SWL 800.62

36

FWS/ARW-RF2

APR 18 1988

Memorandum

To: Refuge Manager, Swan Lake National Wildlife Refuge

From: Regional Refuge Supervisor

Subject: Annual Water Management Program, Parts 1 and 2

The two attached subject documents have been reviewed and are well prepared and thorough. They are approved subject to the modification discussed below. This reflects the changes we discussed on the telephone last week.

The plan should be changed to reflect the fact that Silver Lake is not to be drained this year. Water level management of that area is to be in conformance with the Land Use Plan approved previously this year for Swan Lake Refuge. The land use plan calls for maintaining water levels in Silver Lake between elevations 662.0 and 664.0 April through August with a raising of the water in early fall to an elevation of 665.5.

I agree that draining the lake would be beneficial, and I feel that this will be a viable option in 1989. However, I would like to visit the refuge and to discuss it further with the State of Missouri before the plan is implemented.

Attachments

MATTHIAS KERSCHBAUM

RF2:TLarson:mm:4/18/88:x3701

ANNUAL WATER MANAGEMENT PLAN, PART I

Swan Lake National Wildlife Refuge

Sumner, Missouri

Prepared by: Patti Thomsen Date: 1-26-88

Assistant Refuge Manager

Submitted by: Johnnie Sayre Date: 1-26-88

Refuge Manager

_____ Date: _____

Approval: Matthias A. Mendenhall Date: 4/18/88

ANNUAL WATER MANAGEMENT PLAN, PART I

Swan Lake National Wildlife Refuge

Sumner, Missouri

Prepared by: Patti Thomsen Date: 1-26-88

Assistant Refuge Manager

Submitted by: John Smyth Date: 1-26-88

Refuge Manager

_____ Date: _____

Approval: _____ Date: _____

WATER MANAGEMENT PLAN - 1988

SWAN LAKE NWR

General Information

Swan Lake National Wildlife Refuge is located in north-central Missouri, near the confluence of the Missouri and Grand Rivers. The refuge is bordered on the south by Yellow Creek, and three intermittent creeks flow into the refuge; Turkey Creek, Elk Creek and Tough Branch. Most of the 10,670 acre refuge is relatively flat, with elevations ranging from 653.9' above sea level to a maximum of 741.56'. As a result, management of water on Swan Lake Refuge is greatly influenced by external sources.

The refuge currently has seven small, semi-manageable moist soil units, covering approximately 633 acres. These units are difficult to manage due to frequent natural flooding and the lack of adequate drainage structures. Swan Lake and South Pool, encompassing 1,100 and 1,850 acres, respectively, make up our two large moist soil units. Silver Lake, a 3,050 acre open body of water, is used as a reservoir for the moist soil units. South Pool, Swan Lake, and moist soil units 1 through 4 are filled via a gravity flow system from Silver Lake. Water is supplied to moist soil units 5 through 7 via three siphoning tubes. The water is pulled from Silver Lake, under levee 3, into individual units. Each sub-unit is filled by gravity flow.

I. 1987 Water Management Program

A. Climatic Conditions

For the second year in a row, winter temperatures were extremely mild. January began with warm days and cold nights. A snow storm on the 9th left six inches of snow which quickly melted since temperatures reached into the 60°'s. Another eight inches of snow fell from January 16-19th, but all snow melted by the end of the month.

Only two inches of snowfall was received in February. This was followed by unseasonably warm, dry weather conditions until late March when temperatures returned to near normal.

April temperatures can only be classified as ideal with warm days and cool nights. Minor flooding occurred on the 14th after four inches of precipitation in a two day period; however, dry conditions prevailed throughout the rest of the month. These dry conditions continued into May and June. Only 4.1" of precipitation fell during these two months, which is more than five inches below average. Daily temperatures remained hot, occasionally exceeding 100°.

Following several months of dry weather, 6.65" of precipitation fell between July 5 and 13th. The rain caused major flooding of all moist soil units, in addition to flooding most of the cropland farmed by State personnel. July and August temperatures remained above normal with daily highs in the upper 90°'s and low 100°'s. Lowland flooding again occurred following almost eight inches of rain during August 13-16.

Unseasonably warm temperatures and below normal precipitation continued into September and October. Precipitation was almost two inches below average. The first frost occurred on October 6, but temperatures rose quickly and the month ended with temperatures in the mid to high 70°'s.

November was also unusually warm, with highs in the upper 70°'s. Precipitation was about one inch above normal which again caused flooding of low-lying areas of the refuge by high runoff from Yellow Creek.

Weather conditions became more normal during December. A major snowstorm on December 14th deposited 14" of snow and left most roads impassable because of high winds and major drifting problems. Temperatures continued to drop during the last half of the month as an Arctic Express stalled in the midwest.

TABLE I: 1987 CLIMATIC DATA

Month	Total Precip. Rain	Total Precip. Snow	20 Year Average Precip.	Number Days Precip.	Temperature Extremes °F Max.	Temperature Extremes °F Min.
Jan.		14"	1.64"	5	65	-4
Feb.		2"	1.79"	1	65	18
Mar.	1.0"		2.57"	5	75	20
Apr.	4.4"		3.72"	5	90	22
May	2.4"		4.52"	4	88	48
June	1.7"		4.87"	9	101	51
July	6.7"		3.92"	5	100	57
Aug.	8.7"		3.67"	5	101	55
Sept.	3.1"		4.88"	5	91	45
Oct.	2.8"		2.72"	5	82	25
Nov.	4.3"		2.32"	7	78	20
Dec.	1.5"	15"	1.65"	9	57	4
Total	36.6"	31"	38.27"	65		

ANNUAL WATER MANAGEMENT PLAN

SWAN LAKE NATIONAL WILDLIFE REFUGE

WATER UNIT Silver Lake

Maximum elevation permissible: 669.0 **Surface acres:** 3,050

Elevation of general pool bottom: 658.0

Flowline elevation of lowest drain structure: 657.38

Water Surface Elevations for 1987				Planned Elevations for 1988	
Date		Elevations	Reasons	Elevations	Reasons
Jan.	1	665.98		664.5	Reduce winter fish kill.
	15	666.10	Precipitation.		
Feb.	1	666.28	Drawdown.		
	15	665.96			
Mar.	1	665.75			
	15	665.84	Precipitation.		
Apr.	1	665.90			
	15	666.70	Precipitation.	664.5	Drawdown: Stabilize lake bottom. Moist soil plant production.
May	1	666.00	Drawdown.	664.0	
	15	666.00		663.0	
June	1	665.86	Evaporation.	662.0	
	15	665.60		661.0	
July	1	665.58	10th Flood. Turkey Creek	660.5	
	15	667.50		660.0	
Aug.	1	666.00	Drawdown.		
	15	667.50	Heavy rains.	660.0	
Sep.	1	665.75	Drawdown.	659.0	
	15	665.50	Evaporation.	659.0	
Oct.	1	665.67	Flooding moist soil units.	658.0	Migratory bird loafing area.
	15	665.30			
Nov.	1	665.03			
	15	665.10	Precipitation.		
Dec.	1	666.10	Flood. Turkey Creek		
	15	665.62	Drawdown.		
	31	667.10	Flood. Turkey Creek	658.0	

ANNUAL WATER MANAGEMENT PLAN

SWAN LAKE NATIONAL WILDLIFE REFUGE

WATER UNIT Swan Lake

Maximum elevation permissible: 663.0 **Surface acres:** 1,100

Elevation of general pool bottom: 651.5

Flowline elevation of lowest drain structure: 652.98

Water Surface Elevations for 1987				Planned Elevations for 1988	
Date		Elevations	Reasons	Elevations	Reasons
Jan.	1	655.70		656.0	Drawdown: Reduce dike
	15	655.70		655.5	damage by wave action.
Feb.	1	655.70		655.0	Gradual drawdown: Prepare
	15	656.00	Gradual drawdown.	654.5	for Silver Lake drainage.
Mar.	1	655.10		654.0	
	15	654.80		653.5	
Apr.	1	655.00	Precipitation.		
	15	655.20	Continue drawdown.	653.5	Flood with Silver Lake water.
May	1	654.60		655.0	
	15	654.40		657.0	Remain flooded to kill undesirable vegetation.
June	1	653.86	Evaporation.		
	15	652.00	Lake totally dry.		
July	1	652.00			
	15	659.56	10th Flood. Yellow Crk.		
Aug.	1	657.90	Drawdown.		
	15	658.55	Precipitation.		
Sep.	1	657.30	Maintain high water		
	15	657.19	level to kill Amer. lotus and bulrush.	657.0	Remove stop logs: Use water to flood moist soil units.
Oct.	1	657.15	Evaporation.	656.5	
	15	657.00		656.5	Invertebrate food source for fall migrants.
Nov.	1	657.00		656.0	
	15	656.95			Migratory bird loafing area.
Dec.	1	657.00	Drawdown.		
	15	656.00	Reduce dike damage		
	31	656.60	Flood w/Silver Lake water to alleviate flooding in that lake.	656.0	

ANNUAL WATER MANAGEMENT PLAN

SWAN LAKE NATIONAL WILDLIFE REFUGE

WATER UNIT South Pool

Maximum elevation permissible: 663.0 **Surface acres:** 1,850

Elevation of general pool bottom: 653.5

Flowline elevation of lowest drain structure: 652.0

Water Surface Elevations for 1987				Planned Elevations for 1988	
Date		Elevations	Reasons	Elevations	Reasons
Jan.	1	655.10		654.5	Migratory bird loafing area.
	15	655.40	Drawdown.		
Feb.	1	655.34			
	15	655.30			
Mar.	1	654.50			
	15	654.10		654.5	
Apr.	1	654.50	Precipitation.	654.0	Drawdown.
	15	654.70	Gradual drawdown.	653.0	Flood with Silver Lake water.
May	1	654.08		654.5	
	15	654.02			
June	1	654.14	Evaporation.		
	15	653.60			Maintain elevation for duck and otter habitat and moist soil plant production.
July	1	652.80	10th Flooded by Yellow Ck.		
	15	660.22			
Aug.	1	654.14	Rapid drawdown.		
	15	654.90	Precipitation.		
Sep.	1	654.27	Evaporation.		
	15	653.14		654.5	Flood with Swan Lake water.
Oct.	1	653.75	Flood with Silver	655.0	
	15	654.80	Lake water.		Food source for fall migrants.
Nov.	1	655.00			
	15	654.00	Drawdown. Begin construction work.		Migratory bird loafing area.
Dec.	1	654.10			
	15	654.10	Continue construction.		
	31	654.00		655.0	

B. 1987 Water Management Efforts

Plans were made to manage Swan Lake and South Pool in a similar manner. Both units were to be drawn down in the spring to allow the production of moist soil vegetation followed by reflooding in the fall. As usual, extensive natural flooding created major changes in the actual management. Gradual drawdown of both impoundments began on schedule in the spring. By mid-June Swan Lake was totally dry for the first time in many years and South Pool had been entirely drained except for water left in old creek channels. Production of vegetation was good; although, an extensive growth of river bulrush in Swan Lake was not desired. The dry conditions allowed the mowing of most of the bulrush. As summer continued growth of the moist soil vegetation was excellent.

Heavy rains in July changed everything. Swan Lake and South Pool were inundated by almost eight feet of water on July 10th. Water in South Pool was quickly drained by the end of July, but draining Swan Lake took a much longer time. For instance, it took four months of draining and evaporating to remove all standing water earlier this year. However, an attempt was made to drain the floodwater and save some vegetation and by August 1st the water level was lowered by 1½ feet. Additional precipitation raised the level one half foot by mid-August. Since it was too late to drain the lake, it was decided to keep the water level high for the remainder of the year in an effort to kill some of the American lotus and river bulrush.

To compensate for keeping Swan Lake at full capacity, the water elevation in South Pool was kept slightly lower during the remainder of the summer. It was slowly flooded in October as originally planned but again changes were necessary. South Pool had to be drawn down in early November and kept drained to enable renovation of the Silver Lake control structure apron. Unexpectedly, the drawdown proved quite beneficial to waterfowl and usage increased dramatically as the mudflats were exposed. Heavy usage continued throughout November.

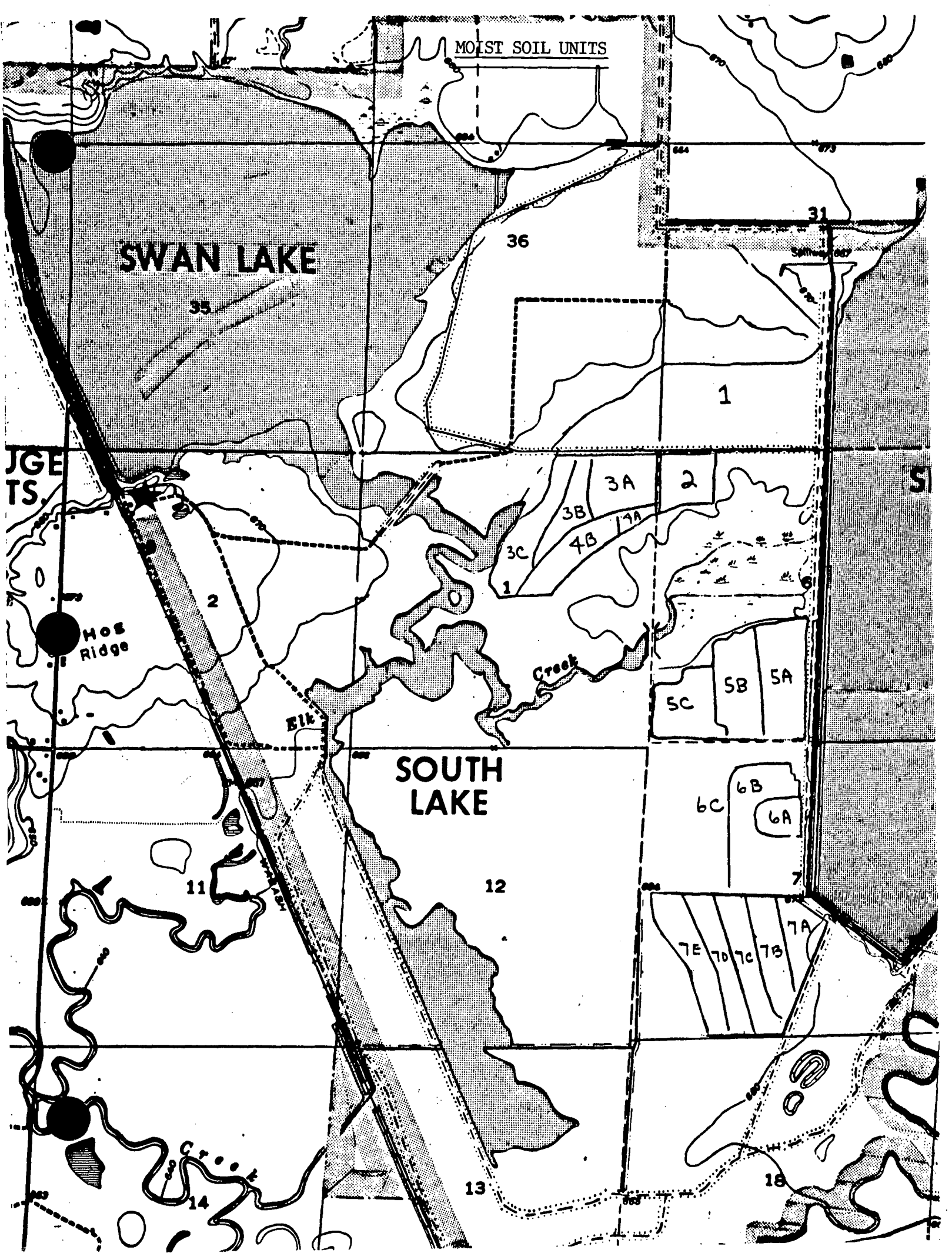
All small moist soil units were drawn down by mid-May with the exception of units 5A and 7 which retained water year-round.

The refuge staff disked and planted wheat in unit 1 and sorghum in units 3 and 4. Sorghum production was excellent until it was destroyed in the July flood due to our inability to drain water quickly. Fortunately, production of natural vegetation occurred and provided some food by fall.

A second natural flood occurred in August but was less severe. Unit 2 was only partially drained after the August flood, leaving shallow water in the stand of marsh smartweed. All other units except 5 and 7 were totally drained. Units 2,5,6, and 7 produced very good stands of natural vegetation with each unit providing a diverse mixture of plants.

In an effort to provide greater diversity, fall flooding of the small moist soil units was done on a staggered schedule. It was initiated on September 30, when the siphon tube to unit 6 was started. A second siphon tube was started on October 15 to flood unit 7. The siphon tube to unit 5 was never used since a break in the north levee was discovered.

The north valve of Silver Lake was opened on October 5th to begin flooding units 1 and 3. It was quickly discovered that unit 1 had to be totally inundated before water would begin to enter unit 3. Unfortunately, that amount of water would also destroy the winter wheat growing in a portion of unit 1. Flooding efforts were immediately terminated to allow the geese some time to feed on the wheat. In the meantime an attempt was made to flood units 3 and 4 from the south by raising the water level of South Pool. Before the water in these units was at the desired level, South Pool had to be drained to allow renovation of the Silver Lake apron. All small units were finally flooded by mid-November. Waterfowl use was extremely high in all units until freeze-up in mid-December.


MOIST SOIL UNITS
SWAN LAKE
35
36
31
1
3A
2
3B
4A
4B
3C
1
2
Hog Ridge
Creek
5C
5B
5A
Elk
SOUTH LAKE
6C
6B
6A
11
12
7
7E
7D
7C
7B
7A
Creek
14
13
18

MARSH AND WATER MANAGEMENT PLAN - ANNUAL MSU EVALUATION

MSU # 1 YEAR 1987

VEGETATION TRANSECT DATE 9-11-87

DOMINANT VEGETATION	% COVER
Bidens	7
Red Top grass	8
Millet, Walter's	7
Smartweed	3
Sumpweed	3
Cocklebur	1
Wheat	70

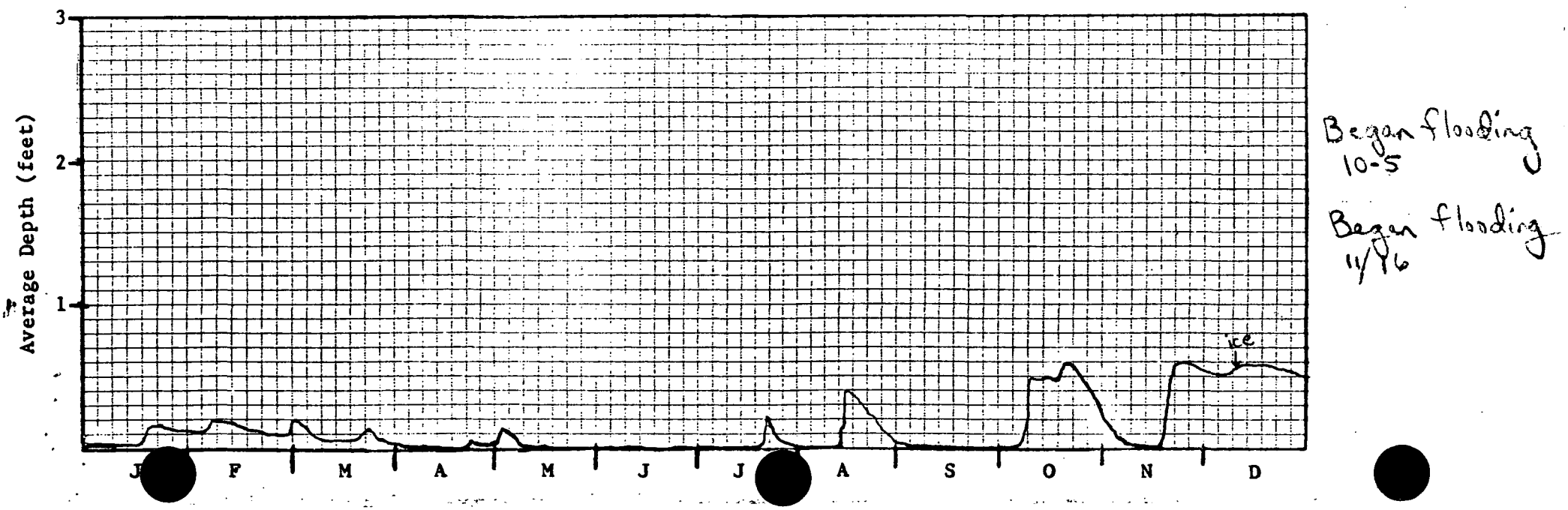
WILDLIFE USE

	Use Days*	% Change from 1986
Ducks	18,400	no data
Geese	22,550	
Thr. spp.	140	
Other	60	

*10/8-12/11/87

SOIL AND VEGETATION TREATMENT

e 7/3's planted to wheat



MARSH AND WATER MANAGEMENT PLAN - ANNUAL MSU EVALUATION

MSU # 2 YEAR 1987

VEGETATION TRANSECT DATE 9-11-87

DOMINANT VEGETATION	% COVER
Smartweed	55
Open water	40
Sumpweed	5

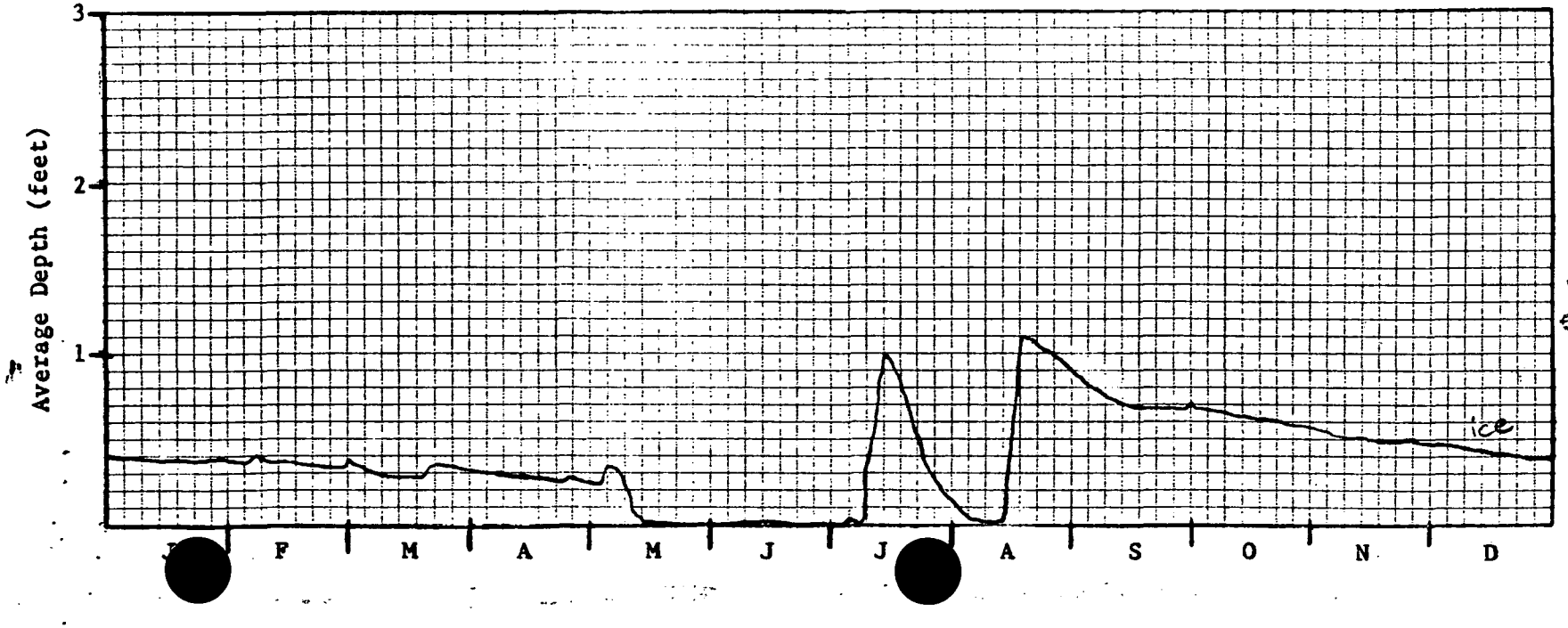
WILDLIFE USE

	Use Days *	% Change from 1986
Ducks	79,500	no data
Geese	2,100	
Thr. spp.		
Other		

* 9/29 - 12/11/87

SOIL AND VEGETATION TREATMENT

none



flooded 7/11

flooded 8/13
drained to .8'
level in Sept.

water slowly
evaporated to
end of year.

MARSH AND WATER MANAGEMENT PLAN - ANNUAL MSU EVALUATION

MSU # 3A+B YEAR 1987

VEGETATION TRANSECT DATE 9-11-87

DOMINANT VEGETATION	% COVER
Spikerush	20
Ammania coccinea	35
Walters millet	15
Nutsedge	15
Panicum spp.	5
Smartweed	1
Evening primrose	1
Amaranthus spp.	1
Willow	<1

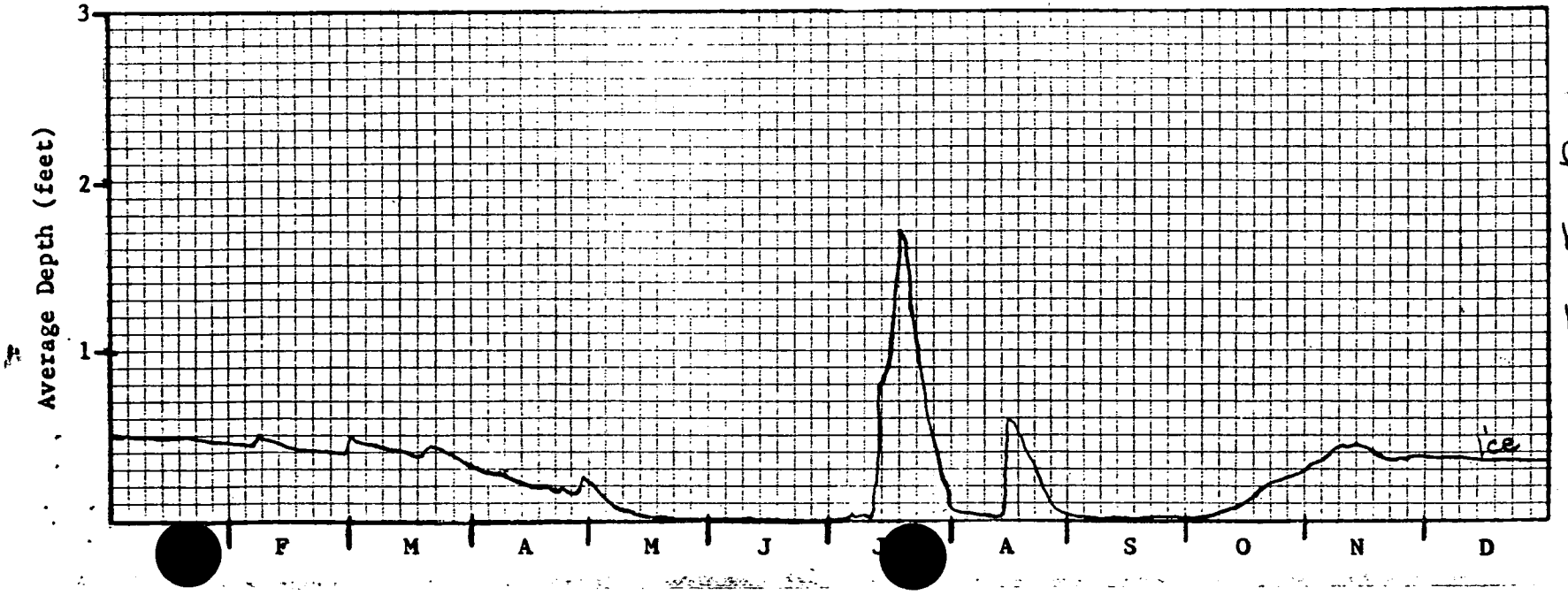
WILDLIFE USE

	Use Days*	% Change from 1986
Ducks	9,000	no data
Geese	28,000	
Thr. spp.		
Other		

9/29-12/11/87

SOIL AND VEGETATION TREATMENT

entire field disked & planted to milo



disked 6-16
milo planted 6-18 (879o)
flooding began 7/10
heavy rains 8/13
began flooding 10/5

MARSH AND WATER MANAGEMENT PLAN - ANNUAL MSU EVALUATION

MSU # 3C YEAR 1987

VEGETATION TRANSECT DATE 9-11-87

DOMINANT VEGETATION	% COVER
Spikerush	35
Nutsedge	25
Smartweed	10
Ammania coccinea	10
Walters millet	1
Evening primrose	1
Willow	<1
Bulrush	<1
Ricecut grass	<1
Open water	15

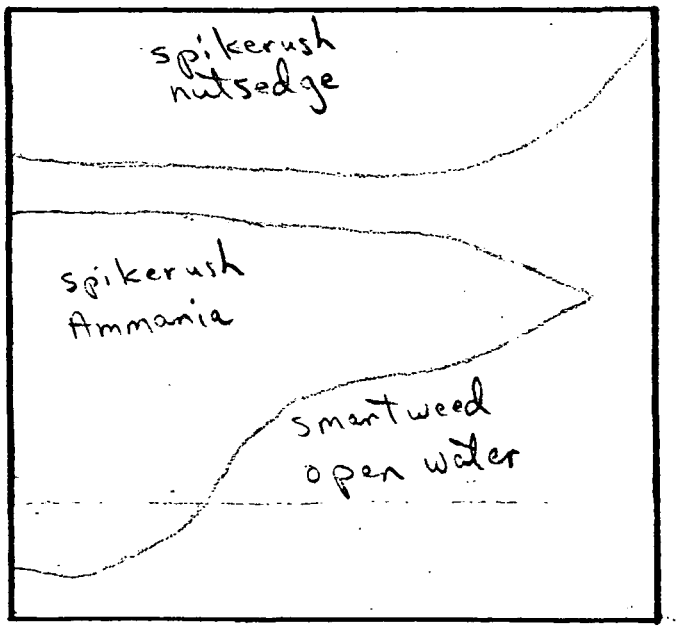
WILDLIFE USE

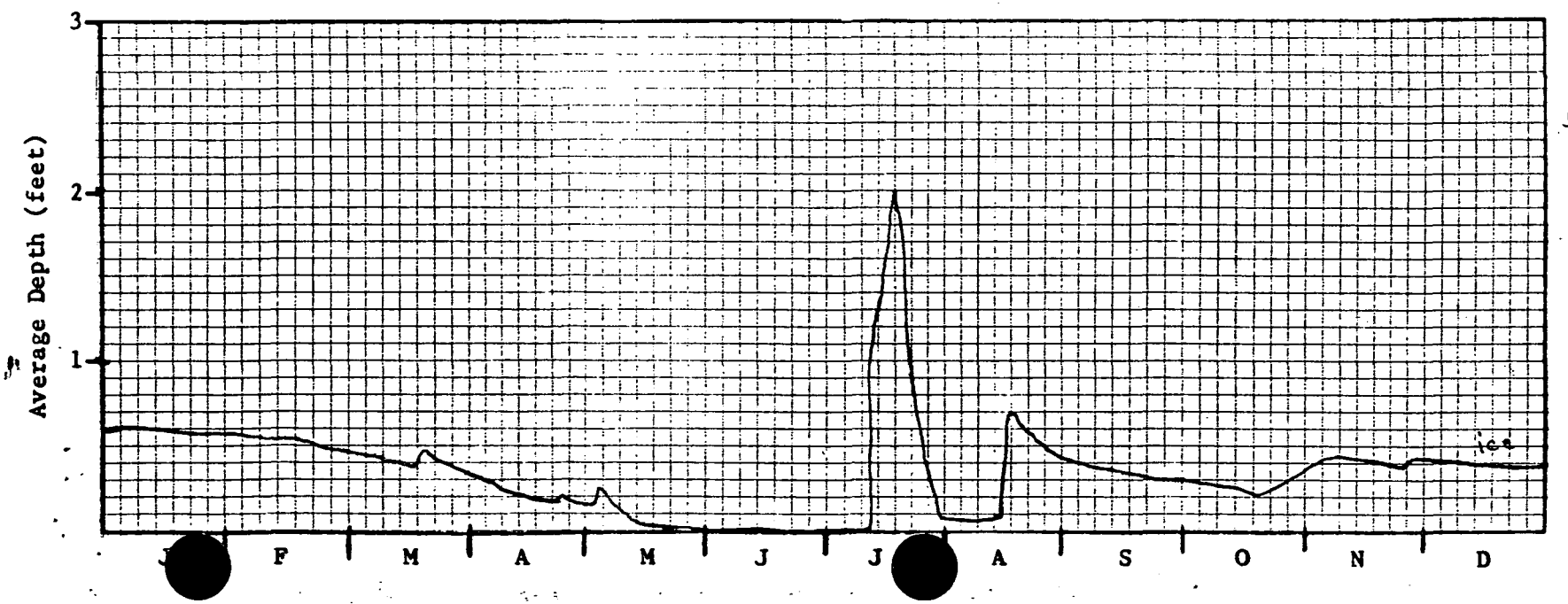
	Use Days*	% Change from 1986
Ducks	5,000	no data
Geese	10,000	
Thr. spp.		
Other		

*9/29-12/11/87

SOIL AND VEGETATION TREATMENT

entire area disked + planted to milo





disked 6-16
milo planted 6-18
flooding began 7/10 am
heavy rains 8/13
began flooding 10/16

MARSH AND WATER MANAGEMENT PLAN - ANNUAL MSU EVALUATION

MSU # 4 YEAR 1987

VEGETATION TRANSECT DATE 9-11-87

DOMINANT VEGETATION	% COVER
Nutsedge	80
Walters millet	12
Spikerush	4
Ammania coccinea	3
Smartweed	2
Amaranthus spp.	2
Beggarticks	<1
Monkey flower	<1

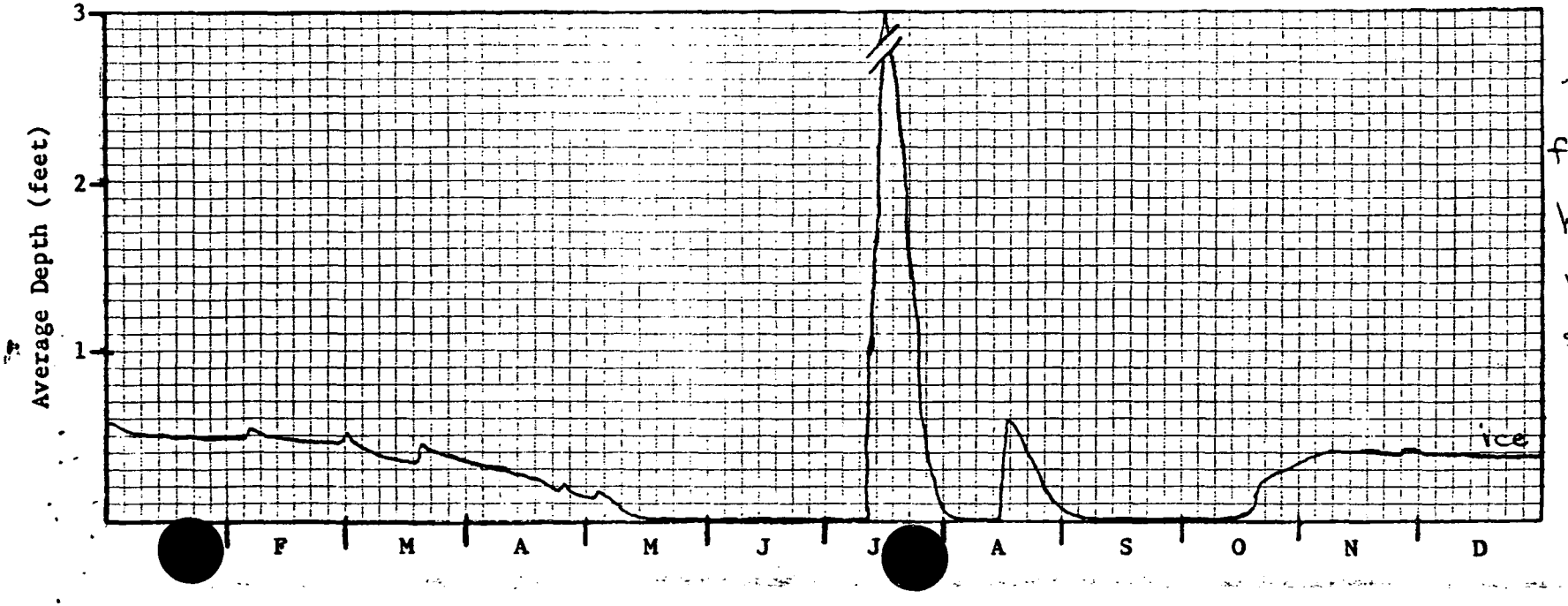
WILDLIFE USE

	Use Days*	% Change from 1986
Ducks	150,000	no data
Geese	60,000	
Thr. spp.		
Other	60	

* 9/29 - 12/11/87

SOIL AND VEGETATION TREATMENT

field disked + planted to milo



disked 6-17
milo planted 6-18 (8790)
flooding began 7/9 pm
heavy rains 8/13
began flooding 10/21
stopped flooding Nov. 6 due to construction work

MARSH AND WATER MANAGEMENT PLAN - ANNUAL MSU EVALUATION

MSU # 5A YEAR 1987

VEGETATION TRANSECT DATE 9-11-87

DOMINANT VEGETATION	% COVER
Smartweed	62
Walter's millet	8
Ricecut grass	15
Beggarticks	2
Sumpweed	2
Evening primrose	1
Buttonbush	1
Hibiscus syricus	1
Willow	<1
Open water	10

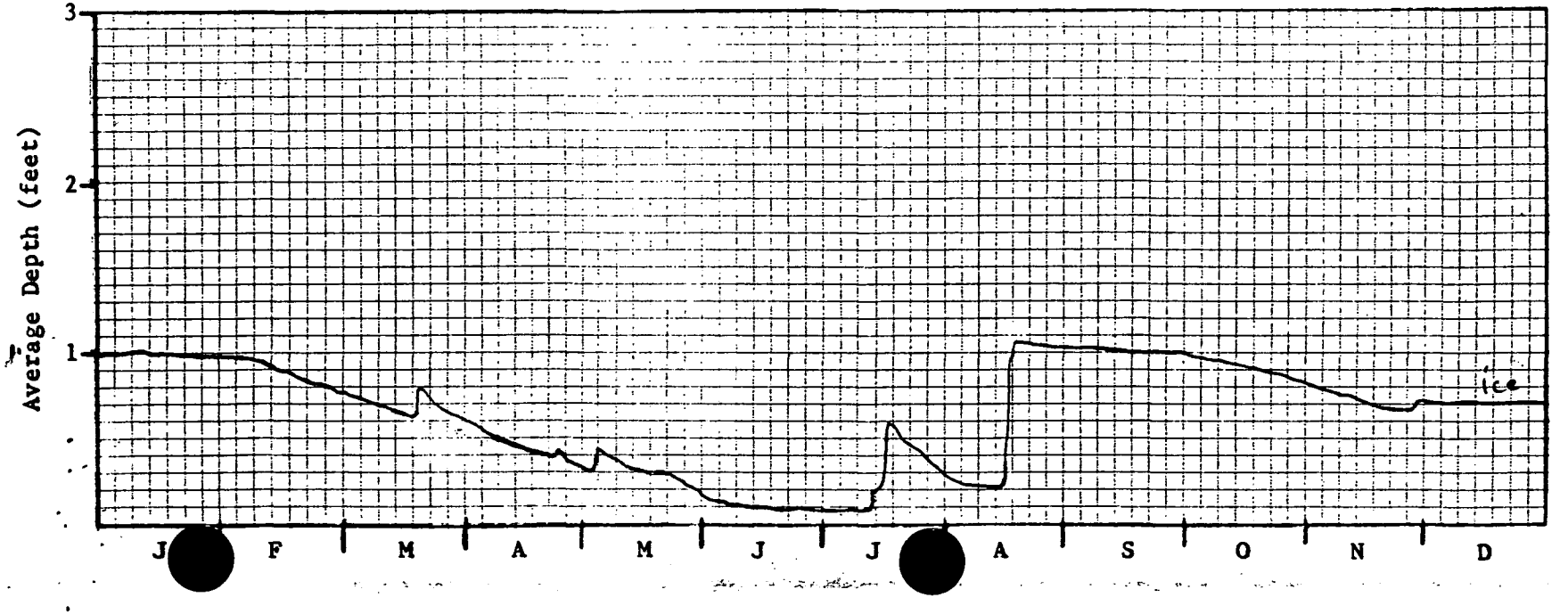
WILDLIFE USE

	Use Days*	% Change from 1986
Ducks	155,000	no data
Geese	45,500	
Thr. spp.	100	
Other		

* 9/29-12/11/87

SOIL AND VEGETATION TREATMENT

none



flooding began 7/14

heavy rains 8/13

beaver construction prevented drawdown to .8'

MARSH AND WATER MANAGEMENT PLAN - ANNUAL MSU EVALUATION

MSU # 5 B+C YEAR 1987

VEGETATION TRANSECT DATE 9-11-87

DOMINANT VEGETATION	% COVER
Smartweed	65
Ricecut grass	22
Sumpweed	1
Bulrush	1
Walter's millet	1
Hibiscus syricus	<1
Buttonbush	<1
Open water	12

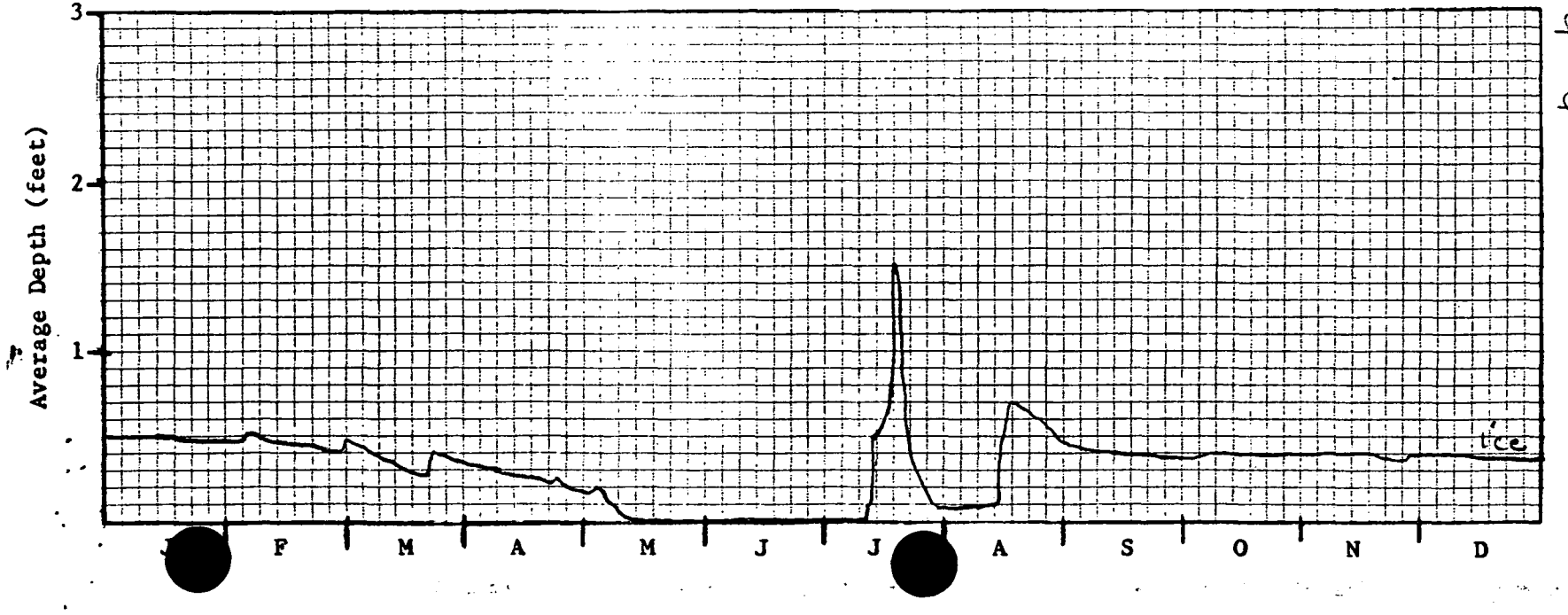
WILDLIFE USE

	Use Days*	% Change from 1986
Ducks	165,000	no data
Geese	122,000	
Thr. spp.	200	
Other		

* 9/29-12/11/87

SOIL AND VEGETATION TREATMENT

none



flooding began 7/10 in unit 5C
flooding 5B 7/11

heavy rain 8/13

11/18 discovered break in north levee, unit B, remaining water ~ 3-4" deep

MSU # 6 Coons Field YEAR 1987

VEGETATION TRANSECT DATE 9-11-87

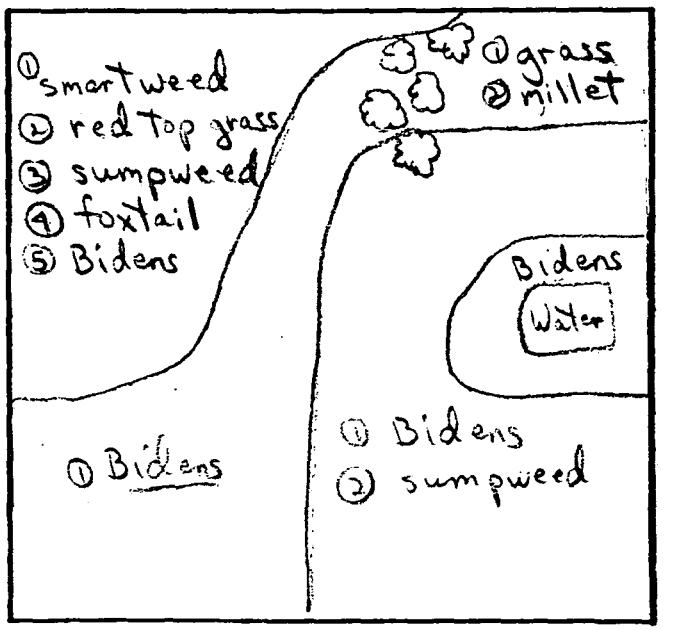
DOMINANT VEGETATION	% COVER
Beggarticks	53
Sumpweed	20
Smartweed	12
Redtop grass	7
Walter's millet	3
Foxtail	3
Nutsedge	1
Ricecut grass	1
Locust trees	<1
Hibiscus	<1
Sagitaria	<1

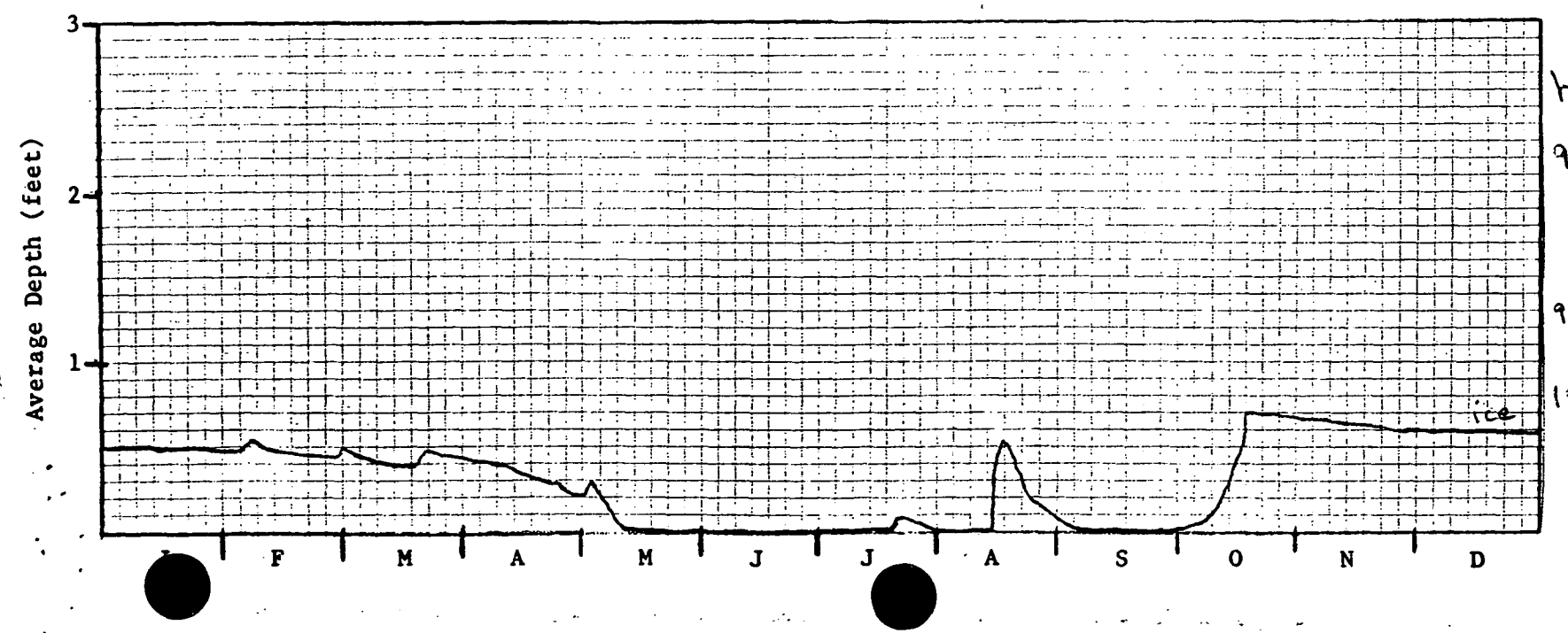
WILDLIFE USE

	Use Days *	% Change from 1986
Ducks	140,000	no data
Geese	30,000	
Thr. spp.	120	
Other		

* 9/29 - 12/11/87

none





heavy rains 8/13

9/21 Travel lanes for waterfowl made using 3-wheeler

9/30 opened siphon Tube

12/16 closed Tube

MARSH AND WATER MANAGEMENT PLAN – ANNUAL MSU EVALUATION

MSU # 7 A+B YEAR 1987
Hensley + W fields

VEGETATION TRANSECT DATE 9-21-87

DOMINANT VEGETATION	% COVER
Walters millet	17
rice cut grass	14
Ammania coccinea	9
Evening primrose	9
Sago pondweed	7
Nutsedge	6
Foxtail	6
Red top grass	6
Cattail	4
Beggarticks	3
Buttonbush	3
Smartweed	3
Sagitaria	2

WILDLIFE USE

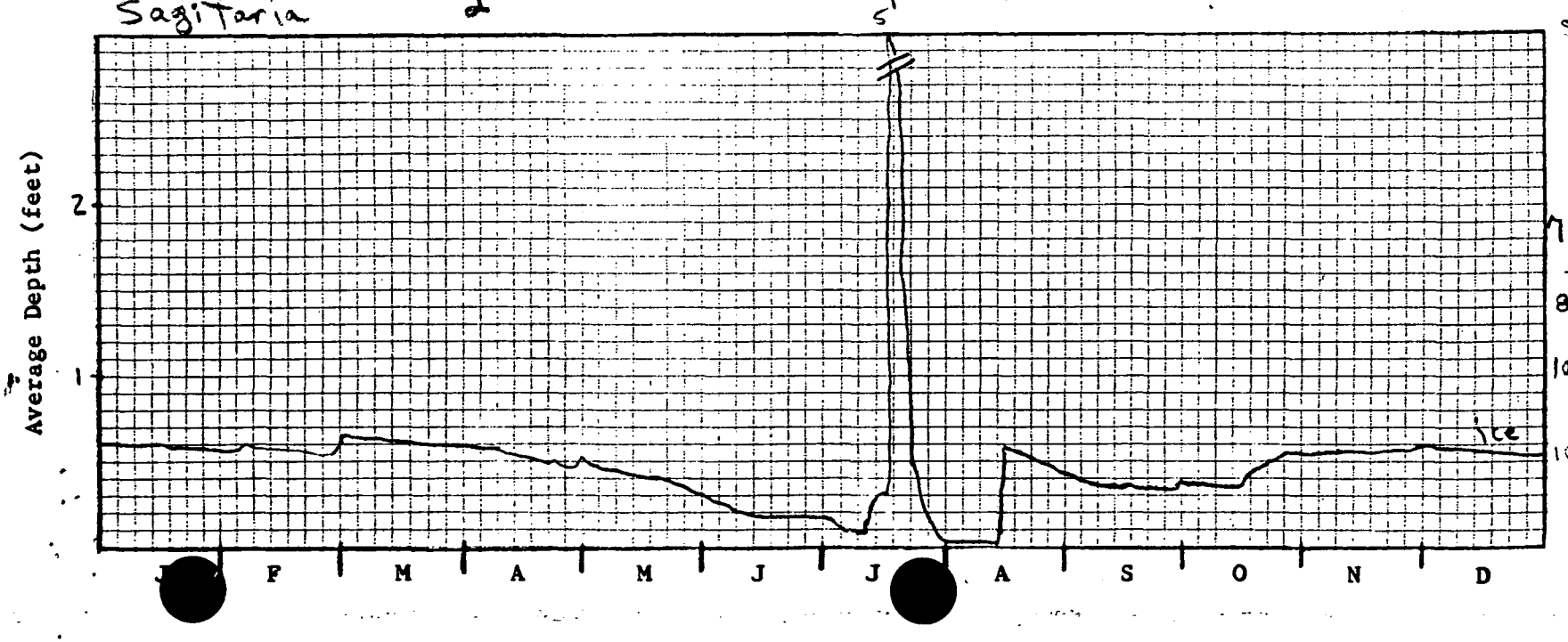
	Use Days *	% Change from 1986
Ducks	30,000	no data
Geese	60,000	
Thr. spp.	60	
Other		

Marshelder 2%
Locust trees 1%
Willow 1%
Open water 5%

* 9/29-12/11/87

SOIL AND VEGETATION TREATMENT

none



5-19-87 7C-E still draining, otters & beavers plugging spillway

7/10 flooding began 7E

8/13 heavy rains

10/15 started siphon tube

10/28 closed siphon tube

MARSH AND WATER MANAGEMENT PLAN - ANNUAL MSU EVALUATION

MSU # 7 C,D+E YEAR 1987

VEGETATION TRANSECT DATE 9-21-87

DOMINANT VEGETATION	% COVER
Sago pondweed	40
Sagittaria latifolia	30
Spikerush	6
Ricecut grass	3
Smartweed	2
Duckweed	2
Cattail	2
Evening primrose	2
Ammania coccinea	2
Unk. rush	2

WILDLIFE USE

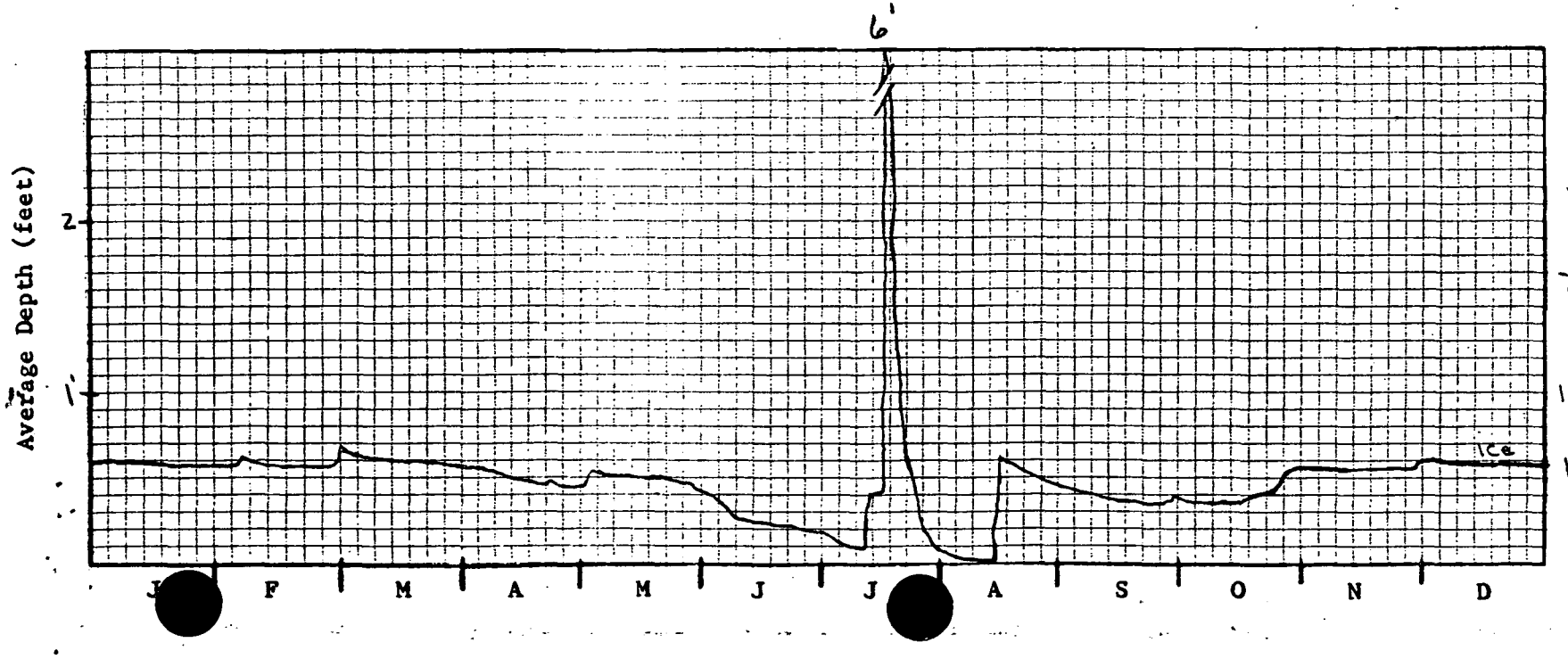
	Use Days*	% Change from 1986
Ducks	30,000	no data
Geese	55,000	
Thr. spp.		
Other		

Millet 1%
Buttonbush 1%
Open water 3%
Algae 1%

* 9/29 - 12/11/87

SOIL AND VEGETATION TREATMENT

none



5-19-87
7 C-E still draining others avg.
7/10 flooding began 7E
10/15 started siphon tube
10/28 closed tube

MARSH AND WATER MANAGEMENT PLAN - ANNUAL MSU EVALUATION

MSU # Swan Lake YEAR 1987

VEGETATION TRANSECT DATE July 13

DOMINANT VEGETATION	% COVER
American lotus	20
river bulrush	18
smartweed	6
willows	4
spikerush	2
open water	50

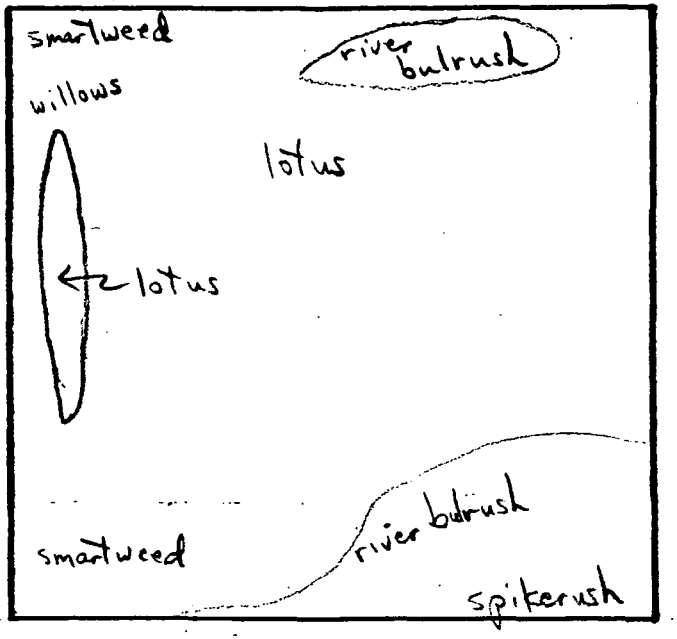
WILDLIFE USE

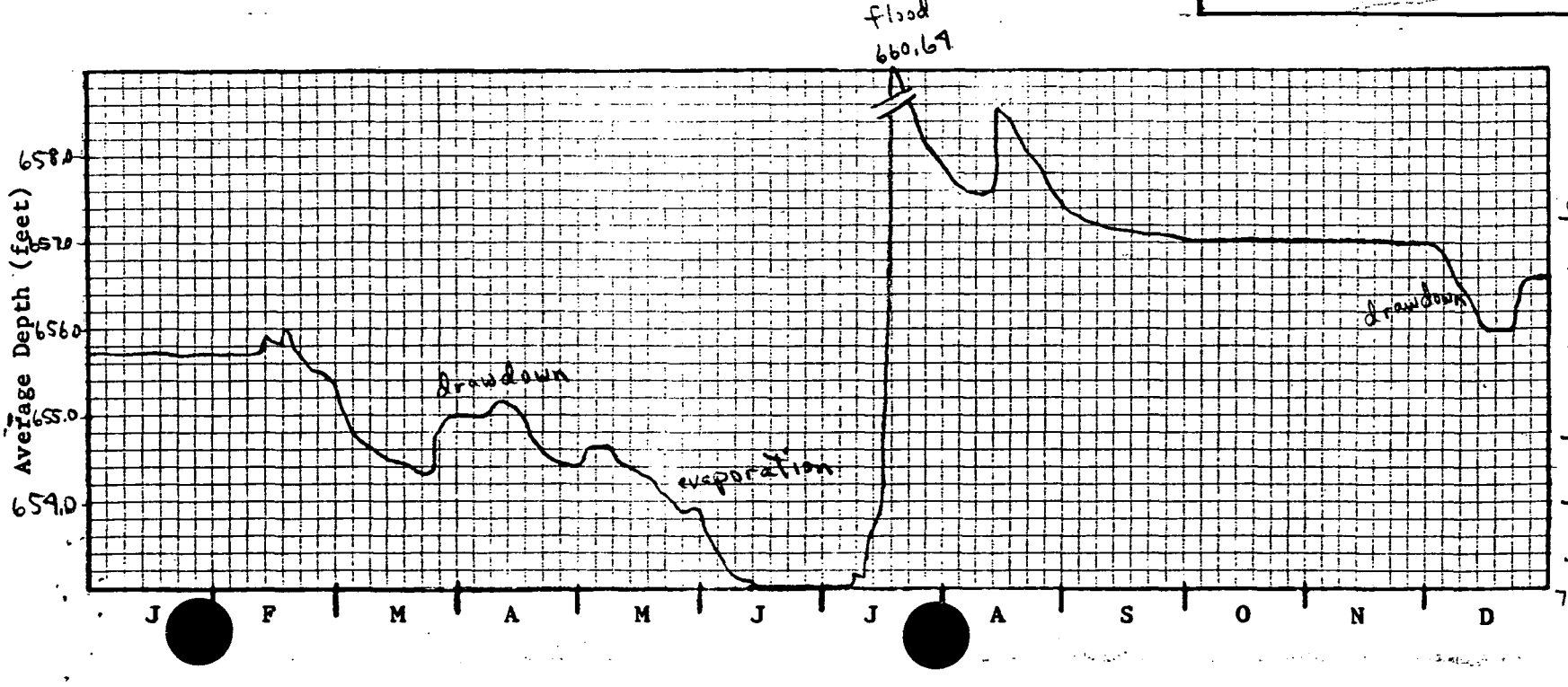
	Use Days *	% Change from 1986
Ducks	700,000	no data
Geese	600,000	
Thr. spp.	4,000	
Other		

* entire year

SOIL AND VEGETATION TREATMENT

Kept water high after July flood to kill lotus & bulrush





The lake bed is totally dry June 13; disked bulrush June 22
sprayed willows 1st week of July
rain 7-7 - standing H2O center of lake & at levees
7-9 H2O began flooding lake over crop levee
7-10 H2O over N-most spillway
7-11 H2O over spillway
7-27 H2O off spillway

MARSH AND WATER MANAGEMENT PLAN - ANNUAL MSU EVALUATION

MSU # SouthPool YEAR 1987

VEGETATION TRANSECT DATE 9-21-87

DOMINANT VEGETATION	% COVER
river bulrush	25
smartweed	20
willows	10
buttonbush	2
open water	

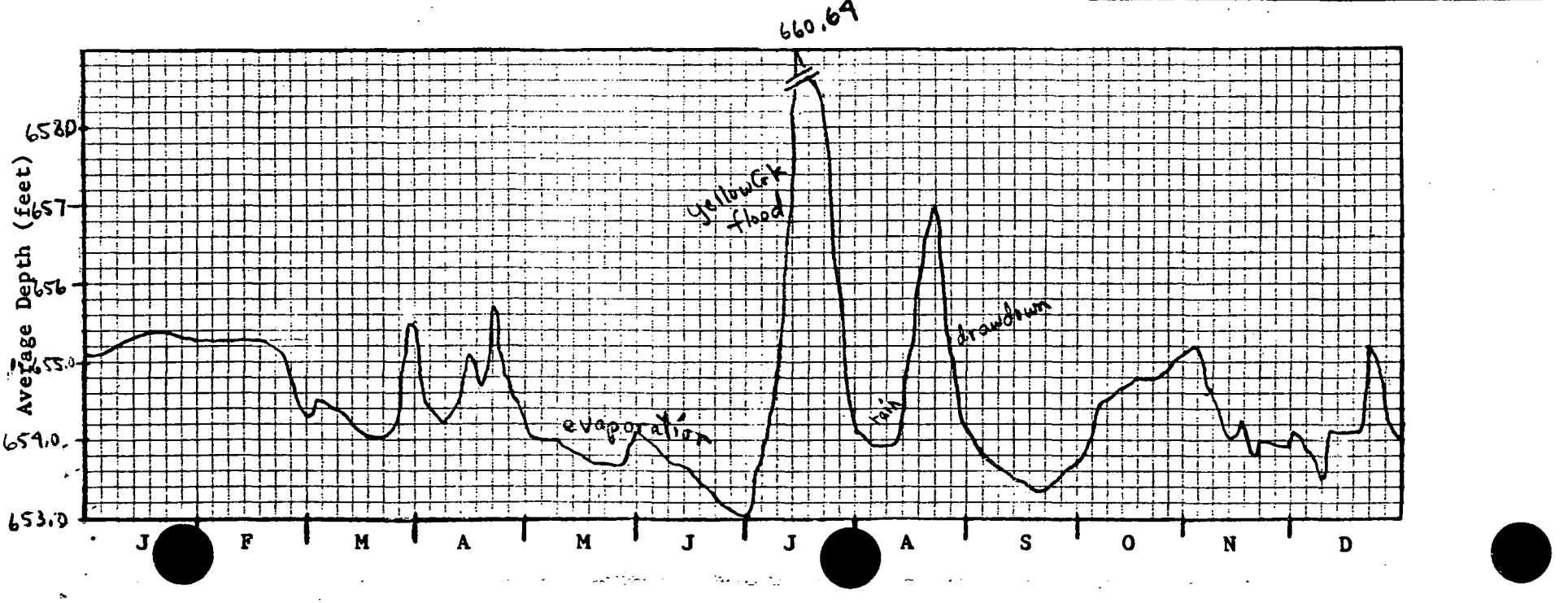
WILDLIFE USE

	Use Days *	% Change from 1986
Ducks	1,030,000	no data
Geese	2,000,000	
Thr. spp.	2,500	
Other		

* entire year

SOIL AND VEGETATION TREATMENT

bulldozed willows growing on west side of lake



ANNUAL WATER MANAGEMENT PLAN, PART II

Swan Lake National Wildlife Refuge

Sumner, Missouri

Prepared by: Pollie A. Thomas Date: 11-25-87
Assistant Refuge Manager

Submitted by: John R. Sauer Date: 11-25-87
Refuge Manager

John V. Ramsaur Date: 1/5/88

Approval: Matthew T. Hogan Date: 4/11/88
RF 2

II. 1988 WATER MANAGEMENT PROGRAM

Primary Objectives

1. Manipulate water levels to promote growth of preferred natural vegetation and provide optimum feeding/loafing conditions during spring and fall migration.
2. Maintain increased acreage of water for otter and wood duck brood habitat.
3. Perform maintenance and rehabilitation of water management facilities for continued operation.

A. Water Manipulation

Management strategies are designed to increase waterfowl usage, in addition to meeting the objectives for endangered species, other migrant species, and resident wildlife. A variety of habitats must be maintained to achieve these objectives.

Silver Lake has been rapidly silting in during recent years as evidenced in depth readings taken. In order to stabilize the lake bottom, the lake will be drained in the spring. The water will be transferred to South Pool and Swan Lake, both of which will be previously drained. Additional benefits will be the production of approximately 3,000 acres of moist soil vegetation and hopefully the elimination of the vast growth of American lotus.

Swan Lake will be slowly drained from January to April. This will allow maximum usage by spring migrating species by providing both shallow water and exposed mudflats. The water from Silver Lake can then be drained into Swan Lake, thus keeping some of the fish population on the refuge. From mid-May Swan Lake will be kept at full capacity to set back woody vegetation, mostly willows. It is also felt the increased water level will kill some of the river bulrush and American lotus growing throughout the lake.

As with Swan Lake, the water in South Pool will be drained in the spring. Some of the water from Silver Lake can then be diverted into South Pool. Again, this will maintain most of the fish population on the refuge. During the summer, the water in South Pool will be kept slightly higher than previous years to help compensate for the loss of water in Silver Lake. It will also kill some of the many willow seedlings flourishing in the lake. The higher elevation will increase the pool area by approximately 200 acres. As a result all old creek channels, oxbows, and low-lying areas will be kept full, providing crayfish for otters and habitat for duck broods. This elevation will still permit about 750 acres of moist soil production.

Water in the moist soil units will be manipulated at different times to provide optimum diversity during the migrational periods. Water manipulation will have to be adjusted depending on the success of draining Silver Lake.

Moist Soil Units 2 and 5-A will remain flooded year-round. The water level during the summer will decrease slowly through evaporation. No water will be added during the summer months unless the depth falls below .4'. These permanent wet units provide many benefits for wildlife since they will increase vegetational diversity, macroinvertebrate production, and accessible nesting cover.

The water control gates in Moist Soil Units 1 and 6 will be opened in April to allow an early drawdown of water. This will allow ample time for the ground to dry for discing in early June. This soil disturbance is necessary to promote desirable vegetation.

Moist Soil Unit 3 will be drawn down slowly in early May. The early season drawdown produces more diverse vegetation with greater total seed production. The early vegetational growth can also provide a nesting area for mallards.

Moist Soil Units 4, 5-B, and 5-C will be drawn down in early June. This later drawdown should produce different vegetation. It will also provide a loafing area for waterfowl and various water birds in the spring.

Flooding of the moist soil units in the fall will be done on a staggered schedule. It is not known if it is possible to totally drain Silver Lake. If it cannot be drained, water will be pumped from Silver Lake into the moist soil units at the designated times using a Crissafulli pump. Pumping into units 5-B, 5-C, 6, and 7 will be initiated in the second week of September. These units require a greater length of time to fill due to their size, and by beginning the process in September, an optimum habitat can be provided for early migrating birds. Flooding of Moist Soil Units 1, 3, and 4 will commence in early October. Again, water will have to be pumped from Silver Lake.

At the same time in October, water will be discharged from Swan Lake into South Pool until the appropriate level is achieved. If Silver Lake can be drained, the water in Swan Lake will have to be used to fill all moist soil units. Stop logs will be removed from Levee 5 in early September to discharge water into South Pool. As the level of water in South Pool increases, the moist soil units will flooded from the low side.

ANNUAL WATER MANAGEMENT PLAN

SWAN LAKE NATIONAL WILDLIFE REFUGE

WATER UNIT Silver Lake

Maximum elevation permissible: 669.0 **Surface acres:** 3,050

Elevation of general pool bottom: 658.0

Flowline elevation of lowest drain structure: 657.38

Water Surface Elevations for _____			Planned Elevations for 1988	
Date	Elevations	Reasons	Elevations	Reasons
Jan. 1			664.5	Reduce winter fish kill.
15				
Feb. 1				
15				
Mar. 1				
15				
Apr. 1				
15			664.5	Drawdown: Stabilize lake bottom. Moist soil plant production.
May 1			664.0	
15			663.0	
June 1			662.0	
15			661.0	
July 1			660.5	
15			660.0	
Aug. 1				
15			660.0	
Sep. 1			659.0	
15			659.0	
Oct. 1			658.0	Migratory bird loafing area.
15				
Nov. 1				
15				
Dec. 1				
15				
31			658.0	

ANNUAL WATER MANAGEMENT PLAN

SWAN LAKE NATIONAL WILDLIFE REFUGE

WATER UNIT Swan Lake

Maximum elevation permissible: 663.0 Surface acres: 1,100

Elevation of general pool bottom: 651.5

Flowline elevation of lowest drain structure: 652.98

Water Surface Elevations for _____			Planned Elevations for 1988	
Date	Elevations	Reasons	Elevations	Reasons
Jan. 1			656.0	Drawdown: Reduce dike
15			655.5	damage by wave action.
Feb. 1			655.0	Gradual drawdown: Prepare
15			654.5	for Silver Lake drainage.
Mar. 1			654.0	
15			653.5	
Apr. 1				
15			653.5	Flood with Silver Lake water.
May 1			655.0	
15			657.0	Remain flooded to kill undesirable vegetation.
June 1				
15				
July 1				
15				
Aug. 1				
15				
Sep. 1				
15			657.0	Remove stop logs: Use water to flood moist soil units.
Oct. 1			656.5	
15			656.5	Invertebrate food source for fall migrants.
Nov. 1			656.0	
15				Migratory bird loafing area.
Dec. 1				
15				
31			656.0	

ANNUAL WATER MANAGEMENT PLAN

SWAN LAKE NATIONAL WILDLIFE REFUGE

WATER UNIT South Pool

Maximum elevation permissible: 663.0 **Surface acres:** 1,850

Elevation of general pool bottom: 653.5

Flowline elevation of lowest drain structure: 652.0

Water Surface Elevations for _____			Planned Elevations for 1988	
Date	Elevations	Reasons	Elevations	Reasons
Jan. 1			654.5	Migratory bird loafing area.
15				
Feb. 1				
15				
Mar. 1				
15			654.5	
Apr. 1			654.0	Drawdown.
15			653.0	Flood with Silver Lake water.
May 1			654.5	
15				
June 1				
15				Maintain elevation for duck and otter habitat and moist soil plant production.
July 1				
15				
Aug. 1				
15				
Sep. 1				
15			654.5	Flood with Swan Lake water.
Oct. 1			655.0	
15				Food source for fall migrants.
Nov. 1				
15				Migratory bird loafing area.
Dec. 1				
15				
31			655.0	

B. Construction and Maintenance

1. Disc Moist Soil Unit 6 to disturb the soil. Sorghum will be planted if possible. Unit maintenance will be accomplished by force account.
2. Remove interior levees in Moist Soil Unit 5 (Levee B) and Moist Soil Unit 6 (Levee A).
3. If possible, replace the 8" tubes with 24" diameter culverts and gates in Moist Soil Units 2 and 3.
4. Mow rank vegetation within the moist soil units to provide open water and travel lanes for waterfowl.
5. Disc the western half of Moist Soil Unit 1. This area will be planted to corn. Unit maintenance will be accomplished by force account.