

Identifying Bluffs and Steep Slopes with MnTOPO

Bluff Development Regulations

Many communities regulate development on or near bluffs and steep slopes by administering various statewide land use regulations through local zoning ordinances. The purpose of these bluff regulations is to reduce erosion and bluff failure and risk to structures and public safety. The state [Shoreland Management program](#) affects the largest geographical area. Other programs, each with their own unique bluff definitions include the [Mississippi River Corridor Critical Area program](#), the [Wild and Scenic River program](#), and the [Lower Saint Croix Riverway program](#).

Desktop Methods for Identifying Bluffs and Slopes

MnTOPO is a handy web-based tool to quickly identify if a bluff or steep slope exists. It uses Minnesota's LiDAR-derived elevation data and is accurate to within ±1 foot (elevations provided in NAVD 88). GIS users can also download elevation data, as well as DNR's Bluff Mapping Tool through Minnesota Geospatial Commons. The bluff mapping tool is helpful for large-scale, general planning purposes, but is unable to map bluffs in shoreland areas where the base of the slope is more than 50 feet from the OHWL (see Figure 1) similar to example 2 below.

If MnTOPO or the bluff mapping tool indicate that a bluff likely exists, a field survey would still be needed to determine the location of the bluff impact zone (BIZ) and structure setbacks from the top of bluff. A zoning administrator always has the discretion to require a survey where development encroaches on or near a bluff that clearly, or even potentially, exists.

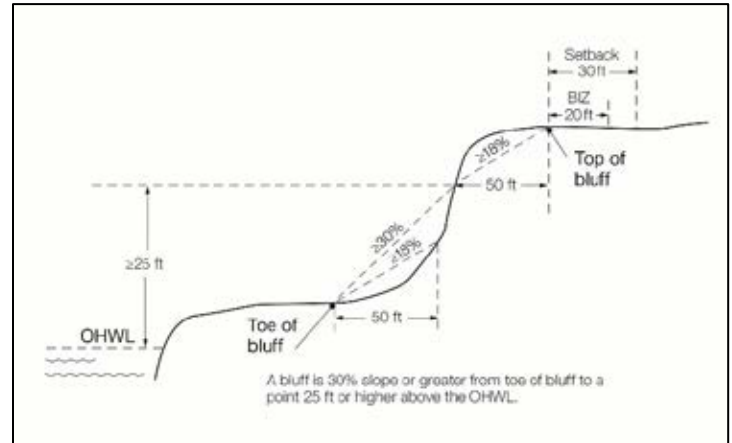
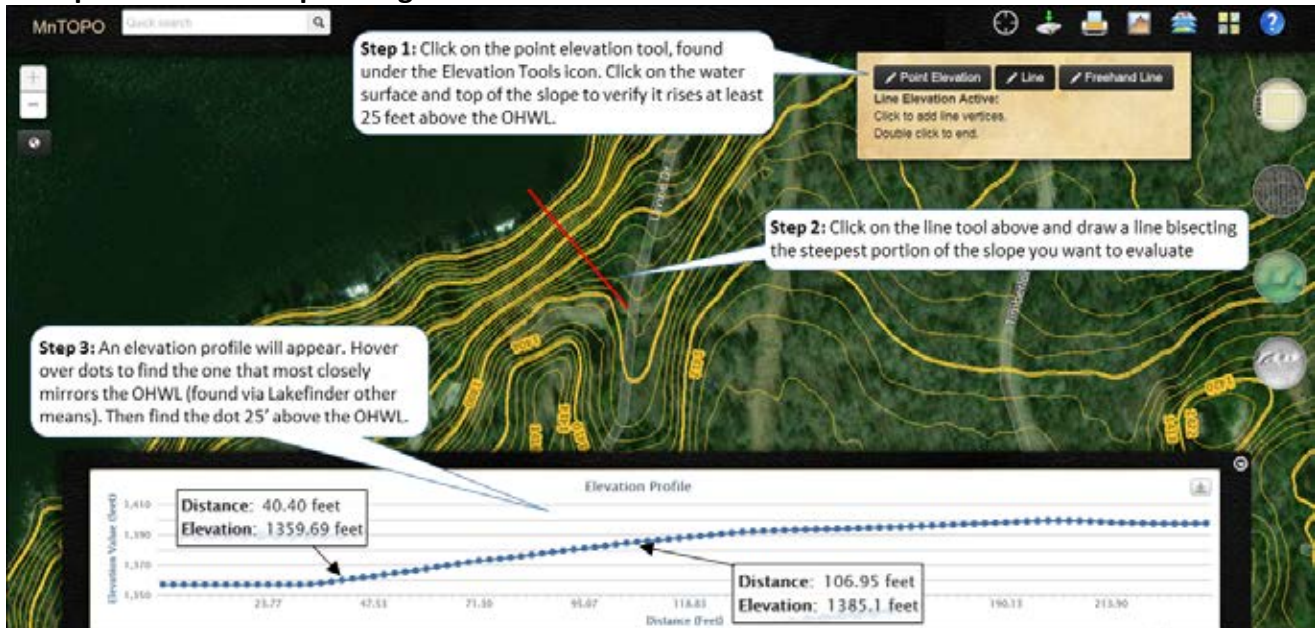


Figure 1. To find a bluff in shoreland areas, 1) confirm the slope rises at least 25' above the water; 2) find the toe of bluff, which may be the ordinary high water level (OHWL); and then 3) verify the presence of a slope of at least 30% between the toe and any point 25' above the OHWL.

Following are examples of how to use MnTOPO to find bluffs based on the shoreland program bluff definition. The same approach can be used for other program bluff definitions

Example 1: Bluff or slope along shore

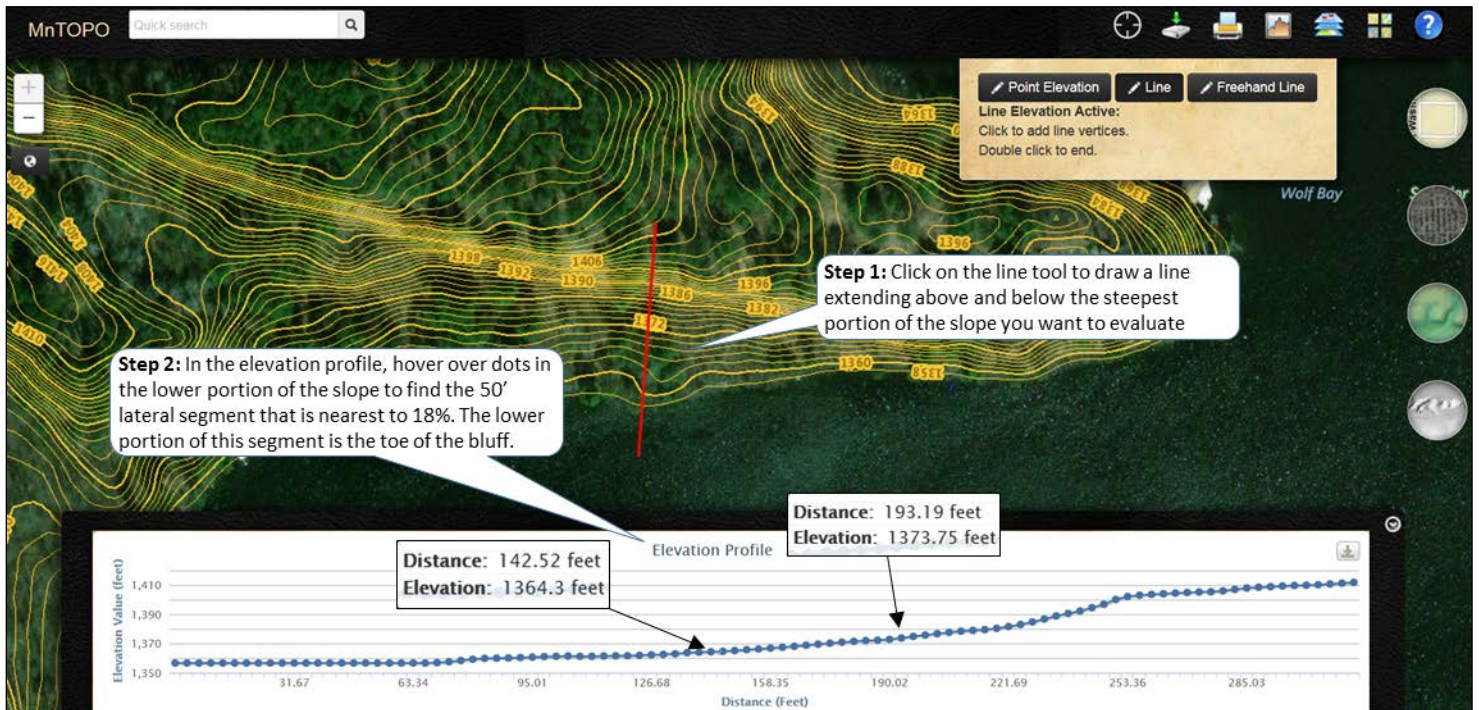


Step 4: Calculate rise/run to determine whether the slope exceeds 30%

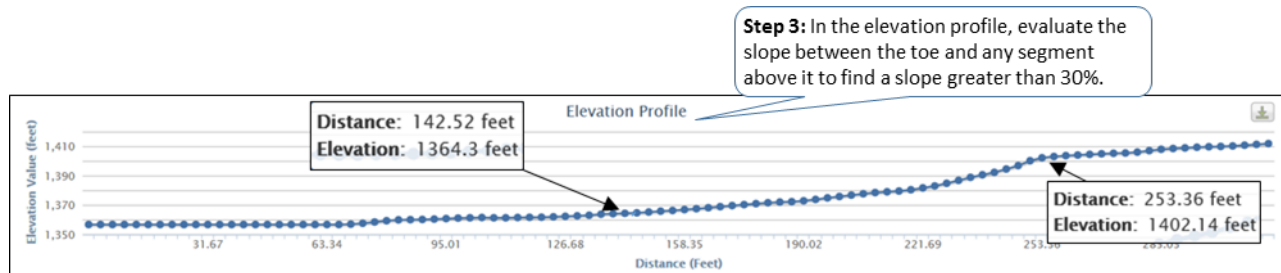
$$\frac{1385.1 - 1359.69}{106.95 - 40.40} = \frac{25.41}{66.55} = 38.2\%$$

Example 2: Bluff or slope away from shore

Determining the presence of a bluff when the base of the slope is greater than a 50 foot distance from the shoreline is more complex. The steps below detail how this may be completed.



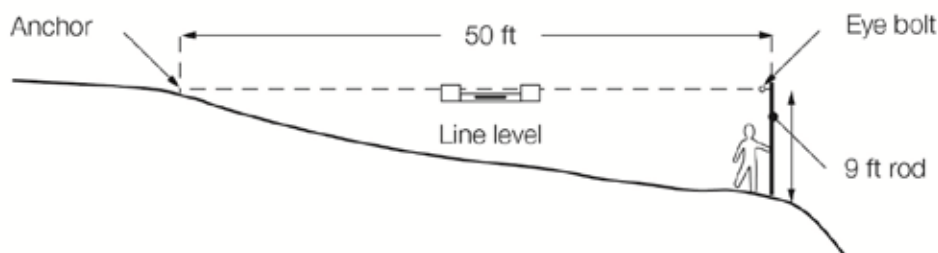
$$\frac{1373.75 - 1364.30}{193.19 - 142.52} = \frac{9.45}{50.67} \approx 18\%$$



$$\frac{1402.14 - 1364.30}{253.36 - 142.52} = \frac{37.84}{110.84} = 34.1\%$$

A bluff is likely present, and an on-site survey would be required to confirm and identify the top and toe of the bluff for development purposes. In this second example, you may notice that the bluff is measured from the toe, which is almost 100 feet from the steepest part of the slope. In situations where the slope starts away from the edge of the water, the slope must be very steep to be considered a bluff. Here, the steepest part of the slope has a grade over 80%, but would just barely be considered a bluff.

Find Top or Toe of the Bluff



Once the presence of a bluff has been verified, the top or toe of the bluff can be found by finding the higher (or lower) point of a 50 foot segment with an average slope of 18% (which would be a 9 foot rise over 50 lateral feet).