



Memorandum

463 New Karner Road
Albany, NY 12205

ICarballo@awstruewind.com
Voice: 512-535-2322
Fax: 518-213-0045

TO: Sara Tyler, Shell Wind Energy
FROM: Vince Green, Modeling Specialist and Ignacio Carballo, Project Manager
DATE: October 23, 2009
RE: **Hermosa Viewshed Analysis**

Summary

AWS Truewind, LLC was requested by Shell to complete a viewshed analysis on a proposed turbine layout with a hub height of 80m and a rotor diameter of 101m. This analysis was run for a 10 mile buffer of the turbine layout and five key observation points (KOP) identified by Shell. Included in this memo are a map of the viewshed results for the entire area of interest, a map for each KOP, a table identifying the number of turbines visible at each KOP, and a brief description of methodology.

Background

As growth in wind energy development continues it has become increasingly important to assess the impacts of these developments on surrounding communities. Among the most significant of impacts may be a farm's visibility from any given point on the landscape. One method of quantifying visual impact is through viewshed analysis.

Viewshed analysis is a visual impact assessment tool performed in a Geographic Information System (GIS). It can be used to identify visibility between two features on the landscape or identifying exposure of one feature across the landscape. This analysis utilizes a digital elevation model (DEM) combined with a feature layer of observation points. Several variables may be applied to the calculation to control for the characteristics of the features in question. Figure 1 below illustrates each of these variables. Two offsets may be used to define the height of the features in the viewshed. Offset A (OF1) represents the height of the observer while Offset B (OF2) represents the height of the feature considered for visibility. The user can control both, horizontal and vertical scan with AZ1-2, and V1-2 respectively, while also defining the search distance with R1-2.

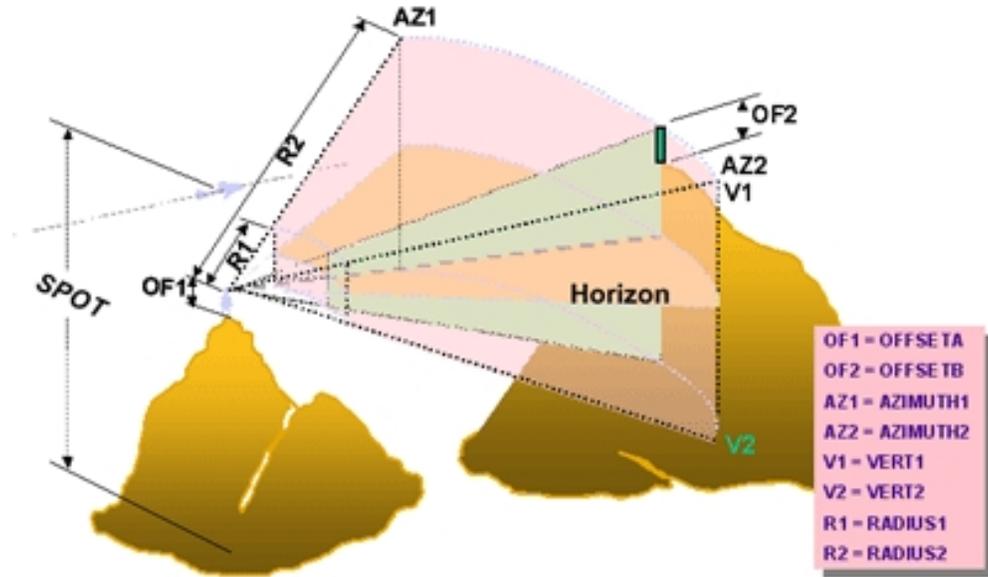


Figure 1. Source: ESRI, ArcGIS Help Files, "Performing a viewshed analysis", Version 9.3.1, 2009

When the appropriate parameters have been defined the model computes the visibility of the observation points for each pixel in the raster. It is important to note that this operation does not consider the obstruction of visibility due to vegetation. In order to evaluate the influence of vegetation the elevation model must be manipulated to account for the increased height of the vegetation. Vegetation was not considered in this analysis.

Methodology and Results

This viewshed analysis was run using the Spatial Analyst extension in ArcGIS 9.3.1. The scenario assumed a non-vegetated condition with a turbine structure height of 130.5m and an observer eye height of 1.5m. The turbine structure height of 130.5m assumes a hub height of 80m and a rotor radius of 50.5m (101m rotor diameter). Elevation data was provided by Shell at a resolution of 5m for the area immediately surrounding the proposed turbines, which was merged with 10m USGS National Elevation Data (NED) data. The 10m resolution data was resampled to 5m in order to retain the precision of the higher resolution data near the turbines. The following table lists the number of proposed turbines that would be visible from each KOP, assuming a non-vegetated landscape.

Key Observation Point (KOP)	ID	# of Turbines Visible
20-acre Ranchettes	1	219
Priority Residential Growth Area	2	200
Ames Monument	3	164
Fish Creek Ranch	4	99
Virginia Dale	5	48

Table 1. Key Observation Points and number of turbines visible.

A map showing the viewshed of the proposed turbine layout over the entire study area is shown in Figure 2. Maps showing each of the KOPs are provided in Figures 3-7.

The results of the viewshed analysis are a modeled simulation and assess a worst-case scenario without vegetative cover. This analysis does not account for obstructions due to vegetation or man-made structures. It is important to note that the above values in Table 1 represent the visibility at the center point of each KOP, assuming a generalized elevation dataset. The number of turbines visible at each point may vary based on local terrain character not captured by the elevation dataset, the presence of intervening vegetation, and atmospheric conditions that impact visibility distance.

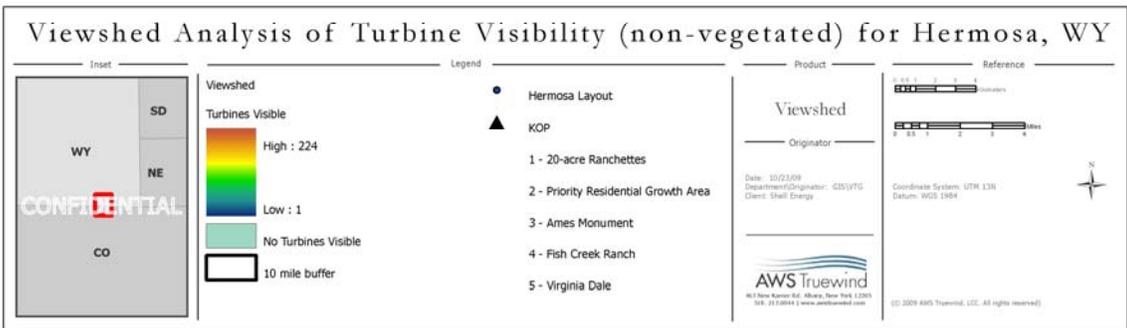
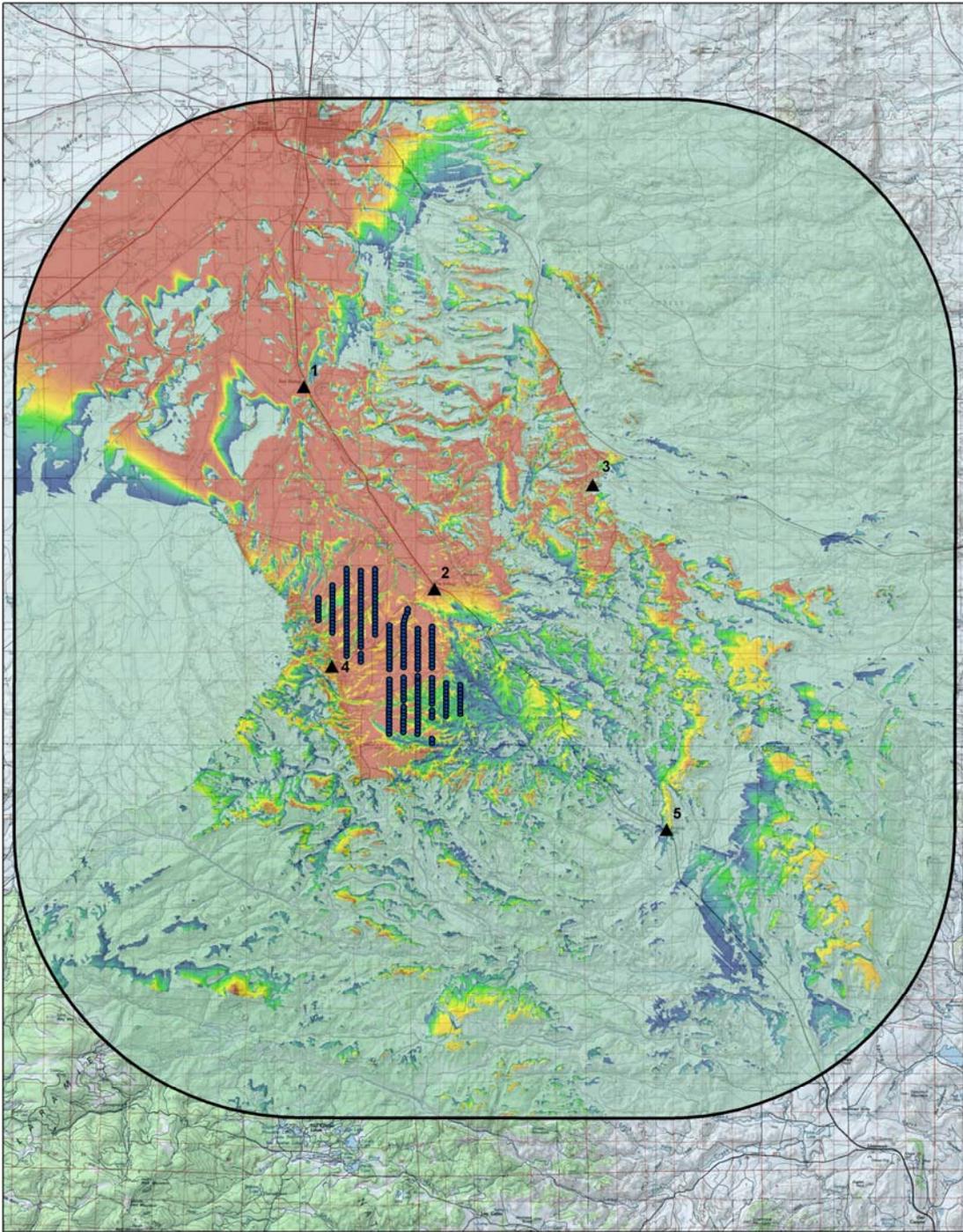


Figure 2. Viewshed of Hermosa Turbine Layout

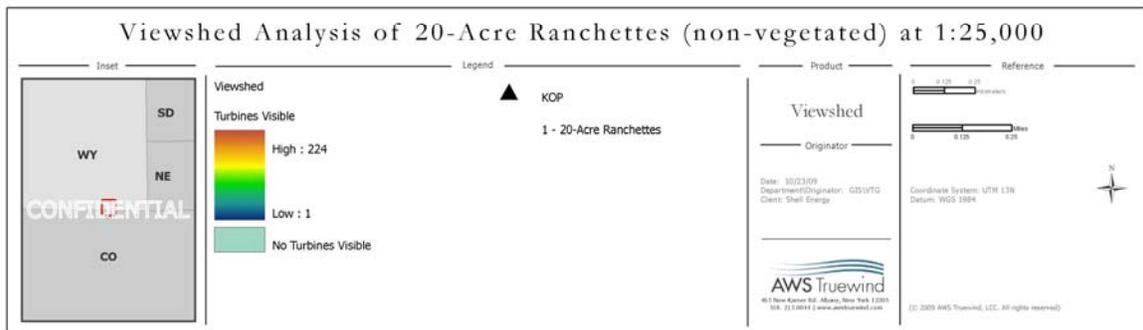
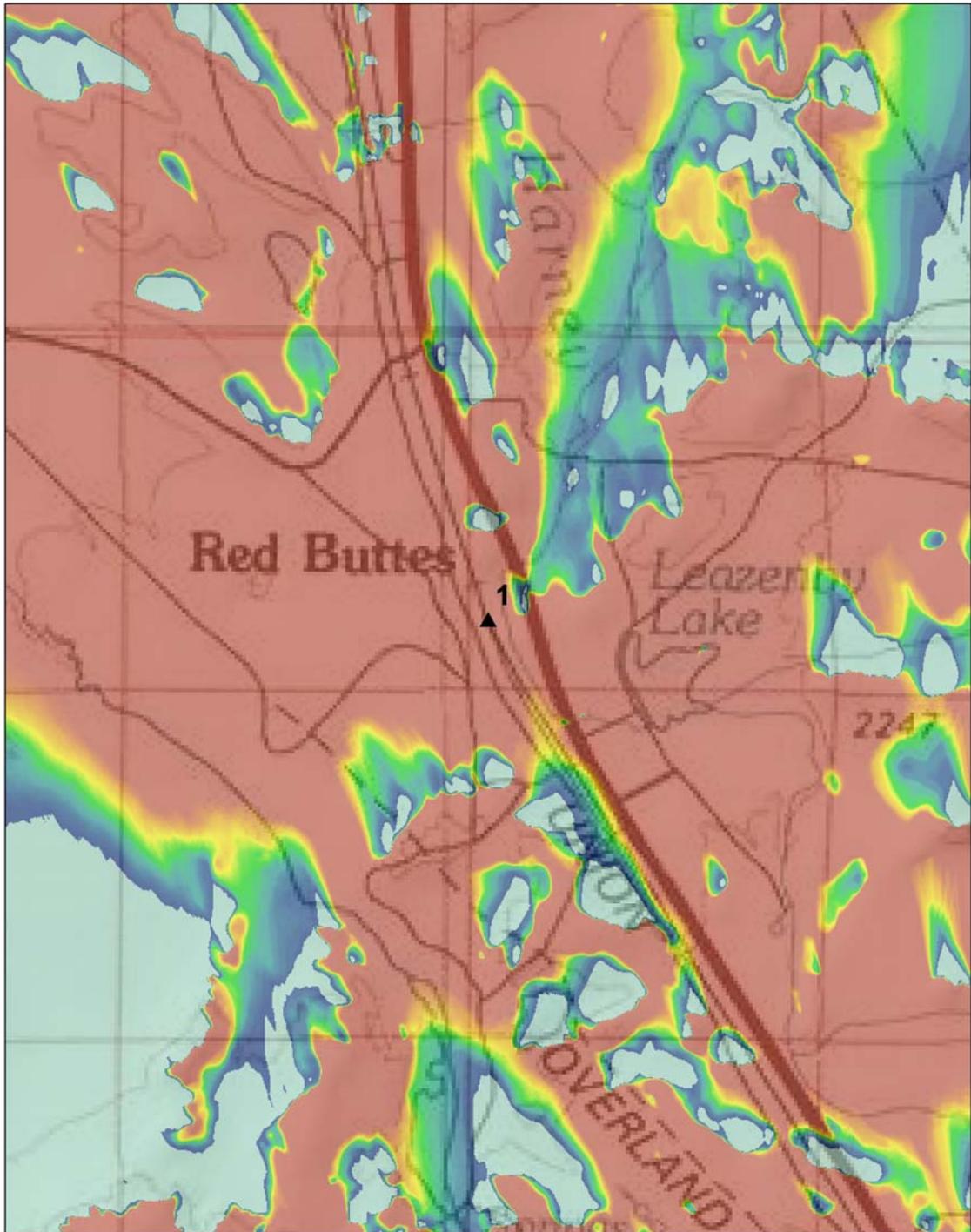


Figure 3. 20-Acre Ranchettes KOP

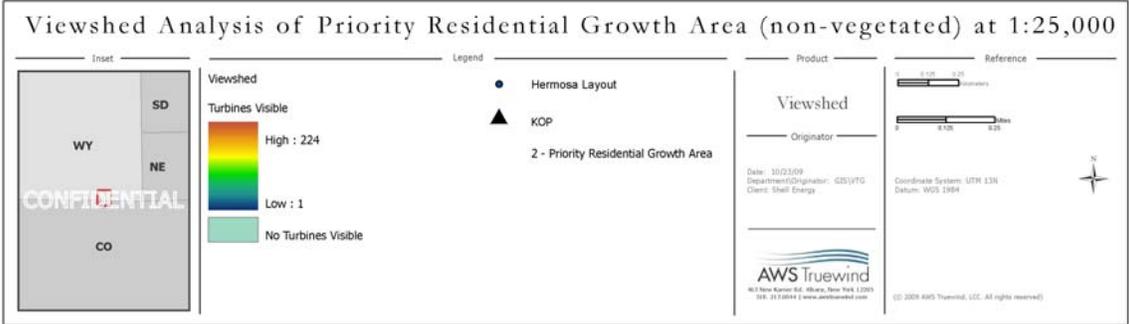
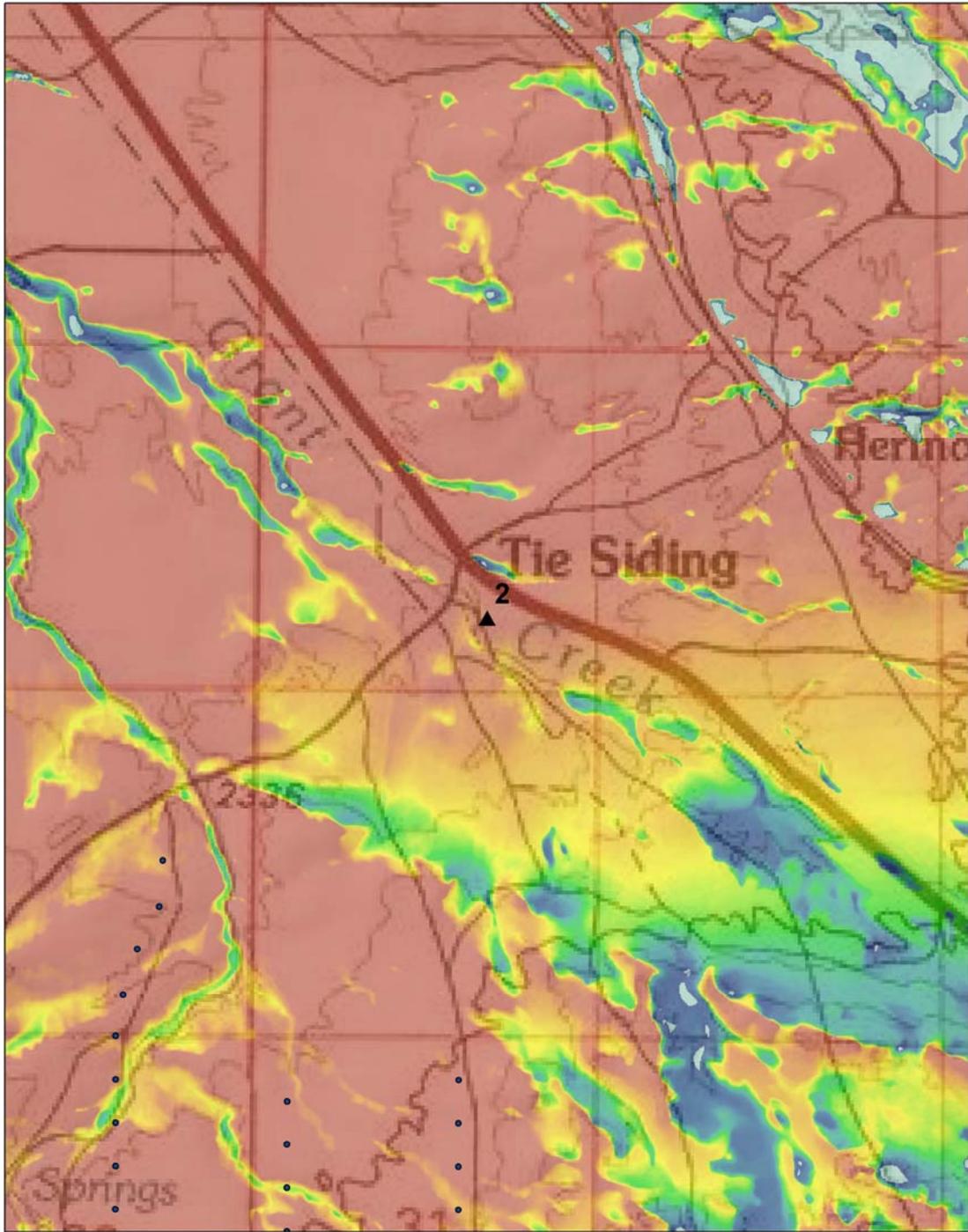


Figure 4. Priority Residential Growth Area KOP

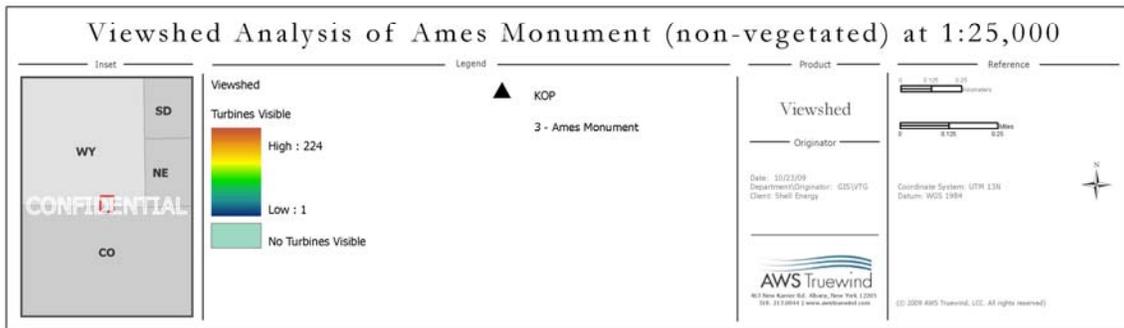
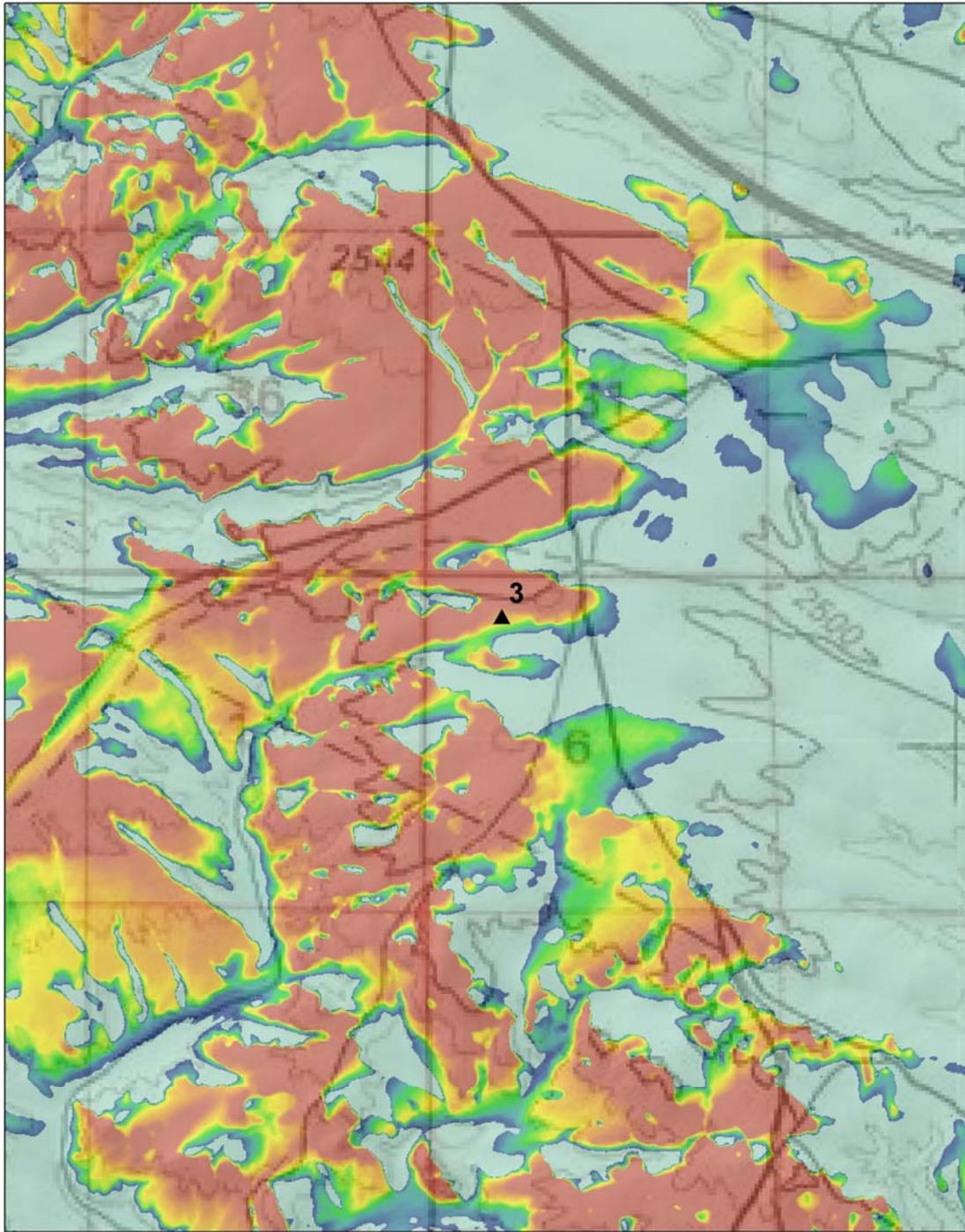


Figure 5. Ames Monument KOP

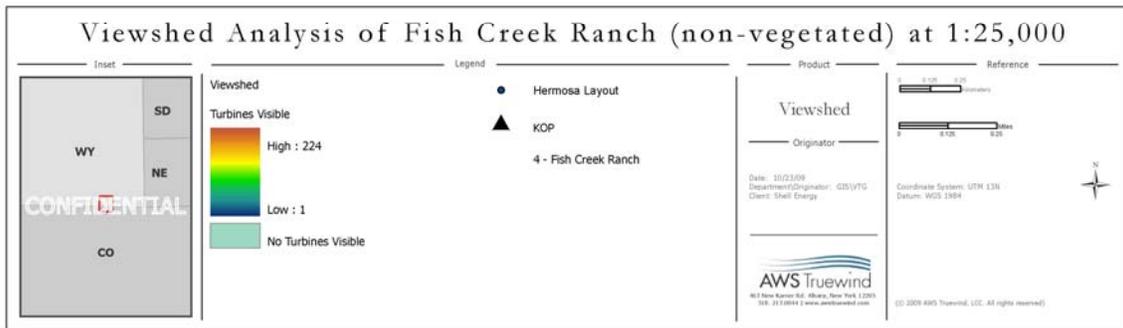
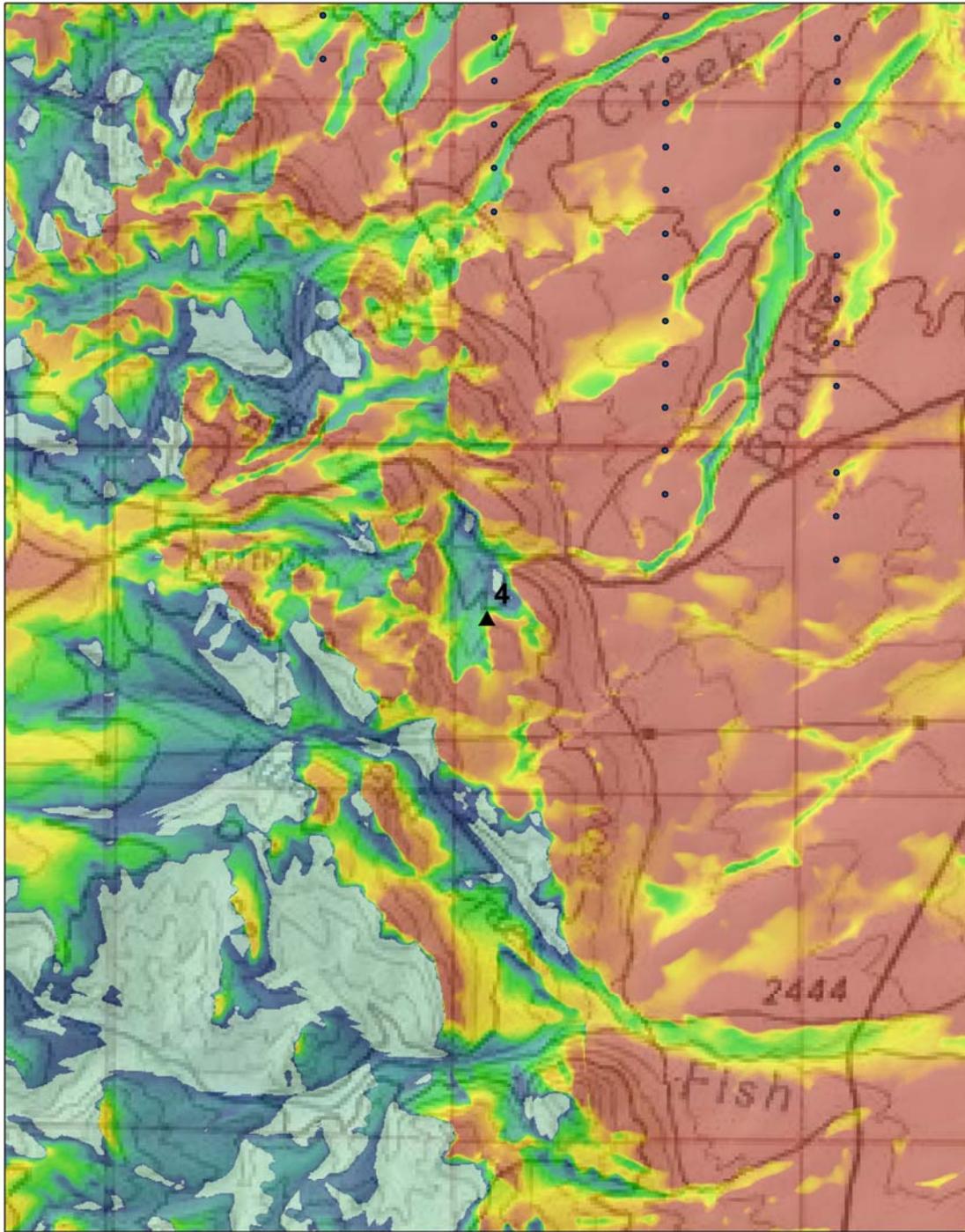


Figure 6. Fish Creek Ranch KOP

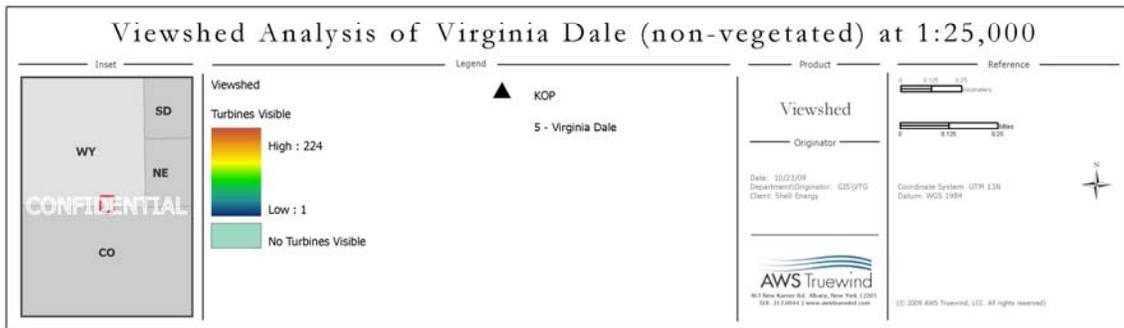
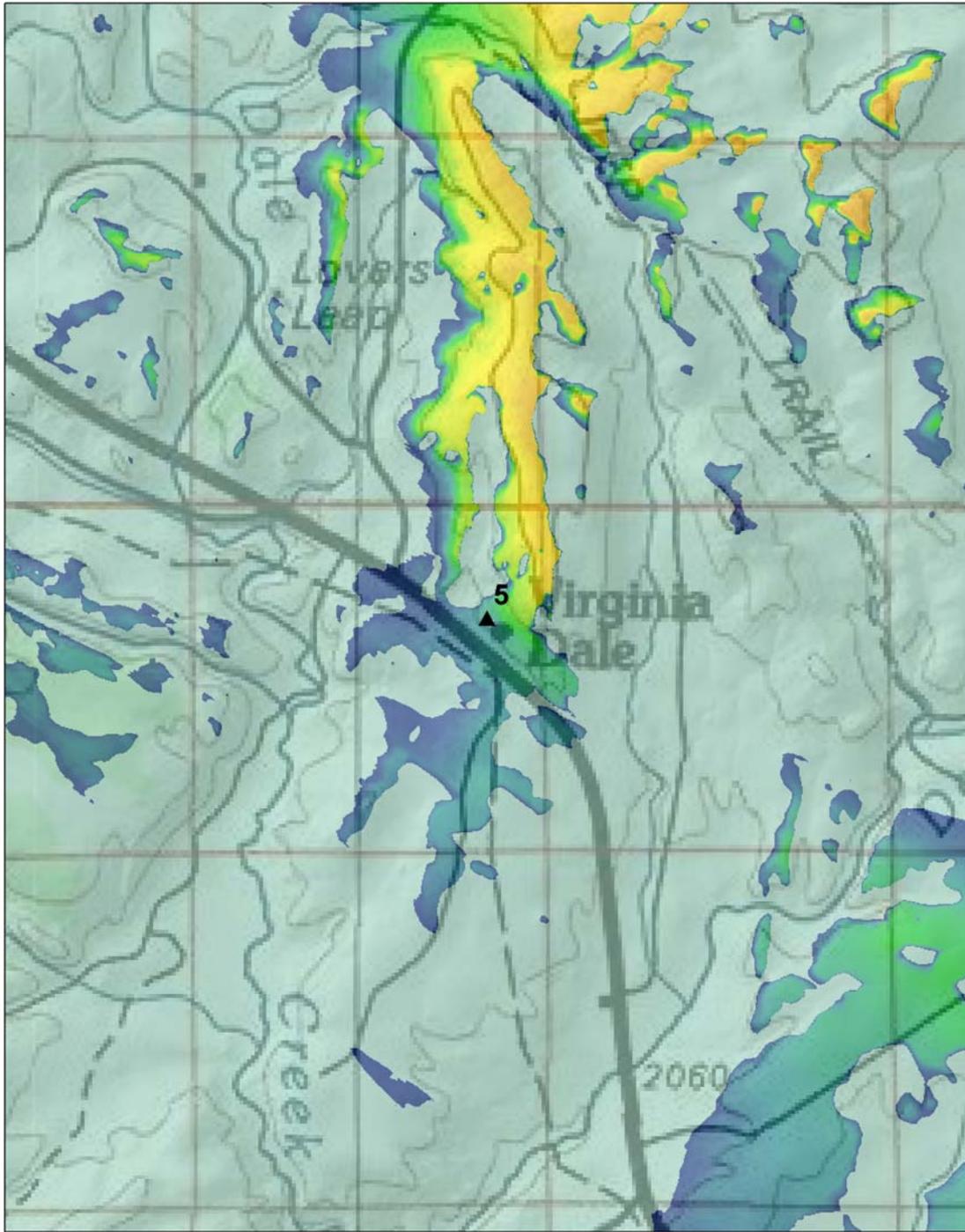


Figure 7. Virginia Dale KOP