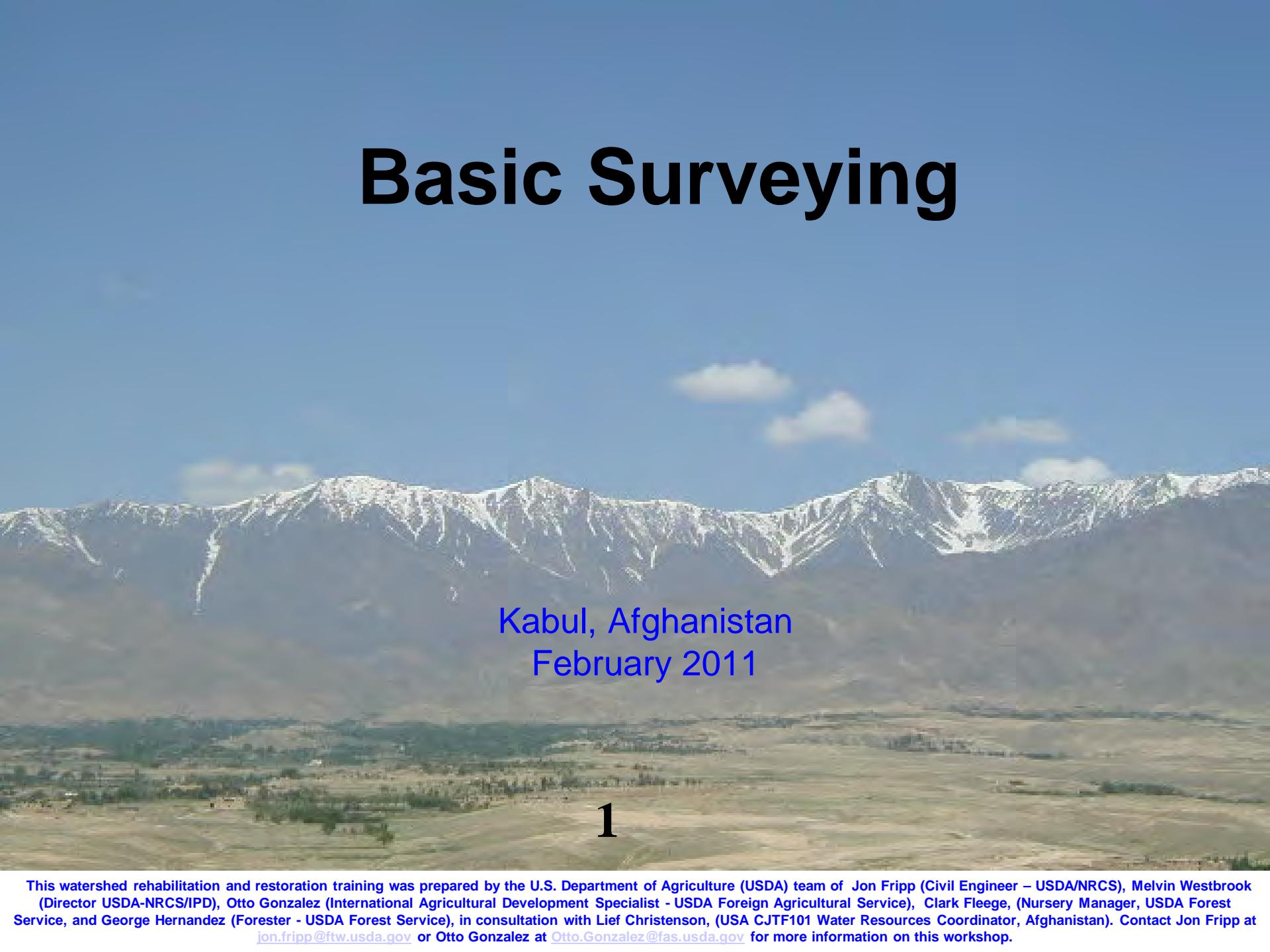


# Basic Surveying



Kabul, Afghanistan  
February 2011

1

# Basic Surveying

## Module Topics:

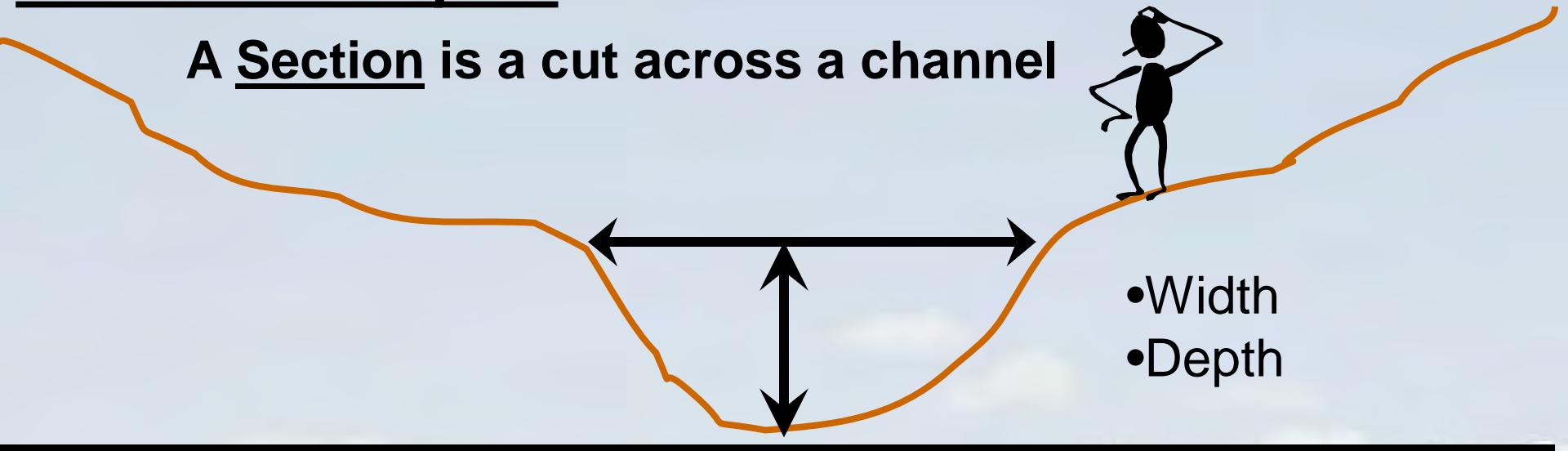
- Reading a plan
- Using a hand level
- Measuring vertical distance
- Measuring a slope
- Establishing a level contour
- Measuring a cross section
- Basic project site survey *– putting the pieces together*



*These skills are used for assessment  
as well as design and construction*

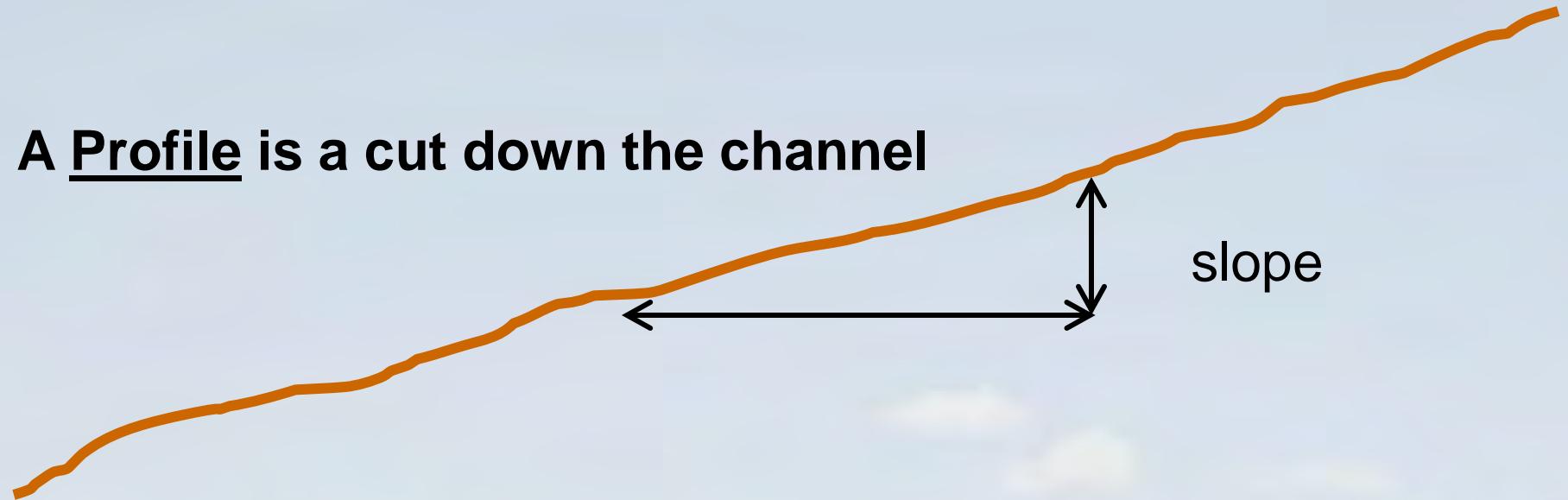
# How to read a plan

A Section is a cut across a channel



# How to read a plan

A Profile is a cut down the channel



# Basic Surveying Tools

Many soil conservation practices require basic measurements of a site. Surveys can be complicated but approximations can be accomplished with a minimum of effort and tools.

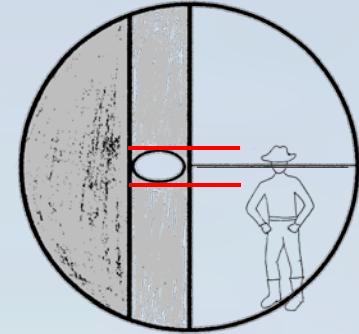
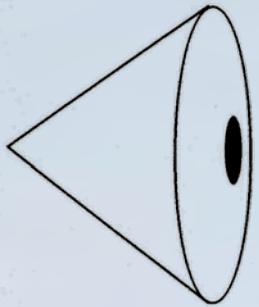
- Tape
- Hand level
- Pocket rod
- Compass/GPS
- Notebook
- Field pack



# How to use a hand level



- Look through hand level
- Be sure the bubble is up.



- Align the bubble between the cross wires
- The middle wire is at the same level as your eye



- Use two hands
- Hold the tube with finger tips
- Brace elbows to chest
- Stand up straight



Don't bend over



15 10:46

Don't hold it with one hand



15 10:46PM

Straight  
Back

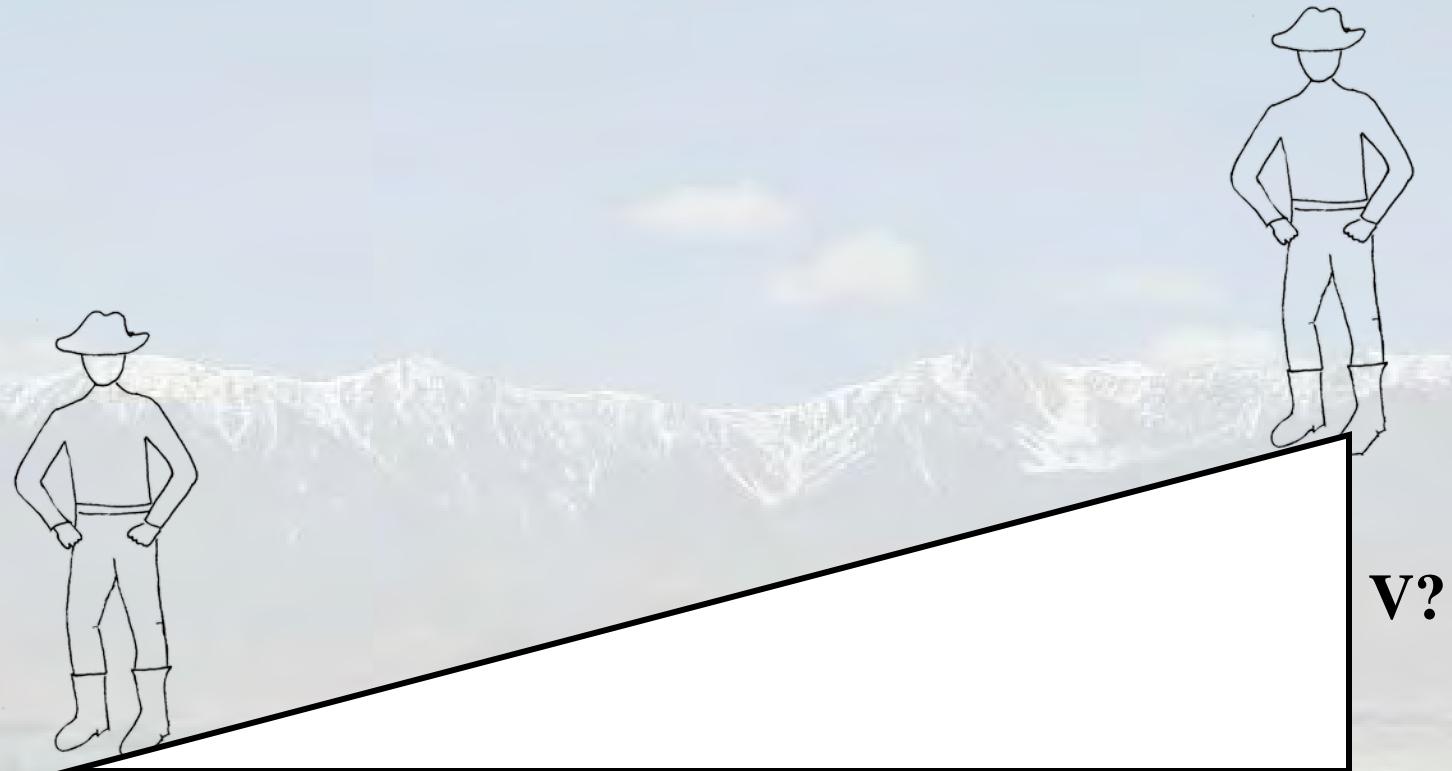


Elbows on chest

Two Hands  
Finger tips

15 1:58AM

# How to measure a vertical distance



# How to measure a vertical distance

- Measure the height of the eye of the person with the hand level
- Identify the height of survey rod at the point of interest
- The difference between these values is the difference in elevation between where the person is standing and the location of the survey rod



# How to measure a vertical distance

If you do not have a tape or a rod....

- Find where the eye of the person with the hand level will line up on his/her partner
- Mark that spot of his shirt

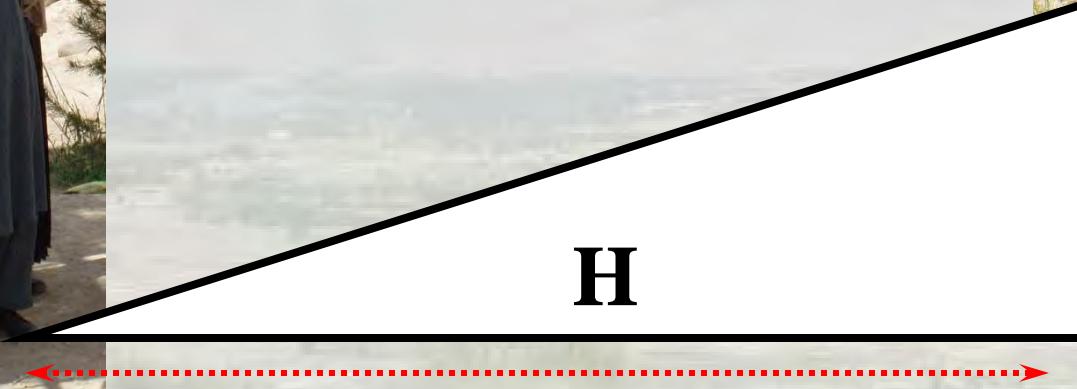


- The distance from that spot to where the person with the hand level sees is the distance that one without the level is above or below the person with the level

# How to Determine a Slope

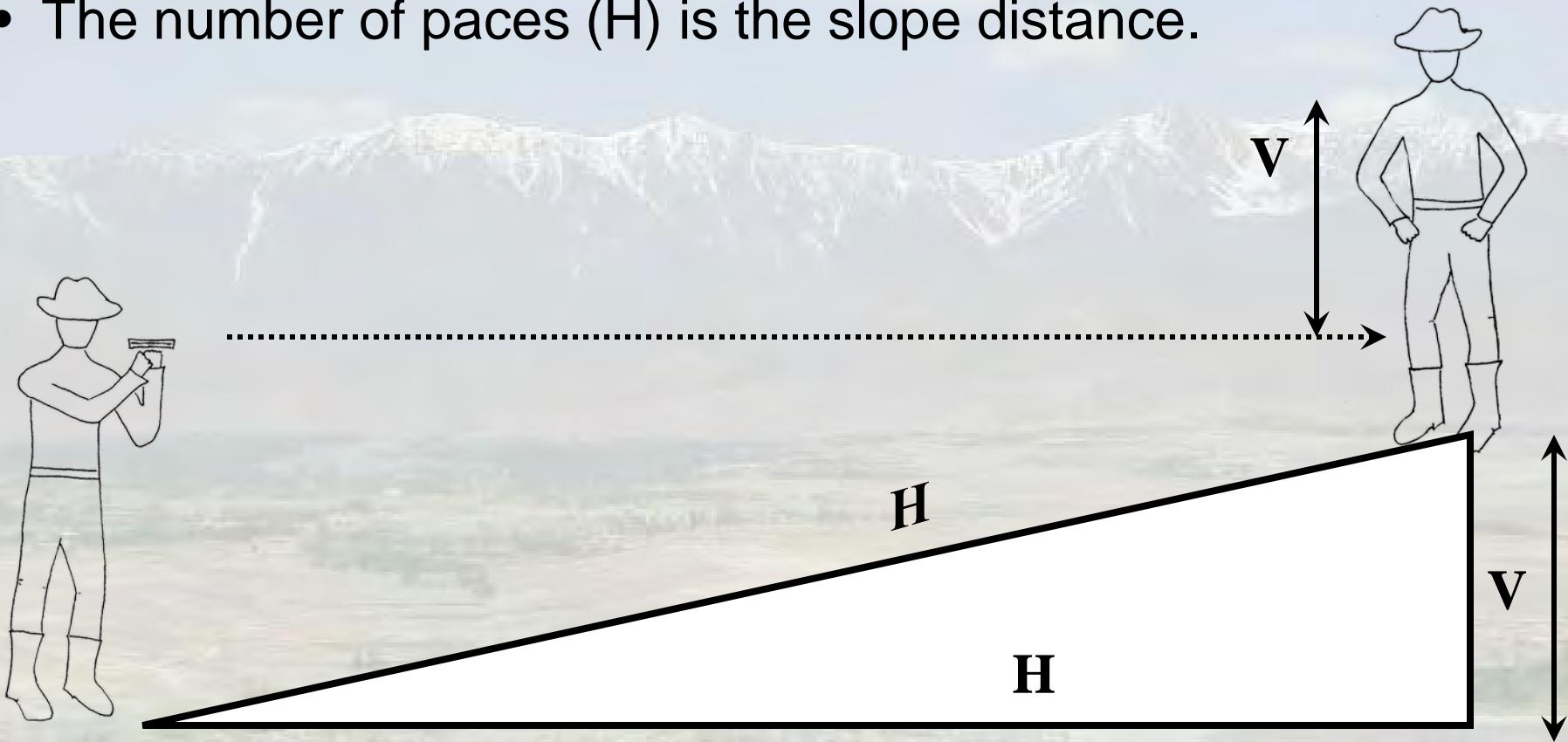
The assessment of many conditions as well as the design of many rehabilitation techniques depends on the slope of the ground. These slopes are often expressed as a ratio of a horizontal measurement to a vertical measurement (V:H).

Measure the V as before  
Measure the H with a survey tape



# If you do not have a tape or a rod

- A typical pace is the same distance from the eyes to the knee. This is considered to be one increment of vertical (V) measurement.
- The second man stands beside the first man and paces up hill along the slope line until this ‘fixed’ point is aligned with the middle wire.
- The number of paces (H) is the slope distance.



# How To Set A Level Contour

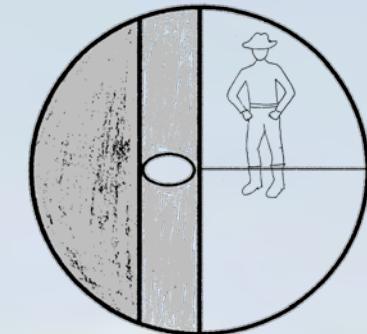
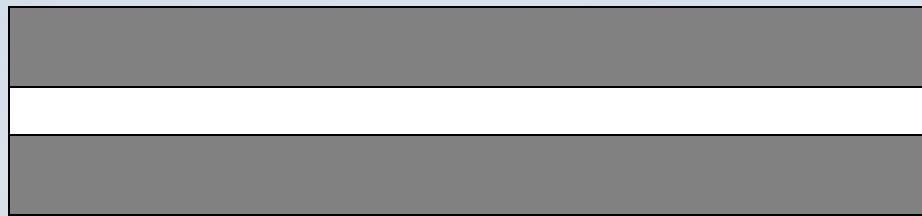
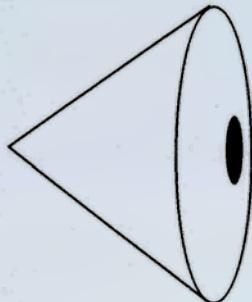
- Needed for assessment
- Design of terraces and hillside ditches
- And...

## Need

- Hand level
- Two people

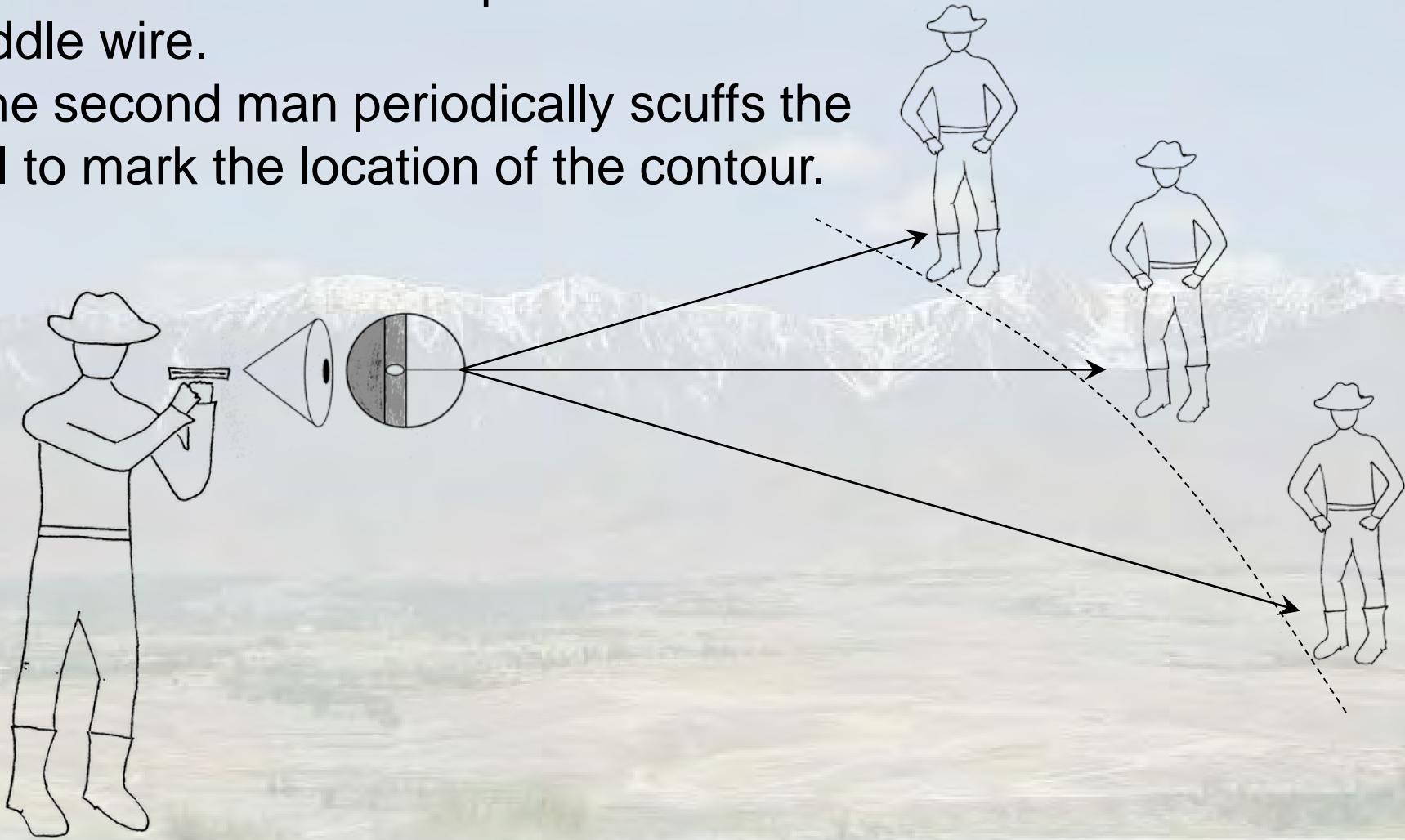


# Set a contour up a hill



- The hand level is held up to one eye so that the bubble is aligned between the cross wires.
- The second man stands up hill to where the contour is to be determined. The first man must be able to see some portion of his body (for example: the top of his boot) through the hand level.
- This point is mentally ‘marked’.

- The second man slowly walks along the approximate contour.
- The first man tells him to walk up or down slope depending on the relative location of the ‘marked’ point to the middle wire.
- The second man periodically scuffs the soil to mark the location of the contour.



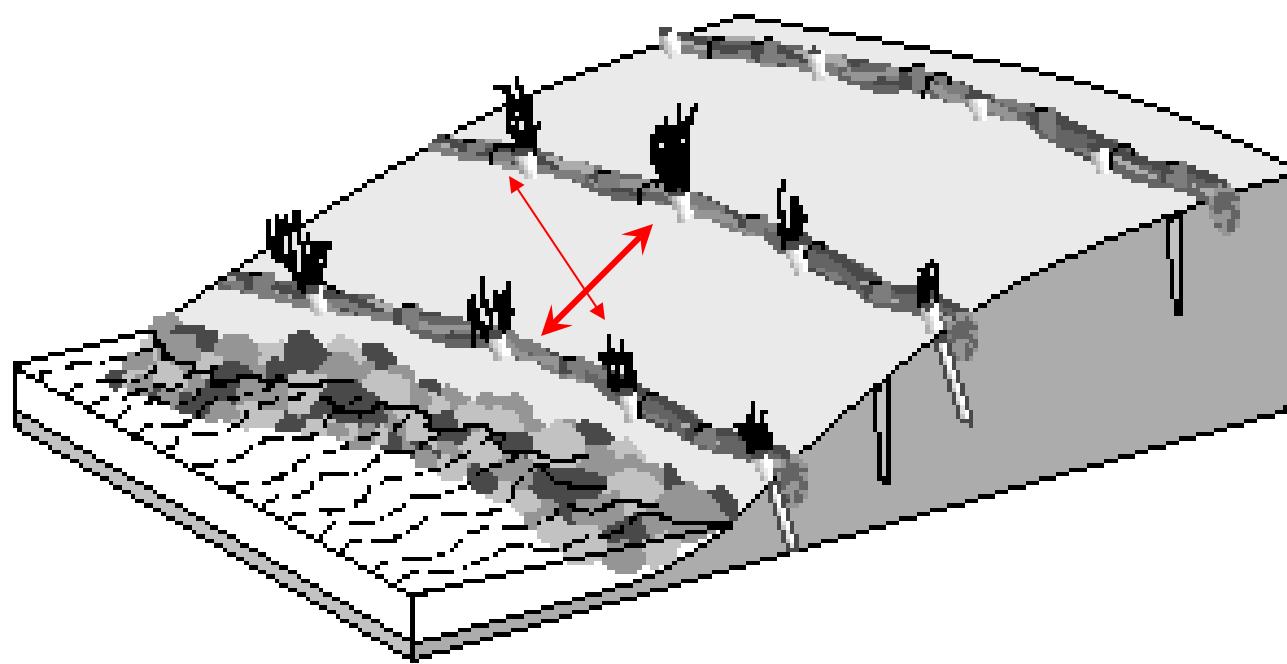
We can check if an existing terrace is flat in the same manner

1. Have one man stand on the terrace
2. The man with the level locates a spot on the terrace man
3. The man on the terrace walks slowly along the terrace
4. If the man with the hand level sees the spot go up or down, he knows the terrace is not flat



# How to determine the steepness of a slope

- The assessment and design for many restoration techniques are based on the slope of the ground.
- The slope is defined along a line that is perpendicular to a contour.



# How to determine a perpendicular line

- The first man stands with his heels aligned to the contour.
- The first man stretches his arms straight out from the sides and aligns his hands to that they are along the contour.



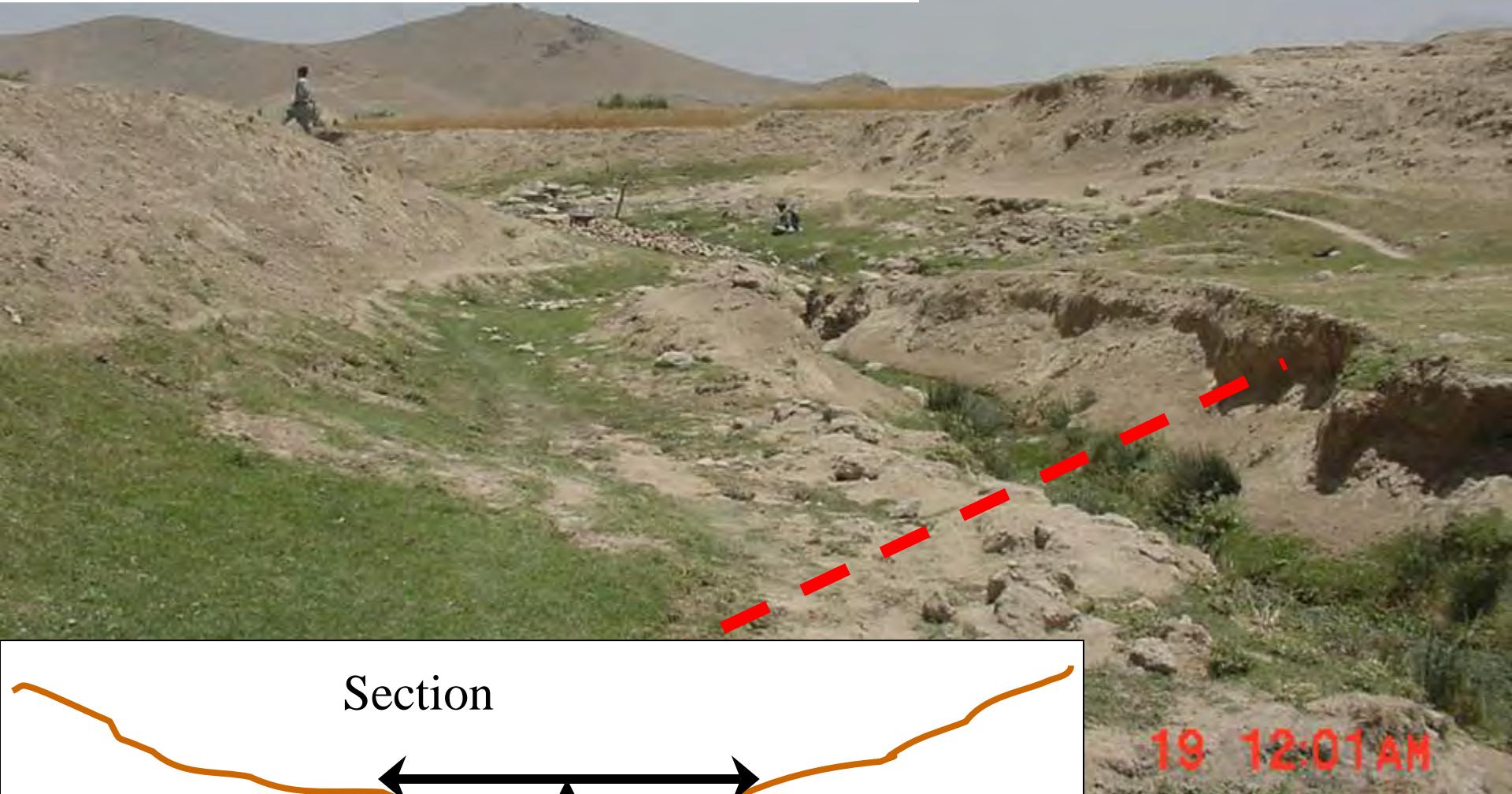
- The first man closes his eyes.
- While keeping his arms straight, the first man brings his hands together in front of him in a clapping motion by swinging his arms over his head.
- The first man opens his eyes and directs the second man to where his hands are pointing.
- Now measure the slope between the two as before



# How to measure a section

Used to assess a site

Used for design and construction



# To do this, we need to set up a level string

- Line level
- Stake
- String



When bubble is between lines, it is level

Drive a stake  
on one side



Drive the stake on  
the other side



- Tie String to Stake
- Attach line level
- Adjust string to achieve level



- Keep the string tight
- Do not let it sag



11 4:55AM



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Tie other end of  
string when level

Then measure from the string

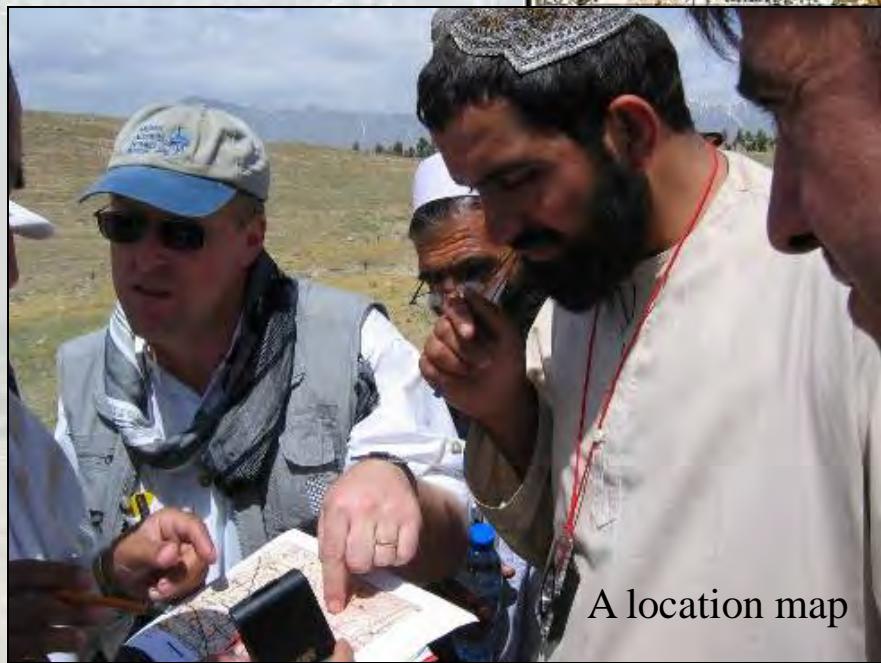
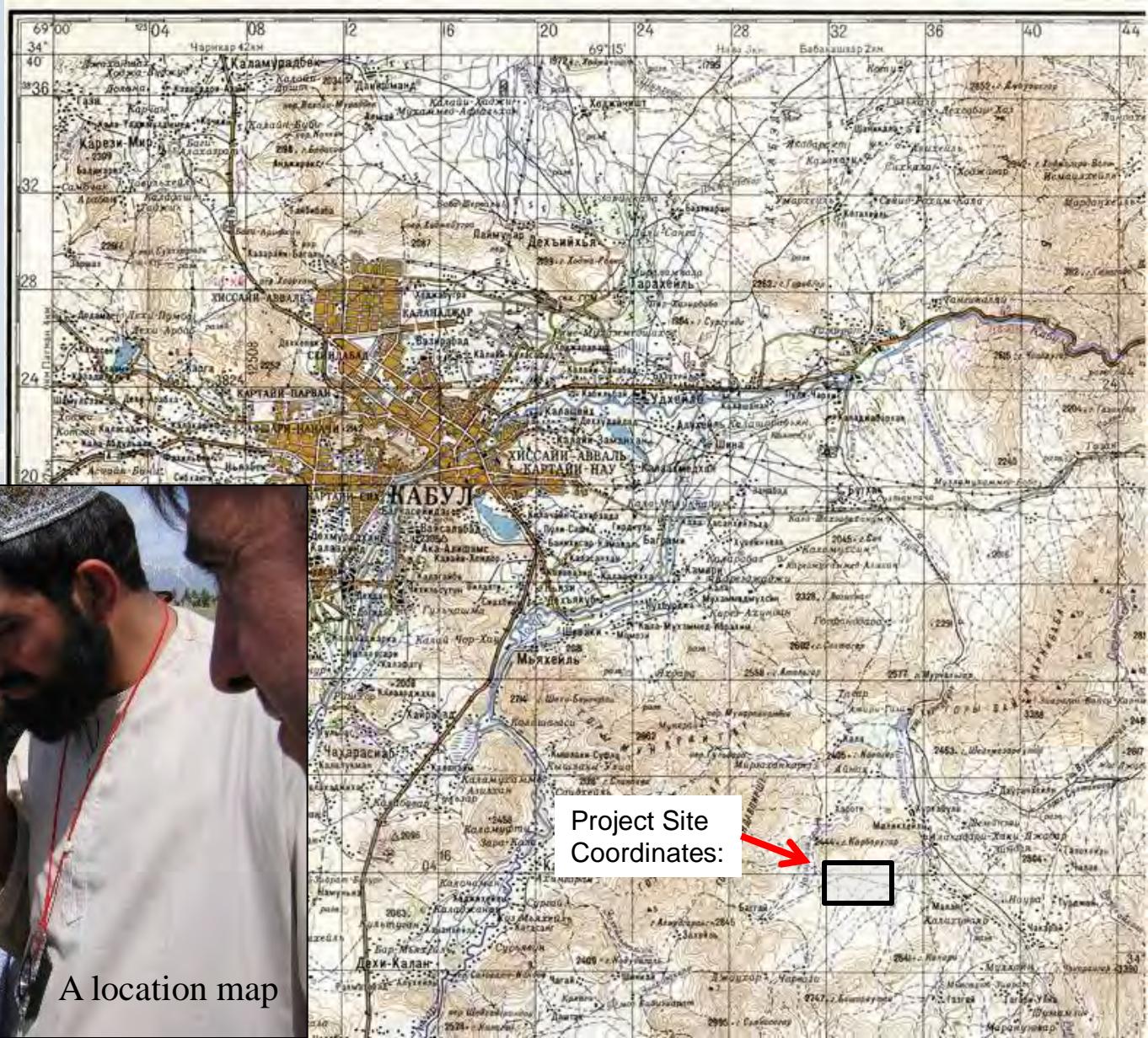


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# Basic Project Survey

Locate Project on a Large Scale Map

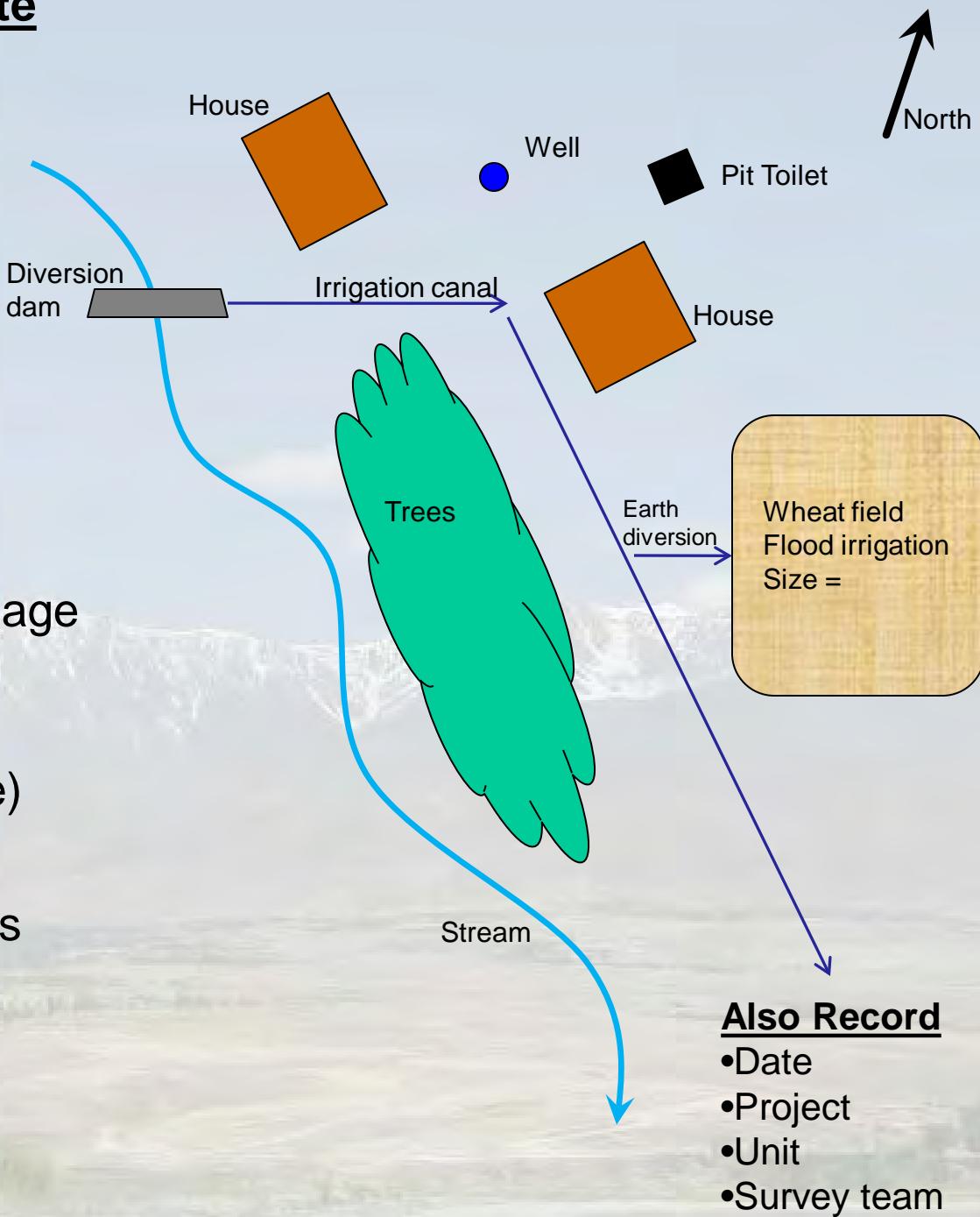
- GPS
- Compass



A location map

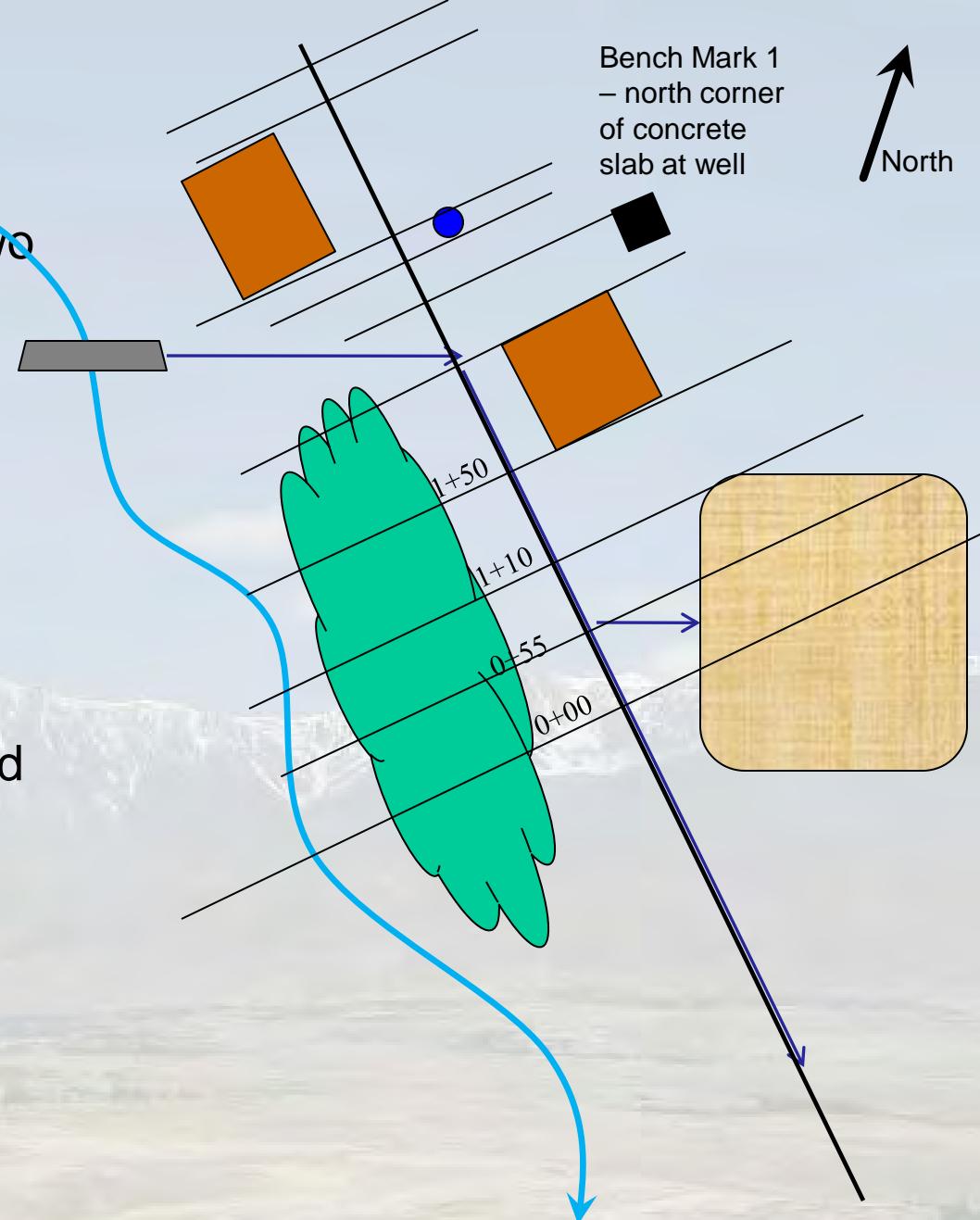
## Draw a Specific Map of the Site

- Locate the site
- Location of test pits
- Water lines/Power lines
- Wells
- North Arrow
- Wetlands
- Trees
- Streams/Rivers
- Drainage Ditches, note drainage direction
- Slope of land (use arrows to indicate direction of drainage)
- Relative elevations
- Location and size of buildings
- Sewage source
- Location of roads
- Any evidence of flooding



## Survey the site

- Establish a base line on some central feature
- Determine and locate at least two project bench marks
- Measure perpendicular to the base line
- Record the distance up the baseline of each offset
- Locate features based on the baseline and offset
- Measure elevation of ground and features
- Record section of channels
- Record slope of channels
- Record condition and size of structures



# Sample survey sheet

| Station | HI    | FS  | BS  | Elev  | Description  |
|---------|-------|-----|-----|-------|--|
| 1       |       |     | 3.5 | 100.0 | TBM1, mark on NW bridge abutment                                 |
|         | 103.5 |     |     |       |  |
|         |       | 2.3 |     | 101.2 | pnt 1, NW floor of school  |
|         |       | 2.4 |     | 101.1 | pnt 2, SW floor of school  |
|         |       | 4.1 |     | 99.4  | Turning point 1, mark on well casing                             |
| 2       |       |     | 1.1 | 99.4  |  |
|         | 100.5 |     |     |       |  |
|         |       | 4.5 |     | 96.0  | Center of road, 0+00   |
|         |       | 5.4 |     | 95.1  | Center of road, 1+00   |
|         |       | 6.1 |     | 94.4  | Center of road, 2+00   |
|         |       | 0.6 |     | 99.9  | closes within 0.1' which is sufficient for recon survey purposes |



# Bottom line

Make lots of measurements

Take lots of notes

