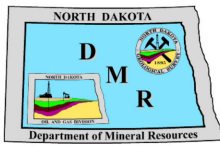
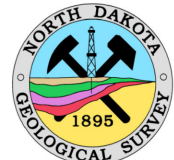


# LANDSLIDE AREAS IN ADAMS COUNTY, NORTH DAKOTA

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## LANDSLIDES IN ADAMS COUNTY

Landslides are masses of rocks and sediment that have tumbled or slid down a slope under their own weight. Landslides are one of the most common geologic hazards in North Dakota and can destroy buildings, roads, railroad tracks, pipelines, transmission lines, and other types of infrastructure. Landslides are generally characterized in the field by steep, near-vertical slopes (the scarp) that are upslope from a mound of displaced rock (the body). The body of the slide may be relatively intact, or it may be severely fragmented. Recent or relatively new landslides are generally characterized by a fresh (well-exposed rock) scarp and a sparsely vegetated body. Older slides are typically more difficult to identify in the field because the topography of the scarps and bodies may be smoother and more subdued due to weathering. Landslides are most readily identifiable from Light Detection and Ranging (LiDAR) data, supplemented with aerial imagery.

Landslides in Adams County were mapped from LiDAR data collected in November 2021, along with NAIP digital imagery from 2016 to 2022 and a complete set of historical aerial photographs flown from July to September in 1957 at a scale of 1:20,000. The aerial photographs were taken when leaves were on the trees which is unfortunate because groves of leaf-bearing trees tend to obscure landslides, especially small ones. On the other hand, leaves can sometimes make it easier to identify these features as trees and bushes are often aligned within very distinct parallel-, transverse-, and/or semi-circular-depressions that generally occur within the body of the landslide. Using LiDAR elevation data allows us to see through most of the areas previously obscured by vegetation in the historical imagery and aerial photography and greatly increases our ability to identify additional landslide areas.

A total of 196 landslide areas were identified in Adams County. Some of these slide areas may be localized landslide complexes, consisting of multiple landslides that formed from different events. Therefore, the number of individual landslides in this county may be somewhat higher. Collectively, these landslide areas cover 0.62 square miles (400 acres). Most of the landslides (88%) cover less than three acres (Figure 1) and are found in the central portion of the county north and west of Hettinger. Landslides are commonly concentrated along drainages, ravines, and coulees, and around areas of high local topographical relief such as around buttes.

Several historical abandoned mine lands (AMLs) are scattered across Adams County. These small coal mines, commonly referred to as wagon mines, are found along the ND HWY 12 corridor and somewhat scattered across the eastern half of the county. Larger-scale surface and underground mining was also conducted near Haynes in the south-central part of the county. Some collapse features from underground voids were visible on the surface in the county, and may occur in the subsurface beyond the boundaries of the known AML locations since a mine is reported to have existed at these locations, according to records compiled by the North Dakota Public Service Commission. It can be difficult to determine whether small surface irregularities along drainage slopes are old mines or slumps, further complicated as abandoned mines are susceptible to slope failure. Thus, some areas mapped as landslides may include the collapse of abandoned mine-headwalls.

Slopes fail for various reasons including the steepness or angle of the slope, rock type, bedding, and moisture content of the rocks. Most landslides in western North Dakota are rotational slumps that have a well-defined head and toe. Typically, the part of the slope that breaks apart slides down the slope as a single unit and the beds tilt back in the direction of the slope. The failed mass of rock is, however, never a cohesive unit; tension cracks generally cause the failed material to splinter into smaller portions. Successive landslides may occur at the same location. Over time, the accumulated material from multiple, adjacent landslides can cover an area that is much larger than a single landslide area.

The sedimentary bedrock geology of Adams County consists of sandstone, siltstone, mudstone, claystone, and lignite deposited in ancient seaways, rivers, floodplains, lakes, and swamps primarily during the late Cretaceous and Paleocene. The majority of the surface is underlain by rocks belonging to the Ludlow, Slope, Cannonball, Bullion Creek and Sentinel Butte (Paleocene) Formations. Minor areas of sandstone and conglomerate belonging to the Chadron (late Eocene) Formation are present at the top of the Whetstone Buttes and Wolf Butte in the northwestern part of the county.

Small landslides, 10 acres or less in size, are common throughout the rugged topography of western North Dakota. Many of these, as well as larger landslides, can be obscured by slopewash or colluvium. Layers or blankets of slopewash typically cover the lower portion of a slope and extend horizontally from its base. Thick smooth layers of slopewash can completely obscure the broken, jumbled beds of landslide material. In some areas, smaller landslides, or landslides that are very old and have been inactive for a long period of time, are only visible if slopewash is thin or absent, or the beds are sufficiently displaced to create subtle irregularities at the surface. An area with many landslides suggests that the slopes in that area may be predisposed to future slides. Even when landslides are not identified in these types of settings, these areas often remain vulnerable to slope failure and should be evaluated prior to the development of any civil works or energy infrastructure projects and, when possible, be avoided.

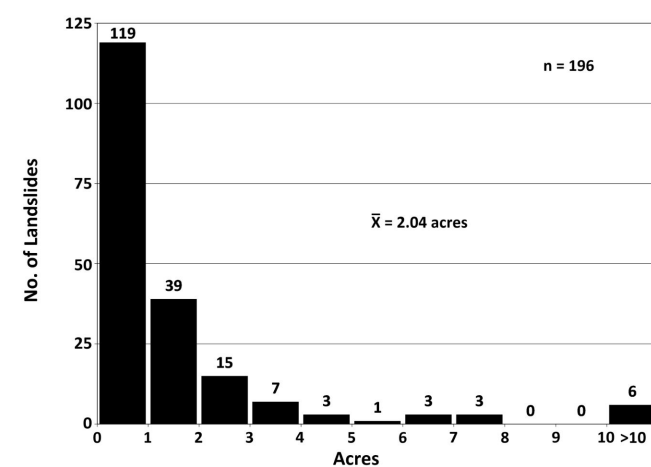
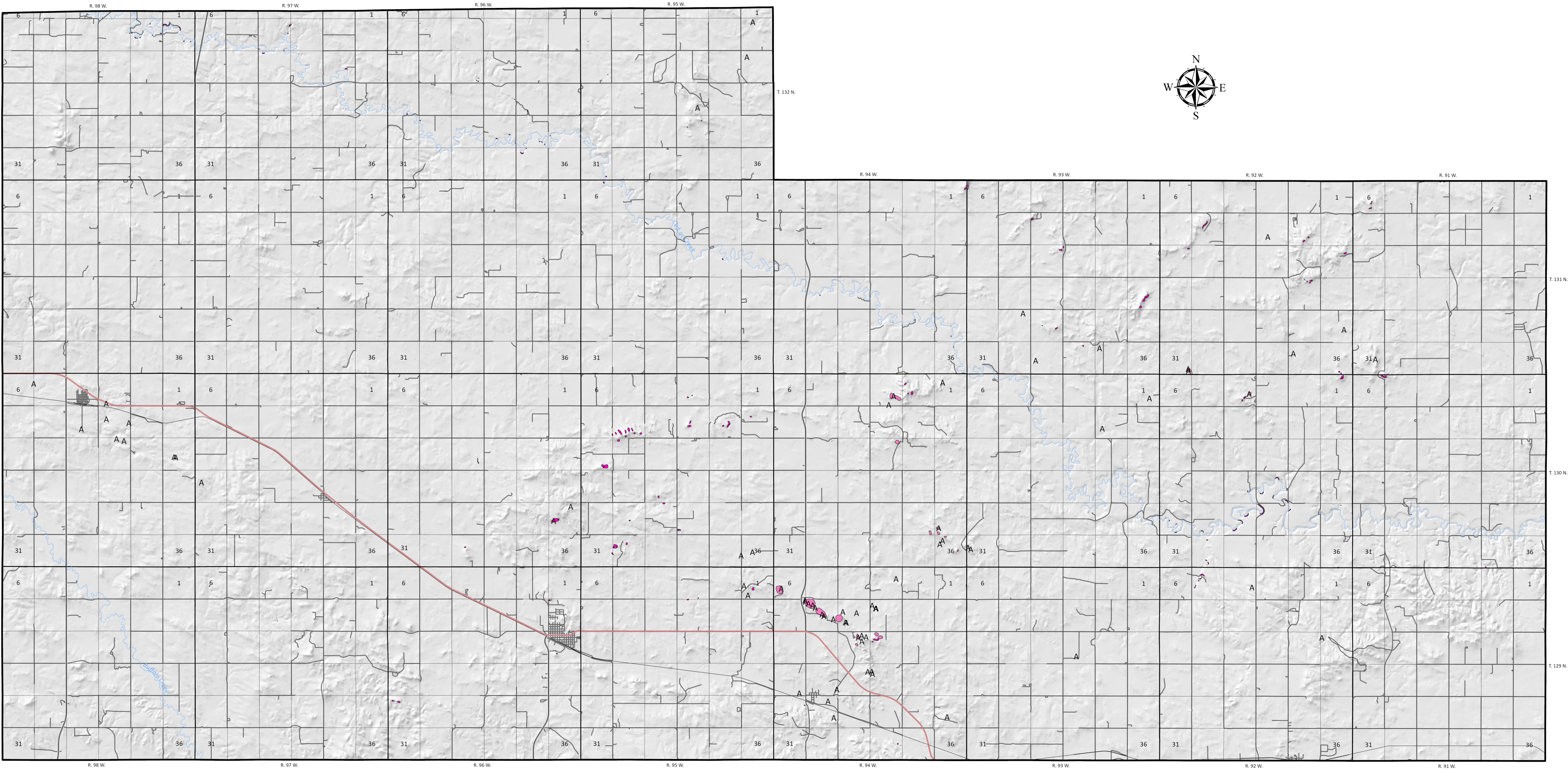
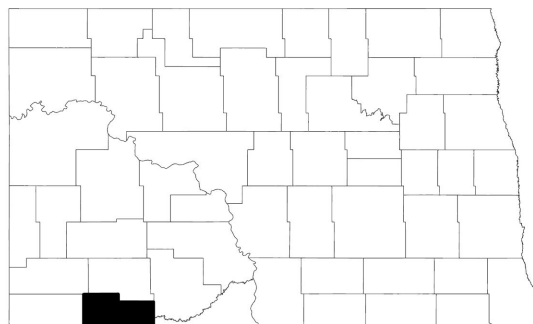


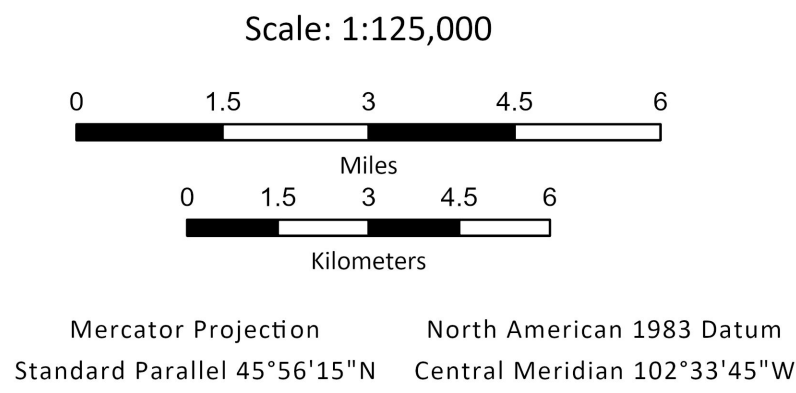
Figure 1. Distribution of landslide areas mapped in Adams County.

-102°30'													
	Cedar Lake	Enterprise	Lewis	Albany	Mont								
	Butte	Butte	Butte	Butte	Butte								
	-102°												
46°15'	Whetstone	Wolf	Eller	Taylor	Reed	Eller	Eller	Eller	Eller	Eller	Eller		
	Butte	Butte	Butte	Butte	Butte	Butte	Butte	Butte	Butte	Butte	Butte		
	-102°30'												
	Reeder	Bucarus	Hettinger	Taylor	Pearl	Bartles	Cedar	Norris	Reeder				
	Butte	Butte	Butte	Butte	Butte	Butte	Butte	Butte	Butte				
	-103°												
	Coal	Coal	Hettinger	Kid	White	Levens	Levens	Thunder					
	Butte	Butte	Butte	Butte	Butte	Butte	Butte	Butte					
	-103°												

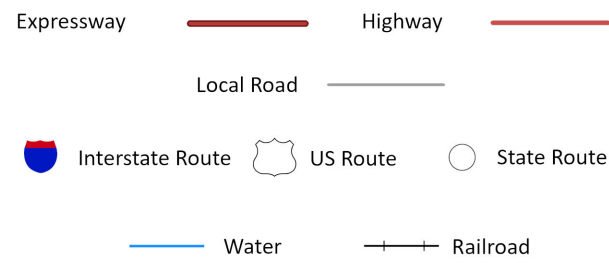
Index to 1:24,000 Quadrangles



ADAMS COUNTY, NORTH DAKOTA



## ROAD CLASSIFICATION



## EXPLANATION

### Qls Landslide Deposits

A mass of material that has moved downslope. Includes earth flows, slumps, and areas of soil creep.

### Qml Abandoned Mine Lands

Surface may be underlain by voids created by the underground mining of lignite. Collapse of the mine voids often creates sinkholes or depressions at the surface.

A Abandoned Mine Lands (AML) location data maintained by the North Dakota Public Service Commission's Abandoned Mine Lands Program.