

Non- Survey Grade GPS Guidance Document

- a. Background. Field tests with Differential (with beacon signal) Global Positioning System (DGPS) have shown that the accuracy of these systems is as good as or better than our current methods of measurements. DGPS units properly used by trained personnel can meet current NRCS spot checking tolerances for practice certification. Supervisors shall ensure employees/individuals have sufficient training and competency using the DGPS system in collecting waypoints, measuring lengths, and measuring areas before using equipment for practice certification as per job approval authority. When collecting waypoints, it is recommended to use point averaging for a minimum of one minute to increase the accuracy of measurement.
- b. Non-survey grade GPS without differential correction (hand held unit only) shall not be used for design, layout or construction survey. They shall not be used for measurement of areas or length required for practice certification.
- c. Area Measurements. DGPS can be used to measure any area for practice certification provided the accuracy level calculated by the DGPS unit is 12 feet or less.
- d. Length Measurements. DGPS can be used to measure length for practice certification on slopes less than 15% provided the accuracy level calculated by the DGPS unit is 12 feet or less.

Measurement with DGPS shall not be used when the total length of the measured practice is less than 250 feet. Use another approved method for these practice measurements.

If slopes exceed 15% for a portion of the measurement, those segments exceeding 15% slope must be measured by another approved method or adjusted by using an appropriated slope adjustment factor as shown below (see example).

$$SlopeAdjustmentFactor = \sqrt{\left(\frac{\%slope}{100}\right)^2 + 1.0}$$

% Slope	Slope Adjustment Factor
15	1.011
16	1.013
17	1.014
18	1.016
19	1.018
20	1.02
21	1.022
22	1.024

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23	1.026
24	1.028
25	1.031
26	1.033
27	1.036
28	1.038
29	1.041
30	1.044
35	1.059
40	1.077
45	1.097
50	1.118

Example:

Pipeline planned downhill

Start of Pipeline – Elevation 8000 feet

End of Pipeline – Elevation 7500 feet.

Distance measured with DGPS = 2000 feet

$$\% \text{ Slope} = \frac{8000 - 7500}{2000}(100) = 25\%$$

Slope Adjustment Factor = 1.031

Actual Length of Pipeline = 2000 x 1.031 = 2062 feet.

- e. Vertical Measurements. DGPS will not be used for vertical measurement for all practices requiring accurate elevation. For practices where a vertical error of twice the horizontal error (2x12ft= 24ft) is acceptable, the derived elevation may be used if appropriate steps are taken in the design process. For example, elevation may be used for the design of a livestock pipeline that would have normally been designed from of a topographic map, as long as the minimum pressure supplied to all locations is greater than 24 ft.
- f. Documentation and use of DGPS Data for Practice Certification. All area and length measurements obtained with DGPS units for practice certification must be downloaded using DNRGarmin or other suitable software. Hard copies of the downloaded data shall be placed in the case file and/or an electronic version shall be kept in the Customer file folder in Toolkit. Lengths and area measurement shall be computed using appropriate CADD or GIS software (e.g. AutoCAD, TerraModel, ArcGIS, etc.).