SNAKE RIVER VALLEY (JACKSON) WETLAND COMPLEX

Regional Wetlands Conservation Plan

A Wyoming Bird Habitat Conservation Partnership regional step-down plan under the

Wyoming Wetlands Conservation Strategy

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Wyoming Game and Fish Department
Teton Conservation District
Ducks Unlimited of Jackson Hole
Meg and Bert Raynes Wildlife Fund

Project Lead and Editor:

Susan Patla, Nongame Biologist
Wyoming Game and Fish Department
PO Box 67, Jackson, WY 83001
(307) 733-2321
susan.patla@wyo.gov

Prepared by:

Alder Environmental, LLC

Water • Wetlands • Ecological Consulting

PO Box 6519, Jackson, Wyoming 83002
(307) 690-3625 brian@alderenvironmental.com

Ravenworks Ecology
P.O. Box 4226, Jackson, WY 83001

and

Teton Conservation District Est. 1946

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ACRONYMS AND ABBREVIATIONS

ACOE	Army Corps of Engineers
BHCA	Bird Habitat Conservation Area
BLM	United States Bureau of Land Management
BMP	Best Management Practice
BTNF	Bridger-Teton National Forest
DEQ	Wyoming Department of Environmental Quality
EPA	United States Environmental Protection Agency
GIS	Geographic Information Systems
GTNP	Grand Teton National Park
GYCC	Greater Yellowstone Coordinating Committee
IWSCP	Intermountain West Shorebird Conservation Plan
IWWCP	Intermountain West Waterbird Conservation Plan
LDRs	Land Development Regulations (county)
NSS	Native Species Status, Wyoming State Wildlife Action Plan
NAWCA	North American Wetland Conservation Act
NAWCP	North American Waterbird Conservation Plan
NAWMP	North American Waterfowl Management Plan
NAWQA	North American Water Quality Assessment
NER	National Elk Refuge
NPW	National Park Service
NWI	National Wetlands Inventory
PIF	Partners in Flight North America
PIF – WY	Wyoming Partners in Flight Bird Conservation Plan
RMP	Resource Management Plan
SGCN	Species of Greatest Conservation Need
SCORP	Statewide Comprehensive Outdoor Recreation Plan
SRWC	Snake River Wetland Complex (Jackson)
SRV	Snake River Valley (near Jackson, Wyoming)
SWAP	Wyoming State Wildlife Action Plan
TNC	The Nature Conservancy
USDA	United States Department of Agriculture
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
WBHCP	Wyoming Bird Habitat Conservation Partnership
WGFD	Wyoming Game and Fish Department
WJVSC	Wyoming Joint Ventures Steering Committee
WSC-IWJV	Wyoming Steering Committee – Intermountain West Joint Venture
WWNRT	Wyoming Wildlife and Natural Resources Trust
WWS	Wyoming Wetlands Society

INTRODUCTION

The Snake River Valley Wetland Complex (SRWC) in the Jackson area of Teton County is 1 of 9 priority wetland complexes identified by the WY Joint Ventures Steering Committee (Fig. 1 – WJVSC 2010). The Steering Committee (now the WY Bird Habitat Conservation Partnership or WBHCP) emphasizes conservation efforts within the priority wetland complexes. This Regional Wetland Conservation Plan describes local and regional wetland and riparian resources and tailors conservation strategies to address specific threats and opportunities unique to the SRWC. Its ultimate purpose is to increase our capacity to identify, plan and fund wetland and riparian conservation projects on a regional level.

Snake River Valley Wetland Complex

The SRWC was delineated in The Nature Conservancy's (TNC) Wetlands Assessment Study (Copeland et. al. 2010). The TNC study used National Wetland Inventory map layers (USFWS 2012a) to identify wetland complexes based on polygons containing average wetland densities of at least 1/km^2. The SWRC is 256 mi^2 and encompasses 8,544 acres of palustrine wetland systems (described as freshwater ponds, freshwater emergent wetlands, and freshwater forest/shrub wetlands)

The TNC study, did not identify extensive wetlands associated with Jackson Lake and the Snake River north of Jackson Lake dam as part of the SRWC (Figs. 1, 2). These wetlands may have been excluded because the NWI classified them as lacustrine (lake) wetlands. These additional wetlands and others are designated as the "Extended Wetland Complex Area" and considered part of the SRWC for purposes of this plan.

Copeland et.al. (2010) developed the following quantitative and qualitative description of the SRWC:

Total Area:	255.9 mi^2
Number of Wetlands:	1,919
Wetland Area:	8,544 acres
Percent of the Wetland Complex under Irrigation:	12%
Percent of Wetlands Currently Protected:*	39%
Number of Wetland Species of Concern:	32
Number of Rare Wetland Species of Concern:	4
Overall Integrity Score (0 = Low, 100 = High):	70
Overall Vulnerability Score (0 = Low, 100 = High):	44
Key Vulnerabilities:	Rural Residential Development, Water Diversion & Channeling, Levee Construction
Project Opportunity (WJVSC):	High

*National Park Service lands and conservation easements

Fig. 1. Snake River Valley Wetland Complex.

Fig. 2. Wetland in extended complex area near Jackson Lake.

Topography

The Snake River Valley and surrounding mountains are comprised of three topographic formations: 1) western mountains, 2) valley floor and 3) eastern mountains. The valley floor and some of the eastern mountains (Gros Ventre) were subjected to past glacial activity. Glaciers left resistant rock that formed hills, buttes, and outcrops. Prominent features include the East and West Gros Ventre Buttes, Blacktail Butte, Timbered Island (a moraine), Burned Ridge (a moraine), Antelope Flats, and Baseline Flats. The valley gradually gives way to undulating hills and low mountains to the East and North. The Snake River and its terraces contain the area's most significant distribution of wetlands. The elevation of the valley decreases as the Snake River flows to the south.

Geology

The Teton Mountain Range bordering the western edge of the wetland complex is the most prominent geologic feature. The range extends 40 miles in a north-south direction and rises abruptly to about 7,000 ft above the valley floor. The Teton Mountain Range formed as a geologic uplift, while Tertiary sedimentary rocks accumulated in the basins. The Teton fault began moving upwards to the west and downwards to the east about 13 million years ago. This movement created a "hole" where the valley floor is located, and is why the Jackson region became known as Jackson's Hole to the early fur trappers (eventually shortened to Jackson Hole).

The valley floor is composed of soil and rock deposited by landslides, erosion, and glacial activity. Interbedded layers of basalt flows and rhyolite ash flow tuffs were deposited by surrounding volcanic activity. Much of the valley floor consists of alluvial outwash carried by glaciers from the mountain canyons. The pothole region in northern Grand Teton National Park is an area of dense wetlands formed originally as glacial kettles. (Love et. al., 2003).

Climate

Climatic conditions and seasonal progression differ greatly between the mountains and valley floor. Most of SRWC is in the lower elevations. Snowfall in the valley floor typically begins in early November and can accumulate as much as 15 feet throughout the winter. Average winter temperatures range from 6-29^{o} F. The onset of spring thaw varies between March and May. Runoff from extensive mountain snowmelt continues through the summer months, depending on snowpack, and feeds water and sediment to the streams and eventually to the Snake River and associated wetlands. The warmer summer season extends from June through August with temperatures varying from 40-76^{o} F. Summer days are mostly sunny, except spotty afternoon thundershowers occasionally develop. Smoke from fires sometimes lingers in the surrounding forests. During winter months, cloud cover often inundates the valley and deposits snow (Cogan, 2005).

Greater Yellowstone Ecosystem

The Greater Yellowstone Ecosystem is one of the last relatively intact ecosystems in the northern temperate zone of the world. The SRWC is within the southern region of the Greater Yellowstone Ecosystem (Fig. 1) and supports a diverse assemblage of native wildlife including moose, bison, trumpeter swan, harlequin duck, grizzly bear, and recently, gray wolf.

A 1986 a Congressional Research Service report concluded the area's essential values were at risk (GYCC 2006). The Greater Yellowstone Coordinating Committee (GYCC, established in 1983) offered suggestions to better manage the land (GYCC 2006). In 2000, the *Unified Federal Policy for a Watershed Approach to Federal Land and Resource Management* was developed to identify approaches for protecting watershed areas (GYCC 2006). Those efforts led to a framework for protecting the Greater Yellowstone Ecosystem, which became the foundation for additional protection plans and legislation. The Craig Thomas Snake Waters Legacy Act (2009) added 387 miles of the Snake River and its tributaries to the Wild & Scenic Rivers System (GTNP 2010, BTNF 2012). The National Wild and Scenic Rivers System (established in 1968) protects rivers and streams that fall into one or more of the following categories: 1) wild river area; 2) scenic river area; or 3) recreational river area. The headwaters of the Snake River include all 3 categories. The Snake River Headwaters Comprehensive River Management Plan includes two requirements related directly to wetlands; 1) clearly describe the rivers "outstandingly remarkable values," which are river-related or dependent and are unique, rare, or exemplary characteristics that make the river eligible for inclusion in the national wild and scenic rivers system; and 2) establish a management program that protects the river's outstandingly remarkable values, free flowing condition and water quality. A third requirement is to provide documentation to support wild, scenic, or recreational designations within specific river boundaries and segments. This third requirement can incorporate adjacent floodplain wetlands and riparian habitats within a wild and scenic classification boundary.

Public lands

Approximately 64% (171,583 acres) of the SRWC is public land (Fig. 3). These public lands are managed by the NPS (85,434 acres), USFS (51,366 acres), BLM (1,014 acres), State of Wyoming (2,023 acres), and USFWS (2,229 acres) (Fig. 3). The NPS manages Grand Teton National Park and the Laurence S. Rockefeller Preserve, which together cover 137,538 acres of the SRWC. The USFWS manages the National Elk Refuge which covers 9,219 acres of the SRWC. Teton County owns approximately 250 acres. The Town of Jackson owns approximately 334 acres, of which

nearly half (144 acres) is the wastewater treatment facility adjacent to the South Park Wildlife Habitat Management Area (WHMA).

Private Lands

Private lands cover approximately 36% (95,484 acres) of the SRWC. Private lands include primarily urban areas, resorts, commercial businesses, golf courses, subdivisions, and working ranches. Unprotected wetlands and riparian habitats on private lands are the most vulnerable to potential development.

Conservation Easements

Approximately 18% (17,291 acres) of the private lands within the SRWC are encumbered by perpetual conservation easements managed by the following organizations:

- Jackson Hole Land Trust (11,657 acres)
- Teton County Scenic Preserve Trust (2,762 acres)
- The Nature Conservancy (2,246 acres)
- US National Forest Service (593 acres)
- National Fish and Wildlife Foundation (32 acres)

Easement agreements contain specific provisions that place restrictions on development, land use and management. Conservation easements typically consist of large contiguous tracts of land with significant natural resource values, often including or adjoining wetlands and riparian habitats.

Land Use

Although much of the private land is used for cattle ranching, recreation is undoubtedly the dominant land use throughout the SRWC. The Snake River, its tributaries, and Jackson Lake are popular boating and fishing destinations. Portions of GTNP and nearby forest lands are used for wildlife and scenic viewing, hiking, camping, biking, livestock grazing, and hunting. Private agricultural land is used mainly to produce hay and pasture grass for livestock. BLM and State Trust Lands along the Snake River are also grazed by cattle and horses. Approximately 21,333 acres within the SRWC area are irrigated (States West 2003).

Economy

The largest share of the Jackson Hole economy is supported by tourism and second homeownership. Tourism got started in the late 19th and early 20th centuries when local residents began outfitting and guiding visitors to hunt and fish. Then some of the ranchers began operating “dude ranches” to accommodate visitors wanting to spend summers in the area. In 1929, Grand Teton National Monument was established and became an added attraction. Today the area is a popular vacation destination for people visiting the parks in summer and skiing in winter. Along with the growth of tourism, the desire to live within Jackson Hole year round and seasonally began to develop strongly in the 1990’s. Consequently, pressures from residential development have impacted private lands throughout the southern portion of the Snake River Valley Wetland Complex (Daugherty 1999).

Hydrology

The Snake River floodplain supports a variety of wetland types from Jackson Lake to just south of the confluence with the Hoback River (Fig. 4). The SRWC is largely defined by the path of the Snake River (Fig. 5). Wetland and riparian features along riverine systems are influenced by the hydrologic cycle and annual hydrograph (McKinstrey et. al. 2004). Although the extended SRWC covers 267,000 acres, the contributing land area that drains to the SRWC is estimated at nearly 1.8 million acres. Jackson Lake is by far the largest open water feature, accounting for nearly 86% (25,530 acres) of the total lacustrine area (29,514 acres) throughout the SRWC.

Approximately 373 miles of streams flow through the SRWC. The Snake River originates at the confluence of three small headstreams on the southwest flank of Two Oceans Plateau in Yellowstone National Park. From there, it flows west and south into Jackson Lake. Downstream from Jackson Lake dam, the Snake River gathers flow from the Buffalo Fork, Gros Ventre, and the Hoback rivers, and several smaller creeks before entering the Snake River canyon south of the SRWC. Many springs emerge within the Snake River floodplain south of the Buffalo Fork confluence. Most streams originate in the mountains and are perennial, although reaches of some streams become intermittent in dry years. In late summer through early spring, streamflow is maintained by discharge from alluvial aquifers.

Flows recorded on the Snake River below Flat Creek, based on a 36 year record, were: average daily flow = 3,627 cfs; record high flow = 30,200 cfs (06/1997); and record low flow = 690 cfs (07/1988). Stream flow is routinely measured by the USGS at 12 locations within or immediately adjacent to the SRWC (www.waterdata.usgs.gov/wy/nwis/rt).

Jackson Lake is the only major reservoir in the Snake River system upstream from the Wyoming State line and Palisades Reservoir. Natural lakes within the SRWC include Jenny, Leigh, Phelps, Two Ocean, and Emma Matilda lakes. All drain into the Snake River. Storage in Jackson Lake primarily serves water users in Idaho. The Snake River Compact requires Wyoming must maintain a specified flow rate in the Snake River at the state line to meet the demands of downstream water users (State West 2003). Article III of the Snake River Compact states, "The waters of the Snake River, exclusive of established Wyoming rights (as of 1950) and other uses coming within the provisions of C of this article III, are hereby allocated to each state for storage or direct diversion as follows:

To Idaho.....96 percent
To Wyoming.....4 percent

Jackson Lake reservoir is operated to assure stream flows required by terms of the Compact are met throughout the year. Prescribed flows are also maintained to support habitat for fish and other aquatic life as well as recreation. However, Jackson Lake Reservoir has severely altered the natural flow regime and channel forming processes of the Snake River. Along with a series of levees downstream, the altered flow regime has adversely impacted wetland, riparian, and aquatic habitats within the floodplain corridor (Kiefling 1978).

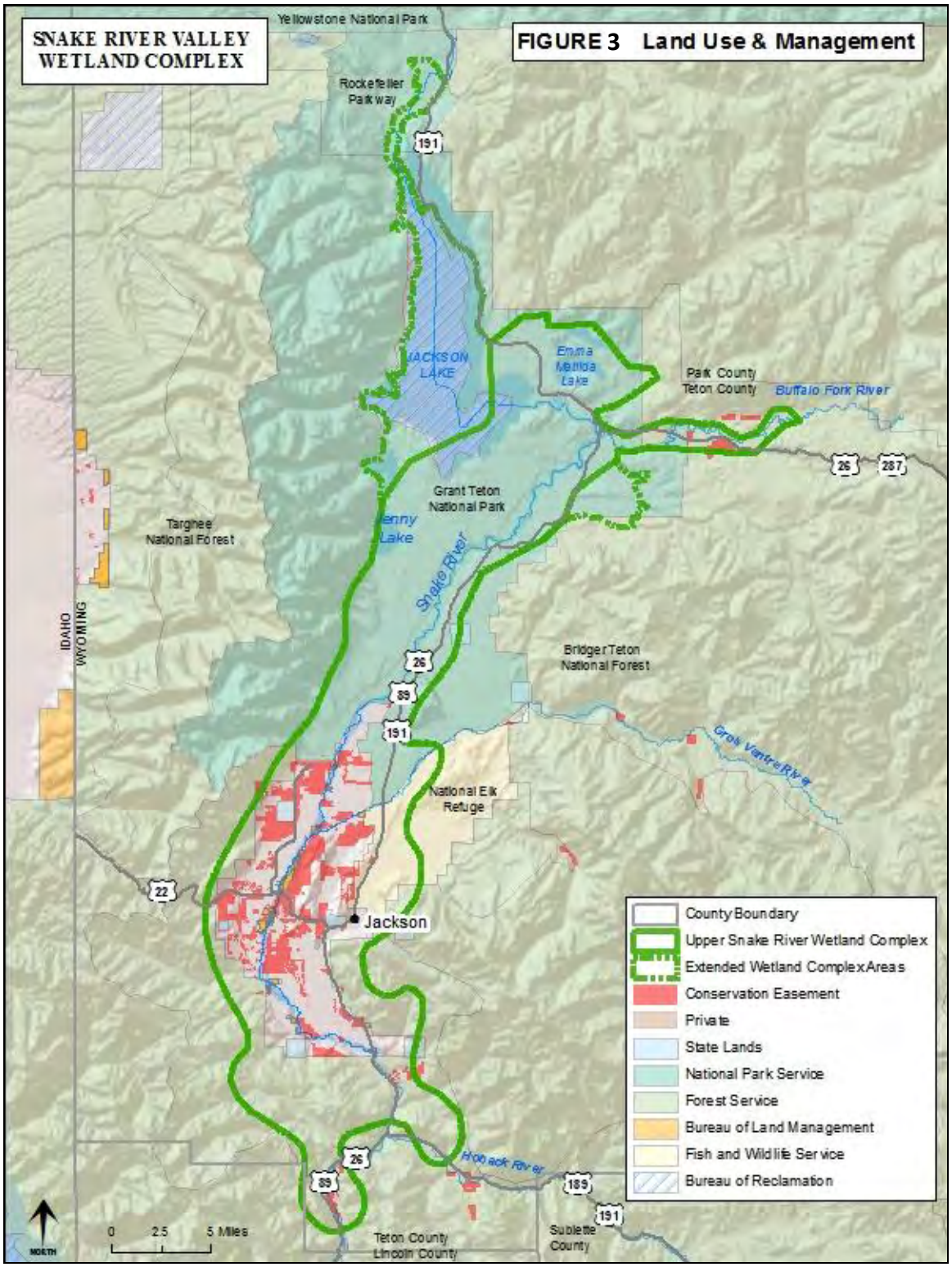

Fig. 3. Land ownership within the SRWC and adjacent areas.

Fig. 4. Typical thematic cross section of wetland complex on private land without levees.

The demand for high quality water has increased along with population growth in the Upper Snake River Basin (States West 2003). For this reason, the Upper Snake River Basin (USRB) is one of the USGS study units for the North American Water Quality Assessment (NAWQA) Program. NAWQA was implemented in 1991 to collect information to support decisions related to water policy and management. The NAWQA Study determined the upper Snake River is a significant source of clean water for agricultural irrigation and municipal uses downstream (States West 2003).

The Teton Conservation District and USGS have monitored water quality in the Fish Creek and Flat Creek drainages since 1996. Their findings suggest anthropogenic sources of nitrogen, glycol, sediment and *E. coli* may be impacting beneficial uses within those watersheds (Eddy-Miller 2010, Dan Leemon personal communication, Wright 2010). Constructed wetlands are one of the best management practices (BMPs) recommended to remediate point and non-point sources of pollution.

Water within the SRWC is used predominantly for irrigation, domestic use, and wildlife habitat. There are 166 surface water diversions, approximately 21,333 acres of irrigated land, and roughly 3,194 groundwater wells within the SRWC (Fig. 6, States West 2003).

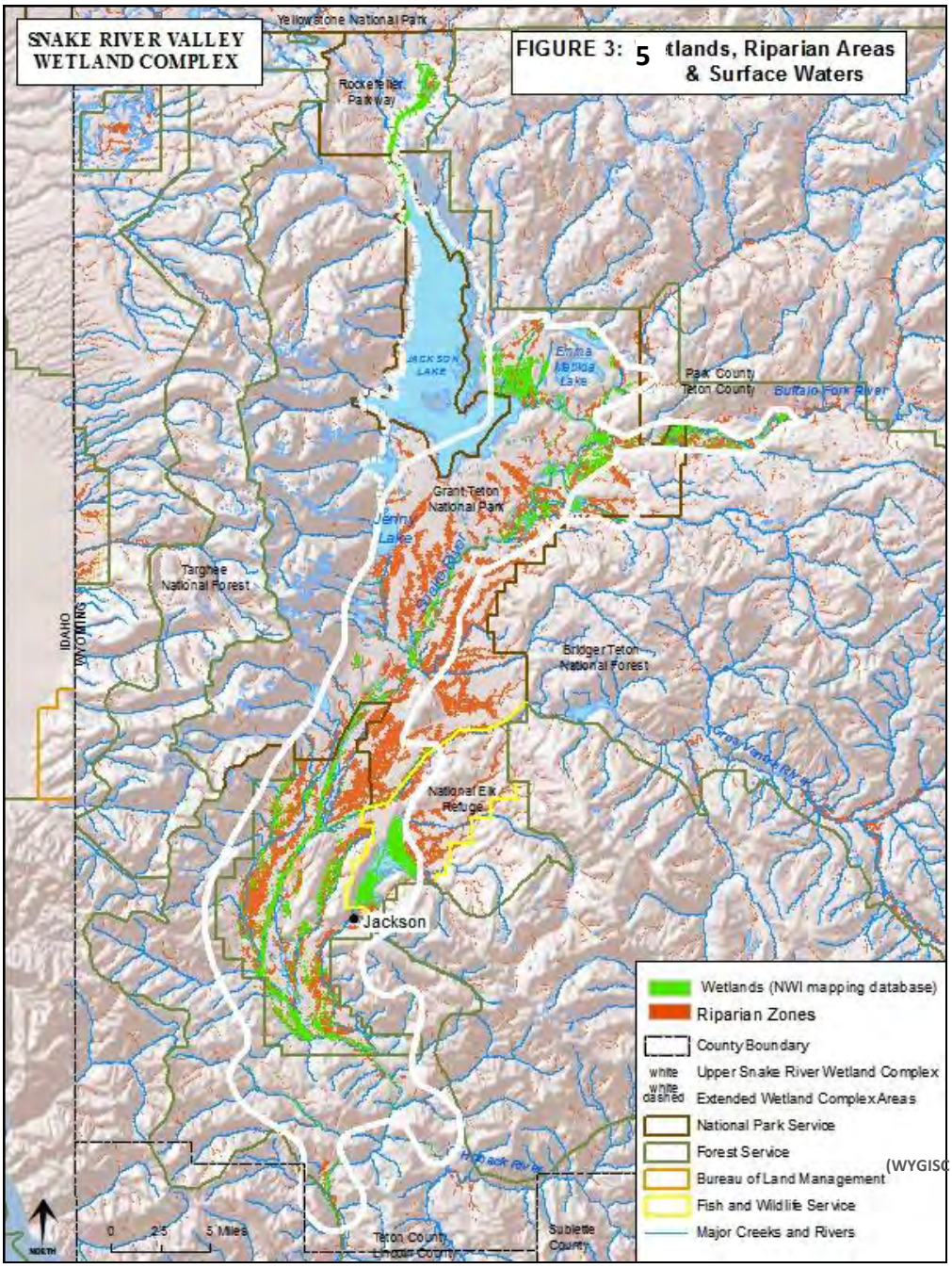

Fig. 5. Wetlands, riparian areas, and surface waters.

Wetlands

Wetlands serve many important ecological functions such as water and carbon storage, water quality improvement, wildlife habitat and focal areas of biodiversity (McKinstry et. al. 2004, Mitsch and Gosselink 2007). Wetland locations and forms within the SRWC derive primarily from past glacial and riverine processes (Figs. 4, 7, 8)). Approximately 17,626 acres of seasonally flooded palustrine wetlands were mapped by the National Wetlands Inventory (NWI) within the SRWC (Fig. 9). The largest densities of wetlands are located at Jackson Lake and on the National Elk Refuge (Figs. 10, 11). A general summary of the common wetlands types within the SRWC follows:

Table 1. NWI wetland types within the SRWC.

System Level	Class Level	Geomorphology	Water Source	Hydroperiod
Riverine (associated with flowing water)				
(6,354 ac.)	Emergent	stable shorelines, flood channels, oxbows	channel flow, overbank flow	seasonal
	Unconsolidated Shore	braided channels, coarse substrate	channel flow, overbank flow	seasonal
Palustrine (small without flowing water, Figs. 12-15)				
(17,626 ac.)	Aquatic Bed	depressions, potholes, sloughs	groundwater, precipitation, seeps, springs	seasonal, perennial
	Emergent	depressions, potholes, sloughs	groundwater, precipitation, seeps, springs, flood irrigation	seasonal
	Forested/Scrub-Shrub	floodplains, Depressions	groundwater, precipitation, seeps, springs	seasonal
Lacustrine (larger and lake-like, includes deepwater aquatic habitats, e.g. Jenny Lake)				
(30,523 ac.)	Aquatic Bed & Unconsolidated bottom	glacial scour & end moraines	streams, groundwater	perennial
	Emergent	fine substrate (shoreline fringe)	overbank flow	perennial, seasonal
	Unconsolidated Shore	coarse substrate	waterbody	perennial, seasonal

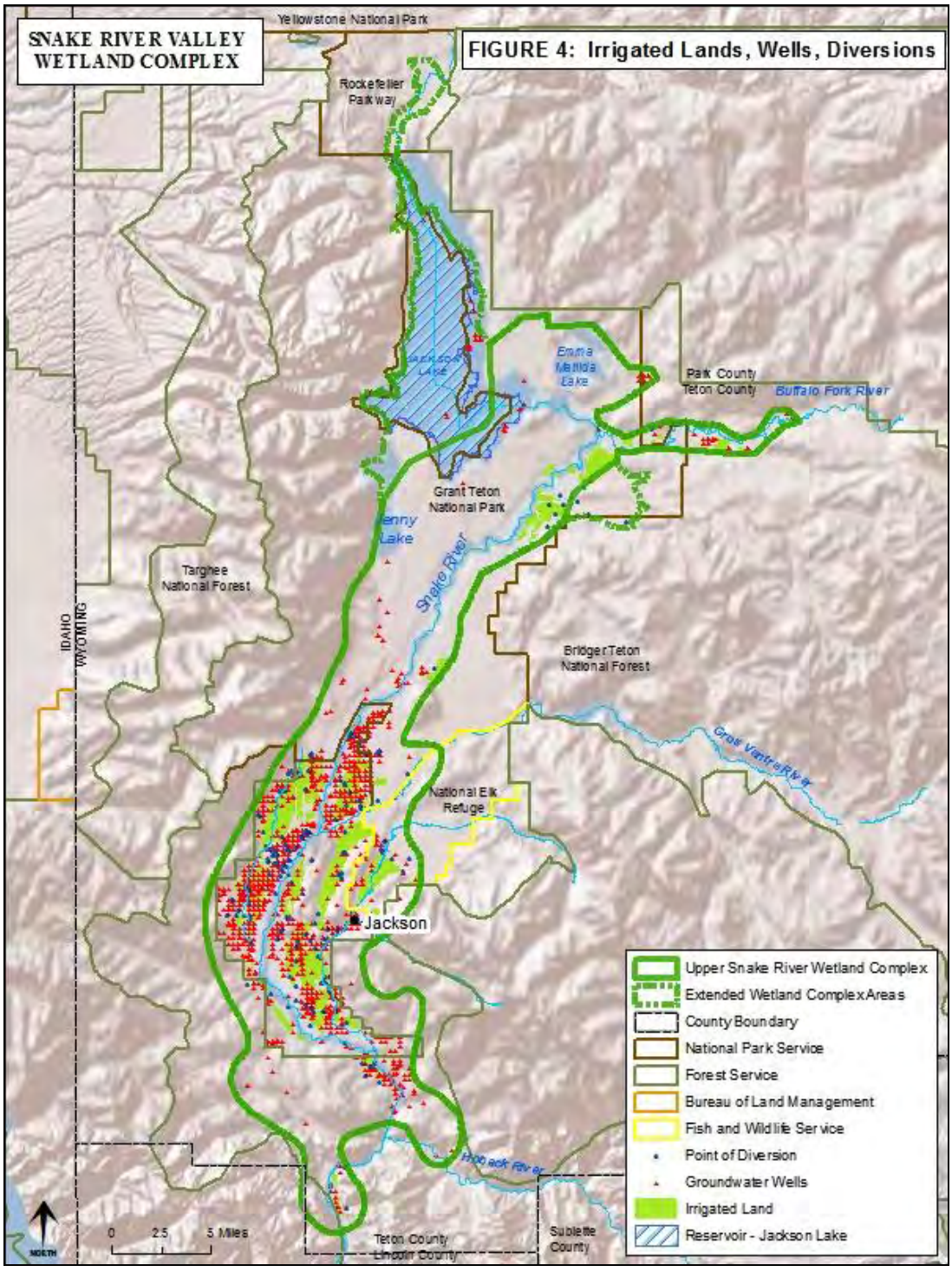

Fig. 6. Irrigated lands, wells, and diversions.

Fig. 7. Riverine wetland, riparian shrubs, and forest adjacent to an oxbow.

Fig. 8. Riverine emergent wetland and riparian forest on the Snake River floodplain.

Fig. 9. Palustrine scrub-shrub and emergent wetland.

Fig. 10. Palustrine scrub-shrub and emergent wetland adjacent to Jackson Lake.

Fig. 11. Palustrine emergent and aquatic bed wetlands on the National Elk Refuge.

Fig. 12. Palustrine emergent scrub-shrub and aquatic bed wetlands

Fig. 13. Creek and palustrine emergent, scrub-shrub riverine wetland.

Fig. 14. Palustrine wetland within a portion of the Snake River floodplain cut off by levees.

Fig. 15. Emergent and scrub-shrub wetlands along an irrigation ditch.

Wetlands have been constructed throughout hundreds of acres within the SRWC to create and enhance wildlife habitat, mitigate or reclaim gravel quarries, and treat wastewater (Figs. 16, 17) among other purposes. Approximately 292 acres of wetlands were constructed in 1991 to mitigate impacts caused by the Jackson Lake dam and reservoir. Mitigation sites included the WGFD South Park Habitat Unit (Fig. 16) and the National Elk Refuge (Fig. 11). Other wetlands were created in conjunction with private trout ponds or for primarily aesthetic purposes. Many constructed wetlands are maintained by sources of supplemental water such as groundwater wells and water diverted from streams.

Fig. 16. Constructed wastewater treatment ponds and associated wetlands on the South Park WHMA.

Fig. 17. Constructed stormwater treatment wetland at Karns Meadow in Jackson.

Riparian Areas

The floodplain of the Snake River forms a diverse and interconnected mosaic of riparian areas, streams, and palustrine and riverine wetlands (Fig. 5). An estimated 65,630 acres of riparian habitats line 2nd-9th order streams within the SRWC (WYGISC 2009). Riparian areas are typically dominated by narrowleaf cottonwood (*Populous angustifolia*), willow (*Salix spp*.) and alder (*Alnus incana*), often in dense, multistory stands (Fig. 18). Riparian areas delineated through remote sensing analysis overlap with wetlands identified on the NWI map layer.

Federal and private levees along the lower Snake and Gros Ventre Rivers have significantly altered regeneration of cottonwood forests and shrub understories. Cattle grazing and encroachment by upland shrubs and conifers have caused a significant loss of habitat diversity (Fig. 19).

Fig. 18. Alder and cottonwood riparian habitat with dense herbaceous understory within the Snake River floodplain.

Fig. 19. Cottonwood forest riparian zone isolated from the Snake River by levees and grazed by livestock.

Ecological & Vegetative Land Cover Types

The GAP national land cover data, based on the NatureServe Ecological Systems Classification, is the most detailed, consistent map of vegetative associations available for the United States and was used to inventory important wetland, riparian and upland habitat in the SRWC (Fig. 20). The WGFD State Wildlife Action Plan (2010) uses the GAP Landcover Ecological Systems to characterize and quantify habitats in Wyoming. Grand Teton National Park (2005) and the National Elk Refuge (2009) have recently completed vegetation mapping projects using remote sensing and ground truthing techniques. A simple comparison of the NWI, NatureServe, and Grand Teton National Park/National Elk Refuge vegetation cover layers for the area covered by the GTNP vegetation mapping is provided in Table 2. The quantified cover types from these vegetation inventories were generally within 10-20% of each other.

Teton County, Wyoming government is currently in the process of mapping vegetation types on private lands within the county. The final digitized product will be similar to the 2005 GTNP mapping project and is projected for completion in the fall of 2014.

Managed Wetlands and Riparian Habitats

WGFD, the National Elk Refuge, and local nonprofit organizations including the Wyoming Wetlands Society and Teton Science Schools all manage constructed and natural wetlands primarily for waterfowl habitat.

WGFD manages the South Park WHMA at the southern end of the SRWC. This 1,200 acre WHMA includes 50 acres of natural and created wetlands managed to provide nesting, brood rearing, and migration habitat for waterfowl including trumpeter swans. Cottonwood riparian corridors along the Snake River and Flat Creek also provide nesting habitat for ospreys and bald eagles, and wintering habitat for resident and migrating eagles. The WHMA serves as an elk winter feed ground and is open to hunters, anglers and recreationists on a seasonal basis. The Wyoming Statewide Comprehensive Outdoor Recreation Plan (SCORP) identified the South Park–Jackson management area as the sixth "Fine-Scale Prioritization" in the state due to "High waterfowl production, winter trumpeter swan habitat, and nesting/wintering bald eagle habitat"(WY Dept. of Commerce 1995).

Table 2. Areas of wetland, riparian and open water cover types estimated from 3 landcover mapping sources.

Landcover Mapping Source	Cover Type (acres)		
	Wetlands	Open Water	Riparian
GTNP/NER	15,413	36,145	7,924
GAP NatureServe *	18,179	32,126	9,668
NWI *	17,084	31,313	n/a

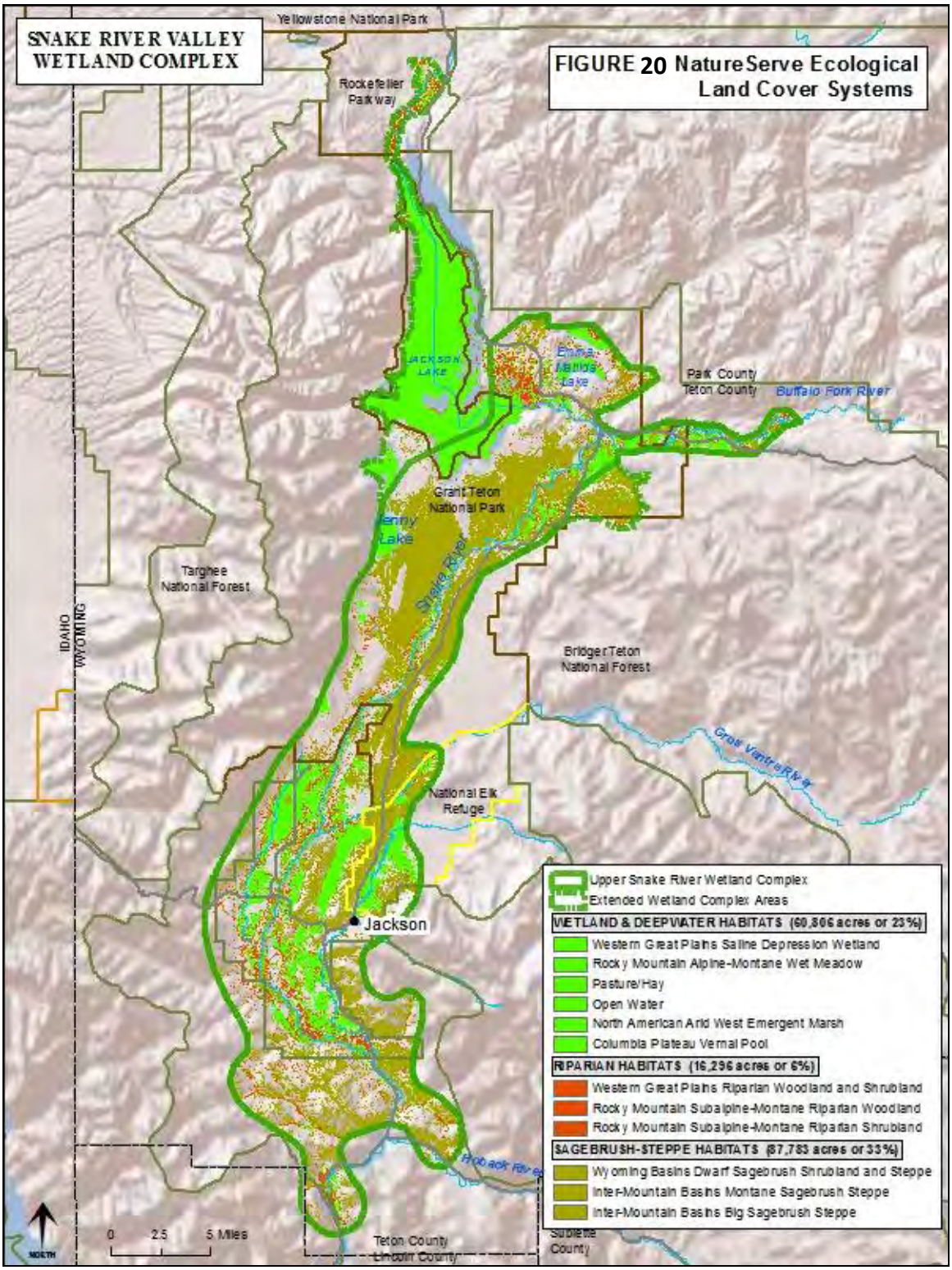

Fig. 20. NatureServe ecological landcover classifications within the SRWC.

WETLANDS AND RIPARIAN HABITAT ASSOCIATED WILDLIFE

Wetlands and riparian habitats are vitally important to birds and other wildlife inhabiting the arid, high elevation basin of the Upper Snake River. Such habitats as sedge marshes, willow bottoms, cottonwood forests, and mixed riparian woodlands are essential and often limiting to scores of species during breeding, migration and winter periods.

Twenty-five bird (Table 3) and 11 mammal (Table 5) "Species of Greatest Conservation Need" (SGCN) are affiliated with wetlands and riparian habitats in the SRWC (WGFD 2010a, www.wgfd.wyo.gov). In addition, 75 species of waterfowl and other waterbirds (Table 4) and dozens of more common bird and mammal species use the wetlands of the basin (WGFD 2010, www.wgfd.wyo.gov). The SRWC includes portions of 2 Bird Habitat Conservation Areas (BHCAs) identified in the Coordinated Implementation Plan for Bird Conservation in Wyoming (WSC-IWJV 2005) (Fig. 21). BHCAs are geographic areas with the best opportunities for bird conservation projects.

BIRDS

Raptors

Many raptors use wetlands and riparian habitats for hunting, roosting and nesting. Bald Eagle and Osprey in particular are closely affiliated with rivers and lakes. The Osprey is an obligate piscivore, and resident Bald Eagles in the Snake River drainage forage primarily on fish (Harmata and Oakleaf 1992). Both species nest in large trees usually within view of water bodies. Other raptors such as Red-tailed Hawk, Swainson's Hawk, Cooper's Hawk, Sharp-shinned Hawk, American Kestrel, and Great Horned Owl often nest in riparian woodlands. The Northern Harrier frequently hunts over grassy wetlands and nests on the ground in wet meadows and grasslands (Ehrlich et al. 1988). Migrating and nesting falcons (including Peregrine, Prairie, and Merlin) forage along major river corridors and tributaries response to concentrations of prey in these habitats. Northern Goshawk, Northern Pygmy Owl, and Great Gray Owl are generally associated with conifer forest, but often use riparian cottonwood forests for roosting and foraging in winter.

All raptors are protected under the Migratory Bird Treaty Act and eagles are protected under the Bald and Golden Eagle Protection Act (USFWS 2012). The Bald Eagle, Northern Goshawk, Great Gray Owl, Peregrine Falcon, Swainson's Hawk, Merlin and Northern Pygmy Owl are classified as Wyoming SGCN (WGFD 2010).

Bald Eagle: The Snake River drainage contains the highest density of bald eagle nest sites in Wyoming (Harmata and Oakleaf 1992). Hundreds Bald Eagles from northern Canada also migrate annually through the area. Numbers peak in October and November when eagles congregate to forage on carcass remains during the late elk hunt in Jackson Hole (WGFD 2010), and to prey on fish and migrating waterfowl along the river. A small number overwinter in Jackson Hole, but most migrate to more southern states. Craighead Beringia South has conducted research on bald eagles within the vicinity of the SRWC. Information about their research is available at beringiasouth.org/avian-projects.

The potential loss of large mature cottonwoods and other trees along river corridors could limit eagle nesting habitat in the future. Additional concerns include persistence of native fish as a prey source, diseases, contaminates, and increasing human recreation activity and development (WGFD 2010).

Waterfowl

On a continental scale, the Upper Snake River is not considered a major waterfowl concentration area. Aquatic and wetland habitats in the basin serve as regionally important nesting and migration habitat. Many of the waterfowl that migrate through the area stop to rest and forage in the Great Salt Lake marshes during spring and fall. Smaller numbers of cold-hearty waterfowl overwinter along the Snake River corridor or where springs maintain open water during cold temperatures. At least 25 species of ducks and geese have been documented in Jackson Hole, and 21 are known to breed there (Orabona 2012, Raynes 2008). Dabbling ducks and geese prefer shallow ponds and creeks surrounded by marshy areas. Goldeneyes and Mergansers inhabit the Snake River proper and some of the larger lakes. Trumpeter Swan, Northern Pintail, Canvasback, Redhead, Barrow's goldeneye, Harlequin Duck and Lesser Scaup are classified as Wyoming SGCN.

Trumpeter Swan: The Trumpeter Swan was nearly extirpated by the early 20th century. Only 60 to 70 resident birds were thought to persist in the Greater Yellowstone region of Wyoming, Idaho and Montana by the 1930s. A concerted conservation effort restored the population to about 500 birds by the 1950s, but numbers declined sharply after a winter feeding program was discontinued at Red Rock Lakes NWR in 1993. The population increased afterward and in recent years (since 2006) has fluctuated about an average of slightly over 370 resident adults (USFWS 2012d). Important swan habitats include shallow marshes, ponds, lakes, river oxbows, and slow-moving creeks (WGFD 2010).

Swans were reintroduced to the Green River drainage beginning in the early 1990s (Patla and Oakleaf 2004, Patla 1999-2011). Currently, about 125 resident birds are distributed between the Snake River drainage (40%) and the Green River drainage (60%) in western Wyoming. The growth rate of the Green River segment continues to be robust, whereas overall trends in numbers and productivity of resident swans have declined slightly in the Snake River core area. Up to ten times as many swans are present in Wyoming during winter months due to a major influx of swans from interior Canada. The Canadian segment has increased greatly over the past 25 years (USFWS 2012d). From November to mid-March, largest numbers of wintering swans (over 300) concentrate along the open spring creeks adjacent to the Snake River. During extended cold snaps, swans retreat to the main river where lack of food and cover can result in high mortality levels in some years. In the nesting season, the majority of swans move to public lands. However in winter, almost all swans rely on aquatic habitats within the private land portions of the Snake River area.

Resident trumpeter swans in Wyoming are part of the Tri-state Area Flocks of the Rocky Mountain Population and managed through the Pacific Flyway (USFWSPFC 2012). Conservation concerns in Wyoming include limited nesting and wintering habitat, long-term drought, collisions with powerlines, illegal shooting, competition with increasing numbers of migrant swans, sensitivity to human activity, habitat loss and fragmentation, and low recruitment of subadults into the nesting population (WGFD 2010 PFC 2012).

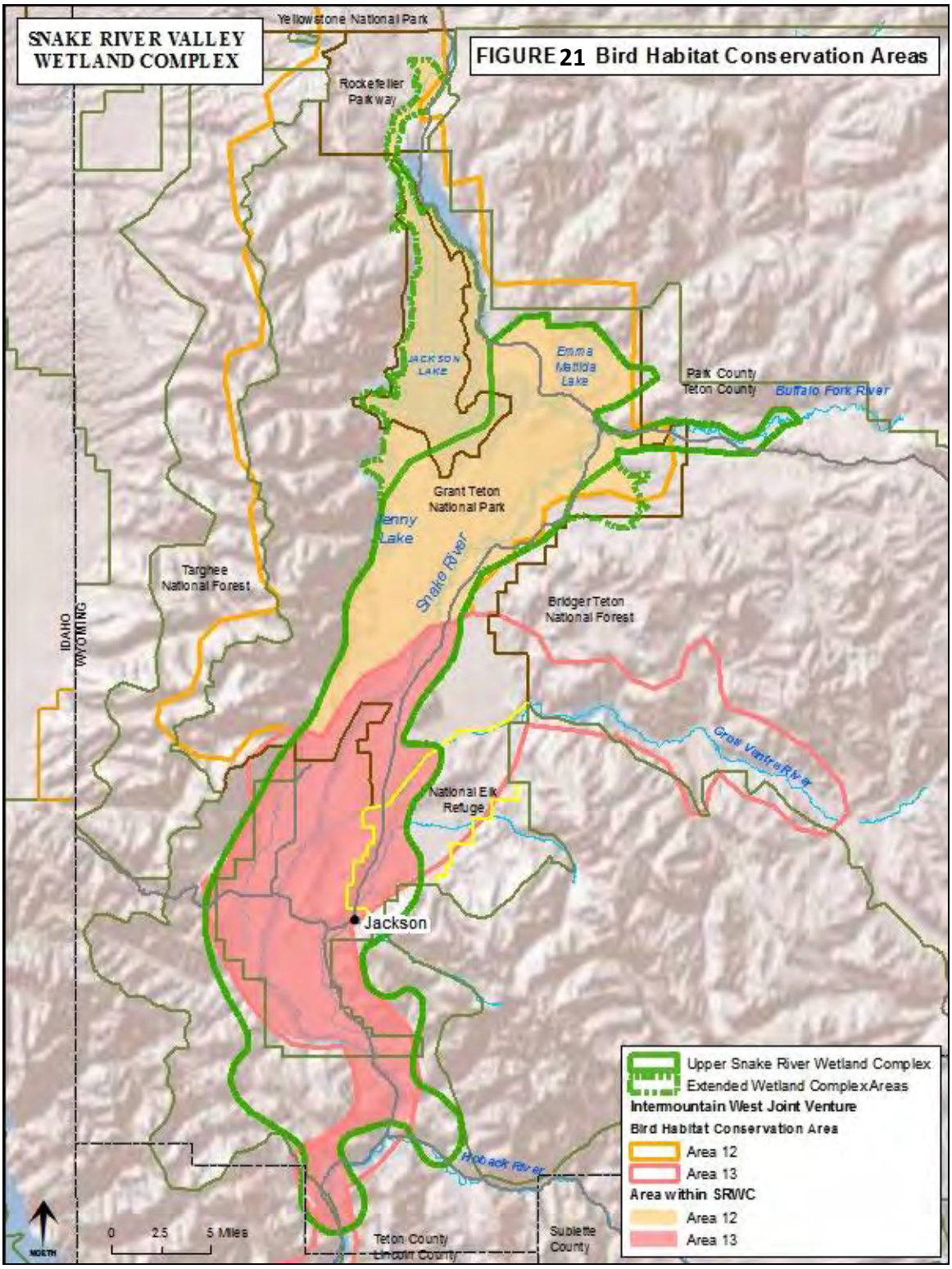

Fig. 21. Bird habitat conservation areas within the SRWC.

Waterbirds & Shorebirds

At least 49 species of waterbirds and shorebirds have been documented in Jackson Hole. Most migrate through the area, however 17 species are known to breed there (Orabona 2012, Raynes 2008). Eleven species are classified as Wyoming SGCN: Common Loon, American Bittern, Black-Crowned Night-Heron, White-Faced Ibis, Virginia Rail, Long-billed Curlew, Franklin's Gull, Caspian Tern, Forster's Tern, Black Tern, Clark's Grebe, and Greater Sandhill Crane (WGFD 2010).

Marshes, shallow wetlands, lakes with shallow and marshy margins, and seasonal mudflats are important habitats for waterbirds and shorebirds. Grebes, pelicans and loons inhabit the deep waters of Jackson Lake and many migratory shorebirds forage on the seasonal mudflats created by lake level management (Raynes and Wile 1994).

Common Loon, American Bittern, Virginia Rail, Long-billed Curlew, and Greater Sandhill Crane (Fig. 22) breed in Jackson Hole, but only the latter two are common (Raynes 2008). Both breed in moist grasslands – the curlew in grassy meadows near water and the crane in shallow wetlands, usually with nest mounds surrounded by water. Common Loons nest on emergent vegetation at the edge of shallow water, in association with deep water lakes. Loon nests are especially vulnerable to disturbance and water level fluctuations. Loons that nest in the Jackson area and in Yellowstone National Park represent the most southerly nesting loons in North America and are isolated from other breeding populations (WGFD 2010). Virginia rails nest in cattails, reeds and dense grass, and the bittern on dry ground or mud in tall emergent vegetation (Ehrlich et al. 1988). American Bitterns are rarely observed in the Jackson area; the last documented record in 2010 was from the extensive marshes along the Snake River south of Flagg Ranch in GTNP (WGFD records, Susan Patla).

Fig. 22. Sandhill Cranes within the Flat Creek wetlands on the National Elk Refuge.

Landbirds

Highest densities and diversities of landbirds in the arid west are associated with wetlands and riparian habitats. Many landbirds are neotropical migrants that winter in Mexico, Central or South America. Riparian woodlands and willow bottoms provide essential nesting and foraging habitat for dozens of species during the breeding season. In late summer and early fall, many other landbirds move into riparian habitats to forage and store energy prior to migration.

Four landbird species that rely on riparian or wetland habitats in the USRB are classified as Wyoming SGCN: Greater Sage-grouse, Lewis's Woodpecker, Willow Flycatcher, and Yellow-billed Cuckoo (WGFD 2010). Sage-grouse, Lewis's Woodpecker and Willow Flycatcher breed in Jackson Hole. The Yellow-billed Cuckoo is a rare visitor to the area (Raynes 2008).

The Wyoming Bird Conservation Plan identifies 16 priority landbird species associated with wetlands, plains/basin, or montane riparian habitats in the USRB (Nicholoff 2003):

- Level I (Conservation Action Needed) – Greater Sage-grouse;
- Level II (Monitoring Needed) – Yellow-billed Cuckoo, Western Screech Owl, Black-chinned Hummingbird, Broad-tailed Hummingbird, Lewis's Woodpecker, Willow Flycatcher, Hammond's Flycatcher, Cordilleran Flycatcher, Marsh Wren, American Dipper, Macgillivray's Warbler, Wilson's Warbler;
- Level III (Local Conservation Action/ Monitoring) – Northern Rough-winged Swallow, Lazuli Bunting and Bullock's Oriole.

Greater Sage-grouse

Although the Greater Sage-grouse is an obligate of sagebrush shrub-steppe, we identify it in this plan because of the species' dependence on mesic habitats for brood-rearing. In summer, adults and broods forage for forbs and insects in moist sites including wet meadows and riparian habitats immediately adjacent to sagebrush (WGFD 2010, Paige 1999).

Range-wide, Greater Sage-grouse have been in long-term decline. In 2002 and 2003, the species was petitioned for listing under the Endangered Species Act (ESA). Sage-grouse are still relatively common in Wyoming where much of the core habitat remains. The small population in Jackson Hole is largely isolated and near the upper limit of elevation and snow depth where the species can survive. Federal and state agencies, nonprofit groups and private landowners are engaged in cooperative efforts to conserve sage-grouse habitats and prevent the need for listing the species.

MAMMALS

Moose: The Shiras moose (*Alces alces shirasi*), is a relatively recent immigrant from Idaho and Montana: there is no archaeological evidence of moose prior to the 19th century in Wyoming. Preferred habitats include stands of willow and other deciduous vegetation, often within or adjacent to conifers. Moose in the basin generally use mid- to upper-elevation conifer forests during spring, summer and fall, then move to riparian habitats at lower elevations in winter. Wintering moose often occupy residential areas where they are attracted to a variety of ornamental trees and shrubs (TSS 2008, WGFD 2010a). Moose have declined statewide and in the USRB. However, monitoring moose populations is difficult and causes of the declines are not well understood. Habitat condition, predation, parasites and disease have been cited as contributing factors (TSS 2008, WGFD 2010). The Jackson moose herd winters in 4

major riparian complexes in the basin. Individual moose tend to remain the same local area for lengthy periods until browse is depleted (TSS 2008).

Northern River Otter: The river otter (*Lontra canadensis*) was historically extirpated from most of Wyoming, but has re-colonized much of its former range. A lack of status information and statewide inventories resulted in a reclassification of its state Native Species Status to Unknown (NSSU). The river otter occupies lakes, and streams within healthy riparian systems (Fig. 23). Otters are closely associated with bog lakes, beaver lodges, and banks containing burrows excavated by other semi-aquatic mammals. Habitat alteration and contamination of aquatic systems are concerns (WGFD 2010a).

Fig. 23. River Otter along the Snake River in Grand Teton National Park.

Bats: Six bat species that occur in the USRB are Wyoming SGCN: Townsend's big-eared bat (*Corynorrhinus townsendii*), long-eared myotis (*Myotis evotis*), long-legged myotis (*Myotis volans*), big brown bat (*Eptesicus fuscus*), little brown myotis (*Myotis lucifugus*), and western small-footed myotis (*Myotis ciliolabrum*). These bats are year-round residents and hibernate during winter months (WGFD 2010a).

These species range across several habitat types, but concentrate along riparian and wetland areas for feeding and commuting. Riparian woodlands, particularly deciduous forests, also provide cavities for roosting. All six species are sensitive to human disturbance and may respond by abandoning young and roosts (WGFD 2010a).

Small Mammals: Three species of small mammals in the USRB are Wyoming SGCN: water vole (*Microtus richarsoni*), Preble's shrew (*Sorex preblei*), and vagrant shrew (*Sorex vagrans*). The water vole occupies wet alpine and subalpine meadows and streamside habitats, and is vulnerable to overgrazing and climate change. Preble's shrew is only found in far northwestern Wyoming, including the Snake River Canyon. This species is associated with sagebrush shrub-steppe and also occupies habitats near creeks, bogs, willow and riparian shrub and grassy marshes. The vagrant shrew is associated with a

variety of riparian shrub and marsh habitats, particularly those areas with accumulated leaf litter and rotting logs (WGFD 2010a). Vagrant shrews are widely distributed in Wyoming.

Beaver: Although not classified as a species of conservation concern, beaver (*Castor canadensis*) fulfill a key ecological role in the creation and dynamics of wetlands and riparian habitats (Fig. 24). Beaver dams broaden stream floodplains, raise the water table, trap sediments, improve water quality and increase growth of riparian vegetation. Beaver ponds also help maintain year-round stream flows and prolong late season flows in intermittent streams. Beaver ponds and associated wetlands provide important habitat for waterfowl, fish, amphibians and aquatic mammals. Enhanced growth of riparian vegetation around active and abandoned beaver ponds sustains a much greater diversity and abundance of bird species (WGFD 2010a).

Once abundant and broadly distributed, by the early 19th century beaver were largely trapped out by the fur trade. Historic decimation of the beaver population altered stream and upland ecology and greatly reduced the extent of beaver-created wetlands. Today, beavers have reoccupied most of their historic range, but at only about 10% of densities prior to European contact (Naiman et al. 1988, WGFD 2010a). The Wyoming State Wildlife Action Plan (WGFD 2010a) encourages beaver restoration to enhance stream and riparian habitats where it will not create conflicts due to unwanted flooding and tree damage.

The Wyoming Wetland Society instituted a beaver restoration project in 2004 to assist local landowners by relocating problem beavers. The beaver have been relocated to areas of the Gros Ventre River and adjacent drainages to restore and maintain wetland habitats.

Fig. 24. Beaver dam on a side channel of the Snake River.

REPTILES AND AMPHIBIANS

Several reptile and amphibian SGCN use wetlands and riparian areas within the SRWC. They include: wandering garter snake (*Thamnophis elegans vagris*), boreal toad (*Anaxyrus boreas*), boreal chorus frog (*Pseudacris triseriata maculate*), spotted frog (*Rana* spp.) and northern leopard frog (*Lithobates pipiens*) (WGFD 2010a). Amphibians serve as an indicator species for monitoring riparian and wetland health. They are also an important link in terrestrial and aquatic food webs. Surveys of amphibians and reptiles have been conducted in Grand Teton National Park and the National Elk Refuge since the early 1990s. These efforts have increased since 2000, supported by the USGS Amphibian Research and Monitoring Initiative and the NPS Inventory and Monitoring Program (Patla and Jean 2010). Threats to amphibians include the disease chytridiomycosis, chemical contaminants such as pesticides, UV-radiation, invasive species, road, residential development and drought.

AQUATIC WILDLIFE

Fish

Twenty-one species of fish inhabit waters of the SRWC. Five are considered SGCN in Wyoming: bluehead sucker (*Catostomus Discobolus*), northern leatherside chub (*Snyderichthys copei*), mountain whitefish (*Prosopium williamsoni*), Snake River cutthroat (*Oncorhynchus clarkia*), and Yellowstone cutthroat (*Oncorhynchus clarkii bouvieri*) (WGFD 2010a). Healthy riparian areas and wetlands fulfill several important habitat requirements of fish in the SWRC. Overhanging vegetation, wood debris, and undercut banks provide shade, cover and current breaks. Riparian areas are also sources of terrestrial insects. Adjacent and connected floodplain wetlands can serve as nursery areas, sources of aquatic insects and plants, and they accumulate organic detritus that is a base of the aquatic food chain. Riparian areas and floodplain wetlands exert a direct influence on stream stability, base flows, and channel morphology, which determine the character of the fishery.

Crustaceans and Mollusks

Crustaceans and mollusks are important links in stream, riparian and wetland food webs. The Pilose crayfish (*Pacifastacus gambelii*), western pearlshell (*Margaritifera falcata*) and Jackson Lake springsnail (*Pyrgulopsis robusta*) are identified as SGCN within the SRWC (WGFD 2010a).

Table 3. Bird species of greatest conservation need (SGCN) associated with wetland, riparian or aquatic habitats within the USRB (WGFD 2010a). [Birds of Jackson Hole abundance codes: C = common; O = occasional; R = rare; X = accidental. (Raynes 2008)]

Native Species Status	Priority Tier	USFWS ESA or BCC	SPECIES	PRIMARY HABITAT	SECONDARY HABITAT	NAWCA - BCR10	PIF - PA64	PIF - WY	IWSCP	NAWCP	IWWCP	Documented		Birds of Jackson Hole Abundance* (Raynes 2008)			
												BREEDING	MIGRATORY	Spring	Summer	Fall	Winter
NSS1	I		**Common Loon**	Lakes				II			X	X	X	o	o	o	x
NSS2	I		**Greater Sage-grouse**	Shrub-steppe	Wet Meadows		X	I				X		c	c	c	c
NSS2	I	BCC	**Bald Eagle**	Riparian	Coniferous Forest	X		I				X	X	c	c	c	c
NSS2	II		**Trumpeter Swan**	Lakes, Rivers	Wetlands		X	I				X	X	c	c	c	c
NSS3	II		**Black-crowned Night Heron**	Wetlands	Lakes								X	r	r	r	
NSS3	II	BCC	**American Bittern**	Wetlands				I	X		X	X	X	o	o	o	-
NSS3	II		**White-faced Ibis**	Wetlands						X			X	o	-	-	-
NSS3	II		**Northern Pintail**	Lakes, Rivers	Wetlands							X	X	o	o	c	c
NSS3	II		**Canvasback**	Lakes, Rivers	Wetlands							X	X	o	r	o	-
NSS3	II		**Redhead**	Lakes, Rivers	Wetlands							?	X	o	o	c	-
NSS3	II		**Lesser Scaup**	Lakes, Rivers	Wetlands							X	X	o	o	o	-
NSS3	II		**Harlequin Duck**	Lakes, Rivers				II				X	X	o	o	o	-
NSS3	II		**Barrow's Goldeneye**	Lakes, Rivers	Riparian		X					X	X	c	c	c	o
NSS3	II		**Virginia Rail**	Wetlands								X	X	o	o	o	x
NSS3	II	BCC	**Long-billed Curlew**	Shrub-steppe, grasslands	Mudflats			I				X	X	c	c	o	

Table 3 continued

Native Species Status	Priority Tier	USFWS ESA or BCC	SPECIES	PRIMARY HABITAT	SECONDARY HABITAT	NAWCA - BCR10	PIF - PA64	PIF - WY	IWSCP	NAWCP	IWWCP	Documented		Birds of Jackson Hole Abundance* (Raynes 2008)			
												BREEDING	MIGRATORY	Spring	Summer	Fall	Winter
NSS3	II		**Franklin's Gull**	Wetlands	Lakes		X	I		X	X		X	o	o	o	-
NSS3	II		**Caspian Tern**	Wetlands	Lakes					X	X		X	r	o	o	-
NSS3	II		**Forster's Tern**	Wetlands	Lakes			I			X		X	r	r	r	-
NSS3	II		**Black Tern**	Wetlands	Lakes			I	X				X	o	o	o	-
NSSU	II	BCC	**Lewis's Woodpecker**	Riparian	Coniferous Forest	X	X	II				X	X	o	o	r	-
NSS4	III		**Greater Sandhill Crane**	Wetlands	Shrub-steppe						X	X	X	c	c	c	
NSS4	III	BCC	**Willow Flycatcher**	Riparian		X		II				X	X	o	o	o	-
NSSU	II		**Clark's Grebe**	Lakes	Wetlands			III					X	o	o	o	-
NSSU	II	BCC	**Swainson's Hawk**	Riparian	Shrub-steppe	X	X	I				X	X	c	c	c	
NSSU	III	Can.	**Yellow-billed Cuckoo**	Riparian		X		II					X	r	r	r	-

*abundance codes are based on likelihood of observing these species rather than actual numbers

NSS: Native Species Status, Wyoming State Wildlife Action Plan (SWAP)

Priority Tier: Conservation Priority, Wyoming State Wildlife Action Plan (SWAP): I = highest; II = moderate; III = lower.

USFWS: Can. = Candidate for Threatened or Endangered Species status; BCC = Birds of Conservation Concern

NAWCA - BCR10: Priority bird species in Bird Conservation Region 10 as identified by North American Wetland Conservation Act.

PIF – PA64: Partners in Flight North America Physiographic Area 64 Level 1 Priority Species

PIF WY: Wyoming Partners in Flight Bird Conservation Plan

IWSCP: Intermountain West Shorebird Conservation Plan

NAWCP: North American Waterbird Conservation Plan

IWWCP: Intermountain West Waterbird Conservation Plan

Table 4. Waterfowl, waterbirds, and shorebirds that occur within the USRB, and their classifications in various conservation plans. [Birds of Jackson Hole abundance codes*: C = common; O = occasional; R = rare; X = accidental. (Raynes 2008)]

WGFD SGCN - NSS	Priority Tier	USFWS	Species	NAWMP - WCR10	NAWCA - BCR10	PIF - PA64	PIF - WY	IWSCP – No. Rockies	NAWCP	IWWCP - BCR10	ABC/Audubon Watchlist	Breeding	Migratory	Birds of Jackson Hole Abundance* (Raynes 2008)			
														Spring	Summer	Fall	Winter
			WATERFOWL														
			Tundra Swan										x	o	-	o	o
NSS2	II		**Trumpeter Swan**	High		X	I				X	x	x	c	c	c	c
			Ross's Goose											r	r	r	r
			Snow Goose										x	o	-	o	r
			Canada Goose	Mod Low								x	x	c	c	c	c
			Wood Duck	Moderate								x	x	r	r	r	r
			Green-winged Teal	Moderate								x	x	c	c	c	o
			Mallard	High								x	x	a	c	a	c
NSS3	II		**Northern Pintail**	High								x	x	o	o	c	c
			Blue-winged Teal									x	x	c	o	c	r
			Cinnamon Teal	Mod High								x	x	o	o	r	x
			Northern Shoveler	Moderate								x	x	o	r	o	o
			Gadwall	Moderate								x	x	c	o	c	o
			American Wigeon	Mod High								x	x	c	c	c	r
NSS3	II		**Canvasback**	Mod High								x	x	o	r	o	-
NSS3	II		**Redhead**	Mod High								?	x	o	o	c	-
			Ring-necked Duck	Moderate								x	x	o	c	c	r
NSS3	II		**Lesser Scaup**	High								x	x	o	o	o	-
NSS3	II		**Harlequin Duck**	Moderate			II					x	x	o	o	o	-
			Common Goldeneye	Mod High								x	x	o	o	o	o
NSS3	II		**Barrow's Goldeneye**	Moderate		X						x	x	c	c	c	o

Table 4 continued

WGFD SGCN - NSS	Priority Tier	USFWS	Species	NAWMP - WCR10	NAWCA - BCR10	PIF - PA64	PIF - WY	IWSCP – No. Rockies	NAWCP	IWWCP - BCR10	ABC/Audubon Watchlist	Breeding	Migratory	Birds of Jackson Hole Abundance* (Raynes 2008)			
														Spring	Summer	Fall	Winter
			Bufflehead	Moderate								x	x	o	c	o	c
			Hooded Merganser	Mod Low								x	x	r	-	r	o
			Common Merganser									x	x	c	c	c	c
			Red-breasted Merganser										x	o	-	o	?
			Ruddy Duck									x	x	o	o	o	x
			WATERBIRDS & SHOREBIRDS														
NSS1	I		**Common Loon**				II			High		x	x	o	o	o	x
			Pied-billed Grebe							Mod		x	x	o	o	o	r
			Horned Grebe							Low			x	r	r	o	-
			Eared Grebe							Low		?	x	c	o	o	-
			Western Grebe				III		Mod	Mod		x	x	o	o	o	-
NSS4	II		**Clark's Grebe**				III		Low	Mod	X		x	o	o	o	-
			American White Pelican			X	II		Mod	High			x	c	c	c	-
			Double-crested Cormorant									x	x	c	c	c	-
NSS3	II	BCC	**American Bittern**				I			Mod		x	x	o	o	o	-
			Great Blue Heron							Mod		x	x	c	c	c	o
NSS3	II		**Black-crowned Night Heron**						Mod	Mod			x	r	r	r	
			Great Egret											r	r	r	
			Snowy Egret							Mod			x	o	o	o	-
NSS3	II		**White-faced Ibis**						Low	Mod			x	o	-	-	-
NSS3	II		**Virginia Rail**							Mod		x	x	o	o	o	x
			Sora							Mod		x	x	c	c	c	-
			American Coot									x	x	o	o	c	r
NSS3			**Greater Sandhill Crane**							Mod		x	x	c	o	c	-

Table 4 continued

WGFD SGCN - NSS	Priority Tier	USFWS	Species	NAWMP - WCR10	NAWCA - BCR10	PIF - PA64	PIF - WY	IWSCP – No. Rockies	NAWCP	IWWCP - BCR10	ABC/Audubon Watchlist	Breeding	Migratory	Birds of Jackson Hole Abundance* (Raynes 2008)			
														Spring	Summer	Fall	Winter
			Black-bellied Plover										x	r	-	r	-
			Semipalmated Plover										x	r	-	r	-
			Killdeer					2				x	x	o	c	c	o
			Black-necked stilt					3					x	r	x	x	
			American Avocet				III	3				x	x	o	o	o	-
			Greater Yellowlegs					3					x	o	o	o	-
			Lesser Yellowlegs					2					x	o	o	o	-
			Solitary Sandpiper					2					x	o	r	o	-
			Willet				III	3				x	x	o	r	o	-
			Spotted Sandpiper					3				x	x	c	c	c	-
NSS3	II	BCC	**Long-billed Curlew**		X		I	4			X	x	x	o	o	o	-
			Marbled Godwit								X		x	o	r	r	-
			Sanderling										x	x	r	x	-
			Semipalmated Sandpiper								X		x	-	r	o	-
			Western Sandpiper					2			X		x	x	r	o	-
			Least Sandpiper					2					x	o	r	o	-
			Baird's Sandpiper										x	r	o	o	-
			Pectoral Sandpiper										x	-	-	r	-
			Stilt Sandpiper										x	r	-	-	-
			Long-billed Dowitcher					2					x	o	o	o	-
			Wilson's Snipe					3				x	x	c	c	c	-
			Wilson's Phalarope				I	3				x	x	-	c	o	r
			Red-necked Phalarope										x	r	-	r	-
NSS3	II		**Franklin's Gull**			X	I		Mod	High			x	o	o	o	-

Table 4 continued

WGFD SGCN - NSS	Priority Tier	USFWS	Species	NAWMP - WCR10	NAWCA - BCR10	PIF - PA64	PIF - WY	IWSCP – No. Rockies	NAWCP	IWWCP - BCR10	ABC/Audubon Watchlist	Breeding	Migratory	Birds of Jackson Hole Abundance* (Raynes 2008)			
														Spring	Summer	Fall	Winter
			Bonaparte's Gull										x	o	-	r	-
			Ring-billed Gull										x	r	o	r	-
			California Gull						Mod	Mod			x	c	c	c	-
NSS3	II		**Caspian Tern**						Low	Low			x	r	o	o	-
			Common Tern						Low				x	-	r	r	-
NSS3	II		**Forster's Tern**				I		Mod	Mod			x	r	r	r	-
NSS3	II		**Black Tern**				I	I	Mod	Mod			x	o	o	o	-

*abundance codes are based on likelihood of observing these species rather than actual numbers

NSS: Native Species Status, Wyoming State Wildlife Action Plan (SWAP)

Priority Tier: Conservation Priority, Wyoming State Wildlife Action Plan (SWAP): I = highest; II = moderate; III = lower.

USFWS: Can. = Candidate for Threatened or Endangered Species status; BCC = Birds of Conservation Concern

NAWMP - WCR10: North American Waterfowl Management Plan priority species

NAWCA - BCR10: Priority bird species in Bird Conservation Region 10 as identified by the North American Wetland Conservation Act.

PIF – PA64: Partners in Flight North America Physiographic Area 64 Level 1 Priority Species

PIF - WY: Wyoming Partners in Flight Bird Conservation Plan: I = conservation action, II = monitoring, II = local interest.

IWSCP – No. Rockies: Intermountain West Shorebird Conservation Plan priority birds in Northern Rockies region; 4 = very important, 3 = important, 2 = slightly important.

NAWCP: North American Waterbird Conservation Plan

IWWCP: Intermountain West Waterbird Conservation Plan

ABC/Audubon Watchlist 2007

Table 5. Mammal species of greatest conservation need (SGCN) associated with wetlands, riparian, or aquatic habitats within the USRB (WGFD 2010a).

NATIVE SPECIES STATUS	PRIORITY TIER	SPECIES	PRIMARY HABITAT	SECONDARY HABITAT	DOCUMENTED IN PROJECT AREA
NSS2	I	**Townsend's Big-eared Bat**	Riparian	Coniferous forests, aquatic	Observed
NSS2	II	**Long-eared Myotis**	Coniferous Forest	Riparian, shrub-steppe, aquatic	Breeding
NSS2	II	**Long-legged Myotis**	Coniferous Forest	Riparian, aquatic	Breeding
NSS3	II	**Big Brown Bat**	Coniferous-deciduous forest	Riparian, aquatic	Breeding
NSS3	II	**Little Brown Myotis**	Riparian	Shrub-steppe, aquatic	Breeding
NSS3	II	**Moose**	Riparian, coniferous forest	Wetlands, shrub-steppe	Breeding
NSS3	II	**Preble's Shrew**	Wetlands	Riparian	Observed
NSS3	II	**Water Vole**	Subalpine/alpine Riparian		Breeding
NSS3	II	**Western Small-footed Myotis**	Shortgrass prairie	Riverbanks, aquatic	Observed
NSS3	III	**Vagrant Shrew**	Riparian	Shrub-steppe	Breeding
NSSU	II	**Northern River Otter**	Riparian	Wetlands	Breeding

WETLAND CONSERVATION PLANS & INITIATIVES

Several agencies and organizations involved in resource management and conservation were invited to contribute the following information for inclusion in this plan.

- Quantitative and qualitative data on wetlands and riparian resources
- Unique GIS layers
- Inventory reports and scientific studies
- Wetland associated wildlife studies
- Management plans and initiatives
- Description of major factors that threaten wetland and riparian integrity and functions
- Description of managed / manipulated wetland systems
- Future wetland and riparian conservation projects

What follows is a brief synopsis of the information these organizations provided as well as a review of relevant information from conservation plans and initiatives. This review is not intended to be all inclusive – many plans are extensive and multifaceted.

Snake River Levee – Environmental Restoration Feasibility

In 1990, Congress authorized the U.S. Army Corps of Engineers (ACOE) to conduct the *Jackson Hole, Wyoming, Environmental Restoration Feasibility Study* (Feasibility Study) (ACOE 2000). The purpose was to investigate feasibility of restoring fish and wildlife habitat that has been degraded by construction, operation, and maintenance of a system of flood control levees completed along the Snake River in 1964. The report recommends an environmental restoration project on a 22-mile reach from Grand Teton National Park to the South Park WHMA.

Before the levee system was built, the Snake River was a complex system of braided channels and wooded islands that provided highly diverse and productive habitat for both aquatic and terrestrial species. The levees were intended to reduce property damage from flooding within the river corridor. However, constraining all flows between the levees caused channel instability and severe habitat degradation (ACOE 2000). Moreover, elimination of the threat of flooding encouraged additional building and infrastructure development within the flood plain. Without remediation, the remaining riparian, wetland and riverine habitats will convert to gravel bars, further reducing biological diversity within the riverine system (ACOE 2000).

Restoration Plans: Two restoration plans were determined feasible: the Initially Proposed National Ecosystem Restoration Plan (Initial Restoration Plan) developed as part of the Feasibility Study; and a second, more Progressive Restoration Plan (Progressive Plan) resulting from subsequent review and coordinated partnering among regional agencies, interest groups, and the study team.

a. Initial Restoration Plan: The plan that was initially proposed involves remediation only at selected sites within the levee system. Only one restoration project has been partially implemented in one area since 2000. Through habitat modeling, the Initial Restoration

Plan was predicted to improve aquatic and riparian habitats by 22 and 153 percent, respectively, over a 50-year period and at a cost of $26.3 million. These habitat improvements are accrued within the project sites and do not apply to the entire section of river impacted by the levee system.

b. Progressive Plan: The Progressive Plan involves remediation of the entire 22-mile levee system from approximately 2 miles south of Moose, Wyoming, downstream to Flat Creek at the South Park WHMA. The Progressive Plan is the Army Corps of Engineers' preferred alternative.

   The Progressive Plan is predicted to improve aquatic and riparian habitats by 28 and 137 percent, respectively, over a 50-year period. The Progressive Plan provides the opportunity for greater ecosystem restoration over a larger geographic area. The expanded restoration effort will also provide greater synergistic effect on adjacent habitats.

Bureau of Land Management – Snake River Resource Management Plan

The Bureau of Land Management (BLM) Snake River Resource Management Plan (RMP) provides management direction for approximately 981 acres of public land surface and 15,123 acres of federal mineral estate administered by the BLM in the Snake River corridor (BLM 2004). The properties evaluated in this RMP are currently in the process of being transferred to Teton County, WY and a separate RMP is being drafted by Teton County. The following management objectives and actions were included in the BLM RMP (BLM 2004).

> VEGETATION MANAGEMENT OBJECTIVE: Maintain or improve the diversity of plant communities to support wildlife habitat, watershed protection, scenic resources, and livestock grazing; control existing noxious weed infestations and prevent their spread.
>
> WATERSHED MANAGEMENT OBJECTIVES: Maintain or improve water quality and comply with Wyoming DEQ water quality standards. Reduce erosion by improving vegetative production and ground cover to maintain or improve wetland and riparian habitat condition.
>
> MANAGEMENT ACTIONS: Riparian areas will be maintained for wildlife habitat as a condition of transfer of the public land parcels. Riparian habitats that are outside the Snake River channel will be maintained in proper functioning condition. (Riparian habitats between the levees on the Snake River are in nonfunctioning condition due to the impact of flood control. This condition will remain unless the levee system is dismantled.)
>
> WILDLIFE AND FISH HABITAT MANAGEMENT OBJECTIVE: Maintain or enhance riparian and upland habitat for wildlife and fish and promote species diversity.
>
> > Wildlife Habitat – Measures to protect avian habitats will include seasonal restrictions on surface-disturbing activities within buffer distances that will be determined based on species, individuals, and/or habitat characteristics. The acquiring or managing agency or entity will make decisions regarding actions necessary to maintain wildlife habitat. To the extent possible, suitable habitat and forage will be provided to support wildlife populations defined in the WGFD

Strategic Plan objectives. Raptor nest sites and roosts, cottonwood trees, riparian areas, and other habitats related to raptor foraging and concentration areas will be protected by restricting surface-disturbing activities on public lands near these habitat areas.

Fish Habitat – Projects that maintain or improve fisheries habitat will be considered to the extent possible in a riverine system that has been modified by levees. Projects that adversely affect fisheries or aquatic habitats will be mitigated to the extent possible. Mitigation could include, but will not be limited to, such considerations as timing to minimize effects. For example, surface-disturbing activities that add sediment to the river will be prohibited during fish spawning or egg incubation periods. If the adverse impacts of a proposed project are unacceptable, the project may not be approved.

Grand Teton National Park

The last Master Plan for Grand Teton National Park (NPS 1976) includes very little mention of wetland and riparian area management. Broadly speaking, the Park's mandate is to preserve, unimpaired, the resources of the park for current and future generations.

The Snake River Management Plan prepared by GTNP in 1997 focused mostly on recreational use of the river (float trips), but does provide much information regarding biological and physical characteristics of the Snake River Corridor in GTNP. The Snake River Management Plan identified the following resource issues (GTNP 1997):

- Observed decline in cottonwood seed regeneration in the riparian areas.
- Changes in the river structure caused by the altered flow regime below Jackson Lake Dam.
- Trumpeter swans do not presently nest in the river bottom areas, but historically nested in the Oxbow Bend area. Two great blue heron rookeries in the Oxbow Bend have also not been used in a number of years.
- Wintering wildlife and areas around nesting raptors are presently protected with closures.
- River side use for meals (up to 500 people at a time – Lodge Company Float Trips) may have an impact on riparian areas.
- Indicators to determine resource conditions include occupancy and productivity of bald eagle nests and the great-blue heron rookery.

The final EIS for the GTNP Transportation Plan (September 2006) is a somewhat useful document to obtain information on wetlands inside the park. The Transportation Plan evaluated wetlands in the context of impacts from improvements (i.e. pathways). The Transportation Plan describes wetlands and hydrologic features along the project area roadways. Mitigation is provided for impacts to wetlands caused by transportation improvements.

> *"The Park is also currently planning several projects that may create mitigation areas. Several locations, such as the Snake River Pit, Lower Flagg Ranch development area, and along the Moose-Wilson Road, will likely have the potential to restore more than 10*

acres combined. The Moose-Wilson Road realignment, which is part of the Final Plan/EIS, is anticipated to restore approximately 2 acres of wetlands."

A *Wyoming Water Resources Scoping Report* completed by GTNP in 1998 evaluated riparian and wetland habitat issues. Hydrologic modification, levees and grazing by wildlife and livestock were considered the most relevant threats to these habitats (GTNP 1998).

Bridger-Teton National Forest

A relatively small portion of the Snake River Valley wetland complex is within the Bridger-Teton National Forest (BTNF). However, activities on the forest can have significant impact on wetlands and riparian areas in the valley. The forest stores the majority of the snowpack and water that sustains wetlands and riparian resources in the valley. The 1986 BTNF Land Resource Management Plan stated that current water quality conditions are "pristine" (BTNF 1986). Potential sources of water quality impairment include livestock grazing, timber harvest, oil and gas development, recreation activities and road building. Specific management prescriptions for riparian areas, wetlands and floodplains are incorporated in the Forest Plan. The prescriptions focus primarily on avoiding impacts to streams and on restoring degraded streams.

In 2007, vegetation was mapped on over 3.4 million acres of the BTNF in western Wyoming (BTNF 2001). This mid-level map and associated products will be used for the BTNF forest plan revision and other purposes related to forest management.

In 2009, the BTNF drafted a Five Year Monitoring Report that describes existing conditions, trends and proposed actions related to plant communities, wildlife and watersheds (including wetland and riparian function) (BTNF 2009). The report concluded resource utilization in certain areas has impacted the extent of riparian areas and their proper functioning condition. Those activities include road construction, pioneered roads and trails, dispersed campsites, and livestock grazing. Many areas are recovering under improved management practices in recent years, whereas others continue to be degraded. Additional impacts to riparian areas are caused by changes in beaver presence, elk concentrated in managed feedgrounds, and changes in natural disturbance regimes that can alter riparian characteristics (e.g., fire suppression, expansion of conifers into riparian areas).

The BTNF identified the following issues as "Need for Change Emphasis Items."

<u>Ecosystem Diversity</u>

- Introduction and spread of noxious weeds cause habitat loss (including riparian); this reduces quality and quantity of wintering (crucial) habitat; reduces forage for birds/small mammals and ungulates.
- Advanced succession and conifer encroachment reduce the abundance and distribution of many wildlife species, especially those associated with willows & meadows.

<u>Watershed Function</u>

- Watershed function is at risk within watersheds rated Condition Class III. These watersheds have higher overall road densities, higher road densities within riparian areas, greater numbers of stream crossings, and the highest percentages of unstable soils.

Improve Streambank Stability

- Channel function is at risk in portions of some cattle allotments because grazing management does not take into account mechanical damage to stream banks. Other activities (e.g., vehicle and equipment use) may also compromise stream banks in certain locations. Where streambank disturbance is excessive, the ability to achieve proper hydrologic function and aquatic habitat condition is compromised (as evidenced by channel widening, loss of water storage in floodplains, and changes in sediment transport).

Improve Riparian Vegetation Management

- Where management documents have not undergone a recent NEPA review, rangeland managers often lack tools to apply appropriate limits to allowable forage use in riparian areas. Field observations by trained ecologists have provided qualitative evidence of declining vigor and extent of riparian vegetation due to excessive utilization on the BTNF. There is clear evidence (published literature) that the "Riparian Range Site Forage Utilization Standard" (page 128 of the current Forest Plan) is not supported by current science.
- Riparian shrubs within some moose winter ranges have become decadent, resulting in lower productivity, palatability and nutritional quality.

National Elk Refuge – Comprehensive Conservation Plan

Nearly 1,600 acres of open water and marshland are present on the National Elk Refuge (NER). The US Fish and Wildlife Service is currently developing a Comprehensive Conservation Plan (CCP) to guide management and use of the NER for the next 15 years. The CCP is scheduled to be completed in spring, 2014 [http://www.USFWS.gov/mountain-prairie/planning/ccp/wy/ner/ner.html]. A Bison and Elk Management Plan (described below) was recently completed in 2007. Accordingly, the CCP will not address bison and elk management on the refuge but will cover other aspects of refuge management including migratory birds, threatened and endangered species, visitor use, and cultural resources.

Bison and Elk Management Plan

The *Final Bison and Elk Management Plan and Environmental Impact Statement* outlines the legal foundation of elk and bison management on the National Elk Refuge and in Grand Teton National Park / John D. Rockefeller Jr. Memorial Parkway, and evaluates six alternatives for managing elk and bison in these areas. While there have been many public benefits associated with large numbers of elk and bison wintering on the refuge, high animal concentrations have created an unnatural situation that has contributed to overuse of riparian vegetation. The recommended alternative (Alternative 4) includes an irrigation expansion project to increase forage production on the NER. The expansion project was implemented in 2010 and increased the areas under sprinkler and flood irrigation by 3,538 100 acres, respectively. Specific findings of the management plan relative to wetlands and associated species are summarized below:

Wetland & Riparian Habitat – The plan concluded impacts to marshlands on the National Elk Refuge would be negligible under all alternatives. However, alternatives providing for relatively high numbers of elk and bison would cause habitat conditions in

wet meadows to decline to fair or poor condition. Alternatives with fewer elk and bison would enable wet meadows with suppressed willows to recover.

Teton County/Jackson Comprehensive Plan

The 2012 Jackson/Teton County Comprehensive Plan (Comp Plan) guides policy, investment, programs, and land use decisions on behalf of residents and businesses of the town of Jackson and Teton County. The most recent plan was adopted on May 8, 2012.

Teton County Senior Planner, Susan Johnson, provided the following comments (paraphrased) on some of the wetland issues relevant to the county regulations and comprehensive plan.

- All wetland information the County has can be downloaded from the County GIS (http://www.tetonwyo.org/gis). Wetlands are described as vegetative cover types.
- The county Natural Resources Technical Advisory Board will eventually develop a plan identifying wetland mitigation sites that are more meaningful than the parcel-by-parcel mitigation currently required under the county Land Development Regulations (LDRs).
- Major factors that threaten wetland functions include:
  - wetland crossings by culverts rather than bridges (bridges are not required under the LDRs); and
  - recent appeals of wetland decisions made by the Planning Director regarding wetland protection on Neighborhood Conservation–Single-family zoned properties and policy changes that may occur after Board of County Commissioners rules on these appeals.
- The most significant factor threatening integrity of riparian habitat is the continued construction of levees for flood control along the major rivers. Existing levees prevent annual inundation, which is necessary for cottonwood regeneration and groundwater recharge. As a result, areas behind the levees are converting to mature cottonwood and mixed cottonwood/spruce stands with little understory, thus producing minimal browse for moose.
- An interesting [residential] wetland/wastewater project is being built on a property in Schofield Patent subdivision.
- Teton County recently completed vegetative cover type mapping on all private lands in the County. Cover types include wetlands and riparian habitats are included.
- There is a proposal for the ACOE to certify additional levees. This could enable development to expand in riparian areas where it is not currently allowed.

Wyoming Statewide Comprehensive Outdoor Recreation Plan

In 1986, Congress enacted the Emergency Wetlands Resources Act (PL 99-645). Section 303 required each Statewide Comprehensive Outdoor Recreation Plan (SCORP) to specifically address wetlands as an important outdoor recreation resource. The SCORP is updated every 5 years to maintain state eligibility for Land and Water Conservation Fund (LWCF) grants. Under LWCF guidelines, the SCORP document must include a wetlands component, which the Wyoming Game and Fish Department has prepared during each plan update. To our knowledge, no LWCF grants have been expended to acquire or enhance wetlands in Wyoming. The SCORP

identified the South Park–Jackson wetland complex south of the town of Jackson and adjacent to the Snake River as a fine-scale priority. This complex was identified as having high value for waterfowl production, winter trumpeter swan habitat, and nesting/wintering bald eagle habitat.

Wild and Scenic Rivers Act

The "Snake River Headwaters Wild and Scenic River System" in northwest Wyoming is protected under the Wild and Scenic Rivers Act (16 U.S.C. 1271 et seq.) in 2009. These rivers and streams are the heart of the SRWC. The BTNF, GTNP and USFWS are currently working on plans to manage and protect the 400 miles of rivers and streams within the Snake River Headwaters System. After draft management standards are developed for the river corridors, a Comprehensive River Management Plan will be prepared along with additional information about existing conditions and potential areas for improvement. The Snake River Headwaters Comprehensive River Management Plan will:

1. Promote the rivers' natural hydrological processes, channel form and function, and ability to shape the landscape. Reduce impediments to free flow, ensure sufficient flows to protect and enhance outstandingly remarkable values, and ensure the maintenance of water quality.
2. Protect and enhance the natural biodiversity, complexity, and resiliency of riparian areas, wetlands, floodplains and adjacent uplands.
3. Protect and enhance cultural resources as important links to the human history of the river corridors, including historical and archeological sites and cultural landscapes and resources.
4. Provide a diversity of opportunities and settings for visitors of varying abilities to experience, learn about, and have a direct connection with the rivers and their special values.
5. Allow for multiple and historic land uses and associated developments that are consistent with the classification of each river segment and support the protection and enhancement of river values.

Proposed resource standards and guidelines relevant to wetlands and riparian areas within the Snake River Headwaters system include:

Water Development Projects Standard: Within the designated river corridors, no projects subject to license by the Federal Energy Regulatory Commission shall be permitted.

Wildlife and Vegetative Habitat Guideline: The composition, structure and function of native plant and animal habitats should be maintained or restored by promoting natural ecological processes to the extent practical throughout mapped corridors (riverine, riparian and upland habitats).

Forest Health Guideline: Insects and disease should be managed only as necessary to protect human life and critical infrastructure.

Biodiversity Guideline: To the fullest practical extent, management should maintain genetic integrity of native plant and animal species, and maintain native populations at all trophic levels. Some short term negative impacts to individual native species may be realized in the process of conducting long term restoration efforts.

Range Utilization Standard: Both upland and riparian utilization rates for all herbivores on key vegetative species shall be no higher than 50%. [This standard is obsolete and not supported by science. There is general agreement the sustainable utilization threshold for shrubs is 35% (WGFD 2013:40). Fifty percent utilization *may* be appropriate for some herbaceous systems.]

Aquatic Habitat Guidelines: Managers should maintain and/or restore self-perpetuating floodplain and riparian conditions. Natural stream habitat conditions should be sustained, as indicated by channel dimensions, shape, gradient, and presence of hydric vegetation and large woody debris. Spawning, rearing, and adult fish habitats may also be restored in designated corridors. Landscapes affected by restoration projects should be natural-appearing and compatible with other identified river values.

Wyoming Game and Fish Department – Habitat Priority Areas

Goal 1 identified in the 2009 Strategic Habitat Plan of the WGFD is "*Conserve and manage wildlife habitats that are crucial for maintaining terrestrial and aquatic wildlife populations for the present and future.*" Designated priority habitats under Goal 1 are crucial for meeting that goal. An important component of this Strategic Habitat Plan is the recognition of "crucial" wildlife habitats, including degraded habitats that have potential for enhancement (WGFD 2009).

Crucial Habitat Priority Areas

Crucial Habitat Priority Areas are based on significant biological or ecological values. They are the most important places that need to be protected or managed in order to maintain viable, healthy populations of terrestrial and aquatic wildlife. The Department will concentrate habitat protection and management activities in these areas. Crucial Habitat Priority Areas within the SRWC include:

- Snake River Corridor
- East Tetons
- Southwestern Hoback
- Lower Pacific Creek

Solutions or actions identified for Crucial Areas include:

- Improve aspen, willow and riparian vegetation communities, and promote an aggressive prescribed fire program to restore and maintain habitat conditions.
- Improve beaver habitat by maintaining healthy aspen, willow and cottonwood communities, and adequate stream base flows.

- Develop enhancement and education projects with private landowners to sustain spawning gravel beds, pools, overhead cover, and migration routes for native Snake River cutthroat trout.
- Manage riparian communities based on the condition status of their willow component. Manage livestock and wildlife numbers based on the level of willow utilization.
- Monitor beaver populations and habitat. Investigate whether adequate beaver populations are being maintained under current trapping pressure.
- Maintain fluvial connectivity to Jackson Lake

Enhancement Habitat Priority Areas

Enhancement Habitat Priority Areas offer a reasonable potential to improve, enhance, or restore wildlife habitats. Enhancement Areas can either be distinct from, or overlap crucial habitats. Enhancement Areas are based on habitat considerations identified by regional WGFD personnel. Enhancement Habitat Priority Areas within the SRWC include:

- Spring Creek Corridors.
- Buffalo Valley Forks.

Solutions or actions identified for crucial areas include:

- Develop and implement cooperative agreements and management plans with private landowners, land management agencies, and permittees. Develop winter elk feeding management plans to improve riparian conditions.
- Develop enhancement and maintenance projects with private landowners to sustain spawning gravel beds, pools, overhead cover and migration routes for native Snake River cutthroat trout.
- Restore, maintain, and ensure access to spawning habitats adjacent to areas of extensive subdivision throughout the Jackson Hole area.
- Aggressively implement riparian enhancements by improving grazing and wildlife feeding management plans.
- Coordinate with irrigators, NRCS and Teton Conservation District to reduce impacts of flood conveyance infrastructure, improve irrigation efficiency, and restore aquatic migration routes
- Coordinate with WYDOT, USFS, and Teton County to improve culvert and bridge installations.

Wyoming Game and Fish Department – Snake/Salt Aquatic Basin Plan

The WGFD Snake/Salt Aquatic Basin Plan focuses primarily on fish species including SGCN. Priority locations for conservation of aquatic resources include, but are not limited to, the mainstem Snake River corridor, spring streams tributary to the Snake River, the lower reaches of Pacific Creek, and Snake River tributaries. These waters are managed to sustain wild cutthroat trout populations free of nonnative species. The plan identifies the following potential threats to aquatic resources:

- Water development/altered flow regimes (moderate)

- Invasive species (moderate)
- Drought and climate change (moderate)

The following conservation actions are recommended:

- Protect and enhance Snake River tributary streams.
- Secure and enhance populations and habitats in SGCN priority areas.
- Increase educational efforts regarding the ecological, economic, and social values of aquatic SGCN.
- Continue aquatic habitat work in the basin including watershed scale vegetation treatments.

Wyoming Water Development Commission – Snake/Salt Basin Plan

The 2001 Wyoming Legislature authorized the Wyoming Water Development Commission (WWDC) to complete the Snake/Salt River Basin portion of the State Water Plan (States West 2003). The plan predicts water use in the basin is likely to decline under low and moderate growth scenarios. The plan briefly describes wetlands and existing projects, such as the Jackson Lake Dam mitigation and Snake River Levee Restoration projects. A short list of future water management opportunities for the Snake River Basin was compiled and evaluated in the plan. The opportunities include:

1. Convert Spring Gulch Irrigation System to Sprinkler.
2. Convert South Park Irrigation System to Sprinkler.
3. Construct Cottonwood Creek Reservoir (Gros Ventre).
4. Improve Winter Flood Control in Jackson.
5. Transfer GTNP Water Rights to Instream Flow.
6. Increase flows in West Bank Creeks.

Wyoming Wetlands Society

Primary objectives of the Wyoming Wetlands Society (WWS) are to assist with restoration of the Rocky Mountain Population of Trumpeter Swans and to protect, preserve, restore and enhance the wetlands they depend on. The WWS manages several wetlands to support a trumpeter swan captive breeding program within the SRWC. Additional waterfowl and wetland dependent species benefit from these managed wetlands. WWS also works to restore wetlands in and around the area of Jackson, WY. Projects have included restoration of gravel pits to reestablish wetland habitats historically present south of Jackson, and improvement of existing water control structures to restore or create wetland habitat.

THREATS TO WETLANDS

Major threats to wetland integrity and functions were identified by the plan committee and cooperators, and through review of relevant conservation and land management plans. Common threats include:

1. Water development/altered flow regimes
2. Overgrazing by ungulates and livestock on riparian areas
3. Unrestricted livestock access to wetlands and streambanks, overgrazing in wetland watersheds.
4. Conversion of flood irrigation to sprinkler systems
5. Levees/disconnected floodplain
6. Invasive species
7. Climate change

Additional threats specific to private lands include:

1. Rural residential developments (fragmentation, degradation and loss of habitat/flood irrigated lands)
2. Weakened regulatory protections
3. Beaver removal

Additional threats specific to public lands include:

1. Recreational use; Properly managed recreation can also good for wetland conservation because it creates a user advocacy group that supports wetland conservation initiatives and funding.
2. Unrestricted access by livestock, overgrazing in wetland watersheds.

Potential threats to wetlands within the Snake River Valley Wetland Complex are qualitatively ranked in Table 6. The rankings were based on existing conservation and land management plans relevant to the SRWC area.

Water Development/Altered Flow Regimes/Stream Dewatering

Although potential for new water development projects is low in the SRWC, altered flow regimes due to the existing Jackson Lake dam and water diversions have had both positive and negative impacts on wetland and riparian hydroperiods (McKinstry 2004).

The current distribution and types of wetlands within the wetland complex are heavily influenced by flood irrigation and seepage from irrigation ditches. Seasonal irrigation has significant effect on groundwater dynamics that contribute hydrologically to many emergent and scrub-shrub wetlands in the valley. As a result, several areas historically considered uplands have been converted to seasonally-flooded wet meadows. Areas where irrigation runoff accumulates and drains have also developed wetland functional characteristics. Altered flow regimes within the Snake River have impacted the health, vigor and extent of floodplain wetlands and riparian areas due to diminished annual flooding and groundwater influence

(GTNP 1997). On the other hand, wetlands not associated with watercourses (such as irrigated fields) are flooded more frequently and consistently.

Table 6. Potential threats to wetlands in the Snake River Valley Wetland complex.

Potentials Threats	Severity of Threat				Potential for Improvement[†]
	Low	Moderate	High	Extreme	
Climate Change / Drought			X		M
Compromised Regulatory Programs			X		H
Rural Residential Developments			X		M
Dam/Reservoir Construction	X				L
Stream Flow Stabilization			X		M
Stream Dewatering			X		H
Channel Alterations, Structures or Modifications in Floodplains				X	H
Transportation Infrastructure		X			L
Energy Exploration and Development	X				L
Mining	X				L
Timber Harvest		X			M
Irrigation Improvements (e.g., ditch & canal lining)		X			M
Conversions to Center Pivot Irrigation				X	H
Intensive Farming Practices	X				L
Overutilization by Ungulates				X	M
Invasive Plant Species		X			H
Management/Maintenance at Existing Wetland Projects		X			M
Disturbances Associated with Recreational Use		X			H
Public Awareness and Support		X			H
Insufficient Funding for Monitoring, Protection, Mitigation		X			H

[†] L = low, M = moderate, H = high potential for improvement

Climate Change / Drought

Rapid changes in climate are occurring and projected to accelerate over the coming century (McWethy et al 2010). Wyoming's water resources are highly vulnerable to climatic variability and change (Andersen 2009). Vulnerability is greatest in the semi-arid regions of Wyoming and regions that are most dependent on snowpack (Gray 2009). The Snake River Valley Wetland Complex is surrounded by relatively plentiful

snowpack, and benefits from being situated at the "top of the watershed" (McWethy et al 2010).

Aquatic systems are already responding to climate change in the Greater Yellowstone Ecosystem (GYC 2010). Snowpack is on a downward trend and peak spring runoff in the Intermountain West is occurring 10 to 20 days earlier than the historical average. This translates to lower and warmer summer flows, which have negative implications for cold-water fisheries and wetlands. The Snake River fine-spotted cutthroat trout is considered highly vulnerable to the effects of climate change (GYC 2010).

Compromised Regulatory Programs

Federal Clean Water Act

In May of 2011, the U.S. Environmental Protection Agency (EPA) and ACOE released a draft *Guidance Regarding Identification of Waters Protected by the Clean Water Act.* This revised guidance clarified how EPA and ACOE would identify waters protected under the Act consistent with Supreme Court case law and relevant science. The agencies expected the extent of jurisdictional waters would increase compared to those designated under prior guidance, but the extent of protection afforded truly isolated wetlands would remain somewhat lower than the interpretation predating the SWANCC and Rapanos and Carabell U.S. Supreme Court decisions – *Solid Waste Agency of Northern Cook County (SWANCC) v. U.S. Army Corps of Engineers*, 531 U.S. 159 (2001); *Rapanos v. United States*, 547 U.S. 715 (2006). A proposed rule entitled, *Definition of "Waters of the United States" under the Clean Water Act* [79 FR 22188] was released on April 21, 2014. This proposed rule considers all tributaries and "adjacent waters" as connected to navigable waters of the United States. If the proposed rule becomes final in its current form, very few waters in the USRB will fall outside EPA and COE jurisdiction.

Moderate impacts to the Snake River Valley wetlands and riparian areas were expected to continue under the 2011 revised guidance. In recent years, the Wyoming Regulatory District of the ACOE determined several isolated wetlands in the SRWC had no "significant nexus" with navigable waters (e.g. Teton Meadows Ranch/Seherr-Thoss Property, 2007 & Walden Pond Phase B, 2009). This resulted in loss of wetlands, without mitigation, due to residential development. However, fewer of these wetlands will be considered as lacking a "significant nexus" under the proposed rule.

Teton County Land Development Regulations

Teton County's current Land Development Regulations (LDRs) do not protect streams and associated riparian areas with mean annual flows of less than 3 cfs, or those lacking wetlands above the Ordinary High Water Mark (Teton County 1994). Past enforcement of the Teton County *Waterbodies, Ten (10) Year Floodplains, and Wetlands* LDR (Article III, Section 3220) has been potentially compromised due to lack of sufficient data and information to make a determination of stream flow. This has resulted in decisions

causing potential loss of riparian areas to development (e.g. Edmiston Spring in Wilson, Environmental Analysis EVA2010-0007) (Teton County 1994).

The recent revision of the Teton County Comprehensive Plan and subsequent LDRs may provide both stronger and weaker protection to categories of wetlands and riparian areas (Teton County 2012). For example, isolated wetlands are currently protected under the County regulations, however wetlands solely induced by agricultural irrigation are not protected. Elected officials have recently discussed whether isolated wetlands should continue to be protected (Teton County Wetlands and Waterbodies Training Seminar, June 22, 2011).

Rural Residential Developments

Because private developable lands (36% of the SRWC) are limited, ongoing pressures to develop residential areas constitute major threats to wetlands and riparian habitats on those lands. While federal and local regulations do protect most wetlands and require mitigation of impacts, irrigation-induced wetlands and some riparian areas adjacent to unprotected streams (without stream and wetland setbacks) are highly vulnerable. Such areas may be filled and cleared without mitigation (Teton County 1994). Riparian areas within the Teton County designated Natural Resources Overlay District (NRO) are potentially protected through a habitat ranking system (Teton County 1994). Wetlands and waterbodies within the Teton County Neighborhood Conservation District are exempt from the waterbody, wetland, and NRO protection standards of Division III of the Teton County LDRs (except within new subdivisions). Thus, isolated wetlands not protected by Section 404 of the Federal Clean Water may be filled without mitigation in the Neighborhood Conservation District zones (Teton County 1994, EPA 2008). Again, the determination of isolated wetlands will likely change after *Definition of "Waters of the United States" under the Clean Water Act* [79 FR 22188] becomes final rule.

Loose domestic dogs and cats can be a particular threat to wildlife, including wetland-dependent species, in and around residential areas. Teton County and WGFD many times have little knowledge of wildlife harassment by domestic pets and exercise little control over it.

Residential development pressure will continue to drive some of the federal levee maintenance and expansion. Extension of the levee system will detach additional portions of the floodplain, and alter geomorphic processes that are essential for riparian and wetland habitat maintenance.

Conversion of flood-irrigated hay meadows and pasture to residential developments will directly impact wetlands and riparian habitats associated with seasonally flooded fields and irrigation supply ditches. Indirect impacts resulting from elimination of irrigation include lowering of the groundwater table and cessation of return flows and groundwater discharge to spring creeks.

Other activities on residential properties have included excavation of emergent wetlands to create deep ponds.

Overutilization by Domestic Livestock and Wild Ungulates

Livestock grazing impacts riparian areas along the Snake River and tributaries, specifically areas where the riparian floodplain is detached from the Snake River by the levee system. Elk and bison overutilization of riparian areas on feedgrounds, and along the Snake River corridor is well documented in the *Final Bison and Elk Management Plan and Environmental Impact Statement* and *WGFD* 2009 *Strategic Habitat Plan.*

WETLAND CONSERVATION OBJECTIVES & STRATEGIES

To provide meaningful results, conservation actions should be accomplished through collaborative efforts between private landowners, land management agencies, wildlife managers and conservation organizations. Implementation strategies should address the most serious threats identified by existing management and conservation plans.

1. Protect and maintain existing high quality wetlands and riparian habitats.

A. Identify high quality wetlands and specific threats. Where appropriate, base protection strategies on habitat needs of focal species. Focus conservation efforts on:
   - Isolated wetlands
   - Snake River floodplain/riparian areas without levees
   - Wetlands susceptible to hydrologic alteration
   - Recreational areas
   - Wetlands most susceptible to climate and hydrologic change

B. Determine the most appropriate mechanisms for protection and maintenance (Patla and Lockman 2004):
   - Conservation easements
   - Public land management policy
   - Ungulate and livestock grazing best management practices

C. Identify funding sources for protection:
   - Land Trusts and conservation easement funding organizations
   - Mitigation funds
   - Federal grants – USDA Wetlands Reserve Program, USDA Farm and Ranch Protection Program, and North American Wetlands Conservation Act (NAWCA)
   - State grants and funding – Wyoming Wildlife and Natural Resource Trust Fund (WWNRT), WGFD Habitat Trust Fund, etc.

D. Strengthen local land development regulations:
   - Continue protection of isolated wetlands.
   - Provide incentives to shift development rights onto lands with lesser wetland and riparian values.

- Revise land development regulations to require setbacks beyond the high water mark from all waterbodies.
- Maintain existing programs that protect Trumpeter Swan summer and winter habitats.

2. Restore and enhance degraded wetlands and riparian habitats.

A. Identify opportunities to restore wetland functions in degraded sites. Where appropriate, base restoration design on habitat requirements of focal species. Potential sites include:
   - Gravel quarries
   - Historic floodplain, riparian areas, channels that have become detached from the Snake River by levees
   - Drained wetlands
   - Overgrazed wetlands and riparian habitats
   - Sites impacted by recreational and human disturbance
   - Fallow pastures that were historically flood-irrigated
   - Sites degraded by noxious and invasive weeds

B. Determine mechanisms for restoration and enhancement:
   - Consider feasibility of success.
   - Identify isolated wetlands dependent on irrigation and determine means for restoring or maintaining those water sources .
   - Address management, long term maintenance, and protection of restored sites.
   - Restore hydrology to wetlands and riparian areas isolated by Snake River levees.

C. Identify sources of funding to support restoration projects:
   - Mitigation funds – includes developers' mitigation requirements
   - Federal grants – USDA Wetlands Reserve Program and North American Wetlands Conservation Act (NAWCA)
   - State grants and funding – Wyoming Wildlife and Natural Resource Trust Fund (WWNRT) and WGFD Habitat Trust Fund
   - Non-profit and special interest organizations – local and national

D. Support efforts to strengthen local land development regulations:
   - Provide incentives to encourage voluntary restoration and enhancement of wetlands and riparian areas on private property.
   - Clearly recognize stream, riparian, and wetland restoration efforts in the land development regulations and exempt them from expensive and involved permitting requirements.
   - Consider protection of irrigation-induced wetlands and riparian habitats through land development regulations.
   - Encourage creation of productive shallow-water wetlands capable of providing habitat for waterfowl and amphibians where appropriate.

3. Provide effective mitigation for impacts to wetlands and riparian habitats.

A. Identify mitigation sites/actions that restore the functions and values impacted:
   - Collaborate and consult with wildlife managers, land planners and local professionals who are knowledgeable about the area and habitat needs of focal species.
   - Rely on existing data such as vegetation mapping, aerial imagery, land use and ownership information, and existing land management and wildlife conservation plans to assist in determining suitable locations for mitigation.
   - Consider mitigation for indirect impacts to wetlands and riparian habitats such as disturbance from nearby facilities construction and operation, including recreational facilities.

B. Identify appropriate strategies for restoration and enhancement:
   - Onsite mitigation to replace lost functions and values
   - Offsite mitigation to maintain watershed and wetland complex function and values – this may be accomplished through the mitigation bank concept.

C. Identify sources to fund mitigation projects
   - Developer-sponsored onsite mitigation – the preferred approach to mitigate wetland or riparian impacts is "in-kind, on-site" mitigation.
   - Developer payments to purchase mitigation credits from an existing mitigation bank.
   - Direct compensation payments from developers – In-Lieu Fee Program. This option enables developers to make a direct payment to fund a mitigation implementation program that typically is administered by a government agency.
   - Funding from the *Jackson Hole Flood Control Project Restoration Program* (federal levee system).

D. Strengthen local land development regulations
   - Require mitigation or other meaningful compensation for filling or draining irrigation-induced wetlands.
   - Require 2:1 mitigation total with the option of 1:1 mitigation onsite and 1:1 mitigation at an approved large scale mitigation location.
   - Allow mitigation sites to be banked then sold to meet mitigation requirements provided mitigation sites are fully functional and within the same watershed unit where the impacts are proposed. Base mitigation requirements on "functional units" rather than solely on the area impacted.
   - Review national wetland mitigation research and applicability to local wetland regulations and desired outcomes.
   - Monitoring of wetland mitigation and restoration sites needs to be strengthened and extended to 5 years or more.

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