

Oregon Historic Site Record

LOCATION AND PROPERTY NAME			
address:	State St Lake Oswego, Clackamas County (97034)	historic name:	Oregon Iron Company Furnace
assoc addresses:	611 State Street	current/other names:	Oswego Iron Furnace
location descr:	George Rogers Park	block/lot/tax lot:	/ 100
		twshp/rng/sect/qtr sect:	2S 1E 11
PROPERTY CHARACTERISTICS			
resource type:	Structure	height (stories):	1.0
elig evaluation:	eligible/significant	total elig resources:	1
prim constr date:	1866	second date:	
		total inelig resources:	1
		NR Status:	Individually Listed
		date indiv listed:	02/12/1974
primary orig use:	Manufacturing Facility	orig use comments:	
second orig use:		prim style comments:	
primary style:	Utilitarian	sec style comments:	
secondary style:		siding comments:	
primary siding:	Stone:Other/Undefined	architect:	
secondary siding:	Brick:Other/Undefined	builder:	George D. Wilbur
plan type:	Other/Undefined		
COMMENTS/NOTES:			
2008 context, "Recommendations for Restoring the Oswego Furnace" by the Historic Furnace Restoration Task Force, is filed in the NR folder. National Register nomination and survey file may contain errors. 2014 survey was authored by Susanna Kuo, an expert on the Oswego Iron Furnace.			
GROUPINGS / ASSOCIATIONS			
Not associated with any surveys or groupings.			
SHPO INFORMATION FOR THIS PROPERTY			
NR date listed:	02/12/1974	106 Project(s):	None
ILS survey date:	08/14/2014	Special Assess Project(s):	None
RLS survey date:		Federal Tax Project(s):	None
ARCHITECTURAL / PROPERTY DESCRIPTION			
<i>(Includes expanded description of the building/property, setting, significant landscape features, outbuildings and alterations)</i>			
<p>Description of Surviving Resources Furnace BUILDER In 1866, H.C. Leonard, vice president of the Oregon Iron Company, was delegated to recruit a furnace builder. He hired 23-year-old George D. Wilbur of Sharon, Connecticut, to supervise construction of the furnace (Oregon Iron Company 1866). Wilbur was a protégé of the celebrated furnace builder Isaac Newton Bartram of Sharon, Connecticut. The Oswego Furnace was modeled on the Lime Rock Furnace, a furnace that Wilbur had helped build for the Barnum Richardson Company (Kirby 2011:75–81). The Oswego Furnace had all the hallmarks of a Connecticut furnace: fine ashlar masonry, Gothic arches, and a barrel-vaulted flue in the rear wall of the stack. Construction began in the spring of 1866 and was completed 10 months later, whereupon Wilbur returned to Connecticut. The first pig iron was cast on August 27, 1867. A few months later, the iron works were photographed by legendary San Francisco photographer Carleton E. Watkins. (Footnote 2) STACK Stone for the furnace was quarried from a basalt ledge on the north side of the lake (Oregon Daily Journal 1926). The furnace or "stack" is shaped like a truncated pyramid and the four sides are pierced with arches of red brick. Blast pipes or "tuyeres" were inserted through the three smaller arches and the furnace was tapped through the largest arch, known as the "casting arch." Iron tie rods run through the masonry to prevent the stack from swelling from the intense heat. The rods are held in place by anchor plates with keys inserted through slots in the ends of the rods (Gordon 1996:106). Historic sources disagree about the dimensions of the stack so measurements were taken during the 2009 restoration. They showed that the original stack was 32 square feet at the base, 32 feet high, and 26 square feet on top. Furnaces of this size were known as a 10-ton "stacks" because they could produce a maximum of 10 tons of iron a day, although the reality was about 8 tons (The Oregonian 1866). In the winter of 1878–1879 the second owners added 12 feet to the top of the stack, making it 44 feet high (JCIW 1880a:7–8). The stonework of the addition lacks the refinement of the original masonry, but the added height and the improvements to the blast system doubled the productivity of the furnace (JCIW 1880b:33). FOUNDATION Because of their immense weight, iron furnaces were built on a massive foundation. An archaeological investigation by Heritage Research Associates in 2006 confirmed that the foundation is 10 to 12 feet deep and rests on bedrock (Minor 2008:56). Instead of being a single monolithic structure, the foundation was built in two tiers. The lower tier is a rough platform of dry-laid basalt approximately 35 square feet and 7 or 8 feet high. Sitting on top of this are four diamond-shaped platforms that support the four piers of the furnace. These footings are 32 inches high. In the center of the second tier is the firebrick hearth, also 32 inches high. The space between the piers (inside the arches) is filled with sand. This loose sand would have been easy to shovel out when the workers needed to repair the hearth (Minor 2008:57–59). ARCHITECTURE CHIMNEY AND HEAT EXCHANGER The Oswego Furnace is what was known as a hot blast charcoal furnace, meaning the blast was preheated and the furnace burned charcoal fuel, rather than coke or anthracite. Early photos show that two important features on top of the stack—the chimney and the heat exchanger—were removed shortly after the furnace was abandoned. Like the inwall, these structures were probably dismantled so the bricks could be reused. During the 2009 restoration, the footprint of the heat exchanger was discovered on top of the stack (Minor 2010:35–39). Preheating the air consumed less fuel and improved efficiency. A double row of U-shaped iron tubes filled the interior of the brick-walled heat exchanger. As pressurized air passed through the tubes, it was heated to about 800 degrees by hot furnace gases. The preheated blast was piped to the base of the furnace where it was injected into the crucible. As The Oregonian described it, "the effect upon the burning mass of coal, ore and lime is something too fierce for description" (Gordon 1996:110–114; The Oregonian 1867). DUCTWORK None of the original cast-iron ductwork has survived. Like the firebricks, it was probably salvaged. Two channels in the shaft wall show where the original downcomer pipes were located. When the furnace was remodeled in 1878, the dual downcomers were replaced with a single downcomer outside the stack.(Footnote 3) HOT GAS FLUE High up on the northeast wall of the stack is a barrel-vaulted brick flue. In Connecticut where streams can run dry in summer and freeze in winter, the combustible gases from a furnace could be used to heat a boiler and run a steam engine when waterpower was not</p>			

available. There is no evidence that the flue in the Oswego Furnace was ever used for this purpose. What is certain is that both ends of the 7-foot flue were bricked up when the height of the stack was increased in 1878–1879 (footnote 4). The flue could not have been used after this date because it was below the stock line. By the late twentieth century bricks had fallen out of the flue and barn owls were using it as a roost. Because the flue is such a handsome feature, the decision was made during the 2009 restoration to remove the remaining bricks blocking the flue and restore it to its original condition (Minor 2010:14–18). As a precaution against roosting owls, the open ends of the flue were fitted with acrylic covers. BLAST HOUSE The blast house foundation is the most significant surviving remnant of the iron works after the furnace. It was built above the creek just west of the furnace (footnote 5). A flume running down the north side of the creek carried water to the turbine inside the blast house. According to an August 27, 1867, article in *The Oregonian*, the building was 38 square feet. A Leffel double turbine water wheel drove the blowing engine, which consisted of a pair of wooden tubs fitted with pistons driven by a walking beam (The Oregonian 1867). Pressurized air from this machine was sent through a long pipe to the heat engine on top of the furnace. Portions of the blast house foundation survive, but outflow from a culvert under Green Street has eroded much of it. In the summer of 2012 the city installed a large drainage pipe to channel water away from the foundation. While this work was being done, the site was photographed and surveyed by senior archaeologist Rick Minor of Heritage Research Associates and Lake Oswego researcher Susanna Kuo. Portions of three parallel walls can be seen above the ground. They appear to be interior walls rather than perimeter walls of the building. The top of a large iron cylinder 45 inches in diameter is exposed near the lowest wall. A flange around the rim is studded with heavy iron bolts. This may have been the discharge cylinder for the water turbine (Leffel News Print 1885). Three large anchor bolts protrude from the tallest wall, which is completely buried except for its top. CHARGING WALLS The charging terraces behind early iron furnaces were typically reinforced with one or more masonry walls. Early photos of the Oswego Furnace show at least two walls. The stone wall immediately behind the furnace appears to have changed little since the furnace was photographed in 1866 (footnote 6). A much larger wall once supported the south side of the charging terrace and the end of the ore house. This wall has disappeared, but some of its stones appear to have been used in a low wall bordering the road behind the furnace (footnote 7). Several of these stones contain quarry marks, which suggests they came from the charging wall. SLAG HEAPS AND FURNACE PRODUCTS Although slag heaps might seem to be of little consequence, they are the most enduring feature at furnace sites and can reveal much about the type and quality of iron produced there. Other artifacts are often found in slag deposits so they are a valuable archaeological resource (Weitzman 1980:142–143). In George Rogers Park, slag deposits cover much of the riverbank as well as the creek bank near the north end of the footbridge. During the park renovations of 2005, several of these deposits were exposed while a path and the stairway to the beach were being constructed. The slag in George Rogers Park is predominantly black, but there is a wide range of colors from sapphire blue to turquoise and green. The texture also varies enormously from solid, glassy chunks to frothy pieces that will float. Materials found in the slag deposits during archaeological monitoring included nails and spikes, firebricks, ceramic fragments, and a bar of pig iron (Minor 2006:11–14, 30–33). The two “salamanders” were also discovered on top of the slag deposits. A giant mass of slag and firebrick (probably the product of a furnace accident) rests on top of a slag deposit near the north end of the footbridge over the creek. Footnotes (2) Carleton E. Watkins photographs are on file at the Oregon Historical Society (OrHi #1455, #21592, #21593, #21594, #21596). (3) The downcomer is clearly shown on the exterior of the stack in a ca. 1890 photo in the collection of Alex Blendl. (4) See historical photos in the Lake Oswego Public Library (LOPL #773, #1595, and #3342). (5) See historical photos in the collections of the Oregon Historical Society (OrHi #21593, #21594, #21596) and the Lake Oswego Public Library (LOPL #133b, #165, #3542). (6) See photo #837 in the collection of the Lake Oswego Public Library. (7) See Photo #133b in the Lake Oswego Public Library, C.E. Watkins photo #21592 in the Oregon Historical Society, and c. 1890 photo in the collection of Alex Blendl. This history was authored by local historian Susanna Kuo

HISTORY

(Chronological, descriptive history of the property from its construction through at least the historic period - preferably to the present)

The first iron smelting operation on the Pacific Coast was established in 1865 in Oswego, Oregon, a small village on the west bank of the Willamette River 8 miles south of Portland. The Oswego iron works operated intermittently from 1867 to 1885 under the ownership of three different companies: the Oregon Iron Company (1865–1877), the Oswego Iron Company (1877–1882), and the Oregon Iron and Steel Company (1882–1885). The blast furnace was the centerpiece of an industry that eventually employed more than 600 workers, owned 24,000 acres of timber, two mines, railroads, two town-sites, workers' housing, barns, stores, and a cemetery (Hergert 1948:6; The Oregonian 1891). The discovery of iron near Oswego in 1861 excited hopes that the West Coast could end its dependence on imported iron. In 1864 Oregon paid \$19,740 in import duties on iron shipped 14,000 miles around the Horn (Hergert 1948:3). Western foundries struggled to meet the demand for iron and steel products in the rapidly growing region. The establishment of an iron works in Oregon was hailed as “one of the most important and useful enterprises that has yet been undertaken ... on the Pacific Coast” (San Francisco Bulletin 1866). On February 24, 1865, the Oregon Iron Company was incorporated by a group of Portland merchants whose investments in shipping and railroads, banking and real estate, and gas and water systems shaped the future of Portland as the cultural and commercial center of Oregon. Banker William S. Ladd was elected president of the company, H. C. Leonard, Vice-president, and Henry D. Green, Secretary (Hergert 1948:3). Controlling the means of iron production was part of their vision for a commercial empire in the Pacific Northwest. The first pig iron was cast on August 24, 1867. Two weeks later, 50 tons of pig iron were shipped to San Francisco (Hergert 1948:5). Despite this auspicious start, the company soon encountered difficulties. The furnace was fueled by charcoal and charcoal production was very labor intensive. In sparsely populated Oregon, where labor was expensive, charcoal was one of the company's biggest expenses. Competition from cheaper eastern iron and a dispute over water rights brought operations to a halt in 1869. Operations resumed in 1874 under new ownership, but the company still struggled to make a profit. To satisfy a judgment in favor of the company's creditors, all the property of the Oregon Iron Company was sold at a sheriff's auction in 1877. (The Oregon City Enterprise 1877). The next owners were experienced iron makers from the Hanging Rock Iron Region of Ohio. Ernest W. Crichton, Lamar B. Seeley, and Charles Donohue incorporated the Oswego Iron Company on March 9, 1878 (Hergert 1948:15). They made numerous improvements to the furnace and doubled its output. They also opened a new tunnel in the mine on Iron Mountain, built a railroad from the mine to the furnace, and enlarged the company's timber holdings from 800 to 24,000 acres (Journal of the United States Association of Charcoal Iron Workers (JCIW) 1882). These improvements left them in debt and they decided to sell to Simeon G. Reed, who was eager to buy the company. The Oregon Iron & Steel Company was incorporated on April 22, 1882. With financial support from railroad baron Henry Villard, Reed began ambitious plans to build a state-of-the-art iron and steel complex a quarter of a mile north of the original furnace. The old furnace was blown out for the last time on November 1, 1885. After many delays due to Reed's difficulty securing financing and lawsuits over his management of the company, the new furnace was blown in on October 18, 1888 (Hergert 1948:17–31; JCIW 1886). The capacity of the new furnace was five times that of the old one. In addition to a state-of-the-art blast furnace, the company also built the first pipe foundry west of St. Louis, which produced gas and water pipe for Portland's Bull Run water system and other cities on the West Coast (The Oregonian 1892; West Shore 1889: 232–238). The company's best year was 1890 when it produced 12,305 tons of pig iron. Unfortunately, the expansion of the operation coincided with one of the worst depressions in U.S. history, the Panic of 1893 (Hergert 1948: 35). Because of the large investment required for iron making, many charcoal blast furnaces closed. Throughout its history, the Oregon iron industry was undercapitalized and struggled to compete with cheaper British pig iron as the tariff on imports was repeatedly reduced (The Oregonian 1893, 1894). The new furnace shut down in early 1894 and hundreds of workers lost their jobs with less than a week's notice (Lake Oswego Public Library 2010). After repeated failures to revive the business, the furnace was sold to the Pacific Coast Steel Company in 1917. Oregon Iron and Steel retained ownership of the pipe works and continued to manufacture water pipe until 1928. Plans to start up the furnace never materialized and it was finally dismantled in 1929 (Daniels 1929:24–26; The Oregonian 1929). Among the pioneer iron works built in Utah, Oregon, Washington, and California, the Oregon iron industry lasted the longest (27 years) and produced more iron than the other three combined (Daniels 1929:10–12). Portland's wealth of cast-iron architecture was closely linked to the Oswego iron industry and remains a lasting legacy of that enterprise (Hawkins 1976:190). Today the 1866 furnace in Oswego is the only surviving nineteenth-century iron furnace west of the Rocky Mountains. It reportedly withstood an attempt to dynamite it in the 1920s (Lake Oswego Review 1965). After narrowly escaping several proposals to remodel or demolish it, the furnace was listed on the National Register of Historic Places in 1974 (Oregon Daily Journal 1926; The Oregonian 1965). In 2003, the Lake Oswego City Council appointed a citizen task force to study options for preserving the furnace. A Save America's Treasures grant paid for archaeological work and an engineering plan to stabilize the structure (Historic Furnace Restoration Task Force and City Staff 2008). Restoration work began in January 2009 and was completed in February 2010. The project subsequently received three awards: the 2012 Richard H. Driehaus National Preservation Award from the National Trust for Historic Preservation, the 2013 BAC Craft Award for Best Restoration Project from the International Union of Bricklayers and Allied Craftworkers, and the 2013 DeMuro Award for Excellence in Preservation from Restore Oregon. Site Boundaries The furnace site covers an area of approximately 5 acres bordered by the Willamette River on the east and Oswego Creek on the south. A long terrace extends across the north side. On the west, and shortest side, the land slopes down to the creek. This area represents the original furnace site, which was purchased in two parcels. On January 26, 1864, Henry Dodge Green purchased 4 acres at the mouth of Sucker Creek (present-day Oswego Creek) along with a water rights easement to the east end of Sucker Lake (now Oswego Lake). On July 5, 1866, the Oregon Iron Company purchased two additional acres, which cover the area of the charging terrace (Oregon State Archives 1941). A large complex of wooden buildings surrounded the furnace. The principal structures were the stack house, casting house, blast house, blacksmith shop, and the covered bridge that linked the furnace to the hill behind it (The Oregonian 1867). Raw materials were stored in large sheds on this hill, which was known as the “furnace bank” or the “charging terrace” (footnote 1). By building next to a hill, iron makers solved the problem of hoisting tons of raw materials to the top of the furnace every 15 to 20 minutes. They simply wheeled cartloads of charcoal, limestone, and ore across the bridge and dumped them into the open top of the furnace (Gordon 1996:14–15; National Park Service 1983). The flow of materials followed a continuous downhill path from the charging terrace to the river where the pig iron was loaded on ships. The furnace site remained in iron company ownership for 80 years. In 1945 the city purchased it for the town's first public park (Oral 2002:109). As a result, the site retains all of the natural features that made it a good location for an iron furnace. The Iron Making Process Elemental iron is rarely found in nature. To obtain pure iron, mineral ore (iron oxide) must be “smelted” to remove the oxygen. The type of ore mined in Oswego was bog ore or limonite, a hydrated form of iron oxide (Pumpelly 1886: 470, 496–497). The most efficient way of smelting iron is in a blast furnace, which consists of an inner wall of firebrick and an outer wall of stone enclosing the space where smelting takes place. At the Oswego furnace, air was blown into the base of the chamber through blast pipes that were cooled by water constantly circulating in a metal sleeve to prevent the pipes melting in

the heat of the furnace. Workers called "fillers" fed limestone, charcoal, and iron ore into the open top of the shaft every 15 to 20 minutes. As the solid materials descended and liquefied, a chemical reaction "reduced" or removed the oxygen from the iron. This transformation took place in the widest part of the shaft called the "bosh" where the temperature was around 2,800 degrees Fahrenheit. Molten iron collected in the bottom, which was known as the crucible or the hearth. Slag, containing the impurities from the ore, floated on top of the heavier iron. The furnace operated 24 hours a day, 7 days a week. It shut down only when there was a need for repairs or a drop in the market for pig iron (Gordon 1996:119–120). Attached to the furnace was the "casting house," a large open building with a sand floor. Several times a day the keeper opened the "slag notch," a hole on top of the dam stone, and let the slag floating on top of the iron run into a pit on one side of the floor. Once cooled, the slag was broken up and dumped on the riverbank. Every 12 hours, workers called "guttermen" prepared molds in the sand. When enough iron had accumulated in the bottom of the furnace, the keeper broke a clay plug in the dam stone, releasing a stream of white-hot metal. The iron poured down a long channel and filled the trenches in the sand. Early ironworkers saw a resemblance in the pattern of molds to a sow nursing piglets so they named the long trenches "sows" and the short ones "pigs." When the ingots had cooled, they were broken off the sow with a sledgehammer. A bar of pig iron was typically about 3 feet long and weighed a little over 100 pounds (Gordon 1996:121–124). Pig iron is a crude form of iron, which must be further refined to make all kinds of iron and steel products. The enormous acreage owned by the company was necessary for its mining and charcoal operations. There were two mines, the Patton Mine on the south side of the lake and the larger Prosser Mine on the north side, which provided three-quarters of the ore. Charcoal making was the company's biggest expense because it was so labor intensive (The Oregonian 1876). More than half of the company's workforce was engaged in charcoal production and the majority were Chinese woodcutters, who cut old-growth Douglas-fir into cordwood for the charcoal burners or "colliers." Footnotes (1) See historic photos of the stock houses in the Lake Oswego Public Library (LOPL #165 and #859) and the Oregon Historical Society (ORHi #1455, #21592, #21593, #21594, #21596). This history was authored by local historian Susanna Kuo

RESEARCH INFORMATION

✓ Title Records	✓ Census Records	✓ Property Tax Records	✓ Local Histories
✓ Sanborn Maps	✓ Biographical Sources	✓ SHPO Files	Interviews
✓ Obituaries	✓ Newspapers	State Archives	✓ Historic Photographs
✓ City Directories	✓ Building Permits	State Library	

Local Library:	Lake Oswego Public	University Library:	
Historical Society:	Oregon Historical Society.	Other Respository:	

Bibliography:

Crichton, E.W. 1881 The Oswego Furnace, Oregon. Journal of the United States Association of Charcoal Iron Workers 2:288–289. Daniels, Joseph 1929 Iron and Steel Manufacture in Washington, Oregon, California and Utah. Bulletin of University of Washington Experiment Station 2 (December 15). Seattle. Fulton, Ann 2002 Iron, Wood & Water. Historical Publishing Network, San Antonio, Texas. Gordon, Robert 1996 American Iron, 1607-1900. Johns Hopkins University Press, Baltimore, Maryland. Hawkins, William J. III 1976 The Grand Era of Cast-Iron Architecture in Portland. Binford & Mort, Portland. Hegert, Herbert 1948 Early Iron Industry in Oregon. Reed College Bulletin 22. Historic Furnace Restoration Task Force and City Staff 2008 Recommendations for Restoring the Oswego Furnace. Historic Furnace Restoration Task Force and City Staff, Lake Oswego, Oregon. Johnson, J.E. Jr. 1917 Blast-Furnace Construction in America. McGraw-Hill, New York. 1918 The Principles, Operation and Products of the Blast Furnace McGraw-Hill, New York. Journal of the United States Association of Charcoal Iron Workers (JCIW) 1880a Charcoal Iron in Oregon. JCIW 1(1): 7–8. 1880b Words of Cheer. JCIW 1(2):33. 1882 JCIW 3:363. 1886 Letters. JCIW 7:109–110. Kirby, Ed 2011 Seldom Told Tales of Sharon, Book Three. Sharon Historical Society, Sharon, Connecticut. Lake Oswego Review 1965 Spray the Vines and Save the Chimney. Lake Oswego Review 2 September. Leffel News Print 1885 Illustrated Hand Book of James Leffel's Improved Double Turbine Water Wheel for 1885 and 1886. Leffel News Print, Springfield, Ohio. Minor, Rick 2006 Archaeological Monitoring at the Historic Oswego Iron Furnace. HRA Report No. 291. Heritage Research Associates, Eugene, Oregon. 2008 Structural Foundation Explorations at the Oswego Iron Furnace, Lake Oswego, Oregon. HRA Report No. 324. Heritage Research Associates, Eugene, Oregon. 2010 Archaeological Investigations for the Oswego Iron Furnace Restoration, Lake Oswego, Oregon. HRA Report No. 342 Heritage Research Associates, Eugene, Oregon. National Park Service 1983 Hopewell Furnace: A Guide to Hopewell Village National Historic Site, Pennsylvania. National Park Handbook 124. U.S. Department of the Interior, Washington, D.C. Oregon City Enterprise 1877 Iron Works Sold. Oregon City Enterprise 20 September. Oregon City, Oregon. Oregon Daily Journal 1926 L. B. Seeley, 75, Recalls Pioneer Days of Oregon. Oregon Daily Journal 21 May. Oregon Iron Company 1866 Contract to Build the Stone Furnace Stack, Oregon Iron Co. Between Hermon C. Leonard, Sec'y and George D. Wilbur, April 1, 1866. Barnum Richardson Co., Lime Rock, Connecticut. Mss 333. On file, Oregon Historical Society, Portland. Oregon State Archives 1941 Abstract of Title of the Durham DLC: Abstract to Lakewood Plat No. 1 and Lakewood Plat No. 2, 1867 plat of Oswego, City of Lake Oswego online maps. Clackamas Abstract and Trust Company. The Oregonian 1866 The Iron Furnace at Oswego, Oregon. The Oregonian 23 July:4. Portland, Oregon. 1867 Oswego Iron Works. The Oregonian 27 August:3. Portland, Oregon. 1876 The Oswego Iron Furnace. The Oregonian 10 February. Portland, Oregon. 1891 Improvement at Oswego: The Oregon Iron and Steel Company to Extend its Plant. The Oregonian 12 October:6. Portland, Oregon. 1892 A Day with the Furnaces. The Oregonian 8 August:8. Portland, Oregon. 1893 A Local Object Lesson: The Menace of Free Trade, and Its Effect Upon Oregon's Industry. The Oregonian 21 August:4. Portland, Oregon.