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Historical Summary and Archival Photographs

The Hanna Furnace Corporation and the Union Ship Canal

Buffalo, Erie County, New York (01PR0610)

Prepared for:

Development Downtown, Inc.
Buffalo, New York

Prepared by:

PANAMERICAN CONSULTANTS, INC.
Buffalo Branch Office

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Historical Summary
and
Archival Photographs

The Hanna Furnace Corporation
and
The Union Ship Canal

Buffalo, Erie County, New York

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1. Introduction

Development Downtown Inc., (DDI) has requested the City of Buffalo to amend and modify the City Zoning Ordinance and to establish the Union Ship Canal District. This action will encourage a controlled development of former industrial and railroad lands whose previous owners declared bankruptcy and abandoned the property. Revising the zoning regulations for this area will be a critical step in revitalizing this portion of the city, encouraging job growth, and returning these lands to productive use.

Pursuant to the New York State Environmental Quality Review Act (SEQR), a Draft and Final Environmental Impact Statement and the Findings Statement have been prepared and were accepted by the Buffalo Common Council on June 11, 2002.

The proposed Union Ship Canal District includes approximately 275 acres in southwest Buffalo. Approximately 114 acres will be transferred to the DDI, the city's economic development agency. This parcel is located immediately north of the Buffalo/Lackawanna border and immediately east of the Fuhrmann Boulevard. This land contained the Union Ship Canal and a few structural remains of the former Hanna Furnace Corporation Plant. It corresponds to the south end of the Buffalo Outer Harbor, immediately north of the Lackawanna/Buffalo border (Figure 1, Plate 1).

The Union Ship Canal – a former slip for bulk cargo carriers that is connected to Lake Erie - remains intact. The Hanna Furnace Corporation plant had been largely demolished between 1983 and 1985. This demolition involved removal of an extensive rail network as well as all structural elements pertaining to iron smelting, forming, and shipping. Similarly, all specialized rolling stock and most of the administrative and support buildings were also removed. However, as late as the summer of 2001, a number of partially demolished or dismantled structures still remained, all in an advanced state of deterioration. They included a machine shop, oil shack, oil storage building, locker room, filter house, trestle ramp, and furnace foundations. In April 2001, an independent consultant determined that the existing structures were "dilapidated, hazardous, poorly maintained and generally unsafe." (PTG 2001:12) The report also stated that "basements filled with fluid/water are drowning hazards" and that deformed beams and reinforcement bars are impalement hazards. The report documented evidence of vandalism and trespass and concluded that the site constitutes a "potential threat to public safety" (PTG 2001:12-13). In August 2001, the City of Buffalo concluded that the remaining buildings of the Hanna Furnace plant were structurally unsound and unsafe and were in danger of collapse. The city also determined that these ruins were being used for illicit and unsafe activities by children, teenagers, and adults, and that these activities could result in injury or death. The Commissioner of Permit and Inspection Services determined that securing and restoring these structures was not feasible. (Masiello, 8/16/2001; McGurn 7/2/2001). Consequently, the city undertook the demolition of the remains of the facility in the fall of 2001 and spring 2002.

As a measure of salvage documentation, the city of Buffalo contracted with Panamerican Consultants, Inc. (PCI), to take fifteen photographs of the existing structures to document the extant remains of the Hanna Furnace Corporation prior to demolition. Ecology and

Environment, Inc. (E & E) was contracted to generate a brief historical report documenting a general history of the facility. The data collection took place at the Buffalo and Erie County Historical Society, the Steel Plant Museum of the Lackawanna Public Library, the Buffalo and Erie County Public Library, and the office of the City Architect.

2. Early Iron Industry in Buffalo

During its early history, the Buffalo area was not significantly conducive to the flourishing of the iron and steel industry because it was not located in easy proximity to significant fuel or iron ore deposits, and lacked convenient means of communication with the parts of the country that had both (Entwisle 1945:94). Prior to 1826, the manufacture of iron in the Buffalo area took place in small local blacksmith shops that were sufficient to service the iron-related needs of the Niagara Frontier. The first iron foundry and machine shop with the first steam engine was established by Beals –Mayhew Company in 1826 - at the time of the completion of the Erie Canal - at the corner of Ohio and Indiana streets. In 1838, a Mr. Justin established a forge at the Black Rock Dam, and in 1841 the Buffalo Engine Works were established to produce engines for steamboats. Other iron works, including the Buffalo Rolling Mill and Iron Works built by Corns and Company, the Howard Iron Works, the Niagara Forge, and the E &B Holmes Machine Corporation were established in the area between 1846 and 1852. These early iron and steel industries in the Buffalo area depended on importation of raw iron *via* the Erie Canal from the Adirondack region or the eastern seaboard (Entwisle 1945:93 -94).

In the 1850s and 1860s, a number of factors pertaining to environment, economy, and human geography rendered the Niagara Frontier relatively more suitable for the development of a large-scale iron industry.

Construction of the network of railroads and the completion in 1856 of the Genesee River Canal (Holton nd: 3-6, 16) connecting the Allegheny River with the Erie Canal resulted in the availability of coal from the coalfields of Pennsylvania. Anthracite or bituminous coal was used as the fuel for iron smelting until the late 1870s (Entwisle 1945:24; Bethlehem Steel Company nd: 6). Limestone – the second critical ingredient in iron smelting - was abundant in the Niagara Frontier.

Located at the terminus of the Erie Canal, Buffalo was the beneficiary of numerous working-class European immigrants that were making their way from the eastern seaboard into the Great Lakes region and thus could offer a large workforce.

Enormous supplies of iron ore were discovered in the Lake Superior region in 1844 (Entwisle 1945:93) but did not become widely used for a number of years. However, with time, the availability of these ores that could be relatively cheaply shipped to Buffalo from Michigan played an important role in the development of the local iron and steel industries. Lastly, emergence of persistent businessmen and entrepreneurs was a significant factor in the development of the iron and steel industry. In 1848 Pascal P. Pratt – a third generation Buffalo businessman and senior partner in Pratt and Company - persuaded William. Letchworth of New York to come to Buffalo and form a company specializing in saddlery and carriage equipment. In the next decade, Pratt and Letchworth became involved in iron manufacture. In 1857, Pratt bought the Buffalo Rolling Mill and Iron Works, expanded it, and renamed it Buffalo Iron and Nail Works. The new enterprise contained sixteen puddling furnaces, nine heating furnaces, fifty nail-forming machines, a large blacksmith shop and a millwright shop. These works produced iron bars, nails, spikes, bands, and plates. They

employed 500 men and were among the largest enterprises of their kind in the world (Entwisle 1945: 4). Pratt and Letchworth also purchased the Buffalo Car Company and converted it into an iron and brass foundry. Following the construction of the second foundry, the company (renamed the Buffalo Steel Company) produced the first steel in 1861. In 1863 Pratt and Company built a blast furnace in Black Rock; this furnace supplied iron to the Buffalo Steel Company and The Buffalo Iron and Nail Works.

In 1861, Pratt was instrumental in forming the Union Iron Company. It built three blast furnaces, six rolling mills, and sixteen puddling furnaces. It could produce 100 tons of iron a day and 80 tons of finished product, including bar iron, girders, car axles, rails, and metal plate for Great Lakes ships. The Union Iron Company and the Buffalo Iron and Nail Works were abandoned in 1876 and 1885 respectively. However, in 1872 Pratt also organized a Niagara River Iron Company. It was eventually sold to the Tonawanda Iron and Steel Company in 1889.

A hallmark date in the development of the local industry was 1899. In that year, the Lackawanna Iron and Steel Company moved their plant from Scranton, Pennsylvania to a site in southeast Buffalo, laying the foundation of the future Bethlehem Steel Company – one of the largest steel manufacturers in the United States from the 1930s to the 1970s (Leary and Sholes 1987; Entwisle 1945: 94-95). During the end of the 19th century and the beginning of the 20th century, Buffalo contained dozens of business that utilized iron both for manufacture of steel and iron/steel products (Entwisle 1945: 96). The formation in 1902 of the Buffalo and Susquehanna Iron Company, the precursor of the Hanna Furnace Corporation, was facilitated by the ever increasing demands for raw iron in Buffalo and the Great Lakes.

3. The Union Ship Canal and the Storage Yards

The Union Ship Canal, a distinct physical feature that outlived the Hanna Furnace, had been, nevertheless, an inseparable part of the Hanna Furnace plant (Figure 2, 3). The canal came about as a collective effort of railroad, shipping, banking, and iron smelting business interests.

In 1902, the Buffalo and Susquehanna Iron Company was formed by Rogers, Brown, & Company that had interests in numerous blast furnaces, S.M. Clements of the Marine National Bank, and Frank and Charles Goodyear of the Buffalo and Susquehanna Railroad (BSR). The Goodyear family controlled rail lines to Buffalo from the coal fields and coke ovens in Tyler and Sykesville, Pennsylvania. It also had interests in the Great Lakes shipping that could supply iron ore from Iron Mountains, Michigan and Hobbing, Minnesota. In cooperation with the Pennsylvania Railroad, the BSR initiated the excavation of the Union Ship Canal (originally called the "Goodyear Slip") in 1903. The canal originated at the shore of Lake Erie and crossed Fuhrmann Boulevard, which was spanned, as part of the canal construction, with the Scherzer Rolling Bridge. In 1910 the canal was extended by additional 950 feet. In its final form the Union Ship Canal was 2,240 feet long, 222 feet wide, and accommodated vessels up to 23 feet in draft (SIA 1992:79; THFC nd:2).

The walls of the canal are composed of the concrete dock face, sheathed in place with metal plate. The dock face is supported by a timber cribbing that stands on bedrock. The walls are approximately 7 feet above the water level (RECRA 1988: Figure 1-2)(Figure 4).

The Union Ship Canal was used for berthing the bulk cargo carriers that brought iron ore and limestone. The Great Lakes freighters used for transporting bulk minerals typically ranged in capacity from 10,500 tons to 19,900 tons; such ships constituted the fleet of the Bethlehem Steel Corporation that supplied minerals to their Lackawanna plant, immediately west of the Hanna Furnace plant (Bethlehem Review 1956:3). The six boats supplying the Hanna Furnace appeared to have been smaller, with a capacity averaging 10,000 tons, and with some boats having a 2,500 tons capacity only. (NSC nd: 25)(See a note on the dating of this source in References).

The imported minerals were stored at two locations. To the north of the Union Ship Canal, the James Thompson Ore Dock was established by the Pennsylvania Railroad. A 1970 low-level aerial photograph shows massive piles of ore and limestone at this dock (Courier Express September 5, 1970). These materials were unloaded by means of the PRR 10-ton electric Huelett unloader (SIA 1992:79). South of the canal the imported minerals were stored on the grounds of the Hanna Corporation storage yard (Plate 2).

At the peak of the pig iron production during the World War II, the Hanna storage yard would typically store an annual supply of 650,000 tons of ore brought from Lake Superior mines, 150,000 tons of limestone from Rogers City on Lake Huron, and 350,000 tons of coke brought from the Buffalo Plant of the Donner-Hanna Coke Corporation. While the ore and limestone arrived at the plant via the Union Ship Canal, the coke from the Donner-Hanna arrived by rail cars (Courier Express, March 8, 1940). The coke could be stored in bins below

the elevated railroad trestle near the furnaces or in piles on the storage dock (NSC nd: 24; Soltis 2002).

The ship-borne iron ore was unloaded from the freighters by six 5-ton Brown Hoisting Machinery Traveling Bridges (commonly called crane bridges). These bridges were designed at the end of the 19th century in Cleveland. Their span of 225 feet permitted them to scoop the ore by means of the grab bucket from the holds of the cargo ships, move them south, and deposit them in piles on the Hanna Furnace storage yard close to the blast furnaces (SIA 1992:79) (Figure 3; Plate 3). According to a publication of the Society for Industrial Archaeology, the bulk of the limestone was delivered by a "self-loader" to a site on the Buffalo River and "subsequently trucked to the plant" (SIA 1992:79). According to the Hanna Furnace Corporation Handbook, the limestone, unlike the iron ore, was shipped directly to the Hanna plant and unloaded by means of the conveyers that piled the stones directly on the storage yard (NSC: 25).

A larger boat could be unloaded in nine to sixteen hours. During the summer months, the shipment of iron ore and limestone was a continuous round-the-clock undertaking in order to provide the furnaces with the minerals for the ongoing smelting operations and also lay down the reserves for the winter, when the Great Lakes were icebound (NSC nd: 25; Soltis 2002).

The Union Ship Canal was also used for berthing ships that carried pig iron from the Hanna Furnace Plant to points on the Great Lakes. A 1972 newspaper photograph shows the crane carrier *W.C. Richardson* of the Cleveland-based Oglebay, Norton, & Co. berthed at the Union Ship Canal. The ship carried two on-board cranes that were used to load 7,000 tons of pig iron for delivery to Detroit (Courier Express, May 4, 1972). The Hanna Furnace plant shipped the pig iron from its Union Ship Canal dock to automobile plants, steel mills, and foundries in Canada, Connecticut, Illinois, Massachusetts, Maryland, Michigan, New Jersey, New York, Ohio, Pennsylvania, Rhode Island, Vermont, Virginia, West Virginia, and Wisconsin (NSC nd: 16).

In 1961 a high-level viaduct known as the Father Baker Bridge was built over the Union Ship canal in order to accommodate the passage of large lake freighters. This bridge has been replaced by a modern low-level bridge carrying the NY Route 5 (SIA 1992:92).

In all probability, the last delivery of ore or limestone via the Union Ship Canal took place in the summer/fall of 1981. Following the demolition of the Hanna plant and the Pennsylvania Railroad ore dock in 1983-1985, the Union Ship Canal ceased operation as a terminus for bulk cargo shipment. However, it remains a large inland slip that may yet be revitalized.

4. The Hanna Furnace Corporation: Corporate Evolution

In 1890, William A. Rogers, an iron industry entrepreneur and the founder of the Cincinnati-based Rogers-Brown & Company, moved to Buffalo. Rogers – Brown & Company had extensive experience with the construction and operation of twenty-three furnaces throughout the country, including one in Tonawanda. In the beginning of the 20th century, Rogers, in partnership with Frank H. Goodyear, Charles H. Goodyear, and the Iroquois Iron Company, organized a new company for the manufacture of pig iron (THFC nd 2). This company acquired a parcel of land along the Hamburg Turnpike (currently Fuhrmann Boulevard) and began the construction of an iron smelting plant.

The corporate history of this company is the subject of accounts that are not altogether in agreement. E.F. Entwisle, the former general manager of the Bethlehem Steel, who published an extensive account of the early iron and steel industries in Buffalo, identified the new company as the **Buffalo and Susquehanna Furnace Company**. According to this source, the company was founded in 1902, the first furnace was blown in September, 1904, and the second in July, 1905 (Entwisle 1945:95). A publication of the Society for Industrial Archaeology supports the dates for the blowing of furnaces but calls the new entity **Buffalo and Susquehanna Iron** (SIA 1992:78).

An undated manuscript ("The Hanna Furnace Corporation", Accession # C89-3) on file with the Buffalo and Erie County Historical Society Library (BECHS) states that the **Buffalo and Susquehanna Iron Company** was founded in 1902 and that both furnaces were blown in 1903 (THFC nd: 1).

Another source - a photocopy in the BECHS' "Hanna Furnace File" of an edition of Buffalo Live Wire (March 1926) states that "in 1902 ...the **Buffalo and Susquehanna Company** was founded and erected two blast furnaces on the Hamburg Turnpike at the Buffalo city limits."(BLW 1926).

Lastly, a short "History of the Company" section in an undated Hanna Furnace Corporation Handbook that is preserved in the Steel Plant Museum of the Lackawanna Public Library stated that "the plant was originally organized ...in the year 1902 and was called the **Buffalo and Susquehanna Iron Company** (emphasis added). ... In 1904, the first blast furnace was completed and blown, and the second, later in the same year." (NSC nd: 21).

The Buffalo and Susquehanna Iron Company owned large mining property in Minnesota and coal properties in Pennsylvania. Given the ready availability of limestone in the Great Lakes region, it began to acquire cheap materials for iron manufacture.
In cooperation with the Pennsylvania Railroad, the Buffalo and Susquehanna Iron Company also began the construction of the Union Ship Canal, which would connect the new plant with Lake Erie (see above).

In 1908, William A. Rogers and other investors, including Charles H. Goodyear, Stephen M. Clement, Hugh Kennedy, and William T. Shepard, formed the South Buffalo Canal and Dock Company for the purpose of buying additional land in the vicinity of the Union Ship

Canal. This company was dissolved in 1910 when the Buffalo and Susquehanna Iron Company was merged with the Rogers-Brown Iron Company (THFC nd: 2).

In 1910, the Rogers-Brown Iron Company began construction of two additional furnaces. All sources agree that the new furnaces (#3 and # 4) were blown in 1912 (Entwisle 1945:96; NSC nd: 21; SIA 1992:78).

The corporate history between 1910 and 1930 is also available in somewhat discrepant versions. Entwisle stated that "in 1920 the plant was leased to the M.H. Hanna Company, which operated it until 1927," when it was "absorbed by the Buffalo Union Furnace Company." This latter entity controlled the plant until 1930, when it was merged with the Hanna Division of the National Steel Company (Entwisle 1945:78).

Another source indicated that the Rogers-Brown Iron Company had gone bankrupt in 1927 and was bought by the M. A. Hanna Company (THFC nd: 2). On April 21, 1930, the certificate for the change of name from the Buffalo Union Furnace Corporation was issued to the Hanna Furnace Corporation (THFC nd: 3).

However, according to the Hanna Corporation Handbook, the M.H. Hanna Company bought the plant in 1927, changed its name to the Hanna Furnace Corporation in 1928, and merged with the National Steel Corporation in 1929 (NSC nd: 21).

At its height during the 1950s, the National Steel Corporation consisted of a number of subsidiaries. Apart from the Hanna Furnace Corporation it included the Wierton Steel Company (Weirton, W.Va., Steubenville, OH), a tinplate manufacturer; the Great Lakes Steel Corporation (Detroit, MI), a major producer of standard and carbon steel; Stran – Steel Corporation (Ecorse, MI, Terre Haute, ID), a manufacturer of Quonset buildings and malleable framing; Hanna Iron Ore Company (Cleveland, Oh), an ore producer from many Great Lakes holdings; National Mines Corporation, a supplier of high-grade metallurgical coal; and the National Steel Products Company (Houston, TX), a distributor of steel products (NSC nd: 29).

Following the unsettled early corporate history of the plant, the Hanna Furnace Corporation became a part of a large steel conglomerate, settled into the business of pig iron manufacture, and operated the plant until its final closure in 1982.

5. The Hanna Furnace Corporation: the Plant Layout.

The Hanna Furnace Corporation was an industrial entity with a narrow specialization – production of pig iron and specialty iron for steel manufacturers in more than a dozen U.S states and Canada (NSC nd:16).

The early founders of the Buffalo and Susquehanna Iron Company - the Goodyear brothers and William A. Rogers hired Julian Kennedy, "whose career as an engineer was comparable to the works of Louis Sullivan or Frank Lloyd Wright in modern architecture" (SIA 1992:78). Kennedy designed the initial plant, and his design emphasized the economy of handling the materials from ore and limestone to ready-made pig iron. Whereas the plant increased in size and capacity between 1904 and 1940, the basic layout remained, essentially, unchanged. This layout is best understood by means of a conceptual idealized transect traversing the plant from north to south (Figures 2 and 3). The extreme northern portion of the plant – the Union Ship Canal – was the primary avenue by which the bulk of the raw materials was delivered to the plant. Farther south lay the great (approximately 2,000 feet long, 250 feet wide) storage yard capable of handling 600,000 tons of ore and limestone (Plates 2 and 3). Further south were situated in line along the elevated rail-carrying trestle all four furnaces of the plant (Figure 3, Plate 4). The trestle was used for loading the furnaces with ore, limestone, and coke. Each furnace was supported by boilers and power sources (Plate 5). Farther south, parallel to all furnaces, large ladles moved on tracks collecting the molten metal and delivering it to the pig casting machines. The hot slag was temporarily placed into slag dumps arranged in line with the furnaces (Figure 3, Plate 6). The iron pigs were deposited yet further south, either into the pig iron storage or on the storage yard threaded with multiple railroad sidings (Plate 7). The pigs were placed in separate piles according to their grade. The rail lines on the pig storage yard were connected with sidings along the Union Ship Canal and the Pennsylvania Railroad line (Figure 2); from here pig iron could be transported to customers either by rail or ship. The extreme south portion of the facility was used for storage of enormous piles of slag that was transported here from the slag dumps near the furnaces.

The plant achieved its final extent by the beginning of the World War II (Sanborn 1940). Physically, the plant was approximately 3,000 feet long and some 1,200 feet wide and occupied an area of approximately 69 acres.

6. The Hanna Furnace Corporation: Operations

At the heart of the Hanna Furnace plant were four relatively large blast **furnaces** that were approximately 100 feet high and 25 feet in diameter (NSC nd: 22). Blast furnaces were cylindrical steel shells lined with fire resistant bricks (Photograph 5). These furnaces were erected on very strong concrete foundations that would support the enormous weight of the furnace and its charge and could also withstand side forces exerted by **skip bridges** and **downcomers** (Photograph 4)(See below).

The starting point of the **charging** (loading) of the blast furnaces at the Hanna plant was the **elevated trestle** with a rail spur (Figure 5-1). The six crane bridges loaded limestone and iron from the dock yard on **transfer rail cars** on the trestle. These materials were dumped from the transfer cars via the bottom hatches into the **hoppers** (bins) below the trestle. The coke delivered from the Donner-Hanna coke plant by rail was also dumped into the hoppers (Figure 5-2). Iron ore, limestone, and coke were carefully weighted depending on the desired grade of the iron to be smelted. A Hanna furnace at a peak of the production could use 1,000 tons of ore, 500 tons of coke, and 250 tons of limestone in a given 24-hour period, producing 500 tons of pig iron (NSC nd: 22). The weighted minerals were placed into a **skip car** under the hoppers (Figure 5-3). The skip car was hoisted along the 60° **inclined skip bridge** to the receiving hoppers by means of the power provided by the **hoist house** (Figure 5-4, 5-5, 5-6, Plate 4).

The minerals, elevated by the skip car, were introduced into the furnace through **bells** that sealed the gases in the furnace and distributed the minerals evenly. A system of conduits – the **uptakes** and the **downcomer** - directed the combustible gas that rose through the ore limestone and coke into the **dustcatcher,** which accumulated particles and eventually deposited them into a railcar. The production of one ton of iron typically generated 75 kilograms of dry flue dust. Further cleaning of gases took place in the washer that purified the gas to an extent that it was ready to be used for burning in the **stoves** of the plant (Figure 5-7, 5-8, 5-9, 5-10, 5-11).

The hot blast stoves were cylindrical firebrick structures percolated with U-shaped cast iron pipes in which gases were burned and circulated. The exhausted gases were vented through a 200-foot high **stack** (Figure 5-12, 5-12). The clean air was supplied to the stoves from the blowing engines through a **cold blast line**. Passing between the heated U-shaped pipes the air was heated to approximately 1800°F and directed through a valve and the **hot blast** main into the **mixer line** that regulated the temperature of the air that was introduced into the furnace. The portion of the furnace with vertical walls near the bottom area is the **hearth.** The walls of the furnace were penetrated with **tuyers** - openings that direct the blast of hot air into the furnace. The operation of each furnace also required the circulation of 1,500,000 gallons of water per hour through the hollow plates in the walls in order to keep it cool (Figure 5- 14, 5-15. 5-16, 5-17). The melting operation took place in the **bosch** at a temperature of approximately 1540°F and pressure of 10-30 psi. The combustion of coke in the furnace reduced the ore and melted it into the molten iron that descended to the bottom of the hearth.

The **hot metal notch** that directed the molten metal outside of the furnace into the molds was typically 3 feet above the bottom of the hearth. The slag notch was approximately 0.5 feet higher since the lighter slag floats on top of the molten iron (Figure 5 –18, 5-19) (HWRC 1911:12-37; ATSI nd: 3-9; RECRA 1988: 1-17, 1-26, The Buffalo News 3/4/1940). The hot liquid slag was directed into slag dumps where it cooled and solidified (See section 4).

During the early stage of the development of the plant, the iron casting was probably done in chill molds – beds of cast iron that were fed with molten iron through a center sand runner. Prior to casting the surface of the chill, molds were washed with a solution of clay water that would dry and coat the pig beds with a fused coat of clay; this prevented the molten iron from melting the chill forms. The pig iron was removed from the chill forms either by crowbars or by pig-breaking machines that used a hydraulic plunger to break pigs into short sections. The process of casting in chills took place in cast houses. In 1921, there were four cast houses at the Hanna furnace (Johnson 1917:329-333; Sanborn 1917/1921;).

By 1940, the Hanna Furnace plant had a separate pig casting house, south of blast furnaces #2 and #3 (Figures 2 and 3). The molten iron was poured into 70- ton capacity ladles that were mounted on tracks. These ladles were filled by the molten iron diverted from a furnace by means of a spout. At the pig casting house, the molten iron was cast into a long continuous series of molds that were carried on an moving endless chain. The casting molds typically produced 40-pound pigs, each iron bar being 25 x 8 x 5 inches. Twelve-pound blocks could also be cast. The hot pigs were cooled by the metallic molds and re-circulating water, and by the time it reached the end of the chain, the solid pig fell out of the tipped-over mold into the railroad car. The mold then traveled back to the ladle spout underneath the conveyer chain. As it traveled back, it was sprayed by the mixture of liquefied clay and coal that dried quickly on the hot surface. By the time the mold was again positioned upright under the ladle's spout, it was coated with dried coat of clay that would prevent the hot iron from sticking to the form (The Buffalo News, 4/ 8/1940; RECRA 19881-20).

The Hanna Furnace ladles containing molten iron also traveled by rail to the neighboring Shenango Inc., foundry that was built in 1963. It was housed in a single large metal frame structure approximately 250 feet east of the Union Ship Canal (Sanborn 1982). The Shenango foundry manufactured large ingot molds that were supplied to the Great Lakes Steel Corporation in Detroit and to the local plant of the Republic Steel Corporation (RECRA 1988-23).

The Hanna Furnace had a very substantial capacity. Its No.1, No.2, and No.3 furnaces were each able to produce 700 net tons of iron per day. The No.4 furnace had a capacity of 1,000 net tons per day (RECRA 1988; Table 1-2). But the plant did not always work to its full capacity. The No.1 furnace, the oldest of the four furnaces of the facility, had been idled since 1929 due to the reduced demands for iron during the Depression and was rebuilt and blown in 1941(Courier Express, 6-5-41).

All furnaces were periodically blown out due to rebuilding, scab removal, relining, and other emergencies, including strikes and walkouts. The onset of World War II greatly increased the requirements for the plant's product. In July 1941, the Hanna Furnace Corporation

manufactured 63,000 tons of pig iron in one month. At that time the plant employed 800 workers, some 300 more than in March of 1940 (The Buffalo News, 1941).

During the 1950s and 1960s, the plant continued to be a successful producer of pig iron in the east, employing 500 - 700 workers (The Hanna Furnace Corporation nd.: 3). In 1970, Hanna experienced very heavy demand for pig iron and, in expectation of further sales, accumulated large stocks of ore, coke, and limestone. (Courier Express 9/5/1970).

7. The Hanna Furnace Corporation: Finale

The boom in iron and steel manufacture that began during the World War II and extended throughout the 1960s was followed by a general economic slowdown of the iron and steel industry in Buffalo (Leary and Sholes 1987: 109). In the fall of 1971, only two of the Hanna's four furnaces were in operation (Courier Express 5/4/1972). Aging technology, labor conflicts, foreign competition, and reduction in demand for locally produced iron resulted in declining profitability of the local industry (Leary and Sholes 1987:117-121; Soltis 2002).

The new environmental regulations also affected Hanna Furnace. The process of iron smelting generated very large volumes of byproducts. Approximately 5,600 to 7,200 tons of dry flue dust were generated every year and deposited as fill in the northern portion of the facility. Approximately 0.25 tons of slag was generated for every ton of iron; this slag emitted sulfide compounds in the air during quenching of slag in slag pits (The Buffalo News 3/8/1940). The blowdown from the furnaces and the water used for cooling of pig iron in molds generated wet sludge containing water, iron oxides, oxides of phosphorus, magnesium, calcium, phosphates of calcium, and other contaminants. The sludge was discharged to the filter facility in the eastern portion of the plant. From the filter house it was brought as filter cake to the north of the plant for landfilling (RECRA 1988:1-24). Furthermore, the blast furnace processes typically produced emissions of sulfur dioxide, carbon monoxide, and other gases. In 1976, the Environmental Protection Agency had cited the Hanna Furnace Corporation for emission violations which, according to the EPA, continued unabated. In April, 1979, the EPA filed a suit against the Hanna Furnace Corporation under the provisions of the 1977 amendments to the Clean Air Act. These amendments imposed fines of $25,000 per day for each day of violation.

The suit was one of the first such suits ever filed against an iron/steel company and fueled speculations that it was a dress rehearsal by the EPA for preparation of similar suits against the Bethlehem Steel Corporation and the Republic Steel Corporation – two of the largest steel producers in the region. Representatives of major steel-related manufacturers objected to the new regulations as unreasonable and excessive. William M. Smith, the environmental control director of the of the National Steel Corporation, of which Hanna Furnace was a subsidiary, stated that cessation of emissions at the Buffalo plant, as required by the EPA, would necessitate $14.6 million in capital improvements and $2.2 million in additional annual costs for plant operation (The Buffalo Evening News 4/6/1979). The cost of compliance with the EPA requirements appears to have been a factor that would have reduced the profitability of the plant and contributed to Hanna's decision to cease operations (Soltis 2002).

Another factor in this decision related to Hanna's industrial partner. During the 1960s and 1970s, both the Hanna Furnace Corporation and the Pennsylvania Railroad significantly benefited from Shenango, Inc. operations because this foundry was one of the major consumers of Hanna's products and, locally, of the PRR services. Shenango Inc. produced up to 560 tons of ingot molds per day during a successful season and shipped tens of thousand of tons of its product via PRR. All of the Shenango Inc. iron was supplied by Hanna Furnace

(The Buffalo News, 12/10/64). The closure of Shenango in 1981 made further operation of the Hanna Furnace unfeasible. The early 1980s also saw the demise of other Niagara Frontier producers – the Lackawanna plant of the Bethlehem Steel Corporation, the Donner - Hanna Coke Corporation, and Republic Steel.

On January 29, 1982, Hanna Furnace Corporation shut down all operations and laid off 350 workers (The Hanna Furnace Corporation nd: 3). In 1983, the plant was bought by the Jordan Foster Scrap Corporation for the purpose of dismantling the Hanna plant. It contracted with Controlled Demolition, Inc., and on December 6, 1983 this contractor received an approval from the City of Buffalo (Building permit #B39589) to demolish furnaces through the use of high explosives. By 1985, Jordan Foster had dismantled most of the plant's structures and removed rails from the Hanna Furnace rail yard. This dismantling affected all four furnaces and associated components such as dustcatchers, gas washers, mud legs, gas mains, dryers, skip bridges, etc. Similarly, other devices and elements pertaining to iron smelting, forming, and disposal such as boilers, ladles, crane bridges, gas blowing machines, ducts, rail lines, molds, etc., were also removed together with the specialized rolling stock. By the end of the demolition in 1985, the Hanna Furnace plant contained no machinery related to iron smelting. Furthermore, most of the metal frame and brick frame structures housing the plant had been demolished.

In 1986 the site was leased to the Equity Scrap Processing Company. The City of Buffalo gained title to the land due to non-payment of taxes in 1998 (Malcolm Pirnie 2000:3).

The physical remains at the former plant that were still in existence in 2001 included a brick two-story main office building, a two-story machine shop, remnants of the four demolished furnaces, sheet metal frame buildings, concrete foundations, slag pits, a section of concrete trestle bridge, etc. These structures are documented in Appendix A. They were demolished in fall 2001 and spring 2002 to make way for redevelopment of the property.

One of the last physical mementos of the Hanna Furnace Corporation plant is preserved in the small Steel Plant Museum that is housed in the Lackawanna Public Library. It is an ingot of coated iron with the inscription chiseled into the metal:

The Hanna Furnace Corporation
Last Cast
45 tons iron
1-30-82
Time 5:30 AM
Silicone 1.80
Sulf .006
Phosph .094
Mang 1%
No.4 furnace
Charles H. Flessel
Hired Sept. 3 -1940
Retired April 1- 1982

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permits to narrow down the period of its compilation: "After the new St. Lawrence Seaway Canal is completed, large ore boats will be used" (NSC nd: 25). This statement strongly suggests that the construction of the canal was already under way but not yet finished. The construction of the St. Lawrence Seaway took place in 1954-1959, and this date range appears to be very consistent with the clothing and illustrations in the Handbook.

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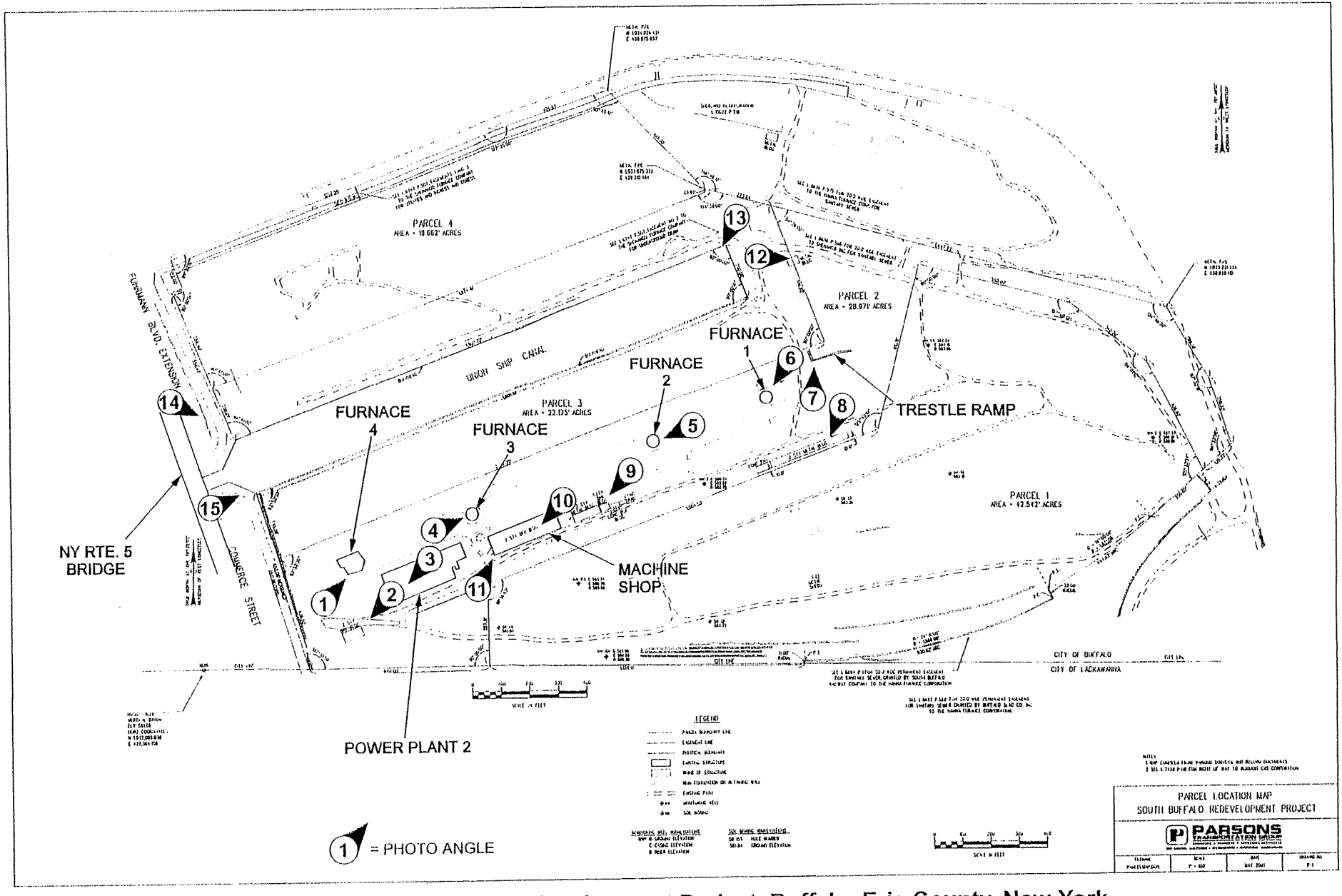
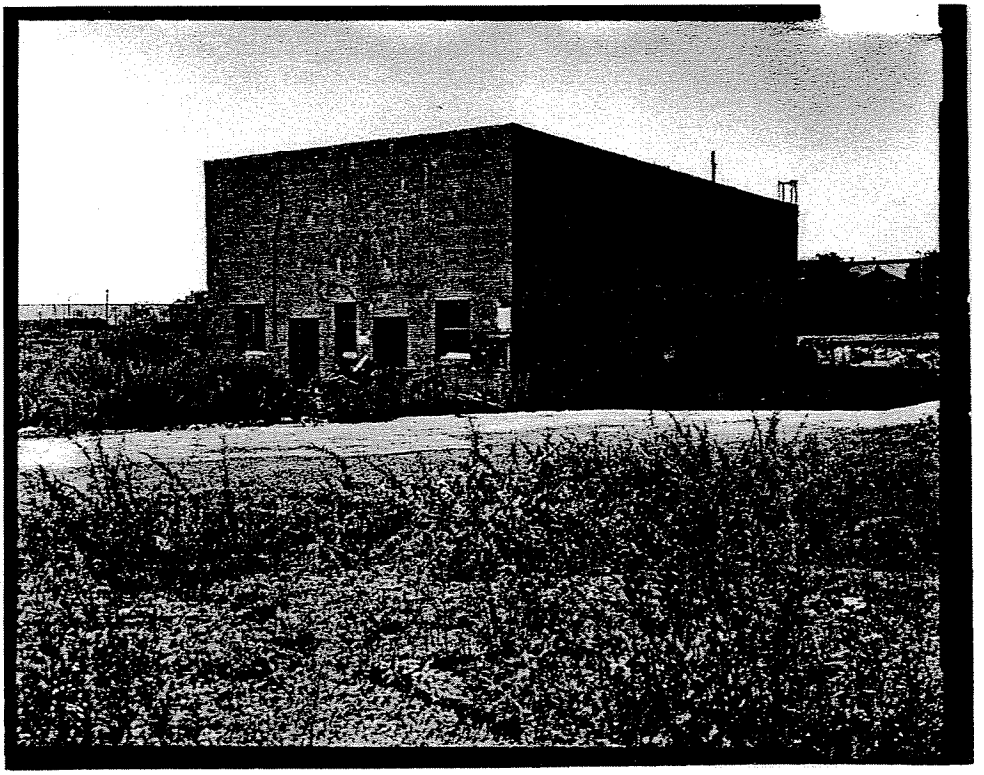
Appendix A

This photographic record of the ruins of the Hanna Furnace Corporation was compiled by Christine Longiaru, Mark Drumlevitch (PCI), and Leonid I. Shmookler (E & E) on 9-11-01.

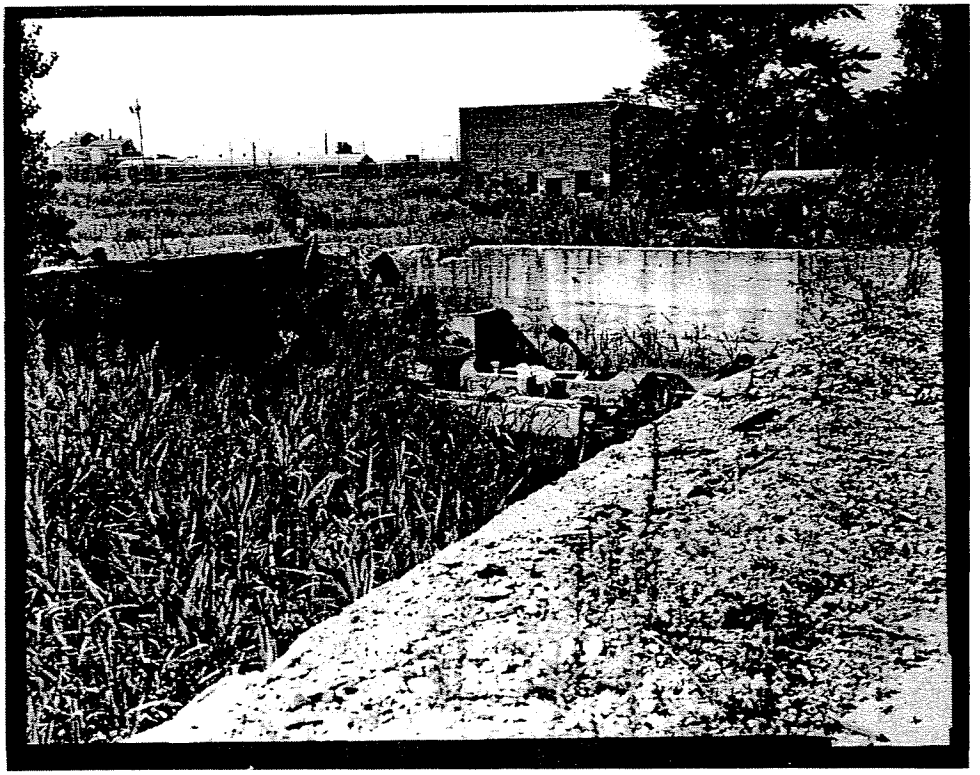


Site plan with photo angles. Hanna Furnace Redevelopment Project, Buffalo, Erie County, New York.

Photograph 1. Southwest section of Hanna Furnace No. 4, facing north. Hanna Furnace Redevelopment Project, Buffalo, Erie County, New York *(PCI 2001).*



Photograph 2. East and north elevations of Hanna Furnace Locker Room, facing southwest. Hanna Furnace Redevelopment Project, Buffalo, Erie County, New York *(PCI 2001).*

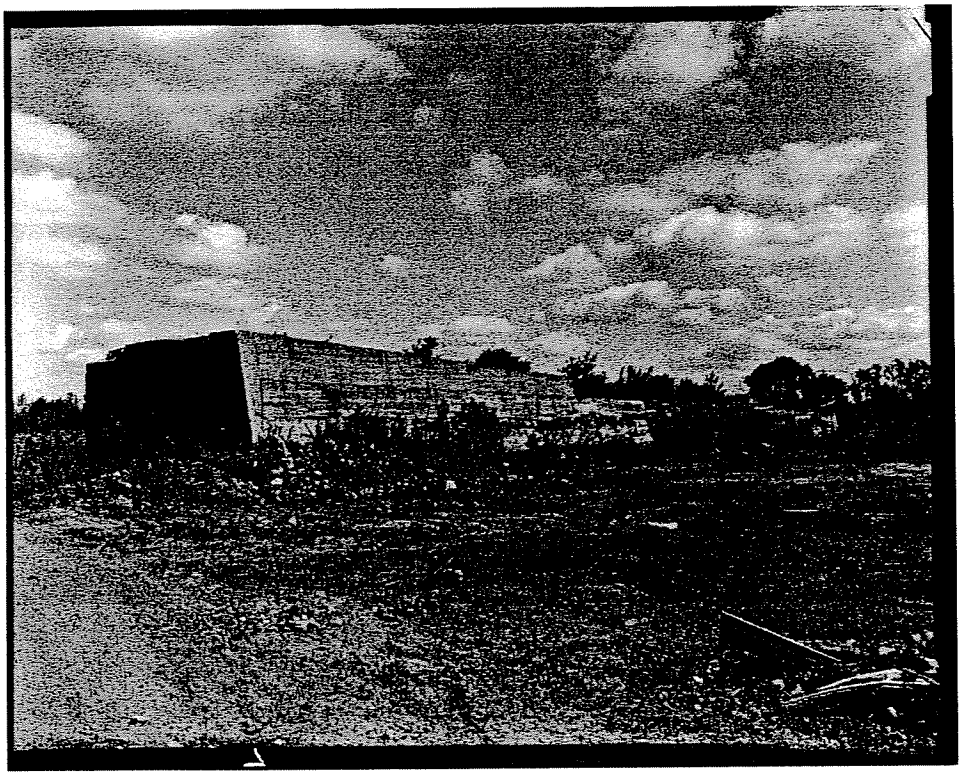


Photograph 3. Southwest corner of Hanna Furnace Power Plant No. 3 showing basement with pumps, facing southwest. Note Locker Room in the distance. Hanna Furnace Redevelopment Project, Buffalo, Erie County, New York *(PCI 2001).*

Photograph 4. West elevation of Hanna Furnace No. 3, facing east. Hanna Furnace Redevelopment Project, Buffalo, Erie County, New York *(PCI 2001).*

Photograph 5. Southeast section of Hanna Furnace No. 2, facing northwest. Hanna Furnace Redevelopment Project, Buffalo, Erie County, New York *(PCI 2001).*

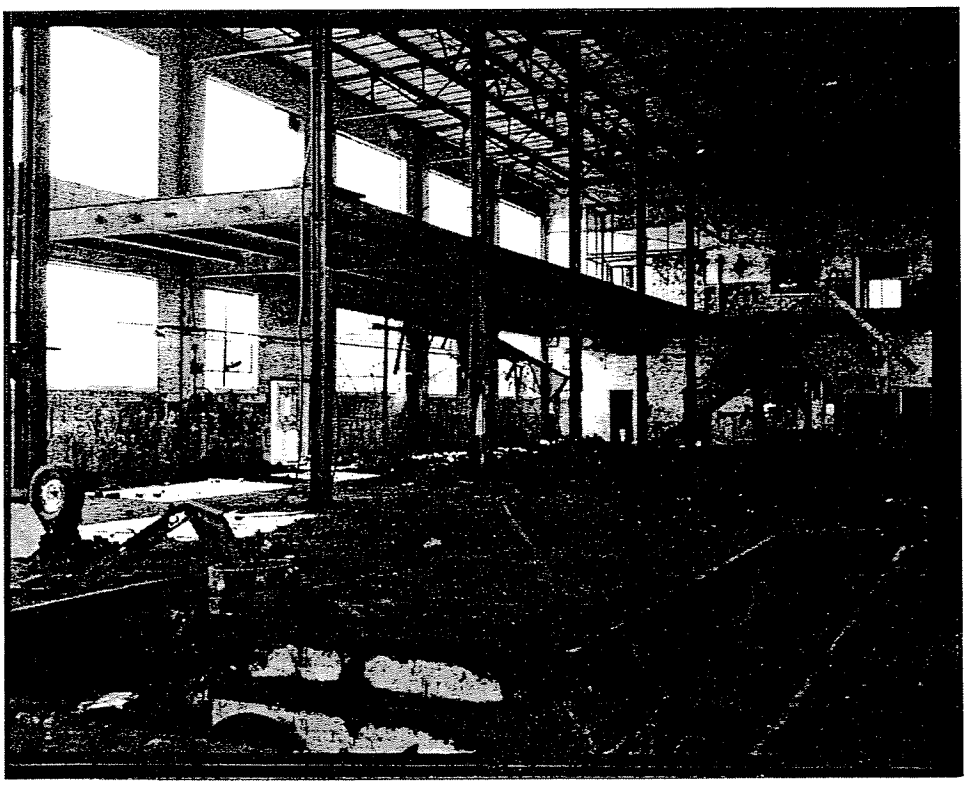
Photograph 6. Hanna Furnace No. 1 with slag dump and drain, facing southwest. Hanna Furnace Redevelopment Project, Buffalo, Erie County, New York *(PCI 2001).*



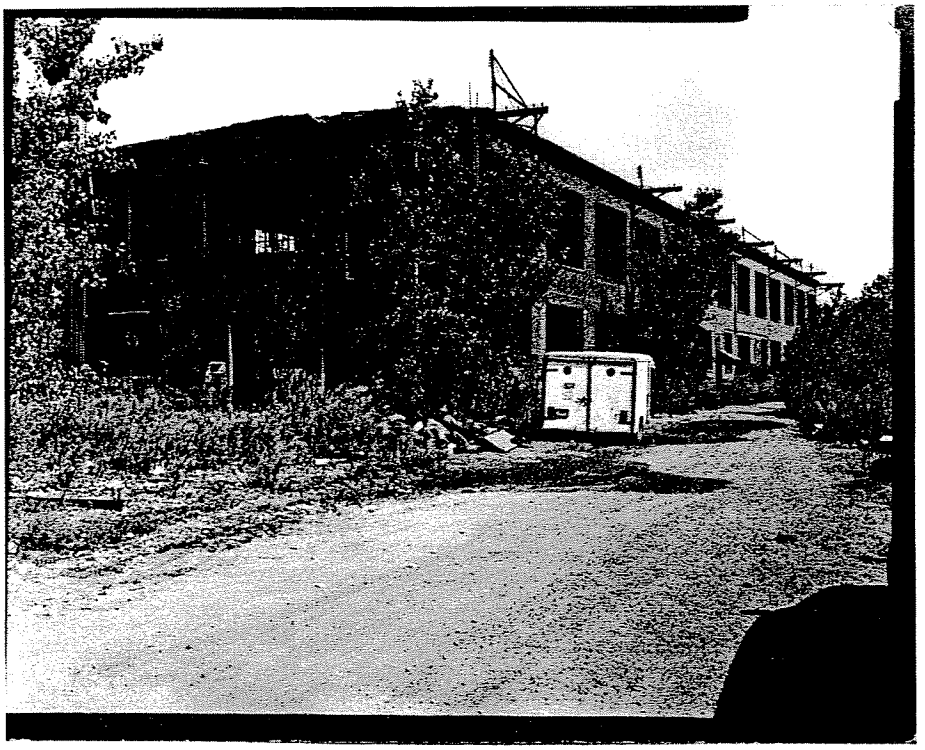
Photograph 7. South and west elevations of Hanna Furnace Trestle Ramp, facing north-northeast. Hanna Furnace Redevelopment Project, Buffalo, Erie County, New York *(PCI 2001).*

Photograph 8. North elevation of Hanna Furnace Storage Shed, facing southwest. Hanna Furnace Redevelopment Project, Buffalo, Erie County, New York *(PCI 2001).*

Photograph 9. South elevations of Hanna Furnace Oil Shack and Coal Storage Building, facing south. Hanna Furnace Redevelopment Project, Buffalo, Erie County, New York *(PCI 2001).*

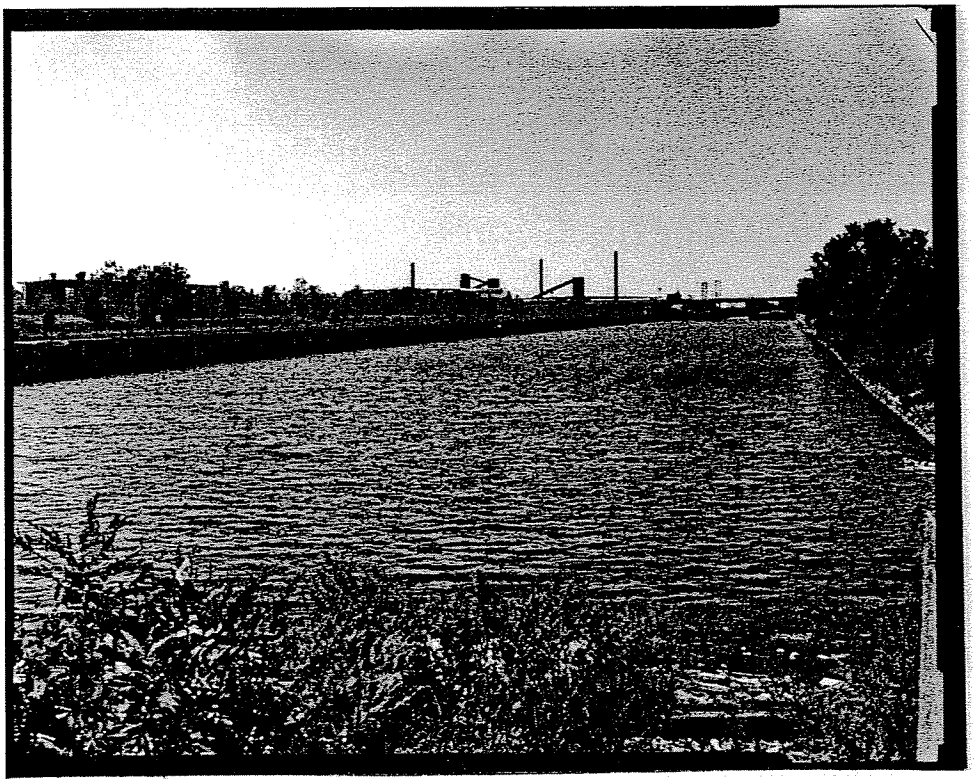


Photograph 10. Interior of Hanna Furnace Machine Shop from northeast corner of the building, facing southwest. Hanna Furnace Redevelopment Project, Buffalo, Erie County, New York *(PCI 2001).*

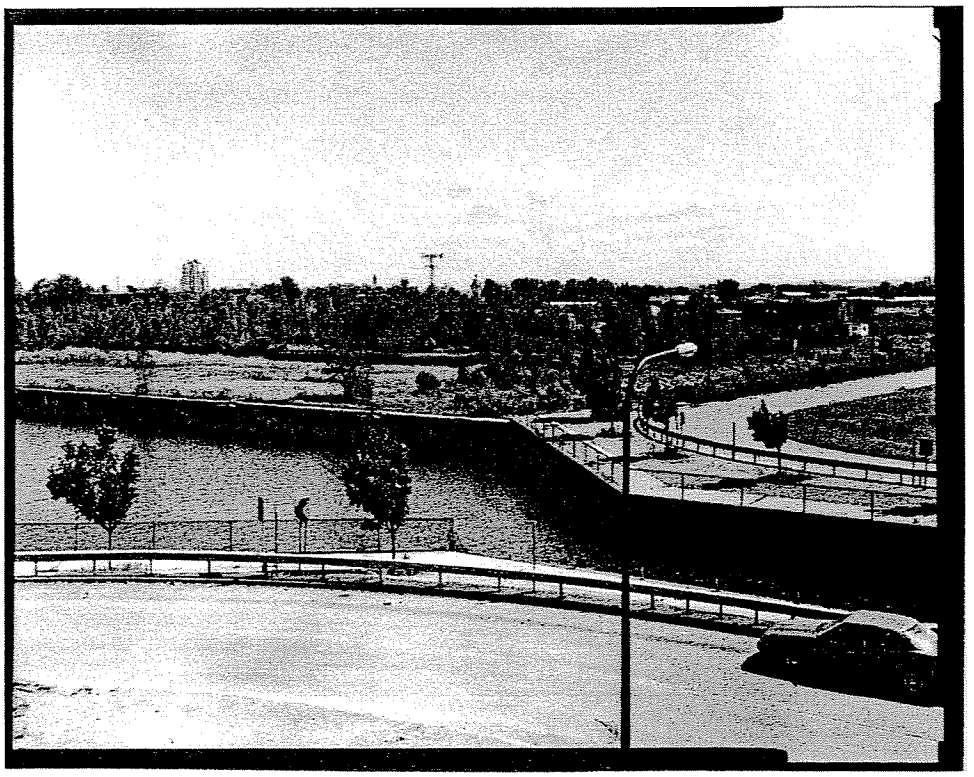


Photograph 11. West and south elevations of Hanna Furnace Machine Shop, facing northeast. Hanna Furnace Redevelopment Project, Buffalo, Erie County, New York *(PCI 2001).*

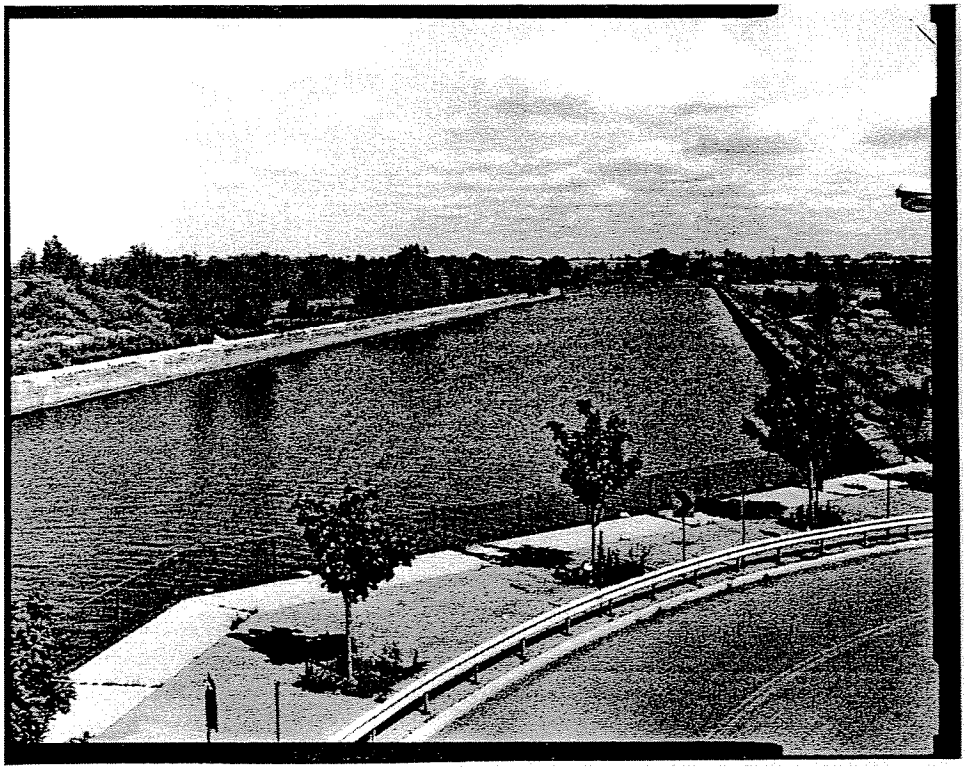
Photograph 12. North and west elevations of Hanna Furnace Filter House, facing east. Hanna Furnace Redevelopment Project, Buffalo, Erie County, New York *(PCI 2001).*



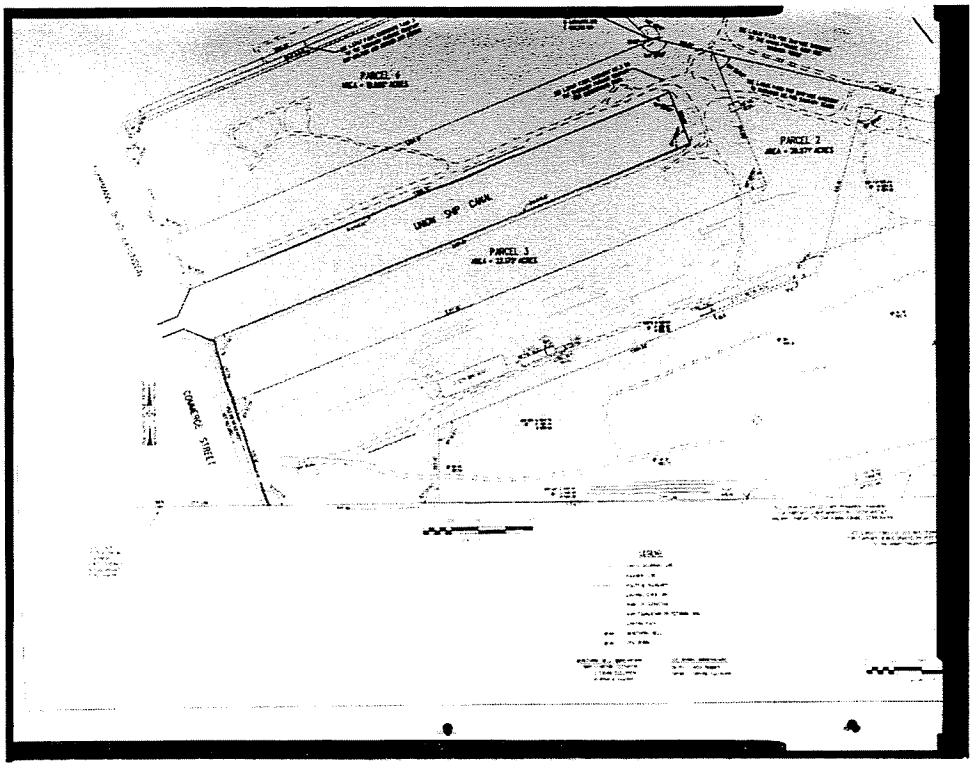
Photograph 13. Union Ship Canal from the northeast corner of the canal, facing southwest. Note Hanna Furnace complex and Machine Shop to the left. Hanna Furnace Redevelopment Project, Buffalo, Erie County, New York *(PCI 2001).*



Photograph 14. Union Canal with Hanna Furnace complex in background from NY Route 5 Bridge, facing southeast. Hanna Furnace Redevelopment Project, Buffalo, Erie County, New York *(PCI 2001).*



Photograph 15. Union Ship Canal from NY Route 5 Bridge, facing east. Hanna Furnace Redevelopment Project, Buffalo, Erie County, New York *(PCI 2001).*



Photograph 16. Site plan. Hanna Furnace Redevelopment Project, Buffalo, Erie County, New York *(PCI 2001).*