THE EFFECTS OF *CASTOR CANADENSIS* (NORTH AMERICAN BEAVER) REPOPULATION ON A MINE DRAINAGE IMPACTED STREAM

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Introduction

Hypotheses & Objectives

Methods

Results

Conclusions

Introduction

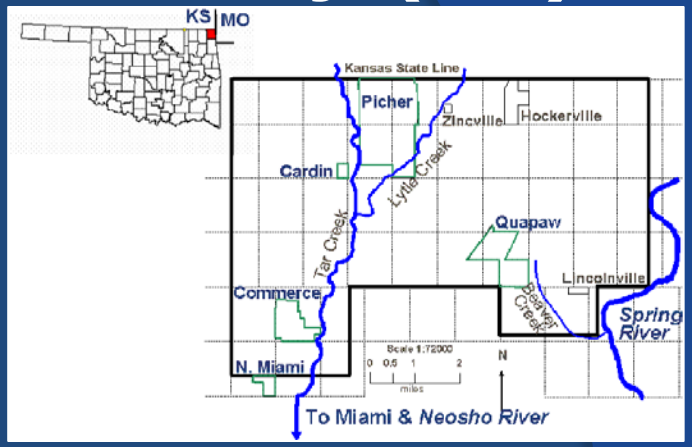
Introduction: *Castor canadensis*

- Life cycle
  - 10 year life expectancy in wild
  - Sexual maturity in 1.5 to 2 years
  - Average 5 kits per birth at a 100 day gestation period
    - 2.7% mortality rate for first 2 years
- Site preferences
  - Dam narrow portions of waterways to create larger water surface area and increase water depth
  - Abundant food sources
    - Aquatic vegetation: duckweed and pondweed
    - Woody plants: Trembling aspen and willow

Introduction: *Castor canadensis*

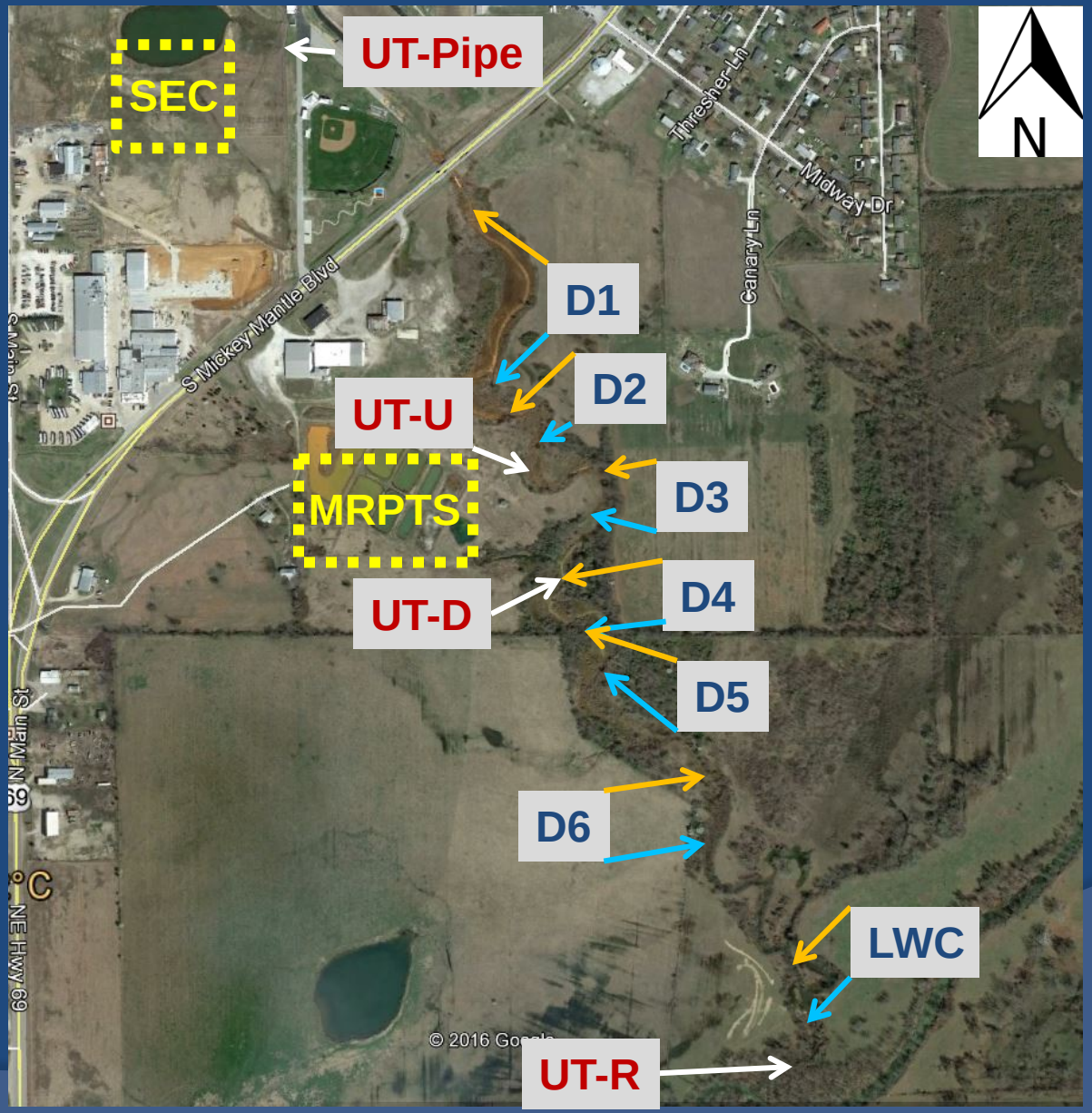
- Ecosystem engineers
  - Alter riparian area and form extensive wetlands
  - Provide habitat variety
  - Increase plant and animal species richness
- Water quality impacts
  - Largely inconclusive, mainly regarding nutrients

Introduction: Unnamed Tributary (UT)



- Located in Commerce, OK
  - Tar Creek Superfund Site
- Impacted by mine drainage
  - Headwaters are untreated mine drainage (SEC)
    - Treatment began Feb. 2017 (Dr. Nairn: Wed. 8 am)
  - Second source 1/3 mile downstream (MRPTS)
    - Treatment began Nov. 2008
- Tributary one mile long and flows into Tar Creek
- Evidence of beaver presence in 2013/2014

Introduction: UT Sites



Hypotheses & Objectives

Hypotheses

1. Presence of beaver dams will show improvement in water quality and decreases in metals concentrations based on historical data

2. Water exiting the beaver dam ponds will have lower metals concentrations than waters entering dam impounded water

3. Sediment total metals concentrations will exceed EPA site specific guidelines

Objectives

1. Identify water quality trends using historical data
2. Determine water quality impacts due to presence of beaver dams
3. Determine sediment total metals concentrations

Methods

Methods: Historical Data

- Dates back to 2004
- Two sites (UT-U and UT-D)
- Establish dates of events that would impact UT water quality
  - Background (regular monitoring 2004 to 2006)
  - SEC French drain construction (2006/2007)
  - MRPTS construction (2008)
  - Established beaver population (2013/2014)
- Identify trends between each event

Methods: In and Out

Water Quality

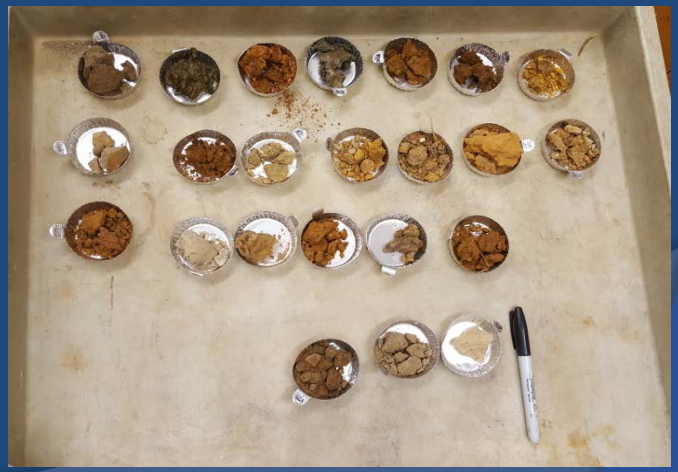
Parameters	Measurement
Physical Water Quality Parameters	Alkalinity
	Turbidity
	Temperature, Specific Conductance, DO %, pH
Total and Dissolved Metals	As, Cd, Fe, Pb, Zn

Methods: In and Out

Sediment Characterization

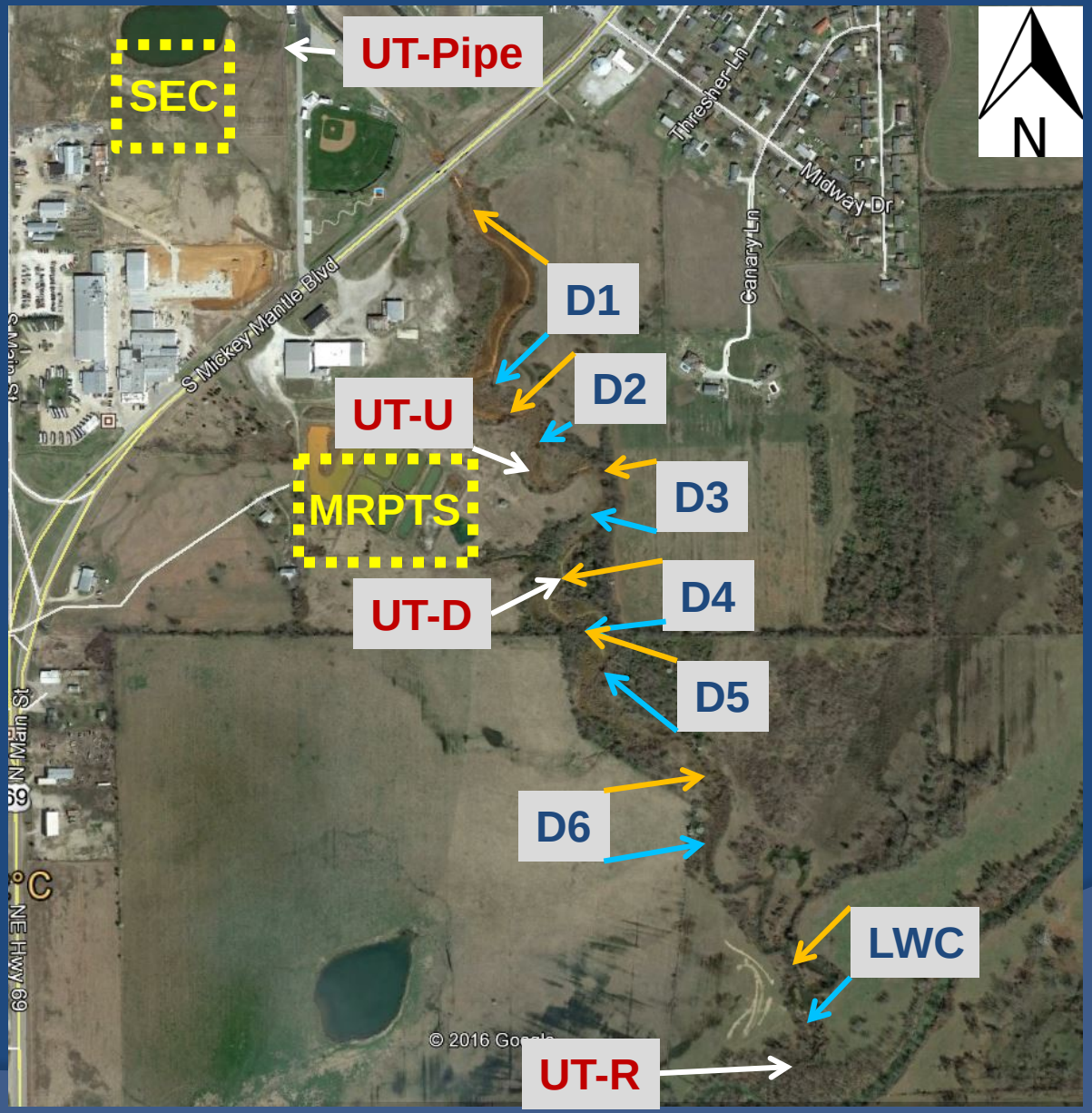
Particle Size Analysis

Solids Digestion



Total Metals

Methods: UT Sites



Results

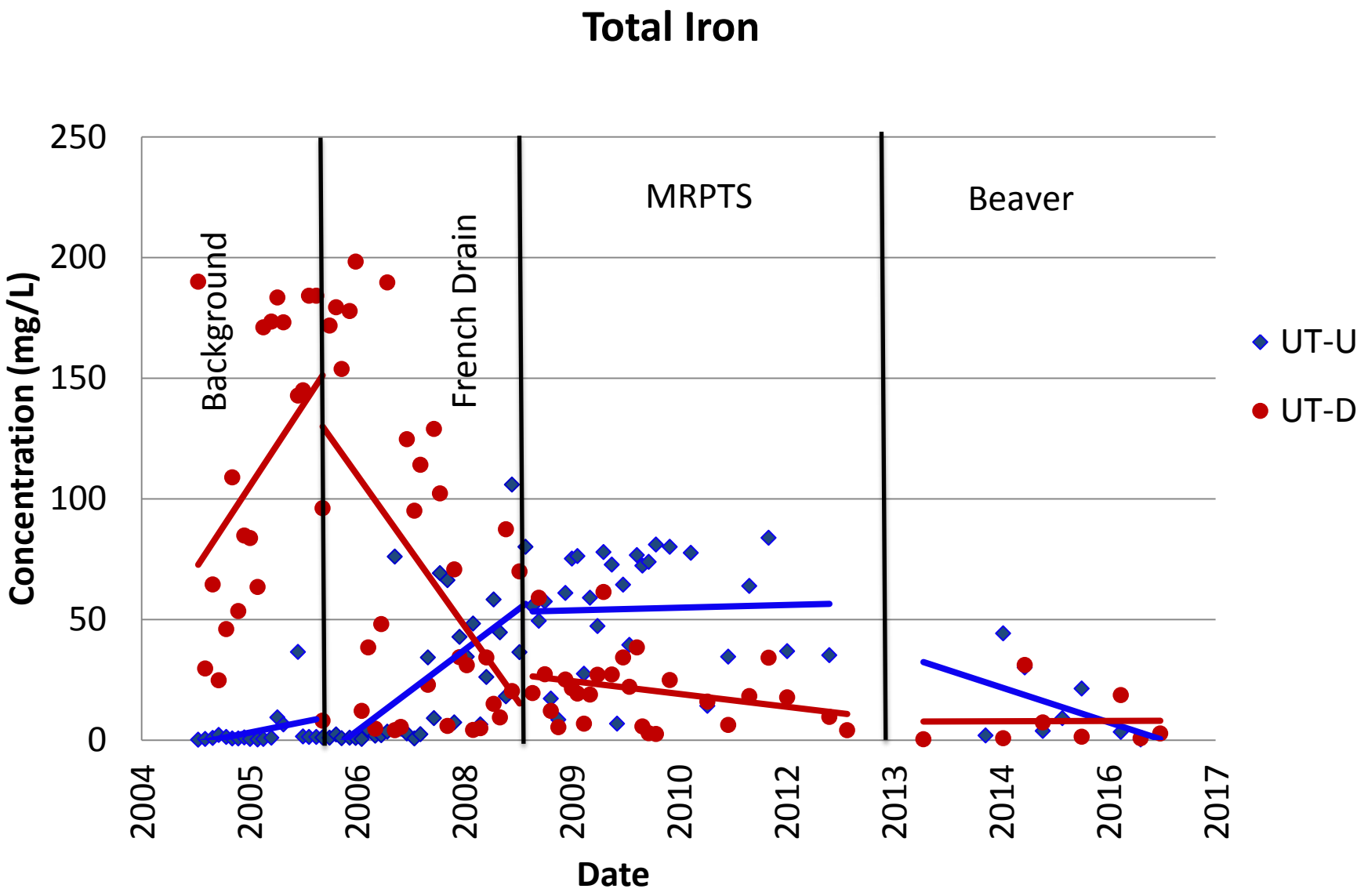
Historical Data

Unit

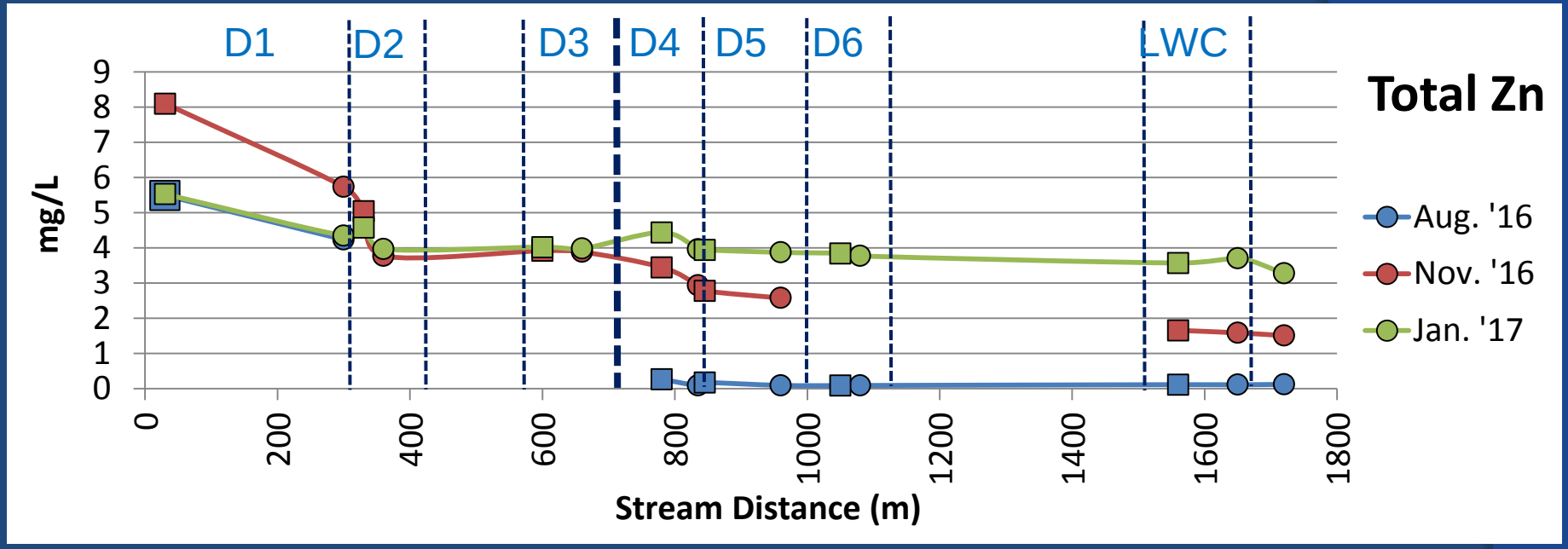
8
7
7
6
6
5

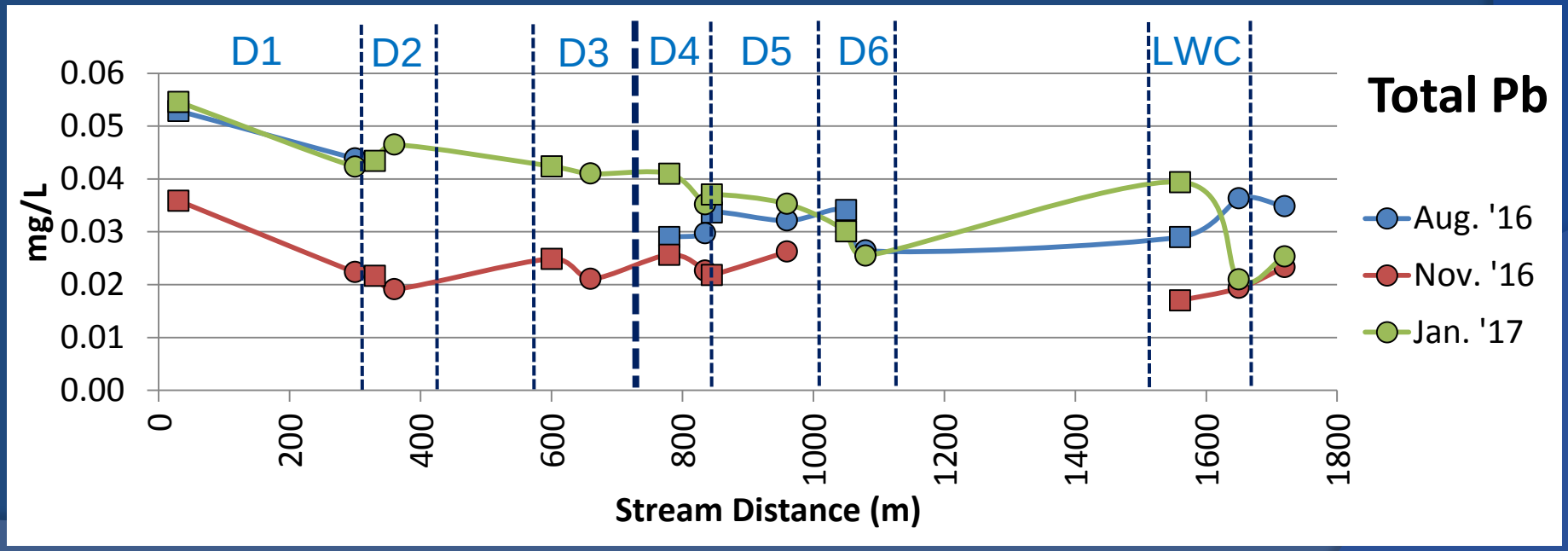
2017

Historical Data



Metals Concentrations In and Out of Beaver Dams





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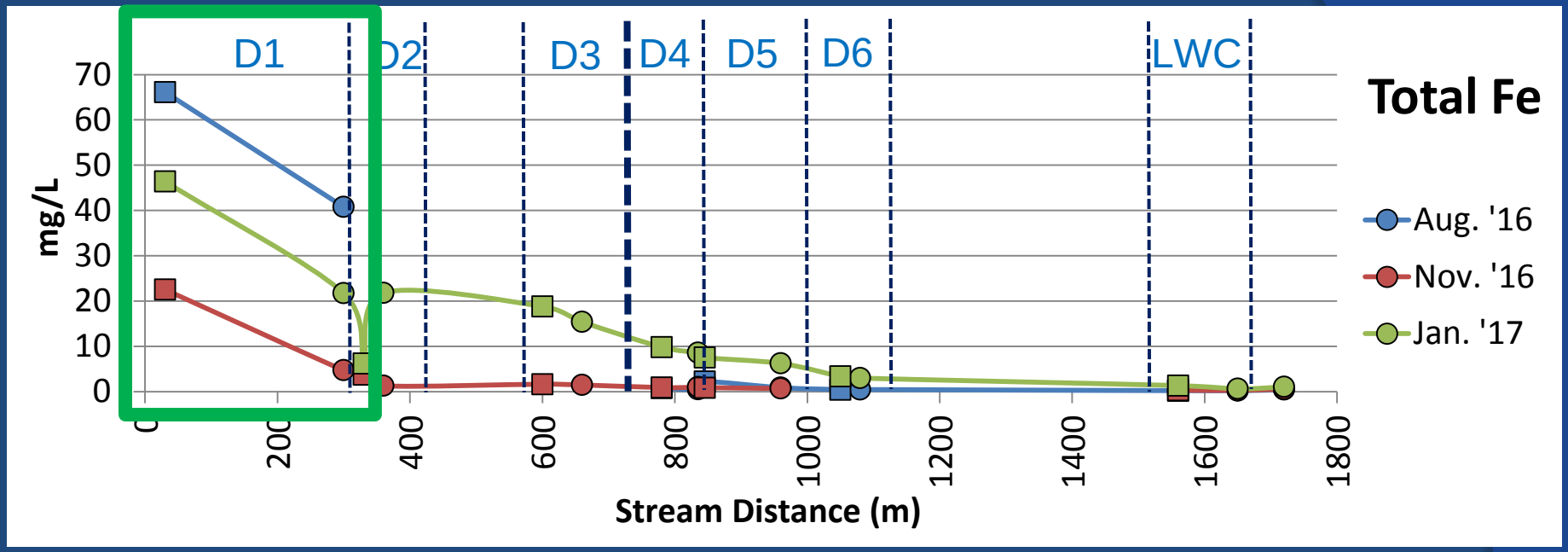
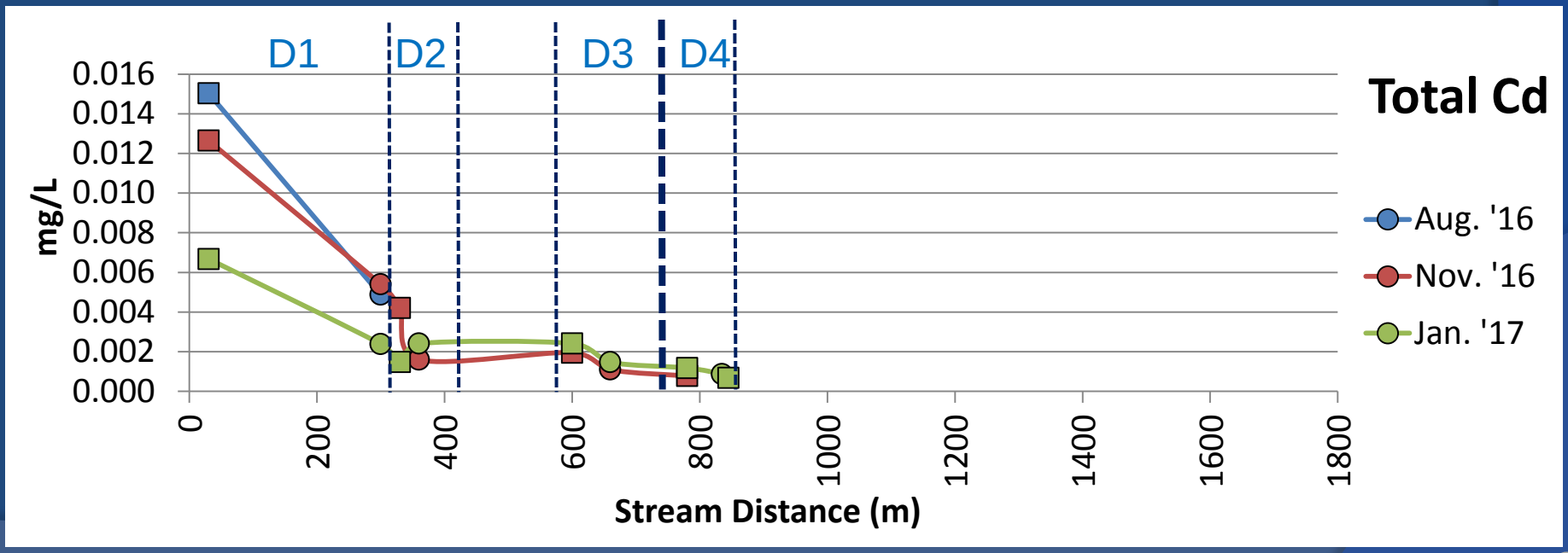




MRPTS designed Fe removal rate

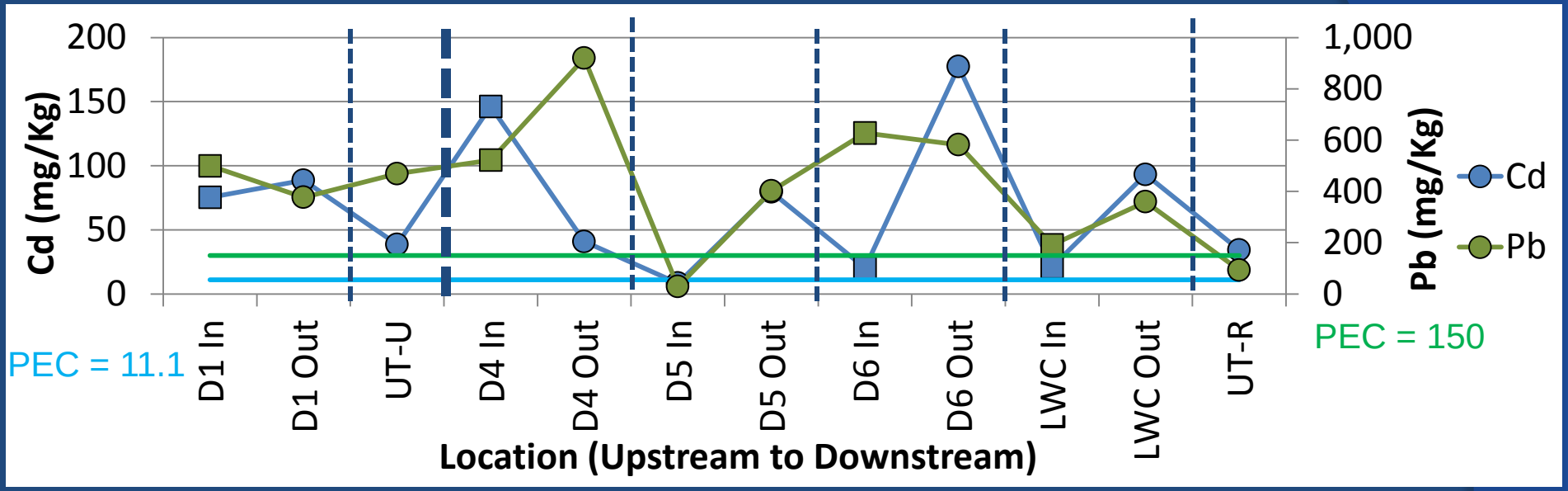
20 g m^{-2} day^{-1}

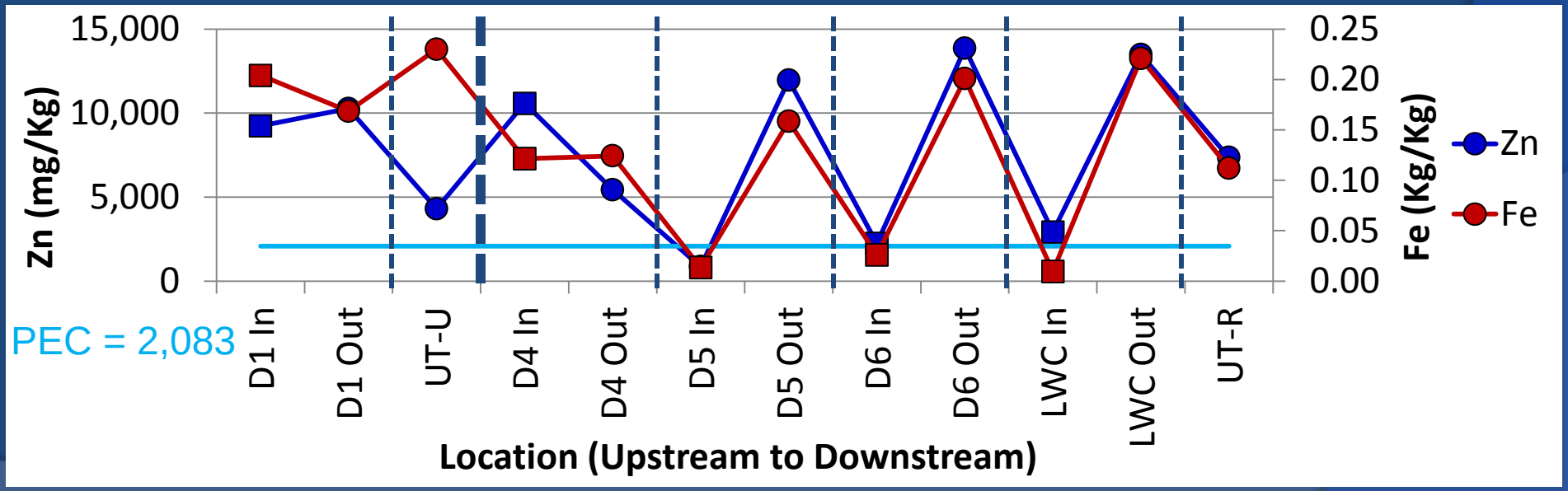
Iron Removal Rate at Dam 1

- From rapid habitat assessment:
  - Volume : 1,560 m^3
  - Surface area: 3,000 m^2

- Beaver Dam 1 Fe removal rate: 7.2 g m^{-2} day^{-1}

Sediment Concentrations: Total Metals





Conclusions

Conclusions

1. Presence of beaver dams will show improvement in water quality and decreases in metals concentrations based on historical data

Accepted

2. Water exiting the beaver dam ponds will have lower metals concentrations than waters entering dam impounded water

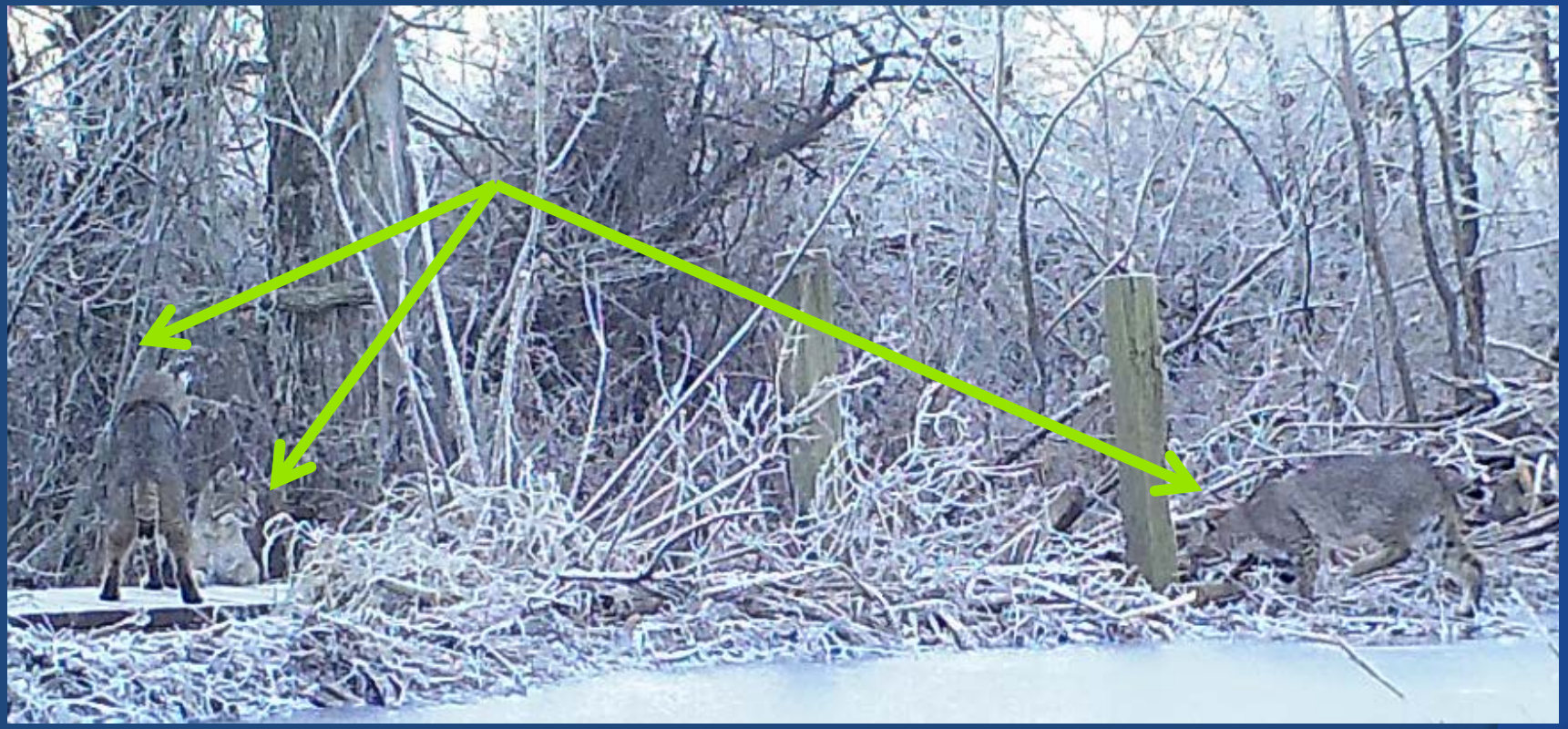
Partially accepted: Minimal impact on [Pb]

3. Sediment total metals concentrations will exceed EPA site specific guidelines

Partially accepted: two sites below total metals guidelines

Acknowledgements

- Property Owners: Mayer and Martin Families
- Grand River Dam Authority
- City of Commerce
- University of Oklahoma: School of CEES
- Oklahoma Department of Environmental Quality
- Center for Restoration of Ecosystems and Watersheds (CREW)
  - Especially Brandon Holzbauer-Schweitzer and Bryan Page



Questions?