

**NORTH DAKOTA
DEPARTMENT OF TRANSPORTATION**

**MATERIALS AND RESEARCH
DIVISION**

Experimental Study ND 2010-03

**Evaluation of ScourStop® Flow Transition Mats
For Scour Protection**

Construction-Evaluation

SU-2-987(029)033

February, 2013

Prepared by

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T.J. Murphy

Disclaimer

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EXPERIMENTAL PROJECT REPORT

EXPERIMENTAL PROJECT	EXPERIMENTAL PROJECT NO.					CONSTRUCTION PROJ NO	LOCATION
	STATE	Y EAR	NUMBER	SURF		SU-2-987(029)033	I-94 Jamestown business loop
	1 ND	2010	- 03		8		28
SHORT TITLE	EVALUATION FUNDING						
	1 HP&R	3 DEMONSTRATION	NEEP NO.	PROPRIETARY FEATURE?			
	48 2 CONSTRUCTION	4 X IMPLEMENTATION	49	51	No		
SHORT TITLE	TITLE 52 Evaluation of ScourStop® Flow Transition Mats for Scour Protection						
THIS FORM	DATE	MO.	YR.	REPORTING			
	140	February	-- 2013	1 X INITIAL	2 ANNUAL	3 FINAL	
KEY WORDS	KEY WORD 1			KEY WORD 2			
	145 ScourStop			167 Flow Transition Mats			
	KEY WORD 3			KEY WORD 4			
	189			211			
CHRONOLOGY	UNIQUE WORD		PROPRIETARY FEATURE NAME				
	233		255 ScourStop				
CHRONOLOGY	Date Work Plan Approved	Date Feature Constructed:	Evaluation Scheduled Until:	Evaluation Extended Until:	Date Evaluation Terminated:		
	277 August 2010	281 June 2012	285 September 2018	289	293		
QUANTITY AND COST	QUANTITY OF UNITS (ROUNDED TO WHOLE NUMBERS)		UNITS		UNIT COST (Dollars, Cents)		
	297		305		306		
AVAILABLE EVALUATION REPORTS	CONSTRUCTION		PERFORMANCE		FINAL		
	315 X						
EVALUATION	CONSTRUCTION PROBLEMS			PERFORMANCE			
	1 X NONE	2 SLIGHT	3 MODERATE	4 SIGNIFICANT	5 SEVERE	1 EXCELLENT	2 GOOD
	318 4 SIGNIFICANT	5 SEVERE	319 5 UNSATISFACTORY				
APPLICATION	1 ADOPTED AS PRIMARY STD.		4 X PENDING		<i>(Explain in remarks if 3, 4, 5, or 6 is checked)</i>		
	2 PERMITTED ALTERNATIVE		5 REJECTED				
	320 3 ADOPTED CONDITIONALLY		6 NOT CONSTRUCTED				
REMARKS	321 The four installations of ScourStop® were successfully installed according to the plans and manufacturer's recommendation. The top soil adjacent to the installations was eroded away during the flood of 2011 prior to installation. This resulted in a low success rate of the permanent seeding around the ScourStop® installations. The picture in photo 6 captures the state of the permanent seeding in August of 2012. The sod appears to be growing and is covered with a minor amount of top soil.						

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Evaluation of ScourStop® Flow Transition Mats For Scour Protection

Purpose and Need

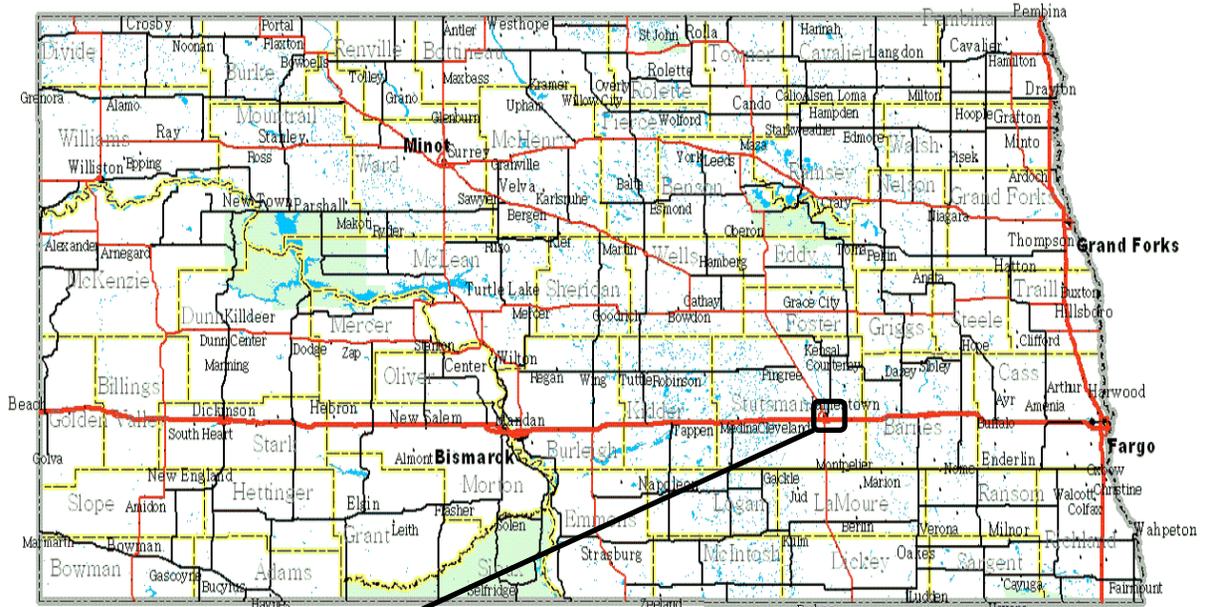
Storm water flow from culverts and pavement in urban and rural settings can accelerate soil scour and erosion in turn impeding proper drainage which then may require maintenance to restore. Rip-rap and TRM “turf reinforcement mat” is currently used as a permanent scour and erosion protection, but rip-rap revetment may erode away and disintegrate over time requiring periodic maintenance. Rip-rap also may pose a safety hazard to children in residential settings and can collect debris and weeds producing an aesthetically unappealing structure. Flow Transition Mats are designed to replace rip-rap revetment as a permanent maintenance free scour and erosion protection system at culverts, pipes, and pavement drainage areas. Mats allow vegetation to become established and protect flow paths from erosion.

Objective

The objective of this experimental project is to evaluate the performance of ScourStop® Flow Transition Mats as a permanent method for energy dissipation to prevent scour downstream from culverts, pipes, or pavement.

Location

NDDOT plans to incorporate ScourStop® Flow Transition Mats as part of project SU-2-987(029)033. This project is located near Jamestown Business Loop East respectively.



SU-2-987(029)033
Begin Project

SU-2-987(029)033
End Project

Proposed ScourStop®
Location (south ditch)

Design

NDDOT plans to incorporate ScourStop® Flow Transition Mats on I-94 near Jamestown as part of project SU-2-987(029)033 designed by Ulteig Engineers, Inc. ScourStop® Flow Transition Mats shall be installed according to plan and abiding all manufacturers' recommendations. The plan note used to incorporate ScourStop® is included below.

709-P01 EROSION CONTROL TRANSITION MAT: The contractor shall install Erosion Control Transition Mat at the storm drain outlets indicated in the plan. The Erosion Control Transition Mat shall be ScourStop®.

Installation shall be in accordance with the following:

1. The Erosion Control Transition Mat shall butt directly against the flared end section.
2. The Erosion Control Transition Mat shall not be installed on bare soil. The Erosion Control Transition Mat shall be placed on sod. The cost of sod shall be included in the price bid for "Erosion Control Transition Mat."
3. Use flexible strapping with deadman anchor, flat washers (>2.5 inches) and one way stops to attach the Erosion Control Transition Mats to the soil a minimum of 24 inches. Firmly pull straps to snug the Erosion Control Transition Mat down against the soil with the washer and one-way stop.
4. Discharge area width shall be as level as possible to avoid water concentration and riling. Mats may be installed in partial lengths; downstream mats may be shingled to minimize anchors.

SU-2-987(029)033

This project consists of the reconstruction of the Jamestown Business Loop East from 12th Street SE to Country Club Drive. The roadway will have four installation of ScourStop®. For exact installations locations see Appendix A. The project will also have a control site with conventional rip rap; for exact installations locations see Appendix A.

Evaluation

The project will be evaluated during construction and completion and then followed up with an annual evaluation for the next six years. The project will be evaluated on the following criteria:

- Visual Inspection
- Durability Issues
- Photos
- District comments on their visual observations
- Maintenance cost

Materials and Research will publish a biennial report documenting the observations of this project.

Construction

Project SU-2-987(029)033 was a reconstruction administered by Ulteig Engineering. ScourStop® was installed June 12 and June 13 of 2012 by Pro Landscapers LLC. A small crew of landscapers was able to perform the four ScourStop® installations over two days. Installation sites required minimal grade preparation as pictured below.



Photo 1: Crew performing grade prep prior to install.

Once the grade was ready for installations the area was covered with sod.



Photo 2: Site with sod placed.

Once the sod had been placed the matrix of 4'x4' ScourStop® Panels was laid out; some panels were cut to achieve the desired dimension in the plans. No panels were overlapped as the contractor advised against overlapping panels.



Photo 3: Crew placing the ScourStop® panels.

ScourStop® Bullet anchors were then inserted 18" deep into the soil with rebar and secured with locking washers pictured below in photo 4. The depth of anchoring was inspected with a tape measure to insure proper embedment. The crew pounded the first few anchors in with a sledge hammer; this process was time consuming and an air hammer was brought over to speed up the process. It should also be noted that once the rebar was used to pound the anchors it often became stuck due to the confining pressure of the in place embankment. The process was slowed by the time required to remove the stuck rebar. A post puller would have been useful in speeding up anchor installation. The crew at the time did not have a post puller and used a skid steer bucket to remove stuck rebar.



Photo 4: ScourStop® bullet anchor.

The anchoring pattern was recommended by the manufacturer. Each 4'x4' panel was secured with eight anchors. It should be noted that to reduce anchors the panels can be overlapped in the direction of flow. The contractor opted to not overlap panels due to their past experience. The contractor felt the ScourStop® panels perform better when placed flush. Pictured in photo 5 is a completed installation of ScourStop®.



Photo 5: Completed ScourStop® installation.

Summary

The four installations of ScourStop® were successfully installed according to the plans and manufacturer's recommendation. The top soil adjacent to the installations was eroded away during the flood of 2011 prior to installation. This resulted in a low success rate of the permanent seeding around the ScourStop® installations. The picture in photo 6 captures the state of the permanent seeding in August of 2012. The sod appears to be growing and is covered with a minor amount of top soil. Photos documenting the condition of each installation as of August of 2012 can be found in Appendix B.

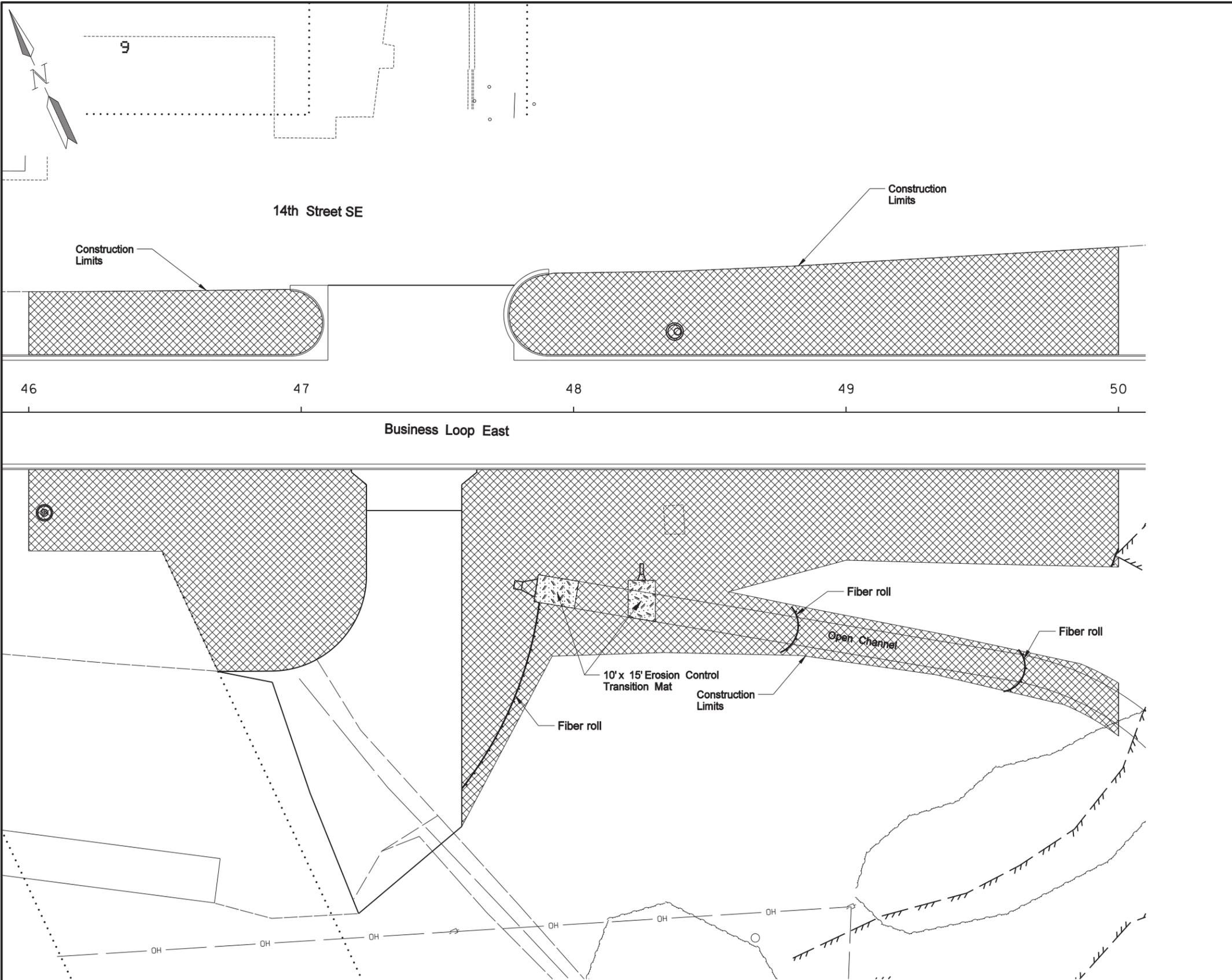


Photo 6: ScourStop® installation August 2012.

The ScourStop® installations will be monitored for durability and performance over the next 6 years.

Appendix A

STATE	PROJECT NO.	SECTION NO.	SHEET NO.
ND	SU-2-987(029)033	075	10



Fiber Rolls 12IN

Sta. 47+60 Rt. to Sta. 47+87 Rt.	75 LF
Sta. 48+80 Rt.	20 LF
Sta. 49+65 Rt.	20 LF

Seeding-Hydromulch

Sta. 46+00 Lt. to Sta. 47+08 Lt.	0.057 Acre
Sta. 46+00 Rt. to Sta. 47+24 Rt.	0.144 Acre
Sta. 47+76 Lt. to Sta. 50+00 Lt.	0.170 Acre
Sta. 47+59 Rt. to Sta. 50+00 Rt.	0.348 Acre

Erosion Control Transition Mat

Sta. 47+90 Rt.	17 SY
Sta. 48+25 Rt.	17 SY

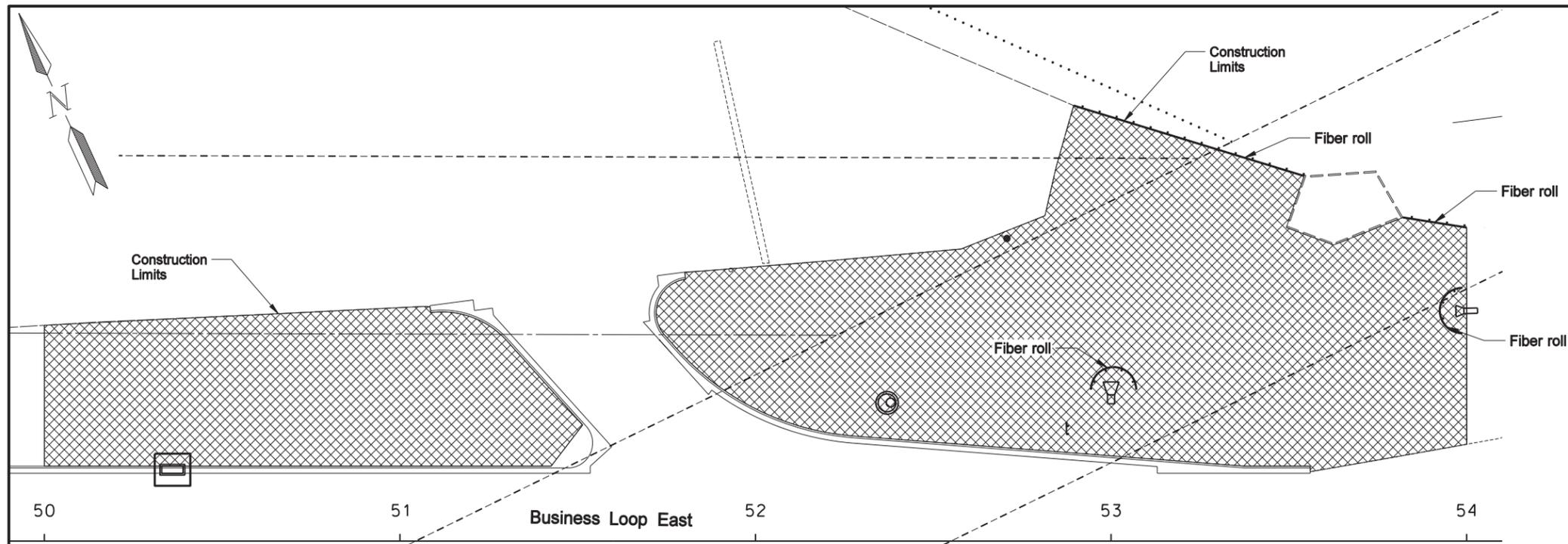
Legend

	Seeding-Hydromulch
	Inlet Protection-Sandbag
	Fiber Rolls 12 IN
	Existing Delineated Wetland
	Permanent Wetland Impacts
	Temporary Wetland Impacts

This document was originally issued and sealed by Clinton Knutson Registration Number PE-4523, on 10/05/2010 and the original document is stored at the City of Jamestown

Business Loop East
Wetlands, Erosion Control & Seeding
Sta. 46+00 to Sta. 50+00

STATE	PROJECT NO.	SECTION NO.	SHEET NO.
ND	SU-2-987(029)033	075	11



Inlet Protection-Sandbag

Sta. 50+36 Lt.	1 EA
Sta. 50+36 Rt.	1 EA

Fiber Rolls 12 IN

Sta. 50+00 Rt. to Sta. 53+56 Rt.	430 LF
Sta. 52+90 Lt. to Sta. 53+54 Lt.	68 LF
Sta. 53+00 Lt.	20 LF
Sta. 53+82 Lt. to Sta. 54+00 Lt.	18 LF
Sta. 53+90 Lt.	20 LF

Seeding-Hydromulch

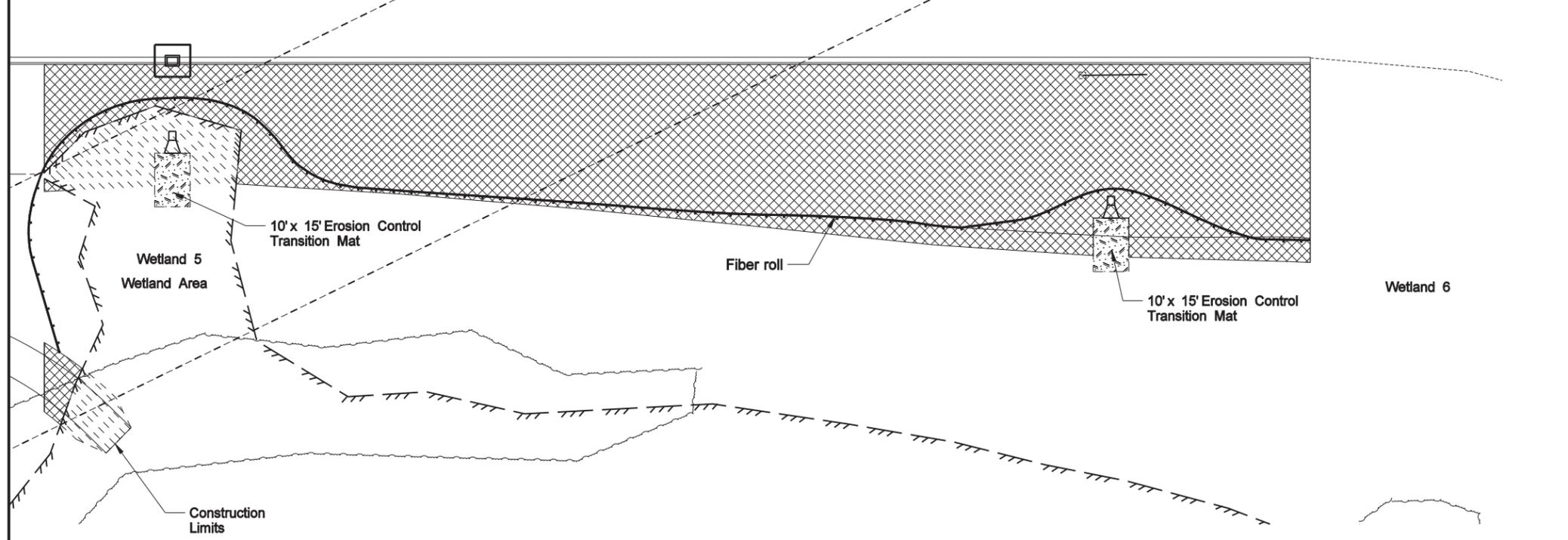
Sta. 50+00 Lt. to Sta. 51+51 Lt.	0.136 Acre
Sta. 51+72 Lt. to Sta. 54+00 Lt.	0.331 Acre
Sta. 50+00 Rt. to Sta. 53+56 Rt.	0.338 Acre

Erosion Control Transition Mat

Sta. 50+36 Rt.	17 SY
Sta. 53+00 Rt.	17 SY

Legend

	Seeding-Hydromulch
	Inlet Protection-Sandbag
	Fiber Rolls 12 IN
	Existing Delineated Wetland
	Permanent Wetland Impacts
	Temporary Wetland Impacts



This document was originally issued and sealed by Clinton Knutson Registration Number PE-4523, on 10/12/2010 and the original document is stored at the City of Jamestown

Business Loop East
Wetlands, Erosion Control & Seeding
Sta. 50+00 to Sta. 54+00

Appendix B.



Installation A-Sta. 47+90 RT



Installation B-Sta. 48+25 RT



Installation C – Sta. 50+36 Rt.



Installation D - Sta. 53+00 Rt.



Control Installation Sta. 24+36 Rt. to Sta. 24+57 Rt.

