01 Water Banking Purposes

02 Example Water Banks

03 Preliminary Conclusions
Assignment from March
Water Banking Workshop #1

• Prior to next workshop, come up with your own list of project needs
• What would YOU like a water bank to do for you?
Water Banking Purposes

- Prevent Fully Appropriated status in the future
- Protect existing uses and infrastructure
- Maintain local control
- Allow for future development
- Facilitate water transfers
- Meet specific flow needs at a specific time
- Follow consistent accounting of water across Coalition area
- Provide assurances that banked water will be protected against future accounting changes
- Enable sustainability in non-hydrologically connected areas
Water Banking Purposes

Balancing Overall Supplies and Demands
- Prevent Fully Appropriated status in the future
- Protect existing uses and infrastructure
- Allow for future development
- Follow consistent accounting of water across Coalition area
- Provide assurances that banked water will be protected against future accounting changes
- Enable sustainability in non-hydrologically connected areas

Moving and/or Retiming Supplies
- Meet specific flow needs at a specific time
- Facilitate water transfers

Maintain Local Control
Water Banking Examples

Balancing Overall Supplies and Demands
• Sargent Canal Recharge
• Sherman Reservoir Operations

Moving and/or Retiming Supplies
• Skull Creek Reservoir
• Augmentation Pumping Project
Water Banking Examples

Augmentation Project

Sherman Reservoir

Skull Creek Reservoir
Balancing Overall Supplies and Demands

Sargent Canal Recharge
Sargent Canal Recharge

[Diagram of Sargent Canal Recharge showing North Loup River, Middle Loup River, LOUP, Lower Loup River, South Loup River, Mullen, and Brown's Draw.]
Sargent Canal Recharge

Middle Loup River

Sargent Canal
Sargent Canal Recharge

39.6 miles
260 cfs diversion capacity
Sargent Canal Recharge

Canal Recharge Operations

• Divert in April, May and October, November (before and after irrigation season)
• Seepage from canal provides return flows over entire year, including irrigation season
• Recharge activity could shift supplies from Non-Peak to Peak period, when supplies are usually more scarce
• Would make Fully Appropriated determination less likely, allow for future development, etc.
Sargent Canal Recharge

Peak

Milburn Dam

Sargent Canal

Middle Loup River
Sargent Canal Recharge

Sargent Canal Example - Instream Demand Scenario
(24YR Diversion vs. 43YR Accretion Totals)
(Cap Diversion to 475 AF)

Monthly Values (AF)

Jan  | Feb  | Mar  | Apr  | May  | Jun  | Jul  | Aug  | Sep  | Oct  | Nov  | Dec  
---   | ---  | ---  | ---  | ---  | ---  | ---  | ---  | ---  | ---  | ---  | ---  
50,000 | 50,000 | 50,000 | 300,000 | 300,000 | 250,000 | 250,000 | 200,000 | 200,000 | 150,000 | 150,000 | 100,000 | 100,000 | 50,000 | 50,000

Accretion | Diversion
Sargent Canal Recharge

Middle Loup River Flow

Before Recharge

After Recharge
Sargent Canal Recharge

Annual

Before Recharge: Supply
After Recharge: Supply

Non-Peak

Before Recharge: Supply
After Recharge: Supply

Peak

Before Recharge: Supply
After Recharge: Supply
Sherman Reservoir Operations

About 68,000 acre-feet capacity
Active capacity 58,000 af

Sherman Reservoir

Middle Loup River

Muilen
Sherman Reservoir Operations

- Sherman Feeder Canal
  - 19.1 miles long
  - 850 cfs capacity
- Farwell Main and Lower Main Canal
  - 37.5 miles long
  - 960 cfs capacity
- Farwell Central Canal
  - 18.5 miles long
  - 170 cfs capacity
- Farwell South and Upper South Canal
  - 39.7 miles long
  - 340 cfs capacity
Sherman Reservoir Operations

Reservoir Operations

• Normally store water during off-season for later irrigation releases

• Reallocate storage (2-3 feet) in fall or spring to hold excess flows

• Reservoir seepage, and/or releases to Farwell canals for subsequent canal seepage could shift supplies from Non-Peak to Peak period, when supplies are usually more scarce

• Would make Fully Appropriated determination less likely, allow for future development, etc.
Sherman Reservoir Operations

Sherman Reservoir

Arcadia Diversion Dam

Sherman Feeder Canal

Reservoir

Seepage

Peak

Farwell Main Canal

Farwell Central Canal

Oak Creek

Farwell South Canal

Middle Loup River

Loup City

Valley

Westerville

Howard

St. Paul

St. Libory

Ravenna

0 mi
Sherman Reservoir Operations

- Arcadia Diversion Dam
- Sherman Feeder Canal
- Sherman Reservoir
- Peak
- Canal Seepage
Sherman Reservoir Operations

Middle Loup River Flow

Before Operation Changes

After Operation Changes
Sherman Reservoir Operations

- **Annual**
  - Before Operations: Supply
  - After Operations: Supply
  - Before Operations = After Operations

- **Non-Peak**
  - Before Operations: Supply
  - After Operations: Supply
  - Before Operations ≥ After Operations

- **Peak**
  - Before Operations: Supply
  - After Operations: Supply
  - Before Operations < After Operations
Moving and/or Retiming Supplies

Skull Creek Reservoir
Skull Creek Reservoir

New Reservoir and Operations

- Store flows during Non-Peak months, release when needed
- Permitting required
- New storage right and storage use rights through DNR
- Losses from reservoir to delivery point
- Could provided wet water when needed
Skull Creek Reservoir

Roughly 60 miles from reservoir site to Ashland
Skull Creek Reservoir

Lower Platte River Flow

- Non-Peak
- Peak
- Non-Peak
- Peak
- Non-Peak

Storage

Reservoir Release

Dry Year

Before Reservoir

After Reservoir

Lower Platte Streamflow (cfs)
Skull Creek Reservoir

**Annual**

Supply Before Reservoir = Supply After Reservoir

**Non-Peak**

Supply Before Reservoir > Supply After Reservoir

**Peak**

Supply Before Reservoir < Supply After Reservoir
Skull Creek Reservoir

Impacts to Overall Basin Accounting

• Shift water supply from Non-Peak to Peak period
• Could be used to meet increased downstream demands during Peak period
• Would require cooperation between multiple NRDs – using common accounting
Moving and/or Retiming Supplies

Augmentation Pumping Project
Augmentation Pumping Project

Augmentation Operations

• Develop wellfield at location with significant, and accessible, groundwater supplies – preferably at considerable distance from stream (low SDF)

• Pump water when needed for downstream demands

• Losses along path to diversion point

• Could use a DNR “Conduct Water” permit to protect water from diversion
Augmentation Pumping Project

- Augmentation Wells
- Pipeline
- Distance from Stream
- Delivery Point
- River
Augmentation Pumping

Lower Platte River Flow

Before Augmentation Pumping
After Augmentation Pumping

Pumping
Depletion Impact

Non-Peak  Peak  Non-Peak  Peak  Non-Peak
Augmentation Pumping

**Annual**

Before Augmentation: $\leq$

After Augmentation: $>$

**Non-Peak**

Before Augmentation: $\approx$

After Augmentation: $\approx$

**Peak**

Before Augmentation: $\leq$

After Augmentation: $>$
Augmentation Pumping Project

Impacts to Overall Basin Accounting

• Lag effects from groundwater pumping delayed, but accumulate over time

• Increase in supply as measured by pipeline discharge

• Net long-term impacts depend on hydrologic connectivity to stream, and pumping methods

• Could include retirement of irrigated acres to counter pumping depletions (as with N-CORPE)
Water Banking

“Speed of Delivery” Spectrum

Passive
- Delayed
- Canal Recharge
- Reservoir
- Seepage

Active
- Reservoir Releases
- Augmentation
- Pumping
- On Demand
Preliminary Conclusions

• Water banking has potential to meet needs to:
  • Balance overall water supplies and demands
  • Meet specific demands at particular times
• All banking operations can be tracked by overall accounting methods
• Some banking activities may require cooperation between NRDs, while some could be done within a single NRD
• This is a small sample – banking options are almost limitless, and could be tailored for specific region and purpose
Questions?