United States Department of the Interior
National Park Service

National Register of Historic Places Registration Form

This form is for use in nominating or requesting determinations for individual properties and districts. See instructions in National Register Bulletin, *How to Complete the National Register of Historic Places Registration Form.* If any item does not apply to the property being documented, enter "N/A" for "not applicable." For functions, architectural classification, materials, and areas of significance, enter only categories and subcategories from the instructions.

DRAFT

1. Name of Property

Historic name: Union Iron Works Historic District

Other names/site number: Potrero Works, Union Yard, Bethlehem Steel Yard, Potrero Yard, San Francisco Yard

Name of related multiple property listing:
N/A

(Enter "N/A" if property is not part of a multiple property listing.)

2. Location

Street & number: South of Illinois Street between 18th and 22nd Streets

City or town: San Francisco State: California County: San Francisco

Not For Publication: ☐ Vicinity: ☐

3. State/Federal Agency Certification

As the designated authority under the National Historic Preservation Act, as amended,

I hereby certify that this ___ nomination ___ request for determination of eligibility meets the documentation standards for registering properties in the National Register of Historic Places and meets the procedural and professional requirements set forth in 36 CFR Part 60.

In my opinion, the property ___ meets ___ does not meet the National Register Criteria. I recommend that this property be considered significant at the following level(s) of significance:

___national ___statewide ___local

Applicable National Register Criteria:

___A ___B ___C ___D

Signature of certifying official/Title: **Date**

State or Federal agency/bureau or Tribal Government

In my opinion, the property ___ meets ___ does not meet the National Register criteria.

Signature of commenting official: **Date**

Title : **State or Federal agency/bureau or Tribal Government**

4. National Park Service Certification

I hereby certify that this property is:

___ entered in the National Register

___ determined eligible for the National Register

___ determined not eligible for the National Register

___ removed from the National Register

___ other (explain:) _____

Signature of the Keeper Date of Action

5. Classification

Ownership of Property

(Check as many boxes as apply.)

Private: [X]

Public – Local [X]

Public – State [ ]

Public – Federal [ ]

Category of Property

(Check only **one** box.)

Building(s) [ ]

District [X]

Site [ ]

Structure [ ]

Object [ ]

Number of Resources within Property
(Do not include previously listed resources in the count)

Contributing	Noncontributing	
38	4	buildings
1	0	sites
4	7	structures
0	0	objects
43	11	Total

Number of contributing resources previously listed in the National Register 0

6. Function or Use

Historic Functions
(Enter categories from instructions.)
INDUSTRY/manufacturing facility – shipyard/ship repair
DEFENSE/naval facility – shipyard/ship repair
GOVERNMENT/office – Naval office
COMMERCE/professional – shipyard office
INDUSTRY/industrial storage –warehouse

Current Functions
(Enter categories from instructions.)
INDUSTRY/manufacturing facility – ship repair
GOVERNMENT/storage – warehouse
COMMERCIAL/storage – warehouse
COMMERCIAL/professional – artist studio
VACANT/NOT IN USE

7. Description

Architectural Classification
(Enter categories from instructions.)
OTHER - Industrial
MODERN MOVEMENT – Moderne
LATE 19TH and 20TH CENTURY REVIVALS – Beaux Arts
LATE 19TH and 20TH CENTURY REVIVALS – Classical
LATE VICTORIAN – Renaissance Revival

Materials: (enter categories from instructions.)
Principal exterior materials of the property:

foundations	concrete; brick; wood
roofs	metal – iron/steel; tar and gravel; wood
walls	metal – iron/steel; brick; concrete; wood
walls	plastic sheeting
other	terra cotta

Narrative Description
(Describe the historic and current physical appearance and condition of the property. Describe contributing and noncontributing resources if applicable. Begin with **a summary paragraph** that briefly describes the general characteristics of the property, such as its location, type, style, method of construction, setting, size, and significant features. Indicate whether the property has historic integrity.)

Summary Paragraph

The Union Iron Works (UIW) shipyard, located at Potrero Point in San Francisco, California, comprises 65 acres.[1] Bordered by the San Francisco Bay, it lies at the foot of Potrero Hill in San Francisco's Central Waterfront District (Figures 1 and 2). The area is primarily industrial, with a power plant and the historic American Can Company building nearby, and is rapidly being transformed to a mixed-use district including commercial, light industrial, and residential uses. The Dogpatch Local Historic District — a primarily residential neighborhood interspersed with commercial establishments — lies several blocks to the west. Third Street, one block west of the district, is the main thoroughfare connecting to the rest of the city, with a light rail line extending public transportation to the area. The district itself features 54 contributing and

[1] Union Iron Works moved to Potrero Point in 1884, and the shipyard has taken on many names over the years. For consistency in the following pages, the name Union Iron Works (UIW) is used to indicate all incarnations of the shipyard associated with Pier 70 from 1884 to 1945. The Ownership Map (Figure 3) shows the rough boundary of the Union Iron Works Shipyard in 1884 along with the various owners of the southeastern portion of the district prior to the U.S. Navy purchase of the area in 1940 and the construction of the extant Building 12 Complex. Previous owners included Pacific Rolling Mills (1868-1900), Risdon Iron and Locomotive Works (1900-1912), and U.S. Steel Products Company (1912-1940) who owned the land when the U.S. Destroyer yard was built and operated by the Union Iron Works Company.

noncontributing resources, including buildings, piers, slips, cranes, segments of a railroad network, and landscape elements. Most buildings are industrial, constructed of unreinforced brick masonry, concrete, and steel framing with corrugated iron or steel cladding. There are also several architect designed buildings from prominent San Francisco late nineteenth and early twentieth century architectural firms. Also present are modified waterfront structures inherent to shipbuilding and ship repair, including slipways, wharves, and floating drydocks, remnants of the district's historical function. The property maintains exceptional integrity in terms of location, design, setting, materials, workmanship, feeling, and association.

Narrative Description

Site Overview

Union Iron Works stands on what was once a small promontory surrounded by deep waters, called Point San Quentin in the 1850s and later renamed Potrero Point. By the late 1870s, a bird's-eye view showed Potrero Point developed with industrial and residential buildings. No filling or grading of the point occurred prior to the construction of Union Iron Works during the early 1880s.[2]

In 1884, Union Iron Works moved from the northwest corner of First and Mission Streets in San Francisco to a new 22 acre shipyard situated along the shoreline with the steep cliffs of Irish Hill creating a physical boundary to the south, east, and west (Figure 4). The Pacific Rolling Mills buildings stood at the end of the point to the east and south of Union Iron Works.

The initial development consisted of six main buildings and a wharf.[3] The machine, erecting, and smith shops and the pattern house stood to the south of 20th Street. Apart from the pattern house, all of these original Union Iron Works buildings were red brick with iron roofs, stylistically similar to Building 113/114, the only remaining building of this original complex (Figure 5).[4] To the north of 20th Street, along the shoreline, stood the plate shop – sometimes known as the ship shop or machine shop, the slip way, wet basin, and wharves. The plate shop was likely of wood construction, but is not shown on the early yard views. This basic division and the original placement of buildings in the 1880s continued through World War II.

The shipyard was designed with 20th Street as the north-south dividing line between the machine shop and the fabrication yard. The fabrication portion of the yard was used to construct vessel hulls. The machine shop portion produced engines, boilers, hardware, and all other components necessary for building or repairing a ship.

The oldest and most prominent buildings are located along 20th Street. These include Building 113/114, the original Union Ironworks Building (1885), and Building 101, the Administration Building (1917). 20th Street terminates at a powerhouse with an iconic smokestack (Building 103; 1937). Beyond this building, and forming the only diagonal, is the massive, sheet metal-clad Building 6 (1941). To the south and east is the New Yard, consisting of World War II-vintage buildings, dominated by the Building 12 Complex (1941) and the six story concrete

[2] San Francisco Planning Department, *Central Waterfront Cultural Resources Survey Summary Report and Draft Context Statement, (*2001), 16.
[3] Sanborn Insurance Company Map, San Francisco, Vol. 5 (1886), sheet 153.
[4] "Valuable Industries: The New Union Iron Works and the Arctic Oil Works," *San Francisco Call,* January 24, 1884, 5.

Building 2 (1941 and 1944). An open layout and slips area lies to the east of the New Yard and the remnant of Irish Hill stands to the south and west. Major buildings north of 20th Street include Building 109, the oldest extant plate shop (1912), and Building 111, a six-story brick-clad concrete warehouse and office building (1917). Nearby buildings include Building 38 (1915) and Building 108 (1911). Slips 1, 2, 3, and 4 form the northwest edge with the Bay; remnants of slips and wet basins form the remaining northern edge.

The UIW Historic District retains a significant concentration of contributing resources, primarily buildings. It also contains noncontributing features including piers, wharves, and remnants of slipways and rail spurs. The district includes the entire 65 acres that encompass the maximum build-out of the shipyard in 1945, at the end of the period of significance.

Two sides of the district border the San Francisco Bay, with views of the San Francisco-Oakland Bay Bridge, the East Bay, Treasure and Yerba Buena Islands, and downtown San Francisco. The terrain is flat with a bluff at the southwest corner at the foot of the former Irish Hill. The northern portion of the district remains a working ship repair yard and drydock run by BAE Systems San Francisco Ship Repair. A metal salvage company is situated along the southeastern waterfront. Several other buildings are currently used either for interim industrial storage or as artist studios. The main entrance is at 20th and Illinois Streets, with a secondary entrance at 22nd and Michigan Streets.

Current Conditions and Character Defining Features

The buildings located along 20th Street – Buildings 113, 101, 102, 103, and 104 – and the south wall of Building 105, function to create an architectural promenade and entrance to the yard and, as a group, define the strong character of this portion of the district. The fencing installed during World War I along Illinois and 20th Streets is largely intact, and the entrance to the shipyard has remained at the same location since the 1890s.

The buildings north of 20th Street associated with shipbuilding and ship repair at Slips 1 through 4 and Pier 68 have experienced little modification since the end of the period of significance. The surviving buildings at the New Yard, the World War II era portion of the shipyard, are largely intact. Slips 5, 6, 7 and 8, directly associated with the New Yard, have lost all above grade features and no longer contain sufficient integrity to qualify as contributing resources.

The density of this urban industrial center and the variation in materials, styles, rooflines, cranes, chimneys, and waterfront features convey its historic evolution and distinguish it from other shipyard and industrial sites built or heavily remodeled during a single period. The materials used within the district are a physical record of the evolution of UIW and include unreinforced masonry, wood, concrete, and sheet metal construction.

Buildings that create visual landmarks by their prominence, location, and size can be considered character defining features of the district, as well as contributing resources. Since the 1930s, Building 103 and its large smokestack have dominated the view of UIW from its entrance, and have defined the end of 20th Street. The 512-foot long Building 6, constructed at a diagonal to the shoreline, counters the otherwise rectilinear plan of the shipyard. It expresses the scale of the materials used at the yard, demonstrates the historic interaction between materials and the water, and distinguishes this yard from others by its angled placement. Though some multi-story buildings erected within the district during the period of significance

are no longer extant, Building 2 and Building 111, both over 60 feet tall, convey the variation in building height seen at the yard since its inception.

While some of the existing open areas represent a loss of resources, others were purposefully left open and functioned as layout and welding areas important in the process of building a ship. The lot to the west of Building 12 was a plate storage yard during World War II, and open areas to the east of the Building 12 Complex contained welding platforms and slipways. Similarly, open spaces around Building 109 functioned as plate storage yards on the south and slipways on the north since the late nineteenth century. Some of the open spaces surrounding neighboring buildings were used for staging the ship repair and fabrication process but are not considered character defining features because they no longer convey their historic function from the period of significance.

Character defining features of the historic district are summarized as follows:

- Waterfront location/shoreline
- Minimal planted vegetation
- Open areas that are either paved with asphalt or covered with gravel
- Streets that are improved without curbs and gutters, except for 20th Street, which has granite curbs
- Dense urban-industrial character
- Variation in materials, styles, rooflines, and window types
- Variation in height and scale, with resources that range from one to six stories (80 feet) in height, some with large footprints of 60,000 to 100,000 square feet.
- Certain groupings of buildings, such as the entry promenade along 20th Street and the Building 12 complex
- Features such as cranes
- Ship repair activities
- Yard layout and plan

District Integrity

World War II represented the maximum build-out of the district. Since 1945, few new buildings have been added, and buildings of primary importance from all periods of growth and modernization remain.

UIW became part of Bethlehem Steel Corporation in 1905. Bethlehem Shipbuilding Corporation, Ltd. incorporated in October 1917; in 1938, Bethlehem Shipbuilding Corporation, Ltd. became the Bethlehem Steel Company, Shipbuilding Division. The district includes 43 contributing resources, listed here using Bethlehem Steel's numbering system. The resources table (Figure C) provides construction date, historic function, and photograph reference information.

Contributing Resources

1. Building 2 – Warehouse No. 2
2. Building 6 – Light Warehouse No. 6
3. Building 11 – Tool Room and Navy Office
4. Building 12 – Plate Shop No. 2
5. Building 14 – Heavy Warehouse

6. Building 15 – Layout Yard
7. Building 16 – Stress Relieving Building
8. Building 19 – Garage No. 1
9. Building 21 – Substation No. 5
10. Building 25 – Washroom and Locker Room
11. Building 30 – Template Warehouse
12. Building 32 – Template Waterhouse
13. Building 36 – Welding Shop
14. Building 38 – Pipe and Electric Shop
15. Building 40 – Employment Office Annex
16. Building 49 – Galvanizing Warehouse
17. Building 50 – Pier 68 Substation No. 2
18. Building 58 – Pier 68 Substation No. 4
19. Building 64 – Pier 70 Substation No. 6
20. Building 66 – Welding Shed
21. Building 101 – Main Office/Administration Building
22. Building 102 - Powerhouse
23. Building 103 – Steam Powerhouse No. 2
24. Building 104 – UIW Office Building/Industrial Relations Building
25. Building 105 – Forge Shop
26. Building 107 – Lumber Storage
27. Building 108 – Planning Mill and joinery Shop
28. Building 109 – Plate Shop No. 1
29. Building 110 – Yard Washroom and Locker Room
30. Building 111 – Main Office and Substation No. 3
31. Building 113/114 – UIW Machine Shop, Blacksmith Shop
    a. Building 23 – Boiler House Testing (addition to Building 113)
    b. Building 24 – Washroom and Locker Room (addition to Building 113)
32. Building 115/116 – Concrete Warehouses
33. Building 117 – Warehouse No. 9/Shipyard Training Center
34. Building 119 – Yard Washroom
35. Building 120 – Pipe Rack and Women's Washroom and Locker Room
36. Building 121 – Drydock Office
37. Building 122 – Check House No. 1
38. Building 123 – Check House No. 2
39. Irish Hill remnant
40. Slip 4, Cranes 14 and 30
41. Whirley Crane 27
42. Iron Fence on 20th and Illinois Streets
43. Pier 68

Noncontributing resources

1. Building 41 – Fire Station
2. Building 68 – Drydock Office/Substation 7
3. Building 127 – Pier 68 Production Offices
4. Building 141 – Pier 68 Breakroom/Washroom/Restroom
5. Wharves 1, 3, and 4
6. Drydocks 2 and Eureka

7. Pier 70 Wharves 6, 7, and 8
8. Slips 1, 2, and 3 remnants
9. Slips 5, 6, 7, and 8 remnants
10. 20th Street Paving Stones
11. Rail Spur Remnants

The most notable modifications to the historic district since World War II include the following:

- Removal of above-grade features of Slipways 1 through 3 and 5 through 8
- Removal or rebuilding of wharves and piers including: Pier 68 Wharves 1, 3, 4, 5, and Pier 70 Wharf 8; Wharf 8 was altered in 1941, 1942, and 1944, and completely rebuilt after 1980
- The loss of support buildings on deteriorating wharves
- Relocation of Buildings 122 and 123, Check Houses No. 1 and 2, respectively
- Removal or paving over of paving stones and rail lines
- Removal of the large gantry cranes associated with Buildings 12 and 109
- The installation of modular buildings and construction of new buildings including the BAE office and a Butler Building to accommodate sandblasting functions north of Building 105
- Removal of a row of buildings between Building 6 and the New Yard; the following buildings were removed from this area after the period of significance and all but the first two date from the World War II expansion:[5]
    - Building 4 – Sheet Metal Shop (built in 1900 with WW I and WW II additions)
    - Building 5 – Copper Shop (built in 1900 with WW I and WW II additions)
    - Building 7 – Light Warehouse
    - Building 8 – Riggers, Carpenters, and Painters Shop
    - Building 9 – Pipe Shop No. 2
    - Building 10 – Pipe Rack and Locker Room
    - Building 22 – Washroom
    - Building 56 – Sheet Metal Shop
    - Building 57 – Central Kitchen
    - Building 61 – Scale House

The annotated 1945 site plan (Figure 16) shows extant contributing buildings and buildings demolished after 1945. Despite the loss of some resources, UIW contains 43 contributing and 11 noncontributing resources (Figure 17) and forms a contiguous district with a variety of conditions. The district includes examples from all periods of construction and expansion from the opening of the yard in the early 1880s to the end of World War II. It retains sufficient historic integrity to convey its role in the birth and expansion of the U.S. steel hull shipbuilding industry and reflects the development of industrial architecture from the 1880s to 1945.

Location
UIW retains integrity of location. The yard retains its original relationship with the shoreline and with the city street grid. Apart from the waterfront features, the vast majority of extant buildings and structures remain in their original, historic locations.

[5] This list is based on a comparison between the Bethlehem Steel Company 1945 site plan and a 2008 aerial photo (Figure 18). Building numbers and uses are also based on that plan. See Figure 16 for a site plan of extant and demolished buildings.

Design
UIW was first designed in the early 1880s to build and repair steel hull ships. The district retains the essence of its original design and is an expression of the subsequent evolution in shipyard design throughout the period of significance.

The original plan for the UIW shipyard is expressed by the basic distinction between the machine shop, on the south side of 20th Street, and the plate shop and waterfront features, on the north side, with means to move materials between the two areas. This basic layout continued through World War II. The district was originally an integrated yard and continued to build ships and retain the ability to manufacture all the parts for a ship throughout its period of significance. Although the yard modernized and expanded several times, its basic layout remains. This expression of the original and later 1945 plan survives, in part, because the use of the area generally remained constant although the buildings or structures were replaced. For example, outdated plate shops were replaced by new plate shops, and slips and wharves were rebuilt in similar locations.

From 1900 until the end of World War II, the southeastern portion of UIW was developed as a second shipyard within the district, first by Risdon in 1900, then by the Emergency Fleet Corporation for World War I, and, finally, by the United States Navy for World War II. This facility was entirely rebuilt three times within the period of significance. The basic layout of the slips, shoreline, and plate shop remained the same from World War I to World War II, although the facilities themselves were rebuilt and enlarged. This portion of the historic district retains integrity of design as a result of the continued presence of Buildings 2, 11, 21 and the Building 12 complex, all of which are contributing resources.

Although visual connections between these resources and the water remain, the piers, wharves and above-grade portions of slips that formed the complete physical build-out have been compromised by deterioration, alteration, or demolition, and do not retain integrity. Likewise, the rail network that serviced the shipyard is no longer intact and retains insufficient integrity to be a contributing resource. However, remnants of rail closely associated with district resources (e.g., Slip 4 and Building 113) are character defining features of these contributing resources.

UIW's buildings and features were designed to move materials through the yard toward the slips or outfitting wharves. The general arrangement of slips, wharves, and wet basins supports a general understanding of the historic design of the shipyard, the ship repair and fabrication process, and the yard's historic relationship to the bay. However, because these features have either lost integrity or post-date the period of significance they are noncontributing.

Setting
The historic setting of UIW was the industrial zone of Potrero Point situated along the deep waters of the San Francisco Bay. In the 1880s, the area surrounding UIW contained industrial uses mixed with residential and commercial. The city street grid extended to the edge of the district and the shipyard was situated along the shoreline. Although the city has extended past Potrero Point, these basic characteristics of the historic setting remain.

Excavation of Irish Hill and the expansion of the yard into the bay altered the character of UIW and changed the relationship between the built environment and the adjacent natural features.

These changes all occurred during the period of significance and play a role in expressing the district's significance, thus they do not negatively impact the integrity of the district's setting.

Essential to the setting of the district and its ability to reflect the historic functions of the shipyard is the development along the shoreline. The yard's expansion into the bay is conveyed by the existing wharves, piers, and slips. This expansion is essential to understanding the character and development of the district. The majority of these features are noncontributing, since they post-date the period of significance. However, within the active BAE Systems ship repair portion of the district, noncontributing piers, slips, transient vessels, floating drydocks and cranes convey the historic function of the district and its relationship to the bay.[6]

Materials
UIW retains a high degree of integrity of materials. Limited adaptive reuse of the district contributors after the period of significance has allowed the remaining resources to retain significant integrity of materials. The few adaptive reuses that have occurred, such as conversion to light industrial functions, have left the materials of the contributing resources mostly unaltered. Although the shipyard has been largely repaved, the slips filled in, and the wharves rebuilt, almost all of the contributing resources possess their key exterior materials. The materials show some degradation from exposure and neglect, but clearly identify the district as an industrial shipyard.

Workmanship
UIW's contributing resources retain a very high degree of integrity of workmanship across the range of architectural styles and construction methods. The junction of older buildings with newer buildings through the district's 61-year period of significance illustrates two or more separate periods of workmanship within the same building. Strong examples of workmanship, including steel riveting, brick detailing, board-formed concrete, and wood-framed construction expresses UIW's industrial heritage.

Feeling
UIW clearly evokes the feeling of a historic shipyard. The continued presence of the ship repair activity along the north shore together with the contributing resources, especially the oldest surviving resources along 20th Street, express the district's historic function and therefore maintain the district's integrity of feeling. Cumulatively, the district's integrity of location, design, setting, workmanship and materials convey the district's strong character as an historic shipyard.

Association
UIW retains integrity of association with shipbuilding and ship repair. The yard is the longest continually operating ship repair facility in the country. Buildings remain from the original UIW period, associated with the birth of the nation's steel shipbuilding industry, and from all subsequent waves of development associated with the national shipbuilding industry. Subsequent periods of expansion and modernization reflected in the district are directly associated with national war efforts from the Spanish-American War through World War II.

[6] National Park Service, *National Register Bulletin: How to Apply the National Register Criteria for Evaluation*, ed. Interagency Resources Division National Register Branch (Washington, DC, 1997), 45.

Resource Descriptions

All resources within the UIW District are described in the following narrative. Resources are organized by contributing and noncontributing status and then by resource type, beginning with buildings. Building number references are those which appear in Bethlehem Steel Company's 1945 General Plan. This building number system was in place by World War II and adhered to by all surveys of the district. The building number is followed by the resource's name during World War II in parentheses.

Although the building numbering reflects the full build-out of the property, some numbers were missing – notably those from 70 to 100. It is possible that some numbers were not used to allow for yard expansion. Since then, some buildings have been demolished, resulting in numbering gaps. The demolished buildings located between Building 6 and the New Yard were listed previously; others were scattered throughout the district. Many of these were small sheds, such as Building 1, located in the parking area west of Building 113/114. Others were more prominent, such as Building 112, the old Pattern Warehouse that was one of the first UIW buildings.

Additions to existing buildings were historically given separate building numbers, especially where the addition had a distinct use. In some cases, these are counted as separate resources. In other cases, such as where the addition is very small and/or internally connected to the main building, the addition is considered part of the main resource. Where descriptions are grouped together in the following narrative, one resource is counted.

Contributing Resources

Building 2 (Warehouse No. 2)

Physical Description

Building 2 stands east of the complex formed by Buildings 113/114, 115/116, and 117, establishing a courtyard with Building 14. The land was formerly occupied by a portion of Irish Hill. The architect and builder of this industrial-vernacular building are unknown. It was likely designed and built by government personnel as part of the joint public-private World War II shipbuilding effort.

Building 2 is a six-story, board-formed, concrete warehouse, rectangular in plan with a flat roof. Constructed in 1941 and 1944, it measures 256' long, 76'-9" wide, and 79'-6" high. Containing a total of 98,804 square feet, it is one of the tallest extant buildings in the district. It runs north-south, with one loading door at the north façade and three at the north end of the west façade. Also on the north façade is a personnel entrance protected by a flat awning and accessed by three stairs. The windows are steel, multi-pane, fixed sash and most contain operable, four-lite, central vent sashes. The top floor, dating to 1944, has wood sash windows, which match the style of the steel sash on the lower floors. An elevator and stair tower project slightly from the west façade. Painted signage on the north end designates the building as "Warehouse 2." Additional signs were added as the function of the building evolved. Several original light fixtures remain on the west façade above the paired loading dock doors.

As on the exterior, concrete is the primary interior building material. The walls and ceiling of each floor are of board-formed concrete and the floor is exposed concrete slab, except at the sixth floor, which has wood boards over the original concrete roof slab. Columns on a 20' grid

divide the interior into bays; columns located on floors one through four are round with flared capitals and those on floors five and six are square. Except for the columns, each level consists primarily of open space used for storage. The large freight elevator and stairwell stand along the west wall near the north end of the building.

Historic/Current Use
Building 2, constructed during World War II, originally functioned as a warehouse to support hull construction at the Building 12 Complex and outfitting. The sixth floor of the building contained a drafting room and offices were located on the first and second floors. A bridge connects the fourth floor to the mold loft in Building 12, located to the south of Building 2. This building is currently used for commercial storage. Along with Building 111, Building 2 is one of two multi-story warehouses extant in the district.

Integrity
Building 2 has undergone few alterations since its construction, with the exception of the sixth-floor addition in 1944 that falls within the period of significance for the district. Therefore, the building retains a high degree of integrity, and is a contributing resource for its associations with World War II shipbuilding. It is one of the few concrete buildings from the World War II period and adds to the diversity of materials used within the district.

Building 6 (Light Warehouse No. 6)
Physical Description
Building 6 stands at an angle along the waterfront between Pier 70 and Pier 60. Built on vacant land and tidal flats it was associated with several smaller, now demolished, sheds. A BAE Systems materials layout and storage yard now surrounds the building to the east and south. Built in 1941, the architect/engineer and builder are unknown. This building was likely designed and built by government personnel as part of the World War II effort.

Building 6 is a 512’ long, 72’ wide, and 52’ tall, industrial-vernacular, pile-supported rectangular steel warehouse that encompasses 37,128 square feet. It has corrugated metal siding and a gable roof. The axis is generally north-south with a large rolling metal door on both north and south elevations. A continuous band of steel sash windows glaze the north and south elevations; most lites are broken. A loading dock covered by a corrugated metal awning spans the entire western façade; metal loading doors have 16-lite steel sash windows. A band of 25-lite continuous, fixed steel sash windows with operable central ventilators runs above the awning. Located below the eaves is a second band of 15-lite fixed, steel sash windows also with operable ventilators. The eastern elevation has similar glazing, and the lack of loading doors allows for the lower band to consist of larger 30-lite windows. A metal ladder ascends to a roof-level platform at the southwest corner of the building.

The interior is an immense and completely open, long rectangular space. The gable roof is supported by Fink trusses with king posts on exposed steel I-beams. East and west walls show steel cross and diagonal bracing. The openness of the space is accentuated by the lack of interior support columns. Crane tracks extend along both the east and west sides but the bridge cranes are missing. The ceiling and walls consist of the inside surfaces of the exterior cladding. The floor is concrete. The west elevation has 17 bays with hanging metal freight doors leading to the exterior concrete loading platform. The north and south ends have vehicular metal roll-up doors and interior loading docks. A rail spur ends at the northern loading dock. A small wood

platform stands in the northwest corner. Graffiti covers much of the interior. Empty electrical panels hang on the western wall. Several pendant light fixtures and reflectors remain.

Historic/Current Use
This building originally functioned as a warehouse to store materials used to outfit ships in the outfitting docks off of both Pier 68 and Pier 70. Building 6 is currently vacant.

Integrity
The building retains a high degree of integrity as it is has experienced few alterations It is a contributor to the historic district for its association with World War II steel shipbuilding. It is also a representative example of industrial architecture from World War II. Additionally, the massing and angled footprint of Building 6 is also a character defining feature of the overall yard design.

Building 11 (Tool Room and Office/Noonan Building)
Physical Description
Building 11 stands just east of Building 21 and west of a paved parking lot, accessed by a road to the north. The infilled Slips 5 through 8 are to the southeast, and the Building 12 complex is to the southwest. Located on the site of the Pacific Rolling Mills sheet and tin plate warehouse, Building 11 was built in 1941 by the Navy as part of the New Yard to aid in production related to World War II.[7]

This three-story, rectangular wood frame building is 156’ long by 72’ wide by 38’ high, containing 32,664 square feet. It has a flat tar and gravel roof, and is clad with horizontal wood siding. Two stair towers project one story above the roof. Windows are wood double-hung with simple wood surrounds, often paired. Exterior open staircases at the west and north elevations lead to small landings and doors at the second story. Doors include single metal units at each elevation, a wood freight door centered in the east elevation, and a sliding metal door at the north.

The interior currently includes artist studios and office space. First floor spaces open directly to the exterior, without internal circulation. Exterior stairs access the second floor double-loaded corridor, while interior winding stairs connect the second and third floors. Corridors feature resilient sheet flooring, plaster walls, glue-up acoustical tile ceilings, simple wood door and window trim, and wood baseboards. Office doors at the second level are glazed, with a central, large rectangular lite. Third floor corridors are similar to the second, and walls are finished with vertical tongue-and-groove wood paneling and topped with a grid-like transom. Wood-paneled office doors at this level are glazed with frosted glass. At least one space retains original light fixtures, and a large safe with a hand-painted door is located on the third level as well.

Historic/Current Use
Building 11 provided support for hull construction at the Building 12 Complex. The first floor originally contained a tool room, temporary lights department, and burner department, as well as three small offices. The two upper floors were devoted to office space.[8] Interior signage indicates that the offices were used by the United States Navy. The building contained a cafeteria as well.[9] Currently, artist studios and offices occupy the building.

[7] Tim Kelley, “Building, Structure, and Object Record,” Central Waterfront Survey Advisory Committee, 2001.
[8] Bethlehem Steel Co. Plan 1945, Sheet 23.
[9] Kelley, “Building, Structure, and Object Record.”

Integrity
While the building has sustained minor alterations, mostly on the interior related to change of use, it maintains a high degree of integrity of location, setting, feeling, and association; and a moderate degree of integrity of design, materials, and workmanship. Therefore, it is a contributing resource for its association with World War II.

Building 12 (Plate Shop No. 2)
Physical Description
Building 12 stands at the south end of the district, part of a complex of related buildings. The Building 12 Complex, comprising Buildings 12, 15, 16, 25, 32, and 66, was constructed mainly in 1941 as the central building of the New Yard. The building was designed and built by government (Navy) personnel as part of the joint public-private World War II shipbuilding effort.

Building 12 measures 248'-2"by 242'-2" in plan by 59'-6" tall, and contains 118,890 square feet spread across two floors. Construction is steel and wood with corrugated steel cladding. The roofline is an Aiken configuration, with five raised, glazed monitors running east-west for the width of the building. Clerestory multi-lite steel sash awning windows extend the length of the monitors on the north and south sides. The central monitor measures twice the width of the others. Twelve vertical bays divide the east and west elevations into 24' sections. Three bands of multi-lite steel sash awning windows, with a double-height bottom band, line the north and east elevations. Below the topmost band of windows, the south elevation directly connects to Building 15. Four bands of multi-lite steel sash awning windows run the length of the east elevation and the top band on all four sides provides light into the Mold Loft. A shallow ridge runs north-south along the center of the building, over the monitors, and the roof gently slopes at ¼" per foot to the east and west.[10] The west elevation has three vehicle roll-up doors, while the north has two.

On the ground floor two rows of columns running north-south divide the interior into three bays. Exposed square Howe trusses support the second floor 38'-4" above the ground. Lighting consists of standard factory lights with glass reflectors. On the north end of the building two steel staircases with concrete treads provide access to the upper level. Asphalt paves the ground floor.

The 360 degree band of windows and the clerestory monitor windows give the second story Mold Loft superlative light qualities. The Mold Loft has a wood plank floor, and wood cladding lines the walls up to window height. The ground floor columns penetrate through the Mold Loft floor to divide the space into three separate bays, with 9'-7" ceilings that rise to 17'-4"' in the monitors. The mold loft has industrial light fixtures similar to those on the first floor. Two personnel doors open onto the roof of Building 15 on the south elevation, and on the north elevation an enclosed walkway connects to Building 2. A dumbwaiter shaft opens near the walkway. In the northeast corner, partitions enclose an office, game room, and bathroom.

Historic/Current Use
Building 12 housed the plate shop and mold loft for the Building 12 Complex and was central to hull construction at Slips 5 through 8 to the east. The building was constructed on newly leveled

[10] Bethlehem Steel Co. Plan 1945, Sheet 54.

ground where most of Irish Hill once stood. It was one of a number of buildings constructed for the large enterprise of shipbuilding specifically for World War II. In the process of producing a ship from blueprint to hull, the construction plans were first transferred to a life-size model in the Mold Loft. This pattern was then taken to the mold makers who made a template out of wood, used for the guidance of marking the steel plates. Steel plates were stored in the adjacent yard to the west. The marked plates were then cut and shaped into the desired hull shapes. The finished plates were then transferred to the adjacent Layout Yard (Building 15) where the plates were checked against the molds and plans before welding.[11] The plates were moved from the yard to Building 12 and from Building 15 to the welding platforms and slips via U.S. Navy-owned rail lines. A rail line connecting Building 12 to the rest of the shipyard also ran next to the east elevation of Building 2. Building 12 stood adjacent to Machine Shop 2 (now demolished) and Layout Yard (Building 15) as the center of this World War II era complex. Welding platforms adjoined these buildings to the south linking the complex with Slips 5 through 8. The building is currently vacant.

Integrity
Building 12, Plate Shop No. 2, has experienced few alterations and retains integrity of location, design, setting, materials, workmanship, feeling, and association. The main alteration to the building is the removal of machinery and equipment, including cranes, from the first floor. Building 12 contributes to the Union Iron Works Historic District because of its association with the World War II shipbuilding historic context. It is also a representative example of industrial architecture from World War II. It forms the core of the Building 12 Complex, which also includes Buildings 15, 16, 25, 32, and 66.

Building 14 (Heavy Warehouse)
Physical Description
Building 14, the Heavy Warehouse, stands east of the complex created by Buildings 113/114, 115/116, and 117, and together with Building 2, forms a courtyard. The architect/engineer and builder of this 1941 industrial-vernacular building are unknown. It was likely designed and built by government personnel as part of the joint public-private World War II shipbuilding effort.

Building 14 is a double-gable metal building measuring 140’ by 116’-6” in plan by 66” tall, containing 15,969 square feet. Corrugated galvanized iron siding clads the building. Two tiers of ribbon windows punctuate both the north and south façades; the west façade has one window in each bay. One window remains in the east façade (north bay); modifications to the south bay resulted in the removal of the other window. A large, rolling metal door and adjacent personnel entrance penetrate the south elevation, near a faded “Warehouse 14” sign painted on the exterior. Two additional loading doors are on the east façade, one in each gabled section.

The interior forms a single space. Walls are corrugated metal, and the floor is asphalt. A central row of steel I-shaped columns and modified Pratt trusses support the double gable roof. A 20-ton crane with cab runs along the south side. Eight wall-mounted heaters attach to the walls on the interior, four on the south wall and four on the north.

[11] San Francisco Planning Department, 2001.

Historic/Current Use
Building 14 historically functioned as a Heavy Warehouse where equipment was stored for work on heavy machinery in Machine Shop 1 and for outfitting ships with mechanical and propulsion systems. A U.S. Navy-owned rail line transported materials from the warehouse to Slips 5-8. The building is currently used for storage by the Port of San Francisco's maintenance division.

Integrity
The building retains a high degree of integrity as it has experienced few alterations. Building 14 is a district contributor for its association with the World War II shipbuilding context.

Building 15 (Layout Yard)
Physical Description
Building 15 stands at the south end of the district and is part of the Building 12 Complex. The group, including Buildings 12, 15, 16, 25, 32, and 66, was constructed in 1941-1944 specifically for World War II. The architect/engineer and builder are unknown. The building was likely designed and built by government personnel as part of the joint World War II effort.

This east-west oriented warehouse is immediately adjacent to Building 12 and measures approximately 242'-8"by 71'-7", with an interior area of 17,134 square feet. A Fink truss with a king post supports the gabled roof, with the peak approximately 53' off the ground. Nine columns along the interior walls subdivide the space into eight distinct bays. The gabled roof covers the seven eastern bays; a flat roof of wood joists and decking covers the eighth, westernmost bay. A steel staircase on the south exterior wall leads to the flat roof, and a personnel platform on the roof rises slightly above the steel parapet.

Part of the Building 12 Complex constructed specifically for World War II, Building 15 attaches to four other buildings, three to the south (Buildings 32, 25, and 16) and one to the north (Building 12), leaving only the eastern and western ends exposed. On the interior, no significant walls or partitions separate Building 15 from Buildings 12 or 32, creating a unified interior space between the three buildings, although at the northeast corner of Building 15 a corrugated steel wall with multi-lite steel sash windows partially divides the easternmost bay from Building 12. The southern interior wall features a cut-out through the corrugated steel that reveals the exterior north elevation of Building 25. Short wood planking serves as a roof over the approximately one foot gap between the two buildings. Two wood personnel doors on either side of the Building 25 cut-out provided access between the two buildings. Where Building 16 and Building 15 meet, newer corrugated steel covers the wall and non-corrugated steel panels cover the wall at ground level. Standard industrial light fixtures, apparently original, remain.

On the exterior, the upper portion of the western façade features a corrugated steel parapet above a continuous band of multi-lite, steel sash pivot windows spanning the entire façade width. A similar band of windows glazes the ground level, interrupted by a large vehicle door in the central bay. Most of the southern elevation attaches to smaller buildings, but the western end of this elevation features a band of multi-lite windows above a vehicle door large enough for rail cars. The eastern elevation includes a band of multi-lite steel sash pivot windows at the upper level, and a roll-up steel door at the ground level. All of the northern façade attaches to Building 12.

Historic/Current Use
The Layout Yard served as an intermediate staging area for the steel plates of a vessel's hull used for hull construction in Slips 5 through 8. As the plates left the Plate Shop (Building 12) adjacent to the north, they were arranged, numbered, and checked against the molds and plans. This process assured that the welders had the correct panels lined up for welding. This occurred on either one of the welding platforms, if preassembled, or directly on the hull of the ship in one of the slips to the east. U.S. Navy-owned rail lines transported the steel plates to the welding platforms and slipways of the New Yard.

The personnel platform and stairs leading up to the flat roof on the western edge of the building indicate a potential use as a viewing platform to oversee activities in the plate storage yard to the west. These former staging areas remain between Building 12 and the remnant of Irish Hill to the west. The building is vacant.

Integrity
Building 15 contributes to the Union Iron Works Shipyard because of its association with the World War II steel shipbuilding effort undertaken at the New Yard. Building 15, the Layout Yard, has experienced few alterations and retains integrity of location, design, setting, materials, workmanship, feeling, and association.

Building 16 (Stress Relieving Building)
Physical Description
Building 16, at the south end of the district, is part of the Building 12 complex, comprised of Buildings 12, 15, 16, 25, 32, and 66. It was constructed in 1941 specifically for the World War II effort. The architect and builder are unknown. It was designed and built by government personnel as part of the joint World War II effort.

This two-story gabled warehouse measures 50'-10" by 152'-2" in plan and 45'7" in height. It contains a total of 7,588 square feet, and corrugated steel panels cover the steel frame. Five prominent vents run along the gable ridge. The upper portion of all exposed façades features a band of multi-lite, steel sash awning windows with operable vents near the top of the building. The eastern façade has five bays and two roll-up steel doors that interrupt a lower band of windows. The southern façade, divided into three bays, is almost entirely covered with steel sash windows, and has a single steel personnel door. The western façade, visible from a courtyard formed by neighboring Buildings 15 and 32, reveals more multi-lite, steel sash windows and two metal personnel doors with windows.

The interior consists of one open bay, with a concrete foundation and a double-height ceiling approximately 33'-7" from the ground. An exposed steel compound Fink truss with a king post top forms the gable, rising an additional 12'. The former entrance from Building 16 into Building 15 now appears covered with metal panels. Some standard factory light fixtures remain.

Along the western façade a large industrial furnace with a gable roof approximately 20' tall attaches to Building 16. The furnace features steel framed doors at the east and west elevations, with the eastern door opening directly into Building 16. The doors slide vertically into a protected compartment, and fire brick appears through holes in the doors. Four hydraulic actuators to tightly seal the furnace wrap around the door's perimeter. A chimney stands along

the southern side, and numerous exposed mechanical components envelop the north and south elevations of the furnace.

Historic/Current Use
The Stress Relieving Building was used for hull construction at the Building 12 Complex. Related to quality control, pre-assembled welded components for ship hulls in Slips 5, 6, 7, or 8 would have joints relieved of the stress inherent in the bond from imperfect welds. Stress relieving involved re-heating the bond juncture, burning the ridge and inserting a splint or "strong back" mechanically, and re-welding the joint in a controlled environment. The building is currently vacant.

Integrity
Building 16, the Stress Relieving Building, has experienced few alterations and retains integrity of location, design, setting, materials, workmanship, feeling, and association. Building 16 contributes to the historic district for its association to the World War II steel shipbuilding effort at the New Yard. The industrial furnace connected to this building is also a character defining feature and is the only example of this type of furnace in the district.

Building 19 (Garage No. 1)
Physical Description
Building 19, just south of Building 108, is surrounded by open space on the east, west, and south elevations. This building stands at the end of 20th Street, which was closed during World War II. Built in 1941, the architect and builder of this simple, industrial building are unknown. This is a one-story, rectangular-plan gable-roofed warehouse with corrugated, galvanized steel roofing and cladding. It measures 50'-8" by 24'-6" in plan and 31'-6" tall, and contains a total of 6,152 square feet. Windows are fixed, multi-lite steel sash with central ventilators; many lites are boarded or painted over. Rolling metal doors appear on the west, east, and south elevations. The north elevation is board-formed concrete and stands higher than the adjacent east and west. A small metal shed attaches to the west elevation.

The interior is a single open space. Walls are corrugated metal, except for the concrete north wall. Modified Howe trusses form the roof structure and the floor is concrete slab. Freestanding machinery includes a sifter/conveyor, and the building stores sandblast grit, used to sandblast ships prior to painting.

Historic/Current Use
Listed as Garage No. 1 and owned by the Government on the Bethlehem 1945 plan, this building was used as a garage and housed a small office during World War II. It adjoins Building 108, a planing mill and joiner shop. Building 19 is currently used by BAE Systems for storage of sandblasting grit. [12]

Integrity
Despite minor alterations, such as the attached metal shed at the west elevation, the building retains a high degree of integrity and therefore is a contributing resource. Building 19 is a contributor for its association with the World War II shipbuilding effort at the yard.

[12] Bethlehem Steel Co. Plan 1945, Sheet 1.

Building 21 (Substation No. 5)

Physical Description

Building 21 stands just west of the Noonan Building (Building 11), surrounded by two paved roads to the north and west, and a paved lot to the south and southeast, the site of infilled Slips 5 through 8. The architect/engineer and builder of this industrial-vernacular building, constructed circa 1900, are unknown.

This two-story rectangular-plan building measures 101'-2" long by 75'-6" wide by 44' high, and contains 10,172 square feet. It has a steel frame, with corrugated metal cladding. The roof, also corrugated metal-clad, is double gable, and each gable has a wide roof monitor. The glazing consists primarily of multi-lite, double hung wood or horizontal steel sash windows, many with an operable vent sash. Many windows are covered with plywood or metal security grates; the monitor windows have been covered with corrugated metal.

The primary elevation is north; the west half features two sets of personnel doors. Two glazed metal doors at the center of the elevation lead to the Port of San Francisco's electrical storage area, and a pair of metal doors east of center lead to the radio tower control room. The east half of the north elevation features two pairs of steel freight loading doors, glazed with twelve lites per door. Two additional personnel doors open at the second level, the easternmost accessed by a metal stairway.

The south elevation has two freight doors, each centered on the east and west half of the wall. A shed-roofed utility building attaches to this elevation at the southeast corner. The west elevation features a set of five hanging steel freight doors, now soldered shut. Each door is glazed with twenty-four lites.

Subdividing the building interior is a board-formed concrete wall running north-south. An east-west trending concrete wall divides the west interior portion into two sections. The east interior portion is two stories; steel I-beams support the second story.

Historic/Current Use

This building dates to the Risdon Iron Works period and is the only building left from that iron works. Since the functional history of Building 21 is linked to its ownership history, it is useful to recount some key transitions in land use and ownership of Risdon Iron and Locomotive Works. In 1911, the Risdon yard shut down and a subsidiary of the U.S. Steel Corporation purchased the yard. During World War I, the Union Iron Works Company built and operated, for the Emergency Fleet Corporation, a United States destroyer plant on the site of the former Risdon yard. The destroyer plant was commonly known as the Risdon Plant.[13] In 1940, during the build-up to World War II, the Navy built an entirely new shipyard on the site of the old Risdon Yard. According to *The Argonaut*, the Navy purchased the Risdon Yard in 1940. "This was operated by Bethlehem, and it was at this 'New Yard,' as it came to be known during World War II, that four high-speed anti-aircraft cruisers were built."[14]

[13] "History of Bethlehem's San Francisco Yard," *Pacific Marine Review,* XLVI (October 1949), 31; "1849-1949, A Century of Progress," Bethlehem Steel Company Shipbuilding Division, San Francisco, 15-16; "History of the San Francisco Yard, Bethlehem Steel Company, Shipbuilding Division," *The Argonaut,* Vol. CXXVI (August 29, 1947), 11.
[14] "History of the San Francisco Yard," 11.

While the construction date of this building has been identified as 1900, the documentary record suggests some possible contradictions. A 1905 Sanborn Insurance Company Map of the portion of the Risdon Iron Works east of the machine shop, appears to show a power house in the approximate location of Building 21. Although the map is an update and somewhat difficult to decipher, the Risdon Iron Works power house shown on the 1905 map appears to have similar dimensions but a different configuration from that of Building 21 as it appears on the 1945 Bethlehem Steel General Plan and the 1936 Sanborn Map of Union Iron Works. Furthermore, a 1902 *Marine Engineering* article on Risdon Iron Works describes a new powerhouse in the center of Risdon Iron Works as a one-story steel building 100 feet by 150 feet, whereas Building 21 is 101 feet long by 75 feet wide. The *Marine Engineering* article provides dimensions of all the main buildings at Risdon Iron Works in 1902 and many of the minor buildings including warehouses and a stable; none of the buildings described in the article matches the dimensions of Building 21 in 1945. However, a turn-of-the-century photograph shows a Risdon building similar to Building 21, indicating that this building was built circa 1900.[15]

Both the 1914 and 1936 Sanborn Maps show Building 21 to be a machine shop and transformer house. A 1945 Bethlehem Steel Company plan describes Building 21 as Sub-Station No. 5 and Electric Shop No. 2. It is described as a government owned building; the owner prior to 1941 is shown as Columbia Steel Co. (U.S. Steel Corp.)[16]

In 1945, the first floor had a compressor room in the northwest corner, with air compressors from 1942, and a small electric parts room east of the compressor room. Adjoining the compressor room and electrical parts room to the south was an area used for housing large equipment, including transformers. Most of eastern portion of the first floor was used as an electrical shop, with a small office in the northeast part of the floor. The second floor housed a shop in the north portion and a store room in the south.[17]

Building 21 now functions as a substation for the area and for storage. The roof was replaced in kind in 2008.

Integrity
The building retains its integrity. Building 21 is a district contributor because of its association with the development and expansion of power distribution at the yard, a key component in the advancement of shipbuilding processes during the late nineteenth and early twentieth centuries. Building 21 is also the earliest example of steel clad construction at UIW and is the only extant example of the turn-of-the-century buildings constructed by Risdon.

Building 25 (Washroom and Locker Room)
Physical Description
This single-story, steel frame, gable-roofed industrial building with corrugated metal-clad walls measures 51'-6" long by 29' wide by 19' tall, and contains 1,493 square feet. Built in 1941, it

[15] Sanborn Map Company, San Francisco, Vol. 5 (1905), sheet 544; Sanborn Insurance Company Map, Vol. 6 (1936), sheet 594; Sanborn Map Company (1914), sheet 594; "Risdon Iron Works, San Francisco," *Marine Engineering*, 7 (February 1902), 50; 1897 to 1904 Risdon Catalog, San Francisco Maritime National Historical Park, San Francisco.
[16] Sanborn Insurance Company Map, Vol. 6 (1914), sheet 594 and (1936), sheet 594; Bethlehem Steel Co. Plan 1945, Sheet 34.
[17] Bethlehem Steel Co. Plan 1945, Sheet 34.

stands in a courtyard created by four other buildings: 15, 16, an unnumbered mechanical building addition to 16, and 32. Building 25's northern end attaches to Building 15. A band of multi-lite, steel sash pivot and awning windows runs continuously on three exposed elevations, approximately 8' from the ground. Metal double doors with four-lite glazed upper panels open on the western façade. The steel Howe truss supports the gable roof.

No alterations to the plan or external materials are evident. The toilets, sinks, and urinals still line the walls, although all fittings have been removed. Most stall partitions have also been removed, as have the shower stalls near the center of the room. Prominent anti-Lyndon Johnson and anti-NAACP graffiti remains over one of the urinals.

Historic/Current Use
This building contains shower, bathroom, and locker facilities for the workers who labored in the adjacent buildings. Building 25 is one of the seven washroom and locker room facilities installed in 1941. It is the only example of a corrugated metal clad washroom from that period, but is similar in style to the two washrooms, Buildings 110 and 119, constructed during the late 1930s. Washrooms, lockers, and lunch rooms were scattered throughout the yard as a means of providing needed amenities to the workers where they worked, a more efficient means of running a business with hundreds of workers.[18]

Integrity
Building 25, the Washroom and Locker Room, has experienced few alterations and retains integrity of location, design, setting, materials, workmanship, feeling, and association. Building 25 is a district contributor for its association with the improvement of worker amenities during World War II.

Building 30 (Template Warehouse)
Physical Description
Building 30, just south of Building 49, stands in the northwest quadrant of the Union Iron Works yard. It runs northeast-southwest, parallel and adjacent to Slip 4, and in 1945 adjoined a welding platform. A crane stands to the east of this building, along Slip 4. Constructed in 1941, the architect and builder are unknown.

This is a tall, single story, rectangular warehouse that measures 61' long by 18' wide by 25'-6" high, containing 991 square feet. It has a flat roof and corrugated metal-clad walls. The northwestern elevation features three bays of windows covered with plastic sheeting. The northeastern elevation has a large, rectangular ground-level opening. A shed extension with a personnel door and several windows attaches to the southwestern elevation. Three large openings covered with metal panels comprise most of the southeastern elevation. The building is purely utilitarian and lacks ornamentation.

The main interior space is a single story, with elevated wooden walkways supported by metal straps hanging from the ceiling. Corrugated metal and plastic sheeting clad the wood frame, with wood panels along the southwestern wall of the attached shed. The floor and foundation are concrete. Wooden access ladders to the elevated wooden walkways mount to the southern

[18] San Francisco Planning Department, 2001.

corner and along the southeast wall. The wooden shed extension, one step lower than the main space, contains two rectangular offices.

Historic/Current Use
The Template Warehouse, Building 30, stored wooden templates used to mark the steel hull plates at Building 109. It is one of two extant template warehouses in the district. Used in the production of multiple hulls of the same design, the templates could be reused several times. Building 30 is currently unused.

Integrity
Alterations include a shed addition to the south elevation, and the replacement of some windows with plastic sheeting. These changes do not significantly compromise the integrity of the building; therefore, Building 30 contributes to the district for its association with the World War II shipbuilding effort.

Building 32 (Template Warehouse)
Physical Description
Building 32 stands at the south end of the district and is part of the Building 12 Complex (Buildings 12, 15, 16, 25, 32, and 66). The complex was constructed 1941-1944, specifically for World War II as part of the New Yard. The architect and builder of this 1941 building are unknown. It was likely designed and built by government personnel as part of the joint World War II effort.

This single-story, semi-attached, rectangular warehouse with a gable roof is of steel frame construction with corrugated metal-clad walls. It measures 100’ long by 50’ wide by 32’ high, and contains 4,900 square feet. Its northern end attaches to Building 15. Exposed steel compound Fink trusses with a king post form the gable and create a clear interior space with no support columns. The western façade features two rows of four, evenly space rectangular multi-lite steel sash awning windows with steel sills. The southern façade contains vents and a metal personnel door with four window panes. Multi-lite steel sash windows can be seen on the eastern façade from the courtyard formed by the neighboring Buildings 15 and 16. Wood planking, exposed on the interior and covered with roll roofing at the exterior, clads the roof. Two prominent vents sit on the gable ridge.

The interior ground floor has been repaved with asphalt and any mechanical and/or template storage racks have been removed. Many small standard factory light fixtures remain intact.

Architectural plans illustrate a mezzanine that wrapped around the entire second story, with offices in the northeast and northwest corners. The mezzanine rose 10’ from the floor and sat 11’ from the bottom of the trusses. Little evidence of the mezzanine or offices remains, except for a belt of steel beams that runs around the interior perimeter at approximately 10’ from the floor.

Historic/Current Use
The Template Warehouse, Building 32, stored wooden templates used in shaping steel hull plates at the Building 12 Complex. It is one of two extant template warehouses at the yard. Used in the production of multiple hulls of the same design, the templates could be reused several times.

Integrity
Building 32, the Template Warehouse, has experienced few alterations and retains integrity of location, design, setting, materials, workmanship, feeling, and association. It contributes to the historic district for its association with the World War II shipbuilding effort at the New Yard.

Building 36 (Welding Shop)
Physical Description
Building 36, the Welding Shop, is located between Buildings 104 and 109. Open, paved areas used for parking and storage surround the building on all sides. Built in 1941, the architect and builder are unknown.

This rectangular metal industrial building measures 200' long by 60'-9" wide and 47' high. It has an east-west axis and contains 12,050 square feet. Both the walls and the gable roof are clad in corrugated, galvanized iron. A 17'-9" high shed extension runs along the entire south elevation. Windows are multi-lite steel sash, with operable central ventilators, and consist of 16- or 20-lite panels arranged in rows of three or four. At the shed extension, windows are tall, 28-lite units in groups of three. Some windows at the north elevation are now covered with metal sheeting, and others, at the shed-roofed extension, have been altered as doorways.

The interior consists of an open area with a row of steel columns that separate the shorter, southern shed extension from the main space. Walls consist of the exposed steel structure, with the exterior corrugated steel cladding behind. The main roof structure is a series of compound fan trusses overlaid with corrugated metal cladding. Simple triangular trusses support the shed roof over the southern extension. The floor is concrete and in good condition. Four swing-out, one-ton cranes extend from the north wall, and two mount to the south. Double tracks for working 10-ton cranes run along both the east and west ends. Sliding metal freight doors in the east wall and double metal doors in south extension access the space. A personnel door and a soldered-shut freight door penetrate the west wall. An office occupies the southeast corner.

Historic/Current Use
As part of the hull construction process during World War II, this building was originally used for welding preassemblies that were then moved to the slipways, Slips 1 through 4, using Bethlehem Steel-owned rail lines. Building 36 is currently in use as a machine shop by BAE Systems after the ship repair company moved out of Building 113/114.

Integrity
Building 36, the Welding Shop, has experienced few alterations and retains integrity of location, design, setting, materials, workmanship, feeling, and association. Building 36 contributes to the historic district for its association with shipbuilding during World War II.

Building 38 (Pipe and Electric Shop)
Physical Description
Building 38 stands northeast of Building 105, with an open area to the east between Buildings 105 and 109. Building 111, a substation and warehouse, is directly to the west, and Building 119 is directly to the south. The building is adjacent to the wharves of Pier 68, currently used by BAE Systems. This building dates from 1915 and was altered in 1941; the architect and builder are unknown.

This two-story, rectangular plan, reinforced concrete building measures 138' long by 124' high by 36'-6" high and contains 30,519 square feet. Shaped parapets on the north and south elevations conceal the double gable roof. The walls are board-formed concrete. A projecting belt course separates the first floor from the second. Each elevation contains a variety of openings on both floors, showing many modifications.

The primary elevation is east. The first floor features two damaged metal roll up doors, two wood personnel doors, and one double-hung and one fixed wood sash, multi-lite window. The primary glazing on the second level is 20-lite, fixed wood sash; four of twelve are boarded or replaced with four-lite fixed sashes.

A one-story metal, gable-roofed shed addition with five damaged metal rolling doors opening to the north covers most of the north façade. A kiln stands along this elevation adjacent to the shed projection. Primary glazing on the north elevation is eight-over-eight, double-hung wood sash, mostly on the second floor.

The west façade contains five, 24-lite windows on the ground level and three, 8-lite fixed wood sash windows over three personnel doors. Two metal rolling doors also penetrate this elevation. On the second level are two personnel doors with transoms opening onto cantilevered wooden decks. Multi-lite double-hung and awning wood sash windows glaze the second story.

The south elevation, like the north, features a shaped double parapet. The concrete wall surface is spalling and failing over approximately 50 percent of the elevation, exposing rebar on the southeastern side. Windows along this elevation are fixed, wood sash, multi-lite.

The first floor divides into two unconnected bays with a northern shed addition. The west bay is an open shop area with a chain link partitioned storage enclosure in the southern half. Typical first floor construction includes board-formed concrete walls, steel columns, and steel beams that carry the second floor wood joists. The walls are of board-formed concrete and the exposed steel frame supports the roof structure. The floor is covered with wood planks. At the first floor, the ceiling consists of wood joists supporting the exposed diagonal floorboards from above. Double crane rails hang in the northern half.

Within the projection on the north side, the former exterior wall now functions as an interior wall that divides the main space from the shed addition. This wall displays multi-lite wood sash windows and wood industrial doors with diagonal beadboard. The east bay contains two spaces, accessible from the exterior or from a second-floor staircase along the south wall; doorways from the west bay are blocked.

The second floor divides into several rooms with a locker room and an electrician's shop occupying most of the floor. Offices, a men's room, and lunchrooms, along with several narrow hallways, fill the rest of this level. Floors are battleship linoleum with wood planking in storage areas. Walls are concrete with plywood and fiberboard finishes. Open storage areas expose the steel roof structure, consisting of flat Pratt and Fink trusses supporting corrugated metal roofing.

Historic/Current Use
Erected in 1915, the shops in Building 38 produced components for a ship's mechanical and propulsion systems during the outfitting phases of shipbuilding. The 1936 Sanborn Map shows a building plan with several functional areas, including a copper and pipe shop, with smaller rooms shown as electrical shop, furnaces, brazing room, and tool room. Most of the western portion of the building served as a pipe shop; the northwest corner had furnaces, and the southwest corner housed a marine electrical shop. The eastern half of the building divided into a marine machinery tool room in the northeast corner, a brazing room south of the tool room, and a copper shop in the southeast corner.[19]

In 1945 the building was called "Pipe and Electric Shop No. 1," with the pipe shop taking up most of the first floor and the electrical shop on the second floor. The first floor plan, labeled "Pipe Shop No.1," shows the west half of the floor as a pipe shop, with a pipe bending area and small soldering room at the northwest. Other spaces are as follows: a hanger shop and small office at the southeast corner, the "Vanstone" department at the center east portion,[20] and the sandblast room and government-owned dust collector at the floorplate's northeast corner.[21] "Vanstone" or "Van Stone" is a type of flanged pipe fitting.[22]

The second floor, in 1945, contained "Electric Shop No. 1," with the electric shop in the west and north portions of the floor, an electrical storage and supply area in the center west portion, offices in the northeast corner and center of the building, a smaller office in the electrical storage and supply area, and a locker room with fountains in the southeast corner of the second floor.[23]

Building 38 currently houses storage, offices, and an electrician's shop for BAE Systems.

Integrity
While portions of the south wall have failed and are now missing, and the building has been "red tagged" by the Port of San Francisco for its loss of structural integrity, the building still retains sufficient integrity to be considered a contributor to the district for its association with shipbuilding and ship repair during World War I and World War II.

Building 40 (Employment Office)
Physical Description
Building 40 is located on Illinois Street, behind Building 101, the Main Office. This is a Bauhaus/Moderne style, three-story rectangular building with a flat roof and two-story, angled, glazed entry feature. It measures 95'-9" long by 41'-9" wide by 34'-6" tall, and contains 8,259 square feet. The building stands adjacent to a retaining wall at Illinois Street, with two stories above street level and the main entry at the second floor.

A bridge flanked by plain, six-foot high stucco walls accesses the building entry from Illinois Street. The door surround is faceted, with a simple, projecting overhang above. A glazed, two-

[19] Sanborn Insurance Company Map, Vol. 6 (1936), sheet 592.
[20] Perhaps named for the "Vanstone" machine centered in the room.
[21] Bethlehem Steel Co. Plan 1945, Sheet 39.
[22] "The process of manufacturing a pipe spool with both flanges rotating without the use of conventionally welded or screw threaded collars is known as the "Conrac" or more properly the "Van Stone" system. The process essentially forms a lap collar by spinning over the parent tube at right angles to the original tube axis." From "What is Van Stone?" http://www.crp.co.uk/technical.aspx?page=263, accessed May 5, 2010.
[23] Bethlehem Steel Co. Plan 1945, Sheet 40.

story, beveled-corner stairhall stands behind the entry door, dominating the façade. Horizontal-paned, vertical wood window sash forms the cladding of this stairhall. The body of the building, extending north from the entry, is a simple, stucco-clad, rectangular block. The double hung windows are arranged in groups of two or three, with simple, horizontal bands of scored stucco relief.

The interior contains three stories, consisting of offices arranged off of double-loaded corridors. The main staircase is at the south end, with a smaller exit stair near the building's north end. The main entrance from Illinois Street accesses the building at the south end of the second floor, and the door opens into a waiting room/lobby. A partition with transaction windows separates the waiting room from an open office area; glazing remains at one opening, and although broken, the words "Employment Information" are still visible. The remainder of this floor contains smaller offices. From the waiting room, the main staircase ascends to the third floor. This part of the stairs, from the second floor to the third, is surrounded by windows, now boarded over. Originally, the space would have been flooded with light. The windows continue into a small, third floor lobby. The remainder of this floor, like the other two, is devoted to offices.

Historic/Current Use
This building was an employment office annex used for interviewing and processing the paperwork of the thousands of employees during World War II. On the March 1945 site plan, this building is labeled "Steel Office." Building 40 is currently vacant.

Integrity
This building is a district contributor for its association with the increase of facilities necessary for managing the vast influx of World War II workers at the yard. The exterior of the building retains sufficient integrity to be included as a district contributor. The interior is in poor condition: the roof has been taking in water in places, and the interior walls are covered with graffiti.

Building 49 (Galvanizing Warehouse)
Physical Description
Constructed circa 1940, this simple industrial building stands in the northwest corner of the yard, just west of Slip 4. The architect and builder are unknown.

This 152' long, 52' wide, and 46' tall rectangular steel frame warehouse contains 8,039 square feet. It has corrugated-metal-clad walls and a concrete foundation. The gable roof features a monitor extending almost the entire length. Crane rails run the length of the building, and two of the original three, six-ton cranes remain. The roof is wood-sheathed under asphalt shingles. There are no openings on the south or east elevations. The west elevation, with two large vehicular doors, each inset with personnel doors, is the primary façade. The northernmost freight door is only partially intact; the top portion is infilled with plastic sheeting. Corrugated plastic sheathing also covers the west window openings. The south elevation features a shed addition clad in corrugated sheet metal. A single metal personnel door stands next to this addition. At the south end of this elevation is a small freestanding shed. A rail spur runs along the north elevation.

The interior is an open, double-height, single-bay space. Compound king post Fink steel trusses extending the width of the building support the ceiling's exposed wood sheathing. The floor is concrete, and the walls display the exterior corrugated metal siding and structural steel

columns. A six-ton crane hangs between the two longer east-west walls. A green tarp divides the space, concealing the northern third of the warehouse. There are no openings along the east wall, and plywood panels lean against much of its base. The south end has two covered plastic openings and a metal personnel door accessing the small shed storage area. The west wall has several variously-sized openings, three of which have been covered with plastic.

Alterations include shed additions along the south elevation, and the removal of windows and doors in the west elevation.

Historic/Current Use
Constructed as a galvanizing plant in 1941, steel hull plates and metal ship components were galvanized in this building. Galvanization, the coating of steel with zinc, was used to reduce corrosion. Building 49 contained a zinc storage area at the southwest corner, and wood-lined concrete tanks containing lye, sulphuric acid, and muriatic acid.[24] The toxicity of this process resulted in the building's placement at the edge of the property. During World War II, rail lines connected the welding shed (Building 36) and Slips 1 through 3 with the galvanizing warehouse. Building 49 is currently unused.

Integrity
The building retains sufficient integrity to be considered a district contributor for its association with the shipbuilding and ship repair processes during World War II.

Building 50 (Pier 68 Substation No. 2)
Physical Description
Building 50 is a single story, steel frame building standing north of Building 110, near Slip 4. It is 30' long, 25' wide, and 23' tall with a square floor plan encompassing 678 square feet. Similar to Buildings 103 and 110, this building has a high brick base below a band of multi-lite, steel sash windows with operable awning ventilators, and corrugated galvanized iron cladding. A metal railing runs along the flat roof, surrounding roof-mounted electrical equipment. This area was originally enclosed with wire.

Historic/Current Use
Building 50 was erected by the government in 1941 when the yard was expanding in response to World War II. It is one of three extant substations built by the government in the district during World War II. It provided electrical power to Slip 4, nearby support buildings, and the welding shed. This building is currently vacant.

Integrity
Building 50 is a contributing building to the district for its association with the expansion of electrical distribution in response to the World War II build-out of the shipyard. Specifically, Building 50 allowed for welding facilities to be installed at Slip 4. It retains its integrity of location, design, materials, setting, workmanship, feeling, and association.

[24]Plans of the San Francisco Yard, Bethlehem Steel Company, Shipbuilding Division 1944-1945, Sheet 56.

Building 58 (Pier 68 Substation No. 4)

Physical Description

Building 58 stands on Pier 68, south of Drydock 1. Built in 1943, the architect and builder are unknown. This rectangular-plan substation measures 40' long, 26'-2" wide, and 21' tall, containing 939 square feet. It rests on chamfered square pylons and extends over the bay. The gable roof with monitor, clad with corrugated metal, runs east to west. Walls are concrete at the base with corrugated metal cladding above. Windows are multi-lite, fixed steel sash, with operable center ventilators. At the primary, south elevation are double steel personnel doors with glazed upper panels; one pane has been removed to allow electrical feeder cable to pass. A double sliding metal loading door with low vents occupies the eastern half of the elevation.

Turbines and other equipment fill the open interior. Floor paving is of 6" by 6" red terra cotta tile. Like the exterior, walls are concrete at the base with the inside face of the corrugated metal cladding set above the exposed steel structure. The ceiling consists of exposed steel trusses supporting the corrugated roof cladding.

Historic/Current Use

Building 58 is labeled Substation 4 on the March 1945 plan. It provided easily accessible AC and DC power to Pier 68 and the drydocks. The building is still in use as a substation for the drydock facilities.

Integrity

The building retains a high degree of integrity, and is therefore eligible as a district contributor for its association with the expansion of electrical distribution essential to welding and the World War II ship repair effort.

Building 64 (Pier 70 Substation No. 6)

Physical Description

Building 64, built in 1945, stands on Pier 70 near Wharf 8, situated between the now-collapsed Wharves 7 and 8, along Wet Basin 7. This is a single story, steel frame building with corrugated steel siding and a corrugated steel roof. It measures 52'-4" long by 41'-4" wide by 25'-3" tall, and contains 2,070 square feet. The western elevation includes three bays of industrial steel sash windows, while the northern elevation has a sliding steel door. The architect and builder are unknown.

Historic/Current Use

Like Building 58, Building 64 was a substation installed on the piers to meet power demands for outfitting ships in the outfitting docks. This installation was one of many upgrades to UIW's infrastructure to increase efficiency during World War II.

Integrity

This building displays little or no alteration, and is eligible for listing as a district contributor for its association with World War II ship construction and repair. The building is at risk of collapsing into the bay as Pier 70 continues to fail.

Building 66 (Welding Shed)

Physical Description

Placed northeast of Building 12, Building 66 marks the northern end of the Building 12 Complex, a series of six buildings constructed specifically for the World War II effort (Buildings 12, 15, 16, 25, 32, and 66). The Bethlehem Steel Company's 1945 architectural plans indicate that the federal government erected a welding platform n 1941, but the plans do not show a shed. The shed first appears in a 1945 aerial photo. Its architect and builder are unknown.

This large, rectangular plan, two-story, steel frame shed with corrugated metal siding measures approximately 220' long by 105' wide and covers 23,100 square feet. It is almost completely open on the north and south ends, providing an unobstructed north-south view through the building. Columns divide the space into eleven vertical bays, and Pratt trusses support the roof gable.

Along the west elevation, an attached men's locker room, measuring approximately 15' by 60', sits outside the main bay of Building 66. At some point following the period of significance, the locker room's north end sustained significant damage, with the roof torn off and the interior exposed to the elements. Two personnel doors from the locker room opened to the west and one opened to the east, into the main Welding Shed bay. Almost all interior fixtures have disappeared, but a few toilets, urinals, and a prominent "Men Only" sign stenciled on a western door remain in place. Large, angled support columns for Building 66 penetrate the locker room, dividing the space into distinct bays. The locker room roof, approximately 15' high along the western wall, slopes down and eastward at an approximately 15 degree angle. Translucent roof panels provided interior lighting.

At the east corner of the northern elevation, a sliding vehicle door on an overhead track remains, supported by horizontal beams. No other steel panels surround the door, although a personnel door opens through the vehicle door.

Note that this Building 66, as described here, differs from the Building 66 described on the 1945 Bethlehem Steel map. That plan shows Building 66 as a small building north of Wet Basin 7, which housed Drydock 2. The building was called the "No. 2 Drydock Building." The present building's appearance in the 1945 aerial photo places it within the period of significance.

Historic/Current Use

Building 66 was used for welding pre-assemblies and other hull components during hull construction at the Building 12 Complex and Slips 5 through 8. When Building 66 was constructed in 1945 on land that was formerly part of the Pacific Rolling Mills site, most of the yard was used for the production of war vessels. This open building sheltered outdoor activities so that the welding work would not have to depend on good weather.[25]

Integrity

Building 66, the Welding Shed, has experienced few major alterations and retains its original spatial qualities. Therefore, it retains integrity of location, design, setting, materials, workmanship, feeling, and association, and contributes to the UIW historic district for its association with the World War II shipbuilding effort at the New Yard.

[25] Tim Kelley, "Building, Structure and Object Record," 2001.

Building 101 (Main Office/Administration Building)

Physical Description

Building 101 stands at the corner of 20th and Illinois Streets, marking the corner and the entry to the shipyard. An iron perimeter fence frames the entrance to this building and originally extended down both 20th and Illinois Streets; this fence is still partially intact and described as a separate resource. Designed by preeminent San Francisco architect Fredrick H. Meyer and built in 1917, the building is Classical Revival in style.

This classically detailed, three-story-with-basement concrete and brick building is "L" shaped in plan with a wide bevel at the outside corner of the "L." It measures 140'-6" long by 51'-10" wide by 72'-0" high, and contains 56,268 square feet. Stucco clads the exterior, and is rusticated at the first floor. The roof is flat. At the beveled corner, granite steps lead to an elaborate, recessed entry. A keystone with egg and dart molding, and an oval cartouche caps the entry arch. The primary window type on all elevations is one-over-one, double-hung, wood sash with lamb's tongue details and operable transoms. Windows on the first floor are paired. A wide string course encircles the building between the first and second floors, with projecting balustraded window sills over the entry and at both end bays of the street-facing façades. These window sills are concrete and are supported by curved brackets with acanthus leaf ornamentation. Two-story fluted Doric pilasters ascend from the stringcourse, dividing the primary façades into bays. Set within each bay on the second and third floors, windows are in threes, with ornamental spandrel panels between the second and third floors. As seen on the west façade, these spandrel panels originally were ornamented with low relief floral patterns, although all of these have been lost on the south façade. A wide, simple entablature tops the building, with a projecting cornice band and solid parapet.

Structurally, the building consists of cast-in-place concrete slabs supported by steel beams encased in concrete, which are in turn supported on unreinforced brick walls at the perimeter of the building.

This building has three approximately 11,000 square-foot full stories over a basement and sub-basement, with a partial 1,512 square-foot fourth floor and penthouse. Double-loaded corridors access offices at the three primary floors and the basement.

The octagonal main lobby features cast stone walls over pink marble wainscoting and a pink marble floor. Centered on the coffered ornamental plaster ceiling is an octagonal bronze and glass pendant light fixture. The elevator, with Art Deco doors and a pink marble door surround, is along the south wall.

The lobby leads to the circular main stairhall. Extending to the third floor, it has marble steps and landings and an ornamental metal railing. The walls above the third floor level are ornamental plaster; those below are ashlar-patterned granite. Low marble walls divide the stairhall from the lobbies at each floor. An ornamental plaster ceiling tops the space.

The first floor corridor has a marble floor and marble wall cladding, which extends up from the ground approximately seven feet. The marble cladding is topped with oak picture rails. Above the oak rails are wood and glass clerestories and plaster wall finish. Cove moldings ring the plaster ceilings. Executive offices are located at the first floor. Rooms 116 and 117 exhibit

herringbone-patterned wood flooring and floor-to-ceiling wood-paneled walls with dentiled cornices.

Like the first floor corridors, those at the second and third floors feature clerestories over wood moldings. Third floor corridor walls have circa 1950 blond wood paneling, patterned vinyl asbestos tile (VAT) flooring, and glue-up acoustical tile ceilings. Two types of staff offices occupy the second and third floors. Second floor staff offices include resilient sheet flooring, plaster walls and ceiling, wood wainscot, profiled wood door and window trim, and heavy wood crown molding at the ceiling. The flooring is generally in poor condition, and walls and ceilings are in fair condition. Third floor staff offices include plastered ceilings covered by glue-up acoustical tiles, resilient sheet flooring, gypsum board walls, wood baseboards and chair rails, and simple wood door and window trim.

A small theater at the fourth floor features wavy wall cladding. At the ceiling, an enclosed former skylight is now surrounded by wavy paneling, and a series of wavy glass panels interrupt its reveal.

Vandals have stripped the vacant building of the ornamental metal railings from the first floor stairs, and most of its door hardware and light fixtures. Water damage has occurred in several of the offices on the second and third floors.

Historic/Current Use
Building 101 was designed as a new main office building in 1917, to accommodate the "enormously increased business of the Potrero plant and its branch across the bay," in Alameda, according to the *San Francisco Chronicle*. Architect Frederick H. Meyer told the *San Francisco Chronicle* in January 1917 that the building, then under construction, would be the largest and best equipped private office building in the West, accommodating 350 clerical, professional, and executive staff:

> The Union Iron Works company is constructing an office building at its plant in the Potrero, this city, at a cost of $250,000....Work on the building is to be rushed in order that the various departments to occupy it may have the space already needed....The present brick building at the entrance to the Potrero works, large as it is, does not accommodate the office forces which are scattered through the works in other buildings, and when the new structure is occupied the present one may be demolished to make room for the shipyards.[26]

Meyer's building plan, described in the *Chronicle*, had executive offices on the first floor, clerical departments on the second floor, drafting and naval architects on the third floor, a basement floor with blueprinting rooms and laboratories, and a sub-basement for storage and a service plant:

> Strictly Class A
> The big structure will stand at the corner of 20th and Illinois streets, on both of which streets it will have a frontage of 140 feet with a depth of fifty feet for each

[26] *San Francisco Chronicle,* January 27, 1917, p. 11/3.

> wing. It will be of class A type, which calls for steel frame with concrete walls, floors and roof, and it will have three stories, a basement and sub-basement.
>
> Brick and stone will be used in the exterior finish, and the interior will be done in hardwoods and marble, after the style of first-class office buildings. Special attention has been given the finish of the executive offices, which will be on the first floor. Specially designed rooms are provided for the president, general manager, vice-president, secretary, treasurer and cashier on this floor.
>
> Entrance to Be Imposing
> The second story will be laid out for various clerical departments, purchasing agents, estimating, etc., and also for a private dining-room, with kitchen, for the officers and department heads. The third floor will be used by the drafting forces and naval architects, with accommodations for 150 men. In the basement will be testing rooms, laboratories, and blueprinting rooms, while the sub-basement will be used for storage and service plant. Approximately 350 persons will be housed in the building, including officials, clerical forces and drafting and scientific staff.
>
> An imposing entrance and vestibule are designed in relation to the general interior plan. With maximum window space on fronts and backs of the building, the offices and other rooms will be flooded with light while careful provision has been made for ideal ventilation and heating, with efficiency the uppermost idea in the planning.[27]

In the mid-1930s much of the office equipment was replaced during a site-wide upgrade; some interior modification may have been made at this time.[28] In 1945 Building 101 remained the shipyard's main office building and still had executive offices on the first floor. One striking difference in 1945 was the expansion of vital functions into the basement and sub-basement floors, including a cafeteria and Navy dining room in the sub-basement.

The sub-basement also had a vault, boiler room, kitchen, storage, printing shop, janitor's quarters, file room, a small office, and a storage area.

The basement floor contained the office of the plant engineer, file room, cashier, purchasing department, blueprinting department, dark room, photostat room, dumb waiter, and women's and men's restrooms.

The first floor featured offices and a vault, the second had offices and restrooms, the third had a drafting room, offices, a vault, dumb waiter, and supply room. The penthouse had a drafting room, a PBX room, and a rest room. PBX stands for "private branch exchange," and refers to a telephone service for in-house use.[29]

The building is currently vacant.

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[27] *San Francisco Chronicle,* January 27, 1917, p. 11/3.
[28] Plans of The San Francisco Yard, Bethlehem Steel Company, Shipbuilding Division 1944-1945, Sheets 16-17.
[29] Plans of The San Francisco Yard, Bethlehem Steel Company, Shipbuilding Division 1944-1945, Sheets 16-17.

Integrity
Building 101 defines the entrances to the shipyard and conveys the prominence and success of the yard during World War I. It is an important district contributor that functions as the cornerstone to the promenade along 20th Street. The building expresses the growing role of management and administration in the shipbuilding process during World War I and World War II. Despite interior modifications on the upper levels and vandalism that resulted in the removal of character defining railings, light fixtures, and hardware, Building 101 maintains a high degree of integrity and is therefore a district contributor.

Building 102 (Powerhouse)
Physical Description
Building 102 fronts 20th Street. Along with Building 101 to the west and Building 104 to the east, it creates a strip of architect designed buildings at the entrance to the shipyard. It was designed by San Francisco architect Charles Peter Weeks and built in 1912.[30]

This tall, rectangular, concrete building has a hipped roof clad with straight mission tiles. It measures 128'-6" long, by 42'-4" wide, by 48' tall, and contains 8,428 square feet over the first floor and basement. The front (south) and rear (north) façades are each five bays wide. A large, arched, multi-lite wood window occupies both the east and west ends. Five arched window openings dominate the primary façade. The center, cartouche-topped arch contains galvanized metal-clad paneled entry doors. Each of the doors is glazed with a vertical strip of wood framed square lites. The remaining arched openings on the front façade, and all five at the rear, enclose multi-lite wood windows with operable transoms, and are topped with a decorative scrolled keystone. The entablature is notable for its terra cotta shell motif frieze and copper modillioned cornice. The ground level on the north elevation also has three sets of paired, two-over-two, double hung windows with lamb's tongue details, as well as two personnel doors. Each entry consists of paired, wood paneled six-lite doors. All doors and windows on this ground level have transom openings secured with metal grates.

The interior of Building 102 consists of a main floor over basement. The main floor is a single, large space with partial-height wood-and-glass partitions forming three rooms at the west end. Four turbines occupy the main floor, with newer electrical racks at the east end. The floor, of hexagonal tile with Greek key borders, is in good condition. Walls are of plaster at the upper portions, with white Carrera glass wainscoting, broken in a few places. Windows are trimmed in wood. The gabled ceiling is wood with exposed steel trusses. Crane equipment spans the ceiling north-south, and crane tracks run east-west. Offices at the west end feature linoleum floors, plastered walls with partial-height wood and glass partitions, and Carrera glass wainscoting. Plasterboard ceiling panels over the offices are framed in wood.

The basement has a concrete floor, poured-in-place-concrete walls with visible horizontal form-board delineations, and a concrete ceiling. Electrical equipment fills the room.

Historic/Current Use
Before construction of the new powerhouse in 1912, the entire Union Iron Works was operated from two isolated steam-driven power stations. Direct current energy was chiefly used to drive

[30] Charles Peter Weeks (1870-19280 was a significant San Francisco-based architect, responsible for such buildings as the Mark Hopkins (1926), Huntington (1922), and Sir Francis Drake (1928) Hotels, and the Shriner's Hospital (1923) in San Francisco. He also designed the State Library and Courts Building in Sacramento (1924-1926).

the machinery in the plate shop, the woodworking shop, boiler shop, machine shop, and foundry, while steam-driven compressors were operated for the air tools and all other pneumatic tools.[31]

For the new powerhouse, shipyard management decided to purchase power from a power company, for both maximum consistency and affordability. The contract was awarded to the Pacific Gas and Electric Company. "Continuity of service was paramount and it was felt that the company's big station at Humboldt and Georgia streets offered maximum security against interruptions."[32] Contract bids for construction of a new powerhouse opened in early October 1912. The powerhouse was built for $145,000.[33]

The shipyard used many different kinds of power, including compressed air for pneumatic tools; low pressure air for forges and oil burners; hydraulic power for presses and lifts; direct electrical current for general purposes as well as electric welding; alternating current for lighting, for starting air compressors, and for running rotary converters; and salt water power for fire protection and sprinkling.[34] Due to the different types of power used in the district, the power house functioned both as a generator of power for non-electrical equipment and as an electrical substation that transformed and distributed electrical power from the Pacific Gas and Electric Company.

According to the *Journal of Electricity, Power, and Gas*, the heaviest load on the power plant when it opened in 1912 was the compressed air service, at 100 pounds per square inch, for operation of all the pneumatic equipment, including drills, and chipping and caulking hammers. Compressed air was also used for many other purposes, "such as blowing out motors and machinery and operating small steam engines and hoists on ships laid up for repairs." Four large electrically operated air compressors furnished power for the pneumatic tools. They are "of the Franklin type manufactured by the Chicago Pneumatic Tool Company and are two-stage machines 28 in. and 17 in. diameter by 26 inch stroke, each having a capacity of 2,500 cubic feet of free air per minute."[35]

For general power distribution, the power plant had two rotary converters. "Direct current for general power distribution at 230 volts was furnished by two 3-phase, 60 cycle, 1,200 r.p.m. shunt-wound, rotary converters rated 200 kilowatts at unity power factor, and operated in parallel on the direct current end."[36] The switchboard in the power house gave the operator complete control of all the electrical power circuits in the various shops.[37]

The power house design and equipment were proudly described in PG&E's *Pacific Service Magazine* in June, 1916:

> Under the roof of this building, which is a beautiful piece of architecture of the Spanish Renaissance type, built of reinforced concrete, in dimensions 126 feet by 40

[31] *Journal of Electricity Power and Gas*, XXXI, November 15, 1913; *Pacific Service Magazine*, VIII, June 1916, p. 3.
[32] *Journal of Electricity Power and Gas*, XXXI, November 15, 1913, p. 436.
[33] *San Francisco Call*, October 5, 1912, p. 12/2; *Pacific Service Magazine,* VIII (June 1916), 4-5.
[34] *Journal of Electricity, Power, and Gas,* XXXI, November 15, 1913, p. 436.
[35] *Journal of Electricity, Power, and Gas*, XXXI, November 15, 1913, p. 438.
[36] *Journal of Electricity, Power, and Gas,* XXXI, November 15, 1913, p. 438.
[37] "Modern Facilities for Building Modern Liners," *Pacific Marine Review*, XXV, August 1928, p. 359.

> feet, are housed the four large Chicago Pneumatic Tool Company air compressors for supplying air for pneumatic hammers, each compressor being direct-connected to a 450-horsepower General Electric synchronous motor. Located here are also two rotary converters of a capacity of 200 k.w. each, which are used for supplying all direct current required for cranes, special machinery, etc., in the shops…[next to the converters is the switchboard]. The 18-panel switchboard located at one end of the building behind which are located three 500-k.v.a., 11,000/480-volt transformers, the three 50-k.v.a., 11,000/120-volt transformers and the two 225-k.v.a. transformers. Above all of this machinery may be seen the large 10-ton electrically-driven traveling crane which spans the entire width of the building. Beneath the switchboard, and on a lower floor, are the 11,000-volt switch compartments which receive the incoming cables that enter the building through underground ducts, the works being fed by two distinct circuits, one of which is direct from the Pacific Gas and Electric Company's main generating station at the Potrero. By this means there is a surety of service which is unexcelled. On this floor also is located the electric department, where all new and repair work is done.[38]

The *Pacific Service Magazine* described in 1916 how the new powerhouse affected "nearly every other feature of the works," permitting direct connections of all machine tools to individual motors:

> With the coming of central station energy came also numerous alterations and improvements of the departments; main line shafts and countershafts were eliminated, doing away with the use of belting, and all machine tools were direct connected to individual motors, which, besides making a great savings in power, made the shops light and much more inviting to the workmen.[39]

The electric distribution system was all underground. "There are twelve main feeders leaving the power house consisting of four direct current and six alternating current power feeders and two alternating current lighting feeders, all of which were from 400 to 600 amp capacity."[40]

Notably, the division between the north and south sides of 20th Street, which had long been considered the north and south districts of the shipyard, also comprised distinct electrical districts when the power house opened:

> The works were divided by 20th Street into north and south districts and as far as possible this natural boundary line has been followed in the separation of the alternating and direct current distributions. The south works consists mainly of machine shops and forms the direct current district while the north works is principally devoted to plate work and forms the alternating current district. There is however a certain amount of unavoidable overlap which is taken care of by one feeder running to each works and looped through all departments to provide for portable tools, etc.[41]

[38] *Pacific Service Magazine,* VIII (June1916), 4-5.
[39] *Pacific Service Magazine,* VIII (June1916), 4-6.
[40] *Journal of Electricity, Power, and Gas,* XXXI, November 15, 1913, p. 439.
[41] *Journal of Electricity, Power, and Gas,* XXXI, November 15, 1913, p. 439.

The Bethlehem Steel Company's 1945 General Plan identifies Building 102 as Powerhouse No.1 Electric. The main floor contained offices, four air compressors for pneumatic power (dating from 1913-1914), three rotary converters dating from 1913, a switchboard, a traveling crane beam, and five transformers, also dating from 1913. The basement held paper storage, a chain hoist, a monorail, and vault, switch cells and other electrical equipment.[42] This building continues to serve some of the electrical needs of BAE Systems.

Integrity
Building 102 is a contributing resource because of its high architectural value and its place in the architect designed group of buildings along 20th Street. This group functions as the main entrance to the yard and is a character defining feature of the district. Building 102, particularly with its intact pre-World War I pneumatic and electrical equipment, is associated with ongoing upgrades to the power distribution at the yard, which allowed the yard to remain a top tier shipbuilding facility during the early twentieth century. The building retains a high degree of integrity, as it has experienced few alterations. One of the exterior light fixtures framing the main entrance was stolen.

Building 103 (Steam Powerhouse No. 2)
Physical Description
Building 103 stands at the end of 20th Street. Its tall smokestack is a character defining feature, creating a visual anchor from the district entry at 20th and Illinois Streets. Built in 1937, the architect and builder are unknown.

This is a tall, one-story rectangular steel frame powerhouse, with a gabled monitor roof. It measures 62'-8" long, by 38'-2" wide, by 45'-6" tall, and contains 2,258 square feet. This building has a brick-clad base over a concrete foundation, and corrugated steel cladding and roofing. It is glazed with two rows of multi-lite steel sash windows on all but the east elevation, giving an appearance of a two-story building. A black-painted steel smokestack ascends from the southeast corner with "BETHLEHEM" still barely visible on the west elevation. A large, sheet-metal funnel-shaped chimney, likely associated with the boilers, stands adjacent to the east wall; metal ducting emerges from it and runs eastward, above Building 107. Sliding double metal doors, with square panels, penetrate the north elevation. The bottom row of windows, consisting of two, triple 30-lite units, has an irregular pattern of operable ventilators. Similar glazing occurs along the south elevation, giving the building a sense of translucence. Four, fixed multi-lite steel sash windows glaze the west façade. There are no openings along the east elevation.

The interior is a single space filled with steam generating equipment, including a control panel at its center. Two rectangular boilers dominate the eastern mass. Constructed from brick masonry and steel, they tower almost to the ceiling. Metal walkways wrap the boilers at the upper window level, reached by stairs along the north wall. Flooring is checkered steel and walls are corrugated metal over brick masonry. Fink trusses support the corrugated metal roofing. Ducts, entering from the west wall, run along the entire northern length of the building to the boilers.

[42] Plans of The San Francisco Yard, Bethlehem Steel Company, Shipbuilding Division 1944-1945, Sheet 38.

Historic/Current Use
Construction of Building 103 in 1937 was part of a sweeping program of shipyard modernization that took place in the late 1930s. A photograph and description of the building appeared in a 1938 edition of *Pacific Marine Review*:

> In order to make this yard independent a complete steam power plant has been installed in a separate power house. Two water tube boilers are used, each having a rated capacity of 350 horsepower and each being capable of continuous operation under a load of 700 horsepower. These boilers are equipped with Bethlehem-Dahl combination gas and oil burners fitted with automatic firing control. Normally the burners use natural gas. If for any reason natural gas supply fails, the burners can be changed over to oil fuel in a few minutes.[43]

Three air compressors with a combined capacity of 1700 cubic feet of free air per minute are installed in this new power house. In order to facilitate connection, inspection, maintenance, and repairs, a pipe trench of reinforced concrete was installed in a loop encircling the entire yard. The various pipelines, including fresh and salt water, hydraulic service pneumatic service, natural gas and fuel oil services, are carried on hangers on each side of this trench. This trench gives ample room for a man to pass between the pipes. It is covered at the top with checkered iron plates. Passing under railroad tracks it connects through 42-inch diameter corrugated steel culverts.[44]

A Bethlehem Steel Company building floor plan dated October 1944 shows the two water tube boilers and three air compressors described in the 1937 *Pacific Marine Review* article. The compressors are in the west portion and the boilers in the east portion of the building.[45]

Building 103 continues to serve its historic function as a steam powerhouse, now for BAE Systems.

Integrity
The building retains a high degree of integrity as it is has experienced few alterations. Building 103 is a contributing resource because of its associations with the World War II building campaign. Building 103 and its prominent smokestack also function visually to mark the end of 20th Street and have defined the view down 20th Street from the entrance of the yard since the 1930s; therefore, this building is also a character defining feature of the district.

Building 104 (UIW Office Building/Industrial Relations Building)
Physical Description
Designed by prominent San Francisco architects George Percy and Frederick Hamilton, this red brick Renaissance Revival style building is two stories high with a full basement and attic. It fronts 20th Street and is the third in the line of architect designed buildings along this street. Built in 1896, it is the earliest of the architect designed buildings.

The building measures 150’-6” long by 49’-6” wide by 60’ tall, contains 37,641 square feet, and has a hipped, clay tile roof and wood, one-over-one, double-hung windows. Originally T-shaped,

[43] “Bethlehem Reconditions Potrero Works,” *Pacific Marine Review,* 35 (October 1938), 23.
[44] “Bethlehem Reconditions Potrero Works,” *Pacific Marine Review,* 35 (October 1938), 23-24.
[45] Bethlehem Steel Co. Shipbuilding Division 1944, Sheet 38.

with the primary rectangular mass on 20th Street and a projecting center bay at the rear, the rear void areas have been infilled to create a rectangular footprint. The primary (south) façade features two-story brick arches, each containing paired, first and second story windows, which dominate the front (20th Street) and two side façades. These arches are set above a rock-faced, rusticated, concrete base, dressed to imitate sandstone. Actual sandstone accents the building as quoins, water table, keystones, windowsills, lintels and an upper-level string course which separates the second floor from the attic. Deeply set, paired, rectangular windows with shouldered molded brick and terra cotta surrounds punctuate this level. A copper modillioned cornice, in poor condition, tops the building.

A finely detailed sandstone Renaissance style portico at the front entrance features banded rustication, engaged Ionic columns, and a projecting cornice over the arched opening. The entry recess includes a coffered, barrel-vaulted ceiling and polished marble walls. The arched sandstone door surround with voussiors frames the wood-paneled, glazed front doors with transom and sidelites. The original door hardware has been removed.

The original rear (north) projection is flanked on either side by infill additions constructed in 1941. Bands of multi-lite steel sash windows with central ventilator sash are located at both the second and third stories. The original (1896) central portion features seven wood sash windows of different types and one personnel door at the ground level. The east addition also has personnel entrance doors at the ground level. Both additions have one-over-one, double hung wood windows at the ground level, and are covered with metal cladding, pressed to imitate brick on the upper two levels, and wood lap siding at the ground level. A metal fire escape attaches to the east end of the addition.

The interior of Building 104 includes three floors over a basement. The first level has linoleum floors, plaster walls and ceilings, and wood window trim. At the east end is an open office area with columns and some partial-height wood and glass partitions. The lobby at the main entrance exhibits World War II era alterations including vinyl asbestos tile (VAT) flooring, wood paneling at the walls, and streamlined horizontal steel railing at the lobby stair hall. Similar vintage alterations are found at the west end of the first floor including wood paneled walls and built-in wood counters.

The second floor is a single column-free space with noncontributing carpeted floors, plaster walls, and a plaster ceiling. There are three private offices at the east end with mid twentieth century alterations, possibly from World War II. These include wall trim, flush doors, and blond wood wainscoting. Wood and glass partitions also occur at the east end. Stairhall features at the second floor include glass dividers and a safe with the words “National Safe & Lock Co., Cleveland, O.” The second floor also features a World War II era photo mural of shipbuilding and shipyard workers.

The third floor contains a single large room with partial height wood-and-glass partitions along the east, west, and south sides. The linoleum flooring is in poor condition. Walls are of painted brick, and the ceiling is constructed of wood with wood cross trusses in both the north-south and east-west directions. The ceiling has a total of 17 skylights.

Historic/Current Use

From the mid-1880s until 1896 the Union Iron Works executive offices were located in a corner of the western portion of the machine shop, Building 113; offices for bookkeepers, draftsman, and clerks were located in the basement of the boiler house, in the eastern portion of Building 113. The firm also had administrative offices in downtown San Francisco; in 1895, these downtown offices were located at 222 Market Street.[46]

In 1896, the company constructed a new office building to achieve many goals: to house its offices in one place, including an "elegant suite" for the executives; to consolidate the shipyard's two drafting rooms, for the Shipbuilding and Engineering departments, into one efficient system; and to relieve bookkeepers, draftsmen, and clerks, who had been toiling in the dark basement of the boiler house, where, according to the *San Francisco Call*, "they were compelled to work by gaslight during the daytime."[47]

A notable functional feature of Building 104 at the turn of the twentieth century was an iron bridge spanning 20th Street, creating "ready access" between Building 104 and the machine shop in Building 113.[48] No physical evidence of this bridge could be found at either building.

Storage rooms occupied the basement. The ground floor had a furnace, chemical laboratory, check house, and storeroom. The first floor contained offices. To the west of the entrance hallway were the offices of the shipyard manager, secretary, and cashier. To the east were offices for Navy inspectors. The first floor also had a central telephone station with 32 circuits to various parts of the plant, and to the downtown offices of Union Iron Works.[49]

The most noteworthy feature of the four-story office building was the new drafting department, occupying the entire second floor. The drafting system was considered so exemplary at the time that *The Engineering Record* devoted an entire article to it in March 1900. The UIW drafting department shared the second floor with U.S. Navy drafters, who had separate drafting rooms in the western portion. The UIW drafting room contained three departments: Shipbuilding, Engineering, and Electrical.[50]

Before construction of Building 104, drawings in both the shipyard and engineering departments had been stored in chests of drawers, and by 1895 there were about 60,000 drawings in a "deplorable state of preservation." Two female employees — Miss Turrell and Mrs. Davidson — spent two years indexing about 25,000 of the drawings, storing them in paper cylinders in custom-built galvanized steel racks, and developing a bookkeeping system for keeping track of them as they circulated throughout the shipyard.[51]

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[46] "Industry 1895," in Ruth Teiser Manuscript Collection, Series 6, Subseries 3, Box 146, File 10, Folder 10, J. Porter Shaw Library, San Francisco Maritime Historical Park; *San Francisco Call,* July 26, 1896, p. 10/2.
[47] *San Francisco Call*, July 26, 1896, p. 10/2.
[48] *The Engineering Record,* Vol. 41, March 10, 1900, p. 227.
[49] *The Engineering Record*, Vol. 41, March 10, 1900, pp. 226-228; Sanborn Map Company, Vol. 6, Sheet 591.
[50] *Marine Engineering* (January 1900), 16; *The Engineering Record,* Vol. 41, March 10, 1900, pp. 226-228; Sanborn Map Company, Vol. 5 (1899), sheet 541.
[51] *The Engineering Record*, Vol. 41, March 10, 1900, 227.

Tracings were stored on the third level of a three-story fire-proof vault. On the ground floor the vault served as a safe for the chemical laboratory. On the first story it was the cashier's safe. At the drafting-room floor it held all the tracings.[52]

The third floor housed the blueprinting and photography departments, a laying-out floor space for the shipyard department, several offices, and a room for the electrical draftsmen. Most of the drawings were circulated in blueprint form, but photography was used to reduce drawings to a small size for mailing.[53]

In 1917 a new Main Office building (Building 101) was built at the corner of 20th and Illinois Streets. By 1938, Building 104 was referred to as the Navy Office building.[54]

In 1941, the rear, north elevation was infilled from the central staircase to the east and west corners. The Bethlehem Steel Company 1945 General Plan, calls the building "Navy Office-Hospital." The hospital most likely was introduced in 1941 at the time of the addition. The 1945 Plan shows a sub-basement with storage spaces and vaults, as well as unexcavated spaces. The basement floor contained an office for Navy Inspectors at the southwest corner; hospital emergency rooms, a doctor's office, and waiting room at the northeast corner; and additional offices, a dark room, and lockers. The first and second floor held offices, while the third floor had a duty officer's room, women's lounge, supply room, locker room, and storage room. The three story vault is shown extending from the sub-basement through the second floor.[55]

The building is currently vacant.

Integrity
The building retains a high degree of integrity. Interior alterations appear to date to the period of significance. The exterior retains a high degree of integrity, with no major alterations since 1941. Building 104 is a contributing resource because of its associations with the early Union Iron Works period through World War II, and for its high architectural value.

Building 105 (Forge Shop)
Physical Description
Building 105 stands along 20th Street and is the last of the line of buildings along the north side of the street. It was constructed in 1937, incorporating one wall of an earlier late nineteenth century building. The architect/engineer and builder are unknown.

This 223' long, 93' wide, and 63' tall, rectangular building contains 20,111 square feet. It has a gabled, monitor roof with ventilation grilles. A one-story, shed-roofed projection, with its own roof monitor, runs along the south, 20th Street side. This steel framed building has corrugated metal cladding and steel sash windows along three sides. The south elevation incorporates an earlier one-story brick wall with twelve bays of wood 15-lite hopper windows separated by projecting brick piers, probably dating to the nineteenth century.[56] The building steps back above this elevation to reveal a high ribbon of steel sash windows set in corrugated metal cladding. The

[52] "Draughting Department, Union Iron Works," *The Engineering Record,* Vol. 41, March 10, 1900, p. 227.
[53] "Draughting Department, Union Iron Works," 227-228; Sanborn Map Company, Vol. 5 (1899), sheet 541.
[54] *Pacific Marine Review,* 35 (October 1938), p. 26.
[55] Bethlehem Steel Co. Shipbuilding Division, San Francisco Yard Calif., 1945, Sheet 20.
[56] The 1899 Sanborn Map shows a flinch shop and boiler shop in this location.

remaining elevations rest on a five-foot high brick base. The north and west elevations have two levels of steel sash ribbon windows: an upper level, four lites high, and a lower level of continuous two-tier multi-lite steel sash units. A crane platform mounts over the first level of windows on the north façade and a crane extends northward. The east elevation is almost completely open, with crane rails projecting out into the yard. Rolling metal doors penetrate the north and east elevations.

The interior consists of a 20,739 square-foot, two-bay open shop space with crane rails and a working crane running the entire east-west length of the northern bay. The ceiling consists of exposed steel Belgian trusses with sub-diagonals below corrugated metal roof cladding. The south wall is brick, while remaining walls are exposed steel frame with corrugated metal sheeting over a brick base. An office booth clad with sheet metal and steel sash windows stands at the west end. The floor is concrete with steel panels.

Historic/Current Use
The building originally constructed at the yard appeared as a flange shop, boiler shop, and sheet metal shop on the 1899 Sanborn Map; it did not appear on the 1886 map. The 1914 Sanborn Map shows this L-shaped building infilled to form a square; the circa 1914 portion housed a blacksmith shop. The brick wall fronting 20th Street remains from the pre-1899 building. The March 1945 site plan labels Building 105 as a “Forge Shop.”

The original part of Building 105, at the south wall of the existing building, was built circa 1899, and was described as a new building housing a boiler shop and flanging shop in a January 1900 article in *Marine Engineering*:

> The boiler shop is a new building, 90 ft. by 200 ft., with a flanging shop 60 ft. by 100 ft. attached. The frame is of steel, the walls of brick, and the interior is particularly well arranged and equipped. It contains some large tools, among which might be mentioned the large hydraulic riveter, with 12 ft. gap; the vertical bending rolls, that can roll I 3-4 in. plate 10 ft. wide; the horizontal rolls, that can bend I 1-4 in. plate 18 ft. wide; and the guillotine shears, that can shear 88 in. of I in. plate at one cut. There is also a new boiler shell drilling machine, in which a 16 ft. boiler can be set up on end and five drilling heads, each head operating three drills, can be worked simultaneously upon it. Flanging is done with a large Tweddell hydraulic flanging machine, circular flanges are beveled on a large milling machine made for the purpose, and manholes in heavy plate are cut with an elliptical boring machine or man-hole cutter. There is a fine assortment of punches, shears, gang drills, etc., and plenty of hydraulic jib cranes for handling the light work. Two 50 ton, overhead electric cranes, traveling on the same track, do the handling in the main shop, and the two large riveters have overhead traveling cranes of their own. All the large shears, punches, rolls, etc. are driven by independent motors.[57]

The 1899 and 1905 Sanborn Maps showed the original part of Building 105 divided into three functional areas: a boiler shop in the east portion of the building, a sheet iron works in the west portion, and a flange shop in the western portion of the building that formed the short wing of the “L.” A coal shed attached to the northeast corner. The yard south of the coal shed and east of the building is labeled “scattered lumber.”[58]

[57] “Shipbuilding Plant of the Union Iron Works at San Francisco,” *Marine Engineering* (January 1900), 16.
[58] Sanborn Map Company, Vol. 5 (1899), sheet 541; Sanborn Map Company, Vol. 5 (1905), sheet 541.

The 1913 Sanborn Map showed this L-shaped building infilled to form a square; the new northeast portion housed a blacksmith shop. A new copper and tin shop occupied the center of the building, where the sheet iron works had been located in 1899 and 1905. The coal shed and lumber yard area east of the original building were also filled in by 1913, forming a rectangular extension along the whole east side, labeled "lumber storage area."[59]

In 1937, the building was entirely rebuilt, retaining only the south wall of the earlier building. The new building retained not only the masonry wall, but also a function and layout similar to that shown on the 1913 Sanborn Map. Bethlehem Steel Company's 1944 building plan labels the building as a forge shop. The plan shows that all the building's cranes date to 1937, and all other equipment and tools including forges, furnaces, hammers, blowers, pumps, and tanks, date to either 1937 or 1941.[60] The building still functions as a shop for BAE Systems.

Integrity
The building retains a high degree of integrity, as it is has experienced few alterations since its construction in 1937. Building 105 is a contributing resource because of its associations with the build-up prior to World War II as well as for its earlier associations with Union Iron Works.

Building 107 (Lumber Storage)
Dating to 1937 and standing just north of Building 19, Building 107 is a 3,461 square-foot rectangular plan, narrow steel frame shed measuring 124' long, 33' wide, and 20' 8" tall. It is clad and roofed with corrugated sheet metal, and has a 4' tall brick base at the western and southern elevations. [61] The eastern portion attaches to Building 108 and infills the southwest corner of Building 108's rectangular floor plan. Approximately 50 feet of Building 107 extends westward from Building 108 toward Building 103. Portions of the north elevation are open. Metal ducting runs east-west on triangular truss supports approximately 8 feet above the roof. Most of the southern elevation is concealed by Building 19.

A compressor room lies near the western end of the building; it is enclosed by corrugated sheet metal and has a metal door facing north. Building 107 shares its northern wall with Building 108, and multi-lite windows and doorways currently connect the two buildings. Building 107 also includes a gate that provides access between the east and west portions of the yard.

Historic/Current Uses
Built in 1937 by Bethlehem Steel, this building was used for lumber and tube storage for work occurring in Building 108. It is part of the late 1930s upgrades to the yard that increased storage space and organization of materials. Building 107 is currently used by BAE Systems, mainly for storage.

Integrity
This simple industrial shed has seen little alteration and retains its integrity. Building 107 is a district contributor for its association with the late 1930s district-wide upgrades that positioned the yard for World War II government contracts.

[59] Sanborn Map Company, Vol. 6 (1913), sheet 591.
[60] Bethlehem Steel Company Shipbuilding Division 1944, Sheet 43.
[61] Brick bases were common to the buildings constructed during the late 1930s.

Building 108 (Planing Mill and Joinery Shop)

Physical Description

Building 108 stands within a cluster of buildings including Building 111 (former Main Office, Warehouse and Substation No. 3), Building 38 (former Boiler Shop) and smaller storage sheds (Buildings 107 and 120). Built in 1911 and expanded in 1913, the architect and builder are unknown.

This two-story industrial building measures 155' long, 149' wide, and 50' tall, and contains 40,846 square feet. The building incorporates two distinct masses, each under its own north-south oriented gable roof. The western half was constructed in 1911 and the eastern half was constructed two years later. A monitor sits along the western gable; skylights also penetrate the slopes of both gables. Corrugated steel sheathes the walls and roofs. Each mass has distinct openings – the eastern mass features eight-over-eight wood double-hung windows, while continuous bands of multi-lite steel sash stretch across the north, west, and south elevations of the western mass. At the eastern mass, wood rafter tails extend at the gable-ends; they do not at the western mass. Doors include rolling metal loading doors at the north and west elevations, and two personnel doors at the north end of the west elevation.

The 20,423 square-foot first floor contains a shop, a bathroom/locker room, and a storage area. Many large shelves and cabinets break up the otherwise uninterrupted space. Atop the concrete foundation, the floor is wood tongue and groove, worn and covered with plywood and steel plates in some areas. Walls are corrugated metal with exposed steel framing. The exposed ceiling structure consists of wood joists and cross-bracing supporting narrow tongue and groove wood sheathing. Riveted steel I-beams support the joists at regular intervals. The second floor boasts the same square footage and contains an open shop space with two small, narrow rooms at the north and south ends. The floor is wood, and walls are corrugated metal over exposed steel framing. Steel trusses support the roof at both gables. Skylights on the west face are exposed and those on the east have been covered.

Historic/Current Use

The shops of Building 108 worked to outfit the ships in the outfitting docks. The 1914 and 1936 Sanborn Maps call Building 108 a saw mill and joiner shops building. A joinery department built the living quarters on a ship, such as lounges, recreational rooms, and crew space. Joiners produced fancy woodwork, trimmings, and wood railings – finish carpentry – in contrast to a carpentry department that typically built staging areas, launch ways, shoring, and supports for a ship under construction. Both joiners and carpenters historically were part of the outfitting division of a shipyard, along with the electrical department, sheet metal department, and paint department.[62]

The 1914 Sanborn Map shows a car shop adjoining the southwest portion of the saw mill and joinery shop building. There are only two notable alterations shown on the 1936 Sanborn Map: an extension and partition in the southeast corner of the building labeled "varnishing room," and a lumber shed in place of the car shop that appeared in 1914, Building 107.

In 1945, Building 108 functioned similarly to before, as a Planing Mill-Joiner Shop. The planing mill occupied almost the entire first floor at this time, with a small office at the northwest corner.

[62] Bethlehem Steel Co. Shipbuilding Division, "An Introduction to Shipbuilding," (1942), 46-49.

Tools in the planing mill dated from 1911 to 1942, and included planers, saws, grinders, knives, drills, surfacers, jointers, and borers.[63]

A joinery shop occupied most of the second floor in 1945, except for, again, a small office in the northwest corner, and a varnishing room and polishing room in the southeast corner. Tools installed at the shop dated from 1911 to 1942 and included drills, chisels, saws, grinders, sanders, lathes, clamps, and a hoist.[64]

The building is currently used for storage by BAE Systems, and retains wood shop equipment at the second level.

Integrity
The building retains a high degree of integrity, as it is has experienced few alterations. Building 108 is a contributing resource because of its associations with pre-World War I Bethlehem Steel site development.

Building 109 (Plate Shop No. 1)
Physical description
Building 109 stands near the district's northern edge, beside Slips 1, 2 and, 3. Building 109 was mostly constructed in 1912 as a Plate Shop and Mold Loft, although the easternmost section was added in 1936 as a Tool Room. The architect and builder of this industrial-vernacular building are unknown.

Building 109 measures 483'-6" east-west, by 152' north-south, and 37' at the peak of the mold loft. It contains 82,099 square feet of floor space. Corrugated steel clads the riveted steel frame. The plan forms a truncated "L" shape, with the short arm of the "L" facing south. Semi-exposed machine shops occupy the western part of the plan, while enclosed machine shops and the second story Mold Loft occupy the eastern section.

Sixteen bays measuring approximately 20' wide run the length of the eastern arm of the building, beneath the mold loft. The 1945 Bethlehem Steel architectural plans indicate that the two easternmost bays were added on to the rest of the building in 1936 for use as a tool shop. A series of five glazed monitors, each two bays wide, forms an uneven roofline along the north and south elevations, with a low-slope gable roof made of Howe trusses. The clerestory windows allowed maximum light into the mold loft, although most of the windows have been covered over with corrugated steel or fiberglass panels.

Diverse window and door openings appear on the elevations around the mold loft, reflecting the building's expansions and alterations. A continuous band of wood framed multi-lite windows runs the length of the second story of the eastern elevation and wraps around the corner of the north elevation. Some of the windows are operable. The ground level of the east elevation features two bands of multi-lite windows, interrupted by multiple personnel doors and a vehicle door. The north elevation of the mold loft features an overhanging bay that projects approximately 12' beyond the footprint of the building and houses offices, bathrooms, and crane rooms for moving material to and from the ground level. A diverse series of steel sash windows, personnel doors, and vehicle doors line the north elevation beneath the projecting bay of the

[63] Bethlehem Steel Co. Shipbuilding Division 1945, Sheet 64.
[64] Bethlehem Steel Co. Shipbuilding Division 1945, Sheet 65.

Mold Loft. The south elevation of the Mold Loft is currently unfenestrated, although cuts and infill in the metal cladding relate to prior window openings. A post period of significance warehouse sits at the southeastern corner of the building, partially obscuring the south elevation. The Mold Loft was used to store a collection of wood templates used in the shipbuilding process in racks against the west wall. Along the east end, a series of numbers indicating the grid used to lay out templates is painted on the floor.

The western part of Building 109 features a saw-tooth roof with a shed roof over the "L" extension and multiple ventilators and monitors penetrating the roof. Open to the north and south, the steeply pitched roof forms abut the monitors of the Mold Loft to the east. A line of continuous steel frame multi-lite windows runs the length of the first floor of the west elevation, with corrugated steel panels above and below.

Building 52, added to Building 109 in 1941, consisted of a lean-to shed housing a craneway along the short "L" portion of the southern façade. It measured 16' wide by 16' high, and 181' long in the east-west direction. Although this building is no longer extant it still appears on the maps in Figure B and Figure 17.

Historic/Current Use
Building 109 housed a mold loft and plate shop where essential steps in hull construction took place. In the process of producing a ship from blueprint to hull, the construction plans were first transferred to a life-size model in the mold loft. This pattern was then taken to the mold makers who made a template out of wood, used for the guidance of marking the steel plates. The marked plates were then cut and shaped into the desired hull shapes in the plate shop. The finished plates were then transferred to the adjacent layout yard east of Building 109, where the plates were checked against the molds and plans before final assembly.[65] Building 109 stands next to Slips 1, 2, and 3, which facilitated the easy transfer of steel plates from the plate shop to the awaiting ships. The slips were infilled between 1959 and 1964. The plate shop served a critical role in the construction of a ship, and the multiple railways and craneways that served Building 109 underscore this role.

The Sanborn map from 1886 shows a machine shop and mold loft on piers in tidewater flats, at roughly the location of Building 109. The 1914 Sanborn Map shows an expanded machine shop in the same location, with the tidewater flats infilled. The 1945 Bethlehem Steel plans indicate that most of Building 109 was erected in 1912. [66]

Currently, BAE Systems uses the exposed, western part of Building 109 for tool and equipment storage. The mold loft serves primarily as storage, although BAE Systems uses the central section for repair of sandblasting curtains. Multiple machine shops and painting sheds subdivide the area beneath the mold loft.

Integrity
Despite changes to doors and windows, as discussed above, and damage to some windows and corrugated steel panels, Building 109 retains integrity of location, design, materials, workmanship, feeling, and association. Building 109 is a district contributor because it was a central feature of the steel shipbuilding process from the early 1910s through World War II.

[65] San Francisco Planning Department, 2001.
[66] Sanborn Map Company, Vol. 5 (1886), sheet 153; Sanborn Map Company, Vol.6 (1914), sheet 591.

Building 110 (Yard Washroom and Locker Room)

Physical Description

Building 110 stands to the west of Slip 4 and to the north of Building 109 in the northwestern portion of the shipyard. It forms a complex with Building 50, which stands immediately to the north. It is one of two extant washroom and locker room facilities installed during the late 1930s. Built in 1936, the architect and builder are unknown. This is a rectangular, 85'-4" long, 46' wide, 24' tall metal building that contains 1,356 square feet. It has a gable monitor roof and corrugated metal siding and roofing, set above five-foot high brick walls. The horizontal strip windows are steel sash with operable awning panels.

Historic/Current Use

Building 110 was part of the yard's 1930s modernization effort, which included new worker facilities near the slipways. A 1938 article in the *Pacific Marine Review* described in glowing terms the "reconditioning" of the venerable Union Iron Works shipyard, "recently…rejuvenated and transformed into a modern shipbuilding establishment."[67]

Singled out for special praise was the upgrading of amenities for workers, including washrooms like Buildings 110 and 119, both built in 1936:

> The most spectacular betterment in this program of progress is the modern sanitary provision for the comfort of the employees. For every man employed there is provided a large steel locker, and adjacent to these lockers is installed ample provision in lavatories and toilets. These are all kept in sanitary condition by an ample corps of janitors. Mastic tile is used on all floors.[68]

The Bethlehem Steel Company plan for Building 109 of January 1945 also shows Building 110, labeled "wash room erected 1936," but does not include a floor plan.[69]

Building 110 is currently vacant.

Integrity

Building 110 shows few alterations and therefore retains integrity of location, design, materials, workmanship, feeling, and association. It contributes to the historic district because of its association with the late 1930s upgrade to increase worker facilities. Building 110 is also a representative example of the architectural style and materials used in the district during the late 1930s.

Building 111 (Main Office/Warehouse and Substation No. 3)

Physical Description

Building 111 is part of a group of buildings that includes Building 38 (1915) and Building 108 (1911). This industrial/Renaissance Revival style building dates from 1917. The architect/engineer and builder are unknown.

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[67] "Bethlehem Reconditions Potrero Works," *Pacific Marine Review,* 35 (October 1938), 22.
[68] "Bethlehem Reconditions Potrero Works," 25-26.
[69] Bethlehem Steel Co. Shipbuilding Division 1945, Sheet 49.

This four-story, rectangular, and finely-detailed brick building has a flat roof and extensive glazing. It measures 212' long, 50' wide and 65' tall, and contains 46,272 square feet. The first floor is high, and topped by a wide, cast belt course. Openings on this floor have arched heads, with terra cotta keystones and impost blocks. At the northern end, a mezzanine creates a second story. This area contains office space, with wood, two-over-two double-hung windows and paneled spandrels between the two levels. The second bay has a personnel door in a profiled surround. An open, north-south loading bay runs through the building west to east. The seventh bay of the west elevation has a metal rolling door. At the southern end, the arched window openings contain steel sash panels with some operable awning sash. The three floors above are uniform, with wide rectangular steel sash windows. Windows on the second and third floors along the north elevation have been replaced with aluminum units. A machicolated cornice tops the building.

The brick masonry is of a very high quality. In addition to the cornice detailing, header courses run vertically up both sides of each pier. Rowlock courses run at the top of each window. Diagonally placed bricks form diamonds, centered in each spandrel panel at the third and fourth floor levels.

The approximately 40,000 square-foot interior consists primarily of open storage space, with some offices and partitions on each floor. The open warehouse space has board-formed square concrete columns with angled tops. Floors and ceilings are painted concrete and exterior walls are painted brick. Interior partitions on some floors include drywall and hollow clay tile. Board-formed poured concrete walls form the elevator shaft. Poured concrete stairs are surrounded by concrete walls, with metal pipe handrails at the upper floors. Plaster and marble wainscoting clad the stairwell between the first and second floors, along with decorative cast iron and wood handrail assemblies. Notable features include a counter-weighted metal fire door at the south end and original wood shelves and work benches.

The northern end of the first floor and the mezzanine that sits half a floor above it contain finely-detailed, richly-finished offices. Walls are painted plaster and brick. Marble wainscoting lines the foyer and oak trim includes door-height picture moldings. Doors are paneled wood, with wire-glazed upper panels and original hardware. Above the wood picture moldings are oak-trimmed clerestory windows.

Historic/Current Use
Building 111 was built to be multifunctional, and principally provided support for outfitting activities at Pier 68. Within its walls were offices, warehouse space, and power generation facilities. It is currently used for inactive storage by BAE Systems.

Integrity
Despite window replacements at the north end and some noncontributing interior finishes, Building 111 retains a good degree of integrity, especially at the exterior. The west, primary elevation exhibits few modifications. Building 111 is therefore a contributing resource because of its associations with World War I and its high artistic merit.

Building 113/114; Additions Building 23 and Building 24

Physical Description

Building 113/114 stands on the south side of 20th Street. The earliest remaining building in the district, it was designed by Civil Engineer Dr. D. E. Melliss.[70] Building 113/114 consists of an eastern portion completed in 1885, and the western, in 1886.[71] The two buildings were joined by a connector in 1914.

This two-block long industrial building consists of the two original unreinforced brick buildings, and the central reinforced concrete connector. Building 113/114 measures 492' long by 175'-6" wide by 62' tall, and contains 89,686 square feet of floor space. Both brick buildings have high gable roofs with monitors, projecting piers, arched windows and simple corbelled cornices. A lower, double gable section extends the western portion south creating an "L." While the two sides of the building are similar in form, scale, and materials, they differ in terms of fenestration, bay width, and rooflines.

Building 113 includes all of the 81,964 square-foot area beneath the high, single gable, as well as the northern portion of the double gable building, which includes an 8,800 square-foot mezzanine. Building 114 comprises only the 7,722 square-foot area beneath the southern gable of the double gable portion.

The eastern portion originally housed the blacksmith and boiler shop. It stands under a single gable roof with an original central, venting monitor and two, slightly later strip skylights along the northern and southern roof slopes, which appear in the 1899 and not the 1886 Sanborn Map. The long, north and south elevations are eleven bays wide. Each bay contains a single arched wood multi-lite window. The short, east elevation is seven bays wide, with a corrugated metal-clad shed addition, built in 1941, abutting the southern end (Building 23).[72] Like the long elevation, each bay has one arch-topped, multi-lite wood window. In addition, a high, arch-topped window penetrates each of the three central bays.

The connector is similar in style to the roughly contemporaneous steam power house across the street (Building 102). It is classically detailed, with a large, arched central opening and flanking steel sash windows. Cast cartouche ornaments top each of the four piers and a dentiled cornice completes the wall.

The western portion, which originally housed the machine shop, sits beneath a high and broad, nine-bay wide single gable, and two lower and smaller three-bay gables. The primary (north) elevation has eleven bays. Most bays feature three arched window openings at both the first and second story; however, the central bay has five arched windows at each level, and an infilled brick arch between the first and second levels, indicating that this may have once been the primary entry for this building. The arched windows are multi-lite wood sash.

The west elevation is fifteen bays wide. A corbelled band continues across this elevation at the same level of the north elevation's cornice, visually dividing the elevation into two stories. Beneath the larger, nine-bay gable, the three northernmost bays feature paired, arched

[70] Machine Shop, Union Iron Works Original Drawings 1882-1884, Tube #900, J. Porter Shaw Library; "*San Francisco Call*, January 24, 1884, p. 5/7.
[71] Bethlehem Steel General Plan, 1945.
[72] This shed addition is Building 23, "Testing and Boiler House."

windows similar to those at the north elevation. The three central bays have a single larger arched window in each bay, with four arched windows at the second level. The last three bays beneath the wide gable, as well as the six bays under the lower, double gabled portion, each have a single multi-lite arched window, narrower than those in the central bays. A one-story World War II vintage addition was constructed along the west elevation to provide additional showers, lockers, and restroom facilities for the labor force that worked out of Building 113/114.

The east elevation of the double-gabled portion features three arches. A single monumental arch stands beneath the northern gable; its lower portion has been infilled, while the upper retains multi-lite wood window sash. A central pilaster divides the southern gable façade into two bays; each of these has a single, arched multi-lite wood window, extending only halfway down the wall. At the lower portion, a loading door accesses the building, centered beneath the pilaster. Smaller, 12-lite wood windows flank the loading door.

The interior beneath the main, high-gabled portion of Building 113 is a clear span space with machinery and free-standing office enclosures at the connector. A railroad track bisects the space transversely. Attached to the exposed steel truss ceiling are two 30-ton bridge cranes, one marked “7” and the other marked “8,” which appear to date to 1896. Two 5-ton bridge cranes span the south bay of the eastern portion and may date to the late 1890s. Two 20-ton bridge cranes span the south bay of the western portion and may date to 1896.[73] Jib cranes are attached to the steel columns in the central bay and project from the north and south walls in the eastern half. Several pieces of large equipment remain; footprints of additional removed machinery are also visible. A concrete pit with a maze-like layout of concrete walls slices through the eastern end of Building 113; it allowed workers access to the underside of equipment. This pit was likely added after the period of significance, as it does not appear on the 1945 Plan or any of the earlier Sanborn maps.

End-grain wood blocks, roughly six inches square and covered with asphalt, pave the floor. The building’s walls are unreinforced brick, with one concrete section. A mezzanine hangs over the north side of the western half. It is accessed at the east end by an iron staircase and on the west by an iron spiral staircase. Small wood-framed, free-standing, one-and-two story single-room office enclosures stand within and adjacent to the connector. These sheds have varying ceiling heights and multi-lite steel sash windows. A sign on one of these enclosures reads: “Notice to Employees: Machine Shop No. 1 & No. 2. All employees must return all tools to the tool crib when finished with job…only the tools that were originally issued with tool boxes are to be kept out.” Another sign reads: “The Machine Department has worked____ days without a disabling injury.”

The interior of Building 114 is separated from that of Building 113 by a brick masonry fenestrated wall. Building 114 measures 200’ long by 40’-6” wide and contains approximately 8,000 square feet of floor space. The floor is asphalt paved, and walls are unreinforced brick, except for the south wall, which is board-formed concrete possibly dating to 1917 when the adjacent Building 115 was constructed. The ceiling is an exposed steel structure, which in this case includes five, four-sided caged trusses. A skylight sits over the western end. Rail lines run across the center of the building transversely, connecting to both Buildings 113 and 115. There

[73] Plans of The San Francisco Yard, Bethlehem Steel Company, Shipbuilding Division 1944-1945, Sheets 45 and 46.

are also 10 ton cranes, and several curbs and platforms that once held ovens, furnaces, and other foundry-related equipment.

Historic/Current Use

Building 113 changed functions and floor plans several times between its construction in the mid-1880s and World War II. The western portion of Building 113 originally housed the Machine Shop, while the eastern portion contained the Blacksmith and Boiler Shops. By 1945, the entire Building 113 served as a Machine Shop, with Building 114 serving as the Foundry Furnace Building. The buildings are not currently in use.

Machine shops have historically been considered part of a shipyard Engineering Department, along with the Blacksmith Shop, Pipe Shop, Boiler Shop, Foundry, and Pattern Shop. According to a Bethlehem Steel Company manual, produced for new employees in World War II, shipyard engineering work included a ship's propulsion and auxiliary machinery, steering apparatus, and all piping.[74]

Building 113 was designed as a multi-purpose building, with a functional division between the eastern and western portions. In the late 1880s most of the western portion was devoted to the Machine and Erecting Shop, with car tracks crossing the floor. The eastern portion had a Blacksmith Shop in the north half and a Boiler Shop in the southern portion. There was also a small, two-story management office and drawing room in the northeast corner of the western (machine shop) portion of the building. That was the main shipyard office until 1896. Other shipyard offices were located in the basement of the Boiler Shop in the eastern portion. The southwest corner of the Machine Shop had a brass foundry, copper shop, and tool room. An engine room was at the southeast corner of the machine shop.[75]

A simple description of the function of the Union Iron Works Machine Shop appears in an 1885 report on shipping and shipbuilding in San Francisco, by lead author Caspar Hopkins. It offers an invaluable description of the shipyard in its first years of operation:

> In this shop engines, large or small, can be put together complete, then picked up by an overhead traveling crane, placed upon a car, and taken to the wharf, where a set of steam shears, with a capacity of 100 tons in a single piece, again picks it up and puts it in a vessel in the position required.[76]

The western portion of Building 113 was divided by four rows of cast-iron columns into five bays: four of them were 40' by 200', and one was 55' by 200'. In the 1880s the erecting shop used two bays, each equipped with overhead hydraulic traveling cranes. Three of the bays contained operating machinery.[77]

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[74] Bethlehem Steel Co. Shipbuilding Division (1942), 16, 43-44.
[75] Sanborn Map Company, Vol. 5 (1886), sheet 153; General Plan: Machine Shop, Union Iron Works Original Drawings 1882-1884 Tube #900, J. Porter Shaw Library; Hopkins 1885, pp. 35-37; *San Francisco Call*, July 26, 1896, p. 10/2.
[76] This 1885 report was prepared by three prominent San Francisco business groups: The Manufacturers' Association, the Board of Trade, and the Chamber of Commerce. Lead author was Caspar Hopkins. Hopkins 1885, p. 36.
[77] Hopkins 1885, p. 35; *San Francisco Call,* January 24, 1884, p. 5/7.

According to the Hopkins report, the machine shop equipment was considered state-of-the-art in 1885. The shop had a planer that could "plane a surface twelve feet wide and twenty-six feet long, fitted with six cutting tools, suited for planing and cutting any type of machinery." The lathe department had a lathe that could "turn a shaft 49 feet long, or a crank shaft, such as is used in compound marine engines… the most complete tool of its class in the United States." The shop's largest boring mill could "turn thirty feet in diameter and ten foot face, or it will plane a surface thirty feet long by ten feet wide. The machine will also perform boring, planing, slotting, drilling and key-seating…It combines all the modern tool improvements known up to 1884, and is said not to be excelled by any similar machine in the world." The machine shop also had "one of the largest hydraulic presses in the world, for pressing in crank pins and pressing on crank plates."[78]

Engine House/Boiler Room (western portion of Building 113)
A 40' by 80' engine house and boiler room (no longer extant), with a 120-foot high octagonal chimney, was adjacent to the southeast end of the machine shop. It was described in detail by a reporter for the *San Francisco Call,* who visited the shipyard in January 1884:

> In the [engine house] will be a condensing horizontal engine…. There are also a separate engine for the electric light machines, an air compressor, and pumps for the accumulator for supplying hydraulic power throughout the establishment. In the boiler room there are two boilers of the Dickie patent... The chimney is a handsome octagonal structure, 120 feet high and 6 feet internal diameter. The roof of the engine building is an iron tank two feet in depth, in which will be cooled the water from the condensers of the main engine, thereby saving considerable expense, as by this method only about 800 gallons of water per day will be required.[79]

The reporter further noted that "Those living in the neighborhood of the works will be pleased to hear that the furnaces are claimed to be absolute smoke-consumers."

Tool Room/Blacksmith Shop (western portion of Building 113)
The 1884 *San Francisco Call* article and the 1885 Hopkins report both describe a small tool room adjacent to the southwest end of the machine shop. The 1886 Sanborn Map shows a small blacksmith shop in this location.[80]

Brass and Copper Shops (western portion of Building 113)
Adjoining the south end of the tool room/blacksmith shop was the brass foundry and copper shop. The brass foundry was described in 1900 as a very busy shop; Union Iron Works made a great deal of brass work, such as valves and marine fittings that most shipyards bought from special manufacturers. In 1900 it had an overhead electric crane of 12 tons capacity, as well as hardening furnaces, tempering and babbitting furnaces, and hydraulic cranes.[81]

The 1914 Sanborn Map shows an enlarged and reconfigured Brass Foundry in the southwest corner of Building 113. A 1916 article in *International Marine Engineering* cites a new brass

[78] Hopkins 1885, pp. 35-36.
[79] *San Francisco Call,* January 24, 1884, p. 5/7.
[80] Hopkins 1885, p. 37; Sanborn Map Company, Vol. 5 (1886), sheet 153.
[81] *Marine Engineering* (January 1900), 14; Hopkins 1885, p. 37.

foundry among the many improvements at the shipyard under new Bethlehem Steel management.[82]

Offices in the Machine Shop (western portion of Building 113)
The offices of Irving M. Scott and his brother, Henry T. Scott, general manager and president, respectively, of Union Iron Works, were described in the *San Francisco Call* newspaper in 1892:

> Blueprints and lithographs hang on the walls and are standing in rolls in nearly [every shelf] of the office of Irving M. Scott, the president of the Union Iron Works… Mr. Scott's office has three sections, one an outer room for his employees, one for himself and his brother, Henry T. Scott, and another adjoining the latter one, containing a long table and cases full of drawings. The last-mentioned room is for consultations of a mechanical nature, and the long table is for the purpose of spreading out the drawings. The desk of Mr. Scott is a double flat one, and is occupied by the two brothers, one on each side. Between them is the paraphernalia necessary to complete the furniture of a writing-desk, and most days a lot of letters, pamphlets, price lists or circulars.[83]

Other shipyard offices occupied the basement of the boiler shop before the mid-1890s. By 1896 these machine shop offices were described as "inconvenient and in such a scattered location that bookkeepers, draughtsmen and clerks were compelled to work by gaslight during the daytime."[84]

Most of the shipyard offices were relocated to a new office building (Building 104) in 1896. The 1899 Sanborn Map shows that the old two-story machine shop offices in the northeast corner of Building 113 were converted to a tool room and electrical department, with a small office space remaining in the northeast corner.[85]

By 1914 the offices in the northeast corner of Building 113 had apparently been removed; the Sanborn Map of that year shows no demarcation of space in the northeast corner. This map does show a new mezzanine at the north side of the building's western half.[86]

The Boiler House (eastern portion of Building 113 in 1885)
The boiler shop, in the southern half of the buildings eastern section, was used for construction of ships' steam boilers. According to the *San Francisco Call*, the building's eastern half, housing the boiler shop and blacksmith shop, was the first completed building at the Union Iron Works shipyard. It was described on January 24, 1884, as "ready for occupancy, and the machinery is being placed in position with all possible haste, the probability being that in about two weeks the shop will be in running order."[87]

[82] Sanborn Map Company, Vol. 6 (1913), sheet 593; *Marine Engineering* (March 1916). Pam File, Union Iron Works, J. Porter Shaw Library, no page number.
[83] *San Francisco Call*, November 25, 1892, p. 6/1.
[84] *San Francisco Call,* July 26, 1896, p. 10/2.
[85] Sanborn Map Company, Vol. 5 (1899), sheet 543.
[86] Sanborn Map Company, Vol. 6 (1913), Sheet 593.
[87] *San Francisco Call*, January 24, 1884, p. 5/7.

The boiler shop had hydraulic machines for riveting, planing, and shearing, bending machines for shaping or bending iron, rollers for rolling iron or steel boiler plates, and heating furnaces for plates. It also had smaller equipment such as angle iron shears and punches. A railroad connected to an overhead hydraulic traveling crane which moved through the entire length of the building, for efficient and cost-effective movement of work and materials.[88]

The Blacksmith Shop (eastern portion of Building 113 in 1885)

The Blacksmith Shop, in the north half of the building's eastern section, had three steam hammers as well as other tools for forging work, and a system of hydraulic cranes. In 1900 the blacksmith shop had 24 fires, and hydraulic jib cranes for handling heavy work under the hammers.[89]

Alterations to the Plan of Building 113

By 1899 the building's internal functions and plan had changed. The Erecting Shop had been moved from the western (Machine Shop) portion to the south half of the eastern portion, taking the place of the Boiler Shop. In 1899 the eastern portion was shared by the Forge Shop in the north wing and erecting shop in the south. The Boiler House was moved from the east wing to the southeast corner of the western half of the Machine Shop, where the Engine House had been located in 1886. The offices in both halves of the building were relocated to the newly erected Building 104, constructed in 1896. This arrangement also appears on the 1905 Sanborn Map update.[90]

In 1914, a connector building joined the eastern and western halves of Building 113. By 1914, the Boiler House and Forge were no longer part of the Machine Shop complex. A new Bolt and Rivet Shop was located in the north half of the building's eastern portion, where the Forge Shop stood in 1899 and 1905. The Erecting Shop remained in the south part of the eastern portion.[91] The 1936 Sanborn Map shows the same basic layout as the 1914 Sanborn Map.

The Foundry Building, Building 114

Foundry workers made metal castings of tools or machinery based on drawings produced by shipyard draftsmen, and machine part forms produced by the pattern shop. In the foundry, molders worked with several large cranes and cupolas (round furnaces) capable of melting tons of iron, large core ovens, and pits for making castings of molten iron or steel in almost any size and shape. In the late nineteenth century, the molds were mostly constructed of sand, although some loam was used.[92]

The 1886 Sanborn Map shows that the south end of the foundry had several functional features: a core room with core ovens at the southwest corner, three cupolas on an iron floor in the center of the south end, and a coke shed at the southeast corner. The coke shed does not appear on the 1899 Sanborn Map.[93]

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[88] Hopkins 1885, pp. 38-39; *San Francisco Call*, January 24, 1884, p. 5/7.
[89] Hopkins 1885, p. 40; *Marine Engineering* (January 1900), 15.
[90] Sanborn Map Company, Vol. 5 (1899), sheet 543; Sanborn Map Company, Vol. 5 (1905), sheet 543.
[91] Sanborn Map Company, Vol. 6 (1913), sheet 593.
[92] Blum 1989, pp. 98, 110.
[93] Sanborn Map Company, Vol. 5 (1886), sheet 153; Sanborn Map Company, Vol. 5 (1899), sheet 543; Hopkins 1885, p. 37.

There are no signs of shipyard development south of Building 114 on the 1886 Sanborn Map. From 1899 to 1905, however, the open space south of the foundry had a rail line, a Flask Storage Yard behind the Foundry's western portion, and a scrap iron yard behind its eastern portion.[94]

Foundry Molding Pit and Core Ovens

The main molding pit for making the largest metal castings was 14 feet in diameter and 14 feet deep. A second pit was 9 feet in diameter and 10 feet deep. The foundry had four core ovens for drying cores from a few ounces to 20 tons, and an overhead traveling crane covering the whole space of the foundry floor "so that a casting may be run from or to any part of it."[95]

Foundry Cupolas

Hopkins described the three foundry cupolas as capable of making castings weighing 60 tons in three hours. The cupolas had a hydraulic lift to carry up iron, coal, and coke.[96]

Hopkins admired the shipyard's system of car tracks that facilitated movement of materials within buildings. In the foundry, "the car track delivers the iron, coal, or coke, or takes the material from the cupolas without any additional cost for handling or transportation, and also enters the foundry at two points convenient to the overhead cranes."[97]

Building 113/114 was used as a machine shop for the on-going ship repair operation until 2001 when it was closed by the Port of San Francisco and red tagged by the Port due to its hazardous structural condition resulting from its unreinforced masonry construction. Building113/114 is currently vacant.

Building 23

Building 23 is a single story steel frame building attached to the east elevation of Building 113. It was added in 1941. It has a shed roof and corrugated steel siding. Large industrial steel sashes dominate the east and north elevations. The east elevation also has a pair of sliding steel doors, which also feature steel sashes. The west wall is shared with Building 113, while the south wall attaches to Building 24.

Building 23 functioned as a boiler house testing building. It is currently vacant.

Building 24

Building 24 stands at the east end of Building 113/114 and shares its western wall with Building 23. It was one of three small buildings at the east end of Building 113/114. While two of the three buildings (23 and 24) survive, only the concrete foundation of the third, Building 118, remains. This one-story, exposed concrete building measures 38'-8" long by 15'-6" wide by 11'-6" tall, and contains 519 square feet. Eight square windows penetrate the long eastern elevation, with two similar openings on the southern elevation. Rainwater leaders extend from the low-pitched roof. Most of the window openings have been secured with plywood. The building is purely utilitarian and lacks ornamentation. The architect and builder are unknown.

[94] Sanborn Map Company, Vol. 5 (1886), sheet 153; Sanborn Map Company, Vol. 5 (1899), sheet 543; Sanborn Map Company, Vol. 5 (1905), sheet 543.
[95] Hopkins 1885, p. 37.
[96] Hopkins 1885, p. 37.
[97] Hopkins 1885, p. 38.

Building 24 was constructed in 1914 and upgraded in 1936 and 1941. It functioned as a washroom and locker room for the Machine Shop,[98] one of the seven washroom and locker room facilities constructed or upgraded in 1941 to meet the need of a rapidly expanding workforce. Of the four extant facilities it is the only one of concrete; the rest are steel. This building is currently unused and in a semi-ruined state.

Integrity
Building 113/114 retains a very high level of integrity. It is a contributor to the historic district because of its associations with the earliest Union Iron Works period through World War II. Building 113/114 was one of the original buildings constructed in the district and is a necessary element in understanding the district's layout. It is the only extant example of the American round-arched style, used for the original construction of the yard and is an essential component of the district's ability to represent industrial architecture from the 1880s through 1945. Building 23, in fair condition, retains its integrity. Building 24 retains integrity of location, setting, and association and lacks integrity of materials, design, feeling, and workmanship. It is in very poor condition, and its function and previous appearance are no longer discernible.

Building 115/116 (Concrete Warehouses)
Physical Description
These buildings stand along the western edge of the district, between Buildings 114 and 117. Built in 1916-1917, the architect/engineer and builder are not known. [99]

This three-bay reinforced concrete building has a strong, industrial modernist aesthetic, characterized by expressed structure with expansive, multi-lite wood sash windows. Altogether the three sections measure 218' long, by 174' wide, by 57'-2" tall at the highest gable, and contain 33,858 square feet of floor space. Constructed as a single building with three similar gable bays, a board-formed, poured-in-place concrete wall divides Building 115 (northernmost bay) from the double gable Building 116. The southern bay of 116 is higher than the two northern bays of the group. The gable roofs have squared parapets at the gable tops. Beneath the two gables of Building 116 are ventilation grilles; plywood infills the vent opening on Building 115. The words "Pacific Coast Steel Corporation" appear on the center gable of the west façade.[100] A corrugated metal shed-roofed addition abuts the south end on the west side.

Building 115 is one story tall and measures approximately 60' wide by 200' long. The primary entry is through the east end. The roof assembly consists of steel decking over steel framing with Belgian trusses spanning the full width of the building. The east and west walls are primarily solid, board-formed concrete. The north perimeter wall is contiguous with Building 114, has a clerestory of steel sash windows in the upper portion, and a center opening connecting to Building 114. The south wall is a partition shared with Building 116. A central opening provides access between the two buildings. A heavy, rigid conduit rises from a box mounted at the north end and runs along the west wall. Pipes run along the north, south, and west walls, with a caged

[98] Bethlehem Steel Co. Plan 1945, Sheet 1.
[99] Bethlehem Steel's plans for the yard lists 1917 as the construction date. A January 1916 newspaper article, however, discusses the building. Most likely, the buildings were constructed in 1916 and completed later that year or in early 1917. Plans of the San Francisco Yard, Bethlehem Steel Company, Shipbuilding Division 1944-1945, Sheet 62.
[100] Pacific Coast Steel was a subsidiary of Bethlehem Steel acquired in 1929. *Time*, December 16, 1929.

stairway at the northeast corner. One large 20-ton crane on heavy steel tracks mounts on the walls. Three two-ton jib cranes attach to the south wall, and a one-ton jib crane swings out from the west wall. The asphalt floor is in good condition.

Building 116 is a double-bay building measuring 120' by 200'. A row of columns runs between the two bays. Interior floor, wall, and ceiling finishes are similar to those in Building 115. The east and west walls of the north bay are primarily glazed. In the south bay, high wood sash windows run the length of the building, with two tiers of steel sash, five bays each, at the east end. Openings at the concrete west end, infilled with boards, opened to the adjacent Building 117. Two, one ton, swing-out cranes mount to the center columns. Vertical pipes attach to a central column, one for acetylene gas and the other for oxygen; each has six spigots. A wood plank wall runs along the center west portion at the south side of the columns. A one-story CMU shed stands along the west wall in the south bay.

Historic/Current Use
Buildings 115 and 116 were used for fabricating and erecting components for a ship's mechanical and propulsion systems, as well as producing a wide range of metal components for shipbuilding, ship repair, and the shipyard.

Building 115
Building 115 was constructed as a new foundry, adjacent to the original shipyard foundry, Building 114. A contract for building the new, one-story reinforced concrete and steel foundry was awarded in January 1916. According to PG&E's *Pacific Service Magazine*, the new foundry was under construction by June 1916.[101] The *San Francisco Examiner* described Building 115 as "the first building included in the many improvements to be made at the plant of the Union Iron Works," to meet a growing demand for ships. The building contract was for almost $100,000; neither the contractor nor the designer was mentioned in the *Examiner* article.[102]

The *Bethlehem Star,* a journal published by the Bethlehem Shipbuilding Corporation in 1918-1919 for the employees of the Union Iron Works shipyard, described the iron foundry, under the leadership of R. Schilling, as one that "turns out more iron per man than any other foundry on the Pacific Coast."[103] By 1919, the *Bethlehem Star* reported that the new foundry was producing over a million pounds of castings a month for the machine shop. "Last January the foundry management promised J. J. Tynan [Joseph J. Tynan, General Manager] to turn over to the machine shop a million pounds of good clean castings each month. We have made good, J. J., and have over a million pounds to spare."[104]

Building 115 is identified on the Bethlehem Steel 1945 General Plan as a foundry mold room building, in contrast to Building 114, which is identified as a foundry furnace building. A double rail track connected Buildings 114, 115, and 116.

[101] *Pacific Service Magazine,* VIII (June 1916), 6.
[102] "Iron Works Is To Build An Addition," *San Francisco Examiner,* January 16, 1916, p. 45, Real Estate & Finance Section; *San Francisco Examiner*, January 26, 1916, p. 3/1.
[103] An intriguing note was included about R. Schilling as a "politician [who] used to rule Scotch Hill," known later as Irish Hill. *Bethlehem Star,* I (June 1918), 9.
[104] "Foundry Smoke," *Bethlehem Star*, I (April 1919).

Building 116
1n 1945 Building 116 served a dual function: an ordnance repair shop in the northern half and a warehouse in the southern half.[105] The ordnance repair function was a World War II development. A plan of the shipyard published by *Pacific Marine Review* in 1938 identifies Building 116 simply as "Steel Warehouse." [106] In 1945 the western half of the Ordnance Repair Shop was divided by a wood partition, 8' high, with an office beneath the southwest corner. A second small office stood at the building's southeast corner, in the warehouse section.[107]

Tools and Equipment in the Ordnance Repair Shop section of Building 116 during World War II were as follows: Radial Drill (1942, owned by the Government); Bench Drill #16, "Buffalo" (1942, Government); Contour Saw (1942, Government); 2 Grinders (1942, Government); Core Oven UIW (1917, owned by Bethlehem); Babbit Pot 2 Holer B. S. Co. (1937, Bethlehem); 15 foot 1 ton Jib Crane Yale (1918, Bethlehem); Shop Car UIW (1917, Bethlehem); Bending Slab on Legs (1943, Bethlehem). Tools and Equipment in the warehouse portion of Building 116 that Bethlehem owned included generators under the platform at the western section: one generator, 25 kw "Allis Chalmers" (1937); one 40 H.P. Motor (1937); a thirty-ton Crane "Cyclops" (1937); and a Pitchometer (1919). Government owned equipment in the warehouse included a Power Hack Saw from 1943. [108]

Currently both buildings are used for Port of San Francisco maintenance.

Integrity
The buildings retain a high degree of integrity, experiencing few alterations since 1917. These buildings contribute to the historic district because of their association with both World Wars. They are also important to the district's expression of the development of industrial architecture. Buildings 115 and 116 are either a precursor to or a very early example of Modern Movement principles applied to industrial architecture and contribute to the shipyard's embodiment of significant twentieth century trends in industrial architecture.

Building 117 (SF Shipyard Training Center – Warehouse No. 9)
Physical Description
Building 117 stands south of the complex created by Buildings 113/114, 115/116 and 102. Together with Building 14, it forms a large courtyard space (Figure 17). Constructed in 1937-41, Building 117 is a wide, one-story warehouse building located between the remnants of Irish Hill to the south and Building 116 to the north. It measures 240' long, by 131' wide, by 45'-6" high at the gable, and contains 30,940 square feet of floor space. The architect and builder are unknown.

Corrugated, galvanized iron siding clads both the exterior walls and roof of the building. A shed addition attaches to the south elevation. Continuous bands of multi-lite steel sash windows stretch across each elevation, some with operable central vent sash. A personnel door opens at the north corner of the east elevation, and a large roll-up metal door on the east corner of the north elevation allows freight to be transferred to the warehouse interior. Painted signage

[105] Plans of the San Francisco Yard, Bethlehem Steel Company, Shipbuilding Division 1944-1945, Sheet 62.
[106] *Pacific Marine Review*, 35 (October 1938), 26.
[107] Plans of the San Francisco Yard, Bethlehem Steel Company, Shipbuilding Division 1944-1945, Sheet 62.
[108] Plans of the San Francisco Yard, Bethlehem Steel Company, Shipbuilding Division 1944-1945, Sheet 62.

underneath the east gable reads, “San Francisco Shipyards Training Center.” This signage dates from the 1990s.

The roof consists of steel decking over steel roof rafters, spanning modified Pratt trusses. The trusses are supported by a central row of steel I-section columns. Industrial incandescent light fixtures and corrugated plastic skylights light the interior. The slab-on-grade floor is covered with asphalt. The floor inclines to the south and the entire south bay is elevated approximately eighteen inches. Railroad rails run from the loading door at the northeast corner to the raised area at the southeast corner. Crane tracks attach to the roof, running east to west for the length of the building. The west wall has concrete infill spanning between steel columns. The north wall is contiguous with Building 116 and is composed primarily of concrete infill; wood infill at the west end indicates a blocked access door to the adjacent building.

Historic/Current Use
Building 117 is listed in the 1945 Site Plan as a “Warehouse.” It still serves as a storage building.

Integrity
The building retains integrity, having experienced few alterations. Building 117 contributes to the historic district for its relationship with sweeping site upgrades prior to World War II and its association with the influx of new workers during World War II.

Building 119 (Yard Washroom)
Physical Description
Building 119, constructed in 1936, stands immediately south of Building 38. Its architect/engineer and builder are unknown. It is one of two washrooms added during the late 1930s and one of four World War II era washrooms extant in the district.

This one-story rectangular metal building is 60’ long, by 24’ wide, by 19’ high, and contains 3,925 square feet of floor space. It has a corrugated metal, gabled, truss-supported roof with monitor. Cladding is corrugated steel over five-foot high brick walls, typical of the late 1930s construction style in the district. Windows are steel sash with pivot ventilators and ventilation grilles in the raised monitor. Glazed metal entry doors, each with a three-lite transom, are at both the east and west ends.

The 1,400 square-foot interior is mostly open, with metal stalls along the south wall. A row of five circular concrete washbasins dominates the remaining area. The ceiling consists of Fink trusses supporting corrugated metal roofing. The walls are corrugated metal and painted brick with exposed steel structure.

Historic/Current Use
This building is currently unoccupied because of structural damage caused by the 1989 Loma Prieta Earthquake. The building provided washroom facilities for the labor force and was part of Bethlehem Steel’s pre-World War II construction campaign.

Integrity
The building retains a high degree of integrity. This is a contributing resource because of its associations with the construction of worker facilities prior to World War II.

Building 120 (Pipe Rack and Women's Washroom and Locker Room)

Physical Description

Building 120 is an open shed located between Buildings 108 and 111. A simple utilitarian building, this single story, steel frame shed was constructed in 1936 and expanded in 1942. The building measures 71' long, by 22' wide, by 20' 8" high, and contains 1,392 square feet. The cladding is corrugated metal set above a brick base. Five open bays on the west elevation reveal an interior brick cross-wall between the first and second bays and a metal cross-wall between the second and third bays. A metal ramp ascends to the northernmost bay, while a fence encloses the three southern bays and the adjacent paved area to the west.

Historic/Current Use

This building served as a "Pipe Rack," an ancillary building to the adjacent Planing Mill (Building 108). The northern end was constructed in 1942 to provide a women's washroom and lockers. During World War II separate women's facilities were added to existing buildings (Buildings 11, 12, 14, 39, 54 101, 104, 110, and 113 all have clearly marked women's facilities), and several separate facilities, no longer extant, were erected on the wharves. [109] This building is currently used for storage.

Integrity

In 2008 a portion of Building 120 was removed to create vehicle access between the ship yard and its triangular parking lot/staging area adjacent to Warehouse No. 6 to the east. The building retains sufficient integrity for inclusion in the historic district because of its association with pre-World War II upgrades aiming to increase material storage and handling and to improve worker facilities during World War II. The expansion of Building 120 catered to the growing female labor population at the yard during World War II.

Building 121 (Drydock Office)

Physical Description

This building stands in an open area north of Building 105. Originally constructed in 1941, it was moved before 1975 from its original location near Building 6, where it was designed to fit between two buildings so as not to impede traffic on the dock.

This single-story, freestanding, flat-roofed wood frame office building is clad in shiplap siding and has an irregularly shaped six-sided footprint that contains 584 square feet. The building has a variety of opening types. Doors are wood; they are found at the east, the short north wall, and the west elevations. Windows along the east and northeast elevations are continuous bands of multi-lite wood sash, while the western façade features three high, four-lite wood sash.

Historic/Current Use

Building 121 originally served as a Timekeeper's Office. It remains in use as a field office by BAE Systems.

Integrity

Despite a move that postdates the period of significance, the building retains integrity of design, materials, workmanship, feeling, and association. While it retains an industrial context, its move

[109] Plans of the San Francisco Yard, Bethlehem Steel Company, Shipbuilding Division 1944-1945, Sheet 64.

to an open site, rather than a constrained one, renders the building's odd shape meaningless. The interior has been modified extensively. This building retains sufficient integrity for inclusion in the historic district, relating to the increased need of management oversight at the wharves during World War II.

Building 122 (Check House No.1)

Physical Description

Located between Buildings 102 and 104, this small Spanish Eclectic building was constructed in 1937.[110] It is one of two extant check houses in the district. The architect and builder are unknown. One-story high, the concrete, stucco-clad building measures 30'long, 25' 6" wide, and 16' 8" high, and contains 714 square feet. Its hipped roof is clad in straight mission tiles. Three bays, marked by simple pilasters, enclose three pairs of wood-paneled, multi-lite glazed doors. Exterior decorative elements consist of basic details such as the simple, moulded cornice and blank frieze panel above the projecting stringcourse. Metal partitions divide the interior into six lanes that the workers passed through twice daily when they entered and exited.[111]

Six original doors on the south elevation have been replaced with glazed plywood panels. The original light fixtures are still extant.

Historic/Current Use

In 1938, Building 122 was described as a "new checking house" providing "comforts for workmen." The article appeared in the *Pacific Marine Review*, which also featured a photograph of the building, offered the following description of Building 122: "Another provision which aids in morale of employees is the new checking house with its six check lanes eliminating all delays in the check in and check out process. This house, located between the Power House, Building 102 and the Navy office building, Building 104 adds a very pleasing architectural effect."[112] Building 122 is currently used for storage.

Integrity

Building 122 is a contributor to the historic district for its association with the influx of workers, the management of the labor force, and efficiency of operations during World War II. The building retains a high level of integrity of location, design, materials, workmanship, and association. Temporary fencing installed to protect this building and the adjacent buildings has impacted the setting and feeling and could easily be removed.

Building 123 (Check House No. 2)

Physical Description

Building 123 abuts Building 104 at the southeast corner and is the second of two extant check houses in the district. The architect and builder of this small, Spanish Eclectic style building, built in 1914 and altered in 1941, are unknown. [113]

This single-story, concrete, stucco-clad building measures 25' long, 16' wide, and 14' tall, and contains 384 square feet. It has a hipped roof clad in straight mission tiles. The front (south)

[110] Bethlehem Steel Company Shipbuilding Division, October 1944-1945, Sheet 25.
[111] The six check lanes in the 765 square-foot building are shown on the Bethlehem Steel 1944 floor plan of Building 122. Plans of the San Francisco Yard, Bethlehem Steel Company, Shipbuilding Division 1944-1945, Sheet 25.
[112] "Bethlehem Reconditions Potrero Works," *Pacific Marine Review*, 35 (October 1938), 26.
[113] Plans of the San Francisco Yard, Bethlehem Steel Company, Shipbuilding Division 1944-1945, Sheet 25.

elevation has two bays, one covered by a sliding metal door. A projecting flat awning protects the opening from weather. The building has a simple, moulded cornice and blank frieze panel above the projecting stringcourse. Window sashes have been removed from the two window openings on the east elevation. Metal partitions divide the 584 square-foot interior space into six lanes that the workers passed through to enter and exit.

Historic/Current Use
The 1936 Sanborn Map shows the original 1914 building on the southeast corner of Building 104, described as one of a pair of small "gatesmen's houses" on 20th Street; the other small gatesmen's house (Building 124 on the 1944 plan) adjoined the southwest corner of Building 105 and is no longer extant.[114]

The Bethlehem Steel Company 1944 plan shows that like Building 122, Building 123 had six check lanes. However, at approximately 400 square feet, it was about half the size of the more commodious Checkhouse No. 1.[115]

Integrity
The building retains a high level of integrity of location, design, materials, workmanship, setting, association, and feeling. It is a contributing resource because of its associations with the construction of worker facilities prior to World War II.

Irish Hill Remnant
Physical Description
Irish Hill is an approximately 24' tall, rocky promontory standing in the undeveloped southwestern portion of the district and is the remains of the originally 70 to 100-foot tall geological land form that dominated the southern portion of the yard. The remnant of this land form stands near the corner of Illinois and 22nd Streets. It was once a point of land that extended from the San Francisco Bay to Potrero Hill. During the late nineteenth century, the hill towered over the shipyard, visually separating it from the adjacent Pacific Rolling Mills to the east (Figure 4). To the west, a small enclave that housed the unskilled labor force of Union Iron Works and other factories balanced on its slope. Around 1917, much of the hill was flattened and dumped into the bay as landfill. All that remains is a serpentine outcropping with a small stand of trees on its eastern embankment.

Historic/Current Use
By the 1880s Irish Hill, originally Scottish Hill, was a compact neighborhood of mostly lodging houses, restaurants, and saloons. The majority of residents were Scottish or Irish immigrant industrial workers who, despite the noise and pollution of the factories nearby, were drawn to the area because of its proximity to their places of work. Irish Hill remained a favored residential enclave for Irish immigrants until the early twentieth century, when the majority of the hill was flattened and used as landfill to make way for shipyard expansion.

Integrity
What was once Irish Hill is represented by the remaining peak east of Illinois and 22nd Streets and south of Building 117. The topography of Irish Hill was modified during the district's period of significance and expresses the struggle between lower income, worker communities, and the

[114] .Sanborn Map Company, Vol. 6 (1936), sheet 591.
[115] Plans of The San Francisco Yard, Bethlehem Steel Company, Shipbuilding Division 1944-1945, Sheet 25.

shipyard's desire to expand and promote itself. Because the remaining portion of Irish Hill is the last vestige of a residential enclave that served early Irish immigrant workers who were mostly employed by waterfront industry, Irish Hill contributes to the historic district. Irish Hill, in its modified form, qualifies as a contributing landscape feature that resulted from the World War I expansion of Union Iron Works, retaining all seven aspects of integrity: location, design, materials, workmanship, setting, association, and feeling. [116]

Slip 4 and Cranes 14 and 30

Physical Description

Slip 4 was built by the government in the northeast corner of the yard in 1941. The slipway is 550 feet long and is concrete-lined with timber piles at the northeast end at the waterline. It is oriented on an axis running roughly northeast–southwest. Steel service columns supporting utility pipes flank the slipway and are badly bent along a portion of the eastern edge. Portions of the wood runway structure used to support and launch the hull, including remnants of the wood foundations for the keel blocks and the timber ground ways and sliding ways. The runway extends to the edge of the slip and into the launching basin where it is still supported on piles visible in the shallow waters of the bay. Railroad spurs run parallel to the slip. A light pole, also installed during World War II, still stands to the southwest of the slipways.

Cranes 14 and 30 stand on either side of the slipway. Crane 14 is an American Hoist & Derrick Co. 50-ton crane, erected by the government in 1941. Crane 30 is an American Hoist & Derrick Co. 30-ton crane, originally erected by the government in 1943, and moved to Slip 4 after 1944.[117]

Historic and Current Use

The slip or slipway is where the ship's hull is constructed and launched. A slipway was first constructed in this area during the 1890s and has been rebuilt several times in association with yard modernization programs and war efforts. Slip 4 was constructed in 1941 to facilitate the World War II increase in shipbuilding at the yard. During World War II, three cranes were installed at this slip: Crane 14 on the northeast track (still extant) and Cranes 9 and 12 on the southwest track. This slip is not currently in use and is non-functional.

Integrity

Slip 4 is associated with World War II shipbuilding. Besides the removal of some of the above ground features, this slip appears to have undergone little modification since 1945 and retains its integrity of location, design, materials, workmanship, setting, association, and feeling. Slip 4 is one of five slips constructed at the yard during World War II and is the most intact example of a slipway in the district. Slip 4, the steel service columns, and its associated cranes comprise a contributing structure to the district. The steel service columns provided the necessary infrastructure to allow hull construction at the yard, specifically, the electricity required for welding.

Crane 14, on Slip 4, has remained in its current location since the government erected it in 1941 and retains a high degree of integrity. Crane 30 currently sits on the east side of Slip 4. The 1944 Bethlehem Steel plans indicate that the government originally installed Crane 30 on Pier

[117] Plans of the San Francisco Yard, Bethlehem Steel Company, Shipbuilding Division 1944-1945, Sheets 8 and 10.

10 in 1943.[118] Despite Crane 30's move from its original location, most likely after the period of significance, it retains its integrity because cranes are by nature a moveable feature, and it was relocated to a location within the historic district compatible with its original setting.

Whirley Crane 27

Physical Description

One of the nine whirley cranes within the district is eligible as a contributing resource: Crane 27 on Wharf 3 at Pier 68. The two cranes associated with Slip 4 are included as contributing elements to that resource and are included in the Slip 4 description and evaluation. The other cranes within the district were installed at the yard after the period of significance.

The whirley cranes all feature a revolving crane on top of a steel tower base. The cranes have steel latticed booms, with steel cable guy lines and hoist rope. Their size and location mark them as important parts of the Union Iron Works skyline.

Crane 27 is an American Hoist & Derrick Co. 30-ton, model R-20, originally erected by the government in 1942. [119] The other cranes, while similar to those used at the yard during World War II, were not identified, based on model and number, with cranes shown in the 1945 Bethlehem Plan.

Historic/ Current Use

Whirley cranes first came to American shipyards in the 1920s and became an omnipresent feature of during World War II. They evolved from gantry cranes, which are cranes that travel on the ground and are mounted on tall legs. By adding a revolving mechanism on the platform at the top of the legs, the whirley crane was born. The flexibility and high lifting capacity of the cranes made them popular in shipyards. Two or more cranes could do a joint lift for objects too heavy for a single crane.[120]

Although a wide variety of crane makes and models existed, the typical whirley crane at UIW stood approximately 60' tall at the operator's level, ran on tracks from 24' to 32' wide, and had a 100' boom.[121] The height of the crane's legs allowed a truss design that permitted vehicles and material to pass beneath them, ensuring the free flow of traffic on the wharves and docks. Electric motors fed by a third rail powered the cranes.

Whirley cranes form the final step of the materials handling system of a shipyard. Rail carts move parts fabricated in the machine shop or plate shop to staging areas around the cranes. Welding platforms around the shipyard occupied space within the reach of one or more whirly cranes. The cranes moved the finished part to its assembly point on the ship under construction. Previous to World War II, a slip or wet basin did not always have cranes operating on either side of it. The tight time schedules and heavy lifting requirements of wartime production demands mandated an expanded use of cranes, frequently with two cranes on either side of a slip or wet

[118] Pier 10 was part of the World War II submarine repair base owned by the U.S. Navy and operated by Bethlehem, located several block to the north, off of 16th Street. Only fragments of the wharf structure associated with this base remain.
[119] Plans of the San Francisco Yard, Bethlehem Steel Company, Shipbuilding Division 1944-1945, Sheet 1.
[120] Richmond Shipyard #3 HAER documentation, 130.
[121] *Build Ships*, 63.

basin.[122] Two cranes per side also permitted the occasional four crane joint lift of extremely heavy parts. The increased lifting ability allowed for the movement of prefabricated ship components and of hull sections from the welding platforms to slip and wet basins. This ability transformed the movement of materials and changed the layout of shipyard complexes during World War II. Crane 27 still operates at the south end of Wharf 3.

Integrity
Cranes were an integral part of the hull construction process and allowed for the use of prefabricated components that changed the layout and design of shipyard complexes during World War II. Crane 27 currently stands on the south end of Wharf 3. The 1944 Bethlehem Steel plans indicate that the government originally installed Crane 27 on Pier 7 in 1942. Its overall integrity remains high. Although Crane 27 was moved from its original wharf, most likely after the period of significance, it is by nature a moveable feature, and has retained its integrity of setting and association. Crane 27 has also retained its integrity of materials, workmanship, design, and feeling and is a contributor to the district.

Fence on 20th and Illinois Streets
Physical Description
A decorative iron fence surrounds the western end of the shipyard extending from Building 104 on 20th Street westward, and northward along Illinois Street to the yard's north gate near Building 49. The fence abuts the façade of Building 101, creating a grand entrance to this office building and also unifying the district visually along the 20th and Illinois Street frontages. The fence consists of pointed iron spikes, joined by double horizontal rails at top and bottom. Within the double rails are circular motifs. Finial-capped cast iron newel posts ornament and support the fence approximately every six feet. The fence is imbedded in a granite curb.

Eastward, the iron fence appears to terminate just before Building 104, although a portion of the fence near Building 101 was removed by the Port of San Francisco several years ago. At this point the perimeter fence begins to show a slight difference in design. Although the circle and spike motifs remain, here each spike terminates in a cast finial.

Historic/ Current Use
The fence was erected in 1917, when the shipyard underwent a significant phase of modernization and expansion, as Union Iron Works became the centerpiece to Bethlehem's Pacific Coast shipbuilding complex. Historic photos provide no indication that the fence extended beyond its current length. The fence still provides security to the northern section of the district.

Integrity
The iron fencing at the corner of 20th and Illinois Streets was built during World War I and retains integrity of location, association, setting, materials, workmanship, and feeling. This qualifies it as a contributing resource for its association with the World War I era plan to create a grand entrance to the shipyard, Bethlehem Steel's West Coast shipbuilding center.

[122] Richmond Shipyard #3 HAER, 142-143.

Pier 68

Physical Description

From the northeast corner of the district, Pier 68 extends approximately 780 feet east into the San Francisco Bay and measures approximately 78 feet wide for most of its length. It links Wharves 3 and 4 with the northeast edge of the yard. The pier sits on pilings of reinforced concrete and structural steel. The substructure includes concrete framing, consisting of cab beams, stringers, and deck, supported on coated H-piles at the eastern half, and coated steel pipe at the western half. It is paved with asphalt.[123]

Historic/Current Use

Pier 68 dates to circa 1920, with alterations in 1941 and 1942.[124] It was expanded in width in 1942 by the construction of a wood addition to the south that is no longer extent. It links the wharves to the rest of the shipyard and serves as a road to transport materials, utilities, services, and people to the moored ships and drydocks. It also supports multiple buildings that facilitate the process of ship repair, including Building 127 (offices), Building 58 (electrical substation), a locker room/washroom, and additional offices. A boiler called a “steam donkey,” used to generate steam for servicing the ships, also sits on Pier 68. Large steel cargo containers used for storage line most of the southern side of the pier. It serves the same function today as it has historically.

Integrity

The pier is in good condition overall, with some condition issues including pile settlement, chipped concrete, broken and hollow fender piles, and corroded H-piles. A portion of the pier sustained damage in the 1989 Loma Prieta Earthquake and a steel bridge has been installed to provide access over the damaged portion of the deck. The Pier was “Green Tagged” in 2011, indicating that it was approved for unrestricted use, and may require minor repairs. An isolated area was “Red Tagged” at that time, because of pile settlement. “Red tagging” indicates an unsafe notice. Per “red tag” requirements, this area is fenced off to prevent public access.[125]

Despite condition issues, Pier 68 retains high integrity overall, including location, association, setting, materials, workmanship, and feeling. The pier can thus express its association with both World War I and World War II yard improvements.

Noncontributing Resources

Building 41 (Fire Station)

Physical Description

Partially submerged in the San Francisco Bay south of Warehouse 6, Building 41 is a single story, steel frame building with a corrugated steel-clad gable roof. Most of the siding and any windows that may have been present are now missing. The pier on which it was constructed collapsed and the building settled into the bay. The architect and builder are unknown.

[123] Sherban A. Duncan, P.E., “Substructure Rapid Structural Assessment Form, Pier 68,” Port of San Francisco, June 17 and June 20th, 2011
[124] Plans of the San Francisco Yard, Bethlehem Steel Company, Shipbuilding Division, 194401945, Sheet 4.
[125] Duncan, “Rapid Structural Assessment Form.”

Historic/Current Use
This building functioned as fire station, located on a pier leading to the drydocks and wet basins, and was one of the safety features added during World War II. It is currently underwater.

Integrity
Most of the building is underwater and the visible portion of the roof is a remnant. The building therefore does not retain sufficient integrity for listing as a contributing resource.

Building 68 (Drydock Office/Substation 7)
Physical Description
This small, brick-clad building stands along the wharf near the drydocks. It appears to post-date 1945, as it does not show up on either the site plan or aerial photo from that date.

This one-story, rectangular plan, flat-roofed office and substation is of brick masonry construction. The parapet topping the brick, running bond walls has a terra cotta coping. Windows are aluminum sash, four-lite, with some fixed and awning sash. Angled courses form sills under windows. The foundation is poured concrete. A corrugated single-story metal shed addition runs along the west side.

Historic/Current Use
This building currently serves as a powerhouse (east side) and office (west side) for BAE Systems and is part of the functioning wharf operation.

Integrity
The building post-dates the period of significance; therefore, it is a noncontributing resource.

Building 127 (Pier 68 Production Offices)
Physical description
Building 127, a two story, wood framed building with a shallow gable roof, sits on Pier 68 near Building 58 (Pier 68 Substation No. 4). It measures 24' by 44', oriented east-west, rises to 22' at the ridgeline, and contains 1,056 square feet.[126] An exterior stair on the east elevation accesses the second story. The building was constructed of wood and corrugated galvanized iron, with "bitumuls" and wood flooring and composite roofing.[127]

After the period of significance, the building underwent major alteration. Vinyl siding replaced the original corrugated galvanized iron cladding. The building also now has aluminum double-hung windows, vinyl composite flooring, hollow metal doors and door frames, and gypsum board interior partitions.

Historic/Current Use
Bethlehem Steel erected the building in 1944 to house offices on the second floor, and storage rooms and lockers on the first. BAE Systems continues to use the building for offices.

[126] Plans of the San Francisco Yard, Bethlehem Steel Company, Shipbuilding Division 1944-1945, Sheet 35.
[127] Plans of the San Francisco Yard, Bethlehem Steel Company, Shipbuilding Division 1944-1945, Sheet 35.

Integrity
Because of extensive modifications, Building 127 lacks integrity of design, materials, workmanship, and feeling. The building therefore does not retain sufficient integrity for listing as a contributing resource.

Building 141 (Pier 68 Breakroom/Washroom/Restroom)
Physical Description
Building 141 is a rectangular-plan steel frame restroom building with steel siding and a flat roof. It stands on Pier 68 near Building 127, and has a projecting canopy that shelters tables. This building is not shown on the 1945 Bethlehem Steel Plan.

Historic/Current Use
Not shown on the 1945 Bethlehem Steel Plan, this building was added to the yard after the period of significance. It appears to retain its original function as a restroom and break area.

Integrity
This building was constructed after the period of significance; therefore, it is not a contributor.

Wharves 1, 3, and 4
Physical Description
The remains of Wharf 1 extend northwards approximately 360 feet, marking the western border of the wet basins and the eastern boundary of Slips 1 through 3. Constructed in 1915, Wharf 1 consists of wood decking (presently collapsing) over concrete piles. Wharves 3 and 4, built after World War II, extend north from Pier 68 into the bay approximately 650 feet each. The pier and wharves feature concrete decking. The existing wharves and Drydock 2 enclose three wet basins.

Wharves 3 and 4 include all the necessary infrastructure to service large, modern, oceangoing vessels. Distribution centers with attachments for compressed air, fresh water, salt water, oxygen, electricity, steam, and several other services sit at regular intervals along the wharf. The pipes that carry the services appear on the side of the wharf, beneath the wharf decking. Each wharf also has two 35-ton whirley cranes with the rails embedded in the deck approximately 24 feet apart. Wood timbers, treated against decay, line the edges of the wharves. Massive steel mooring bits, spaced approximately 50 feet apart, line the sides of the wharf and serve as anchor points to lash the ships to the wharf.

Historic/Current Use
UIW established the first wharves in 1883 when it began its initial shipbuilding operations. UIW used the wharves to finish outfitting the ships and make straightforward repairs. The shipyard has changed the position of the docks numerous times over the course of its history, as each advance in ship design required different infrastructure to service those ships. A major upgrade occurred in 1915 when the slips, wharves, and wet basins associated with Pier 68 were all rebuilt. Piles associated with these earlier wharves are likely mixed in with the piles from the existing wharves and Pier 68.

The most recent round of changes to the wharves' positions occurred sometime after 1945 with the goal of providing larger wet basins for larger modern ships. It involved the destruction of Wharf 2, and the shifting of Wharf 3 to the north in 1967. Wharf 4 was rebuilt in 1957 but

remained in approximately the same location. Wharf 5 was demolished by the Port of San Francisco in 2001 because of impending collapse and because it was a navigational hazard.

The wet basins consist of the parts of the bay enclosed by the wharves. Originally, the wet basins served as the final stop in the shipbuilding process. After the shipyard launched the ship down the slip, the fitting out tasks, including final electrical installation, fine woodworking, and appliance installation, took place at the fitting-out wharves while the ship sat in the wet basin. Only after the fitting-out process was the ship actually "finished." The wet basins also served as the holding area for the ship while undergoing repairs. Together, the wharves and wet basins make up the interface point between land and sea. They constitute the place where finished goods produced in land-based factories become ocean-going vessels.

Integrity
Wharf 1 is collapsing into the bay and has lost integrity of materials, design, and workmanship. Its setting has been impacted by the filling in of Slips 1 through 3. Wharves 3 and 4 were rebuilt after the period of significance and hence lack integrity of materials, design, workmanship, and feeling, and are not recognized as contributing resources. Because the wharves define the physical boundaries of the wet basins, the wet basins also lack integrity and do not contribute to the district. Since the wharves represent a continual process of rebuilding, they may contain fragments of earlier wharves.

The piers, wharves, and wet basins form an integral part of the historic shipyard and illustrate critical steps in the shipbuilding and repair process. These features play an integral role in the setting and design of the district and help to express the district's historic function.

Pier 68 Drydock No. 2 and Drydock Eureka
Physical Description
Two floating drydocks are currently moored at Pier 68. These drydocks are all steel vessels with a U-shaped cross-section. The bottom and sides contain flotation tanks used to submerge or float the dock. Drydock 2, approximately 900 feet long, has a permanent mooring point at the eastern tip of Pier 68. Drydock 2 dates to the 1960s and has a control room. Drydock Eureka, a World War II vintage drydock, was brought to the district by the Port of San Francisco in the 1990s and is moored to the west of Wharf 3. Drydock 2 and Eureka are in use at the ship repair yard and retain working cranes.

Historic/Current Uses
Drydocks are essential components of ship repair work that allow vessels to be removed from the water for repairs. Floating drydocks are submerged, the ship is maneuvered into the dock and the dock is then re-floated and the ship raised out of the water. The floating drydock provides a stable surface for ship repair work. During World War II, the U.S. Navy had a standard design for floating drydocks that resulted in Drydock Eureka. Standard Navy drydocks included repair facilities and crew quarters, allowing the docks to be moved, unless they were built for civilian yards, where such services were unnecessary.

Integrity
Drydock Eureka was moved to the district after the period of significance. The historic significance of the drydocks is evaluated under Criterion A, the yard's role in the birth and expansion of the United States steel hull shipbuilding and ship repair industry. The Drydock

Eureka is not significant under this criterion, nor is it significant under Criterion C. Drydock 2 was built 25 years after the period of significance. Therefore, none of the drydocks is a contributing resource to the district.

Pier 70 and Wharves 6, 7, and 8

Physical Description

Pier 70 extends eastward into the bay near Building 6 and directly north of Slips 5 through 8. The pier consists mainly of wood decking over wood piles, and the decking has collapsed or is collapsing in many areas. Wharves 6, 7, and 8 project northward off the pier, creating Wet Basins 6 and 7. Wharves 6 and 7 are constructed of wood piles supporting wood decking and are missing most of the wood decking and large portions of their wood piles. Viewed from above, a rough outline of the wharves is still visible, but from many perspectives in the district even the rough footprint of these two wharves is no longer discernible. Wharf 8 was rebuilt with wood decking, concrete, and steel after 1980 as a fuel dock, and is currently in poor condition.

Historic/ Current Uses

Since the late nineteenth century, piers and wharves have been erected and replaced in the vicinity of Pier 70. The first pier was constructed by the Pacific Rolling Mills in the late nineteenth century. Risdon Iron Works appears to have expanded this pier during the early twentieth century. Piles associated with these piers are likely mixed in with the piles from Wharf 6 or Pier 70. The western end of Pier 70 appears to date to World War I; however, portions of the turn of the twentieth century Risdon pier may have been incorporated. The 1936 Sanborn Map shows little change to the pier from the 1914 Sanborn Map. The pier was extended and Wharves 6, 7, and 8 were added during World War II. Therefore, most of the extant wharves and wet basins of Pier 70 date to World War II and were owned and built by the U.S. Navy.

The pier was strengthened in 1941 and widened in 1942 and 1944.

Wharf 6 originally extended northward off the eastern edge of Pier 68 in 1920. It was extended southward to join with Pier 70 in 1941, creating Wet Basin 6. This wharf was widened toward the west in 1943 and 1945. A rail line on Wharf 6 connected Pier 68 and Pier 70, and crane rails also extended down the wharf. Wharf 7 was 1,674 feet long with a rail and crane track to move materials onto and along the wharf. Wharf 8 was originally constructed in 1944 and rebuilt in the 1980s. It consists of wood decking over a structural steel frame on steel cylinders filled with concrete.

These waterfront features are no longer in use.

Integrity

Pier 70, Wharves 6 and 7, and Wet Basins 6 and 7 are associated with the expansion of the yard during World War II. Portions of Wharves 6 and 7 have collapsed into the bay and have lost their integrity of design, workmanship, materials, and feeling. Due to the loss of these wharves, the associated wet basins are no longer discernible and have also lost their integrity. Wharf 8 was rebuilt outside of the period of significance. None of these waterfront structures is a contributing resource. The removal of the buildings between the Building 12 Complex and Building 6, which provided support for workers, has also impacted the setting of these piers and wharves.

Slips 1, 2, and 3

Physical Description

Slips 1, 2, and 3 are situated next to Wharf 1 and directly north of Plate Shop No. 1 (Building 109). Slips 1, 2, and 3 were built in 1915. They are approximately 70 feet wide and 325 feet long, running north-south, and were infilled between 1959 and 1964. Subsurface portions, including the timber pilings, caps, and stringers; the concrete slab and posts of Slip 1; the crushed rock fill of Slip 2; and the crane runway supports, are assumed to be preserved beneath the infill and asphalt paving. Portions of the crane runway supports and the ends of Slips 1 and 2 are visible.

Historic and Current Use

These slips at Pier 68 are the earliest remaining at the yard, earlier than the World War II Slips 5 through 8 at the New Yard, and were used to construct smaller ships. In 1886 a slip was constructed in the vicinity of Slip 1, and two slips were built in the vicinity of Slips 2 and 3 in 1900. All three slips were rebuilt in 1915. Steel hulls were constructed in the slipways on keel blocks and heavy wooden posts. Layers of timber, called ground ways and sliding ways, were placed on top of the keel blocks to form runways beneath the ship.[128] Prior to World War II steel plates were cut to size, bent, punched for rivet holes, and transported to the slipways where they were fitted into place on the hull and riveted. By World War II the yard had moved to welding and welding platforms were installed at the head of the ways. Crane tracks constructed on truss towers measuring approximately 70 feet tall flanked the slips, and two cranes were installed on each track in order to move plates and pre-assemblies into place. When the hull was complete it was launched and moved to the nearby wet basins where it was outfitted.

A small portion of the infilled Slips 1 through 3 is currently used for storage and is fenced. The rest of the slips are vacant.

Integrity

Slips 1 through 3 are associated with both World War I and World War II shipbuilding efforts at the yard. Due to the dismantling of the 70-foot crane runway towers, removal of the cranes, and infill of the slips, these features have lost their integrity of design, workmanship, materials, and feeling. This loss of integrity renders the resources noncontributing.

Slips 5, 6, 7, and 8

Physical Description

Slips 5, 6, 7, and 8 were built in 1941 as part of the New Yard (Building 12 Complex) designed and built by the U.S. Navy. Slips 5 and 8 were 400 feet long and Slips 6 and 7 were 660 feet long descending from the shoreline into San Francisco Bay. All are oriented east-west, and are longer than the Pier 68 slips, allowing for the construction of larger ships. All slips were infilled after 1964 and the associated platforms and cranes were removed. It is assumed that the subsurface portions of the ways are preserved under an asphalt parking lot. The crane ways and the edge of the ways are visible along the shoreline.

Historic/Current Uses

Slips 5 through 8 were installed in 1941 when the U.S. Navy constructed the Building 12 Complex. The hulls were constructed in the ways before they were launched and moved over to

[128] *An Introduction to Shipbuilding*, Shipbuilding Division, Bethlehem Steel Co., (Washington, D.C., 1942), 41.

the adjacent wet basins for outfitting. These slips were designed to accommodate one 6,000-ton cruiser or two 2,100-ton destroyers.[129] Welding and prefabrication were the primary methods of steel hull construction during World War II. Welding platforms were placed on all available sides of the slips, including a larger platform at the head of Slip 8. Two head house buildings, Buildings 34 and 35, no longer extant, sat at the head of the longer slips, Slips 6 and 7. Instead of the 70-foot crane track towers found at Slips 1 through 3, single Colby cranes ran on crane tracks only slightly raised above the slip ways. Rail lines and a semi-gantry crane moved plates and materials from the Building 12 Complex to the slips.

This area is currently used as vehicle storage for Auto Return, the city's towing company.

Integrity
Slips 5 through 8 were integral to the World War II shipbuilding process at the New Yard and are a defining feature of the layout of the Building 12 complex. These slips were infilled and paved over during the 1960s and have lost their integrity of design, materials, workmanship, and feeling. Because of this loss of integrity they are noncontributing resources.

Paving Stones
Physical Description
The basalt paving blocks along 20th Street are a testament to early paving in San Francisco. The approximately 5" by 10" blocks are laid between granite or concrete curbs that extend along the street between Illinois and Louisiana Streets. Asphalt now covers the majority of the historic paving. The paving is visible along the curb on both sides of 20th Street and in several potholes in the center of the street.

Historic/Current Use
According to the Board of Supervisors report, the blocks date from 1893-1895. Historically the roads of the shipyard and the majority of roads in San Francisco were paved with basalt blocks. The blocks are still found, beneath several later layers of asphalt, at currently functioning roads.

Integrity
These paving stones are the same paving material used historically for most roads in San Francisco. The basalt paving stones thus represent a vestige of San Francisco's original paving material, and the paved roads played an integral role in the early development of the shipyard. The paving stones retain integrity of location, setting, association, and materials. However, because the stones are currently covered with asphalt it is unclear if the paving extends across the entire street. Therefore, the paving stones are a noncontributing element to the district.

Rail Lines
Physical Description
Currently, there are two visible rail spurs that connected with rail lines on Illinois Street. Several visible rail lines once used to move materials around the district are also extant within or adjacent to buildings. These tracks are part of a complex and interconnected system of rail lines that was essential to the shipbuilding and ship repair activities from the 1880s until 1945. The extant lines at the shipyard are visible through several layers of asphalt that had once covered

[129] Plans of The San Francisco Yard, Bethlehem Steel Company, Shipbuilding Division 1944-1945, Sheet 11.

them but has since failed. Additional rail lines may be buried beneath still sound asphalt. The locations of the known rail spurs are as follows.

A rail spur enters the district off of Illinois Street which was associated with both the Santa Fe and Atchison Topeka Rail Road and the Southern Pacific Rail companies. This line begins at the corner of 20th and Illinois Streets, branches near the eastern edge of Building 101, and heads toward Building 113, where it turns and runs along the eastern edge of Buildings 115 to Building 117. The other branch runs down 20th Street where, during World War II, it met with a U.S. Navy-owned line near Building 103. The portion of the track from its point of entry to the district boundaries until the point where it joined the government-owned line remains intact.

An exposed rail spur enters the district at the northwestern gate near Building 49 and Slip 4. This line runs south past Building 30 toward Building 101. It curves near Building 101 and runs east, ending near Building 36. Based on the 1945 Plan this line was owned by Bethlehem Steel and the majority of this spur is visible.

A rail line runs to the west of Slips 1 through 3 and to the east of Buildings 110 and 50. Owned by Bethlehem Steel during World War II, this line connected Building 109, the Plate Shop, with the welding platform at Slips 1 through 3.

A rail line remnant is visible in front of the main entrance to Building 113; another visible line connects Buildings 113, 114, and 115, and a line runs into Building 117.

Historic/Current Use
In 1886, the first rail line at the shipyard was located along Georgia Street between 21st and 20th Streets, running between the two halves of Building 113. Sanborn maps indicate that by 1899 at least fifteen more rails were added. By 1914, the number of rail lines had almost doubled, and more were added until the late 1930s. Historically, these lines made it possible for the movement of materials and supplies to, from, and within the district. The rail lines played a significant role in the development and success of UIW.

Currently the rails are no longer in use and have all been covered with multiple layers of asphalt. Industry once relied heavily upon rail line transportation for the locomotion of supplies, but advancements in technology ushered in their replacement with internal combustion vehicles. This transformation is evident at the shipyard in the overlay of asphalt on partially exposed rail lines.

Integrity
The extant rail lines date from the period of significance and played a significant role in the production and development of the shipyard. Rail lines were essential to the movement of materials around the shipyard as well as for importing raw materials for shipbuilding. The extension of private rail lines into the yard allowed for steel plates and other materials to be delivered directly to the areas where they were needed, streamlining the shipbuilding process. While these rail lines retain some integrity they do not appear to form a complete transportation network and therefore are not a contributor to the district. However, extant fragments associated with specific resources are considered character defining features of those resources. Examples include the rail lines within Building 113, and on Slip 4.

Future Development

In 2010, the Port of San Francisco prepared a draft preferred Master Plan that established a land use and conceptual development program for the entire 65 acre UIW Historic District. The Master Plan included specific historic preservation objectives and policies for the district that call for the rehabilitation of numerous contributing resources, creation of parks, and significant new infill development on the open and vacant areas of the district. The Port has selected two private development partners that are proposing to utilize Federal Rehabilitation Tax Credits for the rehabilitation of many of the district's contributing resources.

8. Statement of Significance

Applicable National Register Criteria
(Mark "x" in one or more boxes for the criteria qualifying the property for National Register listing.)

- [x] A. Property is associated with events that have made a significant contribution to the broad patterns of our history.
- [ ] B. Property is associated with the lives of persons significant in our past.
- [x] C. Property embodies the distinctive characteristics of a type, period, or method of construction or represents the work of a master, or possesses high artistic values, or represents a significant and distinguishable entity whose components lack individual distinction.
- [ ] D. Property has yielded, or is likely to yield, information important in prehistory or history.

Criteria Considerations
(Mark “x” in all the boxes that apply.)

- [ ] A. Owned by a religious institution or used for religious purposes
- [ ] B. Removed from its original location
- [ ] C. A birthplace or grave
- [ ] D. A cemetery
- [ ] E. A reconstructed building, object, or structure
- [ ] F. A commemorative property
- [ ] G. Less than 50 years old or achieving significance within the past 50 years

Areas of Significance
(Enter categories from instructions.)
Industry - Maritime
Architecture - Industrial

Period of Significance
1884-1945

Significant Dates

Significant Person
(Complete only if Criterion B is marked above.)

Cultural Affiliation

Architect/Builder
Hamilton, Frederick
Melliss, Dr. D. E., Civil Engineer
Meyer, Fredrick H.
Percy, George
Weeks, Charles Peter
Unknown Bethlehem Steel architects
Unknown U.S. Navy architects

Statement of Significance Summary Paragraph (Provide a summary paragraph that includes level of significance, applicable criteria, justification for the period of significance, and any applicable criteria considerations.)

Union Iron Works (UIW) is a maritime industrial district eligible for the National Register of Historic Places under Criteria A and C. The district is significant at the national level under Criterion A for its association with the development of steel shipbuilding in the United States. The period of significance begins in 1884, with the construction of the shipyard, and ends in 1945 at the close of World War II, when the yard was at its greatest build-out. UIW is significant for its pioneering technological developments in shipbuilding, and the production of significant wartime vessels. The district is also eligible at the local level under Criterion C in the area of Architecture for the same period of 1884 to 1945. The UIW historic district is a physical record of the trends in industrial architecture from the late nineteenth century through World War II.

Narrative Statement of Significance (Provide at least **one** paragraph for each area of significance.)

General History of the Union Iron Works/Bethlehem Steel Shipyard
UIW tells the story of the American steel hull shipbuilding industry from the late nineteenth century through World War II. As California's pioneering iron works, the Union Iron Works early history coincides with the shift from wood to iron shipbuilding. By opening the first steel shipyard on the West Coast in 1884, Union Iron Works established a national steel hull shipbuilding industry. Over the next three decades, the shipyard played an integral role in the United States government's efforts to increase naval resources and bolster the nation's image as an international military power. By World War I, the yard stood at the center of the shipbuilding industry on the West Coast. A crew of mostly skilled laborers produced dozens of warships and submarines that resulted in the United States' overwhelming success in World War I. The combination of a skilled labor force and the yard's ability to build or repair all ships afloat kept it open during the lean interwar years. As World War II approached, UIW participated in the unprecedented military build-up occurring across the country. The World War II development there resulted in an increase in unskilled workers and mass production. At the same time, ship repair and naval contracts completed by the yard's skilled laborers made a significant contribution to the war, and by maintaining many of the older buildings, produced UIW's unique collection of buildings from all periods of the United States' steel shipbuilding industry.

The UIW Historic District can trace its origins to California's first iron works, opened by Peter and James Donahue at Jackson and Montgomery Streets in San Francisco during the Gold Rush. In the early 1850s, the works moved to First and Mission Streets and in 1853 was renamed the Union Iron Works. The works constructed engines and boilers for iron ships, locomotive equipment for California's first trains, and the majority of mining equipment used in the Comstock silver mines. Irving M. Scott managed the works starting in 1865, after Donahue retired, and was responsible for transforming it into one of the country's leading steel hull shipbuilding and repair companies.

By the early 1860s the city's early wood ship builders abandoned the crowded shoreline along Steamboat Point in San Francisco's South of Market district for the deep waters and vacant

lands around Potrero Point. John North was the first shipbuilder to relocate in 1862, followed by Henry Owens, William E. Collye, and Patrick Tiernan.[130] The 1867 completion of the Long Bridge from South of Market over the waters of Mission Bay, and the extension of Third Street, improved access and eased transportation to this developing manufacturing center in the Potrero district. The Irish Hill and Dogpatch neighborhoods emerged as workers moved to the area. The Irish Hill neighborhood consisted of two settlements of cottages, lodging houses, and saloons clinging to the hillside north of the Pacific Rolling Mills and around the intersection of 20th and Illinois Streets.[131]

The deep waters around Potrero Point facilitated easy loading and unloading of cargo, making it an excellent location for the new Union Iron Works shipyard. Located in the outskirts of the city, the Point also made an ideal manufacturing area for hazardous materials. The E. I. du Pont de Nemours Company was one of the first manufacturers to exploit this region in 1854 to manufacture black powder. Over the following decades the Tubbs Cordage Company/San Francisco Cordage Manufactory, Pacific Rolling Mills, and City Gas Company Works moved to the area. Pacific Rolling Mills, whose property would eventually be managed by Union Iron Works under Bethlehem Steel ownership, was the first manufacturer of steel on the West Coast, starting in the 1860s.

The Union Iron Works shipyard opened at Potrero Point in 1884 with a machine shop (Building 113), plate shop, pattern shop, foundry, smith shops, and slipways. The next year the yard launched the *Arago*, the first steel hull ship produced by UIW and launched on the West Coast, and one of the first steel hull ships completed in the country. In 1885, after the yard's success with the *Arago*, Scott and Union Iron Works secured naval contracts, initiating a relationship between the U.S. Navy and the yard that lasted through World War II. During the late nineteenth century, the shipyard completed some of the most famous warships of the Spanish-American War, including the *USS Oregon* and the *USS Olympia*.[132]

A new era in the history of UIW began with the turn of the new century. In 1902 the United States Shipbuilding Company (USSC) acquired UIW along with other yards and steel mills across the country. Two years later the USSC collapsed, allowing Charles Schwab to purchase the shipyard in 1905 on behalf of the Bethlehem Steel Corporation, the second largest steel manufacturer in the country. In the spring of 1908, Schwab personally oversaw upgrades to the yard's repair facilities, which allowed the yard to repair the Great White Fleet, the naval fleet that President Theodore Roosevelt famously ordered to sail around the world between 1907 and 1910 as a brazen display of the country's growing military power.

By World War I, the shipyard served as the headquarters of a West Coast shipbuilding complex, which included the Hunters Point Drydock, the Alameda Yard, and the U.S. Navy Destroyer Plant. Renowned San Francisco architects designed buildings along 20th Street, creating a grand entrance to the yard. The shipyard expanded and modernized during the 1910s, including infrastructure expansion, a new plate shop (Building 109), and new foundries (Building

[130] Roger Olmstead, et al., *San Francisco Bayside Historical Cultural Resource Survey, San Francisco Clean Water Program,* 191.
[131] San Francisco Planning Department, *Central Waterfront Cultural Resources Survey Summary Report and Draft Context Statement,* 16.
[132] William H. Thiesen, *Industrializing American Shipbuilding: The Transformation of Ship Design and Construction, 1820-1920* (Gainesville, 2006), 176. Also see Figure E, "List of Vessels."

115/116). The destroyer plant run by the Union Iron Works used some of the new prefabrication methods of the period to produce three destroyers per month. The Navy prioritized submarine destroyers as the primary fleet defense against torpedo attacks from submarines and the 66 destroyers produced by the yard made a substantial contribution to the World War I naval effort. The yard survived the lean years after World War I on commercial ship construction and ship repair contracts.

United States Maritime Commission contracts, starting in 1936, resulted in a new wave of modernization at the yard. Upgrades included a new boiler house (Building 103) and a yardwide transformation from riveting to welding, which helped the yard adapt to standardized mass production that typified World War II ship production. During the war, the yard was primarily under naval management. The New Yard shipbuilding facility (Building 12 Complex) built by the Navy stands on the former destroyer plant. The yard also significantly contributed to World War II in the repair of 2,500 ships.

Labor played an integral role throughout the history of UIW. From the earliest days as one the first steel hull shipbuilders, the yard employed highly skilled laborers who could adapt to new technologies and modes of production. While most shipyards closed during the interwar period, the skilled workers and the flexibility of the yard's facilities kept UIW open. Since World War II, the yard has not led innovations in shipbuilding technology or production. Instead the skilled labor force has enabled the district to become the longest continually operating ship repair facility in the nation.

After World War II, the yard continued to build government and commercial ships into the 1970s. In the early 1980s, the Bethlehem Steel Company went bankrupt and sold the shipyard for one dollar to the Port of San Francisco. Todd Shipyards purchased much of the machinery and leased portions of the yard for ship repair. Today, BAE Systems San Francisco Repair leases portions of the yard from the Port of San Francisco and continues to operate a repair facility onsite, making the yard the longest operating steel hull ship repair yard in the country.

Ship Construction at the Yard during the 1880s

During the late nineteenth century, ship hulls were constructed starting with the laying of the keel in the shipways. Workers then riveted steel frames and plates in place to construct the hull. After the completion of the hull, the ship was launched ceremoniously and moved to the wet basins or outfitting docks to be fitted with propulsion systems and outfitted.[133]

Hull Construction

UIW erected the ship hulls in one of the slipways at the northern edge of the yard along the waterfront. Instead of tailoring each new hull plate to fill a vacant position on the partly constructed hull as the older lifting method required, hull frames and plates were produced following templates from models. Templates were wood or sometimes paper patterns, produced by loftsmen. Working in the mold loft, in the second floor of the plate shop standing at the head of the slips, loftsmen produced templates by scaling up from a wood model of the ship. In his discussion of the *USS Olympia*, historian Robert Stewart describes the process used:

[133] This process is shown in Figure 6, which indicates the separate and often concurrent processes of hull construction and the fabrication of engine and outfitting components.

> Loftsmen would produce a table of offsets that gave the ship's scaled-up dimension at 'stations' of location along the length of the hull. This table of offsets determined the contours of full-sized hull lines on the loft floor. Loftsmen then cut wooden shapes or patterns to make full-sized templates. Each template conformed to a frame in the full structure. Skilled workers cut the frames and plates out of steel plate, carefully trimming them to match the template shapes.[134]

Templates were brought downstairs to the plate shop. Steel hull plates, often produced by Pacific Rolling Mills, were stored in a yard to the south of the ship shop and were moved into the plate shop. During the 1880s, unskilled workers or livestock moved plates on carts from the storage area to the plate shop and then to the slips. By the 1890s, several track cranes moved plates around the shipyard on railroad lines.

Workers in the plate shop would bend and shear the plate to match the templates and punch it with rivet holes. The plate shop included a drawing board, bending floor, blacksmith shop, offices, and a second story molding loft and drawing room. This building is no longer extant, but a plate shop has continuously stood roughly in the same location. Building 109, a Plate Shop and Mold Loft, constructed in 1912, stands there today. Support buildings for the plate shop in the late nineteenth century included a coppersmith shop, blacksmith shops with furnaces, and bending shop, water closets, and rigging storage; none of these early wooden buildings remain.

Next, steel hull plates were moved to the slips, where the hull was riveted together by rivet gangs. According to Caspar T. Hopkins et al., writing in 1884, UIW opened with overhead cranes to position plates above the slips, then called ways.[135] Plates did not always fit and workers used hand-tools or hydraulic shears to custom tailor the plate on the slips; occasionally they had to scrap plates.[136]

Based on drawings from the late nineteenth century, the shipyard had four slips with the westernmost slips appearing narrower than the eastern (Figure 7). The yard retained slips at this location through World War II, though they were rebuilt several times during and after the period of significance. After the hull was completed, the ship was launched ceremoniously and moved for outfitting to the ways or wet basins located to the east of the slips, in the approximate location of Pier 68 today. Piers and wet basins at Pier 68 have been rebuilt and extended several times since the 1880s. The current waterfront structures were built after World War II.

By the late 1880s a floating hydraulic drydock was installed along the eastern end of the wharf. The drydock raised ships out of the water for ship repair. Ship repair often consisted of cleaning and repainting hulls, and also included the replacement of components or entire propulsion systems, which the yard produced in its machine and metal shops.

Engineering and Outfitting

The UIW shipyard was able to fabricate, forge, and machine all metal components necessary for ship construction onsite, from the smallest bolt to entire engines and boilers. Most of these components were used in building ship propulsion systems (engineering) or for the installation

[134] Robert C. Stewart, "Historic American Engineering Record: U.S.S. Olympia," (U.S. Department of the Interior, National Park Service, 1998).
[135] Hopkins et al., *Report on Shipping*, 41.
[136] Thiesen, *Industrializing American Shipbuilding*, 186.

of all non-structural ship components (outfitting). During the nineteenth century this work was done on the south side of 20th Street and this basic arrangement of buildings remains, anchored by Building 113.

The process of fabricating equipment often started at the pattern house and shop. Located southeast of Building 113, this building was four stories high with the upper stories used for storage, making it the tallest building at the yard during nineteenth century. In the pattern house workers produced patterns or forms for shaping molds used to produce metal castings for machine parts. [137] Pattern makers utilized motorized tools run by a wire line connected to the boiler house. Materials for the machine shops and foundries were also stored here. The pattern house was demolished after World War II.

After the patterns were made, molds were poured in the foundry. In 1884, the foundry building was the southernmost building at the yard. The western portion of Building 113, divided in the 1880s by Georgia Street, housed the machine and erecting shop where workers constructed marine engines. In the eastern half stood the blacksmith and boiler shop with forges, where the boilers for the ship engines were constructed. Engines, boilers, and other large components constructed in the southern portion of the yard were moved to the wet basins or outfitting piers where the ships were outfitted. To the south of the machine shop stood several smaller buildings, housing a brass foundry and blacksmith shop.

An engine house south of Building 113 supplied power for the cranes and motorized tools. During the 1880s, the boilers in the engine house used steam power to turn a series of cranks, shafts, wires, and belts that ran the motorized tools in the machine shop and tool room. Air compressors located here supplied power to the overhead traveling cranes and to hydraulic pumps for powering hydraulic machinery in the nearby buildings. Dynamos were also housed in the engine room.[138] A 120-foot octagonal brick chimney rose from the engine house and is shown on the 1880s sketch of the yard (Figure 5). When the yard opened, electricity was used only for powering electric lights.

Circulation Systems

Based on an early lithograph, the shoreline ran just north of 20th Street (then Napa Street) with a small inlet extending south of 20th Street into Union Iron Works, just west of the machine shop (Building 113). A 20th Street bridge crossed over the inlet and functioned as the main access to the works (Figure 5).

The city's gridiron street plan was only roughly followed within UIW, and several planned city streets were never opened within the shipyard boundaries. The Board of Supervisors during the mid-1880s closed all planned streets except Napa Street (20th Street) inside the Union Iron Works property.[139] Only one rail line, running between the buildings south of 20th Street and extending to the waterfront north of 20th Street, was installed by the mid-1880s. By the late 1890s, a fence enclosed the shipyard with the entrance at the corner of 20th and Georgia Streets, the current entrance to the ship repair yard.

[137] Shipbuilding Division, Bethlehem Steel Co., "An Introduction of Shipbuilding," (Washington, D. C., 1942), 44.
[138] W. W. Hanscom, "Electricity in the Union Works," *The Journal of Electricity, Power and Gas,* XI (1901), 112.
[139] Hopkins et al., *Report on Shipping*.

The yard maintained this general process of ship construction well into the twentieth century. The extant buildings continued to convey the design and layout of the yard throughout the period of significance, although most of the earliest buildings were replaced by World War II.

Turn of the Twentieth Century

In 1896, UIW built an office-specific building (Building 104), and defined office spaces in existing buildings, expanded the rail and crane system, introduced electric-powered tools, expanded its boiler shops, and expanded and upgraded the ship shop, slips, and piers. All of the metal shop buildings constructed in the early 1880s were still in use at this time with little or no modification or changes in function. The yard expanded to cover 28 acres, and included new rail lines between buildings and open truss structures over four slips.

Building and Waterfront Structure Upgrades

In 1896 prominent San Francisco architects George Percy and Frederick Hamilton designed the new UIW office building. Standing on the north side of 20th Street, across from the machine shop, this brick Renaissance Revival style building was the first of several architect designed buildings to grace the street. During the 1890s, UIW expanded the plate shop and mold loft, and added a bolt and forge shop, planing mill, and a copper smith and tin shop. The large plate shop, also called a machine shop during this period, contained a bending floor, ship blacksmithing shop, and iron plate storage area. This building is no longer extant and was replaced by Building 109.

At the same time, UIW erected an expanded boiler shop on the north side of 20th Street, closer to the outfitting piers. This brick building, designed to match the original 1880s era buildings, contained a flange shop, boiler shop, and coal shed.[140] One wall of this building remains as the southern elevation of Building 105. The Thorneycroft boiler shop and storage buildings were all located to the east along 20th Street. A steel forge stood to the northeast.[141]

By the turn of the twentieth century, the yard contained seven slips fitted with truss structures for overhead cranes (Figure 8). The introduction of cranes at the slips significantly eased the construction of the hull and allowed ship designers to use larger steel plates and frames. Slips 5 and 6 were the largest slips on site at 480 feet long and approximately 80 feet wide. Slips 1 through 4 were approximately 300 feet in length and varied in width.[142] Narrow buildings containing a bolt shed, tool chest shed, and tin shop stood on piers between slips. Directly to the east of the slips was the warship-completing berth and three more wet basins.

Ship repair facilities also increased to allow for larger ships. A floating hydraulic drydock, an engineering feat at the time, was located at the northeast end of the yard,[143] along with the shipyard's repair shops; none of these remain. Several narrow support buildings (e.g. calkers, tool shop, drydock storage, rigger, and restroom) stood near the drydock on the wharf.[144] A

[140] Sanborn Map Company, San Francisco, Vol. 5 (1899), sheet 544.
[141] This building was dedicated to bending, grinding and sawing off Thornycroft boiler tubes and other tubes for ship water boilers. "Union Iron Works, San Francisco," *Marine Review,* February 7, 1901, pp. 6-9.
[142] "Union Iron Works, San Francisco," *Marine Review,* February 7, 1901, pp. 6-9.
[143] Approximately at the location of the present-day Wharf 3.
[144] Sanborn Insurance Company Map, San Francisco, Vol. 5 (1899), sheet 541.

drydock engine and pump house, in a slightly different location than shown on the 1887 general plan, stood at the head of the dock and supplied the power for the shipyard.[145]

Little construction associated with UIW occurred south of 20th Street during the late nineteenth century. Sheds and outbuildings were added near the pattern shop and behind the machine shop. To accommodate the introduction of electric-powered tools in the machine shop, the engine house was slightly expanded and reconfigured. During the 1890s, UIW switched to electric cranes.[146] By 1901, UIW had installed 35 cranes across the district, including cranes in the machine shop, brass foundry, iron foundry, erecting shop, boiler shop, and blacksmith shop.[147] The bridge cranes extant in Building 113 date to this period.

Infrastructural Improvements
A boiler and engine house, and a coal storage building, no longer extant, were built during this period to provide electricity to the northern portion of the yard.

By the turn of the century UIW installed an expanded rail system with overlapping lines, and branches connected most buildings. A Southern Pacific Rail Road line extended down 20th Street and into the adjacent Risdon Iron and Locomotive Works, located at the former Pacific Rolling Mills site.[148] More than one line ran along Georgia Street, with the rail lines fanning out just north of 20th Street. One line ran northeast, extending onto the wharf between the drydock and warship berth, and continued to make a circle in front of the slips. Another ran northwest and exited UIW at the northwest corner to continue along Illinois Street.

A twelve-foot high picket fence surrounded the northern portion of UIW, separating the shipyard from the saloons and residences at the corners of 20th and Illinois Streets. Lumber storage and a corral lay near Illinois Street, marking the northwestern corner of the yard. A small gate house stood at the corner of 20th and Georgia Streets. By the turn of the century, Irish Hill continued to be graded toward the south and was used to fill the inlet around 20th Street, replacing the bridge access.

Risdon Iron and Locomotive Works
In 1901, the Risdon Iron and Locomotive Works erected a shipyard on the Pacific Rolling Mills property to the southeast of UIW. Risdon removed all of the earlier Pacific Rolling Mills' buildings and replaced them with steel-clad buildings with monitor roofs. Building 21 was built during this first stage of redevelopment of the southeastern portion of the UIW and is the only remaining Risdon building.

UIW and Bethlehem Steel through World War I
During the 1910s, the yard continued to expand. This included the transformation of 20th Street into a grand entrance and the construction of a new administration building in 1917, at the corner of 20th and Illinois Streets. The yard also upgraded and expanded its plate shop, foundries, drydock facilities, and electrical infrastructure both before and during World War I. Similar to the site upgrades in the 1890s, this wave of new development upgraded or replaced

[145] W. W. Hanscom, "Electricity in the Union Works," *The Journal of Electricity, Power and Gas*, XI (1901), 112.
[146] "Shipbuilding Plant of the Union Iron Works at San Francisco," *Marine Engineering* (1900), 14.
[147] Hanscom, "Electricity," 112.
[148] Sanborn (1899), sheets 541, 543.

existing facilities and kept the yard competitive for World War I naval contracts, but did not transform the basic process of steel hull ship construction from the 1880s.

Development along 20th Street

By 1914, the houses and saloons along Illinois Street near 20th Street were razed and the fence dividing the shipyard from these buildings was removed. By the beginning of World War I, the corral and storage area along Illinois Street, north of 20th Street, was no longer in use and the area was mainly vacant. The removal of the corral likely marks the end of animal-powered material movement at the yard.

In 1912, a new powerhouse (Building 102) designed by Charles Peter Weeks was constructed on 20th Street. It supplied power, including alternating current, direct current, hydraulic, and compressed air for pneumatics, to the entire UIW yard.[149] The new powerhouse, with its increased supply of electric power, allowed for widespread use of independent motorized tools, removing the earlier limitations of belt driven tools. Additionally, the infrastructural upgrades associated with the new powerhouse resulted in new underground power trenches across the yard.

One of the more noticeable changes during World War I was the construction of a Renaissance Revival style administration building (Building 101), designed by Fredrick H. Meyer in 1917. Building 101 extended the yard to 20th and Illinois Streets and completed the row of architect designed buildings here (Figures 10 and 11). A new fence, still extant, was installed in 1917 along both 20th and Illinois Streets, abutting the new office building. Double guardhouses stood on the north side of 20th Street, marking the entrance to the northern portion of the shipyard.

Plate Shop and Waterfront Structure Upgrades

The early twentieth century was marked by further transformation of the waterfront and the area north of 20th Street (Figure 9). Building 109 replaced the earlier plate shop at the head of the slipways. A large crane ran along the south side of Building 109, and the surrounding open area was used for hull plate storage. By the mid-1910s, many of the earlier wood buildings adjoining the plate shop, largely smith shops, had been demolished. Additional flange shops were erected during this time. The plate shop bending floor and the plate racks, dating to the turn of the century, were moved and expanded nearby.

The expansion of slips and drydocks to the east into the bay occurred during the first two decades of the twentieth century (Figure 10). The hydraulic (floating) drydock was badly damaged in the 1906 earthquake and was replaced by two floating drydocks. Bethlehem's Union Iron Works Company installed additional wharves, which extended the yard further east into the bay. By 1914, several small offices were scattered throughout the district.[150] In 1915, the northeast slips were rebuilt. A pipe and copper shop replaced the earlier power station near the head of Pier 2.[151]

During World War I, Piers 1, 4, and 6 were built and Piers 2 and 3 were reconstructed from the original mid-1880s construction. Two slips with trestles and overhead cranes were added to the

[149] H. P. Pitts, "Union Iron Works at San Francisco," *Pacific Service Magazine* (June 1916), 2-10.
[150] Sanborn Insurance Company Map, San Francisco, Vol. 6 (1914), Sheets 591-592.
[151] Sanborn Insurance Company Map, San Francisco, Vol. 6 (1914), Sheets 591-592.

yard, to accommodate larger ships, and ran diagonally to the slips and piers. These new slips were located in roughly the same location as the existing Slip 4.

Machine and Metal Shop Upgrades
A consolidation of metal shops occurred during this period as the auxiliary foundries and blacksmith shop that had moved near the waterfront were centralized near 20th Street. A blacksmith shop became the rear extension of the boiler and flange shops fronting 20th Street. The bolt and riveting shop, located near the plate shop and the slipways at the turn of the century, were moved to the south side of 20th Street, near the machine shop (Building 113). In 1914, a connector building joined the two halves of Building 113 into a single building.

During World War I, several of the original UIW buildings south of 20th Street were demolished. Two new foundry buildings, Buildings 115 and 116, replaced the earlier 1880s foundry. Building 115/116 still stands, and displays a strong industrial modernist aesthetic. This is one of many cases where similar functions continue in the same location even though a new generation of buildings replaced the originals. In 1917, a brick warehouse (Building 111) was constructed north of 20th Street.

The Risdon Yard
At this time, another wave of development occurred to the east of UIW. The United States Steel Products Company, which acquired UIW, repurposed the 1900 era buildings of the Risdon Iron and Locomotive Works, closed in 1911, for warehouse and storage uses (Figure 9). The former Risdon Iron and Locomotive Works property also contained a circa 1900 machine shop and transformer house (Building 21). As the 75-foot bluff on which the Irish Hill neighborhood stood was graded and removed, the houses were demolished and a rail line inserted. A small wharf marked the eastern edge of the property.

During World War I, the Union Iron Works Company operated a destroyer plant, known as the Risdon Yard, at the former Risdon Iron and Locomotive Works site. New building slips were erected at the southeastern edge of this property and a warehouse was modified to house a new plate shop. The slips for the plant lay beneath a single steel framed roof at the eastern end along the bay (Figure 13).

Circulation Systems
By the end of World War I, the rail lines at UIW were simplified and only a single rail line along Georgia Street ran through the new connector building of Building 113 and crossed 20th Street. Rather than fanning out into several rail lines, a rail loop north of 20th Street connected the buildings south of 20th Street to the plate shop and slips. This line, visible today, moved goods and materials into the yard. Additionally, rail lines connected the new building slips and plate shop at the destroyer plant with the remainder of the yard, and several rail spurs directly connected this new development to the older wharves.

Between the Wars
As depicted on the 1936 Sanborn Map, little modification occurred at UIW between the end of World War I and the wave of modernization that began in 1936 (Figure 12). 1936 development included the construction and demolition of several buildings, modernization of the foundries and shops, and upgrades to power and infrastructure.

Building Construction and Upgrades
In 1938, a new steam powerhouse (Building 103) was constructed at the end of 20th Street. This building represents a yardwide infrastructural shift back to internally generated power. The most drastic change to the north side of 20th Street was the removal of the four-story boiler shop that fronted 20th Street since circa 1900 and its replacement by a new forge shop (Building 105). The south brick wall fronting 20th Street still remains from the earlier building. Additional construction included new buildings for painters and riggers along the slipways and worker facilities throughout the yard. A steel warehouse (Building 117) was constructed between 1936 and 1938.[152] Irish Hill was further excavated to make way for increased development to the south. Building 117 marked the southwestern edge of the district, and extended the footprint of the original 1883 UIW southward for the first time.

Infrastructure Upgrades
A new utility trench was dug to move fuel, electricity, water, and air to the various buildings, cranes, and slips throughout the district. Movable steel panels covered the trench, allowing for easy maintenance access.[153] The steel plates and trench are still visible near Buildings 21 and 11. In addition, Bethlehem undertook a general upgrade of the yard's utilities and modernization of shop machinery. New Holophane Prismatic Refractor light fixtures were installed throughout the district and remain in most of the buildings.[154]

World War II
General expansion of the shipyard occurred during the start of WWII, including new buildings and further construction and expansion of slips and wet basins along the waterfront (Figure 13). Much of this work was designed, owned, and paid for by the U.S. Navy. The most substantial development was the expansion of the southeastern slips and construction of the New Yard, also known as the Building 12 Complex. UIW also saw increased specialization of buildings during this period, specifically buildings for outfitting and ship repair.

The New Yard/Building 12 Complex
The New Yard consisted of four slipways, a plate shop, machine shop, warehouse, layout yard, welding platforms, and additional smaller support buildings (Figure 13). The shift toward welding required welding platforms and layout areas around the slips. The slips for the New Yard were completed in 1941, replacing the World War I era destroyer yard slips and associated plate shop. Building 2 replaced a warehouse dating to the Risdon period. This portion of UIW was developed with buildings and structures ranging from 80 feet (Building 2) to 120 feet high (scaffolding for Slips 5, 6, 7 and 8).

World War II Changes in Shipbuilding at the New Yard
The New Yard optimized its layout for pre-assembly and welding following the turning flow design. Since the beginning of steel shipbuilding, the goal of shipyards was to keep parts moving forward, from the arrival of raw materials through the final assembly of vessels. By World War II, the use of a linear or straight flow of materials was considered optimal and a straight line flow was a noted accomplishment of the new World War II yards. However, shipyards with limited space often implemented the turning flow design Instead of the optimal strictly linear movement from the storage areas to the slipways, the turning flow design allowed

[152] Sanborn Insurance Company Map, San Francisco, Vol. 6 (1936), sheet 594.
[153] "Bethlehem Reconditions Potrero Works of Union Plant," *Pacific Marine Review,* Vol. 35 (1938), 23.
[154] "Bethlehem Reconditions Potrero Works of Union Plant," *Pacific Marine Review,* Vol. 35 (1938), 24.

for materials to enter the yard parallel to the shoreline, move through the shops in a straight line, and then turn to be assembled on the shipways (Figure 14).

At the New Yard the working plans for a ship were drafted in the administration office (Building 101) or the naval office (Building 104). Plans were laid down in the mold loft and templates were made and moved downstairs to the plate shop. Following the turning flow process, raw steel entered by rail at the top end of the yard and was held in storage yards to the west of the plate shop (Building 12) until needed. The steel was then formed in the plate shop and, as required, joined into sub-assemblies. Cranes carried the sub-assemblies to the welding platforms where the parts were joined into even larger sections, such as deck houses and bow and stern assemblies.[155] Completed sub-assemblies were then moved by cranes to the slipways. At the New Yard, preassembly was also completed on welding platforms adjacent to the slips. When the hull was completed it was launched and moved to outfitting piers.

During World War II, specialized engineering and outfitting buildings were constructed or repurposed between the New Yard and the outfitting wharves. These buildings corresponded with specific outfitting and engineering divisions, including pipe, rigging, electrical, carpentry and joinery, sheet metal, and paint shops. The majority of engine and boiler work remained at Building 105 and Buildings 113/114. Material was moved by rail and cranes from these buildings to the outfitting wharves and installed in the hulls.

Building Construction at UIW
Building 6, the approximately 500-foot long light warehouse, was erected along the shoreline during World War II expansion. The building's angled placement is a character defining feature of the yard's layout (Figure 15). New bay fill between Building 6 and the New Yard supported the expansion of the wharves and wet basins.

Construction also occurred along the waterfront in the northern portion of the yard. Slip 4 was built at a diagonal to allow for expanded length and width. Wet Basins 6 and 7 and Wharves 7 and 8 were added to the southeast. Wet Basins 4 and 5 and Wharves 4, 5, and 6 were altered and expanded from their World War I era construction and configuration.

To increase the flexibility of power distribution, the yard management constructed substation buildings, and existing buildings were modified to house substations, as occurred at Building 11. The number of support buildings and workers' facilities increased throughout the yard during World War II, to included locker rooms, kitchens, and washrooms; many of the small buildings stood on or near newly erected piers.

Circulation Developments
During World War II, two separately-owned and possibly separately-operated rail lines operated at the shipyard: the Bethlehem Steel line and the U.S. Navy line. A Southern Pacific rail line entered the yard at 20th Street and ran through the district on Illinois Street. According to the 1945 site plan, the U.S. Navy rail line connected the Building 12 Complex to the newer slips and wet basins.[156] Additionally, this rail system connected the new wet basins and slips to the large light warehouse (Building 6) and other newly constructed warehouses and shops at the eastern

[155] Carey & Co., "Seawall Lot 349 at Pier 70, Building 12 Complex San Francisco Electrical Reliability Power Project Setting Analysis," (2003), 9.
[156] Plans of The San Francisco Yard, Bethlehem Steel Company, Shipbuilding Division 1944-1945, Sheet 1.

edge of the district. The Bethlehem rail line, still following the general loop around the district established by the end of World War I, extended down each of the northern wharves. Several rail spurs surrounded Slip 4.

UIW Chronology

The following chronology outlines significant events associated with UIW including the history of Union Iron Works, Bethlehem Steel, Pacific Rolling Mills, Risdon Iron and Locomotive Works, U.S. Steel Corp., and the U.S. Navy, all land owners in the district during the period of significance. This chronology also includes significant events that shaped the United States steel hull shipbuilding industry.

1849	Donahue brothers opened California's first iron foundry during the height of the California Gold Rush.
1853	Peter Donahue became sole owner and renamed the foundry Union Iron Works.
1857	Bethlehem Steel Company started as an iron works in Bethlehem, Pennsylvania.
c.1860	Wooden shipbuilders John North and Henry Owen moved to Potrero Point.
1861-1865	Civil War.
1865	Irving M. Scott became a partner and Peter Donahue retired.
1868	Pacific Rolling Mills opened on Potrero Point as the first steel mill on West Coast.
1870s	Irish Hill neighborhood established; Union Iron Works purchased Henry Owen's shipyard.
1884	Union Iron Works shipyard opened.
1885	First U.S. Naval contract for steel hull ship given to John Roach's Delaware River Iron Shipbuilding and Engine Works shipyard: "ABCD ships," for *Atlanta, Boston, Chicago*, and *Dolphin*.
	UIW successfully launched its first steel hull ship, the *Arago*, a commercial ship.
	San Francisco iron workers' successful strike for higher wages revived labor movement in San Francisco, led to formation of the first iron trades council in the United States (Federated Iron Trades Council), and created model of labor organization across the country.
1886	Newport News Shipbuilding and Drydock Company opened in Virginia.
	UIW built the Blacksmith Shop and Machine Shop, the brick masonry sections of what is now Building 113/114.
	UIW secured first Naval Contract to build the steel steamer *General McDowell.*
	UIW built world's first hydraulic drydock.
1896	UIW built Building 104, its first dedicated office building.
1898	Spanish American War; UIW's *USS Olympia* served as Admiral George Dewey's flagship during his successful defeat of the Spanish fleet at Manila Bay.
	UIW's battleship *USS Oregon* completed high-profile, 15,000-mile trip around tip of South America to confront four cruisers of the Spanish fleet in Cuba.

1900	Risdon Iron and Locomotive Works purchased the Pacific Rolling Mills, demolished all the mill buildings, and established a shipyard.
1901-1903	San Francisco machinists, in association with International Association of Machinists, launched a successful two-year strike for nine-hour day.
1902	United States Shipbuilding Company acquired Union Iron Works.
1904	Bethlehem Steel Corporation formed to consolidate Bethlehem Steel Company with other companies.
1905	Union Iron Works Company incorporated in New Jersey on January 1.
	Bethlehem Steel Corporation purchased the Union Iron Works Company. The yard took on several names, including the Union Plant, Union Yard, and Potrero Yard.
1908	Hunters Point Drydock acquired by Union Iron Works Drydock Company, a Union Iron Works Company subsidiary.
1912	U.S. Steel Products Company formed as a subsidiary of U.S. Steel.
	Bethlehem Steel Corporation constructed Building 102, Powerhouse 1.
1914	World War I broke out in Europe.
	United States Shipping Board (USSB) established to direct national shipbuilding program.
	Sanborn Map showed U.S. Steel Products Company owning the Risdon Iron and Locomotive Works.
1916	UIW Company purchased the Alameda shipyard of the United Engineering Co.
	UIW ran U.S. Naval Destroyer Plant on U.S. Steel Products Co. property.
	Bethlehem Steel Corporation constructed Buildings 116 and 117; two concrete warehouses.
1917	United States officially entered World War I.
	Bethlehem Steel Corporation constructed Building 101; the Bethlehem Steel Administration Building.
	Emergency Fleet Corporation (EFC) incorporated to distribute funds to national shipbuilding program.
	Bethlehem Shipbuilding Corporation, Ltd. incorporated in October and leased the Alameda and Potrero Plants from the UIW Company.
	Shipbuilding Labor Adjustment Board established to broker regional wartime agreements on hours, wages, working conditions, and union powers.
	Pacific Coast Strike over wage demands in San Francisco, Seattle, and Portland.
1918	World War I ended.
1924	Bethlehem Shipbuilding Corp., Ltd., bought UIW, Alameda, and San Pedro plants.
1927	American Bureau of Shipping approved welded hulls.
1929	Stock Market Crash.

U.S. Steel Corp. absorbed Columbia Steel Corp., Los Angeles; used former destroyer plant.

Bethlehem acquired Pacific Coast Steel Company in Seattle and its subsidiary, Southern California Iron & Steel Co.

1932 Franklin Roosevelt elected President.

1934 General Strike in San Francisco.

1936 Merchant Marine Act passed and United States Maritime Commission established to direct national shipbuilding program (replaced United States Shipbuilding Board).

UIW received contracts from U.S. Navy for two 1500-ton destroyers, first of 70+ ships to be built at UIW during World War II era; major modernization program at UIW began.

1938 Bethlehem Shipbuilding Corp., Ltd. became the Bethlehem Steel Company, Shipbuilding Division and the UIW yard renamed the San Francisco Yard.

1939 Germany invaded Poland; World War II began.

1940 U.S. Navy purchased the Risdon Plant from Columbia Steel of San Francisco, a U.S. Steel subsidiary, and constructed the Building 12 Complex, also known as the New Yard.

National Defense Appropriation Act passed.

U.S. Navy purchased Hunters Point.

Henry J. Kaiser opened first of four shipyards in Richmond.

1941 Japan attacked Pearl Harbor; U.S. entered World War II.

President Roosevelt signed Executive Order 8802, creating a Fair Employment Practices Committee and paving way for African Americans to work at shipyards.

1942 W. A. Bechtel Co. opened Marinship in Sausalito.

1945 World War II ended. Union Iron Works was at its maximum build-out.

Marinship in Sausalito and Kaiser shipyards in Richmond closed. UIW remained open.

1982 Bethlehem Steel sold UIW to the Port of San Francisco.

Criterion A: The Steel Hull Shipbuilding Industry

The Union Iron Works Historic District is significant for its substantial role in the birth and development of the national steel hull shipbuilding industry from 1884 through 1945. Union Iron Works (UIW) was one of the nation's leading shipyards and is the oldest continuously operating steel ship repair yard in the country. UIW maintained the ability to fabricate on site all the components necessary for building or repairing a ship. This flexibility and a skilled labor force allowed the yard to successfully produce a wide variety of government and commercial ships, including several of the most famous naval warships of the Spanish-American War. UIW also played a significant role in both World War I and World War II naval mobilization efforts. By World War I, UIW was the centerpiece of Bethlehem's West Coast shipbuilding complex. The

yard was a technical pioneer during the late nineteenth century and continued to expand and modernize its facilities through World War II. During World War II, it matured into the best-equipped repair yard on the West Coast. The UIW Historic District embodies the major trends in the American steel shipbuilding and ship repair industries from 1884 to 1945, including the interdependence of private shipyard development and naval expansion programs; the national evolution of shipbuilding methods in pursuit of greater efficiency and mechanization; the relationship between technological advances, the rise of scientific management, and labor; and the blending of shipbuilding and metalworking industries.

The yard's lasting contribution to the national steel shipbuilding industry was its breadth and flexibility, and its consistent balance of emerging technology with the older arts of shipbuilding required for repair work. It is this diversity that permits UIW to convey its national significance under Criterion A for each phase of expansion and modernization in shipbuilding, rather than just a single period, and to convey its historic association with the birth and development of the United States' steel hull shipbuilding industry.

Union Iron Works

James and Peter Donahue founded California's first iron works in a tent at the corner of Jackson and Montgomery Streets in 1849 at the height of the Gold Rush.[157] The following year, the newly named Union Iron and Brass Foundry moved to the South of Market District, establishing a foundry district near the waterfront. In 1853, Peter Donahue became the sole owner and renamed the firm Union Iron Works. By the end of the decade, UIW employed over 120 men and contained more than $150,000 worth of equipment.[158] While Donahue continued to own the works until 1865, it was Irving M. Scott who managed and directed the factory from the early 1860s through the turn of the century.[159] During this period, Scott's vision and leadership turned the works into one of the most successful shipyards in the country.

UIW established itself as vital to steel shipbuilding on the West Coast and nationally from the earliest days of the industry. Similar to other iron works that moved into shipbuilding during the late nineteenth century, Union Iron Works built engines and produced other metal parts for wooden ships.[160] Naval historian Hugo P. Frear writes that starting in the 1850s, Union Iron Works' casting for the shaft of the steamer *John S. McKim* was the first iron casting in the state of California.[161] UIW continued ship-related manufacturing with the production of steam engines, specifically an engine for the U.S. sloop *Saginaw,* the first government vessel completed on the West Coast. After prefabrication by the Secor Brothers in Jersey City, New Jersey, and shipment around Cape Horn, Union Iron Works constructed the *USS Camanche*, an iron monitor, in 1864; possibly the only iron hull ship constructed on the West Coast.[162]

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[157] Gray Brechin, *Imperial San Francisco: Urban Power, Earthly Ruin* (Berkeley: University of California Press, 1999), 127.
[158] California State Agricultural Society, "Report of the Visiting Committee of the State Agricultural Society," (Wilmington, Del.: Hagley Museum and Library, 1859).
[159] Scott was hired by Donahue in 1860 as a draftsman and by 1865, as Donahue retired, became a full partner. By the 1890s, Scott was a nationally known figure and a potential Vice President nominee for President McKinley in 1900. "Talk of Western Candidates" *New York Times,* June 14, 1900.
[160] Besides fabricating ship parts, UIW was famous for building over 90 percent of the machinery for Nevada's Comstock mines, and also produced railroad locomotives and agricultural equipment.
[161] Hugo P. Frear, *History of Bethlehem's San Francisco Yard: Formerly the Union Iron Works*, 238.
[162] "Launch of the Camanche," *San Francisco Evening Bulletin,*10 November, 1864.

Scott was the mastermind behind UIW's transition from an iron works to a shipyard. Scott ran the works with Henry J. Booth and G. W. Prescott for the next decade, ending in 1875. The three men planned a shipyard in the early 1870s and secured land in the Potrero Point district of San Francisco, as they were familiar with the inefficiencies of separate machine works and shipyards and aware of the increasing demand for metal hull ships. They purchased Henry Owen's shipyard, one of the first wooden shipyards to move to the Point. [163] Union Iron Works remained at their south of Market location for another decade.

Scott decided to open the steel shipbuilding yard during a round-the-world trip with millionaire and miner James G. Fair in 1880. Scott was inspired to follow his plans of the previous decade and open the Union Iron Works yard after visiting the steel shipyards of Europe.[164] In 1881, Fair became a U.S. Senator, creating direct connections for Scott to Washington. This likely included knowledge of the lucrative naval shipbuilding contracts that Congress would soon authorize and the lack of domestic shipyards able to build the modern steel hull warships that the Navy desired. By 1883, Scott purchased adjacent parcels at Potrero Point amounting to approximately twenty-five acres and began construction of the Union Iron Works shipyard.

The Union Iron Works Shipyard and Shipbuilding

The new Union Iron Works shipyard opened in 1884 was a pioneering facility that used the latest technological innovations and steel shipbuilding methods. UIW was designed as an integrated yard able to produce all ship components on site, which allowed for the greatest flexibility in the type of ships that could be built or repaired. The plate shop and shipways utilized the new lofting method of shipbuilding, rather than the earlier lifting method, and the machine and metal shops were an upgrade from the already renowned south of Market Street works.

The yard's original layout captured the scale of Scott's lofty ambitions and his business acumen. UIW consisted of five machine shop buildings on the south side of 20th Street and the plate shop and a wharf across the street along the waterfront (Figure 5). It was designed with machine shops (west portion of Building 113), smith shops (east portion of Building 113), foundries for producing metal components, along with all the necessary shipyard facilities for hull construction and outfitting. As discussed by geographer William Walters, such yards were known as integrated yards because they built engines as well as ships and did not need to subcontract with other companies for components.[165] The late nineteenth century integrated yards built the largest and heaviest mercantile and naval ships, and by the turn of the century these yards were generally considered the premier steel shipyards in the country. The yard's metal working and machining capabilities continued over the years, and proved crucial not only to the yard's lasting success, but also to the endurance of UIW's early layout and design. Scott's decision to build an integrated yard allowed UIW to remain competitive in both government and private shipbuilding through World War II and to remain a successful ship repair facility today.

Similar to most of the nation's leading integrated shipyards, UIW's layout consisted of a basic division between shipyard and machine shop. This reflected the origins of steel hull shipbuilding in the melding of the wood shipbuilding and metal working industries. Ironclad and iron hull shipbuilding during the Civil War first witnessed the amalgamation of these two industries. Only

[163] Irving M. Scott Interview, San Francisco, 7 April 1891, original typescript in Biographical Materials Relating to Irving Murray Scott, Hubert Howe Bancroft Collection, Bancroft Library, University of California Berkeley, Berkeley, 7.
[164] Hubert H. Bancroft, *Chronicles of the Builders of the Commonwealth,* Vol. I (San Francisco, 1891), 461.
[165] William D. Walters, *American Naval Shipbuilding: 1890-1989*, *Geographical Review,* 90 (2000), 419.

in the 1880s, however, did UIW and other shipyards pioneer a national shipbuilding industry that grew out of established iron machine shops and wooden shipyards and improved many of the characteristics and techniques of each. Iron works that moved into shipbuilding, in particular, drew from the knowledge and expertise of existing wooden shipbuilding firms and their workers.[166]

Philadelphia shipbuilder Charles Cramp described the conversion of shipyards during the shift from wood to metal hull vessels during the nineteenth century:

> The old shipbuilding district …has changed in appearance; where piles of planking, ship timber and lumber, etc., occupied the principal space in the shipyard, will be found great buildings filled with machinery, and where hundreds of men were formerly seen plying the axe, adze, maul, etc., will be found railway tracks occupied by yard locomotives, overhead traveling cranes and piles of plates, angle bars and beams. The buildings are devoted to machinery and tools for working the plates, etc. These will be found besides, power plants, steam, electric, pneumatic, hydraulic, and other machinery.[167]

A similar transformation occurred when the UIW shipyard replaced the 1860s wood shipyards at Potrero Point. UIW thus illustrates early efforts to combine the shipbuilding and metal working industries. Specifically, it retains a division between the shipyard and machine shop, even as they are located on the same site. This arrangement dates to the yard's 1884 opening, building upon the tradition of custom crafting ship components then transporting them to the shipyard.[168] The need to optimize the relationship between the machine shop and the shipyard was one factor driving shipyards to combine with iron works. The layout of early steel hull shipyards often retained a separation of the two departments while attempting to ease the movement of parts and materials around the shipyard and, ideally, limiting any backward movement of rejected parts.[169]

Lifting and Lofting Methods of Shipbuilding

UIW was designed to utilize the most advanced methods of shipbuilding. Scott's experience with the early days of iron shipbuilding and the inefficiencies of the lifting method compelled him to design UIW according to the new lofting method. For the lifting method, shipbuilders created new templates by *lifting* their outlines from the hull itself while it was being built, rather than from plans or drawings. William H. Thiesen, a maritime historian, wrote of the process: "Rather than prefitting and prefabricating iron parts for assembly at the shipways, each piece had to be fabricated and attached to the hull in sequences as the hull grew from the keel up."[170] For each new piece to be fit, a template was tailored to its vacant position on the partly constructed hull. Using this template, the plate shop would bend and shear a plate to match and punch it with

[166] William H. Thiesen, *Industrializing American Shipbuilding. The Transformation of Ship Design and Construction, 1820- 1920* (Gainesville: University Press of Florida, 2006), 80 and Marjorie Dobkin, "Labor History of Union Ironworks, 2008, 45 & 46.
[167] David B. Tyler, *The American Clyde: A History of Iron and Steel Shipbuilding on the Delaware from 1840 to World War I* (New York: University of Delaware Press, 1958), 73-74.
[168] David B. Tyler, *The American Clyde: A History of Iron and Steel Shipbuilding on the Delaware from 1840 to World War I* (New York: University of Delaware Press, 1958), 88.
[169] J. Mitchell, *Shipbuilding and the Shipbuilding Industry* (London: Sir Isaac Pitman & Sons, Ltd., 1926), 34-35.
[170] Thiesen, *Industrializing American Shipbuilding,* 100.

rivet holes. This custom method proved inefficient, not only because parts were unique, but also because it required many rounds of communication between the slipways and the shops.

The lofting method superseded the lifting method. Using the new method, templates were produced in mold lofts based on models and plans.[171] As the lofting method grew popular, the mold loft became an essential component of the shipyard, and the locations of hull plate storage and metal shops changed to suit the new workflow. Ships engineered by this method were known as fabricated ships.[172] Prefabrication and further standardization in shipbuilding and ship design was introduced at the turn of the century, which led to government sponsored prefabrication yards by World War I.

The UIW shipyard opened in the 1880s with a template shop and a fully equipped and modern mold loft.[173] The yard also boasted drafting rooms and an entire floor for drawing and copying blueprints.[174] The mold loft was used to lay down the lines of the hull by scaling up designs from wood models. This method produced accurate templates for the hull frames and still required skilled workers to reproduce the curves and angles on the hull plates and to punch precise rivet holes, ensuring that hull plates aligned properly. At the turn of the century, the lofting method was streamlined by standardization of ship design and an increased reliance on drawings and templates.

When the UIW shipyard opened it utilized the most efficient methods of shipbuilding then available (Figure 6). The yard's lasting design and layout was solidified during the late nineteenth century, as shipbuilding processes continued at their original locations, though the buildings and structures that housed them were replaced and upgraded. Building 113/114, commonly referred to as the machine shop, anchored the yard's plan.

The New Navy and the Birth of America's Steel Ship Industry

At the end of the Civil War, the country focused on domestic rebuilding efforts, and few resources were devoted to maintaining the naval fleet. By the 1880s, most of the Civil War ironclads had deteriorated and were sold for scrap, leaving the U.S. Navy with a fleet of mainly wooden ships, which was considered an outmoded "laughing-stock for the nations of the earth" compared to powerful European steel navies.[175] This perception resulted in a growing public and Congressional conviction that development of a new, stronger Navy was needed to protect trade interests and to recover the nation's naval prestige.[176] A nationwide steel shipbuilding industry soon developed.

On March 3, 1883, Congress authorized $1.3 million for the construction of the first steel warships and thus initiated the steel hull ship industry in the country. UIW, along with the major private East Coast shipyards, pursued these naval contracts. As the iron shipbuilding industry

[171] Robert C. Stewart, *Historic American Engineering Record: U.S.S. Olympia*, (U.S. Department of the Interior, National Park Service, 1998), 10.
[172] Fredric L. Quivik, *Historic American Engineering Record: Kaiser's Richmond Shipyards*, (National Park Service, 2004), 132.
[173] Caspar T. Hopkins, et al., *Report on Shipping and Ship-Building to the Manufacturer's Association, the Board of Trade and the Chamber of Commerce* (San Francisco: Joint Committee of the three Associations, 1884/1885), 41-42.
[174] Caspar T. Hopkins, et al., *Report on Shipping and Ship-Building to the Manufacturer's Association, the Board of Trade and the Chamber of Commerce* (San Francisco: Joint Committee of the three Associations, 1884/1885), 42.
[175] Ruth Teiser, "The Charleston: An Industrial Milestone," *California Historical Society Quarterly* 25 (March 1946), 39.
[176] Andrew Gran, *Bethlehem Steel* (New York, 1999), 14.

had been created for the military during the Civil War, the mid-1880s push for the New Navy directly resulted in the birth of the United States steel ship industry. In order to create its steel fleets, the government turned to commercial yards, as it would continue to do for every war effort through World War II. This cycle of government contracts for steel ships established at the industry's founding determined the industry's trajectory for the next sixty years through World War II.

The U.S. Navy and Private Shipyards

The government chose to encourage private shipyards and steel mills to expand their facilities to build the New Navy rather than rely on international yards or on government naval yards. The Navy offered contracts in batches large enough to incentivize domestic companies to build the necessary facilities, an approach that continued through World War II. Leading Civil War era shipyards on the East Coast, such as Pusey and Jones, Harlan and Hollingsworth, John Roach (earlier Reaney, Son, and Archbold), and William Cramp and Sons, were all contenders for the initial naval contracts.[177] The latter two yards, along with Union Iron Works and the Newport News Shipbuilding and Drydock Company of Virginia which opened in 1886, became the major players in the creation of the steel shipbuilding industry.

The government rarely allocated funds, even during wartime development, for the construction or improvement of shipbuilding facilities at government yards. Instead, contracts went to private yards for building steel ships to naval specifications. Government shipyards were largely responsible for ship repair during the late nineteenth and early twentieth centuries.[178] There were fewer than ten naval yards prior to World War II and these built only a handful of ships from the end of the Civil War until the early twentieth century.[179] Shipbuilding was not common at naval yards until World War II, which saw a nationwide increase in government naval shipbuilding yards. On the West Coast, only two naval yards pre-dated the twentieth century: Mare Island opened in 1854, and a yard at Bremerton, Washington, opened in 1891.

During most of the nineteenth century, the Navy depended on the private sector not only for its shipyards but also for its engineering and design expertise. Naval facilities for training engineers did not open until the 1870s. Naval oversight of military shipbuilding, which included assuming greater responsibility for specifications, generally increased during the late nineteenth and early twentieth centuries. Thus, the steel hull shipbuilding industry gradually underwent a transition away from the loose technical organization of its early days, when specifications tended toward generality fostering free experimentation by commercial yards, toward a regime of more strictly detailed designs and guidelines.

In 1885, John Roach's Delaware River Iron Shipbuilding and Engine Works won the contract to build the first American steel warships; the so-called ABCD ships, for *Atlanta*, *Boston*, *Chicago*, and *Dolphin*.[180] While Roach was risking bankruptcy attempting to fulfill these initial contracts,

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[177] Leonard Alexander Swann, *John Roach, Maritime Entrepreneur* (New York, 1980), 51; Thiesen, *Industrializing American Shipbuilding,* 123; E. F. Kenny, "The Development and Use of Steel in Shipbuilding," in *Historical Transactions, 1893-1943* (Westport, Conn., 1945), 445.
[178] Frank A. Beard and Robert L. Bradley, *Portsmouth Naval Shipyard National Register Nomination,* (U.S. Department of the Interior, National Park Service, 1977), Section 8, 4.
[179] Douglas C. McVarish, *Philadelphia Naval Shipyard Historic District, National Register Nomination,* (U.S. Department of the Interior, National Park Service, 1999), Section 8.
[180] Stewart, *HAER: U.S.S. Olympia*, 5-6.

UIW successfully launched its first steel hull ship, the *Arago*, a commercial ship.[181] The hull plates were manufactured by Pacific Rolling Mills, a pioneering industry at Potrero Point. Most other parts were manufactured on site at UIW. The *Arago* was one of the first steel hull ships built in the United States, helping to establish the capabilities of the national shipbuilding industry. She was the first steel hull ship built on the West Coast, establishing UIW as a capable shipyard, as worthy as any established East Coast yard for lucrative naval contracts.

Naval Contracts at UIW

The ships built at UIW serve as a testament to the significance of the yard at this time. After launching the *Arago,* Irving Scott and UIW landed their first naval shipbuilding contracts, inaugurating a lasting relationship between the government and this West Coast yard. UIW soon emerged as a national leader in steel shipbuilding, successfully competing with the top tier yards on the East Coast. During the 1890s, UIW continued to upgrade its facilities. It remained an industry leader, along with a handful of East Coast steel shipyards, through the turn of the century. [182] Among the ships built at UIW in this early period of steel shipbuilding are the first protected cruiser, and the fastest ship of its day. Ships built here were often innovative in design, and some fought in decisive battles.[183]

UIW quickly established its prominence in the steel hull shipbuilding industry. In 1886, UIW built the steel steamer *USS General McDowell* for the Navy and received the contract for a protected cruiser, the *USS Charleston*; the first built in the country.[184] In 1888, the yard started on *USS San Francisco* and *USS Cruiser No. 5*.[185] These ships were followed by contracts for the *USS Monterey*, a coast defense ship, and the *USS Olympia*, a cruiser, the same year. Richard Stewart writes that the ship's design was "the realization of a generation of improved steel ship designs... [the] design achieved a successful balance of armament, protection, speed and endurance."[186] Today, the *USS Olympia* is the world's oldest extant steel hull warship.[187]

In 1890, Congress approved funds for three *Indiana* Class sea-going coastal battleships, the *USS Indiana*, *USS Massachusetts*, and *USS Oregon*. In 1900, Frank Marion Bennett stated that the ships were built exclusively from American designs and pioneered the "distinctively American battleship."[188] Cramp's shipyard received the contract for the first two ships. UIW won the contract for the battleship *USS Oregon* in 1891.[189] The 11,688-ton *USS Oregon* was the largest ship built at the yard during the nineteenth century and was one of the first battleships constructed in the country. The *USS Oregon* was also celebrated as one of the fastest battleships in the world and catapulted UIW's reputation in shipbuilding even before the *USS Oregon's* famed role in the Spanish-American War.

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[181] "Shipbuilding Plant of the Union Iron Works at San Francisco," *Marine Engineering,*(1900), 14.
[182] Theisen, Industrializing American Shipbuilding, 176.
[183] Stewart, *HAER: U.S.S. Olympia,* 14; and Rotem Kowner, The A to Z of the Russo-Japanese War, (Maryland: Scarecrow Press, 2006) 89.
[184] "Our State: Retrospect of the Twelve Months of Prosperity," *San Francisco Call,* 1 January 1887, 2.
[185] "Our Shipyards: A Year of Prosperity for Builders," *San Francisco Chronicle,* 1 January 1889, 5; Naval Historical Center and the Ships History Branch, *Dictionary of American Naval Fighting Ships,* Naval Warfare Division, ed. (Department of the Navy, 1991).
[186] Stewart, *HAER: U.S.S. Olympia,* 19.
[187] Stewart, *HAER: U.S.S. Olympia*, 1.
[188] Frank Marion Bennett, *The Monitor and the Navy under Steam* (Boston and New York, 1900), 258-260.
[189] "*The Pride of the Coast*, *"New York Times,* 16 August 1891, 9.

UIW captured international attention by designing the Imperial Japanese cruiser *Chitose,* which at the turn of the century was the fastest cruiser built to date in the United States.[190] The *Chitose*, launched in 1898, was the second capital warship ordered by the Imperial Japanese Navy from an American shipbuilder, and the last one it commissioned from any foreign shipyard. Despite its name, which means "a thousand years of peace" in Japanese, the ship was active in the Russo-Japanese War, taking part in the battle of the Yellow Sea, and in the final decisive Battle of Tsushima, which left her damaged. The *Chitose* was later disarmed and served for coastal defense.[191]

While UIW fulfilled government contracts, it continued to undertake a variety of private shipbuilding contracts and ship repairs. It constructed commercial vessels throughout its history—mainly barges during the late nineteenth century, but also steamers, tug boats, oil tankers, and passenger freighters. As the original ironworks had done, the shipyard produced parts for other shipyards as well. In 1885, for instance, UIW constructed parts for the Mare Island drydock, the first of its kind built on the West Coast, and installed new boilers on the *State of California*.[192] During the 1880s, UIW also continued building mining equipment. These activities illustrate the continuing influence of UIW's beginnings as an iron works, as well as the yard's versatility.

Late Nineteenth Century Developments in Power Distribution and Materials Management at UIW

UIW's national preeminence in shipbuilding dates to the late nineteenth century. UIW pioneered the use of hydraulic power, applying this technology to an innovative drydock as well as to riveting, and becoming a model for other shipyards.[193] UIW also pioneered many new shipbuilding methods, and applied the latest theories in shipyard layout to optimize the shipbuilding process (Figure 7).[194]

Shipyard Infrastructure

Two technological developments—new sources of power and new methods of transmitting power—had the greatest impact on the United States shipbuilding industry and shipyard design near the end of the nineteenth century. The development of hydraulic, pneumatic, and electric power changed how materials were moved around the district. Maritime historian William Thiesen wrote that "[n]ew and powerful machines for materials handling made obsolete the need for manpower and animal power to lift and transport items within the shipyard."[195] These developments also eliminated earlier restrictions imposed by the steam-powered tools and equipment on the layout of building interiors and the shipyards as a whole.

UIW was at the forefront of these new technologies, being the first in the nation to adopt hydraulic power. Again, according to Thiesen:

> For American shipbuilders interested in expanding their business in the 1880s, hydraulic machinery appeared to be the way of the future. That is probably why

[190] Frear, *History of Bethlehem,* 239.
[191] Kowner, The A to Z of the Russo-Japanese War, 89.
[192] *Mining and Scientific Press*, (10 January 1885).
[193] Thiesen, *Industrializing American Shipbuilding,176.*
[194] *Union Iron Works,* (1900), document on file at the San Francisco Maritime Museum.
[195] Thiesen, *Industrializing American Shipbuilding,* 169.

> San Francisco's Union Iron Works, the only major shipyard to undergo major expansion during the 1880s, proved a singular example of a shipyard to fully embrace its use. The only major nineteenth century West Coast shipyard, Union Iron Works began the process of modernizing its facilities in 1883. Union was in a prime situation to do so because there existed no Panama Canal at the time and the U.S. Navy had begun to modernize its fleet. Since electricity had not been developed to the point of commercial application, Union decided to follow the British lead and install hydraulic machinery. The yard's hydraulic system supplied power to nearly all heavy machinery, such as stationary riveters, bending presses, plate planers, machine shop cranes, traveling cranes over its shipways, as well as a hydraulically powered drydock. Throughout the late 1880s and early 1890s, Union Iron Works remained the nation's state-of-the-art shipbuilding establishment, constructing numerous capital warships, such as the famous War of 1898 naval vessels [*USS] Olympia* and [*USS] Oregon*. America's newest shipbuilding establishment, C. P. Huntington's Newport News Shipbuilding Company, followed the example of Union by installing its own hydraulic shop and overhead cranes.[196]

The Hydraulic Drydock

An application of hydraulics, and one of UIW's technological innovations during the late nineteenth century, was its hydraulic drydock, which, according to a contemporaneous *New York Times* article, was the most advanced in the country.[197] A drydock is a necessary component in a shipyard for ship repair. A significant portion of ship repair consists of cleaning and painting the hull. These tasks require a quick turnaround, making it necessary to limit the time required to move ships in and out of the drydock. During the mid-1880s, the UIW management considered a graven or sunken drydock, common at the time, but quickly determined that cleaning the mud out of the dock would take more time than the ship work itself.[198] UIW chief engineer George W. Dickie came up with an innovative solution: a lift dock.

Dickie invented a hydraulically powered drydock. Hydraulic power utilizes "fluid pressurized in a cylinder forcing a piston to transmit energy in a steadier, more efficient way than force applied directly from a steam engine."[199] The new drydock was capable of lifting 600 tons to a height of 32 feet. It consisted of a platform measuring 62 feet wide and 435 feet long,[200] and "hydraulic rams on each side" performed the lifting.[201] All the components of the drydock were constructed on site at UIW. *Marine Engineering* and *Scientific American* hailed the dock as a feat of engineering, and it performed without mishap for almost twenty years, until it was destroyed in the 1906 earthquake.[202] The drydock allowed the yard to shorten the total turnaround time required for ship repair, as well as to service the largest ships on the West Coast.

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[196] Thiesen, *Industrializing American Shipbuilding,* 175-176*.* In fact, rather than "modernizing its facilities," as Thiesen states, UIW began construction of its new steel shipbuilding division at Potrero Point in 1883.
[197] "Far Ahead of America," *New York Times,*" 30 August 1891.
[198] "*Hydraulic Lifting Drydock at Union Iron Works*," Marine Engineering 4, San Francisco, 1899, 189.
[199] Thiesen, *Industrializing American Shipbuilding*, 175.
[200] *Hydraulic Lifting Drydock at Union Iron Works* (San Francisco, 2 July 1892), 189.
[201] Waldon Fawcett, *The Ship-Building Yards of the United States, Engineering Magazine* (1900), 502.
[202] *Hydraulic Lifting Drydock at Union Iron Works* (San Francisco, 2 July 1892), 1.

Riveting

UIW also applied hydraulics to riveting. Hydraulic riveters were commonly employed at British shipyards during the 1870s. They allowed for the four-man riveting gang to complete riveting in one-third the time, half the cost of hand riveting, and with better quality.[203] R. H. Tweddell designed a stationary hydraulic riveting machine for shipyards in 1865 in England and Fielding and Platt introduced a first portable version in 1871.[204] These riveters were either stationary, as was typical in the shops, or were moved with cranes or on tracks either in shops or along the slips.[205] UIW installed hydraulic bull riveting machines in its shops around the mid-1880s.[206]

Pneumatic riveters proved to be more versatile than the hydraulic versions and gained popularity at U.S. shipyards during the 1890s.[207] In the United States, Roach's shipyard first used Allen pneumatic riveters in the early 1880s, which were then introduced to other shipyards during the late nineteenth century.[208] Too heavy for a single man to carry, late nineteenth century pneumatic riveters were not useful as portable riveters and remained mainly in the shops. By the turn of the century, lighter and portable pneumatic tools were in use at Newport News, Cramp's shipyard, and New York Ship. These tools, however, only reduced the traditional riveting gang by one man; the rivet gang would continue until welding replaced riveting after World War I. [209] Both pneumatic and hydraulic riveters increased the rate of production and "the elaboration and enhanced refinement of detail demanded by the much more exacting standard of modern times."[210] By 1900, UIW installed both hydraulic and pneumatic hand tools in its shops and along the slips.[211]

Electrification

During the late 1880s and 1890s, shipyards started to electrify across the country, and UIW was no exception. During the nineteenth century, electricity proved most useful for its portability and flexibility, particularly because it could be used for work aboard ships. With electric tools, the layouts of the yard and shop were no longer constrained by the reach of steam-powered shafts, belts, or pullies.[212] Electricity also enabled shipyards to expand, and as yards increased in size during the early twentieth century, electricity became the dominant power source.

UIW demonstrates the impact of electricity on shipbuilding and on shipyard design. UIW introduced electricity during the 1880s, beginning with electric lighting, followed by a few electric tools that often replaced hand tools.[213] By 1895, UIW had 400 horsepower of generating capacity. The engine house, which stood behind Building 113 during the 1890s, contained a compound engine and air compressor for overhead traveling cranes as well as hydraulic pumps for supplying hydraulic power throughout the works.[214] When a new powerhouse was built in 1912, it also functioned as a central location to supply these various types of power.

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[203] David H. Pollock, *Modern Shipbuilding and the Men Engaged in It.* (London: E. & F. N. Spon, 1884), 139.
[204] John Wilton Cuninghame Haldane, *Steamships and Their Machinery from First to Last.* (London: E. & F. N. Spon, 1893), 136.
[205] Pollock, *Modern Shipbuilding and the Men Engaged in It.*, 140.
[206] *"A Great Industry," San Francisco Newsletter and California Advertiser,* (1886).
[207]Thiesen, *Industrializing American Shipbuilding*, 177.
[208] Thiesen, *Industrializing American Shipbuilding*, 179.
[209] Thiesen, *Industrializing American Shipbuilding*, 181.
[210] Pollock, *Modern Shipbuilding*, 129.
[211] "Shipbuilding Plant of the Union Iron Works at San Francisco, *"Marine Engineering,*1900, 16.
[212] Thiesen, *Industrializing American Shipbuilding,* 182.
[213] W. W. Hanscom, "Electricity in the Union Works," *Journal of Electricity, Power and Gas,* XI (1901), 111.
[214] W. W. Hanscom, "Electricity in the Union Works," *Journal of Electricity, Power and Gas,* XI (1901), 112

Materials Movement

Union Iron Works and the Newport News Shipbuilding Yard pioneered the use of overhead crane systems in the United States. Prior to these developments, man and animal power, with occasional and selective aid from steam power, were the principal power sources for manufacturing and for transporting materials around the shipyard. The type and size of ships that a yard produced or repaired depended partly on its ability to transport materials around the shipyard. The speed and expense of shipbuilding was likewise tied to the movement of materials. Cranes and rail lines proved essential for quickly relocating massive ship components, particularly hull plates.[215] Thus, steel shipyards generally were one of the first industries to rely upon cranes in the United States.[216]

When the yard opened, UIW had a single rail line as well as bridge and jib cranes in several buildings, including a gantry crane near the plate shop, overhead traveling cranes at the slipways, and a 100-ton, steam powered lifting shears at the outfitting wharf. By the late 1880s, UIW increased its use of rail and cranes. Overhead hydraulic cranes were used during ship construction, and cars and tracks moved heavy equipment around the yard.[217] These helped build the *USS Charleston*, the *USS San Francisco*, and the *USS Monterey*.[218] Each slip was covered with skeleton framing for supporting two cranes.[219] During the 1890s, UIW switched to electric cranes, ensuring it remained a technological leader in the industry.[220] Reliance on cranes thereafter continued to increase at UIW and at shipyards around the country. By 1901, UIW had installed 35 cranes across the district, including in the machine shop (West portion of Building 113), brass foundry, iron foundry, erecting shop, boiler shop, and blacksmith shop (East portion of Building 113).[221] Overhead electric bridge cranes from the 1890s are still suspended from the ceiling in Building 113, and remnants of rail spurs are visible throughout the district, reminders of these major technological developments in materials movements at UIW.

UIW maintained its status as a leading steel shipyard thanks to Scott's original plan for the yard as well as the continual improvements made there. During the late nineteenth century the United States shipbuilding industry developed more effective means to distribute power within shipyards. UIW was a national leader in the advancement of power and materials distribution. It was a leader in the use of hydraulics, as well as an early adopter of electrical power. Its innovative design and construction of a hydraulic drydock was unique in American yards. By the 1890s, UIW had even installed a crane and rail system that extended across the yard. Although this system did not fully implement the principles of efficiency experts and scientific management that were pioneered at the turn of the century and popularized during World War I, it was a technological innovation at the time. During the late nineteenth century, according to the yard's own literature, the UIW's design embodied the best and most progressive ideas for shipyard layout.[222]

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[215] Thiesen, *Industrializing American Shipbuilding* 186
[216] Quivik, *HAER: Kaiser's Richmond Shipyards*, 111.
[217] "A Great Industry," *San Francisco Newsletter and California Advertiser,* 1886.
[218] *The Bay of San Francisco*.
[219] W. W. Hanscom, "Electricity in the Union Works," *Journal of Electricity, Power and Gas,* XI (1901), 113.
[220] "Shipbuilding Plant of the Union Iron Works at San Francisco," 14.
[221] W. W. Hanscom, "Electricity in the Union Works," *Journal of Electricity, Power and Gas,* XI (1901), 112.
[222] *Union Iron Works,* (1900), document on file at the San Francisco Maritime Museum.

It wasn't only its own press that recognized the prominence of UIW. An article in *The Engineering Magazine* from 1900 placed it among the three top shipyards in the country, along with William Cramp and Sons of Philadelphia, and the Newport News Shipbuilding and Drydock Company of Virginia.[223] Newport News was influenced by UIW in its use of hydraulics and overhead cranes. Newport News changed ownership many times and is now a division of Huntington Ingalls Industries. [224] Cramp and Sons closed in 1927.[225] Neither shipyard is listed in the National Register of Historic Places.

The Spanish-American War

The Spanish-American War of 1898 provided the United States with an opportunity to showcase its military prowess and modern naval fleet. As one of the most modern yards of its time, UIW built some of the largest and now best known ships of the Spanish-American War. The influence of the national United States steel shipbuilding industry and UIW's central role in the industry became clear with the naval victories of the Spanish-American War.

President Benjamin Harrison called for a naval fleet that could offer defensive and commercial protection and could also serve as an offensive force. In June 1890, Congress answered this call by authorizing the construction of three battleships, *USS Indiana*, *USS Massachusetts,* and *USS Oregon*. The last of these was built at UIW.[226] Along with the *USS Iowa*, these ships formed the core of the new United States fleet. In 1897, prior to the declaration of war, the United States Navy underwent a phase of growth and reform. The Navy released a new wave of contracts in 1896 and UIW received contracts for the gunboats *USS Wheeling* and *USS Marietta*, plus *USS Farragut*, a torpedo boat, and *USS Wisconsin*, another battleship.

The Spanish-American War started in Cuba with the destruction of the battleship *Maine* in Havana's harbor on February 15, 1898. Although the explosion is now known to have been an accident, 266 Americans lost their lives. The event made potent propaganda for the pro-war contingent and the United States declared war in March. Spain's Pacific territories created a second front and it was the battle of Manila Bay in May 1898 that reshaped the world's opinion of the U.S. Navy and sealed the success of the nation's steel ship makers, including UIW. Admiral George Dewey was charged to attack and blockade the Spanish fleet and, if possible, to capture Manila Bay. Union Iron Work's *USS Olympia* was Dewey's flagship, of which he assumed command on January 3, 1898. Dewey destroyed the Spanish fleet in a sunrise attack that lasted for only several hours. Not a single American sailor was lost, and the Spanish lost seven major ships, with 381 men killed and 1,800 wounded.[227]

The UIW's Battleship *USS Oregon* likewise captured national attention in July of 1898 when she raced around the tip of South America to engage Admiral Cevera's four cruisers of the Spanish fleet in Cuba. Secretary Long ordered the *USS Oregon* to depart from Bremerton, Washington on March 7. The *USS Oregon* concluded its 15,000-mile trip less than three months later, arriving at Key West in full working order and ready to take on the Spanish fleet. Her feat demonstrated the viability of the new steel navy and UIW's high quality of work.

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[223] Waldon Fawcett, "The Ship-Building Yards of the United States", *Engineering Magazine* (1900), 496.
[224] www.huntingtoningalls.com, accessed October 14, 2013.
[225] Gail Farr, *Shipbuilding at Cramp & Sons: A history and Gude to the Collections of the William Crap & Sons Ship and Engine Building Company 1830-1927* (1991) Philadelphia Maritime Museum.
[226] Michael J Crawford, et al.,*The Spanish American War Historical Overview and Select Bibliography,* (1998).
[227] Stewart, *HAER: USS Olympia*, 30.

During the war, new naval contracts were awarded to all the major yards, including UIW. In 1899 UIW built the battleship *Ohio,* monitor *Wyoming*, and several destroyers. The yard also started to build submarines at the turn of the century. Although most of these ships were not finished until after the war, the contracts occupied the yard into the twentieth century, until it was sold to the United States Shipbuilding Company.

The new steel fleet's success in the Spanish-American War was hailed as a triumph of the domestic steel shipbuilding industry. In less than two decades, the new shipbuilding industry had grown to maturity. UIW and the leading East Coast yards, such as William Cramp and Sons of Philadelphia, Newport News Shipbuilding and Drydock Company of Virginia, and the new New York Shipbuilding Company in New Jersey, proved that world-class ships could be built in America. The New Navy helped the U.S. emerge as a world power in the twentieth century.

The Growth of the United States Steel Ship Industry

With the New Navy's success came the vision of a national shipbuilding corporation that could fulfill naval and commercial needs across the country. With the turn of the century, and the formation of the United States Shipbuilding Company (USSC), the steel shipbuilding industry entered into a new phase of industry consolidation. This development fostered new methods in ship design and management, with an ongoing emphasis on efficiency and standardization. To remain competitive before and during World War I, the dominant late nineteenth century yards like UIW required further expansion and modernization.

In 1901, John W. Young formed the USSC to create a national steel shipbuilding company. As his partner, Young recruited Lewis Nixon, the naval designer responsible for the *Oregon* and other battleships.[228] In August 1902, USSC purchased eight shipbuilding companies: Union Iron Works; Bath Iron Works and the Hyde Windlass Company in Bath, Maine; the Crescent Shipyard Company and the Samuel L. Moore & Sons Company in Elizabeth, New Jersey; the Eastern Shipbuilding Company in New London, Connecticut; the Harlan & Hollingsworth Company in Wilmington, Delaware; and the Canda Manufacturing Company in New York. Young also purchased the capital stock of the Bethlehem Steel Company in Pennsylvania. The sale of UIW occurred less than a year before Irving Scott, the long-time manager of UIW, died in 1903.[229]

The USSC was a troubled enterprise from the beginning. Of the shipyards purchased, Bath, Crescent, Moore, Eastern, and Harlan & Hollingsworth were deeply indebted, and were thus overvalued. The par value of the aggregate purchase, $69.5 million, far exceeded the total appraised value of $12.5 million. As a result, the new venture was unattractive to investors, and by 1905 the USSC had failed. The failure resulted in a shift of ownership and a rearrangement of the dominant players in the shipbuilding industry. By the end of 1905, Charles Schwab and Bethlehem Steel controlled UIW as well as several other east coast shipyards.[230] The Union Iron

[228] L. Walter Sammis, "*The Relation of Trust Companies to Industrial Combinations, as Illustrated by the United States Shipbuilding Company," Annals of the American Academy of Political and Social Science* (1904), 242-243.
[229] L. Walter Sammis, "*The Relation of Trust Companies to Industrial Combinations, as Illustrated by the United States Shipbuilding Company," Annals of the American Academy of Political and Social Science* (1904), 242.
[230] To understand how this transformation occurred and to understand its future impact on UIW and the shipbuilding industry as a whole requires some background on Bethlehem and Schwab. Bethlehem Steel Company started as an iron works in Bethlehem, Pennsylvania in 1857. By 1885, the works was producing heavy forgings and castings using open-hearth steel techniques and the next year signed the first contract in the United States to provide steel armor

Works Company was incorporated in New Jersey in 1905 as a subsidiary of the Bethlehem Steel holding company. After the acquisition, Bethlehem Steel replaced all yard managers, and used corporate funds to expand and modernize several of the shipyards, including UIW. Schwab planned this modernization and expansion effort after touring European shipbuilding and ship repair yards. These plans were not implemented at UIW for several years.

The Modernization and Expansion of UIW (1908 – World War I)

Under Schwab's management Bethlehem Steel quickly became the largest shipbuilder in the country and the second largest steel producer. Of the five main steel shipbuilding companies, Bethlehem Steel owned two of the five largest steel hull shipyards in the country: Union Iron Works in San Francisco and Fore River Yard in Massachusetts.[231] In 1910, UIW was the largest private shipyard on the West Coast and was the core of an expanding West Coast shipbuilding industry.[232] Three major national trends in the shipbuilding industry directly impacted UIW between 1908 and World War I: the new principles of scientific management spurred a wave of modernization at the yard; the country's expanding role as a global power fostered expansion of the UIW facilities; and the opening of the Panama Canal increased shipping demands. The results of these trends on steel hull shipyards are still visible at UIW.

The Expansion of UIW

In the winter of 1907, following the end of the Russo-Japanese War, President Roosevelt ordered the Navy's Great White Fleet on a worldwide cruise. Roosevelt used the fleet to exhibit America's military power and to install a naval presence on the West Coast. The fleet was scheduled to arrive in San Francisco after many months of travel in the spring of 1908 and would require repairs. UIW was the only yard on the West Coast capable of repairing the naval fleet and Roosevelt persuaded Schwab, who was currently dismantling UIW,[233] to prepare the yard for the fleet's arrival.[234] Encouraged by the government's need for a large, private shipyard on the West Coast, Schwab personally oversaw the initial rehabilitation of the yard. During the next decade, Schwab upgraded and modernized UIW's facilities, which prepared the yard for World War I naval contracts. By the start of World War I, UIW was the center of shipbuilding on the Pacific Coast.

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plates for the U.S. Navy. Charles Schwab, while president of J. P. Morgan's United States Steel Corporation, acquired a controlling interest in Bethlehem in 1901. Schwab started in the steel industry as a worker at the Carnegie Steel Company. Following a similar trajectory to Irving Scott, Schwab rose to president of the company by 1897 at the age of 35. Several years later, Morgan and Co. appointed Schwab president of U.S. Steel Corporation, the country's largest steel trust. In order to retain his position at U.S. Steel, Schwab sold Morgan his recently acquired Bethlehem Steel Company. In June of 1902, Morgan authorized the sale of Bethlehem to USSC, and Schwab offered his own funds to insure the transfer. Of the properties controlled by USSC, only Bethlehem Steel was profitable, and the USSC teetered on the verge of collapse. In order to prop up the parent shipbuilding corporation, Schwab released funds from Bethlehem to USSC in exchange for a primary lien on the USSC properties. Schwab's gamble paid off. The USSC failed and Schwab gained control of Bethlehem Steel and eventually UIW. In response to this move, amidst charges of fraud and extortion, Schwab was forced out of U.S. Steel. By 1905, all of USSC's property was transferred to a Reorganization Committee. Later that year, Bethlehem Steel incorporated in New Jersey as a holding company and took control of the former USSC shipyards, including the Union Iron Works. Schwab thus became the president and the major owner of the new Bethlehem Steel.; Robert Hessen, *The Transformation of Bethlehem Steel, 1904-1909,* ("*The Business History Review," Volume* 46, No. 3, 1972), 344-46.

[231] Walters, *American Naval Shipbuilding,*421.

[232] "*Union Iron Works Company*," *Pacific Gas and Electric Magazine,* Volume 2, (1910), 256-257.

[233] In 1907, when Schwab had initially order the closure of UIW, the steel market had crashed and UIW had just lost millions of dollars completing naval contracts signed under Scott's management at the turn of the century.

[234] Matthew M. Oyos, *Theodore Roosevelt and the Implements of War," The Journal of Military History,* Vol. 60, No. 4," (October 1996), 632; "*Schwab to Reopen Shipyard for Fleet*" *New York Times,* 13 October 1907.

Starting in 1908, with the purchase of the San Francisco Drydock Company, UIW expanded by acquiring other facilities around the San Francisco Bay. During the 1906 Earthquake, the passenger vessel *Columbia* crashed into the water, destroying UIW's famed hydraulic drydock.[235] The drydock was directly adjacent to the shipyard's repair facilities and had allowed the shipyard to repair many of the longest ships of the day. By the turn of the century, UIW did considerable business repairing and drydocking vessels. Many of the steam vessels operating on the West Coast were serviced by the yard. The loss of the hydraulic drydock impacted UIW's dominance on the West Coast, so the Union Iron Works Company purchased the San Francisco Drydock Company, located in Hunters Point. Two floating drydocks from Hunters Point subsequently moved to UIW.

The newly acquired Hunters Point yard, with its two graven docks, continued as a ship repair yard, expanding UIW's ship repair facilities. In 1916, a new graven dock was built at Hunters Point to accommodate any size of ship then in existence; including all battleships.[236] The government negotiated with the Union Iron Works Company for the use of these facilities during World War I and finally purchased Hunters Point during World War II.

In 1916, the Union Iron Works Company purchased the United Engineering Company in Alameda, which became known as the Alameda Yard. UIW also expanded its shipbuilding operation into the adjacent Risdon Yard to operate a United States Destroyer Plant, known as the Risdon Plant, for the Navy. In 1912, the former Risdon Iron and Locomotive Works[237] was purchased by a subsidiary of the U.S. Steel Corporation and the area was leased to the government during the war.

The Modernization of UIW

During the 1910s, two types of related modifications occurred at the yard. The first involved upgrading utilities, expanding facilities to accommodate increased production, and incorporating new trends in shipbuilding based on scientific management and naval design requirements. Notable construction included a new power plant, a new plate shop, new foundries, and new slipways. The second was the removal of the Irish Hill neighborhood and the clearing of the front entrance to the district to make way for a grand entrance and a new office building befitting the yard's new status.

Scientific Management and its Influence at UIW

The 1890s saw the introduction of scientific management to the shipbuilding industry. Scientific management was a set of measures calculated to decrease costs and increase efficiency while boosting the rate of production. It involved such principles as deskilling, mechanization, standardization, interchangeable parts, piecework, and hourly wages. Henry G. Morse and his business partner, Henry Lysholm, were two of the most influential forces behind the application of scientific management to the shipbuilding industry. Morse came out of the bridge building

[235] Frear, *History of Bethlehem*, 240.
[236] H. P. Pitts, "*Union Iron Works at San Francisco*," *Pacific Service Magazine*, June 1916, 8.
[237] The Risdon Iron and Locomotive Works moved to the southeast portion of the Union Yard when it acquired the Pacific Rolling Mills site in 1900. Like the Union Iron Works, Risdon was originally an ironworks that moved into shipbuilding, particularly gold dredges, while continuing to make parts for ships and for a wide variety of other industries, with a product line ranging from bolts to highly specialized machinery. "*The Risdon Iron and Locomotive Works*," Pacific Gas and Electric Magazine, 1911, 307, and 311.

industry, where he oversaw such reforms as design uniformity and subassembly lines for prefabricated parts. These developments became possible through the standardization of everything from the language of blueprints to individual parts and the spacing of rivets.

In 1899, Morse started his own shipbuilding plant, the New York Shipbuilding Company, in Camden, New Jersey, and introduced such widely influential changes to the industry that he earned the moniker, "the father of modern shipbuilding."[238] Three specific aspects of shipbuilding at the New York Shipbuilding Company transformed the industry, shifting shipbuilding toward prefabrication. First, Morse housed the entire shipbuilding process under a single roof, which prevented bad weather from stopping work and compromising the integrity of building materials. Second, Morse dramatically reduced the time and cost required to fabricate and transport ship parts. Lastly, the overhead crane system not only helped to speed up production, but also allowed for heavy machinery to be installed on the slips rather than at a separate outfitting dock. Other shipyards of the time, including UIW, followed New York Ship's efforts in streamlining production and increasing the use of overhead cranes, but they did not invest in the expensive upgrades associated with housing the entire shipbuilding process under a single roof.

Henry Lysholm was largely responsible for perfecting the most important element of Morse's system: streamlining production through the "American method," otherwise known as the "mold system," "factory principle," "universal system," or "template system."[239] Custom fitting the plates individually to their positions on a hull was tedious, and the process often required time-consuming alterations. Adoption of the lofting method by the leading nineteenth century shipyards improved this process. Morse's system offered further refinement by creating molds, out of which were made templates used to produce plates that fit exactly to the frame when the time came to rivet them. In addition to speeding up production and dramatically reducing costs, this method led to a shift in the guiding principles of shipbuilding: engineering for efficient production displaced speed and seaworthiness. This sacrifice stemmed from the requirement for highly accurate blueprints as well as from the requirement to fit prefabricated plates reliably to the frame of a ship. These two requirements conspired to favor more geometric and industrial (rather than graceful and curvilinear) ship forms. They likewise fostered modularity. The variety of ship forms predictably decreased so that standardized plates could be prefabricated for more than one type of ship and for more than one ship at a time.[240]

Upgrades at UIW

Bethlehem's Union Iron Works Company implemented several of Morse and Lysholm's methods of shipbuilding during the early 1910s, including the replacement of the 1880s plate shop and mold loft and the rearrangement storage yard, cranes, and rail lines (Figure 9). Simultaneously, UIW increased its office space and blueprint storage.[241] A new power station also centralized the yard's power and supported the yard's increased use of electric power.

Prior to 1912, isolated steam powered plants generated electricity for all machinery in the plate shop (Building 109), woodworking shop (Building 108), boiler shop, machine shop (Building 113/foundries) and foundry, as well as for the steam compressors used for air tools and other

[238] [footnote pending]
[239] [footnote pending]
[240] "The Risdon Iron and Locomotive Works," *Pacific Gas and Electric Magazine,* 1911, 192-202.
[241] "Record Yard for the Union Iron Works Co., *International Marine*, 1916.

pneumatic tools. In 1912, the yard switched from internally generated power to electric power supplied by PG&E and fed to the yard from a new powerhouse located at Building 102. The new power station transformed every aspect of the yard and gave operators in Building 102 complete control of all the electrical power circuits in the various shops around the yard.[242] Numerous alterations and improvements occurred in the machine shop and the foundry in response to the increased availability of electricity and the introduction of independent motors for running tools.[243]

Several alterations at UIW during the 1910s were similar to those of Henry G. Morse at his New York Shipbuilding Company, implementing the emerging principles of scientific management and efficiency in shipbuilding and design. Rebuilding the plate shop (Building 109), rearranging the metal shops and storage areas, constructing new foundry buildings (Buildings 115 and 116), and further expansion of the rail lines were all attempts to streamline production and to conform the yard to the leading ideas in shipbuilding. These improvements, along with the expansion of the slipways, the joining of the machine shops, and the construction of a longer drydock, ensured that the Yard would continue to build and repair efficiently the ships of the day. These upgrades, occurring in tandem with worker incentives for increased production, both of which occurred nationally across the shipbuilding industry, allowed UIW to cut dramatically the time required to build a ship. This proved decisive as demand spiked during World War I, allowing UIW to remain competitive as a leading shipbuilding yard during the war.

Major alterations to UIW's entrance revealed the growing division between shipyard workers and managers. Under Schwab's guidance, management at the Union Iron Works Company created a public façade befitting the yard's role as the centerpiece of its growing shipbuilding complex on the West Coast. Prior to the mid-1910s the shipyard lacked a public front and a grand entrance. The shipyard's management started transforming the yard's entrance by removing the cottages, boarding houses, and saloons of the mainly unskilled laborers along Illinois Street. Prior to World War I, portions of the Irish Hill neighborhood at 20th and Illinois Streets and on the bluff east of Illinois and 22nd Streets were removed as well. A fence was built along the north side of 20th and Illinois Street and double gatesmen's houses were also added during the 1910s. Frederick Meyer's classically-detailed office building at the corner of 20th and Illinois Street, Building 101, created an entrance showcasing the yard and its management. This new office building corresponded with the general increase of office space during the first two decades of the twentieth century, resulting in the implementation of Evans' and Taylor's new management principles.[244]

As the United States entered World War I, UIW was the centerpiece of the Bethlehem's commercial shipbuilding presence on West Coast. Developments during the pre-war period exhibited continuous pressure to modernize the yard in order to retain its status as the main commercial shipbuilding yard on the coast and in the country. Although the yard embraced the efficiency measures popular at the time, it also maintained and expanded its capacity to fabricate its own components, distinguishing it from the prefab yards built for the war. This decision had a lasting impact on the success of the yard after World War I and during World War II. It also resulted in the ongoing use and maintenance of the machine shop, Building

[242] "Modern Facilities for Building Modern Liners," *Pacific Marine Review,* Volume 25, *August 1928, 359.*
[243] Pitts, *Union Iron Works,* 3-5.
[244] [footnote pending]

113/114, and the persistence of the yard's 1880s layout, which distinguishes UIW from other extant shipyards.

World War I

World War I broke out in Europe in the summer of 1914, but the United States remained officially neutral until April 1917. The United States shipbuilding industry expanded to repair Allied ships, replace merchant ships sunk by U-boats, and support the growth of the U.S. Navy in preparation for the anticipated American entry into the war. This wave of shipyard expansion and modernization, like the changes that gripped UIW in the 1910s, took place nationwide. President Wilson formed the United States Shipping Board (USSB) near the beginning of the war to manage the construction of new ships and to direct funds for the construction of new shipyards and the expansion of existing yards. The Emergency Fleet Corporation (EFC) was incorporated in April 1917, as a publicly funded corporation to assist the distribution of funds.

President Wilson called for a special session of Congress to declare war after German U-boats sank three American supply ships en route to England in March 1917. With the onset of war, the country needed ships to move millions of men and supplies to Europe. The government immediately requisitioned over 430 steel ships for the war effort in 1917 and 75 percent of the nation's shipyards began to build for the Navy.[245] Navy Secretary Josephus Daniels quickly determined that anti-submarine destroyers and their ability to target U-boats would determine the outcome of the war. In order to meet this crucial need in a limited amount of time, a new approach to ship construction was necessary.[246] The country immediately needed to switch shipyard production from larger battleships and battle cruisers to destroyers.[247]

As a result, UIW became the main commercial yard in the San Francisco Bay Area to build naval vessels for World War I.[248] Although there were other yards such as Moore & Scott fulfilling government contracts, Bethlehem's shipyards, headed by UIW, remained the major shipbuilder on the West Coast during the war. The yard produced sixty-six destroyers and eighteen submarines along with cargo vessels and tankers.[249]

The U.S. Navy Destroyer Plant at UIW

During World War I, destroyers saw extensive deployment as escorts, patrols, and raiders. They were especially important as the primary fleet defense against torpedo attacks from submarines and small surface craft. By summer 1917, Navy Secretary Daniels determined that the government needed approximately 200 destroyers, and met with all of the commercial yards able to produce warships to formulate a plan to meet the country's demand.[250] Bethlehem

[245] Pitts, "Union Iron Works," 106.
[246] *Annual Report of the United States Shipping Board, United States Shipping Board,* (Government Printing Office, 1918), 129.
[247] William J. Williams, "Josephus Daniels and the U.S. Navy's Shipbuilding Program During World War I," *Journal of Military History*, Volume 60, 1996, 7.
[248] Wayne Bonnett, *A Pacific Legacy: A Century of Maritime Photography, 1850-1950* (San Francisco, 1991), 12.
[249] *Bethlehem's Pacific Coast Shipyards,* (Wilmington: Hagley Museum and Library, 1940), 6.
[250] The list of yards specializing in warship construction is a familiar list of the leading shipyards in the country: the Bath Iron Works in Maine; Bethlehem's Fore River Shipbuilding Company near Boston; the New York Shipbuilding Corporation in Camden, New Jersey; the William Cramp and Sons Company in Philadelphia; the Newport News Shipbuilding and Drydock Company in Virginia; and the Union Iron Works on San Francisco Bay. Williams, "Josephus Daniels and the U.S. Navy's Shipbuilding Program During World War I," 21.

offered to build two destroyer plants for the government, at the government's expense, and to build 150 destroyers in eighteen months. According to William Walters,

> The program called for the construction of two 'assembling yards,' each with up to twenty shipways. One of these plants would be located near Bethlehem's Fore River yard in Massachusetts and the second on land adjacent to the Union Iron Works on the San Francisco Bay. The firm also outlined plans to build various shops to produce turbines, boilers, and other equipment. Bethlehem offered to construct these facilities at no profit to itself, and noted that after the war the 'assembling yards' and shops 'would remain the property of the government.' Bethlehem's only profit would come from the ships it produced.[251]

In contrast, the other yards agreed to take on contracts for 25 destroyers each if the government paid to expand their facilities. In October 1917, Congress approved $350 million to fund the construction of destroyers and ordered more than 265 destroyers.[252] The EFC joined with the larger commercial shipyards to build and operate specialized facilities for the mass production of destroyers.[253]

These yards, of which UIW is a primary example, worked closely with government officials, particularly as officials assumed greater control over the commercial yards that operated newly built naval-owned yards and were filled almost exclusively with government contracts. When the EFC was first formed, its primary functions were placing contracts and developing ship designs. The EFC hired naval architects to design the ships needed for the war effort.[254] As the shipbuilding program expanded, the EFC also took on managerial functions at the commercial yards. The Corporation built "an organization which would supplement the functions usually served by the yard managements and would in many cases in fact supersede them."[255] The EFC formed a Supply Division to centralize supply chain management for all its ships. This division organized the supply chains for almost 150 shipyards across the country.[256] EFC's Division of Shipyard Plants oversaw engineering and technical aspects at commercial yards fulfilling government contracts. The engineers of this division oversaw all plans for and supervised all aspects of new shipyard construction funded by the EFC.[257]

During the war, the EFC oversaw the building of the government-owned destroyer plant adjacent to UIW and run by Bethlehem's Union Iron Works Company. The plant was built on the adjacent former Risdon Works site, which was owned by a subsidiary of the U.S. Steel Corporation. The EFC designed the new plant according to modernization and efficiency trends pioneered earlier in the century, including competition between shipyards and worker incentives

[251] The list of yards specializing in warship construction is a familiar list of the leading shipyards in the country: the Bath Iron Works in Maine; Bethlehem's Fore River Shipbuilding Company near Boston; the New York Shipbuilding Corporation in Camden, New Jersey; the William Cramp and Sons Company in Philadelphia; the Newport News Shipbuilding and Drydock Company in Virginia; and the Union Iron Works on San Francisco Bay.; William J. Williams, "Josephus Daniels and the U.S. Navy's Shipbuilding Program During World War I," *Journal of Military History*, Volume 60, 1996, 21.
[252] Benedict Crowell and Robert Forrest Wilson, *How America Went to War: An Account from Official Sources of the Nation's War Activities, 1917-1920.* (Yale University Press, 1921), 466.
[253] William D. Walters, *American Naval Shipbuilding,* 422.
[254] Thiesen, *Industrializing American Shipbuilding,* 205.
[255] Board, *Annual Report of the United States Shipping Board,* 119.
[256] Board, *Annual Report of the United States Shipping Board,*149-150.
[257] Board, *Annual Report of the United States Shipping Board,* 122.;Dobkin, *Labor History*, 61-63.

to increase productivity. A single structure covered the four slips, adjacent to a new plate shop. This layout followed Morse's principles of scientific management, which emphasized cranes for moving equipment and specified roofs over shipbuilding areas to prevent delays caused by bad weather. Thanks to this new yard, destroyer production spiked. In 1914, the average total latency to make a destroyer was two and half years from Congressional authorization until the boat's commissioning. At the UIW-run United States Destroyer Plant, shipbuilders turned out destroyers at the rate of three per month.[258]

Prefabrication Yards

The great demand for ships during World War I resulted in a further push for speed and efficiency, giving rise to prefabrication yards. Building on the techniques used at New York Ship starting at the turn of the century, the Navy requisitioned specialized yards to assemble ship components, which were fabricated by steel mills nationwide.[259] In order to improve standardization, modularity, and ease of construction, naval engineers designed ships with simple lines, flat decks, and few curves.[260] Arguably, this process represents a throwback to the separation of metal works and shipbuilding during the Civil War, but with the advantage of standardization and detailed plans that eliminated the inefficiencies inherent to customization.

The Hog Island Yard, Harriman Yard, and Newark Bay Shipyard were all prefabrication yards designed and paid for by EFC. The American International Shipbuilding Corporation at Hog Island, constructed for approximately $65,000,000, was the largest of these yards, covering 846 acres with 50 slips.[261] Maritime historian William Thiesen wrote, "Hog Island became the assembly area of a nationwide shipbuilding factory, to which structural steel fabricators shipped parts from all corners of the United States."[262] In addition to the standardization of components, prefabrication also entailed the standardization of ship designs at each yard so that the same ship design could be used repeatedly. The World War I prefabrication process has been described as follows:

> Such a wartime effort entailed, for the first time in U.S. history, the prefabrication of components and the standardization of ship designs to facilitate prefabrication. Standardization did not occur nationwide as in World War II, however. Rather, each shipyard designed its own standardized ship, which it could build in multiple copies. Not only did inland plants produce machinery for use on ships; such plants also fabricated pieces of hulls. Inland shops cut, bent, rolled, and punched steel plates and shapes. The shipyards themselves became more specifically sites for assembly and erection.[263]

Although the World War I prefabrication network did not reach later levels of national standardization, the EFC did have Class A and B vessels designed by naval architects and produced at its prefabrication yards. By 1918, the EFC attempted to standardize building

[258] Shipbuilding Division Bethlehem Steel Co., *A Century of Progress: 1849-1949,* (San Francisco, 1949), 16.
[259] Tyler, *The American Clyde*, 107.
[260] Board, *Annual Report of the United States Shipping Board,* 129.
[261] Board, *Annual Report of the United States Shipping Board,* 130.
[262] Thiesen, *Industrializing American Shipbuilding*, 206.
[263] Quivik, *HAER: Kaiser's Richmond Shipyards*, 11.

methods at all the yards under its supervision.[264] This process was incomplete by the end of World War I and would have to wait until World War II.

In contrast to the prefabrication yards, UIW continued to fabricate its own components during the war. Remaining an integrated yard, it was able to build, equip, outfit, and drydock all on one site. UIW continued to manufacture boilers and turbines on site during World War I, while it continued to improve on existing techniques. The plant also built the new tooling on site, including air drills and riveters specifically designed for small work.[265] The yard additionally conducted ship repairs during the war, which required custom work that more closely resembled the old lifting process than the new prefabrication methods.[266]

The End of the War

In early October 1918, Germany unexpectedly entered into discussions with United States to sue for peace. Mutiny broke out in the German Navy and revolution quickly swept the country. A provisional government assumed power and agreed to an armistice, signed on November 11, 1918.[267] Few of the ships contracted by the government in 1917 were complete at the time of the armistice and the prefabrication yards had just started delivering ships. Many of the ships under contract continued to be built into the 1920s, including the majority of the destroyers and submarines built by UIW. The hundreds of ships that were either completed or were in the slips just a year after the declaration of war has been cited by many as a great achievement of the shipbuilding industry; even if many of those ships never saw battle. Historian David Budlong Tyler argues that the shipbuilding program "was an important factor in convincing the Germans that they could not win [the war] with their submarines."[268] The failure of the government to mobilize earlier, however, was not to be repeated during World War II.

UIW's successful adaptation to prefabrication and its successful destroyer plant allowed the yard to make a substantial contribution to the World War I shipbuilding program. Its ship repair business, while likewise contributing substantially to World War I, was the key to the yard's continuation at the end of the war. The yard's capacity to build on site all the components necessary to fabricate and repair a ship became a major selling point during the interwar period. As the yard attempted to lure civilian contracts in the post-war years, its marketing literature emphasized that unlike specialized shipbuilding yards, its pattern, foundry, erecting, and machine shops were equipped "to undertake any engineering construction," allowing for more flexibility in fulfilling commercial shipbuilding contracts.[269]

The Interwar Period

Government contracts vanished by the early 1920s, triggering a national depression in shipbuilding that persisted through the mid-1930s. Most American shipyards were liquidated and layoffs occurred across the country.[270] Many of the country's oldest yards, as well as the World War I prefabrication yards, were forced to close with the disappearance of government

[264] Thiesen, *Industrializing American Shipbuilding*, 207.
[265] Fred H. Colvin, "*Methods in a Shipbuilding Plant*," *American Machinist,* Volume 54, 1921, 673.
[266] Wayne Bonnett, *Build Ships! Wartime Shipbuilding Photographs San Francisco Bay: 1940-1945,* (Sausalito, 1999), 98.
[267] Williams, *Josephus Daniels and the U.S. Navy's Shipbuilding Program During World War I,* 34.
[268] Tyler, *The American Clyde*, 108.
[269] "The Union Plant of the Bethlehem Shipbuilding Corporation, a Consistent Producer of Good Naval and Mercantile Vessels," *Pacific Marine Review,* Volume 15, *1928, 358.*
[270] Quivik, *HAER: Kaiser's Richmond Shipyards*, 13.

contracts and with the onset of the Great Depression. William Cramp & Sons, one of the original steel ship builders, closed in 1927. The massive yard at Hog Island was disassembled, and the site later became Philadelphia's airport.[271] A soap factory took over the Harriman prefabrication yard in the mid-1920s.

Bethlehem's shipyards, on the other hand, managed to retain their prominence at the end of World War I through the 1920s and 1930s.[272] In 1924, Bethlehem reorganized its West Coast shipbuilding operation and the Union Irons Company was folded into the Bethlehem Shipbuilding Corporation. During the 1920s, the yard was reorganized to focus on ship repair and thus continued operations through the lean years that ensued. UIW did build a number of tankers and barges during this time, but output was minimal enough that the old Iron Works Shipbuilding yard is often spoken of as being reopened in the mid-1930s.[273] During the 15 years after World War I, all the yards that survived scaled back their facilities and only a handful of new oceangoing ships were produced in the entire country.

The United States Maritime Commission

As the threat of a second world war loomed on the horizon in the mid-1930s, few operating shipyards still had the facilities to build oceangoing vessels. The first clear signs of European conflict spurred the government to action. It feared a repeat of World War I, when the shipbuilding drive began too late and over 80 percent of the tonnage authorized for the war was actually launched after its end.[274] In the summer of 1936, Congress passed the Merchant Marine Act, which created the United States Maritime Commission and granted it the powers of the former United States Shipping Board.

President Roosevelt appointed five men to the U.S. Maritime Commission in 1936 to direct the country's shipbuilding program. The main objective of the Commission was "the creation of an adequate and well-balanced merchant fleet to provide shipping service on all routes essential for maintaining the flow of commerce of the United States."[275] The Commission was further directed to coordinate with the Navy Department so that vessels would be designed for easy conversion to wartime transportation and supply vessels in the case of national emergency or national defense.

The first job of the Commission was to survey the existing status of the American merchant marine and to create a long range program for required additions and replacements.[276] The Commission adopted a long range plan calling for fifty new ships a year over the next ten years. It further developed standardized plans for the cargo ships that it planned to build, implementing for the first time a nationally standardized ship design.[277] The Commission also collaborated with shipbuilders to develop "plans for the economical construction of vessels and their propelling machinery, of the most modern economical types, giving thorough consideration to all well-recognized means of propulsion and taking into account the benefits accruing from

[271] Thiesen, *Industrializing American Shipbuilding*, 208.
[272] Quivik, *HAER: Kaiser's Richmond Shipyards,* 15.
[273] "Bethlehem's Pacific Coast Shipyards." 6. See Frederic Chapin Lane, *Ships for Victory; a History of Shipbuilding under the United States Maritime Commission in World War II* (Baltimore: Johns Hopkins Pres, 1951), 45 for a brief discussion on the yard reopening to take on Maritime Commission contracts.
[274] Bonnett, *Build Ships! Wartime Shipbuilding Photographs San Francisco Bay: 1940-1945*, p. 24.
[275] Merchant Marine Act of 1936, Section 210.
[276] Merchant Marine Act of 1936, Section 210.
[277] Quivik, *HAER: Kaiser's Richmond Shipyards,* 14.

standardized production where practicable and desirable."[278] The Maritime Commission quickly determined that the shipyards of the San Francisco Bay were the only yards on the Pacific Coast with facilities sufficient to build oceangoing merchant vessels.[279] At the same time, Congress increased naval appropriations, resulting in the reactivation of Navy yards and a small number of new warship contracts. Authorization of contracts for both naval and merchant ships caused the immediate rehabilitation and expansion of existing yards.

Modernization at UIW

In 1936, the UIW yard received contracts from the U.S. Navy for two 1500-ton destroyers, the first of more than seventy ships the yard would build for World War II.[280] To complete these initial contracts and to prepare for the impending wave of government contracts, UIW again undertook a round of modernization and expansion in its history. The yard had made few modifications since World War I, so it needed an infrastructural upgrade as well as new tools and shop facilities. This round of modernization also allowed the UIW yard to institute some of the shipbuilding optimizations used during World War I at the prefabrication yards on the East Coast and at the adjacent U.S. Destroyer Plant. The most notable change during the upgrade, however, was the broad adoption of welding.

The 1936 modifications to the yard resulted in only a few new buildings (Buildings 50, 103, 105, 110, 119, and 120), but transformed how the existing spaces were utilized and how materials moved around the district. The 1936 modernization aimed to improve the movement of material from storage areas through the shops and to the slipways; to improve power distribution; to provide space and facilities for welding and sub-assembly fabrication; to provide workers' facilities and improve working conditions; and to provide storage space and parking. Besides new bathrooms and the changing use of existing open spaces, the most notable addition was a new boiler house (Building 103) installed at the end of 20th Street. The upgrades resulted in moving the materials through the fabrication process in as straight a line as possible, a design optimization that would prove to be a major factor in World War II shipyard design. At UIW, these upgrades allowed for materials to move "in a line from steel plate and shape storage, and sub-assembly spaces to the building ways. It is also true of movement of material and equipment through the machine shop (Building 113), the forge shop (Building 105), the mill-pattern-joiner shop (Building 108), or the pipe (Building 38) and copper shop (Building 103) to either the building ways or the outfitting docks."[281] The other major transformation was the repurposing of open spaces for pre-assembly, indicating a planned shift toward welding and pre-assembly at the yard.

Welding and Pre-Assembly

Prior to the 1930s, welding was mainly used for ship repair. For instance, UIW started using electric welding by the early 1910s to repair boilers and defective steel casting.[282] During World War I, however, engineers realized that welding held many advantages over riveting, particularly with respect to time and labor costs. Most significantly, welding drastically reduced hull construction time in the slipways, which were always a bottleneck in shipbuilding. In addition,

[278] Merchant Marine Act of 1936, Section 212(c).
[279] Quivik, *HAER: Kaiser's Richmond Shipyards*, 1.
[280] *Bethlehem's Pacific Coast Shipyards*, 6.
[281] "Bethlehem Reconditions Potrero Works of Union Plant," *Pacific Marine Review,* Volume 35, 1938, 23.
[282] R. H. Fenkhausen, "Electricity in the Union Iron Works," *Journal of Electricity Power and Gas,* Volume 31, 1913, 440. (1913), 440.

welding could reduce the weight of the hull by removing the need for thousands of rivets.[283] Welding did not, however, replace riveting overnight. Rather, it was adopted gradually as the industry came to accept it as a strong and safe method of joining steel. In 1927, the American Bureau of Shipping approved of welded hulls.

Starting in the 1920s, shipyards internationally began to move toward the extensive pre-assembly of ship components that utilized welding rather than riveting. Pre-assembly was not new to shipbuilding; it had been used in the World War I prefabrication yards. World War I yards pre-assembled components for cargo ships, including floors, bulkheads, deck girders, deck houses, and stern assemblies. Pre-assembly allowed for sections of the ship to be constructed and then moved to the slipways.[284]

During World War II, shipyards relied heavily on both welding and pre-assembly to meet the growing demand for ships. Starting with the first round of Maritime Commission ships, plans specified welding methods and encouraged "shipyards to devise assembly plans that could save labor or speed production."[285] Ship contracts were awarded in batches of four to six units at a time, which provided direct incentives for shipyards to employ pre-assembly and standardization in order to accelerate production of the batch of identical ships.[286] When building in volume, shipyards could prefabricate the various pieces, construct subassemblies, and then quickly assemble multiple ships in the slipways with minimal retooling, few adjustments, and little reworking of parts.

Scaling up production required space and cranes. Space was not an issue when shipbuilding consisted of riveting a hull from the keel on up. [287] Pre-assembling, however, required large areas, preferably areas lying between the fabrication shop and slipways, where workers could layout and assemble sections with easy access to welding equipment and cranes. Allocating these large areas often proved difficult for older yards, resulting in piece-by-piece assembly on the ways.[288] UIW provided space for pre-assembly near the slipways and infrastructure upgrades to the slipway superstructure provided more flexibility for welding in the ways. Welding platforms were also installed at the yard. This configuration was improved upon at the New Yard, built adjacent to UIW by the U.S. Navy in 1940, where considerable room was given for pre-assembly.

By 1939, the Commission deemed its plan for 50 ships a year to be inadequate, and the program was doubled, then tripled, before the first contracts were complete.[289] At the end of 1940, nineteen yards were building ships for the Commission, and some of these yards agreed to expand their capacity in order to produce naval warships.[290] With existing plants at capacity, new shipyards would need to be built. The Merchant Commission chose the Pacific Coast to build expansive new ship yards because open areas were still available along the shoreline.

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[283] Quivik, *HAER: Kaiser's Richmond Shipyards,* 118.
[284] Quivik, *HAER: Kaiser's Richmond Shipyards,* 112, 118.
[285] Quivik, *HAER: Kaiser's Richmond Shipyards*, 120.
[286] Bonnett, *Build Ships!,* 25.
[287] Nancy Goldenberg, Jody R. Stock, *National Register of Historic Places: Richmond Shipyard Number Three, Kaiser Shipyards, Richmond, California,* (1999), 18.
[288] Quivik, *HAER: Kaiser's Richmond Shipyards,* 20.
[289] Marshall Maslin, *Western Shipbuilders in World War II, a Detailed Review of Wartime Activities of Leading Maritime and Navy Contractors* (Oakland, 1945).
[290] Quivik, *HAER: Kaiser's Richmond Shipyards,* 22.

With this investment, the San Francisco Bay Area became the nation's largest shipbuilding center by the end of the war.

The Bethlehem Shipbuilding Corporation was in a unique position with the country once again on the brink of war. Bethlehem was a leader in steel manufacture, shipbuilding, and ship repair on both coasts.[291] Once again, Bethlehem reorganized. The Bethlehem Steel Company, Shipbuilding Division was formed in November 1938, and the Potrero Yard (as UIW was known during the 1920s and 1930s) became the San Francisco Yard. Bethlehem received some of the first Maritime Commission contracts and in 1939 UIW received contracts for five C-1B cargo vessels.[292] The experience of building these vessels convinced the yard that they needed larger facilities to take on Navy contracts. To this end, the Navy built the New Yard on the site of the World War I destroyer plant.[293] By 1940, Bethlehem was balancing both Commission and Navy contracts, and UIW had landed additional naval contracts for twenty destroyers and four cruisers.

World War II and UIW's Contribution to the War Effort

Although the Commission and the Navy were authorized to spend funds for shipbuilding and shipyard expansion, it was the National Defense Appropriation Act in the spring of 1940 that unleashed billions of federal dollars for the war effort.[294] With this event, the United States once again made the transition to a wartime economy. The government became the main client of the entire national shipbuilding industry. By this time, the shipbuilding industry was habituated to working with the government.[295] Its leaders were accustomed to seeking government financial support and accepting supervision.

During World War II, two government agencies oversaw shipbuilding during the war: the Navy Department and the United States Maritime Commission. By 1941, the Navy and the Commission were competing for available slipways, and in March of that year, shipyards were divided between the two.[296] UIW became a Navy yard. After the Japanese bombed Pearl Harbor in December of 1941, the United States officially entered the war and Roosevelt created the War Production Board. The Board quickly ballooned to an 18,000-person agency intended to oversee "conversion to war production and coordinate material and production priorities."[297] The Board continued to grant contracts but national coordination of materials and production schedules was not achieved until 1943 with the formation of a Controlled Materials Plan and Roosevelt's establishment of the Office of War Mobilization.[298]

During World War II, UIW occupied a similar position to its role during the First World War. The yard had recently undergone modernization, and it operated a prefabrication yard while

[291] Lane, *Ships for Victory; A History of Shipbuilding under the United States Maritime Commission in World War II*, 33.
[292] Bethlehem Steel Co., *A Century of Progress: 1849-1949*, 20, 25.
[293] *Bethlehem's Pacific Coast Shipyards*, 6.
[294] Marilyn M. Harper, et al., *World War II and the American Home Front Theme Study*, (National Park Service, 2004), 11.
[295] Lane, *Ships for Victory*, 3.
[296] Bonnett, *Build Ships!,* 27.
[297] Marilyn M. Harper, et al., *World War II and the American Home Front Theme Study*, (National Park Service, 2004), 11.
[298] Marilyn M. Harper, et al., *World War II and the American Home Front Theme Study*, (National Park Service, 2004), 12.

continuing to run an integrated yard and a repair facility. UIW again was able to embrace the newest technologies and shipbuilding methods, in this case welding and pre-assembly, while also running the largest and best equipped commercial repair yard in the country, with a machine shop unrivaled on the West Coast.[299] The UIW, along with the New Yard, turned out 72 ships during the war. These were mainly destroyers varying from 14,000 to over 37,000 displaced tons, but the yard also built the Commission's five cargo ships in 1940 to 1941, as well as destroyer escorts, aircrafts transport lighters, and self-propelled lighters under Navy contract. Four high speed anti-aircraft cruisers were built at the New Yard between 1941 and 1945. Although this performance was on par with its World War I output, it was only one tenth of the quantity produced by the new prefabrication yards such as Kaiser's Richmond yards. UIW's true contribution to the war was its repair of 2,500 ships. It was also the only yard to repair submarines. The submarine repair facility stood several blocks to the northeast of the UIW district and is no longer extant. The yard's flexibility guaranteed its lasting impact and its contribution to World War II.

The New Yard

Three main types of ships were built during World War II: the Navy's capital ships and cruisers, the Maritime Commission's cargo vessels, and the Navy's smaller vessels and landing crafts. The latter two were needed in such numbers that subassembly and even assembly line practices were used to build them. The Navy's larger capital ships and cruisers required "massive and complete facilities for individualized production."[300] These facilities were also able to utilize some methods of subassembly and mass production methods, particularly the incorporation of much of the fitting out into subassembly, but they were limited often by space.[301]

The Navy built the New Yard in 1940 specifically to produce anti-aircraft cruisers.[302] Between 1941 and 1945, this yard built four cruisers of 46,000 displaced tons each. The Bureau of Ships drafted contract plans for these vessels "showing detailed specifications" but the working plans were prepared by the building yard, allowing UIW to optimize its yard layout.[303] The New Yard combined preassembly and individual production necessary for anti-aircraft cruisers. The New Yard optimized its layout for pre-assembly and for welding, following the turning flow design. While not as efficient as the straight line flow of materials used in the new World War II shipyards, turning flow designs, where materials moved through the yard parallel to the shoreline, were employed at older urban yards during the war, which had less space. At the New Yard, also to save space, preassembly was completed on welding platforms adjacent to the slips. Even with this space saving design, the New Yard greatly expanded the footprint of the World War I destroyer yard.

Ship Repair Facilities

Ship repair was the main contribution of UIW to the World War II effort. During the Second World War, the yard built over 70 ships and repaired 2,500 ships. The repair yard, which contained structures and even equipment that dated back to the origins of steel shipbuilding in

[299] Shipbuilding Division Bethlehem Steel Co., *Bethlehem Ship Repair Facilities* (New York: Bethlehem Steel Company, 1947), 24.
[300] F. G. Fassett, ed., *The Shipbuilding Business in the United States of America,* Vol. I, (New York, 1948), 201.
[301] F. G. Fassett, ed., *The Shipbuilding Business in the United States of America,* Vol. I, (New York, 1948), 225.
[302] Bethlehem Steel Co., *A Century of Progress: 1849-1949*, 24.
[303] E. L. Cochrance "Shipbuilding," *Public Administration Review,* Volume 5, 1945, 330.

this country, was one of the best and the largest commercial repair yards in the country.

In 1945, a *Fortune* magazine article argued that for the Pacific Fleet, repair was more crucial than construction, and the UIW shipyard was at the heart of the repair cycle as it aided the naval yards in their repair duties. *Fortune* continued, "It was not a job for the Pacific Coast 'miracle men' who had captured the public imagination and fat Maritime Commission contracts with their new methods of prefabricated shipbuilding. This was work called for improvisation by men and machines, and familiarity with naval craft."[304] The UIW had knowledgeable workers and had maintained the facilities to offer the breadth of services required for repair work. Their ability to fabricate any replacement part made them especially invaluable to the maintenance of the Pacific Fleet.

The first wartime repair at the yard started when the battleships that survived Pearl Harbor began to limp into the yard. The yard repaired *USS California, USS Maryland, USS Mississippi, USS Nevada,* and *USS Pennsylvania*.[305] Examples of other ships overhauled include the *SS Nieu Amsterdam (*a Dutch passenger liner requisitioned by the British for troop transport), the Navy troop transport *USS Monticello* (the Italian passenger liner *Conte Grande* purchased by the U.S. in 1942 and returned to Italy after the war), and a 25,000-ton aircraft carrier. The most famous repair job was the 1942 installation of a second battery on *USS Pennsylvania*. UIW finished the repair, which other yards had estimated would take almost a year, in just 88 days.[306]

New drydock facilities were installed at UIW after the Navy took over the Hunters Point drydock facilities. The Navy built a new pier (Pier 70) at UIW, adding 2,000 feet of additional berthing space as well as a 14,500 ton capacity drydock, making UIW "the largest privately operated ship-repair facility in the country."[307] During World War II, UIW was able to dock 29 vessels at one time.[308]

In 1945, *Fortune* noted that older buildings at the yard were filled with what appeared to be disused tools and spaces: the "art of shipbuilding outgrows and discards its old tools. The art of ship repair keeps them against the day when it might possibly need them again."[309] Thanks to this collection of tooling and supplies accumulated over its history as well as a work force that knew how to use them, the yard was able to repair a steel ship from almost any period. This was clearly a point of pride. If a part was not immediately available on the West Coast, UIW could make it in-house, since UIW's active machine shops were also the most complete and most modern on the West Coast.[310] The yard could repair ships over 30,000 tons and it successfully modernized older ships in the fleet in record time.[311]

The End of the War

[304] "West Coast Yards, Navy Repairmen," *Fortune*, 1945, 129.
[305] Carey & .Co. *Seawall Lot 349 at Pier 70, Building 12 Complex San Francisco Electrical Reliability Power Project Setting Analysis*, (2003), 2.
[306] Bethlehem Steel Co., *A Century of Progress: 1849-1949*., 22.
[307] "West Coast Yards, Navy Repairmen," 232.
[308] "Bethlehem's Repair Facilities at San Francisco," *Pacific Marine Review,* Volume 43, 1946, 15.
[309] "West Coast Yards, Navy Repairmen," 232.
[310] "Bethlehem's Repair Facilities at San Francisco," *Pacific Marine Review,* Volume 43, 1946, 14.
[311] "Bethlehem's Repair Facilities at San Francisco," *Pacific Marine Review,* Volume 43, 1946, 14.

At the end of the war and the completion of all government contracts, the UIW yard became a drydock and ship repair and conversion facility. By the end of the war the yard occupied 65 acres, and contained five floating drydocks, and eight slipways varying in length from 390 to 640 feet.[312] During the late 1940s the yard continued to receive conversion contracts from Navy, Army, and commercial shipping firms. The yard continued to build naval ships into the 1960s and barges into the 1970s. The yard also built the tubes for the Bay Area Rapid Transit (BART) tunnel under San Francisco Bay linking San Francisco and the communities of the East Bay. In the early 1980s, the Bethlehem Corporation sold the shipyard for one dollar to the Port of San Francisco. Todd Shipyards purchased much of the machinery. Today, BAE Systems San Francisco Repair leases portions of the yard from the Port of San Francisco and continues to operate a repair facility, including two floating drydocks, on site. The 1884 machine shop (Building 113) remained in use at the yard throughout the twentieth century and was vacated in 2004.

Criterion A Summary

UIW was one of the first steel hull shipyards in the country, and the first on the West Coast. It actively participated in every trend in steel shipbuilding, and the yard embodies each of those trends. UIW was an industry leader and technological pioneer during the late nineteenth century through the turn of the twentieth century, influencing shipyards in other parts of the country. It continued successfully to adopt emerging practices in prefabrication and design standardization, while retaining its original capacity to fabricate all ship components on site. The yard made significant contributions to every war effort from the Spanish-American war through World War II. It produced hundreds of ships and repaired thousands, including each of the most influential types of vessels in each war. UIW furthermore originated steel shipbuilding on the West Coast, and for most of its history served as the headquarters of domestic shipbuilding and ship repair for the Pacific. It was able to consistently balance emerging technology with older shipbuilding and repair practices, enabling the yard to convey its national level of significance over each phase of development, rather than just one single period.

Criterion C: Industrial Architecture and Design

Union Iron Works (UIW) is significant under Criterion C at the local level as a district that represents a distinctive and exceptional entity. It illustrates national trends in industrial, and especially shipyard architecture from 1884 to 1945. Functional and aesthetic forces determined the appearance of the buildings and the layout of the yard, forces that relate to the larger national context of factory design from the early 1880s to 1945.

UIW's built environment subdivides into four periods, each corresponding to larger national trends in industrial architecture. The first period from 1884 to 1900 includes the first Union Iron Works buildings at Potrero Point: heavy, unreinforced masonry buildings in the American round-arched style, and the first architect designed office building. Architecture from the second period from 1900 to 1918 reflects experimentation with new construction technologies, including reinforced concrete and structural steel frames. Additional architect designed buildings were also constructed at this time. They reflect the architectural and physical separation of management from labor. During the period from 1919 to 1935, little development occurred at the shipyard. General trends in industrial architecture that occurred in this between the wars period are discussed in relation to the final period of development at UIW. The final period from 1936 to

[312] Bethlehem Steel Co., *A Century of Progress: 1849-1949*, 32.

1945 includes the construction boom leading up to and during World War II, primarily involving steel framed buildings with corrugated iron cladding.

1884-1900: Late Nineteenth Century Industrial Architecture

The earliest buildings at the UIW Shipyard, built of heavy brick masonry and designed by a civil engineer, reflect several national trends in industrial architecture at this time (Figure 5). First, the yard itself is typical of late nineteenth century factory layouts. The buildings incorporate form giving functional elements standard for industrial buildings of the period. They are representative of at least two of the three industrial building types of the day: the production shed and the loft. Stylistically, all of these buildings exemplify the American round-arched style, a style brought to the United States by German immigrants during the 1840s.

Layout

The initial development of Union Iron Works consisted of six main buildings and a wharf.[313] The Machine (Building 113), Erecting, and Smith Shops and the Pattern House stood south of 20th Street. North of 20th Street, along the shoreline, stood the ship assembly area: plate shop, slip way, wet basin, and wharves. The dispersal of various functions into separate buildings, and the distance between buildings, was typical of industrial sites during this period.

For most of the late nineteenth century, factory layouts were confined by pre-electric power distribution systems and material handling systems that necessitated limited space between buildings. These restrictions also had to be balanced by the need for fire separation, daylight, and ventilation.[314]

Before the widespread use of electricity, power distribution in industrial complexes came from a series of shafts or cables rotated by a centralized steam engine. These spinning shafts and belts, called millwork, penetrated into the different buildings. Instead of individual motors, a complex network of belt transmissions and clutches connected to the engine room powered individual machines. The layout of industrial complexes centered on the engine room as shorter lines of millwork resulted in less friction and more power.

The material handling requirement for short lines of travel between buildings also encouraged compact industrial sites, with railways and cartways running into and out of buildings. Workers typically used jib cranes to move materials on and off carts, as millwork occupied the upper reaches of the factory and prevented the use of overhead traveling cranes.[315] With improvements in electricity came overhead cranes, easing the movement of materials.

In contrast to many modern industrial facilities where all activities are housed under one roof, older industrial plants housed different activities in separate buildings.[316] The original UIW buildings, including the Machine Shop (western portion of Building 113), Blacksmith Shop (eastern portion of Building 113), Foundry, and Engine Room, illustrate this. The various shops were spread among separate buildings to prevent fires and to provide adequate light and ventilation. The Machine Shop and Foundry stood close to the Engine Room for easy access to power, while the Blacksmith/Boiler Shop and Pattern House stood apart, on the east side of

[313] Sanborn Insurance Company Map, San Francisco, Vol. 5 (1886), sheet 153.
[314] Bradley, *The Works*, 56.
[315] Bradley, *The Works*, 99.
[316] Bradley, *The Works*, 83.

Georgia Street, providing a separation to mitigate their greater risk of fire. Both the Machine Shop and Blacksmith/Boiler Shop were on Napa (now 20th) Street, with a north-south rail line running between them to move heavy parts to the docks for assembly. Connected by rail to the rest of the complex, the wooden Plate Shop (then called the "Ship Shop") stood north of 20th Street, with easy proximity to the wharf.

Function

During this period, the technological advancements made in industry affected industrial architecture in general, and shipyard buildings in particular. New power generation and transmission methods, new transportation systems, and newer, more efficient labor methods changed the way industry used buildings.[317]

Industrial buildings of this era responded to physical demands. For example, machines could create potentially damaging vibrations, so builders used thick walls and robust framing to resist vibration and oscillation.[318] Long, uninterrupted stretches of wall are particularly vulnerable to vibrations, so pilasters and short-wall turnouts helped break walls into smaller segments. Large windows, roof monitors, and skylights brought natural light and ventilation. Materials such as brick and large timbers resisted fire. Especially fire-prone activities, such as forging, typically were isolated in separate buildings.[319] A complex material handling system of cranes and railways tied the discrete buildings into a unified whole.

The extant original UIW building, Building 113/114, exemplifies these characteristics. Both the former Machine and Blacksmith/Boiler Shops feature a three-galley space with the central galley served by an overhead traveling crane. Riveted steel columns support both overhead crane tracks and Fink roof trusses. Large arched windows on all sides of the building provide optimal visibility, while skylights bring additional light into the interior. A ventilator along the ridgeline helps circulate fresh air. The northeast corner of the Machine Shop also features a mezzanine level initially used as the shipyard's primary office. Rails and track ran through all portions of the buildings, some of which remain.

Building Types

Although only Building 113/114 survives from the original UIW complex, lithographs, Sanborn maps, and descriptions portray the five main buildings at the original works. These sources show a Foundry building, south of the Machine Shop, as well as a high, four-story Pattern House.[320]

The Machine Shop (Building 113/114, western half), Blacksmith and Boiler Shop (Building 113/114, eastern half), and Foundry are all typical of the production shed. Buildings of this type were one story, rectangular in form, often of great width, and of any required length. Their engineering permitted wide spans, considerable height, and the strength and stability to handle traveling cranes. Exterior brick walls were most common, with an interior frame of wood, iron, or steel. Roofs usually incorporated lighting and ventilation and featured a distinctive profile.[321]

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[317] Thiesen, *Industrializing American Shipbuilding,* 169.
[318] Bradley, *The Works*, 110.
[319] Bradley, *The Works*, 117.
[320] The Machine Shop to the west and Boiler/Blacksmith Shop buildings (east) were Joined together in 1914 by a connector to form the present-day Building 113/114.
[321] Bradley, *The Works*, 39.

Building 113/114, the remaining building from this period, illustrates this building type well. One story high, it features brick walls and a structural steel frame supporting not only the roof, but also traveling cranes, which were installed in the 1890s. Its roof has skylights and a ventilating monitor, providing the requisite distinctive profile.

The Pattern House (Building 112) constructed circa 1885 and demolished following World War II, illustrated the second common industrial building type: the industrial loft. Industrial loft buildings consisted of two or more stories, featuring an elevator, hoist, or other means of vertical circulation. Materials were often heavy timber, with stone or brick exterior walls.[322] Later, reinforced concrete or steel frame would replace heavy timber construction. The Pattern House clearly reflected these trends. This four-story building featured brick walls, a heavy timber frame,[323] an elevator at one end, and a hoist at the other.[324] Later industrial lofts at UIW include Building 111 (1917) and Building 2 (1941, 1944), both warehouse buildings.

Style

Over time, the specialized functions and uniform styling of industrial buildings gave rise to a discernible industrial aesthetic. In the mid and late nineteenth century, when architectural styles favored ornamentation, engineers sought simplicity, designing for function rather than architectural effect. Designers used the inherent expressive qualities of masonry, such as color, bond pattern, and load-supporting arched openings. The intrinsic aesthetic qualities of the material led designers to the American round-arched style.[325]

Beginning in the 1840s, German immigrants and, in particular, a number of central European immigrant architects including Charles Blesch, Henry Engelbert, and Alexander and Edward Saeltzer, brought the round-arched style to America. It quickly became popular for industrial buildings. The *Rundbogenstil*, as it was known in Germany, relied on locally available materials, including brick, and blended elements of classical and medieval styles. Characteristics, aside from the use of arches, included pilasters and horizontal bands forming grids, brick corbelling, and molded surrounds around door and window openings. Segmentally-arched windows also appeared by the mid nineteenth century. The American round-arched style found favor with builders because its basic architectural language was already familiar to masons and owners.[326]

All of the original Union Iron Works buildings in the yard displayed this style. The surviving Building 113/114 features arched windows, brick corbelling, and rows of pilasters. The corbelling and prominent window sills along the mezzanine level form horizontal bands. Illustrations of the now-demolished early 1880s Pattern House, and the south wall of Building 105, remaining from a building constructed circa 1890, also display this style.

The First Office Building

Building 104, standing north of Building 113 across 20th Street, was the yard's first dedicated office building.[327] From the mid-1880s until 1896, the UIW executive offices occupied a corner of

[322] Bradley, *The Works*, 37. Although Building 104 is trimmed with sandstone, stone buildings in general are absent from this district.
[323] "Plans of the San Francisco Yard," Bethlehem Steel Company Shipbuilding Division (San Francisco, 1944), Sheet 32.
[324] Sanborn Insurance Company Map, San Francisco, Vol. 5 (1886), sheet 153.
[325] Bradley, *The Works*, 234-235.
[326] Bradley, *The Works*, 235-237.
[327] *The Engineering Record,* Volume 41 (March 10, 1900), 227.

the Machine Shop (Building 113), while bookkeepers, draftsmen and clerks were in the Boiler House basement. UIW also maintained administrative offices in downtown San Francisco. In 1895, these downtown offices stood at 222 Market Street.[328] In 1896, UIW constructed Building 104 to achieve many goals: to consolidate its offices, to offer an "elegant suite" for executives, and both to integrate the shipyard's two drafting rooms (shipyard and engineering) and to enhance working conditions for these staff.[329]

This new office building reflects several general trends in industry and industrial architecture. The period from the mid nineteenth century to the turn of the twentieth century saw the expansion of administrative functions and the ensuing need to house them. During the early years of this period, the factory office tended to be humble, either housed in a small freestanding building or in a portion of a main building, as was the case at UIW. Later, larger administration buildings provided more room for executive offices, engineers, and drafting. As the latter half of the nineteenth century progressed, factory offices were more likely to be imposing, architect designed buildings. Many of these offices also featured an attic drafting room.[330] Building 104, with both elegant offices for executives and an attic drafting suite, followed this pattern.

Building 104 was also the first UIW building designed by a prominent architectural firm, Percy & Hamilton. Both George Percy (1847-1900) and Frederick Hamilton (1851-1899) came from Maine and worked extensively in native granite prior to moving west. Both men began their careers apprenticing with eastern architects – Hamilton, with Boston architect Hammatt Billings, and Percy with Portland, Maine architect Francis H. Fassett. Both men also likely gained exposure while in the northeast to the work of Henry Hobson Richardson, whose work influenced many of their later California commissions, such as Greystone Cellars in St. Helena and the Sharon Building in Golden Gate Park, in San Francisco.[331] The two men also designed a building for Wells Fargo at 2nd and Mission, completed 1897, and an office and museum for the California Academy of Sciences on Market Street, completed 1899, both in San Francisco. Other San Francisco projects included the First Unitarian Church at Franklin and Geary, completed 1887, and the Seventh Day Adventist Church at California and Broderick, completed 1892, as well as several houses in the Pacific Heights neighborhood.

Stylistically, Building 104 conforms to the trend toward a higher design aesthetic for this building type. It combines elements of the Richardsonian Romanesque in its arched openings and deep reveals, and the Renaissance Revival style with its large quoins, a rusticated base, and a prominent central entry. The building has a formality suitable for an office building, while its mass implies a strength and durability appropriate for an iron works. The arched brick aesthetic also blended well with the existing American round-arched style factory buildings already on site.

Comparisons

[328] Industry 1895, in Ruth Teiser Manuscript Collection, Series 6, Subseries 3, Box 146, File 10, Folder 10, J. Porter Shaw Library; *San Francisco Call* July 26, 1896, p. 10/2.
[329] *San Francisco Call* (26 July 1896), 10/2.
[330] Bradley, *The Works*, 35-37.
[331] David Parry, "Percy & Hamilton," *Encyclopedia of San Francisco*, http://www.sfhistoryencyclopedia.com accessed 12/4/2007.

Illustrating the universality of these trends is the Sacramento Rail Yard, a contemporaneous industrial district comparable to UIW, established by the Central Pacific Railroad in the 1860s. Near the western end of the transcontinental railroad, it featured maintenance and construction buildings similar in scale and layout to those at UIW. It evolved to become the largest West Coast railroad construction and repair shop,[332] much like Union Iron Work's status as the premiere West Coast ship construction and repair yard. The initial group of Sacramento Rail Yard buildings featured a large machine shop, accessory storage buildings, and a steam engine power plant. In 2013, the 237 acre district featured 34 buildings and structures that retain historic significance.[333]

The layout of the original buildings centered on the large steam engine, which powered millwork line shafts to separate buildings. Although the steam engine and its building have disappeared, the brick Blacksmith Shop, built in 1869, still stands. The one-story building featured brick walls, with pilasters framing each round-arched window opening. Wooden trusses supported the corrugated iron roof and provided open floor space for equipment. The roof monitor included pivot windows to help dissipate heat from the shop floor. Hoods and stacks along the exterior walls exhausted smoke from the forges.[334]

The Sacramento Rail Yard Blacksmith Shop is directly comparable to Building 113/114 at Union Iron Works. They are stylistically similar, with arched windows, pilasters and corbelling consistent with the American round-arched style. Both buildings are brick, with trusses supporting corrugated iron roofs. Both have monitors for ventilation, and both had chimney stacks penetrating the roof. Both also formed core parts of large West Coast industrial complexes.

The comparison of these two complexes shows that during this period, industrial buildings were essentially interchangeable. While industrial districts included different building types, such as lofts, sheds and powerhouses, few industrial building types were industry specific. This changed as the twentieth century developed.

1900-1918: Early Twentieth Century Architecture

The next phase of Union Iron Works began just at the turn of the twentieth century. Several important events at this time impacted industrial environments. The widespread use of electricity had pronounced effects on the layout of factory spaces, and allowed for shop arrangements that optimized the production process. Electricity meant that industrial buildings no longer needed to cluster around the engine room.[335] For shipyards, new shipbuilding techniques, including templating, increased production efficiency and required substantial capital investments in new buildings, as did increasing specialization of workers and a boom of white-collar jobs. Industrial engineering, in its infancy in the late nineteenth century, became an influential discipline, and architects began to consider seriously the requirements of industrial buildings for the first time. Finally, World War I required more ships, spurring the growth of shipyards' physical plants. UIW's architectural landscape embodies all of these changes.

[332] "Southern Pacific Sacramento Yards," *Historic American Engineering Record,* (2001), 1.
[333] [footnote pending]
[334] "Southern Pacific Sacramento Yards," *Historic American Engineering Record,* (2001), 95.
[335] Theisen, *Shipbuilding*, 183.

New construction methods also had an important impact on industrial architecture during the early twentieth century. Reinforced concrete became popular because of its strength, fire resistance, and relatively low cost. Steel framed buildings clad with corrugated iron panels first appeared at this time, providing flexibility and speed of fabrication with fire resistance. The older technology of iron roof trusses further developed to produce a variety of industrial roof forms, such as sawtooth and Aiken. Brick remained in use, but primarily as a veneer for concrete buildings. Both structurally and stylistically, this period is marked by eclecticism and experimentation.

Stylistically, the influence of the Ecole des Beaux Arts began to be seen, particularly in the architect designed buildings constructed along 20th Street during this period. The architects commissioned for these buildings either trained at the Ecole, as did Charles Peter Weeks, or were influenced by its teachings, as was Frederick H. Meyer. The academic Beaux Arts style taught at the Ecole strongly influenced American architecture from 1885 to 1920. Its principal characteristics included symmetry, spatial hierarchy, and references to classical models.

The 1893 World Colombian Exposition in Chicago popularized Beaux Arts aesthetic and urban planning principles. The "White City," as it was known, featured a strong rectilinear plan, monumental Beaux Arts buildings covered in white stucco, a uniform cornice line, and coordinated ornamentation. A movement termed "City Beautiful" grew out of this fair, which had a strong impact on San Francisco. Daniel Burnham, the fair's main designer, proposed a widely exhibited, mostly unrealized, urban plan for the San Francisco in 1904 that incorporated many City Beautiful ideals. The 1915 Panama-Pacific International Exhibition was built on the 1893 Colombian Exposition model and featured a strong Beaux Arts theme, as did the San Francisco Civic Center of the same period.

A confluence of these trends occurred at Union Iron Works. The overwhelming majority of buildings constructed at this time were concrete, sometimes in combination with other materials such as brick, wood, or steel. Some of the buildings were architect designed and prominently located in the district, reflecting both the influence of the Ecole des Beaux Arts and Bethlehem Steel's desire to express its corporate image. The utilitarian buildings, by contrast, were stylistically varied, ranging from those with applied ornament and enriched surfaces (Building 111), to pure expressions of function (Building 115/116).

Reinforced Concrete

> Reinforced concrete has provided for the manufacturer an entirely new building material. Indestructible, economical and fireproof, it offers under most conditions features of advantage over every other type of construction.[336]

The use of reinforced concrete construction, beginning in the late nineteenth century, was one of the most important developments in the history of industrial architecture, enabling engineers to build factories more efficiently.[337]

Reinforced concrete construction revolutionized an ancient technology. The Romans discovered concrete in the second or first century BCE, thereby transforming the architecture of antiquity.

[336] Sanford E. Thompson, *Reinforced Concrete in Factory Construction*, (New York, 1907), 1.
[337] Lindy Biggs, *The Rational Factory* (Baltimore and London, 1996), 81.

However, Roman concrete differed from modern in several ways, including composition, finishing, and most importantly, its lack of ferrous metal reinforcement.[338] Reinforced concrete became common around the turn of the twentieth century and continued to be a popular choice for industrial buildings through World War II.[339] The technology allowed five important developments in factory construction: (1) it reduced floor vibration from machines, (2) it required fewer interior columns than earlier construction types, (3) its strength allowed greater window areas, and (4) it allowed buildings to be much larger than before. Perhaps most importantly, (5) it was almost completely fireproof.[340]

When steel reinforced concrete became more commonly available in the early twentieth century, industrial builders, impressed by its structural merits, were among the first to realize its potential.[341] Although reinforced concrete offered superb physical qualities, such as high strength and fire resistance, its aesthetic qualities were considered a challenge to early twentieth century designers. The problem led to experiments with many modalities. These included attempts to replicate familiar architectural elements – such as columns, arches, corbels, and pediments – in concrete; the use of various styles in the search of an appropriate vernacular; and the cladding of the concrete building with other materials, such as brick or stucco.[342] UIW presents a broad spectrum of experiments with reinforced concrete technology.

Architect Designed Buildings

As a prominent industrial company, Bethlehem Steel desired to project a powerful corporate image, and used architecture as a public relations tool. The company initiated a modernization program shortly after acquiring UIW and commissioned two new buildings in prime locations on 20th Street. The first, completed in 1912, was a Powerhouse (Building 102), while the second, completed in 1917, served as a corporate office (Building 101). Both were designed by prominent local architects – the Powerhouse, by Charles Peter Weeks, and the Office Building, by Frederick H. Meyer – and both were expressions of the Classical Revival Style, influenced by the Ecole des Beaux Arts.

Architect Charles Peter Weeks was born in Ohio in 1870 and attended the Ecole des Beaux Arts in Paris, where he trained in the atelier of Victor Laloux, one of the most prominent French architects of the time and the most popular mentor among American architects studying in Paris. In 1902, Weeks joined John Galen Howard, a fellow student of Laloux, in the New York firm of Howard & Cauldwell. Weeks then followed Howard to Berkeley in 1903-04 to assist with the design of the new campus for the University of California, the largest Beaux Arts project in the U.S. Weeks next joined San Francisco architect Albert Sutton in 1903 to form Sutton & Weeks. After Sutton moved to Oregon in 1910, Weeks worked independently until joining forces with William Peyton Day in 1916.

It was during his solo period that Weeks designed the Powerhouse, along with several prominent residences in San Francisco, including 2150 Washington Street for Mary Louise

[338] Henry J. Cowan and Peter R. Smith, *The Science and Technology of Building Materials,* (New York, 1988) 120.
[339] The first reinforced concrete buildings in the San Francisco Bay Area appeared in the 1880s. The Ernest Ransome family, based in Oakland and San Francisco, was the most important U.S. manufacturer until around 1906. Bradley, *The Works*, 155.
[340] Biggs, *Rational Factory*, 83-83.
[341] Bradley, *The Works*, 155-160
[342] Bradley, *The Works*, 240.

Phelan, sister of former Mayor James Duval Phelan. The Phelan house was a Renaissance Revival style building sharing many features with the UIW Powerhouse, including bilateral symmetry – a hallmark of Beaux Arts planning, a hipped, clay tile roof, and arched window openings. Literature of the period ascribed Building 102 to the "Spanish Renaissance" style, most likely because of the prominent clay tile roof.[343] With Day, Weeks later designed Shriner's Hospital (1923), the Huntington Hotel (1924), and the Mark Hopkins Hotel (1925). Weeks died on March 25, 1928, found dead in the living room of his apartment by his wife's maid.[344]

Week's 1912 Powerhouse (Building 102) is a celebration of the shipyard's modernization, allowing for further upgrades as the yard became electrified and power sources centralized. The new Powerhouse supplied various types of power, including alternating current, direct current, hydraulic pressure, and compressed air for pneumatics, to the entire UIW yard.[345]

Like many of the other buildings of this period, Building 102 is of reinforced concrete, here clad with stucco. Exterior ornamentation, including a shell-motif frieze and refined interior finishes, bely the utilitarian function of the building, which housed four large electrically-powered air compressors to power pneumatic tools, and two rotary converters for general power distribution.[346]

The ornamented powerhouse is a common San Francisco building typology, related to the City Beautiful movement's desire to beautify ordinary industrial buildings. Willis Polk, one of San Francisco's most influential architects of this period, and Frederick H. Meyer, architect of Building 101, both designed several Classically styled powerhouses in and around San Francisco in the first decades of the twentieth century for the Pacific Gas and Electric Company.[347] Prominent among these is the Jessie Street Substation, by Willis Polk (1905).[348] Such powerhouses were built on City Beautiful ideals to create sanitary, orderly, beautiful, and modern cities. They typically exhibited a refined and orderly use of ornamentation.

By updating the infrastructure at UIW, Building 102 paved the way for further improvements. In 1916, *Pacific Service Magazine* described how the new powerhouse affected "nearly every other feature of the works."

> With central station energy came also numerous alterations and improvements of the departments: main line shafts and countershafts were eliminated, doing away with the use of belting, and all machine tools were directly connected to individual motors, which, besides making a great savings in power, made the shops light and much more inviting to the workmen.[349]

With these alterations and the need for more ships for World War I, came other new buildings. Building 108 (Planing Mill/Joinery), and Building 109 (the Plate Shop) were built at the same

[343] *Pacific Service Magazine,* 8 (June1916), 4-5.
[344] David Parry, "Architects' Profiles: Pacific Heights Architect #20 – Charles Peter Weeks," *McGuire Real Estate*, http://www.classicsfproperties.com, accessed 12/4/2007.
[345] Pitts, "Union Iron Works at San Francisco."
[346] *Pacific Service Magazine,* 8 (June1916), 4-5.
[347] *The Architect and Engineer*, 54 (July 1918).
[348] The Jesse Street Substation was placed on the National Register of Historic Places in 1974 for architectural merit. http://www.nr.nps.gov/Red%20Books/74000555.red.pdf, accessed 12/11/2007.
[349] *Pacific Service Magazine*, 8 (June1916), 4-6.

time as the Powerhouse. Several other buildings followed between then and the end of World War I. This growth, and the destruction of the floating hydraulic drydock during the 1906 earthquake, also caused the modification of most of the northern waterfront features and the expansion of rail lines.

Just west of Building 102 stands Building 101, erected in 1917 and designed by Frederick H. Meyer. Prominently situated at the corner of 20th and Illinois Streets, at the entry to the shipyard, this building represents not only the growth of the shipyard and the concomitant need for more administrative offices, but also the desire to express and promote the company's position as the leader of the shipbuilding industry on the West Coast. Like Building 102, Building 101 has stucco cladding and classical detailing. Unlike Building 102, the use of reinforced concrete on Building 101 was confined to the floor slabs and the casing of the steel beams which support them. Perimeter walls are of unreinforced brick.

Unlike Charles Peter Weeks, architect of Building 102, Frederick Herman Meyer (1876-1961) had no formal architectural training. Like many architects of the period, he trained by apprenticing in various architectural firms. A San Francisco native and son of a cabinetmaker, Meyer's first partnership was with architect Samuel Newsom, with whom he designed large residential projects. In 1902, Meyer partnered with Smith O'Brien, designing office buildings such as the Rialto Building at 116 New Montgomery and the Humbolt Bank Building at 785 Market Street. On his own from 1908, he worked with John Galen Howard and John Reid, Jr. on the layout of the new City Beautiful-inspired San Francisco Civic Center. Meyer and Reid designed the Civic Auditorium (1915 – now the Bill Graham Civic Auditorium).[350] Meyer's portfolio also included other shipyard projects, including a Powerhouse for Bethlehem's Alameda yard, [351] and the complete design of the Pacific Coast Shipbuilding Company's yard in Bay Point, approximately 35 miles east of San Francisco, completed in 1918.[352]

Specifically designed to be "imposing," Building 101 marks the entry into the industrial streetscape of 20th Street. Bethlehem required the building in order to keep pace with the "enormously increased business of the Potrero plant and its branch across the bay," in Alameda, according to the San Francisco *Chronicle*. Architect Frederick H. Meyer told the *Chronicle* in January 1917 that the building, then under construction, would be the largest and best equipped private office building in the West, accommodating 350 clerical, professional and executive staff.[353]

The white Neoclassical office building asserts Bethlehem Steel's desire to associate urbane taste with its corporation. Its location at the shipyard, rather than downtown, and its housing of administrative functions for both the Pier 70 facility and Bethlehem's Alameda yard, indicates the importance Bethlehem associated with the yard. In placing the building so prominently, Bethlehem also continued the nineteenth century tradition of centrally locating the office or

[350] David Parry, "Meyer, Frederick Herman," *Encyclopedia of San Francisco*, http://www.sfhistoryencyclopedia.com/articles/m/meyerFrederick.html, accessed June 9, 2008.
[351] The Union Iron Works Powerhouse, as the building is called today, was listed on the National Register of Historic Places in 1980. "Union Iron Works Powerhouse," National Park Service, *http://www.nps.gov/nr/travel/wwIIbayarea/uni.htm*, accessed November 30, 2007.
[352] M. B. Levick, "The Architect and the Shipbuilding Industry," *The Architect and Engineer*, and "Pacific Coast Shipbuilding Company, Bay Point CA," http://www.coltoncompany/shipbldg/ussbldrs/prewwii/shipyards
[353] *San Francisco Chronicle* January 27, 1917 11/3

placing it near the main gate, facilitating better supervision, expressing management's power, and underscoring the separation of blue collar and white collar work.[354]

[354] Bradley, *The Works*, 36.

UIW Concrete Utilitarian Structures

While Bethlehem Steel was commissioning architect designed reinforced concrete buildings, it was also building utilitarian warehouses of the same material. Notable new pre-World War II concrete buildings, in addition to Building 102, include Building 38 (Pipe and Electric Shop, 1915), Checkhouse No. 2 (1916), Building 115/116 (Foundry and Warehouse, 1917), and Building 111 (Warehouse, 1917). These buildings exemplify the period's aesthetic experimentation with reinforced concrete.

Building 38, constructed in 1915, stands at the southern edge of an open yard. Board-formed reinforced concrete comprises the exterior load bearing walls, while steel interior columns support the wood second floor and the corrugated steel roof. On all four elevations, traditionally dimensioned, double-hung wood sash windows penetrate the walls. Structurally, therefore, this building constitutes a hybrid: while the exterior walls are concrete, in other respects the building is a wood and steel frame construction. On the north and south elevations, a shaped parapet provides Mission Revival character. Mediterranean and Mission style architecture inspired many early concrete buildings, since designers felt that the stucco cladding and monolithic character of these styles was similar to concrete.[355]

Building 111 displays another approach to concrete industrial architecture. Completed in 1917 to serve primarily as a warehouse, it also contained finely detailed, richly finished offices at the north end. Unlike Building 38, this multi-story loft building is of concrete frame construction. Exterior walls are non-load bearing brick curtain walls, while floors are reinforced concrete slab. Original windows, unlike Building 38, are expansive steel sash units, with the exception of the office portion, which are wood. The brick exterior was a popular response to the perceived aesthetic challenges of the new material. Brick stylistic vocabularies had developed over the centuries, and brick also had the advantage of blending well with existing urban or plant construction. During the 1910s, construction costs for a brick clad concrete building and an all concrete one were similar. However, the owners most likely paid a premium for the elaborately coursed brickwork of Building 111.[356] In terms of exterior expression, the building's designers adopted traditional styling, consisting of segmentally arched openings at the high first story, cast stone keystones, headers and sills, and a corbelled brick cornice. The industrial grid of windows, piers, and floor slabs feature similar stylistic devices.[357]

Although Building 111, as earlier UIW buildings (Building 113/114 and Building 104 especially), sports a brick exterior, its windows reveal the new structural approach. The square heads of the upper floor openings, the proportion of window to solid wall, and the shallower reveals, illustrate some of the possibilities of the new concrete structural system. Concrete headers replace the arches, allowing squared openings without the wood or steel headers that would have appeared on earlier unreinforced masonry buildings where arches were omitted. The thinner reveals represent the greater material efficiencies of concrete, as the massive walls of an unreinforced masonry building were no longer required for structural support.

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[355] Bradley, *The Works*, 240.
[356] Bradley, *The Works*, 241.
[357] An example of a similar approach is found in Factory No. 2 for the Dayton Engineering Laboratories building (c. 1916; Dayton, Ohio) or Albert Kahn's "Building B" at Ford Motor Company's Highland Park Plant (1910-1914). The majority of Kahn's buildings at the Highland Park plant were also of concrete, with brick facing. A closer example is the American Can Company Building, at Third and 20th Streets in San Francisco; begun in 1915 and displaying a similar aesthetic concept.

Building 115/116, constructed in 1917, the same year as Building 111, demonstrates a third approach to reinforced concrete design. Here, the reinforced concrete frame is unsheathed, with no ornamental devices to mask the innate expressiveness of the concrete itself. Concrete piers and spandrels alternate with wide expanses of steel sash window. The proportion of void to solid is even greater than on Building 111. This approach is perhaps the most modernist – or at least the one that would be most admired by advocates of the Modern Movement, which was developing at this time.

The construction of Building 115/116 corresponds to the infancy of U.S. Modernism. In 1932, Philip Johnson and Henry-Russell Hitchcock wrote, "On the whole, American factories, where the client expects no money to be spent on design, are better buildings and at least negatively purer in design than those constructions in which the architect is forced by circumstances to be more than an engineer."[358] However, what Hitchcock and Johnson defined as "modernism" was as rare in American industrial architecture during this period (1900-1918) as it was in American architecture in general. European architects, however, took a different approach. Such industrial projects as Peter Behren's Turbine Erecting Shop for AEG (Berlin, 1909) and Hans Poelzig's Water Works (Posen, 1911), published in *The American Architect* in 1917, show a willingness to break with the past and explore new vernaculars for the new materials and functions of industrial buildings. Albert Kahn remarked upon the confusion in industrial architectural design in the U.S. compared to Europe, where such architects as Peter Behrens developed a new methodology based upon simplification: the avoidance of traditionally applied ornament, functionality, and the intelligent use of materials. While this approach ultimately spread to all types of architecture, Kahn, like Hitchcock and Johnson, noted that the approach in the U.S. was first adopted by industrial architects and engineers.[359] Building 115/116 represents an early example of Modern Movement principles applied to industrial architecture.

The First Steel Framed Buildings

Although the vast majority of steel frame buildings at UIW date to the World War II era, steel frame buildings first appear just prior to World War I. Similar to Building 115/116, these buildings are devoid of extraneous ornament. Steel frame buildings from the 1900 to 1918 period include Building 21 (c.1900), Building 108 (1911-1913), and Building 109 (1912). Buildings 108 and 109 combine a steel frame with wood floors and ceilings.

In addition to reinforcing concrete, builders began to use steel as the structural frame for industrial buildings in the late nineteenth century. The great strength, standardized dimensions, and speed of assembly through riveting made steel a fine choice for industrial buildings. Steel, cast iron, and wrought iron were initially used in brick buildings for internal columns and roof trusses.[360] The earliest UIW buildings at the yard, including Building 113/114, followed this model. Around 1900, handbooks of steel design became available and during the first decade of the twentieth century, curtain wall construction appeared. These walls consisted of steel load bearing columns with non-load bearing cladding, initially of brick, tile or concrete. After this first decade, the all-masonry curtain wall was replaced by one of corrugated sheet metal and steel sash windows, often over a low brick wall, three to four feet high, which was used as a moisture

[358] Henry-Russel Hitchcock and Philip Johnson, *The International Style* (New York, 1932; reprint, 1995), 53.
[359] Bradley, *The Works*, 246-247.
[360] Bradley, *The Works*, 144.

barrier.[361] While the earliest steel frame buildings in the district did not rest on low masonry walls, those constructed in the 1930s do.

Alongside steel structural framing, two additional fire resistant ferrous metal building materials were introduced: corrugated sheet metal, used for wall and roof cladding, and steel sash windows. These materials were galvanized to improve corrosion resistance. As a steel structural frame eliminated the need for a load bearing enclosing wall, very thin materials could form the new curtain wall. In addition to low cost and ease of fabrication, the fire resistive properties of corrugated sheet metal made it a popular material for industrial buildings. Ferrous sheet metal panels corrugated for strength and galvanized for rust resistance were in use as roofing and wall sheathing as early as the 1870s. Building 113/114 (1885-1886) reflects these trends in its use of corrugated galvanized iron roof cladding.[362]

Metal windows were available as early as 1860, but did not become widely available in the U.S. until after 1910.[363] New technology borrowed from the rolling industry allowed mass production of these windows, while urban fires, including the 1906 fire resulting from the earthquake in San Francisco, increased their popularity. As these windows were mass produced, they were reasonably priced. Additionally, they were durable, easily transported, and available in a wide variety of types, including double-hung, pivot, projecting, austral, and continuous.[364]

UIW Early Steel Framed Buildings

The first buildings at Union Iron Works featured corrugated iron roofs, represented now by Building 113/114. The earliest steel frame building in the district, Building 21, was not built by Union, but by Risdon Iron Works, circa 1900. UIW's first steel frame corrugated metal-clad buildings were Building 108 (1911-1913) and Building 109 (1912).

Risdon Iron Works, which occupied the southeast portion of UIW, commissioned the construction of Building 21 circa 1900. This is the district's earliest steel framed, sheet metal clad building.[365] The two-story, rectangular plan building features a striking double gable roof, with each gable consisting of a wide roof monitor.

Building 21 served various functions overtime and exemplifies the flexibility of steel frame and galvanized sheet metal construction. As curtain walls do not support the building, they are relatively easy to reconfigure. The building has served as a power house, transformer house, machine shop, electric sub-station, and electrical shop, and has been in service through two world wars. Based upon a historic photograph, the north elevation has been reconfigured, and now displays a different pattern of openings, illustrating the adaptability of curtain wall construction.

Building 108, constructed in 1911 and 1913, was the first building at UIW constructed by Bethlehem Steel to feature a steel frame with corrugated galvanized iron cladding. Built as a

[361] Bradley, *The Works,* 147
[362] Bradley, *The Works*, 142-143
[363] Bradley, *The Works*, 166.
[364] Steel windows continued to be popular throughout World War II, at which point cheaper, non-corroding aluminum windows supplanted them. Sharon C. Park, "The Repair and Thermal Upgrading of Historic Steel Windows," *Preservation Briefs 13* (Washington D.C.: US Government Printing Office) 2.
[365] The data upon which this date is based is somewhat contradictory. See the description section of this document for further information.

Joiner Shop and Sawmill, it continued to function as such throughout the period of significance. The older, western portion of the building features steel sash ribbon windows and the eastern half, completed two years later, features wood. The differing window types could relate to different light requirements on one side of the building versus the other, or to the availability of the materials when each portion of the building was constructed.

Building 109 (Plate Shop No. 1) was completed 1912, and replaced two earlier similarly functioning buildings on the same site.[366] New power sources, changes in engineering processes, and the desire to build larger ships contributed to the need to replace the earlier buildings.[367]

The 1912 Plate Shop is a steel frame building with corrugated sheet metal cladding. Unlike the earlier shops, this one included a semi-enclosed foundry at the west end and, similar to the earlier iterations, included a second story mold loft for the production of templates from which plates were cut. The building includes an Aiken roof, consisting of alternating high and low bays with associated roof monitors, maximizing daylighting into the mold loft.[368] Windows are wood sash at the north elevation and steel sash at the south, arranged in continuous horizontal ribbons.

1919-1935: Between the Wars

Few UIW facilities were expanded or modernized between 1919 and 1935. As documented under Criterion A, demand for new ships declined precipitously after World War I, and many shipyards in the U.S. closed during this time. UIW, with its ability to repair as well as to build ships, was able to remain functioning, better positioning itself to obtain government contracts once war work resumed.

1936-1945: World War II and Its Build-up

In 1936, Bethlehem Steel began to upgrade its UIW facilities. They constructed or expanded ten buildings between 1936 and 1940. Another 123 buildings or features at the yard were built or modified from 1941 to 1945.[369] This unprecedented build-up dramatically increased the shipyard's ability to produce, and changed its look, feel, and layout.

At the same time, the war created an emergency situation requiring the construction of new ships, and, therefore, new shipbuilding facilities, as quickly as possible. The majority of new buildings from this period, similar to other World War II shipyards, were steel frame construction with corrugated metal cladding, relatively quick to erect. Buildings constructed in the 1930s have a brick base; those constructed after 1940 do not. Steel frame buildings, including pre-fabricated

[366] 1886 Sanborn Insurance Company Map, San Francisco, Vol. 5 and Sheet 153. The first, constructed circa 1885, is listed as a "Machine Shop" and "Mold Loft" on the 1886 Sanborn Maps. Descriptions of function in an early article clarify that the "Machine Shop" or "Ship Shop" actually included "handling, rolling, planing, drilling, counter-sinking, punching, shearing and fitting the plates and ribs of the ship." These functions, then, were very similar to that of a Plate Shop. The second, larger building appears on the 1889 Sanborn and this building is called out as a Plate Shop with a second story Mold Loft.

[367] New templating methods pioneered by Henry G. Morse for the New York Shipbuilding Company beginning in 1899 sped production and decreased cost. Thiesen, *Shipbuilding*,188-192; also see discussion in the Criterion A section of this document.

[368] This roof form is named after Henry Aiken, a consulting engineer practicing in Pittsburgh in the early twentieth century. Bradley, *The Works*, 259.

[369] "Plans of the San Francisco Yard," Bethlehem Steel Company Shipbuilding Division, 1944, Sheet 1.

buildings, became especially popular during World War II for both military and civilian industrial uses because of their relative ease and speed of construction.

Concrete buildings, such as Warehouse 2 (1941), continued to be built, as did many smaller wood frame buildings, most providing worker amenities. While the buildings from this period were similar in size, design, and layout to those at other shipyards, they were not necessarily typical of other industrial buildings during this period. This was due to trends in industrial building design towards functional specificity: the desire for industrial buildings to respond as directly as possible to the industrial processes contained within.

Industrial Architecture

Industrial engineers and their desire to develop rational production processes revolutionized the factory design of this period. As part of this rationalization, they sought to make industrial buildings as functional as possible to optimize manufacturing efficiency. The factory building itself was considered a machine for efficient production.[370] As a result, industrial buildings became less generic and more industry specific. "The plant must be built around the process" became the axiom of production engineers.[371] According to a source from 1940: "Each industry – as chemical, textile, machine parts, etc. – presents special problems involving column spacing, floor and building heights, ventilation, lighting, etc., all of which influence plant design and building costs. Requirements may vary even within an industry, depending upon the particular type of product made."[372]

Production Processes and Architectural Design

Improvements in production technology in the early twentieth century increased potential for faster production and greater output. This potential could only be realized with major reorganization of the factory, in the processes, as well as the buildings that housed them. The automobile and aeronautics industries led these developments, particularly the collaborative work of Henry Ford and Albert Kahn. Between 1900 and 1940, Albert Kahn designed approximately 2,000 factory buildings. These projects increasingly reflected his belief that factories should be designed around production processes, rather than the other way around. Improvements in construction technology and power distribution allowed him to realize these goals.

Kahn's collaboration with Ford at River Rouge in Dearborn, Michigan exemplifies his design ideas. As it was designed initially to manufacture ships, River Rouge is especially relevant to UIW. Ford designed Building B, the first building at River Rouge, to assemble Eagle Boats, submarine chasers for World War I. At seventeen hundred feet long by three hundred feet wide, the building dwarfed all earlier factories. The building contained a three-story high open space, allowing the ships to pass through as they were assembled. Here, the designers attempted to apply continuous conveyor assembly production techniques to mass produce ships. The experiment proved unsuccessful, with few ships completed. According to military historian David Hounshell, "Among the most prominent [reasons for failure] were the company's unbridled confidence in the wide applicability of its assembly line methods, as well as its failure to

[370] "Industrial Building Types Studies," February 1940, in Kenneth Reid, A.I.A., ed., *Industrial Buildings, The Architectural Record of a Decade*, (New York, 1951), 1.
[371] Reid, *Industrial Buildings,* 1
[372] Reid, *Industrial Buildings,* 3.

recognize that marine engineering involved design problems and construction techniques different from auto making."[373]

Kahn also designed the building to convert easily to automobile production once the war work was completed, inserting three floors and retooling for Model T production following the War.[374] The failure of the building to work for shipbuilding may be because the requirement for conversion took precedence over shipbuilding, thus reinforcing the concept of functional specificity. Building B, and the failure of Ford to build Eagle Boats within it, illustrates that the processes of building a ship are different from those of other industries, and that if mass production techniques are to be applied to shipbuilding they must be applied differently. By implication, it shows that since buildings were designed around production processes, buildings to house the ship assembly process needed to be inherently different from buildings for other industries. If the processes contained in Building B had been more ship specific, Building B might not have been so easily converted to auto production after the war, and Ford may thus have been more successful at building Eagle Boats.

The relevance of the Building B experiment to UIW is evident in the design of the Building 12 Complex, known as the New Yard during World War II. The New Yard was designed around a very ship specific production process. Though the buildings of the complex are linked together by party walls and rail lines, unlike Building B at River Rouge, they remain separate buildings, each housing a specific function. Functions more appropriately occurring outdoors or on the water were relegated to layout yards or slips. This production process is reflected in the Building 12 Complex.

Style
Architecturally, the large industrial "machines" built between the wars reflected general stylistic trends. European Modernists' application of non-traditional styling to industrial and other buildings prior to World War I became known as the Modern Movement. The other modernist styles of the era, including Art Deco and Moderne, were also reflected in industrial architecture. At UIW, Building 40, constructed in 1941 as the Employment Office annex, shows the influence of the Moderne, with its two-story, beveled, glazed stair tower and entry. The entry door surround is faceted, with a simple, projecting overhang above.

Worker Amenities
The role of workers also changed, particularly during World War II, when massive labor pools, round the clock operation, and wartime production schedules made intense demands on both the worker and employer. Worker amenities, such as cafeterias, washrooms, and health care facilities, helped get top performance from the workers. These amenities were prominent in the World War II build-out at UIW.

Union Iron Works
UIW buildings followed general industrial trends in the choice of building material, primarily steel or concrete, as well as in the increased construction of worker amenities at the yard. UIW buildings from this period were not stylistically veneered with Modern Movement or Moderne façades with the exception of Building 40, as the necessity to build quickly and economically

[373] David Hounshell, "Ford Eagle Boats and Mass Production during World War I," *Military Enterprises and technological Change, Perspectives on the American Experience* (1985), 175.
[374] Biggs, *The Rational Factory,* 145

rendered such veneers superfluous. There was also no attempt to house the entire shipbuilding process under one roof, as was common in other industries. However, UIW did follow the most important trend, functional specificity: the plant was built around the process. As at other shipyards, the various shipbuilding processes were housed in separate buildings or areas of the district and linked by a material movement system.

Shipyard Architecture

Unlike other industries, U.S. shipbuilding declined following World War I. Since the U.S. entered World War I late, many of the ships constructed were actually completed after the war and many of these were stored, sold, or scrapped. During the Great Depression, additional maritime cutbacks were implemented. However, shipbuilding technology advanced despite the slowdown and ships became faster, safer, and larger. Designers envisioned new types of vessels, including aircraft carriers and small landing crafts.[375] Modifications in ships and technology resulted in changes to shipyards and associated buildings, particularly in the age of functional specificity. The transition from riveting to welding, for example, brought modifications to the shipyard and buildings and, similarly, new attitudes toward labor brought additional worker amenities such as cafeterias, washrooms, locker rooms, and health care facilities. Techniques of mass production perfected in other industries were also applied to shipbuilding. All of these developments were reflected in shipyards generally, and at UIW in particular.

The ability to pre-assemble small components into large assemblies was an important factor in the shipbuilding speed records achieved during World War II. The pre-assembly zone became a defining element of World War II shipyards, and the feature that clearly distinguished these new yards from older ones. New shipyards were specially designed with ship construction efficiency in mind and featured straight line, turning, or angle flow of materials, eliminating wasteful material transportation.

Straight line flow required a site with inland depth: materials could enter the yard be processed and fabricated in a linear flow, and arrive at the shoreline for final assembly at the shipways. If the site had limited space inland, but a lengthy shoreline, as with UIW, the turning flow design was used. [376] In this method, materials entered parallel to the shoreline, were processed in a straight line flow, and then turned at right angles to be assembled on the shipways.[377] Despite the option of the turning flow process, shipyard designers preferred straight line flow where property depth permitted. As Harry Gard Knox explained, “To whatever extent they depart from a straight line flow, some handling efficiency is apt to be lost.”[378]

Pre-assembly depended on a continuation of the trend begun before World War I, to modify the ship’s form to support ease of construction rather than optimal performance. Ship design was standardized and engineers were able to adapt mass production techniques from other industries and apply them to shipbuilding, particularly where parts were interchangeable. Thus, clients were able to order multiple quantities of identical ships.[379] This process brought increases in construction speed and efficiency, and required larger open spaces for layout and powerful cranes integrated into an extensive materials handling system.

[375] Bonnett, *Build Ships!,* 18-21.
[376] Also see Criterion A context in this document for discussion of the turning flow layout design.
[377] Bonnett, *Build Ships*!, 50.
[378] Harry Gard Knox, “Multiple Yards,” in Fassett, *Shipbuilding Business,* 213.
[379] Bonnett, *Build Ships!*, 25

Welding also impacted shipyard layout and design. Shipyards erected specialized welding platforms large enough to handle ship components, and the infrastructure to support this technology. While engineers during World War I began to realize the advantages of welding over riveting, the change did not take place immediately. It was not until 1927 that the welded hull was approved by the American Bureau of Shipbuilding.[380] These general trends in shipyard design were reflected at UIW.

Rapid Growth at UIW

In 1936, the federal government expanded shipyard infrastructure across the country, funding $10,013,000 in improvements at Bethlehem Steel's Union Iron Works.[381] This led to a period of rapid modernization and expansion, including an infrastructure upgrade, new tools, and new shop facilities. Most notably, these upgrades facilitated welding processes. Many of the upgrades focused on space utilization and material movement, both within existing buildings and in the yard. These improvements sought, to the extent possible in an existing yard, to provide a straight line pattern for the movement of materials.[382]

New buildings dating from the pre-war upgrades were all steel frame and included steel sash windows and doors. Walls were glazed to the maximum extent possible and stood over a five-foot high brick wall, with corrugated metal panels above the windows and cladding the roofs. Building interiors, for both new and existing buildings, were painted white to improve lighting and therefore increase worker safety. Each building was also equipped with Holophane Prismatic Refractor lighting fixtures in sufficient quantity to eliminate shadows. New buildings provided ample room around tools for swinging large work, while existing buildings were retooled to provide additional space to the extent possible.[383] Buildings erected during the war years were of similar construction; however, the masonry base on the earlier buildings, which acted as a moisture barrier, was omitted from the war era buildings, streamlining their construction. By 1945, UIW included over 150 separate resources—buildings, piers, slips, wet basins, and assembly yards; approximately 60 of these were buildings. An extensive material handling system and service trench tied these separate components into one unified whole.

In 1940, UIW was contracted, along with only five other private shipyards nationwide, to perform Navy work exclusively.[384] To promote this contractual arrangement, the federal government made further investments in UIW. Most notable was the New Yard, now known as the Building 12 Complex, located at the district's southeast quadrant where Risdon Iron Works once stood. A major upgrade to the rail system united the new facility with the rest of the shipyard.

The Building 12 Complex, comprising Buildings 12, 15, 16, 25, 32, and 66, was largely built in 1941 to construct anti-aircraft cruisers. Building 12**,** which housed the Plate Shop and Mold Loft, measures 248'-2" by 242'-2" in plan by 59'-6" tall, and is, as was most typical of this period, of steel frame construction with corrugated steel cladding. The complex lacks a stylistic veneer,

[380] Quivik, "Kaiser's Richmond Shipyards," 18.
[381] "Bethlehem Reconditions Potrero Works of Union Plant*."*
[382] "Bethlehem Reconditions Potrero Works of Union Plant," 23.
[383] "Bethlehem Reconditions Potrero Works of Union Plant," 24.
[384] After the attack on Pearl Harbor, the Navy program expanded and by spring 1942, over 60 yards were employed by the Navy.; Bonnett, *Build Ships!* 25.

but displays a visual power derived from its massing and the rhythm of its openings and roof monitors.

The Building 12 Complex and other developments at UIW from this period reflect the concept of functional specificity in several ways. Most important was the rationalization of the workflow process by establishing a straight or turning flow pattern. The desire for efficient work flow affected building placement and adjacencies, as well as the material handling system connecting the buildings. Other examples of functional specificity include the establishment and strategic placement of welding platforms and assembly layout areas, and adjacencies to slips, where final assembly and fitting out occurred.

Buildings 12, 15, 32, and 16 connect on at least one elevation. Within, they form a single interior space. While the compact Building 12 Complex approaches the industrial ideal of containing an entire production process within one space, much of the assembly took place on open platforms or in adjacent slips. Spatial constraints most likely dictated the compact form, as well as the turning, rather than the straight flow process. At shipyards where space constraints were not a factor, not only was the straight flow arrangement used, but the buildings remained widely spaced. Richmond Shipyard Number 3 is a good example of a contemporaneous shipyard arranged to permit straight flow, with ample space between buildings.

Part of the 1936 upgrades throughout the shipyard included new worker amenities. As at other industrial complexes, facilities such as washrooms, locker rooms, and cafeterias were built throughout, close to where people concentrated, based on the idea that improving facilities would improve performance. Building 25, nestled in a courtyard formed by much larger industrial buildings, exemplifies such amenities. This steel framed, steel clad building encloses rows of toilets, urinals, and gang washbasins. Other washrooms were scattered throughout the yard. Building 11, now housing artist studios, included a cafeteria.

The first aid facility occupied part of Building 51, which was an addition to the north elevation of Building 104, turning the 1896 building's former "T" shaped footprint into a rectangle. Offices occupied the upper two floors of the addition, while the first aid station, with separate areas for men and women, was located on the ground floor. This steel framed addition features a continuous ribbon of large multi-lite windows. The continuous window wall, essentially a curtain wall, was typical of the new buildings of this period at UIW, as well as of the general trend in industrial architecture.

Criterion C Conclusion

In each of the periods, UIW illustrated general trends in industrial architecture. From 1884 to 1900, the brick masonry buildings displayed the American round-arched style. 1900 to 1918 reflected the use of new building technologies, particularly reinforced concrete. The construction of administration buildings at this time illustrated the growing role of management, the desire for physical separation of management from labor, and the influence of the Ecole des Beaux Arts on American architecture. While little new building occurred from 1919 to 1935, the period from 1936 to 1945 depicted the influence of mass production, welding, and the desire to construct functionally specific buildings and spaces. UIW remains an exceptional and distinctive entity of local stature, reflecting developments in industrial architecture and shipyard design.

The buildings at Union Iron Works are significant because they represent important trends in industrial architecture over a 61 year period. They also form an exceptional, distinctive entity. Of the nation's major 1880s shipyards, only Newport News in Virginia and UIW survive today. Most extant World War II shipyards, such as Kaiser's Richmond Shipyard Number Three, only represent one significant time period in the history of American shipbuilding. The continued survival of Union Iron Works over its long history leaves an impressive architectural record, telling the story of the evolution of industrial architecture, and specifically of shipyards, during a period of profound technological and stylistic change in American architecture.

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____ preliminary determination of individual listing (36 CFR 67) has been requested
____ previously listed in the National Register
____previously determined eligible by the National Register
____designated a National Historic Landmark
____ recorded by Historic American Buildings Survey #_____
____recorded by Historic American Engineering Record # _____
____ recorded by Historic American Landscape Survey # _____

Primary location of additional data:
____ State Historic Preservation Office
____ Other State agency
____ Federal agency
_X_ Local government
____ University
____ Other
Name of repository: _Port of San Francisco_____

Historic Resources Survey Number (if assigned): _____

10. Geographical Data

Acreage of Property ___65_____

Latitude/Longitude Coordinates
Datum if other than WGS84:_____
(enter coordinates to 6 decimal places)

1. Latitude: 37.763497 Longitude: -122.379509

2. Latitude: 37.759964 Longitude: -122.379182

3. Latitude: 37.759659 Longitude: -122.381199

4. Latitude: 37.758183 Longitude: -122.381076

5. Latitude: 37.757831 Longitude: -122.381285

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10A. Latitude: 37.758718 Longitude: -122.386597

10B. Latitude: 37.759046 Longitude: -122.386612

11. Latitude: 37.758955 Longitude: -122.387277

12. Latitude: 37.763056 Longitude: -122.387722

13. Latitude: 37.763099 Longitude: -122.387057

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22. Latitude: 37.762283 Longitude: -122.384123

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26. Latitude: 37.762522 Longitude: -122.383136

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33. Latitude: 37.764125 Longitude: -122.381714

34. Latitude: 37.764956 Longitude: -122.381655

35. Latitude: 37.764956 Longitude: -122.380947

36. Latitude: 37.763349 Longitude: -122.380866

37. Latitude: 37.763357 Longitude: -122.380711

38. Latitude: 37.760211 Longitude: -122.380394

39. Latitude: 37.760257 Longitude: -122.379552

40. Latitude: 37.763485 Longitude: -122.379815

Verbal Boundary Description (Describe the boundaries of the property.)

See Boundary Map (Figure 18). Starting from the southeastern point and running clockwise, the district's boundary begins at the waterline, follows the property line just south of Slip 5 and south of the Building 12 Complex. The boundary runs west and continues to follow the property line, curving along the southern edge of the access road. The boundary then runs north, crosses 22nd Street, and continues north to the southeast corner of Building 117. It then runs west until it hits the eastern side of Illinois Street. The boundary follows Illinois Street past 20th Street and continues northward until reaching the north gate to the yard near Building 49. The boundary follows the northern edge of Building 49, running eastward toward Slip 4. The boundary lines jogs to the northeast, following the edge of Slip 4, and then continues eastward, following the northern edge of Slips 1 through 3. The boundary then wraps around the shoreline, jogging to include Wharves 3 and 4, but excluding wet basins enclosed by these wharves. It then follows the northern edge of Pier 68, turning north to include the two drydocks. It wraps the northern edge of the drydocks, turns east to wrap the northern ends of these features, and south along the eastern edge of drydock 2. It turns briefly east to include remnants of wharves 6 and 7, jogs back south until it hits Pier 70, then turns east to hug the northern edge of Pier 70. It follows this edge east, then wraps Wharf 8 off of Pier 70, then follows the southern line of Pier 70, turns southward, then west along the southern edge of Pier 70, and follows the eastern most point of Slips 5 through 8.

Boundary Justification (Explain why the boundaries were selected.)

The Union Historic District boundary is based on the boundary of the shipyard at the end of WWII, according to the Bethlehem Shipbuilding Division's 1945 Master Plan. The end of

WWII corresponds to the maximum build out and expansion of the yard. The district boundary, therefore, captures the entire shipyard's development from 1884 through 1945, except for the submarine repair yard, located off site to the north and no longer extant.

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11. Form Prepared By

name/title: Nancy Goldenberg, Principal Architectural Historian;
Allison Vanderslice, Cultural Resource Specialist
organization: Carey & Co., Inc.
street & number: 460 Bush Street
city or town: San Francisco state: California zip code: 94108
e-mail: nancy@careyco.com
telephone: 415-773-0773 x 225
date: Revised November 2013

Additional Documentation

Submit the following items with the completed form:

- **Maps:** A **USGS map** or equivalent (7.5 or 15 minute series) indicating the property's location.
- **Sketch map** for historic districts and properties having large acreage or numerous resources. Key all photographs to this map.
- **Additional items:** (Check with the SHPO, TPO, or FPO for any additional items.)

Photographs

Submit clear and descriptive photographs. The size of each image must be 1600x1200 pixels (minimum), 3000x2000 preferred, at 300 ppi (pixels per inch) or larger. Key all photographs to the sketch map. Each photograph must be numbered and that number must correspond to the photograph number on the photo log. For simplicity, the name of the photographer, photo date, etc. may be listed once on the photograph log and doesn't need to be labeled on every photograph.

Photo Log

Name of Property: Union Iron Works Historic District
City or Vicinity: San Francisco County: San Francisco
State: California
Photographer: Carey & Co., Inc.
Date Photographed: October 2013
Location of Original Digital Files: 460 Bush Street, San Francisco CA, 94108
Description of Photograph(s) and number, include description of view indicating direction of camera:

Photograph #1
Aerial view of Pier 70 and vicinity. North is to top of image.

Photograph #2
20th Street camera facing east.

Photograph #3
Building 101 camera facing northeast. Showing west and south façades.

Photograph #4
Building 102, camera facing northwest. Showing south façade.

Photograph #5
Building 104, camera facing northwest. Showing south façade.

Photograph #6
Building 103, camera facing southeast. Showing north façade and a segment of craneway from Building 105.

Photograph #7
Building 122, camera facing north. Showing south façade.

Photograph #8
Building 2, camera facing southeast. Showing west and north façades.

Photograph #9
Building 6, camera facing northeast. Showing west and south façades.

Photograph #10
Building 11, camera facing southwest. Showing east façade.

Photograph #11
Building 21, camera facing southeast. Showing north façades.

Photograph #12
Building 14, camera facing northeast. Showing west and south façades.

Photograph #13
Building 12, camera facing east. Showing west façade.

Photograph #14
Building 15, camera facing north. Showing south façade and opening through Building 15 into Building 12.

Photograph #15
Building 16, camera facing northwest. Showing east and south façades.

Photograph #16
Building 25, camera facing northeast. Showing south and west façades with Building 16 to the east and Building 15 to the north.

Photograph #17
Building 66, camera facing north. Showing south façade.

Photograph #18
Building 36, camera facing northwest. Showing south façade.

Photograph #19
Building 38, camera facing southeast. Showing north façade.

Photograph #20
Building 105, camera facing northeast. Showing west façade and south brick façade that faces 20th Street.

Photograph #21
Building 109, s camera facing northwest. Showing east façade.

Photograph #22
Buildings 110 and 50, camera facing northwest. Showing east façades.

Photograph #23
Building 11, camera facing southeast. Showing west and north façades.

Photograph #24
Building 113/114, camera facing southeast. Showing west façade and Building 115 and Building 116 to the south.

Photograph #25
Building 113/114, camera facing southeast. Showing north façade and 20th street.

Photograph #26
Building 113/114, camera facing southwest. Showing east façade.

Photograph #27
Building 115 and Building 116, camera facing west. Showing east façade and roof ventilators.

Photograph #28
Building 12, camera facing southeast. Showing north and west façades.

Photograph #29
Buildings 41 and Building 6 in background, camera facing southwest. Showing east façade of Building 6 and the now-underwater Building 141.

Photograph #30
Building 58, camera facing northeast. Showing west and south façades.

Photograph #31
Building 64, camera facing northeast. Showing west and south façades.

Photograph #32
Wharf No. 3, camera facing north. Showing the wharf deck and Whirley Crane No. 27.

Photograph #33
Drydock No. 2, camera facing north. Showing interior of drydock.

Photograph #34
Wharf No. 1, camera facing northwest. Showing east side of wharf and decayed deck.

Photograph #35
Wharf No. 6, camera facing south. Showing decayed decking with piles in the water.

Photograph #36
Slip No. 4, camera facing northeast. Showing slip and adjacent Whirley Cranes.

Photograph #37
Whirley Cranes, camera facing east. Showing Whirley Cranes and ships.

Photograph #38
Industrial Landscape, camera facing southeast. Showing west façades and roofs of Buildings 113/114, 115, and 116, Irish Hill, and Buildings 2 and 12 in background.

Photograph #39
Industrial Landscape, camera facing southwest. Showing roof of Building 38. Building 103 is to east of 20th Street. Showing north façades of buildings to north of 20th street, from left to right, including Buildings 105, 104, 102, and 101. Building 113/114 in background to south of 20th Street.

Photograph #40
Industrial Landscape, camera facing north. Showing Roof of Building 14 to left, Building 103 and 105 in foreground, Building 38, Building 111 and Whirley Crane in mid ground, and the San Francisco Bay Bridge in background.

Paperwork Reduction Act Statement: This information is being collected for applications to the National Register of Historic Places to nominate properties for listing or determine eligibility for listing, to list properties, and to amend existing listings. Response to this request is required to obtain a benefit in accordance with the National Historic Preservation Act, as amended (16 U.S.C.460 et seq.).
Estimated Burden Statement: Public reporting burden for this form is estimated to average 100 hours per response including time for reviewing instructions, gathering and maintaining data, and completing and reviewing the form. Direct comments regarding this burden estimate or any aspect of this form to the Office of Planning and Performance Management. U.S. Dept. of the Interior, 1849 C. Street, NW, Washington, DC.

Figure A. Latitude and Longitude Coordinates on Map. Background image Google Maps, 2008.

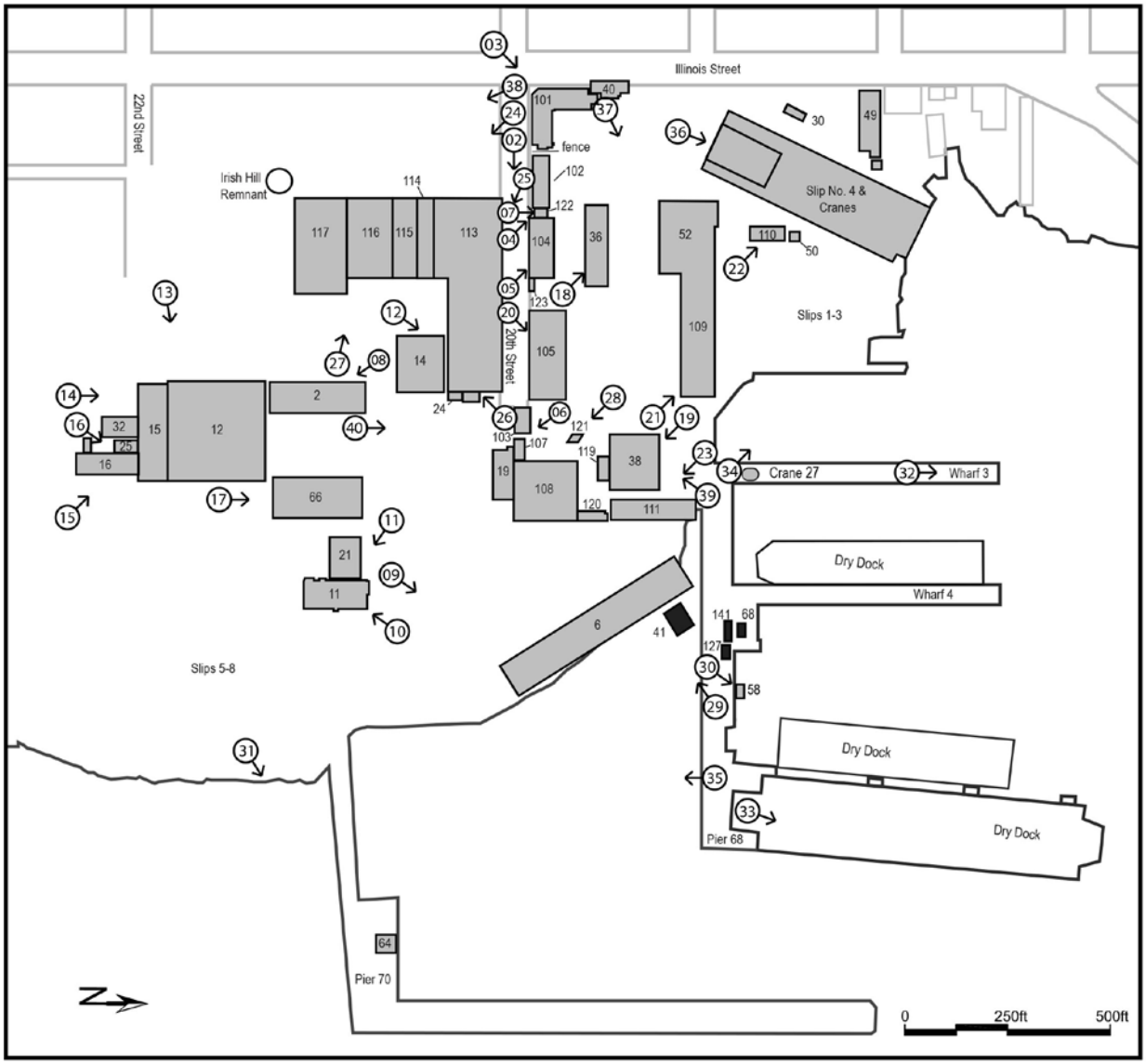

Figure B. Photo Key.

(#)→ Photo number, location and orientation

Figure C.

Union Iron Works Resources				
Contributing Buildings				
No.	**Historic Name**	**Historic Function**	**Construction Date**	**Photo Number**
2	Warehouse No. 2	drafting room, offices	1941, 1944	8
6	Light Warehouse No. 6	outfitting warehouse	1941	9, 29
11	Building 11	tool room, office	1941	10
12	Plate Shop No. 2	plate shop, mold loft	1941	13
14	Heavy Warehouse	heavy equipment storage	1941	12
15	Layout Yard	hull construction staging area	1941, 1944	14
16	Stress Relieving Building	hull construction	1941	15
19	Garage No. 1	garage, office	1941	
21	Substation No. 5	powerhouse, machine shop, transformer house	1900	11
25	Washroom and Locker Room	washroom, locker room	1941	16
30	Template Warehouse	wooden template storage	1941	
32	Template Warehouse	wooden template storage	1941, 1944	
36	Welding Shop	welding preassemblies	1941	18
38	Building 38	copper and pipe shop, electrical shop, brazing and tool room	1915, 1941	19
40	Building 40	employment office	1941	
49	Building 49	galvanizing warehouse	1941	
50	Building 50	substation	1941	
58	Building 58	substation	1943	30
64	Building 64	substation	1945	31
66	Building 66	welding shed	1945	17
101	Building 101	office	1917	3
102	Building 102	powerhouse	1912	4
103	Building 103	steam powerhouse	1937	6
104	Building 104	office	1896, 1941	2, 5
105	Building 105	flange, boiler, sheet metal, and forge shop	1890, 1937	20
107	Building 107	lumber and tube storage	1937	
108	Building 108	saw/planing mill, joiner shop	1911, 1913	
109	Building 109	plate shop, mold loft, machine shop, tool room	1912, 1936	21
110	Building 110	washroom, locker room	1936	22
111	Building 111	offices, storage, substation	1917	23
113/114, 23,24	Machine Shop, Blacksmith Shop	machine, erecting, blacksmith, engine, tool, brass, copper, bolt, rivet, and boiler shops, foundry furnace building, office, drawing room, testing	1885, 1886 1914	24, 25, 26, 38
115/116	Building 115/116	foundry, ordnance repair shop, warehouse, office	1916, 1917	27
117	Building 117	warehouse	1937, 1941	
119	Building 119	washroom	1936	
120	Building 120	pipe rack, women's washroom and locker room, storage	1936, 1942	
121	Building 121	timekeeper's office	1941	28
122	Building 122	checking house, storage	1937	
123	Building 123	gatemens' house	1914, 1941	

Contributing Structures and Sites				
	Historic Name	**Historic Function**	**Construction Date**	**Photo No.**
	Slip 4, Cranes 14 and 30	hull construction and launching	1941, 1943	36
	Whirley Crane 27	lifting and moving	1942	32
	Iron fence on 20th and Illinois Streets	decoration at entrance	1917	3
	Irish Hill	neighborhood/excavated for fill	excavated during WW I	
	Pier 68	transporting materials & labor	c. 1920, 1941, 1944	

Noncontributing Buildings				
No.	**Historic Name**	**Historic Function**	**Construction Date**	**Photo No.**
24	Washroom and Locker Room	washroom, locker room	1914, 1936, 1941	
41	Building 41	fire station	1941	
68	Building 68	powerhouse, office	1945	
127	Building 127	office, storage, locker room	1944	
141	Building 141	restroom, break area	1945	

Noncontributing Structures				
	Historic Name	**Historic Function**	**Construction Date**	**Photo No.**
	Wharves 1, 3, and 4	mooring, transporting materials	1883, 1915, 1957	
	Dry Docks 2 and Eureka	mooring, ship repairs	1960s, 1940s	33
	Pier 70 Wharves 6, 7, and 8	mooring, transporting materials	1941, 1942, 1945, 1980	35
	Slips 1, 2, and 3	ship construction	1915, 1959-1964	
	Slips 5, 6, 7, and 8	ship construction	1941, 1964	
	20th Street Paving Stones	transportation	1893-1895	
	Rail lines	transportation	1886-1930s	

Figure D. Sketch Map. Background image Google Maps, 2008.

Figure E.

List of Vessels Built at UIW 1884-1945

Ship Name	Owner	Type	Launched
Arago	Oregon Coal Company	Collier	2/27/1885
Adeline		Steam Launch	
General McDowell		Freighter	2/28/1885
Balboa	Panama Railroad	water boat	7/14/1886
Jubilee	Canadian Pacific Railroad Company	new steel steamer	7/20/1887
Emerald		Passenger	
Premier			
Charleston	US Navy	Cruiser	7/19/1888
Pomona	Pacific Coast Line	Cruiser	
Active	US navy	Tug	
San Francisco	US Navy	Cruiser	10/26/1889
Cruiser No. 5	US Navy	Cruiser	3/3/1885
Romola		Launch	
Colis	San Francisco Co.	Tug	
Salmo			
Monterey	US Navy	Monitor	4/28/1891
Whisper			
Olympia	US Navy	Cruiser	11/5/1892
Oregon	US Navy	Battleship	10/26/1893
Columbia	US Lightship Service	Light Ship	
Fearless	US Navy	Tug	
Peru	Pacific Mail Line	Freighter	
El Primero	Edward Hopkins	Steam Yacht	
Gracie S	Bay Pilots Assn.	Pilot Boat	
Santa Lucia		Tug	
George Loomis	Standard Oil Co.	Tanker	
(15) No name		Barges	
Northern Light			
Tahoe		Passenger Freighter	
Wheeling	US Navy	Gunboat	3/18/1897
Marietta	US Navy	Gunboat	3/18/1897
Helene	Wilder Steamship	Passenger Freighter	
Farragut	US Navy	Torpedo Boat	7/16/1898
Wisconsin	US Navy	Battleship	11/26/98
Izabel	Pacific Mail Line	Water Boat	
Chitose	Japanese Navy	Cruiser	1/22/98
No name		Launch	
Senator	Pacific Coast Line	Passenger Freighter	
Maui	Wilder Steamship	Passenger Freighter	
Berkeley	San Francisco Co.	Ferry	
St. Paul	Alaska Coal Co.	Freighter	
Sadie	Alaska Coal Co.	Tug	
Fearless	Spreckels Co.	Tug	
Wallula	Oregon Railraod	Tug	
Union	Union Iron Works	Tug	

List of Vessels Built at UIW 1884-1945

Ship Name	Owner	Type	Launched
Ohio	US Navy	Battleship	5/18/01
Wyoming	US Navy	Monitor	9/8/00
Paul Jones	US Navy	Destroyer	6/14/02
Perry	US Navy	Destroyer	10/27/00
Preble	US Navy	Destroyer	3/2/01
San Pablo	Santa Fe Railroad	Ferry	
Californian	American Mail Line	Freighter	
Manulani	Wilder Steamship	Passenger Freighter	
Tacoma	US Navy	Cruiser	6/2/03
Alaskan	American Hawaiin	Freighter	
Tamalpais		Ferry	
Spokane	Pacific Coast Line	Passenger Freighter	
Arizonian	American Hawaiin	Freighter	
Grampus	US Navy	Submarine	7/31/02
Pike	US Navy	Submarine	1/14/03
California	US Navy	Cruiser	4/28/04
South Dakota	US Navy	Cruiser	7/21/04
Milwaukee	US Navy	Cruiser	9/10/04
Mamaulate		Launch	
Whittler	Union Line	Passenger Freighter	
Like Like		Freighter	
Mexican	American Hawaiin	Freighter	
Columbian	American Hawaiin	Freighter	
Isthmian	American Hawaiin	Freighter	
Mauna Kea	Inter Island Line	Passenger Freighter	
Contra Costa	Standard Oil Co.	Tank Barge	
LT W. L. Murphy	US Navy	Passenger Tug	
LT J. A. Pusney	US Navy	Passenger Tug	
CAPT Anton Springer	US Navy	Passenger Tug	
No name	US Navy	Caisson	
No name		Pontoon	
F-1	US Navy	Submarine	3/12/12
F-2	US Navy	Submarine	3/19/12
Napa Valley		Ferry	
San Pedro	Santa Fe Railroad	Ferry	
Kilauea	Inter Island Line	Passenger Freighter	
H-1	US Navy	Submarine	5/6/12
H-2	US Navy	Submarine	6/4/13
H-3	US Navy	Submarine	3/14/14
No name	US Navy	Caisson	
K-7	US Navy	Submarine	6/20/14
K-8	US Navy	Submarine	7/11/14
No name	US Navy	Pontoon	
William Chatham	Loop Lumber Co.	Lumber Carrier	
Henry T. Scott		Lumber Carrier	

List of Vessels Built at UIW 1884-1945

Ship Name	Owner	Type	Launched
Aroline		Passenger Freighter	
Petroleum No. 3	Standard Oil Co.	Tanker	
Pico		Tank Barge	
Frank H. Buck	Tidewater Oil Co.	Tanker	
No name	Panama Canal Commission	Caisson	
No name	Standard Oil Co.	Barge	
No name	Union Iron Works	Dredge	
J. A. Moffett	Standard Oil of California	Tanker	
Lyman Stewart	Standard Oil of California	Tanker	
No name		Dredge	
U.I.W. No. 3	Union Iron Works	Launch	
Pacific	American South African Line	Passenger Freighter	
Eurana	American South African Line	Passenger Freighter	
Olinoa	Union Oil of California	Tank Barge	
La Brea	Union Oil of California	Tanker	
Los Angeles	Union Oil of California	Tanker	
D.G. Scofield	Standard Oil of California	Tanker	
Acme	Soconey-Vacuum Oil	Tanker	
Davenger	Nav. & Coal Co.	Freighter	
Maui	Matson Navigation	Passenger Freighter	
Astral	Soconey-Vacuum Oil	Tanker	
H.C. Folger	Atlantic Refining	Tanker	
J. W. Van Dyke	Atlantic Refining	Tanker	
Paulsboro	Soconey-Vacuum Oil	Tanker	
War Knight	UK Admiralty	Freighter	
War Monarch	UK Admiralty	Freighter	
Fred W. Weller	Standard Oil of New Jersey	Tanker	
A.C. Bedford	Standard Oil of California	Tanker	
Eagle	Soconey-Vacuum Oil	Tanker	
Tiger	Soconey-Vacuum Oil	Tanker	
Talabat		General Cargo	
Bessa		General Cargo	
George G. Henry	Standard Oil of New Jersey	Tanker	
War Sword	UK Admiralty	General Cargo	
J. E. O'Neil	Atlantic Refining	Tanker	
Herbert L. Pratt	Atlantic Refining	Tanker	
S. M. Spalding	Standard Oil of New Jersey	Tanker	
Paul H. Harwood	Standard Oil of New Jersey	Tanker	
W. S. Rheem	Standard Oil of New Jersey	Tanker	
W. M. Irish	Atlantic Refining	Tanker	
W. M. Burton	Atlantic Refining	Tanker	
Volunteer	US Shipping Board	General Cargo	
Wichita/Liberator	US Shipping Board	General Cargo	
No name	Union Iron Works	Dry Dock	
Challenger	US Shipping Board	General Cargo	

List of Vessels Built at UIW 1884-1945

Ship Name	Owner	Type	Launched
Redondo	A.O. Linovig.	General Cargo	
No name	Union Iron Works	Caisson	
McKee	US Navy	Destroyer	3/23/18
Robinson	US Navy	Destroyer	3/28/18
Ringgold	US Navy	Destroyer	4/14/18
McKean	US Navy	Destroyer	7/4/18
Harding	US Navy	Destroyer	7/4/18
Gridley	US Navy	Destroyer	7/4/18
War Harbour/Independence	UK Admiralty	General Cargo	
War Haven/Victorious	UK Admiralty	General Cargo	
War Ocean/Defiance	UK Admiralty	General Cargo	
War Rock/Invincible	UK Admiralty	General Cargo	
War Sea/Courageous	UK Admiralty	General Cargo	
War Cape/Triumph	UK Admiralty	General Cargo	
War Surf/Eclipse	UK Admiralty	General Cargo	
War Wave/Archer	UK Admiralty	General Cargo	
Steadfast	US Shipping Board	General Cargo	
Dreadnaught	Rolph Navigation Co.	Tug	
Undaunted	Rolph Navigation Co.	Tug	
R-15	US Navy	Submarine	12/10/17
R-16	US Navy	Submarine	12/15/17
R-17	US Navy	Submarine	12/24/17
R-18	US Navy	Submarine	1/8/18
R-19	US Navy	Submarine	1/28/18
R-20	US Navy	Submarine	1/21/18
Schey	US Navy	Destroyer	3/28/18
Champlin	US Navy	Destroyer	4/7/18
Mugford	US Navy	Destroyer	4/14/18
Chew	US Navy	Destroyer	5/26/18
Hazelwood	US Navy	Destroyer	6/22/18
Williams	US Navy	Destroyer	7/4/18
Crane	US Navy	Destroyer	7/4/18
Hart	US Navy	Destroyer	7/4/18
Ingraham	US Navy	Destroyer	7/4/18
Ludlow	US Navy	Destroyer	7/9/18
Burns	US Navy	Destroyer	7/4/18
Anthony	US Navy	Destroyer	8/10/18
Sproston	US Navy	Destroyer	8/10/18
Rizal	US Navy	Destroyer	9/21/18
Mackenzie	US Navy	Destroyer	9/29/18
Renshaw	US Navy	Destroyer	9/21/18
O'Bannan	US Navy	Destroyer	9/28/18
Hogan	US Navy	Destroyer	4/12/19
Howard	US Navy	Destroyer	4/26/19
Stansbury	US Navy	Destroyer	5/16/19

List of Vessels Built at UIW 1884-1945

Ship Name	Owner	Type	Launched
S-30	US Navy	Submarine	11/21/18
S-31	US Navy	Submarine	12/28/18
S-32	US Navy	Submarine	1/11/19
S-33	US Navy	Submarine	12/5/18
S-34	US Navy	Submarine	2/13/19
S-35	US Navy	Submarine	2/27/19
S-36	US Navy	Submarine	6/3/19
S-37	US Navy	Submarine	6/20/19
S-38	US Navy	Submarine	6/17/19
S-39	US Navy	Submarine	7/2/19
S-40	US Navy	Submarine	1/5/21
S-41	US Navy	Submarine	2/21/21
Heffron	US Shipping Board	Cargo Ship	
Hegira	US Shipping Board	Cargo Ship	
Chauncey	US Navy	Destroyer	9/29/18
Fuller	US Navy	Destroyer	12/5/18
Percival	US Navy	Destroyer	12/5/18
John Francis Burns	US Navy	Destroyer	11/10/18
Farragut	US Navy	Destroyer	11/21/18
Somers	US Navy	Destroyer	12/28/18
Stoddart	US Navy	Destroyer	1/6/19
Reno	US Navy	Destroyer	1/22/19
Farquhar	US Navy	Destroyer	1/18/19
Thompson	US Navy	Destroyer	1/19/19
Kennedy	US Navy	Destroyer	2/15/19
Paul Hamilton	US Navy	Destroyer	2/21/19
William Jones	US Navy	Destroyer	4/9/19
Woodbury	US Navy	Destroyer	2/6/19
S. P. Lee	US Navy	Destroyer	4/22/19
Nicholas	US Navy	Destroyer	5/1/19
Young	Us Navy	Destroyer	5/8/19
Zeilin	US Navy	Destroyer	5/28/19
Yarborough	US Navy	Destroyer	6/20/19
La Vallete	US Navy	Destroyer	7/15/19
Sloat	US Navy	Destroyer	5/14/19
Woodbury	US Navy	Destroyer	5/28/19
Shirk	US Navy	Destroyer	6/20/19
Kidder	US Navy	Destroyer	7/10/19
Selfridge	US Navy	Destroyer	7/25/19
Marcus	US Navy	Destroyer	8/22/19
Mervine	US Navy	Destroyer	8/11/19
Chase	US Navy	Destroyer	9/2/19
Robert Smith	US Navy	Destroyer	9/19/19
Mullany	US Navy	Destroyer	7/9/20
Coghlan	US Navy	Destroyer	6/16/20

List of Vessels Built at UIW 1884-1945

Ship Name	Owner	Type	Launched
Preston	US Navy	Destroyer	8/7/20
Lamson	US Navy	Destroyer	9/1/20
Bruce	US Navy	Destroyer	5/20/20
Hall	US Navy	Destroyer	2/18/21
Macdonough	US Navy	Destroyer	12/15/20
Ferneholt	US Navy	Destroyer	3/9/21
Sumner	US Navy	Destroyer	11/24/20
Corry	US Navy	Destroyer	3/28/21
Melvin	US Navy	Destroyer	4/11/21
San Mateo	Jas. Ralph & Co.	Ferry	
Shasta	Jas. Ralph & Co.	Ferry	
Yosemite	Jas. Ralph & Co.	Ferry	
Standard Service	Standard Oil	Tanker	
Alaska Standard	Standard Oil	Tanker	
Barge No. 5	Shell of California	Tank Barge	
Barge No. 6	Shell of California	Tank Barge	
Shaloe	Pacific Coast Line	Passenger Freighter	
Hawaii	Hawaii Mail Line	Passenger	
El Paso	Richmond & SF TPTN. Co.	Ferry	
New Orleans	Richmond & SF TPTN. Co.	Ferry	
Klamath	Richmond & SF TPTN. Co.	Ferry	
Hawaiin Standard	Standard Oil	Tanker	
General	General Petroleum	Cargo Ship	
Richlube	Richfield Oil	Tanker	
Barge No. 2	Richfield Oil	Tank Barge	
Associates	Associates Oil	Tanker	
Fresno	Southern Pacific Railroad	Ferry	
Stockton	Southern Pacific Railroad	Ferry	
Mendocino	Southern Pacific Railroad	Ferry	
	Santa Fe Railroad	Car Float	
Waialeale	Inter Island Line	Passenger/Cargo	
Hualalai	Inter Island Line	Passenger/Cargo	
Delta Standard		Tanker	
Humuula		Passenger	
Eleu		Tug	
Los Angeles		Derrick Barge	
Y.B.5		Deck Barge	
Y.B.6		Deck Barge	
Y.B.7		Deck Barge	
Y.B.8		Deck Barge	
Mamo			
Y.B.10		Deck Barge	
Barge No. 7		Deck Barge	
McCall	US Navy	Destroyer	11/20/37
Maury	US Navy	Destroyer	2/14/38

List of Vessels Built at UIW 1884-1945

Ship Name	Owner	Type	Launched
John F. Hartley	US Coast Guard	Revenue Cutter	
Water Nymph			
Kingfisher			
Dauntless			
Luckenbach No. 5	LuckenBach SS Co.	Tug	
Denis T. Sullivan			
David Scannell			
Leslie Baldwin			
San Gabriel			
Santa Cruz	US Navy	C1-B	10/30/41
Alcoa Pioneer	US Navy	C1-B	11/29/41
Alcoa Pilgrim	US Navy	C1-B	1/15/42
Alcoa Patriot	US Navy	C1-B	2/12/42
Alcoa Puritan	US Navy	C1-B	3/17/42
No name	US Navy	YB	4/11/42
Laffey	US Navy	DD	5/8/42
Woodworth	US Navy	DD	6/4/42
Caldwell	US Navy	DD	7/18/42
Coghlan	US Navy	DD	10/23/42
Fazier	US Navy	DD	7/30/42
Gansevoort	US Navy	DD	4/11/42
Gillespie	US Navy	DD	5/8/42
Hobby	US Navy	DD	6/4/42
Kalk	US Navy	DD	7/18/42
Oakland	US Navy	CL	10/23/42
Reno	US Navy	CL	12/23/42
Abner Read	US Navy	DD	8/18/42
Ammen	US Navy	DD	9/17/42
Mullany	US Navy	DD	10/10/42
Bush	US Navy	DD	10/27/42
Trathen	US Navy	DD	10/22/42
Hazelwood	US Navy	DD	11/20/42
Heerman	US Navy	DD	12/5/42
Hoel	US Navy	DD	12/19/42
McCord	US Navy	DD	1/10/43
Miller	US Navy	DD	3/7/43
Owen	US Navy	DD	3/21/43
The Sullivans	US Navy	DD	4/4/43
Stephen Potter	US Navy	DD	4/28/43
Tingey	US Navy	DD	5/28/43
Twining	US Navy	DD	7/11/43
Yarnall	US Navy	DD	7/25/43
No name	US Navy	YB	
Flint	US Navy	CL	1/25/44
Tucson	US Navy	CL	9/3/44

List of Vessels Built at UIW 1884-1945

Ship Name	Owner	Type	Launched
	US Navy	DD	
	US Navy	DD	
Stockham	US Navy	DD	6/25/43
Wedderburn	US Navy	DD	8/1/43
Foreman	US Navy	DE	8/1/43
Whitehurst	US Navy	DE	9/5/43
England	US Navy	DE	9/26/43
Witter	US Navy	DE	10/17/43
Bowers	US Navy	DE	10/31/43
Willmarth	US Navy	DE	11/21/43
Gendreay	US Navy	DE	12/12/43
Fieberling	US Navy	DE	4/2/44
William M. Cole	US Navy	DE	12/29/43
Paul G. Baker	US Navy	DE	4/7/44
Damon M. Cummings	US Navy	DE	4/16/44
Vammen	US Navy	DE	5/21/44
Putnam	US Navy	DD	3/26/44
Strong	US Navy	DD	4/23/44
Lofberg	US Navy	DD	8/12/44
John W. Thomason	US Navy	DD	9/30/44
Buck	US Navy	DD	3/11/45
Henley	US Navy	DD	4/8/45
William C. Lawe	US Navy	DD	5/21/45
Lloyd Thomas	US Navy	DD	10/5/45
Keppler	US Navy	DD	6/24/46
Lansdale	US Navy	DD	12/20/46
Seymour D. Owens	US Navy	DD	1/24/47
Hoel	US Navy	DD	
Abner Read	US Navy	DD	

Pier 70 San Francisco-Historic Shipyard at Poterro Point, *Ships Built at Pier 70, San Francisco,* http://www.pier70sf.org/history/shipsBuilt/ShipsBuiltAll.html#preWW2 and http://www.pier70sf.org/history/shipsBuilt/ShipsBuiltAll.html#WW2 (accessed 2008).

Figure 1. Aerial view of the Union Iron Works Historic District with property identified by name or number. Background image Google Maps, 2008.

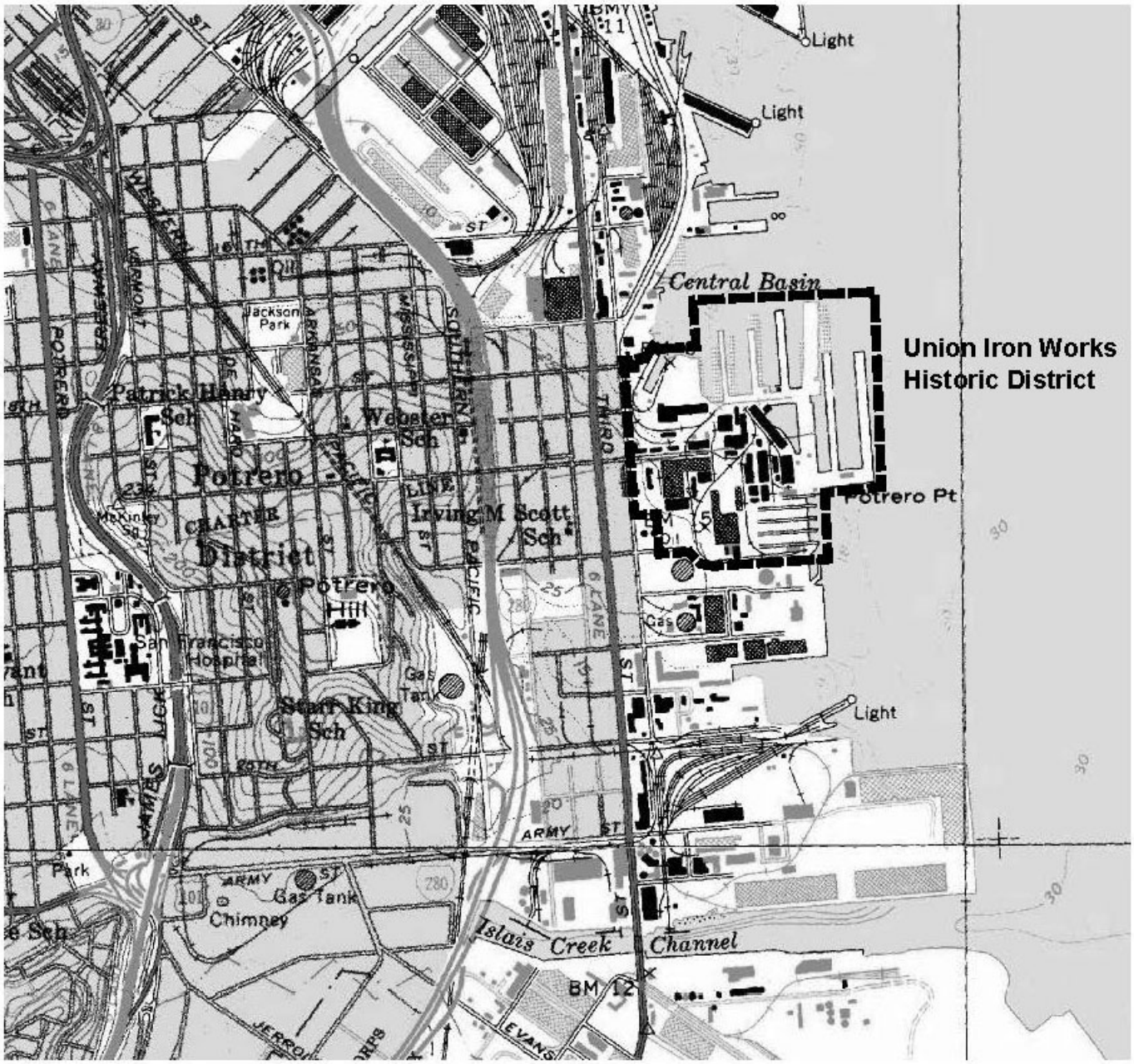

Figure 2. Union Iron Works Historic District Location Map, San Francisco North Quad, 1978.

Figure 3. Ownership Map of the Union Iron Works Historic District. Boundaries shown above are approximate and are roughly based on the 1886, 1899, and 1914 Sanborn Maps. Background image Google Maps, 2008.

Union Iron Works District Boundary

Pacific Rolling Mills (1868-1900)
Boundary estimated from 1886 Sanborn

Union Iron Works Shipyard in 1884
Boundary estimated from 1886 Sanborn

Risdon Iron and Locomotive Works
(1900-1911)

Boundary of the WWI U. S. Destroyer Plant operated by Union Iron Works Company
Owned by the U. S. Steel Products Company (U. S. Steel Corp. Subsidiary)

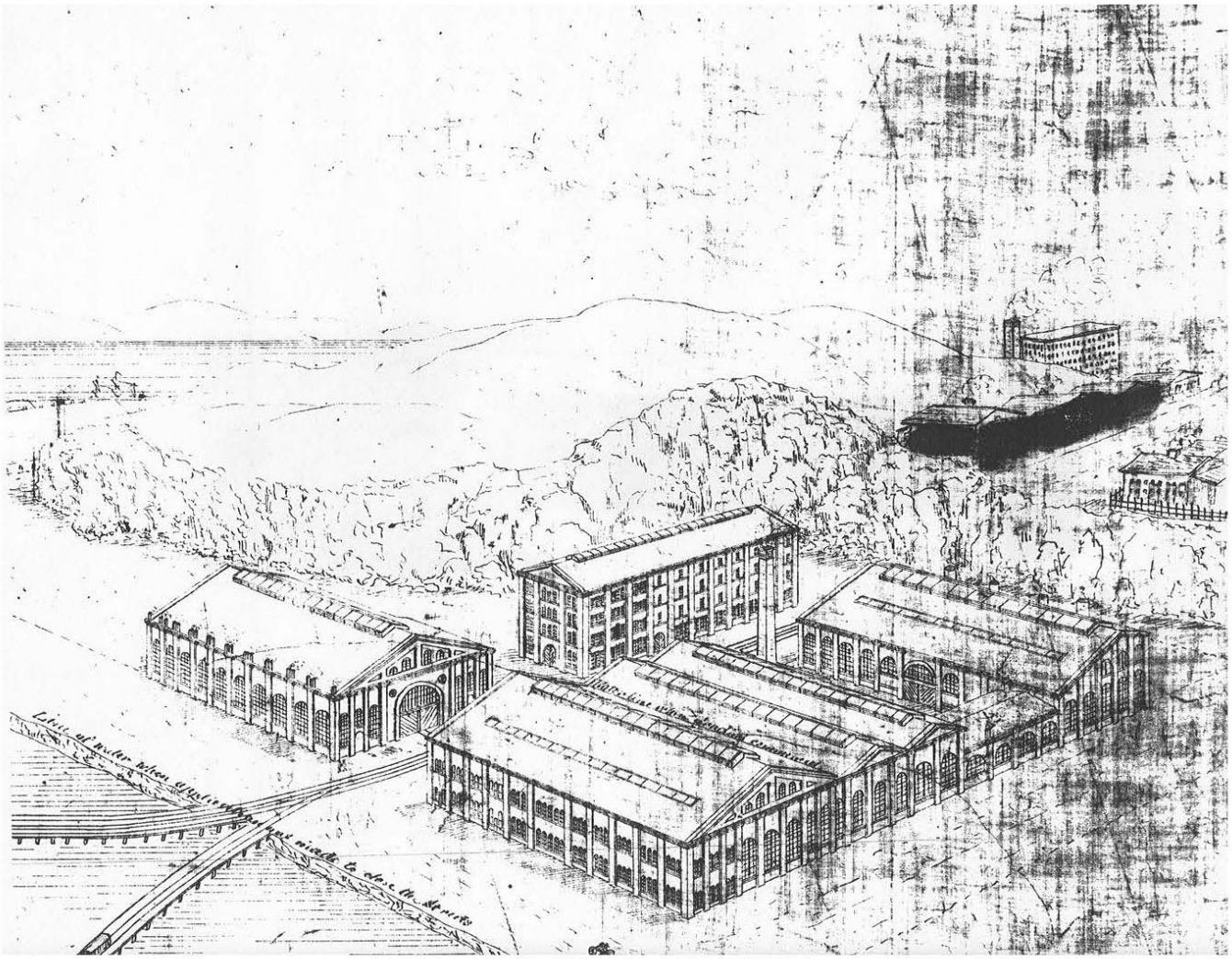

Figure 4. An 1884 Line drawing showing the extent of Irish Hill behind the original Union Iron Works buildings. San Francisco Maritime Museum.

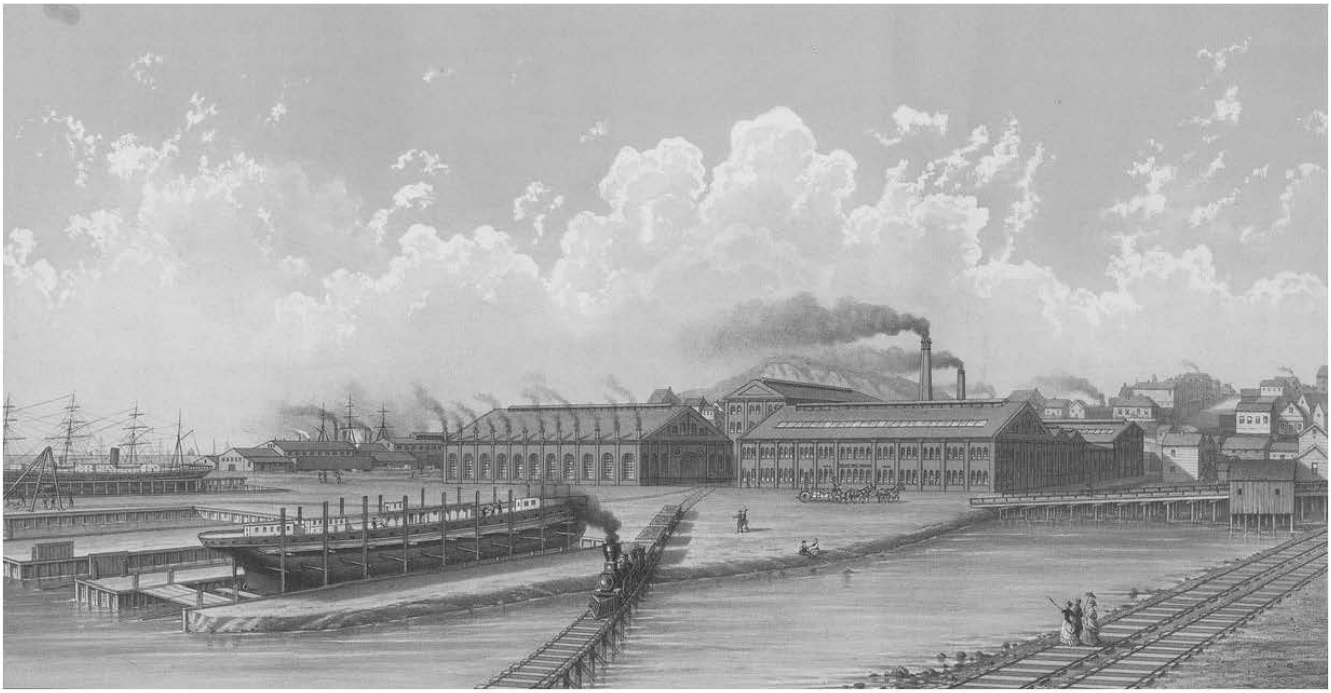

Figure 5. 1880s view of Union Iron Works showing the early development of the waterfront and Building 113 before it was connected in 1914. This view fails to show the plate shop at the head of the slipways. Note the bridge access to the yard along 20th Street.
Bancroft Library, University of California at Berkeley.

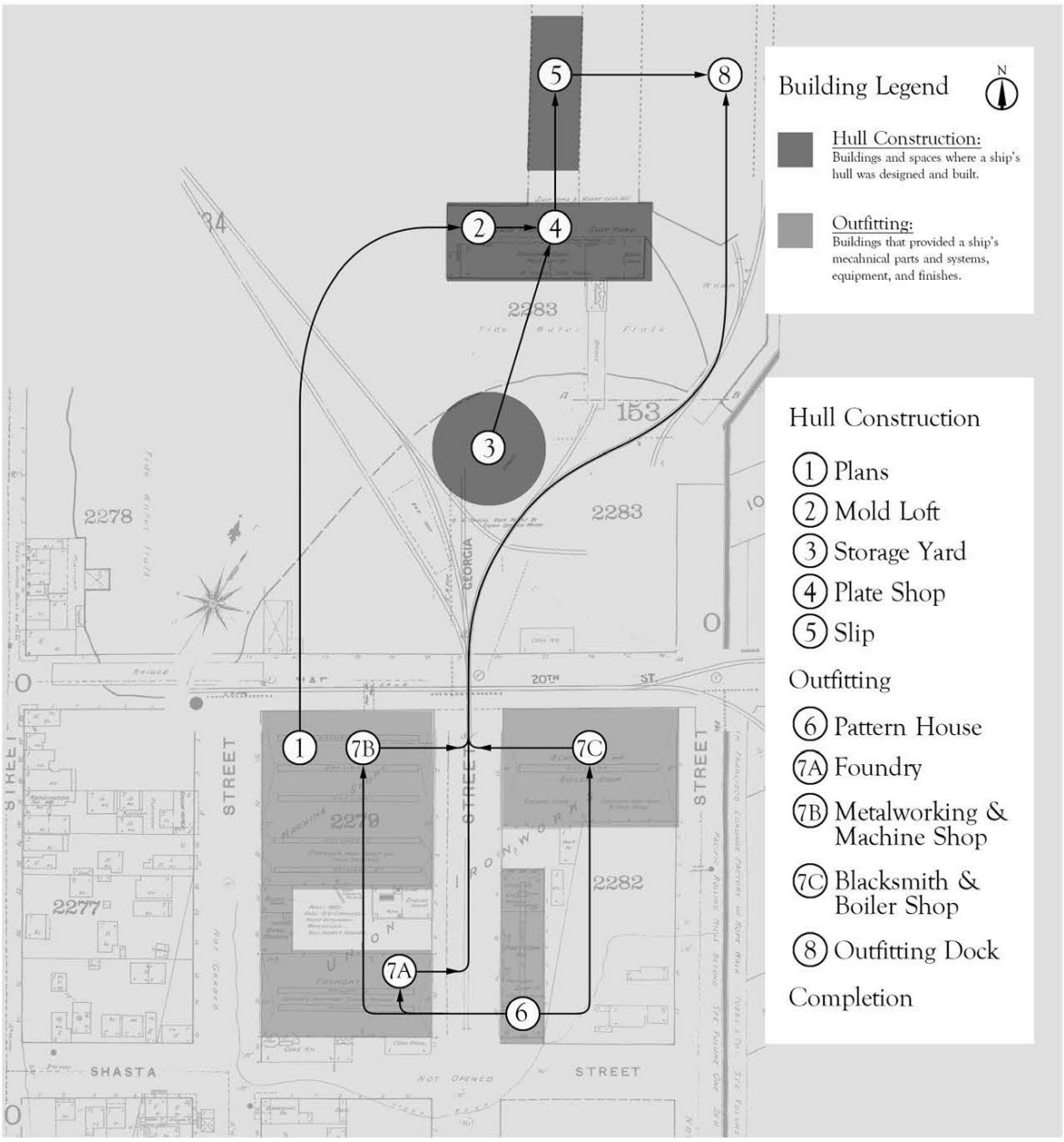

Figure 6. The Shipbuilding Process at Union Iron Works during the 1880s.
This map shows the general process of hull construction and outfitting at the yard. A ship's design or **plan** originated in the yard's office in the Machine Shop's mezzanine (Building 113). Loftsmen laid down the lines of the hull on the **mold loft** floor by scaling up from wood models or plans. Full-sized templates for the hull plates were measure on the floor, cut, and moved downstairs to the plate shop. Workers moved steel plates from the **storage yard** to the **plate shop**, where skilled workers cut the steel plates, carefully trimming them to match the templates. Workers moved the plates on carts to the hull on the **slip**, cranes positioned plates, and rivetting gangs riveted the plates to the hull. After the hull was complete, it was launched, moved to the **outfitting dock**, and fitted with propulsion systems, infrastructure, and crew quarters. Components for a ship's engine or boiler often started as wood patterns produced by pattern makers in the **pattern house**. Propulsion-related components were cast in the **foundry** and moved to the **machine shop** or **boiler shop**. Completed engines, boilers, or other components were moved by rail to the **outfitting dock**.

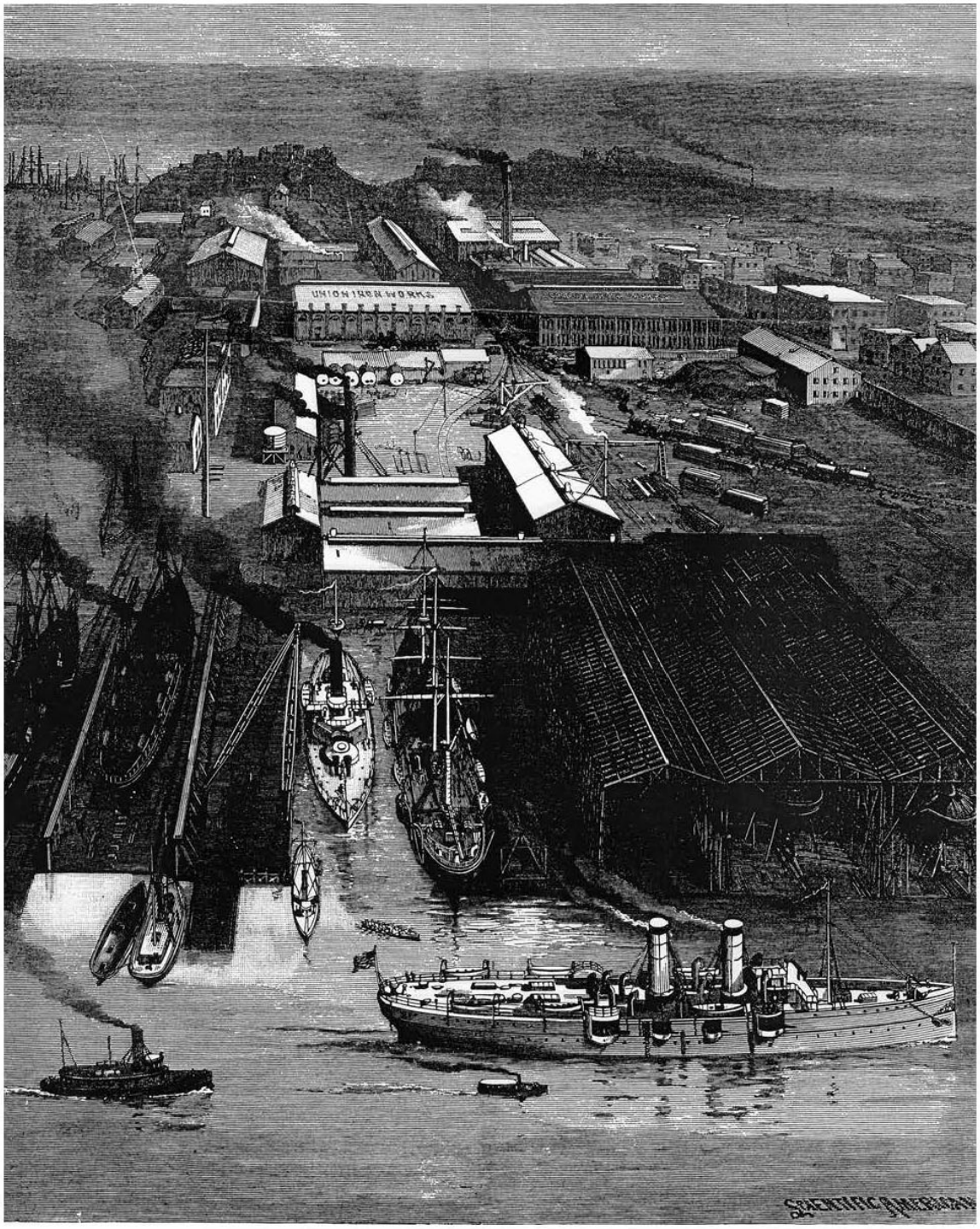

Figure 7. 1892 Scientific American View of the Union Iron Works Shipyard.
This view shows the plate shop, the hydraulic dry dock, the truss structures and cranes over the slips, and the storage areas south of the plate shop along with the machine and metal working shops shown on earlier views.

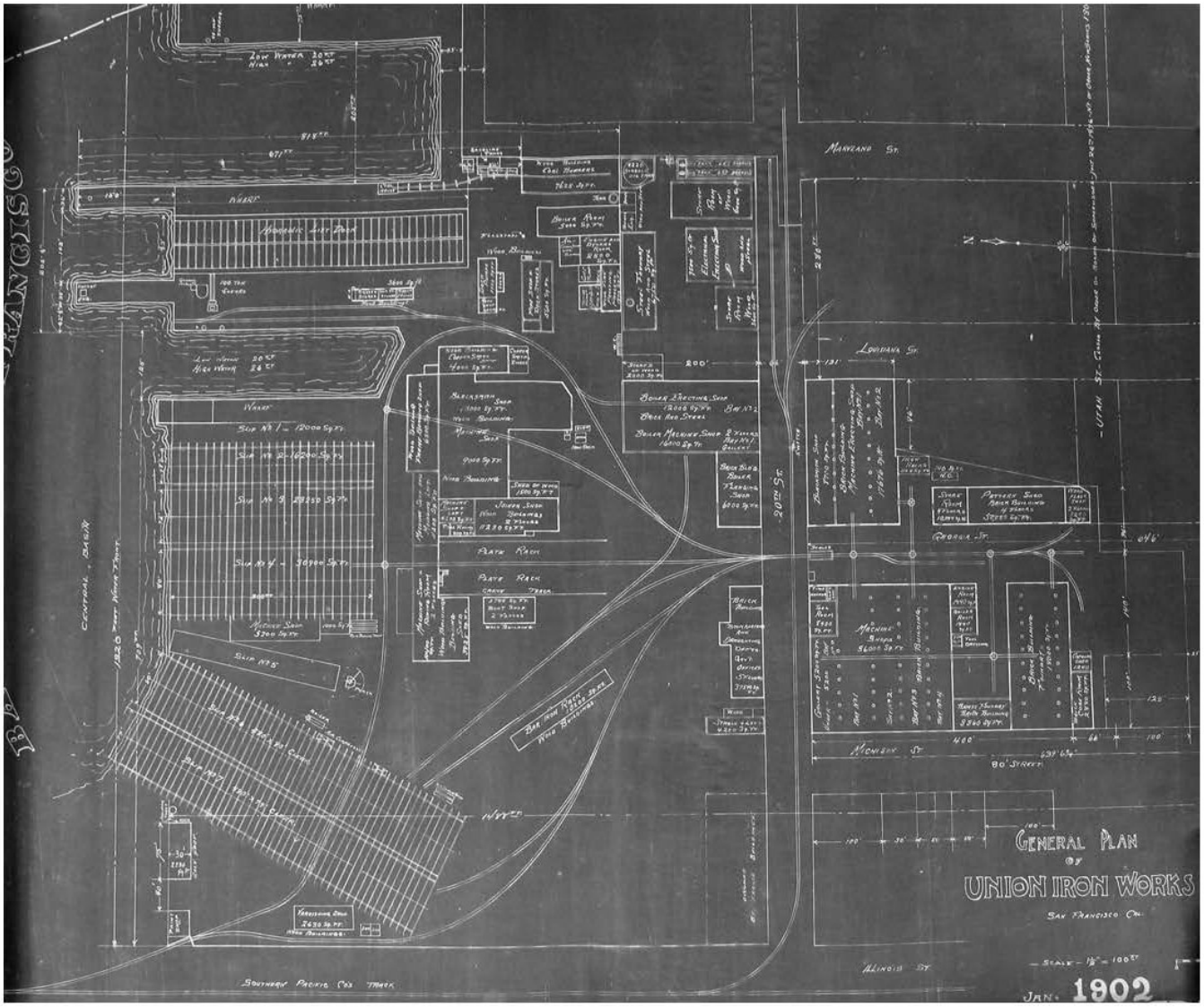

Figure 8. 1902 General Plan of the Union Iron Works. San Francisco Maritime Museum.

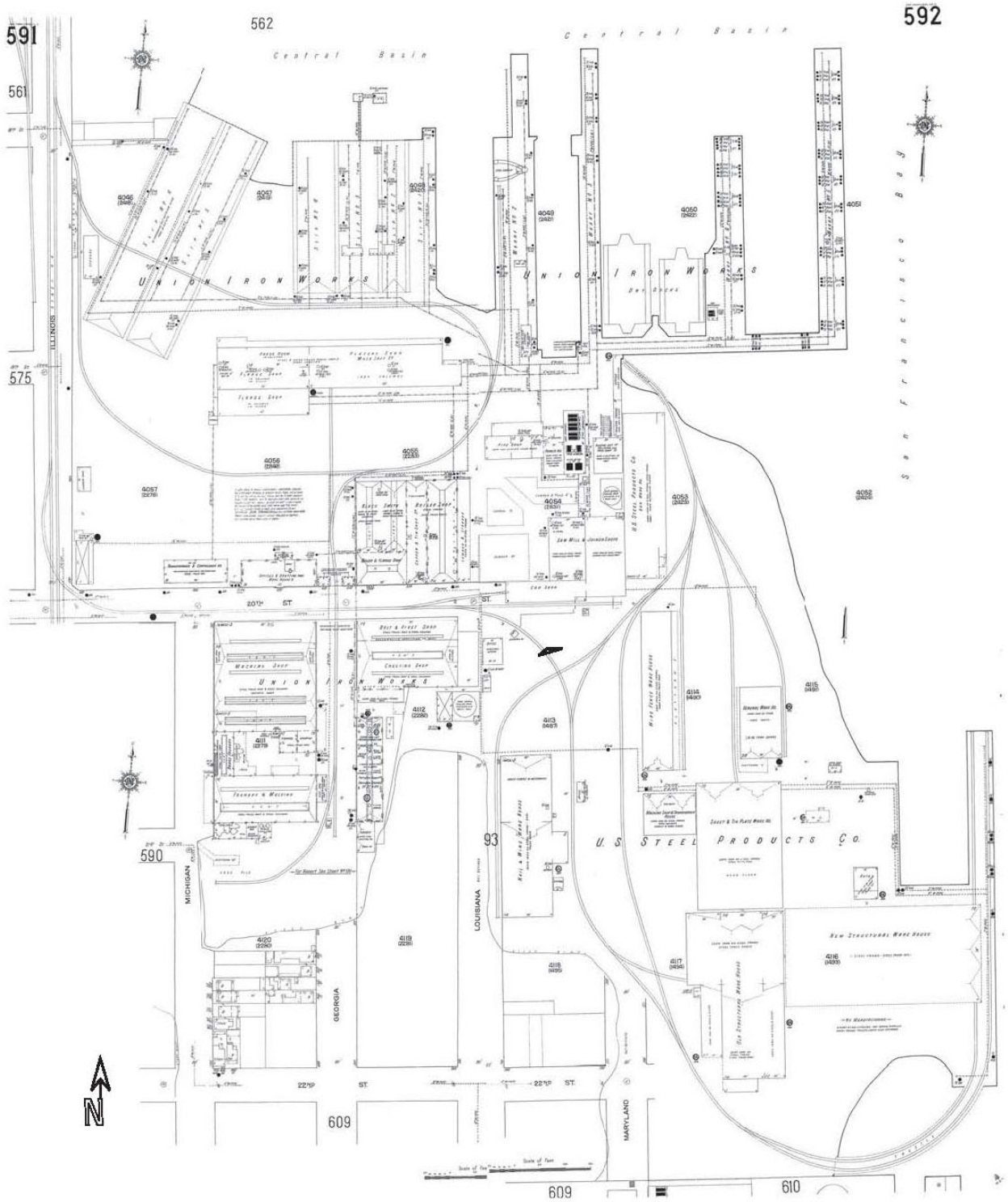

Figure 9. 1914 Sanborn Insurance Company Map of Union Iron Works. Note that the U. S. Steel Products Co. is the owner of the former Risdon shipyard and that the Risdon buildings were mainly used for warehouses. Note that the majority of the streets shown on this map are labeled as unopened and several are impassable.

Figure 10. View of Union Iron Works c. 1917. San Francisco Maritime Museum.

Figure 11. View of Union Iron Works Company during WWI. San Francisco Maritime Museum.

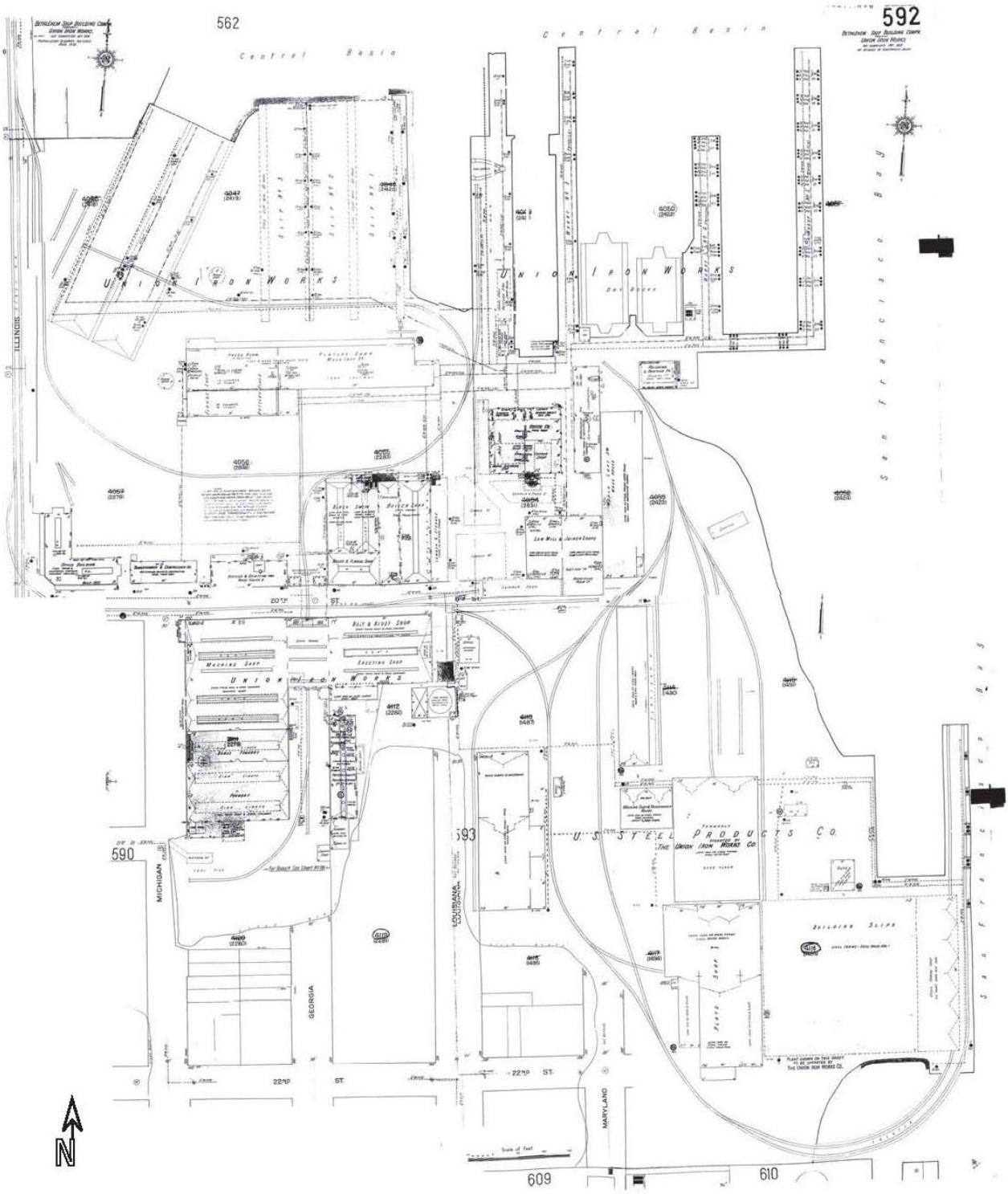

Figure 12. 1936 Sanborn Insurance Company Map showing UIW during the 1936 upgrades and WWI destroyer shipyard in the southeastern corner.

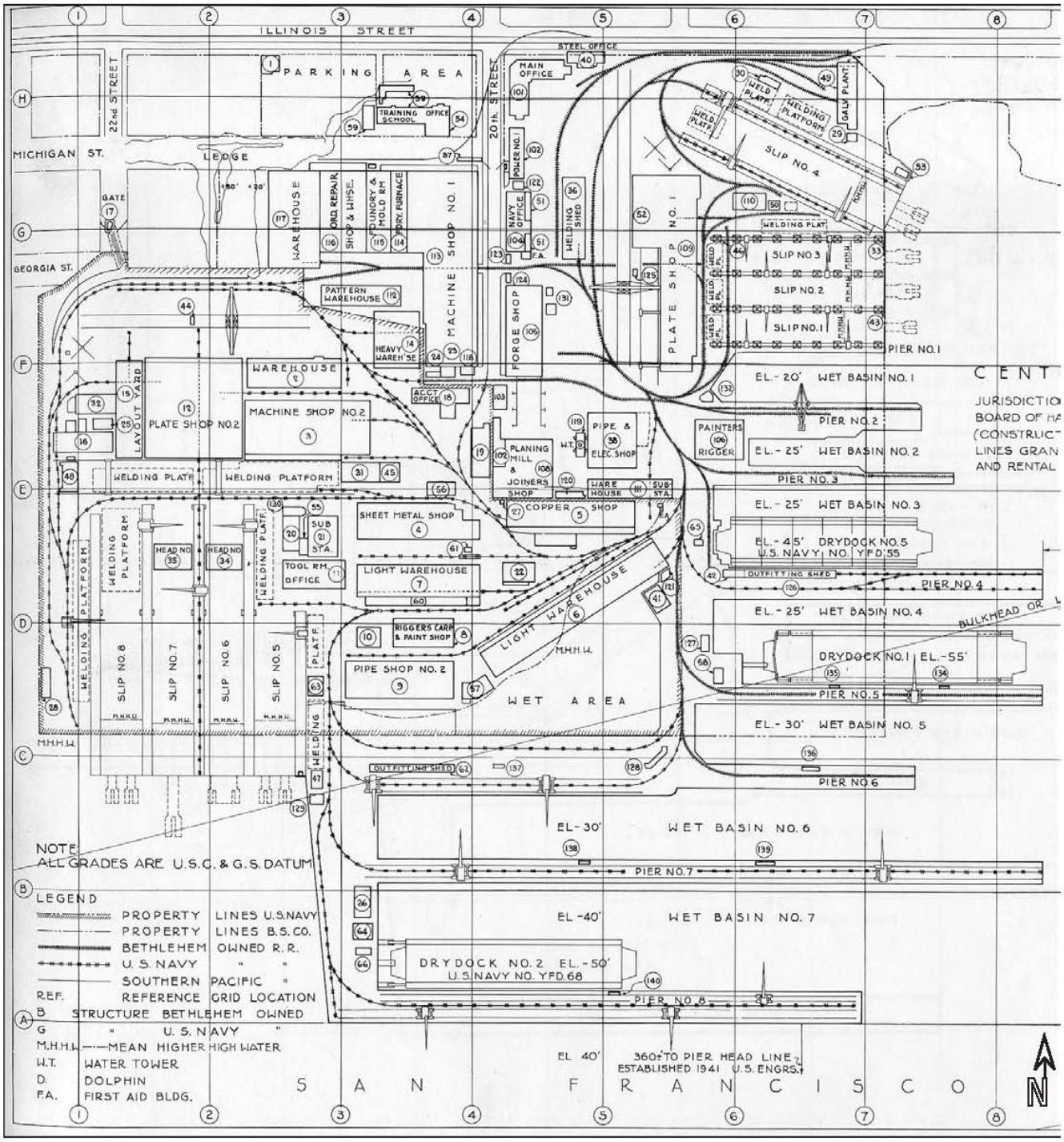

Figure 13. 1945 Bethlehem Steel Site Plan showing the yard's maximum build out. The New Yard or Building 12 Complex is shown in the lower left corner. Note the different ownership of rail lines.

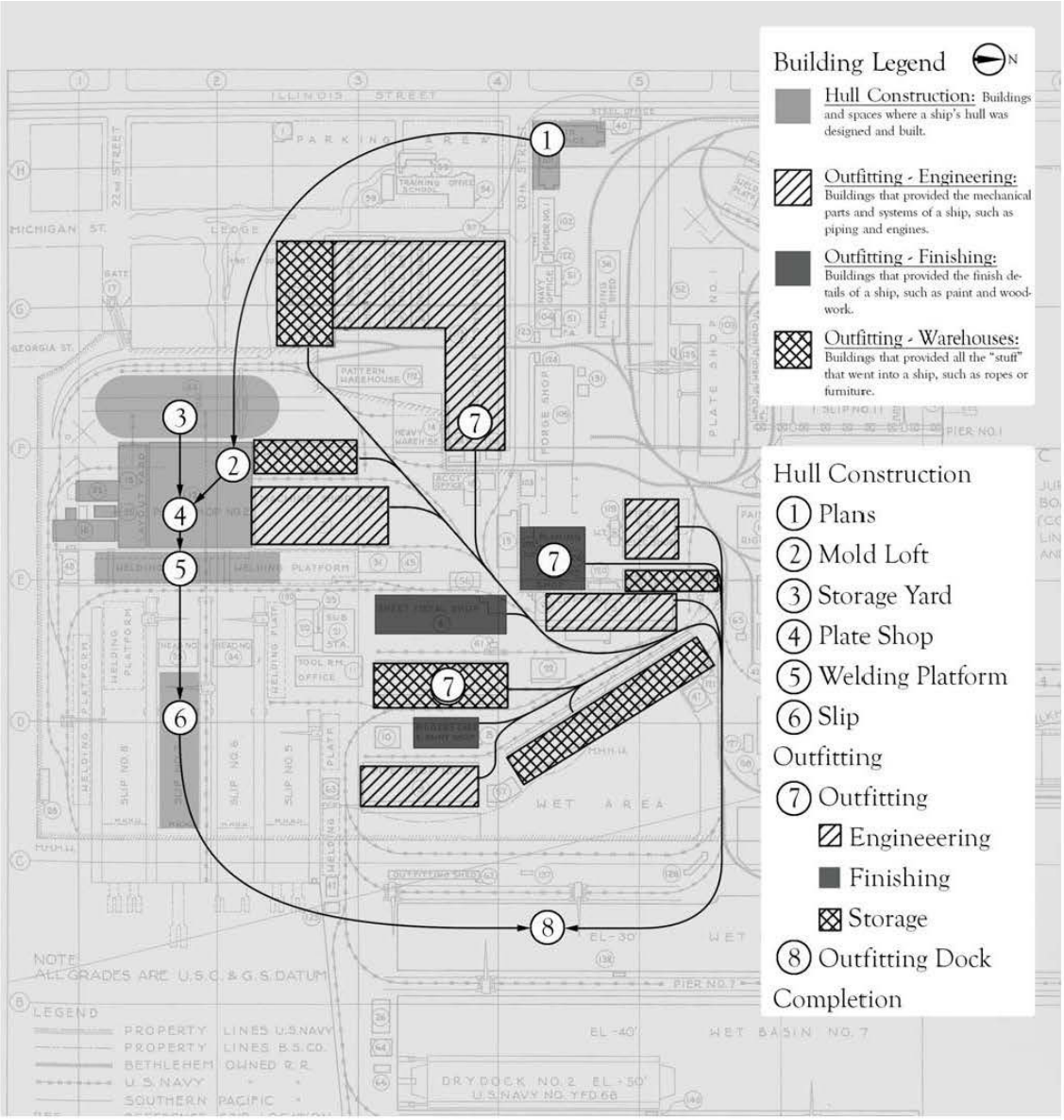

Figure 14. The Shipbuilding Process at the New Yard during WWII.
This map shows the general process of hull construction and outfitting at the New Yard. The working plans for a ship were drafted in the **administration office** (Building 101) or the naval office (Building 104). Plans were laid down in the **mold loft**; templates were cut and moved downstairs to the plate shop. Cranes moved steel plates from the **storage yard** to the **plate shop** and workers cut and bent plates to match the templates. Plates were joined into sub-assembles, when called for, and moved by rail or crane to **welding platforms**, where parts were joined into even larger sections, such as deck houses, and bow and stern assemblies. Cranes moved completed sub-assemblies to the **slips**. When the hull was complete it was launched and moved to **outfitting docks**. During WWII outfitting tasks were accomplished in specialized finishing and engineering buildings and were supported by various warehouses. Cranes and rail line moved outfitting components through the yard to the outfitting dock.

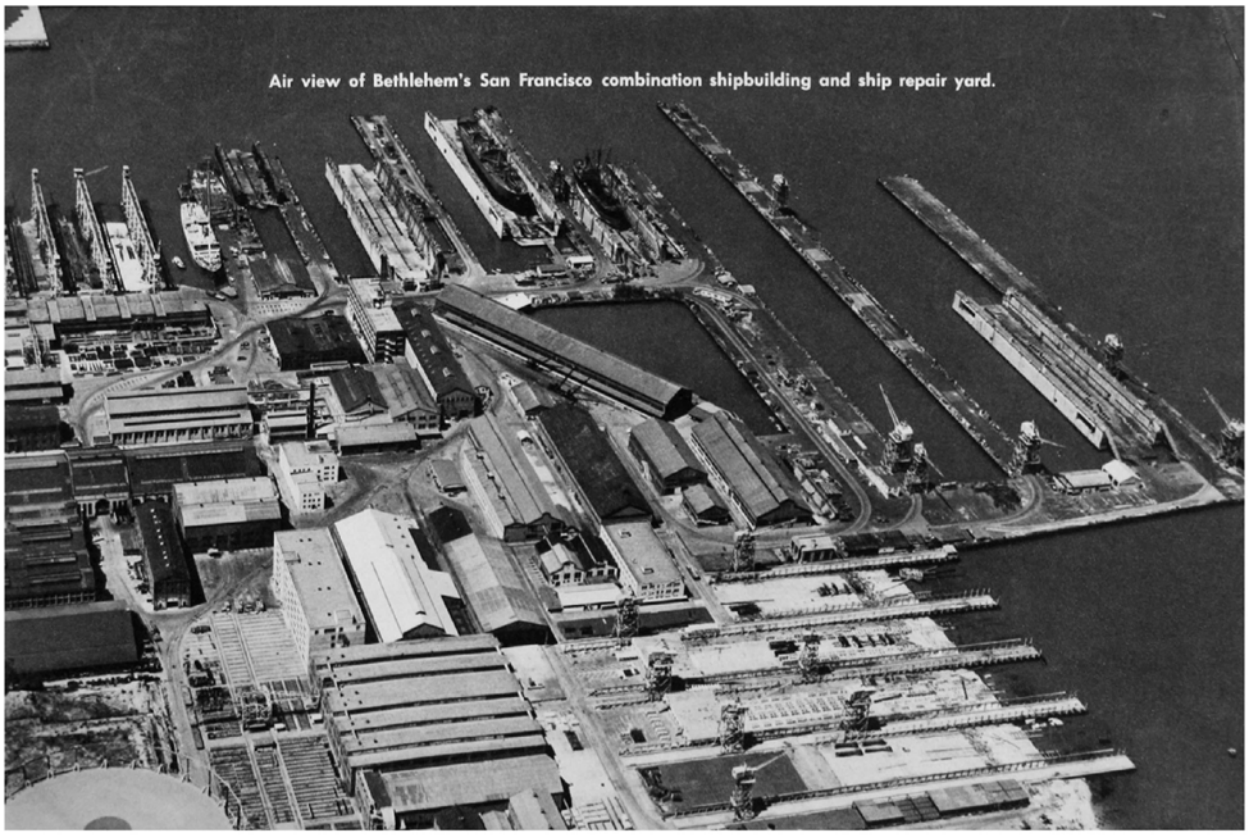

Figure 15. World War II-era aerial view of the Union Iron Work Historic District.
Bethlehem Steel Co., *A Century of Progress: 1849-1949.* San Francisco: Bethlehem Steel, 1949.

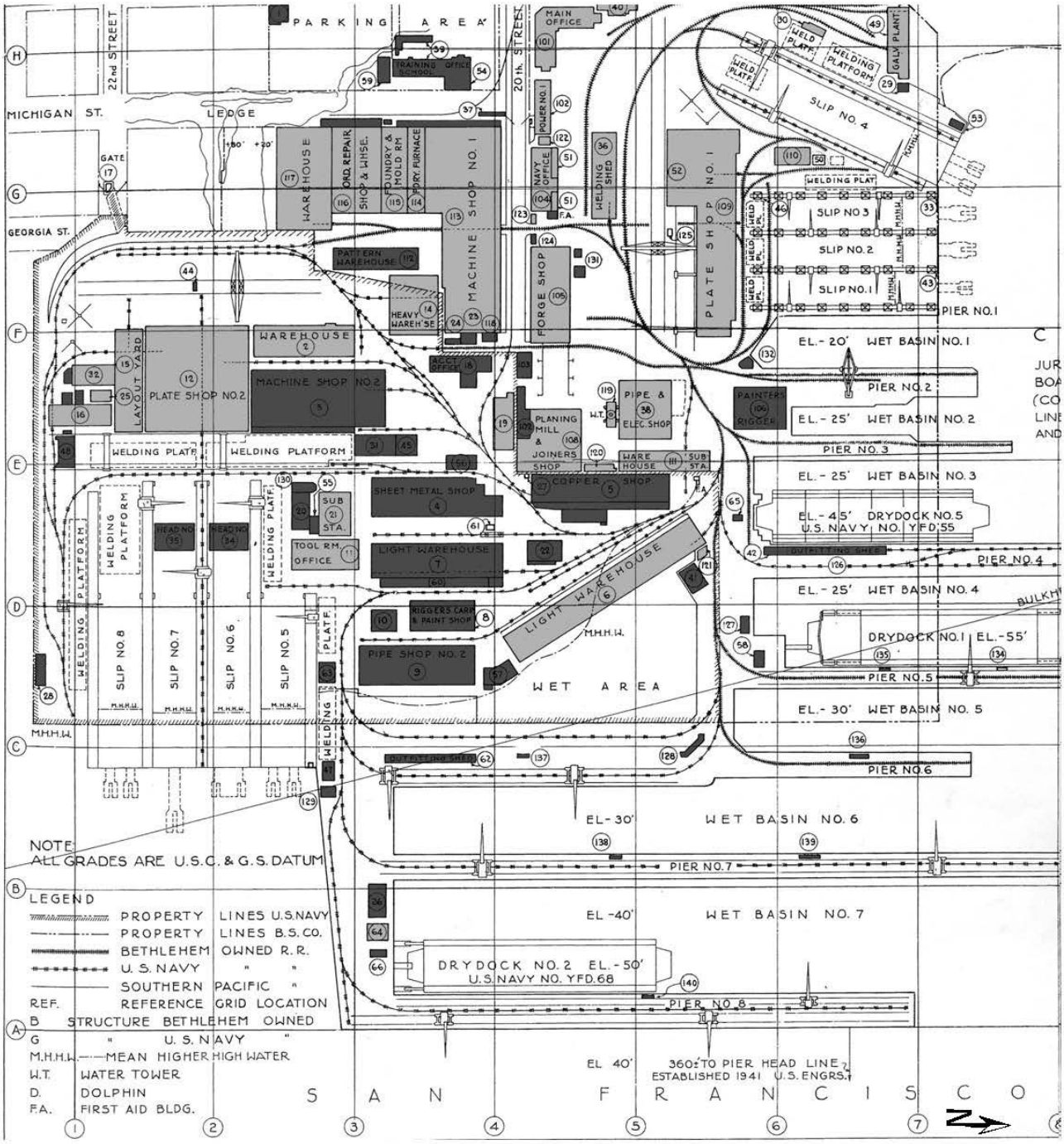

Figure 16. Extant and Demolished buildings. The color-coding on this 1945 site plan indicates the buildings currently standing within the district's boundaries and those demolished after 1945.

Extant buildings

Buildings demolished after 1945

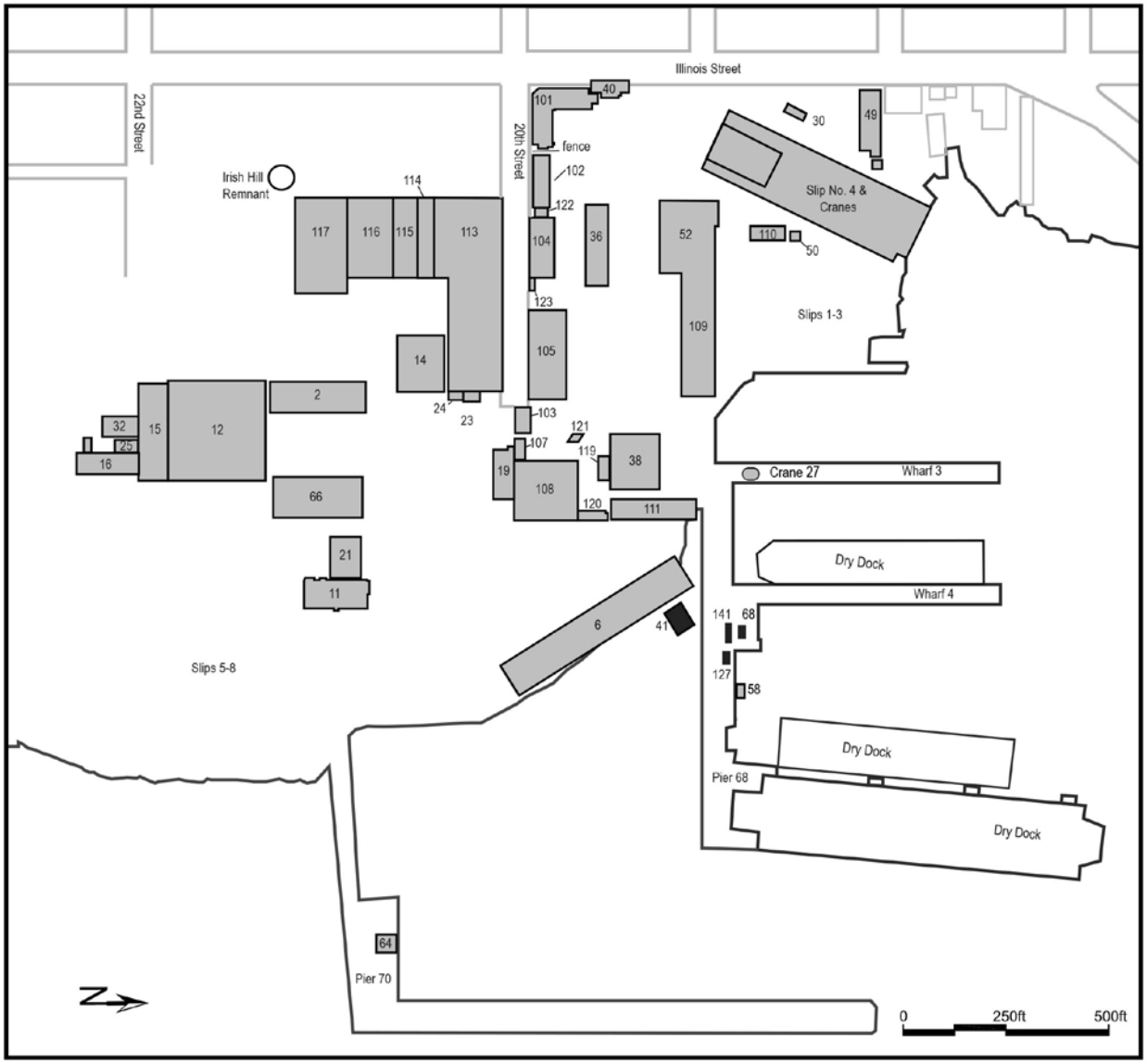

Figure 17. Contributing and Noncontributing buildings of the Union Iron Work Historic District.

Historic Significance

Contributing

Noncontributing

Figure 18. Boundary Map for the Union Iron Work Historic District, see Section 10 for Boundary Description and Justification. Background image Google Maps, 2008.