonite; PID Bkgrd 25.0 ppm

WATER LEVEL DATA

While Drilling: **34.50 ft**
At Completion of Drilling: **34.00 ft**
Time After Drilling: **NA**
Depth to Water: **NA**

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Wang Engineering
wangeng@wangeng.com
1145 N Main Street
Lombard, IL 60148
Telephone: 630 953-9928
Fax: 630 953-9938

BORING LOG 4NE-TC-06

WEI Job No.: 786-40-01

Client: **CDM Smith, Inc.**
Project: **CLCJAWA System Expansion**
Location: **Lake County, Illinois**

Datum: NAVD88
Elevation: 763.83 ft
North: 2083333.46 ft
East: 1078147.69 ft
Station:
Offset:

Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
763.6	3-inch thick, dark brown SILT ($); organic matter, topsoil (ML)					
	Medium stiff, brown SILTY CLAY ($yC), trace fine gravel; fill (CL)		1	4 3 3 5	4.25 P	16
761.8	--PID = 15.5 ppm--					
	Very stiff, brown CLAY & SILT (C&$), little fine sand, trace fine gravel; (CL)		2	6 6 9 11	4.35 B	17
	--PID = 16.7 ppm (LS)--					
	--same--					
	--PID = 15.7 ppm--	5	3	5 10 12 15	7.13 B	13
	--same--					
	--PID = 13.8 ppm--		4	4 6 9 11	3.44 B	14
	--same, stiff--					
	--PID = 13.9 ppm--		5	2 5 8 9	3.28 B	15
		10				
	--same, brown and gray--					
	--PID = 15.1 ppm--		6	3 7 8 10	2.05 B	15
752.8	Stiff, brown SILTY CLAY ($yC), trace fine gravel; (CL)					
	--PID = 16.7 ppm (LS)--		7	2 4 4 7	2.13 B	27
	--same, gray--	15	8	2 4 5 7	2.87 B	25
	--same, gray--		9	3 4 7 7	3.00 P	16
	--same, gray--	20	10	4 5 7 8	1.64 B	16
	--same, gray--		11	1 3 7 7	2.21 B	15
	--same, gray--		12	4 5 7 9	2.05 B	14
	--same, gray--	25	13	4 5 7 7	1.80 B	16
	--same, gray--		14	2 3 5 5	1.31 B	19
	--same, gray--					
	--spoon wet at 29 feet--		15	2 7 5 9	1.23 B	20
		30				
	--same, gray--		16	2 3 7 8	1.31 B	16
	--same, gray--		17	4 6 8 10	2.54 B	15
	--same, gray--	35	18	3 7 7 9	2.71 B	15
727.8	Boring terminated at 36.00 ft					
		40				

GENERAL NOTES

Begin Drilling: **08-19-2014** Complete Drilling: **08-19-2014**
Drilling Contractor: **Wang Testing Service** Drill Rig: **CME-55**
Driller: **R&J** Logger: **D. Kolpacki** Checked by: **M. Snider**
Drilling Method: **3.25 IDA HSA, 140 lb auto, 30" drop, 2" DIA SS;**
Backfilled with soil cuttings and bentonite; PID Bkgrd 15.0 ppm

WATER LEVEL DATA

While Drilling: **29.00 ft**
At Completion of Drilling: **29.00 ft**
Time After Drilling: **NA**
Depth to Water: **NA**

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Wang Engineering
wangeng@wangeng.com
1145 N Main Street
Lombard, IL 60148
Telephone: 630 953-9928
Fax: 630 953-9938

BORING LOG 4NE-TC-07

WEI Job No.: 786-40-01

Client: **CDM Smith, Inc.**
Project: **CLCJAWA System Expansion**
Location: **Lake County, Illinois**

Datum: NAVD88
Elevation: 768.71 ft
North: 2082550.75 ft
East: 1078099.55 ft
Station:
Offset:

Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
768.5	3-inch thick, dark brown SILT ($); organic matter, topsoil (ML)						
	Very stiff to hard, brown SILTY CLAY ($yC), trace fine gravel; (CL)			1	3 10 20 23	> 4.50 P	11
	--PID = 11.0 ppm--						
	--same--			2	6 16 22 23	> 4.50 P	12
	--PID = 7.6 ppm--						
	--same--						
	--PID = 7.3 ppm--	5		3	9 13 15 21	6.23 S	14
	--same--						
	--PID = 9.4 ppm--			4	4 9 13 15	7.79 B	16
	--same--						
	--PID = 10.2 ppm--			5	4 8 12 17	5.99 B	17
758.7		10					
	Stiff, brown CLAY & SILT (C&$), trace fine gravel; (CL-ML)						
	--PID = 10.3 ppm--			6	4 6 8 9	3.20 B	15
	--same--			7	3 5 7 10	3.28 B	15
754.7							
	Stiff, gray SILTY CLAY ($yC), trace fine gravel; (CL)	15		8	3 5 6 6	2.46 B	21
	--same--			9	3 5 6 9	1.89 B	21
	--same--			10	3 4 7 9	3.12 B	24
		20					
	--same--			11	4 5 9 10	3.28 B	21
747.2							
746.7	Medium stiff, gray SILT ($); moist (ML)						
746.2	Loose, gray, medium SAND (S); wet (SP)			12	0 2 3 3	1.75 P	26
744.7	Medium stiff, gray CLAY & SILT (C&$), trace fine gravel (CL-ML)						
	Stiff, gray SILTY CLAY ($yC), laminated silt and trace fine gravel; (CL)	25		13	3 6 8 11	2.54 B	21
742.7							
	Stiff, gray CLAY & SILT (C&$); (CL-ML)			14	4 5 7 10	2.54 B	16
740.7							
	Stiff, gray SILTY CLAY ($yC), trace fine gravel; (CL)			15	4 6 7 9	1.48 B	17
		30					
	--same--			16	4 4 7 7	1.89 B	18
	--same--			17	3 4 6 7	2.21 B	20
	--same--	35		18	4 5 7 14	2.30 B	16
732.7							
	Boring terminated at 36.00 ft						
		40					

GENERAL NOTES

Begin Drilling: **08-11-2014** Complete Drilling: **08-11-2014**
Drilling Contractor: **Wang Testing Service** Drill Rig: **CME-55**
Driller: **R&J** Logger: **D. Kolpacki** Checked by: **MdIR**
Drilling Method: **3.25 IDA HSA, 140 lb auto, 30" drop, 2" DIA SS;**
Backfilled with soil cuttings and bentonite; PID Bkgrd 8.0 ppm

WATER LEVEL DATA

While Drilling: **22.00 ft**
At Completion of Drilling: **23.00 ft**
Time After Drilling: **NA**
Depth to Water: **NA**

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Wang Engineering
wangeng@wangeng.com
1145 N Main Street
Lombard, IL 60148
Telephone: 630 953-9928
Fax: 630 953-9938

BORING LOG 4NE-TC-08

WEI Job No.: 786-40-01

Client: **CDM Smith, Inc.**
Project: **CLCJAWA System Expansion**
Location: **Lake County, Illinois**

Datum: NAVD88
Elevation: 760.77 ft
North: 2081168.09 ft
East: 1078322.02 ft
Station:
Offset:

Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
760.5	3-inch thick, dark brown SILT ($); organic matter, topsoil (ML)					
	Soft to stiff, brown CLAY & SILT (C&$); fill (CL-ML)		1	4 6 5 7	> 4.50 P	10
	--PID = 6.2 ppm--					
	--same--		2	4 4 2 2	1.50 P	17
	--PID = 6.9 ppm--					
	--same--		3	2 1 2 2	0.75 P	22
	--PID = 5.7 ppm--	5				
755.3	Medium stiff to stiff, brown SILTY CLAY ($yC), trace fine gravel; (CL)					
	--PID = 5.6 ppm--		4	2 2 3 4	1.56 B	16
	--same--		5	2 3 6 8	1.64 B	16
	--PID = 5.1 ppm--	10				
	--same--		6	4 5 6 8	3.61 B	16
	--PID = 2.1 ppm--					
	--same--		7	3 3 3 6	1.97 B	20
746.8	Medium stiff to stiff, gray CLAY & SILT (C&$), interbedded silt; moist (CL-ML)	15	8	3 3 4 6	1.64 B	18
	--same, no interbeds--		9	2 3 4 5	1.86 B	15
742.8	Stiff, gray SILTY CLAY ($yC), trace fine gravel; (CL)		10	3 4 7 7	1.39 B	15
		20				
	--same--		11	2 4 5 6	1.72 B	17
	--same--		12	2 4 6 7	1.80 B	16
	--same--	25	13	3 4 6 8	2.21 B	19
	--same--		14	3 4 6 6	1.97 B	20
	--same, very stiff--		15	3 5 11 11	1.64 B	20
730.8	Stiff, gray SILT ($); saturated (ML)	30	16	3 6 8 8	NP	16
	--same--		17	1 7 7 8	NP	15
	--same--	35	18	3 5 6 5	NP	17
724.8	Boring terminated at 36.00 ft					
		40				

GENERAL NOTES

Begin Drilling: **08-12-2014** Complete Drilling: **08-12-2014**
Drilling Contractor: **Wang Testing Service** Drill Rig: **CME-55**
Driller: **R&J** Logger: **D. Kolpacki** Checked by: **MdIR**
Drilling Method: **3.25 IDA HSA, 140 lb auto, 30" drop, 2" DIA SS;**
Backfilled with soil cuttings and bentonite; PID Bkgrd 0.0 ppm

WATER LEVEL DATA

While Drilling: **30.00 ft**
At Completion of Drilling: **36.00 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.

Wang Engineering
wangeng@wangeng.com
1145 N Main Street
Lombard, IL 60148
Telephone: 630 953-9928
Fax: 630 953-9938

BORING LOG 4NE-TC-09

WEI Job No.: 786-40-01

Client: **CDM Smith, Inc.**
Project: **CLCJAWA System Expansion**
Location: **Lake County, Illinois**

Datum: NAVD88
Elevation: 764.00 ft
North: 2079890.55 ft
East: 1078445.34 ft
Station:
Offset:

Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
763.0	12-inch thick ASPHALT --PAVEMENT--		1	4 2	3.50 P	11
762.8	2-inch thick, white CRUSHED STONE; aggregate base, dry					
	Soft to stiff, gray and brown CLAY & SILT (C&$), some fine sand, trace fine gravel; fill (CL) --PID = 1.0 ppm--		1	2 1 3 4	3.00 P	18
	--same-- --PID = 0.8 ppm--	5	3	3 4 6 6	3.20 B	16
	--same, some fine sand-- --PID = 1.1 ppm (LS)--		4	3 6 7 9	2.95 B	13
757.0	Stiff to very stiff, gray SILTY CLAY ($yC), trace fine to medium gravel; (CL)					
	--same-- --PID = 0.9 ppm--	10	5	4 7 10 10	3.53 B	18
	--same-- --PID = 0.3 ppm--		6	6 8 11 12	2.46 B	19
	--same, medium sand seams--		7	2 4 5 6	2.13 B	22
	--same--	15	8	2 5 6 6	1.64 B	17
	--same--		9	5 6 6 6	1.56 B	16
	--same--	20	10	1 4 5 7	1.50 P	17
	--same--		11	3 3 6 7	1.07 B	21
741.0	Loose to medium dense, gray, fine to medium SAND (S), trace fine to medium gravel; wet (SW)		12	2 4 5 5	NP	24
	--same--	25	13	3 5 8 6	NP	17
	--same--		14	4 6 12 12	NP	20
	--same--	30	15	6 7 9 7	NP	19
	--same--		16	3 4 4 5	NP	20
	--same--		17	2 3 5 8	NP	25
		35	18	2 3 3 5	NP	20
728.5	Stiff, gray SILTY CLAY ($yC), some fine sand, trace fine to medium gravel; (CL)					
			19	5 3 5 6	1.56 B	17
726.0	Boring terminated at 36.00 ft	40				

GENERAL NOTES

Begin Drilling: **09-25-2014** Complete Drilling: **09-25-2014**
Drilling Contractor: **Wang Testing Service** Drill Rig: **CME-55**
Driller: **R&J** Logger: **A. Happel** Checked by: **MdIR**
Drilling Method: **3.25 IDA HSA, 140 lb auto, 30" drop, 2" DIA SS;**
Backfilled with soil cuttings and bentonite; PID Bkgrd 0.0 ppm

WATER LEVEL DATA

While Drilling: **23.00 ft**
At Completion of Drilling: **33.00 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.

Wang Engineering
wangeng@wangeng.com
1145 N Main Street
Lombard, IL 60148
Telephone: 630 953-9928
Fax: 630 953-9938

BORING LOG 4NE-TC-10

WEI Job No.: 786-40-01

Client: **CDM Smith, Inc.**
Project: **CLCJAWA System Expansion**
Location: **Lake County, Illinois**

Datum: NAVD88
Elevation: 773.35 ft
North: 2078261.23 ft
East: 1078826.49 ft
Station:
Offset:

Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
773.1	3-inch thick, dark brown SILT ($); organic matter, topsoil (ML)						
	Stiff to very stiff, brown SILTY CLAY ($yC); fill (CL)			1	2 7 9 10	> 4.50 P	9
	--PID = 5.2 ppm--						
	--same--			2	3 8 6 4	> 4.50 P	15
	--PID = 4.2 ppm--						
769.6	Very stiff, brown CLAY & SILT (C&$), little fine sand; (CL)						
	--PID = 5.8 ppm--	5		3	4 10 9 9	> 4.50 P	14
	--same--						
	--PID = 4.5 ppm--			4	4 6 9 11	3.77 B	16
	--same--						
	--PID = 4.2 ppm--			5	3 7 13 13	4.59 B	13
		10					
	--same, trace fine gravel--			6	3 9 13 9	3.12 B	12
761.4	Stiff, gray SILTY CLAY ($yC), trace fine gravel; (CL)						
				7	2 4 5 8	2.46 B	16
	--same--						
		15		8	3 4 6 8	2.54 B	16
	--same, very stiff--						
				9	6 10 9 9	2.21 B	12
	--same--						
		20		10	3 5 8 10	2.87 B	15

Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
	--same--			11	3 4 7 8	2.05 B	16
	--same--			12	2 4 6 9	2.21 B	16
	--same--						
		25		13	4 5 7 8	2.21 B	16
	--same--						
746.1	Medium stiff, gray SILT ($); saturated (ML)			14	4 4 5 6	2.05 B	25
				15	1 2 3 4	NP	20
743.4	Very loose to medium dense, gray, fine to medium GRAVEL (G); wet (GW)	30		16	0 0 0 4	NP	15
	--same, with medium sand--			17	10 11 13 13	NP	10
739.4	Medium dense, gray, medium SAND (S); wet (SP)	35		18	3 5 9 12	NP	20
737.4	Boring terminated at 36.00 ft	40					

GENERAL NOTES

Begin Drilling: **08-12-2014** Complete Drilling: **08-12-2014**
Drilling Contractor: **Wang Testing Service** Drill Rig: **CME-55**
Driller: **R&J** Logger: **D. Kolpacki** Checked by: **MdIR**
Drilling Method: **3.25 IDA HSA, 140 lb auto, 30" drop, 2" DIA SS;**
Backfilled with soil cuttings and bentonite; PID Bkgrd 0.0 ppm

WATER LEVEL DATA

While Drilling: **27.40 ft**
At Completion of Drilling: **20.00 ft**
Time After Drilling: **NA**
Depth to Water: **NA**

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Wang Engineering
wangeng@wangeng.com
1145 N Main Street
Lombard, IL 60148
Telephone: 630 953-9928
Fax: 630 953-9938

BORING LOG 4NE-TC-11

WEI Job No.: 786-40-01

Client: **CDM Smith, Inc.**
Project: **CLCJAWA System Expansion**
Location: **Lake County, Illinois**

Datum: NAVD88
Elevation: 770.87 ft
North: 2076601.86 ft
East: 1079763.47 ft
Station:
Offset:

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
	770.6	3-inch thick, dark brown SILT ($); organic matter, topsoil (ML)						
		Very stiff, brown SILTY CLAY ($yC), trace fine gravel; fill (CL)			1	3 9 10 10	> 4.50 P	12
		--PID = 8.9 ppm--						
		--same--			2	5 8 11 9	> 4.50 P	13
		--PID = 7.5 ppm--						
	767.1	Very stiff, brown SILTY CLAY ($yC), trace fine gravel; (CL)						
		--PID = 7.1 ppm--	5		3	4 8 13 14	4.00 P	15
		--same--			4	5 8 11 14	5.82 B	14
		--PID = 8.5 ppm--						
		--same--			5	3 7 8 12	5.58 B	17
		--PID = 7.7 ppm--	10					
		--same, brown and gray--			6	3 6 11 12	6.81 B	18
		--PID = 7.6 ppm--						
	758.9	Stiff, gray CLAY & SILT (C&$), trace fine gravel; (CL-ML)			7	2 4 7 8	2.30 B	14
	756.9	Stiff to very stiff, gray SILTY CLAY ($yC), trace fine gravel; (CL)	15		8	3 4 7 10	3.03 B	15
		--same--			9	4 5 8 10	2.05 B	15
		--same--	20		10	4 5 9 11	2.21 B	22
		--same--			11	3 5 8 9	3.03 B	21
		--same--			12	3 7 8 11	3.20 B	15
		--same--	25		13	4 8 8 11	2.71 B	15
		--same--			14	3 5 7 11	2.21 B	16
		--same--			15	3 8 8 8	2.30 B	15
		--2-inches fine sand, moist--	30					
		--same, interbedded silt and fine sand, saturated--			16	4 7 7 10	2.50 P	18
		--same, interbedded fine sand, wet--			17	3 5 9 10	3.03 B	17
		--same--	35		18	5 8 15 15	4.67 B	17
	734.9	Boring terminated at 36.00 ft	40					

GENERAL NOTES

Begin Drilling: **08-14-2014** Complete Drilling: **08-14-2014**
Drilling Contractor: **Wang Testing Service** Drill Rig: **CME-55**
Driller: **R&J** Logger: **D. Kolpacki** Checked by: **M. Snider**
Drilling Method: **3.25 IDA HSA, 140 lb auto, 30" drop, 2" DIA SS;**
Backfilled with soil cuttings and bentonite; PID Bkgrd 0.0 ppm

WATER LEVEL DATA

While Drilling: **30.00 ft**
At Completion of Drilling: **30.00 ft**
Time After Drilling: **NA**
Depth to Water: **NA**

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Wang Engineering
wangeng@wangeng.com
1145 N Main Street
Lombard, IL 60148
Telephone: 630 953-9928
Fax: 630 953-9938

BORING LOG 4NE-TC-12

WEI Job No.: 786-40-01

Client: **CDM Smith, Inc.**
Project: **CLCJAWA System Expansion**
Location: **Lake County, Illinois**

Datum: NAVD88
Elevation: 786.26 ft
North: 2075551.17 ft
East: 1080180.49 ft
Station:
Offset:

Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
785.9	5-inch thick, dark brown SILT ($); organic matter, topsoil (ML)						
	Stiff, brown SILTY CLAY ($yC), trace fine gravel; fill (CL)			1	3 4 6 7	> 4.50 P	12
	--PID = 15.8 ppm--						
	--same--			2	5 5 4 4	> 4.50 P	13
	--PID = 14.6 ppm--						
	--same, medium stiff--			3	3 3 3 5	2.05 S	22
	--PID = 14.0 ppm--	5					
780.5	Stiff, brown SILTY CLAY ($yC), trace fine gravel; (CL)			4	4 5 6 9	2.46 B	17
	--PID = 15.8--						
	--same--			5	4 7 8 11	3.85 B	15
	--PID = 11.5 ppm--	10					
	--same--			6	4 5 9 10	3.94 B	14
	--PID = 13.7 ppm--						
	--same, gray--			7	3 5 8 9	2.21 B	15
	--same, gray--	15		8	3 4 6 9	2.05 B	19
	--same, gray--			9	3 4 6 7	1.97 B	13
	--same, gray--	20		10	3 4 7 9	1.80 B	16
765.8	Stiff, gray CLAY & SILT (C&$), trace fine gravel; (CL-ML)			11	4 6 7 8	1.39 B	11
764.3	Stiff, gray SILTY CLAY ($yC), trace fine gravel; (CL)			12	2 5 7 8	2.05 B	20
	--same--	25		13	4 6 7 10	1.89 B	13
	--same--			14	4 5 7 7	1.89 B	15
	--same--	30		15	3 4 6 9	1.72 B	13
	--same--			16	4 5 9 9	2.46 B	17
	--same--			17	3 4 7 7	1.72 B	15
	--same--	35		18	4 5 7 12	1.39 B	13
750.3	Boring terminated at 36.00 ft	40					

GENERAL NOTES

Begin Drilling: **08-14-2014** Complete Drilling: **08-14-2014**
Drilling Contractor: **Wang Testing Service** Drill Rig: **CME-55**
Driller: **R&J** Logger: **D. Kolpacki** Checked by: **M. Snider**
Drilling Method: **3.25 IDA HSA, 140 lb auto, 30" drop, 2" DIA SS;**
Backfilled with soil cuttings and bentonite; PID Bkgrd 0.0 ppm

WATER LEVEL DATA

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

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Wang Engineering
wangeng@wangeng.com
1145 N Main Street
Lombard, IL 60148
Telephone: 630 953-9928
Fax: 630 953-9938

BORING LOG 4NE-TC-13

WEI Job No.: 786-40-01

Client: **CDM Smith, Inc.**
Project: **CLCJAWA System Expansion**
Location: **Lake County, Illinois**

Datum: NAVD88
Elevation: 766.22 ft
North: 2075494.25 ft
East: 1081954.04 ft
Station:
Offset:

Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
765.9	4-inch thick, black CLAY & SILT (Cy$); topsoil, dry (CL-ML)						
	Medium dense, brown and black, fine GRAVEL (G), and fine sand; fill, dry (GP)			1	8 15 11 5	NP	5
764.2	--PID = 0.7 ppm--						
	Stiff, brown and black CLAY & SILT (C&$), some fine sand, trace fine gravel; fill, dry (CLS)			2	6 6 5 6	2.21 B	24
	--PID = 0.7 ppm (LS)--						
	--Same--						
	--PID = 0.6 ppm--	5		3	3 4 6 10	3.20 B	16
760.2							
	Very stiff, gray SILTY CLAY ($yC), trace fine gravel; (CL)			4	4 9 9 10	2.62 B	14
	--PID = 0.6 ppm--						
758.2							
757.7	Brown, fine SAND (S), and silt; dry (SP-SM)						
	Stiff to very stiff, gray SILTY CLAY ($yC), trace fine gravel; (CL)			5	3 6 9 8	3.53 B	17
		10					
	--PID = 0.6 ppm--						
	--same, fine sand seams, moist--			6	3 3 5 5	2.05 B	18
	--PID = 0.6 ppm--						
	--Same, fine sand seams, moist--			7	7 7 10 9	2.87 B	18
	--same--						
		15		8	5 6 9 8	2.05 B	17
	--same--			9	5 6 7 11	2.79 B	16
	--same--			10	3 4 8 14	2.54 B	17
		20					
	--same--			11	5 10 13 15	2.87 B	17
	--same--			12	1 4 9 10	2.05 B	18
	--same--						
		25		13	4 6 8 9	2.13 B	18
	--same--			14	5 5 6 9	2.13 B	19
	--same, fine sand seams, moist--			15	4 6 6 14	2.05 B	18
		30					
	--same, fine sand seams, moist--			16	6 10 12 14	2.38 B	18
	--same--			17	6 7 8 10	2.62 B	20
	--same--						
		35		18	4 6 8 9	2.62 B	25
730.2	Boring terminated at 36.00 ft						
		40					

GENERAL NOTES

Begin Drilling: **09-04-2014** Complete Drilling: **09-04-2014**
Drilling Contractor: **Wang Testing Services** Drill Rig: **D-50 ATV**
Driller: **K&K** Logger: **A. Happel** Checked by: **MdIR**
Drilling Method: **3.25 IDA HSA, 140 lb auto, 30" drop, 2" DIA SS;**
Backfilled with soil cuttings; PID Bkgrd 0.6 ppm

WATER LEVEL DATA

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

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Wang Engineering
wangeng@wangeng.com
1145 N Main Street
Lombard, IL 60148
Telephone: 630 953-9928
Fax: 630 953-9938

BORING LOG 4NE-TC-14

WEI Job No.: 786-40-01

Client: **CDM Smith, Inc.**
Project: **CLCJAWA System Expansion**
Location: **Lake County, Illinois**

Datum: NAVD88
Elevation: 763.92 ft
North: 2075484.27 ft
East: 1083993.05 ft
Station:
Offset:

Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
763.8	2-inch thick, black CLAY & SILT; topsoil, dry (CL-ML)						
	Stiff, brown and gray SILTY CLAY ($yC), and fine sand, trace fine gravel; fill (CLS)			1	4 3 6 6	4.50 P	13
	--PID = 6.2 ppm--						
	--Same, fine sand seams, moist--			2	4 5 6 8	1.25 P	18
	--PID = 13.6 ppm (LS)--						
	--Same, no sand--						
	--PID = 14.3 ppm--	5		3	6 4 8 10	2.87 B	14
	--Same--						
	--PID = 24.4 ppm--			4	4 5 6 7	1.64 B	16
	--Same--						
	--PID = 30.3 ppm--			5	3 7 8 9	3.03 B	16
753.9		10					
	Dense, brown, fine SAND (S), and silt; wet (SP-SM)						
	--PID= 0.6 ppm--			6	13 14 16 12	NP	19
751.9							
751.4	Stiff, brown and gray, SILTY CLAY ($yC), and fine sand, trace fine gravel; (CLS)			7	6 5 10 9	NP	21
749.9	Dense, brown, fine SAND (S), trace fine gravel; wet (SP)						
	Stiff, gray SILTY CLAY ($yC), trace fine gravel; (CL)	15		8	3 6 8 13	2.62 B	16
	--same, fine sand seams--			9	7 7 7 10	2.21 B	13
	--same, fine sand seams--			10	3 4 5 8	2.54 B	16
		20					

Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
742.9	Stiff, gray CLAY & SILT (C&S), trace fine gravel; (CL-ML)			11	10 10 11 13	2.87 B	16
				12	3 4 5 8	1.80 B	15
739.9	Stiff, gray SILTY CLAY ($yC), trace fine sand; (CL)	25		13	4 6 7 10	2.38 B	16
	--same, very stiff--			14	7 8 9 12	2.30 B	16
	--same--			15	4 7 11 12	3.28 B	15
734.4	Dense, gray, fine to coarse SAND (S), some clay, trace fine gravel; moist (SW)	30		16	11 19 18 23	NP	13
	--same, moist--			17	7 13 17 17	NP	15
	--same, dry--						
728.9	Very stiff, gray SILTY CLAY ($yC), trace fine gravel; (CL)	35		18	6 10 11 14	3.36 B	15
727.9	Boring terminated at 36.00 ft						
		40					

GENERAL NOTES

Begin Drilling: **09-04-2014** Complete Drilling: **09-04-2014**
Drilling Contractor: **Wang Testing Services** Drill Rig: **D-50 ATV**
Driller: **K&K** Logger: **A. Happel** Checked by: **MdIR**
Drilling Method: **3.25 IDA HSA, 140 lb auto, 30" drop, 2" DIA SS;**
Backfilled with soil cuttings; PID Bkgrd 0.6 ppm

WATER LEVEL DATA

While Drilling: **10.00 ft**
At Completion of Drilling: **DRY**
Time After Drilling: **NA**
Depth to Water: **NA**

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Wang Engineering
wangeng@wangeng.com
1145 N Main Street
Lombard, IL 60148
Telephone: 630 953-9928
Fax: 630 953-9938

BORING LOG 4NE-TC-15

WEI Job No.: 786-40-01

Client: **CDM Smith, Inc.**
Project: **CLCJAWA System Expansion**
Location: **Lake County, Illinois**

Datum: NAVD88
Elevation: 791.85 ft
North: 2074505.36 ft
East: 1080240.34 ft
Station:
Offset:

Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
791.6	3-inch thick, dark brown ORGANIC SILT; topsoil, dry (OL)						
	Medium stiff, brown CLAY & SILT (Cy$), trace fine gravel; fill (CL-ML)			1	1 2 4 4	2.50 P	15
789.4	--PID= 0.7ppm (LS)--						
788.6	Medium stiff, dark brown SILTY CLAY ($yC); organic material, buried topsoil (CL)			2	2 3 5 6	2.75 P	25
	Stiff, brown SILTY CLAY ($yC), trace fine gravel; (CL) --PID = 0.7ppm--	5		3	2 3 4 6	1.95 B	23
	--same-- --PID = 0.7ppm--			4	2 3 6 6	1.23 B	22
	Very stiff, brown SILTY CLAY ($yC), trace fine gravel; (CL) --PID = 0.7ppm--	10		5	3 5 11 12	4.67 B	16
	--same-- --PID = 0.7ppm--			6	4 10 17 20	4.76 B	17
	--same--			7	4 8 12 15	3.36 B	11
777.9							
	Stiff, gray CLAY & SILT (Cy$), trace fine gravel; (CL-ML)	15		8	3 5 8 11	3.90 P	15
775.9							
	Stiff to very stiff, gray SILTY CLAY ($yC), trace fine gravel; (CL)			9	4 9 9 10	1.95 B	16
	--same--	20		10	3 5 9 25	2.54 B	14
	--same--			11	5 11 14 17	3.53 B	13
	--same--			12	3 5 9 12	2.30 B	16
	--same--	25		13	3 6 8 10	2.13 B	17
	--same--			14	4 6 8 9	2.21 B	16
	--same--	30		15	4 6 9 12	2.87 B	18
	--same, interbedded silt--			16	4 7 11 10	2.79 B	14
	--same--			17	3 6 8 9	2.62 B	17
	--same--	35		18	9 9 11 15	4.36 B	17
755.9	Boring terminated at 36.00 ft	40					

GENERAL NOTES

Begin Drilling: **09-04-2014** Complete Drilling: **09-04-2014**
Drilling Contractor: **Wang Testing Services** Drill Rig: **D-50 TMR**
Driller: **R&J** Logger: **D. Kolapcki** Checked by: **MdIR**
Drilling Method: **3.25 IDA HSA, 140 lb auto, 30" drop, 2" DIA SS;**
Backfilled with soil cuttings and bentonite; PID Bkgrd 0.5 ppm

WATER LEVEL DATA

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

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Wang Engineering
wangeng@wangeng.com
1145 N Main Street
Lombard, IL 60148
Telephone: 630 953-9928
Fax: 630 953-9938

BORING LOG 4NE-TC-16

WEI Job No.: 786-40-01

Client: **CDM Smith, Inc.**
Project: **CLCJAWA System Expansion**
Location: **Lake County, Illinois**

Datum: NAVD88
Elevation: 782.26 ft
North: 2073252.21 ft
East: 1080244.13 ft
Station:
Offset:

Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
781.9	4-inch thick, black CLAY & SILT (Cy$); topsoil, dry (CL-ML)						
	Soft to medium stiff, brown and gray CLAY & SILT (C&$), some fine sand, trace fine gravel; fill (CL)			1	2 1 2 4	3.25 P	19
	--PID = 0.9 ppm (LS)--						
	--same, with seams of sand, moist--			2	2 2 3 3	1.48 B	29
	--PID = 0.7 ppm--						
	--same--						
777.3	--PID = 0.6 ppm--	5		3	3 2 4 5	3.00 P	20
	Very stiff, gray and brown CLAY & SILT (C&$), some fine sand, trace fine gravel; fill (CL)						
	--PID = 0.6 ppm--						
	--same, no sand seam--			4	4 8 10 12	6.15 B	18
	--PID = 0.6 ppm--						
773.8							
	Stiff, gray SILTY CLAY ($yC), trace fine sand, trace fine gravel; (CL)			5	7 12 13 15	2.87 B	16
	--PID = 0.7 ppm--	10					
	--same--						
	--PID = 0.7 ppm--			6	12 11 12 11	2.62 B	15
	--same--						
	--PID = 0.7 ppm--			7	3 5 6 7	2.79 B	16
	--same--	15		8	4 5 6 8	1.64 B	17
	--same--			9	3 4 4 5	1.23 B	17
	--same, medium stiff--			10	2 3 3 3	1.39 B	15
		20					
	--same--			11	6 6 6 7	1.72 B	19
	--same, medium stiff--			12	2 3 4 5	1.97 B	18
	--same--	25		13	3 4 5 7	2.13 B	17
	--same--			14	4 6 6 9	2.05 B	20
	--same, very stiff--			15	7 8 9 12	3.53 B	17
	--same, very stiff--	30		16	10 11 12 13	2.13 B	17
	--same, fine sand seam, wet--			17	2 4 7 9	2.21 B	17
	--same--	35		18	4 6 8 9	2.62 B	19
746.3	Boring terminated at 36.00 ft						
		40					

GENERAL NOTES

Begin Drilling: **09-05-2014** Complete Drilling: **09-05-2014**
Drilling Contractor: **Wang Testing Services** Drill Rig: **D-50 ATV**
Driller: **K&K** Logger: **A. Happel** Checked by: **MdIR**
Drilling Method: **3.25 IDA HSA, 140 lb auto, 30" drop, 2" DIA SS;**
Backfilled with soil cuttings; PID Bkgrd 0.6 ppm

WATER LEVEL DATA

While Drilling: **32.00 ft**
At Completion of Drilling: **36.00 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.

Wang Engineering
wangeng@wangeng.com
1145 N Main Street
Lombard, IL 60148
Telephone: 630 953-9928
Fax: 630 953-9938

BORING LOG 4NE-TC-17

WEI Job No.: 786-40-01

Client: **CDM Smith, Inc.**
Project: **CLCJAWA System Expansion**
Location: **Lake County, Illinois**

Datum: NAVD88
Elevation: 772.51 ft
North: 2071559.14 ft
East: 1080425.77 ft
Station:
Offset:

Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
772.3	3-inch thick, black and brown, CLAY & SILT (C&$); topsoil (CL-ML)			1	7 8 9 9	4.50 P	17
	Very stiff, brown and gray SILTY CLAY ($yC), trace fine sand, trace fine gravel; fill (CL)						
	--PID = 0.5 ppm--			2	9 13 16 17	8.53 S	15
	--same--						
	--PID = 0.8 ppm--						
	--same--			3	5 10 12 16	7.46 B	15
	--PID = 1.2 ppm--	5					
	--same--			4	10 13 16 20	7.30 B	17
	--PID = 2.0 ppm--						
	--same--			5	8 12 15 22	6.97 B	13
	--PID = 2.8 ppm (LS)--						
762.5		10					
762.0	Brown, fine SAND (S), and silt; wet (SP-SM)			6	17 20 21 22	1.31 B	15
	Very stiff to hard, gray CLAY & SILT (C&$), some fine sand, trace fine gravel; (CLS)						
	--same--			7	7 7 11 17	5.33 B	16
	--PID = 1.8 ppm--						
759.0							
758.5	Brown, fine SAND (S), and silt; moist (SP-SM)						
	Stiff, gray SILTY CLAY ($yC), trace fine sand, trace fine gravel; (CL)	15		8	7 6 7 9	2.05 B	16
	--same--			9	2 4 5 7	1.48 B	16
	--same, medium stiff--			10	3 3 4 4	1.23 B	17
		20					
	--same, very stiff--			11	9 11 15 17	5.82 B	13
	--same--			12	2 4 7 10	3.03 B	14
	--same--	25		13	4 4 6 9	1.56 B	16
	--same, very stiff--			14	5 8 11 14	2.62 B	22
	--same--	30		15	3 4 8 11	4.10 B	20
	--same, hard--			16	14 15 16 17	3.36 B	23
740.0	Medium dense, brown and gray, fine to coarse SAND (S), some fine gravel; wet (SW)			17	4 8 12 10	2.00 P	13
738.5	Very stiff, gray SILTY CLAY ($yC), trace fine gravel; (CL)	35		18	7 14 11 20	3.28 B	24
736.5	Boring terminated at 36.00 ft						
		40					

GENERAL NOTES

Begin Drilling: **09-08-2014** Complete Drilling: **09-08-2014**
Drilling Contractor: **Wang Testing Services** Drill Rig: **D-50 ATV**
Driller: **K&K** Logger: **A. Happel** Checked by: **MdIR**
Drilling Method: **2.25 IDA HSA, 140 lb auto, 30" drop, 2" DIA SS;**
Backfilled with soil cuttings; PID Bkgrd 0.5 ppm

WATER LEVEL DATA

While Drilling: **10.00 ft**
At Completion of Drilling: **DRY**
Time After Drilling: **NA**
Depth to Water: **NA**

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Wang Engineering
wangeng@wangeng.com
1145 N Main Street
Lombard, IL 60148
Telephone: 630 953-9928
Fax: 630 953-9938

BORING LOG 4NE-TC-18

WEI Job No.: 786-40-01

Client: **CDM Smith, Inc.**
Project: **CLCJAWA System Expansion**
Location: **Lake County, Illinois**

Datum: NAVD88
Elevation: 752.92 ft
North: 2070613.86 ft
East: 1080372.19 ft
Station:
Offset:

Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
752.4	6-inch thick, black CLAY & SILT (C&$); topsoil (CL-ML)					
	Stiff, gray CLAY & SILT (C&$), some fine sand, trace fine gravel; (CLS)		1	4 6 7 8	4.50 P	12
	--PID = 0.4 ppm--					
	--same--		2	6 8 6 7	0.98 B	17
	--PID = 0.9 ppm--					
	--same, organic matter and roots, moist--					
	--PID = 0.6 ppm--	5	3	4 3 4 5	2.00 P	16
746.9						
	Stiff, brown and gray SILTY CLAY ($yC), trace fine sand, trace fine gravel; (CL)		4	2 3 4 5	1.89 B	16
	--PID = 1.0 ppm (LS)--					
	--same--					
	--PID = 0.6 ppm--		5	5 5 7 11	3.77 B	17
		10				
	--same, very stiff--					
	--PID = 0.5 ppm--		6	8 10 11 10	4.02 B	15
741.9						
	Stiff, gray CLAY & SILT (C&$), some fine sand, trace fine gravel; (CLS)		7	3 5 6 7	2.21 B	15
	--same--					
		15	8	4 5 4 7	1.56 B	14
736.9						
736.4	6-inch thick, gray, fine SAND (S), and silt; moist (SP-SM)					
	Medium stiff to stiff, gray SILTY CLAY ($yC), trace fine sand, trace fine gravel; (CL)		9	4 4 4 7	0.82 B	16
	--same--					
		20	10	4 6 5 4	1.31 B	16
	--same--					
		25	11	5 8 7 9	0.33 B	17
	--same--					
			12	2 3 4 4	0.90 B	18
	--same--					
		25	13	5 6 6 8	1.23 B	19
	--same--					
			14	3 3 4 8	1.64 B	15
	--same--					
			15	6 7 9 11	1.48 B	16
		30				
	--same, very stiff--					
			16	10 10 13 15	2.21 B	17
	--same--					
			17	3 4 8 10	2.87 B	18
	--same--					
		35	18	6 3 6 12	1.64 B	22
716.9						
	Boring terminated at 36.00 ft					
		40				

GENERAL NOTES

Begin Drilling: **09-08-2014** Complete Drilling: **09-08-2014**
Drilling Contractor: **Wang Testing Services** Drill Rig: **D-50 ATV**
Driller: **K&K** Logger: **A. Happel** Checked by: **MdIR**
Drilling Method: **2.25 IDA HSA, 140 lb auto, 30" drop, 2" DIA SS;**
Backfilled with soil cuttings; PID Bkgrd 0.5 ppm

WATER LEVEL DATA

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

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Wang Engineering
wangeng@wangeng.com
1145 N Main Street
Lombard, IL 60148
Telephone: 630 953-9928
Fax: 630 953-9938

BORING LOG 4NE-TC-19

WEI Job No.: 786-40-01

Client: **CDM Smith, Inc.**
Project: **CLCJAWA System Expansion**
Location: **Lake County, Illinois**

Datum: NAVD88
Elevation: 762.79 ft
North: 2069625.10 ft
East: 1080258.33 ft
Station:
Offset:

Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
762.3	6-inch thick, black CLAY & SILT (C&$); topsoil (CL-ML)						
	Stiff, brown to gray CLAY & SILT (C&$), trace fine sand, trace fine gravel; fill (CL)			1	4 4 4 6	2.13 S	17
	--PID = 0.8 ppm--						
	--same--			2	12 7 9 10	1.07 B	19
	--PID = 0.3 ppm--						
	--same--						
	--PID = 0.3 ppm--	5		3	7 5 10 10	3.20 B	15
	--same--						
	--PID = 1.1 ppm--			4	5 6 6 5	2.46 B	15
754.8							
	Very stiff, brown to gray SILTY CLAY ($yC), trace fine sand, trace fine gravel; (CL)			5	3 5 6 9	2.79 B	16
	--PID = 1.5 ppm--	10					
	--same--						
	--PID = 1.7 ppm (LS)--			6	6 8 8 9	2.46 B	15
	--same, stiff--			7	2 3 5 7	2.46 B	16
	--same, stiff--	15		8	2 5 6 11	3.03 B	14
	--same--			9	11 10 18 20	4.92 B	13
	--same--	20		10	8 13 15 19	5.74 B	16
	--same--			11	17 20 21 29	2.25 P	15
	--same--			12	5 8 12 15	4.26 B	16
	--same--	25		13	3 7 11 17	5.41 B	16
	--same--			14	6 10 14 17	2.00 P	17
	--same--	30		15	8 10 11 12	3.69 B	18
	--same--			16	13 16 13 19	4.18 B	17
	--same, stiff--			17	2 4 7 11	3.03 B	18
	--same--	35		18	7 8 9 11	3.12 B	22
726.8	Boring terminated at 36.00 ft	40					

GENERAL NOTES

Begin Drilling: **09-08-2014** Complete Drilling: **09-08-2014**
Drilling Contractor: **Wang Testing Services** Drill Rig: **D-50 ATV**
Driller: **K&K** Logger: **A. Happel** Checked by: **MdIR**
Drilling Method: **2.25 IDA HSA, 140 lb auto, 30" drop, 2" DIA SS;**
Backfilled with soil cuttings; PID Bkgrd 0.5 ppm

WATER LEVEL DATA

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

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Wang Engineering
wangeng@wangeng.com
1145 N Main Street
Lombard, IL 60148
Telephone: 630 953-9928
Fax: 630 953-9938

BORING LOG 4NE-TC-20

WEI Job No.: 786-40-01

Client: **CDM Smith, Inc.**
Project: **CLCJAWA System Expansion**
Location: **Lake County, Illinois**

Datum: NAVD88
Elevation: 742.50 ft
North: 2067465.02 ft
East: 1080245.61 ft
Station:
Offset:

Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
742.2	3-inch thick, dark brown ORGANIC SILT; topsoil, dry (OL)					
	Stiff, brown SILTY CLAY ($yC), trace fine gravel; fill (CL) --PID= 0.7ppm (LS)--		1	1 3 6 8	> 4.50 P	17
			2	3 6 8 11	> 4.50 P	19
739.0	Very stiff, brown to gray CLAY & SILT (C&$), trace fine gravel; (CL)					
	--PID = 0.7 ppm--	5	3	6 8 11 16	4.43 B	13
	--same-- --PID = 0.7 ppm--		4	4 8 12 16	4.76 B	15
	--same-- --PID = 0.7 ppm--	10	5	5 9 15 16	5.00 B	19
	--same-- --PID = 0.7 ppm--		6	6 7 11 14	NA	19
	--same--		7	4 7 10 12	4.76 B	17
	--same--	15	8	4 4 7 11	2.21 B	17
726.5	Medium dense, gray, medium SAND (S); wet (SP)		9	5 7 8 12	NP	19
724.0	Stiff, gray SILTY CLAY ($yC), trace fine gravel; (CL)	20	10	3 4 6 8	1.75 P	19
	--same--		11	3 4 8 10	3.53 P	16
	--same--		12	3 4 6 7	2.21 B	19
	--same--	25	13	5 7 8 8	2.46 B	19
	--same--		14	3 5 7 8	1.00 P	19
	--same, very stiff--	30	15	4 6 13 12	2.13 B	16
712.5	Very stiff, gray SILT ($); saturated (ML)		16	5 9 11 14	NP	16
	--same--		17	5 14 14 8	NP	15
708.5	Very stiff, gray SILTY CLAY ($yC), trace fine gravel; (CL)	35	18	3 6 11 13	2.13 B	19
706.5	Boring terminated at 36.00 ft	40				

GENERAL NOTES

Begin Drilling: **09-04-2014** Complete Drilling: **09-04-2014**
Drilling Contractor: **Wang Testing Services** Drill Rig: **D-50 TMR**
Driller: **R&J** Logger: **D. Kolpacki** Checked by: **MdIR**
Drilling Method: **3.25 IDA HSA, 140 lb auto, 30" drop, 2" DIA SS;**
Backfilled with soil cuttings and bentonite; PID Bkgrd 0.5 ppm

WATER LEVEL DATA

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

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Wang Engineering
wangeng@wangeng.com
1145 N Main Street
Lombard, IL 60148
Telephone: 630 953-9928
Fax: 630 953-9938

BORING LOG 4NW-01

WEI Job No.: 786-40-01

Client: **CDM Smith, Inc.**
Project: **CLCJAWA System Expansion**
Location: **Lake County, Illinois**

Datum: NAVD88
Elevation: 785.00 ft
North: 2089135.61 ft
East: 1039963.99 ft
Station:
Offset:

Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
784.8	2-inch thick, white, fine to coarse CRUSHED STONE (G);						
784.0	shoulder aggregate, fill, dry (GW)			1	4 4 2 4	NP	9
	Medium stiff, black and brown SILT ($), trace fine sand; some medium Gravel, fill, dry (ML) --PID = 13.8 ppm--			2	3 4 4 5	1.25 P	18
781.0	Stiff, brown and gray SILTY CLAY ($yC); trace roots (CL) --PID = 13.9 ppm--						
	Very stiff to hard, brown and gray SILTY CLAY ($yC), trace fine gravel; (CL) --PID = 13.7 ppm--	5		3	6 8 10 12	7.38 S	16
	--same-- --PID = 13.0 ppm--			4	8 14 20 21	7.87 B	18
	--same-- --PID = 13.3 ppm--			5	6 15 21 25	7.59 B	18
	--same-- --PID = 13.4 ppm (LS)--	10		6	8 13 15 25	4.67 S	6
773.0	Boring terminated at 12.00 ft						
		15					
		20					

GENERAL NOTES

Begin Drilling: **08-25-2014** Complete Drilling: **08-25-2014**
Drilling Contractor: **Wang Testing Services** Drill Rig: **D-50 TMR**
Driller: **R&J** Logger: **A. Tomaras** Checked by: **BW**
Drilling Method: **3.25 IDA HSA, 140 lb auto, 30" drop, 2" DIA SS;**
Backfilled with soil cuttings and bentonite; PID Bkgrd 0.0 ppm

WATER LEVEL DATA

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

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Wang Engineering
wangeng@wangeng.com
1145 N Main Street
Lombard, IL 60148
Telephone: 630 953-9928
Fax: 630 953-9938

BORING LOG 4NW-02

WEI Job No.: 786-40-01

Client: **CDM Smith, Inc.**
Project: **CLCJAWA System Expansion**
Location: **Lake County, Illinois**

Datum: NAVD88
Elevation: 756.15 ft
North: 2088778.42 ft
East: 1039487.86 ft
Station:
Offset:

Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
755.7	5-inch thick, black SILT ($), with fine sand; organic matter, topsoil (ML)		1	1 2 3 3	NP	19
754.4	Loose, brown SILT ($), some fine sand; dry (MLS) --PID = 12.0 ppm--					
	Loose to medium dense, brown, fine SAND (S); dry (SP) --PID = 12.1 ppm--		2	2 3 4 2	NP	19
	--same-- --PID = 12.5 ppm--	5	3	4 6 5 4	NP	11
	--same, moist-- --PID = 13.2 ppm--		4	4 5 5 5	NP	22
	--same, with silt, saturated-- --PID = 12.0 ppm--	10	5	5 5 5 8	NP	27
	--same, saturated-- --PID = 19.6 ppm (LS)--		6	3 6 7 5	NP	25
744.2	Boring terminated at 12.00 ft	15				
		20				

GENERAL NOTES

Begin Drilling: **08-25-2014** Complete Drilling: **08-25-2014**
Drilling Contractor: **Wang Testing Services** Drill Rig: **D-50 TMR**
Driller: **R&J** Logger: **A. Tomaras** Checked by: **BW**
Drilling Method: **3.25 IDA HSA, 140 lb auto, 30" drop, 2" DIA SS;**
Backfilled with soil cuttings and bentonite; PID Bkgrd 10.2 ppm

WATER LEVEL DATA

While Drilling: **7.75 ft**
At Completion of Drilling: **10.00 ft**
Time After Drilling: **NA**
Depth to Water: **NA**

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Wang Engineering
wangeng@wangeng.com
1145 N Main Street
Lombard, IL 60148
Telephone: 630 953-9928
Fax: 630 953-9938

BORING LOG 4NW-03

WEI Job No.: 786-40-01

Client: **CDM Smith, Inc.**
Project: **CLCJAWA System Expansion**
Location: **Lake County, Illinois**

Datum: NAVD88
Elevation: 774.19 ft
North: 2088786.80 ft
East: 1040489.53 ft
Station:
Offset:

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
	773.9	4-inch thick, black SILT ($), with fine sand; organic matter, topsoil (ML)			1	2 4 4 5	3.50 P	16
		Medium stiff, brown and gray SILTY CLAY ($yC), trace fine gravel; trace roots, fill (CL) --PID = 22.7 ppm-- --same, no roots-- --PID = 16.1 ppm--			2	3 3 4 4	2.25 P	20
		--same-- --PID = 13.9 ppm--	5		3	2 5 5 5	2.50 P	20
	768.7	Very stiff, brown and gray SILTY CLAY ($yC), trace fine gravel; (CL) --PID = 13.6 ppm--			4	4 6 11 13	6.40 S	15
		--same, interbedded fine sand-- --PID = 14.2 ppm--			5	6 10 16 15	8.12 B	16
		--same-- --PID = 14.8 ppm--	10		6	6 13 14 19	3.69 S	17
	762.2	Boring terminated at 12.00 ft						
			15					
			20					

GENERAL NOTES

Begin Drilling: **08-25-2014** Complete Drilling: **08-25-2014**
Drilling Contractor: **Wang Testing Services** Drill Rig: **D-50 TMR**
Driller: **R&J** Logger: **A. Tomaras** Checked by: **BW**
Drilling Method: **3.25 IDA HSA, 140 lb auto, 30" drop, 2" DIA SS;**
Backfilled with soil cuttings and bentonite; PID Bkgrd 9.8 ppm

WATER LEVEL DATA

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

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Wang Engineering
wangeng@wangeng.com
1145 N Main Street
Lombard, IL 60148
Telephone: 630 953-9928
Fax: 630 953-9938

BORING LOG 4NW-04

WEI Job No.: 786-40-01

Client: **CDM Smith, Inc.**
Project: **CLCJAWA System Expansion**
Location: **Lake County, Illinois**

Datum: NAVD88
Elevation: 812.73 ft
North: 2088771.36 ft
East: 1042482.18 ft
Station:
Offset:

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
	812.5	3-inch thick, brown and gray CRUSHED STONE (G); shoulder aggergate, dry			1	4 4 3 4	3.00 P	16
	810.7	Medium stiff, gray and black SILTY CLAY ($yC), and medium sand, trace fine to medium gravel; fill, (CLS) --PID = 1.0 ppm--			2	4 4 6 7	2.21 B	21
		Stiff to very stiff, brown and gray SILTY CLAY ($yC), trace fine sand, trace gravel; (CL) --PID = 0.8 ppm--	5		3	2 5 7 8	4.92 B	16
		--same-- --PID = 1.3 ppm-- --same-- --PID = 0.6 ppm--			4	7 10 13 17	3.00 P	17
		--same-- --PID = 0.1 ppm--	10		5	9 12 10 14	NR	16
		--same-- --PID = 1.5 ppm--			6	13 11 10 10	2.00 P	17
	800.7	Boring terminated at 12.00 ft	15					
			20					

GENERAL NOTES

Begin Drilling: **09-09-2014** Complete Drilling: **09-09-2014**
Drilling Contractor: **Wang Testing Services** Drill Rig: **D-50 ATV**
Driller: **K&K** Logger: **A. Happel** Checked by: **MdIR**
Drilling Method: **3.25 IDA HSA, 140 lb auto, 30" drop, 2" DIA SS;**
Backfilled with soil cuttings; PID Bkgrd 0.1 ppm

WATER LEVEL DATA

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

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Wang Engineering
wangeng@wangeng.com
1145 N Main Street
Lombard, IL 60148
Telephone: 630 953-9928
Fax: 630 953-9938

BORING LOG 4NW-05

WEI Job No.: 786-40-01

Client: **CDM Smith, Inc.**
Project: **CLCJAWA System Expansion**
Location: **Lake County, Illinois**

Datum: NAVD88
Elevation: 815.58 ft
North: 2088779.71 ft
East: 1043459.04 ft
Station:
Offset:

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
	815.1	6-inch thick, brown, fine to medium SAND (S), some medium gravel; dry (SW)			1	3 3 3 3	4.50 P	16
		Stiff to hard, brown and gray, SILTY CLAY ($yC), trace fine sand, trace fine gravel; (CL) --PID = 0.1 ppm-- --same, 3 inch sand seam-- --PID = 0.3 ppm (LS)--			2	4 3 7 7	3.25 P	22
		--same-- --PID = 0.0 ppm--	5		3	5 9 11 16	7.13 B	16
		--same-- --PID = 0.0 ppm--			4	14 13 17 21	7.05 B	16
		--same-- --PID = 0.0 ppm--	10		5	15 14 19 25	6.56 B	17
		--same-- --PID = 0.2 ppm--			6	15 21 22 17	5.74 B	15
	803.6	Boring terminated at 12.00 ft	15					
			20					

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)

GENERAL NOTES

Begin Drilling: **09-11-2014** Complete Drilling: **09-11-2014**
Drilling Contractor: **Wang Testing Services** Drill Rig: **D-50 ATV**
Driller: **K&K** Logger: **A. Happel** Checked by: **MdIR**
Drilling Method: **2.25 IDA HSA, 140 lb auto, 30" drop, 2" DIA SS;**
Backfilled with soil cuttings and bentonite; PID Bkgrd 0.0 ppm

WATER LEVEL DATA

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

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Wang Engineering
wangeng@wangeng.com
1145 N Main Street
Lombard, IL 60148
Telephone: 630 953-9928
Fax: 630 953-9938

BORING LOG 4NW-06

WEI Job No.: 786-40-01

Client: **CDM Smith, Inc.**
Project: **CLCJAWA System Expansion**
Location: **Lake County, Illinois**

Datum: NAVD88
Elevation: 779.83 ft
North: 2088507.16 ft
East: 1045812.88 ft
Station:
Offset:

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
	779.6	3-inch thick, black CLAY & SILT (C&$); topsoil (CL-ML)						
		Medium stiff to stiff, black, brown and gray SILTY CLAY ($yC), trace fine sand, trace fine gravel; (CL)			1	2 2 4 5	3.25 P	27
		--PID = 0.6 ppm (LS)--			2	4 4 6 10	3.03 B	22
		--same-- --PID = 0.0 ppm--						
		--same-- --PID = 0.0 ppm--	5		3	5 5 9 10	8.28 B	16
	773.8							
		Very stiff to hard, brown and gray SILTY CLAY ($yC), trace fine sand, trace fine gravel; (CL) --PID = 0.0 ppm--			4	9 10 13 20	4.50 P	16
		--same-- --PID = 0.0 ppm--			5	13 13 17 21	2.21 B	15
			10					
		--same-- --PID = 0.0 ppm--			6	13 17 20 18	5.25 B	18
	767.8							
		Boring terminated at 12.00 ft						
			15					
			20					

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)

GENERAL NOTES

Begin Drilling: **09-11-2014** Complete Drilling: **09-11-2014**
Drilling Contractor: **Wang Testing Services** Drill Rig: **D-50 ATV**
Driller: **K&K** Logger: **A. Happel** Checked by: **MdIR**
Drilling Method: **2.25 IDA HSA, 140 lb auto, 30" drop, 2" DIA SS;**
Backfilled with soil cuttings and bentonite; PID Bkgrd 0.0 ppm

WATER LEVEL DATA

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

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Wang Engineering
wangeng@wangeng.com
1145 N Main Street
Lombard, IL 60148
Telephone: 630 953-9928
Fax: 630 953-9938

BORING LOG 4NW-07

WEI Job No.: 786-40-01

Client: **CDM Smith, Inc.**
Project: **CLCJAWA System Expansion**
Location: **Lake County, Illinois**

Datum: NAVD88
Elevation: 785.84 ft
North: 2087779.20 ft
East: 1047522.62 ft
Station:
Offset:

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
	785.6	3-inch thick, dark brown SILT ($); organic material, topsoil (ML)						
		Stiff, brown SILTY CLAY ($yC), trace fine gravel; fill (CL)			1	3 4 4 5	> 4.50 P	18
		--PID = 16.5 ppm (LS)--						
		--same--			2	4 4 5 8	3.75 P	17
		--PID = 16.5 ppm (LS)--						
	781.8							
		Very stiff, brown SILTY CLAY ($yC), trace fine gravel; (CL)						
		--PID = 15.2 ppm--	5		3	4 9 12 14	5.00 B	14
		--same--						
		--PID = 13.9 ppm--			4	8 10 13 15	5.41 B	15
		--same--						
		--PID = 14.7 ppm--			5	5 9 11 15	5.66 B	16
			10					
		--same--						
		--PID = 12.6 ppm--			6	5 7 11 11	5.33 B	17
	773.8							
		Boring terminated at 12.00 ft						
			15					
			20					

GENERAL NOTES

Begin Drilling: **09-02-2014** Complete Drilling: **09-02-2014**
Drilling Contractor: **Wang Testing Services** Drill Rig: **D-50 TMR**
Driller: **R&J** Logger: **D. Kolpacki** Checked by: **MdIR**
Drilling Method: **3.25 IDA HSA, 140 lb auto, 30" drop, 2" DIA SS;**
Backfilled with soil cuttings and bentonite; PID Bkgrd 0.5 ppm

WATER LEVEL DATA

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

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

Wang Engineering
wangeng@wangeng.com
1145 N Main Street
Lombard, IL 60148
Telephone: 630 953-9928
Fax: 630 953-9938

BORING LOG 4NW-08

WEI Job No.: 786-40-01

Client: **CDM Smith, Inc.**
Project: **CLCJAWA System Expansion**
Location: **Lake County, Illinois**

Datum: NAVD88
Elevation: 785.59 ft
North: 2087747.49 ft
East: 1048735.78 ft
Station:
Offset:

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
	785.3	3-inch thick, black CLAY & SILT (C&$); topsoil (CL-ML)						
		Medium stiff, brown and gray SILTY CLAY ($yC), some fine sand, trace fine gravel; (CL)			1	3 3 4 6	3.00 P	14
		--PID = 1.1 ppm (LS)--						
		--same--			2	3 3 3 4	2.71 B	19
		--PID = 0.2 ppm--						
		--same, stiff--						
		--PID = 0.2 ppm--	5		3	3 4 7 9	4.43 B	21
	779.6							
		Very stiff to hard, gray SILTY CLAY ($yC), trace fine gravel; (CL)			4	6 7 10 12	7.46 B	18
		--PID = 0.4 ppm--						
		--same--						
		--PID = 0.4 ppm--			5	4 9 10 13	5.25 B	21
			10					
		--same--						
		--PID = 0.2 ppm--			6	12 14 18 18	4.59 B	23
	773.6							
		Boring terminated at 12.00 ft						
			15					
			20					

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)

GENERAL NOTES

Begin Drilling: **09-11-2014** Complete Drilling: **09-11-2014**
Drilling Contractor: **Wang Testing Services** Drill Rig: **D-50 ATV**
Driller: **K&K** Logger: **A. Happel** Checked by: **MdIR**
Drilling Method: **2.25 IDA HSA, 140 lb auto, 30" drop, 2" DIA SS;**
Backfilled with soil cuttings and bentonite; PID Bkgrd 0.0 ppm

WATER LEVEL DATA

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

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Wang Engineering
wangeng@wangeng.com
1145 N Main Street
Lombard, IL 60148
Telephone: 630 953-9928
Fax: 630 953-9938

BORING LOG 4NW-09

WEI Job No.: 786-40-01

Client: **CDM Smith, Inc.**
Project: **CLCJAWA System Expansion**
Location: **Lake County, Illinois**

Datum: NAVD88
Elevation: 785.97 ft
North: 2088763.51 ft
East: 1049387.11 ft
Station:
Offset:

Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
785.5	6-inch thick, brown and white, coarse to fine GRAVEL (G), some coarse sand; fill; dry			1	3 1 3 3	NP	8
	Soft to medium stiff, gray and brown SILTY CLAY ($yC), and fine sand, trace fine gravel; fill (CLS)			2	5 4 3 3	0.74 B	13
	--PID = 0.6 ppm--						
	--same--						
	--PID = 0.5 ppm--						
	--same--						
781.0	--PID = 3.7 ppm (LS)--	5		3	2 2 3 3	0.25 B	29
780.0	Medium stiff, black SILTY CLAY ($yC); organic (OL)						
	Soft, gray and brown SILTY CLAY ($yC), and fine sand, trace fine gravel; trace organic matter (CLS)			4	1 1 1 3	0.25 B	20
	--PID = 1.4 ppm--						
777.5	Loose, gray and white, medium SAND (S) and silt, trace fine to coarse gravel; wet, fill (SP-SM)			5	3 4 4 6	NP	18
	--PID = 0.0 ppm--	10					
				6	1 2 5 4	NP	18
	--same, fine sand seam--			7	2 4 7 7	NP	14
	--same--						
		15		8	7 7 6 9	NP	14
770.5							
770.0	Stiff, gray and brown SILTY CLAY ($yC), trace fine sand and gravel; fill (CL)						
	Boring terminated at 12.00 ft						
		20					

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)

GENERAL NOTES

Begin Drilling: **09-15-2014** Complete Drilling: **09-15-2014**
Drilling Contractor: **Wang Testing Services** Drill Rig: **D-50 ATV**
Driller: **K&K** Logger: **A. Happel** Checked by: **MdIR**
Drilling Method: **2.25 IDA HSA, 140 lb auto, 30" drop, 2" DIA SS;**
Backfilled with soil cuttings and bentonite; PID Bkgrd 0.5 ppm

WATER LEVEL DATA

While Drilling: **10.00 ft**
At Completion of Drilling: **8.00 ft**
Time After Drilling: **NA**
Depth to Water: **NA**

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Wang Engineering
wangeng@wangeng.com
1145 N Main Street
Lombard, IL 60148
Telephone: 630 953-9928
Fax: 630 953-9938

BORING LOG 4NW-10

WEI Job No.: 786-40-01

Client: **CDM Smith, Inc.**
Project: **CLCJAWA System Expansion**
Location: **Lake County, Illinois**

Datum: NAVD88
Elevation: 785.26 ft
North: 2089728.04 ft
East: 1049381.05 ft
Station:
Offset:

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
	785.1	2-inch thick, black CLAY & SILT (C&$); topsoil (CL-ML)						
		Medium stiff, gray and brown SILTY CLAY ($yC), some fine sand, trace fine gravel; fill (CLS)			1	3 2 2 4	2.75 P	21
	783.3							
	782.8	--PID = 0.5ppm--						
		6-inch thick, brown and gray, medium SAND (S), and silt; moist, fill (SW-SM)			2	5 4 5 6	2.30 B	15
		--PID = 0.7ppm--						
		Medium stiff, gray and brown SILTY CLAY ($yC), trace fine sand, trace fine gravel; (CL)	5		3	4 4 2 4	0.82 B	35
		--same, trace organic matter--						
		--PID = 0.9 ppm--						
		--same--			4	2 3 2 5	0.90 B	30
		--PID = 1.4 ppm--						
		--same, stiff--						
		--PID = 2.9 ppm--			5	4 5 6 7	2.21 B	20
			10					
		--3-inch coarse sand, wet--						
		--PID = 3.1 ppm (LS)--			6	3 3 5 7	3.03 B	19
	773.3							
		Boring terminated at 12.00 ft						
			15					
			20					

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)

GENERAL NOTES

Begin Drilling: **09-12-2014** Complete Drilling: **09-12-2014**
Drilling Contractor: **Wang Testing Services** Drill Rig: **D-50 ATV**
Driller: **K&K** Logger: **A. Happel** Checked by: **MdIR**
Drilling Method: **2.25 IDA HSA, 140 lb auto, 30" drop, 2" DIA SS;**
Backfilled with soil cuttings; PID Bkgrd 0.2 ppm

WATER LEVEL DATA

While Drilling: **10.00 ft**
At Completion of Drilling: **DRY**
Time After Drilling: **NA**
Depth to Water: **NA**

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Wang Engineering
wangeng@wangeng.com
1145 N Main Street
Lombard, IL 60148
Telephone: 630 953-9928
Fax: 630 953-9938

BORING LOG 4NW-11

WEI Job No.: 786-40-01

Client: **CDM Smith, Inc.**
Project: **CLCJAWA System Expansion**
Location: **Lake County, Illinois**

Datum: NAVD88
Elevation: 789.98 ft
North: 2090791.47 ft
East: 1049371.42 ft
Station:
Offset:

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
		Medium dense, brown and white, coarse SAND (S), and fine to medium gravel; moist, fill (SP) --PID = 0.8 ppm--			1	5 5 6 5	NP	5
		--same-- --PID = 0.7 ppm--			2	5 4 4 1	NP	21
	786.5	Soft to medium stiff, gray, black, and brown SILTY CLAY ($yC), trace fine sand, trace fine gravel; trace organic matter (CL) --PID = 3.6 ppm-- --Same-- --PID = 2.6 ppm--	5		3	2 1 3 2	0.25 B	25
	783.2	Very loose to loose, black and brown PEAT; fibrous, dry (PT)			4	3 2 2 5	0.57 B	27
		--same-- --PID = 5.4 ppm (LS)--	10		5	2 3 3 3	NP	199
		--same-- --PID = 1.2 ppm--			6	2 1 2 2	NP	470
		--same--			7	1 1 1 1	NP	507
		--same--	15		8	1 2 1 1	NP	343
		--same, some fine sand and silt--			9	1 2 2 4	0.33 B	53
	772.0	Medium stiff, gray and green SILTY CLAY ($yC), trace fine sand, trace fine gravel; (CL)	20		10	2 2 3 3	0.74 B	25
	768.0	Boring terminated at 22.00 ft	25		11	2 3 3 4	1.15 B	28
			30					
			35					
			40					

GENERAL NOTES

Begin Drilling: **09-12-2014** Complete Drilling: **09-12-2014**
Drilling Contractor: **Wang Testing Services** Drill Rig: **D-50 ATV**
Driller: **K&K** Logger: **A. Happel** Checked by: **MdIR**
Drilling Method: **2.25 IDA HSA, 140 lb auto, 30" drop, 2" DIA SS;**
Backfilled with soil cuttings; PID Bkgrd 0.1 ppm

WATER LEVEL DATA

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

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Wang Engineering
wangeng@wangeng.com
1145 N Main Street
Lombard, IL 60148
Telephone: 630 953-9928
Fax: 630 953-9938

BORING LOG 4NW-12

WEI Job No.: 786-40-01

Client: **CDM Smith, Inc.**
Project: **CLCJAWA System Expansion**
Location: **Lake County, Illinois**

Datum: NAVD88
Elevation: 796.70 ft
North: 2091788.14 ft
East: 1049373.48 ft
Station:
Offset:

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
	796.5	Loose, brown, fine GRAVEL (G),and fine sand; shoulder aggregate (GP)			1	5 4 3 4	2.00 P	23
		Medium stiff to stiff, brown CLAY & SILT (C&$), trace fine gravel; (CL-ML)						
		--PID = 3.5 ppm (LS)--			2	4 2 3 4	2.75 P	20
		--same--						
		--PID = 2.2 ppm--						
		--same--						
		--PID = 1.8 ppm--	5		3	3 4 5 8	3.02 B	21
	790.7							
		Very stiff, brown and gray SILTY CLAY ($yC), trace fine gravel; (CL)			4	4 9 13 14	3.20 B	11
		--PID = 2.2 ppm--						
		--same--						
		--PID = 2.1 ppm--			5	4 8 12 17	4.51 B	15
			10					
		--same--						
		--PID = 1.5 ppm--			6	5 10 15 20	6.89 B	17
	784.7							
		Boring terminated at 12.00 ft						
			15					
			20					

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)

GENERAL NOTES

Begin Drilling: **09-03-2014** Complete Drilling: **09-03-2014**
Drilling Contractor: **Wang Testing Services** Drill Rig: **D-50 TMR**
Driller: **R&J** Logger: **D. Kolpacki** Checked by: **MdIR**
Drilling Method: **3.25 IDA HSA, 140 lb auto, 30" drop, 2" DIA SS;**
Backfilled with soil cuttings and bentonite; PID Bkgrd 0.5 ppm

WATER LEVEL DATA

While Drilling: **DRY**
At Completion of Drilling: **DY**
Time After Drilling: **NA**
Depth to Water: **NA**

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Wang Engineering
wangeng@wangeng.com
1145 N Main Street
Lombard, IL 60148
Telephone: 630 953-9928
Fax: 630 953-9938

BORING LOG 4NW-13

WEI Job No.: 786-40-01

Client: **CDM Smith, Inc.**
Project: **CLCJAWA System Expansion**
Location: **Lake County, Illinois**

Datum: NGVD
Elevation: 794.57 ft
North: 2092385.50 ft
East: 1050171.21 ft
Station:
Offset:

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
	793.9	8-inch thick, brown CLAY & SILT(C&$); Topsoil. (CL-ML)						
	793.7	3-inch thick, brown, fine SAND(S); (SP)			1	PUSH	NP	16
	792.6	9-inch thick, brown SAND(S), with silt; (SM)						
		Stiff, brown CLAY & SILT (C&$); (CL-ML)			2	PUSH	1.00 P	25
	790.6	--PID= 0.3ppm--						
		Very soft, brown CLAY & SILT(C&$); trace fine gravel and sand; (CLS)	5		3	PUSH	< 0.25 P	28
	788.6							
		Stiff to very stiff, brown to gray SILTY CLAY($yC), trace fine gravel; (CL-ML)			4	PUSH	2.00 P	22
		--same--			5	PUSH	1.75 P	19
			10					
		--same--			6	PUSH	3.25 P	17
	782.6							
		Boring terminated at 12.00 ft						
			15					
			20					

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)

GENERAL NOTES

Begin Drilling: **11-26-2014** Complete Drilling: **11-26-2014**
Drilling Contractor: **Wang Testing Services** Drill Rig: **Hand Auger**
Driller: **F&S** Logger: **A. Mohammed** Checked by: **MdIR**
Drilling Method: **Pneumatic-drive Geoprobe sampler due to access restriction;Backfilled with soil cuttings and bentonite; PID**

WATER LEVEL DATA

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

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Wang Engineering
wangeng@wangeng.com
1145 N Main Street
Lombard, IL 60148
Telephone: 630 953-9928
Fax: 630 953-9938

BORING LOG 4NW-14

WEI Job No.: 786-40-01

Client: **CDM Smith, Inc.**
Project: **CLCJAWA System Expansion**
Location: **Lake County, Illinois**

Datum: NAVD88
Elevation: 795.94 ft
North: 2087744.30 ft
East: 1050652.61 ft
Station:
Offset:

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
	795.7	Loose, white, CRUSHED STONE (G); shoulder aggregate (GP)			1	5 7 7 9	3.75 P	16
	793.9	Stiff, brown SILTY CLAY ($yC), trace fine gravel; fill (CL)						
		--PID = 2.0 ppm (LS)--			2	4 5 5 6	> 4.50 P	17
		Stiff to very stiff, brown SILTY CLAY ($yC), trace fine gravel; root debris (CL)						
		--PID = 0.9 ppm--						
		--same, no roots--						
		--PID = 0.8 ppm--	5		3	5 6 8 11	3.61 B	16
		--same, no roots--						
		--PID = 0.6 ppm--			4	6 8 12 15	5.74 B	17
		--same, no roots--						
		--PID = 0.7 ppm--			5	6 14 13 14	3.61 B	16
			10					
		--same, no roots--						
		--PID = 1.1 ppm--			6	7 12 16 18	3.28 B	
	783.9	Boring terminated at 12.00 ft						
			15					
			20					

GENERAL NOTES

Begin Drilling: **09-03-2014** Complete Drilling: **09-03-2014**
Drilling Contractor: **Wang Testing Services** Drill Rig: **D-50 TMR**
Driller: **R&J** Logger: **D. Kolpacki** Checked by: **MdIR**
Drilling Method: **3.25 IDA HSA, 140 lb auto, 30" drop, 2" DIA SS;**
Backfilled with soil cuttings and bentonite; PID Bkgrd 0.4 ppm

WATER LEVEL DATA

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

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Wang Engineering
wangeng@wangeng.com
1145 N Main Street
Lombard, IL 60148
Telephone: 630 953-9928
Fax: 630 953-9938

BORING LOG 4NW-15

WEI Job No.: 786-40-01

Client: **CDM Smith, Inc.**
Project: **CLCJAWA System Expansion**
Location: **Lake County, Illinois**

Datum: NAVD88
Elevation: 809.93 ft
North: 2087772.45 ft
East: 1051829.03 ft
Station:
Offset:

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
	809.7	3-inch thick, dark brown SILT ($); organic matter, topsoil (OL)						
		Medium stiff, brown SILTY CLAY ($yC), trace fine gravel; fill (CL) --PID = 2.7 ppm (LS)--			1	2 2 4 4	1.50 P	20
		--same-- --PID= 1.3 ppm--			2	3 4 4 6	1.56 B	26
	805.7							
		Medium dense, brown, fine SAND (S), and clay; moist (SP-SC) --PID = 1.2 ppm--	5		3	3 7 7 8	NP	13
	803.2							
		Very stiff, brown SILTY CLAY ($yC), trace fine gravel; (CL) --PID = 1.2 ppm--			4	5 10 11 12	> 4.50 P	14
		--same --PID = 0.9 ppm--			5	5 12 13 19	2.95 S	15
		--same-- --PID = 1.2 ppm--	10		6	5 10 17 20	5.90 B	16
	797.9							
		Boring terminated at 12.00 ft						
			15					
			20					

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)

GENERAL NOTES

Begin Drilling: **09-03-2014** Complete Drilling: **09-03-2014**
Drilling Contractor: **Wang Testing Services** Drill Rig: **D-50 TMR**
Driller: **R&J** Logger: **D. Kolpacki** Checked by: **MdIR**
Drilling Method: **3.25 IDA HSA, 140 lb auto, 30" drop, 2" DIA SS;**
Backfilled with soil cuttings and bentonite; PID Bkgrd 0.3 ppm

WATER LEVEL DATA

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

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Wang Engineering
wangeng@wangeng.com
1145 N Main Street
Lombard, IL 60148
Telephone: 630 953-9928
Fax: 630 953-9938

BORING LOG 4NW-16

WEI Job No.: 786-40-01

Client: **CDM Smith, Inc.**
Project: **CLCJAWA System Expansion**
Location: **Lake County, Illinois**

Datum: NAVD88
Elevation: 816.16 ft
North: 2087767.76 ft
East: 1052954.87 ft
Station:
Offset:

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
	815.9	3-inch thick, white CRUSHED STONE (G); shoulder aggregate (GP)			1	7 6 7 8	> 4.50 P	16
		Very stiff, brown SILTY CLAY ($yC), trace fine gravel; (CL)						
		--PID = 4.4 ppm--			2	7 8 12 14	> 4.50 P	13
		--same--						
		--PID = 3.0 ppm--						
		--same--			3	5 8 14 18	7.38 B	14
		--PID = 4.6 ppm--	5					
		--same--			4	7 9 14 17	6.56 B	13
		--PID = 3.8 ppm--						
		--same--			5	5 9 14 19	5.25 B	14
		--PID = 3.1 ppm--	10					
		--same--			6	5 12 15 16	4.76 B	15
		--PID = 17.1 ppm (LS)--						
	804.2	Boring terminated at 12.00 ft						
			15					
			20					

GENERAL NOTES

Begin Drilling: **09-03-2014** Complete Drilling: **09-03-2014**
Drilling Contractor: **Wang Testing Services** Drill Rig: **D-50 TMR**
Driller: **R&J** Logger: **D. Kolpacki** Checked by: **MdIR**
Drilling Method: **3.25 IDA HSA, 140 lb auto, 30" drop, 2" DIA SS;**
Backfilled with soil cuttings and bentonite; PID Bkgrd 9.8 ppm

WATER LEVEL DATA

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

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Wang Engineering
wangeng@wangeng.com
1145 N Main Street
Lombard, IL 60148
Telephone: 630 953-9928
Fax: 630 953-9938

BORING LOG 4NW-17

WEI Job No.: 786-40-01

Client: **CDM Smith, Inc.**
Project: **CLCJAWA System Expansion**
Location: **Lake County, Illinois**

Datum: NAVD88
Elevation: 797.83 ft
North: 2087521.31 ft
East: 1053939.86 ft
Station:
Offset:

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
	797.3	6-inch thick brown, coarse GRAVEL (G), and coarse sand; dry (GP)			1	5 4 4 5	4.35 S	9
		Stiff, gray CLAY & SILT (C&$), trace fine sand, trace fine to medium gravel; fill, dry (CL-ML)						
	795.3	--PID = 1.2 ppm (LS)--			2	5 4 5 6	NP	16
		Medium dense, brown, fine SAND (S), and silt, trace fine gravel; moist (SP-SM)						
		--PID = 0.6 ppm--						
		--same--	5		3	5 6 6 7	NP	17
		--PID = 0.6 ppm--						
	791.8	Very stiff, gray SILTY CLAY ($yC), trace fine gravel; (CL)						
		--PID = 0.5 ppm--			4	7 7 9 13	3.03 B	19
		--same--						
		--PID = 0.6 ppm--			5	7 10 12 14	4.51 B	19
			10					
		--same--						
		--PID = 0.9 ppm--			6	13 13 13 13	5.00 B	19
	785.8	Boring terminated at 12.00 ft						
			15					
			20					

GENERAL NOTES

Begin Drilling: **09-15-2014** Complete Drilling: **09-15-2014**
Drilling Contractor: **Wang Testing Services** Drill Rig: **D-50 ATV**
Driller: **K&K** Logger: **A. Happel** Checked by: **MdIR**
Drilling Method: **2.25 IDA HSA, 140 lb auto, 30" drop, 2" DIA SS;**
Backfilled with soil cuttings and bentonite; PID Bkgrd 0.1 ppm

WATER LEVEL DATA

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

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Wang Engineering
wangeng@wangeng.com
1145 N Main Street
Lombard, IL 60148
Telephone: 630 953-9928
Fax: 630 953-9938

BORING LOG 4NW-18

WEI Job No.: 786-40-01

Client: **CDM Smith, Inc.**
Project: **CLCJAWA System Expansion**
Location: **Lake County, Illinois**

Datum: NAVD88
Elevation: 803.50 ft
North: 2087087.30 ft
East: 1054911.35 ft
Station:
Offset:

Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
803.3	3-inch thick white, coarse GRAVEL (G), and coarse sand; dry (GP)			1	4 3 4 4	2.75 P	12
802.8	Gray and brown SILTY CLAY ($yC), trace coarse gravel; (CL)						
801.2	Medium stiff, gray and black SILTY CLAY ($yC), some fine sand, trace fine gravel; (CLS) --PID = 0.7 ppm--			2	3 2 4 3	NP	19
	Loose, brown, fine SAND (S), and silt, trace fine gravel; moist (SP-SM)	5		3	4 3 1 0	NP	17
798.3	--PID = 1.4 ppm (LS)-- --same-- --PID = 1.9 ppm--						
	Medium stiff to very stiff, gray SILTY CLAY ($yC), trace fine sand, trace fine gravel; (CL)			4	0 2 2 4	1.39 B	22
	--same-- --PID = 0.8 ppm--			5	4 5 6 6	2.13 B	21
	--same-- --PID = 1.0 ppm--	10					
	--same-- --PID = 1.1 ppm--			6	8 10 10 5	NP	12
791.5	Boring terminated at 12.00 ft	15					
		20					

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)

GENERAL NOTES

Begin Drilling: **09-15-2014** Complete Drilling: **09-15-2014**
Drilling Contractor: **Wang Testing Services** Drill Rig: **D-50 ATV**
Driller: **K&K** Logger: **A. Happel** Checked by: **MdIR**
Drilling Method: **2.25 IDA HSA, 140 lb auto, 30" drop, 2" DIA SS;**
Backfilled with soil cuttings and bentonite; PID Bkgrd 0.1 ppm

WATER LEVEL DATA

While Drilling: **5.50 ft**
At Completion of Drilling: **6.00 ft**
Time After Drilling: **NA**
Depth to Water: **NA**

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Wang Engineering
wangeng@wangeng.com
1145 N Main Street
Lombard, IL 60148
Telephone: 630 953-9928
Fax: 630 953-9938

BORING LOG 4NW-19

WEI Job No.: 786-40-01

Client: **CDM Smith, Inc.**
Project: **CLCJAWA System Expansion**
Location: **Lake County, Illinois**

Datum: NGVD
Elevation: 810.85 ft
North: 2086038.79 ft
East: 1056877.53 ft
Station:
Offset:

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
	810.5	4-inch thick, white CRUSHED STONE; shoulder aggregate, dry (GW)			1	8 4 3 3	NP	14
	809.4	Loose, black, fine SAND (S), and silt; moist (SP-SM) --PID = 0.7ppm--			2	3 3 4 3	2.05 B	31
		Medium stiff, brown and gray SILTY CLAY ($yC), trace fine sand, trace fine to medium gravel; fill (CL) --PID = 0.8ppm-- --same-- --PID = 0.9ppm--	5		3	2 2 3 4	2.46 B	17
		--same-- --PID = 0.8ppm--			4	3 3 5 7	3.03 B	18
	802.9	Stiff, brown and gray SILTY CLAY ($yC), trace fine sand, trace fine to medium gravel; (CL) --PID = 0.5ppm--	10		5	2 4 4 6	3.28 B	17
		--same-- --PID = 0.4ppm--			6	4 5 5 8	3.85 B	16
	798.9	Boring terminated at 12.00 ft	15					
			20					

GENERAL NOTES

Begin Drilling: **10-08-2014** Complete Drilling: **10-08-2014**
Drilling Contractor: **Wang Testing Services** Drill Rig: **B-57 TMR**
Driller: **R&J** Logger: **A. Happel** Checked by: **MdIR**
Drilling Method: **2.25 IDA HSA, 140 lb auto, 30" drop, 2" DIA SS;**
Backfilled with soil cuttings and bentonite; PID Bkgrd 0.1 ppm

WATER LEVEL DATA

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

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Wang Engineering
wangeng@wangeng.com
1145 N Main Street
Lombard, IL 60148
Telephone: 630 953-9928
Fax: 630 953-9938

BORING LOG 4NW-20

WEI Job No.: 786-40-01

Client: **CDM Smith, Inc.**
Project: **CLCJAWA System Expansion**
Location: **Lake County, Illinois**

Datum: NGVD
Elevation: 819.44 ft
North: 2085050.81 ft
East: 1057058.36 ft
Station:
Offset:

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
	819.14	4-inch thick, white CRUSHED STONE; shoulder aggregate, dry						
	818.4	--PID = 0.3 ppm--			1	5 4 2 5	NP	20
		Loose, black, fine SAND (S), and silt; moist (SP-SM) --PID = 1.5 ppm--						
		Medium stiff to stiff, gray and brown SILTY CLAY ($yC), trace fine sand, trace fine to medium gravel; (CL) --PID = 0.7 ppm--			2	3 3 4 5	1.89 B	16
		--same-- --PID = 0.7 ppm--	5		3	3 3 6 7	4.51 B	17
		--same-- --PID = 0.5 ppm--			4	3 3 4 6	3.03 B	17
		--same, very stiff-- --PID = 0.2 ppm--	10		5	6 8 10 13	4.26 B	15
		--same-- --PID = 0.5 ppm--			6	5 7 6 8	2.05 B	12
	807.4	Boring terminated at 12.00 ft	15					
			20					

GENERAL NOTES

Begin Drilling: **10-08-2014** Complete Drilling: **10-08-2014**
Drilling Contractor: **Wang Testing Services** Drill Rig: **B-57 TMR**
Driller: **R&J** Logger: **A. Happel** Checked by: **MdIR**
Drilling Method: **2.25 IDA HSA, 140 lb auto, 30" drop, 2" DIA SS;**
Backfilled with soil cuttings and bentonite; PID Bkgrd 0.3 ppm

WATER LEVEL DATA

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

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Wang Engineering
wangeng@wangeng.com
1145 N Main Street
Lombard, IL 60148
Telephone: 630 953-9928
Fax: 630 953-9938

BORING LOG 4NW-21

WEI Job No.: 786-40-01

Client: **CDM Smith, Inc.**
Project: **CLCJAWA System Expansion**
Location: **Lake County, Illinois**

Datum: NGVD
Elevation: 803.23 ft
North: 2084059.14 ft
East: 1057225.07 ft
Station:
Offset:

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
	802.9	4-inch thick, white, coarse GRAVEL(G), and coarse sand; dry			1	6 3 4 4	NP	8
	802.2	Loose, black, fine SAND (S), and silt, little fine to coarse gravel; moist, fill, (SP-SM) --PID = 0.8 ppm--			2	3 2 3 3	2.00 P	13
		Medium stiff to stiff, gray and black SILTY CLAY ($yC), some fine sand, trace fine to coarse gravel; fill, (CL) --same-- --PID = 0.5 ppm--	5		3	4 4 4 7	3.69 B	17
		--same-- --PID = 0.5 ppm-- --same-- --PID = 0.5 ppm--			4	4 4 6 9	4.51 B	17
		--same, very stiff-- --PID = 0.4 ppm--	10		5	5 8 10 13	5.00 B	15
		--same-- --PID = 0.5 ppm--			6	5 5 8 10	6.56 S	13
	791.2	Boring terminated at 12.00 ft	15					
			20					

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)

GENERAL NOTES

Begin Drilling: **10-08-2014** Complete Drilling: **10-08-2014**
Drilling Contractor: **Wang Testing Services** Drill Rig: **B-57 TMR**
Driller: **R&J** Logger: **A. Happel** Checked by: **MdIR**
Drilling Method: **2.25 IDA HSA, 140 lb auto, 30" drop, 2" DIA SS;**
Backfilled with soil cuttings and bentonite; PID Bkgrd 0.4 ppm

WATER LEVEL DATA

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

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Wang Engineering
wangeng@wangeng.com
1145 N Main Street
Lombard, IL 60148
Telephone: 630 953-9928
Fax: 630 953-9938

BORING LOG 4NW-22

WEI Job No.: 786-40-01

Client: **CDM Smith, Inc.**
Project: **CLCJAWA System Expansion**
Location: **Lake County, Illinois**

Datum: NGVD
Elevation: 805.70 ft
North: 2083022.45 ft
East: 1057341.19 ft
Station:
Offset:

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
		Medium dense, brown and gray, fine SAND (S), and clay, trace medium to coarse gravel; dry (SP-SC)			1	5 6 9 8	NP	14
	804.2	--PID = 0.6 ppm--						
		Loose, brown and gray, fine SAND (S), and silt, trace fine gravel; fill, moist (SP-SM)			2	3 4 3 6	NP	19
	802.5	--PID = 0.6 ppm--						
		Stiff, brown and gray SILTY CLAY ($yC), some fine sand, trace fine to coarse gravel; fill (CL)	5		3	4 6 5 7	2.46 B	17
		--PID = 1.3 ppm--						
		--same--						
		--PID = 1.1 ppm--			4	4 4 5 7	1.89 B	19
		--same--						
		--PID = 1.2 ppm--						
	797.7							
		Stiff, gray SILTY CLAY ($yC), trace fine sand, trace fine gravel; (CL)			5	4 5 9 8	1.64 B	15
		--PID = 1.2 ppm--	10					
		--same--						
		--PID = 0.8 ppm--			6	5 5 7 10	2.54 B	13
	793.7							
		Boring terminated at 12.00 ft						
			15					
			20					

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)

GENERAL NOTES

Begin Drilling: **10-08-2014** Complete Drilling: **10-08-2014**
Drilling Contractor: **Wang Testing Services** Drill Rig: **B-57 TMR**
Driller: **R&J** Logger: **A. Happel** Checked by: **MdIR**
Drilling Method: **2.25 IDA HSA, 140 lb auto, 30" drop, 2" DIA SS;**
Backfilled with soil cuttings and bentonite; PID Bkgrd 0.6 ppm

WATER LEVEL DATA

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

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Wang Engineering
wangeng@wangeng.com
1145 N Main Street
Lombard, IL 60148
Telephone: 630 953-9928
Fax: 630 953-9938

BORING LOG 4NW-23

WEI Job No.: 786-40-01

Client: **CDM Smith, Inc.**
Project: **CLCJAWA System Expansion**
Location: **Lake County, Illinois**

Datum: NAVD88
Elevation: 793.70 ft
North: 2082414.42 ft
East: 1058036.37 ft
Station:
Offset:

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
		Stiff, black CLAY & SILT (C&$), trace fine to medium gravel; organic matter, topsoil (CL-ML)			1	4 3 5 5	1.39 S	30
	792.2	--PID = 0.2 ppm--						
		Stiff, brown and gray SILTY CLAY ($yC), trace fine to medium gravel; fill (CL) --PID = 0.3 ppm--			2	3 3 7 7	2.71 B	24
	789.2							
		Very loose to loose, brown and gray, medium SAND (S), and silt, trace fine gravel; moist (SP-SM) --PID = 0. 9 ppm--	5		3	2 2 2 2	1.80 B	19
		--same-- --PID = 1.6 ppm (LS)--			4	0 1 1 3	NP	20
	786.5							
		Very loose, brown and gray, fine to coarse SAND (S); moist (SW)						
	785.5							
		Stiff to very stiff, gray SILTY CLAY, trace fine to medium sand; (CL)	10		5	3 3 6 9	3.44 B	17
		--same-- --PID = 0.2 ppm--			6	4 7 12 13	4.92 B	16
	781.7							
		Boring terminated at 12.00 ft	15					
			20					

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)

GENERAL NOTES

Begin Drilling: **09-25-2014** Complete Drilling: **09-25-2014**
Drilling Contractor: **Wang Testing Services** Drill Rig: **CME-55**
Driller: **R&J** Logger: **A. Happel** Checked by: **MdIR**
Drilling Method: **2.25 IDA HSA, 140 lb auto, 30" drop, 2" DIA SS;**
Backfilled with soil cuttings and bentonite; PID Bkgrd 0.0 ppm

WATER LEVEL DATA

While Drilling: **7.25 ft**
At Completion of Drilling: **8.00 ft**
Time After Drilling: **NA**
Depth to Water: **NA**

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Wang Engineering
wangeng@wangeng.com
1145 N Main Street
Lombard, IL 60148
Telephone: 630 953-9928
Fax: 630 953-9938

BORING LOG 4NW-24

WEI Job No.: 786-40-01

Client: **CDM Smith, Inc.**
Project: **CLCJAWA System Expansion**
Location: **Lake County, Illinois**

Datum: NAVD88
Elevation: 787.05 ft
North: 2081012.29 ft
East: 1058636.85 ft
Station:
Offset:

Profile	Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
	786.74	4-inch thick ASPHALT						
	786.5	--PAVEMENT--			1	5 5	4.84 B	
		3-inch thick, white CRUSHED STONE; dry						
		Stiff to very stiff, brown and black SILTY CLAY ($yC), some fine sand, trace fine to medium gravel; fill (CL)			2	2 4 5 8	2.00 P	26
		--PID = 5.3 ppm (LS)--						
		--same--						
		--PID = 4.7 ppm--			3	3 5 8 11	5.74 B	13
		--same--	5					
		--PID = 1.6 ppm--						
		--same--			4	6 7 10 13	5.99 B	14
		--PID = 0.9 ppm--						
	778.6							
		Medium dense, brown and gray, fine to medium SAND (S), little fine to medium gravel; fill, moist (SW)			5	8 11 11 15	2.62 B	10
			10					
		--PID = 0.9 ppm--			6	10 11 13 14	NP	9
		--same, wet--						
		--PID = 0.7 ppm--						
	775.1							
		Boring terminated at 12.00 ft						
			15					
			20					

GENERAL NOTES

Begin Drilling: **10-02-2014** Complete Drilling: **10-02-2014**
Drilling Contractor: **Wang Testing Services** Drill Rig: **CME-55**
Driller: **R&J** Logger: **A. Happel** Checked by: **MdIR**
Drilling Method: **2.25 IDA HSA, 140 lb auto, 30" drop, 2" DIA SS;**
Backfilled with soil cuttings and bentonite; PID Bkgrd 0.4 ppm

WATER LEVEL DATA

While Drilling: **10.00 ft**
At Completion of Drilling: **10.00 ft**
Time After Drilling: **NA**
Depth to Water: **NA**

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Wang Engineering
wangeng@wangeng.com
1145 N Main Street
Lombard, IL 60148
Telephone: 630 953-9928
Fax: 630 953-9938

BORING LOG 4NW-TC-01

WEI Job No.: 786-40-01

Client: **CDM Smith, Inc.**
Project: **CLCJAWA System Expansion**
Location: **Lake County, Illinois**

Datum: NAVD88
Elevation: 796.76 ft
North: 2088761.20 ft
East: 1041559.73 ft
Station:
Offset:

Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
796.3	5-inch thick, fine to coarse GRAVEL (G), and fine sand; dry (GW)			1	43 ~~50/3~~	4.00 P	18
	Medium stiff, brown to gray CLAY & SILT (C&$), trace fine sand; fill (CL-ML)						
	--PID = 13.2 ppm--			2	3 4 5 8	4.18 B	21
793.3	--same--						
	--PID = 13.5 ppm--						
	Very stiff, brown and gray CLAY & SILT (C&$), trace fine sand, trace fine gravel; (CL-ML)	5		3	3 9 11 14	6.72 B	16
	--PID = 13.5 ppm--						
	--same--			4	4 9 15 16	8.04 B	15
	--PID = 13.5 ppm--						
	--same--			5	4 10 15 17	7.46 B	16
	--PID = 13.8 ppm--	10					
	--same, coal fragments--			6	4 10 15 18	8.20 B	16
	--PID = 14.0 ppm (LS)--						
	--same--			7	3 6 11 12	4.84 B	17
	--same--	15		8	9 8 11 14	4.76 B	14
780.8	Medium stiff to stiff, brown and gray SILTY CLAY ($yC), trace fine sand, trace fine gravel; (CL)			9	4 6 9 10	3.20 B	19
	--same--	20		10	4 5 6 8	1.72 B	17
	--same--			11	5 5 8 8	1.89 B	16
	--same, silt and fine sand lenses--			12	3 6 9 10	1.97 B	17
	--same, fine silt lenses--	25		13	4 7 9 10	2.30 B	20
	--same--			14	5 5 9 10	1.64 B	30
	--same, fine silt lenses--	30		15	4 6 8 7	2.38 B	20
	--same, fine silt lenses--			16	2 3 4 6	1.48 B	18
	--same, fine sand lenses--			17	4 4 6 6	2.30 B	19
	--same, fine sand lenses--	35		18	4 5 6 6	2.13 B	20
760.8	Boring terminated at 36.00 ft	40					

GENERAL NOTES

Begin Drilling: **08-25-2014** Complete Drilling: **08-25-2014**
Drilling Contractor: **Wang Testing Services** Drill Rig: **D-50 ATV**
Driller: **R&J** Logger: **A. Tomaras** Checked by: **MdIR**
Drilling Method: **2.25 IDA HSA, 140 lb auto, 30" drop, 2" DIA SS;**
Backfilled with soil cuttings and bentonite; PID Bkgrd 0.1 ppm

WATER LEVEL DATA

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

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Wang Engineering
wangeng@wangeng.com
1145 N Main Street
Lombard, IL 60148
Telephone: 630 953-9928
Fax: 630 953-9938

BORING LOG 4NW-TC-02

WEI Job No.: 786-40-01

Client: **CDM Smith, Inc.**
Project: **CLCJAWA System Expansion**
Location: **Lake County, Illinois**

Datum: NAVD88
Elevation: 797.96 ft
North: 2088780.35 ft
East: 1044367.34 ft
Station:
Offset:

Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
797.73	3-inch thick, white CRUSHED STONE, and coarse sand; dry						
	Medium stiff to very stiff, brown and black SILTY CLAY ($yC), some fine sand, trace medium gravel; fill, (CL)			1	4 6 1 2	1.25 P	8
	--PID = 2.8 ppm--			2	3 8 10 9	2.25 P	18
794.0							
793.5	Gray, coarse SAND (S), and fine to medium gravel; wet (SP-SG)	5		3	3 4 4 6	1.64 B	21
792.2	Stiff, brown and gray SILTY CLAY ($yC), trace coarse sand, trace fine to medium gravel; fill, (CL)						
791.2	--PID = 6.7 ppm--			4	6 7 11 15	3.25 P	16
	Brown, fine SAND (S), and silt; moist, (SP-SM)						
	Very stiff to hard, brown and gray SILTY CLAY ($yC), trace coarse sand, trace fine to medium gravel; (CL)			5	6 8 9 11	6.84 B	16
	--PID = 2.2 ppm--	10					
	--same-- --PID = 0.9 ppm--			6	22 27 20 25	6.31 B	17
	--same--			7	5 10 11 15	5.00 B	18
	--same--	15		8	2 7 9 11	5.17 B	19
	--same--			9	5 7 10 14	5.99 B	18
	--same--	20		10	6 7 11 15	3.77 B	18
	--same--			11	17 29 17 16	4.02 B	16
	--same, no sand--			12	4 8 9 11	2.62 B	18
	--same, no sand--	25		13	5 8 10 13	3.94 B	19
	--same, stiff, no sand--			14	6 6 8 11	2.21 B	16
	--same, no sand--			15	7 8 8 12	2.79 B	16
	--same--	30		16	10 12 12 12	2.54 B	15
	--same--			17	5 8 9 12	1.00 P	21
	--same, stiff--	35		18	5 6 8 10	2.05 B	17
762.0	Boring terminated at 36.00 ft	40					

GENERAL NOTES

Begin Drilling: **09-09-2014** Complete Drilling: **09-09-2014**
Drilling Contractor: **Wang Testing Services** Drill Rig: **D-50 ATV**
Driller: **K&K** Logger: **A. Happel** Checked by: **MdIR**
Drilling Method: **2.25 IDA HSA, 140 lb auto, 30" drop, 2" DIA SS;**
Backfilled with soil cuttings and bentonite; PID Bkgrd 0.1 ppm

WATER LEVEL DATA

While Drilling: **4.00 ft**
At Completion of Drilling: **3.00 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.

Wang Engineering
wangeng@wangeng.com
1145 N Main Street
Lombard, IL 60148
Telephone: 630 953-9928
Fax: 630 953-9938

BORING LOG 4NW-TC-03

WEI Job No.: 786-40-01

Client: **CDM Smith, Inc.**
Project: **CLCJAWA System Expansion**
Location: **Lake County, Illinois**

Datum: NAVD88
Elevation: 775.48 ft
North: 2087913.53 ft
East: 1046517.88 ft
Station:
Offset:

Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
775.2	3-inch thick, brown, fine SANDY GRAVEL (G); shoulder aggregate (GPS)						
	Stiff, brown SILTY CLAY ($yC), trace fine gravel; fill (CL)			1	7 5 7 8	> 4.50 P	20
773.0	--PID = 5.4 ppm (LS)--						
	Dense, brown, coarse SAND (S), and fine gravel; dry, fill (SPG)			2	3 6 18 17	3.50 P	16
772.0	--PID = 0.8 ppm--						
	Very stiff, brown to gray SILTY CLAY ($yC), trace gravel; (CL) --PID = 0.6 ppm--	5		3	3 4 5 6	2.00 P	22
	--same-- --PID = 1.4 ppm--			4	4 5 9 13	6.56 B	19
	--same-- --PID = 3.5 ppm--	10		5	4 8 14 16	6.56 B	19
	--same-- --PID = 4.3 ppm--			6	4 8 11 13	3.36 B	20
	--same--			7	4 7 10 13	2.95 B	21
	--same, stiff--	15		8	3 6 7 11	1.97 B	15
	--same--			9	4 7 10 13	3.20 B	14
	--same--	20		10	3 7 10 15	3.28 B	16
	--same--			11	5 7 11 15	4.02 B	13
	--same--			12	6 6 9 12	3.69 B	16
	--same--	25		13	3 4 7 13	2.46 B	18
749.7	Medium dense, gray, coarse GRAVEL (G), and fine to coarse sand; wet (GP)			14	8 7 7 7	NP	7
747.5	Hard, gray SILTY CLAY ($yC), trace gravel; (CL)			15	5 15 15 11	1.89 B	18
745.5	Stiff, gray SILT ($), trace fine gravel; wet (ML)	30		16	3 5 8 9	NP	17
744.0	Stiff, gray SILTY CLAY ($yC), trace fine gravel; (CL)			17	3 5 6 8	1.56 B	16
	--same--	35		18	3 7 8 10	1.89 B	15
739.5	Boring terminated at 36.00 ft	40					

GENERAL NOTES

Begin Drilling: **09-02-2014** Complete Drilling: **09-02-2014**
Drilling Contractor: **Wang Testing Services** Drill Rig: **D-50 TMR**
Driller: **R&J** Logger: **D. Kolpacki** Checked by: **MdIR**
Drilling Method: **3.25 IDA HSA, 140 lb auto, 30" drop, 2" DIA SS; Backfilled with soil cuttings and bentonite; PID Bkgrd 0.5 ppm**

WATER LEVEL DATA

While Drilling: **24.80 ft**
At Completion of Drilling: **26.00 ft**
Time After Drilling: **NA**
Depth to Water: **NA**

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Wang Engineering
wangeng@wangeng.com
1145 N Main Street
Lombard, IL 60148
Telephone: 630 953-9928
Fax: 630 953-9938

BORING LOG 4NW-TC-04

WEI Job No.: 786-40-01

Client: **CDM Smith, Inc.**
Project: **CLCJAWA System Expansion**
Location: **Lake County, Illinois**

Datum: NAVD88
Elevation: 795.35 ft
North: 2087751.91 ft
East: 1049470.85 ft
Station:
Offset:

Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
795.0	4-inch thick, black CLAY & SILT (C&$); topsoil; (CL-ML)						
	Stiff, brown and gray SILTY CLAY ($yC), trace fine sand, trace fine gravel; fill (CL)			1	5 5 3 4	3.75 P	18
	--PID = 1.1 ppm--						
	--same, fine sand seams--			2	4 4 7 7	3.12 B	24
	--PID = 0.7 ppm--						
	--same--						
	--PID = 0.9 ppm--	5		3	3 4 4 7	2.62 B	19
789.4							
	Very stiff, brown and gray SILTY CLAY ($yC), trace fine gravel; (CL)			4	7 10 13 16	5.49 B	14
	--PID = 1.1 ppm--						
	--same--						
	--PID = 2.2 ppm (LS)--			5	5 9 12 19	5.33 B	16
		10					
	--same, hard--			6	17 19 21 25	5.08 B	19
	--same--			7	5 7 12 15	5.33 B	18
	--same--						
		15		8	7 9 11 16	6.72 B	18
779.4							
	Very stiff, gray SILTY CLAY ($yC), trace fine sand, trace fine gravel; (CL)			9	5 7 14 12	3.61 B	16
	--same, no sand--			10	9 8 16 16	2.54 B	15
		20					
	--same, no sand--			11	10 12 15 17	3.82 B	19
	--same, stiff, no sand--			12	2 7 3 33	1.64 B	23
771.9							
	Dense, brown, fine to coarse SAND (S), trace fine gravel; wet (SW)						
770.9		25		13	17 7 10 16	5.41 B	14
	Very stiff to hard, gray SILTY CLAY ($yC), trace fine gravel; (CL)						
	--same, fine sand seams--			14	5 9 15 23	4.92 B	15
	--same, fine sand seams--			15	8 15 20 22	3.44 B	15
		30					
	--same, some fine sand--			16	16 27 23 25	2.21 B	17
763.4							
	Dense, brown, fine SAND (S), trace fine gravel; wet (SP)			17	4 8 24 35	NP	18
	--same--						
		35		18	15 14 17 20	NP	17
759.4							
	Boring terminated at 36.00 ft						
		40					

GENERAL NOTES

Begin Drilling: **09-15-2014** Complete Drilling: **09-15-2014**
Drilling Contractor: **Wang Testing Services** Drill Rig: **D-50 ATV**
Driller: **K&K** Logger: **A. Happel** Checked by: **MdIR**
Drilling Method: **2.25 IDA HSA, 140 lb auto, 30" drop, 2" DIA SS;**
Backfilled with soil cuttings; PID Bkgrd 0.2 ppm

WATER LEVEL DATA

While Drilling: **24.00 ft**
At Completion of Drilling: **26.00 ft**
Time After Drilling: **NA**
Depth to Water: **NA**

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Wang Engineering
wangeng@wangeng.com
1145 N Main Street
Lombard, IL 60148
Telephone: 630 953-9928
Fax: 630 953-9938

BORING LOG 4NW-TC-05

WEI Job No.: 786-40-01

Client: **CDM Smith, Inc.**
Project: **CLCJAWA System Expansion**
Location: **Lake County, Illinois**

Datum: NAVD88
Elevation: 807.06 ft
North: 2092396.15 ft
East: 1049369.91 ft
Station:
Offset:

Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
806.6	6-inch thick, black CLAY & SILT (C&$); topsoil, fill (CL-ML)						
	Medium stiff, brown and gray SILTY CLAY ($yC), trace fine gravel; organic matter, fill (CL)			1	2 3 4 5	3.00 P	28
805.1	--PID = 0.7 ppm--						
	Stiff, brown and gray SILTY CLAY ($yC), trace fine gravel; fill (CL)			2	4 4 6 7	2.05 B	22
	--PID = 1.5 ppm--						
	--same--						
	--PID = 1.5 ppm--	5		3	4 5 6 10	2.21 B	21
	--same--						
	--PID = 4.1 ppm--			4	4 5 6 8	4.10 S	21
	--same--						
	--PID = 3.2 ppm--			5	4 4 8 8	2.62 B	23
		10					
	--same, very stiff--						
	--PID = 4.3 ppm (LS)--			6	8 11 13 11	2.62 B	23
795.1							
	Stiff to very stiff, brown to gray SILTY CLAY ($yC), trace gravel, some fine sand; (CL)			7	2 4 7 8	1.97 S	22
	--same--						
		15		8	6 8 10 13	3.36 B	12
	--same--			9	5 6 8 10	NR	
	--same--			10	6 7 10 13	1.75 P	16
		20					

Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
	--same, no sand--			11	10 15 18 21	4.86 B	18
	--same, no sand--			12	3 5 8 13	3.61 B	17
	--same, no sand--	25		13	9 10 13 16	5.25 B	16
	--same, no sand--			14	4 8 9 13	3.03 B	17
	--same, no sand--			15	3 5 9 12	3.03 B	18
	--same, no sand--	30		16	10 13 11 19	3.94 B	18
775.1							
	Medium dense, gray, fine SAND, and silt; wet (SP-SM)			17	3 8 7 13	NP	21
	--3 inches silty clay--						
	--same--	35		18	4 6 6 6	NP	21
771.1							
	Boring terminated at 36.00 ft						
		40					

GENERAL NOTES

Begin Drilling: **09-12-2014** Complete Drilling: **09-12-2014**
Drilling Contractor: **Wang Testing Services** Drill Rig: **D-50 ATV**
Driller: **K&K** Logger: **A. Happel** Checked by: **MdIR**
Drilling Method: **2.25 IDA HSA, 140 lb auto, 30" drop, 2" DIA SS;**
Backfilled with soil cuttings; PID Bkgrd 0.0 ppm

WATER LEVEL DATA

While Drilling: **33.00 ft**
At Completion of Drilling: **27.00 ft**
Time After Drilling: **NA**
Depth to Water: **NA**

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Wang Engineering
wangeng@wangeng.com
1145 N Main Street
Lombard, IL 60148
Telephone: 630 953-9928
Fax: 630 953-9938

BORING LOG 4NW-TC-06

WEI Job No.: 786-40-01

Client: **CDM Smith, Inc.**
Project: **CLCJAWA System Expansion**
Location: **Lake County, Illinois**

Datum: NAVD88
Elevation: 806.06 ft
North: 2087050.92 ft
East: 1055457.56 ft
Station:
Offset:

Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
805.6	6-inch thick, black CLAY & SILT (C&$); topsoil (ML)						
	Stiff, brown and black SILTY CLAY ($yC), some fine sand, trace fine to medium gravel; (CLS)			1	4 5 4 6	3.25 P	16
	--PID = 0.8 ppm--						
	--same--			2	4 3 6 8	1.64 B	19
	--PID = 0.9 ppm--						
801.6	Loose, brown, fine SAND (S), and silt, trace fine gravel; dry (SP-SM)	5		3	3 3 5 4	1.31 B	20
800.1	--PID = 4.5 ppm (LS)--						
	Stiff, gray and brown SILTY CLAY ($yC), trace fine to medium gravel; (CL)			4	2 4 5 6	2.87 B	24
	--PID = 1.3 ppm--						
797.4	Loose, gray and brown, fine SAND (S), and silt, trace fine gravel; wet (SP-SM)	10		5	4 3 4 5	NP	23
	--PID= 1.1ppm--						
795.1	Stiff, gray and brown SILTY CLAY ($yC), trace fine to medium gravel; (CL)			6	4 4 4 9	2.95 B	26
793.8	--PID = 0.6 ppm--						
	Loose, gray and brown, fine SAND (S), and silt, trace fine gravel; wet (SP-SM)			7	1 2 7 13	NP	26
	--PID = 1.1ppm--						
791.6	Stiff to very stiff, gray and brown SILTY CLAY ($yC), some fine sand, trace fine to medium gravel; (CLS)	15		8	5 4 7 8	2.71 B	18
	--same--			9	3 5 7 9	2.71 B	14
	--same--	20		10	5 6 7 10	2.30 B	17
	--same--			11	8 10 12 15	3.12 B	21
	--same--			12	5 7 10 13	4.67 B	17
	--same--	25		13	4 6 9 12	2.87 B	22
	--same--			14	4 6 7 8	1.72 B	21
	--same--	30		15	5 6 6 9	2.30 B	22
	--same--			16	8 9 8 10	1.97 B	26
	--same, no sand--			17	3 5 10 12	3.69 B	18
	--same, no sand--	35		18	5 7 10 12	3.44 B	21
770.1	Boring terminated at 36.00 ft	40					

GENERAL NOTES

Begin Drilling: **09-16-2014** Complete Drilling: **09-16-2014**
Drilling Contractor: **Wang Testing Services** Drill Rig: **D-50 ATV**
Driller: **K&K** Logger: **A. Happel** Checked by: **MdIR**
Drilling Method: **2.25 IDA HSA, 140 lb auto, 30" drop, 2" DIA SS;**
Backfilled with soil cuttings; PID Bkgrd 0.1 ppm

WATER LEVEL DATA

While Drilling: **8.75 ft**
At Completion of Drilling: **10.00 ft**
Time After Drilling: **NA**
Depth to Water: **NA**

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Wang Engineering
wangeng@wangeng.com
1145 N Main Street
Lombard, IL 60148
Telephone: 630 953-9928
Fax: 630 953-9938

BORING LOG 4NW-TC-07

WEI Job No.: 786-40-01

Client: **CDM Smith, Inc.**
Project: **CLCJAWA System Expansion**
Location: **Lake County, Illinois**

Datum: NAVD88
Elevation: 812.08 ft
North: 2087064.04 ft
East: 1056557.61 ft
Station:
Offset:

Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
811.5	7-inch thick, black and brown, CLAY & SILT (C&$); topsoil (ML)						
810.1	Medium dense, brown and gray, medium to coarse SAND (S), and coarse gravel; moist, fill (SW)			1	2 5 6 5	NP	10
	--PID = 0.4 ppm--						
	Stiff to very stiff, brown and gray SILTY CLAY ($yC), trace fine to medium sand, little to trace fine to medium gravel; fill, (CL)			2	5 5 7 7	3.12 B	12
	--PID = 1.6 ppm (LS)--						
	--same, and medium sand--	5		3	3 6 7 8	2.54 B	15
	--PID = 0.9 ppm--						
	--same--			4	9 7 11 14	4.51 B	17
	--PID = 1.5 ppm--						
	--same--			5	8 10 12 14	6.81 B	16
	--PID = 0.4 ppm--						
802.6	Stiff to very stiff, gray SILTY CLAY ($yC), some fine to medium sand, little to trace fine to medium gravel; (CLS)	10		6	12 16 15 17	2.95 B	16
	--PID = 0.6 ppm--						
	--same--			7	3 5 6 9	2.13 B	14
	--same--	15		8	4 7 9 12	3.69 B	15
	--same--			9	4 5 7 11	4.18 B	18
	--same--	20		10	4 6 8 11	2.05 B	15
	--same--			11	12 13 14 14	3.44 B	15
	--same--			12	2 4 5 9	1.72 B	13
	--same--	25		13	3 6 7 9	2.21 B	15
	--same, interbedded fine sand--			14	5 6 9 11	4.26 B	13
	--same--	30		15	6 6 6 11	2.05 B	16
	--same--			16	9 12 13 18	4.02 B	17
	--same--			17	3 5 5 8	1.64 B	16
	--same--	35		18	3 6 6 8	2.05 B	19
776.1	Boring terminated at 36.00 ft	40					

GENERAL NOTES

Begin Drilling: **09-16-2014** Complete Drilling: **09-16-2014**
Drilling Contractor: **Wang Testing Services** Drill Rig: **D-50 ATV**
Driller: **K&K** Logger: **A. Happel** Checked by: **MdIR**
Drilling Method: **2.25 IDA HSA, 140 lb auto, 30" drop, 2" DIA SS;**
Backfilled with soil cuttings; PID Bkgrd 0.0 ppm

WATER LEVEL DATA

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

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Wang Engineering
wangeng@wangeng.com
1145 N Main Street
Lombard, IL 60148
Telephone: 630 953-9928
Fax: 630 953-9938

BORING LOG 4NW-TC-08

WEI Job No.: 786-40-01

Client: **CDM Smith, Inc.**
Project: **CLCJAWA System Expansion**
Location: **Lake County, Illinois**

Datum: NGVD
Elevation: 813.24 ft
North: 2086959.20 ft
East: 1056727.79 ft
Station:
Offset:

Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
812.7	6-inch thick, black SILTY CLAY ($yC), and fine sand; topsoil (CL)						
	Loose, black, fine to medium SAND (S), with fine gravel; fill, (SW)			1	2 5 7 5	4.10 B	22
	--PID = 0.8 ppm--						
	--PID = 0.7 ppm--			2	3 4 2 1	NP	17
810.0 / 809.7	Black SILTY CLAY ($yC); trace organic matter (CL)						
	Medium stiff to stiff, brown and gray SILTY CLAY ($yC), trace fine sand, trace fine gravel; (CL)	5		3	0 0 2 1	1.48 B	23
	--PID = 0.6 ppm--						
	--same--			4	0 2 3 5	2.87 B	27
	--PID = 0.6 ppm--						
	--same--			5	3 6 7 7	6.40 B	18
	--PID = 0.6 ppm--	10					
	--same--			6	4 5 8 8	6.07 B	19
	--PID = 0.8 ppm--						
	--same--			7	3 4 6 7	2.46 B	18
	--same--	15		8	4 4 6 9	3.36 B	18
	--same--			9	3 5 7 8	3.03 B	16
	--same--	20		10	3 6 8 10	3.69 B	16
	--same--			11	3 5 5 9	2.54 B	18
	--same--			12	3 7 7 10	3.03 B	19
	--same--	25		13	4 5 7 5	2.05 B	19
	--same--			14	4 5 8 10	2.30 B	14
785.2	Very stiff, gray SILTY CLAY ($yC), trace fine gravel; (CL)			15	4 6 9 12	2.87 B	14
	--same--	30		16	5 7 9 11	2.54 B	19
	--same--			17	4 6 9 10	3.36 B	16
	--same, silt seams--	35		18	4 8 11 13	3.44 B	15
777.2	Boring terminated at 36.00 ft	40					

GENERAL NOTES

Begin Drilling: **10-08-2014** Complete Drilling: **10-08-2014**
Drilling Contractor: **Wang Testing Services** Drill Rig: **B-57 TMR**
Driller: **R&J** Logger: **A. Happel** Checked by: **MdIR**
Drilling Method: **2.25 IDA HSA, 140 lb auto, 30" drop, 2" DIA SS;**
Backfilled with soil cuttings and bentonite; PID Bkgrd 0.4 ppm

WATER LEVEL DATA

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

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Wang Engineering
wangeng@wangeng.com
1145 N Main Street
Lombard, IL 60148
Telephone: 630 953-9928
Fax: 630 953-9938

BORING LOG 4NW-TC-09

WEI Job No.: 786-40-01

Client: **CDM Smith, Inc.**
Project: **CLCJAWA System Expansion**
Location: **Lake County, Illinois**

Datum: NAVD88
Elevation: 784.94 ft
North: 2082207.59 ft
East: 1059100.28 ft
Station:
Offset:

Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
784.2	9-inch thick, black CLAY & SILT (C&$), trace fine to medium gravel; organic matter, topsoil (CL-ML) --PID = 0.0 ppm--			1	3 5 6 5	4.50 P	18
	Medium stiff to very stiff, brown to gray SILTY CLAY ($yC), trace fine to medium gravel; fill (CL) --PID = 0.0 ppm-- --same, fine sand seams-- --PID = 0.3 ppm--			2	3 2 4 7	3.69 B	19
	--same-- --PID = 0.3 ppm--	5		3	3 3 6 8	5.08 B	18
	--same, and fine sand-- --PID = 0.3 ppm--			4	3 5 13 11	5.33 B	17
	--same, and fine sand-- --PID = 0.4 ppm--	10		5	3 5 7 11	2.87 B	17
	--same, and fine sand-- --PID = 0.6 ppm (LS)--			6	4 7 12 14	2.71 B	17
772.9	Stiff, gray SILTY CLAY ($yC), trace fine to medium gravel, with fine sand; (CL)			7	3 6 6 10	2.21 B	14
	--same--	15		8	3 6 6 9	2.62 B	16
	--same--			9	4 4 6 10	2.30 B	11
766.9	Loose, gray, fine to medium SAND (S), trace fine to medium gravel; wet (SW)			10	2 4 7 8	2.21 B	16
765.9	Stiff to very stiff, gray SILTY	20					
	CLAY ($yC), trace fine to medium gravel; (CL)			11	2 5 8 10	2.13 B	18
	--same--			12	3 6 7 8	1.80 B	16
	--same--	25		13	5 8 12 16	4.74 B	19
	--same--			14	5 6 9 11	2.62 B	17
756.4	Medium dense, gray, fine to medium SAND (S), and silt; wet (SP-SM)			15	4 11 17 13	NP	20
	--same--	30		16	4 9 10 16	NP	20
	--same--			17	9 8 4 10	NP	19
750.4	Stiff, gray SILTY CLAY ($yC), trace fine to medium gravel; (CL)	35		18	5 4 8 9	1.72 B	21
748.9	Boring terminated at 36.00 ft	40					

GENERAL NOTES

Begin Drilling: **09-25-2014** Complete Drilling: **09-25-2014**
Drilling Contractor: **Wang Testing Services** Drill Rig: **CME-55**
Driller: **R&J** Logger: **A. Happel** Checked by: **MdIR**
Drilling Method: **2.25 IDA HSA, 140 lb auto, 30" drop, 2" DIA SS;**
Backfilled with soil cuttings and bentonite; PID Bkgrd 0.0 ppm

WATER LEVEL DATA

While Drilling: **15.50 ft**
At Completion of Drilling: **28.00 ft**
Time After Drilling: **NA**
Depth to Water: **NA**

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Wang Engineering
wangeng@wangeng.com
1145 N Main Street
Lombard, IL 60148
Telephone: 630 953-9928
Fax: 630 953-9938

BORING LOG 4NW-TC-10

WEI Job No.: 786-40-01

Client: **CDM Smith, Inc.**
Project: **CLCJAWA System Expansion**
Location: **Lake County, Illinois**

Datum: NAVD88
Elevation: 784.39 ft
North: 2081703.06 ft
East: 1058660.14 ft
Station:
Offset:

Elevation (ft)	SOIL AND ROCK DESCRIPTION	Depth (ft)	Sample Type / recovery	Sample No.	SPT Values (blw/6 in)	Qu (tsf)	Moisture Content (%)
783.9	Loose, brown and black, fine SAND (S), and silt, trace fine to coarse gravel; topsoil, dry (SP-SM)			1	3 5 2 5	NP	16
	Stiff to very stiff, brown and gray SILTY CLAY ($yC), trace fine sand; fill (CL)			2	8 6 8 12	5.74 B	17
	--PID = 0.2 ppm--						
	--same--						
	--PID = 0.4 ppm--						
	--same--						
	--PID = 0.4 ppm--	5		3	4 7 11 12	3.69 B	16
777.9	Medium dense, gray, fine SAND (S), and silt, trace fine gravel; moist (SP-SM)			4	3 8 9 12	NP	11
	--PID = 0.5 ppm--						
775.9	Medium stiff to stiff, gray SILTY CLAY ($yC), trace fine to medium gravel; (CL)			5	3 3 5 6	1.39 B	18
	--PID = 0.4 ppm--	10					
	--same, fine sand seams--						
	--PID = 0.5 ppm--			6	3 5 5 8	1.39 B	17
	--same--			7	3 4 6 8	1.80 B	20
	--same--	15		8	3 5 5 8	2.05 B	17
	Very stiff, gray SILTY CLAY ($yC), trace fine gravel; (CL)			9	4 7 8 12	2.46 B	17
	--same, fine sand seams--			10	4 7 10 14	2.46 B	16
		20					
	--same, fine sand seams--			11	4 8 13 17	4.51 B	14
761.9	Loose to medium dense, gray, medium SAND (S); moist (SP)			12	8 12 11 10	NP	20
	--same, silt, fine sand, trace gravel--	25		13	6 4 3 5	NP	13
758.1	Stiff, gray SILTY CLAY ($yC), trace fine gravel and fine sand; (CL)			14	4 5 6 7	0.66 B	23
	--same--			15	3 3 6 6	0.74 B	24
		30					
	--same--			16	3 5 7 11	0.90 B	25
	--same, fine sand and silt seam--			17	7 6 8 10	1.07 B	24
	--same--	35		18	5 6 8 8	1.48 B	24
748.4	Boring terminated at 36.00 ft						
		40					

GENERAL NOTES

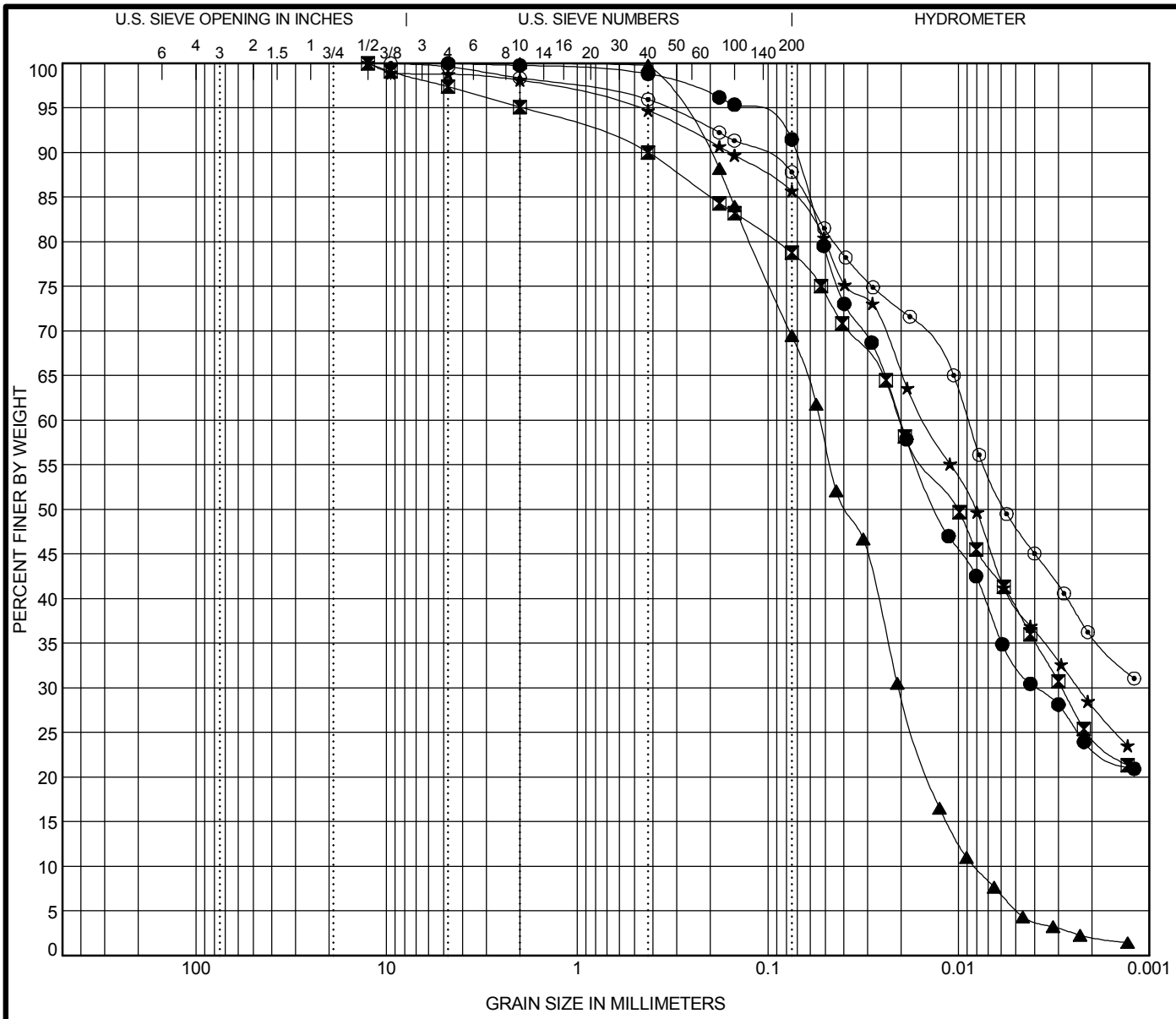
Begin Drilling: **10-02-2014** Complete Drilling: **10-02-2014**
Drilling Contractor: **Wang Testing Services** Drill Rig: **CME-55**
Driller: **R&J** Logger: **A. Happel** Checked by: **MdIR**
Drilling Method: **2.25 IDA HSA, 140 lb auto, 30" drop, 2" DIA SS;**
Backfilled with soil cuttings and bentonite; PID Bkgrd 0.0 ppm

WATER LEVEL DATA

While Drilling: **25.00 ft**
At Completion of Drilling: **26.00 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.

APPENDIX B



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		USCS Classification	LL	PL	PI	Cc	Cu
●	4NE-04#4	6.0 ft	**LEAN CLAY(CL)**	**46**	**21**	**25**		
⊠	4NE-06#3	4.0 ft	**LEAN CLAY with SAND(CL)**	**30**	**17**	**13**		
▲	4NE-08#3	4.0 ft	**SANDY SILT(ML)**	**NP**	**NP**	**NP**	**0.97**	**6.48**
★	4NE-10#3	4.0 ft	**LEAN CLAY(CL)**	**30**	**15**	**15**		
⊙	4NE-11#2	2.0 ft	**LEAN CLAY(CL)**	**46**	**18**	**28**		

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	4NE-04#4	6.0 ft	**4.75**	**0.02**	**0.004**		**0.0**	**8.5**	**58.7**	**32.7**
⊠	4NE-06#3	4.0 ft	**12.5**	**0.02**	**0.003**		**2.6**	**18.6**	**39.9**	**38.9**
▲	4NE-08#3	4.0 ft	**2**	**0.053**	**0.021**	**0.008**	**0.0**	**30.5**	**64.3**	**5.1**
★	4NE-10#3	4.0 ft	**12.5**	**0.015**	**0.002**		**1.2**	**13.1**	**46.5**	**39.2**
⊙	4NE-11#2	2.0 ft	**9.5**	**0.009**			**0.4**	**11.8**	**39.8**	**48.0**

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GRAIN SIZE DISTRIBUTION

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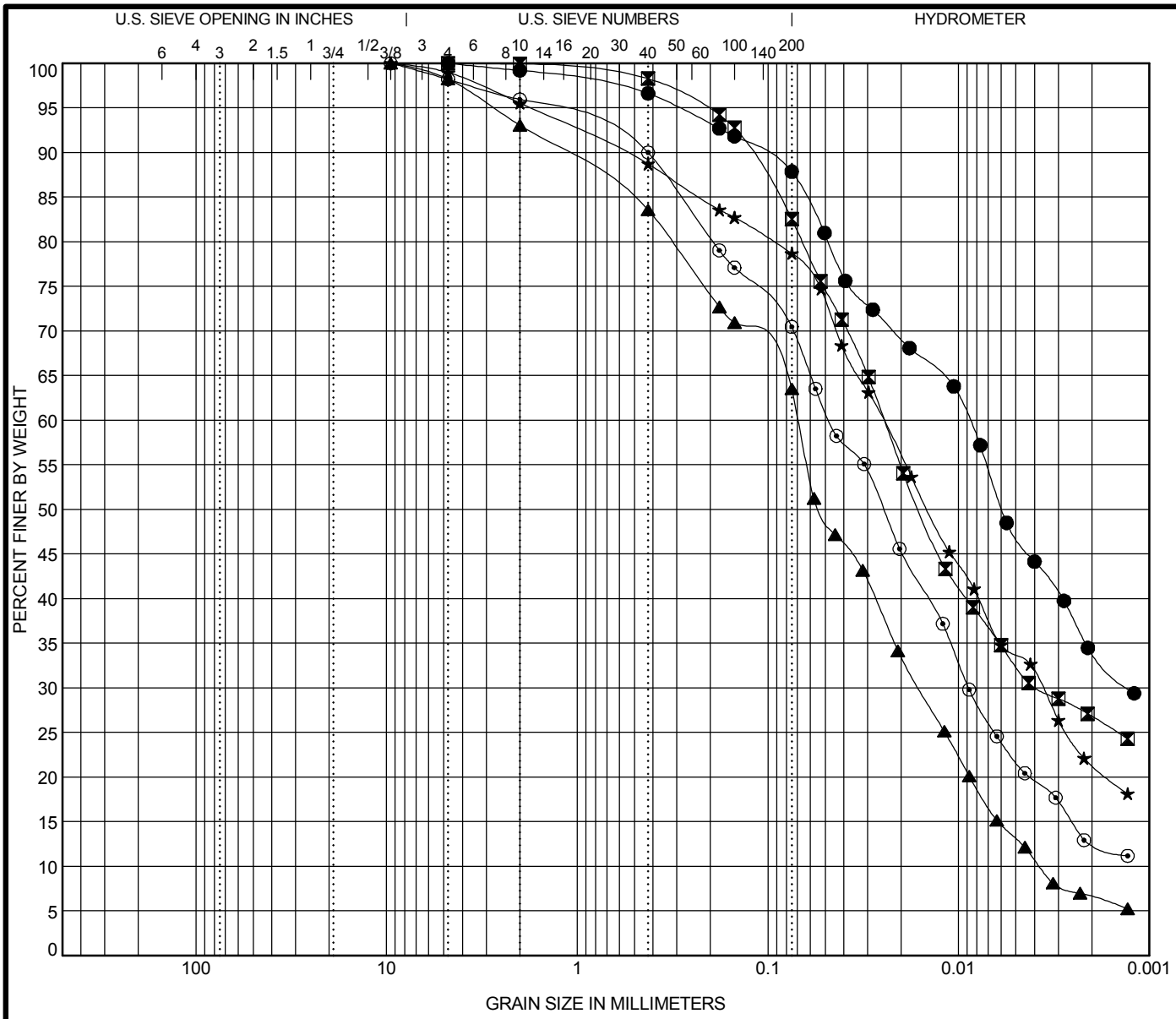
Location: Lake County, Illinois

Number: 786-40-01



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		USCS Classification	LL	PL	PI	Cc	Cu
●	4NE-12#4	6.0 ft	**LEAN CLAY(CL)**	**43**	**18**	**25**		
⊠	4NE-TC-02#3	4.0 ft	**LEAN CLAY with SAND(CL)**	**39**	**17**	**22**		
▲	4NE-TC-03#12	22.0 ft	**SANDY SILT(ML)**	**16**	**13**	**3**	**0.99**	**18.50**
★	4NE-TC-04#5	8.0 ft	**LEAN CLAY with SAND(CL)**	**27**	**16**	**11**		
⊙	4NE-TC-05#4	6.0 ft	**LEAN CLAY with SAND(CL)**	**21**	**12**	**9**		

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	4NE-12#4	6.0 ft	**4.75**	**0.009**	**0.001**		**0.0**	**12.1**	**40.8**	**47.0**
⊠	4NE-TC-02#3	4.0 ft	**4.75**	**0.025**	**0.004**		**0.0**	**17.4**	**50.1**	**32.5**
▲	4NE-TC-03#12	22.0 ft	**9.5**	**0.069**	**0.016**	**0.004**	**1.8**	**34.7**	**50.4**	**13.1**
★	4NE-TC-04#5	8.0 ft	**9.5**	**0.025**	**0.004**		**1.0**	**20.3**	**45.0**	**33.7**
⊙	4NE-TC-05#4	6.0 ft	**9.5**	**0.048**	**0.009**		**1.8**	**27.7**	**48.7**	**21.7**

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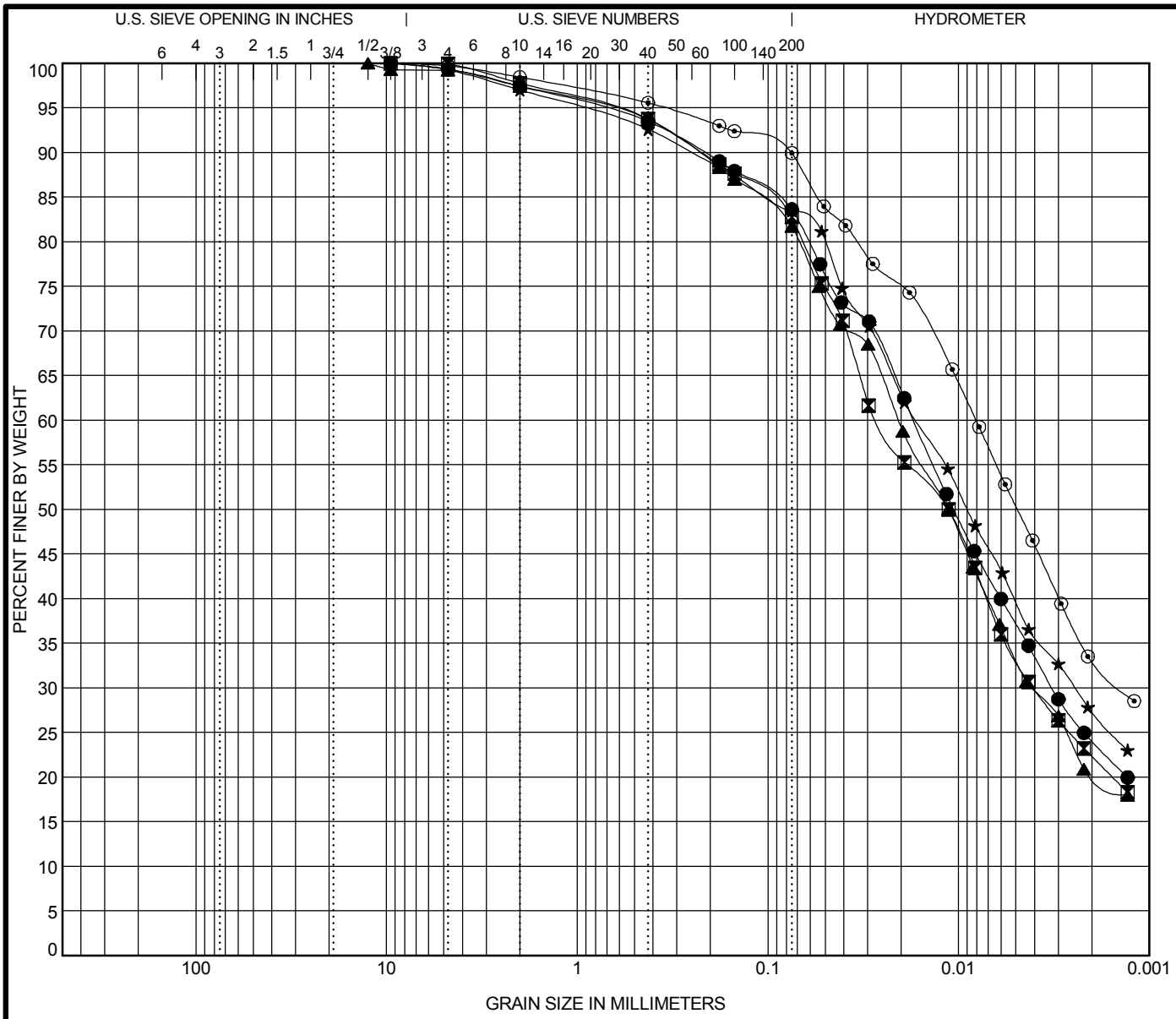

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		USCS Classification	LL	PL	PI	Cc	Cu
●	4NE-TC-06#6	10.0 ft	**LEAN CLAY with SAND(CL)**	**27**	**14**	**13**		
⊠	4NE-TC-07#7	12.0 ft	**LEAN CLAY with SAND(CL)**	**26**	**14**	**12**		
▲	4NE-TC-08#3	4.0 ft	**LEAN CLAY with SAND(CL)**	**32**	**15**	**17**		
★	4NE-TC-10#4	6.0 ft	**LEAN CLAY with SAND(CL)**	**31**	**16**	**15**		
⊙	4NE-TC-11#6	10.0 ft	**LEAN CLAY(CL)**	**38**	**16**	**22**		

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	4NE-TC-06#6	10.0 ft	**9.5**	**0.017**	**0.003**		**0.7**	**15.7**	**46.5**	**37.1**
⊠	4NE-TC-07#7	12.0 ft	**9.5**	**0.026**	**0.004**		**0.1**	**17.2**	**49.7**	**33.1**
▲	4NE-TC-08#3	4.0 ft	**12.5**	**0.021**	**0.004**		**0.8**	**17.5**	**48.5**	**33.2**
★	4NE-TC-10#4	6.0 ft	**9.5**	**0.017**	**0.002**		**0.7**	**15.8**	**43.9**	**39.6**
⊙	4NE-TC-11#6	10.0 ft	**9.5**	**0.008**	**0.001**		**0.3**	**9.8**	**39.6**	**50.3**

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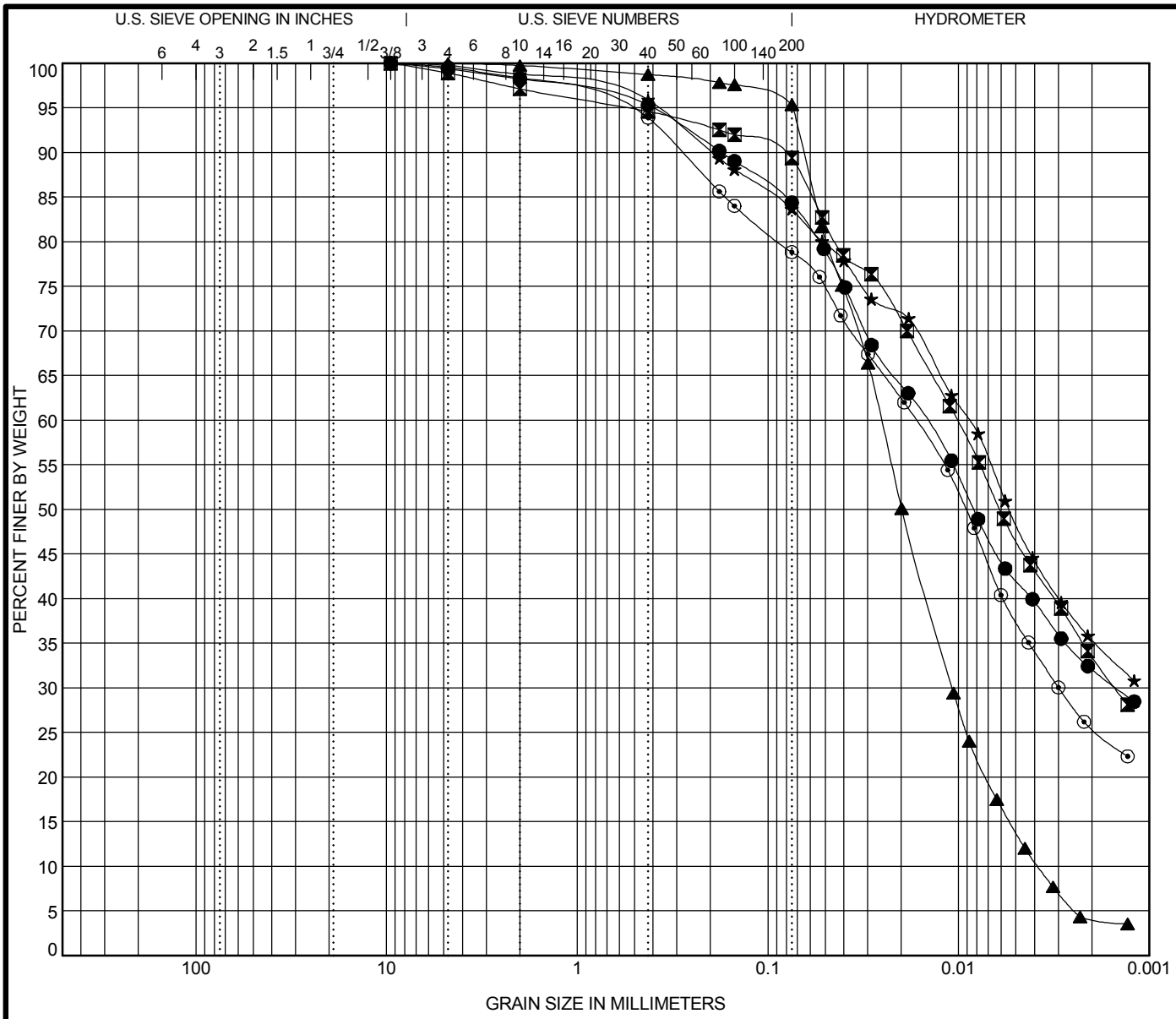

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		USCS Classification	LL	PL	PI	Cc	Cu
●	4NE-TC-12#3	4.0 ft	**LEAN CLAY with SAND(CL)**	**41**	**17**	**24**		
⊠	4NE-TC-13#6	10.0 ft	**LEAN CLAY(CL)**	**34**	**14**	**20**		
▲	4NE-TC-14#6	10.0 ft	**SILT(ML)**	**NP**	**NP**	**NP**	**1.20**	**6.64**
★	4NE-TC-15#2	2.0 ft	**FAT CLAY with SAND(CH)**	**50**	**18**	**32**		
⊙	4NE-TC-16#2	2.0 ft	**LEAN CLAY with SAND(CL)**	**34**	**17**	**17**		

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	4NE-TC-12#3	4.0 ft	**9.5**	**0.015**	**0.001**		**0.6**	**15.0**	**42.4**	**42.0**
⊠	4NE-TC-13#6	10.0 ft	**9.5**	**0.01**	**0.002**		**1.1**	**9.5**	**42.8**	**46.6**
▲	4NE-TC-14#6	10.0 ft	**4.75**	**0.025**	**0.011**	**0.004**	**0.0**	**4.6**	**81.6**	**13.8**
★	4NE-TC-15#2	2.0 ft	**9.5**	**0.009**			**0.2**	**16.1**	**35.3**	**48.4**
⊙	4NE-TC-16#2	2.0 ft	**9.5**	**0.017**	**0.003**		**0.5**	**20.7**	**41.4**	**37.5**

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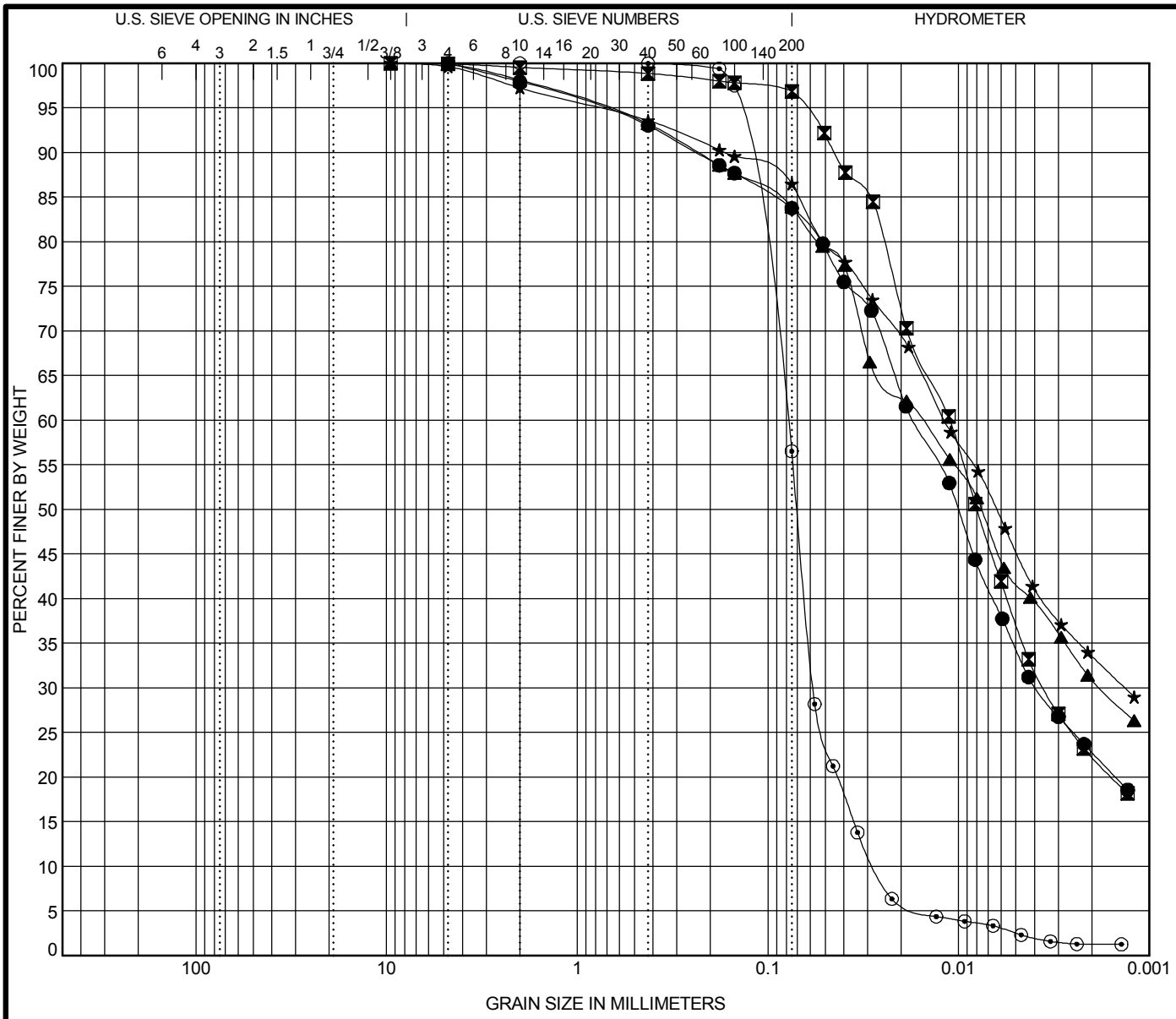

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		USCS Classification	LL	PL	PI	Cc	Cu
●	4NE-TC-17#6	10.0 ft	**LEAN CLAY with SAND(CL)**	**28**	**15**	**13**		
⊠	4NE-TC-18#8	14.0 ft	**LEAN CLAY(CL)**	**24**	**14**	**10**		
▲	4NE-TC-19#2	2.0 ft	**LEAN CLAY with SAND(CL)**	**34**	**16**	**18**		
★	4NE-TC-20#7	12.0 ft	**LEAN CLAY(CL)**	**33**	**16**	**17**		
⊙	4NW-02#4	6.0 ft	**SANDY SILT(ML)**	**NP**	**NP**	**NP**	**1.54**	**2.90**

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	4NE-TC-17#6	10.0 ft	**4.75**	**0.017**	**0.004**		**0.0**	**16.2**	**49.4**	**34.3**
⊠	4NE-TC-18#8	14.0 ft	**9.5**	**0.011**	**0.004**		**0.1**	**3.1**	**59.7**	**37.2**
▲	4NE-TC-19#2	2.0 ft	**9.5**	**0.016**	**0.002**		**0.1**	**16.0**	**42.0**	**41.9**
★	4NE-TC-20#7	12.0 ft	**9.5**	**0.012**	**0.001**		**0.4**	**13.1**	**41.2**	**45.3**
⊙	4NW-02#4	6.0 ft	**2**	**0.08**	**0.058**	**0.027**	**0.0**	**43.5**	**54.0**	**2.5**

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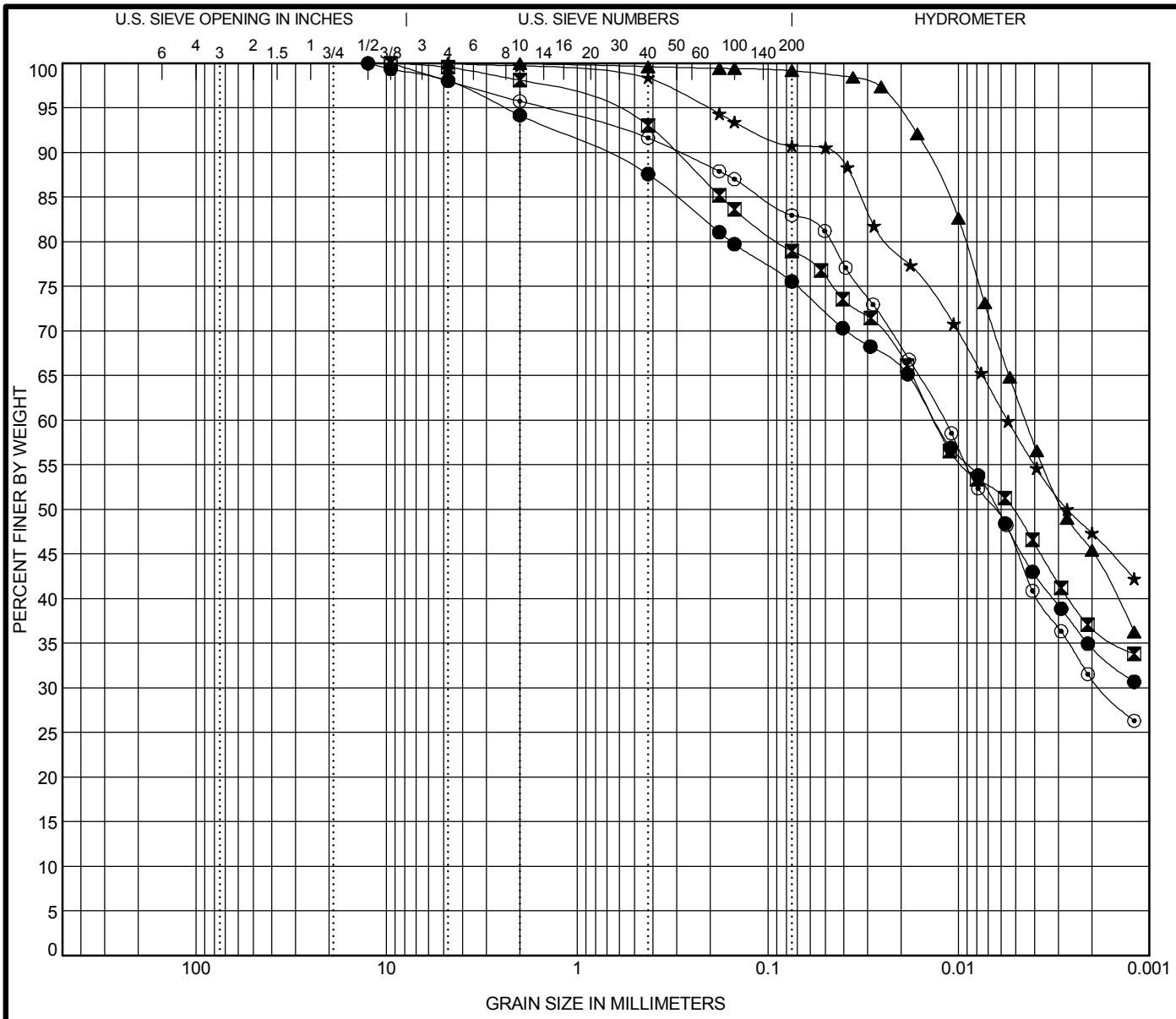

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		USCS Classification	LL	PL	PI	Cc	Cu
●	4NW-03#3	4.0 ft	**LEAN CLAY with SAND(CL)**	**37**	**17**	**20**		
⊠	4NW-04#2	2.0 ft	**LEAN CLAY with SAND(CL)**	**47**	**18**	**29**		
▲	4NW-05#4	6.0 ft	**LEAN CLAY(CL)**	**37**	**18**	**19**		
★	4NW-06#2	2.0 ft	**FAT CLAY(CH)**	**58**	**20**	**38**		
⊙	4NW-07#4	6.0 ft	**LEAN CLAY with SAND(CL)**	**29**	**16**	**13**		

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	4NW-03#3	4.0 ft	**12.5**	**0.013**			**2.0**	**22.5**	**29.3**	**46.3**
⊠	4NW-04#2	2.0 ft	**9.5**	**0.013**			**0.5**	**20.6**	**29.6**	**49.4**
▲	4NW-05#4	6.0 ft	**4.75**	**0.004**			**0.0**	**0.8**	**36.3**	**62.9**
★	4NW-06#2	2.0 ft	**4.75**	**0.006**			**0.0**	**9.3**	**32.3**	**58.4**
⊙	4NW-07#4	6.0 ft	**9.5**	**0.012**	**0.002**		**2.0**	**15.0**	**37.4**	**45.6**

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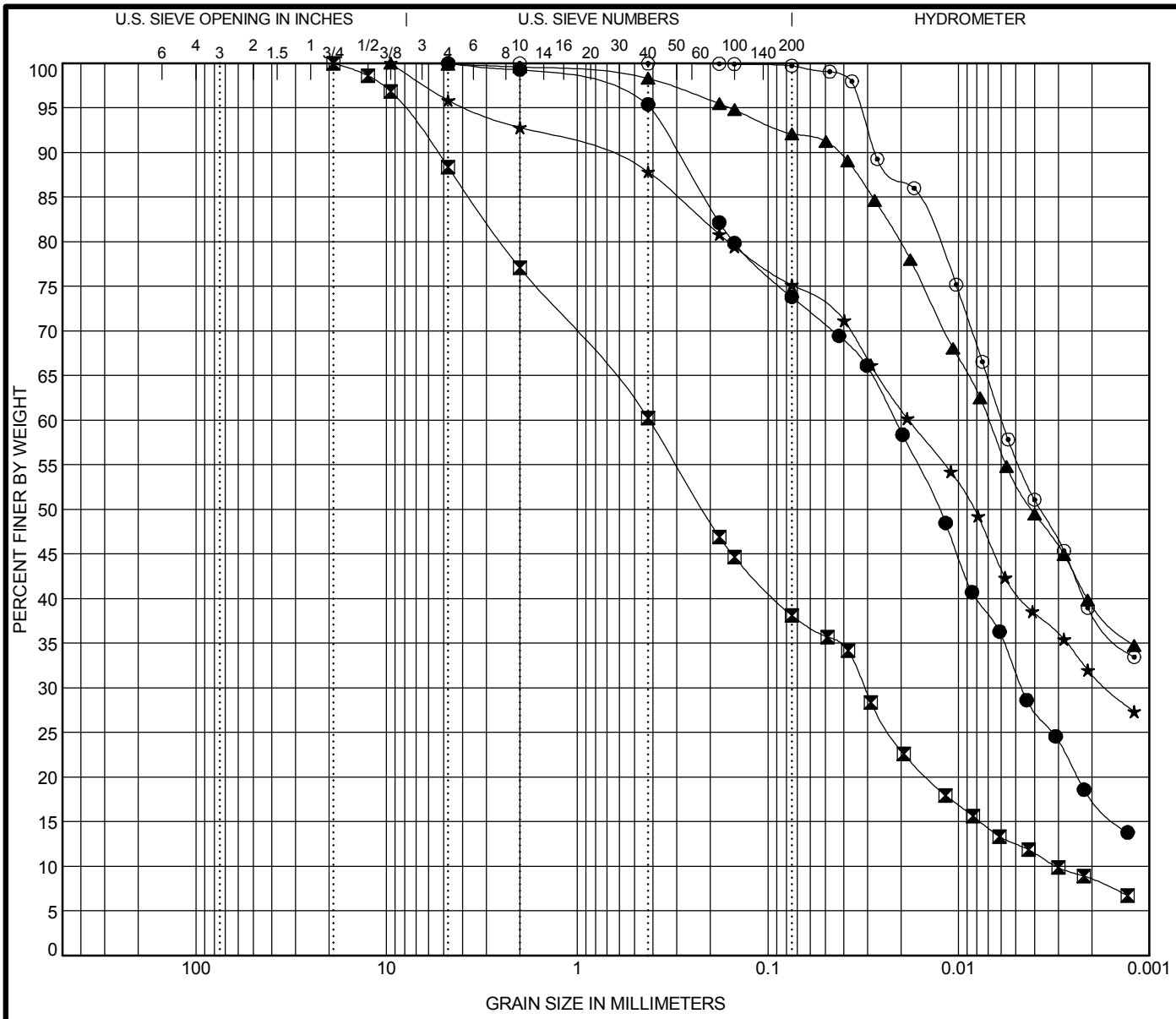

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		USCS Classification	LL	PL	PI	Cc	Cu
●	4NW-09#3	4.0 ft	**FAT CLAY with SAND(CH)**	**55**	**28**	**27**		
⊠	4NW-09#6	10.0 ft	**SILTY SAND(SM)**	**NP**	**NP**	**NP**	**0.75**	**136.15**
▲	4NW-10#4	6.0 ft	**FAT CLAY(CH)**	**51**	**20**	**31**		
★	4NW-11#3	4.0 ft	**LEAN CLAY with SAND(CL)**	**40**	**18**	**22**		
⊙	4NW-11#10	18.0 ft	**LEAN CLAY(CL)**	**33**	**16**	**17**		

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	4NW-09#3	4.0 ft	**4.75**	**0.022**	**0.005**		**0.0**	**26.2**	**42.2**	**31.6**
⊠	4NW-09#6	10.0 ft	**19**	**0.419**	**0.031**	**0.003**	**11.6**	**50.2**	**25.6**	**12.5**
▲	4NW-10#4	6.0 ft	**9.5**	**0.007**			**0.1**	**7.8**	**39.1**	**53.0**
★	4NW-11#3	4.0 ft	**9.5**	**0.018**	**0.002**		**4.1**	**20.7**	**34.3**	**40.8**
⊙	4NW-11#10	18.0 ft	**2**	**0.006**			**0.0**	**0.3**	**43.9**	**55.8**

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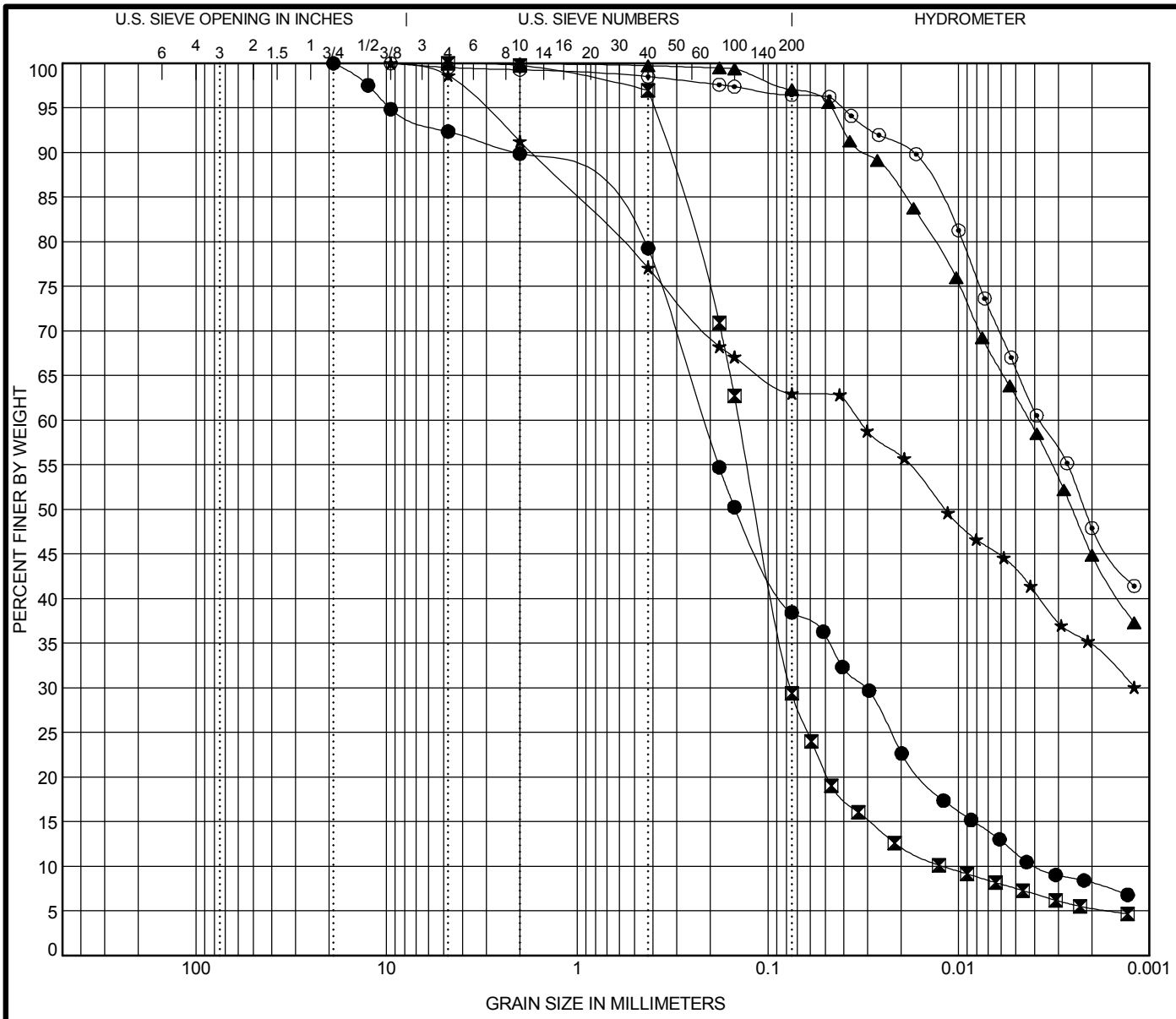

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		USCS Classification	LL	PL	PI	Cc	Cu
●	4NW-15#3	4.0 ft	**CLAYEY SAND(SC)**	**54**	**17**	**37**	**1.11**	**55.23**
⊠	4NW-18#3	4.0 ft	**SILTY SAND(SM)**	**NP**	**NP**	**NP**	**3.35**	**11.69**
▲	4NW-18#4	6.0 ft	**LEAN CLAY(CL)**	**35**	**16**	**19**		
★	4NW-TC-02#3	4.0 ft	**SANDY FAT CLAY(CH)**	**51**	**18**	**33**		
⊙	4NW-TC-03#4	6.0 ft	**LEAN CLAY(CL)**	**43**	**17**	**26**		

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	4NW-15#3	4.0 ft	**19**	**0.217**	**0.031**	**0.004**	**7.6**	**53.9**	**27.0**	**11.5**
⊠	4NW-18#3	4.0 ft	**4.75**	**0.142**	**0.076**	**0.012**	**0.0**	**70.6**	**21.9**	**7.5**
▲	4NW-18#4	6.0 ft	**4.75**	**0.004**			**0.0**	**2.9**	**34.5**	**62.6**
★	4NW-TC-02#3	4.0 ft	**9.5**	**0.033**			**1.4**	**35.6**	**19.9**	**43.1**
⊙	4NW-TC-03#4	6.0 ft	**9.5**	**0.004**			**0.5**	**3.1**	**30.7**	**65.8**

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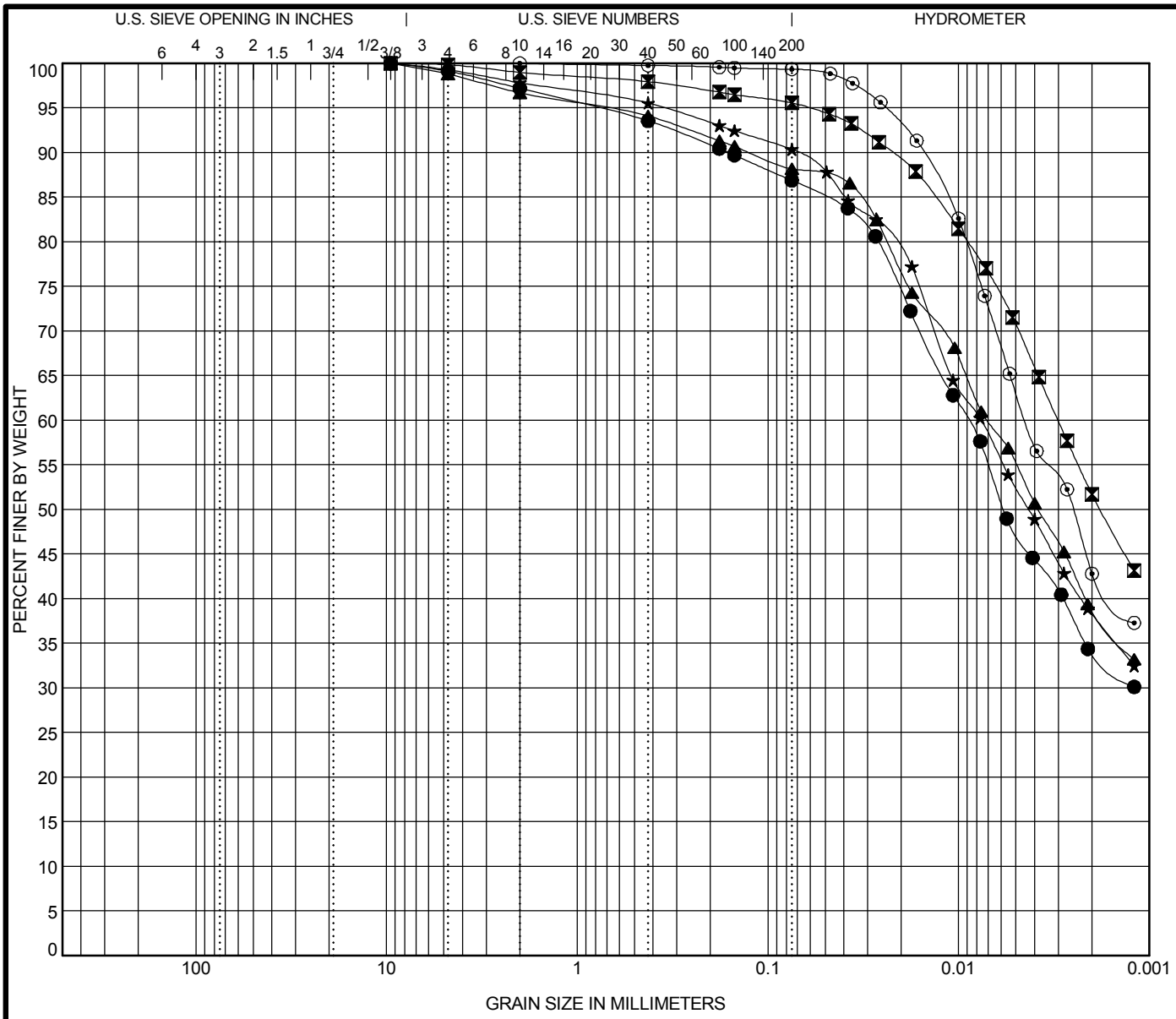

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		USCS Classification	LL	PL	PI	Cc	Cu
●	4NW-TC-04#4	6.0 ft	**LEAN CLAY(CL)**	**32**	**14**	**18**		
⊠	4NW-TC-04#11	20.0 ft	**LEAN CLAY(CL)**	**40**	**17**	**23**		
▲	4NW-TC-05#4	6.0 ft	**LEAN CLAY(CL)**	**37**	**16**	**21**		
★	4NW-TC-05#14	26.0 ft	**LEAN CLAY(CL)**	**32**	**15**	**17**		
⊙	4NW-TC-06#4	6.0 ft	**LEAN CLAY(CL)**	**39**	**17**	**22**		

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	4NW-TC-04#4	6.0 ft	**9.5**	**0.009**			**0.9**	**12.2**	**39.5**	**47.4**
⊠	4NW-TC-04#11	20.0 ft	**9.5**	**0.003**			**0.2**	**4.3**	**24.9**	**70.7**
▲	4NW-TC-05#4	6.0 ft	**9.5**	**0.007**			**1.2**	**10.6**	**33.1**	**55.0**
★	4NW-TC-05#14	26.0 ft	**9.5**	**0.008**			**0.7**	**8.9**	**38.0**	**52.4**
⊙	4NW-TC-06#4	6.0 ft	**2**	**0.004**			**0.0**	**0.7**	**36.2**	**63.2**

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Location: Lake County, Illinois

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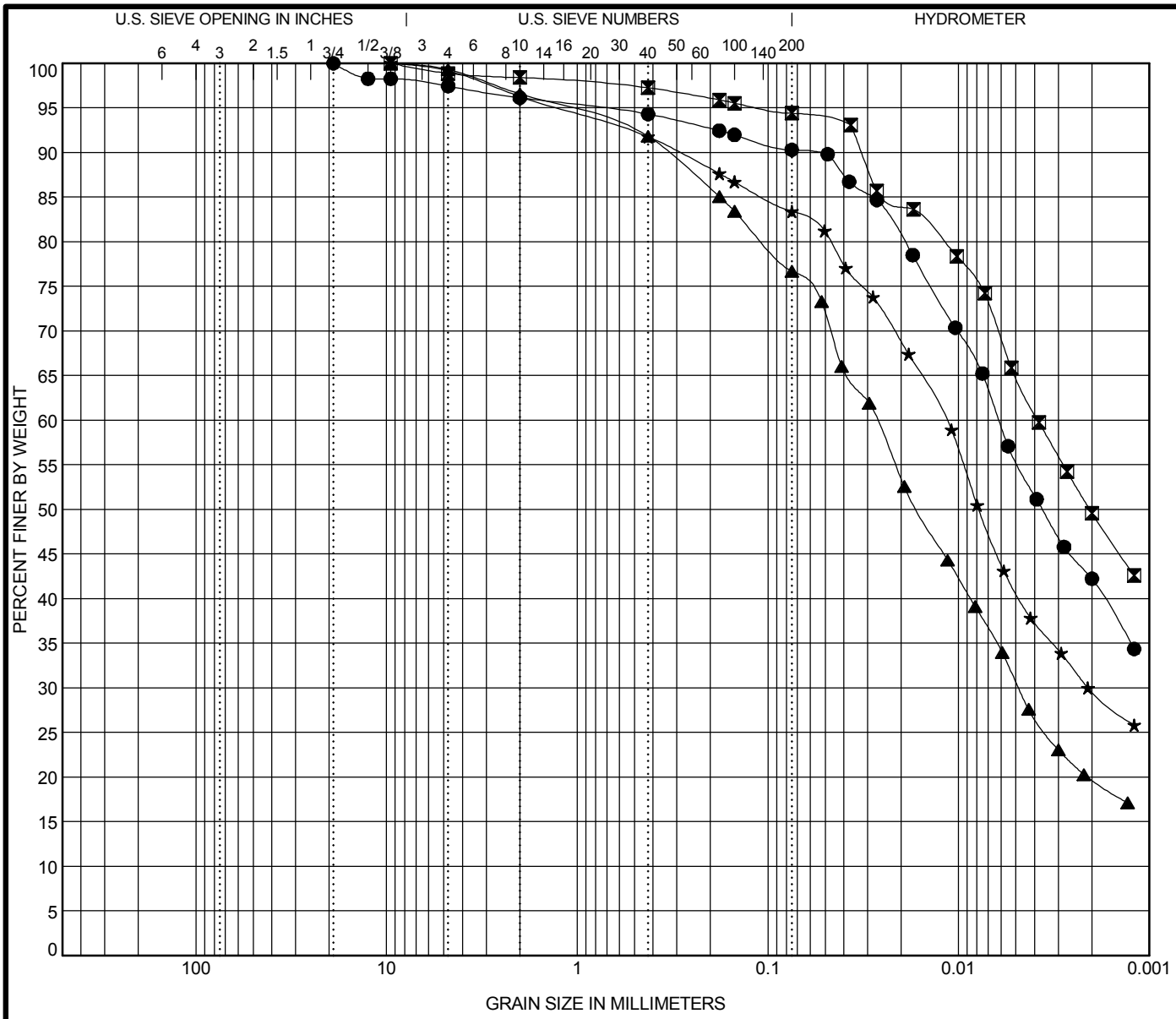

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		USCS Classification	LL	PL	PI	Cc	Cu
●	4NW-TC-06#11	20.0 ft	**LEAN CLAY(CL)**	**35**	**16**	**19**		
⊠	4NW-TC-06#15	28.0 ft	**LEAN CLAY(CL)**	**38**	**17**	**21**		
▲	4NW-TC-09#8	14.0 ft	**LEAN CLAY with SAND(CL)**	**21**	**12**	**9**		
★	4NW-TC-10#5	8.0 ft	**LEAN CLAY with SAND(CL)**	**29**	**13**	**16**		

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	4NW-TC-06#11	20.0 ft	**19**	**0.006**			**2.6**	**7.1**	**34.9**	**55.4**
⊠	4NW-TC-06#15	28.0 ft	**9.5**	**0.004**			**1.1**	**4.4**	**29.6**	**64.8**
▲	4NW-TC-09#8	14.0 ft	**9.5**	**0.027**	**0.005**		**0.7**	**22.6**	**46.1**	**30.6**
★	4NW-TC-10#5	8.0 ft	**9.5**	**0.012**	**0.002**		**0.8**	**15.8**	**42.7**	**40.7**

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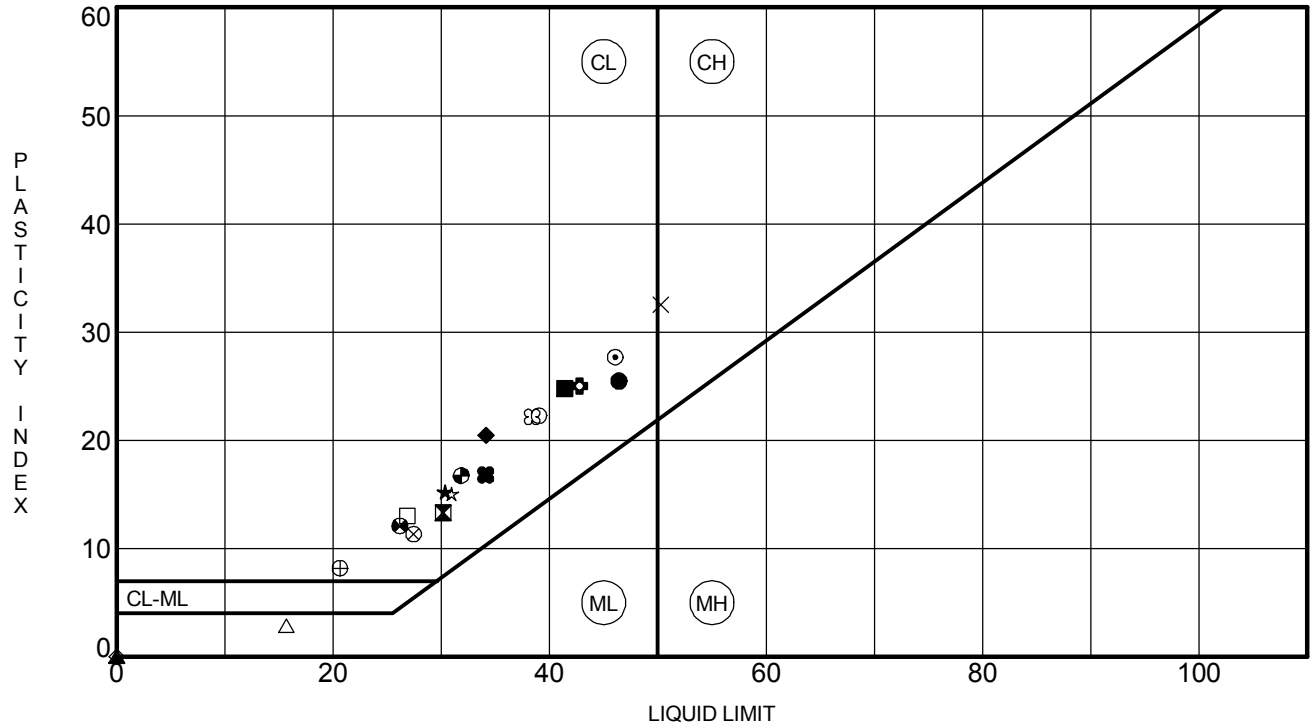
1145 N Main Street
Lombard, IL 60148
Telephone: 630 953-9928
Fax: 630 953-9938

GRAIN SIZE DISTRIBUTION

Project: CLCJAWA System Expansion

Location: Lake County, Illinois

Number: 786-40-01



	Specimen Identification		LL	PL	PI	Fines	USCS Classification
●	4NE-04#4	6.0 ft	46	21	25	91	LEAN CLAY(CL)
⊠	4NE-06#3	4.0 ft	30	17	13	79	LEAN CLAY with SAND(CL)
▲	4NE-08#3	4.0 ft	NP	NP	NP	69	SANDY SILT(ML)
★	4NE-10#3	4.0 ft	30	15	15	86	LEAN CLAY(CL)
⊙	4NE-11#2	2.0 ft	46	18	28	88	LEAN CLAY(CL)
✿	4NE-12#4	6.0 ft	43	18	25	88	LEAN CLAY(CL)
○	4NE-TC-02#3	4.0 ft	39	17	22	83	LEAN CLAY with SAND(CL)
△	4NE-TC-03#12	22.0 ft	16	13	3	64	SANDY SILT(ML)
⊗	4NE-TC-04#5	8.0 ft	27	16	11	79	LEAN CLAY with SAND(CL)
⊕	4NE-TC-05#4	6.0 ft	21	12	9	70	LEAN CLAY with SAND(CL)
□	4NE-TC-06#6	10.0 ft	27	14	13	84	LEAN CLAY with SAND(CL)
⊞	4NE-TC-07#7	12.0 ft	26	14	12	83	LEAN CLAY with SAND(CL)
◕	4NE-TC-08#3	4.0 ft	32	15	17	82	LEAN CLAY with SAND(CL)
☆	4NE-TC-10#4	6.0 ft	31	16	15	83	LEAN CLAY with SAND(CL)
⊠	4NE-TC-11#6	10.0 ft	38	16	22	90	LEAN CLAY(CL)
■	4NE-TC-12#3	4.0 ft	41	17	24	84	LEAN CLAY with SAND(CL)
◆	4NE-TC-13#6	10.0 ft	34	14	20	89	LEAN CLAY(CL)
◇	4NE-TC-14#6	10.0 ft	NP	NP	NP	95	SILT(ML)
×	4NE-TC-15#2	2.0 ft	50	18	32	84	FAT CLAY with SAND(CH)
⊠	4NE-TC-16#2	2.0 ft	34	17	17	79	LEAN CLAY with SAND(CL)

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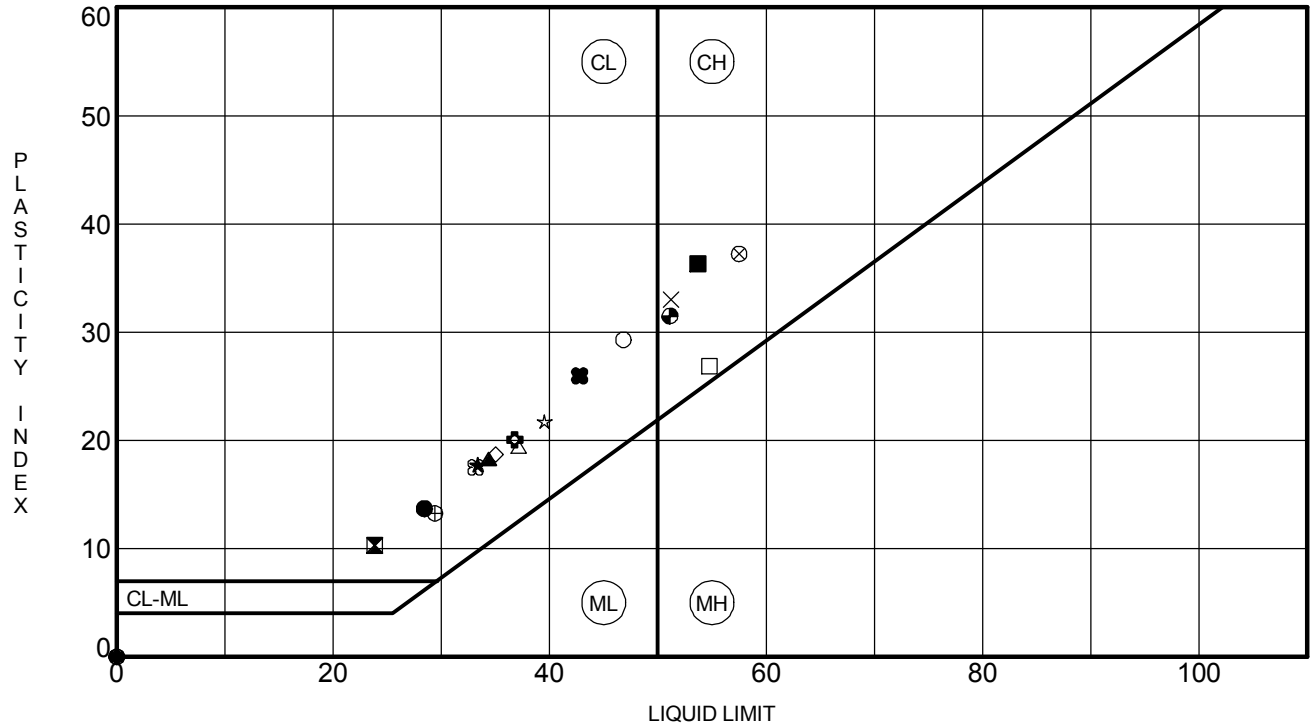
1145 N Main Street
Lombard, IL 60148
Telephone: 630 953-9928
Fax: 630 953-9938

ATTERBERG LIMITS' RESULTS

Project: CLCJAWA System Expansion

Location: Lake County, Illinois

Number: 786-40-01



	Specimen Identification		LL	PL	PI	Fines	USCS Classification
●	4NE-TC-17#6	10.0 ft	28	15	13	84	LEAN CLAY with SAND(CL)
⊠	4NE-TC-18#8	14.0 ft	24	14	10	97	LEAN CLAY(CL)
▲	4NE-TC-19#2	2.0 ft	34	16	18	84	LEAN CLAY with SAND(CL)
★	4NE-TC-20#7	12.0 ft	33	16	17	87	LEAN CLAY(CL)
⊙	4NW-02#4	6.0 ft	NP	NP	NP	57	SANDY SILT(ML)
✿	4NW-03#3	4.0 ft	37	17	20	76	LEAN CLAY with SAND(CL)
○	4NW-04#2	2.0 ft	47	18	29	79	LEAN CLAY with SAND(CL)
△	4NW-05#4	6.0 ft	37	18	19	99	LEAN CLAY(CL)
⊗	4NW-06#2	2.0 ft	58	20	38	91	FAT CLAY(CH)
⊕	4NW-07#4	6.0 ft	29	16	13	83	LEAN CLAY with SAND(CL)
□	4NW-09#3	4.0 ft	55	28	27	74	FAT CLAY with SAND(CH)
⊞	4NW-09#6	10.0 ft	NP	NP	NP	38	SILTY SAND(SM)
◕	4NW-10#4	6.0 ft	51	20	31	92	FAT CLAY(CH)
☆	4NW-11#3	4.0 ft	40	18	22	75	LEAN CLAY with SAND(CL)
⊠	4NW-11#10	18.0 ft	33	16	17	100	LEAN CLAY(CL)
■	4NW-15#3	4.0 ft	54	17	37	38	CLAYEY SAND(SC)
◆	4NW-18#3	4.0 ft	NP	NP	NP	29	SILTY SAND(SM)
◇	4NW-18#4	6.0 ft	35	16	19	97	LEAN CLAY(CL)
╳	4NW-TC-02#3	4.0 ft	51	18	33	63	SANDY FAT CLAY(CH)
✖	4NW-TC-03#4	6.0 ft	43	17	26	96	LEAN CLAY(CL)

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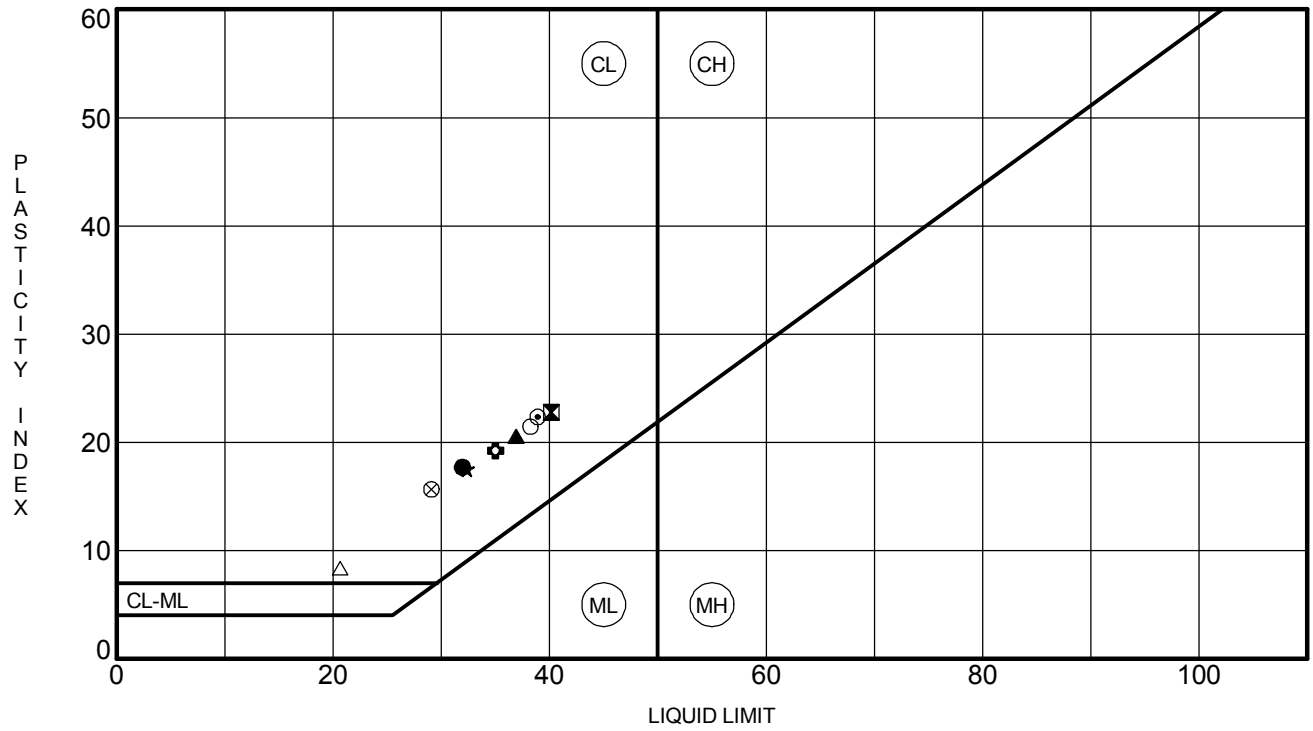
1145 N Main Street
Lombard, IL 60148
Telephone: 630 953-9928
Fax: 630 953-9938

ATTERBERG LIMITS' RESULTS

Project: CLCJAWA System Expansion

Location: Lake County, Illinois

Number: 786-40-01



	Specimen Identification		LL	PL	PI	Fines	USCS Classification
●	4NW-TC-04#4	6.0 ft	32	14	18	87	LEAN CLAY(CL)
⧗	4NW-TC-04#11	20.0 ft	40	17	23	96	LEAN CLAY(CL)
▲	4NW-TC-05#4	6.0 ft	37	16	21	88	LEAN CLAY(CL)
★	4NW-TC-05#14	26.0 ft	32	15	17	90	LEAN CLAY(CL)
⊙	4NW-TC-06#4	6.0 ft	39	17	22	99	LEAN CLAY(CL)
✿	4NW-TC-06#11	20.0 ft	35	16	19	90	LEAN CLAY(CL)
○	4NW-TC-06#15	28.0 ft	38	17	21	94	LEAN CLAY(CL)
△	4NW-TC-09#8	14.0 ft	21	12	9	77	LEAN CLAY with SAND(CL)
⊗	4NW-TC-10#5	8.0 ft	29	13	16	83	LEAN CLAY with SAND(CL)

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1145 N Main Street
Lombard, IL 60148
Telephone: 630 953-9928
Fax: 630 953-9938

ATTERBERG LIMITS' RESULTS

Project: CLCJAWA System Expansion

Location: Lake County, Illinois

Number: 786-40-01

WEI_ATTERBERG_LIMITS USCS 7864001.GPJ US_LAB.GDT 12/15/14

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1145 North Main Street
Lombard, Illinois 60148
Phone (630) 953-9928
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Project: Central Lake County Joint Water Agency North Group System Expansion

Location: Lake County, Illinois

Wang No.: 786-40-01

Sample Identification				Moisture Content	Atterberg Limits				USCS Soil Classification	Burmister (1950) Soil Classification	Particle Size Analysis									Organic Content (LOI)
Boring ID	Sample No.	Sample Depth (feet)	Sample Elevation (feet)	D 2216 w_N %	L_L %	D 4318 P_L %	P_I %	I_L	D 2488		Gravel %	Sand %	Silt %	Clay %	D 422 D_{90}	D_{60}	D_{50}	D_{30}	D_{10}	D 2974 OC %
4NE-04	4	7	718.85	54	46	21	25	1.31	LEAN CLAY (CL)	SILTY CLAY, trace Sand	0.0	8.5	58.7	32.7	0.1	0.0	0.0	0.0	--	--
4NE-06	3	5	722.06	22	30	17	13	0.38	LEAN CLAY with SAND (CL)s	CLAY & SILT, little Sand	2.6	18.6	39.9	38.9	0.4	0.0	0.0	0.0	--	--
4NE-08	3	5	746.94	20	NP	NP	NP	NP	SANDY SILT (ML)	SILT, some Sand	0.0	30.5	64.3	5.1	0.2	0.1	0.0	0.0	0.0	--
4NE-10	3	5	737.85	14	30	15	15	-0.10	LEAN CLAY (CL)	CLAY & SILT, little Sand, trace Gravel	1.2	13.1	46.5	39.2	0.2	0.0	0.0	0.0		--
4NE-11	2	3	743.56	33	46	18	28	0.54	LEAN CLAY (CL)	SILTY CLAY, little Sand	0.4	11.8	39.8	48.0	0.1	0.0	0.0	--	--	--
4NE-12	4	7	756.33	23	43	18	25	0.22	LEAN CLAY (CL)	SILTY CLAY, little Sand	0.0	12.1	40.8	47.0	0.1	0.0	0.0	0.0	--	--
4NE-TC-02	3	5	729.98	26	39	17	22	0.40	LEAN CLAY with SAND (CL)s	SILTY CLAY, little Sand	0.0	17.4	50.1	32.5	0.1	0.0	0.0	0.0	--	--
4NE-TC-03	12	23	726.42	11	16	13	3	-0.53	SANDY SILT (ML)	CLAYEY SILT, some Sand, trace Gravel	1.8	34.7	50.4	13.1	1.2	0.1	0.1	0.0	0.0	--
4NE-TC-04	5	9	767.49	18	27	16	11	0.19	LEAN CLAY with SAND (CL)s	CLAY & SILT, some Sand, trace Gravel	1.0	20.3	45.0	33.7	0.6	0.0	0.0	0.0	--	--
4NE-TC-05	4	7	757.31	12	21	12	8	0.00	LEAN CLAY with SAND (CL)s	SILTY CLAY, some Sand, trace Gravel	1.8	27.7	48.7	21.7	0.4	0.0	0.0	0.0	--	--
4NE-TC-06	6	11	752.83	15	27	14	13	0.07	LEAN CLAY with SAND (CL)s	CLAY & SILT, little Sand	0.7	15.7	46.5	37.1	0.2	0.0	0.0	0.0	--	--
4NE-TC-07	7	13	755.71	15	26	14	12	0.05	LEAN CLAY with SAND (CL)s	CLAY & SILT, little Sand	0.1	17.2	49.7	33.1	0.2	0.0	0.0	0.0	--	--
4NE-TC-08	3	5	755.77	22	32	15	17	0.39	LEAN CLAY with SAND (CL)s	CLAY & SILT, little Sand	0.8	17.5	48.5	33.2	0.2	0.0	0.0	0.0	--	--
4NE-TC-10	4	7	766.35	16	31	16	15	-0.02	LEAN CLAY with SAND (CL)s	CLAY & SILT, little Sand	0.7	15.8	43.9	39.6	0.3	0.0	0.0	0.0	--	--
4NE-TC-11	6	11	759.87	18	38	16	22	0.07	LEAN CLAY (CL)	SILTY CLAY, trace Sand	0.3	9.8	39.6	50.3	0.1	0.0	0.0	0.0	--	--
4NE-TC-12	3	5	781.26	22	41	17	25	0.21	LEAN CLAY with SAND (CL)s	SILTY CLAY, little Sand	0.6	15.0	42.4	42.0	0.2	0.0	0.0	0.0	--	--
4NE-TC-13	6	11	755.22	18	34	14	20	0.22	LEAN CLAY (CL)	SILTY CLAY, trace Sand, trace Gravel	1.1	9.5	42.8	46.6	0.1	0.0	0.0	0.0	--	--
4NE-TC-14	6	11	752.92	19	NP	NP	NP	NP	SILT (ML)	SILT, trace Sand	0.0	4.6	81.6	13.8	0.1	0.0	0.0	0.0	0.0	--
4NE-TC-15	2	3	788.85	25	50	18	33	0.21	FAT CLAY with SAND(CH)	SILTY CLAY, little Sand	0.2	16.1	35.3	48.4	0.2	0.0	0.0	--	--	6.4
4NE-TC-16	2	3	779.26	29	34	17	17	0.67	LEAN CLAY with SAND (CL)s	CLAY & SILT, some Sand	0.5	20.7	41.4	37.5	0.3	0.0	0.0	0.0	--	--
4NE-TC-17	6	11	761.51	15	28	15	14	0.05	LEAN CLAY with SAND (CL)s	CLAY & SILT, little Sand	0.0	16.2	49.4	34.3	0.2	0.0	0.0	0.0	--	--
4NE-TC-18	8	15	737.92	14	24	14	10	0.05	LEAN CLAY (CL)	CLAY & SILT, trace Sand	0.1	3.1	59.7	37.2	0.0	0.0	0.0	0.0	--	--
4NE-TC-19	2	3	759.79	19	34	16	18	0.19	LEAN CLAY with SAND (CL)s	CLAY & SILT, little Sand	0.1	16.0	42.0	41.9	0.2	0.0	0.0	0.0	--	--
4NE-TC-20	7	13	729.5	17	33	16	18	0.10	LEAN CLAY (CL)	CLAY & SILT, little Sand	0.4	13.1	41.2	45.3	0.2	0.0	0.0	0.0	--	--
4NW-02	4	7	749.15	22	NP	NP	NP	NP	SANDY SILT (ML)	SILT, and Sand	0.0	43.5	54.0	2.5	0.1	0.1	0.1	0.1	0.0	--
4NW-03	3	5	769.19	20	37	17	20	0.17	LEAN CLAY with SAND (CL)s	SILTY CLAY, some Sand, trace Gravel	2.0	22.5	29.3	46.3	0.7	0.0	0.0	--	--	--
4NW-04	2	3	809.73	21	47	18	29	0.12	LEAN CLAY with SAND (CL)s	SILTY CLAY, some Sand	0.5	20.6	29.6	49.4	0.3	0.0	0.0	--	--	--
4NW-05	4	7	808.58	16	37	18	19	-0.11	LEAN CLAY (CL)	CLAY & SILT, trace Sand	0.0	0.8	36.3	62.9	0.0	0.0	0.0	--	--	--
4NW-06	2	3	776.83	22	58	20	37	0.06	FAT CLAY (CH)	SILTY CLAY, trace Sand	0.0	9.3	32.3	58.4	0.0	0.0	0.0	--	--	--
4NW-07	4	7	778.84	15	29	16	13	-0.10	LEAN CLAY with SAND (CL)s	CLAY & SILT, little Sand, trace Gravel	2.0	15.0	37.4	45.6	0.3	0.0	0.0	0.0	--	--
4NW-09	3	5	785.97	29	55	28	27	0.02	FAT CLAY with SAND (CH)s	SILTY CLAY, some Sand	0.0	26.2	42.2	31.6	0.3	0.0	0.0	0.0	--	6.9
4NW-09	6	11	785.97	18	NP	NP	NP	NP	SILTY SAND (SM)	SAND, some Silt, little Gravel	11.6	50.2	25.6	12.5	5.4	0.4	0.2	0.0	0.0	--
4NW-10	4	7	778.26	30	51	20	31	0.33	FAT CLAY (CH)	SILTY CLAY, trace Sand	0.1	7.8	39.1	53.0	0.0	0.0	0.0			6.4
4NW-11	3	5	784.98	25	40	18	22	0.31	LEAN CLAY with SAND (CL)s	SILTY CLAY, some Sand	4.1	20.7	34.3	40.8	0.8	0.0	0.0	0.0		--
4NW-11	4	7	782.98	27	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	4.9
4NW-11	7	13	776.98	507	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	84.3
4NW-11	10	19	770.98	25	33	16	17	0.55	LEAN CLAY (CL)	SILTY CLAY	0.0	0.3	43.9	55.8	0.0	0.0	0.0	--	--	6.6
4NW-15	2	3	804.93	26	54	17	36	0.25	CLAYEY SAND (SC)	SILTY CLAY, and Sand, trace Gravel	7.6	53.9	27.0	11.5	2.1	0.2	0.1	0.0	0.0	--
4NW-18	3	3	798.5	17	NP	NP	NP	NP	SILTY SAND (SM)	SAND, some Silt	0.0	70.6	21.9	7.5	0.3	0.1	0.1	0.1	0.0	--
4NW-18	4	7	796.5	22	35	16	19	0.30	LEAN CLAY (CL)	CLAY & SILT, trace Sand	0.0	2.9	34.5	62.6	0.0	0.0	0.0	--	--	--
4NW-TC-02	3	5	792.96	21	51	18	33	0.10	SANDY FAT CLAY s(CH)	SILTY CLAY, and Sand	1.4	35.6	19.9	43.1	1.7	0.0	0.0	--	--	--
4NW-TC-03	4	7	768.48	19	43	17	26	0.07	LEAN CLAY (CL)	SILTY CLAY, trace Sand	0.5	3.1	30.7	65.8	0.0	0.0	0.0	--	--	--
4NW-TC-04	4	7	788.35	14	32	14	18	-0.04	LEAN CLAY (CL)	CLAY & SILT, little Sand	0.9	12.2	39.5	47.4	0.2	0.0	0.0	--	--	--
4NW-TC-04	11	21	774.35	19	40	17	23	0.06	LEAN CLAY (CL)	SILTY CLAY, trace Sand	0.2	4.3	24.9	70.7	0.0	0.0	0.0	--	--	--
4NW-TC-05	4	7	800.06	21	37	16	21	0.22	LEAN CLAY (CL)	SILTY CLAY, little Sand, trace Gravel	1.2	10.6	33.1	55.0	0.1	0.0	0.0	--	--	--
4NW-TC-05	14	27	780.06	17	32	15	18	0.13	LEAN CLAY (CL)	CLAY & SILT, trace Sand	0.7	8.9	38.0	52.4	0.1	0.0	0.0	--	--	--
4NW-TC-06	4	7	799.06	24	39	17	22	0.34	LEAN CLAY (CL)	SILTY CLAY	0.0	0.7	36.2	63.2	0.0	0.0	0.0	--	--	--
4NW-TC-06	11	21	785.06	21	35	16	19	0.29	LEAN CLAY (CL)	CLAY & SILT, trace Sand, trace Gravel	2.6	7.1	34.9	55.4	0.1	0.0	0.0	--	--	--
4NW-TC-06	15	29	777.06	22	38	17	21	0.22	LEAN CLAY (CL)	SILTY CLAY, trace Sand, trace Gravel	1.1	4.4	29.6	64.8	0.0	0.0	0.0	--	--	--
4NW-TC-09	8	15	769.94	16	21	12	8	0.42	LEAN CLAY with SAND (CL)s	SILTY CLAY, some Sand	0.7	22.6	46.1	30.6	0.3	0.0	0.0	0.0	--	--
4NW-TC-10	5	9	775.39	18	29	13	16	0.30	LEAN CLAY with SAND (CL)s	CLAY & SILT, little Sand	0.8	15.8	42.7	40.7	0.3	0.0	0.0	0.0	--	--

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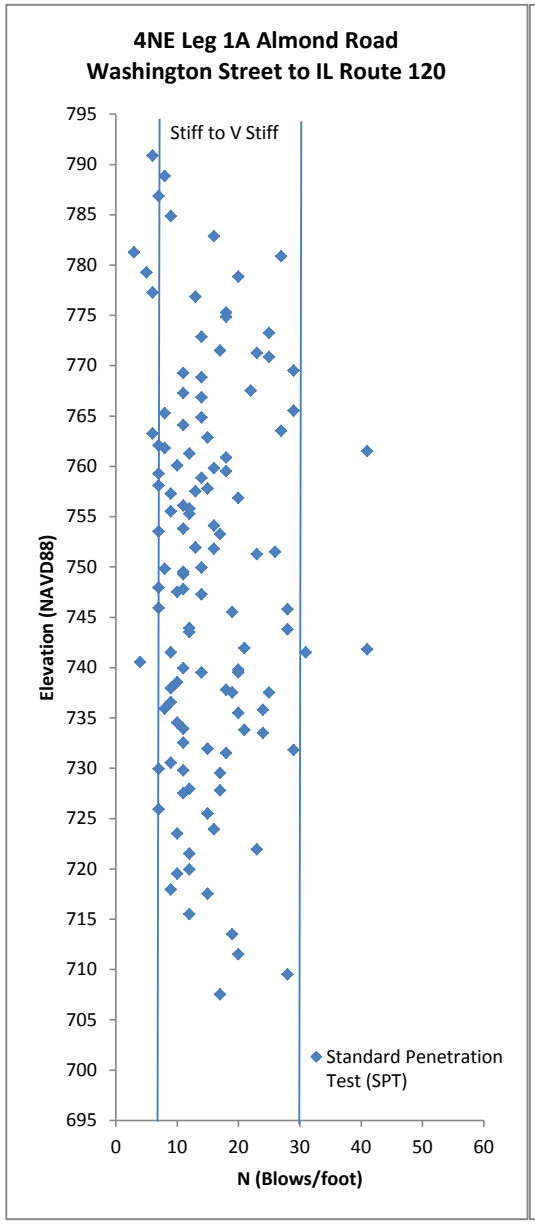

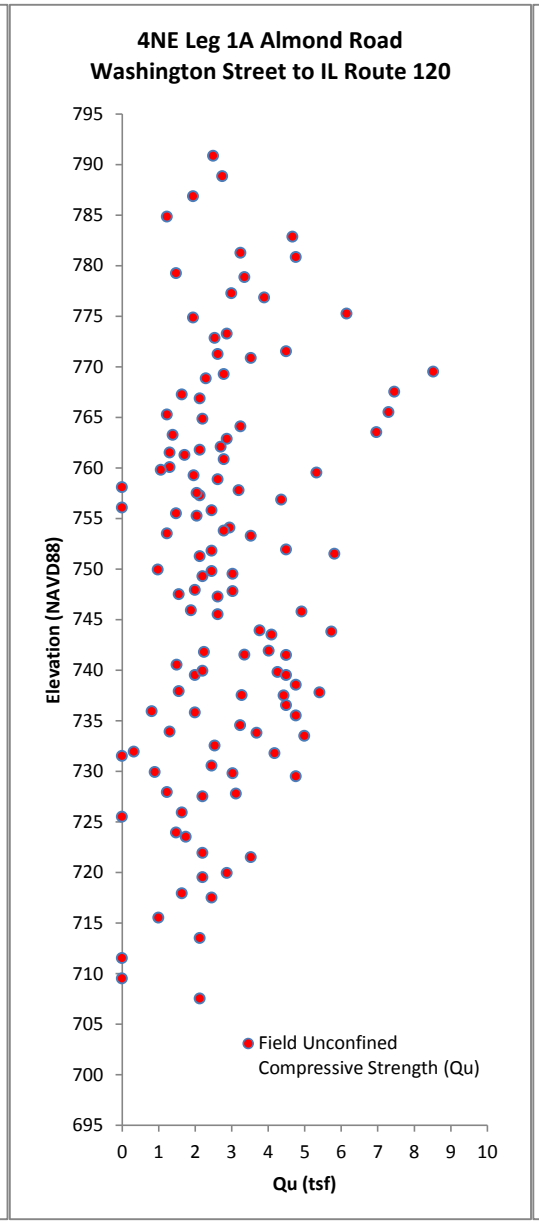

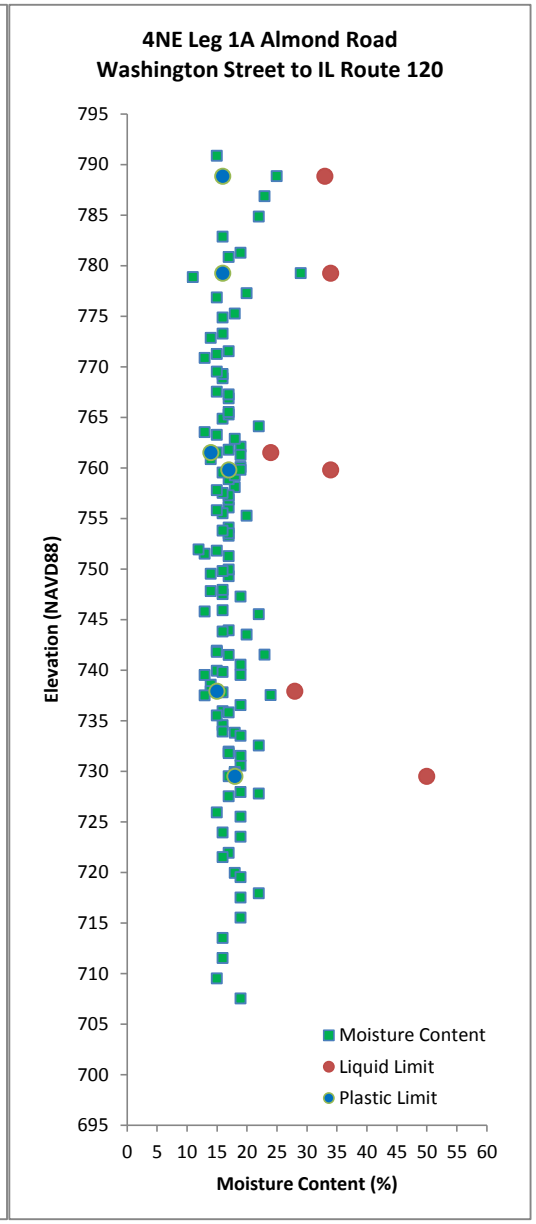

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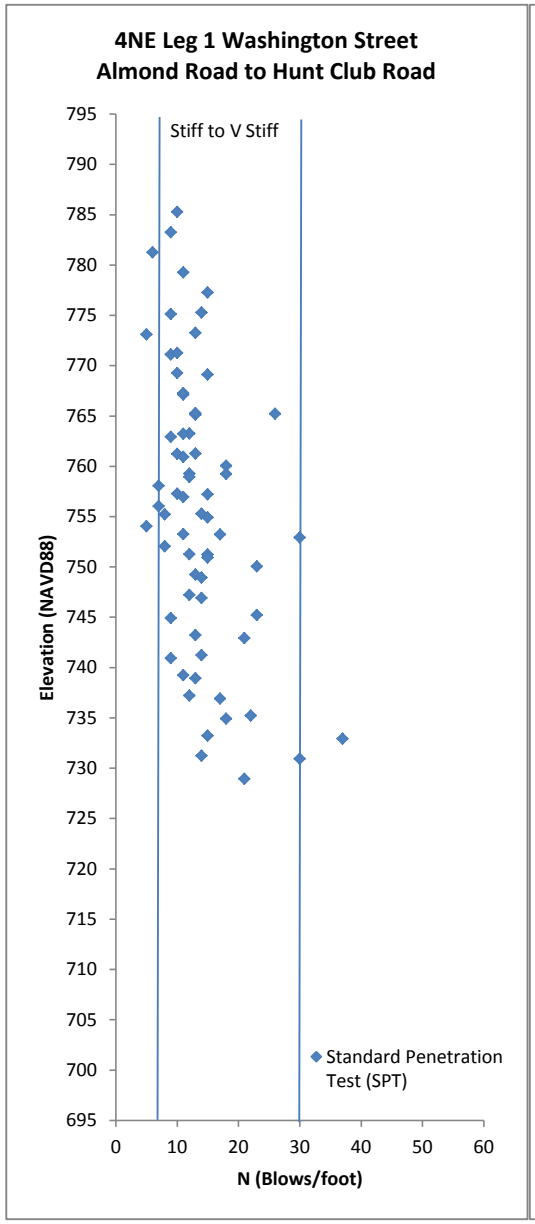

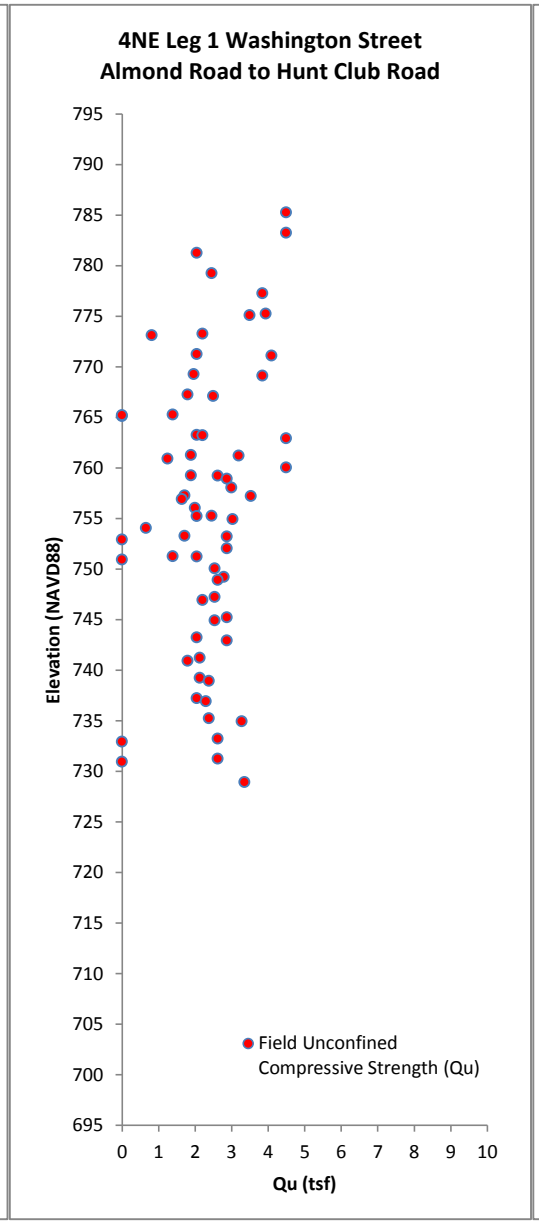

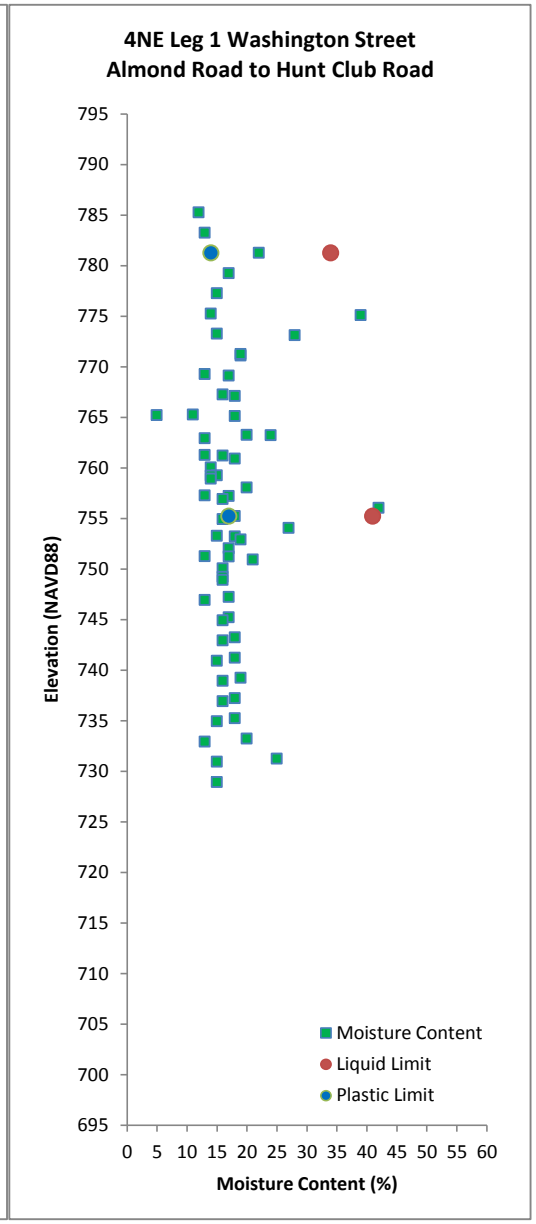

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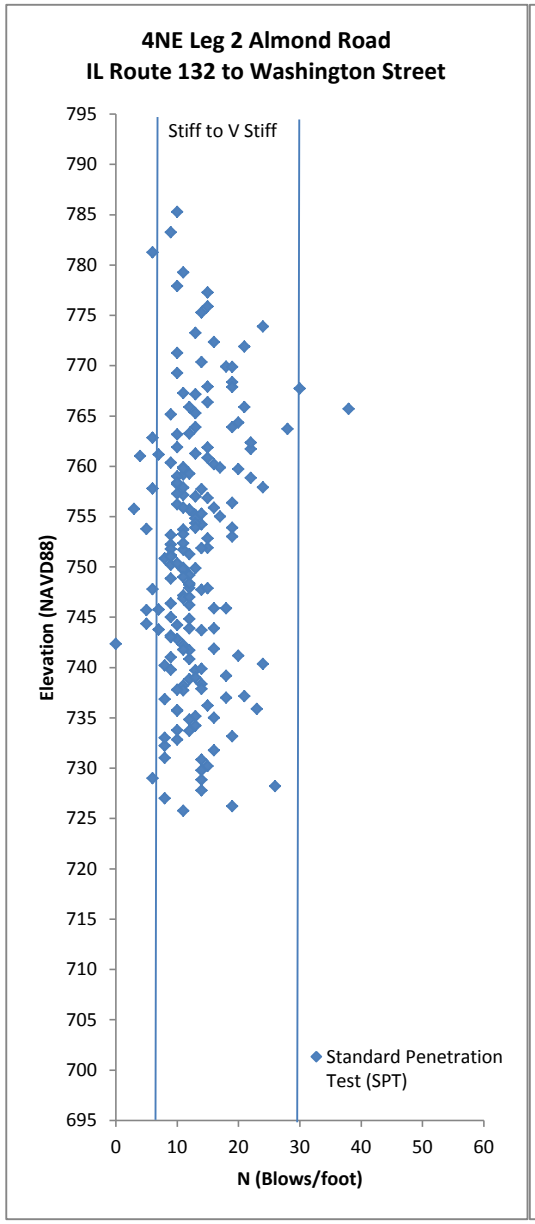

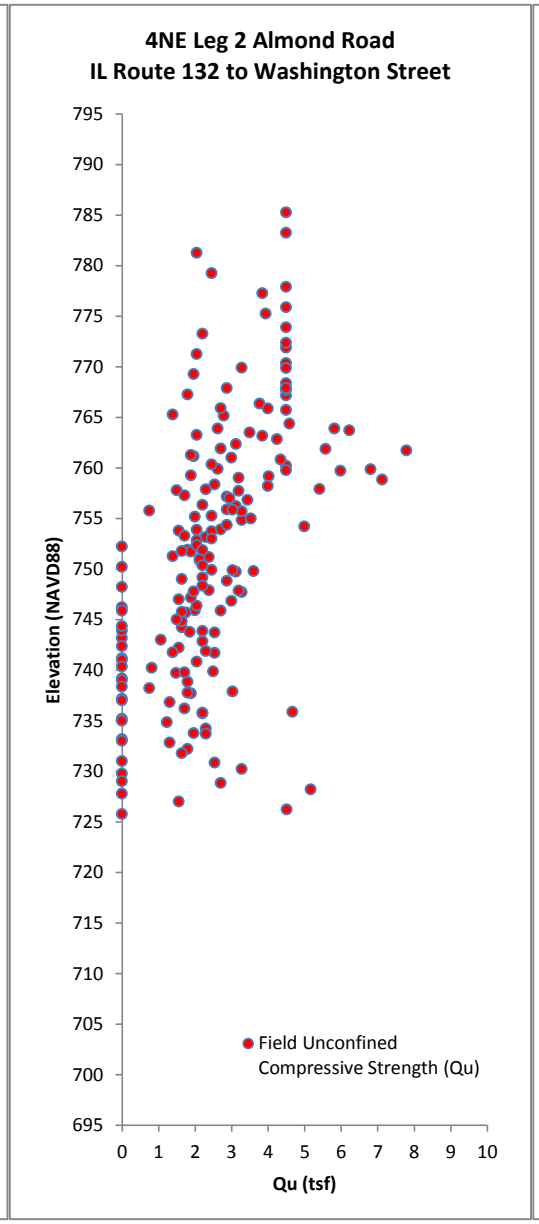

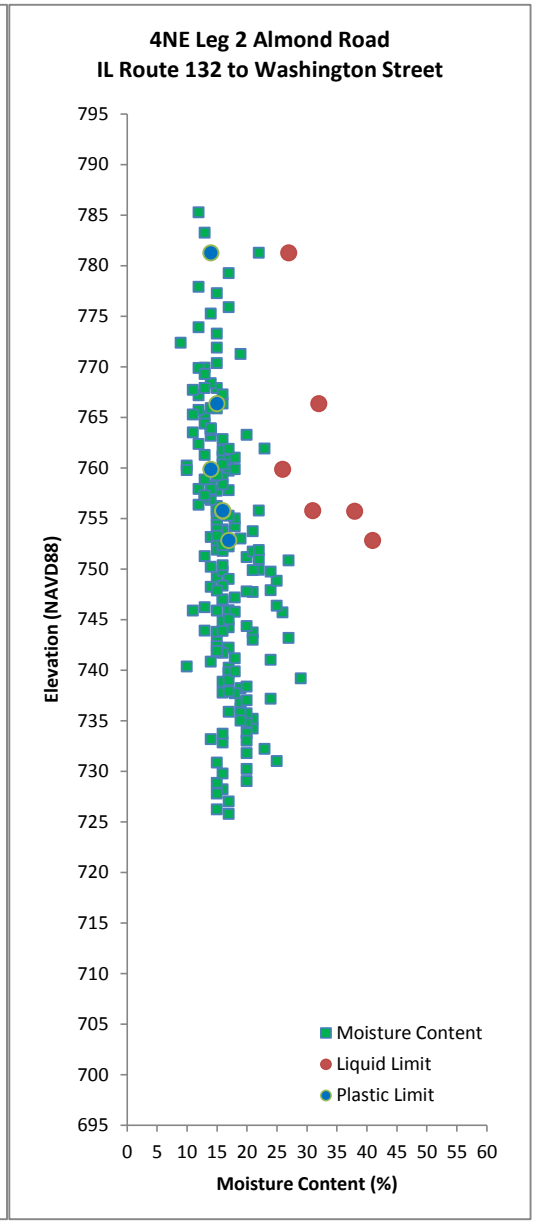

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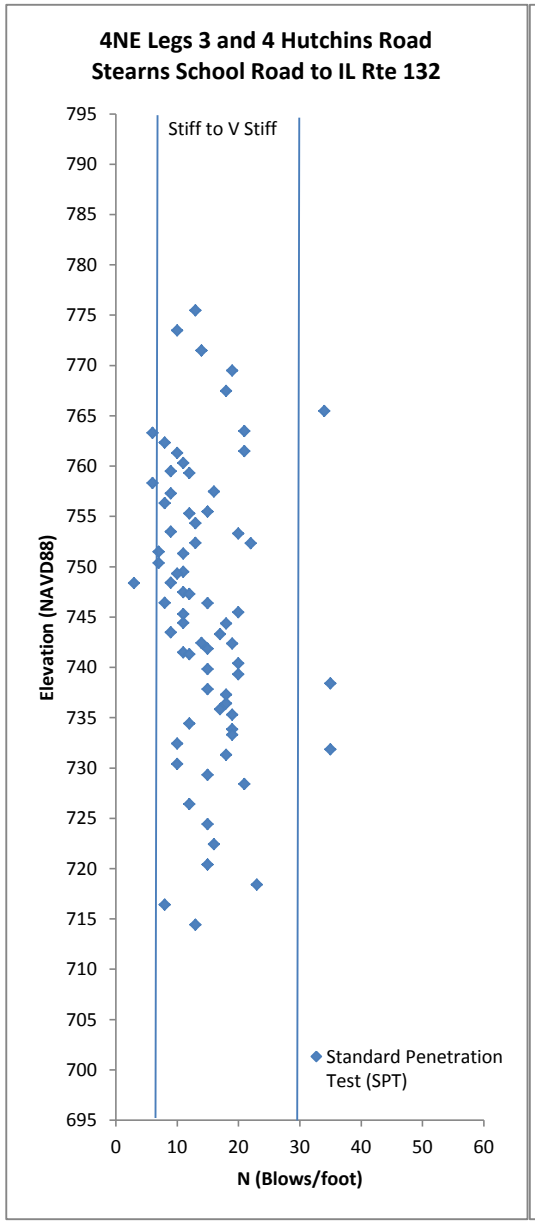

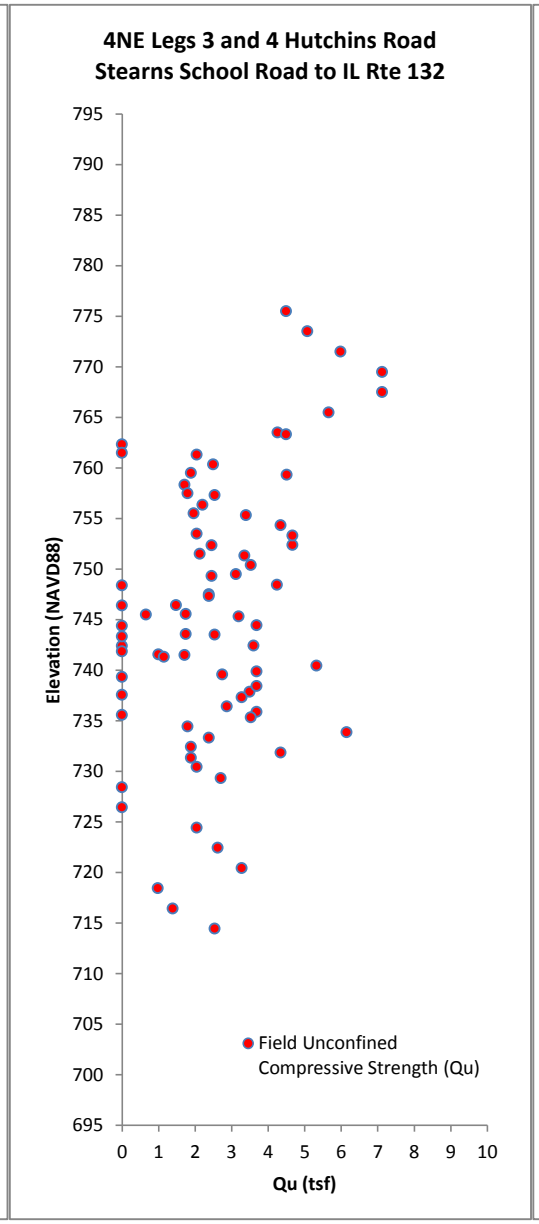

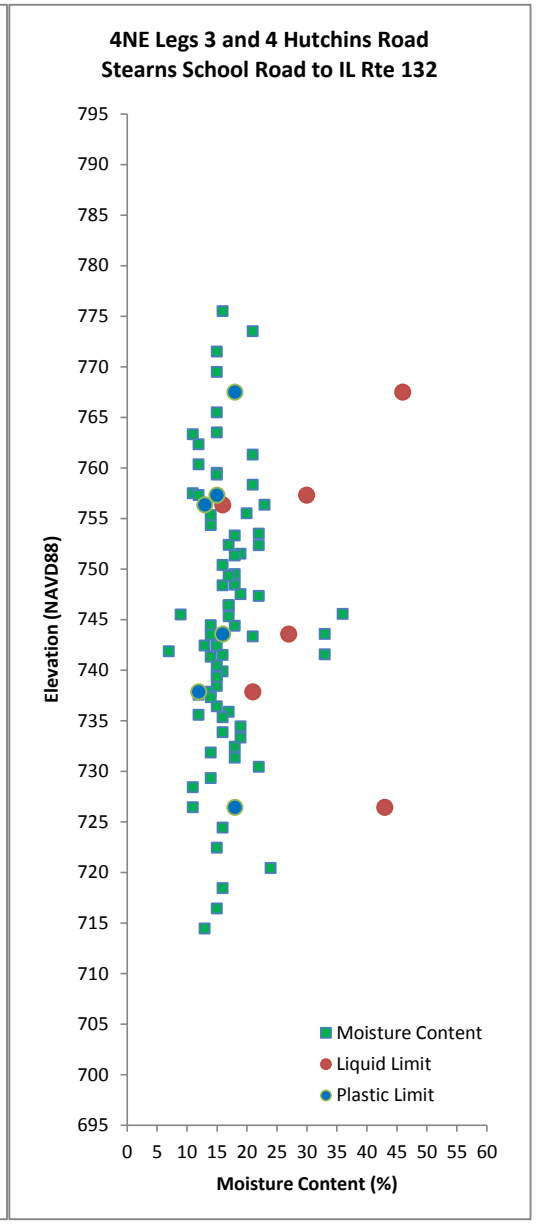

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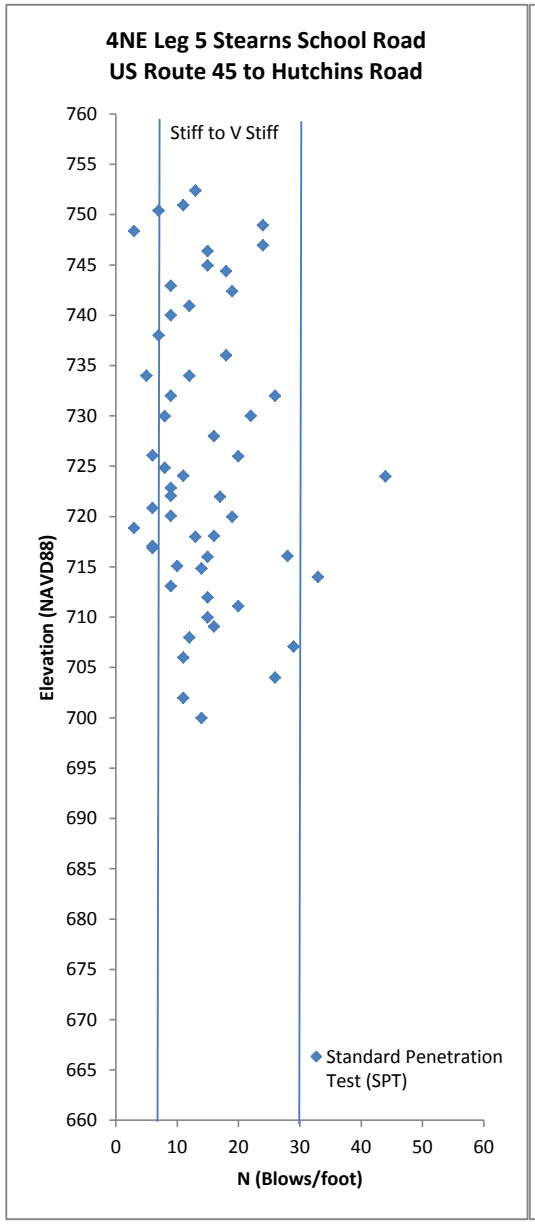

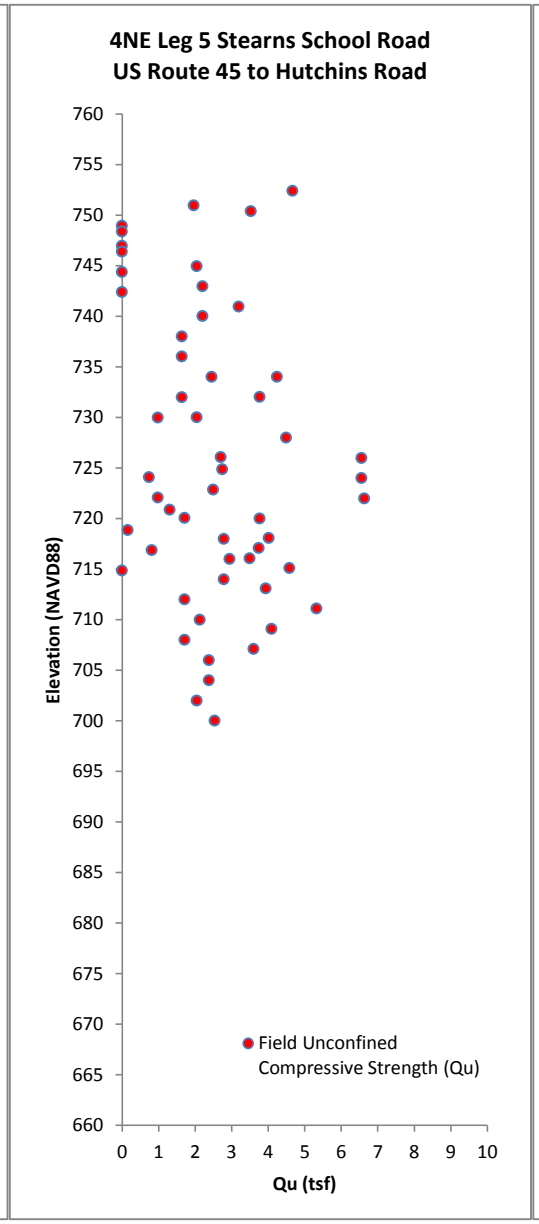

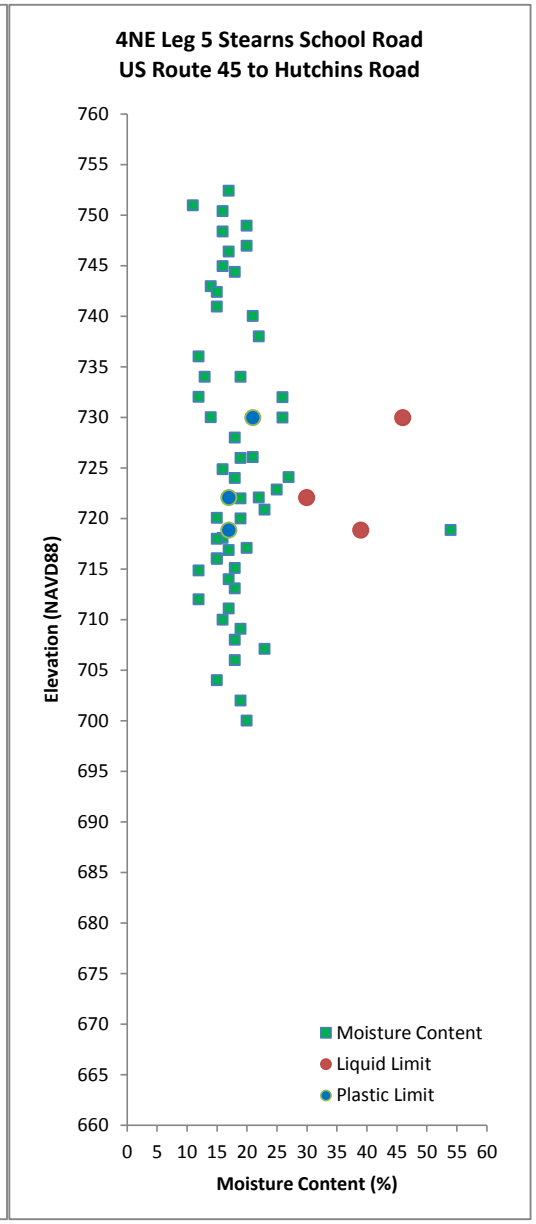

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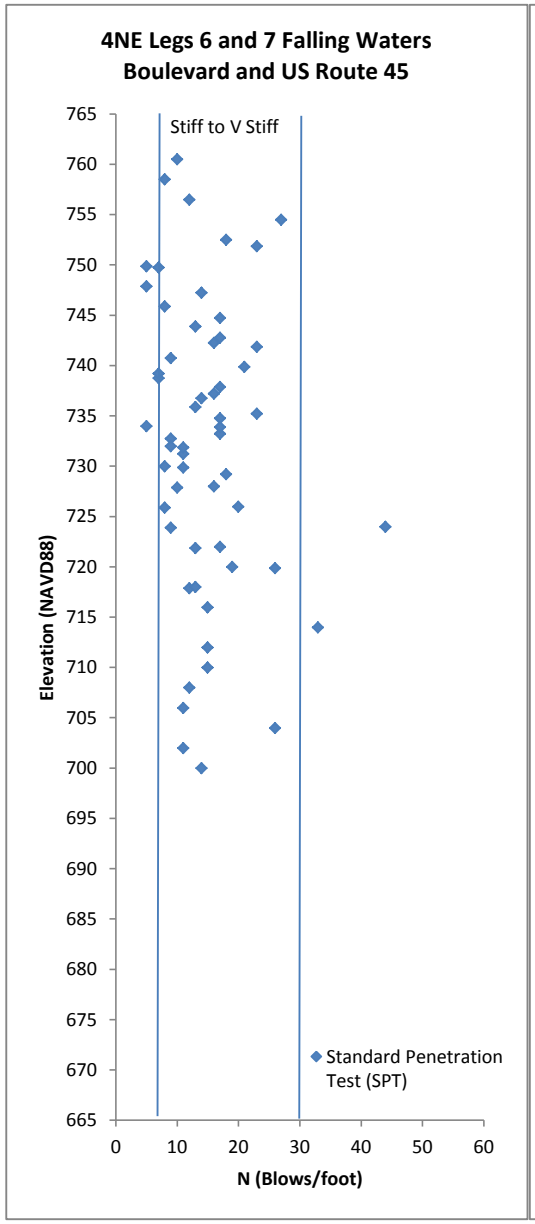

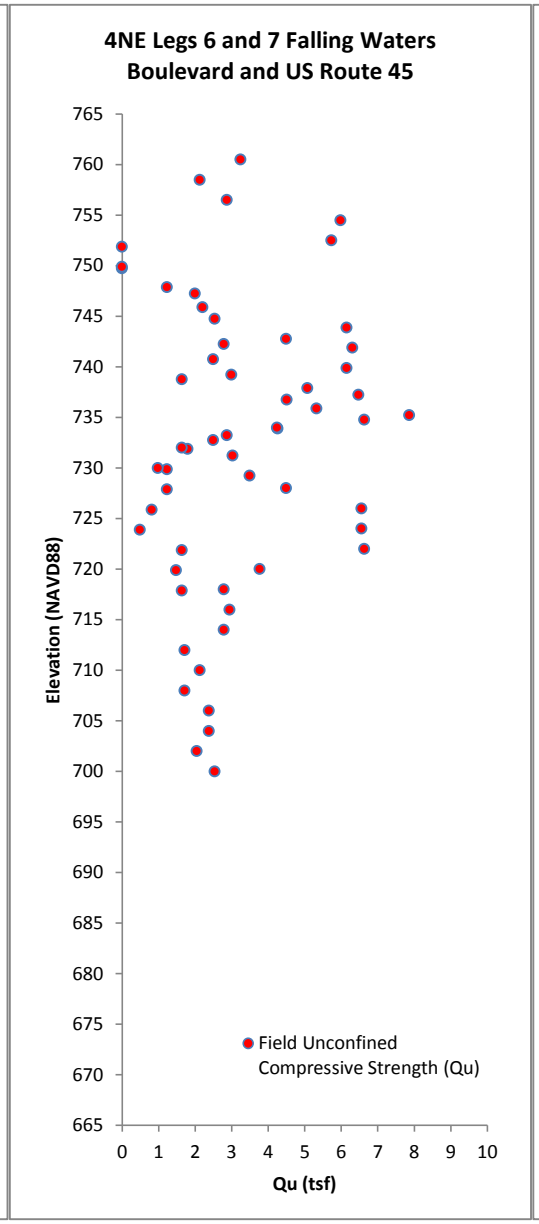

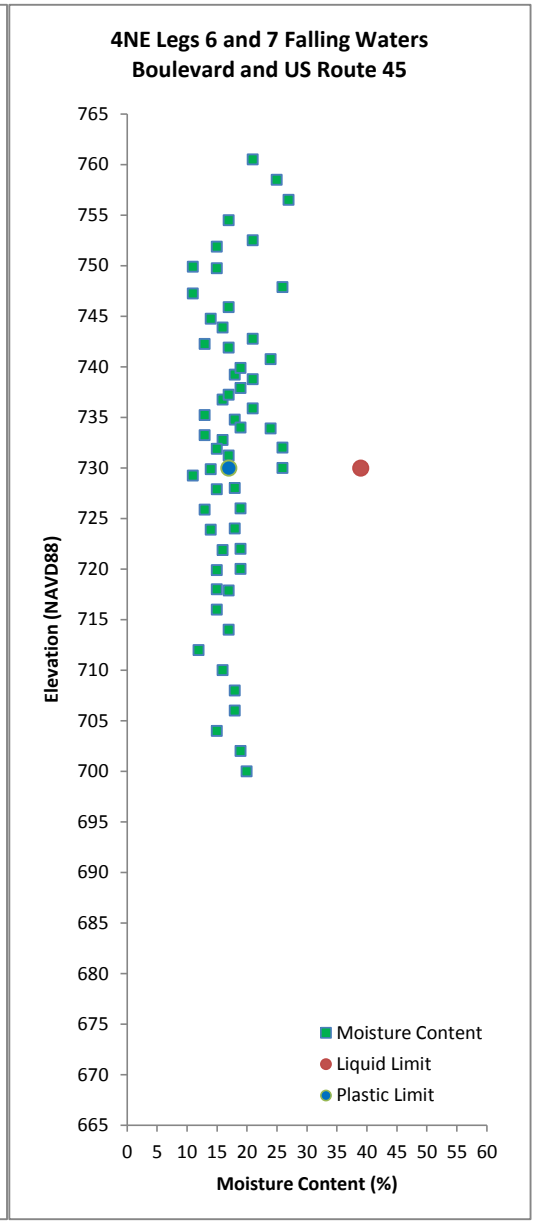

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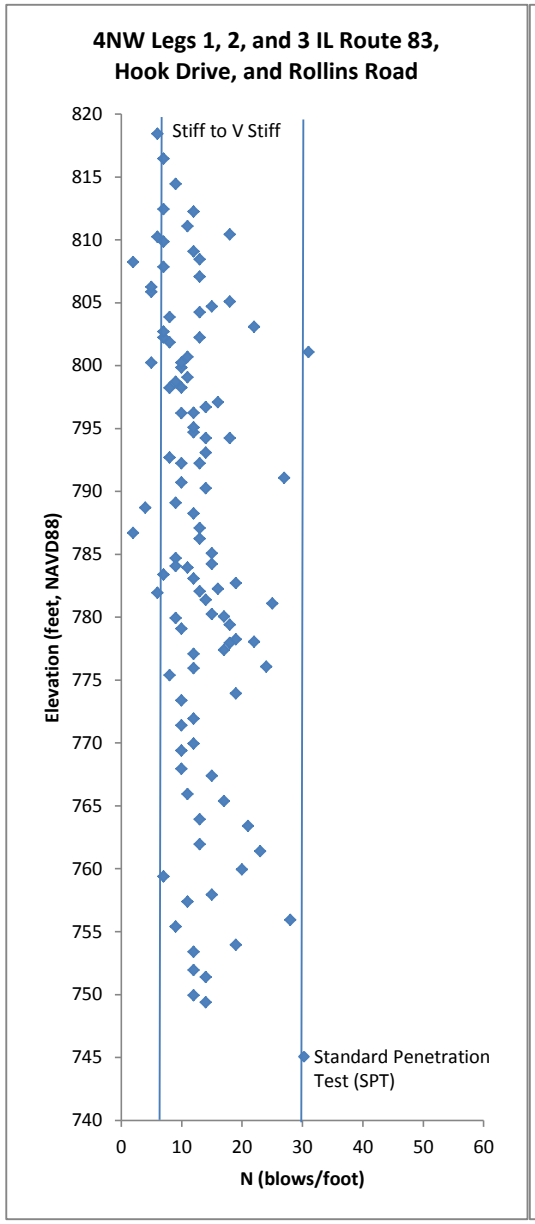

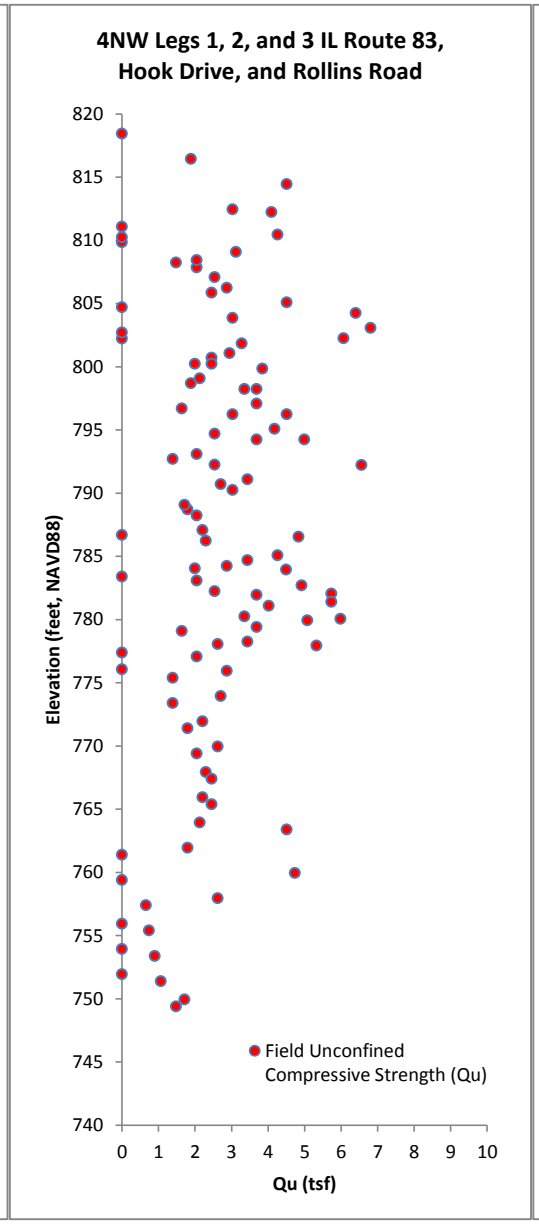

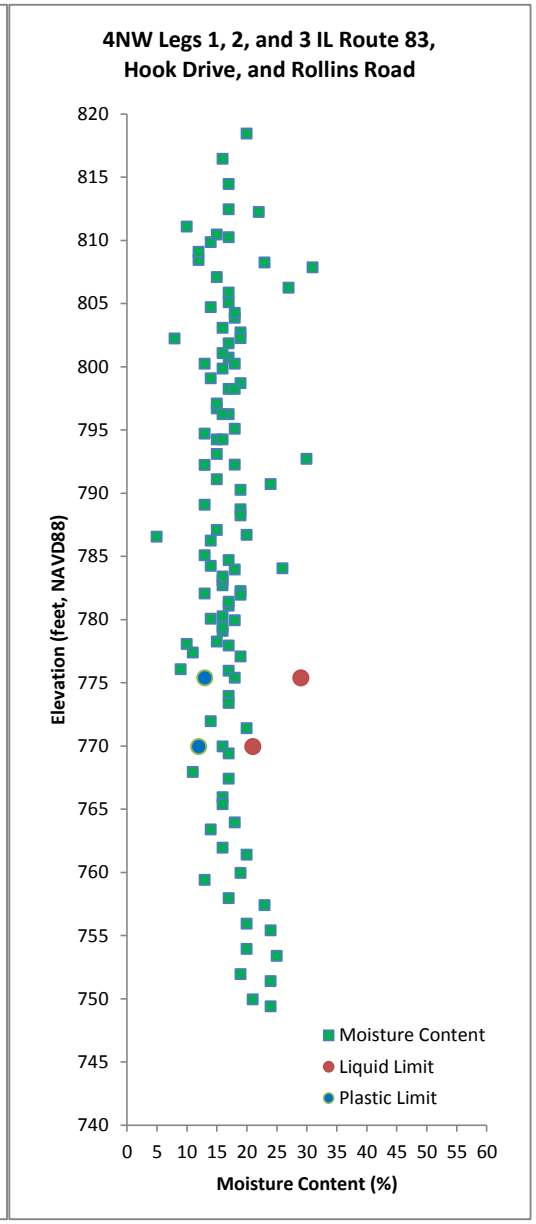

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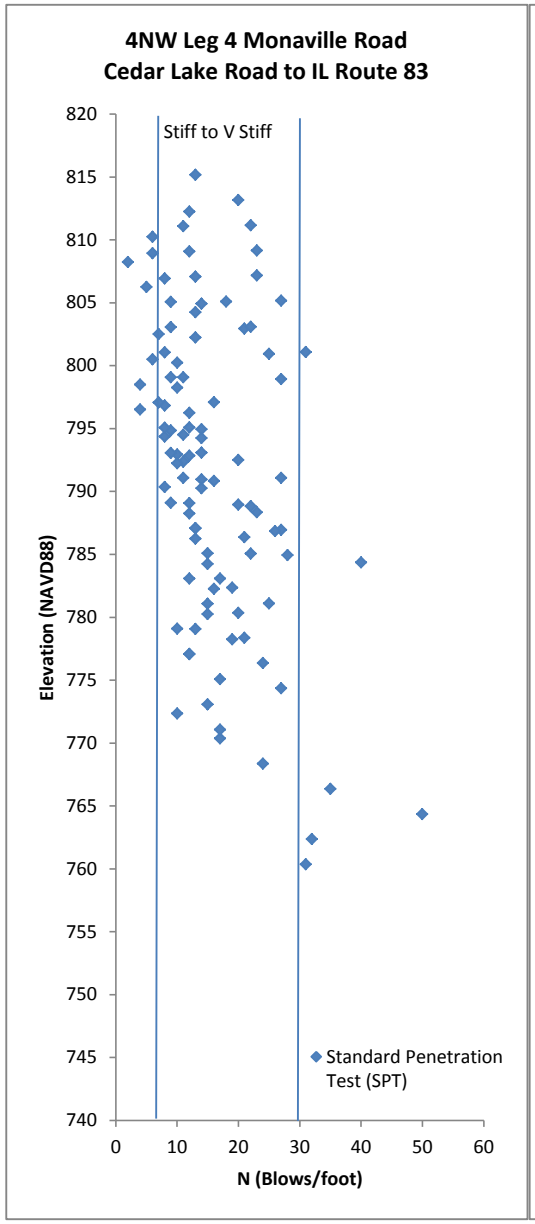

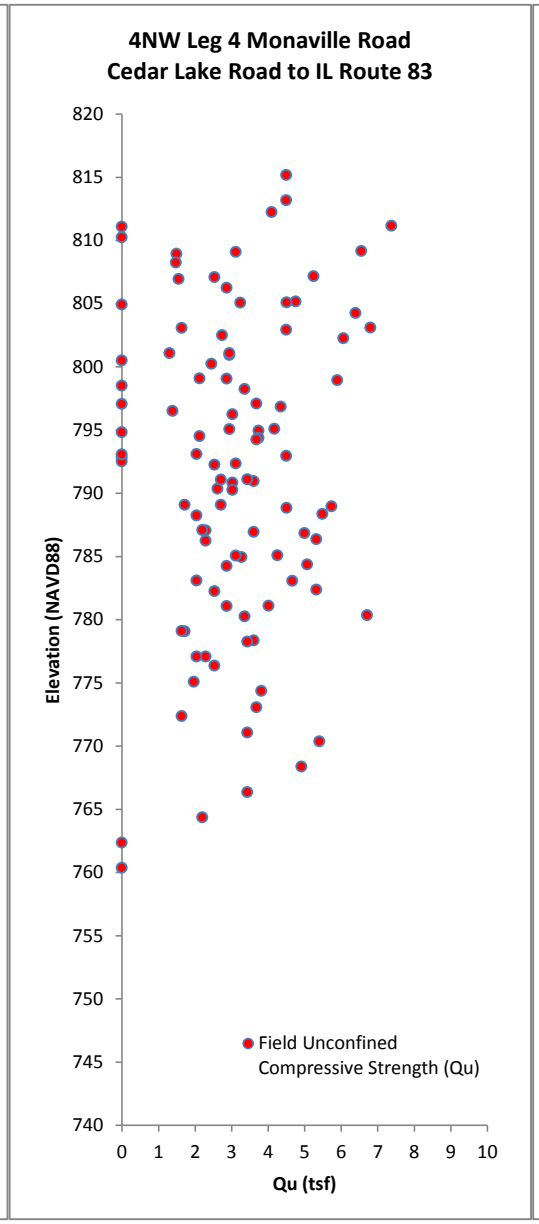

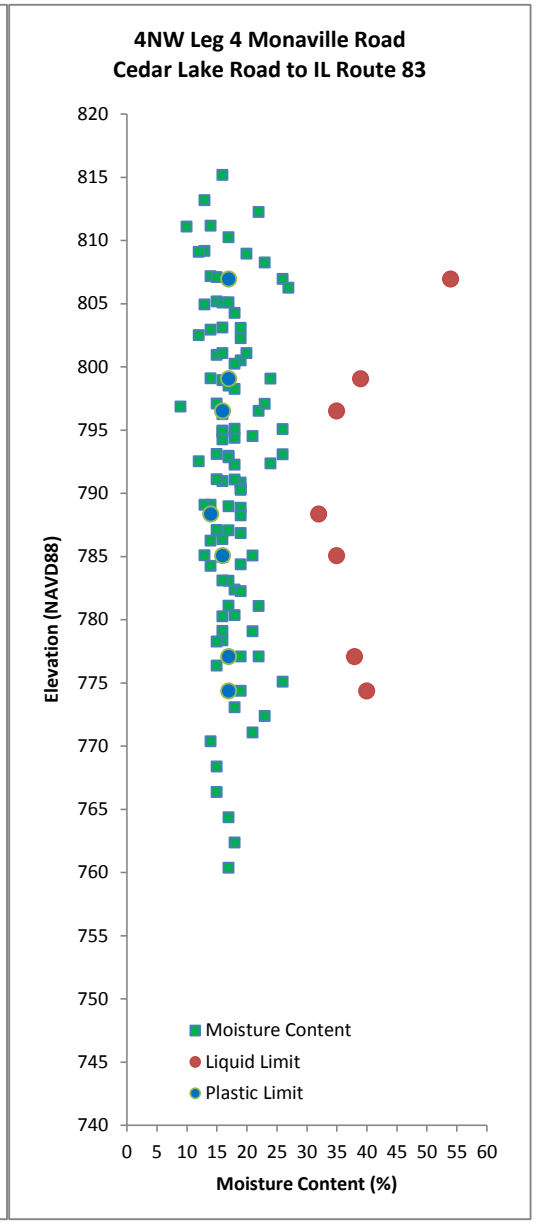

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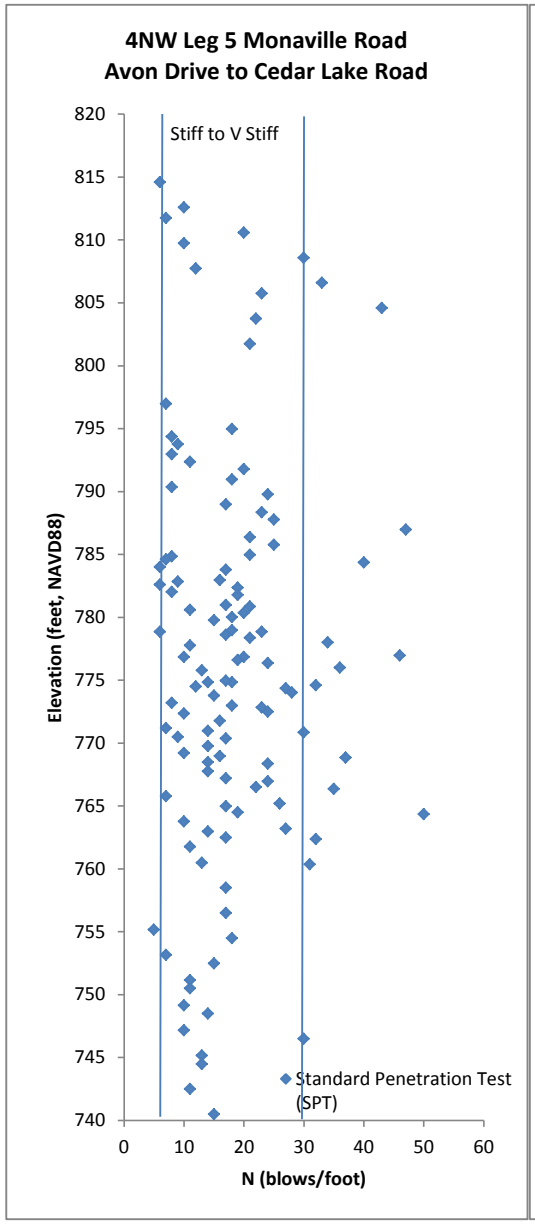

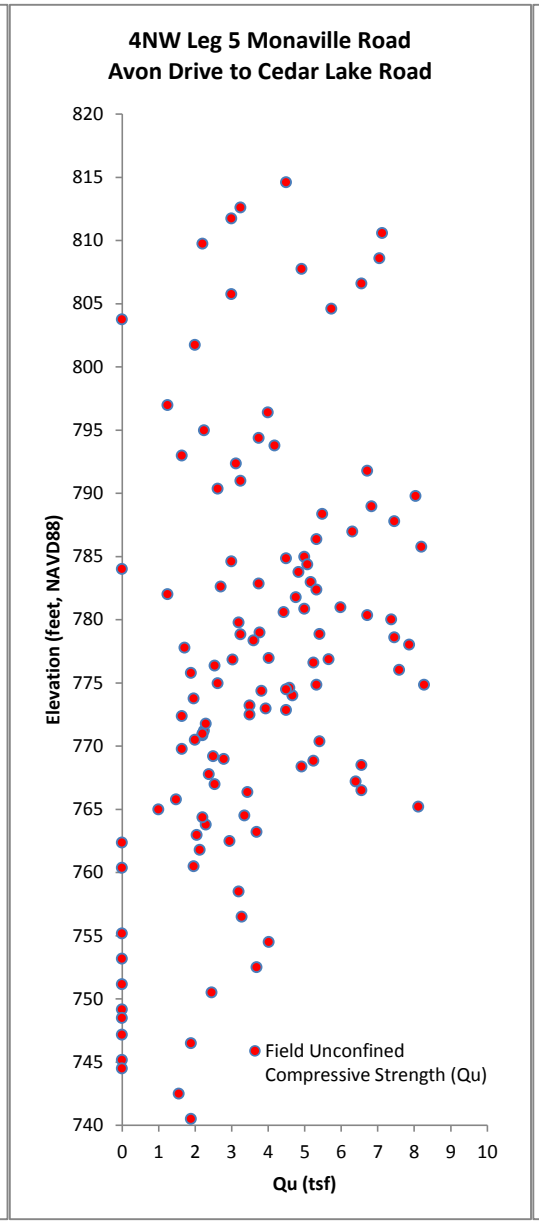

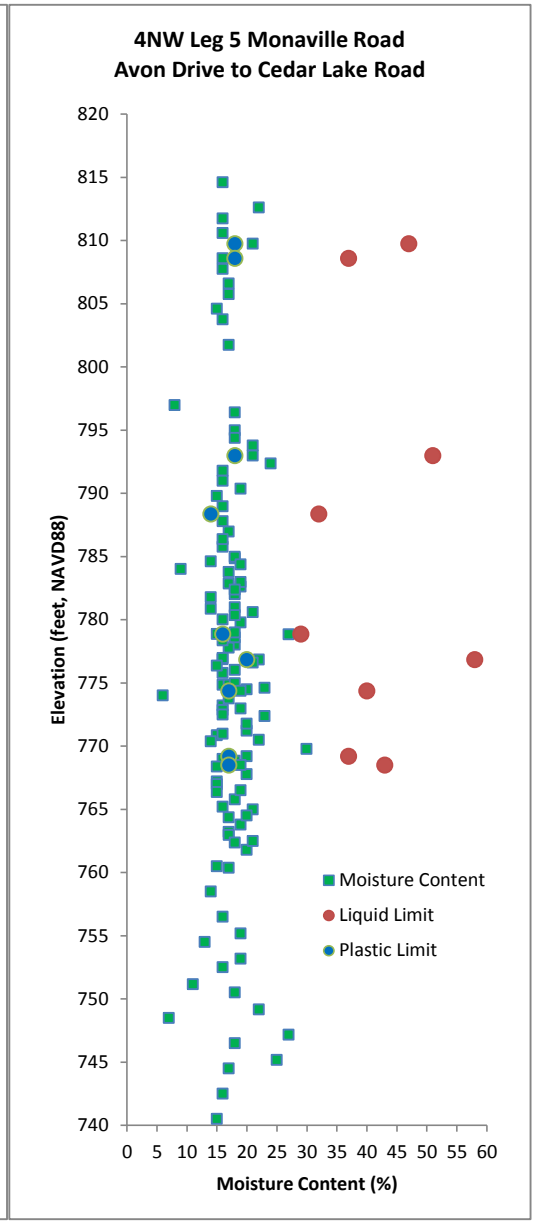

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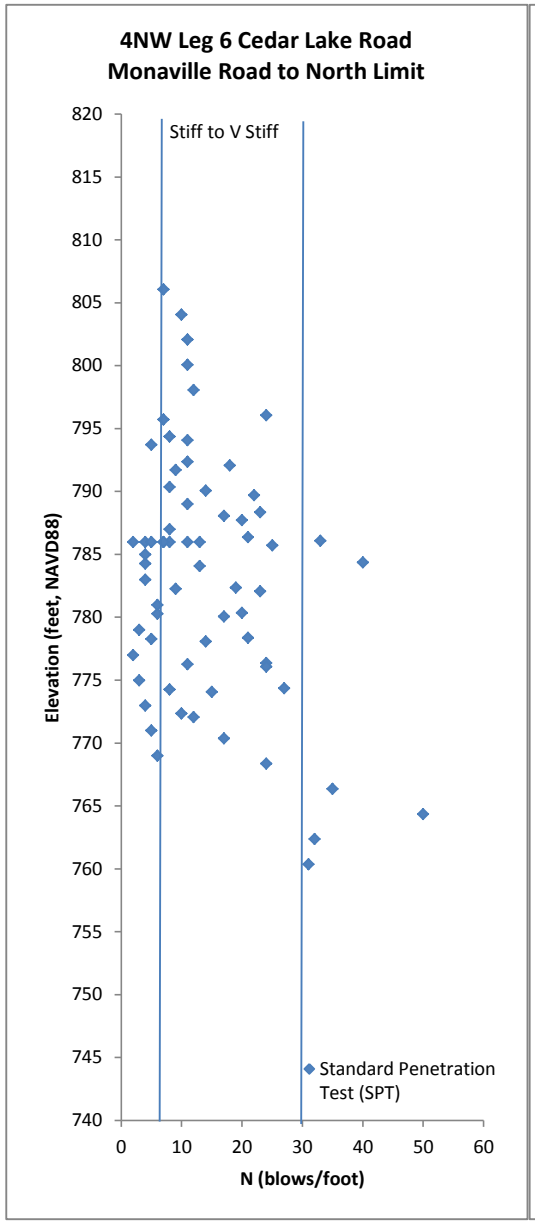

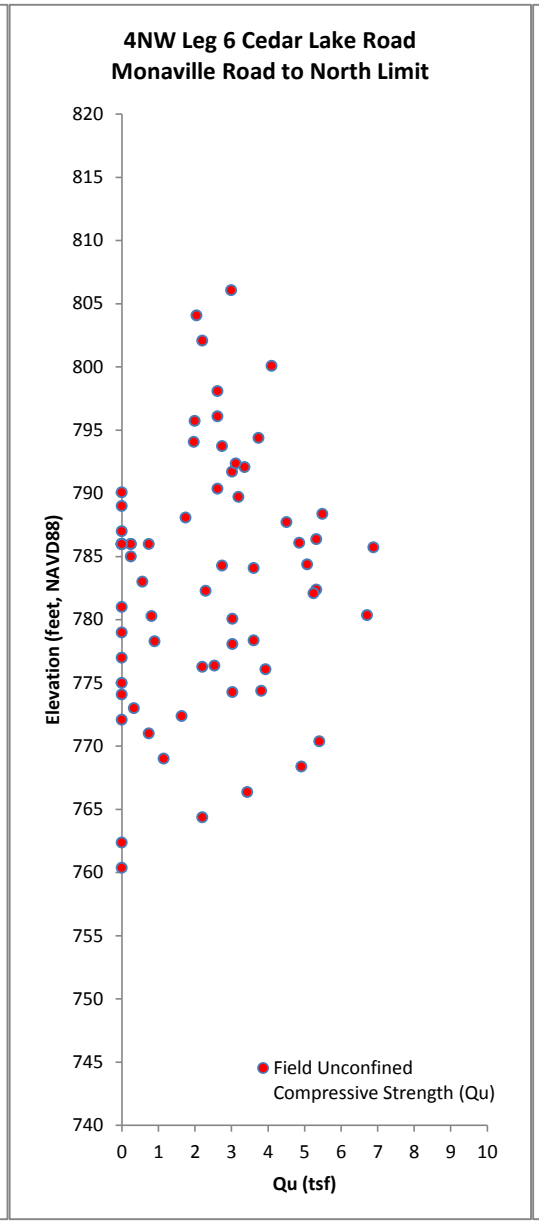

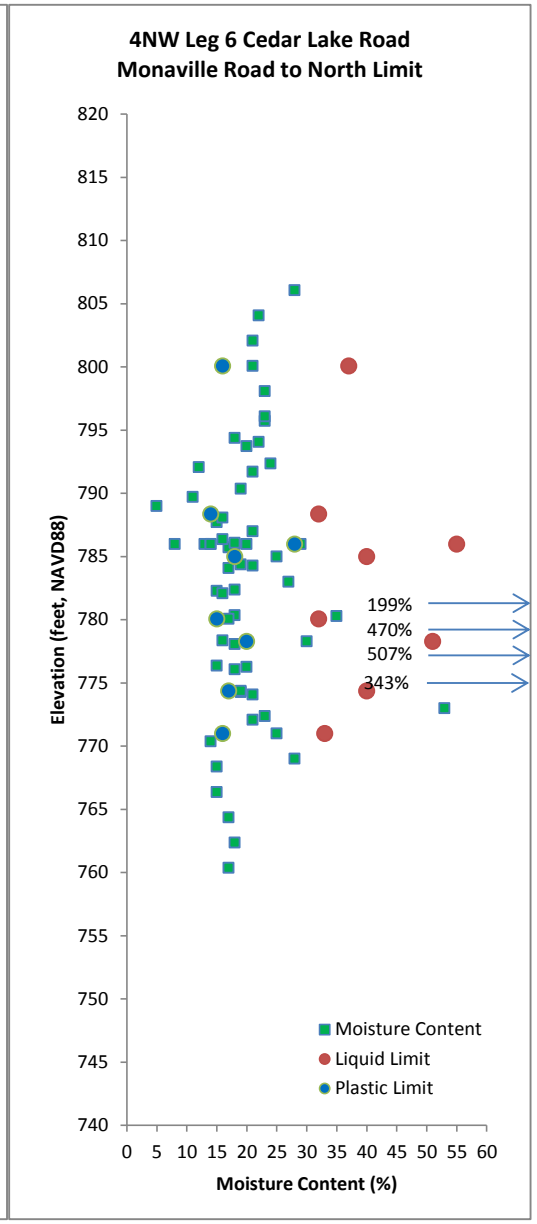

Appendix E

Corrosion Analysis Report

CDM Smith

December 16, 2014

CP Solutions, Inc.®
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CDM Smith, Inc.
125 S. Wacker Drive; Suite 600
Chicago IL 60606

Attention: Mr. Jon Meyers – P.E./Project Engineer

Reference: Corrosion Control Assessment – CLCJAWA Finished WTMs Expansion Projects #4NW and #4NE – Lake County, IL
CPSI Reference #2014-P15

Dear Mr. Meyers:

I have completed my review of the soil boring data and the water transmission main routing maps that were provided to me with regard to the proposed projects referenced above.

CDM Smith, Inc. (hereafter CDMS) authorized me to perform the work under a Subcontract Agreement issued to CP Solutions, Inc. (hereafter CPSI) and dated 7/1/2014.

Project Information Provided by CDMS to CPSI

Information contained in this report regarding the water transmission mains' proposed routing and methods of construction was furnished to me by CDMS is as follows. The majority of the proposed water main will be constructed in cut-and-cover trenches; however, at major roadway, rail and waterway crossings, as well as crossings mandated by local agencies, the new water main may be installed using trenchless construction techniques.

Project #4NW

The 4NW Route begins at the Fox Lake Hills Well House #2 near the corner of Avon Drive and Monaville Road and runs east along the north easement of Monaville Road to STH 83, then turns south and terminates near the intersection of Rollins Road and Wood Street (see Figure 4NW.1 for specific details).

Project #4NE

The 4NE Route begins at the Lindenhurst Connection near Falling Water Boulevard and US Route 45. The proposed WTM runs north along US 45 to Stearns School Road and then runs along Stearns School Road, Hutchins Road, and Almond Road to the corner of Almond Road and Washington Street. At Washington Street, two alternatives will be investigated: the first running along Washington Street to Hunt Club Road and the second continuing south along Almond Road to STH 120 (see Figure 4NE.1 for specific details).

Proposed Pipe Materials – All Projects

Pipe materials will be either PVC or ductile cast iron in sizes ranging from 10- to 20-inches in diameter.

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CP Solutions, Inc.
1167 Independence Drive
Bartlett, IL 60103

P: 630-235-1559
E: jschramuk@outlook.com
www.cpsolutionsinc.net

Soil Boring Lab Test Results and Data Analysis

Tables 1.A and 1.B summarize the soil data parameters which have been obtained from the project's geotechnical consultant[1] for Project #4NW and Project #4NE, respectively.

Soil plays three distinct roles in the external corrosion of buried metallic structures:

- Its electrochemical properties can create galvanic corrosion patterns.
- Its electrical resistance properties control the rate of corrosion.
- Its depolarization properties control the duration of the corrosion process.

Non-uniform soil characteristics between adjacent sections of metallic piping can create galvanic corrosion cells due to differential soil aeration, resistivity, or moisture properties. The electrical conductivity of a soil controls the rate of current flow in a galvanic corrosion cell. The polarization properties of a soil will control the extent of corrosion that will occur over time by chemically influencing the soil's ability to absorb or dissipate corrosion products.

Soil Resistivity

Resistivity is a common parameter for evaluating the corrosiveness of a soil and can also be used to identify areas along a pipeline where deterioration is more likely to be aggressive. Resistivity is the inverse of conductivity, and is measured in the units of ohm-centimeters. Corrosivity is an inverse function of resistivity and low resistivity soils usually are more corrosive than high resistivity soils. Serious corrosion can also be associated with high resistivity soils, especially where the soil is not uniform along the length of a pipeline.

When significant variations develop in the soil resistivity pattern over short distances, these variations can increase the corrosion rate along an underground metallic pipeline due to concentration cell effects caused by changes in soil moisture and oxygen to sustain the corrosion reaction.

Although no national standard exists, the following classifications are generally used by corrosion engineers and the U.S. government[2] as a guide for interpreting soil resistivity data:

- Less than 2000 ohm-cm: Very Corrosive
- 2000 to 5000 ohm-cm: Corrosive
- 5000 to 10000 ohm-cm: Moderately Corrosive
- Greater than 10000 ohm-cm: Progressively Less Corrosive

<u>Project #4NW</u>

The minimum-maximum values range from 400 to 1,700 ohm-cm with both the mean and median values near 950 ohm-cm.

---

[1] Wang Engineering, Inc. Geotechnical Reports (Various Dates)
[2] Reference: "Dept. of the Army, USA, Technical Manual TM 5-811-7, Electrical Protection, Cathodic Protection."

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Project #4NE

The minimum-maximum values range from 440 to 1,600 ohm-cm with both the mean and median values near 1,000 ohm-cm.

These data indicate that the soils into which the proposed water transmission mains will be placed are very corrosive and would be expected to sustain normal corrosion of a buried metallic structure.

Chloride Ions

Laboratory measurements of the concentration of chloride ions (in parts per million) were analyzed (by others). Generally, as the chloride concentration increases, the resistivity tends to decrease and the soil's corrosivity will increase. The professional literature suggests that chloride concentrations of at least 150 ppm represent the minimum threshold for declaring a soil as corrosive. Soils with higher chloride concentrations usually are found in areas that have been contaminated with agricultural chemicals or from winter roadway deicing salts.

Project #4NW

The minimum-maximum values range from 14 to 247 ohm-cm with the mean and median values from 128 and 87 ppm, respectively.

Project #4NE

The minimum-maximum values range from 5 to 313 ohm-cm with the mean and median values from 87 and 123 ppm, respectively.

With few exceptions, the results of the lab chloride ion tests indicate relatively low concentrations of chloride ions in the soil samples that were tested for this parameter.

Moisture Content

Soil moisture is an important factor in evaluating the potential of a soil environment. Normally a soil sample contains a fixed amount of conductive salts that determine a soil's electrolytic characteristics. Low soil moisture may reduce the corrosivity of a given soil sample when compared to a similar soil with a high moisture content. In general, soil moisture does not *significantly* affect a soil's corrosivity *beyond 25% of saturation*. Saturation values between 0% and 25% will significantly alter a soil's corrosive effects. However, seasonal soil moisture variability will affect the local soil conditions and their ultimate corrosiveness.

Project #4NW

The minimum-maximum values range from 10.6% to 14.1% with both the mean and median values near 11.5%. Soil particle size data has not been provided.

Project #4NE

The minimum-maximum values range from 10.2% to 12.4% with both the mean and median values near 11.0%. Greater than 80% of soil particle sizes are finely-textured generally consisting of either silt or clay.

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The soil moisture content data show that the proposed rights-of-way have soils are not expected to drain readily, and which (all other factors being equal) will sustain a corrosion reaction on buried ferrous materials.

Sulfate Ion Concentration

The sulfates of sodium, magnesium, calcium, and potassium are often found in soils or dissolved in groundwater and can result in accelerated corrosion to ferrous piping. Although there is no generally-recognized standard for these soil ions, some corrosion engineers have speculated that sulfate concentrations greater than 150 ppm can enhance corrosion.

Project #4NW

The minimum-maximum values range from 13 to 350 ppm with the mean and median values at 104 and 64 ppm, respectively.

Project #4NE

The minimum-maximum values range from 16 to 149 ppm with the mean and median values at 66 and 40 ppm, respectively.

With few exceptions, the results of the lab sulfate ion tests indicate relatively low concentrations of sulfate ions in the soil samples that were tested for this parameter.

Soil pH (Hydrogen Ion) Tests

Soil pH is the negative logarithm of the hydrogen ion concentration. For ferrous materials, pH in the range of 4 to 10 will have little effect on the rate of corrosion under oxidizing conditions at ambient temperatures. Acid soils are more conductive to ferrous corrosion because at pH values above 10, the steel rapidly polarizes and passivation of corrosion cells is achieved. At pH values below 4, the rate of corrosion accelerates rapidly.

Project #4NW

The minimum-maximum values range from 7.2 to 8.8 with the mean and median values both at 7.9.

Project #4NE

The minimum-maximum values range from 7.7 to 8.3 with the mean and median values both near 8.0.

The lab soil pH data indicate generally a neutral to slightly-alkaline soil environment exists along the water main – a condition that does not significantly influence the corrosion of buried ferrous pipe materials.

Oxidation-Reduction Potential

The oxidation-reduction (redox) potential of a soil is another factor when evaluating the ability of anaerobic sulfate-reducing bacteria (SRB) to exist along a buried ferrous pipeline. Redox potentials only indicate the *availability* rather than the *quantity* of electrons available

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to serve as cathodic depolarizers and thus allow a corrosion reaction to proceed unabated. However, redox measurements become unstable after exposure to oxygen or after a soil sample is older than 24 hours, which often renders this as an *unreliable corrosion predictor*.

Redox potentials greater than +100 mV indicate the soils will be sufficiently aerated so as to inhibit SRB (less corrosive), while potentials less than +100 mV (or even negative) will support SRB (more corrosive).

Project #4NW

The minimum-maximum values range from +341 to +452 ppm with the mean and median values at nearly +395 ppm.

Project #4NE

The minimum-maximum values range from +357 to +450 ppm with the mean and median values at +382 ppm and +368, respectively..

The laboratory redox data indicate that these water mains will be installed in soils that can be considered less corrosive having a median redox potential greater than +100 mV.

DC Interference from Foreign Energy Transmission Pipelines

I reviewed the two projects' route drawings to identify the owners of foreign pipelines that might operate rectified-anode cathodic protection (CP) systems that either cross the proposed water main route or are located within 500' laterally of the proposed water mains' rights-of-way. Since stray DC influence is not limited to arbitrary pipeline segments, I will present my survey results for each foreign pipeline having rectified-anode systems separately.

Kinder-Morgan/NGPL

An RFI was submitted to Kinder-Morgan/NGPL on 8/19/2014 that generated the following email response dated 10/22/2104: *"We have rectifier<s> on line about 6 mile<s> north and 7 mile<s> south of <the> two road<s> you gave me."*

- Grayslake Meter Station: N: 42.30664825; W:-88.00896454 (Figure 4NE.3.C).
- Moraine Meter Station: N: 42.49399948; W: -87.91177368 (Figure 4NE.3.D).

West Shore Pipeline

An RFI was submitted to West Shore Pipeline on 8/15/2014 that generated the following email response dated 8/18/2104: *"I have attached 3 images* (Figures 4NE.4.A to 4NE.4.C) *of the location of our 16" high pressure refined petroleum products pipeline. We have a pump station located in Lindenhurst and there is a rectifier located in the station* (Figure 4NE.4.D). *That location is 42.383879 and -88.019458."*

Peoples Gas Company

An RFI was submitted to Peoples Gas on 8/15/2014 that generated the following email response dated 8/21/2104: *"We do not have any rectified systems in this area."*

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AGL/Nicor Gas Company

An RFI was submitted to AGL/Nicor Gas on 8/19/2014 that generated a response received on 8/19/2104 indicating that only sacrificial anodes are used. However, a rectified-anode system is installed several miles to the east of Project #4NE (Figure 4NE.5.B) to protect a 20-inch gas main that crosses the proposed water main at Almond Road (Figure 4NE.5.A).

Conclusions and Recommendations

Justification for Corrosion Control Measures

Although caution must be exercised in making broad interpretations regarding soil corrosivity with only a small number of boring data points, based upon my experience for critical[3] water transmission mains installed by major water utilities throughout the Midwest, I recommend that all ferrous pipeline materials should be protected from external (soil-side) corrosion.

Exhibit A (attached) contains the project's proposed Corrosion Control Design Standards. Justification for applying these specific corrosion protection practices for the two types of pipe materials being considered are summarized below.

Ductile Iron Pipe Mainline Recommendations

Although the aforementioned soil chemistry appears relatively benign, the right-of-way has clayey soils and poor drainage characteristics that will enhance the corrosion of buried ferrous pipe materials. Poorly-drained clay soils will draw and hold moisture near the pipe trench while better-drained sandy soils would normally drain groundwater much more readily. Metallic pipelines backfilled with non-homogeneous materials can often greater rates of corrosion, all other factors being equal. These factors can create long-line corrosion cells that should be mitigated using suitable pipe coatings supplemented with cathodic protection.

The corrosion of ductile iron pipe used to construct water transmission mains has gained wider publicity in recent years[4]. The water utility industry, corrosion engineers, and pipe manufacturers often disagree when discussing the most appropriate corrosion-control measures for this pipe material[5,6,7,8]. When confronted with aggressive soil environments for new ductile iron water mains, many civil engineers will specify that the pipe be encased solely

[3] Critical water transmission mains are generally municipal mains having diameters ≥ 16" and whose service if disrupted would have a serious impact on the health, safety, security, or economic well-being of a community.
[4] Rajani, B. and Y. Kleiner (2003). "Protecting Ductile Iron Water Mains: What Protection Method Works Best for What Soil Condition?" *Journal of the* American Water Works Association, 95:11:104, Denver, CO.
[5] Bonds, R. et al (January 2005). "Corrosion Control Statistical Analysis of Iron Pipe," *Materials Performance*, NACE International, Houston, TX.
[6] Spikelmire, B. (July 2002) "Corrosion Considerations for Ductile Iron Pipes," *Materials Performance*, NACE International, Houston, TX.
[7] Dechant, D. and G. Smith (January 2004). "Present Levels of Corrosion Protection on Ferrous Water Piping in Municipal Infrastructure: A Manufacturer's Perspective," *Materials Performance*, NACE International, Houston, TX.
[8] American Water Works Service Co. Inc. (May 2002). "Deteriorating Buried Infrastructure, Management Challenges and Strategies."

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with loose polyethylene sheathing (poly wrap) per ANSI/AWWA Standards[9]. Although many corrosion engineers consider poly wrap to be an ineffective means of corrosion protection for DIP, the National Academy of Sciences has stated that if manufactured and installed correctly, polyethylene encasement supplemented cathodic protection provides a "betterment" to bare/as-manufactured ductile iron pipe installed without cathodic protection in highly-corrosive soils[10]. I agree with this statement and I recommend that poly-wrapped DIP be *supplemented* by the addition of sacrificial anodes to be installed within the pipe trench during pipe installation. The long-term effectiveness of a poly-wrapped pipe system has limitations due to field installation competency, resistance to third party damage, and also to long-term soil stresses. However, unlike a bonded pipe coating[11], CP is generally ineffective beneath any gaps that may exist between the pipe surface and the loose polyethylene wrap.

Recommendations to Mitigate Possible Foreign DC Interference on a DIP Mainline

Based upon the information that I have been provided, there are several rectified-anode systems that are in the general vicinity of the proposed 4NE water transmission main. Thus, I recommend that if ductile iron mainline pipe is installed[12], there could be DC interference. With that premise, I recommend that a Foreign Test Station (FTS) be installed at three *crossing(s)*[13] of the proposed water mains with the foreign pipeline crossings having rectified-anode systems listed below:

- K-M/NGPL Gas Crossing at Falling Waters Blvd. (Figure 4NE.3.A)
- K-M/NGPL Gas Crossing at Sand Lake Road (Figure 4NE.3.B)
- AGL/Nicor Gas Crossing (within ComEd corridor) on Almond Rd. (Figure 4NE.5.A)

There would be no wire connections to the foreign pipelines within the FTS. However, should there be need to drain any DC interference current from the new water main back to a foreign pipeline, one or more DC drain cables would be installed to the water main in the FTS for this purpose. The cable(s) could eventually go to a bond station (or some other device) to mitigate any DC interference on the new water main.

PVC Pipeline Recommendations

PVC pipe being a non-metallic material does not experience the same type electrochemical deterioration as ferrous-based materials in corrosive soils. Nevertheless, any metallic valves or fittings will corrode and these structures should be coated with a fusion-bonded epoxy and supplemented with sacrificial anodes. This is standard practice at all U.S. military installations.

[9] American Water Works Association (2009) *Manual of Water Supply Practices M41, Ductile Iron Pipe and Fittings*, Denver, CO.
[10] National Research Council (2009). *Review of the Bureau of Reclamation's Corrosion Prevention Standards for Ductile Iron Pipe, National Materials Board: Division on Engineering and Physical Sciences*, The National Academy of Science, Washington, D.C.
[11] Examples are epoxies and polyurethanes that physically bond to the pipe surface
[12] Should PVC pipe be installed, this recommendation is not necessary
[13] At crossing points, a physical separation of no less than 12 inches (preferably 24 inches) is recommended.

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***

I thank you for the opportunity to have provided my professional services to you, and I look forward to assisting you with the completion of the corrosion-control design for this project.

Please feel free to contact me if you have any questions regarding this report!

Very truly yours,

Jeff Schramuk
NACE CP Specialist #7695

Attachments: Project 4NW – Figures 4NW.1-4NW.4
Project 4NE– Figures 4NE.1-4NE .5
Project 4NW – Table 1.A Lab Soil Data Analysis
Project 4NE– Table 1.B Lab Soil Data Analysis
Exhibit A - CP Design Standards (Metallic and Non-Metallic Pipe Options)

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Fig. 4NW.1: Vicinity Map for Proposed WTM Alignment

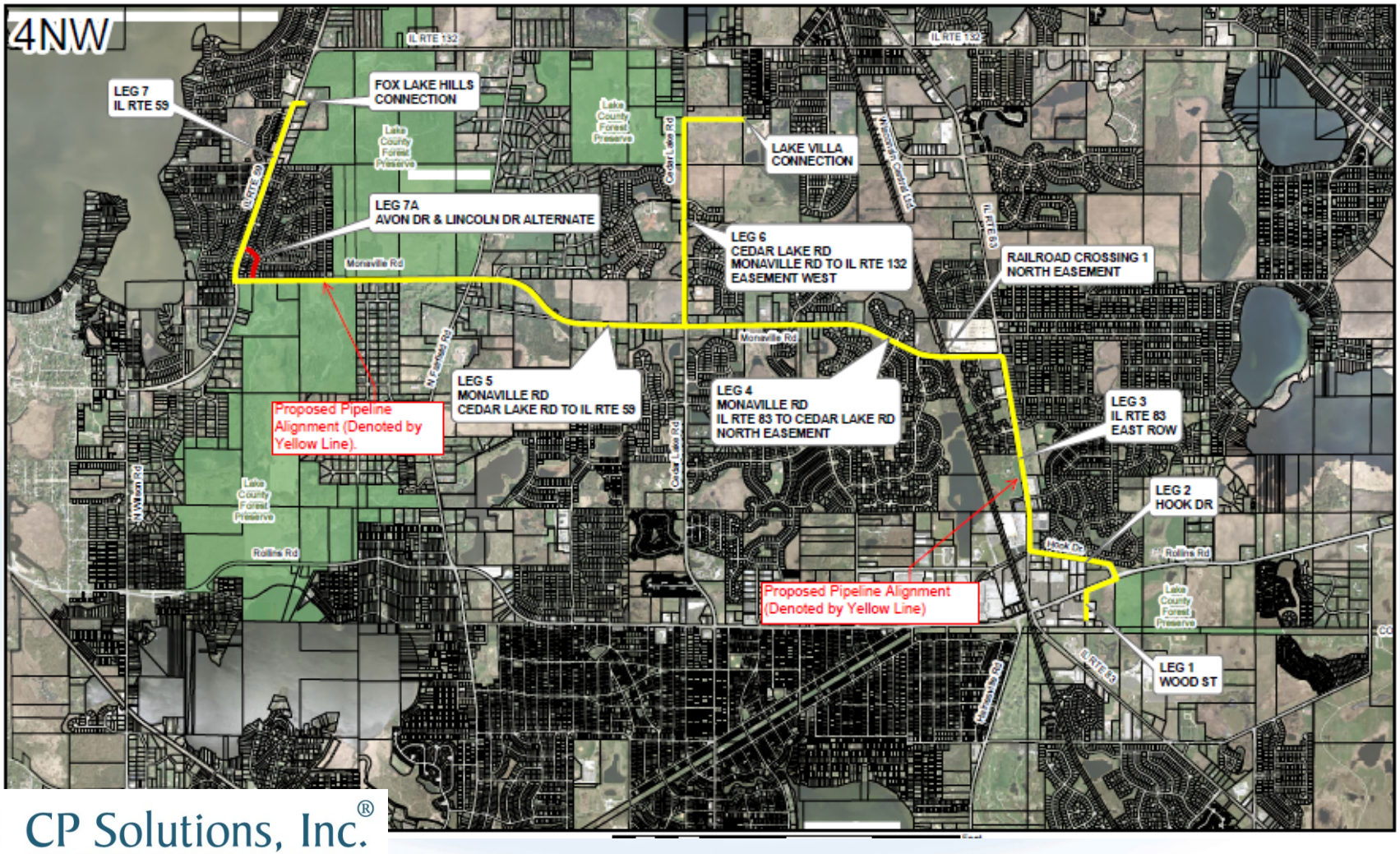

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Fig. 4NW.2: 4NW Soil Boring Corrosivity Test Sites

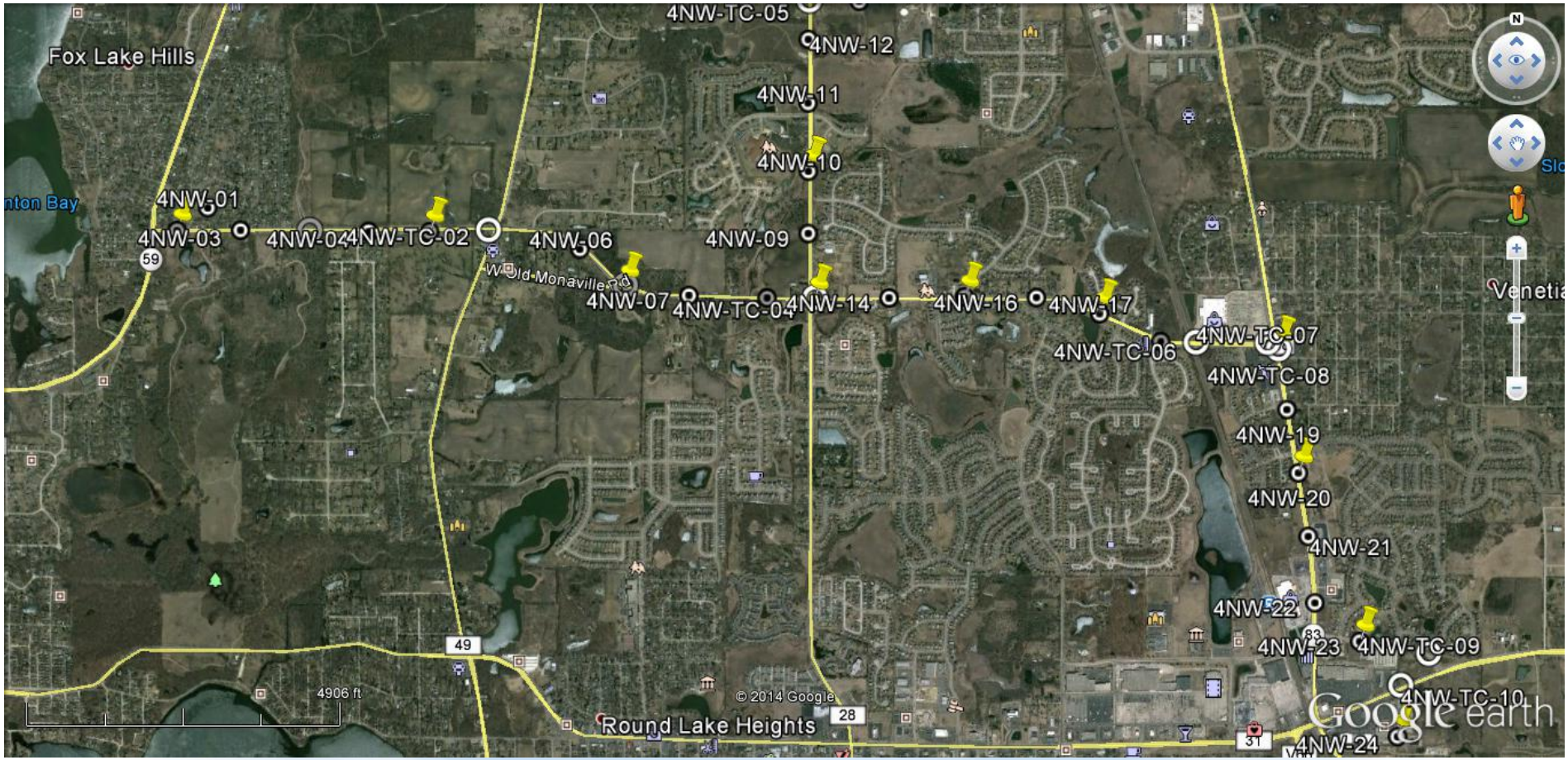

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Fig. 4NW.3: Nicor Gas PL Locations along Monaville Rd.

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Fig. 4NW.4: Nicor Gas Rectifier Location

Nicor Gas uses sacrificial anodes to protect their gas pipelines in this area.

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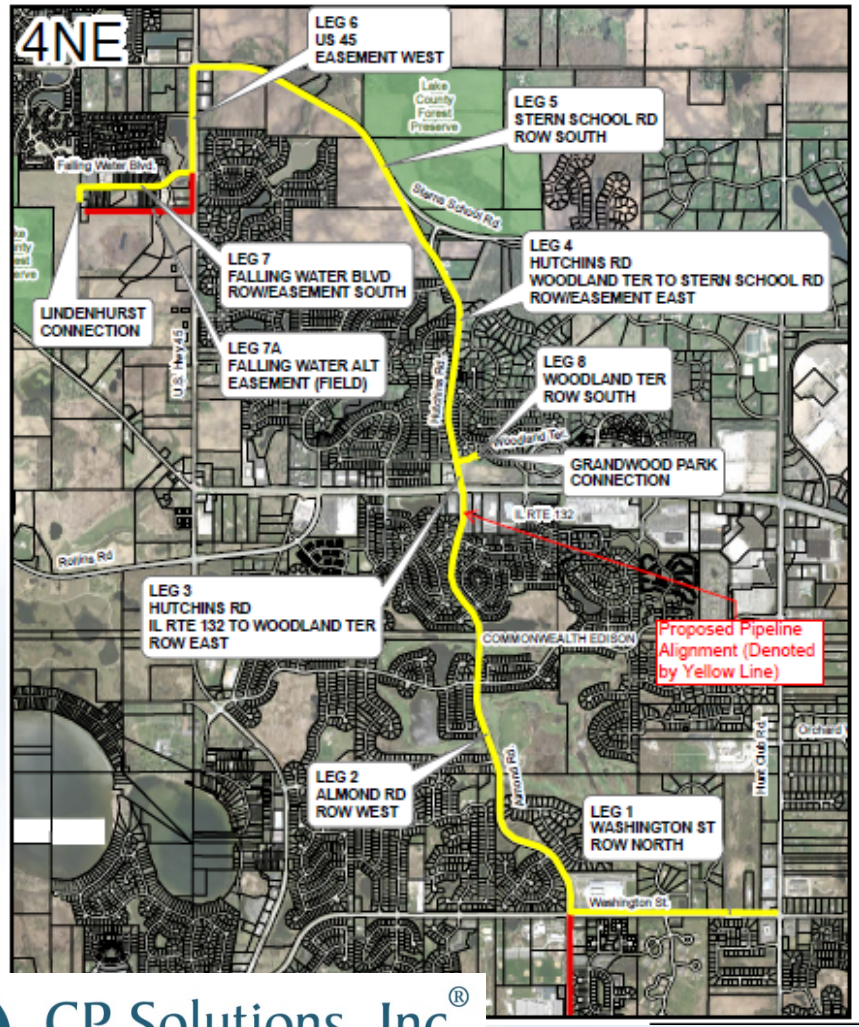
Fig. 4NE.1: Vicinity Map for Proposed WTM Alignment



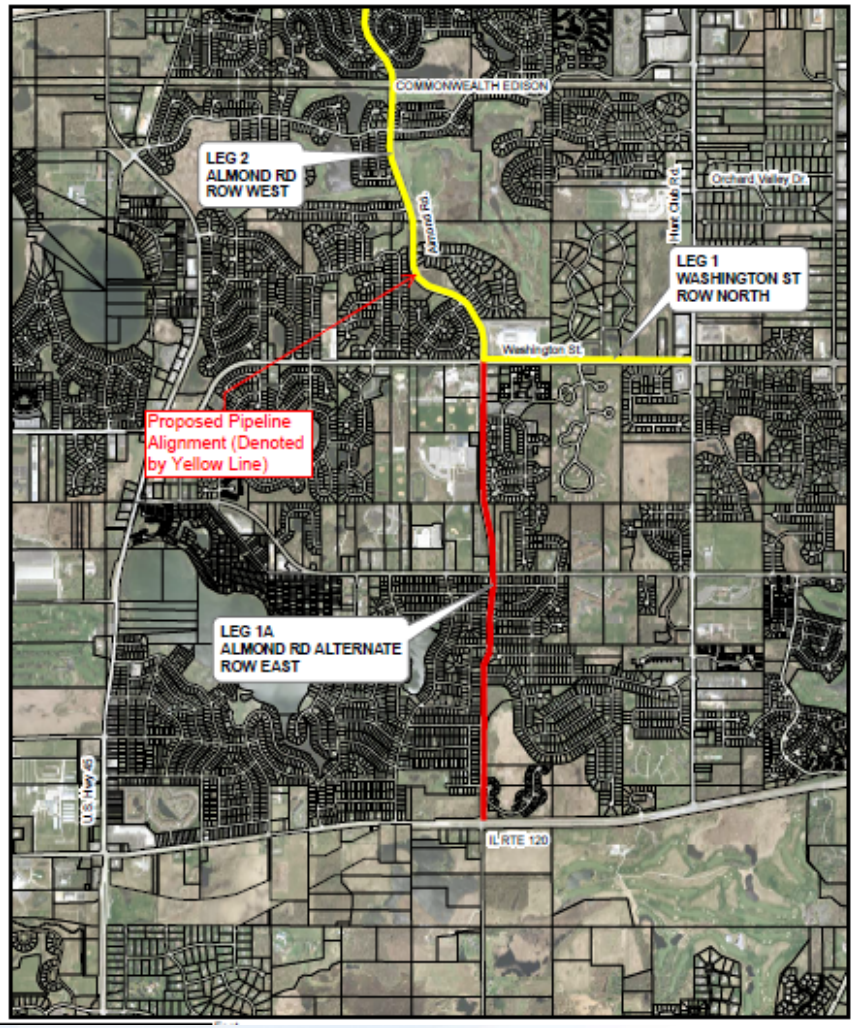


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Fig. 4NE.2: 4NE Soil Boring Corrosivity Test Sites

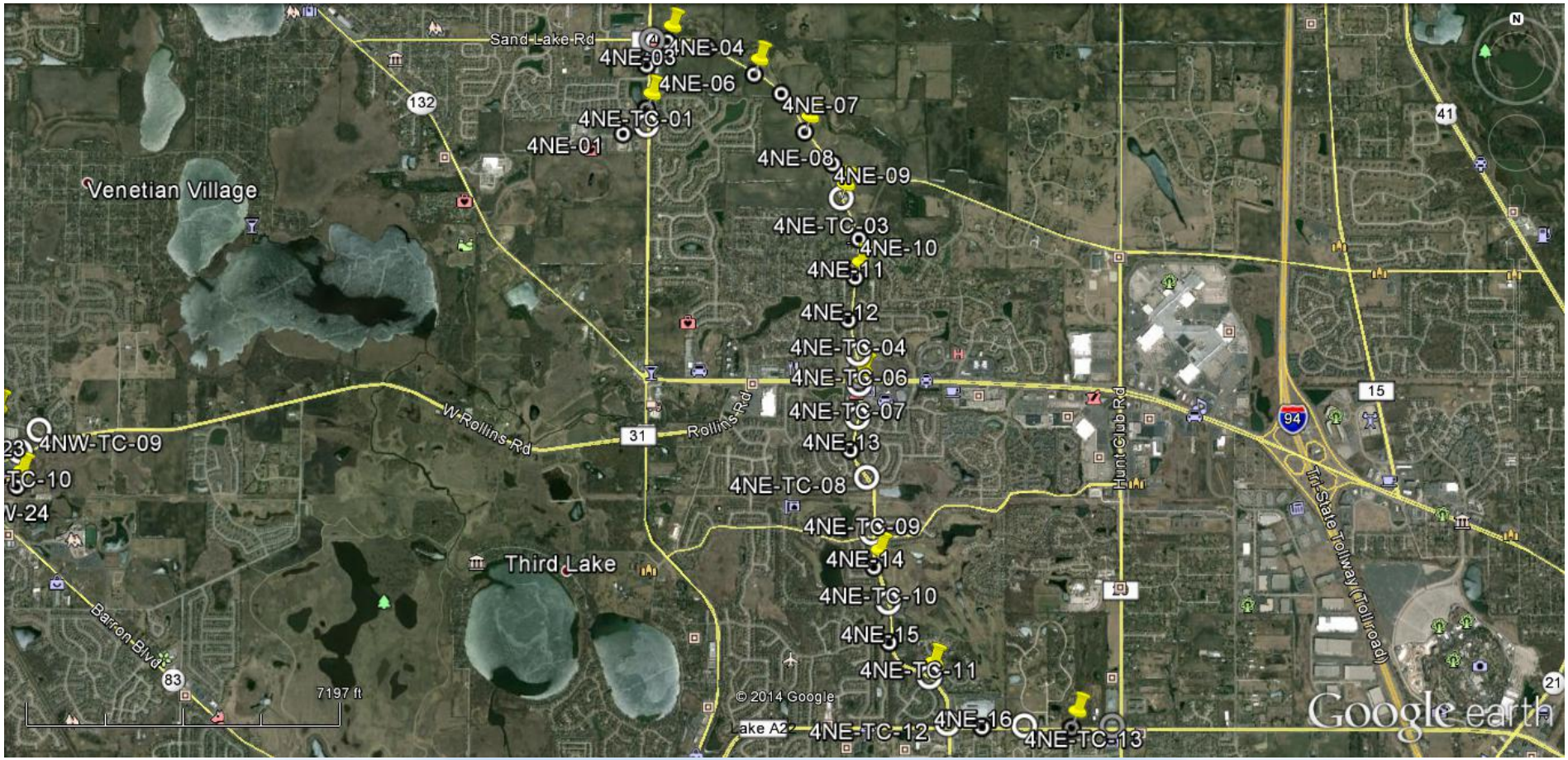

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Fig. 4NE.3.A: NGPL Crossing at Falling Waters Blvd.

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Fig. 4NE.3.B: NGPL Crossing at Sand Lake Road

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Fig. 4NE.3.C: K-M/NGPL Rectifier Location (North)

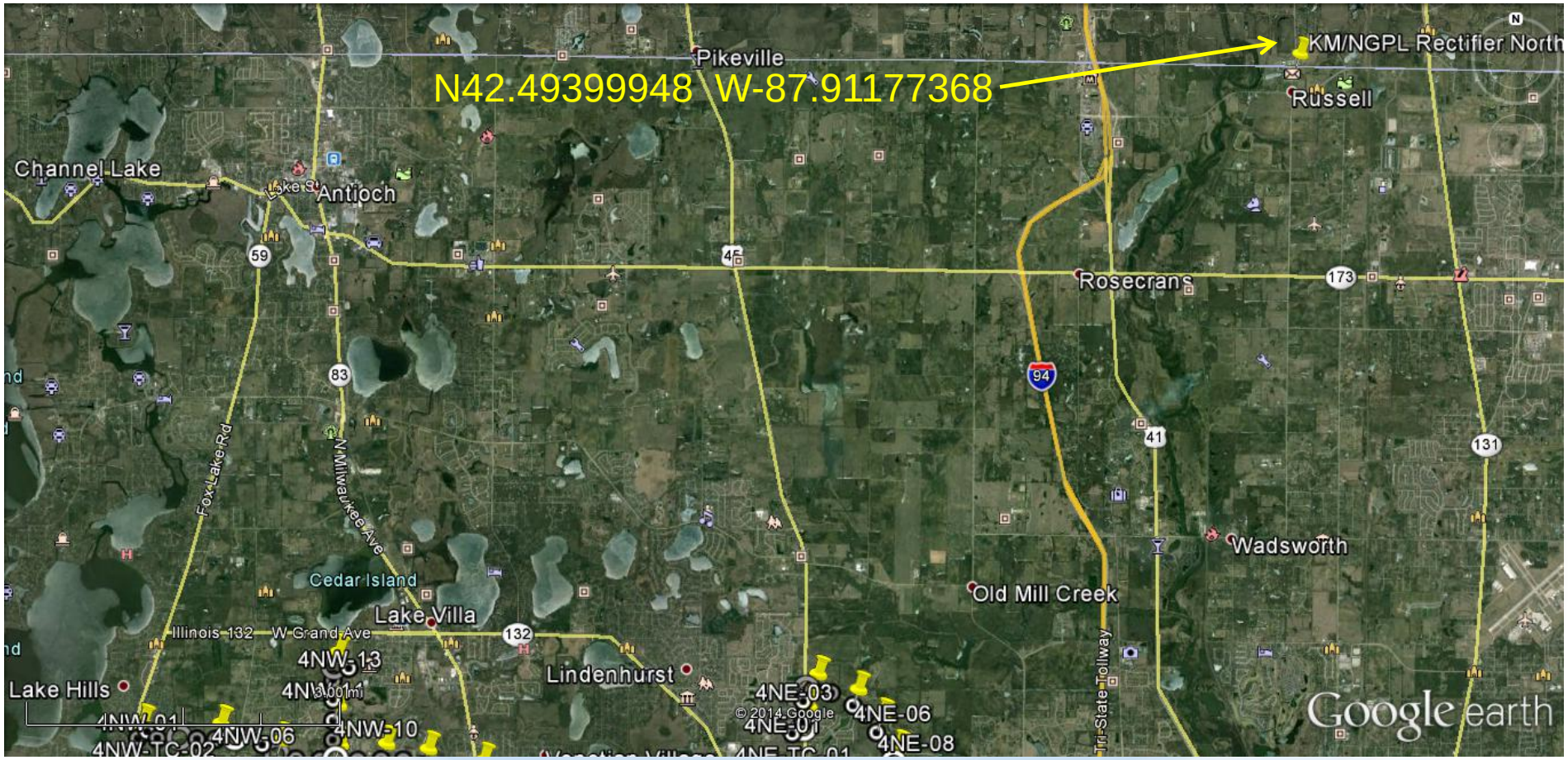

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Fig. 4NE.3.D: K-M/NGPL Rectifier Location (South)

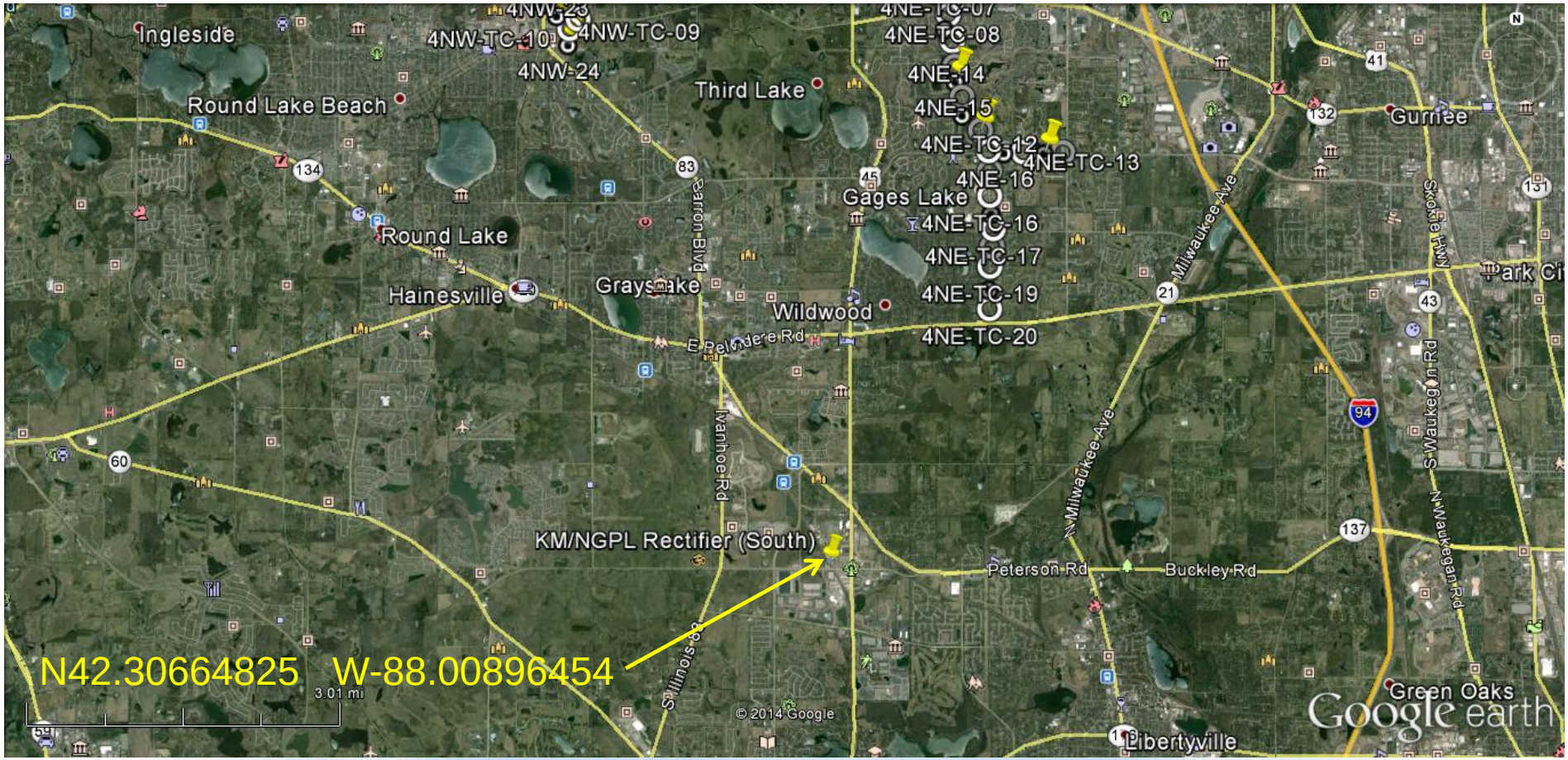

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Fig. 4NE.4.A: West Shore PL (Lindenhurst South)

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Fig. 4NE.4.B: West Shore PL (Lindenhurst Central)

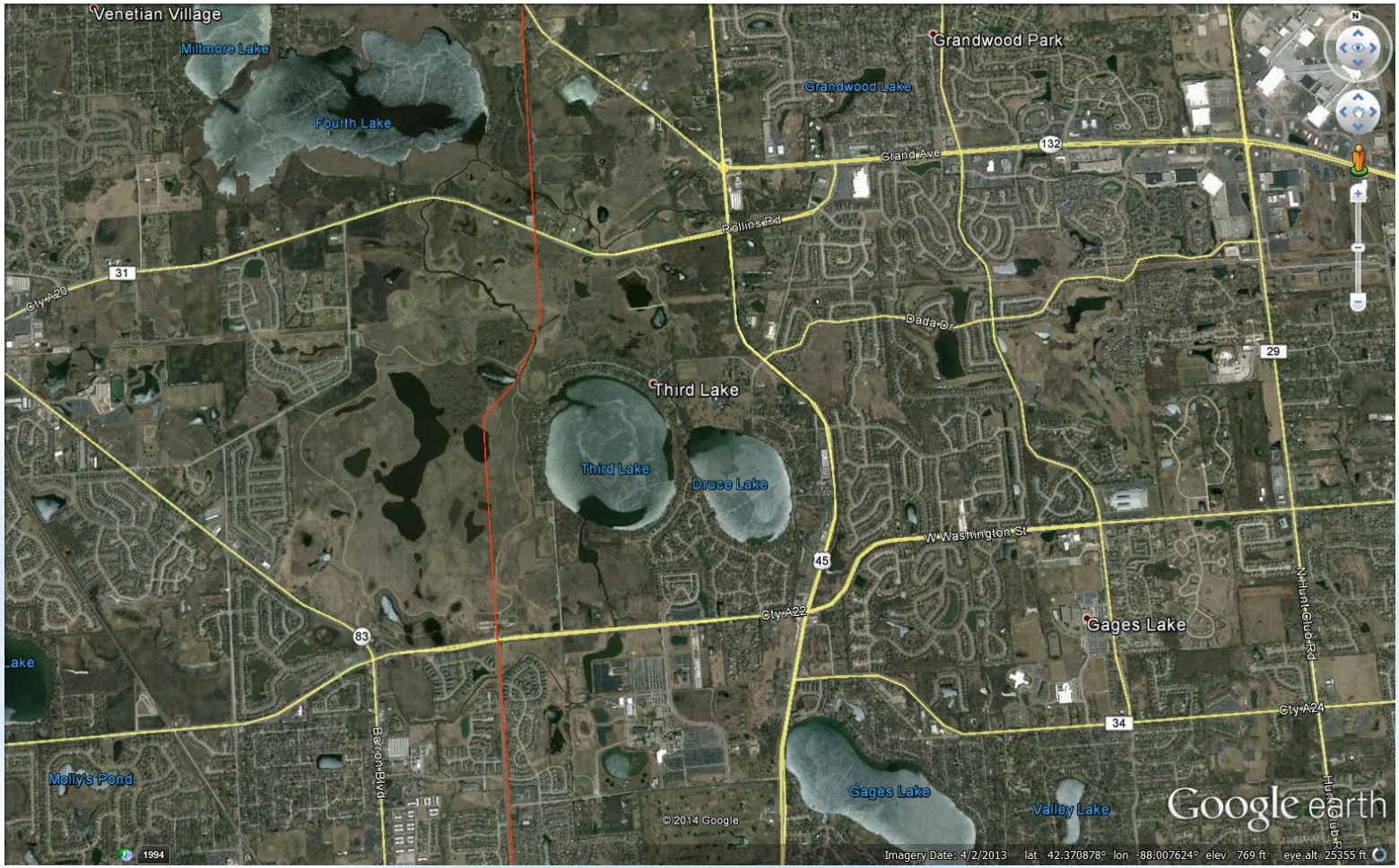

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Fig. 4NE.4.C: West Shore PL (Lindenhurst North)

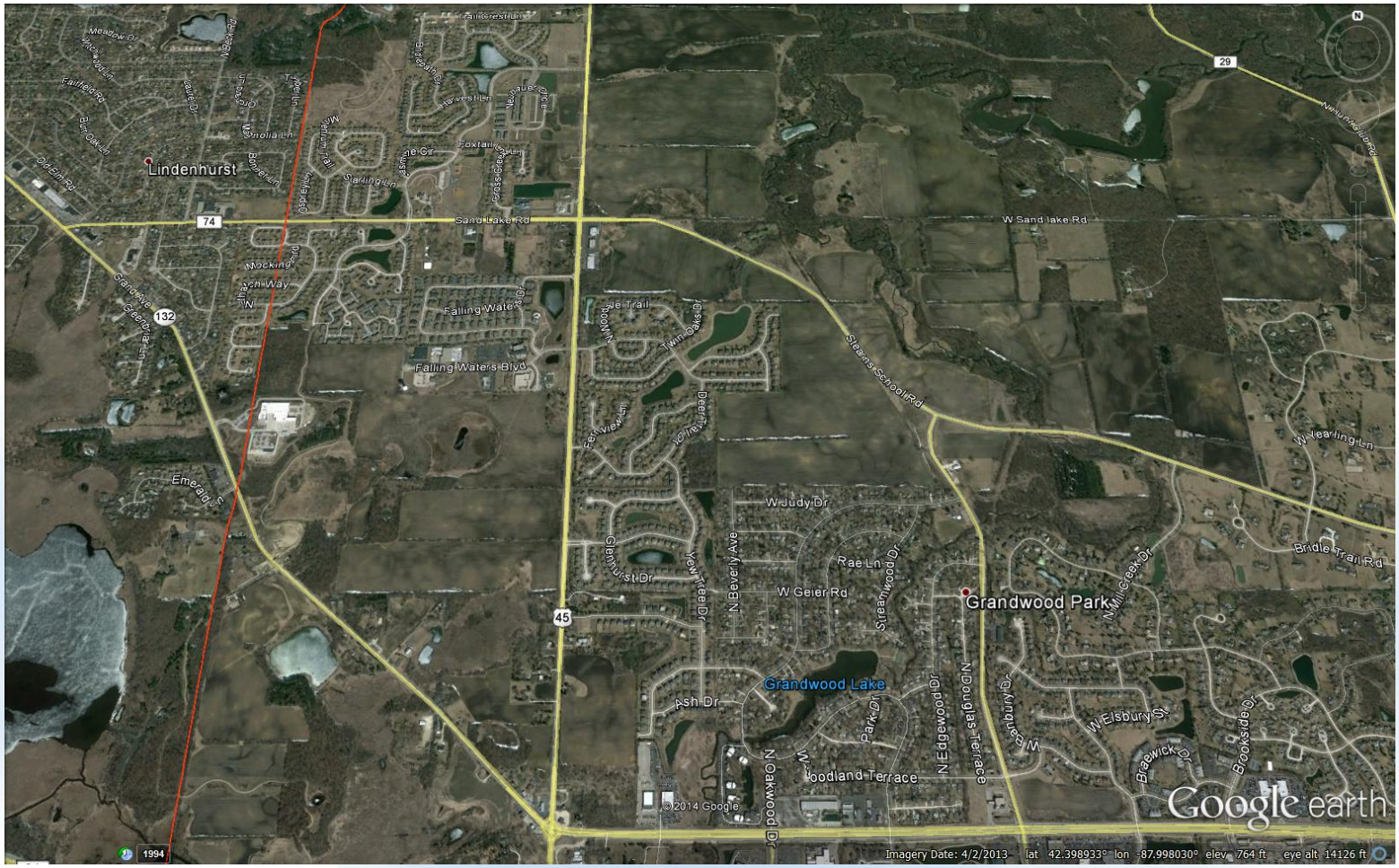

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Fig. 4NE.4.D: West Shore PL Rectifier Location

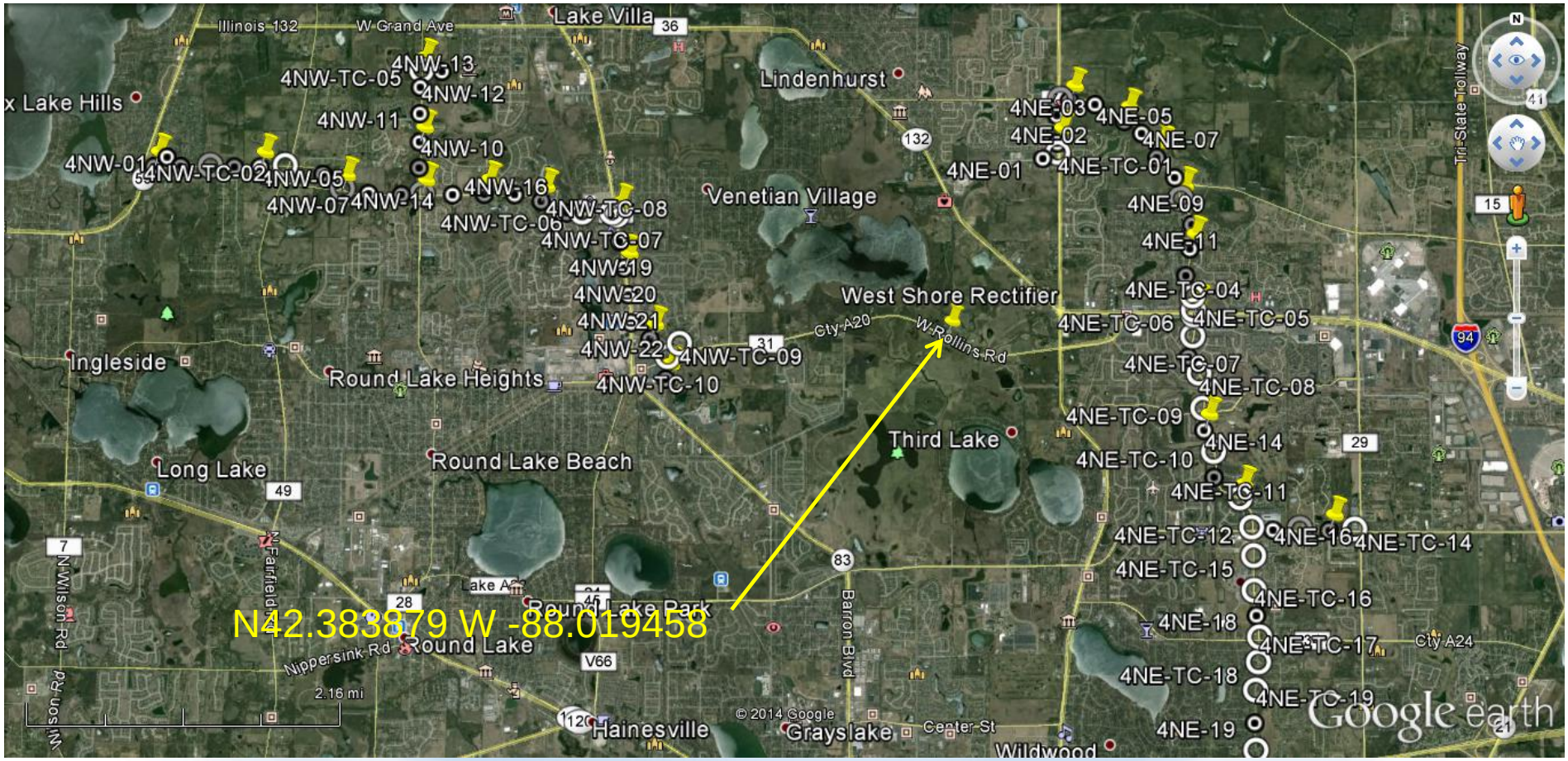

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Fig. 4NE.5.A: Nicor Gas PL Location

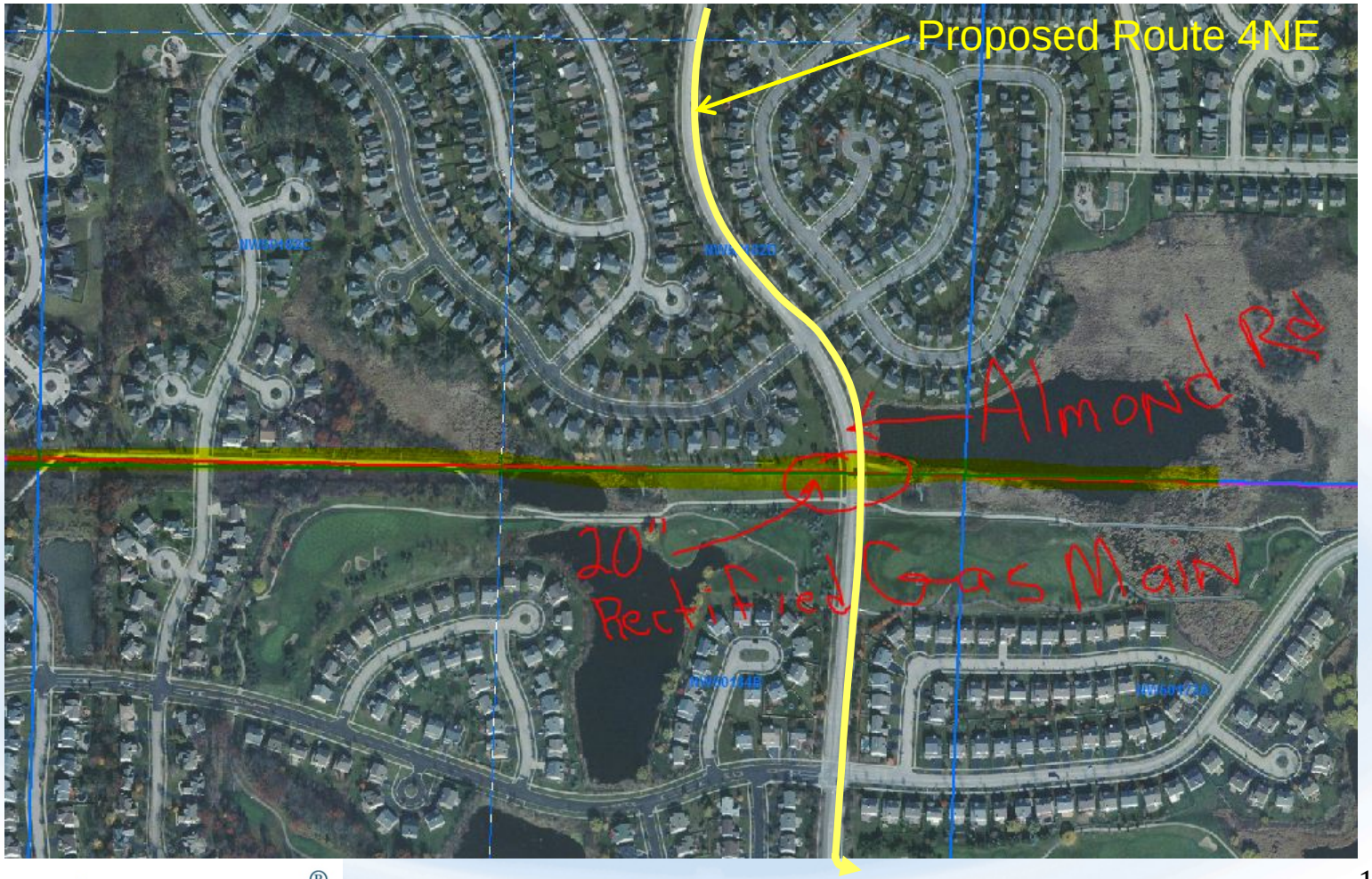

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Fig. 4NE.5.B: Nicor Gas Rectifier Location

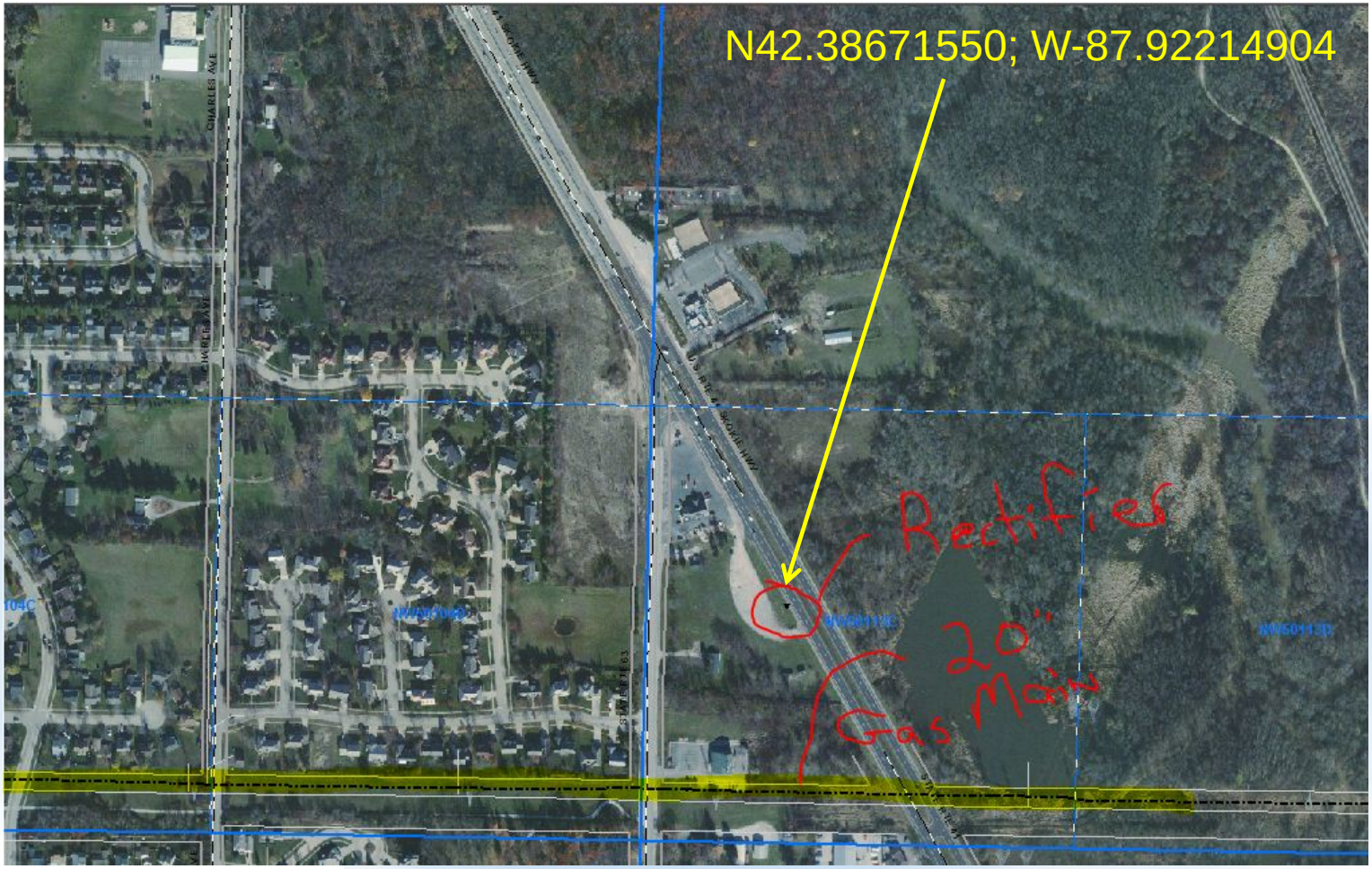

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Table 1.A Project (4NW): CLCJAWA Preliminary Engineering Report/Lab Soil Data Analysis

Location Name	Est. Bore Depth (ft)	Sample Flag	Sample Depth (ft)	Sample Date	Lab Rpt. Date	% Moisture	Soil pH	Cl^- Ions (ppm)	SO_4^{-2} (ppm)	Redox Pot'l (mV)	As-Is SR‡ (ohm-cm)	Sat. SR (ohm-cm)
4NW-TC-03	35	1	12 to 18	9/2/2014	10/10/2014	10.8	7.98	13.6	211.0	356	985	NA
4NW-TC-04	35	1	8 to 14	9/15/2014	10/10/2014	11.8	7.97	22.7	127.0	352	1126	NA
4NW-TC-08	35	1	8 to 12	10/8/2014	11/25/2014	11.5	7.18	45.1	350.0	431	1497	NA
4NW-03	12	1	8 to 12	12/1/2014	12/12/2014	11.2	8.09	226.0	14.4	452	716	NA
4NW-05	12	1	8 to 12	9/11/2014	10/10/2014	11.2	8.11	186.0	14.5	366	884	NA
4NW-15	12	1	8 to 12	9/3/2014	10/10/2014	10.6	8.75		141.0	341	1702	NA
4NW-17	12	1	8 to 12	9/15/2014	10/10/2014	11.3	7.88	79.4	85.9	352	811	NA
4NW-20	12	1	8 to 10	10/8/2014	11/25/2014	11.9	7.82	245.0	13.3	426	746	NA
4NW-23	12	1	8 to 12	9/25/2014	11/25/2014	14.1	7.76	247.0	42.4	436	402	NA
4NW-24	12	1	8 to 12	10/2/2014	11/25/2014	11.1	7.31	87.4	38.1	435	992	NA
					Count	**10**	**10**	**9**	**10**	**10**	**10**	
					Mean	**11.6**	**7.9**	**128.0**	**103.8**	**395**	**986**	
					Median	**11.3**	**7.9**	**87.4**	**64.2**	**396**	**935**	
					Max.	**14.1**	**8.8**	**247.0**	**350.0**	**452**	**1702**	
					Min.	**10.6**	**7.2**	**13.6**	**13.3**	**341**	**402**	
					Std. Dev.	**1.0**	**0.4**	**97.4**	**109**	**44**	**381**	

‡ at 9' Deep

M = Missing Data

Table 1.B Project (4NE): CLCJAWA Preliminary Engineering Report/Lab Soil Data Analysis

Location Name	Est. Bore Depth (ft)	Sample Flag	Sample Depth (ft)	Sample Date	Lab Rpt. Date	% Moisture	Soil pH	Cl^- Ions (ppm)	SO_4^{-2} (ppm)	Redox Pot'l (mV)	As-Is SR‡ (ohm-cm)	Sat. SR (ohm-cm)
4NE-TC-03	35	1	8 to 12	9/2/2014	10/10/2014	11.0	8.14	98.4	66.4	367	797	NA
4NE-TC-06	35	1	8 to 12	12/1/2014	12/12/2014	10.5	7.69	313.0	21.0	450	891	NA
4NE-TC-11	35	1	12 to 18	8/14/2014	10/10/2014	10.7	8.06	5.0	143.0	357	1226	NA
4NE-02	12	1	8 to 12	8/25/2014	10/10/2014	11.8	8.07	296.0	26.0	386	590	NA
4NE-04	12	1	8 to 12	8/25/2014	10/10/2014	12.2	8.11	117.0	21.8	366	536	NA
4NE-06	12	1	8 to 12	9/11/2014	10/10/2014	11.0	8.04	52.3	133.0	357	1173	NA
4NE-08	12	1	8 to 12	9/11/2014	10/10/2014	10.7	7.95	19.2	149.0	362	1132	NA
4NE-11	12	1	8 to 12	9/3/2014	10/10/2014	10.5	8.32	75.8	34.3	369	1615	NA
4NE-14	12	1	8 to 12	12/1/2014	12/12/2014	10.2	7.67	67.7	46.4	431	1400	NA
4NE-17	12	1	8 to 12	9/4/2014	10/10/2014	12.4	8.06	190.0	15.7	377	442	NA
					Count	**10**	**10**	**10**	**10**	**10**	**10**	
					Mean	**11.1**	**8.0**	**123.4**	**65.7**	**382**	**980**	
					Median	**10.9**	**8.1**	**87.1**	**40.4**	**368**	**1012**	
					Max.	**12.4**	**8.3**	**313.0**	**149.0**	**450**	**1615**	
					Min.	**10.2**	**7.7**	**5.0**	**15.7**	**357**	**442**	
					Std. Dev.	**0.8**	**0.2**	**108.6**	**55**	**32**	**392**	

‡ at 9' Deep except 4NE-11 at 6'

M = Missing Data

METALLIC MAINLINE PIPE OPTION

Ductile Iron Pipe (DIP): Reference AWWA Manual M41

- Pipe Specification: AWWA C151 with standard 1 mil asphalt seal coating.
- Fitting Specification: AWWA C110 with standard 1 mil asphalt seal coating.
- Push Joint and Mechanical Joint Specification: AWWA C111.
- Flanged Joint Specification: AWWA C115.
- External Wrapping: Single 8-mil poly wrap per AWWA C105.
- Electrical Continuity: Cable bond across all push-on/mechanical pipe joints.
- Test Stations[1]: Flush polymer concrete enclosure[2] (w/optional marker post) or Post-mounted style per ROW/Owner requirements/preference.
- Cathodic Protection: Sacrificial magnesium anodes installed in clusters installed in the pipe trench and parallel to the new water main.

Pipeline Gate Valves

- Specification: Ductile iron per AWWA C515 (24" maximum pipe size).
- Valve Ends: Flanged connections per ANSI B16.1 with Class 125 drilling pattern.
- Coating (interior/exterior) Specification: 10-mil fusion-bonded epoxy per AWWA C550.

Fire Hydrants

- Hydrant Barrel Material: Ductile iron per AWWA C110.
- External Coating below Ground Line: Two coats asphalt sealant per AWWA C502.
- External Wrapping below Ground Line: Single 8-mil poly wrap per AWWA C105.
- Mechanical Joints: AWWA C111.

Electrical Isolation Requirements

- Electrically isolate all New-to-Existing Connections and all Connections to Existing (Unprotected) Water Main Piping with one of the following devices:
  - PVC Pipe Insert (PPI) installed without a monitoring test station.
  - Prefabricated Flange Isolator (PFI) without a monitoring test station.
  - Pipe Isolation Coupling[3] (PIC) without monitoring test station.
  - Flange Isolation Kit (FIK) with a monitoring test station.
- Contain the aforementioned isolation device(s) within a valve vault, where possible. If a field-assembled metallic isolator must be buried, seal the device in wax encapsulation.
- Electrically isolate metallic casing sleeves (either smooth steel pipe or liner plates) from the carrier pipe with isolating steel band casing pipe skids (no wood chocks).
- Install boot-type elastomeric casing end seals to mitigate water infiltration within the casing annulus. Install a monitoring test station to verify the electrical separation between the casing sleeve and the carrier pipe.

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[1] If the Owner does not intend to monitor the CP system to collect operational data on system effectiveness and anode service life, the anodes could be installed w/o test stations.
[2] Test station enclosure is not intended to be installed in routinely-trafficked areas where an H20 rating would be more appropriate.
[3] With supplemental pipe restraint, *as required.*

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Standardized Color Coding for Test Stations and Wiring

- Test Station Caps:
  - Potential Test Stations: Green
  - Anode Test Stations: Red
  - Casing Test Stations: Blue
  - Isolation Test Stations: Orange
  - Foreign Pipeline[4] (Crossing) Test Stations: White
- Test Station Wiring:
  - Anodes: Red
  - Foreign/Existing Structures: White
  - Water Main: Blue
  - Reference Electrode: Yellow

Mitigation of Potential DC Interference

Several energy (natural gas, petroleum liquids) transmission pipelines are located within a few miles of the proposed water transmission mains. The owners of these pipelines have been determined as well as the type of cathodic protection systems that they operate for DOT/PHMSA compliance, which are summarized below by the two CP system types:

- **Sacrificial Anodes:** No mitigative measures should be necessary.
- **Rectified Anodes:** I recommend that a Foreign Test Station (FTS) be installed at the crossing of three foreign energy pipelines with the proposed water mains. There would be no wire connections to the foreign pipeline(s) within the FTS. However, should there be need to drain any DC interference current from the new water main back to the foreign pipeline, one or more DC drain cables would be installed to the water main in the FTS for this purpose. The cable(s) could eventually go to a bond station (or some other device) to mitigate any DC interference on the new water main.

Mitigation of Potential AC Interference

There are no known high voltage overhead AC transmission lines within the right-of-way of the proposed water transmission mains.

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[4] Normally these would be rectified-anode CP systems maintained by either hazardous gas or liquid pipelines

NON-METALLIC MAINLINE PIPE OPTION

Polyvinyl Chloride (PVC) Pipe

- Pipe Specification: AWWA C900 Water Distribution Pipe, 4 inches through 12 inches.
- Pipe Specification: AWWA C905 Water Distribution Pipe, 14 inches through 36 inches.

Ductile Iron Pipe Fittings

- Standard Fitting Specification: AWWA C110 with 1 mil asphalt seal coating.
- Enhanced Fitting Specification: AWWA C116 with 6-8 mil fusion bonded epoxy coating.
- Electrical Continuity: Cable bond across all push-on/mechanical pipe joints.
- Test Stations: None.
- Cathodic Protection: A sacrificial anode connected directly to the new metallic fitting.

Pipeline Gate Valves (GV)

- Specification: Ductile iron per AWWA C515 (24" maximum pipe size).
- Coating (interior/exterior) Specification: 10-mil fusion-bonded epoxy per AWWA C550.

Fire Hydrants (HYD)

- Hydrant Barrel Material: Ductile iron per AWWA C110.
- External Coating below Ground Line: Two coats asphalt sealant per AWWA C502.
- External Wrapping below Ground Line: Single 8-mil poly wrap per AWWA C105.
- Mechanical Joints: AWWA C111.
- Test Stations: None
- Cathodic Protection: A sacrificial anode connected directly to the new metallic GV/HYD.

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