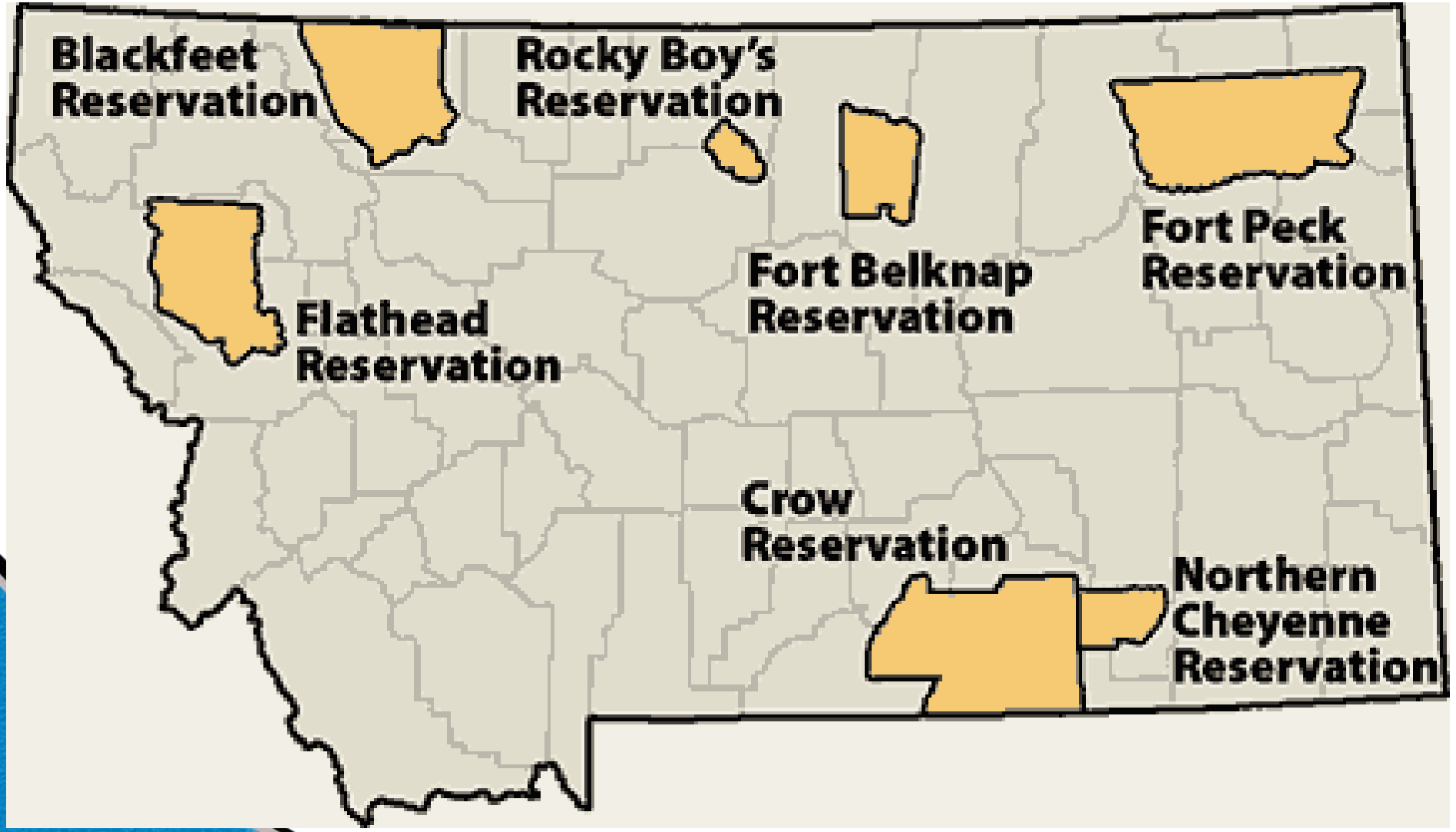
Crow Tribe Water Resources

Crow MR&I Project

Crow Irrigation Project

Presented by: Titus Takes Gun

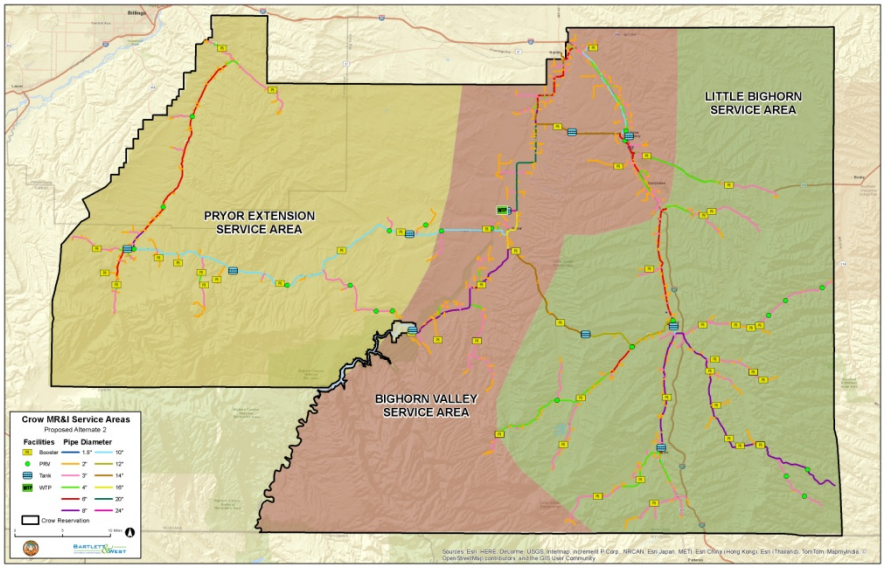
November 5th, 2015


Blackfeet Reservation
Rocky Boy's Reservation
Fort Belknap Reservation
Fort Peck Reservation
Flathead Reservation
Crow Reservation
Northern Cheyenne Reservation

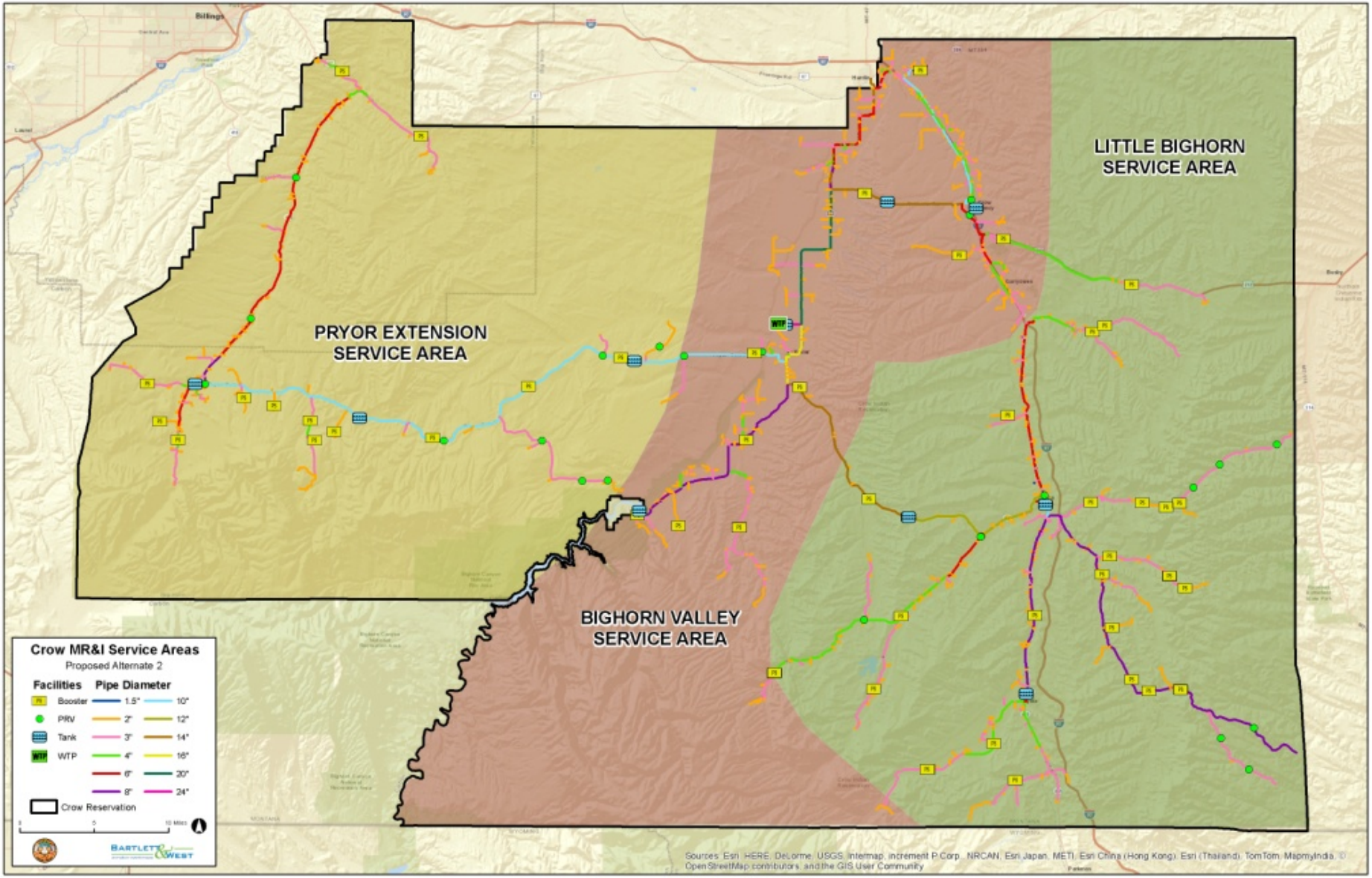
MR&I SYSTEM

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

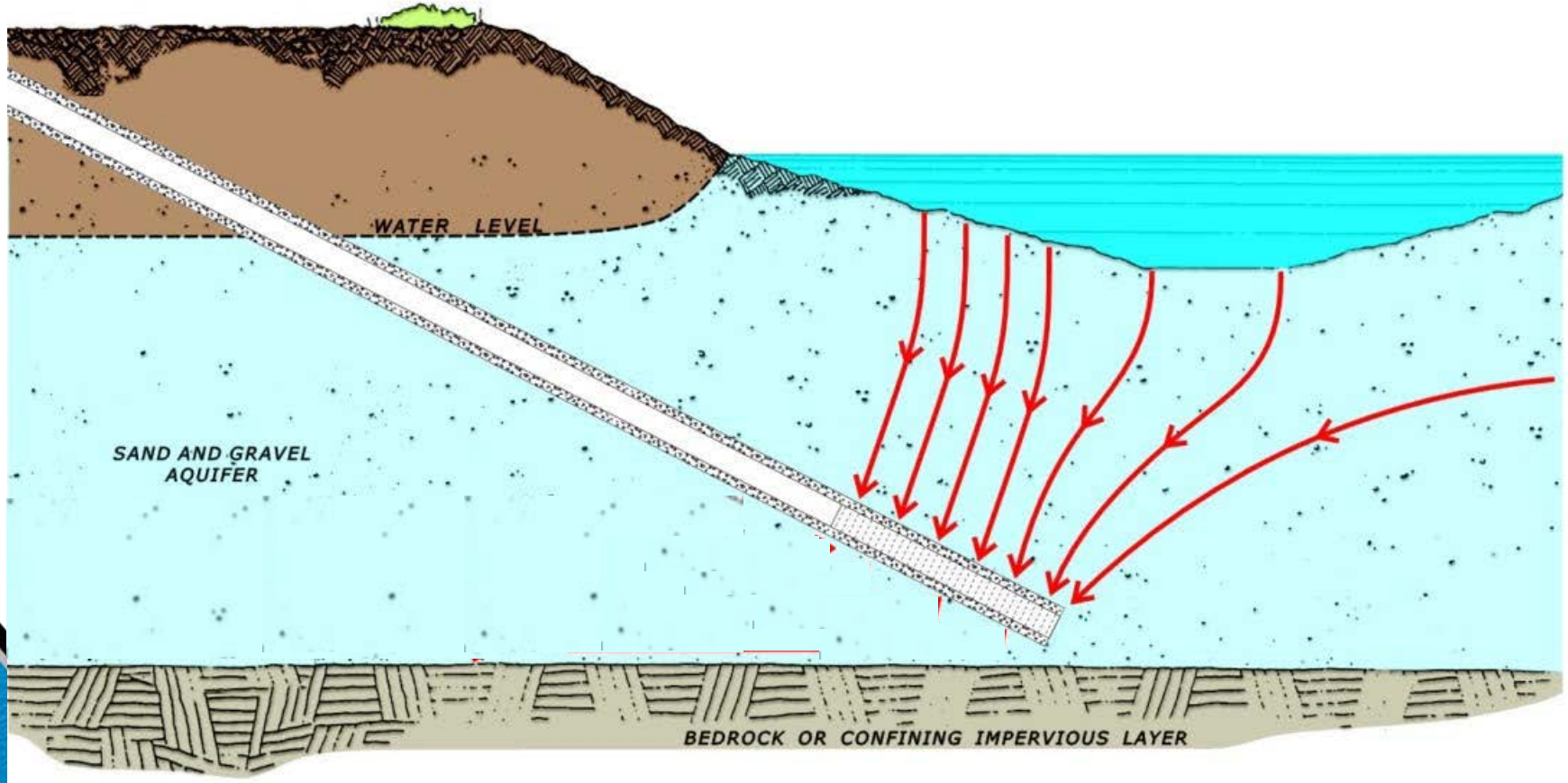
Population & Water Needs

- 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


WATER LEVEL
SAND AND GRAVEL AQUIFER
BEDROCK OR CONFINING IMPERVIOUS LAYER

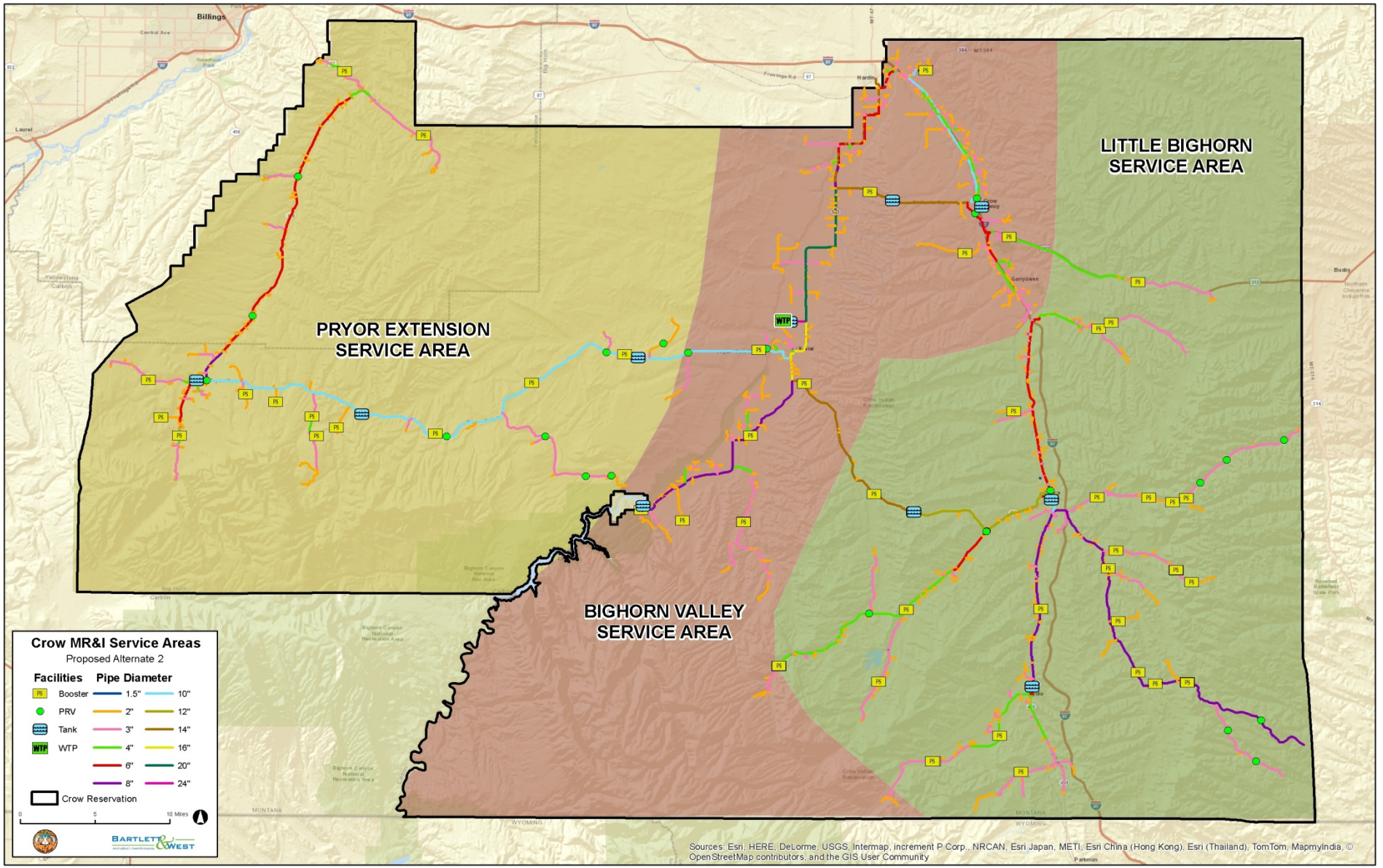
Treatment Plant

- 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

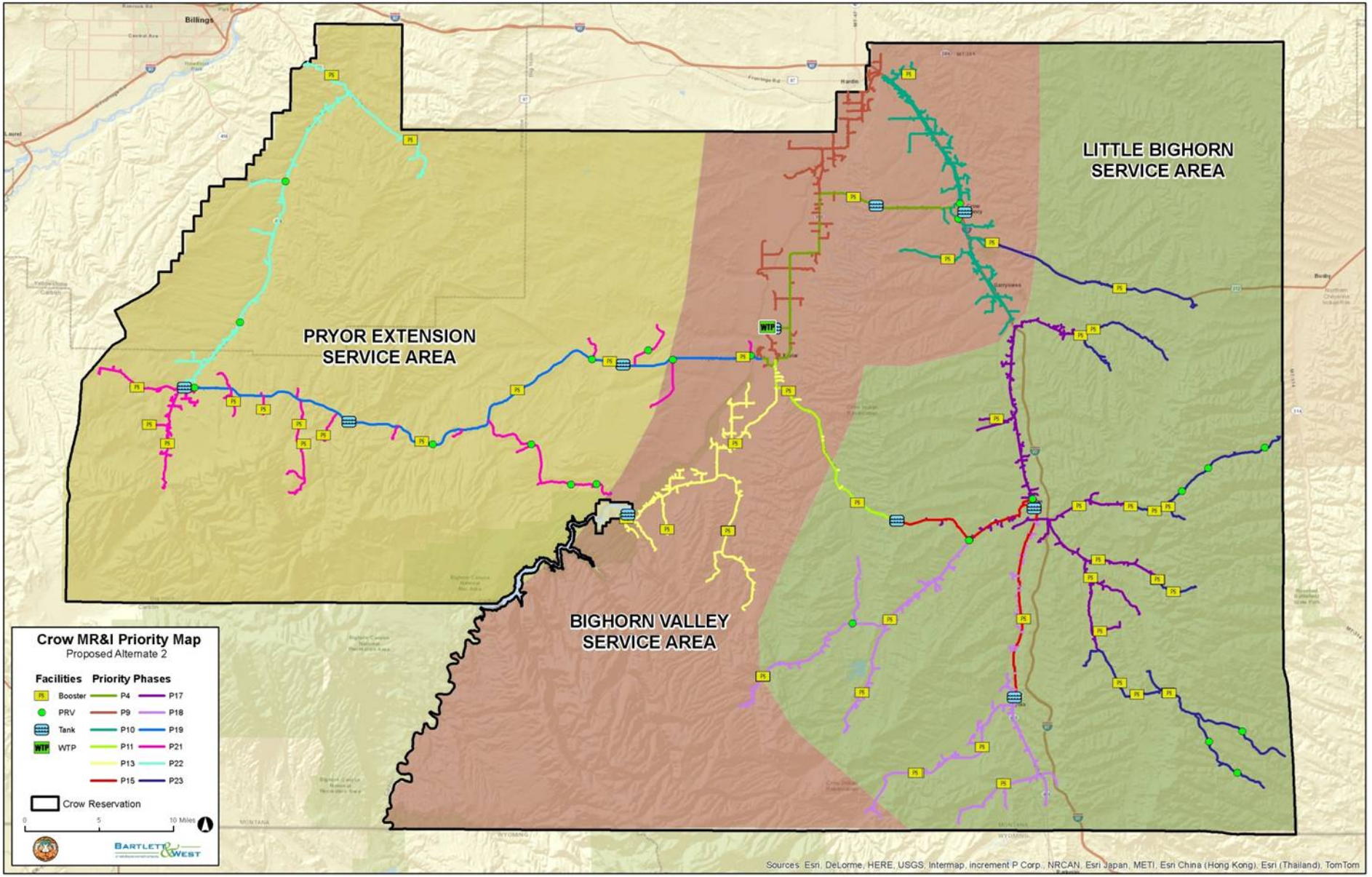
Preliminary Routing



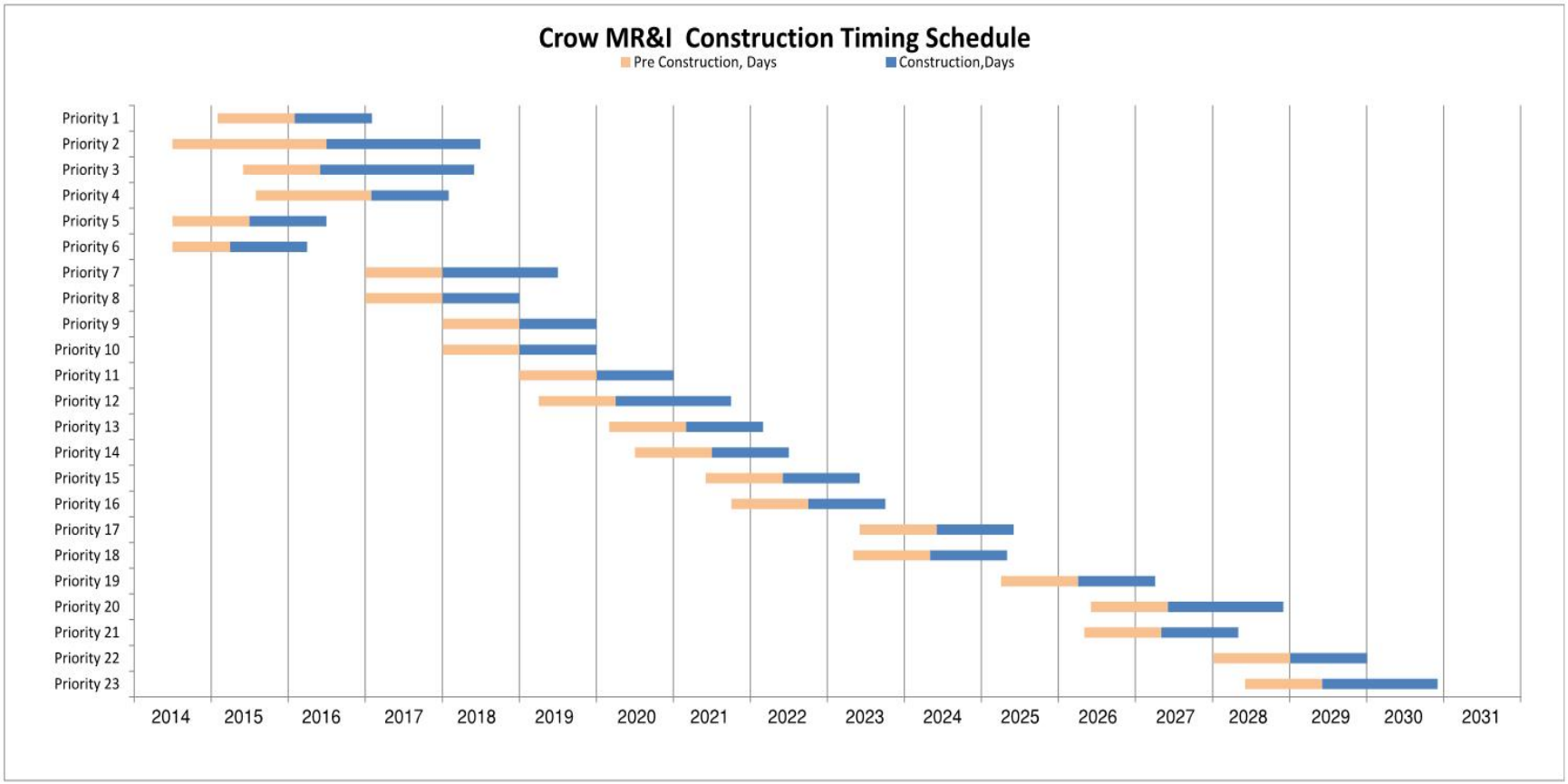
Priority List

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

Priority Map



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
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031

WATER TREATMENT

WATER TREATMENT GOALS

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

- Safe Drinking Water Act
- Primary & Secondary drinking water standards
- Disinfection By-product (DBP) compliance
- Softened water

PROCESS OPTIONS

Treatment Processes	Lime Softening and Media Filtration	Lime Softening and Biological Media Filtration	Lime Softening and Microfiltration	Media Filtration and Reverse Osmosis	Microfiltration and Reverse Osmosis
Water Quality and Flexibility to meet Current and Future Regulations	Good	Good	Good	Better	Best
Capital Costs, in millions	$19-23	$19-23	$20-24	$23-27	$23-27
Operating, Maintenance, and Replacement Costs	Low	Medium	Medium	High	High

DESIGN CONSIDERATIONS

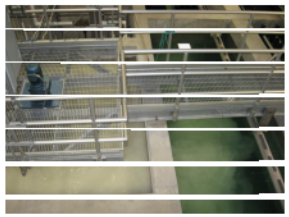
Treatment	Operations	Financial
• Minimize DBP precursors • Iron & Manganese removal • Hardness removal • Treatment of Secondary goals identified	• Flexibility of treatment processes to meet current and future regulations • Challenges of a large distribution system • Labor intensity • Technical difficulty • Residual handling	• Capital costs • OM&R costs • Labor • Residuals handling • Positive economic impact and jobs source for Crow Tribe

CONTAMINANTS OF CONCERN

Contaminant	EPA Required Limit of Treated Water	Big Horn River & River Bank Well Raw Water Sample	Crow MR&I Water Treatment Goal
Iron	0.3 mg/L	0.02-0.06	<0.05
Manganese	0.05 mg/L	0.01-0.7	<0.03
Aluminum	0.2 mg/L	ND-0.6	<0.1
Arsenic	0.01 mg/L	ND-0.002	0.00
Bromide	0.010 mg/	NA	0.00
Selenium	0.05 mg/L	ND-0.002	<0.05
Sulfate	250 mg/L	157-273	< 200
Nitrite	1 mg/L	ND-0.45	<1
Nitrate	10 mg/L	Non-Detection	0
Radium	5 pCi/L	0.2-0.6	0
Uranium	30 ug/L	1.0-6.4	0
Chloride	250 mg/L	9-13	<250
TDS	500 mg/L	472-613	<500
Hardness	NA	176-322 mg/L	100-150

Microfiltration

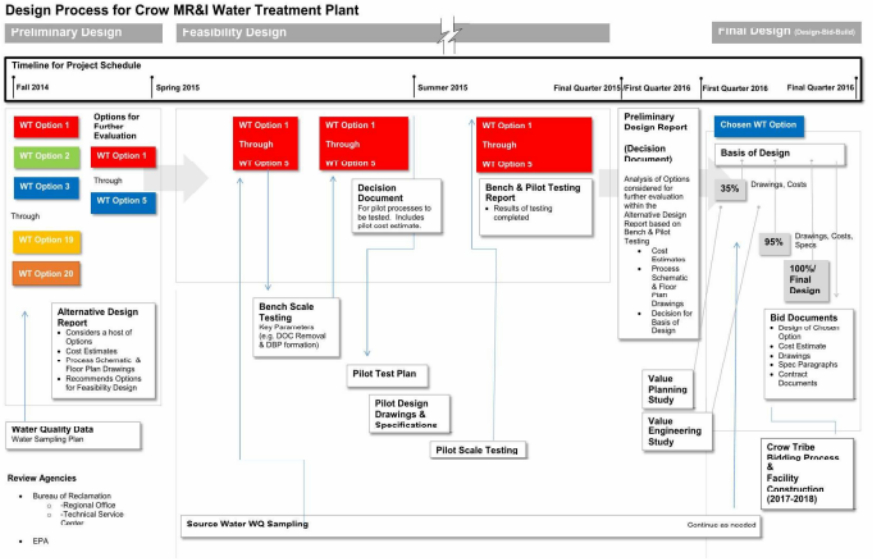
Lime Softening



Reverse Osmosis

Media and Bio Filtration

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

AFFORDABILITY

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

WATER PRICING

WATER CONSUMPTION

Category	Gallons Per Person Daily		
	Average	Winter	Summer
Municipal & Rural	100	60	210
Livestock	18	18	18
Commercial	80	80	80
Industrial	Varies	Varies	Varies

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

Projections

- 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 **$17.25** to **$24.15**
- Range in monthly water bill is proportional to household size

bottles at IGA

1,000 gallons = $10,000

or

MR&I water

1,000 gallons = $3.30

UNIT PRICE OF WATER

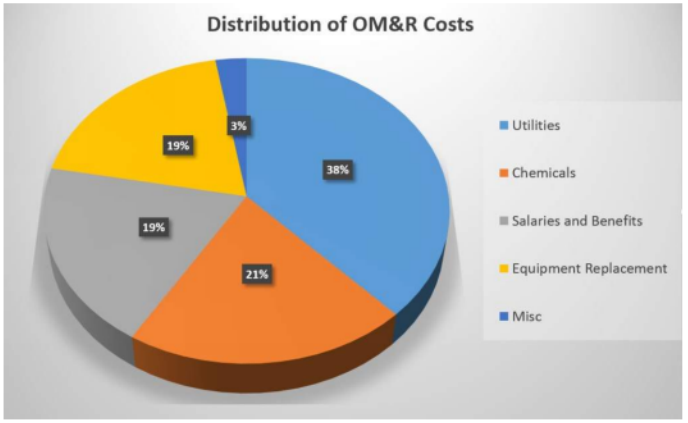
- The unit price of water will vary based on the type of treatment plant used, if customer classification is used, and the method of predicting average volumes used.

Unit Price ($ per 1,000 Gallons)			
	Scenario 1	Scenario 2	
Treatment Alternative	Single User Class	Below Low-income Level	Above Low-income Level
Microfiltration with Reverse Osmosis softening	$ 3.30	$ 1.53	$ 3.45
Microfiltration with Lime softening	$ 3.12	$ 1.53	$ 3.25
Conventional media filtration with Lime softening	$ 2.57	$ 1.53	$ 2.65

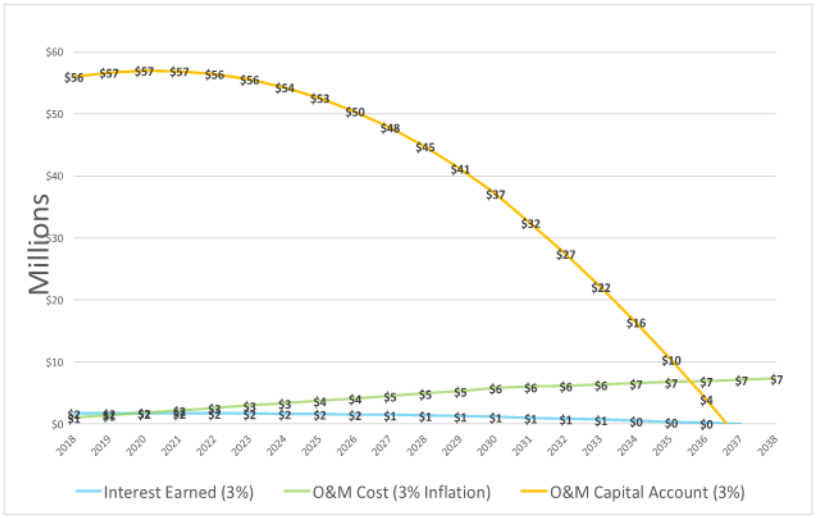
OM&R FUNDS

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."*

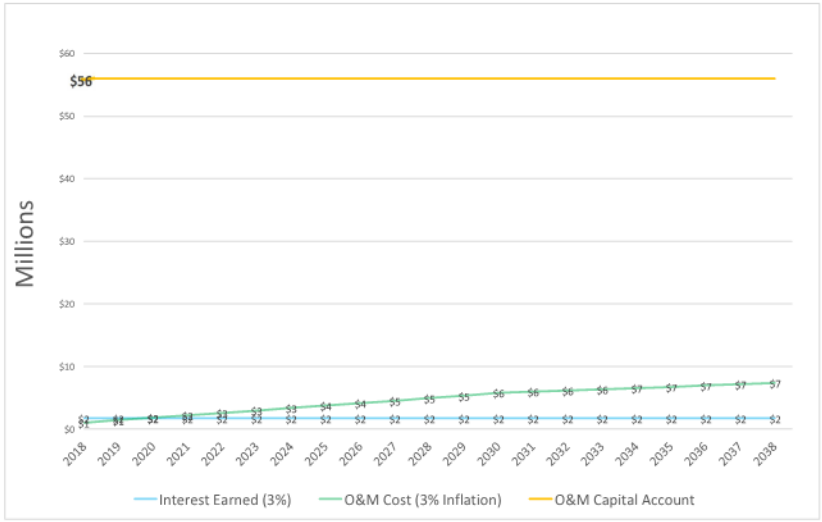
2010	2018
$47,000,000 —>	$56,000,000



Scenario #1—Use Capital



Scenario #2—Maintain Capital



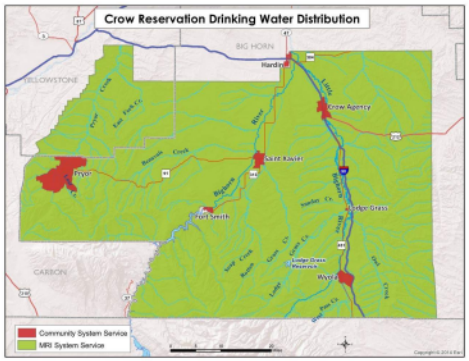
OTHER OPTIONS

-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

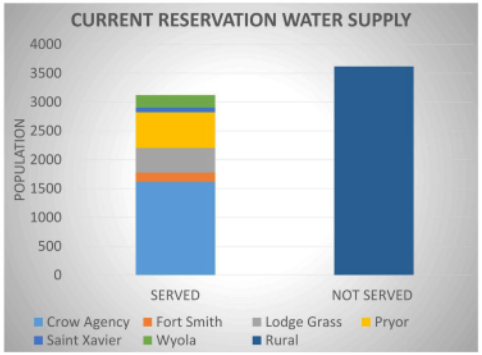
SYSTEM COMPARISON

Centralized Rural Water System vs. Existing Satellite System



Improve health reservation wide

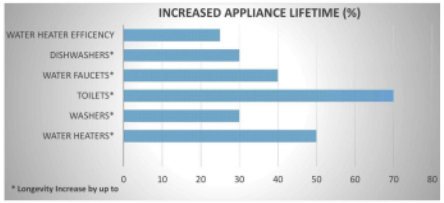
- Reduced sulfate = reduced gastrointestinal illnesses and dehydration
- Reduced nitrate = reduced infant illness and mortality
- Reduced uranium = reduced kidney toxicity
- Reduced Manganese = reduced respiratory problems and neurological damage
- Reduced Arsenic = reduced skin cancer, developmental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



Upgrading existing satellite system does not impact rural water users

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



- Centralized softening would remove softening by individuals

- 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

- 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

- Jobs during construction and operation

- Livestock benefits
- Increased livestock production
- Decreased vet visits

- Decrease pipe scaling
- Extend distribution system life

EXISTING SATELLITE SYSTEM DISADVANTAGES

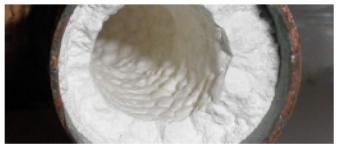
- Increasing difficulty meeting Safe Drinking Water Act Regulations
- Adversely impact public health and safety
- Especially infants and elderly
- Enforcement action

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

- Existing facilities approaching or surpassed expected lifetime

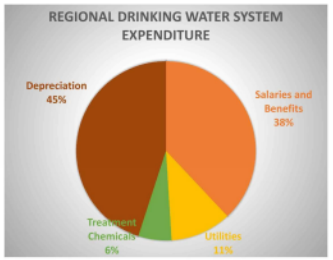
- Livestock consume existing water
- Potentially leading to loss of profits

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



- Pipeline hard water deposits

- Existing satellite systems near or at capacity
- Limiting potential growth



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

Sources:
Crow MR&I Master Plan
http://www.sdarws.com/PDF/SDRWRC/EconomicImpactofSouthDakotaRWS.pdf
http://www.sdarws.com/pdf/sdrwrc/socialphysicalimpactsandwaterconsumptionofrws.pdf
http://www.gao.gov/archive/1999/rc99115.pdf
http://www.ers.usda.gov/media/562429/ra174f_1_.pdf
http://technotes.alconox.com/wp-content/uploads/2013/06/got-scale.jpg
http://biohit.sk/en/clarity-15/
http://www.finsandfeathersonline.com/
http://en.wikipedia.org/wiki/Mining
http://www.who.int/en/

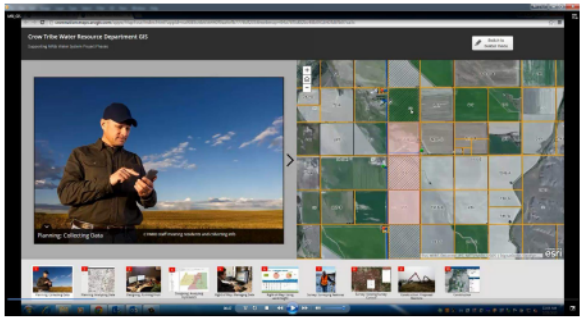
RIGHT-OF-WAY

Crow Tribe Water Resources

BARTLETT & WEST

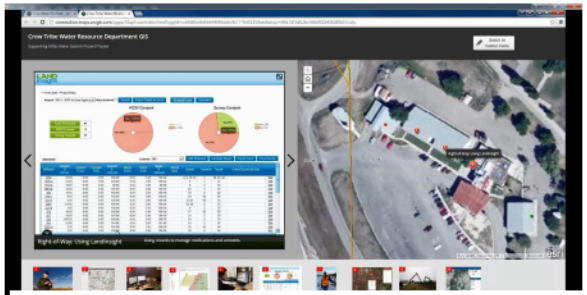
LAND insight *Mobile GIS Solutions*

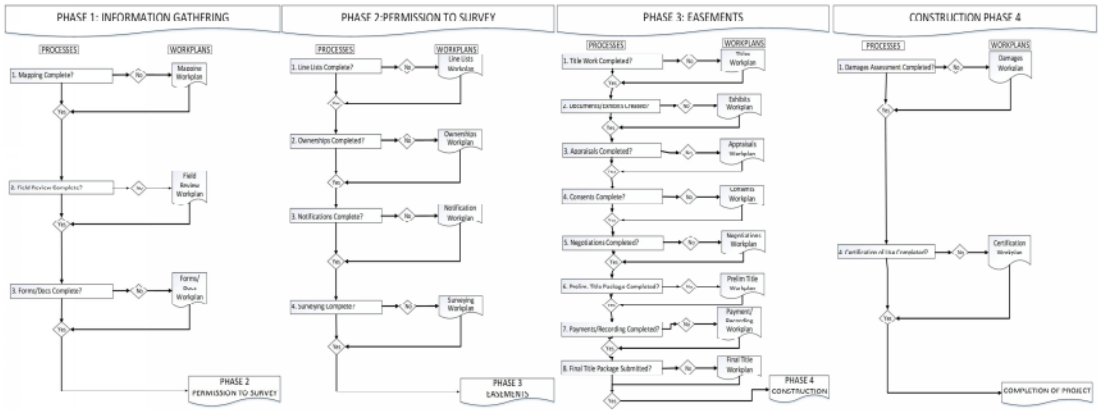
- CONNECT FIELD TO OFFICE



- VIEW CRITICAL DATA IN REAL TIME

- MAKE BETTER DECSIONS FASTER





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-Categorical 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:

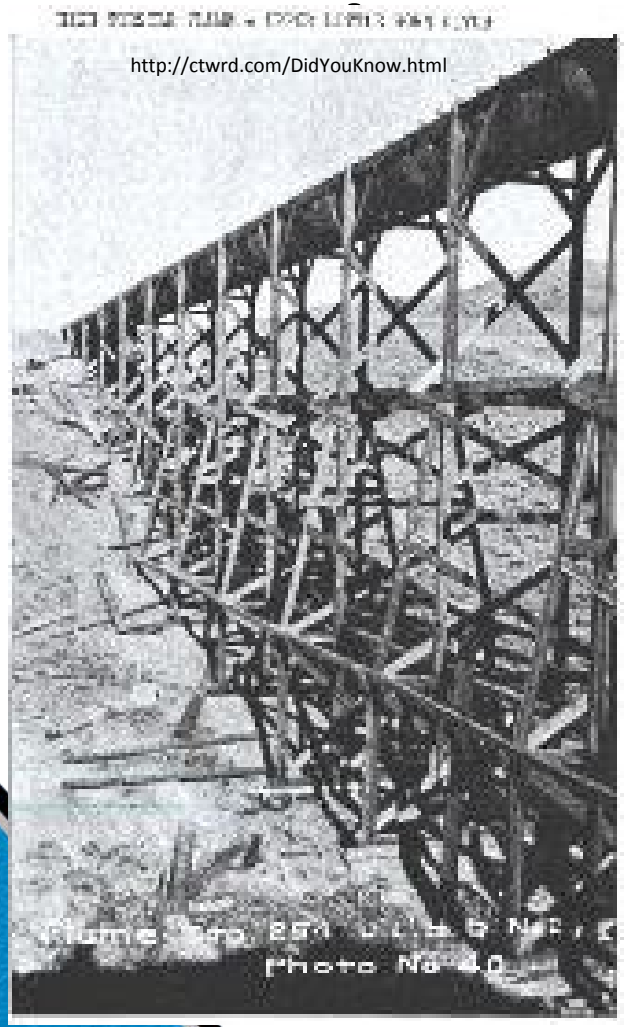
Overview

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

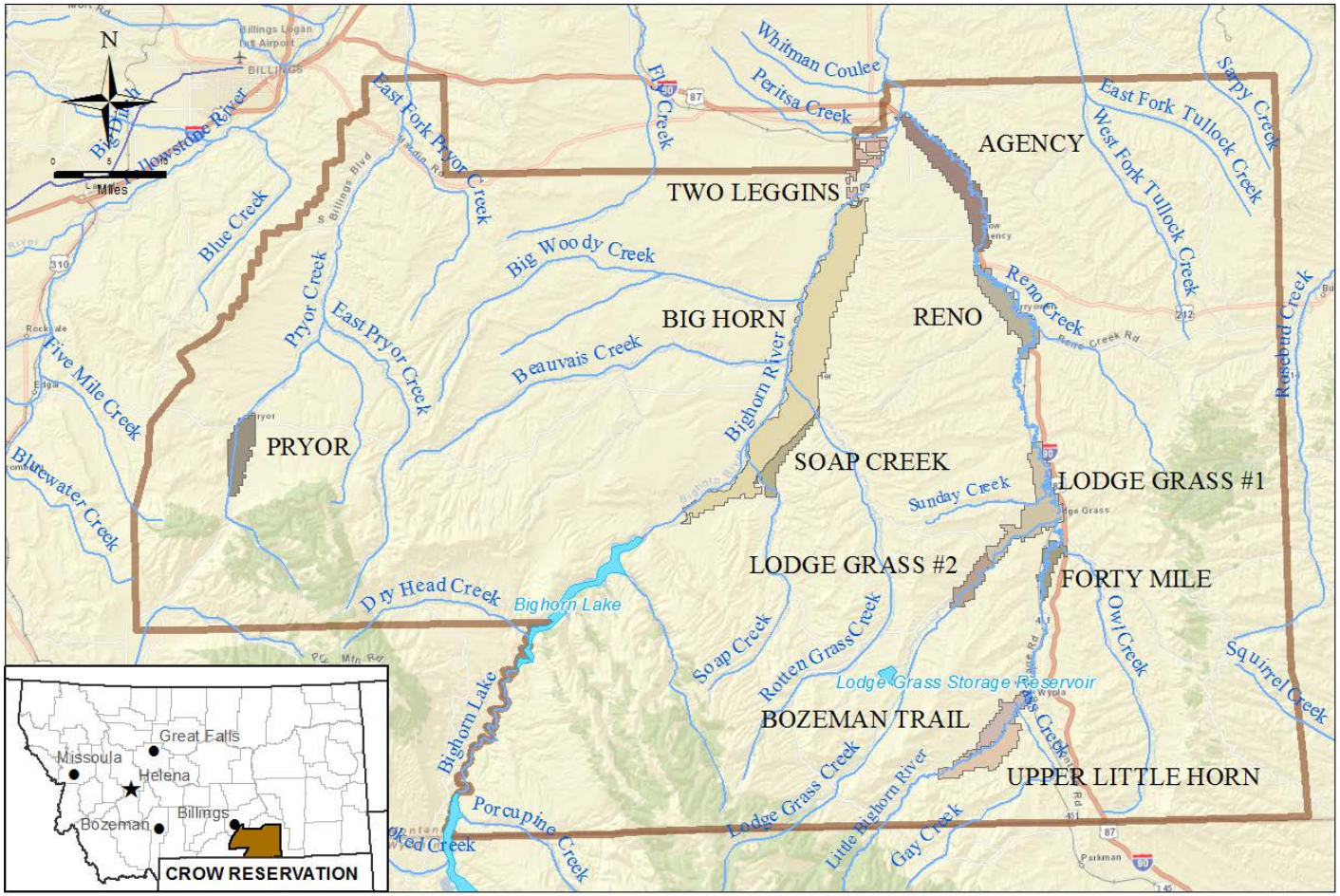
Funding

- $131.8 million - Construction
- $10 million - O&M

Archive Pictures



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

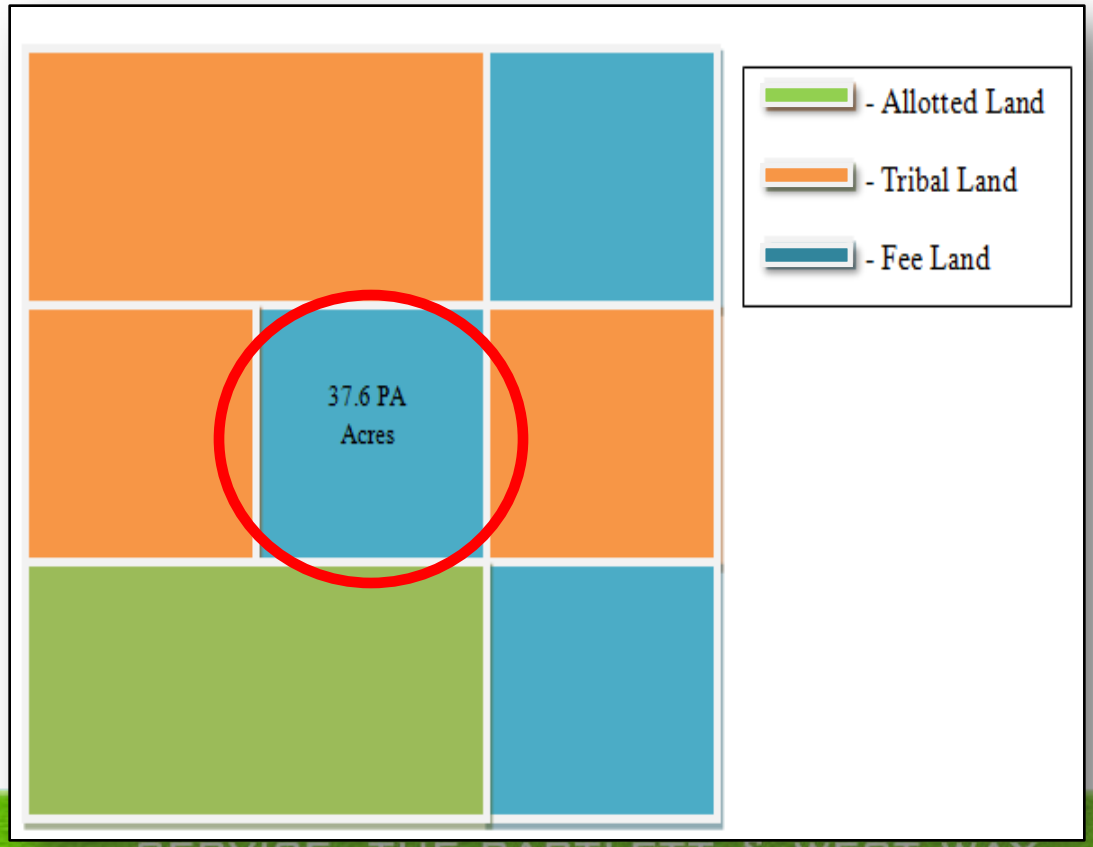
https://www.fas.org/irp/imint/docs/rst/Sect3/originals/Fig3_12.gif

http://www.valmont.com/images/irrigation-products/phoenix2011_valley_aerial_photo_1_web.jpg?sfvrsn=2

http://www.turfmagazine.com/files/Image/TF/TF1002_107.jpg

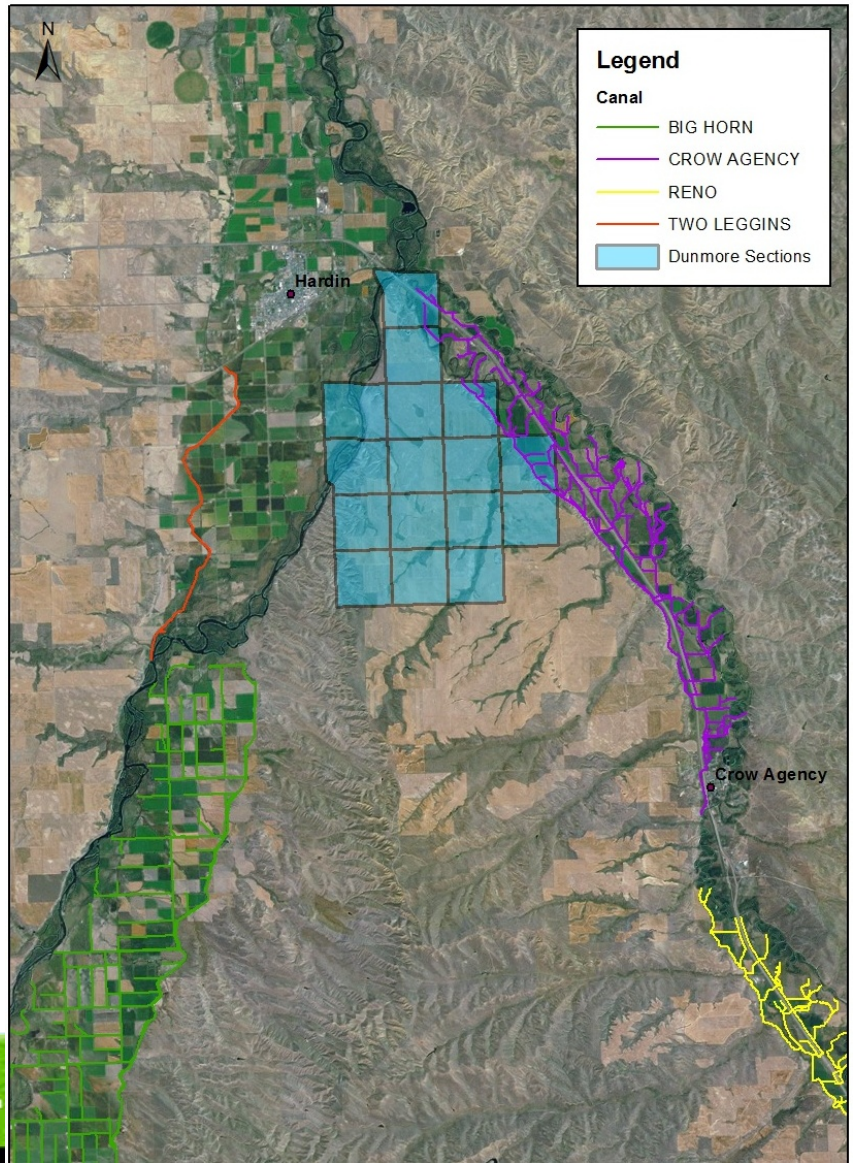
4. Purchase of Fee Lands

- 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

SERVICE. TH

Big Horn High Check Emergency Repair

Before

High Check O&M Road

After

SERVICE. THE

PRYOR WASTEWAY

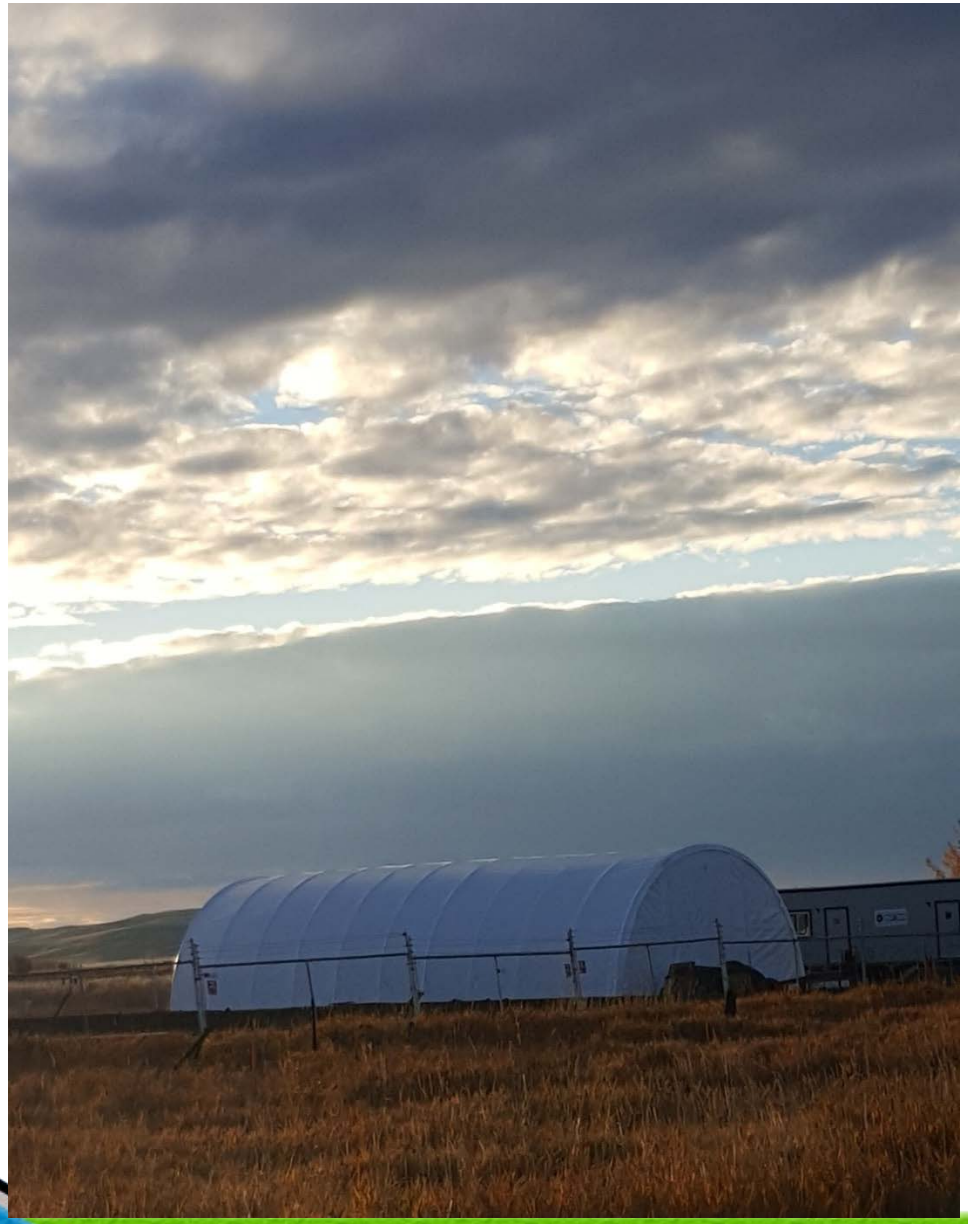
Before

After

SOAP CREEK WASTEWAY

After

PILOT PLANT OPERATIONS



Crow Tribe Water Resources

Questions?

Crow Tribe Water Resources

Thank you!