TECHNICAL MEMORANDUM

SUBJECT: Green River Basin Plan
Environmental Uses

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Introduction

Previous studies have estimated the amount of water designated for or consumed by various environmental uses. These include but are not necessarily limited to minimum reservoir pools and releases, instream bypasses designated to enhance fisheries and wildlife habitat, instream flows as permitted through the Wyoming State Engineer, direct wildlife consumption, evaporation from conservation pools and maintenance of riparian areas. Instream flows, as defined in Wyoming statutes and administered by the State Engineer's Office, are addressed in a separate technical memorandum.

The objectives of this task were to:

- Compile minimum reservoir conservation pools and reservoir bypass requirements.
- Identify and reference existing GIS mapping showing wetlands and other environmental information.
- Identify other programs and issues relating to environmental water use.
- Prepare a memorandum that describes qualitatively the water-related environmental uses and benefits within the basin and brackets the optimum streamflows and/or reservoir levels for these benefits.
- Attempt to quantify environmental uses that cause compact-related depletions.

Approach

The following data was collected to help identify environmental uses in the Green River Basin:

- Minimum reservoir pools and releases
- EPA wetlands mapping
- Seedskadee National Wildlife Refuge information
- State and federal threatened or endangered species programs
- NRCS application data for conservation programs

Reservoir Minimum Pools

Several reservoirs in the basin have storage permitted for a variety of environmental uses. These uses, as they appear on the water rights, include fish, and fish and wildlife. Recreational uses defined on permits can be considered environmental to the extent that water in storage for recreational purposes, and not released for other consumptive or nonconsumptive uses, can be beneficial in an environmental

sense. The reservoirs with fish or fish and wildlife uses or pools listed in their permitting documents include Big Sandy, Boulder (1,621 acre-feet), Flaming Gorge, Fontenelle and High Savery (4,955 acre-feet). In this list, those reservoirs without a defined pool have fish and wildlife (or similar use) listed as an unsegregated portion of their total storage. Those reservoirs with permitted capacity for stock water also serve an environmental function in that water available for stock is also available to local wildlife populations. Additional reservoirs with stock use as a permitted use include Bush Creek, Bush Lake, Divide, Elkhorn (Little Sandy), Fremont, Hay, McNinch No. 1, Middle Piney, Silver Lake, Sixty-Seven, and Willow. The amounts reserved for these uses can be referenced in the Reservoir Technical Memorandum.

The Wyoming Game and Fish has provided information on water levels in lakes and reservoirs that they deem desirable for supporting game fish populations. This information is provided in Table 1. Only standing water bodies larger than 100 surface acres are included, although other smaller bodies have been inventoried. Figure 1 graphically shows the relative water level recommendations.

Maintenance Flows

The Wyoming Game and Fish Department has also provided information on maintenance flows for moving water. These flow amounts are what the Department considers necessary to support game fish populations in the late season, low flow months. These flows may or may not correspond exactly to values of "instream flow" rights filed, if a stream has had a filing submitted to the State Engineer. Instream flow filings generally have seasonally varying amounts, while the maintenance flows discussed here are more a generic indicator of a flow threshold. Maintenance flows (of greater than 10 cfs only) are shown in Table 2. Streams with smaller recommended maintenance flows have also been inventoried. Figure 2 shows these same flows graphically.

Instream Bypasses

Only three reservoirs in the Green River Basin have minimum flow bypasses included in their permitting documents. These include Fontenelle (50 cfs at the town of Green River), Meeks Cabin (10 cfs) and Stateline (7 cfs).

Wetlands Mapping

The National Wetlands Inventory (NWI) of the U.S. Fish and Wildlife Service produces information on the characteristics, extent, and status of the Nation's wetlands and deepwater habitats. Federal, State, and local agencies, academic institutions, U.S. Congress, and the private sector use this information. The Emergency Wetland Resources Act of 1986 directs the Service to map the wetlands of the United States. The NWI has mapped 89 percent of the lower 48 states, and 31percent of Alaska. The Act also requires the Service to produce a digital wetlands database for the United States. About 39 percent of the lower 48 states and 11 percent of Alaska are digitized. Congressional mandates require the NWI to produce status and trends reports to Congress at ten-year intervals. In 1982, the NWI produced the first comprehensive and statistically valid estimate of the status of the Nation's wetlands and wetland losses, and in 1990 produced the first update. Future national updates scheduled for 2000, 2010, and 2020.

The Spatial Data and Visualization Center downloaded the digital line graphs (dlg) from the NWI web page and converted the dlg data to Arc/Info vector coverages with matching attributes. Vector coverages include both line (riverine) and polygon (lacustrine and palustrine) wetland features.

Wetlands are lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water. For purposes of the NWI classification, wetlands must have one or more of the following three attributes:

1) at least periodically, the land supports predominantly hydrophytes;
2) the substrate is predominantly undrained hydric soil; and
3) the substrate is non-soil and is saturated with water or covered by shallow water at some time during the growing season of each year.

The wetland classification system is hierarchical, with wetlands and deepwater habitats divided among five major systems at the broadest level. The five systems include Marine (open ocean and associated coastline), Estuarine (salt marshes and brackish tidal water), Riverine (rivers, creeks, and streams), Lacustrine (lakes and deep ponds), and Palustrine (shallow ponds, marshes, swamps, sloughs). Systems are further subdivided into subsystems, which reflect hydrologic conditions. Below the subsystem is the class, which describes the appearance of the wetland in terms of vegetation or substrate. Each class is further subdivided into subclasses; vegetated subclasses are described in terms of life form and substrate subclasses in terms of composition. The classification system also includes modifiers to describe hydrology (water regime), soils, water chemistry (pH, salinity), and special modifiers relating to man's activities (e.g., impounded, partly drained).

The NWI coverage for the Green River Basin contains 3 systems:

- **Riverine**: The Riverine System includes all wetlands and deepwater habitats contained within a channel, with two exceptions: (1) wetlands dominated by trees, shrubs, persistent emergents, emergent mosses, or lichens, and (2) habitats with water containing ocean derived salts in excess of 0.5 percent. A channel is "an open conduit either naturally or artificially created which periodically or continuously contains moving water, or which forms a connecting link between two bodies of standing water" (Langbein and Iseri 1960:5).
- **Lacustrine:** The Lacustrine System includes wetlands and deepwater habitats with all of the following characteristics: (1) situated in a topographic depression or a dammed river channel; (2) lacking trees, shrubs, persistent emergents, emergent mosses or lichens with greater than 30 percent areal coverage; and (3) total area exceeds 8 ha (20 acres). Similar wetland and deepwater habitats totaling less than 8 ha are also included in the Lacustrine System if an active wave-formed or bedrock shoreline feature makes up all or part of the boundary, or if the water depth in the deepest part of the basin exceeds 2 m (6.6 feet) at low water. Lacustrine waters may be tidal or nontidal, but oceanderived salinity is always less than 0.5 percent.
- **Palustrine**: The Palustrine System includes all nontidal wetlands dominated by trees, shrubs, persistent emergents, emergent mosses or lichens, and all such wetlands that occur in tidal areas where salinity due to ocean-derived salts is below 0.5 percent. It also includes wetlands lacking such vegetation, but with all of the following four characteristics: (1) area less than 8 ha (20 acres); (2) active wave-formed or bedrock shoreline features lacking; (3) water depth in the deepest part of basin less than 2 m at low water; and (4) salinity due to ocean-derived salts less than 0.5 percent.

The three systems are divided into six subsystems:

- **Riverine/Lower Perennial:** The gradient is low and water velocity is slow There is no tidal influence, and some water flows throughout the year. The substrate consists mainly of sand and mud. Oxygen deficits may sometimes occur, the fauna is composed mostly of species that reach their maximum abundance in still water, and true planktonic organisms are common. The gradient is lower than that of the Upper Perennial Subsystem and the floodplain is well developed.
- **Riverine/Upper Perennial:** The gradient is high and velocity of the water fast. There is no tidal influence and some water flows throughout the year. The substrate consists of rock, cobbles, or gravel with occasional patches of sand. The natural dissolved oxygen concentration is normally near saturation. The fauna is characteristic of running water, and there are few or no planktonic forms. The gradient is high compared with that of the Lower Perennial Subsystem, and there is very little floodplain development.
- **Riverine/Intermitten:** In this Subsystem, the channel contains flowing water for only part of the year. When the water is not flowing, it may remain in isolated pools or surface water may be absent. Classes. Rock Bottom, Unconsolidated Bottom, Aquatic Bed, Streambed, Rocky Shore, Unconsolidated Shore, and Emergent Wetland (nonpersistent).
- **Lacustrine/Limnetic:** All deepwater habitats within the Lacustrine System,many small Lacustrine Systems have no Limnetic Subsystem.
- **Lacustrine/Littoral:** All wetland habitats in the Lacustrine System.
- **Palustrine: (**see above definition).

The subsystems are further divided into Classes. The Classes describes the general appearance of the habitat in terms of either the dominant life form of the vegetation or the physiography and composition of the substrate-features that can be recognized without the aid of detailed environmental measurements. Figure 3 shows the NWI coverage divided into eight classes. The following list identifies and defines the classes in the Green River Basin:

- Unconsolidated Bottom: Characterized by the lack of large stable surfaces for plant and animal attachment. They are usually found in areas with lower energy than Rock Bottoms, and may be very unstable. Exposure to wave and current action, temperature, salinity, and light penetration determines the composition and distribution of organisms.
- Streambed: In most cases streambeds are not vegetated because of the scouring effect of moving water, however, they may be colonized by "pioneering" annuals or perennials during periods of low flow or they may have perennial emergents and shrubs that are too scattered to qualify the area for classification as Emergent Wetland or Scrub-Shrub Wetland.
- Aquatic Bed: Represent a diverse group of plant communities that requires surface water for optimum growth and reproduction. They are best developed in relatively permanent water or under conditions of repeated flooding. The plants are either attached to the substrate or float freely in the water above the bottom or on the surface.
- Unconsolidated Shore: Characterized by substrates lacking vegetation except for pioneering plants that become established during brief periods when growing conditions are favorable. Erosion and deposition by waves and currents produce a number of landforms such as beaches, bars, and flats, all of which are included in this Class.
- Emergent: In areas with relatively stable climatic conditions, Emergent Wetlands maintain the same appearance year after year. In other areas, such as the prairies of the central United States,

violent climatic fluctuations cause them to revert to an open water phase in some years (Stewart and Kantrud 1972). Emergent Wetlands are known by many names, including marsh, meadow, fen, prairie pothole, and slough.

- Open Water/Unknown Bottom: Areas of open water such as stock ponds, small lakes,or small ponds.
- Scrub-Shrub: Dominated by woody vegetation less than 6 m (20 feet) tall. The species include true shrubs, young trees, and trees or shrubs that are small or stunted because of environmental conditions.
- Forested: Characterized by woody vegetation that is 6 m tall or taller. They are common in the eastern United States and in those sections of the West where moisture is relatively abundant, particularly along rivers and in the mountains.

The wetlands mapping was overlayed on the GIS Irrigated Acreage coverage used in the Green River Basin plan. More than half of the defined irrigated acreage is classified in the wetlands mapping as Emergent. This may be, in part, due to the scale of the wetlands mapping, which varied between 1:20,000 and 1:132,000. Also, the Emergent wetlands classification reports to be known by many names, including meadow. Almost all of the irrigated acreage in the Green River Basin is meadow composed of emergent plant types.

Wetlands in the Green River Basin provide significant nesting and breeding habitat for local (as opposed to migratory) populations of ducks and geese. In fact, the Green River Basin is an important contributor to Wyoming's status as one of the largest waterfowl-producing states in the western U.S., with total duck breeding pairs more than double the totals in Nebaska and Colorado combined for 1999 (Wilkins and Cooch, 1999). These local birds are the primary target of hunters, and as such their reproductive success is important to both future environmental and recreational pursuits. An area of future environmental concern, or cause for mitigation, is therefore the potential of destruction of breeding and nesting habitat for waterfowl. In the Green River Basin, areas near Farson and Eden (Big Sandy) and the Seedskadee National Wildlife Refuge are the most heavily hunted for waterfowl.

Seedskadee National Wildlife Refuge

Created initially as environmental mitigation following construction of Flaming Gorge and Fontenelle Reservoirs by the Bureau of Reclamation, Seedskadee National Wildlife Refuge (NWR) has become a popular destination for fishermen, hunters, sightseers and birdwatchers. The Refuge contains 26,037 acres of land and covers over 36 miles of the main stem of the Green River from the upper boundary (approximately 2.5 miles below the CCC Bridge) to just below the "Big Island," approximately 20 miles northwest of Green River. While originally planned for protection and production of waterfowl, the Refuge has seen more intensive management of big game, fisheries and other fauna and flora in recent years. The vision statement for the Refuge, as provided by Damberg (2000) is:

> *Seedskadee National Wildlife Refuge will manage for a variety of native plants and wildlife, with emphasis on migratory birds and threatened and endangered species. Natural habitats of the Green River will be preserved or restored. The Refuge will provide interpretation of the natural and human history of the area and provide for wildlife-dependent recreation that is compatible with Refuge purposes. Seedskadee will work with individuals, organizations, and agencies to promote wildlife conservation in the Green River Basin.*

Seedskadee NWR provides significant water-related environmental benefits in an otherwise arid region. Habitats available on the refuge include riverine and backwater aquatic areas, wetland and riparian areas, and drier grassland/shrubland communities. The source of water for these uses is the Green River proper with contributions from the Big Sandy River at its mouth. In a 1962 contract between the State of Wyoming and the Bureau of Reclamation, the first priority of 5,000 acre-feet of reservoir water was designated for the refuge, along with 115 cfs of direct flow rights to be used in conjunction therewith. In addition, Seedskadee uses older pre-refuge irrigation works to distribute water for wetland development and maintenance. Between the reservoir and direct flow water rights, the contract further specifies diversion allocations of 6,000 acre-feet per year for irrigation, plus 22,000 acre-feet per year for "pondage," resulting in a total allotment of up to 28,000 acre-feet per year.

With little use between Fontenelle Reservoir and the Refuge, the Green River provides a relatively reliable water supply to Seedskadee. Although minimum flows by permit are to remain above 50 cfs (at the town of Green River) below Fontenelle, actual flows are historically much larger. According to the Bureau of Reclamation, August to April releases are typically 1,200 to 1,400 cfs with higher flows passed in the spring flooding season.

Consumption of non-irrigation water on the Refuge is limited to evapotranspiration from the wetland and riparian areas. Currently, the Refuge has no plans to create significant new wetlands, although maintenance of existing wetlands and reestablishment of pre-existing wetlands will continue. Currently there are approximately 335 acres of wetland habitat and 1,394 acres of riverine habitat on the Refuge. Acres of actual irrigation use on the refuge (1,671 acres were mapped) are not included herein because they were listed as irrigated lands and, arguably, have been included as agricultural use.

Direct Wildlife Consumption

In Ahern, et al, (1981) it was estimated that 100 AF per year of water originating as groundwater is consumed by wildlife. This estimate, its source referenced as the Rock Springs Office of the Bureau of Land Management, was revisited during the current study. Mr. Dennis Doncaster of the Rock Springs Office of the BLM reviewed the earlier estimate and concluded that 100 AF per year is not an unreasonable estimate. However, it is noted that calculating wildlife water consumption is an uncertain endeavor at best, based upon best estimates of population, individual rates of consumption, and what to include as "wildlife." The above estimate is for large ungulates (big game) and wild horses, but excludes, for example, rodents, birds and predators. Therefore, while some uncertainty exists in the exact consumption value, its probable magnitude is not so high as to materially affect the water plan.

Also in Ahern (ibid.) an estimate of wildlife use of surface water is given. The value, 400 AF per year, is referenced to communication from the Wyoming Game and Fish Department (WGF). Revisiting this number with WGF personnel for the current plan resulted in no change to the estimate (Robert Pistono, WGF, Personal Communication).

Evaporation

Under the Bureau of Reclamation's "Consumptive Uses and Losses Report," a document prepared every five years as required by the Colorado River Basin Project Act of 1968, man-made losses such as evaporation from constructed or enlarged reservoirs are calculated as part of the State's compact

allocation. Some authorities consider that part of calculated evaporation losses are "charged" to environmental uses, especially if a water body exists for the primary purpose of serving environmental needs. However, administratively, these amounts would be counted against Wyoming's allowable consumption under the Upper Colorado River Basin Compact without regard to type of use.

Maintenance of Riparian Areas

In recent years the value and maintenance of riparian zones along stream corridors has been the subject of considerable study. Several interrelated topics emerge from this work, including the value of riparian zones for both aquatic and terrestrial wildlife, the ability of riparian zones to assist in maintaining base flows in streams, and the value of riparian areas in controlling erosion.

The United States Department of the Interior, Bureau of Land Management (BLM) has published several documents relating to riparian area management. For example, User Guides have been developed that allow an interdisciplinary team to determine the "Proper Functioning Condition" of lodic (BLM, 1998) and lentic (BLM, 1999) areas. These guides, however, are qualitative and do not provide quantitative estimates of, for example, potential storage capacity increase due to improved riparian condition. Ponce (1989) provides additional case study histories of several projects where riparian improvement has resulted in improved base flow conditions in the subject streams.

Boelman (1989) and Higley (1996) provide a much more quantitative assessment of the hydrogeologic response of an alluvial stream system to riparian improvements. Both these authors studied Muddy Creek which is tributary to the Little Snake River and part of Wyoming's Green River Basin. Boelman reported phreatic surfaces 15 to 20 feet below ground in degraded riparian areas while the water surface was only a few feet below the surface in improved riparian zones. Boelman also puts forth that instream structures added approximately 0.4 AF per thousand feet of channel in the improving riparian areas.

Higley used a three-dimensional finite difference groundwater model to assess the storage capacity of degraded, improving and improved riparian zones. Higley also noted that while ground water levels are within a few feet of the ground surface in improved riparian areas, they may be tens of feet deeper in degraded reaches.

Wetstein (1989) did not look at riparian areas per se, but rather at the water budget associated with flood irrigation along the New Fork River in Sublette County, Wyoming. Wetstein's findings reflect less the intentional management of water for riparian improvement, and more the actual result of flood irrigation in a typical setting. According to Wetstein: "A large percentage of the diverted water returns to the stream system so there is no loss of beneficial surface flow to the downstream users and the release of stored water during the low flow winter months will help maintain a constant supply of water to the channel system. The saturated aquifer acts as a 24,000 acre-feet underground reservoir that releases most of this volume to the downstream users during the same irrigation season, without excessive evaporation losses."

Recovery Implementation Program for Endangered Fish Species

Under section 2(c) (2) of the Endangered Species Act is written "the policy of Congress is that Federal agencies shall cooperate with State and local agencies to resolve water resource issues in concert with conservation of endangered species." In 1988, the states of Wyoming, Colorado and Utah, the Secretary of the Interior and the Administrator of the Western Area Power Administration entered into a

cooperative agreement to recover four fish species in the Upper Colorado River Basin while allowing for continued and future water development. The species include the Colorado pikeminnow, razorback sucker, humpback chub and bonytail.

Parties to the agreement agreed to participate in and implement a recovery program with the following five principal elements:

- Habitat management through the provision of instream flows;
- Nonflow habitat development and maintenance;
- Native fish stocking;
- Management of nonnative species and sportfishing; and
- Research, data management and monitoring.

The program applies to the upper basin above Glen Canyon Dam, and was initially exclusive of the San Juan River Basin. Since adoption of the original agreement, a separate Recovery Implementation Program for the San Juan River has been instituted.

The intent of the Recovery Implementation Program (RIP) is to provide for the recovery and management of the identified species while continuing to allow for needed water development. It streamlines compliance with ESA requirements by making such compliance a function of all the signatory parties. In Wyoming, the practical effect of the RIP is that it institutes a one-time charge for new depletions which is paid into the management fund. Originally valued at ten dollars ($10) per acre foot of new depletion, this charge is tied to consumer price indices such that the fiscal year 2000 cost totals $14.36 per acre foot.

Information on the RIP can be viewed at www.r6.fws.gov/coloradoriver and www.r6.fws.gov/crrip/ on the internet.

Cutthroat Trout Management

The Wyoming Game and Fish Department has instituted a management program designed to protect and enhance the natural populations of Wyoming's native cutthroat trout. In the Green River Basin of Wyoming, this includes the native Colorado River cutthroat trout. Management of the trout is intended to prevent the species from becoming listed as threatened or endangered. An early strategic plan included the following:

- Identification and protection of waters containing pure cutthroat populations;
- Increase the distribution of cutthroat trout within their ancestral range through habitat protection and rehabilitation;
- Develop brood stock from pure populations; and
- Reintroduce cutthroat trout to native waters.

To achieve these strategic goals a management plan with seven activities was implemented:

1. Fish sampling to locate and evaluate populations;
2. Habitat surveys;
3. Special fishing regulations;
4. Instream flow water right filings;
5. Fish culture activities;
6. Non-native trout removal; and
7. Information and education efforts.

These activities have been undertaken and show promise for protecting the native trout. According to Ron Remmick (personal communication, 2000), Colorado River cutthroat trout occupy 23 percent of the streams in the Green River Basin in reaches totaling 19 percent of the stream miles in the basin. Work involved in protecting these native fish is considered non-consumptive (of water), although the use of instream flow water rights and habitat improvement will affect future water development activities in the immediate vicinity of such work. Protection of important native fish populations is an example of water-related work that can be accomplished without depletion, and shows that water resources can exhibit strong economic value (e.g. recreation) without consumptive use.

Conservation Programs

Requests were made of the local NRCS offices for a listing of lands currently enrolled in the various projects. From these requests (not all counties responded) the current enrollments are provided.

Conservation Reserve Program

The Conservation Reserve Program (CRP) is administered by the USDA Farm Service Agency (FSA). This program offers rental payments, incentive payments, and cost-share assistance for certain conservation practices. This is a voluntary program for private land owners. The objective of the program is to improve wildlife habitat, water quality, and reduce air and water erosion. Some of the techniques used to accomplish these goals are fenced riparian areas, erosion-resistant ground covers, wind and snow breaks, water-filtering grassed strips, contours, and waterways, and shallow water areas. Currently, in the Green River Basin, only Lincoln and Uinta Counties have any land enrolled in the CRP program. The Lincoln County land is utilizing erosion-resistant ground cover, and is not a consumptive water user.

In Uinta County, a joint CRP-WRP project is being developed. This project is located in the north-east corner of the county near the borders with Sweetwater and Lincoln counties. This project involves 27 acres of land utilizing shallow wetlands creation, noxious weed control, fencing, and woody cover. The source of water is the Ham's Fork through the existing Philbrick & Johnson diversion. The technical planning for this project has been completed and construction is scheduled for Spring, 2001. There is also interest in Uinta County in enrolling certain scattered areas in the Smith's Fork, Black's Fork, and Muddy Creek areas into the program. These areas would utilize fencing of riparian areas and windbreaks. To provide water for livestock currently grazing in these riparian areas, a limited number of wells will need to be developed and the related water rights secured. No technical planning has been completed for any of these projects.

More information regarding the Conservation Reserve Program can be found at the website links at the end of this memo.

Wetlands Reserve Program

The Wetlands Reserve Program (WRP) is administered by the USDA Natural Resources Conservation Service (NRCS). This program offers technical and financial assistance for restoring wetlands. This is a voluntary program for private land owners. The objective of the program in the Green River Basin is to diversify the types of wetlands and wildlife habitat in an area. Some of the techniques used to accomplish this are the construction of small dikes in drainage areas and plugs in river ox-bows, and, when necessary, additional grading. The wetlands created are typically 2 to 5 acres in size. With the exception of water loss due to evaporation, this water use is generally non-consumptive. As impoundments are created by these wetlands, the land owner is required to file an application with the State Engineer for storage rights.

While not currently registered as WRP lands, the Little Snake River Conservation District constructed 113.5 acres of wetlands in the 1990s. These projects are estimated to consume approximately 284 acre-feet per year. The District estimates tripling this construction in the planning period resulting in almost 1,000 acre-feet of depletions from wetlands.

Currently WRP-enrolled lands include:

Sublette County:

- 33 acres approximately 17 miles north-west of Pinedale utilizing shallow wetlands.
- 6 acres approximately 4 miles south-east of Pinedale utilizing shallow wetlands.

Sweetwater County:

- 5 acres approx. 1½ miles north-east of Eden utilizing shallow wetlands. Source of water: pipeline from a lateral of the Eden Canal.

Lincoln County:

- None of the enrolled lands in Lincoln County are in the Green River Basin.

More information regarding the Wetlands Reserve Program and the National Resources Conservation Service can be found at the website links at the end of this memo.

Wildlife Habitat Incentives Program

The Wildlife Habitat Incentives Program (WHIP) is administered by the USDA Natural Resources Conservation Service (NRCS). This program offers technical and financial assistance for projects which improve wildlife habitat. This is a voluntary program. Current lands enrolled in theWHIP program are:

Sublette County:

- 160 acres approximately 2 miles north-north-east of LaBarge.

Uinta County:

- 80 acres approx. 2 miles north-east of Fort Bridger utilizing fencing and tree planting.

Lincoln County:

- None of the enrolled lands in Lincoln County are in the Green River Basin.

More information regarding the Wildlife Habitat Incentives Program and the National Resources Conservation Service can be found at the website links at the end of this memo.

Miscellaneous Programs

World Heritage Sites

World Heritage Sites are locations that have been placed on the World Heritage List. This list is determined by the World Heritage Committee of the United Nations Educational, Scientific, and Cultural Organization (UNESCO). In the United States, sites must be nominated to the list by the Office of International Affairs of the National Park Service (Department of the Interior). Currently, there are eighteen sites on the list in the U.S., and two additional sites that straddle the U.S.-Canada border. Yellowstone National Park is the only site on the list with lands in Wyoming. The latest addition to the list was in 1995, and new sites are being considered by the National Park Service in New York and Virginia.

The purpose of the World Heritage Committee is to administer the World Heritage List and World Heritage Fund to encourage nations to preserve places considered to be of outstanding value to humanity. The Committee can provide technical assistance and training to protect sites added to the List, and grant financial assistance from the World Heritage Fund for emergency assistance of sites in danger. Currently, Yellowstone is considered to be a site in danger. The Committee or any other portion of the United Nations does not play any role of the regulation or governing of the sites. More information regarding World Heritage Sites and National Park Service can be found at the website links listed at the end of this memo.

Website Links
USDA Natural Resources Conservation Service homepage:
http://www.nrcs.usda.gov/

NRCS Wetland Reserve Program (WRP):
http://www.wl.fb-net.org/

NRCS Wildlife Habitat Incentives Program (WHIP):
http://wl.fb-net.org/whip

Farm Service Agency Conservation Reserve Program (CRP):
http://www.fsa.usda.gov/dafp/cepd/crpinfo.htm

United Nations Educational, Scientific, and Cultural Organization (UNESCO) World Heritage Site homepage:

http://www.unesco.org/whc/nwhc/pages/home/pages/homepage.htm

U.S. National Parks Service World Heritage Site homepage:
http://www.cr.nps.gov/worldheritage/

Summary of Depletions Attributable to Defined Environmental Uses

The following table summarizes depletions associated with man's construction and/or operation of environmental features:

Summary of Existing Depletions Associated With Environmental Uses

Use	Acres	Depletion, Acre-Feet
Seedskadee NWR	335	840
Little Snake River CD	113.5	284
Wildlife Use	NA	400
CRP	NA	0
WRP	44	110
WHIP	240	0
Total		**1,634**

The above numbers are surface water only (groundwater use is de minimus). It is recognized that actual environmental uses may be significantly higher; only those acts that have been reported and can be quantified are included.

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Table 1. Recommended Standing Water Surface Area Maintenance

Water Name	Tributary To	Total Acres	Min Acres
FLAMING GORGE RESERVOIR	GREEN RIVER	42020	34600
FONTENELLE RESERVOIR	GREEN RIVER	8819	5940
FREMONT LAKE	PINE CREEK	4996	4996
BIG SANDY RESERVOIR	BIG SANDY RIVER	2748	1450
BOULDER LAKE	BOULDER CREEK	1843	1400
WILLOW LAKE	WILLOW CREEK (LAKE CREEK)	1805	1600
VIVA NAUGHTON RESERVOIR	HAMS FORK RIVER	1458	1375
EDEN VALLEY RESERVOIR	SANDY CREEK, BIG & LITTLE	1361	1361
HALFMOON LAKE	POLE CREEK	921	921
NEW FORK LAKE, LOWER	NEW FORK RIVER	837	700
BURNT LAKE	FALL CREEK	815	815
MEEKS CABIN RES	BLACKS FORK RIVER	488	137
GREEN RIVER LAKE, LOWER	GREEN RIVER	453	453
NEW FORK LAKE, UPPER	NEW FORK RIVER	400	370
"67" RESERVOIR	PINEY CREEK, NORTH	323	150
SODA LAKE	FREMONT LAKE AREA	313	313
FAYETTE LAKE	POLE CREEK	288	288
SODA LAKE	BOULDER AREA	261	261
MIDDLE FORK LAKE	BOULDER CREEK, MF	257	257
HALLS LAKE	HALLS CREEK	206	206
SILVER LAKE	SILVER CREEK	171	171
NORTH FORK LAKE	BOULDER CREEK, NORTH FORK	163	163
COOK LAKE, UPPER	POLE CREEK	162	162
JUNCTION LAKE	BOULDER CREEK, MF	160	160
ROLLINS RESERVOIR	BLACKS FORK RIVER	160	60
SENECA LAKE	FREMONT CREEK	159	159
GREEN RIVER LAKE, UPPER	GREEN RIVER	155	155
KEMMERER CITY RESERVOIR	HAMS FORK RIVER	150	130
JIM BRIDGER POND	THREE MILE MARSH	148	148
PINEY LAKE, MIDDLE	PINEY CREEK, MIDDLE	142	120
VICTOR LAKE	BOULDER CREEK, NORTH FORK	139	139
RAID LAKE	BOULDER CREEK, SOUTH FORK	131	131
DIVIDE LAKE	DIVIDE CREEK	130	120
LONG LAKE	FREMONT CREEK	126	126
ISLAND LAKE	FREMONT CREEK	118	118
MEADOW LAKE	MEADOW CREEK	115	115
BEAR LAKE	CLEAR CREEK	107	107
TITCOMB LAKE #5	TITCOMB CREEK	107	107
TITCOMB LAKE #4	TITCOMB CREEK	106	106
SEQUA LAKE	FALL CREEK, LITTLE	106	106
WALL LAKE	POLE CREEK	105	105
HORSESHOE LAKE	FALL CREEK	100	100
JUNCTION LAKE	POLE CREEK	100	100

Source: Ron Remmick, WGF, personal communication, April 28, 2000

Table 2. Recommended Stream Maintenance Flows

Water Name	Tributary To	Maintenance Flow, cfs
GREEN RIVER (below New Fork)	COLORADO RIVER	551
NEW FORK RIVER (below East Fork)	GREEN RIVER	234
GREEN RIVER (Above Daniel)	COLORADO RIVER	200
LITTLE SNAKE RIVER	YAMPA RIVER	167
NEW FORK (East Fk to Pine Cr.)	GREEN RIVER	150
BOULDER CREEK	NEW FORK RIVER	64
PINE CREEK	NEW FORK	59
HAMS FORK (Opal to Kemmer City Res.)	BLACKS FORK RIVER	50
PRAIRIE CREEK	GREEN RIVER	45
BOULDER CREEK SECTION 2	NEW FORK RIVER	40
POLE CREEK SECTION 1	NEW FORK RIVER	36
EAST FORK RIVER SECTION 1	NEW FORK RIVER	33
COTTONWOOD CREEK	GREEN RIVER	33
HORSE CREEK, NORTH	HORSE CREEK	32
GREEN RIVER (above lakes)	COLORADO RIVER	30
HAMS FORK (above Kemmerer City Res.)	BLACKS FORK RIVER	30
HORSE CREEK	GREEN RIVER	30
BIG SANDY RIVER	SANDY RIVER, BIG	29
NEW FORK (above Pine Cr.)	GREEN RIVER	25
FONTENELLE CREEK	GREEN RIVER	23
TITCOMB CREEK	FREMONT CREEK	20
FALER CREEK	GREEN RIVER	20
PINEY CREEK, NORTH	GREEN RIVER	19
NEW FORK RIVER (on Forest)	GREEN RIVER	17
FONTENELLE CREEK, NF	FONTENELLE CREEK	17
PINEY CREEK, SOUTH	GREEN RIVER	17
COTTONWOOD CREEK, NORTH	COTTONWOOD CREEK	15
CLEAR CREEK	GREEN RIVER	15
LABARGE CREEK SECTION 1	GREEN RIVER	15
HORSE CREEK, SOUTH	HORSE CREEK	15
COTTONWOOD CREEK, SOUTH	COTTONWOOD CREEK	15
LABARGE CREEK SECTION 1	GREEN RIVER	15
FISH CREEK	EAST FORK RIVER	15
PINEY CREEK, NORTH	GREEN RIVER	15
POLE CREEK SECTION 2	NEW FORK RIVER	15
SILVER CREEK	EAST FORK RIVER	14
HENRYS FORK RIVER	GREEN RIVER	14
HENRYS FORK RIVER	GREEN RIVER	14
FALL CREEK	POLE CREEK	13
SLIDE CREEK	CLEAR CREEK	10
PINEY CREEK, MIDDLE	GREEN RIVER	10
LAKE CREEK	WILLOW CREEK	10
DUCK CREEK	NEW FORK RIVER	10
ELBOW CREEK	PINE CREEK	10
DEVILS HOLE CREEK	HAMS FORK RIVER	10
FALL CREEK	POLE CREEK	10
LITTLE SNAKE RIVER, NORTH FORK	LITTLE SNAKE RIVER	10
TWIN CREEK, BIG	GREEN RIVER	10
PINEY CREEK, MIDDLE	GREEN RIVER	10

Source: Ron Remmick, WGF, personal communication, April 28, 2000

Figure 1. WGF Recommended Water Levels, Green River Basin

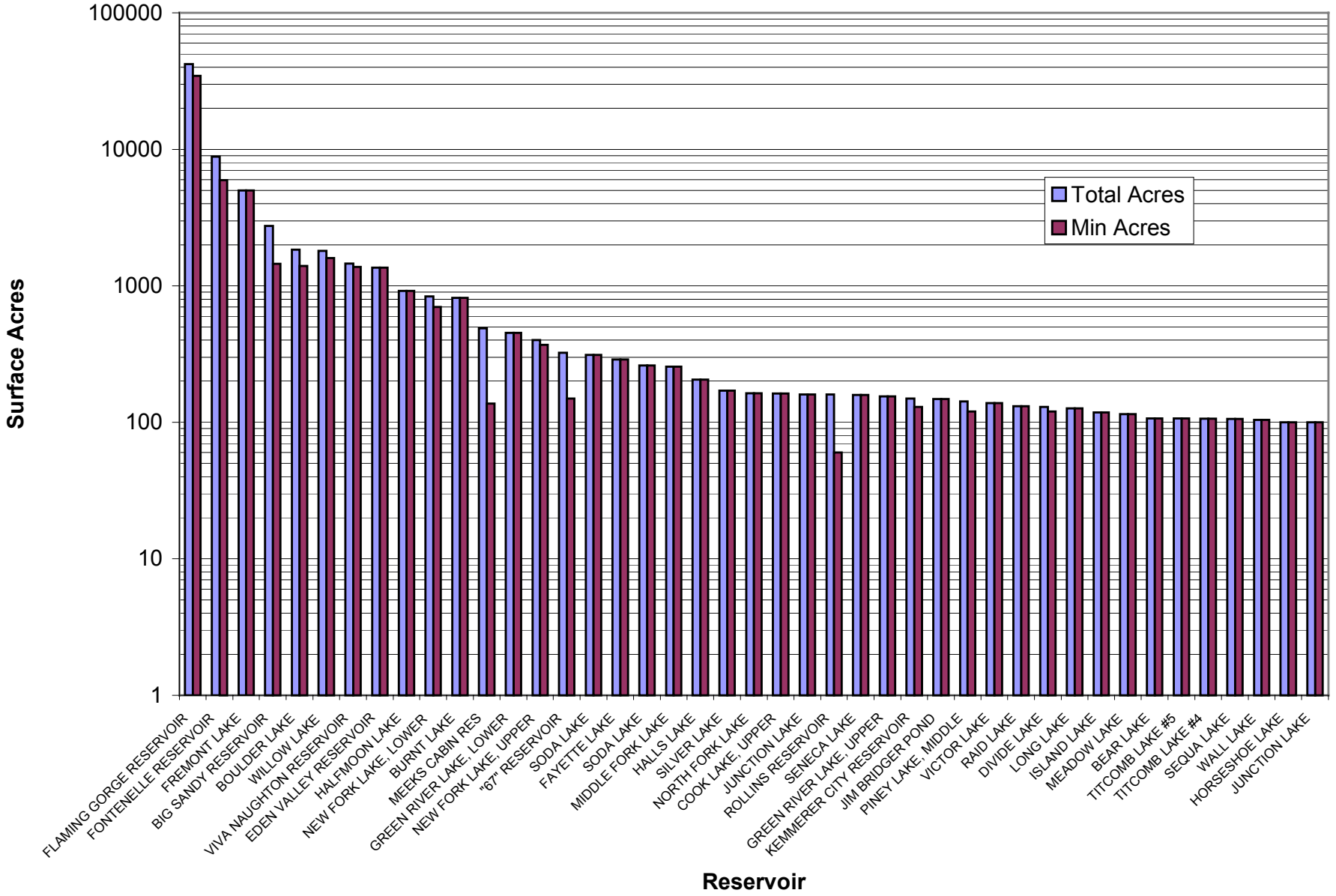
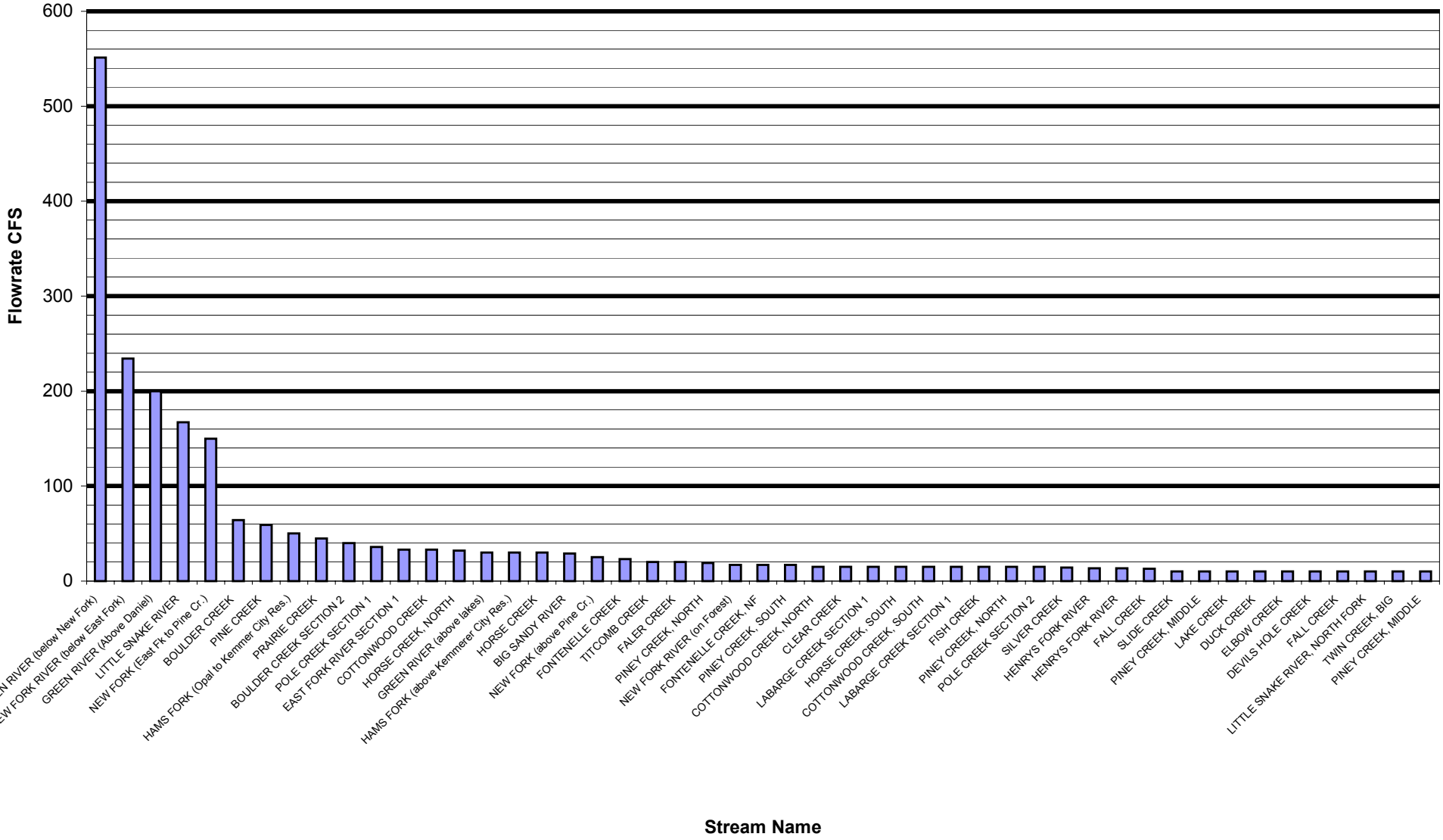
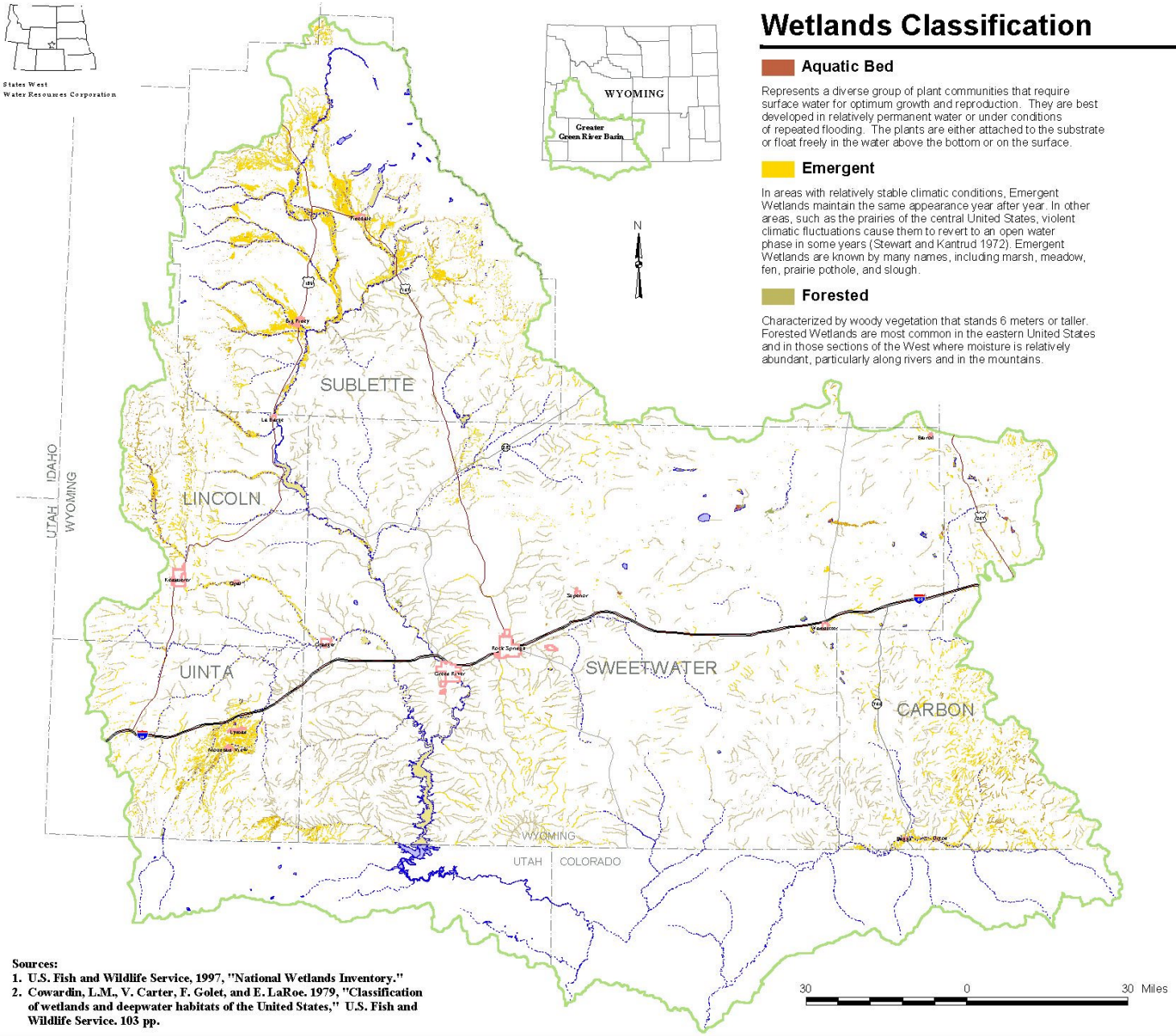


Figure 2. WGF Recommended Maintenance Flows, Green River Basin





Wetlands Classification

Aquatic Bed

Represents a diverse group of plant communities that require surface water for optimum growth and reproduction. They are best developed in relatively permanent water or under conditions of repeated flooding. The plants are either attached to the substrate or float freely in the water above the bottom or on the surface.

Emergent

In areas with relatively stable climatic conditions, Emergent Wetlands maintain the same appearance year after year. In other areas, such as the prairies of the central United States, violent climatic fluctuations cause them to revert to an open water phase in some years (Stewart and Kantrud 1972). Emergent Wetlands are known by many names, including marsh, meadow, fen, prairie pothole, and slough.

Forested

Characterized by woody vegetation that stands 6 meters or taller. Forested Wetlands are most common in the eastern United States and in those sections of the West where moisture is relatively abundant, particularly along rivers and in the mountains.

Rock Bottom

Rock Bottoms are usually high-energy habitats with well aerated waters. Temperature, salinity, current, and light penetration are also important factors in determining the composition of the benthic community. Animals that live on the rocky surface are generally firmly attached by cement or by hooking or sucking devices. A few animals hide in rocky crevices and under rocks, some move rapidly enough to avoid being swept away, and others burrow into the finer substrates between boulders. Plants are also firmly attached (e.g., by hold fasts), and in the Riverine System both plants and animals are commonly streamlined or flattened in response to high water velocities.

Streambed

In most cases streambeds are not vegetated because of the scouring effect of moving water, however, they may be colonized by "pioneering" annuals or perennials during periods of low flow or they may have perennial emergents and shrubs that are too scattered to qualify the area for classification as Emergent Wetland or Scrub-Shrub Wetland.

Scrub - Shrub

Dominated by woody vegetation less than 6 m (20 feet) tall. The species include true shrubs, young trees, and trees or shrubs that are small or stunted because of environmental conditions.

Unconsolidated Bottom

Characterized by the lack of large stable surfaces for plant and animal attachment. They are usually found in areas with lower energy than Rock Bottoms, and may be very unstable. Exposure to wave and current action, temperature, salinity, and light penetration determines the composition and distribution of organisms.

Unconsolidated Shore

Characterized by substrates lacking vegetation except for pioneering plants that become established during brief periods when growing conditions are favorable. Erosion and deposition by waves and currents produce a number of landforms such as beaches, bars, and flats, all of which are included in this Class.

Wetland Class	Irrigated Acres
Aquatic Bed	480
Emergent	136,500
Forested	630
Streambed	10
Scrub-Shrub	7,700
Unconsolidated Bottom	90
Unconsolidated Shore	90

Total Wetland Acres (Irrigated and Non-Irrigated) in Greater Green River Basin ~ 300,000

Sources:

1. U.S. Fish and Wildlife Service, 1997, "National Wetlands Inventory."
2. Cowardin, L.M., V. Carter, F. Golet, and E. LaRoe. 1979, "Classification of wetlands and deepwater habitats of the United States," U.S. Fish and Wildlife Service. 103 pp.

Figure 3
National Wetlands Inventory Mapping Green River Basin, Wyoming