

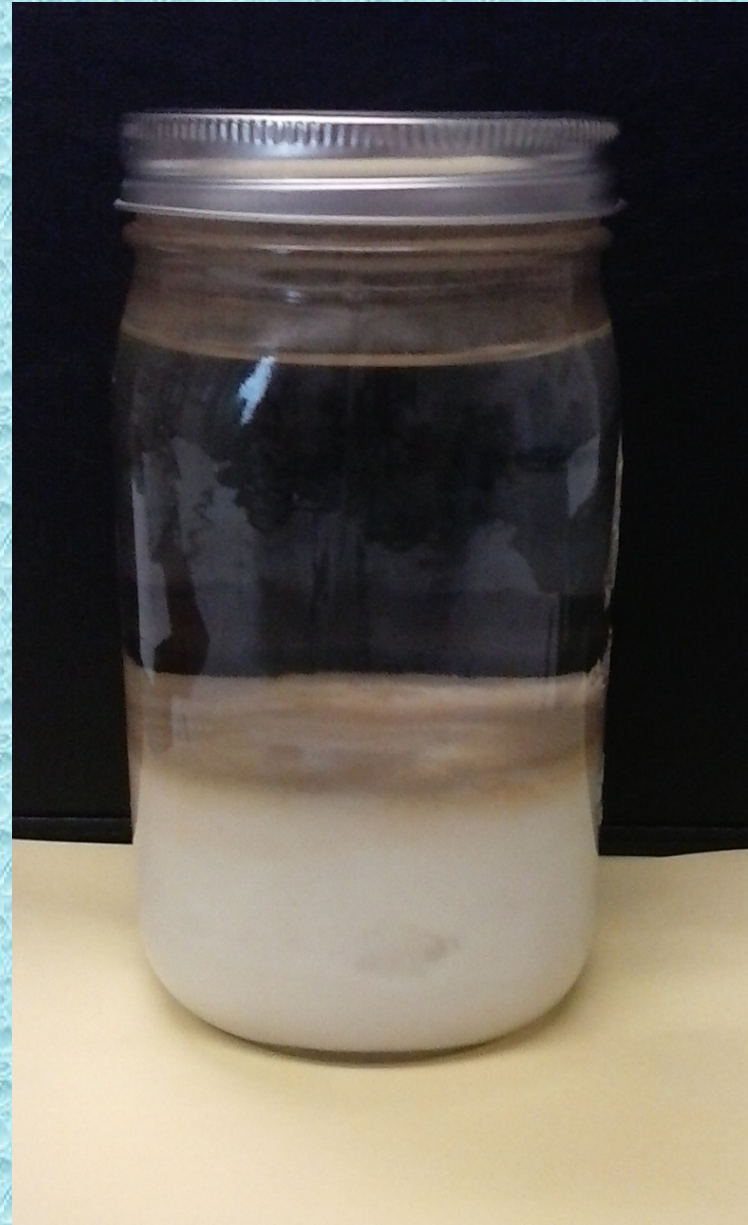


Salt Water Spills

2016 North Dakota Water Quality
Monitoring Conference

Types of Water

- Source Water
- Emulsion
- Produced Water
- Flow-Back Water





Oil Spills in 2015

- 901 Total Spills
- 18,504 Barrels Reported
- 20.5 Barrels/Spill

06.21.2012

Saltwater Spills in 2015



With Blacktail Creek

- 631 Incidents
- 110,491 Barrels Reported
- 175 Barrels/Spill

Without Blacktail Creek

- 630 Incidents
- 40,491 Barrels Reported
- 64.4 Barrels/Spill

01.18.2015 09:51

Remediation Methods

- Dig and Haul
- Calcium Treatment
- Drain Tiles
- Phytoremediation
- Electro Migration
 - Chloride to anode
 - Sodium to cathode



Major Brine Release Sites

- Blacktail Creek – 70,000 bbls Brine
- Jackson 1-29H – 4,500 bbls Brine
- Nova 4-9-163-98H – 4,200 bbls Brine
- Hegstad SWD – 1,500 bbls Brine
- Cramer 1 SWD – Multiple Spills

The Blacktail Creek Spill

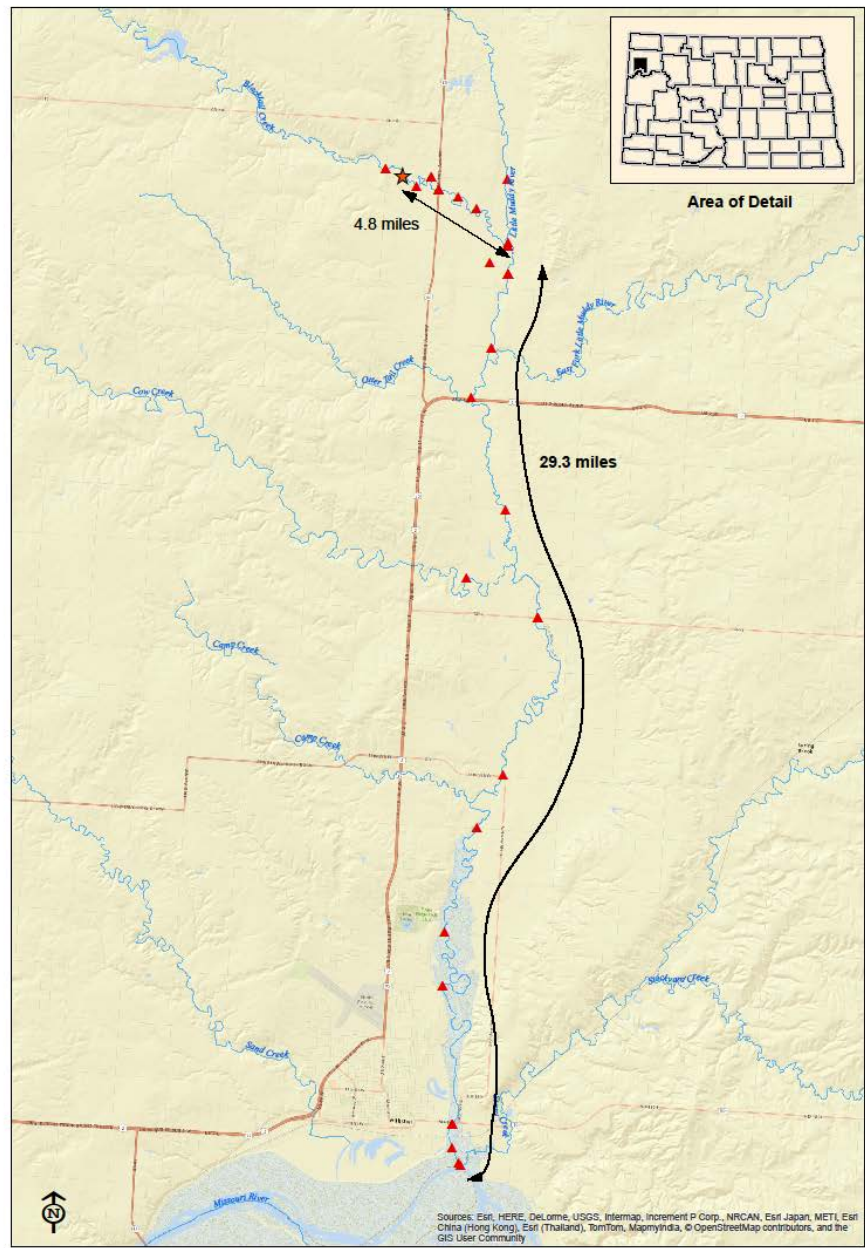
Reported on January 7th, 2015 by
phone @ 1:04 PM

70,000 bbl of brine



01.07.2015 16:10

By
JANUARY
24th
41 Sets
of
Laboratory
Water Quality
Samples
Collected
& 100's of
Field
Screenings



Meadowlark-Summit Midstream/Blacktail Creek Produced Water Spill

This map shows the location of the Meadowlark-Summit Midstream produced water release and the NDDoH surface water sampling locations along Blacktail Creek, the Little Muddy River and its tributaries. The release site is 4.8 miles upstream from the confluence of Blacktail Creek and Little Muddy River. It is 29.3 miles downstream on Little Muddy River to the confluence of the Missouri River.

- ★ Site of Release
- ▲ North Dakota Department of Health Sample Location



Currently on Site

- **Over 80 Interceptor Trenches**
- **Approximately 13 Surface Dams**
- **Subsurface Cutoff Wall**
- **22 Monitoring Wells**
- **2 Private Wells**



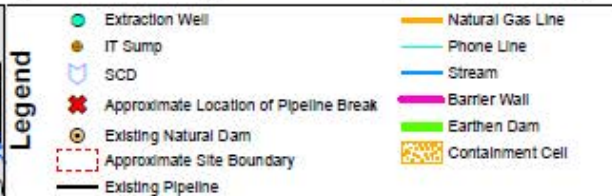
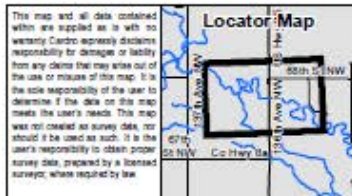
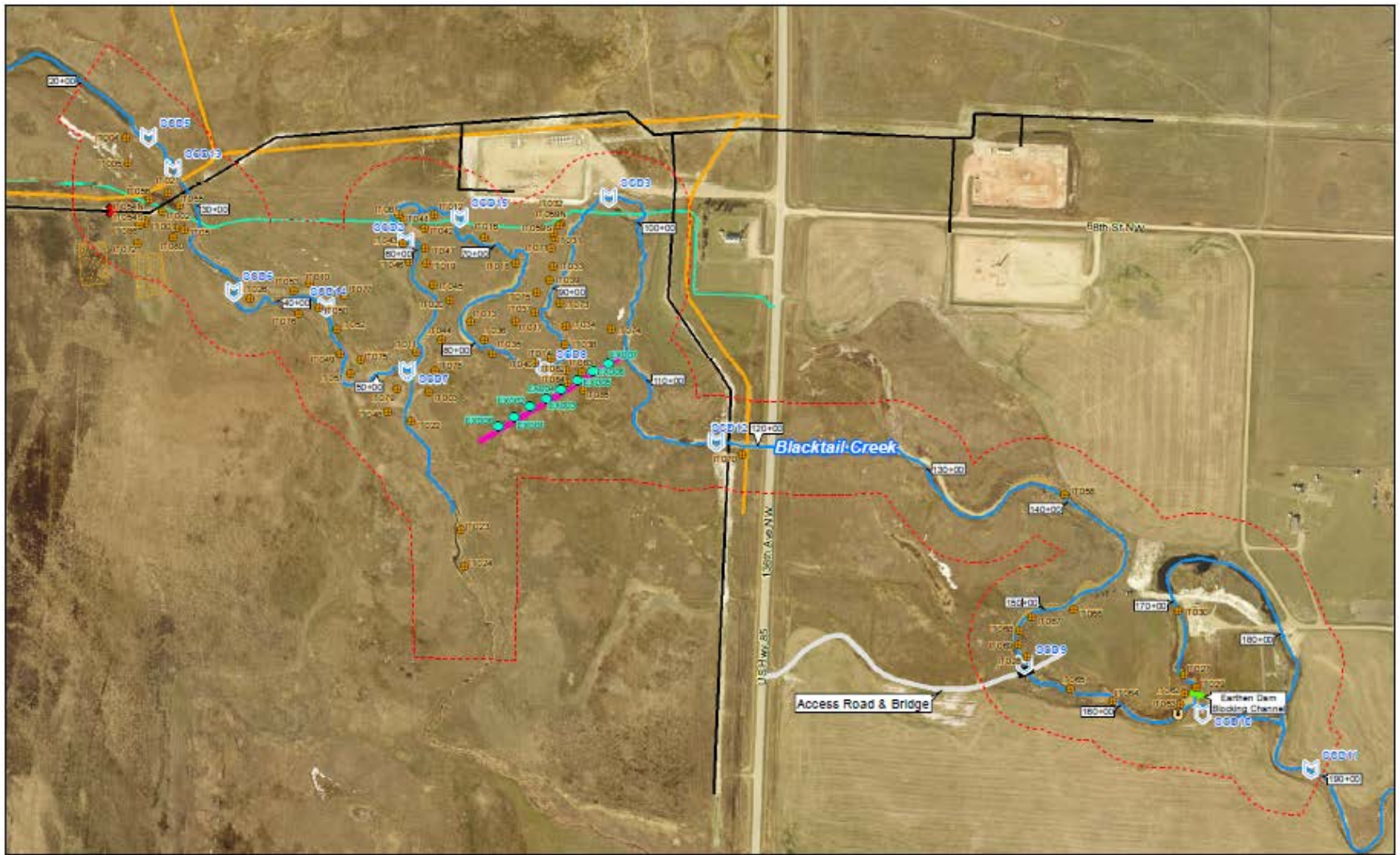


Figure 1
Updated Control Measures
Meadowlark Midstream
Company, LLC

Cardno
 121 Continental Drive, Suite 308 | tel (302) 395-1910
 Newark, DE 19713 | fax (302) 395-1920
www.cardno.com
 Spatial Coordinates (Longitude & Latitude, WG84)
 Upper left-hand corner: -103.8430700 48.4045330
 Lower right-hand corner: -103.8099810 48.3928200

Planned Activities

Winter 2015/2016

- 2nd Electromagnetic survey
- Additional geoprobe work east of Hwy 85
- Planned Installation of Monitoring wells east of Hwy 85
- Discontinued groundwater extraction along creek, except near cutoff wall.
- Use surface dams to maintain hydraulic head on groundwater
- Continued monitoring

Spring 2016

- Resume groundwater extraction
- Ecological Monitoring
- Plant a cover crop
- Continued monitoring

The Jackson 1-29H Spill Charbonneau Creek

Reported on January 5th, 2006

4,500 bbl of brine



02.11.2013

Currently on Site

- 6 – Extraction Points
- 6 – Monitoring Wells
- 7 – Monitoring Locations

Although there are still exceedances, there has been an overall reduction of over 90% of chlorides at the site.

The Nova 4-9-163-98H Spill

Reported on August 5th, 2015

4,200 bbl of brine



08.31.2015 13:5

Currently on Site

- Site has been excavated
- Impacts are now below 500 ppm of chlorides
- Soil amendments have been added
- Area has been mulched
- Apply cover crop
- Monitoring for re-vegetation this Spring

The Hegstad SWD Spill Lake Smishek

Reported on May 6th, 2015

1,500 bbl of brine



05.07.2015 11:46



Leak Location

T160N
R93W

T159N
R93W

Blue County

Currently on Site

- Impacts flowed into unnamed creek
- Creek flows into Lake Smishek
- 33.4 acres impacted
- Fish samples collected June 6, 2015
- 10 surface water sampling points
- 25,000 linear feet of drain tile installed
- 283,325 bbls of water removed
- 3,271 tons of soil excavated

The Cramer 1 SWD Spill

Reported on:

May 10, 2002 – 100 bbl of brine

April 17, 2007 – 100 bbl of brine

July 21, 2011 – 500 bbl of brine

October 27, 2012 – 600 bbl of brine

April 29, 2013 – 91 bbl of brine



Currently on Site

- 112 soil borings
- 8 monitoring wells
- 2 drain tile systems
- 9 new laterals
- Continue to pump sumps
- Tilled organic material into soil
- Application of soil amendments
- Potential cover crop

Questions?

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North Dakota Department of Health

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NORTH DAKOTA
DEPARTMENT *of* HEALTH