3.0 2008 INVENTORY ASSESSMENT AND DATA REVIEW

The primary goal of the Project was to reassess gullies and pipe outfalls identified in the 2008 Gully Inventory (2008 Inventory). The following sections provide the background on the 2008 Inventory, the assessment of the 2008 gully locations, data collection efforts from partner communities and online sources, and the conditional analysis performed to provide a baseline condition for 2008 locations. This analysis formed the foundation of the 2020 field data collection efforts.

3.1 2008 Gully Inventory Background

In 2006, the LMRWD retained the Minnesota Conservation Corps to conduct a gully inventory of the northern watershed cities of Bloomington, Chanhassen, Chaska, Carver, and Eden Prairie. Additional data was collected in 2007 in some of the southern watershed communities, including Jackson Township, Lilydale, Mendota, and Mendota Heights, using the same process as 2006. In 2011, the District compiled the geographic information systems (GIS) data collected, as well as photos, into a single document and called it the 2008 Inventory. The methods used for the 2008 Inventory were not clearly documented, however, the 2010 LMRWD Annual Report provides some insight on how it was developed. The 2010 Annual Report states that the goal of the inventory was to identify gullies that posed current and potential erosion and pollution concerns. LMRWD partner cities reviewed the report and selected public sites requiring immediate attention, completing feasibility studies on these locations. From the feasibility studies developed by the cities, below is a list of cooperative projects completed or in progress to date:

- **Bloomington Parkers Picnic Area (2008):** The District contributed $22,265 for the restoration of a ravine including fill, grading, plantings, and erosion control (Lower Minnesota River Watershed District 2008).
- **Bloomington Minnesota River Valley Washout (2008):** The District contributed $98,214 for streambank restoration on an unnamed stream near Lyndale Avenue and the Minnesota River (Lower Minnesota River Watershed District 2008).
- **Eden Prairie Area 4 (2010):** The District contributed $40,412 for streambank restoration on Purgatory Creek (Lower Minnesota River Watershed District 2011).
- **Eden Prairie Area 3 (Ongoing):** The District contributed $78,704 for a feasibility study of this area of concern at R.M. 19.6 on the left descending bank (Lower Minnesota River Watershed District 2011).

3.2 2008 Inventory Analysis

The 2008 Inventory identified 604 locations or waypoints (the geographic position of an exact intersection of latitude and longitude as marked by a global positioning system [GPS] receiver), each of which was assigned an identification number. In the Inventory, a brief location description with comments that varied in detail, as well as one or two photos, were provided for each waypoint.

In review of the 2008 Inventory, the locations of all previous gullies and pipe outfalls were mapped using GIS. It became apparent that there were discrepancies within the original data set. As part of this analysis, waypoints were removed from the data set if they were determined to be erroneous, duplicates, or not applicable (such as points outside of the LMRWD boundary, storm sewer inlets, and trash or dump sites). Only sites that were clearly and conclusively not applicable were removed from the data set and locations that were indeterminate were included in the Project for field confirmation. Of the 604 waypoints in the 2008 Inventory, 113 sites were removed from the data set, and the remaining 491 were surveyed and assessed as part of the Project (**Figure 2**). While reviewing the waypoints in GIS, researchers observed some conflicts in the unique waypoint ID numbers. To avoid confusion, new numbers were assigned to all the Project sites. A summary table of the 2008 and 2020 identifiers is included in **Appendix A**.

Evaluating the 2008 Inventory presented a unique set of challenges. For example, there were several locations in the 2008 Inventory where multiple points were located in the same gully, but often there were no clear changes in the gully characteristics to explain why the additional points were collected. A clear field protocol was developed to determine how points would be captured as part of the Project (see **Section 4**).

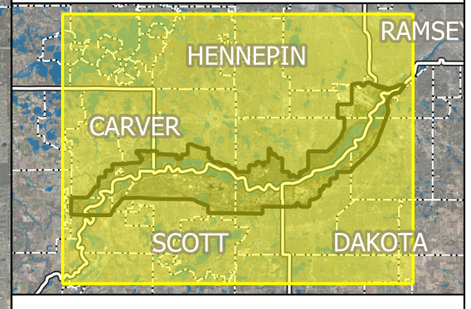
Figure 2: 2008 Waypoint Locations

HENNEPIN
RAMSEY
CARVER
Chanhassen
Eden Prairie
Fort Snelling (unorg.)
Mendota H
Bloomington
Chaska
Eagan
Jackson Twp.
Shakopee
Carver
Burnsville
Savage
Louisville Twp.
SCOTT
DAKOTA
0 1 2 mi

LEGEND

2008 Gully Inventory Waypoints
- Waypoints within LMWRD
- Waypoints Outside LMRWD
- MnDNR Spring Inventory
- Public Waters
- Public Waterbodies
- Cities, Townships, Unincorporated Areas
- County Boundaries
- LMRWD Boundary
- Steep Slopes Overlay District [SSOD]
- High Value Resource Area Overlay District

LMRWD Watershed Location Map



Young Environmental Consulting Group, LLC

LOWER MINNESOTA RIVER WATERSHED DISTRICT

3.3 Erosion Potential

After the 2008 dataset was cleaned up by removing unnecessary waypoints and correcting erroneous identifiers, the content of the remaining waypoints was reviewed to attempt to assess the condition of each gully or outfall as of 2008. As mentioned before, the methods and criteria established to qualify a gully or outfall in the 2008 Inventory were not recorded. The 2008 Inventory did include photos of the gullies and outfalls along with comments for each site, which proved valuable for evaluating specific sites. To compare the 2008 Inventory to the Project using uniform criteria, the erosion potential index was established for gully sites. Pipe outfalls could not be benchmarked from the 2008 Inventory; the photographs often did not capture the entire pipe or provide enough information to determine if it would have been considered an unstable drainage feature (using the criteria in Section 2.2) at the time.

The Project's erosion potential was defined based on the likelihood of erosion occurring, using field observations. The erosion potential for each site was assessed as high, moderate, or low, based on the following typical characteristics:

- **High erosion potential** (**Figure 3**):
  - Gully shape: V-shaped channel cross-section (King 1977)
  - Active erosion: Sloughing banks or recent slumps; active slides or movement of soils; incision or down-cutting of the channel
  - Bank characteristics: Tall banks, typically greater than 10 feet; steep or vertical banks; no connection to a larger floodplain for big storm events (King 1977)
  - Vegetation characteristics: Vegetative overhand or exposed tree roots; lack of vegetation on slopes or gully bottom; invasive species such as buckthorn
  - Trees: Trees with a severe lean or trees that have fallen into the gully channel; leaning trees, especially those with bent or curved trunks ("pistol-butted") which indicate active ground movement/potential slope failure
  - Cattle or livestock impacts: Game trails, stabilized river crossings
  - Evidence of past stabilization: Failed or poor condition riprap, gunnite or concrete slope protection, gabions, etc.

Figure 3. Example of a high erosion potential site along Rice Creek in Fridley, MN in 2019.

Moderate erosion potential (**Figure 4**):

- Gully shape: U- or V-shaped gully cross-section
- Active erosion: Minor signs of sloughing banks, no recent slumps, minor channel incision
- Bank characteristics: Medium bank height between 3 and 10 ft; steeply sloping banks
- Vegetation characteristics: Some vegetative overhang or exposed tree roots; bank slopes predominantly bare of vegetation; invasive species such as buckthorn
- Trees: Leaning trees or trees with bent or curved trunks ("pistol-butted")
- Cattle or livestock impacts: None
- Evidence of past stabilization: Stable or good condition riprap, gunnite or concrete slope protection, gabions, etc.

Figure 4. Example of a moderate erosion potential site in Eden Prairie, MN in 2020.

Low erosion potential (Figure 5):

- Gully shape: Trapezoid or U-shaped gully cross-section
- Active erosion: Little to no signs of active erosion
- Bank characteristics: Short banks, typically less than 3 ft high; gradually sloping side slopes; often connected to a floodplain for large flow events
- Vegetation characteristics: Little to no vegetative overhang or exposed tree roots; bank slopes predominantly vegetated
- Trees: Straight to slightly leaning, straight trunks which indicate active ground movement
- Cattle or livestock impacts: None
- Evidence of past stabilization: Stable or good condition riprap, gunnite or concrete slope protection, gabions, and other signs

Figure 5. Example of a low erosion potential site in Medina, MN in 2020 (Outdoor News 2020).

3.4 2008 Benchmarks

The comments and photos from the 2008 Inventory were used to assign erosion potential to waypoints. The site photos were reviewed in light of the erosion potential criteria and causes of gully development above.

Evidence and details such as fallen/leaning trees, little to no vegetation, exposed and/or overhanging tree roots, and active slides or movement of soils were good indicators for assigning erosion potential. In some cases, photos were used to determine if there was evidence of slumps and previous stabilization attempts. Tree indicators such as leaning or pistol-butted trees were examined to further identify the erosion potential; however, due to the subjective nature and angles of the photographs taken, these were not used as the sole reason to classify a site. The photos often failed to reliably indicate the size or extent of a gully or structure because the image contained no reference points.

Comments from the 2008 Inventory were also used to evaluate the site, especially when the photos or photo scale were not clear. In general, sites that included comments such as “severe,” “extreme,” or “very bad” were classified as having high erosion potential. Comments that indicated erosion as “nonexistent” or “minimal” were typically classified as having low erosion potential; this was confirmed by reviewing the associated site photos. When comments and photos were not provided for a site or were not detailed enough to assign a category, the N/A erosion potential category was assigned.

The recurring phrase “finger gully” was used in the 2008 Inventory to describe thin, shallow gullies forming along the banks of a larger main gully. The term was adopted for the Project to make a note of any small erosional branches receding away from the banks of a main gully.

3.5 Additional Data Review

In addition to reviewing the 2008 Inventory, the team reviewed available data from project partners to identify areas susceptible to gully erosion within the LMRWD as well as to see if any restoration activities had occurred since the 2008 Inventory was completed. The following sections outline the data collected and used.

3.5.1 Local Water Plan Review and Outreach

Current and past local water plans (LWPs) for the cities of Bloomington, Carver, Chanhassen, Chaska, Eden Prairie, Jackson Township, Lilydale, Mendota, Mendota Heights, and Shakopee were reviewed for information and projects relating to the 2008 Inventory. In reviewing the local water plans, five cities (Bloomington, Chanhassen, Chaska, Carver, and Eden Prairie) mentioned gully erosion as an issue facing their community, and most referenced the LMRWD 2008 Inventory within their plans.

The LMRWD municipal partners' Capital Improvement Plans (CIPs) were also reviewed to determine if any gully restoration projects were completed or planned within the next several years. Key words including "gully," "ravine," "bluff," "restoration," and "stabilization" were searched in the online sources to identify targeted projects and previous restoration projects.

In addition to reviewing LWPs, the District's municipal and county partners were solicited for information on past or planned projects and areas that should be included in the Project. The City of Bloomington was the only partner that responded to the solicitation.

From the review of the partner community plans, the following restoration projects were identified and appear on **Figure 6**.

1. City of Bloomington Project 2008-901: Storm Sewer Maintenance (2008)/Parkers Picnic Area
2. LMRWD-Bloomington Minnesota River Valley Washout (2008)
3. Eden Prairie Area 4 (2010)
4. City of Bloomington Long Meadow Lake Outfall Project (2012)
5. City of Bloomington City Project 2014-901: Storm Sewer Maintenance (2014)
6. City of Bloomington Overlook Lake Stormwater Outfall Project (2014)
7. LMRWD Seminary Fen Ravine Restoration and Stabilization (2016)
8. City of Bloomington City Project 2016-902: Storm Sewer and Pond Maintenance Project (2016)
9. RPBCWD–LMRWD Riley Creek Stabilization (2018)
10. LMRWD Lower Riley Creek Ecological Restoration (2019)
11. LMRWD East Chaska Creek Restoration (2020)
12. City of Eden Prairie and LMRWD Area 3 Slope Stabilization (2021)
13. LMRWD Spring Creek Bank Stabilization (TBD)

These sites were added to the Project as having been restored or potentially restored to assess the current conditions. The individual project details are provided in city summaries in **Section 5**.

Figure 6: Planned and Completed Gully Projects

HENNEPIN
RAMSEY
CARVER
SCOTT
DAKOTA
Chanhassen
Eden Prairie
Chaska
Bloomington
Eagan
Fort Snelling (unorg.)
Mendota H
Jackson Twp.
Shakopee
Burnsville
Savage
Louisville Twp.
Carver

10 9 12 7 3 11 13 4 5 1 8 2 6

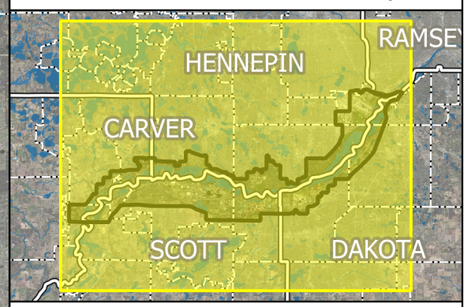
0 1 2 mi

LEGEND

Identified Gully Projects

- Completed Project
- Planned Project
- Public Waters
- Public Waterbodies
- Cities, Townships, Unincorporated Areas
- County Boundaries
- LMRWD Boundary

LMRWD Watershed Location Map



Young Environmental Consulting Group, LLC

LOWER MINNESOTA RIVER WATERSHED DISTRICT

These sites were added to the desktop analysis as having been restored or potentially restored and included in the 2020 field survey to confirm. The individual project details are provided in city summary sections.

3.5.2 Historical Landslide Inventory

The Minnesota Department of Natural Resources (MnDNR), the University of Minnesota, the National Weather Service, and Hennepin County developed the *Historical Landslide Inventory of the Twin Cities Metropolitan Area* (Study) in response to the June 2014 rainfall and subsequent landslides. The glacial sediment terraces along the Minnesota River valley are prone to landslides and tend to fail when stormwater is not well-controlled. While excess rainfall can cause saturation of the soil and induce landslides, groundwater springs in these areas may also contribute to gully development, erosion, and slope movement (Jennings 2016).

The GIS data generated in the Study was reviewed as part of this Project. Hennepin County provided locations of three landslides in Bloomington and Eden Prairie identified in 1987, as well as landslide feature polygons derived from an analysis of LiDAR topography.

The information provided was useful for confirming field observations.

3.5.3 Minnesota Spring Inventory

The MnDNR has been digitizing historic spring data as well as collecting it and crowd sourcing from citizens through the Minnesota Spring Inventory Recording Application. The Spring Inventory contains both potential and verified springs and was used to confirm the presence of springs in the vicinity of the Project area. The Spring Inventory was especially useful when the 2008 Inventory indicated that springs were present, but field surveys for the Project did not note the presence of groundwater seeps or springs.