# CHEYENNE BOTTOMS WILDLIFE AREA

## 2010-2014

## MANAGEMENT PLAN

## INTRODUCTION

Cheyenne Bottoms is a natural land sink located in Barton County, Kansas (Fig. 1). The entire basin is approximately 41,000 acres in size. A detailed description of the soils and geology can be found in Dodge et al. (1981) and Vogler et al. (1987). About 20,000 acres of this basin is deeded to the state and managed by the Kansas Department of Wildlife and Parks (KDWP) as Cheyenne Bottoms Wildlife Area (CHBW). An additional 7,000 acres is owned and managed by The Nature Conservancy.

The Bottoms is home to numerous species of birds, mammals, reptiles, amphibians, fish, invertebrates and plants. Habitats found there include farm land, creek beds, shelter belts and marsh. Of the 417 species of birds documented in Kansas, a minimum of 328 have been observed at the Bottoms. Among these are threatened or endangered species such as the piping plover, least tern, whooping crane, bald eagle and peregrine falcon. The International Shorebird Survey (Manomet Bird Observatory) estimates that approximately 45% of North America's shorebird population stops at Cheyenne Bottoms when migrating north in spring. Waterfowl numbers can approach several hundred thousand. Cheyenne Bottoms, like all wetlands, has direct economic value to society. Visitors to Cheyenne Bottoms make significant contributions to the economic health of surrounding communities, Barton County, and the State of Kansas. According to Sicilian and Coleman (1987) total economic impact of Cheyenne Bottoms on the State's economy is over $2.8 million annually. The impact on Barton County alone is in excess of $1.8 million. Wetlands can improve the quality of the water passing through them, act as sponges during periods of heavy rains and help reduce flooding downstream (Tiner 1984). Wetlands also provide opportunity for bird watching, hunting, research, nature study and simply a place to go to unwind from man's hectic world. In August of 1988 it was designated a Hemispheric Reserve in the Western Hemispheric Shorebird Reserve Network, and in October, 1988, Cheyenne Bottoms was declared a Wetland of International Importance. In May, 2001, the Bottoms was designated as a Globally Important Bird Area by the American Bird Conservancy.

The value of Cheyenne Bottoms to local communities is receiving more recognition each year. The Great Bend Convention and Visitors Bureau (GBCVB) has always realized the value of the Bottoms to attracting visitors (hunters and birdwatchers) to the local area. Their advertising in many national publications has helped place Cheyenne Bottoms on many ‘places to visit’ lists nationwide. In the past few years this acknowledgement has spread to many of the local communities and manifests itself in various forms.

Beginning in 2001, the Wings-N-Wetlands Birding Festival was initiated with support for the event coming from the City of Great Bend, GBCVB, Great Bend Chamber of Commerce and the U.S. National Ramsar Committee. The festival was first held in the spring of 2001, and most recently in the spring of 2009. It has been scheduled as a semi-annual event since 2003. Attendance at the festival generally runs around 210 registered participants and come from all across the country.

Barton, Reno and Stafford Counties and the communities of Stafford, Great Bend, Claflin, Ellinwood, and Hoisington worked together via the Scenic Byways Committee and were not only successful in getting a scenic byway established but getting it a national designation. The National Wetlands and Wildlife Scenic Byway diverts traffic off U.S. 281 and directs it on

state and county highways that border both CHBW and Quivira National Wildlife Refuge. Audio tapes are available at area motels and the GBCVB office for those wanting to tour the byway and provide good educational material on the wetlands and communities as well as other points of interest along the route. In addition, a GPS based audio/video tour guide has been developed by Great Bend Convention and Visitors Bureau to allow visitors to Great Bend to sign out a hand held media player/GPS unit that provides more in depth educational information about the basin. This is also available at area motels and the Visitor Bureau.

The Kansas Department of Wildlife and Parks (KDWP) secured a Travel and Tourism grant from the Kansas Department of Transportation to design and construct the long awaited Kansas Wetlands Education Center (KWEC). The grand opening was held in April of 2009 and the facility is operated by Fort Hays State University (FHSU) as a branch of the Sternberg Museum. Exhibits within the facility highlight the many types of wetlands found, their value to wildlife and human activities and the management of and wildlife and vegetation found in wetlands. The KDWP has one full-time educator position in the facility and FHSU will have 4 full-time employees.

The primary management goal of CHBW over the next 5 years, as in the past, is to provide a diverse marsh habitat for waterfowl and shorebirds during their migratory periods. Two secondary goals are to provide the public recreational opportunities to enjoy the wildlife using the area, provided their activities do not conflict with the other management goals and to increase production of waterfowl and shorebirds that nest on the area. Both the primary and secondary goals will enhance the management of threatened and endangered species and a wide variety of resident wildlife.

To attain these goals, a variety of management tools and techniques are utilized. These tools and techniques must be kept in mind while reading the management plan. These tools include: sufficient water to provide the diverse habitat required by the variety of birds and other species utilizing the area, especially during drought periods; water level management capabilities to allow for the application of moist-soil management; maintenance of physical characteristics to provide a diversity of water depths within any given pool (e.g. level ditches, uneven topography); plant supplemental food sources for wildlife as opportunities arise; maximize hunter opportunity; and sufficient equipment and man power to ensure the use of all other tools.

Moist-soil management involves the de-watering of pools in spring to allow for the germination and growth of plants which are of value to water birds as a food source. The timing, rate of drawdown and time of re-flooding are critical to the success of this management practice (Fredrickson and Taylor 1982, Meeks 1969). To be successful, water must be available when needed and in the quantities needed, and water management capabilities must be such as to allow for the appropriate de-watering schedule.

This 5-year management plan does not contain the detail needed for day to day operations. The goal of this plan is simply to define the goals of management of the Cheyenne Bottoms Wildlife Area for the next 5 years. The day to day operations, and specific pool management is, has, and will continue to be, spelled out in annual work plans.

## BRIEF HISTORY OF CHEYENNE BOTTOMS

The following account is based on Schwilling (1985). A geological map of the drainage systems in Kansas during the Pleistocene Epoch shows the Smokey Hill River drainage flowing southeast across what is now Barton County and joining the Arkansas River drainage near what is now CHBW. Additional evidence that the two rivers were once joined is provided by early samples of fish from Blood and Deception creek drainages. These samples include species found in the Smokey Hill River drainage but not in the Arkansas River drainage mixed with species found in the Arkansas River drainage but not in the Smokey Hill River drainage.

Recent geological studies indicate that structural shifts in the earth's surface between early Late Cretaceous Epoch and latest Pliocene Epoch, about 80 million years ago, altered drainage systems and created the basin. The Bottoms, according to the Kansas Geological Survey, has been a marsh for at least 100,000 years.

The name 'Cheyenne Bottoms' resulted from a battle between the Cheyenne Indians and either the Pawnee or Kiowa over hunting rights to the area. Blood Creek, which flows into the basin, is said to have received its name following the same battle.

The first written account concerning the basin was in 1806, when Zebulon Pike crossed the Cheyenne Bottoms. In 1839, Dr. Fredrick Wislizenus tells of becoming lost in foggy weather in early October, and found himself in a great swamp. In 1867, Kansas Historical Writings tell of the government giving food and buggies to the Indians camped in a large bottom called Cheyenne Bottoms.

Major floods recorded in 1885-87, 1902-05, 1912, 1927-28, 1942, 1951, 1961, 1973, 1981, 2007, and numerous local run-offs resulting from rains in the vicinity of CHBW, produced lake-like conditions in the basin. In 1896, an irrigation congress was called to meet in Great Bend, and the Grand Lake Reservoir Company was formed. The goal of the Grand Lake Reservoir Company was to divert water from the Arkansas River into Cheyenne Bottoms to form a great recreation and resort area, as well as provide water for irrigation. This ditch, called the Koehn Ditch, was completed in 1898 and water ran into the Bottoms spilling down a 30 foot waterfall at the southwest corner. The company went broke and was disbanded in 1903.

After reorganization of the Kansas Forestry, Fish and Game Commission in 1925, the Commission declared that the development of CHBW would be assumed as one of its responsibilities and a part of its long-range program.

The Bottoms filled to a 20,000 acre, or more, lake in 1927 and 1928. Much interest developed for creating a National Wildlife Refuge and the U.S. Biological Survey (forerunner of the U.S. Fish and Wildlife Service (USFWS)) recommended that this be done. For a while this seemed a certainty. Legislation was passed in 1930 to provide $250,000 of federal money to acquire lands and initiate construction of a National Wildlife Refuge. Actual funding was later reduced to $50,000. The project floundered and was scrapped.

With the passage of the Federal Aid for Wildlife Restoration Act in 1937, which provided federal aid to states for wildlife restoration, the Kansas Forestry, Fish and Game Commission was able to purchase and develop CHBW as a wildlife management area. Dikes, roads, concrete hunting blinds, etc. were built and it was partially opened to public hunting in 1952. The official dedication ceremony was held on October 13, 1957, following the completion of the inlet system

and Arkansas River diversion dam. Some other historical notes include: the first oil well in Barton County was drilled in what is now the center pool of the wildlife area; market hunters were attracted to the Bottoms by the huge concentrations of ducks and marsh birds (in 1880 canvasbacks brought $8 per dozen, redheads $6, mallards $3); the area was leased to the U.S. Army Air Corp in 1945-46 for use as a bombing and target range; beginning in 1923, Frank Robl began extensive waterfowl banding; and, Edmund Martinez began banding shorebirds and songbirds on the area in the 1960's, and has probably banded more shorebirds than any other bander in the interior U.S.

On October 8, 1942, the first land was purchased. Total land acquisition was completed in 1956 totaling 19,857 acres. The original engineering plans were developed by Wilson and Company of Salina, Kansas. Most of the construction of water control structures and dams was completed by the late 1950's. The original management plan called for maintaining water levels in Pool 1 as a reservoir to provide water for diversion to perimeter pools. This would fluctuate water levels and help reduce the threat of avian botulism. Originally, there were no plans to drain Pool 1, except for maintenance and repair of dike and water control structures. However, water depths were maintained at uniform levels throughout the project until 1959. The management plan developed by the Forestry, Fish and Game Commission in 1958 promoted greater water level manipulation. Perimeter Pools 2, 3, and 4 were to be drawn down each spring on a particular schedule to permit growth of aquatic plants, while at the same time Pool 1 was to be filled as a reservoir to re-flood the perimeter pools in late summer and fall.

Production of aquatic vegetation is dependent on water fluctuation involving relatively clear water. The 3,300 acre reservoir in Pool 1 was shallow, averaging 4 to 5 feet, and was exposed to severe wind action. Excessive carp populations also developed. The resulting turbidity eliminated virtually all waterfowl food (both vegetation and invertebrate) production in Pool 1 and severely limited production of food plants in the perimeter pools when the turbid water was used to re-flood in the summer and fall. As a result, recommendations by Frank C. Bellrose (1959), Illinois Natural History Survey, called for alternately using Pools 1 and 2 as a reservoir supply to reduce water turbidity.

In 1961, the procedure for manipulating water levels was changed to permit the periodic draining of all pools to: 1) reconsolidate the soil structure in the pools; 2) control carp populations; 3) improve production of food-producing aquatic plants; 4) facilitate reconstruction of 167 earthen islands surrounding concrete hunting blinds in Pools 2, 3 and 4; and 5) facilitate repair of dikes and water control structures.

Periodic drainage of pools was seldom accomplished for several reasons: 1) inadequate capacity of outlet canal; 2) hunter blind island repair schedules; 3) construction and repair of peripheral dikes; 4) construction of pumping station; and 5) untimely and excessive rainfall. In most years, the drawdown was followed by aerial seeding of millet. When the seeded pools produced a good millet crop, peak waterfowl numbers can be high.

Since management at the Bottoms began in the 1950's, CHBW has been a high-profile area. Unfortunately, management of the Bottoms has not always been popular with all of its users. Among other things, limited knowledge about the ecology of the Bottoms has hindered the ability of managers to maximize use of CHBW by a diversity of wildlife species. In 1983, a coalition of citizen groups (Kansas Wildlife Federation, Kansas Audubon Council, Kansas Nongame Advisory Council, Kansas Natural Resources Council, Ducks Unlimited-Kansas

Chapter, The Wildlife Society-Kansas Chapter, American Fisheries Society-Kansas Chapter, Kansas Ornithological Society, Sierra Club - Kansas Chapter) formed the Cheyenne Bottoms Task Force (CBTF). The CBTF was instrumental in helping the Kansas Fish and Game Commission obtain a grant from the Kansas Legislature to study the ecology of Cheyenne Bottoms. This study, entitled Cheyenne Bottoms: An Environmental Assessment, was performed by the Kansas Biological and Geological surveys and was completed in 1987. Topics of study included geology, hydrology, streamflow, vegetation, wildlife, economic impact, and options for improving facilities and management.

With increased emphasis being placed on wetlands and the value of CHBW to the wildlife resource becoming more apparent, the KDWP contracted with an engineering firm to address the physical problems of CHBW. These problems have resulted from aging of the marsh and water control structures, and declining water supplies. In 1988 Howard, Needles, Tammen and Bergendorf (HNTB), of Kansas City, Missouri, began studying the situation and to make recommendations to address the identified problems. In 1991, the construction of the recommendations adopted by the Department was initiated. Subdividing of pools, three new pump stations, upgrading of old water control structures and the three diversion dams, new gates and the development of the mitigation marsh have all been completed. The management capability of the wildlife area is now the best it has been. Funding for this renovation effort (about $17 million total) came from the North American Wetlands Conservation Council, Kansas Water Plan, U.S. Fish and Wildlife Service and numerous other contributors such as Ducks Unlimited.

During the 1960's and 1970's irrigation development increased significantly in the western United States. This increase was predominately due to the rapid rise in popularity of center-pivot irrigation. As more water was being removed from aquifers, many perennial streams lost their base flow. One such stream was Wet Walnut creek (McClain and Shapiro 1987). The KDWP, with support from several private organizations, requested the Chief Engineer to evaluate the need for restrictions on water appropriations in the drainage since the Department's surface water right could no longer be met. In January 1992, the Chief Engineer of the Division of Water Resources, Kansas Department of Agriculture, established an Intensive Groundwater Use Control Area (IGUCA) in the Wet Walnut drainage. This action followed a series of hearings in Great Bend where available hydrologic information for the Wet Walnut system was presented. Irrigation groups, conservation organizations and several state agencies testified before the Chief Engineer. The overall result was a reduction in water use by water rights holders junior to the right held for CHBW. The goal of this action was to reduce withdrawals from the aquifer to restore base flows to the creek.

The KDWP greatly increased the management capability of CHBW with the acquisition of several pieces of heavy equipment. In 1988 an amphibious backhoe was purchased and has been used to battle the silt accumulation within the basin. Funds for this machine came from the State Duck Stamp, Chickadee Check-off and Ducks Unlimited. In 1996 a Caterpillar Challenger Tractor and two 30-foot disks were purchased which have been instrumental in reducing cattail coverage in the marsh. A second, used, Challenger tractor was purchased in 2003, since it was deemed cheaper in the long term to own a tractor as opposed to entering into annual rental agreements.

Beginning in 1998, the Bureau of Reclamation (BOR), U.S. Department of Interior, provided a grant to KDWP-CHBW. This grant would total $1 million over 5 years with KDWP matching that amount. The intent of the effort was to continue efforts of water conservation, evaluate various techniques for cattail control, determine aquatic invertebrate (primarily chironomids, commonly known as blood worms) responses to cattail control techniques and establish on CHBW a GIS/GPS system based on aerial color Infrared photography to monitor vegetation changes. A pull-behind scraper was also purchased for use with the Challenger tractors. This has allowed CHBW staff the ability to re-claim many small wetlands located in the perimeter portion of the property. It has also been used in dealing with the silt problems within the basin.

In 2007, following several large rain events in May, the Bottoms filled to its deepest levels since at least the late 1920's. The perimeter pools filled to 77 inches by June. All dikes were under water save the Pool 1 dikes, but even they received severe damage due to wave action. Total cost estimates for repair of damaged dikes was about $1.5 million. The CHBW staff completed as much of the repairs as possible, with the major damaged sites having to be contracted out for repairs. Much of the money spent on the flood repairs was reimbursed by the Federal Emergency Management Agency.

# WATER MANAGEMENT

## BACKGROUND

### Water Diversion

It has been estimated that Cheyenne Bottoms would go dry, 2 out of every 5 or 6 years, prior to development. With the availability to use the 'new' Federal Aid money, the KFFG saw an opportunity to provide waterfowl hunting opportunity on an annual basis at the Bottoms using supplemental water.

The Department holds certified water rights to 18,185 acre feet/year on the Arkansas River (No. 2427) with a maximum diversion rate of 80 cubic feet per second (cfs), and a right of diversion for 19,175 acre feet on the Wet Walnut Creek (No. 439) with a maximum diversion rate of 500 cfs. These diversions supplement the natural inflows to CHBW from two intermittent streams, Blood and Deception creeks (Fig. 1) as well as overland flows and direct precipitation. Neither of these creeks are controlled by structures on Department property. In addition to the currently held water rights mentioned above, the Department has three other approved applications: Application No. 39789, dated 4 December 1989, is for 9375 acre feet/year on Blood Creek; Application No. 39951, dated 16 April 1990, is for 6000 acre feet/year on Dry Walnut Creek; and Application No. 40081, dated 8 October 1990, is for 2905 acre feet/year on Deception Creek. These have not yet been certified.

During the Renovation effort of the 1990's, 4 flow meters were installed on the inlet system and one on the outlet canal. Since that time all of the original flow meters have failed and those that could be repaired were repaired. The repaired meters have since failed. Since the original meters are now outdated, replacements were required. As of 2009 new flow meters have been purchased and staff has two installed on the inlet (Gages B and C) and one on the outlet canal (Gage E). One meter on the inlet is to be installed in 2009 (Gage A) as the original meter has been determined to be inaccurate, with the fourth meter (Gage D) having been replaced with a USGS monitored and maintained meter.

The current status of the three diversion dams varies with the dam. The Wet Walnut Diversion Dam was re-painted and all concrete cracks repaired in 2006. The west two gates in the dam were abandoned during the renovation effort due to silt accumulation in front of the gates and the reduced flows in the Wet Walnut Creek resulting from the Great Bend flood control project which diverts flood waters in that stream around the city into the Arkansas River. Of the three gates on the canal intake, the center gate is functional only by hand operation. The motor failed and since it is obsolete, replacement would be required to make it functional. The other two gates operate and with the reduced flows in the Wet Walnut are sufficient to divert water to the basin. In 2009 the gates at the Dry Creek Dam were repaired using stainless steel chain and connector links on the lift mechanisms. Some tree removal was accomplished, but more needs to be done. The Arkansas River Diversion Dam continues to receive much vandalism and as a result is always in need of at least some repairs. Many lift cables on the dam gates are in need of replacement. In addition sand and trees accumulate in the front of the dam

and must be removed. Most recently trees were removed in 2006 and contractors have been given the task of removing the current accumulation as soon as conditions allow.

**Inlet Canal**

The inlet canal from Dundee, north to Dry Walnut Creek, is in need of maintenance. Over the past several years stretches of the canal have been the focus of tree removal efforts. These trees jeopardize the integrity of the dike and can pose a problem to water flows should they fall into the canal. In addition, the original lining of the canal has been compromised over the years by simple erosion and vegetation growing in the canal due to extensive dry periods. This has lead to reaches of the canal that 'leak' diverted surface water into underlying groundwater. While benefiting groundwater users adjacent to the canal, it can mean serious reductions in water making it to CHBW. As part of the Bureau of Reclamation work at CHBW, money was provided to study options available to address the water loss. In an effort to accomplish as much as possible with the limited funds available, a contractor was hired to remove trees, dig out silt and generally 'clean up' the inlet canal north of Dundee. As a follow up, and an on going effort, tree control remains a high priority in an effort to avoid a repeat of the past. The Department is conducting internal meetings to assess the direction to take in addressing the leakage of the inlet canal.

**Water Storage**

Water is diverted from both the Arkansas River and Wet Walnut Creek when it is available. This occurs most generally following heavy rains in the respective drainage basins. Most often, this water is placed into Pool 1 for storage and is used to re-flood perimeter pools in the fall. Pool 1A is the primary storage pool on CHBW because its surface area to depth ratio minimizes evaporation. There are times when water is available in these two streams, but none is diverted. This is usually due to the fact that Blood and Deception Creeks are providing all the water needed for the Bottoms since many wet periods include all streams and additional water from outside the basin is not needed.

**Spring Management**

Spring management objectives center around de-watering 2 perimeter pools. De-watering of the first pool is initiated in early April and continued through May. De-watering of the second pool will begin 2 to 3 weeks later. If possible, this water is placed into Pool 1 for storage. The drawdown is meant to accomplish two objectives: provide open mud flat and shallow water foraging areas for the migrating shorebirds; and provide the opportunity for the germination of moist-soil vegetation which will be utilized by waterfowl the following fall (Fredrickson and Taylor 1982).

The number of pools to be de-watered varies from year to year, depending on the number of perimeter pools containing water and their depths as well as weather conditions. When possible, de-watering is done on a rotational basis and de-watered pools should not be adjacent to

one another. This allows for the re-establishment of aquatic invertebrates and adds diversity to the entire basin.

**Summer Management**

During the course of the summer, monitoring of de-watered pools must be conducted to note the establishment of undesirable plants. If these plants are noted, water, if available, may have to be added to the pool to drown them. This will also irrigate the desirable moist soil plants which are wanted since, for the most part, they are more tolerant of shallow water. The pools that were not de-watered are maintained at approximately 16 to 18 inches in depth throughout the summer if sufficient water is available in Pool 1 or in the inlet system. This action accomplishes four primary objectives: slowing of cattail expansion; providing of nesting/brood rearing habitat for waterfowl; providing of habitat for the completion of invertebrate life cycles; and providing of nesting/foraging areas for wading birds (e.g. herons, bitterns).

In years when dry conditions prevail and water to maintain perimeter pools is not available, water levels will decline. It is during these times that close monitoring of the shallow water pools will begin to detect the onset of a botulism outbreak. Table 1 provides the data from recent years showing the more significant botulism outbreaks. Prior to 1990, little effort was made by CHBW staff to address botulism outbreaks. Records do indicate that an outbreak in 1967 was noted. Discussions with former CHBW staff indicate that annual mortality of waterfowl, though most generally minor in number, occurred (Gene Bahr, pers. com.). Since 1990, when botulism outbreaks appear to be more then minor in size, CHBW staff has made concerted efforts to collect dead and sick birds in an effort to stop the cyclic nature of the spread of the toxin. Recent studies have suggested that such efforts may have no affect on slowing or reducing the size of a botulism outbreak. Bollinger, et al, 2002, presented evidence that indicated that carcass clean up was so inefficient in vegetated marshes as to be ineffective in slowing die-offs. In addition, duck mortality on transmitter equipped birds showed no difference between marshes where carcass clean up was employed and those where it was not.

**Fall/Winter Management**

Using stored water, and any water that may be available through the inlet system, the de-watered pools are re-flooded. This generally will begin in late July or August and continue into October. If possible, a variety of water depths between the pools is provided to meet the demands of the various species of birds using CHBW. In addition, due to the size of the pools, diversity of depth occurs within a particular pool. Pools that held water throughout the summer may be allowed to drop in depth to expose mud flats for the fall migration of shorebirds. This practice has been avoided in recent years due to its tendency to favor cattail expansion.

**Habitat Diversity**

Over the years, a number of projects have added great diversity to the various pools of CHBW. The placement of the hunting blinds and the associated islands was the first significant activity in this area. Beginning in the late 1980's, with the acquisition of the aquatic backhoe,

the digging of level ditches provided not only deeper water areas but also the spoil banks along their sides. These islands have served well as loafing sites for waterbirds. The ditches remained cattail free for several years and contributed greatly to habitat diversity as they brought open water through cattail stands, but they are in need of maintenance now. They also provided open water areas close to the upland grasslands that could be used by duck broods leaving their upland nest sites. The renovation effort had in its overall plan, the construction of large islands that consolidated several tons of silt. These islands have further added to the diversity of the marsh. The digging of scrapes is the most recent effort to add to the diversity of CHBW while reducing the cattail acreage.

Table 1. Number of birds collected during botulism outbreaks at Cheyenne Bottoms Wildlife Area, 1990-2000.

| Year | Total Birds Collected | Number of Birds Released from Rehabilitation |
|---|---|---|
| 1990 | 4,241 | 87 |
| 1993 | 2,035 | 171 |
| 1994 | 604 | 37 |
| 1995 | 259 | 14 |
| 1998 | 2,304 | 91 |
| 2000 | 432 | 33 |

## GOALS

* Continue to dry pools on a rotational basis to emulate the natural periodic drying of the marsh before development. This will also allow for infrastructure and vegetation work on a periodic basis.
* Continue to direct efforts to the Dundee inlet canal through tree removal.
* Maintain Pools 1A, 1B and 1C at or near capacity as much as possible to help ensure water is available for re-flooding perimeter pools as needed. Maximize use of pump stations to recover and store water from perimeter pools as opposed to releasing it down the outlet.
* Provide spring shorebird habitat by timing the de-watering of at least one perimeter pool to provide mud flats in mid April to mid May. This should also be timed to encourage moist-soil plants.
* Avoid decreasing water levels and mud flat conditions during late summer and fall. This is the primary time for outbreaks of avian botulism. This also leads to increased cattail expansion through seed germination.

* Maximize habitat diversity through water level differences among the pools.
* With the opening of the KWEC, additional attention needs to be addressed toward intensive management of the wetland acres adjacent to the building.
* Continue efforts to address the leakage of the Dundee inlet canal.

## STRATEGIES

Tree removal along the inlet canal will proceed as funding and conditions permit. In addition, efforts during the course of the year need to include killing small trees as they become established and more frequent burning of the inlet canal should be done.

Employing the inlet system and pump stations should allow for the maintenance of maximum stored water levels in Pool 1. The pump stations, likewise, will reduce the use of the outlet canal. When water availability is limited, Pool 1C could be utilized to contribute to water depth diversity. Diverted inlet canal water should be the primary source of water used to maintain all water levels regardless of time of year.

Spring draw down for shorebird habitat will favor the germination of moist soil vegetation which will be utilized by waterfowl the following fall (Fredrickson and Taylor 1982).

Research at CHBW has indicated that to maximize chironomid populations for the summer-fall shorebird migration, re-flooding of dry pools needs to be done no later than mid-July and draw downs would have to provide mud flats from the second week of July through the third week of September. In order to meet these demands, many other potential problems would be encountered. Trying to re-flood dry pools during the summer would require enormous amounts of water during a period of the year when water is not usually plentiful. In addition, experience has shown that cattail germination is favored by conditions made when shallow water is placed into dry pools following seed release. CHBW has been susceptible to avian botulism. Efforts need to be made annually to reduce the potential for outbreaks. Conducting summer-fall draw downs would greatly increase the potential for avian botulism. The avoidance of declining water levels from July through September is key to minimizing botulism potential (Friend 1987). Even in light of the studies indicating that carcass collection during a botulism die off does little to slow the outbreak, efforts will continue to be made to clean up during the outbreaks. The reasoning behind this decision is to provide staff the opportunity to see areas of the marsh seldom visited during normal duties. In addition, carcass removal shows the public that staff on the Wildlife Area are doing all they can to combat the outbreak and it also helps fight the potential feeling of helplessness that can form in workers on a marsh. And besides, it may help, in spite of the limited research results. Given these facts, there will be limited opportunity to actively provide extensive summer/fall shorebird habitat. However, in many years, natural draw downs and flooding occurs to at least provide some shorebird habitat.

When conditions allow, pool depths should vary from one another. This allows for the maximum amount of habitat diversity. Such diversity is desirable given the number of species of water birds using the area and the demands of the different human users of the property.

One or two pools per year should be held dry, if possible. This allows for vegetation management and/or infrastructure maintenance to be performed. In addition, this would mimic historic water level fluctuations when CHBW would naturally go dry 2 out of every 5 or 6 years. Vegetation conditions may require the same pool to be held dry for 2 or more consecutive years.

Maintain level ditches, blind and renovation islands as well as the spoil banks associated with the level ditches. Whenever possible, the upland areas on the islands and spoil banks will be seeded to native grasses. These ditches will also serve as conduits for water transfer when pumping of the various pools is done. Level ditching, while implemented within the past 20 years, was recommended in the 1958 CHBW management plan (Eggen and Coleman 1958).

The Mitigation Marsh has now been elevated to a higher priority than in past years, with regards to water pumping to the area. With the WEC now in place, vegetation management and the pumping of water to the Mitigation Marsh. While this portion of CHBW has received much attention in the form of wetland development and enhancement, we must now focus more on maintaining water in the marsh for educational purposes. Drying of the marsh will still be required for vegetation management, but the length of these dry periods needs to be shortened as much as possible.

# VEGETATION MANAGEMENT

## BACKGROUND

The vegetation of CHBW has been described to varying degrees of detail since the 1920's. One of the first and most complete attempts was made in 1986 (Brooks and Kuhn 1987). According to their work, hydrophytic (i.e. wetland) plants represent the vast majority of the vegetation found on Cheyenne Bottoms proper. The areas where non-hydrophytic plants occur in great abundance are along the inlet and outlet canals.

The plant communities, which make up the hydrophytic vegetation, vary in size from year to year. These boundary changes reflect changing growing conditions resulting primarily from water level fluctuations. The plant communities described in this section are taken from Brooks and Kuhn (1987).

Four general communities were described in the assessment by Brooks and Kuhn,1987. Open-water/Mudflat, for the most part, is found in Pool 1 and in portions of the perimeter pools closest to Pool 1. It is typical for large expanses of open-water communities to become mudflat as the spring/summer seasons progress. Submergent vegetation which is most commonly found in the open-water areas include: Lemna (*Lemna sp.*); pond weeds (*Potamogeton spp.*); and coontail (*Ceratophyllum demersum*). As mudflats become available, a result of drawdowns or natural drying, a variety of wetland plants, from obligate to facultative, germinate. Some of the most common are: barnyard grass (*Echinochloa crusgalli*); sprangletop (*Leptochloa fasciculatus*);saltmarsh aster (*Aster subulatus*); smartweeds (*Polygonum spp.*); pigweeds (*Amaranthus spp.*); sea-purslane (*Sesuvium verrucosum*); oakleaf goosefoot (*Chenopodium glaucum*);and kochia (*Kochia scoparia*).

The cattail (*Typha spp.*) community can be found in all pools. Some of the more common bulrushes found in the cattail community are: hard-stem (*Scirpus acutus*); river (*S. fluviatilis*); and slender (*S. heterochaetus*). Bulrush stands tend to be small, and scattered throughout the pools. Due to the inadequate water management capabilities at CHBW, the cattail community has expanded rapidly. In the 1960s and 1970s, cattail apparently was a minor component of the wetland vegetation (e.g., in 1960 cattail covered <1% of Pool 3 and was absent from all other pools; Sonnenberg 1961, Hastings 1970). In 1986, cattail covered approximately 43% of Pool 2, 15% of Pool 3, 5-10% of Pool 4, and 50% of Pool 5 (Brooks and Kuhn 1987).

The saltgrass (*Distichlis*)/ wheatgrass (*Agropyron*) community is located in the perimeter Pools 2, 3, 4 and 5. On average, the lower portions of this community hold water for only brief periods of time. For the most part, plants growing in this community can be categorized as facultative wetland or facultative. The more common species include: inland saltgrass (*D. spicata*); western wheatgrass (*A. smithii*); prairie cordgrass (*Spartina pectinata*); alkali sacaton (*Sporobolus airoides*); curlycup gumweed (*Grindella squarrosa*); western ragweed (*Ambrosia psilostachya*); and false willow (*Baccharis spp.*). Salt cedar (*Tamarix ramosissima*) is invading this community.

The spikerush (*Eleocharis spp.*) community is the smallest of the hydrophytic plant communities. Because it occurs in small, scattered depressions in the saltgrass/wheatgrass community, its coverage is difficult to estimate. Historically, spikerushes occurred in the zone

between the open-water/mudflat and saltgrass/wheatgrass communities. Waterfowl food habits work, conducted at Cheyenne Bottoms, have shown it to be heavily utilized, in some years, especially by teal.

Table 2. Vegetation and land use acreage for Cheyenne Bottoms Wildlife Area, 1998 and 2002. From Von Loh and Oliver, 1999 and Houts, 2003.

| Habitat | 1998 | | 2002 | |
|---|---|---|---|---|
| | Number of Sites | Acres | Number of Sites | Acres |
| Cattail marsh | 435 | 6841.2 | 293 | 1656.6 |
| Cattail marsh-sparse | 58 | 642.2 | 105 | 995.2 |
| Cattail management-disked | 9 | 486.3 | 11 | 1111.1 |
| Cattail management-mowed | 2 | 90.5 | 2 | 465.2 |
| Phragmites marsh | 4 | 0.5 | 15 | 0.1 |
| Submergent/floating aquatics | 109 | 391.9 | 0 | 0 |
| Mud flats | 25 | 175.9 | 72 | 2826.2 |
| Undifferentiated emergent wetlands | 69 | 326.2 | 44 | 707.9 |
| Spikerush wetland | 154 | 358.0 | 123 | 361.7 |
| Prairie cordgrass wetland | 120 | 915.7 | 76 | 587.5 |
| Western wheat/saltgrass grassland | 122 | 1874.5 | 112 | 2811.9 |
| Native grass plantings | 2 | 15.6 | 38 | 83.8 |
| Introduced annual vegetation | 240 | 57.1 | 113 | 44.7 |
| Abandoned agriculture | 13 | 936.2 | 8 | 225.1 |
| Indianhemp shrubland | 41 | 23.3 | 27 | 10.6 |
| Pool-open water | 200 | 4043.4 | 36 | 3725.8 |
| Canal-open water | 4 | 70.3 | 6 | 82.4 |
| Pond or dugout | 28 | 35.8 | 8 | 2.8 |
| Ditch-open water | 79 | 91.3 | 26 | 68.4 |
| Dikes | 31 | 219.5 | 31 | 219.5 |
| Fire guard | 17 | 90.9 | 15 | 88.4 |
| Other bare ground | 18 | 32.2 | 57 | 21.8 |
| Food plot | 21 | 143.2 | 17 | 255.0 |
| Leased agriculture | 19 | 679.9 | 18 | 612.4 |
| Windbreak/shelterbelt | 41 | 61.4 | 34 | 63.2 |

The Bureau of Reclamation (BOR), U.S. Department of Interior, began an intensive vegetation mapping effort of CHBW in 1998. This project includes aerial color infra-red photography and extensive ground truthing of the work. This effort continued annually through 2002, with the final year being conducted by the Kansas Applied Remote Sensing (KARS) Program. Table 2 presents the habitats identified in the 1998 and 2002 photography along with the acreage of each. Changes between the two years are the result of management activities,

differing water levels within the marsh and the fact that different individuals interpreted the photography. Table 3 presents a comparison between the 2002 KARS mapping effort, with that of their work done in 2005 (Houts, 2006). Figure 3 presents this information for 2005 in map form.

Table 3. Land cover area comparison between current 2005 map and 2002 map of Cheyenne Bottoms Wildlife Area*. From Houts, 2003 and Houts 2006.

| Habitat | 2002 Acres | 2005 acres |
|---|---|---|
| Saltgrass/wheatgrass | 3037.0 | 2495.6 |
| Cordgrass | 587.5 | 707.3 |
| Spikerush | 361.7 | 295.3 |
| Undifferentiated Emergent vegetation | 707.9 | 2657.8 |
| Cattail | 2651.8 | 874.9 |
| Bulrush | NA | 1215.2 |
| Introduced annuals | 44.7 | 877.2 |
| Agriculture | 867.4 | 821.9 |
| Trees | 66.1 | 97.9 |
| Indian hemp | 10.6 | 7.9 |
| Water | 3728.6 | 1458.0 |
| Bare ground | 2826.2 | 2908.3 |

* To approximate the 2005 classes, several classes from the 2002 map were combined to better reflect the 2005 map classes. Saltgrass/wheatgrass 05=wheatgrass+abandoned agriculture 02, cattail 05=cattail+sparse cattail in 02. Bare ground 05 includes naturally bare uplands, exposed mudflats, while bare ground in 02 included only exposed mud flats.

**Cropland**

There are several, relatively small, cultivated crop fields on the property. A total of about 1150 acres of ground is devoted to cropping. Of this amount, approximately 500 acres are planted by Department personnel and left standing in the field as supplemental food sources for waterfowl and small game. The majority of the 500 acres is wheat providing goose food in the perimeter areas of the pools, or within dry pools themselves. The remaining 650 acres of cropland is leased to area farmers. These acres are planted to wheat for geese and milo for upland game. The Department takes its share as crops left standing in the field (milo) or its share of wheat is sold with the process used for management activities on the property.. Since the Bottoms' primary purpose is to provide marsh habitat and pertinent upland areas, extensive work or planning has not been devoted to developing upland areas. Farming has been and is projected to be the most beneficial use of these areas in terms of the stated goals and purposes at CHBW. When extensive mudflats are present, Japanese millet (*E. crusgalli*), is aerially seeded or drilled

as a supplemental food source for waterfowl. When the plants are sufficiently tall, and water is available, the pool is re-flooded. As cattail coverage declines, additional opportunity for supplemental waterfowl food will increase, whether in the form of millet of wheat planted in the pools.

**Dikes**

The only other community of notable size is the dike area. Most of the plants mentioned above can be found on or along the dikes. Other species not listed include: poison hemlock (*Conium maculatum*); cottonwood (*Populus deltoides*); and thistle (*Cirsium* spp.).

**Moist-soil Management**

As discussed in the Water Management section of this plan, moist-soil management is a major consideration during the spring months. Plants established on these sites tend to be the primary seed producing annuals favored by waterfowl in the fall (Fredrickson and Taylor 1982). Some years moist-soil vegetation may fail to develop on exposed mud flats. This could be due to several reasons. In these instances it may become desirable to seed Japanese millet in an effort to supplement naturally occurring food sources. In most cases, moist soil plants are most likely to become established in the perimeter portions of the pools.

**Problem Plants**

When comparing the 1986 vegetation analysis with that of 1998, significant increases in cattail coverage is noted (Table 4). This dramatic increase in cattail cover is the direct result of the accelerated rate of succession due to increased silt deposition and the staff's inability to set back the aging process. The silt deposition has greatly accelerated in the past 20 years due to the heavy silt load in water brought in via the inlet system. Most often, water is available through the inlet only after significant rain events when erosion of upland fields is greatest. Coupling this with a lack of equipment and staff to deal with the problem, the marsh shows its age.

The acquisition of an aquatic backhoe (1988), a tracked tractor with a 30-foot disk (1996 and 2003), along with a pull behind scraper (2000), has greatly aided in the staffs' ability to set back succession. Traditionally the cattail control efforts employed have been burning, mowing, and disking. With the added equipment, disking has become the most effective and efficient means, provided weather allows for work in the pools. Digging has been employed on a limited basis. This technique is addressing the cause of the cattail expansion, but is costly and slow. The renovation allowed for a relatively large use of silt removal with the construction of the renovation islands. However, continued use of excavation equipment will be limited to scrapers and the aquatic backhoe in small areas close to upland sites to receive the removed material. Herbicides have been used on a limited basis. Wide spread use of chemicals has not been employed due to costs and the short-term results achieved. Burning and mowing are still used, but generally as a preparatory step for disking and/or scraping.

Beginning in 1998, the BOR began funding of a study to evaluate the effects livestock grazing of cattail would have on plant stem density. In addition, the performance of the cattle is being evaluated. This was a four year study, and the final results are not yet available.

Superficially, it appeared that cattle grazing had only short term control on cattail. Their use of the plant as a forage base occurred primarily after the more palatable plants were removed. These were the plants, for the most part, that also produced seeds for waterfowl when the grazing areas were flooded. Shallow water was maintained in the grazing areas to accommodate hunting during the fall and winter. Shallow water was needed to be better able to de-water the area in preparation for the summer grazing season. This shallow water, along with spring rains, provided some excellent growing conditions for cattail, despite the cattle grazing.

Table 4. Percent aerial cover by cattail in Pools 1-5, Cheyenne Bottoms Wildlife Area.

| Year | Pool 1 | Pool 2 | Pool 3 | Pool 4 | Pool 5 |
|---|---|---|---|---|---|
| 1986 | 40 | 43 | 15 | 5-10 | 50 |
| 1998 | 17 | 71 | 82 | 40 | 90 |
| 2002 | 7 | 9 | 49 | 30 | 17 |

Over the years there have been other plants that have become hindrances to the management goals of CHBW. Most recently salt cedar (*Tamarix ramosissima)* and poison hemlock (*Conium maculatum)* were the target of control actions. Salt cedar began its invasion into CHBW in the 1970's. A large tract became established northeast of the area office with isolated small plots throughout the basin. A concerted effort of mowing and herbicide application coupled with burning eliminated all but a few isolated plants that are now killed when encountered. The control effort initiated by The Nature Conservancy upstream from CHBW has further reduced the salt cedar component through reducing the seed source. The dry summer of 2003 allowed for the germination of many salt cedar plants in Pools 2 and 4. So the battle with this plant is not over.

Hemlock became a significant component of the vegetation on the dike system during the late 1980's, primarily as a result of soil disturbance from the use of the aquatic backhoe. Once established, it prevents the growth of more desirable plants. Early spring application of herbicides has reduced its coverage significantly and allowed for the re-establishment of grasses in its place. Velvet leaf (*Abutilon theophrasti*) establishes itself in dried pools and on disturbed sites on the dike system. This plant upon maturation develops into an extremely tough, woody plant and can make walking/boating in a flooded pool difficult. It does provide foraging for pheasant broods during the summer when insects move into the stands.

Woody vegetation has increased on the property the past 30 years. The most common trees noted are: mulberry (*Morus sp.)*, hackberry *(Celtis sp.)*, Russian olive *(Elaeagnus sp.)*, black locust *(Robinia sp.)*, and eastern red cedar *(Juniperus sp.)*. These plants have become established in upland sites due to a lack of burning. Generally, these areas are difficult to burn because they are in the portions of the wildlife area outside the pool fireguard and adjacent to

private land. As a result, burning on a limited basis, in combination with tree removal has been initiated. Cottonwood *(Populus sp.)* and willow *(Salix sp.)* are generally allowed to remain except when growing within the rip-rap of dikes or around water control structures. These trees are a preferred forage base for the few beaver on the area. The inlet canal, particularly the portion north of Dundee, has seen a rapid expansion of trees in the canal and the adjacent uplands. In recent years BOR funds were used to remove large trees and remove silt from the inlet canal north of Dundee. Since that time, it has been recognized that tree re-establishment along this 6 mile length of canal was inevitable. The effort to address this has been a priority with the CHBW staff, and work to control the trees has been done. However, with the many 'emergencies" and other priorities requiring immediate attention, insufficient effort has been devoted to the inlet canal tree problem. It is hoped the next five years will be different.

One other plant that has been noted appearing on CHBW the past several years has been Phragmites (*Phragmites spp.)* or common reed (Table 2). While still very small in area, it has the potential to become a problem plant. During the summer of 2004, more than 250 plots of Phragmites were found in all pools combined. These plots varied in size from one or two plants to a quarter of an acre. Total acreage of the plant is less than 15 acres. In 2009 more than 150 plots were sprayed. It is estimated that the total acreage of these plots was less than 2 acres. It seems that the plots are tending to be smaller, but more numerous and scattered over larger areas of the property. As a result, this plant will be more of a challenge to keep contained since more time and effort will be required to simply locate the plants due to the small, inconspicuous size of each clump.

Noxious weeds do occur on CHBW and they must be controlled when found. Field bindweed (*Convolvulus arvensis*), musk thistle (*Carduus nutans*) and Johnsongrass (*Sorghum halepense*) have been found on the property. Efforts of the past several years has led to the reduction in area covered by these plants, but they are not going to go away.

## GOALS

* Continue to maximize the use of the tracked tractors to control cattail and velvet leaf establishment within the pools. Maintenance of a hemi-marsh condition is desired.
* Maximize the use of the aquatic backhoe and scraper to remove silt from the pools.
* Monitor the presence, and kill when found, all salt cedar on the area.
* Continue efforts to control hemlock on the dike systems.
* Monitor the presence, and control of Phragmites plants.
* Practice moist-soil management in conjunction with draw downs for the spring shorebird migration.
* Maintain the prairie marsh character of CHBW by controlling woody plant invasions into the upland areas. Remove/kill trees becoming established on the dike system rip-rap. Added effort needs to be directed to the trees along the inlet and outlet canal system.
* Monitor and control noxious weeds as needed.
* Provide supplemental food sources for waterfowl and upland game.

## STRATEGIES

Draining pools on a rotational basis to allow for periodic treatment will be necessary. When sufficiently dry, disking of cattail should begin. During these dry periods, scraping will be employed to make small 'potholes' in the perimeter portions of the pools. In the adjacent uplands, numerous small depressions exist that can be enhanced through disking and shallow scraping. The aquatic backhoe, used when water is present, will assist in silt removal when upland areas are immediately adjacent to the area to be dug out.

Addressing the noxious weeds that are found on the property must be continued. Herbicide use will be the primary means of control.

During the course of daily activities any salt cedar plants observed must be killed to prevent their expansion on the wildlife area.

Annual spraying of the dike system will continue to control hemlock expansion. Minimizing velvet leaf stands through disking in the pools and the use of herbicides on the dikes will be performed.

Efforts to monitor and control Phragmites when practical will be made. As the plant spreads over the entire marsh in smaller clumps, the challenge of winning this war will increase. Using one or two staff members to patrol as much of the marsh as possible with ATV's equipped with herbicide spraying equipment for at least a week each year will be required. These patrols will need to be scheduled throughout the growing season and well into the fall. The reason for the numerous patrols at different times is that many clumps do not become visible until later in the year due to their increased stature and/or late germination time.

In the spring, as weather allows, some of the perimeter pools will be allowed to drop in water depths to encourage the establishment of moist-soil plants. This will also help in providing mud flats for foraging shorebirds. This same strategy will be employed when possible at the Mitigation Marsh. Dewatering pools will also provide the opportunity to deal with any spreading emergent vegetation, such as cattail. It will also set the stage for the planting of supplemental waterfowl food sources such as millet and wheat.

Woody invasion of the upland areas will be addressed through removal of established trees. The use of fire will be increased in these areas whenever possible. Establishment of fire guards along the boundary fences or establishing upland game food plots along these fences will make burning of upland areas safer and more efficient. Any trees noted growing in the rip-rap areas of dikes or near any water control structures will be removed. Directing additional work days to the tree control effort on the inlet and outlet canals will reduce woody growth in these grasslands.

Seed dry pools, as opportunities arise, with millet and/or wheat. Aerial seeding as well as drilling are both potential means of millet establishment. Aerial seeding has the advantage of being able to impact larger acerages if successful, while drilling has the advantage of higher germination rates.

Continue the planting of upland game food plots in the form of milo.

# WILDLIFE MANAGEMENT

## BACKGROUND

### Invertebrates

Invertebrates are an important component of the Cheyenne Bottoms food chain. Diets of waterfowl (primarily of breeding females and broods [Collias and Collias 1963, Sugden 1973, Swanson et al. 1979]), shorebirds (Fredrickson and Reid 1986), and wading birds (Fredrickson and Reid 1986) consist primarily of invertebrates. Chironomids (commonly known as blood worms) are major food items for waterfowl and shorebirds. Wading birds consume crayfish in addition to amphibians, reptiles, and fish.

Invertebrates also are important in decomposition of vegetation, nutrient processing, and pollination of flowering plants. One important species that consumes vegetation is the white-veined dagger moth (*Simyra henrici*). At times, caterpillar populations of this species can be large enough to damage hundreds of acres of cattails (Griffith and Welker 1987). Populations of this moth apparently can be limited by a parasitic braconid wasp (*Rogus* sp).

A list of invertebrate species occurring at CHBW has not been compiled. Copepods, cladocerans, ostracods, nematodes, chironomids, and oligochaetes were identified in collections made during a survey conducted in 1985 for the Cheyenne Bottoms Environmental Assessment (Griffith and Welker 1987). Nematodes, oligochaetes, and zooplankton were the most abundant invertebrates at most sites. Although less numerous than other types of invertebrates, chironomids are considered to be more important food items for upper-level consumers (i.e., waterfowl and shorebirds) than nematodes, oligochaetes, and zooplankton. Chironomids were more abundant in stands of millet and in submerged mud than in cattail, bulrush, aster, and forbs. The most even size distribution of chironomids occurred at sites with submerged mud. Large numbers of chironomids and a large diversity of invertebrates were found in cattail stands and at the cattail/open water interface.

A study was conducted in 1988 and 89 to determine relationships between aquatic invertebrates and shorebird use of CHBW. Foraging times of shorebirds were also analyzed in terms of body mass gain (Helmers, 1991).

In 1999, the BOR funded study of management effects on aquatic invertebrates was initiated. This project was a three year effort to evaluate the impacts of cattle grazing, cattail disking, burning and scraping on invertebrate densities. The final report can be found in Kostecke, 2002.

### Fish

Fish are another important food source for upper-level consumers such as wading birds and bald eagles (*Haliaeetus leucocephalus*). Fish also provide some recreational activity for anglers.

Twenty species of fish have been recorded in the entire Cheyenne Bottoms drainage, which includes the Arkansas River; Walnut, Blood and Deception creeks; the inlet and outlet

canals; and the Cheyenne Bottoms pools (Ernsting and Cross 1987). The nine fish species found in Cheyenne Bottoms pools during the 1985 survey are listed in Table 5. None are classified as endangered or threatened in Kansas or the U.S. During a July 1988 survey, the following species, listed from most frequently to least frequently captured, were found: green sunfish (*Lepomis cyanellus*), bluegill (*L. macrochirus*), orangespotted sunfish (*L. humilis*), white crappie (*Pomoxis annularis*), black bullhead (*Ictalurus nebulosus*), common carp (*Cyprinus carpio*), green sunfish x bluegill hybrid, and largemouth bass (*Micropterus salmoides*) (Dep. of Wildl. and Parks, unpubl. data).

Table 5. Fish species found at Cheyenne Bottoms Wildlife Area during a 1986 survey for *Cheyenne Bottoms: An Environmental Assessment.*

| Common Name | Scientific Name | Abundance |
|---|---|---|
| Red shiner | *Notropis lutrensis* | scarce-frequent |
| Fathead minnow | *Pimephales promelas* | abundant |
| Black bullhead | *Ictalurus nebulosus* | abundant |
| Plains killifsh | *Fundulus kansae* | scarce-abundant |
| Common carp | *Cyprinus carpio* | rare-abundant |
| Largemouth bass | *Micropterus salmoides* | rare |
| Green sunfish | *Lepomis cyanellus* | frequent |
| Orangespotted sunfish | *L. humilis* | rare-frequent |
| White crappie | *Pomoxis annularis* | scarce |

There is no active fisheries management performed at CHBW. Fish present in the marsh are simply those that accompany the water entering the basin. Stocking game fish is not done for two primary reasons. First, CHBW is managed as a water bird area. The management requirements for water birds often requires de-watering pools. This is counter-productive to active fisheries management. In addition, if active fisheries management was practiced, during periods when pools are required to be drained for water bird management, anglers would object vehemently. This would lead to conflicts between three different CHBW user groups that would not be productive.

**Herpetofauna**

Reptiles and amphibians also are consumed by upper-level consumers. Reptiles also depredate bird eggs, young birds, frogs, toads, fish, insects, and small mammals.

The reptiles and amphibians observed at are presented in Table 6. This list is from Collins and Collins, 1993. None are classified as endangered or threatened in Kansas or the U.S.

Table 6. Reptiles and amphibians found at Cheyenne Bottoms Wildlife Area, from Collins and Collins, 1993.

| Common Name | Scientific Name |
|---|---|
| Reptiles | |
| Diamondback water snake | *Nerodia rhombifera* |
| Northern water snake | *N. sipedon* |
| Graham's crayfish snake | *Regina grahami* |
| Massasauga rattlesnake | *Sistrurus catenatus* |
| Western plains garter snake | *Thamnophis radix* |
| Red-sided garter snake | *T. sirtalis* |
| Lined snake | *Tropidoclonion lineatum* |
| Prairie kingsnake | *Lampropeltis calligaster* |
| Common kingsnake | *L. getula* |
| Eastern yellowbelly racer | *Coluber constrictor* |
| Bullsnake | *Pituophis catenifer* |
| Red-eared slider | *Trachemys scripta* |
| Western painted turtle | *Chrysemys picta* |
| Western spiny softshell | *Apalone spinifera* |
| Common snapping turtle | *Chelydra serpentina* |
| Yellow mud turtle | *Kinosternon flavescens* |
| Great Plains skink | *Eumeces obsoletus* |
| Prairie-lined racerunner | *Cnemidophorus sexlineatus* |
| Amphibians | |
| Western chorus frog | *Pseudaris triseriata* |
| Spotted chorus frog | *P. clarkii* |
| Blanchard's cricket frog | *Acris crepitans* |
| Bullfrog | *Rana catesbeiana* |
| Plains leopard frog | *R. blairi* |
| Plains spadefoot | *Spea bombifrons* |
| Great Plains toad | *Bufo cognatus* |
| Woodhouse's toad | *B. woodhousei* |
| Tiger salamander | *Ambystoma tigrinum* |

**Birds**

Of the 425 extant species recorded in Kansas, 328 have been identified at CHBW. Two-hundred eighty-five species are classified as nongame. Eighty-seven species are thought to nest on the Bottoms and 49 winter at the Bottoms. Four species (bald eagle [*Haliaeetus leucocephalus*], peregrine falcon [*Falco peregrinus*], whooping crane [*Grus americana*], and interior least tern [*Sterna antillarum anthalassos*]) are considered endangered in the U.S. and Kansas, 1 is federally threatened (piping plover [*Charadrius melodius*]), 2 are threatened in Kansas (snowy plover [*Charadrius alexandrinus*], white-faced ibis [*Plegadis chihi*], and 8 others have been designated by the U.S. Fish and Wildlife Service as "migratory nongame birds of management concern" (American bittern [*Botaurus lentiginosus*], least bittern [*Ixobrychus exilis*], northern harrier [*Circus cyaneus*], black rail [*Laterallus jamaicensis*], black tern [*Chlidonias niger*], loggerhead shrike [*Lanius ludovicianus*], Bell's vireo [*Vireo bellii*], and Baird's sparrow [Ammodramus *bairdii*]) (USFWS 1987).

Limited data on numbers and the habitat used by each species are available. Most complete records are available for shorebirds, waterfowl, whooping and sandhill (*G. canadensis*) cranes, least terns, bald and golden (*Aquila chrysaetas*) eagles, wading birds, American white pelicans (*Pelecanus erythrorhynchos*), and blackbirds.

Nongame Species

*Shorebirds*-- Of these birds only the common snipe is hunted. Shorebirds primarily use CHBW during spring and fall migrations although snowy plovers, killdeer, Wilson's phalaropes, avocets, and upland sandpipers nest on the Bottoms. Numbers of each species present on CHBW vary within the migratory period and among years depending upon habitat availability. Depending on habitat conditions, populations of most migrant species are higher in spring. Data indicate that the most abundant species are dowitchers and Baird's and white-rumped sandpipers in spring, and semipalmated sandpipers, dowitchers, and American avocets in fall.

Based on data from the International Shorebird Survey, ornithologists from the Manomet Bird Observatory consider CHBW as the most important staging area for shorebirds in the Western Hemisphere. It has been estimated that 45% of the North American shorebirds stop at CHBW during spring migration (Harrington 1984). CHBW also attracts an estimated 90% of the white-rumped, Baird's, and stilt sandpipers; long-billed dowitchers; and Wilson's phalaropes, and over half of the pectoral sandpipers and Hudsonian and marbled godwits during spring migration. Occasionally, the federally-threatened piping plover passes through CHBW during spring and fall. Skagen, et al (1999) presents information on the relative abundance of shorebirds during migration in the interior of North America. This report is supportive, for the most part, of estimates made by earlier investigators and underscores the value of CHBW to migrating shorebirds.

Table 7. Habitats used by shorebirds at Cheyenne Bottoms Wildlife Area. Data are from a 1985-86 survey for *Cheyenne Bottoms: An Environmental Assessment.* Habitats are: open water = OW, open shallow = OS, vegetated shallow = VS, open mud = OM, vegetated mud = VM, upland open = UO, and upland vegetated = UV. Each habitat use is ranked from most frequently used (1) to least frequently used (5).

| | **Habitats** | | | | | | |
|---|---|---|---|---|---|---|---|
| Species | OW | OS | VS | OM | VM | UO | UV |
| Semi-plamated plover | 2 | | 1 | | | | |
| Piping Plover | 2 | | 1 | | | | |
| Snowy Plover | 2 | | 1 | | | | |
| Killdeer | | | | 2 | | 1 | 3 |
| Lesser golden plover | | | 1 | | 3 | 2 | |
| Black-bellied plover | | | 1 | | 2 | 3 | |
| Common snipe | | 2 | | 1 | | 3 | |
| Whimbrel | | 1 | | 2 | | | 3 |
| Long-billed curlew | | | 2 | | | 1 | |
| Upland sandpiper | | | 4 | 2 | 3 | 1 | |
| Willet | 1 | 2 | 3 | 4 | | | |
| Greater yellowlegs | 3 | 2 | 1 | 4 | | | |
| Lesser yellowlegs | 2 | 1 | 3 | | | | |
| Pectoral sandpiper | 4 | 1 | 5 | 2 | | 3 | |
| White-rumped sandpiper | 2 | | 1 | | | | |
| Baird's sandpiper | 2 | | 1 | | | | |
| Least sandpiper | | 2 | 3 | 1 | 4 | | |
| Dunlin | | | | 1 | | | |
| Semi-palmated sandpiper | 2 | | 1 | | | | |
| Stilt sandpiper | | 1 | 3 | 2 | | | |
| Buff-breasted sandpiper | | 3 | | 2 | | 1 | |
| Short-billed dowitcher | | 1 | | | | | |
| Long-billed dowitcher | 1 | | | | | | |
| Marbled godwit | | 1 | | 2 | | | |
| Hudsonian godwit | 1 | | 2 | | | | |
| Wilson's phalarope | 1 | 2 | 4 | 3 | | | |
| Northern phalarope | 1 | 2 | 3 | | | | |
| American avocet | | 2 | 1 | 3 | 4 | | |

The Bottoms also is used for nesting by the state-threatened snowy plover and more common species such as American avocets, killdeer, upland sandpipers, and Wilson's phalaropes. Snowy plovers prefer to nest on un-vegetated sites such as salt flats. Killdeer often nest on un-vegetated, gravel substrates along the dike roads. Sparsely-vegetated upland sites are used by nesting upland plovers. American avocets typically nest at sparsely-vegetated sites near shallow water. Wilson's phalaropes nest in shallowly-flooded spike rushes and at dry, grassy sites.

Shorebirds are an extremely diverse group in terms of morphology. Bill lengths range from 1/2 inch in the semipalmated plover to 4 1/2 inches in the marbled godwit (Hayman et al. 1986). Tarsus, the part of the leg below the joint, lengths also vary from 3/4 inch in the least sandpiper to 3 inches in the marbled godwit. Consequently, shorebirds use a variety of habitats from dry mud to water 12 inches deep and from unvegetated to densely vegetated. Habitats used by species that were observed during the 1985-86 survey for the Environmental Assessment are listed in Table 7. Shorebirds consume aquatic and terrestrial invertebrates, primarily chironomids, and small fish (Fredrickson and Reid 1986). Shorebird abundance is related to chironomid biomass and foraging time to gain body mass was influenced by size of chironomids available (Helmers, 1991).

*Cranes*--The federally endangered whooping crane and the abundant sandhill crane stop at CHBW during spring and fall migrations. Whooping cranes have been observed on the Bottoms 20 of 34 years since 1961 (USFWS unpubl. data; KDWP, unpubl. data) with most sightings occurring in fall (early October to mid-November). Up to 35 individuals have been observed in a single year. Some of these observations were of whooping cranes flying over the Bottoms. Whooping cranes that land on the Bottoms normally remain 1-3 days and frequently just overnight. In 1994, at least 2 whooping cranes were on the area from 13 October to 29 November. One group of 5 birds that year stayed 36 days. This is the longest known migrational stop made by whooping cranes in their flyway from Canada to Texas. Whoopers usually feed and roost in open shallow water (2-6 inches deep) most often found in Pools 2, 3, 4 and 5.

Flocks of up to several thousand sandhill cranes pass through the Bottoms during fall. During spring migration, flocks stopping at CHBW are typically smaller (up to several hundred birds). Sandhills usually feed in grain fields adjacent to the Bottoms and roost on the Bottoms in shallow water with sparse emergent vegetation.

*Least Tern*--Historically, 1-2 least tern nests were recorded each year at the Bottoms (Grover and Morrow 1989). Least terns have not been observed nesting at CHBW since 1978. However, least terns continue to nest 20 miles south of the Bottoms at Quivira National Wildlife Refuge and foraging individuals are occasionally observed at the Bottoms. Probable principal reasons why least terns currently do not nest on the Bottoms are: encroachment of vegetation on salt flats where least terns historically nested, lack of nesting substrates that are secure from nest predators, and an insufficient food source near nest sites (Grover and Morrow 1989).

*Wading Birds*--Twenty species of wading birds (herons, egrets, bitterns, storks, ibis, and rails) have been observed at CHBW. Two of these (Virginia rails [*Rallus limicola*] and soras [*Porzana carolina*]) are game species. Fourteen wading bird species are thought to nest on the Bottoms.

American and least bitterns, little blue (*Egretta caerulea*) and green-backed (*Butorides striatus*) herons, snowy (*Egretta thula*) and cattle (*Bubulcus ibis*) egrets, black-crowned night-herons (*Nycticorax nycticorax*), and white-faced ibis are regular breeders; great blue herons (*Ardea herodias*) nest regularly in trees surrounding the Bottoms; and tricolored herons (*Egretta tricolor*) are occasional breeders (KDWP, unpubl. data). In 1982 and 1983, respectively, the number of colonial waterbirds estimated by G. Ernsting (unpubl. data) were: 10 and 110 little blue herons, 450 and 600 black-crowned night-herons, 300 and 70 cattle egrets, 75 and 20 snowy egrets, and 32 and 70 white-faced ibis. Colonies usually are located in dense stands of cattails. White-faced ibis, a state-listed threatened species, black-crowned night herons, and cattle and snowy egrets occasionally nest in flooded stands of firebush (*Kochia scoparia*) (C. Swank, pers. comm.). White-faced ibis also occasionally nest in bulrush (*Scirpus* sp.) (C. Swank, pers. comm.).

*White Pelican*--White pelicans stop at CHBW during spring and fall migrations. During the 1985-86 survey for the Environmental Assessment, numbers of pelicans peaked at 500-800 in spring and 7,200 in mid-August (Hoffman 1987).

Pelicans feed on fish and roost in the open water portions of pools and in the inlet canal. Exposed mud and blind islands also are used for roosting.

*Raptors*--Twenty-nine species of raptors (vultures, kites, hawks, eagles, osprey, falcons, and owls) have been identified at CHBW (KDWP, unpubl. data). Mississippi kites (*Ictimia mississippiensis*), red-tailed hawks (*Buteo jamaicensis*), northern harriers (*Circus cyaneus*), common barn owls (*Tyto alba*), and eastern screech (*Otus asio*) and great horned (*Bubo virginianus*) owls breed on the Bottoms.

Federally endangered bald eagles are common winter residents. Up to 60 bald eagles can be seen in a single day. Typically, wintering bald eagles feed on fish, usually winter-killed carp, and injured and diseased waterfowl. Eagles usually perch on the ice, blind islands, and occasionally in trees on the dikes. A shelter belt on private land east of the Bottoms and a grove of cottonwoods southeast of Ellinwood in Rice County are used for roosting (KDWP, unpubl. data). Historically, 1-3 golden eagles were observed each winter at CHBW (KDWP, unpubl. data). However, since 1979, golden eagle observations at CHBW have not been made annually. Federally endangered peregrine falcons are rarely observed at CHBW. During the 1985-86 survey for the Environmental Assessment, 1 peregrine was seen on October 1, and 2 others were observed between late April and mid-May (Hoffman 1987). Several peregrine falcons also were seen in spring 1989 (C. Swank, pers. comm.). These falcons primarily consume birds.

*Blackbirds*--Large numbers of red-winged (*Agelaius phoeniceus*) and yellow-headed (*Xanthocephalus xanthocephalus*) blackbirds and smaller numbers of great-tailed (*Quiscalus mexicanus*) and common (*Q. quiscula*) grackles breed at CHBW. Extremely large populations of these species winter on the Bottoms. Blackbirds typically feed off the Bottoms on waste grain in harvested fields, standing milo, and on grain in feed lots (Hoffman 1987). Blackbirds return to CHBW at night to roost. Feeding sites are up to 50 miles or more from the Bottoms. Winter roosts at CHBW apparently were first formed in 1969 and had grown to over 12 million birds in 1975. Over 500,000 blackbirds roosted on the Bottoms in February 1986. Nearly 90% of these

were red-winged blackbirds and the rest were brown-headed cowbirds (*Molothrus ater*), European starlings (*Sturnus vulgaris*), and common grackles. These large roosting populations deposit large amounts of guano (an estimated 3,600 pounds per night for a roost of 548,000 birds). Guano deposits represent a large input of nutrients to the Bottoms. Total bird numbers wintering at CHBW have dropped significantly in 2002 and 2003, possibly due to the cattail control effort.

Blackbirds, grackles and starlings are a financial burden on local farmers and feed lots. Large numbers wintering on the area fly to area feed lots where they consume and soil grain being placed for cattle. In the fall congregating blackbirds and starlings feed heavily on ripening milo fields, reducing yield for the grower. Zon guns and other scare devices are generally successful in reducing losses incurred in the fall on standing crops. Feed lot operators, in the past few years, have resorted to poisoning in an effort to cut losses. DRC-1339 and Avitrol have been used to reduce bird numbers. When applied at the feed lot, dead and dying birds are often noted on the wildlife area. These carcasses represent yet another large input of nutrients to the Bottoms.

With the acquisition of two tracked tractors and larger tillage equipment, the cattail area on CHBW has been significantly reduced. This in turn has lead to a drop in blackbirds, grackles and starlings roosting on the wetlands.

*Other nongame birds*--The other nongame birds that utilize CHBW and not discussed above are important components of the Cheyenne Bottoms ecosystem. Species such as sparrows consume seeds; swallows, insects; grebes and cormorants, fish; and loggerhead shrikes, mammals and reptiles. Many small nongame birds are prey for falcons. Non-game birds also provide hours of enjoyment for birdwatchers. The grassland bird surveys, initiated in May 2000, have provided some information on the response of grassland bird abundance in response to management activities. Bird abundance seemed to peak 2 years post burning.

Game Species

*Waterfowl*--Twenty-eight species of ducks have been observed at Cheyenne Bottoms, of these, 17 can be considered common. Pintails (*Anas acuta*), mallards (*A. platyrhynchos*), green-winged teal (*A. crecca*), blue-winged teal (*A. discors*), and shovelers (*A. clypeata*) usually have the highest population levels among the puddle ducks, with gadwalls (*A. strepera*), and widgeons (*A. americana*) close behind. Wood ducks (*Aix sponsa*) can be seen in good numbers in summer and early fall, but seldom show up in the hunter's bag. Cinnamon teal (*Anas cyanoptera*) are common in the spring, but are rarely seen later in the year.

Due to the shallow water conditions, diving ducks are never as numerous as dabblers. The most common are: redhead (*Aythya americana*), ring-necked (*A. collaris*), ruddy (*Oxyura jamaicensis*), bufflehead (*Bucephala albeola*), lesser scaup (*A. affinis*), and common merganser (*Mergus merganser*). Canvasbacks (*Aythya valisineria*) and hooded mergansers (*Lophodytes cucullatus*) are found every year in low numbers. Common goldeneye (*B. clangula*) can be abundant in early winter. Greater scaup (*Aythya marila*), oldsquaw (*Clangula hyemalis*), white-winged scoter (*Melanitta fusca*), surf scoter (*M. perspicillata*), black scoter (*M. nigra*), and red-breasted merganser (*Mergus serrator*) are rare, and are not seen on an annual basis.

The various subspecies of Canada goose (*Branta canadensis*) are the most abundant geese, with white-fronted geese (*Anser albifrons*) being very common in early fall. Snow goose (*Chen caerulescens*) populations have been building over the last several years. More than 90,000 light geese have been counted on CHBW in one day. Ross' geese (*Chen rossi*) and brant (*Branta bernicla*) are very rare and are seldom seen. Other waterfowl species that occasionally stop at the Bottoms include the tundra swan (*Cygnus columbianus*), fulvous whistling-duck (*Dendrocygna bicolor*), black duck (*Anas rubripes*), mottled duck (*A. fulvigula*), and Eurasian widgeon (*A. penelope*).

Migrant and wintering waterfowl have been censused biweekly at the Bottoms since 1961. Duck populations have decreased since 1961, due to declines in continental duck populations (USFWS and CWS 1989) and different census techniques employed by Cheyenne Bottoms personnel. Goose populations have declined less significantly, probably because continental goose populations have been stable to increasing (USFWS and CWS 1989). During the 1990's, duck and especially goose numbers, have made significant increases.

Many species of waterfowl not only use CHBW as a migrational stopover, but also as a breeding grounds. When conditions are favorable, blue-winged teal, mallard, gadwall, pintail, green-winged teal, cinnamon teal, shoveler, widgeon, wood duck, canvasback, redhead, and ruddy duck have nested. During 5 years of study, estimated numbers of nests in the saltgrass/wheatgrass community ranged from 230 in 1970 to 585 in 1990 (Table 8). Nest success ranged from 36% to 59%, which is higher than that reported from sites lacking predator control in North Dakota (Cowardin et al. 1983). The only goose that has been documented to nest on the Bottoms is the large race of Canada geese.

*Other wetland game birds*--Other wetland game birds are found at the Bottoms. Good numbers of sora and Virginia rails are found during late summer and early fall. These rails usually occur in dense vegetation and are difficult to observe. Large numbers of coots (*Fulica americana*) are present usually in early fall. Common snipe are frequently found along marsh borders and in flooded saltgrass during early fall. Despite good numbers of these species, few hunters pursue them.

Table 8. Estimated number of duck nests and nest success (percent of nests that hatched) in the upland regions (i.e., saltgrass/wheatgrass community of Cheyenne Bottoms during June 1967-1970 and 1990.

| Year | Area searched (acres) | No. of nests in plots | Estimated no. of nests on CHBW | Nest success (%) |
|---|---|---|---|---|
| 1967 | 280 | 44 | 440 | 54 |
| 1968 | 280 | 45 | 450 | 53 |
| 1969 | 280 | 39 | 390 | 59 |
| 1970 | 280 | 23 | 230 | 36[a] |
| 1990 | 480 | 100 | 585 | 46 |

[a]Includes some nests that were not in study plots (e.g., nests along dike roads.)

*Upland game birds*--Upland game birds are also very popular with CHBW hunters. High populations of ring-necked pheasants (*Phasianus colchicus*) are found near crop fields, in native grass, and in marsh vegetation. Numbers are highest in the late fall and winter when they leave the marginal habitat on surrounding private land, and look for heavy cover in the Bottoms. Bobwhite quail (*Colinus virginianus*) are present in very low numbers and usually only along the inlet and outlet canals, the east edge of Pool 4. Greater prairie chickens (*Tympanuchus cupido*) are very rare and are probably transient

Table 9. Nongame mammals recorded at Cheyenne Bottoms Wildlife Area and in Barton County (Hoffman and Arbetan 1987; Zajic 1992; L. Fox, pers. comm.; Grover, pers. comm.).

| Common Name | Scientific Name |
|---|---|
| Recorded at CHBW | |
| Short-tailed shrew | *Blarina hylophaga* |
| Black-tailed prairie dog | *Cynomys ludovicianus* |
| Plains pocket gopher | *Geomys bursarius* |
| Thirteen-lined ground squirrel | *Spermophilus tridecemlineatus* |
| Deer mouse | *Peromyscus maniculatus* |
| White-footed mouse | *P. leucopus* |
| Northern grasshopper mouse | *Onchomys leucogaster* |
| Plains harvest mouse | *Reithrodontomys montanus* |
| Western harvest mouse | *R. megalotis* |
| Hispid cotton rat | *Sigmodon hispidus* |
| Prairie vole | *Microtus ochrogaster* |
| Southern bog lemming | *Synaptomys cooperi* |
| Norway rat | *Rattus norvegicus* |
| House mouse | *Mus musculus* |
| Eastern spotted skunk | *Spilogale putorius* |
| Eastern mole | *Scalopus aquaticus* |
| Nine-banded armadillo | *Dasypus novemcinctus* |
| Recorded in Barton County | |
| Big brown bat | *Eptesicus fuscus* |
| Evening bat | *Nycticeius humeralis* |
| Red bat | *Lasiurus borealis* |
| Hoary bat | *L. cinerus* |
| Plains pocket mouse | *Perognathus flavescens* |
| Hispid pocket mouse | *P. hispidus* |
| Ord's kangaroo rat | *Dipodomys ordii* |

from the native prairie in Ellsworth County, to the north. Although wild turkey (*Meleagris gallopavo*) are not found in the marsh habitat, there are small populations of the Rio Grande subspecies along the inlet system and east edge of Pool 4. Mourning doves (*Zenaida macroura*) are very common at CHBW, both as a migrant and as a nester, however, few are harvested by hunters.

**Mammals**

Non-game Species

Seventeen species of nongame mammals have been recorded at CHBW. Another 7 species also may occur on the Bottoms (Table 9). One of these, the eastern spotted skunk (*Spilogale putorius*) is threatened in Kansas. Data on the relative abundance of nongame mammals at CHBW are not available.

Game Species

Several game mammals also are found on the Bottoms. Cottontail rabbits (*Sylvilagus floridanus*) and black-tailed jackrabbits (*Lepus californicus*) are present in limited numbers in the vegetation surrounding the marsh and in the uplands associated with the canals. The fox squirrel (*Sciurus niger*) is common in the timbered areas located on the wildlife area. There are 2 species of big game present on the Bottoms. The white-tailed deer (*Odocoileus virginianus*) is the most common, and is found in the marsh and along the woody habitat of the canal system. Mule deer (*Odocoileus hemionus*), although not abundant, prefer the open grasslands and marsh edges.

Furbearers are very important at Cheyenne Bottoms. High populations of certain species can potentially contribute to high predation on nesting waterfowl, however, predation is a natural and important process in all ecosystems. Muskrats are important in modifying the density, distribution, and species composition of marsh vegetation. The most prevalent furbearer species are: muskrat (*Ondatra zibethicus*), mink (*Mustela vison*), raccoon (*Procyon lotor*), oppossum (*Didelphis virginiana*), striped skunk (*Mephitis mephitis*), badger (*Taxidea taxus*), and coyote (*Canis latrans*). Beaver (*Castor canadensis*), bobcat (*Lynx rufus*), and red fox (*Vulpes vulpes*), are occasionally reported, but never in large numbers. Beginning in 1986, muskrat house counts have been made on the wildlife area. This is intended to provide a trend indicator for rat populations on the area. Table 10 provides the results of these counts. The variation in the muskrat population is directly related to the water present in the marsh from year to year.

Table 10. Muskrat house counts made at Cheyenne Bottoms Wildlife Area, 1992-2009.

| Year | Number of Houses | Year | Number of Houses |
|---|---|---|---|
| 1992 | 1 | 1993 | 0 |
| 1994 | 0 | 1995 | 140 |
| 1996 | 359 | 1997 | 278 |
| 1998 | 528 | 1999 | 1110 |
| 2000 | 515 | 2001 | 200 |
| 2002 | 55 | 2003-2007 | 0 |
| 2008 | 3 | 2009 | 0 |

## GOALS

* Maximize aquatic invertebrate production.
* Manage diverse water levels, as well as mud flat conditions, to meet the needs of spring migrating shorebirds.
* Manage diverse water levels to meet the needs of migrating waterfowl.
* Maintain the health of upland grasslands for bird nesting. Maximize small, upland game food plot plantings in perimeter areas of pools.
* Continue efforts to reduce cattail area but maintain hemi-marsh conditions with more desirable plant species.
* Continue monitoring population trend of muskrats.

## STRATEGIES

Spring water levels need to reflect a diversity of water depths from mud flats to depths favorable to diving ducks. This can generally be accomplished with spring drawdowns and moist soil management in one or two pools annually. These efforts coordinate well with cattail control efforts such as disking and scraping. As a result, several goals can be met with the same strategy.

The health of the upland areas must be addressed. Burning of upland sites, while difficult due to adjacent private land, should be accomplished on a rotational basis as conditions allow. This should greatly assist in the control of woody plant invasions. Grass vigor will also be maintained with this activity. Relocating some of the food plots to perimeter fence lines will aid in conducting controlled burns of upland grass since they can serve as fireguards. Cattle grazing should be added to the management tools used in the upland areas of the property. Properly managed, this range management tool will assist in maintaining a diverse, healthy grassland. Continuing the grassland bird surveys will provide an evaluation tool for management activities in this part of CHBW.

Planting food plots is an activity used to provide increased hunting opportunity of upland game birds, primarily pheasant. Weed production on CHBW ensures that seeds are available to meet the demands of resident birds. Food plots, while they may supplement this food production, serve as areas where birds can more easily be hunted and flushed. Some food plots, especially those that are prone to flooding, will no longer be planted to crops but simply disked to enhance weed production. Upland area food plots, whether planted or disked, provide resources to a wide variety of non-game wildlife as well.

# SILT MANAGEMENT

## BACKGROUND

Silt accumulation is a natural process in the life of a wetland. The geologic process leads to the ecological succession of wetlands (Reid and Wood, 1976). Recent geological investigations at Cheyenne Bottoms Wildlife Area (CHBW) placed the long-term sedimentation rate at approximately 1 foot per 800 years (Vogler, et al, 1987). With the development of CHBW, especially the construction of the inlet system, the sedimentation rate has been accelerated. The inlet system was designed to bring supplemental water to the basin using diversion dams on the Arkansas River and the Wet Walnut Creek. This additional water would be stored and used to augment natural flows into the basin thus reducing the number of dry years when waterfowl hunting was limited or non-existent. During the 1950's and 60's, this additional water was available most, if not all year, every year. The inlet system often was shut down following significant rain events that occurred upstream. This was intended to avoid bringing in silt-laden run off into the basin. As flows in the Ark River and Wet Walnut Creek became less dependable, due to ground water depletion, the luxury of selecting against diverting silt-laden water no longer was an option. In recent years if water becomes available for CHBW through the inlet system, it is diverted, regardless of sediment load. This has resulted in the accelerated aging of CHBW.

Silt is also contributed to CHBW through Blood and Deception Creeks, but at a much slower rate. The relatively long distance these creeks flow through grasslands act as a buffer to remove much of the silt.

With the more rapid succession rate comes the inevitable establishment of emergent vegetation, primarily cattail. The Vegetation Management Section of this Management Plan outlines the various techniques being used to address the control of cattail and other emergent plants. This section will focus on attempts to deal with the accumulating silt, thus reversing the succession of CHBW, in at least limited areas within the marsh.

Silt removal from a wetland the size of CHBW is not only a daunting task, it is also very expensive and time consuming. As a result, addressing silt build up must be done on a very limited basis. Even when dealing with limited areas, the problem of disposing of the removed silt can be challenging. Over the past 30 years at CHBW, silt removal has taken many forms. One of the first was the construction of islands around the 167 concrete hunting blinds built in the hunting pools (Pools 2, 3 and 4) of the marsh. Over the years additional islands, similar in size and shape to the blind islands, were built in the perimeter portions of the hunting pools. In addition boating access lanes were dug to facilitate boat access from perimeter parking lots to the marsh interior. In the early years of CHBW, these activities were done to accommodate hunters and hunting, not for silt removal. The renovation effort of the 1990's included construction projects aimed exclusively at removing/consolidating silt. Ten large islands (1 to 5 acres) were constructed in areas of dense cattail stands in Pools 3 and 4. In addition level ditches were built to connect the perimeter upland areas and parking lots with the marsh interior. These served also as hunter access lanes and travel corridors for duck broods hatched in the perimeter grasslands as they made their way to the wetland interior. These efforts were covered by Corps of Engineers Permit No. 2SB OXR 1 3568. Additional work covered by the Corps' Nationwide Permit

included the digging of many scrapes in the perimeter portion of the pools. The removed material was spoiled on adjacent upland fireguards and/or food plots. In addition silt was removed from the Long Lake area of Pool 2 with that material being placed on adjacent upland sites. Approximately 5 acres of islands were constructed in the western portions of Pool 2 where cattail had become well established.

Regardless of the primary purpose of the dirt projects within the marsh at CHBW, all resulted in the slowing of succession, at least in some areas, and the increasing diversity of wetland habitat available to wildlife. The silt removal process has increased the potential range in water depths and small upland areas have been added in the form of islands, which are used by waterbirds for loafing and nesting. Research at CHBW has shown the use of the renovation islands by nesting waterbirds. In spring 2002, nest searches on 5 of the renovation islands yielded 114 nests (Table 11). The amount and type of bird use of these islands will vary with vegetation cover.

Table 11. Number of nests found, by species, on renovation islands in May 2002, CHBW.

| Species | Number of Nests |
|---|---|
| Double-crested cormorant | 50 |
| American avocet | 37 |
| Blue-winged teal | 16 |
| Mallard | 4 |
| Gadwall | 4 |
| Canada goose | 2 |
| Pintail | 1 |

Scrapes have been of limited value when cost of construction is considered. They have provided cattail free areas for upwards of 7 years, but at a cost of about $11/acre/year of control. This compares to roughly $0.60/acre/year of control when cattail control by disking lasts 7 years ($4.00/acre/year of control if it lasts only 1 year). Their use by waterbirds and invertebrates, most of the time, does not seem to differ significantly with areas cleared of cattail by disking. Enhancing (deepening) small wetlands in the grassland portions of CHBW, however, can be worthwhile since they accumulate silt at a much slower rate being surrounded by grass, and they provide wetland habitat in the upland portion of the property. In addition, many of these small depressions are located along heavily used roads providing excellent wildlife viewing opportunity.

The flood of 2007 not only did significant damage to the dike system at CHBW, but it also re-suspended tons of silt that eventually settled out in the corners and along the edges of the pools. This is also where the water control structures are located. As a result, many structures are no longer functional as they are filled with silt. The aquatic backhoe can deal with some of this silt, but is limited by its restricted reach. Contracting a lattice boom crane and/or long reach backhoe has provided at least some short term relief, making the silt choked structure usable at least for a few months.

## GOALS

* The primary goal of silt management at CHBW is to slow the rate of succession on the wildlife area.
* Increase the amount of grass buffer strips adjacent to streams leading to CHBW and its inlet canal.
* Maximize habitat diversity within pools and in the upland grasslands.
* Increase flows through the inlet canal from the drop structure west of the office to Pool 1A.
* Remove the silt that has accumulated in the water control structures.

## STRATEGIES

Given the limited water availability from the inlet system, the option of not diverting silt-laden water into CHBW is unavailable. If supplemental water is needed and available through the inlet, it must be diverted, regardless of quality. This is because the quantity of water available for diverting in a given year is unpredictable. In addition, this strategy would only slow the aging process and do nothing for reversing it. Therefore, the most effective available technique in slowing/reversing the rate of succession is to remove silt from the marsh. Since removing silt from the entire basin is physically and fiscally not possible, removing or consolidating it from small, limited areas is the remaining option.

As fill material is needed for projects in the upland areas of the property (e.g., fireguard maintenance, parking lot or road fill) the first source to be looked at will be the numerous small wetland depressions located in the upland grass areas of CHBW. The majority of these wetlands have been choked with cattail. As conditions allow, these small wetland areas will be scraped in an effort to re-establish their value to waterbirds. The removed material will be spoiled on nearby food plots and/or fireguards. In recent years grassland depressions have been cleaned out behind Pool 4. The material removed from these sites has been stock piled next to the wetland. Efforts will be made to remove this material and place it on nearby food plots. In addition, other state and county agencies have been notified as to the availability of this material. Attention will also be focused on the marsh interior. The construction of scrapes, in the marsh perimeter and close to the area in need of fill material, will remove some silt from the wetland.

The maintenance of existing structures within the wetland portion of CHBW will, over time, require additional fill. Dikes, renovation and blind islands, as well as the numerous hunting islands constructed over the years are subject to erosion. Maintenance of these structures will be accomplished using silt removed from the wetland and placed on the dikes/islands as needed.

Other maintenance projects that need to be addressed is the cleaning out of the level ditches and boat access channels in Pools 2, 3 and 4 (Figure 4). These structures have accumulated silt to the point they are no longer functional. The aquatic backhoe would be used, as conditions permit, to re-establish these ditches and channels. Removed material will be placed along the entire length of one side of the channel, instead of the small islands on alternating sides as was done in the past. The side selected to receive the spoil will be the one most apt to stop prevailing winds. The small islands tended to erode quickly and were too small to allow for seeding grass to help stabilize them. The long low spoil bank paralleling the ditch could more easily be disked and seeded once the material dries. It will also serve as a wind break for the ditch, reducing wave action and silt deposition in the adjacent channel.

Further consolidation of silt from within the wetland will be accomplished by additional island construction. One prime location is found on the east side of Pool 2, near the Red Wing dike road. This portion of Pool 2 has not had favorable conditions for cattail control work. As a result, cattail establishment and litter accumulation has progressed to the point where digging is the best choice to open up the emergent vegetation. In the event of wet conditions preventing the construction of this island, the aquatic backhoe could be used to construct a shallow level ditch to connect hunting blinds 54, 57 and 58. Removed material would be placed adjacent to the ditch. This spoil bank would slow silt deposition in the excavated area by reducing wave action. Later, should dry conditions return, the island described above could then be built on this 'core' of material. The potential for constructing additional islands exists in Pools 3 and 4 as well. These projects will be done on an opportunistic basis with the primary intent being to address cattail stands in areas where silt accumulation is the worst.

The construction of small potholes in the Phase B portion of the Mitigation Marsh (MM), will provide a more diverse wetland habitat. That portion of the MM is very shallow, and dries quickly. Deepening areas within it will prolong the availability of water and hunting/bird watching opportunity. Spoil will be placed on either the nearby food plot or in areas planned for seeding to native grass. The contractor that was hired to make the necessary repairs to the 2007 flood damaged dikes in Pool 1 provided us an opportunity to enhance some potholes. As this construction effort required fill to repair the eroded dike, it was obtained from three locations. One was on the east end of Pool 5 in the upland portion where a natural shallow depression was lost to cattail. Another was in the Phase A portion of the Mitigation marsh and the third was on the east side of the Bottoms in an upland area of Pool 4 across the road from the east entrance to the property.

One area of maintenance that will require placement of fill within a wetland is in the inlet canal from ¼ mile west of the office to 3 miles east of the office. The banks of the canal have suffered

greatly from erosion over the 50 years since construction. Most of this material has contributed to the filling in of the inlet canal. In addition, the canal has served as a silt 'catch basin' as the material settles out of the water brought in from the Wet Walnut Creek and Arkansas River. It is planned to remove accumulated material from the center of the canal and place it along the outer edges, thus effectively extending the canal bank out 20 to 25 feet. The U.S. Corps of Engineers has reviewed this project and deemed it to be covered by nationwide permit as stated in letter Referenced Number: NWK-2007-389-K.

Work with U.S. Department of Agriculture, The Kansas Alliance for Wetlands and Streams and other government and non-governmental agencies that have programs for cost sharing the establishment of riparian buffer strips. Efforts to encourage upstream landowners to enroll in such programs could improve the quality of water entering CHBW.

The Corps of Engineers have also reviewed proposed work to clean out silt from around the water control structures resulting from the 2007 flood. Relocation of this silt may be by removing from the wetland as much material as possible and constructing habitat islands, excavation of drainage ditches as needed to re-establish water level management capabilities. This notification is in the form of letter Referenced Number 200901055.

# PEOPLE MANAGEMENT

## BACKGROUND

**Visitation/Activities**

The Bottoms offers a variety of recreational opportunities including birdwatching, environmental study, hunting, fishing, and trapping. Visitor numbers are estimated with traffic counters placed at the four main entrances to the property and at the more frequently used parking lots. The placement of traffic counters began in 1996. Table 12 provides the visitation estimates for the most recent years. The significant drop in visitation for the 2005 was due to dry conditions and 2007 reflects the flooded conditions. Waterfowl habitat in the fall, especially in 2005, was poor and as a result attracted few ducks and severely reduced the number of geese on the area. This led to a drop in the number of hunters. The spring shorebird migration for 2007 was excellent, as water levels were good and our visitation was up due to the Wings-n-Wetlands Bird Festival. However, in early May the significant rains hit that resulted in the flooding of the basin. Table 13 presents estimates for the opening week of teal, regular duck and goose seasons as determined by traffic counters.

Table 12. Estimated total visitation to Cheyenne Bottoms Wildlife Area by month, 2005-2009.

| Month | 2005 | 2006 | 2007 | 2008 | 2009 |
|---|---|---|---|---|---|
| January | 1361 | 2861 | 1684 | 1061 | 4440 |
| February | 1375 | 1984 | 1411 | 1964 | 3246 |
| March | 2428 | 1910 | 3564 | 2157 | 3505 |
| April | 2305 | 1675 | 2972 | 2473 | 2723 |
| May | 2749 | 1613 | 2590 | 4305 | 5472 |
| June | 2593 | 2636 | ----* | 3161 | 4081 |
| July | 2133 | 2403 | ----* | 2729 | 3489 |
| August | 2220 | 2986 | 3220# | 3160 | 3266 |
| September | 3418 | 10734 | 1382# | 3988 | 6747 |
| October | 3039 | 9002 | 1969# | 6945 | 9100 |
| November | 3808 | 13443 | 2273 | 5230 | 7430 |
| December | 3092 | 4368 | 1121 | 3523 | 4723 |
| Total | 30,521 | 55,615 | 22,186 | 40,696 | 58,222 |

* All entrance roads to the Wildlife Area were flooded.

\# Only one traffic counter was functional during these months.

Several estimates as to visitor numbers by activity have been made over the years. All of these estimates have had shortcomings that make them inaccurate for determining, for example, how many visitors in a given year are birdwatchers or fisherman. Using the time of year provides as good an estimate as is currently available. Generally January visitation is hunters with some sightseers. February is usually sightseers and some early birdwatchers. March through May is mostly birdwatchers with some sightseers and fishermen. June through August is predominately sightseers and fishermen while September through December is mostly hunters with some birdwatchers and a few fishermen.

Beginning in 1999, hunters were required to complete a daily hunt permit card prior to and after hunting on the wildlife area. These cards were used to more accurately estimate hunter numbers, harvest rate and distribution of hunters on the wildlife area during the waterfowl season. Hunter compliance has been less than desirable, and as a result, the information gleaned from the permits is not as complete as it could or should be. One of the more reliable estimates derived from the daily hunt permits is the hunter residence. Table 14 provides information on the percentage of non-resident hunters at CHBW for the past several seasons.

Table 13. Visitation estimates for the opening week of teal, regular duck and goose seasons, based on traffic counters, at Cheyenne Bottoms Wildlife Area, 2004-09.

| Season | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 |
|---|---|---|---|---|---|---|
| Teal | 1934 | 1004 | 3377 | 419 | 1476 | 2179 |
| Regular duck | 2765 | 991 | 3657 | 704 | 2429 | 1953 |
| Goose | 2623 | 887 | 3302 | 546 | 1468 | 1640 |

Table 14. Percent of hunters at Cheyenne Bottoms Wildlife Area with out-of-state residency as determined by returned daily hunt permits, 2004-2009.

| 2004-2005: 17% | 2005-2006: 13% | 2006-2007: 19% | 2007-2008: 15% | 2008-2009: 20% |
|---|---|---|---|---|

The Mitigation Marsh (Figure 6) is managed as a youth hunting area. Only hunters less than 16 years old or hunters accompanied by a hunter less than 16 may hunt on this portion of the wildlife area. This is intended to offer youth a convenient area to hunt and allow adults to have a location that is less crowded while mentoring their own kids or other youth wanting to hunt waterfowl or upland game. The Kansas Wetlands Education Center is located at the

Mitigation Marsh as well. Wildtrust memorial funds have been identified for building and placing at least two permanent waterfowl hunting blinds on the Mitigation Marsh for use by youth.

Boating restrictions on the wildlife area vary from year to year. When hunting pools are at a maximum in terms of potential hunting area, one of the smaller pools may be closed to the use of motorized watercraft. This is intended to maximize the different types of hunting experiences available on the property. Since 1991 airboats have been prohibited on the wildlife area.

Trapping of furbearers is permitted on CHBW, however, all trappers must obtain a permit from the Area Manager and report numbers and species captured. Only those trappers who failed to comply with CHBW trapping regulations the previous season are denied permits. Number of permits distributed per season ranged from 4 to 52 between 1976-77 and 1989-90 seasons and averaged 23 permits per season (KDWP, unpubl. data). Since the 1982-83 season, the number of permits issued has not exceeded 20 and has averaged 11. Table 15 presents the reported take of furbearers on the wildlife area in recent years. From 2002 through 2008, habitat on CHBW went from one extreme to the other. As a result of going dry, then into record flooding, muskrats have had a tough time establishing a population on the property. In November of 2008, three rat houses were noted. This was the first time since the winter of 2002-03

Table 15. Reported take of furbearers on Cheyenne Bottoms Wildlife Area, 1996-97 to 1998-02.

| Trapping Season | Muskrats | Mink | Beaver | Raccoon | Coyote | Skunk | Bobcat | Opossum | Badger | Trap Nights |
|---|---|---|---|---|---|---|---|---|---|---|
| 1998-99 | 232 | 1 | 0 | 22 | 2 | 2 | 0 | 9 | 0 | 901 |
| 1999-00 | 768 | 3 | 0 | 8 | 0 | 2 | 0 | 7 | 0 | 2914 |
| 2000-01 | 60 | 1 | 2 | 22 | 0 | 0 | 0 | 0 | 0 | 401 |
| 2001-02 | 203 | 3 | 0 | 13 | 1 | 0 | 0 | 0 | 0 | 988 |
| 2002-09 | Trapping not permitted at CHBW due to few or no muskrats | | | | | | | | | |

Educational opportunities are also available at CHBW. An estimated 4 tours and/or programs are given by the CHBW staff each month. Every effort is made to accommodate all program requests. With the opening of the Kansas Wetlands Education Center, demands for programs from CHBW staff will likely decline significantly.

A Christmas bird count is held annually. Generally only 10 participants are present. These people are divided into teams and assigned portions of CHBW or adjacent areas to census. Table 16 provides a brief summary of the count results for the past few years. This has

been a good opportunity for members of the public to contribute to CHBW data collection, while enjoying the outdoors and the wildlife resource.

In May 2000, grassland bird surveys were initiated at CHBW. Two primary reasons for the establishment of this effort was to annually monitor changes in grassland bird abundance and species composition during the breeding season in response to management activities. The second reason was to provide interested individuals the opportunity to volunteer time to assist in monitoring wildlife populations at CHBW and at the same time enjoy the outdoors and the wildlife resources of the area. Thus far, 8 non-department people have volunteered to help with this work.

Table 16. Number of participants and bird species observed on the Christmas Bird Count at Cheyenne Bottoms Wildlife Area, 2004-2009.

| | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 |
|---|---|---|---|---|---|---|
| Number of Participant's | 14 | 12 | 7 | 10 | 7 | 15 |
| Number of Species | 80 | 63 | 67 | 76 | 71 | 74 |

**Refuge Areas**

Figure 2 shows the portion of the wildlife area that is refuge. Parts of the refuge may be opened for special purposes. For example, a portion of Pool 5 is open for hunting during the teal season and the refuge portion of Pool 5, south of the fireguard and the refuge portion of Pool 2 are open for pheasant hunting the last few days of the season. These refuge suspensions are done to increase hunting opportunity and harvest birds in areas normally not hunted. Pool 1C has been opened for teal season in the past in an effort to offset the loss of hunting areas due to the renovation demands of dry perimeter hunting pools.

Refuges in time are often employed in the hunting pools in an effort to reduce hunter disturbance to birds. Examples of this may be having a pool open for hunting on odd number dates only, or open for hunting half-days. This has a tendency to encourage birds to remain on the area longer, thereby lengthening hunter opportunity.

In an effort to reduce human disturbance to nesting/brood rearing birds, boat and foot access to the marsh, outside the waterfowl season, is restricted. Research has shown that human disturbance can have negative impacts on migrating and staging birds by reducing their ability to

rest and feed (Batten 1977; Owens 1977; Tuite et al. 1983; Korschgen et al. 1985; Bellanger and Bedard 1989). Research has also shown that human disturbance can lower the reproductive success of water birds (Hunt 1972; Ellison and Cleary 1978; Anderson and Keith 1980; Robertson and Flood 1980; Flemming et al. 1988). Motor-powered watercraft are permitted in the marsh only during the waterfowl season. During the waterfowl season, no out-of-water-propeller driven watercraft (i.e., airboats) are permitted. Access by Hand-powered watercraft and foot are permitted in the marsh except between the hours of 10 AM and 5 PM from April 15 to August 15.

Fishing is permitted from all dikes except the Pool 1B/1C, Pool 1A/1B-1C and Pool 1A-1C/Pool 5 dikes. These dikes lie within the refuge portion of the wildlife area.

**Facilities**

A small primitive campground is located 3/4 mile west of the headquarters. Data on campground use are limited. The campground is used primarily by hunters during opening weekends of the duck season (an average of four groups per night) and by birdwatchers, scout groups and tourists during spring (4 to 5 nights per month) (K. Grover, pers. comm.).

Each hunting pool has at least one boat ramp. Maintenance of these boat ramps has improved since the acquisition of the Posi-Track.

At the headquarters building, the front lobby was used as a check station during the waterfowl season. It has been modified to be used throughout the year as a lecture/conference room. It is there where public programs are given, provided the audience size is less than 30. Recent years has seen the addition of cabinets designed to facilitate educational efforts. Displays of historical items, mounted wildlife as well as a collection of skulls and tanned mammal skins have contributed greatly to the use of the office as an educational facility. In front of the area office is a handi-capped accessible outhouse. In addition, a fully accessible hunting/photo blind is available by reservation.

CHBW is an intensively managed property, and as such, it has extensive infrastructure. This includes: 26 water control structures; 5 pump stations; 3 diversion dams; 6 flood water distribution structures; 30 miles of dikes/roads; 5 flow meters; 19 parking lots and 15 boat ramps. Not to mention the miles of fence, ditches and canals, as well as hunting/nesting islands in need of maintenance. All of the structures are prone to vandalism, particularly the Arkansas River diversion dam.

The Department has placed an educator position at the recently opened Kansas Wetland Education Center. This position will greatly increase the educational opportunities available to area schools and other groups. The nature trail at the KWEC was originally funded by a Travel and Tourism Grant obtained by Great Bend Convention and Visitor Bureau and the Friends of Cheyenne Bottoms. It has been replaced by a concrete permanent trail funded by the Stumps Memorial Trust through Ducks Unlimited. Interpretive signs and benches (paid for by the tourism grant) need to be maintained.

**Public Outreach**

A radio program was initiated in 1998. This is a live, phone in program running from 8:30 AM to 9:00 AM. The number of programs each month and the day they are aired is dependent upon the ability of the radio station to adjust program scheduling. It is carried by

KVGB, 1590 AM, Great Bend. A diversity of topics are discussed with guests from every Division and from outside the Department participating.

A public meeting is held annually, generally in late August. Discussions typically focus on planned area regulations for the upcoming waterfowl season. Since 1995 four newsletters are sent out each year (January, April, July and October). This serves as a tool to inform interested public on the plans and activities on the wildlife area throughout the year. The mailing list has grown to over 330 in 2009. Beginning in 2010 an electronic version will be emailed out to those preferring this to paper copies in the mail.

Every other year (most recently 2009) the Wings-N-Wetlands Bird festival is held in the spring at Great Bend. Efforts need to continue to ensure this event is a success and take the opportunity to educate the attendees on CHBW and its value and funding sources.

## GOALS

* Maximum the range of hunting opportunities the marsh conditions allow.
* Make efforts to provide young people the opportunity to experience hunting.
* Maximize bird watching/wildlife photography opportunities as marsh conditions allow.
* Provide trapping opportunities.
* Provide fishing opportunities without active fisheries management activities.
* Provide primitive camping/picnic opportunities.
* Make every effort to honor all requests for educational/informational programs both on and off site.
* Assist KDWP educator and other staff members at the Kansas Wetland Education Center with public programs and maintenance of the nature trail.
* Work with the Cheyenne Partnership and Friends of Cheyenne Bottoms to advance the mutual goals of the organizations and the Wildlife Area.
* Continue to be a part of the organizing committee for the Wings-N-Wetlands Bird Festival.
* Ensure that hunter registration cards and pencils are available throughout the hunting seasons.
* Make efforts to keep the public informed and involved in activities at CHBW.
* Reduce vandalism on CHBW facilities.
* Maintain existing infrastructure.

## STRATEGIES

Quality outdoor experiences are defined in almost as many different ways as there are outdoor enthusiasts. As a result, efforts must be made to accommodate as many demands as possible. The use of primitive hunting pools (no motorized watercraft), varying water depths and habitat types will be used as conditions allow to meet these demands. Management of the Mitigation Marsh as a youth and mentor only hunting area will continue. Providing a hunting opportunity at the ADA hunting/photo blind helps address an area in waterfowl hunting not often available.

The spring drawdown of at least one pool will provide bird watching opportunities during the spring migration. This is the time of the year most often utilized by birders. Photography opportunities will be expanded beyond the current ADA blind by constructing more blinds available for use without reservations.

Trapping opportunities will provide for the maintenance of a healthy furbearer population. Monitoring of the harvest must be continued to ensure muskrat populations are kept at optimal levels to assist with cattail control.

Ensure all staff members, both permanent and temporary, contribute to the presentations of programs as requested. Some staff members are better at certain topics than others. This diversity should be kept in mind as requests for programs are honored.

Every Monday and Friday, during the hunting season, staff needs to visit every hunter registration box on the area to collect completed cards and ensure that blank forms and pencils are sufficient to last to the next visit.

Work closely with the organizing entity of the Wings-N-Wetlands Bird Festival. The next festivals are scheduled for 2011 and 2013.

The radio show will continue to serve as an outlet for public information as long as KVGB provides the opportunity. The newsletter mailing list will be increased. Assist as much as possible the staff of the KWEC.

Efforts to work more closely with local law enforcement agencies will be made to reduce vandalism on the area facilities, especially the Arkansas River diversion dam.

Monitor the signs, benches and nature trail at the Wetland Education Center.

Work closely with the Cheyenne Partnership and Friends of Cheyenne Bottoms (if re-established) by attending meetings and exchanging ideas on needs of the Wildlife Area that are compatible with the goals of the property and the organization.

Continued monitoring of infrastructure with attention placed on equipment not performing adequately.

# RESEARCH

## BACKGROUND

A number of research efforts have been accomplished since the addition of a biologist to the staff at CHBW in 1989. These efforts have been directed at evaluating the success, or lack thereof, of management actions. Waterfowl nesting, shorebird nesting success in the old goose pen, cattail control using disking, burning, mowing, scraping and crop plantings, and the effects these activities have on aquatic invertebrates, have all been investigated. In addition, evaluations of habitat use by waterbirds has been directed at the level ditch construction and scraping of potholes. Muskrat impact on cattail has also been investigated in recent years. These efforts have been described and presented in the CHBW annual reports for the past several years. An attempt to describe them here will not be made. Over the past several years, the CHBW biologist has been given more statewide responsibilities and as a result, less time has been spent on efforts at CHBW.

There have been several research efforts accomplished by outside individuals and universities (Sonnenberg 1961; Tomanek and Kinsinger 1961; Hastings 1970; Baird 1974; Tacha 1975; Shipley 1980; Helmers 1991; Saunders, 1992; Zajic 1992; Satomi, 1997; Harvey, 2000; Kostecke, 2002). In 1986, the Kansas Biological and Geological Surveys performed a series of investigations to assess the value of CHBW from biological, economic, hydrologic and geologic points of view (Kansas Biological and Geological Surveys, 1987).

From 1998 to 2002, the BOR funded several research projects on CHBW. One of the studies looks at the effects of cattle grazing on cattail and its effect on weight gain of livestock. This is a 4 year effort with three years of grazing evaluation. This project is aimed at determining if livestock can be used as another tool to address the expanding cattail community. A Doctoral candidate (Charlie Lee) from Kansas State University is undertaking this work. Another study supported by the BOR looked at the effects of cattle grazing, disking and scarping on aquatic invertebrates. This project is completed and can be found in Kostecke, 2002. A third study established a vegetational data base using color infra-red photography and a computer GIS program. This will provide the ability to monitor the changes in vegetation resulting from the cattail control measures that dominate the management activities at CHBW. The Remote Sensing and Geographic Information Group in the Denver BOR office (coordinated by Jan Oliver) did the initial work on this effort. Five years of annual photography were obtained (1998-2002). A solid base line of information has been obtained from this effort.

Beginning in 2007, a Fort Hays State University (FHSU) graduate student, Jason Black, began a research effort on duck food habits, stable isotope analysis of feathers, Daily Hunt Permit hunter compliance, and a survey of hunters on various management options used at CHBW. The results of this effort are not yet available.

The KWEC was to have provided 4 graduate research positions for FHSU students. Research emphasis was to focus on wetlands and be based out of the education center with field work to be done at wetlands across the state but centered on CHBW and Quivira National Wildlife Refuge.

## GOALS

* Continue the research efforts of the CHBW staff.
* Encourage the research efforts of outside universities, with an emphasis on plant and animal responses to management activities.

## STRATEGIES

Work needs to continue in the area of monitoring wildlife use changes on CHBW resulting from management actions. With the added equipment and renovation effort, management activities have a much greater potential to affect changes in the habitats of CHBW than in past years. While it is hoped these changes are positive, monitoring will be needed to ensure any negative affects are detected so as to avoid them in the future. It may be necessary to obtain additional help in these endeavors, as the staff biologist has other responsibilities besides work at CHBW.

Should the research efforts of the graduate students at the KWEC materialize, this could be an outstanding source of evaluation of management actions. A close relationship must be kept in place with the FHSU Biology Department and the Director of the KWEC.

# SIGN PLAN

## BACKGROUND

Two objectives of the Public Lands Section are: 1) to reduce the number of signs on all public lands and 2) to have all public area signs to be uniform with respect to material and design. To accomplish these objectives, a sign manual was developed (KDWP 1990). This manual will be used to guide the signage at Cheyenne Bottoms.

Two primary entrance signs have been placed at CHBW. One is located at the current Area office, another at the U.S. 156 highway entrance. At these two locations the large information/self-pay center design was used for the information sign. At the secondary entrances, south of Redwing and at the east entrance off NE 100 Avenue, information bulletin board type signs were placed (See Figure 1). Nineteen area information signs (similar to the information bulletin board in the Sign Manual) have been placed at every parking lot on the area. All 23 of these signs have a small (approx. 2'x3') lexan door under which area maps and other paper and/or permanent signs are placed. All 23 information signs have the Wildlife Restoration logo, plastic hunting regulations, non-toxic shot sign, no trash policy sign, area maps, special regulations for the area, 911 emergency locator number, the pool where the sign is located and any other signs for the specific pool.

Should area regulations call for additional signs in a given pool, they are placed on existing signs such as foot crossing/blind number signs or signs placed with mileage and direction to area office. This reduces the number of posts/signs on the area.

The Kansas Audubon Council has funded the construction and placement of signs for a self-guided auto tour through the area. This includes large signs describing the auto tour (which begins at the K-156 entrance) that are located at the K-156 and area office entrances. There are 13 numbered stops on the tour. Each stop has a numbered post at the appropriate location. In addition, five interpretive signs have been placed adjacent to 5 of the numbered stops. These signs give brief sketches on birds commonly seen on the area and/or history and value of CHBW or wetlands in general.

All wildlife area boundaries and refuge boundaries are marked with appropriate signs. Spacing of these signs is generally dictated by the particular location and circumstance.

The nature trail, located west of the KWEC, has a number of interpretive plant ID signs that must be placed appropriately. Many of these ID signs will have to be placed as plantings are done, as many of the plant species were drowned out during the flood of 2007 and will need to re-establish themselves or be planted.

## GOALS

* Maintain all area signs in good condition.
* Ensure that all information on the signs is readable and timely.
* Repair any vandalized signs as needed.
* Ensure Audubon interpretive signs are readable and in good repair.
* Ensure that all area regulations are placed in conspicuous and appropriate locations.
* Establish all interpretive signs possible on the WEC nature trail.

## STRATEGIES

Most all goals for area signage can be met while doing other activities on the area. For example, while obtaining weekly water levels, make note of any shortcomings on area signs. While patrolling the area during waterfowl season take note of all signs and their condition. When collecting hunter registration cards all area information signs are visited and can be maintained at that time. Crews doing fence replacement and/or repairs can make necessary sign maintenance as well.

Special efforts at maintenance will be required to make necessary repairs to information/interpretive signs that have been vandalized or damaged in other ways. In addition, a special effort to place interpretive signs as they are appropriate will need to be made at the nature trail. This effort could potentially be used as a friends group project or even as an Eagle Scout project.

# FIGURES

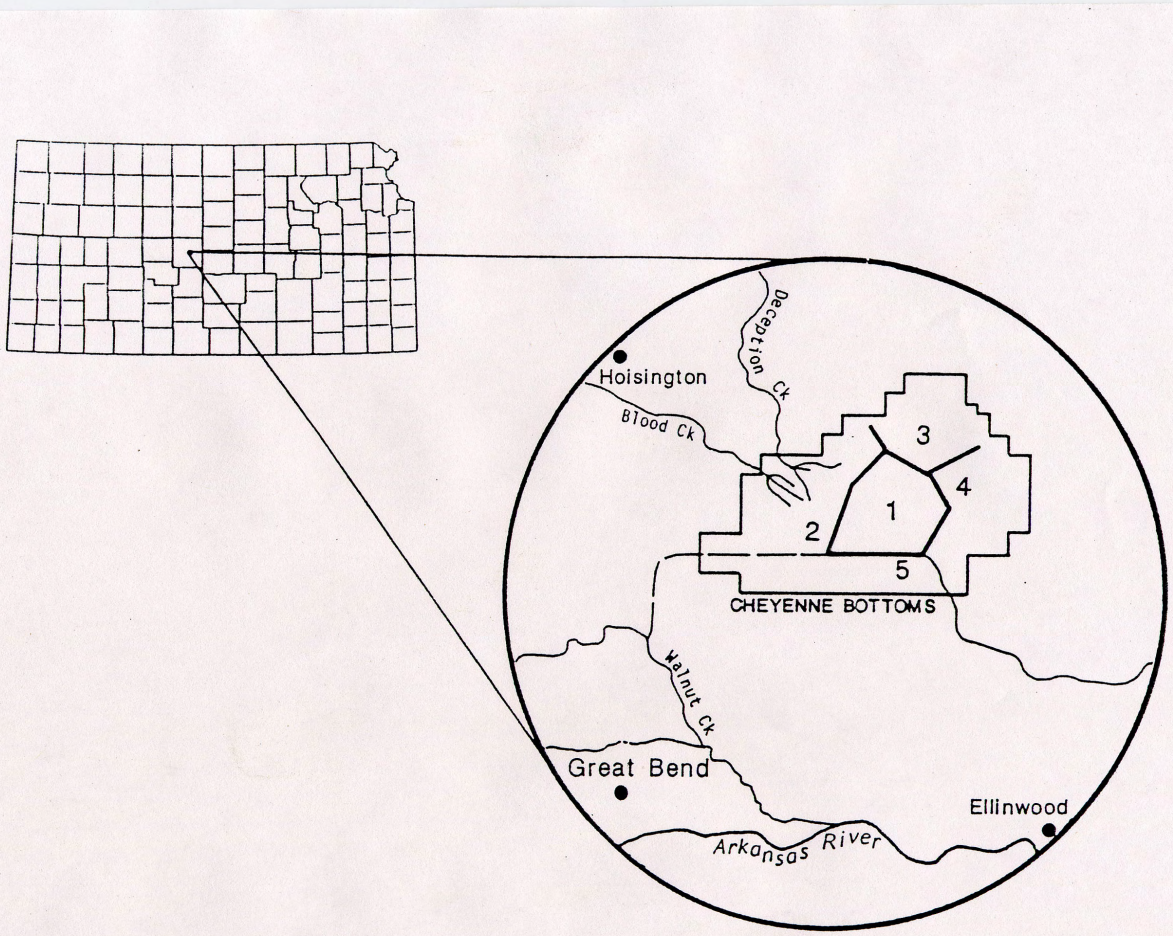


Figure 1. Location of Cheyenne Bottoms Wildlife Area within the State of Kansas.

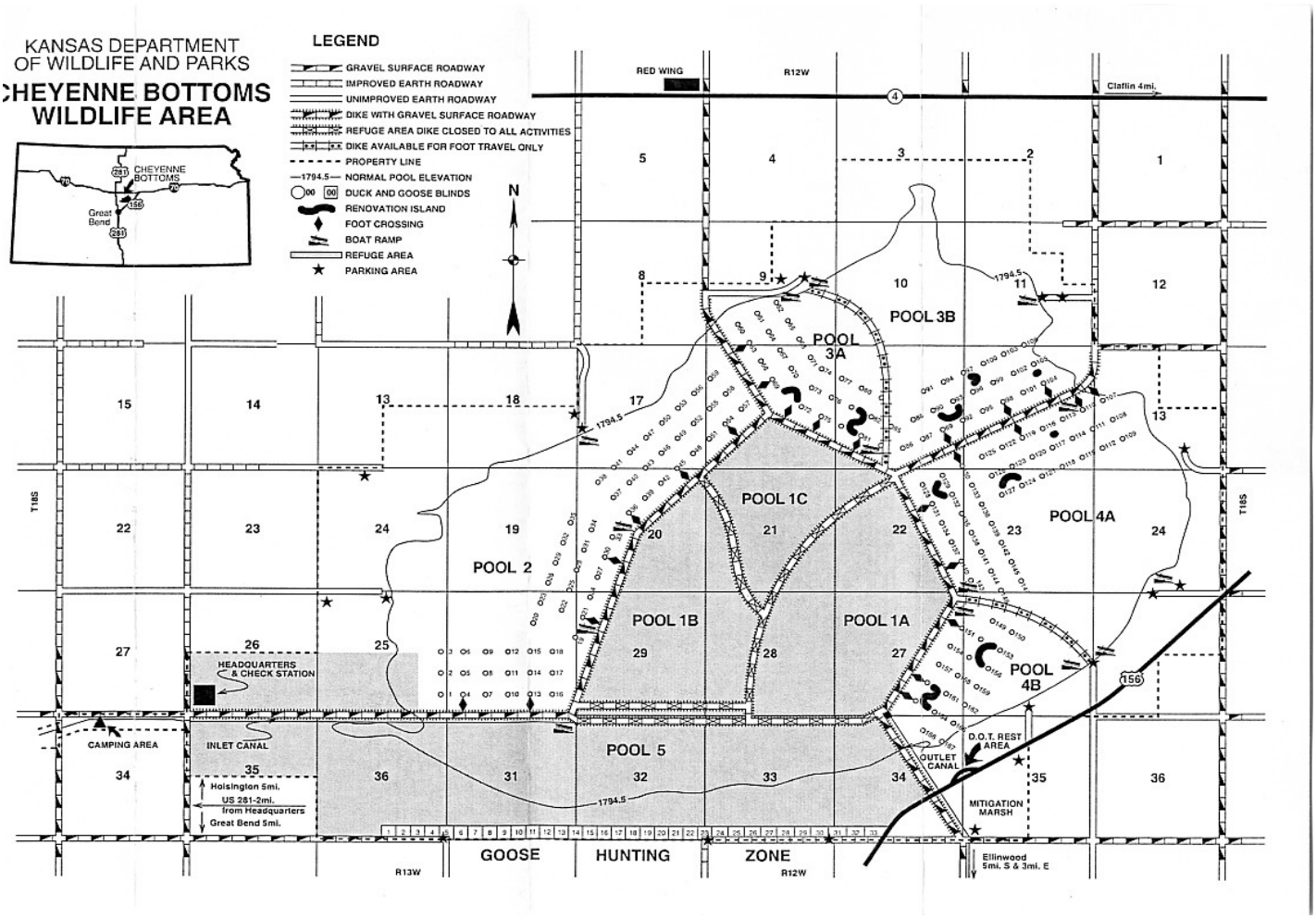


Figure 2. Current map of Cheyenne Bottoms Wildlife Area.

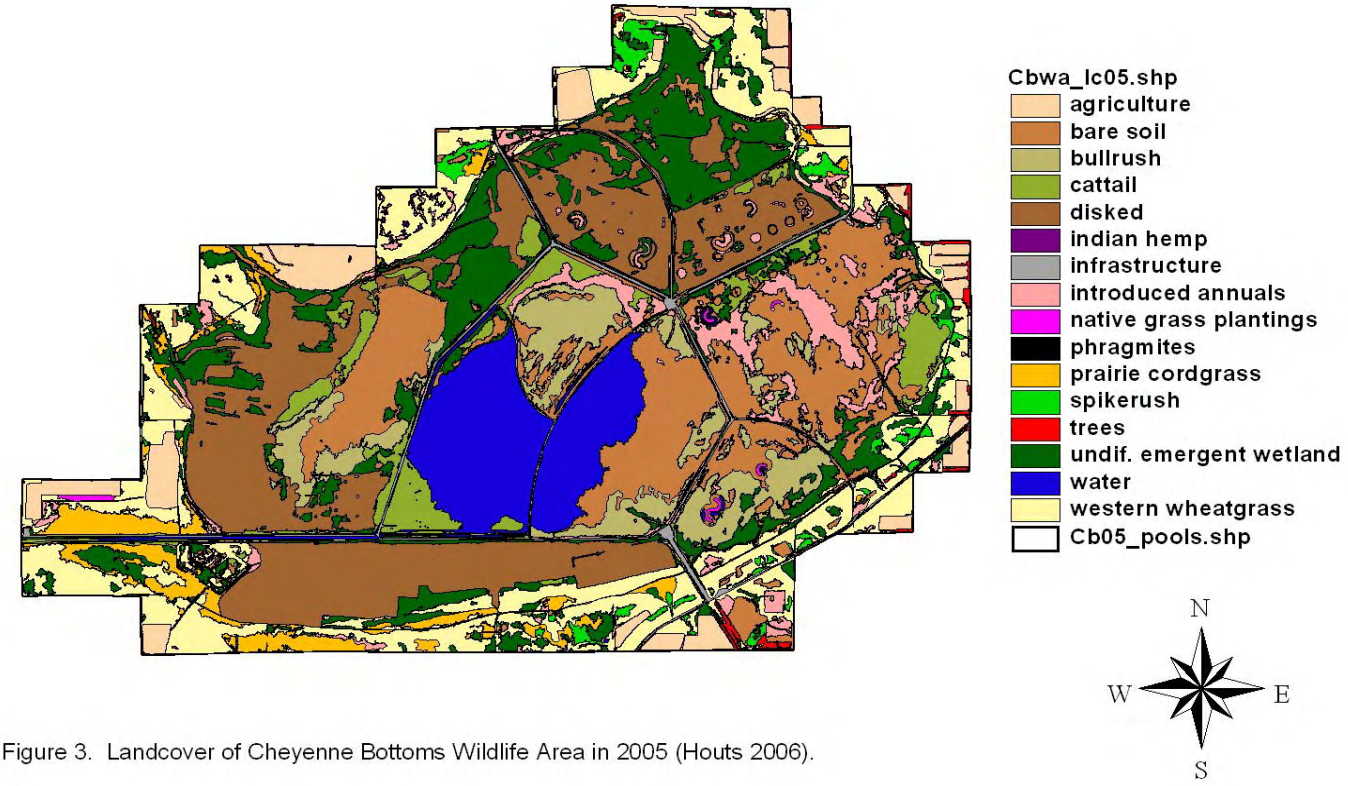


Figure 3. Landcover of Cheyenne Bottoms Wildlife Area in 2005 (Houts 2006).

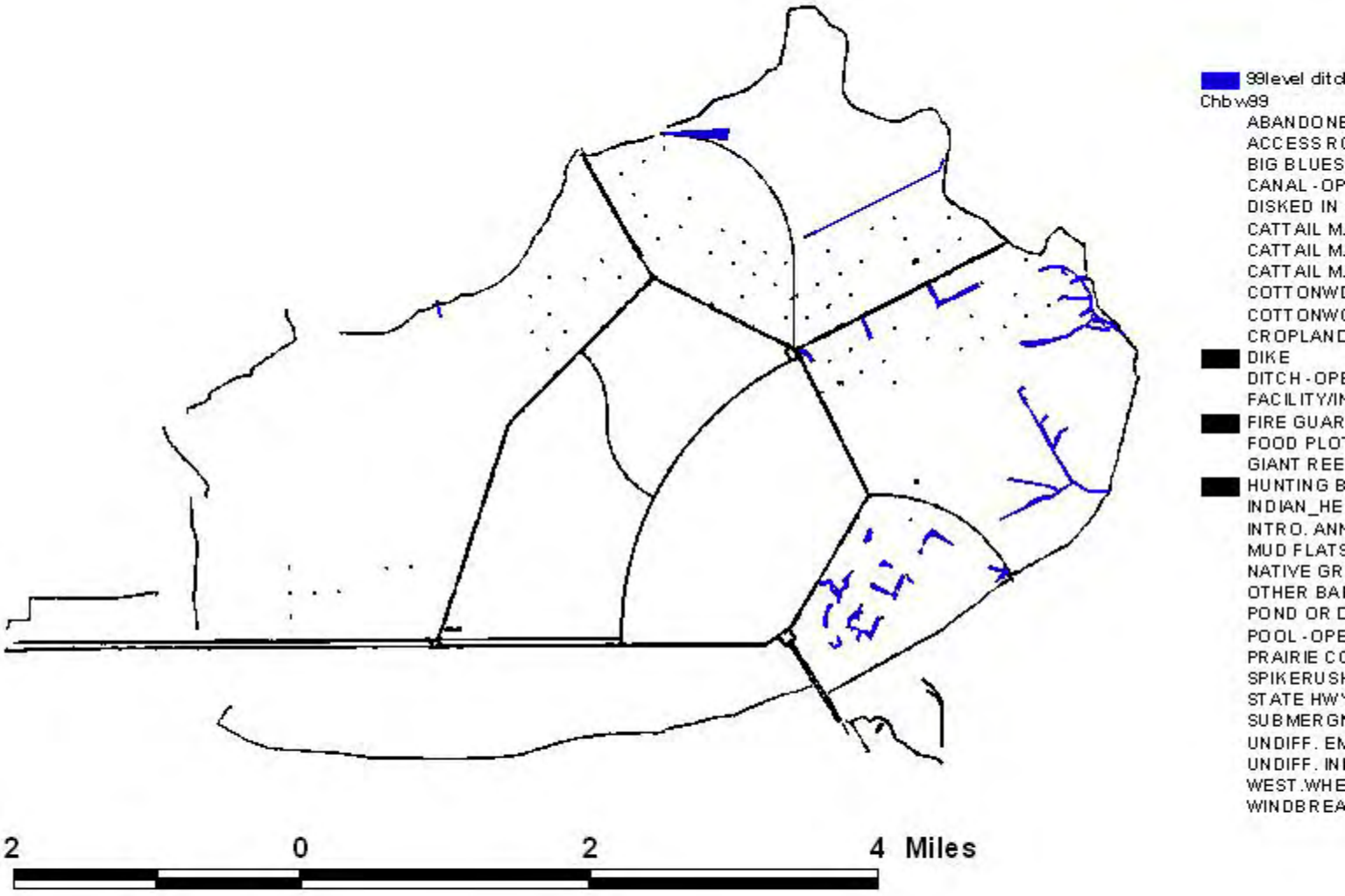


**Figure 4. Location of level ditches and boat access channels at Cheyenne Bottoms Wildlife Area.**

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