

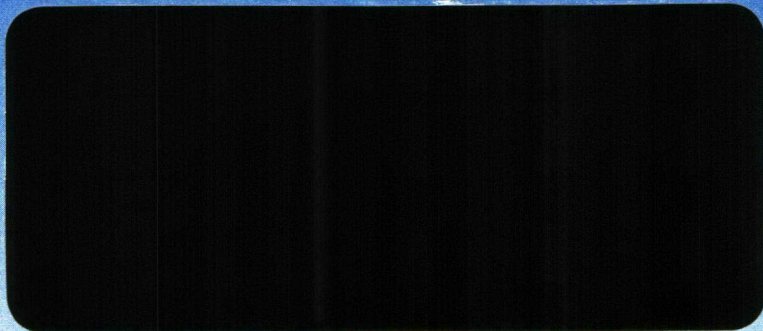


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**Inland Waters and Lands  
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Région de l'ouest et du nord**

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Canada

ALBERTA  
GAUGING STATION  
CONSTRUCTION AND MAINTENANCE  
ANNUAL REPORT  
1987-88

June 1988

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TABLE OF CONTENTS

	<u>Page</u>
1.0 INTRODUCTION . . . . .	1
2.0 COST-SHARING ARRANGEMENTS. . . . .	2
3.0 THE 1987/88 CONSTRUCTION PROGRAM. . . . .	3
3.1 Distribution of Costs . . . . .	3
Table 1 - 1987/88 Construction Projects and Cost Distribution . . . . .	4
3.2 Specific Costs and Site Locations . . . . .	3
Table 2 - Construction Costs at Each Site, 1987/88 . . . . .	5
Figure 1 - Station Location Map . . . . .	7
3.3 Summary of Maintenance Vote Costs . . . . .	8
Table 3 - Summary of Maintenance Vote Costs . . . . .	8
3.4 Typical Costs . . . . .	8
Table 4 - Typical Costs of Gauging Station Installation and Equipment . . . . .	9
4.0 STATION COST BREAKDOWN . . . . .	10
4.1 Definitions . . . . .	10
4.2 Site Specific Cost Breakdowns . . . . .	11
4.2.1 Federal-Provincial . . . . .	11
4.2.2 Federal . . . . .	22
4.2.3 Provincial . . . . .	28
5.0 APPENDIX. . . . .	32
Description of Construction Practices . . . . .	33
Photographs . . . . .	38

## 1.0 INTRODUCTION

Annual gauging station construction reports have been prepared by the Calgary District, Water Survey of Canada Division since 1949. These reports contain financial and construction details for all projects which incurred Capital expenditures. This report is for the fiscal year April 1, 1987 to March 31, 1988.

The contents of this report include a summary of expenditures incurred during 1987/88 for new station construction, for normal maintenance, and for electrical power installations.

The report also contains details on work performed and expenditures at each site. Cost breakdowns are grouped by gauging station designation; Federal-Provincial, Federal, and Provincial.

Brief descriptions of construction practices, material and equipment are presented in the Appendix. Also in the Appendix are photographs of some of the projects carried out during the year.

## 2.0 COST-SHARING ARRANGEMENTS

The 1987/88 construction and maintenance program between Canada and the Province of Alberta is managed under the Memorandum of Agreement for hydrometric surveys signed by both governments on April 15, 1975. Determination of the construction program is a joint consultative process between Alberta Environment and Environment Canada.

Under the terms of the agreement each gauging station is designated as Federal, Federal-Provincial or Provincial by a Co-ordinating Committee. Maintenance, power installation upgrading or new construction costs are shared according to the designation of the hydrometric gauging station.

Costs chargeable to the construction program are defined in the Memorandum of Agreement and Schedule B of the agreement. In summary, direct costs such as salaries of construction personnel, field travel expenses, vehicle costs, construction materials, contract payments for services and depreciation of construction equipment are chargeable. Stations designated as Federal are the cost responsibility of the Water Survey of Canada; stations designated as Federal-Provincial are cost-shared equally; and stations designated as Provincial are the cost responsibility of the Province of Alberta. The exceptions relate to equipment and instrumentation whereby, under Article VII of the Memorandum of Agreement, the operating agency is responsible for providing and paying the total cost of the basic water level recording equipment. However, beginning with 1983/84, manometer gauges have been included in the cost-sharing agreement. Specialized equipment and/or instrumentation is paid for by the party or parties requiring the service.

### 3.0 THE 1987/88 CONSTRUCTION PROGRAM

Two new gauging stations were constructed during 1987/88. Both of these stations were constructed by the Province in the Peace-Athabasca Delta area.

In all, maintenance was carried out at 56 gauging stations. At two of these sites major maintenance was required because of severe flooding in July in west-central Alberta. These projects were carried over from the previous year to allow for the reconstruction of bridges. The shelter on the Simonette River was lost due to flooding in 1987 and had to be replaced.

Maintenance at the fifty-three remaining stations consisted of:

- Removal of seventeen stations;
- Relocation of five stations;
- Upgrading of three stations;
- Cableway towers were replaced at two sites and new cableway built at two locations;
- Stilling well intake repair was carried out at eight sites;
- Cableway repairs were made at five sites;
- Minor maintenance was carried out at eight sites;
- New concrete control installed at Miners Coulee near International Boundary (photographs during the installation are contained in the Appendix);
- A large concrete orifice retainer was installed at South Wabasca Lake at Demarais by service contract.

In addition AC power was installed at three sites and one evapo-transpiration station was moved.

#### 3.1 Distribution of Costs

Table 1, which follows, contains a summary of costs and the numbers of construction projects according to gauging station designation. The costs in Table 1 include instrumentation and supervision, but do not include costs for depreciation.

#### 3.2 Specific Costs and Site Locations

Table 2 contains information on construction costs for each specific site and Figure 1 is a map showing the general location of each of the projects.

New construction in the table and on the map is represented by the letter "C", normal maintenance by the letter "M", and power installations by the letter "E".

TABLE 1

1987/88 CONSTRUCTION PROJECTS AND COST DISTRIBUTIONS

Type	Number of Stations	Designation	Cost
New Gauging Stations	2	Federal-Provincial	\$17,693.00
TOTAL	2		\$17,693.00
Normal Maintenance	28	Federal-Provincial	41,043.84
	17	Federal	28,887.90
	11	Provincial	15,769.06
TOTAL	56		\$85,700.80
Power Installations	2	Federal	3,453.10
	1	Provincial	953.82
TOTAL	3		\$4,406.92

TABLE 2

CONSTRUCTION COSTS AT EACH SITE

1987/88

Station	Construction Cost	Instrumentation		Share	
		Provincial	Federal	Provincial	Federal
<b>Federal-Provincial</b>					
C-1 Embarras River breakthrough to Mamawi Creek <sup>(1)</sup> (07KF901)	2,073.50	4,636.50	2,136.50		
C-2 Embarras River below the Divergence <sup>(1)</sup> (07DD003)	2,073.50	4,636.50	2,136.50		
TOTAL F/P NEW CONSTRUCTION COSTS .....	\$4,147.00	\$9,273.00	\$4,273.00	\$11,346.50	\$6,346.50
M-1 Beaverhill Creek near the Mouth (05EB015)	687.70				
M-2 Bow River below Carseland Dam (05BM002)	569.46				
M-3 Boyer River near Ft. Vermilion (07JF002)	356.70				
M-4 Brown Creek at Forestry Road <sup>(2)</sup> (05DD004)	2,224.18	2,136.50	2,136.50		
M-5 Clear Brook near Stavely (05AG003)	380.74				
M-6 Driftpile River near Driftpile (07BH003)	626.99				
M-7 Eureka River near Worsley (07FD013)	300.00				
M-8 Haynes Creek near Haynes (05CD006)	737.23				
M-9 Jackpine Creek at Wadlin Lake Road (07JD003)	1,919.37				
M-10 Keg River at Highway 35 (07HF002)	387.74				
M-11 Lobstick River near Styal (07BB003)	440.09				
M-12 Lloyd Creek near Bluffton (05CC009)	232.74				
M-13 Muskwa Creek No. 1 ab Bearhills Lake (05FA014)	340.30				
M-14 Meadow Creek near the Mouth (05AB029)	561.99				
M-15 Meander River above Hutch Lake (07OB005)	857.82				
M-16 Middle Fork Creek near Seebe (05BP017)	921.29				
M-17 Middle Fork Crk. in Cirque nr Seebe (05BP020)	1,235.12				
M-18 Mill Creek near the Mouth (05AA011)	544.59				
M-19 Montagneuse River near Hines Creek (07FD012)	2,965.38				
M-20 Namepi Creek near the Mouth (05EC004)	5,739.65				
M-21 Nordegg River at Sunchild Road (05DD009)	1,169.38				
M-22 Oldman River at Waldron's Corner (05AA023)	1,792.36				
M-23 Ram River near the Mouth (05DC006)	4,362.61				
M-24 Red Deer River above Panther River (05CA004)	2,169.18				
M-25 Simonette River near Goodwin (07GP001)	609.10				
M-26 Streeter Creek Main Stem near Nanton (05AB030)	767.58				
M-27 Todd Creek at Elton's Ranch (05AA006)	441.76		2,500.00		
M-28 Twin Creek near Seebe (05BP018)	929.79				
TOTAL F/P MAINTENANCE COSTS .....	\$34,270.84	\$2,136.50	\$4,636.50	\$19,271.92	\$21,771.92
<b>Federal</b>					
M-29 Bear Creek. nr International Bdry. (11AA028)	3,707.95				
M-30 Bow River at Banff (05BB001)	2,358.92				
M-31 Bow River near the Mouth (05BN012)	338.75				
M-32 Brewster Creek near Banff (05BB004)	402.54				
M-33 Cascade River above Lake Minnewanka (05BD005)	262.09				
M-34 Coal Lake Reservoir near Wetaskiwin (05FA016)	1,908.37				
M-35 Little Bow River below Travers Dam (05AC012)	3,936.17				
M-36 Milk River Natural Flow Study	416.71				
M-37 Milk River near Pendant d'Oreille (11AA035)	449.10				
M-38 Milk River at Milk River (11AA005)	2,266.26				
M-39 Miners Coulee nr International Bdry. (11AA029)	7,859.75				
M-40 Mountain View Irrigation Dist. Canal (05AD017)	267.03				
M-41 Notikewin River at Manning (07HC001)	945.29				
M-42 Redearth Creek near the Mouth (05BB005)	327.94				
M-43 Smoky River at Watino (07GJ001)	653.01				
M-44 Waterton Lake at Waterton Park (05AD025)	100.00		2,500.00		
M-45 Waterton River at Waterton Park (05AD003)	188.02				
TOTAL F MAINTENANCE COSTS .....	\$26,387.90		\$2,500.00		\$28,887.90
<b>Provincial</b>					
M-46 Battle River above Pipestone Creek (05FA023)	340.45				
M-47 Baptiste River near the Mouth (05DC012)	1,977.00	4,273.00	2,500.00		
M-48 Bear River near Grande Prairie (07GE005)	522.77				
M-49 Boyer River near Paddle Prairie (07JF004)	975.53				
M-50 Cabin Creek near Seebe (05BP019)	560.78				
M-51 Hines Creek near Fairview (07FD008)	776.82				
M-52 Kirkpatrick Lake Trib. near Spondin (05GA009)	386.74				
M-53 Nose Creek at Calgary (05BH003)	553.34				
M-54 Oldman River near the Mouth (05AG006)	338.75				
M-55 Pembina River near Entwistle (07BB002)	1,363.18				
M-56 South Wabasca Lake near Desmarais (07JA002)	1,200.70				
TOTAL P MAINTENANCE COSTS .....	\$8,996.06	\$4,273.00	\$2,500.00	\$13,269.06	\$2,500.00
... continued					

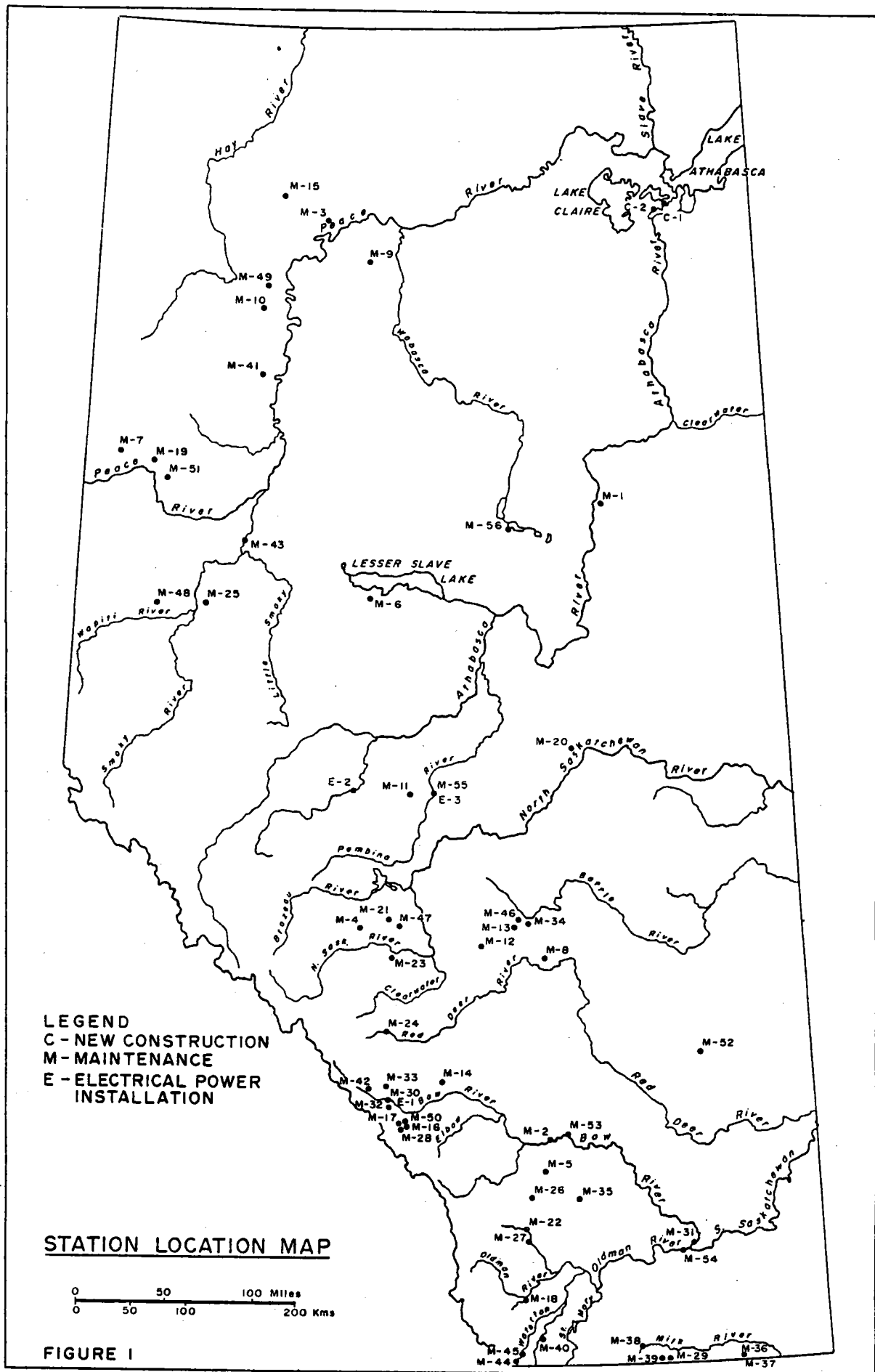
C = Construction  
M = Maintenance  
E = Electrical power Installation



TABLE 2 (continued)

Station	Construction Cost	Instrumentation		Share	
		Provincial	Federal	Provincial	Federal
<b>Power Installations</b>					
<b>Federal</b>					
E-1 Bow River at Banff (05BB001)	2,780.00				
E-2 McLeod River near Rosevear (07AG007)	673.10				
	\$ 3,453.10				\$ 3,453.10
<b>Provincial</b>					
E-3 Pembina River near Entwistle (07BB002)	953.82				
	\$ 953.82			\$ 953.82	
<b>SUBTOTAL</b>	\$ 4,406.92			\$ 953.82	\$ 3,453.10
<b>Total Cost of Construction and Maintenance</b>	\$78,208.72	\$15,682.50	\$13,909.50	\$44,841.30	\$62,959.42
Construction of C-1 and C-1 by Province <sup>(1)</sup>	(4,147.00)	(9,273.00)	(4,273.00)	(11,346.50)	(6,346.50)
1986-87 Provincial Funding of M-4 and M-47 <sup>(2)</sup>				(6,466.50)	
<b>TOTAL COST OF CONSTRUCTION AND MAINTENANCE PROGRAM CONDUCTED BY CANADA</b>	\$74,061.71	\$ 6,409.50	\$ 9,636.50	\$27,028.30	\$56,612.92
<p>(1) Stations C-1 and C-2 were constructed by the Province. Both parties provided bubble gauges, and the Province, as the operating party, provided the water level recording equipment. The cost of shelters are included in the construction cost, but weren't costed to Canada as Alberta had salvaged these from TransAlta Utilities. Therefore, the only recoverable costs from Canada is the amount of \$1,073.50, which is 50% of the total installation cost of \$2,147.00.</p> <p>(2) The maintenance costs shown are in gross dollars, whereas, during 1986-87 the Province paid \$6,466.50 towards the cost of purchasing materials and instrumentation for these two sites.</p>					

C = Construction  
M = Maintenance  
E = Electrical power installation



LEGEND  
C - NEW CONSTRUCTION  
M - MAINTENANCE  
E - ELECTRICAL POWER  
INSTALLATION

**STATION LOCATION MAP**

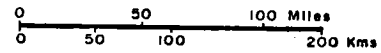


FIGURE I

3.3 Summary of Maintenance Vote Costs

This table is an addition to this report. Utilizing the specific expenditures for each station described in Chapter 4, a total vote (i.e., Capital, Salary, O&M) expenditure is provided for each hydrometric station designation.

TABLE 3

SUMMARY OF MAINTENANCE VOTE COSTS

SUMMARY OF MAINTENANCE COSTS - ALBERTA

STATION & DESIGNATION	TOTAL COSTS			
	CONSTRUCTION CAPITAL	INSTRUMENTATION CAPITAL	O & M	SALARY
Federal-Provincial	16,275.54	6,773.00	5,333.30	12,662.00
Federal	19,027.13	2,770.00	3,037.89	7,505.98
Provincial	<u>4,448.28</u>	<u>6,773.00</u>	<u>1,493.30</u>	<u>4,008.30</u>
TOTALS:	\$39,750.95	\$16,316.00	\$9,864.49	\$24,176.28
NOTE: These costs do not include the construction costs of stations C-1 and C-2, which were constructed by the Province.				

3.4 Typical Costs

Table 4 indicates the average cost of various types of installations without instruments, for stations installed in Alberta during 1987/88. Costs are for standard access sites and remote installation costs would be approximately double the cost shown. This table also provides a breakdown of the costs of various types of frequently used instrumentation.

TABLE 4

TYPICAL COSTS OF GAUGING STATION INSTALLATIONS AND EQUIPMENT

ITEM	AVERAGE COST
Insulated steel shelter 1.63m x 1.63m x 2.44m on wooden foundation for manometer installation	\$ 2,560.00
Gauge well 3.66m x 1.52m' with 1.63m x 1.63m x 2.44m standard steel shelter	\$ 3,830.00
Cableway 50m span with 3.05m and 3.66m A-Frames	\$ 4,260.00
Recorder A-71	\$ 2,500.00
Manometer 10.67m stage	\$ 4,273.00
Boat	\$ 800.00
Data Collection Platform (complete)	\$ 7,000.00
Electric Contact Gauge	\$ 135.00
Wire Weight Gauge	\$ 206.00
Steel Shelter 1.63m x 1.63m x 2.44m	\$ 804.00

#### 4.0 STATION COST BREAKDOWN

##### 4.1 Definitions

The following are definitions and/or lists of items included in this report.

Labour:	Hired construction foreman (excluding supervision and work conducted by hydro-metric field technicians).
Labour Board:	Hired construction foreman's board and room.
Travel:	Scheduled air flights, gas, oil, vehicle repairs, construction foreman's travel.
Material, Supplies Contracts:	Culvert, lumber, pipe, and cement, gravel freight, cable, hardware, etc.  Electric power installation poles, wire, service connection.  Equipment rental - boat, truck, etc.  Aircraft charter.  Excavation: rental of backhoe, bulldozer, dragline, etc.  Telephone installation.  Concrete, etc.
Equipment:	Stevens A-71 recorder (weight, negator, electric).  Manometer (10.66m or 15.24m), including servo-control, etc.  Telemark & adapter (Code-a-Phone).  Heating unit (stove, pipes, thermostat, etc. - Cata-Dyne).

Supervision: An EG-ESS-08 is assigned full time to the construction program during the construction season (April to November) and his total salary for that period has been charged. This salary has been distributed to the various individual projects on a percentage basis calculated according to the cost of construction for that site, as compared to the total construction costs. Instrumentation costs are excluded from the calculations.

4.2 Site Specific Cost Breakdowns

For each gauging station site at which either a new station was established and built, normal maintenance was carried out, or electric power was installed, the cost breakdowns are contained in this section and divided according to designation.

4.2.1 Federal-Provincial (F-P)

C-1: Embarras River breakthrough to Mamawi Creek (07KF901) (F-P)

Installed shelter to house manometer and recorder. Work done by provincial government.

Cost as Constructed:

Labour .....	\$ 1,073.50
Material, Supplies & Contract ...	1,000.00
Recorder .....	2,500.00
Manometer .....	<u>4,273.00</u>
Total:	\$ 8,846.50

C-2: Embarras River below the Divergence (07DD003) (F-P)

Installed shelter to house manometer and recorder. Work done by provincial government.

Cost as Constructed:

Labour .....	\$ 1,073.50
Material, Supplies & Contract ...	1,000.00
Recorder .....	2,500.00
Manometer .....	<u>4,273.00</u>
Total:	\$ 8,846.50

M-1: Beaverhill Creek near the Mouth (05EB015) (F-P)

Station discontinued; shelter removed; well backfilled and seeded to grass.

Cost as Constructed:

Labour .....	\$ 99.85
Labour Board .....	68.85
Travel .....	79.00
Material, Supplies & Contract ...	240.00
Supervision .....	<u>200.00</u>
Total:	\$ 687.70

M-2: Bow River below Carseland Dam (05BM002) (F-P)

Former shelter below bridge removed, well backfilled, equipment returned to stores and all usable material salvaged.

Cost as Constructed:

Labour .....	\$ 138.21
Labour Board .....	8.50
Travel .....	30.00
Material, Supplies & Contract ...	292.75
Supervision .....	<u>100.00</u>
Total:	\$ 569.46

M-3: Boyer River near Ft. Vermilion (07JF002) (F-P)

Extended stand pipes in well.

Cost as Constructed:

Labour .....	\$	99.85
Labour Board .....		15.85
Travel .....		75.00
Material, Supplies & Contract ...		16.00
Supervision .....		<u>150.00</u>
Total:	\$	356.70

M-4: Brown Creek at Forestry Road (05DD004)

Installed standard steel shelter on wooden base to house manometer and recorder.

Cost as Constructed:

Labour .....	\$	394.65
Labour Board .....		213.65
Travel .....		200.50
Material, Supplies & Contract ...		1,065.38
Manometer .....		4,273.00
Supervision .....		<u>350.00</u>
Total:	\$	6,497.18

Refunded by Province (last year)	\$	1,216.50
Balance:	\$	2,032.09

M-5: Clearbrook near Stavely (05AC033) (F-P)

Station discontinued. Removed well and shelter, backfilled site and seeded to grass. ✓

Cost as Constructed:

Labour .....	\$	118.24
Labour Board .....		8.50
Travel .....		74.00
Material, Supplies & Contract ...		80.00
Supervision .....		<u>100.00</u>
Total:	\$	380.74



M-6: Driftpile River near Driftpile (07BH003) (F-P)

Station discontinued. Removed shelter and cableway and returned all usable material to stores.

Cost as Constructed:

Labour .....	\$	239.64
Labour Board .....		37.35
Travel .....		100.00
Supervision .....		<u>250.00</u>
Total:	\$	626.99

M-7: Eureka River near Worsley (07FD013) (F-P)

Shelter moved under contract due to road construction.

Cost as Constructed:

Material, Supplies & Contract ...	\$	<u>300.00</u>
Total:	\$	300.00

M-8: Haynes Creek near Haynes (05CD006) (F-P)

Lowered well and lower intake approximately 0.36m.

Cost as Constructed:

Labour .....	\$	236.48
Labour Board .....		181.50
Travel .....		53.00
Material, Supplies & Contract ...		66.25
Supervision .....		<u>200.00</u>
Total:	\$	737.23

M-9: Jackpine Creek at Wadlin Lake Road (07JD003) (F-P)

Due to road construction, well and shelter were removed in September. Reinstalled shelter on wooden platform to house manometer.

Cost as Constructed:

Labour .....	\$ 691.05
Labour Board .....	443.95
Travel .....	348.00
Material, Supplies & Contract ...	286.37
Supervision .....	<u>150.00</u>
Total:	\$ 1,919.37

M-10: Keg River at Highway 35 (07HF002) (F-P)

Extended stand pipes and desilted well.

Cost as Constructed:

Labour .....	\$ 53.24
Labour Board .....	18.50
Travel .....	50.00
Material, Supplies & Contract ...	16.00
Supervision .....	<u>250.00</u>
Total:	\$ 387.74

M-11: Lobstick River near Styal (07BB003) (F-P)

Station discontinued. Removed shelter, backfilled well and reseeded site to grass.

Cost as Constructed:

Labour .....	\$ 118.24
Labour Board .....	20.90
Travel .....	55.95
Material, Supplies & Contract ...	145.00
Supervision .....	<u>100.00</u>
Total:	\$ 440.09

M-12: Lloyd Creek near Bluffton (05CC009) (F-P)

Installed new top on recessed recorder compartment.

Cost as Constructed:

Labour .....	\$	118.24
Labour Board .....		8.50
Travel.....		65.00
Material, Supplies & Contract ...		<u>41.00</u>
Total:	\$	232.74

M-13: Maskwa Creek No. 1 above Bearhills Lake (05FA014) (F-P)

Removed shelter, backfilled well and seeded site to grass.

Cost as Constructed:

Labour .....	\$	99.85
Labour Board .....		11.45
Travel .....		79.00
Supervision .....		<u>150.00</u>
Total:	\$	340.30

M-14: Meadow Creek near the Mouth (05AB029) (F-P)

Installed 1.2m x 1.2m x 2.4m steel shelter on existing well.

Cost as Constructed:

Labour .....	\$	118.24
Labour Board .....		68.85
Travel .....		48.50
Material, Supplies & Contract ...		126.40
Supervision .....		<u>200.00</u>
Total:	\$	561.99

M-15: Meander River above Hutch Lake (070B005) (F-P)

Station discontinued. Removed shelter, backfilled well site and seeded.

Cost as Constructed:

Labour .....	\$	189.72
Labour Board .....		168.10
Travel .....		100.00
Material, Supplies & Contract ...		150.00
Supervision .....		<u>250.00</u>
Total:	\$	857.82

M-16: Middle Fork Creek near Seebe (05BF017) (F-P)

Station discontinued. Removed V-notch weir and all other material. Site landscaped and seeded to grass.

Cost as Constructed:

Labour .....	\$	118.24
Labour Board .....		8.50
Travel .....		65.80
Material, Supplies & Contract ...		478.75
Supervision .....		<u>250.00</u>
Total:	\$	921.29

M-17 Middle Fork Creek in Cirque near Seebe (05BF020) (F-P)

Station discontinued. Removed well, flume and all other material. All usable material returned to stores.

Cost as Constructed:

Labour .....	\$	128.22
Labour Board .....		8.50
Travel .....		65.80
Material, Supplies & Contract ...		782.60
Supervision .....		<u>250.00</u>
Total:	\$	1,235.12

M-18: Mill Creek near the Mouth (05AA011) (F-P)

Shelter and cableway removed. Well backfilled and seeded to grass.

Cost as Constructed:

Labour .....	\$	118.24
Labour Board .....		70.80
Travel .....		33.00
Material, Supplies & Contract ...		122.55
Supervision .....		<u>200.00</u>
Total:	\$	544.59

M-19: Montagneuse River near Hines Creek (07FD012) (F-P)

Installed 20m span cableway with 2.4m A-Frame on both sides.

Cost as Constructed:

Labour .....	\$	317.94
Labour Board .....		200.00
Travel .....		223.30
Material, Supplies & Contract ...		1,724.14
Supervision .....		<u>500.00</u>
Total:	\$	2,965.38

M-20: Namepi Creek near the Mouth (05EC004) (F-P)

Station moved downstream approximately 0.7 km. Installed 3.6m x 1.6m well with pipe inlets and standard steel shelter. Installed 60m span cableway with 3.0m A-Frame on both sides.

Cost as Constructed:

Labour .....	\$	642.64
Labour Board .....		270.50
Travel .....		200.19
Material, Supplies & Contract ...		4,126.32
Supervision .....		<u>500.00</u>
Total:	\$	5,739.65

M-21: Nordegg River at Sunchild Road (05DD009) (F-P)

Removed fallen trees from cable and installed new marker cones.  
Installed new orifice line and heavy orifice block.

Cost as Constructed:

Labour .....	\$ 414.63
Labour Board .....	155.60
Travel .....	113.15
Material, Supplies & Contract ...	186.00
Supervision .....	<u>300.00</u>
Total:	\$ 1,169.38

M-22: Oldman River at Waldron's Corner (05AA023) (F-P)

Installed new 3.0m steel A-Frame on right bank.

Cost as Constructed:

Labour .....	\$ 236.48
Labour Board .....	79.25
Travel .....	85.61
Material, Supplies & Contract ...	1,141.02
Supervision .....	<u>250.00</u>
Total:	\$ 1,792.36

M-23: Ram River near the Mouth (05DC006) (F-P)

Installed 3.6m well with pipe inlets and standard steel shelter. Former station removed and site backfilled.

Cost as Constructed:

Labour .....	\$ 572.81
Labour Board .....	243.35
Travel .....	200.00
Material, Supplies & Contract ...	3,096.45
Supervision .....	<u>250.00</u>
Total:	\$ 4,362.61

M-24: Red Deer River above Panther River (05CA004) (F-P)

Installed new 4.3m steel A-Frame on right bank, complete with platform and aircraft marker extension.

Cost as Constructed:

Labour .....	\$ 264.43
Labour Board .....	161.20
Travel .....	100.10
Material, Supplies & Contract ...	1,143.45
Supervision .....	<u>500.00</u>
Total:	<u>\$ 2,169.18</u>

M-25: Simonette River near Goodwin (07GF001) (F-P)

Installed shelter salvaged from Bear Creek near Grande Prairie. Found, removed, and scraped shelter washed out in recent flood.

Cost as Constructed:

Labour .....	\$ 178.15
Labour Board .....	70.95
Travel .....	110.00
Supervision .....	<u>250.00</u>
Total:	\$ 609.10

M-26: Streeter Creek Main Stem near Nanton (05AB030) (F-P)

Station removed and all usable material salvaged. Site landscaped and seeded to grass.

Cost as Constructed:

Labour .....	\$ 236.48
Labour Board .....	17.00
Travel .....	83.50
Material, Supplies & Contract ...	30.60
Supervision .....	<u>400.00</u>
Total:	\$ 767.58

M-27: Todd Creek at Elton's Ranch (05AA006) (F-P)

Station upgraded from manual to recording. Installed 2m x .457m culvert with California shelter.

Cost as Constructed:

Labour Board .....	\$	17.00
Travel .....		35.00
Material, Supplies & Contract ...		139.76
Recorder .....		2,500.00
Supervision .....		<u>250.00</u>
Total:	\$	2,941.76

M-28: Twin Creek near Seebe (05BF018) (F-P)

Station discontinued. Removed V-notch weir and all other material. All usable material returned to stores. Site landscaped and seeded to grass. ✓

Cost as Constructed:

Labour Board .....	\$	118.24
Labour Board .....		17.00
Travel .....		65.80
Material, Supplies & Contract ...		478.75
Supervision .....		<u>250.00</u>
Total:	\$	929.79



4.2.2 Federal (F)

M-29: Bear Creek near International Boundary (11AA028) (F)

Removed 1.2m diameter well with recessed recorder compartment and replaced it with a 1.5m x 2.4m well with pipe inlets and standard steel shelter.

Cost as Constructed:

Labour .....	\$	209.68
Labour Board .....		73.35
Travel .....		120.60
Material, Supplies & Contract ...		2,669.32
ECCG .....		135.00
Supervision .....		<u>500.00</u>
Total:	\$	3,707.95

M-30: Bow River at Banff (05BB001) (F)

Removed former shelter, which was attached to bridge. Moved manometer into existing shelter across road. Power and telephone installed at present location.

Cost as Constructed:

Labour .....	\$	354.72
Labour Board .....		175.20
Travel .....		93.00
Material, Supplies & Contract ...		1,486.00
Supervision .....		<u>250.00</u>
Total:	\$	2,358.92

M-31: Bow River near the Mouth (05BN012) (F-P)

Installed two new marker cones on cableway.

Cost as Constructed:

Travel .....	\$	25.75
Material, Supplies & Contract ...		113.00
Supervision .....		<u>200.00</u>
Total:	\$	338.75

M-32: Brewster Creek near Banff (05BB004) (F)

Changed box culvert intake to open trench intake.

Cost as Constructed:

Labour .....	\$	118.24
Labour Board .....		116.10
Material, Supplies & Contract ...		68.20
Supervision .....		<u>100.00</u>
Total:	\$	402.54

M-33: Cascade River above Lake Minnewanka (05BD005) (F)

Repaired hand rail on bridge.

Cost as Constructed:

Labour .....	\$	118.24
Labour Board .....		20.90
Material, Supplies & Contract ...		22.95
Supervision .....		<u>100.00</u>
Total:	\$	262.09

M-34: Coal Lake Reservoir near Wetaskiwin (05FA016) (F)

Installed new shelter at same location.

Cost as Constructed:

Labour .....	\$	298.39
Labour Board .....		92.80
Travel .....		232.50
Material, Supplies & Contract ...		984.68
Supervision .....		<u>300.00</u>
Total:	\$	1,908.37

M-35: Little Bow River below Travers Dam (05AC012) (F)

Removed 1.2m diameter well and California shelter. Installed 1.5m x 2.4m well with pipe inlets and standard steel shelter.

Cost as Constructed:

Labour .....	\$ 512.90
Labour Board .....	232.09
Travel .....	235.45
Material, Supplies & Contract ...	2,355.73
Supervision .....	<u>600.00</u>
Total:	\$ 3,936.17

M-36: Milk River Natural Flow Study (F)

Moved shelter from Lethbridge to Pendant d'Oreille.

Cost as Constructed:

Labour .....	\$ 236.48
Labour Board .....	87.03
Travel .....	<u>93.20</u>
Total:	\$ 416.71

M-37: Milk River near Pendant d'Oreille (11AA035) (F)

Removed cableway and salvaged all usable material.

Cost as Constructed:

Labour .....	\$ 178.15
Labour Board .....	70.95
Travel .....	100.00
Supervision .....	<u>100.00</u>
Total:	\$ 449.10

✓?

M-38: Milk River at Milk River (11AA005) (F)

Lowered well and bottom intake approximately 0.3m.

Cost as Constructed:

Labour .....	\$ 276.42
Labour Board .....	135.50
Travel .....	144.55
Material, Supplies & Contract ...	1,309.79
Supervision .....	<u>400.00</u>
Total:	\$ 2,266.26

M-39: Miners Coulee near International Boundary (11AA029) (F)

Removed 1.2m diameter well with recessed recorder compartment and replaced it with 1.5m x 2.4m well with pipe inlets and standard steel shelter. Removed former concrete control and replaced it with a new concrete V-notch control. Improved and gravelled road into station.

Cost as Constructed:

Labour .....	\$ 519.89
Labour Board .....	251.00
Travel .....	149.75
Material, Supplies & Contract ...	5,804.11
E.C.G. ....	135.00
Supervision .....	<u>1,000.00</u>
Total:	\$ 7,859.75

M-40: Mountain View Irrigation District Canal (05AD017) (F)

Repaired and patched control.

Cost as Constructed:

Labour .....	\$ 118.24
Labour Board .....	49.32
Travel .....	45.50
Material, Supplies & Contract ....	<u>53.97</u>
Total:	\$ 267.03

M-41: Notikewan River at Manning (07HCOO1) (F)

Installed new valve and stand pipe on upper intake, desilted well and placed 20 yds. of fill around well.

Cost as Constructed

Labour .....	\$	158.18
Labour Board .....		70.95
Travel .....		125.00
Material, Supplies & Contract ...		341.16
Supervision .....		<u>250.00</u>
Total:	\$	945.29

M-42: Redearth Creek near the Mouth (05BB005) (F)

Repainted well and shelter.

Cost as Constructed:

Labour .....	\$	118.24
Labour Board .....		109.70
Supervision .....		<u>100.00</u>
Total:	\$	327.94

M-43: Smoky River at Watino (07GJ001) (F)

Repaired and shortened tower platform. Reinforced leg of tower with a steel plate.

Cost as Constructed:

Labour .....	\$	138.21
Labour Board .....		87.70
Travel .....		100.00
Material, Supplies & Contract ...		77.10
Supervision .....		<u>250.00</u>
Total:	\$	653.01

M-44: Waterton Lake at Waterton Park (05AD025) (F)

Station upgraded from manual to recording. Installed California type shelter on Warden's dock. Installation done by field technicians.

Cost as Constructed:

Material, Supplies & Contract ...	\$ 100.00
Recorder .....	<u>2,500.00</u>
Total:	\$ 2,600.00

M-45: Waterton River at Waterton Park (05AD003) (F)

Installed new lower intake and flushing system. All work performed by field personnel.

Cost as Constructed:

Material, Supplies & Contract ...	\$ <u>188.02</u>
Total:	\$ 188.02

FEDERAL POWER INSTALLATIONS - (F)

E-1: Bow River at Banff (05BB001) (F)

Power Company Installation .....	\$ 2,780.00
Shelter Wiring .....	<u>0</u>
Total:	\$ 2,780.00

E-2: McLeod River near Rosevear (07AG007) (F)

Power Company Installation .....	\$ 0
Shelter Wiring .....	<u>673.10</u>
Total:	\$ 673.10

4.2.3 Provincial (P)

M-46: Battle River above Pipestone Creek (05FA023) (P)

Station discontinued. Removed shelter and returned it to stores.

Cost as Constructed:

Labour .....	\$	99.85
Labour Board .....		11.60
Travel .....		79.00
Supervision .....		<u>150.00</u>
Total:	\$	340.45

M-47: Baptiste River near the Mouth (05DC012) (P)

Installed standard steel shelter on wooden base to house manometer and recorder.

Cost as Constructed:

Labour .....	\$	309.69
Labour Board .....		151.10
Travel .....		152.00
Material, Supplies & Contract ...		1,034.21
Recorder .....		2,500.00
Manometer .....		4,273.00
Supervision .....		<u>330.00</u>
Total:	\$	8,750.00

Refunded by Province (last year)	\$	5,250.00
Balance:	\$	0

M-48: Bear River near Grande Prairie (07GE005) (P)

Station discontinued. Removed shelter and reinstalled it at Simonette River near Goodwin.

Cost as Constructed:

Labour .....	\$	128.22
Labour Board .....		64.55
Travel .....		80.00
Supervision .....		<u>250.00</u>
Total:	\$	522.77

M-49: Boyer River near Paddle Prairie (07JF004) (P)

Replaced both intakes and flushing systems and desilted well.

Cost as Constructed:

Labour .....	\$	86.52
Labour Board .....		81.45
Travel .....		175.00
Material, Supplies & Contract ...		382.56
Supervision .....		<u>250.00</u>
Total:	\$	975.53

M-50: Cabin Creek near Seebe (05BF019) (P)

Removed shelter, flume and all material from site. Site landscaped and seeded to grass. ✓

Cost as Constructed:

Labour .....	\$	236.48
Labour Board .....		8.50
Travel .....		65.80
Supervision .....		<u>250.00</u>
Total:	\$	560.78

M-51: Hines Creek near Fairview (07FD008) (P)

Replaced cable on cableway.

Cost as Constructed:

Labour .....	\$	128.22
Labour Board .....		73.60
Travel .....		50.00
Material, Supplies & Contract ...		275.00
Supervision .....		<u>250.00</u>
Total:	\$	776.82



M-52: Kirkpatrick Lake Tributary near Spondin (05GA009) (P)

Station removed and all usable material salvaged.

Cost as Constructed:

Labour .....	\$	118.24
Labour Board .....		8.50
Travel .....		60.00
Supervision .....		<u>200.00</u>
Total:	\$	386.74

M-53: Nose Creek at Calgary (05BH003) (P)

Station removed and all usable material salvaged.

Cost as Constructed:

Labour .....	\$	236.48
Material, Supplies & Contract ...		216.86
Supervision .....		<u>100.00</u>
Total:	\$	553.34

M-54: Oldman River near the Mouth (05AG006) (P)

Installed two new aircraft marker cones on cableway and painted left bank tower.

Cost as Constructed:

Travel .....	\$	25.75
Material, Supplies & Contract ...		113.00
Supervision .....		<u>200.00</u>
Total:	\$	338.75

M-55: Pembina River near Entwistle (07BB002) (P)

Removed extended portion of well. Installed standard steel shelter on existing well.

Cost as Constructed:

Labour .....	\$	434.60
Labour Board .....		206.45
Travel .....		200.00
Material, Supplies & Contract ...		272.13
Supervision .....		<u>250.00</u>
Total:	\$	1,363.18

M-56: South Wabasca Lake near Desmarais (07JA002) (P)

Permanent orifice installed under contract.

Cost as Constructed:

Material, Supplies & Contract....	<u>\$ 1,200.70</u>
Total:	\$ 1,200.70

PROVINCIAL POWER INSTALLATIONS - (P)

E-3: Pembina River near Entwistle (07BB002) (P)

Power Company Installations .....	\$ 0
Shelter Wiring .....	<u>953.82</u>
Total:	\$ 953.82

A P P E N D I X

## DESCRIPTION OF CONSTRUCTION PRACTICES

### MATERIAL AND EQUIPMENT

#### Well and Shelter Construction

##### In-Bank Well Installations

Practically all in-bank installations of stilling wells were made with triple C wood staves, radially milled to internal and external circumference of pipe size used. They are interlocked by tongue and groove and the edges of the staves are in full bearing with each other. Commonly used soft wood species are the pines, western and eastern hemlock, and Douglas fir. Any soft wood which meets grading specifications and is suitable for pressure treatment may be used. All staves are pressure-treated in accordance with the C.S.A. 080 Specification Group Pentaclorophenol. Standard staves are used (65mm thick) for 1.22m and 1.58m inside diameter wells (1.22m diameter culverts for well and hinged roof cone shelter; 1.52m diameter culverts for well and steel walk-in shelter). Access to bottom of well is by two aluminum ladders, one the full well depth and the other one half the well depth.

Hoops are milled steel, rolled to the correct diameter and dipped in tar or asphalt-base paint to give them long life. Their principal function is to keep the staves in tight bearing with each other. Hoops are placed at 0.61m intervals and tightening is accomplished by a 15.6mm bolt and nut working against a bracket welded to the angle.

##### Other Wells

A few wells are installed using .457m diameter, 16-gauge corrugated steel pipe (galvanized) with a look-in shelter to house the recorder. These installations are made by strapping the culvert to suitable bridge abutments, piers, or piles.

##### Stilling Well Inlet System

Inlet systems are 75mm steel pipes or box culverts. Both inlet pipes (76mm) are reduced to 50mm in the well and all installations are provided with a standard flushing system. In streams where velocity past the pipe could affect stage, the lower inlet is provided with a static tube. The lower inlet is placed on the stream bed and generally the bottom of the well is excavated 0.3m below the lower inlet. The upper inlet is placed approximately 0.3m above the winter ice level. This pipe is supported before the trench is backfilled to prevent the pipe from sagging. Box culverts are made of treated fir (50mm x 200mm on top and bottom, and 50mm x 150mm on sides) and installed in the well, using slotted anchorage holds in the 50mm x 150mm for easy adjustment to

the gauge. All inside gauges are fitted with a level rod support of plated steel angle iron for easy gauge checking.

### Shelters

Steel shelter, 1.6256m x 1.625m x 2.4384m (walk-in type) erected on a concrete foundation for manometer or pressure-type gauge installation, insulated and lined.

Steel shelters, 1.6256m x 1.6256m x 2.4384m, erected on top of 1.524m diameter stilling wells for walk-in shelter. The former designs of "walk-in" shelters have been abandoned in favour of steel shelters. The shelters are insulated, lined, shelved, with plywood floor and access trapdoor to the well. The shelter is supported on a 75mm x 75mm x 6.25mm angle iron frame attached to the well.

### Station Bench Marks

Each station is supplied with two bench marks. A standard bench mark cap is set in a 50mm diameter standard pipe 1.524m in length and riveted to the pipe. The pipe has a 20mm diameter, 6.25mm steel plate welded on the bottom. A hole approximately 304.8mm square is dug to take the length of the pipe. At ground level a 50mm x 100mm x .4064m square frame is built and the hole and square frame is filled with concrete.

Normally, one bench mark is placed near the shelter with the second placed at a convenient spot well away from any danger of loss.

### Cableways

#### Towers and Platforms

All cableways are built to standard plan. A 100mm fabricated standard steel galvanized pipe is used for A-Frame construction. All steel is painted International orange and white to Department of Transport specifications. Cablecar access platforms are also provided and are made of 62.50mm x 62.50mm x 6.25mm angle iron, 1.2192m wide by 1.397m long, with Armco floor plank (50mm rib) interlock leg, 16-gauge, 35 gram galvanized steel, non-skid surface.

#### Anchorage and A-Frame Pedestal

Concrete: 20 MPa at 28 days, maximum size of aggregate 25mm is specified. Where necessary, sulphate resistant cement is used in the mixture; otherwise normal Portland cement is used. Anchorage deadmen and pedestals are steel-reinforced. Deadmen are not a standard size, but are designed according to span and soil conditions for each cableway. Transit Mix concrete is used for cableways where available; otherwise, it is mixed on the job. Cable steel "U" bars are imbedded in the

anchorage 25mm diameter x 3.048m main cable and 19mm diameter x 1.8288m for tie-back cable. A-Frame pedestal form is .4572m sonotube for A-Frames 1.8288m to 3.6576m and .6096m diameter for 4.2672m, 4,8768m and 5.4864m A-Frames.

#### Wire Rope

19mm diameter main cableway milled plough steel cable, galvanized 6 x 7 or 6 x 19 construction with fibre core, regular lay 14 043 kg breaking strength.

25mm diameter main cableway milled plough steel cable, galvanized 6 x 7 or 6 x 19 construction with fibre core, regular lay 24 494 kg breaking strength.

12.50mm diameter tie-back cable milled plough steel cable, galvanized 6 x 7 or 6 x 19 construction with fibre core, regular lay 6 350 kg breaking strength.

12.50mm diameter main aircraft warning cable guy cable 1 x 7 construction, grade 110 galvanized 7 076 kg breaking strength.

9.37mm diameter main aircraft warning cable guy cable 1 x 7 construction, grade 110 galvanized 3 742 kg breaking strength.

4.68mm diameter tag line cable aircraft control cable, 7 x 19 construction, galvanized or tinned 1 905 kg breaking strength.

#### Cable Accessories

Turnbuckle 31.25mm diameter x .6096m, jaw and eye galvanized drop forged, approximate strength 24 041 kg.

Turnbuckle 19mm diameter x .4572m, jaw and eye galvanized drop forged, approximate strength 8 165 kg.

Crosby clips - 25mm, 19mm, 12.5mm drop forged and galvanized.

Wire rope thimbles - 25mm, 19mm, 12.5mm regular pattern galvanized.

#### Aircraft Warning Markers

Standard extensions are designed for attachment to the 100mm pipe A-Frames. 12.5mm or 19mm (1 x 7) cable is used, depending upon the span, to carry the cones. The cable is anchored to the deadman and is provided with a turnbuckle for adjustment.

Various types of cones were used. Fibreglass-molded cones .7620m diameter x .7620m high, painted orange; also .4522m spherical

cones, constructed in two halves, fabricated or molded fibreglass and painted International orange and white, half-and-half, and both made by commercial firms. Cones .4572m in diameter were made by combining polyurethane (Super Secand Resin) approximately 1 kg of each by weight, and pouring the liquid in a 150mm diameter latex meteorological air balloon. This mixture will expand the balloon to a half circle, .4572m diameter. The two halves are glued together and a 50mm ready rod is put through the centre of the cone for hanging the cone to the cable. The cone is painted orange and white, half-and-half. These cones are light and durable.

### Cable Cars

#### Standard Sit-Down

Standard sit-down car with two seats and foot rest is 1.829m x .6096m x .2794m, made with 50mm x 100mm fir frame covered with a crezon plywood. The top edge of the plywood is covered with a galvanized 28-gauge metal strip 19mm wide and 12.5mm sides to keep out moisture. Standard cablecar hangers and foot rest irons are made of 4.68mm x 50mm aluminum alloy 6061-T6. Sheaves are 0.203m in diameter cast with groove for 19mm cable supplied with two SKF 1716204-012 bearings. The car is moved by hand cable puller. It is painted International orange and white to Department of Transport specifications.

#### Cablecar Puller

Adjustable aluminum cablecar puller is made to standard plan.

#### Cablecar Lock and Car Holder

Aluminum construction made to standard plans and anchored to the main cable with two clips. A standard padlock is used to lock the car.

### Control Construction

#### Gabion

Several gabion controls were installed for stream bed stabilization. In most cases these were a single row of gabions (.9144m x .3048m x 2.443m) filled with rock in place. Erosion may take place below gabion control, in the centre of the stream. This can be overcome by placing two rows of gabions with the lower gabion at the stream bed level to dissipate the energy of the water falling over the upper gabion.

### Steel Sheet Piling

Built by driving 4.877m splined steel piling. The piling is trimmed to make a .787m head 125° notch weir of angle iron bolted to the piling, or can be cut for desired head and angle of notch. In most cases, log or timber approach sections are installed.

### Concrete Controls

Various designs and sizes, with V-notches, H-flumes, San Dimas flumes, broad-crested weirs, etc. have been constructed. Standard plans are used for most projects, with special design for projects when required.

## CONSTRUCTION PERSONNEL

### Labour

The construction in Alberta was carried out by one field crew consisting of a foreman and one or more hydrometric field technicians.

### Supervision

Construction supervision is carried out by one full time supervisor.

### Equipment

During 1987/88, the construction crew used two vehicles, a 9 000 kg GVW truck and a heavy duty pickup, to haul staff, materials and tools to the job sites.

### Hired Equipment

Backhoes, draglines, ready mix concrete trucks and gravel trucks were hired under service contracts, when required. Helicopters were used in remote areas to transport staff and materials.





Rebuilding Control  
Miner's Coulee near International Boundary



Control  
Miner's Coulee near International Boundary

Replacing A-Frame  
Oldman River near Waldron's Corner

GB  
708  
.A3  
A43  
1987-88

Alberta gauging station and  
construction and maintenance:  
annual report.

GB  
708  
.A3  
A43  
1987-88

Alberta gauging station and  
construction and maintenance:  
annual report.

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