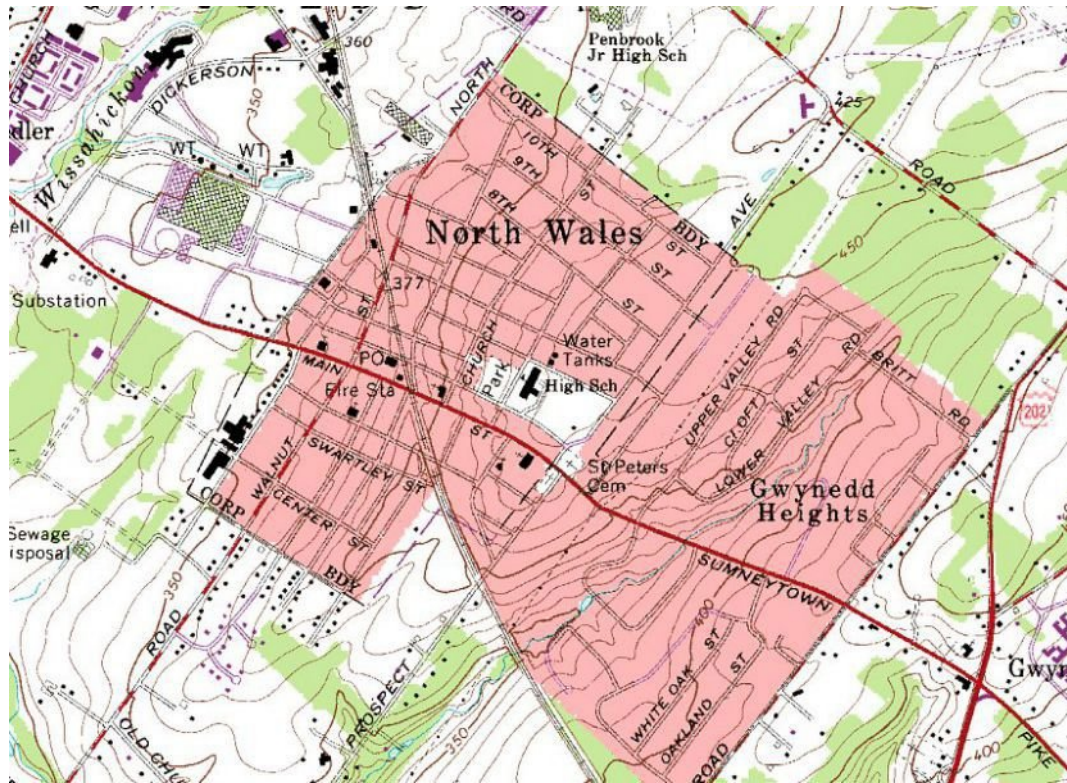


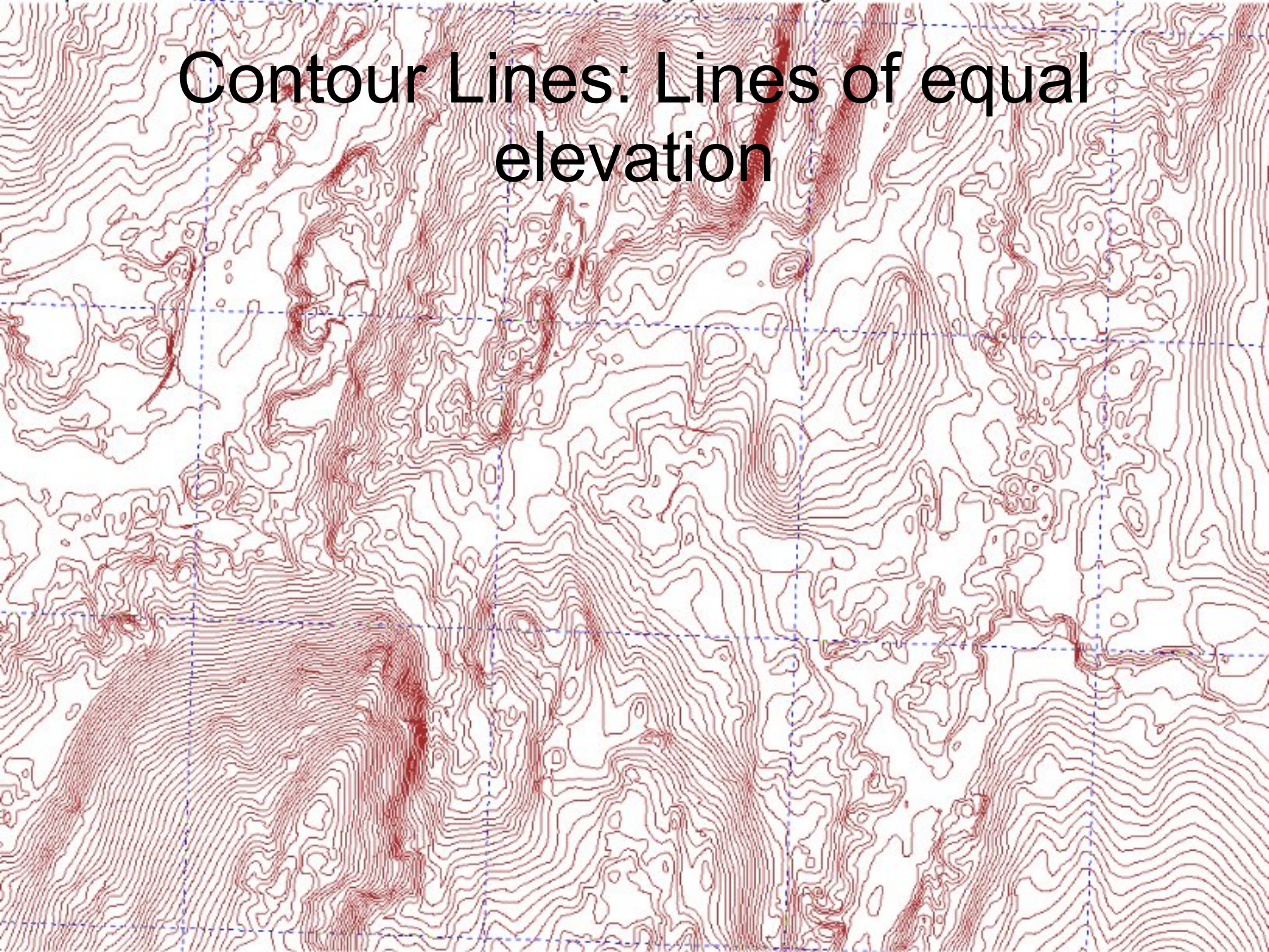
# Land Navigation I: Topography



# Map and Air Photo

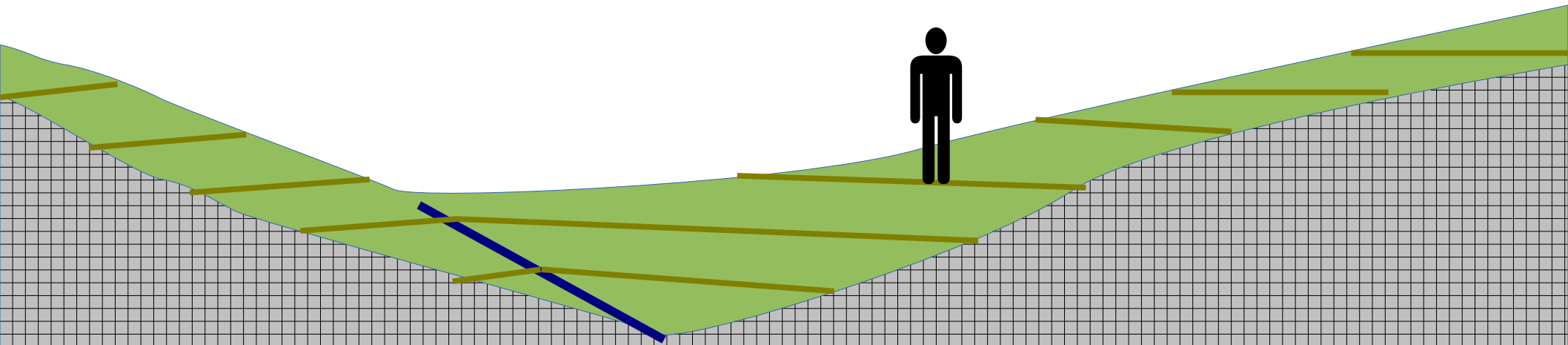


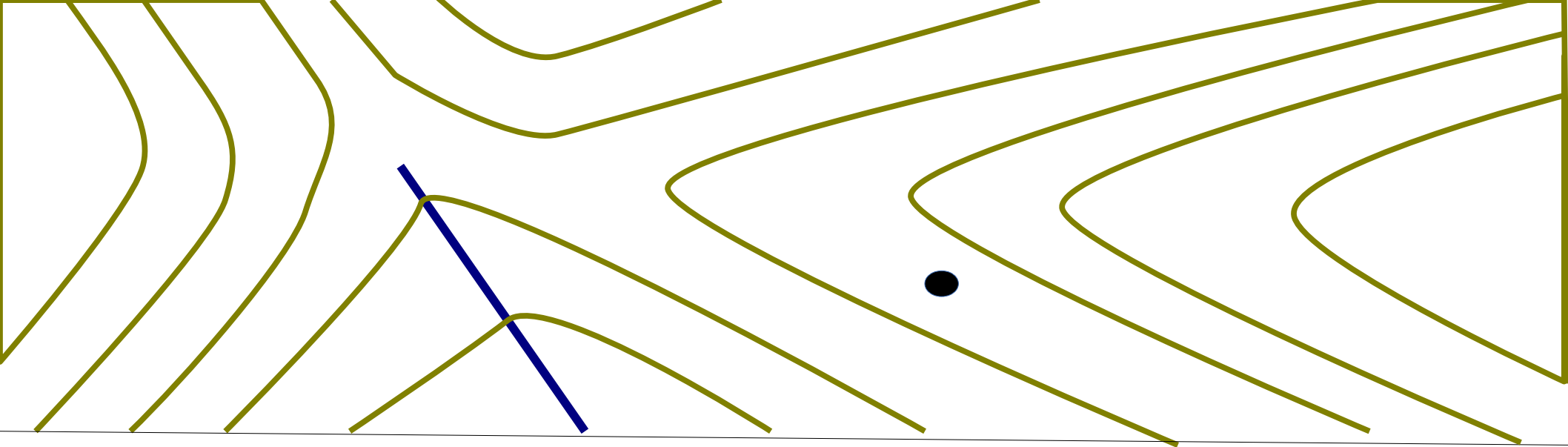
# Contour Lines: Lines of equal elevation



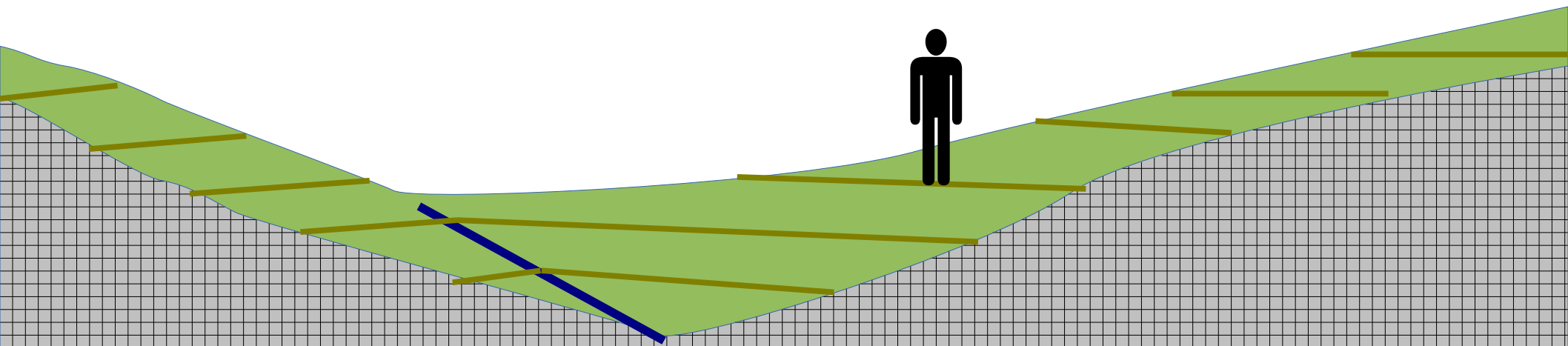
# Valley between two hills

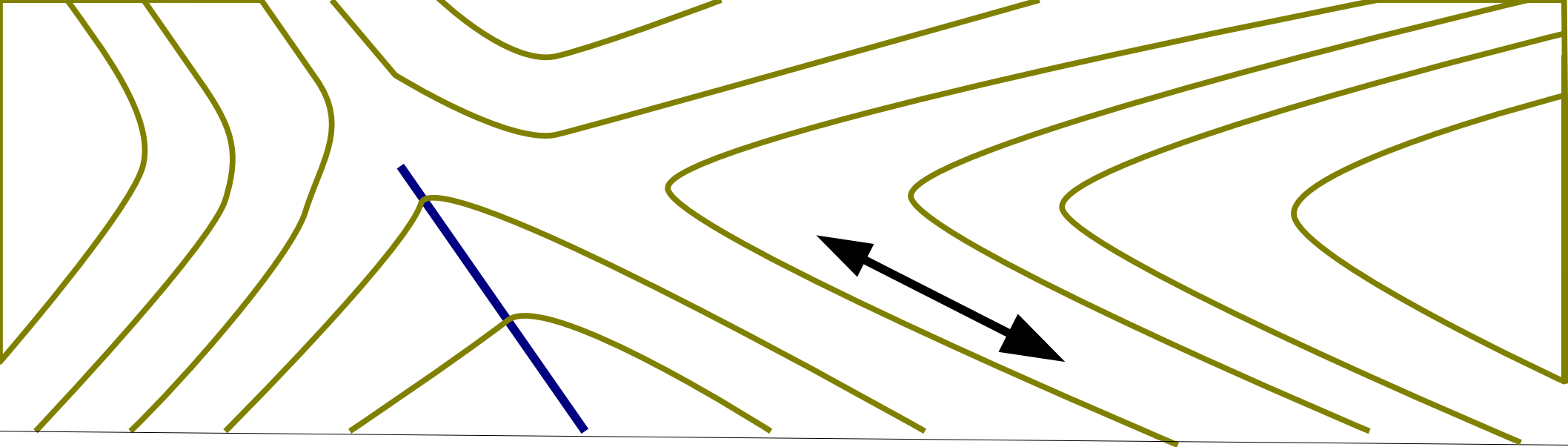
## View from ground level



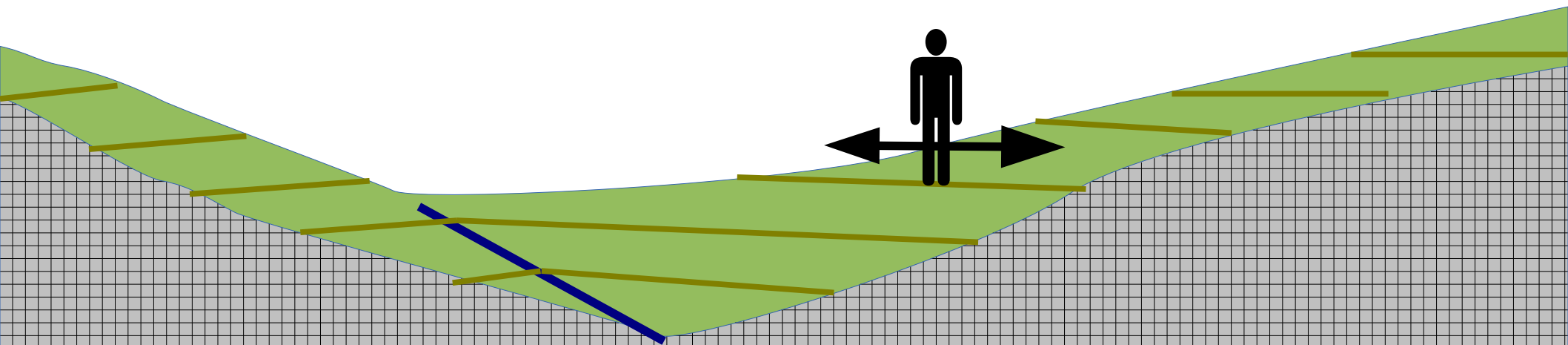


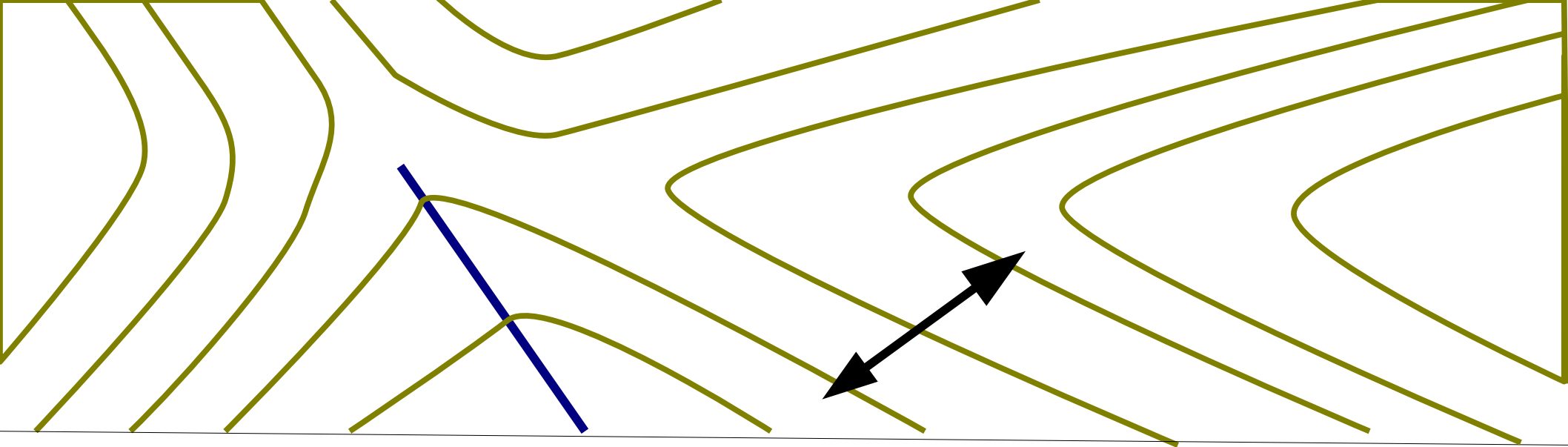
Map: view from above  
(with contour lines)



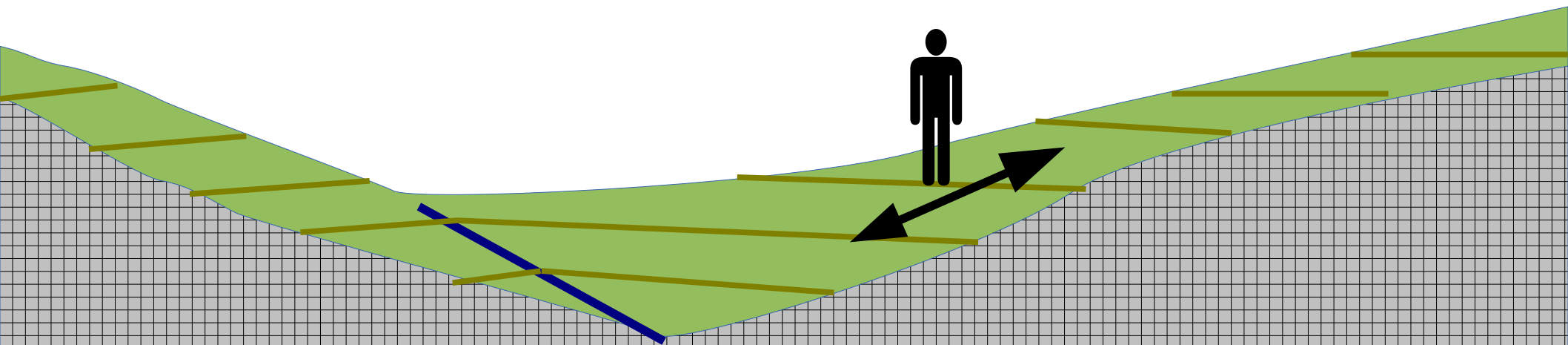


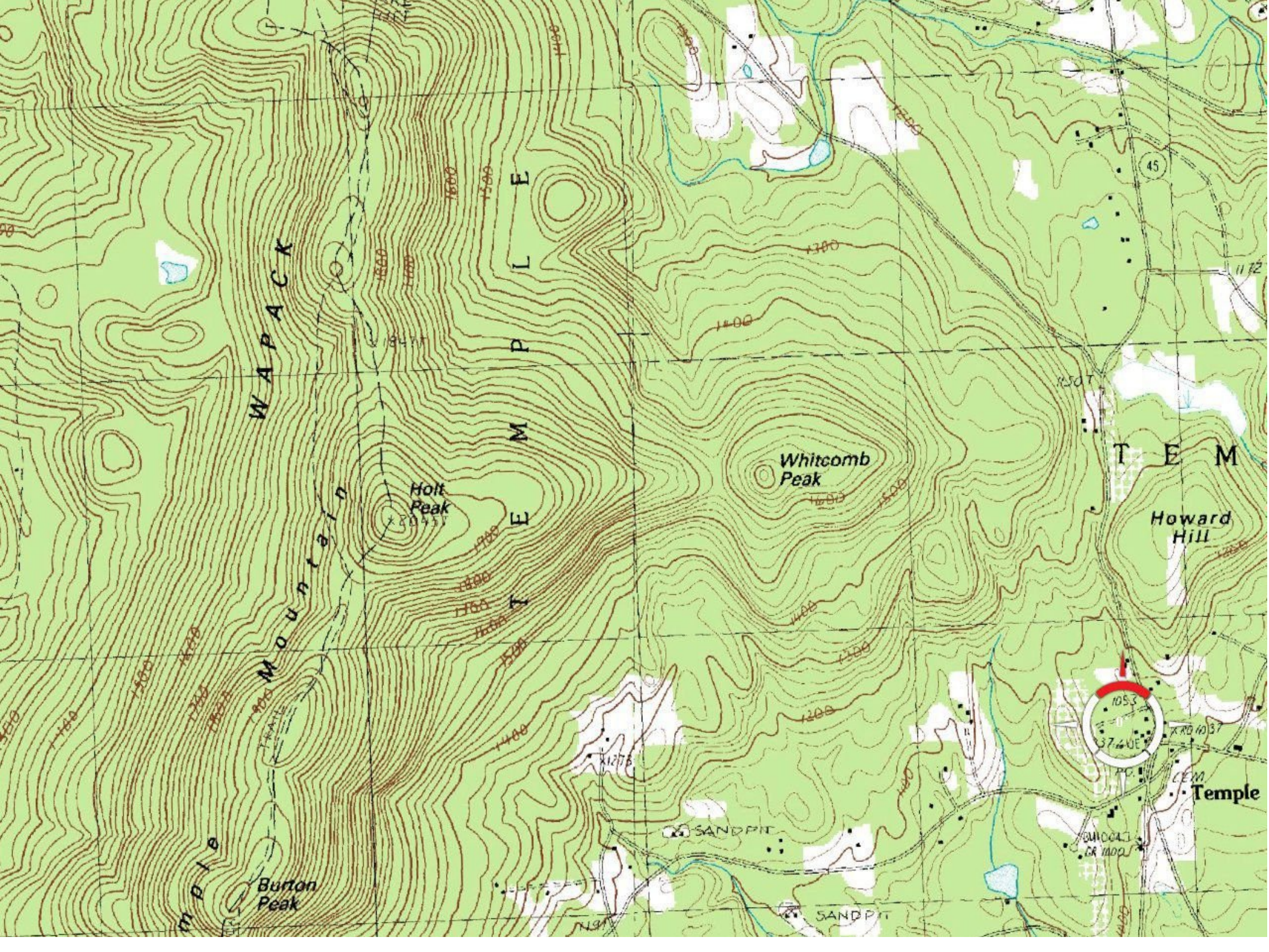
Along contour line:  
Staying at the same elevation





Across contour lines:  
Up or down hill





W A P A C K

P L E

M M

T E

T E M

Howard Hill

Holt Peak

Whitcomb Peak

Burton Peak

Temple

105.3  
37.40E

SANDPIT

SANDPIT

45

N 31

CEM

QUICKS  
CR 1002

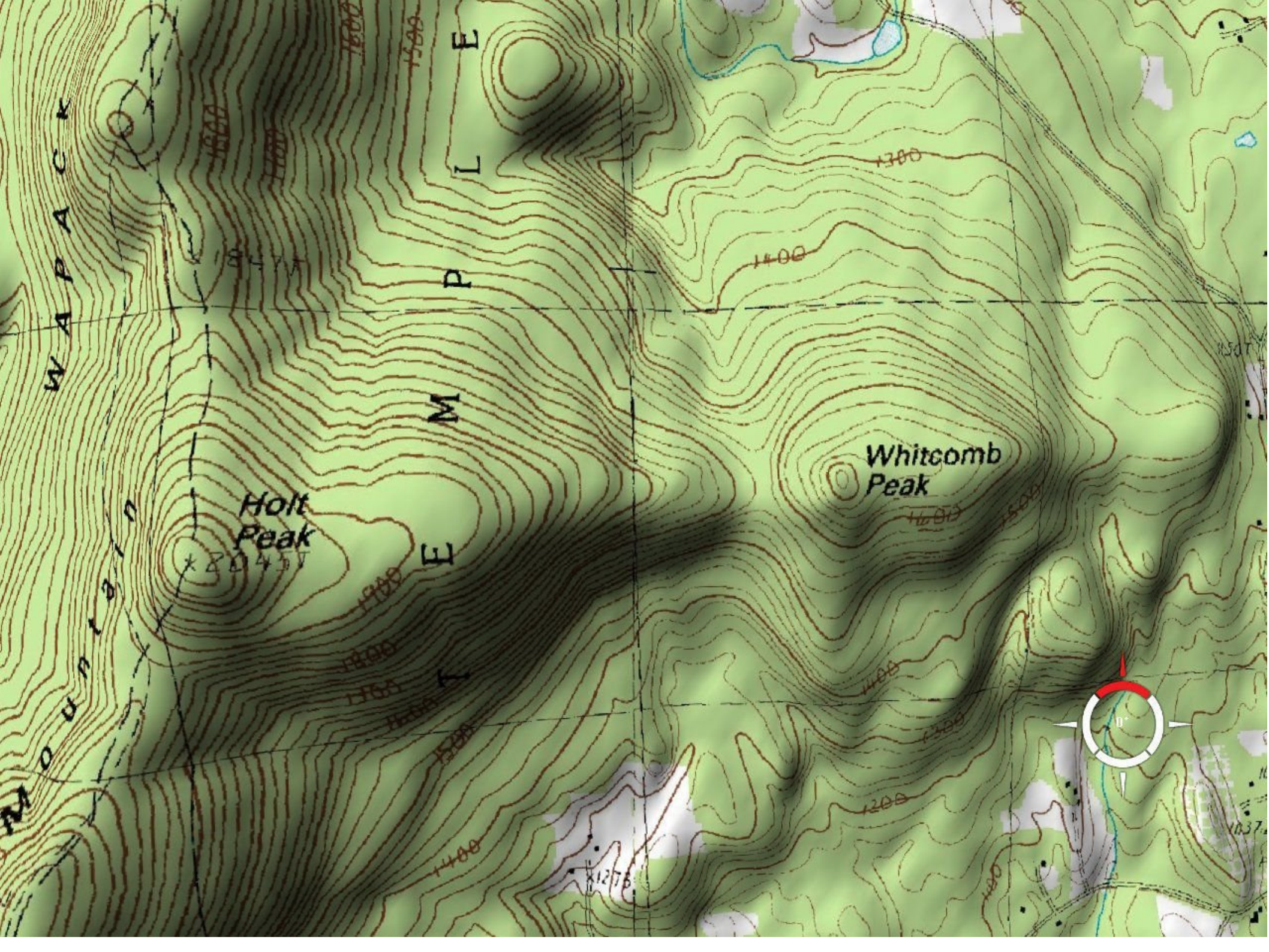
CR 1037

PO

m p l e

Temple Mountain





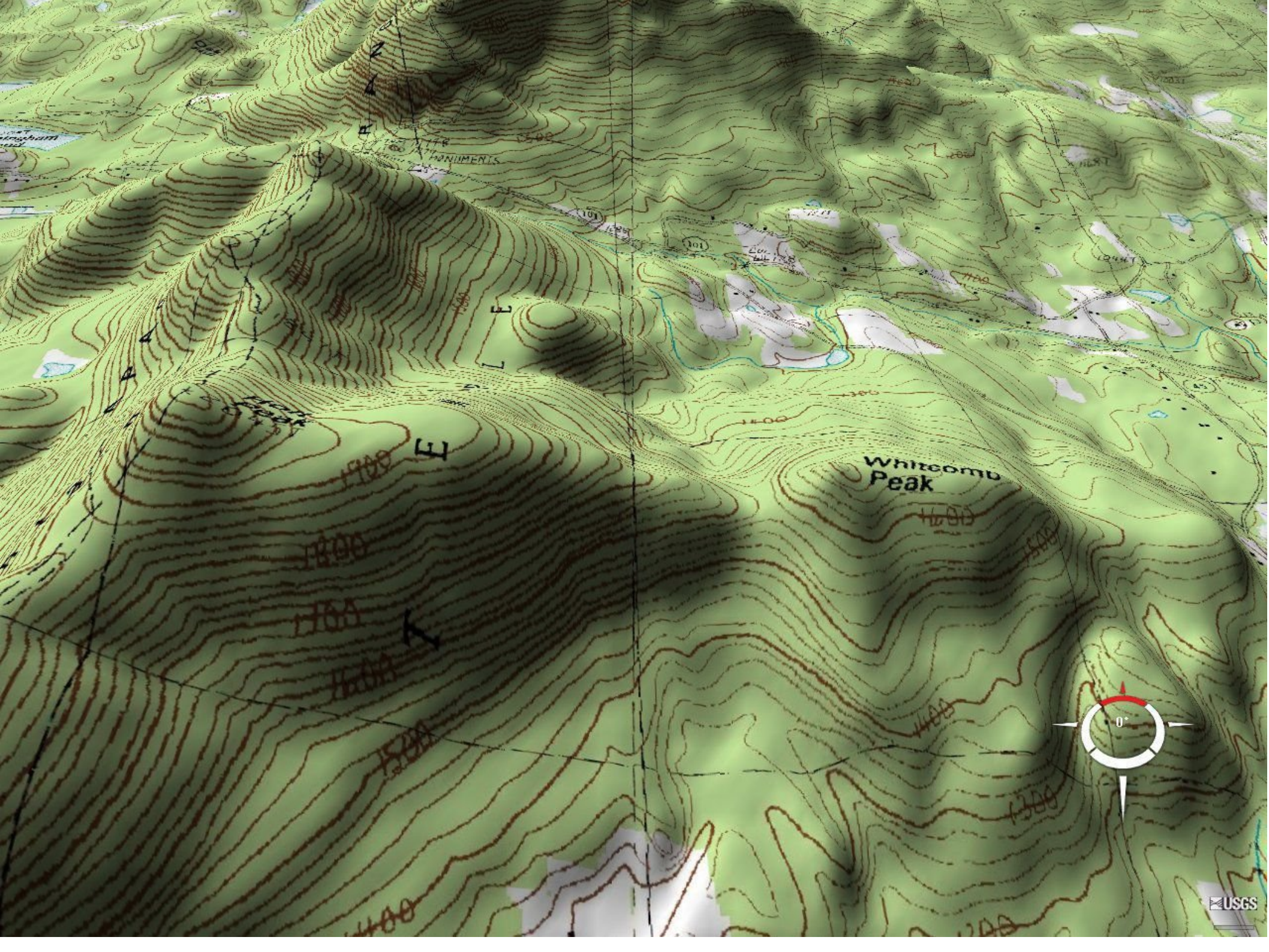
W A P A C K

M P E

Holt Peak  
x20457

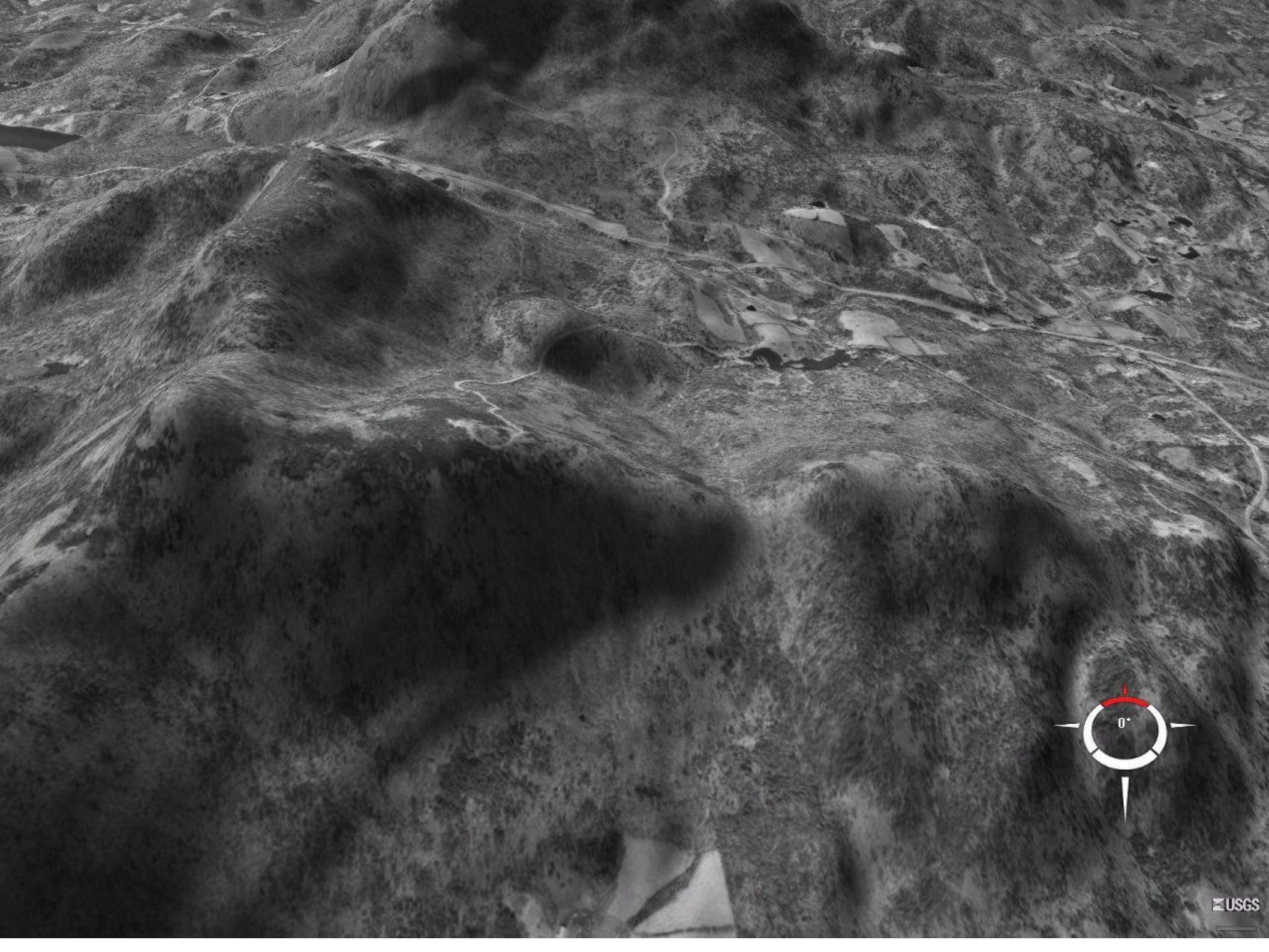
Whitcomb Peak

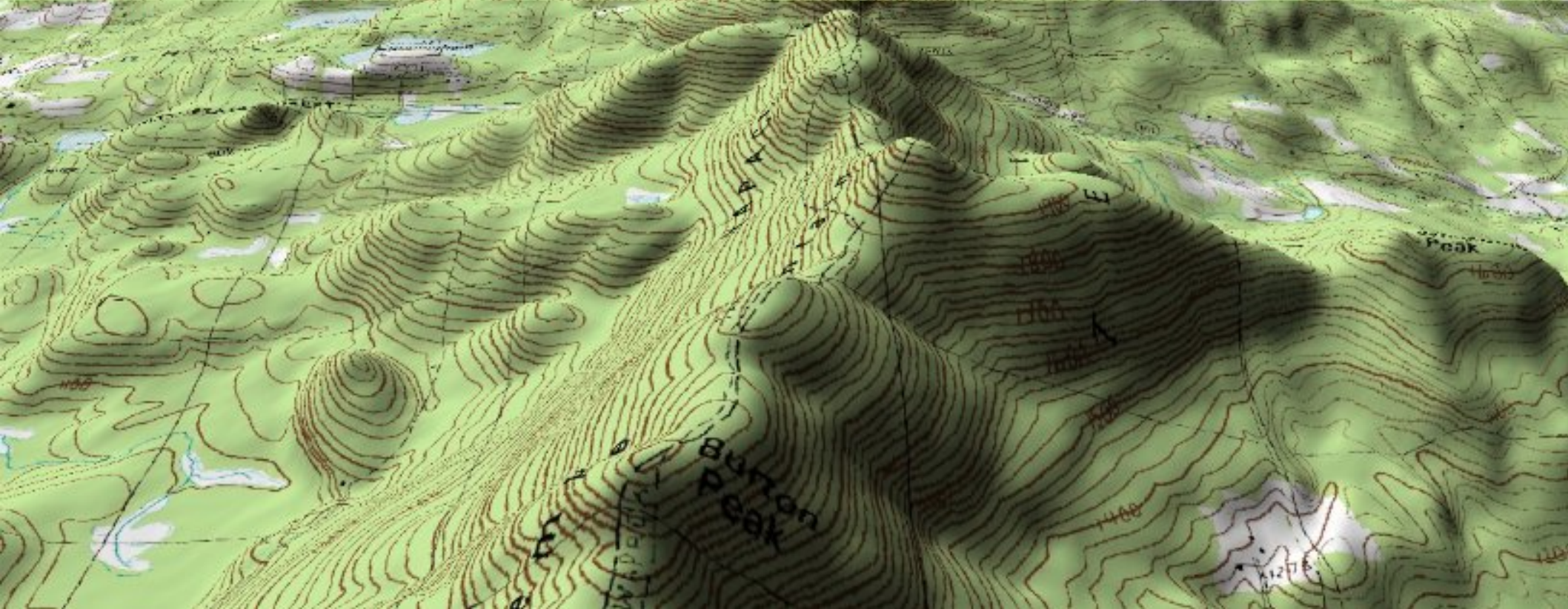


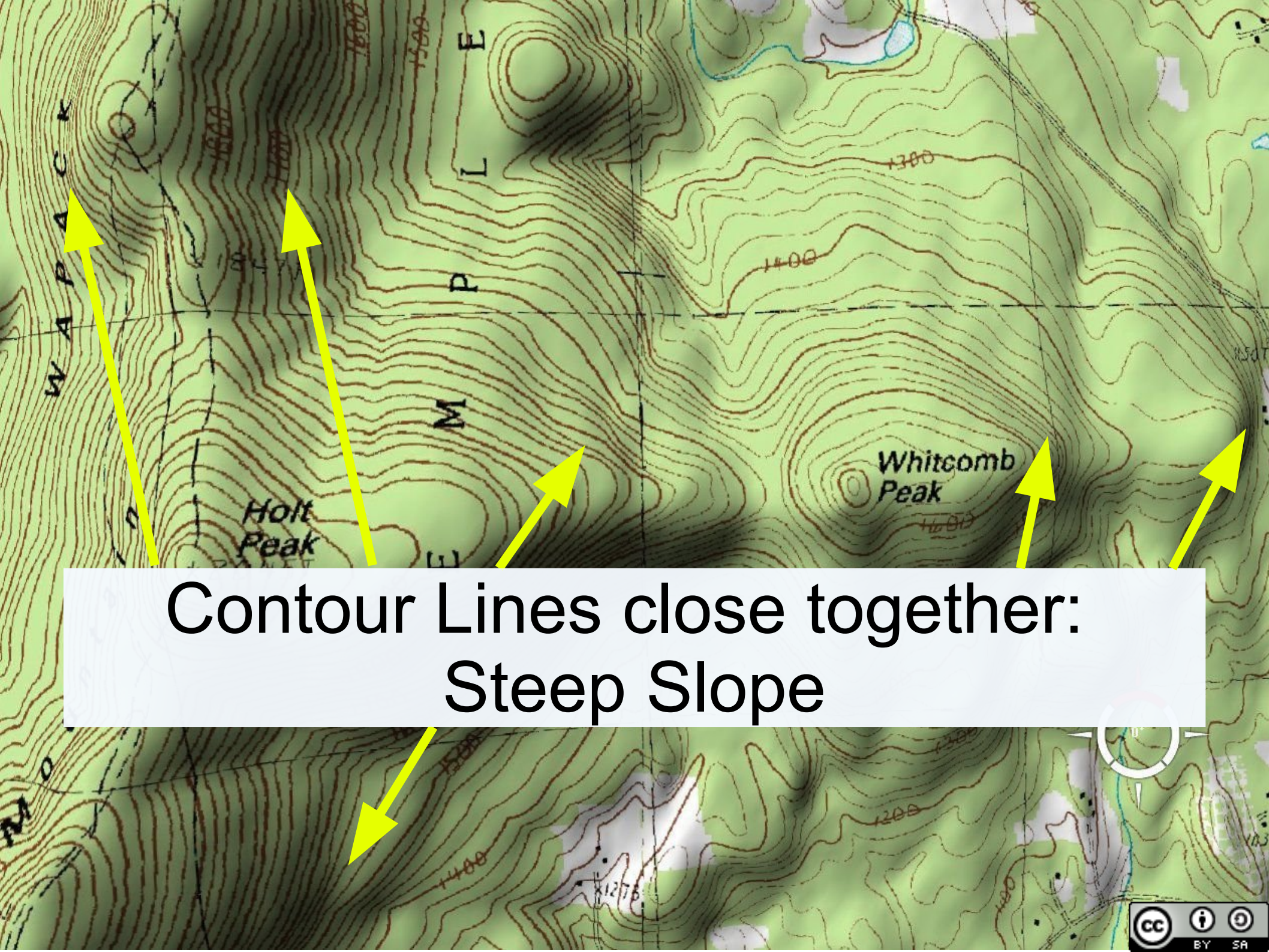


Whitecomb Peak

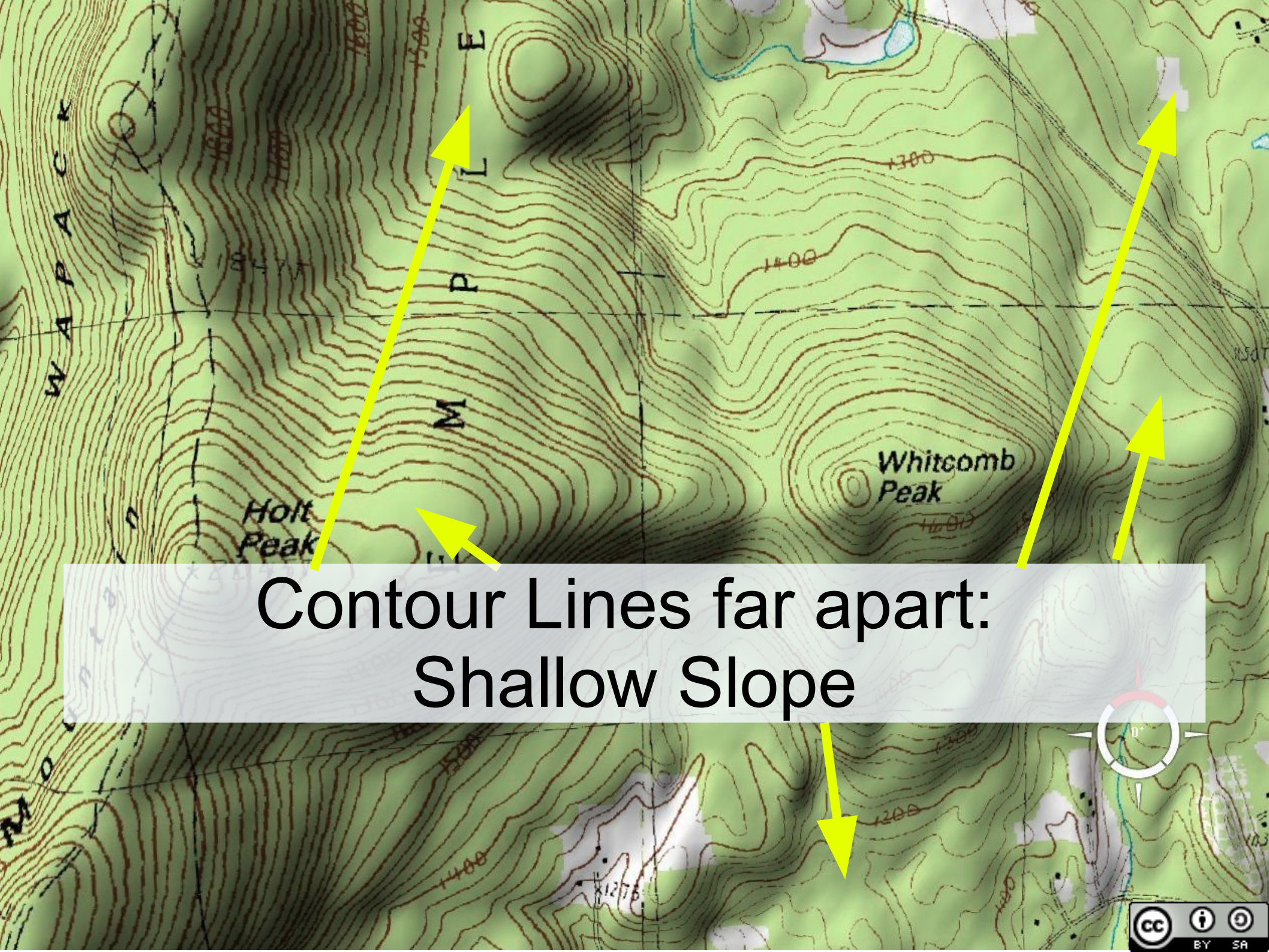








**Contour Lines close together:  
Steep Slope**



Holt Peak

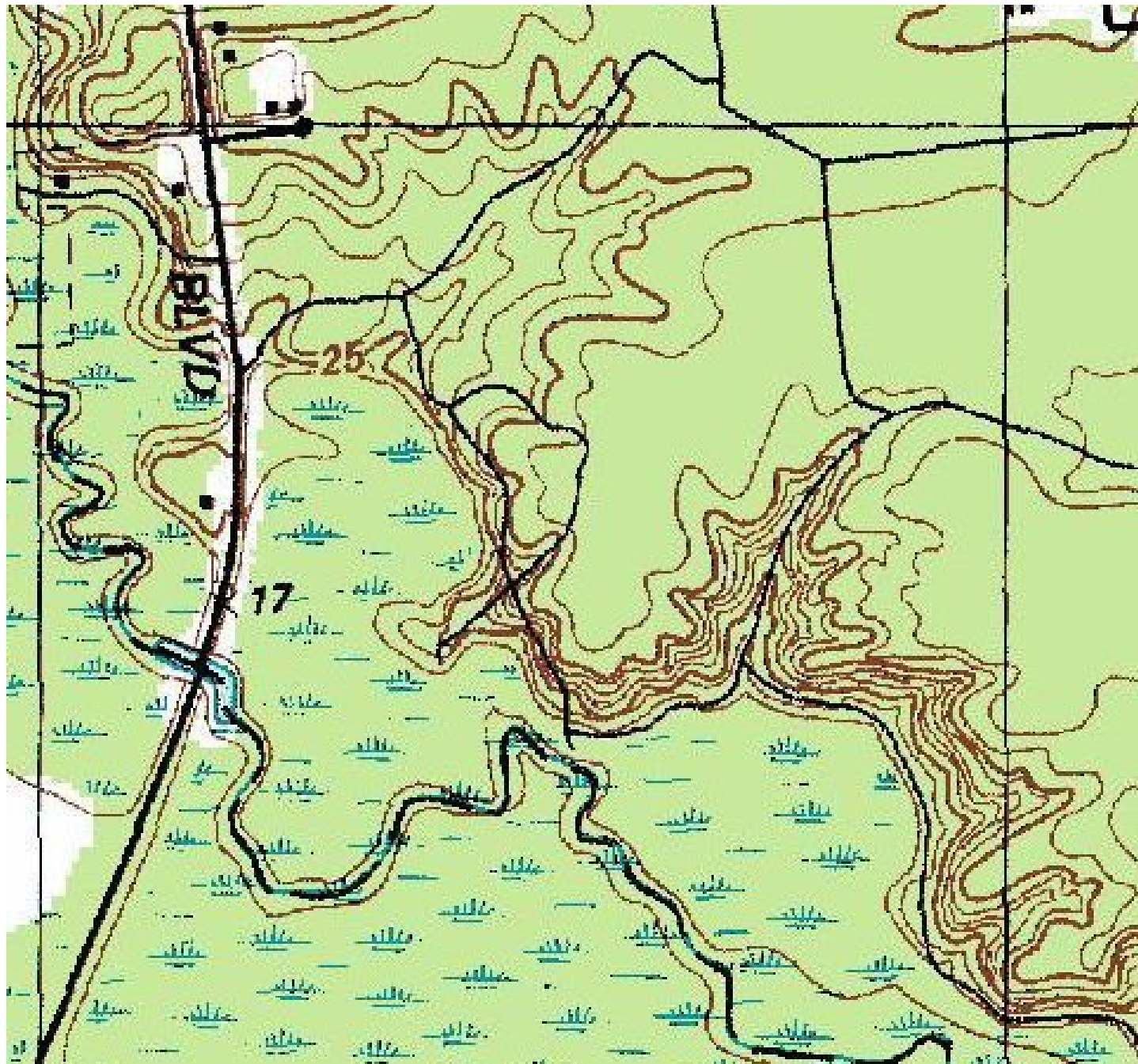
Whitcomb Peak

M  
I  
L  
L  
E  
R

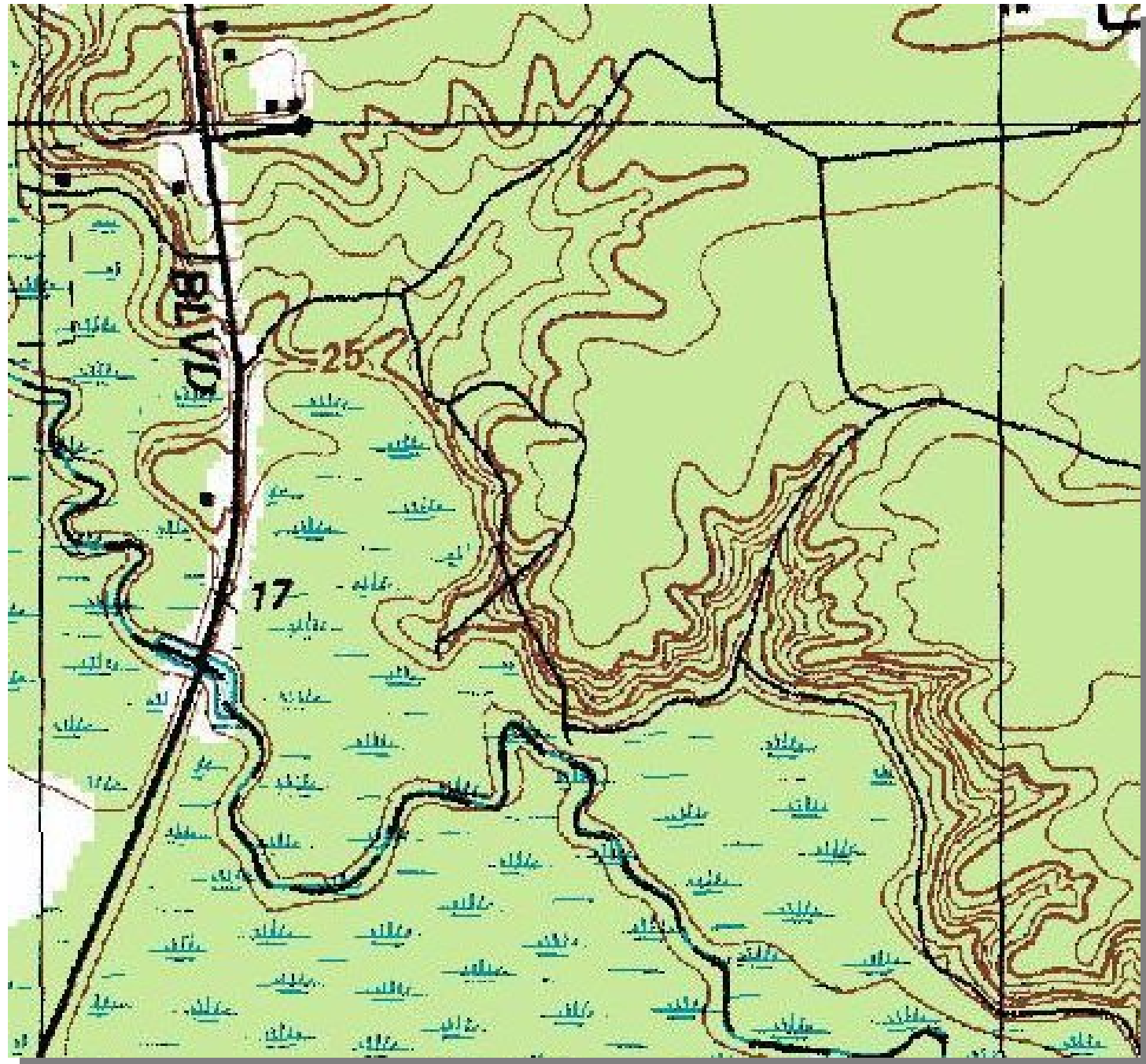
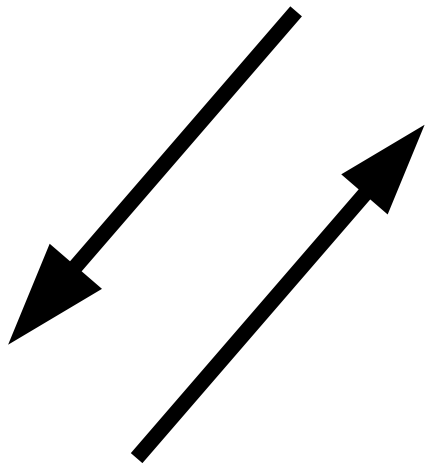
W  
A  
P  
A  
C  
K

Contour Lines far apart:  
Shallow Slope

# Where are the steep slopes?

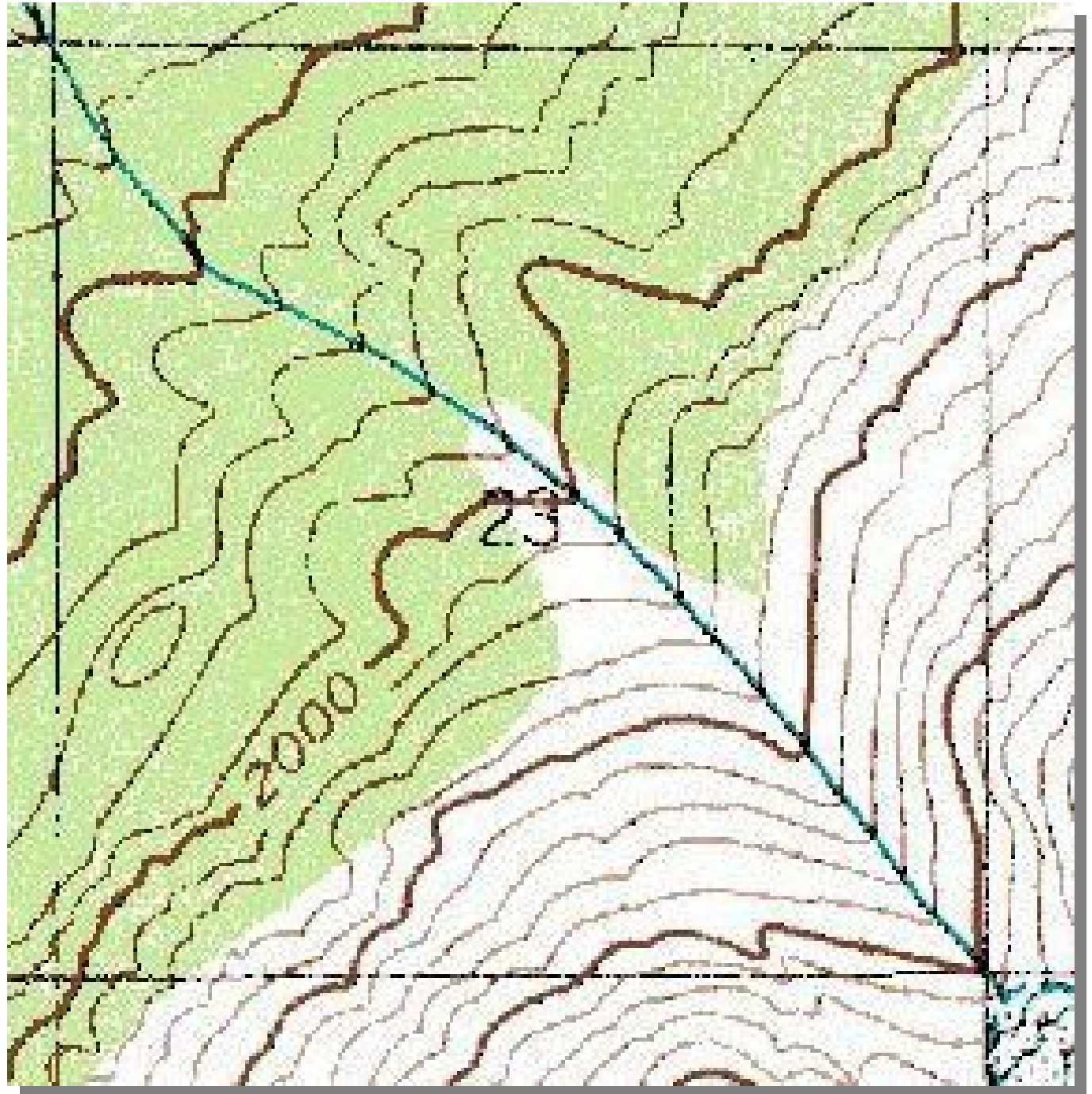
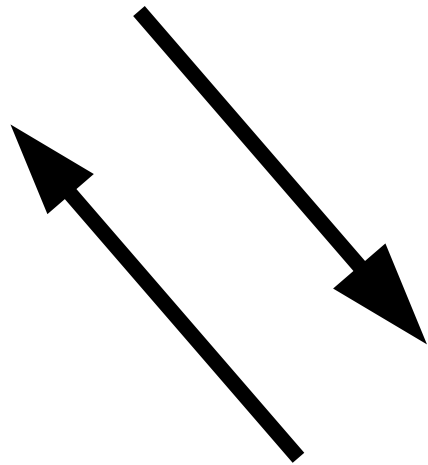


Which way  
is uphill?

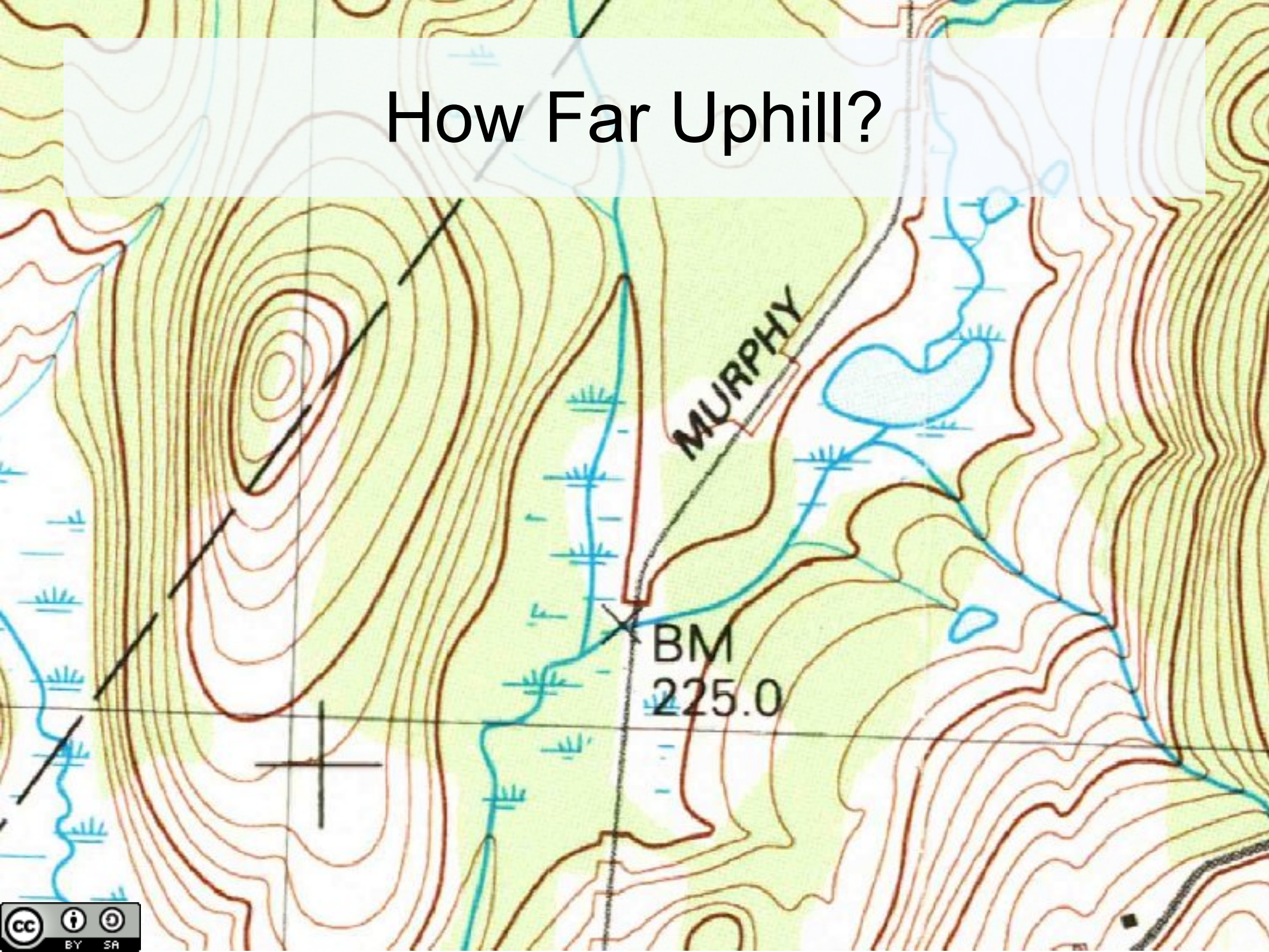




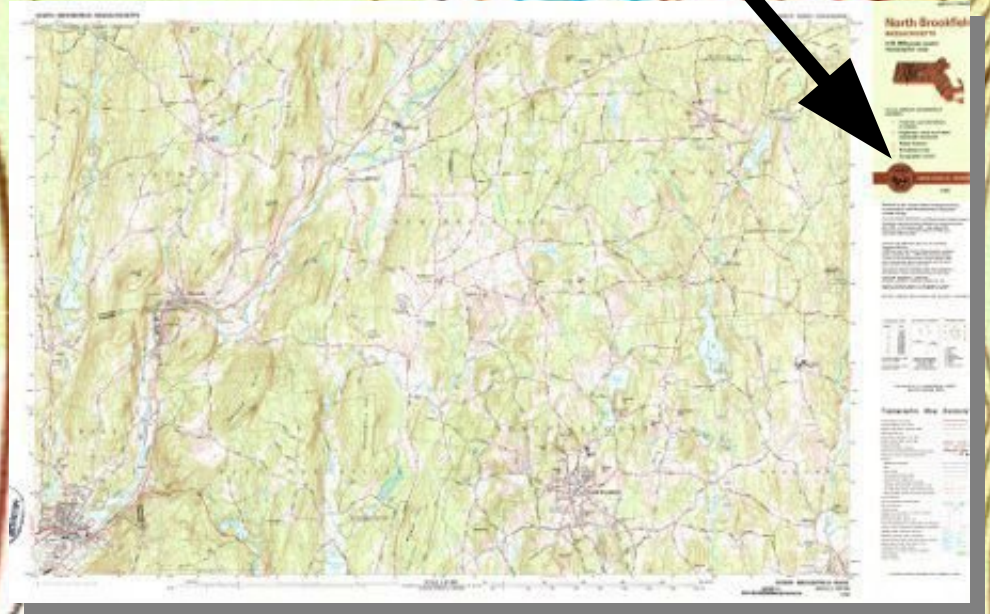
Which way  
is uphill?



# How Far Uphill?



**CONTOUR INTERVAL 3 METERS**

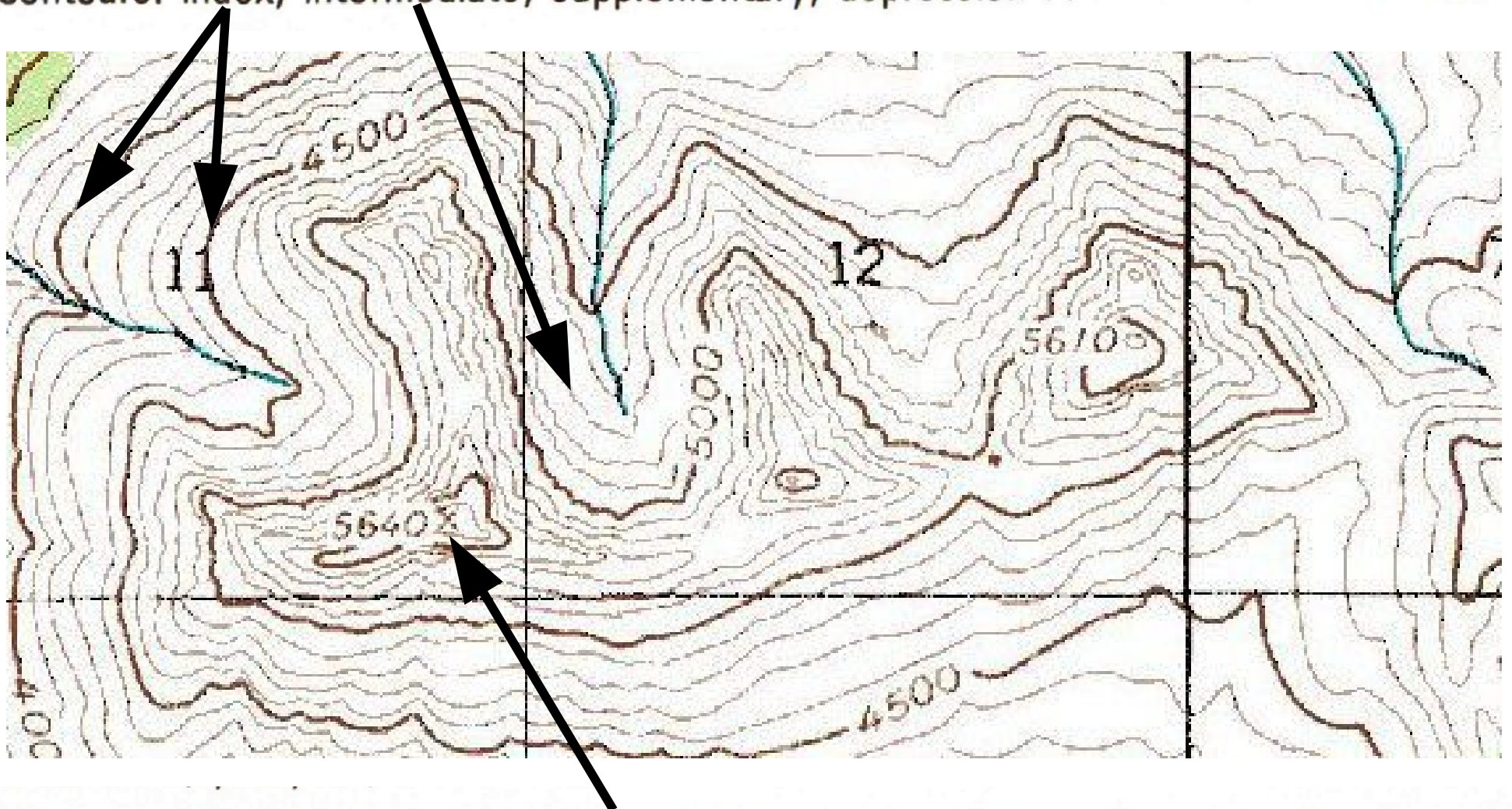


BM  
225.0

Control: horizontal station; vertical station; spot elevation ..



Contours: index; intermediate; supplementary; depression ..



Control: horizontal station; vertical station; spot elevation ..



Contours: index; intermediate; supplementary; depression ..

Control: horizontal station; vertical station; spot elevation ..

Contours: index; intermediate; supplementary; depression ..



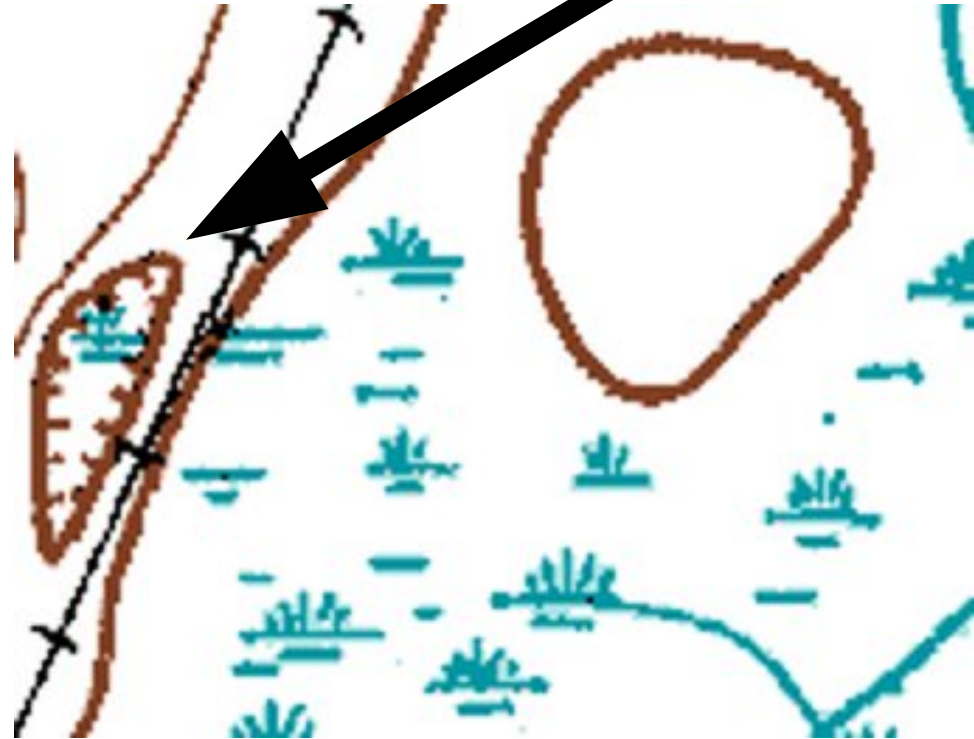
Boundary Monument  
Vertical: 377 (Feet)

Control: horizontal station; vertical station; spot elevation ..

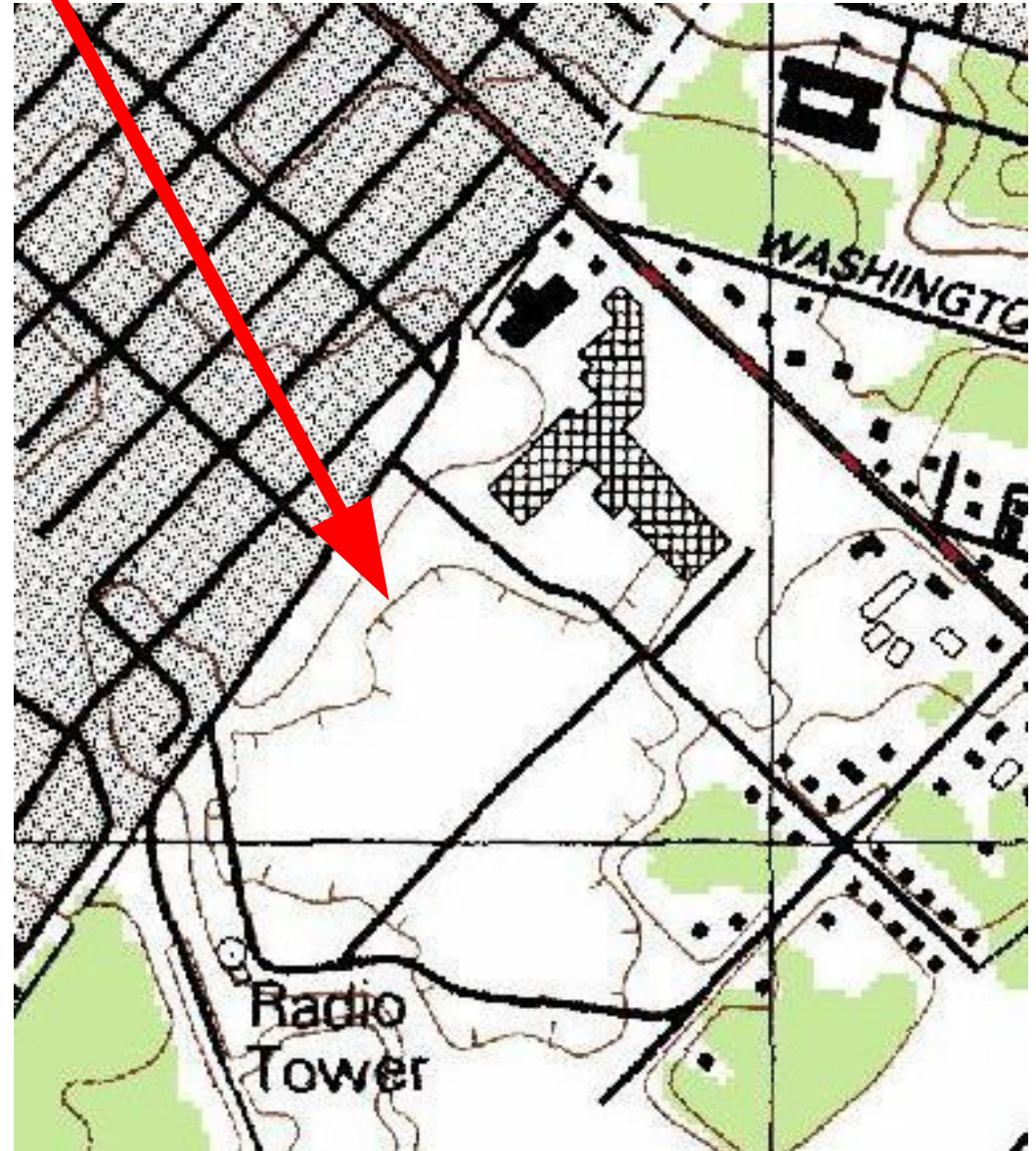
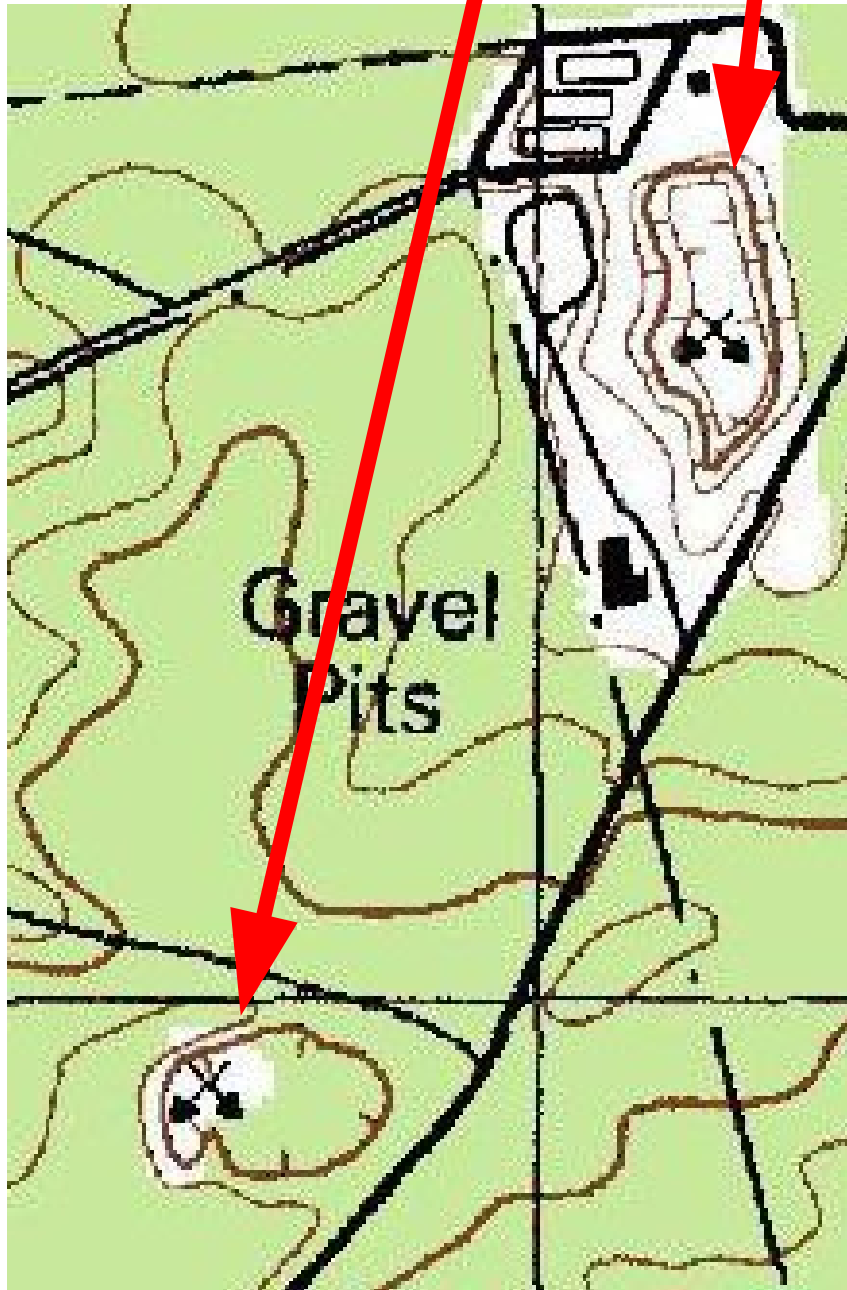
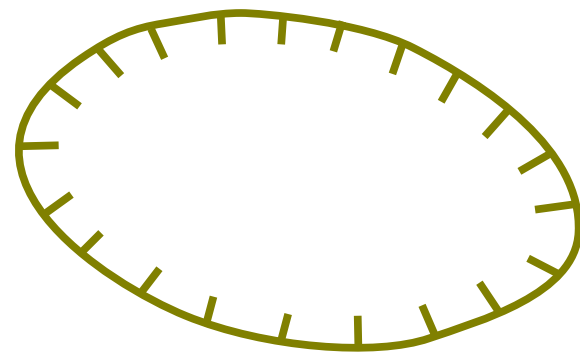
Contours: index; intermediate; supplementary; depression ..

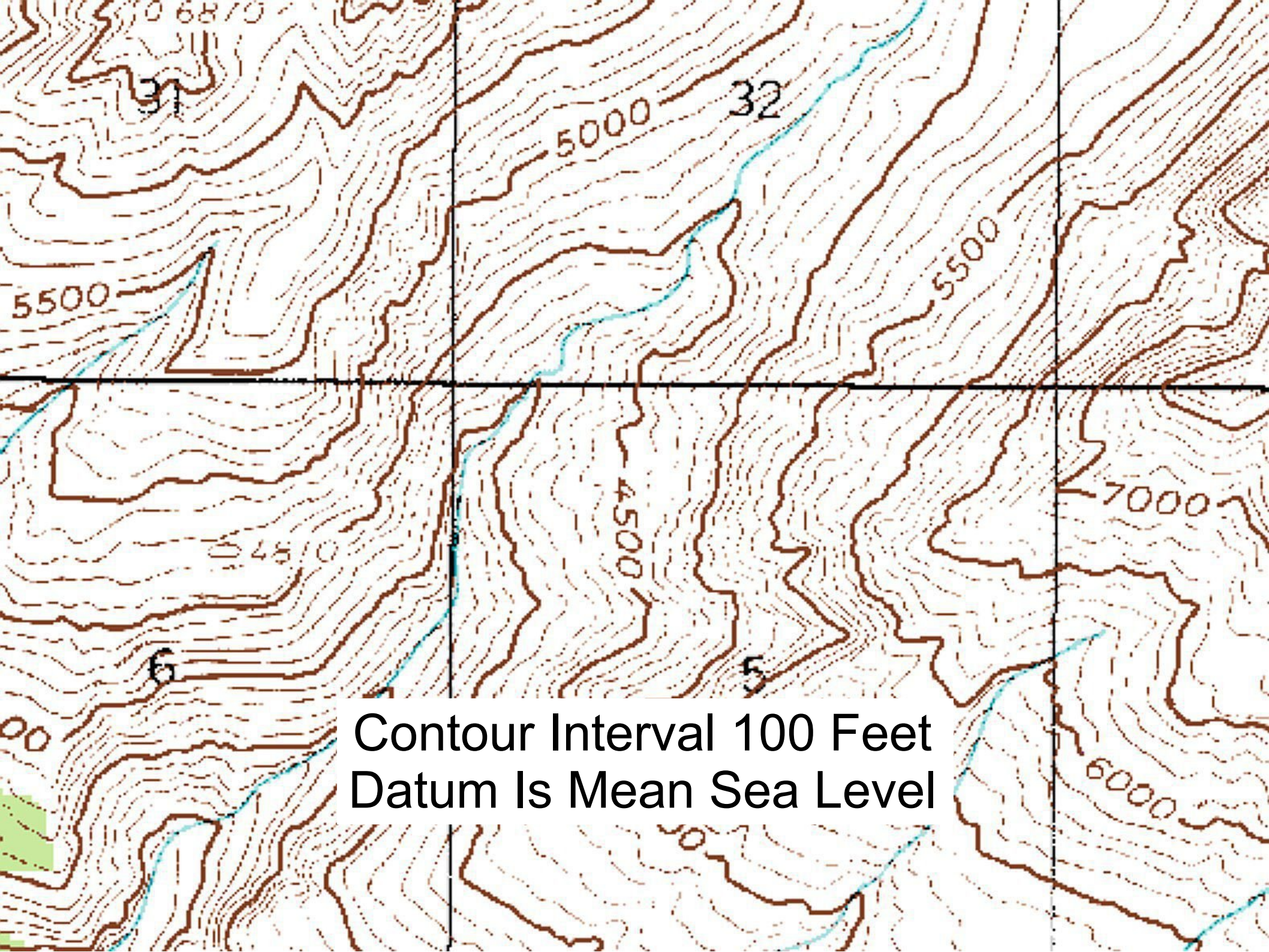


# Depression



# Depressions





Contour Interval 100 Feet  
Datum Is Mean Sea Level



# Map Metadata

Produced by the United States Geological Survey  
in cooperation with Massachusetts Department of  
Public Works

Control by USGS, NOS/NOAA, and Commonwealth of  
Massachusetts agencies

Compiled by photogrammetric methods from aerial photograph  
taken 1980. Field checked 1981. Map edited 1988  
Supersedes Athol and Templeton 1:25,000-scale maps  
dated 1970

Projection and 1000-meter grid, zone 18

Universal Transverse Mercator

10,000-foot grid ticks based on Massachusetts coordinate system  
mainland zone

1927 North American Datum

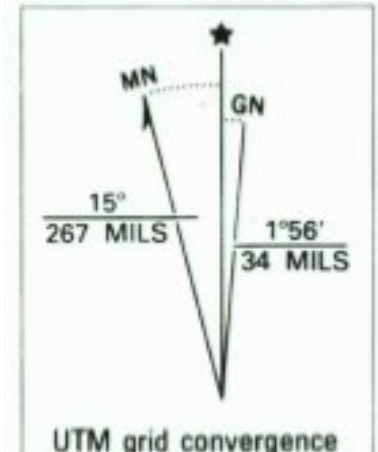
To place on the predicted North American Datum 1983,

move the projection lines 5 meters south and

39 meters west as shown by dashed corner ticks

There may be private inholdings within  
the National or State reservations shown

DECLINATION DIAGRAM



U.S. National Grid

100,000-m Square ID

YN

Grid Zone Designation

18T

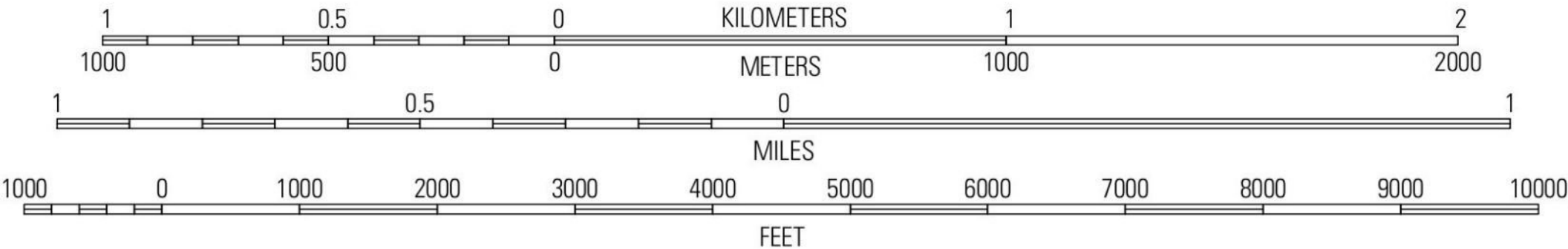
magnetic  
(N)  
approximate

Field Checked 1981

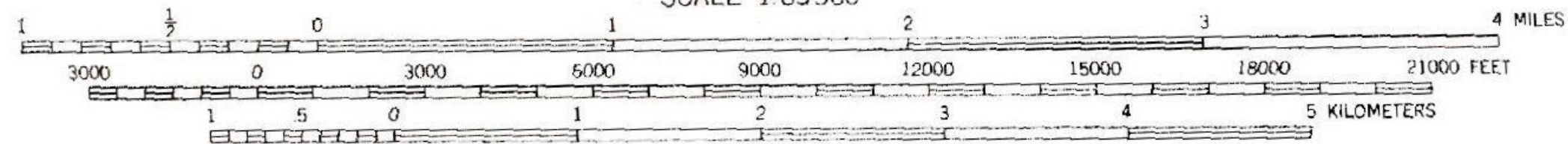
North American Datum, 1927

# Map Scales and Distance

**SCALE 1:24 000**



**SCALE 1:63 360**



**CONTOUR INTERVAL 100 FEET**

DATUM IS MEAN SEA LEVEL

DEPTH CURVES AND SOUNDINGS IN FEET—DATUM IS MEAN LOWER LOW WATER

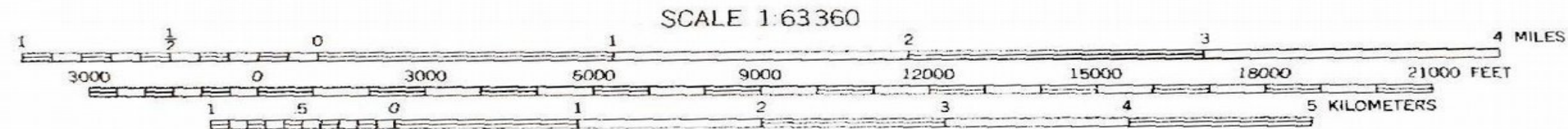
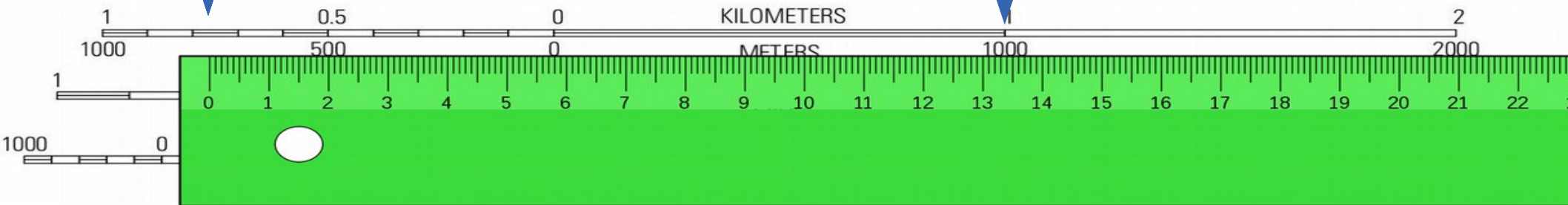
SHORELINE SHOWN REPRESENTS THE APPROXIMATE LINE OF MEAN HIGH WATER

THE AVERAGE RANGE OF TIDE IS APPROXIMATELY 8 FEET

# Map Scales and Distance

13.5 mm on ruler  
1,780m

SCALE 1:24 000



CONTOUR INTERVAL 100 FEET

DATUM IS MEAN SEA LEVEL

DEPTH CURVES AND SOUNDINGS IN FEET-DATUM IS MEAN LOWER LOW WATER

SHORELINE SHOWN REPRESENTS THE APPROXIMATE LINE OF MEAN HIGH WATER

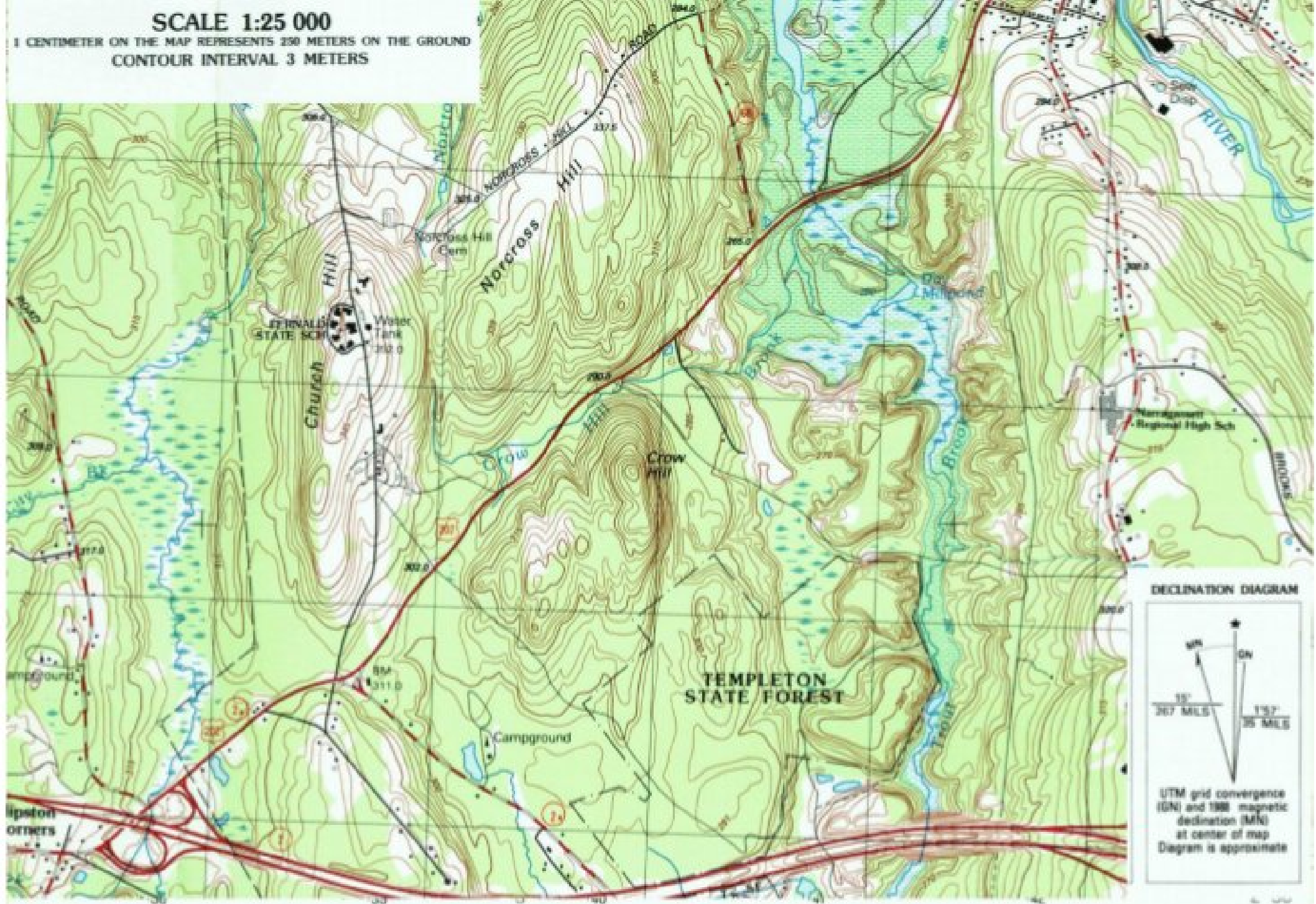
THE AVERAGE RANGE OF TIDE IS APPROXIMATELY 8 FEET

# Measuring Distances on a Map

- Straight Line
- Curved Lines (lay out string on curve, pull straight and transfer to scale)

**SCALE 1:25 000**

1 CENTIMETER ON THE MAP REPRESENTS 250 METERS ON THE GROUND  
CONTOUR INTERVAL 3 METERS



**DECLINATION DIAGRAM**

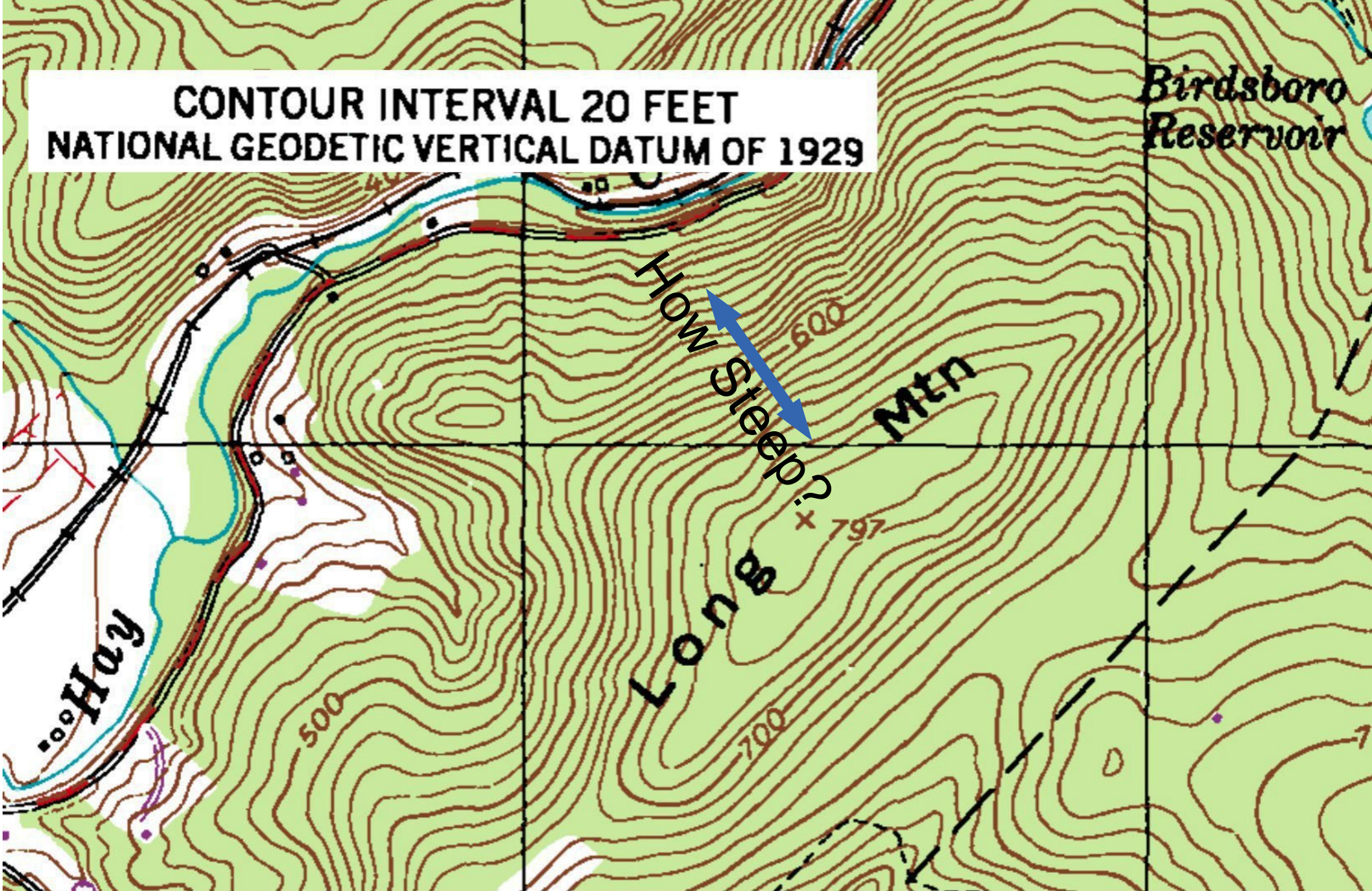


UTM grid convergence (GN) and 1988 magnetic declination (MN) at center of map  
Diagram is approximate



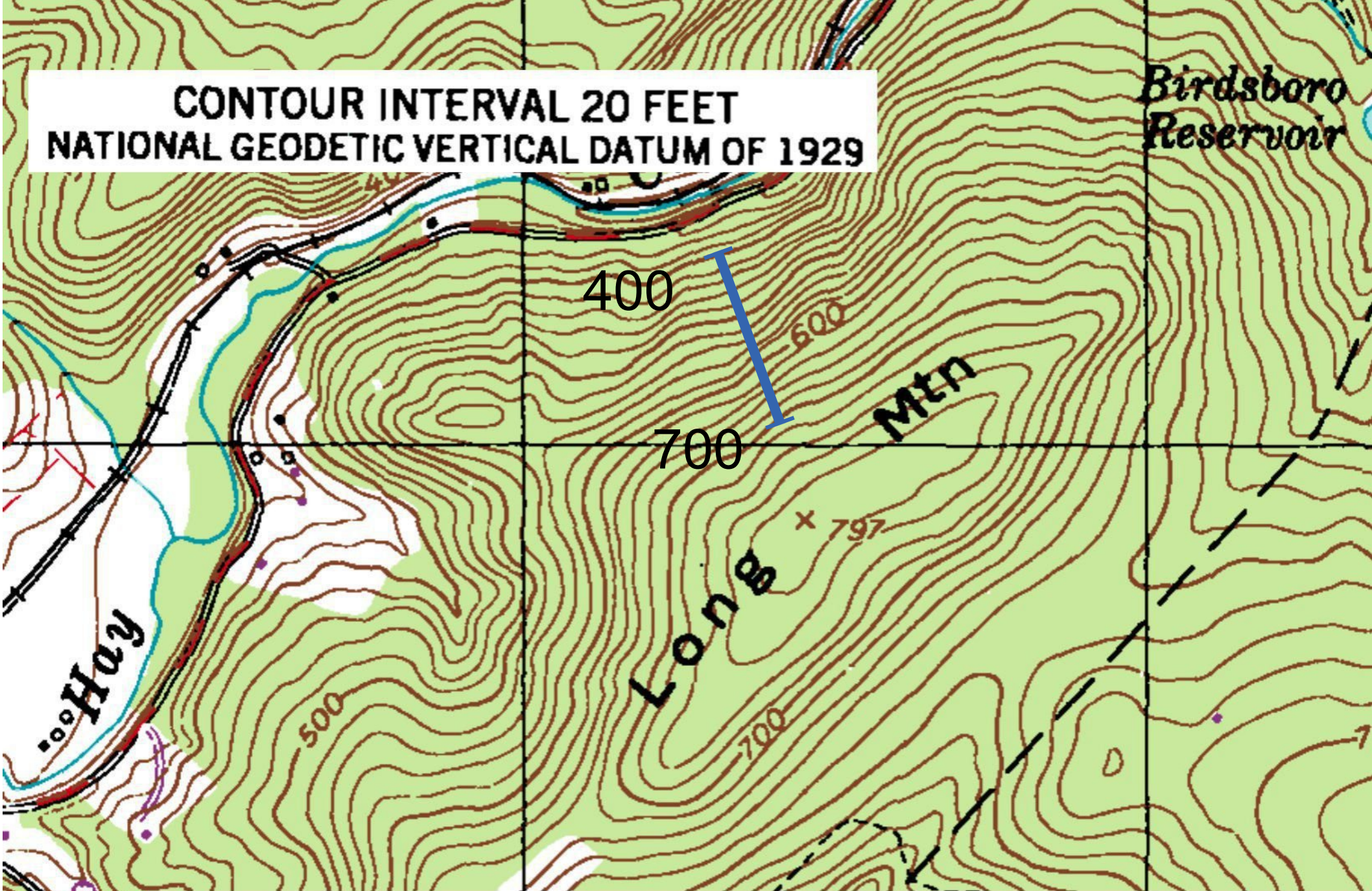
CONTOUR INTERVAL 20 FEET  
NATIONAL GEODETIC VERTICAL DATUM OF 1929

Birdsboro  
Reservoir



**CONTOUR INTERVAL 20 FEET  
NATIONAL GEODETIC VERTICAL DATUM OF 1929**

*Birdsboro  
Reservoir*



400

700

600

Men

x 797

Long

700

Hay

500

1000

0

1000

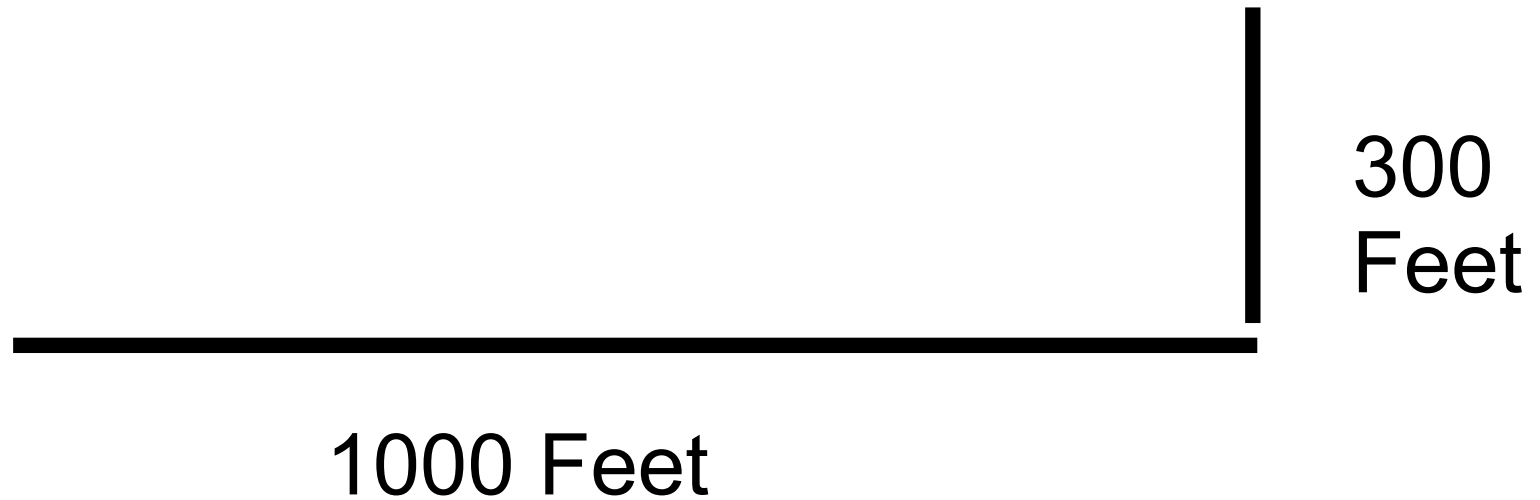
2000

3000

4000

5000

FEET

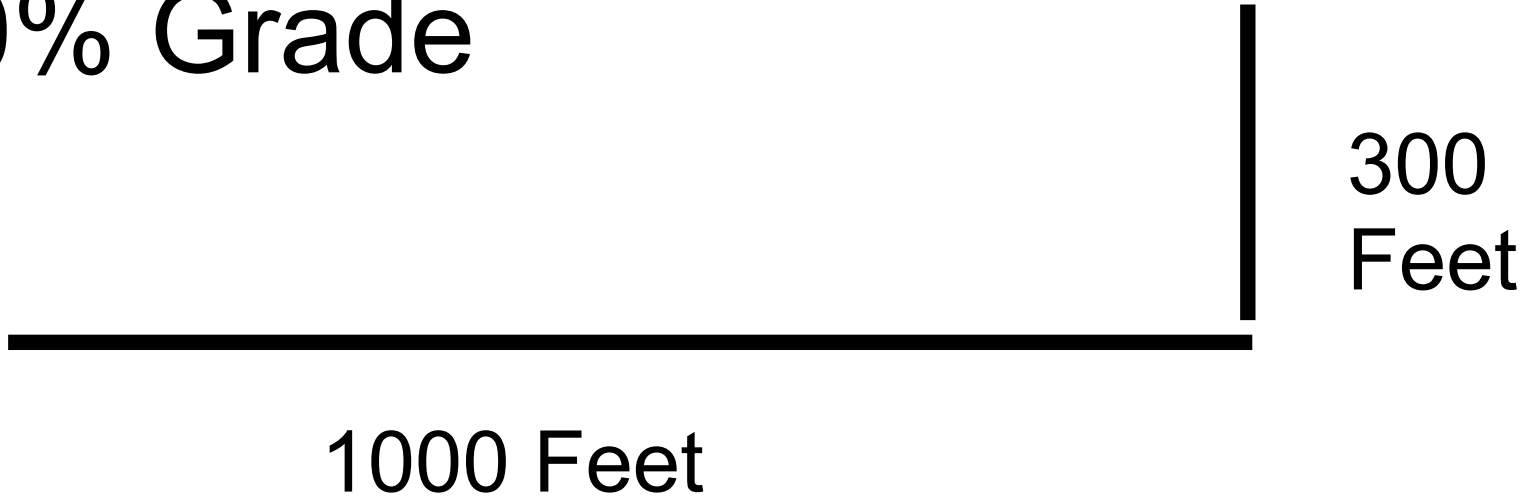


Grade: 3 in 10 = 30%

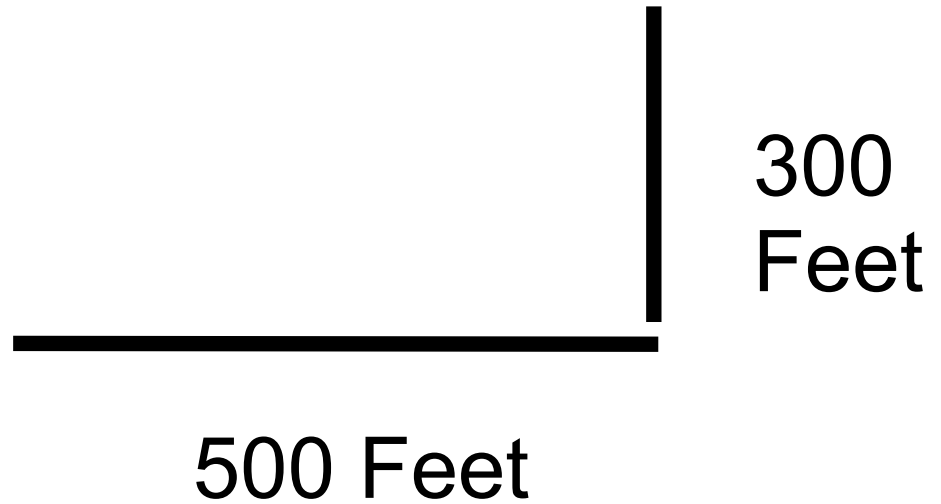
$(\text{Rise/Run}) * 100\%$

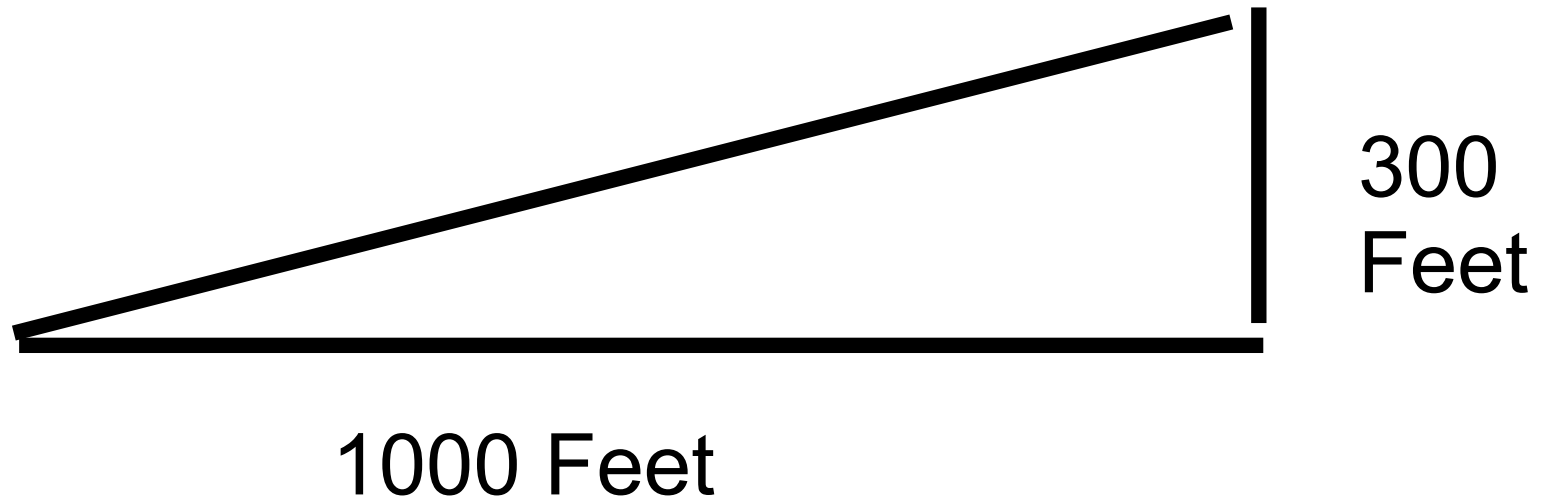


# 30% Grade



# 60% Grade





Grade: 3 in 10 = 30% = 17°

arc tan (rise/run)

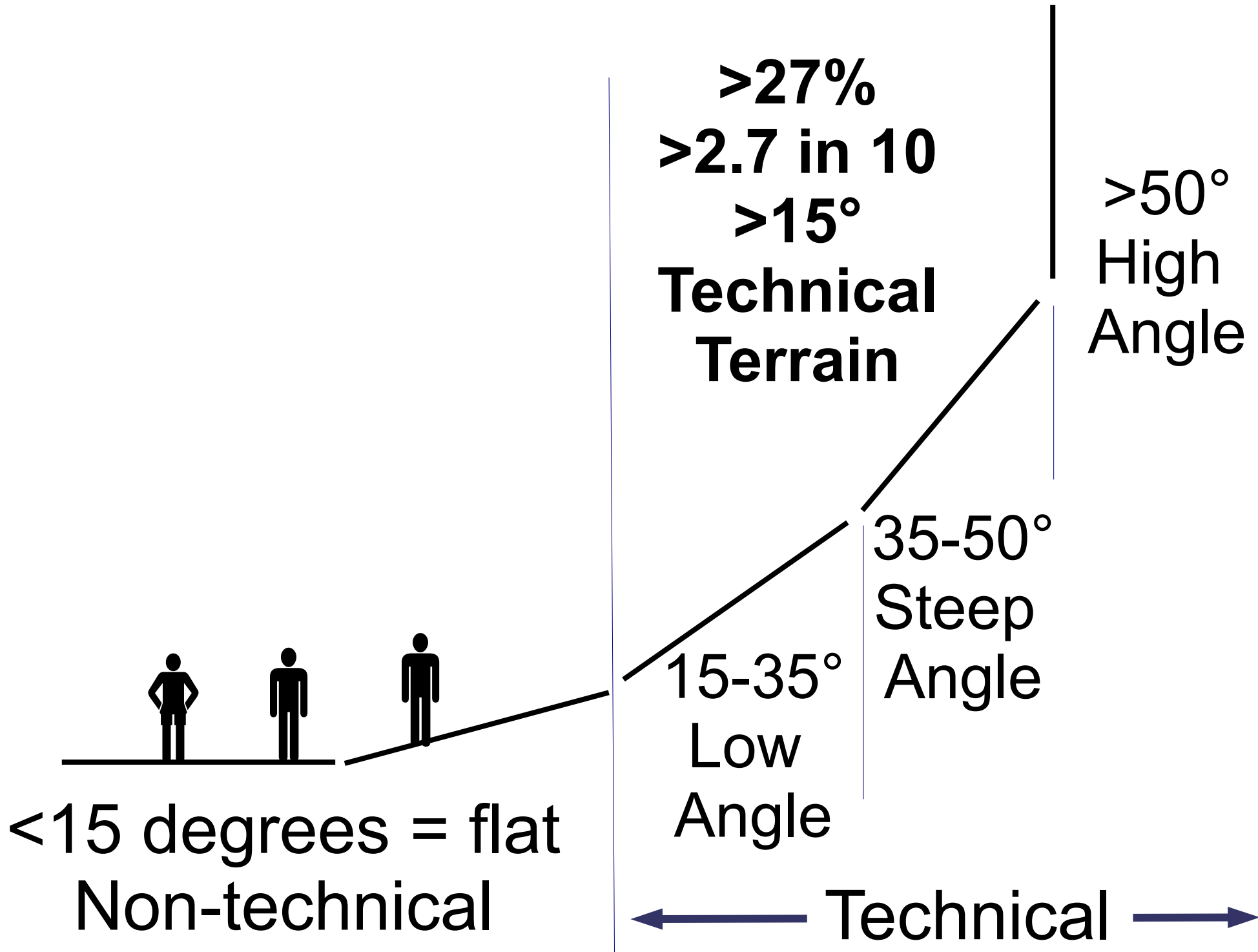
# Slopes

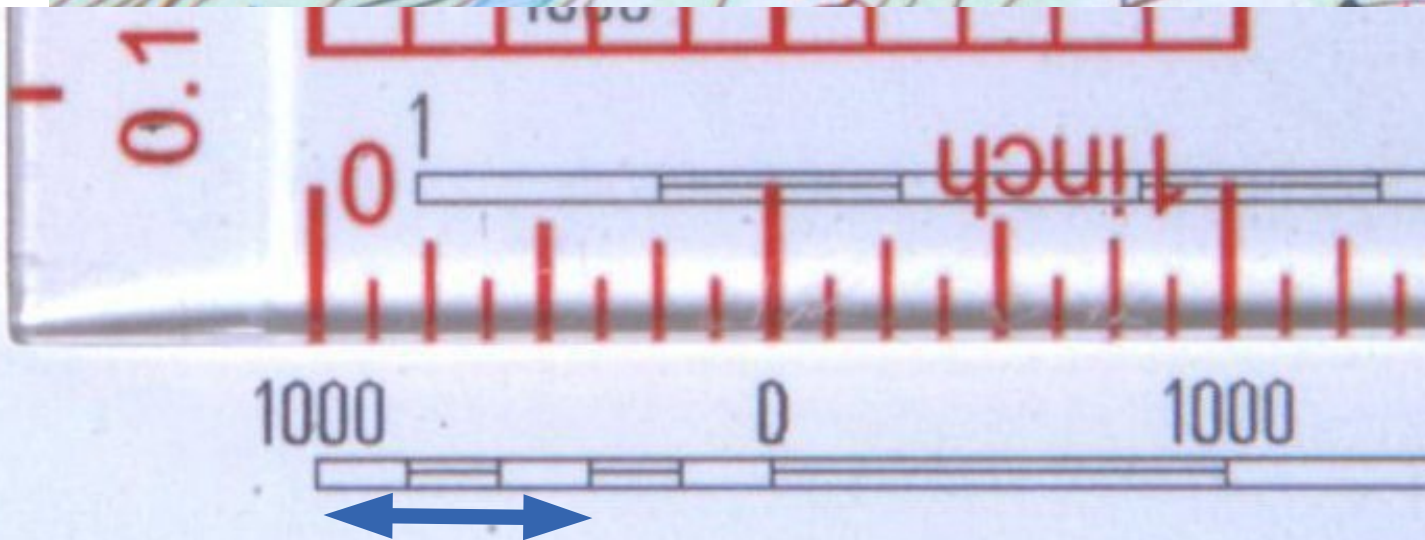
- High Angle
  - Weight is supported by a rope
- Low Angle
  - Weight is supported by the ground
  - Use rope for an assist
- Non-Technical
  - May use rope for an assist



Top Image: Public Domain, Glacier National Park, NPS  
Image by: Jacob W. Frank, 2016/NPS.

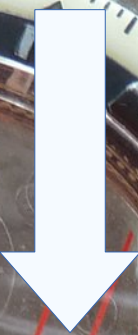
Bottom image: © 2009 CC Attribution Share Alike Some rights reserved by AusAID: Department of Foreign Affairs and Trade. Members of the Namuka village (Fiji) disaster management committee in an exercise.



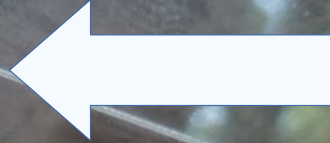


50 foot rise, 600 foot run

Ignore the Magnetic Needle



Read the slope angle here.



Sight on a target uphill.

# Estimating Area

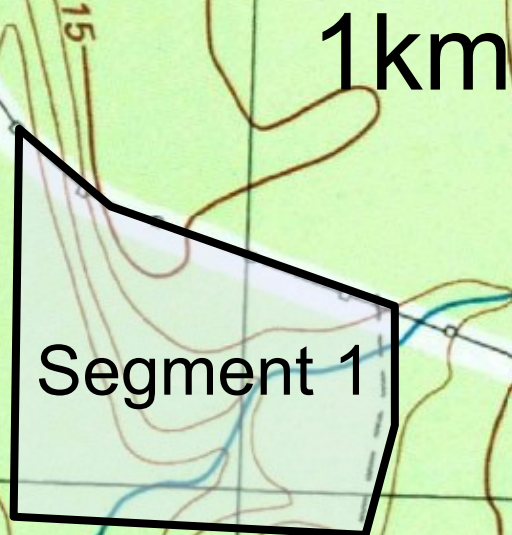
- 100m by 100m about 2.5 acres
- 500m by 300m about 40 acres
- 500m by 500m about 60 acres
- 500m by 1km about 120 acres

1km

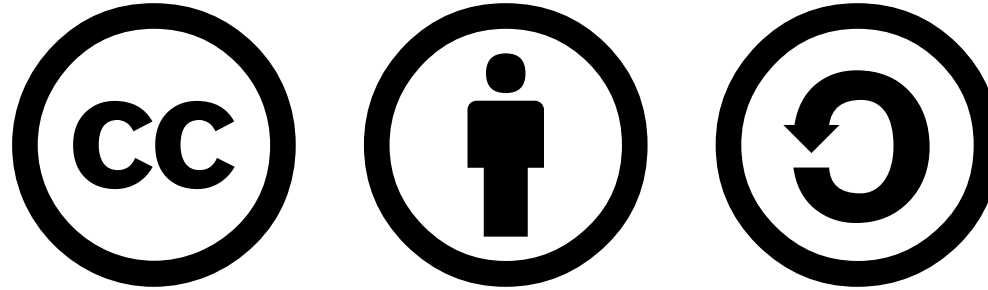


# Estimating Area

- **500m by 300m about 40 acres**
- **500m by 500m about 60 acres**
- **500m by 1km about 120 acres**







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