SolidEarth Geotechnical Inc.
www.solidearth.ca

GEOTECHNICAL ASSESSMENT

Vermilion Airport Rehabilitation – Runway and Taxiway
Vermilion, Alberta

Prepared for:

Town of Vermilion
c/o McElhanney

Date:

Initial Submittal: 12 September 2023
Revised Submittal: 26 October 2023

Project File #: PG23-1717.R1

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1.0 INTRODUCTION

This report presents the results of the geotechnical investigation conducted for the proposed airport runway and taxiway rehabilitation project in the Town of Vermilion, Alberta. The geotechnical investigation was carried out by SolidEarth Geotechnical Inc. (SolidEarth) at the authorization of Eric Valois, P.Eng. of McElhanney.

The purpose of the geotechnical investigation was to assess the subsurface soil and groundwater conditions at selected locations within the airport runaway and taxiway and to provide geotechnical recommendations associated with the proposed rehabilitation.

2.0 PROJECT BACKGROUND

Based on information provided to SolidEarth, it was understood that the project consists of rehabilitation of the entire airfield (runway, taxiways, and parking pad). It was understood that the existing airfield has been experiencing pavement deterioration. It was suspected that the pavement deterioration was related to frost activity.

It was understood that the existing airfield was initially paved in the early 1970's. Based on an aerial photograph review, it appeared that transverse / block cracking had developed after a relatively short period (in the order of several years). In 1996, a second layer of asphaltic concrete pavement (ACP) was placed over the existing airfield.

It was also understood that a grain silo was built along the runway alignment creating restrictions along the flight path. Therefore, there have been suggestions of re-orienting the airfield to resolve both the existing pavement deterioration and alignment issues.

The scope of work completed by SolidEarth included a desktop review of published aerial imagery and Atlas of Canada - Toparama; drilling boreholes, conducting laboratory review and testing on recovered soil samples; and undertaking geotechnical engineering analysis and preparation of this report.

3.0 SITE DESCRIPTION

The Vermilion Airport was located just northeast of the town, directly north of the Town's Public Works Shop and Yard, within portions of Sec. 30-50-6 W4M. The existing airfield consisted of an approximately 1 km long and 25 m wide runway, a 225 m long and 10 m wide taxiway and a 60 by 90 m parking pad.

The runway appeared elevated above surrounding grades, with swales located along both sides of the airfield. The edges of the swales were approximately 10 to 20 m from the edge of the pavement.

The airfield alignment on an aerial photograph is presented as Figure 1. Photographs showing site conditions that existed at the time of the field investigation are presented in Appendix A.

4.0 FIELD AND LABORATORY INVESTIGATION

4.1 GROUND DISTURBANCE AND SAFETY PERFORMANCE

Prior to field drilling, a SolidEarth representative completed internal ground disturbance procedures, which included placing an Alberta One Call. McElhanney also cleared the borehole locations. Before starting onsite work, a daily field level hazard assessment was conducted and was communicated with all workers involved during the tailgate meeting. The field work was completed without any near misses or incidents.

4.2 FIELD DRILLING AND TESTING

The borehole locations were selected and marked in the field by SolidEarth with consultation with McElhanney, with some of the boreholes being located within areas experiencing severe cracking. The borehole location plan on an aerial photograph is presented as Figure 1.

SolidEarth subcontracted Drilling Solution Inc. of Sherwood Park, Alberta to drill the boreholes. Drilling was completed using a truck-mounted auger drill rig utilizing 150 mm solid-stem continuous flight augers.

The field investigation was undertaken on 17 July 2023 and consisted of drilling a total of 11 boreholes (BH23-01 to -11). The boreholes were drilled to approximate depths ranging between 2.4 and 4.6 m below the existing paved surface. Prior to drilling, the asphalt surface at the borehole locations was cored to visually inspect the condition of the ACP.

During drilling, soil samples were collected at approximately 0.75 m intervals along the depth of the boreholes. Pocket penetrometer testing was conducted on selected unfrozen cohesive soil samples to obtain an indication of the unconfined compressive strength of disturbed soil samples from the auger. Standard Penetration Tests (SPT) were conducted at selected depths (typically every 1.5 m) to assess the in-situ strength of the soils encountered. The soil sampling and testing sequences are shown on the borehole logs, Appendix B.

A SolidEarth geotechnical technologist monitored the drilling operations and logged the recovered soil samples from the auger cuttings and the SPT samples. The soils were logged according to the Modified Unified Soil Classification System, which is described in the Explanation of Terms and Symbols in Appendix B. Due to the method by which the soil cuttings were returned to surface, the depths noted on the borehole logs may vary by ± 0.3 m from those recorded.

Groundwater seepage conditions were monitored during and immediately following completion of drilling. No standpipes were installed as they will cause a traffic hazard and will likely be destroyed.

Following completion of drilling, the lateral coordinates (northing and easting) of the borehole locations were recorded by the SolidEarth representative using a hand-held GPS unit. These coordinates are shown on the borehole logs.

4.3 LABORATORY INVESTIGATION

All collected samples were submitted to the laboratory for further examination and testing. Laboratory testing conducted included visual examination of the ACP cores; visual examination, determination of the in-situ moisture content on all collected samples; and grain size distribution, and Atterberg limits on selected samples. The results of the laboratory testing are presented on the borehole logs, Appendix B.

5.0 SUBSURFACE CONDITIONS

The subsurface soil conditions encountered at the borehole locations generally consisted of ACP structure, followed by clay fill, and underlain by clay till. A brief summary of the subsurface conditions encountered is presented below. A detailed description of the subsurface conditions encountered at each borehole location is provided on the borehole logs.

Pavement Structures

Asphalt was encountered at the ground surface of all borehole locations with approximate thicknesses ranging between 100 and 140 mm, with an average of 120 mm. Gravel base was encountered below the asphalt at all borehole locations with approximate thicknesses ranging between 150 and 355 mm, with an average of 260 mm.

Due to the drilling method used in the investigation (auger drilling), the exact thicknesses of the gravel could not be accurately determined as the soils were ground and mixed by the auger during drilling. Additionally, the quality of the gravel material was variable and included high contents of sands and fines (silt and clay sizes), making it difficult to identify the interface between this material and the clay fill soils. The best estimate of the thickness of the gravel layers and the measured thickness of the ACP cores are shown on the borehole logs.

Fill

Clay fill was encountered below the pavement structures at all borehole locations, except at the location of BH23-04 and -09 and extended to approximate depths ranging between 0.7 and 2.7 m below the existing ground surface. The fill was predominantly mineral in nature with some organic inclusions, except at the location of BH23-02 and -06, which contained high degrees of organic contents below the depths ranging between 0.5 and 1.4 m, approximately.

The clay fill was generally classified as “clay, some to and sand, silty to and silt, trace gravel”, was medium plastic, grey-brown to grey, and moist. The moisture content of the clay fill ranged between 8 and 17 percent, with an average of 14 percent. Liquid and plastic limits of the clay fill samples were in the order of 32 to 34 percent and 11 to 14 percent, respectively. Based on comparison with the plastic limit of the soil, it is expected that the average moisture content of the majority of the clay fill was near to its optimum moisture, with some wetter zones at depth in a couple of borehole locations (e.g., BH23-02 and -06) where higher organic contents were encountered.

The consistency of the clay fill was generally assessed to be very stiff based on the SPT “N” and pocket penetrometer values.

Clay Till

Clay till was encountered below the fill at all borehole locations and extended to beyond the borehole exploration depth. The clay till was generally classified as “clay, some to and sand, silty to and silt, trace gravel”, was low to medium plastic, grey-brown to grey, and moist.

The natural moisture content of the clay till ranged between 9 and 16 percent, with an average of 13 percent. Liquid and plastic limits of a sample of the clay till were in the order of 33 percent and 10 percent, respectively. Based on comparison with the plastic limit of the soil, it is expected that the average in-situ moisture content of the clay till was near its optimum moisture.

The consistency of the clay till was assessed to be stiff to very stiff based on the SPT “N” and pocket penetrometer values.

Groundwater Levels

No seepage was encountered at any borehole locations during drilling, and all boreholes were dry at completion of drilling. Based on field observations (particularly the geometry of the airfield), it was anticipated that the water table was likely deeper than 1 to 1.5 m below the paved surface.

6.0 DESKTOP REVIEW

Aerial Photographs

Aerial photographs of the project site were obtained to determine the historic land features, use, and the changes that occurred within the project area. Aerial photographs were obtained through Google Earth Pro® and the Alberta Environment and Parks (AEP) Air Photo Library.

As aerial photographs do not provide a continuous record of site development, it is possible that features of interest may have been present in the study area between the dates of coverage. In addition, photographic quality and scale are variable and may make features difficult to identify or their nature difficult to determine.

Aerial photographs that were reviewed included the years 1969, 1977, 2003 and 2006. Reproductions of these aerial photographs are provided in Figures 2 to 5, respectively. A summary of the aerial photograph review is provided in Table 1.

Table 1: Historical Aerial Photograph Review

Year	Description
1969	The site along the airfield alignment appeared to be undeveloped and covered with grass. There appeared to be some type of ground disturbance on the northwestern corner of the alignment.
1977	The airfield was clearly visible. Evidence of cracking was visible across the entire airfield alignment.
2003	It appeared that the existing airfield pavement was re-surfaced. There was no sign of cracks at this time.
2006	It appeared that the cracking had re-developed across the airfield alignment.

Site Topography and Drainage

Site topography was assessed by reviewing Atlas of Canada-Toporama from the Natural Resources Canada website. Figure 6 presents the approximate site elevations from this website. According to the Atlas of Canada-Toporama, the elevation of the study area has a relief of less than 10 m. In addition, the airfield alignment appeared to be on the bank of Vermilion River valley.

7.0 GEOTECHNICAL ANALYSIS AND RECOMMENDATIONS

7.1 ANALYSIS OF SITE CONDITIONS

7.1.1 Condition of the Existing Pavement

The thicknesses of the existing pavement materials encountered at the borehole locations are summarized in Table 2. The existing pavement materials included approximately 120 mm of ACP underlain by approximately 260 mm of cement stabilized base course (CSBC). The moisture content of the base course ranged between 6 and 12 percent, with an average of 9 percent.

Table 2: Measured Thicknesses of ACP and CSBC

Borehole ID	BH23-01	BH23-02	BH23-03	BH23-04	BH23-05	BH23-06	BH23-07	BH23-08	BH23-09	BH23-10	BH23-11	MEAN	S.DEV.
ACP (mm)	125	140	105	115	125	125	100	135	100	120	140	121	15
CSBC (mm)	279	184	298	267	273	254	279	254	356	152	267	260	54

The current project scope included a visual inspection and review of historical aerial photographs. A full-scale assessment of the pavement's condition (e.g., using a falling weight deflectometer, GPR, or other methods) was outside the scope of this project. Based on the visual observations during the field investigation and review of the aerial photographs, it appeared that transverse / block cracking was the predominant deteriorating feature across the airfield pavement. The pavement surface appeared aged. No sign of major rutting and potholes were noted. These deteriorations have been developing in a relatively short period (in the order of several years) following the pavement of the airfield.

7.1.2 Subgrade Conditions

Subgrade Material, Moisture, and Strength

Based on the subsurface soil conditions encountered, it is expected that the near surface subgrade soils will consist of medium plastic clayey soils.

The average in-situ moisture content of the clayey soils was near (approximately within 3 percent) to the optimum moisture content of the soil, with a few wetter zones at depth in a few of borehole locations where higher organic contents were encountered. The consistency of the near surface clay was assessed to be generally stiff.

Based on the findings at the borehole locations, it is anticipated that soft subgrade conditions are not expected to be a major concern.

Frost Susceptibility of the Subgrade Soils

Frost heave of the subgrade soils is generally related to the particle size distribution of the soils, moisture content, and the presence of a relatively shallow groundwater table.

The near surface clayey soils encountered were generally of medium plasticity. The grain size distribution of these soils generally consisted of approximately 20 to 34 percent by weight of clay size particles with the remaining portions as silt, sand and gravel size particles. These soils were generally considered to be moderately susceptible to frost heaving and formation of ice lenses in the presence of water.

Generally, moist soil conditions were observed within the upper 3 m of the soil profile at most borehole locations. The groundwater table was suspected to be lower than 1 to 1.5 m below paved surface.

Given the above and with proper drainage and surface water management, the risk of frost heaving was considered to be moderate. It is to be noted that poor surface drainage leading to water inundating the subgrade soils will significantly increase the risk level.

Due to the general variability in the soil makeup and groundwater seepage paths in soil deposits, it is not possible to predict with certainty the magnitude of frost heaving at specific locations. It is generally recommended that an observational approach be adopted over the first two winter seasons to identify problematic areas.

Frequently, areas exhibiting the formation of ice lenses and frost heaving during one winter season will exhibit the same during subsequent winter seasons. If areas with problematic frost conditions are observed, then remedial measures may be implemented.

The most suitable remedial measure will have to be assessed on a case by case basis as it depends on the severity of the problem, service/use interruption of the affected area, and the sensitivity of the pavement structure to frost heaving. Remedial measures may include soil replacement, ground insulation, or periodic maintenance (in the case of low use areas).

7.1.3 Overall Assessment

Based on the subsurface soil and groundwater conditions encountered during drilling and the review of historical records, the following observations were made:

- The near-surface subgrade soils were predominantly mineral in composition, of medium plasticity, stiff in consistency, and near optimum moisture content.
- Groundwater table likely deeper than 1 meter below paved surface.
- The near-surface subgrade conditions were considered moderately susceptible to frost heaving and ice lens formation.
- The pavement cracking was the predominant deteriorating feature. No evidence of bearing or fatigue failure in the ACP was noted. Additionally, the thickness of the ACP and CSBC appeared to be adequate for typical regional airfields.
- The cracking appeared to be repeated yearly. The cracks are associated with heaving of the ACP surface and to be worst during the spring thaw season.
- Cracking appeared across the airfield alignment in both areas where clay fill and native clay till was present below the pavement. Therefore, the presence of fill was not suspected to be a contributing factor.

It is anticipated that the likely contributors to crack formation was frost induced movement. This movement could be caused by a combination of:

- Moderately susceptible subgrade to frost action
- Fairly rigid CSBC material. Frost induced movement in the subgrade would lead to cracking and block movement in the CSBC and would be reflected to the ACP surface.
- Relatively impervious CSBC that does not provide good drainage under the ACP. Surface water entering the base from surface cracks during spring thaw will likely pond, and re-freeze at night, making the cracking and heaving worse.

7.2 REHABILITATION CONSIDERATIONS

Option 1 – Asphalt Resurfacing (Milling and Overly)

The re-surfacing of the existing airfield pavement will include milling a portion of the existing ACP and placing a new ACP overlay while maintaining the existing CSBC in place. Subgrade improvement will be required in selected areas where severe distresses or failures are observed during construction.

It should be noted that this option may be cost effective but is considered a temporary solution. The risk of failure was considered to be high as the previous asphalt re-surfacing developed severe cracking in a relatively short period (a few years).

If this option was followed, it is recommended that at a minimum 25 mm of existing ACP should be milled and at a minimum overlay thickness of 25 to 40 mm should be used.

Option 2 – Complete Rebuild

The complete re-build of the existing airfield pavement will include removing the existing ACP and CSBC layers, subgrade preparation and inspection, and placement of new ACP and gravel base course. This option will involve removal of the existing poor-quality fill with high degree of organic content in selected areas and replacement with engineered fill. This option was considered to be a long-term solution with a life expectancy in the order of 20 years.

As outlined earlier, there has been a suggestion of re-aligning the existing airfield to improve flight path safety. Depending on the proposed airfield relocation, additional geotechnical investigation may be required to assess the subsurface soil and groundwater conditions along the new alignment.

Recommendations regarding subgrade preparation and inspection are outlined in the following section.

7.3 SITE DEVELOPMENT CONSIDERATIONS

7.3.1 Site Grading and Earthworks

During initial grading, it is recommended that all existing asphalt pavement should be stripped and removed within the proposed airfield alignment. The existing granular material (CSBC) is anticipated to be nicely cemented and will be chunky. Re-using this material may not be possible.

The near surface soil encountered at the borehole locations were generally medium plastic clay fill and appeared to be predominantly mineral in nature. The consistency of the soil was assessed to be generally stiff. The result of the laboratory moisture content testing indicated that the average moisture content of the near surface clayey soils was near (approximately within 3 percent) to the optimum moisture content of the soil.

Poor-quality fill with high degrees of organic content were encountered in a couple of borehole locations. It was recommended that these fills should be removed and replaced with engineered fill. At a minimum, 0.9 m separation is recommend between the top of any buried organic soils and the underside of the granular base course.

Soft subgrade conditions are not expected to be a major concern but may be encountered at some locations across the site, particularly following snow melt and heavy rain events. Where soft and wet subgrade conditions are encountered, the subgrade should be scarified, air dried, and re-compacted (if good weather conditions prevail) or the soft wet material removed and replaced with drier clay or granular material placed as engineered fill.

Construction traffic on the unprotected subgrade should be kept to a minimum and restricted to low pressure track equipment to the extent possible. The use of heavy rubber-tire equipment (such as rock trucks) during construction will likely lead to significant disturbance to the subgrade and should be avoided to the extent possible.

All exposed subgrades, following achievement of rough grades and prior to placement of engineered fill should be inspected by the geotechnical engineer. The inspection may include a proof-roll test to confirm that deflections from construction traffic are minimal. Soft and weak areas identified during inspection should be strengthened and improved.

Regardless of the above, it is recommended that where subgrade support is required, the upper 300 mm of the subgrade soil be strengthened/improved. Subgrade strengthening/improvement would include scarifying and re-compacting the subgrade (if good weather conditions prevail) or the soft wet material removed and replaced with drier clay or granular material placed as engineered fill. Requirements for engineered fill are discussed below.

7.3.2 Requirements of Engineered Fill

Engineered fill should consist of low to medium plastic clay or a well-graded granular material. Silt or sand which is uniformly graded, or which contains more than 10 percent passing the 0.080 mm sieve is not recommended for this, as these materials are generally frost susceptible and are difficult to compact (require strict control of moisture content). All fill soils should be free from any organic materials, contamination, deleterious construction debris, and stones greater than 150 mm in diameter.

The mineral portion of the existing clay fill may be used as engineered fill. Selective borrowing from the existing fill is recommended and the soils should be inspected and approved by geotechnical personnel prior to use. Moisture conditioning of all soils may be required and will depend on weather conditions during construction.

Engineered fill should be thawed when placed and placed during non-frozen conditions. If winter construction is proposed, SolidEarth can provide additional recommendations once the overall development plan has been finalized.

All engineered fill should be compacted to a minimum of 98 percent of SPMDD. The standard of compaction should be increased to 100 percent of SPMDD for the upper 300 mm of the subgrade soil (below the underside of the granular base). The fill should be compacted in lift thicknesses of 300 mm (loose) or less, and within two to three percent of the optimum moisture content of the soil. Fill placement procedures and quality of the fill soils should be monitored by geotechnical personnel. Field monitoring should include compaction testing at regular frequencies.

Even for well compacted fill, some fill settlement under self-weight will occur. Settlement in the order of one to three percent of the fill thickness should be anticipated for engineered fill compacted to between 98 and 95 percent SPMDD. The majority of this settlement is expected to occur within the first year following construction.

7.3.3 Site Drainage

The performance of the pavement structure will be enhanced to a greater degree with proper management of surface water. It is recommended that a minimum grade of two percent be provided at the subgrade level, and that the gravel base course material be properly drained into a positive gravity drainage system (catch basins, side ditches, etc.). This will reduce the risk of water ponding above the clay subgrade and potential of softening and/or volume change associated with the presence of excess water. The final pavement surface should also be properly sloped to promote surface water runoff away from the paved surface.

Positive drainage away from the pavement surface is particularly important during the spring thaw and snow melt season. If water from melting snow is allowed to remain on the paved surface and subsequently freezes, significant damage to the pavement (and formation of potholes) may be encountered.

7.4 PAVEMENT STRUCTURE

Recommendations presented in Section 7.3 “Site Development Considerations” regarding subgrade preparation and inspection should be followed. Recommendations presented in this section are based on the assumption that a stable and competent subgrade is achieved prior to the placement of the pavement structure.

A preliminary recommendation for flexible asphalt pavement structure is provided Table 3. This recommendation is based on previous projects on similar soil conditions, and would be considered suitable for a Dash 8 Q400 airplane or comparable.

This preliminary recommended section should be treated for high-level design and budgeting purposes only. Once the final design remediation plan has been selected and the type of the design airplane identified, further evaluation should be completed to confirm the required pavement structure. A detailed design should be based on Transport Canada standards.

Table 3: Preliminary Flexible Asphaltic Concrete Pavement Design

Material	Recommended Minimum Thickness (mm)
Hot Mix Asphalt	135
20 mm Crushed Granular Base Course (AT Designation 2 Class 20)	350
Subgrade Preparation	300

The granular base course should be placed in maximum 150 mm thick lifts and uniformly compacted to a minimum of 100 percent of SPMDD at moisture content within two percent of the optimum moisture content. A reduced lift thickness may be required depending on the capability of the compaction equipment available to achieve the required densities.

Asphaltic concrete material and placement requirements should comply with the local and industry standards.

8.0 TESTING AND INSPECTION

Recommendations presented in this report may not be valid if adequate engineering inspection and testing programs during construction are not implemented or if other building code requirements are not followed. Testing and inspection programs should consist of:

- Full-time monitoring and compaction testing during site grading, subgrade preparation and fill placement.
- Asphalt concrete material testing as per local and industry standards.

9.0 CLOSURE

The recommendations presented in this report are based on the results of soil sampling and testing at 11 borehole locations advanced during the field investigation. Soil conditions by nature can vary across any given site. If different soil conditions are encountered at subsequent phases of this project, SolidEarth should be notified immediately and given the opportunity to evaluate the situation and provide additional recommendations as necessary.

The recommendations presented in this report should not be used for another site or for a different application at the same site. If the intended application of the site is changed or if the assumptions outlined in this report became invalid, SolidEarth should be notified and given the opportunity to assess if the recommendations presented herein should be modified.

This report has been prepared for the exclusive use of Town of Vermilion c/o McElhanney and their authorized users for the specific application outlined in this report. No other warranties expressed or implied are provided. This report has been prepared within generally accepted geotechnical engineering practices.

Respectfully submitted,
SolidEarth Geotechnical Inc.

JAY JABER
ID#: 78563 26 October 2023

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SolidEarth Geotechnical Inc.
APEGA Permit Number 11884

26 October 2023
Jay Jaber, P.Eng.
ID#: 78563

Figures

CLIENT:

TOWN OF VERMILION ALBERTA

PROJECT NAME:

Proposed Airport Runway and Taxiway Rehabilitation
4120 - 52 Avenue
Vermilion, Alberta

DRAWING TITLE:

Project Layout and Borehole Location Plan on Aerial Photograph

SCALE: NTS

DRAWN BY: MK

FIGURE No.: 1

REVISION No.: 1

DATUM: -

DATE: August 2023

PROJECT No.: PG23-1717

SolidEarth GEOTECHNICAL

SolidEarth Geotechnical Inc.
4336 97 Street, Edmonton, AB, T6E 5R9

SCALE: NTS	DRAWN BY: MK	FIGURE No.: 2	REVISION No.: 1	PROJECT NAME: Proposed Airport Runway and Taxiway Rehabilitation 4120 - 52 Avenue Vermilion, Alberta
DATUM: -	DATE: August 2023	PROJECT No.: PG23-1717		

SolidEarth Geotechnical Inc.

4336 97 Street, Edmonton, AB, T6E 5R9

DRAWING TITLE:

1969 Aerial Photograph of the Site

CLIENT:

TOWN OF VERMILION ALBERTA

CLIENT: TOWN OF VERMILION ALBERTA

PROJECT NAME: Proposed Airport Runway and Taxiway Rehabilitation
4120 - 52 Avenue
Vermilion, Alberta

DRAWING TITLE: 1977 Aerial Photograph of the Site

SCALE: NTS	DRAWN BY: MK	FIGURE No.: 3	REVISION No.: 1
DATUM: -	DATE: August 2023	PROJECT No.: PG23-1717	

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CLIENT: TOWN OF VERMILION ALBERTA

PROJECT NAME:
Proposed Airport Runway and Taxiway Rehabilitation
4120 - 52 Avenue
Vermilion, Alberta

DRAWING TITLE:
2003 Aerial Photograph of the Site

SCALE: NTS	DRAWN BY: MK	FIGURE No.: 4	REVISION No.: 1
DATUM: -	DATE: August 2023	PROJECT No.: PG23-1717	

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CLIENT: TOWN OF VERMILION ALBERTA

PROJECT NAME: Proposed Airport Runway and Taxiway Rehabilitation
4120 - 52 Avenue
Vermilion, Alberta

DRAWING TITLE: 2006 Aerial Photograph of the Site

SCALE: NTS	DRAWN BY: MK
DATUM: -	DATE: August 2023
FIGURE No.: 5	REVISION No.: 1
PROJECT No.: PG23-1717	

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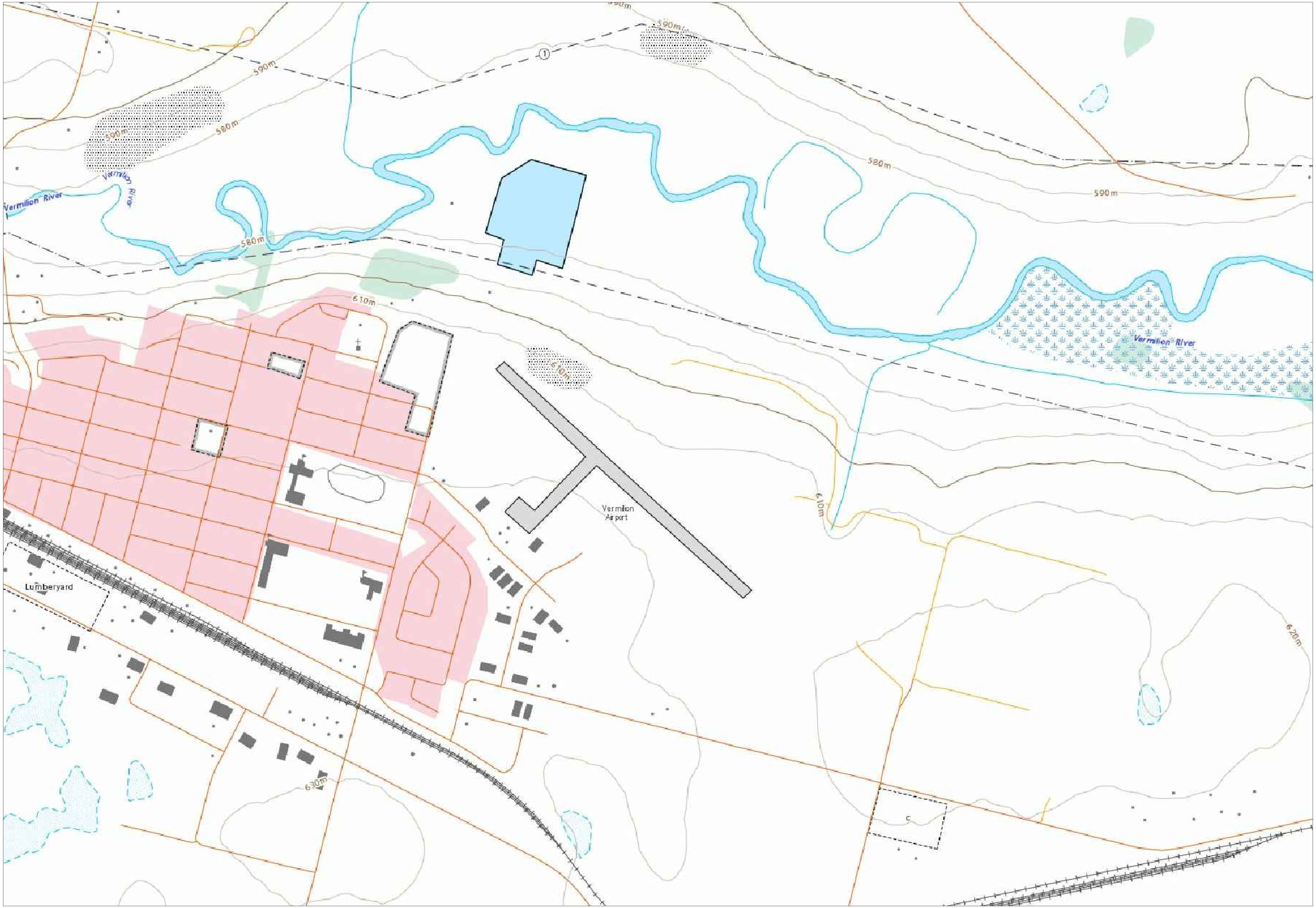

CLIENT: TOWN OF VERMILION ALBERTA

PROJECT NAME:
Proposed Airport Runway and Taxiway Rehabilitation
4120 - 52 Avenue
Vermilion, Alberta

DRAWING TITLE:
Atlas of Canada - Toparama Maps

SCALE: NTS
DRAWN BY: MK
FIGURE No.: 6
REVISION No.: 1
DATUM: -
DATE: August 2023
PROJECT No.: PG23-1717

SolidEarth Geotechnical Inc.
4336 97 Street, Edmonton, AB, T6E 5R9

Appendix A

Site Photographs Taken During the Field Investigation

Photograph 1: Asphalt core from the location of BH23-2

Photograph 1: Asphalt core from the location of BH23-5

Photograph 3: Looking at auger retrieval (depths of 0.3 to 2.3 m at BH2-02)

Photograph 4: Looking at auger retrieval (depths of 1.5 to 3.0 m at BH23-06)

Photograph 5: Looking northwest towards BH23-01

Photograph 6: Looking southwest toward BH23-08

Photograph 7: Looking northeast towards BH23-11

Appendix B

Borehole Logs
Explanation of Terms and Symbols

Project Name: Proposed Airport Runway and Taxiway Rehabilitation
Client Name: Town of Vermilion c/o McElhanney
Site: 4120 - 52 Avenue, Vermilion, Alberta
Northing: 5912208 Easting: 511253
Elevation:

Borehole #: **BH23-01**
Project #: PG23-1717
Logged By: JS / Reviewed By: TF
Driller: Drilling Solution Inc.
Drill Method: 150 mm Solid Stem Auger

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Completion Date: 23-7-17
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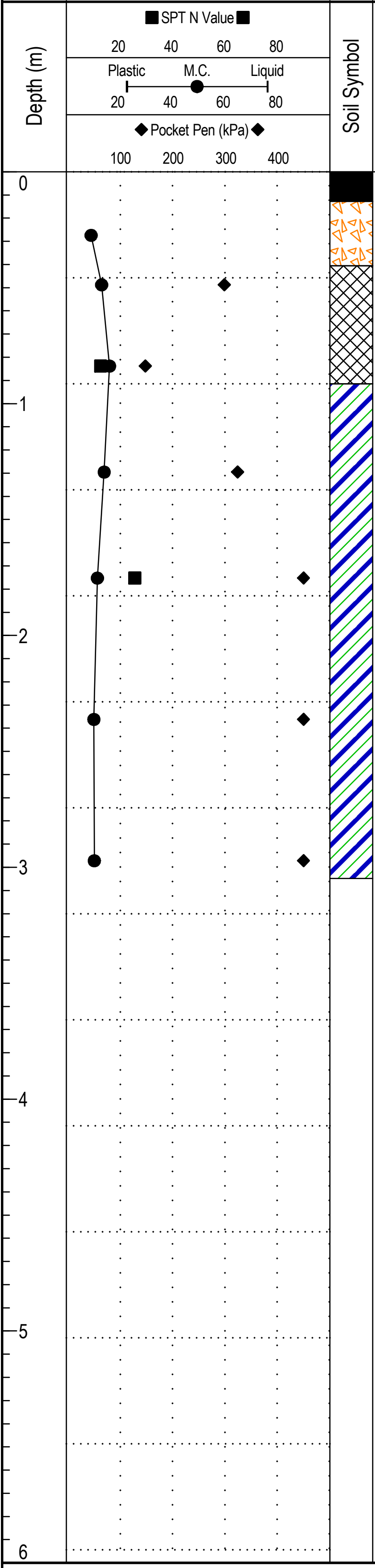

USCS	Material Description
AS	**ASPHALT (~ 125 mm Thickness)**
GW	**GRAVEL (~ 280 mm Thickness)**
FILL	**FILL (CLAY)**, and silt, sandy, trace gravel, medium plastic, grey, moist
CI	**CLAY TILL**, silty to and silt, sandy, trace gravel, stiff, medium plastic, grey-brown mottled, trace sand lenses, moist - becoming very stiff

COMPLETION DEPTH: 3.0 m below ground surface

At Completion
No accumulation of water or slough material.
Borehole backfilled with drill cutting and bentonite plug.

Sample Symbol	Sample #	SPT (N-Value)
Grab Sample	1	
Grab Sample	2	
SPT Test (N)	3	13
Grab Sample	4	
SPT Test (N)	5	26
Grab Sample	6	
Grab Sample	7	

BACKFILL DETAILS: Grout; Bentonite; Drill Cuttings

Additional Data & Notes

Sample Symbol	■ Shelby Tube	▨ No Recovery	☒ SPT Test (N)	☰ Grab Sample	▥ Split-Pen	▮ Core
Backfill Symbol	■ Bentonite	⬚ Pea Gravel	▥ Slough	⁘ Grout	▨ Drill Cuttings	⁘ Sand

Project Name: Proposed Airport Runway and Taxiway Rehabilitation
Client Name: Town of Vermilion c/o McElhanney
Site: 4120 - 52 Avenue, Vermilion, Alberta
Northing: 5912123 Easting: 511398
Elevation:

Borehole #: **BH23-02**
Project #: PG23-1717
Logged By: JS / Reviewed By: TF
Driller: Drilling Solution Inc.
Drill Method: 150 mm Solid Stem Auger

SolidEarth GEOTECHNICAL

Completion Date: 23-7-17
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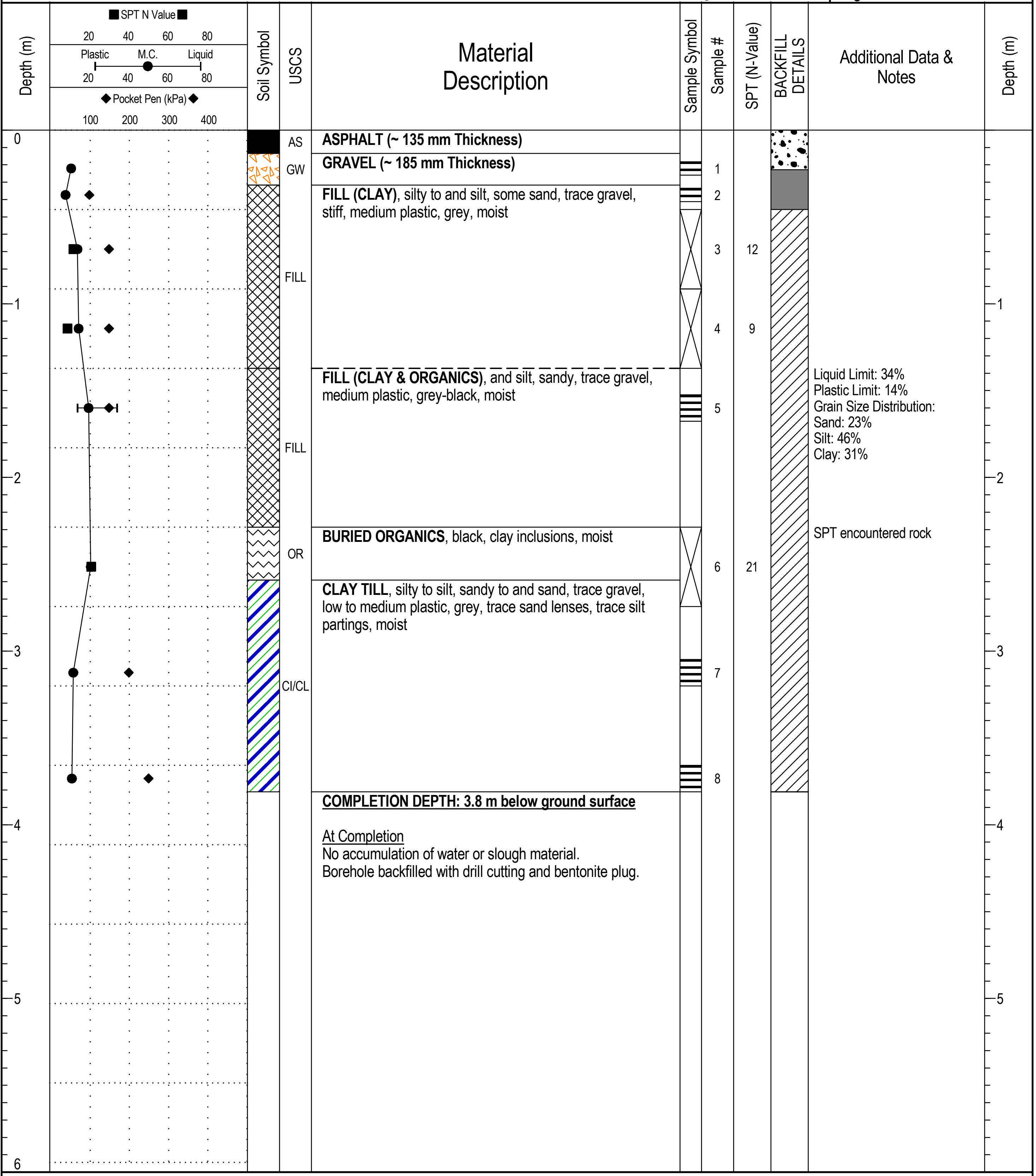

USCS	Material Description	Sample #	SPT (N-Value)	Additional Data & Notes
AS	**ASPHALT (~ 135 mm Thickness)**			
GW	**GRAVEL (~ 185 mm Thickness)**	1		
FILL	**FILL (CLAY)**, silty to and silt, some sand, trace gravel, stiff, medium plastic, grey, moist	2 3 4	 12 9	
FILL	**FILL (CLAY & ORGANICS)**, and silt, sandy, trace gravel, medium plastic, grey-black, moist	5		Liquid Limit: 34% Plastic Limit: 14% Grain Size Distribution: Sand: 23% Silt: 46% Clay: 31%
OR	**BURIED ORGANICS**, black, clay inclusions, moist	6	21	SPT encountered rock
CI/CL	**CLAY TILL**, silty to silt, sandy to and sand, trace gravel, low to medium plastic, grey, trace sand lenses, trace silt partings, moist	7 8		

COMPLETION DEPTH: 3.8 m below ground surface

At Completion
No accumulation of water or slough material.
Borehole backfilled with drill cutting and bentonite plug.

Sample Symbol	■ Shelby Tube	▢ No Recovery	☒ SPT Test (N)	☰ Grab Sample	▥ Split-Pen	▮ Core
Backfill Symbol	■ Bentonite	⁙ Pea Gravel	▥ Slough	⁘ Grout	▨ Drill Cuttings	⁙ Sand

Project Name: Proposed Airport Runway and Taxiway Rehabilitation
Client Name: Town of Vermilion c/o McElhanney
Site: 4120 - 52 Avenue, Vermilion, Alberta
Northing: 5912022 Easting: 511577
Elevation:

Borehole #: **BH23-03**
Project #: PG23-1717
Logged By: JS / Reviewed By: TF
Driller: Drilling Solution Inc.
Drill Method: 150 mm Solid Stem Auger

SolidEarth GEOTECHNICAL
Completion Date: 23-7-17
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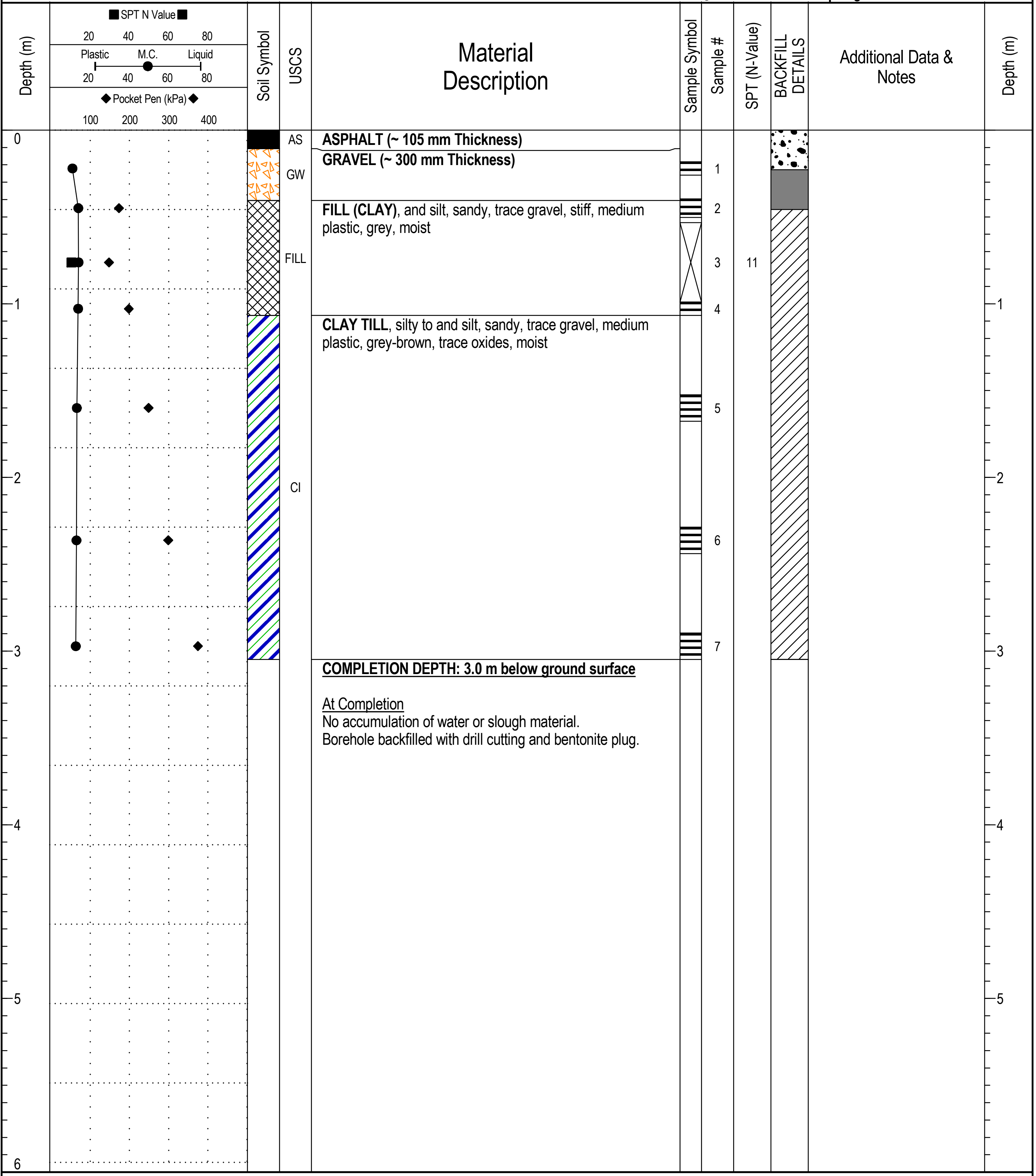


Material Description

ASPHALT (~ 105 mm Thickness)

GRAVEL (~ 300 mm Thickness)

FILL (CLAY), and silt, sandy, trace gravel, stiff, medium plastic, grey, moist

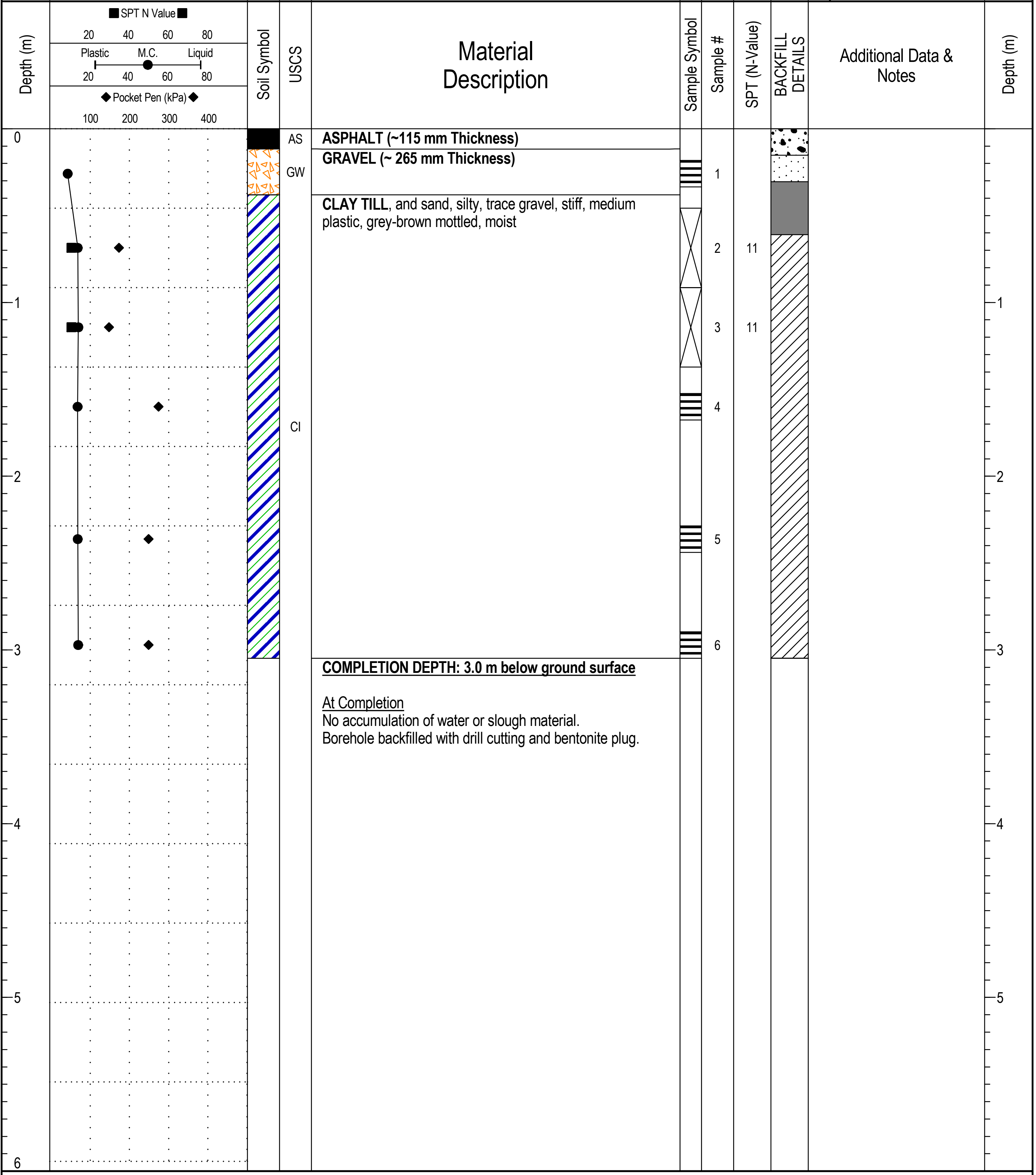
CLAY TILL, silty to and silt, sandy, trace gravel, medium plastic, grey-brown, trace oxides, moist

COMPLETION DEPTH: 3.0 m below ground surface

At Completion
No accumulation of water or slough material.
Borehole backfilled with drill cutting and bentonite plug.

Sample Symbol	■ Shelby Tube	▨ No Recovery	☒ SPT Test (N)	☰ Grab Sample	▥ Split-Pen	▮ Core
Backfill Symbol	■ Bentonite	⬚ Pea Gravel	▥ Slough	⁘ Grout	▨ Drill Cuttings	⁘ Sand

Project Name: Proposed Airport Runway and Taxiway Rehabilitation	Borehole #: **BH23-04**		
Client Name: Town of Vermilion c/o McElhanney	Project #: PG23-1717		
Site: 4120 - 52 Avenue, Vermilion, Alberta	Logged By: JS / Reviewed By: TF		
Northing: 5911941 Easting: 511759	Driller: Drilling Solution Inc.	Completion Date: 23-7-17	
Elevation:	Drill Method: 150 mm Solid Stem Auger	Page 1 of 1	



USCS	Material Description	Sample #	SPT (N-Value)
AS	**ASPHALT (~115 mm Thickness)**		
GW	**GRAVEL (~ 265 mm Thickness)**	1	
CI	**CLAY TILL**, and sand, silty, trace gravel, stiff, medium plastic, grey-brown mottled, moist	2	11
		3	11
		4	
		5	
		6	

COMPLETION DEPTH: 3.0 m below ground surface

At Completion
No accumulation of water or slough material.
Borehole backfilled with drill cutting and bentonite plug.

Sample Symbol	■ Shelby Tube	▨ No Recovery	☒ SPT Test (N)	☰ Grab Sample	▥ Split-Pen	▯ Core
Backfill Symbol	■ Bentonite	⬚ Pea Gravel	▥ Slough	⁘ Grout	▨ Drill Cuttings	⁘ Sand

Project Name: Proposed Airport Runway and Taxiway Rehabilitation
Client Name: Town of Vermilion c/o McElhanney
Site: 4120 - 52 Avenue, Vermilion, Alberta
Northing: 5911854 Easting: 511903
Elevation:

Borehole #: **BH23-05**
Project #: PG23-1717
Logged By: JS / Reviewed By: TF
Driller: Drilling Solution Inc.
Drill Method: 150 mm Solid Stem Auger

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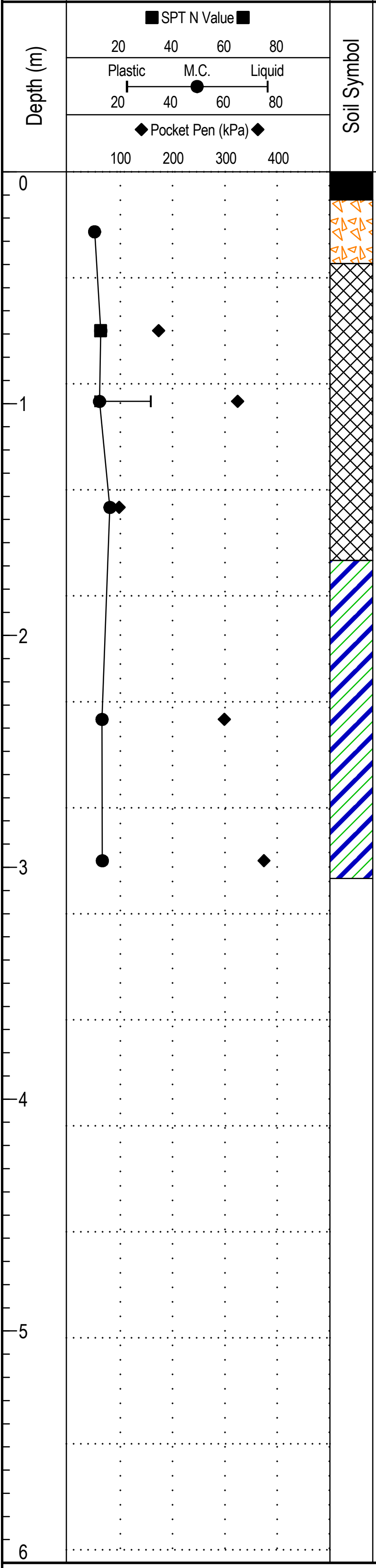

USCS	Material Description	Sample #	SPT (N-Value)	Additional Data & Notes
AS	**ASPHALT (~ 120 mm Thickness)**			
GW	**GRAVEL (~ 275 mm (Thickness)**	1		
FILL	**FILL (CLAY)**, and sand, silty, trace gravel, stiff, medium plastic, grey-brown mottled, trace oxides, moist	2	13	Liquid Limit: 32% Plastic Limit: 11% Grain Size Distribution: Gravel: 4% Sand: 38% Silt: 27% Clay: 31%
	- becoming trace buried organic pockets	3 4		
CI	**CLAY TILL**, silty to and silt, sandy, trace gravel, medium plastic, grey-brown mottled, trace sand pockets, trace oxides, moist	5 6		

COMPLETION DEPTH: 3.0 m below ground surface

At Completion
No accumulation of water or slough material.
Borehole backfilled with drill cutting and bentonite plug.

Sample Symbol	■ Shelby Tube	▨ No Recovery	☒ SPT Test (N)	☰ Grab Sample	▥ Split-Pen	◨ Core
Backfill Symbol	■ Bentonite	⁘ Pea Gravel	▥ Slough	⁘ Grout	▨ Drill Cuttings	⁘ Sand

Project Name: Proposed Airport Runway and Taxiway Rehabilitation
Client Name: Town of Vermilion c/o McElhanney
Site: 4120 - 52 Avenue, Vermilion, Alberta
Northing: 5911768 Easting: 512054
Elevation:

Borehole #: **BH23-06**
Project #: PG23-1717
Logged By: JS / Reviewed By: TF
Driller: Drilling Solution Inc.
Drill Method: 150 mm Solid Stem Auger

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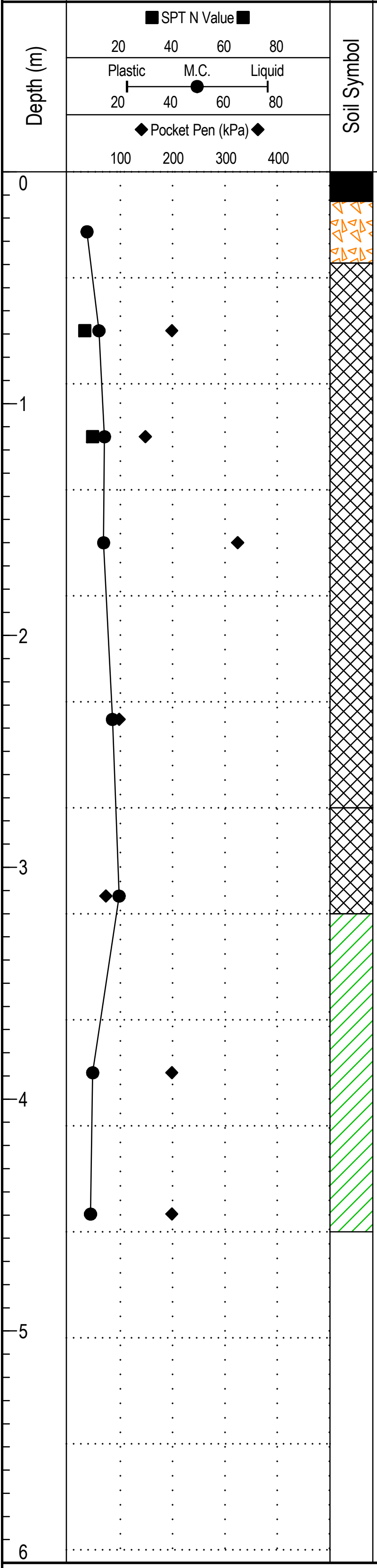
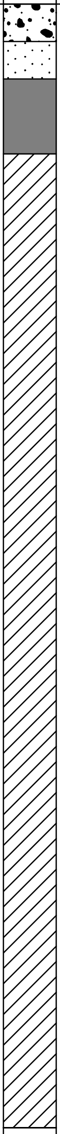


USCS	Material Description	Sample Symbol	Sample #	SPT (N-Value)
AS	**ASPHALT (~ 125 mm Thickness)**			
GW	**GRAVEL (~ 265 mm Thickness)**	☰	1	
FILL	**CLAY (FILL)**, and silt, sandy, trace gravel, firm, medium plastic, grey, trace buried organics, moist	☒	2	7
	- becoming stiff	☒	3	10
	- becoming trace to some buried organics	☰	4	
	- becoming very moist	☰	5	
FILL	**FILL (CLAY & ORGANICS)**, silty to and silt, some sand, trace gravel, medium plastic, grey-black, moist	☰	6	
CL	**CLAY TILL**, and sand, silty, trace gravel, low plastic, grey, trace sand lenses, moist	☰	7	
		☰	8	

COMPLETION DEPTH: 4.6 m below ground surface

At Completion
No accumulation of water or slough material.
Borehole backfilled with drill cutting and bentonite plug.

BACKFILL DETAILS



Additional Data & Notes

Sample Symbol ■ Shelby Tube ▢ No Recovery ☒ SPT Test (N) ☰ Grab Sample ▥ Split-Pen ◧ Core

Backfill Symbol ▩ Bentonite ⁘ Pea Gravel ▥ Slough ⁘ Grout ▨ Drill Cuttings ⁘ Sand

Project Name: Proposed Airport Runway and Taxiway Rehabilitation
Client Name: Town of Vermilion c/o McElhanney
Site: 4120 - 52 Avenue, Vermilion, Alberta
Northing: 5912027 Easting: 511507
Elevation:

Borehole #: **BH23-07**
Project #: PG23-1717
Logged By: JS / Reviewed By: TF
Driller: Drilling Solution Inc.
Drill Method: 150 mm Solid Stem Auger

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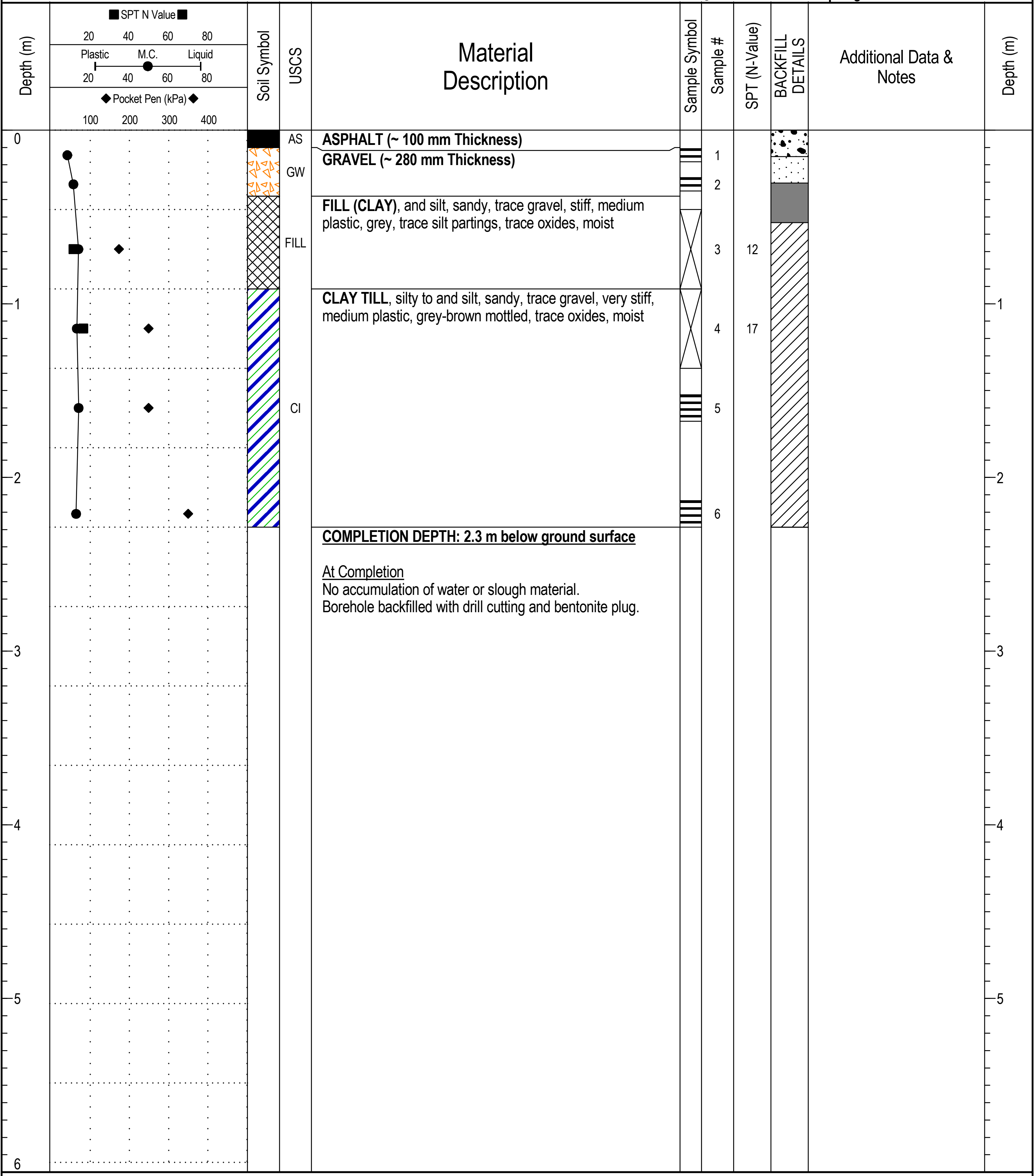

ASPHALT (~ 100 mm Thickness)

GRAVEL (~ 280 mm Thickness)

FILL (CLAY), and silt, sandy, trace gravel, stiff, medium plastic, grey, trace silt partings, trace oxides, moist

CLAY TILL, silty to and silt, sandy, trace gravel, very stiff, medium plastic, grey-brown mottled, trace oxides, moist

COMPLETION DEPTH: 2.3 m below ground surface

At Completion
No accumulation of water or slough material.
Borehole backfilled with drill cutting and bentonite plug.

Sample Symbol	■ Shelby Tube	▨ No Recovery	☒ SPT Test (N)	☰ Grab Sample	▥ Split-Pen	◨ Core
Backfill Symbol	■ Bentonite	⁙ Pea Gravel	▥ Slough	⁙ Grout	▨ Drill Cuttings	⁙ Sand

Project Name: Proposed Airport Runway and Taxiway Rehabilitation
Client Name: Town of Vermilion c/o McElhanney
Site: 4120 - 52 Avenue, Vermilion, Alberta
Northing: 5911933 Easting: 511459
Elevation:

Borehole #: **BH23-08**
Project #: PG23-1717
Logged By: JS / Reviewed By: TF
Driller: Drilling Solution Inc.
Drill Method: 150 mm Solid Stem Auger

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Completion Date: 23-7-17
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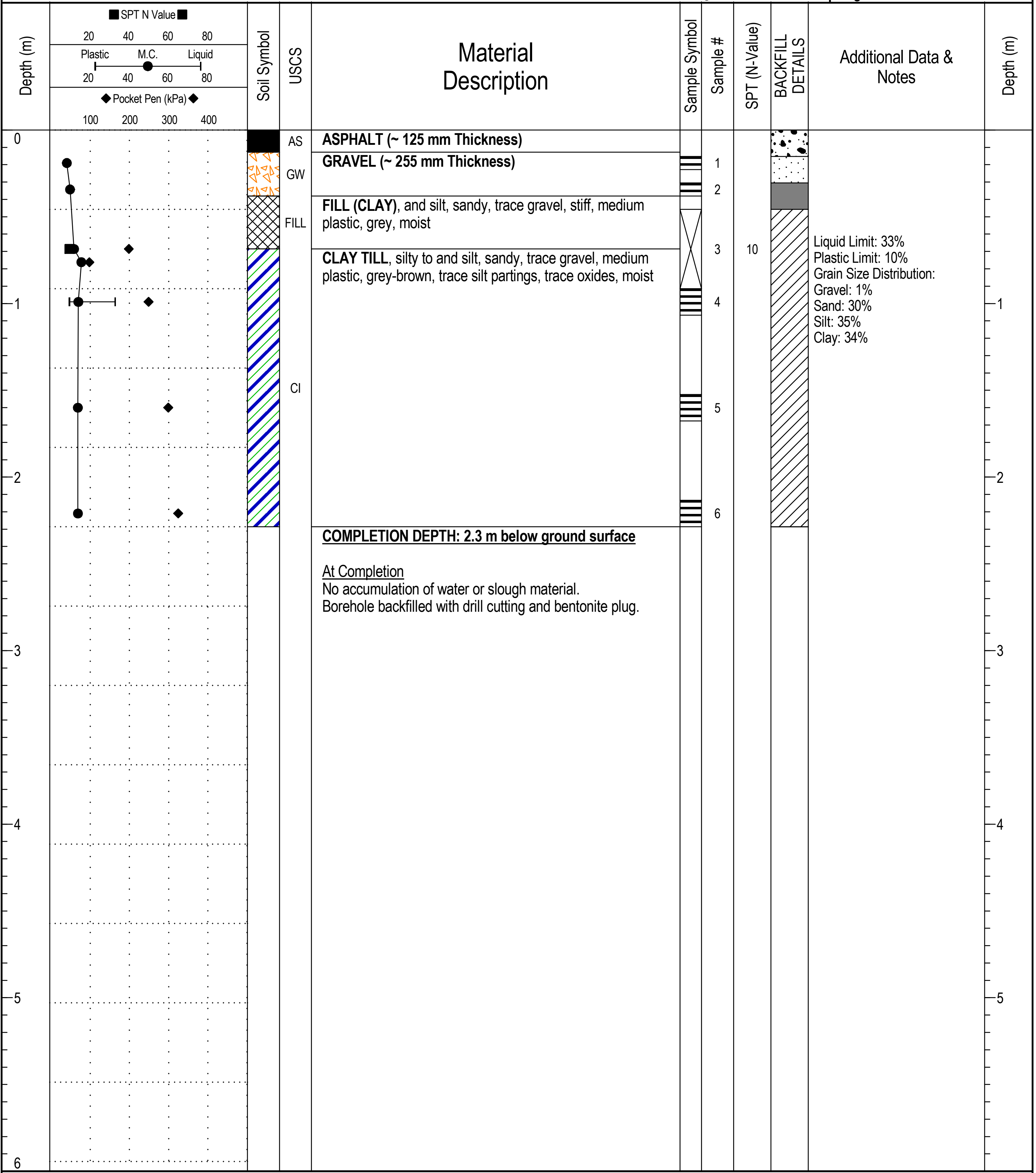

Material Description

ASPHALT (~ 125 mm Thickness)

GRAVEL (~ 255 mm Thickness)

FILL (CLAY), and silt, sandy, trace gravel, stiff, medium plastic, grey, moist

CLAY TILL, silty to and silt, sandy, trace gravel, medium plastic, grey-brown, trace silt partings, trace oxides, moist

COMPLETION DEPTH: 2.3 m below ground surface

At Completion
No accumulation of water or slough material.
Borehole backfilled with drill cutting and bentonite plug.

Additional Data & Notes

Liquid Limit: 33%
Plastic Limit: 10%
Grain Size Distribution:
Gravel: 1%
Sand: 30%
Silt: 35%
Clay: 34%

Sample Symbol	■ Shelby Tube	▭ No Recovery	☒ SPT Test (N)	☰ Grab Sample	▥ Split-Pen	◨ Core
Backfill Symbol	■ Bentonite	⬚ Pea Gravel	▥ Slough	⁘ Grout	▨ Drill Cuttings	⁘ Sand

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Project Name: Proposed Airport Runway and Taxiway Rehabilitation
Client Name: Town of Vermilion c/o McElhanney
Site: 4120 - 52 Avenue, Vermilion, Alberta
Northing: 5911858 Easting: 511422
Elevation:

Borehole #: **BH23-09**
Project #: PG23-1717
Logged By: JS / Reviewed By: TF
Driller: Drilling Solution Inc.
Drill Method: 150 mm Solid Stem Auger

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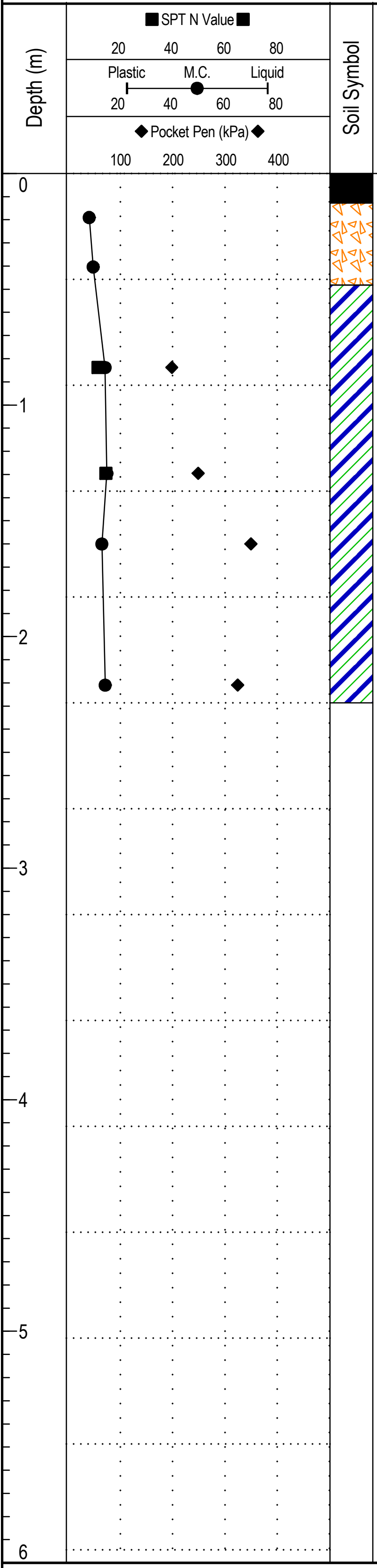

USCS	Material Description	Sample Symbol	Sample #	SPT (N-Value)	BACKFILL DETAILS	Additional Data & Notes
AS	**ASPHALT (~ 125 mm Thickness)**					
GW	**GRAVEL (~ 355 mm Thickness)**	Grab Sample	1			
		Grab Sample	2			
CI	**CLAY TILL**, silty to and silt, sandy, trace gravel, stiff, medium plastic, grey-brown, trace silt partings, trace oxides, moist	SPT Test (N)	3	12		
	- becoming very stiff, grey-brown mottled	SPT Test (N)	4	15		
		Grab Sample	5			
		Grab Sample	6			

COMPLETION DEPTH: 2.3 m below ground surface

At Completion
No accumulation of water or slough material.
Borehole backfilled with drill cutting and bentonite plug.

Sample Symbol	■ Shelby Tube	▨ No Recovery	☒ SPT Test (N)	☰ Grab Sample	▥ Split-Pen	▮ Core
Backfill Symbol	■ Bentonite	⁘ Pea Gravel	▥ Slough	⁘ Grout	▨ Drill Cuttings	⁘ Sand

Project Name: Proposed Airport Runway and Taxiway Rehabilitation
Client Name: Town of Vermilion c/o McElhanney
Site: 4120 - 52 Avenue, Vermilion, Alberta
Northing: 5911818 Easting: 511364
Elevation:

Borehole #: **BH23-10**
Project #: PG23-1717
Logged By: JS / Reviewed By: TF
Driller: Drilling Solution Inc.
Drill Method: 150 mm Solid Stem Auger

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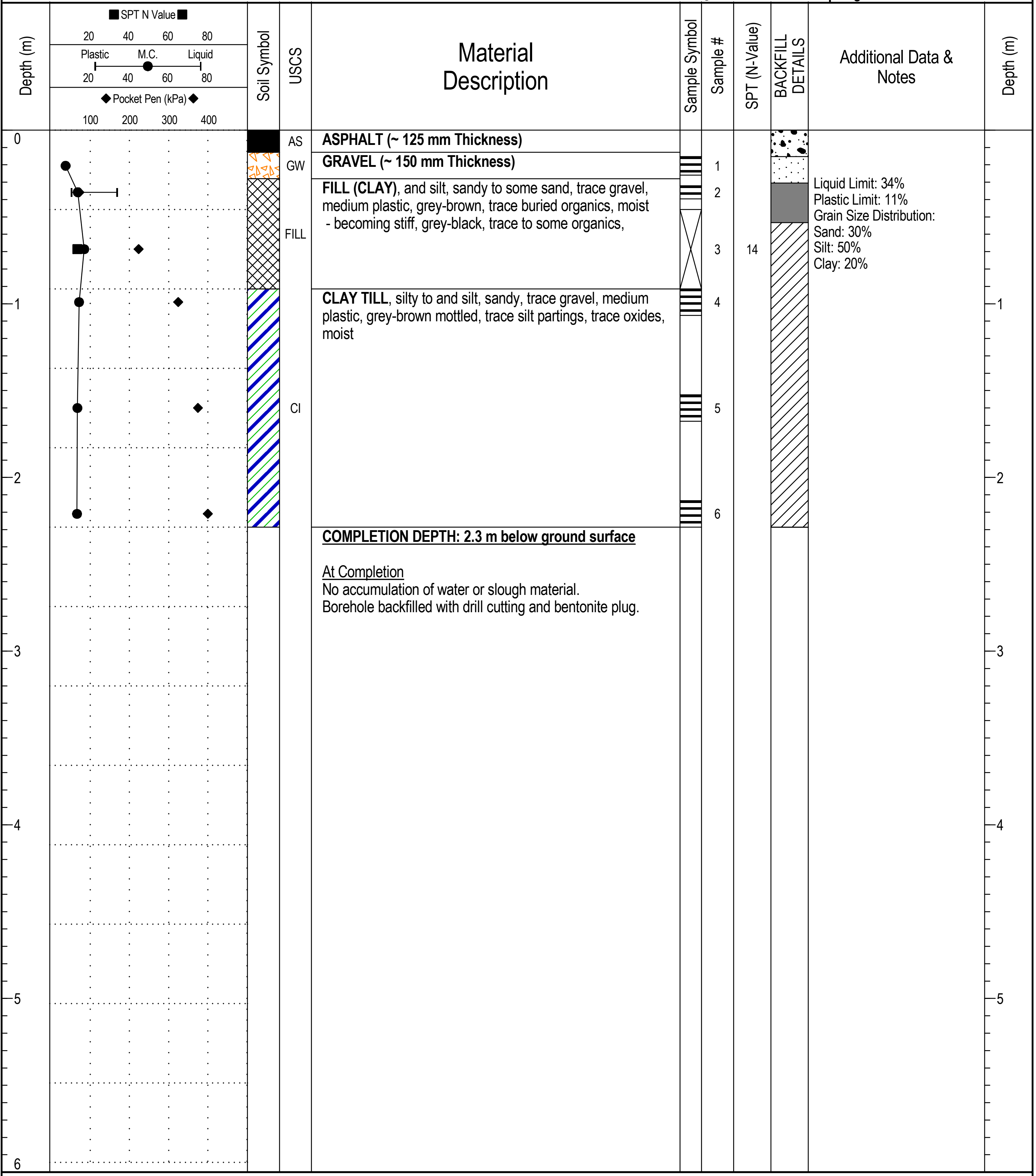

ASPHALT (~ 125 mm Thickness)

GRAVEL (~ 150 mm Thickness)

FILL (CLAY), and silt, sandy to some sand, trace gravel, medium plastic, grey-brown, trace buried organics, moist
- becoming stiff, grey-black, trace to some organics,

CLAY TILL, silty to and silt, sandy, trace gravel, medium plastic, grey-brown mottled, trace silt partings, trace oxides, moist

COMPLETION DEPTH: 2.3 m below ground surface

At Completion
No accumulation of water or slough material.
Borehole backfilled with drill cutting and bentonite plug.

Liquid Limit: 34%
Plastic Limit: 11%
Grain Size Distribution:
Sand: 30%
Silt: 50%
Clay: 20%

Sample Symbol	■ Shelby Tube	▱ No Recovery	☒ SPT Test (N)	☰ Grab Sample	▥ Split-Pen	▮ Core
Backfill Symbol	■ Bentonite	⬚ Pea Gravel	▥ Slough	⁘ Grout	▨ Drill Cuttings	⁘ Sand

Project Name: Proposed Airport Runway and Taxiway Rehabilitation
Client Name: Town of Vermilion c/o McElhanney
Site: 4120 - 52 Avenue, Vermilion, Alberta
Northing: 5911863 Easting: 511346
Elevation:

Borehole #: **BH23-11**
Project #: PG23-1717
Logged By: JS / Reviewed By: TF
Driller: Drilling Solution Inc.
Drill Method: 150 mm Solid Stem Auger

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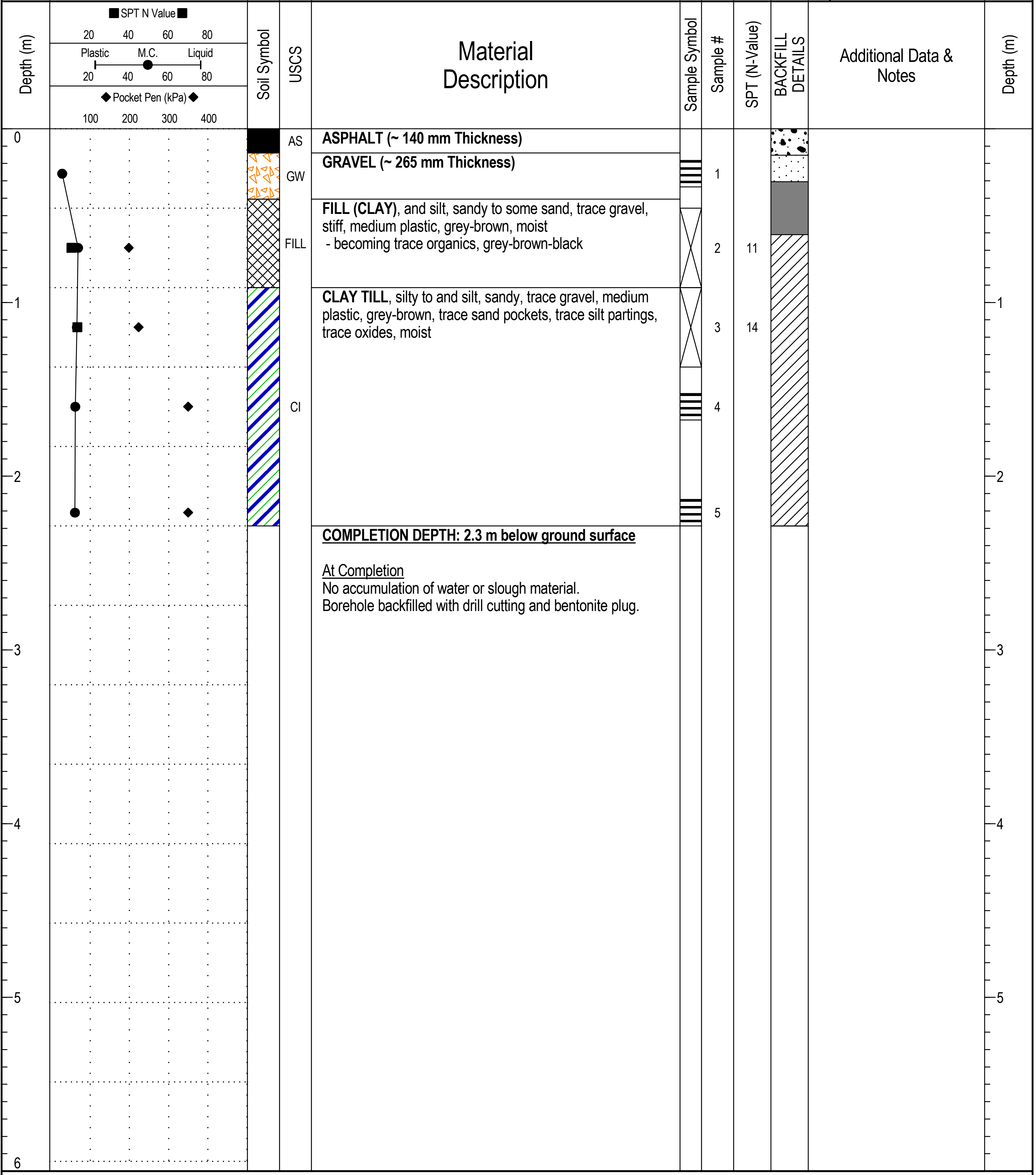

USCS	Material Description	Sample #	SPT (N-Value)
AS	**ASPHALT (~ 140 mm Thickness)**		
GW	**GRAVEL (~ 265 mm Thickness)**	1	
FILL	**FILL (CLAY)**, and silt, sandy to some sand, trace gravel, stiff, medium plastic, grey-brown, moist - becoming trace organics, grey-brown-black	2	11
CI	**CLAY TILL**, silty to and silt, sandy, trace gravel, medium plastic, grey-brown, trace sand pockets, trace silt partings, trace oxides, moist	3	14
		4	
		5	

COMPLETION DEPTH: 2.3 m below ground surface

At Completion
No accumulation of water or slough material.
Borehole backfilled with drill cutting and bentonite plug.

Sample Symbol	■ Shelby Tube	▨ No Recovery	☒ SPT Test (N)	☰ Grab Sample	▥ Split-Pen	▯ Core
Backfill Symbol	■ Bentonite	⁞ Pea Gravel	▥ Slough	⁘ Grout	▨ Drill Cuttings	⁘ Sand

EXPLANATION OF TERMS & SYMBOLS

The terms and symbols used on the borehole logs to summarize the results of the field investigation and laboratory testing are described on the following two pages.

1. VISUAL TEXTURAL CLASSIFICATION ON MINERAL SOILS

CLASSIFICATION	APPARENT PARTICLE SIZE	VISUAL IDENTIFICATION
Boulders	> 200 mm	> 200 mm
Cobbles	75 mm to 200 mm	75 mm to 200 mm
Gravel	4.75 mm to 75 mm	5 mm to 75 mm
Sand	0.075 mm to 4.75 mm	Visible particles to 5 mm
Silt	0.002 mm to 0.075 mm	Non-plastic particles, not visible to naked eye
Clay	< 0.002 mm	Plastic particles, not visible to naked eye

2. TERMS FOR CONSISTENCY & DENSITY OF SOILS

Cohesionless Soils

DESCRIPTIVE TERM	APPROXIMATE SPT “N” VALUE
Very Dense	> 50
Dense	30 to 50
Compact	10 to 30
Loose	4 to 10
Very Loose	< 4

Cohesive Soils

DESCRIPTIVE TERM	UNDRAINED SHEAR STRENGTH	APPROXIMATE SPT “N” VALUE
Hard	>200 kPa	> 30
Very Stiff	100 to 200 kPa	15 to 30
Stiff	50 to 100 kPa	8 to 15
Firm	25 to 50 kPa	4 to 8
Soft	10 to 25 kPa	2 to 4
Very Soft	< 10 kPa	< 2

***** SPT “N” Values – Refers to the number of blows by a 63.5 kg hammer dropped 760 mm to drive a 50 mm diameter split spoon sampler for a distance of 300 mm after an initial penetration of 150 mm.

3. SYMBOLS USED ON BOREHOLE LOGS

SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION
N(■)	Standard Penetration Test (CSA A119 1-60)	SO_4	Concentration of Water-Soluble Sulphate
N_d	Dynamic Cone Penetration Test	C_u	Undrained Shear Strength
pp (♦)	Pocket Penetrometer Strength	γ	Unit Weight of Soil or Rock
q_u	Unconfined Compressive Strength	γ_d	Dry Unit Weight of Soil or Rock
w (●)	Natural Moisture Content (ASTM D2216)	ρ	Density of Soil or Rock
w_L	Liquid Limit (ASTM D 4318)	ρ_d	Dry Density of Soil or Rock
w_P	Plastic Limit (ASTM D 4318)	▽	Short-Term Water Level
I_P	Plastic Index	▼	Long-Term Water Level

MODIFIED UNIFIED CLASSIFICATION SYSTEM FOR SOILS

MAJOR DIVISION			GROUP SYMBOL	TYPICAL DESCRIPTION	LABORATORY CLASSIFICATION CRITERIA	
COARSE GRAINED SOILS (MORE THAN HALF BY WEIGHT LARGER THAN 75 µm)	**GRAVELS** (MORE THAN HALF COARSE GRAINS LARGER THAN 4.75mm)	CLEAN GRAVELS (LITTLE OR NO FINES)	**GW**	WELL GRADED GRAVELS AND GRAVEL-SAND MIXTURES, LITTLE OR NO FINES	$C_u = D_{60}/D_{10} > 4$ $C_c = (D_{30})^2/(D_{10} \times D_{60}) = 1 \text{ to } 3$	
			GP	POORLY GRADED GRAVELS AND GRAVEL-SAND MIXTURES, LITTLE OR NO FINES	NOT MEETING ABOVE REQUIREMENTS	
		GRAVELS (WITH SOME FINES)	**GM**	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES	CONTENT OF FINES EXCEEDS 12%	ATTERBERG LIMITS BELOW 'A' LINE I_p LESS THAN 4
			GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES		ATTERBERG LIMITS ABOVE 'A' LINE I_p MORE THAN 7
	SANDS (MORE THAN HALF COARSE GRAINS SMALLER THAN 4.75mm)	CLEAN SANDS (LITTLE OR NO FINES)	**SW**	WELL GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES	$C_u = D_{60}/D_{10} > 6$ $C_c = (D_{30})^2/(D_{10} \times D_{60}) = 1 \text{ to } 3$	
			SP	POORLY GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES	NOT MEETING ALL GRADATION REQUIREMENTS FOR SW	
		SANDS (WITH SOME FINES)	**SM**	SILTY SANDS, SAND-SILT MIXTURES	CONTENT OF FINES EXCEEDS 12%	ATTERBERG LIMITS BELOW 'A' LINE I_p LESS THAN 4
			SC	CLAYEY SANDS, SAND-CLAY MIXTURES		ATTERBERG LIMITS ABOVE 'A' LINE I_p MORE THAN 7
FINE GRAINED SOILS (MORE THAN HALF BY WEIGHT SMALLER THAN 75 µm)	**SILTS** (BELOW 'A' LINE NEGLIGIBLE ORGANIC CONTENT)	$W_L < 50$ %	**ML**	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY SANDS OF SLIGHT PLASTICITY	CLASSIFICATION IS BASED UPON PLASTICITY CHART (SEE BELOW)	
		$W_L > 50$ %	**MH**	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS		
	CLAYS (ABOVE 'A' LINE NEGLIGIBLE ORGANIC CONTENT)	$W_L < 30$ %	**CL**	INORGANIC CLAYS OF LOW PLASTICITY, GRAVELLY, SANDY, OR SILTY CLAYS, LEAN CLAYS		
		$30 \% < W_L < 50 \%$	**CI**	INORGANIC CLAYS OR MEDIUM PLASTICITY, SILTY CLAYS		
		$W_L > 50$ %	**CH**	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS		
	ORGANIC SILTS & CLAYS (BELOW 'A' LINE)	$W_L < 50$ %	**OL**	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY		
		$W_L > 50$ %	**OH**	ORGANIC CLAYS OF HIGH PLASTICITY		
HIGHLY ORGANIC SOILS			**Pt**	PEAT AND OTHER HIGHLY ORGANIC SOILS	STRONG COLOUR OR ODOUR, AND OFTEN FIBROUS TEXTURE	
BEDROCK			**BR**	SEE REPORT DESCRIPTION		

Soil Components

Component	Size Range (mm)	Descriptor	% by Weight
Cobbles	> 76	and	> 35
Gravel	76 to 4.75		
Coarse	76 to 19	-y, -ey	35 to 20
Fine	19 to 4.75		
Sand	4.75 to 0.075	some	20 to 10
Coarse	4.75 to 2		
Medium	2 to 0.425	trace	10 to 1
Fine	0.425 to 0.075		
Fines (Silt or Clay)	< 0.075