Module 22: Subsidence Control and Underground Mine Maps

Instructions: Information submitted under this Module must be certified by a licensed professional engineer or a licensed professional land surveyor.

Note: That at a minimum, the subsidence control plan shall address all areas within a 30-degree angle of draw of underground mining which will occur during the five (5)-year term of the permit.

22.1 Subsidence Control Plan.

a. Describe the equipment to be used for development and retreat phases of mining.

b. State the range of proposed mining centers for entries and crosscuts within the mains, submains, butts, rooms, etc.

c. State the average and maximum proposed entry and crosscut widths. These must be specific to the various entries and crosscuts to be used throughout the mine - such as mains, submains, butts, rooms, belt and track entries and any other areas in which the entry and crosscut width may vary.

d. Provide a description including sketches, if necessary, indicating the method of secondary or retreat mining to be used. The description should address the following, as applicable:

   i. Method of mining (pillar recovery, slabbing, splitting, longwall, shortwall, etc.);

   ii. The sequence of pillar recovery;

   iii. The sequence and widths of cuts, slabs, or splits;

   iv. Configuration of remaining pillars, fenders, or stumps, etc.

   v. The range of the length and width of the longwall panels.

e. State the proposed extraction percentages for mains, submains, butts, rooms, etc. for development and retreat phases.

f. Describe whether subsidence, if it is likely to occur, could cause material damage to any structure or could adversely affect any water supply.

g. Describe in detail how mining activities will be planned and conducted to not cause material damage or reduce the reasonably foreseeable use of the following features as present within the subsidence control plan area:

   i. Noncommercial structures commonly used by the public such as churches, schools, and hospitals;
ii. Public facilities such as government office buildings, police stations, prison complexes, municipal swimming pools, municipal utilities, public water lines, municipal airports, public park pavilions and maintenance facilities;

iii. Impoundments or other bodies of water with a storage capacity of 20 acre-feet or more;

iv. Bodies of water or aquifers that serve as significant sources of public water supply.

h. Describe the measures to be taken to minimize damage, destruction, or disruption of services to the following items as present within the subsidence control plan area or provide information showing that facilities will not be damaged. The description must address notification procedures, agreements and precautionary measures (at the land surface or in the mine).

i. Gas wells and oil wells;

ii. Water wells (wells which penetrate the target coal seam must have a block of coal around them);

iii. Oil, gas, and coal slurry pipelines (if necessary mining is proposed, the type, use, pressure, composition, and approximate age of the gas pipeline must be included);

iv. Rail lines;

v. Electric and telephone lines; and

vi. Water and sewerage lines.

i. Describe any applicable subsidence control measures required to satisfy the following statutes:

i. Act of December 22, 1959 (Act No. 729, Mining in Safety Zones);

ii. Oil and Gas Act (58P.S. §§601.101-601.605)

iii. Section 419 of the State Highway Law (Act No. 428); and

iv. Act of June 1, 1933 (Act No. 296, State Mining Commissions).
j. Describe how proposed mining will serve to maximize the stability of the workings that will remain when mining is complete. Discuss various scenarios of mining height, extraction percentage, and cover thickness as necessary to cover the range of conditions that will be encountered in the underground permit area. Describe the anticipated effects of planned subsidence.

i. For settings where pillars will be left in place, provide calculations to show their ability to provide continual support to the overlying strata; or the results of a geotechnical investigation of a previously mined area where equal or smaller pillars proved to be stable.

ii. If mining will take place under less than 100 feet of cover, also provide assessment of roof stability.

iii. For settings where final mine stability will be achieved by removing enough coal to induce roof collapse, provide calculations to show that remaining stumps will lack the ability to support the overlying strata, or the results of a geotechnical investigations showing that stumps of equal or larger size failed within a few years of mining. (If longwall mining will be conducted, simply state - "Longwall Mining" in response to this item.)

k. Describe the methods that will be used to mitigate subsidence damage that may occur (purchase, restoration, compensation, etc.). Provide a statement affirming that damaged structures will be repaired or replaced, or that the structure owner will be compensated for the cost of the repair or replacement. If secondary mining will occur beneath dwellings, barns, or silos, include a description of the measures to prevent irreparable damage to these structures if the structure owner does not concur to allow irreparable damage.

l. If an operator employs a mining technology that provides for planned subsidence in a predictable and controlled manner, describe the necessary and prudent measures that will be used to minimize material damage to the extent technologically and economically feasible to the structure(s).

m. If an operator employs a mining technology that does not result in planned subsidence in a predictable and controlled manner, describe the necessary and prudent measures that will be used to prevent subsidence and subsidence-related damage to the extent technologically and economically feasible to the structure(s), describe the measures that will be taken to prevent subsidence-related adverse impacts to places listed or eligible for listing, on the National Register of Historic Places and archaeological resources.

i. For mining that is proposed beneath structures where the depth of overburden is less than 100 feet, include a description of the site characteristics and/or mining techniques, which will ensure stable mine workings and prevent irreparable damage to overlying structures. Describe the measures to be taken to maintain the value and reasonably foreseeable use of surface lands.

ii. Describe the measures that will be used to correct any subsidence-related damage to surface lands. Describe the measures to be taken to maintain the value and reasonably foreseeable use of surface lands.
iii. Indicate whether the mine has caused irreparable damage to any dwelling or agricultural structure listed under 89.142a or if it is likely to cause such damage. If irreparable damage is likely to occur, indicate the measures that will be used to prevent that level of damage should the structure owner not consent.

iv. Describe any monitoring that will be performed to prevent, reduce, identify, or correct subsidence-related damage.

### 22.2 Geologic Considerations

a. Describe the minimum, maximum, and average cover conditions within the subsidence control plan area.

b. Describe the minimum, maximum, and average mining height within the subsidence control plan boundary.

c. Discuss the geologic factors which may serve to cause, prevent, or otherwise influence the following:
   i. Height and form of caving;
   ii. Pillar failure;
   iii. Pillars punching into mine floor or roof; and
   iv. Floor heave.

d. Describe any site-specific geologic conditions which are relevant to the likelihood or extent of subsidence-related damage.

### 22.3 Index Map

Provide a 7.5 minute USGS map that shows the underground permit area and index to the six-month map series. Include a legend containing the map title, mine name, company name, coal seam, township, county, scale, engineer's (or surveyor's) signature, and seal. Show the following:

a. Boundary of the underground permit area;

b. Boundary of the subsidence control plan area;

c. A sheet index for the six-month maps;

d. A sheet index for the subsidence control maps (Module 22.4 map).

### 22.4 Subsidence Control Plan Map (see mapping standards in Module 22.9)

Provide a subsidence control plan map at a scale of 1 inch = 500 feet or larger, showing the information listed in this section. Include either a north arrow or coordinate grid system for orientation; and a legend containing the map title, mine name, company name, coal seam, township, county, scale, index sheet number, engineer’s (or surveyor’s) signature and seal. The map must include all areas where structures or perennial streams may be impacted by underground mining activities. At a minimum, the map must cover the area determined by projecting a plane along a 30-degree angle upward and outward from the limits of the planned coal extraction area. However, all adjacent underground mine workings within 1,000 feet of the proposed mine must be shown.

a. The boundaries of the underground permit area and subsidence control plan area.
b. Coal barriers to be maintained around the perimeter of the underground permit area.

c. A mining forecast showing the size and sequence of incremental mining areas over the life of the operation.
   i. For areas within the subsidence control plan boundary, the forecast must be in yearly increments (i.e., Year 1, Year 2, etc.) with single line projections indicating proposed main, submain, and butt headings, gate entries and longwall panels.
   ii. For areas outside the subsidence control plan boundary, the remaining parts of the mine plan may be shown by outlining proposed mining areas in increments of five (5) years or less. Mine life must be consistent with Module 10.1a.

d. Structures, features and resources relevant to subsidence control plan development, including:
   i. The boundaries of lands and names of current surface and coal owners of record. (Key to Module 5.)
   ii. Dwellings, public buildings and facilities, churches, schools, hospitals and impoundments with a storage capacity of 20 acre-feet, identified by numerical reference.
   iii. Buildings that are accessible to the public including, but not limited to commercial, industrial and recreational buildings and all permanently affixed appurtenant structures identified by numerical reference.
   iv. Noncommercial buildings that are customarily used by the public, and not listed in Item iii, identified by numerical reference.
   v. Dwellings that are used for human habitation and permanently affixed appurtenant structures and improvements. (Identify any improvements that are not subject to repair requirements because they were not in place on August 21, 1994 or on the date of first publication of the most recent permit or permit renewal application.)
   vi. Barns and silos identified by numerical reference.
   vii. Permanently affixed structures of 500 or more square feet in area that are used for raising livestock, poultry or agricultural products, for storage of animal waste or for the processing or retail marketing of agricultural products on the farm on which the structures are located identified by numerical reference.
   viii. Public parks and historic structures.
   ix. Structures which are entitled to support by law or agreement, identified by numerical reference.
   x. Water supply wells identified by numerical reference.
   xi. Water supply springs identified by numerical reference.
   xii. Major electric transmission lines, including identification by name or numerical reference.
   xiii. Public roads by route number, and railroads.
   xiv. Oil, gas and coal slurry pipelines larger than four inches in diameter, including identification by name or numerical reference.
   xv. Water and sewer mains and transmission lines, including identification by name or numerical reference.
   xvi. Surface water bodies, including perennial streams, lakes, ponds, dams and impoundments with a volume of 20 acre-feet or more, indicating by numerical reference those perennial streams and other bodies of water which are a significant source for a public water supply system.
   xvii. Coal refuse disposal areas, solid and hazardous waste disposal areas, and other air and water pollution control facilities, all identified by name or numerical reference.
xviii. Gas, oil and water wells.

xix. Surface sites and facilities associated with the underground permit application.

xx. Political subdivisions.

xxi. Landslide prone areas.

xxii. Areas over the proposed mine where the overburden is 100 feet or less.

xxiii. Coal seam contours.

xxiv. All historical or existing sealed mine openings (including boreholes), as well as all proposed mine openings within the permit area.

e. Identify in a distinguishing manner those structures, features and facilities that must be protected against material damage or reduction in reasonably foreseeable use in accordance with 89.142a(c), including:

i. Churches, schools and hospitals.

ii. Public buildings, facilities, and water lines.

iii. Impoundments with a storage capacity of 20 acre-feet or more.

iv. Bodies of water with a volume of 20 acre-feet or more.

v. Bodies of water or aquifers that serve as significant sources to a public water supply system.

vi. Perennial streams that serve as significant sources to a public water supply system.

22.5 Public Notice (89.144)

Provide examples of notification letters that will be sent to property owners, residents, and local government offices. A copy of each notice will be required at a later date to coincide with six-month map reviews. (Note: transfer applicants must re-notify parties who have yet to be undermined even though they were notified by the previous permittee.)

22.6 Six-Month Projection Maps (see mapping standards in Module 22.9)

Six-Month Projection Maps and the Index Map (Module 22.3) must be submitted to and accepted by the Department before underground mining begins. However, these maps need not be submitted with the initial permit application. The six-month maps must be on a scale of not less than 1 inch = 200 feet and must include, at a minimum, the information listed in Modules 22.4.d and 22.4.e.

The following information must also be included on six-month maps where an applicant chooses to submit "combined maps" that will satisfy mapping the requirements under the Bituminous Coal Mine Act as provided for under the Department's Technical Guidance 563-2000-610:

a. All openings, excavations, shafts, slopes, drifts, tunnels, planes, main entries, cross entries and rooms and the name or number of each;

b. The direction of air currents, indicated by arrows, with each split numbered and suitably designated;

c. Elevations of the top and bottom of each shaft and slope, of all drifts, tunnels, planes and of the faces of entries including the number of last survey station and the date of such survey;

d. Location and elevation of any body of water dammed in the mine, or held back in any portion of the mine.

(Note: Gas wells are required to be shown on Six-Month Projection Maps, therefore, the applicant is reminded to contact the appropriate regional Oil and Gas Management office to obtain this information).
22.7 Structure Inventory

Provide a list of all surface owners and structures, facilities and features identified by numerical reference located within the subsidence control plan boundary and within a 30-degree angle of draw projected from that boundary. List properties and structures in order of their identification numbers and provide the following information:

a. Surface owner name and address;

b. Parcel number or tax identification number associated with each surface (use a period "." to separate the parcel number or tax identification number (ex. "12.345.5678").

c. A unique structure identification number;

d. Type or use of structure;

e. Identify each structure to which damage must be prevented; and

f. Map sheet (1 inch = 100 feet or 1 inch = 200 feet map set) on which structure appears.

22.8 Property Assessment Data

Provide the total tax assessment value of all properties within the subsidence control plan boundary and within a 30-degree angle of draw projected from that boundary.

22.9 Mine Map Standards

It is extremely beneficial for all mining operations in a given area to be tied into the same standardized coordinate system. This minimizes problems along boundaries and at mine connections. Additionally, this system must be tied into and made part of the state grid system. Therefore, the following minimum standards shall be adhered to for mine maps:

a. Minimum angular and coordinate ties for raw data would be an angular tie of less than 00°01’00” (1 minute) and a coordinate tie of greater than 1:10,000 (1 foot in 10,000 feet) for any given closed loop survey.

b. A closed loop survey is required to be at the next to last open crosscut of the mining section, but not more than 100 feet from the final face of a mining section.

c. Elevation closure of +/- 0.01 feet per 5,000 feet.

d. Vertical elevation shall be based on mean sea level (USGS elevation).

e. Preferred datum is the Pennsylvania State Plane coordinate system (NAD83 Datum).

f. Where applicable, appropriate coordinate transformation equation(s) should be placed on the map.

22.10 Adjacent Mine Working(s)

Utilize any and all sources necessary to accurately determine the full extent and location of adjacent abandoned mine workings. Document the types of sources used on the attached Form 22.10 which provides a check list of potential sources. Document any additional sources utilized in the form’s blank spaces.

Provide a narrative summary of all information used and the steps taken to obtain that information. At a minimum, the summary should address the following types of information:

a. Identification of all data sources used to verify and validate mine maps as documented on Form 22.10;

b. Listing of all mine map repositories searched during the research process;

c. Procedures used to orient and locate nearby abandoned mine workings with respect to the proposed mine;

d. A description of and results of field reconnaissance used to delineate mine workings;

e. Identification of all maps found in the search and relied upon to map abandoned mine workings, including ID or catalog numbers, archive location, scale, and condition;
f. Local gas well or water well drill logs that may indicate the presence of absence of mine voids;

g. Underground mine inspection records;

h. Annual coal production report data, including mine opening date and last coal extraction;

i. Permit information cross-checks with the Bureau of Mining and Reclamation;

j. Mechanical, geologic, or geophysical testing used to verify the mine workings, such as vertical or horizontal drilling or geophysical surveying;

k. An operational history of each adjacent abandoned mine including all ownership changes, dates of operation, dates when the mine was idle, date of mine closure, mine name changes, coal company name changes, and all permit identification numbers including an explanation showing that the map corresponds to the data found in the history;

l. An explanation of how mine pool elevation data for each abandoned mine was determined;

m. A discussion of any disparities between sources of information including site-specific details provided by local residents
In order to validate mine void location information provided to the Department, an applicant for an underground mine permit should use all sources necessary to accurately ascertain the full extent and location of adjacent abandoned mine workings. Potential sources of useful information are listed on the following checklist. Additional space is provided to add additional sources as needed.

<table>
<thead>
<tr>
<th>Information Source</th>
<th>Place a check (√) next to each information source relied upon to validate location of mine workings</th>
<th>Date that Source Review was Completed</th>
<th>Reviewer’s Initials</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coal production records</td>
<td>☐</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tax records</td>
<td>☐</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Local Driller’s logs (gas and water)</td>
<td>☐</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Worker’s compensation records</td>
<td>☐</td>
<td></td>
<td></td>
</tr>
<tr>
<td>County property records</td>
<td>☐</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Employment records</td>
<td>☐</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Newspaper accounts</td>
<td>☐</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Private mine map archives (local coal companies, museums and universities)</td>
<td>☐</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Museums</td>
<td>☐</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Local citizens</td>
<td>☐</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Field reconnaissance</td>
<td>☐</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Universities</td>
<td>☐</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Libraries</td>
<td>☐</td>
<td></td>
<td></td>
</tr>
<tr>
<td>State Mine Inspector’s records</td>
<td>☐</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Federal Mine Inspector’s records</td>
<td>☐</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operational histories of local mining companies</td>
<td>☐</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Survey data – notes, traverse books, sheets, etc…</td>
<td>☐</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Applicant’s Signature ___________________________ Date _____________________