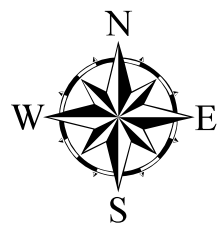


Areas of Landslides

Parshall 100K Sheet, North Dakota

Williston	Stanley	Minot
Watford City		Garrison
Grassy Butte	Killdeer	Hazen
Adjoining 100K Maps		



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General Information on Landslides

Landslides are masses of rocks and sediment that have tumbled or slid down a slope under their own weight. They constitute geologic hazards that can damage 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 scarps may be covered with vegetation and the landslide bodies are often well-vegetated, covered by mature trees.

Landslides are most readily identifiable from the air. The landslides mapped on the Parshall Sheet were identified from a set of aerial photographs (1:20,000 scale) that were flown between May and September of 1958. It is unfortunate that these photographs were taken when leaves were on the trees 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. 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. The roots of vegetation can help to stabilize landslide areas.

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, almost 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 several thousand feet wide and several miles long.

The Parshall Sheet

Most of the area of the Parshall Sheet is underlain by the Sentinel Butte Formation (Paleocene), which consists of alternating beds of sandstone, siltstone, mudstone, claystone, clinker, and lignite. A veneer of glacial deposits covers much of the upland areas.

In the area covered by the Parshall Sheet, landslides are most prevalent within the Little Missouri River Badlands and the drainages along the west side of the Missouri River Valley between New Town and Independence Point. The rocks in these two areas are generally no different than those outside of these landslide-prone areas. Landslides are most prevalent along the Little Missouri River Valley and this short segment of the Missouri River Valley because both were carved relatively quickly (in geologic terms) when glacial ice diverted the Little Missouri and Missouri River into and through these areas. Approximately 600,000 years ago, glaciers blocked the path of the north-flowing ancestral Little Missouri River near the west border of the North Unit of the Theodore Roosevelt National Park. The glacier forced the river to turn east and carve the steep, rugged badlands in this area. As a result, the older, north-trending segment of the Little Missouri River badlands (Marmarth to Grassy Butte) is wider, with gentler slopes than the younger, narrower east-trending segment covered by this map sheet. Therefore, landslides are less common in the Little Missouri River badlands from Marmarth to Grassy Butte.

Similarly, a glacier blocked the path of the Missouri River near New Town approximately 14,000 years ago. Prior to that event, the Missouri River had flowed for tens of thousands of years through the New Town Sag creating the valley that is now occupied in part by the Van Hook Arm of Lake Sakakawea. The old channel (Van Hook Arm) is about five miles wide in contrast to the much younger, present-day channel to the west, which is only about one mile wide. The old and new channels converge at Independence Point. The new, steep slopes of the rapidly carved channel are highly susceptible to slope failure as are the rapidly cut ravines and coulees between Blue Buttes and the western edge of the Missouri River Valley. Landslides are so prevalent near the mouth of Bear Den Bay that both Lewis and Clark noted them in their journal entries of April 14, 1805.

Over 2,400 landslides were identified and are plotted on the Parshall Sheet. Many of these slide areas are complexes that contain multiple landslides that may have occurred over a long period of time. These slides cover an area of 35,000 acres or approximately 4 % of the total land mass of this map. More locally, landslides occupy up to 30 or 40% of the Little Missouri River Badlands and the Missouri River Valley and associated drainages in the Blue Buttes area. Landslide areas may extend along valley walls for more than four miles and can exceed one-half mile in width. Most of these landslides are well-vegetated indicating they are quite old, perhaps thousands of years old, near Bear Den Bay and tens, if not hundreds, of thousands of years old in the Little Missouri River Badlands. Slope failure likely occurred relatively quickly after the steep-sided badlands slopes had formed. In these areas, careful consideration is required prior to construction to avoid landslide prone areas. Construction activities can reactivate landslides that have been stable for hundreds or thousands of years. Furthermore, the presence of numerous landslides in an area (such as the Little Missouri River Badlands and the Missouri River Valley southwest of New Town) generally indicate widespread slope instability necessitating extreme caution be used when building on, or adjacent to, slopes anywhere within that area.

UNIT DESCRIPTIONS

GU Surface geology undifferentiated

QUATERNARY

RECENT/PLEISTOCENE

Qls Landslide

A mass of sediment and/or rock that have slid or tumbled down slope. A pink area on the map may represent dozens of individual landslides.

Other Features

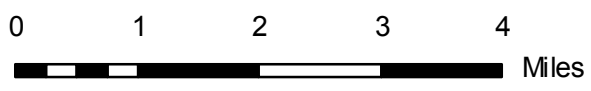
Water	River/Stream	Tribal Boundary
Water - Intermittent	Stream - Intermittent	State Highway
Marsh	Section Corner	Paved Road
	County Boundary	Unpaved Road

Geologic Symbols

Known contact between two geologic units

The North Dakota Geological Survey compiled this map according to conventional cartographic standards, using what is thought to be the most reliable information available. The North Dakota Geological Survey does not guarantee freedom from errors or inaccuracies and disclaims any legal responsibility or liability for thereon.

Scale 1:100,000



Mercator Projection 1927 North American Datum

Standard parallel 47°45' Central meridian 102°30'

Shaded Relief - Vertical Exaggeration 9x