Valentine National Wildlife Refuge Water Use Report 2009-2010

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Valentine National Wildlife Refuge

Water Use Report for 2009-2010

Introduction

The Nebraska Sandhills overlay the High Plains Aquifer - commonly referred to as the Ogallala Aquifer. This groundwater resource creates an interspersion of semipermanent and temporary wetlands, and shallow lakes in the lower elevations and valleys where the groundwater is exposed. Water resources are the driving force supporting the ecological diversity and integrity of the Nebraska Sandhills.

On Valentine NWR, there are thirty-seven major wetland complexes totaling approximately 13,000 acres. These wetlands are a mix of shallow lakes, marshes, seasonal wetlands, wet meadows, fens, and small streams that run during high water periods. Wetlands are well dispersed throughout the Refuge grasslands. Aquatic vegetation (both emergent and submergent) found in the lakes and marshes ranges from very sparse to dense depending on water depth, soils and alkalinity. Emergents include cattail, bulrush, wild rice, and phragmites. Submergents include pondweeds and duckweeds. Vegetation bordering lakes and wetlands is primarily grasses, although some lakes have a scattered border of trees, primarily on the south shores. Water control structures have been installed on six lakes, however, only four can increase water elevations significantly above the maximum, naturally functioning level. None of these water control structures allow for moist soil management; as previously noted, water levels can be held above the naturally functioning level on a few lakes, but none of the lakes can be completely drawn down with these water control structures. By the same token, refuge managers do not have the ability to control reflooding of refuge lakes once they are drawn down, as recharge is dependent on groundwater and precipitation. Only Calf Camp Marsh has a water control structure which allows some degree of moist soil management, and even this marsh cannot be completely drained by pulling boards out of the water control structure. Six Refuge lakes have water level gauges where lake levels are recorded. Refuge staff also record water levels in U.S. Geological Survey groundwater survey wells.

Some old drainage ditches dug before the Refuge was established remain. These ditches are only partially functional due to siltation, ditch plugging, and perhaps poor design. In several areas, wetlands have been created by digging or blasting holes in wet meadows and fens to produce open water areas. The water level in most Refuge wetlands rises and falls depending on precipitation and groundwater levels. Precipitation was generally higher than average for the area from 1981-1998 (Figure 1), which resulted in record levels for lakes. The Marsh Lakes, historically a very large cattail marsh with three areas of open water and a closed basin, is currently one large lake with little emergent cattail. Water flowed out of the Marsh Lakes basin during this high precipitation period, allowing common carp to enter the lake. The combination of high water and the influx of common carp have combined to greatly reduce the quality of this wetland complex as wildlife habitat. Refuge wetlands normally function as a closed system and only during high precipitation periods does excess surface water exit the Refuge. This year saw a marked improvement in water levels on the refuge as several years of average to above average precipitation have offset the effects of drought conditions experienced early in the past decade.

Lakes and Wetlands

Valentine NWR has 34 named lakes (Table 1). Water levels in these lakes are dependent on groundwater levels and precipitation. During years when groundwater levels are high and in years of high precipitation, lake levels are generally high. Water levels are monitored in six lakes that have elevation gauges set at the water control structure (Table 2). The water control structure on Willow Lake washed out in 1997 and has not been replaced. A survey done by refuge personnel in 2006 indicates that Willow Lake will flow out at an elevation of 2912.25, which is considerably lower than elevations recorded when the water control structure was in place (1988-1997 averages: 2915.08 during spring, 2913.42 during fall). Additionally, a court order in 1952 (Young, Harse, and Harms v. State of Nebraska, District Court order docket 24 #6949 page 249) set the maximum elevation at which water can be held in Willow Lake at 2916.91 feet.

In 2000, Ducks Unlimited provided funding to renovate a dike and place a water control structure in the dike to provide water control for the Calf Camp marsh. This impoundment is under Surface Water Right A-17895, priority date 20 July 2000, and grants water rights to 90 acre feet of water. The refuge receives notices regulating the storage of water in Calf Camp marsh from the Nebraska Department of Natural Resources via the USFWS Water Resources Division in Denver, CO. Water released from Calf Camp Marsh flows through a series of wetlands into the Marsh Lakes. As noted earlier, the Marsh Lakes are typically a closed basin, and water only enters Plum Creek in years when water levels are above average. Water releases from Calf Camp Marsh thus have no impact on water users downstream in the watershed, with the exception of those years when water levels are high in all wetlands in the Sandhills. Water inputs into to Calf Camp marsh are from a flowing well at the west end of the marsh, and from precipitation and groundwater. This water control structure became plugged in 2005, and the dike and road were threatened by high water. The marsh was mechanically pumped down so that the dike could be repaired and the water control structure could be unplugged. This water control structure has continued to be susceptible to becoming plugged, and refuge personnel have spent time every year unplugging this structure.

Refuge Wells

Valentine NWR maintains 86 active windmills (Appendix 1) to provide water to cattle grazing on the refuge. These tanks also provide a water source for refilling fire engines responding to a wildfire on the refuge. Six of these wells are registered with the State of Nebraska (Table 3); these six wells were drilled after the state required well registrations for stock wells. All other windmills on the refuge were drilled before this requirement went into effect. None of these wells are metered, so data on volume pumped are not available. Windmills are serviced annually and as needed to provide water for stock. There are also three domestic wells on Valentine NWR that provide water for Hackberry Headquarters, Pony Lake subheadquarters, and Pelican Lake subheadquarters.

There are 32 United States Geological Survey groundwater monitoring wells on and adjacent to Valentine NWR. These are monitored twice annually by refuge staff, with records held at the refuge dating back to 1970.

Yellowthroat Wildlife Management Area

The 480 acre Yellowthroat Wildlife Management Area is located in Brown County and is managed by Valentine NWR. The east part of the WMA contains Yellowthroat Lake, and the

west part Yellowthroat Marsh. These two bodies of water are connected by a channel, and there is a water control structure in the channel. Water flow is west to east. There is a gauge at the water control structure, although it is not tied to elevation above sea level. The USFWS holds the registration of two irrigation wells at Yellowthroat (G-048942 and G-048939). One of these wells is capped.

Water use in 2009

Three years of average to above average rainfall have helped the water levels in refuge lakes to rebound from the drought conditions experienced from 1999-2004. In 2007 and 2008, precipitation was just above average, and in 2009 was well above average. Lake levels in 2008 were recovering, but were still over a foot below average at the spring reading. By spring 2009, the seven lakes measured were only 0.36' (4.3") below the spring average. By fall, only Whitewater Lake remained below average elevation for the time of year. Water levels actually increased in 5 of 7 lakes from spring to fall readings, which is unusual for the Sandhills (Table 2). Some water was run from Whitewater Lake to Dewey Lake, and from Dewey Lake to Clear Lake. It was hoped that this flowing water would stimulate common carp to swim into traps between the lakes where they could be removed, but the carp didn't cooperate this year. Water levels in Dewey and Whitewater were not significantly affected by these releases, and water flowed out of Dewey Lake most of 2009 after we replaced boards in mid-June.

The 86 windmills on Valentine NWR received annual maintenance, and additional maintenance as required to provide water to stock grazing on the refuge. Grazing is used to manage refuge grasslands, and adequate water is required to allow cattle to graze where management is needed. Three domestic wells are also active and tested periodically to maintain a safe drinking water supply. In spring 2009, groundwater levels measured at the USGS monitoring wells showed that groundwater levels are recovered from the drought as well. Only eight of the wells showed levels below their long term average, and the wells averaged 6.84" above spring averages (Table 4). By the fall reading, only six wells remained below average, and the abundant rain in 2009 had apparently helped groundwater as well, with fall readings averaging 10.2" above the fall average levels. As with lake levels, these observations reflect a recovery in the water table following a series of dry years.

A fence in front of the water control structure at Yellowthroat WMA was removed in 2009. The fence had plugged up with vegetation and fallen into the water, so was no longer functional. A couple of boards were placed in the structure to raise the water level in the marsh.

Planned water use for 2010

Lake levels have risen enough already this year that water is flowing out of several of the lakes (Pelican, Watts, Dewey, Clear). Some water may need to be released during the year to prevent water from flowing out across the dikes, potentially washing them out or allowing unwanted fish (primarily common carp) to enter the lake. Water will be released from Whitewater to Dewey Lake, and will be allowed to continue to run between Dewey and Clear lakes in an attempt to trap and remove common carp. Infestations of common carp have been problematic on refuge lakes since they entered the refuge lakes via the Gordon Creek diversion. Two fish screen will be installed on existing culverts at West Long and Pony lakes as conditions allow. These are self-cleaning screens designed to prevent movement of fish into the lakes. The Nebraska

Department of Natural Resources is scheduled to do a dam inspection of the dike and water control structure at Calf Camp Marsh sometime during the year, and the Fish and Wildlife Service will be conducting a national inventory of dams on its properties.

Lake levels will be measured at least twice during the year, along with the USGS groundwater monitoring wells. The refuge will also continue to maintain 86 windmills and 3 domestic water wells.

At Yellowthroat WMA, some boards may be added at the water control structure to bring water levels up in the marsh. There are also plans to cover the remaining irrigation well if it can be located.

Table 1. Catalog of refuge lake (modified from McCarraher 1977).

Lake	Normal Surface Acres	Depth (feet) Max	Depth (feet) Mean	Type of Drainage
Baker	16	--	--	Closed
Center	80	4.6	2.9	Closed
Clear	424	11.5	5.6	Open
Coleman	46	4.6	3.0	Closed
Cow	30	4.6	2.6	Closed
Crooked	32	--	--	Closed
Dad's	1025	11.2	9.5	Closed
Dew	28	--	--	Closed
Dewey	550	8.9	4.6	Open
Duck	66	7.9	3.9	Open
East Long	638	5.9	3.6	Closed
East Sweetwater	113			Open
East Twin	67	5.9	3.6	Closed
Hackberry	680	5.9	3.3	Open
Homestead	23	4.9	3.9	Closed
Lee	16			Closed
Little Hay	24			Open
Lost	68	5.9	3.9	Closed
McKeel	48	5.2	2.9	Closed
Marsh	2300	7.8	3.9	Closed
Mule	348	9.8	6.6	Closed
Pelican	798	5.5	3.3	Open
Pony	153	5.9	3.6	Open
Punch Bowl	30	7.5	4.9	Closed
Rice	48	5.6	3.9	Closed
School	84	4.9	2.9	Closed
Tom's	23	4.9	2.9	Closed
Twenty-one	250	4.9	2.9	Closed
Watts	230	5.9	4.3	Open
West Long	62			Open
West Sweetwater	36			Open
West Twin	98	5.9	3.9	Closed
Whitewater	600	6.6	3.9	Open
Willow	354	7.9	4.6	Open

Note – Lee, Little Hay, West Long, and West Sweetwater lakes were not included in McCarraher, but are added here to complete the catalog of Refuge lakes.

Table 2. Lake elevations recorded on Valentine NWR, 2005-2009. For all lakes, average spring elevations are based on the highest elevation recorded in Mar-May from 1988-2009, and the average fall elevations are based on the lowest elevation recorded in Aug-Oct from 1988-2009.

Lake	Season	2005	2006	2007	2008	2009	Averages
Clear	Spring	2917.02	2915.92	2913.94	2913.72	2916.68	2916.74
	Fall	2916.12	2914.22	2913.41	2915.05	2916.74	2915.95
Dewey	Spring	2924.08	2924.08	2923.84	2923.9	2924.08	2924.33
	Fall	2923.20	2922.63	2922.84	2923.1	2923.52	2923.27
Hackberry	Spring	2923.72	2921.84	2922.19	2922.62	2923.43	2924.296
	Fall	2923.64	2921.36	2921.26	2922.12	2923.75	2923.698
Pelican	Spring	2941.02	2941.91	2941.69	2941.94	2941.84	2942.54
	Fall	NA	2941.16	2940.92	2941.76	2942.62	2941.94
Watts	Spring	2923.54	2921.38	2922.22	2923.14	2923.54	2923.68
	Fall	2922.96	2921.37	2921.40	2922.16	2923.60	2922.81
Whitewater	Spring	2927.16	2927.00	2926.66	2927.42	2927.70	2928.13
	Fall	2926.58	2926.16	2926.06	2926.48	2926.96	2927.41
Willow*	Spring	NA	2910.67	2909.71	2909.31	2909.94	2909.908
	Fall	NA	2909.3	2908.32	2909.03	2912.71	2909.726

Willow* - The water control structure on Willow Lake washed out in 1997. Averages shown for 2006-2009 represent measures since the structure washed out.

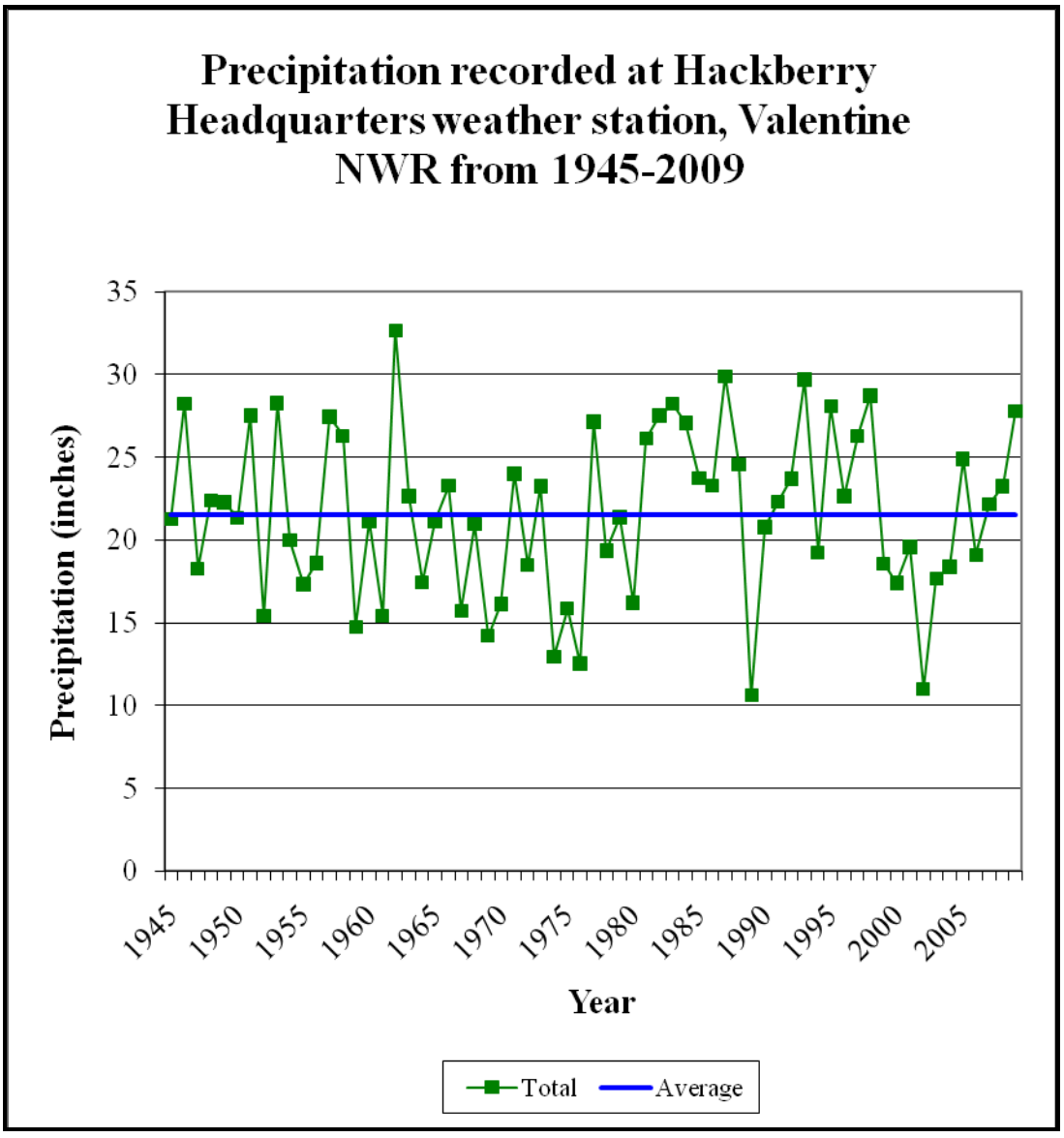
Table 3. Windmills on Valentine NWR currently registered with the Nebraska Department of Natural Resources

Well No.	Habitat Unit	Status	GPM	Location
G-111983	27B1	Active	4	NENE Sec 7 T28N R27W
G-116570	34C	Active	4	SWSW Sec 32 T29N R26W
G-124920	5A	Active	4	NESW Sec 26 T30N R29W
G-116571	8C3	Active	4	N Sec 2 T29N R29W
G-081629	30C1	Active	10	SW Sec 21 T29N R27W
G-124917	23A	Active	4	SESW Sec 13 T29N R28W

Table 4. USGS groundwater monitoring well readings during the spring and fall 2009, and long term averages 1970-2009. Values are groundwater elevation in feet, with the exceptions of wells 17, 31, 35, and 39, where the elevation of the monitoring well is unknown. Wells numbered 25 and 29 were dry when checked spring and fall in 2009.

Well No.	Spring 2009	Spring Average	Fall 2009	Fall Average
1	2876.13	2874.527	2875.93	2873.341
2	2895.83	2894.588	2894.23	2893.165
3	2899.97	2899.499	2898.87	2897.461
4	2921.29	2919.322	2920.39	2918.526
5	2896.55	2896.391	2896.15	2895.109
6	2916.33	2915.557	2915.33	2913.704
7	2917.04	2916.096	2917.24	2916.029
8	2898.68	2899.272	2898.78	2898.165
10	2924.41	2922.91	2923.61	2922.474
13	2917.05	2917.15	2917.35	2917.071
14	2921.77	2920.186	2921.27	2919.073
15	2926.57	2925.156	2925.87	2924.657
16	2899.87	2898.833	2898.17	2897.552
17	98.1	95.53333	99.5	95.55588
20	2925.26	2924.71	2924.96	2924.055
21	2925.44	2924.848	2924.84	2924.386
22	2924.29	2923.734	2922.89	2923.022
23	2924.39	2923.709	2924.09	2923.748
25	2942.52	2943.539	2942.52	2943.253
26	2963.78	2964.972	2963.38	2964.875
27	2957.19	2957.468	2956.19	2956.311
29	2948.69	2948.374	2948.69	2947.616
30	2940.24	2940.437	2939.44	2939.371
31	95.8	98.00294	95.8	98.23077
32	2942.35	2941.607	2941.95	2940.85
33	2979.8	2979.727	2978.7	2978.848
34	2925.39	2924.06	2925.59	2923.869
35	97.7	96.25135	97.3	95.40263
36	2926.67	2926.953	2926.77	2926.346
38	2921.44	2920.532	2921.04	2919.756
39	95.3	94.37333	95.5	94.06296

Figure 1. Yearly precipitation totals recorded at Valentine NWR from 1945-present.



Appendix 1. Habitat unit, registration number, well status, and location of all windmills on Valentine NWR.

Habitat Unit	Registration No. (if registered)	Well Status	Location (Latitude/Longitude)
01A1		Active	N42°35.477' W100°44.090'
01A2		Active	N42°35.122' W100°43.379'
02B		Active	N42°33.014' W100°42.445'
05A	G-124920	Active	N42°32.112' W100°42.804'
05B (2B1)		Active	N42°32.615' W100°41.445'
06		Active	N42°31.864' W100°40.182'
07B		Active	N42°31.845' W100°42.877'
08A		Active	N42°30.997' W100°43.151'
08C	G-116571	Active	N42°31.087' W100°41.166'
08D		Active	N42°31.001' W100°40.506'
08E1		Active	N42°30.796' W100°38.882'
08E3		Active	N42°30.620' W100°38.076'
09A		Active	N42°30.489' W100°42.076'
09C1		Active	N42°28.624' W100°41.471'
09C3		Active	N42°28.214' W100°41.540'
09C6		Active	N42°28.412' W100°42.153'
09C10		Active	N42°23.345' W100°42.544'
11A1		Active	N42°28.256' W100°40.820'
11A5		Active	N42°28406' W100°39.993'
12A1		Active	N42°28.248' W100°38.836'
12A4		Active	N42°28.720' W100°38.684'
14A4		Active	N42°30.571' W100°36.436'
14B1		Active	N42°31.268' W100°35.351'
14B4		Active	N42°30.384' W100°35.583'
14B5		Active	N42°34.255' W100°41.649'
15C		Active	N42°30.858' W100°37.388'
16A		Active	N42°32.655' W100°35.989'
16E1		Active	N42°31.366' W100°36.519'
16E3		Active	N42°31.449' W100°35.484'
18A2		Active	N42°32.692' W100°34.746'
18A4		Active	N42°31.684' W100°33.292'
18A6		Active	N42°31.968' W100°35.027'
18B2		Active	N42°30.433' W100°33.168'
18B8		Active	N42°31.515' W100°32.763'
18B9		Active	N42°31.444' W100°32.281'
19A		Active	N42°31.958' W100°32.030'
19B		Active	N42°30.455' W100°33.091'
20A		Active	N42°32.810' W100°29.214'
20B4		Active	N42°32.316' W100°27.779'
20B5		Active	N42°32.175' W100°28.360'

Habitat Unit	Registration No. (if registered)	Well Status	Location (Latitude/Longitude)
21A		Active	N42°30.455' W100°33.092'
22A1		Active	N42°30.185' W100°34.135'
22A2		Active	N42°29.695' W100°33.430'
22A3		Active	N42°29.007' W100°32.777'
22B		Active	N42°29.445' W100°32.247'
23A	G-124917	Active	N42°28.799' W100°33.142'
24A2		Active	N42°28.379' W100°34.926'
24A5		Active	N42°27.905' W100°34.408'
24C1		Active	N42°28.064' W100°33.986'
24C3		Active	N42°27.821' W100°32.846'
25C3		Active	N42°26.441' W100°31.076'
25C4		Active	N42°37.071' W100°31.652'
26A1		Active	N42°25.614' W100°31.449'
26A2		Active	N42°25.451' W100°32.176'
26B		Active	N42°25.841' W100°30.840'
27A		Active	N42°25.348' W100°30.663'
27B	G-111983	Active	N42°25.193' W100°30.188'
28A		Active	N42°25.267' W100°29.556'
28B1		Active	N42°25.396' W100°29.160'
28B3		Active	N42°26.302' W100°28.282'
28C		Active	N42°26.490' W100°28.001'
29A		Active	N42°27.361' W100°31.556'
29B		Active	N42°26.573' W100°28.874'
30A1		Active	N42°28.647' W100°31.247'
30A4		Active	N42°27.731' W100°32.366'
30B1		Active	N42°27.546' W100°28.916'
30B4		Active	N42°27.327' W100°29.379'
30C1	G-081629	Active	N42°27.856' W100°30.721'
30C3		Active	N42°27.561' W100°30.325'
31B		Active	N42°29.117' W100°29.421'
32A(SE)		Active	N42°28.197' W100°28.709'
32A(SW)		Active	N42°28.431' W100°30.207'
32C		Active	N42°28.522' W100°27.524'
33		Active	N42°27.569' W100°27.063'
34A1		Active	N42°27.533' W100°25.466'
34A3		Active	N42°27.692' W100°24.196'
34B		Active	N42°27.672' W100°23.392'
34C	G-116570	Active	N42°26.587' W100°24.772'
34D		Active	N42°27.285' W100°23.970'
34E		Active	N42°26.177' W100°23.724'
35A		Active	N42°26.927' W100°22.450'
35C		Active	N42°27.123' W100°21.947'
37A		Active	N42°28.902' W100°26.038'

Habitat Unit	Registration No. (if registered)	Well Status	Location (Latitude/Longitude)
37B		Active	N42°28.720' W100°26.660'
37A/C		Active	N42°28.390' W100°25.314'
37B/C		Active	N42°28.316' W100°25.950'