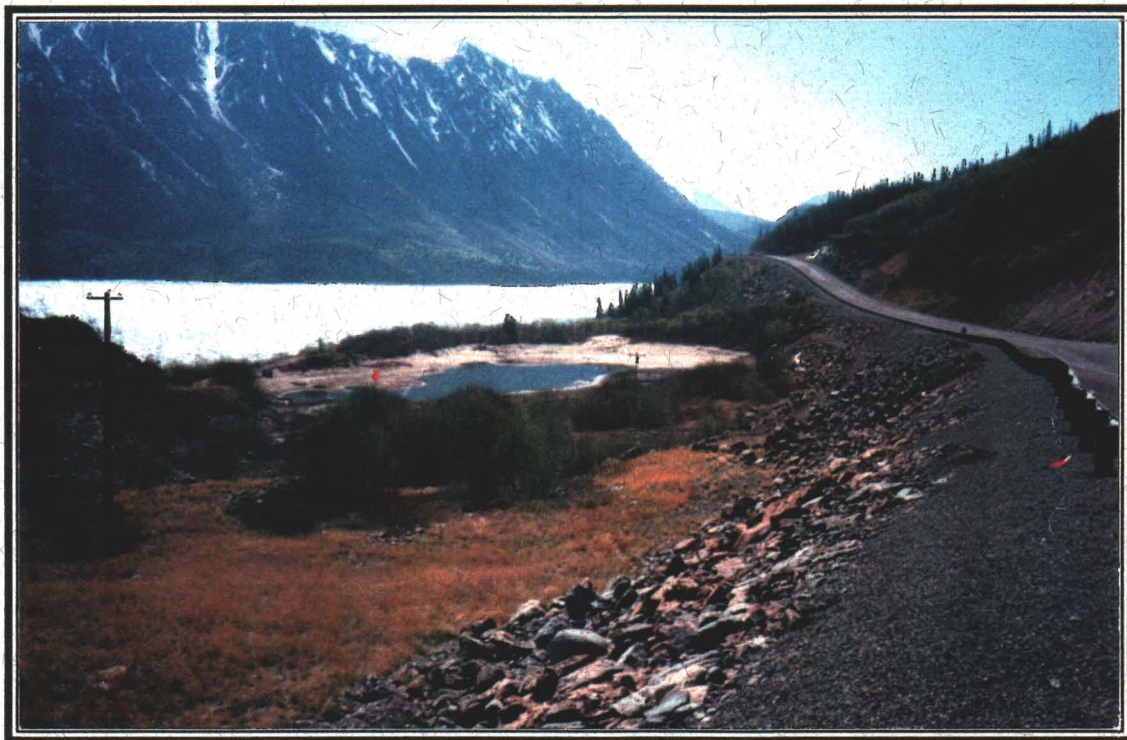


PWGSC

Quality in Environmental Services



DESIGN OF
VENUS MINE TAILINGS
SITE REHABILITATION



FINAL DESIGN

JULY 1995
(Revised September, 1995)



Public Works and
Government Services
Canada

Travaux publics et
Services gouvernementaux
Canada

Canada

Printed on recycled paper 

This Specification is part of the document referred to as
"Plans and Specifications" and marked "A" in the Articles of
Agreement entered into

on the _____ day of _____ 19__.

Between Her Majesty the Queen

and _____

Signed _____
(Authorized Departmental Officer)

(Contractor)

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Title: VENUS Mine Tailings
Site Rehabilitation
Tailings Treatment Plan

Project No.: 626483

Date: Revised September 7, 1995

1. DESCRIPTION OF WORK

- .1 Work under this Contract covers the "in place" environmental clean up of mine tailings, at the Venus Mine Tailings Site, and related works.
- .2 The Venus Mine Tailings Site is located at approximate km 86.5 on the Skagway-Carcross Highway; granular material is located at Community and Transportation Services, Transportation Engineering Branch pit at Km 90 and capping material is located approximately 2 Km north of Carcross, and is currently being landfarmed.
- .3 Work under this Contract covers the following as indicated on the drawings and specifications:
 - .1 Installation of an impermeable wall (Waterloo Barrier) to contain the tailings pile at its current location.
 - .2 Loading, hauling, and placing a silty clay cap.
 - .3 Collecting and disposing wood debris, sealing pipes, and removing scrub brush.
 - .4 Excavating wind blown tailings and levelling the tailings site.
 - .5 Constructing a drainage discharge system.
 - .6 Supply and installation of a geotextile.
 - .7 Hauling, and placing granular capillary break material.
 - .8 Community consultation.
- .4 Related work associated with this Contract include:
 - .1 Provision of an on site construction office suitable for use by the Owner's site representative and the contractor's superintendent.
- .5 Testing services on this Contract will be provided as follows:
 - .1 The Owner will provide testing personnel to perform compaction testing (if specified), grain size analysis, sieve analysis, and testing for contaminants.

- .2 The tests performed by the Owner's testing personnel will form the basis for determining the depth and extent of materials to be removed, and will form the basis for acceptance of the work.
- .6 Items peculiar to this contract include:
 - .1 The Contractor is free to use his discretion on the selection and utilization of equipment for this project.
 - .2 To the extent indicated on the contract drawings and specifications, the Owner's intent is to have the bulk of the work completed prior to March 31, 1996.
 - .3 Test borings undertaken by Public Works in 1986 and 1987 and 1995 indicate the presence of high water tables. The selection of suitable equipment will be crucial on this project.

2. **CODES**

- .1 Perform work in accordance with National Building Code of Canada (NBC), and any other code of the Yukon Territory or local application, provided that in any case of conflict or discrepancy, the more stringent requirements shall apply.
- .2 Meet or exceed requirements of:
 - .1 Contract documents.
 - .2 Specified standards, codes and referenced documents.

3. **DOCUMENTS REQUIRED**

- .1 Maintain at job site, one copy of each of the following:
 - .1 Contract drawings.
 - .2 Specifications.
 - .3 Addenda.
 - .4 Change Orders.
 - .5 Field test reports.
 - .6 Copy of approved work schedule.
 - .7 Permits, licenses and land use regulations.
 - .8 Environmental assessment report.
 - .9 Labour and Materials Payment and Performance Bonds.

4. SITE CONDITIONS

- .1 Site information contained in these contract documents was derived from several sources listed below:
 - .1 Tailings Characterization was derived from a report prepared by Rock Group Consulting Engineers dated August 1994, titled "Tailings Characterization".
 - .2 Remedial Options, and anticipated volumes were derived from a report prepared by Klohn-Crippen, "Study of Remedial Options" dated March 1994.
 - .3 Subsurface information was obtained from the Kohn-Crippen report, the Rock Group Report, borings undertaken by PWGSC in 1986 and 1987, and sampling programs undertaken by PWGSC in 1995.
 - .4 Topographic survey undertaken by PWGSC in 1995.
 - .5 Location and depth of tailings were compared with reports prepared by United Keno Hill Mines Ltd. in 1980.
 - .6 Selected geotechnical information is appended to these documents as Appendix 'A'.
 - .7 Photographs dating from 1970 until the present were consulted in deriving the extent of tailings.
- .2 This Contract deals with environmental clean up. Information in the various reports regarding the depth and extent of tailings is contradictory. While every effort has been made to accurately depict the nature and extent of the work to be undertaken, some subsurface conditions may vary from those depicted on the drawings. Accordingly, the Owner will arrange for continuous on site testing to ensure that the intent of the specifications will in fact be met.
- .3 The tailings samples are reasonably typical of a polymetallic deposit with sulphur contents ranging from 3 to 20%, iron from 4 to 9%, with associated arsenic (2.5 to 7.9), zinc (0.05 to 1%) and to a lesser degree cadmium, cobalt, copper, lead and nickel values.

5. WORK SCHEDULE

- .1 Provide and maintain a work schedule showing anticipated progress stages

and final completion of work within time period required by contract documents.

- .2 Interim reviews of work progress based on work schedule will be conducted as decided by the Owner's site representative and schedule updated by contractor in conjunction with and to the approval of the Owner's site representative.

6. **COST BREAKDOWN**

- .1 Before submitting first progress claim, submit breakdown of contract price in detail as directed by the Owner's site representative and aggregating contract price. After approval by Owner's site representative, cost breakdown will be used as basis for progress payments.

7. **MEASUREMENT FOR PAYMENT**

- .1 Due to the nature of the work it is proposed to use a combination of lump sum payments and unit price items to enumerate the Contractor on this contract.

- .2 Items which the Contractor will submit prices for are as follows:

- .1 Supply and installation of an impermeable wall (Waterloo barrier) to contain the tailings pile at its current location.

Pricing to be based on proposal submitted.

Lump Sum _____

- .2 Load, haul, place, grade and compact a silty clay cap. Price to include all labour and equipment to construct a silty clay cap.

2,650 cu. m. @ _____ = _____

- .3 Collect and dispose (by burning) wood debris on site, and dispose of brush, and seal decant pipe. Price to include all labour and equipment necessary to clean up work areas at the Venus Mine Tailings site.

Lump Sum _____

- .4 Excavating wind blown tailings and levelling tailings site. Price to include all labour and equipment necessary to excavate wind blown tailings; excavate high areas on the tailings pile and move to low

areas; final levelling and compaction of tailings site.

- .1 Excavate and place wind blown tailings, including material in the drainage discharge area.

1,600 cu. metres @ _____

- .2 Excavate and relocate tailings on site.

1,700 cu. metres @ _____

- .3 Final shaping, grading, and compaction of tailings site.

13,300 square metres @ _____

- .5 Supply and installation of geotextile. Price to include all labour and equipment necessary to supply a geotextile, and place the geotextile in accordance with manufacturer's recommendations, over the mine tailings.

13,300 square metres @ _____

- .6 Constructing a drainage discharge system. Price to include the supply and installation of piping material; supply and installation of end sections and all connections.

Lump Sum _____

- .7 Loading, hauling, and placing capillary break material. Price to include the loading, hauling, placing, and compaction of a capillary break material to the lines and grades specified.

4,100 cu. m. @ _____ = _____

- .8 Supply and place pitrun aggregate in the outfall area.

300 cu. m. @ _____ = _____

- .9 Costs to complete project. Price to include supervision, profit, administration, community consultation, supply of temporary facilities, flagpersons, scale persons, dewatering, and any costs for items not covered above.

Lump Sum _____

8. **CONTRACTOR'S USE OF SITE**

- .1 Contractor has use of site with the following restrictions:
- .1 Use of site shall comply with environmental protection requirements.
 - .2 Tracking of mud onto the Skagway-Carcross Highway is not permitted.
 - .3 Contractor shall undertake any snow clearing at the Venus Mine Tailings Site.
 - .4 The Skagway-Carcross Highway may be subject to snow slides during the winter months. The Owner assumes no responsibility for lost time in the event that access to the site is curtailed for any length of time due to snow slides or other natural phenomenon.

9. **PERMITS**

- .1 The Contractor shall be responsible for paying all costs associated with obtaining licenses, permits and royalties. Costs for these items will be covered under the cash allowance provided in the cost tables.
- .2 The Contractor shall register, obtain and pay for all licenses and permits for individual tradespersons employed for work of their section.

10. **PROJECT MEETINGS**

- .1 The Contractor and the Owner's site representative will develop an appropriate schedule for holding project meetings.
- .2 For contract activities which are ongoing, project meetings shall be held monthly.
- .3 For contract activities which are unique, e.g. Waterloo Barrier, installation of geomembrane and start of winter operations, meetings shall be scheduled at the start of each activity.
- .4 Times and locations of meetings to be approved by Owner's site representative.
- .5 Notify participants of meetings.
- .6 Record minutes of meetings, and distribute to participants within 3 days of meeting.

11. **SITE SUPERVISION**

- .1 Contractor will designate a competent and qualified supervisor to be on site at all times during construction, to have full authority to make decisions for the Contractor, to be knowledgeable of the requirements of the contract, and to act on the Owner's site representative's instructions.

12. **COMMUNITY RELATIONS**

- .1 The Contractor will be responsible for undertaking any community consultations required for this project.
- .2 The Contractor shall be responsible for providing and paying for any required translation services, and for recording and distributing minutes of meetings on approval of the Owner's representative.
- .3 The Owner, and Owner's site representative will attend any community meetings related to this project at the request of the Contractor.

13. **SETTING OUT OF WORK**

- .1 The Owner's representative will arrange and pay for a survey crew to provide initial layout of the work, periodic grade stakes, measurements for final payment, and line and grade for the drain pipe.
- .2 The Contractor shall employ methods to place the drain pipe at the correct elevation from lines and grades provided.
- .3 The Contractor shall take precautions to protect survey stakes. Costs to replace the indiscriminate removal of grade stakes will be back-charged to the Contractor.

14. **EXISTING SERVICES**

- .1 Power poles and lines exist at the Venus Mine Tailings Site. These lines are outside the work area and will be left in place.

15. **ADDITIONAL DRAWINGS**

- .1 Owner's site representative may furnish additional drawings for clarification. These additional drawings have same meaning and intent as if they were included with plans referred to in Contract documents.

16. WORK METHODOLOGY PLAN

- .1 The Contractor shall provide, prior to start of work, a Work Methodology Plan that demonstrates how the various activities will be carried out.
- .2 The plan, shall be submitted in three copies, and indicate the equipment to be used, sources of materials, and anticipated durations.

17. EXAMINATION OF SITE

- .1 Prior to finalizing pricing negotiations, the Contractor, a representative from DIAND, and a representative from the design team shall visit the site to ensure that all aspects of the work are clearly understood.
- .2 The Contractor shall notify the Owner's site representative, in writing, of any matters which could prejudice proper execution of the work.

18. DEFINITIONS

- .1 The **Owner**, as described in these documents is the Manager, Contaminants/Waste Programs, Renewable Resources, Indian and Northern Affairs, Whitehorse.
- .2 The **Owner's Site Representative** is the Divisional Manager, Environmental Services, Public Works and Government Services Canada, Edmonton, Alberta.
- .3 The **Contractor** is the Tagish/Carcross Band.
- .4 It is understood that the contract will be undertaken through a contribution agreement with the Tagish/Carcross Band.

19. LOCAL CONTENT

- .1 Two fundamental principles apply to the manner in which this contract is to be executed. These are as follows:
 - .1 Human resources to execute the work to be recruited from local communities to the maximum extent possible. Any legislation effective in the Yukon Territory relating to use of local human resources must be complied with without exception.
 - .2 Training as required is to be provided to local recruits in undertaking all aspects of the work.

1. **PROJECT CONTROL SYSTEM REQUIREMENTS AND APPLICATION**

- .1 The Owner's site representative will operate a system of overall project control of which this contract forms a part. The Contractor is required to provide the Owner's site representative with information and assistance necessary to manage the project control system.

2. **CONTRACTOR PROJECT CONTROL**

- .1 The Contractor will be required to input into two aspects of the project control system, as follows:

.1 **Schedule Control**

- .1 The Contractor shall provide a schedule (bar chart) to indicate when various activities in the contract will be carried out.
- .2 Schedules shall be updated monthly to indicate actual performance vs planned performance.
- .3 Deviations from the schedule shall be addressed by the Contractor in such a manner that assurance is provided that the contract will be completed by the specified date.

.2 **Cost and Quantity Control**

- .1 Maintain accurate up-to-date record of quantities of work carried out.
- .2 Quantities of materials to be paid for by the cubic metre will be measured by the Owner's site representative prior to start of work and after completion of the work.
- .3 Lump sum items shall be submitted by the Contractor as applicable work is carried out.
- .4 On a monthly basis, report status on all items, report statistics on lost time accidents, and cost data for cash allowance items.

3. **PURPOSE**

- .1 The purpose of Project Control Information includes the following:

-
- .1 Provide the Contracting Authority with the basis for allocating resources to the project.
 - .2 Identify cash flow requirements.
 - .3 Documents how specific project objectives are being achieved.
 - .4 Provide the Contracting Authority with the basis for making contract payments.
- .2 The Contractor is advised that revisions to the plan to maximize project efficiencies will be permitted.
4. **UPDATING, MAINTAINING AND REPORTING PROGRESS**
- .1 As part of each site meeting, the Contractor and the Owner's site representative shall inspect all of the work in progress, and note any variances from the approved contract requirements, or schedules.
5. **EFFECT OF ACCEPTANCE**
- .1 Acceptance by the Owner's site representative of the Contractor's schedules does not relieve the Contractor from any duties or responsibilities required by the contract.

1. **GENERAL**

- .1 This section covers requirements for inspection and testing services for this contract.

2. **APPOINTMENT AND PAYMENT**

- .1 The Contractor will appoint and pay for services of testing laboratory for the following:

- .1 Inspection and testing required by laws, ordinances, rules, regulations or orders of public authorities.
- .2 Inspection and testing performed exclusively for Contractor's convenience.
- .3 Testing, adjustment and balance of weigh scales.

- .2 The Owner's site representative will appoint and pay for services of testing laboratory for the following:

- .1 Inspection and testing required by the condition of land use permits issued for the work.
- .2 Testing to confirm the presence or absence of contaminated materials.
- .3 Testing required under monitoring programs.
- .4 Compaction testing.

- .3 The Supplier will appoint and pay for testing laboratory for the following:

- .1 All quality assurance and certificates for compliance related to installation of the Waterloo Barrier.
- .2 All quality assurance and certificates for compliance related to installation of the geomembrane.

1. GENERAL

- .1 Temporary facilities consist of essential temporary buildings, structures, utilities and services required at the site during clean up of the site.
- .2 Temporary facilities shall meet the requirements of Federal, Territorial and local authorities having jurisdiction.

2. SANITARY FACILITIES

- .1 Provide sanitary facilities for work force in accordance with governing regulations and ordinances.
- .2 Post notices and take such precautions as required by local health authorities. Keep area and premises in sanitary condition.
- .3 Sanitary facilities to be provided at the mine tailings site.

3. SITE OFFICE

- .1 Provide a site office, at the Venus Mine Tailings Site, for use by the Contractor and the Owner's site representative.
- .2 Inside dimensions for area to be used by Owner's site representative shall be minimum 3.6 m long x 3 m wide, by 2.4 m high, complete with 4-50% opening windows and one lockable door.
- .3 Equip office with 1 x 2 m table, 4 chairs, 6 m of shelving 300 mm wide, one 3-drawer filing cabinet, one plain rack and one coat rack and shelf.
- .4 Site office shall be insulated, and a heating system installed to maintain 22°C inside at -30°C outside temperature.
- .5 Install electrical lighting system to provide min. 750 lx using surface mounted, shielded commercial fixtures with 10% upward light component.
- .6 Arrange and pay for a communication system. Long distance calls placed on this phone by the Owner's site representative will be paid for by the Owner.
- .7 Maintain in clean condition.

4. PAYMENT

- .1 Payment for temporary facilities will be paid for by the Contractor under "costs to complete project".

1. GENERAL

- .1 Personnel safety, and reliable communications are of concern due to the remoteness of the site.

2. CONSTRUCTION SAFETY MEASURES

- .1 Observe and enforce construction safety measures required by the latest revisions of Canada Labour Code, Workers' Compensation Board, and applicable Occupational Health and Safety Regulations, Territorial and local statutes and authorities.

3. SIGNAGE AND TRAFFIC CONTROL

- .1 Erect construction signs as indicated on the contract drawings.
- .2 Maintain signs on a daily basis, including covering messages during periods of inactivity.
- .3 Post flag persons at the mine tailings site when hauling is being carried out.
- .4 Two flag persons shall be posted during periods of high tourist traffic. During winter months, with low vehicular traffic, flag persons will not be required.
- .5 Observe any regulations for flag persons required by the Yukon Highway Department.

4. COMMUNICATIONS

- .1 Establish a communications network for communications on site, with the nearest community and through long distance networks.
- .2 Flag persons shall be provided with portable radios suitable for communicating with each other, and with a base station located at the construction office.
- .3 Communication facilities in the field office shall be suitable for making long distance calls to Carcross, to Whitehorse and points south.

5. MEASUREMENT FOR PAYMENT

- .1 Work under this section will be paid for under "Costs to Complete Project".

1. **GENERAL**

- .1 The Contractor shall ensure that all applicable legislation, regulations, guidelines and codes of practice are followed.

2. **REFERENCES**

- .1 Although not necessarily limited to, some key environmental references are:
- .1 Canadian Environmental Protection Act (1988) CEPA.
 - .2 Occupational Health Regulations.
 - .3 "Guidelines for the Abandonment and Restoration Planning of Mines in the Northwest Territories", Northern Territories Water Board and Northern Territories Region Northern Affairs Program, Department of Indian Affairs and Northern Development, September 1990.
 - .4 "Guidelines for Tailings Impoundment in the Northwest Territories", February 1987.
 - .5 "Acid Rock Drainage Potential in the Northwest Territories: An Evaluation of Active and Abandoned Mines", Minister of Indian Affairs and Northern Development, Ottawa, 1994.
 - .6 MacLaren Plansearch, "Environmental Guidelines: Pits and Quarries", Minister of Indian Affairs and Northern Development, Ottawa, 1989.

3. **SUBMITTALS**

- .1 PWGSC will make necessary submittals for land use permit requirements directly to the responsible agency.

4. **ENVIRONMENTAL ASSESSMENT**

- .1 The environmental assessment for this project, prepared by DIAND, forms part of this contract.

5. **FIRES**

- .1 Fires and burning of rubbish on site permitted only on approval of the Owner's site representative.
- .2 Provide supervision, attendance and fire protection measures as directed.

1. GENERAL

1.1 WORK INCLUDED

- .1 This section specifies requirements for furnishing all materials and equipment and for performing all operations to install the steel sheet pile barrier walls including joint sealing procedures as shown on the Drawings. Sheet piling shall also be installed where required by the Contractor's method of construction and the existing conditions. This steel sheet pile barrier wall technology is described in a British Patent issued April 7th, 1993 (No. 2228760).
- .2 The Owner has undertaken a geotechnical survey of the site. Information contained in the test logs are generally indicative of the types of materials which will be encountered. Soils information is not available on the final selected alignment of the Waterloo Barrier. The supplier, as part of his overall cost, must undertake sufficient additional borings to determine the exact length of sheet piles required.
- .3 The Owner will specify the top elevation and configuration of the sheet piles, and will specify the criteria for acceptance of the bottom elevation of the piles.

1.2 RELATED WORK

- .1 Related work, specified in the "Scope of Work" section of the specifications includes:
 - .1 Excavation of wind blown tailings and levelling of the tailings pile.
 - .2 Screening, hauling, and placing capillary break material.
 - .3 Supply and installation of a geomembrane.
 - .4 Construction of a drainage outfall structure.

1.3 REFERENCE STANDARDS

- .1 American Society for Testing and Materials (ASTM):
 - .1 A 36 - Standard Specification for Structural Steel.
 - .2 A 328 - Standard Specification for Steel Sheet Piling.

- .3 A 572 - High Strength Low Alloy Columbium-Vanadium Steels of Structural Quality.
- .4 A 668 - Standard Specification for Steel Forging, Carbon and Alloy, for General Industrial Use.
- .2 American Welding Society (AWS). D1.1 - Structural Welding Code.
- .3 Canadian Standards Association:
 - .1 G40.20 General Requirements for Rolled or Welded Structural Quality Steel.
 - .2 G40.21 Structural Quality Steels.
- .4 Figures showing sections of the Waterloo Barrier™ are provided at the end of this section.

1.4 **SUBMITTAL**

- .1 Submit the following items for review by the Engineer:
 - .1 Certification: Provide documentation of agreement with Waterloo Barrier Inc. licensed installer (C3 Environmental, 519-648-3611, Breslau, Ontario) for provision of quality control services for the sheet pile installation and to complete joint sealing.
 - .2 Pile Installation Plan which outlines detailed pile placement, equipment used, splicing requirements and details, the method to achieve verticality within 1 percent, quality control measures, joint preparation prior to sealing and grout materials, mixing and placement.
 - .3 Mill test documentation for piling to be used on project.
 - .4 Manufacturer's data that indicates the structural properties of piling section(s) to be used, including I, S, Moment Capacity, thickness and width/depth dimensions.
 - .5 Proposed welding procedures and certification of welders.
 - .6 Proposed method of sealing ends between Waterloo Barrier and rock surface.

1.5 **COORDINATION**

- .1 Notify the Engineer at least 5 working days prior to beginning pile driving operations at any location. This will not relieve the Contractor of his responsibilities for performing the work in accordance with these specifications and contract drawings.

1.6 **QUALITY CONTROL**

- .1 The Quality Assurance Quality Control (QA/QC) program and joint sealing to be completed by Waterloo Barrier Inc. licensed installer (C3 Environmental, 519-648-3611, Breslau, Ontario).
- .2 Horizontal Alignment and Plumbness Tolerances: The maximum permissible horizontal tolerance in pile driving will be a deviation of not more than 150 mm (6 inches) from the plan location indicated on the Drawings.

2. **PART 2 - PRODUCTS**

2.1 **RELATED WORK**

- .1 Provide piling as manufactured by Canadian Metal Rolling Mills in Cambridge, Ontario, or other approved manufacturer under licence from Waterloo Barrier Inc.
- .2 A foot plate will be welded to the base of each female joint of the sealable sheet piling to prevent soil from entering the joint as the pile is driven into the ground. The fabrication and attachment of the foot plate will be the responsibility of the Site Contractor. Exact dimensions of the foot plate will be based on the final rolled sheet piles. The Contractor will make the necessary fabrication arrangement to assure manufacture of the foot plates does not delay the sheet pile installation.
- .3 If the Contractor chooses to drive sheet piles in doubles, a cone will be employed to prevent soil from entering the mated (centre) joint. The Contractor will be responsible for the fabrication and installation of the cone for each paired sheet pile set. Foot plates will be welded to the base of the female joint of the paired set as described in the preceding paragraph.
- .4 Minimum Section Properties of Piling:
- | | | | |
|----|------------|--------------|--------|
| .1 | Thickness: | 0.295 inches | 7.5 mm |
|----|------------|--------------|--------|

.2	Nominal Width:	22.25 inches	565 mm
.3	Section Area:	10.47 square inches	$6.7 \times 10^{-10} \text{ m}^2$
.4	Weight:	19.2 lbs./square foot	93.8 kg/m ²
.5	Radius of Gyration:	3.39 inches	86.1 mm

- .5 The sealant to be used to seal the Waterloo Barrier™ sheet pile wall will be a silica fume modified, thixotropic cementitious based grout, WBS Type 301 or approved equal.

3. EXECUTION

3.1 SHEET PILE INSTALLATION

- .1 Handling Sheet Piles:
- .1 Lift in a manner which will not cause excessive bending stresses.
 - .2 Do not damage sheet piles in either handling or installing operations.
 - .3 The joint of each sheet pile will be visually inspected by the Contractor prior to installation. Any foreign material will be removed and damaged joints and/or sheet piles will be rejected.
 - .4 Replace or repair sheet piles which are damaged during installation.
- .2 Location and Tolerances:
- .1 Drive piles vertically and in correct alignment so that the top of the wall lies on a straight line and ensure a proper interlocking throughout the entire length of the piles.
 - .2 Sheet pile locations on the Drawings are approximate and will be field located when appropriate and when approved by the Engineer.
 - .3 Deviation in horizontal alignment will not exceed 10 degrees at each joint.
 - .4 The maximum permissible vertical tolerance (plumbness) in the pile installation will not be greater than a deviation of 1/16 inch per 1 foot vertical. The integrity of the interlock between

adjacent pile will be verified by flushing the joint. Joint inspection and flushing will be performed by the Quality Control Engineer.

- .3 The Contractor will use suitable templates to ensure alignment and plumbness during driving.
- .4 Pile Installation:
 - .1 Install piles with equipment suitable for the conditions encountered. The method and equipment selected will install the piling to the design depths as shown on the Drawings and minimize damage to each end of piling and adjacent interlocks. Suitable procedures must be employed to prevent damage to the pile tops and joints.
 - .2 Prevent and correct any tendency of the sheet piles to bend, twist or rotate, and to pull out of interlock. The integrity of each pile and interlocked joint must be maintained during and after driving.
 - .3 Top of pile at elevation of cut-off will be within 2 inches (50 mm) of the specified alignment. Manipulation of piles to force them into position will not be permitted. Piles will be checked for heave. Piles found to have heaved will be redriven to the required point elevation.
 - .4 Piles damaged or driven outside the above tolerances will be replaced. Any sheet pile ruptured in the interlock or otherwise damaged during installation will be immediately pulled and replaced.
 - .5 Piles will be driven not deeper than 1 foot (300 mm) of the specified depths for each location. The Contractor will take the necessary precautions to assure adjacent piles do not penetrate deeper during pile installation.
 - .6 Pull any sheet piling that are known to have pulled out of the interlock or are suspected of having tip or interlock damage, as determined by the Quality Control Engineer, and pull for visual inspection before proceeding further.
 - .7 Splicing is permitted if shown on the Drawings or as approved by the Engineer.

- .8 Make splices using a full penetration weld or as otherwise directed by the Engineer for structural purposes.
- .9 Space between the end section of Waterloo Barrier, and rock face are to be sealed.

3.2 JOINT SEALING

- .1 All sheet pile joints are to be sealed. Joint sealing is to be completed by Waterloo Barrier Inc. licensed installer (C3 Environmental, 519-648-3611, Breslau, Ontario).
- .2 Joint sealing will not be performed adjacent to sheet pile installation within a radius of the length of a sheet plus 10 feet (3 mm) from the sheet piling installation point.
- .3 After sheet piling has been installed in the ground all sealable cavities will be checked by probing and flushing of the joints with pressurized water to remove any remaining loose material.
- .4 During the flushing, a hose or pipe will be inserted into the sealable cavity and advanced downward. The hose will allow soil particles to travel up and out of the cavity.
- .5 The flushing operation will be considered complete when the hose has been passed to the base of the sealable cavity and the water escaping from the top of the joint is reasonably clean. The flushing hose may then be removed from the cavity.
- .6 A tremie hose or tube for pressure injection of the sealant will be inserted into the sealable cavity. When the tube has reached the bottom of the hole, sealant injection will begin. The hose will be withdrawn progressively up the hole as the sealant fills the space below. Keep tremie nozzle at least 6 inches (150 mm) below rising surface of sealant.
- .7 The speed at which the injection tube is withdrawn must be carefully regulated to prevent trapping water bubbles within the sealant and to ensure there is adequate sealant to fill the cavity.

3.3 RECORDS

- .1 Provide accurate records of each sheet pile driven. Submitted records will include the following information:

- .1 Pile identification number.
- .2 Date and time of driving.
- .3 Model of hammer and energy rating.
- .4 Elevation of top of pile.
- .5 Length of sheet pile in the ground when driving is complete.
- .6 Rate of penetration in feet/minute.
- .7 Detailed remarks concerning alignment, obstructions, etc.
- .8 Plumbness records of each sheet pile installed.
- .9 Joint flushing records for each joint installed.

.2 Mark waterproof identification number clearly visible on each sheet pile, within 2 feet (600 mm) from the top of pile.

.3 Spray paint all sheet piles rejected from the work for any reason, at the time of rejection, with the letter "X" within 3 feet (1 m) of both ends.

.4 Provide accurate sealant installation records. Submitted records will include the following information:

- .1 Joint identification number.
- .2 Date and time of sealing operation.
- .3 A complete list of the equipment used during the installation.
- .4 Volume of sealant required to seal each joint.

4. REJECTION

4.1 If rejected from the work because of deviation from location, plumbness requirements, excessive bending, twisting, or pulling out of interlock, or other reasons, take suitable corrective action at no additional cost to the Owner. Suitable action includes extracting, and furnishing and driving of replacement sheet piles, so that all sheet piles installed meet the requirements of this Specification.

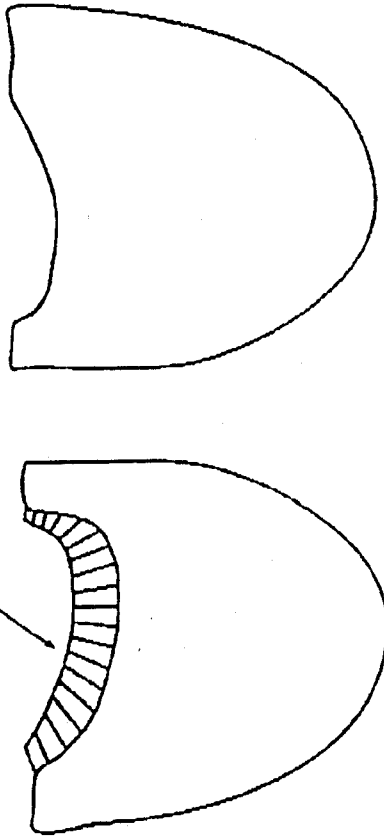
5. MEASUREMENT FOR PAYMENT

5.1 Payment for supply and installation of the Waterloo Barrier shall be made on the basis of a proposal to be submitted by the supplier, which shall include as a minimum the following breakdowns:

- .1 Mobilization and fixed costs.
- .2 Accommodation, travel and communications expenses.
- .3 Quality assurance/quality control inspection services.

- .4 Waterloo Barrier, Sheet Piling supply and preparation. This cost to be quoted on a square foot basis.
- .5 Waterloo Barrier, Sheet Pile Installation - this cost to be quoted on a per linear foot basis, to include any preparation work, and final clean up. Price to also include any support material outside of the containment area to provide stability.
- .6 Waterloo Barrier Sheet Pile Joint Sealing - price to include sealing both ends to adjacent rock faces.

Approximately 45° ground surface

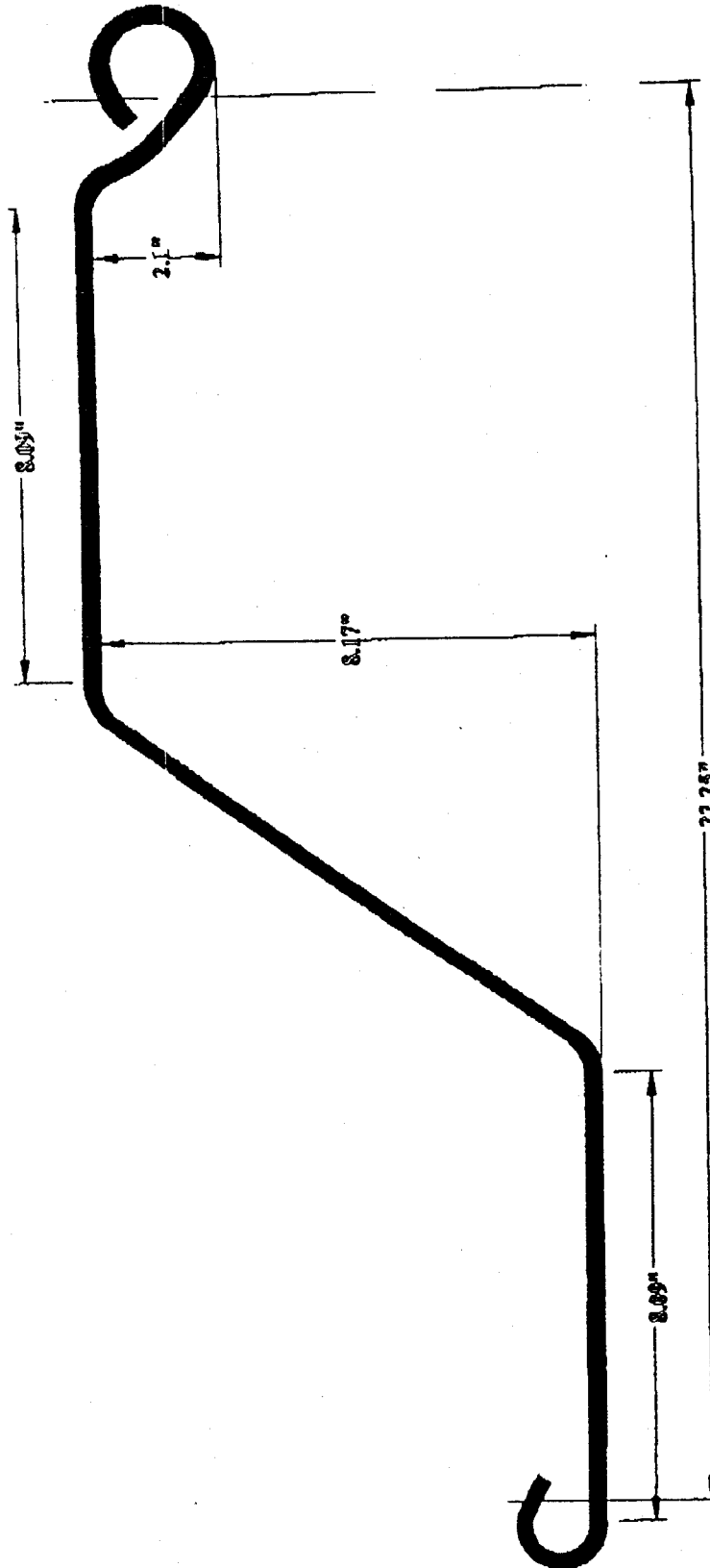


ACTUAL SIZE

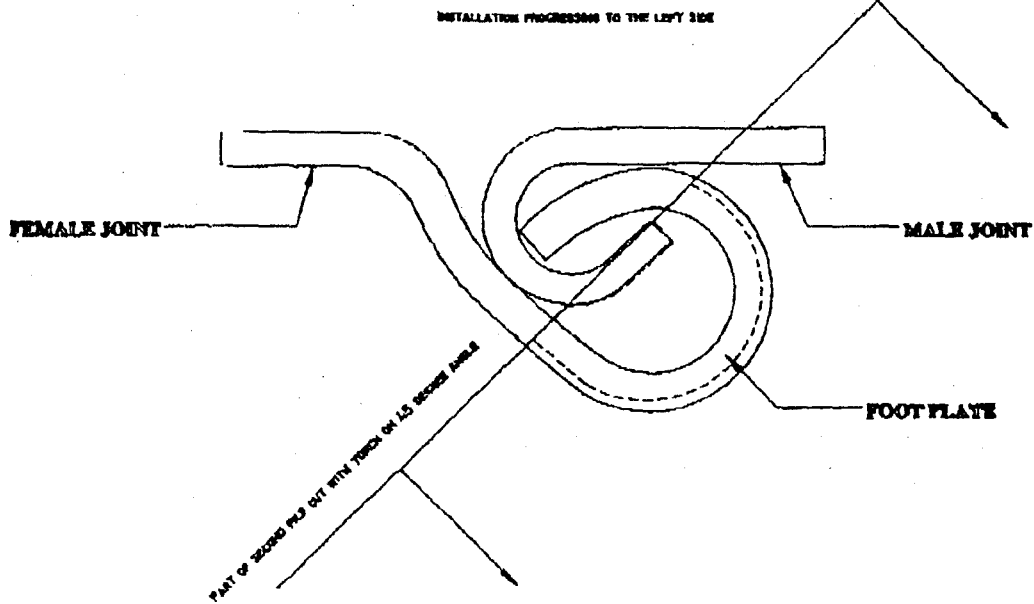
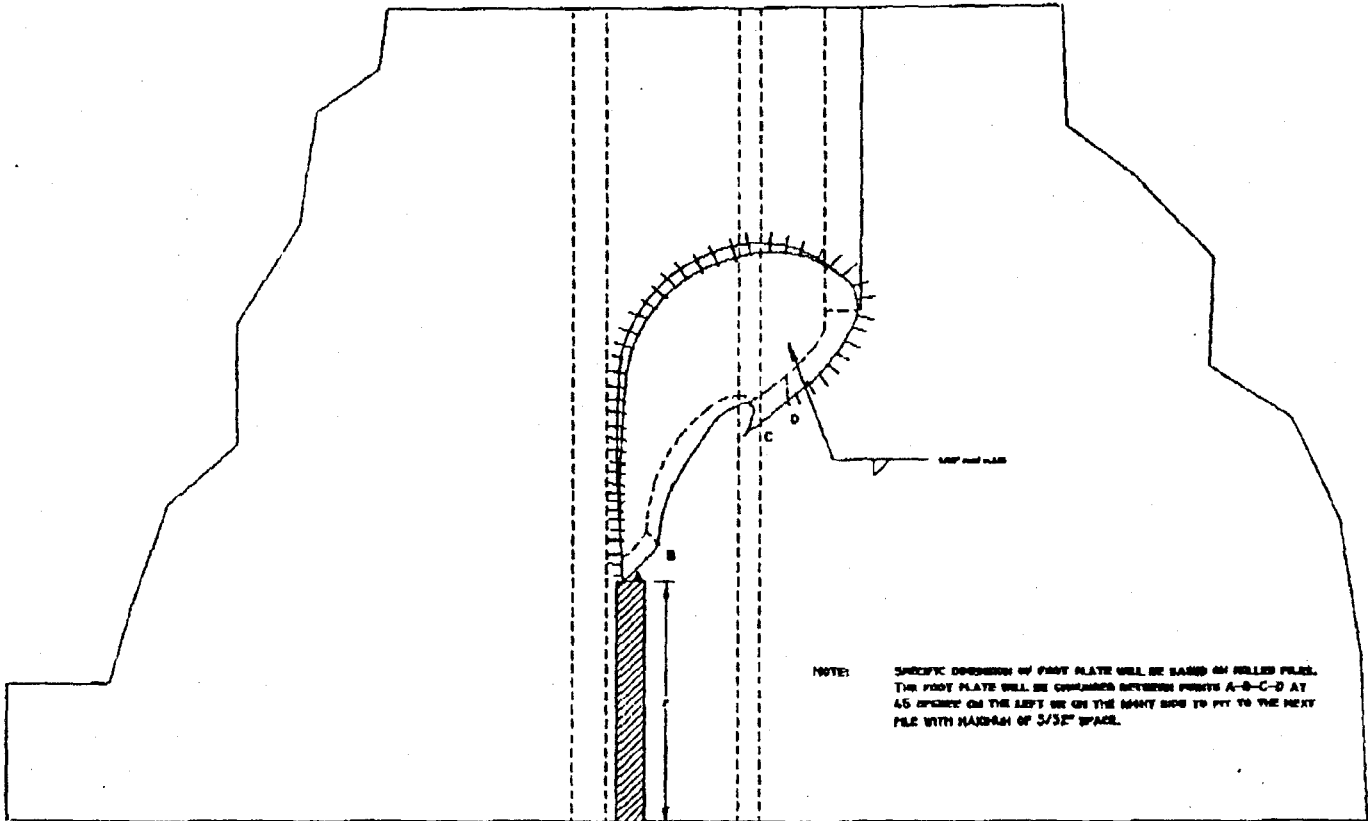
C3 ENVIRONMENTAL LIMITED - BRESLAU, ONTARIO

FOOT PLATE CONFIGURATION

DATE: 10/19/94 SCALE: N.T.S DRAWN BY: MLE



C3 ENVIRONMENTAL LIMITED - BRISLAU, ONTARIO
STANDARD WATERLOO BARRIER SHEET PILE SECTION
DATE: 10/23/94 SCALE: N.T.S. DRAWN BY: MLE



CS ENVIRONMENTAL LIMITED - BURLAU, ONTARIO		
FOOT PLATE WELD DETAIL		
DATE: 10/12/94	SCALE: N.T.S	DRAWN BY: M.L.R

1. SCOPE OF WORK

- 1.1 The scope of work under "Collection and Disposal of Debris at the Venus Mine Tailings Site" includes the supply of labour and equipment necessary to collect and dispose of (by burning) wood debris at the Venus Mine Tailings Site, sealing the decant pipe, and cutting and disposing of brush within the work area.

2. METHODOLOGY

- 2.1 All loose wood debris located on the mine tailings shall be collected, piled on the mine tailings site and burned.
- 2.2 All scrub brush located in work areas shall be cut to ground level, collected and burned at the mine tailings site.
- 2.3 Ashes from burning are to be collected and spread over the tailings.
- 2.4 The Contractor shall be responsible for obtaining any necessary burning permits, and for compliance with any local or territorial by laws or codes with request to burning.
- 2.5 The decant pipe located in the work area shall be sealed at its inlet, and at the location where the decant pipe crosses the Waterloo Barrier. Sealing may be accomplished by use of lean mixed concrete or any other means proposed by the Contractor and accepted by the Engineer.

3. MEASUREMENT FOR PAYMENT

- 3.1 Work under this section will be paid for at the lump sum price bid for "Collection and Disposal of Debris, Disposal of Brush, and Sealing Decant Pipe".

1. **SCOPE OF WORK**

1.1 The scope of work under "Excavate Wind Blown Tailings, and Level Existing Mine Site" includes excavating wind blown tailings outside the containment area, excavating tailings at the outfall (breach), and levelling the site to the design grade.

2. **METHODOLOGY**

2.1 Scrub brush, debris, and the existing pipe is to be removed and disposed of.

2.2 Wind blown tailings in the area designated shall be picked up, transported to the tailings area, dumped, and spread out.

2.3 Excavation in areas designated as wind blown tailings to be removed to a depth of 0.3 metres.

2.4 Tailings in the outfall area to be removed to a depth of one meter, loaded, hauled to low areas in the tailings pile, and spread.

2.5 The entire mine tailings area is to be levelled to elevation 82.5.

2.6 Compaction in low areas shall be achieved by the judicious routing of contractors equipment, aided with a wobbly wheel packer.

2.7 Final compaction shall be achieved by the judicious routing of contractors equipment, plus a minimum of 3 passes with an 8 to 10 tonne wobbly wheel packer. Compaction shall be deemed acceptable only after a minimum of 3 passes, and when the surface is free from ruts caused by the compaction equipment.

2.8 Concurrent to levelling and compaction, the entire surface is to be graded to a smooth flat surface, within 25 mm of the established grade, but not uniformly high or low.

3. **MEASUREMENTS FOR PAYMENT**

3.1 Payment for cleaning up wind blown tailings, excavation of tailings in the outfall area, and for levelling and compacting the entire mine site area will be made at the unit price bid to supply and labour and equipment under three (3) categories as follows:

.1 Clean up wind blown tailings and excavate tailings in the outfall area, will include all costs related to excavating material outside the

Waterloo Barrier.

- .2 Levelling the tailings area will include all costs related to excavation and movement of material inside the Waterloo Barrier.
- .3 Levelling and compaction will include all costs related to achieving specified grade and compaction requirements.



NILEX

NILEX GEOTEXTILES

Nilex Office: (604) 20-6443
 Vancouver: (604) 463-9535
 Edmonton: 403 (604) 463-9535
 Calgary: 403 (604) 236-8385

TYPICAL VALUES - METRIC

Property	Test Method	Units	Nonwoven Geotextiles							Woven Geotextiles							
			4535 C10	4545 C14	4551 C24	4553 C34	4557 C54	4561	4599 AmoPave	2000 P100	2002 P500	2006 P600	2016	2044	1198	1199	1380 Silt Stop
Grab Tensile Strength	ASTM-D-4632	N	374	490	779	1068	1455	1687	485	●712	●1024	●1513	●1590	●3000 ▲960	●1429 ▲1268	●1691 ▲1268	●1046
Grab Tensile Elongation	ASTM-D-4632	%	70	70	70	70	70	70	66	●24	●22	●22	●22	●22	●32	●36	●26
Mullen Burst	ASTM-D-3786	kPa	1419	1826	2633	3618	4962	6850	1716	2519	2963	4376	5920	10000	3205	3653	2929
Puncture	ASTM-D-4833	N	215	356	520	700	912	1522	330	356	445	623	623	745	623	668	490
Trapezoid Tear	ASTM-D-4533	N	128	227	338	467	600	1055	205	356	490	668	670	1560	400	400	400
UV Resistance	ASTM-D-4355	%	85	85	85	85	85	70	70	70	70	70	80	80	90	90	80
Apparent Opening Size	ASTM-D-4751	um	115	100	100	75	75	50	n/a	212	212	212	212	150	212	150	300
Permittivity	ASTM-D-4491	sec ⁻¹	2.7	2.5	1.9	1.5	1.1	0.7	n/a	0.04	0.04	0.02	0.55	0.15	0.5	0.04	0.4
Flow Rate	ASTM-D-4491	L/s/m ²	200	169	121	92	65	34	n/a	3.4	3.4	1.7	40	12	34	4	36
Unit Weight		g/m ²	125	175	230	285	400	455	125	125	180	230	256	425	177	177	234
Thickness		mm	1.2	1.7	3.0	3.2	4.3	5.4	1.5	0.45	0.5	0.6	0.7	0.9	0.6	0.6	0.7

● Warp ▲ Fill Amoco Product Number Nilex Product Number

The above geotextiles are manufactured for Nilex by Amoco Fabrics and Fibers Company

DEFINITION: *Typical Value*

Since various companies perform their "typical value" tests differently, it is difficult to define the method used to obtain a Typical Value. Generally, the *Typical Value* is the average (arithmetic mean) value of an indeterminate number of sample tests (I.E. Could be the average of 2 samples or of 2000 samples). *Typical Values* should therefore be used only if *Minimum Average Roll Values* are not available.

Disclaimer: The information presented herein, while not guaranteed, is to the best of our knowledge true and accurate, and the recipient assumes all responsibility for its use. No warranty, expressed or implied, is made regarding the performance of any product, as the manner of use and handling are beyond our control. Nothing contained herein is to be construed as permission or as a recommendation to infringe any patent.

GEOTEXTILES IN SEPARATION APPLICATIONS GUIDE SPECIFICATION

DESCRIPTION

This work shall consist of furnishing and placing a geotextile for use as a permeable separator to prevent inter-mixing of dissimilar materials such as: subgrades and surfaced or unsurfaced pavement materials; and foundations and select fill materials. The geotextile shall be designed to allow passage of water while retaining in-situ soil. This specification does not address geotextiles used for reinforcement.

MATERIAL REQUIREMENTS

Geotextile: The geotextile shall be composed of synthetic fibers formed into a woven or nonwoven fabric. Fibers used in the manufacture of the geotextile shall be composed of at least 85 percent by weight polyolefins, polyesters, or polyamides. The geotextile shall be free of defects or flaws which significantly affect its physical properties. The geotextile shall meet the requirements of Table 5-1. The choice of a geotextile for this application is determined by the ability of the geotextile to survive installation stresses as shown in Table 5-2.

CONSTRUCTION AND INSTALLATION REQUIREMENTS

Geotextile Shipment/Storage: The geotextile rolls shall be furnished with suitable wrapping for protection against moisture and extended ultraviolet exposure prior to placement. Rolls shall be stored in a manner which protects them from the elements. If stored outdoors, they shall be elevated and protected with a waterproof cover. At no time shall the geotextile be exposed to ultraviolet light for a period exceeding fourteen days. The geotextile rolls shall be labeled as per ASTM D 4873, "Guide for Identification, Storage, and Handling of Geotextiles".

Site Preparation: The installation area shall be prepared by clearing all debris or obstructions which may damage the geotextile. Trees and large bushes should be cut at ground level. In most cases, all native vegetation, roots and topsoil must be removed from the roadway subgrade prior to geotextile placement. Where required by the contract documents, soft and otherwise unsuitable subgrade areas shall be identified, excavated and backfilled with select material in accordance with the contract documents. Stabilization of these areas may be enhanced by use of a geotextile at the bottom of the excavation before backfilling. However, when designed for soft or wet subgrade conditions, native vegetation, roots and topsoil may be left in place so as to limit disturbance and resulting shear strength loss of the subgrade soil.

Geotextile Placement: The geotextile shall be unrolled as smoothly as possible on the prepared subgrade in the direction of construction traffic. Geotextile rolls shall be overlapped in the direction of subbase placement. The geotextile shall be overlapped or seamed in accordance with the minimum requirements provided in Table 5-3. Sewing is recommended where subgrade soils exhibit a CBR less than 0.5 and is preferred where subgrade soils exhibit a CBR greater than 0.5 but less than or equal to one.

If required, the geotextile may be held in place prior to subbase placement with pins, sand bags, or piles of fill or rock. On curves, the geotextile may be folded or cut to conform to the curve as illustrated in Figure 5-1. If site conditions require geotextile seaming, the geotextile shall be cut and seamed on the curve. The fold or overlap shall be in the direction of construction and shall be held in place as prescribed above. The geotextile shall not be dragged across the subgrade.

Damaged geotextiles, as identified by the engineer, shall be repaired immediately. The damaged area plus an additional three feet around the damaged area shall be cleared of all fill material. A geotextile patch extending three feet beyond the perimeter of the damage shall be constructed as directed by the engineer. Sewing of a geotextile patch may be required over soft subgrades as directed by the engineer. Damaged geotextile shall be repaired at no cost to the owner.

Aggregate Placement: The aggregate base or subbase (aggregate) shall be placed by end dumping adjacent to the geotextile or over previously placed aggregate. End dumping or tail gate dumping of aggregate on the geotextile will not be permitted. The aggregate shall be spread from the backdumped pile using a bulldozer or motor grader. A sufficient thickness of aggregate should be in place prior to dumping to minimize the potential of subgrade pumping and localized subgrade failure.

The aggregate shall be placed on the geotextile in lifts not less than 6-in. thick. For low volume roads, the minimum lift may be reduced to a 4-in. thickness at the discretion of the engineer. Traffic shall not be permitted directly on the geotextile. Sudden stops or turns by equipment operating on aggregate placed over the geotextile shall be avoided. A smooth drum roller shall be used to achieve specified aggregate density. Any ruts occurring during construction shall be filled with additional aggregate and compacted to the specified density. Vibratory compaction shall not be used on the initial lift over the geotextile.

METHOD OF MEASUREMENT

Geotextile: The geotextile shall be measured by the number of square yards from the payment lines shown on the plans or from the payment lines established in writing by the engineer. This excludes seams and overlaps. Excavation, backfill, bedding, and cover material are separate pay items.

BASIS OF PAYMENT

Geotextile: The accepted quantities of geotextile shall be paid for at the contract unit price per square yard in place.

TABLE 5-1
 PHYSICAL REQUIREMENTS^{1, 2, 3}
 GEOTEXTILES IN SEPARATION APPLICATIONS

Property	Units	Required Values		Test Method
		Medium Survivability ⁴	High Survivability ⁴	
Tensile Strength	lbs	180	270	ASTM D 4632
Elongation	%	50	50	ASTM D 4632
Seam Strength	lbs	160	240	ASTM D 4632
Puncture Strength	lbs	70	100	ASTM D 4833
Trapezoid Tear Strength	lbs	70	100	ASTM D 4533
Permitivity	1/sec	.02 ⁽⁵⁾	.02 ⁽⁵⁾	ASTM D 4491
Apparent Opening Size	U.S. Standard Sieve	(6)	(6)	ASTM D 4751
Ultraviolet Stability ⁷	%	70	70	ASTM D 4355

Notes:

1. Conformance of geotextiles to specification property requirements shall be determined according to ASTM D 4873, "Guide for Identification, Storage, and Handling of Geotextiles".
2. Contracting agency may require a letter from the manufacturer certifying that its geotextile meets specification requirements.
3. All numerical values, except those of elongation, represent minimum average roll values (i.e., average test results from any sampled roll in a lot shall exceed the minimum average roll values) in weaker principal direction. Values of elongation represent maximum average roll values. Lot sampled according to ASTM D 4354, "Practice for Sampling Geosynthetics for Testing".

TABLE 5-2
 CONSTRUCTION SURVIVABILITY RATINGS^{1, 2, 3, 4}

Subgrade CBR At Installation	<1		1-2		>2	
Equipment Contact Pressure (psi)	>50	<50	>50	<50	>50	<50
Compacted Aggregate Thickness (in) ⁽⁵⁾						
4 ⁽⁶⁾	NR	NR	H	M	M	M
6	NR	NR	H	H	M	M
12	NR	H	M	M	M	M
18	H	M	M	M	M	M

Notes:

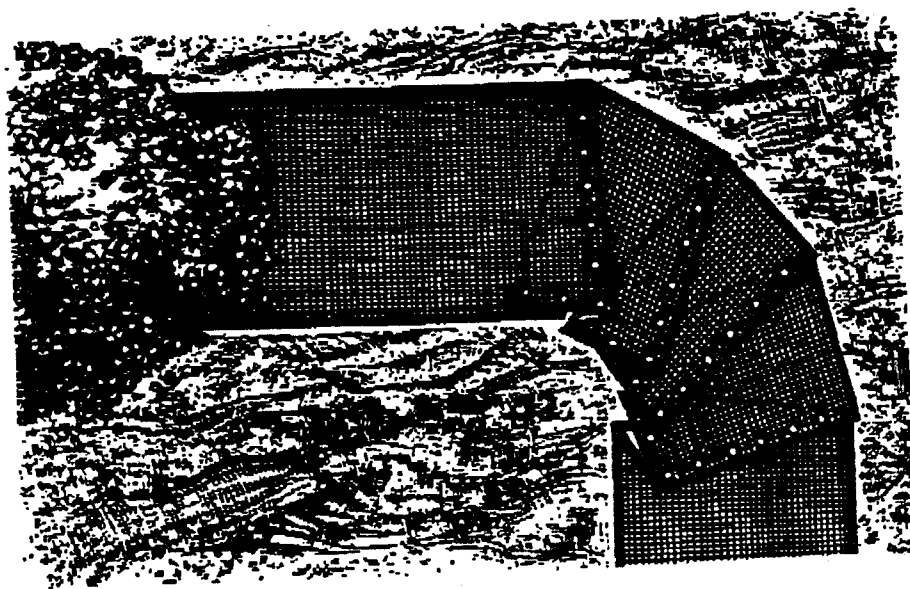
1. From "Geotextile Design and Construction Guidelines", Federal Highway Administration, Publication No. FHWA-HI-90-001, October 1989.
2. H - HIGH
3. M - MEDIUM
4. NR - NOT RECOMMENDED
5. Maximum aggregate size not to exceed one half the compacted thickness.
6. The four inch minimum cover is intended for existing road bases and not intended for use in new construction.

TABLE 5-3
SEAM RECOMMENDATIONS^{1,2}

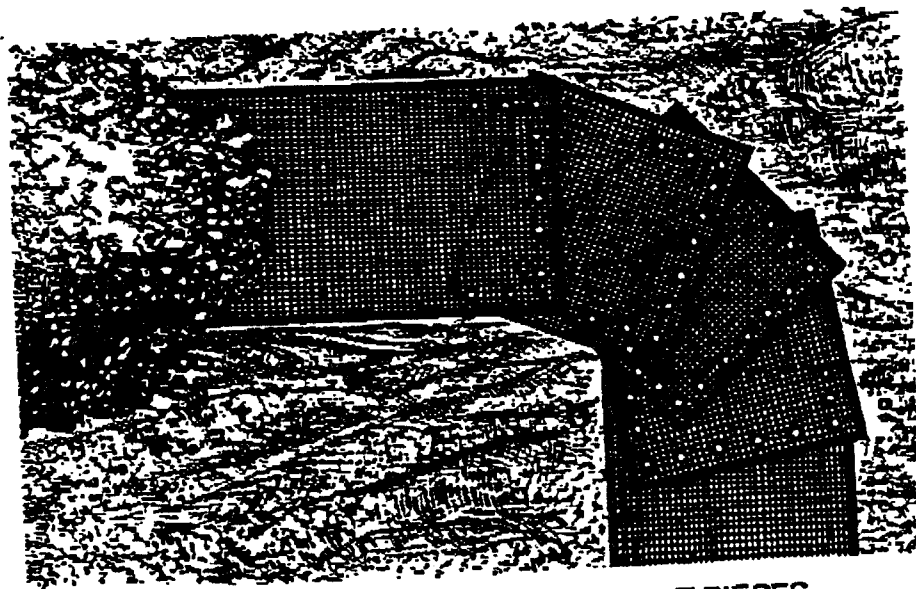
Overlap Location	Soil Strength (CBR)	Minimum Overlap (ft)
Overlap of adjacent geotextile rolls	< 0.5	3 ⁽³⁾
	$\leq 1 > 0.5$	3 ⁽⁴⁾
	≤ 2	2.5 ⁽⁵⁾
	> 2	1.5 ⁽⁵⁾
Overlap of geotextile roll ends	≤ 0.5	3 ⁽³⁾
	> 0.5	3 ⁽⁵⁾

Notes:

1. Adapted from Task Force 25 and "Geotextile Design and Construction Guidelines," Federal Highway Administration Publication No. FHWA-HI-90-001, October 1989.
2. Overlap requirements are not applicable to sewn seams.
3. Overlaps are not recommended for soil CBR less than 0.5.
4. Sewn seams of adjacent geotextile rolls are preferred for soil CBR greater than 0.5 but less than or equal to one.
5. Sewn seams are acceptable for all soil CBRs.



A. FORMING A CURVE USING FOLDS



B. FORMING A CURVE USING CUT PIECES

Figure 5-1 PLACEMENT OF SEPARATION GEOTEXTILE ON CURVES [FHWA, 1989]

(Note: o - indicates locations of pins, sandbags, piles of fill or rock, or other means of temporarily anchoring geotextile. Anchors shall be placed on 2 feet centers minimum.)

1. **SCOPE OF WORK**

1.1 The scope of work under "Capillary Break Material" includes the loading, hauling, weighing, placing, grading, and compacting of granular materials.

2. **METHODOLOGY**

2.1 Material for use as a capillary break material shall be screened pit run stone or gravel, meeting the following gradation:

Sieve Designation	% Passing
75 mm	100%
25 mm	60 to 100%
12.5 mm	38 to 70%
0.075 mm	2 to 10%

Material to be tested to ASTM C136 and ASTM C117; sieve sizes up to CAN/CGSB-8.1.

2.2 Screened pit run material is to be loaded, hauled, weighed at the mine site, and spread over the clay cap.

2.3 Material shall be placed in one 300 mm (compacted) lift.

2.4 Compaction shall be achieved by the judicious routing of construction equipment, plus a minimum of 3 passes with an 8 to 10 tonne steel roller.

2.5 The final surface shall be graded and compacted to a flat, firm surface, within 25 mm of the established grade, but not uniformly high or low.

2.6 Material is to be placed on clean, unfrozen surfaces, free from ice or snow.

2.7 Material shall not be frozen when placed.

3. **MEASUREMENT FOR PAYMENT**

3.1 Capillary break material shall be paid for at the unit price tendered per cubic metre, measured in place. Price to include all labour and equipment to load, haul, grade, compact, and place the material to the level indicated on the contract drawings.

1. **SCOPE OF WORK**

1.1 The scope of work under this section includes the supply and placement of pitrun aggregate for use as a fill at the outfall, outside of the Waterloo Barrier.

2. **METHODOLOGY**

2.1 Material to be used for fill outside the Waterloo Barrier, shall consist of pitrun aggregate, with 100% passing a 200 mm screen.

2.2 Screened material shall be loaded, hauled, and placed at the outfall.

2.3 Material shall be placed in layers not exceeding 500 mm and compacted with spreading equipment (dozer).

2.4 The final surface shall be at the design grade at the Waterloo Barrier, and sloped to blend with existing terrain.

3. **MEASUREMENT FOR PAYMENT**

3.1 Material used for fill at the outfall shall be paid for at the unit price tendered, per cubic metre, measured in place. Price to include all labour and equipment necessary, to screen, load, haul, weigh, and place material at the outfall.

1. **SCOPE OF WORK**

1.1 The scope of work under this section includes supply and installation of piping and end sections at the drainage outfall.

2. **METHODOLOGY**

2.1 Water discharging from the tailings shall be collected by means of a galvanized steel end section for round pipe.

2.2 Pipe shall be supplied to the configuration shown on the drawings and shall be 600 mm corrugated metal pipe.

2.3 Galvanized steel end sections for round pipe shall be installed at both ends.

2.4 Pipe and end section leaving the outlet shall be supported by pitrun gravel, maximum size 200 mm.

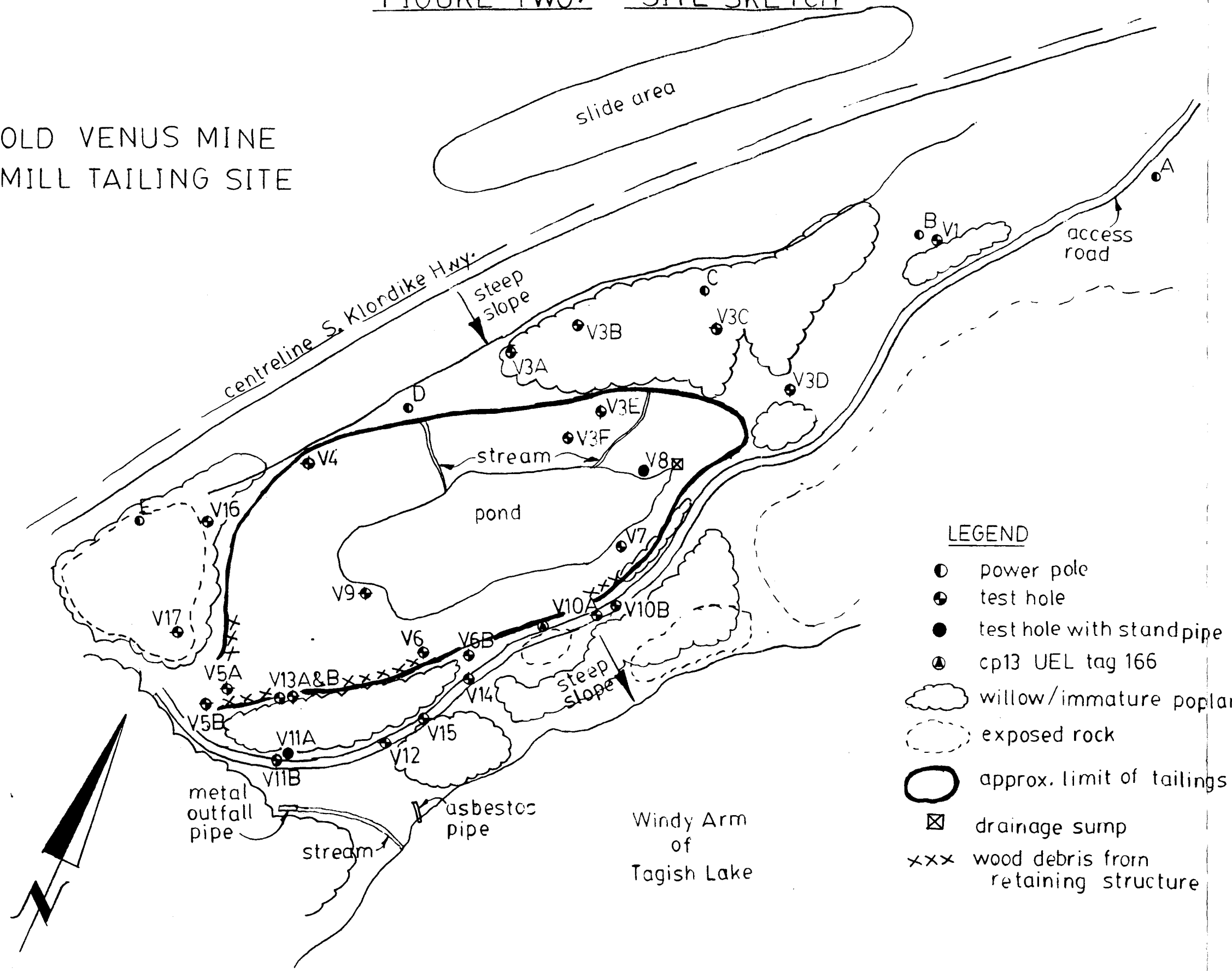
2.5 Pipe at the discharge section shall be covered with a minimum of 300 mm native material and compacted to the density of adjacent undisturbed material.

3. **MEASUREMENT FOR PAYMENT**

3.1 Payment for constructing the outfall structure will be at the lump sum price tendered for constructing the drainage outfall structure. Price to include all labour, equipment and materials, except for 200 mm pitrun aggregate which will be paid for as a separate item.


FIGURE TWO: SITE SKETCH

OLD VENUS MINE
MILL TAILING SITE



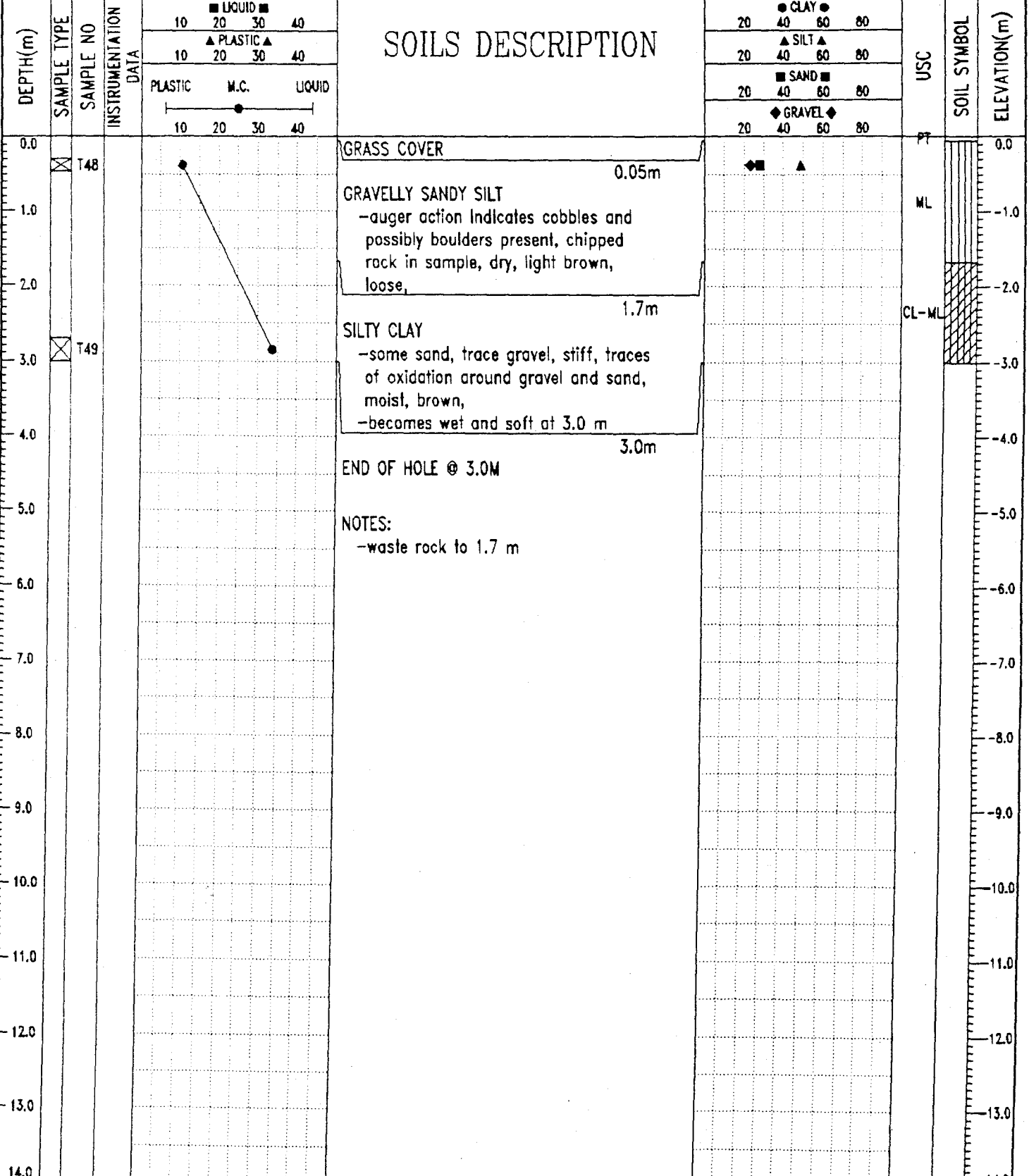
LEGEND

- power pole
- test hole
- test hole with standpipe
- ⊙ cp13 UEL tag 166
- ☁ willow/immature poplar
- ⋯ exposed rock
- approx. limit of tailings
- ⊠ drainage sump
- XXX wood debris from retaining structure

 J. R. Paine & Associates Ltd. <small>GENERAL AND TESTER ENGINEERS</small>	
VENUS MINE TAILINGS TESTING AND DRILLING PROGRAM KM 86.5 AND KM 97.5 SOUTH KLONDIKE HIGHWAY	
Dwn. By MEB	Date 1995/07/05
Scale 1:1500	Plate No. 1 of 1

Public Works Canada Environmental A&S Venus Mine Tailings Site BOREHOLE NO: V1
 Drilled using CME 75 track mounted rig V1 located adjacent to power pole "B" PROJECT NO: 8054-12
 with solid stem augers (see site sketch) ELEVATION:

SAMPLE TYPE TUBE LOST AUGER BULK SPT CORE
 BACKFILL TYPE BENTONITE PEA GRAVEL SLOUGH GROUT DRILL CUTTINGS SAND



J.R. Paine & Associates Ltd.
 Whitehorse, Yukon

LOGGED BY: MEB COMPLETION DEPTH: 3.0 m
 REVIEWED BY: WCK COMPLETE: 95/06/15
 Fig. No: 1 Page 1 of 1



J. R. Paine & Associates Ltd.

CONSULTING AND TESTING ENGINEERS

SCREEN ANALYSIS

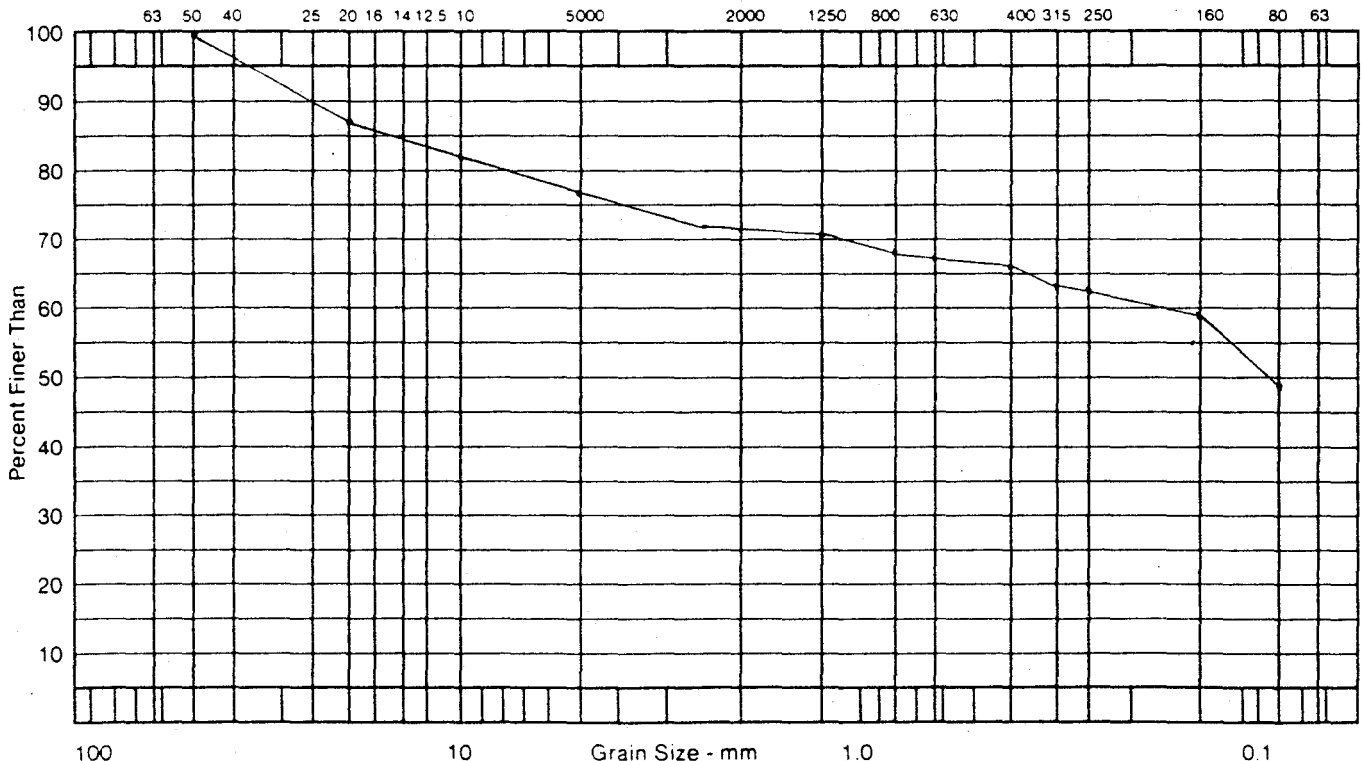
Client: PWGSC, A & ES
 Sample: T48 Depth: 0.3m-0.5m Project: Venus Mines Reclamation
 Location: Tailings Area, Test Hole VI Made by: P.R. Job No.: 8054-12
 Ck'd by: M.B. Date: 95/06/23

Sieve No.	Size of Opening MM	Weight Retained gms	Total Wt. Finer Than gms	Percent Finer Than	% Finer Than Basis Orig. Sample
80,000	80.000				
50,000	50.000				100.0
20,000	20.000				87.1
10,000	10.000				82.2
5,000	5.000				76.7
2,500	2.500				72.5
2,000	2.000				71.8
1,250	1.250				70.1
800	.800				68.5
630	.630				67.5
400	.400				65.5
315	.315				63.8
250	.250				62.5
160	.160				58.1
80	.080				48.6

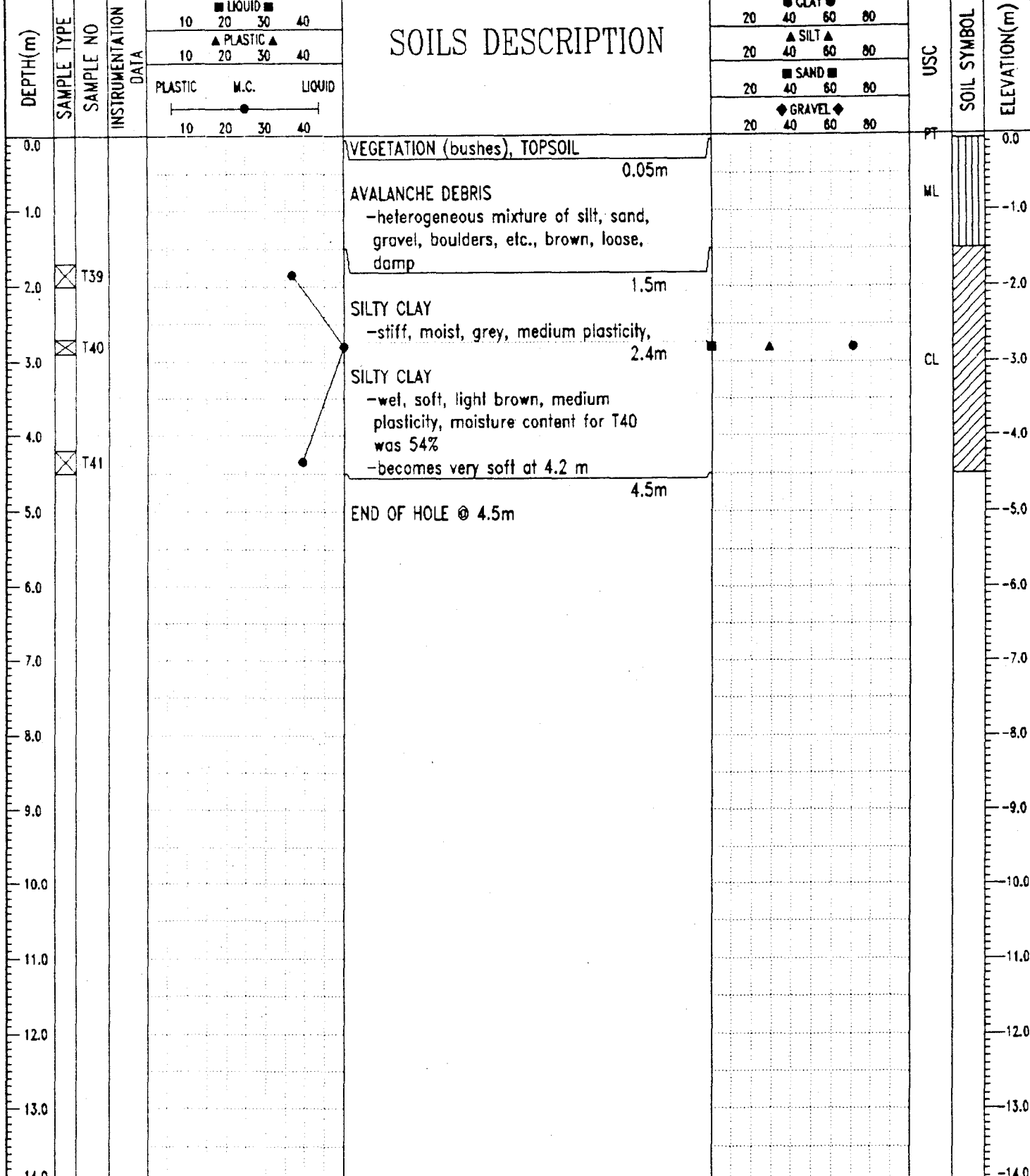
Description of Sample _____
gravelly sandy silt, ML

 Time of Sieving _____ Min.

Method of Preparation _____ Dry _____ Washed X
 Remarks _____
gravel = 23.3
sand = 28.1
fines = 48.6

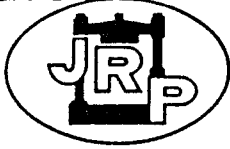


Public Works Canada Environmental A&ES	Venus Mine Tailings Site	BOREHOLE NO: V3A
Drilled using CME 75 track mounted rig	V3A located near toe of highway	PROJECT NO: 8054-12
with solid stem augers	(see site sketch)	ELEVATION:
SAMPLE TYPE <input checked="" type="checkbox"/> TUBE <input type="checkbox"/> LOST <input checked="" type="checkbox"/> AUGER <input type="checkbox"/> BULK <input type="checkbox"/> SPT <input type="checkbox"/> CORE		
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		



J.R. Paine & Associates Ltd.
Whitehorse, Yukon

LOGGED BY: MEB	COMPLETION DEPTH: 4.5 m
REVIEWED BY: WCK	COMPLETE: 95/06/14
Fig. No: 1	Page 1 of 1



J. R. Paine & Associates Ltd.

CONSULTING AND TESTING ENGINEERS

EDMONTON - GRANDE PRAIRIE - WHITEHORSE - PEACE RIVER

PROJECT VENUS MINES RECLAMATION			CLIENT Public Works Canada Environment A & ES		DATE RECORDED 6-26-95
STA.	SAMPLE TYPE AUGER	DEPTH 2.8m	HOLE NO. V3A	FIELD NO.	LAB NO. T40

GRAIN SIZE ANALYSIS

SIEVE SIZE	% FINER BY WEIGHT	SIEVE SIZE	% FINER BY WEIGHT	DIA. mm	% FINER BY WEIGHT	DIA. mm	% FINER BY WEIGHT
				.0272	99.99	.0019	71.28
				.0194	99.00	.0012	55.44
				.0138	98.01		
				.0102	97.02		
				.0072	95.04		
				.0052	91.08		
				.0037	86.13		
				.0027	79.20		

PETROGRAPHIC ANALYSIS

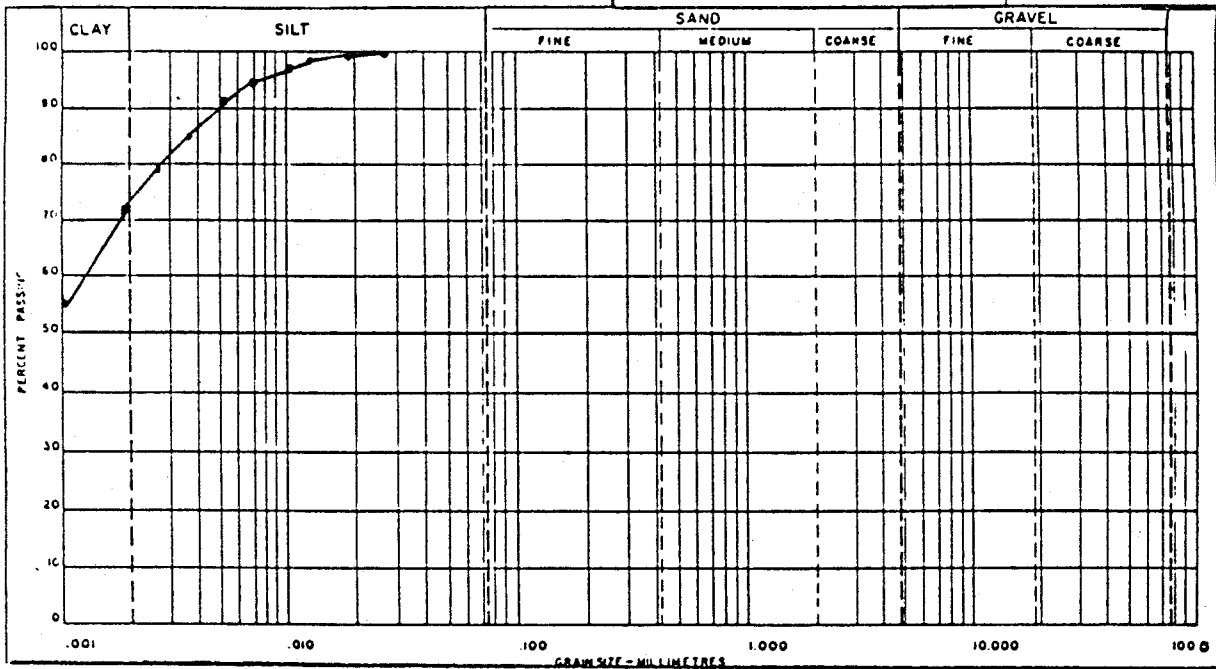
MATERIAL TYPE	% OF TOTAL SAMPLE
SAND	0.0
SILT	29.0
CLAY	71.0

SAMPLE NO.	UNIFIED CLASSIFICATION	LL	PL	PI	NATURAL % H ₂ O	SS
T40	SILTY CLAY				12	

PARTICLE SHAPE ANALYSIS

ROUND	
SUB-ROUND	
ANGULAR	
SUB-ANGULAR	
FLATS	
NEEDLES	

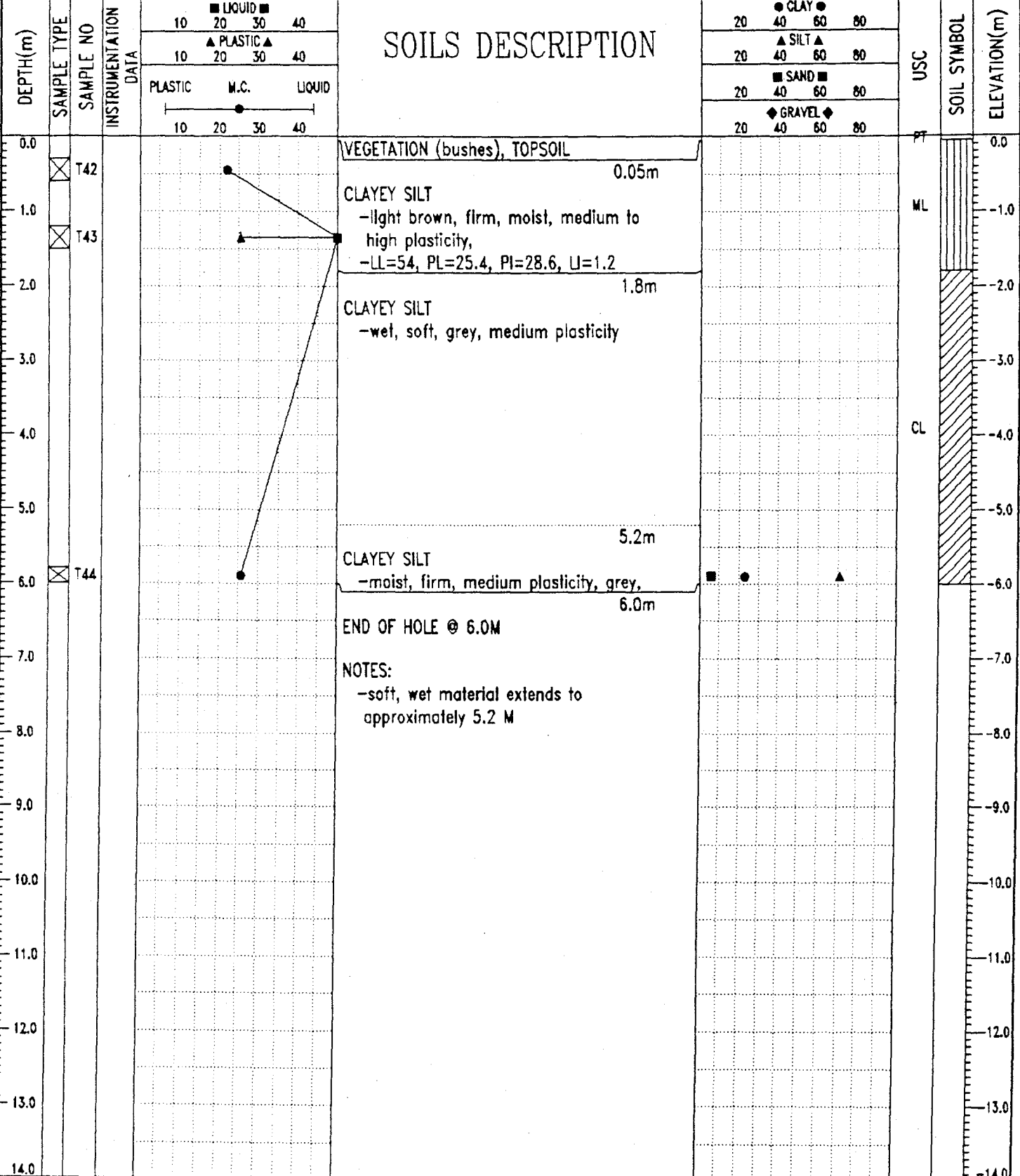
CRUSH COUNT _____ %



LABORATORY'S REMARKS SIEVE ANALYSIS WAS NOT CONDUCTED ON FINE GRAINED SAND

DATE SAMPLED _____
 DATE RECEIVED _____
 TECHNICIAN(S) M.S. / T.D.
 CHECKED BY _____

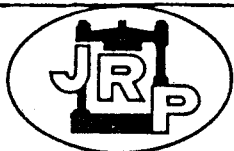
Public Works Canada Environmental A&ES	Venus Mine Tailings Site	BOREHOLE NO: V3B
Drilled using CME 75 track mounted rig	V3B located near toe of highway	PROJECT NO: 8054-12
with solid stem augers	(see site sketch)	ELEVATION:
SAMPLE TYPE	TUBE <input type="checkbox"/> LOST <input type="checkbox"/> AUGER <input checked="" type="checkbox"/> BULK <input type="checkbox"/> SPT <input type="checkbox"/> CORE <input type="checkbox"/>	
BACKFILL TYPE	BENTONITE <input checked="" type="checkbox"/> PEA GRAVEL <input type="checkbox"/> SLOUGH <input type="checkbox"/> GROUT <input type="checkbox"/> DRILL CUTTINGS <input type="checkbox"/> SAND <input type="checkbox"/>	



J.R. Paine & Associates Ltd.
Whitehorse, Yukon

LOGGED BY: MEB
REVIEWED BY: WCK
Fig. No: 1

COMPLETION DEPTH: 6.0 m
COMPLETE: 95/06/14



J. R. Paine & Associates Ltd.

CONSULTING AND TESTING ENGINEERS

EDMONTON - GRANDE PRAIRIE - WHITEHORSE - PEACE RIVER

PROJECT VENUS MINES RECLAMATION		CLIENT <i>Public Works Canada Environment A & ES</i>		DATE RECORDED 6-26-95	
STA.	SAMPLE TYPE AUGER	DEPTH 6.0 m	HOLE NO. V3B	FIELD NO.	LAB NO. T44

GRAIN SIZE ANALYSIS

SIEVE SIZE	% FINER BY WEIGHT	SIEVE SIZE	% FINER BY WEIGHT	DIA. mm	% FINER BY WEIGHT	DIA. mm	% FINER BY WEIGHT
.063	93.8			.0564	92.07	.0044	4.58
				.0404	89.10	.0032	31.65
				.0250	85.14	.0023	25.74
				.0209	82.17	.0014	18.81
				.0151	77.22		
				.0114	69.30		
				.0083	62.37		
				.0060	54.45		

PETROGRAPHIC ANALYSIS

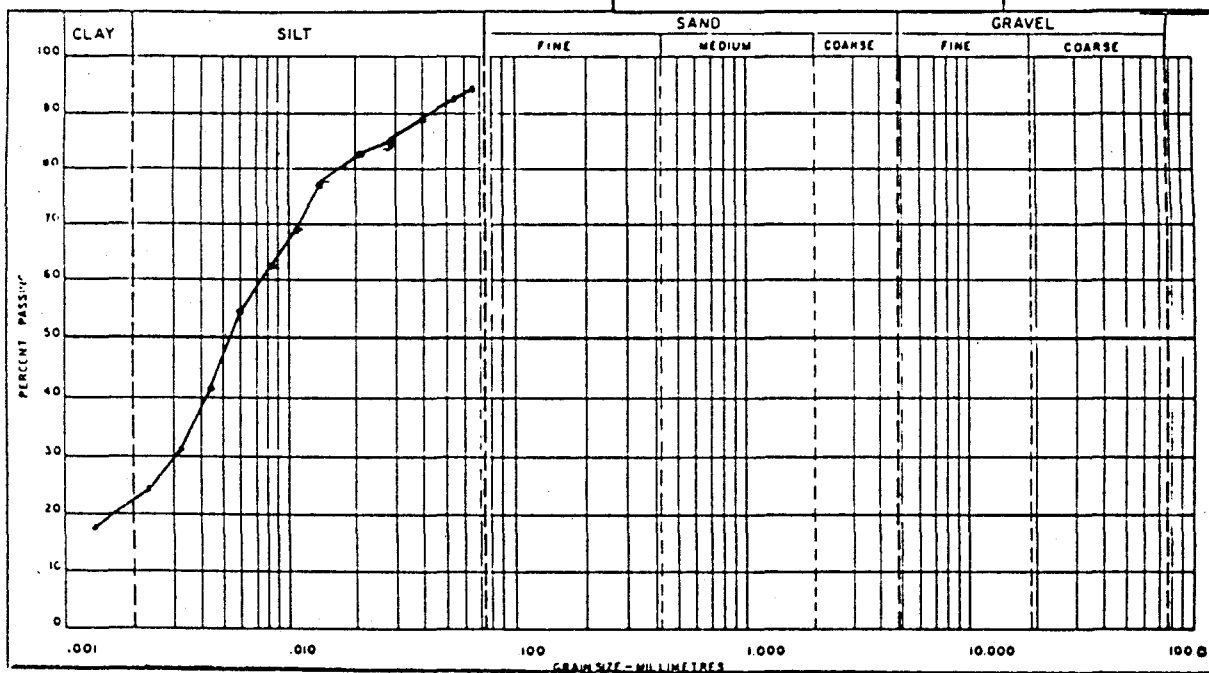
MATERIAL TYPE	% OF TOTAL SAMPLE
SAND	6.0
SILT	71.0
CLAY	23.0

SAMPLE NO.	UNIFIED CLASSIFICATION	LL	PL	PI	NATURAL % H ₂ O	SS.
T44	CLAYEY SILT				26	

PARTICLE SHAPE ANALYSIS

ROUND	
SUB-ROUND	
ANGULAR	
SUB-ANGULAR	
FLATS	
NEEDLES	

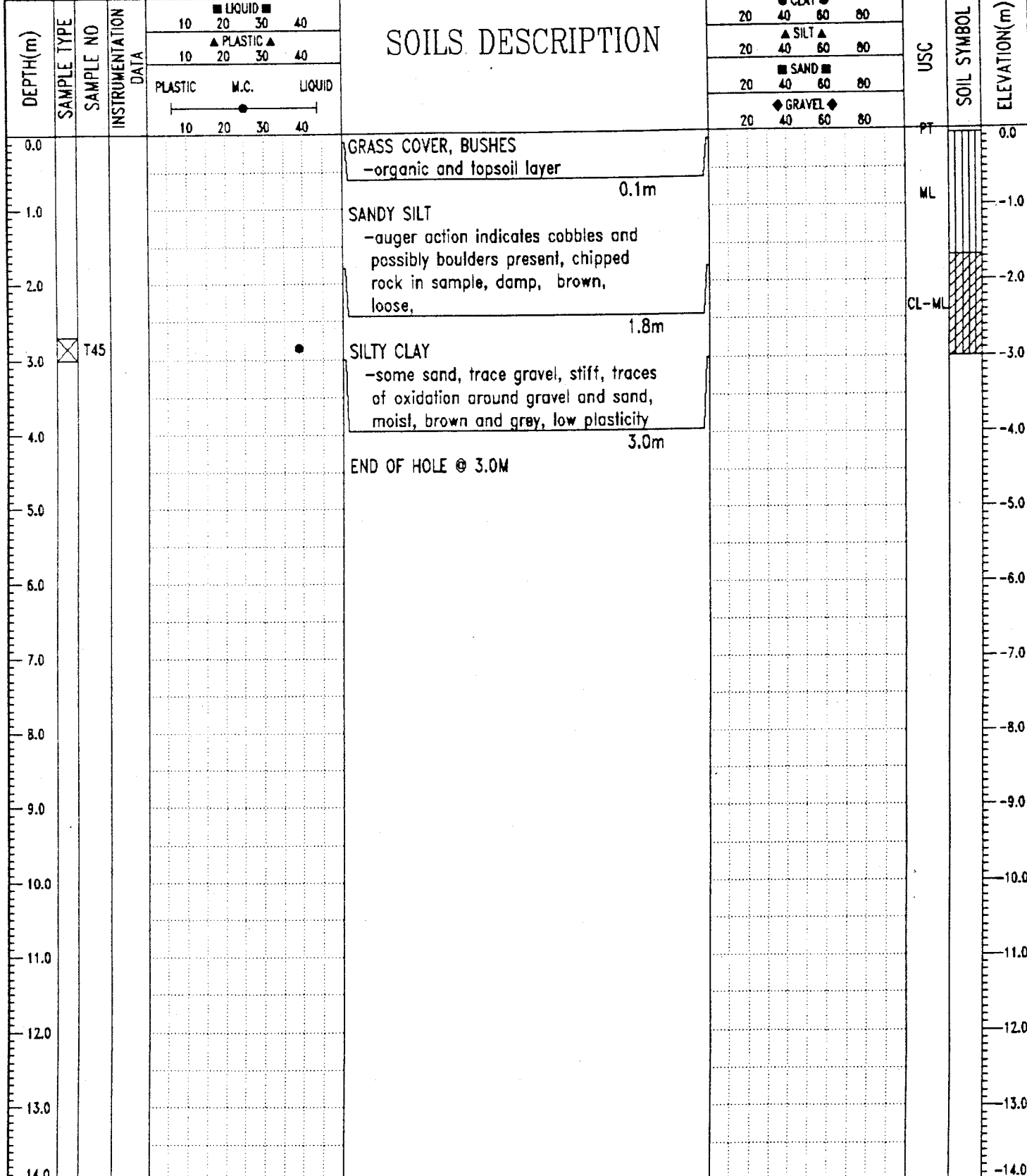
CRUSH COUNT _____ %



LABORATORY'S REMARKS SIEVE ANALYSIS WAS NOT CONDUCTED ON FINE GRAINED SAND.

DATE SAMPLED _____
 DATE RECEIVED _____
 TECHNICIAN(S) M.S. / T.D.
 CHECKED BY _____

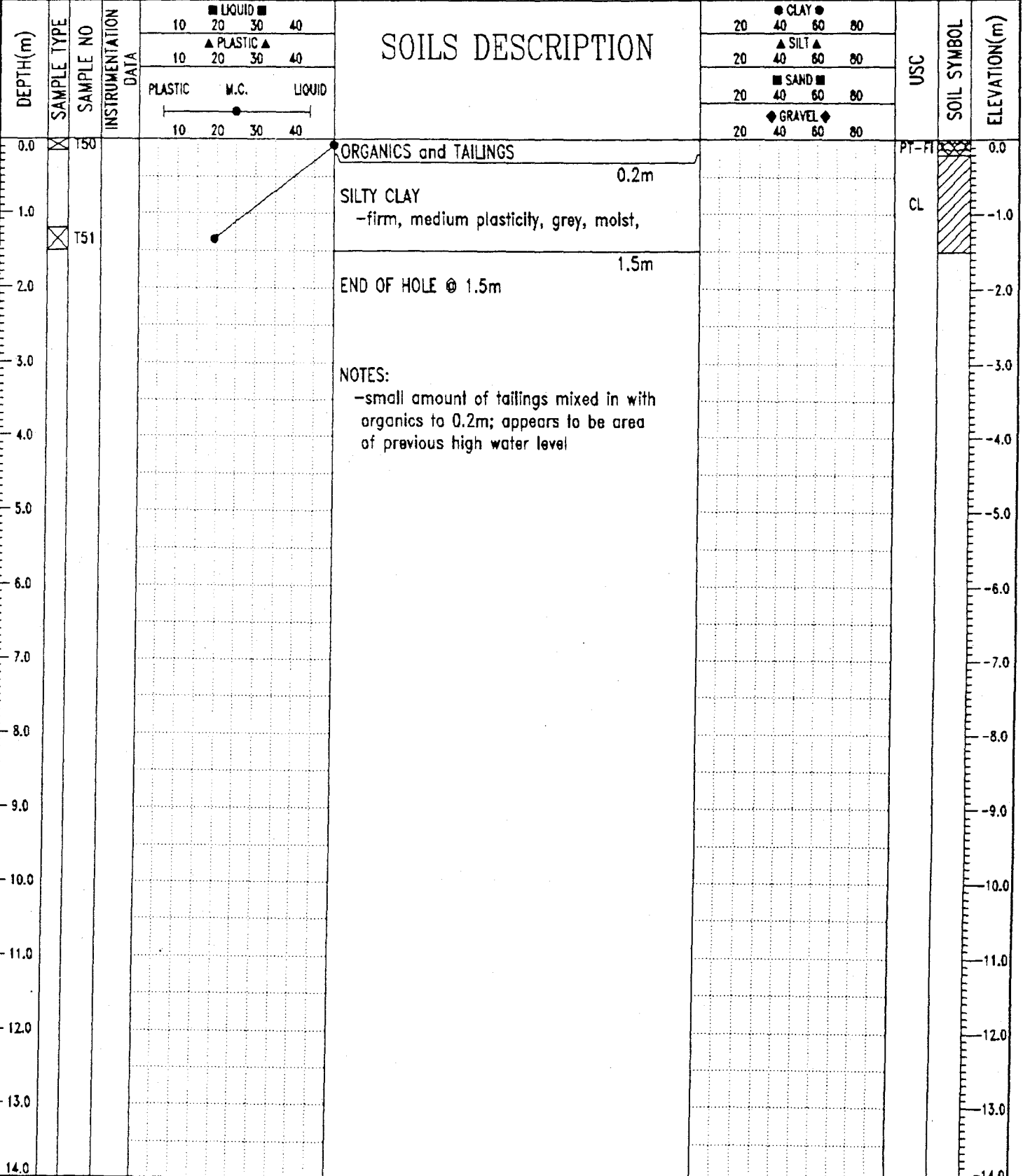
Public Works Canada Environmental A&ES	Venus Mine Tailings Site	BOREHOLE NO: V3C
Drilled using CME 75 track mounted rig	V3C located near power pole "C"	PROJECT NO: 8054-12
with solid stem augers	(see site sketch)	ELEVATION:
SAMPLE TYPE	<input checked="" type="checkbox"/> TUBE <input checked="" type="checkbox"/> LOST <input checked="" type="checkbox"/> AUGER <input type="checkbox"/> BULK <input type="checkbox"/> SPT <input type="checkbox"/> CORE	
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	



J.R. Paine & Associates Ltd.	LOGGED BY: MEB	COMPLETION DEPTH: 3.0 m
Whitehorse, Yukon	REVIEWED BY: WCK	COMPLETE: 95/06/15
	Flg. No: 1	Page 1 of 1

Public Works Canada Environmental A&ES Venus Mine Tailings Site BOREHOLE NO: V3E
 Drilled using CME 75 track mounted rig V3E located near northwest perimeter of PROJECT NO: 8054-12
 with solid stem augers tailings area (see site sketch) ELEVATION:

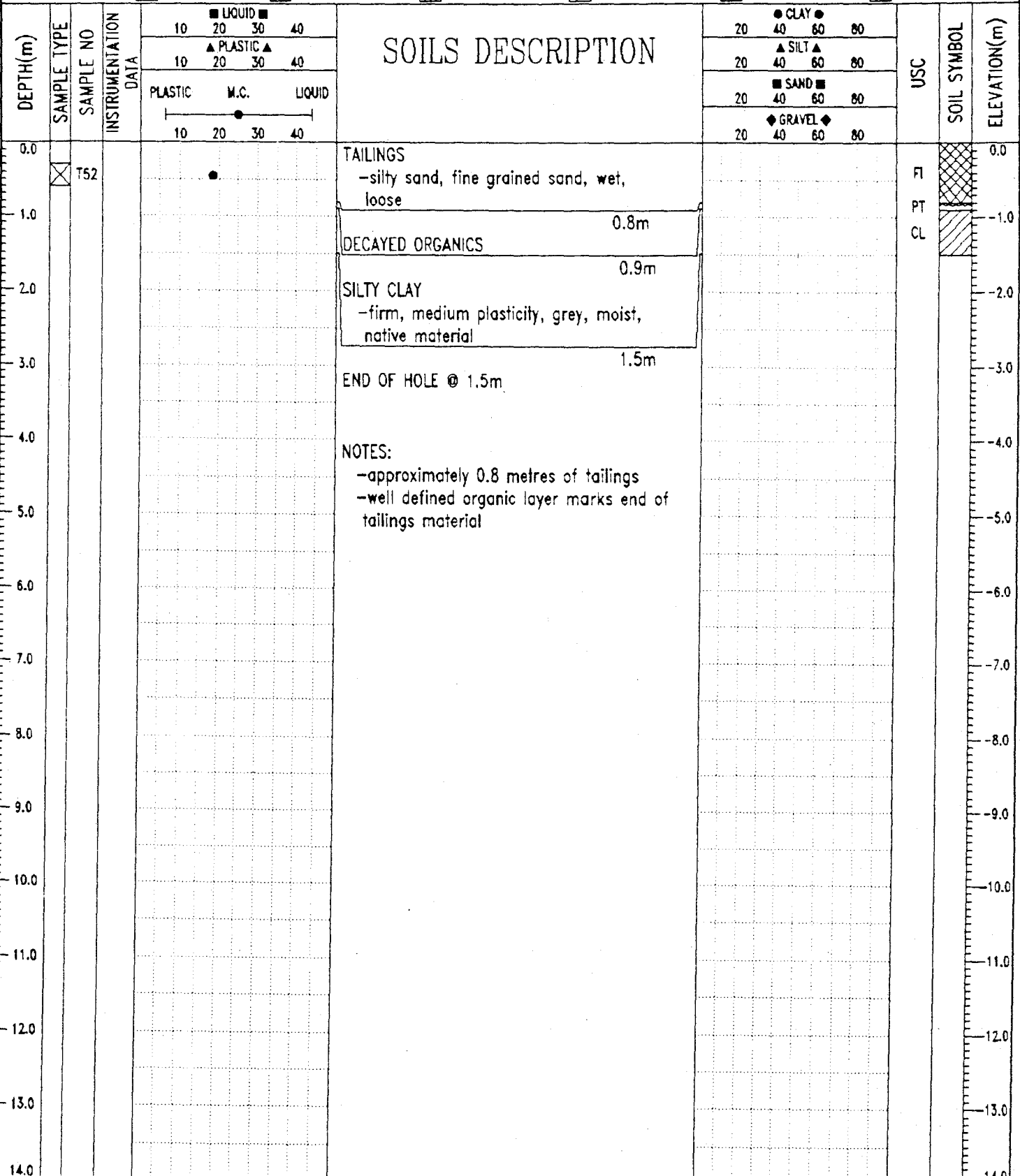
SAMPLE TYPE TUBE LOST AUGER BULK SPT CORE
 BACKFILL TYPE BENTONITE PEA GRAVEL SLOUGH GROUT DRILL CUTTINGS SAND



J.R. Paine & Associates Ltd.
 Whitehorse, Yukon

LOGGED BY: MEB COMPLETION DEPTH: 1.5 m
 REVIEWED BY: WCK COMPLETE: 95/06/15
 Flg. No: 1 Page 1 of 1

Public Works Canada Environmental A&ES	Venus Mine Tailings Site	BOREHOLE NO: V3F
Drilled using CME 75 track mounted rig	V3F located near northwest perimeter of	PROJECT NO: 8054-12
with solid stem augers	tailings area (see site sketch)	ELEVATION:
SAMPLE TYPE <input checked="" type="checkbox"/> TUBE <input type="checkbox"/> LOST <input checked="" type="checkbox"/> AUGER <input type="checkbox"/> BULK <input type="checkbox"/> SPT <input type="checkbox"/> CORE		
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		



J.R. Paine & Associates Ltd.
Whitehorse, Yukon

LOGGED BY: MEB
REVIEWED BY: WCK
Fig. No: 1

COMPLETION DEPTH: 1.5 m
COMPLETE: 95/06/15



J. R. Paine & Associates Ltd.

CONSULTING AND TESTING ENGINEERS

SCREEN ANALYSIS

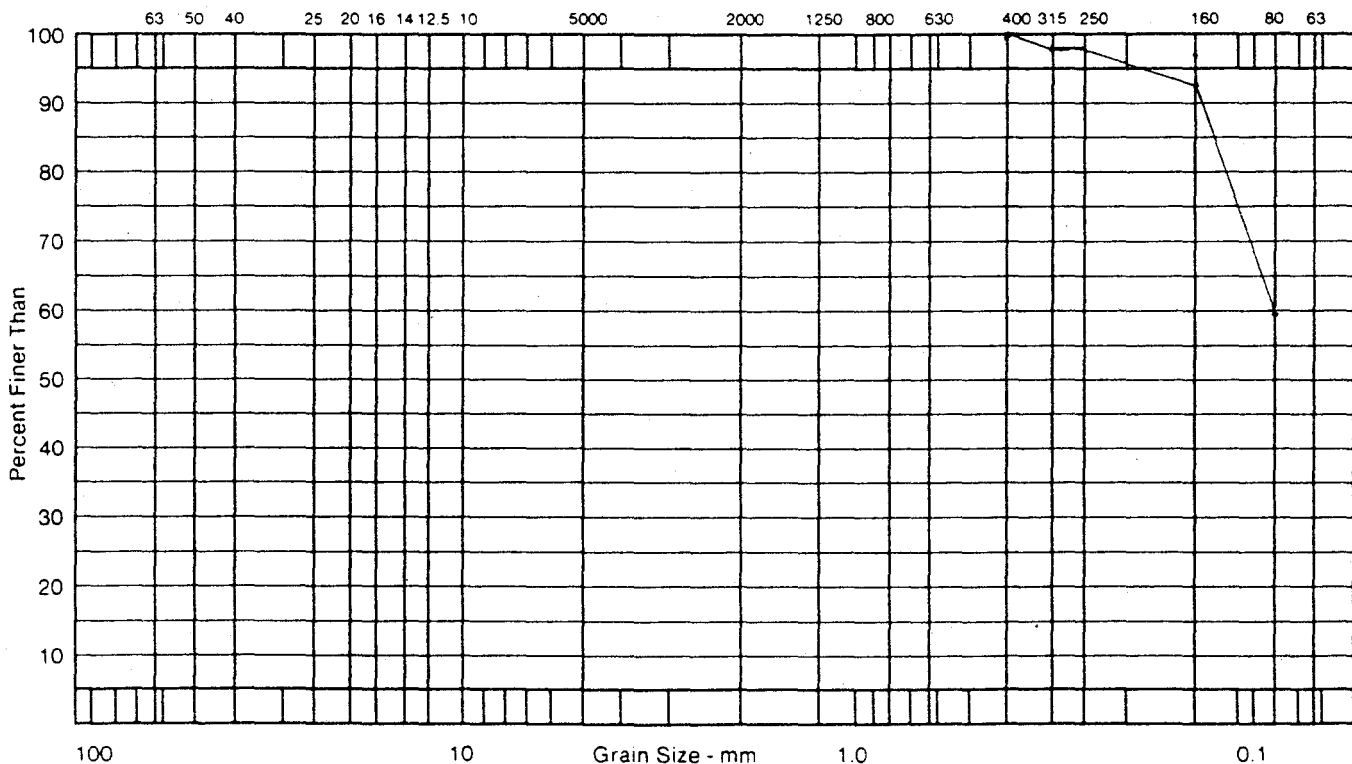
Client: PWGSC, A & ES
 Sample: T36 Depth: 0.2-0.4m Project: Venus Mines Reclamation
 Location: Tailings Area, Test Hole V4 Made by: P.R. Job No: 8054-12
 Ck'd by: M.B. Date: 95/06/23

Sieve No.	Size of Opening MM	Weight Retained gms	Total Wt. Finer Than gms	Percent Finer Than	% Finer Than Basis Orig. Sample
80,000	80.000				
50,000	50.000				
20,000	20.000				
10,000	10.000				
5,000	5.000				
2,500	2.500				
2,000	2.000				
1,250	1.250				
800	.800				
630	.630				
400	.400				100.0
315	.315				98.6
250	.250				98.2
160	.160				92.2
80	.080				59.3

Description of Sample _____
sandy silt, ML

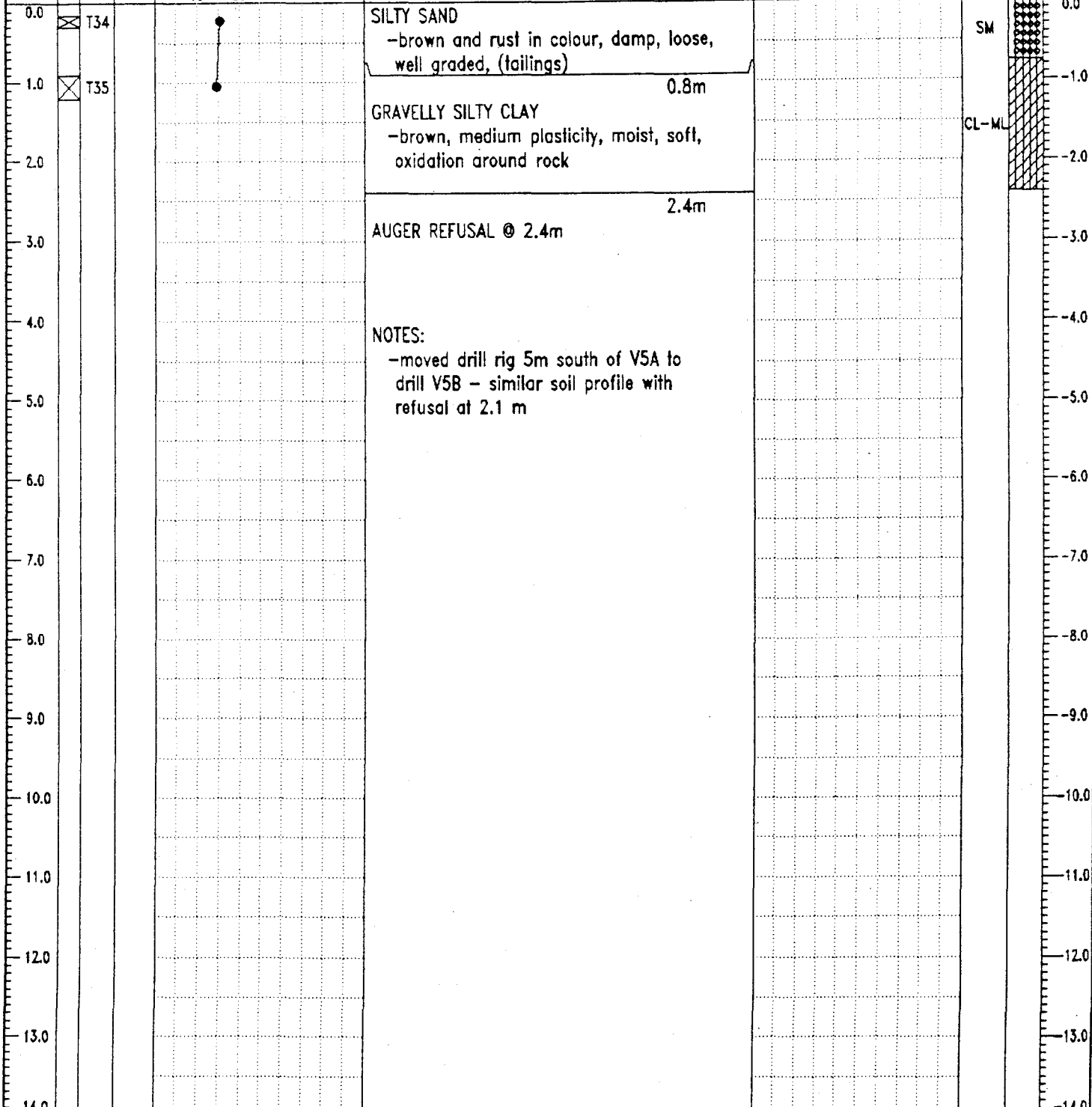
Method of Preparation _____ Dry _____ Washed X
 Remarks _____
gravel = 0 %
sand = 40.7 %
fines = 59.3 %

Time of Sieving _____ Min.



Public Works Canada Environmental A&S Venus Mine Tailings Site BOREHOLE NO: V5A
 Drilled using CME 75 track mounted rig V5A located within breach area- south PROJECT NO: 8054-12
 with solid stem augers west corner of tailings area ELEVATION:

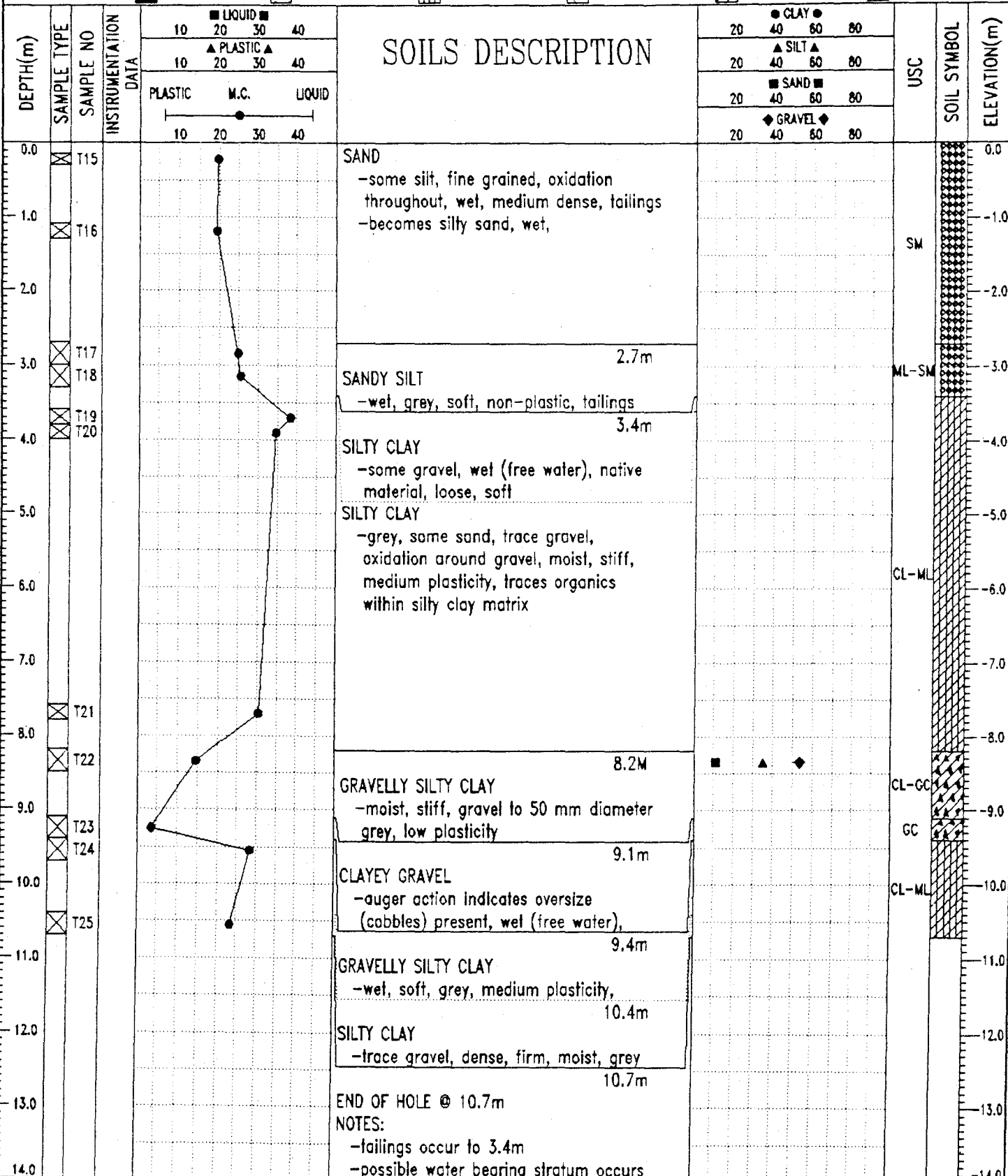
SAMPLE TYPE TUBE LOST AUGER BULK SPT CORE
 BACKFILL TYPE BENTONITE PEA GRAVEL SLOUGH GROUT DRILL CUTTINGS SAND



J.R. Paine & Associates Ltd. LOGGED BY: MEB COMPLETION DEPTH: 2.4 m
 Whitehorse, Yukon REVIEWED BY: WCK COMPLETE: 95/06/14
 Fig. No: 1 Page 1 of 1

Public Works Canada Environmental A&S Venus Mine Tailings Site BOREHOLE NO: V6
 Drilled using CME 75 track mounted rig V6 located west of berm at east edge of PROJECT NO: 8054-12
 with solid stem augers tailings area (see site sketch) ELEVATION:

SAMPLE TYPE TUBE LOST AUGER BULK SPT CORE
 BACKFILL TYPE BENTONITE PEA GRAVEL SLOUGH GROUT DRILL CUTTINGS SAND



J.R. Paine & Associates Ltd.
Whitehorse, Yukon

LOGGED BY: MEB COMPLETION DEPTH: 10.7 m
 REVIEWED BY: WCK COMPLETE: 95/06/14
 Flg. No: 1 Page 1 of 1



J. R. Paine & Associates Ltd.

CONSULTING AND TESTING ENGINEERS

SCREEN ANALYSIS

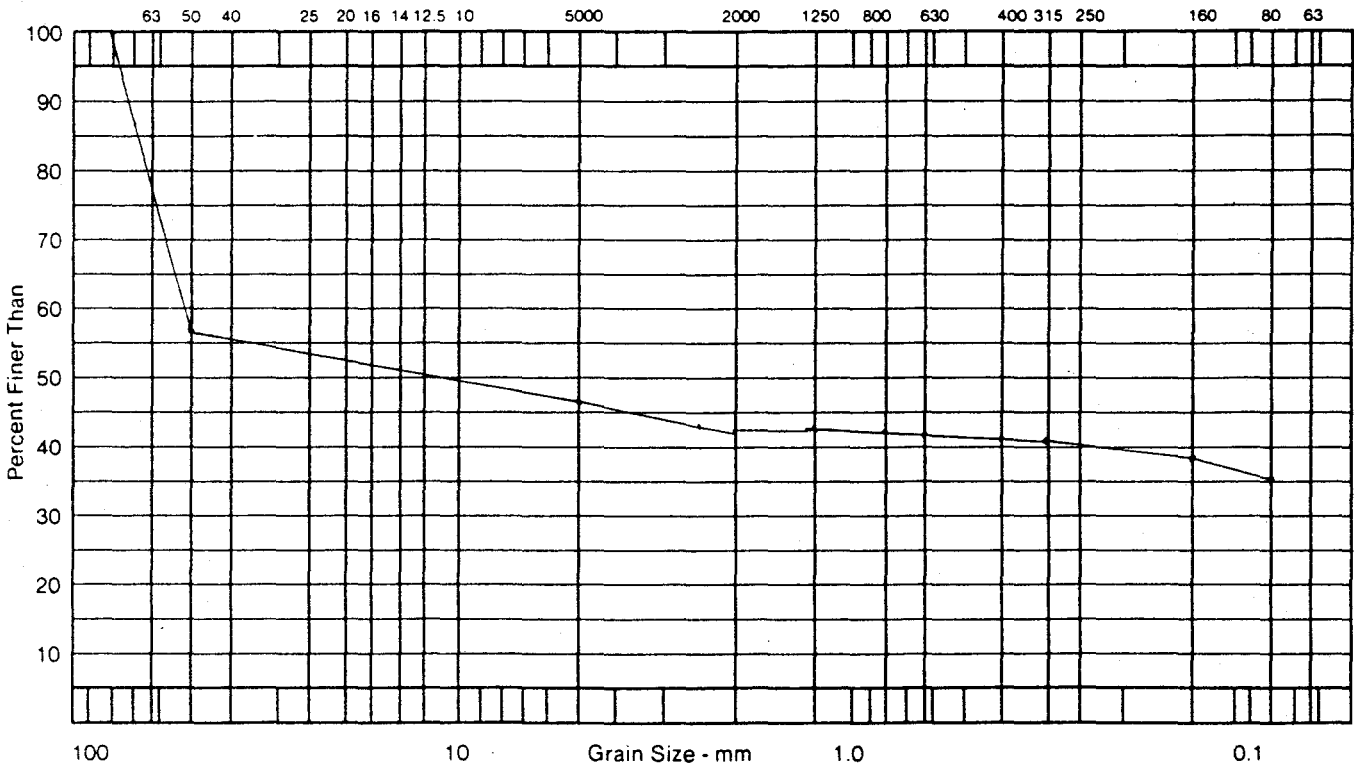
Client: PWGSC, A & ES
 Sample: T22 Depth: 8.2-8.4m Project: Venus Mines Reclamation
 Location: Tailings Area, Test Hole V6 Made by: P.R. Job No: 8054-12
 Ck'd by: M.B. Date: 95/06/23

Sieve No.	Size of Opening MM	Weight Retained gms	Total Wt. Finer Than gms	Percent Finer Than	% Finer Than Basis Orig. Sample
80,000	80,000				100.0
50,000	50,000				56.1
20,000	20,000				
10,000	10,000				
5,000	5,000				46.2
2,500	2,500				43.8
2,000	2,000				43.4
1,250	1,250				42.5
800	800				42.1
630	630				41.6
400	400				41.1
315	315				40.6
250	250				39.8
160	160				38.6
80	80				35.0

Description of Sample _____
silty gravel, some sand, GM

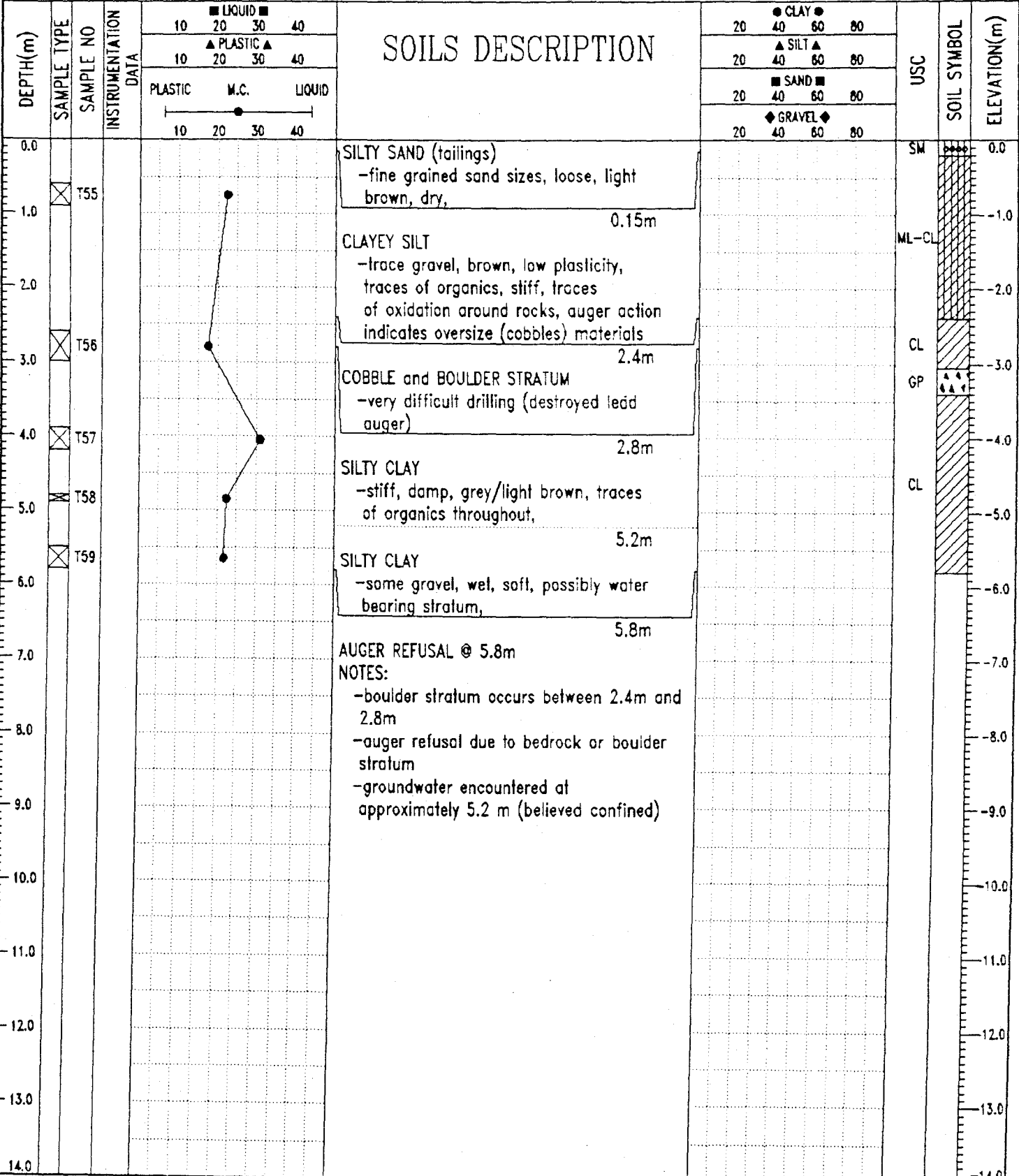
Method of Preparation _____ Dry _____ Washed X
 Remarks gravel = 53.8
sand = 11.2
finer = 35.0
 NOTE: COBBLE IN SAMPLE

Time of Sieving _____ Min.



Public Works Canada Environmental A&S Venus Mine Tailings Site BOREHOLE NO: V6B
 Drilled using CME 75 track mounted rig V10B located on berm at east edge of PROJECT NO: 8054-12
 with solid stem augers tailings area (see site sketch) ELEVATION:

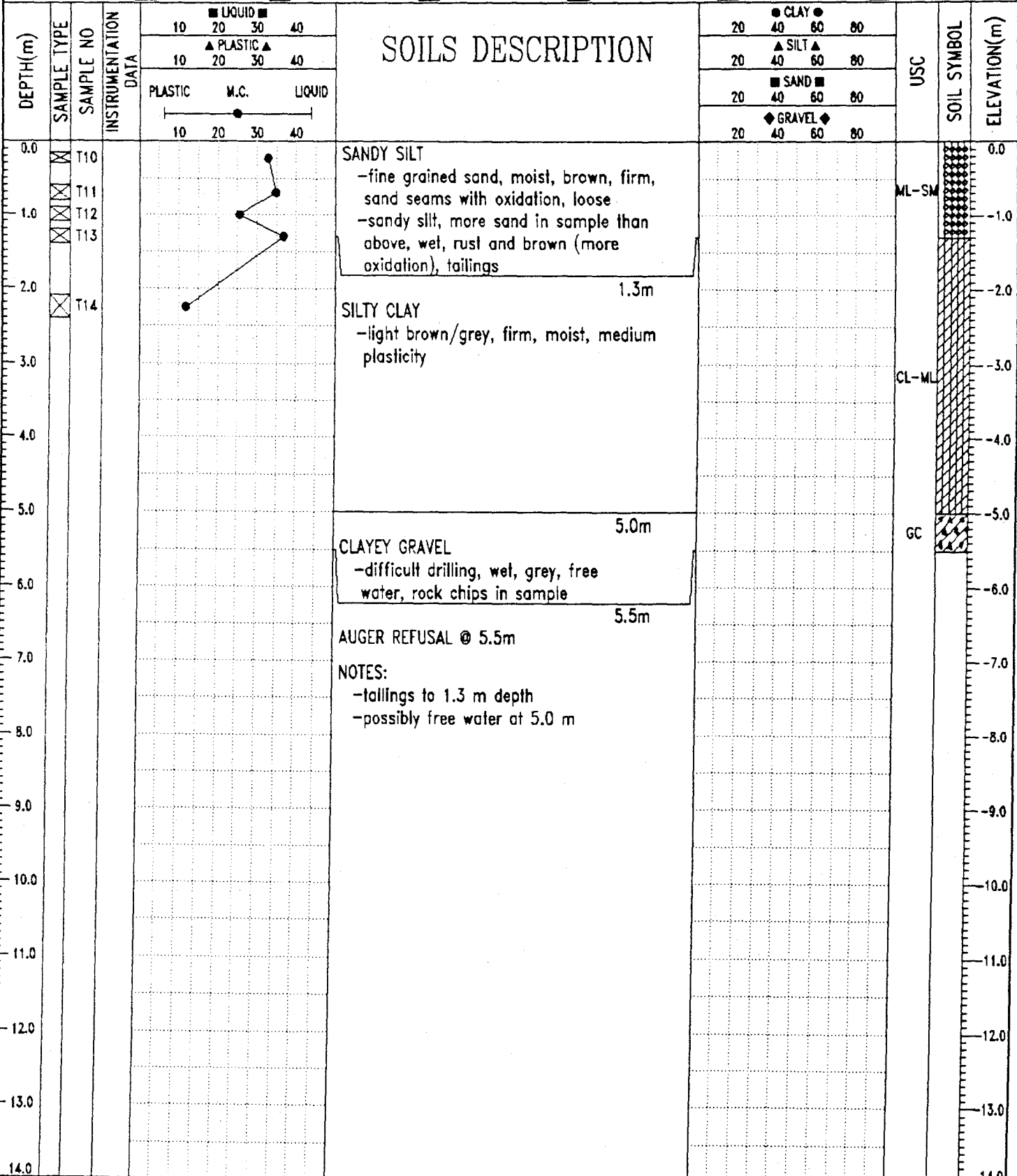
SAMPLE TYPE TUBE LOST AUGER BULK SPT CORE
 BACKFILL TYPE BENTONITE PEA GRAVEL SLOUGH GROUT DRILL CUTTINGS SAND



J.R. Paine & Associates Ltd.
 Whitehorse, Yukon

LOGGED BY: MEB COMPLETION DEPTH: 5.8 m
 REVIEWED BY: WCK COMPLETE: 95/06/15
 Flg. No: 1 Page 1 of 1

Public Works Canada Environmental A&ES	Venus Mine Tailings Site	BOREHOLE NO: V7
Drilled using CME 75 track mounted rig	V7 located north east perimeter of	PROJECT NO: 8054-12
with solid stem augers	tailings area (see site sketch)	ELEVATION:
SAMPLE TYPE <input checked="" type="checkbox"/> TUBE <input type="checkbox"/> LOST <input checked="" type="checkbox"/> AUGER <input type="checkbox"/> BULK <input type="checkbox"/> SPT <input type="checkbox"/> CORE		
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		



SANDY SILT
 -fine grained sand, moist, brown, firm, sand seams with oxidation, loose
 -sandy silt, more sand in sample than above, wet, rust and brown (more oxidation), tailings

SILTY CLAY
 -light brown/grey, firm, moist, medium plasticity

CLAYEY GRAVEL
 -difficult drilling, wet, grey, free water, rock chips in sample

AUGER REFUSAL @ 5.5m

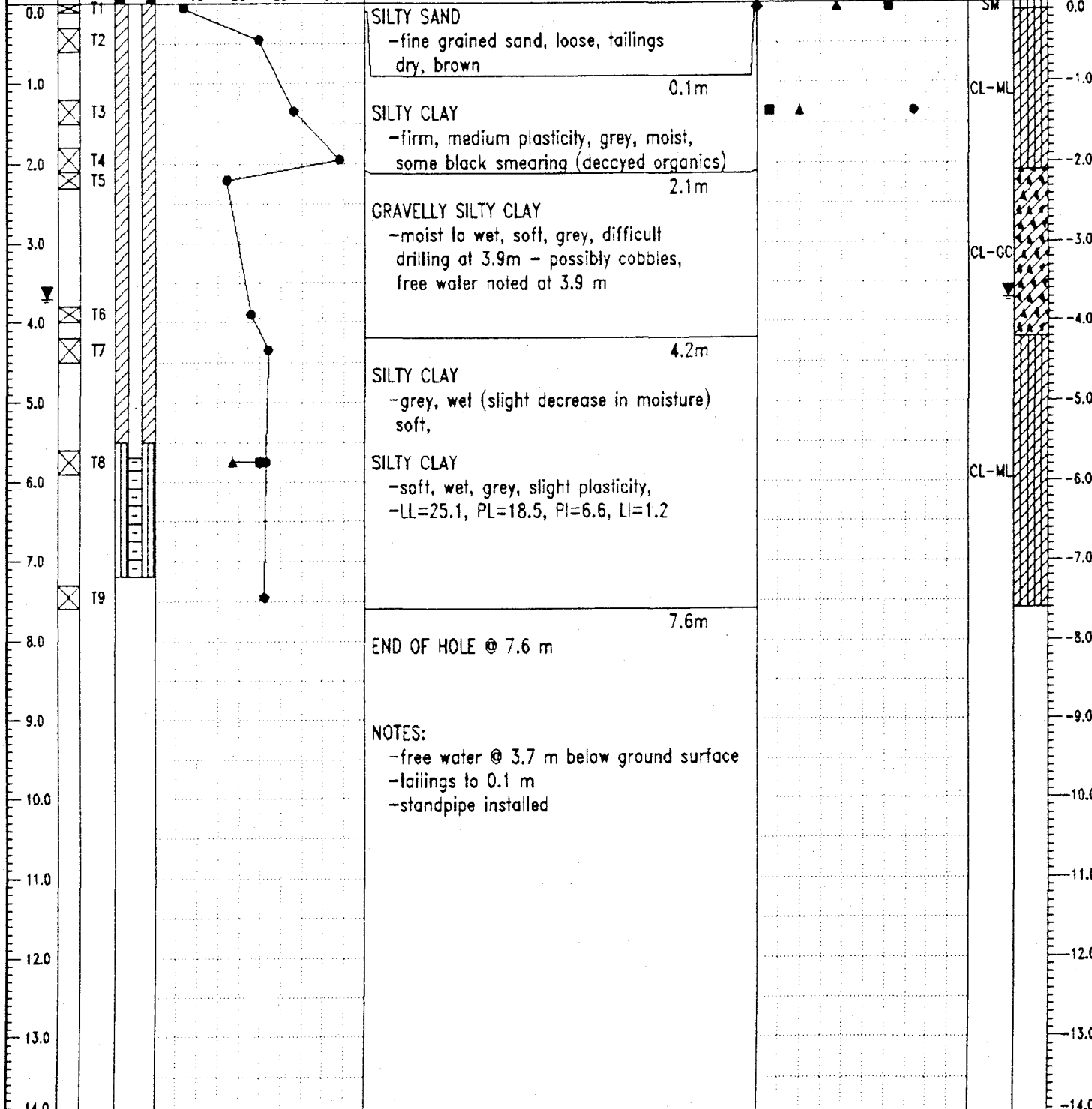
NOTES:
 -tailings to 1.3 m depth
 -possibly free water at 5.0 m

J.R. Paine & Associates Ltd.
 Whitehorse, Yukon

LOGGED BY: MEB	COMPLETION DEPTH: 5.5 m
REVIEWED BY: WCK	COMPLETE: 95/06/14
Fig. No: 1	Page 1 of 1

Public Works Canada Environmental A&ES	Venus Mine Tailings Site	BOREHOLE NO: V8
Drilled using CME 75 track mounted rig	V8 located north east perimeter of	PROJECT NO: 8054-12
with solid stem augers	tailings area (see site sketch)	ELEVATION:

SAMPLE TYPE	<input checked="" type="checkbox"/> TUBE	<input type="checkbox"/> LOST	<input checked="" type="checkbox"/> AUGER	<input type="checkbox"/> BULK	<input type="checkbox"/> SPT	<input type="checkbox"/> CORE
BACKFILL TYPE	<input checked="" type="checkbox"/> BENTONITE	<input type="checkbox"/> FEA GRAVEL	<input type="checkbox"/> SLOUGH	<input type="checkbox"/> GROUT	<input type="checkbox"/> DRILL CUTTINGS	<input type="checkbox"/> SAND



J.R. Paine & Associates Ltd. Whitehorse, Yukon	LOGGED BY: MEB	COMPLETION DEPTH: 7.6 m
	REVIEWED BY: WCK	COMPLETE: 95/06/14
	Flg. No: 1	Page 1 of 1



J. R. Paine & Associates Ltd.

CONSULTING AND TESTING ENGINEERS

SCREEN ANALYSIS

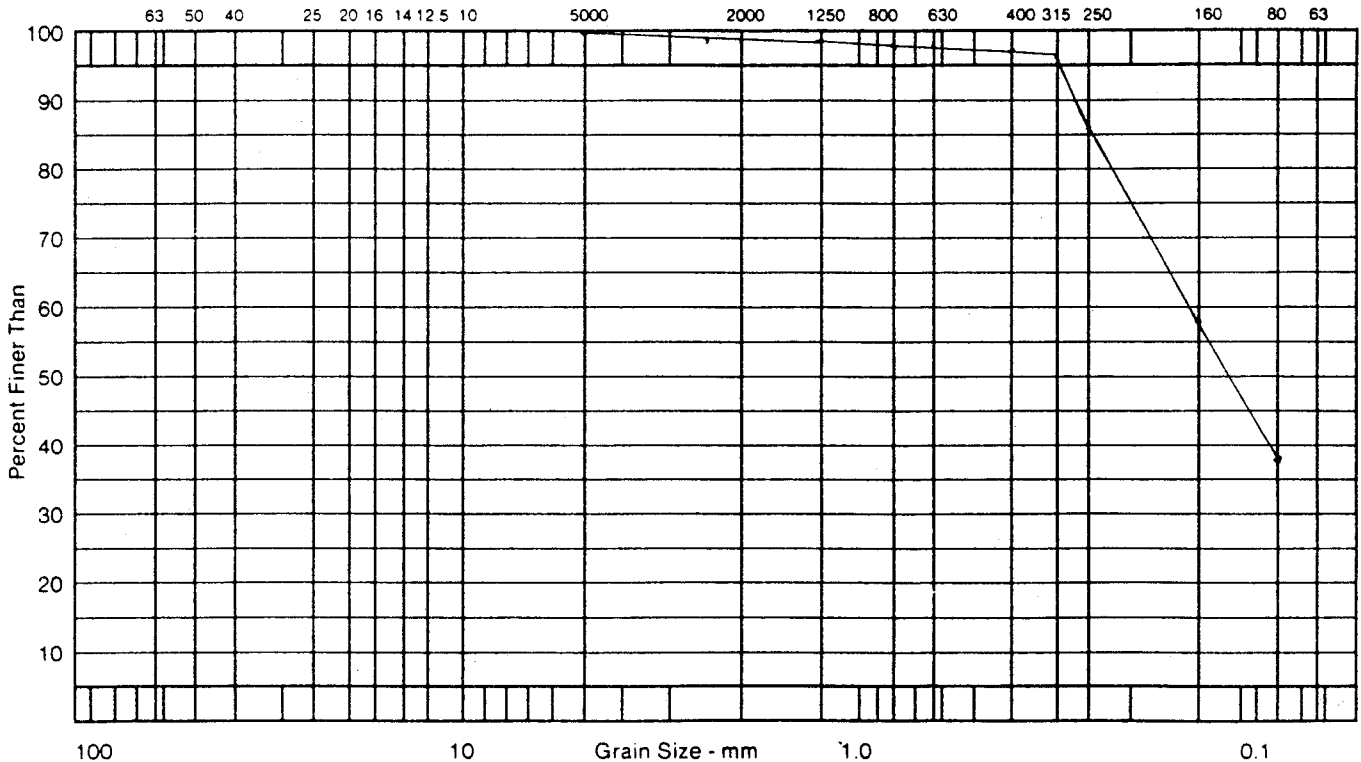
Client: PWGSC, A & ES
 Sample: T1 Depth: 0-0.2m Project: Venus Mines Reclamation
 Location: Tailings Area, Test Hole V8 Made by: P.R. Job No.: 8054-12
 Ck'd by: M.B. Date: 95/06/23

Sieve No.	Size of Opening MM	Weight Retained gms	Total Wt. Finer Than gms	Percent Finer Than	% Finer Than Basis Orig Sample
80,000	80.000				
50,000	50.000				
20,000	20.000				
10,000	10.000				
5,000	5.000				100.0
2,500	2.500				99.6
2,000	2.000				99.4
1,250	1.250				99.1
800	.800				98.5
630	.630				97.9
400	.400				96.3
315	.315				95.5
250	.250				85.2
160	.160				57.7
80	.080				37.6

Description of Sample _____
silty sand, SM

Method of Preparation _____ Dry _____ Washed X
 Remarks _____
gravel = 0 %
sand = 62.4%
finer = 37.6%

Time of Sieving _____ Min.





J. R. Paine & Associates Ltd.

CONSULTING AND TESTING ENGINEERS

EDMONTON - GRANDE PRAIRIE - WHITEHORSE - PEACE RIVER

PROJECT VENUS MINES RECLAMATION		CLIENT Public Works Canada Environment A & ES		DATE RECORDED 6-26-95	
STA.	SAMPLE TYPE AUGER	DEPTH 1.3 m	SOLE NO. V8	FIELD NO.	LAB NO. T3

GRAIN SIZE ANALYSIS

SIEVE SIZE	% FINER BY WEIGHT	SIEVE SIZE	% FINER BY WEIGHT	DIA. mm	% FINER BY WEIGHT	DIA. mm	% FINER BY WEIGHT
.063	93.6			.0105	93.06		
				.0074	89.09		
				.0052	88.50		
				.0037	85.14		
				.0027	80.19		
				.0020	74.25		
				.0012	64.35		

PETROGRAPHIC ANALYSIS

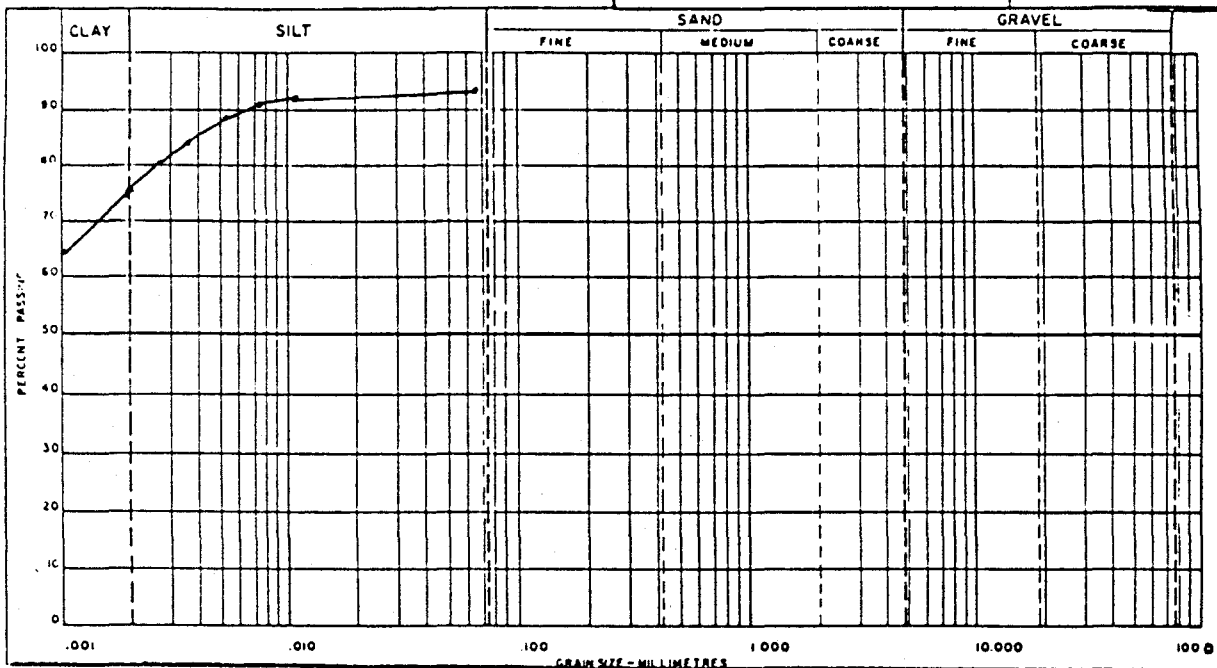
MATERIAL TYPE	% OF TOTAL SAMPLE
SAND	6.0
SILT	20.0
CLAY	74.0

SAMPLE NO.	UNIFIED CLASSIFICATION	LL	PL	PI	NATURAL % H ₂ O	SS.
T3	SILTY CLAY				33	

PARTICLE SHAPE ANALYSIS

ROUND	
SUB-ROUND	
ANGULAR	
SUB-ANGULAR	
FLATS	
NEEDLES	

CRUSH COUNT _____ %

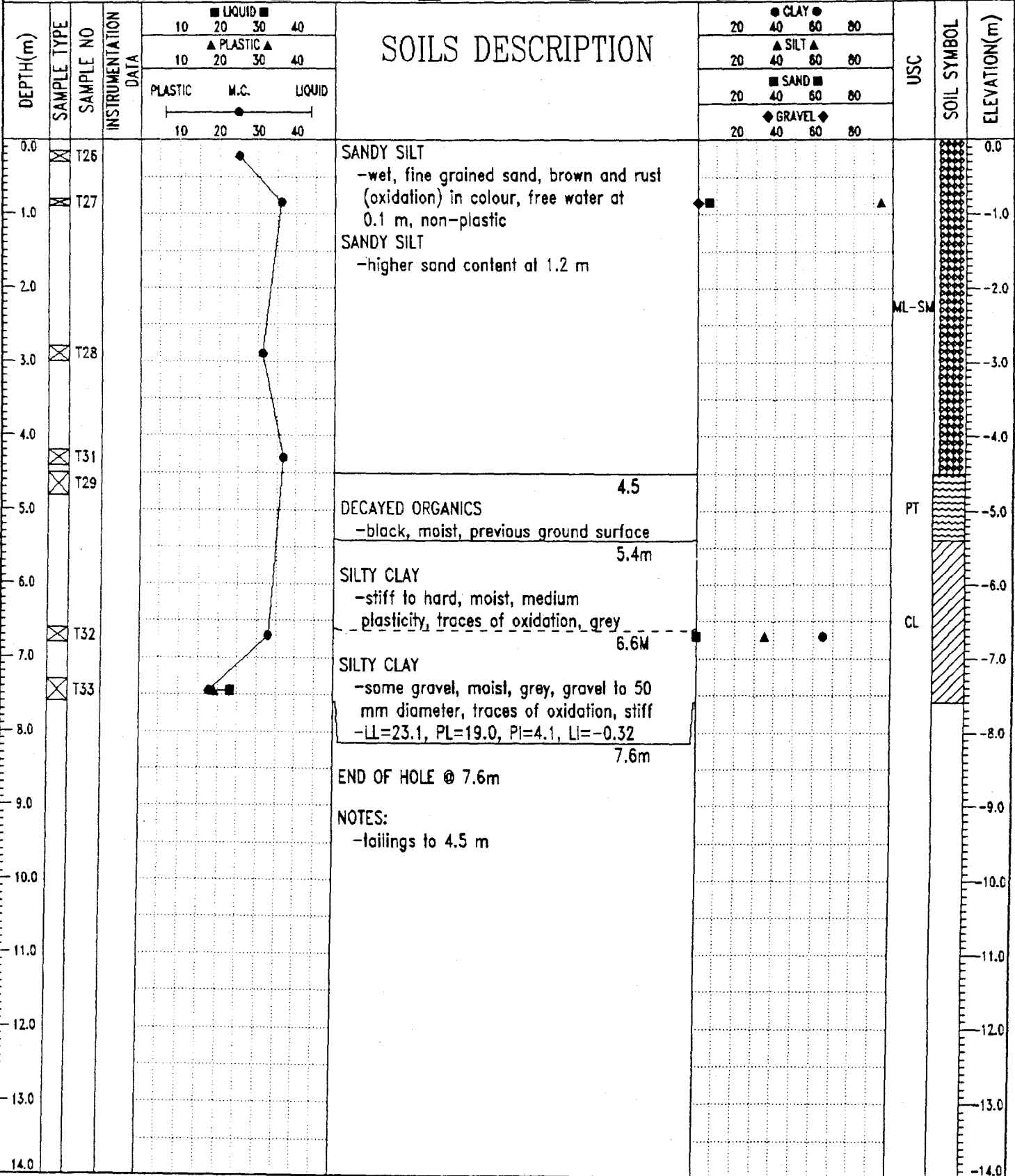


LABORATORY'S REMARKS SIEVE ANALYSIS WAS NOT CONDUCTED ON FINE GRAINED SAND

DATE SAMPLED _____
 DATE RECEIVED _____
 TECHNICIAN(S) M.S. / T.D.
 CHECKED BY _____

Public Works Canada Environmental A&S Venus Mine Tailings Site BOREHOLE NO: V9
 Drilled using CME 75 track mounted rig V9 located just south of tailings pond PROJECT NO: 8054-12
 with solid stem augers within tailings area (see site sketch) ELEVATION:

SAMPLE TYPE TUBE LOST AUGER BULK SPT CORE
 BACKFILL TYPE BENTONITE PEA GRAVEL SLOUGH GROUT DRILL CUTTINGS SAND



J.R. Paine & Associates Ltd.
 Whitehorse, Yukon

LOGGED BY: MEB
 REVIEWED BY: WCK
 Flg. No: 1

COMPLETION DEPTH: 7.6 m
 COMPLETE: 95/06/14



J. R. Paine & Associates Ltd.

CONSULTING AND TESTING ENGINEERS

SCREEN ANALYSIS

Client: PWGSC, A & ES
 Sample: T27 Depth: 0.8-1.0m Project: Venus Mines Reclamation
 Location: Tailings Area, Test Hole V9 Made by: P.R. Job No.: 8054-12
 Checked by: M.B. Date: 95/06/23

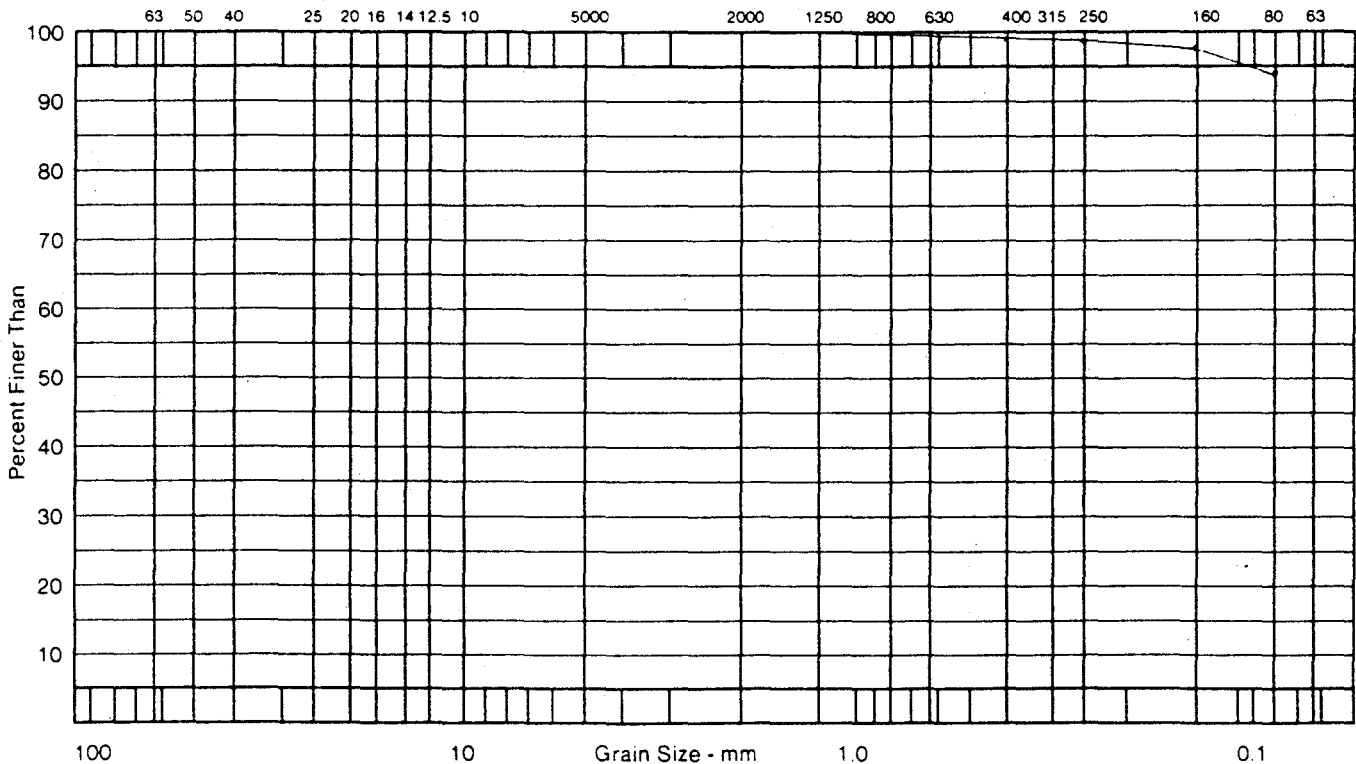
Sieve No.	Size of Opening MM	Weight Retained gms	Total Wt. Finer Than gms	Percent Finer Than	% Finer Than Basis Orig. Sample
80,000	80,000				
50,000	50,000				
20,000	20,000				
10,000	10,000				
5,000	5,000				
2,500	2,500				
2,000	2,000				
1,250	1,250				100.0
800	.800				99.8
630	.630				99.7
400	.400				99.6
315	.315				99.4
250	.250				99.0
160	.160				98.1
80	.080				94.1

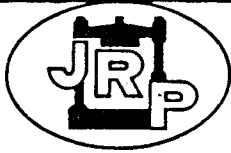
Description of Sample _____
silt, trace sand, ML

Method of Preparation _____ Dry _____ Washed

Remarks _____
gravel = 0 %
sand = 5.9%
finer = 94.1%

Time of Sieving _____ Min.





J. R. Paine & Associates Ltd.

CONSULTING AND TESTING ENGINEERS

EDMONTON - GRANDE PRAIRIE - WHITEHORSE - PEACE RIVER

PROJECT VENUS MINES RECLAMATION		CLIENT Public Works Canada Environment A & ES		DATE RECORDED 6-26-95	
STA.	SAMPLE TYPE AUGER	DEPTH 5.9 m	HOLE NO. V9	FIELD NO.	LAB NO. T32

GRAIN SIZE ANALYSIS

SIEVE SIZE	% FINER BY WEIGHT	SIEVE SIZE	% FINER BY WEIGHT	DIA. mm	% FINER BY WEIGHT	DIA. mm	% FINER BY WEIGHT
				.0192	99.99	.0075	52.47
				.0137	99.00		
				.0101	98.01		
				.0075	95.04		
				.0052	91.08		
				.0037	84.15		
				.0028	75.24		
				.0020	65.34		

PETROGRAPHIC ANALYSIS

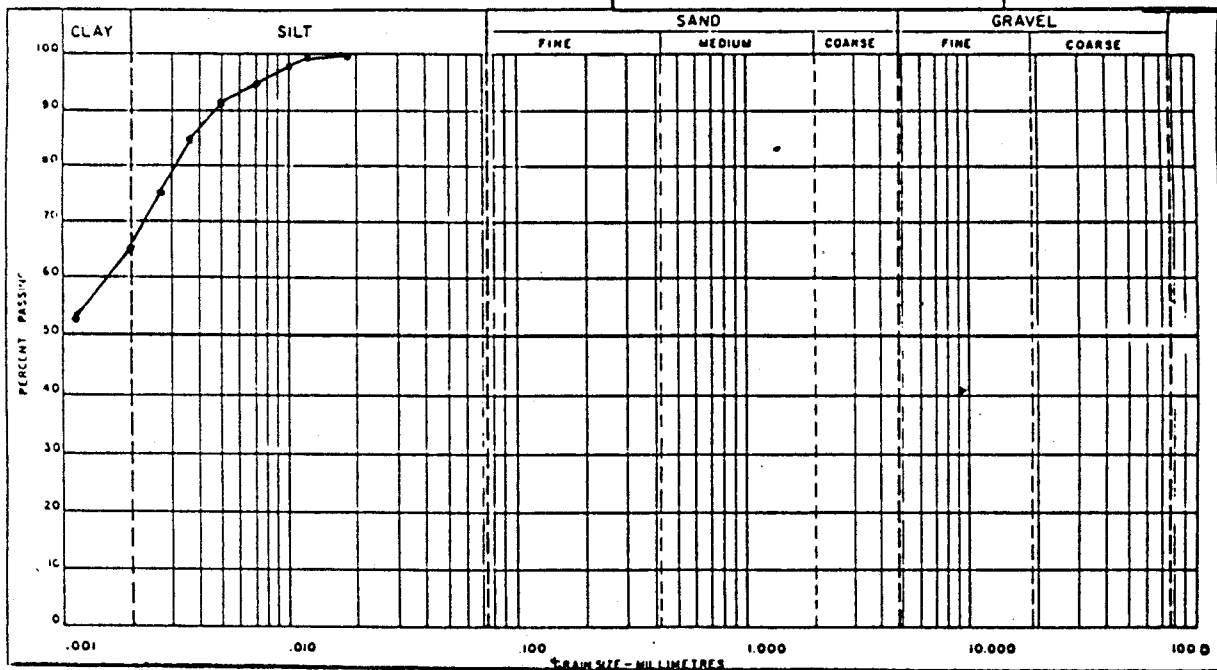
MATERIAL TYPE	% OF TOTAL SAMPLE
SAND	0.0
SILT	35.0
CLAY	65.0

SAMPLE NO.	UNIFIED CLASSIFICATION	LL	PL	PI	NATURAL % H ₂ O	SS.
T32	SILTY CLAY				32	

PARTICLE SHAPE ANALYSIS

ROUND	
SUB-ROUND	
ANGULAR	
SUB-ANGULAR	
FLATS	
NEEDLES	

CRUSH COUNT _____ %

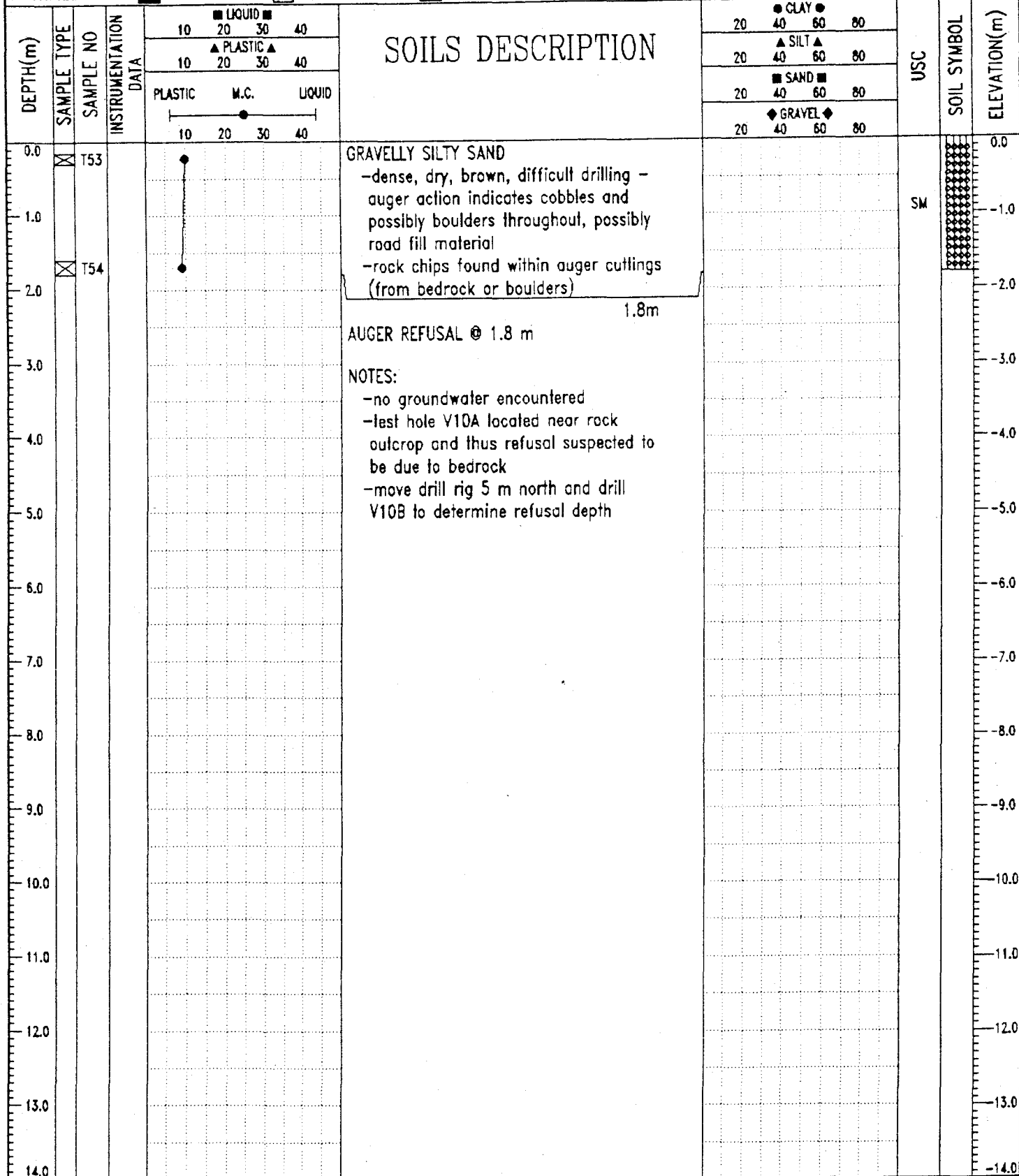


LABORATORY'S REMARKS SIEVE ANALYSIS WAS NOT
CONDUCTED ON FINE GRAINED SAND

DATE SAMPLED _____
DATE RECEIVED _____
TECHNICIAN(S) M.S. / T.D.
CHECKED BY _____

Public Works Canada Environmental A&S Venus Mine Tailings Site BOREHOLE NO: V10A
 Drilled using CME 75 track mounted rig V10A located on access road east of PROJECT NO: 8054-12
 with solid stem augers tailings area ELEVATION:

SAMPLE TYPE TUBE LOST AUGER BULK SPT CORE
 BACKFILL TYPE BENTONITE PEA GRAVEL SLOUGH GROUT DRILL CUTTINGS SAND



J.R. Paine & Associates Ltd.
 Whitehorse, Yukon

LOGGED BY: MEB COMPLETION DEPTH: 1.8 m
 REVIEWED BY: WCK COMPLETE: 95/06/15
 Fig. No: 1 Page 1 of 1

Public Works Canada Environmental A&ES Venus Mine Tailings Site BOREHOLE NO: V10B
 Drilled using CME 75 track mounted rig V10B located on access road east of PROJECT NO: 8054-12
 with solid stem augers tailings area ELEVATION:

SAMPLE TYPE TUBE LOST AUGER BULK SPT CORE
 BACKFILL TYPE BENTONITE PEA GRAVEL SLOUGH GROUT DRILL CUTTINGS SAND

DEPTH(m) SAMPLE TYPE SAMPLE NO INSTRUMENTATION DATA SOILS DESCRIPTION USC SOIL SYMBOL ELEVATION(m)

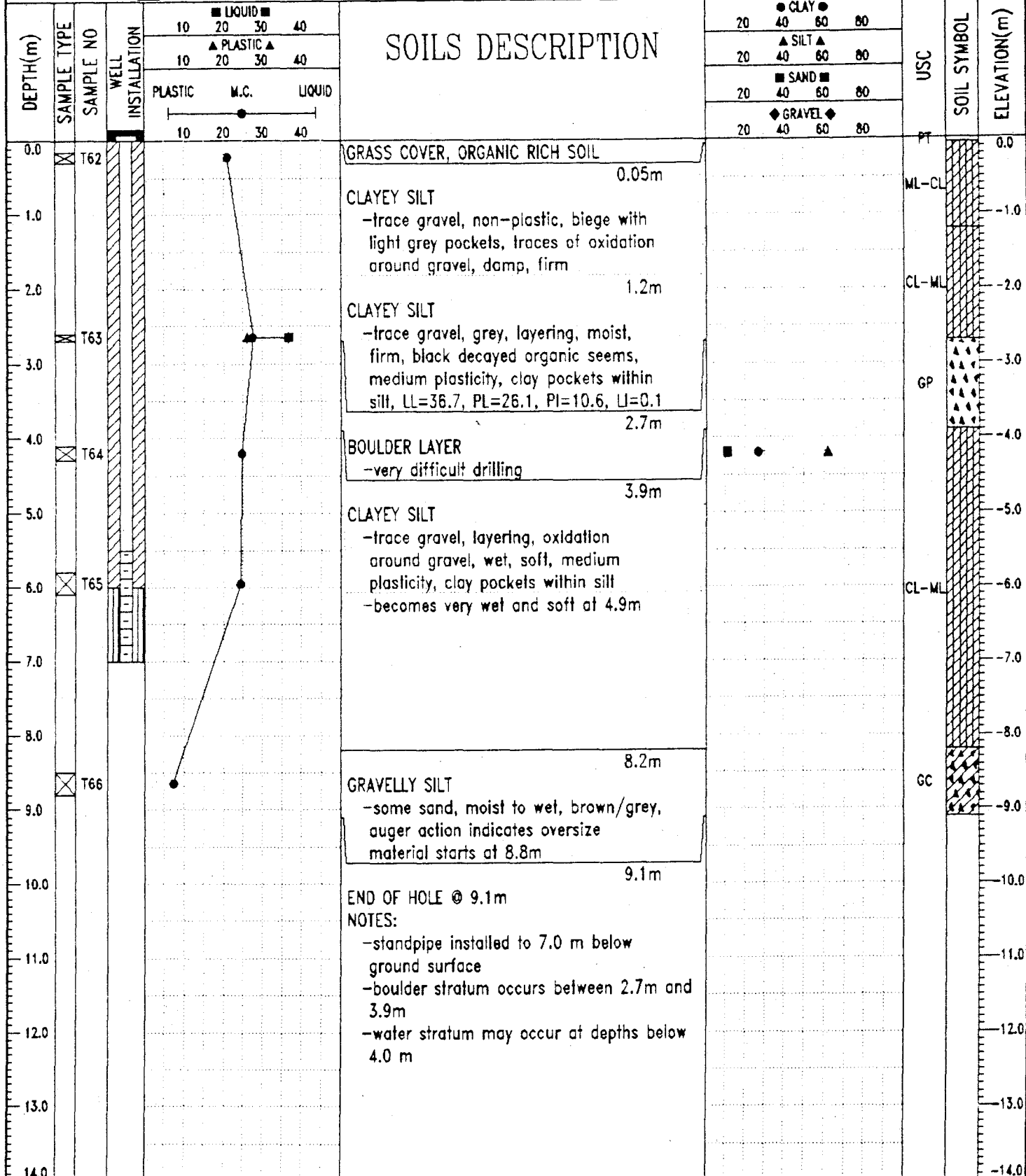
LIQUID PLASTIC SAND CLAY SILT GRAVEL
 10 20 30 40 10 20 30 40 20 40 60 80 20 40 60 80
 PLASTIC M.C. LIQUID 20 40 60 80
 10 20 30 40 20 40 60 80

0.0				SILTY SAND -some gravel, dense, dry, brown, auger action indicates cobbles and possibly boulders throughout, possibly road fill material <div style="text-align: right;">2.8m</div> AUGER REFUSAL @ 2.8 m NOTES: -no groundwater encountered -auger refusal at similar elevation as in V10A, assumed bedrock presence			0.0	
1.0								-1.0
2.0								-2.0
3.0								-3.0
4.0								-4.0
5.0								-5.0
6.0								-6.0
7.0								-7.0
8.0								-8.0
9.0								-9.0
10.0								-10.0
11.0								-11.0
12.0								-12.0
13.0								-13.0
14.0							-14.0	

J.R. Paine & Associates Ltd. LOGGED BY: MEB COMPLETION DEPTH: 2.8 m
 Whitehorse, Yukon REVIEWED BY: WCK COMPLETE: 95/06/15
 Fig. No: 1 Page 1 of 1

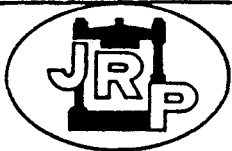
Public Works Canada Environmental A&S Venus Mine Tailings Site BOREHOLE NO: V11A
 Drilled using CME 75 track mounted rig V11A located southeast of tailings- PROJECT NO: 8054-12
 with solid stem augers adjacent to road (site sketch) ELEVATION:

SAMPLE TYPE TUBE LOST AUGER BULK SPT CORE
 BACKFILL TYPE BENTONITE PEA GRAVEL SLOUGH GROUT DRILL CUTTINGS SAND



J.R. Paine & Associates Ltd.
 Whitehorse, Yukon

LOGGED BY: MEB COMPLETION DEPTH: 9.0 m
 REVIEWED BY: WCK COMPLETE: 95/06/21
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CONSULTING AND TESTING ENGINEERS

EDMONTON - GRANDE PRAIRIE - WHITEHORSE - PEACE RIVER

PROJECT VENUS MINES RECLAMATION		CLIENT Public Works Canada Environment A & ES		DATE RECORDED 6-26-95	
STA.	SAMPLE TYPE AUGER	DEPTH 4.2 m	HOLE NO VIIA	FIELD NO.	LAB NO. T64

GRAIN SIZE ANALYSIS

SIEVE SIZE	% FINER BY WEIGHT	SIEVE SIZE	% FINER BY WEIGHT	DIA. mm	% FINER BY WEIGHT	DIA. mm	% FINER BY WEIGHT
.063	89.0			.0579	87.13	.0044	42.57
				.0417	82.17	.0032	34.65
				.0301	77.22	.0023	28.71
				.0219	70.29	.0014	20.78
				.0158	66.33		
				.0117	60.37		
				.0085	54.45		
				.0061	49.50		

PETROGRAPHIC ANALYSIS

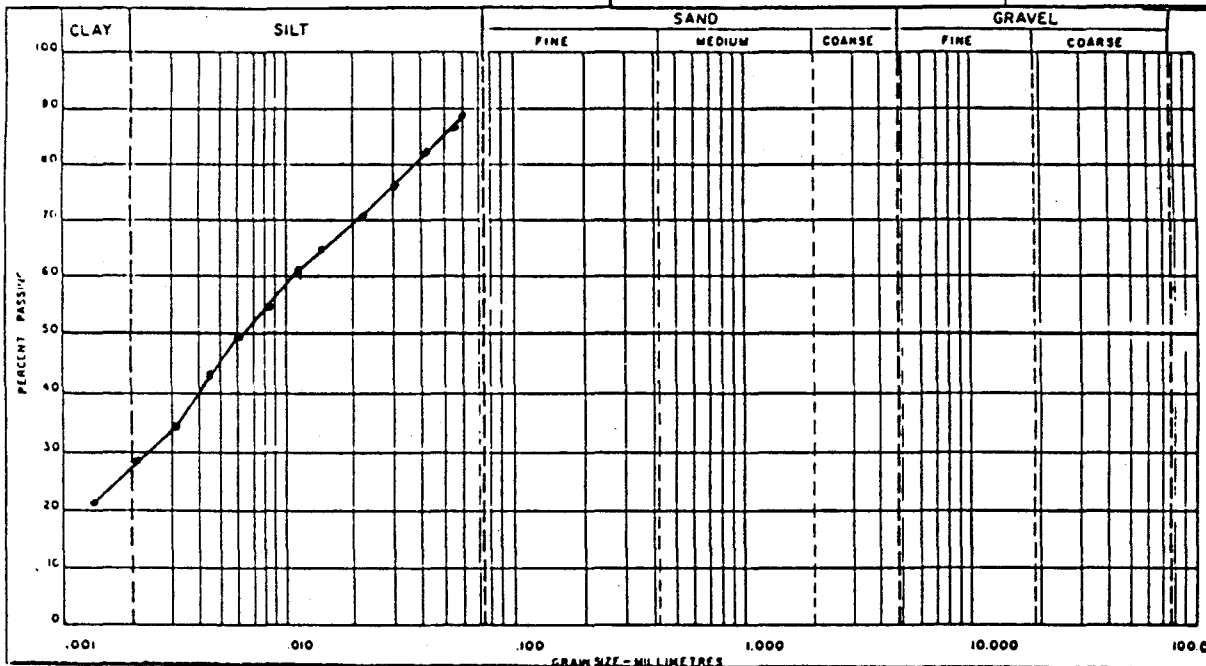
MATERIAL TYPE	% OF TOTAL SAMPLE
SAND	11.0
SILT	62.0
CLAY	27.0

SAMPLE NO.	UNIFIED CLASSIFICATION	LL	PL	PI	NATURAL % MO	SG
T64	CLAYEY SILT				25	

PARTICLE SHAPE ANALYSIS

ROUND	
SUB-ROUND	
ANGULAR	
SUB-ANGULAR	
FLATS	
NEEDLES	

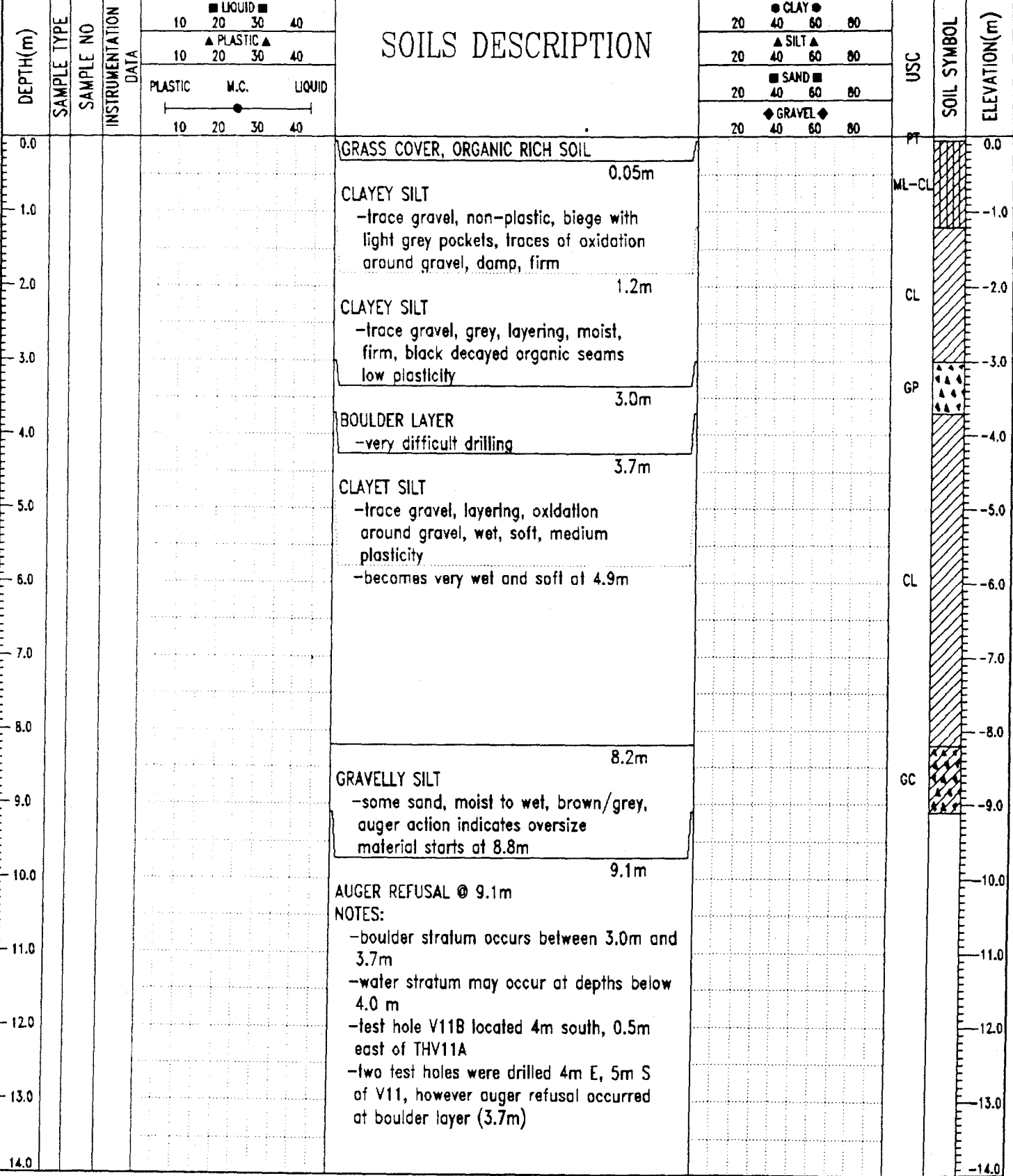
CRUSH COUNT _____ %



LABORATORY'S REMARKS SIEVE ANALYSIS WAS NOT CONDUCTED ON FINE GRAINED SAND

DATE SAMPLED _____
 DATE RECEIVED _____
 TECHNICIAN(S) M.S. / T.D.
 CHECKED BY _____

Public Works Canada Environmental A&ES	Venus Mine Tailings Site	BOREHOLE NO: V11B
Drilled using CME 75 track mounted rig	V11B located southeast of tailings-	PROJECT NO: 8054-12
with solid stem augers	adjacent to road (site sketch)	ELEVATION:
SAMPLE TYPE <input checked="" type="checkbox"/> TUBE <input type="checkbox"/> LOST <input checked="" type="checkbox"/> AUGER <input type="checkbox"/> BULK <input type="checkbox"/> SPT <input type="checkbox"/> CORE		
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		



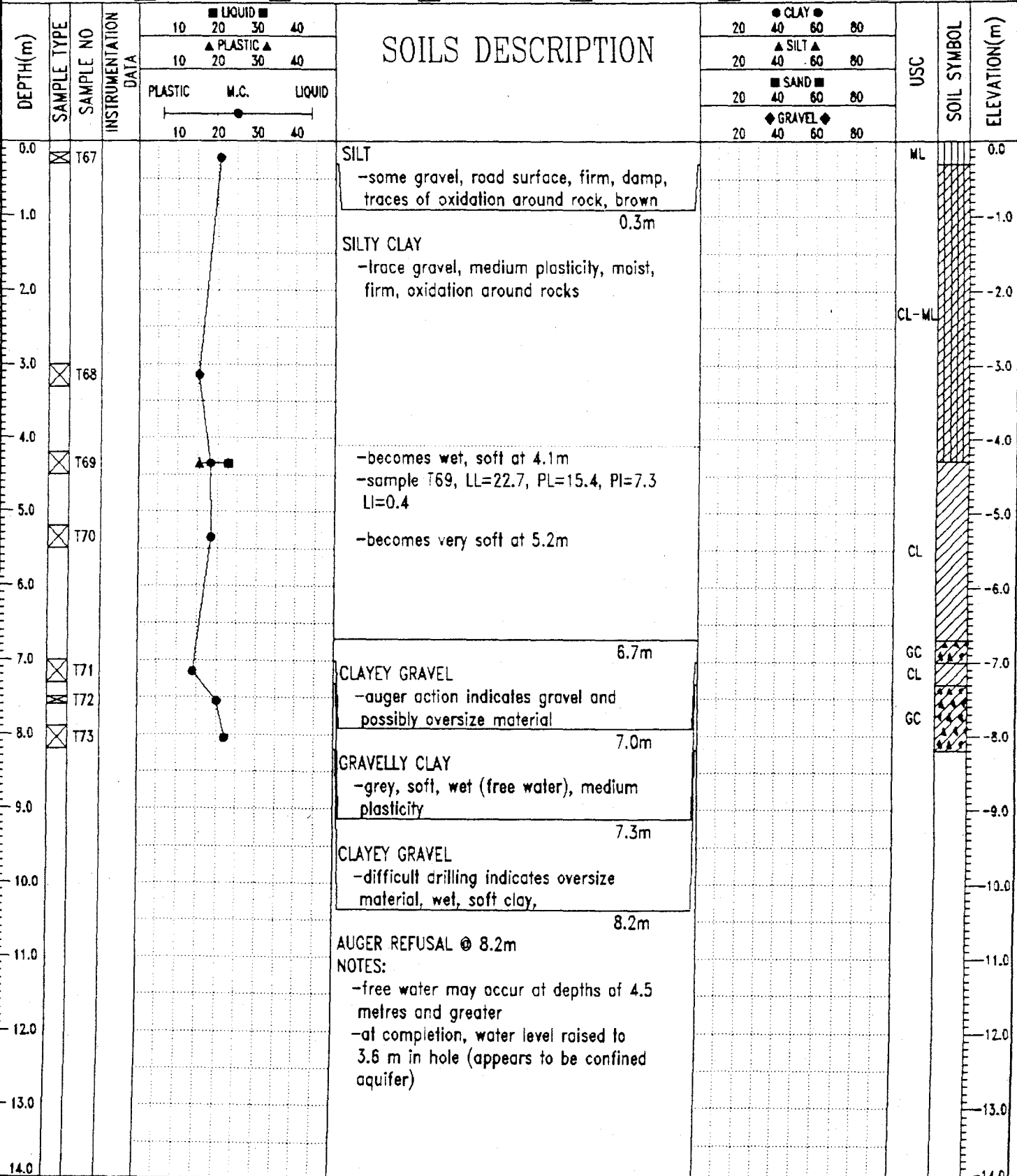
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REVIEWED BY: WCK
Fig. No: 1

COMPLETION DEPTH: 9.8 m
COMPLETE: 95/06/21

95/07/11 02:45PM

Public Works Canada Environmental A&ES	Venus Mine Tailings Site	BOREHOLE NO: V12
Drilled using CME 75 track mounted rig	V12 located east of tailings-	PROJECT NO: 8054-12
with solid stem augers	adjacent to road (site sketch)	ELEVATION:
SAMPLE TYPE <input type="checkbox"/> TUBE <input type="checkbox"/> LOST <input checked="" type="checkbox"/> AUGER <input type="checkbox"/> BULK <input type="checkbox"/> SPT <input type="checkbox"/> CORE		
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		



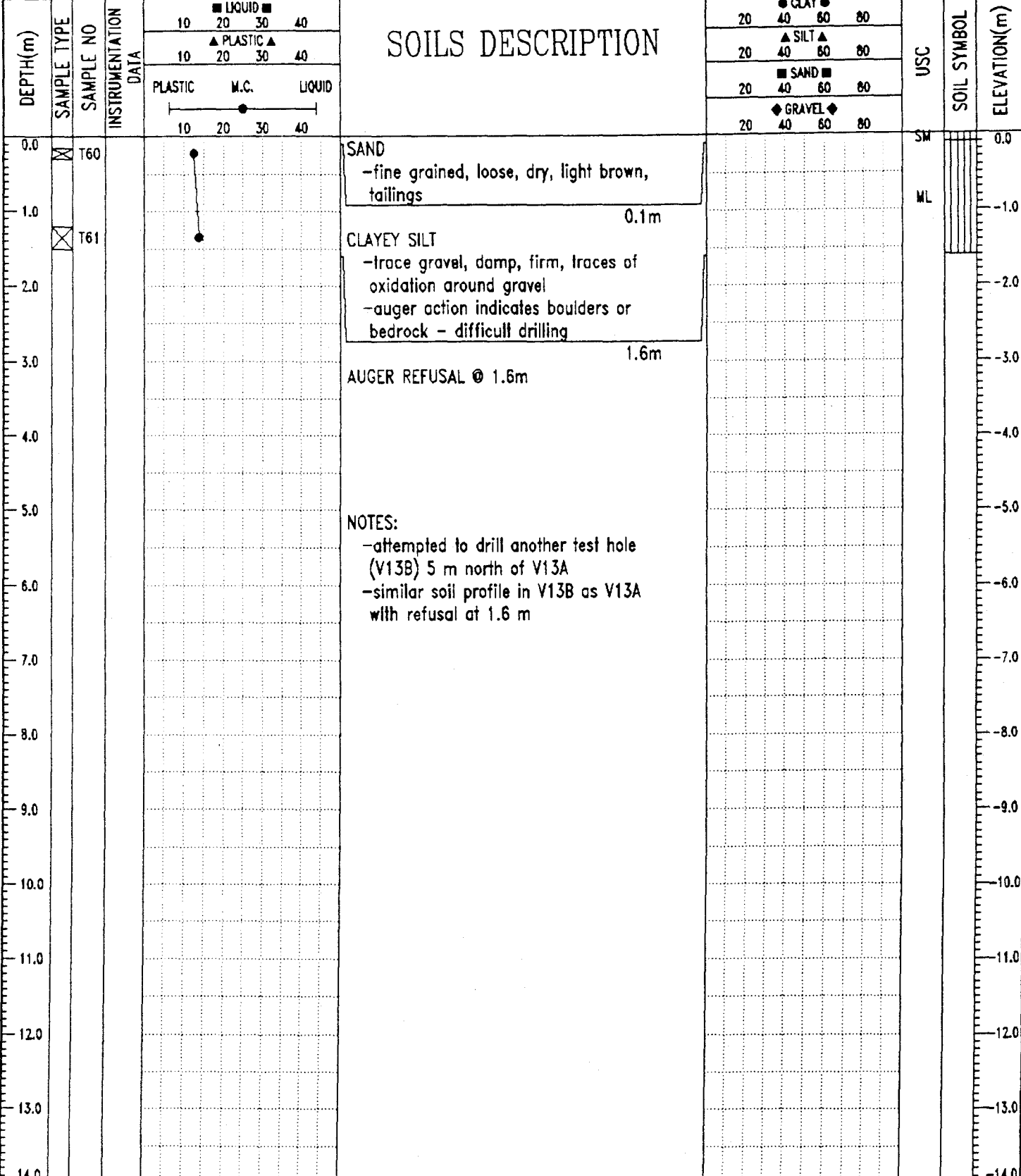
J.R. Paine & Associates Ltd.
Whitehorse, Yukon

LOGGED BY: MEB
REVIEWED BY: WCK
Flg. No: 1

COMPLETION DEPTH: 8.2 m
COMPLETE: 95/06/15

Public Works Canada Environmental A&ES Venus Mine Tailings Site BOREHOLE NO: V13A
 Drilled using CME 75 track mounted rig V13A located on southeast area of berm PROJECT NO: 8054-12
 with solid stem augers (see site sketch) ELEVATION:

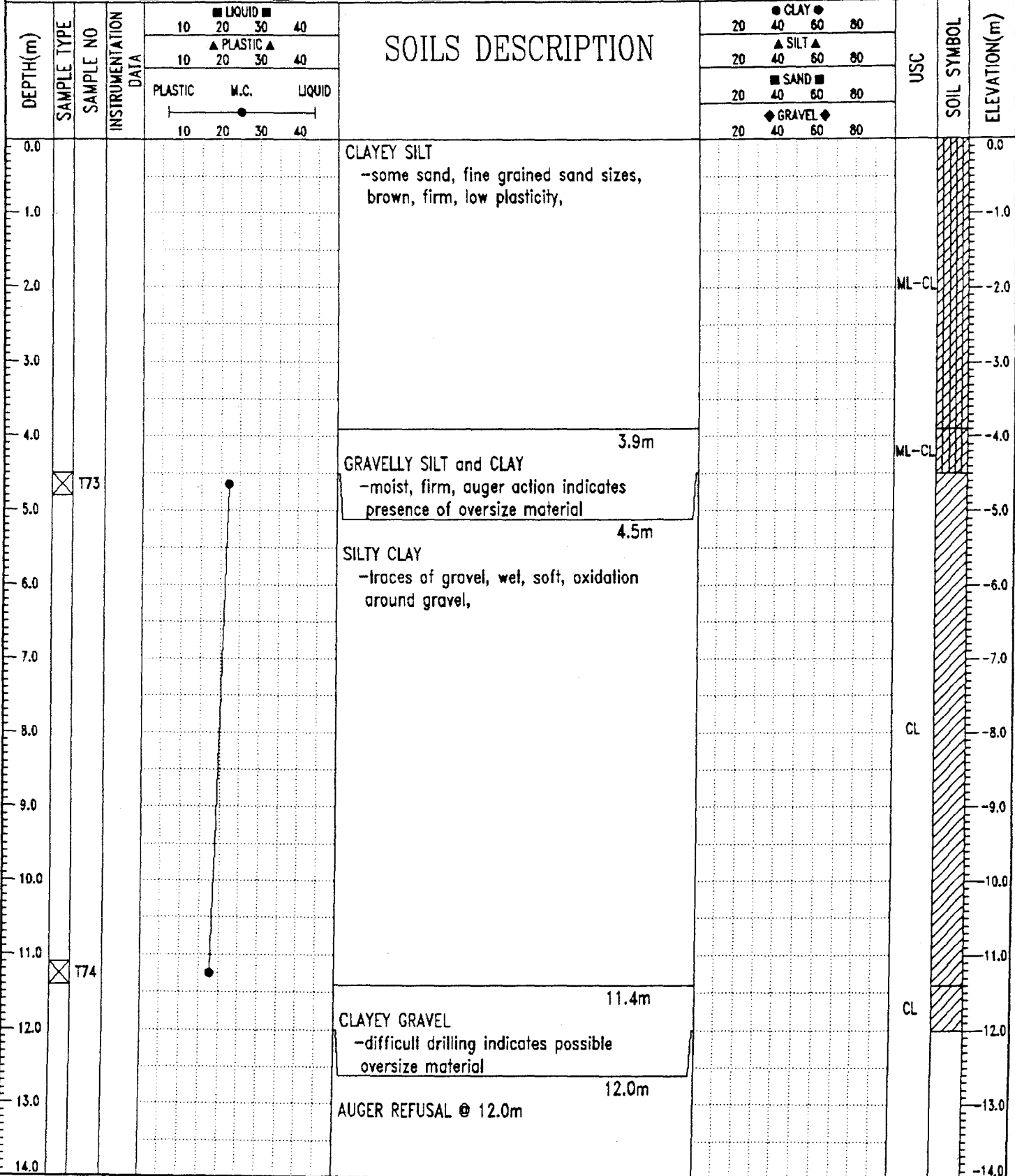
SAMPLE TYPE TUBE LOST AUGER BULK SPT CORE
 BACKFILL TYPE BENTONITE PEA GRAVEL SLOUGH GROUT DRILL CUTTINGS SAND



NOTES:
 -attempted to drill another test hole (V13B) 5 m north of V13A
 -similar soil profile in V13B as V13A with refusal at 1.6 m

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 Whitehorse, Yukon REVIEWED BY: WCK COMPLETE: 95/06/15
 Fig. No: 1 Page 1 of 1

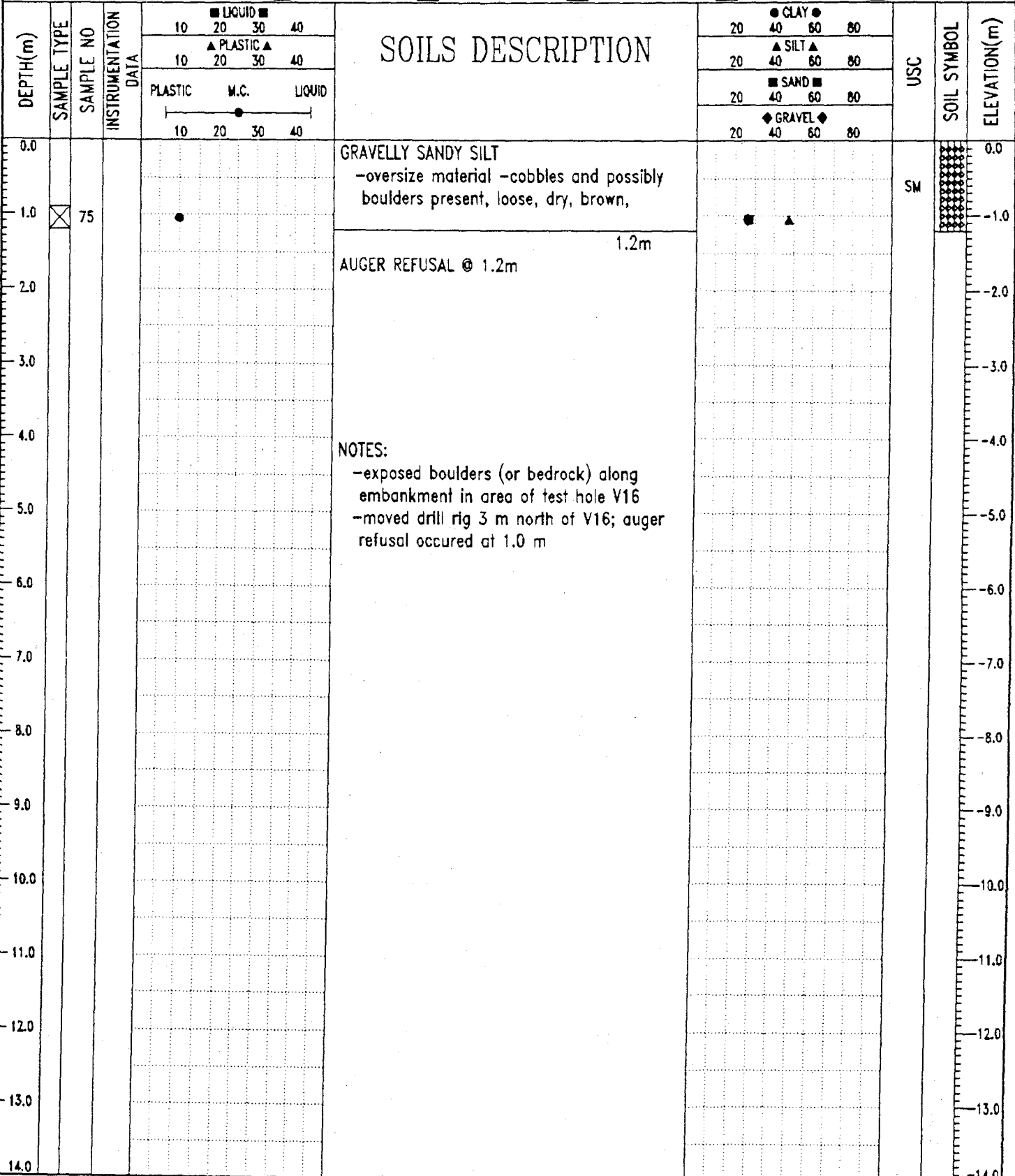
Public Works Canada Environmental A&ES	Venus Mine Tailings Site	BOREHOLE NO: V15
Drilled using CME 75 track mounted rig	V15 located on access road east of	PROJECT NO: 8054-12
with solid stem augers	tailings area	ELEVATION:
SAMPLE TYPE	<input type="checkbox"/> TUBE <input checked="" type="checkbox"/> LOST <input checked="" type="checkbox"/> AUGER <input type="checkbox"/> BULK <input type="checkbox"/> SPT <input type="checkbox"/> CORE	
BACKFILL TYPE	<input 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	



J.R. Paine & Associates Ltd. Whitehorse, Yukon	LOGGED BY: MEB REVIEWED BY: WCK Fig. No: 1	COMPLETION DEPTH: 12.0 m COMPLETE: 95/06/21
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Public Works Canada Environmental A&ES	Venus Mine Tailings Site	BOREHOLE NO: V16
Drilled using CME 75 track mounted rig	V16 located southwest of tailings (see	PROJECT NO: 8054-12
with solid stem augers	site sketch)	ELEVATION:

SAMPLE TYPE	<input checked="" type="checkbox"/> TUBE	<input type="checkbox"/> LOST	<input checked="" type="checkbox"/> AUGER	<input type="checkbox"/> BULK	<input type="checkbox"/> SPT	<input type="checkbox"/> CORE
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



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LOGGED BY: MEB	COMPLETION DEPTH: 1.2 m
REVIEWED BY: WCK	COMPLETE: 95/06/21
Flg. No: 1	Page 1 of 1



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CONSULTING AND TESTING ENGINEERS

SCREEN ANALYSIS

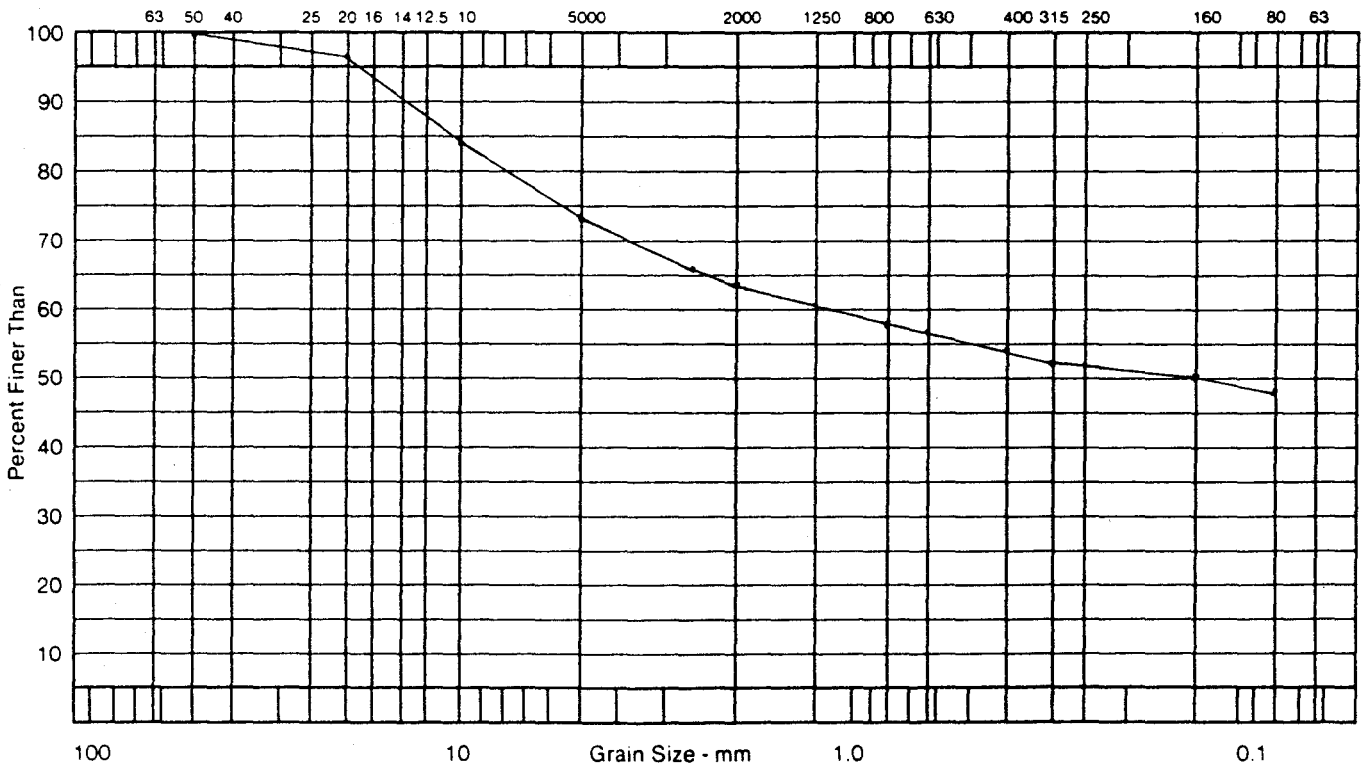
Client: PWGSC, A & ES
 Sample: T75 Depth: 0.9m-1.2m Project: Venus Mines Reclamation
 Location: Tailings Area, Test Hole V16 Made by: P.R. Job No.: 8054-12
 Ck'd by: M.B. Date: 95/06/23

Sieve No.	Size of Opening MM	Weight Retained gms	Total Wt. Finer Than gms	Percent Finer Than	% Finer Than Basis Orig. Sample
80,000	80,000				
50,000	50,000				100.0
20,000	20,000				96.4
10,000	10,000				84.1
5,000	5,000				73.8
2,500	2,500				66.0
2,000	2,000				64.2
1,250	1,250				60.7
800	.800				57.7
630	.630				56.3
400	.400				54.0
315	.315				52.9
250	.250				52.0
160	.160				50.4
80	.080				47.3

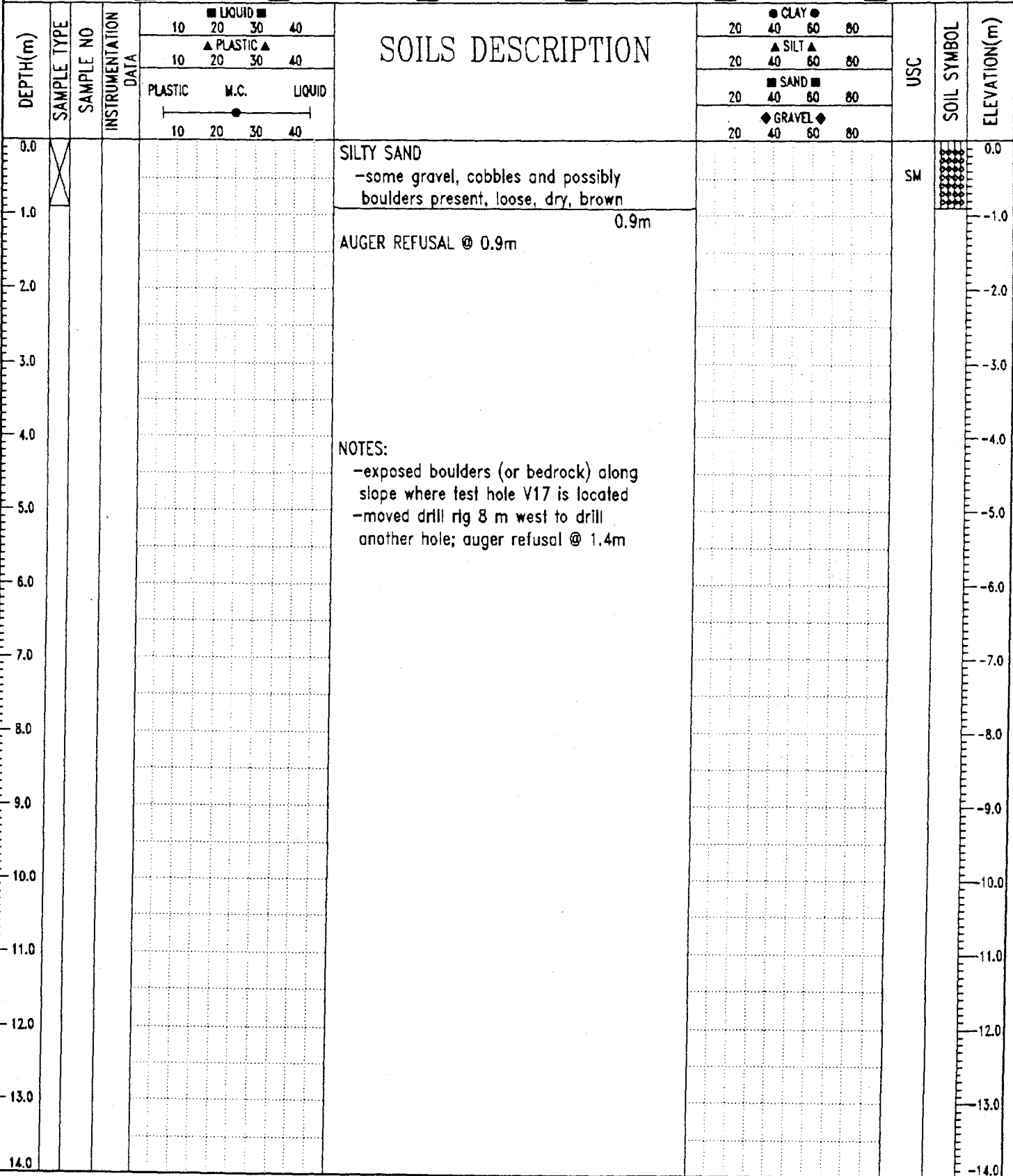
Description of Sample _____
gravelly sandy silt, ML

Method of Preparation _____ Dry _____ Washed X
 Remarks _____
gravel = 26.2
sand = 26.5
finer = 47.3

Time of Sieving _____ Min.



Public Works Canada Environmental A&ES	Venus Mine Tailings Site	BOREHOLE NO: V17
Drilled using CME 75 track mounted rig	V17 located southwest of tailings (see	PROJECT NO: 8054-12
with solid stem augers	site sketch)	ELEVATION:
SAMPLE TYPE <input type="checkbox"/> TUBE <input checked="" type="checkbox"/> LOST <input checked="" type="checkbox"/> AUGER <input type="checkbox"/> BULK <input type="checkbox"/> SPT <input type="checkbox"/> CORE		
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		



NOTES:
 -exposed boulders (or bedrock) along slope where test hole V17 is located
 -moved drill rig 8 m west to drill another hole; auger refusal @ 1.4m

95/07/06 C9-07AM