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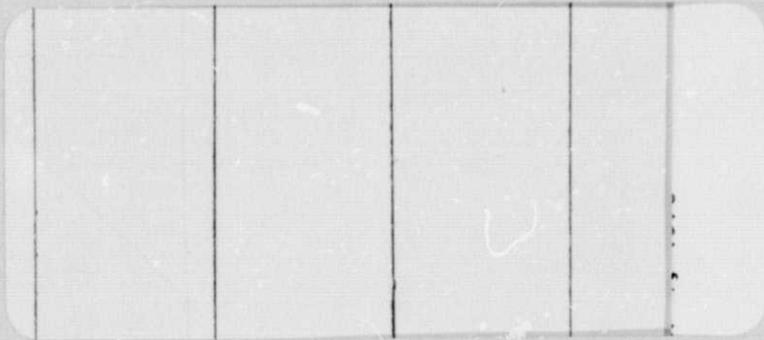
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Retransmission of Hydrometric

Data in Canada

SR 28190

Applied Hydrology Division
Department of the Environment
Ottawa, Ontario, Canada
K1A 0E7

October 1976

Quarterly Report for Period July-September 1976

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	12. Sponsoring Agency Name and Address Canada Centre for Remote Sensing Department of Energy, Mines & Resources 2464 Sheffield Road Ottawa, Ontario, K1A 0Y7	13. Key Words (Selected by Principal Investigator) Landsat DCS, Water Resources Data
14. Supplementary Notes Prepared by I.A. Reid and R.A. Halliday		
15. Abstract Data Collection Platforms have been installed at 23 sites in remote areas of Canada for transmittal of water level and other water resources data. The near real-time data are used for water management purposes. The system has met all requirements and the suitability of satellite retransmission continues to be demonstrated. A contract for installation of a Landsat/GOES DCS downlink at the Prince Albert (Saskatchewan) satellite station has been awarded to SED Systems, Saskatoon, Saskatchewan.		

I. Introduction

The Water Survey of Canada operates over 2,400 hydro-metric stations at which water level data are collected. Because of the isolated locations of many of these stations, it usually is not economically feasible to telemeter data from the sites by conventional means. For this reason an experiment was conducted which involved transmitting data from nine sites by means of Landsat 1. The technical suitability of the system was demonstrated and in response to a demand for near real-time data from additional sites, it was decided to implement a larger network. In this way, it should be possible to determine the benefits and costs associated with a larger operational system.

II. Techniques

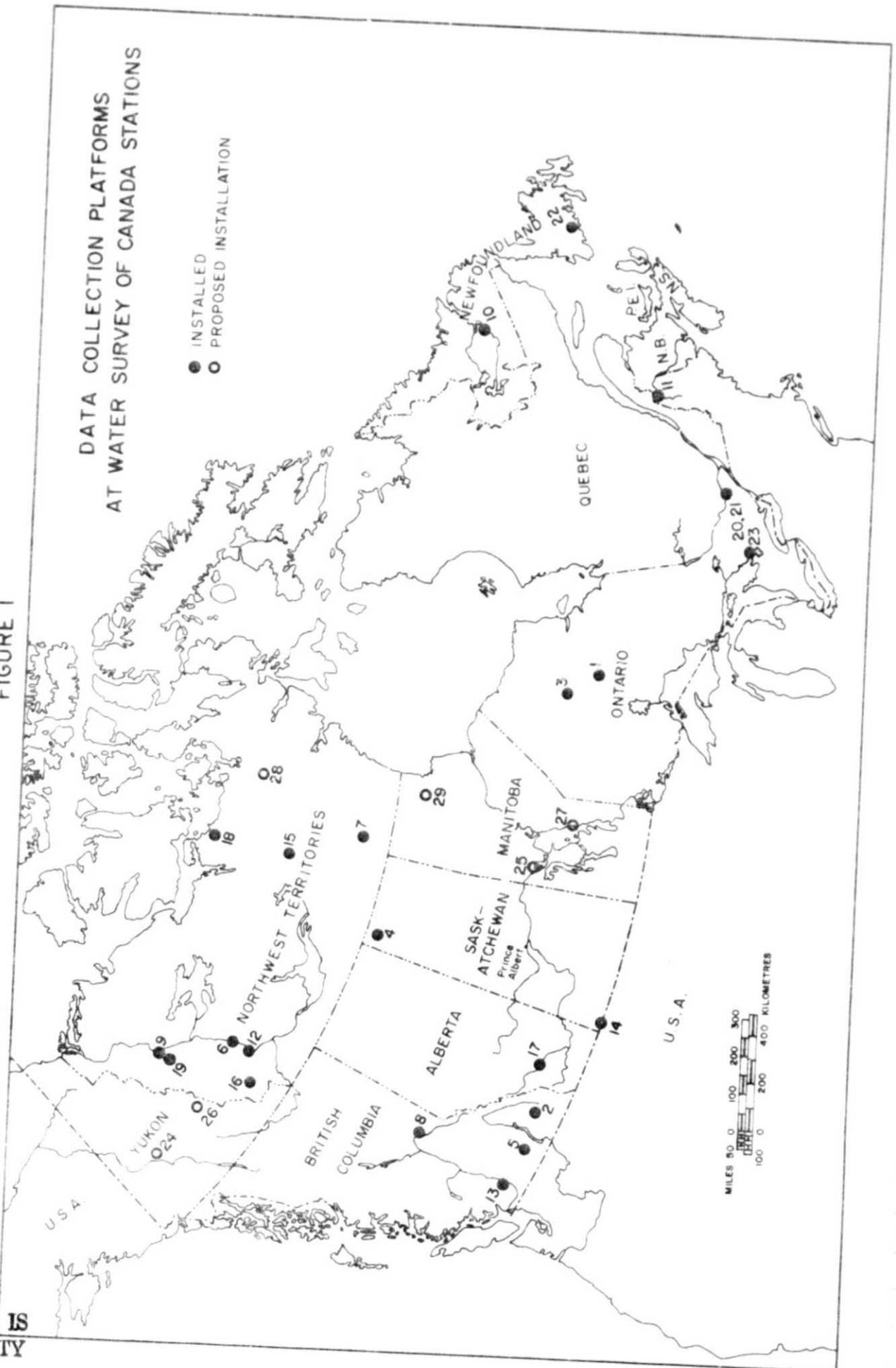
Data Collection Platforms have now been installed at 23 sites. An additional 6 DCPs may be installed in 1976. The sites (Figure 1, Table 1) were selected on the basis of real time data needs for water management purposes. Water level data are transmitted from all sites while additional parameters, mainly meteorological data, are transmitted from some sites.

Water levels are sensed at Water Survey of Canada gauging stations by a float and pulley or by a servomanometer that senses the static pressure in a nitrogen purge system. Water level is usually recorded on a strip chart recorder. At those stations where DCPs are installed, an analogue to digital shaft position encoder (the Stevens Memomark II) is used to encode and store 16 bits (4 BCD digits) of water level data for transmittal by the DCP.

Precipitation data are obtained using a Fisher and Porter weighing type precipitation gauge. The gauge can be equipped with a Telekit for telemetering of data. The gauge is connected to a serial digital interface designed by Atmospheric Environment Service, (AES) Department of the Environment. The interface is known as a Hydrometeorological Automatic Recording and Telemetering System (HARTS). Air temperature in the HARTS system is sensed by a platinum resistance bulb thermometer. A precision thermistor (YSI 44033) is also used in some other cases.

The data transmitted by DCPs are processed by NASA, then sent to Canada in two ways. The first is by land line to the Canada Centre for Remote Sensing in Ottawa. The data usually arrive shortly after each orbit of the spacecraft. At CCRS the data are recorded simultaneously on a teletype hard copier and on magnetic tape. A software data retrieval system sorts the user platforms, reformats the data into engineering units and stores individual user files on disk. The user may then access his data file, usually daily, using either a teletype or telex remote terminal.

FIGURE I



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TABLE 1

LOCATION OF DATA COLLECTION PLATFORMS

	<u>INSTALLED AT HYDROMETRIC STATIONS</u>	<u>DATE INSTALLED</u>	<u>DCP</u>	<u>LAT.</u>	<u>LONG.</u>
1)	Albany River above Nottik Island	Jan 13, 73	6102	51° 38'	86° 24'
2)	Carmey Creek below Pambrun Creek	Mar 25, 75	6126	50° 10'	116° 35'
3)	Winisk River at Kanuchuan Rapids	Sept 27, 74	6137	52° 58'	87° 42'
4)	Lake Athabasca at Crackingstone Point	Sept 19, 72	6150	59° 23'	108° 53'
5)	Snow course No. 5A Mission Creek	Oct 31, 75	6232	49° 57'	118° 55'
6)	Mackenzie River near Wrigley	June 7, 73	6260	63° 16'	123° 36'
7)	Kazan River at Outlet of Ennadai Lake	Sept 19, 72	6353	61° 16'	100° 58'
8)	McGregor River at Lower Canyon	July 26, 76	6354	54° 14'	121° 40'
9)	Mackenzie River at Sans Sault Rapids	May 31, 73	6366	65° 46'	128° 45'
10)	Churchill River at Muskrat Falls	Aug 7, 75	6502	53° 15'	60° 47'
11)	St. Francis River at Outlet of Glasier Lake	Aug 13, 75	6504	47° 12'	68° 57'
12)	Root River near the Mouth	July 15, 75	6512	62° 29'	123° 26'
13)	Nahatlatch River below Tachewana Creek	Oct 20, 75	6514	49° 57'	121° 52'
14)	Battle Creek at International Boundary	Oct 22, 75	6541	49° 00'	109° 25'
15)	Hanbury River above Hoare Lake	July 5, 76	6547	63° 36'	105° 09'
16)	South Nahanni River above Virginia Falls	July 15, 75	6572	61° 38'	125° 48'
17)	Bow River below Carseland Dams	Oct 27, 75	6574	50° 50'	113° 25'
18)	Ellice River near the Mouth	Apr 22, 76	6507	67° 42'	104° 08'
19)	Mountain River below Cambrian Creek	May 7, 76	6542	65° 14'	128° 34'
20)	Rideau River at Ottawa Test Site (now in operation in the GOES mode)		6517	45° 23'	75° 42'
21)	Rideau River at Ottawa Test Site (now in operation in the GOES mode)		6521	45° 23'	75° 42'
22)	Grey River near Grey River	Sept 13, 76	6210	47° 45'	56° 56'
23)	SVERN River above Wasdell Falls	Sept 14, 76	6524	44° 46'	79° 18'
<u>PROPOSED</u>					
24)	Pelly River at Pelly Crossing		6501	62° 50'	136° 35'
25)	Moose River near Moose Lake		6511	53° 38'	100° 19'
26)	South MacMillan River at Mile 249 Canal Road		6522	62° 55'	130° 32'
27)	Lake Winnipeg at Berens River		6527	52° 21'	97° 00'
28)	Back River below Deep Rose Lake		6544	66° 05'	96° 30'
29)	Seal River below Great Island		6571	58° 54'	96° 17'

The second way that data are received from NASA is by punched card and uncalibrated computer listings about two weeks after transmittal by the DCP. These data are delivered to the Canadian Embassy in Washington, D.C., then carried by diplomatic bag to the Department of External Affairs in Ottawa. External Affairs then mails the data to the user. The cards are run in computer programs that sort the data and perform the conversion to engineering units. Data produced in this way are used to generate statistics on DCP performance, for quality checks and for archival purposes.

III. Accomplishments

Platform 6210 was dismantled from the Quebec Department of Natural Resources gauging station on the Rivière Dumoine à la sortie du Lac Dumoine on July 6, 1976, following the successful completion of the Streamflow Synthesis and Reservoir Regulation (SSARR) Model experiment of the Ottawa River.

In response to a request from the Chief Engineer, Freshwater and Anadromous Fisheries Management Program, Department of Environment, St. John's, Newfoundland, PID 6210 was installed on the Grey River near Grey River gauging station on September 13, 1976.

The water level readings transmitted by the Platform are being used to monitor an agreement with Newfoundland Hydro Corporation to maintain a minimum flow in Grey River for fishery purposes.

The Chief Engineer writes "The method of obtaining the data prior to installing the platform was to have a man read the gauge and report by radio-telephone on the level of the water. A request would then be made to Newfoundland Hydro to release water into the river, if necessary. It was costing a fair amount of manpower and dollars to monitor the agreement this way and as a result the agreement was not enforced properly. With the platform installed it is now possible to monitor the water flows on a daily basis. The hydro company is able to conserve water when releases are not required and thus store water for generation of energy. The operation of the gauging station can be monitored as well without having to expend considerable manpower and dollars in sending personnel on a full day's trip into the location by helicopter."

Platform 6524 was installed on the Severn River above Wasdell Falls on September 14, 1976. This gauging station is in the Trent-Severn Waterway below the confluence of several small streams, all of which are regulated. The Severn River is also regulated downstream from the DCP site.

In addition to transmitting water level data, the platform transmits intergrated velocities from a Atlas FLORA 10

acoustic flowmeter. The water level and water velocity data transmitted are used to compute river discharge to effect better operation of control structures.

During this report period several RF testers were purchased from GFA Engineering Inc. These testers are used to determine whether or not the DCP is transmitting after installation in the field.

Three Platforms; one General Electric G.E. (6354) and two Ball Brothers Research Corporation Convertible Data Collection Platforms (BBRC) (6501 and 6522) were repaired by the Instrumentation Section, Water Resources Branch, Department of Environment. In addition, the two BBRC Platforms were converted and checked out in the GOES mode.

The fault in the G.E. Platform was traced to IC U38 on the A3 Assembly, Programmer Board. This is the first failure of this DCP after about 4 years' operation.

The fault with BBRC 6501 was traced to a defective program connector C/P-AJ2-ERTS. The fault with BBRC 6522 was traced to a defectively soldered 2nd Harmonic Trap on the Transmitter Board. Upon resoldering the platform operated normally.

Table 2 is a summary of the data retransmitted for Landsat cycles 29 to 33 inclusive covering the period of July 3 to September 30, 1976. During this period slightly over 23,700 messages were processed. Table 3 summarizes the results of messages for cycle 31 received at Fairbanks, Alaska, Goldstone, California and Greenbelt, Maryland.

A contract was let in August for the installation of Landsat/GOES DCS receive capability at the Prince Albert Satellite Station. The contract is scheduled for completion in May 1977.

The project continues to demonstrate the feasibility of transmitting hydrometric data to polar orbiting spacecraft and using these data on a quasi-operational basis.

All system elements are functioning well.

V. Publications

Mr. Richard W. Paulson, Head, U.S.G.S. Data Relay Project gave a talk in Ottawa to a group interested in data retransmission by satellites. No abstract was prepared.

VI. Problems

At the moment two Ball Brothers Research Platforms, 6527, and 6571 are not transmitting due to unknown malfunctions.

TABLE 2
SUMMARY OF RETRANSMITTED DATA - JULY 3 to SEPT 30, 1976

Daily Mean Transmissions per cycle for cycles 29 to 33 (Landsat-2)
(Transmissions received simultaneously at two or more sites are
counted only once).

Platform	29	30	31	32	33	Daily		Total
						Max	Min	
6102	9	8	8	8	8	11	4	712
6126	5	5	5	5	5	9	1	467
6137	21	20	19	18	18	24	13	1,725
6150	30	30	29	27	29	34	19	2,605
6210	11	14	10	5	5	19	1	651
6232	12	13	12	12	12	19	8	1,106
6260	50	50	47	43	44	58	21	3,906
6353	28	--	1	--	31	45	1	793
6354	1	7	5	5	9	13	1	434
6366	31	31	28	27	29	37	6	2,612
6501	--	1	1	5	13	17	1	68
6502	11	11	11	10	10	15	7	951
6504	10	10	10	10	10	15	4	896
6507	14	15	15	13	19	25	7	1,327
6512	16	17	14	12	14	20	2	1,313
6514	9	8	6	8	9	13	1	722
6522	--	6	6	--	--	10	2	71
6524	--	--	--	--	10	13	6	154
6541	3	2	2	3	3	5	1	240
6542	2	--	--	--	--	4	1	11
6547	11	27	24	24	23	31	2	1,721
6572	16	17	14	12	11	20	4	1,249
								<u>23,734</u>

Note Platform 6260 is on a 90 sec. interval. The minimum daily number of transmissions do not necessarily reflect the true minimum as the DCP could be turned off for a part of the day the minimum value occurred.

TABLE 3
 MESSAGES RECEIVED FROM LANDSAT-2 DURING CYCLE 31 (AUG 7 to AUG. 24, 1976)

PID	Messages					Orbits				
	Received at			Total	Discrete	Messages Received at			Total	Discrete
	A	G	N			A	G	N		
6102	2	23	121	146	136	2	20	61	83	73
6126	40	60	14	114	82	36	46	13	95	63
6137	130	110	181	421	351	80	55	69	204	126
6150	333	140	128	601	525	144	61	60	265	178
6210*	0	4	44	48	44	0	2	14	16	14
6232	114	131	29	274	212	71	57	19	147	90
6260	794	124	28	946	847	161	48	17	226	168
6353*	1	0	0	1	1	1	0	0	1	1
6354*	67	43	2	112	84	50	34	2	86	53
6366	447	97	39	583	522	164	57	29	250	178
6501*	7	10	0	17	11	7	9	0	16	9
6502	38	10	173	221	207	34	10	73	117	88
6504	0	9	186	195	185	0	7	70	77	70
6507	210	33	60	303	275	121	32	48	201	145
6512	232	57	22	311	264	120	47	18	185	129
6514	71	80	9	160	119	55	45	5	105	66
6522*	0	0	25	25	25	0	0	13	13	13
6541	10	34	10	54	42	10	27	9	46	32
6547	356	56	91	503	456	144	43	52	239	171
6572	234	45	7	286	252	114	37	7	158	118

* - Partial Cycle

A - Fairbanks, Alaska

G - Goldstone, California

N - Greenbelt, Maryland

