Pipeline Reclamation at the Williston Research Extension Center - NDSU
Austin Link – Agronomy Research Specialist
Reclaiming a 36” Pipeline with Crop Rotations

• Introduction
  – May 15th, 2015, installation of a 36” water pipeline was completed at the Williston-REC.

  – The pipeline extended 1.25 mi., running north to south, entirely across cropland.

  – Soil disturbance extended 100 ft. on the east and west sides of the pipeline.

  – We took advantage of this research opportunity by selecting several cropping rotations and perennial covers to evaluate as long-term reclamation practices.
Engineering vs. Agronomic Standards

Williams-Bowbells Loam
(Pre-Disturbance)

Ap - 0 to 6 inches: loam

Bt1 - 6 to 10 inches: clay loam

Bt2 - 10 to 15 inches: clay loam

Btk - 15 to 24 inches: clay loam

Bk - 24 to 36 inches: clay loam

C - 36 to 60 inches: clay loam

Soil Placement Standards
During Reclamation

Topsoil – Depth?

Subsoil – Depth?
50’ easement turned into 200’
Challenges in reclaiming pipelines in a cropland setting include, but are not limited to:

- Proper backfilling and topsoil placement
- Areas of extreme compaction
  - Severely reduce infiltration
- Destruction of soil structure
  - Reduced water holding capacity
- Erosion
- Subsidence within the trench
- Reduction of soil microbes
- Reduced nutrient cycling
- Reduced soil fertility
Poor Topsoil Placement and Mixing with Subsoil
North end of the pipeline (previously cropland) was turned into a parking lot by the contractor.
Reclamation Standards vs. Agronomic Standards

• Baseline soil tests have shown
  – Higher pH and lower OM% in disturbed areas.
    • Soils with high pH (>7.4) result in reduced availability of several nutrients
    • Decreasing soil pH has not been shown to be economical for producing agronomic crops, yet...

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Organic Matter</th>
<th>pH</th>
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</thead>
<tbody>
<tr>
<td>Undisturbed</td>
<td>2.4</td>
<td>6.2</td>
</tr>
<tr>
<td>Roadway</td>
<td>2.1</td>
<td>7.4</td>
</tr>
<tr>
<td>Pipeline</td>
<td>1.3</td>
<td>8.0</td>
</tr>
</tbody>
</table>
• Compaction (PSI) > 300 PSI restricts root growth and development
SOIL CONDITIONS & MONITORING

• The soil surface of the pipeline and roadway are **heavily crusted**
• Roadway subsoil is **severely compacted**.
• Because of erosion concerns tillage was avoided and plots were **seeded immediately after top soiling** was completed by the contractor.
• Several soil parameters have been measured and will continue to be monitored throughout the length of this study. These **measurements include infiltration rates, compaction, and standard fertility tests**
Rainfall Simulator/Infiltrometer
Rotations were selected based on the most commonly grown crops in the Mon-Dak Region and will be evaluated for their ability to improve soil health, fertility, and eventually crop yield.

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<tbody>
<tr>
<td>1</td>
<td>HRSW</td>
<td>Durum</td>
<td>Durum</td>
<td>Durum</td>
<td>Durum</td>
<td>Durum</td>
<td>Durum</td>
<td>Durum</td>
<td>Durum</td>
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<tr>
<td>2</td>
<td>HRSW</td>
<td>Peas</td>
<td>Barley</td>
<td>Safflower</td>
<td>Durum</td>
<td>Peas</td>
<td>Barley</td>
<td>Safflower</td>
<td>Durum</td>
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<tr>
<td>3</td>
<td>Peas</td>
<td>Barley</td>
<td>Safflower</td>
<td>Durum</td>
<td>Peas</td>
<td>Barley</td>
<td>Safflower</td>
<td>Durum</td>
<td>Durum</td>
</tr>
<tr>
<td>4</td>
<td>Cover Crop Mix</td>
<td>Durum</td>
<td>Cover Crop Mix</td>
<td>Durum</td>
<td>Cover Crop Mix</td>
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<tr>
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<td>Durum</td>
<td>Cover Crop Mix</td>
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<td>Durum</td>
<td>Cover Crop Mix</td>
<td>Durum</td>
</tr>
<tr>
<td>7</td>
<td>Perennial Grass</td>
<td>Perennial Grass</td>
<td>Perennial Grass</td>
<td>Perennial Grass</td>
<td>Perennial Grass</td>
<td>Perennial Grass</td>
<td>Perennial Grass</td>
<td>Perennial Grass</td>
<td>Durum</td>
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Different Disturbance Areas

<table>
<thead>
<tr>
<th>Undisturbed Reference</th>
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</thead>
<tbody>
<tr>
<td>Compacted Roadway</td>
</tr>
<tr>
<td>Pipeline</td>
</tr>
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</table>
Goals of the Study

Over the next 9 years:

• Evaluate Cropping Rotations for their ability to improve soil health.

• Analyze the economic returns of these rotations.

• Analyze the economic impact of reduced yields and reduced soil fertility.
Differences in soil characteristics showing direct effects on stand and maturity in field peas.
Radish, peas, and wheat roots show differences between disturbance areas.
Letters represent significant differences at a 95% confidence level (p < .05)

Ex:

Treatment 1  A
Treatment 2  B
Treatment 3  B

"1" is significantly different from "2" and "3" but there is not a significant difference between "2" and "3".
## Preliminary Results

### HRSW Performance Under Different Disturbance Levels $P<.05$

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Stand</th>
<th>Height</th>
<th>1000 TKW</th>
<th>Protein</th>
<th>Weight</th>
<th>Yield</th>
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<tbody>
<tr>
<td>Undisturbed</td>
<td>100</td>
<td>A</td>
<td>23</td>
<td>A</td>
<td>23.5</td>
<td>17.4</td>
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<td></td>
<td>%</td>
<td>(in)</td>
<td>grams</td>
<td>%</td>
<td>lb./bu</td>
<td>bu/a</td>
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<tr>
<td>Roadway</td>
<td>50</td>
<td>B</td>
<td>16</td>
<td>B</td>
<td>25.7</td>
<td>16.6</td>
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<tr>
<td></td>
<td>%</td>
<td>(in)</td>
<td>grams</td>
<td>%</td>
<td>lb./bu</td>
<td>bu/a</td>
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<tr>
<td>Pipeline</td>
<td>66</td>
<td>C</td>
<td>19</td>
<td>C</td>
<td>25.0</td>
<td>16.1</td>
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<tr>
<td></td>
<td>%</td>
<td>(in)</td>
<td>grams</td>
<td>%</td>
<td>lb./bu</td>
<td>bu/a</td>
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</table>
## Preliminary Results

### Field Pea Performance Under Different Disturbance Levels % P<.05

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Stand</th>
<th>Height</th>
<th>1000 Seed Weight</th>
<th>Protein</th>
<th>Yield</th>
</tr>
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<tbody>
<tr>
<td>Undisturbed</td>
<td>100</td>
<td>A</td>
<td>A 163.3</td>
<td>A 23.7</td>
<td>A 21.2</td>
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<tr>
<td>Roadway</td>
<td>50</td>
<td>B</td>
<td>B 163.6</td>
<td>A 20.2</td>
<td>B 4.4</td>
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<tr>
<td>Pipeline</td>
<td>68</td>
<td>C</td>
<td>C 156.0</td>
<td>B 21.7</td>
<td>AB 6.0</td>
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Preliminary Results

Alfalfa and Cover Crop Performance Under Different Disturbance Levels P<.05

<table>
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<tr>
<th></th>
<th>Yield</th>
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<tbody>
<tr>
<td></td>
<td>lb./ac</td>
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<tr>
<td>Alfalfa</td>
<td></td>
<td></td>
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<tr>
<td>Undisturbed</td>
<td>1546.2</td>
<td>A</td>
</tr>
<tr>
<td>Roadway</td>
<td>612.9</td>
<td>B</td>
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<tr>
<td>Pipeline</td>
<td>626.8</td>
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<table>
<thead>
<tr>
<th>Cover Crop</th>
<th>Yield</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>lb./ac</td>
<td></td>
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<tr>
<td>Undisturbed</td>
<td>3258.3</td>
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<tr>
<td>Roadway</td>
<td>1444.9</td>
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<tr>
<td>Pipeline</td>
<td>979.2</td>
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FUTURE DEVELOPMENT OF STUDY

• In the spring of 2016 a similar trial will be established and will evaluate the use of manure in combination with cropping rotations to improve soil health and inherently yields.

• Manure will be evaluated against commercial fertilizer and a control to determine if physical and chemical soil properties can be improved without incurring the cost of increased fertilizer application.
Recommendations for Pipeline Reclamation

• Planning
  – Map your soils

• Salvage
  – Segregate true topsoil when conditions are optimal, not wet.
  – Understand that suitable soil depth varies

• Storage

• Replacement

-Brenda Schladweiler, BKS Environmental Associates
Recommendations for Pipeline Reclamation

- Don’t ignore soils...it begins and ends with soils
- Understand the scale of the information you have or need
- Pay attention early in the planning process
- Avoid areas that will give you problems
- Understand the economics of NOT doing the previous points.

-Brenda Schladweiler, BKS Environmental Associates
As a private landowner

• Know your farm or ranch
  – Where are the potential problem areas
  – Where are the areas to be avoided
  – Where is the best reclamation potential
  – Ask if ROW width can be minimized in sensitive areas
  – Document what you desire
  – Take photos from same location
• Try to be available when work is occurring on your property
• Get to know your pipeline representative and your construction foreman
  – Don’t assume that conversation will be passed to the next person

-Brenda Schladweiler, BKS Environmental Associates
ACKNOWLEDGMENTS

• Williston-REC staff and collaborators for their contributions.
• Specifically, thanks go to Dr. Tom DeSutter and Heather Dose for their assistance with designing this study; Chris Augustine for technical guidance in sampling compaction and infiltration; Dr. Gautam Pradhan, Diana Amiot, and Justin Jacobs for assistance in planning this study; Dr. James Staricka for providing baseline soil sampling; and Kyle Dragseth and David Weltikol for hauling manure donated by Tyler & Dale Tjelde.
Further information regarding pipeline reclamation can be found at the USDA-ARS website:

http://www.ars.usda.gov/Main/docs.htm?docid=23060