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NEWFOUNDLAND AND LABRADOR HYDRO

ISLAND POND DEVELOPMENT

PRE-FEASIBILITY REPORT

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PART 3 - HYDROLOGY

3.1 Watershed Diversions

A search for drainage areas adjacent to Island Pond watershed was undertaken to determine whether additional flow could be diverted into Island Pond. Following Hydro's advice catchment areas adjacent to Island Pond, which presently flow into the Noel Pauls Brook drainage area, were not to be considered due to environmental impacts on Noel Pauls Brook and its salmon rearing potential. The search revealed that the topography favoured a few small diversions from Noel Pauls Brook but did not favour diversions from Crooked Lake Brook, across the eastern watershed divide. Nonetheless, one small 6 km^2 diversion from Noel Pauls Brook was identified, costed and found to be economic. However, its implementation is not recommended in view of the negative environmental impact on Noel Pauls Brook and minimal economic benefits.

3.2 Regulation Study

As part of the Upper Salmon Feasibility Study, Acres Consulting Services Limited carried out a detailed regulation study for evaluating the energy potential of the Upper Salmon development. This study simulated the operation of the entire Bay D'Espoir system in considerable detail giving flows, reservoir contents, and water levels at key locations throughout the system. Since the 600 MW size of the Bay D'Espoir Station is much greater than either Upper Salmon or Island Pond, water requirements at Bay D'Espoir powerplant essentially "drive" the system with the smaller plants utilizing flow already in the system for energy production. Given this situation it was

3.2 Regulation Study (Cont'd)

concluded that a development at Island Pond would have little impact on the overall water management in the Bay D'Espoir system, and that such impacts could be adequately assessed by relatively simple manipulations of the results from Acres' regulation study, without the need of a further detailed study.

In Acres' regulation study, operation of the Bay D'Espoir System was simulated on a monthly basis for a study period of 28 years from 1950 to 1977. Releases from storage were computed to supply energy production requirements at Bay D'Espoir as dictated by operational rule curves. Releases from storage were allocated on a priority basis, with upstream reservoirs drained first, Upper Salmon second and Long Pond last. Releases from the upstream reservoirs - Victoria and Meelpaeg appear to have been allocated on a proportionate basis so that water levels in both reservoirs were lowered "in step". Flows, reservoir contents, water levels and energy production at key locations in the Bay D'Espoir system are recorded in tabulated printouts. These results provided sufficient information for manual adjustment to accommodate the addition of Island Pond.

The results of Acres' regulation study were adjusted in order to assess the energy potential of the Island Pond Development, as follows:

(i) Diversion of Island Pond Reservoir into Meelpaeg Reservoir

The purpose of this adjustment was to assess whether spillage at Upper Salmon and Bay D'Espoir could be

3.2 Regulation Study (Cont'd)

(i) Diversion of Island Pond Reservoir into Meelpaeg Reservoir (Cont'd)

reduced if Island Pond flows were diverted into Meelpaeg reservoir. This adjustment involved increasing releases from Meelpaeg by adding inflow from Island Pond. The results were then inspected to see whether Island Pond inflows could be retained in Meelpaeg Reservoir during critical periods to reduce spillage downstream. This inspection showed that downstream spillage was always the result of flood releases from Meelpaeg during periods when Meelpaeg reservoir was full. Under these circumstances, there would be no possibility of holding additional water in Meelpaeg and hence, no benefits would be attributable to the Island Pond-Meelpaeg diversion.

(ii) Reallocation of Upstream Storage Releases

To enhance the output from Island Pond, it would be desirable to maintain the water level in Meelpaeg at as high a level as possible. To do this, a change in the method of allocating releases from storage of the upstream reservoirs would be required. The preferred reservoir operating policy would be to empty Victoria initially before withdrawing water from Meelpaeg Reservoir, and to refill Meelpaeg--Island Pond reservoir preferentially on the filling cycle.

The adjustments carried out to represent this different reservoir operation policy involved reallocation of storage releases between Victoria

3.2 Regulation Study (Cont'd)

(ii) Reallocation of Upstream Storage Releases (Cont'd)

and Meelpaeg Reservoirs so as to maintain levels in Meelpaeg. These reallocation computations respected the following constraints:

- no net change in amount of water released for energy production from upstream reservoirs (additional draft from Victoria = additional stored volume in Meelpaeg);
- releases from Victoria, on the withdrawal cycle, should not exceed the Burnt Canal capacity of 113 m^3/s;
- re-allocation into Victoria, after filling Meelpaeg Reservoir, should not exceed the flow release from Victoria given in Acres' simulation, in order to respect the system water balance.
- Meelpaeg Reservoir level should not exceed the governing level at month end (either flood rule curve elevation or FSL).

The governing water levels shown on Table 3.1 were assumed for Meelpaeg reservoir based on information supplied by Hydro, (J.J. Carnell to D.H. Brown, June 13, 1986) and assume that a dyke will be built to close a low point on the southern rim of Meelpaeg Reservoir.

3.2 Regulation Study (Cont'd)

TABLE 3.1

Meelpaeg Reservoir Water Levels

Month	Month End W.L.	Remarks
January	266.55 m	FSL
February	266.36	*
March	266.26	*
April	266.46	*
May	266.55	FSL
June	266.55	FSL
July	266.55	FSL
August	266.55	FSL
September	266.55	FSL
October	266.55	FSL
November	266.55	FSL
December	266.55	FSL

Data on flows in Granite Canal were not available to check whether capacity limits on Granite Canal would impose a further constraint on flow adjustments. However, as the design capacity of Granite Canal was based on similar criteria to that for Burnt Canal, it would be unlikely that flow would be restricted on Granite Canal while Burnt Canal was operating at less than capacity. Accordingly, it is considered unlikely that significant errors would be introduced into this analysis due to the lack of Granite Canal data.

* Flood Rule Curves adjusted for flood routing through Island Pond

3.2 Regulation Study (Cont'd)

When the operating procedures were adjusted, to maintain Meelpaeg Reservoir at higher levels, several incidents* were encountered where outflows from Ebbegunbaeg Control Structure had to be increased to avoid surcharging the reservoir. Each of these incidents was investigated to see if spill would result at Island Pond, Upper Salmon and Bay D'Espoir.

The results of these investigations indicate small increase in spillage at Upper Salmon and Bay D'Espoir plants would occur, resulting in energy losses of 0.55 MW.mos (0.40 GWh/yr) and 0.27 MW.mos (0.20 GWh/yr), respectively at each plant. Losses at Island Pond were not directly calculated, but were taken into account in computation of the optimum plant capacity. The advantage of this mode of operation was that the mean H.W.L. for the Island Pond would be 265.98 m.

In view of the rather large number of occasions requiring production of "dump energy", with the above mode of operation, the possibility of operating with a "cushion" of 0.5 m on the Meelpaeg Reservoir was then examined.

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* 30 incidents in total of which 8 resulted in losses in energy production.

3.2 Regulation Study (Cont'd)

With this mode of operation the mean H.W.L. would be 265.30 m, and annual energy losses downstream reduced to < 0.1 GWh. This later mode of operation is judged to be the more practical and was used for determination of the plant capacity and energy output. Figure 3.1 shows the Meelpaeg Reservoir elevation duration curve from which it is evident that for 62% of the time the level is above El. 266.0 m, and that the extreme low supply level is El. 263.8 m. The Flow Duration Curve reflecting Ebbegunbaeg adjusted outflows is shown on Figure 3.2.

3.3 Probable Maximum Flood (PMF)

The PMF for the Island Pond drainage area was based on the same rainfall excess (net runoff) values as used in the Acres - Bay D'Espoir Flood Analysis.* The runoff excess amount of 80% of combined probable maximum precipitation and snowmelt, gave a total runoff excess of 600 mm for an 84 hour design storm.

A storm hydrograph was obtained from these statistics utilizing a simplified triangular 6-hour-unit hydrograph based on Snyder hydrograph characteristics for the Meelpaeg sub-basin reported in Appendix A, Table A-13 of the Bay D'Espoir Flood Analysis Report.

The resulting flood hydrograph was found to have a peak of 369 m^3/s which occurred 54 hours after the onset of the storm as shown in Table 3.2.

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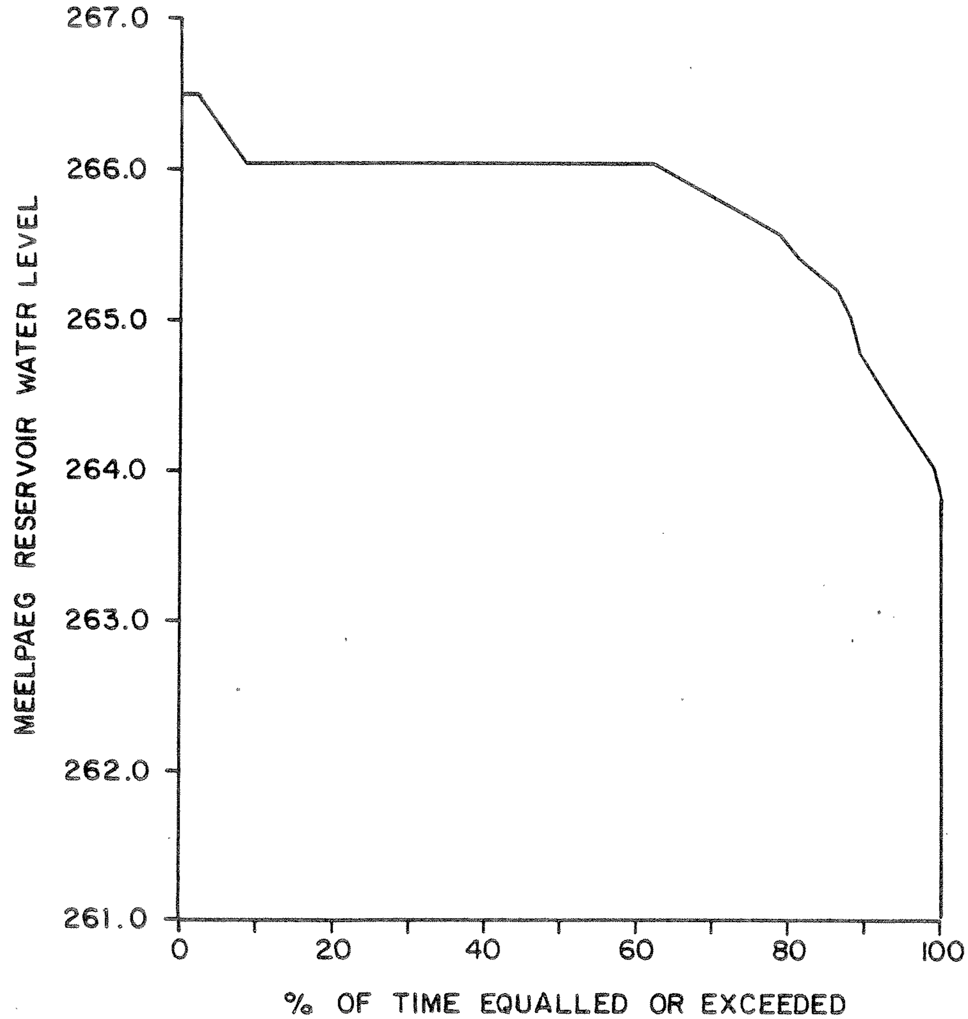
* Refer to Table C-4 in Flood Analysis Report.

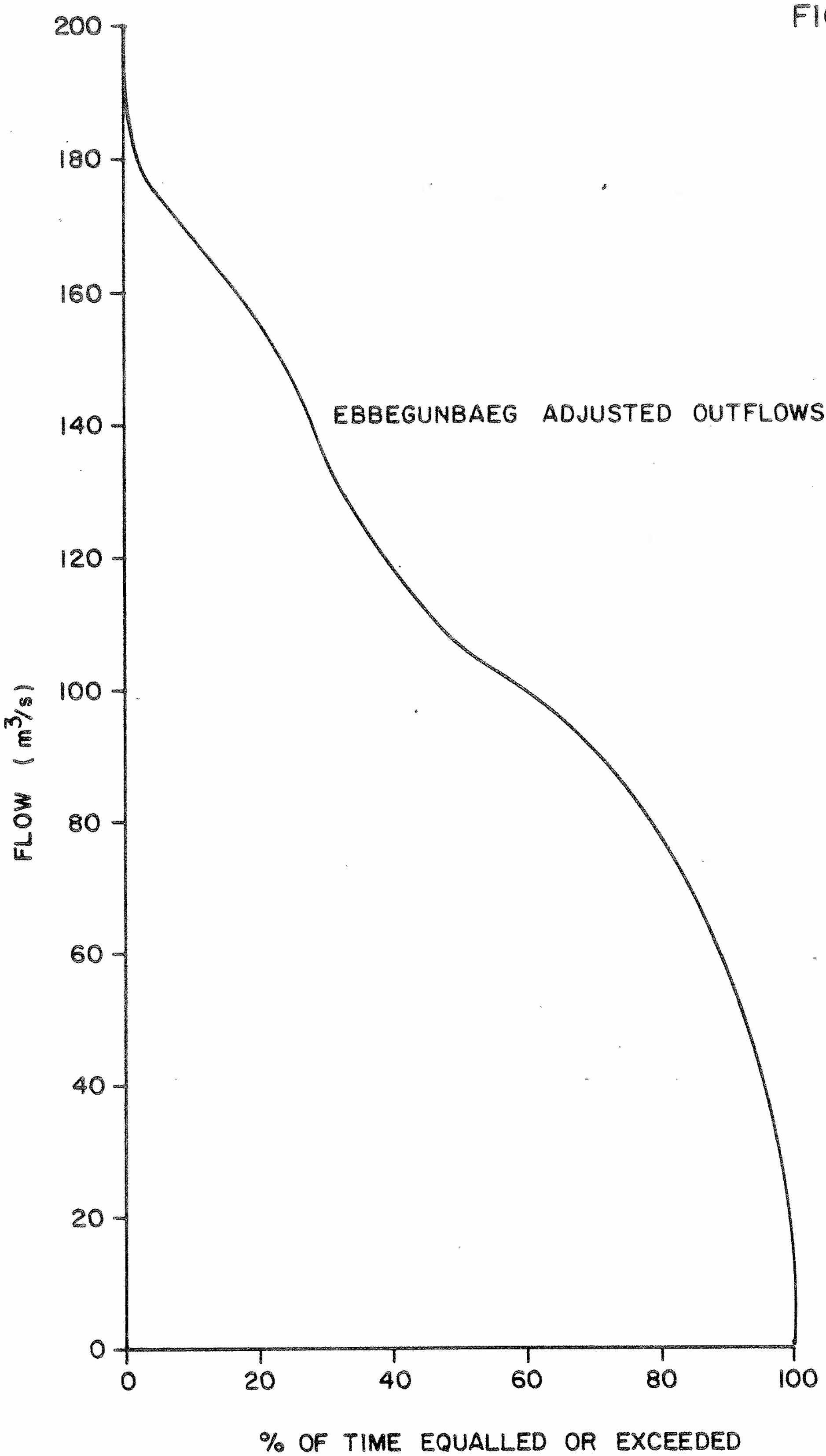
FIGURE 3.1



MEELPAEG RESERVOIR

WATER LEVEL - DURATION CURVE

FIGURE 3.2



FLOW DURATION CURVE

TABLE 3.2

ISLAND POND PMF HYDROGRAPH

TIME	UNITGRAPH (cm)	ISLAND POND	DIRECT INFLOW X 0.187	Inflow from each interval 2.47	2.47	2.47	2.47	3.82	5.54	5.63	5.5	4.78	5.24	5.24	5.28	4.16	4.16	0.5	0.5	TOTAL
0	0	0	0.0	0.0																0.0
6	11.3	125	23.4	27.9	0.0															51.3
12	22.6	173	32.4	55.8	27.9	0.0														116.1
18	15.1	203	38.0	37.3	55.8	27.9	0.0													159.0
24	7.5	248	46.4	18.5	37.3	55.8	27.9	0.0												185.9
30	0	312	58.3	0.0	18.5	37.3	55.8	43.2	0.0											213.2
36		395	73.9		0.0	18.5	37.3	86.3	62.6	0.0										278.6
42		390	72.9			0.0	18.5	57.7	125.2	63.6	0.0									338.0
48		350	65.5				0.0	28.7	83.7	127.2	62.2	0.0								367.1
54		345	64.5					0.0	41.6	85.0	124.3	54.0	0.0							369.4
60		365	66.3						0.0	42.2	83.1	108.0	59.2	0.0						360.8
66		368	68.8							0.0	41.3	72.2	118.4	59.2	0.0					359.9
72		345	64.5								0.0	35.9	79.1	118.4	59.7	0.0				357.6
78		280	52.4									0.0	39.3	79.1	119.3	47.0	0.0			337.1
84		125	23.4										0.0	39.3	79.7	94.0	47.0	0.0		283.4
90		20	3.7											0.0	39.6	62.8	94.0	5.7	0.0	205.8
96		5	0.9												0.0	31.2	62.8	11.3	5.7	111.9
102		5	0.9													0.0	31.2	7.6	11.3	51.0
108		5	0.9														0.0	3.8	7.6	12.2
114		5	0.9															0.0	3.8	4.7
120		5	0.9																0.0	0.9

3.4 Flood Routing Computations

Three sets of flood routing determinations were carried out as below:

Case 1	-	Base Case Meelpaeg only	Check computations to compare with results of Acres computations*
Case 2	-	Combined Meelpaeg-Island Pond Reservoirs	Flood computations to simulate behaviour of combined reservoir after construction of Island Pond.
Case 3	-	Combined Meelpaeg-Island Pond Reservoirs with reductions to new downstream spillway capacity	To test practicality of reducing spillway capacities at North Salmon and Long Pond spillways as made possible by diversion of Island Pond into Meelpaeg.

Flood routing computations were carried out using a single reservoir flood routing model. This approach implies that the difference between water levels in Meelpaeg and Island Pond reservoirs does not have a significant impact on flood routing determinations.

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* "Bay D'Espoir Flood Analysis and Alternatives Study"
Acres International Ltd.
St. John's, 1985, Tables C-4

Bay D'Espoir Flood Analysis and Alternatives Study

Acres International Ltd.

St. John's, 1985

Tables C-4

Table C-4 (a)

PMP (RAIN + SNOW) IN MM
CENTER : MEELPAEG EVENT : WINTER

DAY	MTH	HR	LONG POND	ROUND POND	UPPER SALMON	MEEL-PAEG	GRAN-ITE	BURNT POND	VIC-TORIA
15	MAR	0	.00	.00	.00	.00	.00	.00	.00
15	MAR	6	27.90	27.10	27.90	30.90	30.90	29.70	29.70
15	MAR	12	27.90	27.10	27.90	30.90	30.90	29.70	29.70
15	MAR	18	27.90	27.10	27.90	30.90	30.90	29.70	29.70
16	MAR	0	27.90	27.10	27.90	30.90	30.90	29.70	29.70
16	MAR	6	43.20	41.90	43.20	47.80	47.80	46.00	46.00
16	MAR	12	60.80	58.30	60.80	69.30	69.30	66.00	66.00
16	MAR	18	61.60	59.10	61.60	70.40	70.40	66.90	66.90
17	MAR	0	60.30	57.90	60.30	68.80	68.80	65.50	65.50
17	MAR	6	51.50	49.10	51.50	59.70	59.70	56.50	56.50
17	MAR	12	56.20	53.50	56.20	65.50	65.50	61.90	61.90
17	MAR	18	56.20	53.50	56.20	65.50	65.50	61.90	61.90
18	MAR	0	56.60	53.90	56.60	66.00	66.00	62.30	62.30
18	MAR	6	42.60	39.90	42.60	52.00	52.00	48.30	48.30
18	MAR	12	42.60	39.90	42.60	52.00	52.00	48.30	48.30
18	MAR	18	.20	.20	.20	.20	.20	.20	.20
19	MAR	0	.20	.20	.20	.20	.20	.20	.20
19	MAR	6	.50	.50	.50	.50	.50	.50	.50
19	MAR	12	.50	.50	.50	.50	.50	.50	.50
19	MAR	18	.50	.50	.50	.50	.50	.50	.50
20	MAR	0	.50	.50	.50	.50	.50	.50	.50
20	MAR	6	.50	.50	.50	.50	.50	.50	.50
20	MAR	12	.50	.50	.50	.50	.50	.50	.50
20	MAR	18	.50	.50	.50	.50	.50	.50	.50
21	MAR	0	.50	.50	.50	.50	.50	.50	.50
21	MAR	6	.50	.50	.50	.50	.50	.50	.50
21	MAR	12	.50	.50	.50	.50	.50	.50	.50
21	MAR	18	.50	.50	.50	.50	.50	.50	.50
22	MAR	0	.50	.50	.50	.50	.50	.50	.50
22	MAR	6	.50	.50	.50	.50	.50	.50	.50
22	MAR	12	.50	.50	.50	.50	.50	.50	.50
22	MAR	18	.50	.50	.50	.50	.50	.50	.50
23	MAR	0	.50	.50	.50	.50	.50	.50	.50
23	MAR	6	.50	.50	.50	.50	.50	.50	.50
23	MAR	12	.50	.50	.50	.50	.50	.50	.50
23	MAR	18	.50	.50	.50	.50	.50	.50	.50
TOTAL			653.10	625.30	653.10	750.50	750.50	712.30	712.30

Table C-4 (b)

PMP INFLOW HYDROGRAPHS (m3/s)
CENTER : MEELPAEG EVENT : WINTER

DAY	MTH	HR	LONG POND	ROUND POND	UPPER SALMON	MEEL-PAEG	GRAN-ITE	BURNT POND	VIC-TORIA
15	MAR	0	0.	0.	0.	0.	0.	0.	0.
15	MAR	6	13.	69.	37.	101.	52.	20.	27.
15	MAR	12	67.	231.	129.	329.	170.	94.	125.
15	MAR	18	171.	397.	231.	545.	282.	207.	283.
16	MAR	0	296.	522.	320.	701.	362.	316.	440.
16	MAR	6	421.	687.	434.	908.	469.	422.	597.
16	MAR	12	573.	961.	615.	1280.	661.	577.	819.
16	MAR	18	777.	1253.	820.	1682.	869.	787.	1119.
17	MAR	0	1006.	1474.	998.	1967.	1016.	992.	1423.
17	MAR	6	1203.	1592.	1126.	2106.	1089.	1145.	1660.
17	MAR	12	1341.	1658.	1227.	2185.	1130.	1243.	1822.
17	MAR	18	1435.	1729.	1325.	2275.	1176.	1319.	1950.
18	MAR	0	1509.	1784.	1412.	2343.	1211.	1387.	2064.
18	MAR	6	1562.	1761.	1453.	2312.	1195.	1425.	2138.
18	MAR	12	1570.	1675.	1453.	2206.	1141.	1416.	2145.
18	MAR	18	1506.	1439.	1357.	1855.	959.	1330.	2042.
19	MAR	0	1345.	1088.	1178.	1325.	686.	1134.	1786.
19	MAR	6	1113.	820.	1020.	943.	488.	901.	1463.
19	MAR	12	880.	618.	884.	670.	347.	708.	1184.
19	MAR	18	691.	465.	765.	475.	246.	557.	958.
20	MAR	0	542.	351.	663.	337.	175.	438.	775.
20	MAR	6	425.	263.	574.	239.	124.	344.	627.
20	MAR	12	334.	198.	497.	168.	87.	271.	507.
20	MAR	18	262.	148.	431.	117.	60.	213.	410.
21	MAR	0	206.	111.	373.	80.	42.	167.	332.
21	MAR	6	161.	82.	323.	54.	28.	131.	269.
21	MAR	12	126.	59.	280.	36.	19.	102.	217.
21	MAR	18	98.	43.	242.	23.	12.	80.	176.
22	MAR	0	76.	30.	210.	14.	7.	62.	142.
22	MAR	6	58.	21.	182.	7.	4.	48.	114.
22	MAR	12	44.	14.	157.	3.	2.	36.	91.
22	MAR	18	32.	8.	136.	0.	0.	27.	73.
23	MAR	0	23.	4.	118.	0.	0.	19.	57.
23	MAR	6	17.	2.	102.	0.	0.	14.	44.
23	MAR	12	11.	0.	89.	0.	0.	10.	33.
23	MAR	18	7.	0.	77.	0.	0.	6.	25.
TOTAL Mm3			430.	466.	459.	589.	305.	388.	603.

Table C-4 (c)

ROUTED OUTFLOW HYDROGRAPHS (m3/s)
CENTER : MEELPAEG EVENT : WINTER

DayMthHr	Bay dEspr Plant	Salmon Splwy	Salmon River @ RdPd	North Salmon Splwy	Ebbe Cntrl Gate	Gran-ite Canal	Gran-ite Splwy	Burnt SH Canal	White Bear Splwy	Vic-toria Ctrl.	Vic-toria Splwy
15 MAR 0	174.	0.	121.	1307.	0.	147.	0.	142.	0.	0.	0.
15 MAR 6	174.	0.	185.	795.	186.	147.	0.	133.	0.	27.	0.
15 MAR 12	174.	194.	330.	315.	186.	148.	0.	134.	0.	125.	0.
15 MAR 18	174.	431.	434.	417.	186.	151.	0.	145.	0.	165.	68.
16 MAR 0	174.	651.	529.	507.	187.	155.	0.	154.	206.	165.	68.
16 MAR 6	174.	907.	660.	621.	187.	161.	5.	148.	433.	166.	69.
16 MAR 12	174.	1223.	824.	803.	188.	168.	116.	134.	595.	166.	71.
16 MAR 18	174.	1647.	1044.	1010.	190.	175.	278.	119.	820.	167.	75.
17 MAR 0	174.	1761.	1372.	1189.	191.	181.	494.	102.	901.	0.	80.
17 MAR 6	174.	1777.	1755.	1244.	118.	185.	688.	91.	900.	0.	87.
17 MAR 12	174.	1815.	2129.	1244.	17.	187.	818.	90.	918.	0.	96.
17 MAR 18	174.	1871.	2414.	1244.	0.	189.	913.	93.	946.	0.	106.
18 MAR 0	174.	1940.	2621.	1246.	0.	190.	988.	99.	979.	0.	116.
18 MAR 6	174.	2017.	2760.	1252.	0.	191.	1038.	106.	1016.	0.	126.
18 MAR 12	174.	2101.	2834.	1259.	0.	192.	1062.	139.	1052.	0.	137.
18 MAR 18	174.	2178.	2823.	1265.	0.	191.	1033.	138.	1076.	0.	148.
19 MAR 0	174.	2250.	2713.	1268.	0.	189.	926.	145.	1088.	0.	157.
19 MAR 6	174.	2315.	2536.	1265.	0.	187.	773.	152.	1078.	0.	165.
19 MAR 12	174.	2360.	2340.	1257.	0.	184.	611.	125.	1042.	0.	171.
19 MAR 18	174.	2388.	2149.	791.	0.	181.	449.	113.	987.	0.	176.
20 MAR 0	174.	2398.	1890.	663.	0.	177.	335.	106.	693.	192.	181.
20 MAR 6	174.	2393.	1616.	574.	0.	174.	261.	108.	483.	193.	183.
20 MAR 12	174.	2372.	1386.	497.	0.	172.	203.	112.	377.	193.	185.
20 MAR 18	174.	2340.	1202.	431.	0.	170.	155.	117.	294.	193.	185.
21 MAR 0	174.	2298.	1042.	373.	0.	168.	115.	123.	186.	193.	186.
21 MAR 6	174.	2250.	923.	323.	0.	166.	83.	128.	186.	193.	185.
21 MAR 12	174.	2201.	818.	280.	0.	165.	58.	131.	167.	193.	185.
21 MAR 18	174.	2150.	716.	242.	0.	164.	39.	134.	142.	193.	184.
TOTAL Mm3	105.	1042.	911.	512.	35.	105.	247.	75.	358.	55.	73.

Table C-4 (d)

RESERVOIR TRAJECTORIES (m)
CENTER : MEELPAEG EVENT : WINTER

DAY	MTH	HR	LONG POND	ROUND POND	UPPER SALMON	MEEL-PAEG	GRAN-ITE	BURNT POND	VIC-TORIA
15	MAR	0	180.28	184.97	241.71	266.34	311.20	313.84	323.40
15	MAR	6	180.29	185.54	241.60	266.35	311.21	313.77	323.40
15	MAR	12	180.29	185.88	241.60	266.37	311.27	313.84	323.40
15	MAR	18	180.29	186.01	241.60	266.40	311.36	314.00	323.41
16	MAR	0	180.29	186.21	241.60	266.45	311.49	314.09	323.44
16	MAR	6	180.29	186.46	241.60	266.52	311.65	314.09	323.49
16	MAR	12	180.29	186.79	241.60	266.60	311.83	314.10	323.58
16	MAR	18	180.29	187.23	241.60	266.71	312.02	314.11	323.71
17	MAR	0	180.34	187.71	241.60	266.85	312.17	314.10	323.91
17	MAR	6	180.46	188.15	241.60	266.99	312.26	314.21	324.13
17	MAR	12	180.63	188.48	241.60	267.15	312.33	314.37	324.37
17	MAR	18	180.84	188.72	241.62	267.32	312.38	314.57	324.62
18	MAR	0	181.07	188.89	241.65	267.49	312.42	314.79	324.89
18	MAR	6	181.32	189.00	241.68	267.66	312.44	315.00	325.17
18	MAR	12	181.55	189.04	241.72	267.82	312.44	315.15	325.45
18	MAR	18	181.76	188.99	241.74	267.96	312.41	315.23	325.69
19	MAR	0	181.93	188.83	241.72	268.06	312.32	315.16	325.90
19	MAR	6	182.05	188.64	241.67	268.13	312.23	314.94	326.07
19	MAR	12	182.12	188.44	241.60	268.19	312.13	314.62	326.20
19	MAR	18	182.15	188.26	241.60	268.23	312.03	314.24	326.30
20	MAR	0	182.14	187.94	241.60	268.26	311.95	314.12	326.35
20	MAR	6	182.08	187.64	241.60	268.29	311.88	314.08	326.38
20	MAR	12	182.00	187.38	241.60	268.31	311.82	314.06	326.40
20	MAR	18	181.89	187.14	241.60	268.33	311.77	314.06	326.40
21	MAR	0	181.76	186.92	241.60	268.34	311.72	314.10	326.40
21	MAR	6	181.62	186.72	241.60	268.36	311.69	314.10	326.38
21	MAR	12	181.46	186.54	241.60	268.37	311.67	314.10	326.36
21	MAR	18	181.30	186.35	241.60	268.38	311.65	314.10	326.33
AVG			181.17	187.46	241.63	267.51	311.92	314.32	325.05

Note: Victoria Control Structure OPEN and Godaleich Generating Station CLOSED throughout simulation.

3.4 Flood Routing Computations (Cont'd)

Flood routing computations assume antecedent conditions as given in Acres recent report assuming no cut-off dyke at Meelpaeg. This gave starting water levels of 264.96 m in all cases. Additionally, the Island Pond plant was assumed to be out of service during the flood.

It is now understood that Newfoundland and Labrador Hydro intend to construct this cut-off dyke which would allow a starting level of 266.33 m [March FRC] and high maximum flood level. The consequences of this change have been estimated by adjustment of the results previously obtained.

Diversion of Island Pond into Meelpaeg reduces the area producing uncontrolled runoff into Upper Salmon and hence should allow proportionate reduction in new spillway capacity at North Salmon Spillway and some related reductions in new spillway capacity at Long Pond spillway.

Results of the flood routing computations are shown in Table 3.3

3.4 Flood Routing Computations (Cont'd)

TABLE 3.3

Results of Flood Routing Computations

Case Number	Max. Outflow (m^3/s)	Max. Flood Level m
Case 1 - Base Case	195 (197)	267.06 (267.10)
Case 2 - Combined Meelpaeg-Island Pond Reservoir	195	267.08
Case 3 - Combined Meelpaeg-Island Pond Reservoir [reduced downstream spillway capacity]	197	267.19

NOTE: Acres results are shown in brackets.

3.4 Flood Routing Computations (Cont'd)

The following observations were noted:

(1) The results of the Base Case reproduce Acres' results closely.

(2) Diversion of Island Pond into Meelpaeg does not have a significant impact on the flood handling capacity of the Ebbegunbaeg Control Structure. This result is not unexpected since the flood storage available in Island Pond should largely provide for handling flood flows into Island Pond.

(3) In the case of flood routing starting from a winter flood rule curve of 266.33 m (Meelpaeg with dyke) the maximum flood water level in Case 3 would be 268.45 m or approx. 0.07 m higher than in Case 1. This would require that the winter flood rule curve be lowered by 0.07 m to 266.26 m.

(4) A maximum transfer flow from Island Pond to Meelpaeg was estimated to be in the order of 170 m^3/s. The head difference to produce a flow of this magnitude would be about 1.0 m. Similarily the head differential between Meelpaeg Reservoir and Island Pond due to power production flow [Q = 151 m^3/s] prior to the onset of the storm (and powerplant shutdown) was estimated to be about 0.9 m. As a result of these water level differences, a substantial volume of water would be held in storage in Island Pond which would reduce the calculated maximum flood level in Meelpaeg by a small amount. Thus the use of a single

3.4 Flood Routing Computations (Cont'd)

(4) Cont'd)

reservoir flood routing model gives conservative results which are satisfactory for the purpose of this study at the prefeasibility level.

Case 3 assumed that similar restrictions on flow releases from Ebbegunbaeg, as in the Base Case, would be required if Upper Salmon and Long Pond Spillways were redesigned to fit the runoff from the reduced drainage area downstream of Meelpaeg. In this case, a marginal deterioration of flood handling capability was observed, giving an increase in maximum flood level of 0.013 m, and an increased maximum outflow from Ebbegunbaeg of 2 m^3/s (from 195-197 m^3/s). This result would impose a lowering of the winter flood rule curve of 0.14 m to 264.82 m (no dyke).

3.5 Reservoir Characteristics

Dead Storage

The proposed minimum operating level of Island Pond Reservoir of El. 262.0 m will be slightly below the existing Island Pond level of El. 262.5 m. As a result, there will be no dead storage developed on Island Pond except for the small volume of water required to fill the valley downstream of the forebay canal (below El. 262.0 m). This volume is estimated to be 1.07 million cubic metres and represents a loss in power production of 546,000 kwh. The cost of filling this dead storage is evaluated at less than $20,000 and has not been taken into account in this study.

3.5 Reservoir Characteristics (Cont'd)

Live Storage

The volume of live storage in Island Pond, i.e. the volume of water between 262.0 m and El. 267.0 m is estimated to be approximately 123 million cubic metres.

Drainage Area

Island Pond drainage area is estimated to be approximately 155 km^2.

Flooded Area

The area which will be flooded between the existing level of Island Pond at El. 262.5 m to full supply level at El. 267.0 m is approximately 10 km^2.

Reservoir Filling

The filling of Island Pond will be accomplished by controlling the flow from Meelpaeg Reservoir through the diversion canal. The time required for filling will vary depending on the level of Meelpaeg Reservoir (at the time of filling), but will not exceed one month. The filling of Island Pond from Meelpaeg Reservoir will lower the level of Meelpaeg by no more than 0.5 metres.

NEWFOUNDLAND AND LABRADOR HYDRO

ISLAND POND DEVELOPMENT

FINAL FEASIBILITY STUDY

JANUARY 1988

Prepared by:

SHAWMONT NEWFOUNDLAND LIMITED
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Report No. SMR-02-88 January, 1988

PART 3 - HYDROLOGY

3.1 DRAINAGE AREA

The Island Pond Development would utilize the flow from the Meelpaeg Reservoir, together with the inflow from the 155 km^2 of drainage area for Island Pond, to develop energy through approximately 25 m of head between Meelpaeg Reservoir and Crooked Lake. The water from the Meelpaeg Reservoir would be utilized by diverting flows into Island Pond through a diversion canal. This would not result in any net change to the total drainage area available to the Bay d'Espoir system, but would allow all the inflow to the Meelpaeg Reservoir, in addition to the inflow of Island Pond, to be utilized in developing energy through the available head. During floods, the inflow to Island Pond would be diverted back through the diversion canal and stored in the combined Meelpaeg - Island Pond Reservoir. Therefore, for flood routing purposes the Island Pond drainage area is considered an addition to the Meelpaeg Reservoir drainage area. The following table shows the reallocation of the drainage areas which would result:

Basin	Pre-Development Drainage Area (km2)	Post-Development Drainage Area (km2)
Victoria	1057	1057
Burnt	678	678
Granite	502	502
Meelpaeg	971	971
Island Pond	-	155
Upper Salmon	902	747
Round Pond	944	944
Long Pond	830	830
Total	5884	5884

3.2 HYDRAULIC COMPUTER MODELLING

The hydraulics of the canals and channels within the Island Pond development area were evaluated using the HEC-2 computer program. The HEC-2 model computes water surface profiles and permits the evaluation of headlosses, flow velocities and flow depths. The program was used to determine the headloss in the diversion canal for the alternative layouts considered in optimizing the canal. The details of the methodology used and the steps taken in the optimization are described in the separate optimization report.

3.2 HYDRAULIC COMPUTER MODELLING (Cont'd)

The model of the diversion canal initially used a simplified profile of the canal and, subsequently, field survey data. The channel improvements were evaluated using a model based on ground elevations and soundings taken during the field program. The channel improvements were put in the model by modifying the appropriate cross-sections.

Another model, of the North Salmon River and forebay canal, was used to evaluate the headlosses from Island Pond to the intake.

Each of the models were used separately to evaluate the headlosses in the different sections and then the models were linked to verify the total losses from the Meelpaeg Reservoir through to the intake.

The velocities at critical sections were examined to ensure velocities were low enough to allow development of a stable ice cover and headlosses were evaluated to determine if widening or deepening of the canal would improve the hydraulics.

The diversion canal was modelled in the greatest detail, as it would contribute the largest portion of the total headlosses and would have the biggest impact on energy generation at the Island Pond Plant.

The diversion canal model was also used to evaluate the losses for flows from Island Pond to Meelpaeg, which would occur during the routing of floods back through the diversion canal for storage in the Meelpaeg-Island Pond Reservoir.

The HEC-2 model was used to model the diversion canal flows over a wide range of water levels in Meelpaeg and Island Pond. This was necessary to develop a water level - flow table for the canal (Table 3.1) which could be used by the Bay d'Espoir regulation model to model the impact of the Island Pond Development on the Bay d'Espoir system.

3.3 REGULATION STUDY

As part of the Upper Salmon Feasibility Study, Acres Consulting Services Limited carried out a regulation study for evaluating the energy potential of the Upper Salmon Development. This study simulated the operation of the entire Bay d'Espoir system giving flows, reservoir volumes and water levels at key locations throughout the system.

3.3 REGULATION STUDY (Cont'd)

Concurrent with the Island Pond Final Feasibility Study, Acres completed a new regulation study (the Bay d'Espoir Regulation Study) utilizing a more sophisticated regulation model (ARSP) together with the latest system information and expanding the flow data base to 37 years (1950 to 1986). The new regulation model was calibrated against the existing Bay d'Espoir system and was used to simulate the impact of the Island Pond Development on the total system.

Since the 600 MW size of the Bay d'Espoir station is much greater than either Upper Salmon or Island Pond, water requirements at the Bay d'Espoir powerplant essentially 'drive' the system with the smaller plants utilizing available flow for energy production. Based on this, it was concluded in the Island Pond Pre-feasibility Report that the Island Pond Development would have little impact on the overall water management in the Bay d'Espoir system and that any impact could be adequately assessed by relatively simple manipulations of the results of the original regulation study. For the current Island Pond Final Feasibility Study, the new regulation model, which can incorporate the conceptual Island Pond plant, was used as a basis for the conclusions contained herein. This model verified the conclusions of the Island Pond Pre-feasibility Study and showed no substantial changes from that study.

In the Bay d'Espoir Regulation Study, operation of the Bay d'Espoir system was simulated on a monthly basis for a study period of 37 years. Releases from storage were computed to supply energy production requirements at Bay d'Espoir, as dictated by operational rule curves. Releases from storage were allocated on a priority basis, with upstream reservoirs drained first, Upper Salmon second and Long Pond last. Releases from the upstream reservoirs - Victoria and Meelpaeg were allocated on a proportionate basis so that both reservoirs were lowered 'in step'. Flows, reservoir volumes, water levels and energy production at key locations in the Bay d'Espoir system were recorded in tabulated print outs. These results provided data for the analysis of the impact of additions or changes to components in the Island Pond Development and for the optimization of the target level for the Meelpaeg Reservoir, the diversion canal size, the Island Pond channel improvements, the penstock diameter and the plant capacity.

The results of the Bay d'Espoir Regulation Study were examined in detail and the differences found in the conclusions of the Pre-feasibility Study and those inferred from the inital modelling results were investigated. The

3.3 REGULATION STUDY (Cont'd)

following sections describe some of the refinements made to the initial model, to improve the modelling of Island Pond, and the results obtained. Generally, it was found that the conclusions made in ShawMont's Pre-feasibility Study were upheld by the regulation study, although these were not necessarily obvious from the initial runs of the new regulation model.

3.3.1 Diversion Canal Headloss

The initial model assumed that the diversion canal between Meelpaeg Reservoir and Island Pond could be modelled as a single, constant headloss value. Since the canal would have considerable variation in head-loss due to the variation in flow and water levels between the two reservoirs, a constant headloss value provided incorrect results. A detailed analysis of the flows between the reservoirs was required to develop a waterlevel - flow table (Table 3.1) which was then provided for inclusion in the model.

3.3.2 Reallocation of Upstream Storage Releases

To enhance the output from Island Pond it would be desirable to maintain the water level in Meelpaeg Reservoir as high as possible. To do this, a change in the method of allocating releases from storage of the upstream reservoirs would be required. The preferred reservoir operating policy would be to empty the Victoria Reservoir initially, before releasing water from the Meelpaeg Reservoir, and to refill Meelpaeg and Island Pond Reservoirs on the filling cycle. In the Pre-feasibility Study, flows for Island Pond were based on an adjustment to the output of the original regulation study. For the current Final Feasibility Study, however, the model of the Bay d'Espoir system was used to assess the impact of the changes to the operating rules and the reallocation of storages.

The priorities for the reservoir releases were changed such that Victoria would be drained before Meelpaeg. The storage in Island Pond represents only a small portion of the total storage volume available to the Island Pond plant (Graph 1), it was therefore given a lower priority than the Meelpaeg Reservoir, even though it is a downstream reservoir. This means that the level on Meelpaeg is determined by downstream demands, but the Island Pond level would be determined only by the level on Meelpaeg. This policy was then implemented for a study of the total energy output over a range of target levels on the Meelpaeg Reservoir.

3.3 REGULATION STUDY (Cont'd)

3.3.2 Reallocation of Upstream Storage Releases (Cont'd)

The results of this study indicated a small increase in spillage at Upper Salmon and Bay d'Espoir plants would occur when the reservoir target level is very high, resulting in energy losses at these plants. By lowering the target level below the full supply level, and thereby incorporating an additional storage "buffer" to reduce any flood discharge from Meelpaeg Reservoir, it was found that the downstream losses could be minimized. The energy production at each plant was calculated and plotted (Graph 2). This graph shows that a target level of 265.5 m on Meelpaeg Reservoir would give the highest total energy production for the Bay d'Espoir system as well as the highest production at Island Pond.

The simulated operation of the Bay d'Espoir system resulted in a long term average water level on Meelpaeg Reservoir of 265.62 m, with an average flow of 105.0 m^3/s which would be passed through the diversion canal. There would still be some spill through the Ebbegunbaeg structure, which would be required to meet the downstream demands and which would take priority over the demands at Island Pond. The water level duration curve for Meelpaeg was developed from these regulation study outputs (Graph 3) and was used to determine the headlosses through the diversion canal during the optimization studies. The output of the new regulation study also gave the simulated power flows at the Island Pond plant, and these were used to develop the flow duration curve for the Island Pond plant (Graph 4). The following table summarizes the water levels and flows provided by the new regulation study:

Average Flow - Diversion Canal	=	105.0 m^3/s
Average Spill at Ebbegunbaeg	=	3.6 m^3/s
Total Meelpaeg Outflow	=	108.6 m^3/s
Local Inflow - Island Pond	=	4.3 m^3/s
Total Island Pond Power Flow	=	109.3 m^3/s
Target level - Meelpaeg	=	265.50 m
Average Level - Meelpaeg	=	265.62 m
Target Level - Island Pond	=	264.85 m
Average Level - Island Pond	=	264.92 m

3.3 REGULATION STUDY (Cont'd)

During the study of target levels, it was found that the changes to the operating rules to reallocate the reservoir priorities resulted in violation of a flow limit in the Burnt Sidehill Canal. This canal requires a minimum flow of 42.5 m^3/s during the winter months to ensure a stable ice cover and thus avoid possible ice collapse and constriction of the channel. The suggested change in priority resulted in lower flow on a number of occasions and, after review by Hydro, it was determined that this minimum should not be reduced. By providing a buffer in the Victoria Lake Reservoir to retain sufficient water to maintain the required winter flow in the Burnt Sidehill Canal, the violations were reduced to an acceptable level. It was also determined that the change had only a minor impact on the energy production at Island Pond and did not change any of the conclusions concerning the target level.

The model of the Bay d'Espoir system was used to investigate the firm energy on the system and the changes caused by the Island Pond Development. The firm energy is defined as the maximum system energy which can be produced throughout the firm sequence of flows (June 1959 to March 1962) assuming the system storage is full at the start of the sequence and that no reservoir falls below its low supply level during the drawdown period. The results of the firm energy analysis are contained in the next section of this report.

The firm capacity is computed through a trial and error process in which the demand is increased until all reservoirs just reach empty while meeting the demand. This results in a critical period in which all reservoirs go from full to empty. For the Bay d'Espoir system, the simulaton shows this period to be 34 months, ending with all reservoirs empty in March 1962. This means that the conclusions drawn for the firm energy are based on a short period of simulation, compared to the average results which are based on 37 years of simulated flows and energy. The results cannot have the same reliability as the average but still represent a valid estimate of the system firm energy for comparison.

3.4 PROJECT DESIGN FLOOD

The project design flood for the Island Pond Development is the Probable Maximum Flood (PMF). The PMF for the Island Pond drainage area was based on the same rainfall

3.4 PROJECT DESIGN FLOOD (Cont'd)

excess (net runoff) values as used in the Acres' Bay d'Espoir Flood Analysis Report of 1985 (Table C-4 of that report). The runoff excess amount of 80% of combined probable maximum precipitation and snowmelt, gave a total runoff excess of 600 mm for an 84 hour design storm.

The resulting flood hydrograph was found to have a peak of 369 m^3/s which occurred 54 hours after the onset of the storm as shown in Table 3.2 and as illustrated on Graph 5.

3.5 FLOOD ROUTING

The project design flood was used for the flood routing computations for the development. The Island Pond Reservoir would not have its own spillway and the portion of the flood entering the Island Pond drainage area would flow back through the diversion canal to be stored in the joint Meelpaeg-Island Pond Reservoir.

Flood routing computations were made for two cases as follows:

Case 1 Meelpaeg Reservoir only

A check computation to compare results with Acres' Bay d'Espoir Flood Analysis Report.

Case 2 Combined Meelpaeg-Island Pond Reservoir

Flood computations to simulate the behaviour of the combined reservoir.

Flood routing computations were carried out using a single reservoir flood routing model. This approach implies that the small difference between water levels in the Meelpaeg Reservoir and Island Pond would not have a significant impact on flood routing computations. The combined storage volume curve for the two reservoirs (Graph 1) and the discharge curve for the Ebbegunbaeg Control Structure (Graph 6) were used in conjunction with the water level - flow table (Table 3.1) for the optimized canal, to carry out these computations.

The diversion of Island Pond into the Meelpaeg Reservoir reduces the area producing uncontrolled runoff into the Upper Salmon Development and hence would effectively reduce the spillway discharge at the Upper Salmon Development.

3.5 FLOOD ROUTING (Cont'd)

The results of the flood routing computations for the two cases considered are shown in the following table:

	Max. Outflow (m^3/s)	Max. Flood Level (m)
Case 1 - Meelpaeg Reservoir only	195	268.40
Case 2 - Combined Meelpaeg-Island Pond Reservoir	195	268.40
Bay d'Espoir Flood Analysis (1985)	197	268.40

The following observations were noted:

(1) The results of Case 1 reproduce the 1985 Flood Analysis results closely.

(2) Diversion of Island Pond into the Meelpaeg Reservoir does not have a significant impact on the flood handling capacity of the Reservoir. This result is not unexpected since the flood storage available in Island Pond should largely provide for handling flood inflows to Island Pond.

(3) A maximum transfer flow from Island Pond to Meelpaeg Reservoir was estimated to be in the order of 170 m^3/s. The head difference to produce a flow of this magnitude would be about 1.0 m, at the reservoir levels to be expected during the flood handling. Similarly the head differential between the Meelpaeg Reservior and Island Pond due to power production flow (152 m^3/s), prior to the onset of the storm (and power plant shutdown), was estimated to be about 0.9 m. As a result of this initial water level difference, a substantial volume of water would be held in storage in Island Pond. This would reduce the calculated maximum flood level in Meelpaeg Reservoir by a small amount. The timing of the flood peaks would be such that the Island Pond flood runoff would reach its peak prior to that of the much larger Meelpaeg flood and, consequently, the Island Pond runoff would add only a small amount to the flood peak which would occur in Meelpaeg without the Island Pond Development. Thus, the use of a single reservoir flood routing model gives conservative results which are satisfactory at this level of study.

3.5 FLOOD ROUTING (Cont'd)

The flood handling capabilities of the combined Meelpaeg-Island Pond Reservoir were further examined in the light of the similarity of this arrangement to that of the reservoirs immediately upstream of the Upper Salmon Development. The situation where Island Pond could route water back through a diversion canal to meet its flood handling requirement would be similar to the situation found with Cold Spring Pond routing flow back into Great Burnt Lake. In the latter case it was found that the storage capacity of Cold Spring Pond was not sufficient to absorb the volume of the local PMF, nor was there sufficient freeboard to develop adequate head between Cold Spring Pond and Great Burnt Lake to force the water back through the diversion canal. The Bay d'Espoir Flood Analysis Report (1985) recommended that, to overcome this problem, additional discharge capacity should be added by the construction of a new spillway on Cold Spring Pond. This spillway has since been constructed and is now operational.

The Meelpaeg Reservoir, unlike the reservoir areas at Upper Salmon, is designed to handle floods by storage. It is a very large reservoir and can store the entire PMF by being drawn down to a specified level prior to the flood. This level is referred to as the flood rule curve level (FRC). The governing FRC level is the late winter level of 266.33 m, which is only slightly below the full supply level of 266.55 m which was established, assuming that the low saddle dyke (Ebbegunbaeg Freeboard Dyke) at the eastern extremity of the Meelpaeg Reservoir is constructed. The normal operational scenario assumes that the Ebbegunbaeg Control Structure is open at the start of the flood as required to supply the downstream generating demands. Gates would then be closed as the flood on the lower watershed becomes sufficient to meet generating requirements, or when a major flood event becomes apparent. A major flood is detected by the rate of rise of the reservoir and would normally become apparent only about 48 hours after the start of the flood.

Gates at Ebbegunbaeg normally remain closed throughout floods to absorb the excess discharge and thus reduce the flood routing requirements on the downstream watershed.

The flood handling capacity of Island Pond can be initially examined assuming no attenuation of flood peaks through routing, and considering only the total volumes to be handled. The initial examination also neglects the interaction of Island Pond with the Meelpaeg Reservoir (it is assumed that the flow cannot be routed back through the

3.5 FLOOD ROUTING (Cont'd)

diversion canal and that the entire PMF volume would be absorbed by Island Pond). The following calculations show the volumes and levels which would be reached, assuming no discharge from Island Pond during the flood event and assuming the power station to be out of operation.

Storage Volume at FRC (266.33 m)	=	202.5 Mm3
Added Volume in local PMF	=	91.0 Mm3
Total Volume at end of flood	=	293.5 Mm3
Resulting Island Pond water level	=	268.60 m

This shows that the storage volume at Island Pond would be sufficient under these circumstances to absorb the entire PMF inflow with water rising only 0.20 m above the Design Maximum Flood Level of elevation 268.40 m.

In reality the routing effect of discharge back through the diversion canal, prior to peaking of the level on Meelpaeg would be sufficient to restrict the rise on Island Pond to below the Maximum Flood Level.

The actual maximum level reached on Island Pond would ultimately reflect the maximum level on the Meelpaeg Reservoir.

Further calculations can be made to determine the maximum level that would be reached on Meelpaeg, assuming no discharge through the Ebbegunbaeg Control Structure, to verify the capability of Meelpaeg to handle a flood through storage alone.

Storage Volume at FRC (266.33 m)	=	1821 Mm3
Added Volume of PMF on Meelpaeg	=	708 Mm3
Total Volume at end of flood	=	2529 Mm3
Resulting Meelpaeg water level	=	268.52 m

This level is 0.12 m higher than the maximum flood level of elevation El. 268.40 m. A maximum level of 268.40 m would normally occur if the discharge through the Ebbegunbaeg Control Structure is taken into consideration, as follows:

Discharge through the Control Structure during flood	=	35 Mm3
Total volume in the reservoir at end of flood	=	2494 Mm3
Maximum Meelpaeg water level	=	268.40 m

3.5 FLOOD ROUTING (Cont'd)

The addition of Island Pond would, in reality, add storage volume above Ebbegunbaeg which would assist with the storage of the flood on Meelpaeg. If the case of unrestricted discharge through the interconnecting diversion canal is considered there would be only a slight change to the maximum flood level on Meelpaeg, considering a combined reservoir, as follows:

Volume at FRC (266.33 m)	=	2024 Mm3
Volume of PMF (Meelpaeg)	=	708 Mm3
Volume of PMF (Island Pond)	=	91 Mm3
Discharge through the Control Structure	=	-35 Mm3
Total volume	=	2788 Mm3
Water level (on each reservoir)	=	268.44 m

The above calculations show that the PMF on Island Pond could be handled entirely by storage on Island Pond and that the effect of discharge routed through the interconnecting canal would not alter the integrity of the Meelpaeg Reservoir.

3.6 RESERVOIR CHARACTERISTICS

3.6.1 Dead Storage

The minimum operating level of Island Pond would be 261.67 m. This level is nearly a metre below the existing water level on the pond of 262.5 m. To facilitate the construction of the Island Pond channel improvements and diversion canal, the level in the Pond would be lowered to about elevation 259 m, resulting in some dead storage which would have to be filled prior to commissioning of the plant. The volume in Island Pond which would have to be refilled is estimated to be 57.7 million cubic metres. In addition, there would be a small volume of water required to fill the forebay (below elevation 261.67 m). This volume is estimated to be 1.07 million cubic metres. Therefore the total volume of dead storage which would have to be filled would be about 58.8 million cubic metres.

This volume of water would represent a loss of about 3.2 gWh of energy production at the Island Pond Plant and a loss of about 33.1 gWh of energy production at the downstream plants; however, the initial drawdown of Island Pond would provide about 79.4 million cubic metres of water for energy production at Upper Salmon and Bay d'Espoir, representing a gain in energy production of about 44.6 gwh. This, therefore, would represent a net gain in energy production of about 8.3 gWh with a value of about $415,000 assuming a rate of 50 Mills/kWh.

3.6.2 Live Storage

The volume of live storage in Island Pond is the volume of water between the minimum operating level of 261.67 m (the level generated by sustained average discharge from elevation 264 m in Meelpaeg) and the Full Supply Level of 266.55 m. This volume is estimated from the storage volume curve (Graph 1) to be 153 million cubic metres. The live storage available to the Island Pond plant would also include that of the Meelpaeg Reservoir within this range, which is estimated to be a further 1323 million cubic metres, for a total live storage available of approximately 1476 million cubic metres.

3.6.3 Flooded Area

Upstream of the project, the operating water levels on Meelpaeg Reservoir would be unchanged and therefore the flood zone would not be affected. On Island Pond, however, the FSL would be approximately 4.00 m above the existing normal water level resulting in flooding of shoreline around the perimeter of the pond, submergence of some of the islands in the Pond and flooding of the forebay area between Island Pond and the Dam. The total land areas to be flooded, between the original shoreline and the FSL at Island Pond, and in the forebay area upstream of the dam would be 860 ha and 140 ha, respectively.

Downstream of the project, the waterlevel of Crooked and Great Burnt Lakes would be unchanged.

Most of the northern and western perimeter of Island Pond, as well as the southern shoreline west of the North Salmon River, are covered with bush with a limited growth of small scrub trees in low lying areas. The only wooded areas which would require clearing are along the river valley approaching the dam, and along the relatively steep southeast shoreline of Island Pond, east and north of the forebay channel. The total area to be cleared assuming clearing to 3 m horizontally above the FSL would be 83 hectares.

3.6.4 Reservoir Filling

The filling of Island Pond would be accomplished by closure of the outlet of Island Pond upon completion of the channel improvements through the Pond. This closure would occur prior to the spring flood of 1990, thereby impounding all of the inflow to Island Pond from 155 km^2 of drainage area throughout the last 18 months of the construction schedule, before "On Power". This would ensure complete filling of the live storage from local runoff, effectively precluding any charge against the project for filling from Meelpaeg storage.

3.6.4 Reservoir Filling (Cont'd)

Upon completion of the diversion canal at the end of 1990, and based on the average inflow, the Island Pond water level at the end of 1990 would be about elevation 263 m. If Meelpaeg Reservoir is higher than Island Pond at this time, the cofferdam at the Meelpaeg inlet of the diversion canal could be left in place until water levels are equal on each side, for ease of removal. With an average inflow, the Island Pond water level would be above elevation 265 m at the end of June, 1991.

Filling of the dead storage and live storage are discussed in conjunction with the unwatering and construction sequence for Island Pond and the forebay canal in Part 5.3.

3.6.5 Diversion Canal Flow

Although the low supply level (LSL) on the Meelpaeg Reservoir is 261.67 m, the operational low water level is 264.0 m. This would correspond to a water level of 262.0 m in Island Pond which, at average flow, would result in a water level of 261.67 at the intake. The diversion canal has been optimized to pass the average flow from Meelpaeg and could maintain this average flow with a water level as low as 264.0 m on the Meelpaeg Reservoir. Below a level of 264.0 m, the flow capacity of the canal would be reduced. At the low supply level of 261.67 m on the Meelpaeg Reservoir, the canal capacity would only be 36 m^3/s.

TABLE 3.1

WATER LEVEL - FLOW TABLE

OPTIMIZED DIVERSION CANAL

MEELPAEG WATER LEVEL (M)	ISLAND POND WATER LEVEL (METRES)									
	259.00	262.00	263.00	264.00	264.50	265.00	265.50	266.00	266.50	267.00
262.00	48.00	0.00	-59.00	-98.00	-119.00	-140.00	-167.00	-186.00	-210.00	-235.00
263.00	85.00	66.00	0.00	-84.00	-109.00	-133.00	-158.00	-182.00	-208.00	-233.00
264.00	122.30	110.00	89.00	0.00	-73.00	-108.00	-139.00	-169.00	-197.00	-226.00
264.50	143.50	133.00	116.00	76.00	0.00	-84.00	-121.00	-154.00	-187.00	-218.00
265.00	163.00	157.00	143.00	113.00	85.00	0.00	-91.00	-133.00	-171.00	-205.00
265.50	184.00	181.00	169.00	145.00	126.00	94.00	0.00	-101.00	-145.00	-187.00
266.00	208.00	205.00	195.00	176.00	160.00	138.00	102.00	0.00	-110.00	-161.00
266.50	226.00	230.00	223.00	212.00	194.00	176.00	151.00	113.00	0.00	-119.00
267.00	257.00	256.00	251.00	237.00	226.00	211.00	192.00	164.00	115.00	0.00

NOTES: 1. Flows are in cubic metres per second (M3/s).
2. Negative flow indicates flow upstream (from Island Pond to Meelpaeg).

TABLE 3.2

ISLAND POND PMF HYDROGRAPH

Time (Hours)	Unitgraph (M3/s per cm of rain)	(1) Direct Runoff (M3/s)	(2) cm of rain	2.47	2.47	2.47	2.47	3.82	5.54	5.63	5.5	4.78	5.24	5.24	5.28	4.16	4.16	0.5	0.5	Total Runoff (M3/s)
			Time (Hrs)	6	12	18	24	30	36	42	48	54	60	66	72	78	84	90	96	
0	0	0.0		0.00																
6	11.3	23.4		27.91	0.00															0.0
12	22.6	32.4		55.82	27.91	0.00														51.3
18	15.1	38.0		37.30	55.82	27.91	0.00					(3)								116.1
24	7.5	46.4		18.53	37.30	55.82	27.91	0.00												159.0
30	0	58.3		0.00	18.53	37.30	55.82	43.17	0.00											185.9
36		73.9			0.00	18.53	37.30	86.33	62.60	0.00										213.2
42		72.9				0.00	18.53	57.68	125.20	63.62	0.00									278.6
48		65.5					0.00	28.65	83.65	127.24	62.15	0.00								338.0
54		64.5						0.00	41:55	85.01	124.30	54.01	0.00							367.1
60		68.3							0.00	42.23	83.05	108.03	59.21	0.00						369.4
66		68.8								0.00	41.25	72.18	118.42	59.21	0.00					360.8
72		64.5									0.00	35.85	79.12	118.42	59.66	0.00				359.9
78		52.4										0.00	39.30	79.12	119.33	47.01	0.00			357.6
84		23.4											0.00	39.30	79.73	94.02	47.01	0.00		337.1
90		3.7												0.00	39.60	62.82	94.02	5.65	0.00	283.4
96		0.9													0.00	31.20	62.82	11.30	5.65	205.8
102		0.9														0.00	31.20	7.55	11.30	111.9
108		0.9															0.00	3.75	7.55	51.0
114		0.9																0.00	3.75	12.2
120		0.9																	0.00	4.7

NOTES:
1. Figures represent runoff from Island Pond surface in M3/s.
2. Figures are cm of rain per time interval.
3. Figures represent runoff in M3/s.