

Technical Memorandum

То:	Linda Loomis, Administrator Lower Minnesota River Watershed District
From:	Katy Thompson, PE, CFM Della Schall Young, PMP, CPESC
Date:	July 14, 2021
Re:	University of Minnesota Partnership for the Gully Assessment and Condition Project

Dr. Joe Magner, with the University of Minnesota's Department of Bioproducts and Biosystems Engineering, reached out to the Lower Minnesota River Watershed District (LMRWD or District) through Young Environmental Consulting Group (Young Environmental) in December 2020 to discuss field data collection opportunities for his students taking the Spring Semester 2021 class, Hydrology and Water Quality Field Methods (Environmental Sciences, Policy and Management [ESPM] 3111 and ESPM 5111). The District has enjoyed the benefits of collaborating with Dr. Magner's students because his students helped the District conduct geomorphic assessments of the District's trout streams in 2019. One student, Phil Margarit, who worked for Young Environmental as an intern, also collected gully condition surveys in 2020.

Because of this strong partnership, Young Environmental staff met with Dr. Magner and Phil to discuss opportunities for the ESPM students and developed a workplan for them to help further the identification of gullies in Dakota and Scott Counties during Spring Semester 2021.

Katy Thompson from Young Environmental presented the LMRWD gully project to the ESPM students on January 21, 2021, to provide them with background on the project and the need for additional data collection. The ESPM students were split into two groups to first identify potential sites for field inspections, collect data in the field to determine if the desktop assessment was accurately predicting the location of gullies, and then draft a summary report on their methods and results. Following this initial

meeting, Katy met with Phil and the ESPM students every two weeks for the remainder of the semester in an advisor role to provide feedback on their approach and plan.

Desktop Assessment

As part of the class assignment, the ESPM students were tasked with identifying potential gully locations using GIS software and publicly available data before entering the field. The goal of this desktop assessment was to determine if there is a correlation between these data and the likelihood that gullies may develop within the LMRWD. Between the two groups, the ESPM students utilized publicly available information, including the 2020 Gully Inventory and Conditions Assessment report and GIS data:

- LMRWD Steep Slopes Overlay District (SSOD)
- Minnesota Department of Natural Resources (MnDNR) LiDAR data
- Historic and current landcover information
- Minnesota Department of Health groundwater and well index
- MnDNR spring data
- Natural Resources Conservation Service soils data
- Minnesota Geological Survey surficial geology data

Each team assessed the data differently; however, both teams placed priority on utilizing the SSOD, topography, soil drainage types (with emphasis on poorly drained soils), depth to water table, and proximity to springs.

Field Data Collection

The ESPM students reviewed the available information and discussed internally how to apply the data to assess if an area within LRMWD had potential for gully development. The two groups provided a comprehensive list of 31 potential areas to assess in the field.

The ESPM students went into the field from April 18 to April 25, 2021, to assess the potential gully areas and the conditions of any found gullies using the same format as the *2020 Gully Inventory and Condition Assessment*. Katy provided the students with public access maps and information to avoid trespassing on private property, which removed four locations from the field collection activities.

Of the remaining twenty-seven sites, thirteen were identified in the field as being gullies, whereas six were determined to not be gullies. Several of the potential gully areas were not visited because of difficulties accessing the sites, time limitations, or user error with the survey equipment.

Results

The two ESPM student groups reviewed the data they collected and summarized their findings in independent reports. These reports indicated that some of the criteria used to identify gully locations did not have a noticeable correlation to gully development, in particular the springs and groundwater data. Although groundwater and seeps are known to destabilize soils, the depth to water table and historic springs data did not seem to accurately predict gully development. The factors that did have a more direct correlation to gully development appeared to be steep slopes and stormwater outfalls. Additionally, the ESPM students recommended incorporating land cover, placing more emphasis on the steep slopes, and developing a more objective survey to reduce judgment and estimation for future phases of the gully project.

2021 Gully Inventory and Condition Assessment

The 2021 gully project is currently underway and is utilizing the information the ESPM students vetted. The desktop analysis completed for the 2021 gully inventory work placed the most importance on identifying steep slopes outside of the SSOD, reviewing upstream land use data, and incorporating city-identified erosion hazards into the 2021 field locations. In addition, the survey forms used in 2020 have been revised to incorporate impartial scoring criteria to objectively evaluate gully erosion risk, which can also be applied to the 2020 sites. The interns have surveyed 187 sites to date and will be presenting their findings to the LMRWD managers at the August 18, 2021, board meeting.

Attachments

- Attachment 1—ESPM Survey Locations
- Attachment 2—ESPM Gully Survey Sheets

ATTACHMENT I - ESPM CLASS SURVEY LOCATIONS















Figure 7: Site 13

LEGEND

- April 2021 Gully Locations
- High Erosion Potential
- Moderate Erosion Potential
- Low Erosion Potential
- $\otimes \quad \text{No Gullies Found} \\$
- Potential Gully Areas
- --- Scott Co. Trails
- ---- State Trails
- MnDNR Spring Inventory
- LMRWD Trout Streams
- Public Waters
- Dakota Co. Parcel Data
- Scott Co. Parcel Data
- Public Waterbodies
- Steep Slopes Overlay District
- US Fish & Wildlife Service Property
- LMRWD Boundary

LMRWD Watershed Location Map









LEGEND

- April 2021 Gully Locations
- High Erosion Potential
- Moderate Erosion Potential
- Low Erosion Potential
- \otimes No Gullies Found
- Potential Gully Areas
- --- Scott Co. Trails
- --- State Trails
- MnDNR Spring Inventory
- LMRWD Trout Streams
- Public Waters
- ____ Dakota Co. Parcel Data
- Scott Co. Parcel Data
- ------ MnDNR LiDAR 2-ft Contours
- Public Waterbodies
- Steep Slopes Overlay District
- US Fish & Wildlife Service Property
- LMRWD Boundary

LMRWD Watershed Location Map









Figure 12: Site 28

LEGEND

- April 2021 Gully Locations
- High Erosion Potential
- Moderate Erosion Potential
- Low Erosion Potential
- $\otimes \quad \text{No Gullies Found} \\$
- Potential Gully Areas
- --- Scott Co. Trails
- ---- State Trails
- MnDNR Spring Inventory
- LMRWD Trout Streams
- Public Waters
- Dakota Co. Parcel Data
- Scott Co. Parcel Data
- Public Waterbodies
- Steep Slopes Overlay District
- US Fish & Wildlife Service Property
- LMRWD Boundary

LMRWD Watershed Location Map





ATTACHMENT 2 - ESPM CLASS GULLY DATA SHEETS

GULLY ID:				
ESPM Site 3				
PREVIOUS WAYPOINT ID:				
3				
SURVEY DATE:				
April 18. 2021 1:33 PM				
LOCATION:				
Shakopee				
TYPE OF SITE:				
Gully	1 Aller			
SITE SUMMARY:	/ Poard 60			
Partly Cloudy	County Road by			
Rain in previous 24 hours: No	69			
	Union Pacific			
Off bike trail				
	County of Scott, Three Rivers Park District, Esri Canada, Esri, H Pow			
long: >100' gully				
	Gully Head UTM Estimation: 30',			
The problem indicators were:				
nistol-butted or leaning trees	Observation Point correction, if applicable:			
pistor-butted of learning trees				
	Connections to other points, if applicable:			
	GULLY INFORMATION			
EROSION POTENTIAL:	Low			
GULLY DEPTH:	Medium: 3'-15'			
BOTTOM WIDTH:	Wide: >5'			
TOP WIDTH:	Wide: >10'			
BANK CONDITION:	Some Vegetation			
BOTTOM CONDITION:	Some Vegetation			
CHANNEL SLOPE:	Flat			
GULLY SHAPE:	Trapezoid			
GULLY MATERIAL:	Fine-grained cohesive			
WATER LEVELS	None. N/A			
SEEP	No			
APPARENT CAUSES:	Slope, Unstable drainage feature entering system			
ADDITIONAL NOTES.				
Invasive Species? Linkown				
Type: Unkown				
Type. Ontown				
Debris? Some debris and trash				
Existing Stabilization? Pipran/Jargo	stones			
Chiccoss, Nos				





Bank reinforcing stones





Edge of gully opposite reinforcing edge





Drainage feature blocked by sticks



GULLY ID:				
ESPM Site 6				
PREVIOUS WAYPOINT ID:				
Site 6	McGuile			
SURVEY DATE:	10 SHUTTLES INTEST			
April 22, 2021 12:04 PM				
LOCATION:				
	Drive Bar			
	THE STATES			
TYPE OF SITE:				
Gully				
SITE SUMMARY:				
Sunny				
Rain in previous 24 hours: Yes:				
Low Intensity, No				
	County of Scott, Three Rivers Park District, Esri Canada, Esri, H Pow			
Along a Road				
	Gully Head UTM Estimation: 30 ft,			
Long: >100' gully.				
T he second block is discussed as a second	Observation Point correction, if applicable:			
The problem indicators were:	15T4674994956382			
Degradation, Aggradation,				
Flattened and/or slumping banks	Connections to other points, if applicable:			
(widening), undercut or				
overhanging banks (lateral				
scouring), pistol-butted or				
leaning trees				
	GULLY INFORMATION			
EROSION POTENTIAL:	High			
GULLY DEPTH:	Shallow: <3'			
BOTTOM WIDTH:	Narrow/V Ditch, Medium: 1'-5'			
TOP WIDTH:	Medium: 5'-10', Narrow: 1'-5'			
BANK CONDITION:	Some Vegetation			
BOTTOM CONDITION:	Some Vegetation			
CHANNEL SLOPE:	Steep			
GULLY SHAPE:	U-shaped			
GULLY MATERIAL:	Gravel/cobble/ boulders , Sand, Fine-grained cohesive			
WATER LEVELS	None, N/A			
SEEP	No			
APPARENT CAUSES:	Slope, Unstable drainage feature entering system			
ADDITIONAL NOTES:				
Near site 6				
Invasive Species? None				
Type: Burdock, None				
Debris? Little trash				
Existing Stabilization? Rip rap or burlap under rocks at top of gully				
Success: No				























GULLY ID:	Moraine Drive			
	Monar			
Site 7	12 6 6			
	R.			
April 22, 2021 12:51 DM				
Shakoneo	2 P C C C C C C C C C C C C C C C C C C			
Shakopee				
TYPE OF SITE:	18			
Gully				
SITE SUMMARY:				
Sunny				
Rain in previous 24 hours: No	· · · · · · · · · · · · · · · · · · ·			
	MCG			
Off of Walking Trail	County of Scott. Three Rivers Park District. Esri Canada, Esria Ha, Ore Pow			
Long: >100' gully.	Gully Head UTM Estimation: 5 ft,			
Ine problem indicators were:	Observation Point correction, if applicable:			
Degradation, Loss of Bank				
vegetation, Flattened and/or				
siumping banks (widening),	Connections to other points, if applicable:			
pistoi-butted of leaning trees				
	GULLY INFORMATION			
EROSION POTENTIAL:	Moderate			
GULLY DEPTH:	Shallow: <3'			
BOTTOM WIDTH:	Medium: 1'-5'			
TOP WIDTH:	Medium: 5'-10'			
BANK CONDITION:	Some Vegetation			
BOTTOM CONDITION:	Some Vegetation			
CHANNEL SLOPE:	Steep			
GULLY SHAPE:	U-shaped			
GULLY MATERIAL:	Fine-grained cohesive			
WATER LEVELS	None, N/A			
	NO			
APPARENT CAUSES:	зюре			
ADDITIONAL NOTES:				
Slight slope drains into storm sewer at end of gully				
Invasive Species?				
Туре:				
.,,				
Debris? Lots of trash				
Existing Stabilization? None				
Success: N/A				



















GULLY ID:				
ESPM Site 9	m to			
PREVIOUS WAYPOINT ID:				
Site 9				
SURVEY DATE:				
April 22, 2021 1:58 PM				
LOCATION:				
Savage				
TYPE OF SITE:				
Gully				
SITE SUMMARY:	762 ft			
Sunny	A A A A A A A A A A A A A A A A A A A			
Rain in previous 24 hours: No	e Lane			
Lloovily Forested	B			
Heavily Forested	County of Scott, Three Rivers Park District, Esri Canada, Esri, H Pow			
Medium: 50'-100' gully.	Gully Head UTM Estimation: 5 feet,			
The problem indicators were:	Observation Point correction, if applicable:			
Degradation, Aggradation, Loss				
of Bank Vegetation, Vertical				
and/or bare banks (incision),	Connections to other points, if applicable:			
pistoi-butted or leaning trees				
	GULLY INFORMATION			
EROSION POTENTIAL:	Moderate			
GULLY DEPTH:	Shallow: <3'			
BOITOM WIDTH:	Wide: >5'			
	Medium: 5'-10'			
BANK CONDITION:	Some Vegetation			
	Fide			
	Moderate Slow			
SEED	Ves			
APPARENT CALISES	Seen/groundwater_Slope			
Invasive Species? None				
Type: None				
Debris? No trash some debris				
Existing Stabilization? None				
Success: No, N/A				


















GULLY ID:	We Creek
	E
Site 10	agle
SURVEY DATE:	Q. N.
April 22, 2021 1:11 PM	ick
LOCATION:	
	0
TYPE OF SITE:	
Gully	
SITE SUMMARY:	
Sunny	
Rain in previous 24 hours: No	
Along a Road	
Along a Road	County of Scott, Three Rivers Park District, Esri Canada, Esri, H Pow
Medium: 50'-100' gully	
	Gully Head UTM Estimation: 15 ft,
The problem indicators were:	
Aggradation, Loss of Bank	Observation Point correction, if applicable:
Vegetation, Flattened and/or	
slumping banks (widening),	Connections to other points if applicables
pistol-butted or leaning trees	Connections to other points, if applicable:
	GULLY INFORMATION
EROSION POTENTIAL:	High
GULLY DEPTH:	Deep: >15'
BOTTOM WIDTH:	Medium: 1'-5', Wide: >5'
TOP WIDTH:	Wide: >10'
BANK CONDITION:	Some Vegetation
BOTTOM CONDITION:	Some Vegetation
CHANNEL SLOPE:	Steep
GULLY SHAPE:	V-shaped
GULLY MATERIAL:	Fine-grained cohesive
WATER LEVELS	None, N/A
	NO
APPARENT CAUSES:	Slope, Offstable drainage feature entering system
ADDITIONAL NOTES:	
in state aquatic management site	
Invasive Species?	
Type:	
<i>"</i>	
Debris? Some trash	
Existing Stabilization? None	







04/28/2021











Start of gully



GULLY ID:	
ESPM Site 11	h
PREVIOUS WAYPOINT ID:	High
Site 11	
SURVEY DATE:	
April 22, 2021 1:29 PM	
LOCATION:	
Savage	
Gully	
Guily	
SITE SUMMARY:	
Sunny	
Rain in previous 24 hours: No	wa Lane
	treet West
Along a Road	County of Scott, Three Rivers Park District, Esri Canada, Esri, H Pow
Madium FO' 100' autho	
Medium: 50 - 100 guily.	Gully Head UTM Estimation: 20 feet,
The problem indicators were:	
Degradation Aggradation Loss	Observation Point correction, if applicable:
of Bank Vegetation Vertical	
and/or have hanks (incision)	
Flattened and/or slumning banks	Connections to other points, if applicable:
(widening)	
	GULLY INFORMATION
EROSION POTENTIAL:	High
GULLY DEPTH:	Shallow: <3'
BOTTOM WIDTH:	Medium: 1'-5'
TOP WIDTH:	Narrow: 1'-5'
BANK CONDITION:	Some Vegetation
BOTTOM CONDITION:	Bare Soil
CHANNEL SLOPE:	Steep
GULLY SHAPE:	V-shaped
GULLY MATERIAL:	Sand, Fine-grained cohesive
WATER LEVELS	None, N/A
SEEP	No
APPARENT CAUSES:	Slope, Unstable drainage feature entering system , Channel
	Incision
ADDITIONAL NOTES:	
Invasive Species? None	
Type: None	
Debris? Some debris but no trash	
Existing Stabilization? None	
Success: No, N/A	















GULLY ID:	
ESPM Site 13	
PREVIOUS WAYPOINT ID:	
Site 13	
SURVEY DATE:	
April 22, 2021 2:44 PM	11/1000-
LOCATION:	
Savage	
Cully	1 × ×
Gully	
SITE SUMMARY:	
Sunny	West 6 to
Rain in previous 24 hours: No	893 ft. a
Along a Road	County of Scott, Three Rivers Park District, Esri Canada, Esri, H Pow
Long: >100 guily.	Gully Head UTM Estimation: 50 ft,
The problem indicators were:	
Degradation Elattened and/or	Observation Point correction, if applicable:
clumping banks (widening)	
nistol-butted or leaning trees	
pistor-butted of learning trees	Connections to other points, if applicable:
EROSION FOTENTIAL.	nigii
	Doop: N15'
	Deep: >15' Wide: >5'
BOTTOM WIDTH:	Deep: >15' Wide: >5' Wide: >10' Medium: 5' 10' Narrow: 1' 5'
BOTTOM WIDTH: TOP WIDTH: BANK CONDITION:	Deep: >15' Wide: >5' Wide: >10', Medium: 5'-10', Narrow: 1'-5'
GULLY DEPTH: BOTTOM WIDTH: TOP WIDTH: BANK CONDITION: BOTTOM CONDITION:	Deep: >15' Wide: >5' Wide: >10', Medium: 5'-10', Narrow: 1'-5' Some Vegetation
GULLY DEPTH: BOTTOM WIDTH: TOP WIDTH: BANK CONDITION: BOTTOM CONDITION: CHANNEL SLOPE:	Deep: >15' Wide: >5' Wide: >10', Medium: 5'-10', Narrow: 1'-5' Some Vegetation Some Vegetation
GULLY DEPTH: BOTTOM WIDTH: TOP WIDTH: BANK CONDITION: BOTTOM CONDITION: CHANNEL SLOPE: GUILLY SHAPE:	Deep: >15' Wide: >5' Wide: >10', Medium: 5'-10', Narrow: 1'-5' Some Vegetation Some Vegetation Steep
GULLY DEPTH: BOTTOM WIDTH: TOP WIDTH: BANK CONDITION: BOTTOM CONDITION: CHANNEL SLOPE: GULLY SHAPE: GULLY MATERIAL:	Deep: >15' Wide: >5' Wide: >10', Medium: 5'-10', Narrow: 1'-5' Some Vegetation Some Vegetation Steep V-shaped Fine-grained cohesive
GULLY DEPTH: BOTTOM WIDTH: TOP WIDTH: BANK CONDITION: BOTTOM CONDITION: CHANNEL SLOPE: GULLY SHAPE: GULLY MATERIAL: WATER LEVELS	Deep: >15' Wide: >5' Wide: >10', Medium: 5'-10', Narrow: 1'-5' Some Vegetation Some Vegetation Steep V-shaped Fine-grained cohesive
GULLY DEPTH: BOTTOM WIDTH: TOP WIDTH: BANK CONDITION: BOTTOM CONDITION: CHANNEL SLOPE: GULLY SHAPE: GULLY MATERIAL: WATER LEVELS SEEP	Deep: >15' Wide: >5' Wide: >10', Medium: 5'-10', Narrow: 1'-5' Some Vegetation Some Vegetation Steep V-shaped Fine-grained cohesive None, N/A
GULLY DEPTH: BOTTOM WIDTH: TOP WIDTH: BANK CONDITION: BOTTOM CONDITION: CHANNEL SLOPE: GULLY SHAPE: GULLY SHAPE: GULLY MATERIAL: WATER LEVELS SEEP APPARENT CAUSES:	Deep: >15' Wide: >5' Wide: >10', Medium: 5'-10', Narrow: 1'-5' Some Vegetation Some Vegetation Some Vegetation Steep V-shaped Fine-grained cohesive None, N/A No Slope Unstable drainage feature entering system
GULLY DEPTH: BOTTOM WIDTH: TOP WIDTH: BANK CONDITION: BOTTOM CONDITION: CHANNEL SLOPE: GULLY SHAPE: GULLY SHAPE: GULLY MATERIAL: WATER LEVELS SEEP APPARENT CAUSES: ADDITIONAL NOTES:	Deep: >15' Wide: >5' Wide: >10', Medium: 5'-10', Narrow: 1'-5' Some Vegetation Some Vegetation Some Vegetation Steep V-shaped Fine-grained cohesive None, N/A No Slope, Unstable drainage feature entering system
GULLY DEPTH: BOTTOM WIDTH: TOP WIDTH: BANK CONDITION: BOTTOM CONDITION: CHANNEL SLOPE: GULLY SHAPE: GULLY MATERIAL: WATER LEVELS SEEP APPARENT CAUSES: ADDITIONAL NOTES:	Deep: >15' Wide: >5' Wide: >10', Medium: 5'-10', Narrow: 1'-5' Some Vegetation Some Vegetation Some Vegetation Steep V-shaped Fine-grained cohesive None, N/A No Slope, Unstable drainage feature entering system
GULLY DEPTH: BOTTOM WIDTH: TOP WIDTH: BANK CONDITION: BOTTOM CONDITION: CHANNEL SLOPE: GULLY SHAPE: GULLY SHAPE: GULLY MATERIAL: WATER LEVELS SEEP APPARENT CAUSES: ADDITIONAL NOTES: Invasive Species?	Deep: >15' Wide: >5' Wide: >10', Medium: 5'-10', Narrow: 1'-5' Some Vegetation Some Vegetation V-shaped V-shaped Fine-grained cohesive None, N/A No Slope, Unstable drainage feature entering system
GULLY DEPTH: BOTTOM WIDTH: TOP WIDTH: BANK CONDITION: BOTTOM CONDITION: CHANNEL SLOPE: GULLY SHAPE: GULLY SHAPE: GULLY MATERIAL: WATER LEVELS SEEP APPARENT CAUSES: ADDITIONAL NOTES: Invasive Species? Type:	Deep: >15' Wide: >5' Wide: >10', Medium: 5'-10', Narrow: 1'-5' Some Vegetation Some Vegetation Steep V-shaped Fine-grained cohesive None, N/A No Slope, Unstable drainage feature entering system
GULLY DEPTH: BOTTOM WIDTH: TOP WIDTH: BANK CONDITION: BOTTOM CONDITION: CHANNEL SLOPE: GULLY SHAPE: GULLY SHAPE: GULLY MATERIAL: WATER LEVELS SEEP APPARENT CAUSES: ADDITIONAL NOTES: Invasive Species? Type:	Deep: >15' Wide: >5' Wide: >10', Medium: 5'-10', Narrow: 1'-5' Some Vegetation Some Vegetation Steep V-shaped Fine-grained cohesive None, N/A Slope, Unstable drainage feature entering system
GULLY DEPTH: BOTTOM WIDTH: TOP WIDTH: BANK CONDITION: BOTTOM CONDITION: CHANNEL SLOPE: GULLY SHAPE: GULLY MATERIAL: WATER LEVELS SEEP APPARENT CAUSES: ADDITIONAL NOTES: Invasive Species? Type: Debris? Some trash and debris	Deep: >15' Wide: >5' Wide: >10', Medium: 5'-10', Narrow: 1'-5' Some Vegetation Some Vegetation Some Vegetation Steep V-shaped Fine-grained cohesive None, N/A Slope, Unstable drainage feature entering system
GULLY DEPTH:BOTTOM WIDTH:TOP WIDTH:BANK CONDITION:BOTTOM CONDITION:CHANNEL SLOPE:GULLY SHAPE:GULLY MATERIAL:WATER LEVELSSEEPAPPARENT CAUSES:ADDITIONAL NOTES:Invasive Species?Type:Debris? Some trash and debris	Deep: >15' Wide: >5' Wide: >10', Medium: 5'-10', Narrow: 1'-5' Some Vegetation Some Vegetation V-shaped Fine-grained cohesive None, N/A No Slope, Unstable drainage feature entering system
GULLY DEPTH: BOTTOM WIDTH: TOP WIDTH: BANK CONDITION: BOTTOM CONDITION: CHANNEL SLOPE: GULLY SHAPE: GULLY SHAPE: GULLY MATERIAL: WATER LEVELS SEEP APPARENT CAUSES: ADDITIONAL NOTES: Invasive Species? Type: Debris? Some trash and debris Existing Stabilization? None	Deep: >15' Wide: >5' Wide: >10', Medium: 5'-10', Narrow: 1'-5' Some Vegetation Some Vegetation Steep V-shaped Fine-grained cohesive None, N/A No Slope, Unstable drainage feature entering system















GULLY ID:	
ESPM Site 16	2 Parate State
PREVIOUS WAYPOINT ID:	21th frame
Site 16	128th Street w
SURVEY DATE:	Hollywood
April 22, 2021 3:10 PM	Park
LOCATION:	
Savage	129th Street West
TYPE OF SITE:	And
Gully	
SITE SUMMARY:	
Partly Cloudy	
Rain in previous 24 hours: Yes:	Court
Low Intensity	
Off of Walking Trail	County of Scott, Three Rivers Park District, Esri Canada, Esri, H Pow
Medium: 50'-100' gully.	Gully Head UTM Estimation: 2',
	Observation Point correction, if applicable:
The problem indicators were:	
Loss of Bank Vegetation, Vertical	
and/or bare banks (incision),	Connections to other points, if applicable:
pistol-butted or leaning trees	
	GULLY INFORMATION
EROSION POTENTIAL:	Moderate
GULLY DEPTH:	Shallow: <3'
BOTTOM WIDTH:	Medium: 1'-5'
TOP WIDTH:	Narrow: 1'-5'
BANK CONDITION:	Bare Soil, Some Vegetation
BOTTOM CONDITION:	Some Vegetation
CHANNEL SLOPE:	Flat
GULLY SHAPE:	Trapezoid
GULLY MATERIAL:	Gravel/cobble/ boulders
GULLY MATERIAL: WATER LEVELS	Gravel/cobble/ boulders Low, Slow
GULLY MATERIAL: WATER LEVELS SEEP	Gravel/cobble/ boulders Low, Slow No
GULLY MATERIAL: WATER LEVELS SEEP APPARENT CAUSES:	Gravel/cobble/ boulders Low, Slow No Unstable drainage feature entering system , Channel Incision
GULLY MATERIAL: WATER LEVELS SEEP APPARENT CAUSES: ADDITIONAL NOTES:	Gravel/cobble/ boulders Low, Slow No Unstable drainage feature entering system , Channel Incision
GULLY MATERIAL: WATER LEVELS SEEP APPARENT CAUSES: ADDITIONAL NOTES: Invasive Species?	Gravel/cobble/ boulders Low, Slow No Unstable drainage feature entering system , Channel Incision
GULLY MATERIAL: WATER LEVELS SEEP APPARENT CAUSES: ADDITIONAL NOTES: Invasive Species? Type:	Gravel/cobble/ boulders Low, Slow No Unstable drainage feature entering system , Channel Incision
GULLY MATERIAL: WATER LEVELS SEEP APPARENT CAUSES: ADDITIONAL NOTES: Invasive Species? Type:	Gravel/cobble/ boulders Low, Slow No Unstable drainage feature entering system , Channel Incision
GULLY MATERIAL: WATER LEVELS SEEP APPARENT CAUSES: ADDITIONAL NOTES: Invasive Species? Type: Debris? Some trash	Gravel/cobble/ boulders Low, Slow No Unstable drainage feature entering system , Channel Incision
GULLY MATERIAL: WATER LEVELS SEEP APPARENT CAUSES: ADDITIONAL NOTES: Invasive Species? Type: Debris? Some trash Existing Stabilization? Riprap	Gravel/cobble/ boulders Low, Slow No Unstable drainage feature entering system , Channel Incision





Riprap surrounding outlet feature





Debris and trash





Aproned outlet



PREVIOUS WATPOINT ID:	
SURVEY DATE:	
April 17, 2021 2:26 PM	
LOCATION:	
TYPE OF SITE:	1 1 1 1 1 1 1
Gully	B Hayes D
SITE SUMMARY:	Tennisioux
Sunny	
Rain in previous 24 hours: No	
	00 000
Heavily Forested	County of Dakota, Three Rivers Park District, Esri Canada, Esri, Pow
Long: >100 guily.	Gully Head UTM Estimation: 20,
The problem indicators were:	
Loss of Bank Vegetation	Observation Point correction, if applicable:
undercut or overhanging banks	
(lateral scouring)	
	Connections to other points, if applicable:
	GUILY INFORMATION
FROSION POTENTIAL	
GUILY DEPTH:	Shallow: <3'
BOTTOM WIDTH:	Wide: >5'
TOP WIDTH:	Wide: >10'
BANK CONDITION:	Some Vegetation
BOTTOM CONDITION:	Armored
CHANNEL SLOPE:	Steep
GULLY SHAPE:	U-shaped
GULLY MATERIAL:	Gravel/cobble/ boulders
WATER LEVELS	Low, Slow
SEEP	No
APPARENT CAUSES:	None/Unknown
ADDITIONAL NOTES:	
8ft storm drain outlet creates strea	m
Invasive Species? Medium	
Invasive Species? Medium Type: Common Buckthorn	
Invasive Species? Medium Type: Common Buckthorn	
Invasive Species? Medium Type: Common Buckthorn Debris? Some	
Invasive Species? Medium Type: Common Buckthorn Debris? Some Existing Stabilization? N/a	





Stormwater outlet







GULLY ID:	
ESPM Site 23	
PREVIOUS WAYPOINT ID:	
SURVEY DATE:	
April 17, 2021 2:12 PM	
LOCATION:	
TYPE OF SITE:	Fatara
Gully	
SITE SUMMARY:	P P 8 0-8 5
Sunny	
Rain in previous 24 hours: No	
	Hayes Dr
Off of Walking Trail	County of Dakota, Three Rivers Park District, Esri Canada, Esri, 🍰 Pow
Long: >100 guily.	Gully Head UTM Estimation: 100ft,
The problem indicators were:	
Degradation Loss of Bank	Observation Point correction, if applicable:
Vegetation, Vertical and/or hare	
hanks (incision) nistol-butted or	
leaning trees	Connections to other points, if applicable:
EROSION POTENTIAL:	Hign
	Shallow: <3
	Wide: >5
	Wide: >10
BANK CONDITION:	Some Vegetation
	Gravel/cobble/ boulders
SEED	LOW, SIOW Voc
	Slone Scour from debris iam or other channel obstruction
ATTAILENT CAUSES.	Channel Incision, Dense Canopy
ADDITIONAL NOTES	
In wildlife refuge and disappears a	fter entering hidden pipe, couldn't find outlet
Invasive Species? Medium	
Type: Common Buckthorn	
Debris? No	
Existing Stabilization? Boulders on	slopes (pictured)





Right off road access





150ft down trail





Erosion control structures





Turns into meandering stream



GULLY ID:	
ESPM Site 26	109.4
PREVIOUS WAYPOINT ID:	
SURVEY DATE:	
LOCATION:	Ni C
	^{cols} a
TYPE OF SITE:	10
Gully	Nicols
SITE SUMMARY:	Pacific Contraction of the contr
Sunny	Unger
Rain in previous 24 hours: No	
	Naegle Sign
Along a Road	Caulty of Daluta Three Dian Bade District Sail Causels Sail
-	County of Dakota, Three Rivers Park District, Esh Canada, Esh, Pow
Long: >100' gully.	Gully Head UTM Estimation: 100ftish
	Guily head of M Estimation. Toortish,
The problem indicators were:	Observation Point correction if applicable:
None	observation rome correction, in applicable.
	Connections to other points, if applicable: No
	GULLY INFORMATION
EROSION POTENTIAL:	Low
GULLY DEPTH:	Shallow: <3'
BOTTOM WIDTH:	Medium: 1'-5'
	Narrow: 1'-5'
BANK CONDITION:	Heavy Vegetation
BOTTOM CONDITION:	Bare Soll, Heavy Vegetation
	Flat
	U-snaped
SEED	LOW, SIOW
	Nona/Unknown
APPARENT CAUSES.	None/ Onknown
ADDITIONAL NOTES:	
Invasive Species? None	
Type: None	
Debris? No	
Existing Stabilization? NONE	
-	





Тор





What rest of stream looks like



ESPM Site 28 PREVIOUS WAYPOINT ID: SURVEY DATE: April 17, 2021 12:18 PM LOCATION: TYPE OF SITE: Gully SITE SUMMARY: Sunny Rain in previous 24 hours: No Along a Road Long: >100' gully. The problem indicators were: None GulLY INFORMATION EROSION POTENTIAL: Connections to other points, if applicable: None GULLY INFORMATION EROSION POTENTIAL: Low GULLY INFORMATION EROSION POTENTIAL: Low GULLY DEPTH: Shallow: <3' BOTTOM WIDTH: Medium: 1'-5' TOP WIDTH: Meany Vegetation
PREVIOUS WAYPOINT ID: SURVEY DATE: April 17, 2021 12:18 PM LOCATION: TYPE OF SITE: Gully SITE SUMMARY: Sunny Rain in previous 24 hours: No Along a Road Long: >100' gully. The problem indicators were: None GulLY INFORMATION EROSION POTENTIAL: LORS ON POTENTIAL: Connections to other points, if applicable: We had two locations which are the same gully GULLY INFORMATION EROSION POTENTIAL: LORDY DEPTH: Shallow: <3'
SURVEY DATE: April 17, 2021 12:18 PM LOCATION: TYPE OF SITE: Gully SITE SUMMARY: Sunny Rain in previous 24 hours: No Along a Road Long: >100' gully. The problem indicators were: None Gully Head UTM Estimation: 100ft, Observation Point correction, if applicable: Connections to other points, if applicable: Connections which are the same gully GULLY INFORMATION EROSION POTENTIAL: LOR GULLY INFORMATION EROSION POTENTIAL: LOW GULLY INFORMATION EROSION POTENTIAL: LOW GULLY INFORMATION EROSION POTENTIAL: LOW GULLY INFORMATION BOTTOM WIDTH: Medium: 1'-5' TOP WIDTH: Wide: >10' BANK CONDITION: Armored CHANNEL SLOPE: Flat GULLY MATERIAL: Gravel/coble/ boulders None, N/A <t< td=""></t<>
April 17, 2021 12:18 PM LOCATION: TYPE OF SITE: Gully SITE SUMMARY: Sunny Rain in previous 24 hours: No Along a Road Long: >100' gully. The problem indicators were: None County of Dakota, Three Rivers Park District, Esri Canada, Esri, Pow Gully Head UTM Estimation: 100ft, Observation Point correction, if applicable: Connections to other points, if applicable: We had two locations which are the same gully GULLY INFORMATION EROSION POTENTIAL: GULLY INFORMATION EROSION POTENTIAL: GULLY INFORMATION BOTTOM WIDTH: Medium: 1'-5' TOP WIDTH: Medium: 1'-5' TOP WIDTH: Mide: >10' BANK CONDITION: Heavy Vegetation BOTTOM CONDITION: Heavy Vegetation BOTTOM CONDITION: Armored CHANNEL SLOPE: GILLY MATERIAL: Gravel/cobble/ boulders Worker LEVELS None, M/A SEEP No APPARENT CAUSES: None/Unknown
LOCATION: TYPE OF SITE: Gully SITE SUMMARY: Sunny Rain in previous 24 hours: No Along a Road Long: >100' gully. The problem indicators were: None GulLY INFORMATION EROSION POTENTIAL: GULLY INFORMATION EROSION POTENTIAL: GULLY INFORMATION BOTTOM WIDTH: Medium: 1'-5' TOP WIDTH: BANK CONDITION: BANK CONDITION: BOTTOM CONDITION: BANK CONDITION: CHANNEL SLOPE: Flat GULLY SHAPE: GULLY MATERIAL: Gravel/cobble/ boulders WATER LEVELS None, N/A SEEP No APPARENT CAUSES:
TYPE OF SITE: Gully SITE SUMMARY: Sunny Rain in previous 24 hours: No Along a Road Long: >100' gully. The problem indicators were: None GulLy Head UTM Estimation: 100ft, Observation Point correction, if applicable: Connections to other points, if applicable: Connections to other points, if applicable: Connections which are the same gully GulLY INFORMATION EROSION POTENTIAL: Low GULLY DEPTH: Shallow: <3'
TYPE OF SITE: Gully SITE SUMMARY: Sunny Rain in previous 24 hours: No Along a Road Long: >100' gully. The problem indicators were: None GulLY INFORMATION EROSION POTENTIAL: Connections to other points, if applicable: We had two locations which are the same gully GULLY INFORMATION EROSION POTENTIAL: Convertions to other points, if applicable: We had two locations which are the same gully GULLY INFORMATION EROSION POTENTIAL: Low GULLY INFORMATION BOTTOM WIDTH: Medium: 1'-5' TOP WIDTH: WIDE: BANK CONDITION: Armored CHANNEL SLOPE: Flat GULLY MATERIAL: MATER LEVELS None, N/A SEEP No APPARENT CAUSES:
Gully SITE SUMMARY: Sunny Rain in previous 24 hours: No Along a Road Long: >100' gully. The problem indicators were: None GulLY INFORMATION EROSION POTENTIAL: Counct of Delivers and the same gully GulLY INFORMATION EROSION POTENTIAL: Low GulLY DEPTH: Shallow: <3' BOTTOM WIDTH: Wide: >10' BANK CONDITION: Heavy Vegetation BOTTOM CONDITION: Flat GULLY SHAPE: GULLY GERE: Flat GULLY SHAPE: GULLY GERE: Rank CONDITION: Armored CHANNEL SLOPE: Flat GULLY SHAPE: GULLY MATERIAL: Gravel/cobble/ boulders WATER LEVELS None, N/A SEEP No APPARENT CAUSES: None/Unknown
SITE SUMMARY: Sunny Rain in previous 24 hours: No Along a Road Long: >100' gully. The problem indicators were: None Gully Head UTM Estimation: 100ft, Observation Point correction, if applicable: Connections to other points, if applicable: We had two locations which are the same gully Gully INFORMATION EROSION POTENTIAL: LOW GULLY INFORMATION EROSION POTENTIAL: LOW GULLY DEPTH: Shallow: <3' BOTTOM WIDTH: Medium: 1'-5' TOP WIDTH: Medium: 1'-5' TOP WIDTH: Meavy Vegetation BOTTOM CONDITION: Armored CHANNEL SLOPE: Flat GULLY SHAPE: GULLY MATERIAL: Gravel/cobble/ boulders WATER LEVELS None, N/A SEEP No APPARENT CAUSES: None/Unknown
Sunny Rain in previous 24 hours: No Along a Road Long: >100' gully. The problem indicators were: None Counce of Dakota, Three Rivers Park District, Esri Canada, Esri, Pow Gully Head UTM Estimation: 100ft, Observation Point correction, if applicable: Connections to other points, if applicable: We had two locations which are the same gully GULLY INFORMATION EROSION POTENTIAL: GULLY INFORMATION EROSION POTENTIAL: GULLY INFORMATION BANK CONDITION: BANK CONDITION: BANK CONDITION: BANK CONDITION: Connections to other points, if applicable: We had two locations which are the same gully GULLY DEPTH: Medium: 1'-5' TOP WIDTH: Medium: 1'-5' TOP WIDTH: BANK CONDITION: BANK CONDITION: CHANNEL SLOPE: GULLY SHAPE: GULLY SHAPE: GULLY MATERIAL: Gravel/cobble/ boulders WATER LEVELS None, N/A SEEP No APPARENT CAUSES: None/Unknown
Rain in previous 24 hours: No Along a Road Long: >100' gully. The problem indicators were: None Gully Head UTM Estimation: 100ft, Counct of Dekote, Three Rivers Park District, Esri Canada, Esri, Pow Gully Head UTM Estimation: 100ft, The problem indicators were: None Gully Head UTM Estimation: 100ft, Connections to other points, if applicable: Very Station Point correction, if applicable: Connections to other points, if applicable: We had two locations which are the same gully GULLY INFORMATION EROSION POTENTIAL: GULLY INFORMATION EROSION POTENTIAL: Medium: 1'-5' TOP WIDTH: Medium: 1'-5' TOP WIDTH: Meavy Vegetation BOTTOM CONDITION: Heavy Vegetation BOTTOM CONDITION: Channel SLOPE: Flat GULLY MATERIAL: GulLY MATERIAL: Mone, N/A SEEP No APPARENT CAUSES: None/Unknown
Along a Road County of Dakota, Three Rivers Park District, Esri Canada, Esri, Pow Long: >100' gully. Gully Head UTM Estimation: 100ft, The problem indicators were: Observation Point correction, if applicable: None Connections to other points, if applicable: We had two locations which are the same gully GULLY INFORMATION EROSION POTENTIAL: Low GULLY DEPTH: Shallow: <3'
Along a Road County of Dakota, Three Rivers Park District, Esri Canada, Esri, Pow Long: >100' gully. Gully Head UTM Estimation: 100ft, The problem indicators were: Observation Point correction, if applicable: None Connections to other points, if applicable: We had two locations which are the same gully GULLY INFORMATION EROSION POTENTIAL: Low GULLY DEPTH: Shallow: <3'
Long: >100' gully. Gully Head UTM Estimation: 100ft, The problem indicators were: Observation Point correction, if applicable: None Connections to other points, if applicable: We had two locations which are the same gully GULLY INFORMATION EROSION POTENTIAL: Low GULLY DEPTH: Shallow: <3'
Long: >100' gully.Gully Head UTM Estimation: 100ft,The problem indicators were: NoneObservation Point correction, if applicable:NoneConnections to other points, if applicable: We had two locations which are the same gullyGULLY INFORMATIONEROSION POTENTIAL:GULLY INFORMATIONGULLY DEPTH:Shallow: <3'
The problem indicators were: NoneObservation Point correction, if applicable: We had two locations to other points, if applicable: We had two locations which are the same gullyGULLY INFORMATIONEROSION POTENTIAL:LowGULLY DEPTH:Shallow: <3'
Connections to other points, if applicable: We had two locations which are the same gullyGULLY INFORMATIONEROSION POTENTIAL:LowGULLY DEPTH:Shallow: <3'BOTTOM WIDTH:Medium: 1'-5'TOP WIDTH:Wide: >10'BANK CONDITION:Heavy VegetationBOTTOM CONDITION:ArmoredCHANNEL SLOPE:FlatGULLY SHAPE:U-shapedGULLY MATERIAL:Gravel/cobble/ bouldersWATER LEVELSNone, N/ASEEPNoAPPARENT CAUSES:None/Unknown
GULLY INFORMATIONEROSION POTENTIAL:LowGULLY DEPTH:Shallow: <3'BOTTOM WIDTH:Medium: 1'-5'TOP WIDTH:Wide: >10'BANK CONDITION:Heavy VegetationBOTTOM CONDITION:ArmoredCHANNEL SLOPE:FlatGULLY SHAPE:U-shapedGULLY MATERIAL:Gravel/cobble/ bouldersWATER LEVELSNone, N/ASEEPNoAPPARENT CAUSES:None/Unknown
EROSION POTENTIAL:LowGULLY DEPTH:Shallow: <3'BOTTOM WIDTH:Medium: 1'-5'TOP WIDTH:Wide: >10'BANK CONDITION:Heavy VegetationBOTTOM CONDITION:ArmoredCHANNEL SLOPE:FlatGULLY SHAPE:U-shapedGULLY MATERIAL:Gravel/cobble/ bouldersWATER LEVELSNone, N/ASEEPNoAPPARENT CAUSES:None/Unknown
GULLY DEPTH:Shallow: <3'BOTTOM WIDTH:Medium: 1'-5'TOP WIDTH:Wide: >10'BANK CONDITION:Heavy VegetationBOTTOM CONDITION:ArmoredCHANNEL SLOPE:FlatGULLY SHAPE:U-shapedGULLY MATERIAL:Gravel/cobble/ bouldersWATER LEVELSNone, N/ASEEPNoAPPARENT CAUSES:None/Unknown
BOTTOM WIDTH:Medium: 1'-5'TOP WIDTH:Wide: >10'BANK CONDITION:Heavy VegetationBOTTOM CONDITION:ArmoredCHANNEL SLOPE:FlatGULLY SHAPE:U-shapedGULLY MATERIAL:Gravel/cobble/ bouldersWATER LEVELSNone, N/ASEEPNoAPPARENT CAUSES:None/Unknown
TOP WIDTH:Wide: >10'BANK CONDITION:Heavy VegetationBOTTOM CONDITION:ArmoredCHANNEL SLOPE:FlatGULLY SHAPE:U-shapedGULLY MATERIAL:Gravel/cobble/ bouldersWATER LEVELSNone, N/ASEEPNoAPPARENT CAUSES:None/Unknown
BANK CONDITION:Heavy VegetationBOTTOM CONDITION:ArmoredCHANNEL SLOPE:FlatGULLY SHAPE:U-shapedGULLY MATERIAL:Gravel/cobble/ bouldersWATER LEVELSNone, N/ASEEPNoAPPARENT CAUSES:None/Unknown
BOTTOM CONDITION:ArmoredCHANNEL SLOPE:FlatGULLY SHAPE:U-shapedGULLY MATERIAL:Gravel/cobble/ bouldersWATER LEVELSNone, N/ASEEPNoAPPARENT CAUSES:None/Unknown
CHANNEL SLOPE:FlatGULLY SHAPE:U-shapedGULLY MATERIAL:Gravel/cobble/ bouldersWATER LEVELSNone, N/ASEEPNoAPPARENT CAUSES:None/Unknown
GULLY SHAPE:U-shapedGULLY MATERIAL:Gravel/cobble/ bouldersWATER LEVELSNone, N/ASEEPNoAPPARENT CAUSES:None/Unknown
GULLY MATERIAL:Gravel/cobble/ bouldersWATER LEVELSNone, N/ASEEPNoAPPARENT CAUSES:None/Unknown
WATER LEVELS None, N/A SEEP No APPARENT CAUSES: None/Unknown
SEEP No APPARENT CAUSES: None/Unknown
APPARENT CAUSES: None/Unknown
ADDITIONAL NOTES:
Part of the stormwater drainage system, looks like it receives heavy flow during storm events but
it's in great shape. Gully empties into wetland where it joins wastewater treatment outflow.
Invasive Species? Low
Type: Common Buckthorn
Debris? Not much trash, some
Existing Stabilization? Rip rap with energy dissipation Boulder piles (pictured) also one erosion
control log



2



Near the entre to the wetland





100ft further uphill





At wetland entrance





About 1/3 to top of gully





Other side of the last pictures outlet








Top of gully



GULLY ID:	
ESPM Site 29	
PREVIOUS WAYPOINT ID:	13
SURVEY DATE:	// D/
April 17, 2021 11:06 AM	
LOCATION:	
Gully	
SITE SUMMARY	
Sunny	pie a la construction de la constru
Rain in previous 24 hours: No	Hills I
Off of waiking Irali	County of Dakota, Three Rivers Park District, Esri Canada, Esri, Sten Pow
Short: <50' gully.	Gully Head UTM Estimation: N/a,
The problem indicators were:	
None	Observation Point correction, if applicable:
	Connections to other points, if applicable:
	GULLY INFORMATION
EROSION POTENTIAL:	Low
GULLY DEPTH:	Shallow: <3'
BOTTOM WIDTH:	N/A - NOT VISIBLE
	Narrow: 1'-5'
BANK CONDITION:	Heavy Vegetation
	Heavy Vegetation
	Flat
	Sand
	Sallu None N/A
SEED	None, N/A
	None/Unknown
	None, Onknown
No gully present	
No guily present	
Invasive Species? Low	
Type: Common Buckthorn	
<i>·</i> ··	
Debris? None	
Existing Stabilization? Heavy vegetation, no gully presents	
Existing Stabilization? Heavy veget	ation, no gully presents



PICTURES:



