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National Register of Historic Places
Multiple Property Documentation Form

NATIONAL
REGISTER

This form is for use in documenting multiple property groups relating to one or several historic contexts. See instructions in *Guidelines for Completing National Register Forms* (National Register Bulletin 16). Complete each item by marking "x" in the appropriate box or by entering the requested information. For additional space use continuation sheets (Form 10-900-a). Type all entries.

A. Name of Multiple Property Listing

The Industrial Resources of Huntingdon County, Pennsylvania, between 1780
and 1939

B. Associated Historic Contexts

The Industrial Development of Huntingdon County, Pennsylvania, between 1780
and 1939

C. Geographical Data

Properties included within the multiple property group will, for the most part, be found within the boundaries of Huntingdon County, Pennsylvania, although some properties may be located immediately adjacent to the county boundary.

☐ See continuation sheet

D. Certification

As the designated authority under the National Historic Preservation Act of 1966, as amended, I hereby certify that this documentation form meets the National Register documentation standards and sets forth requirements for the listing of related properties consistent with the National Register criteria. This submission meets the procedural and professional requirements set forth in 36 CFR Part 60 and the Secretary of the Interior's Standards for Planning and Evaluation.

Signature of certifying official

Date

Dr. Brent Glass, Pennsylvania Historical and Museum Commission
State or Federal agency and bureau

I, hereby, certify that this multiple property documentation form has been approved by the National Register, as a basis for evaluating related properties for listing in the National Register.

Signature of the Keeper of the National Register

Date

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BACKGROUND

Huntingdon County, which lies in the Ridge and Valley region of the state, occupies a large area in Central Pennsylvania encompassing 895 square miles. Centre, Mifflin, Juniata, Franklin, Fulton, Bedford and Blair counties adjoin Huntingdon County's irregular boundary. The county's physiography is marked by a series of northeast trending ridges that extend across the county. Ridges consist of resistant sandstones or quartzite with alternating beds of shale and limestone underlying the valleys. In the southern part of the county where Huntingdon, Bedford and Fulton Counties join, is Broad Top Mountain, a level upland surface covering approximately 80 square miles and consisting of geological strata which are relatively younger than the surrounding terrain. This landform contains five beds of semi-bituminous coal.

Drainage is contained within the upper Juniata River system which is comprised of three branches: the Frankstown Branch flowing from the northwest, the Raystown Branch stemming from southern sources, and the Little Juniata and Bald Eagle Creek branches from the north. The Juniata River, generally flowing in a southeasterly direction, provides the only natural pass through rugged mountains. The chief mineral resources of the county are sandstone, limestone, clay, and coal, as well as some thin beds of iron ore which are associated with some of these formations.

This nomination will address some of the major industries of Huntingdon County most of which are related to the processing of natural resources. With the exception of agriculture and agriculturally based products, industry in Huntingdon County began with the erection of the first charcoal iron furnaces during the 1780's. The next large industry to experience economic development was coal and related coke production after the 1850's. The glass sand industry evolved at the same time as coal and coke although in a different location. Refractory brick, which used the same mineral resource as the glass sand industry, developed in the late 1890's. The commercial development of each of these and other industries depended upon market demand for the product and the available transportation to markets for goods produced in Huntingdon County.

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For the purpose of this nomination, the history of the industrial development of the county has been divided into four periods. The first covers the initial settlement of the county through the establishment of the agriculture and charcoal iron industries(1754-1799); the second period covers approximately the time during which iron developed as the primary county industry(1800-1849). The next period contained much industrial diversification and expansion and saw as well the completion of the Pennsylvania Railroad(1850-1919). The last division examines the time during which the county industry experienced general decline, and then leveled off concluding with the present 50-year cut off date of the National Register(1920-1939). The context will conclude with a brief summary of the condition of those historic industries that operated between 1940 through the present.

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Settlement Period -- 1754-1799

In 1754 a treaty was negotiated in Albany, New York between the Crown and the Six Nations for the purchase of the Indian title of that section of Pennsylvania west of the Susquehanna River. Prior to that, European settlement in the lands west of the Susquehanna River was restricted due to the uncertain nature of the land claims by the Indians and provincial authorities. The dissatisfaction of the Indians with the treaty and the commencement of the French and Indian War resulted in the constant threat of attack. Therefore, settlement did not expand greatly until the late 1770's. Huntingdon County was created from Bedford County in 1787 by Act of Assembly, and itself divided in 1800, 1804, and 1846 for the subsequent formation of Blair, Cambria, Centre and Clearfield Counties.

The movement of people or goods through the Ridge and Valley Region in Pennsylvania, of which Huntingdon County is a part, was influenced by topography as well. It was less than favorable for the development of transportation systems in the county, particularly during the settlement period. Early pioneers were attracted by the productive agricultural land, its high quality due in part to the underlying limestone bedrock. Water was also plentiful as well as mineral and other natural resources.

The location of grist mills necessary for agricultural progress was a prime factor in the settlement of towns and villages in the developing region. The site of a mill might develop, and attract additional residents and trades to form a town. Or for other reasons a settlement such as an iron plantation might form as the economic potential of the locally abundant iron ore and limestone was realized. The locations of settlements and towns were also influenced by proximity to transportation routes.

In 1767, the town of Huntingdon was established on the site of the old Indian village of Standing Stone. It was located on the banks of the Juniata River and Standing Stone Creek, near the confluence of Raystown Branch with the Juniata River. With the creation of the county in 1787, the centrally located town was recognized as the county seat. Five or six houses were located within the town of Huntingdon in 1776. By 1782, 23 dwellings

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were occupied increasing to 54 by 1788. As the threat of Indian attack decreased the population rose. In 1790 Huntingdon County reported a total population of 7,565.

Transportation

During the settlement period transportation of people and goods was generally unreliable. The earliest transportation routes into and through Huntingdon County were the Indian paths established long before white settlement began, and adopted as their own by the first European traders and settlers to enter the region. The majority of present state and federal highways through the county closely follow the original route of these pathways up long parallel valleys from south to north, and through natural gaps in the ridges from east to west. From the Susquehanna to the Allegheny Front the long course of the Juniata River created a favored path for east-west travel. The General Assembly authorized a State highway in 1787, along the approximate course of old Route 22, to join the Juniata River with the Conemaugh River in Blairsville, Indiana County. The road was completed in 1790 and passed across the county through the town of Huntingdon. Some local goods were transported east on arks or flat boats upon the Juniata.

Agriculture

Agriculture was and still is the economic base of the county. The first settlers in the region were farmers who arrived shortly after the 1754 treaty. Rich soils provided ample produce for the pioneering Europeans. The relatively rapid appearance of mills and distilleries on early maps of the region exhibits an early attempt to resolve the difficulty farmers faced in transporting excess produce. The ground grains and jugs of whiskey were more easily carried by mules and horses which served as beasts of burden through the wilderness.

Grist mills are Huntingdon County's oldest industry. The earliest mill within the present county was the "tub" mill on the Little Juniata at what became Barree Forge, built about 1774 by Jacob and Josiah Minor. Less than twenty years later, according to Reading Howell's 1792 map of Pennsylvania, there were seventeen grist mills within the county's present boundaries.

Huntingdon County's physical relation with the Juniata River meant that it suffered no lack of good mill sites where

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sufficient power could be developed by damming rivers and streams. Even valley locations, where insufficient fall might be a problem, could obtain adequate head by placing dams some distance upstream and creating a long head race or flume to an overshot wheel. Undershot wheels were employed where necessary, although efficiency was greatly reduced from that of an overshot wheel. Cromwell's Mill, in Black Log Narrows, appears to have been powered by an undershot wheel.

Iron

The first recorded charcoal iron furnace located in Huntingdon County went into blast in 1785. It was named Bedford in honor of the county in which it was located at that time. In the 1790s Centre Furnace began operation in what would become Centre County, on Huntingdon County's northern boundary, and Barree Forge was established on the Little Juniata River to work Centre Furnace pig iron brought down to Huntingdon County through Spruce Creek Valley. That valley was soon in the early stages of its development as Huntingdon County's richest iron producing region, with Huntingdon Furnace and Massey's Forge established before 1800. By the end of the eighteenth century there were approximately five iron facilities in production in the county.

The ingredients required for iron production besides iron ore included water power, timber for charcoal, and limestone for flux, all of which were generally available throughout the region. The early iron sites at Orbisonia and in Spruce Creek Valley were in the southeast and northwest quadrants of Huntingdon County, thirty-five or more miles apart. Remote though they were when the furnaces were established, neither area could compare in isolation with the county's only other eighteenth century iron site near the junction of Great Trough Creek and the Raystown Branch of the Juniata, in the very sparsely settled southwest quadrant. The nature of George Knoblaugh's establishment there was variously identified as a bloomery, an ironworks, a forge, and a furnace during its five-year existence. This early attempt to exploit the iron deposits in so remote an area is proof of the thoroughness with which speculators in the iron business were scouring Central Pennsylvania for places where they might make iron -- and with any luck, their fortune.

Pig iron and cast iron products produced in the Juniata Valley were generally shipped to Pittsburgh and points west via

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pack animal along a trail or road. Those production facilities that could exploited the natural waterways using cheaply constructed flatboats and keelboats to carry goods downstream. Once at their destination, the boats were sometimes sold for lumber avoiding the difficulty of an upstream return.

Exploitation of Natural Resources

Timber was another natural resource located in abundance throughout central Pennsylvania and exploited from the earliest period of settlement. It furnished a building material for the expanding population and the developing industries as well as a source for tools and utensils. The seemingly boundless forests provided fuel for the charcoal iron industry as well as for the comfort and cooking convenience of settlers.

Limestone was another material utilized by the settlers. It was used as building stone and burned for lime. Lime was used in agriculture as a fertilizer and in the commercial production of mortar and plaster. Limestone was broken and used as a flux in the production of charcoal iron.

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Development of Iron as the Primary County Industry -- 1800-1849

The charcoal iron industry was firmly established for the most part during this time period. It was generally located in the northwest and southeast sections of the county. In 1810 the state identified 44 operating blast furnaces within its boundaries, 4 of which were located in Huntingdon County. The isolated nature of the industry by necessity generated the erection of iron plantations which provided housing for workers. The economic potential of the coal deposits located in the Broad Top territory was recognized and some efforts were made to capitalize on them. Transportation was acknowledged as a key element in the ability to fully exploit the coal and timber resources in the southern part of the county, frequently called the Lower End. The Pennsylvania Canal was completed, passing through the county in close proximity to the highway (State Route 22). While iron was transported via the canal a greater tonnage of agricultural products were transported by canal boat. The prosperity of agriculture was reflected in an increasing number of grist mills built in this period. The tanning industry began to develop in Huntingdon County during this period with 15 tanneries in operation in 1810.

The county population continued to rise during the period. In 1800 the reported population was 13,008; in 1810 the figure slowly rose to 14,778; then in 1820 it rose to 20,139; in 1830 the number reached 27,145 then rose in 1840 to 35,484.

Transportation

The transportation facilities of the county continued to develop and change in partial response to the various industrial and commercial demands as well as changes in technology. During this period turnpikes were built in the county and the Pennsylvania Canal system was completed; both occurrences impacted the county transportation.

The turnpike between the Juniata and Ohio River Valleys was authorized in 1806 as the Harrisburg and Pittsburgh Turnpike Road, and, as originally projected, was to pass through Bedford approximating the present course of Route 30. The authorization set standards to be met in order to incorporate and issue stock. The road was not completed. Apparent failure to meet the

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conditions resulted in the powers and privileges of the act being transferred to the Harrisburg, Lewistown, Huntingdon and Pittsburgh Turnpike, and by 1808 a weekly stage was in operation between Harrisburg and Alexandria, in the vicinity of old Route 22. In 1815, stock was issued in the Huntingdon, Cambria and Indiana Turnpike, which completed seventy-seven miles of road along the same approximate route between Huntingdon and Blairsville by 1820. The turnpike, generally represented by old Route 22, originally passed by the Pulpit Rocks, an early landmark between Huntingdon and Alexandria, on a stretch of road which today retains much of the appearance it must have had when first used.

Turnpike companies sprang up everywhere in the first half of the nineteenth century, exacting tolls from travelers for the privilege of enjoying the improved roads in which their stockholders had invested. The ruins of a tollhouse on the Spruce Creek and Water Street Turnpike (now State Route 45) are the county's only remnant of structures associated with this early mode of transportation.

In 1825, Pennsylvania and the rest of the county was "agog" at the impending completion of the Erie Canal across New York State and the effect it would have on travel and trade between east and west. Philadelphia was already hard pressed by competition with Baltimore in western trade, and feared New York's entry into the same markets. A canal for Pennsylvania was proposed, along the route chosen for the State road across the Alleghenies in 1787, with the Juniata and the Conemaugh supplying water to the system and a railroad connecting the east and west divisions across the Eastern Continental Divide.

The construction of the Pennsylvania mainline canal offered an alternative solution to the transportation difficulties the industries of Huntingdon County faced. Heavier loads could be moved faster over further distances. Those industries fortunate enough to be located in close proximity to the canal were able to benefit from it. However, the canal also had its disadvantages as a commercial transportation route. It was subject to the effects of flooding, drought, and freezing temperatures, all of which are frequent in western Pennsylvania.

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The engineering problems encountered on the route were enormous. The Juniata Division, which extended from Duncans' Island in Dauphin County to Hollidaysburg in Blair County, required eighty-eight locks in 127 miles of waterway, to overcome a rise in elevation of 582 feet. Within Huntingdon County, which then included present Blair County, the rise was 250 feet between Mount Union and Williamsburg, and an additional 106 feet to Hollidaysburg. Fourteen river dams provided pools for sixteen miles of slackwater navigation between Huntingdon and Hollidaysburg, and three feeder dams, plus a huge reservoir at Hollidaysburg, provided water to maintain the level in the canal. Aqueducts carried the canal across the river itself twice near Mount Union, and again between Petersburg and Alexandria, in addition to smaller crossings required by the larger streams encountered. Construction was authorized in 1827, and completed to Huntingdon by 1831. The final completion of the Juniata Division of the Pennsylvania Canal was celebrated November 27, 1832.

Figures preserved from the six-to-seven month season of 1833 report \$4700.00 in tolls collected at Huntingdon and more than 6 million pounds of cargo cleared for passage, almost equally divided between east and westbound traffic. Of county products shipped, flour (1.8 million pounds) accounted for more than twice the tonnage of iron (734,459 pounds). Other agricultural products shipped, including 600,984 pounds of grain, 33,796 pounds of seed, 34,029 pounds of butter and lard, and 3,923 gallons of whiskey, illustrate the high degree of cultivation which area farms had attained and the boon the canal represented in transporting their produce to market.

Iron

In the years following the turn of the century, iron production became increasingly more important in Huntingdon County. In general, production was located in the north and southeastern portions of the county. By 1815, Union and Pennsylvania Furnaces, Tyrone, Marshall's, and Upper and Lower Sligo forges, and William McDermott's steel furnace and forge were built along Spruce Creek in the northeast part of the county and nearest the Little Juniata River. The consistent large scale operation of Greenwood Furnace, established in 1833, combined with the continuing prominence of the Spruce Creek Valley, made northern Huntingdon County a more prosperous charcoal iron region

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than the southern part of the county, despite an equal number of furnaces south of the Juniata.

With the exception of the pioneer operations at Bedford Furnace and Knoblauch's bloomery, southern Huntingdon County furnaces sprang up in the 1830s and 1840s, during Central Pennsylvania's greatest period of iron furnace erection. Within a few miles of Orbisonia, where Bedford Furnace and Forge had been inactive since the 1810s, Rockhill, Winchester, Chester and Malinda Furnaces were erected; near Knoblauch's site, Mary Ann (later named Paradise) and Rough and Ready Furnaces appeared; and near the Juniata, Edward and Matilda Furnaces. Not one of them enjoyed the stability or longevity, nor gathered around it the large furnace community, of Greenwood, Huntingdon, and Pennsylvania Furnaces. Most successful of the group seems to have been Rockhill Furnace, which in 1850 employed sixty-five men and produced a thousand tons of pig iron. Significantly, it was operated during that period by Isett, Wigton & Company, well-backed Spruce Creek Valley ironmasters.

Huntingdon County iron ores were of two types: brown hematite or pipe ore and fossil ore. The records of the 1850 Iron Masters Convention, indicating the type of ore used at various furnaces, show county furnaces about evenly divided in their use of the two ores and in the combined use of both. There appear to be no clear geographical limits to the distribution of the two kinds of ore; in other words, both are found throughout the county. The wide geographical distribution of nineteenth century iron furnaces in Huntingdon County was indicative of the presence of the iron ore deposits. Most ore mines were located on lands owned by the furnace operation and operated as part of the larger enterprise, rather than as a separate industry. The ore was surface mined.

The technological aspects of the various Huntingdon County iron operations did not appear to vary significantly. The detailed tables in the report of the Convention of Iron Masters suggest that none of the variables -- hot or cold blast, kind of ore, dimensions of the stack -- determined the degree of success which an individual operation might experience. There were large and small furnace operations in both the hot and cold blast categories, for example. The type of ore used did not distinguish the furnaces geographically or in terms of size. Even the size of

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the bosh and height of the stack varied little between furnaces whose capacities were significantly different. Therefore, the factors determining the efficiency and profitability of various operations are difficult to assess. It would appear that management must have been a critical element in such complex operations. Pennies saved, or wasted, could multiply inordinately in an enterprise involving large numbers of men and animals, provision of their food and housing, mining and hauling ore and limestone, cutting timber and burning charcoal, shipping and marketing products.

The impact of tariffs on the county iron industry was another economic factor that local ironmasters had to consider. The subject was addressed in 1832 when iron manufacturers responded to a questionnaire inquiring into the profitability of their businesses, and asking questions about the tariffs then in effect. Almost without exception, Huntingdon County ironmasters active at that time reported sending their iron to Pittsburgh where, they said, it encountered no foreign competition. Asked whether a reduction in the duty imposed on foreign goods of the kind which they made would cause them to abandon their business, most replied that they would be unable to continue. Likewise, of great economic concern were the effects of unpredictable fluctuations in the price of pig iron on a business which required as much as twenty months in the accumulation of the elements involved -- men, animals, materials, and "fixtures"-- before realizing a saleable product. The resulting losses would probably mean a stoppage of work and the scattering of workers, and a subsequent large expenditure of time and money in reviving the operation should conditions again look favorable.

There were a number of prominent men associated with the iron industry in Huntingdon County who also played a larger role in the development of the iron industry in Pennsylvania. The first step toward establishing the Shoenberger family's powerful role in the Juniata iron region was taken with the building of Juniata Forge near Petersburg in 1804. Dr. Peter Shoenberger, who would later become part owner of the Cambria Iron works in Johnstown, had significant interest in Huntingdon County iron.

Every ironmaster was a very important individual to the people who depended on him for their livelihoods. Besides Shoenberger, who eventually held large shares of many iron

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interests not only in the Juniata Valley but also in Western Pennsylvania, the Huntingdon County iron industry had several other important names identified with the production of iron. Among those are George Anshultz an early ironmaster in the Pittsburgh area who was brought to Huntingdon Furnace and made it an economically feasible production; Wm. McDermott who profitably manufactured steel in the county at Millington forge; David Porter, a future Pennsylvania governor who worked as a clerk and later as a manager at Barree furnace and married the daughter of Wm. McDermott; John Lyon who owned many iron related operations in the county at various times including Pennsylvania Furnace, Coleraine Forges and Tyrone Forges; and the Stewart family who operated Coleraine forges for many years. The national reputation of Juniata charcoal iron was instrumental in the making of such men.

The men with economic iron interests in the county found it necessary to house employees at the generally isolated production facilities thus commencing a tradition of company housing in Huntingdon County dating to 1785 and the establishment of Bedford Furnace in a previously unsettled location. For the next fifty to sixty years, as new iron furnaces and forges were placed in a number of remote areas throughout the county, there existed the same necessity of providing dwellings for workers and their families where none had existed previously. To attract and retain workers an iron community or plantation might include any number of structures and buildings relevant to the needs of the workers as well as the efficient and independent production of iron. The results of the county survey indicate that the isolated iron plantation was more prevalent in the northern iron industry than in the southern.

Coal/Coke

The southern Huntingdon County townships of Carbon, Wood, and part of Todd are included in the Broad Top coal region, which extends into Bedford and Fulton Counties. The coal of this region is classed as semi-bituminous to describe its hardness, which falls between that of hard and soft coal. The Broad Top coal field is unusual in its isolation from other coal deposits. Its extent and geological structure were investigated and described by the First Geological Survey of Pennsylvania in 1836 and small country mines were reportedly opened previous to this with the coal used for blacksmiths' forges. By 1840, the census recorded

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ten coal miners in the county, producing 58,500 bushels of coal. There was no doubt to speculators in the remote region that in order for the Broad Top Coal Bed to yield enough coal to become an economically feasible business concern, a dependable and cheap transportation system was necessary.

Like charcoal, which is a concentrated heat-generating product derived from the controlled burning of wood, coke is a concentrated heat-generating product derived from the controlled burning of coal. Both have been utilized in metallurgical processes with great success over a long period. The first reported coking of Broad Top semi-bituminous coal was by William Firmstone at the Savage Iron Works about 1835. Firmstone, an Englishman experienced in the use of coke, obtained the coal from a Savage-owned mine in Rocky Ridge and presumably coked it in a mound on the ground, by a method analogous to charcoal-making. While primitive by later standards, this method produced dense, well-structured coke. Firmstone's experiment at the Savage Works (alternately referred to as Mary Ann or Paradise Furnace) was no more than that; he moved on shortly to additional experimentation with anthracite fuel further east in Pennsylvania and the Savage Works closed again.

General Manufacturing

In the early nineteenth century, manufacturing of products other than iron was confined in Huntingdon County to relatively small operations making products for local consumption. This pattern was altered with the introduction of improved transportation systems, beginning in 1832 with the Pennsylvania Canal. But the construction of the canal did not alone encourage the establishment of manufacturing concerns whose principal market was outside the local area; the supply of raw materials was just as critical.

The manufacture of paper and paper products occupies a notable place among Huntingdon County industries although few remains have been identified. As early as 1800, John Cadwallader established the first paper mill in Central Pennsylvania near Birmingham. The mill operated until the 1830's and produced the paper on which many early county documents and newspapers were printed.

The tanning industry developed in the region during the

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early 1800's. In 1810 the state census reported 15 operating tanneries in Huntingdon County out of 715 throughout the state. The industry was generally located in the southeastern portion of the county. Shirleysburg was an important tanning center. Both Mount Union and Saltillo supported tanneries also. The tanneries required large quantities of timber in order to operate. Bark was acquired from their own land or purchased from local farmers. Fuel was needed to run the steam machinery.

There were seven distilleries in operation in Huntingdon County in 1810 according to the U.S. Census. At that time distilling continued to provided an important means by which to transport excess grain. During the same year the census counted 50 blacksmiths in the county, not surprising when one considers the agricultural and iron industry demands. Gordon's Gazetteer of the State of Pennsylvania published in 1832, recorded 84 distilleries, 62 grist mills and 24 tanneries in the county as well as 120 sawmills.

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Period of General Industrial Expansion and Development 1850-1919

The beginning of this period was a time of rapid growth for Huntingdon County industry. Industry in general experienced overall diversification and expansion. The coal industry, glass sand production, and at the turn of the twentieth century refractory or silica brick production each emerged as economically profitable and significant industrial operations during this period. A major factor in the industrial development of this period was the improvements in transportation networks. The Pennsylvania Railroad was completed through Huntingdon County and across the state increasing the speed and convenience by which goods and raw material could be transported to markets or production sites. This was particularly important for the county iron industry for the movement of iron to the mills in Pittsburgh. The Pennsylvania Canal was put up for sale by the Commonwealth in the 1840's and purchased by the Pennsylvania Railroad in the 1850's. Some portions of the Pennsylvania Canal remained in operation under railroad control until their final abandonment after the flood of 1889.

In 1857 a financial panic impacted the nation and its various industries but the ensuing Civil War created a demand for iron that temporarily revitalized the slowly diminishing charcoal iron industry. The war also generated an increasing demand for coal. The demand and economic potential was recognized by those individuals with land interests on or near Broad Top Mountain.

While this period may generally be described as a time of industrial expansion in Huntingdon County, some industries did experience some decline. The last charcoal iron furnace in the county, Greenwood Furnace, went out of blast in 1904 and Rockhill II, built as a coke fueled iron furnace, went out of blast in 1908. Strikes in 1892 by the iron and coal workers impacted these industries. The decline of the iron industry in Huntingdon County was compensated by the development of the refractory brick industry several years later. Refractory brick was necessary for the construction of the steel mills that were being built in Western Pennsylvania. World War I increased the nationwide demand for steel, and refractory brick production in the county, as a support industry, reflected the increase by rapid expansion.

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The county population, which had peaked in 1840, appeared to drop in 1850 to 24,786 due to the creation of Blair County in 1846 but increased from 28,100 in 1860 to 31,251 in 1870. The number continued to rise in 1880 to 33,954; 35,751 in 1890 then 34,650 in 1900. In 1910 the population reached a total of 38,304.

Transportation

The roads within and through the county continued to be maintained during this period. Bridges necessary for crossing the many watercourses were constructed and rebuilt as necessary. During this period wooden covered bridges were constructed, as well as reinforced concrete arch bridges and metal truss bridges. The Pratt through truss and the Pratt pony truss designs were being used.

Transportation experienced expansion through technological innovation. The Pennsylvania Railroad (PRR) was completed through Huntingdon in 1850. Like the highways and canal which preceded it, the Pennsylvania Railroad in 1847 chose the Juniata River's course as its route through Central Pennsylvania. Unlike the canal, the railroad elected to follow the Little Juniata, rather than the Frankstown Branch, from the forks just west of Petersburg. This decision avoided conflict with the canal's path through Alexandria, the Water Street gap, and the difficult terrain beyond, but forced the railroad engineers to confront the necessity of constructing a tunnel and twelve bridges within a distance of seven miles, between Barree and Tyrone Forges. It was just such conditions that created the Juniata Valley's reputation as both a corridor of transportation and a barrier to it. The railroad further expanded its ability to transfer goods by laying a second track in the 1860's then 4-tracking the line around 1900.

The boroughs of both Huntingdon and Mount Union were doubly affected by railroad-related expansion, being junctions of the PRR and rail lines serving the Broad Top coal field. Railroad transportation was obviously the key to opening commercially viable coal mines in the region, and before completion of the Pennsylvania Railroad through the county in 1850, the Huntingdon & Broad Top Mountain Railroad was proposed to connect the west Broad Top mines in Huntingdon and Bedford Counties with the PRR main line at Huntingdon. Various obstacles delayed incorporation until 1853, but then construction proceeded rapidly and the

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first coal passed over the line to Huntingdon in 1856. Equally early planning for a railroad link to the east side of Broad Top Mountain encountered even lengthier delays. A charter granted in 1848 failed to result in the organization of a company. Subsequent efforts were finally successful, and the East Broad Top Railroad was completed between Mount Union and Robertsdale in 1874.

The East Broad Top Railroad and Coal Company constructed the thirty-mile-long, three-foot-gauge railroad to link the mines at Robertsdale with the Pennsylvania Railroad at Mount Union. It served the companys' mines on the east side of Broad Top Mountain and performed the necessary transfer of cargo and the standard and narrow gauge trucks, which linking with the PRR required. The association between the Rockhill Iron and Coal Company (RI&C) and the East Broad Top Railroad(EBT) was very strong. They had mutual interests and they economically supported each other. The Rockhill Iron and Coal Company constructed two iron furnaces known as Rockhill II and two banks of coke ovens in Rockhill Borough, Cromwell Township. The EBT Railroad transported the coal and iron needed for operation. Generally recognized as twin companies, the board of directors for each often had the same members.

The expansion of the commercial and economic influence of the Pennsylvania Railroad had a negative impact on the canal. The canal's high construction costs, seasonal operation, and vulnerability to damage by floods made it unprofitable to the State, which came to terms with its losses and offered the main line of the public works for sale in 1844 for \$20 million. No buyer came forward until 1857, when the Pennsylvania Railroad's offer of \$7.5 million was accepted. The Portage Railroad was abandoned promptly, cutting the link between the Juniata and Western Divisions. The Western Division was abandoned during the Civil War, and sections of the Juniata Division west of Huntingdon between 1872 and 1877. Many of the canal structures which had survived years of neglect and even the disastrous 1889 flood were destroyed soon after that event due to the subsequent relocation of the railroad right-of-way upon the existing canal right-of-way.

The choice of the railroad alignment, and subsequent abandonment of the canal, also resulted in isolation of the canal

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towns of Alexandria and Williamsburg from the development that attended service by the main line of the all-important railroad. As a consequence, Petersburg (served directly by the railroad, whereas the canal had crossed to the other side of the river as it passed the town) assumed new importance. Less than half the size of Alexandria in 1850, Petersburg surpassed it in population by 1890 and was almost twice as large by 1900, becoming a shipping point for the surrounding agricultural area, with the only stockyard in the county. Similarly, Mount Union and Huntingdon doubled in population between 1870 and 1900, in no small part due to the effects of the railroad on their economies.

Iron

In 1857, with the country in the throes of a financial panic, the iron furnaces located in the southern part of the county such as Winchester, Chester, Malinda, Paradise, Rough and Ready, and Matilda were out of blast, most of them permanently; by 1860, Rockhill and Edward had joined the group. In the northern section of the county, Huntingdon, Pennsylvania, and Greenwood Furnaces were all at work during the same period, as were the forges and iron works on Spruce Creek and at Barree, Juniata, Petersburg, and Tyrone Forges (just inside Blair County).

The ability of the larger northern furnaces to ride out the effects of fluctuating values of pig iron longer than the smaller operations is related to their association with forges and rolling mills which produced finished products and their greater reliance on western markets. John Wright called attention in 1850 at the Ironmasters Convention to the location of markets and the competition with foreign iron as factors contributing to the success or failure of Huntingdon County iron furnaces. Most of the iron produced in the county was sent west to the mills in Pittsburgh. The eventual demise of the larger iron operations resulted not only from the factors which had doomed the smaller operations earlier, but from revolutionary changes in the technology of iron and steel production. The 1850 report of the Iron Masters convention included figures on the anthracite furnaces of Eastern Pennsylvania that demonstrated their superior efficiency by a comparison of capacity with investment. But it was development of the Bessemer and open-hearth processes of making steel that were truly revolutionary, along with the development of new furnaces and fuels for producing pig iron.

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The Bessemer process was invented in England in 1856 and patented in the United States in 1865. Three years later, the open-hearth method was first used in this country. The Bessemer method gained acceptance more quickly, and among the first companies to employ it was the Freedom Iron and Steel Works at Lewistown in Mifflin County, with which Greenwood Furnace was associated. After 1880, the Bessemer method became widely used, with the open-hearth process gaining ground more slowly, but overtaking it by the end of the century. Concurrent exploitation of the iron ores of the Lake Superior region, and development of transportation facilities for delivering them to Pittsburgh, Youngstown, and Cleveland furnaces, also had a revolutionary effect on the iron and steel industry. At the same time, the use of bituminous coal and coke in the production of pig iron was increasing; 1883 was the first year in which more pig iron was produced with bituminous coal or coke than with charcoal or anthracite coal.

Studies of county iron ore deposits made during the 1885 Geological Survey indicate that their nature made mining by pick and shovel the most feasible means of extraction. Ore was taken from both open pits and drifts, and required washing before use. The slow, labor-intensive methods used to recover and prepare local iron ores made it increasingly difficult for them to compete with the rich Lake ores, once they were discovered and methods of extraction and transportation were arranged.

Rather suddenly, the charcoal iron industry was overwhelmed by innovations and changes it could not adopt and had no hope of competing against. Pennsylvania Furnace, for example, converted to coke for some period prior to its closing in 1888, yet the Second Geological Survey's extensive examination, in 1885, of iron ores in the Pennsylvania Furnace area concluded that most of them "make the best possible iron in cold-blast charcoal furnaces, and good iron with the hot-blast and mineral fuel." The hot blast method of iron production was introduced in the country between 1830 and 1840. Some furnaces converted from cold to hot blast process. The cold blast process blew cold air into the crucible to fuel the fire, the hot blast furnace took the waste heat from the furnace and passed it over the surface of cast iron pipes. It was through these that the blast was conducted to the furnace raising the temperature of the air to

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approximately 250 degrees Fahrenheit. Although Greenwood Furnace was reportedly utilizing hot-blast, perhaps beginning with the blowing in of its second stack in 1864, the Geological Survey reported that Huntingdon County furnaces operated at cold blast, indicating a return to its previous methods. The conclusion seems to be that what the charcoal furnaces of the Juniata region did well -- in their day, as well as anyone -- was all that they were capable of doing. When their product was no longer in demand, whether because it was replaced by steel or simply because its production was too inefficient to be competitive, they were forced to shut down.

Only one Huntingdon County furnace was constructed with the intent to use coke to fuel the works. Near the site of the Juniata Valley's pioneer furnace at Orbisonia, the old Rockhill Furnace was reborn in 1876 as Rockhill II. Through the efforts of Percival P. Dewees, who in partnership with Dr. Lewis Royer had put old Rockhill back in blast in 1868, capital was raised and a company formed to erect new furnaces, along with all the facilities to mine, haul and coke the coal that Dewees recognized as essential to the operation. The Rockhill Iron & Coal Company organized in 1872 with an authorized capital of two million dollars. It acquired eight thousand acres near Orbisonia from which both fossil and hematite ores, limestone, and sand were obtained, and eleven thousand acres of coal and timber lands in the Broad Top region.

By every measurement, Rockhill II dwarfed even the largest of the old charcoal iron furnaces. The physical plant was impressive, including large brick casting houses and blowing engine house, a 280-foot long stock house with air hoists, an office building, and two banks of coke ovens. Its two sixty-five-foot wrought iron stacks had seventeen-foot boshes, five tuyeres, and a blast produced by two massive steam engines with four twenty-four-foot flywheels and ninety-inch blowing cylinders. Production capacity easily reached forty to fifty tons of pig iron a day, and on a record day produced one hundred tons. The average annual production of 18,000 tons was greater than had been produced in any single year by all the county's charcoal furnaces together.

A general business depression, combined with strikes of both iron workers and coal miners, caused Rockhill II to be shut down

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in 1893. Almost a decade passed before a reorganization of companies allowed reactivation of the furnaces in May 1902 with a new subsidiary, the Rockhill Furnace Company, in charge. Production now averaged a hundred tons a day, using Lake ores shipped in from Minnesota. Profitable operation required generally healthy business conditions, however, a situation which prevailed only until 1907, when a depression again caused Rockhill II to close, this time for good, on January 13, 1908. That date marks the end of iron furnace activity in Huntingdon County, although Joseph Thropp's Saxton Furnace, just over the Huntingdon-Bedford County line, operated into the 1920s, using Huntingdon County coal in its coking operations, and employing workers from the Huntingdon County portion of the Broad Top region.

Generally speaking, the iron communities did not survive the demise of the business which was their reason for being. Remote, self-sufficient, and completely surrounded by vast tracts of iron company lands, these communities did not--could not--diversify. They offered no foothold to the independent trades and businesses which an ordinary town of comparable size would attract, so that when the iron works was dead, the community was dead. Its residents had no choice but to go elsewhere to seek work, and the houses in which the workers had lived were seen as superfluous--to be removed, demolished, or abandoned to decay. At Greenwood Furnace, one of the county's largest and longest-lived iron communities, workers' houses were sold for removal when the Commonwealth purchased the site in 1904. Similar disposition was apparently made of worker houses at Monroe and Paradise Furnaces, both acquired for State forest lands.

Coal

The development of Huntingdon County coal mines followed immediately upon completion of the H&BT railroad in 1856, 42,971 tons of coal being shipped in the railroad's first year of operation. By 1860, tonnage increased to 187,853, indicating the rapid strides made by area mine operators. Although the railroad owned coal lands which it sometimes leased for development and sometimes ran under its own management, the typical situation on the west side of Broad Top Mountain (the side served by the H&BT) was for mines to be owned by a variety of different individuals, partnerships, and companies. In this respect, the area was very different from the east side of the coal field, which was

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dominated almost completely by the Rockhill Iron & Coal Company, owners of a unified operation which included not only the mines and railroad, but also coke ovens and iron furnaces. Reported output for the first year of operation (1875) on this side of the coal field was 57,037 tons, with a rise to the neighborhood of 100,000 tons in immediately succeeding years.

By 1881, Huntingdon County's portion of Broad Top coal production was estimated at 390,000 tons, a total which was not surpassed until 1902 when output reached 460,485 tons. Some fluctuation, but an overall rising trend in production to more than one million tons characterized the period from 1902 to 1915, with the county's all-time peak level of 1.3 million tons being achieved in 1918.

The increase in the output of coal was partially impacted by the various changes in the technology of mining. Miner's squib, an explosive charge of black powder was used after the 1850's. In 1877 the air cutting machine was developed and 1889 the air drill was introduced. The electric cutting machine in 1890 and the electric drill in 1914 also facilitated the work of the coal miner.

As was the case throughout Pennsylvania coal regions it was necessary for coal companies to construct housing to attract employees. Coal companies generally wanted stable, preferably married men who would be less likely to suddenly leave. The Rockhill Iron & Coal Company constructed two company towns in previously unsettled locations within the Broad Top coal region of southern Huntingdon County. In 1874 the company town of Robertsdale was laid out immediately adjacent to the Rockhill #1 mine. In 1891, Rockhill Iron & Coal opened a new mine two miles south of Robertsdale and erected the town of Woodvale.

Coke

The first large-scale operation of coke ovens in Huntingdon County began at Rockhill Furnace II in 1875. Percival P. Dewees, whose experience at charcoal iron furnaces in the area dated back more than thirty years, conceived of a modern iron operation in which coke would replace charcoal as fuel. Lacking were a railroad to the East Broad Top coal field, and the large-scale mining operations required to keep the coke ovens supplied. Dewees' recruiting of investors with the capital to remedy these

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lacks resulted in formation of the Rockhill Iron & Coal Company, which integrated the entire process, from ownership of the coal mines to construction and operation of the railroad and the iron furnace. Sixty-eight Belgian ovens, constructed adjacent to the furnace, were soon consuming 40,000 tons of the company's own coal annually. Coke production was an essential component of the total operation, but, like charcoal-burning in an earlier day, had no independent existence as an industry apart from the iron furnace.

As Rockhill II was getting underway, coke manufacture was receiving attention from Pennsylvania's Second Geological Survey, which published two reports by John Fulton, General Mining Engineer for the Cambria Iron Company. His report "On the Methods of Coking Coal for Furnace Use; its Efficiency and Economy, as Compared with Anthracite Coal in the Metallurgy of Iron" stated unequivocally "that coke is destined to become the leading fuel for blast furnaces, and to retain this position from its almost inexhaustible source of supply, its calorific efficiency, and its continued economy." He judged Broad Top coal "very good for the production of a bright, open, tenacious and strong coke." Comparative analysis against Connellsville and Bennington coking coals showed Broad Top coals yielding higher percentages of fixed carbon and, therefore, of coke.

Fulton's report "On the Coking of Bituminous Coal" addressed the relative merits of beehive and Belgian ovens, examining cost as well as product. The report reveals the complex relationship between the structure of various coals and the effects of coking in different types of ovens. The role of experience in achieving optimum results helps to explain why it was not uncommon to find ovens of one type substituted for another type during the history of an operation. Such a decision was made at Rockhill in 1887, when a hundred beehive ovens replaced the Belgian type.

At Minersville, on the west side of the Broad Top coal field, Robert Hare Powell constructed 105 Belgian ovens in 1882 to produce coke for his new furnace at Saxton. Belgian ovens side heated the ovens in narrow vertical chambers; this method eventually led to the development of the modern by-product oven. The capacity was one hundred tons of coke per day, using coal from two Powell mines. Placing the coking operation at the mine mouth, rather than at the furnace, saved hauling costs for

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Powell, who, unlike the Rockhill owners, did not own the railroad which linked his mines and furnace. At Minersville, as at Rockhill, the Belgian ovens were eventually replaced by beehive ovens. Beehive ovens were the first "closed" ovens. Air was admitted for partial combustion of the coal.

Glass sand

Sand and sandstone can be found in abundance in Huntingdon County. The principal productive area in Pennsylvania for glass sand is confined to the outcrops of Oriskany sandstone in Huntingdon and Mifflin Counties. In Huntingdon County, for the most part, these outcrops are located along the eastern boundary where the Juniata River cuts through Jacks Mountain although there is an outcropping near Alexandria in the northwestern section of the county.

The commercial development of glass sand quarries in the vicinity of Mapleton and Mill Creek began in the 1850's. High-grade glass sand is quarried in Huntingdon County in the vicinity of Mapleton and Mill Creek; the quarries are located principally on Sand Ridge, along the west side of Jack's Mountain. The sandstone was quarried where the rock had been weathered long enough to make it friable and easily crushed to original quartz grains. The resulting glass sand is the highest quality in the state. There were about ten plants in operation by 1900.

The glass sand industry became feasible in this area with the availability of rail transportation for delivering sand to glass factories in the Pittsburgh vicinity. The first shipment was reported in 1852, when sand was sent directly from the quarry with no on-site processing. Throughout the period, development of the industry was marked by the creation of a number of businesses, quarrying the same geologic formation at different locations along the same mountain, however, all were dependent upon rail shipment to western Pennsylvania glass factories. No effort appears to have been made to establish a glass factory near the sources of glass sand in the county, although Huntingdon courted a Belgian manufacturer of plate glass in 1877, using the local glass sand as an incentive. The lack of a local source of natural gas, necessary for fuel, was the most obvious reason for the absence of glass factories in the county.

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Refractory Brick

The Oriskany and Gatesburg formations in Huntingdon County are important sources of white refractory clays in the state. The operations that worked these clays produced a refractory cement and furnace lining. Extensive operations existed outside of Alexandria in the northwest and Shirleysburg in the central-southeast portion of the county.

The development and growing use in the 1870s and '80s of open-hearth steel furnaces and coke ovens created a demand for lining materials capable of withstanding more extreme conditions than the fireclay brick or silica brick then available. Once the demand for refractory brick of ganister rock was apparent, and early trials had tested and modified equipment and methods, the market could--and did--expand very rapidly.

Huntingdon County's ability to play a significant role in the refractories industry began in 1899 as a result of the presence of virtually unlimited reserves of quartzite or ganister rock on its mountaintops, combined with direct rail connections to sources of coal for fuel and to the iron and steel centers where refractory products found their markets. Refractory brick and silica brick are thermal products and are used in the construction of metallurgical furnaces, lime and cement kilns, glass ovens and coke ovens, or anywhere a heat resistant material is needed.

A recent history of refractories manufacture calls it "the hidden industry," but Jacks Mountain's potential as a source of ganister or quartzite was never hidden. Vast floes of the rock were exposed on the steeply pitched slopes of Jacks Narrows, where the Juniata River cut the mountain in two. This is the same Tuscarora (or Oriskany) formation used in the glass sand industry but differs in its composition. It consists of grains of quartz that are less friable than those in sandstone. Travelers on the transportation routes which had followed the river's course through the mountain since earliest times seldom failed to comment on the precariously balanced rock slides. Once the commercial value of ganister was recognized, the floes at Mount Union invited exploitation; the exposed rock needed only to be loaded and transported, by narrow-gauge and funicular railway, to the nearby works for processing. When the supply of free rock

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was depleted, quarrying of the mountain top yielded further material.

Capital investment in the industry ran high, and profit margins were slim, which meant that conditions had to be ideal if an operation was to succeed. Tuscarora sandstone which produced ganister is silica rock and was present on the crests of virtually all Central Pennsylvania's high mountain ridges, but only those locations where transportation facilities were most accessible to the best sources of raw materials could attract the serious consideration of refractories manufacturers.

Typically, it was experienced fireclay brick manufacturers who moved into the field of silica brick manufacture. Fireclay brick continued to have useful applications, and many firms produced both types of refractory materials. Initially, there was some conversion of fireclay brick plants to silica or ganister brick works, and some transportation of raw materials from sources of supply to the updated existing works. But as the industry came of age at the turn of the century, the typical pattern was to build new plants near the source of raw materials, and to integrate vertically by controlling the process from extraction of the raw material to sales of the finished product. This was the pattern in Huntingdon County.

The W.J. Haws plant in Mount Union, constructed in 1899, was the first works in the United States built exclusively for the manufacture of refractory brick. Its location at the base of Jacks Mountain, adjoining the main line of the Pennsylvania Railroad, was ideal. A mountain of ganister towered over the plant; the East Broad Top Railroad delivered semi-bituminous coal directly to the site from the Broad Top mines; and the PRR linked the plant to its iron and steel industry consumers in Johnstown and Pittsburgh.

The advantageous location of the Haws plant was immediately appreciated, and Mount Union was launched into a decade and a half of transformation into the "silica brick capital of the world." After a disputed sale of the Haws plant to Harbison-Walker Refractories in 1900, former Haws' partner Scott Dibert founded the rival Mount Union Silica Brick Company in 1901. Two years later, Harbison-Walker built its No.2 Works next to the original plant, thereby doubling capacity. By 1911, a third

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brick company joined the town's industrial ranks, with construction of a plant for Mount Union Refractories. The plants which followed Haws' did not enjoy the earlier site's immediate proximity to quarries on Jacks Mountain, but good railroad service on the short hauls to their respective quarries minimized the effect of this disadvantage.

Alexandria, Huntingdon County's second refractories site, was no match for Mount Union as a "Bricktown," yet construction of a Federal Refractories plant there in 1904 had a significant impact on the town's population and vitality. West of Alexandria, at the base of Tussey Mountain, Federal Refractories chose a site remarkably similar to the Haws site at Mount Union. Clearly visible from Federal's location was the narrow Water Street gap through the mountain, where a precipitously tumbled rock floe had drawn its share of early travelers' comment. An incline connected the Federal plant with its mountaintop quarry, and the recently completed Petersburg branch of the PRR passed within yards of the site, bringing coal to fuel the machinery and kilns, and hauling finished bricks to distant markets.

World War I demands on steel producers sparked concurrent expansion in refractories. Mount Union's 1917 supremacy in the industry reflected a recent build-up, which saw refractory employment in the county reach an all-time high of 1800, with less than 200 of that total at Alexandria. Local residents joined the refractories' work forces in relatively large numbers, but could not begin to satisfy the demand. The 1910 census shows two boarding houses near Alexandria housing fifty immigrant brickworkers from Eastern Europe. Mount Union's foreign labor force was much larger, although the housing pattern was different. Harbison-Walker built one hundred company houses on Ganister Hill, where immigrant families shared their quarters with five to ten single boarders of the same nationality. Italians, as well as a diverse mix of Austro-Hungarians, Serbians, Croatians, Russians, and Macedonians, lived in the Ganister Hill section in 1910. Employees from the local area also occupied company housing, but their households included few non-family members. Later, as the wartime labor market expanded, and a third brick plant and a government munitions plant were built, Mount Union attracted a number of Black workers from the South, giving the town a mix of nationalities and races which is highly unusual in Central Pennsylvania. The Gannister Hill

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housing was demonished by the company for mining. Of refractory built company housing in Huntingdon County, the only identified and the most unique example is the planned community of Kistler.

General Manufacturing

Not until railroads became sufficiently developed to permit efficient shipping of materials to the factory, and products to market, did general manufacturing become feasible on a scale that would justify calling the business a factory, a term implying mass production and the use of machines.

This stage of development existed in Huntingdon following the Civil War, along with a growing population seeking work, a banking system to supply capital, local sources of coal for fuel, and an emerging system of utilities such as gas, telephone, water, and electricity. A reorganization of the way business was conducted was apparent in the altered appearance of Huntingdon's streets in the 1870s and 1880s, as rising numbers of retail merchants built dozens of substantial new places of business. The array of merchandise offered in these establishments bespoke a widespread change brought about by the greater availability and variety of manufactured goods. During this same period, Huntingdon became a contributor to, as well as a consumer of, that flow of goods.

One manufacturing contribution of Huntingdon was directly related to the Pennsylvania Railroad. The railroad's increasing importance locally and nationally, along with a post-Civil War business expansion in Huntingdon, encouraged the firm of Orbison & Welch to establish the Huntingdon Car Works in 1872 for the manufacture of freight cars. The business survived only a few years, but was reactivated by Blain Brothers in 1880. The site of this manufacturing concern has sustained many alterations.

Another concern was a paper products manufacturing business which was founded in Huntingdon by J.C. Blair in 1879 and experienced phenomenal growth. Within five years, the company had one hundred employees, and was carrying Huntingdon's name on its products to all parts of the nation and the world. Blair was a unique figure in Huntingdon County industrial history--its only example of a home-grown, nineteenth-century industrialist-philanthropist. As an employer, he instituted benefit and profit-sharing policies that were ahead of their time, and he and

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his wife made contributions to the community on a scale never equalled locally.

Recognized by his peers in the manufacturing stationers trade association as the inventor of the tablet, Blair made that simple product the trademark item on which his business success depended. Drawing on his early experience as a printer of brightly colored Sunday school reward cards, Blair put color lithographed covers on his tablets, which made them an instant success. The company's entire line of stationery products and school supplies emphasized design, color, and constant innovation and improvement.

A former Blair employee, J.B. Kunz, founded a company in Huntingdon in 1894 to manufacture bank pass books. From the Kunz firm's 1912 expansion to its departure to larger, more modern quarters in 1967, the company provided regular employment for fifty to sixty persons. Comparative figures for the Blair Company ranged from 250 to 350 employees.

In 1850, the region reached a high point in both agricultural and iron production. Huntingdon County had thirty-nine grist mills, which produced more than 35,000 bushels of flour and an even greater amount of chop for animal feed. All were water-powered. By 1870, population had increased from 24,000 to 32,000, but the number of mills in operation had dropped to nineteen. Two or three mills were larger than any recorded in 1850, but the majority produced less flour than in the earlier year. All but one steam-operated mill were still powered by water.

These figures reflected a westward shift in wheat production, and the availability of commercial brands of both flour and bakery products. Both trends continued, bringing about further decline in the number of local mills in operation and in their production of flour in relation to animal feeds. Improved transportation was a factor in bringing outside products into competition with those produced locally, and also in increasing the local area served by those mills which remained in operation.

Other, generally smaller manufactures operated in Huntingdon County during this period. In 1860 the United States Census

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reported boot and shoe production; carriages; furniture cabinetry; liquor distilling; plaster; and pottery. In addition there were 72 lumber, 20 blacksmithing and 20 leather tanning establishments identified in the county that year.

By the 1870's the tanning and extract industry in the southeast part of the county was feeling the strain of timber scarcity. The bark on a tree needed to be twenty years old before it was stripped. Between the industrial useage and forest fires, the natural supply of wood was rapidly decreasing while the demand for coal was increased.

Hydroelectric Facilities

The period from 1905 to 1912 saw two large-scale hydroelectric plants constructed in Huntingdon County: on the Juniata River at Warrior Ridge, four miles north of Huntingdon, and on the Raystown Branch of the Juniata, five miles south of town. The Warrior Ridge dam and power plant was a project of the Juniata Hydro-Electric Company of Philadelphia, which contracted for the construction and installation of equipment with leading firms in the growing field of electrical power generation--General Electric and the Ambursen Hydraulic Construction Company. The concrete reinforced dam had been introduced into the Eastern United States by the Ambursen company about 1902; the design was enthusiastically embraced and many built within a short period. They attracted the keen attention of the engineering world. Ambursen patented the enclosed version (the buttresses were not visible) used at Warrior Ridge in 1904, and construction began the following year. Plans, photographs, and detailed descriptions of the Warrior Ridge project appeared in engineering publications, while area newspapers were full of plans for uses of the new source of electric power. The Wilson Electric Company, which had been supplying power to Alexandria from generators operated by the water wheels of two area grist mills, constructed lines to the dam, and Huntingdon Gas and Electric Company converted its system to alternating current in preparation for receiving power from Warrior Ridge.

Perhaps inspired by the Warrior Ridge project, area investors formed the Raystown Water Power Company in 1908 and undertook construction of a different type of concrete hydropower dam, concrete steps with more rise than run. Like Warrior Ridge, the Raystown plant included a coal-fired steam generating plant

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to supplement its water-powered turbines. When completed in 1912, Raystown was joined to the growing network of power lines serving Central Pennsylvania communities. Both these generating facilities were acquired in the 1920s by the Pennsylvania Electric Company, as electric power increasingly came under the control of large power companies.

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The Beginning of the General Decline of Industry -- 1920-1939

During this period industrial production in Huntingdon County witnessed an overall decline in development and expansion. During the Depression there was a decrease in the demand for coal which was felt in the Broad Top coal fields by the strikes and layoff of miners. Although the iron industry had left Huntingdon County by this time, the depression of the iron and steel industries in Pittsburgh was reflected in the refractory brick industry, an ancillary industry. This spiraled to the railroad industry, a large county employer; less production meant less goods to be transported and less trains. Some farms were foreclosed, but on the whole, general manufacturing continued. The diversified economy of Huntingdon County reduced the potential effect of the depression. While there was general stagnation in the county industry and loss of employment there was not a collapse of the county economy. The myriad of sand plants in the Mapleton area consolidated into one operation. Refractory products were still being fabricated for the steel and glass industries in Pittsburgh. Transportation networks continued to change particularly in response to the escalating importance of the automobile and public works projects. The county population increased again in 1920 to 39,848.

Transportation

The roads through Huntingdon County continued to be maintained. Governor Gifford Pinchot instituted a policy of paving dirt roads to markets for the farmers. Both railroad and roadway bridges were repaired and replaced as necessary. Bridge types recorded in the survey represent construction systems in use at different periods and appropriate to different locations. A steel rope suspension bridge was built during 1937; reinforced concrete arch bridges continued to appear as well as the metal truss bridges.

Refractory Brick

Reflecting general economic conditions, refractories employment in the county leveled off during the 1920s at 1400-1600, and fell to a low of 950 in the mid-1930s. The refractory industry customarily reflected the economic condition of the national iron and steel industries.

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Glass sand

Twentieth century development of the local sand industry emphasized consolidation of the smaller companies formed in the nineteenth century, until only one company -- Pennsylvania Glass Sand's Keystone Works -- survived. By 1924 the Keystone works were constructed immediately north of Mapleton. From the shipping of unprocessed quartzite at the beginning of the industry, the consolidation and construction of the Keystone works has moved the industry toward greater processing for a variety of industrial uses and more exacting quality control to meet the demands of industrial consumers. The primary contaminant of glass sand is iron, and the refining of control over iron content has been of constant concern to Huntingdon County glass sand producers throughout the history of the industry. Control of iron content is achieved by analysis of sand from different quarries, by washing, and by combining sands to achieve the exact percentages allowed or desired by customers.

Coal

The coal industry did not fare as well as the sand industry during this period. With the decreasing demand for coal due to the depression and the expanding use of other fuels the price of coal was down, hence wages went down and working conditions generally declined, although mechanized loading of coal was introduced after the 1920's. A nationwide strike of coal workers began in 1922 and lasted over a year. The Coal and Iron Police appeared in Huntingdon County that year. Many workers and their families were evicted from the company towns and barracks were constructed on private land near the mines. In spite of, or because of these occurrences, Huntingdon County typically ranked eighteenth to twentieth among the twenty-five or twenty-six counties producing bituminous coal in Pennsylvania during the first half of the century, with output falling after World War I and averaging a half million tons per year through the 1930s.

General Manufacturing

Huntingdon County's experience with textile and garment manufacture occurred in the post-World War I period. In 1919, the Susquehanna Silk Mill of New York City constructed a two-story brick factory, two full blocks in length, in Huntingdon. The size of the facility indicated the number of employees required: more than 700 at peak periods. Violating the typical pattern of textile mill employment, which was predominantly

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female, figures for 1922 indicate 296 male and 422 female workers. Huntingdon's population at the time was 7000, so the effect of establishing this industry was substantial. Employment did, however, fluctuate with demand, falling close to 400 at times. Lay-offs of this magnitude are always difficult for a community to absorb.

The Blair paper manufacturing business continued in operation through this period as did the Kunz paper products company. These provided steady employment in Huntingdon borough during the Depression.

In Mount Union, a group of local investors put together a company in 1920 to manufacture men's clothing, and within a few years found a Baltimore manufacturer to buy and operate it. With approximately 1600 men employed in its three refractories plants, Mount Union had a large untapped resource in its unemployed female residents. Beginning with about sixty-five employees, all females but one, the firm grew constantly and consistently, even during the Depression. Mount Union borough also supported a cinder block manufactory and planing mill which continued to operate throughout the period.

Hydroelectric Facilities

In the 1930s many rural areas of Huntingdon County were still not served by power companies, which considered it unprofitable to construct the miles of lines required to link customers in sparsely settled areas. Small hydro-generating facilities were installed at Greenwood Furnace and Whipple Dam State Parks to provide electricity to the recreation areas there, and the water wheel at the old stone mill at Huntingdon Furnace generated electric power for a few homes in the area. But the general lack was addressed by passage of the Rural Electrification Act in 1935, a Federal program which encouraged the formation of rural electric cooperatives and offered low-interest financing for power line construction. Huntingdon, Blair, and Bedford County farmers organized Valley Rural Electric Cooperative in 1938 and constructed a modern headquarters building near Huntingdon in 1940.

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Industry Through the Present--1940-1980's

The continued depressed state of the nationwide iron and steel industries is reflected in the Mount Union industries. Business prospered during the war when the demand for iron and steel was high. However, after the war refractories in Mount Union decreased their production until General Refractories went out of business in the 1950's and Harbison-Walker Refractories ceased production in the 1980's. North American Refractories changed their technological process and no longer use ganister rock but rather an "imported technology" that they discuss very little.

As a part of the war effort the silk plant in Huntingdon borough was purchased by the government and leased to Owens-Corning Fiberglas Corporation to construct war products. Following the war the company bought the works and continues to operate there as one of Huntingdon County's largest employers. Mead Products bought out the concerns of the J.C. Blair company and moved production to Alexandria where it still operates. More than 400 persons are currently employed in the paper products plant, assuring the industry's continuing importance to the county economy.

During World War II as the rival fuel products of petroleum and natural gas became increasingly scarce due to military demands, orders for coal rose again. This did not continue after the war and the coal industry was all but put out of business due to competing fuels such as oil. In the 1950's coal production declined to its lowest output but rose again in the 1960's with new demands from technological changes in other industries such as electricity. Pneumatic tools replaced blasting in some cases but strip mining became the normal practice due to less cost. Huntingdon County's coal production dropped significantly during this period although some strip mining is presently taking place on Broad Top Mountain. In 1954 the Huntingdon and Broad Top Mountain Railroad closed and in 1956 the East Broad Top Railroad closed between Mount Union and Robertsedale; both closings were directly linked with decline in the coal industry.

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Transportation

The dominance of rail transportation, the importance of coal, and their essential link with industrial vitality of the county prevailed into the 1950s. At that time the failure of the Huntingdon and Broad Top Mountain Railroad, soon followed by the decline of the East Broad Top Railroad and the decreasing number of runs made by the Pennsylvania Railroad spelled unemployment for many Huntingdon County residents. Both of the coal-hauling railroads shut down in the mid-'50s; fewer and fewer local industries depended on the PRR for transportation of materials or products; and railroad passenger service was gradually discontinued at every depot but Huntingdon. Structures associated with suspended functions like freight and passenger service and with the defunct lines were extremely vulnerable to neglect and destruction. Little remains of the H&BT: a frequently flood-damaged and repaired trestle at Huntingdon, a little station, moved and adapted for use at the Huntingdon County Fairgrounds, and a water tank and relocated freight station in a park at Dudley.

The situation with the EBT is remarkably different. Perhaps because it was not just a railroad, but a vast complex of rail line and structures, company towns, coal mines, and wooded acreage, there was an interested buyer. In 1960, soon after its purchase, a part of the railroad began operating as a tourist attraction, thus preserving the depot, roundhouse, repair shops, turntable, and other buildings at the railroad headquarters in Rockhill Borough. Structures along unused portions of the right-of-way have fared less well with respect to maintenance, but many survive: a switch engine house containing an engine, and a coal trestle at the Mount Union yard, long bridges at Aughwick Mills and Pogue, small depots at Saltillo and Robertsedale, and the deteriorating tunnels through Sideling Hill and Rocky Ridge. Virtually the entire right-of-way is undisturbed, though overgrown, and much track remains in place. The genuine time capsule aspects of the EBT, whether in the Rockhill shops or out along the line, make it a unique relic of railroading history.

Glass sand

This industry has, of course, been revolutionized in the course of its 140-year history, by mechanization of quarrying, hauling, and processing equipment, which has allowed far greater production with less hand labor and fewer employees. The

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Keystone Works are still in operation north of Mapleton with many of the old buildings still in use. National environmental concerns impacted this industry, for example, water from the washing processes, once returned to the river from which it is drawn, is now pumped to an abandoned quarry for settling. The glass sand industry in Huntingdon County is one of the few industries which still uses the railroad for transportation, although not exclusively.

Refractory Brick

Refractory production climbed to a range of 1200-1400 tons in response to World War II demands. A wave of post-war prosperity carried the local industry into the 1950s, but by the end of the decade, General Refractories at Mount Union and Federal (later known as Stowe-Fuller) at Alexandria were closed. General's closing signaled increased production of chrome and magnesite brick at a new plant with better access to imported materials. Their Mount Union site was cleared in 1956 for a federal housing project. Maryland Refractories acquired the Alexandria plant in 1959 for the manufacture of refractory specialties, from reclaimed brick. Increased hauling costs forced a move to Ohio in the early 1980s, and the plant was razed in 1988.

Harbison-Walker remained actively engaged, into the 1980s, in making the complex coke shapes which were its specialty, enjoying periods of peak employment and production, even in the 1970s when rising fuel costs and shortages threatened profits and production schedules. The plant closed in 1985, a victim of age and the depressed condition of the U.S. steel industry. The huge complex is virtually intact, except for destruction of the highly-regarded impact presses, which the company still considers too valuable to allow to fall into competitors' hands.

North American Refractories (originally Mount Union Refractories) is the only refractories plant still operating in Huntingdon County. The processes going on at North American today have little or nothing to do with the prototypical silica brick plant buildings on the site--no crushing or burning, for example, which were the processes that particularly marked a silica brick plant for what it was. All but two of the unused kilns were demolished, and other idle and obsolete portions of the plant are obviously vulnerable. In their present form, however, this plant

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and--to an even greater degree--the Harbison-Walker plant convey the size and particular configuration of a silica refractories site.

Coal

More than a thousand miners worked Huntingdon County coal mines at their height, but employment decreased dramatically between 1935 and 1943, falling from 1061 to 530. Following a World War II build-up to more than 750 miners, employment plunged again between 1946 and 1954 to just 135. In the early 1960s, workers in the mines numbered less than fifty and production was less than 34,000 tons. Strip mining in a few locations since the 1960s has produced relatively small amounts of county coal and given employment to one or two dozen workers at its height. Two companies presently strip mine on the east side of the coal field, in the vicinity of Woodvale.

General Manufacturing

The existence of the silk industry in Huntingdon had significant consequences during World War II when the Defense Plant Corporation acquired the plant and installed Owens-Corning Fiberglas Corporation there to manufacture essential war materials such as insulating board for planes and ships, and yarn for aircraft wing liners and parachutes. The local pool of experienced textile workers was critical to the plan. Employment during World War II ranged between 900 and 1175. The important long-term result was the exchange of an outmoded product for a modern one with great future potential. Owens-Corning remains in the former silk mill buildings and is still the county's largest employer, with over 700 workers.

By 1956, the work force in the Mount Union mens clothing manufactory included ten times the plant's original number and, with one brick plant out of business and the others cutting employees, the garment factory's place in Mount Union's industrial structure was substantially enhanced. Repeated additions to the original plant have resulted in a block-long factory, now making ladies garments.

Conclusion

The industries of Huntingdon County have changed through the years. The once nationally prominent charcoal iron industry

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decreased and disappeared under the pressures of technology and economics. Other large extractive and/or production industries such as coal, glass sand and refractory brick which once produced in large quantities have reduced their operations significantly in recent years. Agriculture is still a dominant activity throughout the county. Some general manufacturing still operates mostly in the larger boroughs of Huntingdon and Mount Union.

The evolution of industry in Huntingdon County impacted the population and created a demand for transportation. The availability of transportation allowed for the economic profitability of industrial development through the 1930's. Industry and industrial development has decreased in Huntingdon County as technological, environmental and economic changes have occurred at a rapid rate throughout the twentieth century.

F. Associated Property Types

I. Name of Property Type Resources Associated with Iron Production

II. Description

III. Significance

IV. Registration Requirements

☒ See continuation sheet

☒ See continuation sheet for additional property types

G. Summary of Identification and Evaluation Methods

Discuss the methods used in developing the multiple property listing.

☒ See continuation sheet

H. Major Bibliographical References

☒ See continuation sheet

Primary location of additional documentation:

- ☒ State historic preservation office
☐ Other State agency
☐ Federal agency

- ☐ Local government
☐ University
☐ Other

Specify repository: _____

I. Form Prepared By

name/title Deborah L. Suci - Historic Preservation Specialist

organization PHMC - BHP

date July 1989

street & number Box 1026 State Museum

telephone (717) 783-5796

city or town Harrisburg

state PA

zip code 17108-1026

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I. Name of Property Type: Resources Associated with Iron Production

II. Description

During the eighteenth century, the production of iron was crucial to the potential of the developing nation. Huntingdon county was the heart of the nationally recognized Juniata charcoal iron industry which was in production from the 1780s through the 1910s. Presently, less than ten sites contain identifiable remains able to convey the historic magnitude of the industry.

Iron industry resources are a diverse collection of properties that represent the historic process of iron manufacture within the county. Properties within this type range from the solitary remains of an iron furnace stack, to the identifiable remains of an iron plantation. If more remains than an individual building or structure, district boundaries must be established containing all the identifiable resources which retain integrity that are associated with the particular site.

An iron production site in Huntingdon county might have consisted of all or part of the following: an iron furnace stack and/or forge building, associated storage facilities for charcoal and ore, an ironmaster's residence and related outbuildings, workers' housing, company store, iron mines and related transportation resources, stables, a blacksmith shop, an office, church, mill and sometimes a farm with its related outbuildings. Buildings such as workers' houses, farm managers' residences, schools, meathouses, blacksmith shops or storage sheds were generally plain construction of log or plank sometimes with a rubble foundation. Other buildings such as a mill, an office or a church may have been constructed of either wood, stone masonry or a combination.

All the elements necessary for an individual community to operate would have been provided in an iron plantation. Each production site was unique in its means of operation with maximum efficiency and therefore no two are laid out identically nor include all the same components. The physical relationships of the diverse elements of an iron plantation varied from site to

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site depending in part on the topography and geography of the location. While no identified iron production site retains all of its original elements, those components which retain sufficient integrity will be included in the site nomination.

The location of an iron furnace was very dependant on the available natural resources, particularly waterpower. Although the iron industry included many industrial processes that necessitated a variety of industrial structures, the prominent extant industrial structure at production sites is the iron furnace stack. These were generally located in close proximity to or partially built into a hill or cliff. Iron furnaces were limestone masonry structures with a square base, laid without mortar around a brick in-wall. Their height averaged thirty feet. Besides the tunnel head used to load the ore and fuel on top there were at least two arched openings at ground level for casting the iron from the furnace. Attached to the stack were other structures related to the industrial process such as the charcoal storage shed, the casting house and a bridge which led to the tunnel head to permit loading. As these attached buildings and structures were generally constructed of timber and very susceptible to fire, the remains if identifiable would be archaeological. With the exception of the piers for the bridge at Paradise Furnace, none of the above were identified as standing components in this survey.

The charcoal iron furnaces operated cold blast for the most part but after approximately 1850 some were converted to hot blast. Hot blast furnaces made more efficient use of the fuel by recycling the escaping hot air through pipes from the stack and forcing it back into the crucible, thereby increasing the temperature in the crucible. The conversion from cold to hot blast would have had a visual effect on the furnace during its period of operation, however, if the records do not specify the blast type and the remains do not indicate which process was used, chemical analysis of slag debris might indicate the type of blast. While there are several Huntingdon County furnaces that used the hot blast method of production such as Greenwood Furnace, it appears that most did not.

The forges and the iron mill buildings once associated with the iron industry in the county, having been constructed of a less durable material (i.e. wood frame or log), have long since

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disappeared. Iron forges were generally associated with a furnace production site but could be physically removed by some distance and were sometimes completely unrelated in ownership and management. For example, Barree iron works in Porter Township, when it was primarily a forge, serviced both Huntingdon and Centre Furnaces (the latter located in Centre County) while Greenwood furnace in Jackson Township was associated by ownership with Freedom Forge in Mifflin County although the two were located a great distance from one another.

An ironmaster's mansion was often by far the most grandiose building in the vicinity of an iron production site. Those that have been identified date between the 1780s and 1870s. They are typically symmetrical, center hall plan buildings with wings and typically Federal or Georgian style. The identified buildings vary in their construction material between stone, brick and wood. The mansions were an expression of the wealth and prosperity of both the investor and the industry. Some of the houses were enlarged and remodeled as financial circumstances permitted, sometimes a new mansion was built to replace an older one which might be reused as an office.

Housing for employees was provided by the iron companies. Most were log or plank, constructed of materials available on the furnace lands, sawn at their saw mills, and erected by the variously skilled furnace hands. While a few remain standing in close proximity to an iron production site, it is common to find their stone foundation remains lying in regular rows or roads in the vicinity of the industrial operations. Those extant buildings that have been identified have acquired additions or fenestration change and sometimes the whole structure was moved.

III. Significance

These iron resources are important because of their association with the regional theme of the Juniata charcoal iron industry specifically in Huntingdon County. The length of time iron was produced in the county, 119 years, combined with the comparative extent and size of production facilities emphasizes the relative importance of this industry not only within the county but also within the state. The plantations and iron production sites communicate the magnitude of iron production activities as well as the development pattern of iron related

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sites in the county and therefore qualify under criterion A. Properties significant within an iron industry theme under criteria A have been evaluated against other properties at the local level.

Iron production sites that can be directly associated with an individual who contributed to the development of the iron industry in the Juniata region or the Central Pennsylvania area may be eligible under criterion B. For example, the remains of iron resources associated with the first ironworks operated by Dr. Peter Shoenberger who later attained the recognition of his peers as a significant individual in the field, will be considered under criteria B. Criterion B resources were evaluated against others at the local level.

Ironmaster's mansions may also be eligible under Criterion C as locally significant examples of architecture, particularly Federal and Georgian style architecture. Colerain Forges mansion, for example, reflects criterion C for its embodiment of the Federal style of architecture. Individual ironmasters' mansions may be significant under the themes of industry as well as architecture and were evaluated against others at the local level.

As the majority of iron sites will be historic districts, archaeological components may contribute to the eligibility of a site under criterion D if archaeological research has the potential to provide information regarding the important theme of industry, specifically on the historic use of the site. For example, the foundation remains of workers' housing may provide information pertinent to understanding the life of a furnace employee or the slag or debris associated with an iron stack may be analyzed to determine the chemical process that took place. These resources may be significant under the themes of community planning and development and historic archaeology. They were evaluated against others at the state and local level. Other non-archaeological sites may be significant for their potential to yield information on the theme of industry under criteria D for association with iron related resources; for example, the tram right-of-way at Greenwood Furnace which links components of the iron plantation. These resources were evaluated at the local level against others.

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IV. Registration Requirements

Iron related resources may be eligible individually or as part of a district. One structure or building may be eligible if the integrity of historic association, location, material, design and setting are sufficiently intact to convey the relevance of the site to the county iron industry. The remains of a stack may also be a contributing component of a historic district/iron plantation even if the condition of the stack is less than a complete structure. The historic association of the structure or stack to the iron industry must be evident through historical documentation such as historic maps, tax records, company notes or local histories.

Subtype:Furnace Stack

Furnace stacks or the remains of them are the most prominent and readily identifiable iron related resource. The exact locations of many of the associated community and extractive components might be indeterminate with available historic information, therefore, an individual stack may be nominated as the only remaining component of a once extensive site, or as one of the few examples of the magnitude of the iron industry within the county. The standing remains of an iron furnace stack must have enough visual integrity to be distinguishable as to its historic association with the iron industry. At some sites past stabilization efforts may be apparent in the later placement of mortar between the stones of an iron furnace stack. The furnace stack may still be eligible although it has been reconstructed and mortared if the location, setting, design and association with the historic operation is still intact.

A furnace stack is not eligible when the site of an iron furnace has been identified through historical research but the stack no longer retains a physical appearance that clearly defines the historic use, or when a stacks location as well as the location of associated resources cannot be identified due to disturbance of remains.

Subtype:Ironmasters Mansion

The house of an ironmaster or owner must retain integrity of design and material from the period of operation of the industry or occupation of the individual. If an ironmasters' mansion had major additions or alterations these must have been constructed

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during the period of significance. In order to be eligible under criteria B the construction and/or ownership of the building by a significant individual must have taken place during that individual's period of impact on the industry. The historic association of the house with an individual significant in the iron industry must be shown through the historic record. An ironmaster's mansion may be individually eligible or contribute to an iron plantation historic district.

Subtype:Iron Plantation

The remaining elements of an iron plantation will vary from site to site. The contributing components of an iron plantation or production site must retain a general overall integrity of association with the iron production facility. Each building or structure must also retain integrity of materials, location, setting and design. The contributing elements must date from the period of operation and occupation. Many components of an iron plantation or production site may no longer be standing but it is possible that their archaeological components may contribute to a historic district if their integrity of association and setting within the plantation can be identified through visual examination and their historic function and association with the larger district clarified. Non-archaeological sites such as mine tailings and tram right-of-ways must retain integrity of association, location, and setting. The historical association of the different contributing components of the iron plantation with the Juniata charcoal iron industry must be apparent not only from the physical appearance but also from the historic records of the site and the industry.

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I. Name of Property Type: Resources Related to the Refractory
Products Manufacturing

II. Description

A refractory product is a ceramic material which is resistant to high temperatures. The demand for high quality refractory products increased during the nineteenth century due to changes in the technological production of iron, steel and glass industries. The geologic formations of Tussey and Jack's Mountains in northern Huntingdon County contain important sources of white refractory clays necessary to produce refractory cement for furnace linings. Of the historically documented refractory clay production sites only one was identified through the HAER survey. It was located outside of Alexandria and was scheduled for demolition. However, Huntingdon County's most significant role in the refractory industry began at the very end of the nineteenth century with the commencement of the production of refractory brick. Both Tussey and Jack's Mountains also contained large quantities of ganister rock necessary for the production of refractory brick. Properties for the production of refractory brick operated in Huntingdon County between 1899 and 1939. Three were located on the west side of Jack's Mountain in Mount Union, and one by Tussey Mountain in Alexandria.

The various buildings and structures necessary for the production of refractory brick comprises a refractory. Many refractory associated structures and buildings were constructed of brick. Good size additions were frequently made to standing buildings and structures as the operations expanded. These structures would generally include a large refractory brick molding and drying works building constructed of brick; beehive or other shaped kilns of the same material; and adjacent storage and shipping sheds framed of wood or metal and covered but open on the side. A series of crushing and screening facilities may stand, often constructed of frame with corrugated metal covering and connected by conveyors to carry the raw material. Another possible component may be an adjacent or closely associated rock quarry which could extend into the manufacturing site proper such as at the Harbison-Walker works in Mount Union. Conveyors connected the crushing and screening operations, the storage silos, and the mixing and molding areas.

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Other components which may be found within a refractory works are a dust/mortar mill complex; a carpenter shop, used for the fabrication and assembly of carefully shaped molds; a mule barn, used to haul the raw material in the early days; and office buildings. A refractory brick production site could vary in size from approximately 7 acres at the North American Refractory Company to more than 14 acres at the Harbison-Walker Refractory Company both in the Borough of Mount Union.

The placement of the buildings and structures for these various processes was determined through knowledge of the process, the methods by which the raw materials were acquired, and common sense. For the most part, storage sheds line the periphery of the operation, close to the kilns and the transportation lines; the molding and drying, or main works are located with good access to the kilns; the crushing and screening facilities connect with conveyors which lead from a quarry or transportation receiving station to the main works.

Fuel was a critical element in the production of refractory brick. The brick must be baked at specific temperatures for precise periods of time according to mixture. The earliest kilns in Mount Union used coal, transported via the East Broad Top Railroad from the Broad Top coal beds, for fuel. With the coal strikes of the 1930's, the supply of coal became unreliable and the refractories turned to oil and then gas as a cheaper and more reliable fuel. The extant kilns in the refractories often reflect this change by the bricked over doors once used to insert coal and the addition of various piping around the outside of the kiln for adaptation to the fuel change.

The process involved in the manufacture of refractory brick was not fundamentally different from other kinds of brick production: all required extraction of a raw material; preparation of that material by washing, screening, crushing the ganister rock; mixing it into a "mud" capable of being molded into bricks or other shapes; air drying the shapes; and, finally, burning the shapes at temperatures appropriate to the material and ultimate use.

Conditions were conducive to industrial expansion in Mount Union and the refractory brick industry grew with unanticipated speed. The borough was initially unprepared to house the sudden

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influx of workers. In order to operate the three refractory plants in Mount Union, the industry found it necessary to maintain housing for their employees. Each company offered a different solution to the housing shortage problem. Company owned houses were built in Mount Union near the operations for employees. The survey identified a group of General Refractories constructed residences. These were generally two story, balloon wood framed construction. Although it is recognized that Harbison-Walker constructed company houses on the side of Jacks Mountain none were identified in this survey. They were demolished by the company when mining expanded along the east side of the mountain.

III. Significance

These properties date between 1899 and 1939 and are significant on a state and local level for their association with the highly esteemed Mount Union refractory brick industry. The structures and buildings of production facilities that represent the industrial process that functioned there have significance under Industry and will be eligible for the National Register under Criterion A. The community resources communicate the efforts of a rapidly expanding and developing industry to resolve its own housing dilemma. These groups of buildings will qualify for the National Register under Criterion A for their close relationship with Industry as well as Community Planning and Development; and Criterion C if, as for Kistler, they represent the work of a noted individual such as the landscape architect and planner John Nolen.

The extant remains of a refractory brick complex are significant as a reflection of the development and expansion of the industry at a local and state level. The prominence of the industry in the county is evident in the construction and rapid development of three refractory brick plants in Mount Union and the one in Alexandria during the short period after 1899. Their subsequent expansion and growth before 1939 is evident in the general dates of construction assigned to different buildings and structures. The importance of the production site and its relationship to the necessary raw materials of ganister rock and coal as well as the essential transportation networks is visible in the plans of the sites.

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The planned community, designed and constructed under the auspices of an industry for the ultimate convenience of the company and the employees, illustrates the recognition by industry and society in the early twentieth century that in order to attract and maintain a competent workforce adequate housing must be made available. In the Borough of Kistler, the building types designed and named by Nolen and constructed by Mann and MacNeill reflect a change in the concept of company housing visible in the earlier coal company towns by including a variety of styles mixed throughout the community. The importance of neighborhood is evident in the placement of housing around a central locale where community buildings such as the store, parks, the community center and firehouse were originally located.

Kistler is triangular in shape, fitted into a flat expanse of land next to the Juniata River. In 1919 it held approximately 70 single family residences, 23 duplexes, and 12 quads as well as two fire houses, a community hall, a park, a company store/school, a pool hall, parks, playing fields and a school/library. Single and double family housing extended along the river and the state route. Four family houses were located further south along the river. The non-residential buildings and spaces were centrally clustered between the two groups of single and double houses along the state route.

IV. Registration Requirements

These resources must be documented to have association with the refractory industry in Huntingdon County in order to be nominated to the National Register. They may retain integrity of location, design, setting, materials, feeling, and association; and fall into one of the following subtypes: refractories and community resources.

subtype:Refractories

Resources under this subtype will be historic districts. All components once associated with the resource might not be included in a nomination due to demolition or loss of integrity. However, those that retain sufficient integrity of location, setting, materials, feeling, and association to contribute to the eligibility of the district will be included.

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Although portions of the refractories may have been altered or removed due to the maintenance, removal or reuse of machinery or structures, those that remain must retain enough physical integrity to portray the industrial activity historically associated with the site. Those contributing buildings and structures that survive must be in their original configuration and retain the feeling and character of the industrial production site. It is possible that with the continued use of the site new additions that do not contribute may be found within the district. Identifiable remains of kilns and storage structures which once dominated the facility and the extant structures from the description necessary for the production process must survive.

subtype:Community Resources

A planned community may retain integrity of location, design, setting, material, feeling and/or association with a refractory company. A community nomination must include all the remaining residential and community buildings which stand and that contribute to the character of the resource such as a school, residence or a store. Resources under this subtype will be historic districts. Although individual structures or features of a district may have had alterations such as the addition of a dormer, the enclosure of a porch, or the replacement of siding or the complete removal of a building or structure due to continued use of the community, those that remain must have sufficient integrity to reflect the original character of the overall resource. If the resource is associated with a planner, the original design must be identifiable.

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I. Name of Property Type: Resources Associated with
Transportation

II. Description

Transportation resources are those properties which were historically associated with the movement of people, manufactured goods or raw materials necessary for industrial processes within the county. The properties date from the arrival of the first Europeans in the 1780's through 1930's. These resources represent the historic transportation networks such as roadways, the Pennsylvania canal, the Pennsylvania Railroad and other railroads that ran through the county. Transportation resources may be associated with historic industries or only with the transportation industry.

Transportation improvements are first evident in the construction and maintenance of private turnpikes and local or state roadways through parts of the county. The earliest industries within the county depended on improved roads to export the products. The roads began as trails that were improved by widening and clearing. The right-of-ways were peppered with associated components such as toll houses and bridges. Early bridges were constructed of wood or stone but were subject to frequent flooding. These were replaced as necessary by stone arch, metal truss, concrete or, in one unusual case, by a suspension bridge. While bridges still stand in the same location on right-of-ways, they have frequently been improved or replaced in recent years. The HAER survey identified one suspension bridge, one covered bridge and five county owned metal truss bridges (three of which were Pratt through trusses and two Pratt pony trusses), and seven concrete arch bridges. Toll houses were built of timber or stone, however, no extant structures were identified.

In 1827 construction was authorized for the Pennsylvania canal and in 1832 the Juniata Division was completed. In part located and built in response to industrial demands, the canal was associated with the development of the Juniata charcoal iron industry. Features related to the operation of the canal included dams and locks and feeder canals and the canal bed. Canal locks and dams and feeder canals were typically constructed

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of stone although some may have been lined with plank at one time. The doors of the locks were plank. Only one canal lock was identified during this survey. The canal right-of-way consisted of an earthen ditch often located in close proximity to the river. Canal associated structures and buildings identified in the survey include the Lloyd and Henry warehouse built by the railroad but placed between the canal and the railroad in Huntingdon Borough for the transfer of cargo. Warehouses in general were rectangular and heavily constructed of stone, brick or wood, which were located immediately adjacent to the right-of-way. The survey did not identify any warehouses constructed for use only by the canal although one still stands in Mount Union which is owned and run as a museum by the Mount Union Historical Society. Many sections of the canal were abandoned then filled after acquisition by the Pennsylvania Railroad. Some associated structures such as warehouses or lockhouses were either abandoned or adaptively used. No lockhouses were identified during this survey.

The Pennsylvania Railroad completed its line through to Huntingdon in 1850. Engineering features associated with the railroad right-of-way were tunnels cut into the mountain and bridges, originally of wood or metal but replaced by masonry construction bridges. These have been in active use, subject to repair and replacement through the present and, therefore, are not uncommon. They represent the change in bridge engineering over the years. The survey identified sixteen stone arch railroad bridges built between 1886 and 1907. Most have been widened and reinforced with concrete. Also identified were an 1850 and 1900 railroad tunnel, the latter was constructed when the right-of-way was four-tracked.

Other railway resources are freight and passenger stations as well as warehouses constructed by, or in league with the railroad. The warehouses were rectangular structures heavily constructed of wood, brick or stone and located immediately adjacent to the right-of-way. They might have contained offices as well as storage space. Three freight stations and one warehouse were identified in the HAER survey. The freight stations were abandoned although one was recently moved and is used as a museum at the county fairgrounds. The Lloyd and Henry

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warehouse was moved following the 1889 flood is still used as a warehouse along the railroad.

The appearance of the Pennsylvania Railroad in the county promoted the construction of spur lines leading from industrial production facilities to the mainline. Two small private rail lines that coupled with the PRR mainline were privately financed by investors in the coal industry. The resources were the Huntingdon and Broad Top Mountain Railroad, which ran from Saxton to the borough of Huntingdon and the East Broad Top Railroad, a narrow line which ran from Wood to Mount Union Borough. Both of these connected with the Pennsylvania Railroad at their northern terminus. The right-of-way of the East Broad Top Railroad is for the most part intact and is a National Historic Landmark. Only a few railroad trestles remain to denote the right-of-way of the Huntingdon and Broad Top Railroad.

III. Significance

The significance of transportation resources to the county is in their ability to communicate the growth and development of local industry and its changing demand for an increasingly sophisticated means by which to transport products and raw materials. These resources can also be important for their role in the development of transportation in the county and for their engineering significance. These resources must have been constructed and in use between the 1780's and the 1930's. Transportation resources may qualify for National Register listing under criteria A, C, or D, individually or in combination and represent the themes of transportation, industry or engineering.

Transportation resources significant under Criterion A represent important themes in the development of state or local transportation networks such as the construction of private turnpikes, the Pennsylvania Canal or the Pennsylvania Railroad through Huntingdon County. These resources would have been used in the transportation of goods, raw materials and people. Transportation resources may also be directly associated with industries identified as significant in Huntingdon County, for example spur railroads owned and operated by local coal companies

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or railroads which transported iron products. Properties significant under Criterion A have been evaluated against other properties at the local level.

Transportation resources are significant under Criterion C when they represent important theme of engineering. For example, a stone arch bridge may represent a rare survivor of an important method of bridge engineering practiced at a specific time. These resources were evaluated against others at the local level.

Finally, transportation resources are significant under Criterion D for their potential to yield information on important themes of transportation, engineering or industry. For example, the remains at the feeder canal lock and dam may yield information regarding the construction methods or engineering used on the Pennsylvania Canal through Huntingdon County.

IV. Registration Requirements

In order to qualify for listing the transportation resources must have been used by the transportation industry or by another industry for the transportation of county produced goods or the transportation of raw materials and people. The properties must be intact examples of one of the identified subtypes; road resources, canal resources or railroad resources. Many bridges associated with roads or railroads have been maintained or replaced in situ before 1939 and are currently in use. Except where specified eligible transportation resources must have integrity of location, design, setting, materials and association.

subtype:road resources

Road bridges are eligible under Criterion A in the area of transportation if they served as important links in the local road network and in the transportation of goods, raw materials, or people within the county. The historic materials, form and setting of the bridge must be intact.

In order to be eligible under Criterion C in the area of engineering a bridge must be an example of a bridge design that

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was important in the construction of bridges in Huntingdon County. Those properties eligible for engineering significance should be considered even if alterations to form and materials exist so long as the significant engineering design is prominent and intact.

subtype:canal resources

The remains of a canal right-of-way or structural components must be visually evident and any disturbance that may have occurred must not have compromised the potential for the site to yield information relevant to the historic use or engineering of the site. Canal resources must retain integrity of location, design, materials and association. Canal resources eligible under Criterion A must be associated with an important transportation route or industry in the county such as the Pennsylvania Canal. A portion of a canal right-of-way must retain the visual appearance of an earthen ditch in order to be considered for eligibility under Criterion A. For the same criterion a enough of the stone walls of a lock or dam must stand to represent the original function of the feature. Log planking which may have been associated with a canal resources need not remain in order for the resource to be considered for listing.

The abandonment of the canal has resulted in the natural deterioration of the individual components. In order to be eligible under Criterion D, a canal resource must be able to yield information on the historic functions or engineering of the canal. Canal resources must also retain original materials, setting, and configuration to be eligible under Criterion D.

Subtype:railroad resources

The historic right-of-way completed by the Pennsylvania Railroad in 1850 for the most part is presently in use by Conrail, thus the significant features associated with the operation of the line have, by necessity, been subject to continuing maintenance, upkeep or replacement as necessary. Other railroad resources may be associated with local industry that operated rail lines as part of their operations such as the East Broad Top Railroad by the Rockhill Iron and Coal Company.

In order to be eligible in the area of transportation under

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Criterion A railroad resources must be in important link in the local railroad network or in the transportation of goods and people through or within Huntingdon County. In order to be eligible in the area of industry under Criterion A, railroad resources must be associated with a locally important industry such as the coal or coke industry. To be eligible in the area of engineering under Criterion C, railroad resources must be an example of a bridge or tunnel design that was important in the construction of bridges and tunnels in Huntingdon County; or be an example of engineering needed by railroad companies in overcoming mountainous terrain in western Pennsylvania. As part of the Pennsylvania Railroad's efforts to maintain or increase carrying capacity on bridges in Huntingdon County, the Pennsylvania Railroad reinforced bridges in Huntingdon County with concrete during the first decades of the twentieth century. The concrete reinforcing is considered as contributing to the historic significance of these bridges; this reinforcing enabled the Pennsylvania Railroad to continue its important role in local and regional transportation to 1939. Pennsylvania Railroad tunnels similarly remain eligible for the National Register even though two of the four tracks constructed at the turn of this century have been removed. The railroad track and bed remain eligible as long as the original alignment and grade of the bed and track have been maintained. The railroad track and bed are eligible even though ties and rails may have been replaced; such replacements are considered essential to the continuing operation of the railroad line. Railroad resources were evaluated at the local level.

Warehouses constructed by the Pennsylvania Railroad must retain their proximity to the right-of-way as well as their original design and construction material in order to be eligible under Criterion A for association with the transportation industry. They may also exemplify the use of the railroad by a significant historic industry. For railroad warehouses eligible under Criterion C for their engineering significance it is not necessary for them to retain their original location as long as the original setting, association and engineering features have been retained.

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I. Name of Property Type: Resources Associated with Coal and Coal Mining

II. Description

Historic resources directly related to the extraction of coal in Huntingdon County may include but not be limited to mine shafts with openings of wood or concrete, coal tipples of wood or metal construction, engine houses of wood with concrete foundations, ventilation buildings, blacksmith shops and a right-of-way for rail transportation. These will generally date to the end of the nineteenth and the early twentieth centuries. As a profitable coal vein was exploited expansion was common. Rail lines were generally added after the profitability of a coal mine had been verified. The right-of-way was often centrally located at the extraction site with trails leading from the mines to the rails.

HAER identified two coal company towns; Robertsdale and Wood during the recent survey. The remains of the coal extraction site associated with Robertsdale were identified and the mines and coke ovens associated with Minersville, Carbon Township. Although several other coal company towns are known to exist in Huntingdon County, they were not inventoried by HAER at this time and no separate coal extraction sites were surveyed.

The relationship of the components of a coal extraction site will vary according to the physical environment of the site including the location of water, the coal seams and the best economic and topographic location for the rail right-of-way. The abandonment of most of these sites with the end of mining activity resulted in the demolition of many structures and the stripping of machinery. Those elements that were not demolished such as coal tipples have been subject to slower deterioration by natural elements. That which remains of the individual components can sometimes be identified through historic maps or interviews. The location of poured concrete foundations or equipment bases may help to explain the use of sites. In this manner the site use or activity pattern can be identified and plotted.

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In addition to the extraction of coal, and associated with it, were coking ovens. A coke production site may consist of, but not necessarily be limited to, a series of coke ovens with the remains of a rail right-of-way through, and extending from them. Coke production sites will generally date between the 1870s and the 1940s. The standing or below ground remains of ancillary buildings or structures such as an office, a coal tipple or a mine shaft, may survive in close proximity to coke ovens. Coke ovens used in Huntingdon County were generally beehive or Belgian design although records indicate that a Mitchell oven design was under construction in Minersville.

The kilns were located in one or more banks or rows with between ten and fifty ovens each and were always immediately adjacent to rail lines for the loading of coal and the removing of coke. Beehive and Belgian coke ovens consisted of a firebrick lined arch with a round hole for charging of fuel and venting of waste gases; and an opening in the side for removal of the coke. Limestone masonry encompassed the refractory brick in a beehive shape and with the assistance of metal tie rods tied them together. In most cases the outer stonework is presently missing for it was not mortared together. The rail right-of-way may run between two banks of coke ovens or on either side. The right-of-way was linked with the source of coal or the destination of the coke. The Mitchell ovens were square brick structures with poured concrete bases. As well as retaining a direct relationship with the coal industry, a coking site may be linked with an iron production facility.

Remains of the two beehive oven sites identified in Huntingdon county are considerable in light of the date of abandonment: 1908 at Rockhill and about 1925 at Minersville. Both sites appear relatively undisturbed, with the exception of trees whose roots have undermined the structures. The Minersville site also includes the foundations of a bank of the Mitchell ovens, begun in the 1920s and abandoned before completion. References to the Mitchell ovens are undetailed and incomplete.

An important component of the coal industry, although not part of the production facilities, was the community that supported it. Company housing or company towns associated with

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the coal industry in Huntingdon county were constructed and owned by the mine owner or company. They were located in close proximity to the mine head for convenience and economy and were generally laid out on a vague grid plan or occasionally completely irregular plan.

Two coal company towns have been identified in Huntingdon County by HAER to date, Robertsdale, which dates to 1874 and Wood or Woodvale, dating to the early 1890s. The historic relationship between the coal company patch or town and the mining operations is reflected in the physical relationship between the two towns, between each community and its industry, and in the planning and construction of the community buildings and dwellings.

The original houses in Robertsdale and Wood were semi-detached two-story structures with gable roofs, symmetrically placed windows and doors, and main entrances frequently on non-gable ends. They were constructed of wooden plank with brick chimneys and large yards with outhouses behind. The later houses introduced different sizes, shapes and roof types: pyramidal and hipped roofs, shed-roofed wall dormers, and a small number of bungalows with clipped gables. All but the bungalows continued to display the company's preference for duplex housing. Their construction has not been examined, but the later houses are likely to be balloon-framed, rather than plank. In time, the town acquired more variety in the appearance of its structures, as the original houses were enlarged by one and two-story additions to the sides and rear and as the company expanded the town to accommodate additional workers.

Minor variations in house layout and design define several house types in Robertsdale. These will be defined at a later date. All but one of these house types can be found in Woodvale. Woodvale also had two or three types, with multiple examples which are not found in Robertsdale. In both towns, houses of the same type tend to be grouped together. In conception, Woodvale's plan resembles Robertsdale's -- a rough grid and a pre-existing road -- except for Woodvale's Fulton Street, added about 1915; it winds along Great Trough Creek with nearly thirty houses arranged along just one side of the street. Both Robertsdale and Wood were constructed by the Rockhill Iron and Coal Company.

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III. Significance

The extraction of coal from the Broad Top coal beds was taking place before the 1830's. With the completion of the Pennsylvania Railroad in 1850 which was soon followed by the construction of the Huntingdon and Broad Top Mountain Railroad in 1855, commercial mining expanded rapidly on the west side of Broad Top. Exploitation of the resources on the east side was activated by the completion of the East Broad Top Railroad in 1874.

Coal extraction and coke production facilities are eligible under Criterion A in the area of industry for their association with a historically significant industry in Huntingdon County. When historic documentation or physical remains reflect the presence of a technological change or advancement in the methods of extraction or production of coal or coke at a site, the resource may be eligible under Criterion C. A resource may also be eligible under Criterion D in the area of historical archaeology for their potential to yield information on the scale and methods of operation of the extraction and production facilities at any particular facility in the county. For example, the study of the arrangement and identification of foundation remains at a coal extraction site can identify the industrial relationships of buildings and structures necessary to operate a type of coal mine efficiently under specific topographic conditions. The lack of efficiency of operation may also be identified.

Coal community resources are eligible under Criterion A in the area of community development for representing how a coal town was planned and laid out by a coal company. It can also demonstrate what services and amenities various workers obtained in a coal town. These resources are eligible under Criterion A in the area of industry for association with a significant industry. Coal community resources may also be eligible under Criterion C in the area of architecture for representing various "types" of coal company housing in the county.

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III. Registration Requirements

To qualify for listing under Criterion A and/or D, the resources must be associated with the development and operation of the coal industry in Huntingdon County. Because of the nature of the coal industry with its many activities, most resources associated with the industry will be eligible as part of a historic district.

subtype: Production Facilities

Coal extraction and coke production sites frequently have been stripped of that machinery and materials that could be reused upon closure. Many times these sites were abandoned and left to deteriorate.

Coke production sites are eligible under Criterion A and/or D if the remains of the coke ovens can be visibly identified, and some of the adjacent building or structure remains such as rail transportation components, or mine shafts or tipples with which association with the industry can be documented. All identified, associated components should be included within district boundaries if association can be documented. The integrity of the coke ovens and associated buildings and structures may have suffered from physical deterioration by weather or stripping of metal and stone components for reuse and/or scrap. However, if their historic use is still evident or has the potential to yield information the resource is still eligible.

The sites of coal extraction should retain integrity of setting and association. Due to the transient nature of the extractive process, buildings and structures associated with the mining activity have been subject to deterioration and/or salvage. The remains of associated resources no longer standing but visibly identifiable with the potential to further our understanding of the site or process may be included as a component of a district. These remains may include but not necessarily be limited to stone or concrete foundations, portions of brick walls, concrete pads, wooden coal trestles and rail right-of-ways. An eligible historic district may include both production facilities and community resources.

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subtype:Community Resources

These resources will be evaluated as historic districts. They must have been planned and/or constructed either by a coal company or demonstrate historic association with a company that extracted or processed coal or coke. Residential or commercial structures that can document association with the coal industry but which were privately owned will may included as contributing elements of a district.

Community resources historic districts must retain integrity of design. If the layout of the community was deliberately designed the original plan must be evident. If the town developed piecemeal as economic or industrial expansion dictated, this too must be reflected in the existing design of the town.

As company owned housing was generally repetitious if not identical in an effort to reduce cost it is likely that changes will have occurred to separate structures as occupants individualized their living spaces. These changes may include but not be limited to new siding, porch additions, porch enclosures, and the transformation of duplexes into single family residences. If such changes change the physical character so that the resource no longer resembles its original appearance and use, the building may be identified as a noncontributing component of the district. If buildings in a section of, or the whole town have been subject to physical changes that have altered the character of the town or a section of it, that section or the town may be determined not eligible. The feeling or character of the community must be evident by the retention of the physical appearance and relationship between the individual components.

The proximity of the related production facility must be documented although the production facility may not itself be eligible or still remain. Where both the community resources and the production resources have been identified the historic district may be comprised of both.

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I. Name of Property Type: Hydro Powered Resources

II. Description

Water power was utilized in Huntingdon County from the first settlements through the present day adapting to technological changes when economically feasible. This power served many industrial purposes such as powering iron furnaces or forges but the resources addressed in this property type were used to grind the locally produced flour and feed or later to generate electricity in Huntingdon County. The mills that remain standing in the county reflect a late nineteenth century change in mill technology from grindstones to rollers. The hydroelectric dam and plant was constructed just after the turn of the century and the dam represents the first of its design in the country.

The mills that survive in Huntingdon County are generally three plus stories, frame or timber post-and-beam structures with a concrete or stone foundation and a small fourth story section generally protected an elevator. Only one example of a three story stone mill was identified, it is located in an iron plantation historic district and has a later timber addition. The extant mills may have originally operated by waterwheel or turbine or steam, however, if they are still in operation the power source has changed to electricity. Some surviving mills will be included as contributing components of some iron plantation historic districts. In some cases the remains of a millrace may lie undisturbed and should be included as contributing to the resource. The remains of a millrace may be an earthen ditch leading from a watercourse to the mill and back to the watercourse. If it survives, a millrace is generally overgrown with weeds and dumped refuse. Those at Juniata Iron Works Historic District form one edge of the district boundary.

Some feed or grist mills may retain some or all of the following machinery: a grain bin, hopper, shoe, damsel, flour and/or feed mills, water wheel, pulleys, shafts, elevators and/or hoists, diesel engine, separator, feed mixer, feed grinder, cockle machine, or receiving separator. These machines were not all in use in every mill.

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Nine grist mills or remains survive in the county: three in operation, two adaptively used, one vacant but well-maintained, two empty and decaying, and one which has been in ruins since 1879. Only three of these were identified as eligible resources. The Shade Gap Mill, built in 1846, is the oldest of the operating mills and is of particular interest because its 1900-era milling equipment remains in place. The Andrews Mill in Mapleton, built in 1914 as a feed mill, retains much of its original appearance and equipment. Once some mills were no longer used or needed for the grinding of grain they were subject to physical adaptation such as the removal of milling machinery and replacement with generators used for local production of electricity. The mill in the Juniata Iron Works Historic District is an example of this.

In order to harness the water power necessary to operate the mills, dams were constructed. Dams were also a component of the development of hydroelectric plants used for the mass production of electricity for industrial, commercial and later private use. The control of water flow by dams was used to convert the energy of moving water into mechanical power. First, waterwheels were used for this purpose like those on an early gristmill, then these were replaced by the smaller and more energy efficient turbines. Electric generators were developed in the late nineteenth century. The rotary motion of the turbine, when connected with an electric generator, produced electricity. This last development promoted the formation of hydroelectric plants for broad commercial and industrial use.

The technological development of dam engineering played a crucial role in the exploitation of water power by increasing the potential head of water that rotates the wheel or the turbine. Huntingdon County has two hydroelectric dams. The Raystown Dam was constructed by the Raystown Water Power Company in 1910 and rebuilt by the U.S. Army Corps of Engineers in the 1960's. It creates Raystown Lake extending south from Huntingdon Borough. Warrior Ridge Dam and Power Plant was constructed in 1905-07 by the Juniata Hydro-Electric Company of Philadelphia. It is a reinforced-concrete, flat-slab Ambursen buttress dam. In order to insure homes for their employees the company constructed four

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company-owned frame houses and a church which still stand. The power plant was put out of operation in 1972 as a result of damage by tropical storm Agnes. Reconstruction operations began in 1979 which included demolition of auxiliary buildings and part of the powerhouse.

III. Significance

Grist mills are eligible under Criterion A in the area of industry for association with a locally important industry. They may also be eligible under Criterion C in the area of engineering for representing machinery in use during the late nineteenth and early twentieth centuries.

Agriculture and iron production developed at virtually the same time in Huntingdon County history. The early iron plantations constructed sawmills and gristmills to provide their own needs. The high productivity of the soil generated a surplus to ship to eastern markets. Ground grain transported better and was less expensive to ship than whole grain, therefore mills became increasingly important through the nineteenth century. Nineteenth century canal records reflect the production of a surplus of agricultural products in the county. Mills were evaluated against others in the county on a local level.

Hydroelectric facilities are eligible under Criterion A in the area of industry for an important industry that provided power to Huntingdon County industry, commercial enterprises and homes. They are also eligible under Criterion C in engineering for representing an important type of dam construction. Company houses at hydroelectric facilities are eligible under Criterion A in the area of industry. The electric company participated in an industry wide practice of constructing housing in remote areas for workers who operated and maintained their dams.

IV. Registration Requirements

Hydraulically powered resources must have been constructed fifty or more years ago in Huntingdon County in order to be considered eligible for the National Register. They must also

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retain integrity of setting, design, materials, feeling and association.

The continued use of a mill may have resulted in changes or adaptations to the resource. It need not still function as a grist mill if the physical integrity is intact. A mill may still be eligible if its original power source has changed, for instance from waterpower to steam or electric power. If a mill is eligible under Criterion C for engineering it must retain a sufficient portion of its original machinery to represent the process. A mill may also have additions which reflect the growth of the enterprise, and still be eligible so long as the design of the original structure is still apparent and the feeling of the original resource is evident.

Hydroelectric facilities eligible under Criterion A and C may have lost some of the original buildings, structures and machinery such as some of the auxiliary buildings and power plants. However, the original design of the dam must still be intact.

Houses associated with a hydroelectric facility must retain their original design or character. As typical with company housing, the individual buildings and structures may have been altered by individual owners and still be eligible if they retain their original character. These changes may include but not be limited to new siding, porch additions, porch enclosures, and the transformation of duplexes into single family residences. If such changes change the physical character so that the resource no longer resembles its original appearance and use, the building may be identified as a noncontributing component of the district. The feeling or character of the community must be evident by the retention of the physical appearance and relationship between the individual components.

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The multiple property nomination for historic industrial resources in Huntingdon County includes the historic remains of industries that operated between 1780 and 1939. The nomination began as a cooperative effort between the Pennsylvania Historical Museum Commission (PHMC), the Historic American Engineering Record (HAER) and the National Register of Historic Places with the counsel of the America's Industrial Heritage Project (AIHP).

The project began with a survey of historic industrial resources by HAER in the summer of 1988. The documentation of name, location, dates, uses, constructor, material, structural system and machinery associated with the resources was gathered by the HAER historian. HAER also produced a written history of each identified resource and an overview of each industry type. The resources were photographed as a form of historical documentation according to HAER standards. The PHMC surveyor gathered information on the UTM coordinates, ownership, contributing and non-contributing components, function, notable features, areas of significance, associated persons, period of significance and significant dates. The existence of previous documentation as well as the primary location of the data was noted by both HAER and PHMC surveyors. Information collected by both agencies was combined and computerized in a Database III program created through the efforts of the National Register. National Register Registration Forms for nominated resources were generated directly from this database.

Resources that were documented by HAER were initially identified through review of earlier surveys. HAER had conducted an industrial survey in 1976 and the Huntingdon County Historical Society, assisted by a PHMC grant, conducted a survey of historic sites in Huntingdon County in 1978. Resources identified in these surveys served as a starting point but did not limit the HAER survey as new information and resources were identified. HAER documented a total of 78 industrial resources in the 1988 survey. The HAER survey was not comprehensive. Only county owned or private bridges were surveyed. In general, archaeological sites were not surveyed unless they were associated with standing resources. Although two coal company towns (Robertsdale and Wood) and one refractory town (Kistler) were identified, information on other workers' housing located throughout the county was not necessarily gathered. Robertsdale,

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Wood and Kistler are currently being documented by the Historic American Buildings Survey (HABS). At the time that information is completed, they will be nominated to the National Register of Historic Places.

HAER submitted their documentation of individual sites to the PHMC Bureau for Historic Preservation. This material was presented to the staff committee of the Bureau for Historic Preservation for National Register eligibility determination. The historic significance and integrity of each resource was discussed and considered. Generally properties were evaluated against other properties at the local level. National Register criteria and integrity requirements provided the basis for determining resources eligible for the nomination. Integrity requirements were lowered for properties which represented a rare but significant type or which had distinctive historical significance. In some cases the staff requested specific additional information and site visits by staff members in order to make a final determination of eligibility.

For most resources, site visits were made by a PHMC staff member prior to or immediately following an eligibility determination by the PHMC staff committee. Local informants were questioned when possible and historic maps and documents were compared with the site.

If a resource was identified as a historic district by the PHMC staff, a site visit was conducted by staff and a member of the Historic Preservation Board in order to identify boundaries. The staff examined the different components of the site in order to determine which contributed and which did not contribute to the eligibility of the site. Associated buildings and structures, site topography, legal boundaries, historic maps, and the presence of above ground historic materials associated with the resource were used to determine boundaries. Boundaries of historic districts were not restricted by the material collected in the HAER survey.

The HAER survey did not include investigation of autonomous archaeological industrial resources, therefore, the PHMC survey and subsequent nomination does not reflect the existence and knowledge of these resources. No subsurface testing was conducted, rather historic documentation and the visible surface

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remains of historic materials determined the contributing status of archaeological resources identified in association with a standing structure or building. The National Register boundaries of historic districts were drawn to include only those areas where visible historic resources exist.

Development of the historic context and property type analysis proceeded concurrently then continued after the eligibility determination of individual properties and historic districts. Property types were finalized by examination and comparison of the identified resources. The breakdowns were based on identification of the economically prominent industries that operated within the county. These included iron, coal, refractory brick, transportation and one catchall, minor industrial resources. The property types are associated with the overall historic context.

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Section E of the National Register Multiple Property Documentation Form for "The Industrial Resources of Huntingdon County, Pennsylvania, between 1780 and 1939" and the individual nominations contain material taken directly from the unpublished report prepared in 1988 for the Historic American Engineering Record (see bibliography).

The author of that report, Nancy Shedd, is a major contributor to the text of this nomination although not the preparer.