MR&I SYSTEM

Overview

- Municipal, Rural, and Industrial System
- Provide water to majority of Reservation
- Pipeline Network
- Economies of Scale of a large system
Crow Reservation: 2.3 million acres
Funding

$246.4 million – Construction
$47 million – OM&R
Population & Water Needs

- 2010 Population -6863
- 2060 Population -9050
Intake

- Bighorn River near St. Xavier
  - 7-10 cfs of Water
    - 2,500 cfs – Optimum River Flow
Angled Well
Treatment Plant

- 4.5 MGD To 6.7 MGD
Pipelines

- 750 Miles of Pipe
- PVC and Ductile Iron Pipe
- 1.5” to 24” Diameter
- Route along roads
- Pump Stations
Preliminary Routing
## Priority List

<table>
<thead>
<tr>
<th>Priority</th>
<th>Project</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Intake &amp; Discharge Facility &amp; Raw Water Pipeline</td>
</tr>
<tr>
<td>2</td>
<td>Water Treatment Plant</td>
</tr>
<tr>
<td>3</td>
<td>St. Xavier Regional Tank</td>
</tr>
<tr>
<td>4</td>
<td>Transmission Pipeline from WTP to Crow Agency Regional &amp; Community Tank</td>
</tr>
<tr>
<td>5</td>
<td>Pryor &amp; Wyola Community Upgrades</td>
</tr>
<tr>
<td>6</td>
<td>Pryor &amp; Wyola Community Tanks</td>
</tr>
<tr>
<td>7</td>
<td>Crow Agency Regional Tank</td>
</tr>
<tr>
<td>8</td>
<td>Crow Agency Community Tank and Upgrades</td>
</tr>
<tr>
<td>9</td>
<td>St. Xavier to Hardin Distribution Pipeline</td>
</tr>
<tr>
<td>10</td>
<td>Crow Agency Region Distribution Pipeline</td>
</tr>
<tr>
<td>11</td>
<td>Transmission Pipeline from WTP to Lodge Grass Regional Tank</td>
</tr>
<tr>
<td>12</td>
<td>Lodge Grass Regional Tank</td>
</tr>
<tr>
<td>13</td>
<td>South Big Horn Valley Distribution Pipeline</td>
</tr>
<tr>
<td>14</td>
<td>Fort Smith/Government Camp Regional Tank</td>
</tr>
<tr>
<td>15</td>
<td>Transmission Pipeline through Lodge Grass and Wyola</td>
</tr>
<tr>
<td>16</td>
<td>Lodge Grass Community Tank and Upgrades</td>
</tr>
<tr>
<td>17</td>
<td>North and East Little Big Horn Valley Distribution Pipeline</td>
</tr>
<tr>
<td>18</td>
<td>South and West Little Big Horn Valley Distribution Pipeline</td>
</tr>
<tr>
<td>19</td>
<td>Transmission Pipeline from WTP to Pryor</td>
</tr>
<tr>
<td>20</td>
<td>Pryor Regional Tank</td>
</tr>
<tr>
<td>21</td>
<td>East and South Pryor Distribution Pipeline</td>
</tr>
<tr>
<td>22</td>
<td>North Pryor Distribution Pipeline</td>
</tr>
<tr>
<td>23</td>
<td>Cloud Peak Extension</td>
</tr>
</tbody>
</table>
Schedule

Crow MR&I Construction Timing Schedule

- Pre Construction, Days
- Construction, Days

Priority 1
Priority 2
Priority 3
Priority 4
Priority 5
Priority 6
Priority 7
Priority 8
Priority 9
Priority 10
Priority 11
Priority 12
Priority 13
Priority 14
Priority 15
Priority 16
Priority 17
Priority 18
Priority 19
Priority 20
Priority 21
Priority 22
Priority 23

WATER TREATMENT

GOALS

- High quality water
- Affordable
- Easy to operate & maintain
- Creates jobs
- Regulation compliance (now and future)
- Reliable
- Positive economic impact

PROCESS OPTIONS

<table>
<thead>
<tr>
<th>Treatment Processes</th>
<th>Lime Softening and Media Filtration</th>
<th>Lime Softening and Biological Media Filtration</th>
<th>Lime Softening and Microfiltration</th>
<th>Media Filtration and Reverse Osmosis</th>
<th>Microfiltration and Reverse Osmosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water Quality and Flexibility to meet Current and Future Regulations</td>
<td>Good</td>
<td>Good</td>
<td>Good</td>
<td>Better</td>
<td>Best</td>
</tr>
<tr>
<td>Operating, Maintenance, and Replacement Costs</td>
<td>Low</td>
<td>Medium</td>
<td>Medium</td>
<td>High</td>
<td>High</td>
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</tbody>
</table>

DESIGN CONSIDERATIONS

- Minimize GDB precursors
- Iron & Manganese removal
- Hardness removal
- Treatment of Secondary goals identified
- Flexibility of treatment processes to meet current and future regulations
- Challenges of a large distribution system
- Labor intensity
- Technical difficulty
- Residual handling
- Positive economic impact and jobs source for Crow Tribe

CONTAMINANTS OF CONCERN

<table>
<thead>
<tr>
<th>Contaminant</th>
<th>EPA Required Limit of Treated Water</th>
<th>Big Horn River &amp; River Bank Well Raw Water Sample</th>
<th>Crow MR&amp;I Water Treatment Goal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iron</td>
<td>0.3 mg/L</td>
<td>0.02-0.036</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>Manganese</td>
<td>0.05 mg/L</td>
<td>0.05-0.7</td>
<td>&lt;0.1</td>
</tr>
<tr>
<td>Aluminum</td>
<td>0.2 mg/L</td>
<td>ND-0.6</td>
<td>&lt;0.1</td>
</tr>
<tr>
<td>Arsenic</td>
<td>0.01 mg/L</td>
<td>ND-0.062</td>
<td>&lt;0.1</td>
</tr>
<tr>
<td>Bromide</td>
<td>0.01 mg/L</td>
<td>NA</td>
<td>0.2</td>
</tr>
<tr>
<td>Selenium</td>
<td>0.03 mg/L</td>
<td>ND-0.002</td>
<td>&lt;0.03</td>
</tr>
<tr>
<td>Sulfate</td>
<td>25 mg/L</td>
<td>157.7-730</td>
<td>&lt;200</td>
</tr>
<tr>
<td>Nickel</td>
<td>1 mg/L</td>
<td>ND-0.45</td>
<td>&lt;1</td>
</tr>
<tr>
<td>Nitrate</td>
<td>10 mg/L</td>
<td>Non-Detection</td>
<td>0</td>
</tr>
<tr>
<td>Radium</td>
<td>5 pCi/L</td>
<td>2.8-2.66</td>
<td>0</td>
</tr>
<tr>
<td>Uranium</td>
<td>30 mg/L</td>
<td>10-4.4</td>
<td>0</td>
</tr>
<tr>
<td>Chloride</td>
<td>250 mg/L</td>
<td>3.13</td>
<td>&lt;250</td>
</tr>
<tr>
<td>TOX</td>
<td>0.00 mg/L</td>
<td>4.2-6.1</td>
<td>&lt;600</td>
</tr>
<tr>
<td>Hardness</td>
<td>NA</td>
<td>176-322 mg/L</td>
<td>100-150</td>
</tr>
</tbody>
</table>

Design Process for Crow MR&I Water Treatment Plant
WATER AFFORDABILITY (RATES)

GOALS
- High quality, safe and affordable water service
- Affordable service for residents with all levels of income
- Financially sustainable

MR&I SYSTEM OM&R FUNDING
- Annual Operation, Maintenance, and Replacement (OM&R) Cost = $4,095,000
- Settlement Fund OM&R Account includes:
  - $47 Million Principal (2018 Index = $56 Million)
  - 2% Annual Interest = $1,136,800 Million, which is 28% of the OM&R annual cost
- Initial operation shortfall of $2,958,200 annually to be paid by users.
- *Inflation will increase operation costs and water rates

AVAILABLE RATE OPTIONS
- Flat Rate
- Budget Billing
- Income-based
- Late Payment Forgiveness
- Leak Detection Assistance
- Payment Discounts
- Partial Credits
- Minimum Essential Use Rates
- Targeted Conservation

WATER CONSUMPTION

<table>
<thead>
<tr>
<th>Category</th>
<th>Gallons Per Person Daily</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Average</td>
</tr>
<tr>
<td>Municipal &amp; Rural</td>
<td>100</td>
</tr>
<tr>
<td>Livestock</td>
<td>18</td>
</tr>
<tr>
<td>Commercial</td>
<td>80</td>
</tr>
<tr>
<td>Industrial</td>
<td>Varies</td>
</tr>
</tbody>
</table>

AFFORDABILITY
- Low-income (below $20,000 per year) threshold
  - Maximum water bill not to exceed 1% of income
  - 1% of median household income (whichever is less)
  - System-wide average threshold
  - Maximum water bill not to exceed 1% of median

UNIT PRICE OF WATER
- The unit price of water will vary based on the type of treatment plant used, if customer classification is used, and the method of predicting average volumes used.

<table>
<thead>
<tr>
<th>Treatment Alternative</th>
<th>Scenario 1 Single User Class</th>
<th>Scenario 1 Below Low-income</th>
<th>Scenario 2 Level Above Low-income Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Microfiltration with Reverse Osmosis softening</td>
<td>$3.30</td>
<td>$1.53</td>
<td>$3.45</td>
</tr>
<tr>
<td>Microfiltration with Lime softening</td>
<td>$3.12</td>
<td>$1.53</td>
<td>$3.25</td>
</tr>
<tr>
<td>Conventional media filtration with Lime softening</td>
<td>$2.57</td>
<td>$1.53</td>
<td>$2.65</td>
</tr>
</tbody>
</table>

WATER RATE SCENARIOS
Projection Assumptions/Criteria
- Preserve OM&R account principal (use only earned interest to offset MR&I operation costs)
- An annual interest rate on the OM&R account of 2%
- Average per capita water demands based on USGS study from 2005-10
- OM&R costs based on current appraisal level design (Crow MR&I Master Plan)

SCENARIO 1: even allocation of costs across all sectors of water use
- Average unit price of water per 1000 gallons = $3.30
- National average monthly water use of 5000-7000 gallons = bills ranging from $16.50* to $23.10*
  *Exceeds 1% of income for low-income households

SCENARIO 2: adjusted based on low income affordability thresholds
- Adjusted unit price of $1.53 per 1000 gallons for households below the low income level
- Adjusted unit price of $3.45 per 1000 gallons for all other water users
- National average monthly water use = bills for low-income households ranging from $7.65 to $10.71
- National average monthly water use = bills for households above low income ranging from $17.75 to $24.15
- Range in monthly water bill is proportional to household size

1,000 gallons = $10,000
1,000 gallons = $3.30
OM&R FUNDS

Water Settlement Act OM&R Language: “The Secretary of the Treasury shall transfer to the Secretary $47,000,000, adjusted to reflect changes in appropriate cost indices during the period beginning on the date of enactment of this Act and Ending on the date of the transfer, for MR&I System OM&R.”

2010 2018
$47,000,000 —> $56,000,000

Scenario #1—Use Capital

Scenario #2—Maintain Capital

OTHER OPTIONS
-Use interest earned to offset a portion of the Tribal Members costs
-Reinvest a portion of the account interest earned back into the account to grow the balance
SYSTEM COMPARISON
Centralized Rural Water System vs. Existing Satellite System

**REGIONAL SYSTEM ADVANTAGES**

- Entire reservation benefits
- Reduce/eliminate purchased supplemental well water
- Reduce operational costs
- Efficient water delivery
- Increase economic development potential
- Tax revenue
- Property values
- Centralized softening rather than home softeners
- Decrease cleaning time
- Decrease pipe and appliance water scaling
- Decreased appliance repair and replacement costs

**EXISTING SATELLITE SYSTEM DISADVANTAGES**

- Pipeline hard water deposits
- Commercial/industrial expansion requires new water source development
- Limit coal mining development

**REGIONS**

- IRA
- Build
- West
- North

**CURRENT RESERVATION WATER SUPPLY**

- SERVED
- NOT SERVED

**Regional Drinking Water System Expenditure**

- Depreciation 43%
- Salaries and benefits 18%
- Operating costs 39%

**Upgrading existing satellite system does not impact rural water users**

- Rural areas water supply
- Individual wells
- Commonly shallow alluvial groundwater wells
- May be surface water connected
- Purchased water

**Regional Drinking Water System Benefits**

- Meet Safe Drinking Water Act requirements efficiently and reliably
- Allow future growth
- Excess capacity
- Ability to upsize
- Develop most reliable quality water source on the Crow Reservation, Bighorn River
- Livestock consume existing water
- Potentially leading to loss of profits
- Jobs during construction and operation
- Livestock benefits
- Increased livestock production
- Decreased vet visits
- Decrease pipe scaling
- Extend distribution system life
- Centralized softening would remove softening by individuals

**Component of Reservoirs**

- Owned and operated by a single entity, the Tribe
- Provide consistent service reservation-wide
- Requires fewer trained operators
- More easily hire and retain qualified staff to operate, maintain, and manage the water system

**Improved Health Reservation Wide**

- Reduced sulfate = reduced gastrointestinal illnesses and dehydration
- Reduced nitrate = reduced infant illness and mortality
- Reduced uranium = reduced kidney toxicity
- Reduced Manganese = reduced respiratory problems and neurological damage
- Reduced Arsenic = reduced skin cancer, developmental defects, cardiovascular disease, and diabetes
- Reduced health care costs

**Increasing difficulty meeting Safe Drinking Water Act Regulations**

- Adversely impact public health and safety
- Especially infants and elderly
- Enforcement action

**Existing Facilities approaching or surpassed expected lifetime**

- Current operating conditions require water quality treatment upgrades
- Financial debt

**Sources:**

- Montana Department of Health and Human Services: http://www.doh.mt.gov/health/water
- U.S. Environmental Protection Agency: http://www.epa.gov/safewater/
Land Management-ROW Procedures

1. **Project Area & Use**
   - A. Determine if within the Crow Irrigation Project (CIP) or Municipal Rural & Industrial (MR&I) Project
2. **Site Visit with Project Engineers**
   - go over project details and specifics
   - A. Note if staging area, borrow or fence issues may present themselves
   - i. If within existing ROW and/or covered in Encroachment permit or
   - ii. If further permission needed, use a Surface Use Agreement or Revocable Permit from BIA.
3. **Map (GIS/Research Assistant) of the Project showing legal descriptions**
   - A. Research land ownership
   - i. If project parameters fall within:
   -   1. Fee land:
   -       A. Obtain landowner information from Big Horn County
   -       B. Work with landowners, explain project details
   -       C. Then consult Bureau of Reclamation for appropriate forms and permissions.
   -       D. Mail letters to landowners
   -   2. Tribal/Allotted:
   -       A. Obtain Title Status Report (TSR) and addresses from the Bureau of Indian Affairs, discuss permissions needed
   -       B. Work with landowners, explain project details
   -       C. Mail letters to landowners
4. **Work done outside Land Management**
   - Request for NEPA Clearance Category Exclusion Checklist, and Environmental Assessment (EA) from Bureau of Reclamation (BOR). Request Form from Tribal Historic Preservation Office (THPO) for clearance concurrence.
5. **CTWRD/B&W**
   - Work with Big Horn County Electric for any electrical easements. Ensure this is completed before project work commences.
Crow Irrigation Project: Overview

- CIP work commenced 1885
- 11 Irrigation Units
- Water Source
  - Bighorn & Little Bighorn River
  - Sunday Creek
  - Lodge Grass Creek
  - Pryor Creek
  - Lost Creek
Funding

- $131.8 million - Construction
- $10 million - O&M
Irrigation Units
Overview

- ≈ 125 miles main canals
- ≈ 260 miles laterals, sublaterals, drains
- ≈ 3,800 structures
- 11 diversion dams
- 1 storage reservoir
1. Rehabilitation of Structures
2. Rehabilitation of Canals

- Cleaning/Reshaping
- Lining
- Piping
3. Alternative On-Farm Systems

- Lining
- Land Leveling
- Gated Pipe
- Surge Irrigation
- Center Pivots
- Wheel Lines
4. Purchase of Fee Lands

- Tribal Status
- Create land “blocks”
5. Irrigation Development

- Dunmore Bench
- Other CIP Units
COMPLETED PROJECTS

Lodge Grass No. 1 Headworks

Before

After

Lodge Grass No. 2 Headworks
Big Horn High Check Emergency Repair

Before

After

High Check O&M Road
PRYOR WASTEWAY

Before

After
SOAP CREEK WASTEWAY

After
PILOT PLANT OPERATIONS
Questions?
Thank you!