# ILLINOIS NATURAL HISTORY SURVEY

## Section of Wildlife Research

PROPOSED EFFECTS OF LAKE MICHIGAN DIVERSION ON TERRESTRIAL HABITATS IN THE ILLINOIS RIVER VALLEY

FINAL REPORT
ILLINOIS DEPARTMENT OF TRANSPORTATION
DIVISION OF WATER RESOURCES
STIL-TRWRMICHDIV39485

DATE: 30 June 1983

PRINCIPAL INVESTIGATOR: Stephen P. Havera, Associate Professional Scientist

SECTION OF WILDLIFE RESEARCH

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# Proposed Effects of Lake Michigan Diversion on Terrestrial Habitats in the Illinois River Valley

## INTRODUCTION

The 1976 Water Resource and Development Act authorized a study and demonstration of increasing the diversion of Lake Michigan water at Chicago from the current average annual rate of 3,200 cubic feet per second (cfs) to a maximum of 10,000 cfs in order to improve water quality in the Illinois Waterway and to reduce shoreline damages along the Great Lakes. Major operational constraints governing increased diversion of water included suspension of the program when the level of Lake Michigan was below its average level and when the Illinois River stages approached bankfull conditions. Hydraulic computer models simulating average annual diversion rates of 6,600 cfs and 10,000 cfs for low, average, and high flow years in the Illinois Waterway were subsequently assessed and evaluated. The investigation demonstrated that diversion schemes of these magnitudes were not economically justified but suggested examining the merit of smaller diversion increases for optimization of Illinois Waterway benefits with minimization of losses to navigation and hydropower interests on the Great Lakes.

Accordingly, four additional operating plans of diversion of Lake Michigan waters were proposed. These plans were

Plan 1: Divert to provide a relatively constant 7,000 cfs triggering (cut off) on flows at Lockport, and downstream bankfull stages to decrease additional flood damages.

Plan 2: Divert such that flows during non-precipitation periods approximate 5,500 cfs at Lockport.

Plan 3: Divert a variable flow which is triggered on minimum and maximum stages in the La Grange and Peoria pools in order that stages would vary seasonally to provide maximum benefits to waterfowl management. The target range for maximum flow for the period of 1 July to 1 October was 440.5-441.0 ft at the Henry gauge in Peoria Pool and 430.4-431.0 ft at the Havana gauge in La Grange Pool.

Plan 4: Divert to maintain 3,800 cfs flows at Lockport.

The purpose of this investigation is to evaluate any ecological effects of the proposed operating Plans 1, 2, and 3 on the terrestrial environment in selected areas of the Peoria and La Grange pools in the Illinois River waterway.

## Historical Perspective of the Significance of Waterfowl and Wildlife to the Illinois River Valley

The Illinois River valley is renowned for its waterfowl hunting and its importance to migrating and wintering waterfowl in the Mississippi Flyway. The key to the significance of the Illinois River valley as one of the nation's premier areas for migrating waterfowl is the bottomland lakes that flank the river. In the late 19th century, sportsmen recognized the abundance of waterfowl in the bottomland lakes of the valley and

began to acquire bottomland property to be used as duck clubs. By 1941, 432 (55%) of the 792 duck clubs in Illinois were located in the Illinois Valley (Bellrose, 1944:16). In recent years, approximately 250 (71%) of the 350 duck clubs in Illinois occur in the Illinois Valley. These duck clubs currently provide terrestrial and aquatic habitats for a multitude of avian and mammalian species of economic importance among areas intensively developed for agriculture.

Because of changes in hunting regulations, such as the prohibition of baiting for harvesting waterfowl, and changes in the flora of the Illinois Valley, it became essential to have summer water levels conducive to food production to maintain quality waterfowl hunting. In recent decades, increased amounts of sedimentation and turbidity filled the shallow, productive areas of the bottomland lakes and clouded their waters. Consequently, vast expanses of aquatic duck food plants were eliminated from the waters of the Illinois Valley. However, duck food plants, commonly known as moist-soil plants, volunteer or can be sown during the summer on exposed mud flats. These mud flats with their established communities of moist-soil plants attract migrating waterfowl which feed upon their seeds and vegetation. To avoid being dependent upon the actual river levels to expose mud flats, some public and private waterfowl areas in Peoria and La Grange pools manage water levels via impoundments for waterfowl food production.

This report concentrated on Peoria and La Grange pools of the Illinois River valley where the majority of the remaining terrestrial wildlife and waterfowl habitat occurs in the numerous bottomland lakes and sloughs. Peoria Pool contains 147 licensed private duck clubs representing 11,129 ha (27,500 acres) and La Grange Pool hosts 94 licensed clubs encompassing 12,456 ha (30,779 acres). Peoria and La Grange pools thus contain a combined total of 23,585 ha (58,279 acres) or 87.7% of the 26,905 ha (66,482 acres) controlled by licensed duck clubs in the Illinois Valley. In addition, state and federal lands with waterfowl management units total 13,126 ha (32,434 acres) in Peoria and La Grange pools with 7,319 ha (18,085 acres) of water area. Of the 84,986 ha (210,000 acres) of nonleveed floodplain in the Illinois Valley, approximately 36,758 ha (90,829 acres) or 43.3% is used primarily for waterfowl management encompassing 9,853 ha (24,337 acres) of water area on state and federal properties and 26,905 ha (66,482 acres) of licensed private duck clubs.

In September 1978, the Natural History Survey sent a questionnaire to 219 of the duck clubs that owned 16 ha (40 acres) or more along the Illinois River. A total of 160 (73.1%) of the clubs responded, representing 77.3% (20,803 ha; 51,405 acres) of the total area managed by licensed duck clubs in the Illinois Valley (Havera et al., 1980:6-3). Water levels could be controlled for waterfowl food production on approximately 32% (6,603 ha; 16,315 acres) of the total area managed by the clubs

responding to the questionnaire thus leaving about 68% of the area subject to actual river conditions (Havera et al., 1980:6-4). The clubs in La Grange and Peoria pools accounted for 97.8% of the area under water level management.

The U.S. Fish and Wildlife Service and the Illinois Department of Conservation own 20,428 ha (50,478 acres) in the Illinois River valley containing 9,853 ha (24,344 acres) of water. Water levels can be managed on 14.5% (2,990 ha; 7,388 acres) of the total area. La Grange Pool has the greatest number of state and federal areas with water level control (Havera et al., 1980:6-5).

In addition to impoundments where water levels can be controlled, thousands of hectares of publicly- and privately-owned waterfowl areas must rely on naturally occurring low water levels during the summer for the exposure of mud flats and the subsequent establishment of moist-soil vegetation or the planting of agricultural duck foods. Sections of federal, state, and private duck-hunting lands in the valley are vital refuge or "rest" areas where no hunting and little disturbance is permitted during the hunting season in order to provide protection and adequate food for the international waterfowl resource. It is during the critical low flow periods of summer when the flora that provides food for the waterfowl populations migrating through the Illinois Valley is extremely susceptible to increased water levels.

## METHODS

Analyses of the effects of the proposed diversion schemes were conducted in the Peoria and La Grange pools because these pools contain the majority of wildlife and aquatic habitat in the Illinois River valley. Computer models predicting the proposed water levels and the existing water levels were provided from 1970-1978 for Diversion Plan 1 (7,000 cfs) and Plan 2 (5,500 cfs) and from 1972, 1974-1977 for Plan 3 (variable flow) for the Henry gauge in Peoria Pool and the Havana gauge in La Grange Pool. To evaluate any effects of the proposed diversion schemes, the daily proposed and existing water level readings from the computer models were averaged into 52 standardized weeks for each year of the respective models. The average of the proposed and existing water levels for each standardized week was then calculated from all the years of the models. The difference between the proposed and existing average weekly levels was determined and this value represented the increment that the various proposed diversion schemes would add to the Illinois River levels.

The existing water levels generated for the Illinois River by the computer models of the diversion schemes were not the same as the levels that actually occurred. Therefore, we calculated an average of the daily gauge readings that were

measured at the Henry and Havana gauges for the standardized weeks for each year of the proposed diversion plans. An average of the actual gauge readings for the standardized weeks was calculated from all the years of the proposed diversion plans. The average increment of water level increase resulting from each proposed diversion scheme for the standardized weeks was then respectively added to the average actual river levels measured at Henry and Havana for those weeks. We then had an average of the water levels by week that actually occurred at Henry and Havana plus the average increment added by diversion by week for the period of years of each diversion scheme. The sum of these two values provided an average weekly water level for the years of study that could be used to evaluate the inundation of various habitats and allow the assessment of the diversion plans.

Four study areas were selected to evaluate the proposed diversion schemes. One state-owned and one private area were chosen in both Peoria and La Grange pools (Figure 1). Study locations were selected on the basis of their possession of aquatic and terrestrial habitats representative of each pool and areas intensively managed for waterfowl.

In Peoria Pool, private lands along the east side of river mile 196 to 202 near Henry were selected for evaluation (Figure 1). This area consists of 6 major duck clubs plus other private

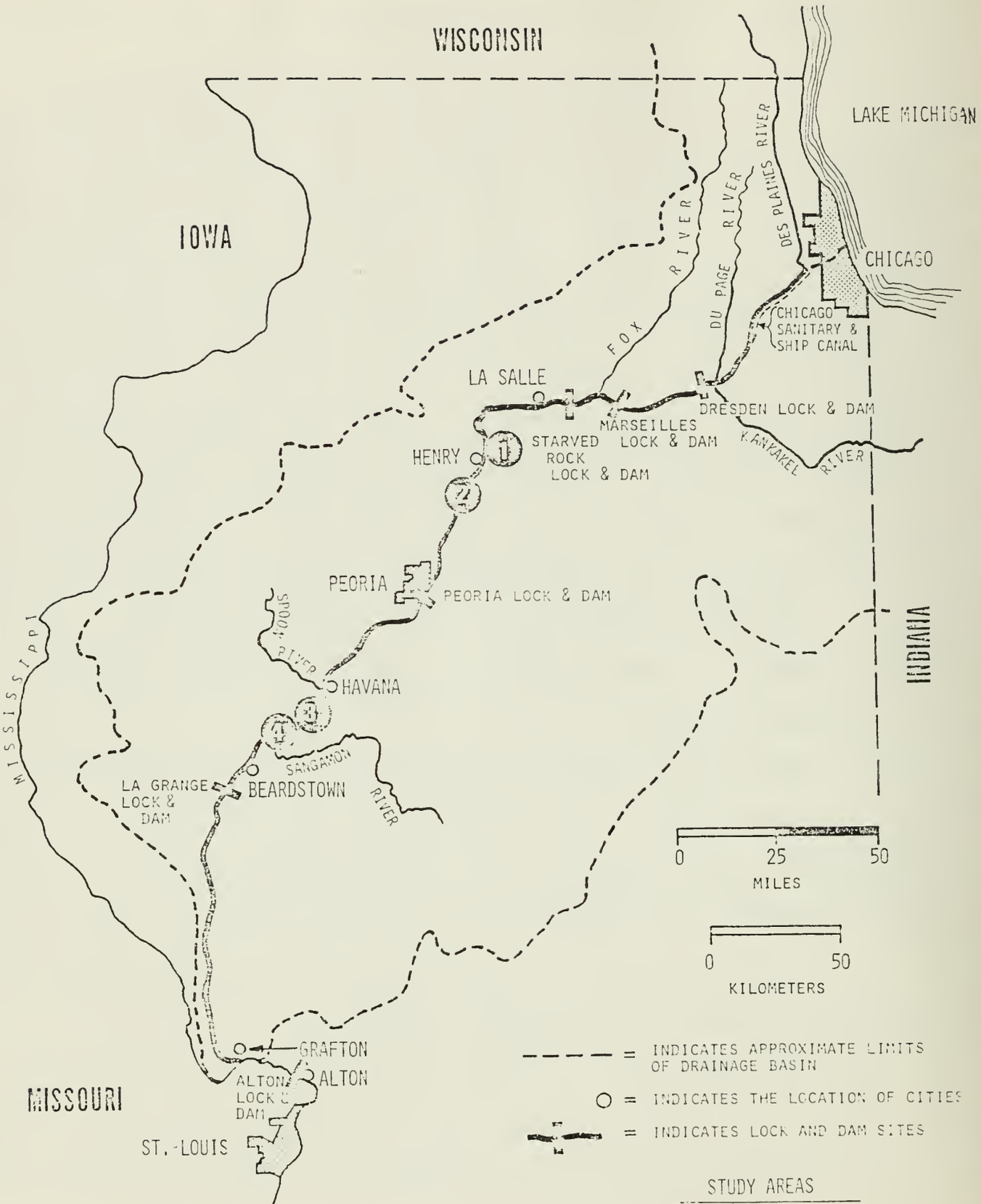


Figure 1. Henry and Marshall County areas in Peoria Pool and Grand Island and Sanganois areas in La Grange Pool selected for evaluation of Diversion Plans 1, 2, and 3.

inholdings. Levees for waterfowl management occurred on some of the duck clubs. The second area selected in Peoria Pool was Marshall County Conservation Area which is owned and managed by the Illinois Department of Conservation. Marshall County Conservation Area contains property on both sides of the river and stretches from river mile 182 to 189. One leveed impoundment for waterfowl management enclosed by a levee 450 ft in elevation occurs on the area.

In La Grange Pool, the private area chosen for evaluation was Grand Island which ranges between river mile 107 and 113 approximately 6 miles below Havana (Figure 1). Grand Island is the largest island in the Illinois River and is a private duck club consisting of a variety of habitats. It contains no leveed areas for intensive waterfowl management. The state area selected for investigation was a section of Sanganois Conservation Area from river mile 95 to 101 at the confluence of the Sangamon and Illinois rivers. Sanganois contains a variety of aquatic and terrestrial habitats and accordingly is one of the best wildlife areas in the Illinois River valley.

In addition to the computer models predicting river levels for the three diversion plans, the Corps of Engineers also provided blue-line maps prepared in 1981 by Aero-Metric Engineering, Inc., Sheboygan, Wisconsin. The blue-line maps were compiled using photogrammetric instruments with aerial photography of the Illinois River valley. The maps had a scale

of 1 in = 200 ft and were delineated in 2-ft contours accurate to approximately 1 ft. Elevations above the surface of water areas were provided at the next even-numbered contour level. The flight dates for aerial photography of the 4 study areas were as follows: Henry Area, 14 January 1980; Marshall County Area, 4 December 1979; and the Grand Island and Sanganois Areas, 4 December 1978.

The aquatic and terrestrial habitats of the study areas were classified into nine categories. The 9 habitat categories are (1) open water; (2) mud flats dominated by moist-soil plants such as millets (Echinochloa spp.), nutgrasses (Cyperus spp.), and smartweeds (Polygonum spp.); (3) marsh containing emergent aquatic vegetation such as bulrushes (Scirpus spp.), duck potato (Sagittaria spp.), and cattails (Typha spp.); (4) scrub-shrub consisting principally of willows (Salix spp.) and buttonbush (Cephalanthus occidentalis) bordering shorelines; (5) forest dominated by silver maple (Acer saccharinum), ashes (Fraxinus spp.), cottonwood (Populus deltoides), willows (Salix spp.) and elms (Ulmus spp.); (6) areas managed for waterfowl including impoundment areas within levees specifically built for water level manipulation for moist-soil plant management or the planting of agricultural foods for waterfowl; (7) stream or river banks; (8) agricultural fields; and (9) miscellaneous including roads, levees, parking areas, buildings, or similar

features. The flora and fauna species composition of these various communities of the Illinois River valley and their relationship to water conditions is thoroughly presented and discussed in a previous investigation of proposed increases in Lake Michigan diversion (Havera et al., 1980) which served as a basis for evaluating any effects of Diversion Plans 1, 2, and 3 in the current report. The amount of area in the nine habitat categories was planimetered by 2-ft contour intervals for each study site. The amount of each habitat by 2-ft intervals could then be compared to the average of the weekly river levels predicted by the three diversion plans which had an accuracy of approximately 1 ft. Thus, the area of the various types of habitats inundated and the duration of inundation resulting from the average actual weekly river levels that occurred during the study periods and from the average weekly levels predicted by the three diversion plans could be determined for the study sites.

Actual and predicted river levels for the Henry and Havana gauges were adjusted to the four study sites. This was done by calculating the fall per mile of the river between two known gauges, multiplying these values by the distance of the study sites from the Henry or Havana gauge, and then adding or subtracting the correction factor to the Henry or Havana gauge elevations depending on whether the study area was above or below these gauges.

# RESULTS

## Peoria Pool

### Description of the Study Areas

Henry Area. The privately-owned land near Henry selected for study consisted of 1,250 ha with good representation of all the habitat classes (Table 1). Impoundments encompassing 98.5 ha and managed for waterfowl were present on the area. The majority of the impoundment area was protected by levees with elevations of 444 ft. The river level for this area ranged between 440.2 to 440.5 ft when the aerial photos were flown on 14 January 1980. The 440.2 to 440.5-ft elevation should allow for maximum mud flat exposure because most of the mud flats occur below 442.1 ft (Havera et al., 1980:5-62). The majority of all habitat classes occur under an elevation of 450 ft. Forest represented 36% of the area sampled and some of the marsh and scrub-shrub habitats were scattered within forested areas.

Marshall County Area. A total of 1,193 ha representing the majority of the Marshall County Conservation Area was selected for analyses (Table 2). All habitat classes were represented with open water and forest accounting for 63% and 20% of the total area sampled, respectively. The river level ranged between 440.4 and 441.0 ft when the aerial photos were taken on 4 December 1979. The majority of mud flats at Marshall County occur below 441.0 ft with approximately 37% occurring below 440.4 ft (Havera et al., 1980:5-62). Accordingly, much of the potential surface area of mud flats were inundated when the

Table 1. Area (hectares and acres) of habitat classes by 2-ft contour intervals at private areas near Henry, Illinois, Peoria Pool.

| Elevation msl (ft) | Habitat Classes | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Open Water | | Mud Flats | | Marsh | | Scrub-Shrub | | Forest | | Impoundments or Intensively Managed | | Stream Bank | | Agriculture | | Miscellaneous (levees, roads, etc.) | |
| | ha | acres | ha | acres | ha | acres | ha | acres | ha | acres | ha | acres | ha | acres | ha | acres | ha | acres |
| 440-42 | 266.4 | 658.0 | 45.5 | 112.4 | 2.1 | 5.3 | 5.5 | 13.6 | 15.4 | 38.0 | 0.9 | 2.2 | 0.7 | 1.6 | 1.5 | 3.7 | 0.5 | 1.2 |
| 442-44 | 12.5 | 30.9 | 16.5 | 40.9 | 15.5 | 38.4 | 45.9 | 113.5 | 139.9 | 345.7 | 0.2 | 0.5 | | | 5.1 | 12.6 | 0.8 | 2.1 |
| 444-46 | 1.5 | 3.8 | 2.8 | 7.0 | 5.9 | 14.7 | 17.0 | 41.9 | 97.6 | 241.1 | 78.9 | 195.1 | | | 2.0 | 4.9 | 0.6 | 1.4 |
| 446-48 | 0.1 | 0.2 | 0.4 | 0.9 | 7.8 | 19.2 | 8.5 | 20.9 | 57.4 | 141.8 | 6.1 | 15.0 | | | 3.7 | 9.2 | 0.2 | 0.5 |
| 448-50 | 0.9 | 2.2 | 0.1 | 0.3 | 10.8 | 26.8 | 88.3 | 218.2 | 51.2 | 126.5 | 5.6 | 13.9 | | | 2.4 | 5.8 | 1.3 | 3.2 |
| 450-52 | 1.9 | 4.7 | | | 8.0 | 19.7 | 5.9 | 14.5 | 33.8 | 83.5 | 6.8 | 17.9 | | | 4.2 | 10.4 | 0.4 | 1.0 |
| 452-54 | 0.3 | 0.8 | | | 4.5 | 11.0 | 5.8 | 14.3 | 21.6 | 53.4 | | | | | 9.6 | 23.6 | 1.4 | 3.5 |
| 454-56 | 2.4 | 5.9 | | | 3.4 | 8.4 | 3.0 | 7.3 | 17.6 | 43.4 | | | | | 18.9 | 46.7 | 1.8 | 4.5 |
| 456-58 | 0.1 | 0.4 | | | 1.0 | 2.4 | 0.7 | 1.7 | 10.6 | 26.3 | | | | | 28.8 | 71.2 | 1.3 | 3.3 |
| 456-60 | 0.1 | 0.1 | | | 0.6 | 1.4 | 0.1 | 0.1 | 5.4 | 13.4 | | | | | 20.2 | 49.9 | 2.7 | 6.7 |
| OTHER | | | | | | | | | | | | | | | | | | |
| 450-60 | | | | | | | | | 0.8 | 1.9 | | | | | | | | |
| 440-48 | | | | | | | | | 0.1 | 0.1 | | | | | | | | |
| 456-60 | 0.1 | 0.1 | | | | | 0.1 | 0.1 | | | | | | | | | | |
| 446-50 | | | | | | | | | 0.1 | 0.3 | | | | | | | | |
| 450-56 | | | | | | | | | | | | | | | | | | |
| 445-56 | | | | | | | 0.1 | 0.3 | | | | | | | | | | |
| 446-50 | | | 0.1 | 0.1 | | | | | | | | | | | | | | |
| TOTAL | 286.3 | 707.2 | 65.4 | 161.5 | 59.6 | 147.2 | 180.9 | 446.8 | 451.5 | 1115.2 | 98.5 | 243.3 | 0.7 | 1.6 | 96.4 | 238.1 | 11.0 | 27.4 |

GRAND TOTAL 1,250.3 ha -- 3,088.2 acres

Table 2. Area (hectares and acres) of habitat classes by 2-ft contour intervals at Marshall County Conservation Area, Peoria Pool.

| Elevation msl (ft) | Habitat Classes | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Open Water | | Mud Flats | | Marsh | | Scrub-Shrub | | Forest | | Impoundments or Intensively Managed | | Stream Bank | | Agriculture | | Miscellaneous (levees, roads, etc.) | |
| | ha | acres | ha | acres | ha | acres | ha | acres | ha | acres | ha | acres | ha | acres | ha | acres | ha | acres |
| 440-42 | 750.2 | 1853.0 | 73.0 | 180.3 | 1.4 | 3.5 | 26.8 | 66.2 | 38.7 | 95.7 | | | | | | | | |
| 442-44 | 0.1 | 0.1 | 6.3 | 15.6 | 13.3 | 32.9 | 16.5 | 40.8 | 121.2 | 299.4 | | | | | | | | |
| 444-46 | | | | | 4.7 | 11.7 | 0.8 | 2.0 | 28.0 | 69.2 | | | | | | | 0.1 | 0.3 |
| 446-48 | 0.2 | 0.6 | 0.1 | 0.3 | 3.1 | 7.6 | 0.9 | 2.2 | 13.0 | 32.0 | | | | | 0.6 | 1.4 | 0.3 | 0.8 |
| 448-50 | | | | | 0.4 | 1.1 | 0.2 | 0.5 | 12.1 | 30.0 | | | | | 2.1 | 5.2 | 0.7 | 1.8 |
| 450-52 | | | | | 0.3 | 0.6 | 0.1 | 0.1 | 7.3 | 18.1 | 39.4 | 97.3 | | | 3.9 | 9.6 | 0.3 | 0.7 |
| 452-54 | | | | | 0.2 | 0.6 | | | 5.2 | 12.9 | | | | | 3.2 | 7.8 | 0.3 | 0.8 |
| 454-56 | | | | | | | | | 3.2 | 8.0 | | | | | 1.7 | 4.2 | 0.3 | 0.8 |
| 456-58 | 0.1 | 0.3 | | | | | | | 2.4 | 6.0 | | | | | 1.0 | 3.5 | 0.7 | 1.6 |
| 458-60 | 0.1 | 0.1 | | | | | | | 2.5 | 6.2 | | | | | 0.9 | 2.3 | 0.4 | 0.9 |
| OTHER | | | | | | | | | | | | | | | | | | |
| 452-58 | | | | | | | | | | | | | | | | | 0.4 | 0.1 |
| 454-60 | | | | | | | | | 0.2 | 0.4 | | | | | | | | |
| 450-58 | | | | | | | | | | | | | | | | | 1.1 | 2.7 |
| 450-60 | | | | | | | | | 2.8 | 6.9 | | | | | | | 0.1 | 0.3 |
| 442-50 | | | | | | | | | | | | | | | | | 0.4 | 1.0 |
| TOTAL | 750.7 | 1854.2 | 79.4 | 196.1 | 23.4 | 57.8 | 45.3 | 111.9 | 236.6 | 584.4 | 39.4 | 97.3 | | | 13.4 | 33.1 | 5.1 | 12.6 |

GRAND TOTAL 1,193.3 ha -- 2,947.5 acres

aerial photos were taken and would, therefore, be included in the open water habitat category. A 39-ha impoundment managed for waterfowl was enclosed by a 450-ft levee. The majority of the habitat in the various classes occurred below 446 ft.

Actual River Levels

The weekly average of the actual river levels from 1970-1978 and the corresponding percentages of the various habitat classes that were inundated by these ambient river levels are presented in Table 3 for the Henry Area and Table 4 for the Marshall County Area.

Henry Area. At the Henry Area, the weekly averages of the actual river levels were above 442.0 ft for most of the year except for the period of 24 July through 17 September during the growing season for plants. The averages of the actual river levels appear to exert unfavorable water levels for mud flat habitat, possible marginal levels for forest, and levels conducive to marsh and scrub-shrub.

For the establishment of a productive moist-soil plant community on mud flats, exposure of the mud flats should occur between the end of June and early August for seed germination. Early July is the ideal time. Subsequent inundation of moist-soil plants beyond a critical height prior to maturity in early October results in the death of the plants and poor seed production. At the Henry Area, approximately 30% of the mud flats

Table 3. The 1970-1978 weekly averages of actual river levels and the corresponding percentage of habitat classes inundated for the Henry Area, Peoria Pool. Total hectares of each habitat type are in parentheses.

| Week | Weekly Avg. Water Levels msl (ft) | Habitat Class: Open Water (286.2) | Mud Flats (65.4) | Marsh (59.6) | Scrub-shrub (180.6) | Forest (452.0) | Impoundments or Managed (98.6) | Stream bank (0.7) | Agri-culture (96.4) | Misc. (11.1) |
|---|---|---|---|---|---|---|---|---|---|---|
| Jan 1-7 | 443.4 | 97.4 | 94.8 | 29.7 | 28.5 | 34.4 | 1.1 | 100 | 6.8 | 11.7 |
| Jan 8-14 | 443.5 | 97.4 | 94.8 | 29.7 | 28.5 | 34.4 | 1.1 | 100 | 6.8 | 11.7 |
| Jan 15-21 | 443.5 | 97.4 | 94.8 | 29.7 | 28.5 | 34.4 | 1.1 | 100 | 6.8 | 11.7 |
| Jan 22-28 | 443.9 | 97.4 | 94.8 | 29.7 | 28.5 | 34.4 | 1.1 | 100 | 6.8 | 11.7 |
| Jan 29-Feb 4 | 444.4 | 97.9 | 99.1 | 39.6 | 37.9 | 56.0 | 81.1 | 100 | 8.9 | 17.1 |
| Feb 5-11 | 444.0 | 97.4 | 94.3 | 29.7 | 28.5 | 34.4 | 1.1 | 100 | 6.8 | 11.1 |
| Feb 12-18 | 444.2 | 97.9 | 99.1 | 39.6 | 37.9 | 56.0 | 81.1 | 100 | 8.9 | 17.1 |
| Feb 19-25 | 444.2 | 97.9 | 99.1 | 39.6 | 37.9 | 56.0 | 81.1 | 100 | 8.9 | 17.1 |
| Feb 26-Mar 4 | 444.9 | 97.9 | 99.1 | 39.6 | 37.9 | 56.0 | 81.1 | 100 | 8.9 | 17.1 |
| Mar 5-11 | 445.4 | 97.9 | 99.1 | 39.6 | 37.9 | 56.0 | 81.1 | 100 | 8.9 | 17.1 |
| Mar 12-18 | 445.6 | 97.9 | 99.1 | 39.6 | 37.9 | 56.0 | 81.1 | 100 | 8.9 | 17.1 |
| Mar 19-25 | 446.0 | 97.9 | 99.1 | 39.6 | 37.9 | 56.0 | 81.1 | 100 | 8.9 | 17.1 |
| Mar 26-Apr 1 | 445.2 | 97.9 | 99.1 | 39.6 | 37.9 | 56.0 | 81.1 | 100 | 8.9 | 17.1 |
| Apr 2-8 | 446.0 | 97.9 | 99.1 | 39.6 | 37.9 | 56.0 | 81.1 | 100 | 8.9 | 17.1 |
| Apr 9-15 | 445.7 | 97.9 | 99.1 | 39.6 | 37.9 | 56.0 | 81.1 | 100 | 8.9 | 17.1 |
| Apr 16-22 | 445.3 | 97.9 | 99.1 | 39.6 | 37.9 | 56.0 | 81.1 | 100 | 8.9 | 17.1 |
| Apr 23-29 | 446.4 | 98.0 | 99.7 | 52.7 | 42.6 | 68.7 | 87.3 | 100 | 12.8 | 18.9 |
| Apr 30-May 6 | 446.5 | 98.0 | 99.7 | 52.7 | 42.6 | 68.7 | 87.3 | 100 | 12.8 | 18.9 |
| May 7-13 | 446.1 | 98.0 | 99.7 | 52.7 | 42.6 | 68.7 | 87.3 | 100 | 12.8 | 18.9 |
| May 14-20 | 446.7 | 98.0 | 99.7 | 52.7 | 42.6 | 68.7 | 87.3 | 100 | 12.8 | 18.9 |
| May 21-27 | 446.0 | 97.9 | 99.1 | 39.6 | 37.9 | 56.0 | 81.1 | 100 | 8.9 | 17.1 |
| May 28-June 4 | 444.8 | 97.9 | 99.1 | 39.6 | 37.9 | 56.0 | 81.1 | 100 | 8.9 | 17.1 |
| June 5-11 | 444.5 | 97.9 | 99.1 | 39.6 | 37.9 | 56.0 | 81.1 | 100 | 8.9 | 17.1 |
| June 12-18 | 444.6 | 97.9 | 99.1 | 39.6 | 37.9 | 56.0 | 81.1 | 100 | 8.9 | 17.1 |
| June 19-25 | 445.4 | 97.9 | 99.1 | 39.6 | 37.9 | 56.0 | 81.1 | 100 | 8.9 | 17.1 |
| June 26-July 2 | 445.4 | 97.9 | 99.1 | 39.6 | 37.9 | 56.0 | 81.1 | 100 | 8.9 | 17.1 |

Table 3 (cont). The 1970-1978 weekly averages of actual river levels and the corresponding percentage of habitat classes inundated for the Henry Area, Peoria Pool. Total hectares of each habitat type are in parentheses.

| Week | Weekly Avg. Water Levels msl (ft) | Habitat Class | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Open Water (286.2) | Mud Flats (65.4) | Marsh (59.6) | Scrub-shrub (180.6) | Forest (452.0) | Impoundments or Managed (98.6) | Stream bank (0.7) | Agri-culture (96.4) | Misc. (11.1) |
| July 3-9 | 443.9 | 97.4 | 94.8 | 29.7 | 28.5 | 34.4 | 1.1 | 100 | 6.8 | 11.7 |
| July 10-16 | 442.3 | 97.4 | 94.8 | 29.7 | 28.5 | 34.4 | 1.1 | 100 | 6.8 | 11.7 |
| July 17-23 | 442.1 | 97.4 | 94.8 | 29.7 | 28.5 | 34.4 | 1.1 | 100 | 6.8 | 11.7 |
| July 24-30 | 441.9 | 93.1 | 69.6 | 3.5 | 3.0 | 3.4 | 1.0 | 100 | 1.6 | 4.5 |
| July 31-Aug 6 | 441.6 | 93.1 | 69.6 | 3.5 | 3.0 | 3.4 | 1.0 | 100 | 1.6 | 4.5 |
| Aug 7-13 | 441.9 | 93.1 | 69.6 | 3.5 | 3.0 | 3.4 | 1.0 | 100 | 1.6 | 4.5 |
| Aug 14-20 | 441.8 | 93.1 | 69.6 | 3.5 | 3.0 | 3.4 | 1.0 | 100 | 1.6 | 4.5 |
| Aug 21-27 | 441.6 | 93.1 | 69.6 | 3.5 | 3.0 | 3.4 | 1.0 | 100 | 1.6 | 4.5 |
| Aug 28-Sept 3 | 442.0 | 93.1 | 69.6 | 3.5 | 3.0 | 3.4 | 1.0 | 100 | 1.6 | 4.5 |
| Sept 4-10 | 441.6 | 93.1 | 69.6 | 3.5 | 3.0 | 3.4 | 1.0 | 100 | 1.6 | 4.5 |
| Sept 11-17 | 441.6 | 93.1 | 69.6 | 3.5 | 3.0 | 3.4 | 1.0 | 100 | 1.6 | 4.5 |
| Sept 18-24 | 442.5 | 97.4 | 94.8 | 29.7 | 28.5 | 34.4 | 1.1 | 100 | 6.8 | 11.7 |
| Sept 25-Oct 1 | 442.9 | 97.4 | 94.8 | 29.7 | 28.5 | 34.4 | 1.1 | 100 | 6.8 | 11.7 |
| Oct 2-8 | 442.9 | 97.4 | 94.8 | 29.7 | 28.5 | 34.4 | 1.1 | 100 | 6.8 | 11.7 |
| Oct 9-15 | 442.5 | 97.4 | 94.8 | 29.7 | 28.5 | 34.4 | 1.1 | 100 | 6.8 | 11.7 |
| Oct 16-22 | 442.2 | 97.4 | 94.8 | 29.7 | 28.5 | 34.4 | 1.1 | 100 | 6.8 | 11.7 |
| Oct 23-29 | 441.9 | 93.1 | 69.6 | 3.5 | 3.0 | 3.4 | 1.0 | 100 | 1.6 | 4.5 |
| Oct 30-Nov 5 | 442.2 | 97.4 | 94.8 | 29.7 | 28.5 | 34.4 | 1.1 | 100 | 6.8 | 11.7 |
| Nov 6-12 | 442.3 | 97.4 | 94.8 | 29.7 | 28.5 | 34.4 | 1.1 | 100 | 6.8 | 11.7 |
| Nov 13-19 | 442.2 | 97.4 | 94.8 | 29.7 | 28.5 | 34.4 | 1.1 | 100 | 6.8 | 11.7 |
| Nov 20-26 | 442.3 | 97.4 | 94.8 | 29.7 | 28.5 | 34.4 | 1.1 | 100 | 6.8 | 11.7 |
| Nov 27-Dec 3 | 442.2 | 97.4 | 94.8 | 29.7 | 28.5 | 34.4 | 1.1 | 100 | 6.8 | 11.7 |
| Dec 4-10 | 442.2 | 97.4 | 94.8 | 29.7 | 28.5 | 34.4 | 1.1 | 100 | 6.8 | 11.7 |
| Dec 11-17 | 442.4 | 97.4 | 94.8 | 29.7 | 28.5 | 34.4 | 1.1 | 100 | 6.8 | 11.7 |
| Dec 18-24 | 442.7 | 97.4 | 94.8 | 29.7 | 28.5 | 34.4 | 1.1 | 100 | 6.8 | 11.7 |
| Dec 25-31 | 442.4 | 97.4 | 94.8 | 29.7 | 28.5 | 34.4 | 1.1 | 100 | 6.8 | 11.7 |

Table 4. The 1970-1978 weekly averages of actual river levels and the corresponding percentage of habitat classes inundated for the Marshall County Area, Peoria Pool. Total hectares of each habitat type are in parentheses.

| Week | Weekly Avg. Water Levels msl (ft) | Habitat Class: Open Water (750.6) | Mud Flats (79.5) | Marsh (23.5) | Scrub-shrub (45.2) | Forest (236.6) | Impoundments or Managed (39.4) | Stream bank (0) | Agri-culture (13.4) | Misc. (5.1) |
|---|---|---|---|---|---|---|---|---|---|---|
| Jan 1-7 | 442.1 | 100.0 | 100.0 | 62.6 | 95.6 | 67.6 | 0 | | 0 | 0 |
| Jan 8-14 | 442.2 | 100.0 | 100.0 | 62.6 | 95.6 | 67.6 | 0 | | 0 | 0 |
| Jan 15-21 | 442.2 | 100.0 | 100.0 | 62.6 | 95.6 | 67.6 | 0 | | 0 | 0 |
| Jan 22-28 | 442.6 | 100.0 | 100.0 | 62.6 | 95.6 | 67.6 | 0 | | 0 | 0 |
| Jan 29-Feb 4 | 443.1 | 100.0 | 100.0 | 62.6 | 95.6 | 67.6 | 0 | | 0 | 0 |
| Feb 5-11 | 442.7 | 100.0 | 100.0 | 62.6 | 95.6 | 67.6 | 0 | | 0 | 0 |
| Feb 12-18 | 442.9 | 100.0 | 100.0 | 62.6 | 95.6 | 67.6 | 0 | | 0 | 0 |
| Feb 19-25 | 442.9 | 100.0 | 100.0 | 62.6 | 95.6 | 67.6 | 0 | | 0 | 0 |
| Feb 26-Mar 4 | 443.6 | 100.0 | 100.0 | 62.6 | 95.6 | 67.6 | 0 | | 0 | 0 |
| Mar 5-11 | 444.1 | 100.0 | 100.0 | 82.6 | 97.3 | 79.4 | 0 | | 0 | 2.0 |
| Mar 12-18 | 444.3 | 100.0 | 100.0 | 82.6 | 97.3 | 79.4 | 0 | | 0 | 2.0 |
| Mar 19-25 | 444.7 | 100.0 | 100.0 | 82.6 | 97.3 | 79.4 | 0 | | 0 | 2.0 |
| Mar 26-Apr 1 | 443.9 | 100.0 | 100.0 | 62.6 | 95.6 | 67.6 | 0 | | 0 | 0 |
| Apr 2-8 | 444.7 | 100.0 | 100.0 | 82.6 | 97.3 | 79.4 | 0 | | 0 | 2.0 |
| Apr 9-15 | 444.4 | 100.0 | 100.0 | 82.6 | 97.3 | 79.4 | 0 | | 0 | 2.0 |
| Apr 16-22 | 444.0 | 100.0 | 100.0 | 62.6 | 95.6 | 67.6 | 0 | | 0 | 2.0 |
| Apr 23-29 | 445.1 | 100.0 | 100.0 | 82.6 | 97.3 | 79.4 | 0 | | 0 | 2.0 |
| Apr 30-May 6 | 445.2 | 100.0 | 100.0 | 82.6 | 97.3 | 79.4 | 0 | | 0 | 2.0 |
| May 7-13 | 444.8 | 100.0 | 100.0 | 82.6 | 97.3 | 79.4 | 0 | | 0 | 2.0 |
| May 14-20 | 445.4 | 100.0 | 100.0 | 82.6 | 97.3 | 79.4 | 0 | | 0 | 2.0 |
| May 21-27 | 444.7 | 100.0 | 100.0 | 82.6 | 97.3 | 79.4 | 0 | | 0 | 2.0 |
| May 28-June 4 | 443.5 | 100.0 | 100.0 | 62.6 | 95.6 | 67.6 | 0 | | 0 | 0 |
| June 5-11 | 443.2 | 100.0 | 100.0 | 62.6 | 95.6 | 67.6 | 0 | | 0 | 0 |
| June 12-18 | 443.3 | 100.0 | 100.0 | 62.6 | 95.6 | 67.6 | 0 | | 0 | 0 |
| June 19-25 | 444.1 | 100.0 | 100.0 | 82.6 | 97.3 | 79.4 | 0 | | 0 | 2.0 |
| June 26-July 2 | 444.1 | 100.0 | 100.0 | 82.6 | 97.3 | 79.4 | 0 | | 0 | 2.0 |

Table 4 (cont). The 1970-1978 weekly averages of actual river levels and the corresponding percentage of habitat classes inundated for the Marshall County Area, Peoria Pool. Total hectares of each habitat type are in parentheses.

| Week | Weekly Avg. Water Levels msl (ft) | Habitat Class | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Open Water (750.6) | Mud Flats (79.5) | Marsh (23.5) | Scrub-shrub (45.2) | Forest (236.6) | Impoundments or Managed (39.4) | Stream bank (0) | Agri-culture (13.4) | Misc. (5.1) |
| July 3-9 | 442.6 | 100.0 | 100.0 | 62.6 | 95.6 | 67.6 | 0 | | 0 | 0 |
| July 10-16 | 441.0 | 100.0 | 91.8 | 6.0 | 59.3 | 16.4 | 0 | | 0 | 0 |
| July 17-23 | 440.8 | 100.0 | 91.8 | 6.0 | 59.3 | 16.4 | 0 | | 0 | 0 |
| July 24-30 | 440.6 | 100.0 | 91.8 | 6.0 | 59.3 | 16.4 | 0 | | 0 | 0 |
| July 31-Aug 6 | 440.3 | 100.0 | 91.8 | 6.0 | 59.3 | 16.4 | 0 | | 0 | 0 |
| Aug 7-13 | 440.6 | 100.0 | 91.8 | 6.0 | 59.3 | 16.4 | 0 | | 0 | 0 |
| Aug 14-20 | 440.5 | 100.0 | 91.8 | 6.0 | 59.3 | 16.4 | 0 | | 0 | 0 |
| Aug 21-27 | 440.3 | 100.0 | 91.8 | 6.0 | 59.3 | 16.4 | 0 | | 0 | 0 |
| Aug 28-Sept 3 | 440.7 | 100.0 | 91.8 | 6.0 | 59.3 | 16.4 | 0 | | 0 | 0 |
| Sept 4-10 | 440.3 | 100.0 | 91.8 | 6.0 | 59.3 | 16.4 | 0 | | 0 | 0 |
| Sept 11-17 | 440.3 | 100.0 | 91.8 | 6.0 | 59.3 | 16.4 | 0 | | 0 | 0 |
| Sept 18-24 | 441.2 | 100.0 | 91.8 | 6.0 | 59.3 | 16.4 | 0 | | 0 | 0 |
| Sept 25-Oct 1 | 441.6 | 100.0 | 91.8 | 6.0 | 59.3 | 16.4 | 0 | | 0 | 0 |
| Oct 2-8 | 441.6 | 100.0 | 91.8 | 6.0 | 59.3 | 16.4 | 0 | | 0 | 0 |
| Oct 9-15 | 441.2 | 100.0 | 91.8 | 6.0 | 59.3 | 16.4 | 0 | | 0 | 0 |
| Oct 16-22 | 440.9 | 100.0 | 91.8 | 6.0 | 59.3 | 16.4 | 0 | | 0 | 0 |
| Oct 23-29 | 440.6 | 100.0 | 91.8 | 6.0 | 59.3 | 16.4 | 0 | | 0 | 0 |
| Oct 30-Nov 5 | 440.9 | 100.0 | 91.8 | 6.0 | 59.3 | 16.4 | 0 | | 0 | 0 |
| Nov 6-12 | 441.0 | 100.0 | 91.8 | 6.0 | 59.3 | 16.4 | 0 | | 0 | 0 |
| Nov 13-19 | 440.9 | 100.0 | 91.8 | 6.0 | 59.3 | 16.4 | 0 | | 0 | 0 |
| Nov 20-26 | 441.0 | 100.0 | 91.8 | 6.0 | 59.3 | 16.4 | 0 | | 0 | 0 |
| Nov 27-Dec 3 | 440.9 | 100.0 | 91.8 | 6.0 | 59.3 | 16.4 | 0 | | 0 | 0 |
| Dec 4-10 | 440.9 | 100.0 | 91.8 | 6.0 | 59.3 | 16.4 | 0 | | 0 | 0 |
| Dec 11-17 | 441.1 | 100.0 | 91.8 | 6.0 | 59.3 | 16.4 | 0 | | 0 | 0 |
| Dec 18-24 | 441.4 | 100.0 | 91.8 | 6.0 | 59.3 | 16.4 | 0 | | 0 | 0 |
| Dec 25-31 | 441.1 | 100.0 | 91.8 | 6.0 | 59.3 | 16.4 | 0 | | 0 | 0 |

would begin to appear under actual conditions on 24 July when river levels dropped below 442.1 ft (Table 3). The surface area of mud flats exposed would increase to approximately 70% of the potential mud flat area as levels receded to the 441.6-ft mark (Havera et al., 1980:5-62). However, the average of the actual levels increased to 442.5 ft during the week of 18 September, thus inundating approximately 95% of the mud flat area. The 8-week period of 24 July to 18 September provides only 56 days towards the minimum 70 days required for maturation and development of moist-soil plants (Bellrose et al., 1979:12). Thus, at the Henry Area, moist-soil seed production would generally be poor given the actual water levels that occurred between 1970-1978.

It is unlikely that the ambient water levels which inundated approximately 4 to 53% of the marsh habitat during the growing season for plants of about 30 April to 15 October would result in any significant detrimental effects on this community (Table 3).

The critical period when shrubs and trees are sensitive to flooding is during their growing season extending from approximately 1 May through early October (Bedinger, 1978:429). The species in the scrub-shrub community, such as black willows and buttonbush, are less sensitive than the species in the bottomland forest community. Although the woody species in these two communities will tolerate varying degrees of inundation (Havera et al., 1980:5-1; Teskey and Hinckley, 1977),

the duration of flooding during the same and also consecutive growing seasons is a major limiting factor to survival (Bedinger,1978).

Between 3 and 43% of the scrub-shrub habitat was inundated under ambient conditions during the growing season at the Henry Area (Table 3). It is doubtful that this degree of inundation would have any detrimental effects on these communities.

Approximately 69% of the forest community at the Henry Area was inundated at the beginning of the growing season on 30 April (Table 3). This percentage decreased to 3.4% by 24 July and increased to 34% 8 weeks later on 18 September through the end of the growing season. The inundation of 34% of the forest area until 24 July and then again after 18 September could reduce the establishment and survival of seedlings and stress less vigorous individuals (Bedinger, 1978:429). Over a period of years, this could result in a possible change in the forest composition in the 34% of the area that remains inundated for all but 8 weeks of the growing season (Havera et al., 1980:5-1; Teskey and Hinckley, 1977).

All but 1% of the impounded areas at Henry were free of inundation by ambient water levels after 3 July which would provide an ample growing season for moist-soil vegetation for waterfowl management (Table 3).

Marshall County Area. At the Marshall County Conservation Area downstream from Henry, ambient water levels would be more conducive to mud flat habitat. The potential surface area for

mud flats at Marshall County lies below 441.0 ft with approximately 37% occurring below 440.4 ft (Havera et al., 1980:5-62). Thus, with the aerial photos taken when river levels were between 440.4 and 441.0 ft, much of the potential mud flat surface area was unavailable for measurement (Table 4). The averages of the actual river levels were at or below 441.0 ft for 10 consecutive weeks until 18 September (Table 4). These river levels would allow for exposure of up to approximately 65% of potential mud flat surface area for the 70 days required for maturation of moist-soil plants. At least average seed production should result from moist-soil plants at Marshall County given the river levels that occurred for the 1970-1978 period.

Up to 63% of the marsh habitat was inundated by ambient water levels until 10 July (Table 4). From 10 July through the remainder of the growing season, only 6% of the marsh habitat was inundated resulting in an ample development and growth period for the marsh community.

The scrub-shrub community at Marshall County remained at least 59% flooded for the entire growing season (Table 4). Persistent inundation of this amount of scrub-shrub habitat would lead to a lower diversity of plants and dominance by black willows, buttonbush, and marsh smartweed. These species are extremely water-tolerant, but in some areas of constant inundation after a period of 5-10 years, the black willows and buttonbush would eventually die leaving open water with marsh smartweed around the shoreline.

Approximately 68% of the forest area at Marshall County remained inundated under ambient water levels until the week of 10 July (Table 4). Thereafter, about 16% of the forest area was flooded for the remainder of the year. Stress would result on the forest species in the 16% of the forest inundated for the entire growing season and would yield a forest composition in these areas of low diversity and consisting primarily of water-tolerant species such as black willow. The other 84% of the forested area would support the typical bottomland species dominated by silver maple, cottonwood, and ashes.

The impoundment area at Marshall County is protected by a 450-ft levee which would not have been overtopped by the weekly averages of the river levels from 1970-1978 (Table 4).

Actual River Levels Summary. Generally, during the 1970-1978 period, ambient water levels would have allowed poor to average moist-soil community development at the Marshall County and Henry areas, had little detrimental effect on marsh habitat, minor detrimental effects on scrub-shrub and forest habitat, and no detrimental effects within impoundment areas managed for moist-soil production.

## Diversion Plan 1

The average predicted river levels by week for 1970-1978 resulting from the 7,000 cfs Diversion Plan 1 and the weekly average of the actual river levels measured at Henry are shown in Figure 2. The 1970-1978 weekly averages of the

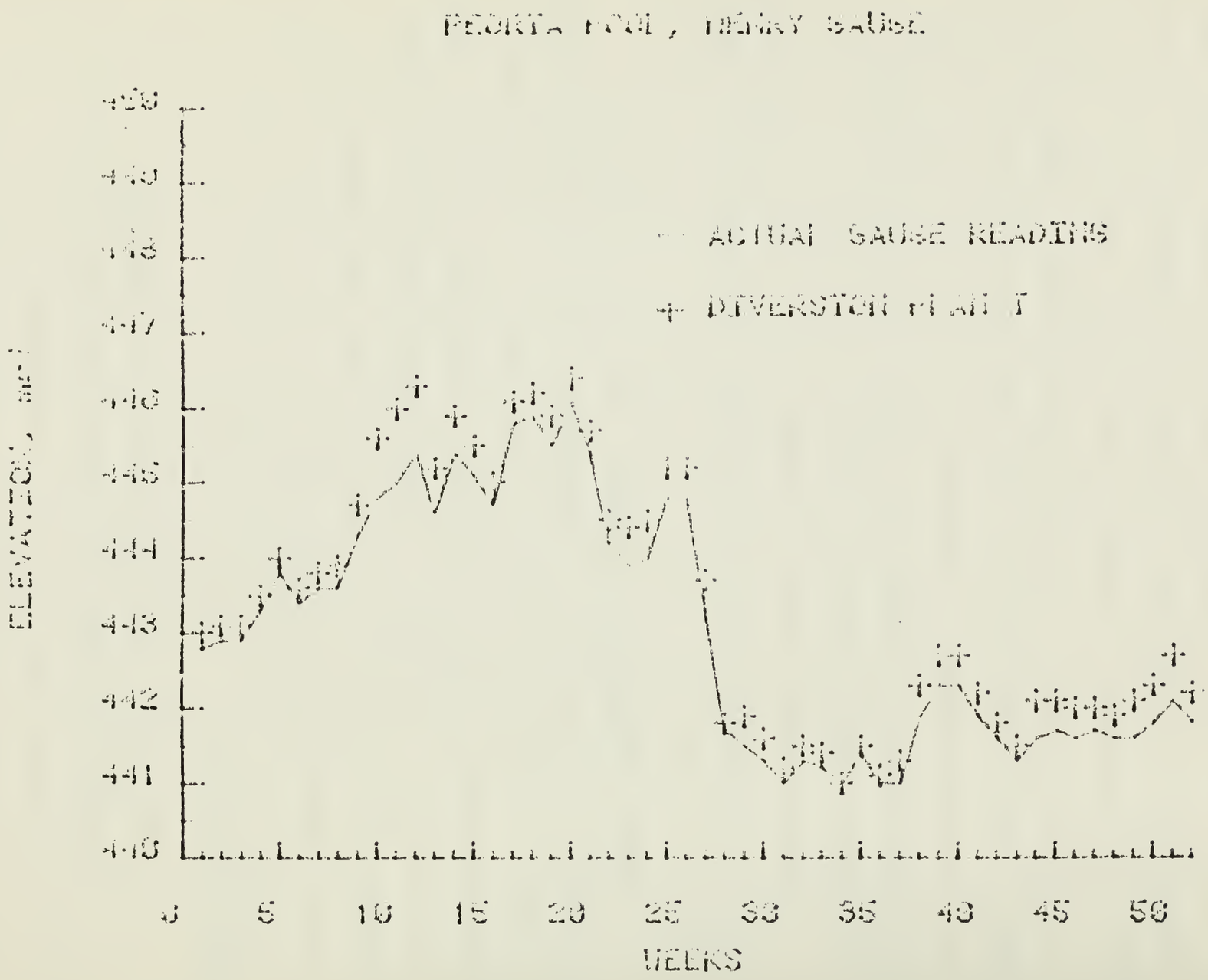


Figure 2. The average of weekly water levels (msl, ft) measured at the Henry gauge, Peoria Pool, and those predicted by Diversion Plan 1, 1970-1978.

increase in river levels predicted from Diversion Plan 1, the sums of these weekly average increase values plus the weekly average of the actual river levels presented in Tables 3 and 4, and the corresponding percentages of habitat classes inundated are presented in Table 5 for the Henry Area and Table 6 for the Marshall County Area.

As indicated in Figure 2 and Tables 5 and 6, the average increase in weekly river levels resulting from Plan 1 during the 1970-1978 study period varied between 0 and 1.0 ft throughout the year. During the growing season for plants extending approximately from 30 April through 15 October, river level increases resulting from Plan 1 varied between 0 and 0.6 ft. The percentage of the nine years from 1970-1978 that diversion resulted from Plan 1 varied between 56 and 89% from 1 January to 29 April, between 22 and 56% during the growing season of 30 April through 15 October, and between 89 and 100% until 31 December (Table 3).

Henry Area. At the Henry Area, where mud flats begin to appear when river levels fall below 442.1 ft, water levels projected by Plan 1 did not fall below this elevation until 31 July (Table 5) as compared with 24 July under ambient conditions (Table 3). River levels projected for Plan 1 would remain below

Table 5. The 1970-1978 weekly averages of the increase in river levels from Diversion Plan 1, the sums of the weekly average increase from Plan 1 plus the weekly average of the actual river levels from Table 3, the percent of years from 1970-1978 that diversion occurred, and the corresponding percentages of habitat classes inundated for the Henry Area, Peoria Pool. Total hectares of each habitat class are in parentheses.

| Week | Average Diversion Increase (ft) | Actual Weekly Avg. + Diversion Increase msl (ft) | % of yrs. with Diversion | Habitat Class | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Open Water (286.2) | Mud Flats (65.4) | Marsh (59.6) | Scrub-shrub (180.6) | Forest (452.0) | Impoundments or Managed (98.6) | Stream bank (0.7) | Agri-culture (96.4) | Misc. (11.1) |
| Jan 1-7 | 0.2 | 443.6 | 56 | 97.4 | 94.8 | 29.7 | 28.5 | 34.4 | 1.1 | 100 | 6.8 | 11.7 |
| Jan 8-14 | 0.2 | 443.7 | 67 | 97.4 | 94.8 | 29.7 | 28.5 | 34.4 | 1.1 | 100 | 6.8 | 11.7 |
| Jan 15-21 | 0.2 | 443.7 | 67 | 97.4 | 94.8 | 29.7 | 28.5 | 34.4 | 1.1 | 100 | 6.8 | 11.7 |
| Jan 22-28 | 0.1 | 444.0 | 67 | 97.4 | 94.8 | 29.7 | 28.5 | 34.4 | 1.1 | 100 | 6.8 | 11.7 |
| Jan 29-Feb 4 | 0.1 | 444.5 | 56 | 97.9 | 99.1 | 39.6 | 37.9 | 56.0 | 81.1 | 100 | 8.9 | 17.1 |
| Feb 5-11 | 0.2 | 444.2 | 67 | 97.9 | 99.1 | 39.6 | 37.9 | 56.0 | 81.1 | 100 | 8.9 | 17.1 |
| Feb 12-18 | 0.2 | 444.4 | 67 | 97.9 | 99.1 | 39.6 | 37.9 | 56.0 | 81.1 | 100 | 8.9 | 17.1 |
| Feb 19-25 | 0.4 | 444.6 | 78 | 97.9 | 99.1 | 39.6 | 37.9 | 56.0 | 81.1 | 100 | 8.9 | 17.1 |
| Feb 26-Mar 4 | 0.5 | 445.4 | 89 | 97.9 | 99.1 | 39.6 | 37.9 | 56.0 | 81.1 | 100 | 8.9 | 17.1 |
| Mar 5-11 | 0.7 | 446.1 | 89 | 98.0 | 99.7 | 52.7 | 42.6 | 68.7 | 87.3 | 100 | 12.8 | 18.9 |
| Mar 12-18 | 1.0 | 446.6 | 89 | 98.0 | 99.7 | 52.7 | 42.6 | 68.7 | 87.3 | 100 | 12.8 | 18.9 |
| Mar 19-25 | 0.9 | 446.9 | 89 | 98.0 | 99.7 | 52.7 | 42.6 | 68.7 | 87.3 | 100 | 12.8 | 18.9 |
| Mar 26-Apr 1 | 0.6 | 445.8 | 89 | 97.9 | 99.1 | 39.6 | 37.9 | 56.0 | 81.1 | 100 | 8.9 | 17.1 |
| Apr 2-8 | 0.5 | 446.5 | 78 | 98.0 | 99.7 | 52.7 | 42.6 | 68.7 | 87.3 | 100 | 12.8 | 18.9 |
| Apr 9-15 | 0.4 | 446.1 | 89 | 98.0 | 99.7 | 52.7 | 42.6 | 68.7 | 87.3 | 100 | 12.8 | 18.9 |
| Apr 16-22 | 0.4 | 445.7 | 89 | 97.9 | 99.1 | 39.6 | 37.9 | 56.0 | 81.1 | 100 | 8.9 | 17.1 |
| Apr 23-29 | 0.3 | 446.7 | 78 | 98.0 | 99.7 | 52.7 | 42.6 | 68.7 | 87.3 | 100 | 12.8 | 18.9 |
| Apr 30-May 6 | 0.3 | 446.8 | 56 | 98.0 | 99.7 | 52.7 | 42.6 | 68.7 | 87.3 | 100 | 12.8 | 18.9 |
| May 7-13 | 0.4 | 446.5 | 56 | 98.0 | 99.7 | 52.7 | 42.6 | 68.7 | 87.3 | 100 | 12.8 | 18.9 |
| May 14-20 | 0.3 | 447.0 | 56 | 98.0 | 99.7 | 52.7 | 42.6 | 68.7 | 87.3 | 100 | 12.8 | 18.9 |
| May 21-27 | 0.2 | 446.2 | 78 | 98.0 | 99.7 | 52.7 | 42.6 | 68.7 | 87.3 | 100 | 12.8 | 18.9 |
| May 28-June 4 | 0.2 | 445.0 | 67 | 97.9 | 99.1 | 39.6 | 37.9 | 56.0 | 81.1 | 100 | 8.9 | 17.1 |
| June 5-11 | 0.5 | 445.0 | 44 | 97.9 | 99.1 | 39.6 | 37.9 | 56.0 | 81.1 | 100 | 8.9 | 17.1 |
| June 12-18 | 0.6 | 445.2 | 44 | 97.9 | 99.1 | 39.6 | 37.9 | 56.0 | 81.1 | 100 | 8.9 | 17.1 |
| June 19-25 | 0.4 | 445.6 | 44 | 97.9 | 99.1 | 39.6 | 37.9 | 56.0 | 81.1 | 100 | 8.9 | 17.1 |
| June 26-July 2 | 0.4 | 445.6 | 44 | 97.9 | 99.1 | 39.6 | 37.9 | 56.0 | 81.1 | 100 | 8.9 | 17.1 |

Table 5 (cont). The 1970-1978 weekly averages of the increase in river levels from Diversion Plan 1, the sums of the weekly average increase from Plan 1 plus the weekly average of the actual river levels from Table 3, the percent of years from 1970-1978 that diversion occurred, and the corresponding percentages of habitat classes inundated for the Henry Area, Peoria Pool. Total hectares of each habitat class are in parentheses.

| Week | Average Diversion Increase (ft) | Actual Weekly Avg. + Diversion Increase msl (ft) | % of yrs. with Diversion | Habitat Class | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Open Water (286.2) | Mud Flats (65.4) | Marsh (59.6) | Scrub-shrub (180.6) | Forest (452.0) | Impoundments or Managed (98.6) | Stream bank (0.7) | Agri-culture (96.4) | Misc. (11.1) |
| July 3-9 | 0.3 | 444.2 | 22 | 97.9 | 99.1 | 39.6 | 37.9 | 56.0 | 81.1 | 100 | 8.9 | 17.1 |
| July 10-16 | 0.3 | 442.6 | 33 | 97.4 | 94.8 | 29.7 | 28.5 | 34.4 | 1.1 | 100 | 6.8 | 11.7 |
| July 17-23 | 0.3 | 442.4 | 44 | 97.4 | 94.8 | 29.7 | 28.5 | 34.4 | 1.1 | 100 | 6.8 | 11.7 |
| July 24-30 | 0.3 | 442.2 | 33 | 97.4 | 94.8 | 29.7 | 28.5 | 34.4 | 1.1 | 100 | 6.8 | 11.7 |
| July 31-Aug 6 | 0.2 | 441.8 | 33 | 93.1 | 69.6 | 3.5 | 3.0 | 3.4 | 1.0 | 100 | 1.6 | 4.5 |
| Aug 7-13 | 0.2 | 442.1 | 33 | 97.4 | 94.8 | 29.7 | 28.5 | 34.4 | 1.1 | 100 | 6.8 | 11.7 |
| Aug 14-20 | 0.2 | 442.0 | 33 | 93.1 | 69.6 | 3.5 | 3.0 | 3.4 | 1.0 | 100 | 1.6 | 4.5 |
| Aug 21-27 | 0.1 | 441.7 | 22 | 93.1 | 69.6 | 3.5 | 3.0 | 3.4 | 1.0 | 100 | 1.6 | 4.5 |
| Aug 28-Sept 3 | 0.0 | 442.0 | 33 | 93.1 | 69.6 | 3.5 | 3.0 | 3.4 | 1.0 | 100 | 1.6 | 4.5 |
| Sept 4-10 | 0.2 | 441.8 | 33 | 93.1 | 69.6 | 3.5 | 3.0 | 3.4 | 1.0 | 100 | 1.6 | 4.5 |
| Sept 11-17 | 0.4 | 442.0 | 56 | 93.1 | 69.6 | 3.5 | 3.0 | 3.4 | 1.0 | 100 | 1.6 | 4.5 |
| Sept 18-24 | 0.3 | 442.8 | 56 | 97.4 | 94.8 | 29.7 | 28.5 | 34.4 | 1.1 | 100 | 6.8 | 11.7 |
| Sept 25-Oct 1 | 0.4 | 443.3 | 56 | 97.4 | 94.8 | 29.7 | 28.5 | 34.4 | 1.1 | 100 | 6.8 | 11.7 |
| Oct 2-8 | 0.3 | 443.2 | 44 | 97.4 | 94.8 | 29.7 | 28.5 | 34.4 | 1.1 | 100 | 6.8 | 11.7 |
| Oct 9-15 | 0.3 | 442.8 | 44 | 97.4 | 94.8 | 29.7 | 28.5 | 34.4 | 1.1 | 100 | 6.8 | 11.7 |
| Oct 16-22 | 0.2 | 442.4 | 89 | 97.4 | 94.8 | 29.7 | 28.5 | 34.4 | 1.1 | 100 | 6.8 | 11.7 |
| Oct 23-29 | 0.3 | 442.2 | 100 | 97.4 | 94.8 | 29.7 | 28.5 | 34.4 | 1.1 | 100 | 6.8 | 11.7 |
| Oct 30-Nov 5 | 0.5 | 442.7 | 100 | 97.4 | 94.8 | 29.7 | 28.5 | 34.4 | 1.1 | 100 | 6.8 | 11.7 |
| Nov 6-12 | 0.4 | 442.7 | 100 | 97.4 | 94.8 | 29.7 | 28.5 | 34.4 | 1.1 | 100 | 6.8 | 11.7 |
| Nov 13-19 | 0.4 | 442.6 | 100 | 97.4 | 94.8 | 29.7 | 28.5 | 34.4 | 1.1 | 100 | 6.8 | 11.7 |
| Nov 20-26 | 0.4 | 442.7 | 100 | 97.4 | 94.8 | 29.7 | 28.5 | 34.4 | 1.1 | 100 | 6.8 | 11.7 |
| Nov 27-Dec 3 | 0.4 | 442.6 | 100 | 97.4 | 94.8 | 29.7 | 28.5 | 34.4 | 1.1 | 100 | 6.8 | 11.7 |
| Dec 4-10 | 0.5 | 442.7 | 100 | 97.4 | 94.8 | 29.7 | 28.5 | 34.4 | 1.1 | 100 | 6.8 | 11.7 |
| Dec 11-17 | 0.5 | 442.9 | 100 | 97.4 | 94.8 | 29.7 | 28.5 | 34.4 | 1.1 | 100 | 6.8 | 11.7 |
| Dec 18-24 | 0.6 | 443.3 | 100 | 97.4 | 94.8 | 29.7 | 28.5 | 34.4 | 1.1 | 100 | 6.8 | 11.7 |
| Dec 25-31 | 0.4 | 442.8 | 100 | 97.4 | 94.8 | 29.7 | 28.5 | 34.4 | 1.1 | 100 | 6.8 | 11.7 |

Table 6. The 1970-1978 weekly averages of the increase in river levels from Diversion Plan I, the sums of the weekly average increase from Plan I plus the weekly average of the actual river levels from Table 4, the percent of years from 1970-1978 that diversion occurred, and the corresponding percentages of habitat classes inundated for the Marshall County Area, Peoria Pool. Total hectares of each habitat class are in parentheses.

| Week | Average Diversion Increase (ft) | Actual Weekly Avg. + Diversion Increase msl (ft) | % of yrs. with Diversion | Habitat Class | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Open Water (750.6) | Mud Flats (79.5) | Marsh (23.5) | Scrub-shrub (45.2) | Forest (236.6) | Impoundments or Managed (39.4) | Stream bank (0) | Agri-culture (13.4) | Misc. (5.1) |
| Jan 1-7 | 0.2 | 442.3 | 56 | 100.0 | 100.0 | 62.6 | 95.6 | 67.6 | 0 | | 0 | 0 |
| Jan 8-14 | 0.2 | 442.4 | 67 | 100.0 | 100.0 | 62.6 | 95.6 | 67.6 | 0 | | 0 | 0 |
| Jan 15-21 | 0.2 | 442.4 | 67 | 100.0 | 100.0 | 62.6 | 95.6 | 67.6 | 0 | | 0 | 0 |
| Jan 22-28 | 0.1 | 442.7 | 67 | 100.0 | 100.0 | 62.6 | 95.6 | 67.6 | 0 | | 0 | 0 |
| Jan 29-Feb 4 | 0.1 | 443.2 | 56 | 100.0 | 100.0 | 62.6 | 95.6 | 67.6 | 0 | | 0 | 0 |
| Feb 5-11 | 0.2 | 442.9 | 67 | 100.0 | 100.0 | 62.6 | 95.6 | 67.6 | 0 | | 0 | 0 |
| Feb 12-18 | 0.2 | 443.1 | 67 | 100.0 | 100.0 | 62.6 | 95.6 | 67.6 | 0 | | 0 | 0 |
| Feb 19-25 | 0.4 | 443.3 | 78 | 100.0 | 100.0 | 62.6 | 95.6 | 67.6 | 0 | | 0 | 0 |
| Feb 26-Mar 4 | 0.5 | 444.1 | 89 | 100.0 | 100.0 | 82.6 | 97.3 | 79.4 | 0 | | 0 | 2.0 |
| Mar 5-11 | 0.7 | 444.8 | 89 | 100.0 | 100.0 | 82.6 | 97.3 | 79.4 | 0 | | 0 | 2.0 |
| Mar 12-18 | 1.0 | 445.3 | 89 | 100.0 | 100.0 | 82.6 | 97.3 | 79.4 | 0 | | 0 | 2.0 |
| Mar 19-25 | 0.9 | 445.6 | 89 | 100.0 | 100.0 | 82.6 | 97.3 | 79.4 | 0 | | 0 | 2.0 |
| Mar 26-Apr 1 | 0.6 | 444.5 | 89 | 100.0 | 100.0 | 82.6 | 97.3 | 79.4 | 0 | | 0 | 2.0 |
| Apr 2-8 | 0.5 | 445.2 | 78 | 100.0 | 100.0 | 82.6 | 97.3 | 79.4 | 0 | | 0 | 2.0 |
| Apr 9-15 | 0.4 | 444.8 | 89 | 100.0 | 100.0 | 82.6 | 97.3 | 79.4 | 0 | | 0 | 2.0 |
| Apr 16-22 | 0.4 | 444.4 | 89 | 100.0 | 100.0 | 82.6 | 97.3 | 79.4 | 0 | | 0 | 2.0 |
| Apr 23-29 | 0.3 | 445.4 | 78 | 100.0 | 100.0 | 82.6 | 97.3 | 79.4 | 0 | | 0 | 2.0 |
| Apr 30-May 6 | 0.3 | 445.6 | 56 | 100.0 | 100.0 | 82.6 | 97.3 | 79.4 | 0 | | 0 | 2.0 |
| May 7-13 | 0.4 | 445.2 | 56 | 100.0 | 100.0 | 82.6 | 97.3 | 79.4 | 0 | | 0 | 2.0 |
| May 14-20 | 0.3 | 445.7 | 56 | 100.0 | 100.0 | 82.6 | 97.3 | 79.4 | 0 | | 0 | 2.0 |
| May 21-27 | 0.2 | 444.9 | 78 | 100.0 | 100.0 | 82.6 | 97.3 | 79.4 | 0 | | 0 | 2.0 |
| May 28-June 4 | 0.2 | 443.7 | 67 | 100.0 | 100.0 | 62.6 | 95.6 | 67.6 | 0 | | 0 | 0 |
| June 5-11 | 0.5 | 443.7 | 44 | 100.0 | 100.0 | 62.6 | 95.6 | 67.6 | 0 | | 0 | 0 |
| June 12-18 | 0.6 | 443.9 | 44 | 100.0 | 100.0 | 62.6 | 95.6 | 67.6 | 0 | | 0 | 0 |
| June 19-25 | 0.4 | 444.5 | 44 | 100.0 | 100.0 | 82.6 | 97.3 | 79.4 | 0 | | 0 | 2.0 |
| June 26-July 2 | 0.4 | 444.5 | 44 | 100.0 | 100.0 | 82.6 | 97.3 | 79.4 | 0 | | 0 | 2.0 |

Table 6 (cont). The 1970-1978 weekly averages of the increase in river levels from Diversion Plan I, the sums of the weekly average increase from Plan I plus the weekly average of the actual river levels from Table 4, the percent of years from 1970-1978 that diversion occurred, and the corresponding percentages of habitat classes inundated for the Marshall County Area, Peoria Pool. Total hectares of each habitat class are in parentheses.

| Week | Average Diversion Increase (ft) | Actual Weekly Avg. + Diversion Increase msl (ft) | % of yrs. with Diversion | Habitat Class | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Open Water (750.6) | Mud Flats (79.5) | Marsh (23.5) | Scrub-shrub (45.2) | Forest (236.6) | Impoundments or Managed (39.4) | Stream bank (0) | Agri-culture (13.4) | Misc. (5.1) |
| July 3-9 | 0.3 | 442.9 | 22 | 100.0 | 100.0 | 62.6 | 95.6 | 67.6 | 0 | | 0 | 0 |
| July 10-16 | 0.3 | 441.3 | 33 | 100.0 | 91.8 | 6.0 | 59.3 | 16.4 | 0 | | 0 | 0 |
| July 17-23 | 0.3 | 441.1 | 44 | 100.0 | 91.8 | 6.0 | 59.3 | 16.4 | 0 | | 0 | 0 |
| July 24-30 | 0.3 | 440.9 | 33 | 100.0 | 91.8 | 6.0 | 59.3 | 16.4 | 0 | | 0 | 0 |
| July 31-Aug 6 | 0.2 | 440.5 | 33 | 100.0 | 91.8 | 6.0 | 59.3 | 16.4 | 0 | | 0 | 0 |
| Aug 7-13 | 0.2 | 440.8 | 33 | 100.0 | 91.8 | 6.0 | 59.3 | 16.4 | 0 | | 0 | 0 |
| Aug 14-20 | 0.2 | 440.7 | 33 | 100.0 | 91.8 | 6.0 | 59.3 | 16.4 | 0 | | 0 | 0 |
| Aug 21-27 | 0.1 | 440.4 | 22 | 100.0 | 91.8 | 6.0 | 59.3 | 16.4 | 0 | | 0 | 0 |
| Aug 28-Sept 3 | 0 | 440.7 | 33 | 100.0 | 91.8 | 6.0 | 59.3 | 16.4 | 0 | | 0 | 0 |
| Sept 4-10 | 0.2 | 440.5 | 33 | 100.0 | 91.8 | 6.0 | 59.3 | 16.4 | 0 | | 0 | 0 |
| Sept 11-17 | 0.4 | 440.7 | 56 | 100.0 | 91.8 | 6.0 | 59.3 | 16.4 | 0 | | 0 | 0 |
| Sept 18-24 | 0.3 | 441.5 | 56 | 100.0 | 91.8 | 6.0 | 59.3 | 16.4 | 0 | | 0 | 0 |
| Sept 25-Oct 1 | 0.4 | 442.0 | 56 | 100.0 | 91.8 | 6.0 | 59.3 | 16.4 | 0 | | 0 | 0 |
| Oct 2-8 | 0.3 | 441.9 | 56 | 100.0 | 91.8 | 6.0 | 59.3 | 16.4 | 0 | | 0 | 0 |
| Oct 9-15 | 0.3 | 441.5 | 44 | 100.0 | 91.8 | 6.0 | 59.3 | 16.4 | 0 | | 0 | 0 |
| Oct 16-22 | 0.2 | 441.1 | 44 | 100.0 | 91.8 | 6.0 | 59.3 | 16.4 | 0 | | 0 | 0 |
| Oct 23-29 | 0.3 | 440.9 | 89 | 100.0 | 91.8 | 6.0 | 59.3 | 16.4 | 0 | | 0 | 0 |
| Oct 30-Nov 5 | 0.5 | 441.4 | 100 | 100.0 | 91.8 | 6.0 | 59.3 | 16.4 | 0 | | 0 | 0 |
| Nov 6-12 | 0.4 | 441.4 | 100 | 100.0 | 91.8 | 6.0 | 59.3 | 16.4 | 0 | | 0 | 0 |
| Nov 13-19 | 0.4 | 441.3 | 100 | 100.0 | 91.8 | 6.0 | 59.3 | 16.4 | 0 | | 0 | 0 |
| Nov 20-26 | 0.4 | 441.4 | 100 | 100.0 | 91.8 | 6.0 | 59.3 | 16.4 | 0 | | 0 | 0 |
| Nov 27-Dec 3 | 0.4 | 441.3 | 100 | 100.0 | 91.8 | 6.0 | 59.3 | 16.4 | 0 | | 0 | 0 |
| Dec 4-10 | 0.5 | 441.4 | 100 | 100.0 | 91.8 | 6.0 | 59.3 | 16.4 | 0 | | 0 | 0 |
| Dec 11-17 | 0.5 | 441.6 | 100 | 100.0 | 91.8 | 6.0 | 59.3 | 16.4 | 0 | | 0 | 0 |
| Dec 18-24 | 0.6 | 442.0 | 100 | 100.0 | 91.8 | 6.0 | 59.3 | 16.4 | 0 | | 0 | 0 |
| Dec 25-31 | 0.4 | 441.5 | 100 | 100.0 | 91.8 | 6.0 | 59.3 | 16.4 | 0 | | 0 | 0 |

442.1 ft for 7 consecutive weeks until 17 September thus providing only 49 days toward the 70-day minimum exposure period required for maturation of moist-soil plants. Only 56 days of exposure would have occurred under ambient conditions during 1970-1978 and conditions would have worsened by the increase of upwards to 0.4 ft in water elevation. Plan 1 would result in the appearance of less mud flat acreage and a shorter period of exposure for those mud flats that were available for colonization by moist-soil plants, thereby further reducing the potential for only a poor seed crop that would likely occur under ambient conditions.

Projected water levels from Plan 1 (Table 5) resulted in between 5 and 31% more of the marsh, scrub-shrub, and forest habitats being inundated over ambient conditions (Table 3) during 5-11 Febrary, 5-25 March, 2-15 April, and 23-29 October of the non-growing season for plants. It is unlikely that the increases in the amount of area inundated during these periods of the non-growing season would have a noticeable impact on these communities. During the growing season, the percent of these 3 habitats inundated by projected Plan 1 levels increased over that inundated by ambient conditions during the periods of 21-27 May, 3-9 July, 24-30 July, and 7-13 August. The increase in the percentage of marsh and scrub-shrub habitats inundated by Plan 1 during these 4 weeks varied between 10 and 26% for marsh

and 5 and 26% for the scrub-shrub habitat. Any significant detrimental effects to either the marsh or scrub-shrub communities resulting from this increased inundation as compared to ambient conditions at the Henry Study Area is doubtful.

The increase in the amount of forest inundated by Plan 1 (Table 5) as compared with ambient conditions (Table 3) for the same 4 weeks during the growing season varied between 13 and 31%. The most critical period of concern is the 8-week interval from 24 July through 17 September when under ambient water levels, only about 3% of the forest area is inundated. Projected levels from Plan 1 increase the 3% of area to 34% for 2 of these weeks thereby allowing only 5 consecutive weeks and 6 weeks total for almost all of the forest to be out of water (Table 5). Over a period of years, this increase in inundation of 30% of the forest area could result in some minor changes in species composition at the Henry Area.

Prior to 28 May, approximately 6% more of the impoundment areas would be inundated for 6 weeks and 80% more for 1 week by water levels projected by Plan 1 (Table 5) as compared to ambient levels (Table 3). In addition, 81% of the impoundment areas would be inundated by Plan 1 levels during the week of 3-9 July as compared to 1% under ambient levels. However, no difference in inundation between Plan 1 and ambient levels existed after 9 July and ample time remains after 9 July for management of moist-soil plants for waterfowl in the impoundments.

Marshall County Area. Whereas the averages of the actual water levels were at or below the 441.0 ft elevation at which mud flats begin to appear for 10 consecutive weeks from 10 July to 17 September, the average projected increase of up to 0.4 ft of elevation by Plan 1 would reduce this 10-week period to 8 weeks from 24 July to 17 September (Table 6). This would shorten the minimum 70-day period required by moist-soil plants for maturation that occurred under ambient conditions to 56 days. Accordingly, the average seed production by moist-soil plants that probably would occur at Marshall County under the ambient river levels of 1970-1978 would be reduced by a shorter maturation period and exposure of less mud flat surface area. Moist-soil plant production at Marshall County under Plan 1 water conditions would be poor at best.

The only difference that occurred between the percentage of marsh, scrub-shrub, and forest habitat that was inundated by the average of the projected Plan 1 levels (Table 6) and the average of the ambient levels (Table 4) was for the period of 26 February to 4 March, 26 March to 1 April, and 16-22 April. During these 3 weeks of the non-growing season for plants, approximately 20% more marsh area was inundated by projected Plan 1 water levels, 2% more scrub-shrub area, and 12% more forest. These minor increases during the plant dormant season would result in no noticeable biological differences to the marsh, scrub-shrub, and forest communities at Marshall County.

Projected water levels for Plan 1 did not exceed the 450-ft levee enclosing the 39-ha impoundment at Marshall County (Table 6).

Diversion Plan 1 Summary. The habitat category that would be most affected by Plan 1 for the 1970-1978 study period would be the mud flat community. Under ambient conditions for the 1970-1978 period, mud flat exposure and subsequent development and maturation of moist-soil plants appeared to be average at the Marshall County Area and poor at the Henry Area. At both areas, the addition of an average increase in weekly water levels of up to 0.4 ft by Plan 1 from mid-July to mid-September would reduce the amount of mud flat surface area exposed and the length of the development period below the 70-day minimum. Moist-soil plant seed production under Plan 1 conditions would, therefore, be poor or worse.

The percentage of marsh, scrub-shrub, and forest habitats inundated by the projected levels of Plan 1 increased for 4 weeks of the growing season for plants from 30 April to 15 October over ambient conditions at the Henry Area and for no weeks at the Marshall County Area. It is unlikely that significant changes to the marsh and scrub-shrub habitats on the

study areas would result from Plan 1 projected water levels. Some minor effects in the forest community in the Henry Area may result over time from an increase of 3 to 34% of forest area being flooded for 2 weeks by Plan 1 water levels during an 8-week period of drying conditions under ambient river conditions.

The management for natural vegetation for waterfowl in impoundments differed by 1 week with Plan 1 water conditions during the growing season at the Henry Area. The inundation of 81% of the impoundment area during the growing season was extended 1 week through 9 July by Plan 1 as compared with ambient conditions. This would delay drawdown and ground exposure within the impoundment for the planting of waterfowl foods such as millet and buckwheat and the development of moist-soil plants. If impoundments are dewatered by gravity flow rather than by pumping, higher water levels resulting from Plan 1 could further delay the drawdown process. However, a sufficient growing period for development and maturation of planted and natural waterfowl foods should remain.

Diversion Plan 2

The average increase in weekly elevation for 1970-1978 at Henry in Peoria Pool for Diversion Plan 2 (5,500 cfs) as compared with the averages of the actual river levels measured at Henry is shown in Figure 3. Tables 7 and 8 present the average weekly increases and resulting elevations at the Henry and Marshall County areas, respectively, for Plan 2 and the corresponding percentages of the habitat classes inundated by 2-ft contour intervals.

Average weekly increases in river levels resulting from Plan 2 varied between 0 and 0.5 ft throughout the year (Table 7). In all but 3 weeks during the growing season for plants from 30 April to 15 October, average weekly increases resulting from Plan 2 were 0.2 ft or less. The percent of the 9 years from 1970-1978 that diversion from Plan 2 occurred ranged from 44 to 78% from 1 January to 29 April, between 33 and 67% during the growing season from 30 April to mid-October, and 78 to 100% thereafter (Table 7).

Henry Area. At the Henry Area, Plan 2 resulted in larger percentages of habitat classes inundated (Table 7) as compared to ambient conditions (Table 3) for the 4 weeks of 5-11 February, 12-25 March and 2-8 April during the dormant season for plants, and for the 4 weeks of 21-27 May, 3-9 July,

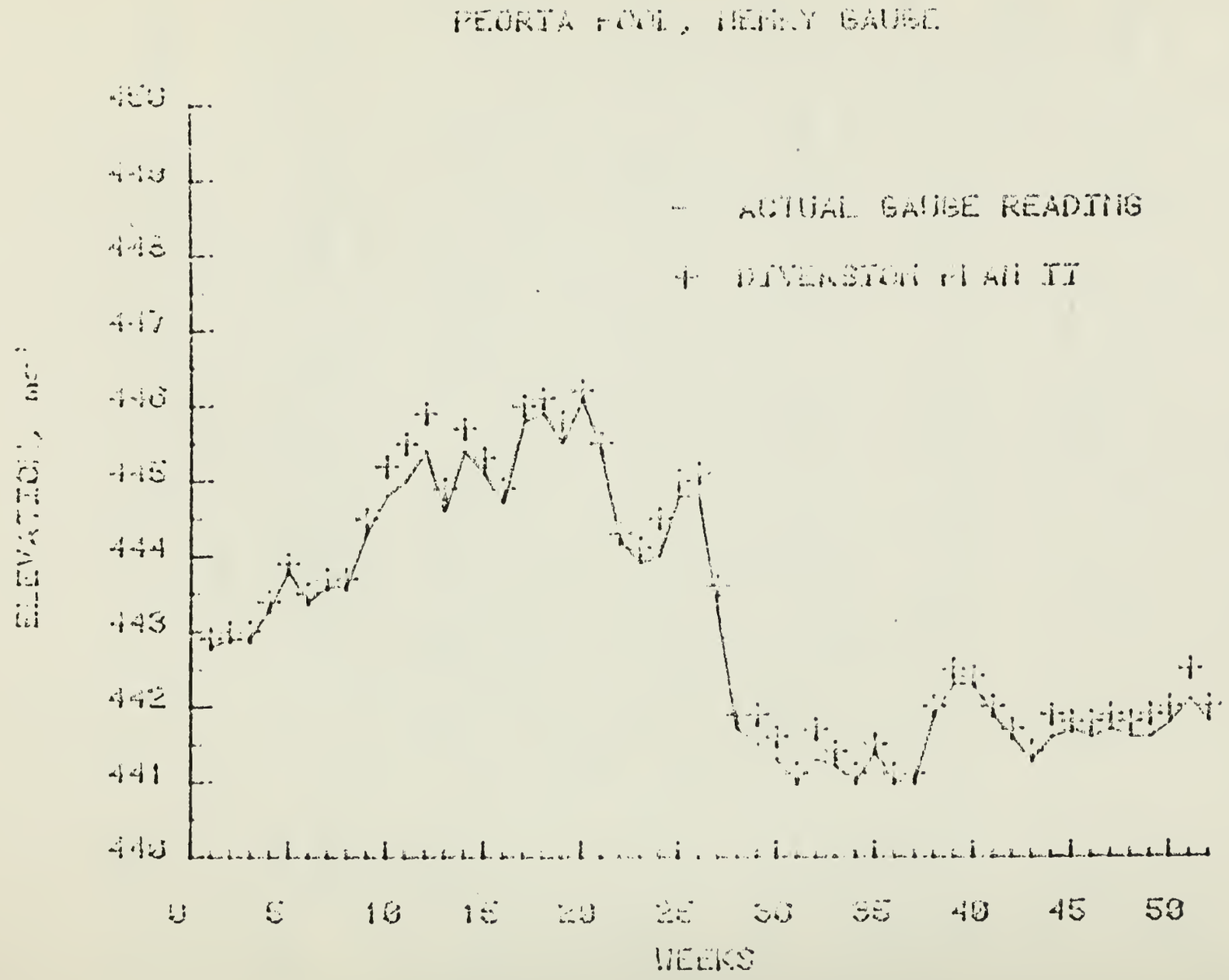


Figure 3. The average of weekly water levels (msl, ft) measured at the Henry gauge, Peoria Pool, and those predicted by Diversion Plan 2, 1970-1978.

Table 7. The 1970-1978 weekly averages of the increase in river levels from Diversion Plan 2, the sums of the weekly average increase from Plan 2 plus the weekly average of the actual river levels from Table 3, the percent of years from 1970-1978 that diversion occurred, and the corresponding percentages of habitat classes inundated for the Henry Area, Peoria Pool. Total hectares of each habitat class are in parentheses.

| Week | Average Diversion Increase (ft) | Actual Weekly Avg. + Diversion Increase msl (ft) | % of yrs. with Diversion | Habitat Class | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Open Water (286.2) | Mud Flats (65.4) | Marsh (59.6) | Scrub-shrub (180.6) | Forest (452.0) | Impoundments or Managed (98.6) | Stream bank (0.7) | Agri-culture (96.4) | Misc. (11.1) |
| Jan 1-7 | 0.2 | 443.6 | 67 | 97.4 | 94.8 | 29.7 | 28.5 | 34.4 | 1.1 | 100 | 6.8 | 11.7 |
| Jan 8-14 | 0.1 | 443.6 | 67 | 97.4 | 94.8 | 29.7 | 28.5 | 34.4 | 1.1 | 100 | 6.8 | 11.7 |
| Jan 15-21 | 0 | 443.5 | 56 | 97.4 | 94.8 | 29.7 | 28.5 | 34.4 | 1.1 | 100 | 6.8 | 11.7 |
| Jan 22-28 | 0 | 443.9 | 44 | 97.4 | 94.8 | 29.7 | 28.5 | 34.4 | 1.1 | 100 | 6.8 | 11.7 |
| Jan 29-Feb 4 | 0.1 | 444.5 | 44 | 97.9 | 99.1 | 39.6 | 37.9 | 56.0 | 81.1 | 100 | 8.9 | 17.1 |
| Feb 5-11 | 0.1 | 444.1 | 56 | 97.9 | 99.1 | 39.6 | 37.9 | 56.0 | 81.1 | 100 | 8.9 | 17.1 |
| Feb 12-18 | 0.1 | 444.3 | 56 | 97.9 | 99.1 | 39.6 | 37.9 | 56.0 | 81.1 | 100 | 8.9 | 17.1 |
| Feb 19-25 | 0.2 | 444.4 | 67 | 97.9 | 99.1 | 39.6 | 37.9 | 56.0 | 81.1 | 100 | 8.9 | 17.1 |
| Feb 26-Mar 4 | 0.2 | 445.1 | 78 | 97.9 | 99.1 | 39.6 | 37.9 | 56.0 | 81.1 | 100 | 8.9 | 17.1 |
| Mar 5-11 | 0.4 | 445.8 | 78 | 97.9 | 99.1 | 39.6 | 37.9 | 56.0 | 81.1 | 100 | 8.9 | 17.1 |
| Mar 12-18 | 0.5 | 446.1 | 78 | 98.0 | 99.7 | 52.7 | 42.6 | 68.7 | 87.3 | 100 | 12.8 | 18.9 |
| Mar 19-25 | 0.5 | 446.5 | 78 | 98.0 | 99.7 | 52.7 | 42.6 | 68.7 | 87.3 | 100 | 12.8 | 18.9 |
| Mar 26-Apr 1 | 0.3 | 445.5 | 67 | 97.9 | 99.1 | 39.6 | 37.9 | 56.0 | 81.1 | 100 | 8.9 | 17.1 |
| Apr 2-8 | 0.3 | 446.3 | 67 | 98.0 | 99.7 | 52.7 | 42.6 | 68.7 | 87.3 | 100 | 12.8 | 18.9 |
| Apr 9-15 | 0.1 | 445.8 | 67 | 97.9 | 99.1 | 39.6 | 37.9 | 56.0 | 81.1 | 100 | 8.9 | 17.1 |
| Apr 16-22 | 0.1 | 445.4 | 67 | 97.9 | 99.1 | 39.6 | 37.9 | 56.0 | 81.1 | 100 | 8.9 | 17.1 |
| Apr 23-29 | 0.2 | 446.6 | 78 | 98.0 | 99.7 | 52.7 | 42.6 | 68.7 | 87.3 | 100 | 12.8 | 18.9 |
| Apr 30-May 6 | 0.1 | 446.6 | 56 | 98.0 | 99.7 | 52.7 | 42.6 | 68.7 | 87.3 | 100 | 12.8 | 18.9 |
| May 7-13 | 0.2 | 446.3 | 56 | 98.0 | 99.7 | 52.7 | 42.6 | 68.7 | 87.3 | 100 | 12.8 | 18.9 |
| May 14-20 | 0.1 | 446.8 | 56 | 98.0 | 99.7 | 52.7 | 42.6 | 68.7 | 87.3 | 100 | 12.8 | 18.9 |
| May 21-27 | 0.1 | 446.1 | 56 | 98.0 | 99.7 | 52.7 | 42.6 | 68.7 | 87.3 | 100 | 12.8 | 18.9 |
| May 28-June 4 | 0.1 | 444.9 | 44 | 97.9 | 99.1 | 39.6 | 37.9 | 56.0 | 81.1 | 100 | 8.9 | 17.1 |
| June 5-11 | 0.2 | 444.7 | 67 | 97.9 | 99.1 | 39.6 | 37.9 | 56.0 | 81.1 | 100 | 8.9 | 17.1 |
| June 12-18 | 0.5 | 445.1 | 67 | 97.9 | 99.1 | 39.6 | 37.9 | 56.0 | 81.1 | 100 | 8.9 | 17.1 |
| June 19-25 | 0.2 | 445.6 | 33 | 97.9 | 99.1 | 39.6 | 37.9 | 56.0 | 81.1 | 100 | 8.9 | 17.1 |
| June 26-July 2 | 0.2 | 445.6 | 33 | 97.9 | 99.1 | 39.6 | 37.9 | 56.0 | 81.1 | 100 | 8.9 | 17.1 |

Table 7 (cont). The 1970-1978 weekly averages of the increase in river levels from Diversion Plan 2, the sums of the weekly average increase from Plan 2 plus the weekly average of the actual river levels from Table 3, the percent of years from 1970-1978 that diversion occurred, and the corresponding percentages of habitat classes inundated for the Henry Area, Peoria Pool. Total hectares of each habitat class are in parentheses.

| Week | Average Diversion Increase (ft) | Actual Weekly Avg. + Diversion Increase msl (ft) | % of yrs. with Diversion | Habitat Class | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Open Water (286.2) | Mud Flats (65.4) | Marsh (59.6) | Scrub-shrub (180.6) | Forest (452.0) | Impoundments or Managed (98.6) | Stream bank (0.7) | Agri-culture (96.4) | Misc. (11.1) |
| July 3-9 | 0.3 | 444.2 | 33 | 97.9 | 99.1 | 39.6 | 37.9 | 56.0 | 81.1 | 100 | 8.9 | 17.1 |
| July 10-16 | 0.2 | 442.5 | 56 | 97.4 | 94.8 | 29.7 | 28.5 | 34.4 | 1.1 | 100 | 6.8 | 11.7 |
| July 17-23 | 0.4 | 442.5 | 56 | 97.4 | 94.8 | 29.7 | 28.5 | 34.4 | 1.1 | 100 | 6.8 | 11.7 |
| July 24-30 | 0.2 | 442.1 | 56 | 97.4 | 94.8 | 29.7 | 28.5 | 34.4 | 1.1 | 100 | 6.8 | 11.7 |
| July 31-Aug 6 | 0.1 | 441.7 | 44 | 93.1 | 69.6 | 3.5 | 3.0 | 3.4 | 1.0 | 100 | 1.6 | 4.5 |
| Aug 7-13 | 0.1 | 442.0 | 44 | 93.1 | 69.6 | 3.5 | 3.0 | 3.4 | 1.0 | 100 | 1.6 | 4.5 |
| Aug 14-20 | 0.2 | 442.0 | 44 | 93.1 | 69.6 | 3.5 | 3.0 | 3.4 | 1.0 | 100 | 1.6 | 4.5 |
| Aug 21-27 | 0.1 | 441.7 | 33 | 93.1 | 69.6 | 3.5 | 3.0 | 3.4 | 1.0 | 100 | 1.6 | 4.5 |
| Aug 28-Sept 3 | 0.1 | 442.1 | 56 | 97.4 | 94.8 | 29.7 | 28.5 | 34.4 | 1.1 | 100 | 6.8 | 11.7 |
| Sept 4-10 | 0.1 | 441.7 | 44 | 93.1 | 69.6 | 3.5 | 3.0 | 3.4 | 1.0 | 100 | 1.6 | 4.5 |
| Sept 11-17 | 0.1 | 441.7 | 56 | 93.1 | 69.6 | 3.5 | 3.0 | 3.4 | 1.0 | 100 | 1.6 | 4.5 |
| Sept 18-24 | 0.1 | 442.6 | 56 | 97.4 | 94.8 | 29.7 | 28.5 | 34.4 | 1.1 | 100 | 6.8 | 11.7 |
| Sept 25-Oct 1 | 0.2 | 443.1 | 56 | 97.4 | 94.8 | 29.7 | 28.5 | 34.4 | 1.1 | 100 | 6.8 | 11.7 |
| Oct 2-8 | 0.1 | 443.0 | 56 | 97.4 | 94.8 | 29.7 | 28.5 | 34.4 | 1.1 | 100 | 6.8 | 11.7 |
| Oct 9-15 | 0 | 442.5 | 56 | 97.4 | 94.8 | 29.7 | 28.5 | 34.4 | 1.1 | 100 | 6.8 | 11.7 |
| Oct 16-22 | 0.1 | 442.3 | 33 | 97.4 | 94.8 | 29.7 | 28.5 | 34.4 | 1.1 | 100 | 6.8 | 11.7 |
| Oct 23-29 | 0.1 | 442.0 | 78 | 93.1 | 69.6 | 3.5 | 3.0 | 3.4 | 1.0 | 100 | 1.6 | 4.5 |
| Oct 30-Nov 5 | 0.3 | 442.5 | 100 | 97.4 | 94.8 | 29.7 | 28.5 | 34.4 | 1.1 | 100 | 6.8 | 11.7 |
| Nov 6-12 | 0.1 | 442.4 | 89 | 97.4 | 94.8 | 29.7 | 28.5 | 34.4 | 1.1 | 100 | 6.8 | 11.7 |
| Nov 13-19 | 0.2 | 442.4 | 89 | 97.4 | 94.8 | 29.7 | 28.5 | 34.4 | 1.1 | 100 | 6.8 | 11.7 |
| Nov 20-26 | 0.2 | 442.5 | 89 | 97.4 | 94.8 | 29.7 | 28.5 | 34.4 | 1.1 | 100 | 6.8 | 11.7 |
| Nov 27-Dec 3 | 0.0 | 442.2 | 89 | 97.4 | 94.8 | 29.7 | 28.5 | 34.4 | 1.1 | 100 | 6.8 | 11.7 |
| Dec 4-10 | 0.3 | 442.5 | 100 | 97.4 | 94.8 | 29.7 | 28.5 | 34.4 | 1.1 | 100 | 6.8 | 11.7 |
| Dec 11-17 | 0.3 | 442.7 | 100 | 97.4 | 94.8 | 29.7 | 28.5 | 34.4 | 1.1 | 100 | 6.8 | 11.7 |
| Dec 18-24 | 0.3 | 443.0 | 100 | 97.4 | 94.8 | 29.7 | 28.5 | 34.4 | 1.1 | 100 | 6.8 | 11.7 |
| Dec 25-31 | 0.3 | 442.7 | 89 | 97.4 | 94.8 | 29.7 | 28.5 | 34.4 | 1.1 | 100 | 6.8 | 11.7 |

Table 8. The 1970-1978 weekly averages of the increase in river levels from Diversion Plan 2, the sums of the weekly average increase from Plan 2 plus the weekly average of the actual river levels from Table 4, the percent of years from 1970-1978 that diversion occurred, and the corresponding percentages of habitat classes inundated for the Marshall County Area, Peoria Pool. Total hectares of each habitat class are in parentheses.

| Week | Average Diversion Increase (ft) | Actual Weekly Avg. + Diversion Increase msl (ft) | % of yrs. with Diversion | Habitat Class | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Open Water (750.6) | Mud Flats (79.5) | Marsh (23.5) | Scrub-shrub (45.2) | Forest (236.6) | Impoundments or Managed (39.4) | Stream bank (0) | Agri-culture (13.4) | Misc. (5.1) |
| Jan 1-7 | 0.2 | 442.3 | 67 | 100.0 | 100.0 | 62.6 | 95.6 | 67.6 | 0 | | 0 | 0 |
| Jan 8-14 | 0.1 | 442.3 | 67 | 100.0 | 100.0 | 62.6 | 95.6 | 67.6 | 0 | | 0 | 0 |
| Jan 15-21 | 0.0 | 442.2 | 56 | 100.0 | 100.0 | 62.6 | 95.6 | 67.6 | 0 | | 0 | 0 |
| Jan 22-28 | 0.0 | 442.6 | 44 | 100.0 | 100.0 | 62.6 | 95.6 | 67.6 | 0 | | 0 | 0 |
| Jan 29-Feb 4 | 0.1 | 443.2 | 44 | 100.0 | 100.0 | 62.6 | 95.6 | 67.6 | 0 | | 0 | 0 |
| Feb 5-11 | 0.1 | 442.8 | 56 | 100.0 | 100.0 | 62.6 | 95.6 | 67.6 | 0 | | 0 | 0 |
| Feb 12-18 | 0.1 | 443.0 | 56 | 100.0 | 100.0 | 62.6 | 95.6 | 67.6 | 0 | | 0 | 0 |
| Feb 19-25 | 0.2 | 443.1 | 67 | 100.0 | 100.0 | 62.6 | 95.6 | 67.6 | 0 | | 0 | 0 |
| Feb 26-Mar 4 | 0.2 | 443.7 | 78 | 100.0 | 100.0 | 62.6 | 95.6 | 67.6 | 0 | | 0 | 0 |
| Mar 5-11 | 0.4 | 444.5 | 78 | 100.0 | 100.0 | 82.6 | 97.3 | 79.4 | 0 | | 0 | 2.0 |
| Mar 12-18 | 0.5 | 444.8 | 78 | 100.0 | 100.0 | 82.6 | 97.3 | 79.4 | 0 | | 0 | 2.0 |
| Mar 19-25 | 0.5 | 445.2 | 78 | 100.0 | 100.0 | 82.6 | 97.3 | 79.4 | 0 | | 0 | 2.0 |
| Mar 26-Apr 1 | 0.3 | 444.2 | 67 | 100.0 | 100.0 | 82.6 | 97.3 | 79.4 | 0 | | 0 | 2.0 |
| Apr 2-8 | 0.3 | 445.0 | 67 | 100.0 | 100.0 | 82.6 | 97.3 | 79.4 | 0 | | 0 | 2.0 |
| Apr 9-15 | 0.1 | 444.5 | 67 | 100.0 | 100.0 | 82.6 | 97.3 | 79.4 | 0 | | 0 | 2.0 |
| Apr 16-22 | 0.1 | 444.1 | 67 | 100.0 | 100.0 | 82.6 | 97.3 | 79.4 | 0 | | 0 | 2.0 |
| Apr 23-29 | 0.2 | 445.3 | 78 | 100.0 | 100.0 | 82.6 | 97.3 | 79.4 | 0 | | 0 | 2.0 |
| Apr 30-May 6 | 0.1 | 445.3 | 56 | 100.0 | 100.0 | 82.6 | 97.3 | 79.4 | 0 | | 0 | 2.0 |
| May 7-13 | 0.2 | 445.0 | 56 | 100.0 | 100.0 | 82.6 | 97.3 | 79.4 | 0 | | 0 | 2.0 |
| May 14-20 | 0.1 | 445.5 | 56 | 100.0 | 100.0 | 82.6 | 97.3 | 79.4 | 0 | | 0 | 2.0 |
| May 21-27 | 0.1 | 444.8 | 56 | 100.0 | 100.0 | 82.6 | 97.3 | 79.4 | 0 | | 0 | 2.0 |
| May 28-June 4 | 0.1 | 443.6 | 44 | 100.0 | 100.0 | 62.6 | 95.6 | 67.6 | 0 | | 0 | 0 |
| June 5-11 | 0.2 | 443.4 | 67 | 100.0 | 100.0 | 62.6 | 95.6 | 67.6 | 0 | | 0 | 0 |
| June 12-18 | 0.5 | 443.8 | 67 | 100.0 | 100.0 | 62.6 | 95.6 | 67.6 | 0 | | 0 | 0 |
| June 19-25 | 0.2 | 444.3 | 33 | 100.0 | 100.0 | 82.6 | 97.3 | 79.4 | 0 | | 0 | 2.0 |
| June 26-July 2 | 0.2 | 444.3 | 33 | 100.0 | 100.0 | 82.6 | 97.3 | 79.4 | 0 | | 0 | 2.0 |

Table 8 (cont). The 1970-1978 weekly averages of the increase in river levels from Diversion Plan 2, the sums of the weekly average increase from Plan 2 plus the weekly average of the actual river levels from Table 4, the percent of years from 1970-1978 that diversion occurred, and the corresponding percentages of habitat classes inundated for the Marshall County Area, Peoria Pool. Total hectares of each habitat class are in parentheses.

| Week | Average Diversion Increase (ft) | Actual Weekly Avg. + Diversion Increase msl (ft) | % of yrs. with Diversion | Habitat Class | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Open Water (750.6) | Mud Flats (79.5) | Marsh (23.5) | Scrub-shrub (45.2) | Forest (236.6) | Impoundments or Managed (39.4) | Stream bank (0) | Agri-culture (13.4) | Misc. (5.1) |
| July 3-9 | 0.3 | 442.9 | 33 | 100.0 | 100.0 | 62.6 | 95.6 | 67.6 | 0 | | 0 | 0 |
| July 10-16 | 0.2 | 441.2 | 56 | 100.0 | 91.8 | 6.0 | 59.3 | 16.4 | 0 | | 0 | 0 |
| July 17-23 | 0.4 | 441.2 | 56 | 100.0 | 91.8 | 6.0 | 59.3 | 16.4 | 0 | | 0 | 0 |
| July 24-30 | 0.2 | 440.8 | 56 | 100.0 | 91.8 | 6.0 | 59.3 | 16.4 | 0 | | 0 | 0 |
| July 31-Aug 6 | 0.1 | 440.4 | 44 | 100.0 | 91.8 | 6.0 | 59.3 | 16.4 | 0 | | 0 | 0 |
| Aug 7-13 | 0.1 | 440.7 | 44 | 100.0 | 91.8 | 6.0 | 59.3 | 16.4 | 0 | | 0 | 0 |
| Aug 14-20 | 0.2 | 440.7 | 44 | 100.0 | 91.8 | 6.0 | 59.3 | 16.4 | 0 | | 0 | 0 |
| Aug 21-27 | 0.1 | 440.4 | 33 | 100.0 | 91.8 | 6.0 | 59.3 | 16.4 | 0 | | 0 | 0 |
| Aug 28-Sept 3 | 0.1 | 440.8 | 56 | 100.0 | 91.8 | 6.0 | 59.3 | 16.4 | 0 | | 0 | 0 |
| Sept 4-10 | 0.1 | 440.4 | 44 | 100.0 | 91.8 | 6.0 | 59.3 | 16.4 | 0 | | 0 | 0 |
| Sept 11-17 | 0.1 | 440.4 | 56 | 100.0 | 91.8 | 6.0 | 59.3 | 16.4 | 0 | | 0 | 0 |
| Sept 18-24 | 0.1 | 441.3 | 56 | 100.0 | 91.8 | 6.0 | 59.3 | 16.4 | 0 | | 0 | 0 |
| Sept 25-Oct 1 | 0.2 | 441.8 | 56 | 100.0 | 91.8 | 6.0 | 59.3 | 16.4 | 0 | | 0 | 0 |
| Oct 2-8 | 0.1 | 441.7 | 56 | 100.0 | 91.8 | 6.0 | 59.3 | 16.4 | 0 | | 0 | 0 |
| Oct 9-15 | 0 | 441.2 | 56 | 100.0 | 91.8 | 6.0 | 59.3 | 16.4 | 0 | | 0 | 0 |
| Oct 16-22 | 0.1 | 441.0 | 33 | 100.0 | 91.8 | 6.0 | 59.3 | 16.4 | 0 | | 0 | 0 |
| Oct 23-29 | 0.1 | 440.7 | 78 | 100.0 | 91.8 | 6.0 | 59.3 | 16.4 | 0 | | 0 | 0 |
| Oct 30-Nov 5 | 0.3 | 441.2 | 100 | 100.0 | 91.8 | 6.0 | 59.3 | 16.4 | 0 | | 0 | 0 |
| Nov 6-12 | 0.1 | 441.1 | 89 | 100.0 | 91.8 | 6.0 | 59.3 | 16.4 | 0 | | 0 | 0 |
| Nov 13-19 | 0.2 | 441.1 | 89 | 100.0 | 91.8 | 6.0 | 59.3 | 16.4 | 0 | | 0 | 0 |
| Nov 20-26 | 0.2 | 441.2 | 89 | 100.0 | 91.8 | 6.0 | 59.3 | 16.4 | 0 | | 0 | 0 |
| Nov 27-Dec 3 | 0.1 | 441.0 | 89 | 100.0 | 91.8 | 6.0 | 59.3 | 16.4 | 0 | | 0 | 0 |
| Dec 4-10 | 0.3 | 441.2 | 89 | 100.0 | 91.8 | 6.0 | 59.3 | 16.4 | 0 | | 0 | 0 |
| Dec 11-17 | 0.3 | 441.4 | 100 | 100.0 | 91.8 | 6.0 | 59.3 | 16.4 | 0 | | 0 | 0 |
| Dec 18-24 | 0.3 | 441.7 | 100 | 100.0 | 91.8 | 6.0 | 59.3 | 16.4 | 0 | | 0 | 0 |
| Dec 25-31 | 0.3 | 441.4 | 89 | 100.0 | 91.8 | 6.0 | 59.3 | 16.4 | 0 | | 0 | 0 |

24-30 July, and 28 August to 3 September during the growing season. Plan 1 resulted in 7 weeks of increased habitat inundation during the dormant season and 4 weeks during the growing season.

Mud flats begin to appear at the Henry Area when river levels recede below 442.1 ft. Under Plan 2 conditions, this would occur on 31 July (Table 7) as compared with 24 July with ambient water levels (Table 3). Under ambient water conditions, the river levels were below 442.1 ft for an 8-week period from 24 July to 17 September exposing up to 70% of the potential surface area available for mud flats. This 56-day period is below the minimum 70 days required for moist-soil plant seed production and a poor crop would generally result. By increasing river levels up to 0.2 ft, Plan 2 would remove 2 of these 8 weeks with water levels below 442.1 ft that would have occurred with actual river levels, thus reducing the moist-soil plant community development and maturation period and causing a further decline in the poor seed production that would be expected under ambient water levels.

With regards to other habitats for the 4 weeks during the growing season when river levels projected by Plan 2 (Table 7) would inundate more area than would have occurred under ambient conditions (Table 3), the increase in the amount of marsh habitat flooded ranged between 10 to 26%, the additional area of scrub-shrub habitat flooded varied between 5 and 26%, and the

increase in the area of forest inundated ranged between 13 and 31% (Table 7). It is unlikely that these increases in the area of marsh and scrub-shrub habitats for 4 weeks during the growing season would have a significant effect on these communities. Only 3% of the forest community at Henry was flooded for 8 consecutive weeks from 24 July through 17 September under ambient water levels (Table 3). Plan 2 increased the percentage of forest flooded from 3% to 34% for 2 of these weeks and left only 4 consecutive weeks for 3% of the forest to be dewatered (Table 7). It is possible that such an increase in the inundation of forest could cause a change in the structure of the affected forest community over time.

The water levels projected by Plan 2 (Table 7) would increase the area of impoundments inundated by 80% over ambient conditions (Table 3) for the week of 5-11 February and by 6% for 12-25 March, 2-8 April, and 21-27 May. These periods would be inconsequential to waterfowl management. However, the river level increases resulting from Plan 2 (Table 7), like Plan 1 (Table 5), increased the percentage of impoundment areas inundated from 1 to 81% for the additional week of 3-9 July over ambient conditions (Table 3).

Marshall County Area. The exposure of mud flats at the Marshall County Area begins at the 441.0-ft level. Under ambient conditions, the average river levels were at or below

441.0 ft for 10 consecutive weeks from 10 July through 17 September (Table 4), thereby providing 70 days for the maturation of moist-soil plants and probably an average seed crop. Under the water regime generated by Plan 2 for this 10-week period, average increases in river levels up to 0.4 ft would occur (Table 8), and the river levels would average 441.0 ft or less for only 8 consecutive weeks from 24 July to 17 September. This is identical to the results from Plan 1 (Table 6). Hence, the 70-day maturation period for moist-soil plants under ambient conditions would be reduced to 56 days by Plan 2 and the estimated average seed production under actual conditions would decrease to below average or poor.

The only weeks that the average of the water levels generated by Plan 2 inundated a larger percentage of the habitat classes than the average of the actual river levels at Marshall County occurred from 26 March to 1 April and 16-22 April (Tables 8 and 4). These 2 weeks of increased inundation by Plan 2 during the dormant season would cause no significant difference in the marsh, scrub-shrub, or forest communities at the Marshall County Area.

The water levels projected for Plan 2 (Table 8) also did not differ from ambient conditions (Table 4) in the inundation of the 450-ft levee protecting the waterfowl impoundment area.

Diversion Plan 2 Summary. As was the case with Plan 1, the habitat category that would be most affected by Plan 2 at the Henry and Marshall County areas is the mud flat community. Under ambient conditions for the 1970-1978 study period, the colonization and maturation of moist-soil plants on exposed mud flats from mid-July through mid-September would produce an estimated average seed yield at Marshall County and poor yield at Henry. At both areas, the projected levels generated by Plan 2 would add up to 0.4 ft in elevation from 10 July to 17 September and consequently reduce the maturation period of moist-soil plants below the required 70-day span to 42 days at the Henry Area and 56 days at the Marshall County Area. Moist-soil plant seed production under Plan 2 conditions would be poor or worse.

The average levels generated by Plan 2 increased the percentage of marsh, scrub-shrub, and forest habitat inundated for 4 weeks of the 30 April to 15 October growing season at the Henry Area and for no weeks at the Marshall County Area. Significant changes in the marsh and scrub-shrub communities on the study areas are unlikely to occur under the average 1970-1978 Plan 2 levels as compared to ambient conditions. Some minor changes in the structure of the forest community at the Henry Area could result from Plan 2 river levels by reducing

the period of 8 consecutive weeks of exposure in mid-July through mid-September to 6 weeks total and only 4 consecutive weeks in 30% of the forest area.

The average water levels from Plan 2 would extend the inundation of 81% of the impoundment area 1 week over actual conditions during the growing season from 2 July to 9 July. Although seeding of managed crops for waterfowl and colonization by moist-soil plants would be delayed 1 week as compared to ambient conditions and longer if impoundments are drained by gravity flow rather than by pumping, an ample growing period should still be available for seed maturation of these plants.

Diversion Plan 3

The average weekly values of the actual river levels measured at Henry and the average levels resulting from Plan 3 for the years of 1972, 1974-1977 are shown in Figure 4. Plan 3 is a diversion scheme implemented to provide benefits to the management of waterfowl principally by avoiding inundation of mud flats during mid-June through early October for the establishment of the moist-soil communities. The average weekly increment of increase resulting from Plan 3, the frequency of of diversion during the 5-year study interval, and the corresponding percentages of habitat classes inundated are presented in Table 9 for the Henry Area and Table 10 for the Marshall County Area.

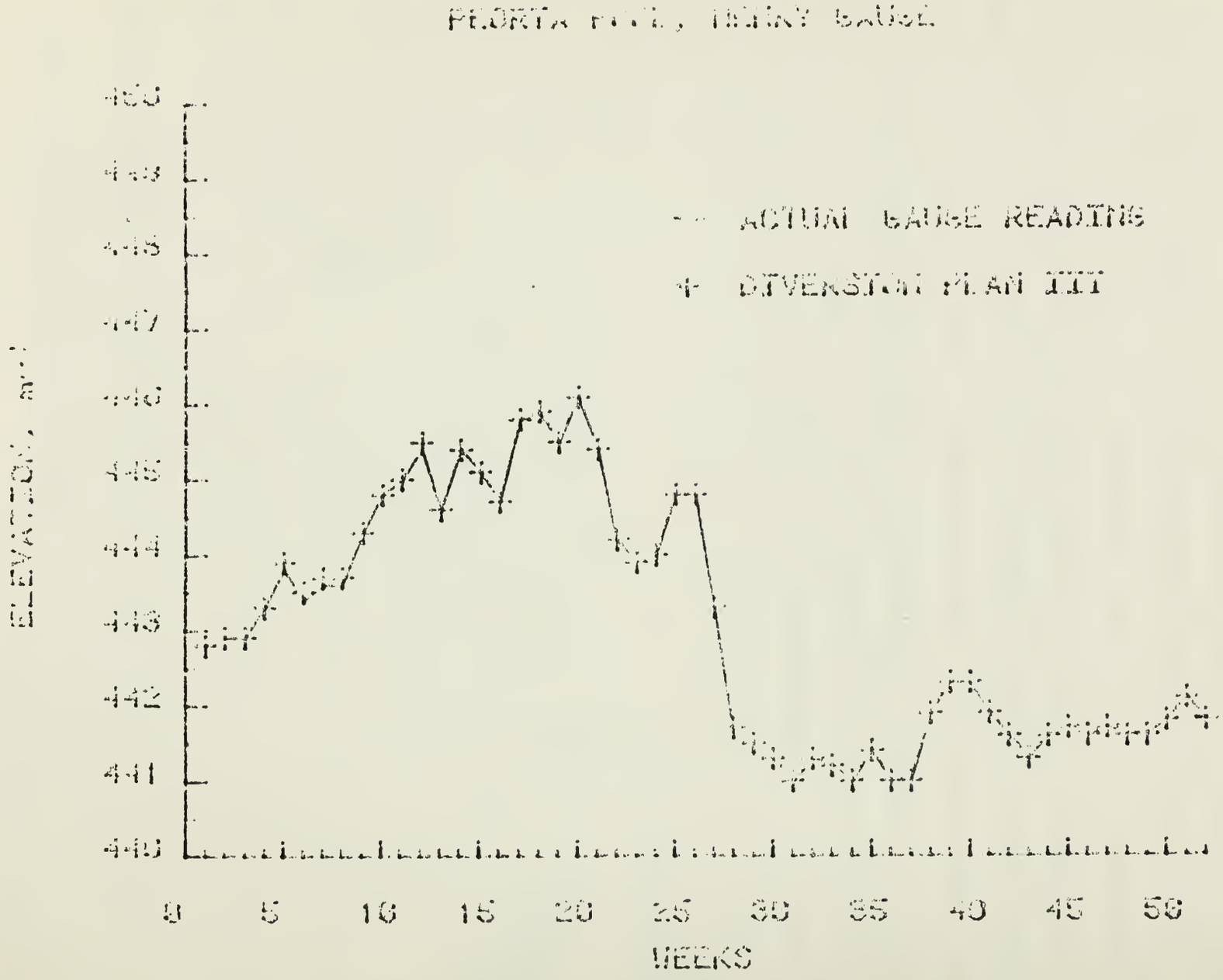


Figure 4. The average of weekly water levels (msl, ft) measured at the Henry gauge, Peoria Pool, and those predicted by Diversion Plan 3, 1972, 1974-1977.

Table 9. The 1972, 1974-1977 weekly averages of the increase in river levels from Diversion Plan 3, the sums of the weekly average increase from Plan 3 plus the weekly average of the actual river levels from Table 3, the percent of years from 1972, 1974-1977 that diversion occurred, and the corresponding percentages of habitat classes inundated for the Henry Area, Peoria Pool. Total hectares of each habitat class are in parentheses.

| Week | Average Diversion Increase (ft) | Actual Weekly Avg. + Diversion Increase msl (ft) | % of yrs. with Diversion | Habitat Class | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Open Water (286.2) | Mud Flats (65.4) | Marsh (59.6) | Scrub-shrub (180.6) | Forest (452.0) | Impoundments or Managed (98.6) | Stream bank (0.7) | Agri-culture (96.4) | Misc. (11.1) |
| Jan 1-7 | 0 | 443.4 | 40 | 97.4 | 94.8 | 29.7 | 28.5 | 34.4 | 1.1 | 100 | 6.8 | 11.7 |
| Jan 8-14 | 0 | 443.5 | 40 | 97.4 | 94.8 | 29.7 | 28.5 | 34.4 | 1.1 | 100 | 6.8 | 11.7 |
| Jan 15-21 | 0 | 443.5 | 40 | 97.4 | 94.8 | 29.7 | 28.5 | 34.4 | 1.1 | 100 | 6.8 | 11.7 |
| Jan 22-28 | 0 | 443.9 | 40 | 97.4 | 94.8 | 29.7 | 28.5 | 34.4 | 1.1 | 100 | 6.8 | 11.7 |
| Jan 29-Feb 4 | 0.1 | 444.5 | 60 | 97.9 | 99.1 | 39.6 | 37.9 | 56.0 | 81.1 | 100 | 8.9 | 17.1 |
| Feb 5-11 | 0.1 | 444.1 | 80 | 97.9 | 99.1 | 39.6 | 37.9 | 56.0 | 81.1 | 100 | 8.9 | 17.1 |
| Feb 12-18 | 0 | 444.2 | 40 | 97.9 | 99.1 | 39.6 | 37.9 | 56.0 | 81.1 | 100 | 8.9 | 17.1 |
| Feb 19-25 | 0 | 444.2 | 60 | 97.9 | 99.1 | 39.6 | 37.9 | 56.0 | 81.1 | 100 | 8.9 | 17.1 |
| Feb 26-Mar 4 | 0 | 444.9 | 40 | 97.9 | 99.1 | 39.6 | 37.9 | 56.0 | 81.1 | 100 | 8.9 | 17.1 |
| Mar 5-11 | 0.1 | 445.5 | 40 | 97.9 | 99.1 | 39.6 | 37.9 | 56.0 | 81.1 | 100 | 8.9 | 17.1 |
| Mar 12-18 | 0 | 445.6 | 20 | 97.9 | 99.1 | 39.6 | 37.9 | 56.0 | 81.1 | 100 | 8.9 | 17.1 |
| Mar 19-25 | 0.1 | 446.1 | 40 | 98.0 | 99.7 | 52.7 | 42.6 | 68.7 | 87.3 | 100 | 12.8 | 18.9 |
| Mar 26-Apr 1 | 0 | 445.2 | 0 | 97.9 | 99.1 | 39.6 | 37.9 | 56.0 | 81.1 | 100 | 8.9 | 17.1 |
| Apr 2-8 | 0 | 446.0 | 0 | 97.9 | 99.1 | 39.6 | 37.9 | 56.0 | 81.1 | 100 | 8.9 | 17.1 |
| Apr 9-15 | 0 | 445.7 | 0 | 97.9 | 99.1 | 39.6 | 37.9 | 56.0 | 81.1 | 100 | 8.9 | 17.1 |
| Apr 16-22 | 0 | 445.3 | 0 | 97.9 | 99.1 | 39.6 | 37.9 | 56.0 | 81.1 | 100 | 8.9 | 17.1 |
| Apr 23-29 | 0 | 446.4 | 0 | 98.0 | 99.7 | 52.7 | 42.6 | 68.7 | 87.3 | 100 | 12.8 | 18.9 |
| Apr 30-May 6 | 0 | 446.5 | 0 | 98.0 | 99.7 | 52.7 | 42.6 | 68.7 | 87.3 | 100 | 12.8 | 18.9 |
| May 7-13 | 0 | 446.1 | 0 | 98.0 | 99.7 | 52.7 | 42.6 | 68.7 | 87.3 | 100 | 12.8 | 18.9 |
| May 14-20 | 0 | 446.7 | 0 | 98.0 | 99.7 | 52.7 | 42.6 | 68.7 | 87.3 | 100 | 12.8 | 18.9 |
| May 21-27 | 0 | 446.0 | 0 | 97.9 | 99.1 | 39.6 | 37.9 | 56.0 | 81.1 | 100 | 8.9 | 17.1 |
| May 28-June 4 | 0 | 444.8 | 0 | 97.9 | 99.1 | 39.6 | 37.9 | 56.0 | 81.1 | 100 | 8.9 | 17.1 |
| June 5-11 | 0 | 444.5 | 0 | 97.9 | 99.1 | 39.6 | 37.9 | 56.0 | 81.1 | 100 | 8.9 | 17.1 |
| June 12-18 | 0 | 444.6 | 0 | 97.9 | 99.1 | 39.6 | 37.9 | 56.0 | 81.1 | 100 | 8.9 | 17.1 |
| June 19-25 | 0 | 445.4 | 0 | 97.9 | 99.1 | 39.6 | 37.9 | 56.0 | 81.1 | 100 | 8.9 | 17.1 |
| June 26-July 2 | 0 | 445.4 | 0 | 97.9 | 99.1 | 39.6 | 37.9 | 56.0 | 81.1 | 100 | 8.9 | 17.1 |

Table 9 (cont). The 1972, 1974-1977 weekly averages of the increase in river levels from Diversion Plan 3, the sums of the weekly average increase from Plan 3 plus the weekly average of the actual river levels from Table 3, the percent of years from 1972, 1974-1977 that diversion occurred, and the corresponding percentages of habitat classes inundated for the Henry Area, Peoria Pool. Total hectares of each habitat class are in parentheses.

| Week | Average Diversion Increase (ft) | Actual Weekly Avg. + Diversion Increase msl (ft) | % of yrs. with Diversion | Habitat Class | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Open Water (286.2) | Mud Flats (65.4) | Marsh (59.6) | Scrub-shrub (180.6) | Forest (452.0) | Impoundments or Managed (98.6) | Stream bank (0.7) | Agri-culture (96.4) | Misc. (11.1) |
| July 3-9 | 0 | 443.9 | 20 | 97.4 | 94.8 | 29.7 | 28.5 | 34.4 | 1.1 | 100 | 6.8 | 11.7 |
| July 10-16 | 0 | 442.3 | 0 | 97.4 | 94.8 | 29.7 | 28.5 | 34.4 | 1.1 | 100 | 6.8 | 11.7 |
| July 17-23 | 0 | 442.1 | 20 | 97.4 | 94.8 | 29.7 | 28.5 | 34.4 | 1.1 | 100 | 6.8 | 11.7 |
| July 24-30 | 0 | 441.9 | 0 | 93.1 | 69.6 | 3.5 | 3.0 | 3.4 | 1.0 | 100 | 1.6 | 4.5 |
| July 31-Aug 6 | 0 | 441.6 | 0 | 93.1 | 69.6 | 3.5 | 3.0 | 3.4 | 1.0 | 100 | 1.6 | 4.5 |
| Aug 7-13 | 0 | 441.9 | 0 | 93.1 | 69.6 | 3.5 | 3.0 | 3.4 | 1.0 | 100 | 1.6 | 4.5 |
| Aug 14-20 | 0 | 441.8 | 0 | 93.1 | 69.6 | 3.5 | 3.0 | 3.4 | 1.0 | 100 | 1.6 | 4.5 |
| Aug 21-27 | 0 | 441.6 | 0 | 93.1 | 69.6 | 3.5 | 3.0 | 3.4 | 1.0 | 100 | 1.6 | 4.5 |
| Aug 28-Sept 3 | 0 | 442.0 | 0 | 93.1 | 69.6 | 3.5 | 3.0 | 3.4 | 1.0 | 100 | 1.6 | 4.5 |
| Sept 4-10 | 0 | 441.6 | 0 | 93.1 | 69.6 | 3.5 | 3.0 | 3.4 | 1.0 | 100 | 1.6 | 4.5 |
| Sept 11-17 | 0 | 441.6 | 0 | 93.1 | 69.6 | 3.5 | 3.0 | 3.4 | 1.0 | 100 | 1.6 | 4.5 |
| Sept 18-24 | 0 | 442.5 | 0 | 97.4 | 94.8 | 29.7 | 28.5 | 34.4 | 1.1 | 100 | 6.8 | 11.7 |
| Sept 25-Oct 1 | 0 | 442.9 | 0 | 97.4 | 94.8 | 29.7 | 28.5 | 34.4 | 1.1 | 100 | 6.8 | 11.7 |
| Oct 2-8 | 0 | 442.9 | 0 | 97.4 | 94.8 | 29.7 | 28.5 | 34.4 | 1.1 | 100 | 6.8 | 11.7 |
| Oct 9-15 | 0 | 442.5 | 0 | 97.4 | 94.8 | 29.7 | 28.5 | 34.4 | 1.1 | 100 | 6.8 | 11.7 |
| Oct 16-22 | 0 | 442.2 | 0 | 97.4 | 94.8 | 29.7 | 28.5 | 34.4 | 1.1 | 100 | 6.8 | 11.7 |
| Oct 23-29 | 0 | 441.9 | 0 | 93.1 | 69.6 | 3.5 | 3.0 | 3.4 | 1.0 | 100 | 1.6 | 4.5 |
| Oct 30-Nov 5 | 0 | 442.2 | 0 | 97.4 | 94.8 | 29.7 | 28.5 | 34.4 | 1.1 | 100 | 6.8 | 11.7 |
| Nov 6-12 | 0 | 442.3 | 0 | 97.4 | 94.8 | 29.7 | 28.5 | 34.4 | 1.1 | 100 | 6.8 | 11.7 |
| Nov 13-19 | 0 | 442.2 | 0 | 97.4 | 94.8 | 29.7 | 28.5 | 34.4 | 1.1 | 100 | 6.8 | 11.7 |
| Nov 20-26 | 0 | 442.3 | 0 | 97.4 | 94.8 | 29.7 | 28.5 | 34.4 | 1.1 | 100 | 6.8 | 11.7 |
| Nov 27-Dec 3 | 0 | 442.2 | 0 | 97.4 | 94.8 | 29.7 | 28.5 | 34.4 | 1.1 | 100 | 6.8 | 11.7 |
| Dec 4-10 | 0 | 442.2 | 20 | 97.4 | 94.8 | 29.7 | 28.5 | 34.4 | 1.1 | 100 | 6.8 | 11.7 |
| Dec 11-17 | 0 | 442.4 | 20 | 97.4 | 94.8 | 29.7 | 28.5 | 34.4 | 1.1 | 100 | 6.8 | 11.7 |
| Dec 18-24 | 0 | 442.7 | 0 | 97.4 | 94.8 | 29.7 | 28.5 | 34.4 | 1.1 | 100 | 6.8 | 11.7 |
| Dec 25-31 | 0 | 442.4 | 0 | 97.4 | 94.8 | 29.7 | 28.5 | 34.4 | 1.1 | 100 | 6.8 | 11.7 |

Table 10. The 1972, 1974-1977 weekly averages of the increase in river levels from Diversion Plan 3, the sums of the weekly average increase from Plan 3 plus the weekly average of the actual river levels from Table 4, the percent of years from 1972, 1974-1977 that diversion occurred, and the corresponding percentages of habitat classes inundated for the Marshall County Area, Peoria Pool. Total hectares of each habitat class are in parentheses.

| Week | Average Diversion Increase (ft) | Actual Weekly Avg. + Diversion Increase msl (ft) | % of yrs. with Diversion | Habitat Class | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Open Water (750.6) | Mud Flats (79.5) | Marsh (23.5) | Scrub-shrub (45.2) | Forest (236.6) | Impoundments or Managed (39.4) | Stream bank (0) | Agri-culture (13.4) | Misc. (5.1) |
| Jan 1-7 | 0 | 442.1 | 40 | 100.0 | 100.0 | 62.6 | 95.6 | 67.6 | 0 | | 0 | 0 |
| Jan 8-14 | 0 | 442.2 | 40 | 100.0 | 100.0 | 62.6 | 95.6 | 67.6 | 0 | | 0 | 0 |
| Jan 15-21 | 0 | 442.2 | 40 | 100.0 | 100.0 | 62.6 | 95.6 | 67.6 | 0 | | 0 | 0 |
| Jan 22-28 | 0 | 442.6 | 60 | 100.0 | 100.0 | 62.6 | 95.6 | 67.6 | 0 | | 0 | 0 |
| Jan 29-Feb 4 | 0.1 | 443.2 | 80 | 100.0 | 100.0 | 62.6 | 95.6 | 67.6 | 0 | | 0 | 0 |
| Feb 5-11 | 0.1 | 442.8 | 40 | 100.0 | 100.0 | 62.6 | 95.6 | 67.6 | 0 | | 0 | 0 |
| Feb 12-18 | 0 | 442.9 | 60 | 100.0 | 100.0 | 62.6 | 95.6 | 67.6 | 0 | | 0 | 0 |
| Feb 19-25 | 0 | 442.9 | 40 | 100.0 | 100.0 | 62.6 | 95.6 | 67.6 | 0 | | 0 | 0 |
| Feb 26-Mar 4 | 0 | 443.6 | 40 | 100.0 | 100.0 | 62.6 | 95.6 | 67.6 | 0 | | 0 | 2.0 |
| Mar 5-11 | 0.1 | 444.2 | 20 | 100.0 | 100.0 | 82.6 | 97.3 | 79.4 | 0 | | 0 | 2.0 |
| Mar 12-18 | 0 | 444.3 | 40 | 100.0 | 100.0 | 82.6 | 97.3 | 79.4 | 0 | | 0 | 2.0 |
| Mar 19-25 | 0.1 | 444.8 | 20 | 100.0 | 100.0 | 82.6 | 97.3 | 79.4 | 0 | | 0 | 0 |
| Mar 26-Apr 1 | 0 | 443.9 | 0 | 100.0 | 100.0 | 62.6 | 95.6 | 67.6 | 0 | | 0 | 2.0 |
| Apr 2-8 | 0 | 444.7 | 0 | 100.0 | 100.0 | 82.6 | 97.3 | 79.4 | 0 | | 0 | 2.0 |
| Apr 9-15 | 0 | 444.4 | 0 | 100.0 | 100.0 | 82.6 | 97.3 | 79.4 | 0 | | 0 | 2.0 |
| Apr 16-22 | 0 | 444.0 | 0 | 100.0 | 100.0 | 62.6 | 95.6 | 67.6 | 0 | | 0 | 2.0 |
| Apr 23-29 | 0 | 445.1 | 0 | 100.0 | 100.0 | 82.6 | 97.3 | 79.4 | 0 | | 0 | 2.0 |
| Apr 30-May 6 | 0 | 445.2 | 0 | 100.0 | 100.0 | 82.6 | 97.3 | 79.4 | 0 | | 0 | 2.0 |
| May 7-13 | 0 | 444.8 | 0 | 100.0 | 100.0 | 82.6 | 97.3 | 79.4 | 0 | | 0 | 2.0 |
| May 14-20 | 0 | 445.4 | 0 | 100.0 | 100.0 | 82.6 | 97.3 | 79.4 | 0 | | 0 | 2.0 |
| May 21-27 | 0 | 444.7 | 0 | 100.0 | 100.0 | 82.6 | 97.3 | 79.4 | 0 | | 0 | 2.0 |
| May 28-June 4 | 0 | 443.5 | 0 | 100.0 | 100.0 | 62.6 | 95.6 | 67.6 | 0 | | 0 | 0 |
| June 5-11 | 0 | 443.2 | 0 | 100.0 | 100.0 | 62.6 | 95.6 | 67.6 | 0 | | 0 | 0 |
| June 12-18 | 0 | 443.3 | 0 | 100.0 | 100.0 | 62.6 | 95.6 | 67.6 | 0 | | 0 | 0 |
| June 19-25 | 0 | 444.1 | 0 | 100.0 | 100.0 | 82.6 | 97.3 | 79.4 | 0 | | 0 | 2.0 |
| June 26-July 2 | 0 | 444.1 | 0 | 100.0 | 100.0 | 82.6 | 97.3 | 79.4 | 0 | | 0 | 2.0 |

Table 10 (cont). The 1972, 1974-1977 weekly averages of the increase in river levels from Diversion Plan 3, the sums of the weekly average increase from Plan 3 plus the weekly average of the actual river levels from Table 4, the percent of years from 1972, 1974-1977 that diversion occurred, and the corresponding percentages of habitat classes inundated for the Marshall County Area, Peoria Pool. Total hectares of each habitat class are in parentheses.

| Week | Average Diversion Increase (ft) | Actual Weekly Avg. + Diversion Increase msl (ft) | % of yrs. with Diversion | Habitat Class | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Open Water (750.6) | Mud Flats (79.5) | Marsh (23.5) | Scrub-shrub (45.2) | Forest (236.6) | Impoundments or Managed (39.4) | Stream bank (0) | Agri-culture (13.4) | Misc. (5.1) |
| July 3-9 | 0 | 442.6 | 20 | 100.0 | 100.0 | 62.6 | 95.6 | 67.6 | 0 | | 0 | 0 |
| July 10-16 | 0 | 441.0 | 0 | 100.0 | 91.8 | 6.0 | 59.3 | 16.4 | 0 | | 0 | 0 |
| July 17-23 | 0 | 440.8 | 20 | 100.0 | 91.8 | 6.0 | 59.3 | 16.4 | 0 | | 0 | 0 |
| July 24-30 | 0 | 440.6 | 0 | 100.0 | 91.8 | 6.0 | 59.3 | 16.4 | 0 | | 0 | 0 |
| July 31-Aug 6 | 0 | 440.3 | 0 | 100.0 | 91.8 | 6.0 | 59.3 | 16.4 | 0 | | 0 | 0 |
| Aug 7-13 | 0 | 440.6 | 0 | 100.0 | 91.8 | 6.0 | 59.3 | 16.4 | 0 | | 0 | 0 |
| Aug 14-20 | 0 | 440.5 | 0 | 100.0 | 91.8 | 6.0 | 59.3 | 16.4 | 0 | | 0 | 0 |
| Aug 21-27 | 0 | 440.3 | 0 | 100.0 | 91.8 | 6.0 | 59.3 | 16.4 | 0 | | 0 | 0 |
| Aug 28-Sept 3 | 0 | 440.7 | 0 | 100.0 | 91.8 | 6.0 | 59.3 | 16.4 | 0 | | 0 | 0 |
| Sept 4-10 | 0 | 440.3 | 0 | 100.0 | 91.8 | 6.0 | 59.3 | 16.4 | 0 | | 0 | 0 |
| Sept 11-17 | 0 | 440.3 | 0 | 100.0 | 91.8 | 6.0 | 59.3 | 16.4 | 0 | | 0 | 0 |
| Sept 18-24 | 0 | 441.2 | 0 | 100.0 | 91.8 | 6.0 | 59.3 | 16.4 | 0 | | 0 | 0 |
| Sept 25-Oct 1 | 0 | 441.6 | 0 | 100.0 | 91.8 | 6.0 | 59.3 | 16.4 | 0 | | 0 | 0 |
| Oct 2-8 | 0 | 441.6 | 0 | 100.0 | 91.8 | 6.0 | 59.3 | 16.4 | 0 | | 0 | 0 |
| Oct 9-15 | 0 | 441.2 | 0 | 100.0 | 91.8 | 6.0 | 59.3 | 16.4 | 0 | | 0 | 0 |
| Oct 16-22 | 0 | 440.9 | 0 | 100.0 | 91.8 | 6.0 | 59.3 | 16.4 | 0 | | 0 | 0 |
| Oct 23-29 | 0 | 440.6 | 0 | 100.0 | 91.8 | 6.0 | 59.3 | 16.4 | 0 | | 0 | 0 |
| Oct 30-Nov 5 | 0 | 440.9 | 0 | 100.0 | 91.8 | 6.0 | 59.3 | 16.4 | 0 | | 0 | 0 |
| Nov 6-12 | 0 | 441.0 | 0 | 100.0 | 91.8 | 6.0 | 59.3 | 16.4 | 0 | | 0 | 0 |
| Nov 13-19 | 0 | 440.9 | 0 | 100.0 | 91.8 | 6.0 | 59.3 | 16.4 | 0 | | 0 | 0 |
| Nov 20-26 | 0 | 441.0 | 0 | 100.0 | 91.8 | 6.0 | 59.3 | 16.4 | 0 | | 0 | 0 |
| Nov 27-Dec 3 | 0 | 440.9 | 0 | 100.0 | 91.8 | 6.0 | 59.3 | 16.4 | 0 | | 0 | 0 |
| Dec 4-10 | 0 | 440.9 | 20 | 100.0 | 91.8 | 6.0 | 59.3 | 16.4 | 0 | | 0 | 0 |
| Dec 11-17 | 0 | 441.1 | 20 | 100.0 | 91.8 | 6.0 | 59.3 | 16.4 | 0 | | 0 | 0 |
| Dec 18-24 | 0 | 441.4 | 0 | 100.0 | 91.8 | 6.0 | 59.3 | 16.4 | 0 | | 0 | 0 |
| Dec 25-31 | 0 | 441.1 | 0 | 100.0 | 91.8 | 6.0 | 59.3 | 16.4 | 0 | | 0 | 0 |

Average weekly increases in river levels resulting from Plan 3 varied between 0 and 0.1 ft from 1 January to 25 March, 3-9 July, 17-23 July, and 4-17 December when the percent of years diversion occurred ranged from 20 to 80% (Table 9). During the majority of the year, no diversion from Plan 3 occurred. No increases in the average weekly water levels over ambient levels during the 30 April to 15 October growing period resulted from Plan 3 for either the Henry or Marshall County areas.

Increases in the percentages of the various habitats inundated by Plan 3 as compared with ambient conditions occurred for the 2 weeks of 5-11 February and 19-25 March at the Henry Area (Tables 3 and 9), and for no weeks at the Marshall County Area (Tables 4 and 10). No significant biological effects would result from the projected Plan 3 water levels compared to ambient conditions at the Henry and Marshall County areas.

## La Grange Pool

### Description of the Study Areas

Grand Island Area. Grand Island is comprised of 1,649 ha (4,073 acres) and the major habitats are open water, mud flats, scrub-shrub, and bottomland forest (Table 11). There are no levees on Grand Island to protect any of the various habitats. Approximately 63% of the surface area of mud flats occurs below 431.4 ft (Havera et al., 1980:5-62), the river level when the aerial photos were taken. Consequently, much of the surface area of mud flats that exists between the 430-432 ft contour was inundated and is in the open water category. River levels below 430.0 ft allow exposure of 87% of the mud flat surface area at Grand Island (Havera et al., 1980:5-62). The 430-ft contour was the lowest one available on the maps. Practically all habitats at Grand Island occur under 440 ft (Table 11). Grand Island is a prestigious waterfowl hunting club that has been in existence since the late 1800's. The surface area of mud flats available to grow moist-soil plants in late summer and early fall is vital to a successful harvest of ducks each year. Grand Island also supports a large amount of bottomland timber that provides habitat to a variety of terrestrial wildlife species.

Table 11. Area (hectares and acres) of habitat classes by 2-ft contour intervals at Grand Island Duck Club, La Grange Pool.

| Elevation msl (ft) | Habitat Classes | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Open Water | | Mud Flats | | Marsh | | Scrub-Shrub | | Forest | | Impoundments or Intensively Managed | | Stream Bank | | Agriculture | | Miscellaneous (levees, roads, etc.) | |
| | ha | acres | ha | acres | ha | acres | ha | acres | ha | acres | ha | acres | ha | acres | ha | acres | ha | acres |
| 430-32 | 594.3 | 1467.9 | 8.5 | 21.0 | | | 105.1 | 259.6 | 7.8 | 19.3 | | | | | | | | |
| 432-34 | 35.0 | 86.5 | 20.2 | 50.0 | | | 184.9 | 456.7 | 123.9 | 306.1 | | | 1.9 | 4.8 | 0.2 | 0.6 | | |
| 434-36 | | | | | | | 11.0 | 27.3 | 216.1 | 533.8 | | | 0.2 | 0.4 | 13.7 | 33.9 | | |
| 436-38 | | | | | | | 0.1 | 0.1 | 173.6 | 428.8 | | | 0.2 | 0.4 | 25.4 | 62.6 | 0.4 | 1.1 |
| 438-40 | | | | | | | | | 98.1 | 242.3 | | | | | 9.0 | 22.2 | 0.9 | 1.9 |
| 440-42 | | | | | | | | | 11.9 | 29.4 | | | | | 0.2 | 0.4 | | |
| 442-44 | | | | | | | | | 0.9 | 2.1 | | | | | | | | |
| 444-46 | | | | | | | | | 0.2 | 0.5 | | | | | | | | |
| 446-48 | | | | | | | | | 0.1 | 0.2 | | | | | | | | |
| 448-50 | | | | | | | | | 0.1 | 0.3 | | | | | | | | |
| 450-52 | | | | | | | | | 0.1 | 0.1 | | | | | | | | |
| OTHER | | | | | | | | | | | | | | | | | | |
| 432-38 | | | | | | | | | 3.7 | 9.0 | | | | | | | | |
| 432-36 | | | | | | | | | 0.1 | 0.3 | | | | | | | | |
| 432-40 | | | | | | | | | 0.9 | 2.2 | | | | | | | | |
| 436-40 | | | | | | | | | 0.1 | 0.1 | | | | | | | | |
| TOTAL | 629.3 | 1554.4 | 28.7 | 70.9 | | | 301.1 | 743.7 | 637.6 | 1574.9 | | | 2.3 | 5.7 | 48.5 | 119.8 | 1.3 | 3.0 |

GRAND TOTAL 1,648.8 ha -- 4,072.5 acres

Bottomland timber comprises 638 of the 1649 ha on Grand Island (Table 11).

Sanganois Conservation Area. A major segment of the Sanganois Conservation Area encompassing a waterfowl management area protected by a 435-ft levee was selected for analysis (Table 12). Substantial amounts of all the habitat classes were represented in the Sanganois sample which indicates why this area supports a high diversity of wildlife species. Water levels varied between 430.5 and 432.5 ft outside of the leveed area and between 431.5 and 432.4 ft inside the levee when the aerial photos were taken. At Sanganois, approximately 75% of the mud flats occur below a level of 430.2 ft (Havera et al., 1980:5-62). Correspondingly, some mud flat areas were inundated on the aerial photos and are included in the open water category. Unfortunately, the lowest contour available on the maps was 430.0 ft.

Actual River Levels. The weekly average of the actual river levels from 1970-1978 and the corresponding percentages of the various habitat classes that were inundated by these ambient river levels are presented in Table 13 for Grand Island and Table 14 for Sanganois.

Table 12. Area (hectares and acres) of habitat classes by 2-ft contour intervals at Sanganois Conservation Area, La Grange Pool.

| Elevation msl (ft) | Habitat Classes | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Open Water | | Mud Flats | | Marsh | | Scrub-Shrub | | Forest | | Impoundments * or Intensively Managed | | Stream Bank | | Agriculture | | Miscellaneous (levees, roads, etc.) | |
| | ha | acres | ha | acres | ha | acres | ha | acres | ha | acres | ha | acres | ha | acres | ha | acres | ha | acres |
| 430-32 | 145.0 | 358.3 | 34.0 | 84.0 | 14.1 | 34.8 | 71.4 | 176.4 | 30.7 | 75.9 | | | 5.5 | 13.6 | | | | |
| 432-34 | 87.3 | 215.7 | 11.6 | 28.7 | 7.2 | 17.8 | 50.4 | 124.5 | 106.1 | 262.2 | | | 1.2 | 3.0 | | | | |
| 434-36 | | | | | | | | | 15.9 | 39.3 | 748.8* | 1850.3 | 0.1 | 0.1 | | | | |
| 436-38 | | | | | | | | | 10.3 | 25.5 | | | | | | | | |
| 438-40 | 0.1 | 0.1 | | | | | | | 1.8 | 4.4 | | | | | | | | |
| 440-42 | | | | | | | | | | | | | | | | | | |
| 442-44 | | | | | | | | | | | | | | | | | | |
| 444-46 | | | | | | | | | | | | | | | | | | |
| OTHER | | | | | | | | | | | | | | | | | | |
| 430-38 | | | | | | | | | | | | | 1.4 | 3.5 | | | 6.1 | 15.1 |
| 430-40 | | | | | | | | | | | | | | | | | 1.1 | 2.7 |
| 434-38 | | | | | | | | | 0.2 | 0.5 | | | 0.1 | 0.1 | | | 0.3 | 0.7 |
| 432-40 | | | | | | | | | | | | | | | | | 0.3 | 0.7 |
| 432-38 | | | | | | | | | | | | | | | | | 2.4 | 5.9 |
| 430-34 | 0.2 | 0.5 | | | | | | | | | | | | | | | | |
| TOTAL | 232.6 | 574.8 | 45.6 | 112.7 | 21.3 | 52.6 | 121.8 | 301.0 | 164.8 | 407.2 | 748.8 | 1850.3 | 8.3 | 20.5 | | | 10.2 | 25.2 |

* COMPOSITION BY HABITAT CLASS OF THE 748.8 HA PROTECTED BY 435' MSL LEVEE

| | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 82.0 | 202.5 | 47.9 | 118.3 | 30.0 | 74.1 | 246.7 | 609.3 | 330.9 | 817.7 | | | 11.3 | 27.9 | | | | |

GRAND TOTAL 1,353.4 ha -- 3,342.9 acres

Table 13. The 1970-1978 weekly averages of actual river levels and the corresponding percentage of habitat classes inundated for the Grand Island Area, La Grange Pool. Total hectares of each habitat class are in parentheses.

| | | Habitat Class | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Week | Weekly Avg. Water Levels msl (ft) | Open Water (629.3) | Mud Flats (28.7) | Marsh (0) | Scrub-shrub (301.0) | Forest (637.3) | Impoundments or Managed (0) | Stream bank (2.2) | Agri-culture (48.5) | Misc. (1.2) |
| Jan 1-7 | 433.0 | 100.0 | 100.0 | | 96.3 | 20.7 | | 84.1 | 0.4 | 0 |
| Jan 8-14 | 433.2 | 100.0 | 100.0 | | 96.3 | 20.7 | | 84.1 | 0.4 | 0 |
| Jan 15-21 | 433.0 | 100.0 | 100.0 | | 96.3 | 20.7 | | 84.1 | 0.4 | 0 |
| Jan 22-28 | 433.2 | 100.0 | 100.0 | | 96.3 | 20.7 | | 84.1 | 0.4 | 0 |
| Jan 29-Feb 4 | 434.0 | 100.0 | 100.0 | | 96.3 | 20.7 | | 84.1 | 0.4 | 0 |
| Feb 5-11 | 434.1 | 100.0 | 100.0 | | 100.0 | 54.6 | | 90.9 | 28.7 | 0 |
| Feb 12-18 | 433.5 | 100.0 | 100.0 | | 96.3 | 20.7 | | 84.1 | 0.4 | 0 |
| Feb 19-25 | 434.3 | 100.0 | 100.0 | | 100.0 | 54.6 | | 90.9 | 28.7 | 0 |
| Feb 26-Mar 4 | 435.0 | 100.0 | 100.0 | | 100.0 | 54.6 | | 90.9 | 28.7 | 0 |
| Mar 5-11 | 435.2 | 100.0 | 100.0 | | 100.0 | 54.6 | | 90.9 | 28.7 | 0 |
| Mar 12-18 | 435.8 | 100.0 | 100.0 | | 100.0 | 54.6 | | 90.9 | 28.7 | 0 |
| Mar 19-25 | 436.6 | 100.0 | 100.0 | | 100.0 | 81.8 | | 100.0 | 81.0 | 33.1 |
| Mar 26-Apr 1 | 436.6 | 100.0 | 100.0 | | 100.0 | 81.8 | | 100.0 | 81.0 | 33.1 |
| Apr 2-8 | 437.2 | 100.0 | 100.0 | | 100.0 | 81.8 | | 100.0 | 81.0 | 33.1 |
| Apr 9-15 | 437.0 | 100.0 | 100.0 | | 100.0 | 81.8 | | 100.0 | 81.0 | 33.1 |
| Apr 16-22 | 436.4 | 100.0 | 100.0 | | 100.0 | 81.8 | | 100.0 | 81.0 | 33.1 |
| Apr 23-29 | 437.0 | 100.0 | 100.0 | | 100.0 | 81.8 | | 100.0 | 81.0 | 33.1 |
| Apr 30-May 6 | 437.6 | 100.0 | 100.0 | | 100.0 | 81.8 | | 100.0 | 81.0 | 33.1 |
| May 7-13 | 437.8 | 100.0 | 100.0 | | 100.0 | 81.8 | | 100.0 | 81.0 | 33.1 |
| May 14-20 | 437.9 | 100.0 | 100.0 | | 100.0 | 81.8 | | 100.0 | 81.0 | 33.1 |
| May 21-27 | 437.0 | 100.0 | 100.0 | | 100.0 | 81.8 | | 100.0 | 81.0 | 33.1 |
| May 28-June 4 | 436.0 | 100.0 | 100.0 | | 100.0 | 54.6 | | 90.9 | 28.7 | 0 |
| June 5-11 | 435.2 | 100.0 | 100.0 | | 100.0 | 54.6 | | 90.9 | 28.7 | 0 |
| June 12-18 | 434.6 | 100.0 | 100.0 | | 100.0 | 54.6 | | 90.9 | 28.7 | 0 |
| June 19-25 | 435.2 | 100.0 | 100.0 | | 100.0 | 54.6 | | 90.9 | 28.7 | 0 |
| June 26-July 2 | 435.8 | 100.0 | 100.0 | | 100.0 | 54.6 | | 90.9 | 28.7 | 0 |

Table 13 (cont). The 1970-1978 weekly averages of actual river levels and the corresponding percentage of habitat classes inundated for the Grand Island Area, La Grange Pool. Total hectares of each habitat class are in parentheses.

| Week | Weekly Avg. Water Levels msl (ft) | Habitat Class: Open Water (629.3) | Mud Flats (28.7) | Marsh (0) | Scrub-shrub (301.0) | Forest (637.3) | Impoundments or Managed (0) | Stream bank (2.2) | Agri-culture (48.5) | Misc. (1.2) |
|---|---|---|---|---|---|---|---|---|---|---|
| July 3-9 | 435.1 | 100.0 | 100.0 | | 100.0 | 54.6 | | 90.9 | 28.7 | 0 |
| July 10-16 | 433.2 | 100.0 | 100.0 | | 96.3 | 20.7 | | 84.1 | 0.4 | 0 |
| July 17-23 | 431.5 | 94.4 | 29.6 | | 34.9 | 1.2 | | 84.1 | 0.4 | 0 |
| July 24-30 | 431.2 | 94.4 | 29.6 | | 34.9 | 1.2 | | 84.1 | 0.4 | 0 |
| July 31-Aug 6 | 430.8 | 94.4 | 29.6 | | 34.9 | 1.2 | | 84.1 | 0.4 | 0 |
| Aug 7-13 | 430.5 | 94.4 | 29.6 | | 34.9 | 1.2 | | 84.1 | 0.4 | 0 |
| Aug 14-20 | 430.6 | 94.4 | 29.6 | | 34.9 | 1.2 | | 84.1 | 0.4 | 0 |
| Aug 21-27 | 429.9 [A] | ---- | ---- | | ---- | --- | | ---- | --- | --- |
| Aug 28-Sept 3 | 429.9 [A] | ---- | ---- | | ---- | --- | | ---- | --- | --- |
| Sept 4-10 | 430.2 | 94.4 | 29.6 | | 34.9 | 1.2 | | 84.1 | 0.4 | 0 |
| Sept 11-17 | 430.0 [A] | ---- | ---- | | ---- | --- | | ---- | --- | --- |
| Sept 18-24 | 431.5 | 94.4 | 29.6 | | 34.9 | 1.2 | | 84.1 | 0.4 | 0 |
| Sept 25-Oct 1 | 432.0 | 94.4 | 29.6 | | 34.9 | 1.2 | | 84.1 | 0.4 | 0 |
| Oct 2-8 | 432.1 | 100.0 | 100.0 | | 96.3 | 20.7 | | 84.1 | 0.4 | 0 |
| Oct 9-15 | 431.7 | 94.4 | 29.6 | | 34.9 | 1.2 | | 84.1 | 0.4 | 0 |
| Oct 16-22 | 431.5 | 94.4 | 29.6 | | 34.9 | 1.2 | | 84.1 | 0.4 | 0 |
| Oct 23-29 | 430.9 | 94.4 | 29.6 | | 34.9 | 1.2 | | 84.1 | 0.4 | 0 |
| Oct 30-Nov 5 | 431.1 | 94.4 | 29.6 | | 34.9 | 1.2 | | 84.1 | 0.4 | 0 |
| Nov 6-12 | 431.4 | 94.4 | 29.6 | | 34.9 | 1.2 | | 84.1 | 0.4 | 0 |
| Nov 13-19 | 431.1 | 94.4 | 29.6 | | 34.9 | 1.2 | | 84.1 | 0.4 | 0 |
| Nov 20-26 | 431.1 | 94.4 | 29.6 | | 34.9 | 1.2 | | 84.1 | 0.4 | 0 |
| Nov 27-Dec 3 | 430.9 | 94.4 | 29.6 | | 34.9 | 1.2 | | 84.1 | 0.4 | 0 |
| Dec 4-10 | 431.6 | 94.4 | 29.6 | | 34.9 | 1.2 | | 84.1 | 0.4 | 0 |
| Dec 11-17 | 432.1 | 100.0 | 100.0 | | 96.3 | 20.7 | | 84.1 | 0.4 | 0 |
| Dec 18-24 | 432.8 | 100.0 | 100.0 | | 96.3 | 20.7 | | 84.1 | 0.4 | 0 |
| Dec 25-31 | 432.8 | 100.0 | 100.0 | | 96.3 | 20.7 | | 84.1 | 0.4 | 0 |

[A] This river level is below the lowest elevation on the contour maps.

Table 14. The 1970-1978 weekly averages of actual river levels and the corresponding percentage of habitat classes inundated for the Sanganois Area, La Grange Pool. Total hectares of each habitat type are in parentheses.

| Week | Weekly Avg. Water Levels msl (ft) | Habitat Class | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Open Water (232.6) | Mud Flats (45.6) | Marsh (21.3) | Scrub-shrub (121.8) | Forest (164.8) | Impoundments or Managed (748.8) | Stream bank (8.3) | Agri-culture (0) | Misc. (10.2) |
| Jan 1-7 | 431.3 | 62.3 | 74.6 | 66.2 | 58.6 | 18.6 | 0 | 66.3 | | B |
| Jan 8-14 | 431.5 | 62.3 | 74.6 | 66.2 | 58.6 | 18.6 | 0 | 66.3 | | |
| Jan 15-21 | 431.3 | 62.3 | 74.6 | 66.2 | 58.6 | 18.6 | 0 | 66.3 | | |
| Jan 22-28 | 431.5 | 62.3 | 74.6 | 66.2 | 58.6 | 18.6 | 0 | 66.3 | | |
| Jan 29-Feb 4 | 432.3 | 100.0 | 100.0 | 100.0 | 100.0 | 83.0 | 0 | 100.0 | | |
| Feb 5-11 | 432.4 | 100.0 | 100.0 | 100.0 | 100.0 | 83.0 | 0 | 100.0 | | |
| Feb 12-18 | 431.8 | 62.3 | 74.6 | 66.2 | 58.6 | 18.6 | 0 | 66.3 | | |
| Feb 19-25 | 432.6 | 100.0 | 100.0 | 100.0 | 100.0 | 83.0 | 0 | 100.0 | | |
| Feb 26-Mar 4 | 433.3 | 100.0 | 100.0 | 100.0 | 100.0 | 83.0 | 0 | 100.0 | | |
| Mar 5-11 | 433.5 | 100.0 | 100.0 | 100.0 | 100.0 | 83.0 | 0 | 100.0 | | |
| Mar 12-18 | 434.1 | 100.0 | 100.0 | 100.0 | 100.0 | 92.6 | 0 | 100.0 | | |
| Mar 19-25 | 434.9 | 100.0 | 100.0 | 100.0 | 100.0 | 92.6 | 0 | 100.0 | | |
| Mar 26-Apr 1 | 434.9 | 100.0 | 100.0 | 100.0 | 100.0 | 92.6 | 0 | 100.0 | | |
| Apr 2-8 | 435.5 | 100.0 | 100.0 | 100.0 | 100.0 | 92.6 | 100.0 | 100.0 | | |
| Apr 9-15 | 435.3 | 100.0 | 100.0 | 100.0 | 100.0 | 92.6 | 100.0 | 100.0 | | |
| Apr 16-22 | 434.7 | 100.0 | 100.0 | 100.0 | 100.0 | 92.6 | 0 | 100.0 | | |
| Apr 23-29 | 435.3 | 100.0 | 100.0 | 100.0 | 100.0 | 92.6 | 100.0 | 100.0 | | |
| Apr 30-May 6 | 435.9 | 100.0 | 100.0 | 100.0 | 100.0 | 92.6 | 100.0 | 100.0 | | |
| May 7-13 | 436.1 | 100.0 | 100.0 | 100.0 | 100.0 | 98.9 | 100.0 | 100.0 | | |
| May 14-20 | 436.2 | 100.0 | 100.0 | 100.0 | 100.0 | 98.9 | 100.0 | 100.0 | | |
| May 21-27 | 435.3 | 100.0 | 100.0 | 100.0 | 100.0 | 92.6 | 100.0 | 100.0 | | |
| May 28-June 4 | 434.3 | 100.0 | 100.0 | 100.0 | 100.0 | 92.6 | 0 | 100.0 | | |
| June 5-11 | 433.5 | 100.0 | 100.0 | 100.0 | 100.0 | 83.0 | 0 | 100.0 | | |
| June 12-18 | 432.9 | 100.0 | 100.0 | 100.0 | 100.0 | 83.0 | 0 | 100.0 | | |
| June 19-25 | 433.5 | 100.0 | 100.0 | 100.0 | 100.0 | 83.0 | 0 | 100.0 | | |
| June 26-July 2 | 434.1 | 100.0 | 100.0 | 100.0 | 100.0 | 92.6 | 0 | 100.0 | | |

Table 14 (cont). The 1970-1978 weekly averages of actual river levels and the corresponding percentage of habitat classes inundated for the Sanganois Area, La Grange Pool. Total hectares of each habitat type are in parentheses.

| Week | Weekly Avg. Water Levels msl (ft) | Habitat Class: Open Water (232.6) | Mud Flats (45.6) | Marsh (21.3) | Scrub-shrub (121.8) | Forest (164.8) | Impoundments or Managed (748.8) | Stream bank (8.3) | Agri-culture (0) | Misc. (10.2) |
|---|---|---|---|---|---|---|---|---|---|---|
| July 3-9 | 433.4 | 100.0 | 100.0 | 100.0 | 100.0 | 83.0 | 0 | 100.0 | | B |
| July 10-16 | 431.5 | 62.3 | 74.6 | 66.2 | 58.6 | 18.6 | 0 | 66.3 | | |
| July 17-23 | 429.8 [A] | ---- | ---- | ---- | ---- | ---- | 0 | ---- | | |
| July 24-30 | 429.5 [A] | ---- | ---- | ---- | ---- | ---- | 0 | ---- | | |
| July 31-Aug 6 | 429.1 [A] | ---- | ---- | ---- | ---- | ---- | 0 | ---- | | |
| Aug 7-13 | 428.8 [A] | ---- | ---- | ---- | ---- | ---- | 0 | ---- | | |
| Aug 14-20 | 428.9 [A] | ---- | ---- | ---- | ---- | ---- | 0 | ---- | | |
| Aug 21-27 | 428.2 [A] | ---- | ---- | ---- | ---- | ---- | 0 | ---- | | |
| Aug 28-Sept 3 | 428.2 [A] | ---- | ---- | ---- | ---- | ---- | 0 | ---- | | |
| Sept 4-10 | 428.5 [A] | ---- | ---- | ---- | ---- | ---- | 0 | ---- | | |
| Sept 11-17 | 428.3 [A] | ---- | ---- | ---- | ---- | ---- | 0 | ---- | | |
| Sept 18-24 | 429.8 [A] | ---- | ---- | ---- | ---- | ---- | 0 | ---- | | |
| Sept 25-Oct 1 | 430.3 | 62.3 | 74.6 | 66.2 | 58.6 | 18.6 | 0 | 66.3 | | |
| Oct 2-8 | 430.4 | 62.3 | 74.6 | 66.2 | 58.6 | 18.6 | 0 | 66.3 | | |
| Oct 9-15 | 430.0 [A] | ---- | ---- | ---- | ---- | ---- | 0 | ---- | | |
| Oct 16-22 | 429.8 [A] | ---- | ---- | ---- | ---- | ---- | 0 | ---- | | |
| Oct 23-29 | 429.2 [A] | ---- | ---- | ---- | ---- | ---- | 0 | ---- | | |
| Oct 30-Nov 5 | 429.4 [A] | ---- | ---- | ---- | ---- | ---- | 0 | ---- | | |
| Nov 6-12 | 429.7 [A] | ---- | ---- | ---- | ---- | ---- | 0 | ---- | | |
| Nov 13-19 | 429.4 [A] | ---- | ---- | ---- | ---- | ---- | 0 | ---- | | |
| Nov 20-26 | 429.4 [A] | ---- | ---- | ---- | ---- | ---- | 0 | ---- | | |
| Nov 27-Dec 3 | 429.2 [A] | ---- | ---- | ---- | ---- | ---- | 0 | ---- | | |
| Dec 4-10 | 429.9 [A] | ---- | ---- | ---- | ---- | ---- | 0 | ---- | | |
| Dec 11-17 | 430.4 | 62.3 | 74.6 | 66.2 | 58.6 | 18.6 | 0 | 66.3 | | |
| Dec 18-24 | 431.1 | 62.3 | 74.6 | 66.2 | 58.6 | 18.6 | 0 | 66.3 | | |
| Dec 25-31 | 431.1 | 62.3 | 74.6 | 66.2 | 58.6 | 18.6 | 0 | 66.3 | | |

[A] This river level is below the lowest elevation on the contour maps.

[B] All of this habitat class consists of levees and none were able to be measured at 2-ft contours.

Grand Island Area. Examination of the actual river levels at Grand Island (Table 13) indicates that for the three most important habitat classes for wildlife on this area--mud flats, scrub-shrub, and bottomland timber--the actual average water levels were generally favorable. Mud flats at Grand Island were inundated until 17 July (Table 13). The river levels remained at or below an elevation of 431.5 ft until 25 September. Large expanses of mud flats would appear in the open water category as the water level decreased below 431.5 to 429.9 ft. Under the average of the actual 1970-1978 water levels, between approximately 37 and 87% of the mud flats should have been available for the establishment and development of moist-soil communities for 10 weeks from 17 July to 24 September. A 2-week rise in levels to 432.0-432.1 ft then subsided to expose more mud flats until early December. This 2-week rise would be detrimental to those growing plants that were overtopped, but probably had no effect on those that reached maturity during the 70 days prior to inundation.

At Grand Island (Table 13), all or most of the scrub-shrub habitat was inundated by actual river levels until mid-July. About 35% of the scrub-shrub habitat remained flooded during the rest of the growing season through October. It is doubtful that this degree of inundation would result in serious detrimental

effects to the scrub-shrub community.

Over half of the large amount of bottomland forest at Grand Island was flooded from late February to mid-July (Table 13). However, during the rest of the growing season, virtually none of the bottomland forest was inundated. The principal tree species in the bottomland forest at Grand Island (Havera et al., 1980:5-26) generally would not be affected by this degree of inundation.

Sanganois Conservation Area. The effects of the actual average river levels on the various habitats in the area sampled at Sanganois are presented in Table 14. Virtually all of the habitat in the various categories occurs below the elevation of 434.0 ft with the exception of about 17% of the forest which occurs above this elevation (Table 12). Approximately 55% of the area planimetered at Sanganois occurred within a 435-ft levee. Habitats examined within and outside the levee were similar. The area within the levee is intensively managed for waterfowl by water-level manipulation. When the 435-ft levee is overtopped, essentially all of the habitat within the levee is inundated except for a minor amount of forest.

With the averages of the actual river levels that occurred at Sanganois from 1970-1978, mud flats would begin appearing on

10 July as levels receded below 429.8 ft to 428.2 ft for a 10-week period of exposure from 17 July to 24 September (Table 14). These water levels would allow approximately 35 to 88% of the potential mud flat area at Sanganois to be exposed for 70 days (Havera et al., 1980:5-62). This would permit good establishment and maturation of moist-soil communities before minor inundation by river levels of 430.3 and 430.4 ft for 2 weeks in late September and early October. This temporary increase in river elevation would probably have only a minor impact on moist-soil plants after the 70-day period of growth that was available unless the plants were overtopped. Thus, the average river conditions at Sanganois for 1970-1978 were conducive to good development of mud flats and moist-soil plant communities.

A similar pattern was noted for the marsh, scrub-shrub, and forest communities. Around 10 July, the inundation of these communities decreased and, except for a 2-week increase in water levels from 25 September to 8 October, these habitats were free of inundation through the remainder of the growing season and into early December (Table 14). The averages of the river level conditions at Sanganois from 1970-1978 would present little stress to these habitats after 10 July. The marsh, scrub-shrub, and forest communities are adapted to these naturally occurring

high water levels in the early segment of the growing season and probably would incur little stress from the high water prior to 10 July given the low water conditions thereafter.

The 435-ft levee would have been overtopped for 7 of 8 weeks from 2 April through 27 May by the average ambient river conditions (Table 14). During the major segment of the growing season after 27 May, the 435-ft levee would have protected the habitats within its confines.

Diversion Plan 1

The average predicted river levels by week for 1970-1978 resulting from the 7,000 cfs Diversion Plan 1 and the weekly averages of the actual river levels measured at Havana are shown in Figure 5. The 1970-1978 weekly averages of the increase in river levels predicted from Diversion Plan 1, the sums of these weekly average increases and the weekly average of the actual river levels presented in Tables 13 and 14, and the corresponding percentages of habitat classes inundated are presented in Table 15 for Grand Island and Table 16 for Sanganois.

As indicated in Figure 5 and Tables 15 and 16, the average increase in weekly river levels resulting from Diversion Plan 1

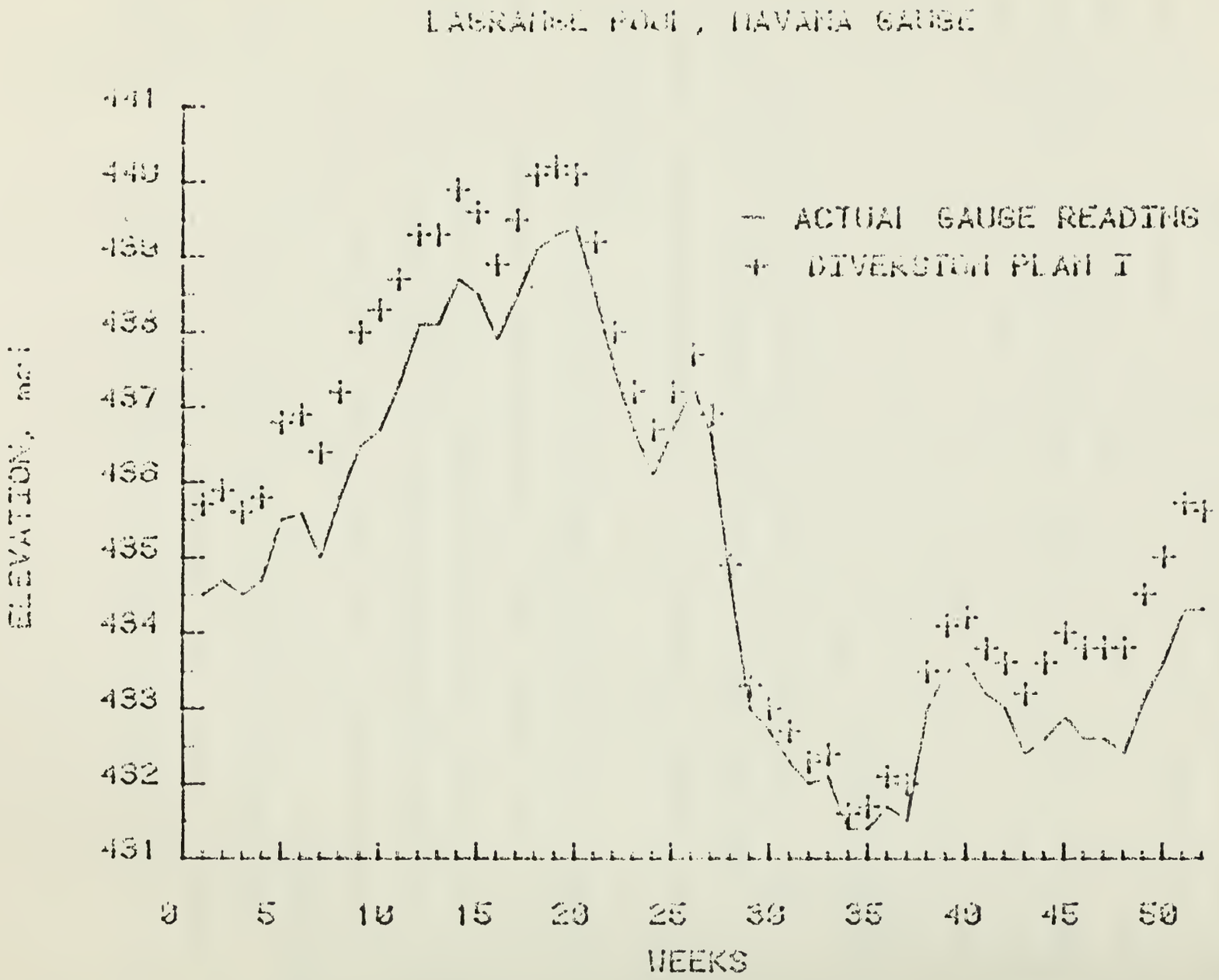


Figure 5. The average of weekly water levels (msl, ft) measured at the Havana gauge, La Grange Pool, and those predicted by Diversion Plan 1, 1970-1978.

Table 15. The 1970-1978 weekly averages of the increase in river levels from Diversion Plan 1, the sums of the weekly average increase from Plan 1 plus the weekly average of the actual river levels from Table 13, the percent of years from 1970-1978 that diversion occurred, and the corresponding percentages of habitat classes inundated for the Grand Island Area, La Grange Pool. Total hectares of each habitat class are in parentheses.

| Week | Average Diversion Increase (ft) | Actual Weekly Avg. + Diversion Increase msl (ft) | % of yrs. with Diversion | Habitat Class | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Open Water (629.3) | Mud Flats (28.7) | Marsh (0) | Scrub-shrub (301.0) | Forest (637.3) | Impoundments or Managed (0) | Stream bank (2.2) | Agri-culture (48.5) | Misc. (1.2) |
| Jan 1-7 | 1.3 | 434.3 | 67 | 100.0 | 100.0 | | 100.0 | 54.6 | | 90.9 | 28.7 | 0 |
| Jan 8-14 | 1.3 | 434.5 | 67 | 100.0 | 100.0 | | 100.0 | 54.6 | | 90.9 | 28.7 | 0 |
| Jan 15-21 | 1.1 | 434.1 | 67 | 100.0 | 100.0 | | 100.0 | 54.6 | | 90.9 | 28.7 | 0 |
| Jan 22-28 | 1.1 | 434.3 | 78 | 100.0 | 100.0 | | 100.0 | 54.6 | | 90.9 | 28.7 | 0 |
| Jan 29-Feb 4 | 1.1 | 435.1 | 67 | 100.0 | 100.0 | | 100.0 | 54.6 | | 90.9 | 28.7 | 0 |
| Feb 5-11 | 1.2 | 435.3 | 67 | 100.0 | 100.0 | | 100.0 | 54.6 | | 90.9 | 28.7 | 0 |
| Feb 12-18 | 1.3 | 434.8 | 67 | 100.0 | 100.0 | | 100.0 | 54.6 | | 90.9 | 28.7 | 0 |
| Feb 19-25 | 1.3 | 435.6 | 78 | 100.0 | 100.0 | | 100.0 | 54.6 | | 90.9 | 28.7 | 0 |
| Feb 26-Mar 4 | 1.5 | 436.5 | 89 | 100.0 | 100.0 | | 100.0 | 81.8 | | 100.0 | 81.0 | 33.1 |
| Mar 5-11 | 1.6 | 436.8 | 89 | 100.0 | 100.0 | | 100.0 | 81.8 | | 100.0 | 81.0 | 33.1 |
| Mar 12-18 | 1.6 | 437.4 | 89 | 100.0 | 100.0 | | 100.0 | 81.8 | | 100.0 | 81.0 | 33.1 |
| Mar 19-25 | 1.3 | 437.9 | 89 | 100.0 | 100.0 | | 100.0 | 81.8 | | 100.0 | 81.0 | 33.1 |
| Mar 26-Apr 1 | 1.3 | 437.9 | 89 | 100.0 | 100.0 | | 100.0 | 81.8 | | 100.0 | 81.0 | 33.1 |
| Apr 2-8 | 1.2 | 438.4 | 89 | 100.0 | 100.0 | | 100.0 | 97.2 | | 100.0 | 99.6 | 100.0 |
| Apr 9-15 | 1.1 | 438.1 | 89 | 100.0 | 100.0 | | 100.0 | 97.2 | | 100.0 | 99.6 | 100.0 |
| Apr 16-22 | 1.1 | 437.5 | 89 | 100.0 | 100.0 | | 100.0 | 81.8 | | 100.0 | 81.0 | 33.1 |
| Apr 23-29 | 1.1 | 438.1 | 89 | 100.0 | 100.0 | | 100.0 | 97.2 | | 100.0 | 99.6 | 100.0 |
| Apr 30-May 6 | 1.0 | 438.6 | 89 | 100.0 | 100.0 | | 100.0 | 97.2 | | 100.0 | 99.6 | 100.0 |
| May 7-13 | 0.9 | 438.7 | 67 | 100.0 | 100.0 | | 100.0 | 97.2 | | 100.0 | 99.6 | 100.0 |
| May 14-20 | 0.7 | 438.6 | 67 | 100.0 | 100.0 | | 100.0 | 97.2 | | 100.0 | 99.6 | 100.0 |
| May 21-27 | 0.7 | 437.7 | 78 | 100.0 | 100.0 | | 100.0 | 81.8 | | 100.0 | 81.0 | 33.1 |
| May 28-June 4 | 0.5 | 437.1 | 67 | 100.0 | 100.0 | | 100.0 | 81.8 | | 100.0 | 81.0 | 33.1 |
| June 5-11 | 0.6 | 435.8 | 67 | 100.0 | 100.0 | | 100.0 | 54.6 | | 90.9 | 28.7 | 0 |
| June 12-18 | 0.6 | 435.2 | 78 | 100.0 | 100.0 | | 100.0 | 54.6 | | 90.9 | 28.7 | 0 |
| June 19-25 | 0.5 | 435.7 | 44 | 100.0 | 100.0 | | 100.0 | 54.6 | | 90.9 | 28.7 | 0 |
| June 26-July 2 | 0.4 | 436.2 | 44 | 100.0 | 100.0 | | 100.0 | 81.8 | | 100.0 | 81.0 | 33.1 |

Table 15 (cont). The 1970-1978 weekly averages of the increase in river levels from Diversion Plan 1, the sums of the weekly average increase from Plan 1 plus the weekly average of the actual river levels from Table 13, the percent of years from 1970-1978 that diversion occurred, and the corresponding percentages of habitat classes inundated for the Grand Island Area, La Grange Pool. Total hectares of each habitat class are in parentheses.

| Week | Average Diversion increase (ft) | Actual Weekly Avg. + Diversion Increase msl (ft) | % of yrs. with Diversion | Habitat Class: Open Water (629.3) | Mud Flats (28.7) | Marsh (0) | Scrub-shrub (301.0) | Forest (637.3) | Impoundments or Managed (0) | Stream bank (2.2) | Agri-culture (48.5) | Misc. (1.2) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| July 3-9 | 0.3 | 435.4 | 33 | 100.0 | 100.0 | | 100.0 | 54.6 | | 90.9 | 28.7 | 0 |
| July 10-16 | 0.2 | 433.4 | 33 | 100.0 | 100.0 | | 96.3 | 20.7 | | 84.1 | 0.4 | 0 |
| July 17-23 | 0.2 | 431.7 | 33 | 94.4 | 29.6 | | 34.9 | 1.2 | | 84.1 | 0.4 | 0 |
| July 24-30 | 0.3 | 431.5 | 56 | 94.4 | 29.6 | | 34.9 | 1.2 | | 84.1 | 0.4 | 0 |
| July 31-Aug 6 | 0.3 | 431.1 | 44 | 94.4 | 29.6 | | 34.9 | 1.2 | | 84.1 | 0.4 | 0 |
| Aug 7-13 | 0.4 | 430.9 | 44 | 94.4 | 29.6 | | 34.9 | 1.2 | | 84.1 | 0.4 | 0 |
| Aug 14-20 | 0.3 | 430.9 | 56 | 94.4 | 29.6 | | 34.9 | 1.2 | | 84.1 | 0.4 | 0 |
| Aug 21-27 | 0.1 | 430.0 [A] | 22 | ---- | ---- | | ---- | ---- | | ---- | --- | --- |
| Aug 28-Sept 3 | 0.3 | 430.2 | 22 | 94.4 | 29.6 | | 34.9 | 1.2 | | 84.1 | 0.4 | 0 |
| Sept 4-10 | 0.4 | 430.6 | 33 | 94.4 | 29.6 | | 34.9 | 1.2 | | 84.1 | 0.4 | 0 |
| Sept 11-17 | 0.5 | 430.5 | 56 | 94.4 | 29.6 | | 34.9 | 1.2 | | 84.1 | 0.4 | 0 |
| Sept 18-24 | 0.6 | 432.1 | 56 | 100.0 | 100.0 | | 96.3 | 20.7 | | 84.1 | 0.4 | 0 |
| Sept 25-Oct 1 | 0.6 | 432.6 | 67 | 100.0 | 100.0 | | 96.3 | 20.7 | | 84.1 | 0.4 | 0 |
| Oct 2-8 | 0.5 | 432.6 | 56 | 100.0 | 100.0 | | 96.3 | 20.7 | | 84.1 | 0.4 | 0 |
| Oct 9-15 | 0.6 | 432.3 | 56 | 100.0 | 100.0 | | 96.3 | 20.7 | | 84.1 | 0.4 | 0 |
| Oct 16-22 | 0.6 | 432.1 | 78 | 100.0 | 100.0 | | 96.3 | 20.7 | | 84.1 | 0.4 | 0 |
| Oct 23-29 | 0.7 | 431.6 | 100 | 94.4 | 29.6 | | 34.9 | 1.2 | | 84.1 | 0.4 | 0 |
| Oct 30-Nov 5 | 1.0 | 432.1 | 100 | 100.0 | 100.0 | | 96.3 | 20.7 | | 84.1 | 0.4 | 0 |
| Nov 6-12 | 1.1 | 432.5 | 100 | 100.0 | 100.0 | | 96.3 | 20.7 | | 84.1 | 0.4 | 0 |
| Nov 13-19 | 1.2 | 432.3 | 100 | 100.0 | 100.0 | | 96.3 | 20.7 | | 84.1 | 0.4 | 0 |
| Nov 20-26 | 1.3 | 432.4 | 100 | 100.0 | 100.0 | | 96.3 | 20.7 | | 84.1 | 0.4 | 0 |
| Nov 27-Dec 3 | 1.4 | 432.3 | 100 | 100.0 | 100.0 | | 96.3 | 20.7 | | 84.1 | 0.4 | 0 |
| Dec 4-10 | 1.4 | 433.0 | 100 | 100.0 | 100.0 | | 96.3 | 20.7 | | 84.1 | 0.4 | 0 |
| Dec 11-17 | 1.4 | 433.5 | 100 | 100.0 | 100.0 | | 96.3 | 20.7 | | 84.1 | 0.4 | 0 |
| Dec 18-24 | 1.4 | 434.2 | 100 | 100.0 | 100.0 | | 100.0 | 54.6 | | 90.9 | 28.7 | 0 |
| Dec 25-31 | 1.3 | 434.1 | 100 | 100.0 | 100.0 | | 100.0 | 54.6 | | 90.9 | 28.7 | 0 |

[A] This river level is below the lowest elevation on the contour map.

Table 16. The 1970-1978 weekly averages of the increase in river levels from Diversion Plan I, the sums of the weekly average increase from Plan I plus the weekly average of the actual river levels from Table 14, the percent of years from 1970-1978 that diversion occurred, and the corresponding percentages of habitat classes inundated for the Sanganois Area, La Grange Pool. Total hectares of each habitat class are in parentheses.

| Week | Average Diversion Increase (ft) | Actual Weekly Avg. + Diversion Increase msl (ft) | % of yrs. with Diversion | Habitat Class | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Open Water (232.6) | Mud Flats (45.6) | Marsh (21.3) | Scrub-shrub (121.8) | Forest (164.8) | Impoundments or Managed (748.8) | Stream bank (8.3) | Agri-culture (0) | Misc. (10.2) |
| Jan 1-7 | 1.3 | 432.6 | 67 | 100.0 | 100.0 | 100.0 | 100.0 | 83.0 | 0 | 100.0 | | B |
| Jan 8-14 | 1.3 | 432.8 | 67 | 100.0 | 100.0 | 100.0 | 100.0 | 83.0 | 0 | 100.0 | | |
| Jan 15-21 | 1.1 | 432.4 | 67 | 100.0 | 100.0 | 100.0 | 100.0 | 83.0 | 0 | 100.0 | | |
| Jan 22-28 | 1.1 | 432.6 | 78 | 100.0 | 100.0 | 100.0 | 100.0 | 83.0 | 0 | 100.0 | | |
| Jan 29-Feb 4 | 1.1 | 433.4 | 67 | 100.0 | 100.0 | 100.0 | 100.0 | 83.0 | 0 | 100.0 | | |
| Feb 5-11 | 1.2 | 433.6 | 67 | 100.0 | 100.0 | 100.0 | 100.0 | 83.0 | 0 | 100.0 | | |
| Feb 12-18 | 1.3 | 433.1 | 67 | 100.0 | 100.0 | 100.0 | 100.0 | 83.0 | 0 | 100.0 | | |
| Feb 19-25 | 1.3 | 433.9 | 78 | 100.0 | 100.0 | 100.0 | 100.0 | 83.0 | 0 | 100.0 | | |
| Feb 26-Mar 4 | 1.5 | 434.8 | 89 | 100.0 | 100.0 | 100.0 | 100.0 | 92.6 | 0 | 100.0 | | |
| Mar 5-11 | 1.6 | 435.1 | 89 | 100.0 | 100.0 | 100.0 | 100.0 | 92.6 | 100.0 | 100.0 | | |
| Mar 12-18 | 1.6 | 435.7 | 89 | 100.0 | 100.0 | 100.0 | 100.0 | 92.6 | 100.0 | 100.0 | | |
| Mar 19-25 | 1.3 | 436.2 | 89 | 100.0 | 100.0 | 100.0 | 100.0 | 98.9 | 100.0 | 100.0 | | |
| Mar 26-Apr 1 | 1.3 | 436.2 | 89 | 100.0 | 100.0 | 100.0 | 100.0 | 98.9 | 100.0 | 100.0 | | |
| Apr 2-8 | 1.2 | 436.7 | 89 | 100.0 | 100.0 | 100.0 | 100.0 | 98.9 | 100.0 | 100.0 | | |
| Apr 9-15 | 1.1 | 436.4 | 89 | 100.0 | 100.0 | 100.0 | 100.0 | 98.9 | 100.0 | 100.0 | | |
| Apr 16-22 | 1.1 | 435.8 | 89 | 100.0 | 100.0 | 100.0 | 100.0 | 92.6 | 100.0 | 100.0 | | |
| Apr 23-29 | 1.1 | 436.4 | 89 | 100.0 | 100.0 | 100.0 | 100.0 | 98.9 | 100.0 | 100.0 | | |
| Apr 30-May 6 | 1.0 | 436.9 | 89 | 100.0 | 100.0 | 100.0 | 100.0 | 98.9 | 100.0 | 100.0 | | |
| May 7-13 | 0.9 | 437.0 | 67 | 100.0 | 100.0 | 100.0 | 100.0 | 98.9 | 100.0 | 100.0 | | |
| May 14-20 | 0.7 | 436.9 | 67 | 100.0 | 100.0 | 100.0 | 100.0 | 98.9 | 100.0 | 100.0 | | |
| May 21-27 | 0.7 | 436.0 | 78 | 100.0 | 100.0 | 100.0 | 100.0 | 92.6 | 100.0 | 100.0 | | |
| May 28-June 4 | 0.5 | 434.8 | 67 | 100.0 | 100.0 | 100.0 | 100.0 | 92.6 | 0 | 100.0 | | |
| June 5-11 | 0.6 | 434.1 | 67 | 100.0 | 100.0 | 100.0 | 100.0 | 92.6 | 0 | 100.0 | | |
| June 12-18 | 0.6 | 433.5 | 78 | 100.0 | 100.0 | 100.0 | 100.0 | 83.0 | 0 | 100.0 | | |
| June 19-25 | 0.5 | 434.0 | 44 | 100.0 | 100.0 | 100.0 | 100.0 | 83.0 | 0 | 100.0 | | |
| June 26-July 2 | 0.4 | 434.5 | 44 | 100.0 | 100.0 | 100.0 | 100.0 | 92.6 | 0 | 100.0 | | |

Table 16 (cont). The 1970-1978 weekly averages of the increase in river levels from Diversion Plan 1, the sums of the weekly average increase from Plan 1 plus the weekly average of the actual river levels from Table 14, the percent of years from 1970-1978 that diversion occurred, and the corresponding percentages of habitat classes inundated for the Sanganois Area, La Grange Pool. Total hectares of each habitat class are in parentheses.

| Week | Average Diversion Increase (ft) | Actual Weekly Avg. + Diversion Increase msl (ft) | % of yrs. with Diversion | Habitat Class | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Open Water (232.6) | Mud Flats (45.6) | Marsh (21.3) | Scrub-shrub (121.8) | Forest (164.8) | Impoundments or Managed (748.8) | Stream bank (8.3) | Agri-culture (0) | Misc. (10.2) |
| July 3-9 | 0.3 | 433.7 | 33 | 100.0 | 100.0 | 100.0 | 100.0 | 83.0 | 0 | 100.0 | | B |
| July 10-16 | 0.2 | 431.7 | 33 | 62.3 | 74.6 | 66.2 | 58.6 | 18.6 | 0 | 66.3 | | |
| July 17-23 | 0.2 | 430.0 [A] | 33 | ---- | ---- | ---- | ---- | ---- | 0 | ---- | | |
| July 24-30 | 0.3 | 429.8 [A] | 56 | ---- | ---- | ---- | ---- | ---- | 0 | ---- | | |
| July 31-Aug 6 | 0.3 | 429.4 [A] | 44 | ---- | ---- | ---- | ---- | ---- | 0 | ---- | | |
| Aug 7-13 | 0.4 | 429.2 [A] | 44 | ---- | ---- | ---- | ---- | ---- | 0 | ---- | | |
| Aug 14-20 | 0.3 | 429.2 [A] | 56 | ---- | ---- | ---- | ---- | ---- | 0 | ---- | | |
| Aug 21-27 | 0.1 | 428.3 [A] | 22 | ---- | ---- | ---- | ---- | ---- | 0 | ---- | | |
| Aug 28-Sept 3 | 0.3 | 428.5 [A] | 22 | ---- | ---- | ---- | ---- | ---- | 0 | ---- | | |
| Sept 4-10 | 0.4 | 428.9 [A] | 33 | ---- | ---- | ---- | ---- | ---- | 0 | ---- | | |
| Sept 11-17 | 0.5 | 428.8 [A] | 56 | ---- | ---- | ---- | ---- | ---- | 0 | ---- | | |
| Sept 18-24 | 0.6 | 430.4 | 56 | 62.3 | 74.6 | 66.2 | 58.6 | 18.6 | 0 | 66.3 | | |
| Sept 25-Oct 1 | 0.6 | 430.9 | 67 | 62.3 | 74.6 | 66.2 | 58.6 | 18.6 | 0 | 66.3 | | |
| Oct 2-8 | 0.5 | 430.9 | 56 | 62.3 | 74.6 | 66.2 | 58.6 | 18.6 | 0 | 66.3 | | |
| Oct 9-15 | 0.6 | 430.6 | 56 | 62.3 | 74.6 | 66.2 | 58.6 | 18.6 | 0 | 66.3 | | |
| Oct 16-22 | 0.6 | 430.4 | 78 | 62.3 | 74.6 | 66.2 | 58.6 | 18.6 | 0 | 66.3 | | |
| Oct 23-29 | 0.7 | 429.9 [A] | 100 | ---- | ---- | ---- | ---- | ---- | 0 | ---- | | |
| Oct 30-Nov 5 | 1.0 | 430.4 | 100 | 62.3 | 74.6 | 66.2 | 58.6 | 18.6 | 0 | 66.3 | | |
| Nov 6-12 | 1.1 | 430.8 | 100 | 62.3 | 74.6 | 66.2 | 58.6 | 18.6 | 0 | 66.3 | | |
| Nov 13-19 | 1.2 | 430.6 | 100 | 62.3 | 74.6 | 66.2 | 58.6 | 18.6 | 0 | 66.3 | | |
| Nov 20-26 | 1.3 | 430.7 | 100 | 62.3 | 74.6 | 66.2 | 58.6 | 18.6 | 0 | 66.3 | | |
| Nov 27-Dec 3 | 1.4 | 430.6 | 100 | 62.3 | 74.6 | 66.2 | 58.6 | 18.6 | 0 | 66.3 | | |
| Dec 4-10 | 1.4 | 431.3 | 100 | 62.3 | 74.6 | 66.2 | 58.6 | 18.6 | 0 | 66.3 | | |
| Dec 11-17 | 1.4 | 431.8 | 100 | 62.3 | 74.6 | 66.2 | 58.6 | 18.6 | 0 | 66.3 | | |
| Dec 18-24 | 1.4 | 432.5 | 100 | 100.0 | 100.0 | 100.0 | 100.0 | 83.0 | 0 | 100.0 | | |
| Dec 25-31 | 1.3 | 432.4 | 100 | 100.0 | 100.0 | 100.0 | 100.0 | 83.0 | 0 | 100.0 | | |

[A] This river level is below the lowest elevation on the contour maps.

during the 1970-1978 study period varied between 0.1 and 1.6 ft throughout the year. The increase in elevations was greater than 1.0 ft from 1 January through 6 May and from 30 October through 31 December. Both of these intervals are during the dormant period of growth for plants. During the remaining time period of 7 May to 29 October, Diversion Plan 1 resulted in river level increases of less than 1.0 ft with increases of less than 0.4 ft in July and August. The percentage of the 9 years from 1970-1978 that diversion would have resulted from Plan 1 varied between 67 and 89% from 1 January to 18 June and between 56 and 100% from 25 September through 31 December (Table 15). For the remainder of the year from 19 June through 24 September, diversion from Plan 1 would have occurred in 22 to 56% of the years of study.

Grand Island Area. At Grand Island, Plan 1 resulted in the inundation of all mud flats with the exception of the interval of 17 July through 17 September and 23-29 October (Table 15). During the 9 weeks of 17 July to 17 September, the averages of the water levels resulting from Plan 1 varied between 430.0 and 431.7 ft (Table 15). There were 8 consecutive weeks with levels at or below 431.5 ft as compared to 10 weeks under actual water conditions (Table 13). With water levels below 430.9 ft, about 60% of the mud flats at Grand Island are exposed. Plan 1

generated levels below 430.9 ft for 4 consecutive weeks whereas actual levels averaged less than 430.9 ft for 7 consecutive weeks. During the period of 17 July to 24 September when actual river levels were at or less than 431.5 ft and conducive to mud flat exposure (Table 13), Plan 1 increased river levels by an average of 0.1 to 0.6 ft thereby decreasing both the amount of mud flats exposed and the length of time of mud flat exposure which is critical to moist-soil plant development and maturation (Table 15). Thus the short exposure period resulting from the average of Plan 1 conditions of 8 weeks or 56 days of 37 to 87% of mud flats is less than the 70-day period required for moist-soil plant maturation. Coupled with the rapid rise in water levels after 18 September at the end of the 56-day period, moist-soil seed production would generally be below average or poor.

The scrub-shrub community at Grand Island would be 96 to 100% flooded by Plan 1 with the exception of the 17 July to 17 September period when 35% would remain inundated (Table 15). The difference in inundation of the scrub-shrub habitat between Plan 1 water levels (Table 15) and the actual water levels at Grand Island (Table 13) occurred from 18 September through the remainder of the growing season when the amount inundated increased from 35% to 96%. Plan 1 resulted in 4 additional weeks after 18 September of 96% of the scrub-shrub community

being inundated rather than 35% under average ambient conditions (Table 13). The scrub-shrub community is generally flood tolerant. However, continual inundation of 96% of this community during 4 more weeks of the growing season may stress some species of plants to the degree that over a period of several years some die-off may occur resulting in a potential conversion of scrub-shrub community to open water.

Diversion Plan 1 resulted in 55% to 97% of the bottomland forest at Grand Island being inundated from 1 January through 9 July (Table 15). During this period, Plan 1 river levels generally resulted in higher percentages of forest being flooded than those occurring under natural conditions (Table 13). From 30 April about when trees leaf-out until 9 July, Plan 1 flooded 16-27% more bottomland forest area than occurred under actual conditions. The other different effect that Plan 1 had on the bottomland community over ambient conditions was the increased inundation of forest area after 18 September from 1% to 21%. This results in an increase of 20% in inundation of forest for the remaining 3-4 weeks at the end of the growing season. The additional amount of forest inundated at Grand Island for the 1970-1978 period at the beginning and at the end of the growing season may stress some of the weaker individuals of the forest community or some more water-sensitive species resulting in a minor detrimental effect to the forest community.

Sanganois Conservation Area. At Sanganois, the averages of the weekly water levels resulting from Plan 1 (Table 16) for the years of 1970-1978 would have increased the amount of open water, mud flat, marsh, and scrub-shrub habitat flooded during 1-28 January, 12-18 February, 18-24 September, 2-22 October, 30 October to 10 December, and 18-31 December over ambient levels (Table 14). However, the weeks during which additional inundation would have biological significance for these communities would be 18-24 September and 2-22 October. With the implementation of Plan 1, mud flats begin to become exposed around 10 July and become increasingly exposed as levels drop below 430.0 ft resulting in an exposure of approximately 30 to 88% of the potential mud flat surface area for 9 consecutive weeks from 17 July to 17 September before increasing to 430.4 ft or above for the next 5 consecutive weeks from 18 September to 22 October (Table 16). For comparison, the average of the actual river values indicated levels below 429.8 ft for 10 consecutive weeks from 17 July to 24 September and then 2 weeks of levels at 430.3-430.4 ft (Table 14). Actual river levels dropped below 428.9 ft for 6 consecutive weeks within this period resulting in exposure of over 70% of the potential mud flat area whereas average levels for Plan 1 generated levels

below 428.9 ft for only 4 consecutive weeks. During the 10-week period of 17 July to 24 September when actual river levels were below 429.8 ft, Plan 1 averaged increases in water levels ranging between 0.1 and 0.6 ft (Table 16). The 9 consecutive weeks of low water levels during Plan 1 would provide approximately 63 days for the establishment and development of the moist-soil plant community. Plan 1 would reduce the length of mud flat exposure to 9 weeks as compared to 10 weeks for actual conditions, reduce the area of mud flats exposed during this period compared with actual levels, and add 0.5 to 0.6 ft to water levels during the ensuing 5 weeks from 25 September to 22 October. These differences between Plan 1 and the actual river levels would reduce the maturation and survival of portions of the moist-soil community and also reduce seed production. Although seed production would be lower than that occurring under ambient conditions, the 63-day low-water period during Plan 1 should still result in poor to average moist-soil seed production at Sanganois.

The increase in inundation over ambient water levels (Table 14) by Plan 1 (Table 16) of the marsh community area from 0 to 66.2% and of the scrub-shrub community area from 0 to 58.6% during 18-24 September and 9-22 October at the end of the growing season would probably present limited detrimental effects on these communities.

Plan 1 resulted in a greater increase in the percentage of forest habitat inundated at Sanganois than any other habitat class (Table 16). During the dormant season, Plan 1 would have resulted in higher percentages of forest being flooded than ambient conditions (Table 14) in 12 of 17 weeks from 1 January to 29 April and 6 of 9 weeks from 30 October to 31 December. In the growing season, Plan 1 would have flooded from 6.3 to 9.6% more forest area for 2 of 11 weeks from 30 April to 16 July than would have been flooded under actual conditions. From 17 July to 17 September, no forest would have been inundated by either Plan 1 or actual conditions. At the end of the growing season, Plan 1 would have inundated 18.6% of the forest area sampled at Sanganois for 3 additional weeks from 18 September to 22 October as compared to ambient conditions. Although some minor changes could occur, it is unlikely that the additional inundation of forest area at Sanganois by Plan 1 would have a significant impact upon the forest community.

The 435-ft levee protecting the impoundment area would have been inundated for 5 more weeks by Plan 1 (Table 16) than normally would have occurred (Table 14) during the period of 5 March to 22 April. Because this period is during the dormant season for plants, no significant biological effects would have

resulted. The additional period of inundation of the levee by Plan 1 could result in possible levee damage.

Diversion Plan 1 Summary. The effects of water levels generated by Plan 1 on the open water and mud flat habitats that support the important moist-soil plant community for waterfowl and other wildlife would be evident on the areas investigated in La Grange Pool during the 10-week period of 17 July to 24 September. At this time, Plan 1 would increase ambient water levels an average of 0.1 to 0.6 ft thereby decreasing the surface area of mud flats exposed. Plan 1 would also decrease the exposure period of mud flats for at least one week over ambient conditions beginning 18 September and thereby reduce the growing period below the minimum 70 days required for moist-soil plant development and maturation. The 0.5- to 0.6-ft increase in water levels projected by Plan 1 for 5 consecutive weeks beginning with 18 September would reduce the maturation and survival of portions of the moist-soil community and would reduce seed production. Accordingly, water levels generated by Plan 1 would result in a reduction in the development of moist-soil communities over average ambient conditions and would typically yield poor to average seed production.

The effects of increased water levels from Plan 1 on the scrub-shrub community at the study areas in La Grange Pool differed from those under actual conditions after 18 September. The amount of scrub-shrub habitat inundated increased approximately 60% over ambient values for 3 to 4 weeks. This resulted in 59 to 96% of the scrub-shrub community being flooded for a continuous period of all but one week from 18 September until the end of the growing season. Such an additional interval of inundation during the growing season over a period of years could present a stress situation to individuals or species such as young silver maples and cottonwoods that are sensitive to increased inundation. The result would be an increase in dominance by black willows or open water habitat if willows are eventually affected.

The amount of marsh habitat inundated at Sanganois was increased by 66% for an additional 3 weeks of the growing season after 18 September by the average of water levels generated by Plan 1. Significant impacts from this change over ambient conditions are doubtful.

The average increases in water levels from Plan 1 would flood approximately 6 to 65% more bottomland forest area at the study sites in La Grange Pool during the non-growing season. The increase in the amount of area flooded during the

non-growing period may have some indirect effects on the forest community such as possible increases in ice and wind action on the trees and an increase in sediment deposition. Over an extended period of time, these factors associated with higher water levels and more area flooded might potentially result in measurable impacts in terms of tree survival or forest composition. During the growing season, the average of Plan 1 water levels would have inundated 6 to 27% more forest area from 30 April until mid-July and 1 to 21% more after 18 September. Between mid-July and mid-September, there was essentially no difference between the amount of forest flooded by ambient water levels and that resulting from Plan 1. The increase in the amount of forest flooded at the beginning and end of the growing season may increase stress on weaker individuals in the forest community or on some of the more water-sensitive species. A minor negative effect on the forest community resulting from water levels generated by Plan 1 during the 1970-1978 study period is possible.

Diversion Plan 2

The average increase in weekly elevations from 1970-1978 at Havana in La Grange Pool for Diversion Plan 2 (5,500 cfs) as compared with the weekly average of the actual river levels

measured at Havana is depicted in Figure 6. Table 17 and Table 18 present the average weekly increases and resulting elevations at Grand Island and Sanganois, respectively, for Plan 2 and the corresponding percentages of the habitat classes inundated by 2-ft contour intervals.

Average weekly increases in river levels resulting from Plan 2 varied between 0.3 and 1.6 ft from 1 January through 13 May, 0.2 to 0.5 ft during the growing season from 14 May through 5 November, and between 0.6 and 1.3 ft for the remainder of the year (Table 17). The river level increases generated by Plan 2 (Table 17) were lower in magnitude than those from Plan 1 (Table 15) for much of the year with the exception of a period during the growing season of 3 July to 24 September when level increases from Plan 1 and Plan 2 were similar. The percent of the 9 years from 1970-1978 that diversion from Plan 2 occurred ranged from 44 to 78% between 1 January and 18 June, 22 to 56% from 19 June to 18 September, and from 44 to 100% during the remainder of the year (Table 17).

Grand Island Area. At Grand Island, Plan 2 (Table 17) had inundation effects similar to those of Plan 1 (Table 15) for the habitat categories of open water and mud flats. Plan 2 differed from Plan 1 by decreasing the amount of open water and mud flat habitats flooded by Plan 1 from 100 to 94.4% and 100 to 29.6%,

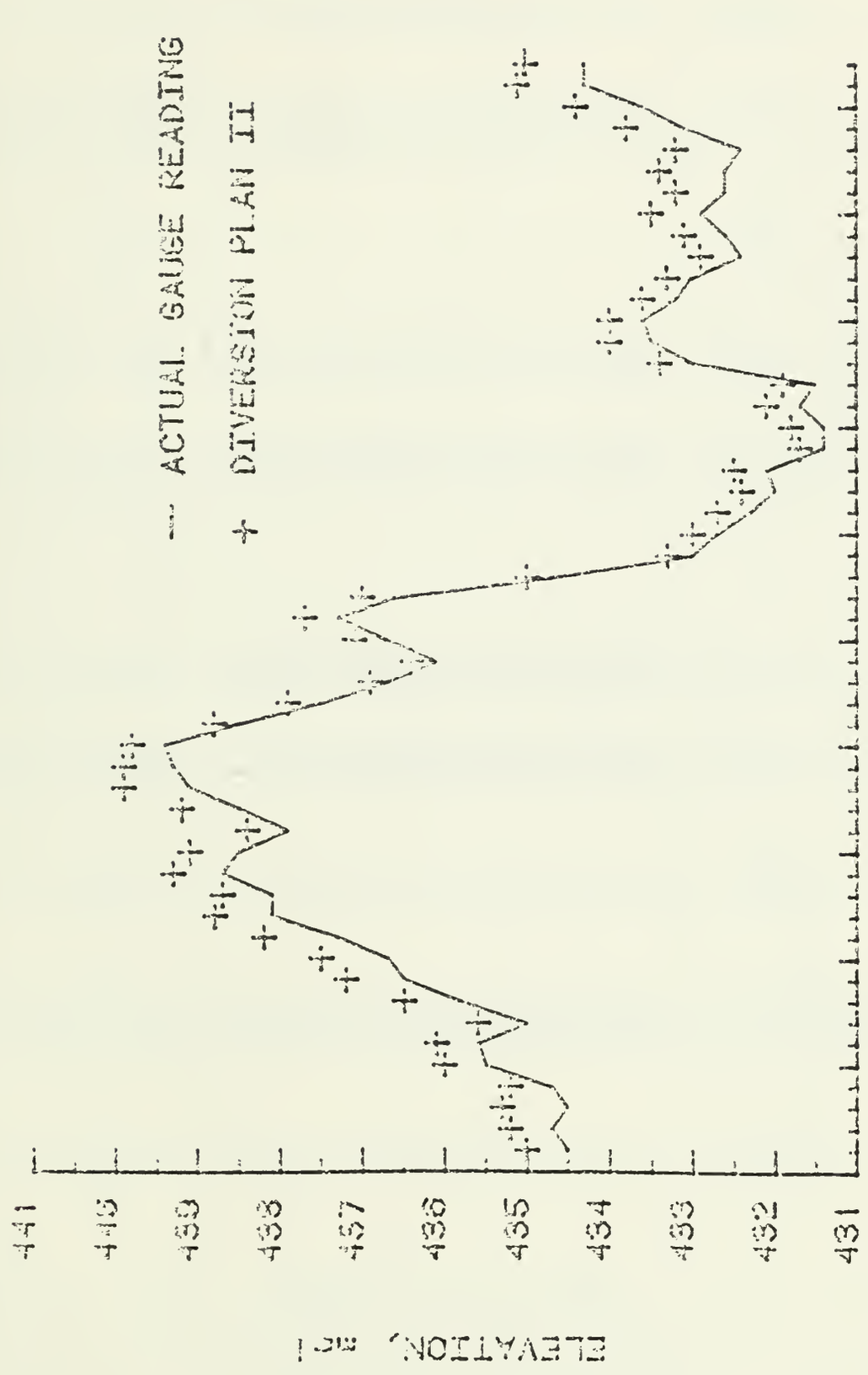


Figure 6. The average of weekly water levels (msl, ft) measured at the Havana gauge, La Grange Pool, and those predicted by Diversion Plan 2, 1970-1978.

Table 17. The 1970-1978 weekly averages of the increase in river levels from Diversion Plan 2, the sums of the weekly average increase from Plan 2 plus the weekly average of the actual river levels from Table 13, the percent of years from 1970-1978 that diversion occurred, and the corresponding percentages of habitat classes inundated for the Grand Island Area, La Grange Pool. Total hectares of each habitat class are in parentheses.

| Week | Average Diversion Increase (ft) | Actual Weekly Avg. + Diversion Increase msl (ft) | % of yrs. with Diversion | Habitat Class | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Open Water (629.3) | Mud Flats (28.7) | Marsh (0) | Scrub-shrub (301.0) | Forest (637.3) | Impoundments or Managed (0) | Stream bank (2.2) | Agri-culture (48.5) | Misc. (1.2) |
| Jan 1-7 | 0.5 | 433.5 | 44 | 100.0 | 100.0 | | 96.3 | 20.7 | | 84.1 | 0.4 | 0 |
| Jan 8-14 | 0.4 | 433.6 | 44 | 100.0 | 100.0 | | 96.3 | 20.7 | | 84.1 | 0.4 | 0 |
| Jan 15-21 | 0.8 | 433.8 | 56 | 100.0 | 100.0 | | 96.3 | 20.7 | | 84.1 | 0.4 | 0 |
| Jan 22-28 | 1.6 | 434.8 | 56 | 100.0 | 100.0 | | 100.0 | 54.6 | | 90.9 | 28.7 | 0 |
| Jan 29-Feb 4 | 0.5 | 434.5 | 56 | 100.0 | 100.0 | | 100.0 | 54.6 | | 90.9 | 28.7 | 0 |
| Feb 5-11 | 0.6 | 434.7 | 44 | 100.0 | 100.0 | | 100.0 | 54.6 | | 90.9 | 28.7 | 0 |
| Feb 12-18 | 0.7 | 434.2 | 44 | 100.0 | 100.0 | | 100.0 | 54.6 | | 90.9 | 28.7 | 0 |
| Feb 19-25 | 0.8 | 435.1 | 56 | 100.0 | 100.0 | | 100.0 | 54.6 | | 90.9 | 28.7 | 0 |
| Feb 26-Mar 4 | 0.7 | 435.7 | 67 | 100.0 | 100.0 | | 100.0 | 54.6 | | 90.9 | 28.7 | 0 |
| Mar 5-11 | 0.8 | 436.0 | 67 | 100.0 | 100.0 | | 100.0 | 54.6 | | 90.9 | 28.7 | 0 |
| Mar 12-18 | 0.9 | 436.7 | 78 | 100.0 | 100.0 | | 100.0 | 81.8 | | 100.0 | 81.0 | 33.1 |
| Mar 19-25 | 0.6 | 437.1 | 56 | 100.0 | 100.0 | | 100.0 | 81.8 | | 100.0 | 81.0 | 33.1 |
| Mar 26-Apr 1 | 0.6 | 437.1 | 67 | 100.0 | 100.0 | | 100.0 | 81.8 | | 100.0 | 81.0 | 33.1 |
| Apr 2-8 | 0.5 | 437.7 | 78 | 100.0 | 100.0 | | 100.0 | 81.8 | | 100.0 | 81.0 | 33.1 |
| Apr 9-15 | 0.3 | 437.3 | 78 | 100.0 | 100.0 | | 100.0 | 81.8 | | 100.0 | 81.0 | 33.1 |
| Apr 16-22 | 0.5 | 436.9 | 67 | 100.0 | 100.0 | | 100.0 | 81.8 | | 100.0 | 81.0 | 33.1 |
| Apr 23-29 | 0.5 | 437.5 | 78 | 100.0 | 100.0 | | 100.0 | 81.8 | | 100.0 | 81.0 | 33.1 |
| Apr 30-May 6 | 0.5 | 438.1 | 78 | 100.0 | 100.0 | | 100.0 | 97.2 | | 100.0 | 99.6 | 100.0 |
| May 7-13 | 0.6 | 438.4 | 56 | 100.0 | 100.0 | | 100.0 | 97.2 | | 100.0 | 99.6 | 100.0 |
| May 14-20 | 0.3 | 438.2 | 56 | 100.0 | 100.0 | | 100.0 | 97.2 | | 100.0 | 99.6 | 100.0 |
| May 21-27 | 0.3 | 437.3 | 56 | 100.0 | 100.0 | | 100.0 | 81.8 | | 100.0 | 81.0 | 33.1 |
| May 28-June 4 | 0.4 | 437.0 | 56 | 100.0 | 100.0 | | 100.0 | 81.8 | | 100.0 | 81.0 | 33.1 |
| June 5-11 | 0.2 | 435.4 | 56 | 100.0 | 100.0 | | 100.0 | 54.6 | | 100.0 | 81.0 | 33.1 |
| June 12-18 | 0.3 | 434.9 | 78 | 100.0 | 100.0 | | 100.0 | 54.6 | | 100.0 | 81.0 | 33.1 |
| June 19-25 | 0.3 | 435.5 | 33 | 100.0 | 100.0 | | 100.0 | 54.6 | | 100.0 | 81.0 | 33.1 |
| June 26-July 2 | 0.2 | 436.0 | 44 | 100.0 | 100.0 | | 100.0 | 54.6 | | 90.9 | 28.7 | 0 |

Table 17 (cont). The 1970-1978 weekly averages of the increase in river levels from Diversion Plan 2, the sums of the weekly average increase from Plan 2 plus the weekly average of the actual river levels from Table 13, the percent of years from 1970-1978 that diversion occurred, and the corresponding percentages of habitat classes inundated for the Grand Island Area, La Grange Pool. Total hectares of each habitat class are in parentheses.

| Week | Average Diversion Increase (ft) | Actual Weekly Avg. + Diversion Increase msl (ft) | % of yrs. with Diversion | Habitat Class | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Open Water (629.3) | Mud Flats (28.7) | Marsh (0) | Scrub-shrub (301.0) | Forest (637.3) | Impoundments or Managed (0) | Stream bank (2.2) | Agri-culture (48.5) | Misc. (1.2) |
| July 3-9 | 0.4 | 435.5 | 33 | 100.0 | 100.0 | | 100.0 | 54.6 | | 90.9 | 28.7 | 0 |
| July 10-16 | 0.3 | 433.5 | 22 | 100.0 | 100.0 | | 96.3 | 20.7 | | 84.1 | 0.4 | 0 |
| July 17-23 | 0.2 | 431.7 | 56 | 94.4 | 29.6 | | 34.9 | 1.2 | | 84.1 | 0.4 | 0 |
| July 24-30 | 0.2 | 431.4 | 33 | 94.4 | 29.6 | | 34.9 | 1.2 | | 84.1 | 0.4 | 0 |
| July 31-Aug 6 | 0.4 | 431.2 | 33 | 94.4 | 29.6 | | 34.9 | 1.2 | | 84.1 | 0.4 | 0 |
| Aug 7-13 | 0.4 | 430.9 | 44 | 94.4 | 29.6 | | 34.9 | 1.2 | | 84.1 | 0.4 | 0 |
| Aug 14-20 | 0.3 | 430.9 | 44 | 94.4 | 29.6 | | 34.9 | 1.2 | | 84.1 | 0.4 | 0 |
| Aug 21-27 | 0.3 | 430.2 | 33 | 94.4 | 29.6 | | 34.9 | 1.2 | | 84.1 | 0.4 | 0 |
| Aug 28-Sept 3 | 0.5 | 430.4 | 44 | 94.4 | 29.6 | | 34.9 | 1.2 | | 84.1 | 0.4 | 0 |
| Sept 4-10 | 0.5 | 430.7 | 33 | 94.4 | 29.6 | | 34.9 | 1.2 | | 84.1 | 0.4 | 0 |
| Sept 11-17 | 0.4 | 430.4 | 44 | 94.4 | 29.6 | | 34.9 | 1.2 | | 84.1 | 0.4 | 0 |
| Sept 18-24 | 0.5 | 432.0 | 56 | 94.4 | 29.6 | | 34.9 | 1.2 | | 84.1 | 0.4 | 0 |
| Sept 25-Oct 1 | 0.3 | 432.3 | 67 | 100.0 | 100.0 | | 96.3 | 20.7 | | 84.1 | 0.4 | 0 |
| Oct 2-8 | 0.2 | 432.3 | 44 | 100.0 | 100.0 | | 96.3 | 20.7 | | 84.1 | 0.4 | 0 |
| Oct 9-15 | 0.3 | 432.0 | 44 | 94.4 | 29.6 | | 34.9 | 1.2 | | 84.1 | 0.4 | 0 |
| Oct 16-22 | 0.5 | 432.0 | 56 | 94.4 | 29.6 | | 34.9 | 1.2 | | 84.1 | 0.4 | 0 |
| Oct 23-29 | 0.4 | 431.3 | 78 | 94.4 | 29.6 | | 34.9 | 1.2 | | 84.1 | 0.4 | 0 |
| Oct 30-Nov 5 | 0.4 | 431.5 | 100 | 94.4 | 29.6 | | 34.9 | 1.2 | | 84.1 | 0.4 | 0 |
| Nov 6-12 | 1.3 | 432.7 | 89 | 100.0 | 100.0 | | 96.3 | 20.7 | | 84.1 | 0.4 | 0 |
| Nov 13-19 | 0.6 | 431.7 | 89 | 94.4 | 29.6 | | 34.9 | 1.2 | | 84.1 | 0.4 | 0 |
| Nov 20-26 | 0.7 | 431.8 | 78 | 94.4 | 29.6 | | 34.9 | 1.2 | | 84.1 | 0.4 | 0 |
| Nov 27-Dec 3 | 0.8 | 431.7 | 89 | 94.4 | 29.6 | | 34.9 | 1.2 | | 84.1 | 0.4 | 0 |
| Dec 4-10 | 0.8 | 432.4 | 67 | 100.0 | 100.0 | | 96.3 | 20.7 | | 84.1 | 0.4 | 0 |
| Dec 11-17 | 0.7 | 432.8 | 89 | 100.0 | 100.0 | | 96.3 | 20.7 | | 84.1 | 0.4 | 0 |
| Dec 18-24 | 0.8 | 433.6 | 89 | 100.0 | 100.0 | | 96.3 | 20.7 | | 84.1 | 0.4 | 0 |
| Dec 25-31 | 0.7 | 433.5 | 89 | 100.0 | 100.0 | | 96.3 | 20.7 | | 84.1 | 0.4 | 0 |

Table 18. The 1970-1978 weekly averages of the increase in river levels from Diversion Plan 2, the sums of the weekly average increase from Plan 2 plus the weekly average of the actual river levels from Table 14, the percent of years from 1970-1978 that diversion occurred, and the corresponding percentages of habitat classes inundated for the Sanganois Area, La Grange Pool. Total hectares of each habitat class are in parentheses.

| Week | Average Diversion Increase (ft) | Actual Weekly Avg. + Diversion Increase msl (ft) | % of yrs. with Diversion | Habitat Class | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Open Water (232.6) | Mud Flats (45.6) | Marsh (21.3) | Scrub-shrub (121.8) | Forest (164.8) | Impoundments or Managed (748.8) | Stream bank (8.3) | Agri-culture (0) | Misc. (10.2) |
| Jan 1-7 | 0.5 | 431.8 | 44 | 62.3 | 74.6 | 66.2 | 58.6 | 18.6 | 0 | 66.3 | | B |
| Jan 8-14 | 0.4 | 431.9 | 44 | 62.3 | 74.6 | 66.2 | 58.6 | 18.6 | 0 | 66.3 | | |
| Jan 15-21 | 0.8 | 432.1 | 56 | 100.0 | 100.0 | 100.0 | 100.0 | 83.0 | 0 | 100.0 | | |
| Jan 22-28 | 1.6 | 433.1 | 56 | 100.0 | 100.0 | 100.0 | 100.0 | 83.0 | 0 | 100.0 | | |
| Jan 29-Feb 4 | 0.5 | 432.8 | 56 | 100.0 | 100.0 | 100.0 | 100.0 | 83.0 | 0 | 100.0 | | |
| Feb 5-11 | 0.6 | 433.0 | 44 | 100.0 | 100.0 | 100.0 | 100.0 | 83.0 | 0 | 100.0 | | |
| Feb 12-18 | 0.7 | 432.5 | 44 | 100.0 | 100.0 | 100.0 | 100.0 | 83.0 | 0 | 100.0 | | |
| Feb 19-25 | 0.8 | 433.4 | 56 | 100.0 | 100.0 | 100.0 | 100.0 | 83.0 | 0 | 100.0 | | |
| Feb 26-Mar 4 | 0.7 | 434.0 | 67 | 100.0 | 100.0 | 100.0 | 100.0 | 83.0 | 0 | 100.0 | | |
| Mar 5-11 | 0.8 | 434.3 | 67 | 100.0 | 100.0 | 100.0 | 100.0 | 92.6 | 0 | 100.0 | | |
| Mar 12-18 | 0.9 | 435.0 | 78 | 100.0 | 100.0 | 100.0 | 100.0 | 92.6 | 100.0 | 100.0 | | |
| Mar 19-25 | 0.6 | 435.5 | 56 | 100.0 | 100.0 | 100.0 | 100.0 | 92.6 | 100.0 | 100.0 | | |
| Mar 26-Apr 1 | 0.6 | 435.5 | 67 | 100.0 | 100.0 | 100.0 | 100.0 | 92.6 | 100.0 | 100.0 | | |
| Apr 2-8 | 0.5 | 436.0 | 78 | 100.0 | 100.0 | 100.0 | 100.0 | 92.6 | 100.0 | 100.0 | | |
| Apr 9-15 | 0.3 | 435.6 | 78 | 100.0 | 100.0 | 100.0 | 100.0 | 92.6 | 100.0 | 100.0 | | |
| Apr 16-22 | 0.5 | 435.2 | 67 | 100.0 | 100.0 | 100.0 | 100.0 | 92.6 | 100.0 | 100.0 | | |
| Apr 23-29 | 0.5 | 435.8 | 78 | 100.0 | 100.0 | 100.0 | 100.0 | 92.6 | 100.0 | 100.0 | | |
| Apr 30-May 6 | 0.5 | 436.4 | 78 | 100.0 | 100.0 | 100.0 | 100.0 | 98.9 | 100.0 | 100.0 | | |
| May 7-13 | 0.6 | 436.7 | 56 | 100.0 | 100.0 | 100.0 | 100.0 | 98.9 | 100.0 | 100.0 | | |
| May 14-20 | 0.3 | 436.5 | 56 | 100.0 | 100.0 | 100.0 | 100.0 | 98.9 | 100.0 | 100.0 | | |
| May 21-27 | 0.3 | 435.6 | 56 | 100.0 | 100.0 | 100.0 | 100.0 | 92.6 | 100.0 | 100.0 | | |
| May 28-June 4 | 0.4 | 434.7 | 56 | 100.0 | 100.0 | 100.0 | 100.0 | 92.6 | 0 | 100.0 | | |
| June 5-11 | 0.2 | 433.7 | 56 | 100.0 | 100.0 | 100.0 | 100.0 | 83.0 | 0 | 100.0 | | |
| June 12-18 | 0.3 | 433.2 | 78 | 100.0 | 100.0 | 100.0 | 100.0 | 83.0 | 0 | 100.0 | | |
| June 19-25 | 0.3 | 433.8 | 33 | 100.0 | 100.0 | 100.0 | 100.0 | 83.0 | 0 | 100.0 | | |
| June 26-July 2 | 0.2 | 434.3 | 44 | 100.0 | 100.0 | 100.0 | 100.0 | 92.6 | 0 | 100.0 | | |

Table 18 (cont). The 1970-1978 weekly averages of the increase in river levels from Diversion Plan 2, the sums of the weekly average increase from Plan 2 plus the weekly average of the actual river levels from Table 14, the percent of years from 1970-1978 that diversion occurred, and the corresponding percentages of habitat classes inundated for the Sanganois Area, La Grange Pool. Total hectares of each habitat class are in parentheses.

| Week | Average Diversion Increase (ft) | Actual Weekly Avg. + Diversion Increase msl (ft) | % of yrs. with Diversion | Habitat Class | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Open Water (232.6) | Mud Flats (45.6) | Marsh (21.3) | Scrub-shrub (121.8) | Forest (164.8) | Impoundments or Managed (748.8) | Stream bank (8.3) | Agri-culture (0) | Misc. (10.2) |
| July 3-9 | 0.4 | 433.8 | 33 | 100.0 | 100.0 | 100.0 | 100.0 | 83.0 | 0 | 100.0 | | B |
| July 10-16 | 0.3 | 431.8 | 22 | 62.3 | 74.6 | 66.2 | 58.6 | 18.6 | 0 | 66.3 | | |
| July 17-23 | 0.2 | 430.0 [A] | 56 | ---- | ---- | ---- | ---- | ---- | 0 | ---- | | |
| July 24-30 | 0.2 | 429.7 [A] | 33 | ---- | ---- | ---- | ---- | ---- | 0 | ---- | | |
| July 31-Aug 6 | 0.4 | 429.5 [A] | 33 | ---- | ---- | ---- | ---- | ---- | 0 | ---- | | |
| Aug 7-13 | 0.4 | 429.2 [A] | 44 | ---- | ---- | ---- | ---- | ---- | 0 | ---- | | |
| Aug 14-20 | 0.3 | 429.2 [A] | 44 | ---- | ---- | ---- | ---- | ---- | 0 | ---- | | |
| Aug 21-27 | 0.3 | 428.5 [A] | 33 | ---- | ---- | ---- | ---- | ---- | 0 | ---- | | |
| Aug 28-Sept 3 | 0.5 | 428.7 [A] | 44 | ---- | ---- | ---- | ---- | ---- | 0 | ---- | | |
| Sept 4-10 | 0.5 | 429.0 [A] | 33 | ---- | ---- | ---- | ---- | ---- | 0 | ---- | | |
| Sept 11-17 | 0.4 | 428.7 [A] | 44 | ---- | ---- | ---- | ---- | ---- | 0 | ---- | | |
| Sept 18-24 | 0.5 | 430.3 | 56 | 62.3 | 74.6 | 66.2 | 58.6 | 18.6 | 0 | 66.3 | | |
| Sept 25-Oct 1 | 0.3 | 430.6 | 67 | 62.3 | 74.6 | 66.2 | 58.6 | 18.6 | 0 | 66.3 | | |
| Oct 2-8 | 0.2 | 430.6 | 44 | 62.3 | 74.6 | 66.2 | 58.6 | 18.6 | 0 | 66.3 | | |
| Oct 9-15 | 0.3 | 430.3 | 44 | 62.3 | 74.6 | 66.2 | 58.6 | 18.6 | 0 | 66.3 | | |
| Oct 16-22 | 0.5 | 430.3 | 56 | 62.3 | 74.6 | 66.2 | 58.6 | 18.6 | 0 | 66.3 | | |
| Oct 23-29 | 0.4 | 429.6 [A] | 78 | ---- | ---- | ---- | ---- | ---- | 0 | ---- | | |
| Oct 30-Nov 5 | 0.4 | 429.8 [A] | 100 | ---- | ---- | ---- | ---- | ---- | 0 | ---- | | |
| Nov 6-12 | 1.3 | 431.0 | 89 | 62.3 | 74.6 | 66.2 | 58.6 | 18.6 | 0 | 66.3 | | |
| Nov 13-19 | 0.6 | 430.0 [A] | 89 | ---- | ---- | ---- | ---- | ---- | 0 | ---- | | |
| Nov 20-26 | 0.7 | 430.1 | 78 | 62.3 | 74.6 | 66.2 | 58.6 | 18.6 | 0 | 66.3 | | |
| Nov 27-Dec 3 | 0.8 | 430.0 [A] | 89 | ---- | ---- | ---- | ---- | ---- | 0 | ---- | | |
| Dec 4-10 | 0.8 | 430.7 | 67 | 62.3 | 74.6 | 66.2 | 58.6 | 18.6 | 0 | 66.3 | | |
| Dec 11-17 | 0.7 | 431.1 | 89 | 62.3 | 74.6 | 66.2 | 58.6 | 18.6 | 0 | 66.3 | | |
| Dec 18-24 | 0.8 | 431.9 | 89 | 62.3 | 74.6 | 66.2 | 58.6 | 18.6 | 0 | 66.3 | | |
| Dec 25-31 | 0.7 | 431.8 | 89 | 62.3 | 74.6 | 66.2 | 58.6 | 18.6 | 0 | 66.3 | | |

[A] This river level is below the lowest elevation on the contour maps.

[B] All of this habitat class consists of levees and none were able to be measured at 2-ft contours.

respectively, for 18-24 September and 9-22 October. During the 9 weeks of 17 July to 17 September, the averages of the water levels resulting from Plan 2 varied between 430.2 and 431.7 ft and added an average of 0.2 to 0.5 ft of water to the ambient river levels (Table 17). With Plan 2, like Plan 1 (Table 15), there were 8 consecutive weeks with levels at or below 431.5 ft as compared to 10 weeks under actual water conditions (Table 13). Both Plan 2 and Plan 1 then generated 5 consecutive weeks beginning with 18 September of river levels reaching or exceeding 432.0 ft as compared with 2 weeks under actual conditions. Given the similar river level conditions with Plan 2 as with Plan 1 and the short 56-day period for establishment and development of moist-soil plants, Plan 2 would also result in generally poor to below average moist-soil seed production.

For the scrub-shrub community at Grand Island, the only difference in inundation between actual river levels (Table 13) and those from Plan 2 (Table 17) during the growing season was an increase in the percentage of this habitat flooded from 34.9% to 96.3% for the week of 25 September-1 October. This increase in inundation over actual conditions for 1 week would have a negligible effect on the scrub-shrub community. When compared with Plan 1 (Table 15), Plan 2 (Table 17) would inundate 96.3%

of the scrub-shrub community for 5 consecutive weeks from 18 September to 22 October during the end of the growing season whereas Plan 2 would inundate only 34.9% for 3 of the weeks during this interval. Plan 2, therefore, would present less of a stress to scrub-shrub community than Plan 1.

Plan 2 (Table 17) resulted in increases in the percentage of bottomland forest flooded over actual river conditions (Table 13) during the dormant season from 20.7 to 54.6% during 22 January to 4 February and 12-18 February, from 54.6% to 81.8% during 12-18 March, and from 1.2 to 20.7% during 6-12 November and 4-10 December. It is doubtful that these increases in inundation during the non-growing season would have a significant impact on the bottomland forest community. However, Plan 2 also resulted in more forest inundation at the beginning of the growing season from 81.8 to 97.2% for 30 April to 20 May and from 54.6 to 81.8% for 21 May to 4 June. These 5 consecutive weeks of increased inundation of the bottomland forest community would increase the period of stress for those species and individuals more susceptible to inundation. Over a period of years, consistently higher water levels during the early growing season could affect the forest community structure by reducing seedling production and survival in those areas not typically flooded every spring. Compared with Plan 1 (Table

15), the amount of forest habitat inundated by Plan 2 was less during the dormant season for 8 weeks between 1 January to 29 April and for 5 weeks after 13 November. During the growing season, Plan 1 flooded 81.8% of the forest area for the week of 26 June to 2 July, but a more noticeable difference occurred at the end of the growing season for the 5 weeks of 18 September to 22 October when 20.7% would have been inundated by Plan 1 (Table 15) as compared to only 1.2% for Plan 2 (Table 17). The effects of Plan 1 would be more limiting to the forest community during this time span than those from Plan 2 which differed little from actual conditions.

Sanganois Conservation Area. Plan 2 (Table 18) would have resulted in an increase in the percent of open water, mud flat, marsh and scrub-shrub habitat flooded at Sanganois over ambient conditions (Table 14) for the periods of 15-28 January, 12-18 February, 18-24 September, 9-22 October, 6-12 and 20-26 November, and 4-10 December. Plan 2 (Table 18) differs from Plan 1 (Table 16) in that fewer periods of increased inundation of the various habitat classes during the dormant season for plants resulted from Plan 2. However, Plan 2 was similar to Plan 1 in that increased inundation of these 4 habitats occurred during the same 3 weeks of growing season: 18-24 September and 9-22 October.

With the river levels generated by Plan 2, mud flats become exposed on 10 July and become increasingly abundant for the next 9 weeks as river levels fall below 430.0 ft (Table 18), essentially the same result as occurs with Plan 1 (Table 16). Plan 2 and Plan 1 differ from ambient conditions during the week of 18-24 September when, after 63 days of exposure of 30 to 88% of the potential mud flats, river levels increase and mud flats become flooded. During 18-24 September, Plan 2 (Table 18) adds an average of 0.5 ft during 18-24 September resulting in a river level of 430.3 ft as compared with 430.4 for Plan 1 (Table 16) and 429.8 for actual conditions (Table 14). Elevations resulting from Plan 2 then vary between 430.3 and 430.6 ft from 25 September to 22 October. Plan 2, like Plan 1, allows 63 days toward the minimum 70 days required for moist-soil community development with subsequent inundation of some mud flat areas. As with Plan 1, this increase in inundation would reduce the survival and maturation of portions of the moist-soil community thereby reducing seed production. Moist-soil seed production for Plan 2 at Sanganois should be comparable to that from Plan 1 and reduced from the production that would have normally occurred. However, at least poor to average production should result.

The effects of Plan 2 on the marsh and scrub-shrub communities were the same as with Plan 1 (Table 16). The increase in inundation over ambient levels (Table 14) by Plan 2 (Table 18) of the marsh community from 0 to 66.2% and the scrub-shrub community from 0 to 58.6% during 18-24 September and 9-22 October would present few significant biological impacts on these communities.

Plan 2 (Table 18) would not result in the degree of inundation of forest habitat that would have resulted from Plan 1 (Table 16). During the dormant season, Plan 2 (Table 18) would have only increased the amount of forest inundated over ambient levels (Table 14) for 4 weeks up to 29 April and for 3 weeks after 30 October. Within the growing season, Plan 2 would have inundated 6.3% more forest area during 30 April-6 May than would have occurred under actual conditions and 18.5% more forest area during 18-24 September and 9-22 October. Plan 2 would have little if any significant biological impact on the forest community at Sanganois.

The 435-ft levee at Sanganois would have been overtopped by Plan 2 (Table 18) and the enclosed habitats inundated for 4 additional weeks from 12 March to 22 April than would have normally occurred (Table 14). This is 1 week less than would have resulted from Plan 1. Because this inundation would have

occurred during the non-growing season for plants, little if any significant biological impacts would occur. An additional 4 weeks of inundation might result in some damage to the 435-ft levee.

Diversion Plan 2 Summary. The increases in river levels resulting from Plan 2 were lower in magnitude than those from Plan 1 for much of the year with the exception of the period 3 July to 24 September during the growing season when increases in water levels for both Plans 1 and 2 were similar. Consequently, prognosticated ecological effects of the increase in water levels resulting from Plan 2 were somewhat similar to those for Plan 1.

During the critical growing season for moist-soil plants, average increases in water levels from Plan 2 ranged between 0.2 and 0.5 ft from 17 July to 17 September. During this 9-week period, up to 90% of the potential mud flat surface area at the study areas could be exposed for variable lengths of time. As with Plan 1, however, Plan 2 differs from ambient conditions by increasing water levels after 18 September thus shortening the period of growth and maturation for moist-soil plants below the critical 70-day limit. Thus, moist-soil plant maturation and

seed development would be reduced compared to ambient conditions and would probably rank between poor and average.

The increase in water levels from Plan 2 and subsequent inundation of scrub-shrub habitat during the growing season differed from ambient conditions by only 1 week on the Grand Island area and by 3 weeks on the Sanqanois Area. The percent of inundation of scrub-shrub habitat at Grand Island resulting from Plan 2 was similar to ambient levels and less than that flooded by Plan 1. At Sanganois, the inundation effects of Plan 2 and Plan 1 for the scrub-shrub habitat were more comparable during the growing season. Overall, Plan 2 increased the inundation of the amount of scrub-shrub habitat over ambient conditions but not as much as would occur with Plan 1. Consequently, it is unlikely that measurable detrimental effects would occur to the scrub-shrub habitat on these areas as a result of water levels proposed by Plan 2 during the growing season and any effects would be less than those incurred by Plan 1.

The average increases in water levels resulting from Plan 2 expanded the amount of marsh habitat flooded by 66% over ambient conditions for 3 weeks after 18 September until the end of the growing season. This is identical with the effects of Plan 1, although levels from Plan 1 maintained this degree of

inundation of marsh habitat more consistently through November than did levels from Plan 2. It is doubtful that significant impacts to the marsh community would result from the additional 3 weeks of inundation in late September and October caused by Plan 2.

Inundation of bottomland forest resulting from the average of projected water levels of Plan 2 would not result in the degree of flooding of forest habitat that would have resulted from Plan 1 although inundation over actual conditions would have increased. During the dormant season, water levels generated by Plan 2 increased the amount of forest inundated sporadically by 20 to 27% at Grand Island and Sanganois. During the growing season, the amount of forest inundated by Plan 2 increased between 0 and 27% before 4 June and between 0 and 20% after 18 September. Any effects on the forest community resulting from Plan 2 water levels would probably occur from the increased amount of forest inundated during the early and late segment of the growing season. Consistently higher water levels during the growing season over a period of years could affect the structure of the forest community by reducing seedling production and survival in those areas not typically inundated each fall and spring as well as increasing the period of stress for species or individuals susceptible to inundation. Thus,

projected water levels from Plan 2 could result in a minor alteration of the forest community over a period of years.

Diversion Plan 3

The average weekly values of the actual river level measured at Havana in La Grange Pool and the average levels resulting from Plan 3 for the years of 1972, 1974-1977 are shown in Figure 7. The average weekly amount of river level increase derived from Plan 3, the frequency of diversion during the 5-year study period, and the corresponding percentages of habitat classes inundated are presented in Table 19 for Grand Island and Table 20 for Sanganois.

Average weekly increases in river levels resulting from Plan 3 varied between 0.2 and 0.5 ft from 1 January through 25 March, and except for sporadic occurrences of 0.1- or 0.2-ft raises, increases were virtually nonexistent for the remainder of the year (Table 19). Accordingly, the frequency of occurrence of Plan 3 for the 5 study years ranged between 40 and 60% for the 1 January to 25 March period and from 0 to 40% thereafter (Table 19).

Grand Island Area. Virtually no difference in the percentage of the various habitat classes inundated at Grand Island occurred between the average levels of Plan 3 (Table 19) and those actually existing (Table 13). The only increase in the

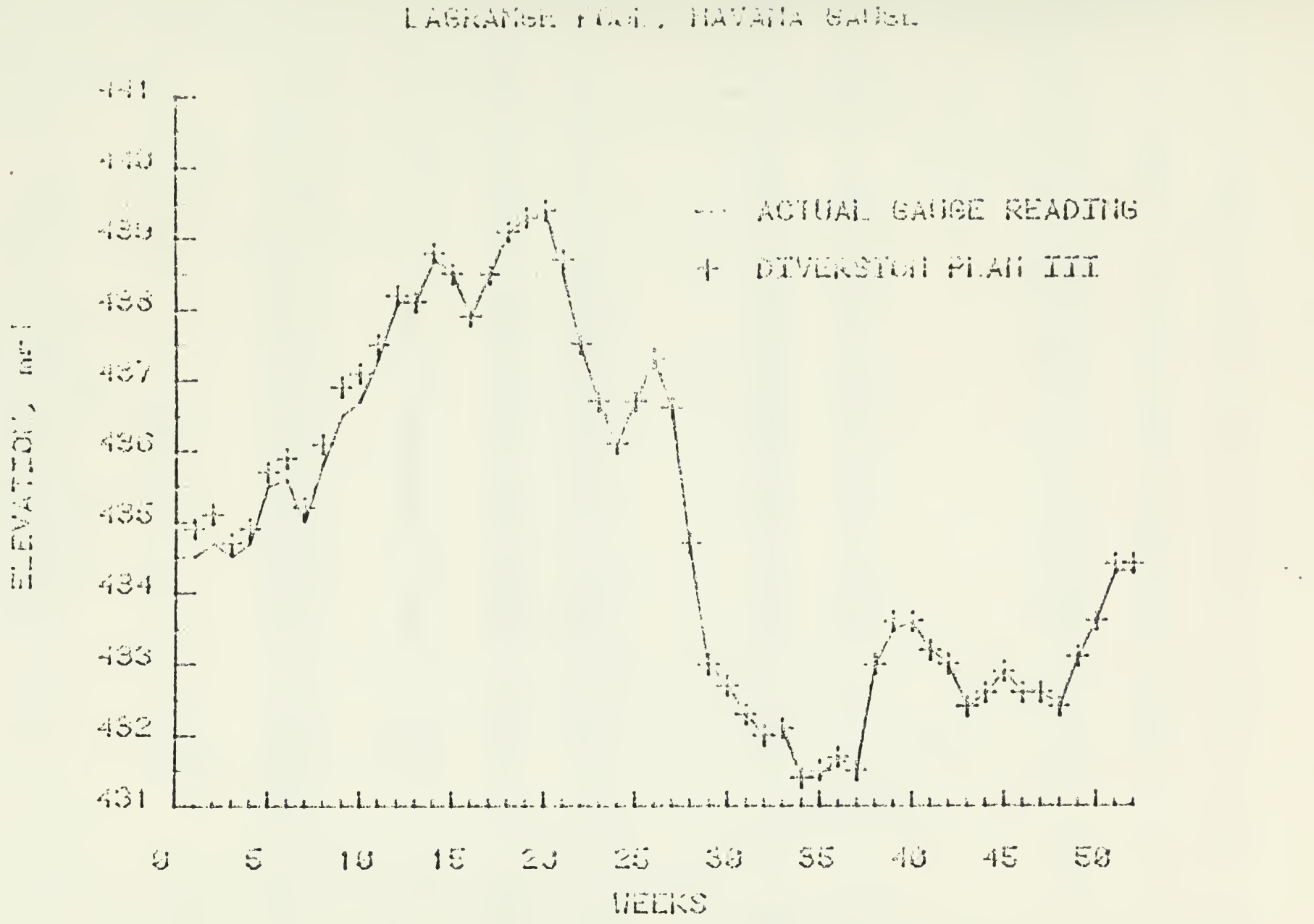


Figure 7. The average of weekly water levels (msl, ft) measured at the Havana gauge, La Grange Pool, and those predicted by Diversion Plan 3, 1972, 1974-1977.

Table 19. The 1972, 1974-1977 weekly averages of the increase in river levels from Diversion Plan 3, the sums of the weekly average increase from Plan 3 plus the weekly average of the actual river levels from Table 13, the percent of years from 1972, 1974-1977 that diversion occurred, and the corresponding percentages of habitat classes inundated for the Grand Island Area, La Grange Pool. Total hectares of each habitat class are in parentheses.

| Week | Average Diversion Increase (ft) | Actual Weekly Avg. + Diversion Increase msl (ft) | % of yrs. with Diversion | Habitat Class | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Open Water (629.3) | Mud Flats (28.7) | Marsh (0) | Scrub-shrub (301.0) | Forest (637.3) | Impoundments or Managed (0) | Stream bank (2.2) | Agri-culture (48.5) | Misc. (1.2) |
| Jan 1-7 | 0.5 | 433.5 | 60 | 100.0 | 100.0 | | 96.3 | 20.7 | | 84.1 | 0.4 | 0 |
| Jan 8-14 | 0.4 | 433.6 | 60 | 100.0 | 100.0 | | 96.3 | 20.7 | | 84.1 | 0.4 | 0 |
| Jan 15-21 | 0.2 | 433.2 | 40 | 100.0 | 100.0 | | 96.3 | 20.7 | | 84.1 | 0.4 | 0 |
| Jan 22-28 | 0.3 | 433.5 | 60 | 100.0 | 100.0 | | 96.3 | 20.7 | | 84.1 | 0.4 | 0 |
| Jan 29-Feb 4 | 0.2 | 434.2 | 60 | 100.0 | 100.0 | | 100.0 | 54.6 | | 90.9 | 28.7 | 0 |
| Feb 5-11 | 0.2 | 434.3 | 60 | 100.0 | 100.0 | | 100.0 | 54.6 | | 90.9 | 28.7 | 0 |
| Feb 12-18 | 0.3 | 433.8 | 60 | 100.0 | 100.0 | | 96.3 | 20.7 | | 84.1 | 0.4 | 0 |
| Feb 19-25 | 0.3 | 434.6 | 60 | 100.0 | 100.0 | | 100.0 | 54.6 | | 90.9 | 28.7 | 0 |
| Feb 26-Mar 4 | 0.4 | 435.4 | 60 | 100.0 | 100.0 | | 100.0 | 54.6 | | 90.9 | 28.7 | 0 |
| Mar 5-11 | 0.4 | 435.6 | 60 | 100.0 | 100.0 | | 100.0 | 54.6 | | 90.9 | 28.7 | 0 |
| Mar 12-18 | 0.2 | 436.0 | 60 | 100.0 | 100.0 | | 100.0 | 54.6 | | 90.9 | 28.7 | 0 |
| Mar 19-25 | 0.2 | 436.8 | 40 | 100.0 | 100.0 | | 100.0 | 81.8 | | 100.0 | 81.0 | 33.1 |
| Mar 26-Apr 1 | 0 | 436.6 | 20 | 100.0 | 100.0 | | 100.0 | 81.8 | | 100.0 | 81.0 | 33.1 |
| Apr 2-8 | 0 | 437.2 | 40 | 100.0 | 100.0 | | 100.0 | 81.8 | | 100.0 | 81.0 | 33.1 |
| Apr 9-15 | 0 | 437.0 | 20 | 100.0 | 100.0 | | 100.0 | 81.8 | | 100.0 | 81.0 | 33.1 |
| Apr 16-22 | 0 | 436.4 | 0 | 100.0 | 100.0 | | 100.0 | 81.8 | | 100.0 | 81.0 | 33.1 |
| Apr 23-29 | 0 | 437.0 | 0 | 100.0 | 100.0 | | 100.0 | 81.8 | | 100.0 | 81.0 | 33.1 |
| Apr 30-May 6 | 0 | 437.6 | 0 | 100.0 | 100.0 | | 100.0 | 81.8 | | 100.0 | 81.0 | 33.1 |
| May 7-13 | 0 | 437.8 | 0 | 100.0 | 100.0 | | 100.0 | 81.8 | | 100.0 | 81.0 | 33.1 |
| May 14-20 | 0 | 437.9 | 0 | 100.0 | 100.0 | | 100.0 | 81.8 | | 100.0 | 81.0 | 33.1 |
| May 21-27 | 0.2 | 437.2 | 20 | 100.0 | 100.0 | | 100.0 | 81.8 | | 100.0 | 81.0 | 33.1 |
| May 28-June 4 | 0 | 436.6 | 0 | 100.0 | 100.0 | | 100.0 | 81.8 | | 100.0 | 81.0 | 33.1 |
| June 5-11 | 0 | 435.2 | 0 | 100.0 | 100.0 | | 100.0 | 54.6 | | 90.9 | 28.7 | 0 |
| June 12-18 | 0 | 434.6 | 0 | 100.0 | 100.0 | | 100.0 | 54.6 | | 90.9 | 28.7 | 0 |
| June 19-25 | 0 | 435.2 | 0 | 100.0 | 100.0 | | 100.0 | 54.6 | | 90.9 | 28.7 | 0 |
| June 26-July 2 | 0 | 435.8 | 20 | 100.0 | 100.0 | | 100.0 | 54.6 | | 90.9 | 28.7 | 0 |

Table 19 (cont). The 1972, 1974-1977 weekly averages of the increase in river levels from Diversion Plan 3, the sums of the weekly average increase from Plan 3 plus the weekly average of the actual river levels from Table 13, the percent of years from 1972, 1974-1977, and the corresponding percentages of habitat classes inundated for the Grand Island Area, La Grange Pool. Total hectares of each habitat class are in parentheses.

| Week | Average Diversion Increase (ft) | Actual Weekly Avg. + Diversion Increase msl (ft) | % of yrs. with Diversion | Habitat Class | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Open Water (629.3) | Mud Flats (28.7) | Marsh (0) | Scrub-shrub (301.0) | Forest (637.3) | Impoundments or Managed (0) | Stream bank (2.2) | Agri-culture (48.5) | Misc. (1.2) |
| July 3-9 | 0 | 435.1 | 0 | 100.0 | 100.0 | | 100.0 | 54.6 | | 90.9 | 28.7 | 0 |
| July 10-16 | 0 | 433.2 | 0 | 100.0 | 100.0 | | 96.3 | 20.7 | | 84.1 | 0.4 | 0 |
| July 17-23 | 0 | 431.5 | 0 | 94.4 | 29.6 | | 34.9 | 1.2 | | 84.1 | 0.4 | 0 |
| July 24-30 | 0 | 431.2 | 20 | 94.4 | 29.6 | | 34.9 | 1.2 | | 84.1 | 0.4 | 0 |
| July 31-Aug 6 | 0 | 430.8 | 0 | 94.4 | 29.6 | | 34.9 | 1.2 | | 84.1 | 0.4 | 0 |
| Aug 7-13 | 0 | 430.5 | 0 | 94.4 | 29.6 | | 34.9 | 1.2 | | 84.1 | 0.4 | 0 |
| Aug 14-20 | 0 | 430.6 | 0 | 94.4 | 29.6 | | 34.9 | 1.2 | | 84.1 | 0.4 | 0 |
| Aug 21-27 | 0 | 429.9 [A] | 0 | ---- | ---- | | ---- | --- | | ---- | --- | -- |
| Aug 28-Sept 3 | 0.1 | 430.0 [A] | 20 | ---- | ---- | | ---- | --- | | ---- | --- | -- |
| Sept 4-10 | 0 | 430.2 | 0 | 94.4 | 29.6 | | 34.9 | 1.2 | | 84.1 | 0.4 | 0 |
| Sept 11-17 | 0 | 430.0 [A] | 0 | ---- | ---- | | ---- | --- | | ---- | --- | -- |
| Sept 18-24 | 0 | 431.5 | 0 | 94.4 | 29.6 | | 34.9 | 1.2 | | 84.1 | 0.4 | 0 |
| Sept 25-Oct 1 | 0 | 432.0 | 20 | 94.4 | 29.6 | | 34.9 | 1.2 | | 84.1 | 0.4 | 0 |
| Oct 2-8 | 0.1 | 432.2 | 20 | 100.0 | 100.0 | | 96.3 | 20.7 | | 84.1 | 0.4 | 0 |
| Oct 9-15 | 0 | 431.7 | 20 | 94.4 | 29.6 | | 34.9 | 1.2 | | 84.1 | 0.4 | 0 |
| Oct 16-22 | 0 | 431.5 | 0 | 94.4 | 29.6 | | 34.9 | 1.2 | | 84.1 | 0.4 | 0 |
| Oct 23-29 | 0 | 430.9 | 0 | 94.4 | 29.6 | | 34.9 | 1.2 | | 84.1 | 0.4 | 0 |
| Oct 30-Nov 5 | 0 | 431.1 | 0 | 94.4 | 29.6 | | 34.9 | 1.2 | | 84.1 | 0.4 | 0 |
| Nov 6-12 | 0.1 | 431.5 | 20 | 94.4 | 29.6 | | 34.9 | 1.2 | | 84.1 | 0.4 | 0 |
| Nov 13-19 | 0 | 431.1 | 0 | 94.4 | 29.6 | | 34.9 | 1.2 | | 84.1 | 0.4 | 0 |
| Nov 20-26 | 0 | 431.1 | 0 | 94.4 | 29.6 | | 34.9 | 1.2 | | 84.1 | 0.4 | 0 |
| Nov 27-Dec 3 | 0 | 430.9 | 0 | 94.4 | 29.6 | | 34.9 | 1.2 | | 84.1 | 0.4 | 0 |
| Dec 4-10 | 0 | 431.6 | 0 | 94.4 | 29.6 | | 34.9 | 1.2 | | 84.1 | 0.4 | 0 |
| Dec 11-17 | 0 | 432.1 | 20 | 100.0 | 100.0 | | 96.3 | 20.7 | | 84.1 | 0.4 | 0 |
| Dec 18-24 | 0.1 | 432.9 | 20 | 100.0 | 100.0 | | 96.3 | 20.7 | | 84.1 | 0.4 | 0 |
| Dec 25-31 | 0.1 | 432.9 | 20 | 100.0 | 100.0 | | 96.3 | 20.7 | | 84.1 | 0.4 | 0 |

[A] This river level is below the lowest elevation on the contour maps.

Table 20. The 1972, 1974-1977 weekly averages of the increase in river levels from Diversion Plan 3, the sums of the weekly average increase from Plan 3 plus the weekly average of the actual river levels from Table 14, the percent of years from 1972, 1974-1977 that diversion occurred, and the corresponding percentages of habitat classes inundated for the Sanganois Area, La Grange Pool. Total hectares of each habitat class are in parentheses.

| Week | Average Diversion Increase (ft) | Actual Weekly Avg. + Diversion Increase msl (ft) | % of yrs. with Diversion | Habitat Class | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Open Water (232.6) | Mud Flats (45.6) | Marsh (21.3) | Scrub-shrub (121.8) | Forest (164.8) | Impoundments or Managed (748.8) | Stream bank (8.3) | Agri-culture (0) | Misc. (10.2) |
| Jan 1-7 | 0.5 | 431.8 | 60 | 62.3 | 74.6 | 66.2 | 58.6 | 18.6 | 0 | 66.3 | | B |
| Jan 8-14 | 0.4 | 431.9 | 60 | 62.3 | 74.6 | 66.2 | 58.6 | 18.6 | 0 | 66.3 | | |
| Jan 15-21 | 0.2 | 431.5 | 40 | 62.3 | 74.6 | 66.2 | 58.6 | 18.6 | 0 | 66.3 | | |
| Jan 22-28 | 0.3 | 431.8 | 60 | 62.3 | 74.6 | 66.2 | 58.6 | 18.6 | 0 | 66.3 | | |
| Jan 29-Feb 4 | 0.2 | 432.5 | 60 | 100.0 | 100.0 | 100.0 | 100.0 | 83.0 | 0 | 100.0 | | |
| Feb 5-11 | 0.2 | 432.6 | 60 | 100.0 | 100.0 | 100.0 | 100.0 | 83.0 | 0 | 100.0 | | |
| Feb 12-18 | 0.3 | 432.1 | 60 | 100.0 | 100.0 | 100.0 | 100.0 | 83.0 | 0 | 100.0 | | |
| Feb 19-25 | 0.3 | 432.9 | 60 | 100.0 | 100.0 | 100.0 | 100.0 | 83.0 | 0 | 100.0 | | |
| Feb 26-Mar 4 | 0.4 | 433.7 | 60 | 100.0 | 100.0 | 100.0 | 100.0 | 83.0 | 0 | 100.0 | | |
| Mar 5-11 | 0.4 | 433.9 | 60 | 100.0 | 100.0 | 100.0 | 100.0 | 83.0 | 0 | 100.0 | | |
| Mar 12-18 | 0.2 | 434.9 | 60 | 100.0 | 100.0 | 100.0 | 100.0 | 92.6 | 0 | 100.0 | | |
| Mar 19-25 | 0.2 | 435.5 | 40 | 100.0 | 100.0 | 100.0 | 100.0 | 92.6 | 100.0 | 100.0 | | |
| Mar 26-Apr 1 | 0 | 435.3 | 20 | 100.0 | 100.0 | 100.0 | 100.0 | 92.6 | 100.0 | 100.0 | | |
| Apr 2-8 | 0 | 434.7 | 40 | 100.0 | 100.0 | 100.0 | 100.0 | 92.6 | 0 | 100.0 | | |
| Apr 9-15 | 0 | 435.3 | 20 | 100.0 | 100.0 | 100.0 | 100.0 | 92.6 | 100.0 | 100.0 | | |
| Apr 16-22 | 0 | 434.7 | 0 | 100.0 | 100.0 | 100.0 | 100.0 | 92.6 | 0 | 100.0 | | |
| Apr 23-29 | 0 | 435.3 | 0 | 100.0 | 100.0 | 100.0 | 100.0 | 92.6 | 100.0 | 100.0 | | |
| Apr 30-May 6 | 0 | 435.9 | 0 | 100.0 | 100.0 | 100.0 | 100.0 | 92.6 | 100.0 | 100.0 | | |
| May 7-13 | 0 | 436.1 | 0 | 100.0 | 100.0 | 100.0 | 100.0 | 98.9 | 100.0 | 100.0 | | |
| May 14-20 | 0 | 436.2 | 0 | 100.0 | 100.0 | 100.0 | 100.0 | 98.9 | 100.0 | 100.0 | | |
| May 21-27 | 0.2 | 435.5 | 20 | 100.0 | 100.0 | 100.0 | 100.0 | 92.6 | 100.0 | 100.0 | | |
| May 28-June 4 | 0 | 434.3 | 0 | 100.0 | 100.0 | 100.0 | 100.0 | 92.6 | 0 | 100.0 | | |
| June 5-11 | 0 | 433.5 | 0 | 100.0 | 100.0 | 100.0 | 100.0 | 83.0 | 0 | 100.0 | | |
| June 12-18 | 0 | 432.9 | 0 | 100.0 | 100.0 | 100.0 | 100.0 | 83.0 | 0 | 100.0 | | |
| June 19-25 | 0 | 433.5 | 0 | 100.0 | 100.0 | 100.0 | 100.0 | 83.0 | 0 | 100.0 | | |
| June 26-July 2 | 0 | 434.1 | 20 | 100.0 | 100.0 | 100.0 | 100.0 | 92.6 | 0 | 100.0 | | |

Table 20 (cont). The 1972, 1974-1977 weekly averages of the increase in river levels from Diversion Plan 3, the sums of the weekly average increase from Plan 3 plus the weekly average of the actual river levels from Table 14, the percent of years from 1972, 1974-1977 that diversion occurred and the corresponding percentages of habitat classes inundated for the Sanganois Area, La Grange Pool. Total hectares of each habitat class are in parentheses.

| Week | Average Diversion Increase (ft) | Actual Weekly Avg. + Diversion Increase msl (ft) | % of yrs. with Diversion | Habitat Class: Open Water (232.6) | Mud Flats (45.6) | Marsh (21.3) | Scrub-shrub (121.8) | Forest (164.8) | Impoundments or Managed (748.8) | Stream bank (8.3) | Agri-culture (0) | Misc. (10.2) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| July 3-9 | 0 | 433.4 | 0 | 100.0 | 100.0 | 100.0 | 100.0 | 83.0 | 0 | 100.0 | | B |
| July 10-16 | 0 | 431.5 | 0 | 62.3 | 74.6 | 66.2 | 58.6 | 18.6 | 0 | 66.3 | | |
| July 17-23 | 0 | 429.8 [A] | 0 | ---- | ---- | ---- | ---- | ---- | 0 | ---- | | |
| July 24-30 | 0 | 429.5 [A] | 20 | ---- | ---- | ---- | ---- | ---- | 0 | ---- | | |
| July 31-Aug 6 | 0 | 429.1 [A] | 0 | ---- | ---- | ---- | ---- | ---- | 0 | ---- | | |
| Aug 7-13 | 0 | 428.8 [A] | 0 | ---- | ---- | ---- | ---- | ---- | 0 | ---- | | |
| Aug 14-20 | 0 | 428.9 [A] | 0 | ---- | ---- | ---- | ---- | ---- | 0 | ---- | | |
| Aug 21-27 | 0 | 428.2 [A] | 0 | ---- | ---- | ---- | ---- | ---- | 0 | ---- | | |
| Aug 28-Sept 3 | 0.1 | 428.3 [A] | 20 | ---- | ---- | ---- | ---- | ---- | 0 | ---- | | |
| Sept 4-10 | 0 | 428.5 [A] | 0 | ---- | ---- | ---- | ---- | ---- | 0 | ---- | | |
| Sept 11-17 | 0 | 428.3 [A] | 0 | ---- | ---- | ---- | ---- | ---- | 0 | ---- | | |
| Sept 18-24 | 0 | 429.8 [A] | 0 | ---- | ---- | ---- | ---- | ---- | 0 | ---- | | |
| Sept 25-Oct 1 | 0 | 430.3 | 20 | 62.3 | 74.6 | 66.2 | 58.6 | 18.6 | 0 | 66.3 | | |
| Oct 2-8 | 0.1 | 430.5 | 20 | 62.3 | 74.6 | 66.2 | 58.6 | 18.6 | 0 | 66.3 | | |
| Oct 9-15 | 0 | 430.0 [A] | 20 | ---- | ---- | ---- | ---- | ---- | 0 | ---- | | |
| Oct 16-22 | 0 | 429.8 [A] | 0 | ---- | ---- | ---- | ---- | ---- | 0 | ---- | | |
| Oct 23-29 | 0 | 429.2 [A] | 0 | ---- | ---- | ---- | ---- | ---- | 0 | ---- | | |
| Oct 30-Nov 5 | 0 | 429.5 [A] | 0 | ---- | ---- | ---- | ---- | ---- | 0 | ---- | | |
| Nov 6-12 | 0.1 | 429.8 [A] | 20 | ---- | ---- | ---- | ---- | ---- | 0 | ---- | | |
| Nov 13-19 | 0 | 429.4 [A] | 0 | ---- | ---- | ---- | ---- | ---- | 0 | ---- | | |
| Nov 20-26 | 0 | 429.4 [A] | 0 | ---- | ---- | ---- | ---- | ---- | 0 | ---- | | |
| Nov 27-Dec 3 | 0 | 429.2 [A] | 0 | ---- | ---- | ---- | ---- | ---- | 0 | ---- | | |
| Dec 4-10 | 0 | 429.9 [A] | 0 | ---- | ---- | ---- | ---- | ---- | 0 | ---- | | |
| Dec 11-17 | 0 | 430.4 | 20 | 62.3 | 74.6 | 66.2 | 58.6 | 18.6 | 0 | 66.3 | | |
| Dec 18-24 | 0.1 | 431.2 | 20 | 62.3 | 74.6 | 66.2 | 58.6 | 18.6 | 0 | 66.3 | | |
| Dec 25-31 | 0.1 | 431.2 | 20 | 62.3 | 74.6 | 66.2 | 58.6 | 18.6 | 0 | 66.3 | | |

[A] This river level is below the lowest elevation on the contour maps.

[B] All of this habitat class consists of levees and none were able to be measured at 2-ft contours.

amount of habitat inundated occurred during the week of 29 January to 4 February with the percentage of scrub-shrub habitat flooded increasing from 96.3 to 100% and inundated forest habitat increasing from 20.7 to 54.6%. Both of these increases are insignificant. Thus, at Grand Island, Plan 3 resulted in no distinguishable difference in habitat inundation over ambient conditions.

Sanganois Conservation Area. The percentages of the various habitat classes at Sanganois inundated by the average weekly water levels resulting from Plan 3 (Table 20) were virtually identical to those flooded by the average of the actual river levels (Table 14). The only difference between Plan 3 and the actual conditions was an increase in the percentage of inundation of all habitats during the week of 12-18 February which would have no biological significance.

Diversion Plan 3 Summary. It is highly unlikely that the river levels projected by Plan 3 would cause any noticeable biological impacts to the terrestrial habitats on the study areas.

# DISCUSSION

A generalized description summarizing the potential effects of the 3 diversion schemes on critical terrestrial habitats at the study areas in Peoria and La Grange pools is presented in Table 21. Plan 1 (7,000 cfs) and Plan 2 (5,500 cfs) had similar effects on the various habitat categories in Peoria Pool where the average weekly increases in river levels for these 2 plans were similar. During the 30 April-15 October growing season for plants, Plan 1 (Table 5) added a weekly average ranging between 0 and 0.6 ft and Plan 2 (Table 7) added averages varying between 0 and 0.5 ft whereas both Plans 1 and 2 contributed increases ranging between 0 and 0.4 ft during the critical growing period for moist-soil plants of 3 July to 24 September. In La Grange Pool, Plan 1 (Table 15) had more of an impact on the habitat categories than Plan 2 (Table 17) because of its generally larger increases in weekly river levels during the growing season. For the 30 April to 15 October period, Plan 1 (Table 15) contributed average weekly increases in elevation ranging between 0.1 and 1.0 ft whereas Plan 2 (Table 17) added increments varying between 0.2 and 0.6 ft; during the 3 July to 24 September period, Plan 1 (Table 15) levels added varied between 0.1 and 0.6 ft above ambient averages as compared to similar increases of 0.2 to 0.5 ft resulting from Plan 2 (Table 17). Projected average water levels from Plan 3 (variable flow)

did not differ from ambient levels during the 30 April to 15 October growing season in Peoria Pool (Tables 3 and 9) and added levels less than 0.2 ft for only 3 weeks during this period in La Grange Pool. Consequently, Plan 3 would not have had any noticeable effects over ambient conditions on the different habitat communities in the study areas investigated.

Constraints involved in this study include: (1) 2-ft contour intervals on the maps used to determine the types and acreages of habitats; (2) the somewhat high river levels which covered the majority of the potential surface area of mud flats when the aerial photos were taken and thus precluded an exact acreage determination; (3) the accuracy of approximately 1 ft for the predictive computer models of the Diversion Plans; (4) the extreme sensitivity of river elevation to flow volume below bankfull conditions as a result of decreased storage capacity of bottomland lakes via sedimentation (Bellrose et al., 1983); and (5) the significant effects of river level changes of less than 2 ft during critical growing periods of the moist-soil community. Given these constraints, the generalized potential effects of the 3 Diversion Plans on the various habitats at the study areas investigated (Table 21) are our best estimation of possible impacts.

The habitat category that would be affected the most by both Plans 1 and 2 on all 4 study areas is the mud flat community (Table 21). Plan 1 would also result in some minor

Table 21. The potential effects of projected water levels from Diversion Plans 1, 2, and 3 as compared to ambient conditions on major habitat categories at the Henry and Marshall County areas in Peoria Pool and the Grand Island and Sanganois areas in La Grange Pool.

| Area | Habitat | Potential Effects | | |
|---|---|---|---|---|
| | | Plan 1 | Plan 2 | Plan 3 |
| | | PEORIA POOL | | |
| Henry | | | | |
| | Mud flats | Major-reduce poor moist-soil seed production to below poor | Major-reduce poor moist-soil seed production to below poor | None |
| | Marsh | None to minor | None to minor | None |
| | Scrub-shrub | None to minor | None to minor | None |
| | Forest | Minor | Minor | None |
| | Impoundments | None to minor | None to minor | None |
| Marshall County | | | | |
| | Mud flats | Major-reduce average moist-soil seed production to poor or worse | Major-reduce average moist-soil seed production to poor or worse | None |
| | Marsh | None | None | None |
| | Scrub-shrub | None | None | None |
| | Forest | None | None | None |
| | Impoundments | None | None | None |

Table 21 (cont). The potential effects of projected water levels from Diversion Plans 1, 2, and 3 as compared to ambient conditions on major habitat categories at the Henry and Marshall County areas in Peoria Pool and the Grand Island and Sanganois areas in La Grange Pool.

| Area | Habitat | Potential Effects | | |
|---|---|---|---|---|
| | | Plan 1 | Plan 2 | Plan 3 |
| | | LA GRANGE POOL | | |
| Grand Island | | | | |
| | Mud flats | Major-reduce good moist-soil seed production to below average or poor | Major- reduce good moist-soil seed production to below average or poor | None |
| | Marsh | ---- | ---- | ---- |
| | Scrub-shrub | Minor | None | None |
| | Forest | Minor | None to minor | None |
| | Impoundments | ---- | ---- | ---- |
| Sanganois | | | | |
| | Mud flats | Major-reduce good moist-soil seed production to below average or poor | Major-reduce good moist-soil seed production to below average or poor | None |
| | Marsh | None | None | None |
| | Scrub-shrub | None | None | None |
| | Forest | Minor | None | None |
| | Impoundments | None | None | None |

detrimental effects to the forest communities on 3 of the 4 areas investigated, whereas Plan 2 conditions would have minor effects on the forest community on the Henry Area. Projected water levels from Plan 1 and Plan 2 could potentially have some minor detrimental impacts on the marsh and scrub-shrub communities at the Henry Area and Plan 1 would have a minor effect on the scrub-shrub community at the Grand Island Area.

Any effects on the various types of floral communities as a result of Plan 1 or Plan 2 diversion schemes are directly related to faunal species which these aggregations of plants support. Although numerous species of birds, mammals, fish, amphibians, reptiles, and invertebrates occur in these various wetland communities, wildlife values of wetlands are often assessed by using selected vertebrates of economic or aesthetic prominance (Committee on Impacts of Emerging Agricultural Trends on Fish and Wildlife Habitat, 1982). For instance, the mud flat community is not only essential to 30-35 species of shorebirds and 15 species of gulls and terns that migrate through the Illinois Valley each fall (Havera et al., 1980:9-1) but also supports the moist-soil plant communities whose seed production has a significant influence on the duck harvest in the valley. The marsh and scrub-shrub communities are essential to good populations of the economically-important species of

muskrat (Ondatra zibethicus), mink (Mustela vison), and beaver (Castor canadensis). The forest community in the bottomlands supports such animal species with economic value as white-tailed deer (Odocoileus virginianus), fox (Sciurus niger) and gray (S. carolinensis) squirrels, raccoons (Procyon lotor), red (Vulpes vulpes) and gray (Urocyon cinereoargenteus) foxes, and coyotes (Canis latrans). Forest communities also provide nesting areas for various species of herons and egrets and a multitude of other avian species. Thus, these habitats provide opportunities for visual-cultural benefits or nonconsumptive uses of wildlife in the areas of recreation, education, and aesthetics (Gupta and Foster, 1975) that are economically significant along with the consumptive values (Chabreck, 1978) of wildlife associated with hunting and trapping.

## Waterfowl Populations

Waterfowl frequent the Illinois River valley throughout the year but they are most abundant in the fall and next most abundant in the spring. At times, several hundred thousand mallards (Anas platyrhynchos) winter in the valley along with hundreds of common goldeneyes (Bucephala clangula) and common mergansers (Mergus merganser). Wood ducks (Aix sponsa) breed more abundantly along the backwater lakes than elsewhere in the state; indeed the Illinois Valley is one of the most important breeding grounds for this species in the nation.

As many as 32 species of waterfowl visit the water areas of the Illinois River; however, only 20 species are of regular occurrence. Dabbling ducks are much more abundant than diving ducks during the fall, less so during the spring. By far the most abundant species is the mallard, composing about 81% of the fall population and 43% of the spring population.

The fall migration period extends from early August with the appearance of a few thousand blue-winged teal (Anas discors) until mid-December with the departure of the bulk of the mallards.

A comparison of the use by ducks during the fall of the Peoria and La Grange navigation pools from 1948 to 1982 is presented in Table 22. The population data in Table 22 are expressed in duck use-days (one bird present one day forms a use-day).

Havera et al. (1980:7-1) found that during the fall migration periods of 1976-1978, there was an average of 39,153,293 use-days by ducks and geese for the Illinois River valley; dabbling ducks composed 92.3%, diving ducks 2.9%, and geese 4.8%. Coots (Fulica americana), which are not true waterfowl but are ecologically similar, averaged 5,750,535 use-days. From 1977-1982, there was a fall average of 11,662,698 duck use-days for the Peoria Pool, an average of 23,351,077 duck use-days for the La Grange Pool, and an average of 17,506,888 duck use-days for both of these pools (Table 22).

Table 22. Use-days for all duck species in the Peoria and La Grange pools during the fall from 1948-1982.

| Year | Peoria Pool | La Grange Pool |
|---|---|---|
| 1948 | 35,702,440 | 23,712,309 |
| 1949 | 47,302,172 | 26,735,176 |
| 1950 | 21,360,314 | 27,892,993 |
| 1951 | 17,632,247 | 19,827,040 |
| 1952 | 18,148,218 | 25,660,752 |
| 1953 | 31,669,687 | 34,878,885 |
| 1954 | 32,430,657 | 40,702,385 |
| 1955 | 18,189,110 | 42,308,484 |
| 1956 | 13,287,420 | 31,061,274 |
| 1957 | 16,937,070 | 21,327,200 |
| 1958 | 9,416,575 | 17,497,538 |
| 1959 | 7,854,612 | 21,616,407 |
| 1960 | 11,282,855 | 17,278,285 |
| 1961 | 7,281,185 | 9,267,683 |
| 1962 | 7,587,561 | 19,640,064 |
| 1963 | 6,912,350 | 23,284,599 |
| 1964 | 7,944,303 | 15,839,829 |
| 1965 | 6,995,797 | 15,220,895 |
| 1966 | 7,632,812 | 18,884,245 |
| 1967 | 10,925,122 | 18,014,992 |
| 1968 | 6,997,127 | 11,151,302 |
| 1969 | 11,287,367 | 24,376,362 |
| 1970 | 10,163,176 | 17,499,021 |
| 1971 | 5,150,137 | 16,087,364 |
| 1972 | 6,555,832 | 10,874,922 |
| 1973 | 6,916,803 | 13,482,267 |
| 1974 | 6,483,601 | 13,145,454 |
| 1975 | 10,585,755 | 24,139,080 |
| 1976 | 8,337,942 | 18,652,110 |
| 1977 | 13,937,426 | 27,338,219 |
| 1978 | 16,272,303 | 35,020,677 |
| 1979 | 15,728,515 | 32,222,087 |
| 1980 | 9,061,383 | 18,004,319 |
| 1981 | 9,173,593 | 16,843,285 |
| 1982 | 5,802,970 | 10,677,873 |

The highest number of waterfowl counted at one time in the Peoria and La Grange pools for each fall from 1977-1982 are presented in Table 23. Peak waterfowl numbers averaged 325,075 for the Peoria Pool and 517,670 in the La Grange Pool for these 6 years.

From 1976-1978, a hectare of water in the Illinois Valley during the fall provided an average day of use for 1,337 waterfowl and 196 coots with Peoria Pool contributing an average of 908 waterfowl and 120 coot use-days and La Grange Pool 1,862 waterfowl and 267 coot use-days (Havera et al., 1980:7-2). During the spring migration, the 1976-1978 hectare density of use-days for both dabbling and diving ducks and geese was 285 for Peoria Pool and 840 for La Grange Pool.

This comparison of the waterfowl use between fall and spring emphasizes the greater importance of the Illinois Valley to many species during the fall. In addition, an average of 16,875,818 waterfowl use-days occurred between spring and fall migration during the winters of 1976-77, 1977-78, 1978-79 in the Illinois Valley.

Data collected by the Illinois Natural History Survey indicates the importance of summer and fall water levels on the production and availability of duck food plants, and in turn their effect upon fall duck populations (Bellrose et al., 1979). Aquatic plants have virtually disappeared from the backwater lakes of the Illinois Valley as a result of sedimentation. The increasing accumulation of sediments has resulted in increased turbidity through the agency of waves and

Table 23. Peak numbers of ducks censused in the Peoria and La Grange pools during fall migration from 1977-1982. Dates for the peak numbers are in parentheses.

| Year | Peoria Pool | La Grange Pool |
|---|---|---|
| 1977 | 399,130 (17 Nov) | 659,485 (11 Nov) |
| 1978 | 456,660 (29 Nov) | 892,285 (29 Nov) |
| 1979 | 487,920 (7 Nov) | 767,905 (7 Nov) |
| 1980 | 217,180 (3 Nov) | 293,300 (3 Nov) |
| 1981 | 228,155 (7 Dec) | 271,995 (1 Dec) |
| 1982 | 161,405 (4 Nov) | 221,050 (6 Dec) |
| Mean | 325,075 | 517,670 |

fish that readily resuspend the flocculent bottom materials (Jackson and Starrett, 1959). Marsh plants, especially those that produce seed for waterfowl food, have also greatly declined (Bellrose et al., 1979). Thus, during the last two decades and into the foreseeable future, moist-soil plants have assumed and will play increasingly important roles in the duck food resources of the Illinois Valley.

To varying degrees, the abundance of the species of dabbling ducks is determined by the availability of moist-soil plant foods (Bellrose et al., 1979). The abundance of moist-soil plants is regulated by low water in midsummer, and the availability of their seeds to ducks is governed by water levels that are slightly above normal during the fall. Therefore, any increase in water levels during the critical development and growth period of moist-soil plants (about 10 July-1 October) would be detrimental to the abundance of the most important species of waterfowl.

In an earlier study, Bellrose et al. (1979) found that the abundance of certain species of waterfowl was correlated with the availability of native food resources. Among dabbling ducks, the size of fall populations of mallards, pintails (Anas acuta), green-winged teal (A. crecca), and wigeon (A. americana) was related to the occurrence of wetland plants. Diving duck numbers were not correlated with the wetland plant abundance. Their populations catastrophically decreased in the

mid-1950's following the disappearance of fingernail clams (Musculium transversum) from the waters of the Illinois Valley (Mills et al., 1966). For unknown reasons, fingernail clams have not recovered. Correspondingly, diving duck numbers have not regained their former abundance.

About one-third of the water areas within the floodplain are subject to low-water management by private duck clubs and state and federal conservation agencies. Low levees prevent small rises in the river level from inundating mud flats and their moist-soil plant beds during the growing season. These shallow impoundments are flooded during the hunting season in late October, November, and early December, by a foot or more of water provided by springs or pumping to make the moist-soil plant seeds available to waterfowl.

Because at the present time about two-thirds of the hectares of lake basins are not protected by small levees, their water levels are regulated entirely by those of the river. A decline in levels during the summer followed by a slight rise during the fall is advantageous to waterfowl. The "normal" seasonal change in river levels almost follows this regime (Figures 2 and 5).

The loss of moist-soil plant resources by untimely high water levels would be particularly detrimental to dabbling duck populations during the fall. Pintails, green-winged teal, and blue-winged teal numbers would decline drastically. The abundance of mallards, the most important duck in the Illinois Valley, would also decrease, but not to the extent of other dabblers because mallards obtain up to half of their food requirements from waste grain gleaned in harvested corn fields. The remainder of their diets is derived largely from moist-soil plant resources. However, there has been a steady decline in the amount of waste corn available to mallards because of an increase in fall plowing, a practice that turns under most of the waste grain, thus placing more importance on moist-soil plants to mallard populations.

Diving duck numbers should not be adversely affected by an increase in summer and fall water levels from diversion. They feed primarily on animal life that might not change greatly in abundance with an increase in water levels. Canada geese (Branta canadensis) and snow geese (Chen caerulescens) feed almost entirely in fields, thus utilizing little of the native food plant resources. Therefore, their abundance would not be influenced by any change in water levels.

Waterfowl Harvest

The success in the harvest of waterfowl in an area is dependent upon the size of the waterfowl population utilizing that locality. Generally, the better the habitat and food conditions, the larger the number of waterfowl that will use the area.

A direct approach to an economic estimate of the value of waterfowl in the Peoria and La Grange pools is through a consumptive use approach of the harvest of waterfowl. However, bagged waterfowl are only part of the total value of the recreational experience which also includes exposure to natural surroundings, exercise, or other intangible aesthetic factors (Hammack and Brown 1974:15). Thus, bagged waterfowl provide a minimal monetary estimate.

The U.S. Fish and Wildlife Service (1982:23) estimated that approximately 4.13 million hunters spent about 33.8 million days pursuing ducks and geese in the United States. The Illinois Valley is a key migratory area for the international waterfowl resource in the Mississippi Flyway. In 1978, an estimated 7.34 million waterfowl were harvested in the Mississippi Flyway by an estimated 826,675 hunters (Voelzer et al. 1982:81). In Illinois alone, waterfowl hunting is an annual multimillion dollar business. In 1981, Anderson (1983) estimated that the average waterfowl hunter in Illinois spent $462 on supplies, travel,

equipment, and other related items each year to hunt waterfowl. This results in an estimate of approximately 26 million dollars spent in 1981 by about 55,500 people in Illinois for hunting waterfowl, or $54.31 for each bird harvested.

The estimated average of the annual hunter effort and harvest of waterfowl including geese and coots for the study areas, all private clubs, and all public areas from 1977-1981 as recorded on the registers required by the Illinois Department of Conservation are presented in Table 24 for Peoria and La Grange pools. Not all private waterfowl hunting clubs complete their records annually as required and often the kill is not recorded accurately. In addition, the U.S. Fish and Wildlife Service estimates the annual duck harvest by county for 10-year intervals. These federal estimates are respected as an index to the duck harvest. As is shown in Table 24, the federal estimates of ducks harvested annually in the Peoria and La Grange pools are about twice the number of ducks, geese, and coots recorded as harvested on Illinois Department of Conservation registers.

By using the value of $54.31 per bird harvested for waterfowl in Illinois by Anderson (1983), a minimal estimate of the economic value of waterfowl hunting can be generated for the selected study areas and the Peoria and La Grange pools (Table 24). At the Henry and Marshall County study areas, the annual

Table 24. Average annual hunter effort, waterfowl harvest, and value of harvested waterfowl at the selected study areas, all private hunting clubs, and all public areas in Peoria and La Grange pools as recorded on Illinois Department of Conservation records from 1977-1981, and the U.S. Fish and Wildlife Service estimated duck harvest for the counties in the Peoria and La Grange pools, 1966-1975.

| Area | Number of Hunter-trips | Waterfowl Harvest | Estimated Value[a] of Harvest |
|---|---|---|---|
| | | PEORIA POOL | |
| Henry | 372 | 618 | $ 33,564 |
| Marshall County | 1,961 | 1,168 | 63,434 |
| 118 Private Clubs[b] | 9,707 | 20,493 | 1,112,975 |
| 3 Public Areas | 4,998 | 4,061 | 220,553 |
| Sum of Private and Public Areas | 10,205 | 24,554 | $1,333,528 |
| Federal Estimate | --- | 51,025 | $2,771,168 |
| | | LA GRANGE POOL | |
| Grand Island | 180 | 823 | $ 44,697 |
| Sanganois | 2,622 | 2,731 | 148,321 |
| 87 Private Clubs[b] | 5,500 | 11,006 | 597,736 |
| 5 Public Areas | 7,467 | 6,495 | 352,743 |
| Sum of Private and Public Areas | 12,967 | 17,501 | $ 950,479 |
| Federal Estimate | --- | 34,863 | $1,893,410 |

[a] Based on $54.31 per bird harvested (Anderson 1983).

[b] Average number of waterfowl clubs during 1977-1981 that completed required harvest registers. Not all waterfowl clubs comply each year.

value of waterfowl harvested averaged $33,564 and $63,434, respectively (Table 24). At the Grand Island and Sanganois areas, the average value of waterfowl harvested annually was estimated to be $44,697 and $148,321, respectively. For Peoria Pool, an estimated annual average of 10,205 hunting trips resulted in a minimal expenditure approximation of 1.33 to 2.77 million dollars for harvesting waterfowl (Table 24). In La Grange Pool, an annual average of 12,967 waterfowl hunting trips resulted in approximately 0.95 to 1.89 million dollars expended for harvesting waterfowl. As mentioned previously, these values do not include many of the intangible, nonconsumptive, aesthetic values associated with waterfowl hunting, the economic importance of resting and feeding areas to the multitudes of waterfowl that use the habitat provided by the public and private areas, nor the value to a variety of vertebrate species that utilize the habitats provided by the public and private areas.

From conversations with club caretakers and owners, many of the major private duck clubs have operating budgets of $50,000 to $60,000 per year. Many clubs have an entry fee of over $15,000 to join the club as a member and annual dues ranging between $1,000 and $3,000 per year. In addition, dues do not include hunting equipment, meals at the club, room fees,

gasoline, or other associated costs. As a result, many of the clientele of the major duck clubs are prominent citizens. A large segment of duck clubs rent memberships to hunters on an annual basis for an average of $800 to $1,000. The hunter at these clubs then provides all equipment or supplies necessary for hunting and is only guaranteed a place to hunt. The waterfowlers who cannot afford to hunt at the private clubs often hunt at the public areas where membership fees are not required and only a location to hunt is furnished. Consequently, the harvest of waterfowl per hunting effort is much lower on public than on private areas (Table 24).

The economics of waterfowl hunting in the Illinois River valley are related to the habitat provided by the public and private areas. If the habitat does not provide adequate food resources, then ducks do not stay for their normal duration in the valley, population numbers decline, and hunting success is reduced. Thus, the importance of low-water conditions during approximately 10 July to 1 October for the exposure of mud flats and establishment of a productive moist-soil plant community and management of impoundments is directly associated with the economics of waterfowl hunting. The largest economic impact resulting from both Diversion Plans 1 and 2 would be the reduction in the moist-soil plant seed production and

corresponding reduction in waterfowl population numbers and harvest in Peoria and La Grange pools (Table 21).

Fur Harvest

The marsh, scrub-shrub, and forest communities of the Illinois River valley support a viable fur resource. The primary species in the fur harvest are muskrats, minks, and raccoons which comprise approximately 90% of the harvest and 88% of the pelt value (George Hubert, Illinois Department of Conservation, personal communication). Other fur species include red and gray foxes, coyotes, and opossums (Didelphis marsupialis).

The average annual harvest of muskrats, minks, and raccoons and the value of their pelts for the 12 counties in Peoria and La Grange pools are presented in Table 25 for the 1979-1981 period. The Illinois River valley is the dominant influence on the fur industry in these 12 counties because the majority of the available habitat is associated with the bottomlands. For the 1979-1981 period, the pelt values for these 3 species averaged approximately 1.31 million dollars in Peoria and La Grange pools (Table 25). Increasing this value by 12% to include foxes and other species, the average annual pelt value approaches 1.48 million dollars in these counties. Average prices per pelt for this period were $5.72 for muskrats, $18.83 for minks, and $22.47 for raccoons. The fur harvest also provided an average annual number of 189,524 recreation days for trapping and 61,290 for hunting (Table 25).

Table 25. Estimated average annual numbers of muskrats, minks, and raccoons harvested, the approximate value of the pelts, the numbers of fur trappers and hunters, and the numbers of trapping and hunting recreation days for the 12 counties in Peoria and La Grange pools, 1979-1981.[a]

| Species | Average No. Harvested Annually | Average Dollar Value of Pelts | Average Annual No. of Trappers | Hunters | Average Annual No. of Recreation Days Trapping | Hunting |
|---|---|---|---|---|---|---|
| Muskrat | 43,879 | 250,988 | 2,646 | | | |
| Mink | 2,222 | 41,840 | 2,308 | | | |
| Raccoon | 45,147 | 1,014,453 | 2,627 | 6,129 | | |
| TOTAL | 91,248 | 1,307,281 | 7,581 | 6,129 | 189,524 | 61,290 |

[a] Data provided by George Hubert, Illinois Department of Conservation, Furbearer Biologist.

Any adverse effects on the marsh, scrub-shrub, and forest communities such as changing the species composition or reducing the diversity of plant species resulting from increased water levels generated by Diversion Plans 1 or 2 (Table 21) could decrease the carrying capacity of important fur species in these habitats. This would lead to lower numbers in the populations of species whose fur have value and, consequently, to a reduced fur harvest. Plan 1 and Plan 2 would have similar impacts ranging from none to minor in the marsh, scrub-shrub, and forest communities in Peoria Pool (Table 21). In La Grange Pool, Plan 2 would have little effect on these communities, but Plan 1 would have a minor impact on the scrub-shrub and forest communities (Table 21).

Harvest of Other Wildlife Species

The bottomlands of the Illinois River valley are rich in other species pursued for sport hunting. In 1980, sport hunting was enjoyed by 17.4 million hunters aged 16 and older who spent 330 million days in the field costing an average of $490 annually per hunter or $26 per day (U.S. Fish and Wildlife Service 1982:20). In Illinois during 1980, 417,000 hunters 16 years and older spent 8.3 million days and 37.3 million dollars pursuing game animals (U.S. Fish and Wildlife Service 1982:105,106). Approximately 90% of Illinois hunters

participated in harvesting small game such as rabbits (Sylvilagus floridanus), squirrels, or bobwhite (Colinus virginianus) which occur in the river valley bottomland forest and agricultural areas (U.S. Fish and Wildlife Service 1982:102). Deer hunting is also popular in the bottomland habitats. Expenditures for small game hunting and big game hunting, such as deer, have been estimated at $11 and $25 per day, respectively (U.S. Fish and Wildlife Service 1982:21). Thus, although the Illinois Valley is rich in waterfowl tradition, the habitat provided by the duck clubs also supports a viable economic interest in other game species. The population densities of many of these species, such as squirrels, rabbits, and deer, are dependent upon the quality of the bottomland forest community. Consequently, water levels resulting from Plans 1 and 2 that affect the forest resource will also influence these game species.

## Forest Resources

Aside from the importance of bottomland forest as habitat to a host of vertebrate and invertebrate fauna, the value of the timber itself is noteworthy. Havera et al. (1980:5-21, 5-22, 5-23, 5-26, 5-27, 5-28) found the following ranges of values of bottomland timber per hectare at the study areas: Henry, $807-$876; Marshall County, $704-$1,245; Grand Island, $857-$928; and Sanganois, $913-$1,469. The prices for

the timber value of the primary bottomland tree species varies periodically, but generally the trend has been upward for the monetary value of timber. Johnson (1978:601) estimated that the best stands in bottomland forests are increasing in value at a rate of $124 or more per hectare annually based on 1978 prices. The composition of the bottomland forest community is governed by the frequency, duration, and depth of flooding with frequency and duration being the most important (Fredrickson, 1978). Accordingly, Plan 1 water levels would have the most impact of the diversion plans evaluated on the structure of the bottomland forest communities in the Peoria and La Grange pools and could result in some minor changes in species composition. Plan 2 would have a more limited effect than Plan 1 but could still have a minor impact on the forest community in upper Peoria Pool and a minor impact to some degree in the La Grange Pool (Table 21).

Nonconsumptive Wildlife Use

In 1980, 288 million nonconsumptive users of wildlife aged 16 and older took trips of at least 1.6 km from their home primarily for the purpose of observing, photographing, or feeding wildlife (U.S. Fish and Wildlife Service 1982:30). Nonconsumptive wildlife-associated recreational activities in the United States resulted in expenditures totaling 14.8 million dollars in 1980 (U.S. Fish and Wildlife Service 1982:31).

According to the U.S. Fish and Wildlife Service (1982:109-115), in the east north-central section of the United States which includes Illinois, approximately 6.1 million nonconsumptive users of wildlife aged 16 years old and older spent an average of about $139 per year or $10 per day during 1980 on this form of recreation. Considering the habitats and wildlife species important to the Illinois River valley, 81% of the 6.1 million nonconsumptive users visited forests, 32.5% visited wetlands, 55.4% visited stream-sides, 66% photographed, observed or fed songbirds, 77.3% enjoyed waterfowl, 23.5% concentrated on shorebirds, 76% were interested in squirrels and chipmunks (Tamias striatus), 55% followed deer, and 60% concentrated on rabbits (U.S. Fish and Wildlife Service 1982:112, 113). A study of the value of Michigan wetlands determined that nonconsumptive recreation resulted in an average annual participant expenditure of $215 or about $25 per recreation day (Jaworski and Raphael 1981:446), about $15 per day more than the amount estimated by the U.S. Fish and Wildlife Service. The Recreation Technical Section of the Upper Mississippi River Conservation Committee (1982:8) mentioned that a reasonable factor for the "multiplier effect" of recreational expenditures in a local community was 1.5. Therefore, for every dollar spent by a recreationist in a community, the local economy is benefited by $1.50.

Nonconsumptive wildlife use is economically important to the Illinois River valley and the interest in this form of recreation is increasing. Any detrimental effects to mud flats, forests, or other communities resulting from increased water levels generated by the implementation of Plans 1 or 2 (Table 21) would correspondingly lower the populations of shorebirds, waterfowl, songbirds, and mammals, thus potentially providing fewer opportunities for nonconsumptive recreation.

# RECOMMENDATIONS

The effects of increased water levels resulting from various diversion schemes are most critical for terrestrial and wetland habitats during the growing season of plants which generally occurs in the Illinois Valley from about 1 May through 15 October. During this period, any water levels that inundate marsh, scrub-shrub, or forest habitats for a longer period of time or greater depth than would occur under actual conditions present potential stress to the floral communities. Because the diversity, density, and general condition of the fauna in the various habitats are directly related to the quality of the flora, differences in water levels generated by various diversion rates affect the populations of animal species that have ecological as well as economic significance.

The Illinois River valley is a major migration area for waterfowl. Considering the well-being of the international waterfowl resource and the associated economic impacts not only in the Illinois Valley but elsewhere in the Mississippi Flyway, it is imperative that water levels are not increased over ambient levels by diversion schemes during the critical period of mud flat exposure and moist-soil community establishment and maturation from approximately 10 July to 1 October. The food produced by moist-soil communities or domesticated plants such

as Japanese millet (Echinochloa frumentacea) sown on mud flats require a minimum growing period of 70 days. The amount of food produced by natural moist-soil communities and by areas intensively managed for waterfowl in impoundments along with waste grain in agricultural fields governs the duration of stay and population numbers of a variety of waterfowl species. Naturally-occuring water levels during the 10 July to 1 October period would also benefit the marsh, scrub-shrub, and forest communities. As a general principle for limiting any detrimental impacts on the terrestrial habitats and associated wildlife populations caused by increased diversion plans, increases in diverted water during the growing season of plants from approximately 1 May to 15 October should be avoided or limited if at all feasible.

If increased diversion plans are implemented and detrimental impacts occur to the public and private areas supporting wildlife habitat in the Illinois Valley, some avenues for determining partial mitigation are available. Impacted areas should be investigated individually. Because approximately two-thirds of the private duck clubs in Peoria and La Grange pools rely on natural river conditions for the production of waterfowl food, higher water levels during critical periods could influence food conditions and, therefore, affect waterfowl harvest. Monetary adjustments for decreased

waterfowl hunting success or loss of hunting opportunity can be approached by examining harvest records and costs of managing and operating the hunting facility. Financial aid in the construction of impoundments with water control used to manage for waterfowl foods could alleviate some problems of higher river levels resulting from increases in diverted water during the period of about 10 July through 1 October. Levee construction and maintenance, rip-rapping, and pumping costs for water control should be considered. For those areas with impoundments that incur negative impacts from higher river levels resulting from increased diversion, economic evaluations could include raising levee heights, repairing damages to levees, and reimbursement for increased pumping costs for water control.

Any detrimental effects of increased water levels resulting from increased diversion rates on various wetland and terrestrial habitats could also be investigated through (1) any changes in the harvest of small game, deer, and furbearers; (2) any decline in nonconsumptive wildlife recreation; and (3) any change in the value of timber in the forest community.

# SUMMARY

Investigations of any potential effects of Diversion Plans 1 (7,000 cfs), 2 (5,500 cfs), and 3 (variable flow) on terrestrial habitats of privately- and publicly-owned areas in Peoria and La Grange pools were conducted. Projected average water levels from Plan 1 and Plan 2 had some potentially negative impacts on various habitat communities whereas any effects on the different types of habitat examined by water levels generated by Plan 3 did not appear to differ from ambient river conditions (Table 21). The habitat category that would be affected the most by projected Plan 1 and Plan 2 water levels on all 4 study areas examined is the mud flat community. This habitat is especially sensitive to water levels because of the rather shallow, platter-shaped bottoms of the lateral lakes. Small increases in the elevation of river levels inundate large areas of mud flats. The mud flat habitat is critical to the Illinois River valley because, given proper river levels allowing exposure for at least a 70-day period between 1 July and 1 October, mud flats are colonized by moist-soil plants. The moist-soil plant community provides food for thousands of waterfowl that use the Illinois Valley as a major migration area each fall. In addition to the value of the moist-soil community to the general welfare of the international waterfowl resource,

the sport hunting of waterfowl is an annual multimillion dollar enterprise in the Illinois Valley. The largest economic impact resulting from both Diversion Plans 1 and 2 would be the reduction of the amount of food produced by the moist-soil plant community and a corresponding decrease in waterfowl populations. Waterfowl harvest, as well as nonconsumptive recreation associated with the mud flat, moist-soil plant complex such as observing waterfowl and shorebirds, would therefore be reduced.

Projected river levels resulting from Plan 1 and Plan 2 would have similar impacts ranging from none to minor in the marsh, scrub-shrub, and forest communities in Peoria Pool (Table 21). In La Grange Pool, Plan 2 projected water levels would have little effect on these communities, but projected levels resulting from Plan 1 would have a minor impact on the scrub-shrub and forest communities. Any detrimental effects on the marsh, scrub-shrub, and forest communities resulting from Plan 1 or Plan 2 water levels would directly influence the economics of the harvest of furbearing mammals and nonconsumptive wildlife recreation. The bottomland forest community is of particular importance because of the diversity of fauna that it supports such as small game and big game species of economic value as well as avifauna for nonconsumptive wildlife recreation. In addition, the value of timber itself is significant. Plan 1 water levels would have the most impact of the Diversion Plans evaluated on the structure of the bottomland

forest communities in the Peoria and La Grange pools and could result in some minor changes in species composition. Plan 2 could have a minor impact on the forest community in upper Peoria Pool and a minor impact to some degree in the La Grange Pool.

Impacts on the flora and fauna of terrestrial habitats of the Illinois River valley resulting from increased rates of diverted water can be minimized if the amount of water diverted during the growing season of plants extending from approximately 1 May to 15 October is limited or if diversion is avoided. Of particular significance is the absence, if at all possible, of any increase in diverted water for at least a 70-day period between 1 July and 1 October for maximum mud flat exposure and subsequent development of moist-soil plant communities.

Mitigation for possible damages to private and public areas used for consumptive and nonconsumptive wildlife recreation resulting from increases in the amount of diverted water could include monetary adjustments for any decreases in the harvest of waterfowl, waterfowl hunting opportunity, harvest of furbearers, harvest of small game and deer, timber value of forests, and nonconsumptive recreational usage.

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