

1993 Annual Water Management Plan

Mark Twain National Wildlife Refuge
Wapello District
Wapello, Iowa

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Wapello District
Mark Twain National Wildlife Refuge
1993 Annual Water Management Plan

1992 Management Summary

For the first time in three years, moist soil management was accomplished on the Louisa Division of Mark Twain. The previous two year's floods, due to the Iowa River levee break, made moist soil management goals impossible to achieve. This year's weather fluctuations again added to the challenge, with record droughts (May and June) and record rainfalls (July and November) occurring. Water management objectives were achieved slightly later in the year than the 1992 plan indicated. This was due to our wet spring. These rains also delayed our cropland management for Louisa. Drought conditions in early summer enhanced normal soil drying rates and permitted us to plan corn and soybeans. May and June registered as 100-year drought records. Planted crops suffered from drought and heat stress.

In spite of the early drought conditions, moist soil vegetation prospered. Vegetation transects were not conducted on the moist soil units, but visual observations were made of dominant species in most units during June, July and August. The poorest species of smartweed, Polygonum amphibium, Polygonum hydropiperoides, Polygonum pennsylvanicum, dominated the Fox Pond impoundments (units 2,3,4,5) to the exclusion of other moist soil plants. Weather conditions made mechanical manipulations possible this year; Units 3 and 4 were mowed in late June and early July. We tried burning the mowed vegetation in Unit 4 on July 6, but not enough fuel was available to carry a hot fire. River bulrush, Scirpus fluviatilis, continues to spread in Units 4 and 5, and was noted in Unit 8 this year as well. The burn was an attempt to set back the progression of this aggressive species. The manipulations we were able to complete considerably aided the diversity of moist soil plants in Units 3 and 4. Nutsedge, Cyperus spp., spikerush, Eleocharis spp., wild millet, Echinochloa spp. and ammannia, Ammannia coccinea, were noted in August. Moist Soil Units 1 and 8 have the greatest variety of moist soil plants on the refuge. Nodding smartweed, Polygonum lapathifolium, grew throughout Moist Soil Unit 7 and the surrounding field. However, water levels in this unit are unreliable, as they are dependent to some extent upon high water levels in Moist Soil 6 and Fox Pond, and also run-off. Therefore, winter wheat was planted in and around this unit for goose browse.

Waterfowl use of the refuge decreased from 1991's numbers. Freak weather patterns in 1991 pushed large concentrations of waterfowl south in one fell swoop. Numbers returned to "normal" in 1992. Mild weather all fall allowed birds to migrate at a leisurely pace, and peak numbers on Louisa were not realized until the third week of November. Cold weather soon followed, and by December 8, most impoundments were frozen. Fox Pond, Moist Soil Units 1 and 8 received most use by waterfowl during the fall migration. Unfortunately, peak water levels were not achieved in Moist Soil Units 2, 3, 4 and 5 until December 1; therefore, these units received minimal waterfowl use by comparison. Waterfowl were forced to use the ditches between units until, and as water began to spread into the units.

Most of the water level gauges on the Louisa Division moist soil units are not set at mean sea level (MSL), nor is there a relation between the gauge reading and the known MSL low pool levels. They only provide a relative water reading from unit to unit. Gauges located on Fox Pond, Prairie Pocket, the Mississippi River, and at the inlet ditch are set to mean sea level. One management goal for 1993 is to set all gauges in each unit to mean sea level. On the Keithsburg

Division, the gauge on the river side of the water control structure is set to MSL, but an adjustment factor is required for the gauge on the refuge pool side of the structure. This, too, is on the agenda for correction in 1993.

Water levels in Fox Pond, and, therefore, Units 2 through 7, are somewhat dependent upon water levels in Lake Odessa, the adjoining state wildlife management area. In past years, the Iowa Department of Natural Resources has attempted to draw down Lake Odessa after July 4. This late draw down is due to heavy public pressure to maintain high water levels for summer recreational boating. Following draw down, they aerially seed Japanese millet onto exposed mudflats. Due to the previous two year's floods this practice was impossible. This year as they began drawing down the area in July, heavy rains forced them to close their outlet gates as the Mississippi River levels rose, back-flowing into Lake Odessa. Bill Ohde, IDNR Biologist, has found that abundant amounts of Walter's millet, Echinochloa walterii, grows naturally on their area, and does not plan to continue aerially seeding Japanese millet. He would like to draw-down the Lake at an earlier date to promote diversity in moist soil plants, but public pressure may lead to the continuation of late draw downs. We work in a cooperative spirit with Bill and his crew at Lake Odessa, with regard to our draw down and fall flooding schedule for Louisa. Manipulations of stoplogs and inlet tubes becomes a weekly chore during fall migration when we are trying to add water to the refuge, and the state area wants more water for waterfowl season. Hopefully, with the implementation of the Environmental Management Plan (EMP) Habitat Rehabilitation and Enhancement Project (HREP) on the Louisa Division, some of these adjustments to our water control management will be eliminated.

Following these narrative descriptions is a map of both the Louisa and Keithsburg Divisions. Water levels and vegetation evaluation are documented on attached forms and in narrative.

Fox Pond Water Impoundment

Fox Pond and the surrounding moist soil units (2, 3, 4 and 5) will be addressed with only two separate evaluations: one for Fox Pond itself, and one for Units 2, 3, 4 and 5. Water levels in each of these units cannot be controlled independently; all are completely dependent upon water levels in Fox Pond. The soil structure in these units, predominantly Coland-Perks-Lawson complex and Ambraw loam, is moderately to rapidly permeable, precluding individual water control.

Water levels remained moderately high in Fox Pond through May. Heavy evaporation through May and June's drought aided our draw-down efforts. We began pumping water out of Fox Pond on June 25 in order to reach our approved draw-down level, 532.00. Over 5" of rain was recorded in just the first 2 weeks of July, negating our draw down attempt. Water levels fluctuated between 531.62 and 534.00 from July through October 1, as we struggled to maintain approved water levels through heavy summer and fall rains. Many benefits were gained from the draw down. Shorebirds and wading birds quickly found and made use of the mudflats and shallow water areas during late July and early August. Large amounts of rough fish became meals for turkey vultures, crows, hawks, raccoons and other scavengers, as water levels decreased. And, finally, moist soil plant production along Fox Pond's shoreline appeared to respond favorably, producing Polygonum, Bidens, and Echinochloa. Fall waterfowl response to shallow water areas and the flooded timber along the northern border of Fox Pond was tremendous.

Moist Soil Units 3 and 4 were mowed in late June and early July to promote diversity in moist soil plants. All Fox Pond impoundments are predominantly Polygonum amphibium, and P. hydropiperoides, to the exclusion of nearly everything except river bulrush, Scirpus fluviatilis. An attempt to burn part of Moist Soil Unit 4 was only partially successful, as fuel was not heavy enough to carry a good fire. The burn was aimed at slowing the spread of river bulrush.

Following the summer rains, it appeared our manipulations were fruitful, as a diversity of moist soil vegetation appeared throughout both units, particularly Unit 3. The floods of 1990 and 1991 and burning some bulrush in 1992 have slowed the progress of this species to some extent. However, Unit 5 has an abundance of the plant and mechanical manipulation will probably be necessary for control. Vegetative response in all units will continue to be monitored in 1993.

Moist Soil Unit 1 (MS1)

Moist Soil 1 had one of the widest varieties of moist soil vegetation on the refuge, and, as a result, received heavy waterfowl use throughout the year. Ducks, geese, coots, herons and egrets all used the area. Water levels never reached 532.0, the approved low water level during the summer; however, water was only located in the unit's ditches. Plant species noted in July included Eleocharis spp., water plantain, Alisima plantago-aquatica, arrowhead, Sagittaria latifolia, Echinochloa, rice cutgrass, Leersia oryzoides, Polygonum spp., cocklebur, Xanthium strumarium, Cyperus spp., partridge pea, Cassia fasciculata, Scirpus fluviatilis, Ammannia coccinea, and beggarticks, Bidens spp..

The dike between MS1 and Fox Pond is in serious disrepair. Water flows freely between the two units, as a gaping hole continues to erode. In addition, the water control structure between the units appears to be nearly full of mud and should be rehabilitated or replaced with a new structure.

Moist Soil Unit 6 (MS6)

Water levels in MS6 are dependent upon the fluctuations of Fox Pond. A levee with a screwgate control separate MS6 and Fox Pond, but seepage between these two units controls water levels as much as the screwgate. MS6 remained dry 7 months of the year, only shallowly filling with spring and fall rains. Winter wheat was planted near the unit to encourage waterfowl use between the field and MS6, but little waterfowl use was noted. Bidens and Polygonum spp. were the predominant plants in the unit.

Moist Soil Unit 7

Winter wheat was planted through this area in 1991, providing goose browse during fall migration. This winter wheat was planned for harvest and re-seeding on the refuge until the grass matured in spring 1992, and was found to be mostly rye! As a result, our contract farmer mowed and baled the rye/wheat mixture, allowing us to re-seed winter wheat in August. Water levels remained below gauge in this unit 10 months of 1992; however, soil in the lowest portion of the unit remained moist, producing hydrophytic vegetation, mainly Polygonum spp., with some Cyperus. Shorebirds and geese were primary users of MS7.

Moist Soil Unit 8 (MS8)

MS8 is located between MS1 and Goose Pond, with road/levees separating the three areas. Heavy waterfowl use in this unit has been noted the past two fall migrations. Plant diversity is most likely responsible for the abundance of mallards, black ducks, blue and green-winged teal, gadwall and wigeon drawn to MS8. River bulrush was noted during vegetation observations in June and July. Further monitoring of this aggressive plant will be necessary to determine if it is spreading in this productive unit.

Heavy rains in November forced water from MS8 northward, into the adjoining cropfield, flooding beans and corn. Ducks made full use of this available water lane and food source.

Moist Soil Unit 9 (MS9)

Moist Soil Unit 9 also remained dry the majority of the year. Due to elevations on the refuge it is one of the last units to flood; water levels did not reach the gauge until November 2. In fall 1991, MS9 received heavy waterfowl use. Considerably less use was noted this fall. Shorebirds were observed taking advantage of mudflats in MS9 on May 18. Vegetation growing in this unit includes spikerush, smartweed and ammannia. MS9 and the adjoining cropfield were mowed in June; Canada geese browsed and loafed in the area during the summer.

Moist Soil Unit 10 (MS10)

Water levels in MS10 are controlled by a pond in the southwest corner of the unit which holds water year-round. During periods of heavy rain, the pond fills first, pushing water into MS10. As a result, this unit remained dry most of 1992. There is a water control structure located at the northeast corner of this impoundment; however, it leaks badly, and seems incapable of holding water at required levels.

Limited waterfowl use was noted in this area during fall migration compared to 1991. Smartweed is the dominant plant species throughout MS10.

Prairie Pocket

Prairie Pocket is a permanent lake containing deep water. Water levels remain fairly stable throughout the year. Prairie Pocket is not managed as a moist soil unit. Seepage from the Mississippi River and precipitation are the main sources of water for Prairie Pocket. No analysis of submergent plants was performed this year. There is some concern for regeneration of bottomland timber along the north shore of Prairie Pocket, and an attempt to lower this unit may aid in seedling regeneration.

Water depths in Prairie Pocket are unknown; it is thought there may be spots 15' deep, but average 2-3'. This unit receives moderate recreational fishing pressure during the summer, and has had commercial fishing parties remove rough fish in past years. It receives little waterfowl use. Occasionally, Canada geese, wood ducks and mallards are observed loafing on the area. It is hoped that we might electrofish Prairie Pocket this summer to sample fish populations.

McNeil Marsh

Our newest Louisa moist soil unit was created by force account and completed in September. An approximately 40-acre moist soil unit was established, removing a cropfield from production. Located on the northern Louisa boundary, the McNeil Marsh will have both flooded timber and open vegetated areas. The unit is naturally leveed on the north by the Michael Creek levee, and a 2300' dike was created to form the west and south boundaries. The created dike then hooks back into the Michael Creek levee at the southeast corner of the unit. Water sources for McNeil Marsh include precipitation and Muscatine Slough. It may prove difficult to lower water levels some years, as we have no control over water levels in Muscatine Slough. This part of the refuge is directly connected to Lake Odessa, therefore, regulated by the state.

Keithsburg

Our main concern at Keithsburg is the lack of regeneration of bottomland timber throughout the entire unit. High water levels the past several years have

affected seedling regeneration, and many dead mature trees have been noted during waterfowl surveys. Keithsburg was drawn down this summer below the approved level of 11.3, to 10.00, in an attempt to save trees and promote reproduction. Excellent moist soil vegetation responded to the draw down efforts.

Waterfowl use of this unit was tremendous, although down from 1991's figures. Gadwalls, wigeons and mallards were the most populous species noted during fall migration waterfowl surveys. Keithsburg also offers prime wood duck habitat; these beautiful birds are seen almost year-round. Many broods were noted this spring and summer using the ditches bordering the Mississippi River levee.

Maintenance Accomplished

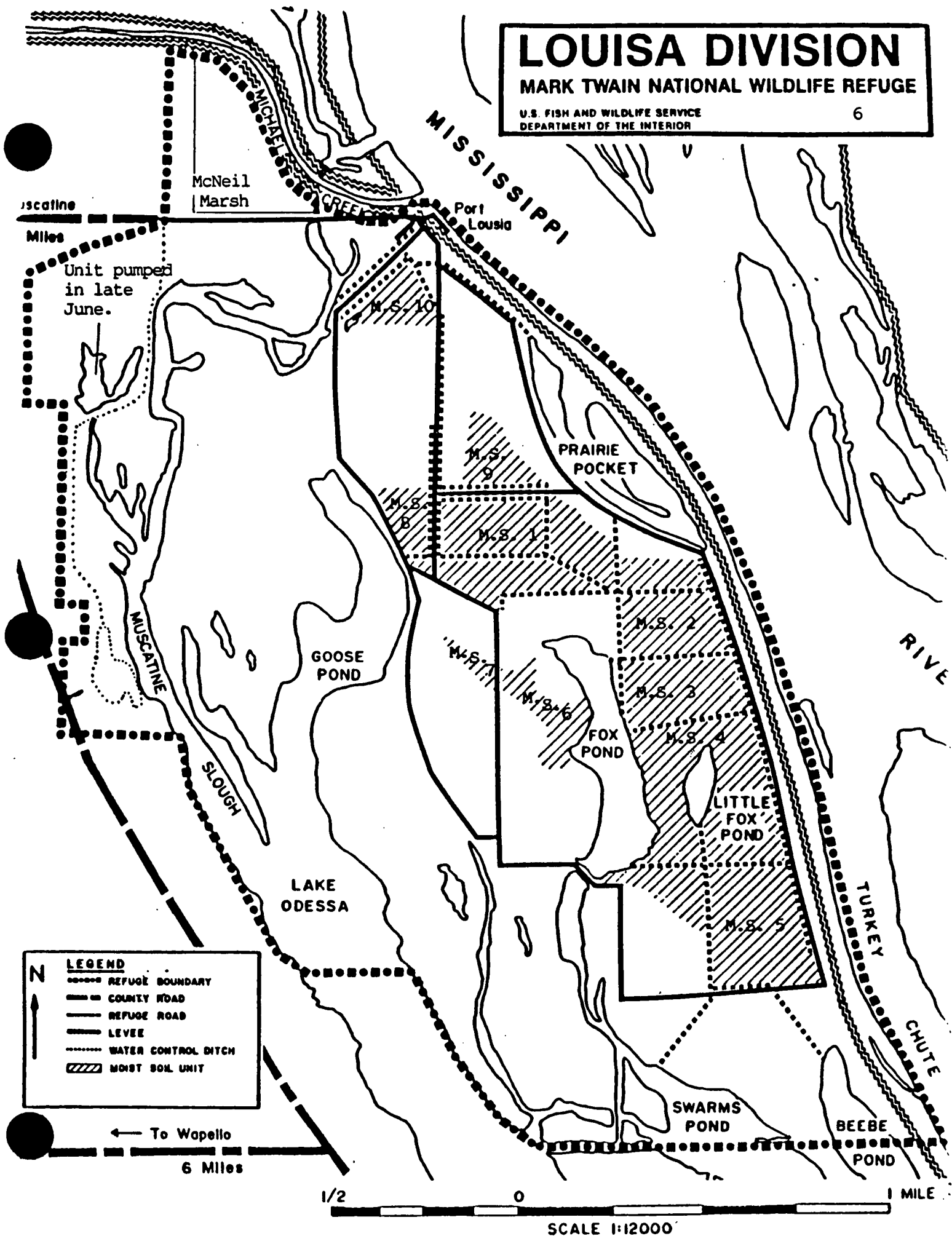
A ditch plug with a culvert and screwgate were placed in the ditch leading to Prairie Pocket. The current culvert and structure are under the road, and leak. To avoid tearing up the main internal refuge road, this ditch plug and structure were positioned in July above the existing structure.

LOUISA DIVISION

MARK TWAIN NATIONAL WILDLIFE REFUGE

U.S. FISH AND WILDLIFE SERVICE
DEPARTMENT OF THE INTERIOR

6



KEITHSBURG DIVISION

MARK TWAIN NATIONAL WILDLIFE REFUGE 7

U.S. FISH AND WILDLIFE SERVICE
DEPARTMENT OF THE INTERIOR

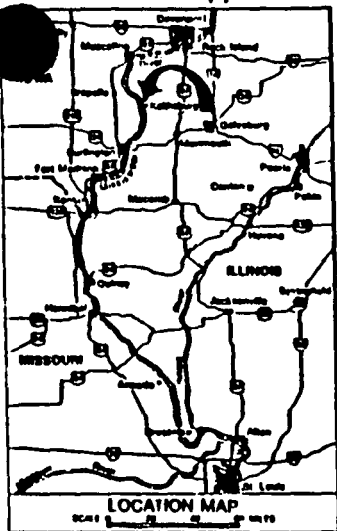
OWA

ILLINOIS

17A

To Keithsburg
1-1/2 Miles

POPE



MISSISSIPPI

RIVER

Slough

Spring

LEGEND

- REFUGE BOUNDARY
- == PAVED ROAD
- GRAVEL ROAD
- LEVEE
- WITH ROAD
- P PARKING
- NR BOAT RAMP

SCALE 1:12000



0 1 MILE

Annual Water Management Plan
Mark Twain National Wildlife Refuge

Unit Fox Pond

8

Maximum Pool Elev. 537.0

General Pool Bottom Elev. 531.0

Unit Acreage 65

Drain Structure Elevation 532.0

Late Drawdown 1989

Vegetation Mgmt. & Year Flood 1990

Flood 1991

Planned Elevation for <u>1992</u>			Actual Elevations for <u>1992</u>	
Date(s)	Elevation	Reasons	Elevations	Reasons
Jan. 1-31	536.0-536.5	Hold water at 536.5-537.0 if waterfowl are still using area, otherwise lower to protect dikes and road during freeze.	No readings taken, area is frozen.	
Feb. 1- Mar. 31	536.5 537.0	As soon as thaw, fill and hold for spring migration.	February - 534.40 - 535.10, Fox Pond opening up. March - 535.05 - 535.98, ice out; river is very high.	
Apr. 1-30	537.0 532.0	Drawdown for start of farming and max. MS production.	April - 536.0 - 536.28 Water levels rising, over two inches rain through month. Waterfowl using unit.	
May 1- Aug. 31	532.0	Keep water level down until completion of wheat planting.	May - 536.70 down to 535.10 Maximum spring level 5/8 is 536.72. Iowa DNR opens outlet gates to lower water levels in Lake Odessa on May 14. Duck pairs observed.	
Sept. 1-15	532.5	Begin gradual reflooding.	June - 534.28 down to 534.10 May and June, record 100-year drought helping with drawdown. Outlet gates closed June 2. Began pumping water out June 25.	
Sept. 16- Nov. 10	533.0	Continue re-flooding at 6" increments. Have max. MS habitat available during peak migration.	July - 534.0 down to 531.62 Continued pumping throughout month to try staying ahead of record rainfalls. Shorebirds, herons, ducks using mudflats. Reached desired levels, 532.0 or less, on 7/9, 7/17, and 7/21. Outlet gates opened 7/9, closed 7/14.	
Nov. 11- Dec. 15	537.0	Maintain maximum water levels while used by waterfowl.	August - 532.0 - 533.68 Iowa DNR releases water beginning August 3. Continue pumping periodically through August. Shorebirds using mudflats.	
Dec. 16-31		Lower at appropriate time to protect roads and dikes.	September - 532.38 - 534.3 Periodic pumping out to achieve desired levels. Over 3" rainfall 9/9.	

(continued on following page)

MARSH AND WATER MANAGEMENT PLAN - ANNUAL MSU EVALUATION

MSU # Fox Pond YEAR 19 92

VEGETATIVE TRANSECT DATE N/A

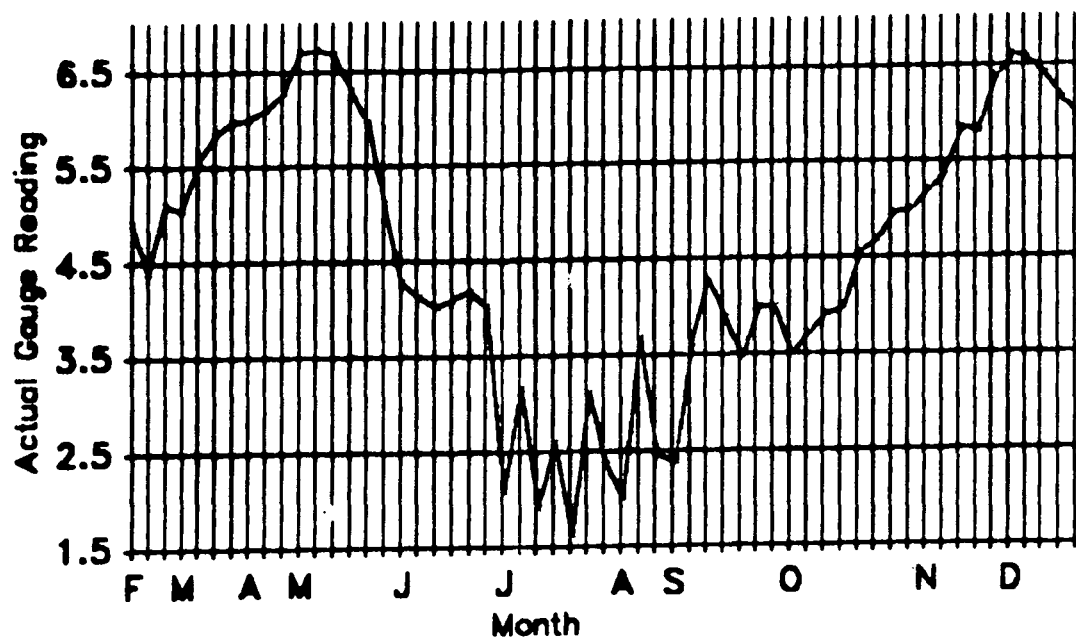
DOMINANT VEGETATION %

_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

Fox Pond, 65 acres

Fox Pond was drawn down in 1992, but no vegetative analyses were made, other than casual observations of Cyperus spp. and Polygonum spp. growing around the perimeter.

SKETCH



WILDLIFE USE

	Use Days*	% Change from 19 ⁹¹
Ducks	<u>1,043,657</u>	<u>4.5 ↑</u>
Geese	<u>178,328</u>	<u>29 ↓</u>
Thr. spp.	_____	_____
Other migr.	_____	_____
WF Prod.	_____	_____

Annual Water Management Plan
Mark Twain National Wildlife Refuge

Unit Fox Pond (continued)

Maximum Pool Elev. _____ General Pool Bottom Elev. _____

Unit Acreage _____ Drain Structure Elevation _____

Vegetation Mgmt. & Year _____

Planned Elevation for _____			Actual Elevations for _____	
Date(s)	Elevation	Reasons	Elevations	Reasons
			<p>October - 533.50 - 535.0 Pumped water out at beginning of month to maintain desired levels. Gradual water increase over month. October 17 inlet tubes opened to refuge, closed to refuge 10/22, re-diverted 10/29. Receiving heavy waterfowl use.</p> <p>November - 535.20 - 536.38 Gradual increase towards desired level. Over 6" rainfall this month. Water diverted to Lake Odessa 11/5, back to refuge 11/12. November 24 inlet tubes closed. Continued heavy waterfowl usage.</p> <p>December - 536.60 down to 535.98 Water frozen 12/8; waterfowl using unit until freeze up. Lake Odessa outlet tubes opened, water levels dropping. Outlet tubes closed 12/16; re-opened 12/28; closed 12/31/92.</p>	

Annual Water Management Plan
Mark Twain National Wildlife Refuge

Unit Fox Pond Water Impoundment
(MS 2, 3, 4, and 5)

Maximum Pool Elev.	MS 2 536.6 MS 3 535.0	General Pool Bottom Elev.	MS 2 535.0 MS 3 534.5
Unit Acreage	MS 2 35.0 MS 3 39.8 MS 4 96.0 MS 5 62.0	Drain Structure Elevation	_____
		Vegetation Mgmt. & Year	<u>See Summary</u>

Planned Elevation for <u>1992</u>			Actual Elevations for <u>1992</u>	
Date(s)	Elevation	Reasons	Elevations	Reasons
Elevations will be dependent upon Fox Pond levels. (See Fox Pond Unit Plan).			Units were lowered or flooded as Fox Pond drained or filled.	
This impoundment has only one water gauge, located at the Fox Pond pumping structure.				
Plan to obtain high water during early spring migration and fall migration.				
Feb. 1 - Mar. 31		As soon as thaw, fill and hold for maximum availability of MS habitat on MS 2-6.		
Apr. - Aug.		Drawdown to facilitate crop planting, discing of MS units, and MS plant promotion.	April Units 3 and 5 receiving waterfowl use.	
			May Duck pairs observed using Unit 3.	
			June Began pumping water out of Fox Pond. Mowed Units 3 and 4 late in month to improve moist soil plant regeneration.	
			July Completed mowing Unit 4. Attempted burning river bulrush infested area of Unit 4 following mowing. Not enough fuel available to carry a hot fire.	
			August Following heavy July rains, moist soil plant regeneration looks promising. Units 3 and 4 no longer are solid "swamp smartweed."	
Sep. 1 - Dec. 15		Gradually re-fill units to obtain highest water levels during fall migration.	September Units still dry.	
			October Water slowly backing into impoundments from Fox Pond; waterfowl observed using all units.	
			November Heavy waterfowl usage in 3, 4, and 5. Somewhat less in 2.	
			December Frozen; water receding from impoundment	

MARSH AND WATER MANAGEMENT PLAN - ANNUAL MSU EVALUATION

MSU # Fox Pond YEAR 19 92

Impoundment: Units 2,3,4,5

VEGETATIVE TRANSECT DATE visual observations

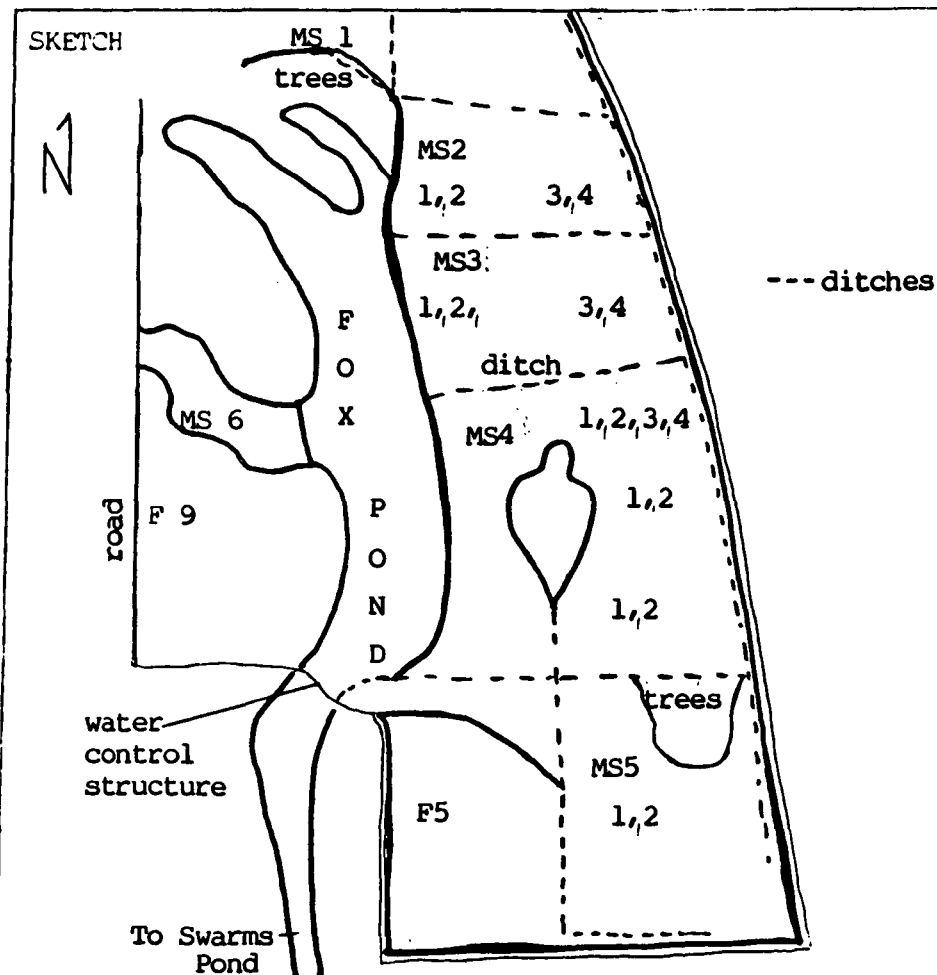
DOMINANT VEGETATION	%
<u>Scirpus fluviatilis</u> ¹	<u>25</u>
<u>amphibium</u> ²	
<u>Polygonum hydropiperoides</u>	<u>40</u>
³	
<u>Cyperus spp.</u>	<u>10</u>
⁴	
<u>Echinochloa spp.</u>	<u>5</u>

WILDLIFE USE		
	Use Days	% Change from 19 <u>91</u>
Ducks	<u>1,043,657</u>	<u>4.5 ↑</u>
Geese	<u>178,328</u>	<u>29 ↓</u>
Thr. spp.		
Other migr.		
WF Prod.		

Fox Pond Impoundment, 233 acres

No water control structures or gauges

between units.



Annual Water Management Plan
Mark Twain National Wildlife Refuge

Unit Moist Soil 1

Maximum Pool Elev. <u>536.27</u>	General Pool Bottom Elev. <u>534.8</u>
Unit Acreage <u>62.2</u>	Drain Structure Elevation <u>532.0</u>
	Vegetation Mgmt. & Year <u>Disced 1983</u>

Planned Elevation for <u>1992</u>			Actual Elevations for <u>1992</u>	
Date(s)	Elevation	Reasons	Elevations	Reasons
January		Ice covered.	No readings taken; ice covered.	
Feb.-Mar.	535.6- 536.27	Hold for spring migrants.	February - OG	Thin ice covering.
			March - OG	Open water; receiving water-fowl usage.
Apr. 1-30	536.27- 532.0	Gradual drawdown to facilitate farm program, MS plants, and repair dike.	April - OG	Heavy spring rains keeping unit full. Continued waterfowl usage.
May 1- Aug. 30	532.0	Keep water level low.	May - OG	Down to 535.64. Drought conditions begin. Duck pairs observed using unit.
			June	535.16 down to 534.74. Drought conditions continue. June 25 began pumping out Fox Pond. River bulrush growing in spotty areas.
			July	534.90 - 534.18 Continued draining following heavy rainfall.
			August	534.14 - 534.10 Could not reach maximum drawdown level due to July rains.
Sept. 1- Dec. 15	532.0- 536.27	Gradual reflooding; maximum habitat available for fall migrants.	September	534.10 - 535.12 Began filling unit.
			October	535.28 - 536.06 Average 535.62; waterfowl begin using unit.
			November	536.14 to OG; unit completely full; heavy duck use.
Dec. 15- Dec. 30	535.6	Lower slightly to protect dike.	December	OG Frozen - unable to remove boards to lower water levels.

MARSH AND WATER MANAGEMENT PLAN - ANNUAL MSU EVALUATION

MSU # 1 YEAR 19 92

VEGETATIVE TRANSECT DATE visual observations in June,

July, August

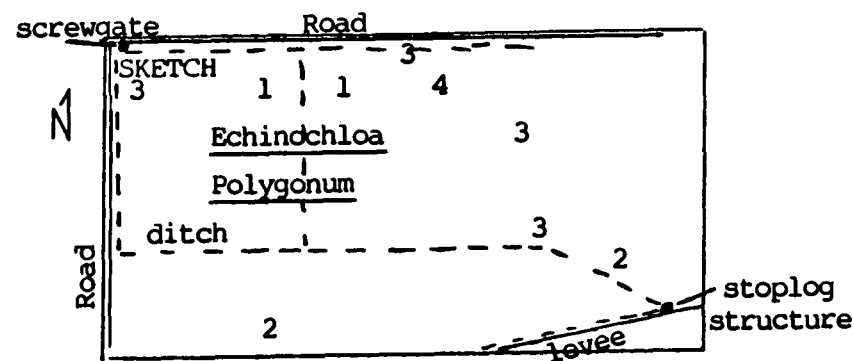
DOMINANT VEGETATION

<u>Echinochloa muricata</u> ¹	<u>25</u>
<u>Polygonum hydropiperoides</u> ²	<u>25</u>
<u>Bidens spp. (shallow areas)</u> ³	<u>20</u>
<u>Eleocharis spp.</u> ⁴	<u>10</u>
<u>Sagittaria latifolia</u>	<u>5</u>
<u>Leersia oryzoides</u>	<u><5</u>
<u>Xanthium strumarium</u>	<u><5</u>

MS 1, 62 acres

One stoplog structure

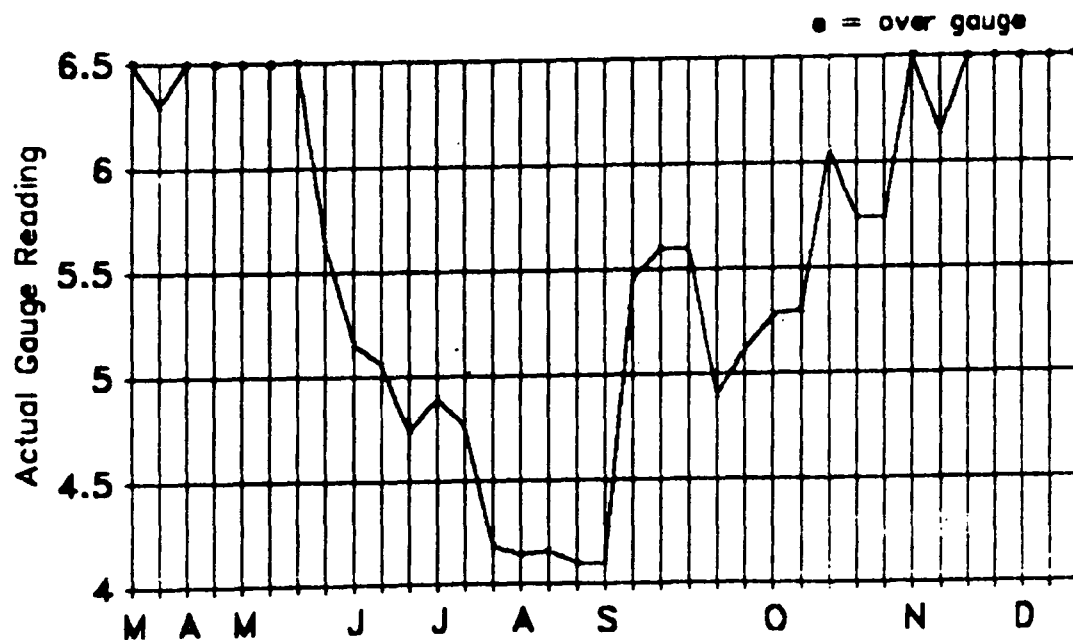
Heavy waterfowl use



WILDLIFE USE

	Use Days*	% Change from 19 91
Ducks	<u>1,043,657</u>	<u>4.5 ↑</u>
Geese	<u>178,328</u>	<u>29 ↓</u>
Thr. spp.	<u> </u>	<u> </u>
Other migr.	<u> </u>	<u> </u>
WF Prod.	<u> </u>	<u> </u>

*Note: Use Days are calculated for entire Louisa Division, not individual units.



Annual Water Management Plan
Mark Twain National Wildlife Refuge

Unit Moist Soil 6

Maximum Pool Elev. <u>537.0</u>	General Pool Bottom Elev. <u>535.0</u>
Unit Acreage <u>20</u>	Drain Structure Elevation <u>535.0</u>
	Vegetation Mgmt. & Year <u>Jap. Millet-1982</u>

Planned Elevation for <u>1992</u>			Actual Elevations for <u>1992</u>	
Date(s)	Elevation	Reasons	Elevations	Reasons
<p>Obtain and hold maximum water possible during spring and fall migrations. Drawdown in summer for MS plant production/possible crop planting.</p> <p>Water dependent on Fox Pond level.</p>			January and February - below gauge	
			March, April, and May water levels in Fox Pond are high, pushing water into MS6; 21.16 - 22.10 (not MSL); some duck usage early.	
			June and July - below gauge	
			August - below gauge. Planted 15 acres winter wheat along west edge of unit.	
			September - October - below gauge	
			November - water backing into unit.	
			December - 21.88 down to 21.48; frozen.	

MARSH AND WATER MANAGEMENT PLAN - ANNUAL MSU EVALUATION

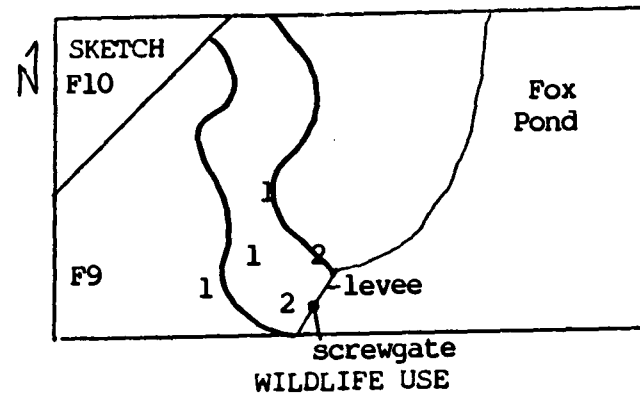
MSU # 6 YEAR 19 92

VEGETATIVE TRANSECT DATE visual observation

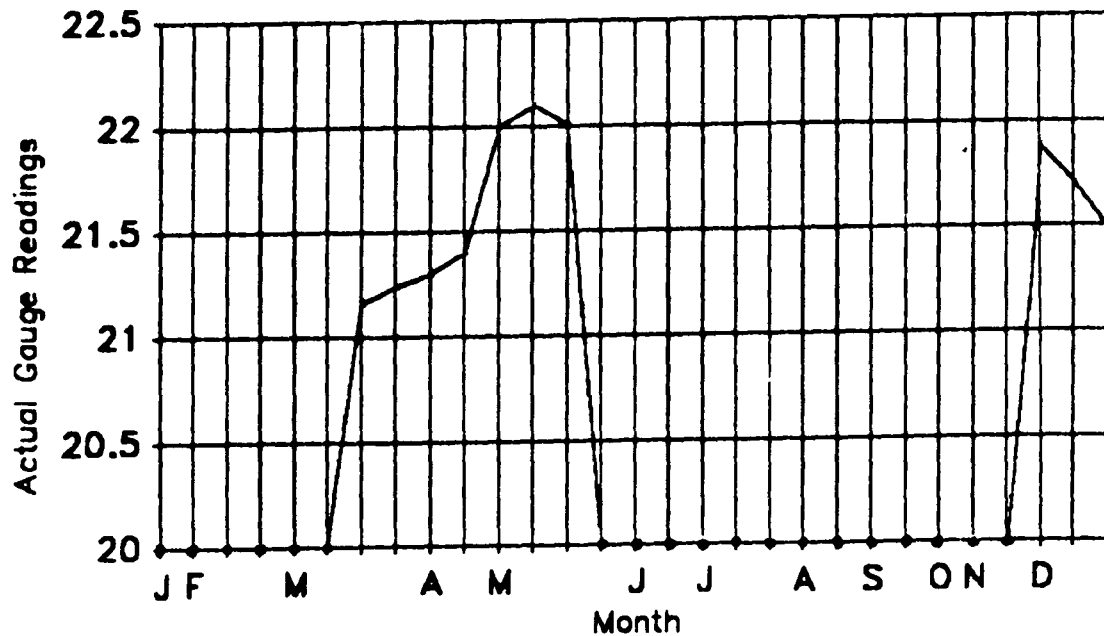
DOMINANT VEGETATION	%
Polygonum spp. (2) ¹	40
Bidens spp. ²	25

MS 6, 20 acres; one screwgate allows
water to flow from Fox Pond into unit.

Run-off also fills MS 6.



● = below gauge



	Use Days*	% Change from 19 90 <u>91</u>
Ducks	<u>1,043,657</u>	<u>4.5</u> ↑
Geese	<u>178,328</u>	<u>29</u> ↓
Thr. spp.	_____	_____
Other migr.	_____	_____
WF Prod.	_____	_____

***Note:** Use Days are calculated for entire Louisa Division, not individual units.

Annual Water Management Plan
Mark Twain National Wildlife Refuge

Unit Moist Soil 7

Maximum Pool Elev. <u>537.0</u>	General Pool Bottom Elev. <u>536.0</u>
Unit Acreage <u>15</u>	Drain Structure Elevation <u>535.5</u>
	Vegetation Mgmt. & Year <u>Buckwheat - 1987</u>

Planned Elevation for <u>1992</u>			Actual Elevations for <u>1992</u>	
Date(s)	Elevation	Reasons	Elevations	Reasons
Obtain and hold maximum water possible during spring and fall migrations. Drawdown in summer for MS plant production/possible crop planting.			February - April 16 - below gauge	
			April 22 - 20.50; heavy spring rains added water to unit.	
			May - below gauge. Duck pairs observed using shallow water in unit.	
			June - below gauge. Custom farmer cut, baled, and removed 1991 rye/winter wheat from unit and surrounding field.	
			July 9 - below gauge	
			July 14 - 20.56; brief flooding of unit during heavy rains.	
			August - below gauge. August 24 planted 15 acres winter wheat within and around unit. Nodding smartweed (<u>Polygonum lapathifolium</u>) throughout unit and field.	
			September - below gauge. Hard rain after wheat planting washed seeding out. Ducks using shallow water impoundment.	
			October - below gauge. Ducks continue using area.	
			November - water backing into unit. 20.80 November 24. Geese using area.	
			December - 20.85 - 21.17; frozen	

Water dependent on MS 6 levels.

MARSH AND WATER MANAGEMENT PLAN - ANNUAL MSU EVALUATION

MSU # 7 YEAR 19 92

VEGETATIVE TRANSECT DATE visual observation August 5, 1992

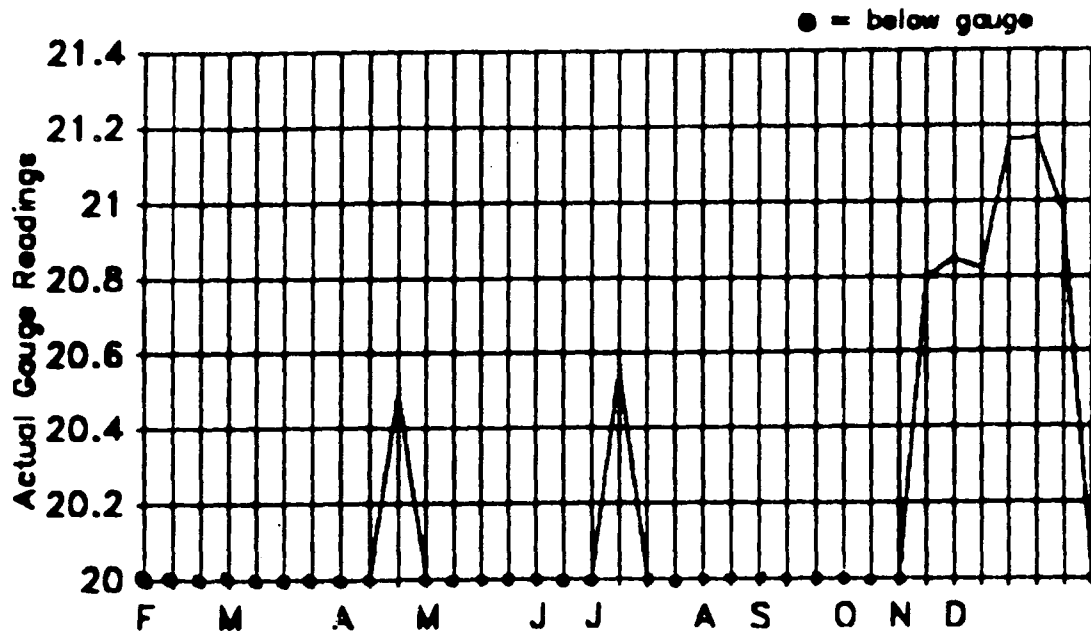
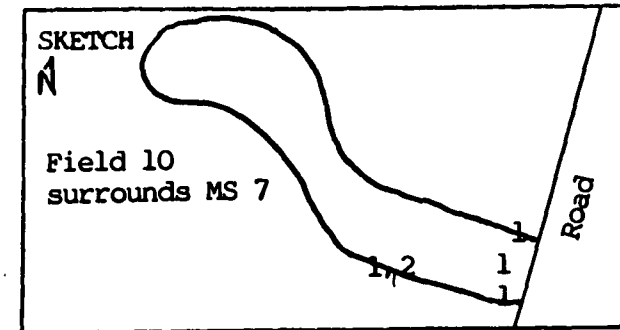
DOMINANT VEGETATION	%
<u>Polygonum spp. (3) ¹</u>	<u>25</u>
<u>Cyperus spp. ²</u>	<u>5</u>
<u> </u>	<u> </u>
<u> </u>	<u> </u>
<u> </u>	<u> </u>
<u> </u>	<u> </u>
<u> </u>	<u> </u>

MS 7, 15 acres

Shorebird and geese usage.

Winter wheat planted through unit

in 1991 and 1992.



WILDLIFE USE

	Use Days*	% Change from 1991
Ducks	<u>1,043,657</u>	<u>4.5 ↑</u>
Geese	<u>178,328</u>	<u>29 ↓</u>
Thr. spp.	<u> </u>	<u> </u>
Other migr.	<u> </u>	<u> </u>
WP Prod.	<u> </u>	<u> </u>

*Note: Use Days are calculated for the entire Louisa Division, not individual units.

Annual Water Management Plan
Mark Twain National Wildlife Refuge

Unit Moist Soil 8

Maximum Pool Elev. 537.0 General Pool Bottom Elev. 535.5
Unit Acreage 20 Drain Structure Elevation 532.0
Vegetation Mgmt. & Year Disced 1983

Gauge at (zero) bottom pool = approx. 13

Planned Elevation for <u>1992</u>			Actual Elevations for <u>1992</u>	
Date(s)	Elevation	Reasons	Elevations	Reasons
Jan.		Ice covered.		
Feb.-	14.0-	Maintain highest level possible for spring migrants without flooding Field 18.	February - below gauge	
Mar.	14.7		March 24 - 13.59, water rising.	
April	12.0- 13.0	Drawdown for crop planting in Field 18, and maximum MS plant production.	April - 13.78 - 14.04	Heavy spring rains; ducks using unit.
May- Aug.	12.0- 13.0	Maintain this low level for farming and possible discing of the unit. This may require some pumping.	May - 14.46	Down below gauge; maximum 14.48 on 5/8/92. Duck pairs observed using unit.
			June - below gauge	
			July - below gauge	Excellent moist soil plant diversity (<u>Eleocharis</u> spp., <u>Polygonum</u> spp., <u>Cyperus</u> spp., etc.)
			August - below gauge	Plant growth continues to be excellent following a very wet July.
Sept.- Dec. 15		Gradually refill to reach maximum level, 14.7-15.0 by Nov. 10, and possibly flood crop fields.	September - below gauge	
			October - below gauge	Ducks using shallow water.
			November	13.82 - 14.77 Heavy duck use.
Dec. 15-31		Lower slightly to protect roads.	December	14.39 down to 13.84; frozen.

MARSH AND WATER MANAGEMENT PLAN - ANNUAL MSU EVALUATION

MSU # 8 YEAR 19 92

MS 8, 20 acres

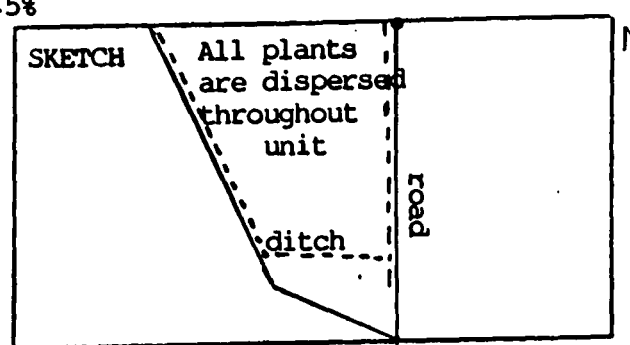
VEGETATIVE TRANSECT DATE Visual observations made in June,
July, August

Excellent moist soil plant production

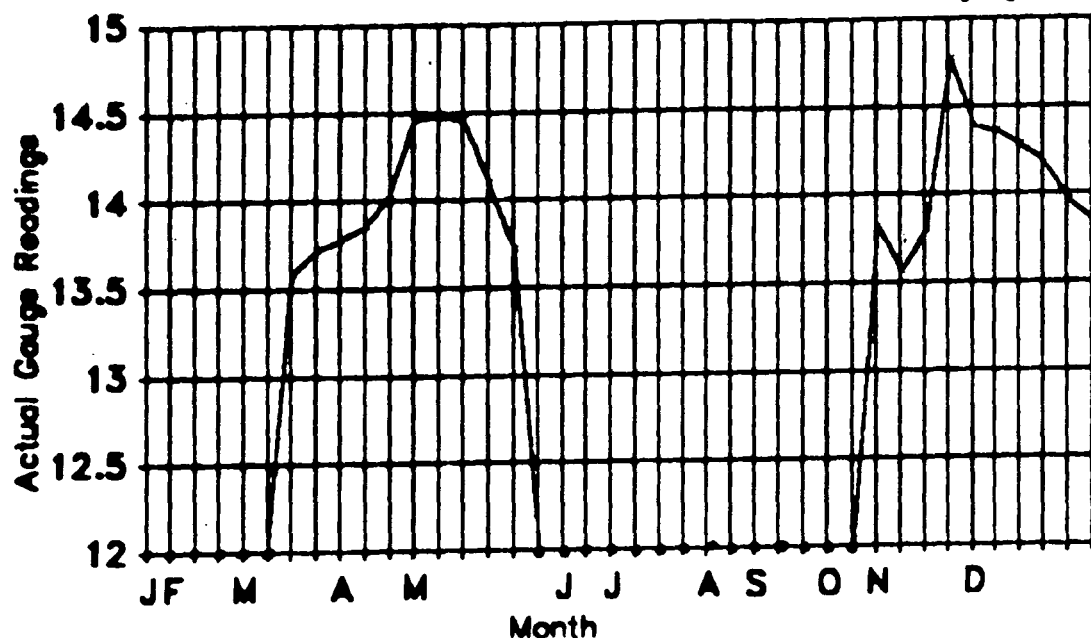
DOMINANT VEGETATION

<u>Polygonum spp. (3)</u>	<u>40</u>	<u>Sagittaria latifolia</u>	<u><5%</u>
<u>Echinochloa muricata</u>	<u>15</u>	<u>Alisma plantago-aquatica</u>	<u><5%</u>
<u>Bidens spp.</u>	<u>10</u>	<u>Ammannia coccinea</u>	<u><5%</u>
<u>Eleocharis spp.</u>	<u>10</u>		
<u>Cyperus spp</u>	<u>5</u>		
<u>Leersia oryzoides</u>	<u>5</u>		
<u>Scirpus fluviatilis</u>	<u><5</u>		

screwgate



• = below gauge



WILDLIFE USE

	Use Days*	% Change from 19 91
Ducks	<u>1,043,657</u>	<u>4.5 ↑</u>
Geese	<u>178,328</u>	<u>29 ↓</u>
Thr. spp.	<u> </u>	<u> </u>
Other migr.	<u> </u>	<u> </u>
WF Prod.	<u> </u>	<u> </u>

*Note: Use Days are calculated for entire Louisa Division, not individual units.

Annual Water Management Plan
Mark Twain National Wildlife Refuge

Unit Moist Soil 9

Maximum Pool Elev. <u>537.0</u>	General Pool Bottom Elev. <u>536.0</u>
Unit Acreage <u>15</u>	Drain Structure Elevation <u>532.0</u>
	Milo 1987
	Disced 1989

Assumed gauge: bottom pool (zero) = approx. 10.20

Planned Elevation for <u>1992</u>			Actual Elevations for <u>1992</u>	
Date(s)	Elevation	Reasons	Elevations	Reasons
Jan.		Ice covered.		
Feb.-	11.05-	Maintain maximum water for spring migrants.	February - below gauge	
March	11.40		March 24 - 10.36, water rising.	
April	11.40-10.5	Begin gradual drawdown for MS plant production and adjacent field work.	April - 10.54 - 10.80; ducks using shallow water.	
May 1-15	10.5-9.8	Drawdown completely to get entire area dry.	May - 11.26 down to below gauge. Shorebirds using exposed mudflats; duck pairs observed in unit.	
May 15-Aug. 31		Maintain drawdown.	June - below gauge	
			July - below gauge; moist soil plants growing throughout unit and surrounding field (<i>Eleocharis</i> spp., <i>Polygonum</i> spp.)	
			August - below gauge	
Sept. 1-15	10.5-10.8	Reflood slightly	September - below gauge	
Sept. 16-Dec. 15	10.8-11.7	Gradually re-flood unit to obtain maximum habitat by Nov. 10 for fall migrants.	October - below gauge; ducks using shallow water.	
Dec. 15	11.05	Lower slightly to protect road/dike.	November - 10.68 - 11.40 Water finally backing into unit. Unusually high precipitation helped. Heavy duck use.	
			December - 11.16 down to 10.59; frozen.	

*Elevation readings are actual gauge readings.

MARSH AND WATER MANAGEMENT PLAN - ANNUAL MSU EVALUATION

MSU # 9 YEAR 1992

VEGETATIVE TRANSECT DATE visual observation only

DOMINANT VEGETATION %

Polygonum spp. ¹ 40

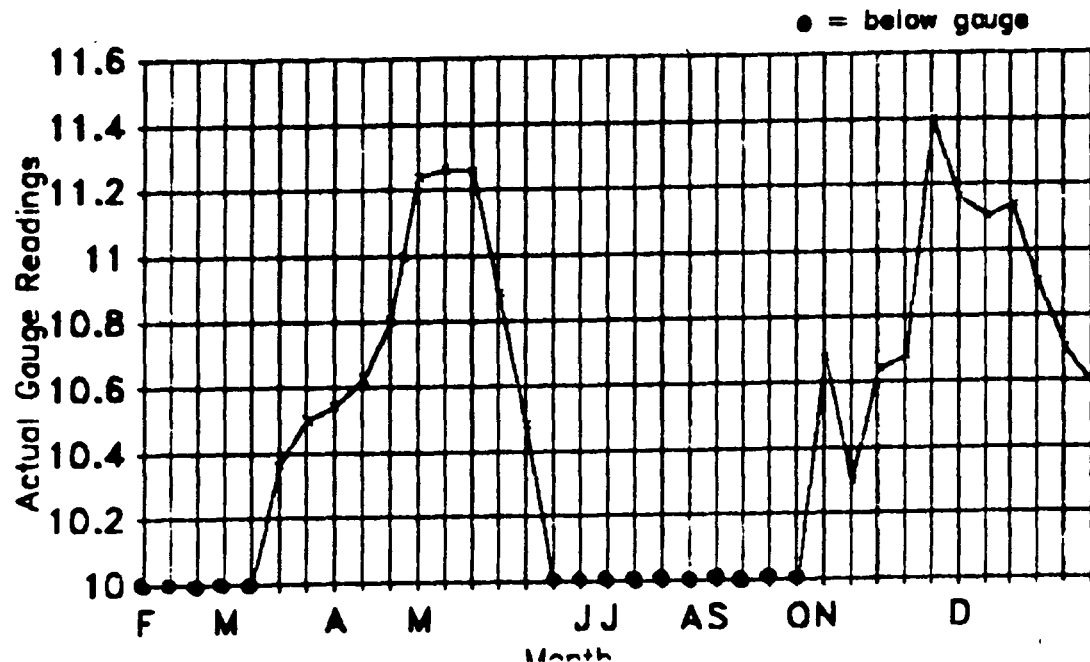
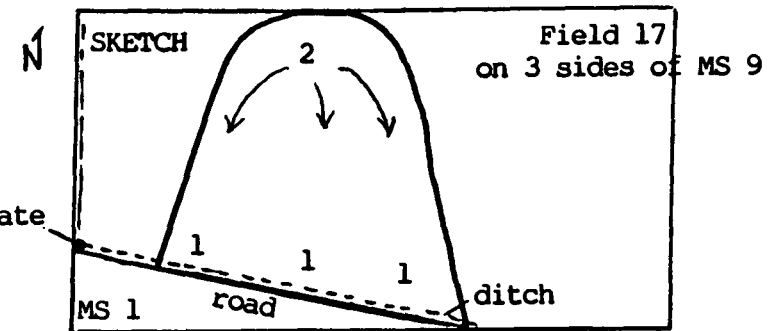
Eleocharis spp. ² 30

Amannia coccinea 5

MS 9, 15 acres

One screwgate in unit, plus run-off

fills acreage



WILDLIFE USE

	Use Days*	% Change from 1991
Ducks	1,043,657	4.5↑
Geese	178,328	29↓
Thr. spp.		
Other migr.		
WF Prod.		

Annual Water Management Plan
Mark Twain National Wildlife Refuge

Unit Moist Soil 10

Maximum Pool Elev. Unknown

General Pool Bottom Elev. Unknown

Unit Acreage 15

Drain Structure Elevation Unknown

Vegetation Mgmt. & Year Discd 1987
Mowed 1989

Planned Elevation for 1992

Actual Elevations for 1992

Date(s) Elevation Reasons

Elevations Reasons

January Ice covered.

Feb.-Mar. Maintain max.
water possible
to provide for
spring migrants.

April Drawdown of unit
for MS produc-
tion and mainte-
nance of timber.

May-Aug. Maintain draw-
down. Complete
discing and re-
placement of
water control
structure and
resetting of
gauge.

Sept.-Dec. Gradually re-
flood to maximum
water level by
Nov. 10 and
maintain for
fall migrants.

February - below gauge

March - below gauge; shallow water over
moist soil plants and through timber.

April - below gauge; shallow water over
moist soil plants and through timber.

May - 6.88 to below gauge; spring rains
in late April added water; duck pairs
observed using unit.

June - below gauge

July - below gauge

August - below gauge

September - below gauge

October - below gauge; receiving water-
fowl use in shallow water.

November - below gauge up to 8.30; con-
tinued waterfowl use, much less than
last year.

December - 6.75 down to below gauge;
frozen 12/1/92.

MARSH AND WATER MANAGEMENT PLAN - ANNUAL MSU EVALUATION

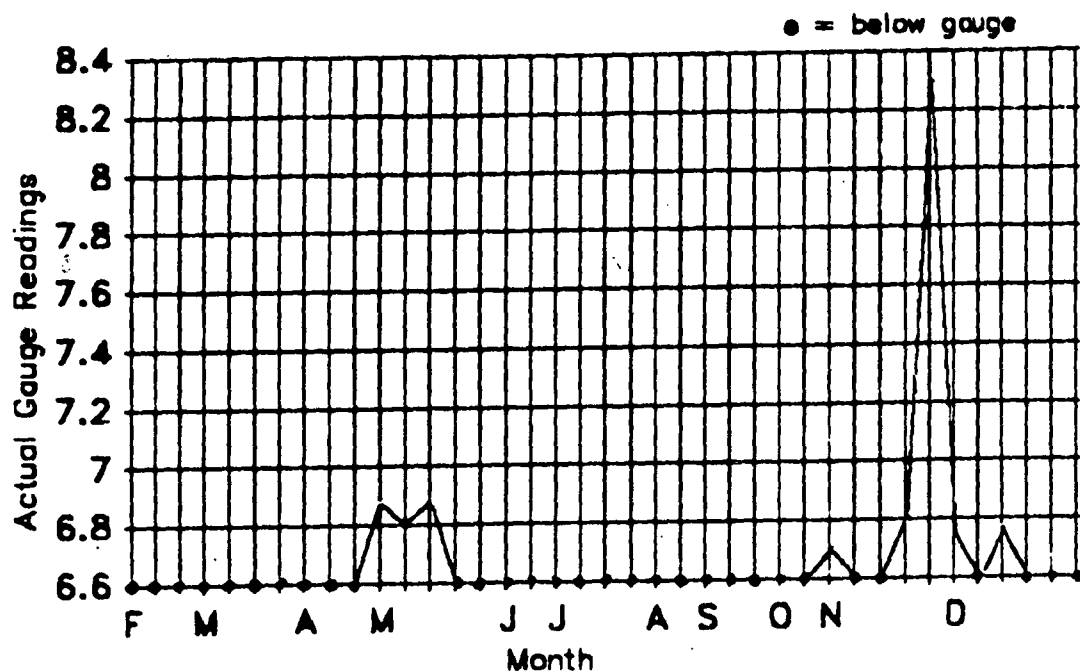
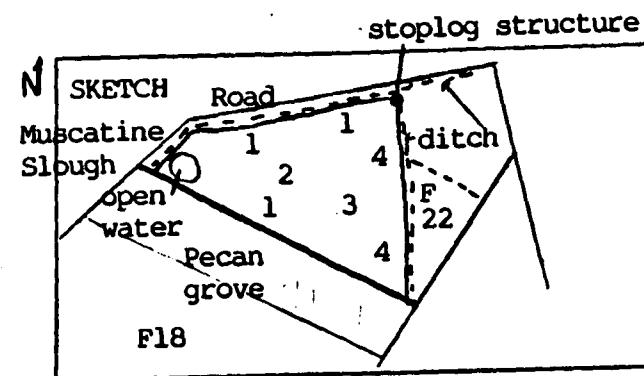
MSU # 10 YEAR 1992

VEGETATIVE TRANSECT DATE visual observations only

DOMINANT VEGETATION	%
<u>Polygonum spp.¹ (2)</u>	<u>50</u>
<u>Scirpus fluviatilis²</u>	<u>10</u>
<u>Cyperus spp.³</u>	<u>10</u>
<u>Apocynum cannabinum⁴</u>	<u>5</u>

MS 10, 15 acres

One stoplog structure



WILDLIFE USE

	Use Days*	% Change from 1991
Ducks	<u>1,043,657</u>	<u>4.5 ↑</u>
Geese	<u>178,328</u>	<u>29 ↓</u>
Thr. spp.		
Other migr.		
WF Prod.		

*Note: Use Days are calculated for entire Louisa Division, not individual units.

Annual Water Management Plan
Mark Twain National Wildlife Refuge

Unit Prairie Pocket

Maximum Pool Elev. 536.7

Unit Acreage 45

General Pool Bottom Elev. Unknown - approx. 532.0

Drain Structure Elevation 533.4

Vegetation Mgmt. & Year 1987 drawdown

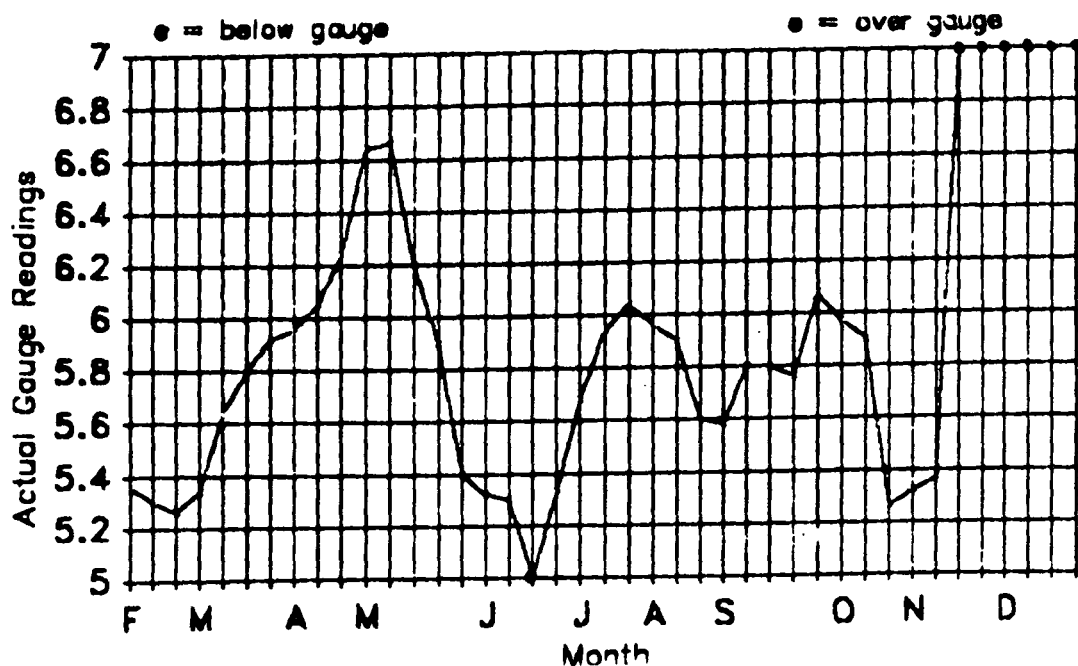
Planned Elevation for <u>1992</u>			Actual Elevations for <u>1992</u>	
Date(s)	Elevation	Reasons	Elevations	Reasons
Jan.-Mar.	536.5	Maintain fishery and water levels as high as possible.	February - 535.36 down to 535.26	
			March - 535.34 - 535.92, water rising.	
Apr.-May	535.0	Maintain stable water levels.	April - 535.96 - 536.24; heavy spring rains.	
			May - 536.64 down to 535.40; water dropping, drought conditions beginning.	
June-Nov.	535.0	Avoid seepage to surrounding grassland and cropland.	June - 535.32 down to below gauge, back to 535.33.	
			July - 535.68 - 536.04, heavy summer rains.	
			August - 535.96 down to 535.60	
			September - 535.58 - 536.08	
			October - 535.97 down to 535.26	
			November - 535.32 - over gauge; heavy fall rains.	
Dec.	536.5	Increase levels to maintain fishery.	December - over gauge; frozen as of 12/8/92.	

MARSH AND WATER MANAGEMENT PLAN - ANNUAL MSU EVALUATION

MSU # Prairie Pocket YEAR 19 91

VEGETATIVE TRANSECT DATE N/A

DOMINANT VEGETATION	%
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____



Prairie Pocket, 45 acres

This area is not managed for moist soil plant production. Water levels remain high throughout the year. Submergents were not evaluated.

SKETCH

WILDLIFE USE

	Use Days	% Change from 19__
Ducks	<u>Virtually no waterfowl</u>	
Geese	<u>usage is recorded on Prairie</u>	
Thr. spp.	<u>Pocket</u>	
Other migr.	_____	_____
WF Prod.	_____	_____

Annual Water Management Plan
Mark Twain National Wildlife Refuge

Unit Muscatine Slough

Maximum Pool Elev. Unknown

General Pool Bottom Elev. Unknown

Unit Acreage 25

Drain Structure Elevation Unknown

Vegetation Mgmt. & Year Structure in-
stalled-1987

Planned Elevation for 1992

Actual Elevations for 1992

Date(s) Elevation Reasons

Elevations Reasons

Jan. Ice covered.

No gauge on this unit.

Feb.-Mar. Maximum water held for spring migrants.

This unit is dependent on water levels on Lake Odessa State Wildlife Area.

April Begin gradual drawdown if possible with levels of Lake Odessa.

Heavy spring rains kept unit full through April.

May-Aug. Maintain lowest levels possible for MS plant production.

In May and June, drought conditions allowed water levels to drop significantly. One small portion of Muscatine Slough has been separated from its body by a refuge road. Draw down of area by pumping attempted in June. Successful rough fish kill!

Although record rainfall was recorded in July, water levels remained fairly low as the State area tried to keep their outlet gates open as much as possible.

Sept.-Dec. Gradually re-flood to obtain maximum water levels for fall migrants.

Water levels were increased throughout fall for waterfowl season.

Area is frozen by mid-December. State personnel opened gates to release water 12/7, closed 12/16, re-opened 12/28, closed 12/31.

MARSH AND WATER MANAGEMENT PLAN - ANNUAL MSU EVALUATION

MSU # Muscatine YEAR 19 92
Slough

VEGETATIVE TRANSECT DATE N/A

DOMINANT VEGETATION %

Muscatine Slough is a contiguous body
of water with Lake Odessa State Wildlife
Area. Water levels rise and fall with
the lake. This unit remains full year-round.

SKETCH

WILDLIFE USE

	Use Days	% Change from 19__
Ducks	_____	_____
Geese	_____	_____
Thr. spp.	_____	_____
Other migr.	_____	_____
WF Prod.	_____	_____

Annual Water Management Plan
Mark Twain National Wildlife Refuge

Unit Keithsburg

Maximum Pool Elev. 543.5

General Pool Bottom Elev.

Unit Acreage 431

Drain Structure Elevation 528.5

Gauge correction factor. Zero =
518.7; 10.8 factor = 529.5 MSL

Levee break - 1987
Vegetation Mgmt. & Year Drawdown from
1988-89

Planned Elevation for 1992

Actual Elevations for 1992

Date(s) Elevation Reasons

Elevations Reasons

Jan. Ice covered.

January (late) - 12.65 - 12.70

Feb.- 13.3- Maintain maximum
Mar. 13.5 water for spring
 migrants.

February - 12.72 Area is frozen early,
but thawing throughout month. February
27 opened one screwgate to release water.
Heavy waterfowl use in open areas.

March - 12.40 -13.10 Forced to close
gate as river rises. Ducks thinning out.

April 13.3- Begin gradual
 12.3 drawdown.

April - 13.18 to over gauge. Opened both
screwgates 4/14, closed both screwgates
4/20. Somewhat heavier waterfowl use
with pairs observed late in the month.

May 12.3- Complete draw-
 11.0 down.

May - over gauge down to 12.48. Opened
both gates 5/12, closed one gate 5/26.
Wood duck pairs noted.

June- 11.0 Maintain draw-
August down level for
 MS plant produc-
 tion.

June - 11.70 down to 10.40. Water still
pouring out of refuge. Tree regeneration
and mortality will be a problem. Many
wood duck broods observed.

July - 10.00 up to 11.36. Closed gate
7/7. Wood duck broods observed.

August - 11.50 - 11.60

Sept. 11.0- Begin gradual
 12.3 reflooding.

September - 11.46 - 14.40 Light water-
fowl use.

October 12.3- Continue re-
 13.5 flooding.

October - 9.86 - 11.96 Building numbers
of waterfowl using area throughout month.
Heavy usage at end of month.

Nov.- 13.6 Maintain maxi-
Dec. mum water for
 fall migrants
 and to preserve
 fishery.

November - 12.10 - 12.25 Continued heavy
waterfowl use.

December - 12.90 - 13.40; frozen.

*Elevation readings are actual gauge
readings.

MARSH AND WATER MANAGEMENT PLAN - ANNUAL MSU EVALUATION

MSU # Keithsburg YEAR 19 92

VEGETATIVE TRANSECT DATE visual observations

DOMINANT VEGETATION %
Echinochloa spp. (Wild millet) _____
Cyperus spp. (Nutsedges) _____
Eleocharis spp. (Spikerushes) _____
Nelumbo lutea (Water lotus) _____
Lycopus americanus (American bugleweed) _____
Phyla lanceolata (Fog-fruit) _____
Mimulus alatus (Sharp-winged monkey flower) _____
Ceratophyllum demersum (Coontail) _____
Cephalanthus occidentalis (Buttonbush) _____
Polygonum spp. (Smartweeds) _____
Bidens spp. (Beggar-ticks) _____
Flooded timber _____

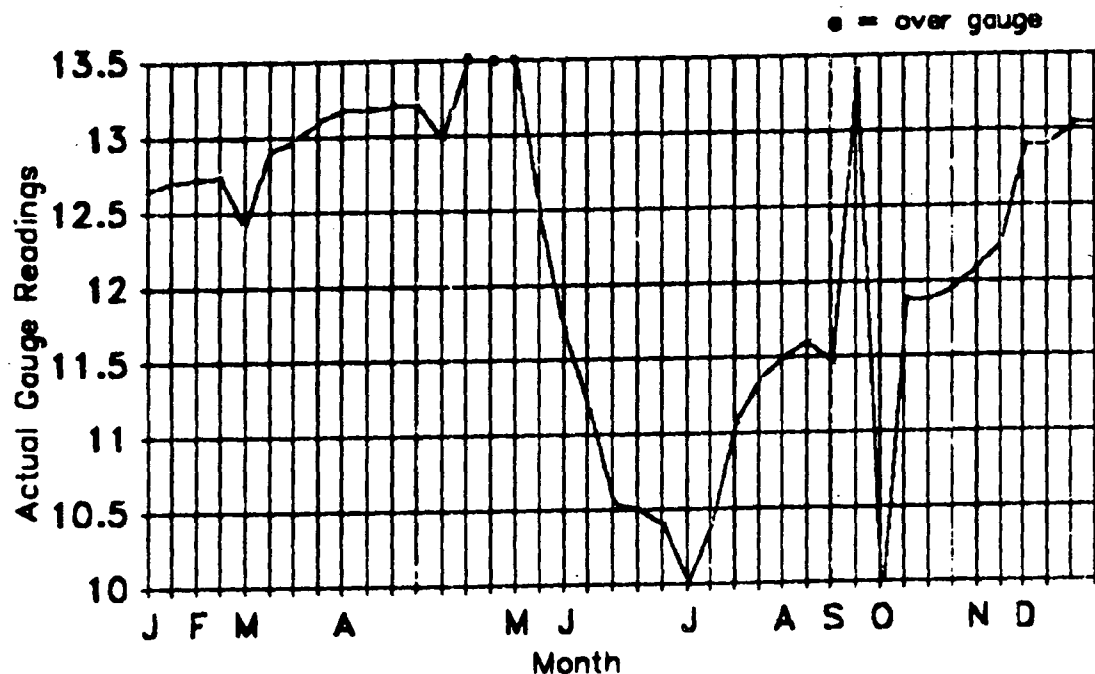
Keithsburg, 1471 acres

Water fern, Azolla mexicana, Duckweed,

Lemna spp., and Pondweeds, Potamogeton spp.

are prevalent through late summer and early fall.

SKETCH



WILDLIFE USE

	Use Days	% Change from 19 ₉₁
Ducks	1,109,590	59↑
Geese	6555	78↑
Thr. spp.		
Other migr.		
WF Prod.		

LOUISA DIVISION					BIG TIMBER DIVISION	KEITHSBURG DIVISION		OG - over gauge BG - below gauge
Date	River Pool 17 Inlet	Diversion Structure	Fox Pond	Prairie Pocket		Interior Pool (actual gauge reading, not MSL)	River Pool 18	Readings are feet from mean sea level. Remarks
January 24						12.65	12.54	
27						12.7	13.5	
February 5						12.72	10.0	Frozen but thawing.
6	6.26	4.68	4.90	5.36				Frozen but thawing.
12						12.74	BG	
20	6.43	4.90	4.40	5.30				Thin ice.
26	6.60	4.91	5.10	5.26				
27								Opened one gate at KTS.
March 2	6.30	4.90	5.05	5.34				No ice.
5						12.4	12.06	
12						12.91	12.00	Water pouring into refuge; gate closed.
17	OG	5.33	5.56	5.64				River high.
18						12.98	15.74	
24	OG	5.62	5.84	5.80				
26						13.10	14.56	
31	OG	5.76	5.98	5.92				
April 1						13.18	13.74	
8	8.28	5.80	6.00	5.96		13.18	13.26	
9						13.20	13.10	
13						13.20	12.62	
14								Opened both gates at KTS.
16	7.12	5.88	6.10	6.05				
17						12.98	12.66	
20								Closed both gates at KTS.
22	OG	6.06	6.28	6.24				
24						OG	15.3	
29						OG	17.1	
May 6	OG	6.48	6.70	6.64				
8	OG	6.50	6.72					
12						OG	13.10	Opened both gates at KTS. North gate off track.

LOUISA DIVISION					BIG TIMBER DIVISION	KEITHSBURG DIVISION		OG - over gauge BG - below gauge
Date	River Pool 17 Inlet	Diversion Structure	Fox Pond	Prairie Pocket		Interior Pool (actual gauge reading, not MSL)	River Pool 18	Readings are feet from mean sea level. Remarks
May	13	7.13	6.50	6.68	6.66			
	14							Iowa DNR outlet tubes opened.
	18	6.35	5.92	6.30	6.20			
	19					12.48	10.50	
	21	6.50	5.58	5.96	5.90			
	26							KTS - closed north gate for repair.
	28	6.36	4.80	5.10	5.40			
June	2	6.18	4.00	4.28	5.32	11.70	10.16	LSA - one inlet tube opened, IDNR gates closed.
	5	6.10	3.91	4.13				
	9					11.18	9.26	
	11	6.00	3.88	4.02	5.30			
	16					10.54	9.60	Cleaned Spring Slough culvert.
	19	6.76	4.02	4.10	BG			KTS - public closed s.g. Re-opened gate.
	22					10.50	9.30	Gate again closed by public Reopened gate.
	24					10.40	10.78	Began pumping Fox Pond.
	25	6.58	4.18	4.18	5.33			Pumped 6/29 - 7/02.
	29			4.02				
July	1					10.00	9.65	
	7					10.40	9.92	Closed gate at KTS. Inlet closed, outlet opened. Still pumping.
	9	6.38	4.10	2.08	5.68			Closed outlet.
	14	7.00	3.80	3.16	5.94	11.08	11.60	Pumped thru 7/17 24 hrs/day
	17			2.90				
	20	6.94	4.14	2.60	6.04			
	21			1.62				
	24					11.36	11.82	
	27			3.10				Pumped Fox Pond 7/27-28.
	28	6.36	4.30					
	29			2.36				Pelican and shorebird use.
August	3							Opened Iowa DNR outlet.
	5	6.12	4.20	2.00	5.96			Pumped off and on since
	10	6.35	3.29	3.68	5.90			7/31.

LOUISA DIVISION					BIG TIMBER DIVISION	KEITHSBURG DIVISION		OG - over gauge BG - below gauge
Date	River Pool 17 Inlet	Diversion Structure	Fox Pond	Prairie Pocket		Interior Pool (actual gauge reading, not MSL)	River Pool 18	Readings are feet from mean sea level. Remarks
August 11						11.50	9.76	
24	5.88	3.10	2.46	5.60				Pumped today only.
26						11.60	8.40	
September 3	6.40	3.10	2.38	5.58				
4								Inlet tubes opened.
9						11.46	9.42	
10	6.58	3.90	3.62	5.80				
22	7.56	4.26	4.30	5.80				Began pumping.
23	8.00	4.30	3.88	5.76				
24			3.46			14.40	11.85	Turned off pump.
28	7.06	4.40	4.00	6.08				
30	6.16	4.42						Pumping out.
October 1			3.50			9.86	11.90	
7	6.20	4.40	3.72	5.97		11.88	9.10	One inlet tube opened 10
13	6.58	4.50	3.92	5.90				
14	6.50		3.98					Flowing from Odessa into Fox Pond.
15						11.88	10.45	
17	6.50	4.50	4.56					2½ tube opened. Water going into refuge.
19	6.48	4.50	4.68					Water diverted to Odessa
27	6.20	4.76	4.96	5.26				
29	6.26	4.70	5.00					Water diverted to refuge
30						11.96	9.36	
November 2	6.00	4.94	5.20	5.32				
5						12.10	10.10	Water diverted to Odessa
6	6.58							
10	6.66	5.46	5.38	5.37				Water diverted to refuge
13						12.25	11.53	11/12.
16	6.40	5.62	5.84					
17	6.66		5.82					

[illegible]

1992
WEATHER DATA

Month	Precip.	Normal	Differ.	Snow-fall*	Temperature						Remarks
					Average High	Average Low	Extreme High	Date	Extreme Low	Date	
Jan.	.71	1.38	- .67		35	21	53	12	- 6	18	
Feb.	1.42	1.08	+ .34		41	27	62	4	10	9	
Mar.	1.94	2.57	- .63		51	32	73	2	15	13	
Apr.	3.13	3.98	- .85		57	39	81	16	26	6	
May	1.43	3.82	-2.39		73	48	87	17	34	7	
June	.62	4.11	-3.49		81	57	90	18	43	21	
July	12.09	4.42	+7.67		79	64	89	14	53	6	
Aug.	1.81	3.86	-2.05		78	57	93	10	46	16	
Sept.	5.35	3.51	+1.84		73	52	85	16	34	29	
Oct.	.75	2.76	-2.01		64	41	83	4	20	23	
Nov.	5.75	1.75	+4.00		42	36	58	17	21	29	
Dec.	1.96	1.67	+ .29		35	21	45	16	- 2	25	6" snowfall December 10
Annual	36.96	34.91	+2.05		59	41	93	Aug. 10	- 6	Jan. 18	

*Our weather reports from Lock and Dam 17 did not record snowfall data.

1993 Water Management Plan

The Louisa Division will always be influenced by water levels of the Mississippi River. Seepage through the main river levee is a constraint on our ability to manage refuge pools. In addition, river levels determine when we can gravity flow water into or out of the refuge. Coupled with our desire to lower or raise water levels at different times than the state of Iowa, and our dependency upon their inlet and outlet tubes, water management on this division remains a major challenge.

Water management strategies will continue to be implemented on Louisa as outlined in previous years.

- 1) Water management (i.e., draw downs, flooding) should not be the same year after year. Alterations in water levels and dates will maximize the benefits to the resource.
- 2) Water levels should not be the same on all units at the same time during migration. Varying water levels will benefit a wider variety of species.
- 3) Draw down and re-flood units as slowly as possible.
- 4) Provide a variety of food sources, i.e., hydrophytic vegetation, row crops, browse material, open water, flooded timber.

Due to the variability of water sources and weather patterns affecting Louisa, much of the above-listed strategies can be accomplished to some degree.

The 1993 Water Management Plan for Louisa Division will be somewhat similar to 1992's approved plan. Due to the 1990 and 1991 floods, the area was virtually unmanageable. 1992 provided a respite from the flooding and allowed most units to be drawn down. This year, an earlier slow draw down is planned to begin in April, if possible. An early draw down will not only promote moist soil vegetative growth, but allow the adjoining cropfield to dry out for planting. Additionally, the sooner the moist soil units dry out, the sooner mechanical manipulations can begin in them.

The Keithsburg Division will also be slowly drawn down in 1993. We continue to receive criticism from the State of Illinois Fisheries personnel regarding this practice, but feel it is necessary to avoid potential bottomland habitat destruction. It is also difficult to maintain low water levels due to fluctuations of the Mississippi River and naturally occurring flowing springs within the Keithsburg unit. A draw down beginning in April will benefit moist soil vegetation, and hopefully allow seedling regeneration to occur. Keithsburg will be re-flooded for fall migration.

Maintenance considerations for 1993:

- Set Keithsburg water gauge to mean sea level on the pool side.
- Fix screwgate at Keithsburg (gate is off-track).
- Fabricate and install a beaver deterrent gate on the Spring Slough culvert at Keithsburg Division.
- Burn Keithsburg levee.
- Burn, mow or cut willows near Spring Slough, Keithsburg Division.
- Set water gauges to mean sea level on moist soil units, Louisa Division.
- Install a new water control structure on MS10.
- Repair MS1 dike; replace stoplog structure on MS1.
- Mow MS2, MS5 and MS10. Disk MS5 and MS10.

Long-term maintenance considerations:

- Lower the pumping unit at Keithsburg for better water management control.
- Continued evaluation of needed dike repairs and rehabilitation on the Louisa moist soil units.
- Clean out west ditch on MS5 to improve flooding and draw-down efficiency.
- Clean out ditch from Prairie Pocket south to MS2.

The following pages give unit water level management objectives for 1993.

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Unit Fox Pond

Maximum Pool Elev.	<u>537.0</u>	General Pool Bottom Elev.	<u>531.0</u>
Unit Acreage	<u>65</u>	Drain Structure Elevation	<u>53.0</u>
		Late drawdown 1989	
		Vegetation Mgmt. & Year	<u>Flood 90,91</u>
		Drawdown 1992	

Planned Elevation for <u>1993</u>			Actual Elevations for _____	
Date(s)	Elevation	Reasons	Elevations	Reasons
January	535.0 - 536.0	Frozen		
February	536.0 - 536.5	Maintain high water levels for spring migrants.		
March	536.5 - 536.0	Maintain water levels early in month, begin lowering late in month.		
April	536.5 - 535.5	Continue lowering water levels preparing for crop input, moist soil plant production, and timber maintenance/regeneration.		
May	535.5 - 534.5	Gradual water reduction.		
June	534.5 - 532.0	Complete draw down and maintain low water levels.		
July	532.0	Maintain draw down.		
August	532.0	Maintain draw down for shore-bird use.		
September	532.0 - 533.0	Gradually allow water into unit maximizing invertebrate production and shore-bird usage.		
October	533.0 - 534.5	Continue flooding Fox Pond gradually.		
November	534.5 - 537.0	Maximize flooding throughout month for peak fall migration.		
December	537.0 - 536.0	Lower water to protect roads and dikes from freeze/thaw effects.		

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		Unit Fox Pond Impoundment MS 2, 3, 4, 5			
Maximum Pool Elev.	MS 2	536.6		MS 2	535.0
	MS 3	535.0		General Pool Bottom Elev.	MS 3 534.5
Unit Acreage	MS 2	35.0		Drain Structure Elevation _____	
	MS 3	39.8		Vegetation Mgmt. & Year <u>See summary</u>	
	MS 4	96.0			
	MS 5	62.0			

Planned Elevation for <u>1993</u>			Actual Elevations for _____	
Date(s)	Elevation	Reasons	Elevations	Reasons
Individual units have no water gauges. Water levels are dependent upon Fox Pond levels (see Fox Pond Unit plan). Only water gauge is located at Fox Pond pumping structure.				
Jan. - March 31		Maintain maximum water levels for spring migration (water level in Fox Pond 535.0 - 536.5).		
April		Draw down units for vegetation manipulations.		
May		Complete drawdown in moist soil units and allow to dry for mechanical vegetation management.		
June		As soon as conditions allow mow units 2 and 5. Disk unit 5.		
July		Complete vegetation mgmt.		
August		Maintain dry units; complete vegetation mgmt. if weather conditions have not previously allowed.		
September		Fox Pond will be gradually filled.		
October		Moist soil units will begin to flood.		
November		Maximize flooded conditions in moist soil impoundments for fall migration.		
December		Water levels will be lowered slightly according to Fox Pond Plan.		

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Unit Moist Soil 1

Maximum Pool Elev. <u>536.27</u>	General Pool Bottom Elev. <u>534.8</u>
Unit Acreage <u>62.2</u>	Drain Structure Elevation <u>532.0</u>
	Vegetation Mgmt. & Year <u>Disced 1983</u> <u>Flood 90, 91</u>

Planned Elevation for <u>1993</u>			Actual Elevations for _____	
Date(s)	Elevation	Reasons	Elevations	Reasons
January	536.0	frozen		
February	536.0 - 535.5	Lower slightly but maintain full pool.		
March	535.5	Maintain water levels for spring migration.		
April	535.5 - 534.5	Begin gradual drawdown for moist soil plant pro- duction, timber maintenance, and regeneration.		
May	534.5 - 533.0	Continue drawdown.		
June	533.0 - 532.0	Complete drawdown for moist soil plant production.		
July	532.0	Maintain low water level. Fix dike if conditions allow.		
August	532.0	Maintain low water level. Fix dike if not completed.		
Sep. 1-15	532.0 - 532.5	Maintain low levels.		
16-30	532.5 - 533.0	Gradually begin filling unit.		
Oct.	533.0 - 534.5	Continue flooding unit.		
Nov.	534.5 - 536.0	Achieve maximum water levels for peak fall migra- tion.		
Dec.	536.0 - 535.5	Lower slightly to protect dike and road.		

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Unit Moist Soil 6

Maximum Pool Elev. 537.0

General Pool Bottom Elev. 535.0

Unit Acreage 20
Bottom gauge (zero) = 20.00
Gauge not at MSL

Drain Structure Elevation 535.0

Vegetation Mgmt. & Year Jap. Millet
1982

Planned Elevation for <u>1993</u>			Actual Elevations for <u>1993</u>	
Date(s)	Elevation	Reasons	Elevations	Reasons
Water levels dependent upon Fox Pond level.				
January	21.0 - 22.0	frozen		
Feb. - Mar.	21.0 - 22.0	Maintain high water levels for spring migrants.		
April	21.0 - BG	Unit will draw down rapidly by beginning Fox Pond drawdown.		
May - September	BG	Unit will remain dry as long as Fox Pond is drawn down. Reset gauge to MSL.		
October	20.0 - 20.5	Some water may begin to seep into unit.		
November	20.5 - 22.3	Maximum water levels will be achieved when Fox Pond is full.		
December	22.0	Maintain maximum water level.		

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Unit Moist Soil 7

Maximum Pool Elev. 537.0

General Pool Bottom Elev. 536.0

Unit Acreage 15

Drain Structure Elevation 535.5

Water gauge not at MSL

Bottom of gauge (zero) = 20.00

Vegetation Mgmt. & Year Buckwheat
1987; Flooded 90, 91; Winter wheat
91, 92

Planned Elevation for 1993

Actual Elevations for _____

Date(s) Elevation Reasons

Elevations Reasons

Water levels are somewhat dependent upon MS 6 and, therefore, Fox Pond water levels. However, runoff precipitation does pool in this unit.

January 20.0 - frozen
 21.0

Feb. - 21.0 - Maintain as high
March 21.5 water levels as
 possible.

April 21.5 - Unit will rapidly
 20.0 lose water in con-
 junction with MS 6
 and Fox Pond.

May - BG Unit will remain
September dry except for
 rain which will
 briefly pool in
 unit. Set water
 gauge to MSL.
 Possible harvest
 of winter wheat
 from unit in July.
 Will re-plant
 surrounding field
 with winter wheat
 in late August.

October 20.0 - Water may begin to
 20.3 seep into unit.

November 20.3 - Maximum water
 21.3 levels will be
 achieved when Fox
 Pond is full, plus
 precipitation.

December 21.3 - Maintain maximum
 20.5 water levels.

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Unit Moist Soil 8

Maximum Pool Elev. <u>537.0</u>	General Pool Bottom Elev. <u>535.5</u>
Unit Acreage <u>20</u>	Drain Structure Elevation <u>532.0</u>
Gauge not at MSL	Vegetation Mgmt. & Year <u>Disced 1983</u>
Gauge at (zero) bottom pool = approx. 13.0	

Planned Elevation for <u>1993</u>			Actual Elevations for _____	
Date(s)	Elevation	Reasons	Elevations	Reasons
January		Ice covered.		
February	13.5 - 14.0	Maintain high water levels.		
March	14.0 - 14.5	Increase water levels for spring migration.		
April	14.0	Maintain high water levels.		
May	14.0 - 13.5	Begin lowering water levels for moist soil plant production and farming efforts.		
June	13.5 - 13.0	Continue drawdown; try to maintain low water levels.		
July - August	BG	Maintain drawdown. Set water gauge to MSL.		
September	BG - 13.0	Gradually flood area for early migrants. Begin flooding by Sept. 15.		
October	13.0 - 13.8	Continue flooding unit towards peak migration.		
November	13.8 - 14.5	Maximize flooding efforts to increase availability of flood to dabblers.		
December	14.5 - 14.0	Lower water to protect road.		

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Unit Moist Soil 9

Maximum Pool Elev. <u>537.0</u>	General Pool Bottom Elev. <u>536.0</u>
Unit Acreage <u>15</u>	Drain Structure Elevation <u>532.0</u>
Bottom pool (zero) = approx. 10.20	Milo 1987
	Vegetation Mgmt. & Year <u>Disced 1989</u>
	<u>Mowed 1992</u>

Planned Elevation for <u>1993</u>			Actual Elevations for _____	
Date(s)	Elevation	Reasons	Elevations	Reasons
January	10.5 - 11.0	Frozen		
February	11.0 - 11.3	When unit thaws, increase water levels for spring migration.		
March	11.0 - 11.3	Maintain high water levels.		
April	11.0 - 10.7	Lower water levels slightly for shorebird use.		
May	10.7 - 10.2	Continue lowering water level for moist soil plant production.		
June	10.20	Maintain low water levels.		
July	BG	Draw down unit completely. Set water gauge to MSL.		
August	BG	Maintain drawdown.		
September	10.2 - 10.5	Raise water level gradually to maxi- mize shorebird use.		
October	10.5 - 11.0	Continue gradual flooding for water- fowl use.		
November	11.0 - 11.5	Maximize water levels for peak waterfowl use.		
December	11.5 - 11.0	Draw down slightly to protect road dike from freeze/ thaw effects		

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Unit Moist Soil 10

Maximum Pool Elev. Unknown

General Pool Bottom Elev. Unknown

Unit Acreage 15

Drain Structure Elevation Unknown

Vegetation Mgmt. & Year Disced 1987
Mowed 1989

Planned Elevation for <u>1993</u>			Actual Elevations for _____	
Date(s)	Elevation	Reasons	Elevations	Reasons
January	6.8 - 7.0	Frozen		
February	7.0 - 7.5	Raise water levels late in month for spring migrants.		
March	7.5 - 8.0	Continue flooding area.		
April	8.0 - 7.50	Begin draw down of unit to protect standing trees and allow for regeneration of seedlings.		
May	7.50 - 6.50	Continue draw down of unit.		
June	6.50 - BG	Complete draw down of unit. Re-set water gauge to MSL.		
July - August	BG	Maintain draw down. When conditions allow, mow and disc unit.		
September	6.00 - 6.30	Begin gradual flooding of unit.		
October	6.30 - 7.50	Continue flooding unit for fall waterfowl migration.		
November	7.50 - 8.50	Achieve maximum flooding conditions by November 15.		
December	8.50 - 7.5	Lower water levels to protect road/dike.		

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Unit Prairie Pocket

Maximum Pool Elev. <u>536.7</u>	Unknown - General Pool Bottom Elev. <u>approx. 532</u>
Unit Acreage <u>45</u>	Drain Structure Elevation <u>533.4</u>
	Vegetation Mgmt. & Year <u>1987 drawdown</u> Flooded 1990, 91

Planned Elevation for <u>1993</u>			Actual Elevations for _____	
Date(s)	Elevation	Reasons	Elevations	Reasons
January	535.5	Frozen		
February	535.5 - 536.0	Maintain high water for fisheries.		
March	536.0	Maintain high water for fisheries.		
April	535.5	Maintain high water for fisheries.		
May	535.0 (BG)	Allow water to evaporate/seep throughout summer to protect timber and promote seed- ling regeneration.		
June	535.0 (BG)			
July	535.0 (BG)			
August	535.0 - 533.0	Late, brief draw down to allow for seedling regenera- tion. Re-set gauge to MSL.		
September	533.0 - 534.0	Increase water levels.		
October	534.0 - 535.0	Continue in- creasing water levels.		
November	535.0	Maintain high water levels for fishery.		
December	535.5			

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Unit McNeil Marsh

Maximum Pool Elev. Unknown

General Pool Bottom Elev. Unknown

Unit Acreage Approx. 40

Drain Structure Elevation Unknown

Vegetation Mgmt. & Year First year of management

Planned Elevation for <u>1993</u>			Actual Elevations for _____	
Date(s)	Elevation	Reasons	Elevations	Reasons
January		Frozen		
February - March		Maximum water held for spring migration.		
April		Begin gradual draw down. Draw down water levels will be somewhat dependent upon water levels in Muscatine Slough.		
May		Continue draw down of area for maintenance and regeneration of timber.		
June - July		Complete and maintain draw down; set water gauge.		
August		Late in month, begin pumping water, if necessary, into unit in preparation for fall migration.		
September		Continue pumping if necessary. Lake Odessa/Muscatine Slough water levels may be high enough to assist with flooding.		
October		Achieve maximum water levels late in month.		
November		Maintain maximum water levels.		
December		Slightly lower water levels, if possible, to protect dikes and roads.		

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Unit Keithsburg

Maximum Pool Elev. 543.5

General Pool Bottom Elev. _____

Unit Acreage 431

Drain Structure Elevation 528.5
Levee break 1987

Gauge correction factor: zero = 518.7
10.8 factor = 529.5 MSL

Vegetation Mgmt. & Year Drawdown
1988-89; Drawdown 1992

Planned Elevation for 1993

Actual Elevations for _____

Date(s)	Elevation	Reasons	Elevations	Reasons
January		Ice covered.		
February	13.0 - 12.0	Lower water levels if conditions permit. By lowering a little now, may prevent extremely high water conditions with spring rains. Need to give trees a change to regenerate.		
March	13.0 - 12.0	Maintain water levels for spring migration.		
April	12.0 - 11.0	Begin gradual draw down.		
May	12.0 - 10.5	Complete draw down.		
June - August	10.5	Maintain draw down for moist soil plant production and tree seedling regeneration. Reset water gauge to MSL. Fix screwgate.		
September	10.5 - 11.5	Begin gradual flooding of unit.		
October	11.5 - 12.5	Continue flooding for fall migration.		
November	12.5 - 13.5	Maximum flooding conditions for fall migrants.		
December	13.5 - 12.7	Maintain maximum flooding early in month. If conditions permit, lower slightly later in month.		