DEPARTMENT OF THE ENVIRONMENT

Canadian Wildlife Service
Western Region

EVALUATION OF COSTS TO IMPOUND AND DYKE THE MAJOR MARSHES OF LAKE WINNIPEG

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INTRODUCTION

Manitoba Hydro has initiated a project to divert waters from the Churchill River to the Nelson River for the purpose of producing hydro power. In addition, Lake Winnipeg will be used as a reservoir to ensure an adequate supply of water during winter.

The overall effect will be to flood Southern Indian Lake and portions of the Rat and Burntwood Rivers, Lake Winnipeg and its Outlet Lakes, and the upper Nelson River. The lower Nelson will receive many times the riparian volume and the lower Churchill will be reduced up to 30,000 cfs. The total cost of construction has been projected in excess of $1 billion (Cass-Beggs, 1970).

Lake Winnipeg will be controlled between 711 and 715 ASL, with summer levels of 712 to 714, and extremes of 710.5 to 715.5 ASL. The cost of this development was estimated to be $50 million (Cass-Beggs, 1970); however, recent calculations indicate a possible $120 million.

The entire affected area comprises 370,000 $mi.^2$, of which, Lake Winnipeg is approximately 9,000 $mi.^2$. Marshes comprise 100,000 acres of Lake Winnipeg, of which, Netley-Libau is 55,000 acres in extent. The long-term mean level of the lake until 1956 was 713.4 ASL (Townsend, 1969), however, since completion of the Red River Floodway, Grand Rapids Dam and Lake Manitoba outlet channel, the lake has remained at a higher level (CWS, 1973). This relationship has not been tested.

High water levels on Lake Winnipeg have had detrimental effects on associated marshes. In 1960 and 1961, severe storms combined with high water levels caused

caused breaches in the Netley-Libau Marsh beach ridge. Above normal inflows between 1964 and 1970 have caused large-scale deterioration and retreat of the beach ridge, shoreline retreat up to 400 feet, and kill of aquatic and beach vegetation (CWS, 1973).

According to Crippen (1970), "There can be little doubt that the high water levels that have prevailed in the Netley Marsh since 1965 have had a detrimental effect on the waterfowl breeding capability of the Netley Marsh". Historical changes in the vegetation patterns of Netley-Libau were recorded by Townsend (1969):

1.	1940's	20,000 acres open water	50 lakes
2.	Late 1960's	30,000 acres open water	17 large lakes

Canadian Wildlife Service (1973) predicted that continued high levels would eventually create 40,000 acres of open water.

Townsend (1969) analyzed the general effects that several controlled lake regimes would have on waterfowl production in the Netley-Libau complex. The only regime that would be more destructive to marsh condition and nests than the natural condition was the 709-715 ASL scheme; this was closest to Hydro's proposal for a 711-715 ASL manipulation. Consequently, the rise in water level would be sufficient to destroy 60% of waterfowl nests in 90 to 95% of years.

EFFECTS ON WATERFOWL AND HUNTING

It is impossible at the present time, to accurately assess the waterfowl losses that will result from the Churchill-Nelson-Lake Winnipeg hydro scheme. This will be established by the F.F. Slaney report to the Manitoba Water Commission in 1974. A general assessment of waterfowl use of the area may, however, be of value. Canadian Wildlife Service (1973) estimated that 513,000 ducks, or 8.7%, and 65,000 geese or 21.5% of the Manitoba fall flight are produced in the area under consideration. Townsend (1969) studied duck production on Lake Winnipeg. He calculated

that a minimum 20,300 breeding pairs using the major marshes and 1,800 pairs along the shoreline contributed 88,500 ducks to the fall flight.

Recent high water levels have altered the duck species composition on Netley-Libau Marshes (Townsend, 1969) as presented in Table 1. Breeding dabblers composed almost the entire spring duck population during the years before high water levels. However, greater depths and increased open water in the marsh have resulted in an increase in the proportion of diving ducks. The proportion of dabblers declined by approximately one-half to 54% in 1969. Conversely, the proportion of dabblers staging during fall of 1939 increased by an average 17% during the period of 1959-69.

Canadian Wildlife Service (1973) reported that the number of hunters using Netley-Libau marsh declined from 4,000 in 1960 to 932 in 1970, and 671 in 1971. A corresponding decrease from 25,000 to 6,630, to 3,280 hunter-days use, respectively was observed. Crippen (1970) claimed that 50,000 hunter-days use was experienced annually on Lake Winnipeg and assessed the wildlife value of the lake at $1.5 million to 3.5 million. The present value of waterfowl hunting on Netley marsh was projected to approximately $5 million for the 10-year period, 1970-79.

Present high water levels are destroying waterfowl production and the recreational potential of all Lake Winnipeg marshes (CWS, 1973). Future lake regimes will be affected by future changes in the watershed: diversions on the upper Red River, U.S.A.; manipulation of Lake Manitoba levels; and additional hydro dams downstream. Accordingly, Canadian Wildlife Service (1973) has urged that existing marshes on Lake Winnipeg be preserved and restored by means of dykes and compartments in order to mitigate for waterfowl losses throughout the Churchill-Nelson-Lake Winnipeg drainage system. Specific recommendations of importance to this report were the following:

Table 1. Proportions of dabbling ducks on Netley-Libau marsh, 1939 to 1969.

Year	Per Cent Dabblers	
	Spring	Late Summer
1949	98	
1961	100	
1969	54	
1939		80
1959-69		97

1. Preservation and restoration of Lake Winnipeg marshes by Federal-Provincial agreement with funding by Manitoba Hydro and administration by a Canada-Manitoba Wildlife Restoration Board.

2. Because total impact of the diversion cannot be forecast, a Canada-Manitoba agreement should be initiated to provide for funding for additional engineering projects to protect, restore, or replace migratory bird habitat. The basis of funding outlined in recommendation 1 should apply.

MITIGATION COSTS

The major marshes of Lake Winnipeg are approximately 100,000 acres in extent; of which, Netley-Libau comprises more than one-half. The southern one-third of the lake is accessible by automobile to large population centres, consequently, marshes from Washow Bay south are susceptible to intensive use.

Lake Winnipeg is approximately 260 miles in length and lies in a north-south attitude. The marshes vary qualitatively with latitude, due to difference in wind tides, climate, and the annual rhythmn of ice cover and break-up. Heavy concentrations of dabbling ducks breed in the southern marshes and are replaced by diving ducks and Canada geese in northern areas.

Any concrete plan of marsh management must consider the differences in waterfowl potential and recreational uses offered by individual marshes. Consideration of the physical effects of the lake as they vary with location is essential. The present assessment, however, is based on prior studies of managed marshes in southwestern Manitoba, Lake Manitoba and the southern basin of Lake Winnipeg. All marshes on Lake Winnipeg are assumed to be similar in quality. Consequently, forecasts of mitigation costs are very general, being extrapolated from a variety of marsh projects carried out by the Province of Manitoba, Ducks Unlimited, private groups, and the Canadian Wildlife Service.

The costs of dyking and impounding important waterfowl marshes in southern Manitoba vary with the location and the physical effects of the local environment (Table 2). Oak-Plum and Oak Hammock marshes may be comparatively inexpensive to manage, as compared to Marshy Point and Delta Marsh on Lake Manitoba. This is

Table 2. Projected cost estimates of present management schemes for major marshes in southern Manitoba.

Project	Acreage	Construction Costs			Maintenance and Operation Costs		
		Land Acquisition	Construction	Total	Per Acre	Per Year	Per Acre/yr.
Oak-Plum	24,000	500,000	240,000	740,000	31.00	2,000	0.01
Oak Hammock	8,000	380,000	420,000	800,000	100.00	20,000	2.50
Marshy Point	8,000		600,000	600,000	75.00	22,000	2.50
Delta	53,000	1,170,000	3,887,000	5,057,000	95.00	30,000	0.57
Netley-Libau	55,000	1,700,000	5,000,000	6,700,000	122.00	150,000	2.73
Willow Point	2,200	68,000	300,000	368,000	136.00		
L. Winnipeg Island Building	1,000	155,000	365,000	520,000	520.00		

due to the necessity of maintaining fewer compartments and water regulation installations. Lake Winnipeg marshes, on the other hand, will be uniquely subject to high water levels that will erode protective beach ridges and man-made dykes (Howard, 1972). The costs of construction of protective works, maintenance, and operation will be correspondingly higher.

In the case of the Netley-Libau complex, construction cost may be $122/acre and maintenance, $2.75/acre/year. Since this marsh is situated at the south end of Lake Winnipeg and is subject to the greatest extremes in wind tide action, these cost values may be excessive when applied to the remainder of the Lake Winnipeg marshes.

It is therefore estimated that the minimum average cost of impounding the major marshes of Lake Winnipeg, excluding Netley-Libau, will be $110/acre. Similarly, operational costs will be approximately $2.50/acre/year. The total expense of impounding 100,000 acres of Lake Winnipeg marshland for the purpose of providing stable waterfowl habitat is $11,650,000; total maintenance and operational costs are $262,500/year (Table 3).

It must be stressed that these figures are very general and are based on cost rates as applied to present management proposals for marshes throughout southern Manitoba.

This is a scheme to impound all major marshes on the lake; it does not consider alternatives. A scientific approach to the many problems inherent with each marsh complex is essential to a precise evaluation. Alternative schemes of marsh management that should be considered are:

1. Fore-dyking, no compartments
2. Inlet manipulation, no compartments
3. Carp-screens
4. Natural system; allow the marsh to adjust to the flow

Any one system of management probably will not achieve maximum results. Combinations of these systems, based on a sound scientific study of each marsh unit, would give greatest efficiency. Costs could possibly be reduced and waterfowl may

Table 3. Estimated minimum costs of impounding and managing the major marshes of Lake Winnipeg.

Marsh	Acreage[a]	Costs ($)	
		Construction	Maintenance (per yr.)
Netley-Libau	55,000	6,700,000	150,000
Willow Point	2,200	242,000	5,500
Riverton	5,400	594,000	13,500
Hecla Island	6,100	671,000	15,250
Washaw Bay	4,500	495,000	11,250
Sturgeon Bay	15,000	1,650,000	37,500
Grand Marais	900	99,000	2,250
Victoria Beach	550	60,500	1,375
Beaconia	1,100	121,000	2,750
Fisher Bay Long Point Limestone Bay	9,250[b]	1,017,500	23,125
Total	100,000	11,650,000	262,500

[a] From Townsend (1969)

[b] Extrapolated total

receive maximum benefits.

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INFORMATION concerning costs of construction of marsh impoundments and controls were donated by personnel of the Manitoba Department of Mines, Resources and Environmental Management, Ducks Unlimited, Delta Waterfowl Research Station, and the Canadian Wildlife Service.