The GLMRIS Report

Appendix H - Geotechnical Engineering

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H.1 INTRODUCTION

H.1.1 Study Background

The United States Army Corps of Engineers (USACE), in consultation with other federal agencies, Native American tribes, state agencies, local governments and non-governmental organizations, is conducting the Great Lakes & Mississippi River Interbasin Study (GLMRIS). In accordance with the study's authorization, USACE has evaluated a range of options and technologies collectively known as aquatic nuisance species (ANS) controls to prevent the spread of aquatic nuisance species between the Great Lakes and Mississippi River via aquatic pathways. For the purposes of this study, the term "prevent" includes the reduction of risk to the maximum extent possible based on potential challenges associated with a plan aimed at finite separation of water between basins. In addition, USACE will analyze the effects given alternatives would have on the aquatic and riparian environments, cultural and archaeological resources, social and economic resources, and with specific focus, on uses of the Chicago Area Waterway System (CAWS). In particular, this report addresses the geological and geotechnical design considerations and concerns associated with various suggested technologies or combination of technologies considered for implementation.

H.1.2 Study Area

The GLMRIS study area includes the Great Lakes and Mississippi River basins (Figure H.1-1). The detailed study area exists along the border of the Great Lakes and the Mississippi River basins, and

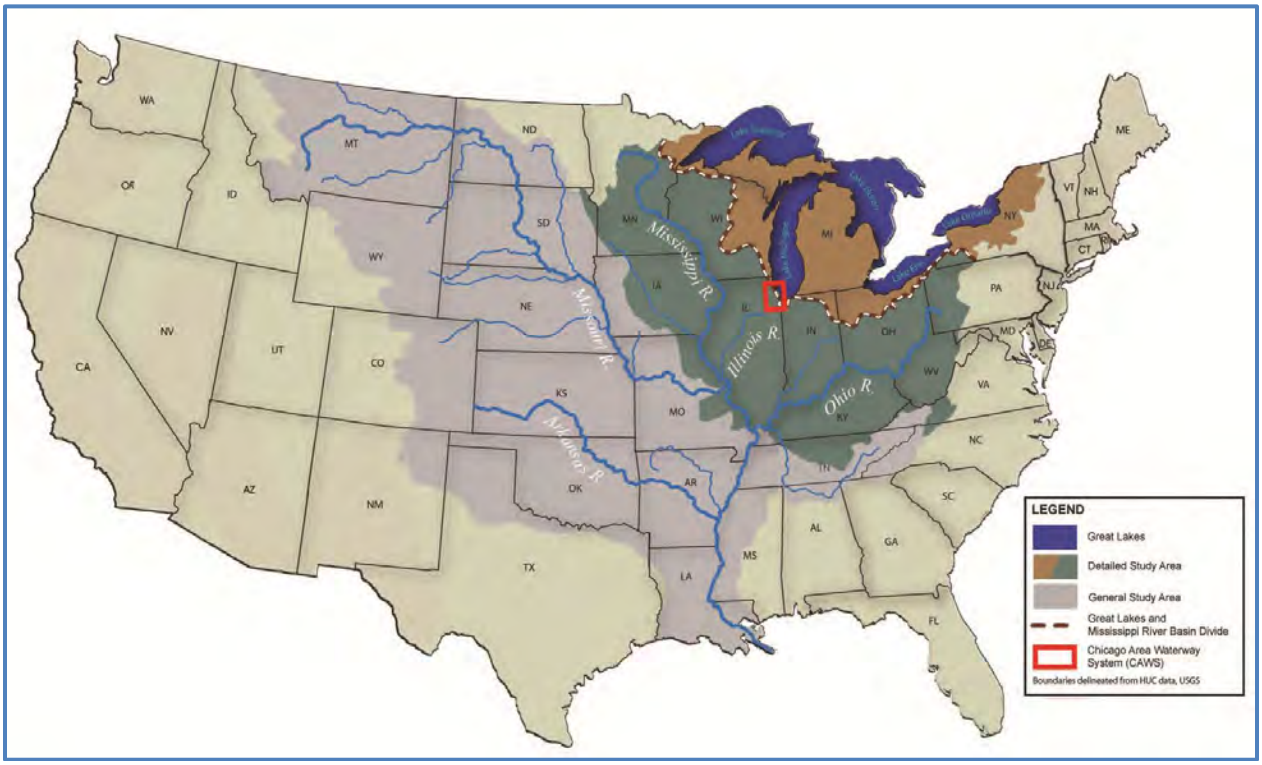


FIGURE H.1-1 GLMRIS Study Area

encompasses the entire Great Lakes basin, the Upper Mississippi River Watershed and the Ohio River watershed. The Detailed Study Area includes portions of seventeen U.S. states and borders two Canadian provinces (Ontario and Quebec). Due to the size of the study area, GLMRIS is being conducted along two parallel tracks. This geotechnical appendix only covers the Chicago Area Waterway System (CAWS), or Focus Area I (Figure H.1-2).

1.2.1 Alternative Locations

All suggested alternatives present technologies or combinations of technologies to be implemented within the CAWS Area. Because of the similarity of the regional geology between many of the proposed locations, three overviews of the regional geology and hydrogeology are presented in Chapter 2. These subcategories include lakefront geology, mid-system geology, and down system geology (Figure H.1-3). Because of the proximity of each region to the other, many geological and hydrogeological conditions have shared characteristics.

FIGURE H.1-2 Focus Area I: CAWS

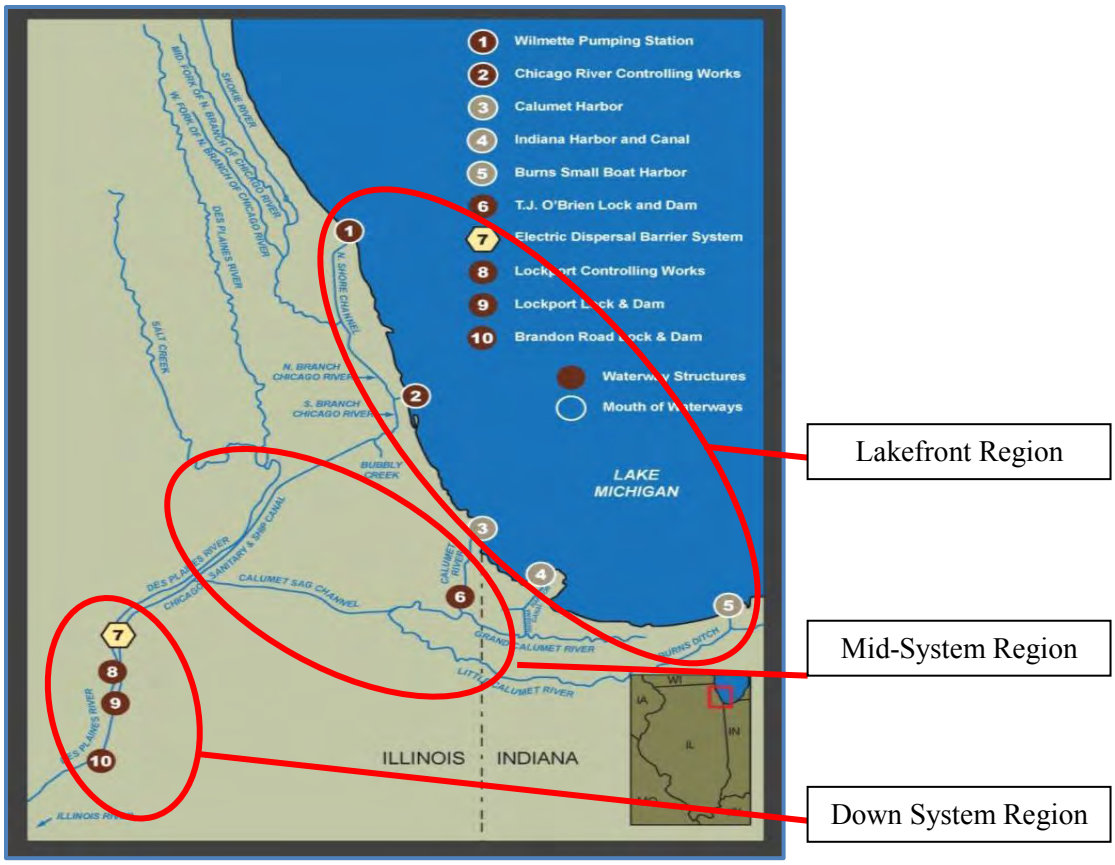


FIGURE H.1-3 Regional Breakdown

H.2 REGIONAL GEOLOGY

H.2.1 Alternative Overview and Applicable Regions

TABLE H.2-1 Alternative and Regional Breakdown

Alternative Name	Applicable Geological Regions		
	Lakefront	Mid-System	Down System
Mid-System Control Technologies without a Buffer Zone		x	
Technology Alternative with a Buffer Zone	X	x	x
Mid-System Separation Cal-Sag Open Control Technologies with a Buffer Zone		x	x
Mid-System Separation CSSC Open Control Technologies with a Buffer Zone	X	x	x
Lakefront Hydrologic Separation	X	x	
Mid-System Hydrologic Separation		x	

H.2.2 General Topography

Chicago, and the greater area surrounding it, was formed through repeated glacial processes during the Pleistocene period and subsequently, by erosion and man-made alterations. Prior to the Wisconsinan age, at least three major glacial events covered the Chicago region in thousands of feet of glacial ice. During the Wisconsinan age, several glaciations events spread over the Chicagoland region forming four types of topographic features: morainic uplands, the lake plain, the shore deposits, and the stream-occupied valleys (Bretz 1955).

As glaciers advanced, soils were transported radially west. As each glacial event receded, materials were deposited at the forefront of the glacier creating morainic uplands. Of these, the Valparaiso Moraine was formed. This terminal moraine forms an immense "U" around present-day Lake Michigan and is primarily the ridge on which the Lake Michigan and Mississippi River basin are divided. The Valparaiso Moraine is part of the larger St. Lawrence Seaway Divide, bounding what is known as the Great Lakes Basin. For the purposes of the GLMRIS study, water to the west of the Valparaiso Moraine is considered to be tributary to the Mississippi River and is distinguished as the Mississippi River Basin, where water to the east of the Valparaiso Moraine flows into Lake Michigan and is considered part of the Great Lakes Basin.

H.2.2.1 Lakefront Topography

As glaciers receded, Lake Chicago (the ancestor of Lake Michigan) continued to drain below the current Lake Michigan water elevation. As the Lake Chicago elevation decreased over time to become present-day Lake Michigan (Figure H.2-1), much of the drift materials were washed away, leaving what is known as a lake plain.

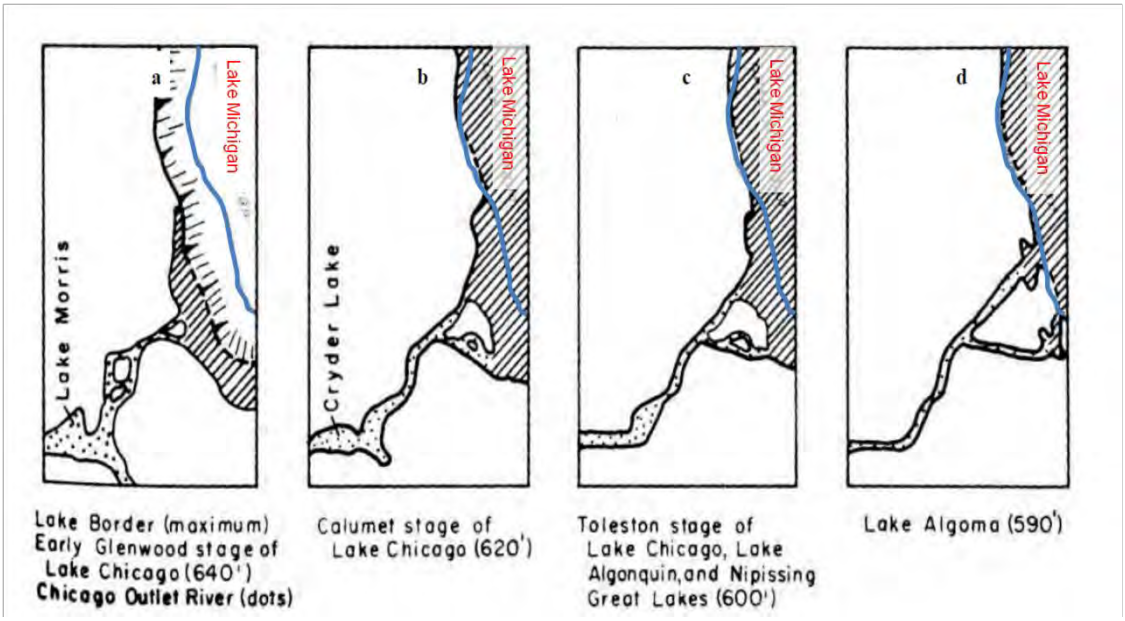


FIGURE H.2-1 Movement of Glacial Lake Chicago

The lake plain area extends approximately 45 miles in the north-south direction and is 15 miles wide at its center. The Tinley Moraine marks the western boundary with an elevation just below 630 ft. The lake plain elevation becomes lower in two distinct steps, approximately 20 ft each, before approaching a boundary elevation of 580 ft, which is equal to that of Lake Michigan. The first step, located at the shoreline of the Calumet stage (mid-system) of Lake Chicago, brings the lake plain elevation to 620 ft. The second major step, located along the shoreline of the Tolston stage of Lake Chicago, brings the lake plain elevation to 600 ft. However, these distinct elevation changes are not as prominent in the northern region of the lake plain between the lake border moraines, where branches of the lake extend to the Des Plaines and the Chicago River (Willman 1971).

H.2.2.2 Mid-System and Down System Topography

The morainic uplands in the Chicagoland region include the Valparaiso Moraine and the Tinley Moraine, of which the glacial movements can be seen in Figure H.2-2. The Valparaiso glaciations extended from Lake Michigan westward to the Joliet and Wheaton quadrangles, and southward just past Matteson. As the Valparaiso glacier spread, soils were pushed westward and were left at the outer limits of the glacier, forming the Valparaiso Moraine, which is the largest moraine formed in the region and consists of a low, broad glacial ridge that encompasses an area running roughly southeastward through the western Chicago region into Indiana. The moraines are a complex of roughly parallel ridges, depressions and valleys generally between 10-15 miles wide, with the highest point lying 219 ft above Lake Michigan (Bretz 1939). The topography of the moraine was caused by unequal distribution of the glacial drift over pre-Valparaiso topography. A large water volume was produced during rapid melting of the glacier, while finer gravel and sand were transported by floodwaters into the valley regions such as the Kankakee Valley, causing what is known as the Kankakee Flood. Two stream-made valleys that were part of the pre-Valparaiso landscape remained and provided an outlet, even after the floodwaters receded across the moraine, Des Plaines River, and Hickory Creek (Bretz 1995).

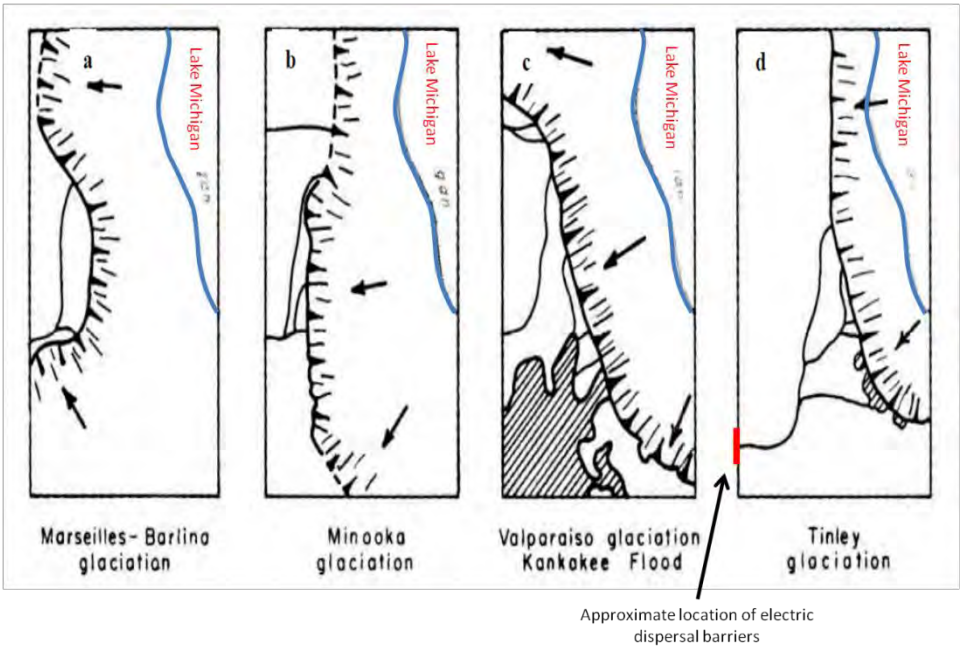


FIGURE H.2-2 Chicago Area Glaciations

The Tinley Moraine was formed to the east of the Valparaiso, during a subsequent, smaller glacial event, extending from near Mundelein to Chicago Heights. Although its width is relatively narrow, averaging 2 miles compared to the Valparaiso, it is the longest moraine in the region. Two valleys transect the moraine, the Des Plaines Valley and the Sag Valley. As water drained during the Tinley glacier melt, water was diverted from the north into the Des Plaines Valley. Ice blockages prevented water from flowing east, resulting in flooding over much of the area. This occurred frequently until an outlet at the headwaters of Hickory Creek was formed (Willman 1971).

The subsequent glacier that built the lake border morainic system deposited sand and gravel through the current Des Plaines Valley location during its glacier melt. Past the Valparaiso moraine, the water drained through the Lily Cache Slough into the Du Page Valley before flooding Lake Morris (Willman 1971). As Lake Morris flooded, it entrenched itself, creating a steep escarpment resulting in a river cut up to 6 miles wide and through bedrock. The eroded bedrock from this process is found along the Des Plaines Valley at Joliet, Lockport, Channahon, and Morris. As the glacier receded, Lake Chicago continued to drain, lowering its level below the current Lake Michigan levels, ending the Woodfordian glacial period.

Additional glaciations and flooding events continued over time as lake levels fluctuated. The Chicago outlet river continued to form, deepening erosion through bedrock and splitting at its origin from the lake, forming today's two Lake Michigan outlets, the Des Plaines River and the Cal-Sag Channel.

H.2.3 Bedrock Geology

Bedrock in the Chicago Area was deposited during the Cambrian to Pennsylvanian eras and overlies Precambrian crystalline rock. The sedimentary rocks generally have very gentle dips and have been subject to periods of uplift, tilting, and erosion, resulting in several unconformities. The Kankakee Arch, a broad anticlinal structure trending northwest to southeast across the southern half of the Chicago area, is the major bedrock structure. The sedimentary rocks generally dip gently to the east from the arch toward the Michigan Basin. This structure is complicated by the Sandwich Fault Zone, southwest of Joliet, and

the Des Plaines Disturbance, a roughly circular down-faulted area in northeastern Cook County thought to be a meteorite impact structure. Devonian rocks can be found beneath Lake Michigan while Mississipian rocks have been removed from the entire area by erosion, except in the Des Plaines Disturbance where they have been preserved by down faulting. Pennsylvanian rocks are found only in the southwest part of the area where they are preserved by down faulting on the Sandwich Fault Zone. Figure H.2-3 represents the geologic stratigraphy of the area.

Time Stratigraphy			Rock Stratigraphy			Thickness	Kinds of Rock
System	Series	Stage	Mega-group	Group	Formation		
Quat.	Pleis.					0-350	till, sand, gravel, silt, clay, peat, marl, loess
Penn.	Desm.			Kewanee	Carbondale	0-125	shale, sandstone, thin limestone, coal
					Spoon	50-75	as above but No. 2 coal
Miss.	Val.				Burl.-Keokuk	0-700	Limestone
	Kind.				Hannibal		Shale, siltstone
Dev.	Up.				Grassy Creek	0-5	shale in solution cavties in Silurian
Silurian	Niagaran		Hunton		Racine	0-300	Dolomite, pure in reefs, mostly silty, argilaceous, cherty between reefs
					Waukesha	0-30	Dolomite, even bedded, slightly silty
					Joliet	40-60	Dolomite, shaly and red at base, white, silty, cherty above, pure at top
	Alex.				Kankakee	20-45	Dolomite, thin beds, green shale partings
					Edgewood	0-100	Solomite, cherty, shaly at base where thick
Ordovician	Cin	Rich		Maquoketa	Neda	0-15	Oolite and shale, red
					Brainard	0-100	Shale, dolomitic, greenish gray
					Ft. Atkinson	0-50	Dolomite, green shale, coarse limestone
		May			Scales	90-120	
		Ed.					Shale, dolomitic, gray, brown, black
	Champlainian	Trent.	Ottawa	Galena	Wise Lake	170-210	Dolomite, buff, pure
					Dunleith		Dolomite, pure to slightly shaly, locally limestone
					Guttenberg	0-15	Dolomite, red specks and shale partings
		Blackriveran		Platteville	Nachusa	0-50	Dolomite and limestone, pure, massive
					Grand Detour	20-40	Dolomite and limestone, medium beds
					Mifflin	20-50	Dolomite and limestone, shaly thin beds
					Pecatonica	20-50	Dolomite, pure, thick beds
				Ancell	Glenwood	0-80	Sandstone and dolomite, silty, green shale
					St. Peter	100-600	Sandstone, medium and fine grained, well rounded grains, chert rubble at base
	Canadian		Knox	Prairie du Chien	Shakopee	0-70	Dolomite, sandy, oolitic chert, algal mounds
					New Richmond	0-35	Standstone, fine to coarse
					Oneota	190-250	Dolomite, pure, coarse grained, oolitic chert
					Gunter	0-15	Sandstone, dolomitic
Cambrian	Croixan	Tremp.			Eminence	50-150	Dolomite, sandy
					Potosi	90-220	Dolomite, drusy quartz in vugs
		Fran.			Franconia	50-200	Sandstone, glaconitic, dolomite, shale
					Ironton	80-130	Sandstone, platly dolomitic, medium grained
		Dres.			Galesville	10-100	Sandstone, fine grained
			Potsdam		Eau Claire	370-570	Siltstone, dolomite, sandstone ans shale, glaconitic
					Mr. Simon	1200-2900	Sandstone, fine to coarse, quartz pebbles in some beds
Pre-Cam							Granite

FIGURE H.2-3 Columnar Section of the Rock Strata in the Chicago Area

H.2.3.1 Lakefront Region

Reef structures are common to the Upper Silurian rocks of northwest Illinois and southwest Wisconsin (Bretz 1939). These are seen in local Chicago quarries. The reef structures consist of domes of massive, unusually coarse-grained, vuggy, and fossiliferous dolomite with finer grained, less fossilferous, dense, and well-bedded dolomite dipping radially off their flanks. Horizontal, inter-reef strata separate the reefs.

In general, the bedrock in the Chicago area belongs to the Silurian System. The Silurian System has a maximum thickness of 500 ft in the southeastern part of the Chicago region, but is measured as only 230 ft thick near the Des Plaines Disturbance, where Silurian strata are overlain by the shale of the Upper Devonian-Mississipian age. The overall system has a slight eastward dip.

H.2.3.2 Mid-System and Down System Regions

The mid- and down-system regions are largely comprised of dolomite beds. The dolomite beds are strong, hard, brittle, and not affected by desiccation. The primarily dolomitic Silurian formations stand in vertical walls in local quarries where they are mined to produce crushed rock products. They part easily along the argillaceous laminations that occur along the bedding planes. The dolomite beds are also subject to solution by groundwater. This is especially true along joints intersecting the bedrock surface. The solution process produces openings in the rock and increased permeability.

Porous white masses, generally the size of pebbles, are common in many of the Silurian dolomite formations (Bretz 1939). The occurrence or absence of these masses is often the criterion for recognizing the formation contacts. They are often referred to as chert nodules, but usually only consist partly of dense, hard chert that forms light gray cores surrounded by the white, porous material that is a mixture of microcrystalline chert and dolomite.

The shale beds are only moderately strong, moderately hard, and slake when exposed. Cores from the shale Maquoketa group begin to split into chips soon after recovery. The shale beds are generally less fractured, not subject to solution by groundwater, and less permeable than the dolomite beds.

H.2.4 Overburden Geology

H.2.4.1 Lakefront Region

The lake plain area along the coast of Lake Michigan has been relatively flattened over time by wave erosion and minor depositions in low areas, and has remained relatively un-eroded by modern streams and rivers that flow above. The lake plain region is composed of Equality Formation materials, specifically the Dolton and Carmi Members, consisting of silt, sand, gravel, and clay deposits that accumulated in the glacial lakes over time.

The Dolton Member is predominantly sand but contains beds of silts, pebbly sand, and gravel. The materials that comprise the Dolton member are typically about 10 ft thick, but some of the more prominent spits can be as thick as 25 ft. Sand and pebbles can be found along narrow belts along the more prominent shorelines were waves eroded the till, silt, and clay. The Dolton Member is exposed in sand pits in the Wilmette spit southwest of Wilmette.

Closer to the city along the lakefront, the Carmi Member is predominates. It consists primarily of silt that is generally well-bedded or laminated. Much of the Carmi Member is also sandy and is comprised of fine sand and clay. In the Chicago area, they are exposed at the top of clay pits near Blue Island and Dolton.

Generally, Richland loess or modern soil overlies the Equality Formation. Nearer the lock area of the lakefront, overlying soils tend to be man-made.

H.2.4.2 Mid-System Region

With the formation of each morainic system, materials were deposited as the glaciers receded. Because of this, the mid-system of GLMRIS can be characterized by either the Valparaiso morainic system to the west or the lake plain system to the east and into Indiana. Proposed GLMRIS locations along the Calumet Rivers and into Indiana can be characterized by lake plain overburden geology and since that was discussed in detail above, it will not be discussed further in this chapter.

The mid-system region near the fork of the Cal-Sag Channel and the Chicago Sanitary and Ship Canal can characterized by the Wadsworth Till Member of the Valparaiso morainic system, glacial outwash plain, or Grayslake peat for areas near the channels itself. The Wadsworth Till Member consists mostly of gray clayey till. Toward west Chicago, the outermost of the Valparaiso moraine, the till is slightly lighter in color, siltier, and contains more gravel lenses. The Wadsworth till contains an abundance of black shale from Mississippian and Devonian formations, both as pebbles and as finely ground particles. Erosional channels created from outlets from glacial lakes contain outwash predominantly comprised of sand and gravel. The soils found in the outwash plains contain sand bars that are described by the Henry Formation. Finally, the mid-system region can also be characterized by Grayslake peat which is found in areas surrounding the canals. Grayslake peat occurs in areas bordering existing lakes or in depressions that previously were lake basins. Although dominantly peat, it includes organic silts and contains interbedded silts and sands that represent slopewash into the basins. Grayslake peat is generally less than 20 feet thick, but can be thicker in some larger areas. Most areas are less than 5 ft thick, however.

H.2.4.3 Down System Region

As previously discussed, in the Chicagoland area during the Pleistocene era, glacial drifts from the Wisconsinan Stage covered bedrock to depths as great as several hundred feet. The Wisconsinan Stage is divided into five substages, of which the majority of the drift in the Chicagoland area was deposited during the Woodfordian substage. The Wedron Group, which primarily consists of till, forms the majority of the drifts or moraines in the area and was discussed above as part of the Henry Formation. The Wedron Group is divided into four formations, which are (in ascending order) the Tiskilwa, Lemont, Wadsworth, and Kewaunee Formations.

The Tiskilwa consists of calcareous, red gray to gray, medium textured clay loam, to loam diamicton with lenses of gravel, sand, silt, and clay that oxidizes to red brown, brown, or yellow brown. The two members in the Tiskilwa Formation, the Delavan and Piatt, contain coarser and grayer diamicton. The Lemont Formation has three members: the Batestown, Yorkville, and Haeger, which successively go from fine to coarse-textured. The Lemont Formation consists of calcareous gray, fine to coarse-textured silty clay, to sandy loam that contains lenses of gravel, sand, silt, and clay.

In the south and west of Chicago, the Wadsworth overlaps the Yorkville Member. The Wadsworth Formation consists of calcareous, gray, fine textured diamicton that contains lenses of sorted and stratified clay, silt and fine sand. The Kewaunee Formation has three members: the Shorewood, Manitowac, and Two Rivers, which are comprised of reddish, silty clay to silt loam matrix where the grain size gets progressively coarser as the members ascend.

H.2.5 Hydrogeology

There are four major aquifers in the Chicago area: glacial drift, shallow bedrock consisting of Silurian dolomite, and two deep bedrock aquifers, the Cambrian-Ordovician and the Mount Simon aquifers (Hughes et al. 1966). The shallow bedrock aquifer directly underlies the glacial drift in the Chicago area. It contains clayey layers that locally act as a confining layer on top of the upper bedrock aquifer, producing perched water tables. However, locally, the upper bedrock aquifer is in hydraulic contact with the drift, particularly where the overburden is relatively thin and/or granular in nature, receiving recharge from precipitation percolating down through the drift. Shale from the Maquoketa Group forms an aquitard separating the shallow bedrock aquifer from the deep bedrock aquifer system.

Many studies (Hughes et al. 1966) suggest that the productivity of the shallow bedrock aquifer is primarily through "solution openings in the upper part of the aquifer" developed on the vertical jointing. Most of the wells in the upper bedrock aquifer are completed in the upper 75 ft of rock because solution channels are concentrated there (Suter et al. 1959). However, aquifer testing for the Tunnel and Reservoir Plan (TARP) (U.S. Environmental Protection Agency 1977) indicated that the horizontal permeability along bedding planes is higher than the vertical, joint-controlled permeability. It is likely that both types of structures contribute to permeability in the upper bedrock aquifer with the relative importance varying with depth. Near the bedrock surface where the solution process is most active and has the best access to the vertical joint sets, permeability is primarily along these joints. Deeper in the rock column, it appears that bedding is the controlling structure.

H.2.6 GLMRIS Study Sites

An array of locations were determined to be appropriate for the measures included in the various alternatives suggested for the Great Lakes Mississippi River Interbasin Study (Figure H.2-4). Localized geotechnical characterization of each site, as well as design considerations, are included. Because many sites include a structural component or components, a summary of the various possible foundational requirements is shown in Table H.2-3.

H.2.6.1 Wilmette, IL

Location used in Alternatives D-1, D-4, and E-1.

H.2.6.1.1 Bedrock Geology

The current topography of the coastal area was formed from the Wisconsinan glaciations. As a result, deposits of glacial till were left behind, and over thousands of years of precipitation, ravines were carved out and are still visible today. The underlying regional bedrock in the area is Silurian-age dolomite. Dolomite beds are strong, hard, brittle, and not affected by desiccation. The primarily dolomitic Silurian formations stand in vertical walls in local quarries where they are mined to produce crushed rock products. They part easily along the argillaceous laminations that occur along the bedding planes. Fractures are common within the formations and therefore subject to solution by groundwater.

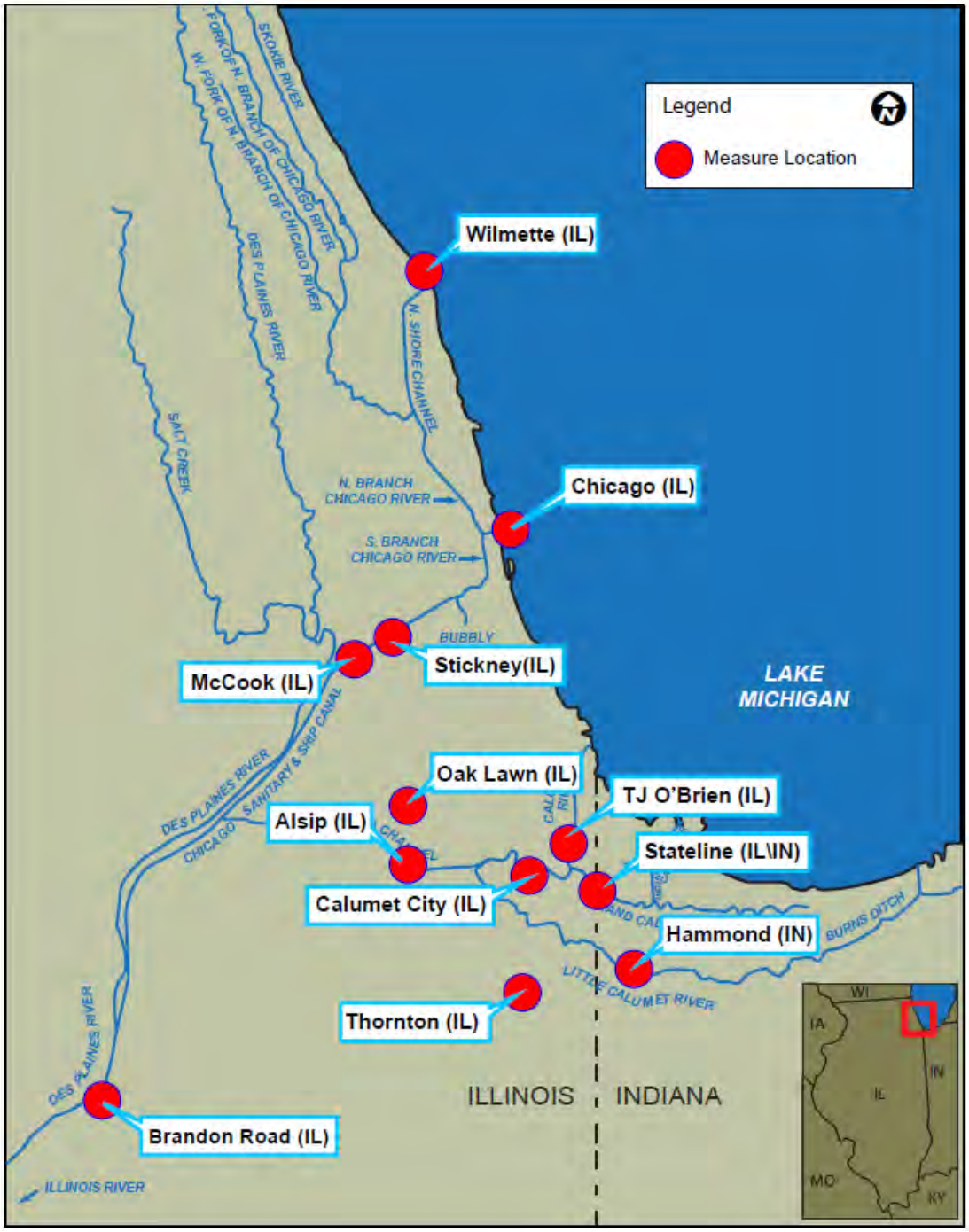


FIGURE H.2-4 GLMRIS Proposed Project Locations

TABLE H.2-2 Proposed Locations and Alternative Matrix

Location	Alternatives					
	Mid-System Control Technologies without a Buffer Zone	Technology Alternative with a Buffer Zone	Mid-System Separation Cal-Sag Open Control Technolgies with a Buffer Zone	Mid-System Separation CSSC Open Control Technolgies with a Buffer Zone	Lakefront Hydrologic Separation	Mid-System Hydrologic Separation
Wilmette, IL		x		x	x	
Chicago, IL		x		x	x	
Stickney, IL	x		x			x
Alsip, IL	x			x	x	x
Calumet City, IL					x	
T.J. O'Brien, IL		x	x			
State Line IL/IN		x	x			
Hammond, IN		x	x			
Brandon Road, IL		x	x	x	x	

H.2.6.1.2 Overburden Geology

The overburden geology of Wilmette consists mainly of glacial lakebed soils. These soils are mainly comprised of lacustrine silt and sand from glacial Lake Chicago. The northern part of the area could also contain overburden material characteristic to the Wadsworth Till Member and the Highland Park moraine. Compact, gray, silty and clayey till is the most common material encountered along the coastal zone of Illinois. This till is exposed along the coastal bluffs, as well as the material first encountered beneath most soils within the area. The thickness of this till can vary greatly depending on the surficial landscape and erosion locally.

Near Winnetka, Illinois, the Zion City and Highland Park moraines dead-end into Lake Michigan. Long-term wave erosion along this morainic upland has resulted in bluffs that form the highest and steepest landscape along the Illinois coast. Slopes along the bluffs are considerably variable and can range from near vertical to about 45 degrees. These bluffs are sometimes discontinuous due to v-shaped ravines that open into the lakeshore.

TABLE H.2-3 Possible Foundational Requirements at Applicable GLMRIS Location

Location	Structural Measure	Foundational Requirements Specified in Structural Appendix
Wilmette, IL	Existing Pump Station Rehab	Unspecified
	ANS Treatment Plant	New plant constructed on site, large footprint would likely require pile foundations
	Physical Barrier	Pile foundation, sheet pile to 30 ft (seepage)
Chicago, IL	Lock	Concrete walls (likely to be founded on piles) with concrete floor
	Electric Barrier	Concrete floor (mat foundation)
	ANS Treatment Plant	New plant constructed on site, large footprint would likely require pile foundations
	Physical Barrier	Pile foundation, sheet pile to 30 ft (seepage)
Stickney, IL	Physical Barrier	Pile foundation, sheet pile to 20 ft (seepage)
Alsip, IL	Physical Barrier	Pile foundation, sheet pile to 20 ft (seepage)
Cal. City, IL	Physical Barrier	Pile foundation, sheet pile to 20 ft (seepage)
T.J. O'Brien, IL	Lock	Concrete walls (likely to be founded on piles) with concrete floor
	Electric Barrier	Concrete floor (mat foundation)
	ANS Treatment Plant	New plant constructed on site, large footprint would likely require pile foundations
	Controlling Works Structure	Likely to include dam with sluice gates, pile foundation with sheet piles likely
	Guide walls	Sheet pile
State Line, IL	Physical Barrier	Pile foundation, sheet pile to 20 ft (seepage)
Hammond, IN	Physical Barrier	Pile foundation, sheet pile to 20 ft (seepage)
Brandon Road, IL	Lock	Concrete walls (likely to be founded on piles) with concrete floor
	Electric Barrier	Concrete floor (mat foundation)
	Guide walls	Sheet pile

H.2.6.1.3 Hydrogeology

An Illinois State Geological Survey (ISGS) water well search failed to locate active wells near the proposed location. Nearby borings indicate a varying water level, as well. Overburden water levels were recorded anywhere from 7.5 ft to 22 ft below the surface. In some nearby borings, water was not encountered at all.

H.2.6.1.4 Design Considerations

The borings located in Enclosure A show that soft clay is present in the overburden material. Because of this, standard footings may not be appropriate for the construction of a foundation at this location and deep foundations such as piles may need to be considered. If either an Aquatic Nuisance Species (ANS) Treatment Plant or Physical Barrier were to be constructed on-site, pile foundations would be recommended for these features.

The bedrock material does not present significant construction problems from a general overview of the materials they are comprised of. Before any design work, local subsurface investigations are recommended with specific analyses on bearing capacity, seepage, and slope stability.

H.2.7.1 Chicago, IL

Location used in Alternatives D-1, D-4, and E-1.

H.2.7.1.1 Bedrock Geology

Similar to the majority of the sites considered in this report, the Chicago location for hydrologic separation is underlain by sedimentary rock that dates to the Silurian Age. The Silurian rocks present at the bedrock surface are predominantly dolomite. The top of the bedrock surface under Chicago does not run parallel to existing topography and is a complex grid of buried valleys, lowlands, and uplands (Figure H.2-5). An ISGS well and boring search shows that near the proposed location, Silurian bedrock was found between 110 to 120 ft.

H.2.7.1.2 Overburden Geology

Soils encountered along the Chicago Sanitary and Shipping Canal (CSSC)near the lakefront are part of the Equality Formation. These soils are mainly composed of silt, sand, gravel and clay deposits that accumulated in glacial Lake Chicago. The Equality Formation is divided into two groups: the Carmi Member and the Dolton Member. Similar to the Stickney Location, the proposed Chicago location contains soils belonging to the Carmi Member. Soils typical to the Carmi Member are dominantly silt, generally well bedded or laminated. Deposits of sand are common, as well as trace sand material within the strata. Clay is also commonly intermixed within the strata as well.

Within the metropolitan Chicago area, a dense layer of outwash sand and gravel, as well as hard, silty till that contains abundant gravel clasts derived from local bedrock, create a strata of material that has come to be known as "Chicago hardpan." This hard-to-penetrate layer of material poses a concern for foundations that are required to be drilled at a depth at or beyond the hardpan material. Though hard to drill through, this layer of hardpan provides a good bearing for deep foundations. Near the proposed area, Chicago hardpan has been found around 75 ft below the surface.

H.2.7.1.3 Hydrogeology

A search of the ISGS database shows no active wells near the proposed Michigan Avenue location for the hydrologic separation. Studies performed by the Illinois State Water Survey show that four major aquifer systems exist in the Cook County Region. These aquifers include (from deepest to more shallow) Elmhurst-Mt. Simon, deep bedrock (typically Cambrian-Ordovician), shallow bedrock, and unconsolidated.

The distribution of sand and gravel aquifers (resulting from glacial deposits) are irregular, and the individual aquifer properties are variable. Local borings taken near the Chicago Harbor Lock indicate an unconsolidated water level at around 10 ft below the surface or at the elevation of Lake Michigan. The next nearest known aquifer is in the Silurian dolomite nearly 120 ft below the surface.

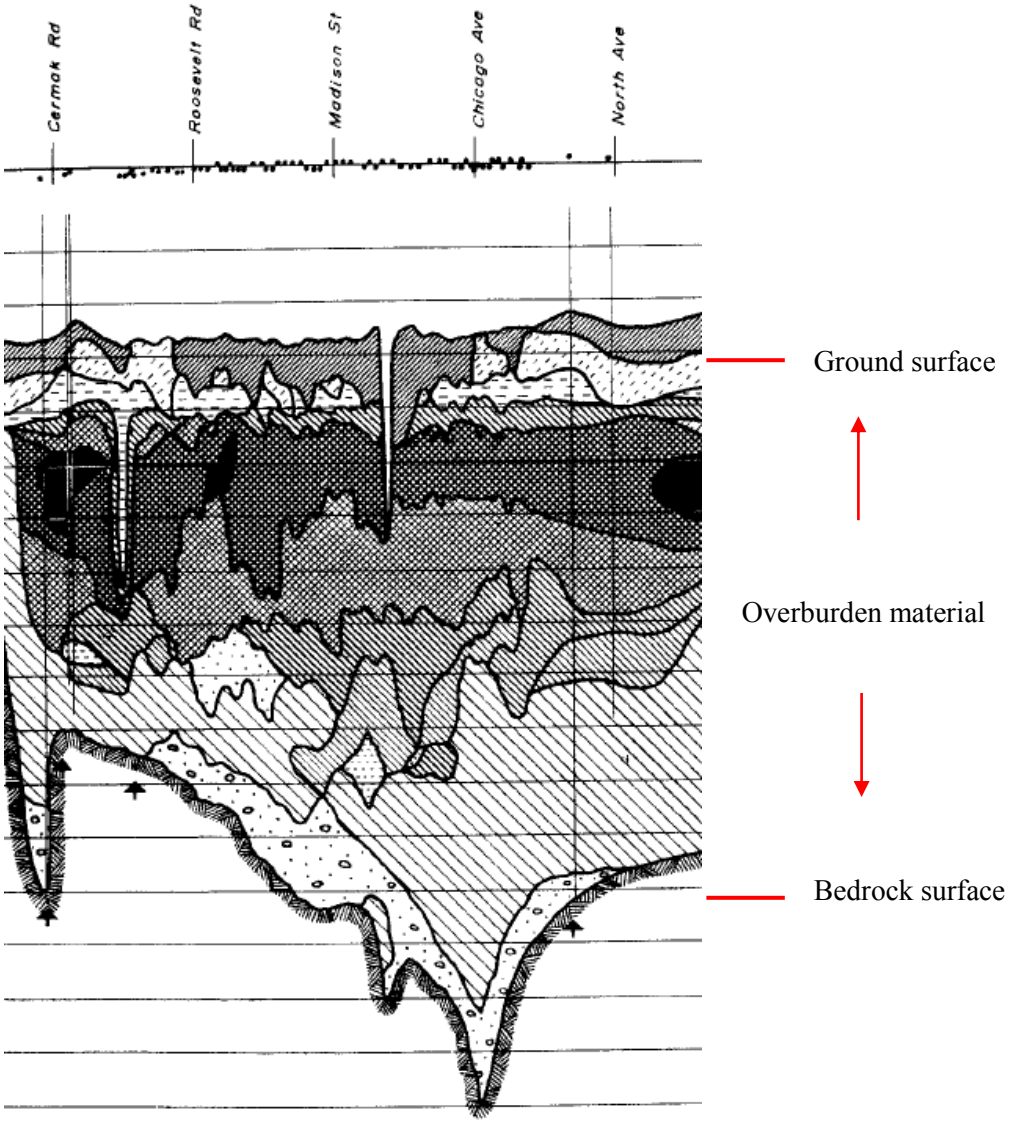


FIGURE H.2-5 Profile of State Street in Chicago, IL

H.2.7.1.4 Design Considerations

If a foundation is required 70 ft below the surface, hardpan will be encountered and special drilling measures will need to be taken. Because some alternatives require either an ANS Treatment Plant or physical barrier for this site, deep foundations are likely necessary. For the construction of the Trump Tower foundation, caissons supporting the core of the skyscraper had to be founded on solid rock, approximately 100 ft below the surface and beyond hardpan. To install temporary casing, Case Foundation used special drill heads provided by Titan Drilling. For the rock socketed caissons, percussion tools were designed and built for the project. To drill the sockets, small-diameter downhole hammers were configured as full-face pilot bits, along with donut-shaped openers that enlarged the pilot bores. This increased the speed at which deep foundations could be drilled since city ordinance does not allow night construction work (Deep Foundations, Fall 2009). With the construction of a dam or structure near this location, similar issues will be encountered during construction and these techniques may have to be employed for deep foundations. Once solid bedrock is encountered, neither the bedrock nor the

overburden materials present a construction concern. Before any design work, local subsurface investigations are recommended with specific analyses on bearing capacity, seepage, and slope stability.

Unconfined aquifers are vulnerable to surface contamination and there are many sources of contamination in the Chicago metropolitan area. Construction in this area could disturb contained contamination and mitigation measures would need to be evaluated.

H.2.8.1 Stickney, IL

Location used in Alternatives C-2, D-2, and E-2.

H.2.8.1.1 Bedrock Geology

As previously stated, Silurian dolomite is present at the bedrock surface for almost all of Cook County. Underlying the Silurian surface are the Cambrian and Ordovician strata, respectively. The Silurian surface layer of rock is considered to be very fissured, with both horizontal and vertical fractures. Since the CSSC was formed by excavation into bedrock, it is typically exposed along waterways and as a result, many studies observing the nature of the fissures in the surface layer have occurred.

According to USGS, near-vertical fractures were prevalent throughout the study area. In the walls of the CSSC, fractures were tightly to near-fully sealed. Silurian dolomite in this area was indentified belonging to the Racine Formation. At the location closest to the possible Stickney hydrologic separation site, blocked walls of Silurian dolomite from the Racine Formation, along with overlying unconsolidated deposits, could be easily viewed from a boat (Figure H.2-6).

FIGURE H.2-6 Vertical Bedrock Outcrop along CSSC

H.2.8.1.2 Overburden Geology

The soils in the area surrounding the Chicago Sanitary and Shipping Canal and around the proposed Stickney, Illinois location are almost exclusively materials belonging to the Carmi Member of the Equality Formation. The Equality Formation is composed of sand, silt, gravel and clay deposits that accumulated in glacial lakes. The Equality Formation is divided into two members: the Carmi and the Dolton. The Carmi Member is dominantly silt and clay.

The Carmi Member is dominantly silt, generally well bedded or laminated. Beds of sand are also typically present throughout the member, but they are typically only a few feet thick. Beds of clay are common, as well. In historic borings of the nearby area, silty clay with trace or some sand composes the majority of the borings presented. It was not uncommon to see strata of sand, and one boring included a layer of peat, as well. Hardpan is also to be expected in the vicinity as it was encountered at the existing McCook Reservoir site.

From the borings located near the proposed location included in Enclosure C, a significant amount of unnatural fill has been placed at the Stickney location. Specifically, borings B1-A, B-1B, B-3, and B-5 show rubble, metal, bricks, glass, coal tar, and chemical odors noted on the boring logs.

H.2.8.1.3 Hydrogeology

A search of the ISGS water well database shows at least two active wells in the area. Both wells are drilled into the natural bedrock aquifer and have a capacity ranging from 10 to 100 gpm. The pump that was rated at 100 gpm was listed as a permanent pump and installed on May 10, 1999.

Information from historic borings logs of the unconsolidated portions of the area show a water table that ranges in depth from 5 ft to 15 ft below the surface in the area.

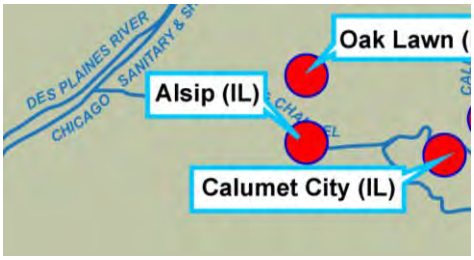
H.2.8.1.4 Design Considerations

The bedrock and overburden material do not present significant construction problems from a general overview of the materials they are comprised of. However, a March 30, 2013, site visit saw a potential slope failure of construction near the proposed Stickney site (Figure H.2-7). Some of the borings near the proposed location indicated large amounts of unnatural fill, possibly leading to the collapse of the damaged structure and potential slope failure. Though it is not known that this caused the failure noted during the site visit, special precaution with regard to slope stability and bearing capacity should be taken at this location, and unnatural fills should be removed before any foundation construction is started.

Before any design work or construction, local subsurface investigations are recommended with specific analyses on bearing capacity, seepage, and slope stability. Any unnatural fill in the vicinity of the construction of the physical barrier would need to be removed and replaced before both sheet piling and pile foundations were constructed.

FIGURE H.2-7 Damaged Structure Due to Possible Slope Failure

H.2.9.1 Alsip, IL



Location used in Alternatives C-2, D-4, E-1, and E-2.

H.2.9.1.1 Bedrock Geology

Like the Calumet City area, the Alsip Dam location bedrock is comprised of Silurian dolomite underlain by Ordovician dolomite and limestone. Both the Silurian and Ordovician systems consist of marine sediments deposited by a shallow sea that covered much of the interior part of the continent. The bedrock in the Chicago area is relatively flat, but has a slight eastward dip due to the Kankakee Arch. The surface of the bedrock is an undulating plain with steep sloped valleys as much as 100 to 150 ft deep of which are entrenched. The slopes on the bedrock surface are rarely parallel to the slopes of the present topography, and it is apparent that the modern rivers and streams have little to do with the formation of the bedrock surface.

H.2.9.1.2 Overburden Geology

With the formation of each morainic system, materials were deposited at the forefront of the receding glacier. Geological mapping of the Cal-Sag Channel shows that the region is comprised of glacial river bottom and outwash materials.

Grayslake peat is the most dominant soil type directly surrounding the Channel boundaries. It occurs in areas bordering existing lakes or in depressions that previously were lake basins. Although dominantly composed of peat, it can include organic silts and interbedded silts and sands from local slopewash into the basins. Grayslake peat is generally less than 20 ft thick and in some areas is less than 5 ft thick.

The other areas surrounding Grayslake peat near the Cal-Sag Channel include soils that are a part of the Valparaiso and Tinley morainic systems, as well as soils typical to lake plain glacial deposits. Soils typical to the moraines are largely silty, sandy, or gravelly till with local areas of silty, clayey till. Locally

present within the lake plain deposits are soils characterized from the Equality Formation. Largely composed of silt, sand, gravel and clay from previous glacial lakes, soils from the Equality Formation are present throughout the area and can even be found underlying the Grayslake peat near the shore.

H.2.9.1.3 Hydrogeology

From an ISGS of active or observation wells near the project site, two active wells were located within the vicinity of the proposed project location. For the pumping well identified, water was obtained from rock at a depth of 112 to 170 ft below the surface. It was discovered that the pumping level was 100 ft when pumping at 3 gpm for 2 hours. The other well identified by the ISGS was an observation well for the Sanitary District.

Like the Calumet City area, the Alsip location is also underlain by Silurian dolomite that contains many fractures that can serve as an aquifer for moderate amounts of water. Higher yields of water can be obtained from the more deeply buried Ordovician sandstone.

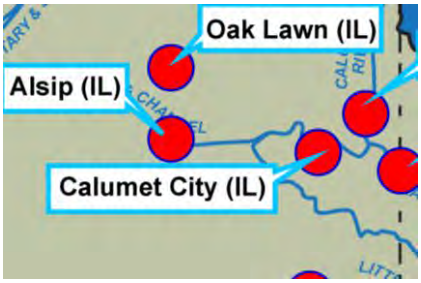
2.9.1.4 Design Considerations

Data obtained from an ISGS well water database search indicated that bedrock in this area was encountered 23 ft below the surface. Bedrock at this location would be considered good for bearing the deep piles required for the proposed physical barrier. Before any design work, local subsurface investigations are recommended with specific analyses on bearing capacity, seepage, and slope stability.

During an initial site visit to the area, it was observed that outfall structures hydrologically connecting smaller catchments empty into the Cal-Sag near Crawford Avenue (Figure H.2-8). Because of this, any hydrologic separation should take place downstream of these outfalls so that ANS do not have a bypass through the system.

FIGURE H.2-8 Outfall in Cal-Sag Channel

H.2.10.1 Calumet City, IL



Location used in Alternative E-1.

H.2.10.1.1 Bedrock Geology

Cook County is situated on the eastern flank of the southward plunging Wisconsin Arch. Silurian rocks thicken eastward into the Michigan Basin and the underlying Cambrian and Ordovician strata thicken southward into the Illinois Basin. The bedrock is typically encountered at an average depth of 300 feet. Silurian-Devonian dolomite and limestone is present at the surface of the bedrock shelf for nearly the entire part of Cook County.

Nearby bedrock sampling from previous projects show a strata with locally porous dolomite, interbedded with dolomitic shale as the top layer of bedrock in the area. Though bedrock in Cook County is encountered at an average depth of 300 feet, bedrock was locally encountered at about 50 to 80 ft near the project site. The Silurian formation of bedrock in the area measures to about a depth of 450 ft (about 400 ft thick). Beyond that, Ordovician shale was encountered until the bedrock boring ended.

H.2.10.1.2 Overburden Geology

The overburden geology of the Calumet City site is likely lake plain. Lake plain geology is characterized by relatively flat, glacio-lacustrine deposits formed by the slow moving waters of glacial Lake Chicago. Local topography typically varies less than 50 ft with a minimum elevation of 580 ft and a maximum elevation of 699 ft above sea level. The soils within the lake plain region consist of poorly drained lake clay with silt, lake sand, and gravel.

Subsurface investigations near the project site indicate local soil strata that vary between silt and clay. Some sand seams and topsoil were encountered in many borings, as well. The water table in the area was located anywhere between the surface and at a depth of 10 ft below the surface.

H.2.10.1.3 Hydrogeology

A local well search in the area indicated that there are no active pumping wells; however, according to ISGS Aquifer Mapping, there is likely a shallow aquifer present in the area less than 50 ft below the surface. There is also likely a major rock aquifer within 300 ft of the surface.

Silurian dolomite forms the uppermost bedrock aquifer in Cook County. The upper part of the dolomite has numerous fractures, crevices, and solution cavities that can provide moderate amounts of water to a well. Higher yields are obtained from the more deeply buried Ordovician St. Peter sandstone, Cambrian Ironton-Galesville sandstone, and the upper part of the Mt. Simon sandstone, which is also Cambrian.

H.2.10.1.4 Design Considerations

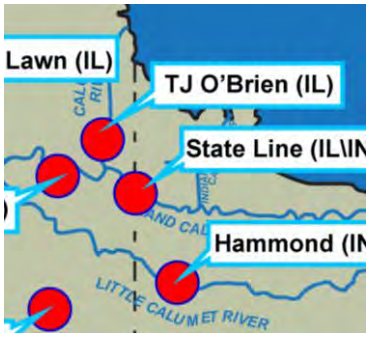
Though the bedrock and subsurface material do not present direct structural concerns, local subsurface investigations would be required to determine if any concerns arise locally. Bedrock at this location would present good bearing for pile foundations required to build the proposed physical barrier. Before construction local investigations requiring bearing capacity, seepage, and slope stability parameters will need to be evaluated as part of the foundation and embankment designs.

A site visit to the location of the Calumet City area presented some structural concerns. Because of nearby landfill operations (Figure H.2-9) and protected wetlands, a direct tie-in to the bridge structure would be required at this site because of environmental and mitigation concerns. Coordination with IDOT would be required.

FIGURE H.2-9 View of Bishop Ford Bridge with Landfill Operations in the Foreground

H.2.11.1 T.J. O'Brien, IL

Location used in Alternatives: D-1 and D-2.



H.2.11.1.1 Bedrock Geology

Like the majority of the Chicago bedrock system, Silurian dolomite underlies the overburden soils near the proposed GLMRIS site. This dolomite ages from the Niagaran Series and is commonly referred to as Racine dolomite. Along the great lakes region, the Niagaran Series is exposed in many places and forms an outcrop belt that swings northward along the west side of Lake Michigan from Chicago then travels east through the eastern end of Michigan's upper peninsula to Lake Huron.

The topography of the bedrock in the area does not follow the surficial topography. Many highs and lows are present in the bedrock surface. Nearby, Stony Reef Island presents a bedrock high likely due to the rock toughness. Though this rock hill feature presents a bedrock high, bedrock lows are present directly east of Lake Calumet, which are much closer to the proposed site. Nearby geologic mapping shows a bedrock surface near 525 ft below the surface.

H.2.11.1.2- Overburden Geology

The overburden geology of the Lake Calumet region is typical of the Lake border soils. The soils in this area referred to as the Lemont drift which is comprised of soil typical of the Carmi and Dolton Members of the Equality Formation.

Right along Lake Calumet, soils from the Carmi member are present. Clay and silt are predominant but localized areas of peat can also be seen. These soils are well bedded due to the slow retreat of the glaciers that deposited these materials. Further to the west along the Illinois/Indiana state line the Carmi Member transitions to the Dolton Member. The clay and silt of the Carmi Member become sand and gravel. The thickness of the overburden layer can vary greatly locally but thickness generally increases from 1 ft near Thornton, IL to about 225 ft thick east of Burns Harbor, IN.

H.2.11.1.3 Hydrogeology

The Lake Calumet region has two aquifers that are used for pumping purposes, the Calumet aquifer and the deeper bedrock aquifer. The Calumet aquifer is an unconsolidated aquifer that is unconfined and continuous through areas east of Lake Calumet but is only present in scattered location west of Lake Calumet.

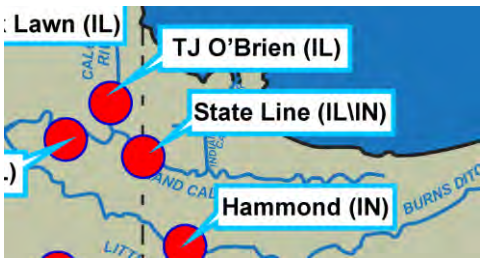
An ISGS water well search showed that active pumps within the area typically utilize the deeper bedrock aquifer for pumping activities. Typical depths of these wells ranged from 100 to 300 ft with a pumping rate no larger than 20 gpm.

H.2.11.1.4 Design Considerations

The bedrock and overburden material do not present significant construction problems from a general overview of the materials they are comprised of. Structural features in this area include an ANS Treatment Plant, a Controlling Works Structure (likely a dam with sluice gates), and guide walls that would all include deep foundations and/or sheet piling. Clay material would dictate the use of piles and could present difficultly for driving sheet piling. Before any design work, local subsurface investigations are recommended with specific analyses on bearing capacity, seepage, and slope stability.

H.2.12.1 State Line, IL/IN

Location used in Alternatives: D-1 and D-2.



H.2.12.1.1 Bedrock Geology

Because of its proximity to the T.J. O'Brien location, underlying bedrock varies very little. The bedrock in this is primarily dolomite, limestone, and shale. Near the state line location, the bedrock is Silurian dolomite from the Niagaran Series. This bedrock formation is up to 300ft thick in the study area. In Indiana the rock formation is known as the Wabash Formation whereas in Illinois this rock formation is referred to as the Racine dolomite.

The Niagaran Series of dolomite contains an irregularly distributed network of vertical fractures. They are typically more abundant near the bedrock surface, where the bedrock has been more weathered. The fractures decrease in number with depth because the rock becomes more competent. Along with fractures, vertical faults can be found within this rock formation. Most faults are oriented northwest to southeast and are 2 to 3 miles long. The nearest fault to the state line location either to the west along the Little Calumet River or just a bit further south near highway 94.

H.2.12.1.2 Overburden Geology

The land surface overburden soils near the State Line location consists of soils from the Equality Formation of the Wisconsinan glacial movement. These soils are primarily sand but can contain thin, discontinuous beds of muck and peat, as well as pebbly sand and gravel. The sand is typical of shore and shallow-water lake deposits that defined former locations of spits and beaches. The land surface deposits are referred to as the Dolton Formation in Illinois and Atherton Formation in Indiana.

Just south of the proposed location the overburden soils become more composed of sand with silt. In Indiana, these soils are referred to the Atherton Formation whereas in Illinois this formation is called Parkland Sand. Soils typical to these formations are well sorted, medium-grained sand that was blown from the glacial outwash and beach deposits into dunes and sheet-like deposits around the dunes.

H.2.12.1.3 Hydrogeology

An ISGS water well search indicated that there are at least two active wells near the project location that utilize the Silurian-Devonian aquifer in the area. The total depths of these wells vary but neither extend beyond 365 ft below the surface. A pumping rate of about 10 gpm is achieved in both wells. According to the USGS the Silurian-Devonian aquifer is pumped for both commercial and industrial supply and serves as a source of drinking water within the proposed location's area. This aquifer is pumped more extensively in Illinois than Indiana. The Silurian-Devonian aquifer is in direct hydraulic contact with the overburden aquifer and is recharged primarily by vertical flow through the confining unit (typically till).

Surficial sands of the Dolton Member, Parkland Sand, and permeable fill deposits constitute the Calumet aquifer, the overburden aquifer near the proposed location. The position of the water table in the Calumet aquifer ranges from near land surface along the Lake Michigan shoreline to more than 100 ft beneath the highest dunes. The depth to water in most places along the state line area is less than 15 ft. This can vary though because the water table has been lowered in some areas due to ditching, drainage, and urbanization.

H.2.12.1.4 Design Considerations

The bedrock and overburden material do not present significant construction problems from a general overview of the materials they are comprised of. Before any design work, local subsurface investigations are recommended with specific analyses on bearing capacity, seepage, and slope stability. Because surface water in the area runs northwest and drains into Lake Calumet, any potential runoff from construction activities may need to be redirected.

H.2.13.1 Hammond, IN

Location used in Alternatives: D-1 and D-2.

H.2.13.1.1 Bedrock Geology

The consolidated rocks of Lake County include more than 4,000 ft of limestone, dolomite, sandstone and shale of Cambrian through Devonian age which rest on a granite basement that is designated Precambrian. These rocks constitute a series of strata that are gently flexed to form the saddle-like structure that is known as the Kankakee Arch. The inclination of the bedrock units is generally southeastward with an average dip of 5 to 7ft per mile.

The bedrock surface lies anywhere between 15 to 270 ft below unconsolidated glacial material and is considered a preglacial erosional feature, therefore; its surface has no relationship to contours on the present land surface. The general attitude of the bedrock surface indicates that surface drainage was northward. Bedrock elevation ranges from a low of about 450 feet above sea level near Lake Michigan to a high of about 650 ft on the ridge in the south under the Kankakee Plain.

According to Figure H.2-10 the surface layer of bedrock, the Antrium shale, is approximately 260 million years old and the granite baselayer of bedrock ages to more than 600 million years. The sedimentary rocks were deposited on top of the granite base layer from the rise and fall of sea levels over time. The sandstones are thought to be derived from the Canadian Shield, the limestones were deposited from moderately shallower waters, and the dolomites and dolomitic limestones resulted from the postdepositional alteration of the limestone. Silurian limestone and dolomites near the top of the bedrock column contain significant fractures or solution features. The solution features are a result from percolating groundwater.

H.2.13.1.2 Overburden Geology

The Hammond Location for hydrologic separation lies within the Calumet Lacustrine Plain which consists of a variety of materials, including fine lake silt and clay, paludal deposits of muck and peat, sand beach with accompanying sand dunes, sand and fine gravel laid down by glacial outwash and as till inclusions, and caly-rich till units of varying thickness and areal distribution.

From the borings (Enclosure A) closest to the proposed location of the dam structure, the stratigraphy of the soil in the area seems to vary between clayey silt and silty clay with some sand seams appearing on the boring logs. The presence of sheet piling indicates that the bedrock in the nearby area is deep and the overburden is not extremely dense (Figure H.2-11).

Most of the sand and clay sediments present in borings of the area were deposited late during the Wisconsinan Age as lake-bottom or near-shore deposits of glacial Lake Chicago. Sediment-laden meltwater from the retreating glacier trapped by the Valparaiso Moraine to the south, east, and west and by the retreating Lake Michigan ice lobe to the north accumulated to form Lake Chicago. As the silt and clay settled out of suspension, great thicknesses of mud accumulated across the lake basin. Outwash sand and gravel washed into the lake and settled rapidly, forming the bars and seams present in the overburden material today. Figure H.2-12 shows the generalized south west-northeast cross section physiography and interrelationships of unconsolidated deposits.

H.2.13.1.3 Hydrogeology

Surface hydrology in the Hammond region has been greatly altered from natural conditions. The natural drainage was extremely poor and as a result the area is swampy and subject to frequent flooding. To allow for industrialization, much of the areas have been ditched and drained. The water table in the area has been lowered as 5 to 10 ft, as well. Even with changes, the area is still subject to frequent flooding during rain events.

There are three aquifer systems in Northern Indiana: the Calumet, Valparaiso, and Kankakee aquifers. The Calumet aquifer extends from Lake Michigan through a wedge-shaped area encompassing the northern quarter of Lake County, which encompasses Hammond, IN. This aquifer is an unconfined aquifer with a water table that ranges from 5 to 75 ft in thickness. The location of the aquifer is typically 15 ft or less below the surface but can be as deep as 90 ft below the surface in higher dunes areas. This can be verified by the boring located in Enclosure H, in which the water table was located around 15 ft on some borings, but not encountered at all in others near the Hammond location.

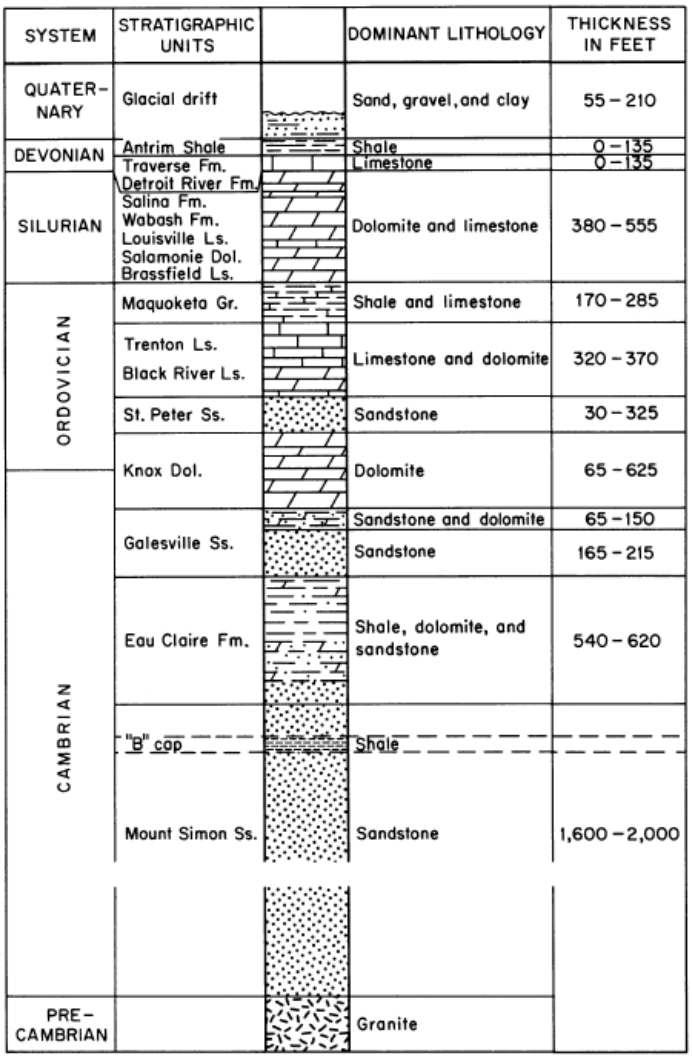


FIGURE H.2-10 Columnar Section of Rock Strata in Northwestern Indiana

H.2.13.1.4 Design Considerations

Most of the clay deposits in the Lake County region are Illite, clay derived from nearby shale, which is considered a stable clay. Therefore no significant structural problems are directly related to the properties of clay in the area. It should be noted though that structural properties of clay can greatly alter with the presence of water. Since there are anticipated deep foundations required at this location, a local subsurface investigation will be required to identify local soil stratigraphy and material properties before any construction work is to begin. In particular, bearing capacity, seepage, and slope stability parameters will need to be evaluated as part of the foundation and embankment designs with a focus on parameters needed for pile design.

FIGURE H.2-11 Sheet Pile Observed during 30 March 2013 Site Visit

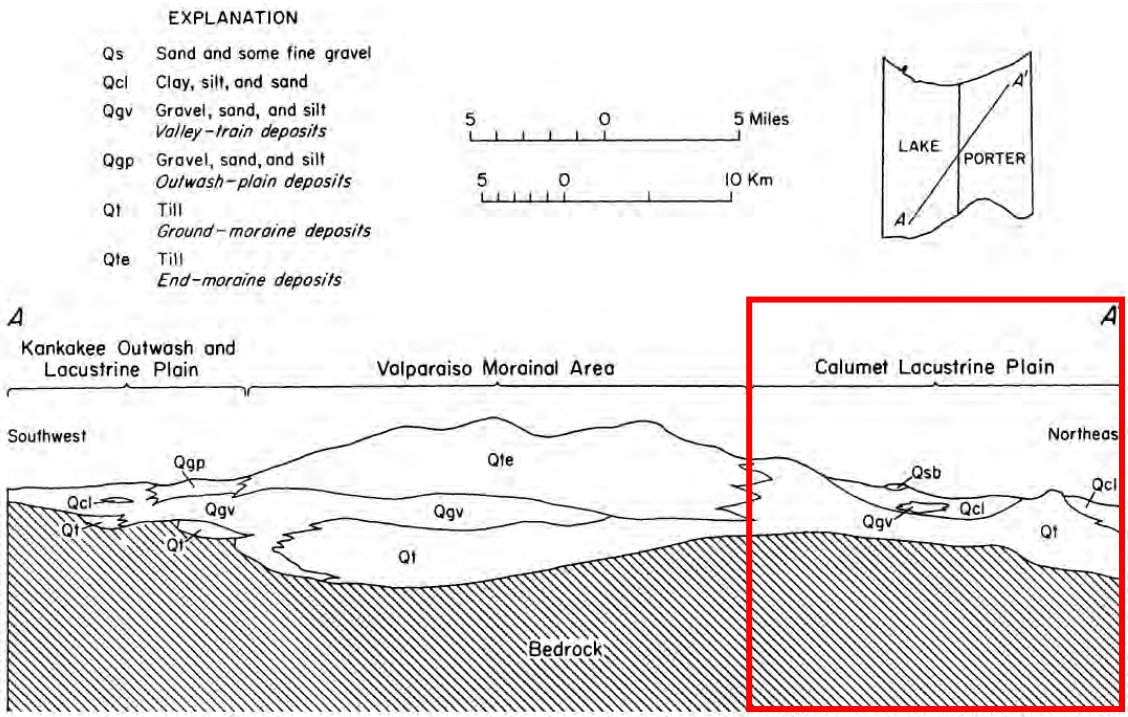


FIGURE H.2-12 Generalized Cross Section of Unconsolidated Composites

H.2.14.1 Brandon Road, IL

Location used in Alternatives: D-1, D-2, D-4, and E-1.

H.2.14.1.1 Bedrock Geology

Bedrock near the Brandon Road is composed of dolomitic limestone from the Silurian period. The Silurian strata dips to the southeast at about a rate of about 10 ft per mile. The thickness of this strata increases from less than 50 ft in McHenry, Kane, and Kendall counties to more than 450 ft thick in southeastern Will County. Near Joliet the thickness is an average of 100 ft thick. Along rivers, exposures of the dolomitic limestone are common.The Silurian Rocks are mainly dolomite and are silty at the base. The Silurian formation is divided into two series: the Alexandrian and Niagaran. The Niagaran Series is the uppermost of the two series and is further divided

into the Joliet, Waukesha, and Racine formations. The Niagaran Series is white to light gray, with some deposits of chert that can generally occur in the upper part of the series. The base of the dolomite is generally green, pink, or red and is slightly silty.

H.2.14.1.2 Overburden Geology

Land surrounding the Brandon Road Lock and Dam area is comprised of soils characteristic from movements of the Valparaiso Moraine, as well till from outwash plains and glacial Lake Chicago. All of the overburden deposits are characteristic of the Wisconsinan Glacial period.

The Valparaiso Moraine was the first major moraine of the Cary substage of the Wisconsinan Glacial period. three minor moraines associated with this stage include: the Minooka, Rockdale, and Manhattan located in Northeastern Illinois. The Rockdale Moraine terminates near the proposed site. Sand and glacial till are typical to this morainal system.

Closer to the present day Des Plaines River, soils common to historic glacial sluiceways are more common. Here the sand and till typical of surrounding areas are mixed with gravel and silt deposited from glacial waters eroding the exposed bedrock in the area.

H.2.14.1.3 Hydrogeology

There are four main aquifers in the Chicago area. In order from shallowest to deepest they include: overburden aquifers (sand and gravel), shallow Silurian aquifers, the Cambrian-Ordovician aquifer, and the Mt. Simon aquifer. Joliet, IL utilizes deep water pumping systems that tap into the Cambrian-Ordovician aquifer system. In descending order the aquifer consists of the Galena-Platteville dolomite, Glenwood-St. Peter sandstone, Prairie du Chien Formation of Ordovician age, the Eminence-Potosi dolomite, Franconia Formation, and Ironton-Galesville sandstone of Cambrian age. The Cambrian-Ordovician aquifer is normally encountered at a depth of 500 ft and averages about 1,000 ft in thickness.

A search of the ISGS water well map service showed an abundance of wells near the project site that pumps from the bedrock aquifer system in the area. Flows pumped ranged from 8–20 gpm and were inbedded in the limestone strata. Suter et al. (1959) estimated the practical sustained yield of the Cambrian-Ordovician in the Chicago area at 46 million gallons per day. This practical yield is the amount of water that can be pumped out of the aquifer without the eventual dewatering of the Ironton-Galesville sandstone or exceeding recharge.

By 1980, strain on deep well aquifers was evident especially in major pumping areas such as Joliet. Dewatering of the uppermost aquifer layers was substantial and by 1980, all of the Galena-Platteville and nearly one-fourth of the Glenwood-St. Peter had been withdrawn. Because of this strain IDOT division of water resources has been charged with allocating Lake Michigan water to cities and towns with respect of population being served and other projected factors. Joliet still plans to continue deep aquifer pumping.

H.2.14.1.4 Design Considerations

The bedrock and overburden material do not present significant construction problems from a general overview of the materials they are comprised of. The presence of coarse grained material in the area would be beneficial to driving sheet piling likely required for the guide walls for the proposed new lock structure. Before any design work, local subsurface investigations are recommended with specific analyses on bearing capacity, seepage, and slope stability.

H.2.15.1 Reservoirs

With the construction of structures that would restrict the flow of water, mitigation structures such as tunnels and reservoirs would be required for the diversion of water. Every alternative utilizes a combination of reservoirs; therefore, four appropriate locations were identified as potential locations for diverted water. Four possible locations for reservoirs have been proposed with two of the reservoirs expected to be constructed out of clay material and two expected to be excavated into bedrock. The general characteristics of each reservoir are noted in Table H-2.4. For further discussion of reservoirs, see Appendix J: Civil Design. Because of the proximity of the possible locations, as well as the uniformity of the bedrock and overburden material within the Chicago area, these locations will be characterized as a group with the exception of the State Line location which has been discussed above.

TABLE H.2-4 GLMRIS Reservoir Characteristics

Clay Reservoirs	Berm Height (ft)	Side Slope (ft)	Interior Base El. (ft)	Capacity (ac-ft)
New Reservoir at Oak Lawn, IL (Mid-System Control Technologies without a Buffer Zone, Mid-System Separation CSSC Open Control Technologies with a Buffer Zone, Mid-System Hydrologic Separation)	10 ft	3 to 1	588	530
New Reservoir at State Line, IL/IN (Technology Alternative with a Buffer Zone, Mid-System Separation Cal-Sag Open Control technologies with a Buffer Zone)	14 ft	3 to 1	580	921
Excavated Reservoirs	Depth (ft)	Width (ft)	Length (ft)	Capacity (ac-ft)
Second Reservoir at McCook, IL (Mid-System Control Technologies without a Buffer Zone)	292	2000	2614	35000
Second Reservoir at McCook, IL (Lakefront Hydrologic Separation)	286	1000	3050	20000
Second Reservoir at McCook, IL (Mid-System Separation Cal-Sag Open Control Technologies with a Buffer Zone, Mid-System Hydrologic Separation)	250	2000	2180	25000
Second Reservoir at Thornton, IL (Mid-System Control Technologies without a Buffer Zone)	285	2000	3703	48500
Second Reservoir at Thornton, IL (Technology Alternative with a buffer Zone, Mid-System Separation Cal-Sag Open Control Technologies with a Buffer Zone)	135	2000	2200	14500
Second Reservoir at Thornton, IL (Lakefront Hydrologic Separation)	296	2400	2550	41430
Second Reservoir at Thornton, IL (Mid-System Separation CSSC Open Control Technologies with a Buffer Zone, Mid-System Hydrologic Separation)	200	2000	1742	16000

H.2.15.1.1 Locations and Associated Alternatives

TABLE H.2-5 Reservoir and Alternative Matrix

	Alternatives					
Reservoirs	C2	D1	D2	D4	E1	E2
McCook, IL	x		x		x	x
Thornton, IL	x	x	x	x	x	x
Oak Lawn, IL	x			x		x
State Line IL/IN		x	x			

H.2.15.1.2 Bedrock Geology

The bedrock in the Chicago area includes Cambrian up through the Ordovician and Silurian systems. The uppermost bedrock is comprised of Silurian age dolomite. Within this system are the Racine, Sugar Run, Joliet, Kankakee, Elwood, and Wilhelmi Formations. When combined, the thickness of these formations is generally around 300 ft The dolomite within each formation is strong, hard, brittle, and not affected by desiccation. The shale and dolomitic shale of the Ordovician system are only moderately strong, moderately hard, and slake when exposed. The shale beds are generally less fractured, not subject to solution by groundwater, and less permeable than the dolomite beds.

H.2.15.1.3 Overburden Geology

Typical Chicago overburden soils vary in thickness. Near the McCook and Oak Lawn locations, overburden soils range from 30-60 ft thick, whereas Thornton overburden soils can be less than a foot thick because of a bedrock high in the area. The upper soils consist of silty clay, but lenses of granular materials ranging from silty sand to clean gravel containing occasional boulders are noted. Below this upper layer lies a dense stratum of highly over-consolidated silt, containing significant amounts of gravel, cobbles, and boulders. This material has been noted as difficult to sample and drill through. This layer has been designated the Lemont Drift

H.2.15.1.4 Hydrogeology

Static groundwater levels in the bedrock are generally located 10 to 60 ft below the surface. Groundwater is also encountered in the overburden and is dependent on lenses of sand and gravel, and the location on the site. Nearer the Des Plaines River, static water levels have been noted at approximately +12 CCD. Near the Chicago Sanitary and Ship Canal, static water was recorded typically between 0 and -2 CCD.

H.2.15.1.5 Design Considerations

The dense layer of over-consolidated silt lying below the uppermost overburden soil layer can present difficulties for drilling and tunneling operations. This material, which has been designated the Lemont Drift, has been noted as difficult to drill and sample through during the existing McCook project. Excavators have had limited ability to penetrate this material. Along with this difficult material, boulders sometimes up to 5 ft in diameter or greater may also have been encountered. Reservoirs constructed out of clay material will require analyses to assure proper compaction, stability of side slope, and that no seepage issues occur during construction. For the excavated reservoirs, blasting operations will be required to bore into the bedrock, so further analysis of the bedrock will be required. Special precautions, such as grout curtains, may be required to prevent seepage issues in fissured bedrock. Cutoff walls will also likely need to be constructed to manage seepage through the overburden where significant layers of sand and silt are present.

H.3 REFERENCES

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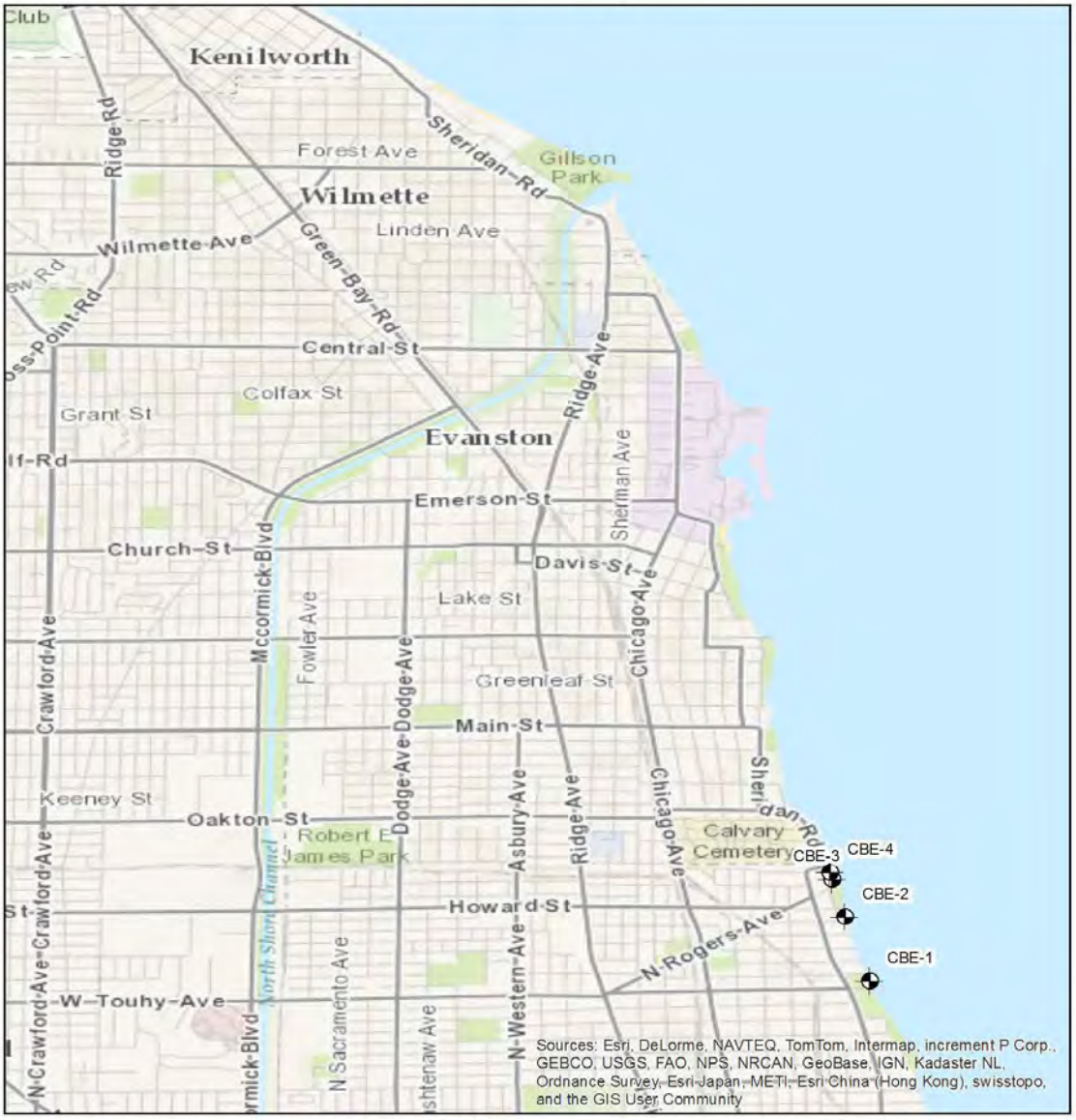
ENCLOSURE A

BORING LOGS NEAR WILMETTE, IL, LOCATION

Wilmette, IL

GLMRIS



Legend

Boring Locations

Date: 9/27/2013

1 IN = 4,167 FT

Path: J:\LRC_Projects\PRJ_GLMRIS\MXD\Borings\Wilmette.mxd

MIRZA ENGINEERING, INC. BORING LOG CHICAGO, ILLINOIS

JOB NO. 8711 CLIENT U.S. ARMY CORPS OF ENGINEERS BORING NO. CBE-1

PROJECT Edgewater/Rogers Park Revetments - Chicago, Illinois DATE March 3, 1987

LOCATION 16' South & 6' East of SE Building Corner of 1201 Chase Avenue

BORING RIG & METHOD CME-550(ATV) w/ Hollow Stem Augers

GROUND WATER OBSERVATIONS

2.0 FT. ELEV. ____ DURING DRILLING

0.5 FT. ELEV. ____ AFTER ¼ HRS.

CORE SIZE ____ IN. CASING LENGTH ____ FT. CASING DIAMETER ____ IN.

DRILLER Groff INSPECTOR Mauter SURF. ELEV. Exist.Grd.

DEPTH	SAMPLE FROM – TO	Depth	SOIL DESCRIPTION AND REMARKS	N	q_u tsf	WATER CONTENT %
	0.0-1.0			Auger		
			Medium Dense Br SAND, little m-f Gravel			
	1.5-2.5			24		
		3.8				
5	4.0-5.0		Sand under hydrostatic pressure below 5'	38		
	6.0-6.2		Cobble noted @ 6'	50/2"		
			Dense Br c-f SAND, trace f Gravel			
10	9.0-10.0			47		
		11.7				
	11.5-12.5		Dense to Medium Dense Gr SAND, little to some m-f Gravel	39		
15	14.0-15.0	14.8		23	(0.2)	
			Very Soft Gr Silty CLAY, trace c-f Sand			
	16.5-17.5	17.5		4	(0.2)	
20			Note: A temporary benchmark was established, consisting of a painted orange " □ " on the top of the south concrete seawall at the southeast corner of the building at 1201 Chase Avenue. The ground surface elevation at Boring CBE-1 is 2.5 feet lower than the temporary benchmark elevation.			

( ) = Estimate

MIRZA ENGINEERING, INC. BORING LOG CHICAGO, ILLINOIS

JOB NO. 8711 CLIENT U.S. ARMY CORPS OF ENGINEERS BORING NO. CBE-2

PROJECT Edgewater/Rogers Park Revetments - Chicago, Illinois DATE March 3, 1987

LOCATION 25' North & 65' West of NE Building Corner of 7507 East Lake Terrace

BORING RIG & METHOD CME-550(ATV) w/ Hollow Stem Augers

GROUND WATER OBSERVATIONS

3.0 FT. ELEV. ____ DURING DRILLING

0.0 FT. ELEV. ____ AFTER ¼ HRS.

CORE SIZE ____ IN. CASING LENGTH ____ FT. CASING DIAMETER ____ IN.

DRILLER Groff INSPECTOR Mauter SURF. ELEV. Exist.Grd.

DEPTH	SAMPLE FROM – TO	Depth	SOIL DESCRIPTION AND REMARKS	N	q_u tsf	WATER CONTENT %
	0.0-1.0	1.4	Medium Dense Br SAND, trace f Gravel, trace Silt	Auger		
	1.5-2.5		Medium Dense to Dense Br SAND and m-f GRAVEL	17		
5	4.0-5.0	5.5	Sand under hydrostatic pressure below 4'	31		
	6.5-7.5		Cobble noted @ 6.3'	93		
10	9.0-10.0		Very Dense to Dense Br SAND, little m-f Gravel	60		
	11.5-12.5	13.0		36		
15	14.0-15.0	15.5	Very Dense Br SAND, some m-f Gravel, trace Silt	72		
	16.5-17.5	17.5	Very Soft Gr Silty CLAY, trace(-) f Sand	4	0.2	
20			Note: A temporary benchmark was established, consisting of a painted orange " □ " on the top of the west concrete seawall (south end), at the north side of the building at 7507 East Lake Terrace. The ground surface elevation at Boring CBE-2 is 5.7 feet lower than the temporary benchmark elevation.			

( ) = Estimate

MIRZA ENGINEERING, INC. BORING LOG CHICAGO, ILLINOIS

JOB NO. 8711 CLIENT U.S. ARMY CORPS OF ENGINEERS BORING NO. CBE-3

PROJECT Edgewater/Rogers Park Revetments - Chicago, Illinois DATE March 3, 1987

LOCATION 27' South & 30' West of SE Corner of East Seawall at 7729 East Lake Terrace

BORING RIG & METHOD CME-550(ATV) w/ Hollow Stem Augers

GROUND WATER OBSERVATIONS

4.0 FT. ELEV. ____ DURING DRILLING

4.0 FT. ELEV. ____ AFTER ¼ HRS.

CORE SIZE ____ IN.

CASING LENGTH ____ FT.

CASING DIAMETER ____ IN.

DRILLER Groff

INSPECTOR Mauter

SURF. ELEV. Exist.Grd.

DEPTH	SAMPLE FROM – TO	Depth	SOIL DESCRIPTION AND REMARKS	N	q_u tsf	WATER CONTENT %
	0.0-1.0			Auger		
	1.5-2.5		Medium Dense to Dense Br SAND, trace (+) m-f Gravel	25		
5	4.0-5.0	5.5		33		
	6.5-7.5		Sand under hydrostatic pressure below 6'	13		
10	9.0-10.0		Cobble noted @ 9'	70		
	11.5-12.5		Medium Dense to Dense Br & Gr SAND, trace to little m-f Gravel	41		
15	14.0-15.0	15.5		52		
	16.5-17.5	18.0	Extremely Dense Br SAND, trace m-f Gravel	86		
20	19.0-20.0	20.5	Loose Br SAND, trace to little m-f Gravel	5		
	21.5-22.5	22.5	Very Soft Gr Silty CLAY, trace c-f Sand, trace m-f Gravel	5	(0.2)	
25			Note: A temporary benchmark was established, consisting of a painted orange " □ " on the top of the south concrete seawall (21' W. of E. end), at the south side of the building at 7729 East Lake Terrace. The ground surface elev. at Boring CBE-3 is 4.2 feet lower than the temporary benchmark elevation.			

( ) = Estimate

MIRZA ENGINEERING, INC. BORING LOG CHICAGO, ILLINOIS

JOB NO. 8711 CLIENT U.S. ARMY CORPS OF ENGINEERS BORING NO. CBE-4

PROJECT Edgewater/Rogers Park Revetments - Chicago, Illinois DATE March 3, 1987

LOCATION 21' North & 20' West of NE Building Corner of 7739 East Lake Terrace

BORING RIG & METHOD CME-550(ATV) w/ Hollow Stem Augers

GROUND WATER OBSERVATIONS

0.5 FT. ELEV. _____ DURING DRILLING

0.0 FT. ELEV. _____ AFTER ¼ HRS.

CORE SIZE _____ IN. CASING LENGTH _____ FT. CASING DIAMETER _____ IN.

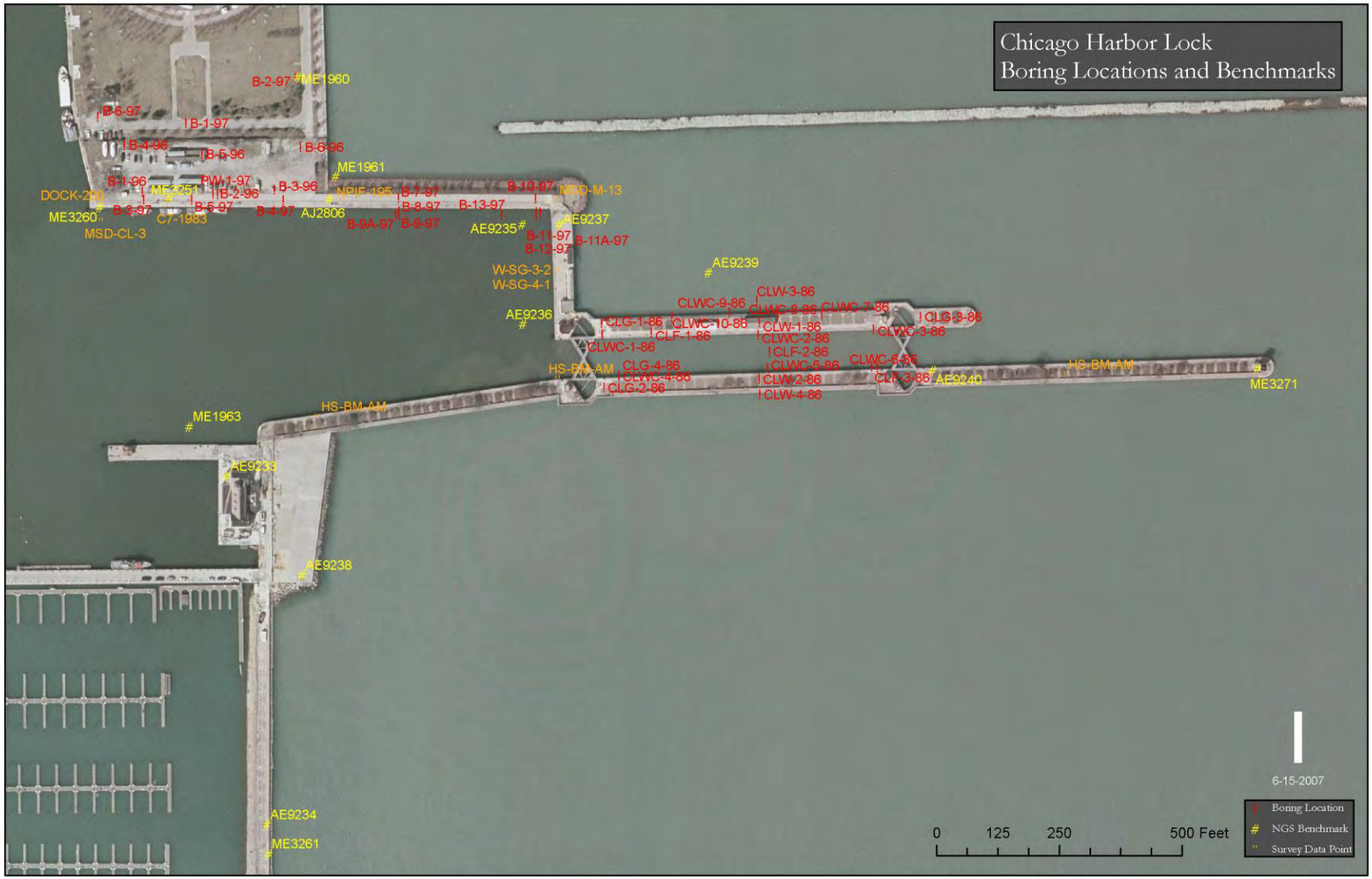
DRILLER Groff INSPECTOR Mauter SURF. ELEV. Exist.Grd.

DEPTH	SAMPLE FROM - TO	Depth	SOIL DESCRIPTION AND REMARKS	N	q_u tsf	WATER CONTENT %
	0.0-1.0			Auger		
			Loose to Medium Dense Br SAND, little(+) m-f Gravel			
	1.5-2.5			8		
		4.3				
5	4.0-5.0			12		
			Medium Dense to Dense Br m-f SAND, trace Silt; random coarse Sand seams noted			
	6.5-7.5			31		
			Sand under hydrostatic pressure below 8'			
10	9.0-10.0			41		
		10.5				
	11.5-12.5		Dense Br SAND, trace m-f Gravel	47		
		14.3				
15	14.0-15.0		Very Dense Gr SAND, some m-f Gravel, trace Silt	67		
		16.0				
	16.5-17.5		Very Soft Gr Silty CLAY, trace(-) c-f Sand	4	(0.1)	
20	19.0-20.0	20.0		4	(0.1)	
			Note: A temporary benchmark was established, consisting of a painted orange " □ " on the top of the west concrete seawall (south end), at the north side of the building at 7739 East Lake Terrace. The ground surface elevation at Boring CBE-4 is 6.1 feet lower than the temporary benchmark elevation.			

( ) = Estimate

ENCLOSURE B

BORING LOGS NEAR CHICAGO, IL, LOCATION


Chicago Harbor Lock
Boring Locations and Benchmarks
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B-6-97
B-1-97
B-4-96
B-5-96
B-6-96
ME1961
B-1-96
ME3251
PW1-97
B-2-96
B-3-96
NPIF-195
B-7-97
B-10-97
MSD-M-13
DOCK-201
ME3260
B-8-97
C7-1983
B-5-97
B-4-97
AJ2806
B-8A-97
B-8-97
B-13-97
AE9235
AE9237
MSD-CL-3
B-9-97
B-11-97
B-12-97
B-11A-97
AE9239
W-SG-3-2
W-SG-4-1
CLW-3-86
CLWC-9-86
CLWC-9-86
CLWC-7-86
CLG-3-86
AE9236
CLG-1-86
CLWC-10-86
CLW-1-86
CLWC-3-86
CLF-1-86
CLWC-2-86
CLWC-1-86
CLF-2-86
CLWC-5-86
HS-BM-AM
CLG-4-86
CLWC-4-86
CLF-3-86
AE9240
HS-BM-AM
ME3271
CLG-2-86
CLW-2-86
CLW-4-86
HS-BM-AM
ME1963
AE9233
AE9238
AE9234
ME3261
0
125
250
500 Feet
6-15-2007
Boring Location
NGS Benchmark
Survey Data Point

Hole No. CLG-1-86

DRILLING LOG	DIVISION	INSTALLATION	SHEET
	North Central	Chicago District	1 OF 4 SHEETS

1. PROJECT	Chicago Harbor Lock
2. LOCATION (Coordinates or Station)	6+65W., 64'N. of Centerline
3. DRILLING AGENCY	Patrick Engineering Inc.
4. HOLE NO. (As shown on drawing title and file number)	CLG-1-86
5. NAME OF DRILLER	Jerry Copak
6. DIRECTION OF HOLE	☐ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN	
8. DEPTH DRILLED INTO ROCK	
9. TOTAL DEPTH OF HOLE	70.0'
10. SIZE AND TYPE OF BIT	Drag Bit
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	Low Water Datum For Lake Michigan
12. MANUFACTURER'S DESIGNATION OF DRILL	CME-55
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN	DISTURBED 12 / UNDISTURBED 6
14. TOTAL NUMBER CORE BOXES	-
15. ELEVATION GROUND WATER	-
16. DATE HOLE	STARTED 7/2/86 / COMPLETED 7/3/86
17. ELEVATION TOP OF HOLE	8.3 LWD
18. TOTAL CORE RECOVERY FOR BORING	N/A %
19. SIGNATURE OF INSPECTOR	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	REC./RUN e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
8.3	0.0		Reinforced concrete cap			
3.3	5.0		28' Void			
-11.7	20.0					

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE.
MODIFIED BY PATRICK ENGINEERING 11/84

PROJECT: Chicago Harbor Lock | HOLE NO. CLG-1-86

Hole No. CLG-1-86

DRILLING LOG	DIVISION	INSTALLATION	SHEET
	North Central	Chicago District	2 OF 4 SHEETS

1. PROJECT: Chicago Harbor Lock	10. SIZE AND TYPE OF BIT: Drag Bit
2. LOCATION (Coordinates or Station): 6+65W., 64'N. of Centerline	11. DATUM FOR ELEVATION SHOWN (TBM or MSL): Low Water Datum For Lake Michigan
3. DRILLING AGENCY: Patrick Engineering Inc.	12. MANUFACTURER'S DESIGNATION OF DRILL: CME-55
4. HOLE NO. (As shown on drawing title and file number): CLG-1-86	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 12; UNDISTURBED 6
5. NAME OF DRILLER: Jerry Copak	14. TOTAL NUMBER CORE BOXES: -
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.	15. ELEVATION GROUND WATER: -
7. THICKNESS OF OVERBURDEN	16. DATE HOLE: STARTED 7/2/86; COMPLETED 7/3/86
8. DEPTH DRILLED INTO ROCK	17. ELEVATION TOP OF HOLE: 8.3 LWD
9. TOTAL DEPTH OF HOLE: 70.0'	18. TOTAL CORE RECOVERY FOR BORING: N/A %
	19. SIGNATURE OF INSPECTOR

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	REC./RUN e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
-11.7	20.0		28' Void			
-24.7	33.0		Reinforced concrete pile cap			4" diameter steel casing set 5" into concrete.
-28.7	37.0		Dark gray silty clay, very soft, medium plasticity, saturated CL			SS-1 penetrated 18" under weight of rods with no recovery.
				22"/ 36"	ST-1 39.0-42.0	ST-1 penetrated 3' under weight of rods. q_u * = 0.1 tsf

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE
MODIFIED BY PATRICK ENGINEERING 11/84

PROJECT: Chicago Harbor Lock | HOLE NO. CLG-1-86

Hole No. CLC-1-86

DRILLING LOG

DIVISION: North Central
INSTALLATION: Chicago District
SHEET 3 OF 4 SHEETS

1. PROJECT: Chicago Harbor Lock
2. LOCATION (Coordinates or Station): 6+65W., 64'N. of Centerline
3. DRILLING AGENCY: Patrick Engineering Inc.
4. HOLE NO. (As shown on drawing title and file number): CLC-1-86
5. NAME OF DRILLER: Jerry Copak
6. DIRECTION OF HOLE: ☐ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN
8. DEPTH DRILLED INTO ROCK
9. TOTAL DEPTH OF HOLE: 70.0'
10. SIZE AND TYPE OF BIT: Drag Bit
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): Low Water Datum For Lake Michigan
12. MANUFACTURER'S DESIGNATION OF DRILL: CME-55
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 12; UNDISTURBED 6
14. TOTAL NUMBER CORE BOXES: -
15. ELEVATION GROUND WATER: -
16. DATE HOLE: STARTED 7/2/86; COMPLETED 7/3/86
17. ELEVATION TOP OF HOLE: 8.3 LWD
18. TOTAL CORE RECOVERY FOR BORING: N/A %
19. SIGNATURE OF INSPECTOR

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	REC / RUN e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
-31.7	40.0		Gray silty clay, very soft, medium plasticity, saturated CL	22"/ 36"	3T-1 39.0- 42.0	q_u* = 0.1 tsf Sample disturbed due to compression.
-33.7	42.0		Gray silty clay, trace coarse to fine sand, trace coarse to fine gravel, medium stiff, medium plasticity, moist CL	24"/ 36"	3T-2 42.0- 44.0	q_u* = 0.7 tsf
			Soft	15"/ 18"	SS-3 44.0- 45.5	3/6/7 q_u* = 0.3 tsf
				24"/ 24"	3T-4 45.5- 47.5	q_u* = 0.5 tsf
				18"/ 18"	SS-5 47.5- 49.0	4/4/5 q_u* = 0.4 tsf
			Very soft	24"/ 24"	3T-6 49.0- 51.0	q_u* = 0.2 tsf
				18"/ 18"	SS-7 51.0- 52.5	15/15/15 q_u* = 0.4 tsf Pounded on gravel piece.
			Soft Little coarse to fine gravel, stiff	24"/ 24"	3T-8 52.5- 54.5	q_u* = 1.4 tsf
				1"/ 18"	SS-9 54.5- 56	SS-9 pushed a piece of coarse gravel, sample disturbed. q_u* = 0.6 tsf
-47.0	55.3		Gray coarse to fine sand, poorly graded, medium dense, saturated SP-SM	10"/ 24"	3T-10 56.0- 58.0	3T-10 pushed on boulder, tube crushed.
				18"/ 18"	SS-11A,B 58.0- 59.5	7/9/16
-50.7	59.0		Gray silty clay, trace coarse to fine sand, trace coarse to fine gravel, medium stiff, medium plasticity, moist CL			
-51.2	59.5					q_u* = 1.3 tsf
	60.0					

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE
MODIFIED BY PATRICK ENGINEERING 11/84

PROJECT: Chicago Harbor Lock
HOLE NO: CLC-1-86

Hole No. CLG-1-86

DRILLING LOG	DIVISION: North Central	INSTALLATION: Chicago District	SHEET 4 OF 4 SHEETS
1. PROJECT: Chicago Harbor Lock		10. SIZE AND TYPE OF BIT: Dragg 8"	
2. LOCATION (Coordinates or Station): 6+65W., 64'N. of Centerline		11. DATUM FOR ELEVATION SHOWN (TBM or MSL): Low Water Datum For Lake Michigan	
3. DRILLING AGENCY: Parrick Engineering Inc.		12. MANUFACTURER'S DESIGNATION OF DRILL: CME-55	
4. HOLE NO. (As shown on drawing title and file number): CLG-1-86		13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 12 / UNDISTURBED 6	
5. NAME OF DRILLER: Jerry Copak		14. TOTAL NUMBER CORE BOXES: -	
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.		15. ELEVATION GROUND WATER: -	
7. THICKNESS OF OVERBURDEN		16. DATE HOLE: STARTED 7/2/86 / COMPLETED 7/3/86	
8. DEPTH DRILLED INTO ROCK		17. ELEVATION TOP OF HOLE: 8.3 LWD	
9. TOTAL DEPTH OF HOLE: 70.0'		18. TOTAL CORE RECOVERY FOR BORING: N/A %	
		19. SIGNATURE OF INSPECTOR	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	REC./RUN e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
-51.2	59.5			18"/ 18"	SS-12 59.5 61.0	SS-12 was pushed because 3T-12 had no recovery.
-51.7	60.0		Gray silty coarse to fine sand, trace coarse to fine gravel, well graded, saturated SM			
				18"/ 18"	SS-13 61.0- 62.5	5/6/6
			Medium dense			
-54.2	62.5		Very dark grayish-brown silty clay, trace coarse to fine sand, trace coarse to fine gravel, stiff, medium plasticity, moist CL	18"/ 18"	SS-14 62.5- 64.0	16/9/18 q_u* = 1.8 tsf
				18"/ 18"	SS-15 64.0- 65.5	9/11/15 q_u* = 1.6 tsf
			Little coarse to fine sand, very stiff	18"/ 18"	SS-16 65.5- 67.0	47/45/57 q_u* > 3.7 tsf
				12"/ 18"	SS-17 67.0- 68.5	23/33/38 q_u* = 4.5+ tsf
			Hard			
				6"/ 18"	SS-18 68.5- 70.0	19/35/39 q_u* = 4.5+ tsf
-61.7	70.0		End of boring @ 70.0'.			

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE
MODIFIED BY PATRICK ENGINEERING 11/84

PROJECT: Chicago Harbor Lock | HOLE NO.: CLG-1-86

Hole No. CLG-2-86

DRILLING LOG	DIVISION	INSTALLATION	SHEET
	North Central	Chicago District	1 OF 4 SHEETS

1. PROJECT	Chicago Harbor Lock
2. LOCATION (Coordinates or Station)	6+61W., 64'S. of Centerline
3. DRILLING AGENCY	Patrick Engineering Inc.
4. HOLE NO. (As shown on drawing title and file number)	CLG-2-86
5. NAME OF DRILLER	Pat Bolger
6. DIRECTION OF HOLE	☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT
7. THICKNESS OF OVERBURDEN	
8. DEPTH DRILLED INTO ROCK	
9. TOTAL DEPTH OF HOLE	70.0'
10. SIZE AND TYPE OF BIT	Drag Bit
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	Low Water Datum For Lake Michigan
12. MANUFACTURER'S DESIGNATION OF DRILL	CME-55
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN	DISTURBED 13 / UNDISTURBED 7
14. TOTAL NUMBER CORE BOXES	N/A
15. ELEVATION GROUND WATER	
16. DATE HOLE	STARTED 7/8/86 / COMPLETED 7/9/86
17. ELEVATION TOP OF HOLE	8.3 LWD
18. TOTAL CORE RECOVERY FOR BORING	N/A %
19. SIGNATURE OF INSPECTOR	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	REC./RUN e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
8.3	0.0		Reinforced concrete cap			
3.3	5.0		28' Void			
-11.7	20.0					

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE
MODIFIED BY PATRICK ENGINEERING 11/84

PROJECT: Chicago Harbor Lock | HOLE NO.: CLG-2-86

Hole No. CLG-2-86

DRILLING LOG	DIVISION: North Central	INSTALLATION: Chicago District	SHEET 2 OF 4 SHEETS

1. PROJECT	Chicago Harbor Lock
2. LOCATION (Coordinates or Station)	6+61W., 64'S. of Centerline
3. DRILLING AGENCY	Patrick Engineering Inc.
4. HOLE NO. (As shown on drawing title and file number)	CLG-2-86
5. NAME OF DRILLER	Pat Bolger
6. DIRECTION OF HOLE	[X] VERTICAL [ ] INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN	
8. DEPTH DRILLED INTO ROCK	
9. TOTAL DEPTH OF HOLE	70.0'
10. SIZE AND TYPE OF BIT	Drag Bit
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	Low Water Datum For Lake Michigan
12. MANUFACTURER'S DESIGNATION OF DRILL	CME-55
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN	DISTURBED: 13 UNDISTURBED: 7
14. TOTAL NUMBER CORE BOXES	N/A
15. ELEVATION GROUND WATER	
16. DATE HOLE	STARTED: 7/8/86 COMPLETED: 7/9/86
17. ELEVATION TOP OF HOLE	8.3 LWD
18. TOTAL CORE RECOVERY FOR BORING	N/A %
19. SIGNATURE OF INSPECTOR	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	REC/RUN e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
-11.7	20.0		28' Void			
-24.7	33.0		4' Reinforced pile cap			4" diameter steel casing shoe set 3" into cement.
-28.7	37.0		Dark gray silty clay, trace coarse to fine sand, very soft, medium plasticity, wet CL	2"/ 18"	SS-1 37.0-38.5	SS-1 penetrated 18" under weight of rods. q_u* = 0.1 tsf
				16"/ 24"	SS-2 38.5-40.5	q_u* = 0.4 tsf
-31.7	40.0		Trace coarse to fine gravel, soft			

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE
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PROJECT Chicago Harbor Lock HOLE CLG-2-86

Hole No. CLG-2-86

DRILLING LOG

DIVISION: North Central
INSTALLATION: Chicago Districts
SHEET 1 OF 1 SHEETS

1. PROJECT: Chicago Harbor Lock
2. LOCATION (Coordinates or Station): 6+61W., 64'S. of Centerline
3. DRILLING AGENCY: Patrick Engineering Inc.
4. HOLE NO. (As shown on drawing title and file number): CLG-2-86
5. NAME OF DRILLER: Pat Bolger
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN
8. DEPTH DRILLED INTO ROCK
9. TOTAL DEPTH OF HOLE: 70.0'
10. SIZE AND TYPE OF BIT: 3 7/8" Rock Bit
11. DATUM FOR ELEVATION SHOWN (USGS or MSL): Low Water Datum For Lake Michigan
12. MANUFACTURER'S DESIGNATION OF DRILL: CME-55
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 13; UNDISTURBED 7
14. TOTAL NUMBER CORE BOXES: N/A
15. ELEVATION GROUND WATER
16. DATE HOLE: STARTED 7/8/86; COMPLETED 7/9/86
17. ELEVATION TOP OF HOLE: 8.3 LWD
18. TOTAL CORE RECOVERY FOR BORING: N/A %
19. SIGNATURE OF INSPECTOR

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	REC./RUN e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
-31.7	40.0		Dark gray silty clay, trace coarse to fine sand, trace coarse to fine gravel, soft, medium plasticity, wet CL	12"/18"	SS-3 40.5-42.0	2/2/3 q_u* = 0.3 tsf
				24"/24"	ST-4 42.0-44.0	q_u* = 0.4 tsf
-35.7	44.0		Gray coarse to fine sand, well graded, loose, saturated SW	18"/18"	SS-5A,B 44.0-45.5	6/9/7
-36.5	44.8		Dark gray silty clay, trace coarse to fine sand, trace coarse to fine gravel, soft, medium plasticity, wet CL			q_u* = 0.4 tsf
				24"/24"	ST-6 45.5-47.5	q_u* = 0.4 tsf
				24"/24"	ST-7 47.5-49.5	q_u* = 0.3 tsf
			Medium stiff	18"/18"	SS-8 49.5-51.0	4/4/6 q_u* = 0.5 tsf
				24"/24"	ST-9 51.0-53.0	q_u* = 0.5 tsf
				18"/18"	SS-10 53.0-54.5	15/20/20 q_u* = 0.7 tsf
				12"/12"	ST-11 54.5-55.5	3T-11 pushed to refusal @ 55.5', q_u* = 0.8 tsf
-47.2	55.5		Brown silty clay, some coarse to fine sand, little coarse to fine gravel, very stiff, medium plasticity, moist CL	18"/18"	SS-12 55.5-57.0	20/36/32 q_u* = 3.0 tsf
				24"/24"	ST-13 57.0-59.0	q_u* = 2.8 tsf
-51.7	60.0		Little coarse to fine sand, trace coarse to fine gravel	18"/18"	SS-14 59.0-60.5	12/17/19 q_u* = 2.0 tsf

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE
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PROJECT: Chicago Harbor Lock
HOLE NO.: CLG-2-86

Hole No. CLC-2-86

DRILLING LOG	DIVISION: North Central	INSTALLATION: Chicago District	SHEET 4 OF 4 SHEETS

1. PROJECT: Chicago Harbor Lock	10. SIZE AND TYPE OF BIT: Drag Bit
2. LOCATION (Coordinates or Station): 6+61½., 64'S. of Centerline	11. DATUM FOR ELEVATION SHOWN (TBM or MSL): Low Water Datum For Lake Michigan
3. DRILLING AGENCY: Patrick Engineering Inc.	12. MANUFACTURER'S DESIGNATION OF DRILL: CME-55
4. HOLE NO. (As shown on drawing title and file number): CLC-2-86	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 13; UNDISTURBED 7
5. NAME OF DRILLER: Pat Bolger	14. TOTAL NUMBER CORE BOXES: N/A
6. DIRECTION OF HOLE: [X] VERTICAL [ ] INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER
7. THICKNESS OF OVERBURDEN	16. DATE HOLE: STARTED 7/8/86; COMPLETED 7/9/86
8. DEPTH DRILLED INTO ROCK	17. ELEVATION TOP OF HOLE: 8.3 LWD
9. TOTAL DEPTH OF HOLE: 70.0'	18. TOTAL CORE RECOVERY FOR BORING: N/A %
	19. SIGNATURE OF INSPECTOR

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	REC. / RUN e	BOX OR SAMPLE NO f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
-51.7	60.0					
-52.2	60.5		Gray silty clay, trace coarse to fine sand, trace coarse to fine gravel, soft, medium plasticity, wet CL	24"/ 24"	SS-5 60.5-62.5	3T-15, no recovery. Pushed SS-15, 24". q_u* = 0.5 tsf
				8"/ 18"	SS-16 62.5-64.0	7/9/10 q_u* = 1.0 tsf
				18"/ 18"	SS-17 64.0 65.5	12/14/13 q_u* = 1.5 tsf
-57.2	65.5		Brown silt, trace coarse to fine sand, very dense, wet ML	18"/ 18"	SS-18 65.5-67.0	30/39/40
-59.0	67.3		Brown silty clay, little coarse to fine sand, trace coarse to fine gravel, hard, medium plasticity, moist CL	18"/ 18"	SS-19 67.0-68.5	11/20/39 q_u* = 4.3 tsf
				18"/ 18"	SS-20 68.5-70.0	16/38/27 q_u* = 4.2 tsf
-61.7	70.0		End of boring @ 70.0'.			

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE
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PROJECT: Chicago Harbor Lock | HOLE NO. CLC-2-86

Hole No. CLG-3-86

DRILLING LOG	DIVISION	INSTALLATION	SHEET
	North Central	Chicago District	1 OF 4 SHEETS

1. PROJECT	Chicago Harbor Lock
2. LOCATION (Coordinates or Station)	0+15W, 60N of Centerline
3. DRILLING AGENCY	Patrick Engineering Inc.
4. HOLE NO. (As shown on drawing title and file number)	CLG-3-86
5. NAME OF DRILLER	Pat Bolger
6. DIRECTION OF HOLE	[X] VERTICAL [ ] INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN	
8. DEPTH DRILLED INTO ROCK	
9. TOTAL DEPTH OF HOLE	70.0'
10. SIZE AND TYPE OF BIT	Drag Bit
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	Low Water Datum For Lake Michigan
12. MANUFACTURER'S DESIGNATION OF DRILL	CME-55
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN	DISTURBED: 10 / UNDISTURBED: 9
14. TOTAL NUMBER CORE BOXES	
15. ELEVATION GROUND WATER	-
16. DATE HOLE	STARTED: 7/10/86 / COMPLETED: 7/11/86
17. ELEVATION TOP OF HOLE	8.3 LWD
18. TOTAL CORE RECOVERY FOR BORING	N/A %
19. SIGNATURE OF INSPECTOR	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	REC./RUN e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
8.3	0.0		Top of North Lock Wall			
			Reinforced concrete cap			
3.3	5.0					
			Void			

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE
MODIFIED BY PATRICK ENGINEERING 11/84

PROJECT: Chicago Harbor Lock | HOLE NO. CLG-3-86

Hole No. CLG-3-86

DRILLING LOG	DIVISION	INSTALLATION	SHEET
	North Central	Chicago District	OF 4 SHEETS

1. PROJECT: Chicago Harbor Lock	10. SIZE AND TYPE OF BIT: Drag Bit
2. LOCATION (Coordinates or Station): 0+15W, 60N of Centerline	11. DATUM FOR ELEVATION SHOWN (TBM or MSL): Low Water Datum For Lake Michigan
3. DRILLING AGENCY: Patrick Engineering Inc	12. MANUFACTURER'S DESIGNATION OF DRILL: CME-55
4. HOLE NO. (As shown on drawing title and file number): CLG-3-86	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 10; UNDISTURBED 9
5. NAME OF DRILLER: Pat Bolger	14. TOTAL NUMBER CORE BOXES
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.	15. ELEVATION GROUND WATER
7. THICKNESS OF OVERBURDEN	16. DATE HOLE: STARTED 7/10/86; COMPLETED 7/11/86
8. DEPTH DRILLED INTO ROCK	17. ELEVATION TOP OF HOLE: 8.3 LWD
9. TOTAL DEPTH OF HOLE: 70.0'	18. TOTAL CORE RECOVERY FOR BORING: N/A %
	19. SIGNATURE OF INSPECTOR: [illegible]

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	REC./RUN e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
-24.7	33.0		Reinforced concrete pile cap			4" diameter steel casing set 4" into cement.
-28.7	37.0		Dark gray silty clay, trace coarse to fine sand, very soft, medium plasticity, saturated CL	5"/ 18"	SS-1 37.0-38.5	SS-1 penetrated 18" under weight of rods. q_u* = 0.1 tsf
			Soft	16"/ 24"	3I-2 38.5-40.5	q_u* = 0.3 tsf

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE.
MODIFIED BY PATRICK ENGINEERING 11/84

PROJECT: Chicago Harbor Lock | HOLE NO.: CLG-3-86

Hole No. CLG-3-86

DRILLING LOG	DIVISION	INSTALLATION	SHEET
	North Central	Chicago District	1 OF 4 SHEETS

1. PROJECT: Chicago Harbor Lock	10. SIZE AND TYPE OF BIT: Drag Bit
2. LOCATION (Coordinates or Station): 0+15W, 60N of Centerline	11. DATUM FOR ELEVATION SHOWN (TBM or MSL): Low Water Datum For Lake Michigan
3. DRILLING AGENCY: Patrick Engineering Inc	12. MANUFACTURER'S DESIGNATION OF DRILL: CME-55
4. HOLE NO. (As shown on drawing title and file number): CLG-3-86	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 10; UNDISTURBED 9
5. NAME OF DRILLER: Pat Bolger	14. TOTAL NUMBER CORE BOXES
6. DIRECTION OF HOLE: [X] VERTICAL [ ] INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER: -
7. THICKNESS OF OVERBURDEN	16. DATE HOLE: STARTED 7/10/86; COMPLETED 7/11/86
8. DEPTH DRILLED INTO ROCK	17. ELEVATION TOP OF HOLE: 8.3 LWD
9. TOTAL DEPTH OF HOLE: 70.0'	18. TOTAL CORE RECOVERY FOR BORING: N/A %
	19. SIGNATURE OF INSPECTOR

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	REC./RUN e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
-31.7	40.0		Dark gray silty clay, trace coarse to fine sand, trace coarse to fine gravel, soft to medium stiff, medium plasticity, wet CL	24"/ 24" 42.5	3T-3 40.5-	q_u* = 0.4 tsf
			Trace coarse to fine gravel	18"/ 18"	SS-4 42.5 44.0	6/5/6 q_u* = 0.4 tsf
				24"/ 24"	3T-5 44.0- 46.0	q_u* = 0.5 tsf
			Soft	5"/ 18"	SS-6 46.0- 47.5	3/4/4 q_u* = 0.3 tsf
			Soft	24"/ 24"	3T-7 47.5- 49.5	q_u* = 0.3 tsf
			Medium stiff	10"/ 18"	SS-8 49.5- 51.0	5/6/10 q_u* = 0.5 tsf
				24"/ 24"	3T-9 51.0- 53.0	q_u* = 0.7 tsf
				7"/ 18"	SS-10 53.0- 54.5	7/9/9 q_u* = 0.5 tsf
				20"/ 24"	3T-11 54.5- 56.5	q_u* = 0.7 tsf
				18"/ 18"	SS-12A, B 56.5- 58.0	9/7/21 q_u* = 0.8 tsf
				24"/ 24"	3T-13 58.0- 60.0	q_u* = 0.9 tsf
-51.7	60.0					

Hole No. CLG-3-86

DRILLING LOG	DIVISION	INSTALLATION	SHEET
	North Central	Chicago District	1 OF 4 SHEETS

1. PROJECT	Chicago Harbor Lock
2. LOCATION (Coordinates or Station)	0+15W, 60N of Centerline
3. DRILLING AGENCY	Patrick Engineering Inc.
4. HOLE NO. (As shown on drawing title and file number)	CLG-3-86
5. NAME OF DRILLER	Pat Bolger
6. DIRECTION OF HOLE	☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN	
8. DEPTH DRILLED INTO ROCK	
9. TOTAL DEPTH OF HOLE	70.0'
10. SIZE AND TYPE OF BIT	Drag Bit
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	Low Water Datum For Lake Michigan
12. MANUFACTURER'S DESIGNATION OF DRILL	CME-55
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN	DISTURBED 10 / UNDISTURBED 9
14. TOTAL NUMBER CORE BOXES	
15. ELEVATION GROUND WATER	-
16. DATE HOLE	STARTED 7/10/86 / COMPLETED 7/11/86
17. ELEVATION TOP OF HOLE	8.3 LWD
18. TOTAL CORE RECOVERY FOR BORING	N/A %
19. SIGNATURE OF INSPECTOR	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	REC./RUN e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
			Very dark gray silty clay, trace coarse to fine sand, trace coarse to fine gravel, stiff, medium plasticity, moist CL	8"/ 18"	SS-14 60.0- 61.5	24/36/38 q_u* = 1.1 tsf
			Medium stiff	24"/ 24"	3T-15 61.5- 63.5	q_u* = 0.6 tsf
				18"/ 18"	SS-16 63.5- 65.0	14/14/28 q_u* = 1.9 tsf
				0"/ 18"	3T-17 65.0- 67.0	3T-17 Recovery all slough, no sample taken.
			Medium stiff	18"/ 18"	SS-18 67.0- 68.5	47/54/60 q_u* = 0.9 tsf
			Stiff	18"/ 18"	SS-19 68.5- 70.0	31/32/54 q_u* = 4.5+ tsf
-61.7	70.0		End of boring @ 70.0'.			

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE.
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PROJECT: Chicago Harbor Lock | HOLE NO.: CLG-3-86

Hole No. CLG-4-86

DRILLING LOG	DIVISION: North Central	INSTALLATION: Chicago District	SHEET 1 OF 4 SHEETS

1. PROJECT: Chicago Harbor Lock
2. LOCATION (Coordinates or Station): 0+14W, 60'S of Centerline
3. DRILLING AGENCY: Patrick Engineering Inc.
4. HOLE NO. (As shown on drawing title and file number): CLG-4-86
5. NAME OF DRILLER: Pat Bolger
6. DIRECTION OF HOLE: [X] VERTICAL [ ] INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN:
8. DEPTH DRILLED INTO ROCK:
9. TOTAL DEPTH OF HOLE: 69.5'
10. SIZE AND TYPE OF BIT: Drag Bit
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): Low Water Datum For Lake Michigan
12. MANUFACTURER'S DESIGNATION OF DRILL: CME-55
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 15; UNDISTURBED 5
14. TOTAL NUMBER CORE BOXES:
15. ELEVATION GROUND WATER:
16. DATE HOLE: STARTED 7/15/86; COMPLETED 7/16/86
17. ELEVATION TOP OF HOLE: 8.3 LWD
18. TOTAL CORE RECOVERY FOR BORING: N/A %
19. SIGNATURE OF INSPECTOR:

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	REC./RUN e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
8.3	0.0		Top of South Lock Wall			
			Reinforced concrete cap			
3.3	5.0					
			Void			

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE
MODIFIED BY PATRICK ENGINEERING 11/84

PROJECT: Chicago Harbor Lock | HOLE NO.: CLG-4-86

Hole No. CLG-4-86

DRILLING LOG

DIVISION: North Central
INSTALLATION: Chicago District
SHEET 2 OF 4 SHEETS

1. PROJECT: Chicago Harbor Lock
2. LOCATION (Coordinates or Station): 0+14W, 60'S of Centerline
3. DRILLING AGENCY: Patrick Engineering Inc.
4. HOLE NO. (As shown on drawing title and file number): CLG-4-86
5. NAME OF DRILLER: Pat Bolger
6. DIRECTION OF HOLE: [X] VERTICAL [ ] INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN
8. DEPTH DRILLED INTO ROCK
9. TOTAL DEPTH OF HOLE: 69.5'
10. SIZE AND TYPE OF BIT
11. DATUM FOR ELEVATION SHOWN (USGS or MSL): Low Water Datum For Lake Michigan
12. MANUFACTURER'S DESIGNATION OF DRILL: CME-55
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 15; UNDISTURBED 5
14. TOTAL NUMBER CORE BOXES
15. ELEVATION GROUND WATER
16. DATE HOLE: STARTED 7/15/86; COMPLETED 7/16/86
17. ELEVATION TOP OF HOLE: 8.3 LWD
18. TOTAL CORE RECOVERY FOR BORING: N/A %
19. SIGNATURE OF INSPECTOR

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	REC./RUN e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
						4" diameter steel casing set 6" into concrete.
-24.7	33.0		4.0' Reinforced concrete pile cap			
-28.7	37.0		Black coarse to fine gravel, loose, poorly graded, saturated GP	18"/ 18"	SS-1A,B,C 37.0-38.5	Q_u* = 0.2 tsf
-29.3	37.6		Gray silty clay, trace coarse to fine sand, trace coarse to fine gravel, very soft, medium plasticity, wet CL			
-29.7	38.0					
-30.2	38.5		Gray silty sand, loose, poorly graded, saturated SP	2"/ 18"	SS-2 38.5-40.0	
			Black coarse to fine gravel, loose, poorly graded, saturated GP			

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE
MODIFIED BY PATRICK ENGINEERING 11/84

PROJECT: Chicago Harbor Lock
HOLE NO. CLG-4-86

Hole No. CLG-4-86

DRILLING LOG | DIVISION: North Central | INSTALLATION: Chicago District | SHEET 3 OF 4 SHEETS

1. PROJECT: Chicago Harbor Lock
2. LOCATION (Coordinates or Station): 0+14W, 60'S of Centerline
3. DRILLING AGENCY: Patrick Engineering Inc.
4. HOLE NO. (As shown on drawing title and file number): CLG-4-86
5. NAME OF DRILLER: Pat Bolger
6. DIRECTION OF HOLE: ☑ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN
8. DEPTH DRILLED INTO ROCK
9. TOTAL DEPTH OF HOLE: 69.5'
10. SIZE AND TYPE OF BIT: Drag Bit
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): Low Water Datum For Lake Michigan
12. MANUFACTURER'S DESIGNATION OF DRILL: CME-55
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 15; UNDISTURBED 5
14. TOTAL NUMBER CORE BOXES
15. ELEVATION GROUND WATER
16. DATE HOLE: STARTED 7/15/86; COMPLETED 7/16/86
17. ELEVATION TOP OF HOLE: 8.3 LWD
18. TOTAL CORE RECOVERY FOR BORING: N/A %
19. SIGNATURE OF INSPECTOR

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	REC./RUN e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
-32.2	40.5		Gray silty clay, trace coarse to fine sand, trace coarse to fine gravel, very soft, medium plasticity, fibers, wet CL	0"/ 18"	3T-3 40.5-41.5	3/2/3 SS-3 driven on a piece of coarse gravel @ 40.0'.
				11"/ 18"	SS-4 41.5-43.0	2/2/4 q_u* 0.1 tsf
				2"/ 18"	SS-5 43.5-44.5	3/3/2 q_u* = 0.1 tsf
				12"/ 18"	SS-6 44.5-46.0	4/5/6 q_u* = 0.2 tsf
			Medium stiff	24"/ 24"	3T-7 46.0-48.0	q_u* = 0.6 tsf
				18"/ 18"	SS-8 48.0-49.5	7/7/8 q_u* = 0.7 tsf
			Soft	24"/ 24"	3T-9 49.5-51.5	q_u* = 0.4 tsf
			Stiff	24"/ 24"	3T-10 51.5-53.5	q_u* = 1.0 tsf
			Medium stiff	18"/ 18"	SS-11 53.5-55.0	4/6/5 q_u* = 0.5 tsf
				24"/ 24"	3T-12 55.0-57.0	
-47.7	56.0		Gray clayey sand, coarse to fine sand, little coarse to fine gravel, dense, moist SC	18"/ 18"	SS-13A,B 57.0-58.5	8/18/14
-49.7	58.0		Gray silt, trace coarse to fine sand, dense, moist ML	24"/ 24"	3T-14 58.5-60.5	

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE
MODIFIED BY PATRICK ENGINEERING 11/84

PROJECT: Chicago Harbor Lock | HOLE NO. CLG-4-86

Hole No. CLG-4-86

DRILLING LOG

DIVISION: North Central
INSTALLATION: Chicago District
SHEET 4 OF 4 SHEETS

1. PROJECT: Chicago Harbor Lock
2. LOCATION (Coordinates or Station): 0+14W, 60'S of Centerline
3. DRILLING AGENCY: Patrick Engineering Inc.
4. HOLE NO. (As shown on drawing title and file number): CLG-4-86
5. NAME OF DRILLER: Pat Bolger
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN
8. DEPTH DRILLED INTO ROCK
9. TOTAL DEPTH OF HOLE: 69.5'
10. SIZE AND TYPE OF BIT: Drag Bit
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): Low Water Datum For Lake Michigan
12. MANUFACTURER'S DESIGNATION OF DRILL: CME-55
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 15; UNDISTURBED 5
14. TOTAL NUMBER CORE BOXES
15. ELEVATION GROUND WATER
16. DATE HOLE: STARTED 7/15/86; COMPLETED 7/16/86
17. ELEVATION TOP OF HOLE: 8.3 LWD
18. TOTAL CORE RECOVERY FOR BORING: N/A %
19. SIGNATURE OF INSPECTOR

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	REC./RUN e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
			Gray silt, trace coarse to fine sand, dense, moist ML	18"/ 18"	SS-15 60.5- 62.0	19/27/29
			Sandy seam at 61.8'.	0"/ 18"	SS-16 62.0- 63.5	8/7/28 SS-16 pushed cobble @ 62.0'. No sample recovered.
-55.2	63.5		Gray silty clay, trace coarse to fine sand, very stiff, medium plasticity, moist CL	0"/ 18"	SS-17 63.5 65.0	7/9/9 No recovery
				18"/ 18"	SS-18 65.0- 66.5	Mix Bentonite 13/18/17 q_u* 2.5 tsf
			Trace coarse to fine gravel	18"/ 18"	SS-19 66.5 68.0	42/57/59 q_u* = 2.0
			Stiff	18"/ 18"	SS-20 68.0- 69.5	13/21/23 q_u* = 1.4 tsf
-61.2	69.5		End of boring @ 69.5'.			

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE
MODIFIED BY PATRICK ENGINEERING 11/84

PROJECT: Chicago Harbor Lock
HOLE NO. CLG-4-86

Hole No. CLF-1-86

DRILLING LOG	DIVISION: North Central	INSTALLATION: Chicago District	SHEET 1 OF 4 SHEETS

1. PROJECT: Chicago Harbor Lock	10. SIZE AND TYPE OF BIT: 3-1/4" I.D. x 6-3/4" O.D. HSA
2. LOCATION (Coordinates or Station): N0+37, W6+20	11. DATUM FOR ELEVATION SHOWN (TBM or MSL): Low Water Datum For Lake Michigan
3. DRILLING AGENCY: Patrick Engineering Inc.	12. MANUFACTURER'S DESIGNATION OF DRILL: CME-55 on Barge
4. HOLE NO. (As shown on drawing title and file number): CLF-1-86	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 11; UNDISTURBED 11
5. NAME OF DRILLER: Jerry Copak	14. TOTAL NUMBER CORE BOXES: N/A
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.	15. ELEVATION GROUND WATER: See Remarks
7. THICKNESS OF OVERBURDEN	16. DATE HOLE: STARTED 6/12/86; COMPLETED 6/12/86
8. DEPTH DRILLED INTO ROCK	17. ELEVATION TOP OF HOLE: 8.3 LWD
9. TOTAL DEPTH OF HOLE: 76'	18. TOTAL CORE RECOVERY FOR BORING: N/A %
	19. SIGNATURE OF INSPECTOR: [signature]

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	REC./RUN e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
8.4	0.0					
			Top of Water (Lock Full)			
4.7	3.7					
			Top of Water (Lock Low)			
-0.6	9.0					
-11.6	20.0					

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE
MODIFIED BY PATRICK ENGINEERING 11/84

PROJECT: Chicago Harbor Lock — HOLE NO. CLF-1-86

Hole No. CLF-1-86

DRILLING LOG

DIVISION: North Central	INSTALLATION: Chicago District
	SHEET 2 OF 6 SHEETS
1. PROJECT: Chicago Harbor Lock	10. SIZE AND TYPE OF BIT: 3 1/8" I.D. x 6 3/4" O.D. HSA
2. LOCATION (Coordinates or Station): N0+37, W6+20	11. DATUM FOR ELEVATION SHOWN (TBM or MSL): Low Water Datum For Lake Michigan
3. DRILLING AGENCY: Patrick Engineering Inc.	12. MANUFACTURER'S DESIGNATION OF DRILL: CME-55 on Barge
4. HOLE NO. (As shown on drawing title and file number): CLF-1-86	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 11; UNDISTURBED 11
5. NAME OF DRILLER: Jerry Copak	14. TOTAL NUMBER CORE BOXES: N/A
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER: See Remarks
	16. DATE HOLE: STARTED 6/12/86; COMPLETED 6/12/86
7. THICKNESS OF OVERBURDEN	17. ELEVATION TOP OF HOLE: 8.3 LWD
8. DEPTH DRILLED INTO ROCK	18. TOTAL CORE RECOVERY FOR BORING: N/A %
9. TOTAL DEPTH OF HOLE: 76'	19. SIGNATURE OF INSPECTOR

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	REC./RUN e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
			Top of Precast Concrete Panel (Bottom of Lock)			
-25.1	33.5		Bottom of Concrete			Augers sank 9" after penetrating concrete.
-25.9	34.3		Black coarse to fine sand, some wood, fibers, well graded, loose, saturated, SW	9"/ 18"	SS-1A,B 35.0-36.5	4/3/2 Pounded SS-1 to remove cement plug from bore.
-26.9	35.3		Gray medium to fine gravel, poorly graded, loose, saturated GP			
					SS-2 36.5-38.5	Pushed 31-2, 24", No recovery, try SS-2 2/3/3
-29.3	37.7		Dark gray silty clay, trace coarse to fine sand, trace coarse to fine gravel, soft, medium plasticity, saturated CL	4"/ 24"		6" coarse to fine sand Entered augers after obtaining SS-2.
				24"/ 24"	31-3 38.5-40.5	q_u* = 0.3 tsf.
-31.6	40.0					

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE
MODIFIED BY PATRICK ENGINEERING 11/84

PROJECT: Chicago Harbor Lock HOLE NO. CLF-1-86

Hole No. CLF-1-86

DRILLING LOG	DIVISION: North Central	INSTALLATION: Chicago District	SHEET 1 OF 4 SHEETS
1. PROJECT: Chicago Harbor Lock		10. SIZE AND TYPE OF BIT: 3-1/4" I.D. x 6-3/4" O.D. HSA	
2. LOCATION (Coordinates or Station): N0+37, W6+20		11. DATUM FOR ELEVATION SHOWN (TBM or MSL): Low Water Datum For Lake Michigan	
3. DRILLING AGENCY: Patrick Engineering Inc.		12. MANUFACTURER'S DESIGNATION OF DRILL: CME-55 on Barge	
4. HOLE NO. (As shown on drawing title and file number): CLF-1-86		13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 11; UNDISTURBED 11	
5. NAME OF DRILLER: Jerry Copak		14. TOTAL NUMBER CORE BOXES: N/A	
6. DIRECTION OF HOLE: [X] VERTICAL [ ] INCLINED ____ DEG. FROM VERT.		15. ELEVATION GROUND WATER: See Remarks	
		16. DATE HOLE: STARTED 6/12/86; COMPLETED 6/12/86	
7. THICKNESS OF OVERBURDEN		17. ELEVATION TOP OF HOLE: 8.3 LWD	
8. DEPTH DRILLED INTO ROCK		18. TOTAL CORE RECOVERY FOR BORING: N/A %	
9. TOTAL DEPTH OF HOLE: 76'		19. SIGNATURE OF INSPECTOR: [illegible]	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	REC./RUN e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
-31.6	40.0		Dark gray silty clay, trace coarse to fine sand, trace coarse to fine gravel, very soft, medium plasticity, saturated CL			3/4/4 q_u* = 0.1 tsf
				18"/18"	SS-4 40.5-42.0	
				16"/24"	3T-5 42.0-44.0	3T-5 Penetrated 24" under weight of rods. q_u* = 0.2 tsf
				0"/18"	SS-6 44.0-45.5	SS-6 Penetrated 18" under weight of rods.
				22"/24"	3T-7 45.5-47.5	3T-7 penetrated under weight of rods. q_u* = 0.2 tsf
						Auger penetrated 1.0' under own weight.
			Medium stiff	24"/24"	3T-8 48.5-50.5	q_u* = 0.8 tsf
				6"/24"	SS-9 50.5-52.5	Pushed 3T-9 24", no recovery. q_u* = 0.8 tsf
-44.1	52.5		Very dark grayish-brown silty clay, trace sand, trace gravel, hard, medium plasticity, moist CL	24"/24"	3T-10 52.5-54.5	q_u* = 4.3 tsf
				15"/24"	3T-11 54.5-56.5	Pushed 3T-11, 24" No recovery Push 3T-11 again q_u* = 4.5+ tsf
				8"/24"	3T-12 56.5-58.5	q_u* = 4.5+ tsf
				6"/24"	3T-13 58.5-60.5	Pushed 3T-13, 24" q_u* = 3.[illegible] tsf
-51.6	60.0		Very stiff			

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE
MODIFIED BY PATRICK ENGINEERING 11/84

PROJECT: Chicago Harbor Lock | HOLE NO. CLF-1-86

Hole No. CLF-1-86

DRILLING LOG

DIVISION: North Central
INSTALLATION: Chicago District
SHEET 4 OF 4 SHEETS

1. PROJECT: Chicago Harbor Lock
2. LOCATION (Coordinates or Station): N0+37, W6+20
3. DRILLING AGENCY: Patrick Engineering Inc.
4. HOLE NO. (As shown on drawing title and file number): CLF-1-86
5. NAME OF DRILLER: Jerry Copak
6. DIRECTION OF HOLE: [X] VERTICAL [ ] INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN
8. DEPTH DRILLED INTO ROCK
9. TOTAL DEPTH OF HOLE: 76'
10. SIZE AND TYPE OF BIT: 3-1/4" I.D. x 6-3/4" O.D. HSA
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): Low Water Datum For Lake Michigan
12. MANUFACTURER'S DESIGNATION OF DRILL: CME-55 on Barge
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 11; UNDISTURBED 11
14. TOTAL NUMBER CORE BOXES: N/A
15. ELEVATION GROUND WATER: See Remarks
16. DATE HOLE: STARTED 6/12/86; COMPLETED 6/12/86
17. ELEVATION TOP OF HOLE: 8.3 LWD
18. TOTAL CORE RECOVERY FOR BORING: N/A %
19. SIGNATURE OF INSPECTOR:

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	REC/RUN e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
-51.6	60.0		Very dark grayish-brown silty clay, trace sand, trace gravel, hard, medium plasticity, moist CL	6"/12"	3T-14 60.5-61.5	Pushed 3T-14 12" to refusal @ 61.5'. q_u* = 4.5+ tsf
				14"/18"	SS-15 62.5-64.5	Pushed 3T-15 24", no recovery. q_u* = 2.8 tsf
			Very stiff			Push SS-15 18" q_u* = 2.5 tsf
				9"/24"	3T-16 64.5-66.5	q_u* = 2.8 tsf
			Hard	10"/24"	3T-17 66.5-68.5	q_u* = 4.5* tsf
				2"/2"	SS-18 68.5-68.7	100 Blows/2"
			Hard	18"/18"	SS-19 70.0-71.5	Drilled past boulder @ 70.5' q_u* = 4.5+ tsf 39/27/30
				18"/18"	SS-20 71.5-73.0	27/31/29 q_u* = 4.5+ tsf
				18"/18"	SS-21 73.0-74.5	15/12/29 q_u* = 4.5+ tsf
				18"/18"	SS-22 74.5-76.0	21/25/32 q_u* = 4.5+ tsf
-67.6	76.0		End of boring @ 76.0'.			

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE
MODIFIED BY PATRICK ENGINEERING 11/84

PROJECT: Chicago Harbor Lock | HOLE NO. CLF-1-86

Hole No. CLF-2-86

DRILLING LOG	DIVISION: North Central	INSTALLATION: Chicago District	SHEET 1 OF 4 SHEETS
1. PROJECT: Chicago Harbor Lock		10. SIZE AND TYPE OF BIT: 6-3/4" O.D. HSA x 3-1/4" I.D.	
2. LOCATION (Coordinates or Station): N0+03, W3+80		11. DATUM FOR ELEVATION SHOWN (TBM or MSL): Low Water Datum For Lake Michigan	
3. DRILLING AGENCY: Patrick Engineering Inc.		12. MANUFACTURER'S DESIGNATION OF DRILL: CME-55 on Barge	
4. HOLE NO. (As shown on drawing title and file number): CLF-2-86		13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 10	UNDISTURBED 14
5. NAME OF DRILLER: Jerry Copak		14. TOTAL NUMBER CORE BOXES	
6. DIRECTION OF HOLE: [X] VERTICAL [ ] INCLINED _____ DEG. FROM VERT.		15. ELEVATION GROUND WATER: -0.2 LWD	
		16. DATE HOLE: STARTED 6/18/86	COMPLETED 6/18/86
7. THICKNESS OF OVERBURDEN		17. ELEVATION TOP OF HOLE: 2.4 LWD (Barge Deck)	
8. DEPTH DRILLED INTO ROCK		18. TOTAL CORE RECOVERY FOR BORING: %	
9. TOTAL DEPTH OF HOLE: 71.5'		19. SIGNATURE OF INSPECTOR	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	REC./RUN e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
			Top of Barge Deck			
2.4	0.0					
			Top of Water (Lock Down)			
-0.2	2.3					
-17.6	20.0					

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE
MODIFIED BY PATRICK ENGINEERING 11/84

PROJECT: Chicago Harbor Lock | HOLE NO: CLF-2-86

Hole No. CLF-2-86

DRILLING LOG

DIVISION	North Central
INSTALLATION	Chicago District
SHEET	2 OF 4 SHEETS
1. PROJECT	Chicago Harbor Lock
2. LOCATION (Coordinates or Station)	N0+03, W3+80
3. DRILLING AGENCY	Patrick Engineering Inc.
4. HOLE NO. (As shown on drawing title and file number)	CLF-2-86
5. NAME OF DRILLER	Jerry Copak
6. DIRECTION OF HOLE	[x] VERTICAL [ ] INCLINED ____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN	
8. DEPTH DRILLED INTO ROCK	
9. TOTAL DEPTH OF HOLE	71.5'
10. SIZE AND TYPE OF BIT	6-3/4" O.D. HSA x 3-1/4" I.D.
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	Low Water Datum For Lake Michigan
12. MANUFACTURER'S DESIGNATION OF DRILL	CME-55 on Barge
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN	DISTURBED: 10; UNDISTURBED: 14
14. TOTAL NUMBER CORE BOXES	
15. ELEVATION GROUND WATER	-0.2 LWD
16. DATE HOLE	STARTED: 6/18/86; COMPLETED: 6/18/86
17. ELEVATION TOP OF HOLE	2.4 LWD (Barge Deck)
18. TOTAL CORE RECOVERY FOR BORING	%
19. SIGNATURE OF INSPECTOR	[signature]

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	REC./RUN e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
			Bottom of Lock			
-22.9	25.3		Concrete 8"			
-23.7	26.0		Dark gray silty clay, trace coarse to fine sand, very soft, medium plasticity, saturated CL	8"/ 18"	SS-1 26.0-27.5	2/2/3 q_u* = 0.1 tsf
				23"/ 24"	3T-2 27.5-29.5	q_u* = 0.1 tsf
				11"/ 24"	3T-3 29.5-31.5	q_u* = 0.1 tsf
				21"/ 24"	3T-4 31.5-33.5	q_u* = 0.1 tsf
				18"/ 18"	SS-5 33.5-35.0	5/3/5 q_u* = 0.2 tsf
-32.6	35.0		Dark gray silty clay, trace coarse to fine sand, trace coarse to fine gravel, soft, medium, plasticity saturated CL	21"/ 24"	3T-6 35.0-37.0	q_u* = 0.[illegible] tsf
				18"/ 18"	SS-7 37.0-38.5	3/4/4 q_u* = 0.4 tsf
				24"/ 24"	3T-8 38.5-40.5	Pushed 3T-8 24" No Recovery. Run in hole again.
-37.6	40.0					

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE

MODIFIED BY PATRICK ENGINEERING 11/84

PROJECT: Chicago Harbor Lock | HOLE NO. CLF-2-86

Hole No. CLF-2-86

DRILLING LOG

DIVISION	North Central
INSTALLATION	Chicago District
SHEET	3 OF 4 SHEETS
1. PROJECT	Chicago Harbor Lock
2. LOCATION (Coordinates or Station)	NO+03, W3+80
3. DRILLING AGENCY	Patrick Engineering Inc
4. HOLE NO. (As shown on drawing title and file number)	CLF-2-86
5. NAME OF DRILLER	Jerry Copak
6. DIRECTION OF HOLE	☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN	
8. DEPTH DRILLED INTO ROCK	
9. TOTAL DEPTH OF HOLE	71.5'
10. SIZE AND TYPE OF BIT	6-3/4" O.D. HSA x 3-1/4" I.D.
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	Low Water Datum For Lake Michigan
12. MANUFACTURER'S DESIGNATION OF DRILL	CME-55 on Barge
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN	DISTURBED 10 / UNDISTURBED 14
14. TOTAL NUMBER CORE BOXES	
15. ELEVATION GROUND WATER	-0.2 LWD
16. DATE HOLE	STARTED 6/18/86 / COMPLETED 6/18/86
17. ELEVATION TOP OF HOLE	2.4 LWD (Barge Deck)
18. TOTAL CORE RECOVERY FOR BORING	%
19. SIGNATURE OF INSPECTOR	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	REC./RUN e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
-37.6	40.0		Dark gray silty clay, trace coarse to fine sand, trace coarse to fine gravel, medium stiff, medium plasticity, saturated CL	18"/ 18"	SS-9 40.5-42.0	3/3/4 q_u* = 0.5 tsf
				15"/ 24"	3T-10 42.0-44.0	q_u* = 0.5 tsf
				18"/ 18"	SS-11 44.0-45.5	3/5/5 q_u* = 0.6 tsf
				16"/ 24"	3T-12 45.5-47.5	Pushed 3T-12 24" No Recovery, run in hole again, wait 2 minutes. q_u* = 0.6 tsf
				18"/ 18"	SS-13 47.5-49.0	4/3/6 q_u* = 0.5 tsf
				20"/ 24"	3T-14 49.0-51.0	q_u* = 0.7 tsf
				0"/ 18"	SS-15 51.0-52.5	12/16/17
-50.0	52.5		Very dark grayish brown gray silty clay, trace coarse to fine sand, trace coarse to fine gravel, very stiff, medium plasticity, moist CL	9"/ 18"	SS-16 52.5-54.5	Push 3T-16 24" No Recovery. Pushed SS-16 q_u* = 2.4 tsf
				18"/ 18"	SS-17 54.5-56.5	Push 3T-17 24" No Recovery. Pushed SS-17 q_u* = 2.6 tsf
				22"/ 24"	3T-18 56.5-58.5	q_u* = 2.6 tsf
				24"/ 24"	3T-19 58.5-60.5	q_u* = 2.8 tsf
-57.6	60.0					

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE
MODIFIED BY PATRICK ENGINEERING 11/84

PROJECT Chicago Harbor Lock | HOLE NO. CLF-2-86

Hole No. CLF-2-86

DRILLING LOG	DIVISION	INSTALLATION	SHEET
	North Central	Chicago District	4 OF 4 SHEETS

1. PROJECT	Chicago Harbor Lock
2. LOCATION (Coordinates or Station)	N0+03, W3+80
3. DRILLING AGENCY	Patrick Engineering Inc.
4. HOLE NO. (As shown on drawing title and file number)	CLF-2-86
5. NAME OF DRILLER	Jerry Copak
6. DIRECTION OF HOLE	☒ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN	
8. DEPTH DRILLED INTO ROCK	
9. TOTAL DEPTH OF HOLE	71.5'
10. SIZE AND TYPE OF BIT	6-3/4" O.D. HSA x 3-1/4" I.D.
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	Low Water Datum For Lake Michigan
12. MANUFACTURER'S DESIGNATION OF DRILL	CME-55 on Barge
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN	DISTURBED 10 / UNDISTURBED 14
14. TOTAL NUMBER CORE BOXES	
15. ELEVATION GROUND WATER	-0.2 LWD
16. DATE HOLE	STARTED 6/18/86 / COMPLETED 6/18/86
17. ELEVATION TOP OF HOLE	2.4 LWD (Barge Deck)
18. TOTAL CORE RECOVERY FOR BORING	%
19. SIGNATURE OF INSPECTOR	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	REC./RUN e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
-57.6	60.0		Very dark grayish brown silty clay, trace coarse to fine sand trace coarse to fine gravel, very stiff, medium plasticity, moist CL	18"/ 18"	SS-20 60.5- 62.0	10/21/26 q_u* = 4.5 tsf
-58.1	60.5		Very dark grayish brown silty clay, trace coarse to fine sand, trace coarse to fine gravel, hard, medium plasticity, moist CL	36"/ 36"	CS-21 62.0- 65.0	q_u* = 4.5* tsf
				60"/ 60"	CS-22A,B 65.0- 70.0	
			2" coarse to fine sand seam @ 68.6'.			Sand sample in CS-22B
						q_u* = 4.5* tsf
				60"/ 60"	CS-23 70.0- 75.0	
						q_u* = 4.5* tsf
			2" coarse to fine sand seam @ 74.2'.			
				18"/ 18"	SS-23A,B 77.0- 76.5	33/55/60 q_u* = 4.5* tsf
-73.6	76.0		Gray coarse to fine sand, trace coarse to fine gravel, well graded, extremely dense, saturated SW			
-74.1	76.5		End of boring @ 76.5'.			
	80.0					

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE
MODIFIED BY PATRICK ENGINEERING 11/84

PROJECT Chicago Harbor Lock | HOLE NO. CLF-2-86

Hole No. CLF-3-86

DRILLING LOG	DIVISION: North Central	INSTALLATION: Chicago District	SHEET 1 OF 4 SHEETS
1. PROJECT: Chicago Harbor Lock		10. SIZE AND TYPE OF BIT: 6-3/4" O.D. HSA x 3-1/4" I.D.	
2. LOCATION (Coordinates or Station): S0+37, W1+14		11. DATUM FOR ELEVATION SHOWN (TBM or MSL): Low Water Datum for Lake Michigan	
3. DRILLING AGENCY: Patrick Engineering Inc.		12. MANUFACTURER'S DESIGNATION OF DRILL: CME-55	
4. HOLE NO. (As shown on drawing title and file number): CLF-3-86		13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 17	UNDISTURBED 8
5. NAME OF DRILLER: Jerry Copak		14. TOTAL NUMBER CORE BOXES: N/A	
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.		15. ELEVATION GROUND WATER: ~0.7 LWD	
7. THICKNESS OF OVERBURDEN		16. DATE HOLE: STARTED 6/19/86	COMPLETED 6/19/86
8. DEPTH DRILLED INTO ROCK		17. ELEVATION TOP OF HOLE: 8.3 LWD	
9. TOTAL DEPTH OF HOLE: 76'		18. TOTAL CORE RECOVERY FOR BORING: N/A %	
		19. SIGNATURE OF INSPECTOR:	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	REC/RUN e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
			Top of South Wall			
8.3	0.0					
			Top of Water (Lock Full)			
4.3	4.0					
			Top of Water (Lock Down)			
~0.7	9.0					
~11.7	20.0					

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE.
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PROJECT: Chicago Harbor Lock | HOLE NO. CLF-3-86

Hole No. CLF-3-86

DRILLING LOG	DIVISION: North Central	INSTALLATION: Chicago District	SHEET 2 OF 4 SHEETS

1. PROJECT: Chicago Harbor Lock	10. SIZE AND TYPE OF BIT: 6-3/4" O.D. HSA x 3-1/4" I.D.
2. LOCATION (Coordinates or Station): S0+37, W1+14	11. DATUM FOR ELEVATION SHOWN (TBM or MSL): Low Water Datum for Lake Michigan
3. DRILLING AGENCY: Patrick Engineering Inc.	12. MANUFACTURER'S DESIGNATION OF DRILL: CME-55
4. HOLE NO. (As shown on drawing title and file number): CLF-3-86	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 17; UNDISTURBED 8
5. NAME OF DRILLER: Jerry Copak	14. TOTAL NUMBER CORE BOXES: N/A
6. DIRECTION OF HOLE: [x] VERTICAL [ ] INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER: -0.7 LWD
	16. DATE HOLE: STARTED 6/19/86; COMPLETED 6/19/86
7. THICKNESS OF OVERBURDEN	17. ELEVATION TOP OF HOLE: 8.3 LWD
8. DEPTH DRILLED INTO ROCK	18. TOTAL CORE RECOVERY FOR BORING: N/A %
9. TOTAL DEPTH OF HOLE: 76'	19. SIGNATURE OF INSPECTOR: [signature]

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	REC./RUN e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
-25.4	33.7		Top of Precast Concrete Panel			
-26.7	35.0		Bottom of Panel Coarse to fine sand, occasional rock chips, well graded, loose, saturated SW	1"/ 18"	SS-1 35.0-36.5	24/3/3/
-27.6	35.9		Medium gravel, medium dense, saturated GP			
				18"/ 18"	SS-2A,B 36.5-38.0	9/10/15
-28.5	36.8		Coarse to fine sand, trace coarse to fine gravel, well graded, medium dense, saturated SW			
				18"/ 18"	SS-3A,B 38.0-39.5	3/7/8
-30.3	38.6		Coarse to fine gravel, trace coarse to fine sand, well graded, medium dense, saturated GW			

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE.

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PROJECT: Chicago Harbor Lock | HOLE NO. CLF-3-86

Hole No. CLF-3-86

DRILLING LOG	DIVISION: North Central	INSTALLATION: Chicago District	SHEET 2 OF 4 SHEETS
1. PROJECT: Chicago Harbor Lock		10. SIZE AND TYPE OF BIT: 6-3/4" O.D. HSA x 3-1/4" I.D.	
2. LOCATION (Coordinates or Station): SO+37, W1+14		11. DATUM FOR ELEVATION SHOWN (TBM or MSL): Low Water Datum for Lake Michigan	
3. DRILLING AGENCY: Patrick Engineering Inc.		12. MANUFACTURER'S DESIGNATION OF DRILL: CME-55	
4. HOLE NO. (As shown on drawing title and file number): CLF-3-86		13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 17	UNDISTURBED 8
5. NAME OF DRILLER: Jerry Copak		14. TOTAL NUMBER CORE BOXES: N/A	
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.		15. ELEVATION GROUND WATER: -0.7 LWD	
7. THICKNESS OF OVERBURDEN		16. DATE HOLE: STARTED 6/19/86	COMPLETED 6/19/86
8. DEPTH DRILLED INTO ROCK		17. ELEVATION TOP OF HOLE: 8.3 LWD	
9. TOTAL DEPTH OF HOLE: 76'		18. TOTAL CORE RECOVERY FOR BORING: N/A %	
		19. SIGNATURE OF INSPECTOR: [signature]	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	REC./RUN e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
-31.7	40.0		Dark gray silty clay, little coarse to fine sand, trace coarse to fine gravel, very soft, medium plasticity, saturated CL	6"/ 18"	SS-4 39.5- 41.0	8/5/7 q_u* = 0.1 tsf
				18"/ 24"	3T-5 41.0- 43.0"	q_u* = 0.2 tsf
			Soft	24"/ 24"	3T-6 43.0- 45.0	q_u* = 0.4 tsf
				18"/ 18"	SS-7 45.0- 46.5	7/7/9 q_u* = 0.3 tsf
				24"/ 24"	3T-8 46.5- 48.5	q_u* = 0.4 tsf
			Medium stiff	20"/ 24"	3T-9 48.5- 50.5	Pushed 3T-9 24" No Recovery, run in hole again. q_u* = 0.6 tsf
			Dark gray silty clay, little coarse to fine sand, trace coarse to fine gravel, medium stiff, medium plasticity, saturated CL	18"/ 18"	SS-10 50.5- 52.0	11/10/12 q_u* = 0.5 tsf
-43.7	52.0		Very dark grayish brown silty clay trace sand, trace gravel, stiff, medium plasticity, saturated CL	24"/ 24"	3T-11 52.0- 54.0	q_u* = 1.1 tsf
				18"/ 18"	SS-12 54.0- 55.5	12/26/33 q_u* = 1.9 tsf
-47.2	55.5		Very dark grayish brown silty clay, trace coarse to fine sand, trace coarse to fine gravel, very stiff to hard, medium plasticity, wet CL	12"/ 12"	3T-13 55.5- 56.5	Pushed 3T-13 12" to refusal
						q_u* = 4.5 tsf
				4"/ 18"	SS-14 57.5- 59.0	8/17/23 q_u* = 4.5 tsf

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE
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PROJECT: Chicago Harbor Lock — HOLE NO. CLF-3-86

Hole No. CLF-3-86

DRILLING LOG

DIVISION: North Central
INSTALLATION: Chicago District
SHEET 1 OF 2 SHEETS

1. PROJECT: Chicago Harbor Lock
2. LOCATION (Coordinates or Station): SO+37, WI+14
3. DRILLING AGENCY: Patrick Engineering Inc.
4. HOLE NO. (As shown on drawing title and file number): CLF-3-86
5. NAME OF DRILLER: Jerry Copak
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN
8. DEPTH DRILLED INTO ROCK
9. TOTAL DEPTH OF HOLE: 76'
10. SIZE AND TYPE OF BIT: 3 1/4" I.D. HSA
11. DATUM FOR ELEVATION SHOWN (Type or MSL): Low Water Datum for Lake Michigan
12. MANUFACTURER'S DESIGNATION OF DRILL: CME-55
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 17; UNDISTURBED 8
14. TOTAL NUMBER CORE BOXES: N/A
15. ELEVATION GROUND WATER: -0.7 LWD
16. DATE HOLE: STARTED 6/19/86; COMPLETED 6/19/86
17. ELEVATION TOP OF HOLE: 8.3 LWD
18. TOTAL CORE RECOVERY FOR BORING: N/A %
19. SIGNATURE OF INSPECTOR

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	REC./RUN e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
			Very dark grayish-brown silty clay, trace coarse to fine sand, trace coarse to fine gravel, very stiff to hard, medium plasticity, wet CL	9"/ 18"	SS-15 59.0-61.0	Pushed 3T-15 No Recovery Drove spoon 8/12/14 q_u* = 1.8 tsf
				19"/ 24"	3T-16 61.0-63.0	q_u* = 2.0 tsf
				12"/ 12"	SS-17 63.0-64.0	25/48 q_u* = 3.2 tsf
				17"/ 24"	3T-18 64.5-66.5	Pushed 3T-18 24" q_u* = 4.5 tsf
				14"/ 18"	SS-19 66.5-68.0	14/21/22 q_u* = 3.0 tsf
				18"/ 18"	SS-20 68.0-69.5	26/31/42 q_u* = 4.5 tsf
				18"/ 18"	SS-21 69.5-71.0	27/31/43 q_u* = 4.5 tsf
				18"/ 18"	SS-22 71.0-72.5	28/31/43 q_u* = 4.5 tsf
				18"/ 18"	SS-23 72.5-74.0	20/23/45 q_u* = 4.5 tsf
						6" Drilled
				18"/ 18"	SS-24 74.5-76.0	26/37/41 q_u* = 4.5 tsf
-67.7	76.0		End of boring @ 76.0'.			

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE
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PROJECT: Chicago Harbor Lock
HOLE NO: CLF-3-86

Hole No. CLW-1-86

DRILLING LOG	DIVISION: North Central	INSTALLATION: Chicago District	SHEET 1 OF 5 SHEETS

1. PROJECT: Chicago Harbor Lock	10. SIZE AND TYPE OF BIT: 3-1/4" I.D. x 6-3/4" O.D. HSA
2. LOCATION (Coordinates or Station): N0+60, W3+90	11. DATUM FOR ELEVATION SHOWN (TBM or MSL): Low Water Datum For Lake Michigan
3. DRILLING AGENCY: Patrick Engineering Inc.	12. MANUFACTURER'S DESIGNATION OF DRILL: CME-55
4. HOLE NO. (As shown on drawing title and file number): CLW-1-86	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 41; UNDISTURBED 7
5. NAME OF DRILLER: Pat Bolger/Jerry Copak	14. TOTAL NUMBER CORE BOXES: N/A
6. DIRECTION OF HOLE: [X] VERTICAL [ ] INCLINED _____ DEG. FROM VERT.	15. ELEVATION GROUND WATER: See Remarks
7. THICKNESS OF OVERBURDEN	16. DATE HOLE: STARTED 5/6/86; COMPLETED 5/9/86
8. DEPTH DRILLED INTO ROCK	17. ELEVATION TOP OF HOLE: 8.3 LWD
9. TOTAL DEPTH OF HOLE: 81.0'	18. TOTAL CORE RECOVERY FOR BORING: %
	19. SIGNATURE OF INSPECTOR:

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	REC./RUN e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
8.3	0.0				AU-1 0.0-0.5	Cement cap.
			6" cement cap			
7.8	0.5		Coarse to fine gravel, poorly graded, loose, dry GP	4"/18"	SS-2 1.0-2.5	5/3/4
				3"/18"	SS-3 2.5-4.0	4/2/3
				6"/18"	SS-4 4.0-5.5	4/4/6
			Saturated	7"/18"	SS-5 5.5-7.0	4/5/4 Water @ 6.5' during drilling will fluctuate with lock level.
2.3	6.0		Coarse to fine gravel, little to some coarse to fine sand, poorly graded, medium dense, saturated GP	7"/18"	SS-6 7.0-8.5	19/6/7 SS-6 driven on a cobble @ 7.0'.
				2"/18"	SS-7 8.5-10.0	9/6/7 Drove 3" O.D. spoon w/140 lb hammer for SS-7 Water @ 10' when lock is down.
				3"/18"	SS-8 10.0-11.5	5/8/6
			Coarse to fine sand	3"/18"	SS-9 11.5-13.0	5/12/8
				2"/18"	SS-10 13.0-14.5	5/8/6
				3"/18"	SS-11 14.5-16.0	11/8/5
			Coarse to fine sand	3"/18"	SS-12 16.0-17.5	11/10/11
			Little coarse to fine sand	3"/18"	SS-13 17.5-19.0	10/15/16
-10.7	19.0		Coarse to fine sand and coarse to fine gravel, well graded, medium dense, saturated SW	3"/18"	SS-14 19.0-21.5	5/10/7 5' blow in.

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PROJECT: Chicago Harbor Lock | HOLE NO.: CLW-1-86

Hole No. CLW-1-86

DRILLING LOG	DIVISION	INSTALLATION	SHEET
	North Central	Chicago District	2 OF 5 SHEETS

1. PROJECT	Chicago Harbor Lock
2. LOCATION (Coordinates or Station)	N0+60, W3+90
3. DRILLING AGENCY	Patrick Engineering Inc.
4. HOLE NO. (As shown on drawing title and file number)	CLW-1-86
5. NAME OF DRILLER	Pat Bolger/Jerry Copak
6. DIRECTION OF HOLE	☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN	
8. DEPTH DRILLED INTO ROCK	
9. TOTAL DEPTH OF HOLE	81.0'
10. SIZE AND TYPE OF BIT	3-1/4" I.D. x 6-3/4" O.D. HSA
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	Low Water Datum For Lake Michigan
12. MANUFACTURER'S DESIGNATION OF DRILL	CME-55
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN	DISTURBED 41 / UNDISTURBED 7
14. TOTAL NUMBER CORE BOXES	N/A
15. ELEVATION GROUND WATER	See Remarks
16. DATE HOLE	STARTED 5/6/86 / COMPLETED 5/9/86
17. ELEVATION TOP OF HOLE	8.3 LWD
18. TOTAL CORE RECOVERY FOR BORING	%
19. SIGNATURE OF INSPECTOR	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	REC./RUN e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
-11.7	20.0		Coarse to fine sand and coarse to fine gravel, well graded, medium dense, saturated SW		SS-14	Bag sample @ 19'-22'.
-12.2	20.5		Coarse to fine gravel, little sand, occasional cobbles, poorly graded, medium dense, saturated GP	2"/ 18"	SS-15 20.5-22.0	21/19/7
				1"/ 18"	SS-16 22.0-23.5	12/13/12
				1"/ 18"	SS-17 23.5-25.0	22/18/19 Drove 3" O.D. spoon w/140 lb hammer for SS-17. Pounded on cobble @ 23.5'.
				1"/ 18"	SS-18 25.0-26.5	15/9/9 Drove 3" O.D. spoon w/140 lb hammer for SS-18.
				1"/ 18"	SS-19 26.5-28.0	14/19/20
				3"/ 18"	SS-20 28.0-29.5	33/23/19
				4"/ 18"	SS-21 29.5-31.0	15/26/13
-22.7	31.0		Coarse to fine sand, little coarse to fine gravel, well graded, very dense, saturated SW-SM	5"/ 18"	SS-22 31.0-32.5	20/28/38
-24.2	32.5		Dark gray silty clay, trace to little coarse to fine sand, trace coarse to fine gravel, trace wood fibers & chared wood, soft, medium plasticity, saturated CL	12"/ 18"	SS-23 32.5-34.0	3/4/3 q_u* = 0.3 tsf
				20"/ 24"	ST-24 34.0-36.0	q_u* = 0.2 tsf
						6-5-86
				8"/ 18"	SS-25 36.0-37.5	6-9-86 Spoon penetrated 18" under weight of rods. q_u* = 0.2 tsf
				12"/ 18"	SS-26 37.5-39.5	Pushed ST-26, 24", no recovery. Tried another tube, let sit & twisted 1/2 turn, no recovery. Push SS-26. q_u* = 0.2 tsf
-31.7	40.0					

Hole No. CLW-1-86

DRILLING LOG	DIVISION: North Central	INSTALLATION: Chicago District	SHEET 3 OF 5 SHEETS
1. PROJECT: Chicago Harbor Lock		10. SIZE AND TYPE OF BIT: 3-7/8" I.D. x 6-3/4" O.D. HSA	
2. LOCATION (Coordinates or Station): N0+60, W3+90		11. DATUM FOR ELEVATION SHOWN (TBM or MSL): Low Water Datum For Lake Michigan	
3. DRILLING AGENCY: Patrick Engineering Inc.		12. MANUFACTURER'S DESIGNATION OF DRILL: CME-55	
4. HOLE NO. (As shown on drawing title and file number): CLW-1-86		13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 41	UNDISTURBED 7
5. NAME OF DRILLER: Pat Bolger/Jerry Copak		14. TOTAL NUMBER CORE BOXES: N/A	
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.		15. ELEVATION GROUND WATER: See Remarks	
		16. DATE HOLE: STARTED 5/6/86	COMPLETED 5/9/86
7. THICKNESS OF OVERBURDEN		17. ELEVATION TOP OF HOLE: 8.3 LWD	
8. DEPTH DRILLED INTO ROCK		18. TOTAL CORE RECOVERY FOR BORING: %	
9. TOTAL DEPTH OF HOLE: 81.0'		19. SIGNATURE OF INSPECTOR	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	REC./RUN e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
-31.7	40.0		Dark gray silty clay, trace coarse to fine sand, trace coarse to fine gravel, very soft to soft, medium plasticity, saturated CL	18"/ 18"	SS-27 39.5- 41.5	0/0/4 q_u* = 0.2 tsf Spoon penetrated 12" under weight of rods.
				18"/ 18"	SS-28 41.5- 43.5	Pushed 3I-28, 24", no recovery; pushed SS-28, 18" q_u* = 0.4 tsf
				18"/ 18"	SS-29 43.5- 45.5 18"R	Pushed 3I-29, 24", no recovery. q_u* = 0.3 tsf
				17"/ 24"	3I-30 45.5- 47.5	Pushed 3I-30, 24" no recovery. Coat inside w/wax & sand. q_u* = 0.4 tsf
				9"/ 18"	SS-31 47.5- 49.0	3/4/6 q_u* = 0.3 tsf
				18"/ 18"	SS-32 49.0- 51.0	Pushed 3I-32, 24" w/wax & sand & dirt, no recovery. Tried again, turn, no recovery, Pushed SS-32, 18".
				0"/ 18"	SS-33 51.0- 53.0	Pushed 3I-33, 24" & waited 2 min. No recovery. Pushed SS-33, no recovery.
				24"/ 24"	3I-34 53.0- 55.0	q_u* = 0.5 tsf
-46.2	54.5		Very dark grayish-brown silty clay, little coarse to fine sand, trace coarse to fine gravel, hard, medium plasticity, moist CL			q_u* = 4.5+ tsf
				16"/ 18"	SS-35 55.0- 56.5 16"R	6/7/19 q_u* = 4.5+ tsf
				12"/ 12"	3I-36 56.5- 57.5	Pushed 3I-36, 12" to refusal. q_u* = 4.5+ tsf
-51.7	60.0			18"/ 18"	SS-37 58.5- 60.0	20/25/40 q_u* = 4.5+ tsf

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE
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PROJECT: Chicago Harbor Lock HOLE NO. CLW-1-86

Hole No. CLW-1-86

DRILLING LOG	DIVISION: North Central	INSTALLATION: Chicago District	SHEET 4 OF 5 SHEETS
1. PROJECT: Chicago Harbor Lock		10. SIZE AND TYPE OF BIT: 3-1/4" I.D. x 6-3/4" O.D. HSA	
2. LOCATION (Coordinates or Station): N0+60, W3+90		11. DATUM FOR ELEVATION SHOWN (TBM or MSL): Low Water Datum For Lake Michigan	
3. DRILLING AGENCY: Patrick Engineering Inc.		12. MANUFACTURER'S DESIGNATION OF DRILL: CME-55	
4. HOLE NO. (As shown on drawing title and file number): CLW-1-86		13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 41	UNDISTURBED -
5. NAME OF DRILLER: Pat Bolger/Jerry Copak		14. TOTAL NUMBER CORE BOXES: N/A	
6. DIRECTION OF HOLE: [X] VERTICAL [ ] INCLINED _____ DEG. FROM VERT.		15. ELEVATION GROUND WATER: See Remarks	
		16. DATE HOLE: STARTED 5/6/86	COMPLETED 5/9/86
7. THICKNESS OF OVERBURDEN		17. ELEVATION TOP OF HOLE: 8.3 LWD	
8. DEPTH DRILLED INTO ROCK		18. TOTAL CORE RECOVERY FOR BORING: %	
9. TOTAL DEPTH OF HOLE: 81.0'		19. SIGNATURE OF INSPECTOR	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	REC./RUN e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
-51.7	60.0		Very dark grayish-brown silty clay, trace coarse to fine sand, trace coarse to fine gravel, very stiff, medium plasticity, wet CL	0"/ 24"	3T-38 60.0-62.0	Pushed 3T-38, 24". Lost tube in hole; pulled loose, pounded tube out of auger & drilled 2.5' & sample w/spoon.
				18"/ 18"	SS-39 62.5-64.0	19/23/17 q_u* = 2.7 tsf
				18"/ 18"	SS-40 64.0-66.0 18"R	Pushed 3T-40, 21" to resistance, no recovery. Pushed a rock @ 64', pushed SS-40, 18" q_u* = 2.4 tsf
				3"/ 3"	SS-41 66.0-66.3	100/3" Pounded on coarse gravel or cobble @ 66.0'. q_u* = 1.3 tsf
				16"/ 16"	SS-42 67.5-68.8	27/83/37 SS-42 driven on cobble @ 67.5'; driven 16". q_u* = 1.2 tsf
				0"/ 18"	SS-43 69.0-70.5	32/70/55 SS-4 driven on rock @ 69', no recovery. Drilled out 24" to 71.0' to go past rock.
				14"/ 18"	SS-44 71.0-72.5 14"R	26/29/38 q_u* = 1.2 tsf
				18"/ 18"	SS-45 72.5-74.0	34/27/26 SS-45 driven on coarse gravel. Disturbed the sample, q_u may not be reliable due to excessive disturbance. q_u* = 2.7 tsf
				18"/ 18"	SS-46 74.0-75.5 18"R	20/39/21 q_u* = 3.8 tsf
				15"/ 16"	3T-47 75.5-77.3	Pushed 3T-47, 16" to refusal @ 76.0'. q_u* = 3.8 tsf
				18"/ 18"	SS-48 77.5-79.0	23/29/37 q_u* = 4.5+ tsf
-71.7	80.0			24"/ 24"	SS-49 79.0-81.0	Pushed 3T-48, 14" to refusal, no recovery. Pushed spoon 24".

Hole No. CLW-1-86

DRILLING LOG	DIVISION: North Central	INSTALLATION: Chicago District	SHEET 5 OF 5 SHEETS

1. PROJECT: Chicago Harbor Lock
2. LOCATION (Coordinates or Station): N0+60, W3+90
3. DRILLING AGENCY: Patrick Engineering Inc.
4. HOLE NO. (As shown on drawing title and file number): CLW-1-86
5. NAME OF DRILLER: Pat Bolger/Jerry Copak
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN:
8. DEPTH DRILLED INTO ROCK:
9. TOTAL DEPTH OF HOLE: 81.0'
10. SIZE AND TYPE OF BIT: 3-1/4" I.D. x 6-3/4" O.D. HSA
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): Low Water Datum For Lake Michigan
12. MANUFACTURER'S DESIGNATION OF DRILL: CME-55
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 41; UNDISTURBED 7
14. TOTAL NUMBER CORE BOXES: N/A
15. ELEVATION GROUND WATER: See Remarks
16. DATE HOLE: STARTED 5/6/86; COMPLETED 5/9/86
17. ELEVATION TOP OF HOLE: 8.3 LWD
18. TOTAL CORE RECOVERY FOR BORING: %
19. SIGNATURE OF INSPECTOR:

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	REC./RUN e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
-71.7	80.0		Very dark grayish-brown silty clay, trace coarse to fine sand, trace coarse to fine gravel, hard, medium plasticity, wet CL	24"/ 24"	SS-49 79.0- 81.0	Pushed 3I-49, 14" to refusal, no recovery. Pushed spoon 24".
-72.7	81.0		End of boring @ 81.0'.			

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE
MODIFIED BY PATRICK ENGINEERING 11/84

PROJECT: Chicago Harbor Lock | HOLE NO. CLW-1-86

Hole No. CLW-2-86

DRILLING LOG

DIVISION: North Central
INSTALLATION: Chicago District
SHEET 1 OF 5 SHEETS

1. PROJECT: Chicago Harbor Lock
2. LOCATION (Coordinates or Station): S0+60, W4+00
3. DRILLING AGENCY: Patrick Engineering Inc.
4. HOLE NO. (As shown on drawing title and file number): CLW-2-86
5. NAME OF DRILLER: Jerry Copak
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN
8. DEPTH DRILLED INTO ROCK
9. TOTAL DEPTH OF HOLE: 81.0'
10. SIZE AND TYPE OF BIT: 3 7/8" I.D. x 6 3/4" O.D. HSA
11. DATUM FOR ELEVATION SHOWN (USM or MSL): Low water datum for Lake Michigan
12. MANUFACTURER'S DESIGNATION OF DRILL: CME-55
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 36; UNDISTURBED 13
14. TOTAL NUMBER CORE BOXES
15. ELEVATION GROUND WATER
16. DATE HOLE: STARTED 6/20/86; COMPLETED 6/23/86
17. ELEVATION TOP OF HOLE: 7.5 LWD
18. TOTAL CORE RECOVERY FOR BORING: N/A %
19. SIGNATURE OF INSPECTOR

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	REC./RUN e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
7.5	0.0		Coarse to fine gravel, trace top-soil, trace coarse to fine sand, trace fibers, poorly graded, loose, dry GP		AU-1 0.0-2.0	
5.5	2.0		Brown silty organic clay, trace coarse to fine sand, trace coarse to fine gravel, trace fibers, very stiff, high plasticity, moist OH	14"/18"	SS-2 2.0-3.5	5/6/10 q_u* = 3.6 tsf
3.7	3.8		Coarse to fine gravel, little coarse to fine sand, poorly graded, medium dense to dense, dry GW	8"/18"	SS-3A,B 3.5-5.0	5/6/6 q_u* = 1.7 tsf
				6"/18"	SS-4 5.0-6.5	3/2/2
			Saturated @ 6.0'.			Water @ 6.0', lock full.
				5"/18"	SS-5 6.5-8.0	3/4/3
				6"/18"	SS-6 8.0-9.5	3/3/6
				8"/18"	SS-7 9.5-11.0	5/14/4 Pounded on cobble @ 10.0'.
				5"/18"	SS-8 11.0-12.5	6/23/17 Pounded on cobble @ 11.4' Diesel odor in sample.
				4"/18"	SS-9 12.5-14.0	14/20/13
				0"/18"	SS-10 14.0-15.5	11/18/7 Pounded on cobble @ 14.0'. No recovery.
			Some coarse to fine sand	8"/18"	SS-11 15.5-17.0	13/10/6
				6"/18"	SS-12 17.0-18.5	9/7/10
				1"/18"	SS-13 18.5-20.0	9/8/6

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE
MODIFIED BY PATRICK ENGINEERING 11/84

PROJECT: Chicago Harbor Lock
HOLE NO. CLW-2-86

Hole No. CLK-2-86

DRILLING LOG

DIVISION: North Central
INSTALLATION: Chicago District
SHEET 2 OF 5 SHEETS

1. PROJECT: Chicago Harbor Lock
2. LOCATION (Coordinates or Station): S0+60, W4+00
3. DRILLING AGENCY: Patrick Engineering Inc.
4. HOLE NO. (As shown on drawing title and file number): CLK-2-86
5. NAME OF DRILLER: Jerry Copak
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN
8. DEPTH DRILLED INTO ROCK
9. TOTAL DEPTH OF HOLE: 81.0'
10. SIZE AND TYPE OF BIT: 3 3/4" I.D. roller 3/4" O.D. HSA
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): Low water datum for Lake Michigan
12. MANUFACTURER'S DESIGNATION OF DRILL: CME-55
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 36; UNDISTURBED 13
14. TOTAL NUMBER CORE BOXES
15. ELEVATION GROUND WATER
16. DATE HOLE: STARTED 6/20/86; COMPLETED 6/23/86
17. ELEVATION TOP OF HOLE: 7.5 LWD
18. TOTAL CORE RECOVERY FOR BORING: N/A %
19. SIGNATURE OF INSPECTOR

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	REC./RUN e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
			Coarse to fine gravel, trace coarse to fine sand, poorly graded, medium dense, saturated GP	3"/18"	SS-14 20.0-21.5	10/10/11
				6"/18"	SS-15 21.5-23.0	28/8/13
				3"/18"	SS-16 23.0-24.5	9/21/7
				2"/18"	SS-17 24.5-26.0	59/29/8 Pounded on cobble @ 24.7', 100 blows/9"
				1"/18"	SS-18 26.0-27.5	24/21/15
			Little coarse to fine sand	8"/18"	SS-19 27.5-29.0	8/12/14
			Some coarse to fine sand	10"/18"	SS-20 29.0-30.5	14/17/13
				10"/18"	SS-21 30.5-32.0	33/7/10 Pounded on cobble @ 30.1".
-24.1	31.6		Coarse to fine clayey sand, little coarse to fine gravel, well graded, medium dense, saturated SC	2"/18"	SS-22 32.0-33.5	6/9/7
-25.4	32.9		Dark gray silty clay, trace coarse to fine sand, trace coarse to fine gravel, soft, medium plasticity, saturated CL	18"/18"	SS-23 33.5-35.0	5/4/7 q_u* = 0.7 tsf
				24"/24"	ST-24 35.0-37.0	Pushed ST-24, 24". q_u* = 0.7 tsf
				24"/24"	ST-25 37.0-39.0	q_u* = 0.8 tsf
				18"/18"	SS-26 39.0-40.5	7/8/6 q_u* = 0.1 tsf

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE
MODIFIED BY PATRICK ENGINEERING 11/84

PROJECT: Chicago Harbor Lock
HOLE NO. CLK-2-86

Hole No. CLW-2-86

DRILLING LOG

DIVISION: North Central
INSTALLATION: Chicago District
SHEET 2 OF 5 SHEETS

1. PROJECT: Chicago Harbor Lock
2. LOCATION (Coordinates or Station): S0+60, W4+00
3. DRILLING AGENCY: Patrick Engineering Inc.
4. HOLE NO. (As shown on drawing title and file number): CLW-2-86
5. NAME OF DRILLER: Jerry Copak
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN
8. DEPTH DRILLED INTO ROCK
9. TOTAL DEPTH OF HOLE: 81.0'
10. SIZE AND TYPE OF BIT: 3 7/8" I.D., 7 3/4" O.D. HSA
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): Low water datum for Lake Michigan
12. MANUFACTURER'S DESIGNATION OF DRILL: CME-55
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 36; UNDISTURBED 13
14. TOTAL NUMBER CORE BOXES
15. ELEVATION GROUND WATER
16. DATE HOLE: STARTED 6/20/86; COMPLETED 6/23/86
17. ELEVATION TOP OF HOLE: 7.5 LWD
18. TOTAL CORE RECOVERY FOR BORING: N/A %
19. SIGNATURE OF INSPECTOR

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	REC / RUN e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
-32.5	40.0		Gray silty clay, trace coarse to fine sand, trace coarse to fine gravel, soft, medium plasticity, wet CL	18"/ 18"	SS-26 39.0- 40.5	7/8/6 q_u* = 0.1 tsf 6/20/86 - 6/23/86.
				14"/ 24"	ST-27 40.5- 42.5	q_u* = 0.2 tsf
				18"/ 18"	SS-28 42.5- 44.0	3/2/3 q_u* = 0.3 tsf
				24"/ 24"	ST-29 44.0- 46.0	q_u* = 0.5 tsf.
			Medium stiff	24"/ 24"	ST-30 46.0- 48.0	q_u* = 0.5 tsf
				18"/ 18"	SS-31 48.0- 49.5	3/3/4 q_u* = 0.9 tsf
				18"/ 18"	SS-32 49.5- 51.5	Pushed ST-32, 24", no recovery, run in hole again, norecovery. Pushed w/SS-32 q_u* = 0.6 tsf
				24"/ 24"	ST-33 51.5- 53.5	q_u* = 0.8 tsf
				18"/ 18"	SS-34 53.5- 55.0	3/4/5 q_u* = 0.8 tsf
-47.5	55.0		Very dark gravish-brown silty clay, trace coarse to fine sand, trace coarse to fine gravel, hard, medium plasticity, moist CL	21"/ 24"	ST-35 55.0- 57.0	Pushed ST-35, 24". q_u* = 4.5+ tsf
			Very stiff	20"/ 24"	ST-36 57.0- 59.0	Pushed ST-36, 20". q_u* = 3.4 tsf
			Stiff	18"/ 18"	SS-37 59.0- 60.5	18/26/22 q_u* = 1.6 tsf

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE
MODIFIED BY PATRICK ENGINEERING 11/84

PROJECT: Chicago Harbor Lock
HOLE NO. CLW-2-86

Hole No. CLW-2-86

DRILLING LOG	DIVISION: North Central	INSTALLATION: Chicago District	SHEET: OF 5 SHEETS

1. PROJECT: Chicago Harbor Lock	10. SIZE AND TYPE OF BIT: 3 3/4" O.D. HSA
2. LOCATION (Coordinates or Station): S0+60, W4+00	11. DATUM FOR ELEVATION SHOWN (Feet or Meters): Low water datum for Lake Michigan
3. DRILLING AGENCY: Patrick Engineering Inc.	12. MANUFACTURER'S DESIGNATION OF DRILL: CME-55
4. HOLE NO. (As shown on drawing title and title number): CLW-2-86	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 36; UNDISTURBED 13
5. NAME OF DRILLER: Jerry Copak	14. TOTAL NUMBER CORE BOXES
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.	15. ELEVATION GROUND WATER
7. THICKNESS OF OVERBURDEN	16. DATE HOLE: STARTED 6/20/86; COMPLETED 6/23/86
8. DEPTH DRILLED INTO ROCK	17. ELEVATION TOP OF HOLE: 7.5 LWD
9. TOTAL DEPTH OF HOLE: 81.0'	18. TOTAL CORE RECOVERY FOR BORING: N/A %
	19. SIGNATURE OF INSPECTOR

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	REC./RUN e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
-52.5	60.0		Very dark grayish-brown silty clay, trace coarse to fine sand, trace coarse to fine gravel, very stiff to stiff, medium plasticity, moist CL	18"/ 18"	SS-37 59.0- 60.5	18/26/22 q_u* = 1.6 tsf
				22"/ 24"	3T-38 60.5- 62.5	Pushed 3T-38, 22" to refusal. q_u* = 2.2 tsf
			Very stiff	18"/ 18"	SS-39 62.5- 64.0	12/13/17 q_u* = 2.5 tsf
				24"/ 24"	3T-40 64.0- 66.0	Pushed 3T-40, 24". q_u* = 2.0 tsf
				18"/ 18"	SS-41 66.0- 67.5	9/11/15 q_u* = 2.2 tsf
-60.0	67.5		Very dark grayish-brown silty clay, trace coarse to fine sand, trace coarse to fine gravel, hard, medium plasticity, moist CL	8"/ 24"	3T-42 67.5- 69.5	Pushed 3T-42, 24". q_u* = 4.5+ tsf
				18"/ 18"	SS-43 69.5- 71.0	32/22/27 q_u* = 4.5+ tsf
				11"/ 24"	3T-44 71.0- 73.0	q_u* = 4.5+ tsf
				18"/ 18"	SS-45 73.0- 74.5	29/33/23 q_u* = 4.5+ tsf
				18"/ 24"	3T-46 74.5+ 76.5	Pushed 3T-46, 24" q_u = 4.5+ tsf
				18"/ 18"	SS-47 76.5- 78.0	34/29/41 q_u* = 4.5+ tsf
				18"/ 18"	SS-48 78.0- 79.5	36/37/38 q_u* = 4.5+ tsf
-72.5	80.0				SS-49	

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE
MODIFIED BY PATRICK ENGINEERING 11/84

PROJECT: Chicago Harbor Lock | HOLE NO: CLW-2-86

Hole No. CLW-2-86

DRILLING LOG

DIVISION: North Central
INSTALLATION: Chicago District
SHEET 5 OF 5 SHEETS

1. PROJECT: Chicago Harbor Lock
2. LOCATION (Coordinates or Station): S0+60, W4+00
3. DRILLING AGENCY: Patrick Engineering Inc.
4. HOLE NO. (As shown on drawing title and file number): CLW-2-86
5. NAME OF DRILLER: Jerry Copak
6. DIRECTION OF HOLE: [X] VERTICAL [ ] INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN
8. DEPTH DRILLED INTO ROCK
9. TOTAL DEPTH OF HOLE: 81.0'
10. SIZE AND TYPE OF BIT: 3 1/8" I.D. x 3/4" O.D. HSA
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): Low water datum for Lake Michigan
12. MANUFACTURER'S DESIGNATION OF DRILL: CME-55
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 36; UNDISTURBED 13
14. TOTAL NUMBER CORE BOXES
15. ELEVATION GROUND WATER
16. DATE HOLE: STARTED 6/20/86; COMPLETED 6/23/86
17. ELEVATION TOP OF HOLE: 7.5 LWD
18. TOTAL CORE RECOVERY FOR BORING: N/A %
19. SIGNATURE OF INSPECTOR

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	REC./RUN e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
			Very dark grayish-brown silty clay, trace coarse to fine sand, trace coarse to fine gravel, hard, medium plasticity, moist CL	18"/ 18"	SS-49 79.5-81.0	18/24/28 q_u* = 4.5+ tsf
-73.5	81.0		End of boring @ 81.0'.			

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE.
MODIFIED BY PATRICK ENGINEERING 11/84

PROJECT: Chicago Harbor Lock
HOLE NO.: CLW-2-86

Hole No. CLW-3-86

DRILLING LOG	DIVISION: North Central	INSTALLATION: Chicago District	SHEET 2 OF 4 SHEETS
1. PROJECT: Chicago Harbor Lock		10. SIZE AND TYPE OF BIT: 2 7/8" O.D. NSA	
2. LOCATION (Coordinates or Station): N0+95, W3+90		11. DATUM FOR ELEVATION SHOWN (TBM or MSL): Low Water Datum for Lake Michigan	
3. DRILLING AGENCY: Patrick Engineering Inc.		12. MANUFACTURER'S DESIGNATION OF DRILL: CME-55	
4. HOLE NO. (As shown on drawing title and file number): CLW-3-86		13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 13 / UNDISTURBED 11	
5. NAME OF DRILLER: Jerry Copak		14. TOTAL NUMBER CORE BOXES: N/A	
6. DIRECTION OF HOLE: [X] VERTICAL [ ] INCLINED ____ DEG. FROM VERT.		15. ELEVATION GROUND WATER: 4.6 LWD	
7. THICKNESS OF OVERBURDEN		16. DATE HOLE: STARTED 6/4/86 / COMPLETED 6/4/86	
8. DEPTH DRILLED INTO ROCK		17. ELEVATION TOP OF HOLE: 7.1 Barge Deck	
9. TOTAL DEPTH OF HOLE: 78.8'		18. TOTAL CORE RECOVERY FOR BORING: %	
		19. SIGNATURE OF INSPECTOR: [signature]	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	REC. / RUN e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
7.1	0.0		Deck elevation 2.3' above water level			
4.8	2.3		Top of water			

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE
MODIFIED BY PATRICK ENGINEERING 11/84

PROJECT: Chicago Harbor Lock | HOLE NO. CLW-3-86

Hole No. CLW-3-86

DRILLING LOG

DIVISION: North Central
INSTALLATION: Chicago District
SHEET 2 OF 4 SHEETS

1. PROJECT: Chicago Harbor Lock
2. LOCATION (Coordinates or Station): N0+95, W3+90
3. DRILLING AGENCY: Patrick Engineering Inc.
4. HOLE NO. (As shown on drawing title and file number): CLW-3-86
5. NAME OF DRILLER: Jerry Copak
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN
8. DEPTH DRILLED INTO ROCK
9. TOTAL DEPTH OF HOLE: 78.8'
10. SIZE AND TYPE OF BIT: 6 3/4" O.D. HSA
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): Low Water Datum for Lake Michigan
12. MANUFACTURER'S DESIGNATION OF DRILL: CME-55
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 13; UNDISTURBED 11
14. TOTAL NUMBER CORE BOXES: N/A
15. ELEVATION GROUND WATER: 4.6 LWD
16. DATE HOLE: STARTED 6/4/86; COMPLETED 6/4/86
17. ELEVATION TOP OF HOLE: 7.1 Barge Deck
18. TOTAL CORE RECOVERY FOR BORING: %
19. SIGNATURE OF INSPECTOR

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	REC./RUN e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
			Lake bottom @ 29.0'			
-21.9	29.0		Dark gray silty clay, trace coarse to fine sand, trace coarse to fine gravel, very soft, medium plasticity, saturated CL			Augers sank under own weight.
				15"/18"	SS-1 33.5-35.0	0/0/2 Spoon penetrated 6" under weight of rods, 9" with hammer. q_u* = 0.5 tsf
				16"/18"	SS-2 35.0-36.5	3T-2 penetrated 12" under weight of rods, pushed additional 12", no recovery. Tried again, no recovery. Pushed SS-2.
				24"/24"	3T-3 36.5-38.5	q_u* = 0.1 tsf
						Auger sank 6".
				18"/18"	SS-4 39.0-40.5	3T-4 penetrated 6" under weight of rods, pushed 18", no recovery. Pushed SS-4, 18". q_u* = 0.1 tsf

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE
MODIFIED BY PATRICK ENGINEERING 11/84

PROJECT: Chicago Harbor Lock
HOLE NO.: CLW-3-86

Hole No. CLW-3-86

DRILLING LOG	DIVISION	INSTALLATION	SHEET
	North Central	Chicago District	3 OF 4 SHEETS

1. PROJECT	Chicago Harbor Lock
2. LOCATION (Coordinates or Station)	N0+95, W3+90
3. DRILLING AGENCY	Patrick Engineering Inc.
4. HOLE NO. (As shown on drawing title and file number)	CLW-3-86
5. NAME OF DRILLER	Jerry Copak
6. DIRECTION OF HOLE	[X] VERTICAL [ ] INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN	
8. DEPTH DRILLED INTO ROCK	
9. TOTAL DEPTH OF HOLE	78.8'
10. SIZE AND TYPE OF BIT	3-1/4" I.D. x 6-1/4" O.D. HSA
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	Low Water Datum for Lake Michigan
12. MANUFACTURER'S DESIGNATION OF DRILL	CME-55
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN	DISTURBED 13 / UNDISTURBED 11
14. TOTAL NUMBER CORE BOXES	N/A
15. ELEVATION GROUND WATER	4.6 LWD
16. DATE HOLE	STARTED 6/4/86 / COMPLETED 6/4/86
17. ELEVATION TOP OF HOLE	7.1 Barge Deck
18. TOTAL CORE RECOVERY FOR BORING	%
19. SIGNATURE OF INSPECTOR	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	REC./RUN e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
-31.7	40.0		Dark gray silty clay, trace coarse to fine sand, trace coarse to fine gravel, very soft, medium plasticity, saturated CL			
				18"/18"	SS-5 41.0-42.5	Pushed 3T-5, 24", no recovery. Pushed SS-5 q_u* = 0.2 tsf
				24"/24"	SS-6 43.0-45.0	Pushed 3T-6, 24", no recovery. Pushed SS-6, 24". q_u* = 0.2 tsf
				7"/24"	SS-7 45.0-47.0	3T-7 penetrated 8" under weight of rods, pushed 16", no recovery. Pushed SS-7, 24". q_u* = 0.2 tsf
				4"/24"	SS-8 47.0-49.0	Pushed 3T-8, 24", nc recovery. Pushed SS-8, 24". q_u* = 0.2 tsf
				24"/24"	SS-9 49.0-51.0	Pushed 3T-9, 24", no recovery. Pushed SS-9, 24". q_u* = 0.3 tsf
-43.9	51.0		Very dark grayish brown, gray silty clay, some coarse to fine sand, trace coarse to fine gravel, hard, low plasticity, wet CL	22"/22"	3T-10 51.0-53.0	Pushed 3T-10, 22" to refusal. q_u* = 4.0 tsf
				12"/18"	3T-11 53.0-54.5	Pushed 3T-11, 18" to refusal q_u* = 4.5+ tsf
				14"/18"	SS-12 55.0-56.5	12/15/13 q_u* = 4.5+ tsf
				14"/17"	3T-13 56.5-58.0	Pushed 3T-13, 17" to refusal. q_u* = 3.0+ tsf
				14"/14"	3T-14 58.5-60.5	Pushed 3T-14, 14" to refusal. q_u* = 1.2 tsf

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE
MODIFIED BY PATRICK ENGINEERING 11/84

PROJECT: Chicago Harbor Lock | HOLE NO.: CLW-3-86

Hole No. CLW-3-86

DRILLING LOG

DIVISION: North Central
INSTALLATION: Chicago District
SHEET 4 OF 4 SHEETS

1. PROJECT: Chicago Harbor Lock
2. LOCATION (Coordinates or Station): N0+95, W3+90
3. DRILLING AGENCY: Patrick Engineering Inc.
4. HOLE NO. (As shown on drawing title and file number): CLW-3-86
5. NAME OF DRILLER: Jerry Copak
6. DIRECTION OF HOLE: [X] VERTICAL [ ] INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN
8. DEPTH DRILLED INTO ROCK
9. TOTAL DEPTH OF HOLE: 78.8'
10. SIZE AND TYPE OF BIT: 3 1/16" 7 D X 6 3/4" O.D. HSA
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): Low Water Datum for Lake Michigan
12. MANUFACTURER'S DESIGNATION OF DRILL: CME-55
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 13; UNDISTURBED 11
14. TOTAL NUMBER CORE BOXES: N/A
15. ELEVATION GROUND WATER: 4.6 LWD
16. DATE HOLE: STARTED 6/4/86; COMPLETED 6/4/86
17. ELEVATION TOP OF HOLE: 7.1 Barge Deck
18. TOTAL CORE RECOVERY FOR BORING: %
19. SIGNATURE OF INSPECTOR

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	REC./RUN e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
-51.7	60.0		Very dark grayish brown, gray silty clay, trace coarse to fine sand, trace coarse to fine gravel, very stiff, medium plas-ticity, wet CL	18"/ 18"	SS-15 60.5- 62.0	18/20/24 q_u* = 3.8 tsf
				20"/ 24"	3T-16 62.0- 64.0	Pushed 3T-16, 24", End of tube smashed. q_u* = 2.6 tsf
			Hard	24"/ 24"	3T-17 64.0- 66.0	Pushed 3T-17, 24" q_u* = 2.0 tsf 6" Slough.
				9"/ 18"	SS-18 66.0- 67.5	22/17/30 q_u* = 4.5+ tsf
				0"/ 18"	3T-19 67.5- 69.0	Pushed 3T-19, 6" to refusal @ 68', no recovery, Drove spoon 33/38/34
				17"/ 24"	3T-20 69.5- 71.5	q_u* = 4.5+ tsf
				15"/ 15"	3T-21 71.5- 72.8	Pushed 3T-21, 15" to refusal. q_u* = 4.5+ tsf
-65.2	73.5		Very dark grayish brown silty clay, trace coarse to fine sand, trace coarse to fine gravel, very stiff, medium plasticity, moist CL	18"/ 18"	SS-22 73.5- 75.0	13/20/34 q_u* = 3.2 tsf
				8"/ 8"	3T-23 75.0- 75.6	Pushed 3T-23, 8" to resistance @ 75.6'. q_u* = 4.5+ tsf
				18"/ 18"	SS-24 77.0- 78.5	17/21/26 q_u* = 4.5+ tsf
				0"/ 4"	3T-25 78.5- 78.8	Pushed 3T-25, 4" to refusal @ 78.8', tube smashed at bottom, no recovery.
-70.5	78.8		End of boring @ 78.8'.			

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE
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PROJECT: Chicago Harbor Lock
HOLE NO: CLW-3-86

Hole No. CLW-4-86

DRILLING LOG	DIVISION: North Central	INSTALLATION: Chicago District	SHEET 1 OF 4 SHEETS

1. PROJECT: Chicago Harbor Lock	10. SIZE AND TYPE OF BIT: 6-3/4" O.D. x 3-1/4" I.D. HSA
2. LOCATION (Coordinates or Station): 4+00W., 95'S. of Centerline	11. DATUM FOR ELEVATION SHOWN (TBM or MSL): Low Water Datum for Lake Michigan
3. DRILLING AGENCY: Patrick Engineering Inc.	12. MANUFACTURER'S DESIGNATION OF DRILL: CME-55
4. HOLE NO. (As shown on drawing title and file number): CLW-4-86	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 19; UNDISTURBED 10
5. NAME OF DRILLER: Pat Bolger	14. TOTAL NUMBER CORE BOXES
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.	15. ELEVATION GROUND WATER
7. THICKNESS OF OVERBURDEN	16. DATE HOLE: STARTED 7/14/86; COMPLETED 7/14/86
8. DEPTH DRILLED INTO ROCK	17. ELEVATION TOP OF HOLE: -20.7 LWD (Lake Bottom)
9. TOTAL DEPTH OF HOLE: 80.5'	18. TOTAL CORE RECOVERY FOR BORING: %
	19. SIGNATURE OF INSPECTOR

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	REC./RUN e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
8.3	0.0		Top of south wall			
			Lake surface			
4.8	3.5		Lake water to 25.5'			

ENG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE.
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PROJECT: Chicago Harbor Lock — HOLE NO.: CLW-4-86

Hole No. CLW-4-86

DRILLING LOG | DIVISION: North Central | INSTALLATION: Chicago District | SHEET 2 OF 4 SHEETS

1. PROJECT: Chicago Harbor Lock	10. SIZE AND TYPE OF BIT: 6-3/4" O.D. x 3-1/4" I.D. HSA
2. LOCATION (Coordinates or Station): 4+00W., 95'S. of Centerline	11. DATUM FOR ELEVATION SHOWN (TBM or MSL): Low Water Datum for Lake Michigan
3. DRILLING AGENCY: Patrick Engineering Inc.	12. MANUFACTURER'S DESIGNATION OF DRILL: CME-55
4. HOLE NO. (As shown on drawing title and file number): CLW-4-86	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 19, UNDISTURBED 10
5. NAME OF DRILLER: Pat Bolger	14. TOTAL NUMBER CORE BOXES
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER
7. THICKNESS OF OVERBURDEN	16. DATE HOLE: STARTED 7/14/86, COMPLETED 7/14/86
8. DEPTH DRILLED INTO ROCK	17. ELEVATION TOP OF HOLE: -20.7 LWD (Lake Bottom)
9. TOTAL DEPTH OF HOLE: 80.5'	18. TOTAL CORE RECOVERY FOR BORING: %
	19. SIGNATURE OF INSPECTOR

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	REC./RUN e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
-11.7	20.0		Lake water to 25.5'			
			Lake bottom			
-20.7	29.0		Blackish-gray organic sediment, trace coarse to fine sand, very soft	18"/18"	CS-1 29.0-30.5	Pushed C.S. 4.5' q_u* < 0.1 tsf
-21.7	30.0		Gray silty clay, trace coarse to fine sand, trace coarse to fine gravel, very soft, medium plasticity, wet CL	18"/18	CS-2 30.5-32.0	q_u* = 0.2 tsf
			Soft	18"/18"	CS-3 32.0-33.5	q_u* = 0.3 tsf
			Very Soft	18"/18"	CS-4 33.5-35.0	3T-4 pushed 24" and allowed to sit and swell. No recovery. Sampled with continuous sampler pushed 4.5'. Recovered 3.0'. q_u* = 0.2 tsf
				18"/18"	CS-5 35.0-36.5	q_u* = 0.2 tsf
				18"/18"	SS-6 36.5-38.0	SS-6 penetrated 18" under weight of hammer. q_u* = 0.2 tsf
			Soft	24"/24"	3T-7 38.0-40.0	q_u* = 0.3 tsf
-31.7	40.0					

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. MODIFIED BY PATRICK ENGINEERING 11/84

PROJECT: Chicago Harbor Lock | HOLE NO. CLW-4-86

Hole No. CLW-4-86

DRILLING LOG	DIVISION: North Central	INSTALLATION: Chicago District	SHEET 3 OF 4 SHEETS
1. PROJECT: Chicago Harbor Lock		10. SIZE AND TYPE OF BIT: 6-3/4" O.D. x 3-1/4" I.D. HSA	
2. LOCATION (Coordinates or Station): 4+00W., 95'S. of Centerline		11. DATUM FOR ELEVATION SHOWN (TBM or MSL): Low Water Datum for Lake Michigan	
3. DRILLING AGENCY: Patrick Engineering Inc.		12. MANUFACTURER'S DESIGNATION OF DRILL: CME-55	
4. HOLE NO. (As shown on drawing title and file number): CLW-4-86		13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 19	UNDISTURBED 10
5. NAME OF DRILLER: Pat Bolger		14. TOTAL NUMBER CORE BOXES	
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.		15. ELEVATION GROUND WATER	
		16. DATE HOLE: STARTED 7/14/86	COMPLETED 7/14/86
7. THICKNESS OF OVERBURDEN		17. ELEVATION TOP OF HOLE: -20.7 LWD (Lake Bottom)	
8. DEPTH DRILLED INTO ROCK		18. TOTAL CORE RECOVERY FOR BORING: %	
9. TOTAL DEPTH OF HOLE: 80.5'		19. SIGNATURE OF INSPECTOR	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	REC./RUN e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
-31.7	40.0		Gray silty clay, trace coarse to fine sand, trace coarse to fine gravel, medium stiff, medium plasticity, wet CL	24"/ 24"	ST-8 40.0- 42.0	q_u* = 0.5 tsf
			Soft	18"/ 18"	SS-9 42.0- 43.5	5/6/6 q_u* = 0.4 tsf
				24"/ 24"	ST-10 43.5- 45.5	q_u* = 0.3 tsf
			Medium stiff	18"/ 18"	SS-11 45.5- 47.0	3/4/3 q_u* = 0.6 tsf
				24"/ 24"	ST-12 47.0- 49.0	q_u* = 0.5 tsf
				18"/ 18"	SS-13 49.0- 50.5	4/7/7 q_u* = 0.8 tsf
			Stiff	24"/ 24"	ST-14 50.5- 52.5	q_u* = 1.0 tsf
			Medium stiff	3"/ 18"	SS-15 52.5- 54.0	3/5/8 q_u* = 0.5 tsf
				24"/ 24"	ST-16 54.0- 56.0	q_u* = 1.8 tsf
			Stiff			Formation stiffens up @ 55.5'.
-47.2	55.5		Very dark grayish brown silty clay, trace coarse to fine sand, trace coarse to fine gravel, very stiff, medium plasticity, moist, CL	18"/ 18"	SS-17 56.0- 57.5	11/14/21 q_u* = 1.7 tsf
				24"/ 24"	ST-18 57.5- 59.5	q_u* = 1.0 tsf
-51.7	60.0					

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE
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PROJECT: Chicago Harbor Lock HOLE NO. CLW-4-86

Hole No. CLW-4-86

DRILLING LOG	DIVISION: North Central	INSTALLATION: Chicago District	SHEET 4 OF 4 SHEETS
1. PROJECT: Chicago Harbor Lock		10. SIZE AND TYPE OF BIT: 4 3/4" O.D. x 3 1/4" I.D. HSA	
2. LOCATION (Coordinates or Station): 4+00W., 95'S. of Centerline		11. DATUM FOR ELEVATION SHOWN (TBM or MSL): Low Water Datum for Lake Michigan	
3. DRILLING AGENCY: Patrick Engineering Inc.		12. MANUFACTURER'S DESIGNATION OF DRILL: CME-55	
4. HOLE NO. (As shown on drawing title and file number): CLW-4-86		13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 19 / UNDISTURBED 10	
5. NAME OF DRILLER: Pat Bolger		14. TOTAL NUMBER CORE BOXES	
6. DIRECTION OF HOLE: ☐ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.		15. ELEVATION GROUND WATER	
		16. DATE HOLE: STARTED 7/14/86 / COMPLETED 7/14/86	
7. THICKNESS OF OVERBURDEN		17. ELEVATION TOP OF HOLE: -20.7 LWD (Lake Bottom)	
8. DEPTH DRILLED INTO ROCK		18. TOTAL CORE RECOVERY FOR BORING: %	
9. TOTAL DEPTH OF HOLE: 80.5'		19. SIGNATURE OF INSPECTOR	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	REC./RUN e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
-51.7	60.0		Very dark grayish brown silty clay, trace coarse to fine sand, trace coarse to fine gravel, stiff, medium plasticity, moist CL	18"/ 18"	SS-19 39.5-61.0	14/17/24 q_u* = 1.6 tsf
				18"/ 24"	3T-20 61.0-63.0	q_u* = 1.9 tsf
			Very Stiff	18"/ 18"	SS-21 63.0-64.5	14/19/27 q_u* = 2.0 tsf
				24"/ 24"	3T-22 64.5-66.5	q_u* = 2.4 tsf
				18"/ 18"	SS-23 66.5-68.0	14/21/26 q_u* = 2.0 tsf
				12"/ 12"	3T-24 68.0-69.0	3T-24 pushed 12" to refusal @ 69.0' q_u* = 4.5- tsf
-60.2	68.5		Very dark grayish brown silty clay, little coarse to fine sand, trace coarse to fine gravel, hard, low plasticity, moist CL	18"/ 18"	SS-25 69.0-70.5	14/19/22
				18"/ 18"	SS-26 71.5-73.0	18/29/38
				18"/ 18"	SS-27 74.0-75.5	23/19/29
			Trace coarse to fine sand	18"/ 18"	SS-28 76.5-78.0	21/45/46
			Little coarse to fine sand	18"/ 18"	SS-29 79.0-80.5	15/37/35
			End of boring @ 80.5'.			

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE
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PROJECT: Chicago Harbor Lock | HOLE NO. CLW-4-86

Hole No. CLWC-1-86

DRILLING LOG	DIVISION: North Central	INSTALLATION: Chicago District	SHEET 1 OF 1 SHEETS

1. PROJECT	Chicago Harbor Lock
2. LOCATION (Coordinates or Station)	6+45W, 40'N., 3.7' From Top of Wall
3. DRILLING AGENCY	Patrick Engineering Inc.
4. HOLE NO. (As shown on drawing title and file number)	CLWC-1-86
5. NAME OF DRILLER	Pat Bolger
6. DIRECTION OF HOLE	☐ VERTICAL ☒ INCLINED 90° DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN	-
8. DEPTH DRILLED INTO ROCK	-
9. TOTAL DEPTH OF HOLE	20.0"
10. SIZE AND TYPE OF BIT	4" Core Barrel
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	Low Water Datum For Lake Michigan
12. MANUFACTURER'S DESIGNATION OF DRILL	Milwaukee Dymoric
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN	DISTURBED: - UNDISTURBED: -
14. TOTAL NUMBER CORE BOXES	
15. ELEVATION GROUND WATER	
16. DATE HOLE	STARTED: 7/18/86 COMPLETED: 7/18/86
17. ELEVATION TOP OF HOLE	4.6 LWD
18. TOTAL CORE RECOVERY FOR BORING	100 %
19. SIGNATURE OF INSPECTOR	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	REC./RUN e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	0.0"			3.5"/ 3.5"	#1 0.0- 3.5	Scale: 1" = 4" Legend: F = Fracture M = Mechanical Break
	-3.5"	M		6.5"/ 6.5"	#2 3.5- 10.0	
	10.0"	M		10.0"/ 10.0"	#3 10.0- 20.0	
		M				
	20.0"		End of boring @ 20.0".			RQD = 100%

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE
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PROJECT: Chicago Harbor Lock HOLE NO.: CLWC-1-86

Hole No. CLWC-2-86

DRILLING LOG

DIVISION: North Central	INSTALLATION: Chicago District
	SHEET 1 OF 1 SHEETS
1. PROJECT: Chicago Harbor Lock	10. SIZE AND TYPE OF BIT: 4" Concrete Barrel
2. LOCATION (Coordinates or Station): 3+86.7W., 40'N., 4' From Top of Wall	11. DATUM FOR ELEVATION SHOWN (TBM or MSL): Low Water Datum For Lake Michigan
3. DRILLING AGENCY: Patrick Engineering Inc.	12. MANUFACTURER'S DESIGNATION OF DRILL: Milwaukee Dymorig
4. HOLE NO. (As shown on drawing title and file number): CLWC-2-86	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED / UNDISTURBED
5. NAME OF DRILLER: Pat Bolger	14. TOTAL NUMBER CORE BOXES
6. DIRECTION OF HOLE: ☐ VERTICAL ☒ INCLINED 90° DEG. FROM VERT.	15. ELEVATION GROUND WATER
7. THICKNESS OF OVERBURDEN	16. DATE HOLE: STARTED 7/17/86 COMPLETED 7/17/86
8. DEPTH DRILLED INTO ROCK	17. ELEVATION TOP OF HOLE 4.6 LWD
9. TOTAL DEPTH OF HOLE 25"	18. TOTAL CORE RECOVERY FOR BORING 100 %
	19. SIGNATURE OF INSPECTOR

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	REC./RUN e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	0.0"		Lock wall	6.0"/ 6.0"	#1 0.0- 6.0	Scale: 1" = 4" Legend: F = Fracture M = Mechanical Break
	2.0"	F				
	3.5"	F				
	4.0"	F	Rebar			
	6.0"	M		6.0"/ 6.0"	#2 6.0- 12.0	
	12.0"	M		7.0"/ 7.0"	#3 12.0- 19.0	
	19.0"	M		6.0"/ 6.0"	#4 19.0- 25.0	
	25.0"	M	End of boring @ 25.0".			RQD = 100%

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. MODIFIED BY PATRICK ENGINEERING 11/84

PROJECT: Chicago Harbor Lock HOLE NO. CLWC-2-86

Hole No. CLWC-3-86

DRILLING LOG	DIVISION: North Central	INSTALLATION: Chicago District	SHEET 1 OF 1 SHEETS
1. PROJECT: Chicago Harbor Lock		10. SIZE AND TYPE OF BIT: 4" Core Barrel	
2. LOCATION (Coordinates or Station): 1+20W., 40'N., 4' From Top of Wall		11. DATUM FOR ELEVATION SHOWN (TBM or MSL): Low Water Datum For Lake Michigan	
3. DRILLING AGENCY: Patrick Engineering Inc.		12. MANUFACTURER'S DESIGNATION OF DRILL: Milwaukee Dymorig	
4. HOLE NO. (As shown on drawing title and file number): CLWC-3-86		13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED	UNDISTURBED
5. NAME OF DRILLER: Pat Bolger		14. TOTAL NUMBER CORE BOXES	
6. DIRECTION OF HOLE: ☐ VERTICAL ☒ INCLINED 90° DEG. FROM VERT.		15. ELEVATION GROUND WATER	
		16. DATE HOLE: STARTED 7/17/86	COMPLETED 7/17/86
7. THICKNESS OF OVERBURDEN		17. ELEVATION TOP OF HOLE: 4.4 LWD	
8. DEPTH DRILLED INTO ROCK		18. TOTAL CORE RECOVERY FOR BORING: 100 %	
9. TOTAL DEPTH OF HOLE: 12.0"		19. SIGNATURE OF INSPECTOR	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	REC./RUN e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	0.0"		Lock wall	2"/ 2"	#1 0.0- 2.0	Scale: 1" = 4" Legend: F = Fracture M = Mechanical Break
	1.8"	F				
	2.0"	M	Rebar			
	2.7"	F		10"/ 10"/	#2 2.0- 12.0	
	3.2"	F				
		M				
	12.0"		Steel sheet pile @ 12.0" End of boring @ 12.0".			RQD = 100%

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE.
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PROJECT: Chicago Harbor Lock | HOLE NO.: CLWC-3-86

Hole No. CLWC-4-86

DRILLING LOG	DIVISION: North Central	INSTALLATION: Chicago District	SHEET 1 OF 1 SHEETS
1. PROJECT: Chicago Harbor Lock		10. SIZE AND TYPE OF BIT: 4" Core Barrel	
2. LOCATION (Coordinates or Station): 6+45W., 40'S., 4.5' From Top of Wall		11. DATUM FOR ELEVATION SHOWN (TBM or MSL): Low Water Datum For Lake Michigan	
3. DRILLING AGENCY: Patrick Engineering Inc.		12. MANUFACTURER'S DESIGNATION OF DRILL: Milwaukee Dymorig	
4. HOLE NO. (As shown on drawing title and file number): CLWC-4-86		13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED -	UNDISTURBED -
5. NAME OF DRILLER: Pat Bolger		14. TOTAL NUMBER CORE BOXES	
6. DIRECTION OF HOLE: ☐ VERTICAL ☒ INCLINED 90° DEG. FROM VERT.		15. ELEVATION GROUND WATER	
		16. DATE HOLE: STARTED 7/18/86	COMPLETED 7/18/86
7. THICKNESS OF OVERBURDEN		17. ELEVATION TOP OF HOLE: 3.8 LWD	
8. DEPTH DRILLED INTO ROCK		18. TOTAL CORE RECOVERY FOR BORING: 100 %	
9. TOTAL DEPTH OF HOLE: 23.0"		19. SIGNATURE OF INSPECTOR	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	REC./RUN e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	0.0"		Lock wall			Scale: 1" = 4"
	1.1"	F		6"/ 6"	#1 0.0- 6.0	Legend: F = Fracture M = Mechanical Break
	4.0"	F				
	6.0"	M		5.5"/ 5.5"	#2 6.0- 11.5	
	11.5"	M		11.5"/ 11.5"	#3 11.5- 23.0"	
	23.0"	M	End of coring @ 23.0".			RQD = 100%

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE
MODIFIED BY PATRICK ENGINEERING 11/84

PROJECT: Chicago Harbor Lock | HOLE NO.: CLWC-4-86

Hole No. CLWC-5-86

DRILLING LOG	DIVISION	INSTALLATION	SHEET
	North Central	Chicago District	1 OF 1 SHEETS

1. PROJECT	Chicago Harbor Lock
2. LOCATION (Coordinates or Station)	3+85W., 40'S., 5' From Top of Wall
3. DRILLING AGENCY	Patrick Engineering Inc.
4. HOLE NO. (As shown on drawing title and file number)	CLWC-5-86
5. NAME OF DRILLER	Pat Bolger
6. DIRECTION OF HOLE	☐ VERTICAL ☒ INCLINED 90° DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN	
8. DEPTH DRILLED INTO ROCK	
9. TOTAL DEPTH OF HOLE	16.0"
10. SIZE AND TYPE OF BIT	4" Core Barrel
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	Low Water Datum For Lake Michigan
12. MANUFACTURER'S DESIGNATION OF DRILL	Milwaukee Dymorig
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN	DISTURBED - / UNDISTURBED -
14. TOTAL NUMBER CORE BOXES	
15. ELEVATION GROUND WATER	
16. DATE HOLE	STARTED 7/18/86 / COMPLETED 7/18/86
17. ELEVATION TOP OF HOLE	3.3 LWD
18. TOTAL CORE RECOVERY FOR BORING	100 %
19. SIGNATURE OF INSPECTOR	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	REC / RUN e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	0.0"					Scale: 1" = 4"
	0.3"	F		11.0"/ 11.0"	#1 0.0-11.0	Legend: F = Fracture M = Mechanical Break
	11.0"	M		5"/ 5"	#2 11.0-16.0	
	16.0"	M	End of coring @ 16.0".			Drill would not advance past 16". RQD = 100%

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE
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PROJECT: Chicago Harbor Lock | HOLE NO: CLWC-5-86

Hole No. CLWC-6-86

DRILLING LOG	DIVISION: North Central	INSTALLATION: Chicago District	SHEET 1 OF 1 SHEETS
1. PROJECT: Chicago Harbor Lock		10. SIZE AND TYPE OF BIT: 4" Core Barrel	
2. LOCATION (Coordinates or Station): 1+20W., 40'S., 5' From Top of South Wall		11. DATUM FOR ELEVATION SHOWN (TBM or MSL): Low Water Datum For Lake Michigan	
3. DRILLING AGENCY: Patrick Engineering Inc.		12. MANUFACTURER'S DESIGNATION OF DRILL: Milwaukee Dymorig	
4. HOLE NO. (As shown on drawing title and file number): CLWC-6-86		13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED -	UNDISTURBED -
5. NAME OF DRILLER: Pat Bolger		14. TOTAL NUMBER CORE BOXES	
6. DIRECTION OF HOLE: ☐ VERTICAL ☒ INCLINED 90° DEG. FROM VERT.		15. ELEVATION GROUND WATER	
7. THICKNESS OF OVERBURDEN		16. DATE HOLE: STARTED 7/18/86	COMPLETED 7/21/86
8. DEPTH DRILLED INTO ROCK		17. ELEVATION TOP OF HOLE: 3.3 LWD	
9. TOTAL DEPTH OF HOLE: 18.0"		18. TOTAL CORE RECOVERY FOR BORING: 100 %	
		19. SIGNATURE OF INSPECTOR	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	REC./RUN e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	0.0"					Scale: 1" = 4"
	0.4"	F		4.5"/	#1	Legend:
	1.0"	F		4.5"	0.0-	F = Fracture
	2.0"	F			4.5	M = Mechanical Break
			Rebar			
	4.5"	M		3.0"/	#2	
				3.0"	4.5-	
					7.5	
	7.5"	M		3.0"/	#3	7-18-86 Stopped drilling
				3.0"	7.5-	@ 10:15 a.m. due to heavy
					10.5	boat traffic.
	10.5"	M		3.0"/	#4	
			Rebar	7.5"	10.5-	
					18.0	
			Rebar			
	18.0"		End of coring @ 18.0".			*Cored 22.5". Could not recover last 4.5". Horizontal rebar holding core in hole. RQD = 100%

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE.
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PROJECT: Chicago Harbor Lock | HOLE NO: CLWC-6-86

Hole No. CLWC-7-86

DRILLING LOG	DIVISION North Central	INSTALLATION Chicago District	SHEET 1 OF 1 SHEETS
1. PROJECT Chicago Harbor Lock		10. SIZE AND TYPE OF BIT 4" Core Barrel	
2. LOCATION (Coordinates or Station) 0.0' N, 0.0' E, 22' From Top of Wall		11. DATUM FOR ELEVATION SHOWN (TBM or MSL) Low Water Datum For Lake Michigan	
3. DRILLING AGENCY Patrick Engineering Inc.		12. MANUFACTURER'S DESIGNATION OF DRILL Milwaukee Dymorig	
4. HOLE NO. (As shown on drawing title and file number) CLWC-7-86		13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN	DISTURBED / UNDISTURBED
5. NAME OF DRILLER Pat Bolger		14. TOTAL NUMBER CORE BOXES	
6. DIRECTION OF HOLE ☐ VERTICAL ☒ INCLINED 90° DEG. FROM VERT.		15. ELEVATION GROUND WATER	
7. THICKNESS OF OVERBURDEN		16. DATE HOLE	STARTED 7/21/86 / COMPLETED 7/21/86
8. DEPTH DRILLED INTO ROCK 24.0"		17. ELEVATION TOP OF HOLE 6.5 LWD	
9. TOTAL DEPTH OF HOLE		18. TOTAL CORE RECOVERY FOR BORING 100 %	
		19. SIGNATURE OF INSPECTOR	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	REC./RUN e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	0'0"					Scale: 1" = 4"
	1.0"	F		4.5"/ 4.5"	#1 0.0-4.5	Legend: F = Fracture M = Mechanical Break
	3.0"	F				
	3.8"	F				
	4.5"	M	Rebar	9.5"/ 9.5"	#2 4.5-14.0	
	14.0"	M		10.0"/ 10.0"	#3 14.0-24.0	
	24.0"	M	End of coring @ 24.0".			RQD = 100%

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE
MODIFIED BY PATRICK ENGINEERING 11/84

PROJECT Chicago Harbor Lock HOLE NO. CLWC-7-86

Hole No. CLWC-8-86

DRILLING LOG	DIVISION: North Central	INSTALLATION: Chicago District	SHEET 1 OF 1 SHEETS
1. PROJECT: Chicago Harbor Lock		10. SIZE AND TYPE OF BIT: 4" Core Barrel	
2. LOCATION (Coordinates or Station): 3+52W., 78'N.		11. DATUM FOR ELEVATION SHOWN (TBM or MSL): Low Water Datum For Lake Michigan	
3. DRILLING AGENCY: Patrick Engineering Inc.		12. MANUFACTURER'S DESIGNATION OF DRILL: Milwaukee Dymorig	
4. HOLE NO. (As shown on drawing title and file number): CLWC-8-86		13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED -	UNDISTURBED -
5. NAME OF DRILLER: Pat Bolger		14. TOTAL NUMBER CORE BOXES	
6. DIRECTION OF HOLE: [X] VERTICAL [ ] INCLINED ____ DEG. FROM VERT.		15. ELEVATION GROUND WATER	
7. THICKNESS OF OVERBURDEN		16. DATE HOLE: STARTED 7/17/86	COMPLETED 7/17/86
8. DEPTH DRILLED INTO ROCK		17. ELEVATION TOP OF HOLE: 8.3 LWD	
9. TOTAL DEPTH OF HOLE: 11.25"		18. TOTAL CORE RECOVERY FOR BORING: 100 %	
		19. SIGNATURE OF INSPECTOR	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	REC./RUN e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	0.0"		Top of north wall	11.25"/ 11.25"	#1 0.0- 11.25	Scale: 1" = 4" Legend: F = Fracture M = Mechanical Break
	2.8"	F				
		M	At 11.25", encountered conduit			
	11.25"		End of coring @ 11.25".			RQD = 100%

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE
MODIFIED BY PATRICK ENGINEERING 11/84

PROJECT: Chicago Harbor Lock | HOLE NO. CLWC-8-86

Hole No. CLWC-9-86

DRILLING LOG	DIVISION: North Central	INSTALLATION: Chicago District	SHEET 1 OF 1 SHEETS

1. PROJECT	Chicago Harbor Lock
2. LOCATION (Coordinates or Station)	4+47W., 80'N., 26" From Top of Wall
3. DRILLING AGENCY	Patrick Engineering Inc.
4. HOLE NO (As shown on drawing title and file number)	CLWC-9-86
5. NAME OF DRILLER	Pat Bolger
6. DIRECTION OF HOLE	☐ VERTICAL ☒ INCLINED 90° DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN	
8. DEPTH DRILLED INTO ROCK	
9. TOTAL DEPTH OF HOLE	27.5"
10. SIZE AND TYPE OF BIT	4" Core Barrel
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	Low Water Datum For Lake Michigan
12. MANUFACTURER'S DESIGNATION OF DRILL	Milwaukee Dymorig
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN	DISTURBED: UNDISTURBED:
14. TOTAL NUMBER CORE BOXES	
15. ELEVATION GROUND WATER	
16. DATE HOLE	STARTED: 7/21/86 COMPLETED: 7/21/86
17. ELEVATION TOP OF HOLE	6.1 LWD
18. TOTAL CORE RECOVERY FOR BORING	96 %
19. SIGNATURE OF INSPECTOR	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	REC./RUN e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	0.0"		#1 completely fragmented	5.0"/ 6.0"	#1 0.0- 6.0	Scale: 1" = 4" Legend: F = Fracture M = Mechanical Break
	6.0"	F	Rebar in 3 orientations, loose sand	4.0"/ 4.0"	#2 6.0- 10.0	
	7.0"	F				
	10.0"	M		10.0"/ 10.0"	#3 10.0- 20.0	
	20.0"	M		7.5"/ 7.5"	#4 20.0- 27.5	
		M				
	27.5"		End of coring @ 27.5".			RQD = 78%

Hole No. CLWC-10-86

DRILLING LOG	DIVISION: North Central	INSTALLATION: Chicago District	SHEET 1 OF 1 SHEETS
1. PROJECT: Chicago Harbor Lock		10. SIZE AND TYPE OF BIT: 4" Core Barrel	
2. LOCATION (Coordinates or Station): 5+68W., 78.5'N.		11. DATUM FOR ELEVATION SHOWN (TBM or MSL): Low Water Datum For Lake Michigan	
3. DRILLING AGENCY: Patrick Engineering Inc.		12. MANUFACTURER'S DESIGNATION OF DRILL: Milwaukee Dymorig	
4. HOLE NO. (As shown on drawing title and file number): CLWC-10-86		13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED — UNDISTURBED —	
5. NAME OF DRILLER: Pat Bolger		14. TOTAL NUMBER CORE BOXES	
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.		15. ELEVATION GROUND WATER	
7. THICKNESS OF OVERBURDEN		16. DATE HOLE: STARTED 7/21/86 COMPLETED 7/21/86	
8. DEPTH DRILLED INTO ROCK		17. ELEVATION TOP OF HOLE: 8.3 LWD	
9. TOTAL DEPTH OF HOLE: 24.5"		18. TOTAL CORE RECOVERY FOR BORING: 100 %	
		19. SIGNATURE OF INSPECTOR	

ELEVATION (a)	DEPTH (b)	LEGEND (c)	CLASSIFICATION OF MATERIALS (Description) (d)	REC./RUN (e)	BOX OR SAMPLE NO. (f)	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) (g)
	0.0"			2.0"/ 2.0"	#1 0.0-2.0	Scale: 1" = 4" Legend: F = Fracture M = Mechanical Break
	2.0"	F	Loose coarse gravel	3.0"/ 3.0"	#2 2.0-5.0	
	4.0"	F	Loose coarse to fine gravel			
	5.0"	F	Loose coarse to fine gravel	3.5"/ 3.5"	#3 5.0-8.5	
	6.0"		Rebar			
	8.5"	M		11.0"/ 11.0"	#4 8.5-19.5	
	19.5"	M		5.0"/ 5.0"	#5 19.5-24.5	
	24.5"	M	End of coring @ 24.5".			RQD = 80%

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. MODIFIED BY PATRICK ENGINEERING 11/84

PROJECT: Chicago Harbor Lock HOLE NO. CLWC-10-86

ENCLOSURE C

BORING LOGS NEAR STICKNEY, IL, LOCATION

Stickney, IL

GLMRIS

Legend

Boring Locations

Date: 9/30/2013

1 IN = 3,806 FT

Path: J:\LRC_Projects\PRJ_GLMRIS\MXD\Borings\Stickney.mxd

BORING LOG

CLIENT **Metro. Water Reclam. Dist. of Greater Chicago**

PROJECT **McCook Reservoir Overburden Investigation-Contract 73-161-CH**

ARCHITECT/ ENGINEER

LOCATION **LASMA Property, Cook County, IL**

BORING NUMBER **B-01**

APPROX. SURFACE ELEVATION (C.C.D.) **+ 17.23 ±**

NORTH **1864198.45** EAST **637505.61**

DEPTH ELEVATION	SAMPLE NO.	SAMPLER TYPE	SAMPLE REC. (%)	SOIL GRAPHIC LOG	DESCRIPTION OF MATERIALS (LABORATORY CLASSIFICATION)	UNIT DRY WT. LBS./FT.3	Unconfined Compressive Strength, Tons/Ft.2 / PL MC LL / STD "N" PENETRATION BLOWS PER FT.	REMARKS
		HS			FILL: SILTY CLAY, Brown and Gray, Trace Dark Gray, Trace Fine to Coarse Sand and Gravel, Very Stiff to Hard, Moist (CL)			
2.5	1	S3	17					
	2	S3	46					
5.0	3	S3	50		FILL: SILTY CLAY, Brown, Gray and Black, Little Organics, Trace Fine to Coarse Sand, Little Fine to Coarse Gravel, Hard, Wet (CL)			
7.5	4	S3	42		FILL: SILTY CLAY, Black and Dark Gray, Trace Brown, Trace Fine to Coarse Sand and Gravel, Some Organics, Stiff to Very Stiff, Moist (CL-OL)			OC=4.4%
10.0	5	S3	54		SILTY CLAY, Black, Dark Gray, Trace Brown, Some Organics, Trace Fine to Coarse Sand, Trace Roots, Very Stiff, Moist (Transitional Material) (CL-OL)			OC=3.2%
					Trace Shell @ 10'			
12.5	6	S3	54		SILTY CLAY, Brown and Gray, Trace Dark Gray, Trace Fine to Coarse Sand and Gravel, Trace Organics, Stiff, Moist (CL)			
	7	S3	58		ORGANIC SILT, Dark Brown and Gray, Some Shells, Loose, Wet (OL)		75	OC=10.3%
15.0								WD
	8	S3	54		WELL GRADED SAND AND GRAVEL WITH COBBLES, Gray, Dense to Extremely Dense, Saturated (GW-SW)		70	
17.5	9	S3	42				165	
20.0	10	S3	25				294	
		HS						
	11	S3	54		SANDY SILTY CLAY, Gray, Trace to Little Fine to Coarse Gravel and Cobbles, Hard to Very Stiff, Moist (CL)	123.0	125	CA
22.5		HS						
	12	S3	63			116.5	141	CA

Calibrated Penetrometer Unconfined Compression

Water Level Observations	SEECO Consultants, Inc.	Boring Started	3/26/01
15' WD	7350 Duvan Drive, Tinley Park, IL 60477	Boring Completed	3/27/01
		Driller **Fox - PE**	Rig **D-120**
	Approved By **CWG** Job No. **6594G**	Drawn By **JB**	Sheet **1 of 3**

BORING LOG

CLIENT **Metro. Water Reclam. Dist. of Greater Chicago**

PROJECT **McCook Reservoir Overburden Investigation-Contract 73-161-CH**

ARCHITECT-ENGINEER

LOCATION **LASMA Property, Cook County, IL**

BORING NUMBER **B-01**

SURFACE ELEVATION (C.C.D.) **+17.23**

NORTH **1864198.45** EAST **637505.61**

DESCRIPTION OF MATERIALS (LABORATORY CLASSIFICATION)

Unconfined Compressive Strength, Tons/Ft.^{2} (1 2 3 4 5)

PL. MC LL

STD "N" PENETRATION BLOWS PER FT. (10 20 30 40 50)

DEPTH ELEVATION	SAMPLE NO.	SAMPLER TYPE	SAMPLE REC. (%)	SOIL GRAPHIC LOG	DESCRIPTION OF MATERIALS (LABORATORY CLASSIFICATION)	UNIT DRY WT. LBS./FT.^{3}	REMARKS
	13	HS S3	21				179
27.5	14	HS S3	21		SANDY SILT WITH GRAVEL AND COBBLES, Gray, Extremely Dense, Saturated (GM-ML)		172
30.0	15	S3	29		SILTY SAND AND GRAVEL AND COBBLES, Little Brown, Trace Gray, Extremely Dense, Saturated (GM-SM)		183
	16	S2	21		SANDY SILT WITH GRAVEL AND COBBLES, Gray, Extremely Dense, Dry to Moist (GM-ML)		200 N=200/5"
32.5	17	S3	25				200 N=200/4"
	18	S3	12				100 N=100/3"
	19	HS S3	12				100 N=100/4"
35.0	20	S3	54				165
37.5	21	S3	29				374 N=374/11"
	22	HS S3	17				100 N=100/5"
40.0	23	S3	12				150 N=150/4"
	24	S3	21				100 N=100/5"
42.5	25	S3	21				100 N=100/4"
	26	S3	17				200 MP N=200/2"
	27	HS S3	12				200 N=200/3"
45.0	28	HS S3	17				100 N=100/1"
	29	HS S3	12				100 N=100/2"
47.5	30	HS S3	12				200 N=200/3"
	31	HS S3	8				150 N=150/2"
	32	HS S3	12				200 N=200/3"
50.0	33	HS S3	12				150 N=150/2"
		HS					

Calibrated Penetrometer Unconfined Compression

SEECO Consultants Inc. Job No. **6594G** Sheet **2 of 3**

BORING LOG

CLIENT: **Metro. Water Reclam. Dist. of Greater Chicago**

PROJECT: **McCook Reservoir Overburden Investigation-Contract 73-161-CH**

ARCHITECT-ENGINEER:

LOCATION: **LASMA Property, Cook County, IL**

BORING NUMBER: **B-01**

SURFACE ELEVATION (C.C.D.): **+17.23**

NORTH: **1864198.45** EAST: **637505.61**

DEPTH ELEVATION	SAMPLE NO.	SAMPLER TYPE	SAMPLE REC. (%)	SOIL GRAPHIC LOG	DESCRIPTION OF MATERIALS (LABORATORY CLASSIFICATION)	UNIT DRY WT. LBS./FT.^{3}	Unconfined Compressive Strength, Tons/Ft.^{2} / PL MC LL / STD "N" PENETRATION BLOWS PER FT.	REMARKS
	34	S3	17		SILTY CLAY WITH GRAVEL, Gray, Trace Fine to Coarse Sand, Hard, Moist			200 N=200/4"
		HS						
52.5	35	S3	17		(CL)			200 N=200/3"
		HS						
	36	S3	17		SANDY SILT WITH GRAVEL, Gray, Trace Clay, Extremely Dense, Moist			200 N=200/3"
		HS			(GM-ML)			
	37	S3	21		SILTY GRAVEL, Gray, Little Fine to Coarse Sand, Extremely Dense, Dry			200 N=200/3"
55.0		HS						
	38	S3	12		(GM)			200 N=200/3"
		S3	0					100 N=100/0"
		S3	0					100 N=100/0"
		S3	0					100 N=100/0"
57.5					DOLOMITE BEDROCK, Light Gray, Hard, Slightly Weathered to Unweathered, Medium Bedded, Highly Fractured, Trace Stylolites and Shale, Trace Clay Filled Bedding Plane Joints, Trace vugs			
60.0					(Racine Formation)			
	R1	NX	100					RQD=90%
62.5								
65.0								
67.5					End of Boring @ 67.00 Feet			
					The borehole was drilled with a 4.25" I.D. X 8.25" O.D. hollow stem auger (HSA) with a pilot bit assembly plug using continuous split spoon sampling. The HSA with pilot bit assembly plug was used to advance the borehole at depths where split spoon refusal was encountered.			
70.0								
					Coring was performed from a depth of 57'-67" using a 2 1/8" diameter (NX size) diamond bit (DB) with a core barrel			
72.5								
75.0								
77.5								

⊗ Calibrated Penetrometer Unconfined Compression

SEECO Consultants Inc. | Job No. **6594G** | Sheet **3 of 3**

BORING LOG

CLIENT: **Metro. Water Reclam. Dist. of Greater Chicago**

PROJECT: **McCook Reservoir Overburden Investigation-Contract 73-161-CH**

ARCHITECT/ ENGINEER:

LOCATION: **LASMA Property, Cook County, IL**

BORING NUMBER: **B-02**

APPROX. SURFACE ELEVATION (C.C.D.): **+ 12.56 ±**

NORTH: **1864035.40** EAST: **637761.08**

DEPTH ELEVATION	SAMPLE NO.	SAMPLER TYPE	SAMPLE REC. (%)	SOIL GRAPHIC LOG	DESCRIPTION OF MATERIALS (LABORATORY CLASSIFICATION)	UNIT DRY WT. LBS./FT.^{3}	Unconfined Compressive Strength, Tons/Ft.^{2} / STD "N" PENETRATION BLOWS PER FT.	REMARKS
		HS			FILL: SILTY CLAY, Brown and Dark Brown to Brown and Gray, Trace Brick Pieces, Trace Sand, Trace to Little Fine to Coarse Gravel, Medium to Stiff, Moist (CL)			
2.5	1	S3	46					
	2	S3	50					
5.0	3	S3	71		SILTY CLAY, Gray, Trace Sand and Fine to Coarse Gravel, With Black Organics, Hard, Moist (CL)			
7.5	4	S3	88		SILTY CLAY, Brown and Gray, Trace Sand and Fine to Coarse Gravel, Hard, Moist (CL)	106.0		CA
10.0	5	S3	92		SILTY CLAY, Gray, Trace Brown, Trace Sand and Fine to Coarse Gravel, Hard, Moist (CL)	102.2		
	6A	S3						CA
12.5	6B	S3	75		SILT, Gray, Trace Fine to Coarse Sand, Little Clay, Very Dense to Dense, Moist (ML)		91	CA
	7	S3	58					CA
15.0	8	S3	50		SILTY SAND WITH GRAVEL, Gray, Dense, Saturated (SM-GM)			WS
17.5	9	S3	75				77	
20.0	10	S3	50		SANDY SILTY CLAY TO SANDY CLAYEY SILT, Gray, Little Fine to Coarse Gravel, Very Stiff to Hard, Moist (CL-ML)		125	CA
	11	S3	100		SILT, Gray, Trace Fine to Coarse Sand, Little Clay, Little Gravel and Cobbles, Very to Extremely Dense, Moist (ML)		85	CA
22.5	12	S3	8				100	N=100/2"
		HS						
	13	S3	12				200	N=200/5"

Calibrated Penetrometer Unconfined Compression

Water Level Observations		SEECO Consultants, Inc.		Boring Started	3/14/01	
				Boring Completed	3/20/01	
15' WD		7350 Duvan Drive, Tinley Park, IL 60477		Driller Fox - PE	Rig	D-120
		Approved By CWG	Job No. 6594G	Drawn By JB	Sheet	1 of 3

BORING LOG

CLIENT: **Metro. Water Reclam. Dist. of Greater Chicago**

PROJECT: **McCook Reservoir Overburden Investigation-Contract 73-161-CH**

ARCHITECT-ENGINEER:

LOCATION: **LASMA Property, Cook County, IL**

BORING NUMBER: **B-02**

SURFACE ELEVATION (C.C.D.): **+12.56**

NORTH: **1864035.40** EAST: **637761.08**

DEPTH ELEVATION	SAMPLE NO.	SAMPLER TYPE	SAMPLE REC. (%)	DESCRIPTION OF MATERIALS (LABORATORY CLASSIFICATION)	UNIT DRY WT. LBS./FT.^{3}	Unconfined Compressive Strength, Tons/Ft.^{2} / STD "N" PENETRATION BLOWS PER FT.	REMARKS
	14	HS	8				250 N=250/4"
		S3		DOLOMITE BOULDER			
		HS					
27.5				DOLOMITE COBBLES AND BOULDERS AND GRAVEL WITH SILT AND SAND , Gray, Extremely Dense, Dry			
	R1	NX	50				RQD=14%
30.0							
		HS					
	15	S3	4				100 N=100/1"
32.5		HS					
		S3	0				100 N=100/0"
		HS					
		S3	0				100 N=100/0"
		HS					
35.0		S3	0	Block Out @ 31.5' and 46.5'			100 N=100/0"
		HS					
	16	S3	17				200 N=200/5"
		HS					
		S3	0				100 N=100/0"
37.5		HS		SILTY SAND AND GRAVEL AND COBBLES, Gray, Trace Boulders, Extremely Dense, Dry (SM-GM))			
	17	S3	17				200 N=200/6"
				DOLOMITE COBBLES AND GRAVEL WITH SILT, Little Sand and Boulders			
40.0							
42.5	R2	NX	19				RQD=0%
45.0							
		S3	0				100 N=100/0"
		S3	0				200 N=200/1"
47.5		S3	0				100 N=100/0"
		S3	0				100 N=200/0"
50.0							
	R3	NX	69				

PL ▲ MC × LL ▲

10 20 30 40 50

Calibrated Penetrometer Unconfined Compression

SEECO Consultants Inc. Job No. **6594G** Sheet **2 of 3**

BORING LOG

CLIENT **Metro. Water Reclam. Dist. of Greater Chicago**

PROJECT **McCook Reservoir Overburden Investigation-Contract 73-161-CH**

ARCHITECT-ENGINEER

LOCATION **LASMA Property, Cook County, IL**

BORING NUMBER **B-02**

SURFACE ELEVATION (C.C.D.) **+12.56**

NORTH **1864035.40** EAST **637761.08**

DEPTH ELEVATION	SAMPLE NO.	SAMPLER TYPE	SAMPLE REC. (%)	SOIL GRAPHIC LOG	DESCRIPTION OF MATERIALS (LABORATORY CLASSIFICATION)	UNIT DRY WT. LBS./FT.^{3}	Unconfined Compressive Strength, Tons/Ft.^{2} / PL MC LL / STD "N" PENETRATION BLOWS PER FT.	REMARKS
52.5					DOLOMITE BEDROCK, Light Gray, Hard, Slightly Weathered, Medium Bedded, Highly Fractured, Trace Stylolites and Shale, Trace Clay Between Bedding Plane Joints			RQD=52%
					(Racine Formation)			
					End of Boring @ 54.00 Feet			
55.0					The borehole was drilled with a 4.25" I.D. X 8.25" O.D. hollow stem auger (HSA) with a pilot bit assembly plug using continuous split spoon sampling. The HSA with pilot bit assembly plug was used to advance the borehole at depths where split spoon refusal was encountered.			
57.5								
					Coring was performed from depths of 26.5'-31.5, 38.5'-46.5' and 48'-54' using a 2 1/8" diameter (NX size) diamond bit (DB) with a core barrel.			
60.0								
62.5								
65.0								
67.5								
70.0								
72.5								
75.0								
77.5								

Unconfined Compressive Strength, Tons/Ft.^{2}: 1 2 3 4 5

PL MC LL

STD "N" PENETRATION BLOWS PER FT.: 10 20 30 40 50

Calibrated Penetrometer Unconfined Compression

SEECO Consultants Inc. Job No. **6594G** Sheet **3 of 3**

BORING LOG

CLIENT **Metro. Water Reclam. Dist. of Greater Chicago**

PROJECT **Overburden Study (73-161-CH)**

ARCHITECT/ ENGINEER

LOCATION **Brisch Brick Site, Village of Stickney, IL**

BORING NUMBER **B-1A**

APPROX. SURFACE ELEVATION (C.C.D.) **+ 13.98 ±**

NORTH **1874921.79** EAST **651161.18**

DEPTH ELEVATION	SAMPLE NO.	SAMPLER TYPE	SAMPLE REC. (%)	SOIL GRAPHIC LOG	DESCRIPTION OF MATERIALS (LABORATORY CLASSIFICATION)	UNIT DRY WT. LBS./FT.3	Unconfined Compressive Strength, Tons/Ft.2 / PL MC LL / STD "N" PENETRATION BLOWS PER FT.	REMARKS
		HS			FILL: SANDY CLAYEY SILT AND GRAVEL, Brown, Trace Dark Gray, Trace Brick and Glass, Medium Dense, Dry (GM-ML)			
2.5	1	S2	29					
		HS						
5.0	2	AS	8		FILL: SILTY CLAY AND GRAVEL, Dark Gray, Trace Black, Trace Bricks, Fabric and Glass Pieces, Little Sand, Trace Organics, Stiff to Very Stiff, Slight Organic Odor, Moist (GC-CL)			N=50/2"
		HS						
7.5	3	S2	50					
		HS			FILL: RED AND TAN BRICKS WITH BROWN TRACE BLACK SILTY SAND, Trace Rubber, Medium Dense to Loose to Medium Dense, Slight Petroleum Odor, Saturated			
10.0	4	S2	46					WD
12.5		HS						
	5	S2	67					
15.0								
		HS						
17.5								
	6	S2	46					
20.0								
		HS						
22.5								
	7A	S2						
	7B	S2	100		FILL: SILTY CLAY TO ORGANIC CLAY, Dark			

Calibrated Penetrometer Unconfined Compression

Water Level Observations		SEECO Consultants, Inc.		Boring Started	6/28/01	
				Boring Completed	6/28/01	
11' WD		7350 Duvan Drive, Tinley Park, IL 60477		Driller D&G--MH	Rig	B-61
		Approved By CWG	Job No. 6594G-BB	Drawn By GG	Sheet	1 of 2

BORING LOG

CLIENT **Metro. Water Reclam. Dist. of Greater Chicago**

PROJECT **Overburden Study (73-161-CH)**

ARCHITECT-ENGINEER

LOCATION **Brisch Brick Site, Village of Stickney, IL**

BORING NUMBER **B-1A**

SURFACE ELEVATION (C.C.D.) **+13.98**

NORTH **1874921.79** EAST **651161.18**

DEPTH ELEVATION	SAMPLE NO.	SAMPLER TYPE	SAMPLE REC. (%)	SOIL GRAPHIC LOG	DESCRIPTION OF MATERIALS (LABORATORY CLASSIFICATION)	UNIT DRY WT. LBS./FT.^{3}	Unconfined Compressive Strength, Tons/Ft.^{2} (1 2 3 4 5); PL MC LL; STD "N" PENETRATION BLOWS PER FT. (10 20 30 40 50)	REMARKS
					Gray and Black, Trace Sand, Little Gravel, Trace Wood and Bricks, Soft to Medium, Moist (CL-OL)			
					End of Boring at 26.00 Feet			
27.5					Total auger refusal encountered at approximately 26 feet below the existing ground level due to possible brick obstructions (Field Geologist's Observation).			
30.0								
32.5								
35.0								
37.5								
40.0								
42.5								
45.0								
47.5								
50.0								

⊠ Calibrated Penetrometer Unconfined Compression

SEECO Consultants Inc. Job No. **6594G-BB** Sheet **2 of 2**

BORING LOG

CLIENT **Metro. Water Reclam. Dist. of Greater Chicago**

PROJECT **Overburden Study (73-161-CH)**

ARCHITECT/ ENGINEER

LOCATION **Brisch Brick Site, Village of Stickney, IL**

BORING NUMBER **B-1B**

APPROX. SURFACE ELEVATION (C.C.D.) **+ 14.36 ±**

NORTH **1874915.55** EAST **651241.12**

DEPTH ELEVATION	SAMPLE NO.	SAMPLER TYPE	SAMPLE REC. (%)	SOIL GRAPHIC LOG	DESCRIPTION OF MATERIALS (LABORATORY CLASSIFICATION)	UNIT DRY WT. LBS./FT.^{3}	Unconfined Compressive Strength, Tons/Ft.^{2} (1 2 3 4 5); PL MC LL; STD "N" PENETRATION BLOWS PER FT. (10 20 30 40 50)	REMARKS
					FILL: SANDY SILT AND GRAVEL, Brown and Tan, Trace Bricks (GM-ML)			
2.5								
5.0		HS			FILL: SILTY CLAY AND GRAVEL, Dark Gray, Trace to Little Sand, Trace Rubber, Trace Wood (GC-CL)			
7.5								
10.0	1	S2	25		FILL: SILTY CLAY AND SAND, Black, Trace Gray, Trace Gravel, Trace Bricks, Soft, Moist (CL-SP)			
12.5		RB			FILL: SILTY CLAY, Gray, Trace Brown and Dark Gray, Trace Sand and Gravel, Soft to Stiff, Wet (CL)			
	2	S2	67			95.0	0.83	
15.0	3	3T	50		FILL: SILTY CLAY, Brown and Gray, Trace Black, Trace Sand and Gravel, Trace Wood, Medium to Stiff, Moist (CL)	106.3		UU
17.5		RB						
	4	S2	33		FILL: SILTY CLAY, Brown, Gray and Black, Trace Sand and Gravel, Trace Brick, Soft to Medium, Moist (CL)			
20.0		RB			FILL: SILTY CLAY, Gray, Trace Brown and Black, Little to Trace Sand, Trace Gravel, Soft to Stiff, Moist (CL)			
22.5	5	S2	25					

Calibrated Penetrometer Unconfined Compression

Water Level Observations

SEECO Consultants, Inc.
7350 Duvan Drive, Tinley Park, IL 60477

Approved By **CWG** Job No. **6594G-BB**

Boring Started **6/29/01**
Boring Completed **7/2/01**
Driller **D&G--MH** Rig **B-61**
Drawn By **GG** Sheet **1 of 3**

BORING LOG

CLIENT: **Metro. Water Reclam. Dist. of Greater Chicago**

PROJECT: **Overburden Study (73-161-CH)**

ARCHITECT-ENGINEER:

LOCATION: **Brisch Brick Site, Village of Stickney, IL**

BORING NUMBER: **B-1B**

SURFACE ELEVATION (C.C.D.): **+14.36**

NORTH: **1874915.55** EAST: **651241.12**

DEPTH ELEVATION	SAMPLE NO.	SAMPLER TYPE	SAMPLE REC. (%)	SOIL GRAPHIC LOG	DESCRIPTION OF MATERIALS (LABORATORY CLASSIFICATION)	UNIT DRY WT. LBS./FT.^{3}	Unconfined Compressive Strength, Tons/Ft.^{2} / STD "N" PENETRATION BLOWS PER FT.	REMARKS
		RB						
27.5	6	S2	75			105.2	0.95	
30.0	7	3T	0		FILL: SILTY CLAY, BRICKS, AND GRAVEL, Brown, Black and Gray, Trace Wood (No shelby tube recovery as end of tube crinkled up when pushing it into this fill material--(Field Geologist's Observation)			
32.5		RB			FILL: BLACK AND BROWN SILTY SAND AND RED AND TAN BRICKS, Trace Wood, Medium Dense, Moist to Wet			
	8	S2	25					
35.0		RB						
37.5	9	S2	21		FILL: SANDY SILTY CLAY WITH BRICK AND ROCK FRAGMENTS, Gray, Trace Wood, Medium, Moist (Rock in bottom of shoe of split spoon sampler at 39.5 feet--Field Geologist's Observation)			N=57/11"
40.0		RB			FILL: SILTY CLAY AND RED BRICKS, Brown, Gray, and Black, Trace Wood, Medium to Stiff, Moist			
42.5	10	S2	25					
45.0		RB			FILL: SILTY CLAY, Brown, Gray, and Black, Trace Bricks, Little Gravel, Stiff, Moist (CL)			
47.5	11A	S2	33			108.9		
50.0	11B	S2			SILTY CLAY, Gray, Trace Sand and Gravel, Stiff to Hard, Moist (CL)			

PL. MC LL

10 20 30 40 50

Calibrated Penetrometer Unconfined Compression

SEECO Consultants Inc. Job No. **6594G-BB** Sheet **2 of 3**

BORING LOG

CLIENT **Metro. Water Reclam. Dist. of Greater Chicago**

PROJECT **Overburden Study (73-161-CH)**

ARCHITECT-ENGINEER

LOCATION **Brisch Brick Site, Village of Stickney, IL**

BORING NUMBER **B-1B**

SURFACE ELEVATION (C.C.D.) **+14.36**

NORTH **1874915.55** EAST **651241.12**

DESCRIPTION OF MATERIALS (LABORATORY CLASSIFICATION)

Unconfined Compressive Strength, Tons/Ft.^{2} (1, 2, 3, 4, 5)

PL MC LL

STD "N" PENETRATION BLOWS PER FT. (10, 20, 30, 40, 50)

DEPTH ELEVATION	SAMPLE NO.	SAMPLER TYPE	SAMPLE REC. (%)	SOIL GRAPHIC LOG	UNIT DRY WT. LBS./FT.^{3}	REMARKS
52.5	12	3T	20		106.1	
		RB				
	13	S2	83		105.7	
55.0						
		RB				
57.5						
	14	S2	100			
60.0						

End of Boring @ 60.00 Feet

D&G Drilling drilled the upper 10 feet of the borehole using an approximate 2.25" diameter hollow stem auger and then installed an approximate 4 inch outside diameter steel casing from approximately 0 to 10 feet below the existing ground level to prevent collapse of upper fill soils into the borehole during drilling. (Field Geologist's Observation)

62.5
65.0
67.5
70.0
72.5
75.0
77.5

3.26

Calibrated Penetrometer Unconfined Compression

SEECO Consultants Inc. Job No. **6594G-BB** Sheet **3 of 3**

BORING LOG

CLIENT: **Metro. Water Reclam. Dist. of Greater Chicago**

PROJECT: **Overburden Study (73-161-CH)**

ARCHITECT/ ENGINEER:

LOCATION: **Brisch Brick Site, Village of Stickney, IL**

BORING NUMBER: **B-2**

APPROX. SURFACE ELEVATION (C.C.D.): **+ 23.45 ±**

NORTH: **1874181.06** EAST: **651396.17**

DEPTH ELEVATION	SAMPLE NO.	SAMPLER TYPE	SAMPLE REC. (%)	SOIL GRAPHIC LOG	DESCRIPTION OF MATERIALS (LABORATORY CLASSIFICATION)	UNIT DRY WT. LBS./FT.^{3}	Unconfined Compressive Strength, Tons/Ft.^{2} (1 2 3 4 5) PL MC LL; STD "N" PENETRATION BLOWS PER FT. (10 20 30 40 50)	REMARKS
		HS			FILL: SANDY CLAYEY SILT, Dark Brown, Trace Brown and Gray, Some Sandy Silty Clay, Trace Gravel, Trace Brick, Loose, Moist (ML)			
2.5	1	S2	75					
		HS						
5.0	2	S2	100		FILL: SILTY CLAY, Gray, Trace Brown, Little Sand, Trace Gravel, Medium to Stiff, Moist (CL)	112.3	1.58	
		HS						
7.5	3	S2	100		(Trace Bricks)	122.3	1.15	
		HS			FILL: WELL GRADED SAND, Gray, Little Gravel, Medium Dense, Moist (SW)			
10.0	4A	S2	100					
	4B	S2			FILL: BLACK AND BROWN SILTY SAND, RED BRICKS AND BLACK CINDERS AND SLAG, Trace Gravel, Medium Dense, Moist			
12.5		RB						
	5A	S2	83		12" SILTY CLAY TOPSOIL, Black, Trace Sand and Gravel, Moist (OL)	102.7		
	5B	S2			SILTY CLAY, Dark Gray, Trace Brown and Gray, Little Sand, Trace Gravel, Stiff, Moist (Transition Material) (CL)	111.6		
15.0		RB			SILTY CLAY, Brown and Gray, Trace Sand and Gravel, Very Stiff to Stiff, Moist (CL)			
17.5								
	6	3T	100			104.3		UU
20.0		RB						
22.5								
	7	S2	83		SILTY CLAY, Gray, Little Sand, Trace Gravel, Stiff to Very Stiff, Moist (CL)	108.6	1.40	

Calibrated Penetrometer Unconfined Compression

Water Level Observations

SEECO Consultants, Inc.
7350 Duvan Drive, Tinley Park, IL 60477

Approved By: **CWG** Job No. **6594G-BB**

Boring Started: **6/29/01**
Boring Completed: **6/29/01**
Driller: **D&G--MH** Rig: **B-61**
Drawn By: **GG** Sheet: **1 of 3**

BORING LOG

CLIENT: **Metro. Water Reclam. Dist. of Greater Chicago**

PROJECT: **Overburden Study (73-161-CH)**

ARCHITECT-ENGINEER:

LOCATION: **Brisch Brick Site, Village of Stickney, IL**

BORING NUMBER: **B-2**

SURFACE ELEVATION (C.C.D.): **+23.45**

NORTH: **1874181.06** EAST: **651396.17**

DESCRIPTION OF MATERIALS (LABORATORY CLASSIFICATION)

Unconfined Compressive Strength, Tons/Ft.^{2} (1, 2, 3, 4, 5)

PL MC LL

STD "N" PENETRATION BLOWS PER FT. (10, 20, 30, 40, 50)

DEPTH ELEVATION	SAMPLE NO.	SAMPLER TYPE	SAMPLE REC. (%)	UNIT DRY WT. LBS./FT.^{3}	DESCRIPTION OF MATERIALS (LABORATORY CLASSIFICATION)	REMARKS
27.5		RB				
	8	S2	100	102.3	SILTY CLAY, Gray, Trace Sand and Gravel, Stiff to Medium to Very Stiff to Medium, Moist to Wet to Moist Note: Sample 8 was obtained by pushing the split spoon sampler using the the Drill Rig--(Field Geologist's Observation) (CL)	
30.0		RB				
32.5	9	3T	63	90.2		SG UU--TC CA
35.0		RB				
37.5	10	S2	100	122.8		
40.0	11	S2	83	109.5		
42.5		RB			CLAYEY SILT, Gray, Dense, Moist	
	12	3T	43	122.1		
45.0		RB				
47.5	13	S2	100	117.3	SILTY CLAY, Gray, Trace Sand and Gravel, Very Stiff to Hard, Moist	
50.0					End of Boring at 50.00 Feet	

1.62

Calibrated Penetrometer Unconfined Compression

SEECO Consultants Inc. Job No. **6594G-BB** Sheet **2 of 3**

BORING LOG

CLIENT **Metro. Water Reclam. Dist. of Greater Chicago**

PROJECT **Overburden Study (73-161-CH)**

ARCHITECT-ENGINEER

LOCATION **Brisch Brick Site, Village of Stickney, IL**

BORING NUMBER **B-2**

SURFACE ELEVATION (C.C.D.) **+23.45**

NORTH **1874181.06** EAST **651396.17**

DEPTH ELEVATION	SAMPLE NO.	SAMPLER TYPE	SAMPLE REC. (%)	SOIL GRAPHIC LOG	DESCRIPTION OF MATERIALS (LABORATORY CLASSIFICATION)	UNIT DRY WT. LBS./FT.^{3}	Unconfined Compressive Strength, Tons/Ft.^{2} 1 2 3 4 5; PL MC LL; STD "N" PENETRATION BLOWS PER FT. 10 20 30 40 50	REMARKS
52.5					D&G Drilling mud rotary drilled the borehole in the upper 10 feet using an approximate 2.25" diameter hollow stem auger and then reamed out the hole before installing an approximate 4 inch outside diameter steel casing from approximately 0 to 10 feet below the existing ground level to prevent collapse of the upper fill soils into the borehole during drilling. (Field Geologist's Observation)			
55.0								
57.5					D&G Drilling attempted to push an approximate 3" diameter Shelby Tube at approximately 10 feet below the existing ground level but were unsuccessful due to the existing gravel and sand thus an approximate 2" diameter split spoon sampler was driven at this depth instead--(Field Geologist's Observation)			
60.0								
62.5								
65.0								
67.5								
70.0								
72.5								
75.0								
77.5								

⊕ Calibrated Penetrometer Unconfined Compression

SEECO Consultants Inc. Job No. **6594G-BB** Sheet **3 of 3**

BORING LOG

CLIENT: **Metro. Water Reclam. Dist. of Greater Chicago**

PROJECT: **Overburden Study (73-161-CH)**

ARCHITECT/ ENGINEER:

LOCATION: **Brisch Brick Site, Village of Stickney, IL**

BORING NUMBER: **B-3**

APPROX. SURFACE ELEVATION (C.C.D.): **+ 16.14 +**

NORTH: **1874507.96** EAST: **650439.86**

DEPTH ELEVATION	SAMPLE NO.	SAMPLER TYPE	SAMPLE REC. (%)	SOIL GRAPHIC LOG	DESCRIPTION OF MATERIALS (LABORATORY CLASSIFICATION)	UNIT DRY WT. LBS./FT.^{3}	Unconfined Compressive Strength, Tons/Ft.^{2} / PL MC LL / STD "N" PENETRATION BLOWS PER FT.	REMARKS
	1A	S2	83		FILL: CLAYEY SILT AND GRAVEL, Gray, Little Sand, Medium Dense, Dry (ML-GM)			
	1B	S2			FILL: SILTY SAND AND GRAVEL, Light Gray to White, Medium Dense, Dry (Possible Crushed Stone Fragments)			
2.5	2	S2	100		FILL: SILTY CLAY, Black, Brown and Gray, Some Organics, Little Sand, Some Gravel, Trace Bricks, Wood, Glass and Fabric, Solvent Odor, Medium to Stiff, Moist (CL-OL)	108.6	1.45	
5.0	3	S2	83		FILL: SILTY CLAY, Brown and Gray, Little Black, Trace Sand, Little Gravel, Trace Rubber, Little Wood, Bricks and Glass, Slight Solvent Odor, Stiff to Very Stiff, Moist (CL)	106.1		▽ WD
	4A	S2	75					
7.5	4B	S2			FILL: SILTY CLAY, Gray, Some Bricks, Little Rubber, Trace Sand and Gravel, Soft to Medium, Wet	113.9		
	5	S2	67		SILTY CLAY, Gray to Gray, Trace Brown, Trace Sand and Gravel, Hard to Very Stiff, Moist (CL)	114.6		
10.0	6	3T	65		SILTY CLAY, Gray, With Sand, Trace Gravel, Stiff to Soft to to Medium, Moist (CL)	110.8		UU CA
12.5	7	S2	100			101.6	0.58	
15.0	8	S2	75			109.2		
	9	3T	54			107.5		UU--TC
17.5	10	S2	75		SILTY CLAY, Gray, Trace Brown, Trace Sand and Gravel, Medium, Moist (CL)	106.9 / 107.8		
20.0	11	S2	79		SILTY CLAY, Gray, Trace Sand and Gravel, Very Stiff to Very Soft, Moist to Wet (CL)	108.7		
22.5	12	S2	83			110.9	0.84	

Calibrated Penetrometer Unconfined Compression

Water Level Observations			SEECO Consultants, Inc.		Boring Started	6/28/01	
					Boring Completed	6/28/01	
	4' WD		7350 Duvan Drive, Tinley Park, IL 60477		Driller D&G--MH	Rig	B-61
			Approved By CWG	Job No. 6594G-BB	Drawn By GG	Sheet	1 of 3

BORING LOG

CLIENT **Metro. Water Reclam. Dist. of Greater Chicago**

PROJECT **Overburden Study (73-161-CH)**

ARCHITECT-ENGINEER

LOCATION **Brisch Brick Site, Village of Stickney, IL**

BORING NUMBER **B-3**

SURFACE ELEVATION (C.C.D.) **+16.14**

NORTH **1874507.96** EAST **650439.86**

DESCRIPTION OF MATERIALS (LABORATORY CLASSIFICATION)

Unconfined Compressive Strength, Tons/Ft.^{2} (1, 2, 3, 4, 5)

PL MC LL

STD "N" PENETRATION BLOWS PER FT. (10, 20, 30, 40, 50)

DEPTH ELEVATION	SAMPLE NO.	SAMPLER TYPE	SAMPLE REC. (%)	SOIL GRAPHIC LOG	DESCRIPTION OF MATERIALS	UNIT DRY WT. LBS./FT.^{3}	REMARKS
	13	S2	83				
	14	3T	100		CLAYEY SILT, Gray, Trace Sand and Gravel, Moist (ML) (Trace of Black Organic at 26 feet)	105.0	
27.5	15	S2	92		SILTY CLAY TO CLAYEY SILT, Gray, Trace Sand and Gravel, Medium to Very Stiff, Moist (CL-ML)	106.2	CA
30.0	16	S2	100		SILTY CLAY, Gray, Trace Sand and Gravel, Very Stiff to Hard, Moist (CL)	123.9	
32.5	17	S2	100			125.5	
35.0	18	S2	100			118.1	
	19	S2	100			124.7	
37.5	20	S2	100			124.3	
40.0	21	S2	100			122.6	
42.5	22	S2	100			118.1	
45.0	23	S2	100			116.8	
	24	S2	100			113.1	
47.5	25	S2	17			110.9	100 N=100/1"
					End of Boring @ 48.6 Feet		
50.0							

Calibrated Penetrometer Unconfined Compression

SEECO Consultants Inc. Job No. **6594G-BB** Sheet **2 of 3**

BORING LOG

CLIENT **Metro. Water Reclam. Dist. of Greater Chicago**

PROJECT **Overburden Study (73-161-CH)**

ARCHITECT-ENGINEER

LOCATION **Brisch Brick Site, Village of Stickney, lL**

BORING NUMBER **B-3**

SURFACE ELEVATION (C.C.D.) **+16.14**

NORTH **1874507.96** EAST **650439.86**

DESCRIPTION OF MATERIALS (LABORATORY CLASSIFICATION)

D&G Drilling drilled the upper 10 feet of the borehole using an approximate 2.25" diameter hollow stem auger and then installed an approximate 4 inch outside diameter steel casing from approximately 0 to 10 feet below the existing ground level to prevent the collapse of the upper fill soils and upper soils into the borehole during drilling. (Field Geologist's Observation)

DEPTH ELEVATION | SAMPLE NO. | SAMPLER TYPE | SAMPLE REC. (%) | SOIL GRAPHIC LOG | UNIT DRY WT. LBS./FT.^{3}

Unconfined Compressive Strength, Tons/Ft.^{2}

1 2 3 4 5

PL MC LL

STD "N" PENETRATION BLOWS PER FT.

10 20 30 40 50

REMARKS

52.5
55.0
57.5
60.0
62.5
65.0
67.5
70.0
72.5
75.0
77.5

Calibrated Penetrometer Unconfined Compression

SEECO Consultants Inc. Job No. **6594G-BB** Sheet **3 of 3**

BORING LOG

CLIENT **Metro. Water Reclam. Dist. of Greater Chicago**

PROJECT **Overburden Study (73-161-CH)**

ARCHITECT/ ENGINEER

LOCATION **Brisch Brick Site, Village of Stickney, IL**

BORING NUMBER **B-4**

APPROX. SURFACE ELEVATION (C.C.D.) **+ 16.33 ±**

NORTH **1875159.14** EAST **650252.66**

DEPTH ELEVATION	SAMPLE NO.	SAMPLER TYPE	SAMPLE REC. (%)	SOIL GRAPHIC LOG	DESCRIPTION OF MATERIALS (LABORATORY CLASSIFICATION)	UNIT DRY WT. LBS./FT.^{3}	Unconfined Compressive Strength, Tons/Ft.^{2} (1 2 3 4 5); PL MC LL; STD "N" PENETRATION BLOWS PER FT. (10 20 30 40 50)	REMARKS
		HS			FILL: SILTY CLAY, Grayish Brown, Little Sand, Trace Gravel, Trace Bricks, Hard, Moist (CL)			
2.5	1	S2	50					
		HS			FILL: SILTY CLAY, Grayish Brown, Trace Brown, Trace Gray, Trace Black, Trace Sand and Gravel, Trace Bricks, Trace Roots, Hard to Very Stiff, Moist (CL)		2.69	
5.0	2	S2	75			111.7		
		HS						
7.5	3A	S2	67					
	3B	S2			SILTY SAND, Gray, Trace Gravel, Trace Roots, Trace Organics, Loose, Saturated (SM)			WD
		HS			CLAYEY SILT, Gray, Trace Sand and Gravel, Trace Roots, Loose, Saturated (ML)			
10.0	4A	S2	42					199
		S2			PEAT, Dark Brown, Trace Black, Loose, Wet (PT)			
12.5		RB						
	5	S2	46		SILTY CLAY, Gray, Trace Sand and Gravel, Medium to Very Stiff to Medium, Moist (CL)	101.7		
15.0	6	3T	66			106.2		UU--TC
17.5		RB						
	7	S2	58			101.5		
20.0								SG
	8	3T	60		CLAYEY SAND, Gray, Fine to Medium Grained, Saturated (SC)			UU CA
22.5		RB			SILTY CLAY, Gray, With Sand, Trace Sand and Gravel, Very Stiff to Medium to Stiff, Moist (CL)	121.2		
	9	S2	67		A two inch thick lense of gray sandy clay was encountered at 22.3 feet	102.8		

Calibrated Penetrometer Unconfined Compression

Water Level Observations

8' WD

SEECO Consultants, Inc.
7350 Duvan Drive, Tinley Park, IL 60477

Approved By **CWG** Job No. **6594G-BB**

Boring Started **7/2/01**
Boring Completed **7/2/01**
Driller **D&G--MH** Rig **B-61**
Drawn By **GG** Sheet **1 of 3**

BORING LOG

CLIENT **Metro. Water Reclam. Dist. of Greater Chicago**

PROJECT **Overburden Study (73-161-CH)**

ARCHITECT-ENGINEER

LOCATION **Brisch Brick Site, Village of Stickney, IL**

BORING NUMBER **B-4**

SURFACE ELEVATION (C.C.D.) **+16.33**

NORTH **1875159.14** EAST **650252.66**

DESCRIPTION OF MATERIALS (LABORATORY CLASSIFICATION)

Unconfined Compressive Strength, Tons/Ft.^{2} (1, 2, 3, 4, 5)

PL MC LL

STD "N" PENETRATION BLOWS PER FT. (10, 20, 30, 40, 50)

DEPTH ELEVATION	SAMPLE NO.	SAMPLER TYPE	SAMPLE REC. (%)	UNIT DRY WT. LBS./FT.^{3}	REMARKS
27.5		RB			
	10	3T	73	119.3	UU--TC
30.0		RB			
32.5					
	11	S2	83	120.1	4.68
35.0		RB			
37.5					
	12	S2	83		
40.0		RB			
42.5					
	13	S2	92	117.6	
45.0		RB			
47.5					
	14	S2	88	132.7	
50.0					

SILTY CLAY, Gray, Little Sand, Trace to Little Gravel, Very Stiff to Hard, Moist (CL)

End of Boring @ 50.00 Feet

Calibrated Penetrometer Unconfined Compression

SEECO Consultants Inc. Job No. **6594G-BB** Sheet **2 of 3**

BORING LOG

CLIENT **Metro. Water Reclam. Dist. of Greater Chicago**

PROJECT **Overburden Study (73-161-CH)**

ARCHITECT-ENGINEER

LOCATION **Brisch Brick Site, Village of Stickney, IL**

BORING NUMBER **B-4**

SURFACE ELEVATION (C.C.D.) **+16.33**

NORTH **1875159.14** EAST **650252.66**

DEPTH ELEVATION	SAMPLE NO.	SAMPLER TYPE	SAMPLE REC. (%)	SOIL GRAPHIC LOG	DESCRIPTION OF MATERIALS (LABORATORY CLASSIFICATION)	UNIT DRY WT. LBS./FT.^{3}	Unconfined Compressive Strength, Tons/Ft.^{2} 1 2 3 4 5 / PL MC LL / STD "N" PENETRATION BLOWS PER FT. 10 20 30 40 50	REMARKS
52.5					D&G Drilling drilled the upper 10 feet of the borehole using an approximate 2.25" diameter hollow stem auger and then installed an approximate 4 inch outside diameter steel casing from approximately 0 to 10 feet below the existing ground level to prevent the collapse of the upper fill soils and upper soils into the borehole during drilling. (Field Geologist's Observation)			
55.0								
57.5								
60.0								
62.5								
65.0								
67.5								
70.0								
72.5								
75.0								
77.5								

⊕ Calibrated Penetrometer Unconfined Compression

SEECO Consultants Inc. Job No. **6594G-BB** Sheet **3 of 3**

BORING LOG

CLIENT **Metro. Water Reclam. Dist. of Greater Chicago**

PROJECT **Overburden Study (73-161-CH)**

ARCHITECT/ ENGINEER

LOCATION **Brisch Brick Site, Village of Stickney, IL**

BORING NUMBER **B-5**

APPROX. SURFACE ELEVATION (C.C.D.) **+ 13.99 +**

NORTH **1874666.93** EAST **650842.17**

Unconfined Compressive Strength, Tons/Ft.^{2} (1, 2, 3, 4, 5)

PL MC LL

STD "N" PENETRATION BLOWS PER FT. (10, 20, 30, 40, 50)

UNIT DRY WT. LBS./FT.^{3}

DEPTH ELEVATION	SAMPLE NO.	SAMPLER TYPE	SAMPLE REC. (%)	SOIL GRAPHIC LOG	DESCRIPTION OF MATERIALS (LABORATORY CLASSIFICATION)	REMARKS
		HS			FILL: CRUSHED STONE AND GRAY SILTY SAND, Some Gravel, Trace Brick Pieces and Asphalt Pieces, Dry (GM-SM)	
2.5	1	S2	100		FILL: SANDY SILT AND CRUSHED STONE, Gray, Little Gravel, Trace Clay, Medium Dense, Dry (GM-ML)	
		HS				
5.0	2	S2	67		FILL: SILTY SAND, Black, Brown and Gray, Some Wood, Trace Rubber, Trace Glass Pieces, Trace Gravel, Slight Organic Odor, Medium Dense, Moist (SM)	▼ ACR
		HS				
7.5	3	S2	46		FILL: BLACK COAL TAR, Trace Plastic Bag Pieces, Trace Greenish Gray and Black Clayey Silt, Napthelene Odor, Dry to Moist	
		HS				▽ WD
10.0	4	S2	83		FILL: SANDY SILTY CLAY TO SANDY CLAYEY SILT, Black, Trace Gray, Some Black Sand, Trace Pink and Green Paint Coloring, Trace Bricks, Plastic, Wood, Glass and Metal, Paint Solvent Odor, Stiff to Very Stiff, Moist	
12.5		HS				
	5	S2	71		FILL: BLACK COAL TAR, Some Wood Pieces, Some Black Roof Shingle Pieces, Little Greenish Gray and Black Clayey Silt, Trace Fibers, Coal Tar Odor, Very Dense to Medium Dense, Moist to Wet	
15.0		HS				
17.5	6	S2	8		Note: A Metal Piece with Black Coal Tar was stuck at the bottom of the split spoon sampler for Sample #6 at approximately 18 feet, thus sample recovery was impeded. (Field Engineer's Observation)	
20.0		HS				
22.5					FILL: SANDY SILT TO SILT, Black, Some Fibers and Wood Pieces, Trace Glass, Trace Gravel, Medium Dense to Dense, Saturated	
	7	S2	58		Coal Tar Odor in Sample #7	

Calibrated Penetrometer Unconfined Compression

Water Level Observations		SEECO Consultants, Inc.		Boring Started	8/21/01	
				Boring Completed	8/21/01	
9.5' WD	6' ACR	7350 Duvan Drive, Tinley Park, IL 60477		Driller D&G--MH	Rig	B-61
		Approved By CWG	Job No. 6594G-BB	Drawn By GG	Sheet	1 of 3

BORING LOG

CLIENT: **Metro. Water Reclam. Dist. of Greater Chicago**

PROJECT: **Overburden Study (73-161-CH)**

ARCHITECT-ENGINEER:

LOCATION: **Brisch Brick Site, Village of Stickney, IL**

BORING NUMBER: **B-5**

SURFACE ELEVATION (C.C.D.): **+13.99**

NORTH: **1874666.93** EAST: **650842.17**

DEPTH ELEVATION	SAMPLE NO.	SAMPLER TYPE	SAMPLE REC. (%)	SOIL GRAPHIC LOG	DESCRIPTION OF MATERIALS (LABORATORY CLASSIFICATION)
27.5		HS			
	8	S2	58		Aromatic Odor in Sample #8
30.0					
		HS			
32.5					
	9	S2	50		FILL: SILTY SAND AND GRAVEL, Black, Some Rubber Pieces and Wood Pieces, Trace Fibers, Trace Brick Pieces, Aromatics Odor, Medium Dense, Saturated
35.0					
		HS			
37.5					FILL: SILTY SAND AND GRAVEL AND BRICKS AND WOOD PIECES, Black, Trace Gravel, Trace Concrete Pieces, Aromatics Odor, Medium Dense, Saturated
	10	S2	42		
40.0					
		HS			
42.5					
	11	S2	8		FILL: SANDY SILT, Black, Some Metal Pieces, Trace Bricks, Aromatics Odor, Saturated
45.0	12	S2	50		SILTY CLAY, Brown and Gray to Brownish Gray, Trace to Little Sand, Trace Gravel, Very Stiff to Medium, Moist (CL)
		HS			
47.5					
	13	S2	29		
50.0					

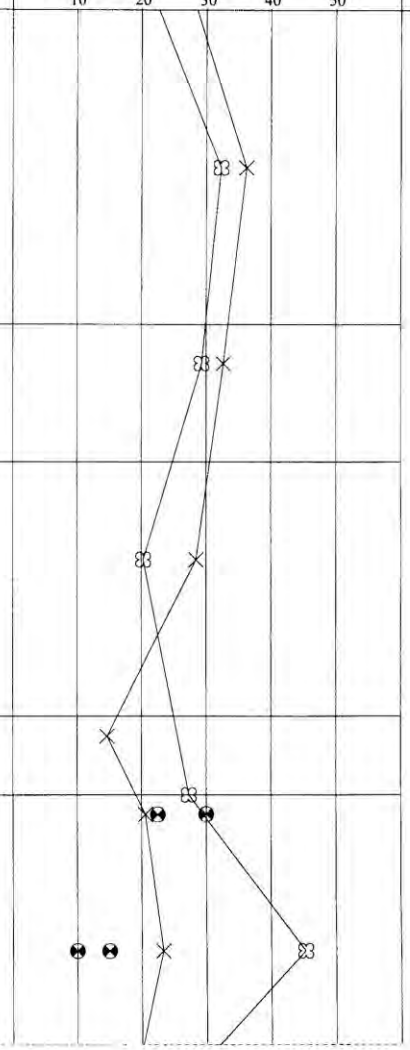
UNIT DRY WT. LBS./FT.^{3}

Unconfined Compressive Strength, Tons/Ft.^{2}: 1 2 3 4 5

PL MC LL

STD "N" PENETRATION BLOWS PER FT.: 10 20 30 40 50

REMARKS



Calibrated Penetrometer Unconfined Compression

SEECO Consultants Inc. | Job No. **6594G-BB** | Sheet **2 of 3**

BORING LOG

CLIENT **Metro. Water Reclam. Dist. of Greater Chicago**

PROJECT **Overburden Study (73-161-CH)**

ARCHITECT-ENGINEER

LOCATION **Brisch Brick Site, Village of Stickney, IL**

BORING NUMBER **B-5**

SURFACE ELEVATION (C.C.D.) **+13.99**

NORTH **1874666.93** EAST **650842.17**

DEPTH ELEVATION	SAMPLE NO.	SAMPLER TYPE	SAMPLE REC. (%)	SOIL GRAPHIC LOG	DESCRIPTION OF MATERIALS (LABORATORY CLASSIFICATION)	UNIT DRY WT. LBS./FT.^{3}	Unconfined Compressive Strength, Tons/Ft.^{2} / PL MC LL / STD "N" PENETRATION BLOWS PER FT.	REMARKS
52.5		HS			SILTY CLAY, Gray, Trace Sand and Gravel, Very Stiff to Hard, Moist (CL)			
	14	S2	42					
55.0					End of Boring @ 55.00 Feet Note: Blow in of fill materials occurred at the bottom of the borehole at an approximate depth of 43 feet below the existing ground level. Thus, a split spoon sampler was used to remove the excess fill material that blew in the bottom of the borehole. The last spoon that was used had been advanced from 43 feet to 44 feet, thus the material in the spoon was not cave-in as it had surpassed the original depth. This material was jarred as Sample #11. However, no blow counts had been obtained in this process. (Field Engineer's Observation)			
57.5								
60.0								
62.5								
65.0								
67.5								
70.0								
72.5								
75.0								
77.5								

Unconfined Compressive Strength, Tons/Ft.^{2}: 1 2 3 4 5

PL MC LL

STD "N" PENETRATION BLOWS PER FT.: 10 20 30 40 50

Calibrated Penetrometer Unconfined Compression

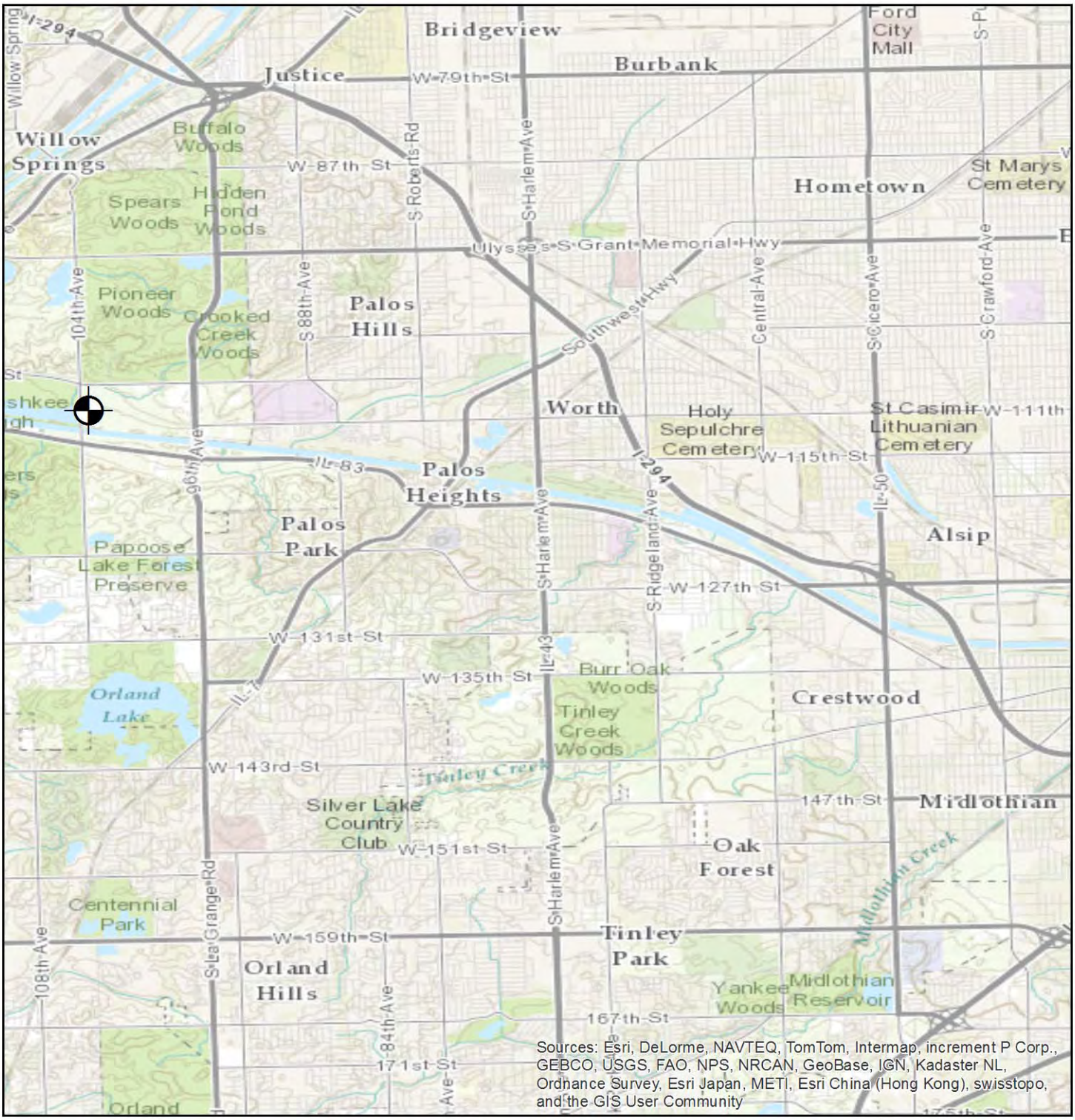
SEECO Consultants Inc. | Job No. **6594G-BB** | Sheet **3 of 3**

ENCLOSURE D

BORING LOGS NEAR ALSIP, IL LOCATION

Alsip, IL

GLMRIS



Legend

Boring Locations

Date: 9/30/2013

1 IN = 8,830 FT

Coordinate System: GCS North American 1983
Datum: North American 1983

Path: J:\LRC_Projects\PRJ_GLMRIS\MXD\Borings\Alsip.mxd

Saganashkee Slough - Proposed Test Pit Locations

U.S. Army Corps of Engineers
Chicago District

FOREST PRESERVE DIST
32 Acres

FOREST PRESERVE DIST
6.59 Acres

FOREST PRESERVE DIST
2.85 Acres

FOREST PRESERVE DIST
41.55 Acres

FOREST PRESERVE DIST
2.94 Acres

FOREST PRESERVE DIST
27.34 Acres

FOREST PRESERVE DIST
39.42 Acres

SB-1

FOREST PRESERVE DIST
10 Acres

SB-2

SB-3

SB-4

SB-5

SB-7

FOREST PRESERVE DIST
15.95 Acres

SB-6

FOREST PRESERVE DIST
41.16 Acres

FOREST PRESERVE DIST
3.15 Acres

FOREST PRESERVE DIST
6.37 Acres

FOREST PRESERVE DIST
18.06 Acres

FOREST PRESERVE DIST
9.56 Acres

FOREST PRESERVE DIST
20.04 Acres

SB-8

FOREST PRESERVE DIST
5.43 Acres

SB-9

FOREST PRESERVE DIST
15.75 Acres

METRO WATER RECLM DI
1.16 Acres

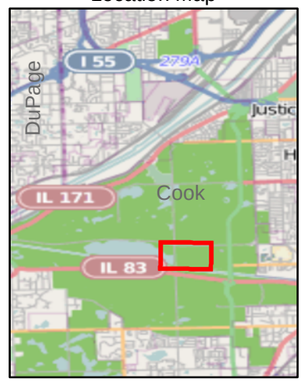
FOREST PRESERVE DIST
20.34 Acres

H-128

Legend

- Test Pits
- Contour
- 598
- 600
- Parcels

Location Map



Date: 5/10/2012

N
W E
S

1 in = 339 ft

Path: J:\LRC_Projects\PRJ_506_Saganashkee_Slough\MXD\Saganashkee Slough Test pit Geotech Map.mxd

Hole No. SB-1

DRILLING LOG	DIVISION: Chicago	INSTALLATION: Test Pit	SHEET 1 OF 1 SHEETS

1. PROJECT	Saganashkee Slough
2. LOCATION (Coordinates or Station)	Palos, IL
3. DRILLING AGENCY	TesTech
4. HOLE NO. *(As shown on drawing title and file number)*	SB-1
5. NAME OF DRILLER	Greg Reid
6. DIRECTION OF HOLE	☐ VERTICAL ☐ INCLINED --- DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN	
8. DEPTH DRILLED INTO ROCK	NA
9. TOTAL DEPTH OF HOLE	4.5
10. SIZE AND TYPE OF BIT	NA
11. DATUM FOR ELEVATION SHOWN *(TBM or MSL)*	
12. MANUFACTURER'S DESIGNATION OF DRILL	NA
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN	DISTURBED 3 / UNDISTURBED
14. TOTAL NUMBER CORE BOXES	
15. ELEVATION GROUND WATER	
16. DATE HOLE	STARTED 8/10/2012 / COMPLETED 8/10/2012
17. ELEVATION TOP OF HOLE	
18. TOTAL CORE RECOVERY FOR BORING	%
19. SIGNATURE OF INSPECTOR	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS *(Drilling time, water loss, depth weathering, etc., if significant)* g
	0.0		TOPSOIL		1 0.0 0.8	All samples are 'Bulk Samples' retrieved from side of test pit.
	0.8		Brown Sandy SILT, few gravel (ML)		2 0.8 1.9	
					3 1.9 4.5	
	4.5					

Hole No. SB-2

DRILLING LOG

DIVISION: Chicago	INSTALLATION: Test Pit	SHEET 1 OF 1 SHEETS	

1. PROJECT: Saganashkee Slough	10. SIZE AND TYPE OF BIT: NA
2. LOCATION (Coordinates or Station): Palos, IL N 1,830,856.8 E 1,109,816.4	11. DATUM FOR ELEVATION SHOWN *(TBM or MSL)*
3. DRILLING AGENCY: TesTech	12. MANUFACTURER'S DESIGNATION OF DRILL: NA
4. HOLE NO. *(As shown on drawing title and file number)*: SB-2	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN — DISTURBED: 2 — UNDISTURBED:
5. NAME OF DRILLER: Greg Reid	14. TOTAL NUMBER CORE BOXES
6. DIRECTION OF HOLE: ☐ VERTICAL ☐ INCLINED ---- DEG. FROM VERT.	15. ELEVATION GROUND WATER
7. THICKNESS OF OVERBURDEN	16. DATE HOLE — STARTED: 8/10/2012 — COMPLETED: 8/10/2012
8. DEPTH DRILLED INTO ROCK: NA	17. ELEVATION TOP OF HOLE
9. TOTAL DEPTH OF HOLE: 5.0	18. TOTAL CORE RECOVERY FOR BORING %
	19. SIGNATURE OF INSPECTOR

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS *(Drilling time, water loss, depth weathering, etc., if significant)* g
	0.0 0.2		TOPSOIL			
			Brown CLAY, some sand, (CL)		1 0.2 1.8	All samples are 'Bulk Samples' retrieved from side of test pit.
					2 1.8 5.0	
	5.0					

Hole No. SB-3

DRILLING LOG	DIVISION: Chicago	INSTALLATION: Test Pit	SHEET 1 OF 1 SHEETS

1. PROJECT: Saganashkee Slough	10. SIZE AND TYPE OF BIT: NA
2. LOCATION (Coordinates or Station): Palos, IL N 1,830,564.1 E 1,109,645.7	11. DATUM FOR ELEVATION SHOWN *(TBM or MSL)*
3. DRILLING AGENCY: TesTech	12. MANUFACTURER'S DESIGNATION OF DRILL: NA
4. HOLE NO. *(As shown on drawing title and file number)*: SB-3	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN — DISTURBED: 3 — UNDISTURBED:
5. NAME OF DRILLER: Greg Reid	14. TOTAL NUMBER CORE BOXES
6. DIRECTION OF HOLE: ☐ VERTICAL ☐ INCLINED ---- DEG. FROM VERT.	15. ELEVATION GROUND WATER
7. THICKNESS OF OVERBURDEN	16. DATE HOLE — STARTED: 8/10/2012 — COMPLETED: 8/10/2012
8. DEPTH DRILLED INTO ROCK: NA	17. ELEVATION TOP OF HOLE
9. TOTAL DEPTH OF HOLE: 5.5	18. TOTAL CORE RECOVERY FOR BORING %
	19. SIGNATURE OF INSPECTOR

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV-ERY e	BOX OR SAMPLE NO. f	REMARKS *(Drilling time, water loss, depth weathering, etc., if significant)* g
	0.0		TOPSOIL			
					1 0.2 2.0	All samples are 'Bulk Samples' retrieved from side of test pit.
	0.7		Brown Silty Clayey SAND (SC-SM)			
					2 2.0 3.5	
	3.5		Brown Silty CLAY, trace gravel (CL)		3 3.5 5.5	
	5.5					

Hole No. SB-4

DRILLING LOG	DIVISION: Chicago	INSTALLATION: Test Pit	SHEET 1 OF 1 SHEETS

1. PROJECT: Saganashkee Slough	10. SIZE AND TYPE OF BIT: NA
2. LOCATION (Coordinates or Station): Palos, IL N 1,830,222.6 E 1,109,685.3	11. DATUM FOR ELEVATION SHOWN *(TBM or MSL)*
3. DRILLING AGENCY: TesTech	12. MANUFACTURER'S DESIGNATION OF DRILL: NA
4. HOLE NO. *(As shown on drawing title and file number)*: SB-4	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN — DISTURBED: 3 — UNDISTURBED:
5. NAME OF DRILLER: Greg Reid	14. TOTAL NUMBER CORE BOXES
6. DIRECTION OF HOLE: ☐ VERTICAL ☐ INCLINED ---- DEG. FROM VERT.	15. ELEVATION GROUND WATER
7. THICKNESS OF OVERBURDEN	16. DATE HOLE — STARTED: 8/10/2012 — COMPLETED: 8/10/2012
8. DEPTH DRILLED INTO ROCK: NA	17. ELEVATION TOP OF HOLE
9. TOTAL DEPTH OF HOLE: 5.0	18. TOTAL CORE RECOVERY FOR BORING %
	19. SIGNATURE OF INSPECTOR

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS *(Drilling time, water loss, depth weathering, etc., if significant)* g
	0.0		TOPSOIL		1 0.0 1.2	All samples are 'Bulk Samples' retrieved from side of test pit.
	0.4		Brown CLAY (CL)		2 1.2 3.0	
	3.0		Brown Silty Sandy CLAY, trace gravel, trace organics (CL)		3 3.0 5.0	
	5.0					

Hole No. SB-5

DRILLING LOG

DIVISION: Chicago	INSTALLATION: Test Pit	SHEET 1 OF 1 SHEETS	

1. PROJECT: Saganashkee Slough	10. SIZE AND TYPE OF BIT: NA
2. LOCATION (Coordinates or Station): Palos, IL N 1,830,320.1 E 1,109,971.9	11. DATUM FOR ELEVATION SHOWN *(TBM or MSL)*
3. DRILLING AGENCY: TesTech	12. MANUFACTURER'S DESIGNATION OF DRILL: NA
4. HOLE NO. *(As shown on drawing title and file number)*: SB-5	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN — DISTURBED: 3 — UNDISTURBED:
5. NAME OF DRILLER: Greg Reid	14. TOTAL NUMBER CORE BOXES
6. DIRECTION OF HOLE: ☐ VERTICAL ☐ INCLINED ___---___ DEG. FROM VERT.	15. ELEVATION GROUND WATER
7. THICKNESS OF OVERBURDEN	16. DATE HOLE — STARTED: 8/10/2012 — COMPLETED: 8/10/2012
8. DEPTH DRILLED INTO ROCK: NA	17. ELEVATION TOP OF HOLE
9. TOTAL DEPTH OF HOLE: 5.0	18. TOTAL CORE RECOVERY FOR BORING %
	19. SIGNATURE OF INSPECTOR

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS *(Drilling time, water loss, depth weathering, etc., if significant)* g
	0.1		TOPSOIL			
			Brown SILT (ML)		1 0.1 1.0	All samples are 'Bulk Samples' retrieved from side of test pit.
					2 1.0 3.5	
					3 3.5 5.0	
	5.0					

Hole No. SB-6

DRILLING LOG

DIVISION: Chicago	INSTALLATION: Test Pit	SHEET 1 OF 1 SHEETS	

1. PROJECT: Saganashkee Slough	10. SIZE AND TYPE OF BIT: NA
2. LOCATION (Coordinates or Station): Palos, IL N 1,829,893.3 E 1,109,773.7	11. DATUM FOR ELEVATION SHOWN *(TBM or MSL)*
3. DRILLING AGENCY: TesTech	12. MANUFACTURER'S DESIGNATION OF DRILL: NA
4. HOLE NO. *(As shown on drawing title and file number)*: SB-6	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN — DISTURBED: 2 — UNDISTURBED:
5. NAME OF DRILLER: Greg Reid	14. TOTAL NUMBER CORE BOXES
6. DIRECTION OF HOLE: ☐ VERTICAL ☐ INCLINED ---- DEG. FROM VERT.	15. ELEVATION GROUND WATER
7. THICKNESS OF OVERBURDEN	16. DATE HOLE — STARTED: 8/9/2012 — COMPLETED: 8/10/2012
8. DEPTH DRILLED INTO ROCK: NA	17. ELEVATION TOP OF HOLE
9. TOTAL DEPTH OF HOLE: 4.5	18. TOTAL CORE RECOVERY FOR BORING %
	19. SIGNATURE OF INSPECTOR

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS *(Drilling time, water loss, depth weathering, etc., if significant)* g
	0.1		TOPSOIL			
			Brown Clayey SAND, some gravel (SC)		1 0.1 2.1	All samples are 'Bulk Samples' retrieved from side of test pit.
					2 2.1 4.5	
	4.5					

Hole No. SB-7

DRILLING LOG	DIVISION: Chicago	INSTALLATION: Test Pit	SHEET 1 OF 1 SHEETS

1. PROJECT: Saganashkee Slough	10. SIZE AND TYPE OF BIT: NA
2. LOCATION (Coordinates or Station): Palos, IL N 1,830,067.1 E 1,109,984.1	11. DATUM FOR ELEVATION SHOWN *(TBM or MSL)*
3. DRILLING AGENCY: TesTech	12. MANUFACTURER'S DESIGNATION OF DRILL: NA
4. HOLE NO. *(As shown on drawing title and file number)*: SB-7	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 3; UNDISTURBED
5. NAME OF DRILLER: Greg Reid	14. TOTAL NUMBER CORE BOXES
6. DIRECTION OF HOLE: ☐ VERTICAL ☐ INCLINED ---- DEG. FROM VERT.	15. ELEVATION GROUND WATER
7. THICKNESS OF OVERBURDEN	16. DATE HOLE: STARTED 8/9/2012; COMPLETED 8/10/2012
8. DEPTH DRILLED INTO ROCK: NA	17. ELEVATION TOP OF HOLE
9. TOTAL DEPTH OF HOLE: 4.0	18. TOTAL CORE RECOVERY FOR BORING %
	19. SIGNATURE OF INSPECTOR

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS *(Drilling time, water loss, depth weathering, etc., if significant)* g
	0.1		TOPSOIL			
			Brown Sandy CLAY, silt and gravel (CL)		1 0.1 1.9	All samples are 'Bulk Samples' retrieved from side of test pit.
	1.9					
			Gray CLAY (CL)		2 1.9 2.9	
					3 2.9 4.0	
	4.0					

Hole No. SB-8

DRILLING LOG	DIVISION: Chicago	INSTALLATION: Test Pit	SHEET 1 OF 1 SHEETS

1. PROJECT: Saganashkee Slough	10. SIZE AND TYPE OF BIT: NA
2. LOCATION (Coordinates or Station): Palos, IL N 1,830,000.0 E 1,110,411.0	11. DATUM FOR ELEVATION SHOWN *(TBM or MSL)*
3. DRILLING AGENCY: TesTech	12. MANUFACTURER'S DESIGNATION OF DRILL: NA
4. HOLE NO. *(As shown on drawing title and file number)*: SB-8	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN — DISTURBED: 3 — UNDISTURBED:
5. NAME OF DRILLER: Greg Reid	14. TOTAL NUMBER CORE BOXES
6. DIRECTION OF HOLE: ☐ VERTICAL ☐ INCLINED ___--___ DEG. FROM VERT.	15. ELEVATION GROUND WATER
7. THICKNESS OF OVERBURDEN	16. DATE HOLE — STARTED: 8/10/2012 — COMPLETED: 8/10/2012
8. DEPTH DRILLED INTO ROCK: NA	17. ELEVATION TOP OF HOLE
9. TOTAL DEPTH OF HOLE: 5.0	18. TOTAL CORE RECOVERY FOR BORING %
	19. SIGNATURE OF INSPECTOR

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV-ERY e	BOX OR SAMPLE NO. f	REMARKS *(Drilling time, water loss, depth weathering, etc., if significant)* g
	0.0		Gray SILT (ML)		1 0.0 1.0	All samples are 'Bulk Samples' retrieved from side of test pit.
					2 1.0 3.0	
	3.0		Brown Sandy CLAY, trace silt, trace gravel (CL)		3 3.0 5.0	
	5.0					

DRILLING LOG

DIVISION: Chicago	INSTALLATION: Test Pit	SHEET 1 OF 1 SHEETS	

1. PROJECT: Saganashkee Slough	10. SIZE AND TYPE OF BIT: NA
2. LOCATION (Coordinates or Station): Palos, IL N 1,829,625.1 E 1,110,359.2	11. DATUM FOR ELEVATION SHOWN *(TBM or MSL)*
3. DRILLING AGENCY: TesTech	12. MANUFACTURER'S DESIGNATION OF DRILL: NA
4. HOLE NO. *(As shown on drawing title and file number)*: SB-9	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN — DISTURBED: 3 — UNDISTURBED:
5. NAME OF DRILLER: Greg Reid	14. TOTAL NUMBER CORE BOXES
6. DIRECTION OF HOLE: ☐ VERTICAL ☐ INCLINED ---- DEG. FROM VERT.	15. ELEVATION GROUND WATER
7. THICKNESS OF OVERBURDEN	16. DATE HOLE — STARTED: 8/10/2012 — COMPLETED: 8/10/2012
8. DEPTH DRILLED INTO ROCK: NA	17. ELEVATION TOP OF HOLE
9. TOTAL DEPTH OF HOLE: 4.5	18. TOTAL CORE RECOVERY FOR BORING %
	19. SIGNATURE OF INSPECTOR

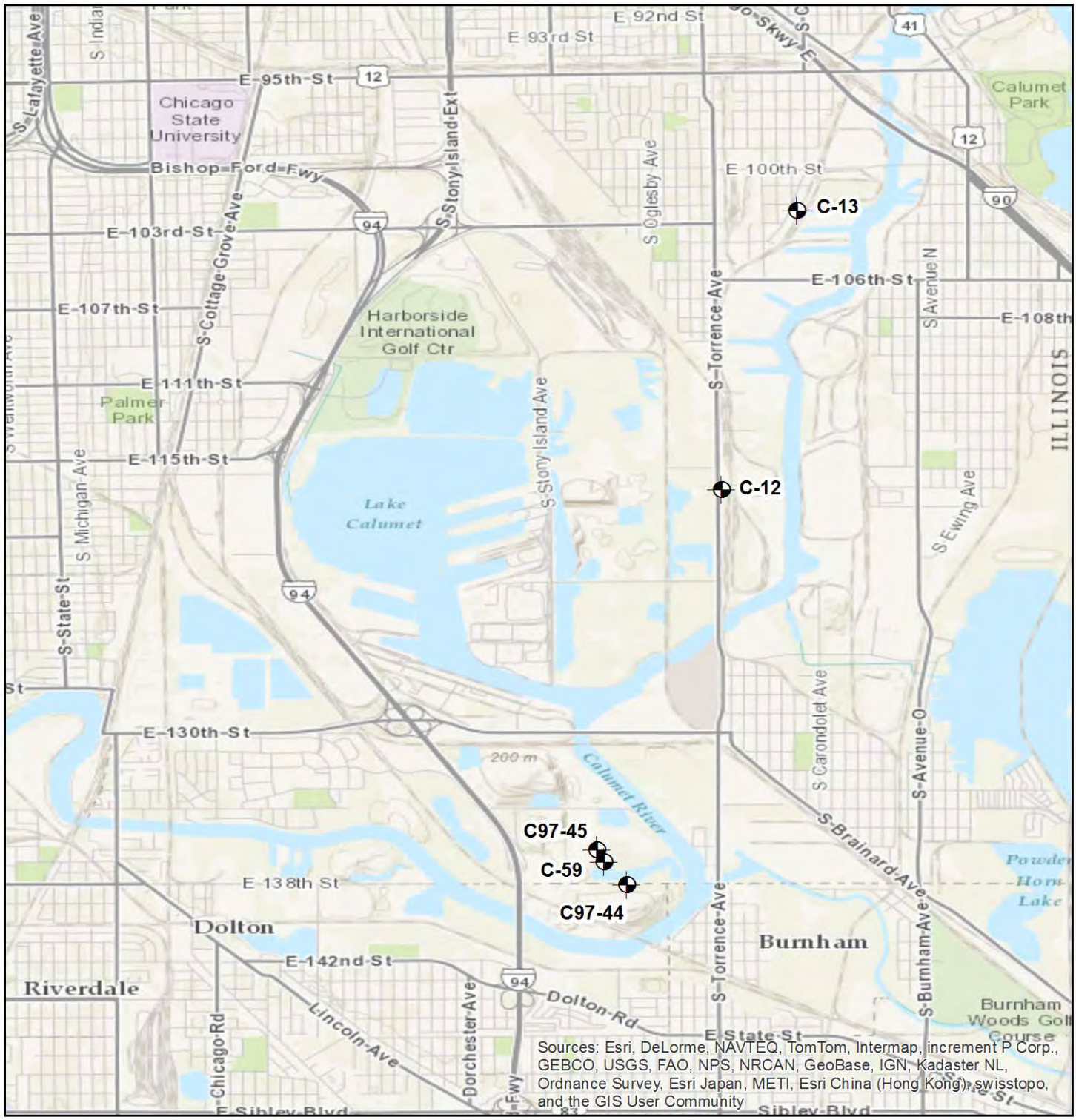
ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS *(Drilling time, water loss, depth weathering, etc., if significant)* g
	0.0		Brown CLAY, trace gravel (CL)		1 0.0 1.0	All samples are 'Bulk Samples' retrieved from side of test pit.
					2 1.0 3.0	
	3.0		Gray Silty CLAY, trace sand, trace gravel (CL)		3 3.0 4.5	
	4.5					

ENCLOSURE E

BORING LOGS NEAR CALUMET CITY, IL LOCATION

Calumet City, IL

GLMRIS



Legend

Boring Locations

Date: 9/30/2013

1 IN = 5,000 FT

Path: J:\LRC_Projects\PRJ_GLMRIS\MXD\Borings\CalCity.mxd

NOTES AND LEGEND

FORMATION: Based on H.B.Willman, 1971

CASING: Indicates casing left in place.

ROCK CONDITION: w = weathered
x = broken or fragmented
s = susceptible to slaking
s = shale partings susceptible to slaking

JOINTING: J = Stratigraphic position of joint with dip in degrees with reference to horizontal. F = fault position. f = fill material with sh for shale, cl for clay, py for pyrite, Ca for calcite, Fe for iron stain, sl for slickensides. Fill thickness in 10^{-2} ft.

BEDDING: Horizontal except as noted.
th = thick-bedded (>2')
t = thin-bedded (2' to 2")
vt = very thin or laminated (<2")

CORE RECOVERY: % core recovered per run.

ROCK QUALITY DESIGNATION (RQD): Indicates ratio of total length of core pieces 4" or longer in length to total length of drilling run. Mechanical breaks are considered as unbroken core.

WATER PRESSURE TEST: Conducted over the stratigraphic intervals shown. Water loss in cfm (net pressure in psi.)

▼ 4/1/74 = Groundwater level and date observed.

WETTING AND DRYING TESTS:
△ = no significant change in sample
▲ = significant change in sample

SOAKING TESTS:
○ = no significant change
● = significant change

UNCONFINED COMPRESSIVE STRENGTH: Ultimate strength in psi.

MODULUS OF ELASTICITY, POISSON'S RATIO: In psi x 10^6
E_t = Young's modulus (static)
E_d = Young's modulus (dynamic)
u_t = Poisson's ratio (static)
u_d = Poisson's ratio (dynamic)

MISCELLANEOUS TESTS:
A = abrasion (percent of wear)
R = Schmidt hammer hardness
k_v = permeability, vertical (darcys)
k_h = permeability, horizontal (darcys)
wc = moisture content (percent)
n = porosity (percent)
Sat = saturation (percent)
I_{dl} = slake-durability index (percent)
G_s = specific gravity
T = split cylinder strength (psi)
γ_d = dry unit weight (pcf)

TESTS FOR WHICH ONLY STRATIGRAPHIC POSITION IS SHOWN:
P = petrographic analysis
C = chemical analysis
Cr = creep
Tr = triaxial

GROUND ELEVATION (CCD): 579.48 U.S.C. and G.S. = Chicago City Datum.

Elevations and Locations were surveyed and furnished by Arthur R. Schmidt

Ill. Reg. No. 35-1935

DESCRIPTION

Coordinates: N 1,827,818.16 E 711,529.32 Angle: Vertical Bearing: ——

Location: 190 ft.S of 117th St., 90 ft.E of Torrence Ave.

Ground Elevation (CCD): 6.27

SYSTEM: QUATERNARY; SERIES OR GROUP: PLEISTOCENE; FORMATION: Racine; GRAPHIC LOG: CASING

Overburden: fill and glacial drift.

NO SAMPLES TAKEN

SYSTEM: SILURIAN; SERIES OR GROUP: NIAGARAN; FORMATION: Racine

Dolomite, inter-reef facies, argillaceous. Fine grained. Light to medium gray, slugish gray, occasionally mottled. Locally porous, dark gray to black shale partings: 97.8 - 142.6.
Breccia, dark gray angular fragments, 0.03 ft. maximum diameter, most smaller, in matrix of light to medium gray dolomite: 107.0 - 108.8.
Brownish dolomitic shale: 123.9 - 124.2.
Light gray clay, medium soft: 125.5 - 126.4.
Interbedded zones of brownish shaly dolomite, dolomitic shale and brown shale partings: 142.6 - 186.3.

Extensively mottled. Occasional thin gray and green shale partings. Some stylolites, especially toward bottom. Slightly porous, increasing downward: 186.3 - 216.1.
Two small vugs, 0.02 ft. in diameter, with pyrite: 192.9.
Vug with pyrite, 0.04 ft. in diameter: 195.8.
Nearly white: 213.0 - 216.1.

Dolomite, reef facies, medium grained. Light, medium and dark gray, occasionally bluish gray. Porous and vuggy with several interbedded zones of fairly dense rock. Numerous stylolites. Core tends to break along stylolites. Some green clay on stylolitic partings: 216.1 - 339.6.
Several scattered white chert nodules: 225.0 - 235.0.

Fairly dense: 280.0 - 288.7.

SYSTEM: SILURIAN; SERIES OR GROUP: ALEXANDRIAN; FORMATION: Joliet; Romeo

Dolomite, dense, fine grained. Light gray to white. Several vugs scattered throughout. Rare green shale partings and rare stylolites: 339.6 - 352.3.
Two vugs, each 0.05 ft. diameter, pyrite: 346.4.

FORMATION: Joliet; Markgraf

Dolomite, moderately argillaceous. Fine grained. Light to medium gray and bluish gray, often mottled. Numerous gray and green shale partings scattered unevenly throughout: 352.3 - 387.4
Vugs with calcite: 357.2 - 357.5, 358.8 - 359.0.
Slightly porous: 383.4 - 387.4.

FORMATION: Kankakee; Edgewood

Dolomite, slightly argillaceous, fine to medium grained. Light to medium gray and pinkish gray. Numerous green shale partings, increase in frequency downward. Partings spaced 0.1 - 0.5 ft. apart, 0.01 ft. thick. Core tends to break along partings. Several scattered vugs: 387.4 - 413.9.

Dolomite, moderately argillaceous. Fine to medium grained. Light to medium gray. Occasional porosity and vugs. Numerous gray and green shale partings, generally less than 0.1 ft. apart. Partings become thicker with depth, especially in lower 10 ft. where rock becomes 40% shale. Numerous white chert nodules and bedded chert, 0.3 ft. maximum thickness. Core tends to break along nodules. Chert decreases below 460.0, and is absent below 466.0: 413.9 - 496.5.

SYSTEM: ORDOVICIAN; FORMATION: Maquoketa; Brainard; Ft. Atkinson

Shale, medium to dark green, very fine grained. Several light gray dolomite interbeds: 496.5 - 501.0.
Brown fragments, 0.01-0.05 ft. diameter, in green shale matrix: 500.0 - 501.0.

Dolomite, medium grained. Pinkish gray. Occasional stylolites and green shale partings, as much as 0.03 ft. thick. Often porous and vuggy.

E.C.H. 505.6

DEPTH IN FEET	ROCK CONDITION	JOINTING	BEDDING	CORE RECOVERY	ROCK QUALITY DESIGNATION	WATER PRESSURE TESTS, CFM, (PSI) & WATER LEVEL	WETTING & DRYING, SOAKING TESTS	UNCONFINED COMPRESSIVE STRENGTH	MODULUS OF ELASTICITY, POISSON'S RATIO	MISCELLANEOUS TESTS AND REMARKS
0						▼ 8-2-74				
100	x		t,vt	100	80			7,600		
	x,w, s		t	98	81					
					100	0.00 (80)				
	x,s, z	J80 J80 f(cl)	t,vt		100			15,700		
					91					
					96	0.00 (80)				
					97					
	s		t		97					
					100	0.00 (80)		19,100	I_{dl} 99.1	
					100					
		J90 J90	th		100			36,100	E_d 1.753 u_d 0.333 E_t 12.50 E_t 12.50	T 1500 R 39 n 3.76 Tr
		J85 f(Py) J90	t		100	0.03 (80)		24,500	E_d 2.985 u_d 0.327 E_t 783.4 u_t 0.216 E_t 11.01	T 1200 R 29 P k_h 8.72 × 10^{-6} k_v 3.83 × 10^{-6}
	x	J90 f(Py) J90			95			14,200	E_d 1.348 u_d 0.290	
		J80			100	0.00 (80)				
					100			11,100		C
	x				94					Tr
	x			100	88	0.03 (80)		15,600		
					87					
					97					
			th		92	0.03 (80)		13,300		
	s	J90	t		92					
					98					
		J80 f(cl) 0.01			98	0.03 (80)				
					100			26,400		
	s		t		100					
					100	0.03 (80)				
	s		t		100					
					99					
					91	0.02 (80)				
					100			13,400		I_{dl} 169.1 G_s 2.71 wc 0.40
					100					
					100	0.04 (80)		24,600		
	s		vt		98					
			t		100					
	s				93					
600										

KEIFER & ASSOCIATES, INC. CHICAGO, ILLINOIS

Drawn C.T.G. Checked C.M.K. Approved [signature] DATE

THE METROPOLITAN WATER RECLAMATION DISTRICT OF GREATER CHICAGO

TUNNEL AND RESERVOIR PLAN
CALUMET SYSTEM
CONTRACT 75-208-2H

DRILL HOLE DATA
C-12

SHEET NO. SB3

271

NOTES AND LEGEND

FORMATION: Based on H.B.Willman, 1971

CASING: Indicates casing left in place.

ROCK CONDITION: w = weathered
x = broken or fragmented
s = susceptible to slaking
s' = shale partings susceptible to slaking

JOINTING: J = Stratigraphic position of joint with dip in degrees with reference to horizontal. F = fault position. f = fill material with sh for shale, cl for clay, py for pyrite, Ca for calcite, Fe for iron stain, sl for slickensides. Fill thickness in 10^{-2} ft.

BEDDING: Horizontal except as noted.
th = thick-bedded (>2')
t = thin-bedded (2' to 2")
vt = very thin or laminated (<2")

CORE RECOVERY: % core recovered per run.

ROCK QUALITY DESIGNATION (RQD): Indicates ratio of total length of core pieces 4" or longer in length to total length of drilling run. Mechanical breaks are considered as unbroken core.

WATER PRESSURE TEST: Conducted over the stratigraphic intervals shown. Water loss in cfm (net pressure in psi.)

▼ 4/1/74 = Groundwater level and date observed.

WETTING AND DRYING TESTS:
△ = no significant change in sample
▲ = significant change in sample

SOAKING TESTS:
○ = no significant change
● = significant change

UNCONFINED COMPRESSIVE STRENGTH: Ultimate strength in psi.

MODULUS OF ELASTICITY, POISSON'S RATIO: In psi x 10^6
E_t = Young's modulus (static)
E_d = Young's modulus (dynamic)
u_t = Poisson's ratio (static)
u_d = Poisson's ratio (dynamic)

MISCELLANEOUS TESTS:
A = abrasion (percent of wear)
R = Schmidt hammer hardness
k_v = permeability, vertical (darcys)
k_h = permeability, horizontal (darcys)
wc = moisture content (percent)
n = porosity (percent)
Sat = saturation (percent)
I_{dl} = slake-durability index (percent)
G_s = specific gravity
T = split cylinder strength (psi)
γ_d = dry unit weight (pcf)

TESTS FOR WHICH ONLY STRATIGRAPHIC POSITION IS SHOWN:
P = petrographic analysis
C = chemical analysis
Cr = creep
Tr = triaxial

GROUND ELEVATION (CCD): 579.48 U.S.C. and G.S. = Chicago City Datum.

Elevations and Locations were surveyed and furnished by Arthur R. Schmidt

Ill. Reg. No. 35-1935

DESCRIPTION

Coordinates: N 1,837,641.44 E 713,438.66 Angle: Vertical Bearing: —

Location: 195 ft.S of 102nd St., 175 ft.W of Commercial Ave.

Ground Elevation (CCD): 7.02

Depth	System	Series or Group	Formation	Graphic Log	Casing	Description	Rock Condition	Jointing	Bedding	Core Recovery	Rock Quality Designation	Water Pressure Tests, CFM, (PSI) & Water Level	Wetting & Drying, Soaking Tests	Unconfined Compressive Strength	Modulus of Elasticity, Poisson's Ratio	Miscellaneous Tests and Remarks
0	QUATERNARY	PLEISTOCENE				Overburden: fill and glacial drift. NO SAMPLES TAKEN										
80						Dolomite, inter-reef facies, moderately argillaceous, fine grained. Light to medium gray and bluish gray, becoming lighter downward. Occasional mottling with dark bluish gray speckling in light gray matrix. Numerous green shale partings scattered unevenly throughout: 79.2-131.0.		J90 f(Py)	t	100	97	10-2-74		16,300		
100						Several small white chert nodules: 110.0 - 110.6. Slight porosity: 111.0 - 131.0. Occasional stylolites: 121.0 - 131.0. Soft green clay: 126.3 - 126.5.				97	100					
120						Dolomite, reef facies, medium grained. Light to medium gray, locally dark gray or brownish gray. Generally porous and vuggy with some interbedded zones of fairly dense rock. Numerous stylolites. Core tends to break along stylolites: 131.0 - 336.5. Fairly dense, light gray to white: 138.5 - 145.0.	x		th		96 100 95 100 92	0.24 (80)		33,600		
140								J90								
160						Extremely vuggy, dark brownish gray to gray. Occasional green shale partings, 0.03 ft. maximum thickness. Partings are usually at 20° angle to horizontal: 165.0 - 193.0.	s	J90			100 100 96			15,900 11,200	E_d 2,340 u_d 0.208 E_t 12.41	T 1,200
180								J90								
200						Fairly dense, light gray to white: 194.6 - 200.0. Fairly dense: 209.0 - 217.0.	x x x	J70 J90 J90			90 75 98	0.19 (80)		17,900 18,700	E_t 9,423 u_t 0.317 E_d 4,194 u_d 0.244	T 1,400 n 2.48 G_s 2.68 γ_d 166.9 wc 2.49 R 21
220											100					
240											100			12,000	E_t 9,452	
260						Core split along axis in two places: 259.9 - 262.2.					100 100	0.27 (80)		7,700		
280							x	J90 f(Cl) 0.01 J90			83 90					
300						Fairly dense, green shale partings: 298.0 - 303.0. Occasional pyrite filled vugs: 307.0 - 320.0.	x			100	60 94			19,300		
320								J90 f(Py)			82					
340			Racine			Porosity decreases: 334.5 - 336.5.		J90	th		100	0.33 (80)		26,100		
360			Joliet			Dolomite, dense, fine grained. Light gray to white. Occasional stylolites. Core tends to break along stylolites: 336.5 - 354.6. Several vugs: 336.7 - 337.1- Several clusters of green shale partings: 351.6 - 354.6.	s	J90 f(Py) J90 f(Py)	t		100 91 98					
380			Markgraf			Dolomite, moderately argillaceous, fine grained. Light to medium gray and bluish gray, slightly mottled. Numerous green shale partings scattered unevenly throughout: 354.6 - 384.2. Fine to medium grained, slightly porous and pinkish: 380.2 - 384.2.	s x				94			28,000		
400			Kankakee			Dolomite, slightly argillaceous, fine to medium grained. Light to medium gray and pinkish gray. Numerous green shale partings scattered throughout. Partings become more frequent with depth, 0.02 ft. maximum thickness, spaced 0.1-0.5 ft. apart. Few partings in upper 10 ft. Core tends to break along partings. Occasional vugs scattered throughout: 384.2 - 410.7. Porous, pinkish white: 384.2 - 386.2.			t		100					
420			Edgewood			Dolomite, moderately argillaceous, fine to medium grained. Light to medium gray, becomes darker gray in lower 15 ft. Numerous green and gray shale partings throughout, less than 0.1 ft. apart. Partings become thicker with depth. In lower 10 ft. partings are as thick as 0.3 ft. where rock becomes 40% shale. Numerous white chert nodules, 0.25 ft. maximum thickness, spaced 0.3-2.5 ft. apart. Chert decreases below 454.5 and is absent below 465.0. Where present chert makes up 10% of rock. Core tends to break along nodules. Slight porosity and some vugs scattered throughout: 410.7 - 492.5.	s				100 90					
440											100	0.01 (60)		13,800		
460											100 100 100 100					
480								J90 f(Cl) 0.02			100					
500	ORDOVICIAN	ALEXANDRIAN	MAQUOKETA			Shale, very fine grained. Dark gray to green. Light gray dolomite interbeds make up 30-40% of rock.	s		vt t							
520			Ft. Atkinson Brainard			Dolomite, fine to medium grained. Pinkish gray. Occasional stylolites and green shale partings.										
540						E.O.H. 496.2										
560																
580																
600																

THE METROPOLITAN WATER RECLAMATION DISTRICT OF GREATER CHICAGO

TUNNEL AND RESERVOIR PLAN
CALUMET SYSTEM
CONTRACT 75-208-2H

DRILL HOLE DATA
C-13

KEIFER & ASSOCIATES, INC. CHICAGO, ILLINOIS

Drawn C.T.G. Checked C.M.K. Approved [signature] DATE SHEET NO. SB4

NOTES AND LEGEND

FORMATION: Based on H.B.Willman, 1971

CASING: Indicates casing left in place.

ROCK CONDITION: w = weathered
x = broken or fragmented
s = susceptible to slaking
s = shale partings susceptible to slaking

JOINTING: J = Stratigraphic position of joint with dip in degrees with reference to horizontal. F = fault position. f = fill material with sh for shale, cl for clay, py for pyrite, Ca for calcite, Fe for iron stain, sl for slickensides. Fill thickness in 10^{-2} ft.

BEDDING: Horizontal except as noted.
th = thick-bedded (>2')
t = thin-bedded (2' to 2")
vt = very thin or laminated (<2")

CORE RECOVERY: % core recovered per run.

ROCK QUALITY DESIGNATION (RQD): Indicates ratio of total length of core pieces 4" or longer in length to total length of drilling run. Mechanical breaks are considered as unbroken core.

WATER PRESSURE TEST: Conducted over the stratigraphic intervals shown. Water loss in cfm (net pressure in psi.)

▼ 4/1/74 = Groundwater level and date observed.

WETTING AND DRYING TESTS:
△ = no significant change in sample
▲ = significant change in sample

SOAKING TESTS:
○ = no significant change
● = significant change

UNCONFINED COMPRESSIVE STRENGTH: Ultimate strength in psi.

MODULUS OF ELASTICITY, POISSON'S RATIO: In psi x 10^6
E_t = Young's modulus (static)
E_d = Young's modulus (dynamic)
u_t = Poisson's ratio (static)
u_d = Poisson's ratio (dynamic)

MISCELLANEOUS TESTS:
A = abrasion (percent of wear)
R = Schmidt hammer hardness
k_v = permeability, vertical (darcys)
k_h = permeability, horizontal (darcys)
wc = moisture content (percent)
n = porosity (percent)
Sat = saturation (percent)
I_{dl} = slake-durability index (percent)
G_s = specific gravity
T = split cylinder strength (psi)
γ_d = dry unit weight (pcf)

TESTS FOR WHICH ONLY STRATIGRAPHIC POSITION IS SHOWN:
P = petrographic analysis
C = chemical analysis
Cr = creep
Tr = triaxial

GROUND ELEVATION (CCD): 579.48 U.S.C. and G.S. = Chicago City Datum.

Elevations and Locations were surveyed and furnished by Arthur R. Schmidt

Ill. Reg. No. 35-1935

DESCRIPTION

Coordinates: N 1,813,956.93 E 709,160.71 Angle: Vertical Bearing: ——

Location: 1645 ft.N of Penn.Cent.RR. ℄, 1615 ft.W of Little Cal. R. ℄

Ground Elevation (CCD): 9.24

Depth	System	Series or Group	Formation	Graphic Log	Casing	Description	Rock Condition	Jointing	Bedding	Core Recovery	RQD	Water Pressure Tests, CFM, (PSI) & Water Level	Wetting & Drying, Soaking Tests	Unconfined Compressive Strength	Modulus of Elasticity, Poisson's Ratio	Miscellaneous Tests and Remarks
0	QUATERNARY	PLEISTOCENE				Overburden: fill and glacial drift. NO SAMPLES TAKEN						▼ 9/17/74				
80						Dolomite, inter-reef facies, argillaceous. Fine grained. Light to medium gray and bluish gray: 83.3 - 159.9. Brown due to iron staining. Locally porous: 83.3 - 91.0. Breccia with dark gray dolomite fragments, angular, maximum 0.05 ft. diameter, in light gray matrix: 88.5 - 91.0. Rare mottling: 91.0 - 159.9. Interbeds of brown shaly dolomite and dolomitic shale, maximum 1.0 ft. thick. Shale makes up 10% of this section. Light gray dolomite blebs and fossil fragments within shaly interbeds: 112.0 - 136.0.	w, x s, s		t t vt, t		97 100 100 100 100			15,000 16,600		
140						Moderately argillaceous. Frequent mottling with dark bluish gray speckling in light gray matrix. Numerous brown, gray, and green shale partings scattered throughout. Also interbeds of brown dolomitic shale make up 10% of rock in this section. Shaly interbeds are usually less than 0.5 ft. thick and contain dolomite blebs and fossil fragments: 159.9 - 232.3.	s, s		t, vt		100 100 100 100 97 100	0.01 (80)		24,200	E_t 6.637	
200			Racine											17,700	E_t 9.001	T 1,680
220						Slightly porous, occasional stylolites: 226.0 - 232.3.	vv	J90	th		100			27,800	E_d 3.95 u_d 0.252	T 1360
240			NIAGARAN			Light gray to white, slight mottling. Occasional stylolites, slightly porous throughout. Several chert nodules near bottom, less than 5% of rock: 232.3 - 253.2.	x	J90 f(py)			97 93	0.00 (80)		24,900	E_d 4.467 u_d 0.219	T 1,620 n 2.67
260						Dolomite, reef facies, medium grained. Light to medium gray, locally dark gray. Porous and vuggy with some interbedded sections of fairly dense rock. Numerous stylolites. Core tends to break along stylolites: 253.2 - 342.0. Core split along axis: 255.1 - 255.7.	x x x	J90 f(cl,py) 0.01 J70 f(cl) 0.01 J80	th		98 100 98			22,400	E_d 3.511 u_d 0.200	
280						Core split along axis: 279.7 - 280.5.	x	J90			94	0.60 (80)		14,100	E_t 11.00	
300						Fairly dense, light gray to white, few green shale partings: 293.1 - 301.1.	x	J90		100	96 94			17,900		
320											94 88					
340			Joliet			Dolomite, fine grained, dense. Light gray to white. Occasional stylolites. Core tends to break along stylolites. Green clay along stylolitic partings: 342.0 - 350.3.	x	J90 f(py)	Tn		86 98			42,700		R 40
360			Markgraf			Dolomite, moderately argillaceous. Fine grained. Light to medium gray and bluish gray, often mottled. Occasional gray and green shale partings scattered throughout. Several stylolites in upper 5 ft.: 350.3 - 387.5. Vug, 0.05 ft. diameter: 351.1. Vug, 0.1 ft. diameter, calcite: 375.3 - 375.4. Vuggy, calcite: 379.1 - 379.6. Slightly pinkish and slightly porous: 384.5 - 387.5.	s J90 x	J90	t		97 100 100	0.36 (80)			
380			Romeo													
400			Kankakee			Dolomite, slightly argillaceous, fine to medium grained. Light to medium gray and pinkish gray. Numerous green shale partings, 0.01 ft. maximum thickness. Partings become more frequent with depth, spaced 0.05 - 0.5 ft. apart: 387.5 - 413.2. Porous, pinkish white: 387.5 - 389.5.	s x x		t		92 73			20,400		
420	ALEXANDRIAN		Edgewood			Dolomite, moderately argillaceous. Fine to medium grained. Light to medium gray, becomes slightly darker towards bottom. Numerous gray and green shale partings, less than 0.1 ft. apart. Partings become thick near bottom. In lower 5 ft. partings are as thick as 0.04 ft. Numerous white chert nodules and some bedded chert, 0.3 ft. maximum thickness, spaced 0.1 - 2 ft. apart. Core tends to break at nodules. Chert decreases below 450.0 and is absent below 464.0. Where present chert makes up 15% of rock. Slightly porous and vuggy throughout: 413.2 - 473.7.	s		t		77 74 91 75	0.00 (80)		14,200		
460											93 95					
480	ORDOVICIAN		MAQUOKETA			Shale, medium to dark green. Very fine grained. Light gray dolomite interbeds make up 20% of rock.	s		s		98 84					
500			Brainard			E.O.H. 481.5										
520																
540																
560																
580																
600																

THE METROPOLITAN WATER RECLAMATION DISTRICT OF GREATER CHICAGO

TUNNEL AND RESERVOIR PLAN
CALUMET SYSTEM
CONTRACT 75-208-2H

DRILL HOLE DATA
C-59

KEIFER & ASSOCIATES, INC. CHICAGO, ILLINOIS

Drawn D.K. | Checked C.W.A. | Approved | DATE | SHEET NO. SB13

EVEREST ENGINEERING CO.

CLIENT: HARZA ENGINEERING COMPANY
PROJECT: TARP, TORRENCE AVENUE LEG
LOCATION: WEST BANK OF CALUMET RIVER

BORING NO.: C97-44 SURFACE ELEV.: 6.38 CCD
N 1,815,150.000 E 708,370.000

JOB NO.: 613
LOGGED BY: R. A. FLOOD DATE: November 6,1997 SHEET 1 OF 2

SCALE	DEPTH ELEV (FT)	SOIL DESCRIPTION	LITHOLOGY	Water Level	SAMPLE TYPE & No.	SCALE	SPT (Blows/6")	RECOVERY (Inches)	q_u (tsf)	PID (ppm)	w (%)	REMARKS
		Loose, Brown SANDY SILT with clay										Hollow Stem Auger to 35.0'
					SS-1		5-5-3-2	18	-	0	25.0	Methane 0%
					SS-2		3-3-5-2	18	-	0	-	Methane 0%
5					ST-1	5	-	16	-	0	-	Methane 0%
	8.5 -2.1	ML (FILL) Dark Brown and Black TOPSOIL			SS-3		3-2-3	12	0.3 B	0	121.0	Methane 0% Sampled By Harza For Chemical Test
10	10.0 -3.6	Medium to Stiff, Gray LEAN CLAY with sand and organics		▼		10						
		sand seam 14.0' - 14.2'			SS-4		2-3-5	18	1.0 P	0	32.4	Methane 0%
15						15						
					SS-5		3-3-5	18	1.1 B	0	18.4	Methane 0%
20						20						
					SS-6		7-7-9	18	1.5 P	0	24.0	Methane 0%
25						25						

Continued Next Page

DRILLED BY: SEECO Environmental Services, Inc.
DRILL RIG: CME 45
BORING STARTED: October 8, 1997
BORING COMPLETED: October 8, 1997

WATER LEVEL
▽ 10.0 ' DURING DRILLING
▽ 10.0 ' AT COMPLETION
▼ 10.0 ' 24 HRS AFTER COMPLETION
▼ AFTER COMPLETION

EVEREST ENGINEERING CO.

CLIENT: HARZA ENGINEERING COMPANY
PROJECT: TARP, TORRENCE AVENUE LEG
LOCATION: WEST BANK OF CALUMET RIVER

BORING NO.: C97-44 SURFACE ELEV.: 6.38 CCD
N 1,815,150.000 E 708,370.000

JOB NO.: 613
LOGGED BY: R. A. FLOOD DATE: November 6,1997 SHEET 2 OF 2

SCALE	DEPTH ELEV (FT)	SOIL DESCRIPTION	LITHOLOGY	Water Level	SAMPLE TYPE & No.	SCALE	SPT (Blows/6")	RECOVERY (Inches)	q_u (tsf)	PID (ppm)	w (%)	REMARKS
30					SS-7	30	3-3-5	18	1.5 B	0	22.7	Methane 0%
	34.0 -27.6	CL										
35	35.0 -28.6	Medium Dense, SILT with sand ML			SS-8	35	11-18-25	18	0.5 B	0	22.6	Methane 0%
		COMPLETED AT 35.0 FEET										

DRILLED BY: SEECO Environmental Services, Inc.
DRILL RIG: CME 45
BORING STARTED: October 8, 1997
BORING COMPLETED: October 8, 1997

THIS LOG IS NOT INTENDED FOR USE INDEPENDENT FROM THE ENGINEERING REPORT

WATER LEVEL
- ▽ 10.0 ' DURING DRILLING
- ▽ 10.0 ' AT COMPLETION
- ▼ 10.0 ' 24 HRS AFTER COMPLETION
- ▼ AFTER COMPLETION

EVEREST ENGINEERING CO.

CLIENT: HARZA ENGINEERING COMPANY
PROJECT: TARP, TORRENCE AVENUE LEG
LOCATION: WEST BANK OF CALUMET RIVER

BORING NO.: C97-45 SURFACE ELEV.: 10.17 CCD
N 1,814,750.000 E 708,570.000

JOB NO.: 613
LOGGED BY: R. A. FLOOD
DATE: November 6,1997 SHEET 1 OF 2

SCALE	DEPTH ELEV (FT)	SOIL DESCRIPTION	LITHOLOGY	Water Level	SAMPLE TYPE & No.	SCALE	SPT (Blows/6")	RECOVERY (Inches)	q_u (tsf)	PID (ppm)	w (%)	REMARKS
		Medium Dense, Brown SILTY SAND with gravel										Hollow Stem Auger to 35.0'
					SS-1		5-5-6	18	-	0	7.2	Methane 0%
					SS-2		7-8-9	18	-	0	9.0	Methane 0% Sampled By Harza For Chemical Test
5						5						
	9.0 / 1.2	SM (FILL)			SS-3		8-6-9	16	0.4 B	0	89.5	Methane 0%
	10.0 / 0.2	Dark Brown and Black TOPSOIL		▼								
10		Loose, Brown and Gray SILTY FINE SAND		▽		10						
					SS-4		6-5-4	18	-	0	29.9	Methane 0%
15	15.0 / -4.8	SM				15						
		Soft to Medium, Gray LEAN CLAY with sand			SS-5		3-4-3	18	0.8 B	0	26.1	Methane 0%
20						20						
					SS-6		3-4-4	18	0.5 P	0	32.3	Methane 0%
25						25						

Continued Next Page

DRILLED BY: SEECO Environmental Services, Inc.
DRILL RIG: CME 45
BORING STARTED: October 8, 1997
BORING COMPLETED: October 9, 1997

WATER LEVEL
▽ 11.5 ' DURING DRILLING
▽ 11.5 ' AT COMPLETION
▼ 10.0 ' 24 HRS AFTER COMPLETION
▼ AFTER COMPLETION

EVEREST ENGINEERING CO.

CLIENT: HARZA ENGINEERING COMPANY
PROJECT: TARP, TORRENCE AVENUE LEG
LOCATION: WEST BANK OF CALUMET RIVER

BORING NO.: C97-45 SURFACE ELEV.: 10.17 CCD
N 1,814,750.000 E 708,570.000

JOB NO.: 613
LOGGED BY: R. A. FLOOD
DATE: November 6,1997 SHEET 2 OF 2

SCALE	DEPTH ELEV (FT)	SOIL DESCRIPTION	LITHOLOGY	Water Level	SAMPLE TYPE & No.	SCALE	SPT (Blows/6")	RECOVERY (Inches)	q_u (tsf)	PID (ppm)	w (%)	REMARKS
30					SS-7	30	4-6-8	18	0.75 P	0	24.4	Methane 0%
35	35.0 -24.8	CL			SS-8	35	8-7-7	18	1.0 P	0	22.4	Methane 0%

COMPLETED AT 35.0 FEET

DRILLED BY: SEECO Environmental Services, Inc.
DRILL RIG: CME 45
BORING STARTED: October 8, 1997
BORING COMPLETED: October 9, 1997

THIS LOG IS NOT INTENDED FOR USE INDEPENDENT FROM THE ENGINEERING REPORT

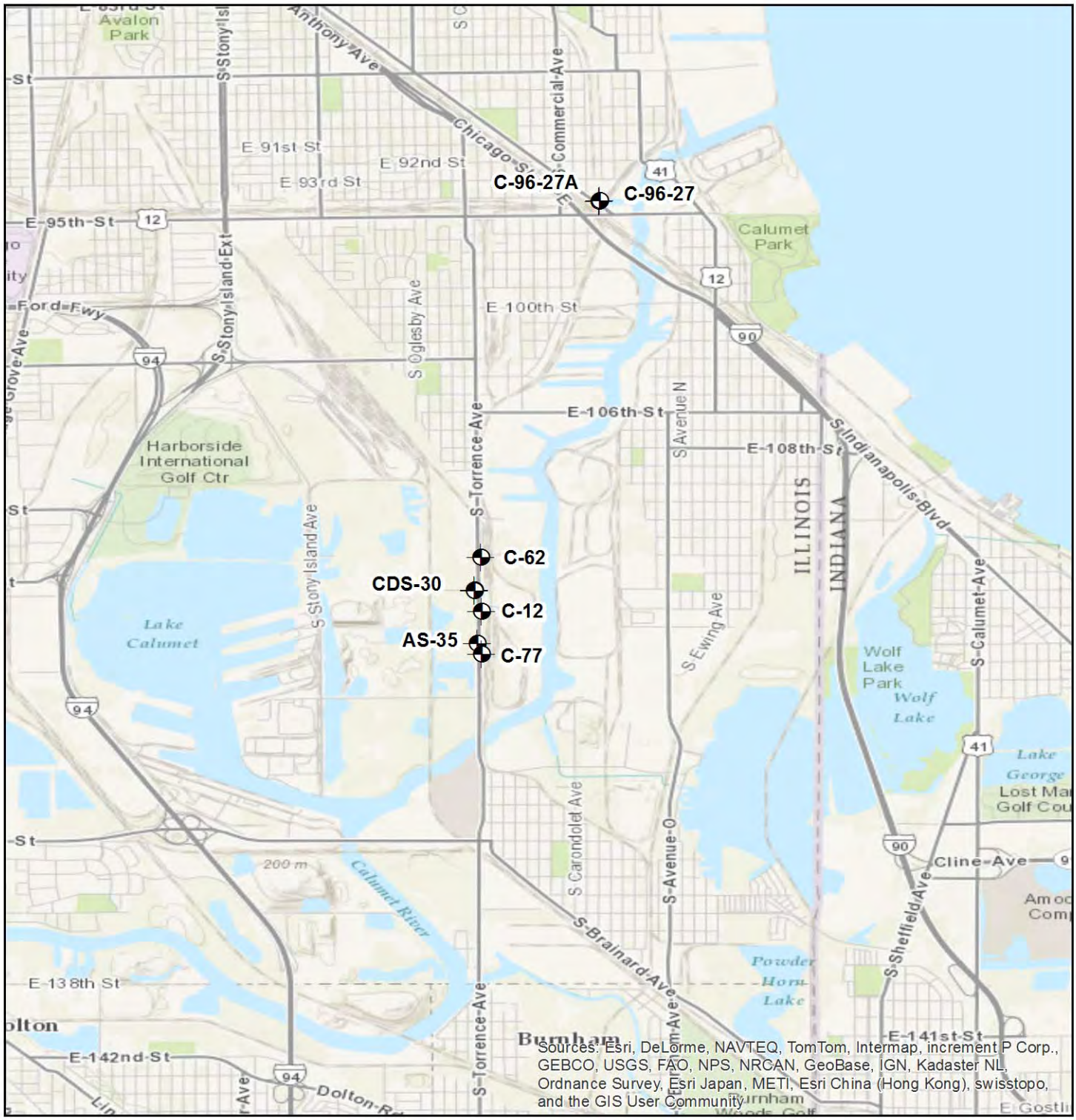
WATER LEVEL
▽ 11.5 ' DURING DRILLING
▽ 11.5 ' AT COMPLETION
▼ 10.0 ' 24 HRS AFTER COMPLETION
▼ AFTER COMPLETION

ENCLOSURE F

BORING LOGS NEAR T.J. O'BRIEN, IL LOCATION

TJ O'Brien, IL

GLMRIS



Legend

Boring Locations

Date: 9/30/2013

1 IN = 5,280 FT

Path: J:\LRC_Projects\PRJ_GLMRIS\MXD\Borings\TJOB.mxd

PROJECT METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO, CALUMET SYSTEM OF THE TUNNEL & RESERVOIR PLAN, TORRENCE AVENUE BRANCH

CLIENT KEIFER & ASSOCIATES, INC., 20 North Wacker Dr., Chicago, Illinois 60606

BORING AS-35 DATE STARTED 2-3-77 DATE COMPLETED 2-3-77 JOB 13,870

ELEVATIONS

GROUND SURFACE 6.3 C.C.D.

END OF BORING -97.2 C.C.D.

N. COORDINATE -- 1,826,611.1

E. COORDINATE -- 711,407.5

WATER TABLE

AT END OF BORING

24 HOURS -3.0'

While Drilling -3.5'

Distance Below Surface in Feet

SAMPLE NO.	TYPE	LENGTH RECOVERY	N	WC	Q_u	γ_{DRY}	DEPTH	ELEV.	SOIL DESCRIPTIONS
							0		
							2.0	4.3	FILL-Black clayey TOPSOIL, very moist
							3.0	3.3	FILL-Reddish-brown sandy CLAY, trace gravel & cinders, wet
1	SS		3	92.7			5.0	1.3	Black organic CLAY, rock pieces, very moist
							8.0	-1.7	Brown PEAT, very moist
2	SS		8				13.5	-7.2	Loose grey fine SAND, little gravel, trace clay, wet
3	SS		7	25.2	1.67 1.5*				Tough to very tough grey CLAY, little silt, moist
4	ST			24.0	2.21 2.07*	102.0			
5	SS		9	25.3	1.85 1.5*				
							28.0	-21.7	
6	ST			22.1	2.45 2.57*	105.2 104.8			Very tough grey silty CLAY, trace sand and gravel, moist
7	SS		12	22.2	2.49 2.25*				
							37.0	-30.7	
8	SS		22	13.1	6.32 4.5+*				Hard to very tough grey silty CLAY, trace sand, gravel and shale, moist

TESTING SERVICE CORPORATION

DRILL RIG NO. 53

CONTINUED ON NEXT SHEET

PROJECT METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO, CALUMET SYSTEM OF THE TUNNEL & RESERVOIR PLAN, TORRENCE AVENUE BRANCH

CLIENT KEIFER & ASSOCIATES, INC., 20 North Wacker Dr., Chicago, Illinois 60606

BORING AS-35 DATE STARTED 2-3-77 DATE COMPLETED 2-3-77 JOB 13,870

ELEVATIONS

GROUND SURFACE 6.3 C.C.D.

END OF BORING -97.2 C.C.D.

N. COORDINATE -- 1,826,611.1

E. COORDINATE -- 711,407.5

WATER TABLE

AT END OF BORING

24 HOURS -3.0'

While Drilling -3.5'

LENGTH RECOVERY	SAMPLE NO.	SAMPLE TYPE	N	WC	Q_u	%DRY	DEPTH	ELEV.	SOIL DESCRIPTIONS
	9	SS	31	13.9	4.5*				Hard to very tough gray silty CLAY, trace sand, gravel and shale, moist
	10	SS	22	16.8	4.23 4.25*				
	11	SS	17	14.6	3.75*				
	12	SS	39	12.7	7.91 4.5+*				
	13	SS	45	12.7	4.5+*				
							67.0	-60.7	
	14	SS	47						Dense grey SILT, trace clay, moist
							71.0	-64.7	
	15	SS	53	12.9	4.5+*				Hard grey silty CLAY, silt seams, trace sand, gravel and shale, moist
	16	SS	54	13.7	8.50 4.5+*				

Distance Below Surface in Feet: 40, 45, 50, 55, 60, 65, 70, 75, 80

DRILL RIG NO. 53

TESTING SERVICE CORPORATION

CONTINUED ON THIS SHEET

METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO, CALUMET SYSTEM OF THE

PROJECT TUNNEL & RESERVOIR PLAN, TORRENCE AVENUE BRANCH

CLIENT KEIFER & ASSOCIATES, INC., 20 North Wacker Dr., Chicago, Illinois 60606

BORING AS-35 DATE STARTED 2-3-77 DATE COMPLETED 2-3-77 JOB 13,870

ELEVATIONS

GROUND SURFACE 6.3 C.C.D.

END OF BORING -97.2 C.C.D.

N COORDINATE -- 1,826,611.1

E COORDINATE -- 711,407.5

WATER TABLE

AT END OF BORING

24 HOURS -3.0'

While Drilling -3.5'

Distance Below Surface in Feet	Length Recovery	Sample No.	Type	N	WC	Q_u	γ DRY	Depth	Elev.	Soil Descriptions
80										Hard grey silty CLAY, silt seams, trace sand, gravel and shale, moist
								83.5	-77.2	
85		17	SS	50/6"						Very dense silty fine SAND and fine sandy SILT, trace gravel and clay, rock pieces, moist
90		18	SS	70/6"						
								92.5	-86.2	
								93.5	-87.2	Weathered LIMESTONE
95										Light gray, Argillaceous, LIMESTONE, Dolomitic in places, moderately soft shale seams at 94.0', 94.7', 97.6', 101.0'. 6" zone of quartz recrystallization at 97.7', frequent stylalites bedding is often irregular where shale and rock fragments have recrystallized. Trace pyrite well fractured.
100		19	"NX" RC RQD	85.0% Recovery = 17%						
105				End of boring at 103.5 feet						*-Approximate unconfined compression strength based on measurements with a calibrated pocket penetrometer.
110										
115										
120										

TESTING SERVICE CORPORATION

DRILL RIG NO. 53

NOTES AND LEGEND

FORMATION: Based on H.B.Willman, 1971

CASING: Indicates casing left in place.

ROCK CONDITION: w = weathered
x = broken or fragmented
s = susceptible to slaking
s = shale partings susceptible to slaking

JOINTING: J = Stratigraphic position of joint with dip in degrees with reference to horizontal. F = fault position. f = fill material with sh for shale, cl for clay, py for pyrite, Ca for calcite, Fe for iron stain, sl for slickensides. Fill thickness in 10^{-2} ft.

BEDDING: Horizontal except as noted.
th = thick-bedded (>2')
t = thin-bedded (2' to 2")
vt = very thin or laminated (<2")

CORE RECOVERY: % core recovered per run.

ROCK QUALITY DESIGNATION (RQD): Indicates ratio of total length of core pieces 4" or longer in length to total length of drilling run. Mechanical breaks are considered as unbroken core.

WATER PRESSURE TEST: Conducted over the stratigraphic intervals shown. Water loss in cfm (net pressure in psi.)

▼ 4/1/74 = Groundwater level and date observed.

WETTING AND DRYING TESTS:
△ = no significant change in sample
▲ = significant change in sample

SOAKING TESTS:
○ = no significant change
● = significant change

UNCONFINED COMPRESSIVE STRENGTH: Ultimate strength in psi.

MODULUS OF ELASTICITY, POISSON'S RATIO: In psi x 10^6
E_t = Young's modulus (static)
E_d = Young's modulus (dynamic)
u_t = Poisson's ratio (static)
u_d = Poisson's ratio (dynamic)

MISCELLANEOUS TESTS:
A = abrasion (percent of wear)
R = Schmidt hammer hardness
k_v = permeability, vertical (darcys)
k_h = permeability, horizontal (darcys)
wc = moisture content (percent)
n = porosity (percent)
Sat = saturation (percent)
I_{dl} = slake-durability index (percent)
G_s = specific gravity
T = split cylinder strength (psi)
γ_d = dry unit weight (pcf)

TESTS FOR WHICH ONLY STRATIGRAPHIC POSITION IS SHOWN:
P = petrographic analysis
C = chemical analysis
Cr = creep
Tr = triaxial

GROUND ELEVATION (CCD): 579.48 U.S.C. and G.S. = Chicago City Datum.

Elevations and Locations were surveyed and furnished by Arthur R. Schmidt

Ill. Reg. No. 35-1935

DESCRIPTION

Coordinates: N 1,827,818.16 E 711,529.32 Angle: Vertical Bearing: ——

Location: 190 ft.S of 117th St., 90 ft.E of Torrence Ave.

Ground Elevation (CCD): 6.27

SYSTEM: QUATERNARY; SERIES OR GROUP: PLEISTOCENE; FORMATION: Racine; GRAPHIC LOG: CASING

Overburden: fill and glacial drift.

NO SAMPLES TAKEN

SYSTEM: SILURIAN; SERIES OR GROUP: NIAGARAN; FORMATION: Racine

Dolomite, inter-reef facies, argillaceous. Fine grained. Light to medium gray, slugish gray, occasionally mottled. Locally porous, dark gray to black shale partings: 97.8 - 142.6.
Breccia, dark gray angular fragments, 0.03 ft. maximum diameter, most smaller, in matrix of light to medium gray dolomite: 107.0 - 108.8.
Brownish dolomitic shale: 123.9 - 124.2.
Light gray clay, medium soft: 125.5 - 126.4.
Interbedded zones of brownish shaly dolomite, dolomitic shale and brown shale partings: 142.6 - 186.3.

Extensively mottled. Occasional thin gray and green shale partings. Some stylolites, especially toward bottom. Slightly porous, increasing downward: 186.3 - 216.1.
Two small vugs, 0.02 ft. in diameter, with pyrite: 192.9.
Vug with pyrite, 0.04 ft. in diameter: 195.8.
Nearly white: 213.0 - 216.1.

Dolomite, reef facies, medium grained. Light, medium and dark gray, occasionally bluish gray. Porous and vuggy with several interbedded zones of fairly dense rock. Numerous stylolites. Core tends to break along stylolites. Some green clay on stylolitic partings: 216.1 - 339.6.
Several scattered white chert nodules: 225.0 - 235.0.

Fairly dense: 280.0 - 288.7.

SYSTEM: SILURIAN; SERIES OR GROUP: ALEXANDRIAN; FORMATION: Joliet; Romeo

Dolomite, dense, fine grained. Light gray to white. Several vugs scattered throughout. Rare green shale partings and rare stylolites: 339.6 - 352.3.
Two vugs, each 0.05 ft. diameter, pyrite: 346.4.

FORMATION: Joliet; Markgraf

Dolomite, moderately argillaceous. Fine grained. Light to medium gray and bluish gray, often mottled. Numerous gray and green shale partings scattered unevenly throughout: 352.3 - 387.4
Vugs with calcite: 357.2 - 357.5, 358.8 - 359.0.
Slightly porous: 383.4 - 387.4.

FORMATION: Kankakee; Edgewood

Dolomite, slightly argillaceous, fine to medium grained. Light to medium gray and pinkish gray. Numerous green shale partings, increase in frequency downward. Partings spaced 0.1 - 0.5 ft. apart, 0.01 ft. thick. Core tends to break along partings. Several scattered vugs: 387.4 - 413.9.

Dolomite, moderately argillaceous. Fine to medium grained. Light to medium gray. Occasional porosity and vugs. Numerous gray and green shale partings, generally less than 0.1 ft. apart. Partings become thicker with depth, especially in lower 10 ft. where rock becomes 40% shale. Numerous white chert nodules and bedded chert, 0.3 ft. maximum thickness. Core tends to break along nodules. Chert decreases below 460.0, and is absent below 466.0: 413.9 - 496.5.

SYSTEM: ORDOVICIAN; FORMATION: Maquoketa; Brainard; Ft. Atkinson

Shale, medium to dark green, very fine grained. Several light gray dolomite interbeds: 496.5 - 501.0.
Brown fragments, 0.01-0.05 ft. diameter, in green shale matrix: 500.0 - 501.0.

Dolomite, medium grained. Pinkish gray. Occasional stylolites and green shale partings, as much as 0.03 ft. thick. Often porous and vuggy.

E.C.H. 505.6

DEPTH IN FEET	ROCK CONDITION	JOINTING	BEDDING	CORE RECOVERY	ROCK QUALITY DESIGNATION	WATER PRESSURE TESTS, CFM, (PSI) & WATER LEVEL	WETTING & DRYING, SOAKING TESTS	UNCONFINED COMPRESSIVE STRENGTH	MODULUS OF ELASTICITY, POISSON'S RATIO	MISCELLANEOUS TESTS AND REMARKS
0						▼ 8-2-74				
100	x		t,vt	100	80			7,600		
	x,w, s		t	98	81					
					100					
	x,s, z	J80 J80 f(cl)	t,vt		100	0.00 (80)		15,700		
					91					
					96	0.00 (80)				
					97					
	s		t		97			19,100	I_{dl} 99.1	
					100	0.00 (80)				
					100				E_d 1.753 u_d 0.333 E_t 12.50 E_t 12.50	T 1500 R 39 n 3.76 Tr
		J90 J90	th		100			36,100		
		J85 f(py) J90			100	0.03 (80)		24,500	E_d 2.985 u_d 0.327 E_t 7.834 u_d 0.216 E_t 11.01	T 1200 R 29 P K_h 8.72 × 10^{-6} K_v 3.83 × 10^{-6}
	x	J90 f(py) J90			100					
		J80			95			14,200	E_d 1.348 u_d 0.290	
					100	0.00 (80)				
					100			11,100		C
	x				94			15,600		Tr
	x			100	88	0.03 (80)				
					87					
					97					
			th		92	0.03 (80)		13,300		
	s	J90	t		92					
					98					
		J80 f(cl) 0.01			98					
					100	0.03 (80)		26,400		
	s		t		100					
					100					
					100	0.03 (80)				
	s		t		100					
					100					
					99					
					91	0.02 (80)				
					100			3,400		E_d 1.691 G_s 2.71 wc 0.40
					100					
					100					
					100	0.04 (80)		24,600		
					98					
	s		t		100					
			t		93					
600										

DEPTH IN FEET

THE METROPOLITAN WATER RECLAMATION DISTRICT OF GREATER CHICAGO

TUNNEL AND RESERVOIR PLAN
CALUMET SYSTEM
CONTRACT 75-208-2H

DRILL HOLE DATA
C-12

KEIFER & ASSOCIATES, INC. CHICAGO, ILLINOIS

Drawn C.T.G. | Checked C.M.K. | Approved [signature] | DATE

SHEET NO. SB3

271

NOTES AND LEGEND

FORMATION: Based on H.B.Willman, 1971

CASING: Indicates casing left in place.

ROCK CONDITION: w = weathered
x = broken or fragmented
s = susceptible to slaking
s' = shale partings susceptible to slaking

JOINTING: J = Stratigraphic position of joint with dip in degrees with reference to horizontal. F = fault position. f = fill material with sh for shale, cl for clay, py for pyrite, Ca for calcite, Fe for iron stain, sl for slickensides. Fill thickness in 10^{-2} ft.

BEDDING: Horizontal except as noted.
th = thick-bedded (>2')
t = thin-bedded (2' to 2")
vt = very thin or laminated (<2")

CORE RECOVERY: % core recovered per run.

ROCK QUALITY DESIGNATION (RQD): Indicates ratio of total length of core pieces 4" or longer in length to total length of drilling run. Mechanical breaks are considered as unbroken core.

WATER PRESSURE TEST: Conducted over the stratigraphic intervals shown. Water loss in cfm (net pressure in psi.)

▼ 4/1/74 = Groundwater level and date observed.

WETTING AND DRYING TESTS:
△ = no significant change in sample
▲ = significant change in sample

SOAKING TESTS:
○ = no significant change
● = significant change

UNCONFINED COMPRESSIVE STRENGTH: Ultimate strength in psi.

MODULUS OF ELASTICITY, POISSON'S RATIO: In psi x 10^6
E_T = Young's modulus (static)
E_d = Young's modulus (dynamic)
u_t = Poisson's ratio (static)
u_d = Poisson's ratio (dynamic)

MISCELLANEOUS TESTS:
A = abrasion (percent of wear)
R = Schmidt hammer hardness
k_v = permeability, vertical (darcys)
k_h = permeability, horizontal (darcys)
wc = moisture content (percent)
n = porosity (percent)
Sat = saturation (percent)
I_{di} = slake-durability index (percent)
G_s = specific gravity
T = split cylinder strength (psi)
γ_d = dry unit weight (pcf)

TESTS FOR WHICH ONLY STRATIGRAPHIC POSITION IS SHOWN:
P = petrographic analysis
C = chemical analysis
Cr = creep
Tr = triaxial

GROUND ELEVATION (CCD): 579.48 U.S.C. and G.S. = Chicago City Datum.

Elevations and Locations were surveyed and furnished by Arthur R. Schmidt
Ill. Reg. No. 35-1935

DESCRIPTION

Coordinates: N 1,829,802.63 E 711,474.99
Angle: Vertical
Bearing: ——
Location: 70 ft E of Torrence Ave., 170 ft S of 114th St.
Ground Elevation (CCD): 6.22

Overburden: fill and glacial drift.

NO SAMPLES TAKEN.

Dolomite, inter-reef facies, argillaceous, fine grained. Light to medium gray and bluish gray. Occasional green and gray shale partings scattered unevenly throughout: 95.0 - 176.9.
Locally brownish gray due to iron staining: 95.0-107.3.
Brown clay with pebbles: 95.8 - 96.9
Water loss at 113.0

Several interbeds of brown dolomitic shale, very fine grained, make up 5-10% of this section: 125.0 - 140.0

Slightly porous in some zones: 148.0 - 176.9.

Brown dolomitic shale: 169.2 - 170.4.

Dolomite, reef facies, fine to medium grained. Light to medium gray and bluish gray. Moderate porosity, occasional stylolites: 176.9 - 218.2.

Dolomite, inter-reef facies, fine grained. Light gray to white. Slightly porous. Scattered white chert nodules make up 10% of rock. Occasional stylolites: 218.2 - 228.0.

Dolomite, reef facies, medium grained. Light, medium and dark gray. Porous and vuggy with some interbedded sections of fairly dense rock. Numerous stylolites. Core tends to break along stylolites: 228.0 - 342.9.
Small white chert nodules make up less than 5% of rock: 228.0 - 247.0.

Fairly dense: 280.7 - 288.6.

Porosity decreases: 333.2 - 343.2.

Dolomite, fine grained, dense. Light gray to white. Occasional stylolites. Core tends to break along stylolites: 342.9 - 354.9.
Vug, 0.15 ft. diameter, pyrite: 346.5.

Dolomite, moderately argillaceous, fine grained. Light to medium gray and bluish gray, slightly mottled. Numerous gray shale partings scattered unevenly throughout: 354.9 - 390.8.

Dolomite, slightly argillaceous, fine to medium grained. Light to medium gray and pinkish gray. Numerous green shale partings, 0.01 ft. maximum thickness. Partings become more frequent with depth, spaced 0.05 - 1.0 ft. apart. Few partings in upper 5 ft.: 390.8 - 417.2.

Dolomite, moderately argillaceous, fine to medium grained. Light to medium gray, becomes dark gray in lower 15 ft. Numerous gray shale partings, less than 0.1 ft. apart. Partings become thicker with depth. In lower 15 ft. partings are as thick as 0.25 ft. where rock becomes 40% shale. Numerous white chert nodules and some bedded chert, 0.3 ft. maximum thickness, spaced 0.2 - 2.0 ft. apart. Chert decreases below 445.0 and is absent below 470.0. Core tends to break at nodules. Where present chert makes up 15% of rock: 417.2 - 502.1.
Scattered vugs: 458.0 - 480.0.

Shale, very fine grained, dark gray to green. Light gray dolomite interbeds make up 40% of rock.

Dolomite, fine to medium grained. Light to medium gray and pinkish gray. Slightly porous, occasional stylolites and green shale partings. Partings have 0.02 ft. maximum thickness.

E.O.H. 507.3.

DEPTH IN FEET	SYSTEM	SERIES OR GROUP	FORMATION	GRAPHIC LOG	CASING
0	QUATERNARY	PLEISTOCENE			
100	SILURIAN	NIAGARAN	Racine		
280			Romeo		
300			Joliet		
320			Nor/agrat		
360		ALEXANDRIAN	Kankakee		
400			Edgewood		
500	ORDOVICIAN	MAQUOKETA	Elkhorn (Brainard)		
600					

DEPTH IN FEET	ROCK CONDITION	JOINTING	BEDDING	CORE RECOVERY	ROCK QUALITY DESIGNATION	WATER PRESSURE TESTS, CFM (PSI) & WATER LEVEL	WETTING & DRYING SOAKING TESTS	UNCONFINED COMPRESSIVE STRENGTH	MODULUS OF ELASTICITY, POISSON'S RATIO	MISCELLANEOUS TESTS AND REMARKS
0										
20						▼ 10/21/74				
40										
60										
80										
100	x,w	J90	t	100	11					
120	s	J90	t	96	47			13,400		
				100	54					
140	s	J60 R(py) J45 Fe J90	vt,t	90	90			27,100		
160	x	J90 J90 R(py) J45 J90	th		94	0.03 (80)		25,000	E_t 4.229 u_t 0.240	
180	x,w	J90	th		97			17,500	E_t 11.48	r 12.30 n 2.43 T 800
200		J90	th		99					
220	x	J90	th		82			17,600	E_t 3.891 u_t 0.286	
240	x	J90	th		95	0.22 (80)		8,100	E_t 5.443	
	x	J60 J60			84					
260	x	J90 R(py) J90		100	93			18,200	E_t 3.094 u_t 0.235	
280		J90			79	0.23 (80)				
					92			12,800		
300		J80			97					
320	x	J90			97			4,300		
	x	J60			88					
340	x	J90	th		86					
	x		t		83					
360		J90 R(py)			95	0.10 (80)		33,000		
380	x	J90			98					
	x,s	J60 J90	t	95	100			24,100		
400	x	J90 J40 Ca,J			100					
	x	J40 Ca,J			68					
420	s		t		89					
					91					
440					98			12,400		
				190	86					
460					91					
					79	0.03 (80)				
480	x	J90			83					
	x	J90 Ca,J			82					
500		J90			47			18,400		
					85					
520	s		vt		87					
	s'		t							
540										
560										
580										
600										

THE METROPOLITAN WATER RECLAMATION DISTRICT OF GREATER CHICAGO

TUNNEL AND RESERVOIR PLAN
CALUMET SYSTEM
CONTRACT 75-208-2H

DRILL HOLE DATA
C-62

KEIFER & ASSOCIATES, INC. CHICAGO, ILLINOIS

Drawn: D.K. Checked: C.M.J. Approved: [signature] DATE

SHEET NO. SB15

283

NOTES AND LEGEND

FORMATION: Based on H.B.Willman, 1971

CASING: Indicates casing left in place.

ROCK CONDITION: w = weathered
x = broken or fragmented
s = susceptible to slaking
s = shale partings susceptible to slaking

JOINTING: J = Stratigraphic position of joint with dip in degrees with reference to horizontal. F = fault position. f = fill material with sh for shale, cl for clay, py for pyrite, Ca for calcite, Fe for iron stain, sl for slickensides. Fill thickness in 10^{-2} ft.

BEDDING: Horizontal except as noted.
th = thick-bedded (>2')
t = thin-bedded (2' to 2")
vt = very thin or laminated (<2")

CORE RECOVERY: % core recovered per run.

ROCK QUALITY DESIGNATION (RQD): Indicates ratio of total length of core pieces 4" or longer in length to total length of drilling run. Mechanical breaks are considered as unbroken core.

WATER PRESSURE TEST: Conducted over the stratigraphic intervals shown. Water loss in cfm (net pressure in psi.)

▼ 4/1/74 = Groundwater level and date observed.

WETTING AND DRYING TESTS:
△ = no significant change in sample
▲ = significant change in sample

SOAKING TESTS:
○ = no significant change
● = significant change

UNCONFINED COMPRESSIVE STRENGTH: Ultimate strength in psi.

MODULUS OF ELASTICITY, POISSON'S RATIO: In psi x 10^6
E_t = Young's modulus (static)
E_d = Young's modulus (dynamic)
u_t = Poisson's ratio (static)
u_d = Poisson's ratio (dynamic)

MISCELLANEOUS TESTS:
A = abrasion (percent of wear)
R = Schmidt hammer hardness
k_v = permeability, vertical (darcys)
k_h = permeability, horizontal (darcys)
wc = moisture content (percent)
n = porosity (percent)
Sat = saturation (percent)
I_{di} = slake-durability index (percent)
G_s = specific gravity
T = split cylinder strength (psi)
γ_d = dry unit weight (pcf)

TESTS FOR WHICH ONLY STRATIGRAPHIC POSITION IS SHOWN:
P = petrographic analysis
C = chemical analysis
Cr = creep
Tr = triaxial

GROUND ELEVATION (CCD): 579.48 U.S.C. and G.S. - Chicago City Datum.

Elevations and Locations were surveyed and furnished by Arthur R. Schmidt
Ill. Reg. No. 35-1935

DESCRIPTION

Coordinates: N. 1,826,237.22 E. 711,530.69
Angle: Vertical
Bearing: —
Location: 1735 ft.S of 117th St., 50 ft.E of Torrence Ave.
Ground Elevation (CCD): 6.55

Overburden: fill and glacial drift.

NO SAMPLES TAKEN

Dolomite, inter-reef facies, argillaceous, fine grained. Light to medium gray and bluish gray: 82.1 - 145.1.

Locally porous and vuggy. Often brown due to iron staining: 82.1 - 112.4.

Rarely mottled. Rare interbeds of brown shale: 112.4 - 145.1.

Moderately argillaceous. Frequently mottled with dark bluish gray speckling in light gray matrix. Interbeds of brown dolomitic shale, usually less than 0.5 ft. thick, make up 15% of the rock. Also brown and occasionally green and gray shale partings scattered unevenly throughout. Slightly porous throughout but increasing downward: 145.1 - 211.6.

Occasional stylolites: 199.6 - 211.6.

Core split along axis: 208.0 - 208.8.

Dolomite, reef facies, medium grained. Light to medium gray, locally dark gray. Porous and vuggy with some interbedded zones of fairly dense rock. Numerous stylolites. Core tends to break along stylolites: 211.6 - 343.2.

Fairly dense. Occasional white chert nodules make up 5-10% of rock: 222.5 - 229.8.

Core split along axis: 243.9 - 244.5.

Fairly dense: 258.0 - 260.0, 263.0 - 265.0.

Fairly dense, occasional shale partings: 281.6 - 293.1.

Numerous large vugs, 0.05 - 0.1 ft. in diameter: 315.0 - 328.0.

Dolomite, dense, fine grained. Light gray to white. Occasional stylolites. Core tends to break along stylolites. Core has split along axis in several places: 343.2 - 352.9.
Vug, 0.1 ft. in diameter: 351.2.

Dolomite, moderately argillaceous, fine grained. Light to medium gray and bluish gray. Occasional mottling. Occasional gray and green shale partings scattered throughout: 352.9 - 391.2.
Several small vugs: 354.5 - 355.5.
Large vug, 0.15 ft. diameter, calcite: 387.1.
Fine to medium grained and slightly pinkish: 387.2-391.2.

Dolomite, slightly argillaceous, fine to medium grained. Light to medium gray and pinkish gray. Numerous gray and green shale partings, 0.1 ft. maximum thickness. Partings increase in frequency with depth, spaced 0.1 - 0.8 ft. apart: 391.2 - 392.0.

Dolomite, moderately argillaceous, fine to medium grained. Light to medium gray. Numerous gray shale partings, less than 0.1 ft. apart. Partings become thicker with depth. In lower 5.0 ft. partings are as thick as 0.1 ft. Numerous white chert nodules, 0.3 ft. maximum thickness, spaced 0.2 - 1.5 ft. apart. Chert decreases below 456.0 and is absent below 470.0. Core tends to break at nodules. Some scattered porosity: 417.2 - 486.0.
Vug, 0.2 ft. diameter, calcite: 419.1.

Shale, very fine grained. Medium and dark green. Light gray dolomite interbeds make up 20% of rock.

E.O.H. 491.4.

DEPTH IN FEET	SYSTEM	SERIES OR GROUP	FORMATION	GRAPHIC LOG	CASING
0	QUATERNARY	PLEISTOCENE			
80	SILURIAN	NIAGARAN	Racine		
340			Romeo		
360			Joliet		
380			Markgraf		
400		ALEXANDRIAN	Kankakee		
420			Edgewood		
480	ORDOVICIAN	MOHAWKIAN	Brainard		
600					

DEPTH IN FEET	ROCK CONDITION	JOINTING	BEDDING	CORE RECOVERY	ROCK QUALITY DESIGNATION	WATER PRESSURE TESTS, CFM (PSI) & WATER LEVEL	WETTING & DRYING, SOAKING TESTS	UNCONFINED COMPRESSIVE STRENGTH	MODULUS OF ELASTICITY, POISSON'S RATIO	MISCELLANEOUS TESTS AND REMARKS	DEPTH IN FEET
0						▼ 4/1/74					0
80	w,x		1	68	61						80
140	s,x		1	100	91	0.08 (80)					140
200		390		100	100				E_t 6.734		200
220	x	360 (Fm)	th	100	92	0.03 (80)			E_t 8.458 E_d 8.276	T 1840 u_t 0.21	220
240	x	380 (Fm)		88	82				E_t 9.521 E_d 9.378	T 1090	240
260	x			100	91	0.05 (80)			E_t 4.208 E_d 4.186		260
280				100	97				E_t 9.337	γ_d 136 G_s 2.61 wc 1.8 T 142.6	280
300	x	340		100	98	0.68 (80)					300
320			th	100	96						320
340	s		1	100	98	0.08 (80)					340
360	x		1	100	100						360
380	s		1	100	98						380
400	s		1	100	96	0.02 (80)					400
420	s		1	100	96						420
480	s		vt	100	100						480
600											600

THE METROPOLITAN WATER RECLAMATION DISTRICT OF GREATER CHICAGO

TUNNEL AND RESERVOIR PLAN
CALUMET SYSTEM
CONTRACT 75-208-2H

DRILL HOLE DATA
C-77

KEIFER & ASSOCIATES, INC.
CHICAGO, ILLINOIS

Drawn C.T.G. | Checked | Approved | DATE | SHEET NO. SB19

EVEREST ENGINEERING CO.

CLIENT: HARZA ENGINEERING COMPANY
PROJECT: TARP, TORRENCE AVENUE LEG
LOCATION: 116TH STREET AND TORRENCE AVENUE

BORING NO.: C96-20 SURFACE ELEV.: 6.00 CCD
N 1,828,602.648 E 711,325.014

JOB NO.: 521
LOGGED BY: A.A. SYED
DATE: JULY 6, 1996

SCALE	DEPTH ELEV (FT)	SOIL DESCRIPTION	LITHOLOGY	Water Level	SAMPLE TYPE & No.	SPT (Blows/6")	RECOVERY (Inches)	q_u (tsf)	PID (ppm)	w (%)	REMARKS
		Very Loose-Medium Dense, Black SILTY SAND with Gravel and Topsoil									Hollow Stem Augers to 23.5'
					SS-1	5-6-8	18		0	24.2	Methane 0%
				▽							
		Organic Silty Sand 3.5'-9.0'			SS-2	1-1-2	18		0	58.0	Methane 0% Sampled By Harza for Chemical Test
5				▽							
	9.0	FILL									
	-3.0	Loose, Gray SILTY SAND			SS-3	2-2-5	18		0	28.9	Methane 0%
10											
	14.8	SM			SS-4	2-2-3	18	0.3 P	0	23.1	Methane 0%
15	-8.8	Very Soft-Hard, Gray Lean CLAY									
		Lean Clay with Sand 18.5'-23.5'			SS-5	1-1-3	18	0.3 B	0	15.1	Methane 0% LL = 29 PI = 9
20				▼							
		Lean Clay 23.5'-28.5'			SS-6	2-4-6	18	1.2 B	0	21.2	Rotary Drilling 23.5'-89.5' Methane 0%
25											

Continued Next Page

DRILLED BY: M. Rosario of K & S Testing and Engineering
DRILL RIG: D120 Diedrich
BORING STARTED: May 22, 1996
BORING COMPLETED: May 28, 1996

THIS LOG IS NOT INTENDED FOR USE INDEPENDENT FROM THE ENGINEERING REPORT

WATER LEVEL
▽ 3.0 ' DURING DRILLING
▼ 6.0 ' AT COMPLETION
▼ 20.0 ' 48 HRS. AFTER COMPLETION
▼ AFTER COMPLETION

EVEREST ENGINEERING CO.

CLIENT: HARZA ENGINEERING COMPANY
PROJECT: TARP, TORRENCE AVENUE LEG
LOCATION: 116TH STREET AND TORRENCE AVENUE

BORING NO.: C96-20 SURFACE ELEV.: 6.00 CCD
N 1,828,602.648 E 711,325.014

JOB NO.: 521
LOGGED BY: A.A. SYED DATE: JULY 6, 1996 SHEET 4 OF 5

SCALE	DEPTH ELEV (FT)	SOIL DESCRIPTION	LITHOLOGY	Water Level	SAMPLE TYPE & No.	SCALE	SPT (Blows/6")	RECOVERY (Inches)	q_u (tsf)	PID (ppm)	w (%)	REMARKS
	78.5	CL										
	-72.5	Medium Dense-Extremely Dense, Gray CLAYEY SILT			SS-17		13-24-20	18	4.5+ P	0	22.9	Methane 0%
80						80						
					SS-18		9-13-16	18	4.5+ P	0	14.8	Methane 0%
85						85						
	89.5	ML/CL			SS-19		25-40-43	18			11.3	
90	-83.5	DOLOMITE: Gray, Fresh, Fine to Medium Grained, Little Fractured, Moderately Hard, Moderately Strong, Occasional Shale Partings, Occasional Vugs Coated with Calcite and Pyrite Run No. 1 89.5'-91.5' REC = 96% RQD = 83%				90						Rock Coring (NX Size) 89.5'-99.5'
95		Run No. 2 91.5'-99.5' REC = 96% RQD = 63%				95						
	99.2											
	-93.2	COMPLETED AT 99.5 FEET										

Continued Next Page

DRILLED BY: M. Rosario of K & S Testing and Engineering
DRILL RIG: D120 Diedrich
BORING STARTED: May 22, 1996
BORING COMPLETED: May 28, 1996

WATER LEVEL
- 3.0 ' DURING DRILLING
- 6.0 ' AT COMPLETION
- 20.0 ' 48 HRS. AFTER COMPLETION
- AFTER COMPLETION

EVEREST ENGINEERING CO.

CLIENT: HARZA ENGINEERING COMPANY
PROJECT: TARP, TORRENCE AVENUE LEG
LOCATION: 116TH STREET AND TORRENCE AVENUE

BORING NO.: C96-20 SURFACE ELEV.: 6.00 CCD
N 1,828,602.648 E 711,325.014

JOB NO.: 521
LOGGED BY: A.A. SYED
DATE: JULY 6, 1996

SCALE	DEPTH ELEV (FT)	SOIL DESCRIPTION	LITHOLOGY	Water Level	SAMPLE TYPE & No.	SCALE	SPT (Blows/6")	RECOVERY (Inches)	q_u (tsf)	PID (ppm)	w (%)	REMARKS
	53.5	CL										
	-47.5	Very Dense-Dense, Gray CLAYEY SILT with Sand			SS-12		34-37-39	18	4.5+ P	0	17.1	Methane 0% GR(M&H) LL=22 PI=6
55						55						
					SS-13		24-21-26	18	4.5+ P	0	12.4	Methane 0%
60						60						
	63.5	CL-ML										
	-57.5	Hard, Gray Lean CLAY			SS-14		7-15-23	18	4.5+ P	0	16.1	Methane 0%
65						65						
					SS-15		5-14-20	18	7.0 B	0	17.4	Methane 0%
70						70						
					SS-16		7-16-22	18	5.8 B	0	14.1	Methane 0%
75						75						

Continued Next Page

DRILLED BY: M. Rosario of K & S Testing and Engineering
DRILL RIG: D120 Diedrich
BORING STARTED: May 22, 1996
BORING COMPLETED: May 28, 1996

THIS LOG IS NOT INTENDED FOR USE INDEPENDENT FROM THE ENGINEERING REPORT

WATER LEVEL
- 3.0 ' DURING DRILLING
- 6.0 ' AT COMPLETION
- 20.0 ' 48 HRS. AFTER COMPLETION
- AFTER COMPLETION

EVEREST ENGINEERING CO.

CLIENT: HARZA ENGINEERING COMPANY
PROJECT: TARP, TORRENCE AVENUE LEG
LOCATION: 116TH STREET AND TORRENCE AVENUE
BORING NO.: C96-20 SURFACE ELEV.: 6.00 CCD
N 1,828,602.648 E 711,325.014
JOB NO.: 521
LOGGED BY: A.A. SYED DATE: JULY 6, 1996 SHEET 2 OF 5

SCALE	DEPTH ELEV (FT)	SOIL DESCRIPTION	LITHOLOGY	Water Level	SAMPLE TYPE & No.	SCALE	SPT (Blows/6")	RECOVERY (Inches)	q_u (tsf)	PID (ppm)	w (%)	REMARKS
	28.5	CL										
	-22.5	Very Stiff-Hard, Gray Lean CLAY			SS-7		3-5-9	18	2.5 B	0	22.0	Methane 0%
30						30						
					SS-8		4-6-10	18	2.3 P	0	22.3	Methane 0%
35						35						
		Lean Clay with Sand 38.5'-53.5'			SS-9		5-7-11	18	5.0 B	0	13.6	Methane 0%
40						40						
					SS-10		5-6-9	18	4.1 B	0	14.1	Methane 0%
45						45						
					SS-11		9-12-19	18	4.5+ P	0	13.7	Methane 0%
50						50						

Continued Next Page

DRILLED BY: M. Rosario of K & S Testing and Engineering
DRILL RIG: D120 Diedrich
BORING STARTED: May 22, 1996
BORING COMPLETED: May 28, 1996

WATER LEVEL
- 3.0 ' DURING DRILLING
- 6.0 ' AT COMPLETION
- 20.0 ' 48 HRS. AFTER COMPLETION
- AFTER COMPLETION

EVEREST ENGINEERING CO.

CLIENT: HARZA ENGINEERING COMPANY
PROJECT: TARP, TORRENCE AVENUE LEG
LOCATION: 116TH STREET AND TORRENCE AVENUE

BORING NO.: C96-20 SURFACE ELEV.: 6.00 CCD
N 1,828,602.648 E 711,325.014

JOB NO.: 521
LOGGED BY: A.A. SYED DATE: JULY 6, 1996 SHEET 5 OF 5

SCALE	DEPTH ELEV (FT)	SOIL DESCRIPTION	LITHOLOGY	Water Level	SAMPLE TYPE & No.	SCALE	SPT (Blows/6")	RECOVERY (inches)	q_u (tsf)	PID (ppm)	w (%)	REMARKS

CONVERTED TO GROUNDWATER SAMPLING WELL

SEE EXHIBIT C96-20 FOR DETAILS

GR - GRADATION
(M) - MECHANICAL
(H) - HYDROMETER
LL - LIQUID LIMIT
PI - PLASTICITY INDEX

DRILLED BY: M. Rosario of K & S Testing and Engineering
DRILL RIG: D120 Diedrich
BORING STARTED: May 22, 1996
BORING COMPLETED: May 28, 1996

THIS LOG IS NOT INTENDED FOR USE INDEPENDENT FROM THE ENGINEERING REPORT

WATER LEVEL
▽ 3.0 ' DURING DRILLING
▼ 6.0 ' AT COMPLETION
▼ 20.0 ' 48 HRS. AFTER COMPLETION
▼ AFTER COMPLETION

EVEREST ENGINEERING CO.

CLIENT: HARZA ENGINEERING COMPANY
PROJECT: TARP, TORRENCE AVENUE LEG
LOCATION: 116TH STREET AND TORRENCE AVENUE
BORING NO.: C96-20A SURFACE ELEV.: 5.90 CCD
N 1,828,601.390 E 711,315.699
JOB NO.: 521
LOGGED BY: A.A. SYED DATE: JULY 6, 1996 SHEET 1 OF 1

SCALE	DEPTH ELEV (FT)	SOIL DESCRIPTION	LITHOLOGY	Water Level	SAMPLE TYPE & No.	SCALE	SPT (Blows/6")	RECOVERY (Inches)	q_u (tsf)	PID (ppm)	w (%)	REMARKS
5		Blank Drill 0'-20.0' For Groundwater Sampling Well		▽ 4.0' DURING DRILLING ▼ 5.0' AT COMPLETION ▼ 19.0' 48 HRS. AFTER COMPLETION		5						
10						10						
15						15						Sampled By Harza For Chemical Test
20	20.0 -14.1	COMPLETED AT 20.0 FEET		▼ AFTER COMPLETION		20						

CONVERTED TO GROUNDWATER SAMPLING WELL

SEE EXHIBIT C96-20A FOR DETAILS

DRILLED BY: M. Rosario of K & S Testing and Engineering
DRILL RIG: D120 Diedrich
BORING STARTED: May 23, 1996
BORING COMPLETED: May 23, 1996

THIS LOG IS NOT INTENDED FOR USE INDEPENDENT FROM THE ENGINEERING REPORT

EVEREST ENGINEERING CO.

CLIENT: HARZA ENGINEERING COMPANY
PROJECT: TARP, TORRENCE AVENUE LEG
LOCATION: SOUTH CHICAGO AVENUE AND HARBOR AVENUE
BORING NO.: C96-27 SURFACE ELEV.: 2.50 CCD
JOB NO.: 521 N 1,843,031.138 E 714,642.101
LOGGED BY: A.A. SYED DATE: JULY 25, 1996 SHEET 1 OF 4

SCALE	DEPTH ELEV (FT)	SOIL DESCRIPTION	LITHOLOGY	Water Level	SAMPLE TYPE & No.	SCALE	SPT (Blows/6")	RECOVERY (Inches)	q_u (tsf)	PID (ppm)	w (%)	REMARKS
		Loose, Black and Brown SILTY SAND with Gravel, Roots, and Organics										Hollow Stem Augers to 23.5'
					SS-1		5-4-3	18		0	11.2	Methane 0%
	4.0	FILL										
	-1.5	Medium Dense-Dense, Brown SILTY SAND with Gravel		▽	SS-2		3-4-13	18		0	12.0	Methane 0% Sample By Harza for Chemcal Test
5						5						
				▼								
					SS-3		9-18-20	18		0	13.6	Methane 0%
10				▼		10						
		Gray Silty Sand with Gravel 13.5'-14.5'										
	14.5	SM			SS-4		2-2-4	18	0.5 B	0	14.2	Methane 0% LL=32 PI=11
15	-12.0	Soft-Very Stiff, Gray Lean CLAY				15						
		Lean Clay with Sand 18.5'-23.5'			SS-5		4-7-11	18	1.9 B	0	14.0	Methane 0%
20						20						
												Rotary Drilling 23.5'-83.0'
		Lean Clay 23.5'-38.5'			SS-6		4-6-11	18	2.6 B	0	12.2	Methane 0%
25						25						

Continued Next Page

DRILLED BY: M. Rosario of K & S Testing and Engineering
DRILL RIG: D120 Diedrich
BORING STARTED: June 5, 1996
BORING COMPLETED: June 5, 1996

WATER LEVEL
▽ 5.0 ' DURING DRILLING
▼ 8.0 ' AT COMPLETION
▼ 10.8 ' 48 HRS. AFTER COMPLETION
▼ AFTER COMPLETION

EVEREST ENGINEERING CO.

CLIENT: HARZA ENGINEERING COMPANY
PROJECT: TARP, TORRENCE AVENUE LEG
LOCATION: SOUTH CHICAGO AVENUE AND HARBOR AVENUE
BORING NO.: C96-27 SURFACE ELEV.: 2.50 CCD
JOB NO.: 521 N 1,843,031.138 E 714,642.101
LOGGED BY: A.A. SYED DATE: JULY 25, 1996 SHEET 2 OF 4

SCALE	DEPTH ELEV (FT)	SOIL DESCRIPTION	LITHOLOGY	Water Level	SAMPLE TYPE & No.	SCALE	SPT (Blows/6")	RECOVERY (Inches)	q_u (tsf)	PID (ppm)	w (%)	REMARKS
30					SS-7	30	6-9-12	18	2.8 B	0	12.7	Methane 0%
35					SS-8	35	6-10-15	18	3.1 B	0	19.5	Methane 0%
	38.5 -36.0	CL Hard, Gray Lean CLAY with Sand and Gravel			SS-9		25-27-44	18	4.5 + P	0	10.7	Methane 0%
40						40						
45					SS-10	45	28-33-50	18	7.5 B	0	10.5	Methane 0%
50					SS-11	50	18-21-35	18	7.4 B	0	11.3	Methane 0%

Continued Next Page

DRILLED BY: M. Rosario of K & S Testing and Engineering
DRILL RIG: D120 Diedrich
BORING STARTED: June 5, 1996
BORING COMPLETED: June 5, 1996

WATER LEVEL
5.0 ' DURING DRILLING
8.0 ' AT COMPLETION
10.8 ' 48 HRS. AFTER COMPLETION
AFTER COMPLETION

EVEREST ENGINEERING CO.

CLIENT: HARZA ENGINEERING COMPANY
PROJECT: TARP, TORRENCE AVENUE LEG
LOCATION: SOUTH CHICAGO AVENUE AND HARBOR AVENUE
BORING NO.: C96-27 SURFACE ELEV.: 2.50 CCD
JOB NO.: 521 N 1,843,031.138 E 714,642.101
LOGGED BY: A.A. SYED DATE: JULY 25, 1996 SHEET 3 OF 4

SCALE	DEPTH ELEV (FT)	SOIL DESCRIPTION	LITHOLOGY	Water Level	SAMPLE TYPE & No.	SCALE	SPT (Blows/6")	RECOVERY (Inches)	q_u (tsf)	PID (ppm)	w (%)	REMARKS
55					SS-12	55	19-21-31	18	7.0 B	0	13.7	Methane 0%
60					SS-13	60	14-20-33	18	6.6 B	0	11.9	Methane 0%
65					SS-14	65	15-23-38	18	7.0 B	0	9.8	Methane 0%
70					SS-15	70	38-50/5"	11	4.5+ P	0	12.3	Methane 0%
75					SS-16	75	24-40-38	18	7.6 B	0	17.1	Methane 0%

Continued Next Page

DRILLED BY: M. Rosario of K & S Testing and Engineering
DRILL RIG: D120 Diedrich
BORING STARTED: June 5, 1996
BORING COMPLETED: June 5, 1996

WATER LEVEL
- 5.0 ' DURING DRILLING
- 8.0 ' AT COMPLETION
- 10.8 ' 48 HRS. AFTER COMPLETION
- AFTER COMPLETION

EVEREST ENGINEERING CO.

CLIENT: HARZA ENGINEERING COMPANY
PROJECT: TARP, TORRENCE AVENUE LEG
LOCATION: SOUTH CHICAGO AVENUE AND HARBOR AVENUE
BORING NO.: C96-27 SURFACE ELEV.: 2.50 CCD
JOB NO.: 521 N 1,843,031.138 E 714,642.101
LOGGED BY: A.A. SYED DATE: JULY 25, 1996 SHEET 4 OF 4

SCALE	DEPTH ELEV (FT)	SOIL DESCRIPTION	LITHOLOGY	Water Level	SAMPLE TYPE & No.	SCALE	SPT (Blows/6")	RECOVERY (Inches)	q_u (tsf)	PID (ppm)	w (%)	REMARKS
	78.5	CL										
	-76.0	Extremely Dense, Gray SILTY SAND with Gravel and Boulders			SS-17		50-50/5"	11	4.5 + P	0	10.4	Methane 0%
80	83.0	SM				80						
	-80.5	DOLOMITE: Gray, Fresh, Fine to Medium Grained, Fractured, Moderately Hard, Moderately Strong, Occasional Shale Partings, Occasional Vugs Coated with Calcite and Pyrite.										Rock Coring (NX Size) 83.0'-93.0'
85		Run No. 1 83.0'-85.0' REC = 100% RQD = 44%				85						
90		Run No. 2 85.0'-93.0' REC = 77% RQD = 69%				90						
	93.0											
	-90.5	COMPLETED AT 93.5 FEET										

CONVERTED TO GROUNDWATER SAMPLING WELL

SEE EXHIBIT C96-27 FOR DETAILS

LL - LIQUID LIMIT
PI - PLASTICITY INDEX

DRILLED BY: M. Rosario of K & S Testing and Engineering
DRILL RIG: D120 Diedrich
BORING STARTED: June 5, 1996
BORING COMPLETED: June 5, 1996

THIS LOG IS NOT INTENDED FOR USE INDEPENDENT FROM THE ENGINEERING REPORT

WATER LEVEL
5.0 ' DURING DRILLING
8.0 ' AT COMPLETION
10.8 ' 48 HRS. AFTER COMPLETION
AFTER COMPLETION

EVEREST ENGINEERING CO.

CLIENT: HARZA ENGINEERING COMPANY
PROJECT: TARP, TORRENCE AVENUE LEG
LOCATION: SOUTH CHICAGO AVENUE AND HARBOR AVENUE
BORING NO.: C96-27A SURFACE ELEV.: 4.50 CCD
N 1,843,055.151 E 714,661.705
JOB NO.: 521
LOGGED BY: A.A. SYED DATE: JULY 25, 1996 SHEET 1 OF 1

SCALE	DEPTH ELEV (FT)	SOIL DESCRIPTION	LITHOLOGY	Water Level	SAMPLE TYPE & No.	SCALE	SPT (Blows/6")	RECOVERY (Inches)	q_u (tsf)	PID (ppm)	w (%)	REMARKS
5		Blank Drill 0'-20.5' For Groundwater Sampling Well		▼		5						
10				▼		10						
15				▽		15						Sampled By Harza For Chemical Test
20	20.5 -16.0	COMPLETED AT 20.5 FEET				20						

CONVERTED TO GROUNDWATER SAMPLING WELL

SEE EXHIBIT C96-27A FOR DETAILS

DRILLED BY: M. Rosario of K & S Testing and Engineering
DRILL RIG: D120 Diedrich
BORING STARTED: June 5, 1996
BORING COMPLETED: June 5, 1996

THIS LOG IS NOT INTENDED FOR USE INDEPENDENT FROM THE ENGINEERING REPORT

WATER LEVEL
▽ 12.0 ' DURING DRILLING
▽ 8.0 ' AT COMPLETION
▼ 7.0 ' 48 HRS. AFTER COMPLETION
▼ AFTER COMPLETION

METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO, CALUMET SYSTEM OF THE

PROJECT TUNNEL & RESERVOIR PLAN, TORRENCE AVENUE BRANCH

CLIENT KEIFER & ASSOCIATES, INC., 20 North Wacker Dr., Chicago, Illinois 60606

BORING CDS-30 DATE STARTED 10-14-76 DATE COMPLETED 10-18-76 JOB 13,870

ELEVATIONS

GROUND SURFACE 6.6 C.C.D.

END OF BORING -100.4 C.C.D.

N. COORDINATE -- 1,828.566.5

E. COORDINATE -- 711,323.6

WATER TABLE

AT END OF BORING -2.0'

24 HOURS -1.5'

While Drilling -4.0'

SAMPLE NO.	TYPE	LENGTH RECOVERY	N	WC	Q_u	γDRY	DEPTH	ELEV.	SOIL DESCRIPTIONS
							1.0	5.6	FILL - Crushed LIMESTONE & CINDERS
									FILL - Dark brown SAND and GRAVEL
							3.5	3.1	
1	SS		2	42.3					FILL - Very loose black SAND and GRAVEL with organic clay, cinders and slag, wet
							8.5	-1.9	(saturated)
2	SS		24						Loose gray very fine to fine SAND, wet
							13.5	-6.9	(saturated)
3	SS		9	23.5	1.97 1.75*				Tough to very tough gray silty CLAY, trace sand, moist
4	ST			21.3	1.65 1.75*	107.5			
5	SS		9	21.3	2.27 2.0*				
6	ST			21.1	3.1 3.0*	107.2			
7	SS		13	16.9	2.55 3.0*				
							38.5	-31.9	Hard gray silty CLAY, trace sand and gravel, moist
8	SS		29	12.4	4.5+*				

Distance Below Surface in Feet

0 5 10 15 20 25 30 35 40

DRILL RIG NO. _____

CONTINUED ON THIS SHEET

METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO, CALUMET SYSTEM OF THE

PROJECT TUNNEL & RESERVOIR PLAN, TORRENCE AVENUE BRANCH

CLIENT KEIFER & ASSOCIATES, INC., 20 North Wacker Dr., Chicago, Illinois 60606

BORING CDS-30 DATE STARTED 10-14-76 DATE COMPLETED 10-18-76 JOB 13,870

ELEVATIONS

GROUND SURFACE 6.6 C.C.D.

END OF BORING -100.4 C.C.D.

WATER TABLE

AT END OF BORING -2.0'

24 HOURS -1.5'

While Drilling -4.0'

N. COORDINATE -- 1,828,566.5

E. COORDINATE -- 711,323.6

Distance Below Surface in Feet	LENGTH RECOVERY	SAMPLE NO.	TYPE	N	WC	Q_u	γDRY	DEPTH	ELEV.	SOIL DESCRIPTIONS
40										Hard gray silty CLAY, trace sand and gravel, moist
						4.28				
45		9	SS	23	13.5	4.5*				
						10.5				
		10	SS	32	12.5	4.5+*				
50								53.5	-46.9	
		11	SS	73	11.7	4.5+*				Hard dark gray silty CLAY, trace sand and some gravel, damp
55										
		12	SS	63	10.9	4.5+*				
60										
		13	SS	42	11.4	4.5+*				
65										
						4.41				
		14	SS	31	16.7	4.5*				
70										
		15	SS	37	25.5	4.5+*				
75										
		16	SS	30	11.3					
80										

TESTING SERVICE CORPORATION

DRILL RIG NO. _____

CONTINUED ON THIS SHEET

PROJECT METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO, CALUMET SYSTEM OF THE TUNNEL & RESERVOIR PLAN, TORRENCE AVENUE BRANCH

CLIENT KEIFER & ASSOCIATES, INC., 20 North Wacker Dr., Chicago, Illinois 60606

BORING CDS-30 DATE STARTED 10-14-76 DATE COMPLETED 10-18-76 JOB L-13,870

ELEVATIONS

GROUND SURFACE 6.6 C.C.D.

END OF BORING -100.4 C.C.D.

WATER TABLE

AT END OF BORING -2.0'

24 HOURS -1.5'

While Drilling -4.0'

N. COORDINATE -- 1,828,566.5

E. COORDINATE -- 711,323.6

Distance Below Surface in Feet	LENGTH RECOVERY	SAMPLE NO.	TYPE	N	WC	Q_u	% DRY	DEPTH	ELEV.	SOIL DESCRIPTIONS
80										
										Hard gray silty CLAY, trace sand and some gravel, damp
85		17	SS	34	11.4	4.5+*				
		18	SS	50/4"				89.5	-82.9	
90										Weathered LIMESTONE
		19	SS	100/3"						
95								97.0	-90.4	
		20	"NX" RC	85% Recovery						Hard very dense white to light gray shaley dolomite with shale seams at 97'6" and 100'1" and layer of coarse calcereous sand at 99'6" to 99'8" -- Unconformities at 99'2" and 100'1" indicating a softer washed out layer of sand or clay
100								102.0	-95.4	
		21	"NX" RC	100% Recovery						Hard white domolite LIMESTONE with thin seams of sand at 104', very thin seams of shale at 102'6", 104'3" and 105'7"
105										
		End of Boring at 107.0 feet								
110										
115										
120										

*-Approximate unconfined compression strength based on measurements with a calibrated pocket penetrometer

TESTING SERVICE CORPORATION

DRILL RIG NO. _____

ENCLOSURE G

BORING LOGS NEAR STATE LINE, IL LOCATION

State Line, IL/IN

GLMRIS

Legend

Boring Locations

Date: 9/30/2013

1 IN = 10,417 FT

Path: J:\LRC_Projects\PRJ_GLMRIS\MXD\Borings\StateLine.mxd

DEPTH IN FEET 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300 320 340 360 380 400 420 440 460 480 500 520 540 560 580 600

MISCELLANEOUS TESTS AND REMARKS

MODULUS OF ELASTICITY, POISSON'S RATIO

UNCONFINED COMPRESSIVE STRENGTH

WETTING & DRYING, SOAKING TESTS

WATER PRESSURE TESTS, CFM,(PSI) & WATER LEVEL

ROCK QUALITY DESIGNATION

CORE RECOVERY

BEDDING

JOINTING

ROCK CONDITION

DESCRIPTION

Coordinates: N 1,796,660.94 Angle: Vertical
E 685,186.94 Bearing:

Location: 490 ft.S of 160th St., 110 ft.W of Ashland Ave.

Ground Elevation (CCD): 29.44

Overburden: fill and glacial drift.

NO SAMPLES TAKEN

Dolomite, inter-reef facies, argillaceous, fine grained. Light to medium gray and bluish gray; 46.0 - 117.0. Interbeds of brown and brownish gray shaly dolomite and dolomitic shale, very fine grained. Such interbeds make up 30% of this section: 57.2 - 80.5.

Gray clay, soft: 82.0.

Green and brown shale: 105.9 - 106.6.

Slightly argillaceous. Rock becomes less argillaceous with depth. Light gray. Frequently mottled with dark bluish gray or pinkish speckling in light gray matrix: 117.0 - 164.9. Pyrite-filled vugs: 120.8 - 121.6.

Occasional stylolites: 150.0 - 164.9.

Dolomite, dense, fine grained. Light gray to white. Rare gray shale partings. Occasional stylolites: 263.0 - 280.6. Vug, 0.06 ft. diameter: 278.7.

Light gray to white with some mottling. Occasional stylolites. Rare green shale partings: 164.9 - 220.5.

Occasional white chert nodules. Nodules make up 5-10% of rock. Core tends to break at nodules: 190.0 - 216.0.

Dolomite, reef facies, medium grained. Light to medium gray. Porous and vuggy with some interbedded sections of fairly dense rock. Numerous stylolites. Core tends to break along stylolites: 220.5 - 263.0. Fairly dense, light gray to white: 231.3 - 235.1.

Porosity decreases: 253.0 - 263.0.

Dolomite, moderately argillaceous, fine grained. Light gray to white. Rare gray medium gray and bluish gray, often mottled. Occasional gray and green shale partings scattered unevenly throughout: 280.6 - 308.8

Fine to medium grained and slightly pinkish: 302.8 - 306.8.

Dolomite, slightly argillaceous. Fine to medium grained. Light to medium gray and bluish gray. Numerous green shale partings. 0.1 ft. maximum thickness. Partings become more frequent with depth, spaced 0.1 ft. apart. Few partings. Core tends to break along partings: 306.8 - 334.1. In lower 15 ft. partings are as thick as 0.2 ft. where rock becomes 30% shale. Numerous white chert nodules and bedded chert, 0.35 ft. maximum thickness, spaced 0.5 ft. apart. Chert is absent below 387.0. Where present, chert nodules make up 15-20% of rock. Core tends to break at nodules: 334.1 - 412.4.

Dolomite, moderately argillaceous. Fine to medium grained. Light to medium gray, becomes dark gray in lower 15 ft. Numerous gray shale partings, spaced 0.05 - 0.5 ft. apart. Partings become more frequent and thicker with depth. In lower 15 ft. partings are as thick as 0.2 ft. where rock becomes 30% shale. Numerous white chert nodules and bedded chert, 0.35 ft. maximum thickness, spaced 0.5 ft. apart. Chert is absent below 387.0. Where present, chert nodules make up 15-20% of rock. Core tends to break at nodules: 334.1 - 412.4.

Shale, very fine grained. Dark gray to green. Light gray dolomite interbeds make up 40% of rock.

Dolomite, fine to medium grained. Pinkish gray. Porous. Green shale partings, 0.03 ft. maximum thickness.

E.O.H. 416.6.

CASING

GRAPHIC LOG

FORMATION: Romeo, Markgraf, Joliet, Kankakee, Edgewood, Ft. Atkinson, Brainard, Maquoketa

SERIES OR GROUP: PLEISTOCENE, Racine, NIAGARAN, ALEXANDRIAN

SYSTEM: QUATERNARY, SILURIAN, ORDOVICIAN

DEPTH IN FEET 0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300 320 340 360 380 400 420 440 460 480 500 520 540 560 580 600

NOTES AND LEGEND

FORMATION: Based on H.B.Willman, 1971

CASING: Indicates casing left in place.

ROCK CONDITION: w = weathered
x = broken or fragmented
s = susceptible to slaking
s = shale partings susceptible to slaking

JOINTING: J = Stratigraphic position of joint with dip in degrees with reference to horizontal. F = fault position. f = fill material with sh for shale, cl for clay, py for pyrite, ca for calcite, Fe for iron stain, sl for slickensides. Fill thickness in 10^{-2} ft.

BEDDING: Horizontal except as noted.
th = thick-bedded (>2')
t = thin-bedded (.2' to 2")
vt = very thin or laminated (<.2")

CORE RECOVERY: % core recovered per run.

ROCK QUALITY DESIGNATION (RQD): Indicates ratio of total length of core pieces 4" or longer in length to total length of drilling run. Mechanical breaks are considered as unbroken core.

WATER PRESSURE TEST: Conducted over the stratigraphic intervals shown. Water loss in cfm (net pressure in psi.)

▼ 4/1/74 = Groundwater level and date observed.

WETTING AND DRYING TESTS:
△ = no significant change in sample
▲ = significant change in sample

SOAKING TESTS:
○ = no significant change
● = significant change

UNCONFINED COMPRESSIVE STRENGTH: Ultimate strength in psi.

MODULUS OF ELASTICITY, POISSON'S RATIO: In psi x 10^6
E_t = Young's modulus (static)
E_d = Young's modulus (dynamic)
u_t = Poisson's ratio (static)
u_d = Poisson's ratio (dynamic)

MISCELLANEOUS TESTS:
A = abrasion (percent of wear)
R = Schmidt hammer hardness
k_v = permeability, vertical (darcys)
k_h = permeability, horizontal (darcys)
wc = moisture content (percent)
n = porosity (percent)
Sat = saturation (percent)
I_{di} = slake-durability index (percent)
G_s = specific gravity
T = split cylinder strength (psi)
γ_d = dry unit weight (pcf)

TESTS FOR WHICH ONLY STRATIGRAPHIC POSITION IS SHOWN:
P = petrographic analysis
C = chemical analysis
Cr = creep
Tr = triaxial

GROUND ELEVATION (CCD): 579.48 U.S.C. and G.S. - Chicago City Datum.

Elevations and Locations were surveyed and furnished by Arthur R. Schmidt
Ill. Reg. No. 35-1935

DRILL HOLE LOCATION SLE SHEET

SEE NOTE ON SHEET

REVISIONS		
NO.	DATE	BY

METROPOLITAN WATER RECLAMATION DISTRICT OF GREATER CHICAGO

CALUMET TUNNEL SYSTEM
CONTRACT 73-271-2H
TUNNELS, SHAFTS, AND CONNECTING STRUCTURES
140TH STREET AND INDIANA AVENUE LEGS
DRILL HOLE - C73

Correct — Engr. of Tunnel and Reservoir Design
Approved — Assistant Chief Engineer
Approved — Chief Engineer

SCALES SHOWN ARE SCALES OF TRACINGS

Drawn | Traced | Checked | DATE FEB. 1990 | SHEET NO. G-45

EVEREST ENGINEERING CO.

CLIENT: HARZA ENGINEERING COMPANY
PROJECT: TARP, TORRENCE AVENUE LEG
LOCATION: 134TH STREET AND TORRENCE AVENUE
BORING NO.: C96-11 SURFACE ELEV.: 7.00 CCD
N 1,816,940.000 E 710,200.000
JOB NO.: 521
LOGGED BY: A.A. SYED DATE: JULY 30, 1996 SHEET 1 OF 2

SCALE	DEPTH ELEV (FT)	SOIL DESCRIPTION	LITHOLOGY	Water Level	SAMPLE TYPE & No.	SPT (Blows/6")	RECOVERY (Inches)	q_u (tsf)	PID (ppm)	w (%)	REMARKS
		Very Stiff, Brown and Gray SILTY CLAY with Sand									Hollow Stem Augers to 30.0'
					SS-1	2-3-5	15	2.3 B	0	18.0	Methane 0%
	3.5	CL/ML									
	3.5	Very Stiff, Gray Lean CLAY with Sand			SS-2	1-3-5	16	3.1 B	0	20.5	Methane 0% Sampled By Harza For Chemical Test
5											
	8.5	CL		▽							
	-1.5	Very Loose-Loose, Gray CLAYEY SILT with SAND			SS-3	1-1-1	14		0	30.4	Methane 0%
10											
					SS-4	2-2-3	18		0	33.3	Methane 0%
15											
	18.5	ML/CL									
	-11.5	Stiff-Very Stiff, Gray Lean CLAY with Sand			SS-5	1-2-3	18	1.0 B	0	35.6	Methane 0%
20											
					SS-6	2-4-5	18	2.0 B	0	22.2	Methane 0%
25											

Continued Next Page

DRILLED BY: P. Delacruz of K & S Testing and Engineering
DRILL RIG: D120 Diedrich
BORING STARTED: July 3, 1996
BORING COMPLETED: July 3, 1996

THIS LOG IS NOT INTENDED FOR USE INDEPENDENT FROM THE ENGINEERING REPORT

WATER LEVEL
▽ 8.5 ' DURING DRILLING
▽ DRY AT COMPLETION
▼ AFTER COMPLETION
▼ AFTER COMPLETION

EVEREST ENGINEERING CO.

CLIENT: HARZA ENGINEERING COMPANY
PROJECT: TARP, TORRENCE AVENUE LEG
LOCATION: 134TH STREET AND TORRENCE AVENUE

BORING NO.: C96-11 SURFACE ELEV.: 7.00 CCD
N 1,816,940.000 E 710,200.000

JOB NO.: 521
LOGGED BY: A.A. SYED
DATE: JULY 30, 1996 SHEET 2 OF 2

SCALE	DEPTH ELEV (FT)	SOIL DESCRIPTION	LITHOLOGY	Water Level	SAMPLE TYPE & No.	SCALE	SPT (Blows/6")	RECOVERY (Inches)	q_u (tsf)	PID (ppm)	w (%)	REMARKS
					SS-7		3-4-6	18	2.1 B	0	21.3	Methane 0%
30	30.0 -23.0	CL COMPLETED AT 30.0 FEET				30						

DRILLED BY: P. Delacruz of K & S Testing and Engineering
DRILL RIG: D120 Diedrich
BORING STARTED: July 3, 1996
BORING COMPLETED: July 3, 1996

THIS LOG IS NOT INTENDED FOR USE INDEPENDENT FROM THE ENGINEERING REPORT

WATER LEVEL
8.5 ' DURING DRILLING
DRY AT COMPLETION
AFTER COMPLETION
AFTER COMPLETION

METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO, CALUMET STATE OF THE

PROJECT TUNNEL & RESERVOIR PLAN, TORRENCE AVENUE BRANCH

CLIENT KEIFER & ASSOCIATES, INC., 20 North Wacker Dr., Chicago, Illinois 60606

BORING CDS-31 DATE STARTED 10-14-76 DATE COMPLETED 10-14-76 JOB 13,870

ELEVATIONS

GROUND SURFACE 8.4 C.C.D.

END OF BORING -47.6 C.C.D.

N. COORDINATE -- 1,832,518.1

E. COORDINATE -- 711,247.6

WATER TABLE

AT END OF BORING -5.0'

24 HOURS -4.5'

While Drilling -8.0'

SAMPLE NO.	TYPE	LENGTH RECOVERY	N	WC	Q_u	γ DRY	DEPTH	ELEV.	SOIL DESCRIPTIONS
							0		
									FILL - Green SAND and CLAY
							3.0	5.4	
1	SS		20						Firm brown fine SAND, moist
							7.0	1.4	
2	SS		30						Dense to firm black fine SAND, wet
3	SS		12						
							17.0	-8.6	
4	SS		14	19.9	2.08 2.0*				Very tough gray silty CLAY, trace sand and gravel, moist
5	ST			20.1	2.28 2.25*	104.4			
							27.0	-18.6	
6	SS		33	17.4	4.96 4.5+*				Hard gray silty CLAY, trace sand and gravel, moist
							32.0	-23.6	
7	SS		36	10.6	4.5+*				Hard gray silty CLAY, trace sand and gravel, damp
8	SS		155	9.8	4.5+*				

Distance Below Surface in Feet: 0, 5, 10, 15, 20, 25, 30, 35, 40

TESTING SERVICE CORPORATION

DRILL RIG NO. _____

CONTINUED ON THIS SHEET

METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO, CALUMET SYSTEM OF THE

PROJECT TUNNEL & RESERVOIR PLAN, TORRENCE AVENUE BRANCH

CLIENT KEIFER & ASSOCIATES, INC., 20 North Wacker Dr., Chicago, Illinois 60606

BORING CDS-31 DATE STARTED 10-14-76 DATE COMPLETED 10-14-76 JOB 13,870

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GROUND SURFACE 8.4 C.C.D.

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WATER TABLE

AT END OF BORING -5.0'

24 HOURS -4.5'

While Drilling -8.0'

LENGTH RECOVERY	SAMPLE NO.	SAMPLE TYPE	N	WC	Q_u	γDRY	DEPTH	ELEV.	SOIL DESCRIPTIONS
									Hard gray silty CLAY, trace sand and gravel, damp
							43.5	-35.1	
	9	SS	100/2"						Weathered LIMESTONE
							46.0	-37.6	
	10	"NX" RC	56% Recovery				48.1	-39.7	Grayish-white coarse crystalline LIMESTONE, vugs, small seams of limy shale - massive bedding - slightly fossiliferous.
							49.1	-40.7	Grayish-white fossiliferous, coarsely crystalline LIMESTONE, porous but not very permeable
	11	"NX" RC	100% Recovery						Blueish-gray - white shaly DOLOMITE. Many seams of calcite- This part of core appears quite disturbed. Dolomite has seams of limy shale and calcite running through it with vugs. Some Pyrite occurs in the Dolomite.
			End of Boring at 56.0 feet						

*-Approximate unconfined compression strength based on measurements with a calibrated pocket penetrometer

Distance Below Surface in Feet

40 45 50 55 60 65 70 75 80

TESTING SERVICE CORPORATION

DRILL RIG NO. _____

PROJECT METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO, CALUMET SYSTEM OF THE TUNNEL & RESERVOIR PLAN, TORRENCE AVENUE BRANCH

CLIENT KEIFER & ASSOCIATES, INC., 20 North Wacker Dr., Chicago, Illinois 60606

BORING CDS-32 DATE STARTED 10-28-76 DATE COMPLETED 10-28-76 JOB 13,870

ELEVATIONS

GROUND SURFACE 8.0 C.C.D.

END OF BORING -86.0 C.C.D.

N. COORDINATE -- 1,835,197.2

E. COORDINATE -- 716,573.0

WATER TABLE

AT END OF BORING -7.0'

24 HOURS -7.0'

While Drilling -8.5'

SAMPLE NO.	TYPE	LENGTH RECOVERY	N	WC	Q_u	% DRY	DEPTH	ELEV.	SOIL DESCRIPTIONS
							0.5	7.5	ASPHALT
							2.0	6.0	CONCRETE
									FILL - Black sandy TOPSOIL
							3.5	4.5	
1	SS		11						Firm brown medium SAND, moist
							8.0	0.0	
2	SS		35						Dense brown medium SAND, trace gravel, wet (saturated)
							12.0	-4.0	
3	SS		22						Firm brown medium SAND, wet (saturated)
							17.0	-9.0	
4	SS		33						Dnese gray fine to medium SAND, trace silt, wet (saturated)
							22.0	-14.0	
5	SS		17	20.1	1.79 2.0*				Tough to very tough gray silty CLAY, trace sand and gravel, moist
6	ST			13.4	5.47 4.5+*	118.4			
7	SS		19	18.4	2.92 3.0*				
8	ST			19.8	2.11 2.5*	107.0			

Distance Below Surface in Feet

0 5 10 15 20 25 30 35 40

TESTING SERVICE CORPORATION

DRILL RIG NO. _____

CONTINUED ON THIS SHEET

PROJECT METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO, CALUMET SYSTEM OF THE TUNNEL & RESERVOIR PLAN, TORRENCE AVENUE BRANCH

CLIENT KEIFER & ASSOCIATES, INC., 20 North Wacker Dr., Chicago, Illinois 60606

BORING CDS-32 DATE STARTED 10-28-76 DATE COMPLETED 10-28-76 JOB 13,870

ELEVATIONS

GROUND SURFACE 8.0 C.C.D.

END OF BORING -86.0 C.C.D.

N. COORDINATE -- 1,835,197.2

E. COORDINATE -- 716,573.0

WATER TABLE

AT END OF BORING -7.0'

24 HOURS -7.0'

While Drilling -8.5'

Distance Below Surface in Feet	LENGTH RECOVERY	SAMPLE NO.	SAMPLE TYPE	N	WC	Q_u	%DRY	DEPTH	ELEV.	SOIL DESCRIPTIONS
40										Tough to very tough gray silty CLAY, trace sand and gravel, moist
						1.54				
45		9	SS	15	23.5	1.75*		45.0	-37.0	
										Hard gray silty CLAY, trace fine sand, moist
50		10	SS	99	13.9	4.5+*				
								52.0	-44.0	
						11.25				Hard gray silty CLAY, trace sand, damp
55		11	SS	99	10.7	4.5+*				
		12	SS	86	11.2	4.5+*				
60										
		13	SS	58						
65										
						9.58				
		14	SS	71	12.7	4.5+*				
70										
		15	SS	75	12.9	4.5+*				
75										
						9.58				
		16	SS	89	12.2	4.5+*				
80										

DRILL RIG NO. _____

CONTINUED ON THIS SHEET

PROJECT METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO. CALUMET SYSTEM OF THE TUNNEL & RESERVOIR PLAN, TORRENCE AVENUE BRANCH

CLIENT KEIFER & ASSOCIATES, INC., 20 North Wacker Dr., Chicago, Illinois 60606

BORING CDS-32 DATE STARTED 10-28-76 DATE COMPLETED 10-28-76 JOB L-13,870

ELEVATIONS

GROUND SURFACE 8.0 C.C.D.

END OF BORING -86.0 C.C.D.

N. COORDINATE -- 1,835,197.2

E. COORDINATE -- 716,573.0

WATER TABLE

AT END OF BORING -7.0'

24 HOURS -7.0'

While Drilling -8.5'

Distance Below Surface in Feet	LENGTH RECOVERY	SAMPLE NO.	SAMPLE TYPE	N	WC	Q_u	%DRY	DEPTH	ELEV.	SOIL DESCRIPTIONS
80										Hard gray silty CLAY, trace sand, damp
		17	SS	100/2"				83.5		Weathered LIMESTONE
85			"NX"					84.0		Gray-white DOLOMITE; crystalline well weathered at 84.0-85.0'; pyrite crystals occur along fracture surfaces, generally unweathered to 88.0'; 88.0-92.0' well fractured and broken; loss of recovery at ±91.0' due to prominent fracture; pyritization has occurred along fractures - shale seams more apparent towards end of core
		18	RC	80% Recovery						
90										
95										
				End of Boring at 94.0 feet						
100										
105										
110										
115										
120										

*-Approximate unconfined compression strength based on measurements with a calibrated pocket penetrometer

DRILL RIG NO. _____

METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO, CALUMET SYSTEM OF THE TUNNEL & RESERVOIR PLAN, TORRENCE AVENUE BRANCH

PROJECT

CLIENT KEIFER & ASSOCIATES, INC., 20 North Wacker Dr., Chicago, Illinois 60606

BORING CDS-33 DATE STARTED 10-18-76 DATE COMPLETED 10-20-76 JOB 13,870

ELEVATIONS

GROUND SURFACE 15.5 C.C.D.

END OF BORING -82.5 C.C.D.

N. COORDINATE -- 1,842,866.6

E. COORDINATE -- 714,581.0

WATER TABLE

AT END OF BORING - 5.0'

24 HOURS -16.0'

While Drilling -19.0'

Distance Below Surface in Feet	LENGTH RECOVERY	SAMPLE NO.	SAMPLE TYPE	N	WC	Q_u	γ_{DRY}	DEPTH	ELEV.	SOIL DESCRIPTIONS
0								1.5	14.0	FILL - Black sandy TOPSOIL
								3.0	12.5	FILL - Medium to large GRAVEL
▽ 5		1	SS	11						FILL - Browm medium SAND and black sandy TOPSOIL (alternating layers), occasional thin clay layer
10		2	SS	8						
15		3	SS	17						
▼								16.0	-0.5	
▼ 20		4	SS	36						Dense brown medium SAND, wet (saturated)
25		5	SS	42						
								27.0	-11.5	
						1.36				Tough to very tough gray silty CLAY, trace sand and gravel, moist
30		6	SS	16	18.7	1.5*				
35		7	ST		21.1	1.25*	106.0			
						2.49				
40		8	SS	23	15.4	2.5*				

TESTING SERVICE CORPORATION

DRILL RIG NO.

CONTINUED ON THIS SHEET

METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO, CALUMET SYSTEM OF THE

PROJECT TUNNEL & RESERVOIR PLAN, TORRENCE AVENUE BRANCH

CLIENT KEIFER & ASSOCIATES, INC., 20 North Wacker Dr., Chicago, Illinois 60606

BORING CDS-33 DATE STARTED 10-18-76 DATE COMPLETED 10-18-76 JOB 13,870

ELEVATIONS

GROUND SURFACE 15.5 C.C.D.

END OF BORING -82.5 C.C.D.

N. COORDINATE -- 1,842,866.6

E. COORDINATE -- 714,581.0

WATER TABLE

AT END OF BORING - 5.0'

24 HOURS -16.0'

While Drilling -19.0'

Distance Below Surface in Feet	LENGTH RECOVERY	SAMPLE NO.	TYPE	N	WC	Q_u	γ_{DRY}	DEPTH	ELEV.	SOIL DESCRIPTIONS
40										
		9	ST		17.9	2.71 2.5*	112.8			Tough to very tough gray silty CLAY, trace sand and gravel, moist
45										
		10	SS	30	12.6	3.81 4.5*				
50								52.0	-36.5	
		11	SS	56	9.6					Dense gray clayey SILT, trace sand and gravel, occasional thin sand and gravel seams, moist
55										
		12	SS	81	9.9					
60										
		13	SS	50	11.2					
65								67.0	-51.5	
		14	SS	97	14.9	3.0*				Very tough to hard gray silty CLAY, trace sand and gravel, moist to damp
70										
		15	SS	49	11.4	6.70 4.5+*				
75										
		16	SS	78	10.0	7.90 4.5+*				
80										

DRILL RIG NO. _____

CONTINUED ON THIS SHEET

PROJECT METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO, CALUMET SYSTEM OF THE TUNNEL & RESERVOIR PLAN, TORRENCE AVENUE BRANCH

CLIENT KEIFER & ASSOCIATES, INC., 20 North Wacker Dr., Chicago, Illinois 60606

BORING CDS-33 DATE STARTED 10-18-76 DATE COMPLETED 10-18-76 JOB L-13,87(

ELEVATIONS

GROUND SURFACE 15.5 C.C.D.

END OF BORING -82.5 C.C.D.

N. COORDINATE -- 1,842,866.6

E. COORDINATE -- 714,581.0

WATER TABLE

AT END OF BORING - 5.0'

24 HOURS -16.0'

While Drilling -19.0'

Distance Below Surface in Feet	LENGTH RECOVERY	SAMPLE NO.	TYPE	N	WC	Q_u	γ DRY	DEPTH	ELEV.	SOIL DESCRIPTIONS
80										Very tough to hard gray silty CLAY, trace sand and gravel, moist to damp
85		17	SS	85	16.6	4.5+*				
								86.0	-70.5	Hard gray silty CLAY with weathered limestone
								88.0	-72.5	
90		18	"NX" RC	88.3% Recovery						Blueish-gray DOLOMITE, very dense, very small seams of pyrite, massive bedding
95										
100				End of Boring at 98.0 feet						*-Approximate unconfined compression strength based on measurements with a calibrated pocket penetrometer
105										
110										
115										
120										

TESTING SERVICE CORPORATION

DRILL RIG NO. _____

ENCLOSURE H

BORING LOGS NEAR HAMMOND, IN LOCATION

Hammond, IN

GLMRIS

Legend

Boring Locations

Date: 10/9/2013

1 IN = 500 FT

Path: J:\LRC_Projects\PRJ_GLMRIS\MXD\Borings\Hammond.mxd

DRILLING LOG

DIVISION: North Central
INSTALLATION: Chicago District
SHEET 1 OF 2 SHEETS

1. PROJECT	Little Calumet River, IN
JOB NUMBER	200604307
2. LOCATION (Coordinates or Station)	Sta. 1920 - N1481433.4450; E390575.1897
3. DRILLING AGENCY	Subsurface Exploration, Inc.
4. HOLE NO. (As shown on drawing title and file number)	C-1
5. NAME OF DRILLER	Mark Baker
6. DIRECTION OF HOLE	[X] VERTICAL [ ] INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN	N/A
8. DEPTH DRILLED INTO ROCK	N/A
9. TOTAL DEPTH OF HOLE	35.0
10. SIZE AND TYPE OF BIT	4 in. PA
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	NGVD 29; NAD 17 (IN St. Plane)
12. MANUFACTURER'S DESIGNATION OF DRILL	Diedrich D-50
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN	DISTURBED 14 / UNDISTURBED
14. TOTAL NUMBER CORE BOXES	N/A
15. ELEVATION GROUND WATER	586.8
16. DATE HOLE	STARTED 8-10-06 / COMPLETED 8-10-06
17. ELEVATION TOP OF HOLE	601.80
18. TOTAL CORE RECOVERY FOR BORING	N/A %
19. SIGNATURE OF INSPECTOR	

ELEVATION (ft) a	DEPTH (ft) b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
			Clayey silt - brown - loose, moist (ML)	42	S-1 0 - 2.0	2-2-3-4 WC=17.1%
598.8	3.0					
598.3	3.5		Silty fine sand - brown- loose - moist (SP-SM)	50	S-2 2.5 - 4.5	3-4-6-8 WC=5.9%
			Clayey silt - brown - medium dense - moist (ML)	50	S-3 5.0 - 7.0	5-5-6-8 WC=14.8%
				58	S-4 7.5 - 9.5	4-4-4-6 WC=14.8%
591.8	10.0		Medium sand - gray - medium dense - moist (SP)	42	S-5 10.0 - 12.0	4-1-7-10 WC=4.2%
589.3	12.5		Sandy silt, little clay - dark brown to black - loose - saturated (SM)	58	S-6 12.5 - 14.5	2-1-1-1 WC=35.8%
586.8	15.0		Organic silty clay - black - medium dense - moist (OH)	54	S-7 15.0 - 17.0	Water at 15 ft. WD 2-2-4-7 WC=77.3% LL=70%, PL=39%, PI=31%
583.8	18.0		Silty clay, trace fine sand - gray - stiff to very stiff (CL)	67	S-8 17.5 - 19.5	7-7-10-13 WC=13.5% Qp=1.5

DRILLING LOG (Cont Sheet) | ELEVATION TOP OF HOLE 601.8 | **Hole No. C-1**

PROJECT: Little Calumet River, IN | INSTALLATION: Chicago District | SHEET 2 OF 2 SHEETS

ELEVATION (ft) a	DEPTH (ft) b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV-ERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth weathering, etc., if significant) g
			Silty clay, trace fine sand - gray - stiff to very stiff (CL)	75	S-9 20.0 - 22.0	5-8-11-12 Qp=2.0 tsf WC=17.1%
			Silt fraction increases with depth.			
				58	S-10 22.5 - 24.5	3-7-8-11 Qp=2.0 tsf WC=18.1%
				83	S-11 25.0 - 27.0	8-9-14 Qp=2.0 tsf
				83	S-12 27.5 - 29.0	8-13-21 Qp=2.75 tsf
				83	S-13 30.0 - 31.5	10-16-25 Qp=2.5 tsf
				75	S-14 33.0 - 35.0	7-9-15-26 Qp=3.0 tsf
566.8	35.0		End of Boring Borehole backfilled with soil cuttings and bentonite chips upon completion.			

Hole No. L-575

DRILLING LOG	DIVISION North Central	INSTALLATION Chicago District	SHEET 1 OF 2 SHEETS

1. PROJECT	Little Calumet River Levees - West Reach
2. LOCATION (Coordinates or Station)	N 1481380.2, E 389914.5
3. DRILLING AGENCY	Dodson-Lindblom Associates, Inc.
4. HOLE NO. (As shown on drawing title and file number)	L-575
5. NAME OF DRILLER	William Wallace
6. DIRECTION OF HOLE	[X] VERTICAL [ ] INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN	25.0
8. DEPTH DRILLED INTO ROCK	0.0
9. TOTAL DEPTH OF HOLE	25.0
10. SIZE AND TYPE OF BIT	4¼" I.D. HSA
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	NGVD
12. MANUFACTURER'S DESIGNATION OF DRILL	Mobile B-57
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN	DISTURBED 10 / UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES	0
15. ELEVATION GROUND WATER	See remarks
16. DATE HOLE	STARTED 8-31-91 / COMPLETED 8-31-91
17. ELEVATION TOP OF HOLE	601.4
18. TOTAL CORE RECOVERY FOR BORING	N/A %
19. SIGNATURE OF INSPECTOR	Jeffrey L. Dodson

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
601.1	0.3		Topsoil - 4"			
			Dark brown silt, little clay, little fine to coarse sand, medium dense, very low plasticity, damp, contains root fragments, fill ML	15/18"	SS- 1 1.0-2.5	6-6-8 wc = 18.7%
598.4	3.0		Gray silty clay, some fine to coarse sand, trace gravel very stiff, medium plasticity damp to moist, contains sand seam, fill CL	16/18"	SS- 2 3.5-5.0	5-10-8 qu* = 4.0 tsf wc = 17.5%
	5					
595.9	5.5		Dark gray clayey silt, little fine to coarse sand, trace gravel, stiff, low plasticity, damp to moist CL-ML	9/18"	SS- 3 6.0-7.5	4-6-7 No H.P. reading wc = 21.5%
593.4	8.0		Gray and brown silty clay, some fine to coarse sand, trace gravel, very stiff, medium plasticity, damp to moist CL	13/18"	SS- 4 8.5-10.0	4-6-11 qu* = 4.0 tsf wc = 17.4%
	10					
590.4	11.0		Gray silty clay, some fine to coarse sand, little gravel, very stiff, medium plasticity, damp CL	13/18"	SS- 5 11.0-12.5	4-9-12 qu* = 3.0 tsf wc = 16.5%
587.9	13.5		Gray silty clay, little fine to coarse sand, trace gravel, stiff to very stiff, medium plasticity, moist CL	16/18"	SS- 6 13.5-15.0	5-9-11 qu* = 3.0 tsf wc = 22.1%
	15		@ 16.0' - 17.5', iron-stained	16/18"	SS- 7 16.0-17.5	2-6-9 qu* = 2.0 tsf wc = 20.9%
				18/18"	SS- 8 18.5-20.0	3-7-9 qu* = 2.0 tsf wc = 21.7%

Hole No. L-575

DRILLING LOG	DIVISION: North Central	INSTALLATION: Chicago District	SHEET 2 OF 2 SHEETS

1. PROJECT: Little Calumet River Levees - West Reach
2. LOCATION (Coordinates or Station): N 1481380.2, E 389914.5
3. DRILLING AGENCY: Dodson-Lindblom Associates, Inc.
4. HOLE NO. (As shown on drawing title and file number): L-575
5. NAME OF DRILLER: William Wallace
6. DIRECTION OF HOLE: [X] VERTICAL [ ] INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 25.0
8. DEPTH DRILLED INTO ROCK: 0.0
9. TOTAL DEPTH OF HOLE: 25.0
10. SIZE AND TYPE OF BIT: 4¼" I.D. HSA
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): NGVD
12. MANUFACTURER'S DESIGNATION OF DRILL: Mobile B-57
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 10; UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES: 0
15. ELEVATION GROUND WATER: See remarks
16. DATE HOLE: STARTED 8-31-91; COMPLETED 8-31-91
17. ELEVATION TOP OF HOLE: 601.4
18. TOTAL CORE RECOVERY FOR BORING: N/A %
19. SIGNATURE OF INSPECTOR: Jeff L. Doyle

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
			Gray silty clay, little fine to coarse sand, trace gravel, stiff to very stiff medium plasticity, moist CL	18/18"	SS- 9 21.0-22.5	3-6-10 qu* = 2.0 tsf wc = 19.3%
				18/18"	SS-10 23.5-25.0	5-7-9 qu* = 2.0 tsf wc = 20.5%
576.4	25		End of boring at 25.0'			No water encountered while drilling. No water encountered immediately after drilling. No water encountered after 24 hours. Hole caved to 18.4'

Hole No. L-576

DRILLING LOG | DIVISION: North Central | INSTALLATION: Chicago District | SHEET 1 OF 2 SHEETS

1. PROJECT: Little Calumet River Levees - West Reach
2. LOCATION (Coordinates or Station): N 1481512.5, E 390136.0
3. DRILLING AGENCY: Dodson-Lindblom Associates, Inc.
4. HOLE NO. (As shown on drawing title and file number): L-576
5. NAME OF DRILLER: William Wallace
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 30.0
8. DEPTH DRILLED INTO ROCK: 0.0
9. TOTAL DEPTH OF HOLE: 30.0
10. SIZE AND TYPE OF BIT: 4¼" I.D. HSA
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): NGVD
12. MANUFACTURER'S DESIGNATION OF DRILL: Mobile B-57
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 12; UNDISTURBED 3
14. TOTAL NUMBER CORE BOXES: 0
15. ELEVATION GROUND WATER: See remarks
16. DATE HOLE: STARTED 10-1-91; COMPLETED 10-1-91
17. ELEVATION TOP OF HOLE: 594.5
18. TOTAL CORE RECOVERY FOR BORING: N/A %
19. SIGNATURE OF INSPECTOR: Jeff L Snyder

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
594.2	0.3		Topsoil - 3.5"			
			Dark brown clayey silt, some fine to coarse sand, trace gravel, stiff to very stiff, low plasticity, moist, contains organic material, fill CL-ML	14/18"	SS- 1 1.0-2.5	3-3-3 qu* = 2.0 tsf wc = 20.6%
591.5	3.0		@ 1.2' - 1.4', sand seam			
			Gray silt "and" fine sand, little clay, loose, low plasticity, wet, contains root fragments, iron-stained fill ML	14/18"	SS- 2 3.5-5.0	1-3-3 wc = 30.5% Water at 3.5' while drilling.
	5					
588.5	6.0		Brown fine sand, trace silt, very loose, wet SP-SM	14/18"	SS- 3 6.0-7.5	0-0-1 wc = 25.8%
			@ 8.5' - 11.0', dark gray, little silt, contains organic material and shell fragments	12/18"	SS- 4 8.5-10.0	2-2-1 wc = 24.5% Gravel = 7% Sand = 79% Fines = 14% Sand heaved 3' into hollow stem augers
	10					
583.5	11.0		Gray silty clay, little fine to coarse sand, trace gravel, stiff, medium plasticity, moist CL	16/18"	SS- 5 11.0-12.5	6-8-12 qu* = 1.5 tsf wc = 20.0%
				16/18"	SS- 6 13.5-15.0	4-8-12 qu* = 1.5 tsf wc = 20.4% R-Test (3T-1): c = 0.31 tsf Ø = 22.9° γd = 110.4 pcf
	15					
			@ 16.0' - 17.5', some fine to coarse sand, little gravel	16/18"	SS- 7 16.0-17.5	4-5-7 qu* = 1.5 tsf wc = 17.9% Q-Test (3T-2): wc = 16.2% c = 0.91 tsf Ø = 0.3° γd = 116.3 pcf LL = 34 PI = 18
			@ 18.5' - 19.3', "and" fine to coarse sand, little gravel	16/18"	SS-8AB 18.5-20.0	4-5-8 qu* = 1.5 tsf wc = 15.4% (SS-8A) wc = 20.3% (SS-8B)

Hole No. L-576

DRILLING LOG | DIVISION: North Central | INSTALLATION: Chicago District | SHEET 2 OF 2 SHEETS

1. PROJECT: Little Calumet River Levees - West Reach
2. LOCATION (Coordinates or Station): N 1481512.5, E 390136.0
3. DRILLING AGENCY: Dodson-Lindblom Associates, Inc.
4. HOLE NO. (As shown on drawing title and file number): L-576
5. NAME OF DRILLER: William Wallace
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 30.0
8. DEPTH DRILLED INTO ROCK: 0.0
9. TOTAL DEPTH OF HOLE: 30.0
10. SIZE AND TYPE OF BIT: 4¼" I.D. HSA
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): NGVD
12. MANUFACTURER'S DESIGNATION OF DRILL: Mobile B-57
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 12; UNDISTURBED 3
14. TOTAL NUMBER CORE BOXES: 0
15. ELEVATION GROUND WATER: See remarks
16. DATE HOLE: STARTED 10-1-91; COMPLETED 10-1-91
17. ELEVATION TOP OF HOLE: 594.5
18. TOTAL CORE RECOVERY FOR BORING: N/A %
19. SIGNATURE OF INSPECTOR: Jeffrey L. Snyder

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
			Gray silty clay, little fine to coarse sand, trace gravel, stiff to very stiff medium plasticity, moist, contains silt lenses CL	18/18"	SS- 9 21.0-22.5	4-9-11 qu* = 2.0 tsf wc = 21.5%
			@ 23.5' - 25.0', some fine to coarse sand	18/18"	SS-10 23.5-25.0	5-8-11 qu* = 2.0 tsf wc = 21.9%
570.0	24.5					
	25		Gray clayey silt, some fine to coarse sand, trace gravel, very stiff, low plasticity, moist CL-ML	14/18"	SS-11 26.0-27.5	4-7-9 qu* = 2.5 tsf wc = 16.6%
567.0	27.5		Gray silty clay, little fine to coarse sand, trace gravel, very stiff, medium plasticity, moist CL	16/18"	SS-12 28.5-30.0	5-9-11 qu* = 2.5 tsf wc = 20.2%
564.5	30		End of boring at 30.0'			Water at 14.3' immediately after drilling. Water at 5.0' at 24 hours.
						A boring was drilled offset to obtain Shelby tubes 3T-1, 3T-2, and 3T-3 at 14.0' - 20.0' 3T-1 Recovery = 24/24" 3T-2 Recovery = 22/24" 3T-3 Recovery = 24/24"

Hole No. L-577

DRILLING LOG	DIVISION North Central	INSTALLATION Chicago District	SHEET 1 OF 2 SHEETS

1. PROJECT	Little Calumet River Levees - West Reach
2. LOCATION (Coordinates or Station)	N 1481334.4, E 390282.1
3. DRILLING AGENCY	Dodson-Lindblom Associates, Inc.
4. HOLE NO. (As shown on drawing title and file number)	L-577
5. NAME OF DRILLER	William Wallace
6. DIRECTION OF HOLE	☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN	30.0
8. DEPTH DRILLED INTO ROCK	0.0
9. TOTAL DEPTH OF HOLE	30.0
10. SIZE AND TYPE OF BIT	4-¼" I.D. HSA
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	NGVD
12. MANUFACTURER'S DESIGNATION OF DRILL	Mobile B-57
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN	DISTURBED 12 / UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES	0
15. ELEVATION GROUND WATER	See remarks
16. DATE HOLE	STARTED 9-3-91 / COMPLETED 9-3-91
17. ELEVATION TOP OF HOLE	595.5
18. TOTAL CORE RECOVERY FOR BORING	N/A %
19. SIGNATURE OF INSPECTOR	J. L. Snyder

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
595.2	0.3		Topsoil - 3"			
			Brown clayey silt, some fine to coarse sand, trace gravel, very stiff, low plasticity, damp, contains wood fragments, fill CL-ML	13/18"	SS- 1 1.0-2.5	4-9-10 qu*= 3.5 tsf wc = 13.6%
592.0	3.5		Light brown silt, trace fine to coarse sand, trace clay, medium dense, non-plastic, dry to damp, fill ML	15/18"	SS- 2 3.5-5.0	8-13-11 wc = 5.7%
590.0	5.0 5.5		Brown and gray silty clay, little fine to coarse sand, trace gravel, very stiff, medium plasticity, damp to moist CL	14/18"	SS- 3 6.0-7.5	3-8-10 qu* = 4.0 tsf wc = 20.3%
587.0	8.5		Gray silty clay, little fine to coarse sand, trace gravel, very stiff, medium plasticity, damp to moist CL	16/18"	SS- 4 8.5-10.0	2-7-6 qu* = 2.5 tsf wc = 19.1%
	10.0		@ 11.0-20.0, medium stiff to stiff, moist	18/18"	SS- 5 11.0-12.5	1-5-6 qu* = 1.0-2.0 tsf wc = 18.1%
				18/18"	SS- 6 13.5-15.0	2-4-6 qu* = 0.5-2.0 tsf wc = 20.8%
	15.0			18/18"	SS- 7 16.0-17.5	2-5-6 qu* = 1.0 tsf wc = 21.7%
				18/18"	SS- 8 18.5-20.0	2-6-8 qu* = 1.5 tsf wc = 20.3%

Hole No. L-577

DRILLING LOG	DIVISION: North Central	INSTALLATION: Chicago District	SHEET 2 OF 2 SHEETS

1. PROJECT: Little Calumet River Levees - West Reach
2. LOCATION (Coordinates or Station): N 1481334.4, E 390282.1
3. DRILLING AGENCY: Dodson-Lindblom Associates, Inc.
4. HOLE NO. (As shown on drawing title and file number): L-577
5. NAME OF DRILLER: William Wallace
6. DIRECTION OF HOLE: [X] VERTICAL [ ] INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 30.0
8. DEPTH DRILLED INTO ROCK: 0.0
9. TOTAL DEPTH OF HOLE: 30.0
10. SIZE AND TYPE OF BIT: 4-1/4" I.D. HSA
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): NGVD
12. MANUFACTURER'S DESIGNATION OF DRILL: Mobile B-57
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 12; UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES: 0
15. ELEVATION GROUND WATER: See remarks
16. DATE HOLE: STARTED 9-3-91; COMPLETED 9-3-91
17. ELEVATION TOP OF HOLE: 595.5
18. TOTAL CORE RECOVERY FOR BORING: N/A %
19. SIGNATURE OF INSPECTOR: Jeff L. Snyder

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
			Gray silty clay, little fine to coarse sand, trace gravel, stiff to very stiff, medium plasticity, moist CL	18/18"	SS-9 21.0-22.5	4-9-13 qu* = 1.5 tsf
571.7	23.8		Gray clayey silt, little fine to coarse sand, very stiff, low plasticity, damp to moist CL-ML	18/18"	SS-10AB 23.5-25.0	4-7-11 qu* = 2.0 tsf (10A) qu* = 3.0 tsf (10B) wc = 18.2% (SS-10A wc = 16.7% (SS-10B)
	25.0					
569.5	26.0		Gray silt, trace fine sand, dense to very dense, non-plastic, damp to moist ML	16/18"	SS-11 26.0-27.5	12-26-23 wc = 18.7%
				18/18"	SS-12 28.5-30.0	14-31-39 wc = 15.9%
565.5	30.0		End of boring at 30.0'.			No water encountered while drilling. No water encountered immediately after drilling. Water at 25.8' after 24 hours. Hole caved to 28.2'.

Hole No. L-578

DRILLING LOG | DIVISION North Central | INSTALLATION Chicago District | SHEET 1 OF 2 SHEETS

1. PROJECT: Little Calumet River Levees - West Reach
2. LOCATION (Coordinates or Station): N 1481763.2, E 390792.0
3. DRILLING AGENCY: Dodson-Lindblom Associates, Inc.
4. HOLE NO. (As shown on drawing title and file number): L-578
5. NAME OF DRILLER: John Benson
6. DIRECTION OF HOLE: [X] VERTICAL [ ] INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 30.0
8. DEPTH DRILLED INTO ROCK: 0.0
9. TOTAL DEPTH OF HOLE: 30.0
10. SIZE AND TYPE OF BIT: 4-¼" I.D. HSA
11. DATUM FOR ELEVATION SHOWN (USM or MSL): NGVD
12. MANUFACTURER'S DESIGNATION OF DRILL: Mobile B-57
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 12; UNDISTURBED --
14. TOTAL NUMBER CORE BOXES: 0
15. ELEVATION GROUND WATER: See Remarks
16. DATE HOLE: STARTED 9-11-91; COMPLETED 9-11-91
17. ELEVATION TOP OF HOLE: 597.0
18. TOTAL CORE RECOVERY FOR BORING: N/A %
19. SIGNATURE OF INSPECTOR: Robert C. Reese

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
596.7	0.3		Sandy topsoil - 4"			
			Gray clayey silt "and" fine to coarse sand, medium stiff, low plasticity, moist, fill CL-ML	12/18"	SS- 1 1.0-2.5	1-2-4 qu* = 1.0 tsf wc = 18.1%
593.5	3.5		Brown and gray silty clay, some fine to coarse sand, trace gravel, very stiff, medium plasticity, moist CL	12/18"	SS- 2 3.5-5.0	4-8-11 qu* = 3.0 tsf wc = 21.1%
	5.0		@ 6.0-7.5, stiff, little fine to coarse sand, iron-stained, contains silt seam	13/18"	SS- 3 6.0-7.5	3-6-7 qu* = 2.0 tsf wc = 20.2%
588.5	8.5		Brown and gray silt, trace fine sand, trace clay, loose to medium dense, very low-plasticity, moist, contains clay lumps ML	12/18"	SS- 4 8.5-10.0	3-4-6 wc = 22.1%
	10.0					
586.0	11.0		Gray silty clay, little fine to coarse sand, trace gravel, very stiff, medium plasticity, moist CL	18/18"	SS- 5 11.0-12.5	8-9-14 qu* = 3.0 tsf wc = 18.8%
				18/18"	SS- 6 13.5-15.0	9-9-12 qu* = 2.5 tsf wc = 18.6%
	15.0			13/18"	SS- 7 16.0-17.5	2-6-7 qu* = 2.5 tsf wc = 19.7%
			@ 18.5-20.0, stiff to very stiff	16/18"	SS- 8 18.5-20.0	2-5-8 qu* = 2.0-2.5 tsf wc = 20.0%

(TRANSLUCENT)
(TRANSLUCENT)

Hole No. L-578

DRILLING LOG	DIVISION: North Central	INSTALLATION: Chicago District	SHEET 2 OF 2 SHEETS

1. PROJECT: Little Calumet River Levees - West Reach
2. LOCATION (Coordinates or Station): N 1481763.2, E 390792.0
3. DRILLING AGENCY: Dodson-Lindblom Associates, Inc.
4. HOLE NO. (As shown on drawing title and file number): L-578
5. NAME OF DRILLER: John Benson
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 30.0
8. DEPTH DRILLED INTO ROCK: 0.0
9. TOTAL DEPTH OF HOLE: 30.0
10. SIZE AND TYPE OF BIT: 4-1/4" I.D. HSA
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): NGVD
12. MANUFACTURER'S DESIGNATION OF DRILL: Mobile B-57
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 12; UNDISTURBED --
14. TOTAL NUMBER CORE BOXES: 0
15. ELEVATION GROUND WATER: See Remarks
16. DATE HOLE: STARTED 9-11-91; COMPLETED 9-11-91
17. ELEVATION TOP OF HOLE: 597.0
18. TOTAL CORE RECOVERY FOR BORING: N/A %
19. SIGNATURE OF INSPECTOR: Robert C. Rees

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
			Gray silty clay, little fine to coarse sand, trace gravel, very stiff, medium plasticity, moist CL	18/18"	SS- 9 21.0-22.5	7-11-14 qu* = 3.0 tsf wc = 18.9%
				18/18"	SS- 10 23.5-25.0	7-9-14 qu* = 3.0 tsf wc = 25.5%
	25			18/18"	SS- 11 26.0-27.1	6-8-11 qu* = 3.0 tsf wc = 24.5%
			@ 28.5-30.0, stiff to very stiff	16/18"	SS-12 28.5-30.0	8-9-13 qu* = 2.0 - 3.0 tsf wc = 22.9%
567.0	30		End of boring at 30.0'.			No water encountered while drilling. Water at 28.4' immediately after drilling. Water at 7.2' after 24 hours. Hole caved to 19.0'.

Hole No. L-591

DRILLING LOG	DIVISION: North Central	INSTALLATION: Chicago District	SHEET 1 OF 2 SHEETS

1. PROJECT: Little Calumet River Levees - West Reach
2. LOCATION (Coordinates or Station): N 1481837.8. E 391242.5
3. DRILLING AGENCY: Dodson-Lindblom Associates, Inc.
4. HOLE NO. (As shown on drawing title and file number): L-591
5. NAME OF DRILLER: John Benson
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 30.0
8. DEPTH DRILLED INTO ROCK: 0.0
9. TOTAL DEPTH OF HOLE: 30.0
10. SIZE AND TYPE OF BIT: 4¼" I.D. HSA
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): NGVD
12. MANUFACTURER'S DESIGNATION OF DRILL: Mobile B57
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED 12; UNDISTURBED -
14. TOTAL NUMBER CORE BOXES: 0
15. ELEVATION GROUND WATER: See remarks
16. DATE HOLE: STARTED 9-11-91; COMPLETED 9-11-91
17. ELEVATION TOP OF HOLE: 598.7
18. TOTAL CORE RECOVERY FOR BORING: N/A %
19. SIGNATURE OF INSPECTOR: Robert C. Bear

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
598.4	0.3		Topsoil - 3"			
			Brown fine to coarse sand, some silt, trace gravel, medium dense, damp, fill SM	10/18"	SS- 1 1.0-2.5	5-6-7 wc = 6.7%
595.7	3.0		Brown and gray silty clay, some fine sand, medium dense, medium plasticity, moist, fill CL	12/18"	SS- 2 3.5-5.0	14-8-11 qu* = 1.25 tsf wc = 18.0%
	5					
593.2	5.5		Brown fine sand, trace silt, loose, moist, possible fill SP	7/18"	SS- 3 6.0-7.5	6-3-2 wc = 11.0%
590.2	8.5		Brown fine to coarse sand, "and" gravel, trace silt, medium dense, wet, possible fill SP-SM	10/18"	SS- 4 8.5-10.0	4-8-5 Water at 9.0' while drilling wc = 10.8% Gravel = 40% Sand = 53% Fines = 7%
	10					
588.2	10.5		Gray silty clay, little fine to coarse sand, trace gravel, stiff to very stiff, medium plasticity, moist, contains silt lenses CL	16/18"	SS- 5 11.0-12.5	5-8-11 qu* = 3.0 tsf wc = 19.7%
				15/18"	SS- 6 13.5-15.0	14-12-14 qu* = 1.5 tsf wc = 19.1%
	15					
				15/18"	SS- 7 16.0-17.5	6-8-10 qu* = 2.5 tsf wc = 17.2%
				18/18"	SS- 8 18.5-20.0	12-11-7 qu* = 2.0 tsf wc = 20.1%

Hole No. L-591

DRILLING LOG | DIVISION: North Central | INSTALLATION: Chicago District | SHEET 2 OF 2 SHEETS

1. PROJECT: Little Calumet River Levees - West Reach
2. LOCATION (Coordinates or Station): N 1481837.8, E 391242.5
3. DRILLING AGENCY: Dodson-Lindblom Associates, Inc.
4. HOLE NO. (As shown on drawing title and file number): L-591
5. NAME OF DRILLER: John Benson
6. DIRECTION OF HOLE: [X] VERTICAL [ ] INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 30.0
8. DEPTH DRILLED INTO ROCK: 0.0
9. TOTAL DEPTH OF HOLE: 30.0
10. SIZE AND TYPE OF BIT: 4½" I.D. HSA
11. DATUM FOR ELEVATION SHOWN (USGS or MSL): NGVD
12. MANUFACTURER'S DESIGNATION OF DRILL: Mobile B57
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED 12; UNDISTURBED -
14. TOTAL NUMBER CORE BOXES: 0
15. ELEVATION GROUND WATER: See remarks
16. DATE HOLE: STARTED 9-11-91; COMPLETED 9-11-91
17. ELEVATION TOP OF HOLE: 598.7
18. TOTAL CORE RECOVERY FOR BORING: N/A %
19. SIGNATURE OF INSPECTOR: Robert C. Russ

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
			Gray silty clay, little fine to coarse sand, trace gravel, stiff to very stiff, medium plasticity, moist CL	18/18"	SS-9 21.0-22.5	7-11-15 qu* = 3.0 tsf Water at 21.0' while drilling wc = 19.3%
574.7	24.0			12/18"	SS-10AB 23.5-25.0	4-7-27 qu* = 2.0 tsf (SS-10A) qu* = 4.5+ tsf (SS-10B wc = 19.7% (SS-10A) wc = 14.2% (SS-10B)
	25		Gray clayey silt, little fine sand, very stiff to hard, low plasticity, damp to moist CL-ML @ 26.0' - 27.5', contains silt seams	10/18"	SS-11 26.0-27.5	37-51-46 qu* = 2.75 tsf wc = 20.0%
				16/18"	SS-12 28.5-30.0	13-33-36 qu* = 4.0 tsf wc = 17.3%
568.7	30		End of boring at 30.0'			Water at 11.8' immediately after drilling. Water at 8.4' after 24 hours. Hole caved to 13.3'

ENCLOSURE I

BORING LOGS NEAR BRANDON ROAD, IL LOCATION

Brandon Road, IL

GLMRIS

Legend

Boring Locations

Date: 9/30/2013

1 IN = 6,322 FT

Path: J:\LRC_Projects\PRJ_GLMRIS\MXD\Borings\BrandonRd.mxd

Illinois Environmental Protection Agency — Field Boring Log

Site File No. _____ County Will Boring No. 3B Monitor Well No. 3B

Site File Name Lockport Prairie Surface Elevation 611.5 Completion Depth 66.0

Fed. ID. No. _____ Auger Depth 30 Rotary Depth 36

Quadrangle Joliet Sec. 28 T. 36N R. 10E Date: Start 11/28/01 Finish 11/28/01

UTM (or State Plane) Coord. N.(X) _____ E.(Y) _____

Latitude ____ ° ____ ' ____ " Longitude ____ ° ____ ' ____ "

Boring Location SE1/4 of NE1/4 of NE1/4

Drilling Equipment Diedrich 120

PERSONNEL
G - R. Hopp
D - Larry
H -
H -

Elev.	DESCRIPTION OF MATERIALS	Graphic Log	Depth in feet	SAMPLE NO.	SAMPLE TYPE	SAMPLE RECOVERY (%)	PENETROMETER	N VALUES (BLOW COUNTS)	OVA or HNU READINGS
	0.0-1.0': SILT, low plasticity, dark yellowish brown (10YR 3/4), organics			SS1		75		6 6	
610.5	1.0-8.0': SAND and GRAVEL, trace silt, few cobbles, fine to medium grained sand, poorly sorted, coarse gravel, rounded to subrounded, nonplastic, hard, yellowish brown (10YR 5/8)		1					12 14	
609.5			2	SS2		50		16 24	
608.5			3					50 /2"	
607.5			4	SS3		75		42 22	
606.5			5					28 41	
605.5			6	SS4		21		50 /5"	
604.5			7						
603.5	8.0-12.0': SAND and GRAVEL, trace silt, few cobbles, fine to medium grained sand, poorly sorted, coarse gravel, rounded to subrounded, nonplastic, hard, brownish yellow (10YR 6/6)		8	SS5		75		27 21	
602.5			9					19 28	
601.5			10	SS6		25		30 50 /5"	

REMARKS

Illinois Environmental Protection Agency — Field Boring Log

Site File No. _____ County Will Boring No. 3B Monitor Well No. 3B

Site File Name Lockport Prairie Surface Elevation 611.5 Completion Depth 66.0

Fed. ID. No. _____ Auger Depth 30 Rotary Depth 36

Quadrangle Joliet Sec. 28 T. 36N R. 10E Date: Start 11/28/01 Finish 11/28/01

UTM (or State Plane) Coord. N.(X) _____ E.(Y) _____

Latitude ____ ° ____ ' ____ " Longitude ____ ° ____ ' ____ "

Boring Location SE1/4 of NE1/4 of NE1/4

Drilling Equipment Diedrich 120

PERSONNEL
G - R. Hopp
D - Larry
H -
H -

Elev.	DESCRIPTION OF MATERIALS	Graphic Log	Depth in feet	SAMPLE NO.	SAMPLE TYPE	SAMPLE RECOVERY (%)	PENETROMETER	N VALUES (BLOW COUNTS)	OVA or HNU READINGS
599.5	12.0-22.0': SAND and GRAVEL, trace silt, few cobbles, fine to medium grained sand, poorly sorted, coarse gravel, rounded to subrounded, nonplastic, hard, yellowish brown (10YR 5/8)		12	SS7		21		50 /5"	
598.5			13						
597.5			14	SS8		75		25 26	
596.5			15					15 8	
595.5			16	SS9		75		14 9	
594.5			17					15 32	
593.5			18	SS10		75		44 34	
592.5			19					35 17	
591.5			20	SS11		75		16 40	
590.5			21					44 40	

REMARKS

Illinois Environmental Protection Agency — Field Boring Log

Site File No. _____ County Will Boring No. 3B Monitor Well No. 3B

Site File Name Lockport Prairie Surface Elevation 611.5 Completion Depth 66.0

Fed. ID. No. _____ Auger Depth 30 Rotary Depth 36

Quadrangle Joliet Sec. 28 T. 36N R. 10E Date: Start 11/28/01 Finish 11/28/01

UTM (or State Plane) Coord. N.(X) _____ E.(Y) _____

Latitude ____ ° ____ ' ____ " Longitude ____ ° ____ ' ____ "

Boring Location SE1/4 of NE1/4 of NE1/4

Drilling Equipment Diedrich 120

PERSONNEL: G - R. Hopp; D - Larry; H - ; H -

Elev.	DESCRIPTION OF MATERIALS	Graphic Log	Depth in feet	SAMPLE NO.	SAMPLE TYPE	SAMPLE RECOVERY (%)	PENETROMETER	N VALUES (BLOW COUNTS)	OVA or HNU READINGS	REMARKS
	22.0-26.0': SAND and GRAVEL, trace silt, few cobbles, fine to medium grained sand, poorly sorted, coarse gravel, rounded to subrounded, nonplastic, hard, brownish yellow (10YR 6/6)			SS12		21		50 /5"		
588.5			23							
587.5			24	SS13		8		70 /2"		
586.5			25							
585.5			26	SS14		50		34		Dry
	26.0-27.0': SAND and GRAVEL, trace silt, few cobbles, fine to medium grained sand, poorly sorted, coarse gravel, rounded to subrounded, nonplastic, hard, yellowish brown (10YR 5/8)							40		
584.5	27.0-30.0': DOLOMITIC BEDROCK		27					52 /2"		Began rotary drilling to seal casing
583.5			28							
582.5			29							
581.5	30.0-46.0': DOLOMITE, yellowish brown, interbedded with 3-6 inches layers of gray dolomite, few chert nodules with white chalky appearance, numerous gray wavy argillaceous partings, few high angle to vertical fractures, fossiliferous		30	Run1		93				Began rock coring START OF RUN1 93% recovery, 95% RQD
580.5			31							
579.5			32							

(950226)

Illinois Environmental Protection Agency — Field Boring Log

Site File No. _____ County Will Boring No. 3B Monitor Well No. 3B

Site File Name Lockport Prairie Surface Elevation 611.5 Completion Depth 66.0

Fed. ID. No. _____ Auger Depth 30 Rotary Depth 36

Quadrangle Joliet Sec. 28 T. 36N R. 10E Date: Start 11/28/01 Finish 11/28/01

UTM (or State Plane) Coord. N.(X) _____ E.(Y) _____

Latitude ____ ° ____ ' ____ " Longitude ____ ° ____ ' ____ "

Boring Location SE1/4 of NE1/4 of NE1/4

Drilling Equipment Diedrich 120

PERSONNEL: G - R. Hopp; D - Larry; H - ; H -

Elev.	DESCRIPTION OF MATERIALS	Graphic Log	Depth in feet	SAMPLE NO.	SAMPLE TYPE	SAMPLE RECOVERY (%)	PENETROMETER	N VALUES (BLOW COUNTS)	OVA or HNU READINGS	REMARKS
577.5	DOLOMITE, yellowish brown, interbedded with 3-6 inches layers of gray dolomite, few chert nodules with white chalky appearance, numerous gray wavy argillaceous partings, few high angle to vertical fractures, fossiliferous		34							
576.5			35							
575.5			36	Run2		100				END OF RUN1 START OF RUN2 100% recovery, 91% RQD
574.5			37							
573.5			38							
572.5			39							
571.5			40							
570.5			41							
569.5			42							
568.5			43							

Illinois Environmental Protection Agency — Field Boring Log

Site File No. _____ County Will Boring No. 3B Monitor Well No. 3B

Site File Name Lockport Prairie Surface Elevation 611.5 Completion Depth 66.0

Fed. ID. No. _____ Auger Depth 30 Rotary Depth 36

Quadrangle Joliet Sec. 28 T. 36N R. 10E Date: Start 11/28/01 Finish 11/28/01

UTM (or State Plane) Coord. N.(X) _____ E.(Y) _____

Latitude ____° ____' ____" Longitude ____° ____' ____"

Boring Location SE1/4 of NE1/4 of NE1/4

Drilling Equipment Diedrich 120

PERSONNEL: G - R. Hopp; D - Larry; H - ; H -

Elev.	DESCRIPTION OF MATERIALS	Graphic Log	Depth in feet	SAMPLE NO.	SAMPLE TYPE	SAMPLE RECOVERY (%)	PENETROMETER	N VALUES (BLOW COUNTS)	OVA or HNU READINGS	REMARKS
566.5			45							
565.5	46.0-56.0': DOLOMITE, light gray, few chert nodules, fine grained, massive to thick bedded, nonporous to slightly porous, wavy greenish gray shale partings		46	Run3		100				END OF RUN2 START OF RUN3 100% recovery, 96% RQD
564.5			47							
563.5			48							
562.5			49							
561.5			50							
560.5			51							
559.5			52							
558.5			53							
557.5	54.0-60.0': DOLOMITE, gray to light gray, few chert nodules, 2" light brownish gray clay partings, high angle to near vertical fractures, yellowish brown water stained		54							

Illinois Environmental Protection Agency — Field Boring Log

Site File No. _____ County Will Boring No. 3B Monitor Well No. 3B

Site File Name Lockport Prairie Surface Elevation 611.5 Completion Depth 66.0

Fed. ID. No. _____ Auger Depth 30 Rotary Depth 36

Quadrangle Joliet Sec. 28 T. 36N R. 10E Date: Start 11/28/01 Finish 11/28/01

UTM (or State Plane) Coord. N.(X) _____ E.(Y) _____

Latitude ____ ° ____ ' ____ " Longitude ____ ° ____ ' ____ "

Boring Location SE1/4 of NE1/4 of NE1/4

Drilling Equipment Diedrich 120

PERSONNEL
G - R. Hopp
D - Larry
H -
H -

Elev.	DESCRIPTION OF MATERIALS	Graphic Log	Depth in feet	SAMPLE NO.	SAMPLE TYPE	SAMPLE RECOVERY (%)	PENETROMETER	N VALUES (BLOW COUNTS)	OVA or HNU READINGS	REMARKS
	fractures, slightly porous									
555.5			56	Run4		100				END OF RUN3 START OF RUN4 100% recovery, 93% RQD
554.5			57							
553.5			58							
552.5			59							
551.5	60.0-66.0': DOLOMITE, gray to light gray, absence of chert nodules, medium grained, slightly porous, green and gray wavy argillaceus partings, mineralization along fractures, fine vuggy appearance		60							
550.5			61							
549.5			62							
548.5			63							
547.5			64							
546.5			65							
	EOB AT 66 FEET BGS									END OF RUN4

(950226)

Illinois Environmental Protection Agency — Field Boring Log

Site File No. _____ County Will Boring No. 5C Monitor Well No. 5C

Site File Name Lockport Prairie Surface Elevation 611.9 Completion Depth 66.0

Fed. ID. No. _____ Auger Depth 30 Rotary Depth 36

Quadrangle Joliet Sec. 22 T. 36N R. 10E Date: Start 11/26/01 Finish 11/26/01

UTM (or State Plane) Coord. N.(X) _____ E.(Y) _____

Latitude ____ ° ____ ' ____ " Longitude ____ ° ____ ' ____ "

Boring Location SE1/4 of NW1/4 of SW1/4

Drilling Equipment Diedrich 120

PERSONNEL: G - R. Hopp; D - Larry; H - ; H -

Elev.	DESCRIPTION OF MATERIALS	Graphic Log	Depth in feet	SAMPLES: SAMPLE NO.	SAMPLE TYPE	SAMPLE RECOVERY (%)	PENETROMETER	N VALUES (BLOW COUNTS)	OVA or HNU READINGS	REMARKS
	0.0-1.0': SILT, low plasticity, very dark brown (10YR 2/2), soft, organics			SS1		50		4 7		
610.9	1.0-2.0': SAND and GRAVEL, trace silt, few cobbles, fine to medium grained sand, poorly sorted, coarse gravel, rounded to subrounded, nonplastic, stiff, brownish yellow (10YR 6/6)		1					8 20		
609.9	2.0-4.0': SAND and GRAVEL, trace silt, few cobbles, fine to medium grained sand, coarse gravel, rounded to subrounded, nonplastic, very stiff, yellowish brown (10YR 5/8)		2	SS2		50		19 22		
608.9			3					16 22		
607.9	4.0-8.0': SAND and GRAVEL, trace silt, few cobbles, fine to medium grained sand, coarse gravel, rounded to subrounded, nonplastic, very stiff, yellowish brown (10YR 5/4)		4	SS3		50		12 16		
606.9			5					20 11		
605.9	Broken DOLOMITE COBBLE, light gray (10YR 7/1), 2" recovery		6	SS4		13		46 /3"		
604.9			7							
603.9	8.0-24.0': SAND and GRAVEL, trace silt, few cobbles, fine to medium grained sand, coarse gravel, rounded to subrounded, nonplastic, very stiff, yellowish brown (10YR 5/8)		8	SS5		50		29 33		
602.9			9					35 47		
601.9			10	SS6		50		22 15		

(950226)

Illinois Environmental Protection Agency — Field Boring Log

Site File No. _____ County Will Boring No. 5C Monitor Well No. 5C

Site File Name Lockport Prairie Surface Elevation 611.9 Completion Depth 66.0

Fed. ID. No. _____ Auger Depth 30 Rotary Depth 36

Quadrangle Joliet Sec. 22 T. 36N R. 10E Date: Start 11/26/01 Finish 11/26/01

UTM (or State Plane) Coord. N.(X) _____ E.(Y) _____

Latitude ____ ° ____ ' ____ " Longitude ____ ° ____ ' ____ "

Boring Location SE1/4 of NW1/4 of SW1/4

Drilling Equipment Diedrich 120

PERSONNEL: G - R. Hopp; D - Larry; H - ; H -

Elev.	DESCRIPTION OF MATERIALS	Graphic Log	Depth in feet	SAMPLE NO.	SAMPLE TYPE	SAMPLE RECOVERY (%)	PENETROMETER	N VALUES (BLOW COUNTS)	OVA or HNU READINGS	REMARKS
	SAND and GRAVEL, trace silt, few cobbles, fine to medium grained sand, coarse gravel, rounded to subrounded, nonplastic, very stiff, yellowish brown (10YR 5/8)							25		
								17		
599.9			12	SS7		75		35		
								39		
598.9			13					50 /4"		
597.9			14	SS8		50		34		
								23		
596.9			15					15		
								17		
595.9			16	SS9		42		14		
								15		
594.9			17					25		
								15		
593.9	Broken DOLOMITE COBBLE, light gray (10YR 7/1), 2" recovery		18	SS10		17		38		
								50 /4"		
592.9			19							
591.9			20	SS11		25		25		
								50 /4"		
590.9			21							

(950226)

Illinois Environmental Protection Agency — Field Boring Log

Site File No. _____ County Will Boring No. 5C Monitor Well No. 5C

Site File Name Lockport Prairie Surface Elevation 611.9 Completion Depth 66.0

Fed. ID. No. _____ Auger Depth 30 Rotary Depth 36

Quadrangle Joliet Sec. 22 T. 36N R. 10E Date: Start 11/26/01 Finish 11/26/01

UTM (or State Plane) Coord. N.(X) _____ E.(Y) _____

Latitude ____ ° ____ ' ____ " Longitude ____ ° ____ ' ____ "

Boring Location SE1/4 of NW1/4 of SW1/4

Drilling Equipment Diedrich 120

PERSONNEL: G - R. Hopp; D - Larry; H - ; H -

Elev.	DESCRIPTION OF MATERIALS	Graphic Log	Depth in feet	SAMPLE NO.	SAMPLE TYPE	SAMPLE RECOVERY (%)	PENETROMETER	N VALUES (BLOW COUNTS)	OVA or HNU READINGS	REMARKS
588.9			23	SS12		25		50 /4"		Dry
587.9	24.0-26.0': SILTY SAND, few cobbles, trace gravel, low plasticity, mottled, dark red (2.5YR 3/6) and very dark grayish brown (10YR 3/2), stiff		24	SS13		42		37		Moist
586.9			25					48 /4"		
585.9	26.0-29.0': SAND and GRAVEL, trace silt, few cobbles, fine to medium grained sand, coarse gravel, rounded to subrounded, nonplastic, very stiff, yellowish brown (10YR 5/8)		26	SS14		75				Wet
584.9			27							
583.9			28							
582.9	29.0-30.0': DOLOMITE, light gray		29							Began rotary drilling to seal casing
581.9	30.0-37.0': DOLOMITE, yellowish brown, chert nodules with off-white chalky appearance, high angle to near vertical fractures, slightly porous to nonporous, weathering has slightly opened bedding planes, fossiliferous.		30	Run1		95				Began rock coring START RUN1 95% recovery, 75% RQD
580.9			31							
579.9			32							

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Illinois Environmental Protection Agency — Field Boring Log

Site File No. _____ County Will Boring No. 5C Monitor Well No. 5C

Site File Name Lockport Prairie Surface Elevation 611.9 Completion Depth 66.0

Fed. ID. No. _____ Auger Depth 30 Rotary Depth 36

Quadrangle Joliet Sec. 22 T. 36N R. 10E Date: Start 11/26/01 Finish 11/26/01

UTM (or State Plane) Coord. N.(X) _____ E.(Y) _____

Latitude ____° ____' ____" Longitude ____° ____' ____"

Boring Location SE1/4 of NW1/4 of SW1/4

Drilling Equipment Diedrich 120

PERSONNEL
G - R. Hopp
D - Larry
H -
H -

Elev.	DESCRIPTION OF MATERIALS	Graphic Log	Depth in feet	SAMPLES: SAMPLE NO.	SAMPLE TYPE	SAMPLE RECOVERY (%)	PENETROMETER	N VALUES (BLOW COUNTS)	OVA or HNU READINGS	REMARKS
577.9			34							
576.9			35							
575.9			36	Run2		90				END OF RUN1 START OF RUN2 90% recovery, 100% RQD
574.9	37.0-49.0': DOLOMITE, gray to light gray, chert nodules with off-white chalky appearance, slightly porous, even textured, argillaceous partings, fossiliferous.		37							
573.9			38							
572.9			39							
571.9			40							
570.9			41							
569.9			42							
568.9			43							

Illinois Environmental Protection Agency — Field Boring Log

Site File No. _____ County Will Boring No. 5C Monitor Well No. 5C

Site File Name Lockport Prairie Surface Elevation 611.9 Completion Depth 66.0

Fed. ID. No. _____ Auger Depth 30 Rotary Depth 36

Quadrangle Joliet Sec. 22 T. 36N R. 10E Date: Start 11/26/01 Finish 11/26/01

UTM (or State Plane) Coord. N.(X) _____ E.(Y) _____

Latitude ____° ____' ____" Longitude ____° ____' ____"

Boring Location SE1/4 of NW1/4 of SW1/4

Drilling Equipment Diedrich 120

PERSONNEL
G - R. Hopp
D - Larry
H -
H -

Elev.	DESCRIPTION OF MATERIALS	Graphic Log	Depth in feet	SAMPLES: SAMPLE NO.	SAMPLE TYPE	SAMPLE RECOVERY (%)	PENETROMETER	N VALUES (BLOW COUNTS)	OVA or HNU READINGS	REMARKS
566.9			45							
565.9			46	Run3		100				END OF RUN2 START OF RUN3 100% recovery, 100% RQD
564.9			47							
563.9			48							
562.9	49.0-54.0': DOLOMITE, gray to light gray, absence of chert nodules, even textured, massive to thick bedding, porous to slightly porous, yellowish brown water stained, high angle fracture @ 53 feet bgs.		49							
561.9			50							
560.9			51							
559.9			52							
558.9			53							
557.9	54.0-66.0': DOLOMITE, light gray, green and red mottling, absence of chert nodules, medium to fine grained, massive to thick bedding, nonporous, interbedding with		54							

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Illinois Environmental Protection Agency — Field Boring Log

Site File No. _____ County Will Boring No. 5C Monitor Well No. 5C

Site File Name Lockport Prairie Surface Elevation 611.9 Completion Depth 66.0

Fed. ID. No. _____ Auger Depth 30 Rotary Depth 36

Quadrangle Joliet Sec. 22 T. 36N R. 10E Date: Start 11/26/01 Finish 11/26/01

UTM (or State Plane) Coord. N.(X) _____ E.(Y) _____

Latitude ____ ° ____ ' ____ " Longitude ____ ° ____ ' ____ "

Boring Location SE1/4 of NW1/4 of SW1/4

Drilling Equipment Diedrich 120

PERSONNEL
G - R. Hopp
D - Larry
H -
H -

Elev.	DESCRIPTION OF MATERIALS	Graphic Log	Depth in feet	SAMPLE NO.	SAMPLE TYPE	SAMPLE RECOVERY (%)	PENETROMETER	N VALUES (BLOW COUNTS)	OVA or HNU READINGS	REMARKS
	greenish gray wavy shale partings, fine vuggy appearance									
555.9			56	Run4		100				END OF RUN3 START OF RUN4 100% recovery, 100% RQD
554.9			57							
553.9			58							
552.9			59							
551.9			60							
550.9			61							
549.9			62							
548.9			63							
547.9			64							
546.9			65							
	EOB AT 66 FEET BGS									END OF RUN4

Illinois Environmental Protection Agency — Field Boring Log

Site File No. _____ County Will Boring No. 6C Monitor Well No. 6C

Site File Name Lockport Prairie Surface Elevation 616.3 Completion Depth 71.5

Fed. ID. No. _____ Auger Depth 32 Rotary Depth 39.5

Quadrangle Joliet Sec. 22 T. 36N R. 10E Date: Start 6/21/01 Finish 6/21/01

UTM (or State Plane) Coord. N.(X) _____ E.(Y) _____

Latitude ____ ° ____ ' ____ " Longitude ____ ° ____ ' ____ "

Boring Location NW1/4 of NE1/4 of SW1/4

Drilling Equipment Diedrich 120

PERSONNEL
G - R. Hopp
D - Dusty
H -
H -

Elev.	DESCRIPTION OF MATERIALS	Graphic Log	Depth in feet	SAMPLES: SAMPLE NO.	SAMPLE TYPE	SAMPLE RECOVERY (%)	PENETROMETER	N VALUES (BLOW COUNTS)	OVA or HNU READINGS	REMARKS
	0.0-3.0': SILT, low plasticity, very dark brown (10YR 3/2), soft			SS1		50		5 5		
615.3			1					5 9		
614.3			2	SS2		42		8 8		
613.3	3.0-4.0': SILT, low plasticity, dark yellowish brown (10YR 3/6), soft		3					9 1		
612.3	4.0-8.0': SAND and GRAVEL, little silt, few cobbles, fine to medium grained sand, poorly sorted, coarse gravel, rounded to subrounded, nonplastic, hard, dark yellowish brown (10YR 4/6)		4	SS3		58		23 50/4"		
611.3			5							
610.3	Broken DOLOMITE COBBLE		6	SS4		13		50/3"		
609.3			7							
608.3	8.0-20.0': SAND and GRAVEL, little silt, few broken dolomite cobbles, sand fine to medium grained, poorly sorted, gravel coarse, rounded to subrounded, nonplastic, hard, brownish yellow (10YR 6/6)		8	SS5		25		112/6"		
607.3			9							
606.3			10	SS6		25		110/6"		

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Illinois Environmental Protection Agency — Field Boring Log

Site File No. _____ County Will Boring No. 6C Monitor Well No. 6C

Site File Name Lockport Prairie Surface Elevation 616.3 Completion Depth 71.5

Fed. ID. No. _____ Auger Depth 32 Rotary Depth 39.5

Quadrangle Joliet Sec. 22 T. 36N R. 10E Date: Start 6/21/01 Finish 6/21/01

UTM (or State Plane) Coord. N.(X) _____ E.(Y) _____

Latitude ____ ° ____ ' ____ " Longitude ____ ° ____ ' ____ "

Boring Location NW1/4 of NE1/4 of SW1/4

Drilling Equipment Diedrich 120

PERSONNEL: G - R. Hopp; D - Dusty; H - ; H -

Elev.	DESCRIPTION OF MATERIALS	Graphic Log	Depth in feet	SAMPLE NO.	SAMPLE TYPE	SAMPLE RECOVERY (%)	PENETROMETER	N VALUES (BLOW COUNTS)	OVA or HNU READINGS	REMARKS
604.3	SAND and GRAVEL, little silt, few broken dolomite cobbles, sand fine to medium grained, poorly sorted, gravel coarse, rounded to subrounded, nonplastic, hard, brownish yellow (10YR 6/6)		12	SS7		42		33 28		
603.3			13					31 50		
602.3			14	SS8		50		31 59		
601.3			15					21 25		
600.3			16	SS9		50		26 30		
599.3			17					26 35		
598.3			18	SS10		50		31 26		
597.3			19					21 24		
596.3	20.0-28.0': SAND and GRAVEL, little silt, few broken dolomite cobbles, sand fine to medium grained, poorly sorted, gravel coarse, rounded to subrounded, nonplastic, hard, yellowish brown (10YR 5/6)		20	SS11		50		35 27		
595.3			21					27 30		

Illinois Environmental Protection Agency — Field Boring Log

Site File No. _____ County Will Boring No. 6C Monitor Well No. 6C

Site File Name Lockport Prairie Surface Elevation 616.3 Completion Depth 71.5

Fed. ID. No. _____ Auger Depth 32 Rotary Depth 39.5

Quadrangle Joliet Sec. 22 T. 36N R. 10E Date: Start 6/21/01 Finish 6/21/01

UTM (or State Plane) Coord. N.(X) _____ E.(Y) _____

Latitude ____ ° ____ ' ____ " Longitude ____ ° ____ ' ____ "

Boring Location NW1/4 of NE1/4 of SW1/4

Drilling Equipment Diedrich 120

PERSONNEL: G - R. Hopp; D - Dusty; H - ; H -

Elev.	DESCRIPTION OF MATERIALS	Graphic Log	Depth in feet	SAMPLES: SAMPLE NO.	SAMPLE TYPE	SAMPLE RECOVERY (%)	PENETROMETER	N VALUES (BLOW COUNTS)	OVA or HNU READINGS	REMARKS
			23	SS12		50		31 44		
593.3								20 44		
592.3			24	SS13		50		35 49		
591.3			25					49 33		
590.3			26	SS14		50		29 37		Dry
589.3			27					29 36		
588.3	28.0-32.0': SAND and GRAVEL, little silt, few broken dolomite cobbles, sand fine to medium grained, poorly sorted, gravel coarse, rounded to subrounded, nonplastic, hard, brownish yellow (10YR 6/6)		28	SS15		40		28 36		Moist
587.3			29					29 36		
586.3			30	SS16		25		70 /6"		Moist
585.3			31							
584.3	32.0-35.0': Weathered DOLOMITE		32	SS17				50 /2"		32' top of weathered bedrock

Illinois Environmental Protection Agency — Field Boring Log

Site File No. _____ County Will Boring No. 6C Monitor Well No. 6C

Site File Name Lockport Prairie Surface Elevation 616.3 Completion Depth 71.5

Fed. ID. No. _____ Auger Depth 32 Rotary Depth 39.5

Quadrangle Joliet Sec. 22 T. 36N R. 10E Date: Start 6/21/01 Finish 6/21/01

UTM (or State Plane) Coord. N.(X) _____ E.(Y) _____

Latitude ____° ____' ____" Longitude ____° ____' ____"

Boring Location NW1/4 of NE1/4 of SW1/4

Drilling Equipment Diedrich 120

PERSONNEL
G - R. Hopp
D - Dusty
H -
H -

Elev.	DESCRIPTION OF MATERIALS	Graphic Log	Depth in feet	SAMPLES: SAMPLE NO.	SAMPLE TYPE	SAMPLE RECOVERY (%)	PENETROMETER	N VALUES (BLOW COUNTS)	OVA or HNU READINGS	REMARKS
582.3			34							
581.3	35.0-44.0': Fractured DOLOMITE with SAND		35							35' bedrock (rotary wash drilling techniques) Description of bedrock geology is based on rotary wash return
580.3			36							
579.3			37							
578.3			38							
577.3			39							
576.3			40							
575.3			41							
574.3			42							
573.3			43							

Illinois Environmental Protection Agency — Field Boring Log

Site File No. _____ County Will Boring No. 6C Monitor Well No. 6C

Site File Name Lockport Prairie Surface Elevation 616.3 Completion Depth 71.5

Fed. ID. No. _____ Auger Depth 32 Rotary Depth 39.5

Quadrangle Joliet Sec. 22 T. 36N R. 10E Date: Start 6/21/01 Finish 6/21/01

UTM (or State Plane) Coord. N.(X) _____ E.(Y) _____

Latitude ____° ____' ____" Longitude ____° ____' ____"

Boring Location NW1/4 of NE1/4 of SW1/4

Drilling Equipment Diedrich 120

SAMPLES: SAMPLE NO. | SAMPLE TYPE | SAMPLE RECOVERY (%) | PENETROMETER | N VALUES (BLOW COUNTS) | OVA or HNU READINGS

PERSONNEL
G - R. Hopp
D - Dusty
H -
H -

Elev.	DESCRIPTION OF MATERIALS	Graphic Log	Depth in feet
	44.0-45.0': SAND		
571.3	45.0-50.0': Fractured DOLOMITE		45
570.3			46
569.3			47
568.3			48
567.3			49
566.3	50.0-55.0': DOLOMITE		50
565.3			51
564.3			52
563.3			53
562.3			54

REMARKS

Description of bedrock geology is based on rotary wash return

Illinois Environmental Protection Agency — Field Boring Log

Site File No. _____ County Will Boring No. 6C Monitor Well No. 6C

Site File Name Lockport Prairie Surface Elevation 616.3 Completion Depth 71.5

Fed. ID. No. _____ Auger Depth 32 Rotary Depth 39.5

Quadrangle Joliet Sec. 22 T. 36N R. 10E Date: Start 6/21/01 Finish 6/21/01

UTM (or State Plane) Coord. N.(X) _____ E.(Y) _____

Latitude ____° ____' ____" Longitude ____° ____' ____"

Boring Location NW1/4 of NE1/4 of SW1/4

Drilling Equipment Diedrich 120

SAMPLES: SAMPLE NO. | SAMPLE TYPE | SAMPLE RECOVERY (%) | PENETROMETER | N VALUES (BLOW COUNTS) | OVA or HNU READINGS

PERSONNEL
G - R. Hopp
D - Dusty
H -
H -

Elev.	DESCRIPTION OF MATERIALS	Graphic Log	Depth in feet
	55.0-60.0': Fractured DOLOMITE		
560.3			56
559.3			57
558.3			58
557.3			59
556.3	60.0-64.0': Fractured DOLOMITE with clay filling		60
555.3			61
554.3			62
553.3			63
552.3	64.0-66.0': Fractured DOLOMITE		64
551.3			65

REMARKS

Description of bedrock geology is based on rotary wash return

(950226)

Illinois Environmental Protection Agency — Field Boring Log

Site File No. _____ County Will Boring No. 6C Monitor Well No. 6C

Site File Name Lockport Prairie Surface Elevation 616.3 Completion Depth 71.5

Fed. ID. No. _____ Auger Depth 32 Rotary Depth 39.5

Quadrangle Joliet Sec. 22 T. 36N R. 10E Date: Start 6/21/01 Finish 6/21/01

UTM (or State Plane) Coord. N.(X) _____ E.(Y) _____

Latitude ____ ° ____ ' ____ " Longitude ____ ° ____ ' ____ "

Boring Location NW1/4 of NE1/4 of SW1/4

Drilling Equipment Diedrich 120

PERSONNEL

G - R. Hopp
D - Dusty
H -
H -

Elev.	DESCRIPTION OF MATERIALS	Graphic Log	Depth in feet	SAMPLES: SAMPLE NO.	SAMPLE TYPE	SAMPLE RECOVERY (%)	PENETROMETER	N VALUES (BLOW COUNTS)	OVA or HNU READINGS
	66.0-71.5': Fractured DOLOMITE with clay filling								
549.3			67						
548.3			68						
547.3			69						
546.3			70						
545.3			71						
	EOB AT 71.5 FEET BGS								

REMARKS

Description of bedrock geology is based on rotary wash return

Illinois Environmental Protection Agency — Field Boring Log

Site File No. _____ County Will Boring No. 7D Monitor Well No. 7D

Site File Name Lockport Prairie Surface Elevation 672.1 Completion Depth 101.0

Fed. ID. No. _____ Auger Depth 64 Rotary Depth 37

Quadrangle Joliet Sec. 21 T. 36N R. 10E Date: Start 6/18/01 Finish 6/18/01

UTM (or State Plane) Coord. N.(X) _____ E.(Y) _____

Latitude ____° ____' ____" Longitude ____° ____' ____"

Boring Location NW1/4 of NW1/4 of NE1/4

Drilling Equipment Diedrich 120

PERSONNEL: G - R. Hopp; D - Dusty; H - ; H -

Elev.	DESCRIPTION OF MATERIALS	Graphic Log	Depth in feet	SAMPLES: SAMPLE NO.	SAMPLE TYPE	SAMPLE RECOVERY (%)	PENETROMETER	N VALUES (BLOW COUNTS)	OVA or HNU READINGS	REMARKS
	0.0-2.0': 6" SILT, trace gravel, gravel to 1/2", nonplastic, very dark brown (10YR 2/2 and 3/2), 2" gravel seam @ 12-14" bgs, stiff			SS1		50		5 12		
671.1			1					12 11		
670.1	2.0-6.0': SILTY CLAY, trace gravel to 1" (dolomite pebbles), low plasticity, mottled yellowish brown (10YR 5/6) and gray (10YR 6/1), stiff		2	SS2		50		5 7		
669.1			3					11 14		
668.1			4	SS3		75		7 9		Dry
667.1			5					11 12		
666.1	6.0-8.0': SILTY CLAY, trace gravel to 1" (dolomite pebbles), subrounded, low plasticity, yellowish brown (10YR 5/4), stiff		6	SS4		100		8 13		Moist
665.1			7					19 22		
664.1	8.0-10.0': SILTY CLAY, trace gravel, subrounded, low plasticity, mottled yellowish brown (10YR 5/4) grading to (10YR 5/8), very stiff		8	SS5		100		9 13		Dry
663.1			9					22 24		
662.1	10.0-12.0': SILTY CLAY, trace gravel to 1" (dolomite pebbles), subrounded, low plasticity, brown (10YR 5/3), stiff		10	SS6		33		8 12		Dry

(950226)

Illinois Environmental Protection Agency — Field Boring Log

Site File No. _____ County Will Boring No. 7D Monitor Well No. 7D

Site File Name Lockport Prairie Surface Elevation 672.1 Completion Depth 101.0

Fed. ID. No. _____ Auger Depth 64 Rotary Depth 37

Quadrangle Joliet Sec. 21 T. 36N R. 10E Date: Start 6/18/01 Finish 6/18/01

UTM (or State Plane) Coord. N.(X) _____ E.(Y) _____

Latitude ____° ____' ____" Longitude ____° ____' ____"

Boring Location NW1/4 of NW1/4 of NE1/4

Drilling Equipment Diedrich 120

PERSONNEL
G - R. Hopp
D - Dusty
H -
H -

Elev.	DESCRIPTION OF MATERIALS	Graphic Log	Depth in feet	SAMPLES: SAMPLE NO.	SAMPLE TYPE	SAMPLE RECOVERY (%)	PENETROMETER	N VALUES (BLOW COUNTS)	OVA or HNU READINGS	REMARKS
								16		
								16		
660.1	12.0-14.0': SILTY CLAY, trace gravel to 1" (dolomite pebbles), rounded, medium plasticity, grayish brown (10YR 5/2), stiff		12	SS7		100		5		Moist
								7		
659.1			13					7		
								12		
658.1	14.0-30.0': CLAY, little silt, trace gravel to 1" (dolomite pebbles), subrounded, medium to high plasticity, gray (10YR 5/1), medium stiff		14	SS8		100		4		Moist
								14		
657.1			15					7		
								7		
656.1			16	SS9		100		4		Moist
								7		
655.1			17					8		
								13		
654.1			18	SS10		100		4		Dry
								7		
653.1			19					10		
								14		
652.1			20	SS11		100		6		Dry
								10		
651.1			21					13		
								16		

Illinois Environmental Protection Agency — Field Boring Log

Site File No. _____ County Will Boring No. 7D Monitor Well No. 7D

Site File Name Lockport Prairie Surface Elevation 672.1 Completion Depth 101.0

Fed. ID. No. _____ Auger Depth 64 Rotary Depth 37

Quadrangle Joliet Sec. 21 T. 36N R. 10E Date: Start 6/18/01 Finish 6/18/01

UTM (or State Plane) Coord. N.(X) _____ E.(Y) _____

Latitude ____ ° ____ ' ____ " Longitude ____ ° ____ ' ____ "

Boring Location NW1/4 of NW1/4 of NE1/4

Drilling Equipment Diedrich 120

PERSONNEL: G - R. Hopp; D - Dusty; H - ; H -

Elev.	DESCRIPTION OF MATERIALS	Graphic Log	Depth in feet	SAMPLE NO.	SAMPLE TYPE	SAMPLE RECOVERY (%)	PENETROMETER	N VALUES (BLOW COUNTS)	OVA or HNU READINGS	REMARKS
	CLAY, little silt, trace gravel to 1" (dolomite pebbles), subrounded, medium to high plasticity, gray (10YR 5/1), medium stiff			SS12		100		8		Dry
								12		
649.1			23					16		
								12		
648.1			24	SS13		100		6		Moist
								9		
647.1			25					13		
								15		
646.1	2" fine sand seam		26	SS14		100		7		Moist
								11		
645.1			27					12		
								14		
644.1			28	SS15		100		7		Moist
								12		
643.1			29					14		
								21		
642.1	30.0-32.0': SILTY CLAY, trace gravel to 1" (dolomite pebbles), subrounded, low plasticity, gray (10YR 5/1), stiff		30	SS16		100		8		Dry
								12		
641.1			31					13		
								17		
640.1	32.0-38.0': CLAY, little silt, trace gravel to 1" (dolomite pebbles), subrounded, medium plasticity, gray (10YR 5/1), stiff		32	SS17		100		6		
								12		

Illinois Environmental Protection Agency — Field Boring Log

Site File No. _____ County Will Boring No. 7D Monitor Well No. 7D

Site File Name Lockport Prairie Surface Elevation 672.1 Completion Depth 101.0

Fed. ID. No. _____ Auger Depth 64 Rotary Depth 37

Quadrangle Joliet Sec. 21 T. 36N R. 10E Date: Start 6/18/01 Finish 6/18/01

UTM (or State Plane) Coord. N.(X) _____ E.(Y) _____

Latitude ____ ° ____ ' ____ " Longitude ____ ° ____ ' ____ "

Boring Location NW1/4 of NW1/4 of NE1/4

Drilling Equipment Diedrich 120

PERSONNEL
G - R. Hopp
D - Dusty
H -
H -

Elev.	DESCRIPTION OF MATERIALS	Graphic Log	Depth in feet	SAMPLE NO.	SAMPLE TYPE	SAMPLE RECOVERY (%)	PENETROMETER	N VALUES (BLOW COUNTS)	OVA or HNU READINGS	REMARKS
								14		
								17		
638.1			34	SS18		100		8		
								9		
637.1			35					13		
								19		
636.1			36	SS19		25		9		Dry
								15		
635.1			37					20		
								27		
634.1	38.0-40.0': SILTY CLAY, 1/2" silt seams every 2-3 inches, nonplastic, gray (10YR 5/1), seams brown (10YR 5/3), stiff		38	SS20		100		7		Moist
								12		
633.1			39					10		
								17		
632.1	40.0-42.0': SILT, little clay, 1/2" silt seams every 2-3 inches, nonplastic, grayish brown (10YR 5/3), seams brown (10YR 5/3), stiff		40	SS21		100		7		Dry
								10		
631.1			41					12		
								18		
630.1	42.0-44.0': SILT, little clay, trace gravel, subrounded, medium plasticity, mottled gray (10YR 5/1) to very dark gray (10YR 3/1), stiff		42	SS22		100		7		
								11		
629.1			43					12		
								15		

Illinois Environmental Protection Agency — Field Boring Log

Site File No. _____ County Will Boring No. 7D Monitor Well No. 7D

Site File Name Lockport Prairie Surface Elevation 672.1 Completion Depth 101.0

Fed. ID. No. _____ Auger Depth 64 Rotary Depth 37

Quadrangle Joliet Sec. 21 T. 36N R. 10E Date: Start 6/18/01 Finish 6/18/01

UTM (or State Plane) Coord. N.(X) _____ E.(Y) _____

Latitude ____ ° ____ ' ____ " Longitude ____ ° ____ ' ____ "

Boring Location NW1/4 of NW1/4 of NE1/4

Drilling Equipment Diedrich 120

PERSONNEL: G - R. Hopp; D - Dusty; H - ; H -

Elev.	DESCRIPTION OF MATERIALS	Graphic Log	Depth in feet	SAMPLES: SAMPLE NO.	SAMPLE TYPE	SAMPLE RECOVERY (%)	PENETROMETER	N VALUES (BLOW COUNTS)	OVA or HNU READINGS	REMARKS
	44.0-46.0': SILT, little clay, 1/2" silt seams every 2-3 inches, nonplastic, grayish brown (10YR 5/3), stiff			SS23		100		8 10 11 13		
627.1			45							
626.1	46.0-48.0': SILT, little clay, low plasticity, grayish brown (10YR 5/3), stiff, homogenous		46	SS24		100		10 13		
625.1			47					17 22		
624.1	48.0-50.0': SILT, little clay, low plasticity, mottled gray (10YR 5/1) to very dark gray (10YR 3/1), stiff		48	SS25		25		9 12		
623.1			49					10 24		
622.1	50.0-52.0': SILTY CLAY, trace sand and gravel, low plasticity, grayish brown (10YR 5/2), stiff		50	SS26		100		14 24		
621.1			51					18 21		
620.1	52.0-56.0': SILTY CLAY, little gravel to 1" (dolomite pebbles), subrounded, low plasticity, grayish brown (10YR 5/2), stiff		52	SS27		100		16 21		
619.1			53					26 26		
618.1			54	SS28		100		9 13		

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Illinois Environmental Protection Agency — Field Boring Log

Site File No. _____ County Will Boring No. 7D Monitor Well No. 7D

Site File Name Lockport Prairie Surface Elevation 672.1 Completion Depth 101.0

Fed. ID. No. _____ Auger Depth 64 Rotary Depth 37

Quadrangle Joliet Sec. 21 T. 36N R. 10E Date: Start 6/18/01 Finish 6/18/01

UTM (or State Plane) Coord. N.(X) _____ E.(Y) _____

Latitude ____° ____' ____" Longitude ____° ____' ____"

Boring Location NW1/4 of NW1/4 of NE1/4

Drilling Equipment Diedrich 120

PERSONNEL: G - R. Hopp; D - Dusty; H - ; H -

Elev.	DESCRIPTION OF MATERIALS	Graphic Log	Depth in feet	SAMPLE NO.	SAMPLE TYPE	SAMPLE RECOVERY (%)	PENETROMETER	N VALUES (BLOW COUNTS)	OVA or HNU READINGS	REMARKS
								15		
								18		
616.1	56.0-60.0': CLAY, little silt, little gravel (dolomite pebbles), subrounded, low plasticity, grayish brown (10YR 5/2), stiff		56	SS29		100		11		
								19		
615.1			57					22		
								32		
614.1			58	SS30		100		11		
								16		
613.1			59					24		
								28		
612.1	60.0-62.0': SILTY CLAY, well sorted, low plasticity, grayish brown (10YR 5/2), very stiff, homogenous		60	SS31		100		12		Dry
								24		
611.1			61					50 /5"		
610.1	62.0-64.0': SAND, GRAVEL, little silt, subrounded, poorly sorted, nonplastic, grayish brown (10YR 5/2), hard		62	SS32		13		50 /3"		Moist
609.1			63							
608.1	64.0-101.0': DOLOMITIC BEDROCK Rotary Wash Drilling (no geologic log)		64							
607.1			65							
	EOB AT 101 FEET BGS									

Illinois Environmental Protection Agency — Field Boring Log

Site File No. _____ County Will Boring No. 8B Monitor Well No. 8B

Site File Name Lockport Prairie Surface Elevation 566.5 Completion Depth 28.0

Fed. ID. No. _____ Auger Depth 6 Rotary Depth 22

Quadrangle Joliet Sec. 27 T. 36N R. 10E Date: Start 6/25/01 Finish 6/25/01

UTM (or State Plane) Coord. N.(X) _____ E.(Y) _____

Latitude ____° ____' ____" Longitude ____° ____' ____"

Boring Location NE1/4 of NW1/4 of NW1/4

Drilling Equipment Diedrich 120

PERSONNEL: G - R. Hopp; D - Dusty; H - ; H -

Elev.	DESCRIPTION OF MATERIALS	Graphic Log	Depth in feet	SAMPLES: SAMPLE NO.	SAMPLE TYPE	SAMPLE RECOVERY (%)	PENETROMETER	N VALUES (BLOW COUNTS)	OVA or HNU READINGS	REMARKS
	0.0-4.0': SILT, little gravel, subrounded to rounded, nonplastic, very dark brown (10YR 2/2), medium stiff			SS1		75		5 7		
565.5			1					4 4		
564.5			2	SS2		50		3 3		Dry
563.5			3					3 4		
562.5	4.0-6.0': SAND and GRAVEL, gravel coarse, subrounded to rounded, poorly sorted, dolomite chips, very pale brown (10YR 7/3), hard		4	SS3				20 50 /4"		Moist
561.5			5							water @ 5' bgs
560.5	6.0-28.0': DOLOMITIC BEDROCK (Rotary wash drilling techniques-no geologic log)		6	SS4				50 /1"		
559.5			7							
558.5			8							
557.5			9							
556.5			10							
	EOB AT 28 FEET BGS									

Illinois Environmental Protection Agency — Field Boring Log

Site File No. _____ County Will Boring No. 9B Monitor Well No. 9B

Site File Name Lockport Prairie Surface Elevation 571.7 Completion Depth 30.5

Fed. ID. No. _____ Auger Depth 3 Rotary Depth 27.5

Quadrangle Joliet Sec. 22 T. 36N R. 10E Date: Start 6/25/01 Finish 6/25/01

UTM (or State Plane) Coord. N.(X) _____ E.(Y) _____

Latitude ____° ____' ____" Longitude ____° ____' ____"

Boring Location NE1/4 of NE1/4 of SW1/4

Drilling Equipment Diedrich 120

PERSONNEL: G - R. Hopp; D - Dusty; H - ; H -

Elev.	DESCRIPTION OF MATERIALS	Graphic Log	Depth in feet	SAMPLES: SAMPLE NO.	SAMPLE TYPE	SAMPLE RECOVERY (%)	PENETROMETER	N VALUES (BLOW COUNTS)	OVA or HNU READINGS	REMARKS
	0.0-3.0': SILT, trace fine to coarse gravel, subrounded to rounded, nonplastic, poorly sorted, dolomite chips, very brownish yellow (10YR 6/6), hard			SS1		75		7 9		
570.7			1					11 7		
569.7			2	SS2		50		7 50		Dry
568.7	3.0-4.0': Weathered DOLOMITE, 2" recovery, very pale brown (10YR 7/3)		3					50 /2"		
567.7	4.0-30.5': DOLOMITIC BEDROCK (Rotary wash drilling techniques-no geologic log)		4	SS3				50 /1"		
566.7			5							
565.7			6							
564.7			7							
563.7			8							
562.7			9							
561.7			10							
	EOB AT 30.5 FEET BGS									