Evaluation of Management Alternatives for the Bear River Migratory Bird Refuge to Increase Performance Metrics of Environmental Flows (working title)

*Project Progress Report*

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# Introduction

The Bear River Migratory Bird Refuge (BRMBR) is a sanctuary for native bird species managed by the U.S. Fish and Wildlife Services. The Refuge was established in 1928 and to this day operates under a singular conservation mission to “administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife and plant resources and their habitats within the United States for the benefit of present and future generations of Americans” (US DOI, 2004). The BRMBR is approximately 74,000 acres and is located directly upstream of the 112,000 acre Bear River delta. Within the BRMBR, 29,259 acres are managed as freshwater wildlife habitat (US DOI, 2004). This area takes the form of many land use types that are designed to benefit a diversity of wetland plants and migratory bird species. In conjunction with the non-watered lands, the refuge provides feeding, breeding, and resting habitat for more than 260 bird species (Downard, 2010).

The BRMBR area is situated near the Bear River delta of the Great Salt Lake. The Bear River Basin, located in northern Utah, southeast Idaho, and southwest Wyoming encompasses an area of 4.8 million acres (US DOI, 2004). With 500 miles of flow from its origin in the Uintah Mountains to the Great Salt Lake, the Bear River is noted for being the longest flowing river in the western hemisphere that doesn’t reach the ocean. Of the water supplied to the Bear River, 60% comes from the Bear River Mountain Range in the form of spring snowmelt. The region is in the rain shadow of the Cascade and Sierra Mountain Ranges resulting in a semiarid climate that on average provides 12.5 inches of precipitation to the refuge annually. Therefore, the each years winter snowpack is crucial for recharging the Bear River and maintaining flows throughout the dry summer months.

Forecasting the water availability to the BRMBR occurs on an annual basis. Managers at the BRMBR look at current NRCS snow survey data for the Bear River Basin each season to estimate water supply and timing. However, the quantity and timing of water delivered to the BRMBR can still be uncertain each year. Therefore, the refuge uses adaptive management approaches to prioritize wetland units so that it maximizes migratory bird habitat and puts the water rights of the BRMBR to beneficial use.

The BRMBR’s primary water right is of 1,000 cfs from the Bear River (UT DWRe, 2010). However, since many user groups in the region made claims to water prior to 1928, the BRMBR is referred to as a junior appropriator, and thus is subject to having their water rights cut off first when shortages occur. In essence, even though the BRMBR has a legal right to 1,000 cfs of water, there is no guarantee water will always be available. Therefore, water security is of great interest for the refuge.

The security of water to the refuge can depend on proposed or available infrastructure and planning for future demands and forecasted availabilities. The implementation structural or non-structural applications can be used to maintain or increase the security of water but comes as a monetary cost to the refuge or as a social cost of conflict among other water user groups. The socially beneficial but most difficult to achieve outcome is an agreement that enhances each user groups water security. Historically, storage and delivery facilities have been implemented to increase water security and reach a beneficial outcome. However, with regional changes in water demands posed by growing populations and subsequent transitions of agricultural lands to developed urban land, it is important the BRMBR managers effectively optimize their infrastructure and planning procedures to ensure water security for the refuge in the future. Therefore, management alternative must be considered now, before shortages have a detrimental impact on the BRMBR.

The BRMBR already faces very unreliable flows with its primary source delivering far lower quantities than the refuge needs during the peak irrigation season, which occurs in the late summer months. The supply of water is imperative when addressing wetland issues because water is the dominant factor determining the nature of soil development and the types of plant and animal communities living in the soil and on its surface (US DOI, 2004). For this reason, this report investigates additional management alternatives that include 1) purchasing water rights to a proposed upstream reservoir, 2) conjunctive ground water use, and 3) environmental easements with local agricultural land users. Each alternative was evaluated based on the metric of flow to the refuge. The evaluation of the proposed management alternatives were carried out using the existing Water Evaluation and Planning (WEAP) model for the Lower Bear River system.

## Objectives of the Bear River Migratory Bird Refuge

The objectives specific to the BRMBR relate to the management or manipulation of target water levels of wetland units to foster desired species occupation. This includes the maintenance, recovery and enhancement of plant and wildlife values. However, problems exist within the wetlands that need to be addressed to meet the objectives of the Refuge. These challenges, among acquiring target environmental flows, include the revival of pre-flood (1983-1988) populations of nesting waterfowl species, control of noxious and invasive species abundance (post-flood), and reduction of pest fish species (carp) that occupy some wetland units.

Not all objectives of the refuge can be met on an annual basis. The maintenance, recovery, and enhancement of plant and wildlife within the refuge are dependent on water availability; primarily form the Bear River, which may be unobtainable in drier years. Due to the variability in annual flows to the BRMBR, managers have developed an adaptive management strategy that prioritizes certain species and wetland units when shortages occur. The goal of this strategy is also to formulate future policies based on what is learned from effects of previous management efforts and protect the resilience to ecosystems.

## Bear River Migratory Bird Refuge Water Uses

The BRMBR uses water to manage species diversity and success. Wetlands within the refuge are managed by a series of dikes and canals that impound and transport the water to individual wetland units. In total, the BRMBR has 26 units divided by 96 miles of dikes (Downard, 2010). This allows the BRMBR managers to control the depth of water for individual units, which creates a variety of wetland habitats to accommodate specific bird species needs. In order to maintain good water quality in the units managers seasonally drain them in a process called drawdown. This is a beneficial practice that helps mitigate the spread of diseases (i.e. avian botulism) and restores a more natural hydroperiod in wetlands (Downard, 2010). A constraint to this however, is the seasonal timing of the drawdown, which may disrupt the benefits of this practice depending on the upstream water forecast.

### Wetland marshes

The wetland marshes, comprised of 29,259 acres, account for the refuge’s largest water needs. These units make up differing soil development and types of plants and animal communities that are directly related to the depth of water. The different wetland types at the BRMBR are deep and shallow submergent, and deep, mid-depth, and shallow emergent. Deep submergent marshes take up 2,500 acres and are filled with 18-36 inches of water at any given time. The shallow submergent marshes cover 8,700 acres and are filled with 4-18 inches of water. The emergent make up 2,800 acres, 6,600 acres, and 8,659 acres of marshes with water depths of 12-24 inches, 8-12 inches, and 2-8 inches respectively.

### Saltair Mudflats

Another major water need on the refuge comes from the saltair mudflats, which encompass 38,064 acres. This land use consists of strongly saline soils and is nearly barren of vegetation. The two forms of mudflats at the BRMBR are vegetated (31,213 acres) and unvegetated (6,852 acres). Water needs are negligible for the unvegetated area as it only receives small amounts of sheet water from snowmelt or heavy rainfall events. However, management of the vegetated mudflats requires the area to be inundated with up to 2 inches of surface water during seasonal high river flows or heavy precipitation.

### Additional Water and Land Uses

While wetlands require the largest quantity of water among the land use types, the BRMBR also has water needs for managing 374 acres of wet meadow, consisting of sedges and rushes, and 45.5 acres of riparian habitat along the stream bank of the Bear River channel. The BRMBR also manages less water dependent areas such as semi-desert alkali knolls (522 acres), alkali bottoms (973 acres) and salt meadows (2,625 acres). Alkali knolls are scattered throughout the landscape of the mudflat habitat as abrupt mounds consisting of forbs, grasses, shrubs, and bare ground. Alkali bottoms consist of similar vegetation while its low-lying characteristic provides nesting for waterfowl species. The salt meadows are more heavily vegetated communities that consist of sedges, rushes and saltgrasses. Lastly, the 96 miles of dikes account for 791 acres within the refuge. While dikes have a major role in the impoundment of water with units they also provide a vegetation community, which is dominated by forbs.

## Bear River Migratory Bird Refuge Management Strategies and Constraints

### Current Management Strategies

Each year the BRMBR develops a Habitat Management Plan that describes how the water will be managed within the wetland units. The decisions are based on the anticipated water supply, which is provided by the annual Natural Resources Conservation Service (NRCS) water supply outlook. The NRCS supplies extensive data in regards to winter snowpack water equivalent, soil moisture, precipitation, and reservoir storage in respect to historical minimums, maximums, and averages. Staff biologists at the BRMBR also use bird survey data with previous water and vegetation management strategies, in what is called adaptive management, to determine the best strategies.

#### Wetlands

* Strategy 1. Manage water and soil salinity
  + 1a. Flushing units
  + 1b. Maintaining water levels
  + 1c. Drawdown
* Strategy 2. Manage water clarity
  + 2a. Restrict carp
  + 2b. Reduce silt loading
* Strategy 3. Control aquatic vegetation community composition
  + 3a.Manage water depts.
  + 3b. Match salinity levels with tolerance ranges of desired macrophytes
  + 3c. Set back succession
    - 3c.i. Periodic drawdown
    - 3c.ii. Prescribed fire or mechanized equipment
    - 3c.iii. Encourage muskrat colonization
* Strategy 4. Manage aquatic invertebrate abundance and diversity.
  + 4a. Manage for a diversity of wetland types
  + 4b. Prohibit pesticide use.
* Strategy 5. Protect and maintain structures and levees.

#### Saltair Mudflat

* Strategy 1. No Management action
* Strategy 2. Spring drawdown
* Strategy 3. Construction of contour furrows

#### Wet Meadow

* Strategy 1. Maintain water supply
* Strategy 2. Prescribed grazing

### Current Management Constraints

#### Wetland

* Strategy 1. The refuge holds a state-certified water right with a priority date of 1928 for 1,000 cfs from Jan 1-Dec 31. “Spring flows supply more water than can be retained by existing facilities. Summer flows tend to be too low to maintain desirable pool elevations on constructed units because net evaporation is about 54 inches annually and the river flow is reduced by upstream irrigations demands”. (HMP 2004)
* Strategy 2b. Refuge may need to take advantage of high river flows, regardless of the silt load, if precipitation forecasts are low.
* Strategy 3. Depends on the amount and timing of water from the Bear River
* Strategy 4. Depends on the amount and timing of water from the Bear River

#### Saltair Mudflat

* Strategy 2. Unable to re-fill the unit due to lack of water or a poor clarity of water upon refill.

## Water Rights of the Bear River Migratory Bird Refuge

http://www.waterrights.utah.gov/cblapps/wrprint.exe?wrnum=29-1014#

Water Rights held by Bear River Migratory Bird Refuge. Bear River Water Rights are Highlighted.9

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Source** | **Priority** | **Quantity (acre-feet)** | **Flow Right (cfs)** | **Right Number** | **Beneficial Use** | **Type** |
| Stauffer- Packer Spring | 1860 | 149.19 | 1.04 | 29-3172 | Irrigation | Diligence |
| Perry Spring Stream | 1869 | 57.21 | 1.00 | 29-951 | Irrigation | Underground claim |
| Unnamed Stream | 1896 | 326.38 |  | 29-1919 | Irrigation, Incidental Wildlife | Diligence |
| Unnamed Spring | 1869 | 283.78; (0.03) |  | 29-973 | Irrigation (Stock, Incidental Wildlife) | Diligence |
| Dan Walker Spring | 1870 | 192.68; (0.64) | 3.06 | 29-936 | Irrigation; (Stock) | Diligence |
| Perry Spring Stream | 1870 | 27.84  (0.56) | 0.56 | 29-937 | Irrigation (Stock) | Diligence |
| Underground Drains | 1870 | 0.22 | 0.002 | 29-3061 | Stock | Underground claim |
| Unnamed Spring Stream | 1880 | 10.86 | 0.02 | 29-2622 | Stock | Diligence |
| Unnamed Spring Stream | 1880 | 49.2  (0.91) | 1.00 | 29-1697 | Irrigation (Stock) | Diligence |
| Unnamed Spring | 1881 | 328.62 | 1.00 | 29-3060 | Irrigation | Diligence |
| Underground Drains | 1885 | 164.40  (0.86) | 1.50 | 29-1915 | Irrigation (Stock) | Underground Claim |
| Underground Drains | 1885 | 329.73 (0.86) | 2.00 | 29-1916 | Irrigation (Stock) | Underground Claim |
| Underground Drains | 1887 | 147.64 (0.86) | 3.00 | 29-1914 | Irrigation (Stock) | Underground Claim |
| East Slough | 1896 | 403.60 | 7.37 | 29-1450 | Irrigation | Decree |
| Black Slough | 1896 | 940.4 | 45.00 | 29-3484 | Irrigation | Decree |
| Underground Drains | 1900 | 231.96 (0.84) | 1.59 | 29-768 | Irrigation (Stock) | Underground Claim |
| Underground Drains | 1900 | 189.08 (0.64) | 1.11 | 29-769 | Irrigation (Stock) | Underground Claim |
| **Bear River** | **1902** | **3840.80** | **15.90** | **29-3485** | **Wildlife** | **Diligence** |
| **Bear River** | **1902** | **2000.00** | **-** | **29-3698** | **Irrigation** | **Diligence** |
| Unnamed Stream | 1902 | 0.28 | 0.002 | 29-3157 | Stock | Diligence |
| Underground Drains | 1920 | 0.86 | 0.01 | 29-770 | Stock | Underground claim |
| Surface Drains | *1907* | *20.52*  *(0.03)* | *0.50* | *29-980* | *Irrigation (Stock)* | *Application* |
| **Bear River** | **1928** | **425,771.00** | **1,000.00** | **20-1014** | **Wildlife** | **Application** |
| Underground Well | 1955 | 0.42 | 0.01 | 29-1165 | Stock | Application |
| Underground Well | 1961 | 0.002 | 0.13 | 29-1330 | Stock | Application |
| Salt Creek | 1991 | 666.25  (666.25)  [1337.75] | - | 29-3668 | Waterfowl (Fisheries) [Irrigation] | Application |
| Stauffer- Packer Spring | 1995 | 4.00 | 1.04 | 29-3825 | Wildlife | Application |
| Underground Drains | 1995 | 40.00 | 1.0 | 29-3824 | Wildlife | Application |
| Surface and Underground Drains | 1997 | 1447.59 | 2.0 | 29-1637 | Stock | Application |
| Total BRMBR  Rights |  | **438785.12** |  |  |  |  |

9 Data gathered from Utah Division of Water Rights (2009) online database.

## Bear River Migratory Bird Refuge Water Demands

# Methods

## Proposed Structural and Non-Structural Management Alternatives

### Structural

#### Conjunctive Groundwater Use

#### Reservoir Storage

#### On-Site Storage

### Non-Structural

#### Water Trading

#### Environmental Easements/Return flow management

#### Water Rights Purchasing from Proposed Upstream Reservoir (BRDP)

## Quantitative Metrics for Evaluating Objective Success

# Results

## Major Findings to Date

## Continuation of this Work

# Discussion

# Conclusions

# References

U.S. Department of the Interior, Fish and Wildlife Service, Bear River Migratory Bird Refuge. Habitat Management Plan (2004). <http://www.fws.gov/refuge/Bear_River_Migratory_Bird_Refuge/what_we_do/resource_management.html>

# Appendix