

...RAL DESIGN SUBMISSION - MACKENZIE HIGHWAY
MILE 844 TO 817.5
NOVEMBER, 1975

Government of Canada / Gouvernement du Canada

**MEMORANDUM** **NOTE DE SERVICE**

TO

W. R. BINKS
Program Manager (Civil)
Public Works Canada
OTTAWA, Ontario

FROM / DE

F. E. KIMBALL
Project Manager
N.W.T. Roads
EDMONTON, Alberta

| SECURITY - CLASSIFICATION — DE SÉCURITÉ | |
|---|---|
| OUR FILE — N/RÉFÉRENCE | 9305-52-300 |
| YOUR FILE — V/RÉFÉRENCE | 000015 |
| DATE | November 14th, 1975 |

SUBJECT / OBJET: FINAL DESIGN SUBMISSION - MACKENZIE HIGHWAY MILE 844 TO 817.5, NOVEMBER, 1975

In accordance with the direction by the Director of Engineering and Architecture Branch, D.I.A.N.D., one set of design plans for contract purposes are enclosed. Twenty-four (24) copies of the narrative portion have been forwarded under separate cover.

One set of sepia mylar copies of the design plans for the above mentioned submission has been forwarded to G.D. Reid for printing and distribution. One set of sepias and five copies of the narrative portion have been forwarded to Mr. C. Amos of D.I.A.N.D. in Yellowknife.

Copies of the plans and narrative have been sent to F. Janz, D.I.A.N.D., D.O.E. in Edmonton and Winnipeg and E.M.R. in Calgary.

The special E.W.G. package has not been produced. Because of the budget restrictions, D.I.A.N.D. instructed that the special package be deferred for Mile 725 to 936.

F. E. KIMBALL
Project Manager
N.W.T. Roads

Attachments

# I N D E X

# INTRODUCTION

The Final Design Submission Miles 844 - 817.5 November, 1975 is a second submission for this section of the proposed Mackenzie Highway. It includes a number of revisions to the horizontal and vertical alignment and detailed culvert design drawings. It also includes, as an appendix to this report, the D.P.W. evaluation of, and recommendations, on the alignment revisions for Mile 830 - 851 suggested in the "Report on Geotechnical Investigation Mile 725 to Mile 936" dated February, 1975.

Although client direction resulting from review of the Preliminary Submission Mile 902 - Mile 802 has not been received, we have received a copy of the E.W.G. comments. Those comments have been considered in preparation of this revised submission but it was not felt that any required specific detailed responses.

The reader should note that this report forms only part of a total design submission, the major portion of which is contained in separate plan form.

# CHAPTER 1

## 1. Alignment

### a) Horizontal

Alignment revisions have been introduced in the following areas:

834.1 - 833.2

826.5 - 824.4

Details and rationale for the changes are included in the "Mackenzie Highway, N.W.T. Mile 732.2(N) - Mile 936 Alignment Update Report of January, 1975."

Further alignment revisions in the Thunder River Area, Mile 830 - 851, are under consideration. Several possible alternates are discussed in detail in Appendix 'A'.

### b) Vertical

A large number of changes to the gradeline have been made to reduce borrow requirements and estimated construction costs. The most common change is the use of fifty (50) m.p.h. design speed sag curves in place of the sixty (60) m.p.h. design speed used previously. Design speed for crest vertical curves is unchanged at sixty (60) m.p.h.

Cuts have been introduced where their use has resulted in a significant reduction in estimated construction costs and/or improvement to the gradeline. Detailed cost comparisons using 1974 bid prices were done for all such areas.

1. b) Vertical (Continued)

For example, the revised gradeline in the area of Joe Creek, Mile 821.3 should result in construction costs approximately 25% less than for the gradeline used in the preliminary package.

All comparisons were based on the use of 'A' type 'V' ditch cuts and the special sub-cutting and backslope blanketing outlined in Section 3 - Soils.

## 2. Drainage

a) General

Site specific designs have been provided for all proposed culverts 72" diameter and larger. This in general corresponds to drainage areas larger than 0.7 square miles although drainage from some areas larger than the above minimum have been handled by multiple smaller pipes.

Drainage areas and flood and fish flows have been taken from the FENCO Report "Bridge and Culvert Hydraulics, Fort Good Hope to Dempster Highway, March, 1974". A study of 1"=3000' aerial photography by D.P.W. staff revealed no significant errors in the larger drainage areas but did result in slight changes to several of the smaller areas.

Drainage areas and design discharges used for design are summarized in Appendix 'B' - Hydrology Summary.

2. a) General (Continued)

Other information including inlet and exit velocities is shown on the respective culvert drawings.

b) Fish Passage Facilities

All streams that show indications of having a marginal or better fish habitat rating have culverts designed to meet D.O.E. Fisheries guidelines for fish migration passage except for the stream at Mile 821.3. In "Addendum Number II, Mackenzie Stream Catalogue to Base Data Report, Section D, Mackenzie Highway, Mile 715 to 936" prepared by Shultz International, the stream is described as having good spawning potential with two grayling observed. However, the presence of a considerable brush - log jam downstream from the centreline may block fish passage and the stream has therefore been rated as being marginal habitat. While examining possible culvert designs for this stream, the design team found that a culvert would have to be sunk 4 feet into the present stream bed and relatively extensive use of rip-rap on both upstream and downstream ends would be necessary in order to meet the guidelines for fish passage migration. In recognition of the potential negative impact on the stream and the increase in cost of such an installation, a "normal" culvert design was applied to the stream.

3. Soils

A limited number of cuts are proposed through fine-grained soils to improve the gradeline and/or minimize construction costs. In such cuts

3. Soils (Continued)

6 feet minimum of imported material will be proved under the roadway and backslopes will be blanketed with the same material to a minimum thickness of 3 feet.

All ice rich fine grained material excavated from cuts will be wasted within the right-of-way or hauled to a borrow pit for disposal. In some cases, separate off right-of-way waste areas may be required to reduce haul costs and details of these waste areas, as required will be included in the contract package.

Additional ditch protection has not been specified as the shale blanket is expected to provide adequate resistance to erosion.

The material from the cuts on the south approach to Thunder River, Mile 844 are expected to be suitable for embankment construction.

4. Borrow

Approximate borrow pit outlines and access roads are shown on the Environmental Data Sheets and bore hole logs are shown on the 1"= 1000' mosaics.

Borrow requirements and approximate pit depths and cleared areas are shown in tabular form below. Pit side slopes have been assumed to be 1:1 for calculation purposes.

4. Borrow (continued)

| MILE | QUANTITY(c.y.) | DEPTH (ft.) | AREA (Acres) |
|---|---|---|---|
| 837.9 | 460,000 | 11 | 31.2 |
| 830.5 | 880,000 | 60 | 10.3 |
| 823.1 | 686,000 | 50 | 11.2 |
| 817.5 | 254,000* | ----- | ----- |

*Estimated volume less stripping. Area not available as pit will also be used for instruction south of Mile 817.5.

Note that only one of the two suggested granular borrow areas at the Thunder River Airstrip adjacent to Mile 837.9 is to be developed under this contract. The second pit is to be reserved for surfacing and maintenance work.

# A P P E N D I X  'A'

## ALIGNMENT REVIEW

## MILE 844 TO 817.5

# APPENDIX 'A'

## 1. Alignment Review - Mile 830 to 951 (Thunder River Area)

This report has been prepared as an alignment review in response to the February 1975, "Geotechnical Investigation Report for Mackenzie Highway Mile 725 to 936," that recommended consideration of a number of alternate route locations in the Thunder River Area that could result in increased availability of bedrock borrow and reduced haul distances. Since this report is based only on air-photo study assisted by additional geotechnical information, it is not possible without a field investigation to fully compare all the various headings requested in the Department of Indian Affairs and Northern Development referral of July 22nd, 1975; therefore this report has been restricted to alignment, borrow sources and estimated construction cost considerations.

Since the submission of the geotechnical report, the Geological Survey of Canada has completed a bedrock geology survey of this area (Reference Paper 74-17) and from this report the bedrock boreholes and outcrop locations have been transferred to the 1:50,000 scale route maps included herein.

From the above noted information, it was possible to eliminate a number of projected routes referred to in the geotechnical report

1. (Continued)

comprising of R2 from Mile 828.2 to 857.2 and R3 from Mile 846.2 to 849.8. R1 from Mile 830.0 to 842.4 remains essentially on the same alignment, whereas R2A has been located to incorporate the first section of R1 to Mile 836.6.

2. Route Location

.1 At Mile 830 the revised alignment 'R1' turns North from the existing route location to ascend approximately 300 feet in two miles on an average gradient of 5% to the higher ground moraine topography. The alignment follows this slightly rolling morainal topography to where it rejoins the original alignment at Mile 842.4 that equals located Mile 842.8, making it .4 miles shorter.

Since the alignment follows the upland terrain, either on the drainage divide or parallel to it, culvert requirements should be substantially reduced in comparison to the original location.

The subsoil conditions will be similar to the geotechnical data referred to in the original alignment for Mile 830 to 845. Two probable bedrock borrow sources have been selected for this alignment. Pit #B101 drilled during the geotechnical investigation is a recommended borrow source and is located

2. Route Location (Continued)

.1 (Continued)

1000' west of Mile 831.8. An expected bedrock source identified through airphoto interpretation 4000' east of Mile 835.8 has been designated for the alignment comparison estimate. The exact location for this borrow source is only approximate until further investigative drilling is carried out. A seismic borehole east of Mile 836.3, logged as bedrock, tends to confirm the borrow pit selection.

.2 At Mile 836.6, Alignment 'R2A' departs easterly from Alignment 'R1' along an upland ground moraine to Mile 841. From this point the alignment follows the bottom of a 'V' shaped creek valley to the Thunder River crossing at Mile 842.7. Since this section of the alignment controls the route selection for 'R2A' it was airphoto mapped to ensure an alignment could be located through the valley and for reference the contour plan and profile is shown on the plan that confirmed a 5% to 6% grade is possible through the valley. A section of the steeper cross slope shows it to be approximate 20%, that could indicate the requirement for sideslope cuts in some sections in order to avoid fill materials in the existing creek channel. The feasibility of a route through this narrow valley can only be confirmed by an actually field survey and soils drilling where sidehill cuts would be required to avoid the stream in the valley

2. Route Location (Continued)

.2 (Continued)

bottom.

The west bank of the Thunder River ascends sharply for approximately 220 feet in 3000 feet requiring up to a 8% grade for a short section, then 6% for the remainder, depending on the subsoil conditions and the Thunder River Crossing elevation. The alignment continues to ascend another 200 feet to a pass at Mile 846.5. From Mile 846.5 the alignment descends to rejoin the original location at Mile 850.4 that equals located Mile 849.7, making it .7 miles longer.

Since Alignment R2A tends to follow the higher terrain along the drainage divide, large culvert requirements are minimal. A longer bridge structure may be required for this Thunder River Crossing since a tentative design grade makes it to 20 feet higher than the lower crossing. If the subsoil conditions permit this grade may be reduced by cutting the west bank approach.

The subsoil conditions along the alignment will be similar to the geotechnical investigation reported for Mile 845 to 855. The alignment was projected to pass within 1500 feet of an expected bedrock borrow source north of Mile 846.5,

2. Route Location (Continued)

.2 (Continued)

designated for the alignment comparison estimate. The Geological Survey report shows a rock outcrop in this area which tends to confirm the borrow potential. Photo interpretation show the west bank of the Thunder River to a glaciofluvial feature similar to that encountered on the east approach to the Thunder River downstream crossing, which was classified as useable silty sand.

.3 Alignment Comparison Table - Mile 830 to 851

| | "L" Line | 'R1' & 'L' | R1 & R2A |
|---|---|---|---|
| 1. Length | 21.0 miles | 20.6 miles | 21.7 miles |
| 2. Fill Quantity | 1,315,000 c.y. | 1,277,000 c.y. | 1,352,000 c.y. |
| 3. Overhaul | 6,842,000 Yd.-M. | 3,599,000 Yd.-M | 2,289,000 Yd.-M. |
| 4. Borrow Sources | Mi. 830, 851 | Mi. 831.8, 835.8, 851 | Mi. 831.8, 835.8 846.5, 851 |
| 5. Estimated Cost (Emb. & Haul) | $6,645,000 | $4,992,000 | $4,524,000 |
| 6. % Less Than Existing Alignment ('L' Line) | | 24.9% | 31.9% |

Est. Unit Price: Borrow @ $2.50/c.y.
Overhaul @ $.50/Yd.-M.

Est. Quantity: Fill @ 60,000 per c.y./mile Includes Haul Roads.

2. Route Location (Continued)

.4 Recommendations

It is apparent from the preceding comparison table that there is a potential substantial reduction in construction cost by following either Alignment R1 or R2A. Prior to the acceptance of either alignment for the final design the following additional data is required:

- Advance geotechnical investigation for confirmation of designated borrow sources.
- Preliminary survey of the creek valley on Alignment R2A from Mile 841.5 to 843.
- Airphoto mapping of the corridors for the alternative routes so a design quantity/cost comparison can be made.

# APPENDIX "B"

# HYDROLOGY SUMMARY

# HYDROLOGY SUMMARY

| DESIGN DATA | | | | FENCO | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| MILE | AREA | $Q_D$* | $Q_F$* | MILE | AREA | $Q_D$ | $Q_F$ | | COMMENTS |
| 840.8 | 6.0 | 425 | -- | 840.8 | 6.0 | 425 | -- | * | |
| 839.7 | 0.9 | 150 | -- | 839.7 | 0.9 | 150 | -- | | Multiple 48" CMP's used. |
| 837.9 | 20.0 | 731 | 182 | 837.9 | 20.0 | 731 | 182 | * | |
| 832.2 | 7.9 | 565 | 141 | 832.2 | 7.9 | 565 | 141 | * | |
| | | | | 831.2 | .7 | 130 | -- | | Revised area approx. 330 acres 60" CSPP used. |
| | | | | 830.6 | .7 | 130 | -- | | Revised area approx. 400 acres 60" CSPP & small CMP's used. |
| 830.2 | 3.4 | 395 | -- | 830.3 | 3.8 | 405 | -- | * | |
| 829.4 | .80 | 140 | -- | 829.4 | 1.0 | 160 | -- | * | FENCO included small independent areas at 830.0 and 829.0 |
| 828.7 | 7.2 | 530 | -- | 828.7 | 7.2 | 530 | -- | * | |
| 828.5 | 1.6 | 230 | -- | 828.5 | 1.6 | 230 | -- | * | |
| 828.0 | 0.6 | 110 | -- | 828.0 | 0.7 | 130 | -- | | 2.48" pipes used. |
| 827.5 | 7.4 | 550 | -- | 827.5 | 7.8 | 560 | -- | * | FENCO included area of 230 Acres at 827.2 and part of area at 826.5 |
| 826.5 | 0.9 | 150 | -- | 826.5 | 0.8 | 140 | -- | * | FENCO included part in area at 827.6 multiple 48" CMP's used. |
| 825.7 NOW | 2.8 | 340 | -- | 824.7 | 3.2 | 375 | -- | * | Area Reduce due to alignment shift. |
| 824.2 | 4.2 | 430 | -- | 824.2 | 4.4 | 430 | -- | * | |
| 823.8 | 1.0 | 160 | -- | 823.8 | 1.0 | 160 | -- | * | Multiple 48" pipes used. |
| | | | | 823.1 | 1.3 | 195 | -- | | FENCO included 2 smaller independent areas. Revised area 410 acres. |
| 821.3 | 10.6 | 670 | | 821.3 | 10.6 | 670 | | | |
| 820.4 | 2.4 | 310 | -- | 820.3 | 2.4 | 310 | -- | * | |
| 819.2 | 1.1 | 170 | -- | 819.2 | 1.1 | 170 | | | 60" CSPP & CMP's used. |
| | | | | 818.6 | 0.6 | 130 | | | FENCO lumped 2 smaller areas 265 and 110 acres multiple CMP's used. |
| 818.4 | 1.1 | 170 | | 818.4 | 1.1 | 170 | | | Multiple 96" CMP's used. |
| 817.9 | 0.9 | 145 | | 817.9 | 1.1 | 170 | | | FENCO included smaller areas - multiple CMP's used. |

* $Q_D$ = 50 yr. Design Discharge; $Q_F$ = Fish Migration Discharge

APPENDIX "C"

DRAFT SPECIFICATIONS

# PLANNING ONLY
# NOT FOR CONSTRUCTION

1.1.1 Description

The description of the contract will be inserted when the client's programming for this section of the proposed highway has been determined.

1.1.2 Location

.1 The location of the contract limits will be inserted when the client's programming has been determined.

.2 Inuvik, N.W.T. is adjacent to approximately Mile 971 of the Mackenzie Highway and is the closest community to the project.

1.1.3 Project Access and Services

.1 The Contractor is referred to the section of these specifications dealing with the construction schedule Division 1, Section 2, for information on any timing restrictions that might be applicable to the various methods of access.

.2 Inuvik, N.W.T. has a barge landing and all-weather paved airstrip. It is not accessible by public road from southern Canada.

.3 Access to the project will be via a barge landing to be developed at the mouth of Joe Creek, approx. adjacent to Mile 821.3 of the Mackenzie Highway. An access road will be constructed along the creek from the Mackenzie River to the highway right-of-way. Full details will be inserted in the contract package.

.4 The Contractor will be permitted to construct a maximum of one airstrip on a section of the Highway. The roadway may be widened to a maximum top width of 50 feet for a length of approximately 2000' to handle light aircraft. The locations will be subject to the approval of the Engineer. Measurement for a payment for construction will be in accordance with the appropriate Unit Price Table items. Maintanence will be performed by the Contractor at no cost to the Department.

.5 The above information on access is for guidance only and it will be the responsibility of the contractor to familiarize himself with the availability of transportation and other services.

1.1.4 Land Use Regulations

.1 Land Use Permit issued to this Department grants 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 and the Operating Terms and Conditions of the Permit. A copy of the Permit and the Operating Terms and Conditions is included in, and forms part of these specifications. The Contractor will be required to operate within the terms of the Permit and attached documents.

1.1.4 Land Use Regulations (Cont'd)

.2 The Contractor's attention is directed to Article 8 of the General Conditons 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 Permitee under the

1.1.4 Land Use Regulations (Continued)

.2 Land Use Permit, resulting directly or indirectly from the Contractor's activities on the project.

1.1.5 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 the work under this contract.

1.1.6 Plan Profile Drawings and 1" to 1000' Mosaics

.1 The profile elevations differ from the elevations shown on the 1" to1000' orthophoto mapping.

The profile elevations are elevations established in the field from Department of Public Works Bench Mark Elevations. The orthophoto mapping elevations are based on a separate map datum and indicate the general relief characteristics of the terrain, with the accuracy obtainable from aerial photogrammetry being approximately within one-half (1/2) the elevation difference between contours in open areas and within one quarter (1/4) the height of the trees in wooded areas. Where there is a discrepancy betweer the mapping and profile elevations, the profile elevations will govern.

.2 Where there is a discrepancy between plan and profile relative to a horizontal location, the profile will govern, subject to final layout in the field by the Engineer.

1.1.7 Measurement of Quantities

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

.2 Volume:

.1 In computing volumes of excavation and embankment the average end area method will be used, except as otherwise decided by the Engineer.

.2 When the 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 levelled and measured at the point of delivery and no allowance will be made for settlement of the material while in transit.

1.1.7 Measurement of Quantities (Continued)

.3 Material specified to be measured by the cubic yard may be weighed and such weights shall be converted to cubic yards for payment purposes. Factors of conversion from weight measurement to volume measurement will be determined by the Engineer and shall be agreed to by the Contractor before such method of measurement of pay quantities will be approved by the Engineer.

. Weight:

.1 The term ton shall mean 2,000 pounds avoirdupois.

.2 All materials which are specified for measurement by weight shall be weighed on scales approved by and at locations designated by the Engineer. Trucks used to haul material being paid for by weight shall be weighed empty at such times as the Engineer directs, and each truck shall bear a plainly legible identification mark.

.3 Weight measurements shall be made by a weighmaster provided by the Department using scales and a scale house provided by the Contractor. The scales shall be of suitable design and of sufficient capacity to accommodate any vehicles used on the work and shall be inspected and teste for accuracy at the Contractor's cost 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 be of suitable size, having one sliding window facing the scale platform, one end window and a shelf desk at least 2 feet wide and 6 feet long. Doors shall not open onto the scale platform. The Contractor shall provide adequate lighting and heating.

.4 If material is shipped by rail, the car weight will be accepted.

1.1.8 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 2 of the specifications. 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 specified in Division 1, Section 2, or in the Operating Terms and Conditions of the Land Use Permit, and when, in the opinion of the Engineer any productive work

1.1.8 Construction Interruptions for Environmental Protection (Continued)

.2 cannot be performed on other sections of the project by the equipment affected by the shutdown, payment will be made to the Contractor for equipment and labour standby costs as follows:

.1 Production Equipment Standby: Production Equipment is only those units listed in the following group:
scrapers, dozers/rippers, front end loaders, trucks larger than 8 cubic yards, rock drills, compressors and backhoes and shovels over 1/2 cubic yard. The formula to be applied in determining standby costs for a piece of equipment shall be 50% of the "Alberta Roadbuilders Association Rental Rate" in effect at the time of the standby less the applicable operator wage rate quoted in the Association rate schedule. Such standby costs will be applicable only up to 10 hours per day, 5 days per week, to a maximum monthly total of 200 hours for any piece of equipment.

The following example illustrates the method of determining such a standby rate based on the 1975 schedule of rates:

| | | |
|---|---|---|
| D-9 Cat Complete with Dozer and Ripper ($70.00 + $9.00) | = | $79.00 |
| Less Operator (Schedule A, Group 2) | = | $ 6.90 |
| Bare Rental | = | $72.10 |
| Standby Rate @ 50% of bare rental | = | $36.05 |

.2 Labour Standby: Labour standby costs will be paid for only those operators assigned to production equipment. Payments made will be in accordance with Article 45 of the General Conditions of the contract 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 will 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 in-

1.1.8 Construction Interruptions for Environmental Protection (Continued)

.3 (Continued)
curred by the Contractor because of unscheduled shutdown of his operations for protection of the environment.

1.1.9 Barricades and Warning Signs

The Contractor shall, at no expense to the Department, 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.

1.1.10 Project Signs

The Contractor shall erect and maintain the standard Department of Public Works sign(s), supplied by the Department. Measurement for payment for the erection and maintenance of the sign(s) will be made on a Change Order in accordance with Clause 45 of the General Conditions of the contract.

1.1.11 Layout of Work

.1 The Engineer will set stakes and establish bench marks to indicate the location, alignment and reference elevations for the work. This will include the setting out of one set of clearing, flagging, grubbing stakes, offset baseline, bench marks, work or slope stakes and culvert plugs, together with two sets of second grade stakes.

.2 Any re-staking resulting from the careless operations of the Contractor will be at the Contractor's expense.

1.1.12 Maintenance of Work During Construction

.1 General
The Contractor shall 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 on the completed or partially completed roadway.

(b) Any portion of the road opened to traffic 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.

1.1.12 Maintenance of Work During Construction (Continued)

.2 Roadway (Continued)

(d) On completion of the project and before the project is accepted by the Engineer, the Contractor will grade the surface of the entire route in one continuous operation.

(e) Except as provided below for the thawing of culverts, maintenance will not be measured separately for payment, but will be considered incidental to the various Unit Price Table items.

.3 Icing of Culverts

The Contractor will be required to thaw iced culverts so as to ensure that culverts are functioning during the period of spring breakup. The Department will provide a mobile steamer for this purpose and the Contractor will be responsible for operating and maintaining this unit and will return it to the Engineer in good condition upon completing this work. This work will be measured for payment as a Change Order in accordance with Clause 45 of the Gneral Conditions of the contract.

1.1.13 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 contract at all times; however, the Contractor may close the road to the general public during construction. Should others request permission to use any section of the constructed roadway prior to completion, authorization may be granted upon consultation with, and written approval from the Engineer.

1.1.14 Forest Protection and Fire Fighting Equipment

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.

The supply of fire fighting equipment shall be incidental to the contract and no separate measurement for payment will be made therefor.

1.1.15 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.

1.1.15 Construction Camp (Continued)

The Contractor shall make application to the Controller of Water Rights, Department of Indian Affairs and Northern Development, Box 1500, 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 startup.

Untreated sewage shall not be discharged directly or indirectly into any natural waters. Depending on camp population, soil conditions, climatic conditions and time duration of 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 suitable 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 flexhose or other suitable arrangement. The lagoon shall be suitably located and at least 300 feet away from the camp being served.

The lagoon shall have a minimum retention period of one year, a liquid depth of 6 feet to 8 feet, a free board minimum of 18 inches and impervious berms having a 10 ft. top width and minimum slopes of 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 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.

1.1.15 Construction Camp (Continued)

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

1.1.16 Employment of the Native People

.1 The Contractor's attention is drawn to the following guidelines on the Employment of the Native People and Section 27(s) of the General Conditions of the contract. Notwithstanding all the terms of Section 27(2), special arrangements are required for this contract in line with these guidelines. The Contractor, prior to recruiting his work force, shall meet with:

Manager, Canada Manpower Centre
INUVIK, N.W.T.

and acquaint him with all his labour force requirements.

The Canada Manpower Centre will identify for the Contractor, local residents in the area of the contract who are 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.

During the progress of the work, the Employment 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.

.2 Project Employment Guidelines

.1 The Contractor and sub-contractors will be required to notify the Canada Manpower Centre of all jobs prior to recruiting their work force and agree to recuit their workers outside the Northwest Territories only to the extent that qualified local residents are not available. The Canada Manpower Centre will act as the employment referral agency.

.2 The Contractor will maintain contact with Liaison Officers provided by the Territorial Government. The Liaison Officers will provide counselling services as required for employees and their families.

.3 The prime Contractor will provide for training on the job contracts, to be arranged by the Territorial Government, for those

1.1.16 Employment of the Native People (Continued)

.2 (Continued)

.3 indigenous Territorial residents who require special assistance in order to fill available jobs.

1.1.17 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 Ministry of Transport.

1.1.18 Environmental Briefings

The successful bidder shall arrange to have all his field staff available for environmental breifings for a period of about one hour when he has commenced operation of all equipment necessary to perform the work identified as clearing, grubbing, common excavation, channel excavation and overhaul and thereafter approximately every three (3) months. The Contractor shall provide space for the briefings at his camp. The Department will arrange to have environmental experts available for the briefings and will bear the cost of bringing in these people. The briefings will be scheduled to fit in with the Contractor's operation (double shift), so as not to cause any shutdown of the construction work. The Contractor will choose the time convenient for him, within a period of ten (10) days, as provided to him by the Engineer in writing.

No payment will be made to the Contractor for the time that his staff attend environmental briefings and/or meetings related to the Land Use Regulations and protection of the environment.

The Department may also have available in the camp, a short photographic slide presentation outlining environmental concerns and precautions to be taken. If such is available, the Contractor shall ensure new employees that he brings onto 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 on this project to review the requirements of the Land Use Permit, to identify areas of environmental concern and to establish special procedures and precautions because of such concerns.

1.1.19 Additional Information Package

An additional information package consisting of:
.1 Final Design Package

.1.19 Additional Information Package (Continued)

.2 Consultant reports (Environmental and Geotechnical)

.3 Mass haul diagram.

Will be available for viewing in the Department's Edmonton Office and Offices at Fort Simpson and Norman Wells. The additional information package is intended to provide the Contractor with background information used by the Department in preparing contract documents. This information package is not part of, nor will it be considered as part of the contract documents under any circumstances.

1.1.20 Engineer's Camp and Board

.1 Description:

This item will consist of the setting up, operating, maintaining, dismantling and moving the Engineer's trailer camp; the supplying of meals, bedding and cleaning services for all camp facilities and staff as may be required therefor. The Engineer's camp may be attached to the Contractor's camp facility subject to approval of the Engineer.

.2 Accommodation:

The Department will supply and the Contractor will service as outlined herein the following equipment for the exclusive use of the Engineer and his staff for the duration of the work and for as long thereafter as required by the Engineer to complete final measurements.

.1 One (1) office trailer (10 feet by 50 feet more or less), three (3) eight-man sleeper trailers (10 feet by 50 feet more or less), one (1) ablution trailer (10 feet by 30 feet more or less), and one (1) recreation trailer (10 feet by 50 feet more or less).

These trailers will be supplied to the Contractor at the barge landing site on the Mackenzie River at its confluence with Little Smith Creek.

.2 The trailers specified above shall be placed into a self-contained unit, and joined by a minimum 8 food wide walkway having the same floor elevation as the trailers. The walkway will be weather-proof, insulated and adequately heated and the layout will be subject to the Engineer's approval. If the Contractor has a camp with enclosed weather-proof walkways, the Engineer's camp may be joined to it and

1.1.20 Engineer's Camp and Board (Continued)

.2 (Continued)

the Department's ablution trailer may be eliminated and the Engineer's staff will use the Contractor's ablution facilities.

All the trailers specified above shall be adequately blocked and weather skirted for winter operation.

.3 One only unheated but weathertight storage shed, a minimum of 8 foot by 12 foot and equipped with one locking door and one interior light, will be supplied by the Contractor and placed near the Engineer's camp, solely for the Engineer's use.

.4 There shall be provided near the office trailer, five (5) parking places for vehicles complete with five (5) exterior electrical outlets for the exclusive use of the Engineer.

.5 The trailers supplied by the Department to the Contractor are the Contractor's responsibility from the time he originally moves them from the barge landing site for the duration of the contract. The trailers shall be set up and ready for occupancy at the same time as the Contractor's own camp. At the completion of contract work, the Contractor will return these trailers to the Department in the same shape as he received them, normal wear and tear excepted. The Engineer will direct whether the trailers are to be left at the last campsite location, move to some other location within the limits of the project, or returned to the barge landing.

The Contractor will be responsible for the operation of the trailers at his own expense. The supplying and installing of any replacement parts to these trailers will be carried out by the Contractor and the work will be measured for payment as a Change Order in accordance with Clause 45 of the Gneral Conditions of the contract.

.6 Services:

.1 The Contractor shall provide all equipment, supplies and labour required to prepare and serve each man on the Department's staff, registered and staying in the camp or as otherwise designated by the Engineer, meals and services of the same quantity and quality as provided for the Contractor's staff. A man will be considered to be in camp unless he is signed out twenty-four

1.1.20 Engineer's Camp and Board (Continued)

.6 Services (Continued)

.1 hours previous. There may be variations in the number of personnel from two to twenty-four over a season.

.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 and one (1) pillow for each occupant.

.3 If the Contractor shows movies, the Engineer's staff shall be allowed to attend these showings.

.4 A water and sewer system shall be provided by the Contractor for the Department's camp or the Contractor shall connect the Departmental ablution trailer to his system. The Contractor must include the Department's trailer units in his application under the Northern Inland Waters Act.

.5 A steady and dependable source of electric power will be supplied by the Contractor. The Contractor shall connect all required trailers, building and exterior outlets to this source.

.6 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.

.7 The Contractor shall dismantle, move and re-establish the camp whenever he moves his own camp.

.7 Measurement for Payment

.1 Measurement for payment for the camp shall be on a LUMP SUM price for the delivery, set up, moving, re-installation and return of the complete camp as specified or as directed by the Engineer. Such payment will include full provision for all work and materials to provide enclosed walkways and otherwise complete the camp and provide facilities as specified above. The payment will also cover the supply and installation of all service connections and service lines outside the trailers themselves.

1.1.20 Engineer's Camp and Board (Continued)

.7 (Continued)

.2 The quantity of board which will be measured for payment will be the number of man-days and fractions thereof, that the Engineer's staff is registered in camp and shall include the supply, preparation and serving of meals, cleaning, bedding, fuel, electric power, garbage and sewage disposal and all other labour, materials and equipment required for the operation and maintenance of the camp. All part days shall be expressed to the nearest third based on the number of meals taken by the occupant.

1.1.21 Clearing and Grubbing

.1 Clearing: shall be in accordance with Division 9, Section 1 of the specification and will include:

(a) Areas of right-of-way not previously cleared by others.

(b) Widening of the existing right-of-way clearing as directed by the Engineer.

(c) Borrow pits and access roads as directed by the Engineer.

The Contractor is advised that a major portion of the right-of-way has been previously hand-cleared by others.

Widening of existing right-of-way clearing will generally be designated by the Engineer where required to provide a minimum of fifteen (15) feet from toe of embankment or from top of excavation backslope to the edge of the right-of-way clearing.

The Contractor shall advise the Engineer not later than October 1st of each year, of the section(s) of anticipated embankment construction between October 1st and April 15th. This is to allow time for the Engineer to arrange for necessary flushcutting of stumps by others within the limits of the proposed winter embankment construction where grubbing or stripping will not be carried out.

.2 Grubbing: where designated by the Engineer, shall be carried out in accordance with Division 9, Section 1 of the specifications.

Notwithstanding Division 9, Section 1 of the specifications, in areas of the previously cleared right-of-way, the Engineer will designate that grubbing be carried out only on proposed excavation

1.1.21 Clearing and Grubbing (Continued)

.2 Grubbing (Continued):

areas where a separate disposal of stumps, roots and other debris is required. On all other right-of-way excavation areas, stumps, roots and other debris shall be removed and disposed of with the excavation and shall be considered incidental to the excavation. Grubbing will only be measured for payment on those areas of the right-of-way where a separate grubbing operation has been designated by the Engineer. In such areas original cross-sections for excavation will be taken after grubbing is complete.

1.1.22 Excavation

.1 All roadway and Borrow Excavation is to be carried out in accordance with the provisions of Division 9, Section 2 of the specifications.

.2 Channel Excavation, as described in Division 9, Section 3, of the specifications, is not expected to be a requirement under this contract. If, however, such excavation is required during construction, the appropriate payment will be made in accordance with Article 45 of the General Conditions of the contract.

1.1.23 Embankments

The embankment construction shall be in accordance with the requirements of Division 9, Section 4, of the specifications.

.1 As this project lies within the zone of permafrost it will be permissible to construct embankment using soils in a frozen state, in a manner designated by the Engineer.

.2 When constructing embankment with frozen material, the Engineer may direct that the embankment be constructed to a specified height above grade to allow for settlement that will occur when the frozen embankment thaws and consolidates.

.3 The Contractor is to provide a minimum of one(1) grid roller, one (1) vibrating steel drum compaction unit Type A, one (1) vibratory steel drum compaction unit Type B, and two (2) self-powered hand-operated vibrating or tamping units. The Engineer may instruct that additional compaction units be placed on the work if necessary to meet the requirements of the Contractor's schedule.

The above units shall conform with the requirements for compaction equipment described in Division 9, Section 4 of the specifications.

1.1.23 Embankments (Continued)

.4 Upon callup, a minimum of one eight (8) hour shift of work will be specified by the Engineer for the compaction equipment except for the self-powered, hand-operated vibrating or tamping units. For these units a minimum of one (1) hour of work will be specified by the Engineer upon callup. Notwithstanding the minimum callup provision, payment will not be made for any down-time or interruptions not authorized by the Engineer.

1.1.24 Culverts

.1 The locations of all culverts and the lengths of Corruguated Metal Pipe Culverts as shown on the plans are approximate only. The exact location of all culverts and the exact lengths of Corrugated Metal Pipe Culverts will be determined in the field by the Engineer.

.2 The assembly and installation of all culverts shall be in accordance with Division 9, Sections 6 and 7 of the specifications. All materials required for Corruguated Metal Pipe Culverts and Corrugated Structural Plate Culverts will be supplied to the Contractor by the Department as follows:
(Details will be inserted)

Upon delivery of culvert materials as outlined above, the Contractor shall supply the Engineer with a certificate acknowledging receipt 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 at no cost to the Department. The materials will be delivered in bundles, pallets or containers having maximum dimensions of 10 feet wide by 9 feet high by 22 feet long.

.3 The materials delivered for structural plate culvert installations having diameters greater than sixty (60) inches include the necessary materials for upstream and downstream cut-off walls as outlined on the Typical Steel Cut-off Wall Details in the plans. The materials will also include the necessary items for installation of hold-down end treatment at the

1.1.24 Culverts (Cont'd) .3 (Cont'd)

installation in accordance with the Typical Hold-down Details in the plans. The following basic information pertains to the hold-down materials.

All angles are pre-drilled. Bolt holes in the culvert for attaching the hold-down and cut-off wall materials shall be cut in the field by the Contractor.

If required prior to tendering, additional information on the hold-down material can be obtained from the Department of Public Works Office in Edmonton. The concrete collar work shown on the plans is not part of this contract.

Notwithstanding Article 9.7.4.1 of the specifications the prices tendered for assembly and installation of Corrugated Strucutral Plate Pipe shall include full provision for any required field fabrication and installation of hold-downs and/or steel cut-off walls where applicable.

1.1.25 Steam Pipe Installation

Where called for on the culvert design drawing a steam pipe will be installed in accordance with typical drawings No. D1, D2, D3 and D4.

Installation of the steam pipe will be considered incidental to the culvert installation. All materials will be supplied by the Department and will be stockpiled at the appropriate culvert material stockpile.

Installation of the steam pipe must be completed to the satisfaction of the engineer prior to covering the culvert with embankment material.

1.1.26 Gravel

Gravel surfacing is not included in this contract.

Rock borrow will be used in lieu of gravel for culvert bedding and backfill.

1.1.27 Rip-Rap

The rip-rap placed on this project will consist of STONE RIP-RAP. The stone rip-rap will be hand-placed rip-rap or heavy rip-rap placed in the random manner, as outlined in Division 9, Section11. The type of stone rip-rap to be used at the various sites shall be as designated by the Engineer.

(Sand cement bags may be required for rip-rap in areas where haul distances prohibit importation of rock. Details will be inserted in contract packages.)

1.1.27 Rip-Rap (Cont'd)

Notwithstanding the provisions of Division 9, Section 11, if the Engineer specifies the alternate use of filter fabric for filter blanket, the necessary filter fabric material will be supplied to the work by the Engineer. There will be no additional payment for use of filter fabric material as an alternate to granular filter blanket material.

For the purpose of calculating quantities of haul for rip-rap and filter blanket materials, a conversion of one (1) cubic yard being equal to one and one-half (1 1/2) tons will be used.

1.1.28 Ditch Linings

This section will be deleted as ditch bottoms and backslopes are to be blanketed with rock borrow in all cuts through fine grained material which is expected to offer adequate resistance to erosion.

1.1.29 Change in Quantities

The Contractor's attention is drawn to Article 11, Paragraphs 2(c) and 2(d) in the Articles of Agreement wherein the Engineer and the Contractor may by an agreement in writing, amend the price set out in the Unit Price Table where the quantities of certain classes of labour, plant or material performed, used or supplied by the Contractor in executing the work is less than seventy-five (75) percent or in excess of one hundred and twenty-five (125) percent of the estimated quantities shown in the Unit Price Table.

1.1.30 Fund Limitations

(If applicable, details will be inserted in the contract package.)

1.2.1 Tender Schedule

Each bidder shall submit with his tender a schedule in bar chart form covering excavation, gravel and structural plate culverts 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 this specification, has examined the site conditions, has made himself aware of access problems to the site and is aware of schedule limitations which may be brought about by climatic conditions or environmental requirements.

1.2.2 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 metal pipe and corrugated structural plate pipe on the basis of a mile by mile identification for the total length of the contract.

1.2.3 Scheduling Details

.1 Milestone Dates

The Contractor's construction schedule must show milestone dates as follows:

Milestone Date 1

(Details will be inserted in contract package)

Milestone Date 2

(Details will be inserted in contract package)

.2 The Contractor's construction schedule must be arranged to minimize the quantity of overhaul.

.3 Commencement Restrictions

The Contractor's attention is drawn to the following circumstances that will affect his mobilization and commencement of the work:

(a) The location and nature of the Contractor's campsite and other facilities must receive the prior approval of the Engineer together with approval under the Land Use Regulations and Northern Inland Waters Act.

1.2.3 Scheduling Details (Continued)

.4 Environmental Protection Schedule Restrictions

(a) No construction activity or alteration or diversion of a stream channel will be permitted in the construction of culverts in excess of 60 inches in diameter from May 1 to June 30th each year.

(b) Travel of the Contractor's vehicles or equipment on the Highway right-of-way will not be permitted prior to construction of the embankment to a minimum height of three (3) feet above the original ground; except when the active layer is completely frozen the Engineer may authorize movement of vehicles and equipment over this completely frozen ground without prior embankment construction.

(c) Stripping of pits and excavation of cuts will only be permitted when the active layer is completely frozen.

(d) Any restrictions to construction as might be specified in the Operating Terms and Conditions of the Land Use Permit.

.5 Other Restrictions

a) The borrow pit proposed for the Thunder River airstrip area, approximately adjacent to Mile 838 is to be utilized only when the active layer is completely frozen to minimize haul road construction requirements.

1.3.1 Description

This item consists of the provision to the Contractor of a fixed sum to cover costs of mobilization of plant, personnel and material, the establishment of temporary buildings, shops, offices and facilities and licenses, fees and premiums necessary to commence the work and which are not specifically measured under any other item contained in the Unit Price Table.

1.3.2 Measurement

Measurement for payment for mobilization will be on the basis of the LUMP SUM amount pre-established by the Department and shown on the Unit Price Table. This amount is to be included in the total amount of the tender and will be paid on the following schedule:

.1 Fifty (50) percent of the fixed amount when the Contractor has established his camp, has placed his fuel storage and has delivered to the camp site all the equipment necessary to perform work identified as clearing, grubbing, and roadway and borrow excavation.

.2 Twenty-five (25) percent of the fixed amount when the Contractor has commenced operation of all the equipment indicated in 1.3.2.1 above in the performance of that work identified as clearing, grubbing and roadway and borrow excavation.

.3 Twenty-five (25) percent of the fixed amount when the Contractor has completed construction of the equivalent of 3 miles of highway grading and drainage.

9.1.1. Description

This item consists of the removal and disposal of trees, stumps, brush, roots, surface logs, imbedded logs, all other surface debris and other work as herein described. The areas to be cleared and/or grubbed shall be those areas indicated on the Plans or designated by the Engineer in the field.

9.1.2. Materials

Not applicable.

9.1.3. Construction

.1 Clearing - Clearing shall consist of the removal and disposal of all trees, brush, fallen trees and other surface debris, except such trees and shrubs as may be designated for preservation. Trees and shrubs designated for preservation 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 any cleared area are to be removed.

(a) Where clearing only is required on the right-of-way or on access roads, trees, brush, rubbish and stumps shall be hand cut to within eight (8) inches of the ground surface. This clearing operation must be carried out in such a manner that will prevent damage to the existing insulating value of the organic material.

(b) Where grubbing is designated by the Engineer, clearing and grubbing may be carried out in one operation if approved by the Engineer.

(c) Generally all right-of-way widenings, right of way adjacent to stream crossings, off-take ditches and haul roads will be cleared by hand, and the use of machinery to pile and dispose of the clearing debris will only be allowed in the winter months. Machine clearing will generally be permitted for the clearing of borrow areas and sections of right-of-way where roadway cuts are proposed.

.2 Grubbing - Grubbing shall consist of the removal and disposal of roots, stumps, imbedded logs and other objectionable debris on the surface and imbedded in the surface. Areas where grubbing is required will be designated by the Engineer. Grubbing will generally be designated on all or portions of those areas on the right-of-way where excavation or subexcavation is to take place but generally will not be required on the right-of-way where the height of embankment will exceed three (3) feet. Grubbing will not normally be designated for borrow areas.

.3 Brush Piles - Brush piles consisting of trees, rubbish and/or organic materials existing from previous clearing operations shall be removed and disposed of by the

9.1.3. Construction (Cont'd).3 (Cont'd)
Contractor. Such work will not be measured separately for payment but will be considered incidental to thos areas staked or designated for clearing and/or grubbing by the Engineer.

.4 Disposal - All clearing and/or grubbing debris shall be disposed of as directed by the Engineer. Generally the disposal will consist of burning and placing of the burned debris in disposal pits or disposal areas. For the clearing and grubbing of borrow pits, the Contractor will generally be permitted to push clearing and grubbing debris into a section of the pit where excavation is completed and to flatten and trim such debris to a condition acceptable to the Engineer. Any earth material pushed in with the clearing and grubbing debris will not be separately measured for payment, but will be considered incidental to the clearing and grubbing operation.

In specific areas, the Engineer may direct that trees from the hand-cut clearing operation to be laid into a uniform mat transverse to the right-of-way centreline within the limits of future embankment. This work shall take place just in advance of the embankment construction.

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

9.1.4. Measurement

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

The quantity of GRUBBING to be measured for payment will be the number of acres acceptably grubbed in accordance with these specifications.

9.2.1. Description

This item consists of the excavation, loading, hauling within the freehaul distance, placing or disposal and trimming of all materials classified as Excavation Rock or Excavation Common. The work is to be carried out in conformity with the lines, grades and dimensions shown on the plans or as staked by the Engineer.

9.2.2. Materials Classification

.1 Excavation Rock - Excavation Rock is defined as:

(a) Material excavated from solid masses of igneous, sedimentary or metomorphic rock which prior to 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 or Channel Excavation.

9.2.3. Construction

.1 Roadway Excavation

(a) Roadway Excavation will include all excavation required for construction of contiguous roadway ditches, embankments, permanent access and connecting roads, berms, haul roads, 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.

(c) All unsuitable and/or excess material excavated from the roadway 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) All roadway excavation shall be to the lines and grades established on the Plans or set in the field by the Engineer to a tolerance maximum of two-tenths (2/10) of a foot.

In addition, variation in grade tolerance between any two successive 100 foot stations shall not exceed one-tenth (1/10) of a foot.

(f) 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.

9.2.3. Construction (Cont'd)

.1 Roadway Excavation (Cont'd)

(g) Where suitable material is encountered at the grade level of a cut, the material shall be removed to a depth of one (1) foot below grade and relaid and compacted in two (2) 6 inch layers.

(h) 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.

(i) Rock which cannot be ripped, shall be drilled and blasted in such a manner as to allow usage of all material excavated.

(j) Rock slopes shall be scaled down to remove boulders and rock fragments which may slide or roll down the slope.

.2 Borrow Excavation

(a) The Engineer will designate and approve all borrow areas and access to borrow areas. Haul roads from borrow areas may consist of one two-way road having a maximum surface width of forty (40) feet or two one-way haul roads each having a maximum surface width of twenty-five (25) feet. The haul roads will generally be doglegged so that only a short section of the haul road is visible from the highway.

(b) The location of potential borrow areas has been indicated generally on the photo mosaic plans. The indicated areas have been provided to give the Contractor an appreciation of the general type of material to be encountered in borrow areas and the general spacing of such borrow areas. The actual location (which need not be the same as indicated on the plans), dimensions and depths for excavation of all borrow areas will be designated in the field by the Engineer.

(c) Slopes of the excavated borrow areas shall not be steeper than two to one (2:1) for excavation common and one quarter to one (¼:1) for excavation rock, unless otherwise directed by the Engineer.

(d) Unsuitable materials excavated from borrow areas will be disposed of by placing it immediately adjacent to the borrow areas as designated by the Engineer in such a location as not to interfere

9.2.3. Construction (Cont'd)

.2 Borrow Excavation (Cont'd)

with the natural ground drainage or drainage from or into the proposed borrow area. The disposed of material will be trimmed as directed by the Engineer.

Where the unsuitable material from borrow areas is to be placed back into the excavated area after completion of the borrow excavation, this material will not be classified as roadway and borrow excavation but will be measured for payment as a Change Order in accordance with Clause 45 of the General Conditions of the contract.

(g) 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.

(h) Rock which cannot be ripped shall be drilled and blasted in such a manner as to allow usage of all material excavated.

9.2.4. Measurement

.1 Excavation Common - The volume of EXCAVATION COMMON which will be measured for payment, will be the number of cubic yards excavated in its original position, loaded, hauled within the free-haul distance, placed, trimmed and accepted in the work or disposed of in accordance with these specifications.

Original cross sections for measurements will be taken after the clearing and/or grubbing is completed.

Removing and replacing suitable material below grade level as specified in Article 9.2.3.1 (h) will be measured for payment as Excavation Common.

.2 Excavation Rock - The volume of EXCAVATION ROCK which will be measured for payment in cubic yards, in its original position, will be the volume of those materials excavated, loaded, hauled within the free-haul distance, placed, trimmed and accepted in the work or disposed of in accordance with these specifications.

Original cross sections for measurements will be taken on top of the exposed rock surfaces.

Where in the opinion of the Engineer, unavoidable overbreak occurs, measurement will be made for the actual quantity involved provided the overbreak does not exceed ten (10) percent of the actual quantity

9.2.4. Measurement (Cont'd)

within the lines as staked by the Engineer between the established 100-foot station intervals where the overbreak occurs. All materials exceeding ten (10) percent by this definition, when placed in the embankment, will be measured for payment as Excavation Common.

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 material within the free haul distance, disposal and trimming of material in accordance with the Plans or as staked by the Engineer. Except for intercepter ditches running generally parallel to the roadway embankment but not contiguous with it, channel excavation will be designated outside the highway right-of-way as delineated by the right of way clearing limits.

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 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 will be disposed of as shown on the Plans or as directed by the Engineer. Suitable material will 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 Engineer must approve the use of excavation equipment other than draglines and/or backhoes.

9.3.4. Measurement

The quantity of CHANNEL EXCAVATION COMMON or CHANNEL EXCAVATION ROCK to be measured for payment, will be the number of cubic yards of material acceptably excavated and disposed of in accordance with the Plans or as directed by the Engineer, measured in its original position.

There will be no measurement for payment for material excavated beyond the lines shown on the Plans or as staked by the Engineer, except that for Channel Excavation Rock where in the opinion of the Engineer unavoidable overbreak occurs, measurement for payment will be made for the actual quantities involved,

9.3.4. Measurement (Cont'd)

provided the overbreak quantity does not exceed ten (10) percent of the actual quantity of rock within the lines as staked by the Engineer between the established 100-foot station intervals where overbreak occurs. Rock excavation beyond the lines staked by the Engineer in excess of the overbreak allowed, will not be measured for payment.

9.4.1. Description

This item consists of the construction of subgrade, approach roads, ditch block embankments, and back-filling culvert and roadway sub-excavations with excavated material, all to the lines, grades, cross-sections and dimensions shown on the plans or as staked or designated by the Engineer.

9.4.2. Materials

The materials shall consist of acceptable earth and rock material free from wood, brush, roots and other organic matter. The Engineer will approve all materials prior to incorporation into embankments.

9.4.3. Construction

.1 Placing Roadway Embankment

(a) The embankment shall be constructed to the lines, grades and cross-section as indicated on the Plans and/or staked by the Engineer. If an embankment is constructed beyond the staked grades and cross-section without the written approval of the Engineer, the excess material shall be removed by the Contractor at his own expense and placed on the grade where the embankment is not completed. If the excess material has not been removed at the time of completion of the work, this material will not be measured for payment. The excavation quantity of excess material will be based on the excess embankment volume times the embankment adjustment factor for the section where the embankment was constructed beyond the staked lines and/or grades.

(b) Sufficient crown and/or superelevation shall be maintained at all times during construction to ensure ready runoff of surface water. The top surface shall be free of ruts and ridges, and windows will not be permitted to remain along the edges of the embankment.

(c) The initial lift of embankment material on unstable foundations shall have a minimum compacted thickness of three (3) feet for support of the 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 work along the right of way. After the initial lift has been constructed to the full design width, embankment material shall be placed in successive uniform layers across the entire width of the embankment. Where considered possible by the Engineer, this shall consist of placing successive layers of eight (8) inch maximum compacted thickness. In embankments composed principally of material obtained from rock cuts, the larger stones shall be carefully distributed and the

9.4.3. Construction (Cont'd)

.1 Placing Roadway Embankment (Cont'd.)

(c) Cont'd
interstices filled with smaller stones and other available material to form as compact a mass as practicable.

(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. All embankments shall be constructed to the lines and grades shown on the plans, or as staked by the Engineer, to a tolerance maximum of two-tenths (2/10) of a foot. In addition, variation in grade tolerance between any two successive 100 feet stations shall not exceed one tenth (1/10) of a foot.

(f) All boulders or stones larger than 6 inches in diameter which are imbedded in or protruding from the surface of the roadway, or which are protruding from the surface of the side slopes, shall be removed and the resulting cavities filled with compacted earth material. The boulders and/or stones removed shall, wherever considered practical and necessary by the Engineer, be used as a source of rip-rap materials. Where this is considered not necessary or practical, the boulders and/or stones shall be placed in disposal areas along the right-of-way designated by the Engineer and in a manner directed by the Engineer. Where, in the opinion of the Engineer, such disposal areas are not feasible, the boulders and/or stones shall be disposed of in depleted borrow pits.

.2 Compaction of Embankment

(a) The embankment shall be placed as described in .1(c) above. Each layer of material shall be spread evenly and to the satisfaction of the Engineer. The hauling equipment shall be directed over the full width of each layer of material placed.

(b) The Engineer will determine if and when additional compaction effort is required other than what is obtained by the hauling units and will decide the type and number of compaction units to be used.

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

(d) During embankment construction, if in the opinion of the Engineer, the material is too wet for placing

9.4.3. Construction (Cont'd)

.2 Compaction of Embankment (Cont'd)

(d) Cont'd

and/or 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 the weather is not suitable for drying, the Engineer may direct that work cease temporarily until such time as drying conditions have improved.

.3 Embankment Adjacent to Structures

(a) Embankment on 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 uniform elevations on both sides of the structure.

(b) Embankment at Culverts - Embankment around culverts shall consist of approved material placed to the limits shown on the typical plans for installation of corrugated metal pipe culverts and corrugated structural plate culverts or as directed by the Engineer. Material shall be placed and compacted in six (6) inch layers alternately on each side of the culvert so as not to displace it during installation. Special attention shall be given to compaction under the haunches.

(c) Fill - Retaining Walls - The fill behind the walls shall be 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.

.4 Compaction Equipment

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

9.4.3. Construction (Cont'd)

.4 Compaction Equipment (Cont'd)

(a) Sheepsfoot compactors shall consist of one or more drum units, having a total minimum width of 8 feet. The length of the tamping feet shall not be less than 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 400 pounds per square inch of cross-sectional area. 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 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 5 pounds per square inch. Pneumatic-tired rollers shall be so constructed that the total weight of the roller shall be not less than 17 tons and that the roller shall develop a minimum of 400 pounds pressure per inch width of tire. During rolling the operating weight of the roller and the tire pressure shall be varied to fit the soil conditions.

(c) Grid Rollers shall weigh not less than 15 tons and shall be of such weight that the load on each square inch of surface in contact with the road at any time shall not be less than 250 pounds.

(d) Type (A) steel drum vibratory compactors shall have a drum width of not less than 6 feet. The weight on the drum end shall not be less than 5 tons with minimum total applied forces of 500 lbs. (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: | 1 ton |
| Width of drums: | 30 inches |
| Drum diameter: | 18 inches |
| Total applied force (Combined vertical components of dynamic and static forces) | 150 lbs. per linear inch of drum |

9.4.3. Construction (Cont'd)

.4 Compaction Equipment (Cont'd)

(f) A compaction unit shall consist of a self-propelled or a power-drawn compactor. Compaction units shall be capable of moving at a speed up to 5 m.p.h. with the exception of the compaction units described in (e) above which shall be capable of moving at speeds up to 1.5 m.p.h.

(g) Self-powered, hand-operated vibrating or tamping units for compaction of backfill and/or embankments immediately adjacent to structures and culverts shall be of a design approved by the Engineer and weighing not less than 100 pounds.

.5 Drying Equipment

(a) Disc plowing harrows shall be of the heavy duty hinge offset type 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) A drying unit shall consist of power-drawn drying equipment. Drying units shall be capable of moving at speeds up to 4 m.p.h.

.6 (a) All drying units and compaction units with the exception of the self-powered hand operated tamper as described in 9.4.3.5 (g) 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

Construction of embankments in accordance with these specifications will not be measured for payment directly but will be considered incidental to the other Unit

9.4.4. Measurement (Cont'd)

Price Table items. The quantity of COMPACTION AND DRYING to be measured for payment, will be the actual number of hours each compaction and/or drying units is operated as directed by the Engineer. Any other equipment used in the drying and compaction operation which is not shown in the Unit Price Table, will not be measured separately for payment but will be considered incidental to the drying and compaction operation.

9.5.1. Description

This item consists of authorized hauling of excavated material, classified under the various excavation items, 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

The quantity of OVERHAUL to be measured for payment will be the number of cubic yard miles of authorized material hauled beyond the 2,640 feet free haul distance as calculated by the Mass Diagram Method.

(a) 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 shall be measured along the shortest route determined by the Engineer as feasible and satisfactory. If the contractor chooses to haul the material over some other route, this route must be approved by the Engineer. The measurement shall be based on the haul distance of the route designated by the Engineer or if the alternate route is shorter, the haul distance will be measured along this route.

(b) 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 will, 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 barge landing and the installation of corrugated metal pipe culverts in accordance with these specifications and to the lines and grades shown on the Plans or as directed by the Engineer.

This work shall include all sizes of corrugated metal pipe culverts except structural plate culverts.

## 9.6.2. Materials

All culvert materials will be supplied to the work by the Department.

## 9.6.3. Construction

### .1 Excavation

(a) The location, elevation and excavation for culverts will be staked by the Engineer.

(b) Excavation shall be carried out in accordance with the requirements for Excavation Common and/or Excavation Rock, Division 9, Section 2.

During construction the contractor may be required to provide for the temporary flow of water outside of the limits of the culvert. The method used in diverting the water shall be approved by the Engineer.

### .2 Bedding

The culvert bed shall provide a firm foundation of uniform density throughout its entire area. When a firm foundation is not encountered at the grade establishing 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 backfilled with material approved by the Engineer.

### .3 Installation

(a) Annular corrugated culvert pipe shall be placed with the inside circumferential laps pointing downstream and with longitudinal laps at the side or quarter points.

(b) The sections of the culvert shall be firmly jointed with coupling bands.

9.6.3. Construction (continued)

.3 Installation (continued)

(c) If a watertight joint is specified, the method used will be as directed by the Engineer.

(d) If insulation is specified, installation of insulation material will 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 the requirements for Embankment Construction, Division 9, Section 4.

The Engineer will determine the amount of compactive effort required.

(f) No strutting of culverts will be allowed without written approval from the Engineer.

9.6.4. Measurement

.1 Delivery and Installation

The quantity of CORRUGATED METAL PIPE to be measured for payment, will be the number of lineal feet of pipe complete in place and accepted by the Engineer. The measurement will be based on nominal length of pipe sections.

Loading of the pipes at the designated stockpile site(s), hauling, unloading the pipes at the culvert sites, preparing the bed, assembling the culvert and placement of backfill material around the pipe will be considered incidental to the culvert installation.

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

9.7.1. Description

This item consists of the transportation from barge landing 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 directed by the Engineer.

9.7.2. Materials

All Corrugated Structural Plate Pipe materials will be supplied to the work by the Department.

9.7.3. Construction

.1 Excavation

(a) The location, elevation and limits of excavation for the culverts will be staked by the Engineer.

(b) Excavation shall be carried out in accordance with the requirement for Excavation Common and/or Excavation Rock, Division 9, Section 2.

(c) Where applicable, the Contractor shall provide a temporary diversion for the flow of water outside the limits of the culvert. The method used in diverting the water shall be approved by the Engineer.

.2 Foundation

The culvert bed shall proved 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.

.3 Assembly

(a) Placing and assembly of the pipe may only proceed after the excavation, foundation and bedding for the pipe has 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 150 foot pounds and not more than 200 foot pounds.

(b) The Contractor shall, when specified in the General Requirements, arrange at his own cost to have in the field a fully qualified representative of

9.7.3. Construction (Continued)

.3 Assembly (Continued)

(a) 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.

.4 Backfilling

Assembly and tightening of all bolts shall be completed and approved by the Engineer before backfilling may commence. Backfill material will be located and approved by the Engineer.

During the course of backfilling around and above the pipe the deflections within the pipe will be measured. Plumb bobs shall be suspended within the pipe by the Contractor at locations under each embankment shoulder, at the midpoint of the pipe and under each slope at locations designated by the Engineer. Plumb bobs shall be suspended at 10, 12 and 1 o'clock positions and maintained by the Contractor throughout the course of backfilling of each pipe. Deflection readings will be taken by the Engineer.

Backfill material shall be placed in successive layers and compacted in accordance with the Plans and Specifications or as directed by the Engineer. Equipment used for the backfilling operation up to 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 mechanical tampers along the face of the pipe. Special attention shall be given to compaction under the haunches.

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. Vertical deflections that tend to increase the original vertical dimension will only be allowed. Vertical deflections will not be permitted to exceed three (3) percent of the original vertical diameter. Horizontal deflections will not be permitted to exceed five (5) percent of the original horizontal diameter.

9.7.3. Construction (Cont'd)

.4 Backfilling (Cont'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 and the Engineer shall be notified. The Engineer may then order the removal and replacement of the backfill in its entirety or in part and may require as a corrective measure that the pipe be strutted, either horizontally or vertically. The Contractor shall undertake the corrective work required entirely at his own expense.

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 pipe supplier for the loadings anticipated.

9.7.4. Measurement

.1 The quantity of Corrugated Structural Plate Pipe (C.S.P.P.) Culverts to be measured for payment will be as a lump sum for transportation and installation of each individual pipe acceptably completed in accordance with the Plans and Specifications or as directed by the Engineer.

.2 The quantities of excavation, backfill and compaction will be measured for payment in accordance with the appropriate items in the Unit Price Table.

9.8.1. Description

This item consists of excavating, crushing, screening or otherwise removing oversize material from gravel or stone and the loading and placing of the material in stockpile(s) or on the road as shown on the Plans or as directed by the Engineer.

9.8.2. Materials

The material will be obtained from sources shown on the Plans, except the Engineer may designate other sources if during the construction other sources are located.

.1 Crushed Gravel - 3/4" Minus

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

| Sieve No. | Percent Passing (By Weight) |
|---|---|
| 3/4" | 100% |
| No. 4 | 40 - 65 |
| No. 10 | 25 - 55 |
| No. 40 | 10 - 30 |
| No. 200 | 3 - 8 |

A minimum of 50% of the material retained on the No. 4 Sieve shall have at least one fractured face.

.2 Screened Gravel - 3" Minus

The material consists 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.

| Sieve No. | Percent Passing (By Weight) |
|---|---|
| 3" | 100% |
| No. 4 | 30 - 70 |
| No. 200 | 3 - 10 |

.3 Pit Run Gravel

The material shall consist of pit run gravel of clean, hard particles free from cementation and organic or other deleterious material. All oversize material shall be removed at the pit or on the road. Stones of dimensions exceeding the thickness of the lift in which the gravel is spread by more than one (1) inch is defined as oversize material; except that material passing the 3 inch sieve will not be classified as oversize.

9.8.3. Construction

.1 Clearing and grubbing of gravel deposit(s) and quarry area(s) access roads and stockpile site(s), shall conform to the requirements for Clearing and Grubbing, Division 9, Section 1.

.2 Excavation and disposal of material overlaying the gravel deposit(s) and quarry area(s) and the construction of access roads, shall be in accordance with the requirements for Excavation Common and Embankments, Division 9, Sections 2 and 4.

.3 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 blading shall be performed as directed by the Engineer.

(b) The hauling shall be uniformly spread over the width of the traffic lanes to produce uniform compaction. The Contractor shall maintain the haulroads at his own expense.

(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 subexcavated areas, and for backfill material around culverts, the backfill operation will be in accordance with the requirements for Embankment, Division 9, Section 4.

(e) Stockpile site(s) shall be firm and level and be 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

The quantity of CRUSHED, SCREENED and/or PIT RUN GRAVEL to be measured for payment, will be the number of tons of material produced, loaded and placed in accordance with this specification and accepted by the Engineer.

Measurement for Gravel Haul will be in accordance with the requirements for Gravel Haul, Division 9, Section 9.

9.8.4. Measurement (Cont'd)

The clearing, grubbing and/or stripping of gravel deposits and stockpile sites and the construction of access roads will be measured for payment in accordance with the appropriate Unit Price Table items.

The removal of snow and ice as specified in Article 9.8.3.3.(e) is considered incidental to the construction and no separate measurement for payment will be made therefor.

9.9.1. Description

This item consists of the authorized hauling of material measured for payment under the classification of gravel.

9.9.2. Materials

Not applicable.

9.9.3. Construction

Not applicable.

9.9.4. Measurement

The quantity of HAUL to be measured for payment will be the number of ton miles of gravel haul acceptably completed.

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

For the purpose of this Specification, the designated delivery point shall be considered as the center of the project mile, except:

(a) If a section is shorter than one mile, the designated delivery point will be the center of that section.

(b) If sections within a project mile are to be constructed at varying rates of application, the designated delivery point will be the center of each such section within the mile.

9.10.1. Description

This item consists of loading, transporting and distributing water required for the construction of highway embankment.

9.10.2. Materials

The Engineer will approve the source of water.

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

9.10.3. Construction

Watering equipment shall consist of water-tight tanks mounted on adequately power trucks. The water shall be applied through a spray bar of such design as to provide a uniform unbroken spread of water the full width of the spray bar. A suitable device for positive shutoff of the spray bar shall be so located as to permit control from the cab.

The Engineer will determine the quantity of water to be applied and the rate of application.

9.10.4. Measurement

The quantity of WATER to be measured for payment, will be the number of 1,000 gallon units of water acceptable loaded, transported and distributed.

Measurement will be made at the point of delivery. The volume of water will be computed from the volumetric capacity of the tank.

## 9.11.1. Description

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

## 9.11.2. Materials

The Contractor shall supply all materials.

.1 Stone Rip-Rap: 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) Hand-placed rip-rap material for corrugated metal pipe culverts, ditch blocks and ditch checks shall consist of stones, boulders or quarry rocks having dimensions of not less than six (6) inches in any one direction.

b) Rip-rap materials for corrugated structural plate culverts, bridges, and channel bank protection shall consist of stones, boulders or quarry rocks meeting the requirements for "Heavy Rip-rap),

HEAVY RIP-RAP

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

or meeting the requirements for "Armour Rip-Rap".

ARMOUR RIP-RAP

| Weight of Stones (lbs) | Percentage |
|---|---|
| 1,200 - 2,000 | 60 - 70 |
| 400 - 1,200 | 20 - 30 |
| 200 - 400 | 10 - 20 |
| Under 200 | - |

Filter blanket material shall be approved by the Engineer.

9.11.2. Materials (Cont'd)

Sand for mortar shall conform to the latest C.S.A. Specifications for Aggregate for Masonry Mortar A 82.56 unless otherwise instructed by the Engineer.

Cement for mortar shall be Portland Cement conforming to the latest C.S.A. Specification A5, (Type 1) unless otherwise specified in Division 1, Section 1.

.2 Sacked Soil-Cement Rip-Rap

a) The soil material shall consist of a sand and/or gravel from a source selected by the Engineer.

b) Sacks shall be manufactured from minimum 10 ounce burlap and shall be approximately 20 inches by 36 inches measured inside the seams when the sack is laid flat. The capacity of each sack shall be approximately 1.25 cubic feet.

c) The cement shall be Portland Cement conforming to the latest C.S.A. Specification A5, Type 1.

9.11.3. Construction

.1 Preparation of Foundation

a) Hand-Placed Rip-Rap: 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 and even surface. Depressions shall be filled and thoroughly compacted.

b) Hand-Placed Grouted Rip-Rap: Preparation of foundation shall be performed as .1 (a) above.

c) Random Rip-Rap: If required, a shelf or ledge shall be excavated to permit dumping of the stones.

d) Sacked Soil-Cement Rip-Rap: Preparation of foundation shall be performed as .1 (a) above.

e) Filter Blanket: 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.

.2 Placing

a) Hand-Placed Rip-Rap: Stones shall be placed by hand to cover the required length, width and thickness. Stones shall be firmly bedded into the slopes and against adjoining stones with spalls used to fill the voids. The larger stones shall be placed in the bottom rows. The largest dimension of the stones shall be perpendicular to the slope, unless such dimension is greater than the specified thickness of the rip-rap.

9.11.3. Construction (Cont'd)

.2 Placing (Cont'd)

b) Hand-Placed Grouted Rip-Rap: The stones shall be placed as specified in .2(a) above. The surface of the stones shall be thoroughly wetted before applying the mortar. The spaces between the stones shall be filled with cement mortar with the outer faces of the stones left exposed. The mortar shall be composed of one (1) part Portland Cement and three (3) parts of sand, of such consistency that it can be placed with a mason's trowel. After completing the grouting, the exposed surfaces of the stones shall be thoroughly brushed to remove the cement mortar. The outer stones shall project two (2) to four (4) inches above the grouted surface.

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

c) Random Rip-Rap: Random rip-rap shall be dumped onto the surface to be rip-rapped and sufficient hand and/or machine work shall be performed to produce a uniform depth and surface of the finished rip-rap.

d) Sacked Soil-Cement Rip-Rap: The Engineer will designate the amount of cement to be used in the preparation of the soil-cement mixture. The soil and cement shall be dry mixed in a manner which, in the opinion of the Engineer, is acceptable for uniformly distributing the cement throughout the soil. Each burlap sack shall be filled with approximately one (1) cubic foot of soil-cement mixture and securely tied at the top in a manner meeting with the acceptance of the Engineer. If the sacks are not to be immediately placed into their final position, they shall be kept dry. Upon placing into the work, each sack shall be 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 staked or designated by the Engineer. If being placed in the summer the sacks shall then be thoroughly soaked with a gentle spray of water and kept moist for twenty-four (24) hours by sprinkling, covering with moist earth or other approved means.

When placing sacked soil-cement rip-rap during the summer months the Contractor may wet mix the soil-cement mixture providing the filled sacks are immediately placed into the work and kept

9.11.3. Construction (Cont'd)

moist for a period of twenty-four (24) hours.

9.11.4. Measurement

The quantity of rip-rap which will be measured for payment shall be the number of cubic yards of rip-rap of the types specified in Division 1, Section 1 and provided for in the Unit Price Table, that have been accepted in the completed work by the Engineer. The measurement will be based on the volume of rip-rap in its final position.

In addition the following related work items will be measured for payment:

.1 The supply and transportation of soil material for the sacked soil-cement will, for the purpose of payment, be measured as PIT RUN GRAVEL and HAUL OF PIT RUN GRAVEL.

.2 The supply and transportation of filter blanket material will, for the purpose of payment, be measured as PIT RUN GRAVEL and HAUL OF PIT RUN GRAVEL.

.3 The transportation of stone rip-rap material will, for the purpose of payment, be measured as HAUL OF PIT RUN GRAVEL.

.4 Portland Cement for sacked soil-cement rip-rap will be measured as the number of 80 pound bags of cement acceptably supplied, delivered and incorporated into the soil-cement mixture.

All other work and materials required for acceptably completing the rip-rap installations with filter blankets where directed, will not be measured separately for payment but will be considered incidential to the work measurements outlined above.

9.12.1. Description

This item consists of the removal and disposal of snow and ice from excavation and/or embankment areas on the highway right-of-way in preparation for winter construction.

9.12.2 Materials

Not applicable.

9.12.3. Construction

.1 Removal of Snow and Ice

a) Snow and ice shall be removed from all right-of-way excavation and embankment areas prior to commencement of winter construction in such areas and they shall be kept free of snow while construction is underway.

b) Snow shall be windrowed along the edge of the right-of-way in such a manner as to avoid damage to adjoining trees.

.2 Snow and Ice Removal Equipment

The Snow and Ice Removal Equipment shall consist of a crawler tractor of minimum 101 net flywheel horse power and equipped with a dozer blade. The blade shall be equipped with two height adjustable mushroom type shoes of a design approved by the Engineer.

The Snow and Ice Removal Equipment shall be equipped with an approved time recording device which accurately records the number of hours the machine is in operation.

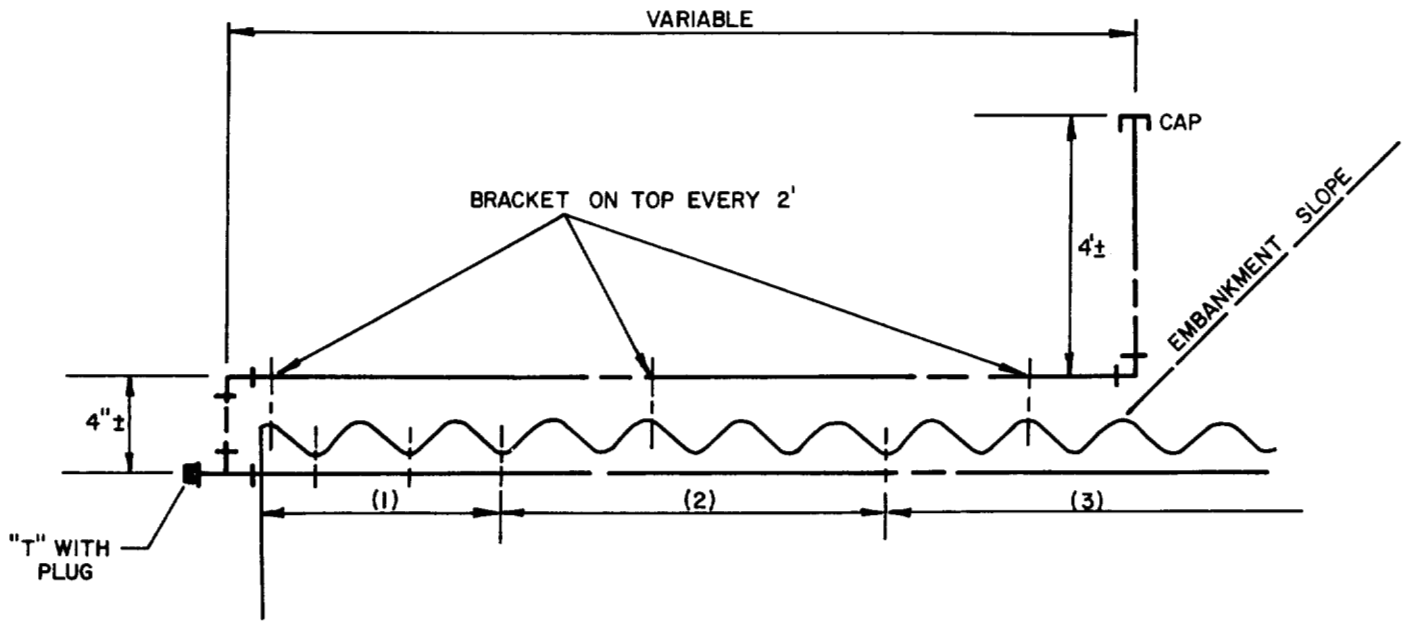
It will be the Contractor's responsibility to ensure that the device is properly mounted and maintained, that the cards are accurately identified as to date and shift, and to daily deliver said cards to the Engineer.

The Engineer will record the number of operating hours for the machine and both the Engineer and the Contractor will certify daily that such records are correct.

9.12.4. Measurement

The quantity of SNOW AND ICE REMOVAL as specified in paragraph 9.12.2.1 to be measured for payment, will be the number of approved hours the Snow and Ice Removal Equipment is operated removing snow and ice on the right-of-way.

Any required removal of snow and ice from borrow areas or other areas outside the highway right-of-way will not be measured separately for payment but will be considered incidental to the construction under other Unit Price Table items.




**NOTES**

(1) BRACKETS EVERY CORRUGATION FOR FIRST THREE CORRUGATIONS

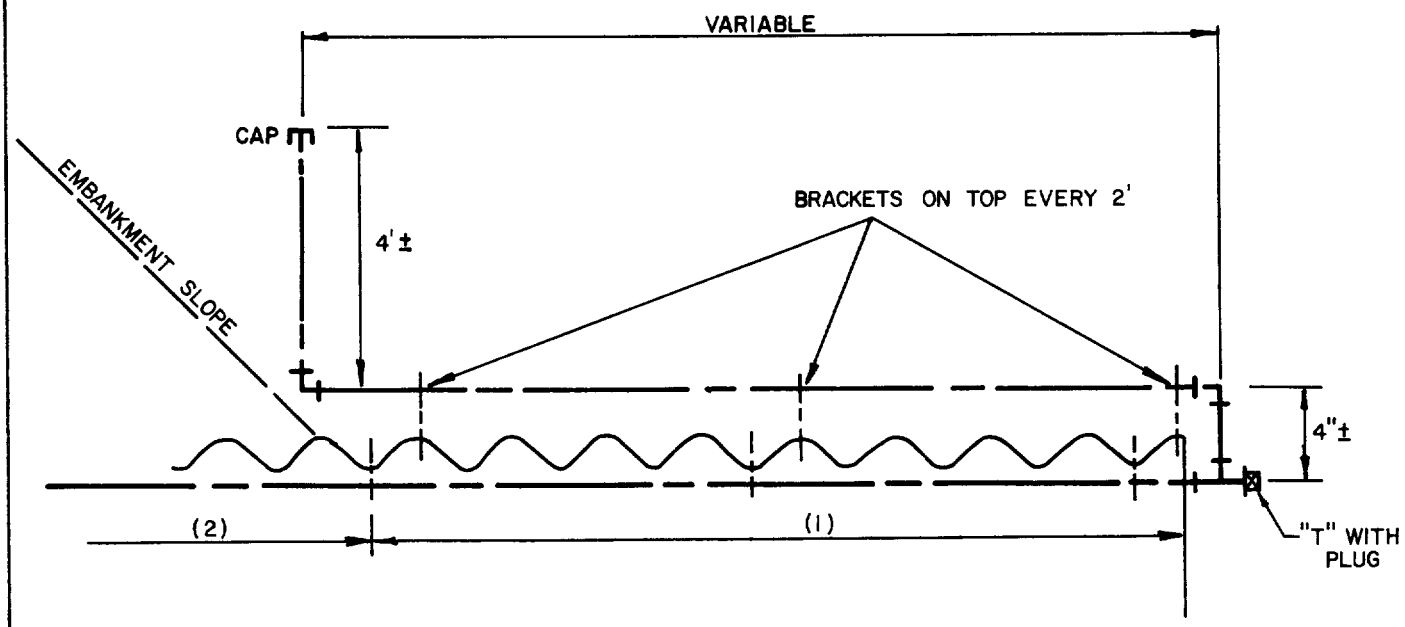
(2) BRACKETS EVERY 2' FOR 8'

(3) BRACKETS EVERY 10' OR 12' TO OUTLET. (i.e. BRACKETS COINCIDE WITH CIRCUMFERENTIAL JOINTS ON CULVERTS)

# STEAM PIPE - INLET END

| | | |
|---|---|---|
| Public Works Canada / Travaux publics Canada | drawing title / titre du dessin: STEAM PIPE INSTALLATION | designed by / conçu par — date |
| | scale / echelle | drawn by / dessiné par: R.P.N. 13/11/75 — date |
| | | reviewed by / examiné par — date |
| | | approved by / approuvé par: [signature] 17/11/75 — date |
| region | revisions — date | project number / no. de entreprise |
| region | revisions | drawing no / no du dessin: D-1 |

D.P.W. 700 A




**NOTES**

(1) BRACKETS EVERY 2' FOR 6'

(2) BRACKETS EVERY 10' OR 12' TO COINCIDE WITH CIRCUMFERENTIAL JOINTS ON CULVERTS

# STEAM PIPE – OUTLET END

Public Works Canada / Travaux publics Canada

drawing title / titre du dessin

## STEAM PIPE INSTALLATION

scale / echelle

designed by / concur par — date

drawn by / dessiné par R.P.N. 13/11/75 — date

reviewed by / examiné par — date

approved by / approuvé par — 19/11/75 date

region

region

revisions — date

revisions

project number

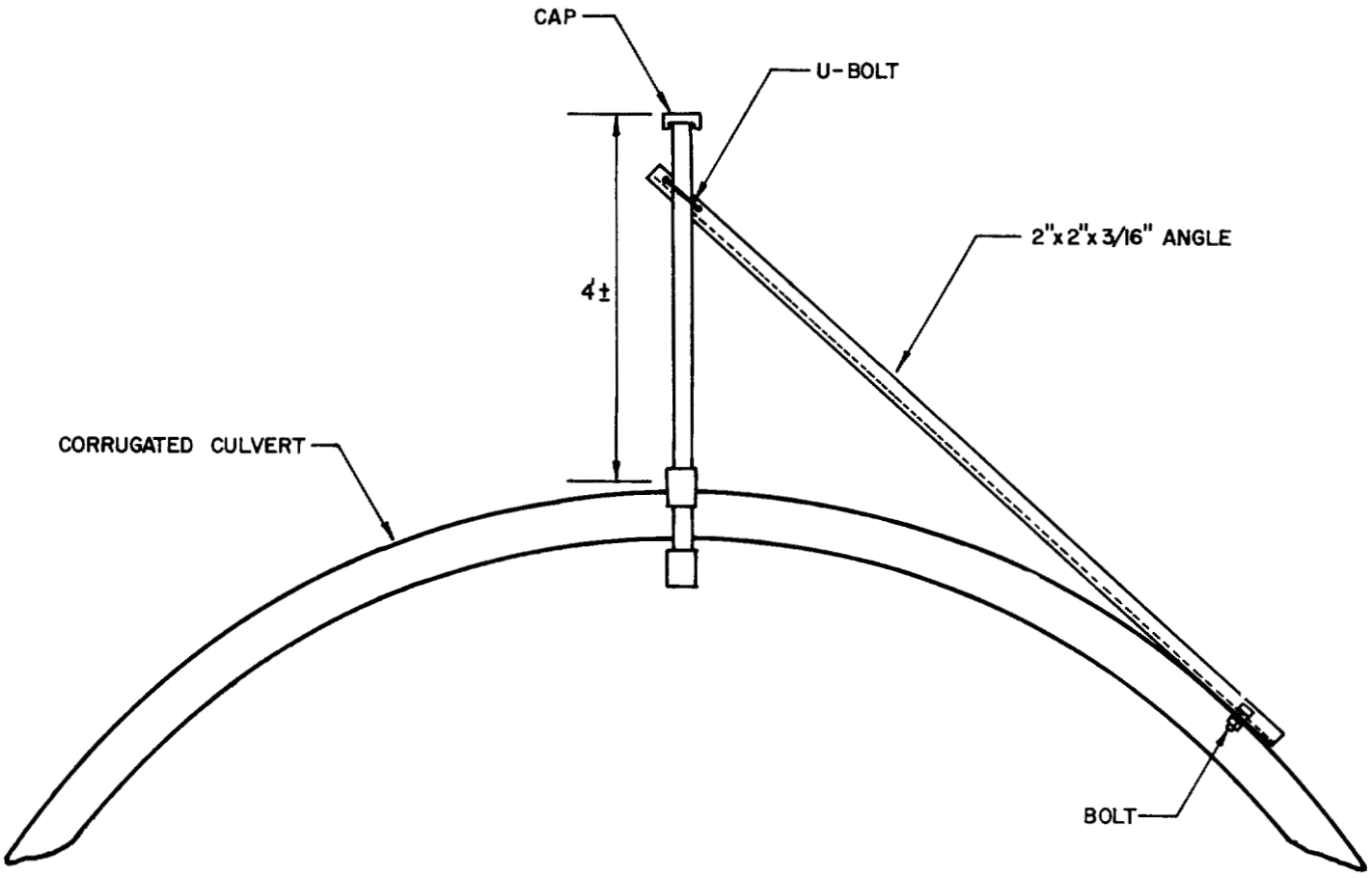
no. de entreprise

drawing no

D-2

no du dessin

D.P.W. 700 A




# RISER PIPE BRACE

## (TYP. BOTH ENDS)

Public Works Canada / Travaux publics Canada

drawing title / titre du dessin

**STEAM PIPE INSTALLATION**

scale / echelle

designed by / conçu par — date

drawn by / dessiné par R.P.N. 13/11/75 — date

reviewed by / examiné par — date

approved by / approuvé par — 17/11/75 date

region

region

revisions — date

révisions

project number

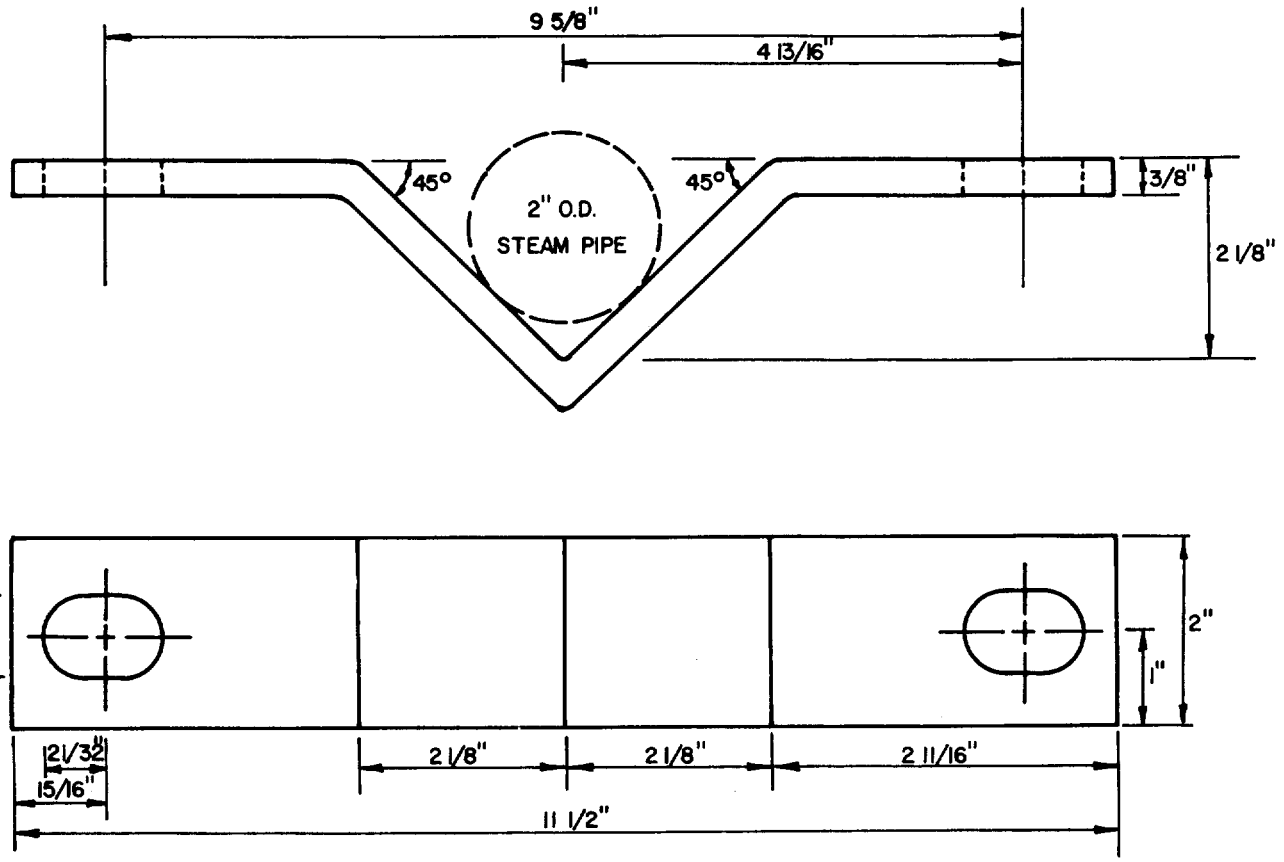
no. de entreprise

drawing no

D-3

no du dessin

D.P.W. 700 A




**NOTES**

1. PIPE & COUPLINGS TO BE 2" CLASS 40 GALVANIZED STEEL
2. HOLES REQUIRED FOR BRACKETS, OTHER THAN THOSE ON CIRCUMFERENTIAL CULVERT JOINTS, SHALL BE FIELD DRILLED.
3. RISERS AT INLET TO BE BUTTED TO END OF CULVERT.

# BRACKET DETAIL

| | | |
|---|---|---|
| Public Works Canada / Travaux publics Canada | drawing title / titre du dessin: STEAM PIPE INSTALLATION | designed by / conçu par — date |
| | scale / échelle | drawn by / dessiné par: R.P.N. 13/11/75 — date |
| | | reviewed by / examiné par — date |
| | | approved by / approuvé par: 17/11/75 |
| region / région | revisions / révisions — date | project number / no. de entreprise |
| | | drawing no / no du dessin: D-4 |

D.P.W. 700 A