New Data and Techniques for Evaluating Subsidence from Abandoned Underground Mines in Ohio

PILOT STUDY

In 2012 a pilot study was initiated to determine areas that are at risk for mine subsidence from abandoned underground mines. The pilot project area was located near Cambridge, Ohio (fig. 18). In 1995, there was a collapse of a mine underneath Interstate 70, near the I-70/I-77 interchange. Due to the large area covered by the Cambridge coal field, the age of the mines, and the potential danger of mine subsidence to damage the road network, the area encompassed by the Cambridge coal field was selected for the pilot project.

A number of different variables that may affect mine subsidence were examined. Variables analyzed as part of this study included age of a mine, depth to a mine, amount of unconsolidated overburden, and roof rock lithology. As mines age, it is thought that the deterioration of the mines will increase. Figure 19 shows a map of the coal mines in the Cambridge coal field, classified by age of abandonment. Figure 20 shows the subsidence events by age of abandonment of the mine. There is a weak correlation between subsidence events and abandonment date. This weak correlation probably is due to older mines being at a shallower depth, more than the increasing deterioration of the mine over time.

Using the NCRDS dataset and the mine elevation points (fig. 21), a detailed coal bed elevation surface can be created (fig. 22). The high-resolution overburden depth is created by subtracting the Upper Freeport elevation surface from the bald earth LiDAR DEM (fig. 23).

When the mine subsidence events are correlated with overburden depth to the mine workings, there is a good correlation showing that most of the mine subsidence events occur at an overburden depth of less than 100 feet (fig. 24). Using this result, the overburden depth to the mines of less than 100 feet can be extracted from the overall overburden grid surface. The extracted layer can then be used to identify highways, roads, properties, and structures that may be susceptible to mine subsidence damage (fig. 25).

ACKNOWLEDGMENTS

Funding was provided by the Ohio Mine Subsidence Insurance Association and by the U.S. Geological Survey National Coal Resources Data System (NCRDS) Cooperative Agreement No. G10AC00296.

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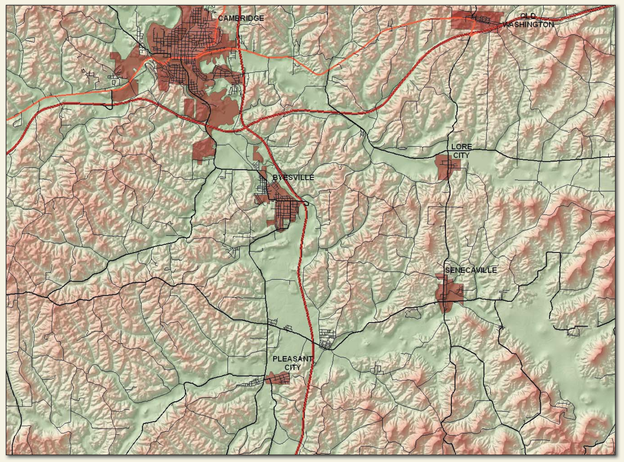

FIGURE 18.—Map showing the location of the pilot project study area in the Cambridge coal field, near Cambridge, Ohio.

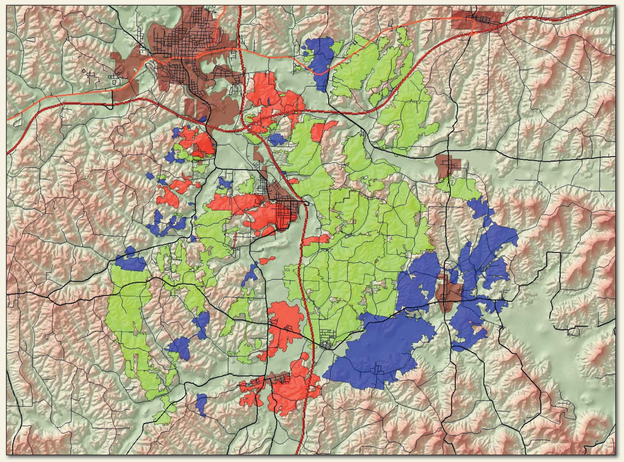

FIGURE 19.—Map showing the abandoned underground mines in the Cambridge coal field. The mines are color classified as to age of abandonment. Mines symbolized in RED were abandoned between 1890 and 1919; mines symbolized in GREEN were abandoned between 1920 and 1939; and mines symbolized in BLUE were abandoned between 1940 and 1960, when the last coal mine in the field was abandoned.

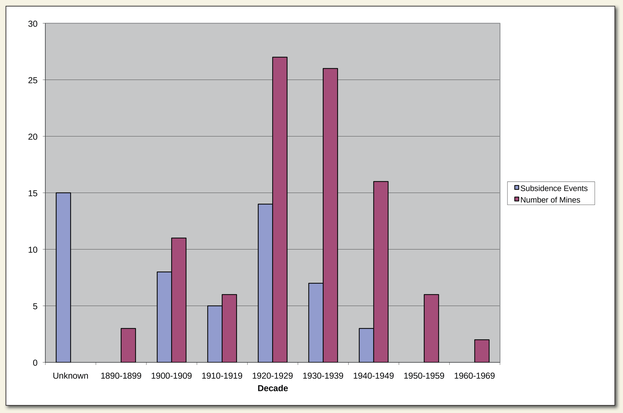

FIGURE 20.—Chart showing the date of abandonment and the subsidence events that correspond to the mine abandonment date. There is a weak correlation between subsidence events and abandonment date. This weak correlation is probably due to older mines being at a shallower depth, more than the increasing deterioration of the mine over time.

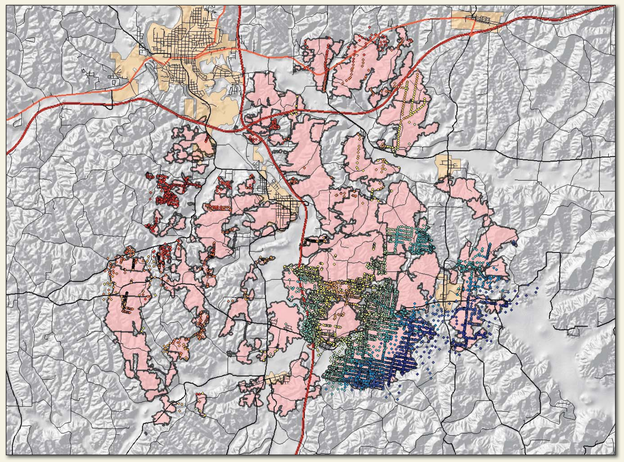

FIGURE 21.—Distribution of the mine elevation data points used to model the coal elevation surface.

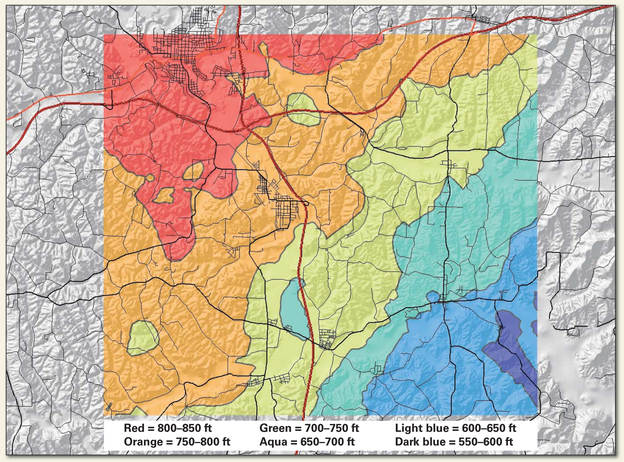

FIGURE 22.—Upper Freeport coal bed elevation surface. Data to model the surface included the mine elevation points, surface measured stratigraphic sections, core descriptions, and mine reclamation drill holes.

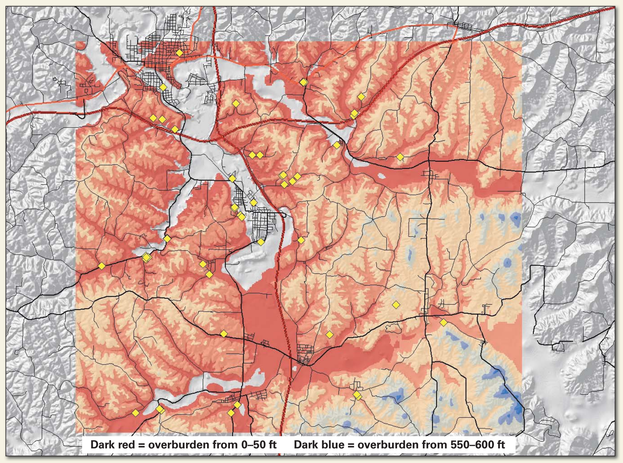

FIGURE 23.—Map showing the overburden thickness and the mine subsidence events. The high resolution overburden thickness is created by subtracting the Upper Freeport elevation surface from the bald earth LiDAR DEM.

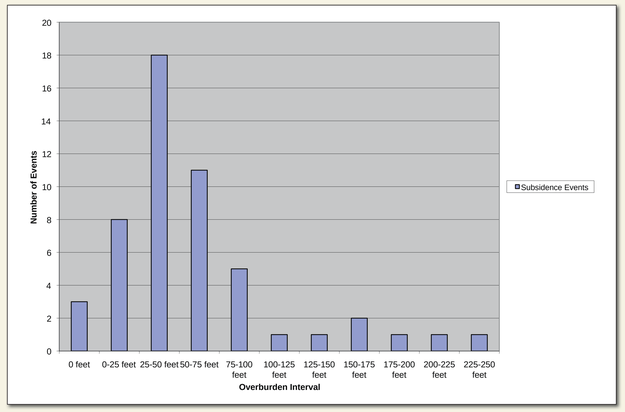

FIGURE 24.—Chart showing the depth to the mine and corresponding mine subsidence event. There is a good correlation showing that most of the mine subsidence events occur at an overburden depth of less than 100 feet.

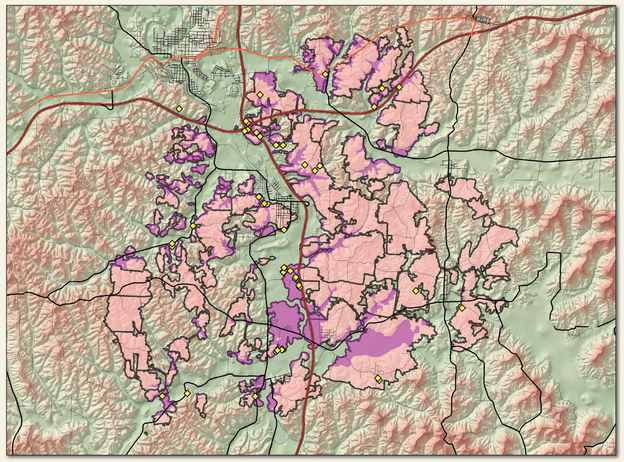

FIGURE 25.—Map showing the overburden depth of less than 100 feet and the highway infrastructure that may be affected by mine subsidence. Mines are represented by light purple while the overburden thickness of less than 100 feet is represented by dark purple.

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