BOWDOIN NATIONAL WILDLIFE REFUGE

WATER MANAGEMENT

ALTERNATIVES

I. INTRODUCTION - Description of Refuge

Bowdoin National Wildlife Refuge is located seven miles east of Malta in northeastern Montana. The refuge is centrally located in Phillips County and lies at about 2,200 feet elevation in the Milk River Valley. This valley is bordered by plateaus ranging in elevation from 2,400 to 2,600 feet above sea level. The climate of the area is semi-arid and characterized by low precipitation which averages about 12 inches annually. Summer temperatures may reach 100 degrees and, during the winter months, minus 30 degrees is common with an occasional minus 50 degrees. Sunny days occur during much of the year and moderate to strong winds prevail during spring and fall.

Bowdoin Refuge was established in 1936 to preserve habitat for the propagation and protection of migratory waterfowl and other wildlife.

The refuge mission is to provide (1) optimum nesting and migration habitat for migratory birds, (2) suitable habitat for resident wildlife and (3) an opportunity for public enjoyment of the Refuge and its wildlife. At present the refuge produces an average of 5,000 ducks annually, supports up to 100,000 migrating waterfowl, and provides wildlife-oriented recreation for approximately 2,000 visitors each year.

The refuge consists of a total of 15,571 acres. Within this total, land types as shown on the Land Type Inventory Form are:

(1)	Inland Fresh Seasonally Flooded Basins or Flats	900 acres
(2)	Inland Fresh Meadows	250 acres
(3)	Inland Fresh Shallow Marshes	380 acres
(4)	Inland Saline Flats	300 acres
(5)	Inland Saline Marshes	2,800 acres
(6)	Inland Open Saline Marshes	4,000 acres
(7)	Native Grasslands	6,400 acres
(8)	Introduced Grasslands	155 acres
(9)	Dense Nesting Cover	210 acres
(10)	Brush	100 acres
(11)	Administrative Lands	76 acres

II. OBJECTIVES

1. Maximize waterfowl production by providing suitable breeding, nesting and brooding habitat in a balanced complex. The quantified objective is to produce 18,000 ducks annually. (PMD Mig. Birds: 21.02, 21.03, 21.08, 31.02, 50.02)
2. Provide annual waterfowl use at a level consistent with flyway management plans. The objective is 15.8 million use days annually. (PMD Mig. Birds: 20.04, 21.08, 31.02, 40.01)
3. Encourage wildlife diversity of all indigenous species and maximize migratory bird species, particularly colonial nesting birds. (PMD Mam. & Non-mig. Birds: Goal 2, PMD Mig. Birds: 20.04, 32.03, 33.02)
4. Provide opportunities for wildlife-oriented recreation and interpretation that is compatible with natural resource objectives. Our objective is 12,000 visits annually. (PMD Interp. & Rec.: Goal C. Recreation)

III. STATEMENT OF PROBLEM

Part of Bowdoin National Wildlife Refuge lies within the flood plain of Beaver Creek. This stream headwaters in the Little Rocky Mountains, about 50 miles to the southwest, and meanders nearly 150 miles to its confluence with the Milk River, approximately 28 miles east of Bowdoin Refuge. Most of this stream's 150-mile course is through lands characterized by saline-sodium soils. These soils, typical of semi-arid areas throughout the western United States, commonly accumulate surface salts through capillary action, seepage and other water transporting mechanisms. This condition exists throughout the Beaver Creek drainage from the Little Rockies to the Milk River and is especially evident in "low spots" where water remains until it evaporates.

At Bowdoin Refuge, Lake Bowdoin and Dry Lake are the "low spots" and the natural saline condition has been compounded by irrigation return flows, saline seeps and land use practices. Historically, all land in the vicinity was grassland. Then, after the construction of irrigation facilities, much of the land adjacent Bowdoin was converted to irrigated crops. Sugar beets were grown during the early days after irrigation water became available (during the 1920's or 1930's); and their production was continued until the early 1960's on some lands. This type of row cropping contributed heavily to silt-laden return flows which, in this vicinity, drained into Lake Bowdoin.

Past Refuge water management practices also contributed to a buildup of salts in these two lake basins. Previous Refuge Managers attempted to hold as much water as possible. The units were flushed infrequently

because adequate water and/or funds were not available during most years. This "closed system" situation resulted in a loss of water, primarily through evaporation and transpiration, which left dissolved solids (in this case salts) trapped in the basins. It wasn't until the mid-1970's that FWS began to realize what problems had developed in Dry Lake and Lake Bowdoin.

Now it is apparent that the many years of salts accumulating on the Refuge have lowered marsh productivity. The decline is especially evident in Dry Lake where cattails and round bulrushes have been replaced by alkali tolerant species. Submerged aquatics such as pondweeds and widgeongrass, which flourished during the 1950's, are nearly gone. Water quality is so bad that refuge waters cannot meet minimum discharge standards established by EPA and the Montana Department of Water Resources. Consequently, it is not possible to reverse the trend by flushing refuge impoundments. Lake Bowdoin is showing signs of the same problems, although it hasn't suffered the degree of decline that is obvious in Dry Lake. This is because Bowdoin is larger and deeper and the process will take longer. However, cattails, which are less tolerant to salinity than bulrushes, have already nearly disappeared from Lake Bowdoin.

Duck production, which is Bowdoin Refuge's highest priority objective, has dropped from 24,000 in 1961 to 3,000 in 1981 (See Appendix IV). The average annual production during the period 1961-70 was 22,000. For the 1971-80 period, average annual production was only 5,000. Refuge marshes today just aren't as attractive to nesting ducks as they were twenty years ago.

There are also off-refuge problems associated with deteriorating on-site water quality. Any seeps through refuge structures or dikes eventually flow into Beaver Creek and are used for irrigating downstream lands. Blowing alkali dust is also deposited on adjacent farmlands if Dry Lake goes dry, which it often does during the summer when adequate water is not available. Both the saline water and alkali dust can cause problems for refuge neighbors through deposition of alkali on agricultural lands, thus lowering productivity. Alkali dust deposits are also a nuisance and inconvenience in the same way that blowing dirt is.

It is evident, therefore, that by improving water quality on the refuge marsh productivity can be restored and some problems for adjacent landowners can be eliminated. However, it must be realized that the intrinsic salinity of clay soils common to the Beaver Creek drainage will not be changed. This basic characteristic of these soils will continue to exist.

IV. ALTERNATIVES

Four alternatives for management of the refuge are considered under the following constraints/considerations.

1. There is a limited water supply available to the refuge during non-flood or low runoff years.
2. During normal runoff years, the Malta Irrigation District allots 3,500 acre feet of water annually for refuge use under contract agreement.
3. Usually, during normal and high runoff years, there is 7,000+ acre feet of water available to the refuge from the Malta Irrigation District. The prognosis on water availability is that it will be less in the future as demand for water throughout the District increases.

4. Based on information from the refuge Annual Narrative Reports, Beaver Creek flood waters come by the refuge on an average of four years out of 10. When this flooding occurs, there is more than 7,000 acre feet of water available to be taken into the refuge. During the period of 1941 to 1981, the longest time between floods was four years and the average was 1.33 years.
5. Irrigation return water, flowing into the refuge from surrounding farmland, amounts to approximately 1,500 acre feet annually.

The present poor quality water on the refuge requires that serious consideration be given to the potential impacts upon water quality downstream, for any planned or naturally-caused discharges in the near or distant future. In considering the alternatives discussed in this document, the State of Montana (Water Quality Bureau and Department of Fish, Wildlife and Parks) and all downstream water users who could be impacted from a water discharge, must be made aware of the seriousness of the water quality problem and its potential impacts in either the near or distant future. Clearly, a cooperative approach is indicated.

Funding to implement a particular management alternative may or may not be available, even though the potential economic impacts from the water quality problem are substantial. All costs discussed in this document are based on current information. Where construction costs are involved, only reasonable and practical methods are considered (i.e., use of on-site fill for dikes rather than hauling).

A. No Action Alternative

1. Features

There would be no change from present operations under this alternative. Existing physical features would continue to function as in the past and natural flows, irrigation return flows and deliveries from Malta Irrigation District would continue.

2. Management

Water management objectives would be to hold enough water to keep all marshes and impoundments at operational levels. Beaver Creek flood water would be utilized whenever possible. Refuge water would be discharged into Beaver Creek during severe floods when it would be necessary to take flood water into Dry Lake and Lake Bowdoin and then release a portion to keep refuge dikes from being washed out.

Emphasis would be on maintaining good quality water in Lakeside, Teal Ponds, Farm Pond, Strater Pond, Patrol Road Pond, Black Coulee Pond, Goose Island Pond, Drumbo and other small impoundments. During years when adequate water and/or funds are not available to maintain both Dry Lake and Lake Bowdoin at operational levels, attempts would be made to keep Dry Lake wet to control blowing alkali. However, during extended droughts, water may not be available and Dry Lake would be totally dry.

3. Consequences

a) Water Quality and Discharges

Salinity would continue to increase in both Dry Lake and Lake Bowdoin as a result of salts being transported into the refuge

in solution and then being deposited when the water evaporates. As salinity increased, the marsh vegetation important for nesting waterfowl would decrease until eventually none will remain. By this time, Bowdoin Refuge would suffer serious reductions in duck production and lose much of its value as a viable National Wildlife Refuge.

With severe Beaver Creek floods, comparable to 1978 or 1979, refuge water of high salinity content would be carried onto downstream lands, possibly leaving deposits of salts. By this time the salinity could be so high that these refuge discharges could also change salinity levels in the Milk River below Beaver Creek. Also, any seepage through refuge structures and/or dikes would continue to flow into Beaver Creek and increase salinity levels in water supplies for downstream irrigators.

b) Blowing Alkali

Without adequate water to maintain both Dry Lake and Lake Bowdoin, one or both would occasionally go dry and blowing alkali would continue to reduce visibility and deposit salts downwind from the refuge.

c) Waterfowl Production

Emergent vegetation productivity would continue to decline under this alternative. Resulting changes in vegetation would make the marshes of Lake Bowdoin and Dry Lake virtually useless as production habitat for ducks, thus eventually resulting in the production of only 2,900 ducks annual (See Appendix I).

unchanged since these species use Lake Bowdoin's islands only as nesting sites and do not depend on Dry Lake or Lake Bowdoin for food.

e) Waterfowl Migration Use

Migrating waterfowl would probably continue to use the area, but spring migration use would probably decline since the marshes would be less attractive to nesting birds. Fall migrants, however, would still find sanctuary and resting areas on the refuge. Food availability would also be changed little for fall migrants that feed mostly in surrounding grain fields. Also, freshwater foods would likely be replaced by saltwater species that are just as attractive to feeding waterfowl.

f) Botulism

Losses from botulism would probably remain about the same. Invertebrate mortality would continue to occur in the brackish water areas created by fresh water draining into Lake Bowdoin. These dead invertebrates would provide a medium for botulism bacteria and feeding waterfowl would ingest the infected carcasses.

g) Public Use

Wildlife observation and hunting, which are the two forms of use that account for about 90 percent of refuge visits, would not be affected by this alternative.

h) Cost

There are no costs, other than the annual operation and maintenance budget, associated with this alternative. Present O&M budget is $177,000 annually.

i) The Community Economy

Productivity on lands downwind from the refuge may decline from prolonged deposits of windblown alkali. Also, the occasional releases associated with severe Beaver Creek floods could affect productivity of downstream lands. In both cases landowner income could be adversely impacted.

B. Natural Rhythm Alternative

1. Features

a) Evaporate Lake Bowdoin down to approximately 1,200 surface acres (2,203.69 m.s.l.).

b) Construct ditch from the reduced Lake Bowdoin level to the outlet structure between Lake Bowdoin and Dry Lake.

c) Increase the capacity of the discharge ditch from Dry Lake to Beaver Creek to handle a 145 c.f.s. flow of water.

d) During the first two or three times when Beaver Creek floods in the spring, water would be allowed to fill Lake Bowdoin and Dry Lake and then flow out with a natural flushing action. The flood waters would dilute the saline refuge waters which would then flow toward Beaver Creek as the flood waters receded. Waters would be allowed to recede until Dry Lake was completely dry and Lake Bowdoin was back down to 1,200 surface acres in size. This flooding/flushing cycle would be continued, during flood years, until the salinity of the water in Dry and Bowdoin Lakes was under 2,000 mmhos. of conductivity.

e) During the non-flood years of the rehabilitation period, which is expected to be between three and six years, Dry Lake would be kept dry and Lake Bowdoin would be maintained at the 1,200 surface-acre size.

f) Develop the four bays on the north side of Dry Lake into semi-permanent wetlands. This would be done by diking across these bays and building a ditch from the present Dry Lake Ditch to supply water to the more eastern bays.

g) Isolate the waters of Drumbo Lake by building a low dike, with a riser control structure, at the railroad tracks where Drumbo flows into Lake Bowdoin. Also construct a shallow ditch to the east from Drumbo to act as a drain and flood water access for Drumbo.

2. Management

After Dry Lake and Lake Bowdoin have been freshened up by two or three flooding/flushing cycles:

a) During non-flood years, maintain Lake Bowdoin at 1,200 surface acres (approximately 1.5-foot maximum depth). This would be accomplished with natural runoff irrigation return water (approximately 1,500 acre feet) that naturally flows into the refuge and water purchases from the Malta Irrigation District.

b) During non-flood years, manage Dry Lake as a seasonal wetland by adding water from the Malta Irrigation District in the late fall or early spring and then discharging it down to Beaver Creek at the end of June.

c) During flood years, fill and hold water in Lake Bowdoin (approximately 3,500 surface acres in size) and Dry Lake (approximately 1,500 surface acres in size) until the end of

June. Then the water would be discharged down to Beaver Creek leaving Lake Bowdoin back at 1,200 surface acres in size and Dry Lake dry or as a wet meadow. Discharge water from this action would be less than 2,000 micromhos/cm. of conductivity, which would be further reduced through dilution upon reaching Beaver Creek. Downstream irrigators and appropriate State officials would be invited to advise in these matters and would be informed on proposed discharge schedules.

d) Allow irrigation return flow waters to flow through Drumbo Lake in order to maintain good water quality in the unit. These waters could be diverted into Lake Bowdoin and/or down to Beaver Creek.

e) If emergent aquatic vegetation (i.e., cattail and/or hardstem bulrush) begins to choke Lake Bowdoin, control management would be necessary.

3. Consequences

a) Water Quality and Discharges

During the first few flood years, downstream water users and the Montana Water Quality Bureau will have to be willing to let the Refuge discharge water of poor quality (5,000 to 10,000 micromhos/cm), which would mix with flood waters, in order to flush and freshen Bowdoin and Dry Lakes. The period that this water would be moving down the Beaver Creek drainage would be during the receding stages of the floods.

At present, the matter of the possible influences from the initial two or three flood year discharges on the fishery resources of

Beaver Creek and the Milk River is being investigated. Information on potential conductivity levels of waters discharged from the refuge, showing the conductivity levels that would result in Beaver Creek and the Milk River under various flow rates, has been sent to the Montana Department of Fish, Wildlife, and Parks for their evaluation. If they determine that there may be possible negative impacts on the fishery resource under certain discharge conditions (i.e., conductivity of discharge water and flow rate of Beaver Creek), discharges made under this alternative would be done so as not to subject the fishery to conditions that would have extensive or lasting effects.

After the first two or three flood cycles (more if necessary) have freshened the refuge lakes, discharges of water from the entire refuge would be suitable for agricultural use downstream. Annual downstream discharges of water would be approximately 3,500 acre feet (more during flood years) and would be made during the early summer period.

b) Blowing Alkali

The amount of alkali available to wind action would eventually be reduced substantially and is expected to be limited to small areas around the perimeter of Lake Bowdoin.

c) Waterfowl Production

Annual duck production, during non-flood years would be approximately 8,000, and during flood years it would be approximately 11,000. This is based on the increased productivity of Bowdoin,

Drumbo and Dry Lakes from freshening and the development of semi-permanent wetlands in the Dry Lake bays (see Appendix I).

d) Colonial Nesting Birds

The only impact on colonial nesting birds would be to change nesting location from the present Woody Island to Pelican Island. At the 1,200 surface-acre level of Lake Bowdoin, Woody Island would be a peninsula and be lost as a nesting site. However, Pelican Island would grow in size due to the lower water level and be comparable to the present size of Woody Island thus providing adequate space for the present populations of colonial nesting birds.

e) Waterfowl Migration Use

During non-flood years, the reduced surface area of refuge waters from the present would cause spring and fall migrational use by waterfowl to be reduced slightly. During flood years, spring migrational use would not be reduced. Flooding would not influence the fall migration period, so migrational use by waterfowl would always be reduced slightly during this season.

f) Botulism

The potential for botulism would be greatly reduced due to the freshened water conditions and the reduced surface area of the lakes during summer. If botulism started to show up, it would be far more easily contained than at present and this would greatly reduce the total losses from the disease.

g) Public Use

Through some alteration of the present public use areas on the refuge, the two main types of public use, hunting and wildlife observation, would remain at current levels.

h) Cost

Estimated construction cost for development and implementation of this option is $256,000. See Appendix II for itemized costs. Annual water cost, during non-flood and low runoff years, is estimated to be $15,000 if the water is available from the Malta Irrigation District.

1) Need 7,000 acre feet of water to compensate for evaporation.
2) Irrigation return water is approximately 1,500 acre feet, for which there is no cost.
3) The balance of 5,500 acre feet of water would be purchased @ 2.75/acre foot from the Malta Irrigation District for $15,125.

i) The Community Economy

Initially the construction cost of $256,000, to implement this option, would benefit the business community.

The refuge would continue to operate on an annual budget of approximately $177,000, which is mostly spent in the local community.

The refuge would continue to attract non-resident travelers, bird watchers, and hunters which all help support the local business community through the purchase of gas, food, motels, sporting goods, etc.

Annual discharges of water into Beaver Creek would increase the availability of water for agricultural use downstream. This will provide an economic benefit to downstream water users through increased flows in Beaver Creek at a time of year when irrigation demand is high.

C. Lake Bowdoin Sump Alternative

1. Features

a) Lake Bowdoin would be reduced to a maximum of 2,000 surface acres (3-foot contour - 2,204.69 m.s.l.) and function primarily as a collecting basin for alkaline waters flushed from other refuge impoundments. A water collecting dike and three or more small impoundment dikes would be constructed in Bowdoin's southwest bay to control and collect return flow irrigation water. This water would create seasonal wetlands behind the impoundment dikes, thus creating additional breeding pair habitat. Also, an old structure in the Nelson Canal would be rehabilitated and the ditch from this structure to Lake Bowdoin would be cleaned. Water from this ditch would enter the Lake Bowdoin basin and be used, through construction of low contour dikes, for spring seasonal ponds. A small impoundment dike constructed upstream on this ditch would also increase spring breeding pair habitat.

b) Dry Lake would be managed as the major production unit of the refuge; water will be flushed into the Lake Bowdoin sump to get Dry Lake water quality equal to or better than water quality in Beaver Creek. A contour ditch would be constructed along the north side of Dry Lake as an extension of the present ditch leading from Lakeside to Dry Lake. Three small impoundment dikes would be built below this ditch across bays of Dry Lake. A drain would be constructed from the Dry Lake/Bowdoin structure into the Lake Bowdoin sump area.

c) Drumbo would be flushed into the Lake Bowdoin sump to improve water quality in Drumbo and improve its waterfowl productivity. A plug, with a tube and riser, would be constructed between Drumbo and Lake Bowdoin. A drain channel would be dug from this plug into the southwest bay of Lake Bowdoin and a second drain ditch dug eastward from the east end of Drumbo to the railroad bridge would permit drainage of drumbo into Dry Lake. Also, the small water supply ditch into Goose Island Pond would need to be cleaned to permit it to carry more water.

2. Management

a) Lake Bowdoin would be allowed to evaporate to about 2203.69 m.s.l. (4-foot contour) prior to freeze-up each year. At this level the lake would have a surface area of approximately 1,200 acres and the Pelican Islands would provide a nesting site for the white pelican colony. Also, at this level the Lake Bowdoin basin could accept spring flush water from other units without breaching the small impoundment dikes in Bowdoin's southwest bay or exceeding the 2,204.69 maximum level. These small impoundments will be managed primarily for waterfowl production. They will be maintained with natural runoff and irrigation return flow through Black Coulee and other drainage channels from south of the Refuge. The proposed collection dike will intercept these scattered flows and consolidate them into a controllable head of water which will be used to provide breeding pair and brood habitat in the Southwest Bay Ponds. These ponds could also provide

resting areas and opportunities for waterfowl hunting when managed as permanent ponds. A continual flow through this series of ponds and/or periodic draining into the sump will maintain acceptable water quality.

Additional breeding pair habitat and one small impoundment would be located in the area near Long Island. Water from the Nelson Canal can be used to maintain this pond and spill from the pond would then create spring breeding habitat behind contour dikes. Then during the month of June water behind these contours would be drained into the sump.

b) Dry Lake would be managed as a seasonal wetland with emphasis on waterfowl production. Three permanent ponds, which will be established by diking across small bays on the lake's north side, will provide brood habitat and resting areas. Water supply to the Dry Lake Unit will be through the existing Lakeside Canal and proposed contour ditch. This ditch will be an extension of the existing canal and will also supply water to the three permanent ponds which will spill into the main Dry Lake basin. These ponds would be flushed annually to keep them fresh and productive. The basin will be flooded each spring to provide pair habitat and will then be drained into the Bowdoin Sump during June. Flooding of the basin may also be accomplished with Beaver Creek flood waters during some years.

After a few years of flushing, Dry Lake waters should improve in quality. Once the quality is equal to or better than Beaver Creek

water quality, discharges could be made into Beaver Creek rather than the Bowdoin Sump. Also, at this point the Dry Lake basin would start showing characteristics of a wet meadow which it would eventually become.

c) Drumbo would be managed to improve water quality and increase productivity. The control structure between Drumbo and Lake Bowdoin would make possible the use of irrigation return flows and/or irrigation district water to freshen Drumbo and the proposed Southwest Bay Ponds as water is released into the Lake Bowdoin Sump. To facilitate delivery of an adequate flow of irrigation district water the small ditch into Goose Island Pond would need some cleaning. The proposed drain ditch from Drumbo to the east would be used to pass water from Drumbo into Dry Lake and ultimately into Beaver Creek once water quality is acceptable for discharge.

3. Consequences

a) Water Quality and Discharges

As a result of flushing and freshening, water quality would be markedly improved in all units except Lake Bowdoin. Since it will be used as a sump to receive alkali water discharges from all other units, Lake Bowdoin's water quality will continue to decline. The decline will be significant during the first few years of flushing. Then after the other units become fresh, the salinity increase in the Bowdoin Sump will slow down considerably.

Because of the poor quality of water in the sump this alternative does not provide for any discharges from Lake Bowdoin. However,

once water quality in the other units was equal to or better than the quality of Beaver Creek water, discharges could be made into Beaver Creek from Dry Lake and Drumbo Lake. These discharges should total about 3,500 acre feet annually and occur during late June and early July. Since this water would be suitable for irrigation and livestock uses, downstream water users would benefit from the additional flow in Beaver Creek during irrigation season.

Although there will be no intentional discharges from Lake Bowdoin under this alternative, extreme flooding of Beaver Creek (50-100-year flood) would probably top Refuge dikes. Flood waters may even erode dikes to the degree that impounded waters would mix with flood waters and be carried into Beaver Creek. This situation occurred in the spring of 1978. Such an occurrence under this alternative would result in strongly alkaline waters from the Lake Bowdoin sump being carried into Beaver Creek by receding flood waters.

b) Blowing Alkali

Alkali dust will continue to blow from Dry Lake until it has been flushed a few times and becomes a fresh meadow. Lake Bowdoin will also contribute alkali dust from the area around the sump. Eventually winds should deplete the alkaline deposits and the sump area will stabilize, thus solving the alkali dust problem. How long this will take is not known.

c) Waterfowl Production

We estimate that waterfowl production will not change much from what it is now. Duck production would be about 7,500 annually (see Appendix I). However, future potential for increasing waterfowl production may develop as a result of water management changes which are features of this alternative, e.g., creating additional small ponds.

d) Colonial Nesting Birds

Nesting opportunities for colonial birds would change very little, if any. The two Pelican Islands would become one at the 3-foot contour level and the area would be about half the size of the present Woody Island. Although Woody Island would probably become a peninsula and be lost as a nesting site, two small islands will be created by the lower water level in Lake Bowdoin. Total area of these and Pelican Island will be almost the same as what is presently available for colonial nesters.

e) Waterfowl Migration Use

Use by spring migrants would be reduced slightly since Dry Lake would be wet and Lake Bowdoin would be about 1,200 surface acres. Fall migrants would still find sanctuary and resting areas on the refuge. Dabbling ducks would continue to feed mostly in off-refuge grain fields and divers would still find adequate food on the Refuge. Consequently, use by fall migrants would decline only slightly also.

f) Botulism

Losses from botulism should be reduced by this alternative since all small ponds, Lakeside Unit and Drumbo will be fresh water and Dry Lake will be dry during the botulism period of late summer. The Lake Bowdoin sump will continue to possess botulism potential, but losses will probably be less than at present. This will be due to the shorter, more regular shoreline and lack of emergent vegetation which will facilitate a more thorough cleanup of sick and dead birds.

g) Public Use

Wildlife observation and upland bird and waterfowl hunting are the uses that attract about 90 percent of refuge visitors annually. This alternative would continue to provide opportunities for hunting and wildlife observation at the present level. Some changes would be necessary to provide for visitor use of areas that are now closed.

h) Cost

Total construction costs for this alternative are estimated to be $518,750. Annual operation and maintenance costs would be the same as they are now. Appendix II shows construction cost details.

i) The Community Economy

Expenditure of more than half a million dollars at Bowdoin Refuge would have a definite effect on the local economy. The degree of effect would vary depending on whether or not local contractors did the work. The annual O&M budget of $177,000 would continue to contribute to the local economy. Also, the annual discharge

of about 3,500 acre feet of water suitable for irrigation use would have positive impacts on the economy of downstream water users.

Visitors to the refuge would continue to spend money locally while in the area.

D. Disposal Alternative

1. Features

FWS will divest itself of Bowdoin NWR. This can be accomplished in three ways.

Through an agreement signed by both parties, management of the refuge will be transferred to the State Department of Fish, Wildlife & Parks. FWS will retain title to the lands. FWS will not impose management requirements. The State will manage the area for its own objectives, at this point undetermined. FWS funding of the refuge will cease. However, equipment and facilities not needed elsewhere by FWS will accompany transfer. If the State does not wish to acquire water from the Malta Irrigation District, water rights will be abandoned.

A second means of disposal will be similar to the first, except that FWS will transfer title of the lands to the State. This will require Congressional approval and appropriate arrangements through BLM and GSA.

If the State does not wish to acquire or manage Bowdoin NWR, FWS will seek Congressional authorization to dispose of the refuge, declare lands and unneeded equipment and facilities excess, and request GSA to proceed with disposal. Water rights would accompany lands to new owner or be abandoned, depending upon intended use of lands and legal considerations in the original agreement providing for water to the refuge.

2. Management

Upon disposal of refuge, there would be no FWS management. At this point it is not possible to know what management the new owners may place upon the land.

3. Consequences

If the new owners/managers purchase water from the Malta Irrigation District and manage the area for the same general purposes as present, they will face the same problems and options that exist presently, and the consequences will be the same. These are covered elsewhere. Therefore, the consequences discussed here will assume that the new owners/manag ers will manage the area for quite different purposes and that they will not purchase water from the Malta Irrigation District.

a) Water Quality and Discharges

Without irrigation water, the new owners/managers may opt to breach and/or level dikes separating Bowdoin and Dry Lake from Beaver Creek. As with the Natural Rhythm Alternative, initially, highly saline waters of 5,000 to 10,000 micromhos/cm conductivity would be discharged into Beaver Creek. Eventually, Dry Lake will return to a wet meadow condition and, during years when Beaver Creek does not flood, Lake Bowdoin will be a stagnant, marshy, sump since return flow irrigation water and highly alkaline seepage will continue to enter the lake basin. If dikes are not breached, Dry Lake will remain dry and the Lake Bowdoin sump will

increase in salinity until another major flood similar to 1978 comes along, breaches the dikes, puts the salts from the bottom of both lakebeds into solution and carries them out as flood waters recede. Conditions will then be the same as if the dikes were deliberately breached except that flood waters will carry heavier loads of salts initially and water will be of a poorer quality than in the Natural Rhytham Alternative.

b) Blowing Alkali

Alkali will continue to blow indefinitely onto downwind lands from the bed of Dry Lake if dikes are not breached. Additionally, the exposed shorelines of Lake Bowdoin will contribute to the problem. Eventually, this problem may subside as wind depletes the alkaline deposits in the lake bottoms. Should the dikes be breached, blowing alkali will essentially cease, as described in the Natural Rhythm Alternative.

c) Waterfowl Production

Waterfowl production will decrease significantly to approximately 1,600 ducks annually, whether or not dikes are breached. When breached, deliberately or by floods, waterfowl production will temporarily increase with the increased size of the two big lakes, but will rapidly decline again. Since there will be no water supply for Lakeside, Teal and Farm Ponds, these ~~acres~~ will produce nothing.

d) Colonial Nesting Birds

Colonial bird nesting would cease. Woody Island will become a peninsula no longer suitable for these birds. Pelican Islands will also be high and dry in at least half of the years, incapable of sustaining a colonial bird nesting population.

e) Waterfowl Migration Use

If dikes are not breached, migratory waterfowl use in spring and fall will decline dramatically. Some shorebirds will find the limited, alkaline shorelines attractive, but these species will also use the area less than at present. With dikes breached, spring migratory bird use may continue at near present levels in those years Beaver Creek floods, but will fall off rapidly during intervening years.

f) Botulism

Botulism mortality will probably continue about at present levels. Lack of management activities to reduce the severity of botulism outbreaks will be offset by lower marsh and waterbird populations and fewer places where botulism can develop.

g) Public Use

Both upland bird and waterfowl hunting opportunities will decline substantially. Without water from the Malta Irrigation District, cover for pheasants and sharp-tailed grouse will deteriorate. Similarly, degradation of wetland habitat will attract fewer waterfowl in the fall. Hunting, generally, on the former refuge

will be mediocre. Waterfowl hunting, especially for geese, will be very adversely affected on neighboring lands since geese depend on the reruge for resting and sanctuary.

The area will no longer support sufficient populations of wildlife for bird observation, photography and similar pursuits.

h) Cost

FWS will have no construction costs or O & M costs. There will be nominal costs associated with closing the station. $177,000 annually in O & M costs and four permanent full-time and one permanent part-time position ceilings will be available for use on other FWS projects. The government will lose $2,000,000 in capital improvements.

i) The Community Economy

The local community will no longer benefit from most of the refugee's annual $177,000 O & M budget and employment of three local people. Benefits in lodging, meals and other sales from most of the nonresidents coming to the refuge to enjoy wildlife and hunt will be lost. Refuge receipts, now $1,000 annually, will no longer be provided Phillips County. However, this could be more than offset by property taxes if the lands went into private ownership.

Offsetting these losses will be whatever income and other benefits the new owners/managers will generate for the community. Assuming

the new owners/managers will not purchase irrigation water, the Malta Irrigation District will be able to either reissue to others the "water rights" associated with the refuge, or use them to offset other appropriations.

BOWDOIN NWR

Duck Production, 1960-81

Year	No. Produced to Nearest Thousand
1960	52,000
1961	24,000
1962	19,000
1963	31,000
1964	35,000
1965	34,000
1966	27,000
1967	16,000
1968	18,000
1969	12,000
1970	8,000
1971	4,000
1972	6,000
1973	No Data
1974	3,000
1975	5,000
1976	5,000
1977	3,000
1978	5,000
1979	8,000
1980	4,000
1981	3,000