WETLAND HABITATS OF THE DICKEY-LINCOLN SCHOOL LAKES PROJECT, MAINE

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1. INTRODUCTION

Wetland types within the St. John watershed serve a wide range of functions depending upon their location, topography, soils, geology, hydrology and vegetative types. A primary function is providing habitat for species of wildlife. An inventory and evaluation of existing wetland environments in the Dickey-Lincoln project area emphasizes the values of the riverine systems and their floodplains. Approximately 7,702 acres of wetlands and deep-water habitats would be inundated by the proposed lakes (USCE, 1977). Evaluation of these wetland losses, surrounding wetland habitats, and the shoreline environments of the proposed lakes is the basis for considering future wetland management alternatives.

2. EXISTING WETLAND AND DEEP-WATER HABITATS

Wetland types and deep-water habitats such as ponds and major rivers in the Dickey-Lincoln area were mapped during the terrestrial ecosystem analysis (USCE, 1977). Delineation of these types was based upon stereoscopic interpretation of color-infrared photography (scale 1:20,000) with ground verification. This methodology provided excellent resolution of water bodies and wetland vegetation types covering greater than 2.5 acres (1 hectare). Key permanent wetland complexes were recognized during mapping. Although beaver impoundments are often too small to be effectively mapped, they contribute to the existing wetland habitats in heavily forested areas.

The importance of wetland types is often expressed in terms of their wildlife habitat value. In the Northeast, vegetation is considered the most important component when evaluating the importance of wetlands as wildlife habitat (Golet and Larson, 1972). Life form (i.e., physical structure or growth habit) is recognized as being more suitable than species composition in defining the vegetation component of wildlife habitat (Golet and Larson, 1972). Water depth and seasonal flooding are factors that influence vegetation development. Seasonal flooding is particularly significant within the St. John watershed due to the extensive riverine systems and meteorological conditions. Many other factors influence the overall value of a wetland type, therefore, each wetland type, their distribution, and their combined wildlife values are discussed separately in this text. Based upon these overall values, key wetland areas within the Dickey-Lincoln project area are presented.

2.1 Descriptions of Wetland Types

The classification of wetlands implies certain general characteristics for each type. Wetland delineations on the vegetation cover map (USCE, 1977) follow a classification system (McCall, 1972) which was adapted from "Wetlands of the United States" (Martin et al., 1953). Principal components of the system are the dominant form of vegetation, water depth during the growing season, and degree of seasonal flooding. The following descriptions recognize that certain characteristics of these components can be applied more specifically to types typical of the St. John watershed. In all cases, however, each wetland will have some individual characteristics.

Type 1 Seasonally Flooded Flats

Flats occur along river courses where flooding ordinarily occurs in spring or late fall. The soil is covered with water or is waterlogged during seasonal periods, but is usually well drained during the growing season. Typical vegetation is grasses, short meadow emergents, and bushy or tall slender shrubs.

In the St. John River basin, there is considerable seasonal variation in runoff. Seasonal flooding is greatest during the months of April, May, and June. When the water subsides, grasses flourish on many islands and flats adjacent to the rivers. Except for their floodplain location, the seasonally flooded flats appear very similar to the meadow type. Areas subject to only temporary flooding rarely develop any wetland vegetation. Shrub complexes dominated by speckled alder (*Alnus rugosa*), willow (*Salix* spp.), and red-osier dogwood (*Cornus stolonifera*) often develop on uplands adjacent to seasonally flooded flats.

Type 2 Meadow

Meadows occur in shallow basins with soil waterlogged to within a few inches of the surface but without standing water most of the growing season. They may also be found on the landward side of shallow marshes (type 3). In some cases former beaver ponds pass through a typical meadow stage of succession.

In the St. John River watershed, large shallow basins within the river floodplains best represent this type. They commonly have characteristics transitional between seasonally flooded flats and shallow marshes. Broad shallow basins adjacent to rivers such as the Little Black have standing surface water during spring runoff, however, they drain early in the growing season. A heavy cover of emergents such as sedges (Cyperaceae), rushes (Juncaceae), and grasses (Gramineae) occur in these meadows. Tussocks of emergents are common in wetter areas.

Type 3 Shallow Marsh

Shallow marshes occur in shallow basins or border deep marshes. Soils are usually waterlogged and often covered with 6 inches or more of water during the growing season. The type may be dominated by robust or marsh emergents. Permanent waters may support submergents and floating-leaved plants. Plant cover is generally more than 50 percent and may cover as much as 90% of the marsh area.

Shallow marshes dominated by narrow-leaved emergents such as bur reeds (Sparganium spp.), bulrushes (Scirpus spp.), and sedges are the typical subtype in the project area. Scattered shrubs are common associates. Secondary beaver impoundments that may be above or below the main dam often create the water regime found in shallow marshes, but the vegetation cover is not well developed. Shallow marshes located in the river floodplains in the project area have high spring water levels similar to deep marshes, but they soon return to shallow marsh conditions during the growing season.

Type 4 Deep Marsh

Deep marshes occupy shallow lake basins and ponds, or border large open water bodies. Average depth is between 6 inches and 3 feet during the growing season. Emergent marsh vegetation or aquatic shrubs dominate shallow water areas. Surface and submergent plants may occur in open water areas.

In the Dickey-Lincoln project area deep marshes occur in old oxbow channels or riverside basins. Aquatic shrubs such as speckled alder and red-osier dogwood will commonly border the type. Beaver impoundments with standing dead trees and shrubs are a deep marsh subtype. Emergent cover is usually limited in the dead woody marshes. Beaver ponds were not recognized as a distinct class because most were less than 2.5 acres and relatively impermanent.

Type 6 Shrub Swamp

This type applies to wetlands dominated by shrubs where the soil is seasonally or permanently covered with a foot or more of water. In the Dickey-Lincoln project area, they occur commonly in floodplain basins and along sluggish or diffuse streams. Three subtypes are found in the project area: 1) tall, slender shrubs dominated by mature speckled alder, 2) bushy shrub swamps including red-osier dogwood, willows and young alders, and 3) compact shrub swamps dominated by sweet gale (*Myrica gale*), leatherleaf (*Chamaedaphne calyculata*) and meadowsweet (*Spiraea* spp.).

Type 7 Wooded Swamp

Wooded swamps occur on flat uplands, shallow lake basins and along sluggish streams. Soils are normally waterlogged but may be seasonally flooded with a foot or more of water.

Coniferous swamps composed of northern white cedar (*Thuja occidentalis*) are representative of this type in the project area. Tamarack (*Larix laricina*) and black spruce (*Picea mariana*) are associate species. Sphagnum moss (*Sphagnum* spp.) is a dominant ground cover in the coniferous swamps.

Type 8 Bogs

Bogs occur most often in upland basins with blocked or closed drainage. They are normally saturated but not usually covered with water. The substrate contains an accumulation of partly decomposed or disintergrated remains of plants. A spongy mat of sphagnum mosses usually covers the bog. Woody plants including ericaceous shrubs and coniferous trees may also occur. Open water areas within bogs are invaded by a floating mat as well as being filled by organic matter.

Most bogs in the project area are covered by the characteristic mat of sphagnum moss with surrounding zones of shrubs and coniferous trees. Common shrubs include bog rosemary (Andromeda glaucophylla), labrador tea (Ledum groenlandicum), and sheep laurel (Kalmia angustifolia). Stunted black spruce are often scattered in these bogs. Mature black spruce commonly surrounds the basins.

Type 4110 River

The major river systems in the project area (St. John, Big Black and Little Black Rivers) are included in this category. The riverine classification includes all wetlands and deep-water habitats within the river channel except islands. Wetlands not within the channel but influenced by the flooding river are classified separately. Wetland and deep-water habitats of the river channels are strongly influenced by water depth and seasonal flow. Interspersion of herbaceous vegetation, shrubs, and trees along the rivers creates a diverse riparian ecotone.

Type 4220 Pond

This category includes ponds and small lakes with permanent open water. Ponds in the project area are generally 3-12' deep (USCE, 1977). Marsh vegetation, shrubs, and conifers border the open water. In shallow-water areas (less than 6 feet) aquatic vegetation develops.

2.2 Distribution of Wetland Habitats Within the Study Areas

The distribution of wetland types was presented graphically by the vegetation mapping of the Dickey-Lincoln project area (USCE, 1977). Wetland acreages were summarized for Dickey and Lincoln School Reservoir areas, and a 2-mile study area surrounding the lakes. In addition, vegetation maps and acreages are available for the "limited access" area (see Figure 2.1). The combined mapping effort provided land cover and wetland types for over a half a million acres in the project region.

Wetland acreages for the separate study areas (Table 2.1) indicate the general wetland distribution within the St. John watershed. Acreages within the proposed impoundments reflect the dominance of the riverine systems in the lower valley. River systems represent 6.6% of the land

TABLE 2.1

SUMMARY OF WETLAND TYPES

Wetlands Types[1]:	Dickey[2] Reservoir acres	Lincoln School[2] Reservoir acres	Study Area[3] acres	Limited Access Area[4] acres
Type 1 - Seasonally flooded flat	427	158	610	109
2 - Meadow	146		238	
3 - Shallow marsh	216		333	30
4 - Deep marsh	60		83	15
6 - Shrub swamp	385	3	485	79
7 - Wooded swamp			38	
8 - Bog	318		880	438
4110 - River	4,613	1,081	6,063	
4220 - Pond	295		600	253
TOTAL	6,460	1,242	9,330	924

[1]Types according to McCall, C. A. 1972. Manual for Maine wetlands inventory. Maine Dept. of Inland Fisheries and Game.

[2]Reservoir areas cover 83,886 acres for Dickey (913 elev.) and 2,619 acres for Lincoln School (620 elev.).

[3]Study area total 390,118 acres which includes the reservoir areas and two areas surrounding the project.

[4]Refers to 183,768 acres of land between the U. S. - Canadian boundary and the proposed reservoir as it inundates (913' elevation) along the Big Black River or Shield Branch and along the Little Black River.

area and 74% of the existing wetland and deep-water habitats within the proposed impoundment areas. Excluding rivers and ponds, existing wetlands types represent 2% of the lower valley. If the reservoir acreages are excluded from the original study area, the extent of adjacent upland wetlands can be derived. Within this 2-mile border, wetland and deep-water habitats cover 0.5% of the land area. Upland wetlands also cover 0.5% of the limited access area between the Dickey Reservoir and the Canadian border.

Physiographic and hydrologic position greatly influence the distribution of specific wetland types in the St. John watershed. In the lower valley (i.e., reservoir areas), seasonally flooded flats are the dominant type (27%), however, other wetland types are well represented. In contrast, bogs are the dominant type in the 2-mile upland border (60%) and limited access area (47%). When evaluating the existing upland wetland habitat, it must be recognized that beaver ponds less than 2.5 acres were not included in the mapping. Considerable beaver activity occurs on most streams within the project area. Therefore, beaver ponds are assumed to be important additional wetland habitat in upland areas based upon the fact that there are 3,450 miles of intermittent and flowing streams in the upper St. John River basin above the proposed dam sites (USCE, 1977).

2.3 Wetland Values

Although the value of wetlands for wildlife is emphasized, wetlands are valuable for their contribution to botanical diversity within the St. John watershed. Most notably, the St. John River riparian zone exists as an important habitat for rare and unusual plant species (USCE, 1977). In the uplands, bogs represent a contrasting stage of succession with unique botanical associations. Species such as pitcher-plant (*Sarracenia purpurea*), sundew (*Drosera rotundifolia*), lady's slippers (*Cypripedium* spp.) and bog rosemary are usually restricted to bogs. In general, all wetlands contribute to the vegetative diversity in the heavily forested project area.

The relative importance of wetlands for wildlife can be derived from their wetland classification and location in the St. John watershed.

Certain values for each type are implied from the criteria used in classifying the wetlands: dominant vegetation form, water depth during the growing season, and degree of seasonal flooding. The value of any wetland type is greatly influenced by three location factors: physiographic location, hydrologic position, and juxtaposition with other wetland and habitat types. In general, vegetative diversity within the wetland and surrounding habitat encourages wildlife diversity. A variety of plant life-forms (i.e., physical structure and growth habit) is critical for bird and waterfowl diversity (MacArthur and MacArthur, 1961; Golet and Larson, 1972). Wildlife habitat is enhanced by the "edge" created by an interspersion of different plant life-forms. Population density and wildlife species diversity are closely related to the length and number of kinds of edge.

Water depth is important as it influences vegetation types and availability of underwater food. A water depth of 2 meters is considered the boundary between wetland and deep-water habitats. This depth represents the maximum limit for the growth of emergent plants (Sculthorpe, 1967; Cowardin et al., 1977).

Seasonal flooding is a key factor influencing vegetation development and food availability in many wetland areas. For migrating waterfowl, seasonal water levels is a key factor affecting the abundance of a particular food item (Mendall, 1949). Spring food sources are available to migrating waterfowl in seasonally flooded flats that are not normally available other times of the year. The seasonal flooding promotes herbaceous and shrub communities which are valuable to upland species.

On a watershed basis, wetland values are often related to regional physiography. Geologic substrate and often the size and abundance of wetlands are determined by physiographic location. Typical of the glaciated Northeast, wetlands at lower elevations occur on alluvium and glacial outwash. At higher elevations, wetlands often occur on shallow glacial till, particularly on the southwest side of the Dickey-Lincoln area. Outwash and till are found on the central upland northwest of the Dickey Reservoir area (McKim and Merry, 1975). Wildlife value is usually higher in bottomland than in upland wetlands for several reasons. Nutrients for plant growth are usually higher in the alluvium deposits. Sediments are annually deposited on seasonally flooded areas. Bottomland wetlands are usually maintained by a regional water table that allows the inflow and outflow of nutrients through surficial deposits. Upland wetlands located on till have a perched water table. These till soils commonly have a "hardpan or fragipan" restricting water movement 12-18" below the surface (McLintock, 1957). The perched wetlands are short-lived, subject to greater water-level fluctuations, and often accumulate plant remains under acid conditions.

A wetland's wildlife value depends upon its hydrologic position which may be isolated, streamside, lakeside or deltaic. Wetlands adjacent to deep-water habitats have greater value than isolated wetlands. Open water areas provide resting and feeding areas for waterfowl but their value for other wildlife is limited by the lack of emergents. Streamside wetlands usually undergo wide water level fluctuations between early spring and late summer. Severe fluctuation can affect nearly all breeding wildlife. Despite water level fluctuation, streamside locations are valuable to waterfowl because it provides an avenue of travel between feeding and nesting areas. Deltaic wetlands have high wildlife value derived from both streamside and lakeside locations (Golet and Larson, 1972).

Wetland juxtaposition is a feature determining wildlife value. Juxtaposition with other wetlands increases wetland values especially if it means a greater interspersion of vegetative life-forms. The same principal applies to surrounding habitats. Wildlife often require certain types of surrounding habitat for food and cover.

Much of data for evaluating wetlands in the Dickey-Lincoln area is documented on existing vegetation, topographic and geologic maps; and recent color-infrared aerial photography. Many factors can be used to support wetland value assessments, however, information on type characteristics and location provides a basis for evaluating wetlands over the large project area.

2.4 Key Wetland Areas

All wetlands contribute to the diversity of vegetation and habitat types in the St. John watershed. A variety of wetland types is desirable so that rating wetlands is essentially a relative comparison based upon their potential for maximum production and diversity of wildlife. The following are the significant wetland areas that would be inundated by the reservoirs. These areas are labeled in Figure 2.1.

1) Portion of Little Black River Floodplain
2) Nine-mile Deadwater of Big Black River
3) Lower stretch of Shields Branch
4) Little Falls and Falls Ponds

2.4.1 Little Black Floodplain

The Little Black floodplain from the mouth of Johnson Brook upstream to the mouth of Oxbow Brook contains diverse wetland habitats interspersed with shrub, spruce-fir, and mixed hardwood-softwood types. Along this 5-mile stretch, the river meanders with many old oxbows. Shrub swamps and meadows are dominant wetland types as indicated on the vegetation map (USCE, 1977). The broad wetland areas are interspersed with other wetland types including shallow marsh, deep marsh, and seasonally flooded flats. Both the meadow and shrub swamp types occur as broad flood plain basins. Their water regime is influenced by seasonal flooding of the Little Black River and small streams which diffuse through the basins. Old oxbows create deep marsh habitats that were too narrow to be delineated on the vegetation map. Deep marshes are present at Carrie Bogan and are more numerous in the first half-mile downstream from Oxbow Brook.

The Little Black River floodplain exists as an important wetland area due to its extent and interspersion of vegetation types and open water. A diversity of meadow and marsh emergents and shrubs increases the value of the area for upland wildlife species. The shrub swamps are composed of low compact shrubs including sweet gale, leatherleaf, and meadowsweet. Speckled alder commonly occurs on the river bank and seasonally flooded flats.

Open water areas are associated with both the meadow and shrub swamps. The river is valuable to waterfowl as a travel way between the wetland complexes. This broad floodplain area is also part of a large winter deer yard area.

2.4.2 Nine-mile Deadwater of the Big Black River

The Nine-mile Deadwater of the Big Black River is another example of large wetland complexes associated with a major riverine system. The most significant wetlands occur along five miles of river below the mouth of Shields Branch. This wide slow-moving portion of the Big Black River provides a deep-water habitat larger than the Little Black River. Shallow marshes, shrub swamps, seasonally flooded flats, and bogs occupy a significant portion of the floodplain. Shrub types dominated by alder and dogwood are well interspersed with wetlands. Deep marsh portions are found in the large shallow marsh types.

The floodplain area is also important because of its size and interspersion of wetland types. The bottomland location of these wetlands increases their wildlife value. Shallow marshes are a dominant type and offer important wildlife habitat. Bogs are the least valuable wetland habitats within this complex due to their lack of open water.

2.4.3 Shields Branch

Shields Branch meanders for approximately 3 miles upstream from its mouth on the Big Black River. Portions of this floodplain are a half mile wide with intermixed deep marsh, shrub swamp, and shrub types. Deep marsh habitats are principally old oxbows. The area is a distinct contrast to the surrounding spruce-fir forests.

Again, the overall value of the area is related to its size and interspersion of types. The Shields Branch complex could be considered as a continuation of the Nine-mile Deadwater of the Big Black River. The proximity of the wetland complexes and the interconnected rivers increases their wildlife value.

2.4.4 Little Falls and Falls Pond

Little Falls and Falls Pond, excluding the river systems, are the largest deep-water habitats (70 and 263 acres) within the proposed reservoirs. These well oxygenated trout ponds have maximum depths of 6-7'. The maximum depth indicates that these ponds are approaching deep marsh habitat. A depth of 6' is considered the maximum for emergents. Little Falls Pond is surrounded by shrub swamp which provides valuable wildlife cover. Falls Pond exists as the largest open water body with adjacent bog habitat. The wetland juxtaposition increases the wildlife value of the bog.

3. FUTURE WETLAND HABITATS WITH THE PROPOSED PROJECT

3.1 Surrounding Wetland Habitats

Section 2.2 indicates that wetlands are less common in upland areas adjacent to the proposed lakes. Wetland complexes comparable to key areas associated with existing river systems (Section 2.4) do not exist in the surrounding study areas. Bogs are the dominant upland wetland type. Although their percentage of land cover is less, ponds are more numerous in the surrounding study area than in the proposed impoundments. In addition, acreages in Table 2.1 do not include nearby Charles Pond and Depot Lake. The estimated population of 441 beaver within the 2-mile limit compared with 98 beaver within the impoundment (USCE, 1977) suggests that beaver ponds could be a common wetland type in the future.

3.2 Shoreline Habitats of the Proposed Lakes

Wetland habitat values of the proposed lakes are dependent upon characteristics of the shoreline and shallow water zones. The newly filled lakes will be subject to inevitable shoreline modifications. Alteration of the shorelines will be determined by the processes of erosion and sediment transport. The lake configuration, shore substrate, magnitude of waves, lake currents, depth of water near shore, and shoreline slopes will influence lakeside morphology. In addition, the exposed shoreline zone of Dickey Reservoir will change due to annual and seasonal fluctuations of the hydrologic cycle. Lincoln School Reservoir will be subject to daily fluctuations.

Dickey Lake will cover approximately 134 square miles of water surface. It will have 350 miles of extremely irregular shoreline typical of a highly dendritic lake. The St. John River arm has 31 tributaries where major coves will form in the lake. The Little Black and Big Black Rivers have 17 and 16 tributaries, respectively, that will form major coves (USCE, 1977). The dendritic configuration means that wave impacts will vary along the shorelines. Prevailing winds will determine shores exposed to wave impact.

A large deep lake with shores composed of glacial drift is expected to show shoreline terrace formation (Sculthorpe, 1967; Reid and Wood, 1976). Wave-cut action would erode glacial till and outwash materials surrounding the Dickey-Lincoln reservoirs and create a coarse-textured terrace. Till is typically a heterogenous mixture of clay, sand, and gravel. In the project area, it varies from compact clayey silt to loose silty sand. Large cobbles are found below 24 inches (McKim and Merry, 1975). Erosion of till soils would proceed to the coarse materials, however, a dense, compact layer occurring generally 12-18 inches below the surface would often be exposed. This layer, commonly referred to as a hardpan or fragipan, is characteristic of glacial till soils in the spruce-fir region of Maine (McLintock, 1957). It is virtually impermeable to water, but it is expected that an exposed hardpan will erode or break down when submerged. Erosion of outwash will remove very fine to coarse sands. Coarse material greater than 0.75 inches in diameter would be exposed at below 20 inches (McKim and Merry, 1975).

The erosion of fine shoreline material normally results in the development of a second terrace beneath the water. It is expected that the hydrologic cycle of the lakes will affect the second terrace development. As more shoreline is exposed during drawdown, the coarse-textured terrace development will continue. The previously established second terrace of alluvial material would shift to a lower position. Thus lakeside morphology will depend upon the reservoir elevation fluctuations.

The full extent of exposed shoreline for Dickey Lake will depend upon the yearly hydrologic regime. Maximum yearly pool levels would range from the 890-910 elevations (USCE, 1977). Lincoln School Reservoir would have an ultimate 30-foot maximum operating range from elevation 590 to 620 msl. Typical operating conditions would produce fluctuations of about 12 feet weekly. Daily fluctuations are expected to be six to seven feet with maximum rates of change equaling about one feet per hour (USCE, 1977).

Over an entire summer terrace development for Dickey Lake would occur within a 2-foot drawdown zone. In addition, wave heights will increase the zone of erosion. It is predicted that winds during June and July averaging 11-13 m.p.h. would create waves 1-2 feet in height. Waves 2-4 feet could occur during stormy weather such as a thunderstorm (USCE, 1977). Sheltered shores or long shallow flats will be less subject to erosion processes. Drawdown will expose greater shoreline where slopes are gentle. A two-foot drawdown for 1%, 5%, and 20% slopes exposes a shoreline width of 200 feet, 40 feet, and 10 feet, respectively (USCE, 1977).

The proposed project construction includes clearing of vegetation from the maximum pool level (910 elevation) to the 913 elevation. Although partially stabilized by the existing vegetation, the 910- to 913-foot elevation zone will be subject to erosion by wave action. Water table changes are expected to occur in this zone. Water tables would be higher on glacial till where water is normally perched. Shrub and grass-sedge communities would probably dominate the moist areas. Speckled alder, red-osier dogwood and willow are dominant shrub species in moist zones along existing river systems. Alders are also primary invaders of denuded areas with saturated soils (Healy and Gill, 1974). Since they are adapted to a variety of soil types, speckled alder, red-osier dogwood, and willow are expected to be significant lakeside species. Tree species would be expected to regenerate in areas of the 910-913 zone not subject to erosion.

During years of below maximum pool levels, vegetation development could occur on gently sloping or sheltered shorelines. In contrast, normal or wet years would lead to flooding and die-off of revegetated areas. Studies at Quabbin Reservoir in western Massachusetts showed that shoreline exposed by drought became vegetated on moist nutrient rich soils (Miner, 1974). The nature of the forest soils in the project area may create some vegetation establishment problems on exposed shoreline. Glacial till soils supporting spruce-fir are shallow with a hardpan layer often within 18 inches of the surface. Erosion to the hardpan layer would create poor sites for plant development. Species expected to invade exposed shores with fine sediments include bulrushes, smartweeds (Polygonum spp.), spikerush (Eleocharis spp.), nutgrasses (Cyperus spp.), sedge (Carex spp.), sweet gale, steeplebush (Spirea tomentosa) and grasses. Some wind-disseminated herbaceous species can cover an exposed area in one year (Miner, 1974; McDonald, 1955).

In evaluating shoreline habitats surrounding the proposed Dickey Lake, sheltered coves offer the greatest potential wildlife value. The hydrologic regime of Dickey Lake would create an ever-changing continuum of environments intergrading between terrestrial and aquatic systems. However, water levels would be fairly stable during the June-August period. This should allow vegetation establishment in shallow cove areas. Coves with stream inlets could develop deltas. Their formation would depend upon shore and near shore slopes, wave impacts, lake currents, and sediment deposition rates. Sediment deposition from major waterways such as the St. John River, Big Black River, Shields Branch, Chimenticook and Pocwock Streams should encourage delta formation. Initially, emergent species would vegetate these sites. As sediments built up above the water level, shrub communities would be expected to develop.

4. WETLAND MANAGEMENT ALTERNATIVES

Wetland management techniques can be applied to mitigate the loss of diverse wetland complexes and enhance the lakeside environment.

Much of the information on wetland management is directed toward waterfowl management. Wetlands are an important habitat for other species such as deer, moose, mink, otter, beaver, and muskrat. Site selection, installation of physical structures, and food plantings are critical management factors. Proper wetland management can increase wetland values.

4.1 Site Selection

Selection of suitable areas for wetland management should consider engineering and biological requirements. Topography, soils, water supply, and surrounding vegetation are factors requiring field reconnaissance (Spencer, 1968; Atlantic Waterfowl Council, 1963; USDA, 1975). For shallow-water environments, the topography of the area to be flooded should be nearly level and have widely spaced marginal contours (Cook and Powers, 1958). Soils with considerable clay content should be sought. Nutrient levels and soil pH will be a primary concern when managing vegetation.

In general, the project exists in an area considered to have poor soils for small marsh construction (Spencer, 1968). Soils in upland areas are generally acid with low fertility. The water regime on glacial till soils is affected by the presence of a perched water table. Water levels would tend to be less permanent on these sites. Outwash areas found along stream channels and on central uplands northwest of Dickey Lake would provide more stable water regimes.

Key areas for wetland management can be presented on the basis that there would be a need for diverse wetland complexes in the study area. Specific site studies would be needed to determine the actual development scheme.

4.1.1 White Pond and Associated Brooks

White Pond (T13 R15) and an associated bog complex exist on wet outwash. Two streams, White Brook and an unnamed stream, flow in outwash channels to the proposed Dickey Lake (Figure 2.1). The drainage system provides potential for developing diverse interconnected wetlands habitats between Dickey Lake and White Pond. The two stream drainages would provide approximately four miles of management area.

4.1.2 Ed Jones Pond

Ed Jones Pond (T12 R15) exists beyond Seven Islands. Billy Jack Brook and an unnamed stream flow from the pond and adjacent upland to the proposed lake (Figure 2.1). The pond occurs on an alluvial terrace. Approximately 0.75 miles of stream length could be enhanced.

4.1.3 Blue Pond

Blue Pond (T13 R13) and Blue Brook occur on a narrow alluvial terrace that would connect with Dickey Lake (Figure 2.1). The stream length between Blue Pond and the lake would be less than a mile. It offers potential for wetland development along Blue Brook.

In general, small streams in surrounding uplands offer potential wetland enhancement areas. Wetland habitats are particularly valuable in the heavily forested uplands. Man-made marshes 5-10 acres in size provide valuable habitat. Many small marshes are effective in supplying the need for nesting sites. Beavers flowages provide important nesting sites for waterfowl in Maine (Spencer, 1968). Beaver management could provide an effective means of wetland enhancement in the surrounding area. Delta sites provide additional areas for wetland management. The use of physical structures to control sediment deposition or water levels is a desirable wetland management alternative due to the fluctuating hydrologic regime of Dickey Lake. Food planting programs could increase the value of exposed delta zones.

4.2 Structures

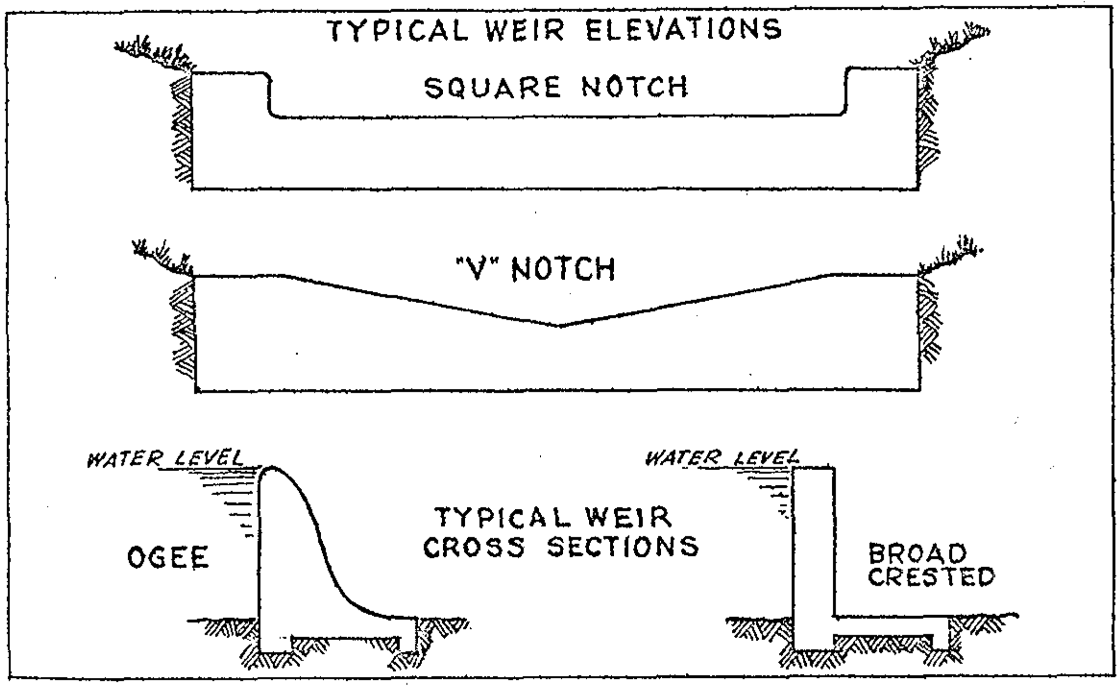
The use of structures to regulate water levels is critical in establishing productive wetlands. Structures designed to remove surface water as opposed to subsurface or bottom water promotes greater wetland fertility (Cook and Powers, 1958). Simple weirs or drop inlet ponds

(Figure 4.1) can provide the necessary structures for most small marsh development in the upland areas surrounding Dickey-Lincoln. Programmed control of water levels can optimize breeding habitat, food and cover for wildlife species (Cringan, 1971; Mendall, 1949). Water level management has been shown to affect food choice of Maine black ducks (Mendall, 1949). Proper use of structures in conjunction with food plantings can increase wetland productivity. Another structural option is to promote beaver ponds, however, they tend to be temporary and are less desirable for food management programs.

Structures can be used to mitigate the fluctuating level of Dickey Lake. The use of dikes at mouths of river inlets would encourage sediment deposition and control water levels for wetland development. Dikes designed to maintain water levels 1-6 feet deep would create shallow marsh to deep marsh wetland types. Structural specifications would be costly and require rock breakwater or floating log booms to prevent soil erosion. Other engineering specifications would depend upon flows of incoming streams.

4.3 Food Plants

Managed wetland habitats would allow effective food planting programs. Controlling water levels is the key to maintaining optimum growth and seed or tuber production of introduced plants (Mendall, 1949). A listing of marsh and aquatic plants in the Northeast Region ranks pondweeds (Potamogeton spp.), bulrushes, smartweeds, and wildrice (Zizania aquatica) as having highest waterfowl usage (Martin et al., 1951). A study in Maine including the St. John River area showed that water bulrush (Scirpus subterminalis) and Torrey's three-square bulrush (S. torreyi) were principal fall and summer foods for black ducks. Bur reeds were next in importance. Sedge seeds and bur reed seeds were predominant spring foods (Mendall, 1949). Wetland foot plants can be supplied for other specific wildlife such as deer. Water-parsnip (Suim suave), water smartweed (Polygonum amphibium) and arrowhead (Sagittaria latifolia) were common species utilized by deer in the Big Meadows area (New Brunswick) along the St. John River (Skinner and Telfer, 1974). Local food studies in the Dickey Lincoln area would be necessary before effective planting programs could be carried out.



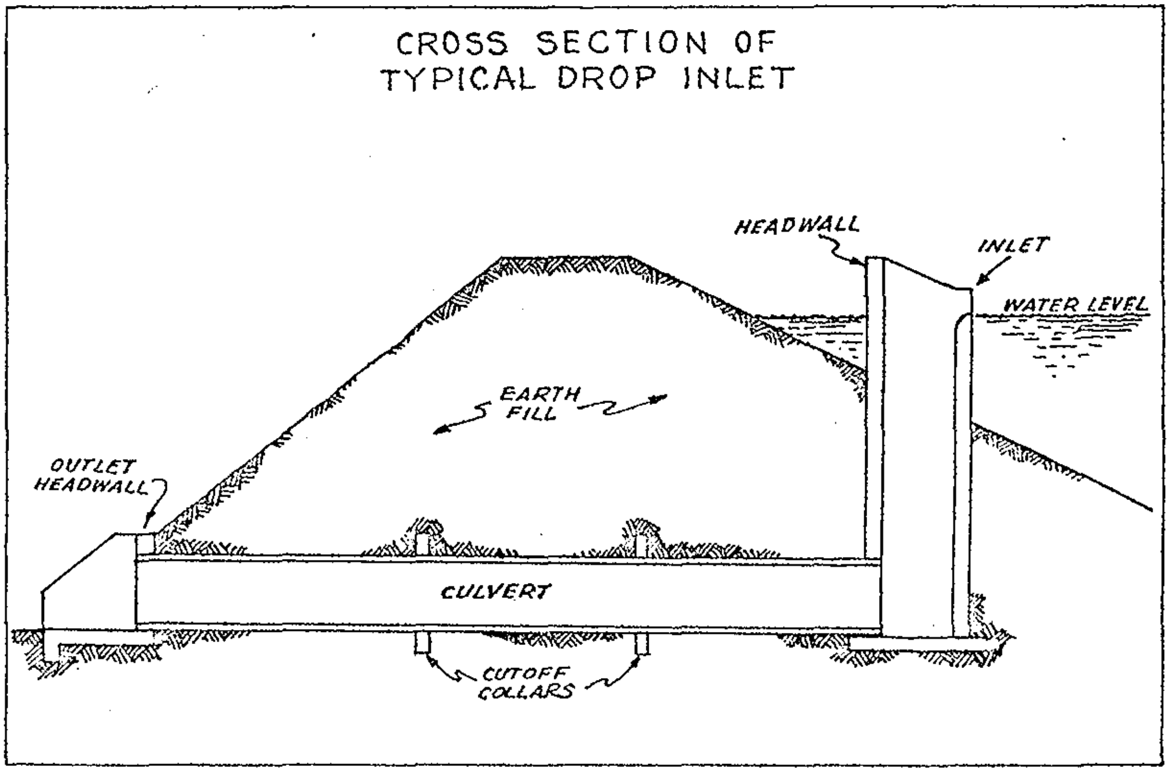


FIGURE 4.1 BASIC STRUCTURES FOR ARTIFICIAL WETLAND DEVELOPMENT (Atlantic Waterfowl Council, 1963)

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