



ROADWAY

LIARD HIGHWAY, N.W.T.

MILE 35.5 TO MILE 40.2

GRADING, DRAINAGE INSTALLATIONS

AND TRAFFIC GRAVEL

PROJECT 085909

MAY, 1978



Western Region

This document is the document referred to as "Plans and Specifications" and marked 'A; in the Articles of Agreement entered into on the

_____ day of _____

1978 between Her Majesty the Queen and

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1.1.1 Description

The work consists of grading, culvert installations and placing traffic gravel on approximately 4.7 miles of the Liard Highway in the Northwest Territories.

1.1.2 Location

Mile 0 of the Liard Highway is at its junction with the Mackenzie Highway, approximately 38 miles southeasterly from the Town of Fort Simpson, N.W.T., and from this point the highway routing runs in a generally southwesterly direction to the N.W.T.-B.C. boundary, a distance of approximately 158 miles. The Mackenzie Highway mileage at its junction with the Liard Highway is 258.4 with Mile 0 being at the Alberta-N.W.T. boundary. The southern limit of the project at Mile 40.2 may be extended further south by the Engineer up to but not beyond Mile 40.8.

1.1.3 Project Access and Services

The northern limit of the project at Mile 35.5 is accessible by road from settled parts in Alberta and the N.W.T. by way of previously completed construction on the Liard Highway from Mile 0 to Mile 35.5 and the Mackenzie Highway. Road access to Fort Simpson, N.W.T. is subject to closure of the Liard River Ferry Crossing during spring breakup and freeze-up in the fall. The previously completed work on the Liard Highway consists of a crushed gravel surface roadway from Mile 0 to Mile 21. From Mile 21 to Mile 35.5, construction of the embankment will be in the final stages during the initial period of this contract and the Contractor is hereby advised that there may be some delays and/or interruptions in road access to the work. A pit run traffic gravel will be placed on the roadway from Mile 21 to Mile 35.5 and should be in place and complete by October 1, 1978. The Contractor is hereby advised that there is a temporary Bailey Bridge Crossing of the Birch River at Mile 32.4. A maximum loading of 55 tons and a maximum speed of 5 miles per hour will be enforced for this structure.

The Fort Simpson airport has a paved runway and is located adjacent to the Mackenzie Highway about 29 miles northwesterly from Mile 0 on the Liard Highway and is accessible by road except during the closure of the Liard River Ferry Crossing. There is regular scheduled commercial air service to the Fort Simpson airport. In addition, there is an airstrip adjacent to the Liard Highway at Mile 21.2 which was previously used by others during construction of the highway.

The Town of Fort Simpson is serviced by barge traffic on the Mackenzie River during the navigation season. There is also a barge landing on the Liard River previously constructed by others adjacent to approximately Mile 21.2 on the Liard Highway with an access trail to the highway.

1.1.3 Project Access
and Services (cont.)

The above information on project access and services is for the Contractors guidance only and it will be his responsibility to fully investigate the access and services available in the area and to make himself familiar with the conditions of their use.

1.1.4 Scheduling

Work on the project shall commence within two weeks of notification of award of contract. All work on the project shall be completed by July 31, 1979.

Installation of culverts and other work in flowing streams will not be permitted during the period May 1 to June 15. The Contractors attention is also directed to provisions elsewhere in these specifications with regard to conditions governing excavations and/or the construction of embankments during the period November 15 to May 15.

1.1.5 Clearing

Right-of-way clearing operations over the entire length of this project were previously carried out by others in 1970 and are generally to a minimum width of 150 feet.

Clearing operations under this contract will consist of any required widenings to the clearing previously carried out, clearing of regrowth and the clearing of borrow pits, haul roads, offtake ditches and disposal areas. Notwithstanding Division 9, Section 1 of the Specifications, clearing operations shall be classified as follows:

- .1 Clearing, Normal - Consists of clearing widenings to the right-of-way previously cleared, borrow pits, haul roads, offtake ditches, disposal areas, and any other required clearing of areas on which previous clearing activities have not taken place.
- .2 Clearing, Regrowth - Consists of clearing of regrowth on areas where previous clearing operations were essentially completed.

The Contractor is hereby advised the above description of the required clearing is for his general guidance only and he shall be responsible for assessing the extent of the work involved in each of the designated classifications of clearing.

Machine clearing will be permitted throughout except in areas where excavations are not proposed and which are designated by the Engineer as unstable terrain.

Right-of-way clearing on this project will be to a minimum width of 150 feet.

1.1.6 Roadway and
Borrow Excavation

All roadway and borrow excavations shall be carried out in accordance with Division 9, Section 2(a) of the Specifications.

Notwithstanding Article 9.4.3.1.(i) of the Specifications the use of frozen materials will not be permitted in the construction of embankments except where specifically approved by the Engineer. Excavations 6 feet deep or less will not be permitted during the period from November 15 to May 15. Excavations deeper than 6 feet will be permitted during this period providing that the Engineer is satisfied that the frozen materials encountered are placed in embankments where the stability will later not be adversely affected and that the work is carried out in a manner to prevent freezing of thawed material prior to placement and to prevent any significant freezing of thawed materials in the excavations prior to their removal.

Should the Contractor elect to work in excavations deeper than 6 feet during the winter months the snow and ice shall be removed from the areas being excavated, as well as within the limits of the embankment. The embankment shall also be kept free of snow and ice during the placement of material.

The removal of snow and ice specified above shall be considered incidental to any grading operations carried out during the winter months and will not be measured separately for payment.

1.1.7 Compaction

Compaction equipment supplied on the work shall meet the requirements of Division 9, Section 4 of the Specifications.

The Contractor shall supply one each of the sheepsfoot compaction unit, pneumatic-tired roller unit, and vibratory drum compaction unit Type A.

The vibratory drum compaction unit Type B, self-powered hand-operated vibratory plate unit, and pneumatic hand-operated tamping unit are intended primarily for use in conjunction with culvert installations. The Contractor shall be responsible for determining the number of each type of unit required based on his proposed culvert installation operations.

1.1.8 Culverts

All culvert and ancilliary materials required for the work will be provided by the Department of Public Works in stockpile near Mile 21. The Contractor shall be responsible for delivery of the materials from the stockpile sites designated above to the individual installation sites.

1.1.9 Engineer's Camp

The Department of Public Works will provide to the Contractor the following trailer units for the purpose of providing an Engineer's camp in accordance with Division 9, Section 14 of the Specifications.

- 1 Office trailer, 10 feet x 40 feet
- 2 Eight man sleeper units, 10 feet x 50 feet

The trailer units to be provided by the Department are stored in the Department's yard in Fort Simpson, N.W.T., approximately 69 miles from the northern limit of the contract.

The Contractor shall provide washroom facilities for up to approximately 12 Department of Public Works employees by either:

- (a) supplying and operating a separate washroom trailer specifically for the purpose, or
- (b) increasing the size and capacity of the facilities provided for his own staff.

The facilities shall be fully self-contained and shall include as a minimum washbasins, showers and flush toilets as required to meet the appropriate regulatory requirements.

The Contractor shall also be responsible for supplying a storage shed together with all materials required for hallways and otherwise setting up the trailers as required in the Specifications.

The trailer units shall be placed in the Contractor's camp as required in Division 9, Section 14 of the Specifications. Upon completion of the work under this contract, the Department's trailer units shall be removed from the camp complex and moved by the Contractor to a site on the project designated by the Engineer.

1.1.10 Traffic Gravel

Pit run gravel shall be placed on all roadway surfaces completed under this contract. The gravel shall come from a stockpile in the vicinity of Mile 33. This stockpile will be constructed by others during the winter of 1978/79.

1.1.11 Rip-Rap

Materials for stone rip-rap shall be sorted and gathered from roadway and borrow excavations on the project or from any other sources of large stone readily available and designated by the Engineer. The haul of stone material from its source to the installation sites will be measured for payment as "Haul of Rip-Rap". The quantity that will be measured shall be

1.1.11 Rip-Rap (cont.)

the product of the volume of rip-rap acceptably placed in cubic yards measured in place and the distance from the source to the point of installation along the shortest feasible haul route measured in miles and fractions thereof.

1.1.12 Metric
Conversion

The Unit Price Table also shows the estimated work quantities in equivalent metric units. The Contractor is hereby advised this is shown for general interest only and is intended as a preliminary step in familiarizing the industry with metric units that will be used on future contracts. The metric units shown are not to be extended or in any way used as a basis for the Contractor's tender.

1.1.13 Co-operation
With Others

During the initial stages of this project, the Contractor will be required to travel through active construction operations from Mile 21 to Mile 35.5 in order to gain access to the work. The Contractor shall ensure that this travel results in a minimum of interference with the activities of others and does not adversely affect the roadway facility. Any damaged or additional costs arising from the Contractor's activities which, in the opinion of the Engineer, could have reasonably been avoided, will be assessed against the Contractor.

The Contractor is also hereby notified that other construction activities extending southward from this project may commence during the period of this contract. For such activities, the Contractor shall co-operate to the extent considered reasonable by the Engineer in providing other Contractors and their agents road access over this project.

1.2.1 Land Use
Regulations

- .1 The Land Use Permit included in the Specifications was issued to this Department, granting it the authority to carry out the work described in the Specifications and Plans subject to the Territorial Land Use Regulations of the Territorial Land Use Act. The Land Use Permit and the attached Operating Conditions shall be considered part of the Contract Specifications.
- .2 The Contractor's attention is directed to Section 8 of the General Conditions "C" of the Contract and he is hereby advised he will be held fully responsible for all fines and penalties issued against the Department of Public Works as Permittee under the Land Use Permit, and which resulted directly or indirectly from the Contractor's activities on the Project.

1.2.2 Control of
Materials

Royalties payable to the Crown under the terms of the Territorial Quarrying Regulations for rock, gravel, sand and/or loam are hereby cancelled for the purpose of carrying out work under this Contract.

1.2.3 Measurement of
Quantities

.1 Linear

All linear measurements shall be based on horizontal distances, except for the measurement of culvert installations as noted elsewhere in these Specifications.

.2 Volume

- .1 In computing volume of excavation and embankment the average end area method will be used, except as otherwise agreed to by the Contractor and the Engineer.
- .2 When materials are to be measured in the haulage vehicle, the vehicle shall be of a size and type acceptable to the Engineer. Unless approved vehicles are of uniform capacity, each must bear a plainly legible identification mark indicating its specific approved capacity. Loads shall be measured at the point of delivery.
- .3 Material specified for measurement by the cubic yard may be weighed and such weights converted to cubic yards for payment purposes. Factors of conversion will be determined by the Engineer and must be agreed to by the Contractor before such method of measurement of pay quantities will be approved by the Engineer.
- .4 When gallons are specified as a measurement, they shall mean imperial gallons.

1.2.3 Measurement of
Quantities (cont'd)

.3 Weight

- .1 The term ton shall mean two thousand (2,000) pounds avoirdupois.
- .2 All materials which are specified for measurement by weight shall be weighed on scales of a type and at a location approved by the Engineer. Trucks used shall be weighed empty at such times as the Engineer directs, and each truck shall bear a clearly legible identification mark.
- .3 Weight measurements will be made by a weighmaster provided by the Department using scales and a scale house to be provided by the Contractor. The scales shall be of suitable design and of sufficient capacity to accommodate any vehicle used on the work in a single weighing operation and shall be inspected and tested for accuracy by the Federal Department of Consumer and Corporate Affairs, Weights and Measures Inspection Branch, as often as may be required by the Engineer. The scale house shall be weatherproof and constructed to afford protection for the recording device of the scales. It shall have one sliding window facing the scale platform, one end window, and a shelf desk at least two (2) feet wide and six (6) feet long. Doors shall not open onto the scale platform. The Contractor shall provide adequate lighting and heating.

The furnishing of scales and scalehouse and the inspection and testing of the scales shall be considered incidental to the work under the Contract and will not be measured separately for payment.

1.2.4 Construction
Interruptions for
Environmental
Protection

- .1 The Contractor will be required to temporarily cease operations on certain sections of the Project for reasons of protecting the environment as outlined in Division 1, Section 1, or in the Operating Conditions of the Land Use Permit. The Contractor shall schedule and organize his works so that the maximum of productive work can continue on other sections of the project during the period(s) of constraint.
- .2 When an unscheduled shutdown of the Contractor's operation has been ordered for reasons of protecting the environment, other than those reasons specified in Division 1, Section 1, or for those reasons in the Operating Conditions of the Land Use Permit, and when, in the opinion of the Engineer, productive work cannot be performed on other sections of the project by the equipment affected by the shutdown,

1.2.4 Construction
Interruptions for
Environmental
Protection (cont'd)

payment will be made to the Contractor for equipment and labour standby costs as follows:

.1 Production Equipment Standby

Production Equipment shall include only those units listed in the following group:

motor-scrappers, crawler tractors, front end loaders, motor graders, trucks larger than eight (8) cubic yards, rock drills, compressors and backhoes, draglines and shovels over one-half (1/2) cubic yard. The formula to be applied in determining standby costs for a piece of equipment shall be fifty (50) percent of the current "Alberta Road-Builders Association Rental Rate less the applicable operator wage rate quoted in the Association rate schedule." Such costs will be applicable up to a maximum of 10 hours per day, 5 days per week.

.2 Labour Standby

Labour standby costs will be paid for only those operators assigned to production equipment mentioned above and which have been affected by the shutdown. Measurement for payment will be made in accordance with Section 45 of the General Conditions "C" and shall be based on actual standby wage costs and costs of board and camp operation incurred by the Contractor. The Contractor may be required to present copies of his payroll records to support any labour costs claimed under this section. Payment for board and camp operation may be calculated on the basis of the Unit Price Table Item "Board for Engineer's Staff."

- .3 The proposed payments outlined above for Production Equipment Standby and Labour Standby shall be considered full and final compensation for all costs directly or indirectly incurred by the Contractor because of unscheduled shutdown of his operations for protection of the environment.

1.2.5 Barricades and
Warning Signs

The Contractor shall, at his own cost, provide, erect and maintain all necessary barricades, suitable and sufficient lights, danger signals and other signs and take all necessary precautions for the protection of the work and the safety of the public.

1.2.6 Project Signs

The Contractor may be required to erect and maintain a standard Department of Public Works project sign(s) supplied by the Department. Measurement for payment

1.2.6 Project Signs
(cont'd)

for the erection and maintenance of the sign(s) will be made in accordance with Section 45 of the General Conditions "C".

1.2.7 Layout of Work

The Engineer will set stakes and bench marks establishing the location, alignment and reference elevations for the work. This will generally include the setting out of one set of clearing markers, offset baseline, bench marks, slope stakes and culvert stakes, together with two sets of second grade stakes.

Any restaking resulting from the careless operations of the Contractor will be at the Contractor's own cost

1.2.8 Maintenance of
Work During
Construction

.1 General

The Contractor shall at his own cost maintain all work during construction. The maintenance shall constitute continuous and effective work, prosecuted day by day, with adequate equipment and forces so that the roadway and/or structures are, at all times, kept in a condition satisfactory to the Engineer.

.2 Roadway

- (a) Ruts and ridges caused by machinery or vehicles shall be removed from the completed or partially completed roadway.
- (b) Any portion of the road used for travel shall be kept free of snow.
- (c) Prior to spring thaw, snow shall be removed from the top of the road, including shoulders, for the full length of completed or partially completed construction as directed by the Engineer.

.3 Icing of Culverts

The Contractor shall, at his own cost, thaw out iced culverts to ensure that culverts are functioning during the period of spring break-up. The Department will provide a mobile steamer for this purpose. The Contractor shall be responsible for operating and maintaining this unit and shall return it to the Engineer in good condition upon completing this work.

1.2.9 Use of Roadway
During Construction

Vehicles of the Government of Canada and the Northwest Territories, or of the Agents or Contractors thereof, will be allowed access within the limits of the project at all times. Unless otherwise

1.2.9 Use of Roadway
During Construction
(cont'd)

provided in Division 1, Section 1, the Contractor may close the road to the general public during construction. The Engineer may, however, grant the use of the road to other operators.

1.2.10 Construction
Camp

The Contractor's camp and service area locations are subject to the approval of the Engineer and shall be set up and operated in accordance with the Government of the Northwest Territories Regulations governing operation of temporary field camps.

The development, maintenance and restoration of the Construction Camp and Service Area shall be considered incidental to the work under the Contract and will not be measured separately for payment.

The Contractor shall make application to the Controller of Water Rights, Department of Indian Affairs and Northern Development, Yellowknife, N.W.T., for authorization for the use of water and disposal of domestic sewage wastes at the camp in accordance with the Northern Inland Waters Act. The Contractor shall obtain this authorization prior to camp start-up.

Untreated sewage shall not be discharged directly or indirectly into natural waters. Depending on camp population, soil conditions, climatic conditions and the duration of the camp at one site, the following generally are acceptable methods of sewage disposal.

- .1 Total underground containment or lagooning by means of:
 - (a) Discharge directly to a suitably cribbed and covered cesspool.
 - (b) Discharge to a suitably cribbed leach pit through a septic tank or through a leach cesspool compartment. The septic tank or leach cesspool compartment is for settlement and digestion and for sludge removal as necessary.
 - (c) Discharge to an underground holding pit (which could be a cesspool, leach pit or tank) of at least one week retention capacity and discharged weekly from there to a lagoon by a portable pump and flex-hose or other suitable arrangement. The lagoon shall be suitably located at least three hundred (300) feet away from the camp being served.

1.2.10 Construction
Camp (cont'd)

The lagoon shall have a minimum retention period of one (1) year, a liquid depth of six (6) feet to eight (8) feet, a free board minimum of eighteen (18) inches and impervious berms having a ten (10) foot top width and minimum slopes of three to one (3:1). Suitable precautions shall be taken for erosion control.

2. Package treatment plants such as rotating Bio Disc, Physical Chemical Plant, etc.:

The plants are to be sized and operated to produce an effluent of secondary treatment quality. The Contractor shall make every effort to use water-saving fixtures in the camps such as low water-use toilets, urinals, wash basin taps, shower heads, and washing machines.

3. Prior to the installation of the camp and related services, a plan of the layout shall be submitted to the Engineer for approval. Upon being vacated the construction camp and service areas shall be left in a condition acceptable to the Engineer.

1.2.11 Forest Protection
and Fire Fighting
Equipment

.1 The Contractor shall comply with the requirements for forest protection and fire fighting equipment regulations as outlined in the Land Use Permit and the Forest Protection Ordinance, Chapter 38 of the Revised Ordinances of the Northwest Territories.

.2 The following fire fighting equipment is required for the construction camp(s):

<u>Equipment</u>	<u>Size of Camp (Men)</u>			
	<u>25</u>	<u>50</u>	<u>75</u>	<u>100</u>
Fire Shovels	5	10	15	20
Axes, boys, 2½ lb.	2	4	6	8
Pulaski Tools	5	10	15	20
Chain Saws	1	1	2	2
Backpack Pumps	5	15	20	20
Power Pumps, 1½" discharge	1	2	2	3
Fire Hose, 1½ standard coupling	1500'	3000'	3000'	4500'
Hose Carrying Bags	3	3	6	9
Water Tank, slip on, 500 gal. capacity movable by truck or crawler tractor	1	1	1	2

The chain saw(s) shall weigh approximately twelve (12) lbs. and be equipped with a sixteen (16) inch bar, tools, fuel, oil, spare spark plugs and carburator

1.2.11 Forest Protection
and Fire Fighting
Equipment (cont'd)

kit.

The power pumps shall be nine (9) horsepower pumps or larger fully equipped with suction hose, couplings, auxiliary tanks, nozzles, funnels, spare spark plugs, fuel, hose wrenches and other tools.

- .3 Fire fighting equipment shall be stored in a conspicuous place in the camp and used exclusively for fire control. Caches should be appropriately signed.
- .4 The Contractor shall designate three (3) persons who will be contacts for the Northwest Lands and Forest Service Field Officer. Prior to commencement of work, the Contractor shall contact the Northwest Lands and Forest Service Field Officer who will instruct the Contractor's "designated persons" so that they will become familiar with the fire regulations, safety precautions and general operating procedures in case of fire.
- .5 The supply of fire fighting equipment shall be considered incidental to the work under the contract and will not be measured separately for payment.

1.2.12 Employment of
Native People

- .1 Notwithstanding all the terms of Section 27(2) of the General Conditions "C", special arrangements are required for the employment of local residents on this project. The Contractor, prior to recruiting his work force, shall meet with the Manager, Canada Manpower Centre, covering the area of the project and advise him of his labour requirements for the project.

The Canada Manpower Centre will identify for the Contractor, local residents in the area of the project who appear to be qualified to perform the duties as outlined by the Contractor and the Contractor must show just cause in event these qualified local people are not offered employment. The Canada Manpower Centre will act as the employment referral agency.

During the progress of the work, the Economic Development Section, Department of Local Government, Government of the Northwest Territories, will make a Liaison Officer available on site to assist the Contractor with any employment arrangements with the local people. The Contractor will maintain contact with Liaison Officers who will provide counselling services as required for employees and their families.

- .2 The Contractor will provide for training on the job

1.2.12 Employment of
Native People
(cont'd)

contracts, to be arranged by the Territorial Government, for those indigenous Territorial residents who require special assistance in order to fill available jobs.

1.2.13 Climatic
Conditions

The Contractor's attention is drawn to the severe climatic conditions at the location of the project. Information regarding the climatic conditions can be obtained from the Department of the Environment.

1.2.14 Environmental
Briefings

When he has commenced operation of all equipment necessary to perform the work identified as clearing and excavation, and thereafter approximately every three (3) months, the Contractor shall arrange to have all his field staff available for a period of about one hour for environmental briefings. The Contractor shall provide space for the briefings at his camp. The Department will arrange for and bear the cost of having environmental experts available for the briefings. The briefings will be scheduled to fit in with the Contractor's operation (double shift), so as not to require any shutdown of the construction work.

The Department may also have available in the camp, a short photographic slide presentation or movie outlining environmental concerns and precautions to be taken. If such is available, the Contractor shall ensure that all new employees on the work view this presentation as soon after arrival as possible.

The Contractor's Superintendent shall meet with the Engineer and the Land Use Officer prior to commencement of any work under this Contract to review the requirements of the Land Use Permit Operating Conditions, to identify areas of environmental concern, and to establish special procedures and precautions because of such concern.

1.2.15 Schedules

.1 Tender Schedules

Each Bidder shall submit with his tender a schedule in bar chart form covering excavation, gravel, structural plate culverts, and temporary bridge structures and showing the calendar dates on which activities on each of those items will take place for each five-mile section of the Contract. This schedule must clearly demonstrate that the Bidder has examined all of the requirements of these Specifications, has examined the site conditions, has made himself aware of the access problems to the site and is aware of schedule limitations which may be brought about by climatic conditions or environmental requirements.

1.2.15 Schedules
(cont'd)

.2 Construction Schedule

After notification of award of Contract, the Contractor must prepare a detailed Construction Schedule showing the calendar time planned for clearing, roadway and borrow excavation, temporary bridge construction, traffic gravel and installation of corrugated steel pipe and corrugated structural plate pipe on the basis of a mile by mile identification for the total length of the Contract. The schedule must meet the requirements of any milestone dates outlined in Division 1, Section 1.

There will be no payment of progress claims until the Construction Schedule is received in a form acceptable to the Engineer.

9.1.1 Description

This item consists of the removal and disposal, in accordance with these Specifications, of trees, brush, stumps, logs and other surface debris from within the highway right-of-way, haul roads, borrow pits, disposal areas, gravel pits and other areas shown on the Plans or designated by the Engineer.

9.1.2 Materials

Not applicable.

9.1.3 Construction

Clearing shall consist of the removal and disposal of all items mentioned in Article 9.1.1, except for trees and shrubs that are designated for preservation. These trees and shrubs shall be protected from scarring, barking or other injury during the construction operations. Dangerous trees and snags overhanging the right-of-way and leaners along the edge of all cleared areas shall be removed. Shrubs and brush less than three (3) feet in height will not require cutting.

.1 Machine Clearing

The Engineer will designate the areas which may be cleared by machine. Machine Clearing will generally be permitted for the clearing of borrow pits and for the clearing of the right-of-way and haul roads where roadway excavations are proposed.

.2 Hand Clearing

Hand Clearing shall be performed on areas designated by the Engineer and shall consist of cutting to within eight (8) inches of original ground surface, all trees and brush. Generally hand clearing will be confined to the right-of-way, offtake ditches and haul roads.

Hand Clearing shall be carried out in a manner that will not damage the existing insulation of organic material. The use of machinery to pile and dispose of the clearing debris will only be permitted over frozen ground conditions.

.3 Debris Piles

Debris piles consisting of trees, rubbish and/or organic materials existing from previous clearing operations shall be removed and disposed of by the Contractor.

.4 Disposal

All clearing debris shall be disposed of as directed by the Engineer. Generally the disposal of right-of-way debris will consist of burning and placing

9.1.3 Construction
(cont'd)

of any unburned debris in disposal pits or disposal areas designated and/or approved by the Engineer. For the clearing of borrow pits, the Contractor will generally be permitted to place the clearing debris into a section of the pit where excavation is completed or along the outside edge of the pit and to flatten, cover with waste excavation and trim such debris to a condition acceptable to the Engineer.

In specific areas, the Engineer may permit or direct that trees from the hand-cut clearing operation be laid into a uniform mat within the limits of future embankment.

.5 Right-of-Way Clearing Limits

Generally the right-of-way will be cleared to a width of one hundred (100) feet or wider, if required, to provide a minimum of fifteen (15) feet from the toe of embankment or from the top of excavation backslope to the edge of the clearing.

.6 Progress of Work

Except as may otherwise be approved or directed by the Engineer, borrow pit areas shall not be cleared in advance of excavation by more than one (1) week. The clearing within the right-of-way shall be completed at least one-half (1/2) mile in advance of the grading operation.

Where portions of the right-of-way have previously been cleared by others, the Contractor shall advise the Engineer no later than October 1st of each year of the section of anticipated embankment construction to take place between October 1st and April 15th.

9.1.4 Measurement

The quantity of CLEARING to be measured for payment shall be the number of acres acceptably cleared in accordance with these Specifications.

The removal of stumps and remaining clearing debris on areas cleared by others shall be considered incidental to the clearing operation and will not be measured separately for payment.

Earth material removed along with the clearing debris during the clearing disposal shall be considered incidental to the clearing operation and will not be measured separately for payment.

9.2(a).1 Description

This item consists of excavating, loading, hauling within the freehaul distance, placing or disposing and trimming of all Roadway and Borrow Excavation materials. The work is to be carried out in accordance with these Specifications and to the lines and grades shown on the Plans or as designated by the Engineer.

9.2(a).2 Materials

.1 Excavation Rock

Excavation Rock is defined as:

- (a) Material excavated from solid masses of igneous sedimentary or metamorphic rock which, prior to its removal, was integral with its parent mass.
- (b) Boulder or rock fragments measuring in volume two (2) cubic yards or more.

.2 Excavation Common

Excavation Common shall consist of all other materials of whatever nature, including dense tills, hardpan and frozen materials that do not come under the classification of Excavation Rock.

9.2(a).3 Construction

.1 Roadway Excavation

- (a) Roadway Excavation will include excavation required for construction of contiguous roadway ditches, embankments, installation of culverts, and the removal and disposal of unsuitable materials.
- (b) All suitable materials excavated shall be placed in roadway embankments except as otherwise directed by the Engineer. The embankment shall be constructed in accordance with Division 9, Section 4.
- (c) All materials which in the opinion of the Engineer are unsuitable for embankments will be disposed of at locations and in a manner as directed by the Engineer.
- (d) All roadway excavation shall be carried out in a manner so as to minimize disturbance to the natural ground cover on adjacent areas.
- (e) Trimming of all excavation surfaces shall be done in a neat and workmanlike manner. Roadway excavations shall not vary from the grades shown on the Plans or as designated by the Engineer by more than two-tenths (2/10) of a foot. In addition the difference between the constructed grade and the designated grade, within any one hundred (100) foot length of roadway, shall not vary by more than one-tenth (1/10) of a foot.

9.2(a).3 Construction
(cont'd)

- (f) Where the subgrade is in transition from excavation to embankment, sub-excavation will be carried out in the transition area in accordance with the Plans or as designated by the Engineer.
- (g) Where unsuitable material is encountered at the grade level of a cut, the sub-grade shall be sub-excavated to the depth staked by the Engineer.
- (h) Where suitable material is encountered at the grade level of a cut, scarifying to a minimum depth of eight (8) inches below sub-grade will be performed prior to shaping and compaction.
- (i) If during excavation, material appearing to conform to the classification of Excavation Rock is encountered, the Contractor shall notify the Engineer and shall provide ample opportunity for the Engineer to investigate and to make such measurements as are necessary to determine the volume of material in question.
- (j) Rock which cannot be ripped, shall be drilled and blasted in such a manner that all material excavated will be usable for embankment construction.
- (k) Where solid rock is encountered at the grade level of a cut, the subgrade shall be sub-excavated as shown on the Plans and back-filled with material designated by the Engineer.
- (l) Rock slopes shall be scaled down removing boulders and rock fragments to form stable slopes.

.2 Borrow Excavation

- (a) The Engineer will designate and approve all borrow sources and haul roads. Haul roads from borrow pits will consist of one (1) two-way road having a maximum surface width of thirty-two (32) feet or two (2) one-way haul roads each having a maximum surface width of twenty (20) feet. The haul roads will generally be doglegged so that only a short section of the haul road is visible from the highway.
- (b) Drill logs in the vicinity of potential borrow sources have been indicated on the Plans. This information has been provided to give the Contractor an appreciation of the general type of material to be encountered in borrow sources and the general spacing of such borrow

9.2(a).3 Construction
(cont'd)

sources. The actual location, dimensions and depths for excavation of borrow sources will be designated in the field by the Engineer.

- (c) Slopes of the excavated borrow pits shall not be steeper than two to one (2:1) for Excavation Common and one-quarter to one (1/4:1) for Excavation Rock, unless otherwise directed by the Engineer.
- (d) Unsuitable materials excavated from borrow pits will generally be disposed of by placing it as designated by the Engineer immediately adjacent to the borrow pit in such a location as not to interfere with the natural ground drainage or drainage from or into the borrow pit. The disposed of material will be trimmed as directed by the Engineer. For certain borrow excavations the Engineer may direct that all or part of the unsuitable material be placed back into the excavated area upon completion of the borrow excavation.
- (e) If during excavation, material appearing to conform to the classification of Excavation Rock is encountered, the Contractor shall notify the Engineer and shall provide ample opportunity for the Engineer to investigate and to make such measurements as are necessary to determine the volume of material in question.
- (f) Rock which cannot be ripped shall be drilled and blasted in such a manner that all materials excavated will be usable for embankment construction.

9.2(a).4 Measurement

- .1 The quantity of EXCAVATION COMMON to be measured for payment shall be the number of cubic yards of material in its original position, acceptably excavated and placed in accordance with these Specifications.

Original cross sections will be taken after the clearing is completed.

Scarifying as specified in Article 9.2(a).3.1(h) shall be considered incidental to the roadway and borrow excavation operation and will not be measured separately for payment.

- .2 The quantity of EXCAVATION ROCK to be measured for payment shall be the number of cubic yards of material in its original position acceptably excavated and placed in accordance with these Specifications.

9.2(a).4 Measurement
(cont'd)

Original cross sections will be taken on top of the exposed rock surface.

- .3 There will be no measurement for payment for material excavated beyond the lines shown on the Plans or as staked by the Engineer except in roadway rock excavations, where in the opinion of the Engineer unavoidable over-break occurs. Measurement for payment will be made for the actual quantity involved provided the over-break does not exceed ten (10) percent of the actual quantity within the lines and grades as staked by the Engineer between the established one-hundred (100) foot station intervals where the over-break occurs. Materials in excess of the allowable over-break when placed in the embankment, will be measured for payment as Excavation Common. Materials in excess of the allowable over-break and not placed in the embankment, will not be measured for payment.
- .4 Where the Engineer directs that unsuitable material from a borrow pit be placed back into the excavated area after completion of the borrow excavation, this work will be measured for payment in accordance with Section 45 of the General Conditions "C".
- .5 The removal and disposal of all roots, stumps, surface debris and other unsuitable materials shall be considered incidental to the measurement made for Roadway and Borrow Excavation.

9.3.1 Description

This item consists of the excavation required for permanently deepening, widening and relocating water channels, the construction of ditches other than contiguous roadway ditches, loading, hauling within the free haul distance, placing or disposing and trimming of materials in accordance with these Specifications and to the lines and grades shown on the Plans or as designated by the Engineer. Except for interceptor ditches running generally parallel to the roadway embankment but not contiguous with it, channel excavation will be designated beyond a distance of fifteen (15) feet from the staked toe of the embankment.

9.3.2 Materials

.1 Channel Excavation Rock

Channel Excavation Rock is defined as:

- (a) Channel material excavated from solid masses of igneous, sedimentary or metamorphic rock which, prior to its removal, was integral with its parent mass.
- (b) Boulder or rock fragments measuring in volume two (2) cubic yards or more.

.2 Channel Excavation Common

Channel Excavation Common shall consist of the excavation of all other materials of whatever nature including dense tills, hardpan and frozen materials that do not come under the classification of Channel Excavation Rock.

9.3.3 Construction

All materials excavated shall be disposed of as shown on the Plans or as directed by the Engineer. Suitable material shall be used in the roadway embankment, where considered practical by the Engineer. When excavated material is placed near the banks of a channel or ditch, provision shall be made to ensure proper flow of water from adjacent land to this waterway. The excavation shall be neatly finished and the disposed of material shall be shaped and trimmed to a condition satisfactory to the Engineer. The excavation equipment is subject to the approval of the Engineer.

All Channel Excavation shall be carried out in a manner as not to damage the natural ground cover on adjacent areas.

9.3.4 Measurement

- .1 The quantity of CHANNEL EXCAVATION COMMON to be measured for payment, shall be the number of cubic yards of material, in its original position, acceptably excavated and placed in accordance with these Specifications.

9.3.4 Measurement
(cont'd)

- .2 The quantity of CHANNEL EXCAVATION ROCK to be measured for payment, shall be the number of cubic yards of material, in its original position, acceptably excavated and placed in accordance with these Specifications.
 - .3 Measurement for payment of material excavated beyond the lines shown on the Plans or staked by the Engineer will not be made except that for Channel Excavation Rock where, in the opinion of the Engineer unavoidable overbreak occurs. Measurement for payment will be made of the actual quantities involved, provided the overbreak quantity does not exceed ten (10) percent of the actual quantity of rock within the lines and grades as staked by the Engineer between the established one-hundred (100) foot station intervals where the overbreak occurs. Channel Excavation Rock beyond the allowable overbreak will not be measured for payment.
 - .4 Original cross sections will be taken after clearing is completed.
-

9.4.1 Description

This item consists of the construction of embankments for the highway, haul roads, access roads, ditch blocks and ditch checks and the backfilling of culverts, structures and sub-excavated areas in accordance with these Specifications and to the lines and grades shown on the Plans or as designated by the Engineer.

9.4.2 Materials

The materials shall consist of acceptable earth and/or rock free from wood, brush, roots and other organic matter. All materials shall be subject to the approval of the Engineer prior to use in embankment construction.

9.4.3 Construction

.1 Placing Embankments

- (a) The embankment shall be constructed to the lines and grades shown on the Plans and/or staked by the Engineer. If an embankment is constructed beyond the designated lines and grades, the excess material shall be removed by the Contractor and placed where the embankment is below grade level. If the excess material cannot be acceptably used in embankment construction, it shall be disposed of at a location designated by the Engineer in a manner approved by the Engineer.
- (b) The initial lift of embankment material on unstable foundations shall have a minimum thickness of three (3) feet for support of construction equipment. The Engineer may permit the initial lift to be placed in a narrow fill along the uphill side of the embankment area to provide access to various works along the right-of-way. Successive lifts on an unstable foundation and all lifts on stable foundations shall be constructed in uniform layers of eighteen (18) inches maximum thickness across the entire width of the embankment with the final lift of eight (8) inches maximum compacted thickness. In embankments composed primarily of material obtained from rock cuts, the larger stones shall be carefully distributed and the voids filled with smaller stones and other available material to form a compact mass.
- (c) The Contractor shall maintain sufficient crown and/or superelevation during the embankment construction to ensure ready transverse runoff of surface water.

9.4.3 Construction
(cont'd)

- (d) Preliminary shaping of side slopes shall be done as close behind embankment placement as possible.
- (e) Trimming of the top surface, side slopes and toe of the embankments shall be done in a neat and workmanlike manner. Final embankments shall not vary from the grades as shown on the Plans or as designated by the Engineer by more than two-tenths (2/10) of a foot. In addition, the difference between the constructed grade and the designated grade, within any one hundred (100) foot length of roadway, shall not vary by more than one-tenth (1/10) of a foot.
- (f) Final trimming shall be under the supervision of a competent foreman and shall be complete by September 15th of each year for all sections of the road which have been constructed to final grade.
- (g) The Contractor shall be responsible for determining the type of equipment most suitable for trimming the materials encountered on the project, and shall provide such equipment on the work as required, to acceptably complete the trimming and clean up.
- (h) Material used in the final eight (8) inch lift of embankment, shall be selected by the Contractor to ensure a minimum of boulders or stone fragments having dimensions larger than six (6) inches. After placing the final eight (8) inch lift, all stones, boulders or rock fragments having a major dimension greater than six (6) inches shall be removed from the material and disposed of at locations approved by the Engineer.
- (i) As this project lies within the zone of permafrost, it will be permissible to construct embankment using soils in a frozen state.

.2 Compaction of Embankments

- (a) Each layer of embankment material shall be spread evenly to the satisfaction of the Engineer. The hauling equipment shall be directed uniformly over the full width of each layer of material placed.
- (b) The Engineer will determine if and when compaction is required in addition to that provided by the hauling units and will designate the type and number of compaction units to be used.

9.4.3 Construction
(cont'd)

- (c) The addition of water to the embankment material may be required during the compaction operation. The Engineer will designate when this is required and the quantities to be applied. The water shall be distributed in accordance with Division 9, Section 10.

.3 Drying of Embankments

During embankment construction, if in the opinion of the Engineer, the material is too wet for compacting, he may direct that drying of the embankment material be carried out. The type and number of drying equipment units and the drying procedure used will be as directed by the Engineer. If in the opinion of the Engineer the weather is not suitable for drying, the drying work will cease and not resume until the Engineer has so directed.

.4 Embankment Adjacent to Structures

(a) Embankment at Bridge Approaches

The permission of the Engineer must be obtained before any fill is placed against concrete arches, abutments or wing walls.

Approach fills to structures, within the lines shown on the Plans or as directed by the Engineer, shall be constructed of approved material placed in layers of maximum compacted thickness of six (6) inches. The amount of compaction and the type of equipment to be used will be determined by the Engineer. For structures requiring embankments on both sides, the embankment shall be placed simultaneously at the same elevations on both sides of the structure.

(b) Embankment at Culverts

Embankment materials around culverts shall be selected by the Engineer and placed to the limits shown on the Plans or as designated by the Engineer. The material shall be placed and compacted in six (6) inch layers alternately on each side of the culvert so as not to displace the culvert during installation. The amount of compaction and the type of equipment to be used will be determined by the Engineer. To obtain the required compaction under the haunches, the material in this area shall be placed and tamped by hand to the satisfaction of the Engineer.

9.4.3 Construction
(cont'd)

(c) Fill - Retaining Walls

The fill behind the walls shall consist of approved material placed in layers not exceeding six (6) inches in thickness and compacted as directed by the Engineer. In the case of cell type retaining walls, the fill behind the wall shall be tamped and kept near but not above the level of the compacted material within the cells. Where fill is to be placed on a sloping surface, the surface must be benched to reduce the load on the retaining structure.

.5 Compaction Equipment

All compactors specified herein for compaction of material shall comply with the following minimum requirements:

- (a) Sheepsfoot compactors shall consist of one or more drum units, having a total minimum width of eight (8) feet. The length of the tamping feet shall not be less than seven (7) inches. Under working conditions, the compactor shall be of such weight that the minimum load upon each tamper foot will not be less than four-hundred (400) pounds per square inch of cross-sectional area of the tamping feet. The sheepsfoot compactor shall be of the self-cleaning type and the ends of the tamping feet shall at all times be kept in a flat condition acceptable to the Engineer.
- (b) Pneumatic-tired rollers shall have a width of not less than six (6) feet. They shall be equipped with pneumatic tires of equal size and diameter. The space between the side walls of adjacent tires shall be not greater than the tire width, and the rear tires shall be staggered in relation to the front tires. The roller shall be equipped with mechanical means of distributing the contact pressure uniformly among all the tires and the tires shall be uniformly inflated so that the air pressure in all tires does not vary more than five (5) pounds per square inch. Pneumatic tired rollers shall be so constructed that the total weight of the roller shall be not less than seventeen (17) tons and that the roller shall develop a minimum of four-hundred (400) pounds pressure per inch width of tire. During rolling, the operating weight of the roller and the tire pressure shall be varied as directed by the Engineer to fit the soil conditions.

9.4.3 Construction
(cont'd)

- (c) Grid Rollers shall weigh not less than fifteen (15) tons. The roller shall have a nominal width of eighty (80) inches; with five (5) inches nominal distance between the centre of the bars forming the grid.
- (d) Type (A) steel drum vibratory compactors shall be of the articulated frame type having a drum width of not less than six (6) feet. The weight on the drum end shall be not less than five (5) tons with minimum total applied forces of five-hundred (500) pounds (combined vertical components of dynamic and static forces) per linear inch of drum.
- (e) Type (B) steel drum vibratory compactors shall consist of a double drum (vibration on both drums), self-propelled compaction unit meeting the following minimum requirements:

Total weight	1200 lbs.
Width of drums	24 inches
Total applied force (combined vertical components of dynamic and static forces)	200 lbs. per linear inch of drum
- (f) Vibratory padfoot drum compactors shall be of the articulated frame type having a drum width of not less than six (6) feet. The weight on the drum end shall be not less than five (5) tons with a minimum total applied contact pressure (combined dynamic and static pressure) of five hundred (500) pounds per square inch.
- (g) Self-powered, hand-operated vibratory plate units for compaction of backfill and/or embankment immediately adjacent to structures and culverts shall be of a design approved by the Engineer and weighing not less than two hundred (200) pounds.
- (h) Pneumatic, hand operated tamping units for compaction of backfill and the haunches of forty-eight (48) inch and larger diameter culverts shall be the ramming type of approved design and weighing not less than thirty (30) pounds.
- (i) Each compaction unit shall consist of a fully operated compactor. Compaction units described in Articles 9.4.3.5(a), (b), (c), (d), (e) and (f) shall be self-propelled or power-drawn, and be capable of moving at a speed up to four (4)

9.4.3 Construction
(cont'd)

miles per hour, with the exception of the compaction units described in Article 9.4.3.5(c) which shall be capable of moving at speeds up to seventy (70) feet per minute.

.6 Drying Equipment

- (a) Drying Equipment shall consist of a heavy duty hinge offset type disc plow meeting the following minimum requirements:

Weight	8000 lbs. with provisions for additional weight as required
Width	8 feet
No. of discs	12
Disc diameter	36 inches

- (b) Each drying unit shall consist of fully operated self-propelled or power-drawn drying equipment. Drying units shall be capable of moving at speeds up to four (4) m.p.h.

.7 Time Recording

- (a) All compaction and drying units with the exception of the self-powered and hand operated vibrating plate and tamping units as described in Articles 9.4.3.5(g) and (h) shall be equipped with an approved time recording device which accurately records the number of hours each machine is in operation.
- (b) It will be the Contractor's responsibility to ensure that the time recording devices are properly mounted and maintained, that the cards are accurately identified as to the machine, date and shift and to daily deliver said cards to the Engineer.
- (c) The Engineer will record the number of operating hours for each machine and both the Engineer and the Contractor will certify daily that such records are correct.

9.4.4 Measurement

- .1 The construction of embankments shall be considered incidental to the work under the Unit Price Table Items, and will not be measured separately for payment.
- .2 The quantity of Compaction to be measured for payment, shall be the actual number of approved hours

9.4.4 Measurement
(cont'd)

each compaction unit is operated as directed by the Engineer in accordance with these Specifications.

- .3 The quantity of Drying to be measured for payment, shall be the actual number of approved hours the drying unit is operated as directed by the Engineer in accordance with these Specifications.
- .4 The Unit Price Table prices for compaction and/or drying units shall be considered all-found fully operated rates including operators as required.
- .5 Other equipment used in the drying and/or compaction operations, which is not shown in the Unit Price Table, shall be considered incidental to the drying and compaction operation and will not be measured separately for payment.
- .6 Work described in Article 9.4.3.1(a) shall be considered incidental to the embankment construction operation and will not be measured separately for payment. Excess material not used in the embankment but disposed of as directed by the Engineer, will be excluded from the excavation measurement at its source.
- .7 The removal and disposal of stones, boulders and/or rock fragments as described in Article 9.4.3.1(h) shall be considered incidental to the embankment construction operation and will not be measured separately for payment.

9.5.1 Description

This item consists of the authorized hauling of excavated material, classified under the various excavation items, in accordance with these Specifications for a distance beyond a free haul distance of one-half (1/2) mile, (2,640 feet).

9.5.2 Materials

Not applicable.

9.5.3 Construction

Not applicable.

9.5.4 Measurement

- .1 The quantity of Overhaul to be measured for payment shall be the number of cubic yard miles of haul of authorized material beyond the two thousand six hundred and forty (2,640) foot free haul distance in accordance with these Specifications. The Haul will be calculated by the Mass Diagram Method.

The overhaul distance shall be the distance between the centres of volume of the overhauled material in its original position and its position after placing, less the free haul distance. The haul distance will be measured along the shortest route determined by the Engineer as feasible and satisfactory.

When material is obtained by extra widening of a right-of-way cut, any area of the excavation more than one hundred and fifty (150) feet from the centreline of the roadway shall, for the purpose of centre of mass and overhaul calculations, be considered as a separate area off the right-of-way and its distance from the roadway will be measured to the centreline of the roadway.

9.6.1 Description

This item consists of the transportation from the designated supply site(s) and the installation of Corrugated Steel Pipe (C.S.P.) Culverts in accordance with these Specifications and to the lines and grades shown on the Plans or as designated by the Engineer.

9.6.2 Materials

- .1 Culverts, couplers and hardware will be supplied by the Department at the designated supply site(s) listed in Division 1, Section 1. The materials will be palletized.
- .2 Materials used for bedding and the fill around culverts will be selected by the Engineer from items listed in the Unit Price Table.
- .3 Materials for water tight joints and insulation will be supplied by the Department to the project.

9.6.3 Construction

.1 Handling of Culvert Material

- (a) The Contractor shall transport the culvert material in the existing pallets from the designated supply site(s) to the Contractors stockpile site(s). The pallets shall be maintained during shipment.
- (b) Prior to removing the culvert material from the designated supply site(s), the Contractor shall supply the Engineer with a certificate acknowledging receipt of the material and from then to completion of the project, the Contractor shall assume full responsibility for the materials and shall replace any lost or damaged items.

The culverts have been nested and palletized in a manner most economical for shipment. The pallets are of such size that they will not exceed the width, height and length requirements for highway transport.

- (c) The culvert material shall be handled so as not to bruise or damage the spelter coating. It shall not be dragged on the ground or manipulated with heavy equipment without proper precaution to protect the surface. Any damage to the spelter coating shall be protected by the application of two (2) coats of weather resistant high zinc dust oxide paint meeting the requirements of the C.G.S.B. Specification No. 1-GP181. The areas damaged shall be thoroughly cleaned and rough edges ground smooth prior to the paint application.

9.6.3 Construction
(cont'd)

.2 Excavation

- (a) The location and elevation of excavations for culverts will be staked by the Engineer.
- (b) During construction the Contractor may be required to provide a temporary channel diversion outside the limits of the culvert. The location of the channel diversion and the method of construction is subject to the Engineer's approval.
- (c) Excavation shall be carried out in accordance with Division 9, Section 2(a) or Section 2(b).

.3 Bedding

The culvert bed shall be constructed to provide a uniform and firm foundation throughout its entire area. When a firm foundation is not encountered at the grade established for the culvert, the bottom of the bed shall be sub-excavated to the dimensions staked by the Engineer. The sub-excavated area shall be back-filled with material approved by the Engineer, and compacted as directed by the Engineer.

.4 Installation

- (a) Corrugated Steel Pipe Culverts shall be placed with the inside circumferential laps pointing downstream. The longitudinal laps for annular corrugated culverts shall be located at the side or quarter points.
 - (b) The sections of the culverts shall be firmly jointed with coupling bands.
 - (c) If watertight joints are specified, the method used shall be as directed by the Engineer.
 - (d) If insulation is specified, installation of insulation materials shall be as shown on the Plans or as directed by the Engineer.
 - (e) The backfilling around the culvert will be in accordance with the Plans and shall conform with Division 9, Section 4. The material used will be subject to the approval of the Engineer who will also determine the amount of compactive effort required.
 - (f) Vehicular traffic and construction equipment will not be allowed to cross over a culvert until the backfill has been constructed and compacted to a minimum depth two (2) feet
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9.6.3 Construction
(cont'd)

over the highest point of the culvert.

- (g) Strutting of culverts will not be allowed without written approval from the Engineer.

9.6.4 Measurement

- .1 The quantity of CORRUGATED STEEL PIPE to be measured for payment, shall be the number of lineal feet of the various sizes of pipe specified in the Unit Price Table acceptably delivered and installed in accordance with these Specifications.

The measurement will be based on the nominal length of pipe sections.

- .2 Installation of watertight joints will be measured for payment in accordance with Section 45 of the General Conditions "C".
- .3 Installation of insulation will be measured for payment in accordance with Section 45 of the General Conditions "C".
- .4 Quantities of culvert excavation, backfill material and compaction will be measured for payment in accordance with the appropriate Unit Price Table Items.
- .5 The replacement of any lost or damaged items as described in Article 9.6.3.1(b) shall be considered incidental to the culvert installation operation and will not be measured separately for payment.
- .6 The provision for a temporary channel diversion as described in Article 9.6.3.2(b) shall be considered incidental to the culvert installation operation and will not be measured separately for payment.

9.7.1 Description

This item consists of the transportation from the designated supply site(s) and the installation of Corrugated Structural Plate Pipe (C.S.P.P.) Culverts in accordance with these Specifications and to the lines and grades shown on the Plans or as designated by the Engineer.

9.7.2 Materials

- .1 The culvert plates, cut-off walls, hold down attachments, steam lines and all hardware will be supplied by the Department at the designated supply site(s) listed in Division 1, Section 1.
2. Materials used for bedding and the fill around the culverts will be selected by the Engineer from one of the Unit Price Table Items.
3. Materials for water tight joints and insulation will be supplied by the Department to the project.

9.7.3 Construction

.1 Handling of Culvert Material

- (a) The Contractor shall transport the culvert material in the existing bundles and/or pallets from the designated supply site(s) to the Contractors stockpile site(s). The bundles and/or pallets shall be maintained during shipment.
- (b) Prior to removing the culvert material from the designated supply site(s), the Contractor shall supply the Engineer with a certificate acknowledging receipt of the material and from then to completion of the project, the Contractor shall assume full responsibility for the materials and shall replace any lost or damaged items.

The culvert material has been palletized in a manner most economical for shipment. The pallets are of such size that they will not exceed the width, height, and length requirements for highway transport.

- (c) The culvert material shall be handled so as not to bruise or damage the spelter coating. It shall not be dragged on the ground or manipulated with heavy equipment without proper precautions to protect the surface. Any damage to the spelter coating shall be restored by the application of two (2) coats of weather-resistant, high zinc dust oxide paint meeting the requirements of the C.G.S.B. Specification 1-GP181. The areas damaged shall be thoroughly cleaned and rough edges ground smooth prior to the paint application.

9.7.3 Construction
(cont'd)

.2 Excavation

- (a) The location, lines and grades of the excavation required for the culvert installations will be as shown on the Plans or as designated by the Engineer.
- (b) During the construction, the Contractor may be required to provide a temporary diversion channel outside the limits of the culvert. The location of the channel diversion and the method of construction is subject to the Engineer approval.
- (c) Excavation shall be carried out in accordance with Division 9, Section 2(a) or Section 2(b).

.3 Foundation

The culvert bed shall provide a firm foundation throughout its entire area. The bed shall be sub-excavated to the dimensions staked by the Engineer and backfilled with approved material which shall be compacted as directed by the Engineer.

.4 Assembly

- (a) Placing and assembly of the pipe may only proceed after the excavation, foundation and bedding for the pipe have been approved by the Engineer. The assembly shall be in accordance with the Shop Drawings. All holes shall be filled with bolts and shall be tightened to a torque of not less than one hundred and fifty (150) foot pounds and not more than two hundred (200) foot pounds.
- (b) The Contractor shall, when specified in Division 1, Section 1, arrange to have in the field a fully qualified representative of the culvert supplier during the period of installation to ensure that the culvert assembly, erection and general construction are in accordance with the Supplier's recommendations.

.5 Backfilling

- (a) Assembly and tightening of all bolts shall be completed and approved by the Engineer before backfilling may commence. Backfill material will be designated by the Engineer.
- (b) Backfill material shall be placed in successive layers and compacted in accordance with the Plans or as directed by the Engineer. Equipment used for the backfilling operation up to

9.7.3 Construction
(cont'd)

three (3) feet above the top of the pipe shall run parallel and as close to the pipe as possible with simultaneous hand spreading and compaction by vibrators and/or mechanical tampers adjacent to the face of the pipe. The material under the haunches shall be hand placed and tamped as directed by the Engineer.

- (c) During the course of backfilling around and above the pipe, the deflections within the pipe will be measured by the Engineer and the results will be made available to the Contractor on a routine basis.

If required, the Contractor shall assist the Engineer in placing the measuring devices. Lateral movement of the pipe shall be prevented by controlling the rate of filling on each side. The Contractor will be responsible for the proper placing of the bedding and backfill as evidenced by the deformation of the pipe from its original shape. No strutting of the pipe will be allowed without written approval from the Engineer.

Unless otherwise directed, the following criteria on deflection will be followed. Only vertical deflections that tend to increase the original vertical dimension will be allowed. Increase in vertical dimension will not be permitted to exceed three (3) percent of the original vertical diameter. Horizontal deflections will not be permitted to exceed a five (5) percent decrease of the original horizontal diameter.

- (d) If during the placement of backfill or embankment around and above the pipe the deformations should exceed the above limits, the work shall cease. The Engineer may then order the removal and replacement of the backfill in its entirety or in part and may require that the pipe be struttred either horizontally or vertically. The Contractor shall undertake the corrective work as designated by the Engineer.
- (e) Vehicular traffic and construction equipment will not be allowed to cross over the structure until the backfill has been constructed and compacted to a minimum depth of three (3) feet over the highest point on the pipe, or to a height specified by the culvert supplier for the loadings anticipated.

9.7.3 Construction
(cont'd)

.6 Cut-Off Walls, Hold Down Attachments, Stiffeners,
Steam Lines

Where specified, cut-off walls, hold down attachments and steam lines shall be installed with the culvert installations in accordance with the Plans. Except where otherwise specified, all required materials will be provided to the Contractor along with the culvert materials.

.7 Dewatering

The foundation shall be kept free of water during the excavation and backfilling of the culvert bed and the assembly of the culvert.

During the backfilling of the culvert bed and around and above the culvert, water levels abutting the backfill shall be kept at least two (2) feet below the level of backfilling.

.8 If watertight joints are specified, the method used shall be as directed by the Engineer.

.9 If insulation is specified, installation of insulation materials shall be as shown on the Plans or as directed by the Engineer.

9.7.4 Measurement

.1 The quantity of CORRUGATED STRUCTURAL PLATE PIPE to be measured for payment shall be as a unit for the acceptable delivery and installation of Corrugated Structural Plate Pipe culvert(s) in accordance with these Specifications at each individual site shown on the Plans and referenced in the Unit Price Table.

.2 The delivery and installation of cut-off walls, hold down attachments and steam lines where specified in the Plans shall be considered incidental to the culvert installation operation and will not be measured separately for payment.

.3 Quantities for culvert excavation, backfill materials and compaction will be measured for payment in accordance with the appropriate Unit Price Table Items.

.4 Installation of watertight joints will be measured for payment in accordance with Section 45 of the General Conditions "C".

.5 Installation of insulation will be measured for payment in accordance with Section 45 of the General Conditions "C".

9.7.4 Measurement
(cont'd)

- .6 The replacement of any lost or damaged items as described in Article 9.7.3.1(b) shall be considered incidental to the culvert installation operation and will not be measured separately for payment.
- .7 The provision for a temporary channel diversion as described in Article 9.7.3.2(b) shall be considered incidental to the culvert installation operation and will not be measured separately for payment.
- .8 The provision to have in the field a representative of the culvert supplier as described in Article 9.7.3.4(b) shall be considered incidental to the culvert installation operation and will not be measured separately for payment.
- .9 Corrective work as described in Article 9.7.3.5(d) shall be considered incidental to the culvert installation operation and will not be measured separately for payment.
- .10 Dewatering as described in Article 9.7.3.7 shall be considered incidental to the culvert installation operation and will not be measured separately for payment.

9.8.1 Description

This item consists of excavating, screening or otherwise removing oversize material from gravel and loading, hauling and placing the material on the road or in stockpile(s) in accordance with these Specifications or as directed by the Engineer.

9.8.2 Materials

Traffic Gravel will consist of either screened gravel or pit run gravel.

.1 Screened Gravel - 3" Minus

The material shall consist of screened gravel of clean, hard particles, free from clay lumps, cementation and organic or other deleterious material and shall meet the following gradation requirement:

<u>Sieve No.</u>	<u>Percent Passing (By Weight)</u>
3"	100%
No. 4	30-70
No. 200	3-10

.2 Pit Run Gravel

The material shall consist of pit run gravel of clean, hard particles free from clay lumps, cementation and organic or other deleterious material. All oversize material shall be removed at the source or at the road. Material exceeding three (3) inches in dimension is classified as oversize material.

9.8.3 Construction

- .1 Clearing of material source area(s), haul road(s) and stockpile site(s) shall be in accordance with Division 9, Section 1.
- .2 Excavation and disposal of material overlaying the gravel source and the construction of haul road(s) and/or stockpile site(s) shall be in accordance with Division 9, Section 2(a) or 2(b) and Section 4.
- .3 To minimize the amount of oversize material hauled to the road, the Contractor shall select and sort out the pit run gravel material at the source.
- .4 Before gravel can be placed either on the road or in stockpile(s), approval must be received from the Engineer.
 - (a) For placement of gravel on the road, the roadbed surface shall be smooth riding and free from potholes and ruts. Scarifying and

9.8.3 Construction
(cont'd)

blading shall be performed as directed by the Engineer.

- (b) Hauling equipment shall be directed over the full width of the traffic lanes to ensure uniform compaction of the roadway surface.
- (c) The gravel shall be dumped and spread uniformly on the roadbed surface at the rate specified by the Engineer.
- (d) When gravel is used to backfill sub-excavated areas, or for backfill material around culverts, the backfill operation shall be in accordance with Division 9, Section 4.
- (e) Stockpile site(s) shall be firm and level and clean of all deleterious material. The stockpile(s) shall be shaped as directed by the Engineer and constructed in layers not exceeding three (3) feet in depth over the entire stockpile area. Stockpiles shall be kept free of snow and ice during the stockpiling operation.

9.8.4 Measurement

- .1 The quantity of SCREENED GRAVEL to be measured for payment, shall be the number of tons of material acceptably placed on the road or in the designated stockpile(s) in accordance with these Specifications.
- .2 The quantity of PIT RUN GRAVEL to be measured for payment, shall be the number of tons of material acceptably placed on the road or in the designated stockpile(s) in accordance with these Specifications.
- .3 The quantity of GRAVEL HAUL to be measured for payment shall be the number of ton miles of gravel haul for traffic gravel acceptably placed in accordance with these Specifications.

The quantity will be computed by multiplying the weight of the material in tons, or fractions thereof, by the haul distance measured in miles, or fractions thereof, along the designated route between the point of loading and the designated delivery point.

- .4 Removal from the road surface and disposal of oversize pit run material shall be considered incidental to the traffic gravel operation and will not be measured separately for payment.
- .5 Clearing, excavation of overburden and construction of haul roads and/or stockpile sites will be measured for payment in accordance with the appropriate

9.8.4 Measurement
(cont'd)

Unit Price Table Items.

- .6 Preparation of the roadbed surface, maintenance of haulroads, and removal of snow and ice as specified in Article 9.8.3.4(e) shall be considered incidental to the traffic gravel operation and will not be measured separately for payment.
-

9.10.1 Description

This item consists of loading, transporting and distributing water required for the construction of highway embankment or the placing of road surfacing materials, all in accordance with these Specifications.

9.10.2 Materials

The water shall be free from undesirable quantities of organic matter and mineral salts.

9.10.3 Construction

- .1 Watering equipment shall consist of water-tight tank(s) mounted on adequately powered trucks. The water shall be applied through a spray bar or nozzle of such design as to provide a uniform unbroken spread of water over a minimum width of eight (8) feet. A suitable device for positive shutoff of the spray bar shall be so located as to permit control from the cab of the truck.
- .2 The Engineer will determine the quantity of water to be applied and the rate of application.
- .3 Water used for dust control will not be measured for payment.

9.10.4 Measurement

- .1 The quantity of WATER to be measured for payment, shall be the number of one thousand (1,000) gallon units of water acceptably distributed in accordance with these Specifications.

9.11.1 Description

This item consists of supplying materials and constructing a protective covering of sacked concrete or approved stone, with or without mortar, on an earth bed or granular filter blanket or filter fabric in accordance with these Specifications. Rip-Rap shall be constructed at the locations and in conformity with the lines and grades shown on the Plans or as designated by the Engineer.

9.11.2 Materials

The Contractor will supply all rip-rap materials except for filter fabrics, which will be supplied by the Department to the project. The materials supplied by the Contractor will be subject to approval by the Engineer.

.1 Stone Rip-Rap:

Stone rip-rap materials shall be of approved quality and shall consist of sound, hard and dense stones, boulders or quarry rocks resistant to the action of air and water and free from seams, cracks or other structural defects.

- (a) Stone rip-rap materials generally designated for corrugated steel pipe culverts, ditch checks and ditch blocks shall meet the requirements of "Normal Stone Rip-Rap". Normal Stone Rip-Rap shall consist of stones, boulders or quarry rocks having dimensions of not less than six (6) inches in any one direction.
- (b) Stone rip-rap materials generally designated for corrugated structural plate pipe culverts, bridges, and channel bank protection shall consist of stones, boulders or quarry rocks meeting with the requirements for "Heavy Stone Rip-Rap" or "Armour Stone Rip-Rap."

HEAVY STONE RIP-RAP

Weight of Stones (lbs)	Percentage
800 - 1,200	40 - 60
400 - 800	20 - 40
50 - 400	10 - 30
Under 50	0

ARMOUR STONE RIP-RAP

Weight of Stones (lbs)	Percentage
1,200 - 2,000	60 - 70
400 - 1,200	20 - 30

9.11.2 Materials
(cont'd)

Weight of Stones (lbs)	Percentage
200 - 400	10 - 20
Under 200	0

- (c) Sand for mortar grout shall conform to the latest C.S.A. Specifications for Aggregate for Masonry Mortar A 82.56 unless otherwise instructed by the Engineer.
- (d) Cement for mortar grout shall be Portland Cement conforming to the latest C.S.A. Specification A5, Type 1.

.2 Sacked Concrete Rip-Rap

- (a) The soil material shall consist of a sand and/or gravel as designated or approved by the Engineer.
- (b) Sacks shall be manufactured from minimum ten (10) ounce burlap and shall be approximately twenty (20) inches by thirty-six (36) inches measured inside the seams when the sack is laid flat. The capacity of each sack shall be approximately one and one quarter (1.25) cubic feet.
- (c) The cement shall be Portland Cement conforming to the latest C.S.A. Specification A5, Type 1.

.3 Filter Blanket

Filter blanket material shall consist of approved well graded granular material free from undesirable quantities of soft particles, organic or other deleterious material. The source shall be subject to the approval of the Engineer.

.4 Filter Fabrics

Filter fabric materials will be supplied to the Contractor in rolls weighing approximately 150 pounds each.

9.11.3 Construction

.1 Preparation of Foundation

- (a) Aprons and slopes to be rip-rapped shall be excavated as shown on the Plans or as directed by the Engineer to provide adequate foundation upon which the rip-rap shall rest. The foundation bed shall be fine graded to form a uniform

9.11.3 Construction
(cont'd)

and even surface. Depressions shall be filled and thoroughly compacted.

- (b) Filter blankets shall be constructed at locations shown on the Plans or where directed by the Engineer, and to the lines and grades as staked by the Engineer.
- (c) Filter fabrics shall be placed at locations designated and in a manner directed by the Engineer. A thin lift of fine grained material will generally be placed over the filter fabric when used on other than hand placed rip-rap installation.

.2 Placing of Rip-Rap

(a) Hand Placed Rip-Rap:

The stones, boulders or quarry rocks shall be placed by hand to conform with the lines and dimensions designated by the Engineer. The stones shall be firmly bedded into the slopes and against adjoining stones, with smaller stones used to fill in the voids.

Hand placing will generally be designated for Normal Stone Rip-Rap.

(b) Machine Placed Rip-Rap:

The stones, boulders or quarry rocks shall be sorted and placed so as to produce a uniform thickness of rip-rap conforming with the lines and grades shown on the Plans or designated by the Engineer. The equipment used for the machine placing operation shall have the capability of handling and positioning individual rip-rap particles.

Machine placing will generally be applicable to Heavy Stone Rip-Rap and Armour Stone Rip-Rap.

(c) Random Rip-Rap:

The stones, boulders and quarry rocks shall be dumped onto the surface to be rip-rapped. Sufficient hand and/or machine work shall be performed to produce a uniform thickness of rip-rap conforming with the lines and dimensions designated by the Engineer.

Random placing may be designated for all types of stone rip-rap.

9.11.3 Construction
(cont'd)

(d) Sacked Concrete Rip-Rap:

The Engineer will determine the mix design of the concrete. Each burlap sack shall be filled with approximately one (1) cubic foot of concrete and securely stapled or tied with wire ties. Within one half hour after mixing of the concrete the sacks shall be placed in their final position on the prepared base, kneaded, rammed and packed into conformance with the prepared base and adjacent sacks already in place. Additional courses of sacks shall be placed to obtain the required depth within the area as designated by the Engineer.

The pattern to which the sacks are laid shall be approved by the Engineer. All earth and other debris shall be removed from the surface of sacks in place before succeeding courses are placed.

Following placing, the sacked concrete rip-rap shall be kept moist for a period of twenty-four (24) hours by sprinkling or other means approved by the Engineer.

(e) Grouted Stone Rip-Rap

Grouted stone rip-rap may be of the hand place or machine placed type. The surface of the stones, boulders or quarry rocks shall be cleaned and thoroughly wetted before applying the mortar. The spaces between the stones, boulders or quarry rocks shall be filled with cement mortar grout with the outer faces of the stones, boulders or quarry rocks left exposed. The grout shall be composed of one (1) part cement to three (3) parts sand, and of such consistency that it can be placed with a mason's trowel. The thickness of the grout between the stones shall be a minimum of four (4) inches or one-third ($1/3$) of the average diameter of the stones, boulder or quarry rock thickness whichever is the greater.

Grouted rip-rap shall be cured using curing compounds or wetted burlap or a blanket of earth kept wet for seventy-two (72) hours, or by sprinkling with a fine spray every two (2) hours during the daytime for a period of three (3) days.

The grouting of the rip-rap can only take place when the air temperature is continuously above freezing.

9.11.4 Measurement

- .1 The quantity of RIP-RAP to be measured for payment shall be the number of cubic yards of each type of rip-rap identified in the Unit Price Table which has been acceptably placed in accordance with these Specifications. Measurement of rip-rap will be made in its final position.
- .2 Haul of rip-rap materials shall be considered incidental to the rip-rap operation and will not be measured separately for payment.
- .3 The quantity of CEMENT to be measured for payment shall be the number of eighty (80) pound bags of cement acceptably incorporated into the construction of sacked concrete and/or grouted rip-rap in accordance with these Specifications.
- .4 The supply and delivery of filter blanket materials will be measured for payment under the appropriate Unit Price Table Items. Placement of the materials will be measured for payment in accordance with Section 45 of the General Conditions "C".
- .5 For the purpose of calculating quantities of haul for filter blanket materials, a conversion of one (1) cubic yard being equal to one and one-half (1.5) tons will be used.
- .6 Installation of Filter Fabrics will be measured for payment in accordance with Section 45 of the General Conditions "C".
- .7 All other work and materials required for the acceptable completion of the rip-rap installations including the preparation of the foundation shall be considered incidental to the rip-rap operation and will not be measured separately for payment.

9.14.1 Description

This item consists of supplying and/or delivering, setting up, operating, maintaining and dismantling the Engineer's Camp and supplying of meals, linen and cleaning services in accordance with these Specifications.

9.14.2 Accommodation

The Engineer's Camp will be for the exclusive use of the Engineer and his staff for the duration of the work.

- .1 The Engineer's Camp will generally consist of the following trailer units: one office trailer, sleeper trailers, one ablution trailer and one recreation trailer.
 - (a) The trailers specified in Article 9.14.2.1 above shall be placed into a self-contained unit joined by a minimum four (4) feet wide walkway having the same floor elevation as the trailers. The walkway shall be weather-proof, insulated and adequately heated. The layout shall be subject to the Engineer's approval.
 - (b) All the trailers specified in Article 9.14.2.1 above shall be adequately blocked and weather skirted for winter operation.
- .2 In addition to the trailer units specified in Article 9.14.2.1, the Engineer's Camp will consist of:
 - (a) One (1), only, unheated but weathertight storage shed, a minimum of eight (8) feet by twelve (12) feet and equipped with one locking door and one interior light. The storage shed shall be placed near the Engineer's camp and will be for the Engineer's exclusive use.
 - (b) Five (5) parking places for vehicles complete with five (5) exterior electrical outlets shall be provided near the office trailer for the exclusive use of the Engineer and his staff.
- .3 The Engineer's Camp shall be set up and ready for occupancy at the same time as the Contractor's camp.
- .4 The Contractor shall be responsible for the operation, repair and maintenance of the trailers, buildings and facilities in the Engineer's Camp.
- .5 The Contractor shall dismantle, move and re-establish the Engineer's Camp whenever he moves his own camp.

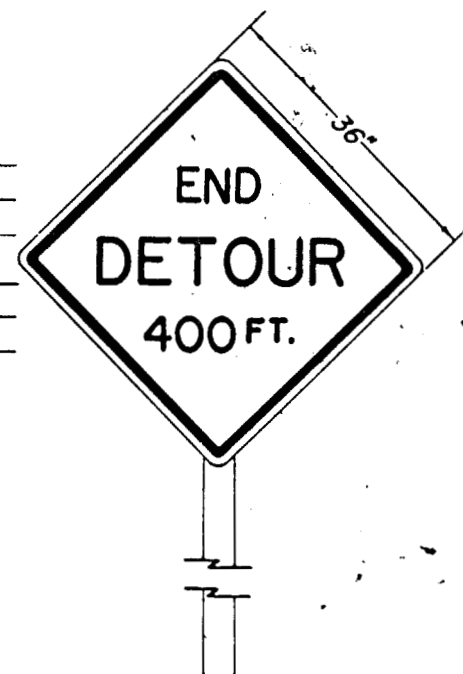
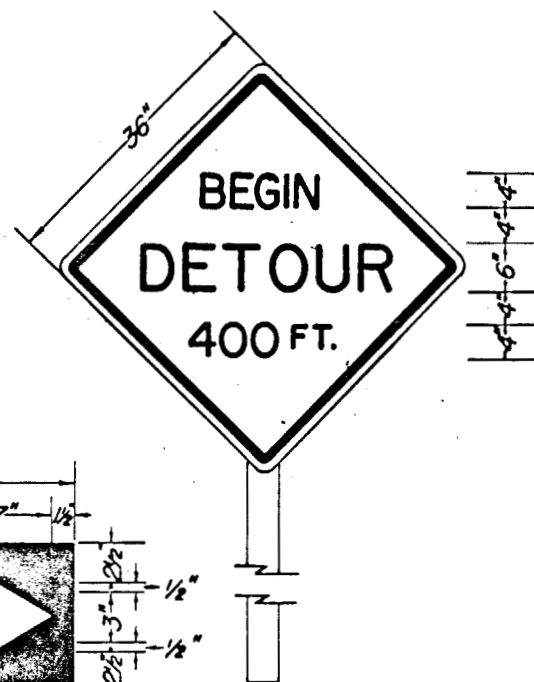
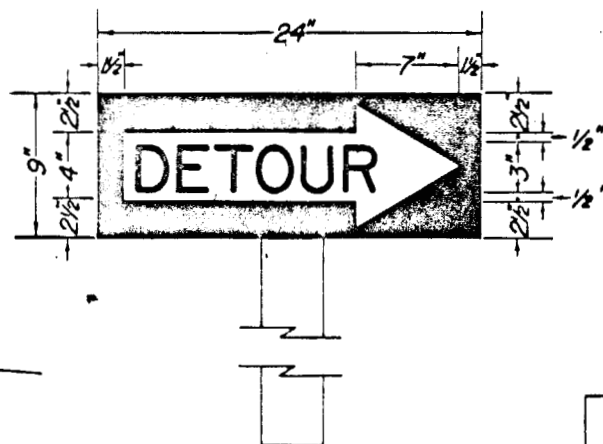
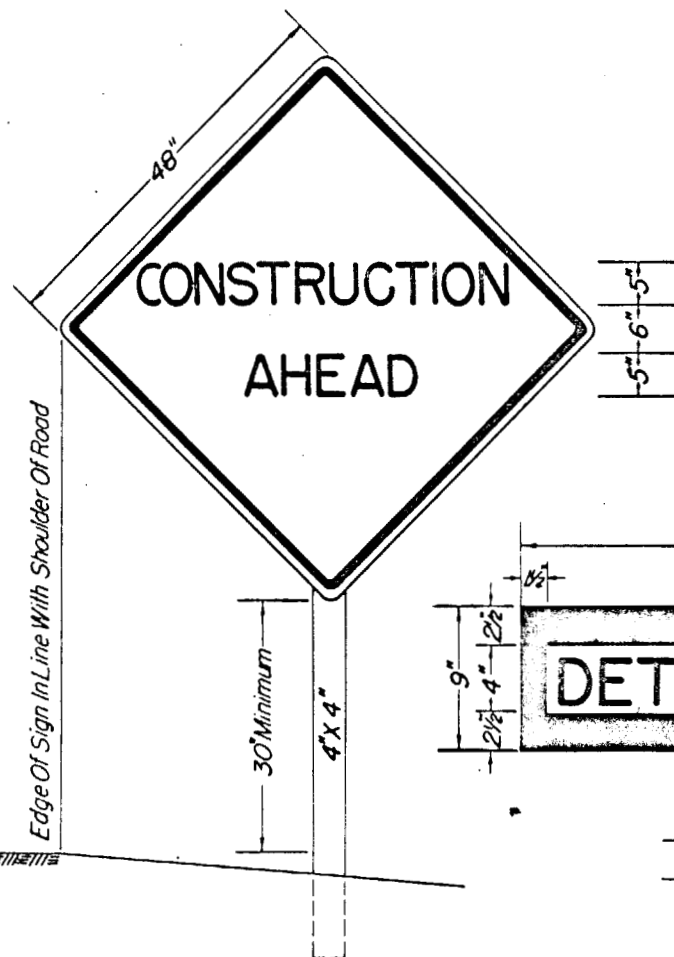
9.14.2 Accommodation
(cont'd)

- .6 The Contractor shall dismantle the Engineer's camp upon completion of the work and shall restore the camp area(s) to a condition satisfactory to the Engineer.
- .1 The Contractor shall provide all equipment, supplies and labour required to provide the Engineer's staff meals and services of the same quantity and quality as provided for the Contractor's staff.
- .2 The Contractor shall clean trailers daily and change the linen weekly or whenever a change in personnel occurs. "Linen" shall consist of three (3) blankets, two (2) sheets, one (1) pillow, one (1) pillow cover and two (2) towels for each occupant.
- .3 A water and sewer system shall be provided by the Contractor for the Engineer's Camp or the Contractor shall connect the Engineer's ablution trailer to his own system. The Contractor must include the Engineer's trailer units in his application under the Northern Inland Waters Act.
- .4 A steady and dependable source of electric power shall be supplied by the Contractor. The Contractor shall connect all trailers, buildings and exterior outlets to this source.
- .5 The Contractor shall supply all the fuel requirements for the camp and shall see that each heating unit is kept supplied with fuel and is in good operating condition.

9.14.3 Measurement

- .1 The quantity of the ENGINEER'S CAMP to be measured for payment shall be as a Unit for the acceptable accommodation in accordance with these Specifications.
- .2 The quantity of ENGINEER'S BOARD to be measured for payment shall be the number of mandays and fractions thereof that the Engineer's staff is acceptably provided with meals and other related services in accordance with these Specifications.

All part days shall be calculated to the nearest one-third ($1/3$) based on the number of meals taken by each member of the Engineer's staff.



Note:

1. Colouring - Black Lettering & Trim On Yellow Background
2. Mounting Posts For All Signs Similar To That Shown By Construction Ahead
3. Corner Radii - $1\frac{1}{2}$ "

DEPARTMENT OF PUBLIC WORKS OF CANADA

TYPICAL SIGNS

TO BE USED BY CONTRACTOR ON CONSTRUCTION
STANDARD DRAWING NO. F 1

DRAWN BY K. MAHONEY

CHECKED BY L.D. Reid

APPROVED: G. Miller

December 1969

DATE



C-4



C-13



C-6

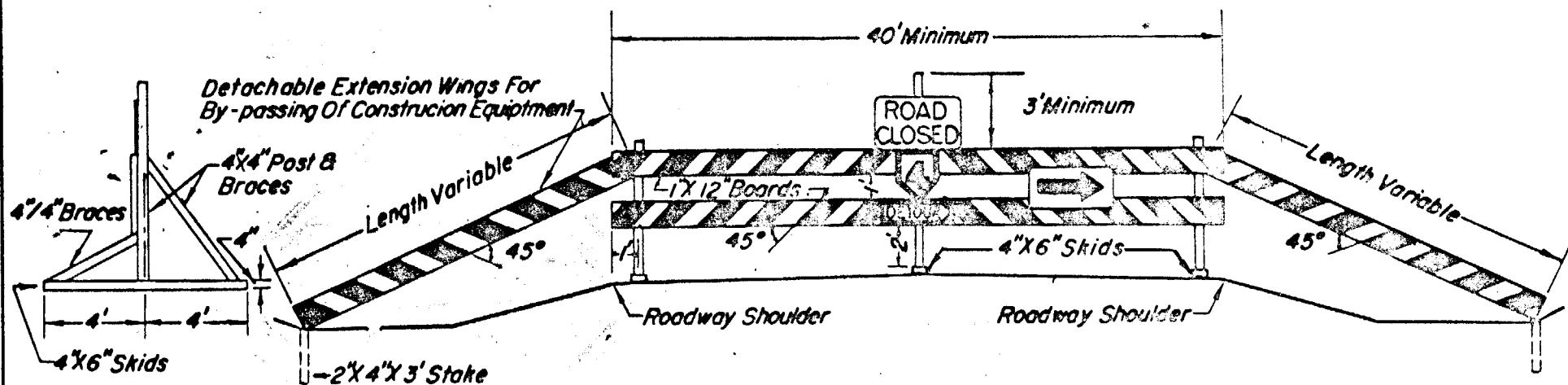
Note:

*All Signs To Conform To Standards Recommended in the Manual, "Uniform Traffic Control Devices For Canada"
Sign Borders To Be $\frac{3}{8}$ " Outside & $\frac{3}{8}$ " Inside
Corners To Be Rounded Using $1\frac{1}{2}$ " Radius
Overall Dimensions As Per Manual*

DEPARTMENT OF PUBLIC WORKS
OF CANADA

TYPICAL SIGNS
HIGHWAY-CONSTRUCTION
STANDARD DRAWING NO. FI-A

DRAWN BY K. MAHONEY CHECKED BY L. J. Smith
APPROVED: Miller December 1969
DATE:



Notes:

1. The Various Types & Combinations Of Approved Signs For Barricades Required For Each Project Will Be Governed By Field Conditions & Subject To Approval By The Engineer
2. All Barricades To Be 1' X 12" Lumber Painted & Alternate Black & Yellow Strips
3. All Skids, Braces & Posts To Be Painted White & Nailed Together With No. 20d Nails
4. Bases To Be Weighted Where Necessary To Provide Stability

DEPARTMENT OF PUBLIC WORKS.
OF CANADA

TYPICAL BARRICADE
TO BE USED BY CONTRACTOR ON CONSTRUCTION
STANDARD DRAWING NO. F3

DRAWN BY K. MAHONEY CHECKED BY [Signature]

APPROVED: [Signature]

DATE: December 1969

LIARD Hwy										DRILL HOLE REPORT		DEPARTMENT OF PUBLIC WORKS, CANADA MACKENZIE HIGHWAY											
DWN		FIELD ENG.		DATE DRILLED 8/01/21		AIRPHOTO NO:		CHAINAGE		OFFSET		TEST HOLE 1											
CKD		TECH PRONCH		RIG B-50		SURFACE DRAINAGE:		VEGETATION		ELEV		MILE B,C,S NUMBER											
DEPTH (FEET)	SAMPLE NUMBER	SAMPLE TYPE	% RECOVERY	PENETRATION RESISTANCE	UNIFIED SOIL SYMBOL	SOIL DESCRIPTION	LIMITS OF FROZEN GROUND	ICE DESCRIPTION	DEPTH (FEET)	WATER CONTENT (% OF DRY WEIGHT)		ICE CONTENT (% OF SAMPLE VOLUME)		GRAIN-SIZE ANALYSIS				WET DENSITY (P.C.F.)	DRY DENSITY (P.C.F.)	REMARKS			
										PLASTIC LIMIT	LIQUID LIMIT	CLAY %	SILT %	SAND %	GRAVEL %								
						CL CLAY - SILTY BROWN																	
2						ML SILT - CLAYNY			2														
4						CL CLAY - SILTY PEBBLES			4														
6									6														
8						CL CLAY - SILTY SANDY GRAVELLY			8														
10						Gc CLAY - SAND - GRAVEL			10														
12									12														
14						Sc SAND - SILTY - CLAYNY GRAVELLY			14														
16									16														
18						CL CLAY - SANDY			18														
20						CI PEBBLES 20'			20														
22						BOTTOM OF HOLE - 20			22														
24									24														

LIARD Hwy										DRILL HOLE REPORT		DEPARTMENT OF PUBLIC WORKS, CANADA MACKENZIE HIGHWAY									
DWN		FIELD ENG.		DATE DRILLED 7/10/21		AIRPHOTO NO.		CHAINAGE		OFFSET		ELEV		TEST HOLE # 2							
CKD		TECH Pronych		RIG B-50		SURFACE DRAINAGE		VEGETATION						MILE B.C.S NUMBER							
DEPTH (FEET)	SAMPLE NUMBER	SAMPLE TYPE	% RECOVERY	PENETRATION RESISTANCE	UNIFIED SOIL SYMBOL	SOIL DESCRIPTION	LIMITS OF FROZEN GROUND	ICE DESCRIPTION	DEPTH (FEET)	GRAIN-SIZE ANALYSIS				WET DENSITY (P.C.F.)	DRY DENSITY (P.C.F.)	REMARKS					
										CLAY %	SILT %	SAND %	GRAVEL %								
						SILT - CLAYEY															
2									2					100	0	0	DAMP				
														100	0	0	DAMP				
4					ML				4					100	0	0	DAMP				
6									6												
8						CLAY - SILTY SANDY GRAVELLY			8					59	20	21	MOIST				
10						1% BELOW P _L			10					45	29	26	MOIST				
12					CL	LOW - MED. PLASTIC			12												
14									14					28	37	35	DAMP				
16									16												
18									18												
20						BOTTOM OF HOLE - 20'			20					55	32	13	DAMP				
22									22												
24									24												

LARD HWY.				DRILL HOLE REPORT				DEPARTMENT OF PUBLIC WORKS, CANADA MACKENZIE HIGHWAY							
DWN		FIELD ENG		DATE DRILLED 78/01/22		AIRPHOTO NO:		CHAINAGE		OFFSET		TEST HOLE 1			
CKD		TECH PRONYCH		RIG B-50		SURFACE DRAINAGE:		VEGETATION:		ELEV		MILE B,C,S NUMBER			
DEPTH (FEET)	SAMPLE NUMBER	SAMPLE TYPE	% RECOVERY	PENETRATION RESISTANCE	UNIFIED SOIL SYMBOL	SOIL DESCRIPTION	LIMITS OF FROZEN GROUND	ICE DESCRIPTION	DEPTH (FEET)	GRAIN-SIZE ANALYSIS				WET DENSITY (P.C.F.)	DRY DENSITY (P.C.F.)
										CLAY %	SILT %	SAND %	GRAVEL %		
										○ = WATER CONTENT (% OF DRY WEIGHT) △ = ICE CONTENT (% OF SAMPLE VOLUME)					
										PLASTIC LIMIT ——— LIQUID LIMIT 20 40 60 80 100 100+					
2					ML	SILT - SANDY			2		52	48	0	DAMP	
4					ML	CLAYEY SAND SILT			4		62	38	0	DAMP	
6					SH	SAND - SILTY FINE			6		82	18	0	MOIST	
8					Sc	PERBBLES CLAYEY			8		38	67	0	MOIST	
10									10		31	69	0	DAMP	
12									12						
14									14		39	59	2	MOIST	
16									16						
18									18						
20									20		42	47	11	MOIST	
22									22						
24									24						
REMARKS A' 6' 20' BOTTOM OF HOLE 20'															

LIARD Hwy				DRILL HOLE REPORT				DEPARTMENT OF PUBLIC WORKS, CANADA MACKENZIE HIGHWAY								
DWN		FIELD ENG		DATE DRILLED 7/1/22		AIRPHOTO NO:		CHAINAGE		OFFSET		TEST HOLE 2				
CKD		TECH PRONY CH		RIG B-50		SURFACE DRAINAGE		VEGETATION		ELEV		MILE B.C.S NUMBER				
DEPTH (FEET)	SAMPLE NUMBER	SAMPLE TYPE	% RECOVERY	PENETRATION RESISTANCE	UNIFIED SOIL SYMBOL	SOIL DESCRIPTION	LIMITS OF FROZEN GROUND	ICE DESCRIPTION	DEPTH (FEET)	GRAIN-SIZE ANALYSIS				WET DENSITY (P.C.F.)	DRY DENSITY (P.C.F.)	REMARKS
										CLAY %	SILT %	SAND %	GRAVEL %			
2						SILT - SANDY			2							
						CLAYEY										
4						SAND - SILTY FINE			4							
6									6							
8									8							
10									10							
12									12							
14									14							
16									16							
18									18							
20									20							
22									22							
24									24							

LIARD Hwy										DRILL HOLE REPORT				DEPARTMENT OF PUBLIC WORKS, CANADA MACKENZIE HIGHWAY			
DWN		FIELD ENG.		DATE DRILLED 8/21		AIRPHOTO NO:		CHAINAGE		OFFSET		TEST HOLE 3					
CKD		TECH PRONYCH		RIG B-50		SURFACE DRAINAGE:		VEGETATION		ELEV		MILE B,C,S NUMBER					
DEPTH (FEET)	SAMPLE NUMBER	SAMPLE TYPE	% RECOVERY	PENETRATION RESISTANCE	UNIFIED SOIL SYMBOL	SOIL DESCRIPTION	LIMITS OF FROZEN GROUND	ICE DESCRIPTION	DEPTH (FEET)	GRAIN SIZE ANALYSIS		WET DENSITY (p.c.f.)	DRY DENSITY (p.c.f.)				
										CLAY %	SILT %						
2					SM	SAND - SILTY FINE			2	19	81	0	DAMP				
4					ML	SILT - SANDY			4	61	39	0	DAMP				
6					SM	SAND - SILTY FINE			6	30	70	0	DAMP				
8					SM ML	SAND - SILT MIX			8	50	50	0	DAMP				
10									10	51	49	0	DAMP				
12									12								
14					SM	SAND - SILTY FINE			14	30	70	0	DAMP				
16									16								
18					SM ML	SAND - SILT MIX			18								
20						20'			20	55	45	0	MOIST				
22						BOTTOM OF HOLE 20			22								
24									24								

LIARD Hwy										DRILL HOLE REPORT		DEPARTMENT OF PUBLIC WORKS, CANADA MACKENZIE HIGHWAY									
DWN		FIELD ENG		DATE DRILLED		AIRPHOTO NO:		CHAINAGE		OFFSET		TEST HOLE 1									
CKD		TECH <u>Pronych</u>		RIG <u>B-50</u>		SURFACE DRAINAGE:		VEGETATION		ELEV		MILE <u>B.P</u> B.C.S. NUMBER <u>10</u>									
DEPTH (FEET)	SAMPLE NUMBER	SAMPLE TYPE	% RECOVERY	PENETRATION RESISTANCE	UNIFIED SOIL SYMBOL	SOIL DESCRIPTION	LIMITS OF FROZEN GROUND	ICE DESCRIPTION	DEPTH (FEET)	GRAIN SIZE ANALYSIS					WET DENSITY (P.C.F.)	DRY DENSITY (P.C.F.)	REMARKS				
										CLAY %	SILT %	SAND %	GRAVEL %								
2					ML	SILT - SANDY CLAYEY 2'			2	○	81	19	0			DAMP					
4					SM	SAND-SILTY FINE			4	○	28	72	0			DAMP					
6					ML	SILT-SAND MIX. 7'			6	○	53	47	0			DAMP					
8						BOTTOM OF HOLE 7'			8												
10						REFUSAL			10												
12						COBBLES			12												
14									14												
16									16												
18									18												
20									20												
22									22												
24									24												

LIARD Hwy				DRILL HOLE REPORT				DEPARTMENT OF PUBLIC WORKS, CANADA MACKENZIE HIGHWAY								
DWN		FIELD ENG		DATE DRILLED 18/01/22		AIRPHOTO NO:		CHAINAGE:		OFFSET						
CKD		TECH PRONYCH		RIG B-50		SURFACE DRAINAGE:		VEGETATION:		ELEV						
DEPTH (FEET)	SAMPLE NUMBER	SAMPLE TYPE	% RECOVERY	PENETRATION RESISTANCE	UNIFIED SOIL SYMBOL	SOIL DESCRIPTION	LIMITS OF FROZEN GROUND	ICE DESCRIPTION	DEPTH (FEET)	GRAIN-SIZE ANALYSIS				WET DENSITY (P.C.F.)	DRY DENSITY (P.C.F.)	REMARKS
										CLAY	SILT	SAND	GRAVEL			
										○ = WATER CONTENT (% OF DRY WEIGHT) △ = ICE CONTENT (% OF SAMPLE VOLUME)						
										PLASTIC LIMIT LIQUID LIMIT 20 40 60 80 100 100+						
2					ML	SILT - SANDY			2		60	40	0			DAMP
4						CLAY - SILTY SANDY			3		81	16	0			DAMP
6						- PEBBLES			5		47	44	9			DAMP
8					CL	GRAVELLY COBBLES			8		45	42	13			DAMP
10						LOW PLASTIC			11		39	44	17			DAMP
12						14% BELOW P _L			13		45	44	11			DAMP
14						BOTTOM OF HOLE 13'										
16						REFUSAL										
18																
20																
22																
24																

LIARD Hwy										DRILL HOLE REPORT		DEPARTMENT OF PUBLIC WORKS, CANADA MACKENZIE HIGHWAY									
OWN		FIELD ENG		DATE DRILLED 18/01/22		AIRPHOTO NO:		CHAINAGE		OFFSET		TEST HOLE 3									
CKD		TECH PRONYCH		RIG B-50		SURFACE DRAINAGE:		VEGETATION:		ELEV		MILE B.C.S NUMBER									
DEPTH (FEET)	SAMPLE NUMBER	SAMPLE TYPE	% RECOVERY	PENETRATION RESISTANCE	UNIFIED SOIL SYMBOL	SOIL DESCRIPTION	LIMITS OF FROZEN GROUND	ICE DESCRIPTION	DEPTH (FEET)	GRAIN-SIZE ANALYSIS				WET DENSITY (PCF)	DRY DENSITY (PCF)	REMARKS					
										CLAY %	SILT %	SAND %	GRAVEL %								
2					ML	BOULDER @ 1"			2												
						SILT-SANDY															
						CLAYEY															
4						GRAVELLY			4												
					GC	SILT-CLAY-GRAVEL															
						SAND MIX															
6									6												
8						CLAY-SILTY			8												
						-SANDY															
						-GRAVELLY															
10						LOW PLASTIC			10												
					CL																
12									12												
14						PEBBLES			14												
						1/2" BELOW P _L															
16									16												
18									18												
20									20												
22									22												
24									24												

LIARD Hwy										DRILL HOLE REPORT		DEPARTMENT OF PUBLIC WORKS, CANADA MACKENZIE HIGHWAY			
OWN		FIELD ENG		DATE DRILLED 8/1/72		AIRPHOTO NO:		CHAINAGE		OFFSET		TEST HOLE 1			
CKD		TECH Bonyeh		RIG B-50		SURFACE DRAINAGE:		VEGETATION:		ELEV		MILE B.C.S NUMBER			
DEPTH (FEET)	SAMPLE NUMBER	SAMPLE TYPE	% RECOVERY	PENETRATION RESISTANCE	UNIFIED SOIL SYMBOL	SOIL DESCRIPTION	LIMITS OF FROZEN GROUND	ICE DESCRIPTION	DEPTH (FEET)	GRAIN-SIZE ANALYSIS		WET DENSITY (P.C.F.)	DRY DENSITY (P.C.F.)	REMARKS	
										CLAY %	SILT %				SAND %
						SILT									
2									2	99	1	0		DAMP	
4					ML	SANDY			4	96	4	0		DAMP	
6									6	88	12	0		DAMP	
8						CORBLES @ 8'			8	72	28	0		DAMP	
10						REFUSAL @ 9'									
12									12						
14									14						
16									16						
18									18						
20									20						
22									22						
24									24						

LARD Hwy.										DRILL HOLE REPORT										DEPARTMENT OF PUBLIC WORKS, CANADA MACKENZIE HIGHWAY									
DWN		FIELD ENG		DATE DRILLED		AIRPHOTO NO.		CHAINAGE		OFFSET		TEST HOLE		MILE		B,C,S		NUMBER											
CKD		TECH		RIG		SURFACE DRAINAGE		VEGETATION		ELEV		B.P.																	
DEPTH (FEET)	SAMPLE NUMBER	SAMPLE TYPE	% RECOVERY	PENETRATION RESISTANCE	UNIFIED SOIL SYMBOL	SOIL DESCRIPTION	LIMITS OF FROZEN GROUND	ICE DESCRIPTION	DEPTH (FEET)	O = WATER CONTENT (% OF DRY WEIGHT) △ = ICE CONTENT (% OF SAMPLE VOLUME)		GRAIN SIZE ANALYSIS				WET DENSITY (PCF)	DRY DENSITY (PCF)	REMARKS											
										PLASTIC LIMIT	LIQUID LIMIT	CLAY %	SILT %	SAND %	GRAVEL %														
2					ML	SILT			2	99	1	0	0	0	0	0	0	0	0	DAMP									
4					ML				4	94	6	0	0	0	0	0	0	0	0	DAMP									
6									6	95	5	0	0	0	0	0	0	0	0	DAMP									
8									8	64	36	0	0	0	0	0	0	0	0	DAMP									
10					ML	SILT - SAND MIXTURE			10	54	46	0	0	0	0	0	0	0	0	DAMP									
12					SM				12																				
14									14																				
16									16	51	49	0	0	0	0	0	0	0	0	DAMP									
18									18																				
20									20																				
22									22																				
24									24																				

LIARD Hwy.										DRILL HOLE REPORT		DEPARTMENT OF PUBLIC WORKS, CANADA MACKENZIE HIGHWAY													
OWN		FIELD ENG		DATE DRILLED 18/10/22		AIRPHOTO NO.		CHAINAGE		OFFSET		TEST HOLE 3													
CKD		TECH PRONYCH		RIG B-50		SURFACE DRAINAGE		VEGETATION		ELEV		<table border="1" style="width:100%; border-collapse: collapse;"> <tr> <th>MILE</th> <th>B,C,S</th> <th>NUMBER</th> </tr> <tr> <td>B.P.</td> <td></td> <td>11</td> </tr> </table>								MILE	B,C,S	NUMBER	B.P.		11
MILE	B,C,S	NUMBER																							
B.P.		11																							
DEPTH (FEET)	SAMPLE NUMBER	SAMPLE TYPE	% RECOVERY	PENETRATION RESISTANCE	UNIFIED SOIL SYMBOL	SOIL DESCRIPTION	LIMITS OF FROZEN GROUND	ICE DESCRIPTION	DEPTH (FEET)	GRAIN-SIZE ANALYSIS				WET DENSITY (PCF)	DRY DENSITY (PCF)	REMARKS									
										CLAY %	SILT %	SAND %	GRAVEL %												
						SILT -																			
2						CLAYEY			2					98	20	DAMP									
4					ML	SANDY			4					98	20	DAMP									
6									6					61	39	DAMP									
8						COBBLES @ 11'			8					82	18	DAMP									
10									10					73	27	Moist									
12									12																
14						ML CLAY-SILTY SANDY GRAVELLY CL Low Plastic			14					37	27	36 DAMP									
16						BOTTOM OF HOLE 15'			16																
18									18																
20									20																
22									22																
24									24																

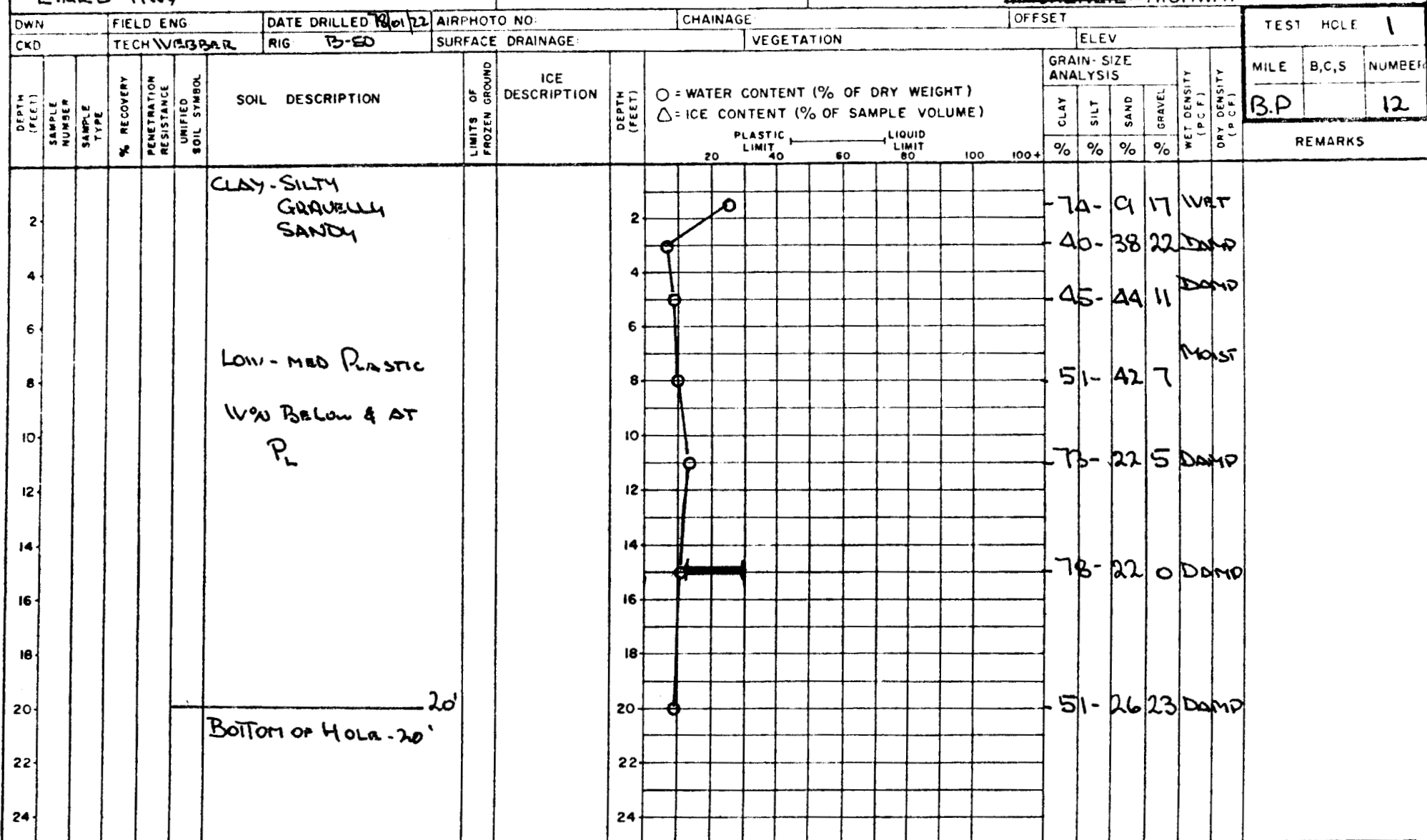
LIARD HWY				DRILL HOLE REPORT				DEPARTMENT OF PUBLIC WORKS, CANADA MACKENZIE HIGHWAY								
DWN		FIELD ENG		DATE DRILLED 8/1/72		AIRPHOTO NO.		CHAINAGE		OFFSET		TEST HOLE 4				
CKD		TECH PRONYCH		RIG B-50		SURFACE DRAINAGE		VEGETATION		ELEV		MILE B,C,S NUMBER				
DEPTH (FEET)	SAMPLE NUMBER	SAMPLE TYPE	% RECOVERY	PENETRATION RESISTANCE	UNIFIED SOIL SYMBOL	SOIL DESCRIPTION	LIMITS OF FROZEN GROUND	ICE DESCRIPTION	DEPTH (FEET)	GRAIN SIZE ANALYSIS				WET DENSITY (P.C.F.)	DRY DENSITY (P.C.F.)	REMARKS
										CLAY %	SILT %	SAND %	GRAVEL %			
										○ = WATER CONTENT (% OF DRY WEIGHT) △ = ICE CONTENT (% OF SAMPLE VOLUME)						
										PLASTIC LIMIT 40 LIQUID LIMIT 60 100 100+						
2						SILT - CLAYEY			2		96	4	0		DAMP	
4									4		95	5	0		MOIST	
6					ML				6		91	9	0		DAMP	
8						SANDY			8		79	21	0		DAMP	
10						Refusal @ 9'			10							
12									12							
14									14							
16									16							
18									18							
20									20							
22									22							
24									24							

~~MACKENZIE HIGHWAY~~

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DEPARTMENT OF PUBLIC WORKS, CANADA

~~MACKENZIE HIGHWAY~~



LIARD Hwy										DRILL HOLE REPORT										DEPARTMENT OF PUBLIC WORKS, CANADA MACKENZIE HIGHWAY									
DWN		FIELD ENG.		DATE DRILLED 18/12		AIRPHOTO NO.		CHAINAGE		OFFSET		TEST HOLE 2																	
CKD		TECH IVB3P22		RIG B-50		SURFACE DRAINAGE		VEGETATION		ELEV		MILE B.C.S		NUMBER															
DEPTH (FEET)	SAMPLE NUMBER	SAMPLE TYPE	% RECOVERY	PENETRATION RESISTANCE	UNIFIED SOIL SYMBOL	SOIL DESCRIPTION	LIMITS OF FROZEN GROUND	ICE DESCRIPTION	DEPTH (FEET)	GRAIN SIZE ANALYSIS				WET DENSITY (P.C.F.)	DRY DENSITY (P.C.F.)	REMARKS													
										CLAY %	SILT %	SAND %	GRAVEL %																
2					ML	SILT - CLAYEY SANDY			2					82	18	0	Moist												
4						CLAY - SILTY SANDY PEBBLES	4'		3					98	2	0	DAMP												
6					CL	LOW PLASTIC 1% AT & BELOW P _L			5					54	35	11	DAMP												
8									8					59	37	4	DAMP												
10							11'		11					52	41	7	Moist												
12						HOLE CAVED IN																							
14																													
16																													
18																													
20																													
22																													
24																													

LIARD Hwy				DRILL HOLE REPORT				DEPARTMENT OF PUBLIC WORKS, CANADA MACKENZIE HIGHWAY							
OWN		FIELD ENG		DATE DRILLED 7/8/22		AIRPHOTO NO:		CHAINAGE		OFFSET		TEST HOLE 3			
CKD		TECH WEBBER		RIG B-50		SURFACE DRAINAGE:		VEGETATION:		ELEV		MILE B.C.S NUMBER			
DEPTH (FEET)	SAMPLE NUMBER	SAMPLE TYPE	% RECOVERY	PENETRATION RESISTANCE	UNIFIED SOIL SYMBOL	SOIL DESCRIPTION	LIMITS OF FROZEN GROUND	ICE DESCRIPTION	DEPTH (FEET)	GRAIN SIZE ANALYSIS				WET DENSITY (P.C.F.)	DRY DENSITY (P.C.F.)
										CLAY %	SILT %	SAND %	GRAVEL %		
						SILT - CLAYEY									
2					ML				2						
4					ML	SAND - SILT MIX			4						
6					SM	PEBBLES			6						
8									8						
10									10						
12						CLAY - SILTY SANDY GRAVELLY MED. PLASTIC			12						
14					CI				14						
16						14% BELOW P _L			16						
18									18						
20									20						
22									22						
24									24						

REMARKS	
<p>○ = WATER CONTENT (% OF DRY WEIGHT)</p> <p>△ = ICE CONTENT (% OF SAMPLE VOLUME)</p> <p>PLASTIC LIMIT 40 60 80 100 100+</p> <p>LIQUID LIMIT 80 100 100+</p>	<p>94-60 Moist</p> <p>98-20 Moist</p> <p>48-51 Damp</p> <p>52-38 Damp</p> <p>49-35 Damp</p> <p>69-21 Damp</p> <p>51-39 Damp</p>

LIARD Hwy										DRILL HOLE REPORT					DEPARTMENT OF PUBLIC WORKS, CANADA MACKENZIE HIGHWAY				
DWN		FIELD ENG.		DATE DRILLED 18/12/22		AIRPHOTO NO:		CHAINAGE		OFFSET		TEST HOLE 4							
CKD		TECH WFBAR		RIG B-50		SURFACE DRAINAGE:		VEGETATION		ELEV		MILE B,C,S NUMBER							
DEPTH (FEET)	SAMPLE NUMBER	SAMPLE TYPE	% RECOVERY	PENETRATION RESISTANCE	UNIFIED SOIL SYMBOL	SOIL DESCRIPTION	LIMITS OF FROZEN GROUND	ICE DESCRIPTION	DEPTH (FEET)	GRAIN-SIZE ANALYSIS				WET DENSITY (P.C.F.)	DRY DENSITY (P.C.F.)	REMARKS			
										CLAY %	SILT %	SAND %	GRAVEL %						
						SILT-CLAYEY													
2									2	96	4	0	0	MOIST					
4									4	97	3	0	0	DAMP					
6					ML				6	98	2	0	0	MOIST					
8						SANDY			8	66	31	0	0	DAMP					
10									10	83	17	0	0	DAMP					
12									12										
14						CLAY - SILTY SANDY	13'		14	85	15	0	0	DAMP					
16					CI	MED. PLASTIC			16										
18						11% AT P _L			18										
20							20'		20	62	17	21	0	DAMP					
22						BOTTOM OF HOLE - 20'			22										
24									24										

DEPARTMENT OF PUBLIC WORKS, CANADA
~~MACKENZIE HIGHWAY~~

TEST HOLE

ELEV

VEGETATION:

ELEV

TEST HOLE

MILE	B,C,S	NUMBER
1		
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4		
5		
6		
7		
8		
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10		
11		
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100		

35

B,C,S

NUMBERS

REMARKS

1

3

SAND - SILTY

SAND-SILT MIX

_____ 19'

Bottom of Hole 10'

CROZMAN

DEPTH
(FEET)

○ = WATER CONTENT (% OF DRY WEIGHT)
△ = ICE CONTENT (% OF SAMPLE VOLUME)

PLASTIC
LIMIT

LIQUID
LIMIT
80

20

LIN

60

60

14

1

04

%

70

70

70

1

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Keywords:

Summary:

Abstract

Abstract

I

MOIST

Moist	
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Most

DAMP

DAMP

LIARD Hwy.				DRILL HOLE REPORT				DEPARTMENT OF PUBLIC WORKS, CANADA MACKENZIE HIGHWAY													
DWN		FIELD ENG.		DATE DRILLED		AIRPHOTO NO.		CHAINAGE				OFFSET		TEST HOLE							
CKD		TECH		RIG		SURFACE DRAINAGE				VEGETATION				ELEV							
DEPTH (FEET)	SAMPLE NUMBER	SAMPLE TYPE	% RECOVERY	PENETRATION RESISTANCE	UNIFIED SOIL SYMBOL	SOIL DESCRIPTION	LIMITS OF FROZEN GROUND	ICE DESCRIPTION	DEPTH (FEET)	○ = WATER CONTENT (% OF DRY WEIGHT) △ = ICE CONTENT (% OF SAMPLE VOLUME)					GRAIN-SIZE ANALYSIS				WET DENSITY (P.C.F.)	DRY DENSITY (P.C.F.)	REMARKS
										PLASTIC LIMIT 20 40 60 80 100 100+					CLAY	SILT	SAND	GRAVEL			
										%	%	%	%			MILE	B,C,S	NUMBER			
																	35		2		
2					ML	SILT - SANDY 2'		Frozen	2										MOIST		
4						SAND - SILTY			4										DAMP		
6					SM	VERY FINE			6										DAMP		
8									8										DAMP		
10									10										Moist		
12									12												
14									14												
16									16												
18									18												
20									20												
22									22												
24									24												

Lizard Hwy										DRILL HOLE REPORT					DEPARTMENT OF PUBLIC WORKS, CANADA MACKENZIE HIGHWAY									
DWN		FIELD ENG.		DATE DRILLED 7/21/21		AIRPHOTO NO:		CHAINAGE		OFFSET		TEST HOLE												
CKD		TECH <u>Pronych</u>		RIG <u>B-50</u>		SURFACE DRAINAGE:		VEGETATION:		ELEV		MILE		B,C,S		NUMBER								
DEPTH (FEET)	SAMPLE NUMBER	SAMPLE TYPE	% RECOVERY	PENETRATION RESISTANCE	UNIFIED SOIL SYMBOL	SOIL DESCRIPTION	LIMITS OF FROZEN GROUND	ICE DESCRIPTION	DEPTH (FEET)	○ = WATER CONTENT (% OF DRY WEIGHT) △ = ICE CONTENT (% OF SAMPLE VOLUME)		GRAIN-SIZE ANALYSIS				WET DENSITY (P.C.F.)	DRY DENSITY (P.C.F.)	REMARKS						
										PLASTIC LIMIT	LIQUID LIMIT	CLAY %	SILT %	SAND %	GRAVEL %									
2					ML	SILT-CLAYEY SANDY 2'			2	○								Moist						
4						SAND - SILTY			4	○								Moist						
6					SM	VERY FINE			6	○								DAMP						
8									8	○								DAMP						
10						10'			10	○								Moist						
12						BOTTOM OF HOLE. 10'			12															
14									14															
16									16															
18									18															
20									20															
22									22															
24									24															

LIARD Hwy				DRILL HOLE REPORT				DEPARTMENT OF PUBLIC WORKS, CANADA MACKENZIE HIGHWAY								
DWN CKD		FIELD ENG		DATE DRILLED 18/12/21		AIRPHOTO NO:		CHAINAGE:		OFFSET:		TEST HOLE				
		TECH Romych		RIG B-50		SURFACE DRAINAGE:		VEGETATION:		ELEV		MILE B,C,S NUMBER				
DEPTH (FEET)	SAMPLE NUMBER	SAMPLE TYPE	% RECOVERY	PENETRATION RESISTANCE	UNIFIED SOIL SYMBOL	SOIL DESCRIPTION	LIMITS OF FROZEN GROUND	ICE DESCRIPTION	DEPTH (FEET)	GRAIN-SIZE ANALYSIS				WET DENSITY (P.C.F.)	DRY DENSITY (P.C.F.)	REMARKS
										CLAY %	SILT %	SAND %	GRAVEL %			
						SILT - SANDY		Frozen								
2					ML				2							Moist
4						SAND - SILTY VERY FINE			4							Moist
6					SH				6							DAMP
8									8							DAMP
10									10							DAMP
12						Bottom of Hole - 10'			12							
14									14							
16									16							
18									18							
20									20							
22									22							
24									24							

LIARD Hwy

DRILL HOLE REPORT

DEPARTMENT OF PUBLIC WORKS, CANADA

MACKENZIE HIGHWAY

DWN		FIELD ENG	DATE DRILLED	AIRPHOTO NO:	CHAINAGE	OFFSET	TEST HOLE									
CKD	TECH	PRONYCH	RIG	8-50	SURFACE DRAINAGE:	VEGETATION:	ELEV	MILE	B,C,S	NUMBER						
DEPTH (FEET)	SAMPLE NUMBER	SAMPLE TYPE	% RECOVERY	PENETRATION RESISTANCE	UNIFIED SOIL SYMBOL	SOIL DESCRIPTION	LIMITS OF FROZEN GROUND	ICE DESCRIPTION	DEPTH (FEET)	GRAIN SIZE ANALYSIS	WET DENSITY (PCF)	DRY DENSITY (PCF)	REMARKS			
										CLAY %	SILT %	SAND %	GRAVEL %			
2						SAND - SILTY VERY FINE		FROZEN	2						DRY	
4									4						DAMP	
6									6						DAMP	
8									8						DAMP	
10						SILT - SAND M.M. 10'			10						DAMP	
12									12							
14									14							
16									16							
18									18							
20									20							
22									22							
24									24							

○ = WATER CONTENT (% OF DRY WEIGHT)
△ = ICE CONTENT (% OF SAMPLE VOLUME)

PLASTIC LIMIT 20 40 60 80 100 100+ LIQUID LIMIT 80 100 100+

55 45 0

LIARD Hwy.										DRILL HOLE REPORT				DEPARTMENT OF PUBLIC WORKS, CANADA MACKENZIE HIGHWAY									
DWN		FIELD ENG.		DATE DRILLED		AIRPHOTO NO.		CHAINAGE		OFFSET		TEST HOLE											
CKD		TECH		RIG		SURFACE DRAINAGE		VEGETATION		ELEV		MILE		B,C,S		NUMBER							
DEPTH (FEET)	SAMPLE NUMBER	SAMPLE TYPE	% RECOVERY	PENETRATION RESISTANCE	UNIFIED SOIL SYMBOL	SOIL DESCRIPTION	LIMITS OF FROZEN GROUND	ICE DESCRIPTION	DEPTH (FEET)	○ = WATER CONTENT (% OF DRY WEIGHT) △ = ICE CONTENT (% OF SAMPLE VOLUME)				GRAIN-SIZE ANALYSIS				WET DENSITY (P.C.F.)	DRY DENSITY (P.C.F.)	REMARKS			
										PLASTIC LIMIT		LIQUID LIMIT		CLAY	SILT	SAND	GRAVEL						
										20	40	60	80	100	100+	%	%	%	%				
2					SM	SAND - SILTY VERY FINE			2														
4									4							28	72	0				DAMP	
6									6													DAMP	
8									8													MOIST	
10					SL FL	SILT - SAND MIX			10													DAMP	
14									14													MOIST	
15									15														
						15'																	
						BOTTOM OF HOLE - 15'																	

LIARD Hwy				DRILL HOLE REPORT				DEPARTMENT OF PUBLIC WORKS, CANADA MACKENZIE HIGHWAY								
OWN		FIELD ENG		DATE DRILLED 7/1/21		AIRPHOTO NO:		CHAINAGE		OFFSET		TEST HOLE				
CKD		TECH PRANCH		RIG B-50		SURFACE DRAINAGE:		VEGETATION:		ELEV						
DEPTH (FEET)	SAMPLE NUMBER	SAMPLE TYPE	% RECOVERY	PENETRATION RESISTANCE	UNIFIED SOIL SYMBOL	SOIL DESCRIPTION	LIMITS OF FROZEN GROUND	ICE DESCRIPTION	DEPTH (FEET)	GRAIN-SIZE ANALYSIS				WET DENSITY (P.C.F.)	DRY DENSITY (P.C.F.)	REMARKS
										CLAY %	SILT %	SAND %	GRAVEL %			
										○ = WATER CONTENT (% OF DRY WEIGHT) △ = ICE CONTENT (% OF SAMPLE VOLUME)						
										PLASTIC LIMIT LIQUID LIMIT 20 40 60 80 100 100+						
2						SAND - SILTY FINE		FROZEN	2							
4									4							
6									6							
8									8							
10									10							
12									12							
14									14							
16									16							
18									18							
20									20							
22									22							
24									24							

LIARD Hwy										DRILL HOLE REPORT										DEPARTMENT OF PUBLIC WORKS, CANADA MACKENZIE HIGHWAY									
DWN		FIELD ENG.		DATE DRILLED 18/1/21		AIRPHOTO NO:		CHAINAGE:		OFFSET:		TEST HOLE																	
CKD		TECH PROMYCH		RIG B-50		SURFACE DRAINAGE:		VEGETATION:		ELEV		MILE 36		B,C,S		NUMBER 4													
DEPTH (FEET)	SAMPLE NUMBER	SAMPLE TYPE	% RECOVERY	PENETRATION RESISTANCE	UNIFIED SOIL SYMBOL	SOIL DESCRIPTION	LIMITS OF FROZEN GROUND	ICE DESCRIPTION	DEPTH (FEET)	GRAIN-SIZE ANALYSIS				WET DENSITY (P.C.F.)	DRY DENSITY (P.C.F.)	REMARKS													
										CLAY %	SILT %	SAND %	GRAVEL %																
										○ = WATER CONTENT (% OF DRY WEIGHT) △ = ICE CONTENT (% OF SAMPLE VOLUME)																			
										PLASTIC LIMIT 20 40 60 80 100 100+																			
2					ML	SILT - SANDY		Frozen	2							DAMP													
4					SM	SAND - SILTY FINE			4							MOIST													
6									6							DAMP													
8					SM				8							DAMP													
10					ML	SAND - SILT MIX			10							56-44 0 MOIST													
12						BOTTOM OF HOLE - 10'			12																				
14									14																				
16									16																				
18									18																				
20									20																				
22									22																				
24									24																				

LIARD Hwy.				DRILL HOLE REPORT				DEPARTMENT OF PUBLIC WORKS, CANADA MACKENZIE HIGHWAY									
DWN CKD		FIELD ENG		DATE DRILLED		AIRPHOTO NO:		CHAINAGE		OFFSET		TEST HOLE					
		TECH		RIG		SURFACE DRAINAGE:		VEGETATION:		ELEV							
		PRONYCH		B-50													
DEPTH (FEET)	SAMPLE NUMBER	SAMPLE TYPE	% RECOVERY	PENETRATION RESISTANCE	UNIFIED SOIL SYMBOL	SOIL DESCRIPTION	LIMITS OF FROZEN GROUND	ICE DESCRIPTION	DEPTH (FEET)	GRAIN-SIZE ANALYSIS				WET DENSITY (P.C.F.)	DRY DENSITY (P.C.F.)	REMARKS	
										CLAY %	SILT %	SAND %	GRAVEL %				
										○ = WATER CONTENT (% OF DRY WEIGHT) △ = ICE CONTENT (% OF SAMPLE VOLUME)							
										PLASTIC LIMIT LIQUID LIMIT 20 40 60 80 100 100+							
2						SAND-SILT MIXTURE			2								
4									4								
6									6								
8									8								
10									10								
12						Bottom of Hole. 10'			12								
14									14								
16									16								
18									18								
20									20								
22									22								
24									24								

LIARD Hwy.										DRILL HOLE REPORT		DEPARTMENT OF PUBLIC WORKS, CANADA MACKENZIE HIGHWAY									
DWN		FIELD ENG.		DATE DRILLED		AIRPHOTO NO.		CHAINAGE		OFFSET		TEST HOLE									
CKD		TECH		RIG		SURFACE DRAINAGE		VEGETATION		ELEV		MILE B,C,S NUMBER									
DEPTH (FEET)	SAMPLE NUMBER	SAMPLE TYPE	% RECOVERY	PENETRATION RESISTANCE	UNIFIED SOIL SYMBOL	SOIL DESCRIPTION	LIMITS OF FROZEN GROUND	ICE DESCRIPTION	DEPTH (FEET)	GRAIN-SIZE ANALYSIS		WET DENSITY (P.C.F.)	DRY DENSITY (P.C.F.)	REMARKS							
										CLAY %	SILT %				SAND %	GRAVEL %					
2						SILT - CLAYEY SANDS			2					MOIST							
4						SAND - SILT MIX			4					MOIST							
6						SAND - SILTY FINE			6					DAMP							
8									8					DAMP							
10									10					MOIST							
12						BOTTOM OF HOLE - 10'			12												
14									14												
16									16												
18									18												
20									20												
22									22												
24									24												

LIARD HWY.				DRILL HOLE REPORT				DEPARTMENT OF PUBLIC WORKS, CANADA MACKENZIE HIGHWAY									
DWN		FIELD ENG		DATE DRILLED 8/9/22		AIRPHOTO NO:		CHAINAGE		OFFSET		TEST HOLE					
CKD		TECH PRONCH		RIG B-50		SURFACE DRAINAGE:		VEGETATION:		ELEV		MILE B,C,S NUMBER					
DEPTH (FEET)	SAMPLE NUMBER	SAMPLE TYPE	% RECOVERY	PENETRATION RESISTANCE	UNIFIED SOIL SYMBOL	SOIL DESCRIPTION	LIMITS OF FROZEN GROUND	ICE DESCRIPTION	DEPTH (FEET)	GRAIN-SIZE ANALYSIS				WET DENSITY (P.C.F.)	DRY DENSITY (P.C.F.)	REMARKS	
										CLAY	SILT	SAND	GRAVEL				
										○ = WATER CONTENT (% OF DRY WEIGHT) △ = ICE CONTENT (% OF SAMPLE VOLUME)							
										PLASTIC LIMIT LIQUID LIMIT 20 40 60 80 100 100+							
2						SAND - SILTY FINE SM			2							MOIST	
4									4							MOIST	
6									6							MOIST	
8									8							DAMP	
10									10							DAMP	
12						10' BOTTOM OF HOLE - 10'			12								
14									14								
16									16								
18									18								
20									20								
22									22								
24									24								

Hwy

DRILL HOLE REPORT

DEPARTMENT OF PUBLIC WORKS, CANADA
~~MACKENZIE HIGHWAY~~

FIELD ENG.

DATE DRILLED 8/21/22

AIRPHOTO NO:

CHAINAGE:

OFFSET:

TECH Probych

RIG B-50

SURFACE DRAINAGE:

VEGETATION:

ELEV

TEST HOLE

MILE B,C,S NUMBER

35

1

REMARKS

SURFACE DRAINAGE:					VEGETATION:					ELEV					
DEPTH (FEET)	SAMPLE NUMBER	SAMPLE TYPE	% RECOVERY	PENETRATION RESISTANCE	UNIFIED SOIL SYMBOL	SOIL DESCRIPTION	LIMITS OF FROZEN GROUND	ICE DESCRIPTION	DEPTH (FEET)	GRAIN-SIZE ANALYSIS				WET DENSITY (PCF)	DRY DENSITY (PCF)
										○ = WATER CONTENT (% OF DRY WEIGHT) △ = ICE CONTENT (% OF SAMPLE VOLUME)					
										20	PLASTIC LIMIT 40	LIQUID LIMIT 60	100	100+	
2					ML	SILT - SAND			2						MOIST
4					SM	MIXTURE			4						DAMP
6									6						DAMP
8									8						MOIST
10									10						WET
12									12						
14									14						
16									16						
18									18						
20									20						
22									22						
24									24						

10'
Bottom of Hole - 10'

LIARD Hwy.										DRILL HOLE REPORT					DEPARTMENT OF PUBLIC WORKS, CANADA MACKENZIE HIGHWAY									
DOWN		FIELD ENG		DATE DRILLED		AIRPHOTO NO:		CHAINAGE		OFFSET		ELEV		TEST HOLE										
CKD		TECH		RIG		SURFACE DRAINAGE:		VEGETATION:																
DEPTH (FEET)	SAMPLE NUMBER	SAMPLE TYPE	% RECOVERY	PENETRATION RESISTANCE	UNIFIED SOIL SYMBOL	SOIL DESCRIPTION	LIMITS OF FROZEN GROUND	ICE DESCRIPTION	DEPTH (FEET)	PLASTIC LIMIT		LIQUID LIMIT		GRAIN-SIZE ANALYSIS				WET DENSITY (P.C.F.)	DRY DENSITY (P.C.F.)	REMARKS				
										20	40	60	80	100	100+	CLAY %	SILT %				SAND %	GRAVEL %		
2						ML SILT - CLAYEY SILT			2															
4						- CLAYEY			4															
6									6															
8									8															
10					SM ML	SAND-SILT MIX 10'			10							55	45	0						
12						BOTTOM OF HOLE - 10			12															
14									14															
16									16															
18									18															
20									20															
22									22															
24									24															

LIARD Hwy.										DRILL HOLE REPORT		DEPARTMENT OF PUBLIC WORKS, CANADA MACKENZIE HIGHWAY											
DWN		FIELD ENG.		DATE DRILLED		AIRPHOTO NO.		CHAINAGE		OFFSET		TEST HOLE											
CKD		TECH		RIG		SURFACE DRAINAGE		VEGETATION		ELEV.		MILE		B.C.S		NUMBER							
DEPTH (FEET)	SAMPLE NUMBER	SAMPLE TYPE	% RECOVERY	PENETRATION RESISTANCE	UNIFIED SOIL SYMBOL	SOIL DESCRIPTION	LIMITS OF FROZEN GROUND	ICE DESCRIPTION	DEPTH (FEET)	○ = WATER CONTENT (% OF DRY WEIGHT) △ = ICE CONTENT (% OF SAMPLE VOLUME)						GRAIN-SIZE ANALYSIS				WET DENSITY (P.C.F.)	DRY DENSITY (P.C.F.)	REMARKS	
										PLASTIC LIMIT		LIQUID LIMIT		CLAY	SILT	SAND	GRAVEL	%	%				%
										20	40	60	80	100	100+	%	%	%	%				
2						CLAY - SILTY SANDY MED. PLASTIC			2	○													WET
4						SILTY			4	○													MOIST
6						10% ABOVE P _L			6	○													MOIST
8									8	○													WET
10						SILT - SANDY	9'		10	○													SAT.
12							10'																
14						BOTTOM OF HOLE - 10'																	
16																							
18																							
20																							
22																							
24																							

LIARD Hwy.										DRILL HOLE REPORT				DEPARTMENT OF PUBLIC WORKS, CANADA MACKENZIE HIGHWAY									
DWN		FIELD ENG		DATE DRILLED 18/01/22		AIRPHOTO NO.		CHAINAGE		OFFSET 4		ELEV		TEST HOLE									
CKD		TECHIRONUCH		RIG B-50		SURFACE DRAINAGE		VEGETATION															
DEPTH (FEET)	SAMPLE NUMBER	SAMPLE TYPE	% RECOVERY	PENETRATION RESISTANCE	UNIFIED SOIL SYMBOL	SOIL DESCRIPTION	LIMITS OF FROZEN GROUND	ICE DESCRIPTION	DEPTH (FEET)	○ = WATER CONTENT (% OF DRY WEIGHT) △ = ICE CONTENT (% OF SAMPLE VOLUME)		GRAIN-SIZE ANALYSIS				WET DENSITY (P.C.F.)	DRY DENSITY (P.C.F.)	REMARKS					
										PLASTIC LIMIT	LIQUID LIMIT	CLAY %	SILT %	SAND %	GRAVEL %								
2					ML	SILT - CLAYEY SANDY			2									SAT.					
4						4'			3									DAMP					
6					SH	SAND-SILT MIXTURE			5									DAMP					
8					ML				8									DAMP					
10						10'			10									DAMP					
12						BOTTOM OF HOLE - 10'																	
14																							
16																							
18																							
20																							
22																							
24																							

LIARD HWY										DRILL HOLE REPORT				DEPARTMENT OF PUBLIC WORKS, CANADA MACKENZIE HIGHWAY									
DWN		FIELD ENG		DATE DRILLED 18/12/22		AIRPHOTO NO:		CHAINAGE:		OFFSET:		ELEV		TEST HOLE									
CKD		TECH PRONYCH		RIG B-50		SURFACE DRAINAGE:		VEGETATION:															
DEPTH (FEET)	SAMPLE NUMBER	SAMPLE TYPE	% RECOVERY	PENETRATION RESISTANCE	UNITED SOIL SYMBOL	SOIL DESCRIPTION	LIMITS OF FROZEN GROUND	ICE DESCRIPTION	DEPTH (FEET)	GRAIN-SIZE ANALYSIS				WET DENSITY (P.C.F.)	DRY DENSITY (P.C.F.)	REMARKS							
										CLAY %	SILT %	SAND %	GRAVEL %										
2						SILT -																	
4						- CLAYY																	
6																							
8																							
10																							
12																							
14																							
16																							
18																							
20																							
22																							
24																							

LIARD Hwy.				DRILL HOLE REPORT				DEPARTMENT OF PUBLIC WORKS, CANADA											
DOWN				FIELD ENG		DATE DRILLED 78 on 22		AIRPHOTO NO:		CHAINAGE		OFFSET		TEST HOLE					
CKD				TECH PRONYCH		RIG B-50		SURFACE DRAINAGE:		VEGETATION		ELEV		MILE B,C,S NUMBER					
DEPTH (FEET)	SAMPLE NUMBER	SAMPLE TYPE	% RECOVERY	PENETRATION RESISTANCE	UNIFIED SOIL SYMBOL	SOIL DESCRIPTION	LIMITS OF FROZEN GROUND	ICE DESCRIPTION	DEPTH (FEET)	○ = WATER CONTENT (% OF DRY WEIGHT) △ = ICE CONTENT (% OF SAMPLE VOLUME)		GRAIN-SIZE ANALYSIS				WET DENSITY (P.C.F.)	DRY DENSITY (P.C.F.)	REMARKS	
										PLASTIC LIMIT	LIQUID LIMIT	CLAY %	SILT %	SAND %	GRAVEL %				
2					ML	SILT-			2	25								Moist	
4									4	25								Moist	
6									6	25								Moist	
8									8	25								Moist	
10						SM SAND-SILTY 10'			10	25								Moist	
12						BOTTOM OF HOLE-10'													
14																			
16																			
18																			
20																			
22																			
24																			

~~MACKENZIE HIGHWAY~~

LIARD Hwy

6973

DEPARTMENT OF PUBLIC WORKS, CANADA
MACKENZIE HIGHWAY

~~MACKENZIE HIGHWAY~~

5973

LIARD Hwy										DRILL HOLE REPORT				DEPARTMENT OF PUBLIC WORKS, CANADA MACKENZIE HIGHWAY									
DWN		FIELD ENG.		DATE DRILLED 8/22/22		AIRPHOTO NO:		CHAINAGE:		OFFSET:		TEST HOLE											
CKD		TECH PRONYCH		RIG B-50		SURFACE DRAINAGE:		VEGETATION:		ELEV		MILE 39		B,C,S		NUMBER 6							
DEPTH (FEET)	SAMPLE NUMBER	SAMPLE TYPE	% RECOVERY	PENETRATION RESISTANCE	UNIFIED SOIL SYMBOL	SOIL DESCRIPTION	LIMITS OF FROZEN GROUND	ICE DESCRIPTION	DEPTH (FEET)	○ = WATER CONTENT (% OF DRY WEIGHT) △ = ICE CONTENT (% OF SAMPLE VOLUME)		GRAIN-SIZE ANALYSIS				WET DENSITY (PCF)	DRY DENSITY (PCF)	REMARKS					
												CLAY %	SILT %	SAND %	GRAVEL %								
						SILT-CLAYEY																	
2									2									SAT.					
4					HL				4									Moist					
6						SILT			6									Moist					
8						1 VET @ 9'			8									Moist					
10									10									1 VET					
						10'																	
						BOTTOM OF HOLE - 10'																	
12									12														
14									14														
16									16														
18									18														
20									20														
22									22														
24									24														

LARD Hwy.										DRILL HOLE REPORT				DEPARTMENT OF PUBLIC WORKS, CANADA MACKENZIE HIGHWAY							
DWN CKD		FIELD ENG		DATE DRILLED 18/01/22		AIRPHOTO NO:		CHAINAGE:		OFFSET		ELEV		TEST HOLE							
		TECH PRONYCH		RIG 13-50		SURFACE DRAINAGE:		VEGETATION:						MILE 39 B,C,S NUMBER 7							
DEPTH (FEET)	SAMPLE NUMBER	SAMPLE TYPE	% RECOVERY	PENETRATION RESISTANCE	UNIFIED SOIL SYMBOL	SOIL DESCRIPTION	LIMITS OF FROZEN GROUND	ICE DESCRIPTION	DEPTH (FEET)	○ = WATER CONTENT (% OF DRY WEIGHT) △ = ICE CONTENT (% OF SAMPLE VOLUME)		GRAIN SIZE ANALYSIS				WET DENSITY (P.C.F.)	DRY DENSITY (P.C.F.)	REMARKS			
										PLASTIC LIMIT	LIQUID LIMIT	CLAY %	SILT %	SAND %	GRAVEL %						
2					ML	SILT - CLAYEY SANDY			2	○											
4									4	○											
6					SM	SAND - SILTY FINE 5			6	○											
8						SILT - SANDY			8	○											
10					ML	WET AFTER 8' CLAYEY 10'			10	○											
12						BOTTOM OF HOLE - 10'															
14																					
16																					
18																					
20																					
22																					
24																					

LIARD Hwy.										DRILL HOLE REPORT		DEPARTMENT OF PUBLIC WORKS, CANADA MACKENZIE HIGHWAY									
DWN		FIELD ENG.		DATE DRILLED 18/1/22		AIRPHOTO NO:		CHAINAGE:		OFFSET:		TEST HOLE									
CKD		TECH P. Ronych		RIG B-50		SURFACE DRAINAGE:		VEGETATION:		ELEV:		MILE 39		B.C.S.		NUMBER 8					
DEPTH (FEET)	SAMPLE NUMBER	SAMPLE TYPE	% RECOVERY	PENETRATION RESISTANCE	UNIFIED SOIL SYMBOL	SOIL DESCRIPTION	LIMITS OF FROZEN GROUND	ICE DESCRIPTION	DEPTH (FEET)	WATER & ICE CONTENT		GRAIN-SIZE ANALYSIS				WET DENSITY (P.C.F.)	DRY DENSITY (P.C.F.)	REMARKS			
										○ = WATER CONTENT (% OF DRY WEIGHT)	△ = ICE CONTENT (% OF SAMPLE VOLUME)	CLAY %	SILT %	SAND %	GRAVEL %						
2						SILT - CLAYEY			2									SAT			
4						. SANDY			4									DAMP			
6									6									Moist			
8									8									Moist			
10						CLAY-SILTY W&SP SANDY			10									Moist			
12									12												
14									14												
16									16												
18									18												
20									20												
22									22												
24									24												

LIARD Hwy										DRILL HOLE REPORT					DEPARTMENT OF PUBLIC WORKS, CANADA MACKENZIE HIGHWAY									
DWN		FIELD ENG		DATE DRILLED 18/01/22		AIRPHOTO NO:		CHAINAGE:		OFFSET		ELEV		TEST HOLE										
CKD		TECH PRONKH		RIG B-50		SURFACE DRAINAGE:		VEGETATION																
DEPTH (FEET)	SAMPLE NUMBER	SAMPLE TYPE	% RECOVERY	PENETRATION RESISTANCE	UNIFIED SOIL SYMBOL	SOIL DESCRIPTION	LIMITS OF FROZEN GROUND	ICE DESCRIPTION	DEPTH (FEET)	○ = WATER CONTENT (% OF DRY WEIGHT) △ = ICE CONTENT (% OF SAMPLE VOLUME)		GRAIN-SIZE ANALYSIS				WET DENSITY (PCF)	DRY DENSITY (PCF)	REMARKS						
										PLASTIC LIMIT	LIQUID LIMIT	CLAY	SILT	SAND	GRAVEL									
										20	40	60	80	100	100+	%	%	%	%					
2					CL	CLAY - SILTY LOW PLASTIC			2	○												SAT.		
4						SILT - CLAYEY	4'		4	○												MOIST		
6									6	○												DAMP		
8					ML	1/2" AFTER 8'			8	○						91	9	0				DAMP		
10						BOTTOM OF HOLE - 10'	10'		10	○												SAT.		
12									12															
14									14															
16									16															
18									18															
20									20															
22									22															
24									24															

LIARD Hwy				DRILL HOLE REPORT				DEPARTMENT OF PUBLIC WORKS, CANADA MACKENZIE HIGHWAY									
DWN		FIELD ENG.		DATE DRILLED		AIRPHOTO NO.		CHAINAGE		OFFSET		TEST HOLE					
CKD		TECH		RIG		SURFACE DRAINAGE		VEGETATION		ELEV		MILE B,C,S NUMBER					
DEPTH (FEET)	SAMPLE NUMBER	SAMPLE TYPE	% RECOVERY	PENETRATION RESISTANCE	UNIFIED SOIL SYMBOL	SOIL DESCRIPTION	LIMITS OF FROZEN GROUND	ICE DESCRIPTION	DEPTH (FEET)	GRAIN-SIZE ANALYSIS				WET DENSITY (P.C.F.)	DRY DENSITY (P.C.F.)	REMARKS	
										CLAY	SILT	SAND	GRAVEL				
										○ = WATER CONTENT (% OF DRY WEIGHT) △ = ICE CONTENT (% OF SAMPLE VOLUME) PLASTIC LIMIT LIQUID LIMIT 20 40 60 80 100 100+							
2					ML	SILT - CLAYEY			2							SAT.	
4					CL	CLAY - SILTY W/ 2' ABOVE P. LOW PLASTIC 4'			4							MOIST	
6						SILT - CLAYEY			6							MOIST	
8					ML				8							MOIST	
10						GRAVELLY - SANDY 10'			10							MOIST	
12						BOTTOM OF HOLE - 10'			12								
14									14								
16									16								
18									18								
20									20								
22									22								
24									24								