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Bear River Migratory Bird Refuge

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Annual Habitat Management Plan
2005

April 6, 2005

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Bear River Migratory Bird Refuge
Brigham City, Utah

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Bear River Migratory Bird Refuge
2005 Annual Habitat Management Plan

HABITAT OBJECTIVE

WETLAND
The overall wetland habitat objective for Bear River Refuge is to manage the 29,259 wetland acres for 9% deep submergent, 28% shallow submergent, 14% deep emergent, 23% mid-depth emergent and 26% shallow emergent marsh (June-October).

1) 2,500 acres of deep submergent marsh with 18.1 to 36 inches of water (March-December), 60-80% coverage by sago pondweed and < 15% coverage by emergent vegetation (June-October).

2) 8,700 acres of shallow submergent marsh with 4 to 18 inches of water (February-December), 60-80% coverage by sago pondweed and < 15% coverage by emergent vegetation (June-October).

3)2,800 acres of deep emergent marsh with 12.1 to 24 inches of water (February-November), 50-70% coverage by emergent vegetation (predominantly hardstem bulrush and alkali bulrush) interspersed with 40-50% open water with submerged sago pondweed (June-October).

4) 6,600 acres of mid-depth emergent marsh with 8.1 to 12 inches of water (February-November), with 50% emergent vegetation (alkali bulrush in shallower areas and hardstem bulrush in deeper zones, phragmites, and cattail) and 50% open water with sago pondweed (June-October).

5)8,659 acres of shallow emergent marsh with 2 to 8 inches of water (February-November) with 50-70% coverage by emergent vegetation (90% alkali bulrush, 10% phragmites and/or cattail) and the remainder open water (June-October).

Water levels in the 26 wetland management units are manipulated or influenced to achieve the objectives. In 2004 these objectives were unmet due to low water conditions. Target water levels (and associated habitat) were maintained in only two units through the summer months; Unit 5B and 4C. Unit 5B was the refuge's highest priority for 2004, as the emergent vegetation in the unit is occupied by a large waterbird colony of several Refuge priority bird species including White-faced Ibis and Franklin's Gull. Other units received water as available from the Bear River. The two units made up 2,803 acres of wetlands that were maintained through July and August out of a possible 29,259 acres. Graphs of the unit water levels for 2004 are found in Appendix A.

2004 Water Summary

Air temperatures were cooler in January and February and slightly warmer than average throughout early spring and into summer. August saw cooler than normal temperatures and September was average. 2004 was the first year since 1993 where not a single day reached 100°F or above.

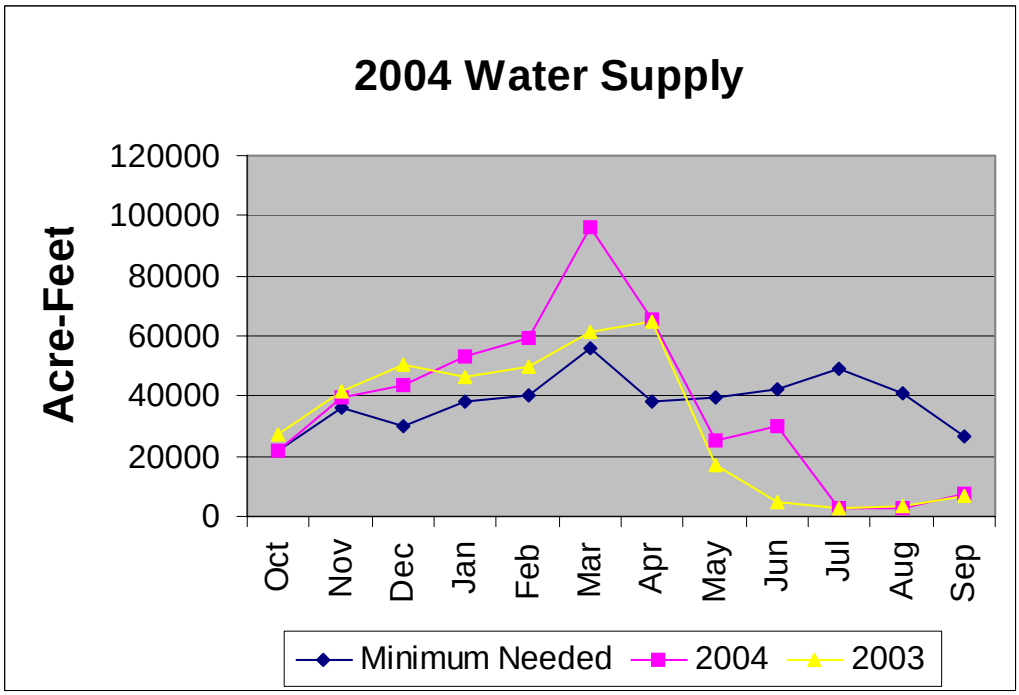
The drought that began in 1997 with below normal snowpack, continued through 2004. The Great Salt Lake Basin snowpack was above average until March. Snowpack decreased 30 to 45 percent in the month of March due to warm temperatures and a lack of accumulation. On March 22,

2004 snowpack in the Bear River Basin was 71% of normal, but by April dropped to 45% of normal. This was down from 78% in 2002 and 68% in 2001.

The National Weather Service forecast for streamflow based on snow-pack was for < 50% of normal amounts ("much below average"). The actual streamflow was 34% of normal. The cumulative effects of seven years of lower than average snowpack resulted in low soil moisture, low water levels in the reservoirs (especially Bear Lake) and decreased river flows.

The 2004 (water-year) Bear River annual mean flow rate was 616 ft^3/s with an annual runoff of 446,900 ac-ft. This compares to the annual mean flow rate of 1,717 ft^3/s and the mean annual runoff of 1,244,000 ac-ft. The low river flows amounted to a Refuge water deficit of 120,718 ac-ft. in seven months of the water year; October-December, May, and July-September (Table 1).

Table1. Water supply scenario, Bear River Migratory Bird Refuge, 2004 water year.



The mean monthly discharge for July and August was 43.0 ft^3/s and 46.7 ft^3/s respectively. The August mean beat out last years' record low of 50.4 ft^3/s. Also, for the second year in a row, a new daily minimum discharge record was set at 23 ft^3/s on July 30, 2004.

With the exception of February and March, the October (2003)-September (2004) flows were all <50% of normal. A large precipitation event around Memorial Day weekend bumped river flows up from 14% of normal in May to 23% of normal in June and allowed for a re-fill of several wetland units heading into the months of high evaporative loss. Bear River flows during June, July, and August (the peak nesting and brood rearing period for Refuge priority bird species and a critical time for aquatic plant germination, growth and production) averaged only 17% of normal at 198 ft^3/s. Low Bear River flows in September led to only a few units re-filled to target level before the onset of fall waterfowl migration.

Unit by unit details follow.

Summary of 2004 management effects

Unit 1 Objective

1. Manage water levels to achieve 440 acres of deep submergent, 2160 acres of shallow submergent, 1491 acres of mid-depth emergent and 547 acres of shallow emergent wetland habitat, April 1-December 15.
Strategy: Re-fill unit 1 with clear water (sans silt) to achieve target elevation of 4204.5 by April 1 and maintain target through December 15.

A. Management Strategy Prescriptions. Water management for the year began by putting two layers of boards in the outlet structure on 3/9. Through-out April and May, Unit 1 fluctuated from .04 to 0.9 below target. Nesting by Franklin's gulls, white-faced ibis, black-crowned night heron, great blue heron and snowy egret was initiated at these below target levels. A large storm event around Memorial Day weekend, caused water levels to rise abruptly about a foot (4203.83 to 4204.79), flooding many of the near-term Franklin's gull nests. As this unit was not one of the priority units, no Bear River water was diverted to maintain the target level so the unit continued to lose water throughout the summer months. It reached a low of 4203.1 on 8/31 though never completely dried out. Re-filling of this unit was initiated on 9/6 after a big release at Cutler Reservoir. The unit fluctuated about 0.2 over and under the target throughout the fall and into mid-December. About 34 acres in Unit 1 were treated for invasives (Appendix B). About 23 acres (along the dikes) were sprayed for whitetop and thistle, while another 11 acres were sprayed for salt cedar.

B. Habitat Response. When the unit is at the target elevation of 4204.5 there are about 2,981 acres of surface water. A survey of the unit in October, indicated that there are 452 acres of emergent vegetation (mainly alkali bulrush) in the unit (Appendix B). Sago pondweed production was not sampled in the unit though it was thought to be fair to good. Soil salinity levels averaged 2,720 ppm with water salinity levels at 4,820 ppm on 10/13.

C. Response of *Resources of Concern*. A colonial waterbird colony was located in this unit. The colony consisted of 2,228 nests of Refuge priority species White-faced Ibis, and 1,131 nests of Franklin's Gulls along with nests of Black-crowned Night Heron (44) and Snowy Egret (6), Eared Grebe (15) and Pied-billed Grebe (3). Many of the Franklin's Gull nests were lost due to the rapid rise of water after the Memorial Day weekend. It is believed the birds re-nested. Unit 1 was a high use unit for duck broods accounting for 11 and 15% of all broods counted on 7/28 and 8/17 respectively.

This unit accounted for 41% of the total Franklin's Gull use of the Refuge in the spring (March-May) and 26% in the summer (June-July) (Tables 2 and 3). The unit also accounted for 54% of summer and 70% fall (August-November) use by Snowy Plover (Table 4). Also in the fall, Unit 1 was important for Cinnamon Teal, Tundra Swan and Long-billed Dowitcher accounting for 33%, 71%, and 54% of total seasonal use respectively (Table 4).

Table 2. Seasonal use by priority species, Spring 2004.

	Spring (Mar-May)					
Species	**Peak No.**	**Peak Date**	**Peak Unit**	**Peak Unit Use**	**Seasonal Use Sum**	**Population Prop (%)**
American Avocet	12,823	23-Apr	6	118,974	490,834	24
Cinnamon Teal	4,600	13-Apr	6	56,362	184,873	30
Black-necked Stilt	4,955	23-Apr	6	77,848	163,136	48
White-faced Ibis	7,691	7-May	6	160,610	299,575	54
Shorebirds	23,776	23-Apr	6	245,611	790,852	31
Waterfowl	79,136	1-Apr	6	526,430	3,319,407	16
Tundra Swan	3,256	18-Mar	5C	25,505	43,114	59
Snowy Plover	22	13-Apr	4A	144	276	52
Marbled Godwit	5,623	23-Apr	6	46,660	96,693	48
Long-billed Curlew	7	7-May	4A	74	300	25
Am. White Pelican	418	13-Apr	6	4,112	19,705	21
Redhead	8,968	25-Mar	5B	52,544	264,744	20
Wilson's Phalarope	140	18-May	3E	2,411	6,738	36
Long-billed Dowitcher	1,541	7-May	3A	7,320	22,828	32
Franklin's Gull	2,341	30-Apr	1	53,847	132,117	41
Black Tern	191	18-May	6	6,475	7,089	91

Table 3. Seasonal use by priority species, Summer 2004.

	Summer (June-July)					
Species	**Peak No.**	**Peak Date**	**Peak Unit**	**Peak Unit Use**	**Seasonal Use Sum**	**Population Prop (%)**
American Avocet	4,243	23-Jul	6	48,612	133,121	37
Cinnamon Teal	4,064	24-Jun	5B	20,308	56,982	36
Black-necked Stilt	7,862	30-Jul	6	47,582	154,318	31
White-faced Ibis	12,420	30-Jul	2D	54,177	212,978	25
Shorebirds	13,929	23-Jul	6	159,817	388,855	41
Waterfowl	13,443	24-Jun	5B	60,959	325,746	19
Tundra Swan	Not Present					
Snowy Plover	24	30-Jul	1	114	210	54
Marbled Godwit	2,301	23-Jul	6	53,905	58,496	92
Long-billed Curlew	36	30-Jul	5D	222	740	30
Am. White Pelican	2,168	2-Jul	2D	21,256	65,427	32
Redhead	1,529	24-Jun	5B	20,187	30,828	65
Wilson's Phalarope	2,074	24-Jun	3E	5,546	18,198	30
Long-billed Dowitcher	208	23-Jul	2A	1,305	2,275	57
Franklin's Gull	3,071	30-Jul	1	13,120	51,250	26
Black Tern	11	30-Jul	2C	54	66	82

Table 4. Seasonal use by priority species, Fall 2004.

	Fall (Aug-Nov)					
Species	**Peak No.**	**Peak Date**	**Peak Unit**	**Peak Unit Use**	**Seasonal Use Sum**	**Population Prop (%)**
American Avocet	10,164	20-Aug	2D	177,840	280,296	63
Cinnamon Teal	1,883	2-Sep	1	19,515	58,295	33
Black-necked Stilt	12,105	13-Aug	2D	163,846	295,207	56
White-faced Ibis	13,858	20-Aug	2D	81,538	301,659	27
Shorebirds	28,591	20-Aug	2D	377,513	777,468	49
Waterfowl	205,949	10-Nov	4C	2,166,681	10,184,488	21
Tundra Swan	18,369	10-Nov	1	265,770	375,363	71
Snowy Plover	17	13-Aug	1	105	150	70
Marbled Godwit	6,373	20-Aug	6	80,300	96,630	83
Long-billed Curlew	66	5-Aug	2D	252	1,158	22
Am. White Pelican	1,328	20-Aug	4C	9,532	42,240	23
Redhead	8,339	15-Oct	4C	210,884	271,407	78
Wilson's Phalarope	1,044	5-Aug	2C	10,986	23,278	47
Long-billed Dowitcher	2,203	13-Aug	1	18,986	34,876	54
Franklin's Gull	5,266	13-Aug	2D	59,276	111,067	53
Black Tern	790	13-Aug	2D	5,992	6,090	98

Table 5. Seasonal use by priority species, Winter 2004.

	Winter (Jan-Feb, Dec.)					
Species	**Peak No.**	**Peak Date**	**Peak Unit**	**Unit Use**	**Use Day Sum**	**Pop. Prop %**
American Avocet	Not present					
Cinnamon Teal	4	20-Feb	5C	56	56	100
Black-necked Stilt	Not present					
White-faced Ibis	Not present					
Shorebirds	Not present					
Waterfowl	36,662	17-Dec	5B	558,424	985,732	57
Tundra Swan	6,385	2-Dec	6	58,156	149,632	39
Snowy Plover	Not present					
Marbled Godwit	Not present					
Long-billed Curlew	Not present					
Am. White Pelican	2	2-Jan	7	28	32	88
Redhead	19	2-Dec	5B	152	152	100
Wilson's Phalarope	Not present					
Long-billed Dowitcher	Not present					
Franklin's Gull	Not present					
Black Tern	Not present					

Units 1A, 3A and 3K Objective

1. Manage water levels to achieve 50% interspersion of open water to 50% emergent vegetation.
A. Management Strategy Prescriptions. Unit 1A The unit was filled in the spring from Bear River inflows through the drive-through spillway. The unit was allowed to dry out in the summer. Staff installed a new drive-through inlet structure and added a stoplog pier to regulate inflows. No interested parties could be located to graze the unit in late July as planned. The stop-logs were left

out in the fall to allow for direct refilling from the Bear River as flows increased in late September-early October. The stop-logs were installed in the new structure on 10/18 with only 1 bay open and remained that way throughout the winter.
Units 3A and 3K No water elevation data is available as these units have no water gauges. In general, the units were filled with water in the spring and went dry by mid-summer. Re-filling began on September 21 via the Bear River inflatable water-control-structure. No grazing of the units occurred as planned. Staff decided against breaching the interior dike between the units to create a single unit.

B. Habitat Response. Unit 1A. A survey of the unit in 2003 indicated that 42% or 232 acres of the unit was open water and the remaining 48% (312 acres) was emergent vegetation. About 25% of the emergent vegetation was alkali bulrush. The remaining area was covered by stands of hardstem bulrush as well as stands of undesirable species of *Phragmites*, cattail, and tamarisk. It is believed the habitat acreages in 2004 are similar to those from 2003. About 65 acres of this unit were treated for tamarisk and whitetop (Appendix B). About twenty acres of whitetop, mainly on the dikes, were sprayed and about 45 acres of salt cedar were sprayed. Habitat objectives for Units 3A and 3K were unmet due to dry conditions. Both units were treated for tamarisk and whitetop. About 6 acres of whitetop were sprayed in 3K. A total of 19 acres were treated in 3A by spraying for both whitetop (6 acres) and salt cedar (13 acres).

C. Response of *Resources of Concern.* There was no significant use (≥10 % of annual use) of Unit 1A by priority species. Unit 3A accounted for about 12% of the annual use by both long-billed dowitcher and Wilson's phalarope (Appendix C). 3A was also important during the spring season, hosting 32% of the March-May population of long-billed dowitcher (Table 2). 3K did not host significant numbers (≥ 10 % of annual total use) of priority species.

Unit 2A and 2B Objectives

1. Manage water levels to achieve 75% cover by alkali bulrush.
A. Management Strategy Prescriptions. No water elevation data is available as these units have no water gauges. Unit 2A and 2B were full in the spring, dry by mid-July and full in late fall. The screw gate into unit 2A was closed on May 24th and again on June 18th. Unit 2B was not grazed as planned. About 17 acres of 2A was sprayed for invasives; 16 acres for salt cedar and a half acre for whitetop. Unit 2B re-filling began on September 28 by boarding up L-Canal/Unit 1 WCS. Seventeen acres of 2B were sprayed for invasives; 12 acres of whitetop and another 5 acres of salt cedar (Appendix B).

B. Habitat Response. The habitat objectives in units 2A and 2B were unmet due to dry conditions.

C. Response of *Resources of Concern.* Unit 2A was important in the summer season, accounting for 56% of the seasonal population of long-billed dowitcher (Table 3). Unit 2B did not host significant numbers of priority species.

Unit 2C Objective
1.Maintain water-level at 4204.5' msl, year-round.
2. Increase sago pondweed to cover 70% of the unit.
3. Manage water levels to achieve 504 acres of shallow submergent wetland and 216 acres of shallow emergent wetland.

A. Management Strategy Prescriptions. The unit was maintained about 0.5' above target throughout winter and early spring. The target elevation was raised by .5' to make sure the salt cedar that had sprouted was killed. The unit reached a low of 4203.75 in late August. Unit was back up near target by mid-October. About 34 acres of invasives were sprayed in the unit; 24 acres of whitetop and 10 acres of salt cedar (Appendix B).

B. Habitat Response. Though the unit was the number 3 priority fill unit, there was not enough flow in July and August to maintain the unit at objective levels. Therefore, habitat objectives were unmet due to drying conditions with little to no sago pondweed production and emergent vegetation.

C. Response of *Resources of Concern*. The unit was important to black terns in the summer hosting 26% of the seasonal use for June-July (Table 2). The unit provided critical habitat to migrant Wilson's phalaropes in the fall, hosting 47% of the August-November population. Over the course of 2004, Unit 2C accounted for 14% of the annual use by American avocet, 11% of use by black-necked stilt, and 24% of use by Wilson's phalarope (Appendix C).

Unit 2D Objective

1. Manage water levels to achieve 4,029 acres of deep submergent and 590 acres of deep emergent habitat.

A. Management Strategy Prescriptions. The target elevation was lowered from the previous year to 4205.25. The spiked about 1.5' after the Memorial Day weekend storm hit then slowly evaporated, reaching a low of 4203.27 on August 31st. The unit provides phenomenal shorebird and wading bird habitat in July and August when the unit is drying between 4204 and 4203. Fall re-filling was initiated on September 3 and achieved a maximum elevation of 4205.17 on October 22. About 530 acres of the unit were treated for invasive plants. Sixty-two acres were sprayed for white top while another 472 were sprayed for salt cedar (Appendix B). No grazing occurred as planned. The 12' X 20' bridge deck on the Unit 2D/GSL 3 bay water control structure was replaced. The deck needed replacement due to de-lamination and rusting of the interior re-bar.

B. Habitat Response. The habitat objective was met only during early spring before drying out, as sago pondweed was noted as abundant during several airboat trips. The unit was unvegetated mudflat habitat from late August to mid-September. The unit froze by mid-December.

C. Response of *Resources of Concern.* This unit was utilized by all the refuge priority species. The unit was especially important to priority species in the summer and fall periods. In summer, 2D accounted for 25% of the use by white-faced ibis and 32% of use by seasons pelicans (Table 3). In the fall, the unit accounted for 63% of the use of American avocet, 56% of the use of black-necked stilt, 27% of white-faced ibis, 49% of all shorebird use, 22% of use by long-billed curlew, 53% of use by Franklin's gull, and 98% of use by black terns (Table 4). Over the entire year, the unit accounted for 48% of annual use by American avocet, 33% of use by black-necked stilt, 29% of white-faced ibis, 22% of use by all shorebird use, 12% of use by long-billed curlew, 22% of use by American white pelican, 18% of use by Wilson's phalarope, 23% of use by Franklin's gull and 45% of use by black tern (Appendix C).

Unit 3B Objective

1. Increase amount of alkali bulrush to account for 60% of emergent vegetation.

A. Management Strategy Prescriptions. No water elevation data is available as this unit has no water gauge. In general, the unit was filled with water in the spring, went dry by lat July (23rd), and was re-filled via H-canal starting September 29th. Twenty-four acres of the unit were treated for invasives by spraying; 17 acres for salt cedar and 7 acres for white top (Appendix B).

B. Habitat Response. The habitat objective was unmet due to drying of the unit.

C. Response of *Resources of Concern.* The unit did not receive significant use by priority species throughout the year.

Units 3C and 3D Objective

1. Maximize deep submergent wetland habitat to provide optimum conditions for production of sago pondweed.

A. Management Strategy Prescriptions. Unit 3C The target elevation of 4205.0 was never achieved. The unit reached a maximum elevation of 4204.0 in early June, but went dry by late July. The unit was noted as 75% dry on July 7th. The unit was re-filled beginning late September and reached a peak elevation of 4204.1 on October 22. Ten acres of the unit was sprayed for white top, while another 35 acres was sprayed for salt cedar. Unit 3D The target elevation of 4205.5 was not achieved. The unit was maintained about 8" below target in the spring then dried out by late July. Re-filling was initiated on September 29th by charging H-Canal. The unit reached 4204.9 on October 15 with the water just running over the boards. About 31 aces of this unit were treated for white top (1acre) tamarisk (30 acres) by spraying (Appendix B).

B. Habitat Response. The habitat objective was not achieved in either unit. There was little to no sago pondweed production in the units.

C. Response of *Resources of Concern.* Unit 3C This unit accounted for 10% of the annual use by long-billed curlew. Unit 3D had no significant use by priority species in 2004.

Units 3E, 3F and 3G

No objectives were set for these units as they were low priority and would not be kept full of water throughout the summer months.

A. Management Strategy Prescription. Unit 3E target elevation of 4205.0 was reached by March 16th, 2004. However, it was decided to drop the target elevation to about 4204.6 as the small islands along D-Line become exposed at this level to accommodate nesting birds. The unit dried out by late July. Re-filling of the unit was initiated on September 29th by charging O-Canal. Four acres of white top were sprayed in 3E and another 16 acres of salt cedar were sprayed (Appendix B). There is no water level data available for unit 3F and 3G as they have no gauges. In general, the units were filled to maximum capacity in the spring (3 boards in outlet structure), allowed to dry in the summer and re-filled starting on September 29th. In unit 3G, 14 acres were sprayed for white top and another 31 acres for salt cedar.

B. Habitat Response. Sago pondweed appeared to germinate in these units but no production was noted due to the dry conditions.

C. Response of *Resources of Concern*. Unit 3E This unit was important to Wilson's phalarope in the spring and summer, accounting for 36% and 30% respectively of the seasonal use (Tables 2 and 3). The unit accounted for 17% of the annual use of this species (Appendix C). Unit 3F had no significant use by priority species in 2004. Unit 3G accounted for 14% of the annual use by snowy plover (Appendix C).

Unit 3H, 3I and 3J Objective

1. Maximize emergent wetland type to encourage colonization of alkali bulrush.
A. Management Strategy Prescriptions. There is no water elevation data available as none of these units have water gauges. In general, the units were full in the spring, dry by late July and then re-flooded starting in late September. Staff noted that Bear River water was high enough to start flowing into "Duckville" through the Bear River flap gate as well as the new flap gate into 3H on September 21. All three units were sprayed for white top; 12 acres in 3H, 11 in 3I and 5 in 3J. About 19 acres of 3H was also sprayed for salt cedar control (Appendix B).

B. Habitat Response. Unit 3H responded to drier than normal conditions with good growth of salt grass and *Salicornia*. Units 3I and 3J are about 70% emergent vegetation (cattail) and 30% open water.

C. Response of *Resources of Concern.* None of the three units received significant use by priority species.

Unit 4A, 5A and 5D Objective

1. Maintain mudflat habitat for foraging and loafing waterbirds.
A. Management Strategy Prescriptions. These units have wet mudflats with less than 2 inches of standing water shortly after precipitation events, otherwise they're dry, alkali mudflats. The Bear River did not flood above its banks and spread out into either of these units in the spring as it has historically. In August and September, a drive-through spillway crossing was constructed across the top of the canal that separates unit 4B and 4C. The crossing acts as a plug or dike and effectively impounds water across Unit 4A up to the 4204 contour creating about 900 acres of additional shallow water wetland habitat ranging from about 2-10" deep. About 105 acres of 4A was sprayed for invasives; 24 acres of white top and 81 acres of salt cedar. About 287 acres of 5A was treated for salt cedar; 10 acres were disced, 49 acres were pulled, and 228 acres were treated by spraying (Appendix B).

B. Habitat Response. Unit 4A had water throughout the fall and winter up to the 4204 contour elevation. No standing water was observed in Unit 5A. The area above the 4024 foot contour in both these units is dry, alkali mudflat habitat. Unit 4A supports scattered patches of saltgrass, pickleweed (*Salicornia rubra)* and an occasional iodinebush (*Allenrolfea occidentalis*). Unit 5A is occupied mostly by sparse pickleweed and cheatgrass.

C. Response of *Resources of Concern.* Unit 4A was important for both snowy plover and long-billed curlew. The unit accounted for 52% of the spring use for snowy plover and 25% of the spring use for long-billed curlew (Table 2). The unit also accounted for 23% of the annual use by snowy

plovers (Appendix C.). While pulling salt cedar, Tim Woodward found a curlew nest in 5A. Upon further investigation of the unit, an estimated 5 pair of curlew were nesting in the unit along with at least 3 snowy plover. The curlew nest was successful in hatching 4 young. Unit 5D was important for long-billed curlew during the summer season, accounting for 30% of the seasonal use (Table 3). A group of up to 20 birds utilized this unit during June and July. They appeared to be a post-breeding flock made up of fledgling birds, adults, and perhaps non-breeding adults. The unit accounted for 13% of the annual use by long-billed curlew.

Unit 4B Objective

As a low priority unit based on predicted water supply, no objectives were set for this unit. General goal was to provide habitat for migratory waterfowl during spring and fall.

A. Management Strategy Prescriptions. The target elevation was raised a foot from 2003 to 4205.5 to encourage colonization of the unit by alkali bulrush. The unit was maintained around 4205.0 throughout the spring, went dry by mid-August and was re-filled to 4204.9 and maintained at that level through the fall. Twenty-nine acres were sprayed for invasives; 25 acres for salt cedar and 4 for white top (Appendix B).

B. Habitat Response. No habitat objectives were set or accomplished as the unit went dry.

C. Response of *Resources of Concern*. This unit supported an Avocet colony on an island in the southeast corner. On June 1, six active California Gull nests were counted on the islands along with an estimated 300 avocet nest cups from which the young had already hatched. The unit hosted 19% of the annual use by long-billed curlew tallying 419 use days.

Unit 4C Objective

1. Maintain soil salinity levels at 5,000 - 10,000 ppm, April 1-October 15.
2. Maintain water level at 4205.75' msl, throughout the year.
3. Increase amount of sago pondweed to cover 60% of the unit.
4. Manage water levels to achieve 1528 acres of deep submergent wetland habitat and kill salt cedar that was treated in 2003.

A. Management Strategy Prescriptions. The target elevation of 4205.75 was achieved by March 16th and was maintained until late April. The water eroded the southwest corner of the unit along D-Line at this level so water was lowered to around 4205.0 and maintained throughout the summer and late fall. About 33 acres of the unit along the dikes were sprayed for invasives; 28 acres for salt cedar and 5 acres of white top.

B. Habitat Response. As a priority unit, the water levels were maintained in the unit throughout the year. Habitat objectives were met. An airboat survey of the unit was conducted on July 27th to take salinity readings and estimate sago pondweed productivty. Sago covered at least 60% of the unit. To sample sago productivity, a 26" square fashioned out of PVC was thrown randomly from the airboat. The area within the square that is occupied by sago pondweed is assessed and scored (Table 6). Seventeen samples yielded an average score of 65.3 for a grade of “Good”.

Table 6. Sago pondweed colonization and productivity scale.

Productivity Key	
Grade	% coverage
Poor	0-25
Fair	26-50
Good	51-75
Excellent	76-100

The vegetation was mapped in July (Appendix B). The unit grew a stand of alkali bulrush covering about 238 acres. The bulrush stand created a fairly dense strip along the south border but was sparse in the central part of the unit. Salinity readings were taken in July 26th and August 31st. The eight samples in July yielded an average soil salinity of 2,662 ppm, an average soil temperature of 23 °C, with an average water salinity of 4,825 ppm and average water temperature of 25.5 °C. The August salinity levels were higher at an average soil salinity of 4,580 ppm and water salinity of 7,280 ppm. The average soil temperature was 22.0 °C and average water temperature was 26.7 °C. The soil salinity levels, though lower than objective levels, still seem to be adequate to encourage desirable emergent species while prohibiting germination and growth of undesirable cattail species.

C. Response of *Resources of Concern.* As one of only 2 units with water during critical July and August months, Unit 4C received heavy use by Refuge priority species. The unit was important to waterfowl, pelican, and redhead during the fall season accounting for 21%, 23%, and 78% seasonal use, respectively (Table 4). In addition, the unit accounted for 10% of the annual use by cinnamon teal, 20% of waterfowl, 11% of tundra swan, 18% of redhead, and 29% of long-billed curlew (Appendix C). The unit has three islands. A survey of the "central" island on June 1st revealed 663 California gull nests, 38 double-crested cormorants, 3 great blue herons and a pelican. The south central island had 493 California gull nests and 58 Caspian terns. The northeast island had 37 California gull nests and about 200 double-crested cormorant nests.

Unit 5B Objective

1. Manage soil salinity levels at about 5,000-8,000 ppm.
2. Maintain water at target elevation of 4204.6' msl April 1-December 15.
3. Increase amount of alkali bulrush to account for 60% of emergent vegetation with a mix of 50% open water to 50% emergent vegetatation over the entire unit.
4. Manage water levels to achieve 582 acres of mid-depth emergent wetland habitat, 207 acres of shallow emergent and 994 acres of vegetated mudflat.

A. Management Strategy Prescriptions. This unit was the highest priority unit so water in-flows were maintained throughout the summer to just off-set evaporation. The unit started the spring just above the target and was brought down to target by mid-April. The unit was maintained within 0.3 of the target throughout the summer months. However, a rapid rise occurred in early June after a large storm event around Memorial Day. This caused flooding and loss of nests within the large waterbird colony in the unit. The birds quickly re-nested as evidenced by the number of nests with only 1 or 2 eggs or incomplete clutches found during a survey on June 4th. Tamarisk stands were treated in the unit by spraying (48 acres), and pulling (15 acres). Another 6 acres were sprayed for white top (Appendix B).

B. Habitat Response. The objectives were partially met. Salinity readings were taken on three occasions (Table 7). Soil and water salinities increased as the season progressed. Soil salinity objectives were met by September.

Table 7. Salinity and temperature readings from Unit 5B, 2004.

	7-Jul	21-Jul	8-Sep	
Soil	1350	3633	6267	ppm
Temp.	22	22	20.0	C
H2O		6100	7567	ppm
Temp.		23	22	C

This unit was surveyed on July 27th for sago pondweed colonization and density. With an average score of 57, the sago stand was considered "good". A survey in July showed about 1,000 acres of open water habitat and about 245 acres of emergent vegetation of which about 10% was alkali bulrush. The emergent vegetation stand is comprised mainly of *Phragmites.* Though the size of the stand of emergent vegetation doesn't seem to grow, Refuge staff have noticed a gradual change in the species composition. Where alkali bulrush used to comprised a much larger percentage of the stand it continues to diminish in size. When the alkali bulrush stand in 4C grows large enough and dense enough to support the waterbird colony that current utilizes the unit 5B stand, the unit will be drained for a management action aimed at reducing the size of the *Phragmites* stand.

C. Response of *Resources of Concern.* The emergent vegetation attracted colony nesting birds such as priority species White-faced Ibis and Franklin's Gull. The colony was surveyed on June 6th and the number of nests were counted. The colony supported an estimated 7,025 white-faced ibis nests, 6 Franklin's gull, 34 black-crowned night heron, 151 snowy egret, 68 cattle egret, 3 great blue heron and 2 or more great egret. In addition, the islands in the unit hosted 6 California gull nests, 30 nests of double-crested cormorant, 4 Caspian Tern, 40 Forster's tern, 5 eared grebe, and 180 American avocet. Also on the islands, 6 separate sets of pelican eggs were found, though the eggs did not appear to be incubated. This is the first record of pelicans nesting anywhere besides Gunnison Island in recent years. Having water all-year round, this unit hosted 22% of the annual use by waterfowl, 47% of Redhead use, and 15% of use by American White Pelican. The unit was also important seasonally for priority birds. The unit hosted 20% of the spring use by redhead, 36% of use of cinnamon teal, 19% of all waterfowl, and 65% of use by redhead in the summer (Tables 2 and 3). In the winter, the unit accounted for 57% of use by waterfowl and 100% of use by redhead (Table 5).

Unit 5C Objective

Complete draw-down of the unit was planned to facilitate tamarisk treatment.

A. Management Strategy Prescriptions. The unit was never filled following winter draw-down and allowed to dry by June. Starting on September 1 about 218 acres of the unit were disced to control salt cedar. Another 2 acres were "pulled" and 60 acres were sprayed along the dikes. Another 32 acres were sprayed for white top control. Re-filling was initiated after October 8th. The unit was filled to fall/winter level of 4204.75 by November 16th and maintained throughout the rest of 2004.

B. Habitat Response. A blanket of salt cedar sprouts covered the entire bottom of the unit throughout the summer. Re-flooding should kill them off.

C. Response of *Resources of Concern.* The unit was important to tundra swan while it was filled in the spring, accounting for 59% of the season use of the species (Table 2). The unit accounted for 12% of the annual use for American avocet, and 18% of use by marbled godwit (Appendix C).

Unit 6

Though not impounded, this unit is influenced by water releases through the D-line dike from unit 5B, 5C and Whistler canal. The unit which is the south boundary of the Refuge, is seamless with the Great Salt Lake. The unit had shallow water covering the soils in the spring and fall, going dry by mid-August. The unit was important to many of the priority species. The unit accounted for 23% of the annual use by American avocet, 28% of cinnamon teal, 28% of white-faced ibis, 29% of shorebirds, 11% of waterfowl, 6% of tundra swan, 72% of marbled godwit, 6% of American white pelican, 13 % of Franklin's gull, and 49% of black tern (Appendix C). In the spring, unit 6 was the most important unit for the priority species accounting for the highest use by 9 out of the 16 species. The unit hosted 24% of the spring population of American avocet, 30% of cinnamon teal, 48% of black-necked stilt, 54% of white-faced ibis, 31% of all shorebirds, 16% of waterfowl, 48% of marbled godwit, 21% of American white pelican, and 91% of black tern (Table 2). In the summer, the unit hosted 37% of the seasonal use by American avocet, 31% of black-necked stilt, 41% of all shorebirds, and 92% of marbled godwits (Table 3). In the fall, the unit was once again the most important to priority species, providing habitat for marbled godwit, accounting for 83% of the seasonal use for this species. In the winter, the unit accounted for 39% of the use by tundra swan (Table 5). Thirty-two acres of unit 6 were treated for salt cedar (8 pulling, 24 spraying).

Dikes

Several dikes were seeded in 2004. The dikes along O-Line canal (both east and west side), and the Unit 3 drain canal from the top of 3B and 3F to the bottom of 3B and 3F were broadcast seeded in March. The seed mix was 49% tall wheatgrass, 14% slender wheatgrass, 12% alti wildrye, 9% thickspike wheatgrass, 9% western wheatgrass, 2% bluebunch wheatgrass, and 1% alkali sacaton. There was no response. We believe the alkalinity is too high on these fairly "new" dikes for these plant species. There is a predicted colonization scheme as alkalinity decreases. Kochia and bassia are the first to colonize these dikes then is succeeded by salt grass. We will wait until kochia and bassia begin to grow before we attempt further seeding. Several miles along D-line adjacent to units 3C and 3D were broadcast seeded with salt grass that was harvested from the Refuge under a special use permit.

The dikes were left entirely unmowed until after the waterfowl nesting season. Mowing was initiated after August 1. The dikes were mowed almost to the waters edge to invigorate salt grass.

2005 Wetland Management Plan

The wetland habitat goal at Bear River Refuge is to provide a diversity of wetland types, a diverse and abundant population of aquatic macro invertebrates, and a range of aquatic plant communities from early to late successional stages.

The following general management strategy applies to all wetlands to achieve the overall Refuge wetland habitat goal and objective. Unit by unit objectives and strategies follow for priority units.

General Management Strategy

In 2005, pools will be filled to target levels according to the availability and turbidity of Bear River water. Pools should be refilled to target levels just prior to the spring peak, to reduce sediment deposits in the pools and turbidity that can inhibit sago pondweed germination, growth, and production. Units should all be brought up to target elevation by April 1 and maintained, when water conditions allow, through December 15. Once at target levels, outflow should be restricted to maintain soil salinity levels appropriate for saline marsh vegetation (hardstem bulrush, alkali bulrush and sago pondweed). Non-priority units allowed to dry naturally through evaporation losses and low water supplies, will be filled beginning in September or when dependable water supply allows, and should be at target level by the first week in November. The larger units, (Unit 1, 2D, 4C and 5C) which are subject to ice damage from wind fetch, will be lowered about 18" before ice-up and will remain in draw-down throughout the winter. All other units will be maintained at or near target levels through the winter. Unit objectives are listed only for those units that can be sustained at target levels throughout the driest part of the year. The general management strategy outlined above will be followed for the non-priority units that the water supply is inadequate to maintain at target level through July, August and September.

A reliable water supply outlook forecasting the April-July runoff based on snowpack, is available around April 1 of each year (http://www.cbrfc.noaa.gov/wsup/wsup.cgi). Wetland unit target elevations are developed and prioritized for filling (spring and fall) and water level maintenance based on the forecast. The following tables provide the priorities of fill and pool retention for 2005.

Snowpack in the Bear river basin was 108% of normal on April 4, 2005. The water supply forecast for 2005 is for “near average ”runoff in the Bear River basin which means 90-110% of normal. However, due to the previous seven years of drought, Bear Lake, which acts as a reservoir, is only at 3% usable irrigation storage capacity. This will equate to extremely low flows around 40-50 cfs in the Bear River for July and August when irrigation demand is high and the Bear River Canal Company’s water right is senior to the Refuge’s. Under these expected low water conditions, we would be able to maintain only the two highest priority units (5B and 4C) throughout the driest period of the year (Table 8).

Table 8. Priority order of wetland management units with “near average” runoff forecast, Bear River MBR, 2005.

Near Average (90-110% of average)				July-August	
Unit	Wet Acres	Cumulative Acreage	Target Elevation	Maintenance Water Need (cfs) Unit/Cumulative	
5B	1,275	1,275	4204.6	22.0	22.0
4C	1,528	2,803	4205.5	26.3	48.4

Unit 5B Objectives

1) Maintain water at target elevation of 4204.6' msl April 1-December 15.
2) Manage soil salinity levels at about 5,000-8,000 ppm (8-12 m.mhos/cm), June-August.
3) Increase amount of alkali bulrush to account for 60% of emergent vegetation with a mix of 70% open water to 30% emergent vegetation over the entire unit.
4) Manage water levels to achieve 582 acres of mid-depth emergent wetland habitat, 207 acres of shallow emergent and 994 acres of vegetated mudflat.

Management Prescription:
1: Maintain water levels by channeling Bear River flows through Whistler canal.
2: Manage salinity levels by adding only enough water to offset evaporation losses.
3: Control aquatic vegetation community composition through water depth management and by matching salinity levels with tolerance ranges of desired macrophytes.
4: Maintaining water levels at the target will create mid-depth emergent, shallow emergent and vegetated mudflat habitats.
If low water supply conditions persist in September and October, the target elevation is lowered to 4204.0.

Unit 4C Objectives

1) Maintain water level at 4205.5' msl, (April 1-October 15).
2) Maintain soil salinity levels at 5,000 - 10,000 ppm (8-15 mmhos/cm), June-August.
3) Increase amount of sago pondweed to cover 70% of unit.
4) Manage water levels to achieve 504 acres of shallow submergent wetland and 216 acres of shallow emergent wetland.

Management Prescription:
1: Maintain water levels by channeling Bear River flows through Whistler canal.
2: Manage salinity levels by adding only enough water to offset evaporation losses.
3: Control aquatic vegetation community composition through water depth management and by matching salinity levels with tolerance ranges of desired macrophytes.
4: Maintaining water levels at the target will create shallow submergent and shallow emergent wetland types.

The following table (Table 9.) illustrates the priority order of fill and maintenance of units should the water supply be better than expected.

When the water supply allows, the units will be re-filled in the order as indicated in Table 9. The order of fall fill does not need to be applied to every unit as after about the first five units, water supply is ample enough to fill many of the units simultaneously.

Table 9. Management priority order of wetland units, Bear River MBR, 2005.

	Total	Wet	Spring	Priority	Maintenance	Cumulative	Fall Fill	Fall
Unit	Acres	Acres	Target	Order	Needs	Needs	Order	Target
			Elevation	2005	(July-Aug.)	(July-Aug.)	2005	Elevation
			2005		cfs	cfs		**2005**
5B	1,783	1,275	4204.60	1	13.6	13.6	1	
4C	1,528	1,528	4205.50	2	26.3	39.9	2	4205.00
4B	1,242	1,242	4205.50	3	21.4	61.3	3	4205.00
5C	2,558	2,558	4205.50	4	24.4	85.7	4	4205.00
3E	1,448	1,448	4204.60	5	25	110.7	5	
3K	230	230	4206.00		4		6	
3I	211	211	4205.00		3.6		7	
3J	166	166	4206.00		3.6		8	
2C	720	720	4205.25		12.4		9	
2D	4,619	4,619	4205.25		79.6		10	4204.75
3D	1,045	1,045	4205.00		18			
1	12,204	4,638	4204.50		59.7			4204.00
3C	549	549	4204.00		9.5			
1A	544	544	4205.40		9.4			
3B	1,085	1,085	4205.00		18.7			
3A	505	505	4206.00		8.7			
2A	135	135	4205.50		2.3			
2B	294	237	4206.00		4.1			
3F	903	903	4205.20		15.6			
3G	1,545	1,047	4205.70		18.1			
3H	655	295	4206.00		5.1			
5A	2,405	495	4205.50		N/A			
4A	2,698	1,523	4205.50		N/A			
5D	939	0	N/A		N/A			
6	3,185	3,185	N/A		54.9			
7	2,581	2,581	N/A		44.5			
8	4,158	4,158	N/A		71.6			
9	5,171	5,142	N/A		88.6			
10	15,262	1,014	N/A		17.5			
Total	**70,368**	**43,078**						

Grassland Ponds

In 2004, the objectives for the grassland ponds were:

1). Manage ponds to achieve mix of 50% open water to 50% emergent vegetation or hemi-marsh conditions, year-round.
2) Maintain water level at 1' below the top of the dike year-round unless otherwise stated.
A. Management Strategy Prescription. All the units were filled in the spring to the objective level. There are no water level data available as there are no staff gauges on the outlet structures. However, water inflow data was collected from June 22 to August 27 from the three flume gauges to each of the Nichols, White and Stauffer tracts. In general, water supply was higher in the month of June and

July for the Nichols and Stauffer tracts compared to last year, but slightly lower for White tract (Table 10). Summer inflows kept the units wet throughout the summer though not at the objective level. The units began to fill in October and reached maximum height by mid-December.

Table 10. Flume measurements for grassland tracts, 2004.

	Nichols		White		Stauffer	
2001-2003	Average	2004	Average	2004	Average	2004
January	0.93		0.66		0.66	
February	6.80		0.66		0.66	
March	1.35	.933	0.66	0.66	0.62	0.66
April	1.01		0.60		0.52	
May	0.62		0.69		1.39	
June	0.50	0.93	0.57	0.44	0.87	1.30
July	0.42	1.02	0.51	0.37	0.58	0.61
August	0.97	1.81	0.40	0.46	0.47	0.29
September	1.82		0.34		0.52	
October	1.12		0.42		0.42	
November	3.17		0.66		0.93	
December	1.24		No Data		0.66	

B. Habitat Response. No aquatic vegetation monitoring was conducted in 2004 so it is not known if the first habitat objective was met. The second habitat objective was not met due to evaporation losses in the summer months.

C. Response of *Resources of Concern*. The grassland ponds are utilized primarily by migratory waterfowl in the spring and fall, cinnamon teal and redhead as pair and brood rearing ponds throughout the spring and summer, as feeding areas for White-faced Ibis, and nesting, resting, feeding and brood rearing areas for black-necked stilts, American avocet, and long-billed curlew. The 2004 total use days by priority species, as tallied from 21 weekly surveys, was 117,746. This is about double the 63,109 total use days from 2003.

Peak count for waterfowl was March 25th at 1,093. Peak count or highest use date by shorebirds was September 10th at 352. Pond N4 was the preferred pond for American avocet, all shorebirds, redhead, Wilson's phalarope and long-billed dowitcher accounting for the highest use by the priority species. Pond N5 had the highest use by cinnamon teal and waterfowl. Pond W5 accounted for the highest use by black-necked stilt, white-faced ibis, and Franklin's gull. Pond N1 accounted for the highest use by long-billed curlew, while Pond N3 accounted for the highest use by American white pelican.

2005 Wetland Management Plan for Grasslands

The 2005 objectives for the grassland ponds remain the same as last year.

Management Prescription: To meet the first objective, the density of cattail needs to be reduced in several ponds. S2 and/or N2 and N3-6 will be drawn down in mid-summer and allowed to dry then disced to decrease amount of cover by cattail. All the other ponds on the Nichols, White, and

Stauffer units will be kept as full as the available water supply will allow.

2004 Summary of Management effects for Uplands

GRASSLAND UPLANDS

The overall grassland objective is to: *Manipulate grassland tracts so that native grasses comprise 65-75% of the stand, forbs 5-10%, and woody shrubs 2-5% while decreasing exotic grasses to < 15%, and noxious grass to < 1% by 2015.* Implied, is that the remainder of the area is bare ground (approximately 30-35%).

Nichols, White, Stauffer Unit objectives
Based on the soils, each of the units supports three habitat types and associated plant communities. The objectives describe climax plant communities for each habitat type.

Alkali Bottom Objectives:
1) Increase cover of grasses (saltgrass, alkali sacaton, wheatgrass, Basin wildrye) to 60% by 2015.
2) Increase forb cover to 5% (silverscale, fireweed, and hollyleaf clover) by 2015.
3) Increase shrub cover to 5% (greasewood) by 2015.
4) Decrease cheatgrass cover to < 15% by 2015.

Salt Meadow Objectives:
1) Increase grass cover (alkali bluegrass and saltgrass) to 65-75% by 2015.
2) Increase forb cover (lanceleaf goldenweed, fiddleleaf hawksbeard and sunflower) to 10% by 2015.
3) Increase shrub cover (iodinebush, rabbitbrush and greasewood) to 1-3% by 2015.

Wet Meadow Objectives:
1) Increase grass cover (*Carex* spp.) to 80% by 2015.
2) Increase forb cover (alkali marsh aster and common silverweed) to 5% by 2015.
3) Decrease shrub cover (rabbitbrush and greasewood) to 1% by 2015.

Saltair Mudflat Objectives:
Maintain natural saltair mudflat range condition consisting of strongly saline soils where:
1) 60-65% of the area is barren alkali flats;
2) 30-35% is grasses (saltgrass);
3) 1-5% forbs (pickleweed and seepweed);
4) $\leq$ 1% fresh water marsh (alkali bulrush, hardstem bulrush, and cattail).

A. Management Strategy Prescriptions. A dormant season graze was initiated in November 2003 and continued until mid January on the Refuge grassland units. The Salt Lake Valley received large amounts of snow around Christmas 2003, which persisted until March. The deep snow forced the removal of the cattle from the Refuge earlier than expected. A late spring/early summer graze was also completed April-early June as an experiment on cheatgrass control.

The goal of the grazing program is to invigorate perennial native grasses (wheatgrass species, salt grass, alkali sacaton, Great Basin wildrye and alkali cordgrass) while suppressing annual cheatgrass. Grazing is a tool to improve habitat for ground nesting migratory birds and to improve habitat conditions for other non-target grassland community species. Dormant season grazing reduces the litter layer that inhibits new plant growth. The removal of residual vegetation allows more sunlight penetration to raise soil temperatures.

The grazing areas and utilization rates for the winter of 2003-04 were as follows:

Nichols Unit

An estimated 2,036 acres in ten designated areas within the Nichols Unit were grazed (Figures 1 and 2). Doug George was the grazing cooperator. The N1 Unit consisted of 162 acres and was grazed for 17 days from November 22 - December 8, 2003. A total of 330 head grazed the unit. The total utilization rate for the unit was 1.15 A.U.M.'s per acre. A total of 187 A.U.M.'s were removed.

Unit N2 consisted of 162 acres and was grazed for 15 days from December 9-23, 2003. A total of 330 head grazed the unit at a rate of 1.02 A.U.M.'s per acre. A total of 165 A.U.M.'s were removed.

Unit N3 consisted of164 acres and was grazed for 8 days from December 24-31, 2003. A total of 330 head grazed the unit at a rate of 0.54 A.U.M.'s per acre. A total of 88 A.U.M.'s were removed.

Unit N4 consisted of 800 acres and was grazed for 16 days from January 1-16, 2004. A total of 330 head grazed the unit with a utilization rate of 0.22 A.U.M.'s per acre. A total of 176 A.U.M.'s were removed.

Unit N5 consisted of 18 acres and was grazed for 5 days from April 24-28, 2004. A total of 270 head grazed the unit at a rate of 2.56 A.U.M.'s/ac. A total of 46 A.U.M.'s were removed.

Unit N6 consisted of 221 acres and was grazed for 10 days from May 1-10, 2004. A total 274 head grazed the unit at a rate of 0.41 A.U.M.'s/ac. A total of 91 A.U.M's were removed.

Unit N7 consisted of 141 acres and was grazed for 6 days from May 11-16, 2004. A total of 274 head grazed the unit at a rate

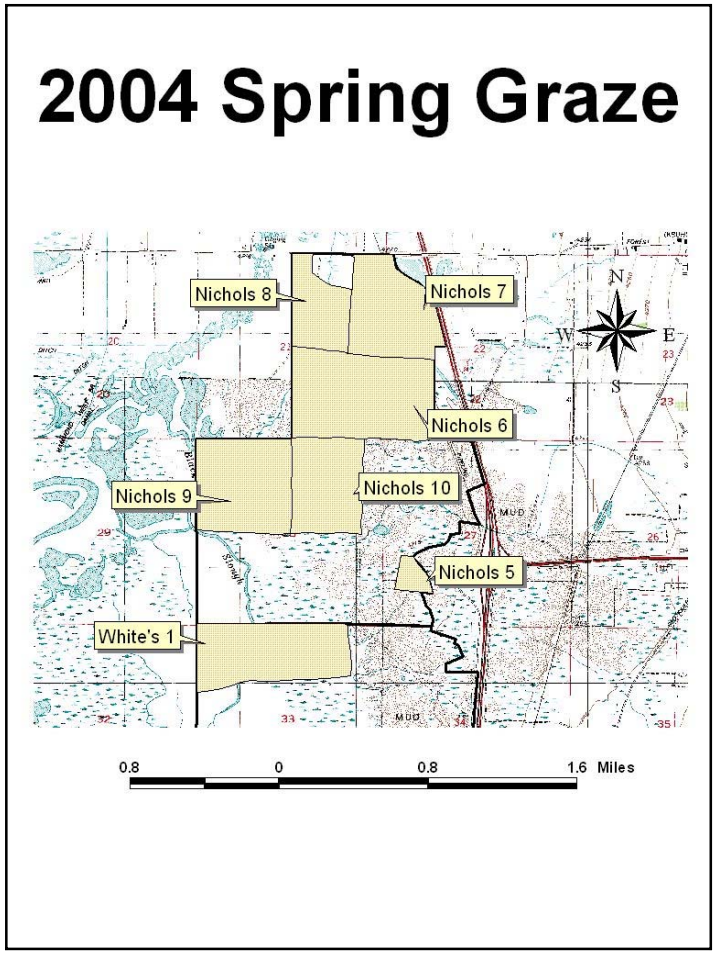


Figure 1. Spring grazing units on Nichols and White, 2003-2004.

of 0.39 A.U.M's/ac. A total of 55 A.U.M.s were removed.

Unit N8 consisted of 81 acres and was grazed for 6 days from May 17-22, 2004.
A total of 274 head grazed the unit at a rate of 0.68 A.U.M's/ac. A total of 55 A.U.M.s were removed.

Unit N9 consisted of 163 acres and was grazed for 8 days from May 23-29, 2004.
A total of 274 head grazed the unit at a rate of 0.45 A.U.M's/ac. A total of 73 A.U.Ms were removed.

Unit N10 consisted of 124 acres and was grazed for 6 days from May 30-June 4, 2004. A total of 274 head grazed the unit at a rate of 0.44 A.U.Ms/ac. A total of 55 A.U.Ms were removed.

About 46 acres of the Nichols tract along Black Slough was treated for salt-cedar by spraying. An additional 20 acres on the Christensen tract were sprayed for salt cedar, touching up sprouts in areas that were pulled in 2003.

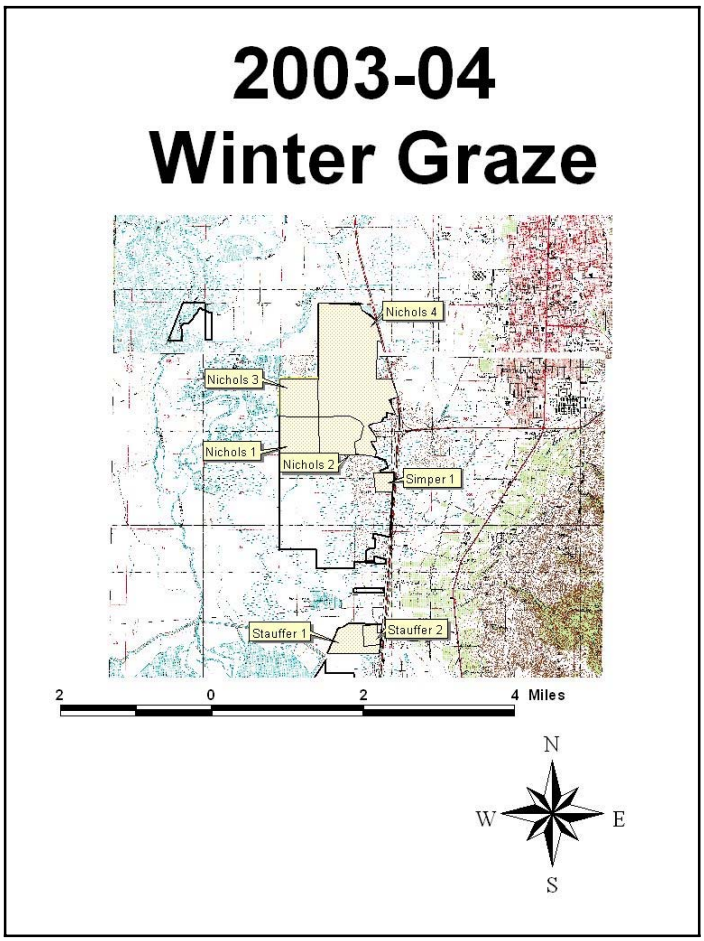


Figure 2. Winter (dormant season) grazing on Nichols and Stauffer, 2003-2004.

White Unit

About 163 acres in one area within the White Unit was grazed (Figure 1). The W1 Unit consisted of 163 acres and was grazed for 8 days from June 5- 12, 2004. A total of 8 head grazed the unit at a rate of 0.45 A.U.M.'s per acre. A total of 73 A.U.M's were removed.

About 36 acres were grazed on the Simper tract. The area was grazed for 3 days from November 19-21, 2003. A total of 330 head grazed the unit at a rate of 0.92 A.U.M's per acre. A total of 33 A.U.M.'s were removed.

Scattered salt cedar plants were sprayed on the White unit over about 209 acres.

Stauffer Unit

A total of 98 acres in two areas were grazed on the Stauffer Unit (Figure 2). S1 consisted of 79 acres and was grazed by 80 head for 8 days from December 8-16, 2003 and then 220 head grazed for 19 more days from December 17-January 4, 2004. The first graze was at a rate of 0.30 A.U.M.s/acre with 24 A.U.M.s removed. The second graze was at a rate of 1.76 A.U.Ms/acre with 139 A.U.Ms removed.

Unit S2 consisted of 19 acres and was grazed by 220 head for 8 days from January 5-12, 2004. The utilization rate was 3.11 A.U.M.'s per acre. A total of 59 A.U.M.'s were removed.

Patches of salt cedar were treated by spraying on the Stauffer unit over an area about 15 acres in size.

B. Habitat Response. A vegetation survey initiated in the fall of 2003, was completed the fall of 2004. A total of 22,000 samples were taken at 55 random points. When the samples were pooled across both ecological site and grassland unit, the frequency of occurrence was 67% grass (38% native, 22% non-native, 7% noxious), 2% shrub, 10% forb, 17% bare ground, and 1% classified as "other" (Table 10).

Table 10. Vegetation survey results (samples pooled), 2003-2004.

Community Characteristics		
	Current %	Objective %
Grass	67	65 to 75
Native Grass	38	65
Non-Native Grass	22	9
Noxious Grass	7	1
Shrub	2	2 to 5
Forb	10	5 to 10
Bare-ground	21	10 to 30
Other	1	0
Total	100	100

The current condition seems to be at objective levels at first glance. However, the following discussion highlights the divergence from current levels compared to objectives.

Grasses. The vegetation survey summary worksheet shows that the most common native grasses were saltgrass, rushes and sedges and wheatgrass. These three comprised 62%, 19% and 10% respectively of the native grass group. Other native grasses in the samples included Nuttall's alkaligrass, *Puccinella nuttalliana*, squirreltail, *Sitanion hystrix*, foxtail, *Hordeum jubatum*, alkali sacaton, *Sporobolus airoides*, alkali cordgrass, *Spartina gracilis*, alkali muhly, *Muhlenbergia asperifolia*, and Basin wildrye, *Leymus cinereus*. Squirreltail and foxtail made up 3% and 1% of the native grass samples respectively. However, these two species were difficult to tell apart so it's likely that foxtail made up a greater percentage than did squirreltail.

The three cheatgrass species, *Bromus tectorum*, *B. japonicus* and *B. commutatus*, were the predominate non-native grasses comprising 68% of this group followed by bulbous bluegrass, *Poa bulbosa*, at 14% and rabbitsfoot grass, *Polypogon monspeliensis* at 6%. All of the noxious grass samples were medusahead, *Taeniatherum caput-medusae*.

Native grasses comprise only 38% of the grass group. This group needs to increase by about 30%. Management strategies that encourage the growth, dispersal, and vigor of wheatgrasses, alkali sacation, Great Basin wild rye, and alkali bluegrass will need to be considered. Native grass species diversity needs to increase also as saltgrass accounts for greater than 50% of the native grass on the units. Exotic grass species, mainly *Bromus* spp., need to be reduced from 22% to 15% or less. The

noxious grass, medusahead, needs to be reduced from 7% to less than 1%.

Prescribed grazing by cattle is the current preferred management prescription. Grazing during the dormancy period (October-May) of the desirable species appears to invigorate these plants. While high intensity (1.25-2.0 AUM/acre), short duration (several days to two weeks) grazing during the spring (late April to mid-May) appears to stunt the growth and vigor of the cheatgrasses. Broadcast seeding with desired grass species during or just prior to a prescribed graze may also help increase native grass species distribution and density. Broadcast seeding may also be considered in areas that contain monotypic stands of saltgrass to increase native grass species diversity.

Forbs. Forbs comprised 10% of the grasslands stand. About 39% of the forb species in the samples were pickleweed, *Salicornia rubra and S. utahensis*, while seepweed, *Suaeda calceoliformis*, accounted for another 16%. Both of these species are associated with highly saline and alkaline soils and are often found colonizing saltair mudflats, seeps and playas. The author considered counting these species under the bare ground category to get a more accurate picture of the true status of the forb group. When these mudflat dependent species are removed from the forb group, forbs then comprise only 4% of the total area.

Excluding pickleweed and seepweed, about 60% of the forb category was native forbs and 40% were non-native. This figure may be erroneous as many of the forb samples considered native were those containing five-horn, *Bassia hyssopifolia*. This plant is actually an introduced species and should have been counted under the non-natives. Native forb samples were dominated by members of the Goosefoot family or Chenopodiaceae (*C. berlandieri and C. album*). This family has both native and introduced species that are naturalized to the U.S. and are difficult to identify. Native forbs in the *Atriplex* genus were also well represented in the samples (*Atriplex orache* and *A. prostrata*). Fewer samples of native forb species included golden pea, *Thermopsis rhombifolia*, Indianwheat, *Plantago patagonica*, spreading alkaliweed, *Cressa truxillensis*, and curly-cup gumweed, *Grindelia squarrosa*.

The non-native forb samples were mostly members of the *Brassicaceae* or Mustard family. Mustard species common to the Refuge grasslands include shepherdspurse, *Capsella bursa-pastoris*, hoary cress, *Cardaria* spp., blue mustard, *Chorispora tenella*, flixweed, *Descurainia sophia*, clasping pepperweed, *Lepidium perfoliatum*, and tumble mustard, *Sisymbrium altissimum*.

The author believes the non-native forbs are more diverse and dense than the native species. Past grazing regimes and the introduction and planting of non-native forage and pasture grass species has eliminated the majority of the native forbs and seed beds. Native forb density needs to be doubled to achieve habitat objectives. As there is believed to be no seed source remaining in the soil, native species will have to be planted in order to restore historic species diversity, density, and structure.

Shrubs. Shrubs comprised 2% of the total grassland cover. Shrubs were separated into three general categories; dwarf shrub, low shrub, and tall shrub. The dwarf shrub category includes species <0.25 m tall with a forb like life form such as Broom Snakeweed, *Gutierrezia sarothrae*. The low shrub category is 0.25 to 1.4 m tall and includes such species as greasewood, *Sarcobatus vermiculatus*, rabbitbrush, *Chrysothamnus nauseosa* and iodinebush, *Allenrolfea occidentalis*. Tall shrub is 1.5 to 5 m tall and includes greasewood and big sagebrush, *Artemesia tridentata*.

Low shrub comprised 93% of the shrub samples, followed by tall shrub (6%), and dwarf shrub (1%). The low shrub samples were 52% iodinebush, 30% saltbush, *Atriplex canescens*, 16% greasewood, and 2% Wood's rose, *Rosa woodsii*. All the tall shrub samples were big sagebrush and the dwarf shrub species were broom snakeweed.

Shrub percent cover at 2% falls within the objective level (2-5%). Shrub species did include climax target species such as iodinebush, greaswood, and big sagebrush. However, shrub species diversity was low with rabbitbrush, *Chrysothamnus* spp., and shadscale, *Atriplex confertifolia*, absent in the samples. The structure of the shrubs is also lower than objective levels. The average height for this category should be about two feet tall. Though the average height readings for the survey weren't separated by grass/shrub/forb categories, my impression is that the dwarf shrub and low shrubs (broom snakeweed and four-winged saltbush) are the most dominant, reducing the average height to < 2 ft. The current rotational grazing management scheme, should allow the current species of shrubs to mature and grow into more robust plants thereby increasing the average height. However, shrub species diversity will have to be increased by direct seeding or planting of saplings.

Bare-ground. Bare-ground accounted for 21% of the grassland area. Bare-ground included salt mudflats, playas and patches of bare ground or unoccupied space between plants. Pockets of emergent marsh were also included in this category as they didn't fit any of the other categories and they had a strong tendency to appear in Saltair Mudflat range type. Emergent marsh equaled about 19% of the area considered bare-ground.

Bare-ground ecological site is not considered a "managed" range type. This range type instead is influenced more by climate and abiotic driven soil conditions such as soil moisture, water inundation duration, as well as alkalinity and salinity rather than by management actions. Though changes and trends in the plant community can be mainly attributed to the above factors, we do acknowledge that the community can be affected to a certain extent as a by-product of management actions on the other adjacent target ecological sites.

Other. The "other" category was devised as a catch-all for samples that didn't fit into any of the above plant community characteristics. This category included such situations where the samples fell on a cow pie, dike (man-made structure) and within one of the constructed ponds. This category comprised only 1% of the grasslands area. About 97% of the "other" category samples fell within a pond.

Summarizing the sampling results illustrated that the White and Stauffer units were very close to objective levels. It was the Nichols unit that showed the greatest divergence from the objectives. By focusing management actions on, or prescribing special actions on the Nichols unit should bring the status of the habitat closer to that described in the overall habitat objective.

C. Response of *Resources of Concern*. The Stauffer and White predator exclosures were chain dragged on May 6th. Only three teal (BWTE/CITE) nests were found on the White portion while none were found on Stauffer. A teal nest was also found on Nichols unit. All four nests failed. No formal surveys of other portions of the upland units was conducted. Several, 2-3 pair, of long-billed curlews nested in the grassland as two nests were discovered by staff and another pair were observed regularly. A Wilson's phalarope nest was also discovered in the Nichols unit closely associated with pond N5.

2005 Grassland Upland Management Plan

The objectives for 2005 in the upland grasslands remain the same as last year.

Management prescription: Dormant season grazing (November-January) of western portions (marshy areas) of the three grassland units will be attempted for cattail and phragmites control in 2005. The entire Nichols and the northern portion of the White units will be dormant season grazed for cheatgrass control and native grass invigoration/enhancement. To set back succession of wetland emergents along the drainages in unit 5D, a September graze is planned.

MONITORING AND EVALUATION

HABITAT

In late June or early July, at the peak of sago pondweed flowering, airboat surveys of the priority units will be conducted with the aid of a GPS unit. The amount of habitat occupied by submergent and emergent vegetation as well as the aquatic plant species diversity will be calculated in order to determine if habitat objectives are being met. Should any of the grassland ponds go dry, the vegetation will be mapped with a GPS unit. The amount of habitat occupied by emergent vegetation in the ponds may also be conducted after winter freeze-up to facilitate surveying.

At least twice monthly, soil salinity readings will be taken at set points within the priority units. During the same sampling trip, sago pondweed coverage and productivity will be monitored.

The water depth at the outlets of priority units will be recorded regularly, to determine amounts and types of habitat associated with the different water depths.

Salt cedar in the main river delta of unit 2D, 5D, 4C, and cleanup along the water courses of L, O, and P-Line will be the focus of saltcedar control efforts in 2005. Treatment methods will include herbicide spraying, discing, mowing and pulling.

The photo points on the Nichols, White, and Stauffer Units should be maintained to monitor any changes in upland habitat.

On the grasslands, the amount of water flowing through the Parshall flumes should be recorded regularly, and note made of the amount of water in unmeasured diversions. The condition of gates (open, closed, partly open) should be noted at the same time. Records of diversions that are shared with other water right holders should be particularly noted. Staff gauges need to be installed on all of the ponds and the water depths recorded regularly.

PRIORITY SPECIES

Weekly waterbird surveys of the 26 wetland management units and the grassland ponds will be conducted to determine use by priority species on a unit by unit basis.

Populations of small mammalian predators increased after the flooding of the 1980s. The striped skunk has always been on the refuge, but large populations of red fox and racoon have inhabited the refuge only since the flood. Wildlife management efforts through predator control

activities will be implemented again in 2005 in partnership with USDA Wildlife Services, Salt Lake City, UT. Canada Goose pair counts, waterfowl nest searches and brood counts will be conducted to estimate nesting success as a measure of the effectiveness of the predator control program.

A research investigation into the productivity of high priority shorebirds; American avocet, black-necked stilt, snowy plover and long-billed curlew by Dr. John Cavitt, Weber State University, Ogden, UT will continue for a 3rd straight year to a diminished degree. The research was supported by a Challenge Cost-Share Grant in 2004 but was not funded for 2005. Nesting success by shorebirds is also used to measure the effectiveness of our predator control program.

Another research investigation to determine live capture methods/techniques for marbled godwits will be initiated in April of 2005.

Point count surveys are planned for the grassland units during the peak of songbird nesting.

Transect surveys of appropriate habitat to determine nesting density of snowy plovers (un-vegetated alkali mudflats, 5A, 5D, and Unit 1), and long-billed curlews (vegetated mudflats 5A, 5D, 8, 9 and 10) is planned.

A secretive marsh bird survey via call-response will be conducted to determine presence of breeding marsh birds including American bittern, coot, pied-billed grebe, marsh wren, sora and Virginia rail.

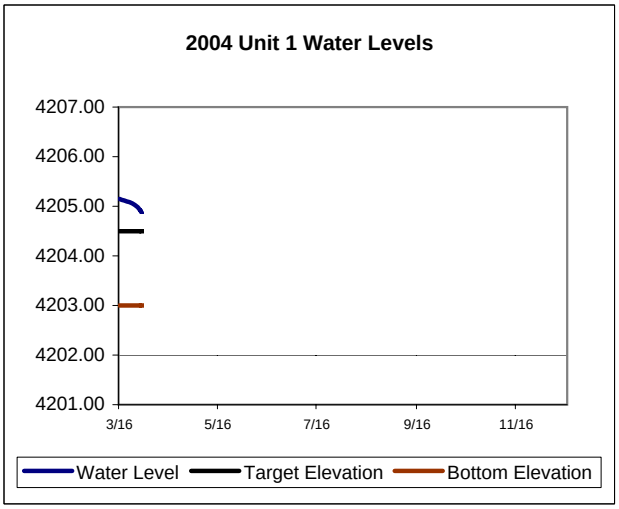
UNMET NEEDS AND STRATEGIES TO ADDRESS THEM

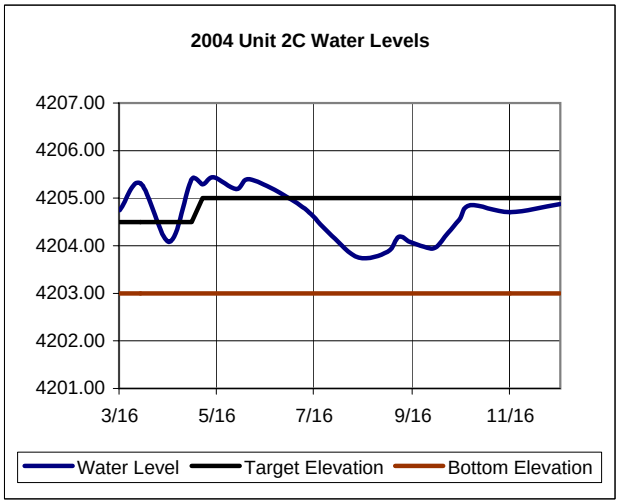
The chief impediment to improved habitat on the Bear River Migratory Bird Refuge is the shortage of water during the summer months, especially July and August. Many strategies have been advanced to remedy this problem, most recently a plan to increase the storage pool at Hyrum Reservoir by 50,000 acre-feet, or a yield of 24,200 acre-feet delivered to the refuge in July and August. This amount of water would allow the refuge to maintain an additional 8-10,000 acres of wetland habitat.

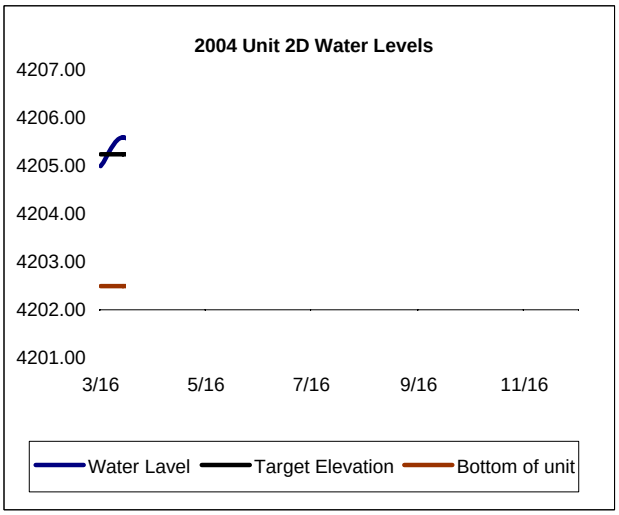
Water is limited on the Nichols, White, and Stauffer Tracts as well. Any opportunity to acquire additional water for those units (such as water under subdivisions in Perry and Brigham City) should be pursued actively.

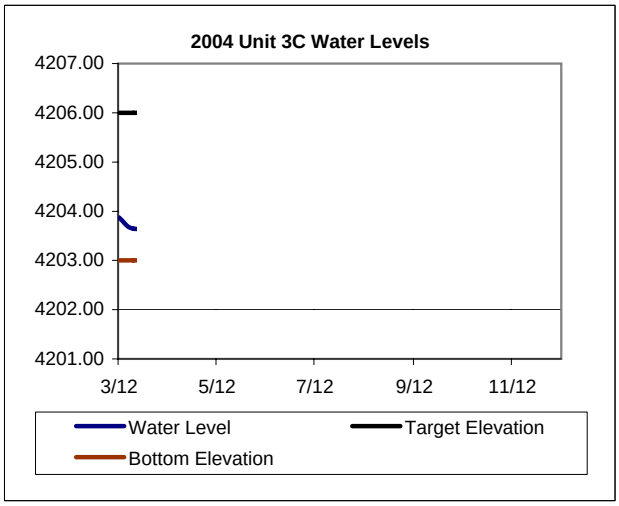
Another permanent, year-round staff position is needed at the Biologist or Biological Technician level to accomplish all the necessary monitoring activities. Currently, only portions of needed monitoring activities are completed in a timely manner with little to no inventory work being completed.

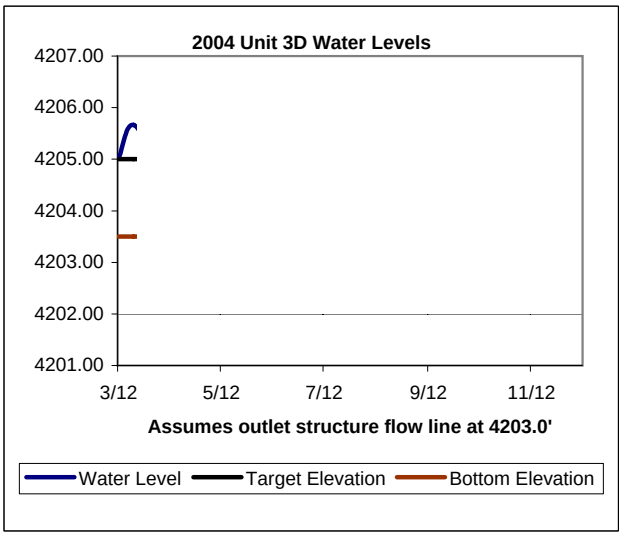
Appendix A.
2004 Unit Water Levels

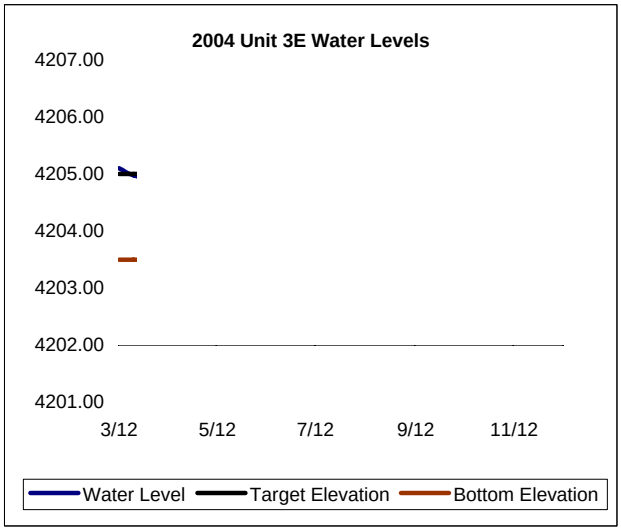

2004 Unit 1 Water Levels
4207.00
4206.00
4205.00
4204.00
4203.00
4202.00
4201.00
3/16
5/16
7/16
9/16
11/16
Water Level
Target Elevation
Bottom Elevation

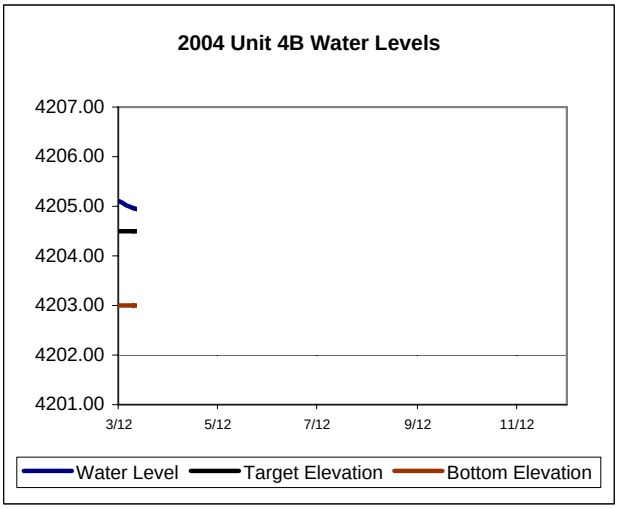

2004 Unit 2C Water Levels
4207.00
4206.00
4205.00
4204.00
4203.00
4202.00
4201.00
3/16
5/16
7/16
9/16
11/16
Water Level
Target Elevation
Bottom Elevation

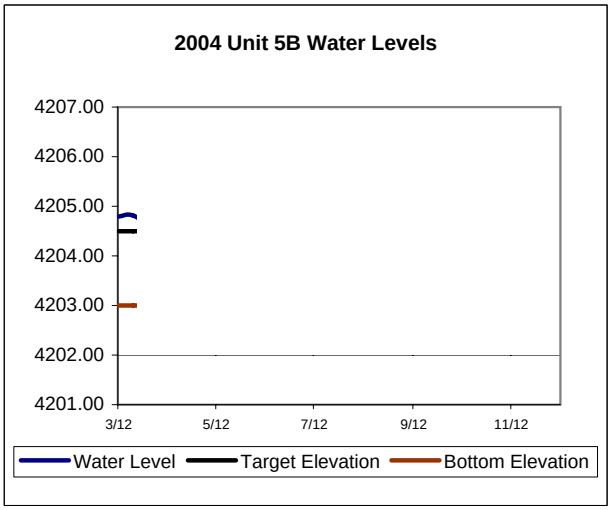

2004 Unit 2D Water Levels
4207.00
4206.00
4205.00
4204.00
4203.00
4202.00
4201.00
3/16
5/16
7/16
9/16
11/16
Water Lavel
Target Elevation
Bottom of unit

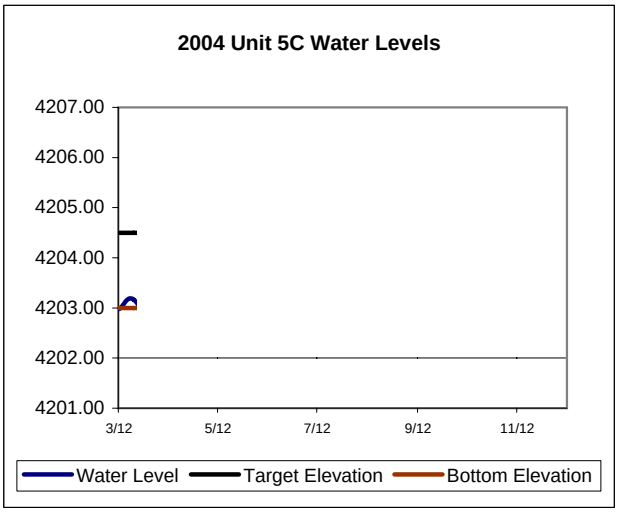

2004 Unit 3C Water Levels
4207.00
4206.00
4205.00
4204.00
4203.00
4202.00
4201.00
3/12
5/12
7/12
9/12
11/12
Water Level
Target Elevation
Bottom Elevation

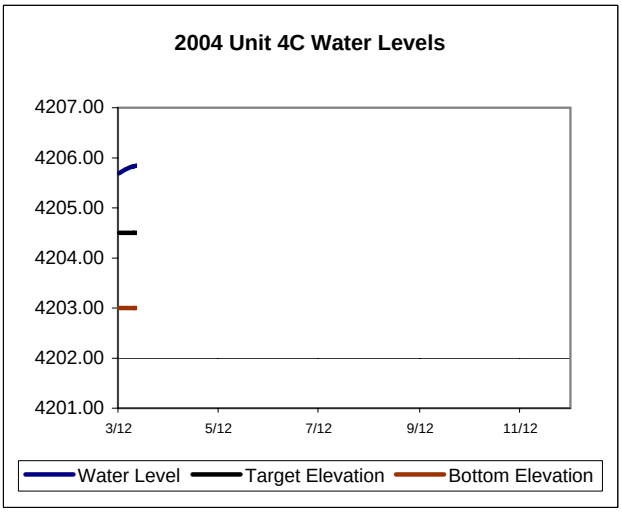

2004 Unit 3D Water Levels
4207.00
4206.00
4205.00
4204.00
4203.00
4202.00
4201.00
3/12
5/12
7/12
9/12
11/12
Assumes outlet structure flow line at 4203.0'
Water Level
Target Elevation
Bottom Elevation


2004 Unit 3E Water Levels
4207.00
4206.00
4205.00
4204.00
4203.00
4202.00
4201.00
3/12
5/12
7/12
9/12
11/12
Water Level
Target Elevation
Bottom Elevation


2004 Unit 4B Water Levels
4207.00
4206.00
4205.00
4204.00
4203.00
4202.00
4201.00
3/12
5/12
7/12
9/12
11/12
Water Level
Target Elevation
Bottom Elevation

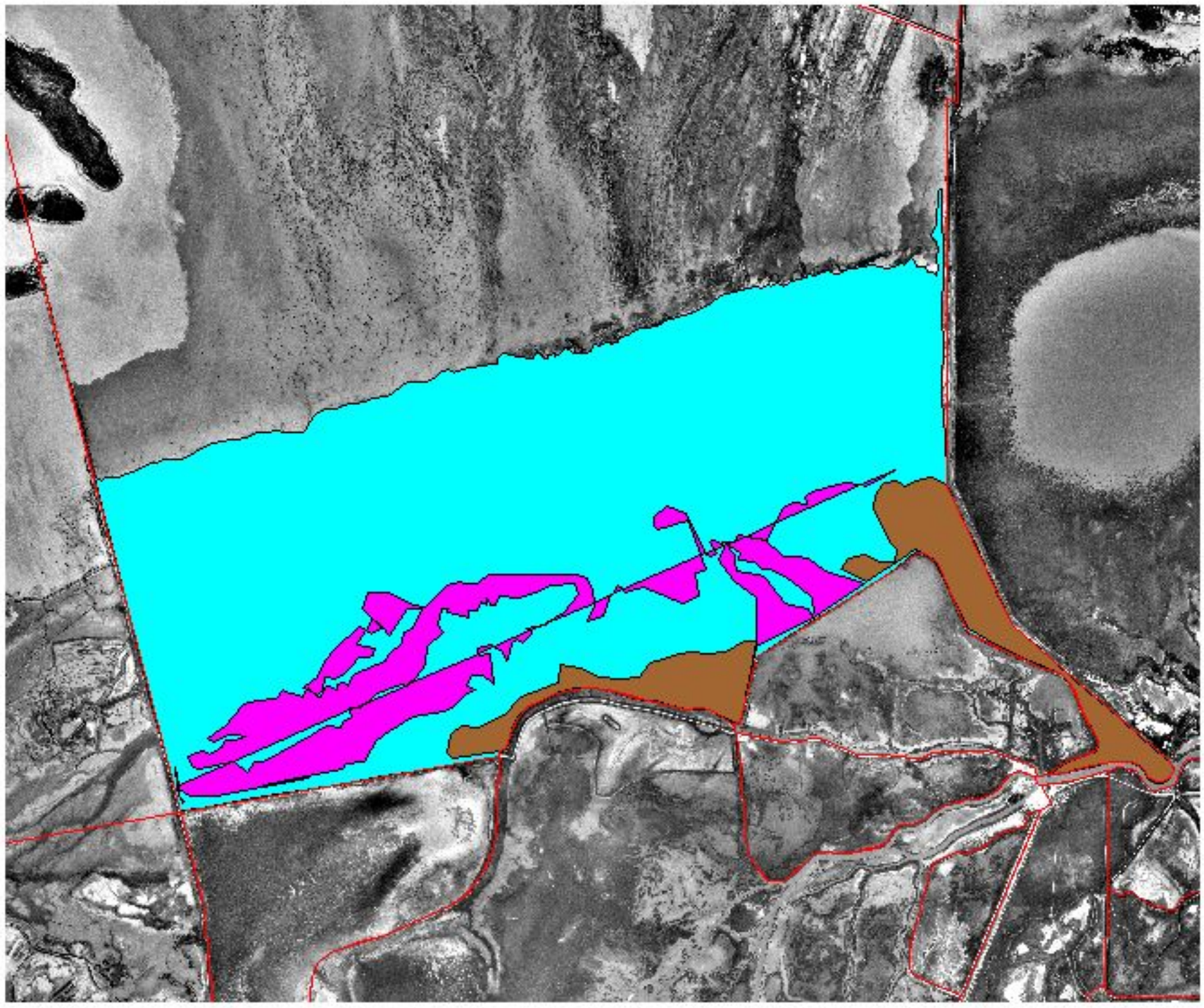

2004 Unit 5B Water Levels
4207.00
4206.00
4205.00
4204.00
4203.00
4202.00
4201.00
3/12
5/12
7/12
9/12
11/12
Water Level
Target Elevation
Bottom Elevation


2004 Unit 5C Water Levels
4207.00
4206.00
4205.00
4204.00
4203.00
4202.00
4201.00
3/12
5/12
7/12
9/12
11/12
Water Level
Target Elevation
Bottom Elevation


2004 Unit 4C Water Levels
4207.00
4206.00
4205.00
4204.00
4203.00
4202.00
4201.00
3/12
5/12
7/12
9/12
11/12
Water Level
Target Elevation
Bottom Elevation

Appendix B.
2004 Habitat Conditions
and
Tamarisk Treatments

Unit 1 Habitats, October 2004.

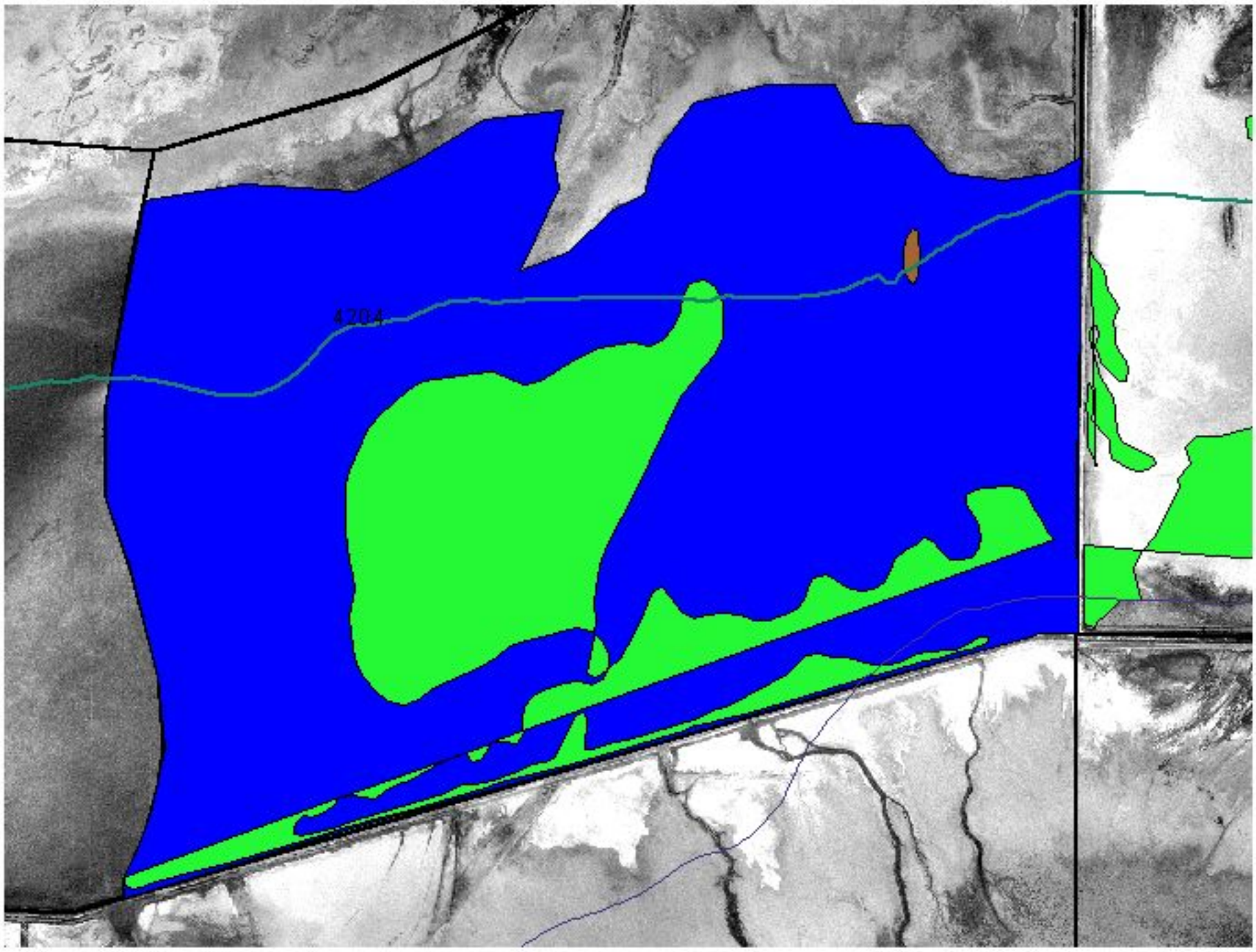


Unit Boundary
Open water
Emergent Vegetation
Saltair Mudflat

0.5 0 0.5 1 Miles

N
W E
S

Unit 4C habitat conditions, July 2004



0.2 0 0.2 0.4 Miles

Open water=886 acres

Emergent vegetation= 238 acres

Island

Elevation 4204

N

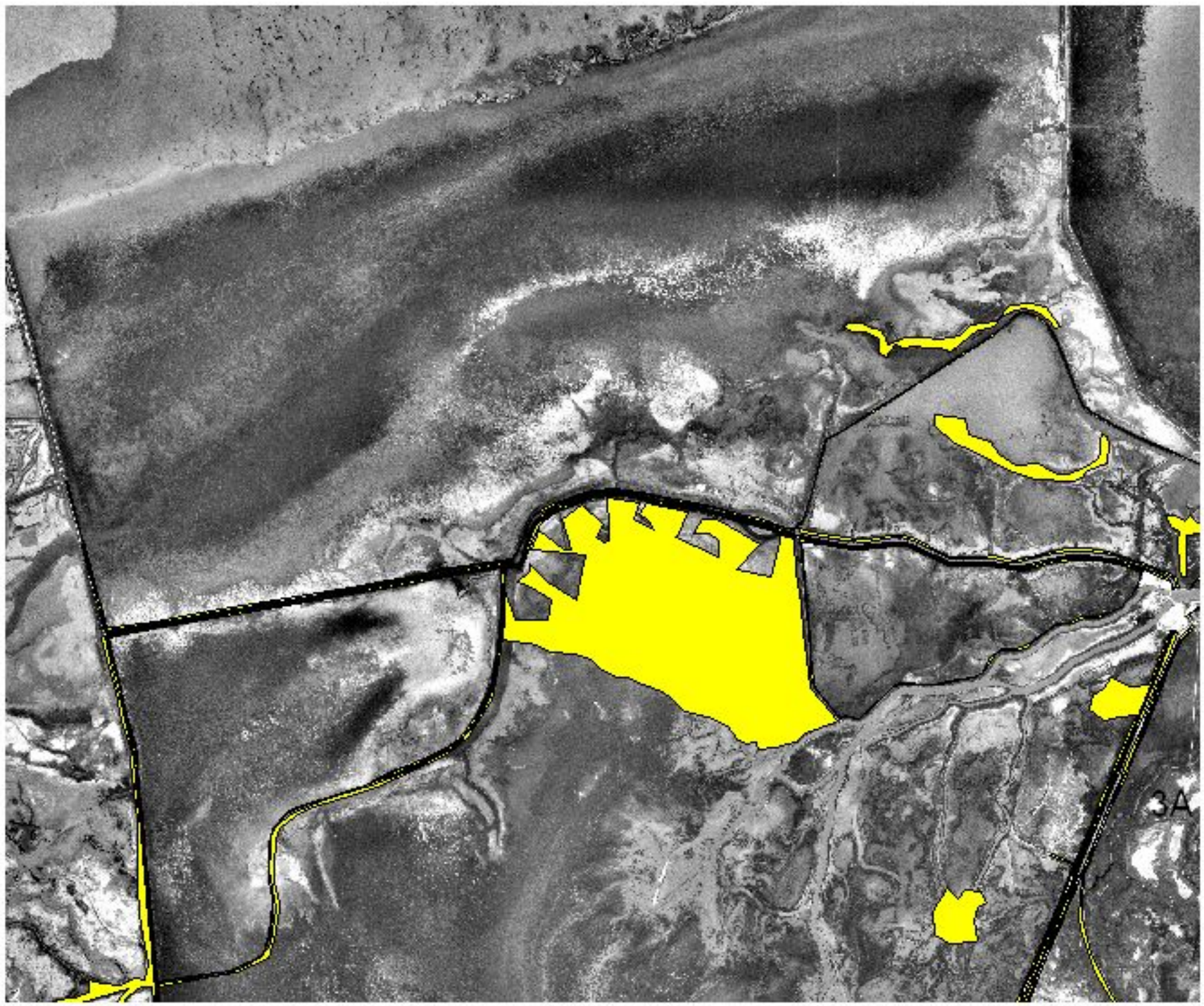
W E

S

Invasive plant treatments by unit, Bear River Refuge, 2004.

Invasive Plant Treatment	
2004	
Unit	**Acres**
1	34.2
1A	65.31
2A	16.57
2B	16.69
2C	33.86
2D	533.83
3A	18.96
3B	24.42
3C	44.37
3D	30.51
3E	20.52
3G	45.47
3H	30.45
3I	10.52
3J	4.71
3K	5.94
4A	105.26
4B	28.62
4C	32.76
5A	100.92
5B	69.1
5C	312.55
5D	186.14
6	31.72
7	24.61
8	50.69
9	16.66
Christensen	20.03
Nichols	45.8
Stauffer	14.82
White	108.56
Total	2084.57

Unit 1 invasives treatment, 2004

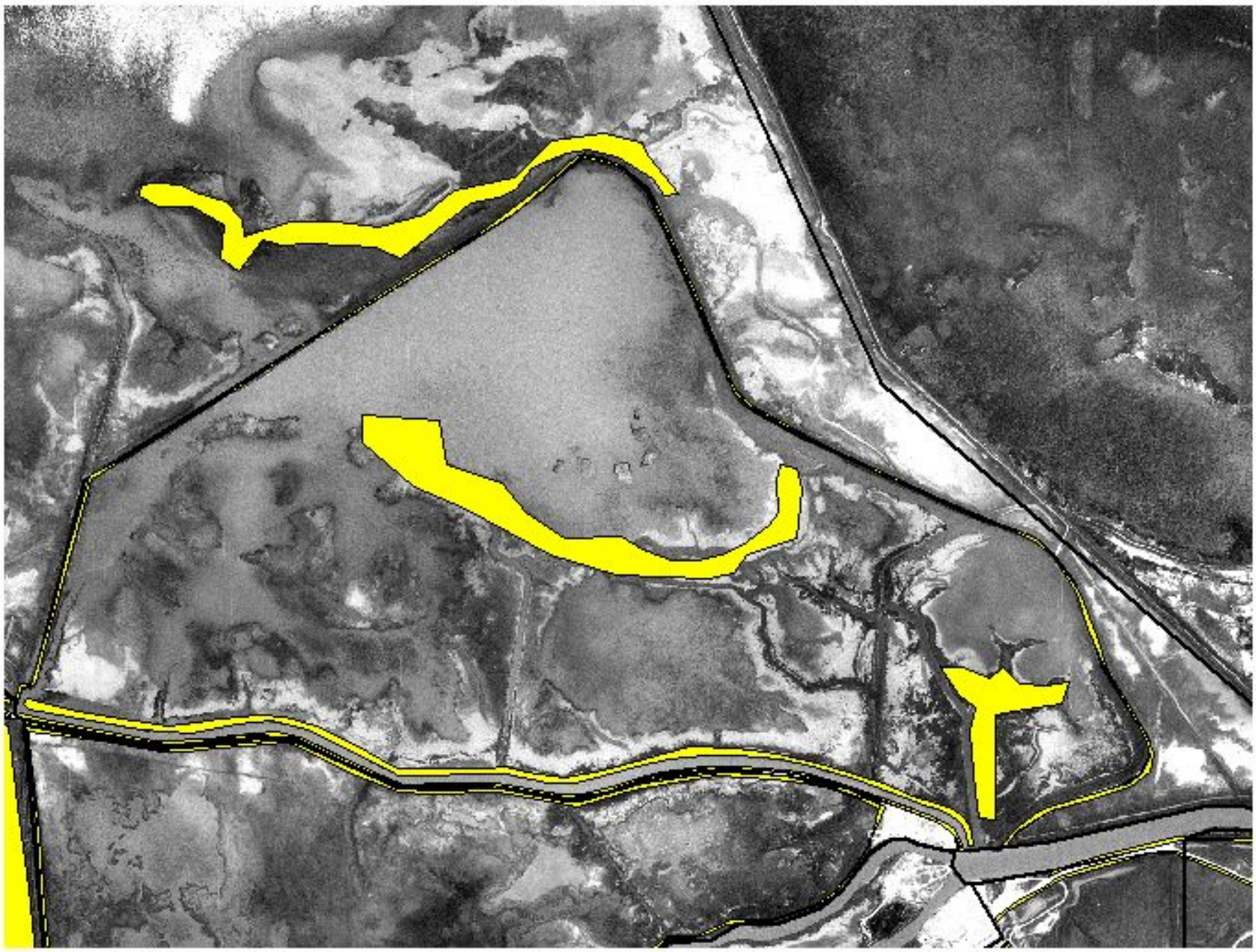


Spray=34 acres

0.4 0 0.4 0.8 Miles

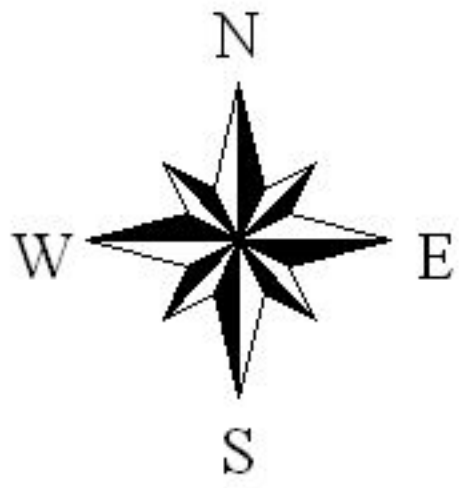
N
W E
S

Unit 1A Invasives Treatment

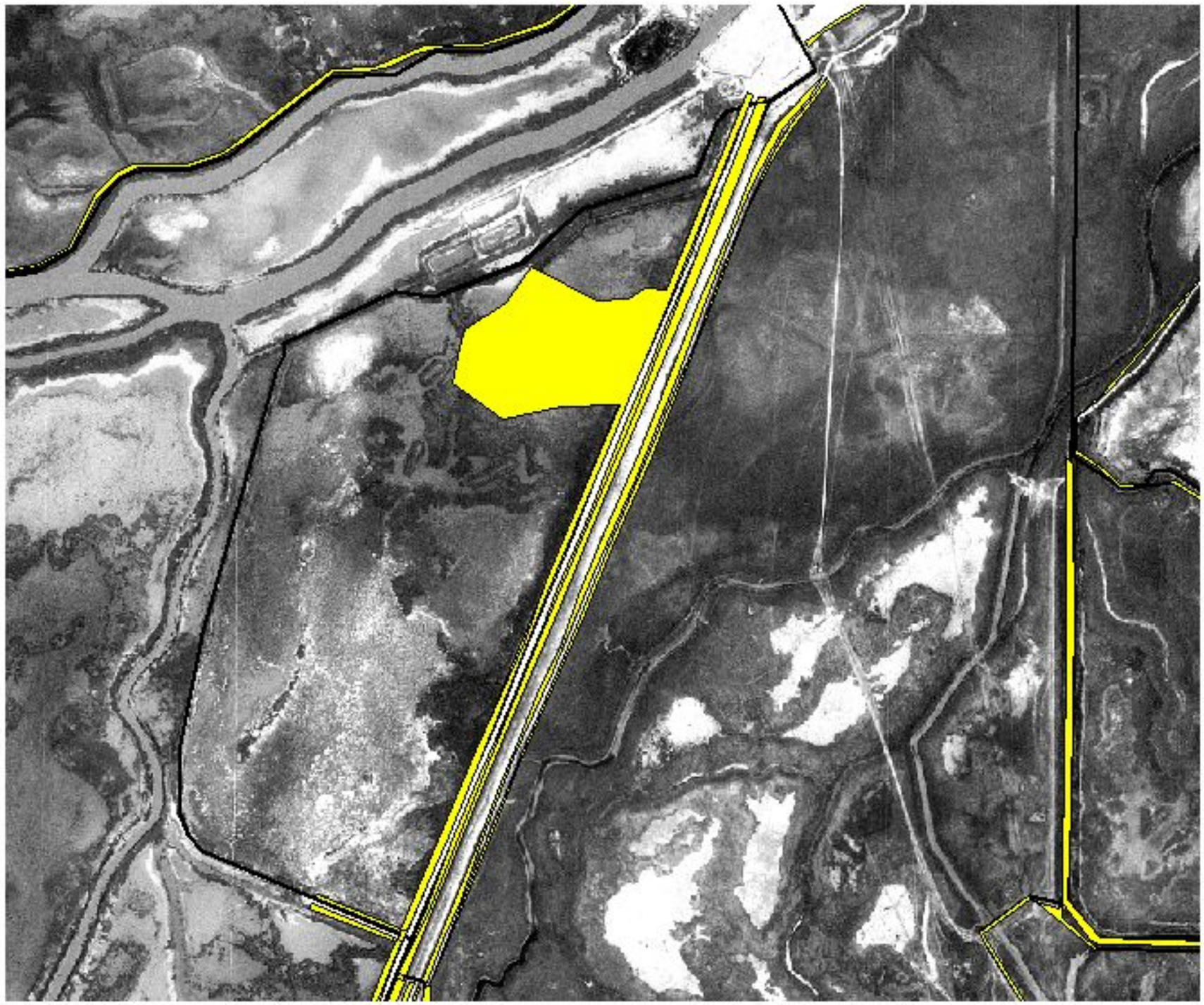


0.1 0 0.1 0.2 Miles

Spray=65 acres



Unit 2B invasives treatment, 2004

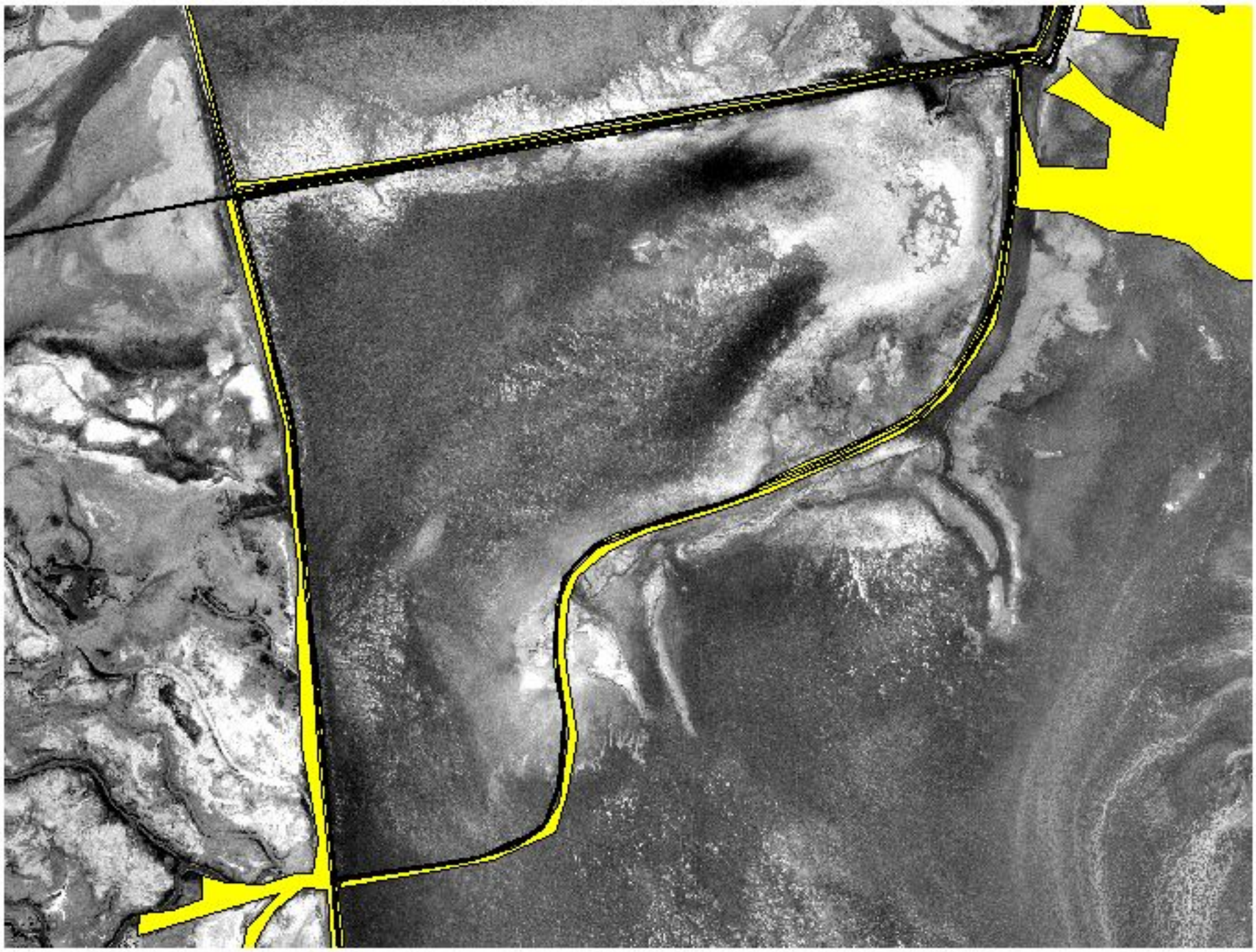


Spray=17 acres

N
W E
S

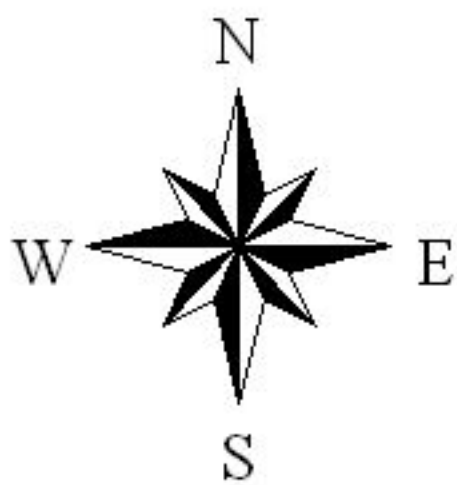
0.09 0 0.09 0.18 Miles

Unit 2C Invasive treatment, 2004

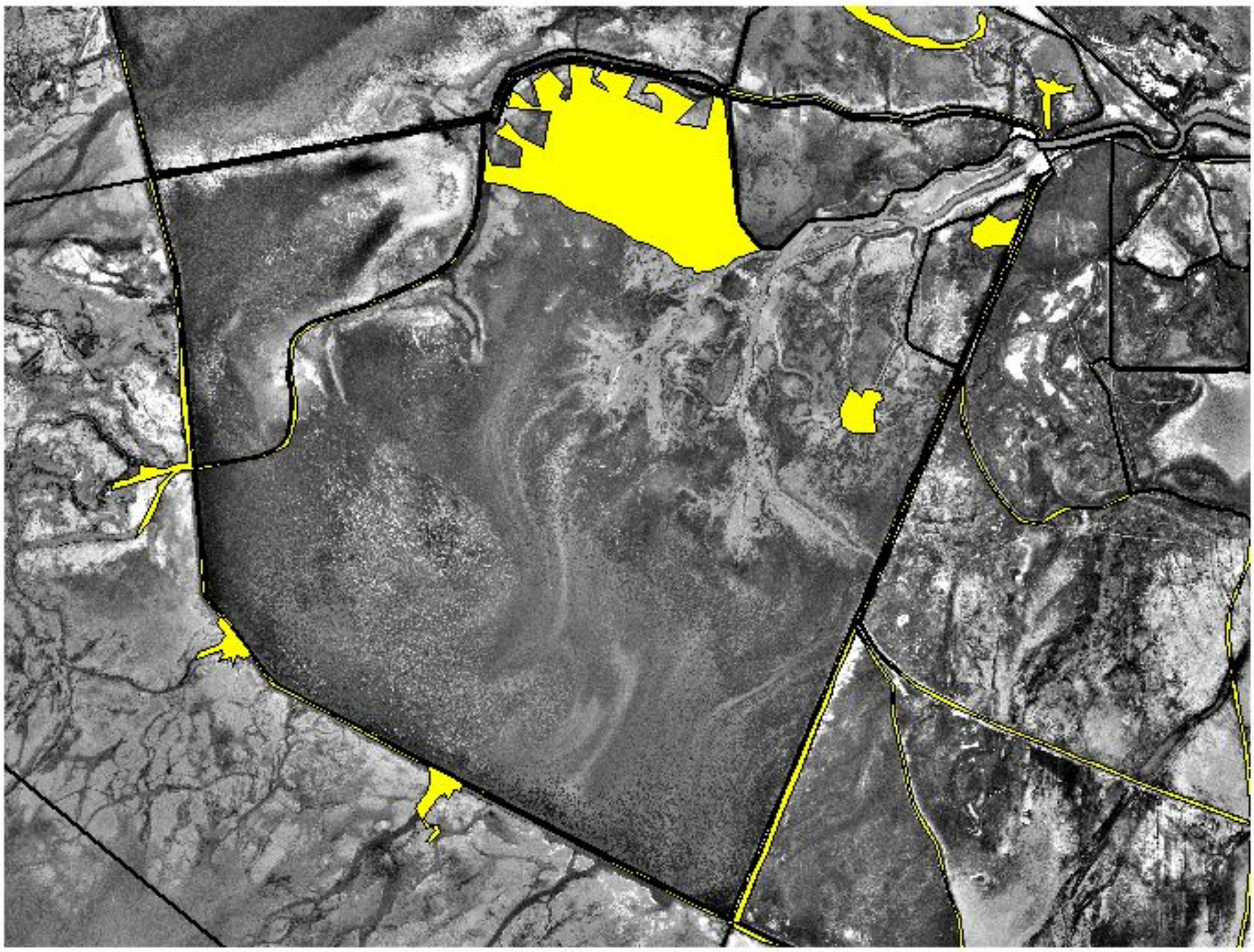


0.2 0 0.2 0.4 Miles

Spray=34 Acres

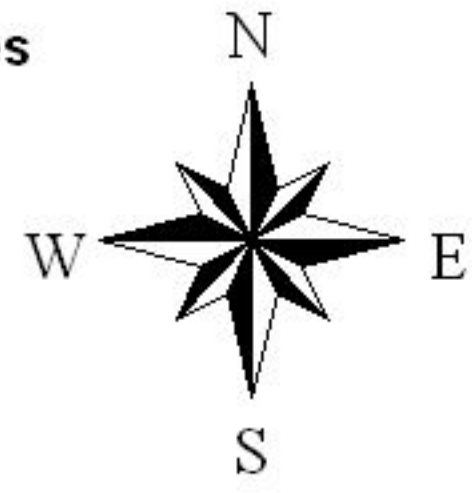


Unit 2D and 9 invasive treatment, 2004

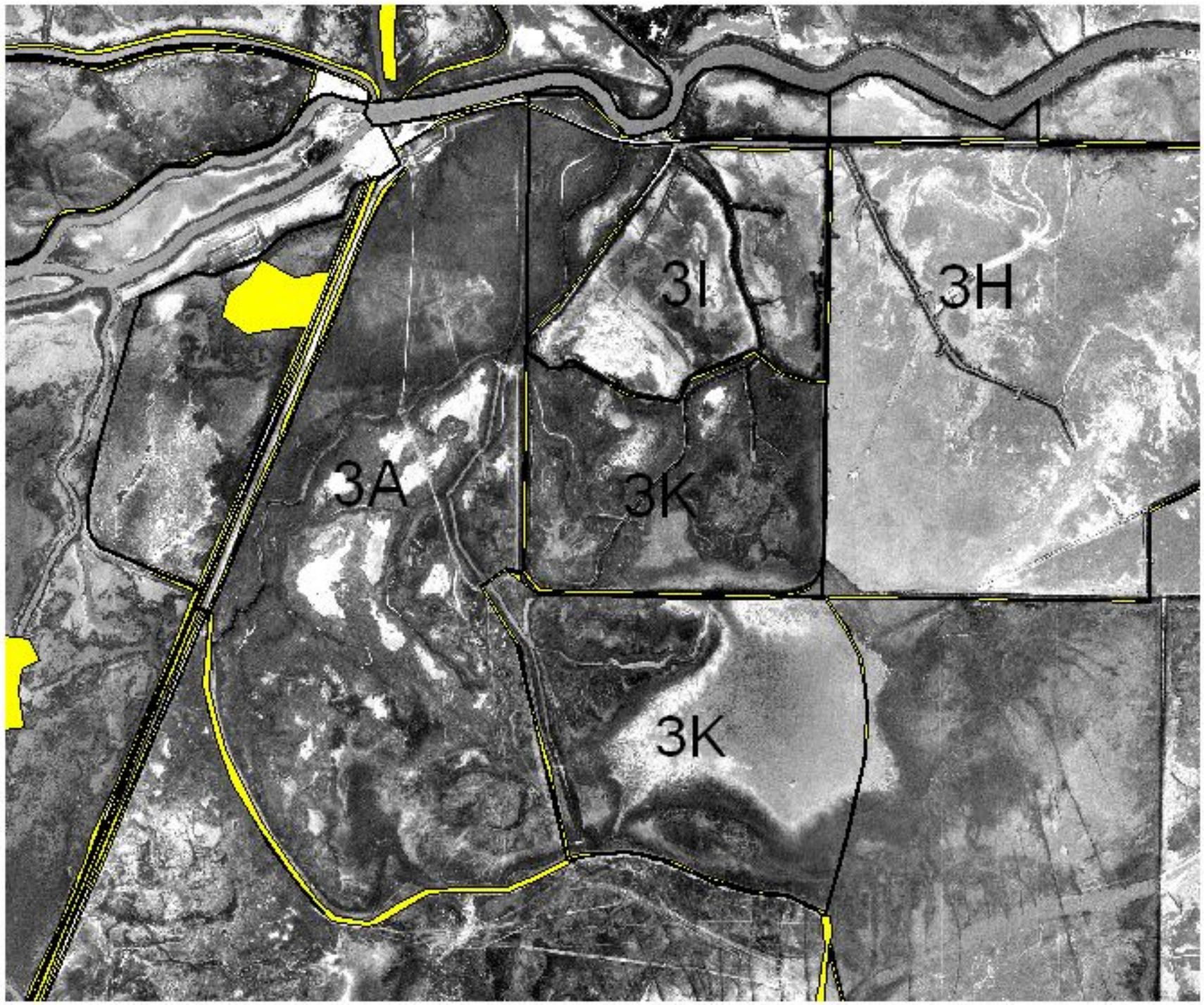


0.4 0 0.4 0.8 Miles

Spray 2D=534 acres Unit 9=17 acres



Unit 3A, 3I-K invasive treatment, 2004



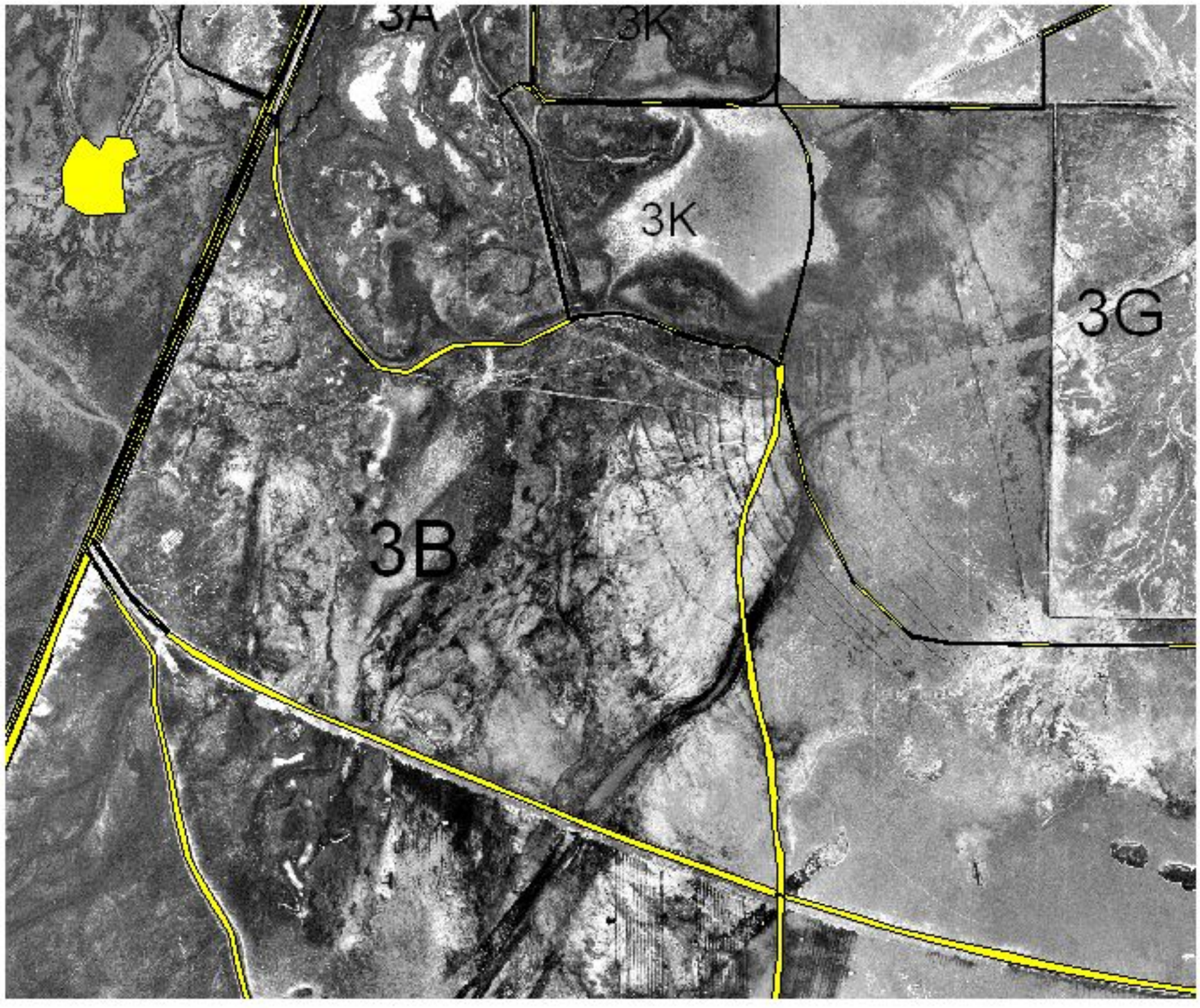
Spray

3A=19 acres
3I=11 acres
3J=5 acres
3K=6 acres

0.2 0 0.2 0.4 Miles

N
W E
S

Unit 3B invasives treatment, 2004

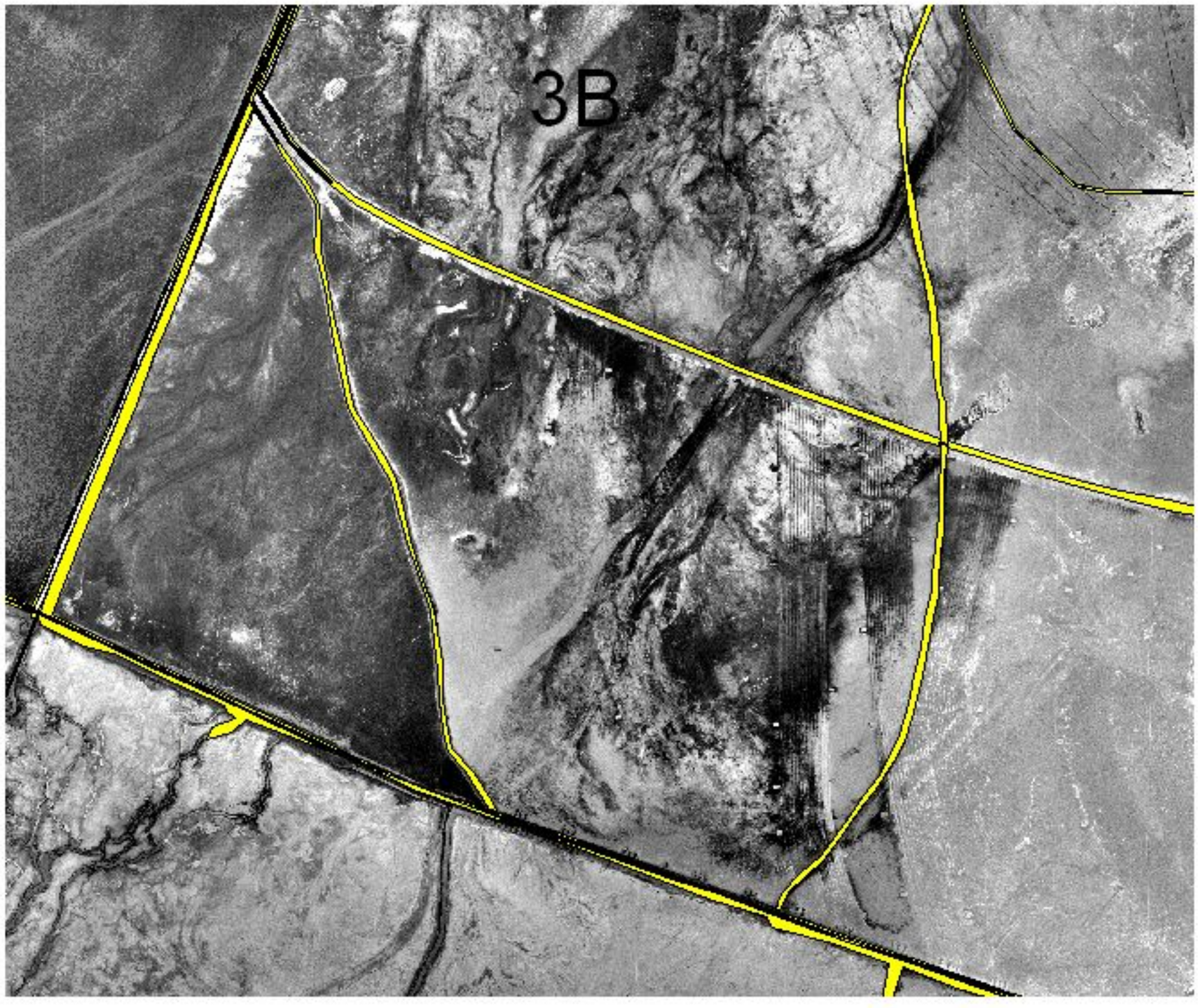


Spray=24 acres

0.3 0 0.3 0.6 Miles

N
W E
S

Unit 3C, 3D and 8 invasive treatment, 2004

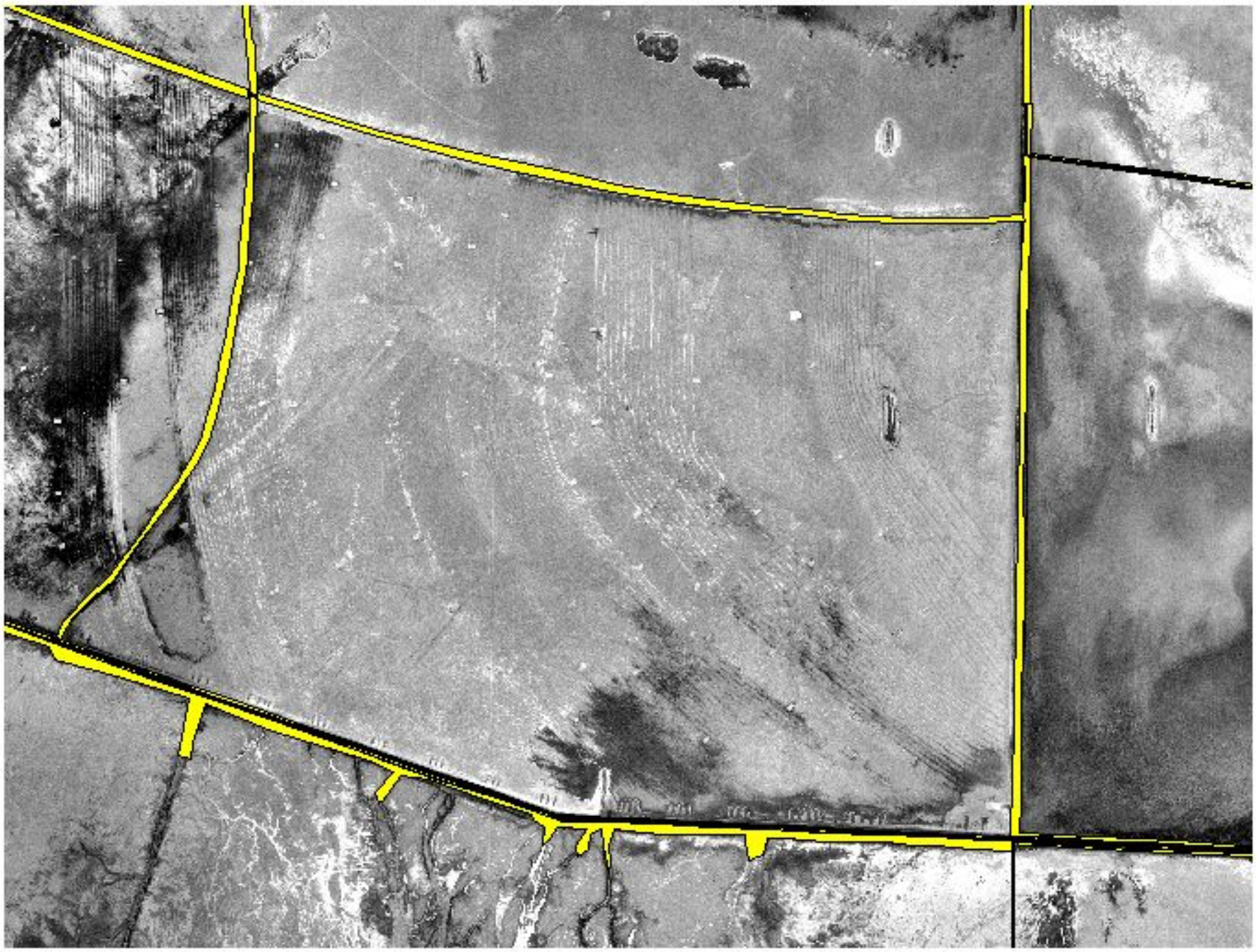


Spray
3C=44 acres; 3D=31 acres;
8=51 acres

N
W
E
S

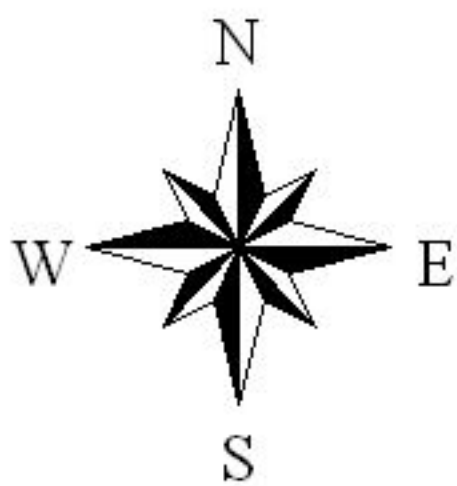
0.3 0 0.3 0.6 Miles

Unit 3E and 8 invasive treatment, 2004

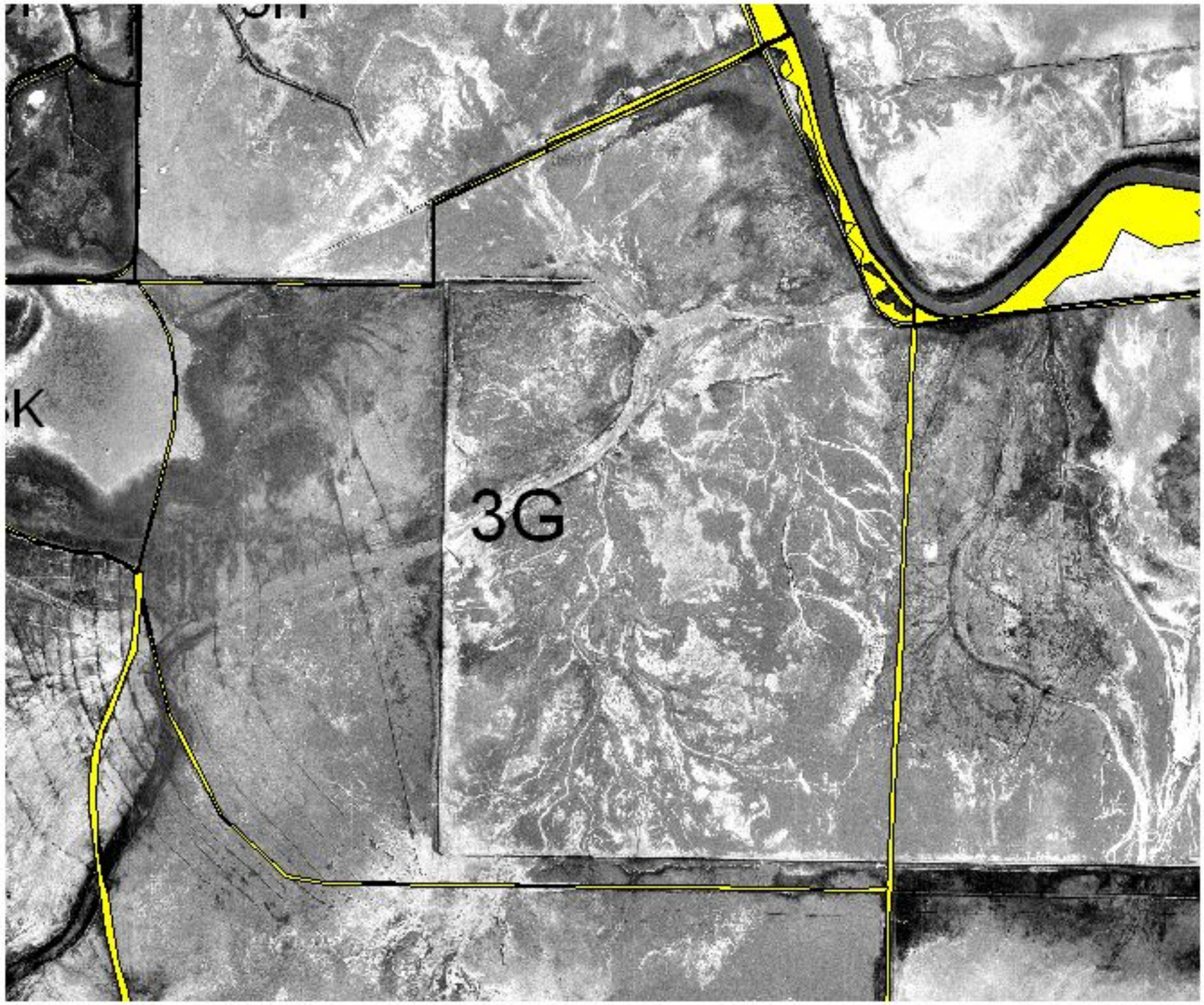


0.2 0 0.2 0.4 Miles

Spray
3E=21 acres
8=51 acres



Unit 3G invasives treatment, 2004

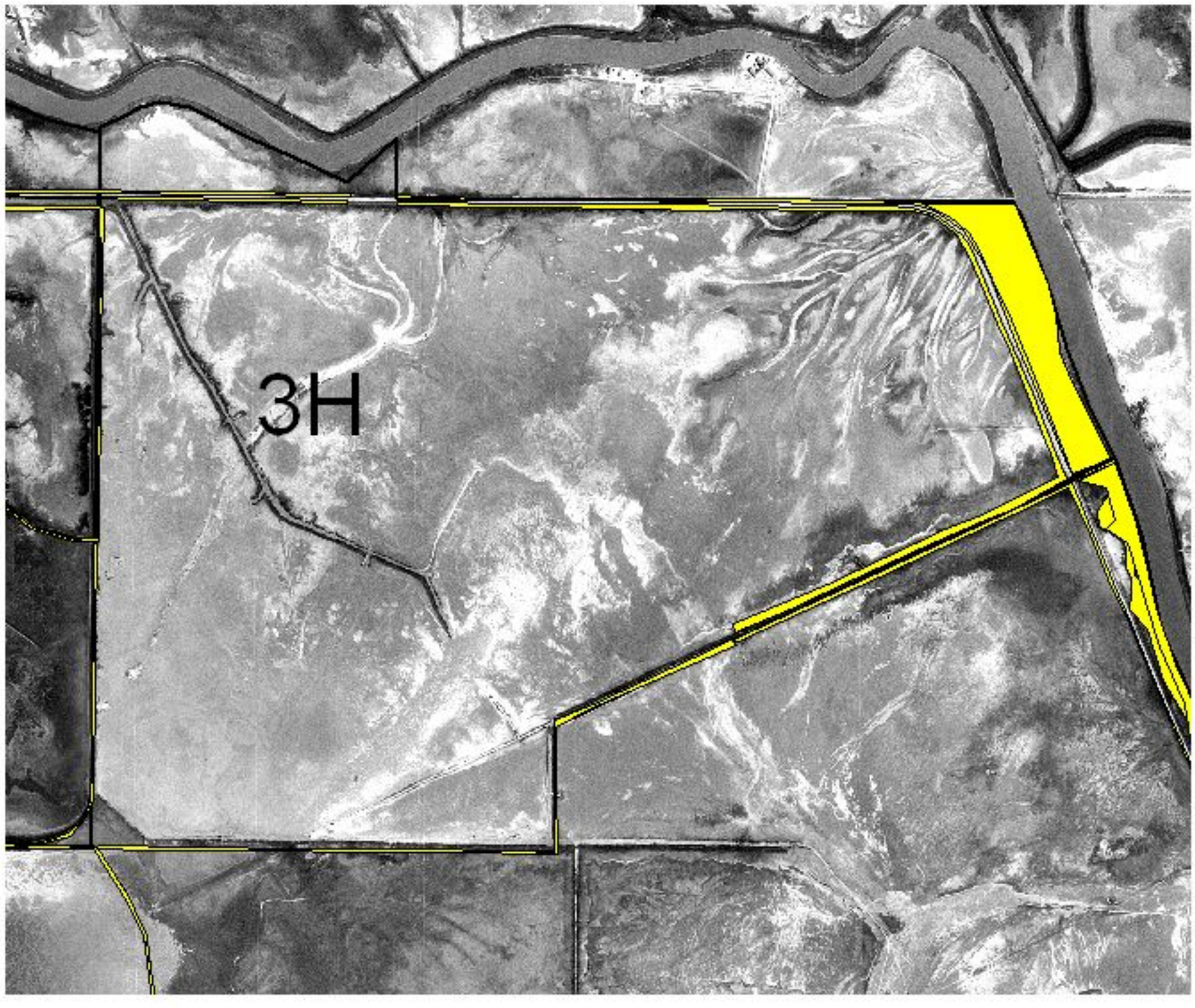


Spray=46 acres

0.2 0 0.2 0.4 Miles

N
W E
S

Unit 3H invasive treatment, 2004

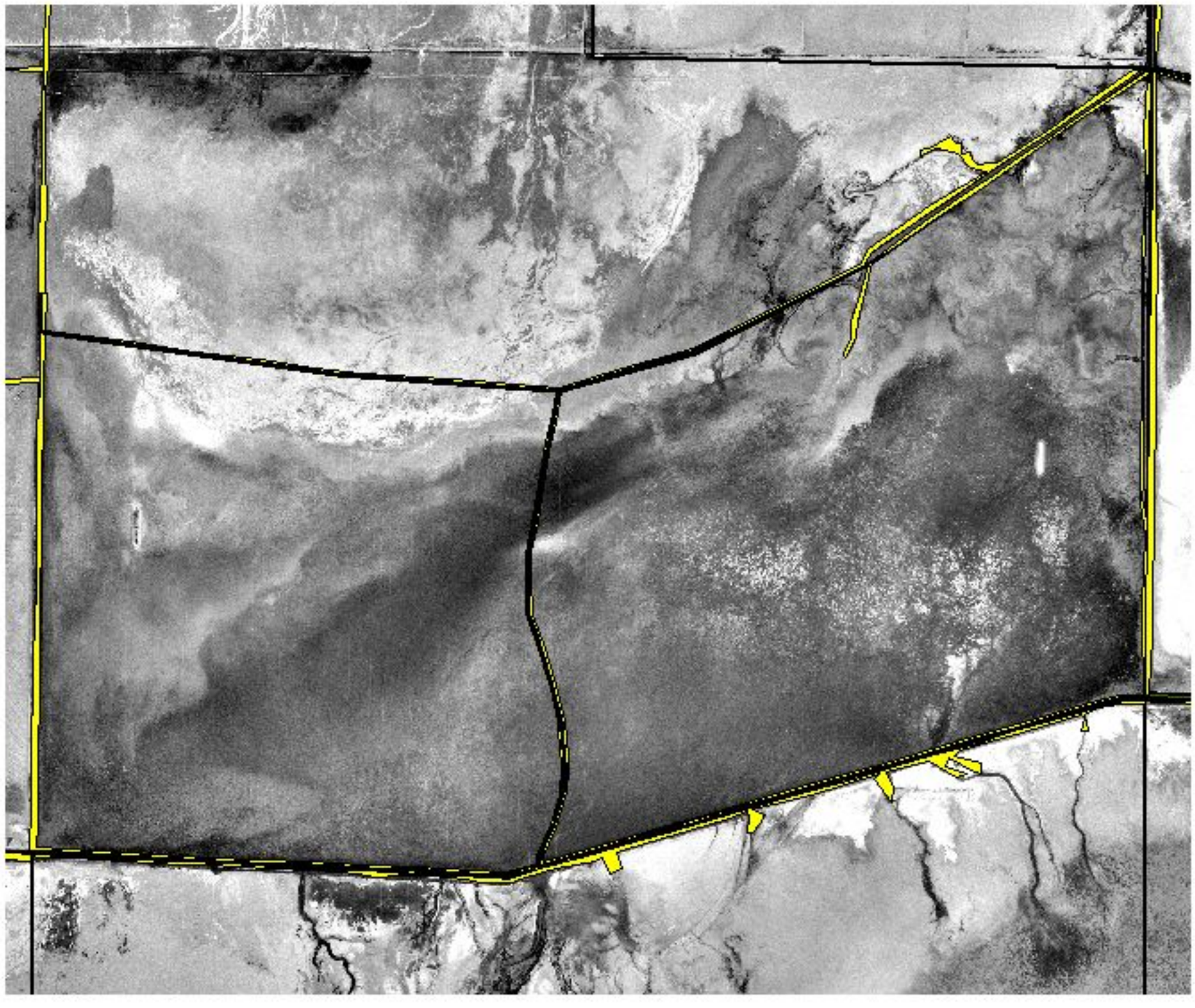


Spray=31 acres

0.1 0 0.1 0.2 Miles

N
W E
S

4A,4B, 4C and 7 invasive treatment, 2004



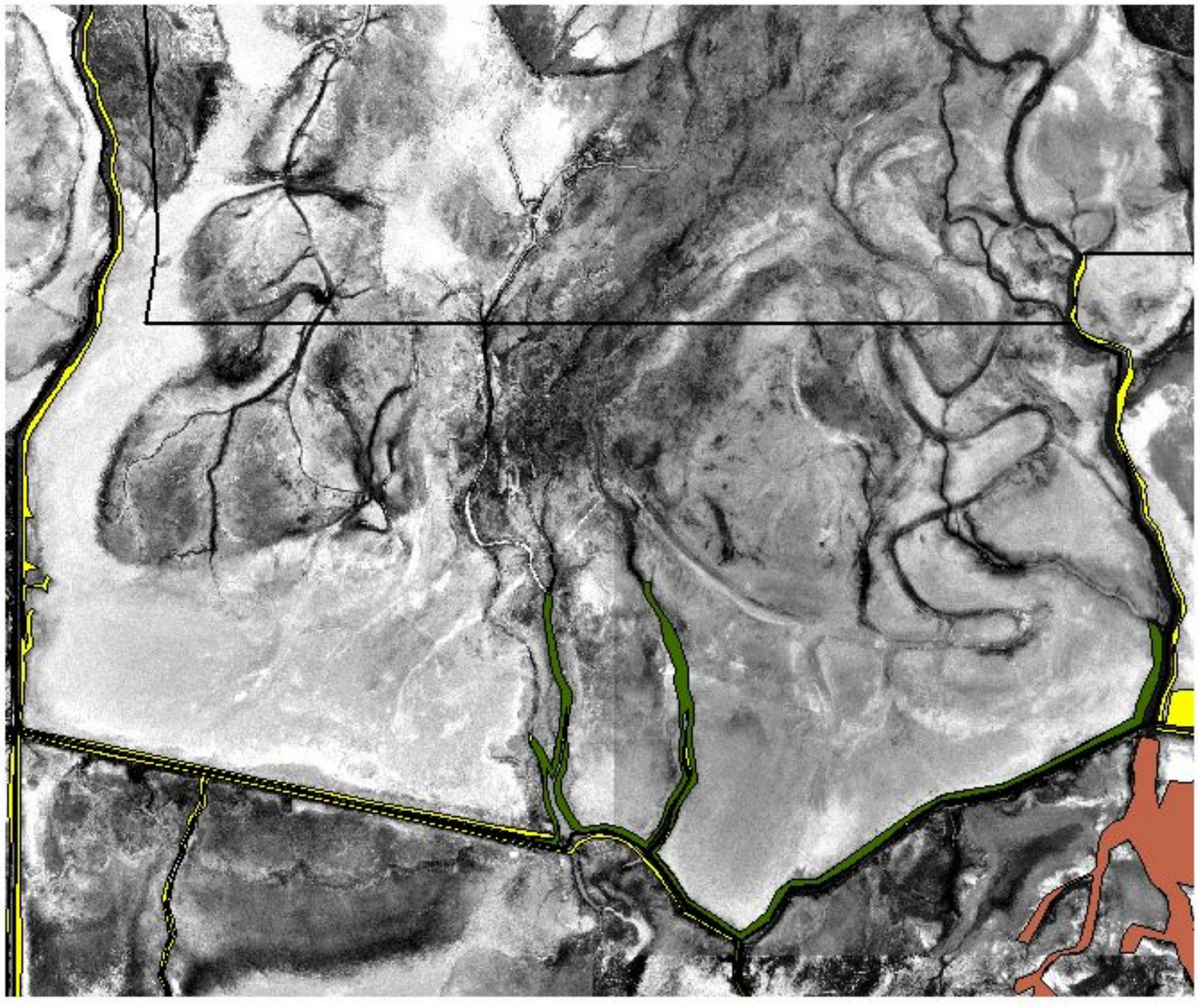
Spray

4A=105 acres
4B=29 acres
4C=33 acres
7=25 acres

0.3 0 0.3 0.6 Miles

N
W E
S

Unit 5A invasives treatment, 2004

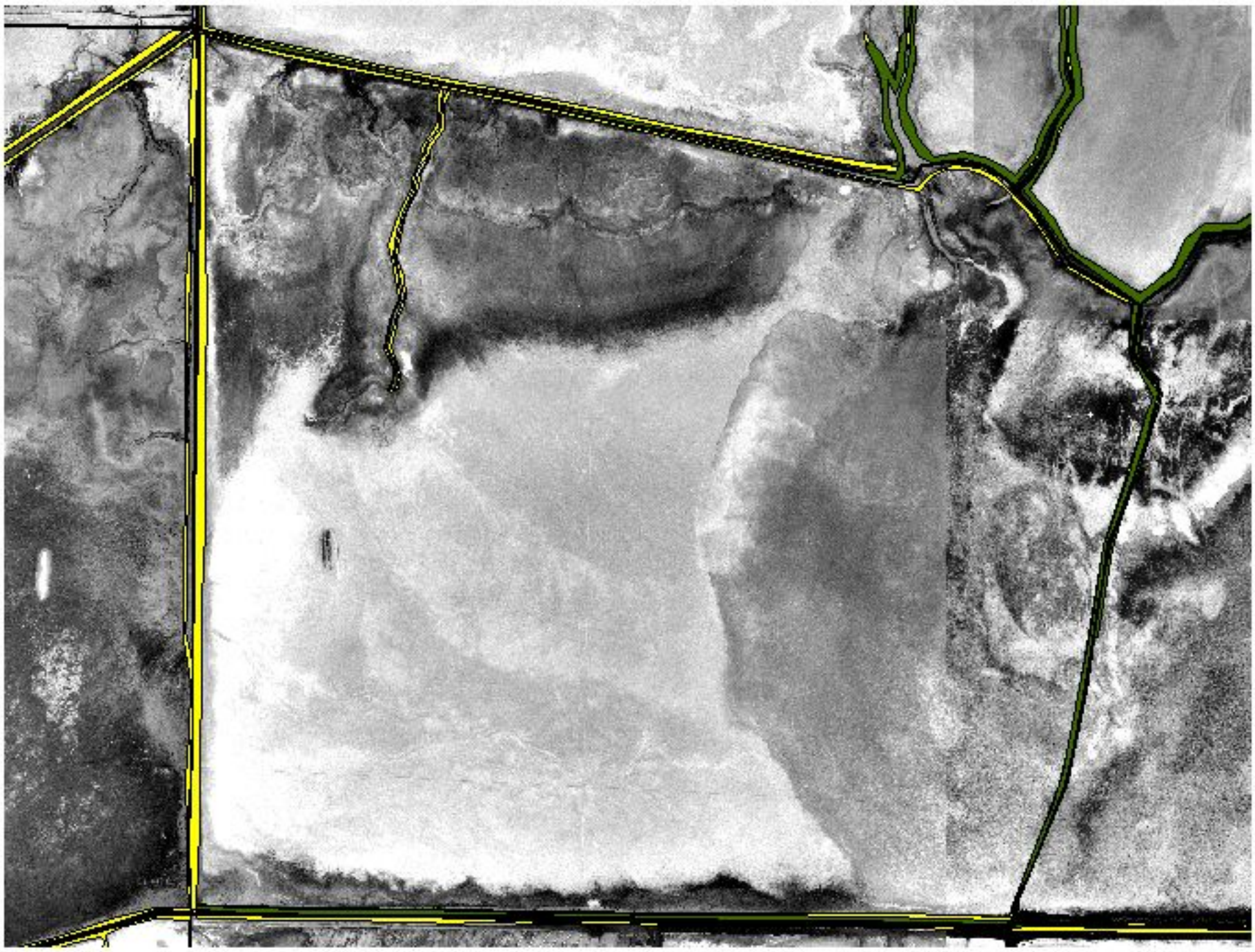


Pull=49 acres
Spray=218

N
W
E
S

0.3 0 0.3 0.6 Miles

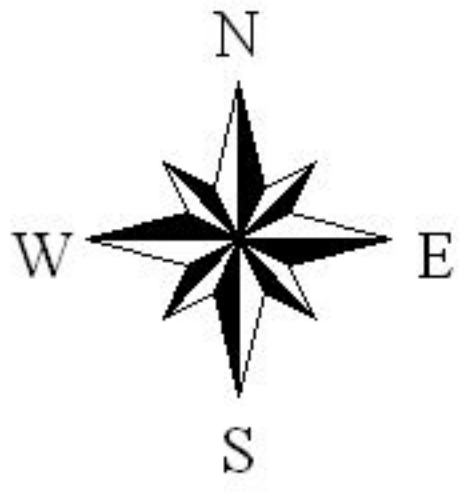
Unit 5B invasives treatment, 2004



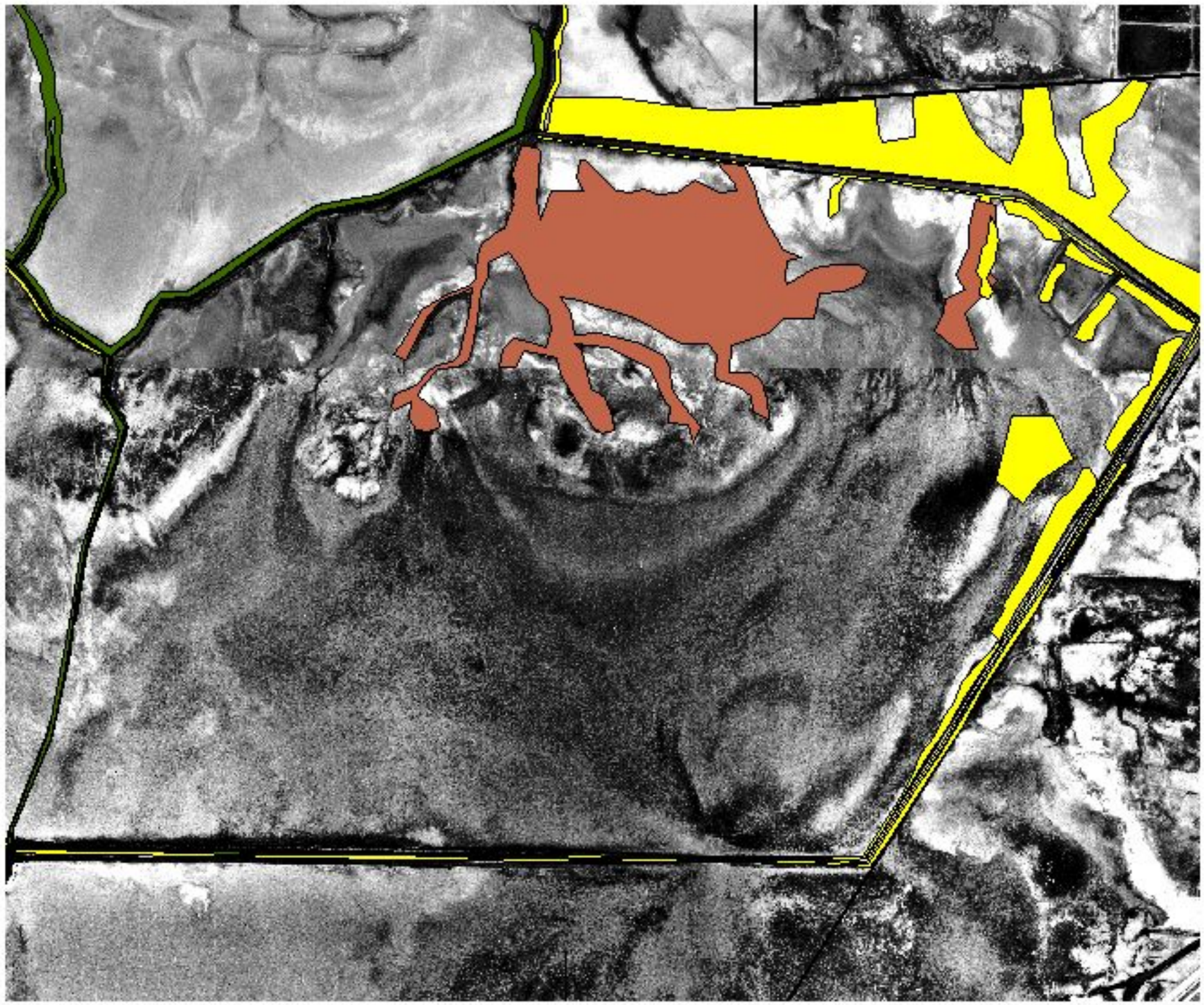
0.2 0 0.2 0.4 Miles

Pull=15 acres

Spray=48 acres



Unit 5C invasives treatment, 2004

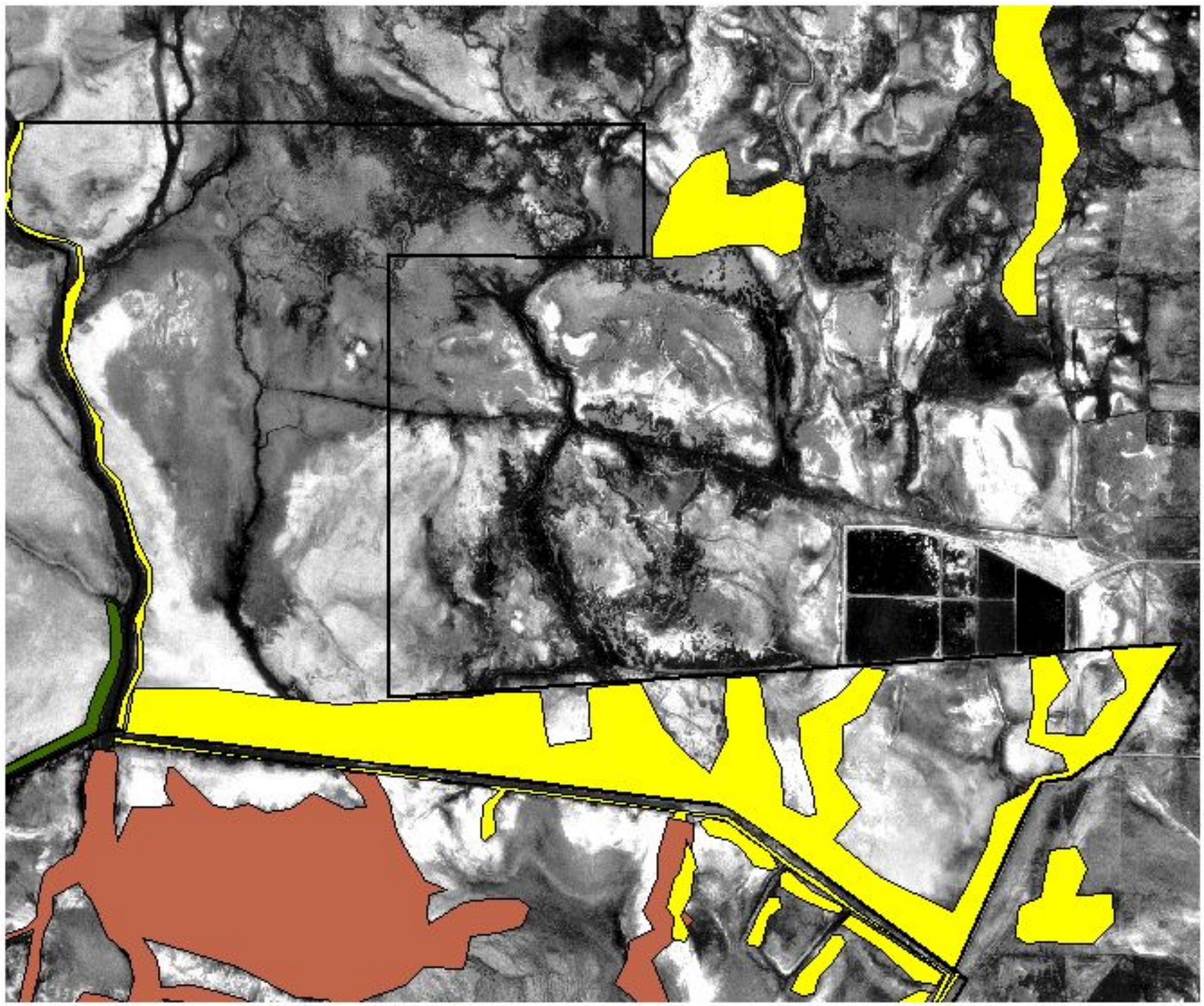


Disc=218 acres
Pull=2 acres
Spray=61 acres

N
W
E
S

0.2 0 0.2 0.4 Miles

Unit 5D invasives treatment, 2004



Disc
Pull
Spray

N
W
E
S

0.2 0 0.2 0.4 Miles

Appendix C. Units with significant use (≥ 10% annual use) by priority speices, 2004.

Priority Rank			
1	American Avocet	Annual	Population
	Unit	Use	Prop. (%)
	2C	904,251	14
	2D	437,072	48
	5C	112,400	12
	6	204,283	23

Priority Rank			
2	Cinnamon Teal	Annual	Population
	Unit	Use	Prop. (%)
	1	30,510	10
	4C	31,497	10
	6	82,814	28

Priority Rank			
3	Black-necked Stilt	Annual	Population
	Unit	Use	Prop. (%)
	2C	65,488	11
	2D	201,702	33
	6	157,213	26

Priority Rank			
4	White-faced Ibis	Annual	Population
	Unit	Use	Prop. (%)
	1	105,743	13
	2D	232,606	29
	6	227,732	28

Priority Rank			
5	Shorebirds	Annual	Population
	Unit	Use	Prop. (%)
	2D	437,072	22
	6	562,845	29

Priority Rank			
6	Waterfowl	Annual	Population
	Unit	Use	Prop. (%)
	1	1,802,579	12
	4C	2,923,162	20
	5B	3,236,001	22
	6	1,610,247	11

Priority Rank			
7	Tundra Swan	Annual	Population
	Unit	Use	Prop. (%)
	1	285,924	50
	4C	63,948	11
	6	71,938	13

Priority Rank			
8	Snowy Plover	Annual	Population
	Unit	Use	Prop. (%)
	1	219	34
	3G	90	14
	4A	144	23

Priority Rank			
9	Marbled Godwit	Annual	Population
	Unit	Use	Prop. (%)
	5C	44,274	18
	6	180,865	72

Priority Rank			
10	Long-billed Curlew	Annual	Population
	Unit	Use	Prop. (%)
	2D	259	12
	3C	229	10
	4B	419	19
	5D	285	13

Priority Rank			
11	Am. White Pelican	Annual	Population
	Unit	Use	Prop. (%)
	2D	28,005	22
	5B	19,349	15
	6	27,179	21

Priority Rank			
12	Redhead	Annual	Population
	Unit	Use	Prop. (%)
	1	71,422	13
	4C	100,424	18
	5B	264,215	47

Priority Rank			
13	Wilson's Phalarope	Annual	Population
	Unit	Use	Prop. (%)
	2C	11,450	24
	2D	8,735	18
	3A	5,656	12
	3E	7,971	17

Priority Rank			
14	Long-billed Dowitcher	Annual	Population
	Unit	Use	Prop. (%)
	1	19,686	33
	3A	7,320	12
	4C	17,223	29

Priority Rank			
15	Franklin's Gull	Annual	Population
	Unit	Use	Prop. (%)
	1	80,451	27
	2D	66,587	23
	6	38,023	13

Priority Rank			
16	Black Tern	Annual	Population
	Unit	Use	Prop. (%)
	2D	6,003	45
	6	6,475	49