state college area
CONNECTOR

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Geotechnical Reconnaissance Summary for the State College Area Connector Environmental Impact Statement

August 2025

Pennsylvania
Department of Transportation

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Federal Highway Administration

Contents

1 INTRODUCTION

1.1 Project History

The State College Area Connector Planning and Environmental Linkages (PEL) Study identified transportation needs within southern Centre County, Pennsylvania in a 70 square mile initial study area. The study evaluated a range of alternatives to determine how the alternatives addressed the Study's purpose and need, balanced impacts on the natural and built environment, addressed traffic concerns within the overall study area, met engineering considerations such as constructability, cost, and considered area planning goals. The PEL Study screened nine corridors to determine the best options to advance for National Environmental Policy Act (NEPA) evaluation and preliminary engineering. Based on the impact analysis, three corridors were identified (US 322-1S, US 322-1OEX and US 322-5) to be advanced as reasonable alternatives, and a specific project area was developed to initiate detailed field investigations and conduct preliminary engineering investigations to address the transportation purpose and needs as part of the NEPA process.

The final PEL Report was published in June 2023 and FHWA acknowledged in a letter, dated September 14, 2023, that the PEL Study was consistent with 23 USC Section 168 and 23 CFR 450.212. As a result, the PEL findings provide a starting point for the NEPA studies and preliminary engineering efforts. Additionally, FHWA concurred that an Environmental Impact Statement (EIS) was the proper NEPA classification for the State College Area Connector project.

The PEL Study also identified other transportation projects which did not meet the full purpose and need but could provide transportation benefits to the study area roadways independently. One such project was a safety study along PA 45 generally from Boal Avenue to PA 144. Subsequent to the PEL completion, additional traffic investigations and analysis and coordination with local officials for the State College Area Connector project determined that the connector road and interior interchange would provide some localized improvements to PA 45. However, it was determined that the connector road and associated interchange was not necessary to address the project's purpose and need, nor did it address corridor wide issues along PA 45. As a result, the proposed interior interchange and local road connection was removed from this State College Area Connector project and will be considered in the independent PA 45 Corridor Improvements project, as appropriate. The State College Area Connector project will advance independently but will not preclude the inclusion of a future interior interchange and local road connection should the independent safety study along PA 45 determine that it would be beneficial in connection with the other proposed PA 45 Corridor Improvements project.

Following the PEL Study, the project area was reduced from 70 square miles to approximately 6 square miles to encompass the three alternatives proposed to move forward into preliminary engineering.

1.2 Project Location

The project area is approximately 3,963 acres, extends through the southern portion of Centre County, and traverses Potter and Harris Townships. See **Figure 1 in Appendix A**. The project area is centered on US 322 which provides local access through the project area and to regional destinations and beyond. US 322, Mount Nittany Expressway at the western end of the project area provides direct access to Interstate 99 (I-99) which, in turn, provides access to nearby I-80. US 322 at Potters Mills provides access south to the Harrisburg area and connects to I-81 and I-83.

1.3 Project Purpose and Need

1.3.1 Project Purpose

The purpose of this project is to improve roadway congestion by achieving acceptable Levels of Service (LOS) and to address safety issues by reducing the predicted crash frequency along the US 322 corridor between Potters Mills and Boalsburg. Additionally, the project will aim to provide a transportation network that meets driver expectations.

1.3.2 Project Needs

- High peak hour traffic volumes cause congestion and result in unacceptable Levels of Service (LOS) (LOS D [rural only], E, F) on US 322 roadway and intersections.
- Existing roadway configurations and traffic conditions contribute to safety concerns in the project area.
- The roadway network and configuration in the project area lacks continuity and does not meet driver expectations.

2 Methodology

Geotechnical impacts and considerations were evaluated based on the published geologic information of the project region as well as the site reconnaissance within the project area. The EIS study phase did not include subsurface drilling, testing, or geotechnical analysis. Consequently, the information presented in this report shall be considered preliminary and based on secondary source information. None of the information presented in the report is intended to be used for design final purposes, without appropriate subsurface investigations.

3 GEOLOGIC BACKGROUND AND GEOLOGIC SETTING

The project area is located within the Ridge and Valley Province in the Appalachian Mountain Section. The Appalachian Mountain Section is generally characterized by long, narrow ridges and broad to narrow valleys with some karst topography. The local relief is described as moderate to very high (approximately between 600 and greater than 1000 feet). The dominant geological structure in this province consists of open and closed plunging folds with narrow hinges and planar limbs. The origin of the topography is fluvial erosion, solution of carbonate rocks, and periglacial mass wasting. Refer to the

Physiographic Provinces Map (**Figure N-2 in Appendix B; Figure C-2 in Appendix C; Figure S-2 in Appendix D)**.

3.1 Project Area Soils

The soils within the project area are anticipated to consist of residuum within the valley and some alluvium around drainage areas. Residual soils can vary in depth based on the weathering of the underlying limestone and dolomite bedrock. Colluvium over residuum is anticipated in the southern portion of the project area along the base of the Tussey Mountain ridge. Based on water well data in the vicinity, the depth to bedrock ranges from 2 feet to 140 feet. The deep bedrock is likely associated with the weathering of limestone and dolomite bedrock within the project area. Refer to the Soils Map of the project area (**Figure N-3A thru N-3F in Appendix B; Figure C-3A thru C-3F in Appendix C; Figure S-3A thru S-3F in Appendix D**).

3.2 Project Area Bedrock

The bedrock within the project area is expected to belong to the following Ordovician-aged formations in stratigraphic order. Refer to the General Geology Maps and Generalized Stratigraphic Sections within the project area (**Figures N-4A/N-4B and N-5 in Appendix B; Figures C-4A/C-4B and C-5 in Appendix C; Figures S-4A/S-4B and S-5 in Appendix D**) .

- The Reedsville Formation
- The Coburn through Nealmont Formations, undivided
    - Consist of the Coburn, Salona, and Nealmont formations.
- The Benner Formation through Loysburg Formation, undivided
    - Consists of the Benner, Snyder, Hatter, and Loysburg formations.
- The Bellefonte Formation
- The Bald Eagle Formation - Found only in the southern portions of the project area within the foothills along the base of Tussey Mountain.

3.2.1 Reedsville Formation

The Reedsville Formation consists of dark gray shale containing thin sandy to silty shale interbeds. The maximum thickness of this formation is approximately 1,000 feet. Foundation stability is good but should be excavated to sound material. Cut slope stability is fair due to disintegration when exposed to moisture and ease of excavation is moderately easy. The base of this formation contains the Antler member in which it consists of carbonaceous shale with relatively higher concentration of in-situ pyrite crystals. Bedrock excavated from this formation tends to degrade faster when excavated.

3.2.2 Coburn Formation

The Coburn Formation consists of medium gray to very dark gray fossiliferous shaly limestone. The maximum thickness of this formation ranges within 350-400 feet. Foundation stability is fair when excavated to sound material and investigated for possible collapse areas. Cut slope stability is good

except in shaly limestone beds due to disintegration when exposed to moisture where it is fair to poor. Steeply dipping beds inclined toward construction can be a stability problem. Excavation can be difficult, complicated by the presence of bedrock pinnacles.

3.2.3 Salona Formation

The Salona Formation consists of dark gray to black limestone with some laminated medium to coarse grained fossiliferous black chert nodules. The thickness of the formation is approximately ranges within 150-170 feet. Foundation stability is good but should be investigated thoroughly for possible solution cavities. Cut slope stability is good except in shaly limestone beds due to disintegration when exposed to moisture. Where this condition is encountered stability is fair. Steeply dipping beds inclined towards the roadway can be a stability problem. Excavation can be difficult, complicated by the presence of bedrock pinnacles.

3.2.4 Nealmont Formation

The Nealmont Formation consists of medium gray coarsely crystalline fossiliferous limestone in its top member and thin bedded finely crystalline shaly limestone at its base. The thickness of the formation ranges within 150-170 feet. Foundation stability is good but should be excavated to sound material and involve a thorough investigation of possible collapse areas. Cut slope stability is good. Steeply dipping beds inclined towards the roadway can be a stability problem. Excavation can be difficult, complicated by the presence of bedrock pinnacles.

3.2.5 Benner Formation

The Benner Formation consists of light to dark gray very finely crystalline limestone in its top member and an argillaceous limestone containing interbedded metabentonite (altered bentonite) at its base. The maximum thickness of the formation is approximately 180 feet. Foundation stability is good but should be investigated thoroughly for solution openings. Cut slope stability is good. Steeply dipping beds inclined towards construction can be a stability problem. Excavation can be difficult, complicated by the presence of bedrock pinnacles.

3.2.6 Snyder Formation

The Snyder Formation consists of medium-to-medium dark gray coarsely crystalline limestone containing limestone conglomerate beds along with impure limestones which show mud cracks and ripple marks, finely crystalline dolomitic limestone, and fine grain oolitic limestone. The formation is approximately 70 feet thick. Foundation stability is good but should be investigated thoroughly for solution openings. Cut slope stability is good. Steeply dipping beds inclined towards the cut slopes can be a stability problem. Excavation can be difficult, complicated by the presence of bedrock pinnacles.

3.2.7 Hatter Formation

The Hatter Formation consists of medium gray silty and argillaceous limestone that is dolomitic and contains oolites. The maximum thickness of this formation is 200 feet. Foundation stability is good but

should be excavated to sound material and involve a thorough investigation for possible collapse areas. Cut slope stability is good. In Shaly limestone beds susceptible to moisture slope stability is fair. Steeply dipping beds inclined towards construction can be a stability problem. Excavation can be difficult, complicated by the presence of bedrock pinnacles.

3.2.8 Loysburg Formation

The Loysburg Formation consists of light to medium gray shaley limestone and alternating with laminated dolomitic limestone and dolomite. The thickness of the formation is approximately 150 feet. Foundation stability is good but should be excavated to sound material and involve a thorough investigation for possible collapse areas. Cut slope stability is good. Steeply dipping beds inclined towards the roadway proposed cuts can be a stability problem. Excavation can be difficult, complicated by the presence of bedrock pinnacles.

3.2.9 Bellefonte Formation

The Bellefonte Formation consists of light to medium gray dolomite with some minor sandstone and chert beds. The thickness range for this formation can reach up to 2,100 feet. Foundation stability is good but should be investigated thoroughly for solution openings. Cut slope stability is good, but intersection of joint and bedding surfaces may create a problem if the cut depth is extreme. Excavation can be difficult, complicated by the presence of bedrock pinnacles.

3.2.10 Bald Eagle Formation

The Bald Eagle Formation is located within the Tussey Mountain foothills. The Bald Eagle Formation consists of gray to olive-gray and grayish-red, fine to coarse-grained cross-bedded sandstone or greywacke sandstone. This formation is known to contain acid-producing bedrock.

3.2.11 Other Geologic Features

Two (2) anticlines (Penns-Valley and Penns-Valley Narrows anticlines) and two (2) synclines (Brush Mountain and Harris synclines) trending northeast-southwest are mapped within the project area. Bedrock is expected to be dipping in northwest or southeast directions within the project area depending on its location with respect to the anticline or syncline locations. A mapped fault is located approximately in the middle of the project area trending northeast-southwest and dipping towards the southeast. Refer to the geologic map of the project area (**Figures N-4A/N-4B in Appendix B; Figures C-4A/C-4B in Appendix C; Figures S-4A/S-4B in Appendix D**).

As indicated on the Karst Density Map and Sinkhole and Karst Related Features Map **(Figures N-6 & N-7A/N-7B in Appendix B; Figures C-6 & C-7A/C-7B in Appendix C; Figures S-6 & S-7A/S-7B in Appendix D) ,** karst related features are present throughout portions of the project area, predominantly in the valley section of the project area along existing SR 322. All the bedrock formations within the project area except the Reedsville and Bald Eagle Formation have or can have karst related features. The highest density of mapped karst related features is located near the middle of the project area between

Sharer Road and Tusseyville Road. Water well information reports from PAGWIS also noted the presence of voids in some areas. Refer to Figure 9 in Appendix A for the water well locations.

Based on the geologic formations within the project limits, there are no mineable coal seams in any of these bedrock formations within the project area. Based on the available literature and preliminary reconnaissance survey, there were no signs of former/existing surface mining within the project area. Based on the oil and gas data, from the PA Spatial Data Access, Pennsylvania Departmental Protection, no oil/gas wells within the project area are identified. Refer to the Oil and Gas Well Map (**Figure N-9 in Appendix B; Figure C-9 in Appendix C; Figure S-9 in Appendix D**) .

Based on DCNR OFMI-05-01.1, "Geologic Units Containing Potentially Significant Acid-Producing Sulfide Minerals", dark shales in the Ridge and Valley region should be considered to have the potential to produce acid bearing rock. Dark shales such as the Reedsville Formation have historically been known to be a source of acid producing rock. Any cut areas within the Reedsville Formation will need to be investigated for the potential of acid producing rock. The Bald Eagle Formation is also known to be a source of acid producing rock.

The source within bedrock that will cause it to be potentially acid-producing is the mineral Pyrite. Pyrite can be found in two main forms: bedding pyrite and/or vein pyrite. Bedding pyrite forms as the bedrock unit is being deposited and it will depend on the environmental deposition and source for the iron and sulfur (Pyrite). This form is very common in dark shales like the Reedsville Formation. It tends to concentrate in certain zones. Vein pyrite can be introduced after the bedrock has been deposited and it depends on potential hydrothermal activities within the region. This activity will deposit a high concentration of pyrite minerals along certain joint systems. Vein pyrite can cause major issues when exposed and untreated and is common in the Bald Eagle formation.

The Reedsville and Bald Eagle Formations are likely to be encountered in any proposed cuts and excavations of the hillsides in the southern portion of the project area south of existing SR 322. These formations were encountered along two nearby projects that required treatments of acid-producing bedrock. US322, Section B06 at Potter Mills encountered elevated pyrite levels in the Reedsville Formation and required treatments and encapsulations. US322 at Skytop encountered vein Pyrite in the Bald Eagle Formation and required extensive treatments, including special handling and disposal of excavated rock, encapsulation, and treatment of exposed cut slopes etc.

4 HYDROGEOLOGIC BACKGROUND

Groundwater within the project region is contained in unconfined or perched aquifers that are controlled or recharged by infiltration or influenced by running streams. Groundwater flow within the project area is expected to be controlled by the geologic structure and influenced by the type of bedrock. Generally, groundwater flow is expected to flow down dip toward the syncline's axis and towards the limbs of the anticline's axis within the project area. Water flow within bedrock is

dependent on its natural porosity as well as on the connectivity of its joint systems. Due to the presence of limestone and dolomite bedrock within the project area, secondary porosity may be present from karst features that can alter typical groundwater flow. A fault is also mapped within the project area so fractures could also impact groundwater flow. Interconnections of karst features and fractures can result in localized flow paths and changes of the water table elevations or create groundwater springs. Wherever the groundwater table intersects the ground surface, seeps or springs are observed. Registered water wells within the project area reported various depths to groundwater for production and use. Construction of the new highway could have the potential to alter groundwater flow or draw down groundwater tables by:

- Covering source areas of recharge to karst features which could cause draw down.
- Exposing karst features and introducing additional recharge which could result in blowouts.
- Introducing sediments or contaminants into the groundwater through karst features.
- Clogging interconnected karst features or fractures which could cause draw down.
- Drawing down water tables in cut areas.

Due to the possible interconnectivity of karst related features, water wells that are not immediately around an area of construction could be negatively impacted from construction activities. Streams within construction areas could also be impacted if a sinkhole is opened and interconnected with other karst features. This could result in a disappearing stream or a blowout introducing sediment into a stream.

Based on the Engineering Characteristics of the rocks of Pennsylvania, by Geyer and Wilshuen, the following is the groundwater potential for each bedrock formation within the project area:

- Reedsville Formation: Median yield 15 gal/min.
- Coburn Formation: Industrial and public groundwater supplies are available, median yield approximately 130 gal/min, good quality but easily contaminated.
- Salona Formation: Median yield 50 gal/min.
- Nealmont Formation: Median yield 50 gal/min.
- Benner Formation: Median yield 50 gal/min. Excellent water quality in most areas.
- Snyder Formation: Median yield 50 gal/min. Excellent water quality in most areas.
- Hatter Formation: Median yield 50 gal/min. Water quality is generally good but easily contaminated.
- Loysburg Formation: Median yield 50 gal/min. Water quality is generally good but easily contaminated.
- Bellefonte Formation: Median yield 100 gal/min industrial and public water supplies available. Highest yields from fractures and solution cavities.

The Coburn and Bellefonte Formations are the highest yielding bedrock units within the project area and are listed as formations that can supply industrial and public supplies.

4.1 Alternative Groundwater Summary

Numerous mapped wells are located within the defined project area with more located within the first 1,000 feet outside of the project area boundaries. Many private and potentially undocumented water wells were noted during the field reconnaissance that are not in the PaGWIS database. Residential and commercial buildings appear to be supplied by private water wells throughout the project area. Refer to **Figures N-9, C-9, and S-9** for each alternative for the Water Well Map.

5 RECONNAISSANCE NOTES

From July 31st to August 1st, 2023, A.G.E.S., Inc. performed a limited site reconnaissance of the project area. Many private properties along the alternatives were not accessible. The site reconnaissance was limited to accessible areas to observe outcrops, water seeps, streams and surface features. Observations from the reconnaissance field view are provided below. A reconnaissance plan and site photographs are provided in **Appendix E**.

General observations of the project area:

At the western limit of the project, where the new alignment ties into the existing Mount Nittany Expressway (SR 322). The area is a mix of residential properties, some commercial properties, small agricultural fields, and patches of woods. (Photos 1-2)

The area from the western limit to Bear Meadows Road is a mix of residential properties, commercial properties, agricultural fields and patches of wood. A golf course is located north of existing SR 322 across from Bear Meadows Road. In this area, the new highway would be constructed at or slightly above existing grade. Galbraith Gap Run passes under existing SR 322 to the west of Bear Meadows Road and there are ponds located south of the existing roadway. A shale outcrop was observed at the intersection of Bear Meadows Road and SR 322. (Photos 3 to 8)

The northern and central sections of the project area adjacent to existing SR 322 between Bear Meadows Road and Neff Road consist primarily of agricultural fields, farms, residential building and small wood patches with commercial properties in the Potter Township Planned Commercial and Industrial District, and the Potter Township Athletic Complex. An existing pond and a tree farm are also located within the impact area. A limestone outcrop was observed near Iron Horse Lane. (Photos 9, 12, 15 to 20, 25)

The southern portion of the project area from Bear Meadows Road to Tussey Sink Road, consists mostly of forest along the base of the mountain. (Photos 10, 11, 13, 14)

The area around Tussey Sink Road and Taylor Hill Road consists of agricultural fields, farms, some residential buildings, and small wood patches. (Photos 20-24)

The area between Taylor Hill Road and Mountain Back Road consists of agricultural fields, farms, wooded areas, commercial buildings, and residential buildings. A shale outcrop was observed along Mountain Back Road and existing SR 322. Several ponds were observed as well as a wetland area along the intersection of existing SR 322 and Red Mill Road. (Photos 26 to 39)

At the eastern end, the project ties back into the existing expressway of SR 322 just to the west of the Potters Mills Gap interchange. The surrounding area consists of agricultural fields, farms, residential buildings, and commercial buildings. A shale outcrop with visible Pyrite was observed along SR 322 eastbound. (Photos 40 to 44)

Water wells were observed along Mountain Back Road, Dogtown Road, Neff Road, and existing SR 322 that were not mapped in PaGWIS.

No signs of karst features were observed within the accessible limits of the project area . Although no karst features were observed during the preliminary field view, sinkhole locations were noted by others performing detailed environmental investigations. Available karst maps also indicate past sinkholes predominantly on the north side of existing SR 322.

Above ground storage tanks at a tractor dealership near the intersection of existing SR 322 and Wagner Road were observed. Some properties throughout the project area had some debris and general construction waste. No other obvious signs of environmental contamination were observed.

Water PH readings were obtained along streams within the proposed project limits. All water PH readings were alkaline.

6 PROPOSED ALTERNATIVES AND GEOTECHNICAL CONSIDERATIONS

The three corridors recommended from the PEL were refined and renamed North, Central and South Alternatives and presented to the public in August 2024 and to the state and federal resource agencies at the October 2024 field view. Additional refinements were made to each alternative based on public and agency feedback including the consolidation of all three alternatives into a common alignment at the eastern end alignment of the project area, and the addition of areas for stormwater control measures (SCMs), private property access, bridges over streams and wetlands, bridges for local roads, and access driveways.

Geotechnical impacts and considerations on each alternative were evaluated based on the published geologic information of the project region as well as the site reconnaissance along the proposed alignment areas. This stage of geotechnical consideration does not include any subsurface drilling, testing or model analysis.

The following section provides a detailed description of each of the alignment alternatives and general geotechnical considerations regarding the design and construction of each. The impact boundaries for each of the three alternatives are shown on the figures found in **Appendices B, C, and D**.

6.1 North Alternative

The western end of the alignment alternatives is the same for all three alternatives, from the SR 45 interchange to just east of the Mountain View Country Club Golf Course. At the western end, local 322 would remain in its current location and the new 4-lane highway would be located on the south side of the existing US 322. Proposed improvements in this area include a pedestrian/bicycle trail on the north side of the existing US 322 from Boal Avenue to Bear Meadows Road. Just east of the Mountain View Country Club Golf Course, the alignment would start to move north of the existing US 322 through the Nittany Farm and around the Kuhn tree farm. It would continue through the agricultural fields on the north side of US 322, avoiding the commercial area on local 322 in Potter Township. The alignment would return to the existing 322 corridor through Tusseyville. The eastern end would maintain the existing 322 corridor as the local 322 in its current position and the 4-lane highway alignment would be located on the south side of the existing 322 corridor from approximately Tusseyville to Potters Mills.

Bridges were added over Maggie's dip (Mountain Back/Red Mill Roads and a Sinking Creek tributary with wetland complex), ponds and a wetland complex near Cider Press Road, Sinking Creek, ponds, and wetlands in Tusseyville, Spring Creek, Sharer Road, a wetland complex along Spring Creek on Nittany Farm, Somerset Drive, and Bear Meadows Road.

The majority of this alternative will be constructed within Limestone bedrock units. Embankment stability will be controlled by the residual soils of the limestone bedrock, mainly clayey soils with potentially higher water content. Cut slopes will be controlled by the bedrock unit's orientations as well as the level of weathering and jointing expressed along the proposed cut surface. Catchment areas might be required for steeply cut slopes. The eastern portion of the proposed alignment will be constructed within the Reedsville shale bedrock units. Shale bedrock from Reedsville formation tends to be soft and degradable. Embankments constructed using this shale could experience excessive settlements. Due to the degradable nature of the shale bedrock, flatter cut slopes are expected within the Reedsville Formation. Where cuts are proposed within Reedsville Shale Formation, treatments for potential acid-producing rock will need to be considered for the cut face as well as for the excavated material. Based on the PaGWIS database, this alignment alternative will impact a total of five (5) water wells that are within the mapped impact zone of the project.

6.2 Central Alternative

The western end of the alignment alternatives is the same for all three alternatives, from the SR 45 interchange to just east of the Mountain View Country Club Golf Course. At the western end, local 322 would remain in its current location and the new 4-lane highway would be located on the south side of the existing US 322. Proposed improvements in this area include a pedestrian/bicycle trail on the north

side of the existing US 322 from Boal Avenue to Bear Meadows Road. Just east of the Mountain View Country Club Golf Course, the alignment would start to move north of the existing 322 corridor through the Nittany Farm and around the Kuhn tree farm. It then crosses over the existing 322 corridor near Bamboo Lane and passes south of the baseball fields at the Potter Township Athletic Complex, avoiding Potter Township's Planned Commercial-Industrial (PCI) District. From there, the alignment crosses Sleepy Creek (stream that drains to Tussey Sink) and starts to move north towards the existing 322 corridor. The alignment would return to the existing 322 corridor near Tusseyville. The eastern end would maintain the existing 322 corridor as the local 322 in its current position and the 4-lane highway alignment would be located on the south side of the existing 322 corridor from approximately Tusseyville to Potters Mills.

Bridges were added over Maggie's dip (Mountain Back/Red Mill Roads and a Sinking Creek tributary with wetland complex), ponds and a wetland complex near Cider Press Road, Sinking Creek, wetlands and access driveways near Tussey Meadow Lane, Tussey Sink and Taylor Hill Road, wetlands and Spring Creek tributaries near Tussey View Lane, Spring Creek, Sharer Road, a wetland complex along Spring Creek on Nittany Farm, Somerset Drive, and Bear Meadows Road.

This alignment is similar to the North Alternative in terms of bedrocks and concerns. The majority of the roadway will be constructed within Limestone bedrock units. Embankment stability will be controlled by the residual soils of the limestone bedrock, mainly clayey soils with potentially higher water content. Cut slopes will be controlled by the bedrock unit's orientations as well as the level of weathering and jointing expressed along the proposed cut surface. Catchment areas might be required for steeply cut slopes. The eastern portion of the proposed alignment will be constructed within the Reedsville shale bedrock units. Shale bedrock from Reedsville formation tends to be soft and degradable. Embankments constructed using this shale could experience excessive settlements. Due to the degradable nature of the shale bedrock, flatter cut slopes are expected withing the Reedsville Formation. For cut slopes proposed within Reedsville Shale Formation, treatments for potential acid-producing rock will need to be considered for the cut face as well as for the excavated material. Based on the PaGWIS database, this alignment alternative will impact a total of six (6) water wells that are within the mapped impact zone of the project.

6.3 South Alternative

The western end of the alignment alternatives is the same for all three alternatives, from the SR 45 interchange to just east of the Mountain View Country Club Golf Course. At the western end, local 322 corridor would remain in its current location and the new 4-lane highway would be located on the south side of the existing 322 corridor. Proposed improvements in this area include a pedestrian/bicycle trail on the north side of the existing US 322 from Boal Avenue to Bear Meadows Road. Just east of the Mountain View Country Club Golf Course, the alignment would start to move south of the existing 322 corridor through the Tait Farm and along the side of the Tussey Mountain ridge behind the neighborhoods and communities along the south side of the existing 322 corridor.

The preliminary engineering design of the South Alternative requires notable depths of cut ranging from 5 to 100 feet, as it traverses approximately 1.5 miles along the Tussey Mountain ridge. The proposed highway then crosses over Sleepy Creek (stream that drains to Tussey Sink) and starts to move north towards the existing 322 corridor. The alignment would return to the existing 322 corridor near Tusseyville. The eastern end would maintain the existing 322 corridor as the local access road in its current position and the 4-lane highway alignment would be located on the south side of the existing 322 corridor from approximately Tusseyville to Potters Mills.

Bridges were added over Maggie's dip (Mountain Back/Red Mill Roads and a Sinking Creek tributary with wetland complex), ponds and a wetland complex near Cider Press Road, Sinking Creek, wetlands and access driveways near Tussey Meadow Lane, Tussey Sink and Taylor Hill Road, a pond and streams near Tussey View Lane, Coxey Lane, Tait Road, Somerset Drive, and Bear Meadows Road.

The majority of this alternative will be constructed within the Reedsville Shale bedrock units. The north-facing cut slope across from Sharer Road has the potential of encountering the Bald Eagle Formation. Embankment stability will be controlled by the residual soils of the shale bedrock, mainly clayey soils with potentially higher water content. Cut slope design is controlled by the degradable nature of the shale, hence, flatter cut slopes are expected. Treatments for potential acid-producing rock will need to be considered for the cut face as well as for the excavated material.

The western portion of the roadway will be constructed within Limestone bedrock units. Embankment stability will be controlled by the residual soils of the limestone bedrock, mainly clayey soils with potentially higher water content. Cut slopes will be controlled by the bedrock unit's orientations as well as the level of weathering and jointing expressed along the proposed cut surface. Catchment areas might be required for steeply cut slopes. Based on the PaGWIS database, this alignment alternative will impact a total of five (5) water wells that are within the mapped impact zone of the project.

6.4 Geotechnical Considerations

Based on the review of published geological data, preliminary field reconnaissance investigations, and a review of the three alternative alignments, general geological and geotechnical considerations along the alignment alternatives are identified. Some of these features may have significant impacts on the design and construction of the proposed highway and therefore, should be taken into consideration in the selection of preferred alternative. These considerations are as follows:

- Shale bedrock within the project limits is considered degradable shale and its use in embankments might reflect a higher rate and longer duration settlement.
- Bedrock excavated from Reedsville Formation may contain pyritic material and when exposed and weathered it may cause acidic drainage. Treatment of the excavated material via encapsulation and the exposed cut slope via benching and covering will be warranted.

- Potential to encounter vein pyrite is higher in the Bald Eagle Formation, which is expected to be encountered by the South Alternative. If vein pyrite is encountered in this area, cost of handling, treatment, and disposal could be significant.
- Cut slopes in shale bedrock units in Reedsville Formation will have to be designed based on higher rate of weathering, hence, flatter cut slopes (1.5H:1V or flatter) are anticipated.
- For cut slopes in Bellefonte and Bald Eagle Formations, orientation of the rock units with respect to the proposed cut slope faces will need to be evaluated for potential sliding and wedge failures for rock cut slopes.
- Cut slopes in limestone rock units can be designed at a steeper angle, but orientation will be a factor in the design. Catchment areas will be designed based on the slope angle and height. If right-of-way or other site constraints limit the use of wider catchment areas, other rockfall protection systems such as rockfall fence or rockfall drape will need to be evaluated.
- Based on State College Area Connector Wetland and Watercourse Identification and Delineation Report, impacts on wetlands are anticipated for all three alternatives. The wetlands are usually associated with the streams that run in the area and the limestone/dolomitic bedrock units below. Weathered limestone/dolomitic bedrock tend to produce high clay content soils, therefore retaining more water and less infiltration. Impermeable lining (ex. geosynthetic clay liner) may be required for the stormwater basins and swales in the areas of karstic geology.
- Clayey and highwater content soils can be an issue in embankment foundations or if used in constructing embankments as “suitable embankment material”. Consideration for potential removal and disposal of such soils will be taken into account. Borrow material might be required to be used in different locations with the project (for embankment stability and drainage). Soil stabilization methods such as lime or cement mixing may also be considered in lieu of remove and replace method, to treat unsuitable bearing conditions below the pavement subgrade and embankment foundations.
- To establish impact boundaries and define a footprint for detailed investigations of each alternative, 2:1 cut and fill slopes were used. If flatter cut slopes are considered based on the subsurface investigations, additional properties might be affected. Steeper slopes can be considered using reinforced slopes or introducing an additional form of retaining structure.
- Certain shale bedrock (other than the Reedsville Formation) tends to also contain higher levels of acid-producing minerals (pyrite). If the subsurface investigation in other formations revealed such higher levels, then consideration during excavation in terms of disposal and treatments of exposed units shall be addressed.
- High clay content soils could be present from residual soils originating from limestone or dolomite. Pinnacled bedrock could be encountered resulting in difficult excavation.
- Higher probability for sinkholes is anticipated along the North and Central alternatives. Potential for subsidence due to sinkhole activity should be investigated for any structure

foundations within these areas. If the subsurface investigation reveals sinkhole activity, expensive treatments such as grouting or removal and replacement with rock may be required.

- Dipping bedrock was observed in outcrops within the project area. Geologic mapping indicates bedrock units are structurally oriented northeast-southwest and controlled by anticlines and synclines. Rock cuts parallel to bedding orientation could be unstable especially with bedrock units daylighting in proposed cuts.
- Private water wells that fall outside the limits of disturbance could be impacted by construction due to the possible presence of karst feature

7 REFERENCES

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APPENDIX A

PROJECT LOCATION MAP

N

All Alternatives Overlap

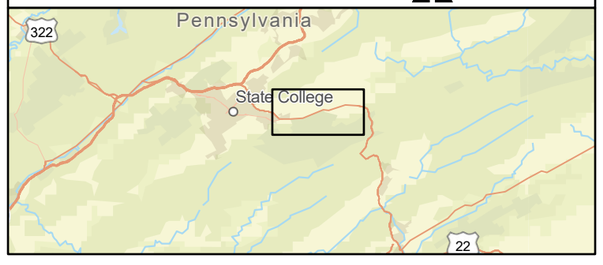
All Alternatives Overlap

Legend

- NEPA Project Area
- North Alternative
- Central Alternative
- South Alternative

0 0.2 0.4 0.8 1.2 1.6 Miles

Index Map



July 2025

State College Area Connector

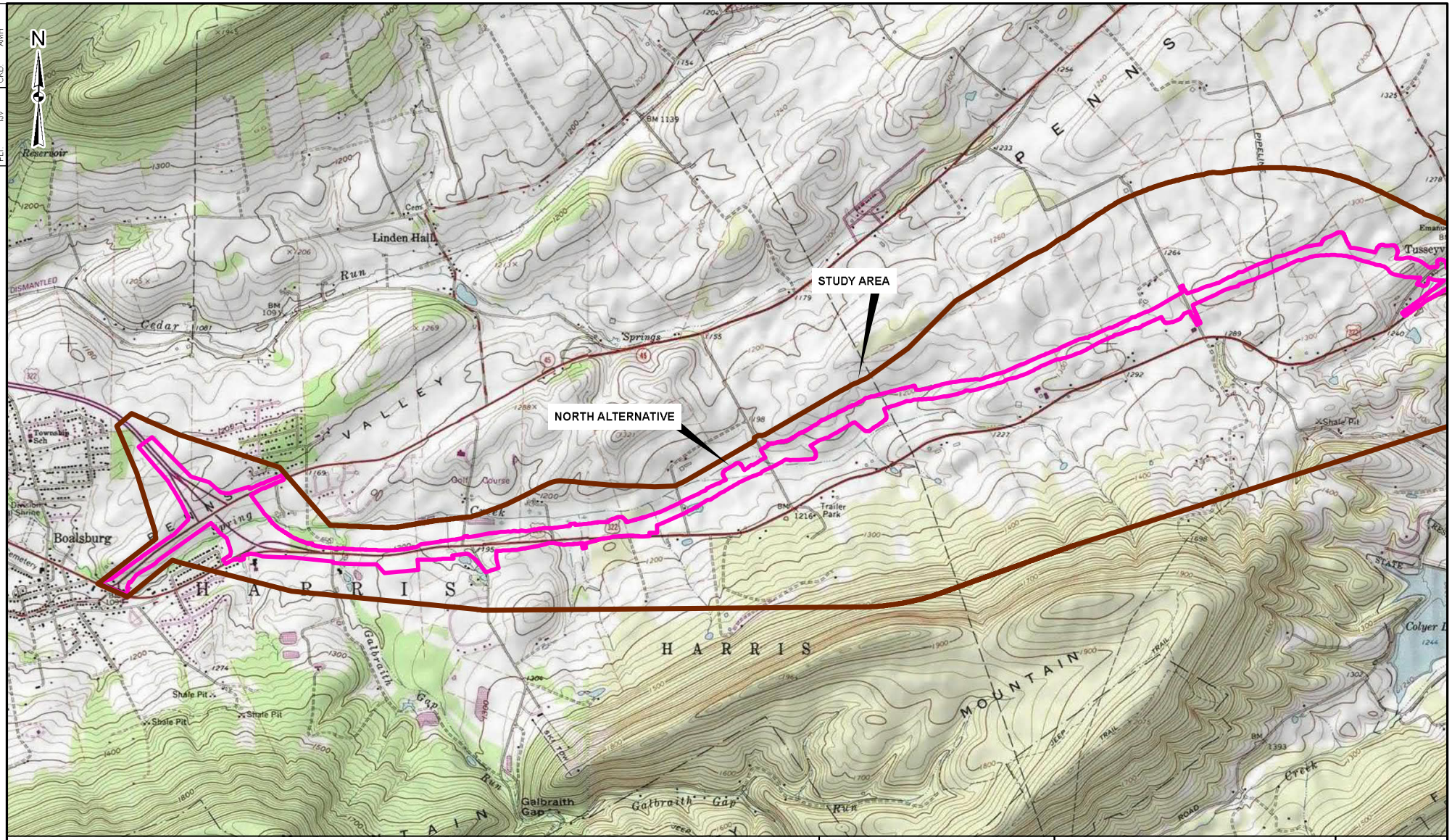
Project Location Map

CENTRE COUNTY, PENNSYLVANIA

1966 (ed. 1990) Centre Hall, PA
USGS 7.5-minute topographic map

1 inch = 2,981 ft

APPENDIX B
NORTH ALTERNATIVE FIGURES



SOURCE: US Geological Survey, Quadrangle Map (7½' Series); Centre Hall and State College, PA

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McLean, VA

NORTH ALTERNATIVE

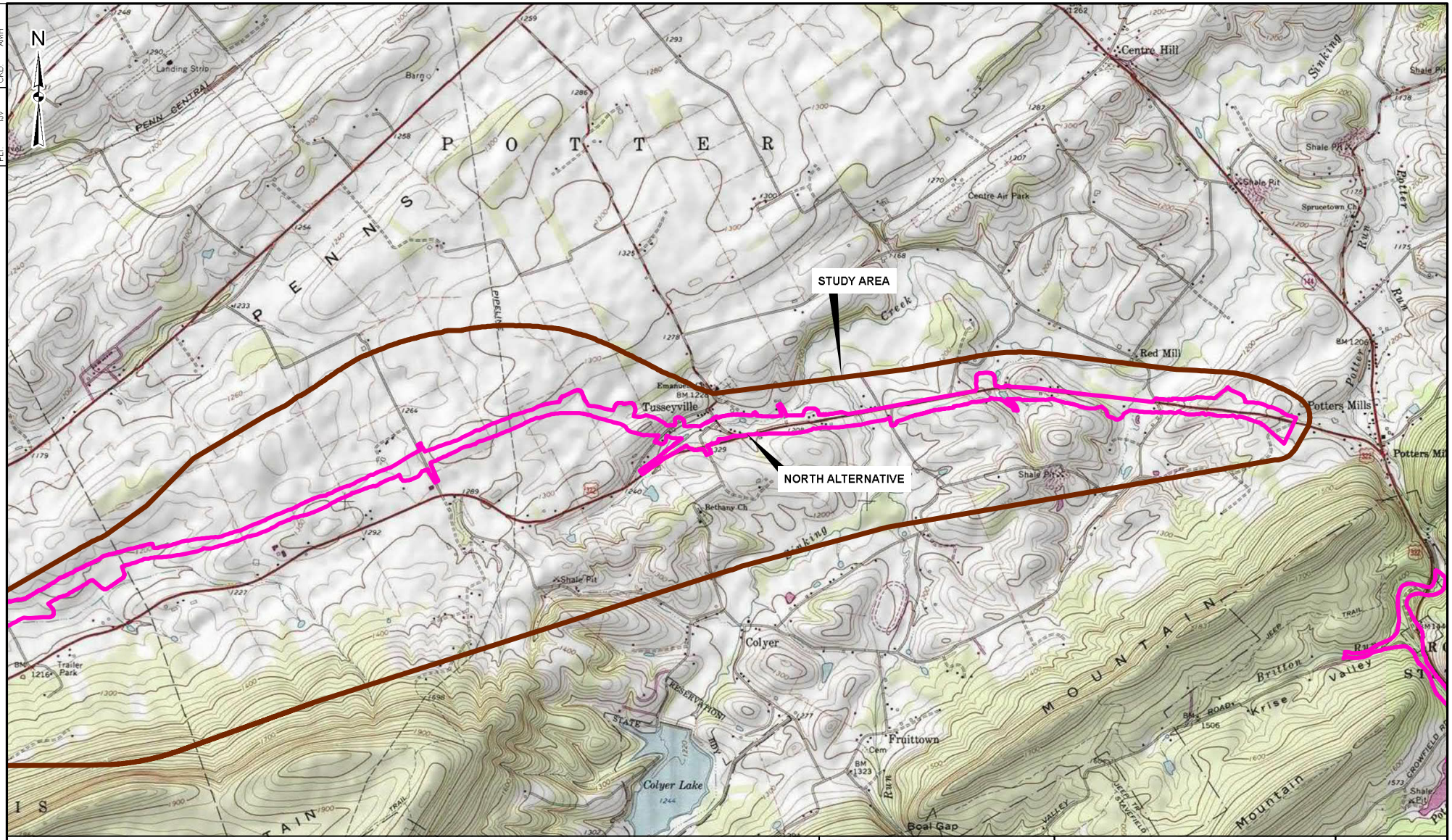
CENTRE COUNTY, PENNSYLVANIA

ALTERNATIVE LOCATION MAP

PROJECT:	20011
DRAWN:	IJV
DATE:	JUL 2025
SCALE:	1" = 2,000'
FIGURE:	N-1A

PLT: IJV CKD: AMH

Path: N:\Arc GIS\Projects\2020\20011\2023 Alternatives\20011 Alternatives - 2025.aprx
Date: 7/31/2025



SOURCE: US Geological Survey, Quadrangle Map (7½' Series); Centre Hall, PA

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NORTH ALTERNATIVE

CENTRE COUNTY, PENNSYLVANIA

ALTERNATIVE LOCATION MAP

PROJECT:	20011
DRAWN:	IJV
DATE:	JUL 2025
SCALE:	1" = 2,000'
FIGURE:	N-1B

PLT: IJV CKD: AMH

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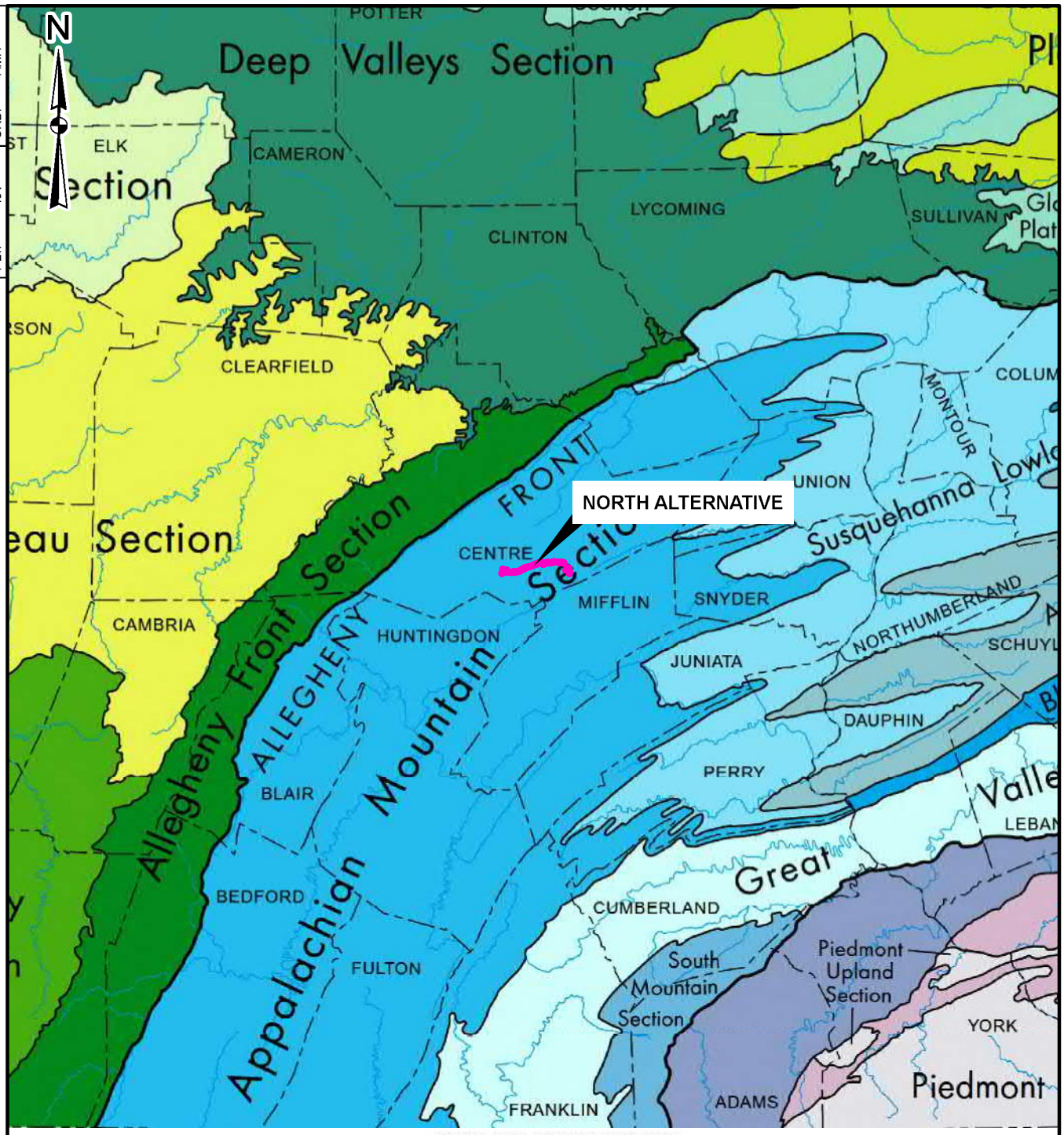
PLT: IJV CKD: AMH



RIDGE AND VALLEY PROVINCE

Appalachian Mountain Section	Susque-hanna Lowland Section	Anthracite Valley Section	Anthracite Upland Section	Blue Mountain Section	Great Valley Section	South Mountain Section

SOURCE: PA Dept. of Conservation & Natural Resources, Bureau of Topographic & Geological Survey; Physiographic Provinces of PA (Map 13)

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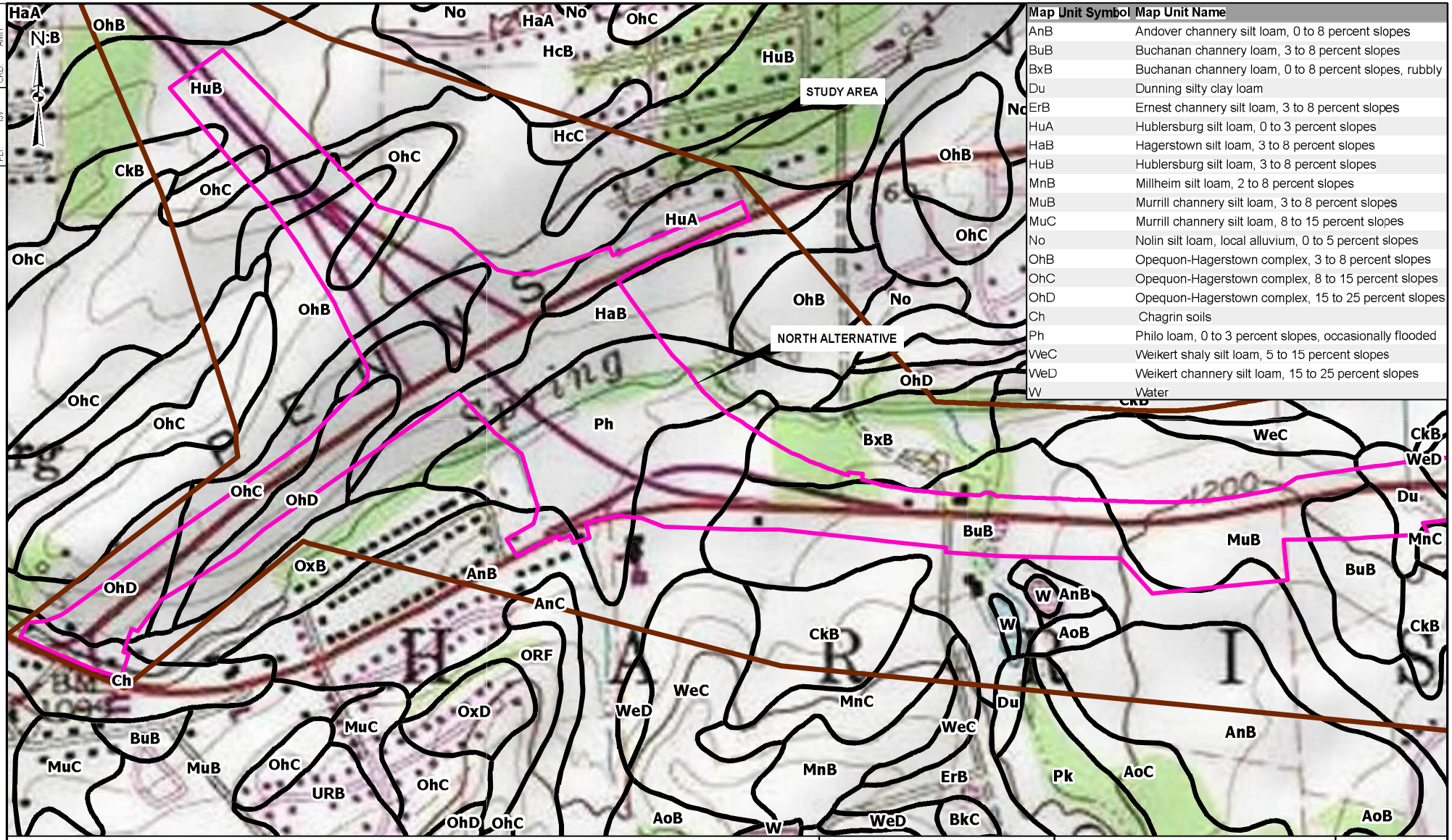
PHYSIOGRAPHIC PROVINCES MAP

PROJECT:	20011
DRAWN:	IJV
DATE:	JUL 2025
SCALE:	1" = 20 MILES
FIGURE:	N-2

Path: N:\ArcGIS\Projects\2020\20011\2023 Alternatives\20011 Alternatives - 2025.aprx
Date: 7/31/2025



Map Unit Symbol	Map Unit Name
AnB	Andover channery silt loam, 0 to 8 percent slopes
BuB	Buchanan channery loam, 3 to 8 percent slopes
BxB	Buchanan channery loam, 0 to 8 percent slopes, rubbly
Du	Dunning silty clay loam
ErB	Ernest channery silt loam, 3 to 8 percent slopes
HuA	Hublersburg silt loam, 0 to 3 percent slopes
HaB	Hagerstown silt loam, 3 to 8 percent slopes
HuB	Hublersburg silt loam, 3 to 8 percent slopes
MnB	Millheim silt loam, 2 to 8 percent slopes
MuB	Murrill channery silt loam, 3 to 8 percent slopes
MuC	Murrill channery silt loam, 8 to 15 percent slopes
No	Nolin silt loam, local alluvium, 0 to 5 percent slopes
OhB	Opequon-Hagerstown complex, 3 to 8 percent slopes
OhC	Opequon-Hagerstown complex, 8 to 15 percent slopes
OhD	Opequon-Hagerstown complex, 15 to 25 percent slopes
Ch	Chagrin soils
Ph	Philo loam, 0 to 3 percent slopes, occasionally flooded
WeC	Weikert shaly silt loam, 5 to 15 percent slopes
WeD	Weikert channery silt loam, 15 to 25 percent slopes
W	Water

SOURCE: US Dept. of Agriculture, Soil Data Mart; Soil Survey for Centre County, PA

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NORTH ALTERNATIVE

CENTRE COUNTY, PENNSYLVANIA

SOILS MAP

PROJECT:	20011
DRAWN:	IJV
DATE:	JUL 2025
SCALE:	1" = 500'
FIGURE:	N-3A

PLT: IJV CKD: ANH

Path: N:\AmGIS\Projects\2000\20011\2023 Alternatives\20011 Alternatives - 2025.aprx
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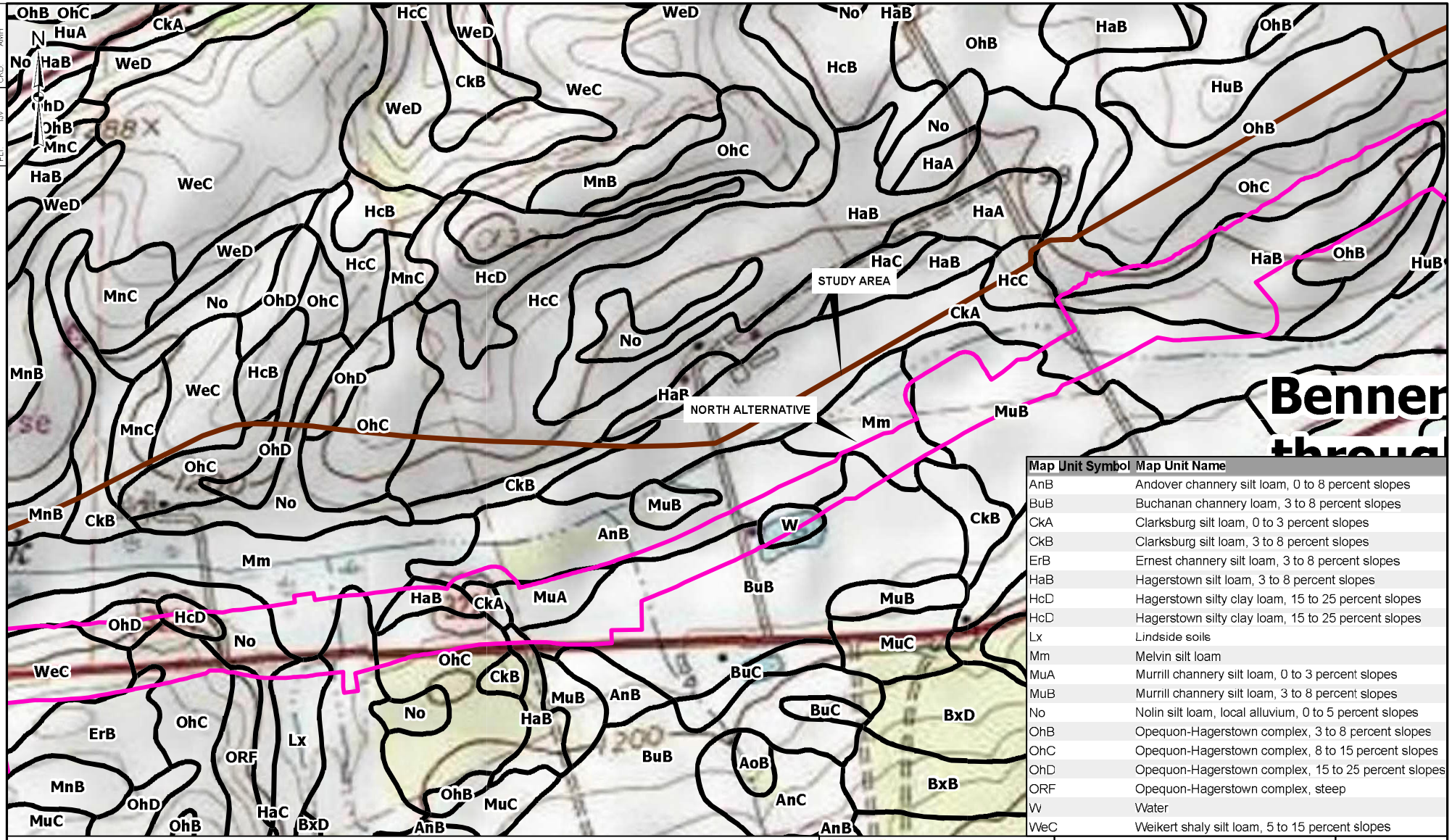

Map Unit Symbol	Map Unit Name
AnB	Andover channery silt loam, 0 to 8 percent slopes
BuB	Buchanan channery loam, 3 to 8 percent slopes
CkA	Clarksburg silt loam, 0 to 3 percent slopes
CkB	Clarksburg silt loam, 3 to 8 percent slopes
ErB	Ernest channery silt loam, 3 to 8 percent slopes
HaB	Hagerstown silt loam, 3 to 8 percent slopes
HcD	Hagerstown silty clay loam, 15 to 25 percent slopes
HcD	Hagerstown silty clay loam, 15 to 25 percent slopes
Lx	Lindside soils
Mm	Melvin silt loam
MuA	Murrill channery silt loam, 0 to 3 percent slopes
MuB	Murrill channery silt loam, 3 to 8 percent slopes
No	Nolin silt loam, local alluvium, 0 to 5 percent slopes
OhB	Opequon-Hagerstown complex, 3 to 8 percent slopes
OhC	Opequon-Hagerstown complex, 8 to 15 percent slopes
OhD	Opequon-Hagerstown complex, 15 to 25 percent slopes
ORF	Opequon-Hagerstown complex, steep
W	Water
WeC	Weikert shaly silt loam, 5 to 15 percent slopes

SOURCE: US Dept. of Agriculture, Soil Data Mart; Soil Survey for Centre County, PA

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NORTH ALTERNATIVE

CENTRE COUNTY, PENNSYLVANIA

SOILS MAP

PROJECT:	20011
DRAWN:	IJV
DATE:	JUL 2025
SCALE:	1" = 500'
FIGURE:	N-3B

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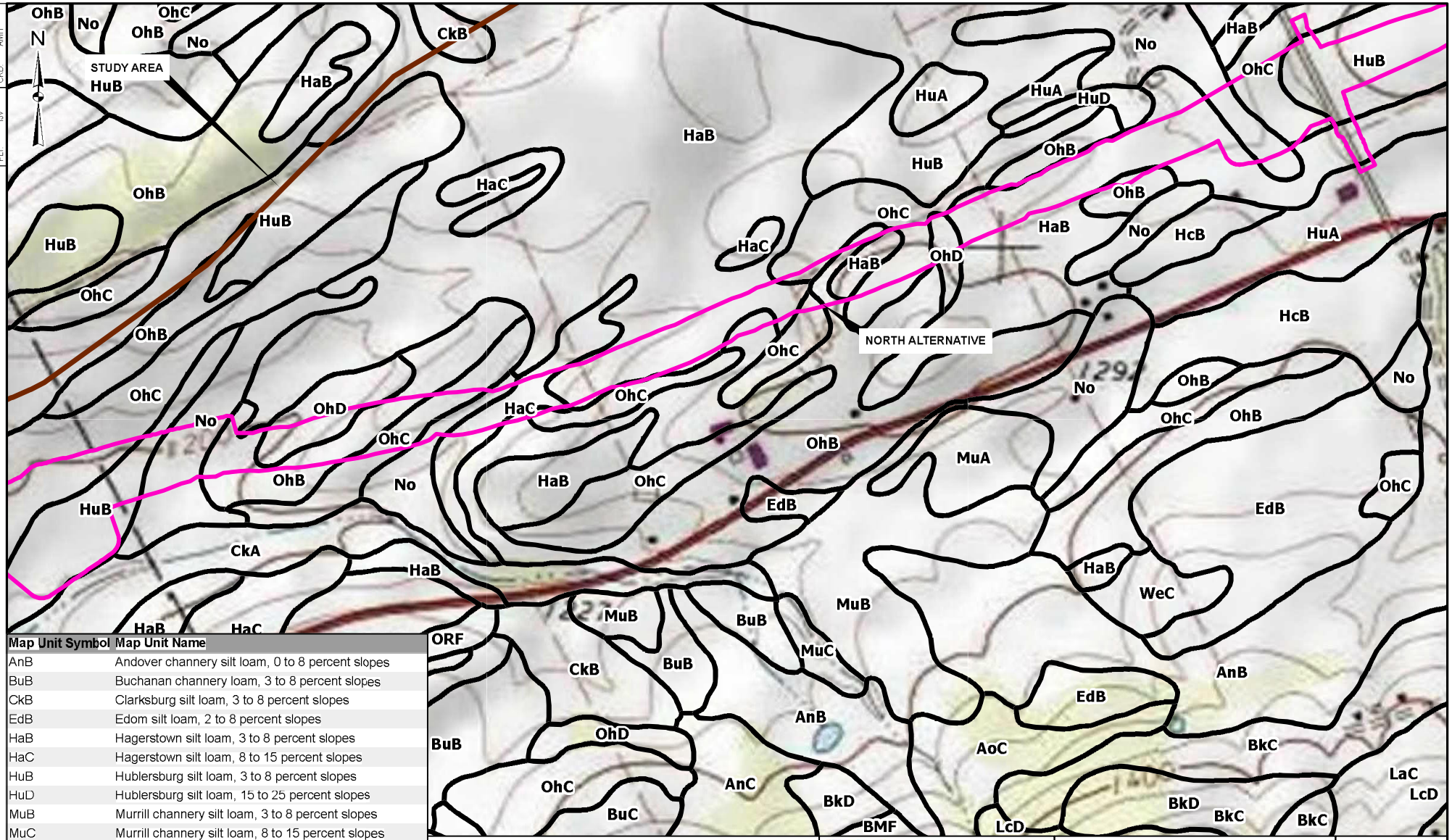

Map Unit Symbol	Map Unit Name
AnB	Andover channery silt loam, 0 to 8 percent slopes
BuB	Buchanan channery loam, 3 to 8 percent slopes
CkB	Clarksburg silt loam, 3 to 8 percent slopes
EdB	Edom silt loam, 2 to 8 percent slopes
HaB	Hagerstown silt loam, 3 to 8 percent slopes
HaC	Hagerstown silt loam, 8 to 15 percent slopes
HuB	Hublersburg silt loam, 3 to 8 percent slopes
HuD	Hublersburg silt loam, 15 to 25 percent slopes
MuB	Murrill channery silt loam, 3 to 8 percent slopes
MuC	Murrill channery silt loam, 8 to 15 percent slopes
No	Nolin silt loam, local alluvium, 0 to 5 percent slopes
OhB	Opequon-Hagerstown complex, 3 to 8 percent slopes
OhC	Opequon-Hagerstown complex, 8 to 15 percent slopes
OhD	Opequon-Hagerstown complex, 15 to 25 percent slopes
WeC	Weikert shaly silt loam, 5 to 15 percent slopes

SOURCE: US Dept. of Agriculture, Soil Data Mart; Soil Survey for Centre County, PA

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SOILS MAP

PROJECT:	20011
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SCALE:	1" = 500'
FIGURE:	N-3C

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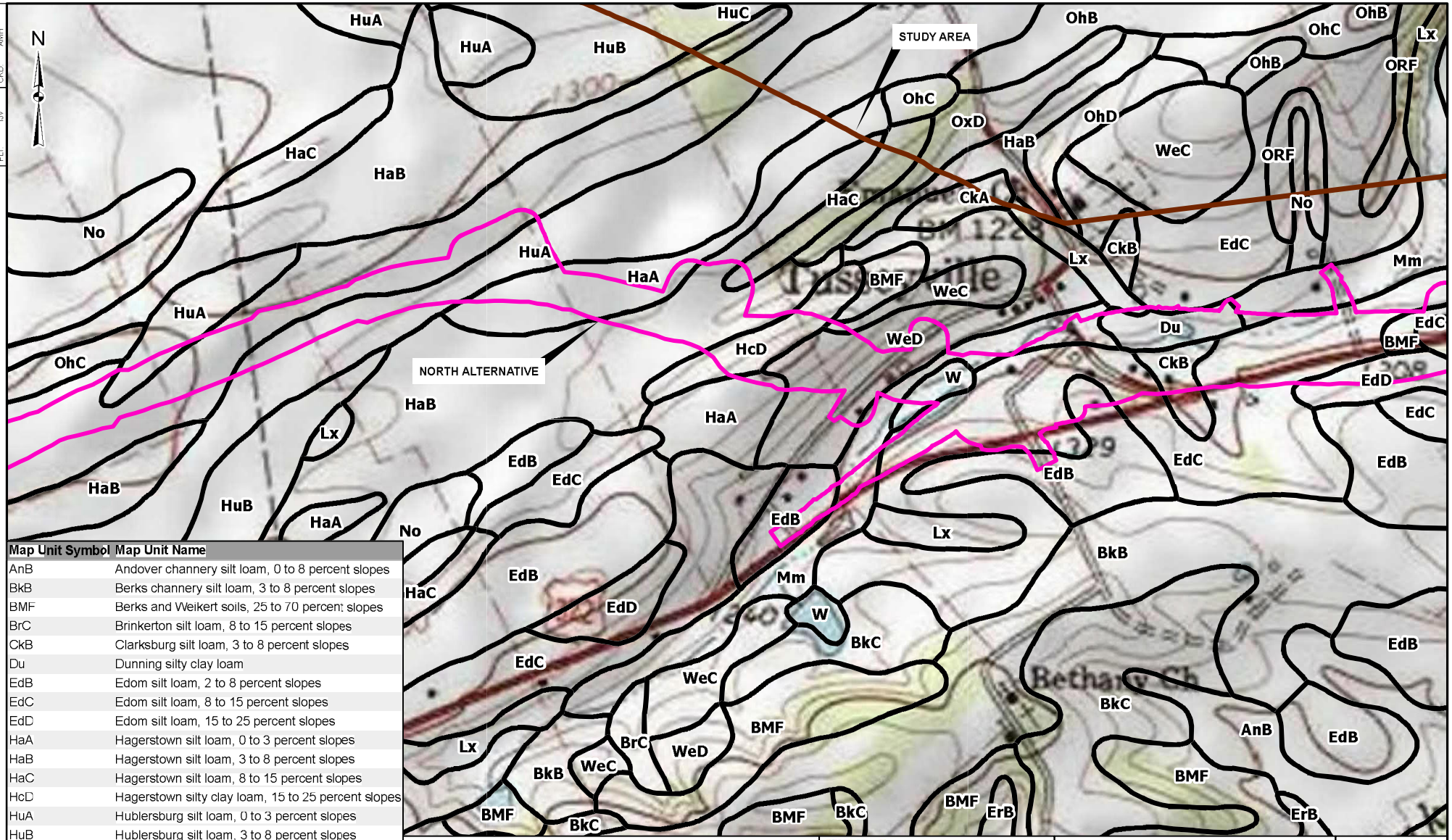

Map Unit Symbol	Map Unit Name
AnB	Andover channery silt loam, 0 to 8 percent slopes
BkB	Berks channery silt loam, 3 to 8 percent slopes
BMF	Berks and Weikert soils, 25 to 70 percent slopes
BrC	Brinkerton silt loam, 8 to 15 percent slopes
CkB	Clarksburg silt loam, 3 to 8 percent slopes
Du	Dunning silty clay loam
EdB	Edom silt loam, 2 to 8 percent slopes
EdC	Edom silt loam, 8 to 15 percent slopes
EdD	Edom silt loam, 15 to 25 percent slopes
HaA	Hagerstown silt loam, 0 to 3 percent slopes
HaB	Hagerstown silt loam, 3 to 8 percent slopes
HaC	Hagerstown silt loam, 8 to 15 percent slopes
HcD	Hagerstown silty clay loam, 15 to 25 percent slopes
HuA	Hublersburg silt loam, 0 to 3 percent slopes
HuB	Hublersburg silt loam, 3 to 8 percent slopes
Lx	Lindside soils
Mm	Melvin silt loam
W	Water
WeC	Weikert shaly silt loam, 5 to 15 percent slopes
WeD	Weikert channery silt loam, 15 to 25 percent slopes

SOURCE: US Dept. of Agriculture, Soil Data Mart; Soil Survey for Centre County, PA

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SOILS MAP

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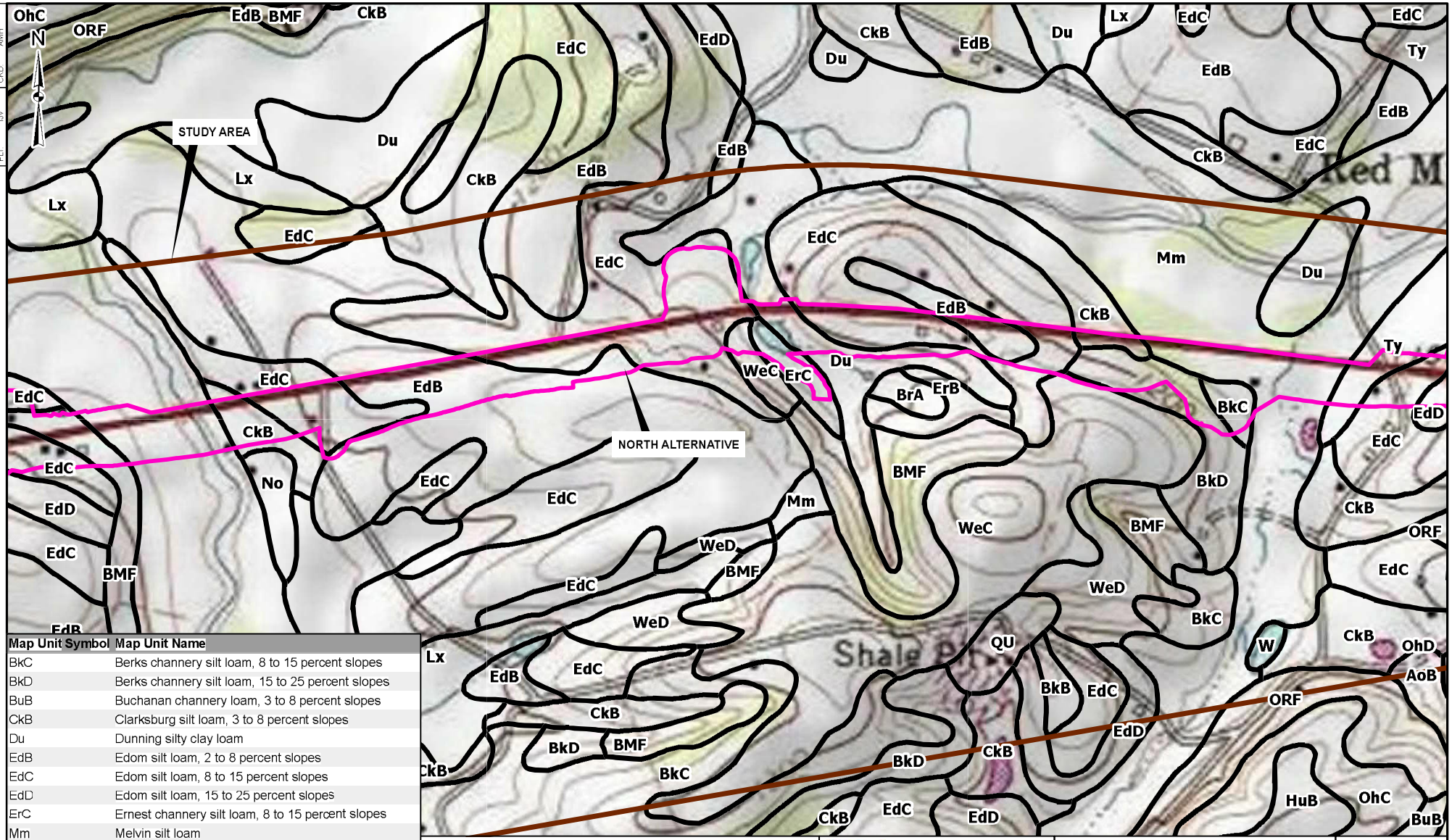

Map Unit Symbol	Map Unit Name
BkC	Berks channery silt loam, 8 to 15 percent slopes
BkD	Berks channery silt loam, 15 to 25 percent slopes
BuB	Buchanan channery loam, 3 to 8 percent slopes
CkB	Clarksburg silt loam, 3 to 8 percent slopes
Du	Dunning silty clay loam
EdB	Edom silt loam, 2 to 8 percent slopes
EdC	Edom silt loam, 8 to 15 percent slopes
EdD	Edom silt loam, 15 to 25 percent slopes
ErC	Ernest channery silt loam, 8 to 15 percent slopes
Mm	Melvin silt loam
MnB	Millheim silt loam, 2 to 8 percent slopes
OhB	Opequon-Hagerstown complex, 3 to 8 percent slopes
OhC	Opequon-Hagerstown complex, 8 to 15 percent slopes
Ty	Tyler silt loam
WeC	Weikert shaly silt loam, 5 to 15 percent slopes

SOURCE: US Dept. of Agriculture, Soil Data Mart; Soil Survey for Centre County, PA

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SOILS MAP

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DATE:	JUL 2025
SCALE:	1" = 500'
FIGURE:	N-3E

PLT: IJV CKD: AMH

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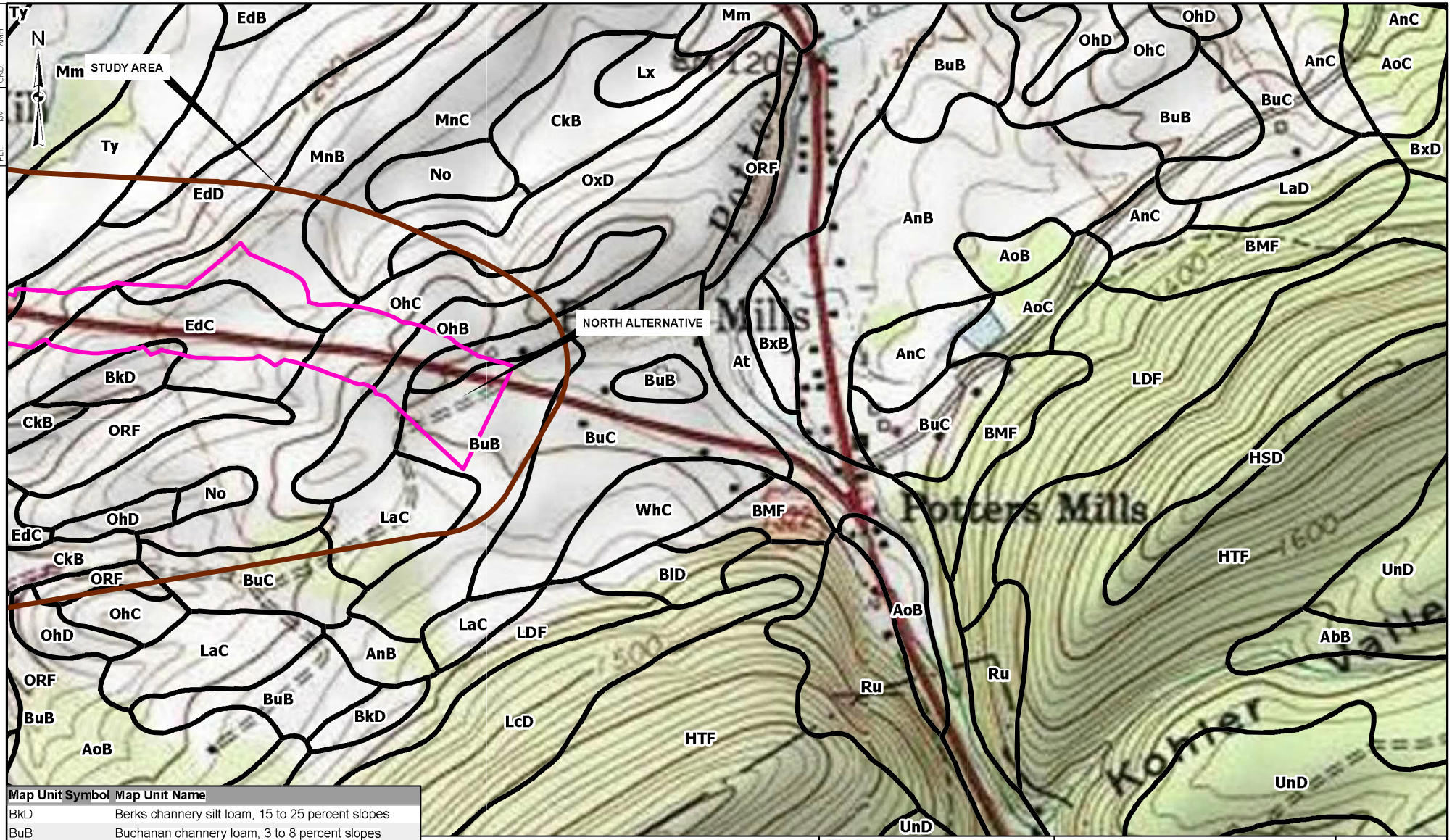

Map Unit Symbol	Map Unit Name
BkD	Berks channery silt loam, 15 to 25 percent slopes
BuB	Buchanan channery loam, 3 to 8 percent slopes
EdC	Edom silt loam, 8 to 15 percent slopes
EdD	Edom silt loam, 15 to 25 percent slopes
MnB	Millheim silt loam, 2 to 8 percent slopes
OhB	Opequon-Hagerstown complex, 3 to 8 percent slopes
OhC	Opequon-Hagerstown complex, 8 to 15 percent slopes

SOURCE: US Dept. of Agriculture, Soil Data Mart; Soil Survey for Centre County, PA

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CENTRE COUNTY, PENNSYLVANIA

SOILS MAP

PROJECT:	20011
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SCALE:	1" = 500'
FIGURE:	N-3F

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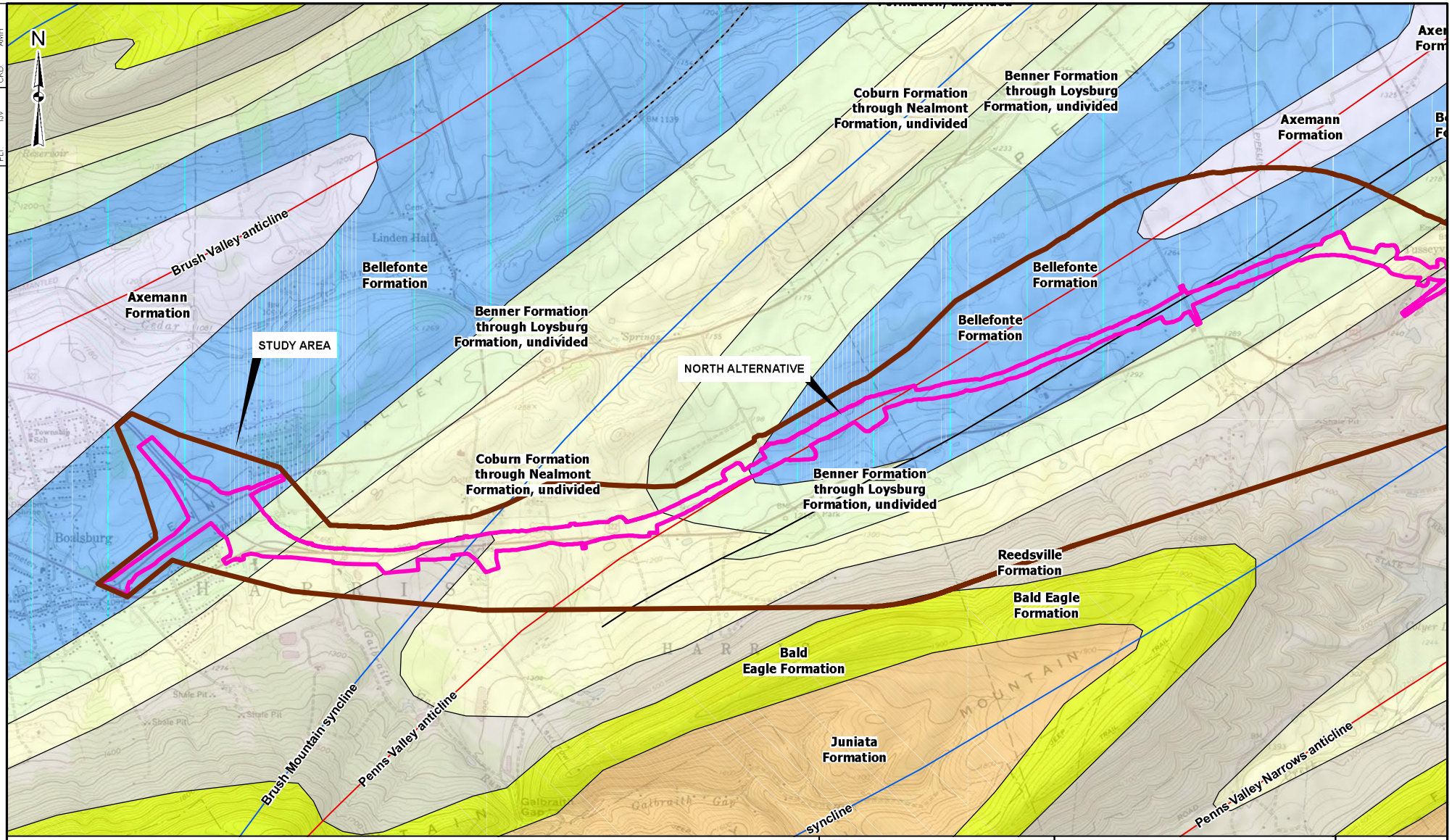

SOURCE: PA Bureau of Topographic and Geologic Survey, DCNR; Bedrock Geology of Pennsylvania

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CENTRE COUNTY, PENNSYLVANIA

GENERAL GEOLOGY MAP

PROJECT:	20011
DRAWN:	IJV
DATE:	JUL 2025
SCALE:	1" = 2,000'
FIGURE:	N-4A

AMH
CKD
IJV
PLT

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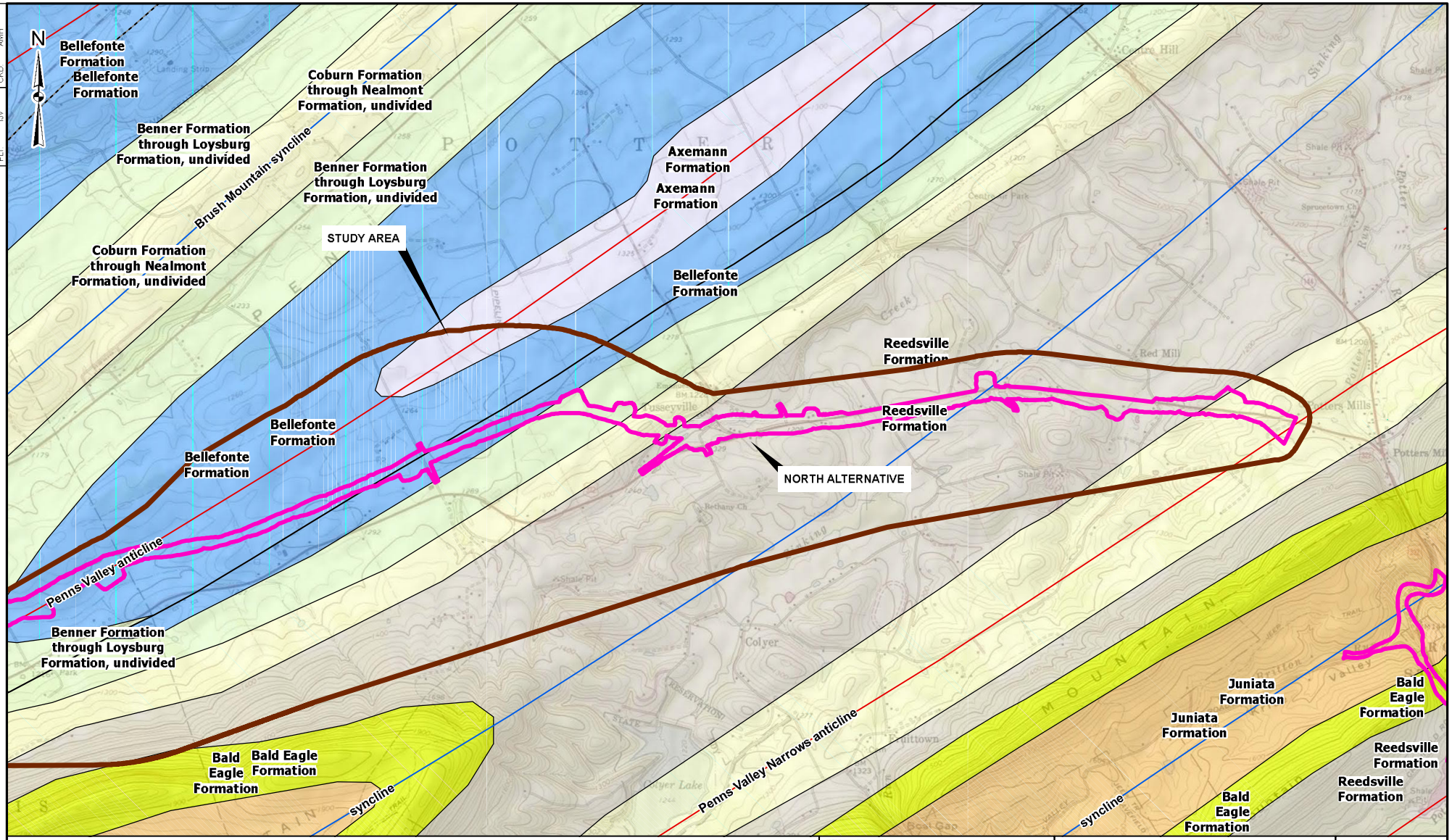

SOURCE: PA Bureau of Topographic and Geologic Survey, DCNR; Bedrock Geology of Pennsylvania

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NORTH ALTERNATIVE

CENTRE COUNTY, PENNSYLVANIA

GENERAL GEOLOGY MAP

PROJECT:	20011
DRAWN:	IJV
DATE:	JUL 2025
SCALE:	1" = 2,000'
FIGURE:	N-4B

PLT: IJV CKD: AMH

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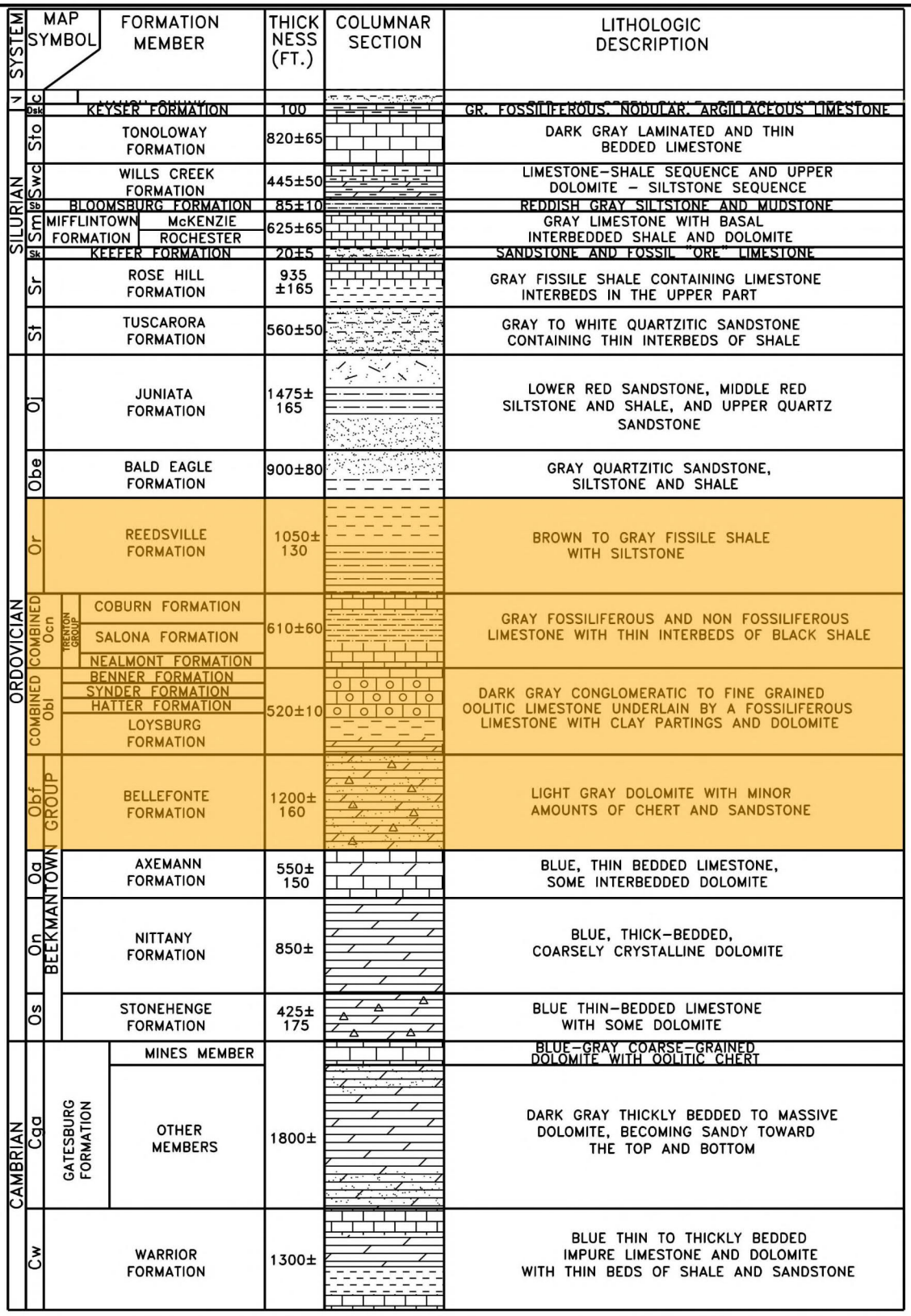

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CENTRE COUNTY, PENNSYLVANIA

GENERALIZED STRATIGRAPHIC COLUMN

PROJECT:	20011
DRAWN:	IJV
DATE:	FEB. 2025
SCALE:	NTS
FIGURE:	N-5

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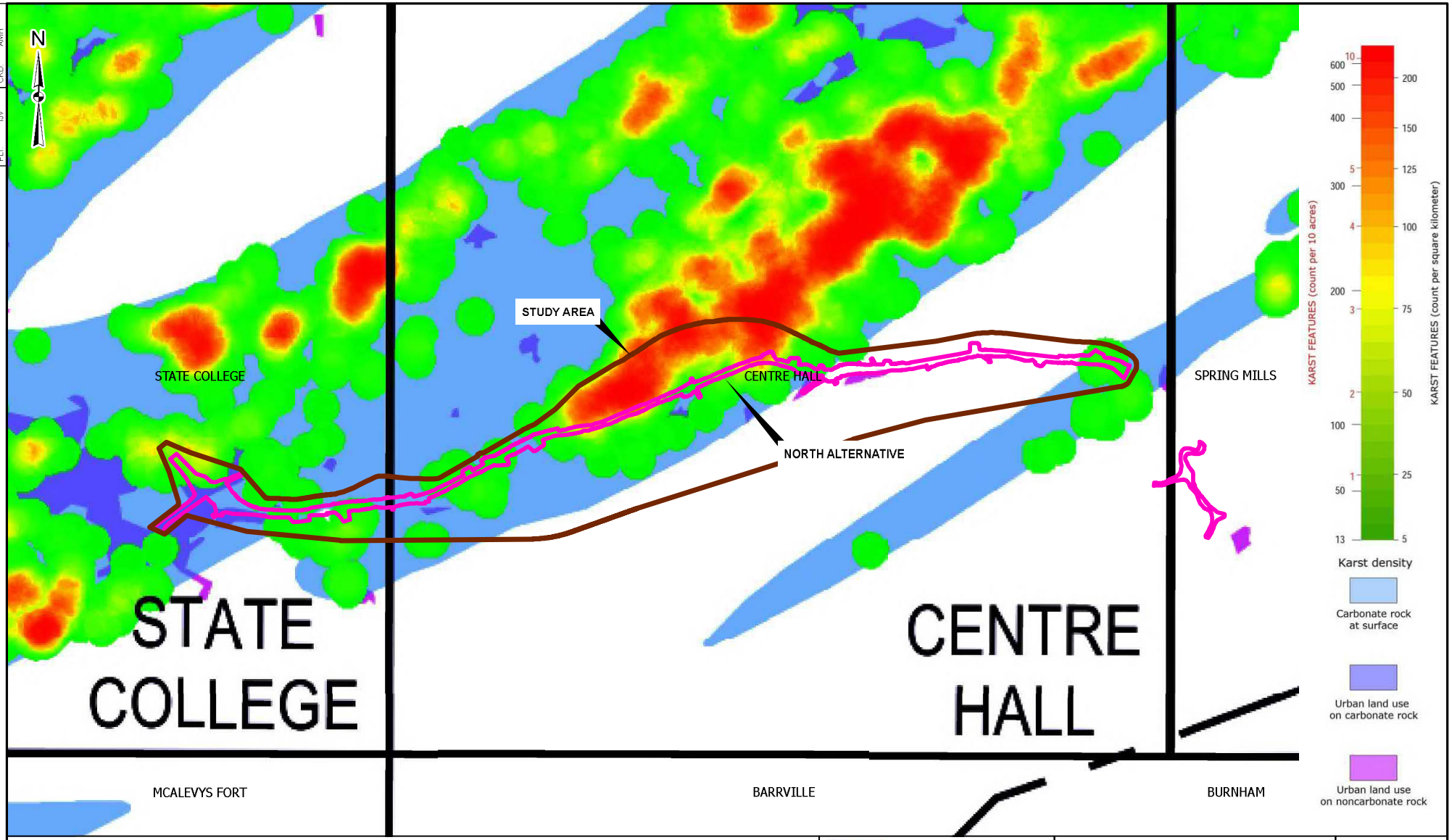

SOURCE: PA Dept. of Conservation & Natural Resources, Bureau of Topographic & Geologic Survey; Density of Mapped Karst Features (Map 68 and 70)

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CENTRE COUNTY, PENNSYLVANIA

KARST MAP

PROJECT:	20011
DRAWN:	IJV
DATE:	JUL 2025
SCALE:	1" = 4,000'
FIGURE:	N-6

PLT: IJV CKD: AMH

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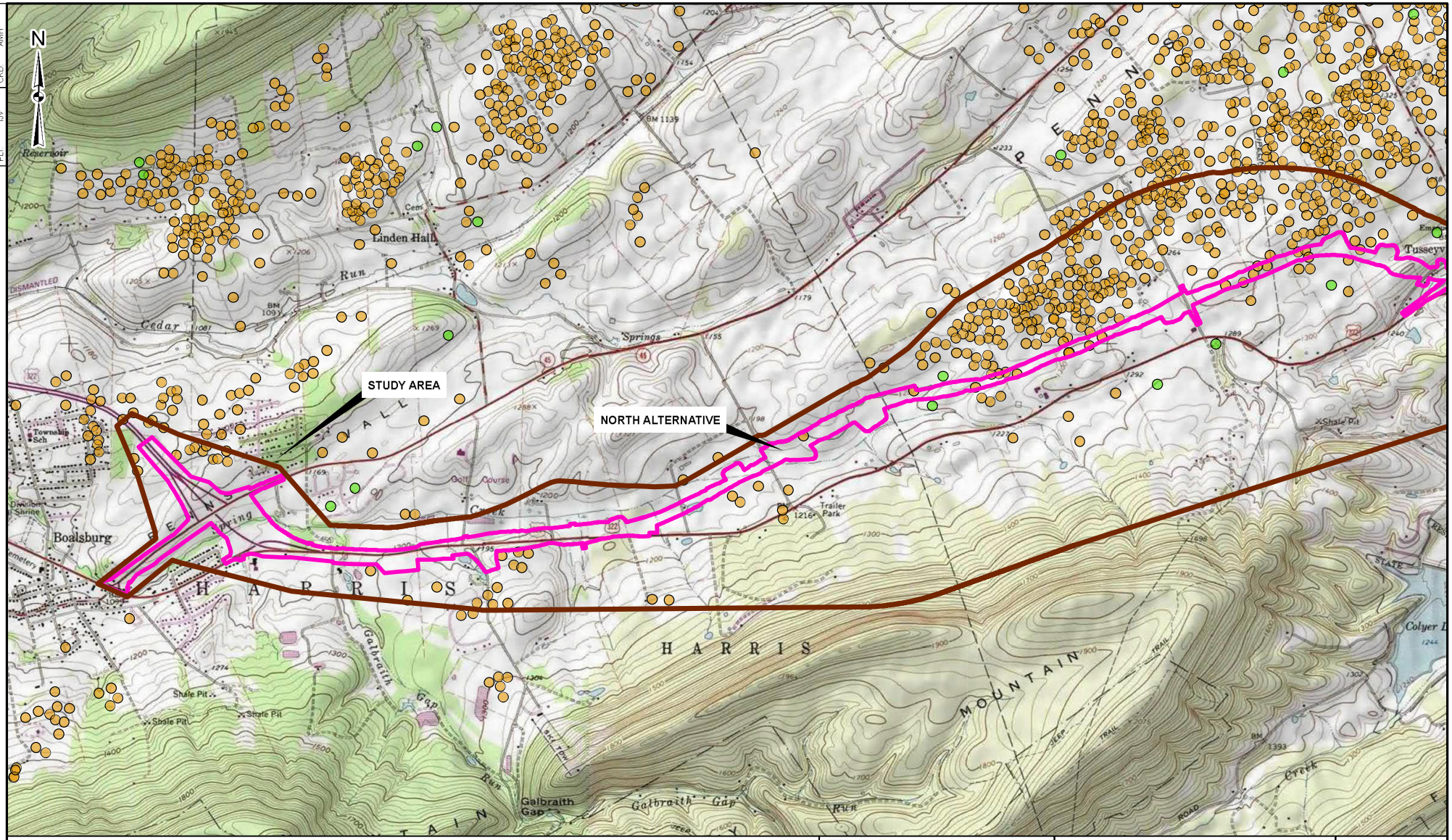

SOURCE: PA Bureau of Topographic and Geologic Survey, DCNR; Karst Features in Pennsylvania

LEGEND

- Sinkhole
- Surface Depression

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CENTRE COUNTY, PENNSYLVANIA

SINKHOLE AND KARST RELATED FEATURES

PROJECT:	20011
DRAWN:	IJV
DATE:	JUL 2025
SCALE:	1" = 2,000'
FIGURE:	N-7A

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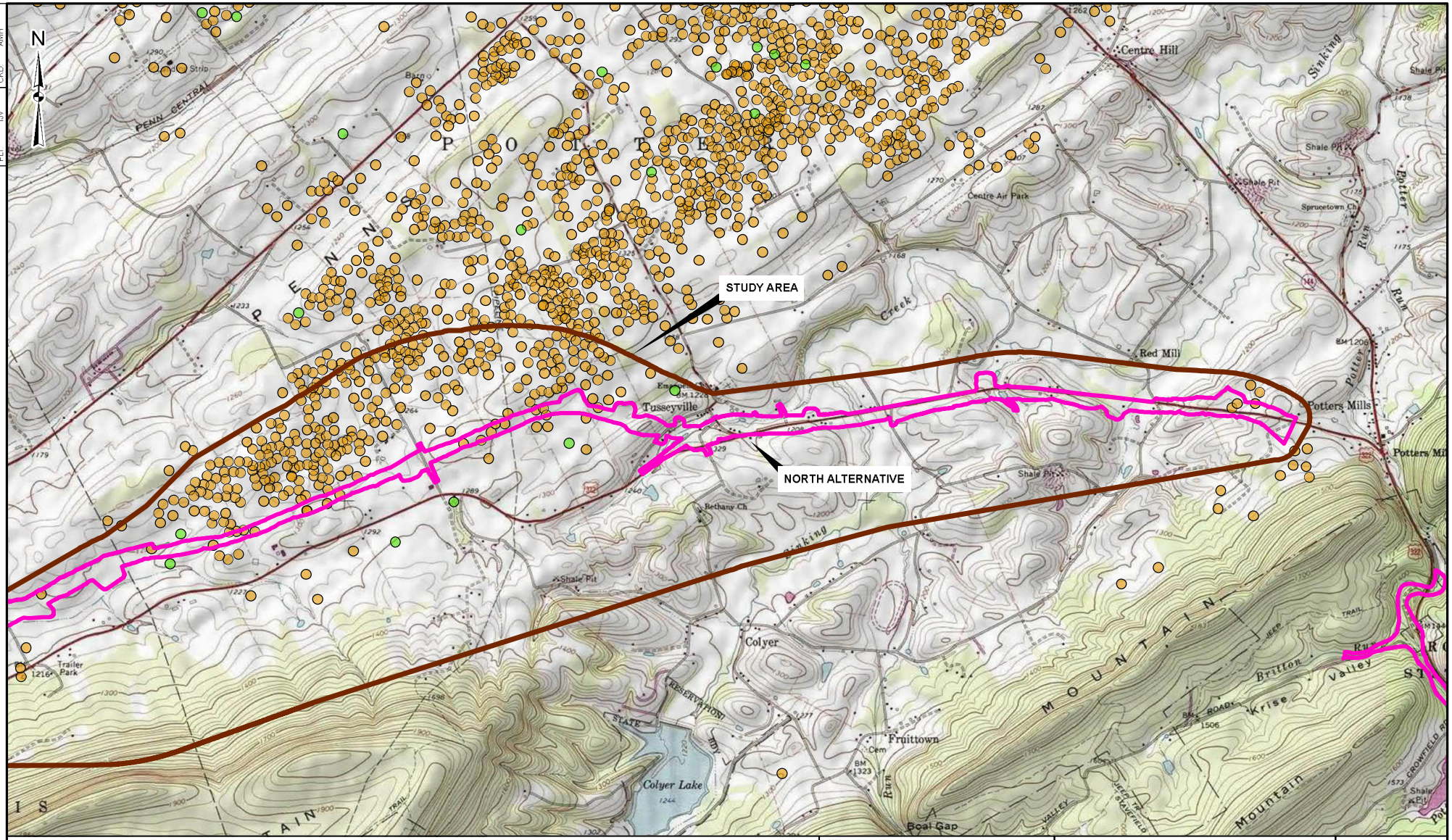

SOURCE: PA Bureau of Topographic and Geologic Survey, DCNR; Karst Features in Pennsylvania

LEGEND

- Sinkhole
- Surface Depression

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CENTRE COUNTY, PENNSYLVANIA

SINKHOLE AND KARST RELATED FEATURES

PROJECT:	20011
DRAWN:	IJV
DATE:	JUL 2025
SCALE:	1" = 2,000'
FIGURE:	N-7B

PLT: IJV CKD: AMH

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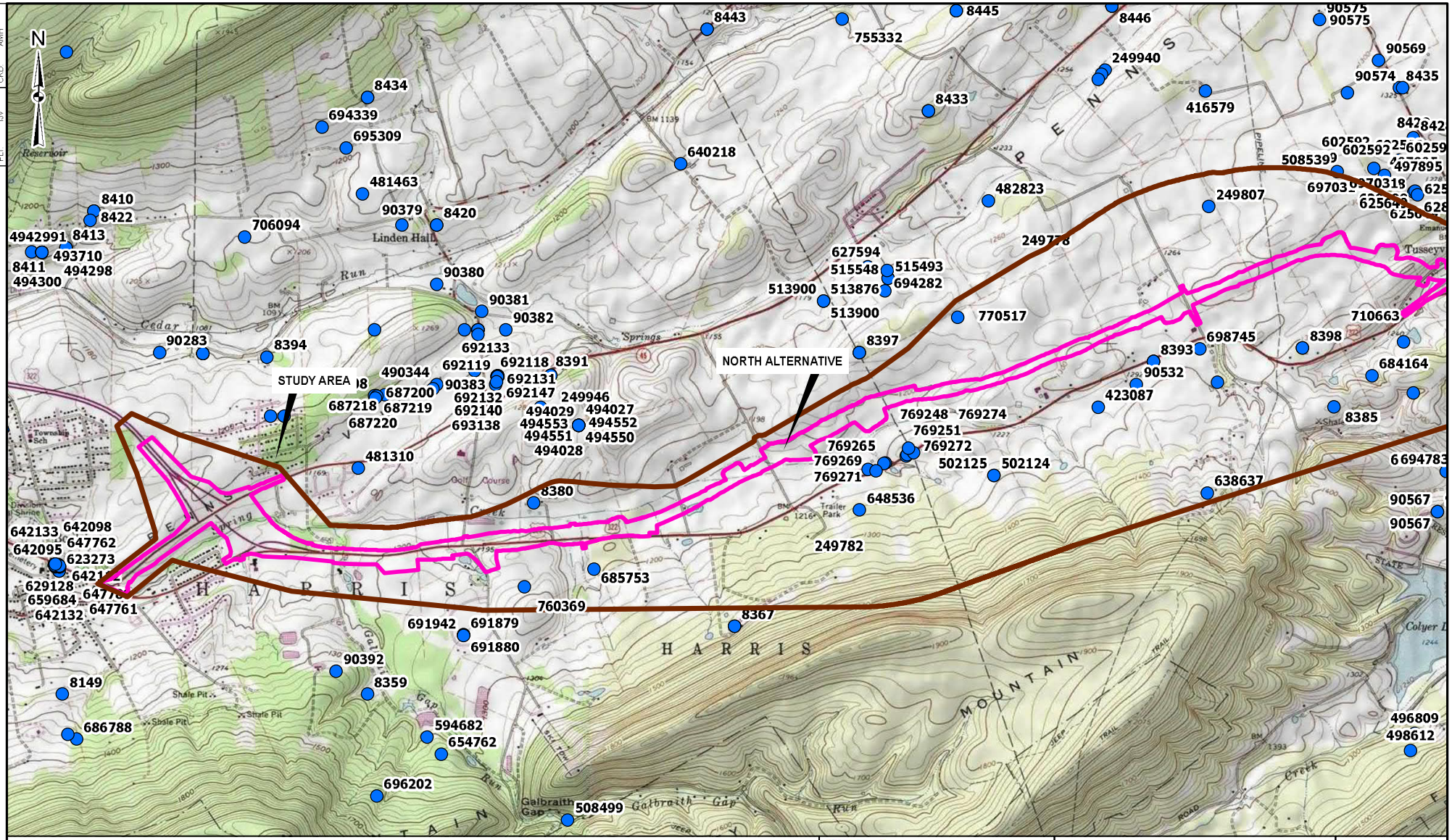

SOURCE: PA Topographic & Geologic Survey, Pennsylvania Groundwater Information System (PaGWIS)

LEGEND

PaGWIS Water Well

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McLean, VA

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CENTRE COUNTY, PENNSYLVANIA

WATER WELL MAP

PROJECT:	20011
DRAWN:	IJV
DATE:	JUL 2025
SCALE:	1" = 2,000'
FIGURE:	N-8A

PLT: IJV CKD: AMH

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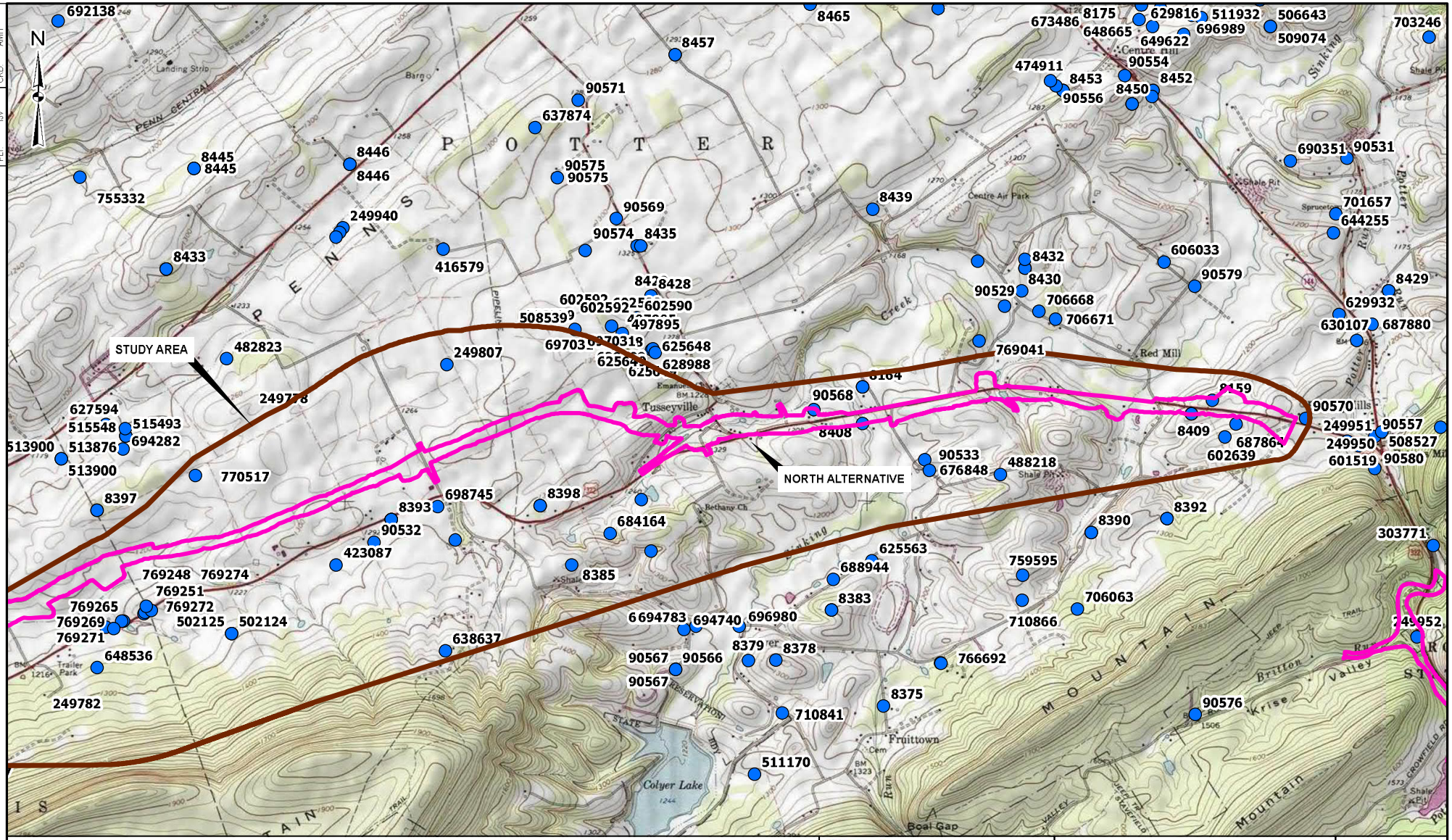

SOURCE: PA Topographic & Geologic Survey, Pennsylvania Groundwater Information System (PaGWIS)

LEGEND

PaGWIS Water Well

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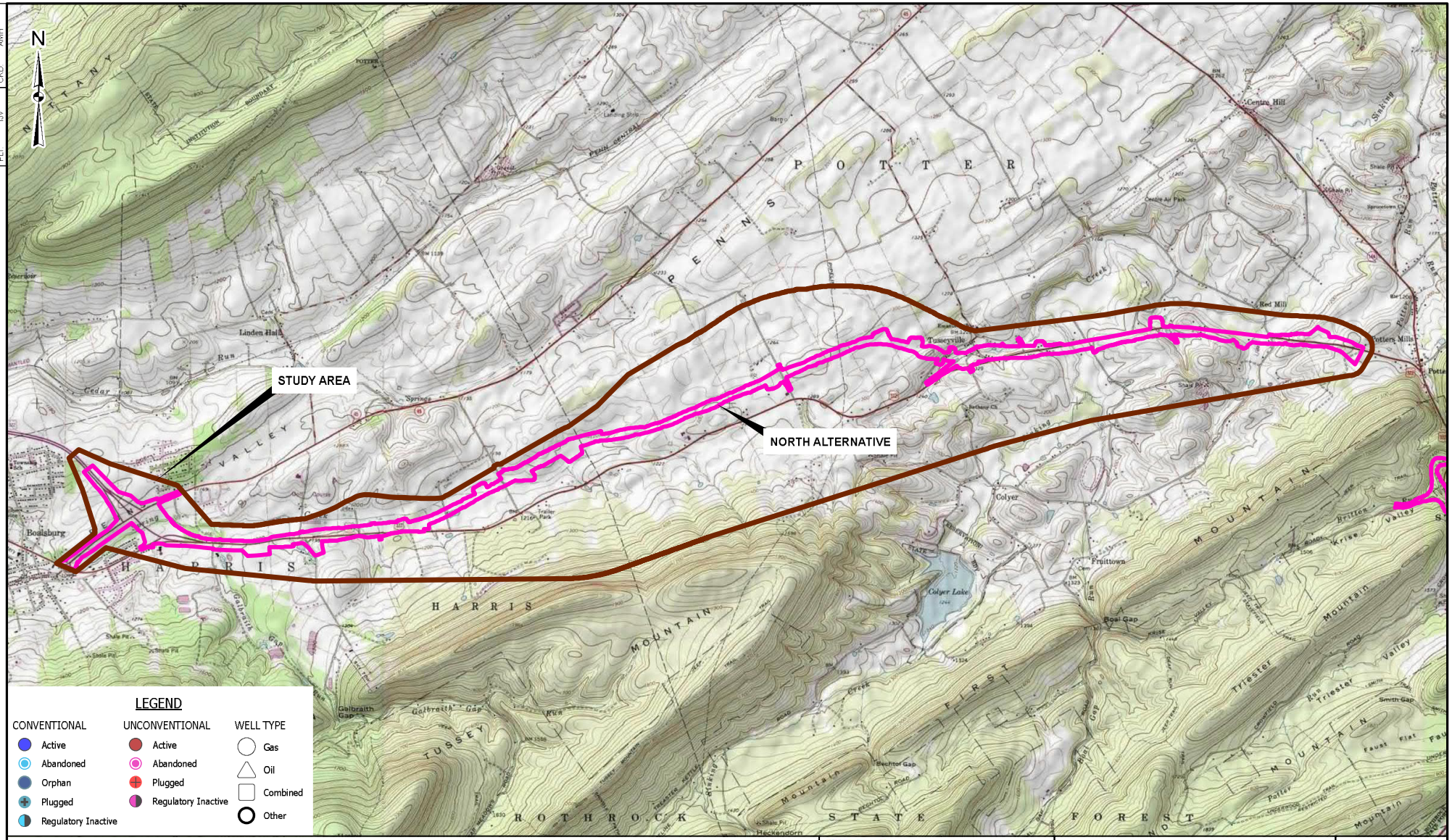
CENTRE COUNTY, PENNSYLVANIA

WATER WELL MAP

PROJECT:	20011
DRAWN:	IJV
DATE:	JUL 2025
SCALE:	1" = 2,000'
FIGURE:	N-8B

PLT: IJV CKD: AMH

Path: N:\AmGIS\Projects\2000\20011\2023 Alternatives\20011 Alternatives - 2025.aprx
Date: 7/31/2025



SOURCE: PA Spatial Data Access, Pennsylvania Department of Environmental Protection; Oil & Gas Locations - Conventional Unconventional.

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NORTH ALTERNATIVE

CENTRE COUNTY, PENNSYLVANIA

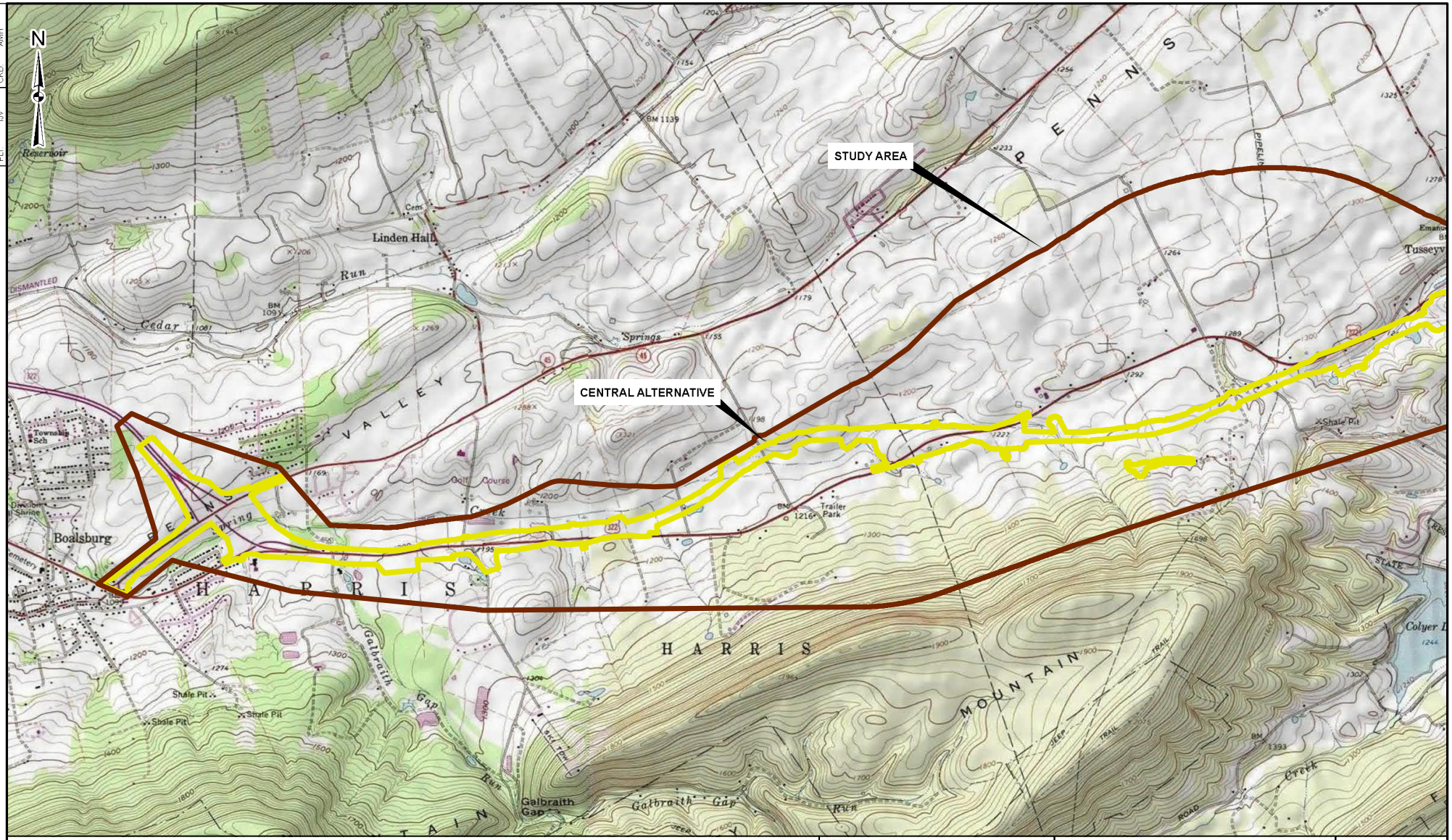
OIL AND GAS WELL MAP

PROJECT:	20011
DRAWN:	IJV
DATE:	JUL 2025
SCALE:	1" = 3,000'
FIGURE:	N-9

PLT: IJV CKD: AMH

Path: N:\Arc GIS\Projects\2020\20011\2023 Alternatives\20011 Alternatives - 2025.aprx
Date: 7/31/2025

APPENDIX C
CENTRAL ALTERNATIVE FIGURES



SOURCE: US Geological Survey, Quadrangle Map (7½' Series); Centre Hall and State College, PA

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CENTRAL ALTERNATIVE

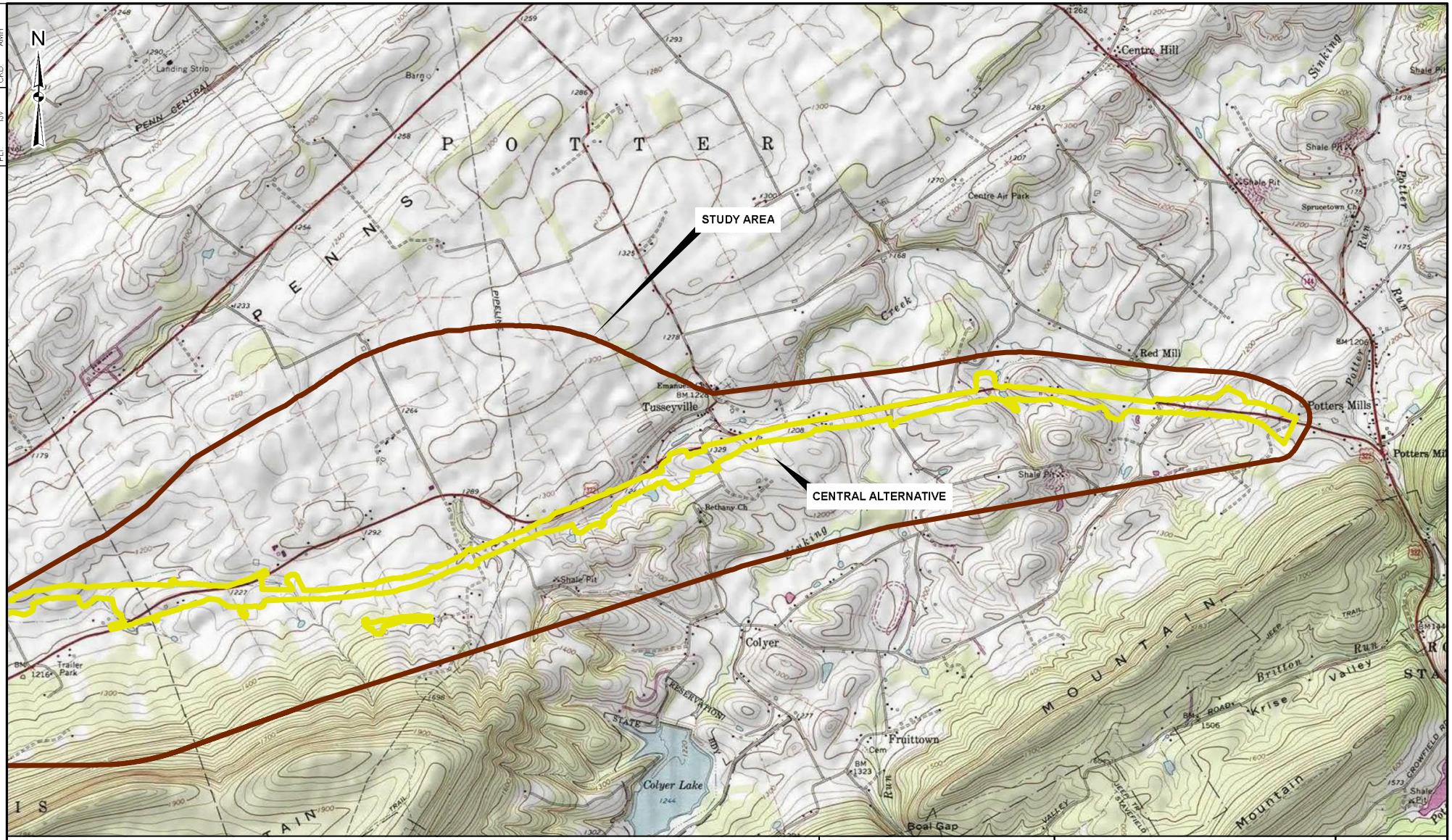
CENTRE COUNTY, PENNSYLVANIA

ALTERNATIVE LOCATION MAP

PROJECT:	20011
DRAWN:	IJV
DATE:	JUL 2025
SCALE:	1" = 2,000'
FIGURE:	C-1A

PLT: IJV CKD: AMH

Path: N:\ArcGIS\Projects\20000\20011\2023 Alternatives\20011 Alternatives - 2025.aprx
Date: 7/31/2025



SOURCE: US Geological Survey, Quadrangle Map (7½' Series); Centre Hall, PA

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CENTRAL ALTERNATIVE

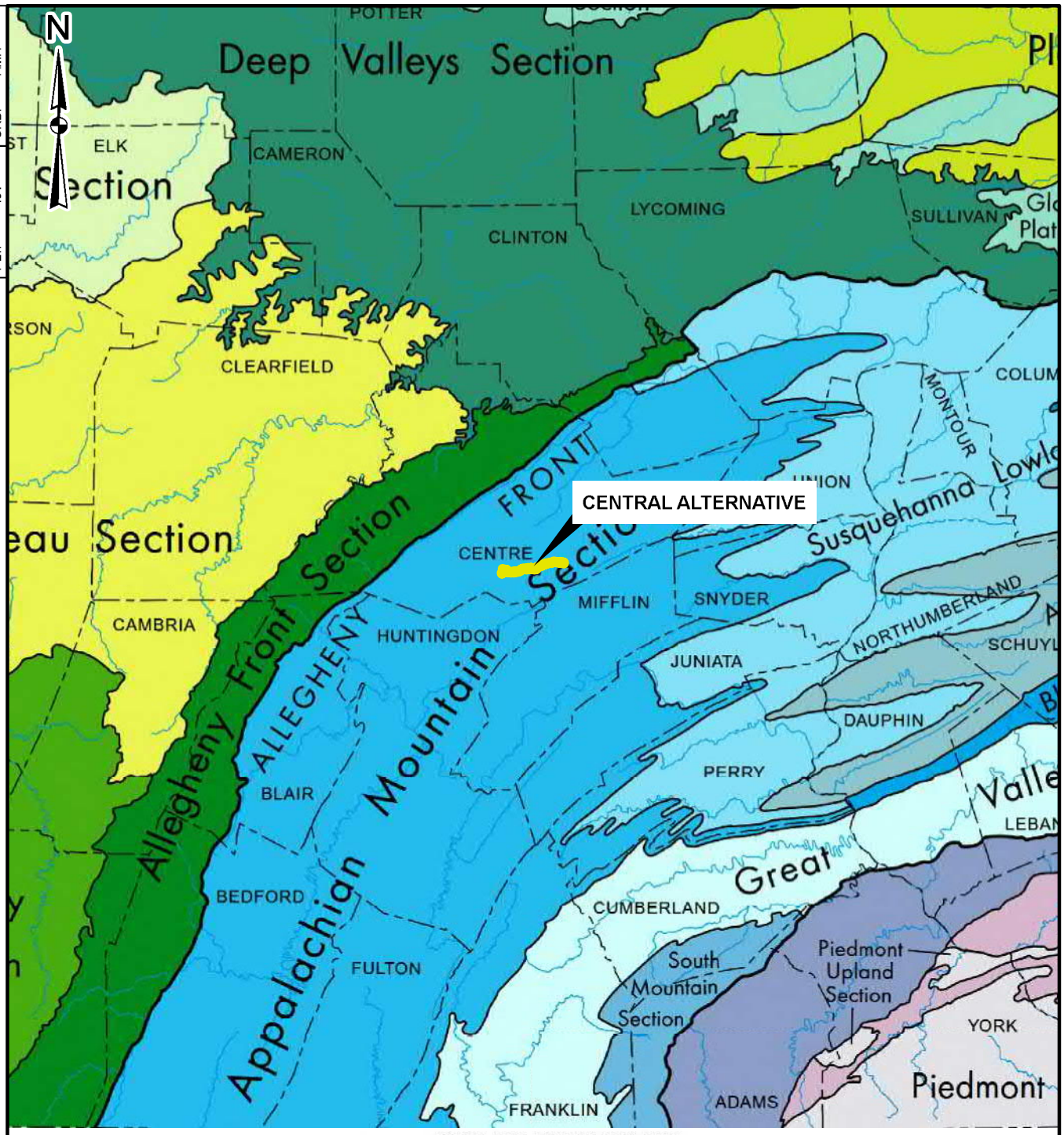
CENTRE COUNTY, PENNSYLVANIA

ALTERNATIVE LOCATION MAP

PROJECT:	20011
DRAWN:	IJV
DATE:	JUL 2025
SCALE:	1" = 2,000'
FIGURE:	C-1B

PLT: IJV CKD: AMH

Path: N:\Arc GIS\Projects\2020\20011\2023 Alternatives\20011 Alternatives - 2025.aprx
Date: 7/31/2025



SOURCE: PA Dept. of Conservation & Natural Resources, Bureau of Topographic & Geological Survey; Physiographic Provinces of PA (Map 13)

PLT: IJV CKD: AMH

Path: N:\ArcGIS\Projects\2020\20011\2023 Alternatives\20011 Alternatives - 2025.aprx
Date: 7/31/2025

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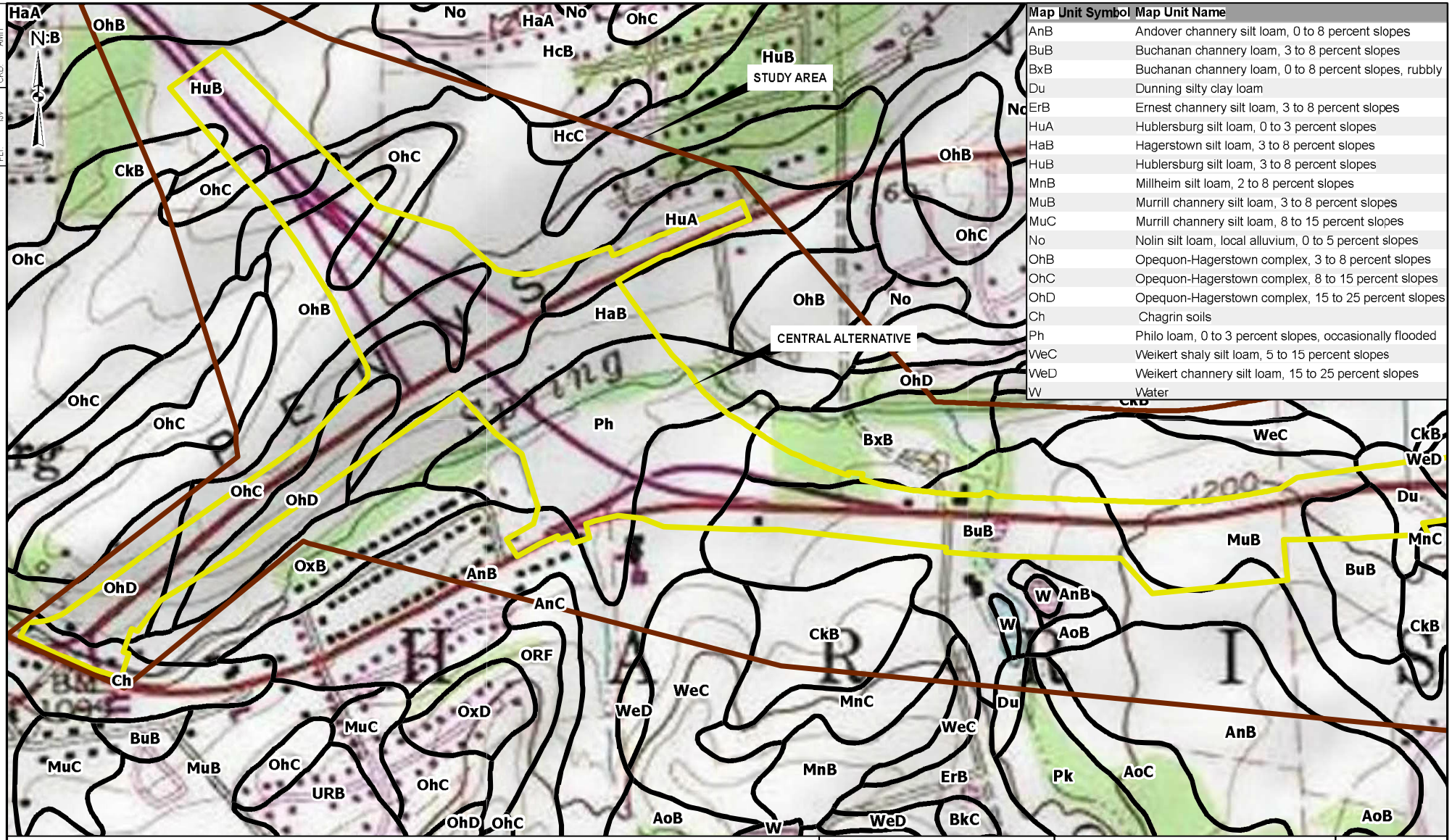
CENTRAL ALTERNATIVE

CENTRE COUNTY, PENNSYLVANIA

PHYSIOGRAPHIC PROVINCES MAP

PROJECT:	20011
DRAWN:	IJV
DATE:	JUL 2025
SCALE:	1" = 20 MILES
FIGURE:	C-2



Map Unit Symbol	Map Unit Name
AnB	Andover channery silt loam, 0 to 8 percent slopes
BuB	Buchanan channery loam, 3 to 8 percent slopes
BxB	Buchanan channery loam, 0 to 8 percent slopes, rubbly
Du	Dunning silty clay loam
ErB	Ernest channery silt loam, 3 to 8 percent slopes
HuA	Hublersburg silt loam, 0 to 3 percent slopes
HaB	Hagerstown silt loam, 3 to 8 percent slopes
HuB	Hublersburg silt loam, 3 to 8 percent slopes
MnB	Millheim silt loam, 2 to 8 percent slopes
MuB	Murrill channery silt loam, 3 to 8 percent slopes
MuC	Murrill channery silt loam, 8 to 15 percent slopes
No	Nolin silt loam, local alluvium, 0 to 5 percent slopes
OhB	Opequon-Hagerstown complex, 3 to 8 percent slopes
OhC	Opequon-Hagerstown complex, 8 to 15 percent slopes
OhD	Opequon-Hagerstown complex, 15 to 25 percent slopes
Ch	Chagrin soils
Ph	Philo loam, 0 to 3 percent slopes, occasionally flooded
WeC	Weikert shaly silt loam, 5 to 15 percent slopes
WeD	Weikert channery silt loam, 15 to 25 percent slopes
W	Water

SOURCE: US Dept. of Agriculture, Soil Data Mart; Soil Survey for Centre County, PA

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CENTRAL ALTERNATIVE

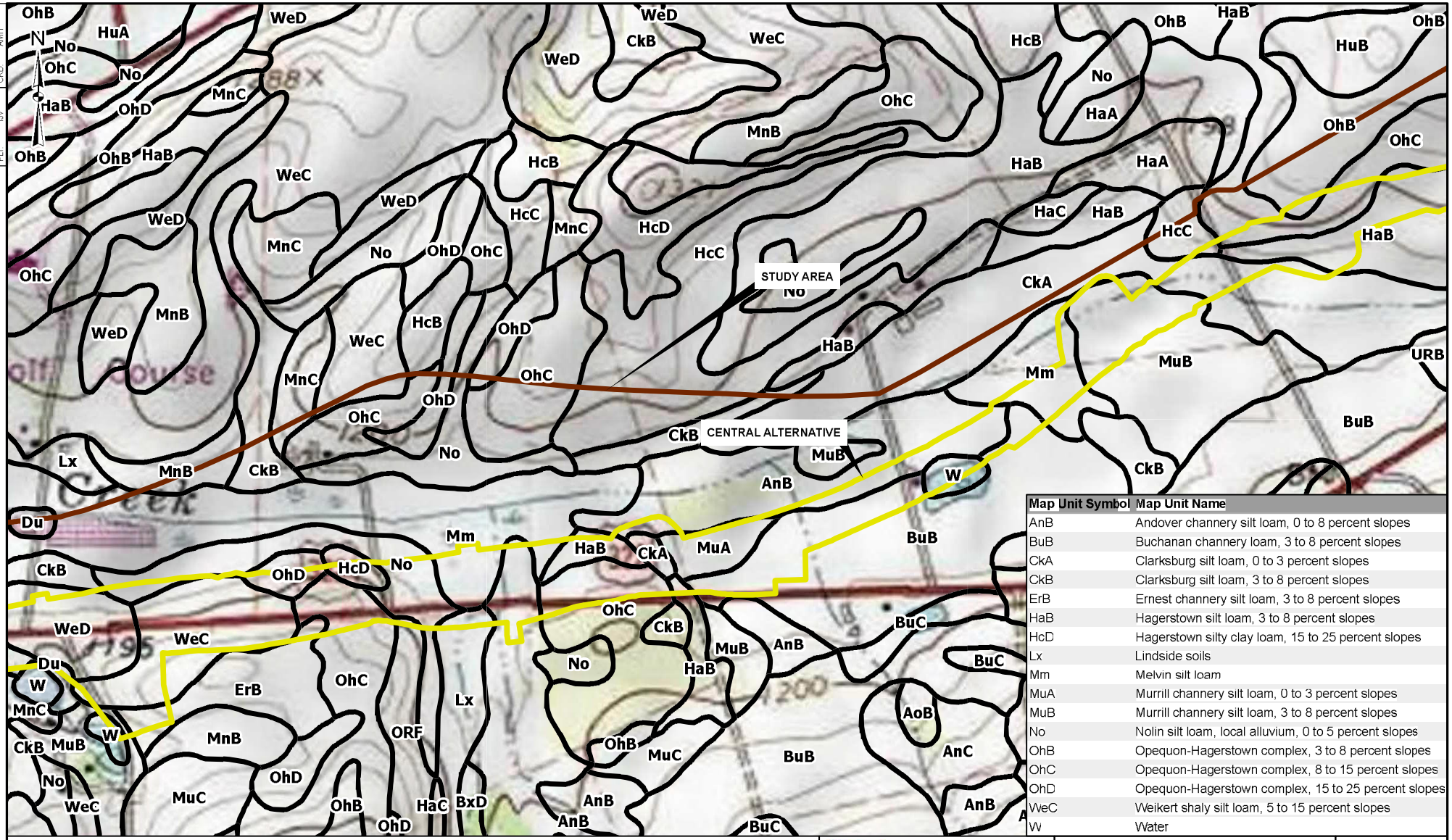
CENTRE COUNTY, PENNSYLVANIA

SOILS MAP

PROJECT:	20011
DRAWN:	IJV
DATE:	JUL 2025
SCALE:	1" = 500'
FIGURE:	C-3A

PLT: IJV CKD: ANH

Path: N:\Arc GIS\Projects\20000\20011\2023 Alternatives\20011 Alternatives - 2025.aprx
Date: 7/31/2025



Map Unit Symbol	Map Unit Name
AnB	Andover channery silt loam, 0 to 8 percent slopes
BuB	Buchanan channery loam, 3 to 8 percent slopes
CkA	Clarksburg silt loam, 0 to 3 percent slopes
CkB	Clarksburg silt loam, 3 to 8 percent slopes
ErB	Ernest channery silt loam, 3 to 8 percent slopes
HaB	Hagerstown silt loam, 3 to 8 percent slopes
HcD	Hagerstown silty clay loam, 15 to 25 percent slopes
Lx	Lindside soils
Mm	Melvin silt loam
MuA	Murrill channery silt loam, 0 to 3 percent slopes
MuB	Murrill channery silt loam, 3 to 8 percent slopes
No	Nolin silt loam, local alluvium, 0 to 5 percent slopes
OhB	Opequon-Hagerstown complex, 3 to 8 percent slopes
OhC	Opequon-Hagerstown complex, 8 to 15 percent slopes
OhD	Opequon-Hagerstown complex, 15 to 25 percent slopes
WeC	Weikert shaly silt loam, 5 to 15 percent slopes
W	Water

SOURCE: US Dept. of Agriculture, Soil Data Mart; Soil Survey for Centre County, PA

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CENTRAL ALTERNATIVE

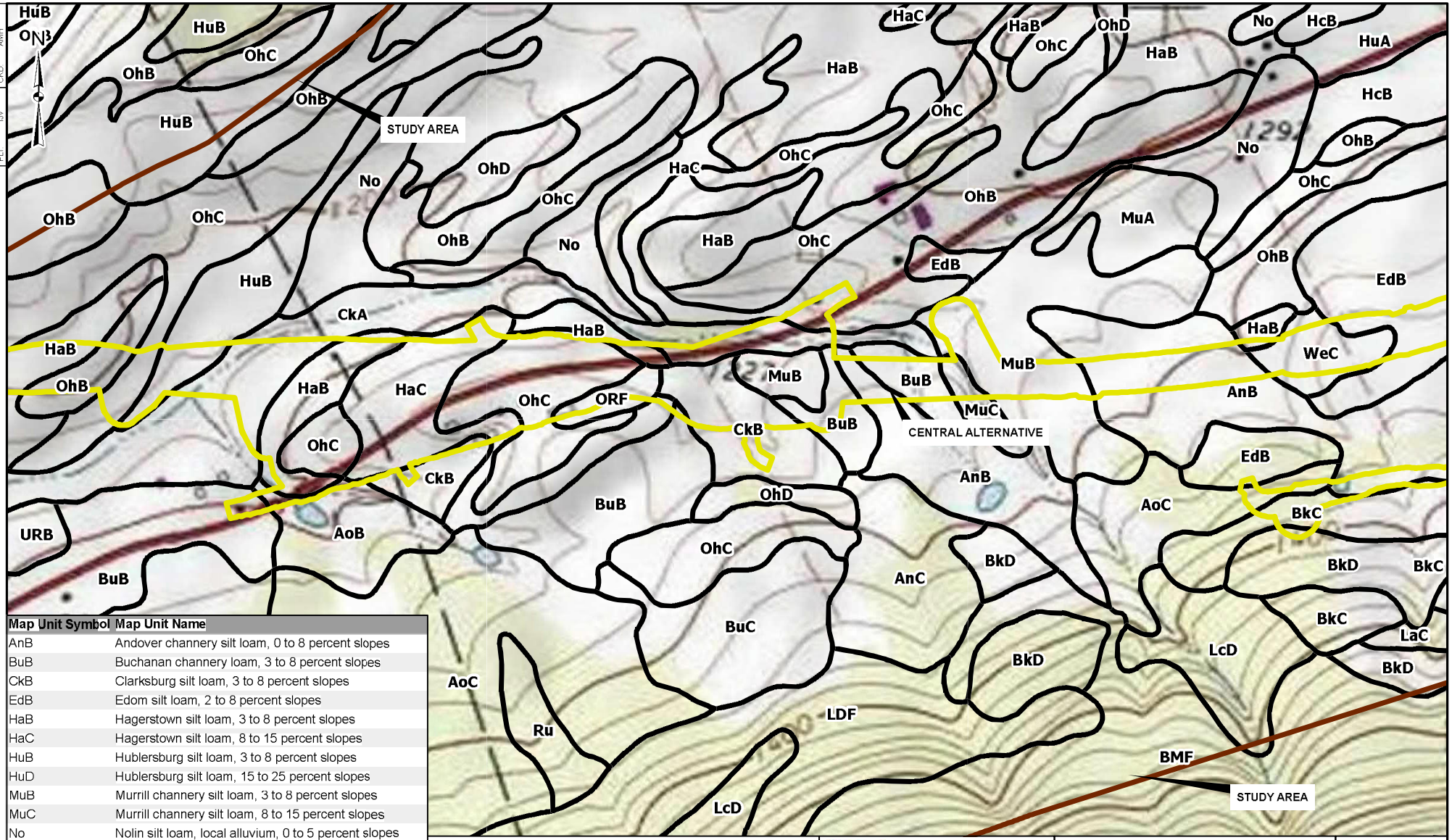
CENTRE COUNTY, PENNSYLVANIA

SOILS MAP

PROJECT:	20011
DRAWN:	IJV
DATE:	JUL 2025
SCALE:	1" = 500'
FIGURE:	C-3B

PLT: IJV CKD: AMH

Path: N:\ArcGIS\Projects\2020\20011\2023 Alternatives\20011 Alternatives - 2025.aprx
Date: 7/31/2025



Map Unit Symbol	Map Unit Name
AnB	Andover channery silt loam, 0 to 8 percent slopes
BuB	Buchanan channery loam, 3 to 8 percent slopes
CkB	Clarksburg silt loam, 3 to 8 percent slopes
EdB	Edom silt loam, 2 to 8 percent slopes
HaB	Hagerstown silt loam, 3 to 8 percent slopes
HaC	Hagerstown silt loam, 8 to 15 percent slopes
HuB	Hublersburg silt loam, 3 to 8 percent slopes
HuD	Hublersburg silt loam, 15 to 25 percent slopes
MuB	Murrill channery silt loam, 3 to 8 percent slopes
MuC	Murrill channery silt loam, 8 to 15 percent slopes
No	Nolin silt loam, local alluvium, 0 to 5 percent slopes
OhB	Opequon-Hagerstown complex, 3 to 8 percent slopes
OhC	Opequon-Hagerstown complex, 8 to 15 percent slopes
OhD	Opequon-Hagerstown complex, 15 to 25 percent slopes
ORF	Opequon-Hagerstown complex, steep
WeC	Weikert shaly silt loam, 5 to 15 percent slopes

SOURCE: US Dept. of Agriculture, Soil Data Mart; Soil Survey for Centre County, PA

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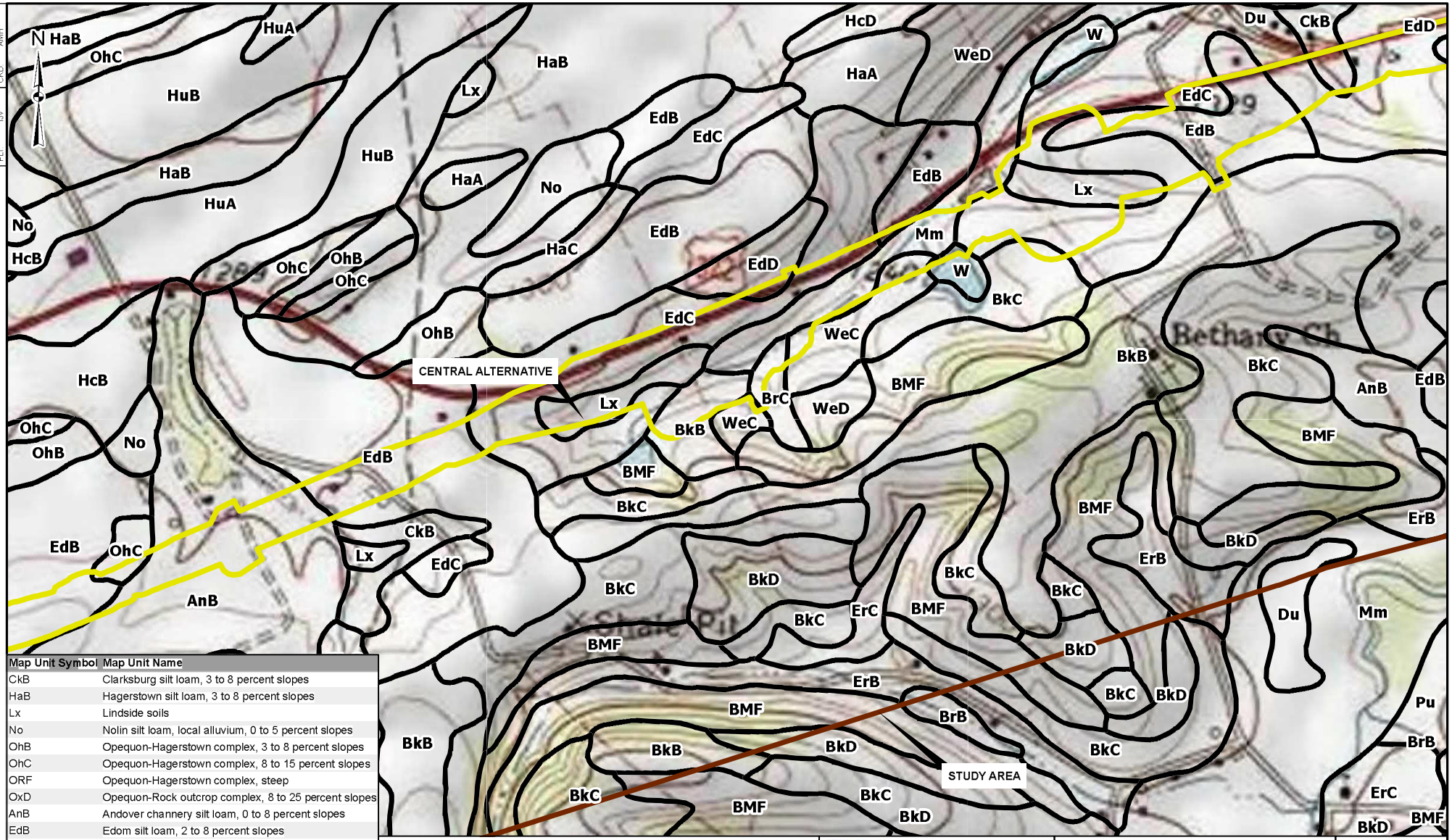
CENTRAL ALTERNATIVE

CENTRE COUNTY, PENNSYLVANIA

SOILS MAP

PROJECT:	20011
DRAWN:	IJV
DATE:	JUL 2025
SCALE:	1" = 500'
FIGURE:	C-3C



Map Unit Symbol	Map Unit Name
CkB	Clarksburg silt loam, 3 to 8 percent slopes
HaB	Hagerstown silt loam, 3 to 8 percent slopes
Lx	Lindside soils
No	Nolin silt loam, local alluvium, 0 to 5 percent slopes
OhB	Opequon-Hagerstown complex, 3 to 8 percent slopes
OhC	Opequon-Hagerstown complex, 8 to 15 percent slopes
ORF	Opequon-Hagerstown complex, steep
OxD	Opequon-Rock outcrop complex, 8 to 25 percent slopes
AnB	Andover channery silt loam, 0 to 8 percent slopes
EdB	Edom silt loam, 2 to 8 percent slopes
EdC	Edom silt loam, 8 to 15 percent slopes
BkB	Berks channery silt loam, 3 to 8 percent slopes
WeC	Weikert shaly silt loam, 5 to 15 percent slopes
BrC	Brinkerton silt loam, 8 to 15 percent slopes
EdD	Edom silt loam, 15 to 25 percent slopes
Mm	Melvin silt loam

SOURCE: US Dept. of Agriculture, Soil Data Mart; Soil Survey for Centre County, PA

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CENTRAL ALTERNATIVE

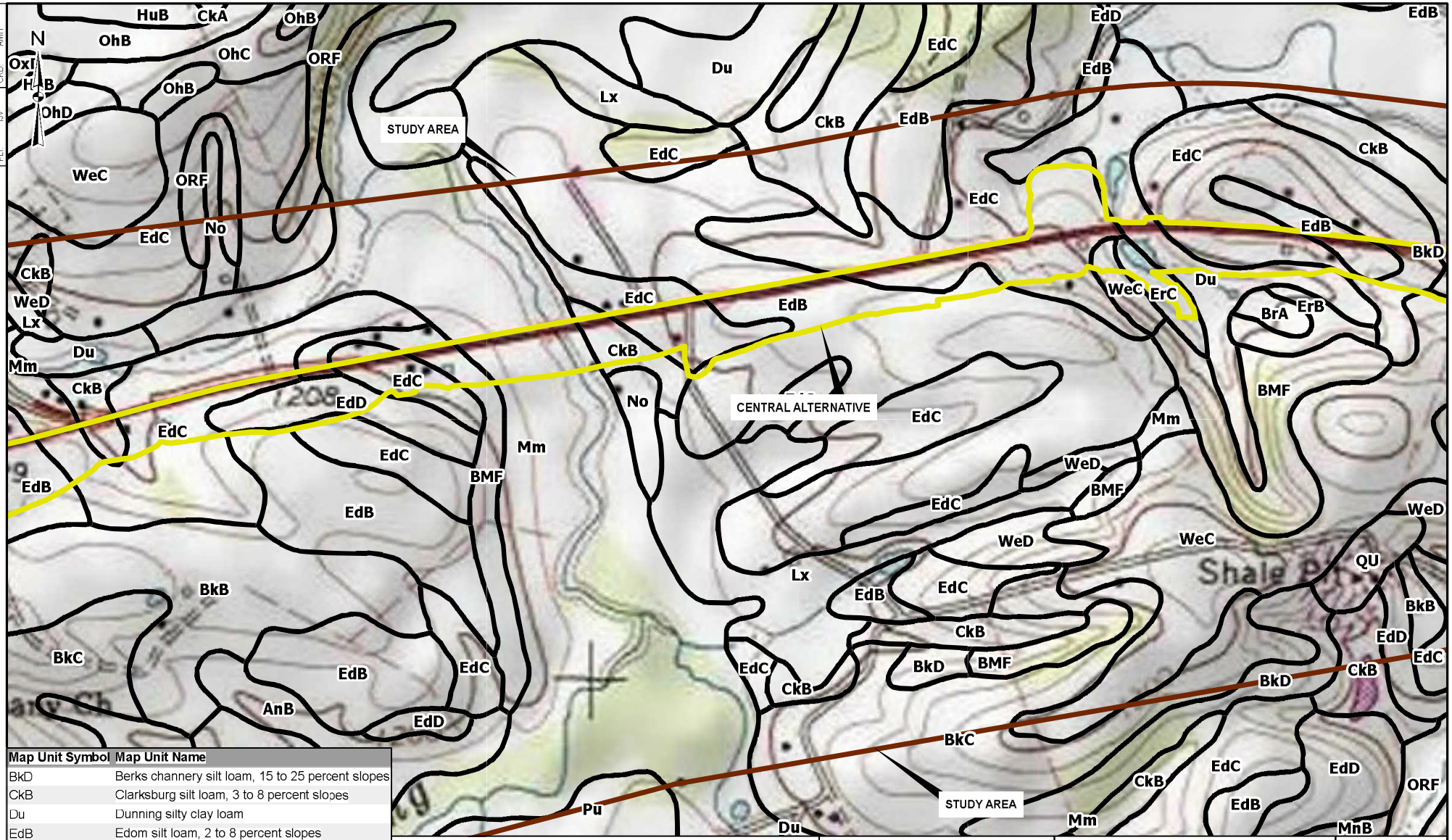
CENTRE COUNTY, PENNSYLVANIA

SOILS MAP

PROJECT:	20011
DRAWN:	IJV
DATE:	JUL 2025
SCALE:	1" = 500'
FIGURE:	C-3D

PLT: IJV CKD: AMH

Path: N:\ArcGIS\Projects\2020\20011\2023 Alternatives\20011 Alternatives - 2025.aprx
Date: 7/31/2025



Map Unit Symbol	Map Unit Name
BkD	Berks channery silt loam, 15 to 25 percent slopes
CkB	Clarksburg silt loam, 3 to 8 percent slopes
Du	Dunning silty clay loam
EdB	Edom silt loam, 2 to 8 percent slopes
EdC	Edom silt loam, 8 to 15 percent slopes
EdD	Edom silt loam, 15 to 25 percent slopes
ErC	Ernest channery silt loam, 8 to 15 percent slopes
Mm	Melvin silt loam
WeC	Weikert shaly silt loam, 5 to 15 percent slopes

SOURCE: US Dept. of Agriculture, Soil Data Mart; Soil Survey for Centre County, PA

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CENTRAL ALTERNATIVE

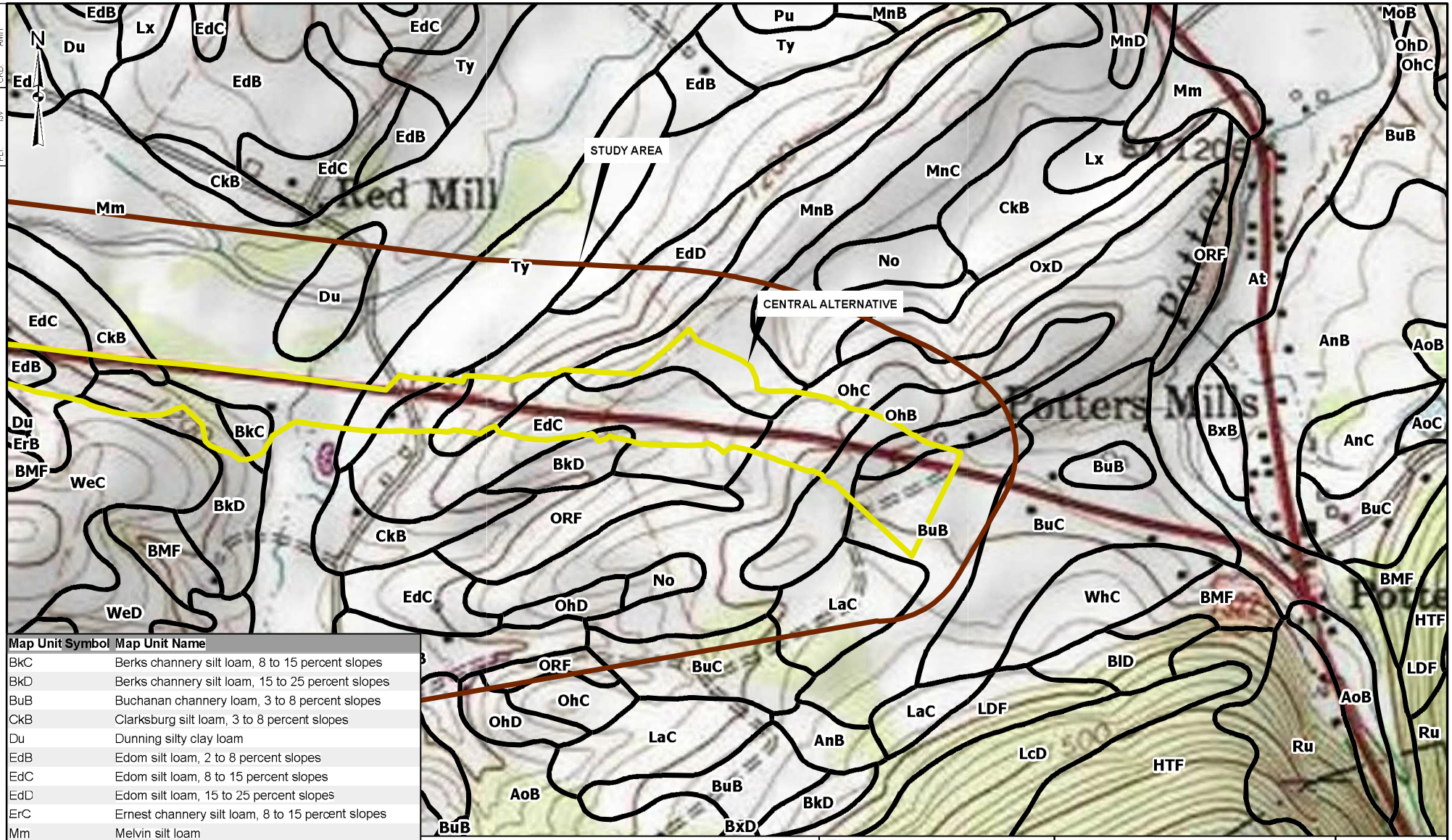
CENTRE COUNTY, PENNSYLVANIA

SOILS MAP

PROJECT:	20011
DRAWN:	IJV
DATE:	JUL 2025
SCALE:	1" = 500'
FIGURE:	C-3E

PLT: IJV CKD: ANH

Path: N:\Arc\GIS\Projects\2020\20011\2023 Alternatives\20011 Alternatives - 2025.aprx
Date: 7/31/2025



Map Unit Symbol	Map Unit Name
BkC	Berks channery silt loam, 8 to 15 percent slopes
BkD	Berks channery silt loam, 15 to 25 percent slopes
BuB	Buchanan channery loam, 3 to 8 percent slopes
CkB	Clarksburg silt loam, 3 to 8 percent slopes
Du	Dunning silty clay loam
EdB	Edom silt loam, 2 to 8 percent slopes
EdC	Edom silt loam, 8 to 15 percent slopes
EdD	Edom silt loam, 15 to 25 percent slopes
ErC	Ernest channery silt loam, 8 to 15 percent slopes
Mm	Melvin silt loam
MnB	Millheim silt loam, 2 to 8 percent slopes
OhB	Opequon-Hagerstown complex, 3 to 8 percent slopes
OhC	Opequon-Hagerstown complex, 8 to 15 percent slopes
Ty	Tyler silt loam
WeC	Weikert shaly silt loam, 5 to 15 percent slopes

SOURCE: US Dept. of Agriculture, Soil Data Mart; Soil Survey for Centre County, PA

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CENTRAL ALTERNATIVE

CENTRE COUNTY, PENNSYLVANIA

SOILS MAP

PROJECT:	20011
DRAWN:	IJV
DATE:	JUL 2025
SCALE:	1" = 500'
FIGURE:	C-3F

PLT: IJV CKD: ANH

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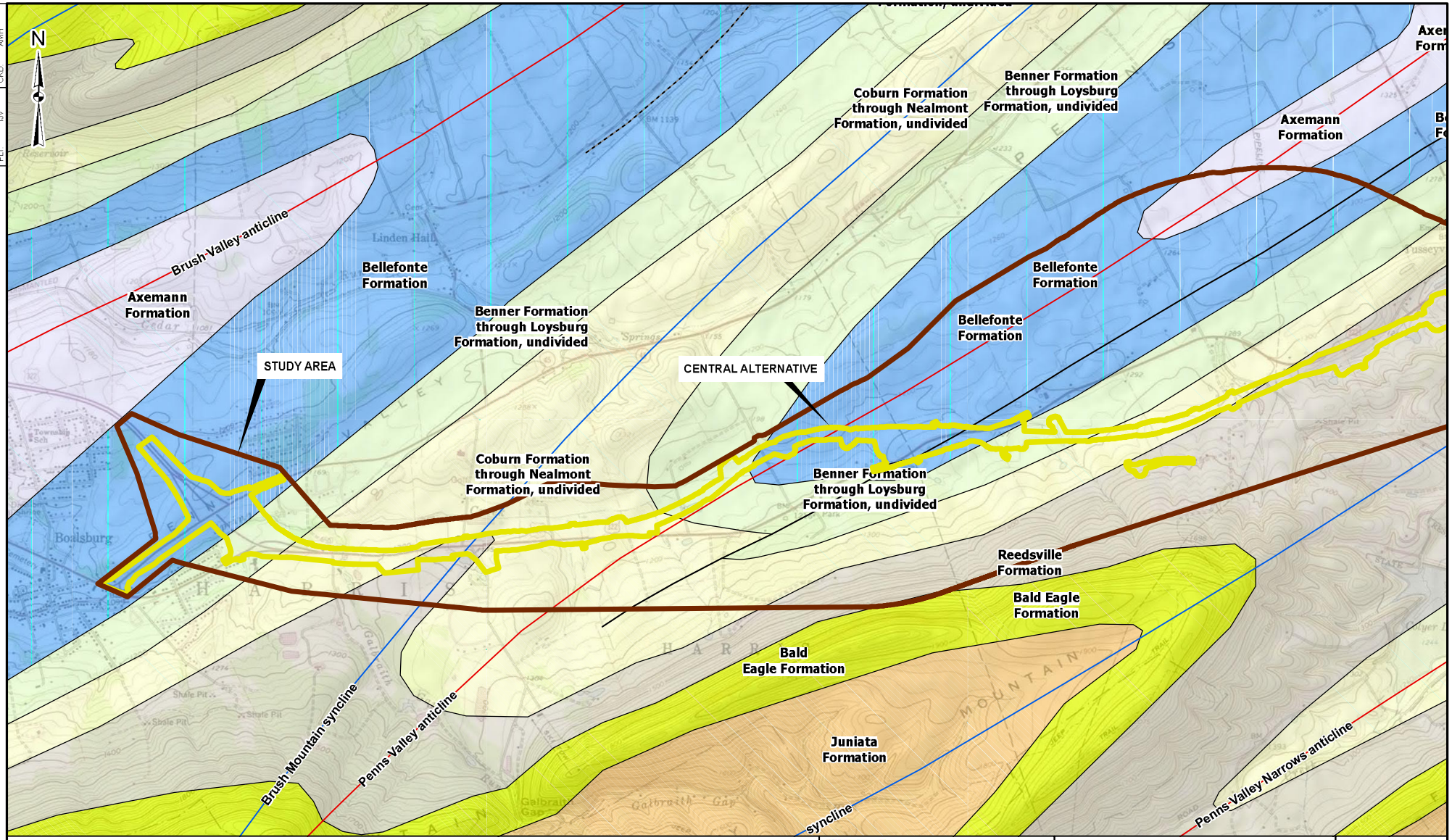

SOURCE: PA Bureau of Topographic and Geologic Survey, DCNR; Bedrock Geology of Pennsylvania

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CENTRAL ALTERNATIVE

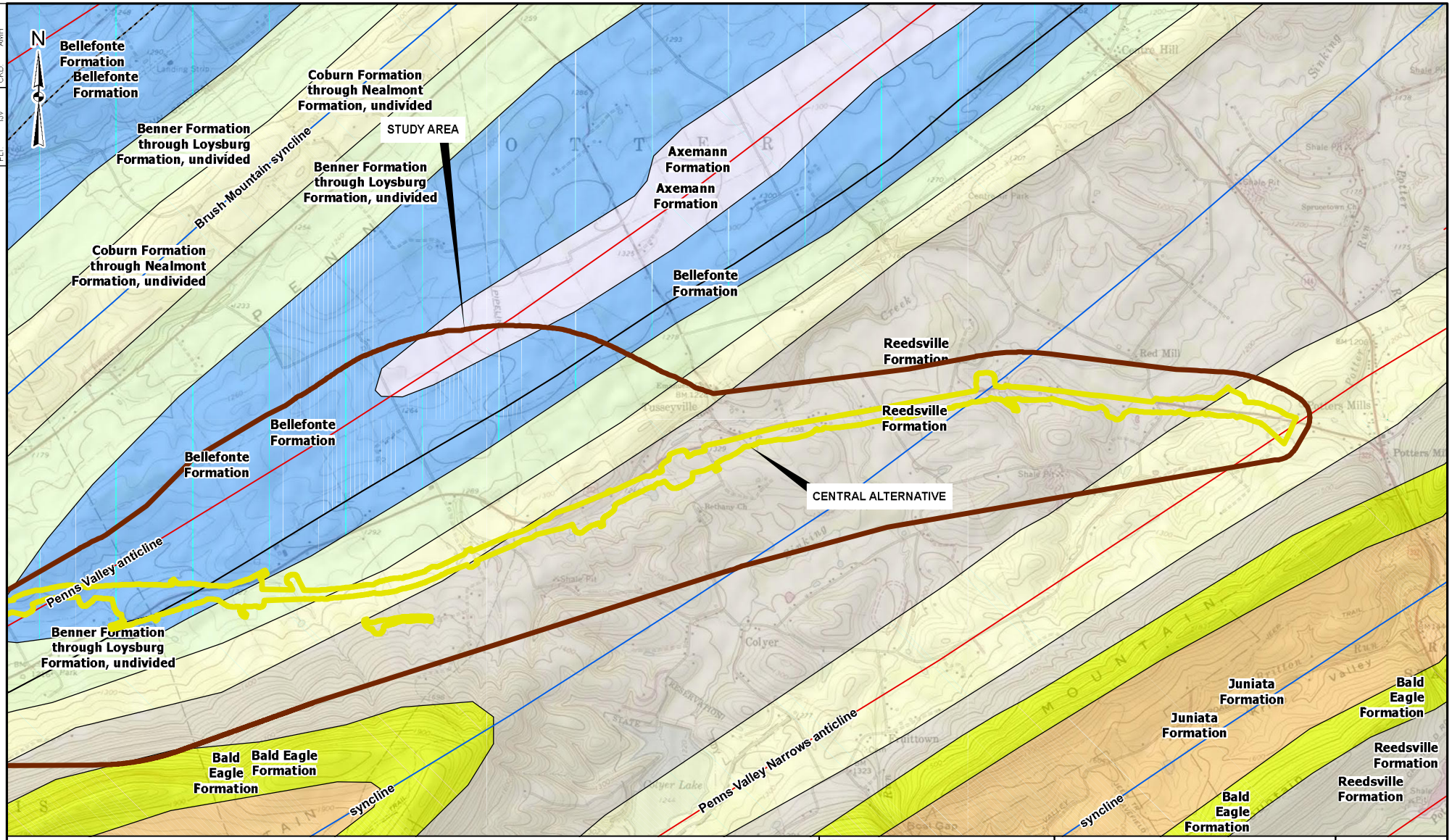
CENTRE COUNTY, PENNSYLVANIA

GENERAL GEOLOGY MAP

PROJECT:	20011
DRAWN:	IJV
DATE:	JUL 2025
SCALE:	1" = 2,000'
FIGURE:	C-4A

AMH CKD IJV PLT

Path: N:\Arc\GIS\Projects\2020\20011\2023 Alternatives\20011 Alternatives - 2025.aprx
Date: 7/31/2025



SOURCE: PA Bureau of Topographic and Geologic Survey, DCNR; Bedrock Geology of Pennsylvania

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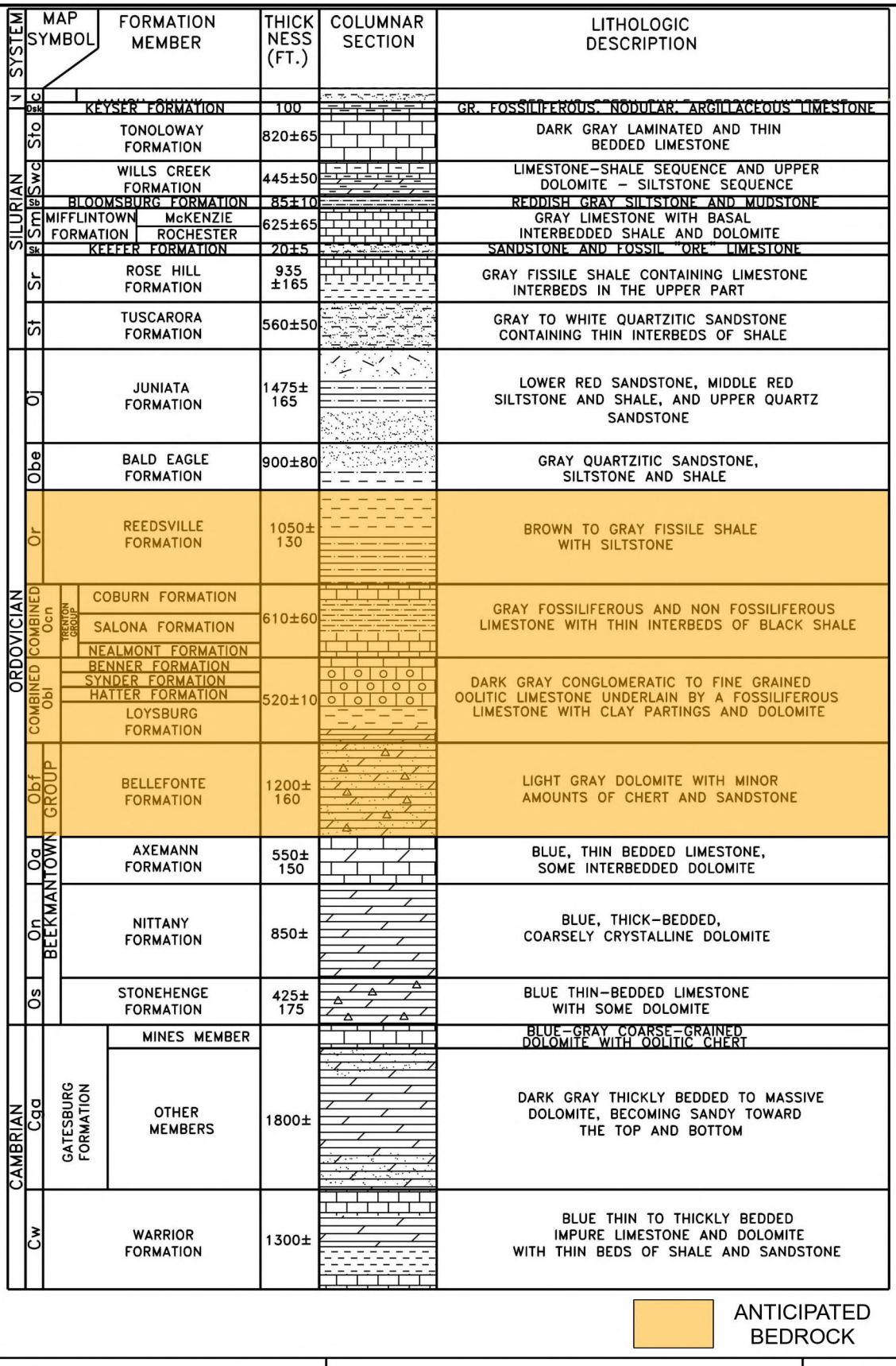
CENTRAL ALTERNATIVE

CENTRE COUNTY, PENNSYLVANIA

GENERAL GEOLOGY MAP

PROJECT:	20011
DRAWN:	IJV
DATE:	JUL 2025
SCALE:	1" = 2,000'
FIGURE:	C-4B

PLT: IJV CKD: AMH



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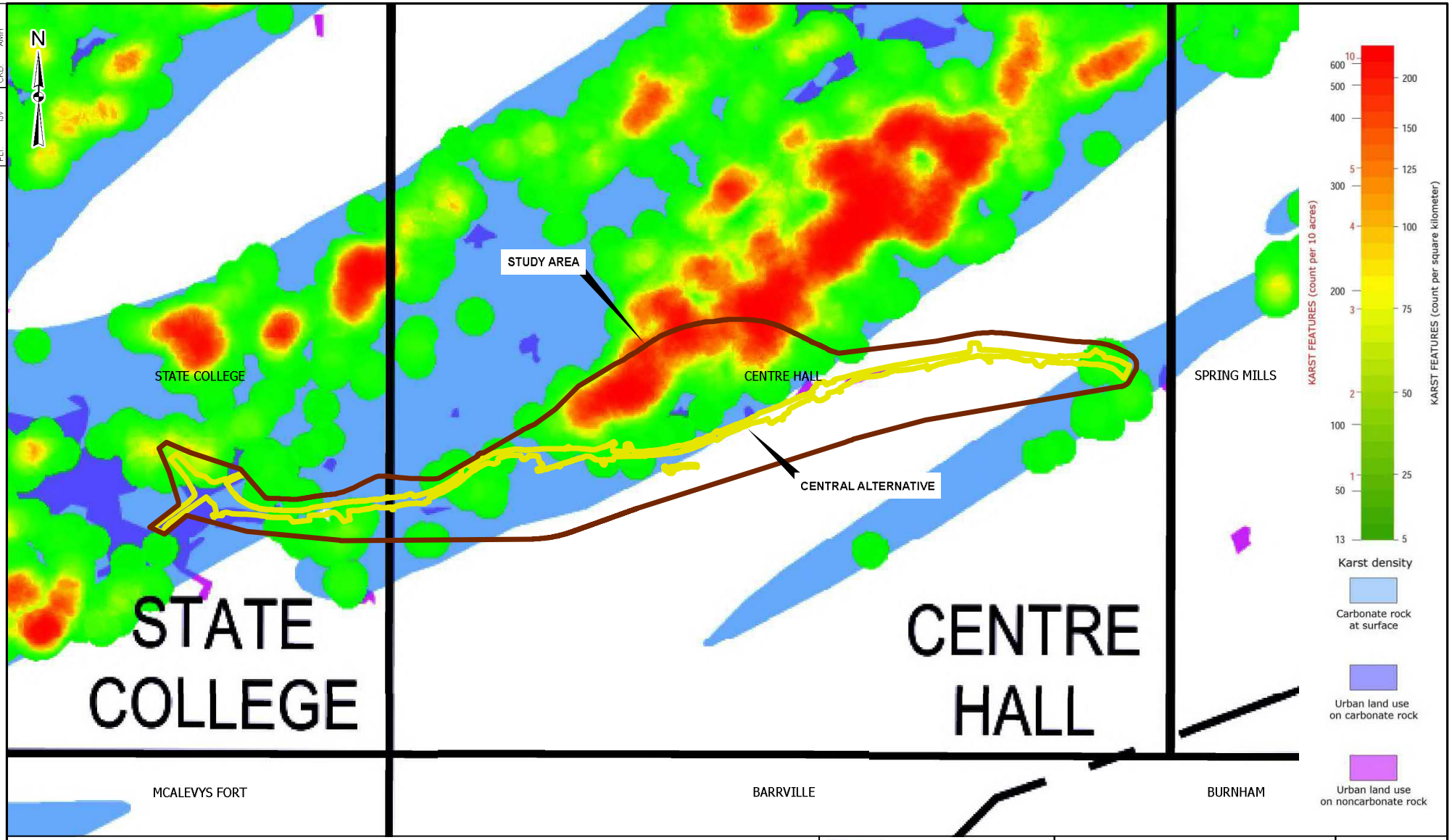
CENTRAL ALTERNATIVE

CENTRE COUNTY, PENNSYLVANIA

GENERALIZED STRATIGRAPHIC COLUMN

PROJECT:	20011
DRAWN:	IJV
DATE:	FEB. 2025
SCALE:	NTS
FIGURE:	C-5

Path: N:\ArcGIS\Projects\2020\20011\2023 Alternatives\20011 Alternatives - 2025.aprx
Date: 5/22/2025



SOURCE: PA Dept. of Conservation & Natural Resources, Bureau of Topographic & Geologic Survey; Density of Mapped Karst Features (Map 68 and 70)

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CENTRAL ALTERNATIVE

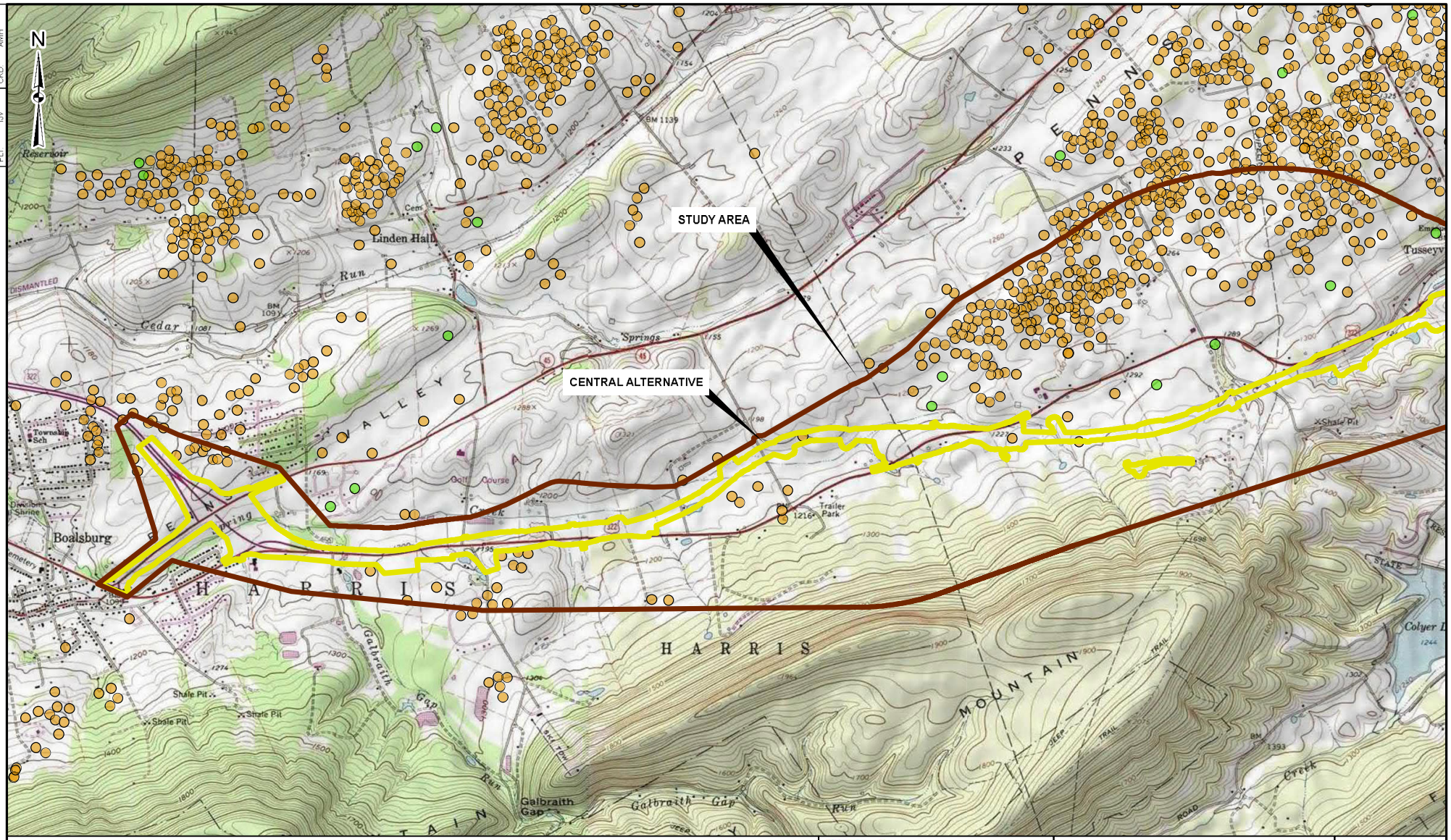
CENTRE COUNTY, PENNSYLVANIA

KARST MAP

PROJECT:	20011
DRAWN:	IJV
DATE:	JUL 2025
SCALE:	1" = 4,000'
FIGURE:	C-6

PLT: IJV CKD: AMH

Path: N:\4+GIS\Projects\2020\20011\2023 Alternatives\20011 Alternatives - 2025.aprx
Date: 7/31/2025



SOURCE: PA Bureau of Topographic and Geologic Survey, DCNR; Karst Features in Pennsylvania

LEGEND

- Sinkhole
- Surface Depression

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CENTRAL ALTERNATIVE

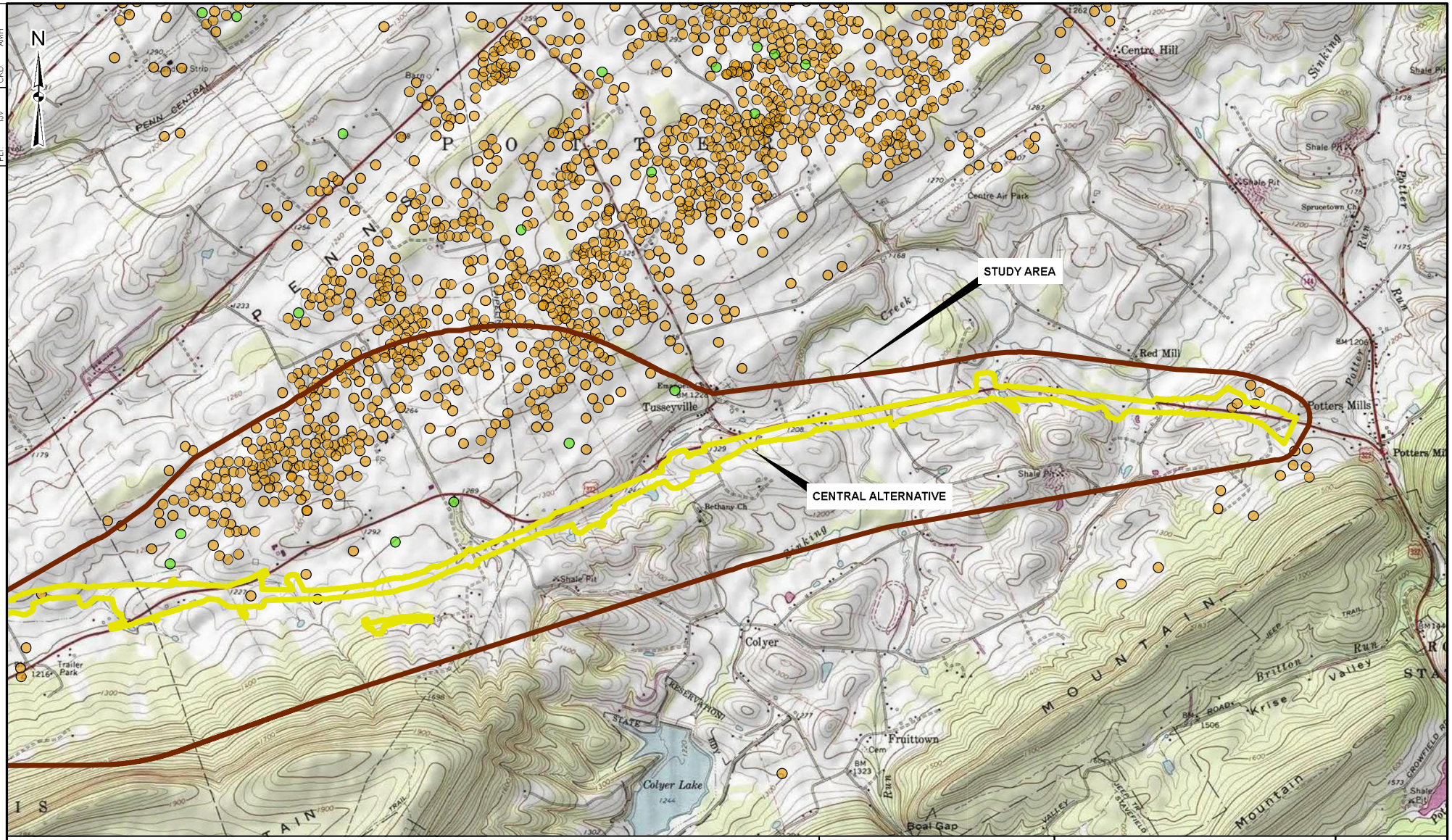
CENTRE COUNTY, PENNSYLVANIA

SINKHOLE AND KARST RELATED FEATURES

PROJECT:	20011
DRAWN:	IJV
DATE:	JUL 2025
SCALE:	1" = 2,000'
FIGURE:	C-7A

PLT: IJV CKD: AMH

Path: N:\ArcGIS\Projects\2020\20011\2023 Alternatives\20011 Alternatives - 2025.aprx
Date: 7/31/2025



SOURCE: PA Bureau of Topographic and Geologic Survey, DCNR; Karst Features in Pennsylvania

LEGEND

- Sinkhole
- Surface Depression

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CENTRAL ALTERNATIVE

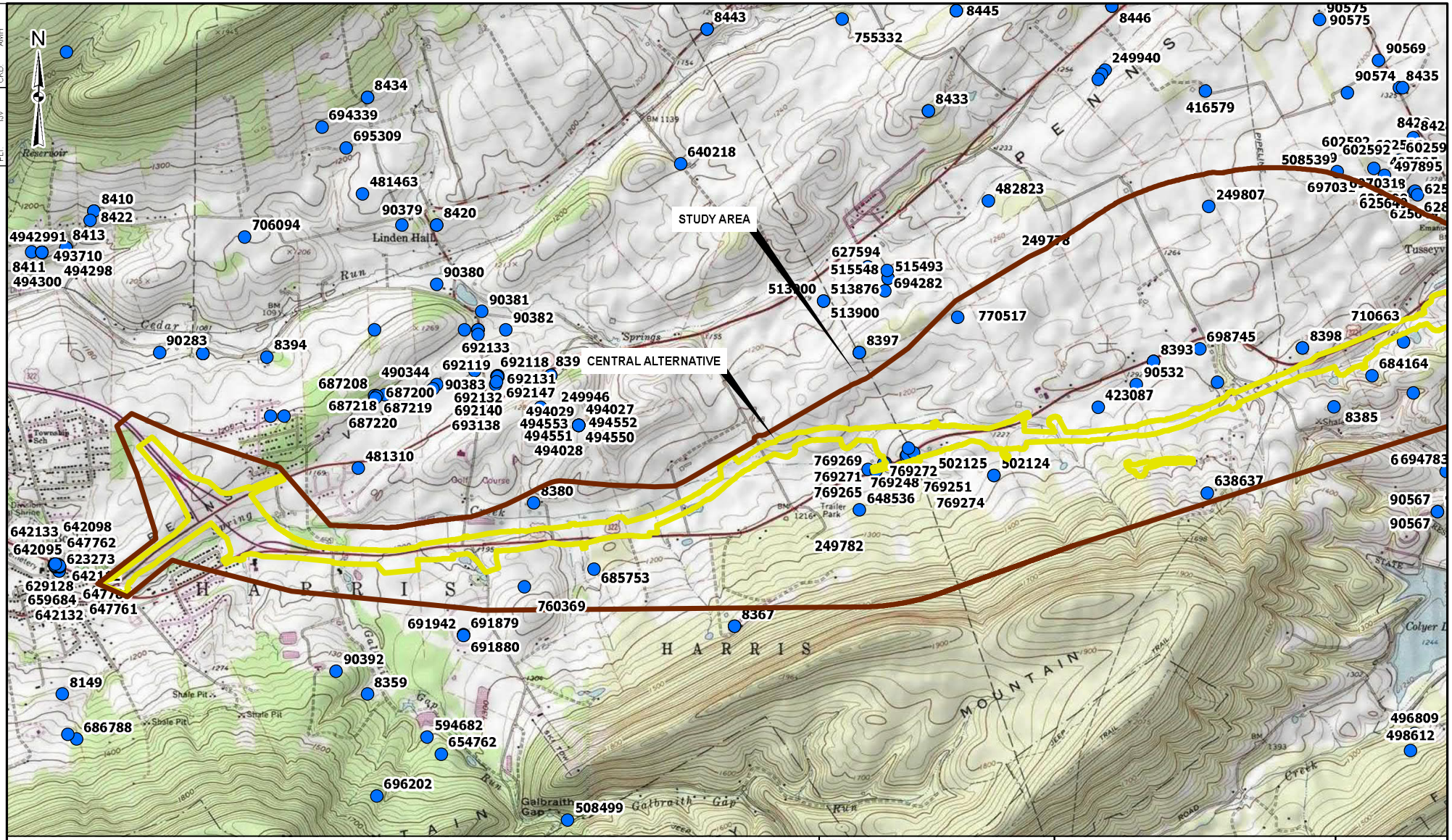
CENTRE COUNTY, PENNSYLVANIA

SINKHOLE AND KARST RELATED FEATURES

PROJECT:	20011
DRAWN:	IJV
DATE:	JUL 2025
SCALE:	1" = 2,000'
FIGURE:	C-7B

PLT: IJV CKD: AMH

Path: N:\ArcGIS\Projects\2020\20011\2023 Alternatives\20011 Alternatives - 2025.aprx
Date: 7/31/2025



SOURCE: PA Topographic & Geologic Survey, Pennsylvania Groundwater Information System (PaGWIS)

LEGEND

PaGWIS Water Well

American Geotechnical & Environmental Services, Inc.

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King of Prussia, PA

McLean, VA

CENTRAL ALTERNATIVE

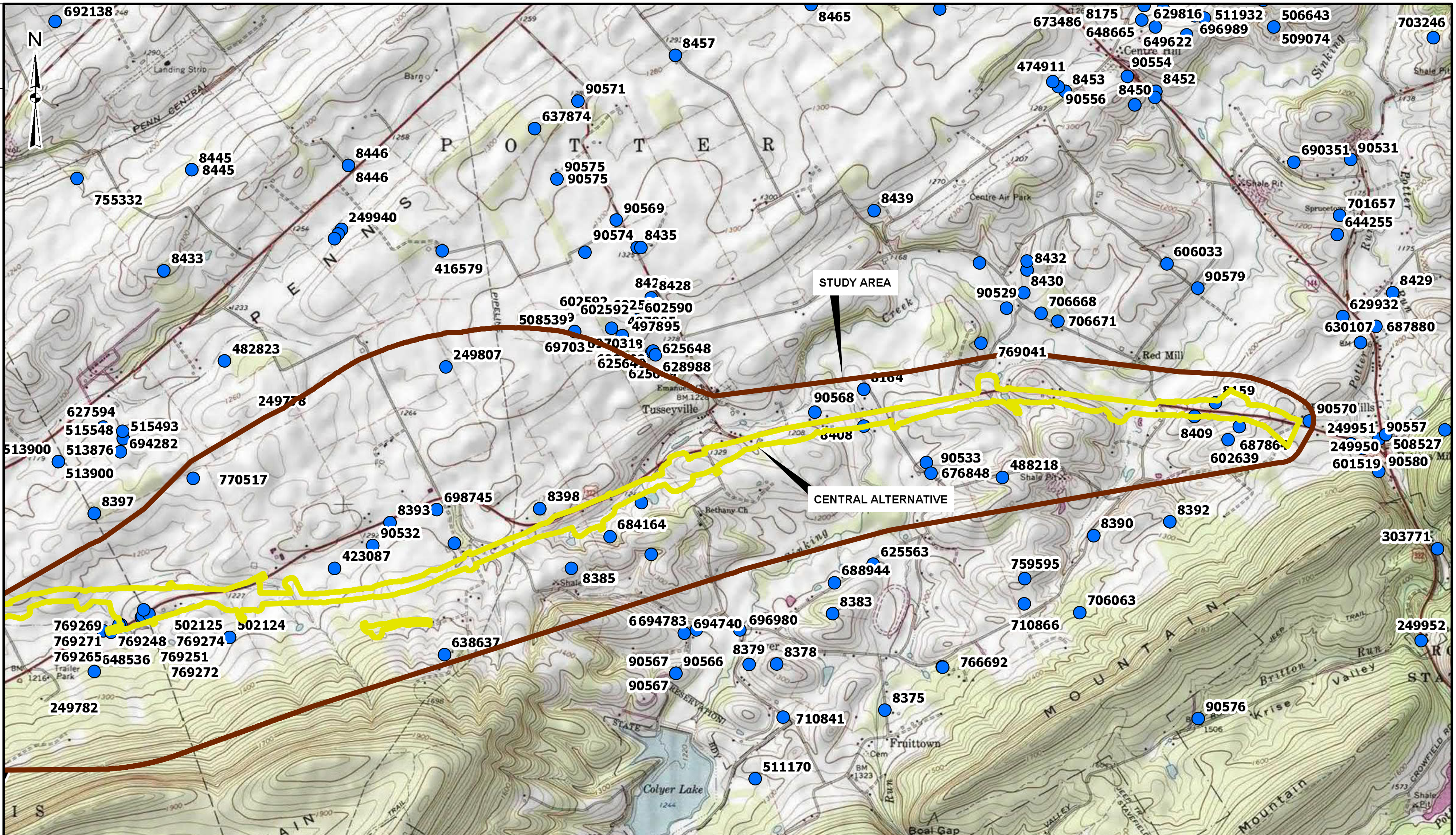
CENTRE COUNTY, PENNSYLVANIA

WATER WELL MAP

PROJECT:	20011
DRAWN:	IJV
DATE:	JUL 2025
SCALE:	1" = 2,000'
FIGURE:	C-8A

AMH | CKD: | IJV | PLT:

Path: N:\AmGIS\Projects\2000\20011\2023 Alternatives\20011 Alternatives - 2025.aprx
Date: 7/31/2025



SOURCE: PA Topographic & Geologic Survey, Pennsylvania Groundwater Information System (PaGWIS)

LEGEND

PaGWIS Water Well

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Canonsburg, PA

King of Prussia, PA

McLean, VA

CENTRAL ALTERNATIVE

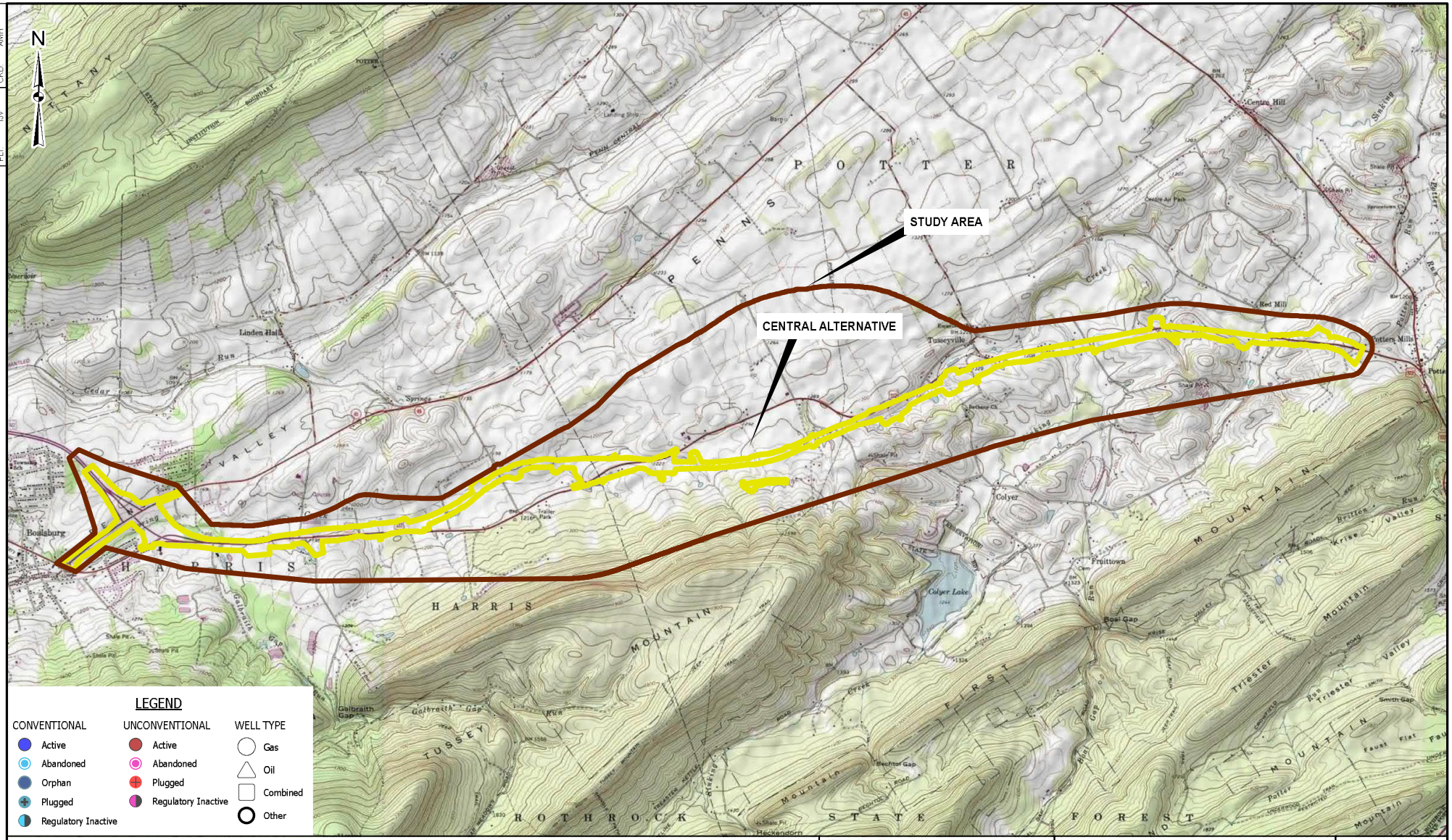
CENTRE COUNTY, PENNSYLVANIA

WATER WELL MAP

PROJECT:	20011
DRAWN:	IJV
DATE:	JUL 2025
SCALE:	1" = 2,000'
FIGURE:	C-8B

PLT: IJV CKD: AMH

Path: N:\ArcGIS\Projects\2020\20011\2023 Alternatives\20011 Alternatives - 2025.aprx
Date: 7/31/2025



SOURCE: PA Spatial Data Access, Pennsylvania Department of Environmental Protection; Oil & Gas Locations - Conventional Unconventional.

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CENTRAL ALTERNATIVE

CENTRE COUNTY, PENNSYLVANIA

OIL AND GAS WELL MAP

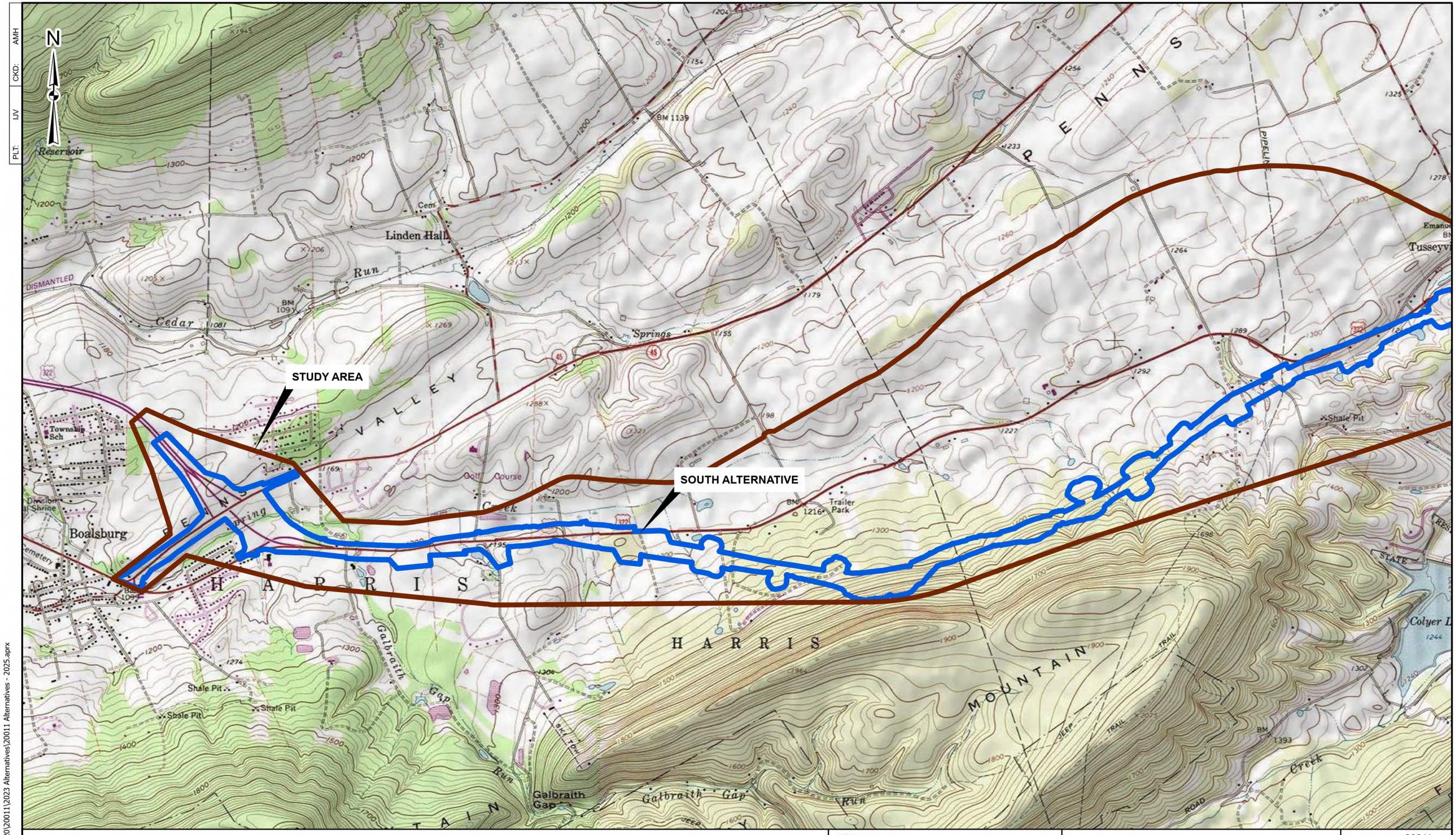
PROJECT:	20011
DRAWN:	IJV
DATE:	JUL 2025
SCALE:	1" = 3,000'
FIGURE:	C-9

PLT: IJV CKD: AMH

Path: N:\ArcGIS\Projects\2020\20011\2023 Alternatives\20011 Alternatives - 2025.aprx
Date: 7/31/2025

APPENDIX D
SOUTH ALTERNATIVE FIGURES

PLT: IJV
CKD: AMH



SOURCE: US Geological Survey, Quadrangle Map (7½' Series); Centre Hall and State College, PA

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SOUTH ALTERNATIVE

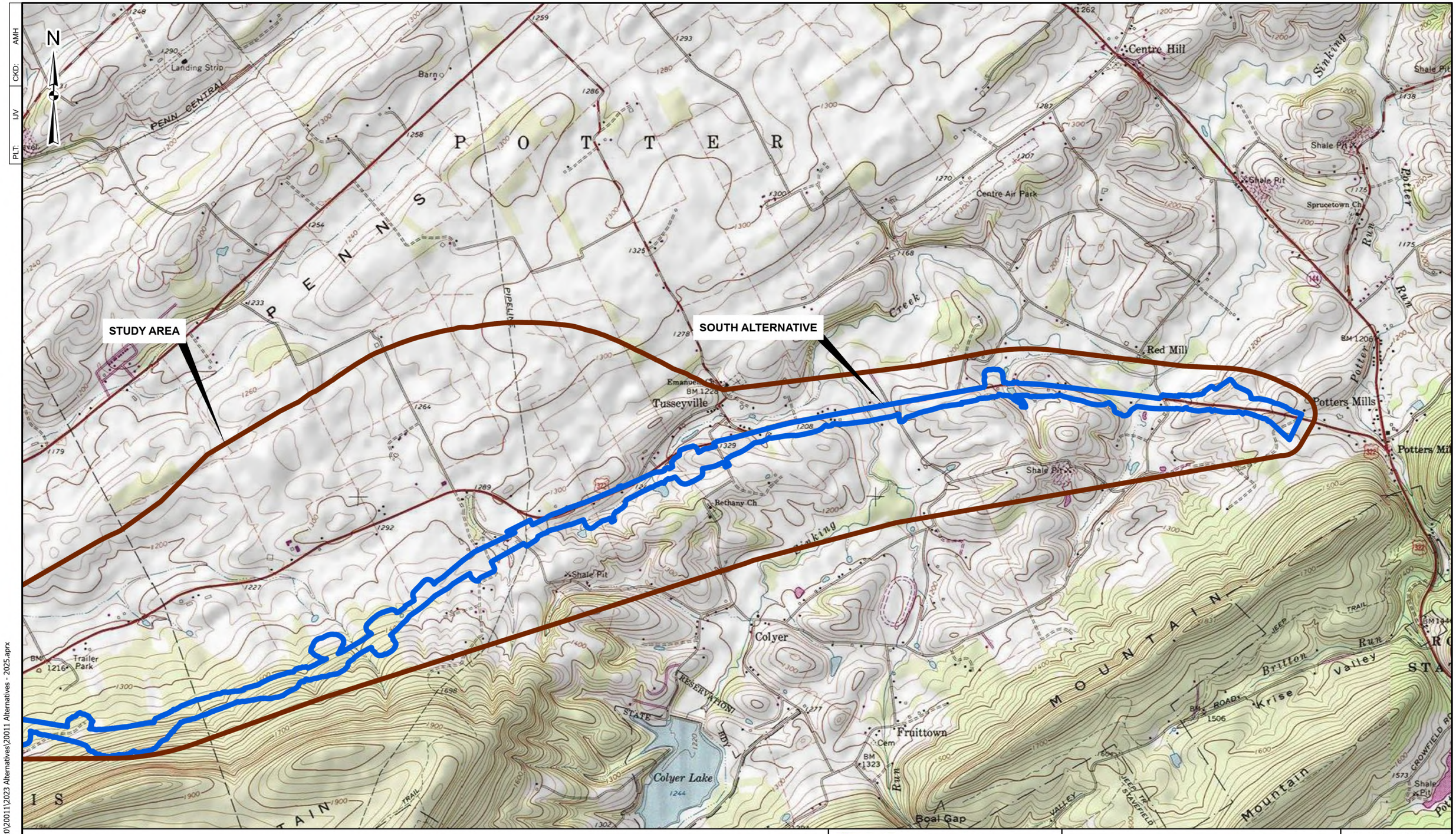
CENTRE COUNTY, PENNSYLVANIA

ALTERNATIVE LOCATION MAP

PROJECT:	20011
DRAWN:	IJV
DATE:	FEB 2025
SCALE:	1" = 2,000'
FIGURE:	S-1A

Path: N:\ArcGIS\Projects\2020\20011\2023 Alternatives\20011 Alternatives - 2025.aprx
Date: 6/13/2025

PLT: IJV CKD: AMH



SOURCE: US Geological Survey, Quadrangle Map (7½' Series); Centre Hall, PA

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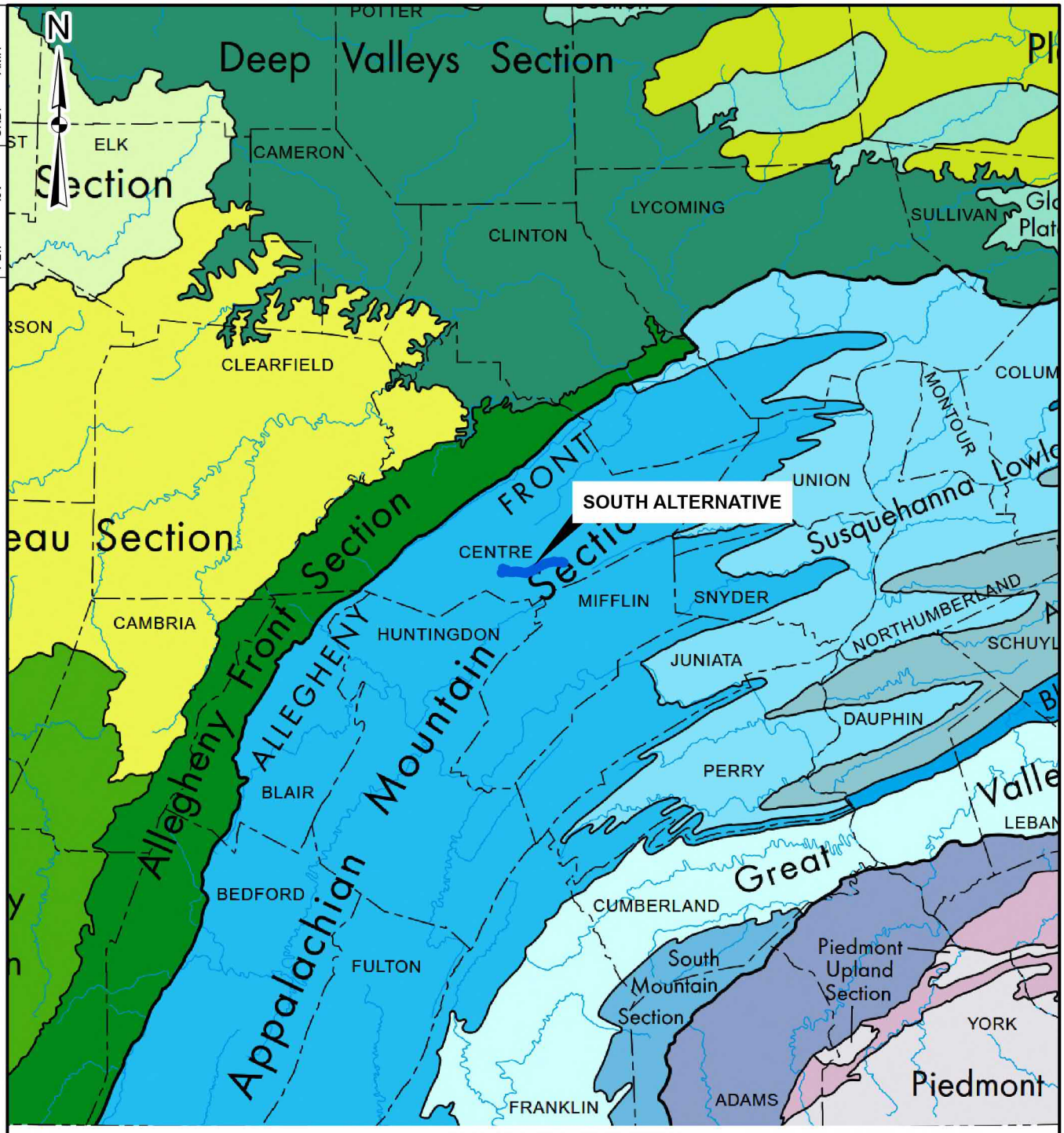
SOUTH ALTERNATIVE

CENTRE COUNTY, PENNSYLVANIA

ALTERNATIVE LOCATION MAP

PROJECT:	20011
DRAWN:	IJV
DATE:	FEB 2025
SCALE:	1" = 2,000'
FIGURE:	S-1B

Path: N:\ArcGIS\Projects\2020\20011\2023 Alternatives\20011 Alternatives - 2025.aprx
Date: 6/13/2025



SOURCE: PA Dept. of Conservation & Natural Resources, Bureau of Topographic & Geological Survey; Physiographic Provinces of PA (Map 13)

PLT: IJV CKD: AMH

Path: N:\ArcGIS\Projects\2020\20011\2023 Alternatives\20011 Alternatives - 2025.aprx
Date: 5/22/2025

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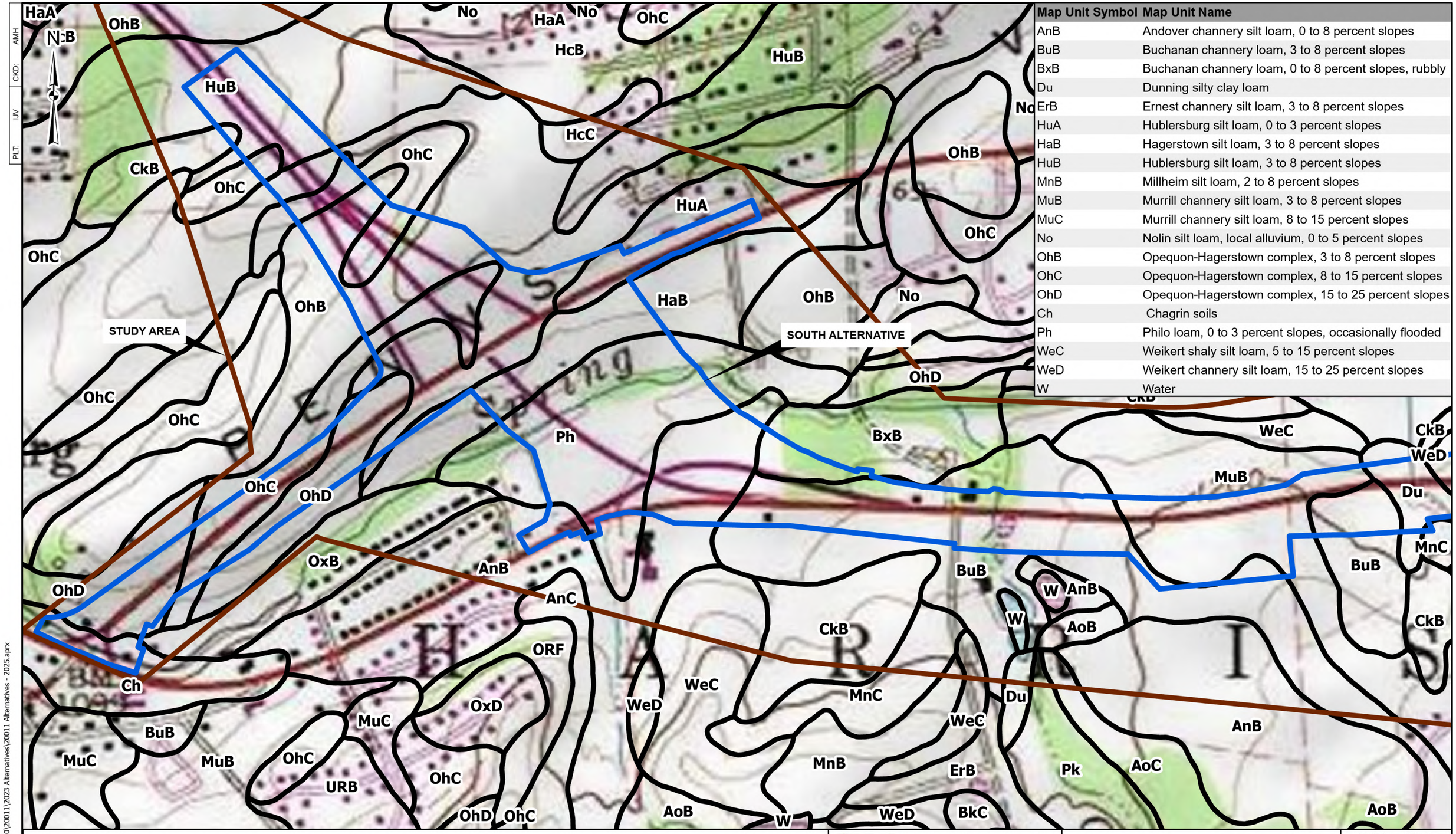
CENTRE COUNTY, PENNSYLVANIA

PHYSIOGRAPHIC PROVINCES MAP

PROJECT:	20011
DRAWN:	IJV
DATE:	FEB. 2025
SCALE:	1" = 20 MILES
FIGURE:	S-2



Map Unit Symbol	Map Unit Name
AnB	Andover channery silt loam, 0 to 8 percent slopes
BuB	Buchanan channery loam, 3 to 8 percent slopes
BxB	Buchanan channery loam, 0 to 8 percent slopes, rubbly
Du	Dunning silty clay loam
ErB	Ernest channery silt loam, 3 to 8 percent slopes
HuA	Hublersburg silt loam, 0 to 3 percent slopes
HaB	Hagerstown silt loam, 3 to 8 percent slopes
HuB	Hublersburg silt loam, 3 to 8 percent slopes
MnB	Millheim silt loam, 2 to 8 percent slopes
MuB	Murrill channery silt loam, 3 to 8 percent slopes
MuC	Murrill channery silt loam, 8 to 15 percent slopes
No	Nolin silt loam, local alluvium, 0 to 5 percent slopes
OhB	Opequon-Hagerstown complex, 3 to 8 percent slopes
OhC	Opequon-Hagerstown complex, 8 to 15 percent slopes
OhD	Opequon-Hagerstown complex, 15 to 25 percent slopes
Ch	Chagrin soils
Ph	Philo loam, 0 to 3 percent slopes, occasionally flooded
WeC	Weikert shaly silt loam, 5 to 15 percent slopes
WeD	Weikert channery silt loam, 15 to 25 percent slopes
W	Water

SOURCE: US Dept. of Agriculture, Soil Data Mart; Soil Survey for Centre County, PA

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SOUTH ALTERNATIVE

CENTRE COUNTY, PENNSYLVANIA

SOILS MAP

PROJECT:	20011
DRAWN:	IJV
DATE:	FEB 2025
SCALE:	1" = 500'
FIGURE:	S-3A

AMH
CKD:
IJV
PLT:

Path: N:\ArcGIS\Projects\2020\20011\2023 Alternatives\20011 Alternatives - 2025.aprx
Date: 6/13/2025

PLT:
IJV
CKD:
AMH

N

SOUTH ALTERNATIVE

STUDY AREA

Map Unit Symbol	Map Unit Name
AnB	Andover channery silt loam, 0 to 8 percent slopes
AnC	Andover channery silt loam, 8 to 15 percent slopes
AoB	Andover very stony loam, 0 to 8 percent slopes
BuB	Buchanan channery loam, 3 to 8 percent slopes
BuC	Buchanan channery loam, 8 to 15 percent slopes
BxB	Buchanan channery loam, 0 to 8 percent slopes, rubbly
CkB	Clarksburg silt loam, 3 to 8 percent slopes
Du	Dunning silty clay loam
BxD	Buchanan channery loam, 8 to 25 percent slopes, rubbly
ErB	Ernest channery silt loam, 3 to 8 percent slopes
ErC	Ernest channery silt loam, 8 to 15 percent slopes
HaB	Hagerstown silt loam, 3 to 8 percent slopes
HcD	Hagerstown silty clay loam, 15 to 25 percent slopes
HTF	Hazleton-Dekalb association, very steep
Lx	Lindside soils
Mm	Melvin silt loam
MuB	Murrill channery silt loam, 3 to 8 percent slopes
No	Nolin silt loam, local alluvium, 0 to 5 percent slopes
OhB	Opequon-Hagerstown complex, 3 to 8 percent slopes
OhC	Opequon-Hagerstown complex, 8 to 15 percent slopes
OhD	Opequon-Hagerstown complex, 15 to 25 percent slopes
ORF	Opequon-Hagerstown complex, steep
W	Water
WeC	Weikert shaly silt loam, 5 to 15 percent slopes
WeD	Weikert channery silt loam, 15 to 25 percent slopes

SOURCE: US Dept. of Agriculture, Soil Data Mart; Soil Survey for Centre County, PA

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SOUTH ALTERNATIVE

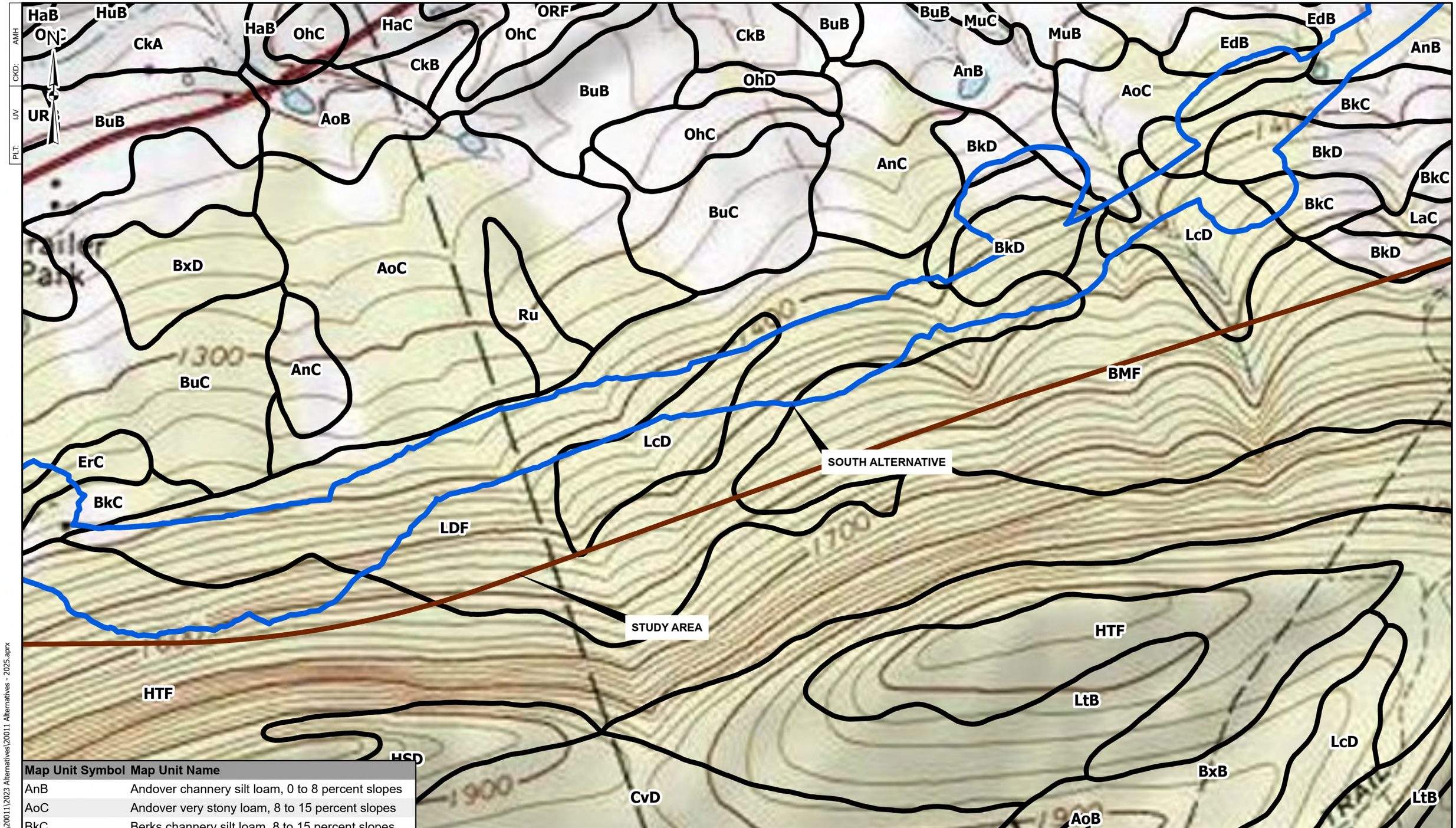
CENTRE COUNTY, PENNSYLVANIA

SOILS MAP

PROJECT:	20011
DRAWN:	IJV
DATE:	FEB 2025
SCALE:	1" = 500'
FIGURE:	S-3B

Path: N:\ArcGIS\Projects\2020\20011\2023 Alternatives\20011 Alternatives - 2025.aprx
Date: 6/13/2025

AMH
CKD:
IJV
PLT:



Map Unit Symbol	Map Unit Name
AnB	Andover channery silt loam, 0 to 8 percent slopes
AoC	Andover very stony loam, 8 to 15 percent slopes
BkC	Berks channery silt loam, 8 to 15 percent slopes
BkD	Berks channery silt loam, 15 to 25 percent slopes
BMF	Berks and Weikert soils, 25 to 70 percent slopes
EdB	Edom silt loam, 2 to 8 percent slopes
LcD	Laidig extremely stony loam, 8 to 25 percent slopes
LDF	Laidig extremely stony loam, steep

SOURCE: US Dept. of Agriculture, Soil Data Mart; Soil Survey for Centre County, PA

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SOUTH ALTERNATIVE

CENTRE COUNTY, PENNSYLVANIA

SOILS MAP

PROJECT:	20011
DRAWN:	IJV
DATE:	FEB 2025
SCALE:	1" = 500'
FIGURE:	S-3C

Path: N:\ArcGIS\Projects\2020\20011\2023 Alternatives\20011 Alternatives - 2025.aprx
Date: 6/13/2025

PLT: IJV CKD: AMH

N

SOUTH ALTERNATIVE

STUDY AREA

Map Unit Symbol	Map Unit Name
AnB	Andover channery silt loam, 0 to 8 percent slopes
BkB	Berks channery silt loam, 3 to 8 percent slopes
BkC	Berks channery silt loam, 8 to 15 percent slopes
BkD	Berks channery silt loam, 15 to 25 percent slopes
BMF	Berks and Weikert soils, 25 to 70 percent slopes
BrC	Brinkerton silt loam, 8 to 15 percent slopes
BuC	Buchanan channery loam, 8 to 15 percent slopes
CkB	Clarksburg silt loam, 3 to 8 percent slopes
EdB	Edom silt loam, 2 to 8 percent slopes
EdC	Edom silt loam, 8 to 15 percent slopes
ErB	Ernest channery silt loam, 3 to 8 percent slopes
ErC	Ernest channery silt loam, 8 to 15 percent slopes
Lx	Lindside soils
Mm	Melvin silt loam
OhC	Opequon-Hagerstown complex, 8 to 15 percent slopes
WeC	Weikert shaly silt loam, 5 to 15 percent slopes

SOURCE: US Dept. of Agriculture, Soil Data Mart; Soil Survey for Centre County, PA

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SOUTH ALTERNATIVE

CENTRE COUNTY, PENNSYLVANIA

SOILS MAP

PROJECT:	20011
DRAWN:	IJV
DATE:	FEB 2025
SCALE:	1" = 500'
FIGURE:	S-3D

Path: N:\ArcGIS\Projects\2020\20011\2023 Alternatives\20011 Alternatives - 2025.aprx
Date: 6/13/2025

PLT: IJV CKD: AMH

N

STUDY AREA

SOUTH ALTERNATIVE

Map Unit Symbol	Map Unit Name
BkC	Berks channery silt loam, 8 to 15 percent slopes
BMF	Berks and Weikert soils, 25 to 70 percent slopes
BrA	Brinkerton silt loam, 0 to 3 percent slopes
CkB	Clarksburg silt loam, 3 to 8 percent slopes
Du	Dunning silty clay loam
EdB	Edom silt loam, 2 to 8 percent slopes
EdC	Edom silt loam, 8 to 15 percent slopes
EdD	Edom silt loam, 15 to 25 percent slopes
ErC	Ernest channery silt loam, 8 to 15 percent slopes
Mm	Melvin silt loam
WeC	Weikert shaly silt loam, 5 to 15 percent slopes

SOURCE: US Dept. of Agriculture, Soil Data Mart; Soil Survey for Centre County, PA

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SOUTH ALTERNATIVE

CENTRE COUNTY, PENNSYLVANIA

SOILS MAP

PROJECT:	20011
DRAWN:	IJV
DATE:	FEB 2025
SCALE:	1" = 500'
FIGURE:	S-3E

Path: N:\ArcGIS\Projects\2020\20011\2023 Alternatives\20011 Alternatives - 2025.aprx
Date: 6/13/2025

AMH
CKD:
IJV
PLT:

N

Red Mill

Potters Mills

Potters Mills

Kohrs

SOUTH ALTERNATIVE

STUDY AREA

Map Unit Symbol	Map Unit Name
BkD	Berks channery silt loam, 15 to 25 percent slopes
BuB	Buchanan channery loam, 3 to 8 percent slopes
CkB	Clarksburg silt loam, 3 to 8 percent slopes
EdC	Edom silt loam, 8 to 15 percent slopes
EdD	Edom silt loam, 15 to 25 percent slopes
Mm	Melvin silt loam
MnB	Millheim silt loam, 2 to 8 percent slopes
OhB	Opequon-Hagerstown complex, 3 to 8 percent slopes
OhC	Opequon-Hagerstown complex, 8 to 15 percent slopes
Ty	Tyler silt loam

SOURCE: US Dept. of Agriculture, Soil Data Mart; Soil Survey for Centre County, PA

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SOUTH ALTERNATIVE

CENTRE COUNTY, PENNSYLVANIA

SOILS MAP

PROJECT:	20011
DRAWN:	IJV
DATE:	FEB 2025
SCALE:	1" = 500'
FIGURE:	S-3F

Path: N:\ArcGIS\Projects\2020\20011\2023 Alternatives\20011 Alternatives - 2025.aprx
Date: 6/13/2025

PLT: IJV CKD: AMH

N

Brush Valley anticline

Axemann Formation

STUDY AREA

Bellefonte Formation

Coburn Formation through Nealmont Formation, undivided

SOUTH ALTERNATIVE

Benner Formation through Loysburg Formation, undivided

Bellefonte Formation

Axemann Formation

Bald Eagle Formation

Juniata Formation

Reedsville Formation

Brush Mountain syncline

Penns Valley anticline

syncline

Penns Valley Narrows anticline

SOURCE: PA Bureau of Topographic and Geologic Survey, DCNR; Bedrock Geology of Pennsylvania

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SOUTH ALTERNATIVE

CENTRE COUNTY, PENNSYLVANIA

GENERAL GEOLOGY MAP

PROJECT:	20011
DRAWN:	IJV
DATE:	FEB 2025
SCALE:	1" = 2,000'
FIGURE:	S-4A

Path: N:\ArcGIS\Projects\2020\20011\2023 Alternatives\20011 Alternatives - 2025.aprx
Date: 6/13/2025

PLT: IJV CKD: AMH

N

Bellefonte Formation

Benner Formation through Loysburg Formation, undivided

Brush Mountain syncline

Coburn Formation through Nealmont Formation, undivided

STUDY AREA

Bellefonte Formation

Penns Valley anticline

Benner Formation through Loysburg Formation, undivided

Bald Eagle Formation

syncline

Axemann Formation

Bellefonte Formation

SOUTH ALTERNATIVE

Reedsville Formation

Penns Valley Narrows anticline

Juniata Formation

Bald Eagle Formation

Reedsville Formation

syncline

SOURCE: PA Bureau of Topographic and Geologic Survey, DCNR; Bedrock Geology of Pennsylvania

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SOUTH ALTERNATIVE

CENTRE COUNTY, PENNSYLVANIA

GENERAL GEOLOGY MAP

PROJECT:	20011
DRAWN:	IJV
DATE:	FEB 2025
SCALE:	1" = 2,000'
FIGURE:	S-4B

Path: N:\ArcGIS\Projects\2020\20011\2023 Alternatives\20011 Alternatives - 2025.aprx
Date: 6/13/2025

PLT: IJV CKD: AMH

SYSTEM	MAP SYMBOL	FORMATION MEMBER	THICKNESS (FT.)	COLUMNAR SECTION	LITHOLOGIC DESCRIPTION
V	Dc	[illegible]			
SILURIAN	Dsk	KEYSER FORMATION	100		GR. FOSSILIFEROUS, NODULAR, ARGILLACEOUS LIMESTONE
	Sto	TONOLOWAY FORMATION	820±65		DARK GRAY LAMINATED AND THIN BEDDED LIMESTONE
	Swc	WILLS CREEK FORMATION	445±50		LIMESTONE–SHALE SEQUENCE AND UPPER DOLOMITE – SILTSTONE SEQUENCE
	Sb	BLOOMSBURG FORMATION	85±10		REDDISH GRAY SILTSTONE AND MUDSTONE
	Sm	MIFFLINTOWN FORMATION: McKENZIE / ROCHESTER	625±65		GRAY LIMESTONE WITH BASAL INTERBEDDED SHALE AND DOLOMITE
	Sk	KEEFER FORMATION	20±5		SANDSTONE AND FOSSIL "ORE" LIMESTONE
	Sr	ROSE HILL FORMATION	935 ±165		GRAY FISSILE SHALE CONTAINING LIMESTONE INTERBEDS IN THE UPPER PART
	St	TUSCARORA FORMATION	560±50		GRAY TO WHITE QUARTZITIC SANDSTONE CONTAINING THIN INTERBEDS OF SHALE
ORDOVICIAN	Oj	JUNIATA FORMATION	1475± 165		LOWER RED SANDSTONE, MIDDLE RED SILTSTONE AND SHALE, AND UPPER QUARTZ SANDSTONE
	Obe	BALD EAGLE FORMATION	900±80		GRAY QUARTZITIC SANDSTONE, SILTSTONE AND SHALE
	Or	REEDSVILLE FORMATION	1050± 130		BROWN TO GRAY FISSILE SHALE WITH SILTSTONE
	COMBINED Ocn (TRENTON GROUP)	COBURN FORMATION / SALONA FORMATION / NEALMONT FORMATION	610±60		GRAY FOSSILIFEROUS AND NON FOSSILIFEROUS LIMESTONE WITH THIN INTERBEDS OF BLACK SHALE
	COMBINED Obl	BENNER FORMATION / SYNDER FORMATION / HATTER FORMATION / LOYSBURG FORMATION	520±10		DARK GRAY CONGLOMERATIC TO FINE GRAINED OOLITIC LIMESTONE UNDERLAIN BY A FOSSILIFEROUS LIMESTONE WITH CLAY PARTINGS AND DOLOMITE
	Obf GROUP	BELLEFONTE FORMATION	1200± 160		LIGHT GRAY DOLOMITE WITH MINOR AMOUNTS OF CHERT AND SANDSTONE
	Oa BEEKMANTOWN	AXEMANN FORMATION	550± 150		BLUE, THIN BEDDED LIMESTONE, SOME INTERBEDDED DOLOMITE
	On BEEKMANTOWN	NITTANY FORMATION	850±		BLUE, THICK–BEDDED, COARSELY CRYSTALLINE DOLOMITE
	Os BEEKMANTOWN	STONEHENGE FORMATION	425± 175		BLUE THIN–BEDDED LIMESTONE WITH SOME DOLOMITE
CAMBRIAN	Cga	GATESBURG FORMATION: MINES MEMBER	1800±		BLUE–GRAY COARSE–GRAINED DOLOMITE WITH OOLITIC CHERT
		GATESBURG FORMATION: OTHER MEMBERS			DARK GRAY THICKLY BEDDED TO MASSIVE DOLOMITE, BECOMING SANDY TOWARD THE TOP AND BOTTOM
	Cw	WARRIOR FORMATION	1300±		BLUE THIN TO THICKLY BEDDED IMPURE LIMESTONE AND DOLOMITE WITH THIN BEDS OF SHALE AND SANDSTONE

ANTICIPATED BEDROCK

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SOUTH ALTERNATIVE

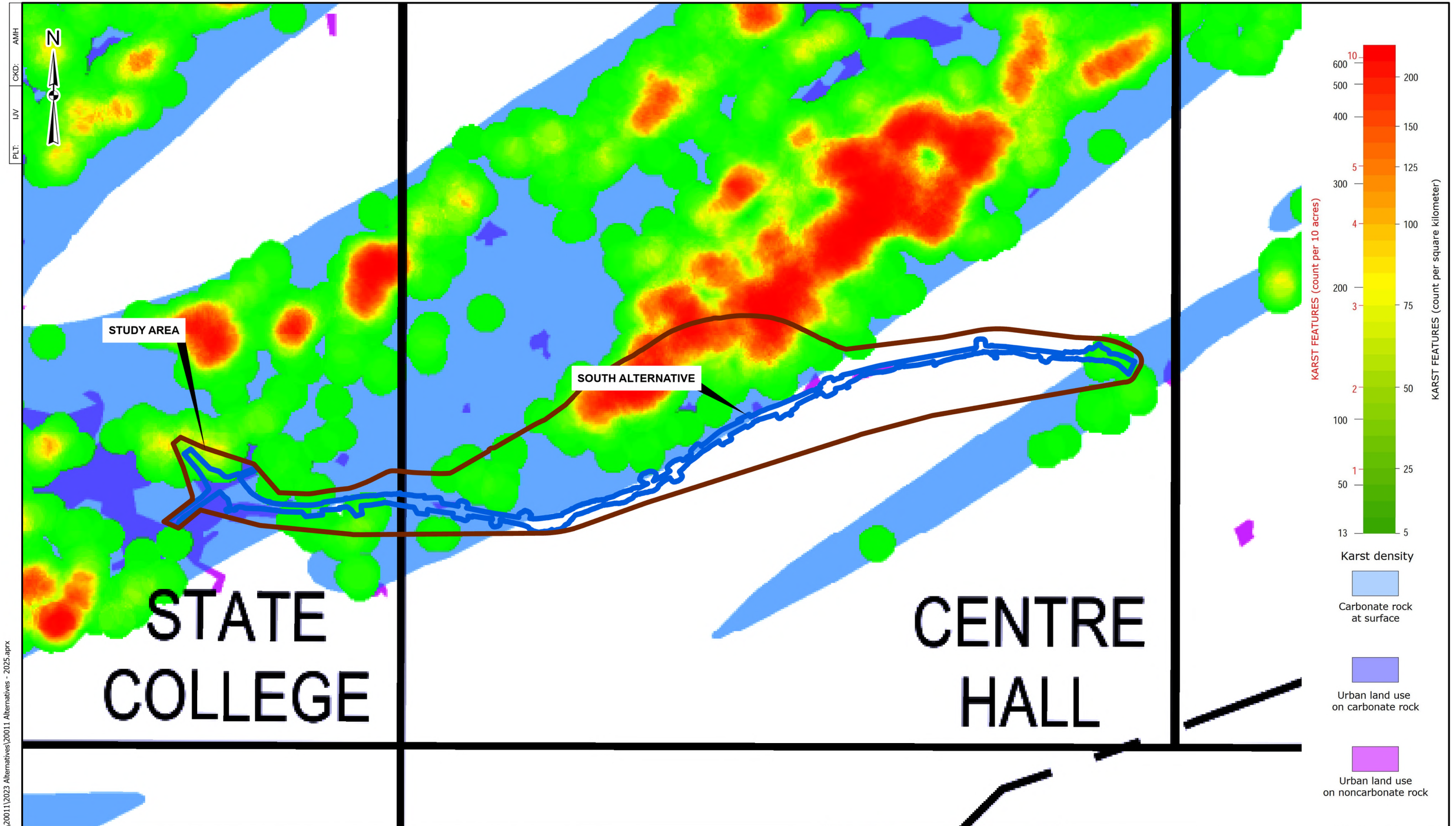
CENTRE COUNTY, PENNSYLVANIA

GENERALIZED STRATIGRAPHIC COLUMN

PROJECT:	20011
DRAWN:	IJV
DATE:	FEB. 2025
SCALE:	NTS
FIGURE:	S-5

Path: N:\ArcGIS\Projects\2020\20011\2023 Alternatives\20011 Alternatives - 2025.aprx
Date: 5/22/2025

PLT: IJV CKD: AMH



SOURCE: PA Dept. of Conservation & Natural Resources, Bureau of Topographic & Geologic Survey; Density of Mapped Karst Features (Map 68 and 70)

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SOUTH ALTERNATIVE

CENTRE COUNTY, PENNSYLVANIA

KARST MAP

PROJECT:	20011
DRAWN:	IJV
DATE:	FEB 2025
SCALE:	1" = 4,000'
FIGURE:	S-6

Path: N:\ArcGIS\Projects\2020\20011\2023 Alternatives\20011 Alternatives - 2025.aprx
Date: 6/13/2025

PLT: IJV
CKD: AMH

STUDY AREA

SOUTH ALTERNATIVE

SOURCE: PA Bureau of Topographic and Geologic Survey, DCNR; Karst Features in Pennsylvania

LEGEND

- Sinkhole
- Surface Depression

Path: N:\ArcGIS\Projects\2020\20011\2023 Alternatives\20011 Alternatives - 2025.aprx
Date: 6/13/2025

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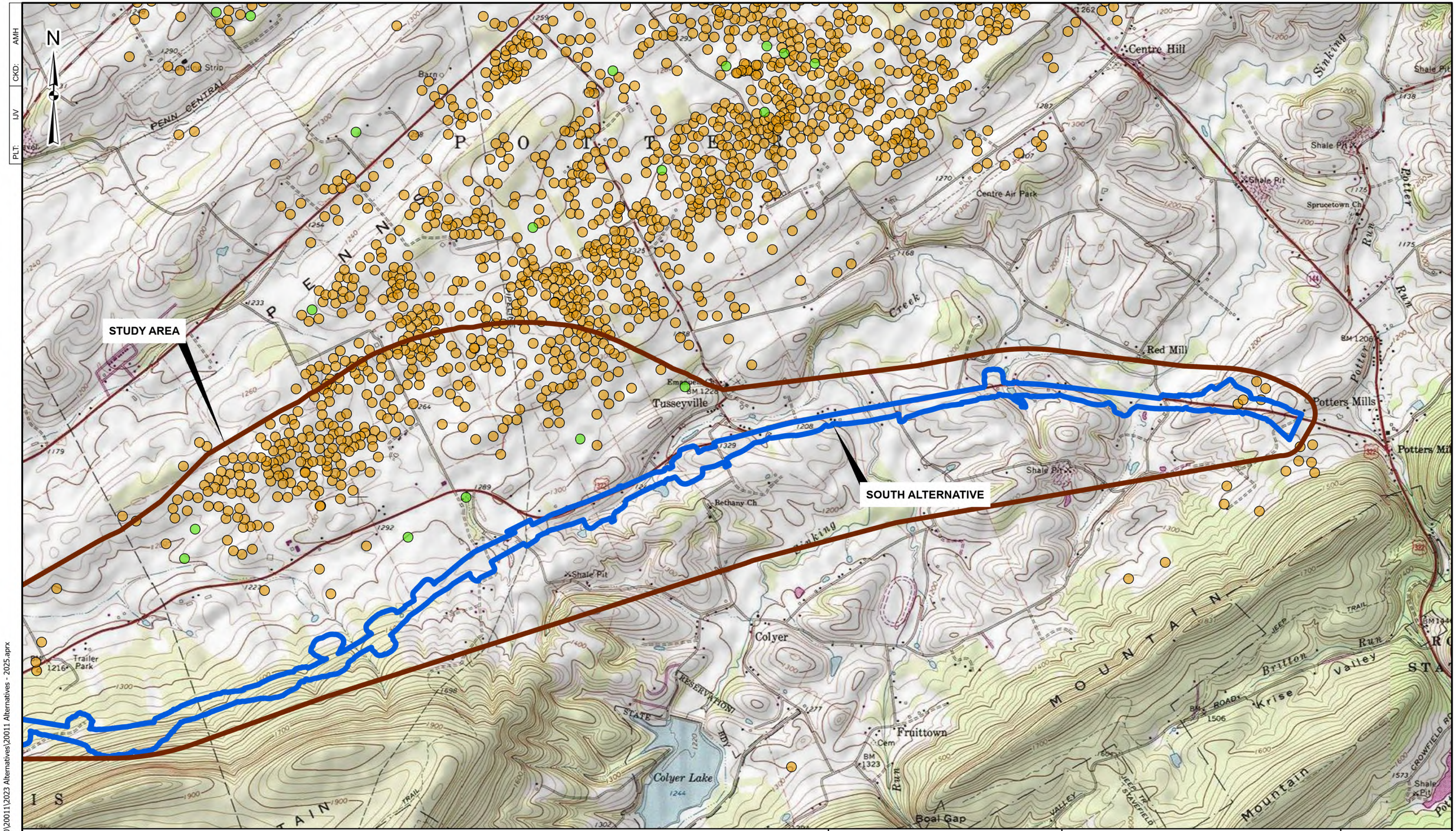
SOUTH ALTERNATIVE

CENTRE COUNTY, PENNSYLVANIA

SINKHOLE AND KARST RELATED FEATURES

PROJECT:	20011
DRAWN:	IJV
DATE:	FEB 2025
SCALE:	1" = 2,000'
FIGURE:	S-7A

PLT: IJV CKD: AMH



SOURCE: PA Bureau of Topographic and Geologic Survey, DCNR; Karst Features in Pennsylvania

LEGEND

- Sinkhole
- Surface Depression

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SOUTH ALTERNATIVE

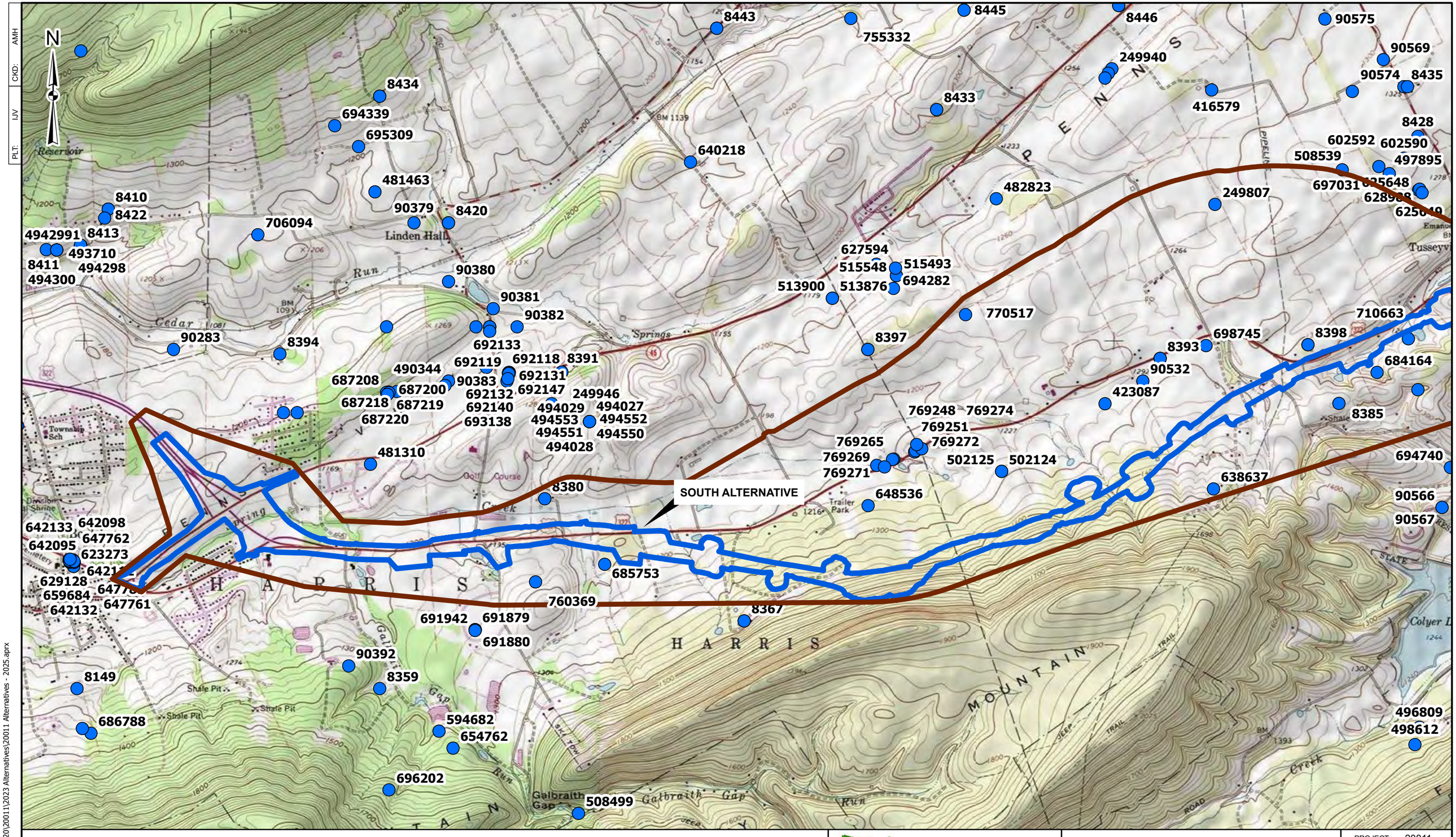
CENTRE COUNTY, PENNSYLVANIA

SINKHOLE AND KARST RELATED FEATURES

PROJECT:	20011
DRAWN:	IJV
DATE:	FEB 2025
SCALE:	1" = 2,000'
FIGURE:	S-7B

Path: N:\ArcGIS\Projects\2020\20011\2023 Alternatives\20011 Alternatives - 2025.aprx
Date: 6/13/2025

PLT: IJV
CKD: AMH



SOURCE: PA Topographic & Geologic Survey, Pennsylvania Groundwater Information System (PaGWIS)

LEGEND

PaGWIS Water Well

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SOUTH ALTERNATIVE

CENTRE COUNTY, PENNSYLVANIA

WATER WELL MAP

PROJECT:	20011
DRAWN:	IJV
DATE:	FEB 2025
SCALE:	1" = 2,000'
FIGURE:	S-8A

Path: N:\ArcGIS\Projects\2020\20011\2023 Alternatives\20011 Alternatives - 2025.aprx
Date: 6/13/2025

PLT: IJV CKD: AMH

N

SOUTH ALTERNATIVE

692138 755332 8445 8446 8433 249940 416579 8457 8465 90571 637874 90575 90569 90574 8435 8428 602592 602590 497895 508539 625648 628988 249807 482823 627594 515548 515493 694282 513876 513900 770517 8397 8393 698745 8398 90532 423087 684164 8385 769248 769274 769251 769272 769265 769269 769271 502125 502124 638637 648536 249782 8439 8432 8430 90529 706668 706671 769041 606033 90579 629932 630107 687880 8429 690351 90531 701657 644255 673486 8175 629816 511932 506643 703246 648665 696989 649622 509074 474911 8453 90554 8452 90556 8450 8164 90568 8408 8159 8409 68786 602639 90570 249951 90557 249950 508527 601519 90580 90533 676848 488218 8392 8390 303771 625563 688944 8383 759595 706063 710866 694783 694740 696980 8379 8378 90567 90566 766692 8375 710841 511170 90576 249952

Tusseyville Landing Strip Barn Bethany Ch Centre Air Park Red Mill Fruittown Colyer Lake Boal Gap Shale Pit Shale Pit Shale Pit

PENN CENTRAL PIPELINE POTTER PENNS MOUNTAIN Sinking Run Potter Run Britton Run Valley Run Mountain

SOURCE: PA Topographic & Geologic Survey, Pennsylvania Groundwater Information System (PaGWIS)

LEGEND

PaGWIS Water Well

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McLean, VA

SOUTH ALTERNATIVE

CENTRE COUNTY, PENNSYLVANIA

WATER WELL MAP

PROJECT:	20011
DRAWN:	IJV
DATE:	FEB 2025
SCALE:	1" = 2,000'
FIGURE:	S-8B

Path: N:\ArcGIS\Projects\2020\20011\2023 Alternatives\20011 Alternatives - 2025.aprx
Date: 6/13/2025

PLT: IJV CKD: AMH

N

STUDY AREA

SOUTH ALTERNATIVE

LEGEND

CONVENTIONAL	UNCONVENTIONAL	WELL TYPE
Active	Active	Gas
Abandoned	Abandoned	Oil
Orphan	Plugged	Combined
Plugged	Regulatory Inactive	Other
Regulatory Inactive		

SOURCE: PA Spatial Data Access, Pennsylvania Department of Environmental Protection; Oil & Gas Locations - Conventional Unconventional.

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SOUTH ALTERNATIVE

CENTRE COUNTY, PENNSYLVANIA

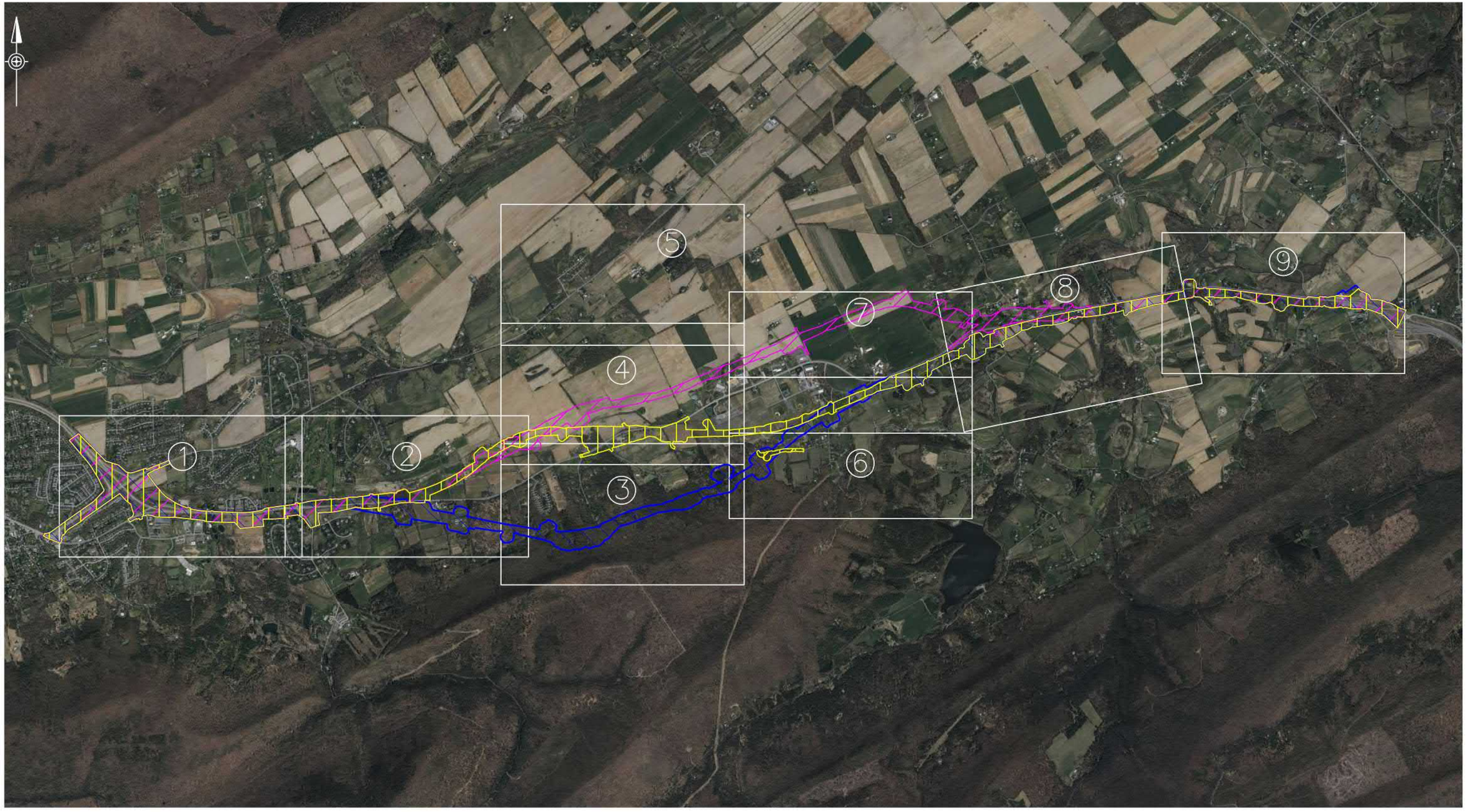
OIL AND GAS WELL MAP

PROJECT:	20011
DRAWN:	IJV
DATE:	FEB 2025
SCALE:	1" = 3,000'
FIGURE:	S-9

Path: N:\ArcGIS\Projects\2020\20011\2023 Alternatives\20011 Alternatives - 2025.aprx
Date: 6/13/2025

APPENDIX E
RECONNAISSANCE PLAN AND SITE PHOTOS

PLT: KDH | CKD: SMF | QA\QC: SKG



LEGEND

① SHEET NUMBER

NORTH ALTERNATIVE

SOUTH ALTERNATIVE

CENTRAL ALTERNATIVE

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STATE COLLEGE AREA CONNECTOR

CENTRE COUNTY, PENNSYLVANIA

SITE RECONNAISSANCE NOTES AND PHOTOGRAPHS INDEX SHEET

PROJECT:	20011
DRAWN:	KDH
DATE:	AUG 2023
SCALE:	1" = 3000'
FIGURE:	

K:_2020\011\exhibits\misc\20011_photo.dgn

PLT: KDH | CKD: SMF | QA\QC: SKG

S.R. 0045

S.R. 0322

01 02 03 04 05 06

SEE SHEET 2 OF 9

LEGEND

01 PHOTO LOCATION / DIRECTION

SOUTH ALTERNATIVE

NORTH ALTERNATIVE

CENTRAL ALTERNATIVE

AMERICAN GEOTECHNICAL & ENVIRONMENTAL SERVICES, INC.

Canonsburg, PA

King of Prussia, PA

McLean, VA

STATE COLLEGE AREA CONNECTOR

CENTRE COUNTY, PENNSYLVANIA

SITE RECONNAISSANCE NOTES AND PHOTOGRAPHS (SHEET 1 OF 9)

PROJECT:	20011
DRAWN:	KDH
DATE:	AUG 2023
SCALE:	1" = 500'
FIGURE:	

K:_2020\011\exhibits\misc\20011_photo.dgn

PLT: KDH | CKD: SMF | QA\QC: SKG

SHARER ROAD

09

S.R. 0322

pH=8.2

SHALE OUTCROP

07 08

BEAR MEADOWS ROAD

SEE SHEET 1 OF 9

SEE SHEET 4 OF 9

SEE SHEET 3 OF 9

LEGEND

01 PHOTO LOCATION / DIRECTION

SOUTH ALTERNATIVE

NORTH ALTERNATIVE

CENTRAL ALTERNATIVE

AMERICAN GEOTECHNICAL & ENVIRONMENTAL SERVICES, INC.

Canonsburg, PA

King of Prussia, PA

McLean, VA

STATE COLLEGE AREA CONNECTOR

CENTRE COUNTY, PENNSYLVANIA

SITE RECONNAISSANCE NOTES AND PHOTOGRAPHS (SHEET 2 OF 9)

PROJECT:	20011
DRAWN:	KDH
DATE:	AUG 2023
SCALE:	1" = 500'
FIGURE:	

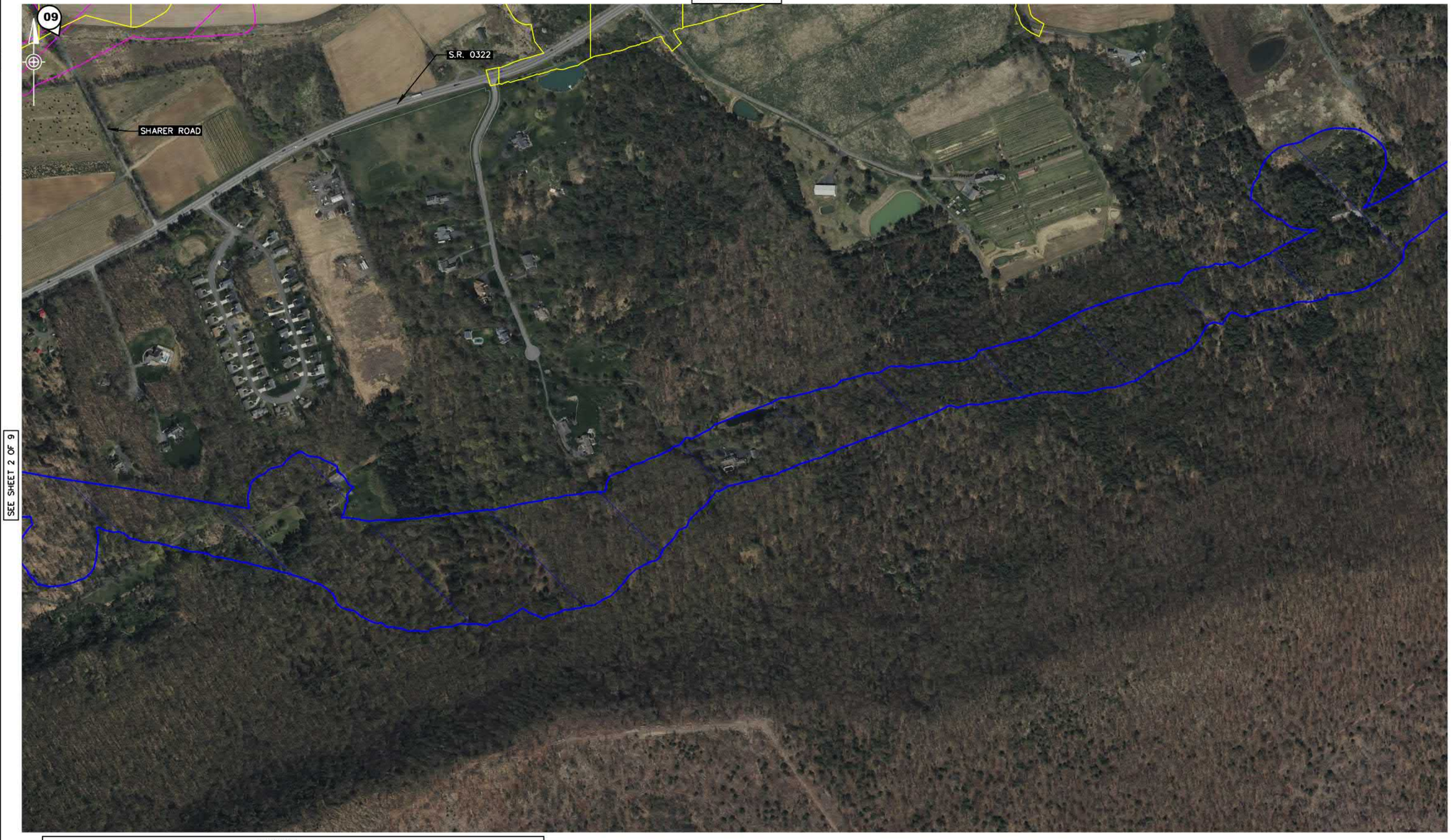
K:_2020\011\exhibits\misc\20011_photo.dgn

SEE SHEET 4 OF 9

SEE SHEET 6 OF 9

SEE SHEET 2 OF 9

PLT: KDH | CKD: SMF | QA\QC: SKG



LEGEND

01 PHOTO LOCATION / DIRECTION	SOUTH ALTERNATIVE
NORTH ALTERNATIVE	CENTRAL ALTERNATIVE

AMERICAN GEOTECHNICAL & ENVIRONMENTAL SERVICES, INC.
Canonsburg, PA
King of Prussia, PA
McLean, VA

STATE COLLEGE AREA CONNECTOR

CENTRE COUNTY, PENNSYLVANIA
SITE RECONNAISSANCE NOTES
AND PHOTOGRAPHS (SHEET 3 OF 9)

PROJECT:	20011
DRAWN:	KDH
DATE:	AUG 2023
SCALE:	1" = 500'
FIGURE:	

M:_2020\011\exhibits\misc\20011_photo.dgn

PLT: KDH | CKD: SMF | QA\QC: SKG

SEE SHEET 5 OF 9

SEE SHEET 7 OF 9

SEE SHEET 2 OF 9

SEE SHEET 6 OF 9

SEE SHEET 3 OF 9

LEGEND

01 PHOTO LOCATION / DIRECTION

NORTH ALTERNATIVE

SOUTH ALTERNATIVE

CENTRAL ALTERNATIVE

AMERICAN GEOTECHNICAL & ENVIRONMENTAL SERVICES, INC.
Canonsburg, PA
King of Prussia, PA
McLean, VA

STATE COLLEGE AREA CONNECTOR

CENTRE COUNTY, PENNSYLVANIA
SITE RECONNAISSANCE NOTES
AND PHOTOGRAPHS (SHEET 4 OF 9)

PROJECT:	20011
DRAWN:	KDH
DATE:	AUG 2023
SCALE:	1" = 500'
FIGURE:	

N:_2020\011\exhibits\misc\20011_photo.dgn

PLT: KDH | CKD: SMF | QA\QC: SKG

LEGEND

01 PHOTO LOCATION / DIRECTION

NORTH ALTERNATIVE

SOUTH ALTERNATIVE

CENTRAL ALTERNATIVE

SEE SHEET 4 OF 9

SEE SHEET 7 OF 9

AMERICAN GEOTECHNICAL & ENVIRONMENTAL SERVICES, INC.
Canonsburg, PA
King of Prussia, PA
McLean, VA

STATE COLLEGE AREA CONNECTOR

CENTRE COUNTY, PENNSYLVANIA
SITE RECONNAISSANCE NOTES
AND PHOTOGRAPHS (SHEET 5 OF 9)

PROJECT:	20011
DRAWN:	KDH
DATE:	AUG 2023
SCALE:	1" = 500'
FIGURE:	

M:_2020\20111exhibits\misc\20111_photo.dgn

SEE SHEET 7 OF 9

SEE SHEET 4 OF 9

SEE SHEET 8 OF 9

SEE SHEET 3 OF 9

PLT: KDH | CKD: SMF | QA\QC: SKG

LEGEND

01 PHOTO LOCATION / DIRECTION

SOUTH ALTERNATIVE

NORTH ALTERNATIVE

CENTRAL ALTERNATIVE

AMERICAN GEOTECHNICAL & ENVIRONMENTAL SERVICES, INC.

Canonsburg, PA

King of Prussia, PA

McLean, VA

STATE COLLEGE AREA CONNECTOR

CENTRE COUNTY, PENNSYLVANIA

SITE RECONNAISSANCE NOTES AND PHOTOGRAPHS (SHEET 6 OF 9)

PROJECT:	20011
DRAWN:	KDH
DATE:	AUG 2023
SCALE:	1" = 500'
FIGURE:	

K:_2020\011\exhibits\misc\20011_photo.dgn

PLT: KDH | CKD: SMF | QA\QC: SKG

SEE SHEET 5 OF 9

SEE SHEET 8 OF 9

SEE SHEET 4 OF 9

WAGNER ROAD

NEFF ROAD

S.R. 0322

TUSSEY SINK ROAD

TAYLOR HILL ROAD

19
17
18
26
25
23
24
22
21
20

SEE SHEET 6 OF 9

LEGEND

01 PHOTO LOCATION / DIRECTION

SOUTH ALTERNATIVE

NORTH ALTERNATIVE

CENTRAL ALTERNATIVE

AMERICAN GEOTECHNICAL & ENVIRONMENTAL SERVICES, INC.
Canonsburg, PA
King of Prussia, PA
McLean, VA

STATE COLLEGE AREA CONNECTOR

CENTRE COUNTY, PENNSYLVANIA
SITE RECONNAISSANCE NOTES
AND PHOTOGRAPHS (SHEET 7 OF 9)

PROJECT:	20011
DRAWN:	KDH
DATE:	AUG 2023
SCALE:	1" = 500'
FIGURE:	

M:_2020\011\exhibits\misc\20011_photo.dgn

PLT: KDH | CKD: SMF | QA\QC: SKG

SEE SHEET 7 OF 9

SEE SHEET 9 OF 9

SEE SHEET 6 OF 9

LEGEND

01 PHOTO LOCATION / DIRECTION

SOUTH ALTERNATIVE

NORTH ALTERNATIVE

CENTRAL ALTERNATIVE

American Geotechnical & Environmental Services, Inc.

Canonsburg, PA

King of Prussia, PA

McLean, VA

STATE COLLEGE AREA CONNECTOR

CENTRE COUNTY, PENNSYLVANIA

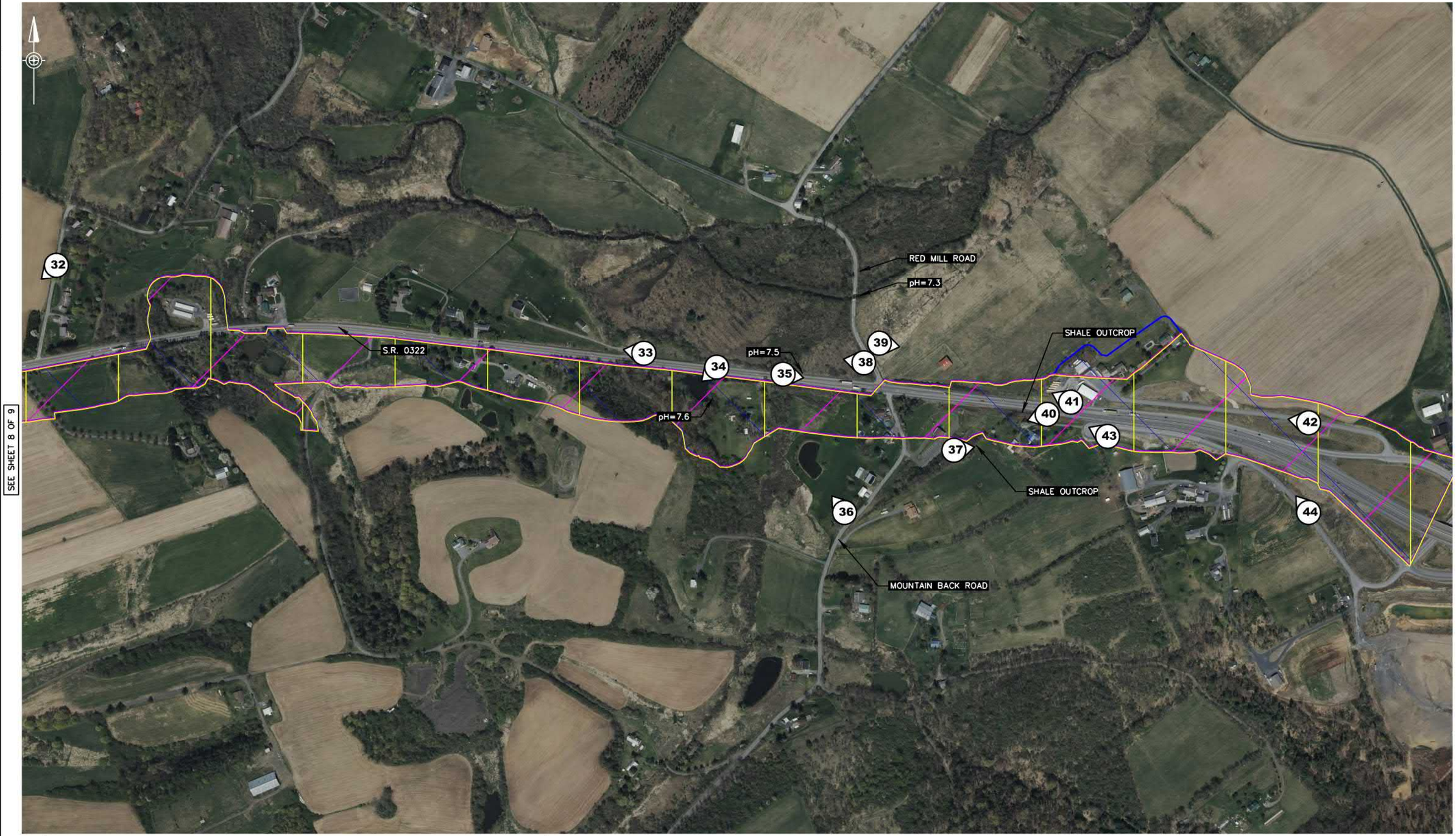
SITE RECONNAISSANCE NOTES AND PHOTOGRAPHS (SHEET 8 OF 9)

PROJECT:	20011
DRAWN:	KDH
DATE:	AUG 2023
SCALE:	1" = 500'
FIGURE:	

N:_2020\20111exhibits\misc\20111_photo.dgn

PLT: KDH | CKD: SMF | QA\QC: SKG

SEE SHEET 8 OF 9



LEGEND

01 PHOTO LOCATION / DIRECTION

SOUTH ALTERNATIVE

NORTH ALTERNATIVE

CENTRAL ALTERNATIVE

AMERICAN GEOTECHNICAL & ENVIRONMENTAL SERVICES, INC.

Canonsburg, PA

King of Prussia, PA

McLean, VA

STATE COLLEGE AREA CONNECTOR

CENTRE COUNTY, PENNSYLVANIA

SITE RECONNAISSANCE NOTES AND PHOTOGRAPHS (SHEET 9 OF 9)

PROJECT:	20011
DRAWN:	KDH
DATE:	AUG 2023
SCALE:	1" = 500'
FIGURE:	

M:_2020\011\exhibits\misc\20011_photo.dgn

Photo 1

Photo 2

Photo 3

Photo 4

Photo 5

Photo 6

Photo 7

Photo 8

Photo 9

Photo 10

Photo 11

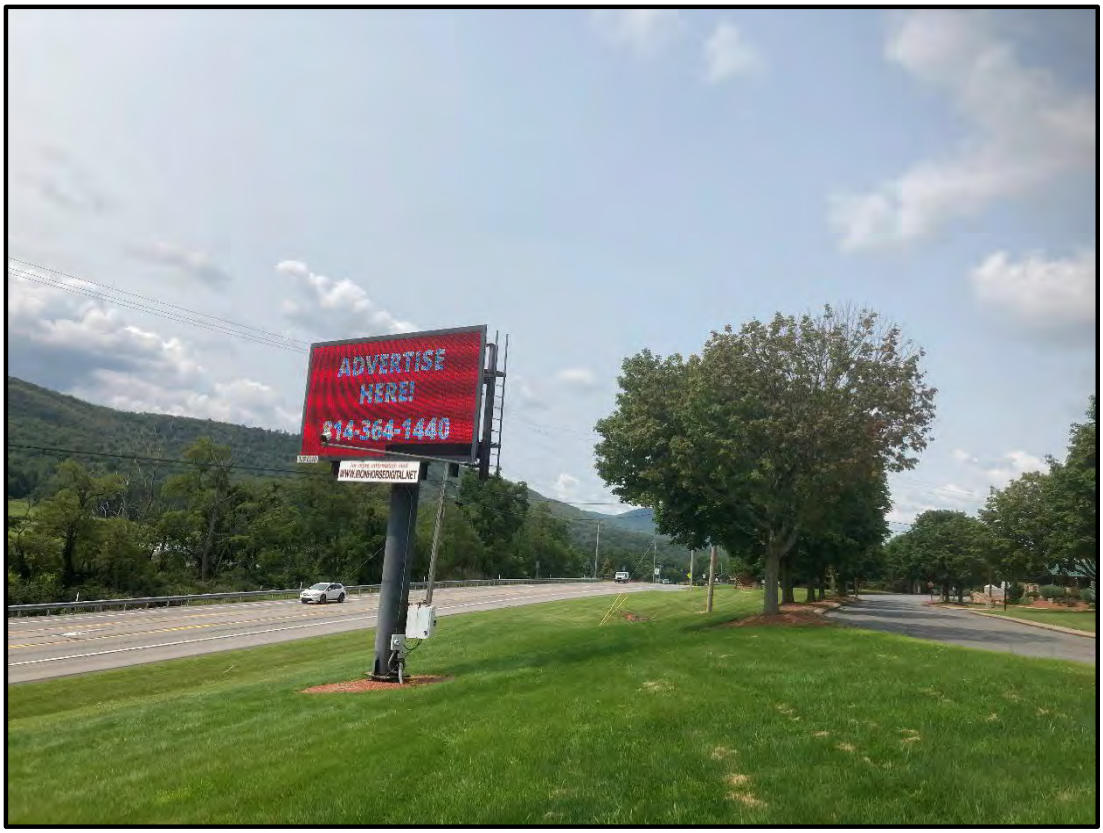


Photo 12

Photo 13

Photo 14

Photo 15

Photo 16

Photo 17

Photo 18

Photo 19

Photo 20

Photo 21

Photo 22

Photo 23

Photo 24

Photo 25

Photo 26

Photo 27

Photo 28

Photo 29

Photo 30

Photo 31

Photo 32

Photo 33

Photo 34

Photo 35

Photo 36

Photo 37

Photo 38

Photo 39

Photo 40

Photo 41

Photo 42

Photo 43

Photo 44