

# **Pipeline Reclamation at the Williston Research Extension Center - NDSU**

## **Austin Link – Agronomy Research Specialist**



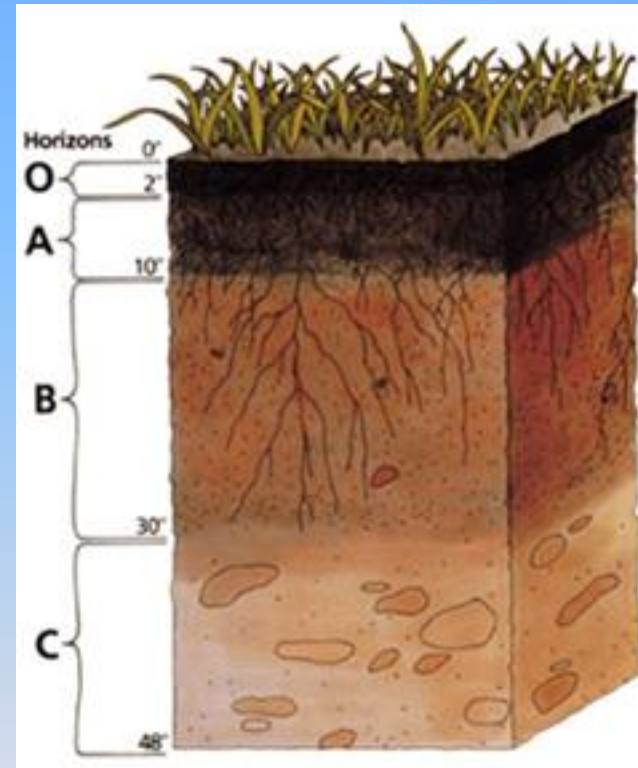


# Reclaiming a 36" Pipeline with Crop Rotations

- Introduction

- May 15<sup>th</sup>, 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

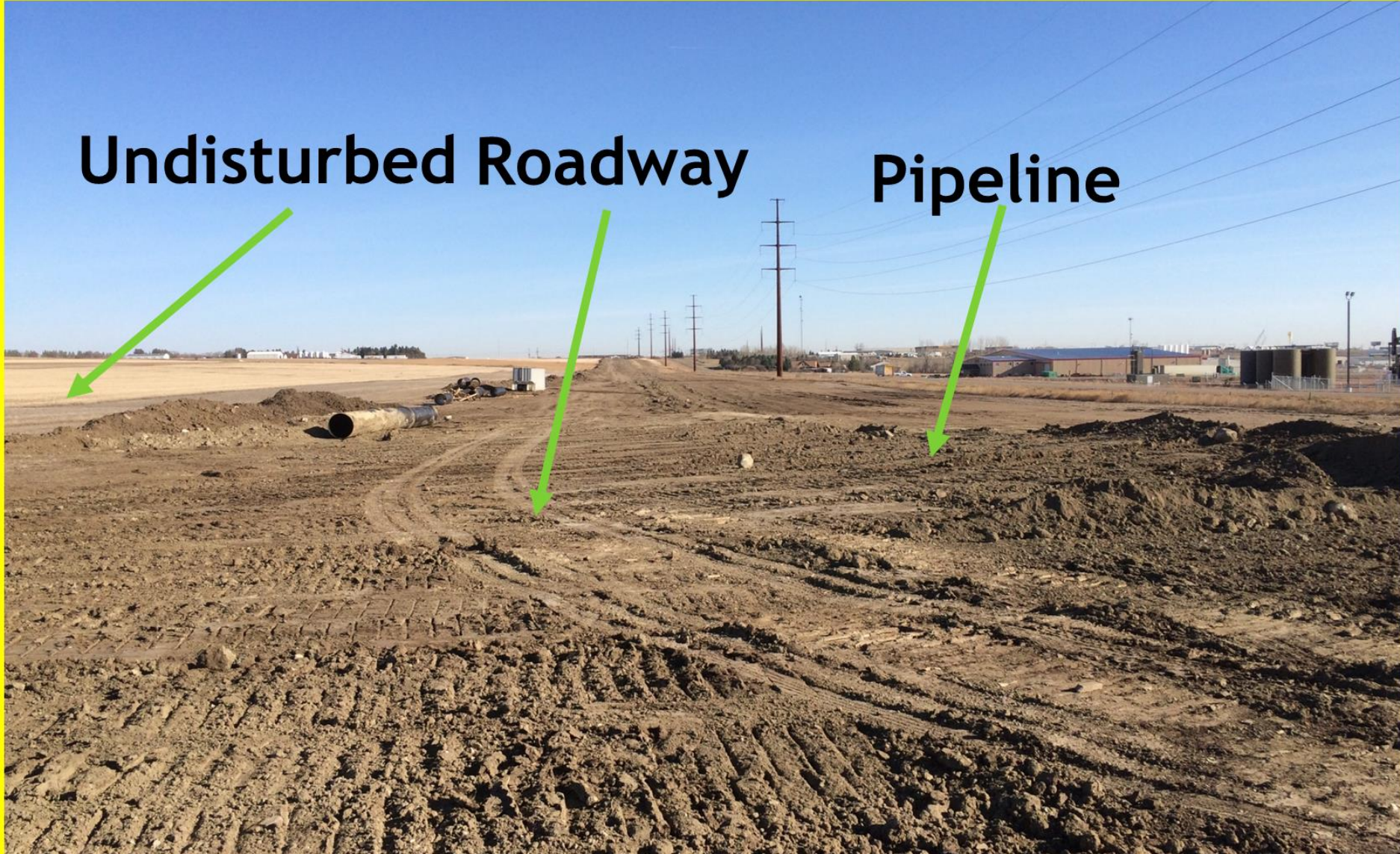
**Topsoil – Depth?**

**Subsoil – Depth?**

# 50' easement turned into 200'

**Undisturbed Roadway**

**Pipeline**

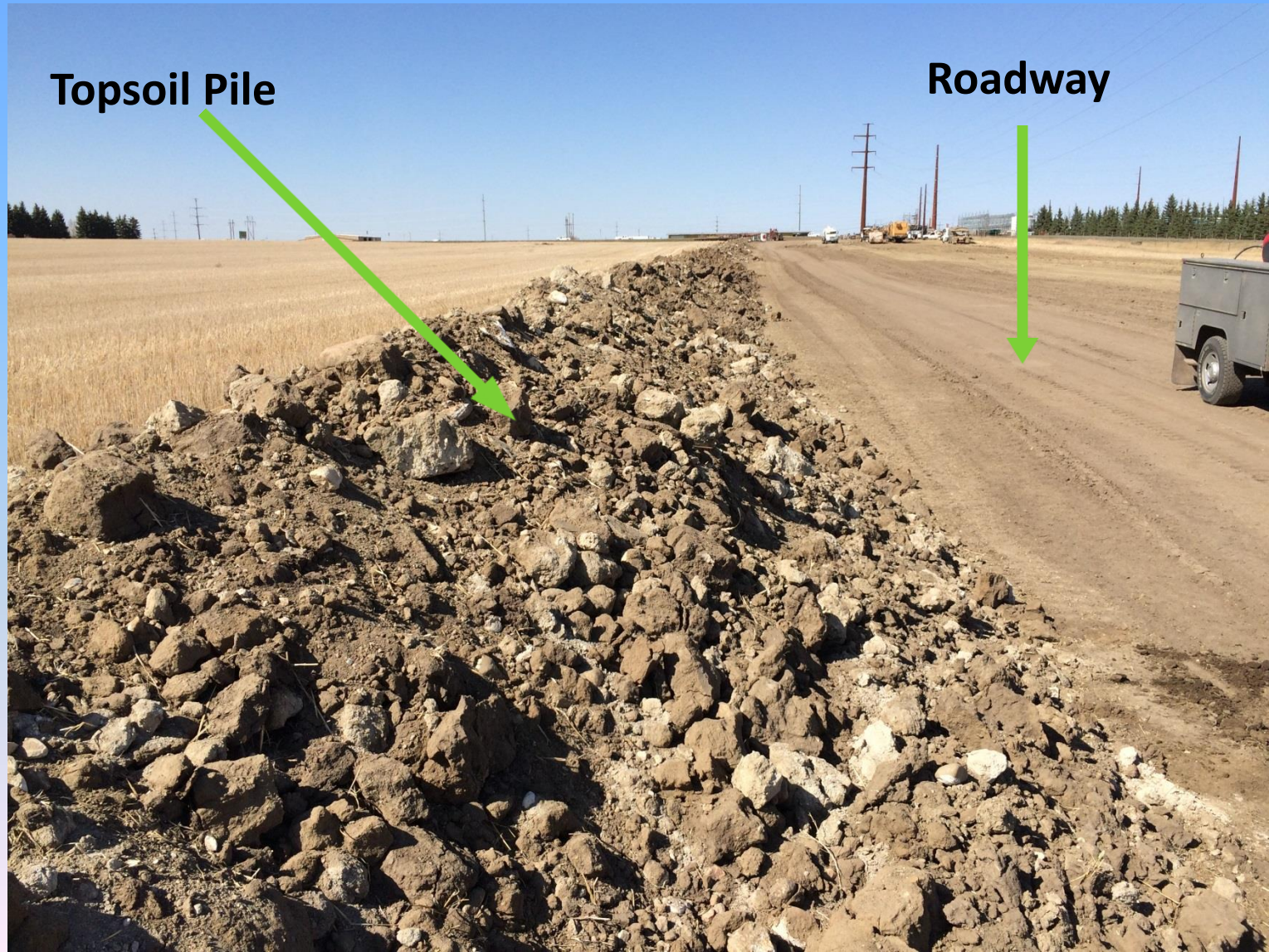




## Challenges in reclaiming pipelines in a cropland setting include, but are not limited to:

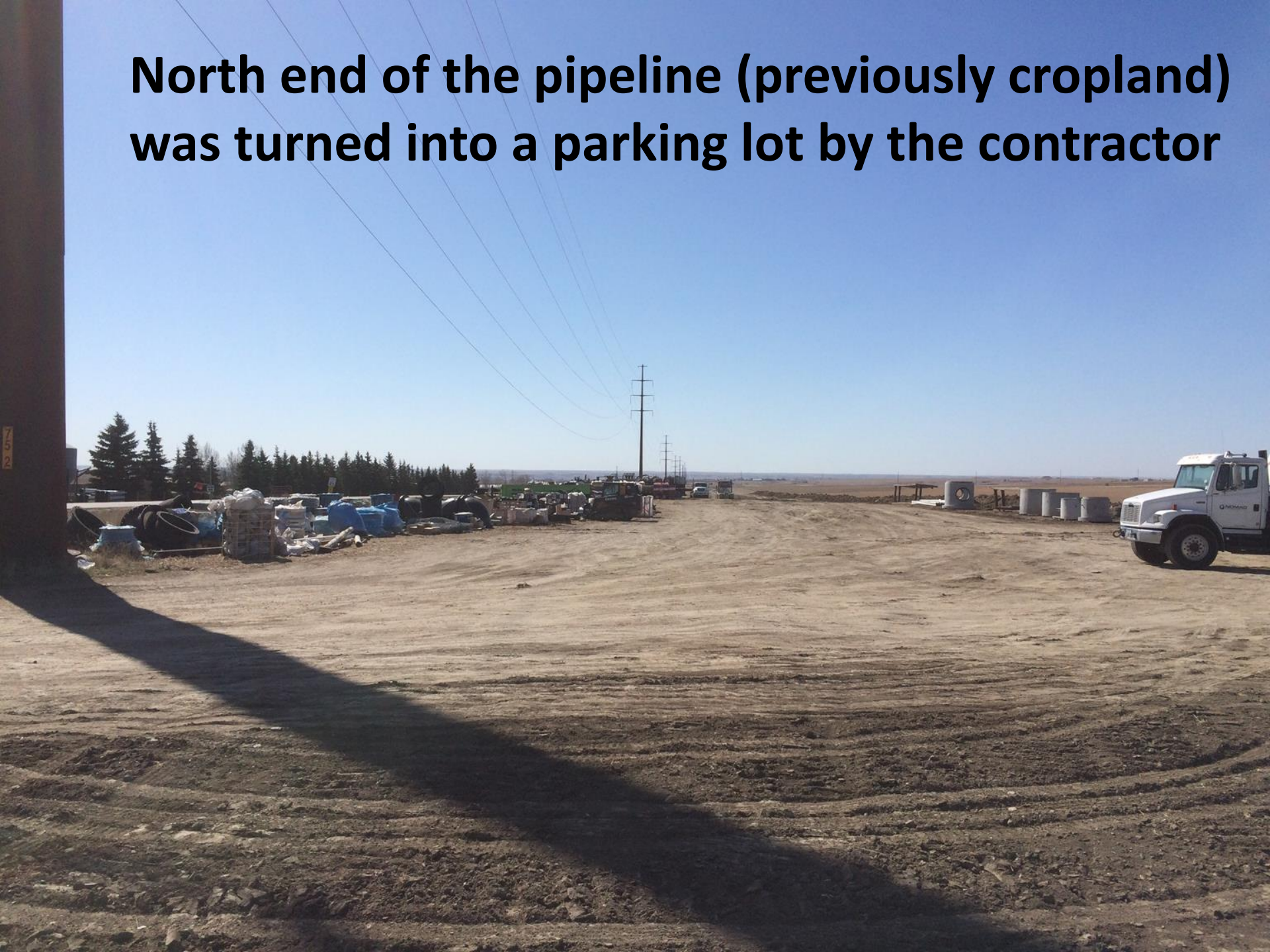
- Proper backfilling and topsoil placement
- Areas of extreme compaction
  - Severely reduce infiltration
- Destruction of soil structure
  - Reduced water holding capacity
- Erosion
- Subsidence within the trench
- Reduction of soil microbes
- Reduced nutrient cycling
- Reduced soil fertility

# Poor Topsoil Placement and Mixing with Subsoil





**North end of the pipeline (previously cropland)  
was turned into a parking lot by the contractor**



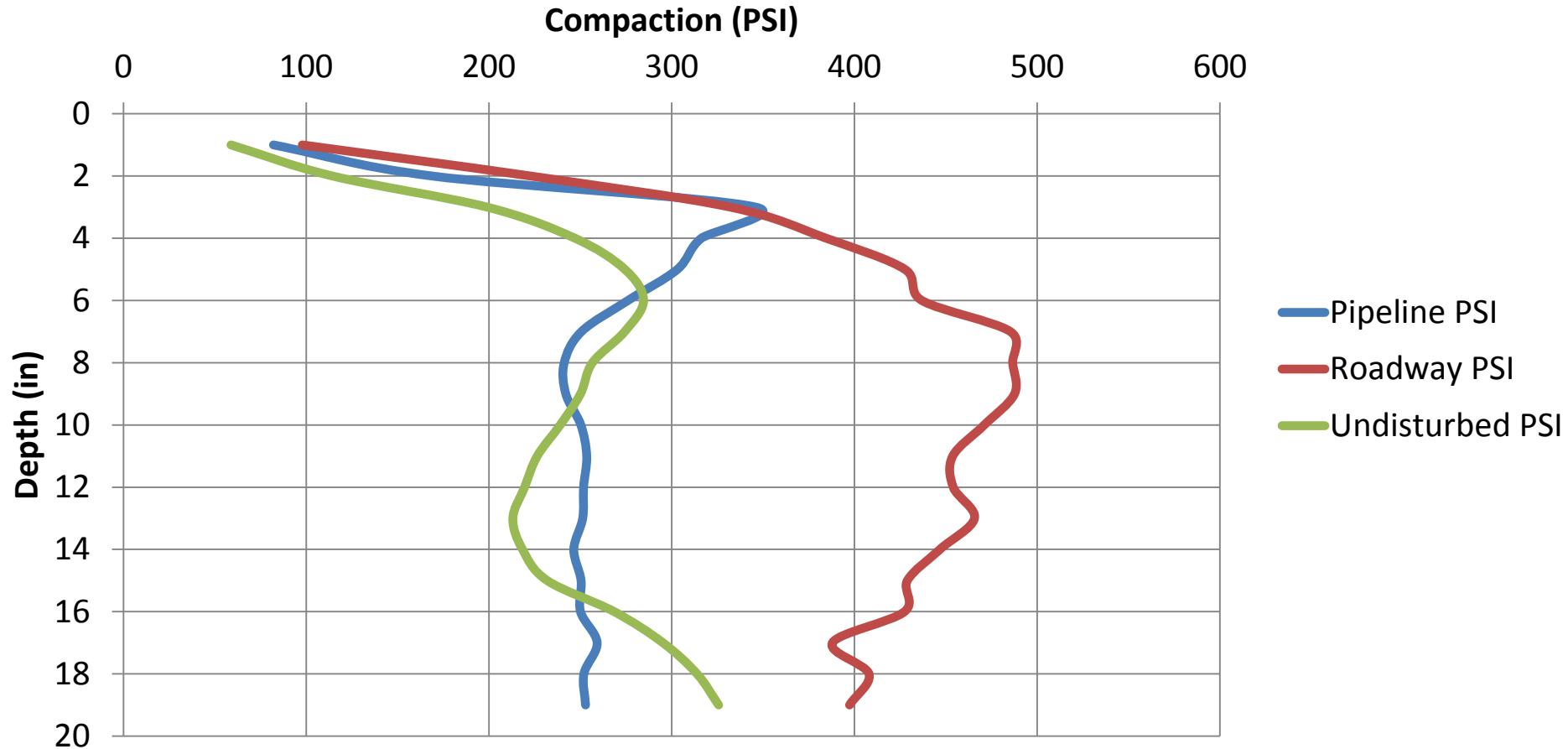
# Reclamation Standards vs. Agronomic Standards

- 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...

Treatment	Organic Matter	pH
	%	
Undisturbed	2.4	6.2
Roadway	2.1	7.4
Pipeline	1.3	8.0



# Compaction After Topsoil Placement



- 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.

Rotation	2015-2016	2016-2017	2017-2018	2018-2019	2019-2020	2020-2021	2021-2022	2022-2023	2023-2024
1	HRSW	Durum	Durum	Durum	Durum	Durum	Durum	Durum	Durum
2	HRSW	Peas	Barley	Safflower	Durum	Peas	Barley	Safflower	Durum
3	Peas	Barley	Safflower	Durum	Peas	Barley	Safflower	Durum	Durum
4	Cover Crop Mix	Durum	Cover Crop Mix	Durum	Cover Crop Mix	Durum	Cover Crop Mix	Durum	Durum
5	HRSW	Cover Crop Mix	Durum	Cover Crop Mix	Durum	Cover Crop	Durum	Cover Crop	Durum
6	RR-Alfalfa	RR-Alfalfa	RR-Alfalfa	RR-Alfalfa	RR-Alfalfa	RR-Alfalfa	RR-Alfalfa	RR-Alfalfa	Durum
7	Perennial Grass	Perennial Grass	Perennial Grass	Perennial Grass	Perennial Grass	Perennial Grass	Perennial Grass	Perennial Grass	Durum

## Different Disturbance Areas

Undisturbed Reference
Compacted Roadway
Pipeline



# Goals of the Study

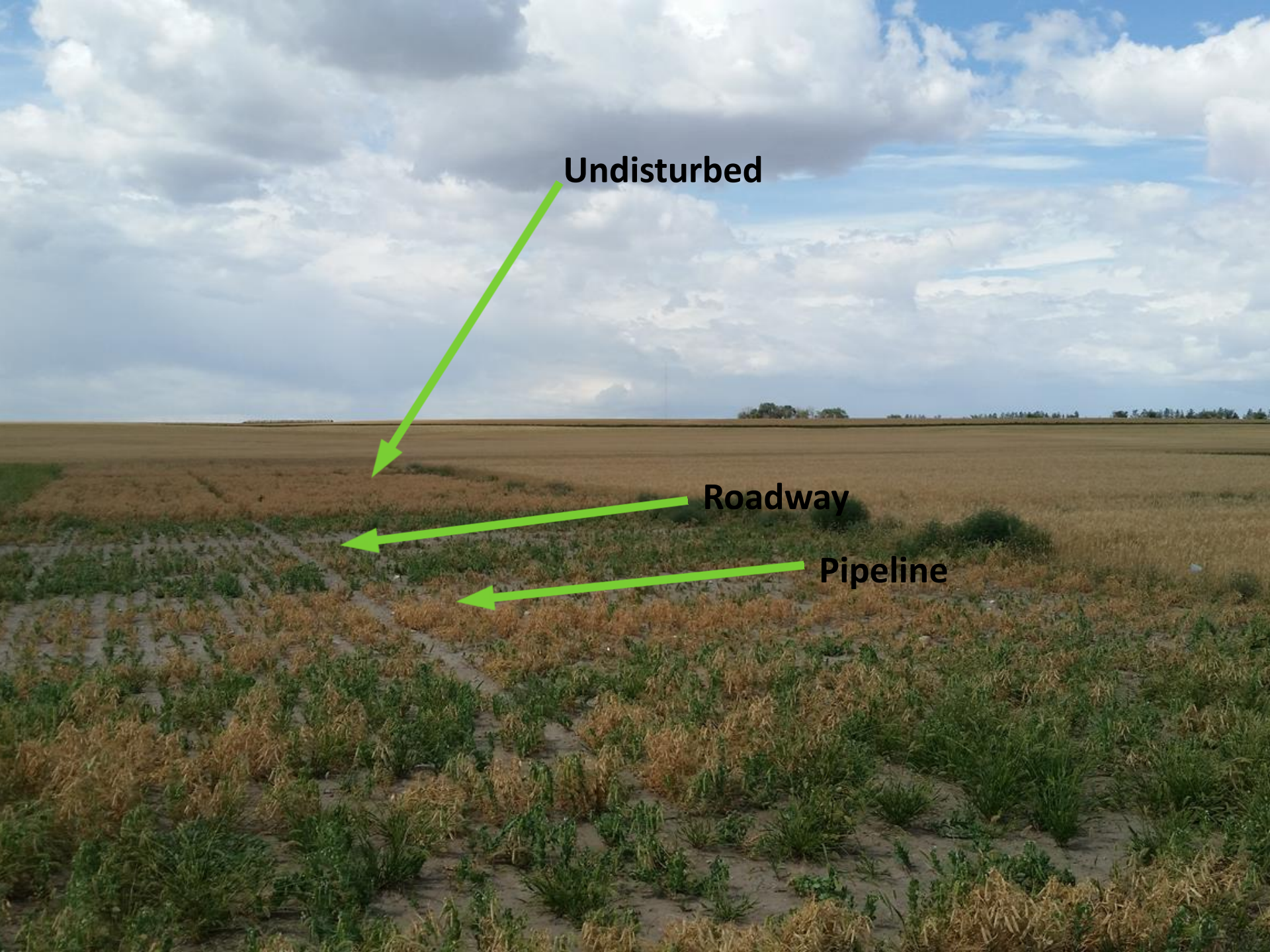
Over the next 9 years:

- 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







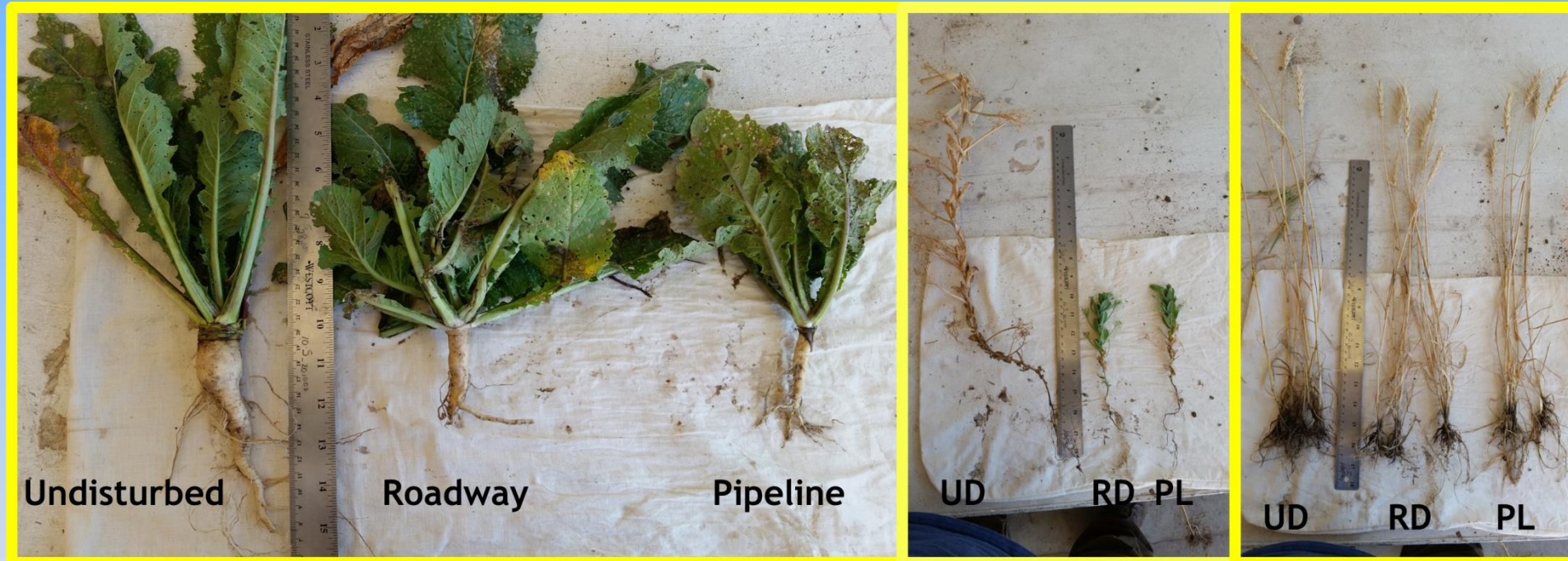
**Undisturbed**

**Roadway**

**Pipeline**



# Radish, peas, and wheat roots show differences between disturbance areas.





# Statistics Overview

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  $P < .05$

Treatment	Stand		Height		1000 TKW		Protein		Weight		Yield	
	%		(in)		grams		%		lb./bu		bu/a	
Undisturbed	100	A	23	A	23.5	A	17.4	A	53.3	A	24.5	A
Roadway	50	B	16	B	25.7	B	16.6	B	53.4	A	9.0	B
Pipeline	66	C	19	C	25.0	C	16.1	C	53.0	A	15.2	C



# Preliminary Results

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

Treatment	Stand		Height		1000 Seed Weight		Protein		Yield	
	%		(in)		G		%		bu/a	
Undisturbed	100	A	16	A	163.3	A	23.7	A	21.2	A
Roadway	50	B	8	B	163.6	A	20.2	B	4.4	B
Pipeline	68	C	10	C	156.0	B	21.7	AB	6.0	B

# Preliminary Results

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

Alfalfa	Yield	
	lb./ac	
Undisturbed	1546.2	<i>A</i>
Roadway	612.9	<i>B</i>
Pipeline	626.8	<i>B</i>

Cover Crop	Yield	
	lb./ac	
Undisturbed	3258.3	<i>A</i>
Roadway	1444.9	<i>B</i>
Pipeline	979.2	<i>B</i>



# 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>