Chapter HN

COAL RESOURCES OF THE HANNA AND CARBON BASINS

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COAL RESOURCES—FERRIS 23, 25, 31, 50, AND 65 COAL ZONES, FERRIS COALFIELD, HANNA BASIN, WYOMING

FERRIS COAL ZONES RESOURCE ESTIMATES—AN OVERVIEW

• Coal resources are calculated using the specific gravity of the coal calculated from apparent coal rank, which is based on weight of coal per unit volume, net coal thickness, and areal extent of the coal.

• Resource tables for the Ferris 23, 25, 31, 50, and 65 coal zones in the Ferris coalfield include coal and overburden thickness categories from Wood and others (1983) that are based on apparent coal rank, and additional categories to provide more detail. Resources are also reported by Federal coal and surface ownership categories and by 7.5-minute quadrangle areas for each of the coal zones.

• Following USGS published guidelines (Wood and others, 1983), coal resource estimates are divided into measured, indicated, and inferred categories according to relative abundance and reliability of data.

• Where data are widely spaced, a hypothetical resource is extrapolated.

• Measured resources are tonnage estimates of coal in the coal zone within a radius of 0.25 mi of a control point where the net thickness of coal is measured.

• Indicated resources are tonnage estimates of coal that is within a radius of 0.25-0.75 mi of a control point where the net thickness of the coal is measured.
• Inferred resources are tonnage estimates of coal that is within a radius of 0.75-3 mi of a control point where the net thickness of the coal is measured.

• Hypothetical resources are tonnage estimates of coal that is beyond a radius of 3 mi of a control point where the net thickness of coal is measured.

• These resource categories assume a high to low degree of geologic assurance. A statistical method, which measures levels of uncertainty (confidence limits) for the Ferris 23, 25, 31, 50, and 65 coal resource estimates in the Ferris coalfield, is also included in this study.

• Resource estimates are reported in millions of short tons with two significant figures.

FERRIS COAL ZONES COAL RESOURCES

The assessment units in the Ferris coalfield were investigated as the Ferris 23, 25, 31, 50, and 65 coal zones. Each coal zone has a specific lateral extent (study limit) based on outcrop data, unpublished maps, drill hole data availability and distribution, and extrapolated overburden. Where overburden was very thick and data were scarce, a generalized boundary was drawn along a geographic or cultural feature that was about three miles from the deepest control point(s).

The study areas in the Ferris coalfield were defined as follows. The Ferris 23 study limit (fig. HN-1) is defined by the outer edge of the Seminoe Reservoir to the northwest, the Ferris 23 outcrop from Glass and Roberts (1980) to the south and southwest, and the contact of the Ferris and Hanna Formations to the east from Dobbin and others (1929). The entire study area is about 50,800 acres (20,558 hectares) in size.
The Ferris 25 study limit (fig. HN-2) is defined by the outer edge of the Seminoe Reservoir to the northwest, the Ferris 25 outcrop to the south and southwest from Glass and Roberts (1980), and the contact of the Ferris and Hanna Formations to the east and northeast from Dobbin and others (1929). The entire study area is about 47,900 acres (19,384 hectares) in size.

The Ferris 31 study limit (fig. HN-3) is defined by the Ferris 31 outcrop to the south from Glass and Roberts (1980), the contact of the Ferris and Hanna Formations to the east from Dobbin and others (1929), and the outer edge of the Seminoe Reservoir to the west. The southeastern boundary is generalized to show the approximate extent of the Ferris 23 coal (where the coal appears to pinch out) based on the drill hole data. The entire study area is about 25,600 acres (10,560 hectares) in size.

The Ferris 50 study limit (fig. HN-4) is defined by the Ferris 50 outcrop to the south and southwest from Glass and Roberts (1980), the contact of the Ferris and Hanna Formations to the east and fault lines in the northwest from Dobbin and others (1929). The northeastern extent is a generalized boundary approximately 3 miles from the deepest control points. The entire study area is about 30,200 acres (12,222 hectares) in size.

The Ferris 65 study limit (fig. HN-5) is defined by the Ferris 65 outcrop to the south and west from Glass and Roberts (1980) and the contact of the Ferris and Hanna Formations to the east from Dobbin and others (1929). The northern extent is a generalized boundary approximately 3 miles from the deepest control points in the eastern part of the study area. The generalized boundary extends west and terminates in the northwest to include an area that contains several control points.
between two bounding faults. The entire study area is about 19,600 acres (7,932 hectares) in size.

Ferris coal resources were calculated using several software packages and custom programs. Details of the resource calculation methodology are given in Ellis and others (1999, in press).

To calculate the Ferris coal resources, data was compiled in a StratiFact* (GRG Corporation, 1996) relational database. The coal beds to be included in the Ferris 23, 25, 31, 50, and 65 coal zones were correlated in the database and data were initially managed in one data set. Data for each coal zone were downloaded individually and a custom program was used to calculate net coal thickness at each data point (drill hole or measured section) location. From this point on, the data for each coal zone were managed separately.

For each coal zone, net coal thickness and overburden thickness was gridded, and isopach maps were produced using EarthVision* (Dynamic Graphics, Inc., 1997) software. The grids were made using an isopach grid option (special handling of 0 values and terminated data) with grid spacings of 50 x 50 meters.

The spatial parameters for querying coal resources (for example, 7.5-minute quadrangle map area (fig. HN-6) (U.S. Geological Survey National Mapping Division unpublished data, undated), Federal coal and surface ownership (figs. HN-7 through HN-11) (Bureau of Land Management unpublished data, undated), reliability, net coal thickness (figs. HN-1 through HN-5), and overburden categories (figs. HN-12 through HN-16)) were created on individual layers as ARC/INFO* (ESRI, 1998a) polygon coverages. The coverages for each coal zone were unioned to make one polygon coverage for each of the five coal zone study
areas. These union coverages contained all of the polygons for each coal zone, with many attributes in every polygon. The polygons in the union coverages were edited in ARC/INFO* and ArcView* (ESRI, 1998b).

Coal resources were calculated for each study area using the EarthVision* (EV) volumetrics tool, which calculates tonnages in each polygon in the union coverage using the net coal thickness grid, the area of each polygon, and a conversion factor of 1,770 short tons per acre-ft for subbituminous rank coal (Wood and others, 1983). Data from the EV volumetrics report and the union coverage polygon attribute table for each of the study areas were combined in Excel* (Microsoft, 1997) spreadsheet software. In each of the five Excel spreadsheets, data for polygons containing mine or lease areas or areas of coal less than 2.5 ft in thickness were deleted from the data sets. Resource tables were created using the data from the remaining polygons (tables HN-1 through HN-10). Lease areas may include public and/or State leases in addition to Federal leases. The final resource areas (areas that met all coal resource criteria) were 24,900 acres (10,077 hectares) in size for Ferris 23 (fig. HN-1), 36,900 acres (14,933 hectares) in size for Ferris 25 (fig. HN-2), 18,900 acres (7,649 hectares) for Ferris 31 (fig. HN-3), 24,300 acres (9,834 hectares) in size for Ferris 50 (fig. HN-4), and 16,800 acres (6,799 hectares) in size for Ferris 65 (fig. HN-5).

*Commercial software package

CONFIDENCE LIMITS FOR FERRIS COAL ZONES COAL RESOURCES

A confidence interval is a statistic designed to capture uncertainty associated with a point estimate. In this study we computed 90-percent confidence intervals on the
volume of coal in the Ferris 23, 25, 31, 50, and 65 coal zones in the measured, indicated, inferred, and hypothetical categories.

The three main potential sources of error that might bias the confidence intervals are preferential sampling, measurement errors, and model fitting. The probabilistic interpretation of a confidence interval is based upon a random sample, which does not apply in this situation, because there is preferential sampling in those areas deemed to be minable. Measurement error can be caused by an error in recording the coal bed thickness or in the definition of coverage areas. Modeling fitting variability and bias result from the choice of models and fitting procedures.

Confidence limits for coal resources of the Ferris 23, 25, 31, 50, 65 coal zones in the Ferris coalfield were calculated by J.H. Schuenemeyer and H.C. Power. The data sets that they used contained net coal measurements from 69 locations for the Ferris 23, 68 locations for the Ferris 25, 14 locations for the Ferris 31, 12 locations for the Ferris 50, and 93 locations for the Ferris 65 coal zones. These data sets only included data points for locations where net coal was greater than or equal to 2.5 ft in thickness (no 0 net coal thickness values) and data that were representative of the entire coal zone (no terminated holes) being represented.

The confidence limits were derived through a complex series of steps. These steps included investigating coal thickness trends and spatial correlation. Ferris 23 and 25 coal zones showed no significant coal thickness trends, therefore coal thickness was used to compute semivariograms, and the semivariograms were fitted to linear models. Parameter estimates for Ferris 23 were sill=40.00 ft$^2$, nugget=0.00 ft$^2$, range=2.50 miles, and slope=16.00. Parameter estimates for Ferris 25 were sill=40.00 ft$^2$, nugget=20.00 ft$^2$, range=3.00 miles, and slope=8.57. Standard deviations of coal thickness were obtained from the semivariogram models. Ferris
31, 50, and 65 coal zones showed no coal thickness trends or spatial correlations that were statistically significant. The standard deviations of coal thickness were obtained directly from the data.

Differences in point densities were compensated for by calculating sample size, called a pseudo $n$, within each reliability category and calculating the variability of volume for each of the reliability categories. Volumes of Ferris 23, 25, 31, 50, and 65 coal were then calculated at a 90-percent confidence interval with measurement error. Sample sizes for the Ferris 31, 50, and 65 coal zones were small, therefore the computed confidence limits are not statistically meaningful. Some of the parameters used and results of the confidence interval calculations are shown in tables HN-11 through HN-15. A detailed description of the methodology used is given in Schuenemeyer and Power (in press) and in Ellis and others (1999, in press).
COAL RESOURCES—HANNA 77, 78, 79, AND 81 COAL ZONES, HANNA COALFIELD, HANNA BASIN, WYOMING

HANNA COAL ZONES RESOURCE ESTIMATES—AN OVERVIEW

- Coal resources are calculated using the specific gravity of the coal calculated from apparent coal rank, which is the weight of coal per unit volume, net coal thickness, and areal extent of the coal.

- Resource tables for the Hanna 77, 78, 79, and 81 coal zones in the Hanna coalfield include coal and overburden thickness categories from Wood and others (1983) that are based on apparent coal rank, and additional categories to provide more detail. Resources are also reported by Federal coal and surface ownership categories and by 7.5-minute quadrangle areas for each of the coal zones.

- Following USGS published guidelines (Wood and others, 1983), coal resource estimates are divided into measured, indicated, and inferred categories according to relative abundance and reliability of data.

- Where data are widely spaced, a hypothetical resource is extrapolated.

- Measured resources are tonnage estimates of coal in the coal zone within a radius of 0.25 mi of a control point where the net thickness of coal is measured.

- Indicated resources are tonnage estimates of coal that is within a radius of 0.25-0.75 mi of a control point where the net thickness of the coal is measured.
• Inferred resources are tonnage estimates of coal that is within a radius of 0.75-3 mi of a control point where the net thickness of the coal is measured.

• Hypothetical resources are tonnage estimates of coal that is beyond a radius of 3 mi of a control point where the net thickness of coal is measured.

• These resource categories assume a high to low degree of geologic assurance. A statistical method, which measures levels of uncertainty (confidence limits) for the Hanna 77, 78, 79, and 81 coal resource estimates in the Hanna coalfield, is also included in this study.

• Resource estimates are reported in millions of short tons with two significant figures.

HANNA COAL ZONES COAL RESOURCES

The assessment units in the Hanna coalfield were investigated as the Hanna 77, 78, 79, and 81 coal zones. Each coal zone has a specific lateral extent (study limit) based on outcrop data, unpublished maps, drill hole data availability and distribution, and extrapolated overburden. Where overburden was very thick and data were scarce, a generalized boundary was drawn along a geographic or cultural feature that was about three miles from the deepest control point(s). The study areas in the Hanna coalfield were defined as follows: The Hanna 77 study limit (fig. HN-17) is defined by the Medicine Bow River along the northern margin and the Hanna 77 coal outcrop from Dobbin and others (1929). The entire study area is about 38,100 acres (15,519 hectares) in size. The Hanna 78 study limit (fig. HN-18) is defined by the Medicine Bow River along the northern margin and the Hanna 78 coal outcrop from Dobbin and others (1929). The entire study area is about 36,100 acres (14,609 hectares) in size. The Hanna 79 study limit (fig. HN-
19) is defined by the Medicine Bow River along the northern margin and the Hanna 79 outcrop from Dobbin and others (1929). The entire study area is about 27,500 acres (11,129 hectares) in size. The Hanna 81 study limit (fig. HN-20) is defined by the Medicine Bow River along the northern margin and the Hanna 81 outcrop from Dobbin and others (1929). The entire study area is about 25,800 acres (10,441 hectares) in size.

Hanna coal resources were calculated using several software packages and custom programs. Details of the resource calculation methodology are given in Ellis and others (1999, in press). To calculate the Hanna coal resources, data was compiled in a StratiFact* (GRG Corporation, 1996) relational database. Coal beds to be included in the Hanna 77, 78, 79, and 81 coal zones were correlated in the database. Data were initially managed in one data set. Data for each coal zone were downloaded individually. A custom program was used to calculate net coal thickness at each data point (drill hole or measured section) location. From this point on, data for each coal zone were managed separately.

For each coal zone, net coal thickness and overburden thickness were gridded, and isopach maps were produced using EarthVision* (Dynamic Graphics, Inc., 1997) software. The grids were made using an isopach grid option (special handling of 0 values and terminated data) with grid spacings of 50 x 50 meters.

The spatial parameters for querying coal resources (for example, 7.5-minute quadrangle map (fig. HN-21) area (U.S. Geological Survey National Mapping Division unpublished data, undated), Federal coal and surface ownership (fig. HN-22 through HN-25) (Bureau of Land Management unpublished data, undated), reliability, net coal thickness (figs. HN-17 through HN-20), and overburden categories (figs. HN-26 through HN-29)) were created on individual layers as ARC/INFO* (ESRI, 1998a) polygon coverages. The coverages for each coal zone
were unioned to make one polygon coverage for each of the four study areas. These union coverages contained all of the polygons for each coal zone, with many attributes in every polygon. The polygons in the union coverages were edited in ARC/INFO* and ArcView* (ESRI, 1998b).

Coal resources were calculated for each study area using the EarthVision* (EV) volumetrics tool, which calculates tonnages in each polygon in the union coverage using the net coal thickness grid, the area of each polygon, and a conversion factor of 1,770 short tons per acre-ft for subbituminous rank coal (Wood and others, 1983). Data from the EV volumetrics report and the union coverage polygon attribute table for each of the study areas were combined in Excel* (Microsoft, 1997) spreadsheet software. In each of the five Excel spreadsheets, data for polygons containing mine or lease areas or areas of net coal less than 2.5 ft in thickness were deleted from the data sets. Resource tables were created using the data from the remaining polygons (tables HN-16 through HN-23). Lease areas may include public and/or state leases in addition to Federal leases. The final resource areas (areas that met all coal resource criteria) were about 32,400 acres (13,112 hectares) in size for Hanna 77 (fig. HN-17), about 30,900 acres (12,505 hectares) in size for Hanna 78 (fig. HN-18), about 24,100 acres (9,753 hectares) in size for Hanna 79 (fig. HN-19), and 21,700 acres (8,782 hectares) in size for Hanna 81 (fig. HN-20).

*Commercial software package

CONFIDENCE LIMITS FOR HANNA COAL ZONES COAL RESOURCES

A confidence interval is a statistic designed to capture uncertainty associated with a point estimate. In this study we computed 90-percent confidence intervals on the
volume (total resource in millions of short tons) of coal in the Hanna 77, 78, 79, and 81 coal zones in the measured, indicated, inferred, and hypothetical categories.

The three main potential sources of error that might bias the confidence intervals are preferential sampling, measurement errors, and model fitting. The probabilistic interpretation of a confidence interval is based upon a random sample, which does not apply in this situation, because there is preferential sampling in those areas deemed to be minable. Measurement error can be caused by an error in recording the coal bed thickness or in the definition of coverage areas. Modeling fitting variability and bias result from the choice of models and fitting procedures.

Confidence limits for coal resources of the Hanna 77, 78, 79, and 81 coal zones in the Hanna Basin were calculated by J.H. Schuenemeyer and H.C. Power. The data sets that they used contained net coal measurements from 74 locations for Hanna 77, 217 locations for Hanna 78, 117 locations for Hanna 79, and 108 locations for Hanna 81. These data sets only included locations that contained Ferris coal in each of the individual coal zones (no 0 values) and data that were representative of the entire coal zones (no terminated holes). Each data set was studied separately.

The confidence limits were derived through a complex series of steps. These steps included investigating coal thickness trends and spatial correlation. Neither the trends nor the spatial correlations in the coal zones were found to be statistically significant. Standard deviations of coal thickness for each coal zone were obtained from the data directly. Volumes of Hanna 77, 78, 79, and 81 coal were calculated at a 90-percent confidence interval with measurement error. Some of the parameters used and results of the confidence interval calculations are shown in tables HN-24 through HN-27. A detailed description of the methodology used is
given in Schuenemeyer and Power (in press) and in Ellis and others (1999, in press).
COAL RESOURCES—JOHNSON-107 COAL ZONE, SOUTH CARBON COALFIELD, CARBON BASIN, WYOMING

JOHNSON-107 COAL ZONE RESOURCE ESTIMATES—AN OVERVIEW

• Coal resources are calculated using the specific gravity of the coal calculated from apparent coal rank, which is the weight of coal per unit volume, net coal thickness, and areal extent of the coal.

• Resource tables for the Johnson-107 coal zone in the South Carbon coalfield include coal and overburden thickness categories from Wood and others (1983) that are based on apparent coal rank, and additional categories to provide more detail. Resources are also reported by Federal coal and surface ownership categories and by 7.5-minute quadrangle areas.

• Following USGS published guidelines (Wood and others, 1983), coal resource estimates are divided into measured, indicated, and inferred categories according to relative abundance and reliability of data.

• Measured resources are tonnage estimates of coal in the coal zone within a radius of 0.25 mi of a control point where the net thickness of coal is measured.

• Indicated resources are tonnage estimates of coal that is within a radius of 0.25-0.75 mi of a control point where the net thickness of the coal is measured.

• Inferred resources are tonnage estimates of coal that is within a radius of 0.75-3 mi of a control point where the net thickness of the coal is measured.
These resource categories assume a high to low degree of geologic assurance. A statistical method, which measures levels of uncertainty (confidence limits) for Johnson-107 coal resource estimates in the South Carbon coalfield, is also included in this study.

Resource estimates are reported in millions of short tons with two significant figures.

JOHNSON-107 COAL ZONE COAL RESOURCES

The lateral extent (study limit) of the Johnson-107 coal zone is defined by the outcrop of the Johnson coal bed as defined by Dobbin and others (1929) to the south and the zero net coal thickness isopach line in the northwest and north central area. The northeastern area was defined by a generalized boundary along a three-mile buffer from the data locations. The entire study area is about 19,400 acres (7,851 hectares) in size.

Johnson-107 coal resources were calculated using several software packages and custom programs. Details of the resource calculation methodology are given in Ellis and others (1999, in press).

To calculate the Johnson-107 coal resources, data was compiled in a StratiFact* (GRG Corporation, 1996) relational database. The beds included in the Johnson-107 coal zone, the Johnson, Finch, C106, and C107 coal beds, were then correlated in the database. A custom program was used to calculate net coal thickness of coal in the Johnson-107 coal zone at each data point (drill hole or measured section) location.

The net coal thickness and overburden thickness were gridded, and isopach maps were produced using EarthVision* (Dynamic Graphics, Inc., 1997) software. The
grids were made using an isopach grid option (special handling of 0 values and terminated data) with grid spacings of 50 x 50 meters.

The spatial parameters for querying coal resources (for example, 7.5-minute quadrangle (fig. HN-30) map area (U.S. Geological Survey National Mapping Division, unpublished data, undated), Federal coal and surface ownership (fig. HN-31) (Bureau of Land Management, unpublished data, undated), reliability, net coal thickness (fig. HN-32), and overburden categories (fig. HN-33)) were created on individual layers as ARC/INFO* (ESRI, 1998a) polygon coverages. The coverages were unioned to make one polygon coverage with many attributes for each polygon. The polygons in the union coverage were edited in ARC/INFO* and ArcView* (ESRI, 1998b).

Coal resources were calculated using the EarthVision* volumetrics tool, which calculates tonnages in each union coverage polygon using the net coal thickness grid, the area of each polygon, and a conversion factor of 1,770 short tons per acre-ft for subbituminous rank coal (Wood and others, 1983). Data from the EV volumetrics report and the union coverage polygon attribute table were combined in Excel* (Microsoft, 1997) spreadsheet software. Data for polygons containing mine or lease areas (fig. HN-32) or areas of net coal less than 2.5 ft thick were deleted from the data set. Lease areas may include public and/or State leases in addition to Federal leases. Resource tables were created using data from the remaining polygons (tables HN-28 and HN-29). The final resource area (fig. HN-32) (area that met all coal resource criteria) was about 14,700 acres (5,949 hectares) in size.

*Commercial software package
CONFIDENCE LIMITS FOR JOHNSON-107 COAL ZONE COAL RESOURCES

A confidence interval is a statistic designed to capture uncertainty associated with a point estimate. In this study we computed 90-percent confidence intervals on the volume (total resource in millions of short tons) of coal in the Johnson-107 coal zone in the measured, indicated, and inferred categories.

The three main potential sources of error that might bias the confidence intervals are preferential sampling, measurement errors, and model fitting. The probabilistic interpretation of a confidence interval is based upon a random sample, which does not apply in this situation, because there is preferential sampling in those areas deemed to be minable. Measurement error can be caused by an error in recording the coal bed thickness or in the definition of coverage areas. Modeling fitting variability and bias result from the choice of models and fitting procedures.

Confidence limits for coal resources of the Johnson-107 coal zone in the South Carbon coalfield were calculated by J.H. Schuenemeyer and H.C. Power. The data set that they used contained net coal measurements from 35 locations. This data set only included data points for locations where net coal was greater than or equal to 2.5 ft in thickness (no 0 net coal thickness values) and data that were representative of the entire coal zone (no terminated holes).

The confidence limits were derived through a complex series of steps. These steps included modeling coal thickness trends and removing the coal thickness trends using a nonparametric regression algorithm called loess (with span=0.5). Spatial correlation, as determined from the semivariogram of residual thickness, was negligible. Standard deviation of coal thickness was computed from residual thickness. Differences in point densities were compensated for by calculating
sample size, called a pseudo $n$, within each reliability category and calculating the variability of volume for each of the reliability categories. The estimated pseudo $n$ for the inferred category was less than one, thus the uncertainty estimates are not statistically meaningful. Volumes of Johnson-107 coal were then calculated at a 90-percent confidence interval with measurement error. Some of the parameters used and results of the confidence interval calculations are shown in tables HN-30 and HN-31. A detailed description of the methodology used is given in Schuenemeyer and Power (in press) and in Ellis and others (1999, in press).
REFERENCES CITED


ESRI-Environmental Systems Research Institute, Inc., 1998, ARC/INFO, v. 7.1.1: Environmental Systems Research Institute, Inc., 380 New York Street, Redlands, CA 92373, USA.

_____ 1998, ArcView, v.3.0a: Environmental Systems Research Institute, Inc., 380 New York Street, Redlands, CA 92373, USA.

GRG Corporation, 1996, StratiFact, relational database software, v. 4.5: GRG Corporation, 4175 Harlan Street, Wheatridge, CO 80033-5150, USA.


Figure HN-1. Ferris 23 net coal isopach map and resource area.
Figure HN-2. Ferris 25 net coal isopach map and resource area.
Figure HN-3. Ferris 31 net coal isopach map and resource area.
Figure HN-4. Ferris 50 net coal isopach map and resource area.
Figure HN-5. Ferris 65 net coal isopach map and resource area.
7.5-minute quadrangle maps

1  Seminoe Dam SE
2  Schneider Ridge
3  Pats Bottom
4  Tenmile Spring
5  Elmo
6  Walcott
7  Dana
8  Hanna

Ferris coalfield
Ferris 23 study limit
Ferris 25 study limit
Ferris 31 study limit
Ferris 50 study limit
Ferris 65 study limit
Common boundary

Figure HN-6. Location of 7.5-minute quadrangle maps in the Ferris coalfield.
Federal Coal = Federal subsurface management of all minerals, coal only, or oil, gas, and coal

Federal Surface = Federal surface ownership

Figure HN-7. Federal coal and surface ownership in the Ferris 23 study limit.
Figure HN-8. Federal coal and surface ownership in the Ferris 25 study limit.
Federal Coal = Federal subsurface management of all minerals, coal only, or oil, gas, and coal

Federal Surface = Federal surface ownership

Figure HN-9. Federal coal and surface ownership in the Ferris 31 study limit.
Federal Coal = Federal subsurface management of all minerals, coal only, or oil, gas, and coal

Federal Surface = Federal surface ownership

Federal coal and Federal surface

Federal coal, but no Federal surface

No Federal coal or Federal surface

Figure HN-10. Federal coal and surface ownership in the Ferris 50 study limit.
Federal Coal = Federal subsurface management of all minerals, coal only, or oil, gas, and coal
Federal Surface = Federal surface ownership

Figure HN-11. Federal coal and surface ownership in the Ferris 65 study limit.
Figure HN-12. Ferris 23 overburden isopach map.
Figure HN-13. Ferris 25 overburden isopach map.
Figure HN-14. Ferris 31 overburden isopach map.
Figure HN-15. Ferris 50 overburden isopach map.

Normal fault
(Glass and Roberts, 1980)
Figure HN-16. Ferris 65 overburden isopach map.
Figure HN-17. Hanna 77 net coal isopach map and resource area.
Figure HN-18. Hanna 78 net coal isopach map and resource area.
Figure HN-19. Hanna 79 net coal isopach map and resource area.
Figure HN-20. Hanna 81 net coal isopach map and resource area.
Figure HN-21. Location of 7.5-minute quadrangle maps in the Hanna coalfield.
Federal coal = Federal subsurface management of all minerals, coal only, or oil, gas, and coal

Federal surface = Federal surface ownership

- Pink: Federal coal and Federal surface
- Blue: Federal coal, but no Federal surface
- White: No Federal coal or Federal surface

Figure HN-22. Federal coal and surface ownership in the Hanna 77 study limit.
Federal coal = Federal subsurface management of all minerals, coal only, or oil, gas, and coal

Federal surface = Federal surface ownership

- **Federal coal and Federal surface**
- **Federal coal, but no Federal surface**
- **No Federal coal or Federal surface**

Figure HN-23. Federal coal and surface ownership in the Hanna 78 study limit.
Figure HN-24. Federal coal and surface ownership in the Hanna 79 study limit.

Federal coal = Federal subsurface management of all minerals, coal only, or oil, gas, and coal.

Federal surface = Federal surface ownership.

- Federal coal and Federal surface
- Federal coal, but no Federal surface
- No Federal coal or Federal surface
Federal coal = Federal subsurface management of all minerals, coal only, or oil, gas, and coal

Federal surface = Federal surface ownership

- **Pink**: Federal coal and Federal surface
- **Blue**: Federal coal, but no Federal surface
- **White**: No Federal coal or Federal surface

Figure HN-25. Federal coal and surface ownership in the Hanna 81 study limit.
Figure HN-26. Hanna 77 overburden isopach map.

Normal faults (Glass and Roberts, 1980)
Figure HN-27. Hanna 78 overburden isopach map.
Figure HN-28. Hanna 79 overburden isopach map.
Figure HN-29. Hanna 81 overburden isopach map.

Overburden thickness (ft)

Normal faults (Glass and Roberts, 1980)
Figure HN-30. Location of 7.5-minute quadrangle maps in the South Carbon coalfield.
Federal Coal = Federal subsurface management of all minerals, coal only, or oil, gas, and coal

Federal Surface = Federal surface ownership

- **Pink**: Federal coal and Federal surface
- **Blue**: Federal coal, but no Federal surface
- **White**: No Federal coal or Federal surface

Figure HN-31. Federal coal and surface ownership in the Johnson-107 study limit.
Figure HN-32. Johnson-107 net coal isopach map and resource area.
Figure HN-33. Johnson-107 overburden isopach map.
Table HN-1. Coal resources of the Ferris 23 coal zone in the Ferris coalfield, Hanna Basin, Wyoming, reported by overburden (fig. HN-12), net coal thickness (fig. HN-1), and reliability categories. Zeros (0) indicate areas where no resources were calculated. Resources are reported in millions of short tons (MST) with two significant figures. The table does not include resources for coal less than 2.5 ft thick or coal in mine or lease areas (fig. HN-1). Resource numbers will not sum to match totals due to independent rounding.

<table>
<thead>
<tr>
<th>Overburden thickness</th>
<th>Net coal thickness</th>
<th>Measured (&lt;1/4 mi)</th>
<th>Indicated (1/4-3/4 mi)</th>
<th>Inferred (3/4-3 mi)</th>
<th>Hypothetical (&gt;3 mi)</th>
<th>Total (MST)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-100 ft</td>
<td>2.5-5 ft</td>
<td>1.8</td>
<td>8.7</td>
<td>5.1</td>
<td>0.27</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>5-10 ft</td>
<td>4.1</td>
<td>7.8</td>
<td>37</td>
<td>2.7</td>
<td>52</td>
</tr>
<tr>
<td></td>
<td>10-20 ft</td>
<td>6.5</td>
<td>5.8</td>
<td>0.17</td>
<td>0</td>
<td>12</td>
</tr>
<tr>
<td>0-100 ft total</td>
<td></td>
<td>12</td>
<td>22</td>
<td>42</td>
<td>3.0</td>
<td>80</td>
</tr>
<tr>
<td>100-200 ft</td>
<td>2.5-5 ft</td>
<td>0.24</td>
<td>0.025</td>
<td>1.3</td>
<td>0.62</td>
<td>2.2</td>
</tr>
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<td>0.71</td>
<td>2.2</td>
<td>1.1</td>
<td>0.11</td>
<td>4.1</td>
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<td>0</td>
<td>0.78</td>
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<td>100-200 ft total</td>
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<td>1.7</td>
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<td>7.1</td>
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<td>0.13</td>
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<td>6.1</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>5-10 ft</td>
<td>2.1</td>
<td>3.4</td>
<td>8.2</td>
<td>0.16</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>10-20 ft</td>
<td>3.7</td>
<td>1.2</td>
<td>0</td>
<td>0</td>
<td>4.9</td>
</tr>
<tr>
<td>200-500 ft total</td>
<td></td>
<td>6.3</td>
<td>4.8</td>
<td>15</td>
<td>6.3</td>
<td>32</td>
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<tr>
<td>500-1,000 ft</td>
<td>2.5-5 ft</td>
<td>0.23</td>
<td>0.069</td>
<td>7.2</td>
<td>4.4</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>5-10 ft</td>
<td>0.78</td>
<td>4.1</td>
<td>13</td>
<td>0.15</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td>10-20 ft</td>
<td>1.2</td>
<td>4.4</td>
<td>0.26</td>
<td>0</td>
<td>5.9</td>
</tr>
<tr>
<td>500-1,000 ft total</td>
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<td>2.2</td>
<td>8.6</td>
<td>20</td>
<td>4.6</td>
<td>36</td>
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<tr>
<td>1,000-1,500 ft</td>
<td>2.5-5 ft</td>
<td>0</td>
<td>0</td>
<td>3.5</td>
<td>5.8</td>
<td>9.3</td>
</tr>
<tr>
<td></td>
<td>5-10 ft</td>
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<td>0</td>
<td>7.8</td>
<td>0.065</td>
<td>7.9</td>
</tr>
<tr>
<td>1,000-1,500 ft total</td>
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<td>0</td>
<td>0</td>
<td>11</td>
<td>5.8</td>
<td>17</td>
</tr>
<tr>
<td>1,000-2,000 ft</td>
<td>2.5-5 ft</td>
<td>0</td>
<td>0</td>
<td>4.2</td>
<td>5.2</td>
<td>9.5</td>
</tr>
<tr>
<td></td>
<td>5-10 ft</td>
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<td>0</td>
<td>2.5</td>
<td>0.061</td>
<td>2.6</td>
</tr>
<tr>
<td>1,500-2,000 ft total</td>
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<td>0</td>
<td>6.8</td>
<td>5.3</td>
<td>12</td>
</tr>
<tr>
<td>&gt;2,000 ft</td>
<td>2.5-5 ft</td>
<td>0</td>
<td>0</td>
<td>7.5</td>
<td>35</td>
<td>42</td>
</tr>
<tr>
<td></td>
<td>5-10 ft</td>
<td>0</td>
<td>0</td>
<td>3.8</td>
<td>3.3</td>
<td>7.2</td>
</tr>
<tr>
<td>&gt;2,000 ft total</td>
<td></td>
<td>0</td>
<td>0</td>
<td>11</td>
<td>38</td>
<td>50</td>
</tr>
<tr>
<td>Grand total (MST)</td>
<td>23</td>
<td>38</td>
<td>110</td>
<td>64</td>
<td>230</td>
<td></td>
</tr>
</tbody>
</table>
Table HN-2. Coal resources of the Ferris 23 coal zone in the Ferris coalfield, Hanna Basin, Wyoming, reported by 7.5-minute quadrangle (fig. HN-6) and Federal coal and surface ownership (fig. HN-7). Resources are reported in millions of short tons (MST) with two significant figures. The table does not include resources for coal less than 2.5 ft thick or coal in mine or lease areas (fig. HN-1). Resource numbers will not sum to match totals due to independent rounding.

<table>
<thead>
<tr>
<th>7.5-minute quadrangle map</th>
<th>Federal ownership</th>
<th>Total (MST)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DANA</td>
<td>No Federal coal or surface ownership</td>
<td>0.15</td>
</tr>
<tr>
<td></td>
<td>Federal coal and surface ownership</td>
<td>0.14</td>
</tr>
<tr>
<td>DANA total</td>
<td></td>
<td>0.29</td>
</tr>
<tr>
<td>PATS BOTTOM</td>
<td>No Federal coal or surface ownership</td>
<td>88</td>
</tr>
<tr>
<td></td>
<td>No Federal coal, but Federal surface ownership</td>
<td>9.0</td>
</tr>
<tr>
<td></td>
<td>Federal coal and surface ownership</td>
<td>27</td>
</tr>
<tr>
<td>PATS BOTTOM total</td>
<td></td>
<td>120</td>
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<tr>
<td>SCHNEIDER RIDGE</td>
<td>No Federal coal or surface ownership</td>
<td>2.6</td>
</tr>
<tr>
<td></td>
<td>No Federal coal, but Federal surface ownership</td>
<td>0.24</td>
</tr>
<tr>
<td></td>
<td>Federal coal and surface ownership</td>
<td>3.8</td>
</tr>
<tr>
<td>SCHNEIDER RIDGE total</td>
<td></td>
<td>6.7</td>
</tr>
<tr>
<td>SEMINOE DAM SE</td>
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<td>42</td>
</tr>
<tr>
<td></td>
<td>Federal coal and surface ownership</td>
<td>39</td>
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<tr>
<td>SEMINOE DAM SE total</td>
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<td>80</td>
</tr>
<tr>
<td>TENMILE SPRING</td>
<td>No Federal coal or surface ownership</td>
<td>9.8</td>
</tr>
<tr>
<td></td>
<td>Federal coal and surface ownership</td>
<td>7.9</td>
</tr>
<tr>
<td>TENMILE SPRING total</td>
<td></td>
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</tr>
<tr>
<td>WALCOTT</td>
<td>No Federal coal or surface ownership</td>
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</tr>
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<td></td>
<td>No Federal coal, but Federal surface ownership</td>
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</tr>
<tr>
<td></td>
<td>Federal coal and surface ownership</td>
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</tr>
<tr>
<td>WALCOTT total</td>
<td></td>
<td>4.0</td>
</tr>
<tr>
<td>Grand total of Federal coal (MST)</td>
<td></td>
<td>78</td>
</tr>
<tr>
<td>Grand total (MST)</td>
<td></td>
<td>230</td>
</tr>
</tbody>
</table>
Table HN-3. Coal resources of the Ferris 25 coal zone in the Ferris coalfield, Hanna Basin, Wyoming, reported by overburden (fig. HN-13), net coal thickness (fig HN-2), and reliability categories. Zeros (0) indicate areas where no resources were calculated. Resources are reported in millions of short tons (MST) with two significant figures. Table does not include resources for coal less than 2.5 ft thick or coal in mine or lease areas (fig. HN-2). Resource numbers will not sum to match totals due to independent rounding.

<table>
<thead>
<tr>
<th>Overburden thickness</th>
<th>Net coal thickness</th>
<th>Measured (&lt;1/4 mi)</th>
<th>Indicated (1/4-3/4 mi)</th>
<th>Inferred (3/4-3 mi)</th>
<th>Hypothetical (&gt;3 mi)</th>
<th>Total (MST)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-100 ft</td>
<td>2.5-5 ft</td>
<td>0.067</td>
<td>0.39</td>
<td>0.12</td>
<td>0</td>
<td>0.58</td>
</tr>
<tr>
<td></td>
<td>5-10 ft</td>
<td>0.30</td>
<td>0.86</td>
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<td>5.6</td>
</tr>
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<td></td>
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<td>0.20</td>
<td>0</td>
<td>6.8</td>
<td>8.0</td>
</tr>
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<td>20-30 ft</td>
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<td>1.6</td>
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<td>17</td>
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<td>2.5-5 ft</td>
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<td>5-10 ft</td>
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<td>1.7</td>
<td>6.4</td>
<td>9.9</td>
</tr>
<tr>
<td></td>
<td>10-20 ft</td>
<td>1.7</td>
<td>0.21</td>
<td>0</td>
<td>7</td>
<td>8.9</td>
</tr>
<tr>
<td></td>
<td>20-30 ft</td>
<td>0.5</td>
<td>0.35</td>
<td>0</td>
<td>5.9</td>
<td>6.8</td>
</tr>
<tr>
<td></td>
<td>100-200 ft total</td>
<td>2.8</td>
<td>1.9</td>
<td>2.0</td>
<td>19</td>
<td>26</td>
</tr>
<tr>
<td>200-500 ft</td>
<td>2.5-5 ft</td>
<td>0.40</td>
<td>0.65</td>
<td>3.7</td>
<td>1.8</td>
<td>6.5</td>
</tr>
<tr>
<td></td>
<td>5-10 ft</td>
<td>1.7</td>
<td>8.9</td>
<td>24</td>
<td>33</td>
<td>68</td>
</tr>
<tr>
<td></td>
<td>10-20 ft</td>
<td>15</td>
<td>23</td>
<td>46</td>
<td>33</td>
<td>120</td>
</tr>
<tr>
<td></td>
<td>20-30 ft</td>
<td>17</td>
<td>9.6</td>
<td>0</td>
<td>13</td>
<td>40</td>
</tr>
<tr>
<td></td>
<td>200-500 ft total</td>
<td>34</td>
<td>42</td>
<td>73</td>
<td>81</td>
<td>230</td>
</tr>
<tr>
<td>500-1,000 ft</td>
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<td>3.2</td>
<td>4.3</td>
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<td>45</td>
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<td>10</td>
<td>0.25</td>
<td>7.3</td>
<td>21</td>
</tr>
<tr>
<td></td>
<td>20-30 ft</td>
<td>1.8</td>
<td>6.9</td>
<td>0</td>
<td>0</td>
<td>8.6</td>
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<tr>
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<td>500-1,000 ft total</td>
<td>5.1</td>
<td>20</td>
<td>17</td>
<td>40</td>
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Table HN-3. Ferris 25 coal resources—continued

<table>
<thead>
<tr>
<th>Overburden thickness</th>
<th>Net coal thickness</th>
<th>Reliability category (distance from data point)</th>
<th>Total (MST)</th>
</tr>
</thead>
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<tr>
<td></td>
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<td>Measured (&lt;1/4 mi)</td>
<td>Indicated (1/4-3/4 mi)</td>
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<tr>
<td>1,000-1,500 ft</td>
<td>2.5-5 ft</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>5-10 ft</td>
<td>0.81</td>
<td>3.2</td>
</tr>
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<td>0.23</td>
<td>0.13</td>
</tr>
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<td>1,000-1,500 ft total</td>
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<td>3.4</td>
</tr>
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<td>1,500-2,000 ft</td>
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<td>0</td>
</tr>
<tr>
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<td>0.41</td>
</tr>
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<td>1,500-2,000 ft total</td>
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<tr>
<td>&gt;2,000 ft</td>
<td>2.5-5 ft</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>5-10 ft</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>&gt;2,000 ft total</td>
<td></td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Grand total (MST)</td>
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<td>46</td>
<td>70</td>
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Table HN-4. Coal resources of the Ferris 25 coal zone in the Ferris coalfield, Hanna Basin, Wyoming, reported by 7.5-minute quadrangle (fig. HN-6) and Federal coal and surface ownership (fig. HN-8). Resources are reported in millions of short tons (MST) with two significant figures. Table does not include resources for coal less than 2.5 ft thick or coal in mine or lease areas (fig. HN-2). Resource numbers will not sum to match total due to independent rounding.

<table>
<thead>
<tr>
<th>7.5-minute quadrangle map</th>
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<th>Total (MST)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DANA</td>
<td>No Federal coal or surface ownership</td>
<td>52</td>
</tr>
<tr>
<td></td>
<td>No Federal coal, but Federal surface ownership</td>
<td>2.2</td>
</tr>
<tr>
<td></td>
<td>Federal coal, but no Federal surface ownership</td>
<td>2.6</td>
</tr>
<tr>
<td></td>
<td>Federal coal and surface ownership</td>
<td>36</td>
</tr>
<tr>
<td>DANA total</td>
<td></td>
<td>93</td>
</tr>
<tr>
<td>ELMO</td>
<td>No Federal coal or surface ownership</td>
<td>0.63</td>
</tr>
<tr>
<td></td>
<td>Federal coal and surface ownership</td>
<td>0.25</td>
</tr>
<tr>
<td>ELMO total</td>
<td></td>
<td>0.88</td>
</tr>
<tr>
<td>HANNA</td>
<td>No Federal coal or surface ownership</td>
<td>4.0</td>
</tr>
<tr>
<td></td>
<td>Federal coal, but no Federal surface ownership</td>
<td>0.54</td>
</tr>
<tr>
<td></td>
<td>Federal coal and surface ownership</td>
<td>3.0</td>
</tr>
<tr>
<td>HANNA total</td>
<td></td>
<td>7.6</td>
</tr>
<tr>
<td>PATS BOTTOM</td>
<td>No Federal coal or surface ownership</td>
<td>120</td>
</tr>
<tr>
<td></td>
<td>No Federal coal, but Federal surface ownership</td>
<td>17</td>
</tr>
<tr>
<td></td>
<td>Federal coal and surface ownership</td>
<td>38</td>
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<tr>
<td>PATS BOTTOM total</td>
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Table HN-4. Ferris 25 coal resources—continued

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<th>7.5-minute quadrangle map</th>
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<th>Total (MST)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SCHNEIDER RIDGE</td>
<td>No Federal coal or surface ownership</td>
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</tr>
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<td></td>
<td>Federal coal and surface ownership</td>
<td>6.7</td>
</tr>
<tr>
<td>SCHNEIDER RIDGE total</td>
<td></td>
<td>12</td>
</tr>
<tr>
<td>SEMINOE DAM SE</td>
<td>No Federal coal or surface ownership</td>
<td>74</td>
</tr>
<tr>
<td></td>
<td>Federal coal and surface ownership</td>
<td>73</td>
</tr>
<tr>
<td>SEMINOE DAM SE total</td>
<td></td>
<td>150</td>
</tr>
<tr>
<td>TENMILE SPRING</td>
<td>No Federal coal or surface ownership</td>
<td>52</td>
</tr>
<tr>
<td></td>
<td>No Federal coal, but Federal surface ownership</td>
<td>4.1</td>
</tr>
<tr>
<td></td>
<td>Federal coal and Surface ownership</td>
<td>41</td>
</tr>
<tr>
<td>TENMILE SPRING total</td>
<td></td>
<td>97</td>
</tr>
<tr>
<td>WALCOTT</td>
<td>No Federal coal or surface ownership</td>
<td>2.3</td>
</tr>
<tr>
<td></td>
<td>Federal coal and surface ownership</td>
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</tr>
<tr>
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<td>No Federal coal, but Federal surface ownership</td>
<td>1.4</td>
</tr>
<tr>
<td>WALCOTT total</td>
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<td>3.8</td>
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<tr>
<td>Grand total Federal coal</td>
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<tr>
<td>Grand total (MST)</td>
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Table HN-5. Coal resources of the Ferris 31 coal zone in the Ferris coalfield, Hanna Basin, Wyoming, reported by overburden (fig. HN-14), net coal thickness (fig. HN-3), and reliability categories. Zeros (0) indicate areas where no resources were calculated. Resources are reported in millions of short tons (MST) with two significant figures. The table does not include resources for coal less than 2.5 ft thick or coal in mine or lease areas (fig. HN-3). Resource numbers will not sum to match totals due to independent rounding.

<table>
<thead>
<tr>
<th>Overburden thickness</th>
<th>Net coal thickness</th>
<th>Reliability category (distance from data point)</th>
<th>Total (MST)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Measured (&lt;1/4 mi)</td>
<td>Indicated (1/4-3/4 mi)</td>
</tr>
<tr>
<td>0-100 ft</td>
<td>2.5-5 ft</td>
<td>0.40</td>
<td>0.30</td>
</tr>
<tr>
<td></td>
<td>5-10 ft</td>
<td>0.087</td>
<td>0.33</td>
</tr>
<tr>
<td></td>
<td>10-20 ft</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>20-30 ft</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>0-100 ft total</td>
<td></td>
<td>0.49</td>
<td>0.63</td>
</tr>
<tr>
<td>100-200 ft</td>
<td>2.5-5 ft</td>
<td>0.094</td>
<td>0.035</td>
</tr>
<tr>
<td></td>
<td>5-10 ft</td>
<td>0.24</td>
<td>0.63</td>
</tr>
<tr>
<td></td>
<td>10-20 ft</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>20-30 ft</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>100-200 ft total</td>
<td></td>
<td>0.33</td>
<td>0.67</td>
</tr>
<tr>
<td>200-500 ft</td>
<td>2.5-5 ft</td>
<td>0.68</td>
<td>1.5</td>
</tr>
<tr>
<td></td>
<td>5-10 ft</td>
<td>0.60</td>
<td>1.9</td>
</tr>
<tr>
<td></td>
<td>10-20 ft</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>20-30 ft</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>200-500 ft total</td>
<td></td>
<td>1.3</td>
<td>3.4</td>
</tr>
<tr>
<td>500-1,000 ft</td>
<td>2.5-5 ft</td>
<td>0</td>
<td>0.57</td>
</tr>
<tr>
<td></td>
<td>5-10 ft</td>
<td>0</td>
<td>0.39</td>
</tr>
<tr>
<td></td>
<td>10-20 ft</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>20-30 ft</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>500-1,000 ft total</td>
<td></td>
<td>0</td>
<td>0.96</td>
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</table>
Table HN-5. Ferris 31 coal resources—continued

<table>
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<th>Overburden thickness</th>
<th>Net coal thickness</th>
<th>Reliability category (distance from data point)</th>
<th>Total (MST)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Measured (&lt;1/4 mi)</td>
<td>Indicated (1/4-3/4 mi)</td>
</tr>
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<td>0</td>
<td>0.065</td>
</tr>
<tr>
<td></td>
<td>5-10 ft</td>
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<td>0.063</td>
</tr>
<tr>
<td></td>
<td>10-20 ft</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>1,000-1,500 ft total</td>
<td></td>
<td>0</td>
</tr>
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<td>1,500-2,000 ft</td>
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<td>0.015</td>
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<td>5-10 ft</td>
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<td>10-20 ft</td>
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<td>0</td>
</tr>
<tr>
<td></td>
<td>1,500-2,000 ft total</td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>&gt;2,000 ft</td>
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<td>0.012</td>
</tr>
<tr>
<td></td>
<td>5-10 ft</td>
<td>0</td>
<td>2.0</td>
</tr>
<tr>
<td></td>
<td>10-20 ft</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>&gt;2,000 ft total (MST)</td>
<td></td>
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</tr>
<tr>
<td>Grand total (MST)</td>
<td></td>
<td>2.1</td>
<td>7.8</td>
</tr>
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</table>
Table HN-6. Coal resources of the Ferris 31 coal zone in the Ferris coalfield, Hanna Basin, Wyoming, reported by 7.5-minute quadrangle (fig. HN-6) and Federal coal and surface ownership (fig. HN-9). Resources are reported in millions of short tons (MST) with two significant figures. Table does not include resources for coal less than 2.5 ft thick or coal in mine or lease areas (fig. HN-3). Resource numbers will not sum to match totals due to independent rounding.
Table HN-7. Coal resources of the Ferris 50 coal zone in the Ferris coalfield, Hanna Basin, Wyoming, reported by overburden (fig. HN-15), net coal thickness (fig. HN-4), and reliability categories. Zeros (0) indicate areas where no resources were calculated. Resources are reported in millions of short tons (MST) with two significant figures. The table does not include resources for coal less than 2.5 ft thick or coal in mine or lease areas (fig. HN-4). Resource numbers will not sum to match totals due to independent rounding.

<table>
<thead>
<tr>
<th>Overburden thickness</th>
<th>Net coal thickness</th>
<th>Reliability category (distance from data point)</th>
<th>Total (MST)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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<td>Indicated (1/4-3/4 mi)</td>
</tr>
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<td>0-100 ft</td>
<td>2.5-5 ft</td>
<td>0.36</td>
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<td>5-10 ft</td>
<td>0.35</td>
<td>0.76</td>
</tr>
<tr>
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<td>12</td>
</tr>
<tr>
<td>0-100 ft total</td>
<td></td>
<td>3.0</td>
<td>15</td>
</tr>
<tr>
<td>100-200 ft</td>
<td>2.5-5 ft</td>
<td>0.14</td>
<td>0.39</td>
</tr>
<tr>
<td></td>
<td>5-10 ft</td>
<td>1.0</td>
<td>1.4</td>
</tr>
<tr>
<td></td>
<td>10-20 ft</td>
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</tr>
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<td>5.2</td>
</tr>
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<td>2.5-5 ft</td>
<td>0.50</td>
<td>0.91</td>
</tr>
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<td></td>
<td>5-10 ft</td>
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<td>6.6</td>
</tr>
<tr>
<td></td>
<td>10-20 ft</td>
<td>1.8</td>
<td>6.3</td>
</tr>
<tr>
<td>200-500 ft total</td>
<td></td>
<td>2.8</td>
<td>14</td>
</tr>
<tr>
<td>500-1,000 ft</td>
<td>2.5-5 ft</td>
<td>0.012</td>
<td>0.13</td>
</tr>
<tr>
<td></td>
<td>5-10 ft</td>
<td>1.1</td>
<td>7.6</td>
</tr>
<tr>
<td></td>
<td>10-20 ft</td>
<td>1.9</td>
<td>11</td>
</tr>
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<td>500-1,000 ft total</td>
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<td>19</td>
</tr>
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<td>0</td>
</tr>
<tr>
<td></td>
<td>5-10 ft</td>
<td>2.3</td>
<td>3.7</td>
</tr>
<tr>
<td></td>
<td>10-20 ft</td>
<td>0.30</td>
<td>7.8</td>
</tr>
<tr>
<td>1,000-1,500 ft total</td>
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<td>2.6</td>
<td>11</td>
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Table HN-7 Ferris 50 coal resources—continued

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<th>Reliability category (distance from data point)</th>
<th>Total (MST)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Measured (&lt;1/4 mi)</td>
<td>Indicated (1/4-3/4 mi)</td>
</tr>
<tr>
<td>1,500-2,000 ft</td>
<td>2.5-5 ft</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>5-10 ft</td>
<td>0.091</td>
<td>4.3</td>
</tr>
<tr>
<td></td>
<td>10-20 ft</td>
<td>0</td>
<td>4.4</td>
</tr>
<tr>
<td></td>
<td>1,500-2,000 ft total</td>
<td>0.091</td>
<td>8.7</td>
</tr>
<tr>
<td>&gt;2,000 ft</td>
<td>2.5-5 ft</td>
<td>0</td>
<td>0</td>
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<td></td>
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<td>10-20 ft</td>
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<td>0.80</td>
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<tr>
<td>&gt;2,000 ft total</td>
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<td>0.80</td>
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<tr>
<td>Grand total (MST)</td>
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<td>14</td>
<td>73</td>
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</table>
Table HN-8. Coal resources of the Ferris 50 coal zone in the Ferris coalfield, Hanna Basin, Wyoming, reported by 7.5-minute quadrangle (fig. HN-6) and Federal coal and surface ownership (fig. HN-10). Resources are reported in millions of short tons (MST) with two significant figures. Table does not include resources for coal less than 2.5 ft thick or coal in mine or lease areas (fig. HN-4). Resource numbers will not sum to match totals due to independent rounding.

<table>
<thead>
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<th>7.5-minute quadrangle map</th>
<th>Federal ownership</th>
<th>Total (MST)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DANA</td>
<td>No Federal coal or surface ownership</td>
<td>36</td>
</tr>
<tr>
<td></td>
<td>No Federal coal, but Federal surface ownership</td>
<td>6.0</td>
</tr>
<tr>
<td></td>
<td>Federal coal, but no Federal surface ownership</td>
<td>3.2</td>
</tr>
<tr>
<td></td>
<td>Federal coal and surface ownership</td>
<td>15</td>
</tr>
<tr>
<td>DANA total</td>
<td></td>
<td>61</td>
</tr>
<tr>
<td>ELMO</td>
<td>No Federal coal or surface ownership</td>
<td>4.2</td>
</tr>
<tr>
<td></td>
<td>Federal coal and surface ownership</td>
<td>1.5</td>
</tr>
<tr>
<td>ELMO total</td>
<td></td>
<td>5.7</td>
</tr>
<tr>
<td>HANNA</td>
<td>No Federal coal or surface ownership</td>
<td>7.2</td>
</tr>
<tr>
<td></td>
<td>Federal coal, but no Federal surface ownership</td>
<td>1.3</td>
</tr>
<tr>
<td></td>
<td>Federal coal and surface ownership</td>
<td>5.0</td>
</tr>
<tr>
<td>HANNA total</td>
<td></td>
<td>14</td>
</tr>
<tr>
<td>PATS BOTTOM</td>
<td>No Federal coal or surface ownership</td>
<td>62</td>
</tr>
<tr>
<td></td>
<td>No Federal coal, but Federal surface ownership</td>
<td>1.1</td>
</tr>
<tr>
<td></td>
<td>Federal coal and surface ownership</td>
<td>35</td>
</tr>
<tr>
<td>PATS BOTTOM total</td>
<td></td>
<td>97</td>
</tr>
<tr>
<td>TENMILE SPRING</td>
<td>No Federal coal or surface ownership</td>
<td>190</td>
</tr>
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<td>No Federal coal, but Federal surface ownership</td>
<td>10</td>
</tr>
<tr>
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<td>Federal coal and surface ownership</td>
<td>130</td>
</tr>
<tr>
<td>TENMILE SPRING total</td>
<td></td>
<td>330</td>
</tr>
<tr>
<td>Grand total of Federal coal</td>
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<td>190</td>
</tr>
<tr>
<td>Grand total (MST)</td>
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<td>510</td>
</tr>
</tbody>
</table>
Table HN-9. Coal resources of the Ferris 65 coal zone in the Ferris coalfield, Hanna Basin, Wyoming, reported by overburden (fig. HN-16), net coal thickness (fig. HN-5), and reliability categories. Zeros (0) indicate areas where no resources were calculated. Resources are reported in millions of short tons (MST) with two significant figures. The table does not include resources for coal less than 2.5 ft thick or coal in mine or lease areas (fig. HN-5). Resource numbers will not sum to match totals due to independent rounding.

<table>
<thead>
<tr>
<th>Overburden thickness</th>
<th>Net coal thickness</th>
<th>Reliability category (distance from data point)</th>
<th>Total (MST)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Measured (&lt;1/4 mi)</td>
<td>Indicated (1/4-3/4 mi)</td>
</tr>
<tr>
<td>0-100 ft</td>
<td>2.5-5 ft</td>
<td>0.27</td>
<td>1.6</td>
</tr>
<tr>
<td></td>
<td>5-10 ft</td>
<td>4.1</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td>10-20 ft</td>
<td>0.79</td>
<td>4.8</td>
</tr>
<tr>
<td>0-100 ft total</td>
<td></td>
<td>5.2</td>
<td>17</td>
</tr>
<tr>
<td>100-200 ft</td>
<td>2.5-5 ft</td>
<td>0.23</td>
<td>1.3</td>
</tr>
<tr>
<td></td>
<td>5-10 ft</td>
<td>0.4</td>
<td>6.9</td>
</tr>
<tr>
<td></td>
<td>10-20 ft</td>
<td>1.0</td>
<td>2.6</td>
</tr>
<tr>
<td>100-200 ft total</td>
<td></td>
<td>1.7</td>
<td>11</td>
</tr>
<tr>
<td>200-500 ft</td>
<td>2.5-5 ft</td>
<td>1.1</td>
<td>3.8</td>
</tr>
<tr>
<td></td>
<td>5-10 ft</td>
<td>0.91</td>
<td>7.2</td>
</tr>
<tr>
<td></td>
<td>10-20 ft</td>
<td>4.9</td>
<td>5.1</td>
</tr>
<tr>
<td>200-500 ft total</td>
<td></td>
<td>6.9</td>
<td>16</td>
</tr>
<tr>
<td>500-1,000 ft</td>
<td>2.5-5 ft</td>
<td>0.075</td>
<td>0.62</td>
</tr>
<tr>
<td></td>
<td>5-10 ft</td>
<td>1.5</td>
<td>2.5</td>
</tr>
<tr>
<td></td>
<td>10-20 ft</td>
<td>4.3</td>
<td>6.5</td>
</tr>
<tr>
<td>500-1,000 ft total</td>
<td></td>
<td>5.9</td>
<td>9.6</td>
</tr>
<tr>
<td>1,000-1,500 ft</td>
<td>5-10 ft</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1,000-1,500 ft total</td>
<td></td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Grand total (MST)</td>
<td></td>
<td>20</td>
<td>54</td>
</tr>
</tbody>
</table>
Table HN-10. Coal resources of the Ferris 65 coal zone in the Ferris coalfield, Hanna Basin, Wyoming, reported by 7.5-minute quadrangle map area (fig. HN-6) and Federal coal and surface ownership (fig. HN-11). Resources are reported in millions of short tons (MST) with two significant figures. The table does not include resources for coal less than 2.5 ft thick or coal in mine or lease areas (fig. HN-5). Resource numbers will not sum to match totals due to independent rounding.

<table>
<thead>
<tr>
<th>7.5-minute quadrangle map</th>
<th>Federal ownership</th>
<th>Total (MST)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DANA</td>
<td>No Federal coal or surface ownership</td>
<td>6.7</td>
</tr>
<tr>
<td></td>
<td>No Federal coal, but Federal surface ownership</td>
<td>0.39</td>
</tr>
<tr>
<td></td>
<td>Federal coal, but no Federal surface ownership</td>
<td>0.16</td>
</tr>
<tr>
<td></td>
<td>Federal coal and surface ownership</td>
<td>3.3</td>
</tr>
<tr>
<td>DANA total</td>
<td></td>
<td>11</td>
</tr>
<tr>
<td>ELMO</td>
<td>No Federal coal or surface ownership</td>
<td>1.5</td>
</tr>
<tr>
<td></td>
<td>Federal coal and surface ownership</td>
<td>0.94</td>
</tr>
<tr>
<td>ELMO total</td>
<td></td>
<td>2.5</td>
</tr>
<tr>
<td>HANNA</td>
<td>No Federal coal or surface ownership</td>
<td>6.4</td>
</tr>
<tr>
<td></td>
<td>Federal coal, but no Federal surface ownership</td>
<td>0.093</td>
</tr>
<tr>
<td></td>
<td>Federal coal and surface ownership</td>
<td>5.1</td>
</tr>
<tr>
<td>HANNA total</td>
<td></td>
<td>12</td>
</tr>
<tr>
<td>PATS BOTTOM</td>
<td>No Federal coal or surface ownership</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td>No Federal coal, but Federal surface ownership</td>
<td>0.11</td>
</tr>
<tr>
<td></td>
<td>Federal coal and surface ownership</td>
<td>7.6</td>
</tr>
<tr>
<td>PATS BOTTOM total</td>
<td></td>
<td>25</td>
</tr>
<tr>
<td>TENMILE SPRING</td>
<td>No Federal coal or surface ownership</td>
<td>86</td>
</tr>
<tr>
<td></td>
<td>No Federal coal, but Federal surface ownership</td>
<td>1.4</td>
</tr>
<tr>
<td></td>
<td>Federal coal and surface ownership</td>
<td>61</td>
</tr>
<tr>
<td>TENMILE SPRING total</td>
<td></td>
<td>150</td>
</tr>
<tr>
<td>Grand total of Federal coal</td>
<td></td>
<td>78</td>
</tr>
<tr>
<td>Grand total (MST)</td>
<td></td>
<td>200</td>
</tr>
</tbody>
</table>
Table HN-11. Parameters and confidence intervals within reliability categories for Ferris 23 coal resources, Ferris coalfield, Hanna Basin, Wyoming. Estimates of uncertainty were calculated with measurement error. Volume refers to the calculated resource in millions of short tons (MST). To show detail, resources in this table are reported using four significant figures. NA, not applicable

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Measured</th>
<th>Indicated</th>
<th>Inferred</th>
<th>Hypothetical</th>
<th>Entire area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area (in square meters)</td>
<td>6,116,176</td>
<td>12,591,713</td>
<td>46,035,986</td>
<td>36,008,928</td>
<td>100,752,804</td>
</tr>
<tr>
<td>Percent of area</td>
<td>6</td>
<td>12</td>
<td>46</td>
<td>36</td>
<td>100</td>
</tr>
<tr>
<td>Acres (area x .0002471)</td>
<td>1,511</td>
<td>3,111</td>
<td>11,376</td>
<td>8,898</td>
<td>24,897</td>
</tr>
<tr>
<td>SD (standard deviation (in ft) from semivariogram model)</td>
<td>2.000</td>
<td>3.464</td>
<td>6.325</td>
<td>6.325</td>
<td>NA</td>
</tr>
<tr>
<td>Acre feet (acres x SD)</td>
<td>3,023</td>
<td>10,778</td>
<td>71,946</td>
<td>56,276</td>
<td>NA</td>
</tr>
<tr>
<td>Volume standard deviation (MST)</td>
<td>2</td>
<td>12</td>
<td>161</td>
<td>100</td>
<td>273</td>
</tr>
<tr>
<td>Pseudo n</td>
<td>12</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>NA</td>
</tr>
<tr>
<td>Total calculated resource (MST)</td>
<td>22.60</td>
<td>38.00</td>
<td>109.3</td>
<td>64.00</td>
<td>233.8</td>
</tr>
<tr>
<td>Lower 90% confidence limit (MST)</td>
<td>20.00</td>
<td>19.00</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Upper 90% confidence limit (MST)</td>
<td>25.00</td>
<td>57.00</td>
<td>374.0</td>
<td>228.0</td>
<td>683.0</td>
</tr>
</tbody>
</table>
Table HN-12. Parameters and confidence intervals within reliability categories for Ferris 25 coal resources, Ferris coalfield, Hanna Basin, Wyoming. Estimates of uncertainty were calculated with measurement error. Volume refers to the calculated resource in millions of short tons (MST). To show detail, resources in this table are reported using four significant figures. NA, not applicable

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Reliability category</th>
<th>Entire area</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Measured</td>
<td>Indicated</td>
</tr>
<tr>
<td>Area (in square meters)</td>
<td>6,563,920</td>
<td>12,895,672</td>
</tr>
<tr>
<td>Percent of area</td>
<td>4</td>
<td>9</td>
</tr>
<tr>
<td>Acres (area x 0.0002471)</td>
<td>1,622</td>
<td>3,187</td>
</tr>
<tr>
<td>SD (standard deviation (in ft) from semivariogram model)</td>
<td>4.705</td>
<td>5.141</td>
</tr>
<tr>
<td>Acre feet (acres x SD)</td>
<td>7,632</td>
<td>16,382</td>
</tr>
<tr>
<td>Volume standard deviation (MST)</td>
<td>4</td>
<td>17</td>
</tr>
<tr>
<td>Pseudo n</td>
<td>13</td>
<td>3</td>
</tr>
<tr>
<td>Volume (MST)</td>
<td>45.60</td>
<td>70.10</td>
</tr>
<tr>
<td>Lower 90% confidence limit (MST)</td>
<td>39.00</td>
<td>42.00</td>
</tr>
<tr>
<td>Upper 90% confidence limit (MST)</td>
<td>52.00</td>
<td>99.00</td>
</tr>
</tbody>
</table>
Table HN-13. Parameters and confidence intervals within reliability categories for Ferris 31 coal resources, Ferris coalfield, Hanna Basin, Wyoming. Estimates of uncertainty were calculated with measurement error. Volume refers to the calculated resource in millions of short tons (MST). To show detail, resources in this table are reported using four significant figures. NA, not applicable

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Measured</th>
<th>Indicated</th>
<th>Inferred</th>
<th>Hypothetical</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area (in square meters)</td>
<td>1,023,193</td>
<td>3,264,636</td>
<td>20,455,234</td>
<td>51,626,255</td>
</tr>
<tr>
<td>Percent of area</td>
<td>1</td>
<td>4</td>
<td>27</td>
<td>68</td>
</tr>
<tr>
<td>Acres (area x 0.0002471)</td>
<td>253</td>
<td>807</td>
<td>5,055</td>
<td>12,757</td>
</tr>
<tr>
<td>SD (standard deviation (in ft) from data)</td>
<td>2.241</td>
<td>2.241</td>
<td>2.241</td>
<td>2.241</td>
</tr>
<tr>
<td>Acre feet (acres x SD)</td>
<td>567</td>
<td>1,808</td>
<td>11,328</td>
<td>28,591</td>
</tr>
<tr>
<td>Volume standard deviation (MST)</td>
<td>1</td>
<td>4</td>
<td>38</td>
<td>51</td>
</tr>
<tr>
<td>Pseudo $n$</td>
<td>2.0</td>
<td>0.7</td>
<td>0.3</td>
<td>1.0</td>
</tr>
<tr>
<td>Volume (MST)</td>
<td>2.095</td>
<td>7.832</td>
<td>52.89</td>
<td>206.1</td>
</tr>
<tr>
<td>Lower 90% confidence limit (MST)</td>
<td>0.9300</td>
<td>1.600</td>
<td>0</td>
<td>122.9</td>
</tr>
<tr>
<td>Upper 90% confidence limit (MST)</td>
<td>3.260</td>
<td>14.07</td>
<td>115.3</td>
<td>289.4</td>
</tr>
</tbody>
</table>

Entire area 76,369,319

Percent 100

Acre feet NA

Volume standard deviation (MST) NA

Pseudo $n$ NA

Volume (MST) 268.9

Lower 90% confidence limit (MST) 115.9

Upper 90% confidence limit (MST) 422.0
Table HN-14. Parameters and confidence intervals within reliability categories for Ferris 50 coal resources, Ferris coalfield, Hanna Basin, Wyoming. Estimates of uncertainty were calculated with measurement error. Volume refers to the calculated resource in millions of short tons (MST). To show detail, resources in this table are reported using four significant figures. NA, not applicable

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Measured</th>
<th>Indicated</th>
<th>Inferred</th>
<th>Hypothetical</th>
<th>Entire area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area (in square meters)</td>
<td>3,330,441</td>
<td>16,842,693</td>
<td>60,894,465</td>
<td>17,082,509</td>
<td>98,150,108</td>
</tr>
<tr>
<td>Percent of area</td>
<td>3</td>
<td>17</td>
<td>62</td>
<td>17</td>
<td>100</td>
</tr>
<tr>
<td>Acres (area x 0.0002471)</td>
<td>823</td>
<td>4,162</td>
<td>15,047</td>
<td>4,221</td>
<td>24,253</td>
</tr>
<tr>
<td>SD (standard deviation (in ft) from data)</td>
<td>3.438</td>
<td>3.438</td>
<td>3.438</td>
<td>3.438</td>
<td>NA</td>
</tr>
<tr>
<td>Acre feet (acres x SD)</td>
<td>2,830</td>
<td>14,310</td>
<td>51,739</td>
<td>14,514</td>
<td>NA</td>
</tr>
<tr>
<td>Volume standard deviation (MST)</td>
<td>2</td>
<td>13</td>
<td>100</td>
<td>26</td>
<td>141</td>
</tr>
<tr>
<td>Pseudo n</td>
<td>6.5</td>
<td>3.7</td>
<td>0.8</td>
<td>1.0</td>
<td>NA</td>
</tr>
<tr>
<td>Volume (MST)</td>
<td>13.61</td>
<td>73.43</td>
<td>338.2</td>
<td>80.31</td>
<td>505.5</td>
</tr>
<tr>
<td>Lower 90% confidence limit (MST)</td>
<td>10.39</td>
<td>51.71</td>
<td>173.0</td>
<td>38.05</td>
<td>273.1</td>
</tr>
<tr>
<td>Upper 90% confidence limit (MST)</td>
<td>16.83</td>
<td>95.15</td>
<td>503.4</td>
<td>122.6</td>
<td>737.9</td>
</tr>
</tbody>
</table>
Table HN-15. Parameters and confidence intervals within reliability categories for Ferris 65 coal resources, Ferris coalfield, Hanna Basin, Wyoming. Estimates of uncertainty were calculated with measurement error. Volume refers to the calculated resource in millions of short tons (MST). To show detail, resources in this table are reported using four significant figures. NA, not applicable

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Reliability category</th>
<th>Entire area</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Measured</td>
<td>Indicated</td>
</tr>
<tr>
<td>Area (in square meters)</td>
<td>5,417,001</td>
<td>17,736,198</td>
</tr>
<tr>
<td>Percent of area</td>
<td>8</td>
<td>26</td>
</tr>
<tr>
<td>Acres (area x 0.0002471)</td>
<td>1,339</td>
<td>4,383</td>
</tr>
<tr>
<td>SD (standard deviation (in ft) from data)</td>
<td>2.469</td>
<td>2.469</td>
</tr>
<tr>
<td>Acre feet (acres x SD)</td>
<td>3,305</td>
<td>10,820</td>
</tr>
<tr>
<td>Volume standard deviation (MST)</td>
<td>2</td>
<td>10</td>
</tr>
<tr>
<td>Pseudo n</td>
<td>10.7</td>
<td>3.9</td>
</tr>
<tr>
<td>Volume (MST)</td>
<td>19.65</td>
<td>53.66</td>
</tr>
<tr>
<td>Lower 90% confidence limit (MST)</td>
<td>16.70</td>
<td>37.66</td>
</tr>
<tr>
<td>Upper 90% confidence limit (MST)</td>
<td>22.60</td>
<td>69.67</td>
</tr>
</tbody>
</table>
Table HN-16. Coal resources of the Hanna 77 coal zone in the Hanna coalfield, Hanna Basin, Wyoming, reported by overburden (fig. HN-26), net coal thickness (fig. HN-17), and reliability categories. Zeros (0) indicate areas where no resources were calculated. Resources are reported in millions of short tons (MST) with two significant figures. The table does not include resources for coal less than 2.5 ft thick or coal in mine or lease areas (fig. HN-17). Resource numbers will not sum to match totals due to independent rounding.

<table>
<thead>
<tr>
<th>Overburden thickness</th>
<th>Net coal thickness</th>
<th>Reliability category (distance from data point)</th>
<th>Total (MST)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Measured (1/4 mi)</td>
<td>Indicated (1-3/4 mi)</td>
</tr>
<tr>
<td>0-100 ft</td>
<td>10-20 ft</td>
<td>0.55</td>
<td>3.0</td>
</tr>
<tr>
<td></td>
<td>40-50 ft</td>
<td>0.51</td>
<td>0.17</td>
</tr>
<tr>
<td></td>
<td>0-100 ft total</td>
<td>1.1</td>
<td>3.2</td>
</tr>
<tr>
<td>100-200 ft</td>
<td>5-10 ft</td>
<td>0</td>
<td>0.0034</td>
</tr>
<tr>
<td></td>
<td>10-20 ft</td>
<td>1.1</td>
<td>7.4</td>
</tr>
<tr>
<td></td>
<td>40-50 ft</td>
<td>2.1</td>
<td>0.29</td>
</tr>
<tr>
<td></td>
<td>100-200 ft total</td>
<td>3.2</td>
<td>7.7</td>
</tr>
<tr>
<td>200-300 ft</td>
<td>5-10 ft</td>
<td>0</td>
<td>0.16</td>
</tr>
<tr>
<td></td>
<td>10-20 ft</td>
<td>1.7</td>
<td>8.3</td>
</tr>
<tr>
<td></td>
<td>30-40 ft</td>
<td>0.078</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>40-50 ft</td>
<td>2.5</td>
<td>1.4</td>
</tr>
<tr>
<td></td>
<td>200-300 ft total</td>
<td>4.3</td>
<td>10</td>
</tr>
<tr>
<td>300-400 ft</td>
<td>5-10 ft</td>
<td>0</td>
<td>0.17</td>
</tr>
<tr>
<td></td>
<td>10-20 ft</td>
<td>3.9</td>
<td>6.3</td>
</tr>
<tr>
<td></td>
<td>30-40 ft</td>
<td>0.43</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>40-50 ft</td>
<td>1.9</td>
<td>3.8</td>
</tr>
<tr>
<td></td>
<td>300-400 ft total</td>
<td>6.3</td>
<td>10</td>
</tr>
<tr>
<td>400-500 ft</td>
<td>10-20 ft</td>
<td>0.42</td>
<td>3.4</td>
</tr>
<tr>
<td></td>
<td>30-40 ft</td>
<td>0.046</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>40-50 ft</td>
<td>0.36</td>
<td>6.6</td>
</tr>
<tr>
<td></td>
<td>400-500 ft total</td>
<td>0.83</td>
<td>9.9</td>
</tr>
<tr>
<td>500-1,000 ft</td>
<td>10-20 ft</td>
<td>0.011</td>
<td>1.0</td>
</tr>
<tr>
<td></td>
<td>40-50 ft</td>
<td>0</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td>500-1,000 ft total</td>
<td>0.011</td>
<td>19</td>
</tr>
</tbody>
</table>
Table HN-16. Hanna 77 coal resources—continued

<table>
<thead>
<tr>
<th>Overburden thickness</th>
<th>Net coal thickness</th>
<th>Measured (&lt;1/4 mi)</th>
<th>Indicated (1/4-3/4 mi)</th>
<th>Inferred (3/4-3 mi)</th>
<th>Hypothetical (&gt;3 mi)</th>
<th>Total (MST)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,000-1,500 ft</td>
<td>10-20 ft</td>
<td>0.94</td>
<td>0.83</td>
<td>4.5</td>
<td>4.0</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>20-40 ft</td>
<td>0</td>
<td>0</td>
<td>1.8</td>
<td>0.55</td>
<td>2.4</td>
</tr>
<tr>
<td></td>
<td>40-50 ft</td>
<td>0.20</td>
<td>2.6</td>
<td>120</td>
<td>3.4</td>
<td>130</td>
</tr>
<tr>
<td></td>
<td>1,000-1,500 ft total</td>
<td>1.1</td>
<td>3.4</td>
<td>130</td>
<td>8.0</td>
<td>140</td>
</tr>
<tr>
<td>1,500-2,000 ft</td>
<td>5-10 ft</td>
<td>0.063</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0.063</td>
</tr>
<tr>
<td></td>
<td>10-20 ft</td>
<td>0.99</td>
<td>2.0</td>
<td>0.69</td>
<td>0.27</td>
<td>3.9</td>
</tr>
<tr>
<td></td>
<td>20-40 ft</td>
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<td>7.5</td>
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</tr>
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<td>0.22</td>
<td>0</td>
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<td>10</td>
<td>100</td>
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<td>11</td>
<td>0</td>
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<td>&gt;2,000 ft total</td>
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<td>23</td>
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<td>630</td>
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<td>40</td>
<td>230</td>
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Table HN-17. Coal resources of the Hanna 77 coal zone in the Hanna coalfield, Hanna Basin, Wyoming, reported by 7.5-minute quadrangle (fig. HN-21) and Federal coal and surface ownership (fig. HN-22). Resources are reported in millions of short tons (MST) with two significant figures. Table does not include resources for coal less than 2.5 ft thick or coal in mine or lease areas (fig. HN-17). Resource numbers will not sum to match totals due to independent rounding.

<table>
<thead>
<tr>
<th>7.5-minute quadrangle map</th>
<th>Federal ownership</th>
<th>Total (MST)</th>
</tr>
</thead>
<tbody>
<tr>
<td>COMO WEST</td>
<td>No Federal coal or surface ownership</td>
<td>490</td>
</tr>
<tr>
<td></td>
<td>Federal coal, but no Federal surface ownership</td>
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<tr>
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<td>Federal coal and surface ownership</td>
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<tr>
<td>COMO WEST total</td>
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<td>830</td>
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<tr>
<td>DIFFICULTY</td>
<td>No Federal coal or surface ownership</td>
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</tr>
<tr>
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<td>Federal coal, but no Federal surface ownership</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td>Federal coal and surface ownership</td>
<td>8.9</td>
</tr>
<tr>
<td>DIFFICULTY total</td>
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<td>Federal coal and Federal surface ownership</td>
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<td>HANNA</td>
<td>No Federal coal or surface ownership</td>
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<tr>
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<td>Federal coal and surface ownership</td>
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<td>HANNA total</td>
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<tr>
<td>T E RANCH</td>
<td>No Federal coal or surface ownership</td>
<td>44</td>
</tr>
<tr>
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<td>Federal coal, but no Federal surface ownership</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>Federal coal and surface ownership</td>
<td>34</td>
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<td>T E RANCH total</td>
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<td>Grand total Federal coal</td>
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<td>Grand total (MST)</td>
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Table HN-18. Coal resources of the Hanna 78 coal zone in the Hanna coalfield, Hanna Basin, Wyoming, reported by overburden (fig. HN-27), net coal thickness (fig. HN-18), and reliability categories. Zeros (0) indicate areas where no resources were calculated. Resources are reported in millions of short tons (MST) with two significant figures. The table does not include resources for coal less than 2.5 ft thick or coal in mine or lease areas (fig. HN-18). Resource numbers will not sum to match totals due to independent rounding.

<table>
<thead>
<tr>
<th>Overburden thickness</th>
<th>Net coal thickness</th>
<th>Reliability category (distance from data point)</th>
<th>Total (MST)</th>
</tr>
</thead>
<tbody>
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<td></td>
<td></td>
<td>Measured (&lt;1/4 mi)</td>
<td>Indicated (1/4-3/4 mi)</td>
</tr>
<tr>
<td>0-100 ft</td>
<td>2.5-5 ft</td>
<td>0.018</td>
<td>0</td>
</tr>
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<td></td>
<td>5-10 ft</td>
<td>0.32</td>
<td>0.27</td>
</tr>
<tr>
<td></td>
<td>10-20 ft</td>
<td>2.1</td>
<td>2.9</td>
</tr>
<tr>
<td></td>
<td>20-30 ft</td>
<td>4.4</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>30-40 ft</td>
<td>8.3</td>
<td>7.0</td>
</tr>
<tr>
<td></td>
<td>0-100 ft total</td>
<td>15</td>
<td>10</td>
</tr>
<tr>
<td>100-200 ft</td>
<td>2.5-5 ft</td>
<td>0.055</td>
<td>0</td>
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<td>5-10 ft</td>
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<td>20-30 ft</td>
<td>6.9</td>
<td>0.69</td>
</tr>
<tr>
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<td>30-40 ft</td>
<td>11</td>
<td>4.2</td>
</tr>
<tr>
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<td>6.6</td>
</tr>
<tr>
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<td>2.5-5 ft</td>
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<td>0</td>
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<td>1.1</td>
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<tr>
<td></td>
<td>20-30 ft</td>
<td>4.7</td>
<td>2.7</td>
</tr>
<tr>
<td></td>
<td>30-40 ft</td>
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</tr>
<tr>
<td></td>
<td>200-300 ft total</td>
<td>17</td>
<td>6.2</td>
</tr>
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<tr>
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</tr>
<tr>
<td></td>
<td>30-40 ft</td>
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<td>300-400 ft total</td>
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<td>8.1</td>
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Table HN-18. Hanna 78 coal resources—continued

<table>
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<th>Overburden thickness</th>
<th>Net coal thickness</th>
<th>Reliability category (distance from data point)</th>
<th>Total (MST)</th>
</tr>
</thead>
<tbody>
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<td></td>
<td></td>
<td>Measured (&lt;1/4 mi)</td>
<td>Indicated (1/4-3/4 mi)</td>
</tr>
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<td>400-500 ft</td>
<td>2.5-5 ft</td>
<td>0.027</td>
<td>0.002</td>
</tr>
<tr>
<td></td>
<td>5-10 ft</td>
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</tr>
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<td>10-20 ft</td>
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<td>4.0</td>
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<td></td>
<td>20-30 ft</td>
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</tr>
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<td>5.0</td>
</tr>
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<td>11</td>
</tr>
<tr>
<td></td>
<td>20-30 ft</td>
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<td>9.0</td>
</tr>
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<td></td>
<td>30-40 ft</td>
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<td>13</td>
</tr>
<tr>
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</tr>
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<td>0</td>
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<td>6.9</td>
</tr>
<tr>
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Table HN-19. Coal resources of the Hanna 78 coal zone in the Hanna coalfield, Hanna Basin, Wyoming, reported by 7.5-minute quadrangle (fig. HN-21) and Federal coal and surface ownership (fig. HN-23). Resources are reported in millions of short tons (MST) with two significant figures. Table does not include resources for coal less than 2.5 ft thick or coal in mine or lease areas (fig. HN-18). Resource numbers will not sum to match totals due to independent rounding.

<table>
<thead>
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<th>7.5-minute quadrangle map</th>
<th>Federal ownership</th>
<th>Total (MST)</th>
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</thead>
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<td>Federal coal and surface ownership</td>
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</tr>
<tr>
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<td>Federal coal and surface ownership</td>
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</tr>
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Table HN-20. Coal resources of the Hanna 79 coal zone in the Hanna coalfield, Hanna Basin, Wyoming, reported by overburden (fig. HN-28), net coal thickness (fig. HN-19), and reliability categories. Zeros (0) indicate areas where no resources were calculated. Resources are reported in millions of short tons (MST) with two significant figures. The table does not include resources for coal less than 2.5 ft thick or coal in mine or lease areas (fig. HN-19). Resource numbers will not sum to match totals due to independent rounding.

<table>
<thead>
<tr>
<th>Overburden thickness</th>
<th>Net coal thickness</th>
<th>Reliability category (distance from data point)</th>
<th>Total (MST)</th>
</tr>
</thead>
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<td>Indicated (1/4-3/4 mi)</td>
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<td>0</td>
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<tr>
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<td>30-40 ft</td>
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</tr>
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<tr>
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<td>0.089</td>
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<td>7.0</td>
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<td>10-20 ft</td>
<td>5.4</td>
<td>4.7</td>
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<tr>
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<td>30-40 ft</td>
<td>0.42</td>
<td>6.6</td>
</tr>
<tr>
<td>300-400 ft total</td>
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<td>11</td>
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<td>400-500 ft</td>
<td>10-20 ft</td>
<td>1.6</td>
<td>6.4</td>
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<td>30-40 ft</td>
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</tr>
<tr>
<td>500-1,000 ft total</td>
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<td>13</td>
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Table HN-20. Hanna 79 coal resources—continued

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<th>Overburden thickness</th>
<th>Net coal thickness</th>
<th>Reliability category (distance from data point)</th>
<th>Total (MST)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Measured (&lt;1/4 mi)</td>
<td>Indicated (1/4-3/4 mi)</td>
</tr>
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<td>1.7</td>
<td>4.7</td>
</tr>
<tr>
<td>1,000-1,500 ft total</td>
<td></td>
<td>1.7</td>
<td>6.6</td>
</tr>
<tr>
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<td>5-10 ft</td>
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<td>0</td>
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<td>0.73</td>
</tr>
<tr>
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<td>30-40 ft</td>
<td>0.98</td>
<td>14</td>
</tr>
<tr>
<td>1,500-2,000 ft total</td>
<td></td>
<td>0.98</td>
<td>14</td>
</tr>
<tr>
<td>&gt;2,000 ft</td>
<td>5-10 ft</td>
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<td>0</td>
</tr>
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<td>10-20 ft</td>
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</tr>
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<td>100</td>
</tr>
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<td>110</td>
</tr>
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<td>180</td>
</tr>
</tbody>
</table>
Table HN-21. Coal resources of the Hanna 79 coal zone in the Hanna coalfield, Hanna Basin, Wyoming, reported by 7.5-minute quadrangle (fig. HN-21) and Federal coal and surface ownership (fig. HN-24). Resources are reported in millions of short tons (MST) with two significant figures. Table does not include resources for coal less than 2.5 ft thick or coal in mine or lease areas (fig. HN-19). Resource numbers will not sum to match totals due to independent rounding.

<table>
<thead>
<tr>
<th>7.5-minute quadrangle map</th>
<th>Federal ownership</th>
<th>Total (MST)</th>
</tr>
</thead>
<tbody>
<tr>
<td>COMO WEST</td>
<td>No Federal coal or surface ownership</td>
<td>240</td>
</tr>
<tr>
<td></td>
<td>Federal coal, but no Federal surface ownership</td>
<td>7.5</td>
</tr>
<tr>
<td></td>
<td>Federal coal and surface ownership</td>
<td>190</td>
</tr>
<tr>
<td>COMO WEST total</td>
<td></td>
<td>440</td>
</tr>
<tr>
<td>DIFFICULTY</td>
<td>No Federal coal or surface ownership</td>
<td>130</td>
</tr>
<tr>
<td></td>
<td>Federal coal, but no Federal surface ownership</td>
<td>17</td>
</tr>
<tr>
<td></td>
<td>Federal coal and surface ownership</td>
<td>2.7</td>
</tr>
<tr>
<td>DIFFICULTY total</td>
<td></td>
<td>150</td>
</tr>
<tr>
<td>ELMO</td>
<td>No Federal coal or surface ownership</td>
<td>150</td>
</tr>
<tr>
<td></td>
<td>Federal coal, but no Federal surface ownership</td>
<td>0.52</td>
</tr>
<tr>
<td></td>
<td>Federal coal and surface ownership</td>
<td>78</td>
</tr>
<tr>
<td>ELMO total</td>
<td></td>
<td>230</td>
</tr>
<tr>
<td>T E RANCH</td>
<td>No Federal coal or surface ownership</td>
<td>35</td>
</tr>
<tr>
<td></td>
<td>Federal coal, but no Federal surface ownership</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td>Federal coal and surface ownership</td>
<td>30</td>
</tr>
<tr>
<td>T E RANCH total</td>
<td></td>
<td>76</td>
</tr>
<tr>
<td>Grand total Federal coal</td>
<td></td>
<td>340</td>
</tr>
<tr>
<td>Grand total (MST)</td>
<td></td>
<td>900</td>
</tr>
</tbody>
</table>
Table HN-22. Coal resources of the Hanna 81 coal zone in the Hanna coalfield, Hanna Basin, Wyoming, reported by overburden (fig. HN-29), net coal thickness (fig. HN-20), and reliability categories. Zeros (0) indicate areas where no resources were calculated. Resources are reported in millions of short tons (MST) with two significant figures. The table does not include resources for coal less than 2.5 ft thick or coal in mine or lease areas (fig. HN-20). Resource numbers will not sum to match totals due to independent rounding.

<table>
<thead>
<tr>
<th>Overburden thickness</th>
<th>Net coal thickness</th>
<th>Reliability category (distance from data point)</th>
<th>Total (MST)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Measured (&lt;1/4 mi)</td>
<td>Indicated (1/4-3/4 mi)</td>
</tr>
<tr>
<td>0-100 ft</td>
<td>2.5-5 ft</td>
<td>0.10</td>
<td>1.2</td>
</tr>
<tr>
<td></td>
<td>5-10 ft</td>
<td>0.86</td>
<td>0.31</td>
</tr>
<tr>
<td></td>
<td>10-20 ft</td>
<td>2.0</td>
<td>0.053</td>
</tr>
<tr>
<td></td>
<td>30-40 ft</td>
<td>14</td>
<td>10</td>
</tr>
<tr>
<td>0-100 ft total</td>
<td></td>
<td>17</td>
<td>12</td>
</tr>
<tr>
<td>100-200 ft</td>
<td>2.5-5 ft</td>
<td>0.00084</td>
<td>0.56</td>
</tr>
<tr>
<td></td>
<td>5-10 ft</td>
<td>0.0098</td>
<td>0.74</td>
</tr>
<tr>
<td></td>
<td>10-20 ft</td>
<td>0.40</td>
<td>0.50</td>
</tr>
<tr>
<td></td>
<td>30-40 ft</td>
<td>7.1</td>
<td>16</td>
</tr>
<tr>
<td>100-200 ft total</td>
<td></td>
<td>7.5</td>
<td>18</td>
</tr>
<tr>
<td>200-300 ft</td>
<td>2.5-5 ft</td>
<td>0</td>
<td>0.40</td>
</tr>
<tr>
<td></td>
<td>5-10 ft</td>
<td>0</td>
<td>0.39</td>
</tr>
<tr>
<td></td>
<td>10-20 ft</td>
<td>0.37</td>
<td>0.68</td>
</tr>
<tr>
<td></td>
<td>30-40 ft</td>
<td>3.9</td>
<td>13</td>
</tr>
<tr>
<td>200-300 ft total</td>
<td></td>
<td>4.3</td>
<td>14</td>
</tr>
<tr>
<td>300-400 ft</td>
<td>2.5-5 ft</td>
<td>0</td>
<td>0.18</td>
</tr>
<tr>
<td></td>
<td>5-10 ft</td>
<td>0</td>
<td>0.41</td>
</tr>
<tr>
<td></td>
<td>10-20 ft</td>
<td>0.20</td>
<td>0.74</td>
</tr>
<tr>
<td></td>
<td>30-40 ft</td>
<td>3.3</td>
<td>7.5</td>
</tr>
<tr>
<td>300-400 ft total</td>
<td></td>
<td>3.5</td>
<td>8.9</td>
</tr>
<tr>
<td>400-500 ft</td>
<td>2.5-5 ft</td>
<td>0</td>
<td>0.0049</td>
</tr>
<tr>
<td></td>
<td>5-10 ft</td>
<td>0</td>
<td>0.35</td>
</tr>
<tr>
<td></td>
<td>10-20 ft</td>
<td>0.045</td>
<td>1.0</td>
</tr>
<tr>
<td></td>
<td>30-40 ft</td>
<td>2.9</td>
<td>5.1</td>
</tr>
<tr>
<td>400-500 ft total</td>
<td></td>
<td>3.0</td>
<td>6.4</td>
</tr>
</tbody>
</table>
### Table HN-22. Hanna 81 coal resources—continued

<table>
<thead>
<tr>
<th>Overburden thickness</th>
<th>Net coal thickness</th>
<th>Reliability category (distance from data point)</th>
<th>Total (MST)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Measured (&lt;1/4 mi)</td>
<td>Indicated (1/4-3/4 mi)</td>
</tr>
<tr>
<td>500-1,000 ft</td>
<td>2.5-5 ft</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>5-10 ft</td>
<td>0.27</td>
<td>5.3</td>
</tr>
<tr>
<td></td>
<td>10-20 ft</td>
<td>1.2</td>
<td>2.1</td>
</tr>
<tr>
<td></td>
<td>30-40 ft</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>500-1,000 ft total</td>
<td>1.5</td>
<td>7.6</td>
</tr>
<tr>
<td>1,000-1,500 ft</td>
<td>10-20 ft</td>
<td>0.017</td>
<td>7.7</td>
</tr>
<tr>
<td></td>
<td>30-40 ft</td>
<td>0.17</td>
<td>1.4</td>
</tr>
<tr>
<td></td>
<td>1,000-1,500 ft total</td>
<td>0.18</td>
<td>9.1</td>
</tr>
<tr>
<td>1,500-2,000 ft</td>
<td>10-20 ft</td>
<td>0.0051</td>
<td>3.9</td>
</tr>
<tr>
<td></td>
<td>30-40 ft</td>
<td>0.42</td>
<td>4.6</td>
</tr>
<tr>
<td></td>
<td>1,500-2,000 ft total</td>
<td>0.43</td>
<td>8.5</td>
</tr>
<tr>
<td>&gt;2,000 ft</td>
<td>5-10 ft</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>10-20 ft</td>
<td>0</td>
<td>2.3</td>
</tr>
<tr>
<td></td>
<td>20-30 ft</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>30-40 ft</td>
<td>10</td>
<td>71</td>
</tr>
<tr>
<td>&gt;2,000 ft total</td>
<td>10</td>
<td>73</td>
<td>170</td>
</tr>
<tr>
<td>Grand total (MST)</td>
<td>47</td>
<td>160</td>
<td>440</td>
</tr>
</tbody>
</table>
Table HN-23. Coal resources of the Hanna 81 coal zone in the Hanna coalfield, Hanna Basin, Wyoming, reported by 7.5-minute quadrangle (fig. HN-21) and Federal coal and surface ownership (fig. HN-25). Resources are reported in millions of short tons (MST) and in two significant figures. Table does not include resources for coal less than 2.5 ft thick or coal in mine or lease areas (fig. HN-20). Resource numbers will not sum to match totals due to independent rounding.

<table>
<thead>
<tr>
<th>7.5-minute quadrangle map</th>
<th>Federal ownership</th>
<th>Total (MST)</th>
</tr>
</thead>
<tbody>
<tr>
<td>COMO WEST</td>
<td>No Federal coal or surface ownership</td>
<td>150</td>
</tr>
<tr>
<td></td>
<td>Federal coal and surface ownership</td>
<td>160</td>
</tr>
<tr>
<td>COMO WEST total</td>
<td></td>
<td>310</td>
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<tr>
<td>DIFFICULTY</td>
<td>No Federal coal or surface ownership</td>
<td>100</td>
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<tr>
<td></td>
<td>Federal coal and surface ownership</td>
<td>0.089</td>
</tr>
<tr>
<td>DIFFICULTY total</td>
<td></td>
<td>100</td>
</tr>
<tr>
<td>ELMO</td>
<td>No Federal coal or Federal surface ownership</td>
<td>87</td>
</tr>
<tr>
<td></td>
<td>Federal coal and Federal surface ownership</td>
<td>47</td>
</tr>
<tr>
<td>ELMO total</td>
<td></td>
<td>130</td>
</tr>
<tr>
<td>HANNA</td>
<td>No Federal coal or surface ownership</td>
<td>87</td>
</tr>
<tr>
<td></td>
<td>Federal coal and surface ownership</td>
<td>0.42</td>
</tr>
<tr>
<td>HANNA total</td>
<td></td>
<td>87</td>
</tr>
<tr>
<td>T E RANCH</td>
<td>No Federal coal or surface ownership</td>
<td>17</td>
</tr>
<tr>
<td></td>
<td>Federal coal and surface ownership</td>
<td>13</td>
</tr>
<tr>
<td>T E RANCH total</td>
<td></td>
<td>30</td>
</tr>
<tr>
<td>Grand total of Federal coal</td>
<td></td>
<td>160</td>
</tr>
<tr>
<td>Grand total (MST)</td>
<td></td>
<td>660</td>
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Table HN-24. Parameters and confidence intervals within reliability categories for Hanna 77 coal resources, Hanna coalfield, Hanna Basin, Wyoming. Estimates of uncertainty were calculated with measurement error. Volume refers to the calculated resource in millions of short tons (MST). To show detail, resources in this table are reported using four significant figures. NA, not applicable

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Reliability category</th>
<th>Entire area</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Measured</td>
<td>Indicated</td>
</tr>
<tr>
<td>Percent of area</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acres (area x 0.0002471)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SD (standard deviation (in ft) derived directly from the data)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acre feet (acres x SD)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Volume standard deviation (MST)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pseudo n</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total calculated resource (MST)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lower 90% confidence limit (MST)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Upper 90% confidence limit (MST)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table HN-25. Parameters and confidence intervals within reliability categories for Hanna 78 coal resources, Hanna coalfield, Hanna Basin, Wyoming. Estimates of uncertainty were calculated with measurement error. Volume refers to the calculated resource in millions of short tons (MST). To show detail, resources in this table are reported using four significant figures. NA, not applicable

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Reliability category</th>
<th>Entire area</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Measured</td>
<td>Indicated</td>
</tr>
<tr>
<td>Area (in square meters)</td>
<td>17,355,245</td>
<td>27,276,139</td>
</tr>
<tr>
<td>Percent of area</td>
<td>14</td>
<td>22</td>
</tr>
<tr>
<td>Acres (Area x 0.0002471)</td>
<td>4,289</td>
<td>6,740</td>
</tr>
<tr>
<td>SD (Standard deviation (in ft) derived directly from the data)</td>
<td>6.827</td>
<td>6.827</td>
</tr>
<tr>
<td>Acre feet (Acres x SD)</td>
<td>29,279</td>
<td>46,017</td>
</tr>
<tr>
<td>Volume standard deviation (MST)</td>
<td>9</td>
<td>33</td>
</tr>
<tr>
<td>Pseudo n</td>
<td>34</td>
<td>6</td>
</tr>
<tr>
<td>Total calculated resource (MST)</td>
<td>129.9</td>
<td>247.1</td>
</tr>
<tr>
<td>Lower 90% confidence limit (MST)</td>
<td>115.0</td>
<td>192.0</td>
</tr>
<tr>
<td>Upper 90% confidence limit (MST)</td>
<td>144.0</td>
<td>302.0</td>
</tr>
</tbody>
</table>
Table HN-26. Parameters and confidence intervals within reliability categories for Hanna 79 coal resources, Hanna coalfield, Hanna Basin, Wyoming. Estimates of uncertainty were calculated with measurement error. Volume refers to the calculated resource in millions of short tons (MST). To show detail, resources in this table are reported using four significant figures. NA, not applicable

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Measured</th>
<th>Indicated</th>
<th>Inferred</th>
<th>Hypothetical</th>
<th>Entire area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area (in square meters)</td>
<td>13,615,932</td>
<td>23,226,193</td>
<td>58,562,863</td>
<td>2,157,339</td>
<td>97,562,328</td>
</tr>
<tr>
<td>Percent of area</td>
<td>14</td>
<td>24</td>
<td>60</td>
<td>2</td>
<td>100</td>
</tr>
<tr>
<td>Acres (area x 0.0002471)</td>
<td>3,365</td>
<td>5,739</td>
<td>14,471</td>
<td>533</td>
<td>24,108</td>
</tr>
<tr>
<td>SD (standard deviation (in ft) derived directly from the data)</td>
<td>4.147</td>
<td>4.147</td>
<td>4.147</td>
<td>4.147</td>
<td>NA</td>
</tr>
<tr>
<td>Acre feet (acres x SD)</td>
<td>13,953</td>
<td>23,801</td>
<td>60,012</td>
<td>2,211</td>
<td>NA</td>
</tr>
<tr>
<td>Volume standard deviation (MST)</td>
<td>5</td>
<td>19</td>
<td>119</td>
<td>4</td>
<td>146</td>
</tr>
<tr>
<td>Pseudo n</td>
<td>27</td>
<td>5</td>
<td>1</td>
<td>1</td>
<td>NA</td>
</tr>
<tr>
<td>Total calculated resource (MST)</td>
<td>73.27</td>
<td>180.6</td>
<td>607.2</td>
<td>34.17</td>
<td>895.2</td>
</tr>
<tr>
<td>Lower 90% confidence limit (MST)</td>
<td>65.00</td>
<td>150.0</td>
<td>412.0</td>
<td>28.00</td>
<td>655.0</td>
</tr>
<tr>
<td>Upper 90% confidence limit (MST)</td>
<td>81.00</td>
<td>211.0</td>
<td>803.0</td>
<td>41.00</td>
<td>1,136</td>
</tr>
</tbody>
</table>
Table HN-27. Parameters and confidence intervals within reliability categories for Hanna 81 coal resources, Hanna coalfield, Hanna Basin, Wyoming. Estimates of uncertainty were calculated with measurement error. Volume refers to the calculated resource in millions of short tons (MST). To show detail, resources in this table are reported using four significant figures. NA, not applicable

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Measured</th>
<th>Indicated</th>
<th>Inferred</th>
<th>Hypothetical</th>
<th>Entire area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area (in square meters)</td>
<td>6,030,945</td>
<td>23,789,170</td>
<td>60,454,785</td>
<td>1,459,792</td>
<td>91.734,691</td>
</tr>
<tr>
<td>Percent of area</td>
<td>7</td>
<td>26</td>
<td>66</td>
<td>2</td>
<td>100</td>
</tr>
<tr>
<td>Acres (area x 0.0002471)</td>
<td>1,490</td>
<td>5,878</td>
<td>14,939</td>
<td>361</td>
<td>22,668</td>
</tr>
<tr>
<td>SD (standard deviation (in ft) derived directly from the data)</td>
<td>7.145</td>
<td>7.145</td>
<td>7.145</td>
<td>7.145</td>
<td>NA</td>
</tr>
<tr>
<td>Acre feet (Acres x SD)</td>
<td>10,648</td>
<td>42,000</td>
<td>106,734</td>
<td>2,577</td>
<td>NA</td>
</tr>
<tr>
<td>Volume standard deviation (MST)</td>
<td>5</td>
<td>33</td>
<td>208</td>
<td>5</td>
<td>251</td>
</tr>
<tr>
<td>Pseudo n</td>
<td>12</td>
<td>5</td>
<td>1</td>
<td>1</td>
<td>NA</td>
</tr>
<tr>
<td>Total calculated resource (MST)</td>
<td>47.52</td>
<td>158.1</td>
<td>443.0</td>
<td>17.61</td>
<td>666.2</td>
</tr>
<tr>
<td>Lower 90% confidence limit (MST)</td>
<td>39.00</td>
<td>104.0</td>
<td>101.0</td>
<td>10.00</td>
<td>254.0</td>
</tr>
<tr>
<td>Upper 90% confidence limit (MST)</td>
<td>57.00</td>
<td>212.0</td>
<td>785.0</td>
<td>25.00</td>
<td>1,078</td>
</tr>
</tbody>
</table>
Table HN-28. Coal resources of the Johnson-107 coal zone in the South Carbon coalfield, Wyoming, reported by overburden (fig. HN-33), net coal thickness (fig. HN-32), and reliability categories. Zeros (0) indicate areas where no resources were calculated. Resources are reported in millions of short tons (MST) with two significant figures. Resources do not include coal less than 2.5 ft thick or coal in mine or lease areas (fig. HN-32). Resource numbers will not sum to match totals due to independent rounding.

<table>
<thead>
<tr>
<th>Overburden thickness</th>
<th>Net coal thickness</th>
<th>Reliability category (distance from data point)</th>
<th>Grand total (MST)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Measured (&lt;1/4 mi)</td>
<td>Indicated (1/4-3/4 mi)</td>
</tr>
<tr>
<td>0-100 ft</td>
<td>2.5-5 ft</td>
<td>0</td>
<td>0.053</td>
</tr>
<tr>
<td></td>
<td>5-10 ft</td>
<td>0.78</td>
<td>4.9</td>
</tr>
<tr>
<td></td>
<td>10-20 ft</td>
<td>2.0</td>
<td>8.9</td>
</tr>
<tr>
<td></td>
<td>20-30 ft</td>
<td>2.0</td>
<td>21</td>
</tr>
<tr>
<td></td>
<td>30-40 ft</td>
<td>0</td>
<td>8.1</td>
</tr>
<tr>
<td></td>
<td>&gt;40 ft</td>
<td>0</td>
<td>71</td>
</tr>
<tr>
<td>0-100 ft total</td>
<td></td>
<td>4.8</td>
<td>110</td>
</tr>
<tr>
<td>100-200 ft</td>
<td>2.5-5 ft</td>
<td>0.022</td>
<td>0.036</td>
</tr>
<tr>
<td></td>
<td>5-10 ft</td>
<td>1.2</td>
<td>1.3</td>
</tr>
<tr>
<td></td>
<td>10-20 ft</td>
<td>0.48</td>
<td>5.5</td>
</tr>
<tr>
<td></td>
<td>20-30 ft</td>
<td>0.63</td>
<td>9.1</td>
</tr>
<tr>
<td></td>
<td>30-40 ft</td>
<td>0</td>
<td>6.8</td>
</tr>
<tr>
<td></td>
<td>&gt;40 ft</td>
<td>3.4</td>
<td>41</td>
</tr>
<tr>
<td>100-200 ft total</td>
<td></td>
<td>5.8</td>
<td>64</td>
</tr>
<tr>
<td>200-300 ft</td>
<td>2.5-5 ft</td>
<td>0.044</td>
<td>0.011</td>
</tr>
<tr>
<td></td>
<td>5-10 ft</td>
<td>1.0</td>
<td>0.064</td>
</tr>
<tr>
<td></td>
<td>10-20 ft</td>
<td>0.52</td>
<td>1.6</td>
</tr>
<tr>
<td></td>
<td>20-30 ft</td>
<td>0.62</td>
<td>6.7</td>
</tr>
<tr>
<td></td>
<td>30-40 ft</td>
<td>0</td>
<td>7.5</td>
</tr>
<tr>
<td></td>
<td>&gt;40 ft</td>
<td>4.1</td>
<td>57</td>
</tr>
<tr>
<td>200-300 ft total</td>
<td></td>
<td>6.3</td>
<td>73</td>
</tr>
</tbody>
</table>

Resources do not include coal less than 2.5 ft thick or coal in mine or lease areas (fig. HN-32). Resource numbers will not sum to match totals due to independent rounding.
Table HN-28. Johnson-107 coal resources—continued

<table>
<thead>
<tr>
<th>Overburden thickness</th>
<th>Net coal thickness</th>
<th>Reliability category (distance from data point)</th>
<th>Grand total (MST)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Measured (&lt;1/4 mi)</td>
<td>Indicated (1/4-3/4 mi)</td>
</tr>
<tr>
<td>300-400 ft</td>
<td>2.5-5 ft</td>
<td>0.11</td>
<td>0.0003</td>
</tr>
<tr>
<td></td>
<td>5-10 ft</td>
<td>0.89</td>
<td>0.65</td>
</tr>
<tr>
<td></td>
<td>10-20 ft</td>
<td>2.5</td>
<td>6.5</td>
</tr>
<tr>
<td></td>
<td>20-30 ft</td>
<td>0.25</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td>30-40 ft</td>
<td>0.24</td>
<td>9.4</td>
</tr>
<tr>
<td></td>
<td>&gt;40 ft</td>
<td>5.2</td>
<td>130</td>
</tr>
<tr>
<td>300-400 ft total</td>
<td></td>
<td>9.2</td>
<td>160</td>
</tr>
<tr>
<td>400-500 ft</td>
<td>2.5-5 ft</td>
<td>0.21</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>5-10 ft</td>
<td>1.7</td>
<td>1.9</td>
</tr>
<tr>
<td></td>
<td>10-20 ft</td>
<td>3.4</td>
<td>8.4</td>
</tr>
<tr>
<td></td>
<td>20-30 ft</td>
<td>1.7</td>
<td>0.9</td>
</tr>
<tr>
<td></td>
<td>30-40 ft</td>
<td>3.2</td>
<td>0.59</td>
</tr>
<tr>
<td></td>
<td>&gt;40 ft</td>
<td>48</td>
<td>99</td>
</tr>
<tr>
<td>400-500 ft total</td>
<td></td>
<td>58</td>
<td>110</td>
</tr>
<tr>
<td>&gt;500 ft</td>
<td>2.5-5 ft</td>
<td>0.61</td>
<td>0.36</td>
</tr>
<tr>
<td></td>
<td>5-10 ft</td>
<td>1.7</td>
<td>3.6</td>
</tr>
<tr>
<td></td>
<td>10-20 ft</td>
<td>0.34</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td>20-30 ft</td>
<td>4.8</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td>30-40 ft</td>
<td>1.7</td>
<td>19</td>
</tr>
<tr>
<td></td>
<td>&gt;40 ft</td>
<td>48</td>
<td>130</td>
</tr>
<tr>
<td>&gt;500 ft total</td>
<td></td>
<td>57</td>
<td>180</td>
</tr>
<tr>
<td>Grand total (MST)</td>
<td></td>
<td>140</td>
<td>700</td>
</tr>
</tbody>
</table>
Table HN-29. Coal resources of the Johnson-107 coal zone in the South Carbon coalfield, Wyoming, reported by 7.5-minute quadrangle map area (fig. HN-30) and Federal coal and surface ownership (fig HN-31). Resources are reported in millions of short tons (MST) with two significant figures. Resources do not include coal less than 2.5 ft thick or coal in mine or lease areas (fig. HN-32). Resource numbers will not sum to match totals due to independent rounding.

<table>
<thead>
<tr>
<th>7.5-minute quadrangle map</th>
<th>Federal ownership</th>
<th>Total (MST)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CARBON</td>
<td>No Federal coal or surface ownership</td>
<td>410</td>
</tr>
<tr>
<td></td>
<td>Federal coal, but no Federal surface ownership</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>Federal coal and surface ownership</td>
<td>48</td>
</tr>
<tr>
<td>CARBON total</td>
<td></td>
<td>470</td>
</tr>
<tr>
<td>ELK MOUNTAIN</td>
<td>No Federal coal or surface ownership</td>
<td>40</td>
</tr>
<tr>
<td></td>
<td>Federal coal, but no Federal surface ownership</td>
<td>0.69</td>
</tr>
<tr>
<td></td>
<td>Federal coal and surface ownership</td>
<td>0.65</td>
</tr>
<tr>
<td>ELK MOUNTAIN total</td>
<td></td>
<td>41</td>
</tr>
<tr>
<td>HALFWAY HILL</td>
<td>No Federal coal or surface ownership</td>
<td>420</td>
</tr>
<tr>
<td></td>
<td>Federal coal, but no Federal surface ownership</td>
<td>3.4</td>
</tr>
<tr>
<td></td>
<td>Federal coal and surface ownership</td>
<td>140</td>
</tr>
<tr>
<td>HALFWAY HILL total</td>
<td></td>
<td>560</td>
</tr>
<tr>
<td>T L RANCH</td>
<td>No Federal coal or surface ownership</td>
<td>66</td>
</tr>
<tr>
<td></td>
<td>Federal coal, but no Federal surface ownership</td>
<td>0.37</td>
</tr>
<tr>
<td></td>
<td>Federal coal and surface ownership</td>
<td>0.095</td>
</tr>
<tr>
<td>T L RANCH total</td>
<td></td>
<td>66</td>
</tr>
<tr>
<td>Grand total of Federal coal</td>
<td></td>
<td>210</td>
</tr>
<tr>
<td>Grand total (MST)</td>
<td></td>
<td>1,100</td>
</tr>
</tbody>
</table>
Table HN-30. Data used for computation of confidence intervals within reliability categories for Johnson-107 coal resources in the South Carbon coalfield, Carbon Basin, Wyoming. Volume refers to the calculated resource in millions of short tons (MST). NA, not applicable

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Reliability category</th>
<th>Entire area</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Measured</td>
<td>Indicated</td>
</tr>
<tr>
<td>Area (in square meters)</td>
<td>9,114,330</td>
<td>37,519,215</td>
</tr>
<tr>
<td>Percent of area</td>
<td>15</td>
<td>63</td>
</tr>
<tr>
<td>Acres (area x 0.0002471)</td>
<td>2,252</td>
<td>9,271</td>
</tr>
<tr>
<td>SD (standard deviation (in ft) from variogram model)</td>
<td>13.780</td>
<td>13.780</td>
</tr>
<tr>
<td>Acre feet (acres x SD)</td>
<td>31,035</td>
<td>127,757</td>
</tr>
<tr>
<td>Volume standard deviation (MST)</td>
<td>13</td>
<td>79</td>
</tr>
<tr>
<td>Pseudo n</td>
<td>18</td>
<td>8</td>
</tr>
</tbody>
</table>

Table HN-31. Estimates of uncertainty (calculated with measurement error) for Johnson-107 coal resources in the South Carbon coalfield, Carbon Basin, Wyoming. To show detail, resources calculations are reported in millions of short tons (MST) with four significant figures

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Reliability category</th>
<th>Entire area</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Measured</td>
<td>Indicated</td>
</tr>
<tr>
<td>Total calculated resource (MST)</td>
<td>141.0</td>
<td>698.5</td>
</tr>
<tr>
<td>Lower 90% confidence limit (MST)</td>
<td>120.0</td>
<td>569.0</td>
</tr>
<tr>
<td>Upper 90% confidence limit (MST)</td>
<td>162.0</td>
<td>828.0</td>
</tr>
</tbody>
</table>