



CT & Associates Engineering Inc.

SUBDIVISION LEVEL GEOTECHNICAL INVESTIGATION

PORTIONS OF LAUREL STAGE 10

**SOUTH OF 23 AVENUE AND WEST OF 17 STREET NW
EDMONTON, ALBERTA**

Prepared for

**CITY OF EDMONTON
c/o
DUNDEE DEVELOPMENTS**

February 2014

CTA File No. 02-1746



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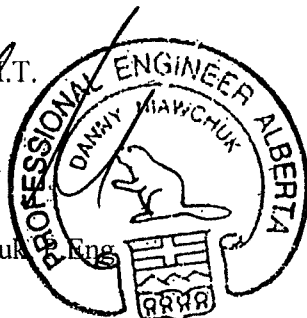
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Prepared by,

CT & ASSOCIATES ENGINEERING INC.

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NR/DSN/lsr



PERMIT TO PRACTICE CT & ASSOCIATES ENGINEERING INC. Signature _____ Date <u>Feb 28 2014</u> PERMIT NUMBER: P 7826 The Association of Professional Engineers, Geologists and Geophysicists of Alberta

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1.0 INTRODUCTION

This report presents the results of a Subdivision Level Geotechnical Investigation for portions of the proposed Laurel Stage 10 lands, located to the south of 23 Avenue and west of 17 Street NW, Edmonton, Alberta.

Authorization to proceed with the project was provided by Mr. Ken Black of Dundee Developments, on behalf of the City of Edmonton, on January 8, 2014.

2.0 SITE AND PROJECT DESCRIPTION

The site contains two parcels of land, identified as 2511-23 Avenue NW and 1707-23 Avenue NW, Edmonton. They are situated on the south side of 23 Avenue and west of 17 Street, within the north half of the northeast quarter of Section 31-51-23-W4M, in southeast Edmonton. The two sites have previously been utilized as cultivated farmland and occupy approximately 20 and 7.6 Acres (8 and 3.1 ha) of land respectively.

An air photo of the development area is shown on Drawings No. A-1, Appendix A.

The investigation was completed for assessment of soils and groundwater conditions within the property, related to future development of the lands including site grading, residential development, infrastructure and roadways.

3.0 FIELD INVESTIGATION

3.1 SITE STUDY AND SITE RECONNAISSANCE

A review of historical air photos for the property was completed, with an initial site review completed on January 9, 2014, to plan the drilling program for the investigation of the soil and groundwater conditions in the subject site.



3.2 DRILLING AND LAB PROGRAM

The field work was conducted on January 16, 2014, consisting of eleven (11) boreholes drilled to depths between 3.8 m and 8.8 m. During drilling, a piezometer was installed at eight (8) borehole locations (at each of the deep boreholes) for groundwater monitoring purposes.

Drilling was conducted with a B-61 truck-mounted drill rig and was supervised at all times by a CT & Associates Engineering Inc. engineer. Disturbed samples were taken from auger cuttings typically at 0.8 m intervals. Standard Penetration Testing (SPT) was conducted at 1.5 m intervals, from which disturbed samples were also taken.

Drawing No. A-1, Appendix A, shows the approximate borehole locations with logs of boreholes included in Appendix B.

Laboratory testing was also conducted on soil samples for the determination of natural moisture content, Atterberg Limits, and soluble sulphate concentrations. Test results are presented on the individual borehole logs contained in Appendix B.

4.0 SITE CONDITIONS

4.1 SURFACE FEATURES

The eastern parcel of land (1707-23 Ave.) is bounded by 23 Avenue to the north, and a stormwater pond to the east. Adjacent to the south and west of the property boundary are lands that have undergone rough grading as part of subdivision developments. The area has had site preparation recently completed under CTA supervision, including the stripping of organics and the placement of engineered clay fill (under CTA supervision). A large stockpile is located just to the west of the property.



The western parcel (2511 23 Ave.) is also bordered by 23 Avenue to the North. Adjacent to the east and south of the property is cultivated farmland undergoing subdivision developments. To the west of the property is a utility right of way and a residential community. Similarly, this area has also had initial stages of site preparation completed, under CTA supervision, including the stripping of organics and the placement of engineered clay fill.

The topography of both sites are relatively flat, with some scattered stockpiles, as preliminary grading and stripping has already occurred.

4.2 REVIEW OF SITE HISTORY

A review of historical air photos was conducted for the subject site and surrounding properties for the period of 1950 through 2013, as available from the Province of Alberta Air Photo Archives and City of Edmonton Air Photo Archives. The review indicates the following:

- The earliest available air photo for the subject site and surrounding area, taken in 1950, shows the property to be undeveloped farmland with low-lying wet areas. The surrounding areas were utilized as cultivated farmland. A farmyard is situated between the parcels. A roadway extends in an east-west direction along the north property boundary (existing 23 Avenue) and in a north-south direction to the east of the eastern property (existing 17 Street);
- By 1976, a farmyard had been constructed on the north portion of the west parcel;
- By 1984, fill material had been placed on the northern portion of the west parcel;
- By 1988, the farmyard buildings situated on the north portion of the west parcel had been removed. Additional surface fill materials had been placed on the west parcel, with the fill material covering the northern one-third portion of this area;



- By 1992, two dugouts, soil stockpiles, and a building had been situated in the area between the two subject parcels;
- By 2007, a commercial shopping centre complex was under construction to the north of the subject site across 23 Avenue;
- By 2011, a residential neighborhood had been constructed to the west of the west parcel;
- By 2012, a stormwater pond has been constructed to the east of the east parcel and soil is being stockpiled on the southern half of the east parcel;
- By the summer 2013, both sites are partially graded for development, with the topsoil and existing fill materials having been stripped and replaced with engineered fill.

In summary, unengineered fill has historically been placed on the northern portion of the west parcel, however in the summer of 2013 all unengineered fill and organic soils have been removed and replaced the engineered fill.

4.3 SOIL CONDITIONS

Both properties were stripped of topsoil and organic materials in the summer of 2013. Engineered clay fill was then placed, with thickness ranging from 0.5 m to 3.1 m. All engineered materials were placed under CTA supervision, to greater than 98% SPD.

Below the clay fill, a firm to stiff, medium plastic clay/clay till-like layer was encountered, on both properties, with a thickness ranging from 0.9 m to 5.2 m. Below the clay/clay till-like layer, a moist, stiff, medium plastic clay till was encountered to the remaining depth of the boreholes (occasional water bearing sand layers, up to 0.5 m thick, were encountered at depth within the clay till layer).



At the location of Boreholes No. 5 and 9, the clay till deposit was encountered immediately below the clay fill.

A generalized soil stratigraphy is summarized in Table 1. Details of the soil stratigraphy can be found in the borehole logs in Appendix B.

**TABLE 1
GENERALIZED SOIL STRATIGRAPHY**

Material	Soil Description	Approximate Depth to Top of Stratum (m)	Range in Thickness of Stratum (m)
CLAY FILL	Silty, some sand to very sandy, trace coal and pebbles, moist, low to medium plastic, dark greyish brown	0.0	0.5 - 3.1
CLAY*	Silty, trace to some sand, firm, medium plastic, moist, dark greyish brown	0.9 - 3.0	0.6 - 3.0
CLAY TILL-LIKE	Silty, some sand to sandy, trace coal and pebbles, moist to wet, medium plastic, firm to stiff, dark greyish brown	0.5 - 4.0	0 - 2.6
CLAY TILL	Silty, some sand to sandy, trace coal and pebbles, stiff, medium plastic, moist, dark greyish brown	1.2 - 6.1	> 6.1

Legend: * Encountered at the locations of Boreholes No. 1, 6, and 7

4.4 GROUNDWATER CONDITIONS

Eight (8) piezometers were installed during drilling for measurement of groundwater conditions. At the time of the installation, groundwater was only encountered at Borehole No. 1 and 6 at 2.4 m and 4.7 m depth respectively. No sloughing was encountered at any of the borehole locations.



Twenty one (21) days after piezometers installation, the groundwater was encountered at depths between 1.0 m and 1.8 m below the ground surface on the west parcel of land, and 2.6 m to 5.1 m below ground surface on the east parcel of land.

TABLE 2
SUMMARY OF PIEZOMETER INSTALLATION
AND WATER TABLE READINGS

Piezo. Location	Piezo. Depth (m)	Intersected Lithology	Ground Elevation (m)	Depth to Water at Time of Installation (Jan. 16, 2014) (m)	Groundwater Level Readings Feb. 6, 2014	
					Depth to Water (m)	Elevation (m)
BH-1	6.9	Clay Fill/ Clay / Clay Till-Like / Clay Till	716.22	2.4	1.4	714.8
BH-2	5.3	Clay Fill / Clay Till-Like / Clay Till	717.47	Dry	1.0	716.5
BH-3	5.3	Clay Fill / Clay Till-Like / Clay Till	718.09	Dry	1.4	716.7
BH-4	5.3	Clay Fill / Clay Till-Like / Clay Till	717.86	4.7	1.1	716.8
BH-5	6.9	Clay Fill / Clay Till	719.02	Dry	1.8	717.2
BH-6	5.3	Clay Fill / Clay / Clay Till-Like	715.87	Dry	2.6	713.3
BH-7	6.9	Clay Fill / Clay / Clay Till-Like / Clay Till	717.32	Dry	3.2	714.1
BH-8	5.3	Clay Fill / Clay Till-Like / Clay Till	717.27	Dry	5.1	712.2



5.0 GEOTECHNICAL EVALUATION AND RECOMMENDATIONS

5.1 GENERAL

Site preparations to date have included stripping and removal of organics and areas of deleterious materials, and initial stages of placement of engineered fill.

Based on the existing and prepared conditions of the site, standard construction practices for additional site grading, utility installation, building foundations, and roadway construction are generally applicable for the proposed development. No significant concerns are anticipated for the design and construction of utilities and house construction, though some drying of the trench backfill can be anticipated.

5.2 SITE PREPARATION AND SITE GRADING

Based on the existing site elevation, some additional site grading may be required. In view of the depth of ground water over the west parcel (groundwater at 1.0 m to 1.8 m depth below existing ground surface), it is recommended that the finished surface not be lowered to minimize effects of seasonal freezing.

The compaction of any additional engineered fill should be conducted according to the criteria presented in Table 3. Engineered fill construction requires full-time monitoring and testing by the geotechnical consultant during construction.



TABLE 3

**COMPACTION CRITERIA FOR SITE GRADING
RESIDENTIAL DEVELOPMENT AREAS**

Depth from Final Grade (m)	Compaction Criteria	
	Clay Fill	Granular Fill
Residential Building Footprint Areas		
0 to 1.0 m	95% Standard Proctor Density*	98% SPD
1.0 to 3.0 m (building footing levels)	98% SPD **	100% SPD
Below 3.0 m	95% SPD *	98 % SPD
Commercial Building Footprint Area		
Full Thickness	98% SPD **	100% SPD
Roadway Areas and Private Parking Area		
0 - 1.0 m depth	98% SPD **	100% SPD
> 1.0 m depth	95% SPD *	98% SPD

Note: * at between optimum to 4% above optimum water content, in maximum 150 mm compacted thickness lifts

** at between optimum to 2% above optimum water content, in 150 mm compacted thickness lifts

5.3 RESIDENTIAL HOUSING FOUNDATIONS AND LOT DEVELOPMENT

The native clay and engineered clay fill materials encountered over the site were found to be suitable for housing development. Strip and spread footings founded on undisturbed native clay may be designed on an allowable net bearing pressure of 90 kPa, exceeding the minimum 75 kPa required by the Alberta Building Code Section 9.



Generally, no significant groundwater issues will be encountered for the building foundations over the site. Any groundwater flow will be minimal and can be handled effectively by normal weeping tile and sump operations.

Proper lot grading away from the houses must be provided to minimize the ingress of surface water into the subsoil. All houses must have at least 1.5 m of earthen cover over its footing elements to prevent potential frost heave problems.

Backfill material around building perimeters should consist of nominally compacted clay fill in order to prevent water from seeping into the basements.

Footings should be cast on a clean, undisturbed surface. No loose or disturbed material should be allowed on the bearing surface of footing excavation prior to pouring of concrete. If acceptable bearing surface can not be prepared using mechanical equipment, hand cleaning will be required.

A granular leveling or course base of at least 150 mm should be placed immediately below all floor slabs. The material should be of free draining sand or sand-gravel mixture compacted to 100% Standard Proctor Density.

Footing excavations should be protected from rain, snow, wetting, drying and inflow of surface and ground water at all times. Footings should not be cast directly onto or over frozen soil, nor should the soil beneath or adjacent to the footings be allowed to freeze subsequent to their installation.



5.4 TRENCHING AND BACKFILL

It is expected that the utility trenches will be in the order of 3 m to 5 m deep. As such, the clayey materials can provide a stable trench for the short term utility installation, provided that the trench slope is no greater than 1(h) : 1.5(v). Depending on the localized soil conditions and effect of groundwater seepage, the slope angle may be required to be less steep. Alternatively, shoring can be utilized.

Temporary surcharge loads such as excavated soils and stockpiles of materials should be kept back from the excavation crest by a minimum distance of one half the excavation depth.

Because of the occasional sand layers within clay till, some groundwater seepage may occur during construction. Since such groundwater flow is anticipated to be nominal, the provision of a normal sump pump should be sufficient to adequately handle such water flow.

In the event the excavation for utility installation is to remain open for prolonged periods, such as due to inclement weather or other construction delays, the slope angle should be lessened to 1 : 1, or the excavation walls terraced. For the terraced trench, the slope angle should be no greater than 2(v) : 1(h).

Any groundwater flow is anticipated to be nominal, as such the provision of a normal sump pump should be sufficient to adequately handle such water flow.

The backfilling of the excavated materials may be conducted according to The City of Edmonton Standard Proctor Criteria of 95% at depth greater than 1.5 m below finished grade and 98% at depth less than 1.5 m below finished grade. Based on the existing moisture conditions of the clay at depth, some drying may be required to achieve the required compaction density.



5.5 ROAD PAVEMENTS

It is anticipated that the major roadway systems in the proposed development are the 9.0 m local residential and 11.5 m local collectors.

Based on the anticipated traffic conditions for these types of roadways as defined by the City of Edmonton and the subsurface conditions encountered in this study, the following pavement designs are recommended for staged construction.

5.5.1 Pavement Structures - Residential and Collectors

STAGE 1

ALTERNATIVE A - GRANULAR BASE		
Material	Layer Thickness (mm)	
	9 m Local Residential	11.5 m Local Collectors (With bus route)
Asphalt Concrete (ACR)	65	75
Crushed Gravel (20 mm)*	200	325
Prepared Sub-grade **	150	150
ALTERNATIVE B - FULL DEPTH ASPHALT		
Material	Layer Thickness (mm)	
	9 m Local Residential	11.5 m Local Collectors (With bus route)
Asphalt Concrete (ACR)	50	75
Asphalt Concrete (ACB)	100	150
Prepared Sub-grade **	150	150

- Legend:
- * Compacted to 100% of Standard Proctor Maximum Dry Density (ASTM D698)
 - ** Compacted to 98% of SPD (ASTM D698)
 - ACR = City of Edmonton Designation Asphaltic Concrete Residential Course
 - ACB = City of Edmonton Designation Asphaltic Concrete Base Course



STAGE 2 - OVERLAY @ FAC

The above alternatives are to be constructed with 35 mm Asphaltic Concrete Overlay (ACO) at FAC.

5.5.2 Sub-grade Preparation

The sub-grade should be proof-rolled to detect any soft spots prior to base construction. If soft areas are encountered, these locations should be further treated as presented for proper sub-grade preparation:

.1 Soil Drying or Material Replacement and Re-Compaction

The top 150 mm of the clay sub-grade should be scarified, dried, and re-compacted to 98% Standard Proctor Density. The sub-grade preparation may have to be extended to 0.5 m depth in areas of disturbance such as utility line trenches.

.2 Cement Stabilization

Alternatively should the sub-grade not provide a non-deflected base through soil re-compaction, the sub-grade clayey soils may be cement treated by mixing a minimum of 10 kg of cement over 1 m² of surface area to a depth of 150 mm, and compacted to 100% of Standard Proctor Density. The cement quantity and depth should be reviewed in the field at time of roadway construction.



5.6 SITE CLASSIFICATION FOR SEISMIC SITE RESPONSE

Based on the encountered soil conditions, the subject site can be classified as Class D (Table 4.1.8.4.A. of NBCC 2005) as the foundation systems of the buildings will be placed within soils of firm to stiff consistency.

5.7 CEMENT TYPE

Four (4) soil samples were tested for water soluble sulphate concentrations. The test results showed sulphate concentrations from < 0.01 % to 3 % (by weight), indicating a wide range of degree of sulphate attack on concrete ranging from negligible to very severe.

As such, exposure Class S-1 is applicable with Cement Type HS (Type 50) required for all concrete elements exposed to fill or native soils. Air entrainment of 4% to 6% by volume is recommended for all concrete exposed to freezing temperatures and/or native soils.

6.0 CLOSURE

This report has been prepared in accordance with generally accepted geotechnical practices and procedures.

Classification of soil and groundwater conditions within the report have been based on generally accepted engineering practices in this area. Conditions identified during the field work, and thereby recommendations presented within this report are considered to be reasonably representative of the site. If however, conditions other than those presented are identified during any other work on the subject property, CT & Associates Engineering Inc. should be notified, and given an opportunity to review or modify our recommendations in light of new findings.



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APPENDIX A

DRAWINGS



20 Avenue

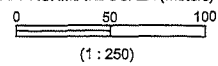
23 Avenue

Property Boundaries

Image © 2014 DigitalGlobe


1) SITE PHOTO (2013) OBTAINED FROM GOOGLE EARTH

APPROXIMATE SCALE (meters)



LEGEND

● BOREHOLE LOCATION

 CT & ASSOCIATES ENGINEERING INC.		PROJECT GEOTECHNICAL INVESTIGATION LAUREL STAGE 10 DEVELOPMENTS EDMONTON, ALBERTA	
CLIENT CITY OF EDMONTON c/o DUNDEE DEVELOPMENTS		TITLE SITE PLAN AND BOREHOLE LOCATIONS	
DATE FEB. 24, 2014	DWN. NR	CHKD. DSN	FILE NO. 02-1746
		FILE NO. 02-1746	DWG. NO. A-1



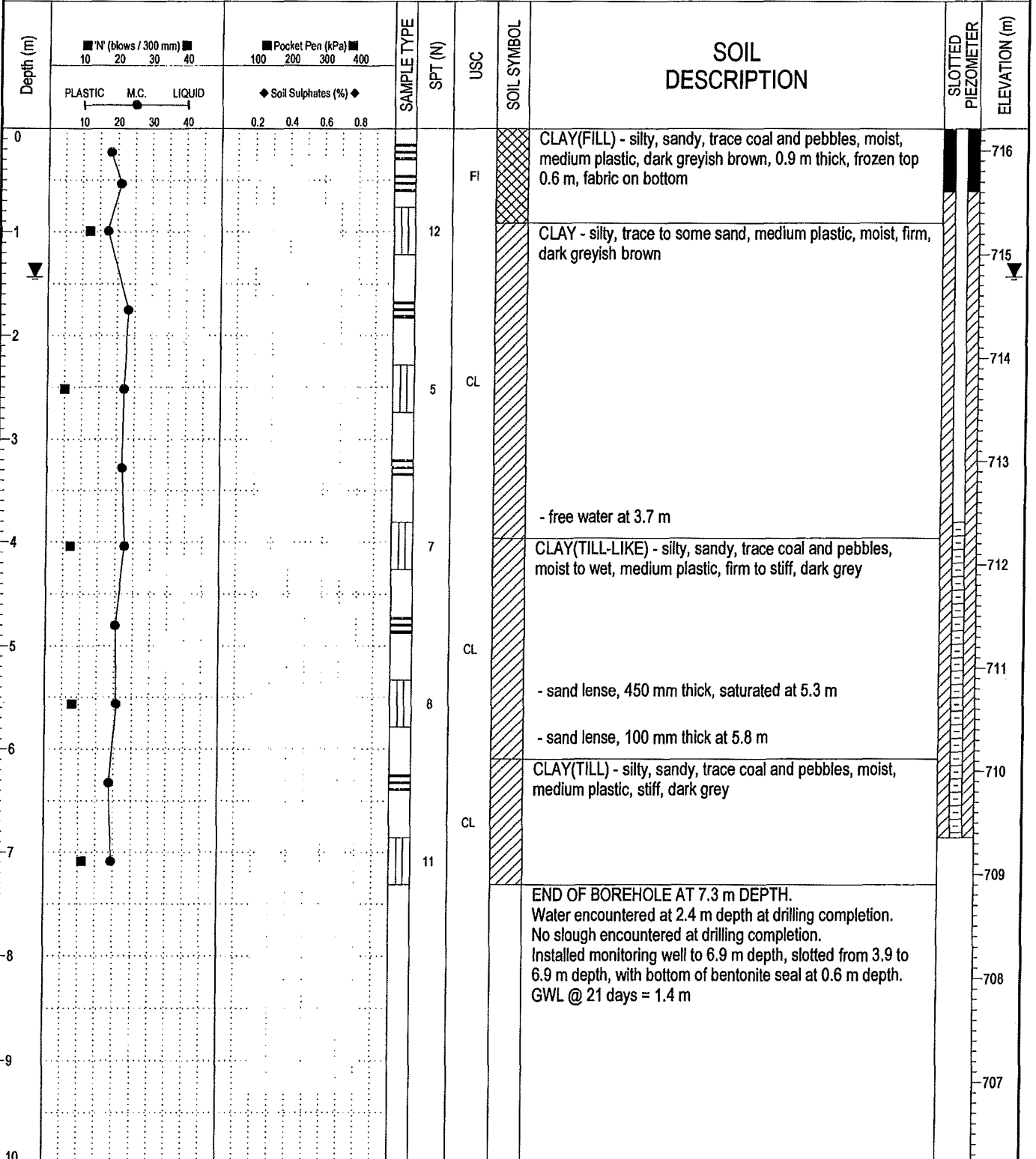
CT & Associates Engineering Inc.

APPENDIX B

BOREHOLE LOGS

GEOTECHNICAL INVESTIGATION	DUNDEE DEVELOPMENTS	BOREHOLE NO: BH-1
LAUREL STAGE 10	UTM ZONE: -	PROJECT NO: 02-1746
1707 AND 2511 23 AVE	SOLID STEM AUGER	ELEVATION: 716.22 m

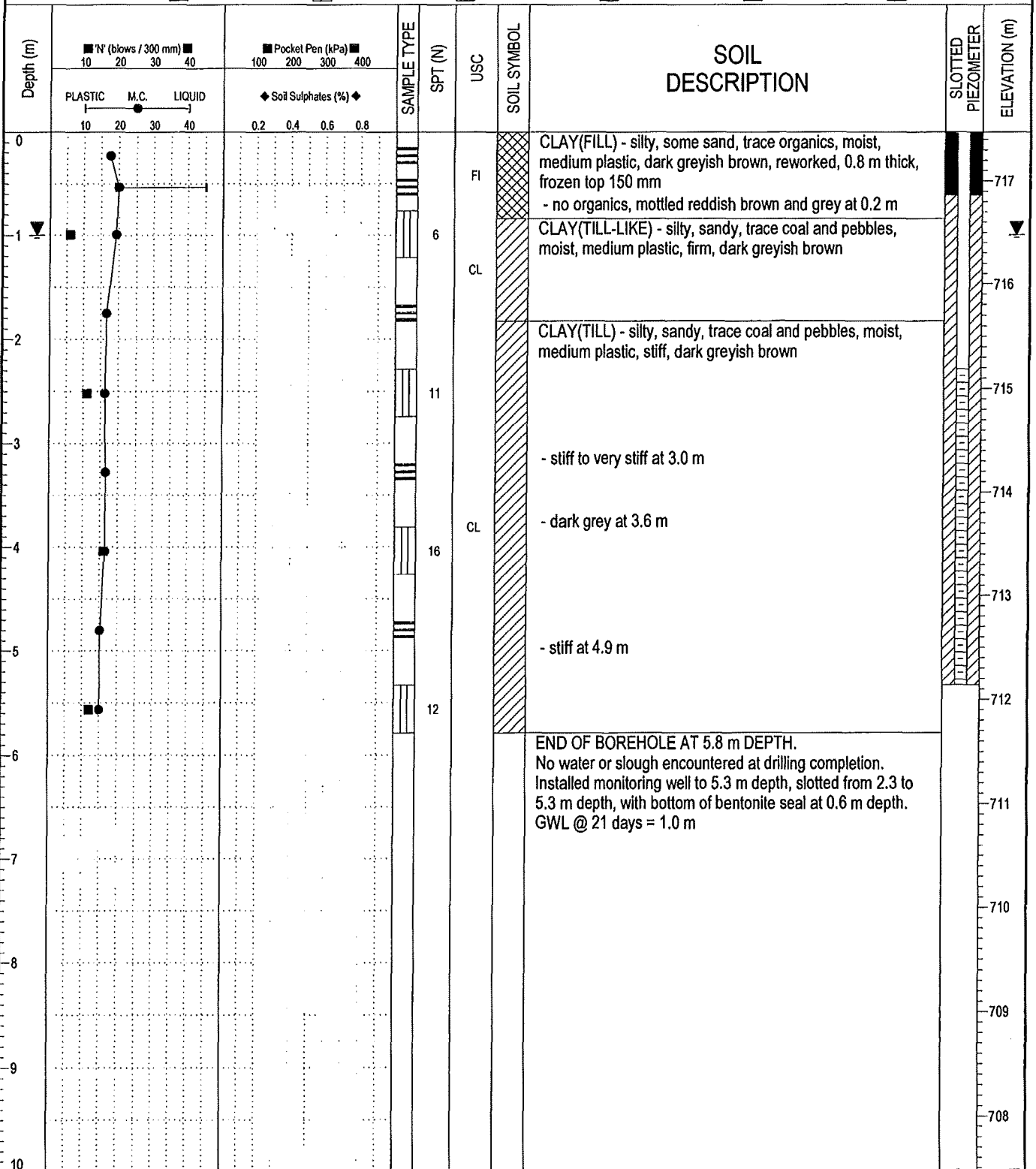
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GEOTECHNICAL INVESTIGATION	DUNDEE DEVELOPMENTS	BOREHOLE NO: BH-2
LAUREL STAGE 10	UTM ZONE: -	PROJECT NO: 02-1746
1707 AND 2511 23 AVE	SOLID STEM AUGER	ELEVATION: 717.47 m

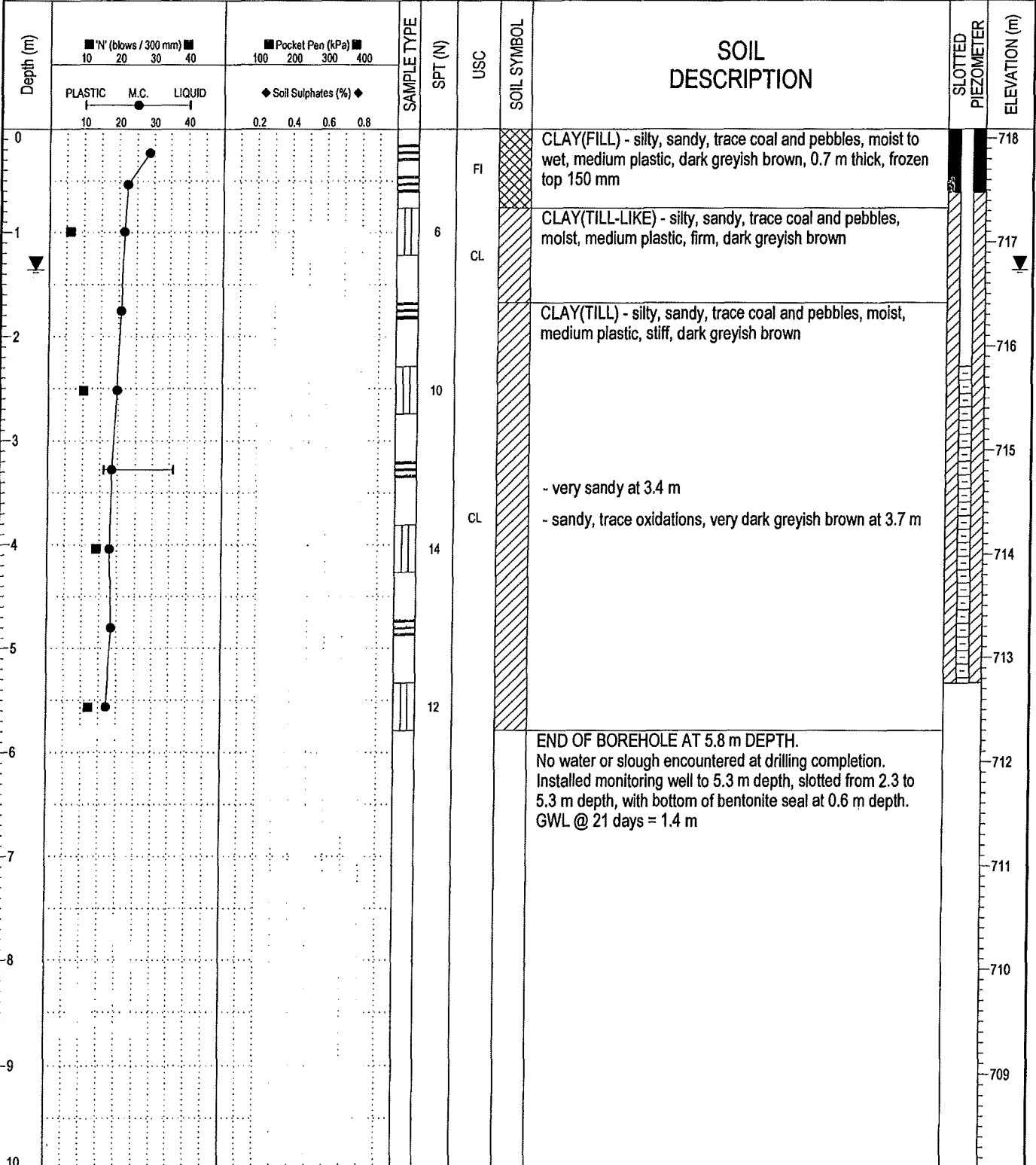
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GEOTECHNICAL INVESTIGATION	DUNDEE DEVELOPMENTS	BOREHOLE NO: BH-3
LAUREL STAGE 10	UTM ZONE: -	PROJECT NO: 02-1746
1707 AND 2511 23 AVE	SOLID STEM AUGER	ELEVATION: 718.09 m

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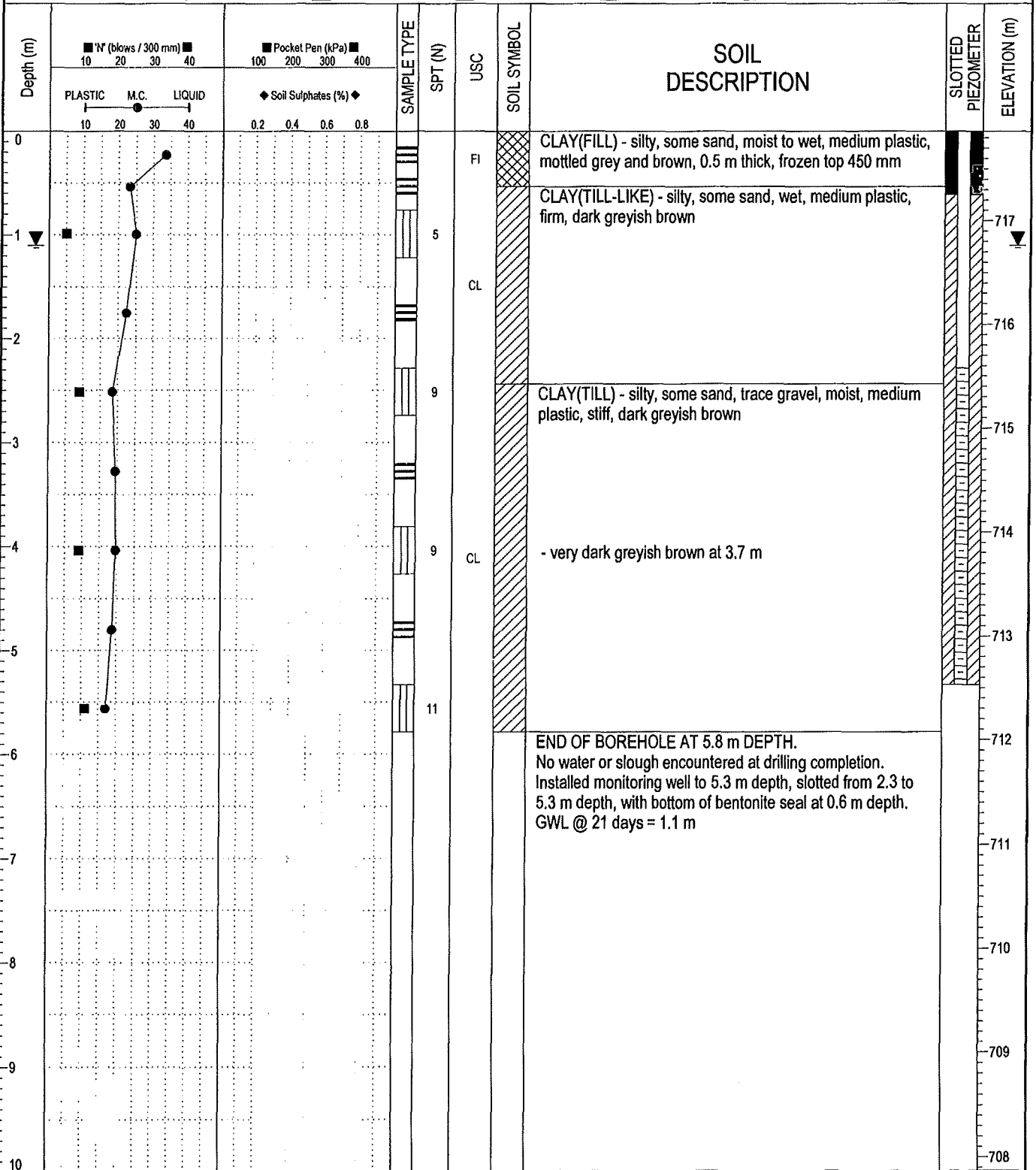
CT & ASSOCIATES ENGINEERING INC.

LOGGED BY: NR
REVIEWED BY: DSN
Fig. No: B-3

COMPLETION DEPTH: 5.8 m
COMPLETION DATE: 1/16/14

GEOTECHNICAL INVESTIGATION	DUNDEE DEVELOPMENTS	BOREHOLE NO: BH-4
LAUREL STAGE 10	UTM ZONE: -	PROJECT NO: 02-1746
1707 AND 2511 23 AVE	SOLID STEM AUGER	ELEVATION: 717.86 m

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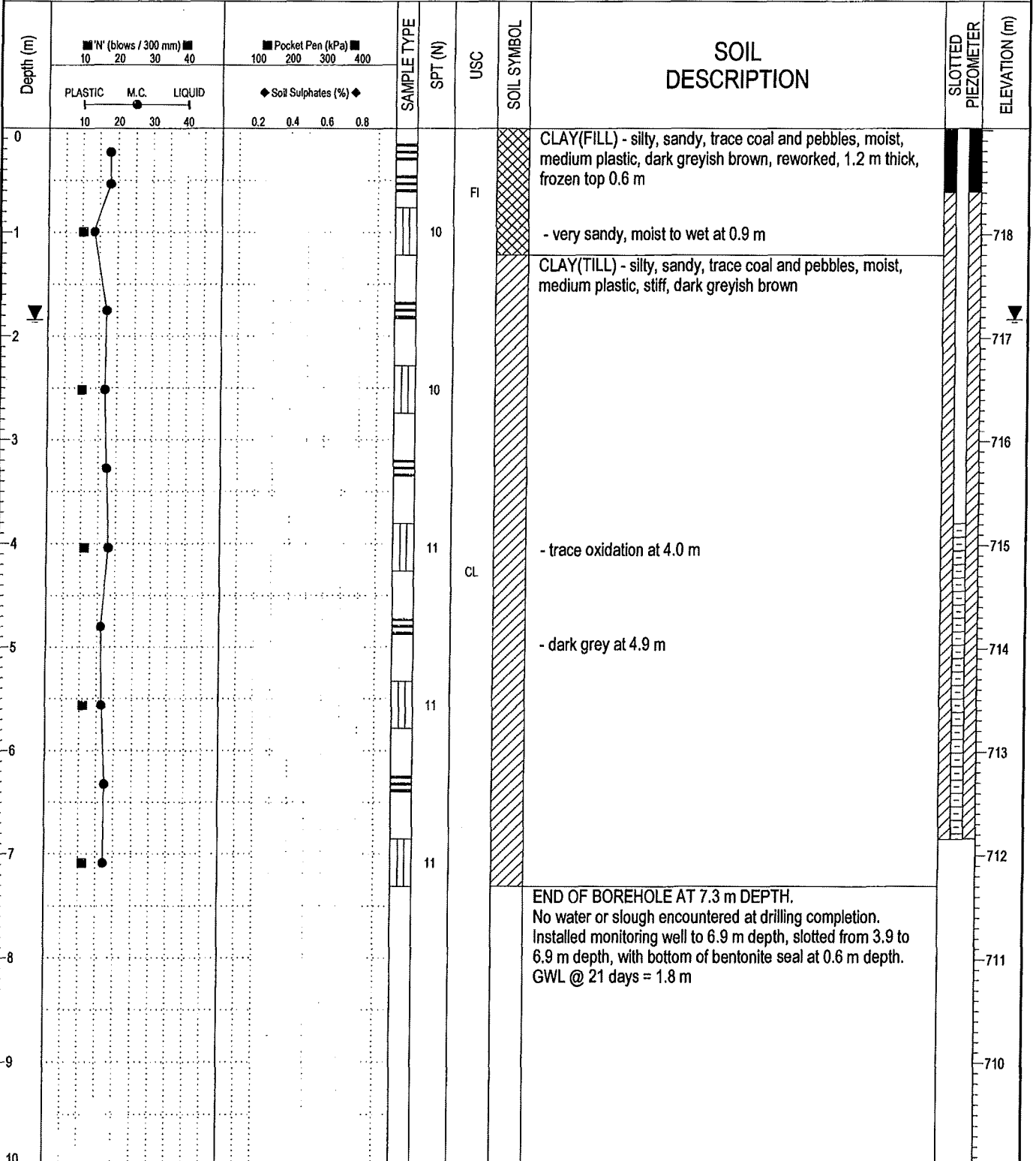


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CT & ASSOCIATES ENGINEERING INC.	LOGGED BY: NR	COMPLETION DEPTH: 5.8 m
	REVIEWED BY: DSN	COMPLETION DATE: 1/16/14
	Fig. No: B-4	Page 1 of 1

GEOTECHNICAL INVESTIGATION	DUNDEE DEVELOPMENTS	BOREHOLE NO: BH-5
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1707 AND 2511 23 AVE	SOLID STEM AUGER	ELEVATION: 719.02 m

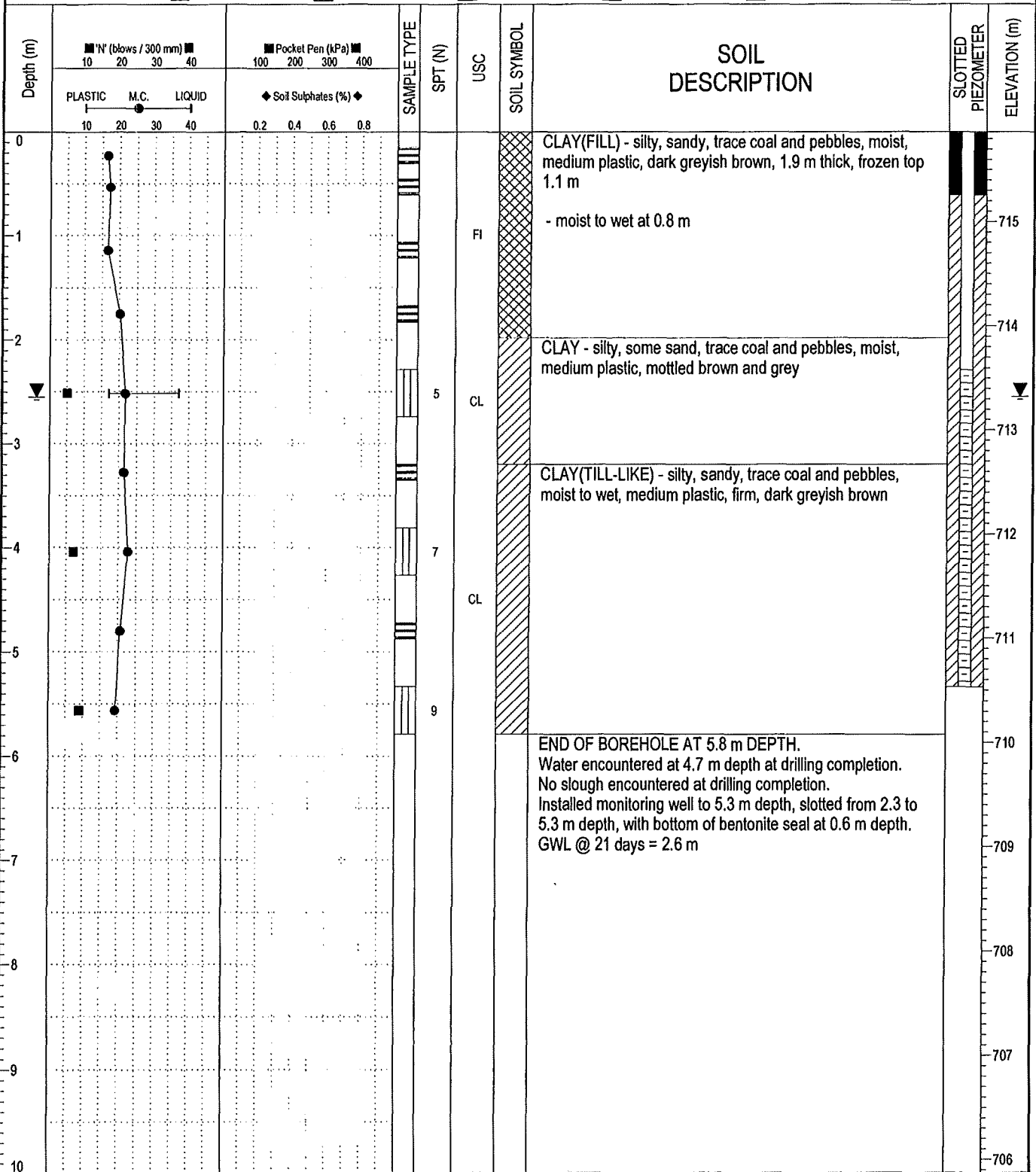
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GEOTECHNICAL INVESTIGATION	DUNDEE DEVELOPMENTS	BOREHOLE NO: BH-6
LAUREL STAGE 10	UTM ZONE: -	PROJECT NO: 02-1746
1707 AND 2511 23 AVE	SOLID STEM AUGER	ELEVATION: 715.87 m

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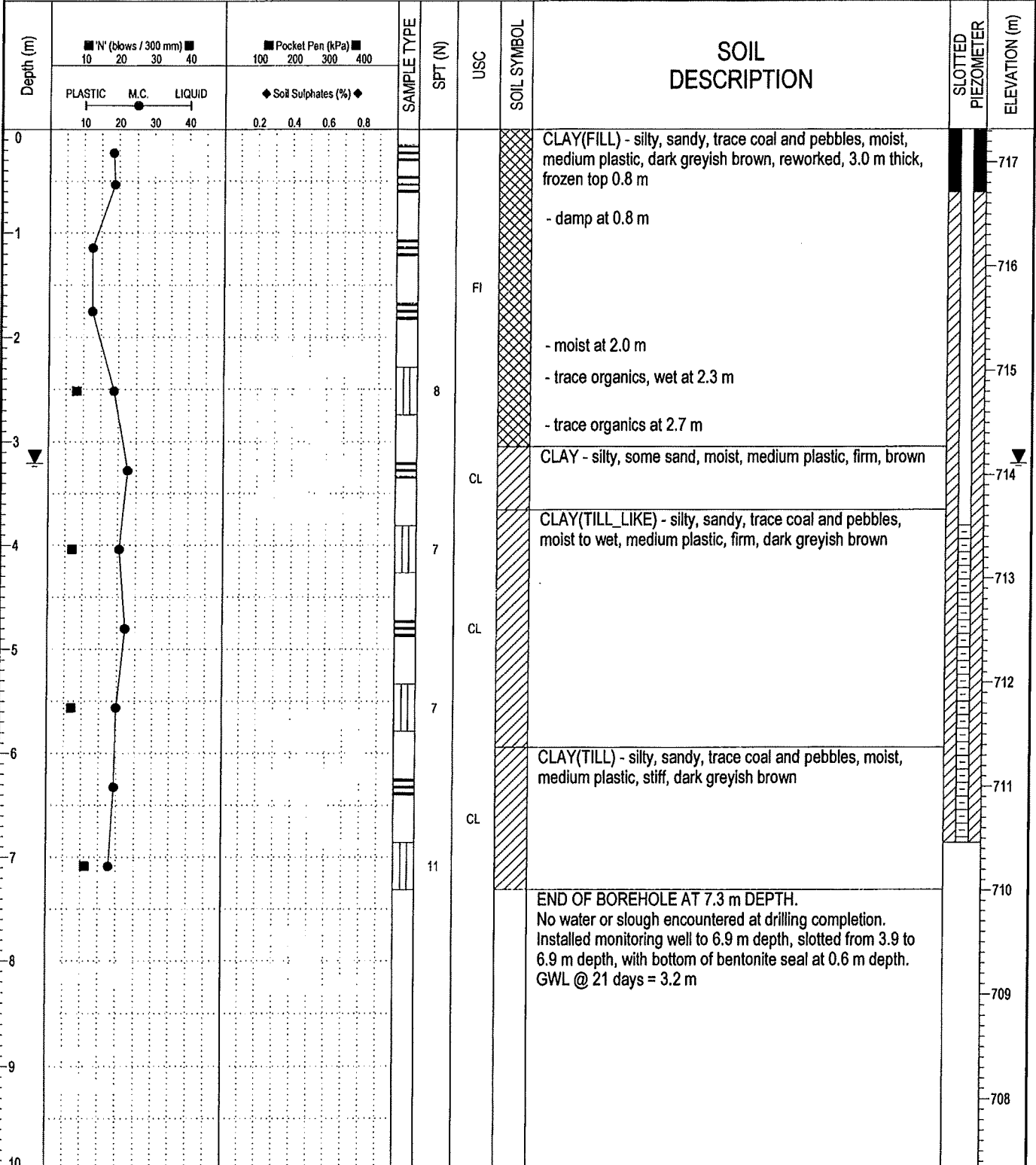
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LOGGED BY: NR	COMPLETION DEPTH: 5.8 m
REVIEWED BY: DSN	COMPLETION DATE: 1/16/14
Fig. No: B-6	Page 1 of 1

GEOTECHNICAL INVESTIGATION	DUNDEE DEVELOPMENTS	BOREHOLE NO: BH-7
LAUREL STAGE 10	UTM ZONE: -	PROJECT NO: 02-1746
1707 AND 2511 23 AVE	SOLID STEM AUGER	ELEVATION: 717.32 m

SAMPLE TYPE	<input checked="" type="checkbox"/> Shelby Tube	<input type="checkbox"/> SPT	<input type="checkbox"/> Disturbed	<input checked="" type="checkbox"/> No Recovery	<input checked="" type="checkbox"/> A Casing	<input type="checkbox"/> Cored Sample
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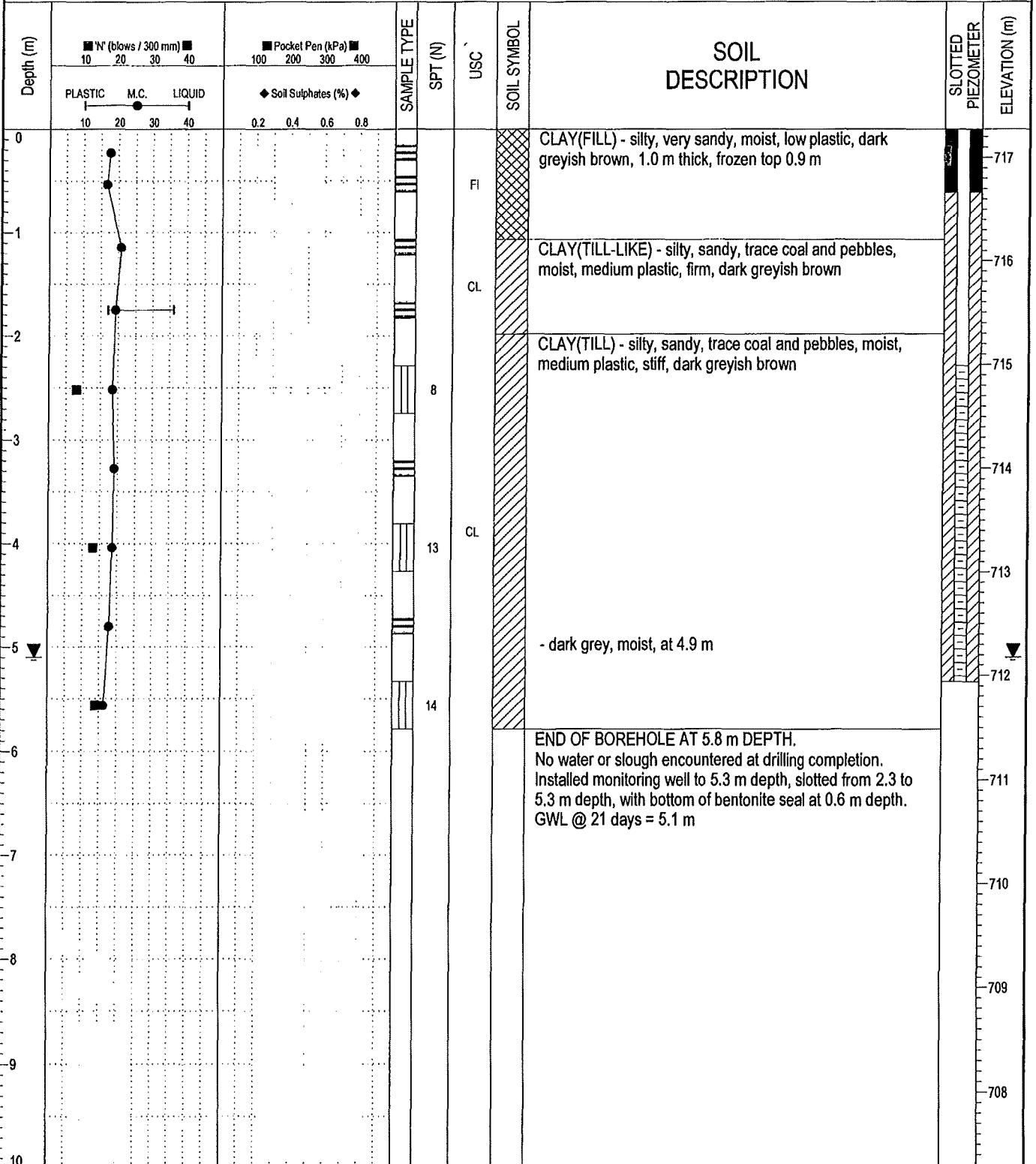
GEO 02-1746.GPJ EDMONTON.GDT 2/26/14

CT & ASSOCIATES ENGINEERING INC.

LOGGED BY: NR	COMPLETION DEPTH: 7.3 m
REVIEWED BY: DSN	COMPLETION DATE: 1/16/14
Fig. No: B-7	Page 1 of 1

GEOTECHNICAL INVESTIGATION	DUNDEE DEVELOPMENTS	BOREHOLE NO: BH-8
LAUREL STAGE 10	UTM ZONE: -	PROJECT NO: 02-1746
1707 AND 2511 23 AVE	SOLID STEM AUGER	ELEVATION: 717.27 m

SAMPLE TYPE	<input checked="" type="checkbox"/> Shelby Tube	<input type="checkbox"/> SPT	<input type="checkbox"/> Disturbed	<input checked="" type="checkbox"/> No Recovery	<input type="checkbox"/> A Casing	<input type="checkbox"/> Cored Sample
BACKFILL TYPE	<input checked="" type="checkbox"/> BENTONITE	<input type="checkbox"/> PEA GRAVEL	<input type="checkbox"/> SLOUGH	<input type="checkbox"/> GROUT	<input type="checkbox"/> DRILL CUTTINGS	<input type="checkbox"/> SAND

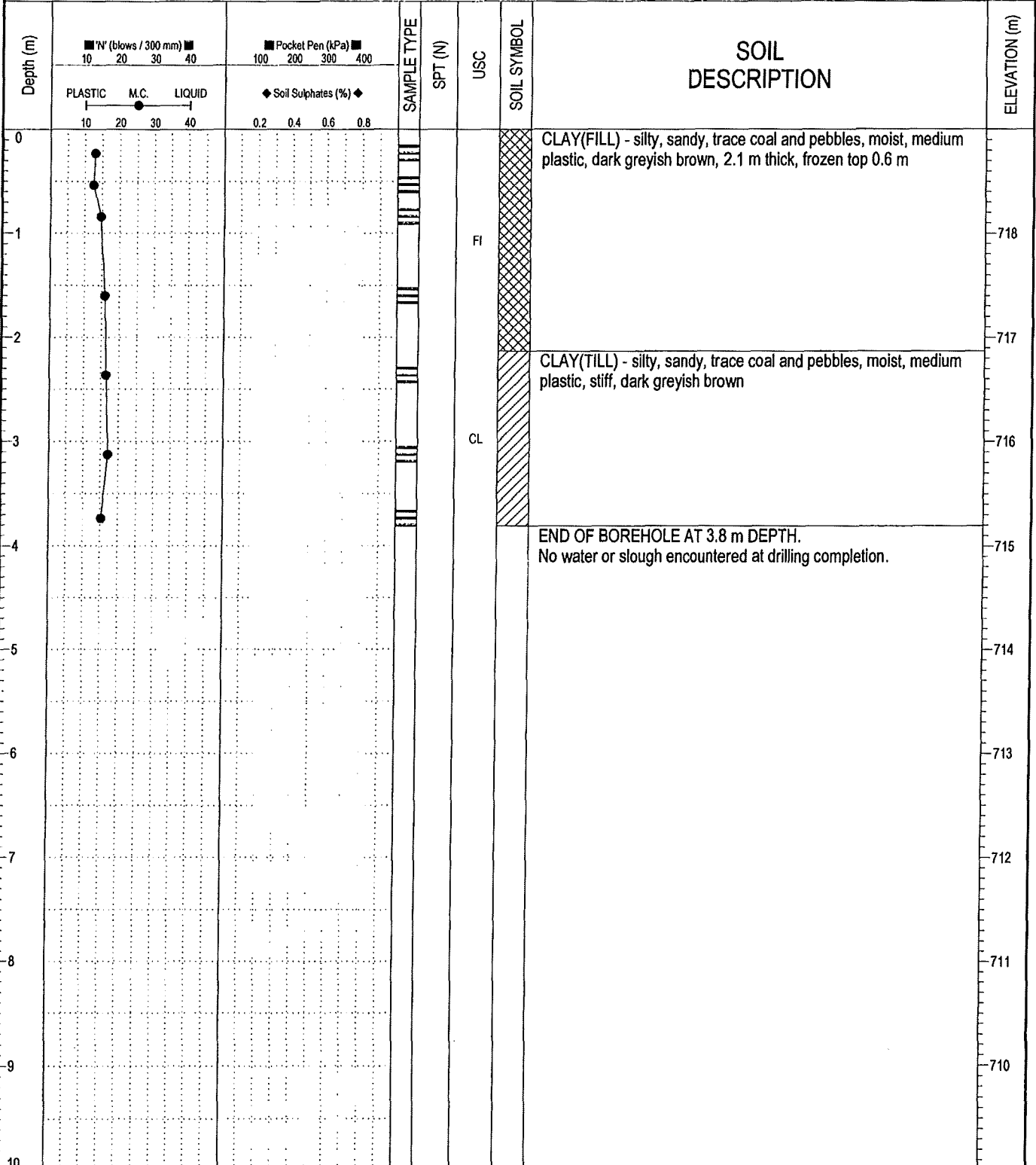


GEO 02-1746.GPJ EDMONTON.GDT 2/26/14

CTA CT & ASSOCIATES ENGINEERING INC.	LOGGED BY: NR	COMPLETION DEPTH: 5.8 m
	REVIEWED BY: DSN	COMPLETION DATE: 1/16/14
	Fig. No: B-8	Page 1 of 1

GEOTECHNICAL INVESTIGATION	DUNDEE DEVELOPMENTS	BOREHOLE NO: BH-9
LAUREL STAGE 10	UTM ZONE: -	PROJECT NO: 02-1746
1707 AND 2511 23 AVE	SOLID STEM AUGER	ELEVATION: 719 m

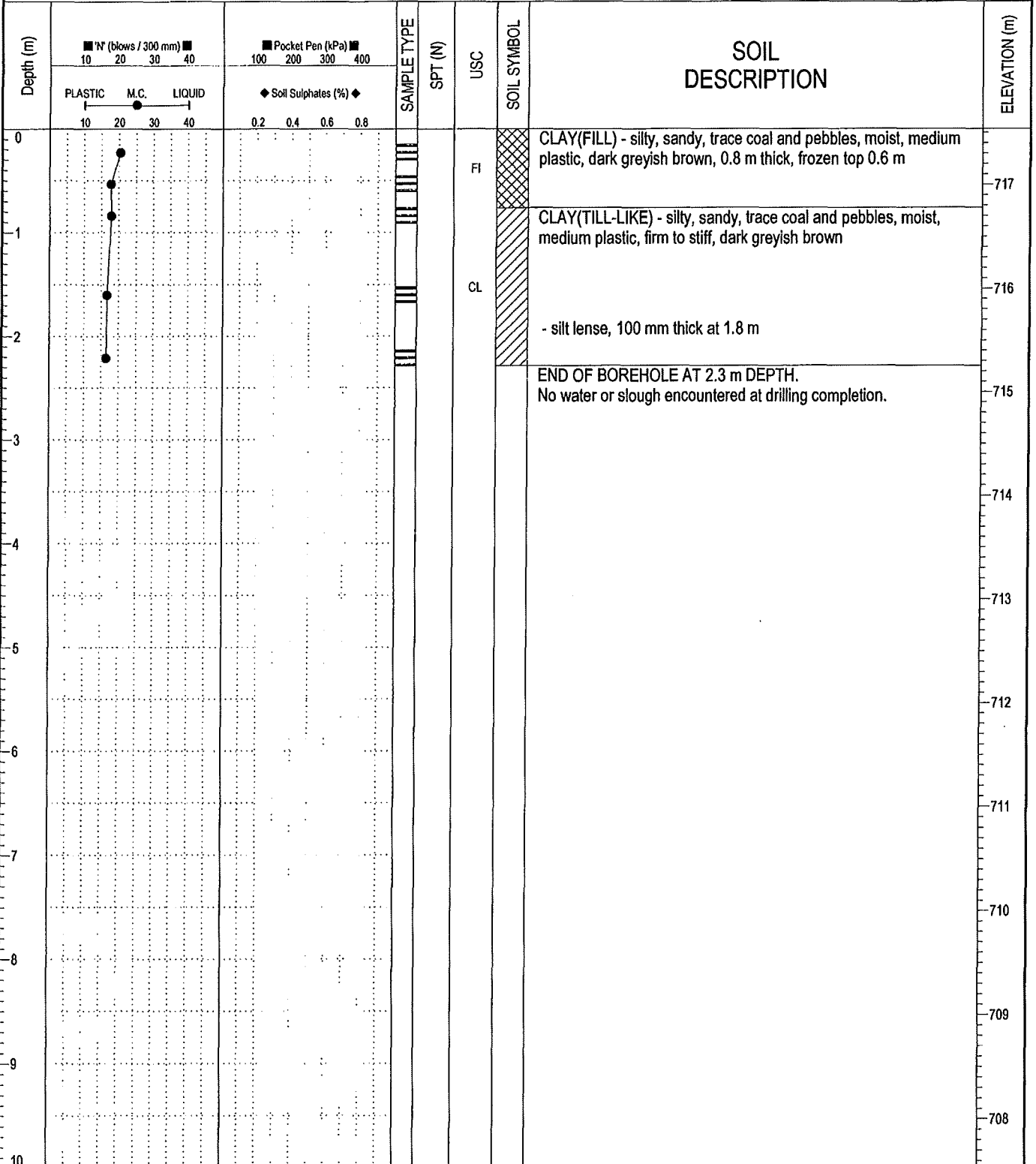
SAMPLE TYPE	<input checked="" type="checkbox"/> Shelby Tube	<input type="checkbox"/> SPT	<input type="checkbox"/> Disturbed	<input checked="" type="checkbox"/> No Recovery	<input checked="" type="checkbox"/> A Casing	<input type="checkbox"/> Cored Sample
BACKFILL TYPE	<input checked="" type="checkbox"/> BENTONITE	<input type="checkbox"/> PEA GRAVEL	<input type="checkbox"/> SLOUGH	<input type="checkbox"/> GROUT	<input checked="" type="checkbox"/> DRILL CUTTINGS	<input type="checkbox"/> SAND



GEO 02-1746.GPJ EDMONTON.GDT 2/26/14

GEOTECHNICAL INVESTIGATION	DUNDEE DEVELOPMENTS	BOREHOLE NO: BH-10
LAUREL STAGE 10	UTM ZONE: -	PROJECT NO: 02-1746
1707 AND 2511 23 AVE	SOLID STEM AUGER	ELEVATION: 717.54 m

SAMPLE TYPE	<input checked="" type="checkbox"/> Shelby Tube	<input type="checkbox"/> SPT	<input type="checkbox"/> Disturbed	<input checked="" type="checkbox"/> No Recovery	<input checked="" type="checkbox"/> A Casing	<input type="checkbox"/> Cored Sample
BACKFILL TYPE	<input checked="" type="checkbox"/> BENTONITE	<input type="checkbox"/> PEA GRAVEL	<input type="checkbox"/> SLOUGH	<input type="checkbox"/> GROUT	<input type="checkbox"/> DRILL CUTTINGS	<input type="checkbox"/> SAND



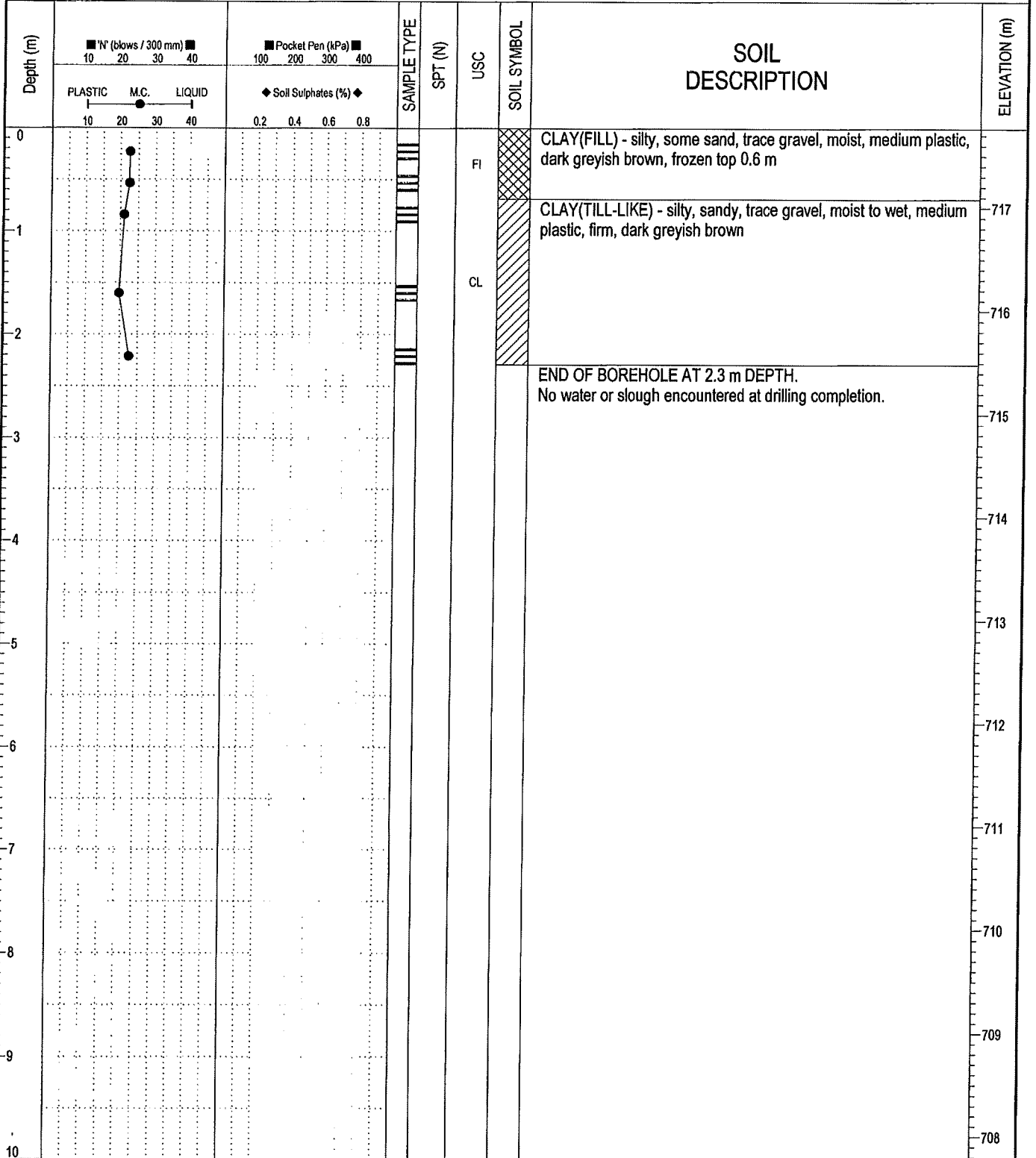
GEO 02-1746.GPJ EDMONTON.GDT 2/26/14

CTA CT & ASSOCIATES ENGINEERING INC.

LOGGED BY: NR	COMPLETION DEPTH: 2.3 m
REVIEWED BY: DSN	COMPLETION DATE: 1/16/14
Fig. No: B-10	Page 1 of 1

GEOTECHNICAL INVESTIGATION	DUNDEE DEVELOPMENTS	BOREHOLE NO: BH-11
LAUREL STAGE 10	UTM ZONE: -	PROJECT NO: 02-1746
1707 AND 2511 23 AVE	SOLID STEM AUGER	ELEVATION: 717.77 m

SAMPLE TYPE	<input checked="" type="checkbox"/> Shelby Tube	<input type="checkbox"/> SPT	<input type="checkbox"/> Disturbed	<input type="checkbox"/> No Recovery	<input type="checkbox"/> A Casing	<input type="checkbox"/> Cored Sample
BACKFILL TYPE	<input checked="" type="checkbox"/> BENTONITE	<input type="checkbox"/> PEA GRAVEL	<input type="checkbox"/> SLOUGH	<input type="checkbox"/> GROUT	<input type="checkbox"/> DRILL CUTTINGS	<input type="checkbox"/> SAND



GEO-02-1746.GPJ EDMONTON.GDT 2/26/14



CT & ASSOCIATES ENGINEERING INC.

LOGGED BY: NR

REVIEWED BY: DSN

Fig. No: B-11

COMPLETION DEPTH: 2.3 m

COMPLETION DATE: 1/16/14

Page 1 of 1



CT & Associates Engineering Inc.

APPENDIX C

HISTORICAL AIR PHOTOS



NOTE: BASED ON PROVINCE OF ALBERTA AIR PHOTO (1950)

APPROXIMATE SCALE 1 : 10 000

CTA CT & ASSOCIATES ENGINEERING INC.	PROJECT								
	SUBDIVISION LEVEL GEOTECHNICAL INVESTIGATION 2511-23 AVENUE NW AND 1707-23 AVENUE NW EDMONTON, ALBERTA								
CLIENT	DUNDEE DEVELOPMENTS		TITLE						
		SITE AIR PHOTO - 1950							
DATE	FEB. 27, 2014	DWN.	NR	CHKD.	DSN	FILE NO.	02-1746-C 1	DWG. NO.	C-1



NOTE: BASED ON PROVINCE OF ALBERTA AIR PHOTO (1962)

APPROXIMATE SCALE 1 : 10 000

CTA CT & ASSOCIATES ENGINEERING INC.	PROJECT			
	SUBDIVISION LEVEL GEOTECHNICAL INVESTIGATION 2511-23 AVENUE NW AND 1707-23 AVENUE NW EDMONTON, ALBERTA			
CLIENT	TITLE			
DUNDEE DEVELOPMENTS	SITE AIR PHOTO -1962			
DATE FEB. 27, 2014	DWN. NR	CHKD. DSN	FILE NO. 02-1746-C2	DWG. NO. C-2



NOTE: BASED ON PROVINCE OF ALBERTA AIR PHOTO (1967)


APPROXIMATE SCALE 1 : 10 000

CTA	CT & ASSOCIATES ENGINEERING INC.		PROJECT SUBDIVISION LEVEL GEOTECHNICAL INVESTIGATION 2511-23 AVENUE NW AND 1707-23 AVENUE NW EDMONTON, ALBERTA						
	CLIENT DUNDEE DEVELOPMENTS		TITLE SITE AIR PHOTO -1967						
DATE	FEB. 27, 2014	DWN.	NR	CHKD.	DSN	FILE NO.	02-1746-C3	DWG. NO.	C-3



NOTE: BASED ON CITY OF EDMONTON ARCHIVES AIR PHOTO (1971)


APPROXIMATE SCALE 1 : 5000

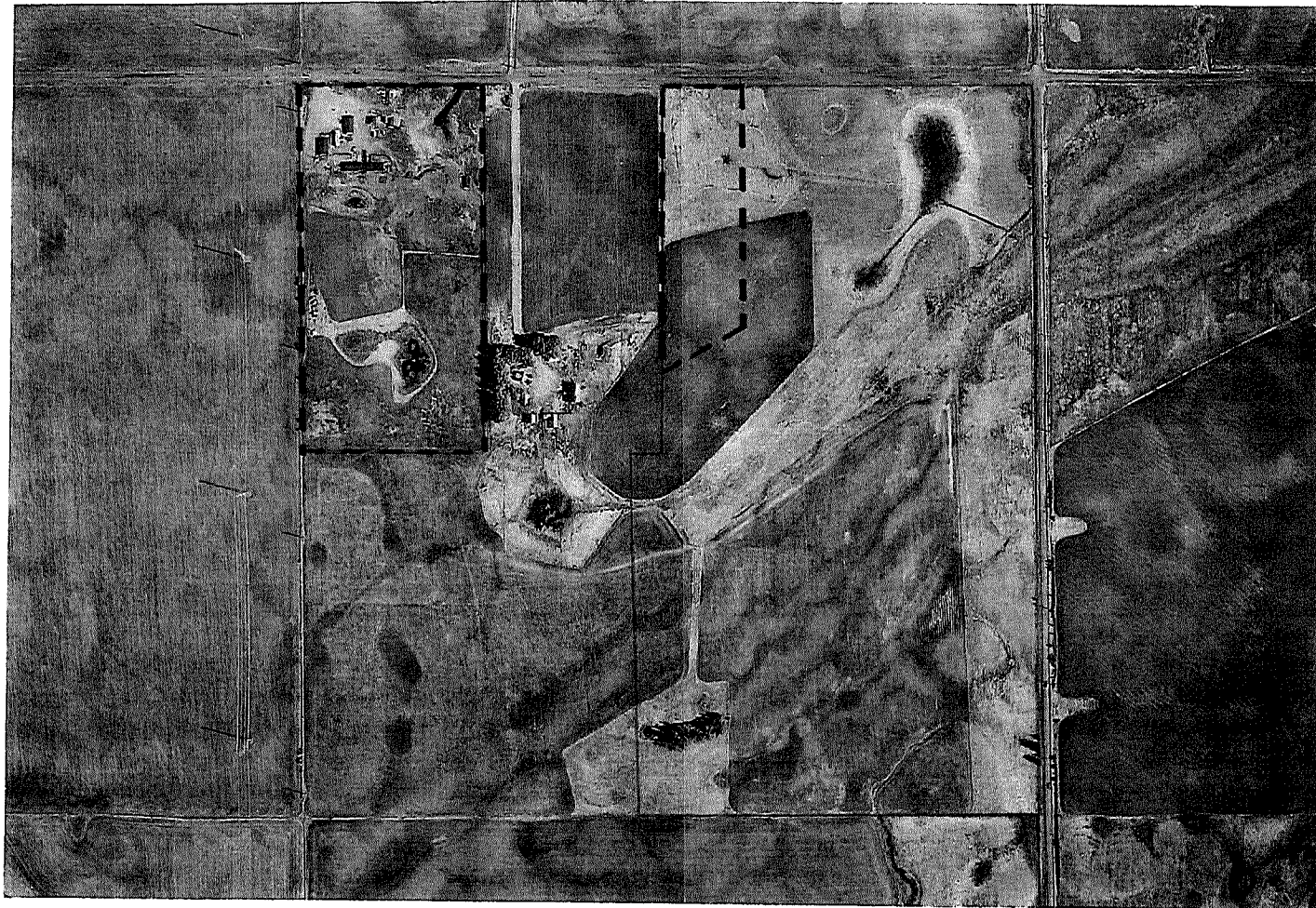
 CT & ASSOCIATES ENGINEERING INC.	PROJECT SUBDIVISION LEVEL GEOTECHNICAL INVESTIGATION 2511-23 AVENUE NW AND 1707-23 AVENUE NW EDMONTON, ALBERTA	
	TITLE SITE AIR PHOTO -1971	
CLIENT DUNDEE DEVELOPMENTS		
DATE FEB. 27, 2014	DWN. NR	CHKD. DSN
FILE NO. 02-1746-C 4		DWG. NO. C-4



NOTE: BASED ON CITY OF EDMONTON ARCHIVES AIR PHOTO (1976)


APPROXIMATE SCALE 1 : 5000

 CT & ASSOCIATES ENGINEERING INC.	PROJECT SUBDIVISION LEVEL GEOTECHNICAL INVESTIGATION 2511-23 AVENUE NW AND 1707-23 AVENUE NW EDMONTON, ALBERTA			
	CLIENT DUNDEE DEVELOPMENTS	TITLE SITE AIR PHOTO - 1976		
DATE FEB. 27, 2014	DWN. NR	CHKD. DSN	FILE NO. 02-1746-C5	DWG. NO. C-5



NOTE: BASED ON CITY OF EDMONTON ARCHIVES AIR PHOTO (1980)


APPROXIMATE SCALE 1 : 5000

 CT & ASSOCIATES ENGINEERING INC.		PROJECT SUBDIVISION LEVEL GEOTECHNICAL INVESTIGATION 2511-23 AVENUE NW AND 1707-23 AVENUE NW EDMONTON, ALBERTA	
CLIENT DUNDEE DEVELOPMENTS		TITLE SITE AIR PHOTO - 1980	
DATE FEB. 27, 2014	DWN. NR	CHKD. DSN	FILE NO. 02-1746-C6
		DWG. NO. C-6	



NOTE: BASED ON CITY OF EDMONTON ARCHIVES AIR PHOTO (1984)


APPROXIMATE SCALE 1 : 5000

 CT & ASSOCIATES ENGINEERING INC.	PROJECT SUBDIVISION LEVEL GEOTECHNICAL INVESTIGATION 2511-23 AVENUE NW AND 1707-23 AVENUE NW EDMONTON, ALBERTA			
	CLIENT DUNDEE DEVELOPMENTS	TITLE SITE AIR PHOTO -1984		
DATE FEB. 27, 2014	DWN. NR	CHKD. DSN	FILE NO. 02-1746-C7	DWG. NO. C-7



NOTE: BASED ON CITY OF EDMONTON ARCHIVES AIR PHOTO (1988)


APPROXIMATE SCALE 1 : 5000

 CT & ASSOCIATES ENGINEERING INC.		PROJECT SUBDIVISION LEVEL GEOTECHNICAL INVESTIGATION 2511-23 AVENUE NW AND 1707-23 AVENUE NW EDMONTON, ALBERTA	
CLIENT DUNDEE DEVELOPMENTS		TITLE SITE AIR PHOTO - 1988	
DATE FEB. 27, 2014	DWN. NR	CHKD. DSN	FILE NO. 02-1746-C8
		FILE NO. 02-1746-C8	DWG. NO. C-8



NOTE: BASED ON CITY OF EDMONTON ARCHIVES AIR PHOTO (1992)


APPROXIMATE SCALE 1 : 5000

 CT & ASSOCIATES ENGINEERING INC.	PROJECT SUBDIVISION LEVEL GEOTECHNICAL INVESTIGATION 2511-23 AVENUE NW AND 1707-23 AVENUE NW EDMONTON, ALBERTA	
	CLIENT DUNDEE DEVELOPMENTS	
DATE FEB. 27, 2014		TITLE SITE AIR PHOTO -1992
DWN. NR	CHKD. DSN	FILE NO. 02-1746-C9
		DWG. NO. C-9



NOTE: BASED ON CITY OF EDMONTON ARCHIVES AIR PHOTO (1998)


APPROXIMATE SCALE 1 : 5000

 CT & ASSOCIATES ENGINEERING INC.				PROJECT SUBDIVISION LEVEL GEOTECHNICAL INVESTIGATION 2511-23 AVENUE NW AND 1707-23 AVENUE NW EDMONTON, ALBERTA	
CLIENT DUNDEE DEVELOPMENTS				TITLE SITE AIR PHOTO - 1998	
DATE FEB. 27, 2014	DWN. NR	CHKD. DSN	FILE NO. 02-1746-C10	DWG. NO. C-10	



NOTE: BASED ON CITY OF EDMONTON ARCHIVES AIR PHOTO (2003)


APPROXIMATE SCALE 1 : 5000

 CT & ASSOCIATES ENGINEERING INC.		PROJECT SUBDIVISION LEVEL GEOTECHNICAL INVESTIGATION 2511-23 AVENUE NW AND 1707-23 AVENUE NW EDMONTON, ALBERTA	
CLIENT DUNDEE DEVELOPMENTS		TITLE SITE AIR PHOTO -2003	
DATE	FEB. 27, 2014	DWN.	NR
CHKD.	DSN	FILE NO.	02-1746-C11
		DWG. NO.	C-11



NOTE: BASED ON CITY OF EDMONTON ARCHIVES AIR PHOTO (2007)

APPROXIMATE SCALE 1 : 5000

 CT & ASSOCIATES ENGINEERING INC.		PROJECT							
		SUBDIVISION LEVEL GEOTECHNICAL INVESTIGATION 2511-23 AVENUE NW AND 1707-23 AVENUE NW EDMONTON, ALBERTA							
CLIENT		TITLE							
DUNDEE DEVELOPMENTS		SITE AIR PHOTO -2007							
DATE	FEB. 27, 2014	DWN.	NR	CHKD.	DSN	FILE NO.	02-1746-C12	DWG. NO.	C-12

