An Assessment of Bird Use and Habitat Conditions of the Russell and Burgess Impoundments, John Lusby Section Chignecto National Wildlife Area

March to August, 1984

C. M. MacKinnon
S. M. Rodda
H. P. Barkhouse

Canadian Wildlife Service
Sackville, N.B.

March, 1985

NWA
Chignecto
12

Environment Canada
Canadian Wildlife Service

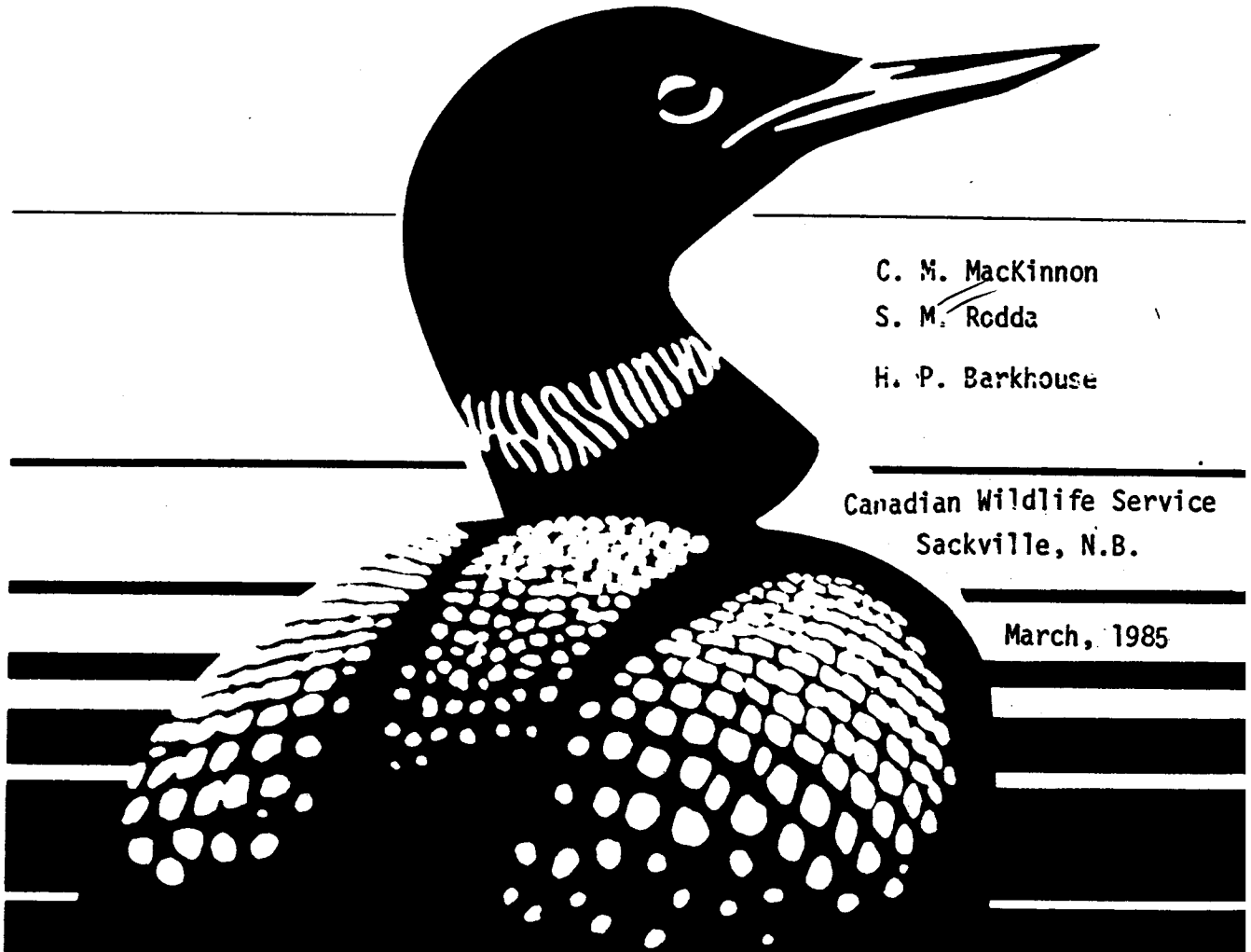
Environnement Canada
Service canadien de la faune

CANADIAN WILDLIFE SERVICE
P. O. BOX 1590
SACKVILLE, N. B.
E0A 3C0

NWA
Chignecto
12

An Assessment of Bird Use and Habitat Conditions of the Russell and Burgess Impoundments, John Lusby Section, Chignecto National Wildlife Area

March to August, 1984



C. M. MacKinnon
S. M. Rodda
H. P. Barkhouse

Canadian Wildlife Service
Sackville, N.B.

March, 1985

Environment Canada
Canadian Wildlife Service

Environnement Canada
Service canadien de la faune

An Assessment of Bird Use and Habitat Conditions of the Russell and Burgess Impoundments, John Lusby Section, Chignecto National Wildlife Area March to August, 1984

Colin MacKinnon
Susan Rodda
Peter Barkhouse
Canadian Wildlife Service
Sackville, New Brunswick

March 1985

Table of Contents

1.0 Introduction

Chignecto National Wildlife Area is located 5 km southwest of Amherst, Cumberland County, Nova Scotia (45 47'N by 64 18'W). The total area of 1095 ha (2705.7 acres) comprises two sections, the Amherst Point Bird Sanctuary and the John Lusby Saltmarsh (Fig. 1).

The John Lusby Marsh was one of the first areas acquired in Canada by the Canadian Wildlife Service as part of its habitat protection program. It is one of the last remaining large saltmarshes along the Bay of Fundy. The site consists of 593 ha (1465 acres) of saltmarsh which was acquired in 1967, and 12 ha (30 acres) of reclaimed marshland that was acquired in 1971. The primary reason for its acquisition was to protect an important Canada Goose migration site.

The marsh was first used for agricultural purposes by Acadian settlers probably during the early eighteenth century. However, in 1947 storm tides broke through the dikes and since then the area has been reverting back to a natural salt marsh.

In the early 1970's two small impoundments were developed by Ducks Unlimited adjacent to the upland (Fig. 1). The Russell impoundment completed in October, 1971 has an area of 8.0 ha (20 acres) and was initially flooded in 1972. The Burgess impoundment completed in November, 1972 has an area of 12.0 ha (30 acres) and was initially flooded in 1974. The Russell impoundment is located on a section of marsh which was protected from tidal flooding for many decades, whereas the Burgess impoundment is located on a section of tidal saltmarsh.

For further background information on the John Lusby saltmarsh refer to Van Zoost (1969), Hounsell (1973) and Barkhouse (1984).

The objectives of this study which was conducted on the Russell and Burgess impoundments from 28 March to 28 August were:

1) To monitor avifauna numbers, especially waterfowl, throughout the period;
2) To monitor basic water quality parameters throughout the study period;
3) To evaluate the composition and abundance of invertebrate fauna and to describe the vegetative covers;
4) To make recommendations for the management of the impoundments.

2.0 Methods

Previous investigations on the John Lusby impoundments have been confined mostly to avifauna counts. Hounsell (1978), Morton (1979) and Barkhouse (1982) made regular counts of waterfowl and other species.

In this study all bird species were recorded during weekly visits to the Russell and Burgess impoundments from 28 March to 28 August. Information on water levels, water quality, invertebrate fauna and vegetation was gathered to further understand the factors which influence the wildlife values of the John Lusby impoundments.

Avifauna counts were conducted at the Russell and Burgess impoundments essentially as described in Morton (1979). Each survey was begun in the southeast corner of the impoundment by conducting a 15 to 30 minute stationary observation. The observer then travelled in a clockwise direction around the impoundment dike. The walk served to make waterfowl more visible by moving them out of the vegetation. Most counts were conducted between 07:30-10:30 AM and were completed within 1-2 hours.

Water samples (500 ml) were collected at 5 sites in the Russell Impoundment and 4 sites in the Burgess Impoundment on each bird survey (Figs. 2 & 3). The samples were returned to the lab and either analyzed immediately or refrigerated for later determination (usually not more than 24 hours).

Analysis consisted of measuring pH with a Digi-Sense pH meter (No. 5994-10) manufactured by Cole-Parmer Instrument Co.; water conductivity (μmho/cm) with a HACH conductivity meter model 2510; and water color (Alpha Platinum Cobalt Units) using a HACH, model co-1, water test kit.

Impoundment water levels were monitored on each bird survey. Measurements were taken from the level of the water to the top level of the control structure. Water depths within the impoundments were measured on 23 May (Burgess, 8 sites) and 25 May (Russell, 11 sites) (Fig. 4) and calibrated to the water levels at the structures.

Invertebrate samples were collected on 25 May and 13 July at the Russell impoundment and 23 May and 13 July at the Burgess impoundment. Eight samples were collected at each impoundment in May and 6 at each impoundment in July (Fig. 2, 3). Samples were collected with a sweep net which consisted of a 25 cm diameter metal rim with a 30 cm deep nylon mesh bag attached to a 130 cm long aluminum handle. Each sweep net sample was collected by making ten figure-of-eight strokes while moving forward so that they did not overlap (total volume sampled was approximately 0.75 m^3). The net was moved constantly from the substrate to the surface while taking the sample. Eight substrate samples were collected at the Burgess and Russell Impoundments on 23 and 25 May respectively using a 20 x 20 cm Eckman grab (Figs. 2, 3).

The collections were placed in labelled plastic bags and refrigerated prior to sorting. Invertebrates were sorted to family or order (Pennak, 1978) and counted. A 500 ml subsample was extracted from each substrate sample for analysis as described above.

A vegetation cover map of each impoundment was prepared which indicated the maximum extent of each principal species for the May to August 1984 period. The cover maps were prepared by using 1:10,000 aerial photographs and field maps sketched during the weekly avifauna surveys. Distribution of plants were mapped in the field and collections were made for identification using Roland and Smith (1969).

3.0 Results and Discussion

3.1 Waterfowl Numbers

Results of the waterfowl surveys conducted at the Russell and Burgess Impoundments from 28 March to 28 August, 1984 are presented in Tables 1 and 2.

Most surveys of the two impoundments were conducted simultaneously and it was found that some waterfowl appeared to use both impoundments. For that reason observations for both impoundments were combined to provide a better understanding of waterfowl use (Table 3).

Green-winged Teal, Black Duck, Northern Pintail and American Wigeon were the most commonly observed species with totals of 447, 908, 252 and 759, respectively. Black Duck and Northern Pintail numbers were highest during the spring staging period with maximums of 145 on 2 April and 38 on 24 May, respectively. Black Duck and American Wigeon numbers were higher in the Russell Impoundment with totals of 666 and 431 birds, respectively. American Wigeon numbers peaked in mid-summer with approximately 100 birds/count between 4-24 July. Their numbers were slightly higher in the Russell Impoundment.

Spring waterfowl activity was greater in the Russell impoundment with a high of 158 birds of four species on 13 April whereas the Burgess Impoundment had its most active day on 28 August with 250 birds of five species.

The Russell Impoundment had the larger number of species with Gadwall, European Wigeon and Scaup species also present.

Green-winged Teal numbers declined through the spring with only 5 birds recorded on 16 May. On 14 May, 4 Blue-winged Teal were observed and their numbers remained constantly low ($\bar{x}$ 4.4 birds/count) throughout the summer, until 20 August when 58 birds were observed. The August increase in Blue-winged Teal numbers coincided with the return of Green-winged Teal to the impoundments. On 20 and 28 August 91 and 255 Green-winged Teal were observed. Hounsell (1978) recorded an average of 36 Green-winged Teal/count from 3 May to 24 August, 1978 which was substantially higher than the numbers observed in 1984.

Some species of waterfowl were observed only for short portions of the study period. For example, Red-breasted Mergansers frequented both impoundments from 19 April to 22 May with a maximum of 68 birds on 27 April. Northern Shoveler were slightly later, being commonly observed between 19 April and 25 June in both impoundments.

Generally the numbers of waterfowl observed on the Russell Impoundment in 1984 were higher than reported by Morton (1979) and comparable to those reported by Barkhouse (1982). The large numbers of wigeon observed throughout July 1984 was an exception as both Morton (1979) and Barkhouse (1982) recorded very few until September.

The numbers of waterfowl observed at the Burgess Impoundment were comparable with those reported by Barkhouse

(1982) in 1980, but less than those recorded by Hounsell (1978) and Morton (1979) (Appendices 5-8).

3.2 Waterfowl Broods

The use of the impoundments by waterfowl broods was very low. Each impoundment had a brood of Black Ducks, and for the third consecutive year a pair of Canada Geese nested in the Burgess Impoundment. Six young were successfully hatched by the pair of geese which nested on one of the man-made islands (closest to the control structure). In contrast to those low numbers, Morton (1979) observed 1 brood of Black Duck, 3 broods of Northern Pintail and 1 brood of American Wigeon on the Burgess Impoundment. He also recorded 1 brood of American Wigeon on the Russell Impoundment.

3.3 Non-waterfowl Species

The species and numbers of birds other than waterfowl observed at the Burgess and Russell Impoundments during 14 May to 28 August, 1984 are presented in Tables 5 and 6.

The Burgess Impoundment had substantially larger numbers of species and birds with 2258 birds of 20+ species compared to 148 birds of 11+ species at the Russell Impoundment. American Bittern, Great Blue Heron and Northern Harrier were the most commonly observed birds on and around both impoundments. A small number (49) of Semipalmated Sandpipers frequented the Burgess Impoundment on 22 and 23 May during their spring migration. They appeared to be feeding mostly on

emerging chironomid larvae.

The largest numbers of birds were observed in the Burgess Impoundment during late July and August. The Burgess Impoundment was unintentionally drained on 29-30 July and the empty impoundment provided habitat for migrating shorebirds that reached peak numbers on 3 August with 1325 birds of 6 species. That was a much larger number of shorebirds than observed by Hounsell (1978) and Morton (1979). They recorded 148 birds of 4+ species on 12 July, 1978 and 152 birds of 4 species on 3 July, 1979 respectively.

Threespine sticklebacks were concentrated in many small pools in the Burgess Impoundment during the period that it was drained and that was probably responsible for the high numbers (16) of Great Blue Heron on 3 August.

Note-worthy species were American Golden Plover (1), Sanderling (2) and Common Tern (1) observed at the Burgess Impoundment on 20, 28 August and 28 June respectively (Table 6).

Species observed frequently, but normally flying over or adjacent to the impoundments, including the American Crow, Swallow species and Bobolinks were probably underestimated in the counts.

3.4 Invertebrates

The composition of invertebrate samples from the Russell and Burgess Impoundments are presented in Tables 7 and 8. Fifteen taxa were identified, but only five were found in significant numbers (Nematods, Amphipods, Corixids, Chironomids and Physa).

Large numbers of Nematods (347) were found only in the 23 May Burgess samples, and not at all in the July samples.

Amphipod numbers in the Russell Impoundment increased from an average of 0.1/sample site in May to 22.8/sample site in July.

Corixids also exhibited this same seasonal fluctuation with an increase in the Burgess Impoundment from 5.0/sample site in May to 49.8/sample site in July.

Chironomid numbers; however, decreased in the Burgess Impoundment and increased in the Russell Impoundment between the two sampling periods of 23-25 May and 13 July.

The numbers of Physa were extremely low in all sampling sites except for one location in the Burgess Impoundment on 23 May (1169 collected). Although the Spartina vegetation around the impoundment perimeters was not sampled, it may also have contained substantial numbers of Physa.

Burgess Impoundment samples contained a small number of Ephydridae (Shore Fly) larvae; a family known to be typical of salt and alkali waters (Pennak, 1978).

The Burgess Impoundment had the largest numbers and variety of invertebrates from both sweep net and substrate samples (Table 9).

3.5 Fish Population

The fish population of the impoundments consisted of Banded Killifish and Threespine sticklebacks.

Banded Killifish were not found in any of the sweep net samples; however, they appeared to be relatively abundant along the edge of the impoundments throughout May.

Threespine stickleback numbers increased significantly as the season progressed and by mid-July their eggs had hatched and large schools of young fry were frequently observed. Adult males defending territories in openings within the algae were a common sight. From the sampling the stickleback population in the Burgess Impoundment appeared to be greater than that in the Russell Impoundment (Tables 7 and 8).

3.6 Vegetative Cover

The vegetative covers of the Russell and Burgess Impoundments were monitored throughout the 1984 study period and the descriptions were compiled to provide one map for each impoundment (Figs. 5 and 6). The development of vegetation followed essentially the same pattern in both impoundments. During May and most of June algae (Enteromorpha sp. and Polysiphonia sp.) covered large portions of both impoundments. In late June there was an increase in water color (Figs. 7 and 8) due to higher levels of suspended particulate matter which corresponded with the end of the 'spring' algae bloom. By early July, Sago Pondweed (Potamogeton pectinatus) was evident in both impoundments (Figs. 5 and 6) and by mid-July a large

seed crop of Sago pondweed had been produced. It is possible that the rapid growth of Sago pondweed in July was the result of an increase in available nutrients following the spring algae bloom. It should be noted, however, that algae remained relatively abundant throughout the summer months.

The Russell Impoundment contains a small, separate pond at its southern limit (Fig. 5). It is essentially a separate aquatic system containing stands of cattail (Typha sp.) and round stem bulrush (Scirpus validus). The conductivity of the pond was considerably lower than the remainder of the impoundment (Appendix 1). Half of the substrate in the Russell Impoundment consists of a thick mat of roots and rhizomes that is believed to be one of the cord grasses (Fig. 5).

During July and August the Burgess Impoundment was covered by a robust crop of Sago pondweed and dense stands of Spartina alterniflora (Fig. 8). The presence of S. alterniflora is indicative of the high salinity levels, and is a result of the low water levels in that impoundment (Fig. 6).

3.7 Water Quality and Levels

Water quality values (conductivity, color, pH) and water levels from May to August for the Russell and Burgess Impoundments are presented in Figures 7 and 8.

Of the four factors, only conductivity and water level were significantly correlated (r^2 = 0.872, p 0.001) (Fig. 9). It appears that the lowering of water levels as a result of

evaporation resulted in higher conductivities due to concentration of dissolved ions. That is significant, for without a source of freshwater the salt concentration within the impoundment may get critically high resulting in the death of less tolerant flora and fauna.

The Russell Impoundment control structure is concrete with wooden stop logs and an outward swinging flapper gate (Fig. 10). The Burgess Impoundment structure consists of a half-round metal pipe that is sunk vertically into a concrete base. The flapper gate on this structure is made of plywood and swings inward (Fig. 11). One of the hinges that holds the gate apparently rusted through resulting in the draining of the impoundment in late July.

The average water depths for the Russell and Burgess Impundments were 32.0 cm and 25.5 cm respectively (Fig. 4) (Appendix 3), which are substantially lower than the generally accepted water level for maximum waterfowl use of 46 cm (18.0 in).

At the present level a significant portion of both impoundments, especially the Burgess, are not flooded at all (Figs. 5 and 6); however, the present Burgess Impoundment structure will not allow additional flooding.

Tidal waters apparently enter the Burgess and Russell Impoundments under certain situations as indicated by previous conditions (extremely high salinity levels), but it was not possible during the investigation to determine the exact nature of those situations. It is possible that high 'spring' tides,

combined with wind action may allow salt water to back up through the control structures and into the impoundments.

The relationship between impoundment water levels and daily precipitation is presented in Figure 12. It is interesting to note that the increase in the Burgess Impoundment water level after it was drained from -95.1 cm below the top of the structure up to -16.0 cm during August, greatly exceed that months total precipitation of 10.0 cm (Fig. 12). During that time the conductivity within the Burgess Impoundment increased dramatically peaking at 45,000 μmho/cm on 3 August and 36,000 μmho/cm on 28 August (Fig. 8). The high conductivities in Burgess Impoundment in conjunction with 'spring' tides recorded on 31 July and 28 August indicates that salt water intrusion did occur.

3.8 Waterfowl Feeding Activity and Food Availability

Direct evidence, such as gut analysis, of waterfowl foods was not obtained during this study; however, information was compiled on waterfowl feeding activity during the course of conducting this investigation.

During May and June the spring chironomid hatch took place. Comments recorded during the 23 May survey at Burgess Impoundment stated, "there were thousands of fly (chironomid) larvae, adults and empty cases at the waters surface." At that time most waterfowl, especially Black Ducks and Northern Shovelers were observed straining food from the waters surface. It appears that those birds were feeding on

chrionomids, especially as it was the only abundant invertebrate present in both impoundments at the time. As waterfowl are basically opportunistic and feed on the most abundant food source (Whitman, 1974), it seems reasonable that the abundant chironomids were a primary food source.

In late June and throughout July Black Ducks "tipped up" more for food and American Wigeon numbers on the impoundments increased. By mid-July Sago pondweed seed production was at, or near, its fullest which appeared to be better on the Burgess Impoundment than on the Russell Impoundment. Waterfowl using the impoundments at that time appeared to be feeding mostly on Sago pondweed seeds. Birds also frequented the partly flooded Spartina alterniflora mats within the impoundments, and it is suspected that they were feeding on the Gastrapod, Physa which were particularly abundant in that location (Table 8).

4.0 Recommendations

4.1 Primary Recommendations

A. The average water level at the Russell Impoundment should be raised by 15.2 cm (6.0"). That would bring the average water depth to approximately 45.7 cm (18.0"). The new water level would then be 64.3 cm below the top of the structure (Fig. 10). This could be accomplished with the present structure by raising the level of the stop logs and removing the flapper gate entirely.

B. The average water depth at Burgess Impoundment should be raised by 20.3 cm (8.0"). That would bring the water depth to approximately 45.7 cm (18.0"). The new water level would then be 19.7 cm above the top of the present structure (Fig. 11). To accomplish that the present structure would have to be altered. It is recommended that the present metal structure be replaced by a concrete one that would allow that additional flooding. Also, it is recommended that the flapper gate not be replaced.

Justification

This greater water depth would be more appropriate for waterfowl and would accomplish the following objectives: 1) the conductivity of both impoundments could be maintained at a lower and more constant level than at present. 2) The greater volume of water and increased water depth would allow greater mixing and thus help prevent stagnation. 3) The increased

water depth would flood the Spartina alterniflora stand in the Burgess Impoundment yielding more suitable habitat. 4) The greater volume of water should provide a more stable aquatic system, allowing aquatic plants and invertebrates to flourish.

Following recommendations 1 and 2, these impoundments could be opened to the tides during key periods to maintain their "brackish water" status. This could be accomplished by : a) opening the control structures during "spring" tides in the spring or fall to "flush out" the impoundments and b) prevent tidal influence for 3 to 5 years and then draw down the impoundment.

4.2 General Recommendations

1. Most of the manmade islands, within impoundments, have been either round or rectangular in shape. Both of these configurations minimize the amount of "edge" available to waterfowl. Further, no attempt has been made to my knowledge to actively vegetate these islands.
   I propose the construction of "horse-shoe" shaped islands with the opening oriented away from the prevailing winds (Fig. 13). This shape would provide a protected cove for waterfowl. Further, if the burrow pits were dug at the "back" of the island (side opposite the cove) this would leave the more productive shallows at the mouth of the horse-shoe.

These islands could easily be seeded to provid more adequate nesting cover and roosts for duck broods. Chaff could be collected from the floors of barns owned by obliging farmers prior to haying season. This mixture of grass seeds would be excellent to initiate a sod cover on recently constructed islands. The labour involved in this process would be minor. After a sod cover of grass was established (1-2 years), willows and other native shrubs could be introduced. The planting of willow would be the easiest and most economical if done in the spring. Slips taken from a live tree can be planted by pushing the cut stem into the ground.

2. Water levels would be easier to maintain if there were a better supply of fresh water reaching the impoundments. A greater flow of fresh water could be balanced with tidal action to achieve the desired aquatic conditions such as water depth and conductivity.

   I propose two methods that could be used to increase the flow of fresh water. For impoundments that border the upland, drainage ditches could be dug parallel to the site and into the impoundment (Fig. 14A). This would increase the size of the impoundments effective watershed. A further possibility for future impoundments would be to erect the dikes in such a way that the impoundment would have its longest side against the upland (Fig. 14B). This would increase the area of the watershed and thus the flow of surface water, due to rain, into the impoundment.

5.0 Literature Cited

BARKHOUSE, H. P. 1982. An Assessment of the Bird Use of Nine Impoundments at Wallace Bay, Chignecto and Tintamarre National Wildlife Areas during the 1980 Breeding and Post Breeding Periods. CWS-AR, Sackville, N.B.

_____. 1984. Management Plan: Chignecto National Wildlife Area. CWS-AR, Sackville, N.B. 30 pp.

HOUNSELL, R. G. 1973. John Lusby National Wildlife Area Management Plan. CWS, Sackville, N.B. 23 pp.

_____. 1979. Avifaunal Use of Selected Impoundments at Four Maritime National Wildlife Areas, CWS, Sackville, N.B.

MORTON, L. D. 1980. 1979 Avifaunal Census Results for Shepody, Chignecto, and Cape Jourimain National Wildlife Areas, CWS, Sackville, N.B. 27 pp.

PENNAK, R. W. 1978. Fresh-water Invertebrates of the United States. New York; Ronald Press. 769 pp.

ROLAND, A. E. and E. C. SMITH. 1969. The Flora of Nova Scotia. The Nova Scotia Museum, Halifax, Nova Scotia. 745 pp.

VAN ZOOST, J. R. 1968. The Ecology and Waterfowl Utilization of the John Lusby NWA. Unpublished M.Sc. Thesis, Acadia University, Wolfville, N.S.

WHITMAN, W. R. 1974. An Invertebrate Sampling Scheme for Different Age Impoundments in the New Brunswick-Nova Scotia Border Area. CWS, Sackville, N.B. 9 pp.

Figure 1.

Figure 1. Chignecto National Wildlife Area, John Lusby Section showing locations of Burgess Impoundment (12 ha) and Russell Impoundment (8 ha).

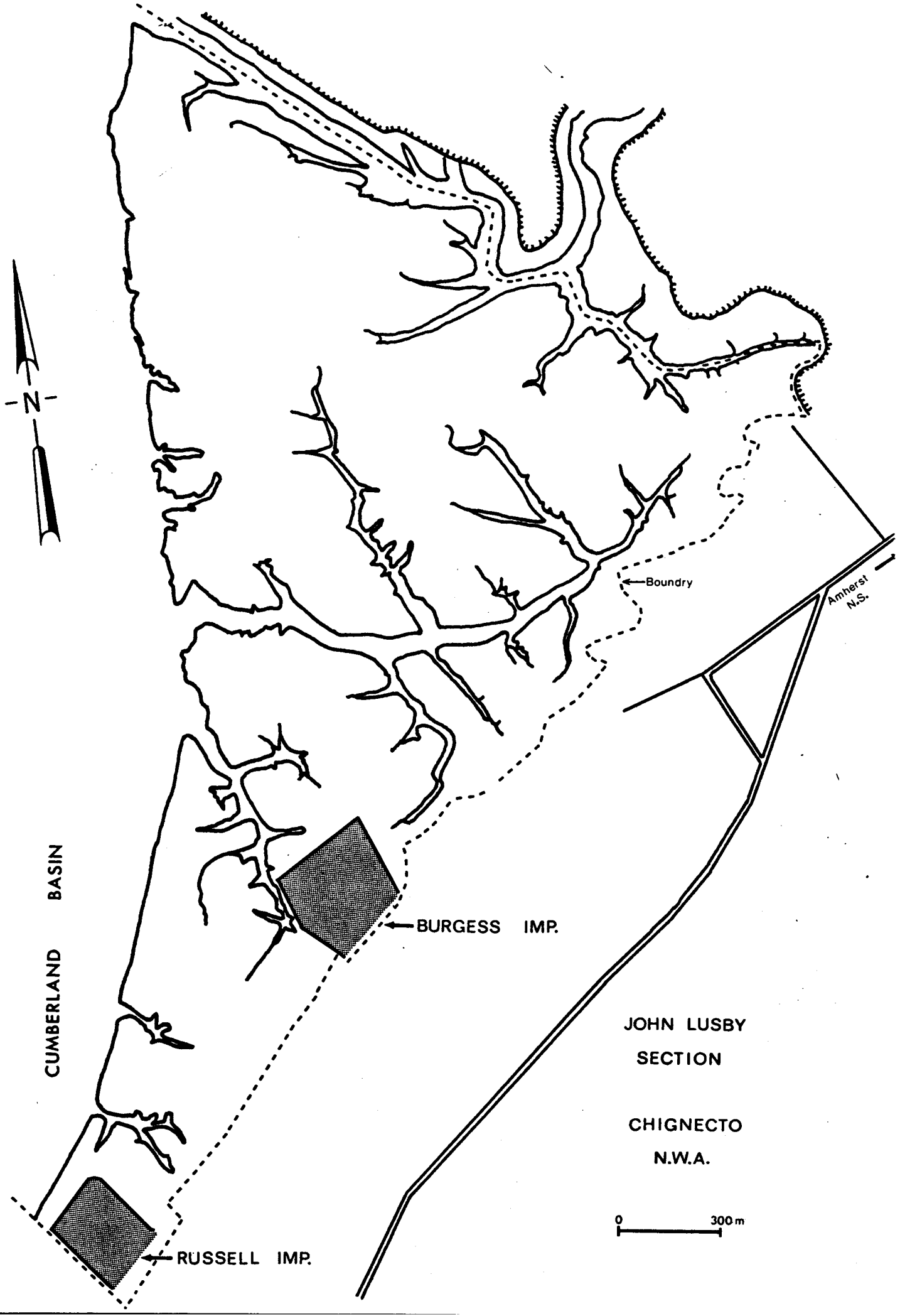

N
Boundry
Amherst
N.S.
CUMBERLAND BASIN
BURGESS IMP.
RUSSELL IMP.
JOHN LUSBY
SECTION
CHIGNECTO
N.W.A.
0
300 m

Figure 2.

Figure 2. Russell Impoundment, locations of Invertebrate sampling sites (■) and water sampling locations (W).

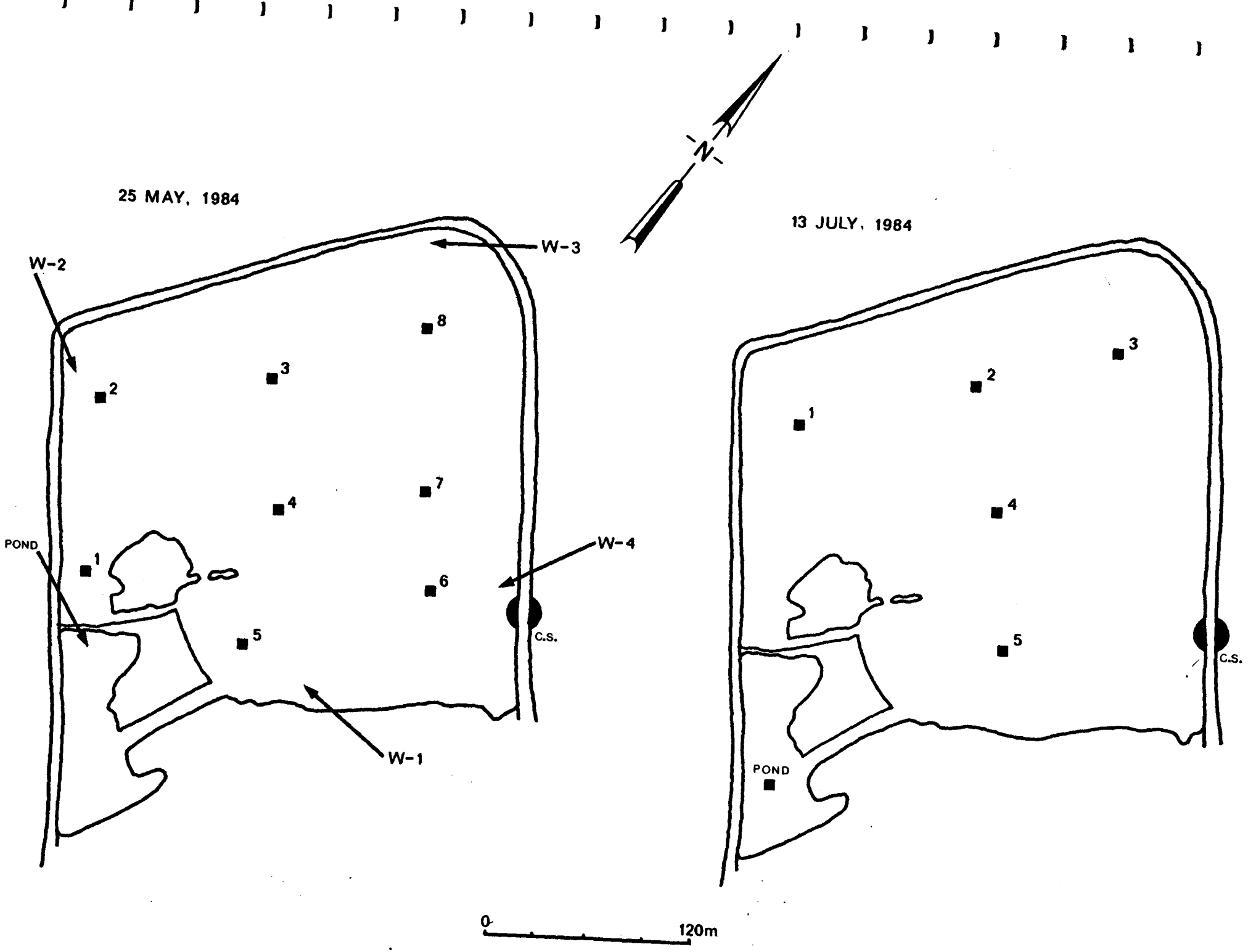
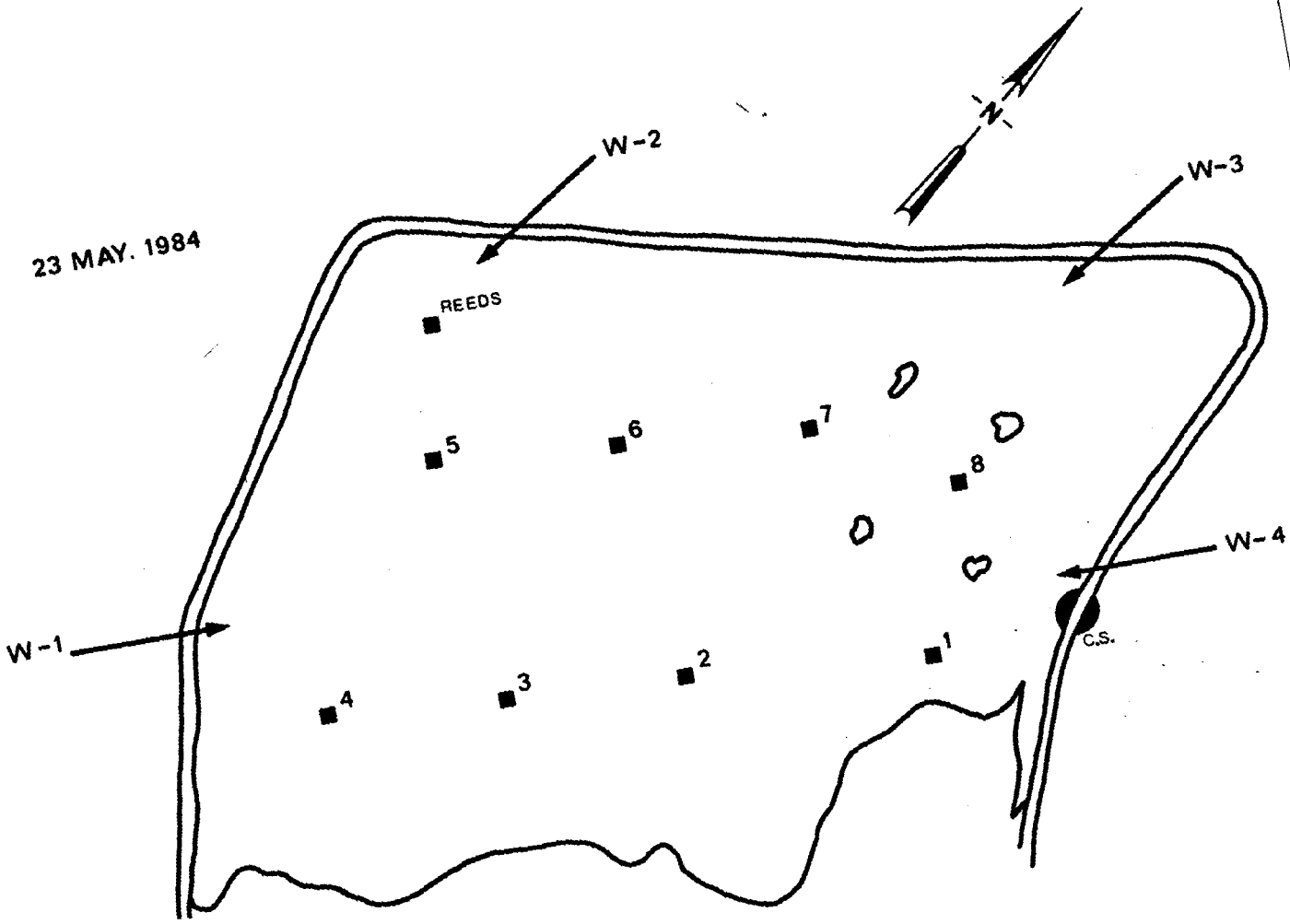
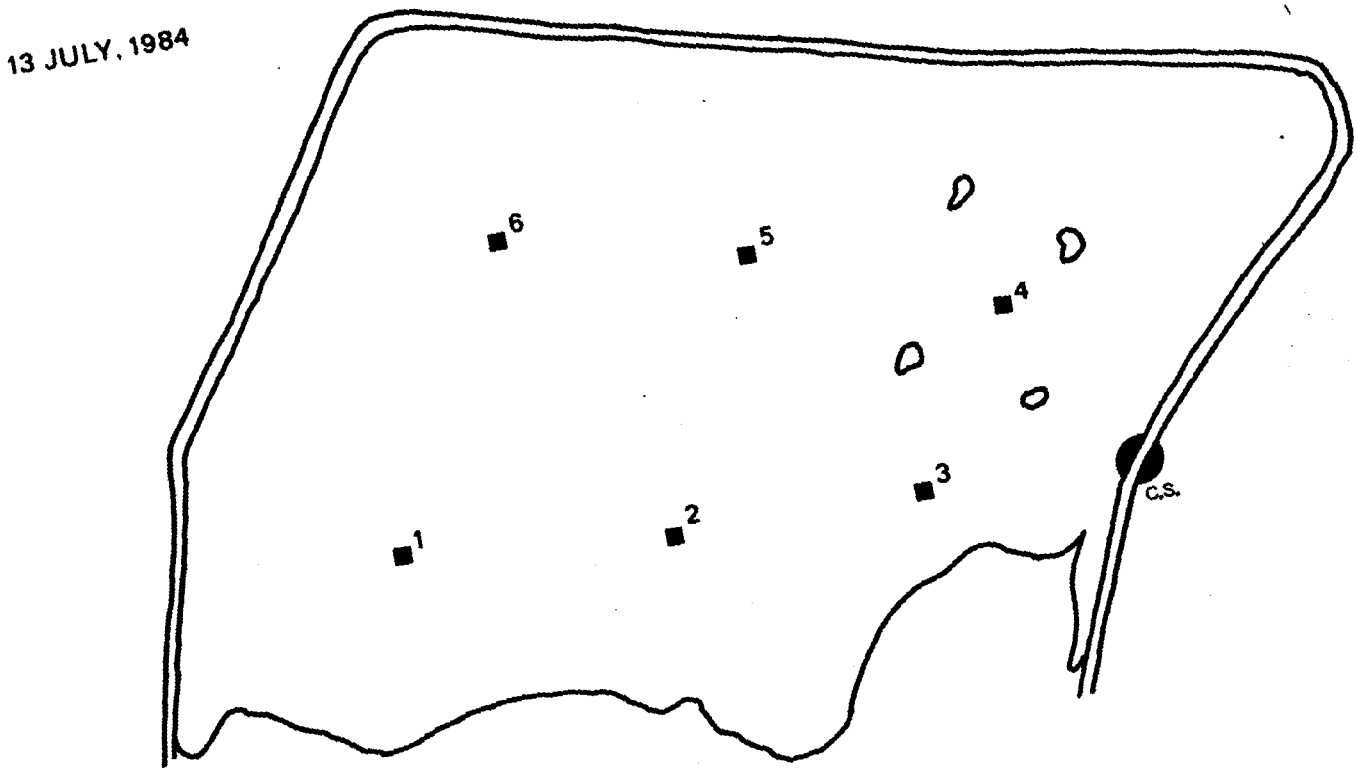

25 MAY, 1984
13 JULY, 1984
N
W-1
W-2
W-3
W-4
POND
C.S.
1
2
3
4
5
6
7
8
0
120m

Figure 3.

Figure 3. Burgess Impoundment, locations of Invertebrate sampling sites (■) and water sampling locations (W).


23 MAY. 1984
N
W-1
W-2
W-3
W-4
REEDS
1
2
3
4
5
6
7
8
C.S.


13 JULY. 1984
1
2
3
4
5
6
C.S.

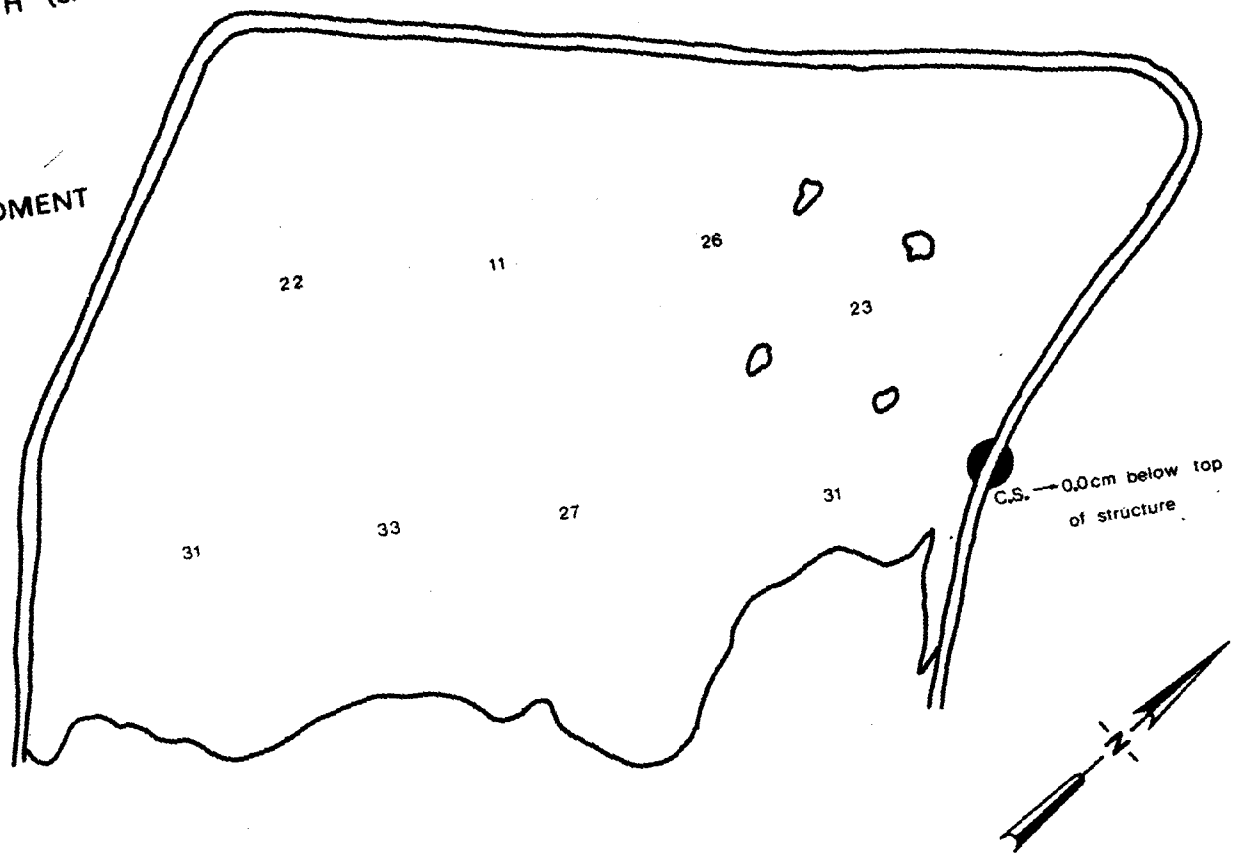
0 120m

Figure 4.

Figure 4. Water depth (cm) at sites within the Burgess and Russell Impoundments. Water levels are at normal operating levels (level with stoplogs).

C.S. = Control Structure

WATER DEPTH (cm)



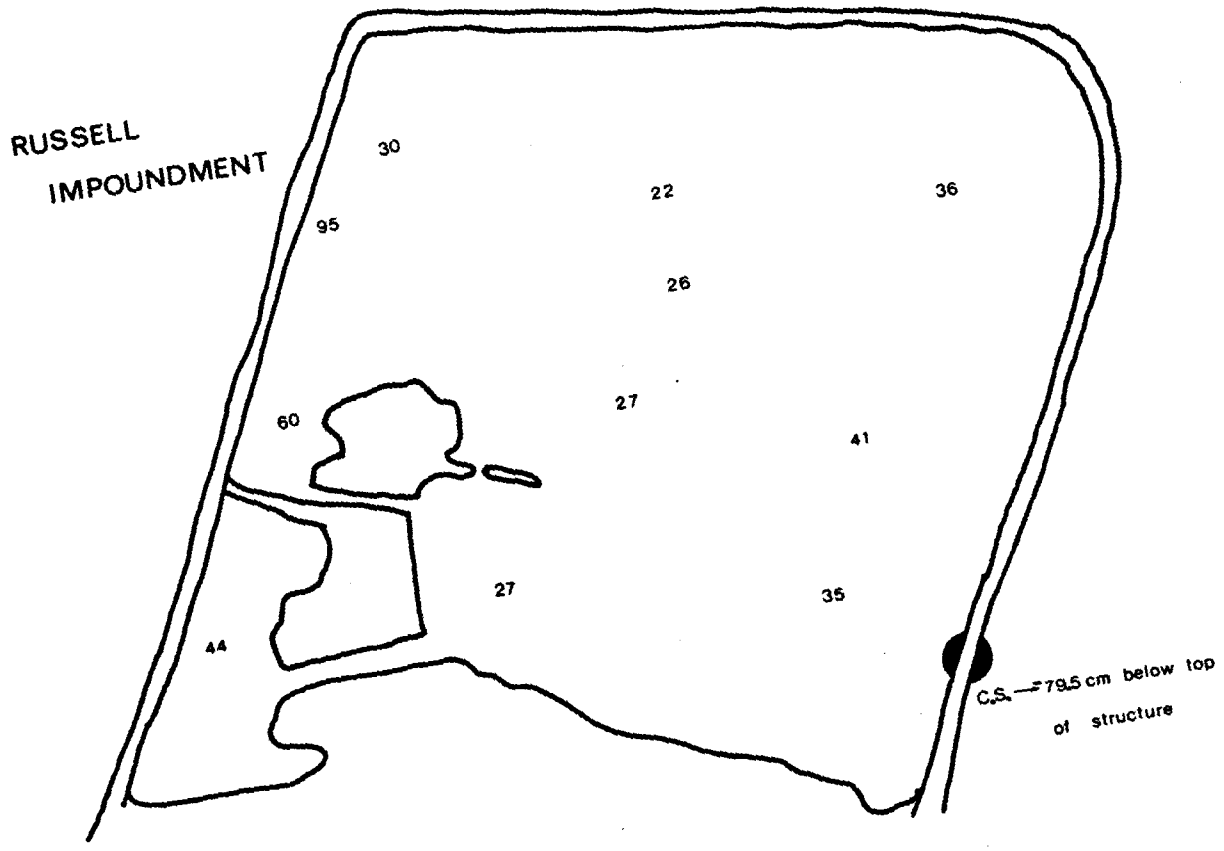


Figure 5.

Figure 5. Vegetation cover map of Russell Impoundment showing locations and maximum extent of principal species during May to August, 1984.

RUSSELL IMPOUNDMENT 1984

LEGEND

Cattail (*Typha* sp.)

Scirpus validus

Algae (*Enteromorpha* sp. *and* *Polysiphonia* sp.)

Potamogeton pectinatus

Spartina pectinata

Substrate of Matted Roots

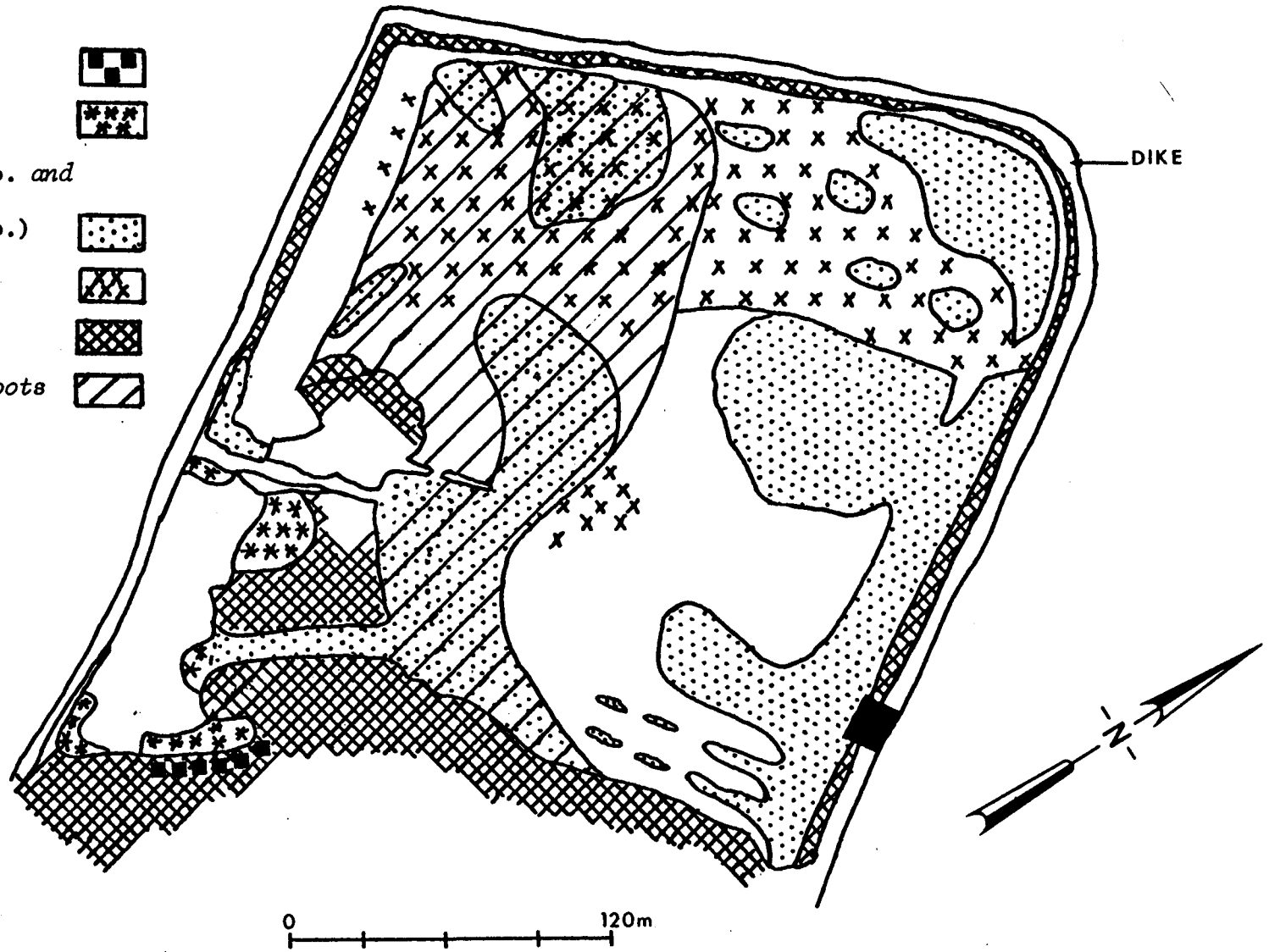


Figure 6.

Figure 6. Vegetation cover map of Burgess Impoundment showing locations and maximum extent of principal species during May to August, 1984.

BURGESS IMPOUNDMENT 1984

LEGEND

Algae (*Enteromorpha* sp. *and*
Polysiphonia sp.)

Potamogeton pectinatus

Zannichellia palustris

Spartina pectinata

Spartina alterniflora

>50%

<50%

Islands

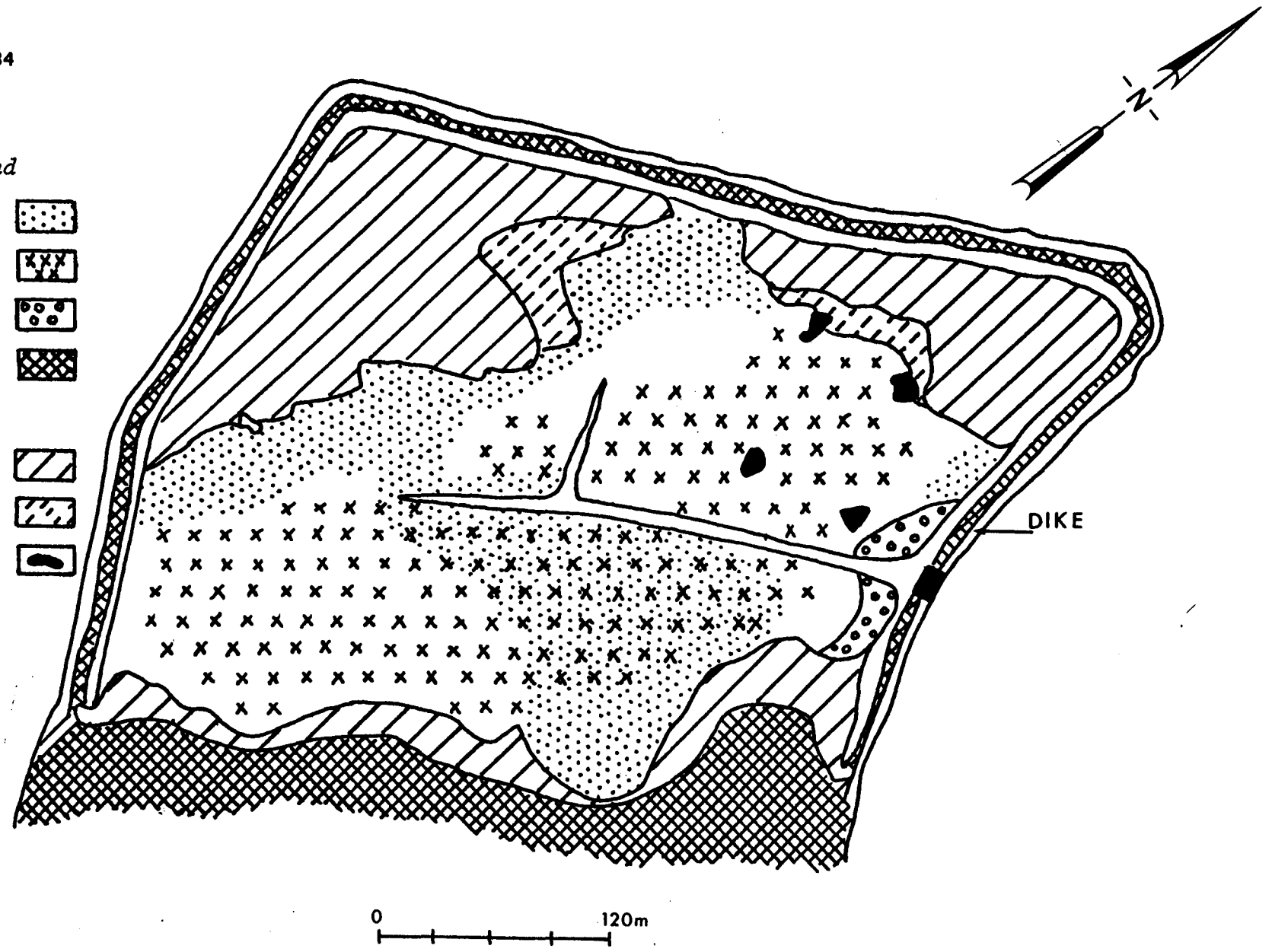


Figure 7.

Figure 7. Water quality values and water levels for Russell Impoundment, May to August, 1984.

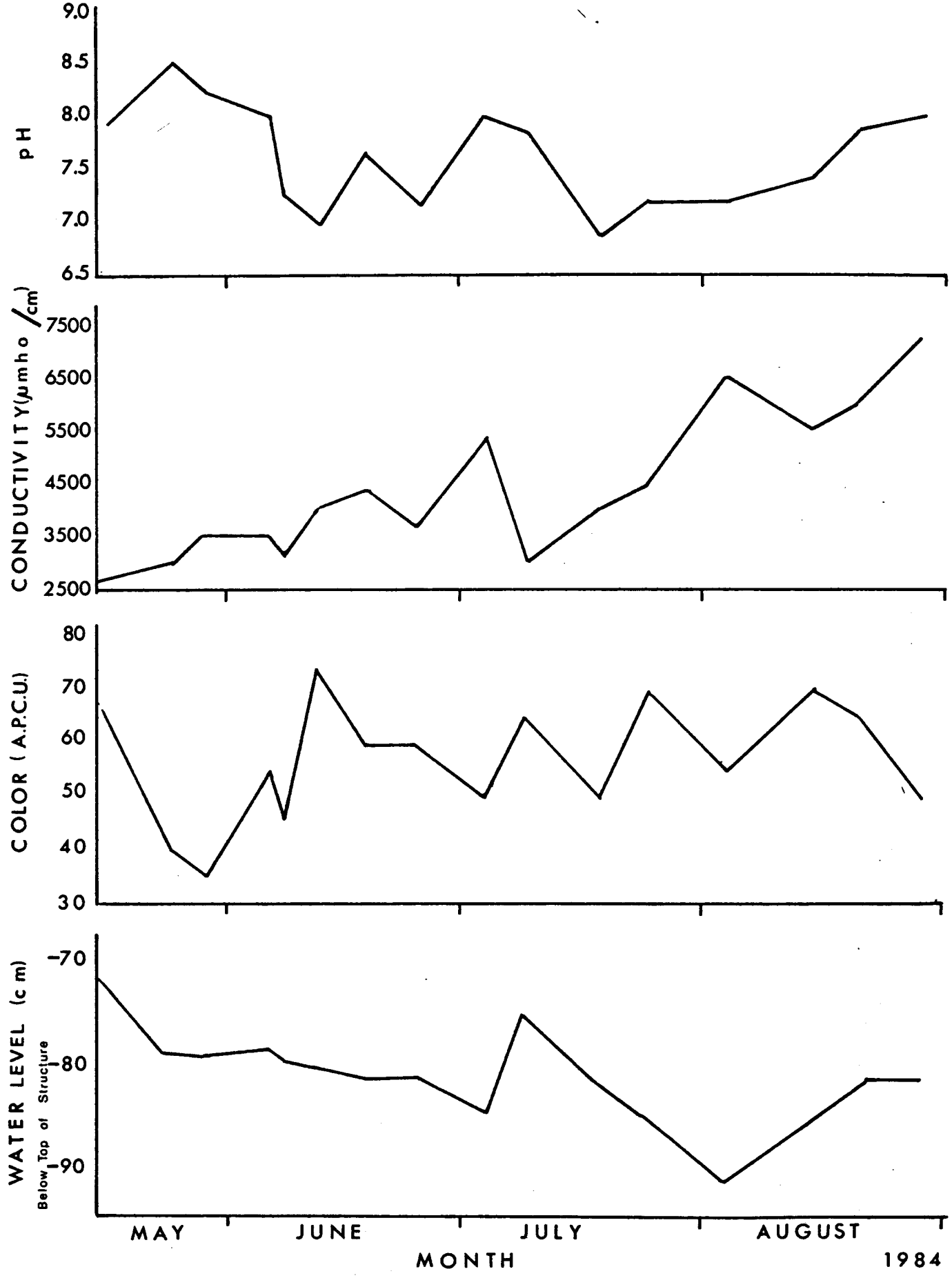

9.0
8.5
8.0
7.5
7.0
6.5
pH
7500
6500
5500
4500
3500
2500
CONDUCTIVITY(μmho/cm)
80
70
60
50
40
30
COLOR (A.P.C.U.)
-70
-80
-90
WATER LEVEL (cm)
Below Top of Structure
MAY
JUNE
JULY
AUGUST
MONTH
1984

Figure 8.

Figure 8. Water quality values and water levels for Burgess Impoundment, May to August, 1984.

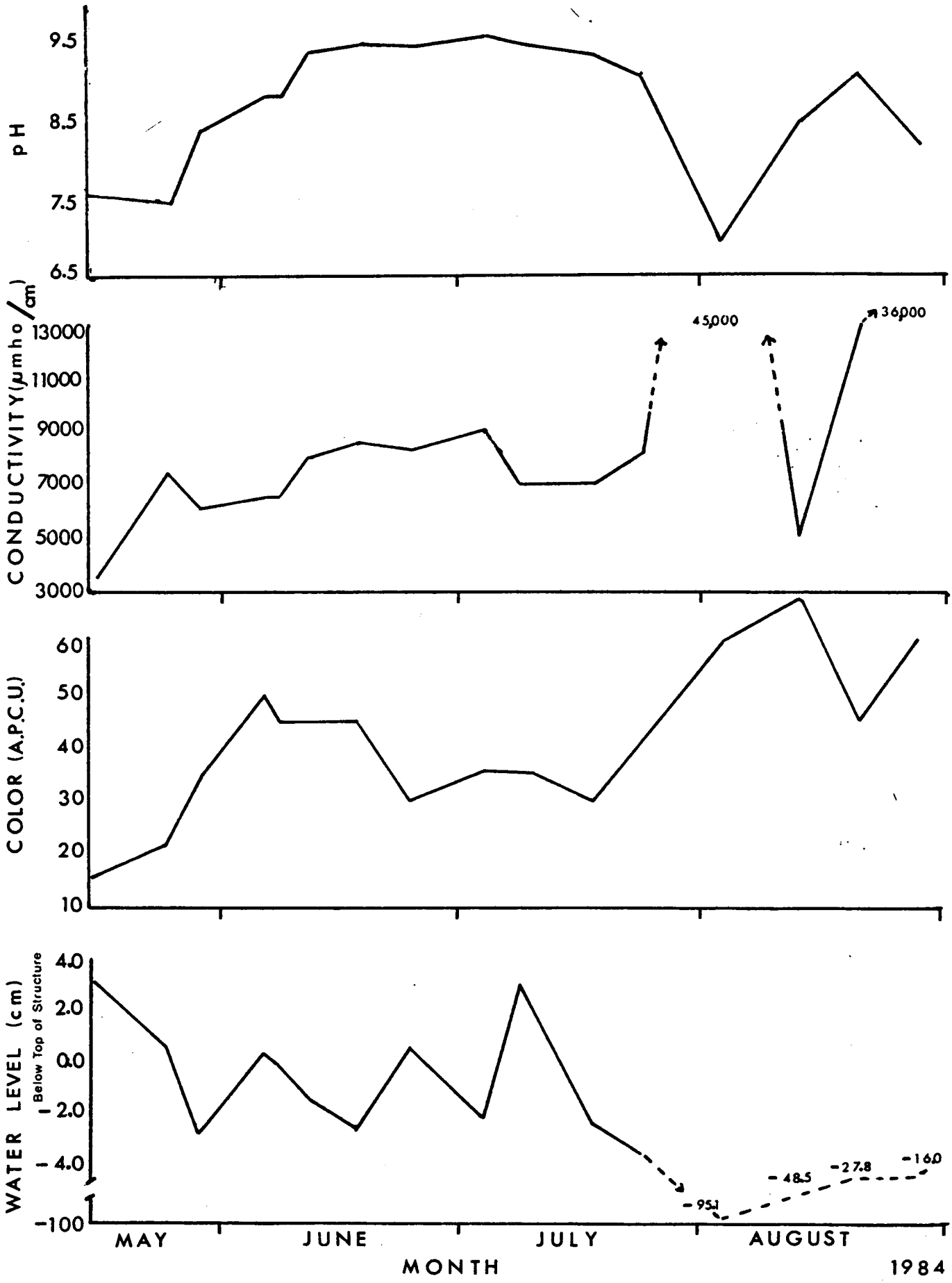

pH
9.5
8.5
7.5
6.5
CONDUCTIVITY(μmho/cm)
13000
11000
9000
7000
5000
3000
45,000
36,000
COLOR (A.P.C.U.)
60
50
40
30
20
10
WATER LEVEL (cm)
Below Top of Structure
4.0
2.0
0.0
- 2.0
- 4.0
-100
-95.1
-48.5
-27.8
-16.0
MAY
JUNE
JULY
AUGUST
MONTH
1984

Figure 9.

Figure 9. Water depth at Russell Impoundment versus conductivity (μmho/cm). Two values have been deleted due to the influence of heavy rain.

$r^2 = 0.872$

p 0.001

F = 82.0063

n = 14

y = -65.425 -0.004x

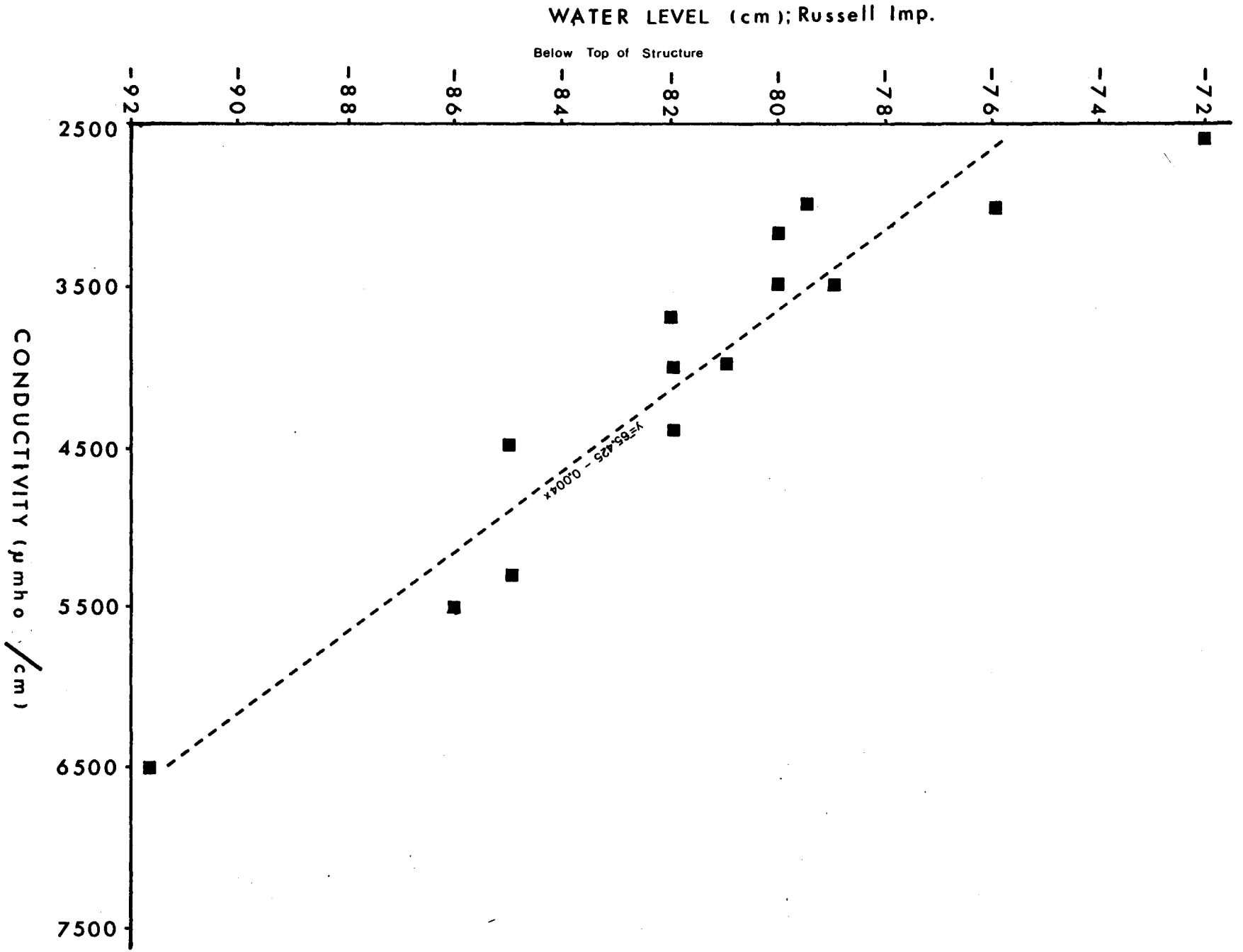
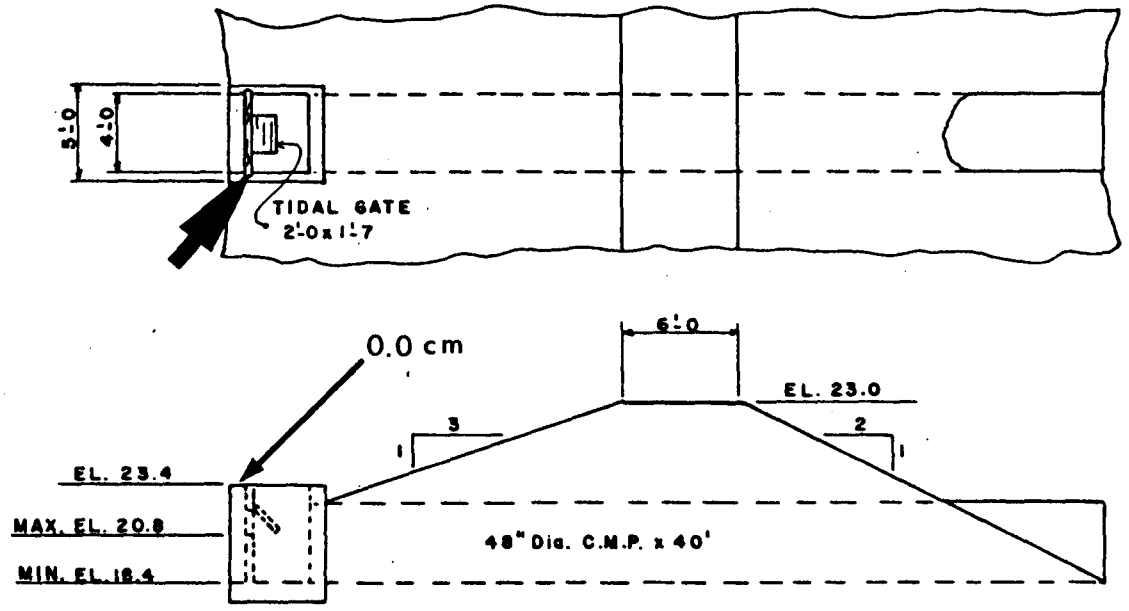

WATER LEVEL (cm); Russell Imp.
Below Top of Structure
-92
-90
-88
-86
-84
-82
-80
-78
-76
-74
-72
2500
3500
4500
5500
6500
7500
CONDUCTIVITY (μmho/cm)
y=65.425 - 0.004x

Figure 10.

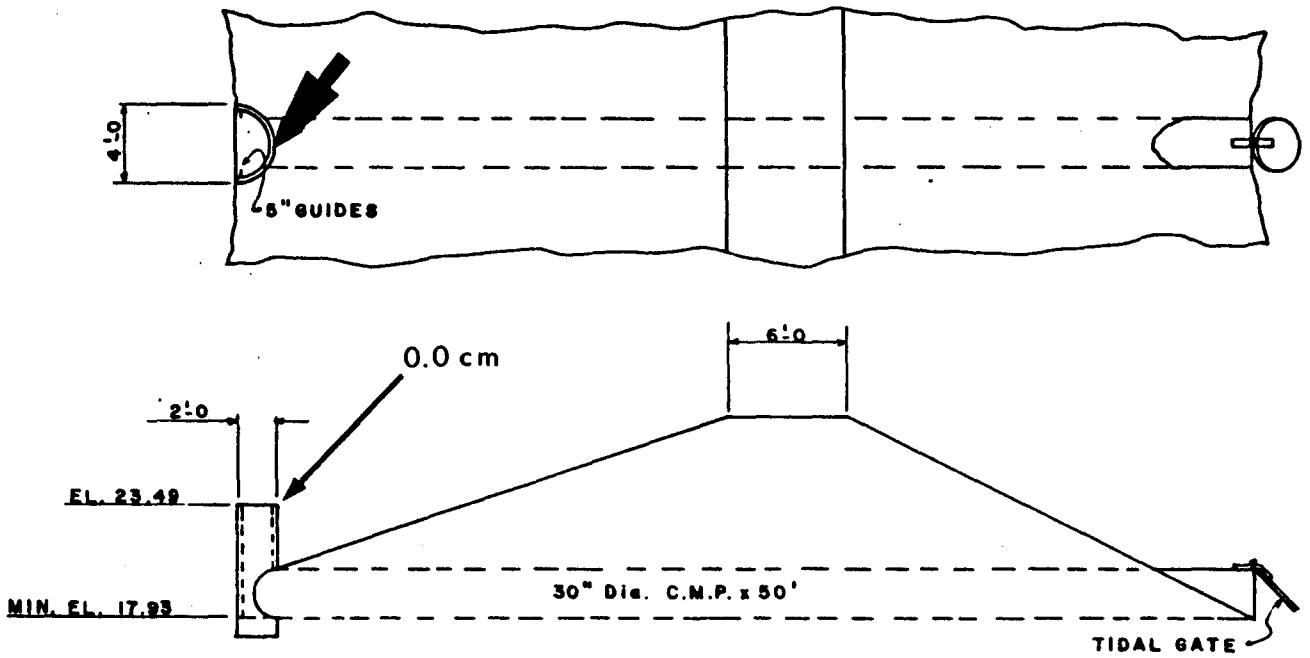
Figure 10. Russell Impoundment (designated as Amherst Point 1 by Ducks Unlimited) water levels were taken from the left side of the control structure when facing the impoundment (see arrow) and were measured from the top. A water depth of 00.0 cm would be level with the top of the concrete (at EL.23.4).



AMHERST PT. 1
STRUCTURE 1-1

Figure 11.

Figure 11. Burgess Impoundment (designated as John Lusby 1 by Ducks Unlimited) water levels were taken from the back of the control structure (see arrow) and were measured from the top. A water depth of 00.0 cm would be level with the top of the pipe (at EL.23.49).

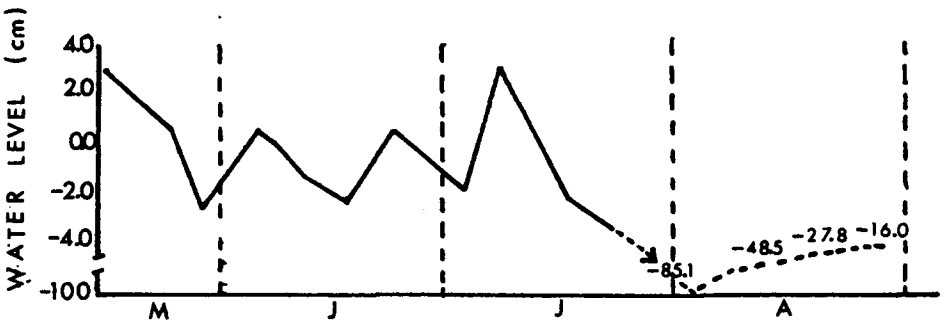


JOHN LUSBY 1
STRUCTURE JL 1-1

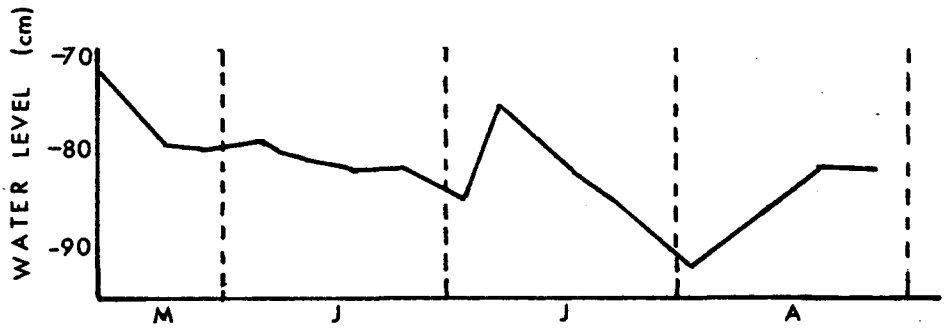
Figure 12.

Figure 12. A comparison of Impoundment water levels with daily precipitation.

BURGESS
IMP.



RUSSELL.
IMP.



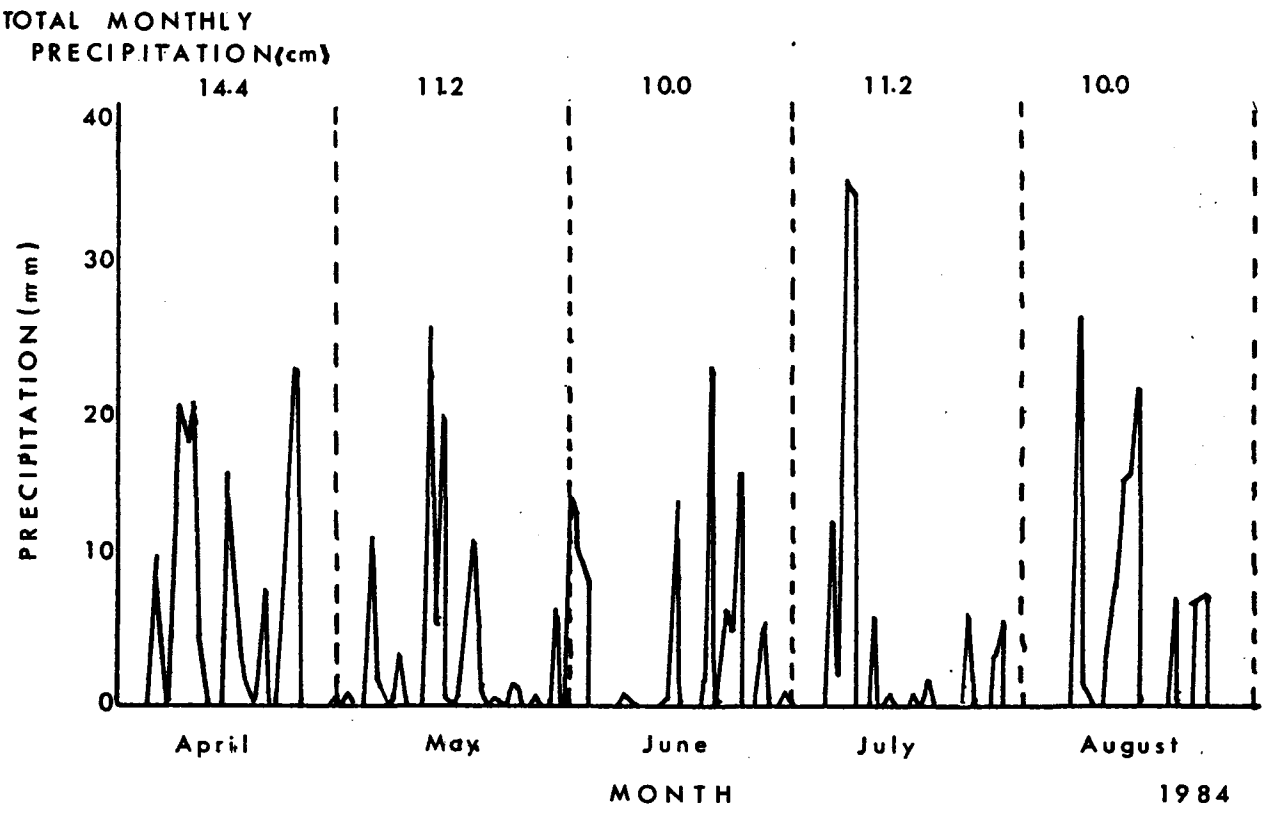


Figure 13.

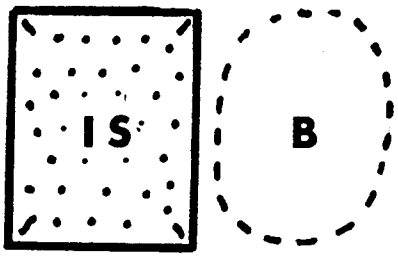
Figure 13. Traditional man-made islands are rectangular in shape with little vegetation cover. An alternative method would be a "horseshoe" shaped island covered with shrubs such as Willow and Mountain Ash to provide cover.

IS - Island
B - Burrow Pit

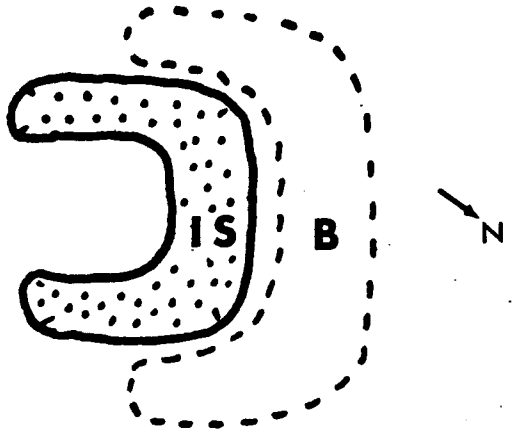
ISLANDS

TRADITIONAL METHOD

ALTERNATIVE METHOD

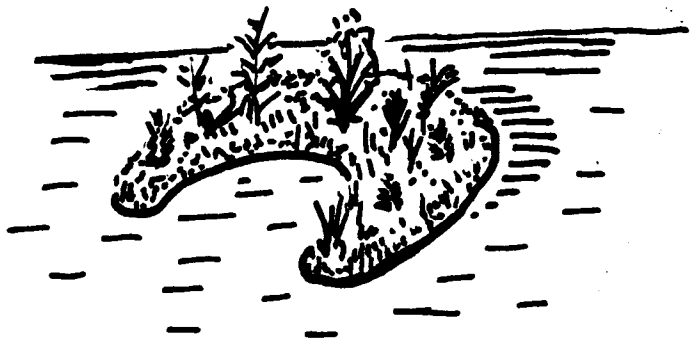


TOP VIEW



SIDE VIEW

non-vegetated



vegetated

Figure 14.

Figure 14. Salt concentration could be reduced and water levels maintained by:

A The digging of drainage ditches parallel to the upland and leading into present structures

Ditch ----

B If new impoundments are to be developed they should have a wide base adjacent to the uplands.

Either of these methods would increase the amount of fresh water that would reach the impoundment.

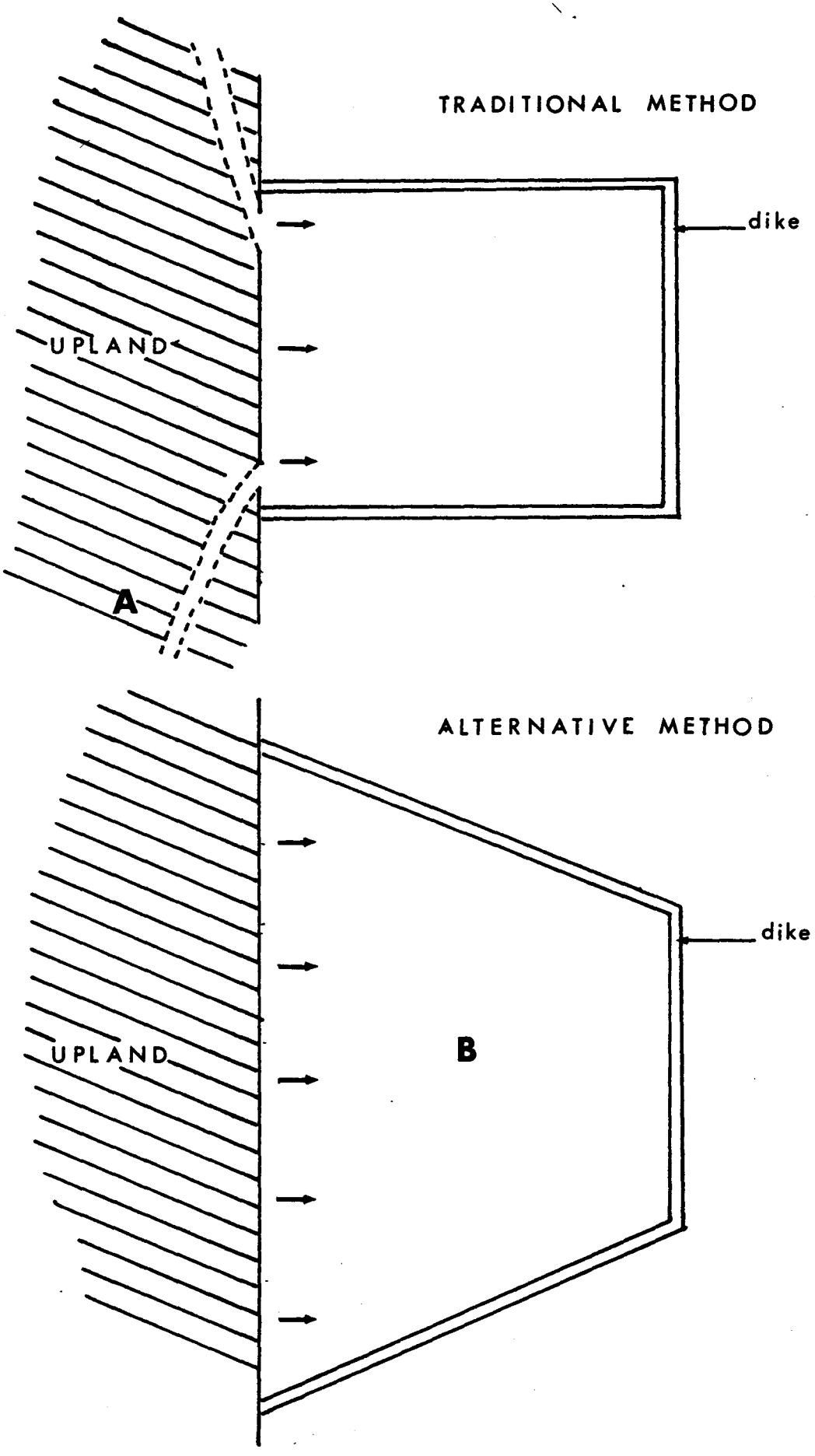

TRADITIONAL METHOD
dike
UPLAND
A
ALTERNATIVE METHOD
dike
UPLAND
B

Table 1. Waterfowl observed on the Russell Impoundment, John Lusby section, 28 March to 28 August, 1984.

Species	March	April								May				June						July					August				Totals
	28	2	4	11	13	16	19	24	27	14	16	22	29	6	7	8	12	18	25	4	9	13	18	24	3	13	20	28	
G.w. Teal	-	-	10	-	4	4	45	3	32	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	10	109
Blk. Duck	21	85	60	75	142	24	6	14	14	25	13	13	6	2	7	6	14	10	10	14	7	4	3	9	25	6	26	25	666
Mallard	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	1
N. Pintail	-	12	12	-	10	5	6	6	4	2	2	1	-	-	2	2	9	3	2	-	-	-	-	-	4	-	3	2	87
B.w. Teal	-	-	-	-	-	-	-	-	-	2	4	4	4	4	3	2	3	3	-	5	2	-	2	-	-	6	18	-	62
N. Shoveler	-	-	-	-	-	-	-	-	1	2	3	2	1	-	-	-	-	2	2	-	-	-	-	-	-	-	-	-	13
Gadwall	-	-	-	-	-	-	-	2	-	-	-	-	-	-	2	2	1	-	-	2	-	-	-	-	-	-	-	-	9
E. Wigeon	-	-	1	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3
A. Wigeon	-	-	8	-	-	12	6	52	26	-	2	1	-	1	-	1	1	3	2	24	16	105	80	55	16	-	-	20	431
Scaup species	-	-	-	-	-	-	5	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9
C. Goldeneye	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
C. Merganser	-	-	-	-	2	-	35	17	46	1	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	107
Totals	21	97	91	75	158	45	100	101	128	32	30	21	11	7	14	13	29	21	16	45	25	109	85	64	45	12	48	57	1500

Note: Observations from 28 March to 27 April were conducted by W. R. Barrow

Table 2 . Waterfowl observed on the Burgess Impoundment, John Lusby section, 28 March to 28 August, 1984.

Species	March	April								May				June						July					August				Totals
	28	2	4	11	13	16	19	24	27	14	16	22	29	6	7	8	12	18	25	4	9	13	18	24	3	13	20	28	
Canada Goose	-	-	-	-	-	-	-	8	2	2	2	2	2	5	2	-	5	4	-	-	-	-	-	-	-	-	-	-	34
G.w. Teal	-	-	10	-	-	-	-	-	-	4	5	-	-	-	-	-	-	1	-	-	-	-	1	-	-	3	90	225	338
Black Duck	-	60	26	-	-	3	2	4	2	4	6	10	34	31	19	-	8	2	-	4	-	4	-	9	-	3	6	11	248
Mallard	-	2	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4
N. Pintail	20	-	25	-	-	-	-	32	9	6	6	6	16	4	6	-	2	2	-	2	2	5	2	8	1	1	8	4	167
B.w. Teal	-	-	-	-	-	-	-	-	-	2	2	4	2	3	6	-	2	-	2	1	2	1	-	-	-	-	40	5	72
N. Shoveler	-	-		-	-	-	-	2	4	2	1	1	2	2	-	-	1	-	-	-	-	-	-	-	-	-	-	-	15
A. Wigeon	-	-	2	-	-	-	-	-	-	-	-	2	1	9	13	-	2	41	-	72	102	-	20	60	-	-	-	5	329
C. Goldeneye	-	-	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8
C. Merganser	-	-	8	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	11
R.b. Merganser	-	1	3	-	-	-	32	35	22	12	8	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	117
Totals (Ducks)	20	63	82	0	0	6	34	73	37	30	28	29	55	49	44	-	15	45	2	79	106	10	23	77	1	7	144	250	1309

Note: Observations from 28 March to 27 April were conducted by W. R. Barrow

Table 3 . Waterfowl observed on the Russell and Burgess Impoundments, John Lusby Sections, 28 March to 28 August, 1984.

Species	March	April								May				June						July					August				Totals
	28	2	4	11	13	16	19	24	27	14	16	22	28/29	6	7	8	12	18	25	4	9	13	18	24	3	13	20	28	
G.w. Teal	-	-	20	-	4	4	45	3	32	4	5	-	-	-	-		-	-	-	-	-	-	1	-	-	3	91	235	447
Black Duck	21	145	86	75	142	27	8	18	16	29	19	23	40	33	26		22	12	10	18	7	8	3	18	25	9	32	36	908
Mallard	-	2	-	-	-	-	-	-	-	-	-	2	-	-	-		1	-	-	-	-	-	-	-	-	-	-	-	5
N. Pintail	20	12	37	-	10	5	6	38	13	8	8	7	16	4	8		11	5	2	2	2	5	2	8	5	1	11	6	252
B.w. Teal	-	-	-	-	-	-	-	-	-	4	6	8	6	7	9		5	5	2	6	4	1	2	-	-	6	58	5	134
N. Shoveler	-	-	-	-	-	-	2	2	5	4	4	3	3	2	-		1	2	2	-	-	-	-	-	-	-	-	-	30
Gadwall	-	-	-	-	-	-	-	2	-	-	-	-	-	-	2		1	-	-	2	-	-	-	-	-	-	-	-	7
E. Wigeon	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	1
A. Wigeon	-	-	10	-	-	12	6	52	26	-	2	3	1	10	13		3	44	2	96	118	105	100	115	16	-	-	25	759
Scaup species	-	-	-	-	-	-	-	5	4	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	9
C. Goldeneye	-	-	8	-	-	-	-	2	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	10
C. Merganser	-	-	8	-	-	3	-	-	1	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	12
R.b. Merganser	-	1	3	-	2	-	67	52	68	13	14	4	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	224
Totals	41	160	173	75	158	51	134	174	165	62	58	50	66	56	58		44	68	18	124	131	119	108	141	46	19	192	307	2798

Note: Observations from 28 March to 27 April were conducted by W. R. Barrow

Table 4. Waterfowl Broods Observed on the Russell and Burgess Impoundments, John Lusby Section, 1984.

Species	Number in Brood	Age Class	Date	Location
Black Duck	2	1a	18 June	Russell Imp.
Black Duck	4	1b	25 June	Russell Imp.
Black Duck	6	1b	6 June	Burgess Imp.
Black Duck	5	2c	24 July	Burgess Imp.
Canada Goose	6	1b	6 June	Burgess Imp.
Canada Goose	6	1c	7 June	Burgess Imp.
Canada Goose	4+	2	18 June	Burgess Imp.

Table 5. Birds other than waterfowl observed on the Russell Impoundment, John Lusby Section, 14 May to 28 August, 1984.

Species	May				June						July					August				Totals
	14	16	22	29	6	7	8	12	18	25	4	9	13	18	24	3	13	20	28	
D.c. Cormorant	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1
American Bittern	1	1	2	-	-	-	-	-	1	1	-	-	1	-	-	-	-	1	-	8
Great Blue Heron	-	-	-	-	1	-	1	-	1	-	-	-	1	-	-	-	1	1	-	6
Northern Harrier	-	-	1	-	-	-	-	2	-	-	-	-	-	-	-	-	-	1	-	4
Greater Yellowlegs	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	2
Lesser Yellowlegs	-	-	-	-	-	-	-	-	-	-	-	-	-	1	2	2	-	3	-	8
Semipalmated Sandpiper	-	-	-	-	-	-	-	-	-	-	-	-	60	-	-	14	20	-	-	94
Common Tern	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1
Belted Kingfisher	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	1	-	2
Swallow Species	-	-	20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	20
Red-winged Blackbird	-	-	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
Totals	1	1	24	0	2	0	1	0	4	1	0	0	62	1	3	16	22	9	1	148

Table 6. Birds other than waterfowl observed on the Burgess Impoundments, John Lusby Section, 14 May to 28 August, 1984

Species	May					June					July					August				Totals
	14	16	22	23	28	6	7	12	18	25	4	9	13	18	24	3	13	20	28	
D.c. Cormorant	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1
American Bittern	-	1	1	-	1	-	-	-	1	-	-	-	-	-	-	1	-	-	-	5
Great Blue Heron	1	-	-	1	-	-	-	-	-	-	2	1	1	-	1	16	8	2	3	36
Osprey	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Northern Harrier	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1	1	4
Lesser Golden Plover	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1
Semipalmated Plover	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	60	250	100	1	411
Greater Yellowlegs	-	-	-	-	-	-	-	6	-	-	-	-	-	-	1	5	10	30	4	56
Lesser Yellowlegs	-	1	-	-	-	-	-	-	-	-	1	2	3	-	-	30	10	60	2	109
Sanderling	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	2
Semipalmated Sandpiper	-	-	40	-	9	-	-	-	-	-	-	-	13	25	20	1100	50	75	15	1347
Least Sandpiper	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	100	25	25	-	150
Short-billed Dowitcher	-	-	-	-	-	-	-	-	-	-	-	-	-	10	-	30	-	-	-	40
Herring Gull	-	-	-	-	-	-	-	4	-	-	-	-	-	-	-	-	-	-	-	4
Common Tern	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Swallow Species	-	-	35	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	35
American Crow	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Common Raven	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	2
Bobolink	-	-	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7
Red-winged Blackbird	-	-	3	-	2	-	-	-	-	-	-	-	-	-	40	-	-	-	-	45
Totals	1	3	87	2	13	0	0	0	11	0	3	3	17	35	62	1345	353	294	29	2258

Table 7. Invertebrates and Fish collected from sweep net samples, Russell Impoundment, John Lusby Section, 1984.

Taxa (Order: Family:)	25 May										13 July							
Sample Sites:	1	2	3	4	5	6	7	8	Totals	$\bar{x}$ (n=8)	Pond	1	2	3	4	5	Totals	$\bar{x}$ (n=5)
Invertebrates																		
Nematoda	2	-	2	-	-	-	-	-	4	0.5	-	-	-	-	-	-	-	0.0
Annelida																		
Hirudinea	-	-	-	-	-	-	-	1	1	0.1	-	-	-	-	-	-	-	0.0
Amphipoda	-	-	-	-	-	-	1	-	1	0.1	-	10	15	29	40	20	114	22.8
Odonata																		
Aeschinidae (Nymph)	-	-	-	-	-	-	-	-	-	0.0	2	-	-	-	-	-	0	0.0
Agrionidae (Nymph)	-	-	-	2	1	1	1	-	5	0.6	-	-	2	1	3	-	6	1.2
Hemiptera																		
Corixidae (Adult)	-	-	-	-	-	-	-	-	-	0.0	2	6	11	7	-	3	27	5.4
Trichoptera																		
Hydroptilidae (Adult)	-	-	-	-	-	-	-	-	-	0.0	-	-	4	19	-	2	25	5.0
Coleoptera																		
Haliplidae (Adult)	2	1	2	-	-	-	-	-	5	0.6	-	-	-	2	-	-	2	0.4
Diptera																		
Chironomidae (Larva)	7	8	15	2	6	11	8	13	70	8.7	9	12	25	34	21	8	100	20.0
Gastropoda																		
Physa	1	-	-	-	-	-	-	-	1	0.1	143	-	-	2	2	-	4	0.8
Totals	12	9	19	4	7	12	10	14	87	10.9	156	28	57	94	66	33	278	55.6
Vertebrates																		
Gasterosteidae																		
Gasterastens aculeatus	-	-	-	-	-	-	-	-	-	0.0	3	11	5	10	12	-	38	7.6

Table 8. Invertebrates and Fish collected in sweep net samples, Burgess Impoundment, John Lusby Section, 1984.

Taxa (Order: Family:)	23 May											13 July							
Sample Sites:	Reeds*	1	2	3	4	5	6	7	8	Totals	$\bar{x}$ (n=8)	1	2	3	4	5	6	Totals	$\bar{x}$ (n=6)
Invertebrates																			
Nematoda	-	8	-	10	33	100	-	176	20	347	43.4	-	-	-	-	-	-	-	0.0
Annelida																			
Hirudinea	-	-	-	-	-	-	-	11	-	11	1.4	-	-	-	-	-	-	-	0.0
Amphipoda	-	-	-	-	2	-	-	-	-	2	0.3	-	7	9	2	2	1	21	3.5
Odonata																			
Aeschnidae (Nymph)	4	-	-	-	-	-	-	-	-	-	0.0	-	-	-	-	-	-	-	0.0
Agrionidae (Nymph)	1	-	1	-	-	-	-	-	-	1	0.1	-	-	-	-	-	-	-	0.0
Hemiptera																			
Corixidae (Adult)	5	-	-	1	-	-	24	15	-	40	5.0	62	115	25	3	85	9	299	49.8
Trichoptera																			
Hydroptilidae (Larva)	-	-	-	-	-	-	-	-	-	-	0.0	-	-	-	8	-	-	8	1.3
Diptera																			
Chironomidae (Larva)	1	2	6	27	1	-	26	15	94	171	21.4	2	2	-	1	-	1	6	1.0
Tabanidae (Larva)	-	-	-	2	1	-	-	-	1	4	0.5	-	-	-	-	1	-	1	0.2
Ephydridae (Larva)	-	-	-	-	-	-	-	2	-	2	0.3	-	-	-	-	-	-	-	0.0
Sciomyzidae (Larva)	-	-	-	-	-	-	-	-	-	-	0.0	-	-	-	-	1	-	1	0.2
Simuliidae (Larva)	-	-	-	-	-	-	-	-	-	-	0.0	-	-	-	-	17	-	17	2.8
Gastropoda																			
Physa	1169	-	-	-	-	-	-	-	-	-	0.0	-	-	2	-	-	-	2	0.3
Planorbidae	-	-	-	-	-	-	-	-	1	1	0.1	-	-	-	-	-	-	-	0.0
Arachnidae	-	1	-	-	-	-	-	-	-	1	0.1	-	-	-	-	-	-	-	0.0
Totals	1180	11	7	40	37	100	50	219	116	580	72.5	64	124	36	14	106	11	355	59.2
Vertebrates																			
Gasterosteidae																			
Gasterasteus aculeatus	-	-	-	-	-	-	-	-	1	1	0.1	19	47	36	8	34	17	161	26.8
Egg Mass	-	1	-	1	1	1	-	-	-	4	0.5	-	-	-	-	-	-	-	0.0
Fish Eggs	-	-	-	2	2	5	-	1	-	10	1.3	-	-	-	-	-	-	-	0.0

*Sample taken from bed of flooded *Spartina alterniflora*

Table 9. Invertebrates collected in 500 ml substrate samples, Russell and Burgess Impoundments, John Lusby Section, 1984.

Taxa	Sample Sites 1	2	3	4	5	6	7	8	Total	$\bar{x}$ (n=8)
Russell Impoundment										Date: 25 May, 1984
Cladocera	-	-	-	26	-	-	1	1	28	3.5
Nematoda	-	-	-	1	-	-	-	-	1	0.1
Diptera										
Chironomidae	-	2	15	9	-	-	9	4	39	4.9
Gastrapoda										
Physa	1	-	-	-	-	-	-	-	1	0.1
Planorbidae	-	-	-	-	-	-	-	1	1	0.1
Totals	1	2	15	36	0	0	10	6	70	8.8
Water Depth (cm)	31	27	33	31	22	11	26	23		
Conductivity of soil sample (μmho/cm)	4200	3500	3000	3300	-	-	4300	8000		
Burgess Impoundment										Date: 23 May, 1984
Cladocera	-	-	2	-	-	-	-	-	2	0.3
Nematoda	-	2	3	-	27	-	-	2	34	4.3
Diptera										
Chironomidae	13	9	11	14	-	1	1	3	51	6.4
Tabanidae	-	-	-	2	-	-	-	-	2	0.3
Gastrapoda										
Physa	-	1	1	1	-	-	-	-	3	0.4
Fish Eggs	-	3	1	-	-	-	-	8	12	1.5
Totals	13	15	18	16	27	1	1	13	104	13.0
Water Depth (cm)	60	30	22	27	27	35	41	36		
Conductivity of soil sample (μmho/cm)	4000	2700	2200	2000	3000	2200	2200	1800		

Appendix 1. The pH, conductivity and water color at 5 sampling sites on the Russell Impoundment, John Lusby NWA, 1984.

	May			June					July				August				
Site	16	25	29	6	8	12	18	25	4	9	18	24	3	13	20	28	
								pH									
1	7.74	8.05	8.00	8.25	9.07	8.70	8.78	7.18	8.31	7.11	9.14	9.06	-	-	-	-	n = 16
2	7.76	7.95	7.43	8.23	7.95	7.89	8.28	8.56	8.00	8.77	8.98	9.15	-	-	-	-	
3	7.75	8.46	7.55	7.85	8.61	8.15	9.26	9.81	9.26	8.48	7.69	8.25	-	-	-	-	
4	7.94	8.55	8.26	7.96	7.28	6.94	7.60	7.15	6.98	7.85	6.85	7.18	7.19	7.43	7.76	7.97	$\bar{x}$ = 7.62
Pond	-	-	-	-	9.85	9.66	9.76	9.83	8.20	7.56	6.90	7.31	-	-	-	-	
								Conductivity (MicrMHos/cm)									
1	2500	3400	580	625	2600	3600	40000	700	4500	1350	160	4300	-	-	-	-	
2	2700	3100	3300	3200	3300	3500	3700	3500	4000	4000	4000	4200	-	-	-	-	
3	2700	3200	3100	3400	3400	3700	4000	3500	4300	3500	4200	4000	-	-	-	-	
4	2600	3000	3500	3500	3200	4000	4400	3700	5300	3000	4000	4500	6500	5500	6000	7200	$\bar{x}$ = 4369
Pond	-	-	-	-	300	300	320	300	300	145	165	250	-	-	-	-	
								Colour (Alpha Platinum Cobalt Units X5)									
1	50	50	50	70	60	50	5o	60	55	100	60	100	-	-	-	-	
2	55	55	45	50	45	45	50	40	50	65	80	90	-	-	-	-	
3	25	40	50	65	55	55	55	50	70	50	70	95	-	-	-	-	
4	70	40	35	55	45	75	60	60	50	65	50	70	55	70	65	50	$\bar{x}$ = 57
Pond	-	-	-	-	70	70	70	65	65	80	95	90	-	-	-	-	
Water level (cm)	-72.0	-79.5	-80.0	-79.0	-80.0	-81.0	-82.0	-82.0	-85.0	-76.0	-82.0	-85.0	-91.7	-86.0	-82.1	-82.2	$\bar{x}$ = -81.6

Appendix 2. The pH, conductivity and water color at 4 sampling sites on the Burgess Impoundment, John Lusby NWA, 1984.

	May			June					July				*	August				
Site	16	25	29	6	8	12	18	25	4	9	18	24		3	13	20	28	
								pH										
1	7.42	7.26	8.00	8.78	9.00	9.10	9.52	9.53	9.17	8.75	8.58	8.91		-	-	-	-	n = 12[1]
2	7.40	7.16	7.43	8.78	9.10	9.14	9.60	9.36	9.28	8.80	8.81	8.88		-	-	-	-	
3	7.56	7.82	7.55	8.90	9.04	9.38	9.54	9.50	9.19	8.93	9.06	8.75		-	-	-	-	
4	7.46	7.44	8.26	8.70	8.72	9.33	9.42	9.42	9.47	9.34	9.25	9.07		6.91	8.43	9.07	8.10	$\bar{x}$ = 8.82
								Conductivity (MicroMHos/cm)										
1	6600	6600	7700	6800	7000	7300	9000	8000	9500	7500	7500	8300		-	-	-	-	
2	5800	7200	8000	7000	7000	7200	9200	8500	10000	7500	7500	8500		-	-	-	-	
3	5600	6800	8050	7000	6900	7200	8500	8500	10100	7000	7300	8200		-	-	-	-	
4	3500	7400	6100	6500	6500	8000	8500	8300	9000	7000	7000	8000		45000	5000	13000	36000	$\bar{x}$ = 7150
								Color (Alpha Platinum Cobalt Units x 5)										
1	25	30	50	50	45	45	40	40	45	30	40	40		-	-	-	-	
2	20	45	45	60	50	50	50	30	40	35	30	35		-	-	-	-	
3	15	25	50	55	45	45	45	40	40	30	30	30		-	-	-	-	
4	12	22	35	50	45	45	45	30	35	35	30	40		60	70	45	60	$\bar{x}$ = 35
Water level (cm)	+3.0	+0.5	-.25	+0.5	0.0	-1.5	-2.5	+0.5	-2.0	+3.0	-2.5	-3.5		-95.1	-48.5	-27.8	-16.0	$\bar{x}$ = -0.6

*Impoundment went down 28-29 July, 1984

[1]16 May to 24 July only.

Appendix 3. Vital Statistics for Burgess and Russell Impoundments, 1984.

Statistic	Russell Impoundment	Burgess Impoundment
Area (ha)	8.0	12.0
Mean water depth (cm) (with impoundment waterlevel even with stop logs)	32.0	25.5 (10.0")
Mean water level (cm) below the stop logs	-2.1	-0.6
below top of structure	-81.6	-0.6
Elevation level (m) of current (1984) stop logs	6.4	7.16
Mean Conductvity (mho/cm)	4369	7150
Mean Color (A.C.P.U.)	57	35
Mean pH	7.62	8.82

Appendix 4. Observation conditions at Burgess Impoundment, 1984

Date	Time	% Cloud	Temp (^{0}C)	Wind (km/hr)	Observer
14 May	0900-1000	100	16	0-5	C.M.; S.R.
16 May	0900-?	90	11	0-5	C.M.; S.R.
22 May	0900-1110	100, Fog	12	0-5	C.M.
23 May	0830-1300	75	18-20	5-10	C.M.
28 May	0730-1045	20	12-20	0	S.R.; S.M.
6 June	0730-0900	100, Fog	8-10	0-5	C.M.
7 June	0900-1030	100	18	0-5	C.M.
12 June	0830-0930	0	20	10-15	C.M.
18 June	0900-1015	5, Haze	20	10-15	C.M.
25 June	0845-1000	100	15	5-10	C.M.
4 July	0900-1010	100	10	5-10	C.M.
9 July	0900-1020	80	22	5	C.M.
13 July	0830-1000	0	20	5-10	C.M.; S.R.
19 July	0900-1010	10	22	0-5	C.M.
24 July	1100-1230	50, Haze	25	5-10	C.M.
3 August	0700-0800	5, Haze	20	0-5	C.M.
13 August	0900-1030	100, Rain	20	0-5	C.M.
20 August	1300-1450	100	20	0-5	C.M.
28 August	1000-1120	0	22	5-10	C.M.
		Observation conditions at Russell Impoundment, 1984			
14 May	1000-1040	100	16	0-5	C.M.; S.R.
16 May	1130-?	60	13	0-5	C.M.; S.R.
22 May	0900-1150	Light	10-18	0-5	S.R.
25 May	0900-1300	5	18	1-3	C.M.; S.R.
29 May	0730-0915	100	8	10-15	S.R.; S.M.
6 June	0730-0930	50	8-15	0-5	S.R.
7 June	1030-1130	100 Rain	12	0-5	C.M.; S.R.
8 June	1100-1230	100 Haze	15	5-10	S.R., C.M., H.P.B., J.G.
12 June	0900-1000	0	20	10-15	S.R.
18 June	0830-1030	20	18	15-20	S.R.
25 June	0830-1030	100	16	15	S.R.
4 July	0900-1020	100	20	5-10	S.R.
9 July	0900-1000	25-75	20	5-10	S.R.
13 July	1020-1200	0	28	5-10	C.M.; S.R.
18 July	0850-1020	10	23	0-5	S.R.
24 July	1100-1230	60 Haze	25	5-10	S.R.
3 August	0700-0800	0-10	20	0-5	S.R.
13 August	0900-1010	100 Rain	20	5	S.R.
20 August	1300-1430	100	20	0-5	S.R.
28 August	1000-1120	0	22	5-10	S.R.

C.M. - Colin MacKinnon
S.R. - Susan Rodda
S.M. - Sharon Marr
H.P.B. - Peter Barkhouse
J.G. - Jocelyn Gauvin

Appendix 5. Total numbers of Ducks and Geese observed on the Burgess Impoundment May 3, 1978 - August 24, 1978

	May			June		July		Aug.	
Species	3	17	31	13	30	12	27	9	24
Black Duck	23	28	26	8	-	20	48	170	110
Pintail	24	4	14	3	17	6	9	59	35
Green-winged Teal	90	15	5	13	9	46	32	65	50
Blue-winged Teal	6	2	3	3	-	-	-	155	115
Canada Goose	33	-	-	1	1	1	-	-	-
Red-breasted Merganser	38	19	-	-	-	-	-	-	-
American Wigeon	-	-	4	20	45	51	24	18	15
Total	214	68	52	45	72	124	113	467	325

Total numbers of non-waterfowl bird species observed on the Burgess Impoundment May 3, 1978 - August 24, 1978

	May			June		July		Aug.	
Species	3	17	31	13	30	12	27	9	24
Gr. Yellowlegs	1	2	2	1	-	11	29	3	-
Herring Gull	-	-	22	-	2	-	-	-	-
Spotted Sandpiper	-	-	-	-	-	2	-	1	-
Lesser Yellowlegs	-	-	-	-	-	60	-	-	-
Unid, peeps	-	-	-	-	-	75	-	-	-
Cliff Swallow	-	-	-	-	-	1	-	-	-
Tree Swallow	-	-	-	-	-	4	-	-	-
Semipalmated Sandpiper	-	-	-	-	-	-	25	10	2
Gt. Blue Heron	-	-	-	-	-	-	1	2	-
Common Snipe	-	-	-	-	-	-	-	1	1
Pectoral Sandpiper	-	-	-	-	-	-	-	1	-
Least Sandpiper	-	-	-	-	-	-	-	1	1
Sharp-tailed Sparrow	-	-	-	-	-	-	-	4	-
Belted Kingfisher	-	-	-	-	-	-	-	-	2
Total	1	2	24	1	2	153	55	23	6

Note: Adapted from Hounsell (1978)

Appendix 6. 1979 Avian Observations - Chignecto NWA, John Lusby Section, Russell Impoundment (Area 12 ha)

Species	Date of Observation					
	June 1	June 14	July 3	July 16	July 30	Sept. 25
Waterfowl (Broods not included)						
Black Duck	3	-	-	-	15	47
Pintail	-	-	-	-	8	3
Green-winged Teal	7	1	-	-	-	-
Blue-winged Teal	1	1	-	-	35	9
American Wigeon	1	1	2	-	-	11
Total	12	3	2	0	58	70
Waterfowl Broods						
American Wigeon			1(IIb)			
Total			1			
Non-Waterfowl						
Great Blue Heron	2	-	-	-	-	1
Marsh Hawk	1	-	-	-	-	-
Osprey	-	1	-	-	-	-
Lesser Yellowlegs	-	-	-	52	10	2
Least Sandpiper	-	-	-	10	-	-
Semipalmated Sandpiper	-	-	-	35	-	-
Dowitcher	-	-	-	-	10	-
Short-eared Owl	-	-	-	1	-	-
Bank Swallow	-	1	-	1	5	-
Barn Swallow	6	-	-	-	10	-
Common Raven	2	-	-	-	-	1
Savannah Sparrow	-	2	-	1	-	-
Total	11	4	-	100	35	4

Remarks:

Impoundment poor in terms of waterfowl breeding and brood-rearing habitat due to lack of vegetation. Has been extensively used by shorebirds as roosting area after summer drawdown of water level.

Note: Adapted from Morton (1979)

Appendix 7. 1979 Avian Observations - Chignecto NWA, John Lusby Section, Burgess Impoundment (Area 18 ha)

Species	Date of Observation					
	May 28	June 14	July 3	July 16	July 30	Sept. 18
Waterfowl (Broods not included)						
Black Duck	14	16	76	11	50	74
Pintail	4	2	88	7	15	50
Green-winged Teal	-	12	10	4	1	-
Blue-winged Teal	10	18	74	43	26	15
American Wigeon	-	26	73	4	14	21
Shoveler	2	-	1	-	-	-
Total	30	74	322	69	106	160
Waterfowl Broods						
Black Duck		4(IIa)	3(IIb)			
Pintail		6(IIb)	6(IIb)			
Pintail			9(IIa)			
Pintail			8(IIb)			
American Wigeon			5(IIb)			
Total		2	5			
Non-Waterfowl						
Pied-billed Grebe	-	-	-	-	-	1
Great Blue Heron	-	-	-	1	3	2
American Bittern	1	-	-	-	-	1
Marsh Hawk	-	-	-	-	-	2
Common Snipe	-	-	1	-	-	-
Spotted Sandpiper	-	-	12	1	2	-
Greater Yellowlegs	-	-	-	4	-	-
Lesser Yellowlegs	-	-	25	25	4	-
Willet	-	-	-	-	-	1
White-rumped Sandpiper	-	-	-	-	-	3
Semipalmated Sandpiper	-	-	35	7	-	-
Dowitcher	-	-	80	-	-	-
Herring Gull	1	1	-	-	-	-

(continued)

Appendix 7. (cont'd.) 1979 Avian Observations - Chignecto NWA, John Lusby Section, Burgess Impoundment (Area 18 ha)

Species	Date of Observation					
	May 28	June 14	July 3	July 16	July 30	Sept. 18
Black Tern	-	-	-	-	1	-
Belted Kingfisher	-	-	-	1	2	1
Tree Swallow	2	-	-	-	-	-
Bank Swallow	-	2	60	1	20	-
Barn Swallow	1	-	-	6	20	-
Common Crow	-	4	-	1	1	-
Starling	-	15	-	-	-	-
Yellow-rumped Warbler	-	-	-	1	-	-
Common Yellowthroat	-	-	-	-	1	-
Bobolink	-	-	-	30	-	-
Red-winged Blackbird	6	1	5	42	-	-
Rusty Blackbird	-	-	1	-	-	-
Common Grackle	1	1	5	-	-	-
Savannah Sparrow	-	-	-	-	4	7
Sharp-tailed Sparrow	-	-	-	-	1	-
Total	12	9	239	120	59	18

Remarks:

Brackish state of this impoundment seems to be ideal for waterfowl use. Adjacent cover is adequate for nesting habitat and small mounds within the impoundment serve as a further attractive feature. Exposed mud areas used to some extent as roosting sites for shorebirds.

Note: Adapted from Morton (1979)

Appendix 8. Chignecto NWA, John Lusby Section, Burgess Impoundment, 1980

Species	Date		
	9 May	24 July	16 September
Black Duck	20	1	3
Pintail	22	35	2
Green-winged Teal	58	75	-
Blue-winged Teal	3		25
American Wigeon	12	-	135
Northern Shoveler	13	-	-
Redhead	1	-	-
Ring-necked Duck	5	-	-
Canada Goose	1	-	-

Chignecto NWA, John Lusby Section, Russell Impoundment, 1980

Species	Date		
	9 May	24 July	17 September
Black Duck	9		27
Pintail	27	75	9
Green-winged Teal	41		330
Blue-winged Teal	1	-	
Northern Shoveler	7	-	-
Mallard	-	-	1
American Wigeon	-	-	104
Redhead	-	-	1
Ruddy Duck	-	-	10

Note: Adapted from Barkhouse, 1982.