Regional Approach to Expand North Dakota Water System

Richard (Bo) Botteicher, PE
January 30, 2018

AEGION®
Stronger. Safer. Infrastructure.®

Underground Solutions®


UCT
THE Event For The Utility Infrastructure Industry
Underground Construction Technology
International Conference & Exhibition

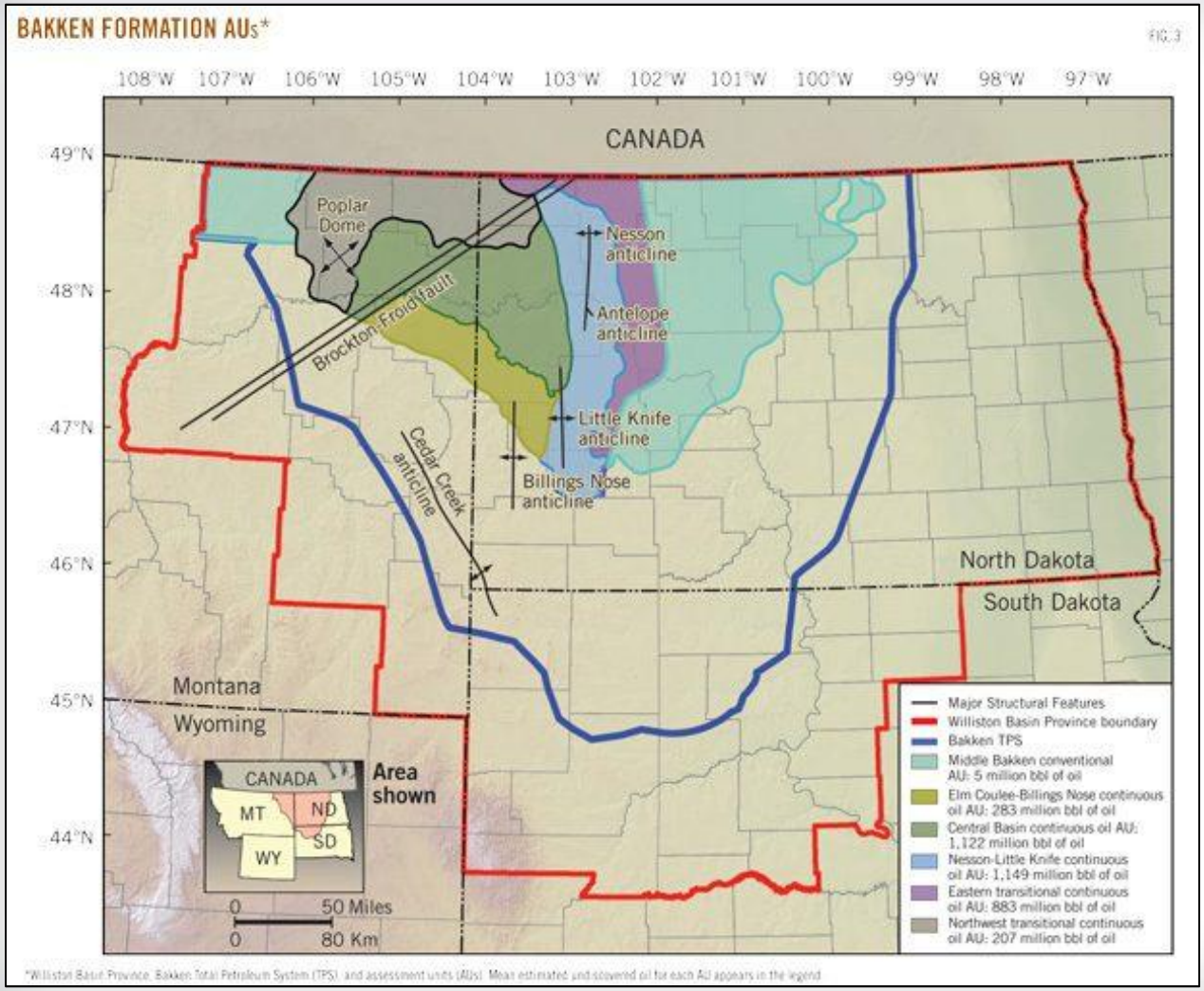
Western Area Water Supply Project Overview

- Regional Background
- Bakken and Population Growth
- Western Area Water Supply Authority (WAWSA)
- Design and Construction Needs
- Design Specifics
- Installation Specifics
- Construction Review
- Future System Buildout
- Summary

Regional Background

- North Dakota
  - Low population
  - Sparse density
  - Lack of urban centers
- Production increases in the Bakken-Three Forks formation from hydraulic fracturing requires additional labor
- 2010 to 2016 – large population growth in response to this support

Bakken / Three-Forks Formation



- Williston Basin Province boundary in Red (in US)
- Bakken TPS boundary in Blue (in US)
- ~3.65 bbl of oil estimated

Population Growth and Water Demand

- 2010 to 2016 saw population growth of 12.69%
- ~672,500 to ~758,000 in 6 years
- Due primarily to hydraulic fracturing in the Bakken-Three Forks TPS, workers for that industry as well as support infrastructure and jobs

North Dakota	2010	2015	2020	2025	2030	2035	2040
Expected Migration Scenario	672,591	756,927	824,344	884,874	931,506	966,375	991,522
High Migration Scenario	672,591	756,927	848,563	925,164	984,147	1,027,760	1,059,672
Low Migration Scenario	672,591	756,927	800,124	844,583	878,865	904,990	923,372

North Dakota Range of Population Growth 2010-2040, North Dakota Census Office

Western Area Water Supply (WAWS) System

- Western Area Water Supply System Authority (WAWSA)
  - April, 2011 – House Bill 1026, North Dakota legislature
  - A singular operating entity to join five existing water supply groups
    - Williams Rural Water
    - McKenzie County Water District
    - City of Williston
    - BDW Water System Association
    - R&T Water Supply Association
  - All groups represented on WAWSA Board

Western Area Water Supply (WAWS) Project

Since inception WAWSA has been working to complete the Western Area Water Supply Project (WAWSP)

- Authorized under House Bill 1206
- To be constructed in three phases
- Will use Missouri River Water as source for North-western North Dakota regional water demand
- Projected to cost ~$450M

5 Counties Covered:

- Burke
- Divide
- McKenzie
- Mountrail
- Williams

11 Cities:

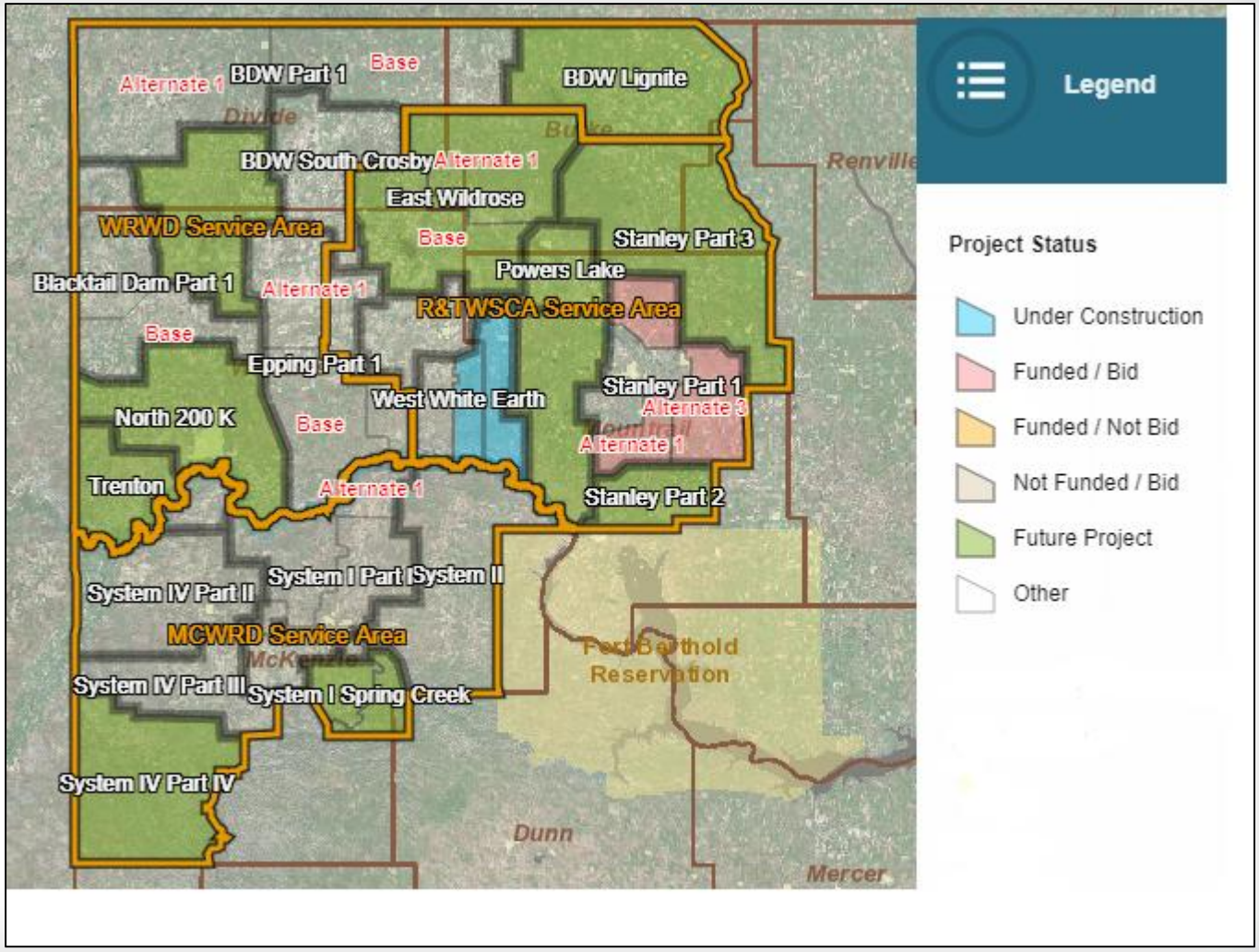
- Williston
- Watford City
- Tay
- Tioga
- Stanley
- Wildrose
- Crosby
- Fortuna
- Noonan
- Columbus
- Ross

Western Area Water Supply (WAWS) Project

- Currently providing water to 60,000
- Projected to cover 160,000 by 2038
- Missouri River source water
- Supplemented with groundwater sources
- Primary treatment at Williston Regional Water Treatment Plant
- Groundwater treatment at R&T Water Supply Commerce Authority's Water Treatment Plant in Ray

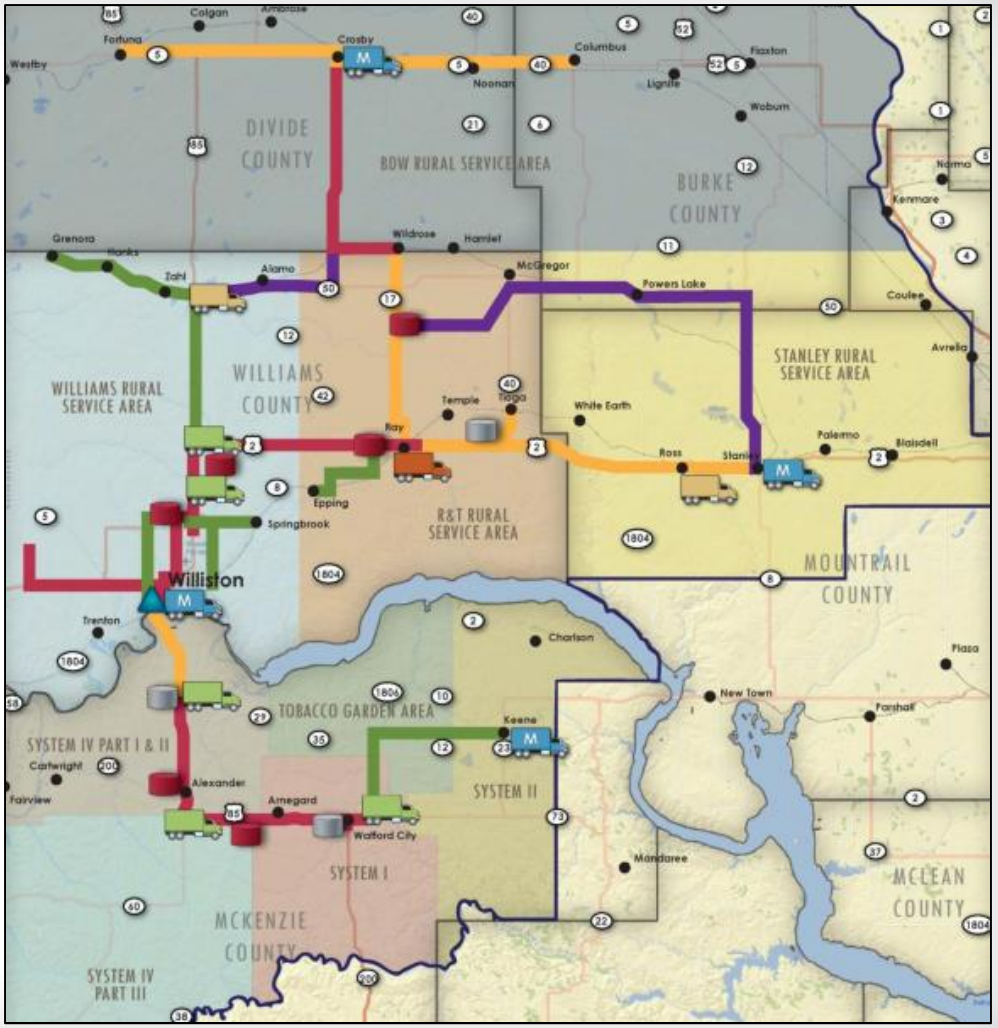
Western Area Water Supply (WAWS) Project

- Phase I
  - Bolster existing systems
  - Ray, Watford City, Stanley, Tioga
- Phase II
  - Rural water strengthening
- Phase III
  - Expansion
  - Outpace demand



Design and Construction Needs

- Phase I
  - $110M in original funding
  - $40M in emergency reserve
- Phase II
  - $119M in funding and loans
- Phase III
  - Total spend could reach $450M
- Bulk of infrastructure capital cost covered by bulk water sales to the energy development industry in the area
- Advanced Engineering and Environmental Services (AE2S) lead design firm

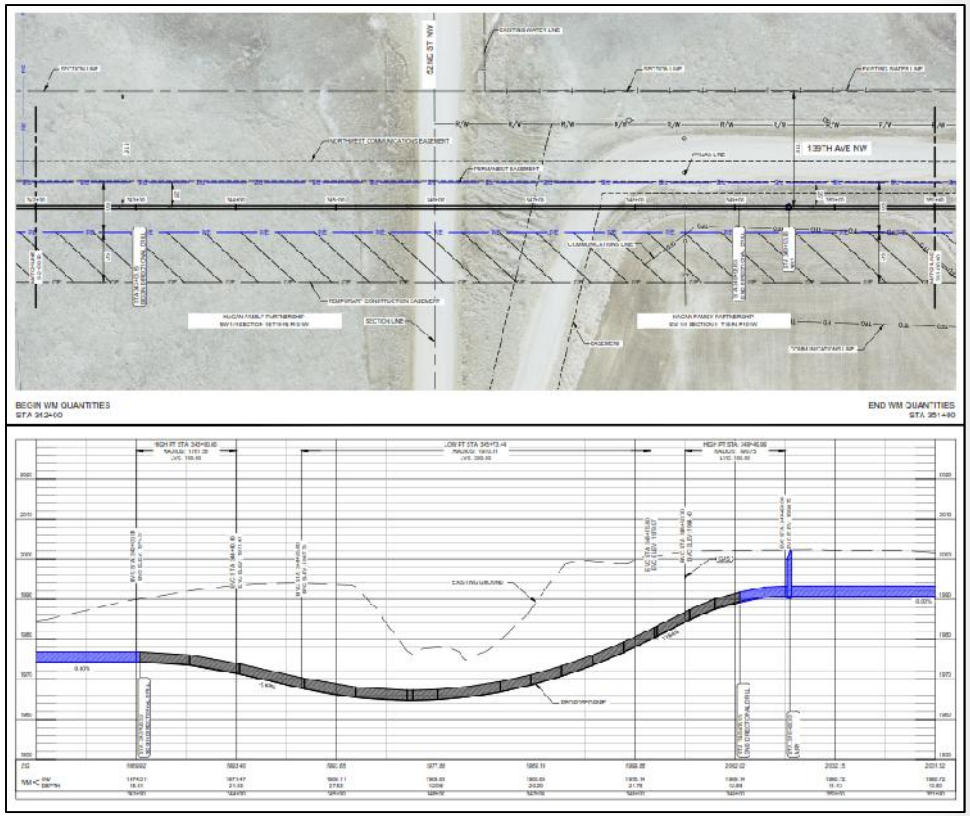


Design and Construction Specifics – Open Cut / Direct Bury

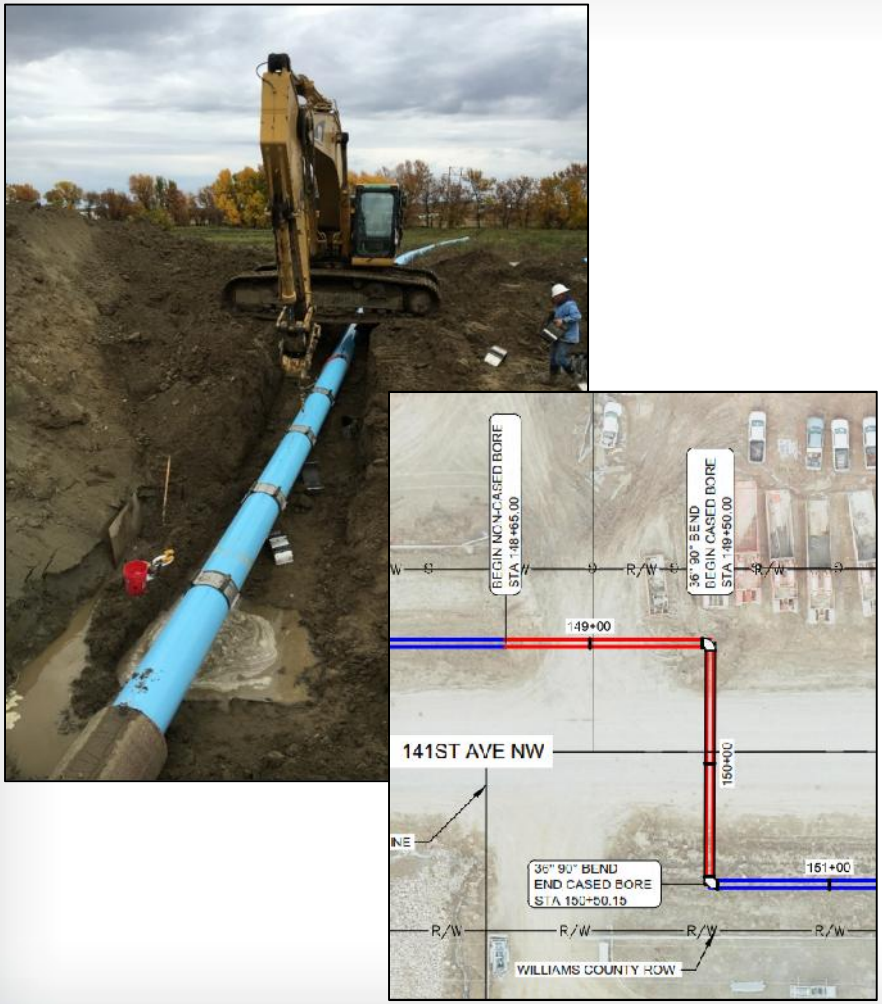
- Pros
  - Open areas and access
  - Most common, greatest contractor competition
  - Generally lowest installed cost
  - Fast installation time
- Cons
  - Can create access issues
  - Disturbance to agriculture areas
  - Variation in soils encountered
  - Bedding materials, select fill

Design and Construction Specifics – Horizontal Directional Drilling or Boring

- Pros
  - Facilitate installations that can't be excavated (river/stream, etc.)
  - Solid base and quality of installers
  - Relatively fast installation time, considering nature of crossings
  - Low disturbance
- Cons
  - Variation in soils encountered creates difficulty
  - Coordination with direct bury and other methods
  - Higher cost



Design and Construction Specifics – Cased Installations



- Pros
  - Facilitate crossings (roads, driveways, access)
  - Solid base and quality of installers
  - Lower disturbance and access issues
- Cons
  - Variation in soils encountered creates difficulty
  - Coordination with direct bury and other methods
  - Higher costs

Design and Construction Specifics – Pipe Materials

- Thermoplastics, specifically polyvinylchloride (PVC) pipe preferred
  - Corrosion resistance
  - Matched typical pressure regimes needed
  - Installation
  - Material cost
  - Familiarity for construction and ongoing operations

Construction Review – Primary Methods

- Direct Bury used wherever feasible.
- PVC bell and spigot
- Restrained joint technologies used to eliminate thrust blocks
- “Typical” construction standards matched designed sections

Construction Review – HDD Installations

- Primary method for river/stream/drainage crossings
- Some installations ~3,000 LF and greater
- Restained Joint used, Fusible PVC® pipe

Construction Review – Cased Bores

- Cased bores used predominantly for road and railroad crossings
- Casing is bored and jacked into position – predominantly steel pipe
- Carrier pipe then inserted into the casing – predominantly restrained joint PVC pipe, like Fusible PVC® pipe
- Common for 90-degree road crossings and parallel intersection crossings

Future System Completion

Current System:

- Serves 60,000 people
- 21 MGD treatment capacity
- 3 water towers
- 10.9 MG Storage
- 1,450 miles of pipelines

Final System:

- Serve 160,000 people by 2038
- 4 water towers
- 110 miles of pipelines in construction
- 122 miles of pipelines in design

Summary

- Rapid system planning, design, construction and expansion required to match the local economy and population demands.
- Unique opportunity to fund the system growth by selling water for hydraulic fracturing development needs in the Bakken-Three Forks TPS
- PVC pipe material and traditional direct bury methods used as well as horizontal directional drilling and cased bores to complete the system.
- System development and segmental completion have been executed at an extremely fast pace.

Regional Approach to Expand North Dakota Water System

Richard (Bo) Botteicher, PE
(303) 521-2618
bbotteicher@Aegion.com
January 30, 2018

AEGION®
Stronger. Safer. Infrastructure.®

Underground Solutions®