

PIERS 58, 59 AND 60 TIMBER PILING INSPECTION (WC1741)



**PIERS 58, 59 AND 60 TIMBER PILING INSPECTION
(WC1741)**

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Prepared For:

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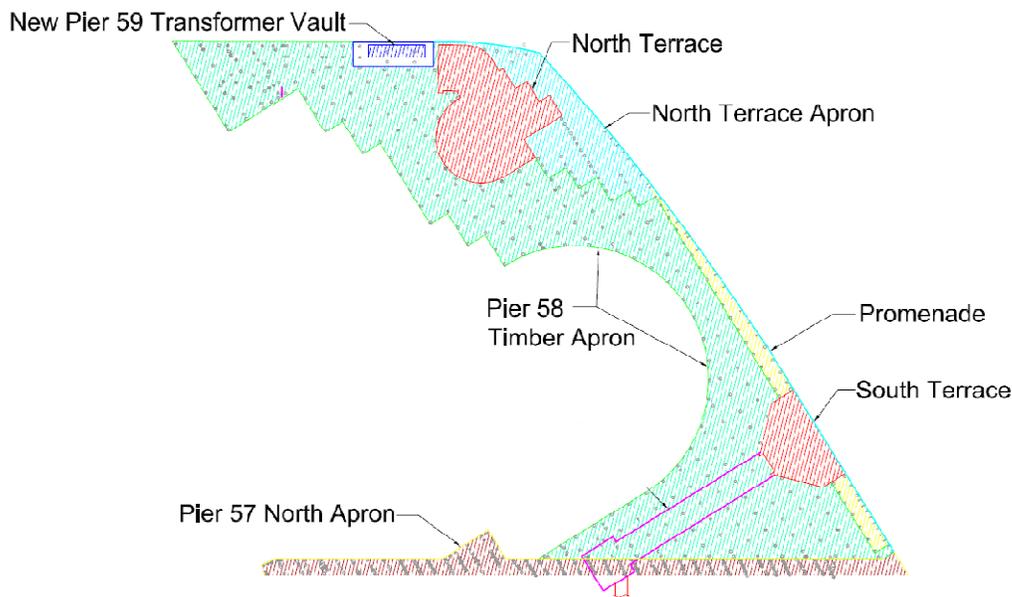
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EXECUTIVE SUMMARY

This 2016 report reviews timber piles that support concrete and timber portions of Piers 58, 59 and 60.

The Seattle Department of Construction and Inspections (SDCI) requires an ongoing maintenance program of all timber piers in the Central Waterfront in accordance with Director's Rule 7-90. This rule requires that, as a minimum, an updated comprehensive investigation of the pier's timber structure every five years. The last report was completed in 2011 by Seattle Structural PS Inc.

The 2006 Tinnea Report outlined recommendations that, if followed, would have returned the structure to a "near-design" level of safety. The 2006 report also allowed for the alternate imposition of load limits (without repairs) that provided "reasonably safe" conditions. Due to changes in the Central Waterfront area and seawall upgrades, as well as financial considerations, the city opted to forego repairs and imposed load restrictions, with the recognition that there was an increased risk of partial collapse in the event of an earthquake or large wind event.

Recently there has been planning for the replacement of Waterfront Park with new public walks and water access. We expect that this new facility will be in place within the next ten years. With this in mind, we understand that the city intends to continue with the policy of maintenance deferral of the existing structure if possible without upgrades.

Pier 58

The 341 timber piles supporting the main timber-deck portions of Pier 58 provide the vertical load-carrying capacity for Pier 58 as well as lateral resistance to earthquake, wind and wave actions. Over time the creosote treatment has washed out of the timber and the piles have lost effectiveness in limiting marine borer attack. Once a pile develops a large number of worm-holes the rate of decay accelerates and the pile will eventually fail.

The standard manner of rating timber piles is to assign a “percentage capacity remaining”. A new pile will have a 100% rating. Once damage starts to accumulate the piles’ ratings diminish. The Pier 58 pile ratings over the past ten years and projected forward 5 years are shown here:

<u>Approximate Average Pile Ratings</u>						
<u>Year Observed</u>	 100%	 90%	 75%	 50%	 25%	 0%
2000	84 (25%)	204 (60%)	37 (11%)	10 (3%)	4 (1%)	2 (1%)
2006	13 (4%)	179 (52%)	112 (33%)	28 (8%)	7 (2%)	2 (1%)
2011	0 (0%)	52 (15%)	161 (47%)	109 (32%)	17 (5%)	2 (1%)
2016	0 (0%)	0 (0%)	3 (1%)	160 (47%)	160 (47%)	18 (5%)
2021 (projected)	0 (0%)	0 (0%)	0 (0%)	68 (20%)	239 (70%)	34 (10%)

Percentages that do not add up to 100% are due to rounding. The quantity of piles at each rating is extrapolated for easier comparison when only a representative sample of piles were inspected that year. Refer to the table in the body of the report for actual quantities.

The original piles had a rated live load capacity of around 20 tons and were capable of supporting 200 psf on the deck area. Even when deteriorated to a 25% rating they retain significant axial capacity (although less than the code-required 100 psf). In order to maintain the load carrying integrity of the pier, piles should be replaced when they reach a rating of 25%.

The original design of Waterfront Park would not meet today’s seismic code requirements. As both the timber and non-timber piles decay, the risk of collapse as a result of a seismic or high wind/wave event increases. Since most of Pier 58’s lateral capacity comes from the Monotube and steel piles, though, the incremental loss of lateral capacity in the timber piles is unlikely to significantly increase the likelihood of a general sway-type collapse (the expected failure is a localized vertical collapse).

In 2006 there were a total of 9 piles (3%) that had a rating at or below 25%. In 2011 there are approximately 19 piles (6%). In 2016 there are 178 piles (52%). Within the next five years (by 2021) it is reasonable to expect that one or more of these piles will fail.

We have studied the consequence of a failed single pile and have determined that the most likely outcome of this is a degree of sagging and reduced live-load capacity. As long as there are no large concentrated loads (from a vehicle, for instance) we do not expect that a collapse will occur as a result of a single pile failure. Our calculations suggest that the actual live load capacity is on the order of 20 psf when a single pile is removed; although this is less than the code-prescribed 100-psf this reduced capacity does not mean that a collapse will occur.

In our reports from 2006 and 2011 we cautioned the city that an eventual failure was likely to occur that would force the closing of the park to public access. Based on the recent successful load (despite the poor pile ratings), we are encouraged that the city can continue to use the park while the full replacement is planned.

In order to continue to utilize the pier as park public space we recommend the following actions:

1. Maintain a ban on all vehicular traffic. Install steel bollards at the access points. If access is needed require a review by a structural engineer prior to accessing. The bollard design has been completed and is attached to this report.

2. Do not permit large gatherings of people for events.
3. Perform periodic load tests (preferably on an annual basis) of piles testing to 6,000# (approx 30 psf) to identify any failed piles. A base-line load test was successfully completed this year (results are attached to this report.)
4. Perform periodic row-throughs (preferably on an annual basis) to look for pile damage.

If a failed pile is identified (as a result of the load tests or row-throughs) then access to that portion of the pier will need to be restricted. Given the current condition of the pier it is possible that the piling will pass this test for the next five years although the city must be prepared to take action if a pile failure occurs.

In the event of a high wind/wave event or an earthquake the pier could experience a partial collapse. The likely mode of failure will be a localized collapse and/or leaning.

Many of the structural components continue to perform well despite deferred maintenance. The timber deck and framed sub-structure condition of Pier 58 has not appreciably degraded since 2006.

Pier 59

Timber piles at Pier 59 are not a major concern. All timber piles needed for vertical support of the timber building were replaced (posted) with steel pipe piles in 2005. Some timber piles were retained as extra piles and are not required for vertical or lateral support. Lateral support for Pier 59 is provided by 140 of the 146 large-diameter steel pipe piles installed in 2005. A portion of the stub piles were inspected and, although some evidence of soil erosion was found, no stubs were exposed. We expect the Pier 59 pile system to continue to perform as designed.

We reviewed a 2015 report by BergerABAM for the Seattle Aquarium. There were no significant areas for immediate concern.

Pier 60

Some modifications have been performed at Pier 60 as part of the seawall construction which reduced the timber deck area and the number of timber piles. We inspected the 20 remaining timber piles and found these piles are in fair to poor condition. Replacement of piles will be needed within 10-20 year.

Conclusions and Recommendations

It is reasonable to allow continued public access to Pier 58 Waterfront Park but with no vehicle access. Load testing and row-through observation should be performed annually. The city should anticipate within five years that portions of the park may need to be closed due to a failed load test, in response to an earthquake or high wind/wave event, or because of the spontaneous loss of a pile due to deterioration.

By continuing to defer maintenance, the practicality of repairing the timber pier to a usable state is diminishing. The estimated cost of restoring the pier structure to near-code condition in 2006 was \$0.7M-\$1.5M. Today the cost of restoration is much higher due to escalation and continued decay, and is likely not practical. Full replacement is the best long term solution.



Photo 1: Pier 58 general condition of timber structure

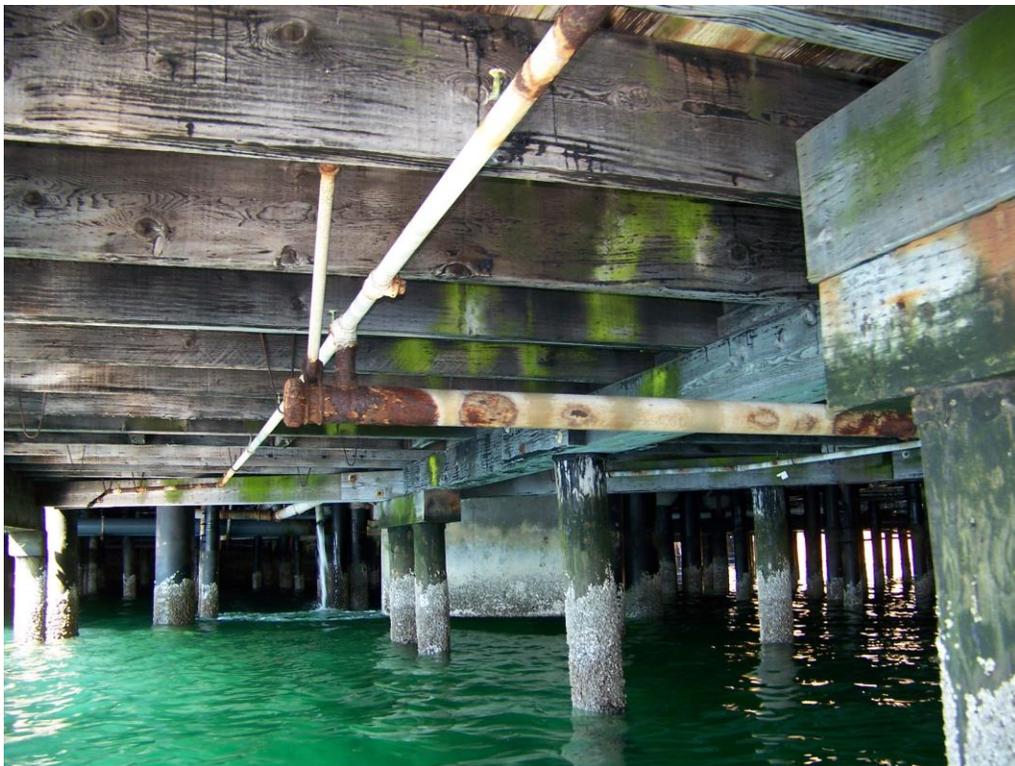


Photo 2: Pier 58 general condition of timber structure



Photo 3: Pier 59 crushed timber beam at pile N2-28 (looking north)



Photo 4: Pier 59 crushed timber beam at pile N2-29 (looking north)



Photo 5: East side of Pier 60 at the Triangle



Photo 6: East side of Pier 60 at the Triangle



Photo 7: East side of Pier 60 recent modifications (looking south)



Photo 8: East side of Pier 60 recent modifications (looking north)

INTRODUCTION

Seattle Department of Construction and Inspections (SDCI) Director's Rule 7-90 calls for a maintenance program for timber piers based on a comprehensive investigation that includes observation and evaluation of a representative sample of caps, stringers, and piles, although the number of piles need not exceed 20% of the total. Seattle Structural was contracted by the Seattle Parks and Recreation Department (PRD) to inspect all timber piling of Pier 58 (Waterfront Park), Pier 59 (Aquarium), and Pier 60 (along Alaskan Way and the Triangle). An inspection of the timber stringers and pile caps at Piers 58 and 60, an inspection of pile stub protection at Pier 59, and a gravity load test of Pier 58 also were performed.

Seattle Structural engineers performed a "row-by" inspection of the timber sub-structures and of timber piles above the waterline. Global Salvage & Diving (Global Diving) was sub-contracted to observe timber piles below the waterline. The following personnel performed the inspections.

- Howard Burton, PE, SE: 35 years of structural engineering experience and 15 years of marine structures experience
- Michael Braun, PE, SE: 36 years of structural engineering experience and 11 years of marine structures experience
- Simon Cleasby, Global Diving & Salvage: licensed commercial diver for 26 years
- Bradley Peterson, Global Diving & Salvage: licensed commercial diver for 10 years
- Christopher Hume, Global Diving & Salvage: licensed commercial diver for 6 years

STRUCTURE DESCRIPTIONS

Pier 58

Pier 58 was built in 1974 using several different construction types. The timber portion is supported by 341 timber piles and accounts for 70% of the area. North and south terraces are cast-in-place (CIP) concrete supported by concrete-filled steel Monotube piles. The concrete apron adjacent to the north terrace is supported by steel H-piles along the seawall and timber piles elsewhere. The concrete promenade along the seawall also is supported by steel H-piles along the seawall and timber piles at the transition to timber portions of Pier 58. The original construction included bridges from the north and south terraces to respective observation towers. The bridges and towers were steel structures supported by timber piles. The north bridge and tower were removed in 2006 when Pier 59 was renovated. The south bridge and tower were removed around 2012. The timber piles and pile caps which had supported the towers remain.

Pier 59

Pier 59 underwent a major structural renovation in 2005. The eastern (landward) one-third of the old timber building was demolished and replaced with concrete construction at the first level, timber at level 2 and the roof, and steel pipe pile supports. The new level 1 concrete construction consists of precast concrete panels supported by CIP concrete pile caps and topping slab. The old timber aprons on the north, south and west sides of the pier also were demolished and replaced with the same type of steel pile supported concrete construction. A pump house and an electric transformer vault at the south apron are CIP concrete slabs supported by steel pipe piles.

Pier 59 has a total of 146 steel pipe piles in the following sizes.

- (39) HSS 30x0.750
- (46) HSS 24x0.625
- (55) HSS 18x0.500
- (6) HSS 12x0.500

Pre-existing concrete and steel piles plus replacement steel piles support the timber structure at the western two-thirds of the building. All timber piles required to help support the existing timber structure were replaced (posted) with 10-inch steel pipe piles. The replacement pipe pile thicknesses are 3/8" or 1/2" depending on the load and pile length. The bottom of the steel replacement piles have an inverted steel "can" which fits over and bears on top of the timber pile stub. The stub was cut off at a depth below mudline where the Bankia destruction ended due to lack of oxygen.

Some creosote and Cheminite treated timber piles in relatively good condition were kept as extra piles. Their condition is not critical because they are not needed to support the timber structure. Other timber piles were cut off 4 to 6-feet above mudline and retained as stubs for future replacement piles. The pile types and quantities are shown in the following table.

Table 1: Pile Types and Quantities Supporting the Pre-existing Timber Building

Action	Pile Type	No. of Piles	
N	New replacement (posted) steel piles		124
K	Kept pre-existing piles		
	Concrete or Colby piles	47	
	Steel piles	31	
	Sub-Total		78
	SUB-TOTAL (new and kept piles)		202
E	Extra piles		
	Creosote treated timber piles	35	
	Cheminite timber piles	15	
	PVC clad creosote piles	7	
	Concrete piles	1	
	Sub-Total		58
	TOTAL (new, kept and extra piles)		260
S	Stub Piles		53

The timber stringers, beams and building perimeter cap beams are supported by 12" deep steel channels both sides of the pre-existing timber pile caps. The steel channels are supported by the steel replacement piles and pre-existing concrete and steel piles mentioned previously. Similar to the extra timber piles, the condition of the pre-existing timber pile caps is not critical because they are not being used to support load. The bolts through the steel channels and the pre-existing timber pile caps are not transferring load to the channels. Timber stringers and beams transfer their load directly to the steel channels in bearing.

The lateral force resisting system at level 1 consists of steel pipe pile and concrete pile cap moment frames. Steel replacement piles and pre-existing piles at the western two-thirds of the timber building support gravity loads only.

Pier 60 Along Alaskan Way and the Triangle

Pier 60 was built in 1974. It is predominantly a concrete structure consisting of CIP concrete pile caps, precast concrete slabs, and CIP concrete topping slabs all supported by prestressed concrete piles. Walls and water tank exhibits are CIP concrete. The roof is framed with timber trusses and decking. A timber walkway around the west (waterward) side was replaced by a steel pipe pile supported concrete walkway in 2012. Only two small areas of timber piling and timber sub-structure remain: the promenade on the northeast side between the concrete structure and the Alaskan Way seawall and the promenade on the east side which forms one side of the open water "Triangle" with Pier 59 and Alaskan Way.

PRIOR INVESTIGATIONS

Pier 58 prior condition studies and the repair history known to us are listed below.

- 1989 – Arnold, Arnold & Associates condition assessment report
- 1992 – CH2M Hill condition assessment report
- 1996 – Sprinkler system replacement in accordance with drawings by Buffalo Design (architect) and Berona/Langebartel (sprinkler engineer)
- 1998-1999 – Tinnea, Echelon, and Tetra Tech condition assessment report
- 2000 – Echelon and Reid Middleton condition assessment report
- 2004 – Repairs to North Terrace in accordance with 1998-1999 report by Tinnea, et al.
- 2006 – Tinnea and Seattle Structural condition assessment report
- 2011 – Seattle Structural condition assessment report
- 2014 – Echelon underdeck inspection along seawall

Pier 59 prior condition investigations and the repair history known to us are listed below.

- 2000 – Echelon and Reid Middleton condition assessment report
- 2005 – Demo and reconstruction of east end and perimeter aprons, and pile replacement under west end timber structure
- 2015 – Tinnea and BergerABAM condition assessment report

Pier 60 prior condition investigations and the repair history known to us are listed below.

- 2006 – Tinnea and Seattle Structural condition assessment report
- 2015 – Tinnea and BergerABAM condition assessment report

The 2014 report by Echelon was prepared for the Mortenson Manson Joint Venture (MMJV). Echelon inspected all piles at Pier 58 within 20 feet of the seawall construction which was ongoing at the time of the inspection. Seventy-six (76) of the inspected piles were timber, which is 22% of all timber piles supporting Pier 58. This inspection was a baseline for monitoring purposes and the piles inspected were not intended to be representative of all piles.

The purpose of the investigation by Tinnea & Associates/BergerABAM in 2015 was to assess the general condition of the piles, pile caps, and level 1 structure of Piers 59 and 60 for the Seattle Aquarium. The scope involved all construction types including reinforced concrete, steel, and timber. BergerABAM inspected a representative sample in most areas plus all of the timber sub-structure of Pier 59.

SCOPE OF OBSERVATIONS

Global Diving inspected 341 timber piles at Pier 58 and 20 timber piles at Pier 60 and the Triangle on August 30-31 and September 15, 2016. On September 9, 2016 Seattle Structural observed all of the same piles above the waterline and the pile caps except the portion between Pier 60 and Alaskan Way which was blocked by floating debris. Pier 59 is supported predominantly by steel and concrete piles and steel channel pile caps. No timber piles or pile caps were inspected except for two timber beams at the west end.

OBSERVATION METHODS

Seattle Structural engineers performed a visual observation of timber piles and sub-structure from a small boat. The Global Diving divers performed a Level 1 inspection in accordance with "Underwater Inspection Criteria" by the Naval Facilities Engineering Service Center. This consisted of a top-to-mudline visual inspection on all sides and sounding with a hammer especially at suspect areas. The divers rated the capacity remaining for each pile in increments of 5 percentage points. The reported pile ratings are rounded off in increments of 25 percentage points in accordance with standard procedure. The diver's helmet camera and microphone were recorded on DVD and were monitored in real time onboard the dive boat by a Seattle Structural engineer.

The pile labeling system for Pier 58 in this report conforms to Seattle Parks & Recreation records as reported by Echelon in 2000 and 2014. The pile label system used in 2011 is also shown for reference. The pile labeling system for Pier 59 is the same as used on the 2005 piling replacement drawings. The pile labeling system for Pier 60 is the same as the 2011 report. The Seattle Parks & Recreation Department records were not available. The system used by BergerABAM for Pier 60 is also shown for reference.

OBSERVATIONS

Pier 58

Timber Piles

Seattle Structural and Global Diving inspected all 341 timber piles at Pier 58 in 2016. The pile ratings are shown graphically on plans in Appendix A and in tables in Appendix B. Prior year's ratings are shown as well as this year's. In a pile-by-pile comparison, there are piles with better ratings this year compared to prior years, which can be attributed to the subjective method of rating timber piles. The piles are rated based on an inspection of the exterior while damage is often internal from the inter tidal zone down to a foot below the mudline.

The video equipment failed during the first of three days of diving and was repaired before the third day. Audio was always available and the diver's verbal description of his observations were recorded manually on dive inspection logs whether video was available or not.

Seventy seven (77) piles along the seawall that Global Diving inspected during the first two days without video had also been inspected by Echelon in 2014. Significant discrepancies were found with a few pile ratings when compared to Echelon's. Global Diving re-inspected these piles to document their condition with video on the DVD recording.

Although we were not able to resolve the discrepancies, we gained confidence with the consistency of the ratings we had obtained. Global Diving rated pile capacity in increments of 5 percentage points. Over 80% of the paired ratings differed from each other by 10 percentage points or less. The reported pile rating for each of these piles is the average of the pair of ratings rounded to the nearest 25th percentile.

A summary of the pile ratings for this year and prior years are shown in Table 2. All or nearly all timber piles were inspected except in 2011, when a representative sample was inspected, and in 2014, when piles were monitored along the seawall construction zone and were not intended to be representative.

The quantity of piles for each rating are the actual values. The table of values in the executive summary are extrapolated for all 341 piles based on the percentages for easier comparison of year-to-year results. Overall, the pile ratings are worse for each successive inspection. This trend is projected out to year 2021 to show how many piles will be in jeopardy in 5 years.

Table 2: Summary of Timber Pile Ratings for Pier 58

Year Observed	Pile Ratings						Pile Qty
	☉100%	☽90%	☾75%	☾50%	☾25%	●0%	
2000	84 (25%)	204 (60%)	37 (11%)	10 (3%)	4 (1%)	2 (1%)	341
2006	12 (3%)	170 (52%)	106 (33%)	27 (8%)	7 (2%)	2 (1%)	324
2011*	0 (0%)	21 (15%)	65 (47%)	44 (32%)	7 (5%)	1 (1%)	138*
2014*	11 (14%)	30 (39%)	23 (30%)	1 (1%)	3 (4%)	8 (11%)	76*
2016	0 (0%)	0 (0%)	3 (1%)	160 (47%)	160 (47%)	18 (5%)	341
2021 (projected)	0 (0%)	0 (0%)	0 (0%)	20 (68%)	239 (70%)	10 (34%)	341

*2011 and 2014 were partial investigations

Note: Inspections of timber piles were performed by the following firms:

- 2000 – Echelon
- 2006 – Seattle Structural/Global Diving
- 2011 – Seattle Structural/Global Diving
- 2014 – Echelon (limited inspection for Mortenson-Manson Joint Venture)
- 2016 – Seattle Structural/Global Diving

Seattle Structural performed a load test of Pier 58 on December 8, 2016. The test was conducted by positioning a 6,000 lb vehicle at each pile and measuring the vertical displacement of the deck surface directly over the pile. The timber deck elevation was determined with a tripod-mounted construction laser and a rod-eye receiver. The accuracy of the equipment is +0.08 inch (+2 mm) within a 100 foot (30 m) radius. If the pile provides no support, the expected displacement is ½" (13 mm) or more.

The measured displacements are shown in Appendix D. No piles at accessible areas of the pier failed the load test. Although at least one pile has a rating of 0%, we did not observe significant deflection at

that pile. Most stringers and pile caps are continuous over 2 spans and distribute load to more than one pile.

The load tests were successful, that is, no pile failures were encountered. The measured deflection at all piles was 0.08 inch (2 mm) or less, which is within the accuracy of the equipment.

Timber Pile Caps

The timber pile caps are above the splash zone and have no significant surface rot and no observable marine borer activity. The ends of some caps at the edge of the pier look “weathered” but they have no significant loss of capacity as the damage that exists is in a region of low stress. A pile cap near Grids 3/U has an inclined crack that has not changed significantly since 2006. The timber pile caps generally are in satisfactory condition. Typical conditions are shown in photos 1 and 2.

Timber Superstructure

No significant deterioration of the deck or stringers was observed.

Pier 59

The timber piles of Pier 59 were not inspected in this contract. None of the existing timber piles at Pier 59 are required to support gravity or seismic loading. The western two-thirds of the timber building is supported by concrete and steel piles and steel channel pile caps. The eastern one-third and the perimeter aprons are concrete construction supported by steel pipe piles.

Global Diving inspected a representative sample of the 124 pile stubs that support steel replacement piles. The purpose was to determine if there has been any soil erosion around the inverted steel “can” protecting each stub. The pile stubs that were inspected and the maximum projection of each above the mudline are shown on sheets S2.0.2 and S2.0.3 from the 2005 record drawing set. The details of the steel “can” are shown on sheet S5.32. These sheets are included in Appendix A.

It is acceptable for the steel “can” to project as much as 12-inches above the mudline. Two (2) of the 38 inspected pile stubs were inspected have inadequate coverage. It is important for all pile stubs to have adequate protection from Bankia (marine borer) damage to ensure the structural adequacy of the western two-thirds of the timber building.

Piles N2-28 and N2-29 support timber beams that are partially rotted and crushed, see photos 3 and 4. This damage was reported by BergerABAM in 2015. These beams and piles support the tall west wall of the Aquarium building. No significant signs of movement were observed above the decking inside the building and none were reported by Aquarium staff. This condition does not appear to be a source of imminent failure.

Pier 60

The timber walkways and promenade around Pier 60 have been modified in the past 5 years. The timber walkway on the west side was replaced with a concrete walkway supported by steel pipe piles. The promenade on the east side forming one side of the Triangle has been reduced in width and one row of creosote-treated timber piles has been removed, see photos 5 through 8. At the time of our inspection a temporary sheet pile bulkhead was installed on the northeast side along Alaska Way and seawall construction was in progress. Three severely damaged creosote-treated timber piles had been removed beneath the concrete sidewalk in the SDOT right-of-way.

Seattle Structural and Global Diving inspected the 20 timber piles that remain on the east and northeast sides of Pier 60. Video and audio from the diver were recorded on DVD. The pile ratings are shown

graphically on a plan in Appendix A and in a table in Appendix C. Prior year ratings are shown as well as this year's. The pile ratings area summarized in the following table.

Table 3: Summary of Timber Pile Ratings for Pier 60

Year Observed	Pile Ratings						Pile Qty
	☉ 100%	☽ 90%	☾ 75%	☾ 50%	☾ 25%	● 0%	
2006	0 (0%)	9 (45%)	2 (10%)	4 (20%)	0 (1%)	5 (25%)	20
2015	0 (0%)	1 (17%)	0 (0%)	4 (67%)	0 (0%)	1 (17%)	6
2016	0 (0%)	0 (0%)	0 (0%)	10 (50%)	9 (45%)	1 (5%)	20

Note: Inspections of timber piles were performed by the following firms:

2006 – Seattle Structural/Global Diving

2015 – BergerABAM

2016 – Seattle Structural/Global Diving

The inspection by BergerABAM was prior to modifications to the timber promenade on the northeast and east sides of Pier 60 and the commencement of seawall construction in this area. It appears that one timber pile was repositioned slightly to support the reduced timber promenade on the east side adjacent to the Triangle.

Timber piles 28/5 through 28/9 (BergerABAM piles Q/5 through Q/9) had 0% ratings in 2006. BergerABAM rated the 3 piles they inspected in 2015 as major to severe damage (0% to 25% ratings). All of these piles have 50% ratings in 2016. These piles support an 8-inch temporary waterline for the Aquarium and are immediately adjacent to the temporary sheet piling for the seawall construction. They may have been replaced (posted) by the seawall contractor.

Timber piles along the Triangle were rated mostly 75% in 2006 and mostly 25% in 2016. These piles support the temporary waterline, a temporary dry system fire line, and a temporary pressurized 4-inch sewer line during the seawall construction.

CONCLUSIONS AND RECOMMENDATIONS

In consideration of tight budgetary constraints, the least-cost actions that we recommend for Pier 58 are as follows:

1. Continue to ban vehicular traffic to all areas of Pier 58. Maintain the posted notice of the vehicle ban. Enforce the ban by installing bollards at access points. If a vehicle needs access, a structural engineer should evaluate the proposed vehicle loading prior to approval and access.
2. Do not encourage large groups of people to congregate in any area of Pier 58.
3. Repair timber beams at the west end of Pier 59 supported by steel replacement piles N2-28 and N2-29.
4. Conduct annual row-throughs under the pier to identify apparent deficient piles and/or sub-structure. A row-through was conducted this year for this report so the first annual row-through should begin in 2017.

5. Conduct annual load tests of timber piles and areas suspected of having deficient capacity. We recommend using a 6,000 lb vehicle (30 psf) to load the test areas. Measure the deflection of the deck to determine if there is any unusual or excessive movement. This test should be conducted or supervised by a structural engineer. The tests conducted in 2011 and 2016 will serve as a baseline of deflection data for future reference. The measured deflection of all tested piles was 0.08 inch (2 mm) or less. No failed piles were encountered and the load tests were successful.
6. The concrete superstructures of the north and south terraces, the north terrace apron, and the promenade will eventually need to be repaired, replaced, or demolished. The north terrace in particular has serious reinforcing steel corrosion that may not be accelerating at this time but is on-going. All of these areas are supported by Monotube piles and steel H-piles that have serious corrosion. The cost of repairs or replacement would be high.

APPENDIX A

Piers 58 & 60 Timber Pile Rating Plans

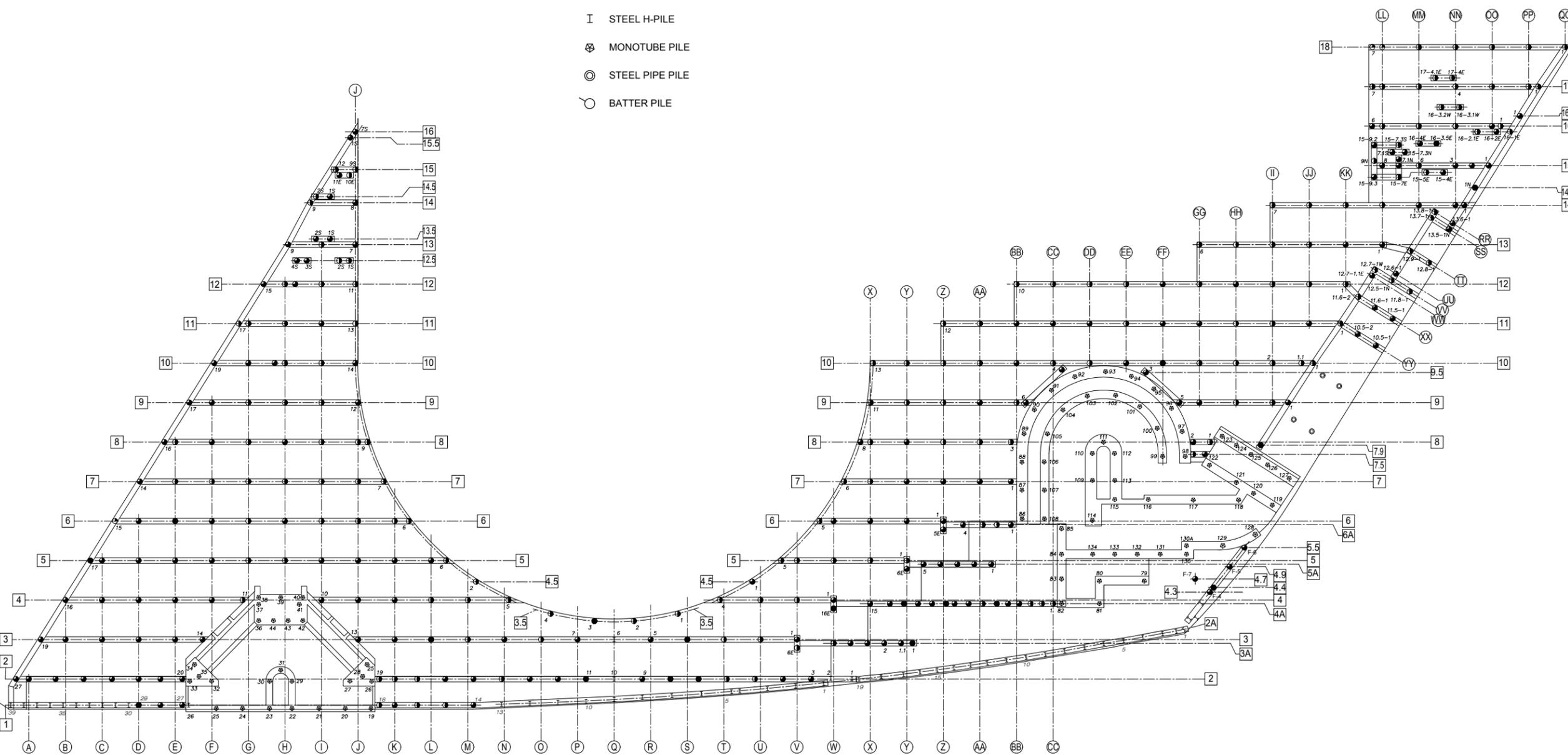
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LEGEND

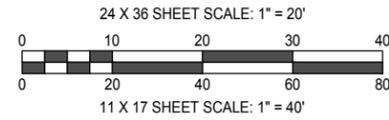
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- 100% REMAINING CROSS SECTIONAL AREA
- 90% REMAINING CROSS SECTIONAL AREA
- 75% REMAINING CROSS SECTIONAL AREA
- 50% REMAINING CROSS SECTIONAL AREA
- 25% REMAINING CROSS SECTIONAL AREA
- 0% REMAINING CROSS SECTIONAL AREA
- I STEEL H-PILE
- ⊕ MONOTUBE PILE
- ⊙ STEEL PIPE PILE
- BATTER PILE

NOTES

1. H PILES #1 THRU #65 ARE HP10x42, #66 THRU #78 ARE HP10x157
SOURCE: 1973 RECORD DWGS
2. MONOTUBE PILES ARE 12"DIA x 7GA (0.179")
SOURCE: 1973 RECORD DWGS



PLAN



**>>>>CAUTION<<<<
CALL BEFORE YOU DIG!**

NOT LESS THAN TWO OR MORE THAN TEN BUSINESS DAYS PRIOR TO COMMENCING EXCAVATION OR DEMOLITION, SECURE THE SERVICES OF A COMMERCIAL UNDERGROUND UTILITIES LOCATOR SERVICE TO IDENTIFY BELOW-GROUND IMPROVEMENTS THAT MAY NOT BE INDICATED ON THE DRAWINGS. FOR IRRIGATION SYSTEMS, CALL SEATTLE PARKS PLUMBING SHOP (206 684 7070)

>>800 424 5555<<



Seattle Structural

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Civil and Structural Engineering
1420 Fifth Avenue, Suite 425
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206-343-3000 phone 206-343-3013 fax

3		
2		
1		
NO.	REVISION	DATE
	AS BUILT	

REVIEWED: _____ DATE _____
PARK ENGINEER _____ DATE _____
All work done in accordance with the City of Seattle Standard Plans and Specifications in effect on the date shown above, and supplemented by Special Provisions.

PIER 58

**2016 TIMBER PILING
CONDITION ASSESSMENT
(WC1741)**

DESIGNED	MOB	DATE	9-12-2016
DRAWN	BDS	SHEET	OF
CHECKED			
ORDINANCE NO.		S1	
JOB NO.	P16028.00		
SCALE	AS NOTED		

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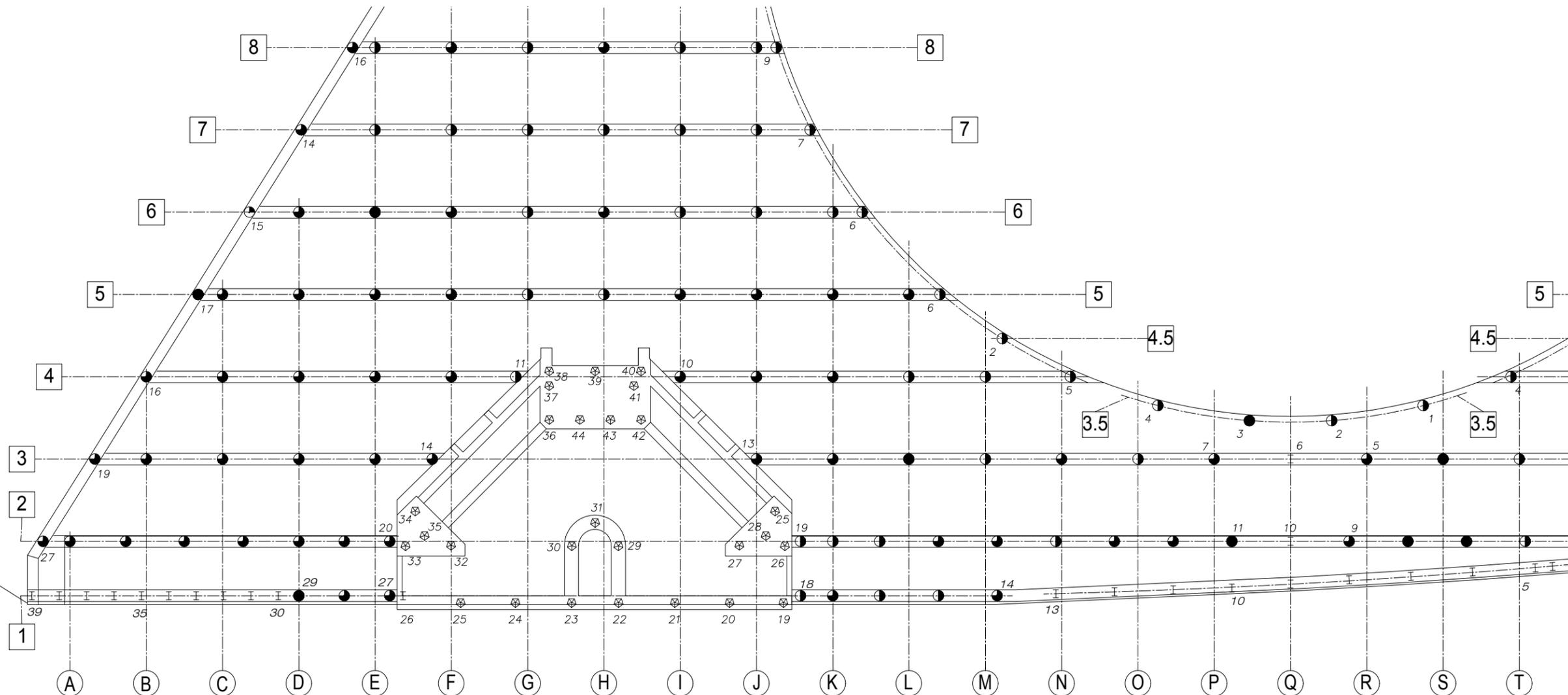
Seattle Structural PS Inc.
Civil and Structural Engineering
1420 Fifth Avenue, Suite 425
Seattle, WA 98101-4019
206-343-3000 phone 206-343-3013 fax

LEGEND

- TIMBER BEARING PILE (NO DATA)
- ◐ 100% REMAINING CROSS SECTIONAL AREA
- ◑ 90% REMAINING CROSS SECTIONAL AREA
- ◒ 75% REMAINING CROSS SECTIONAL AREA
- ◓ 50% REMAINING CROSS SECTIONAL AREA
- ◔ 25% REMAINING CROSS SECTIONAL AREA
- ◕ 0% REMAINING CROSS SECTIONAL AREA
- I STEEL H-PILE
- ⊗ MONOTUBE PILE
- ⊙ STEEL PIPE PILE
- BATTER PILE

NOTES

1. H PILES #1 THRU #65 ARE HP10x42, #66 THRU #78 ARE HP10x157
SOURCE: 1973 RECORD DWGS
2. MONOTUBE PILES ARE 12"DIA x 7GA (0.179")
SOURCE: 1973 RECORD DWGS



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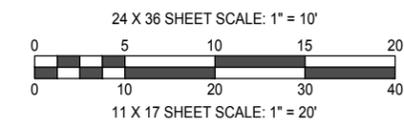
REVIEWED: _____
PARK ENGINEER _____ DATE _____

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PIER 58

**2016 TIMBER PILING
CONDITION ASSESSMENT
(WC1741)**

DESIGNED MOB	DATE 9-12-2016
DRAWN BDS	SHEET OF
CHECKED	
ORDINANCE NO.	S1.1
JOB NO. P16028.00	
SCALE AS NOTED	



PLAN

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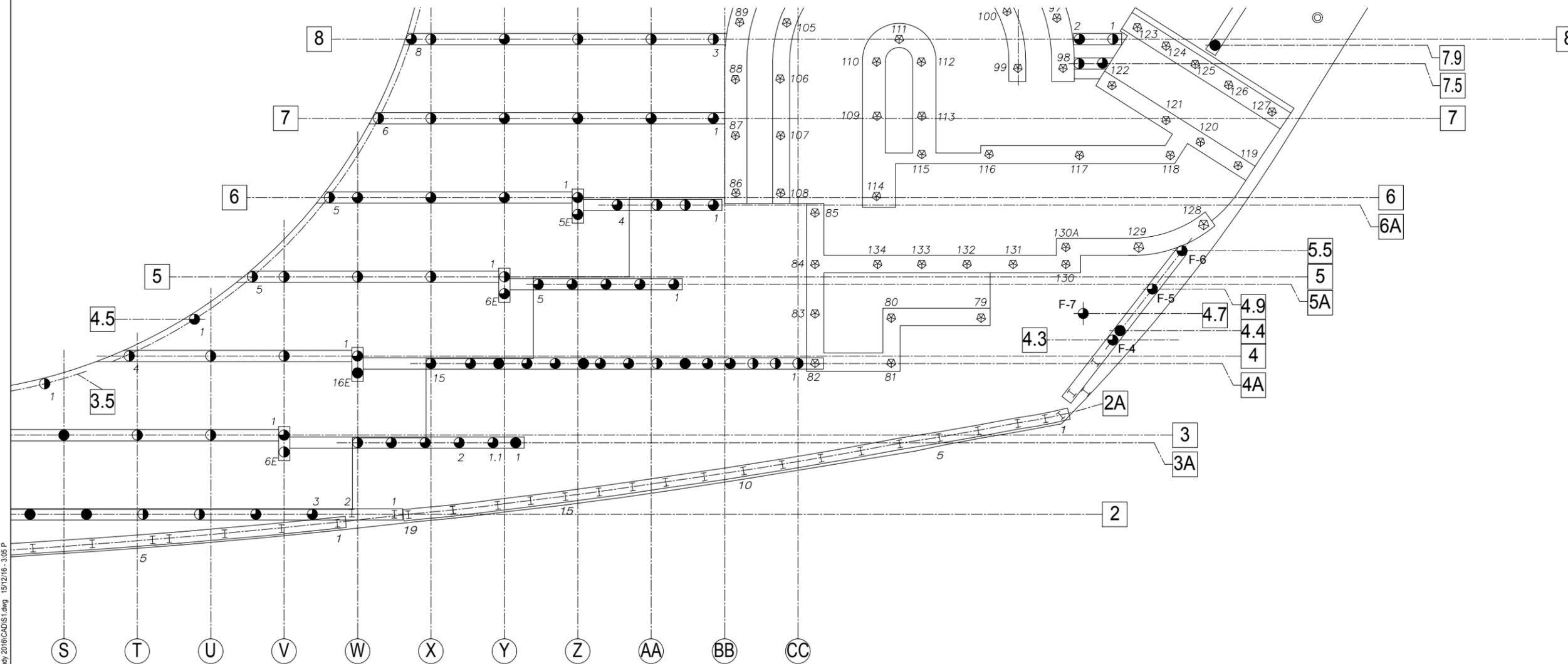
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- ◔ 25% REMAINING CROSS SECTIONAL AREA
- ◕ 0% REMAINING CROSS SECTIONAL AREA
- I STEEL H-PILE (NOTE 1)
- ⊗ MONOTUBE PILE (NOTE 2)
- ◎ STEEL PIPE COL
- STEEL PIPE COL

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SOURCE: 1973 RECORD DWGS



PLAN

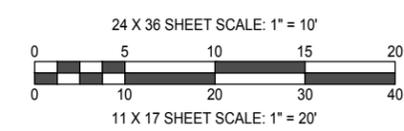
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	AS BUILT	

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PIER 58

**2016 TIMBER PILING
CONDITION ASSESSMENT
(WC1741)**

DESIGNED MOB	DATE 9-12-2016
DRAWN BDS	SHEET OF
CHECKED	
ORDINANCE NO.	S1.2
JOB NO. P16028.00	
SCALE AS NOTED	



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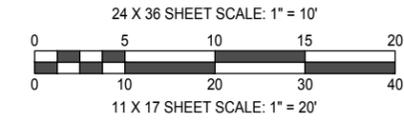
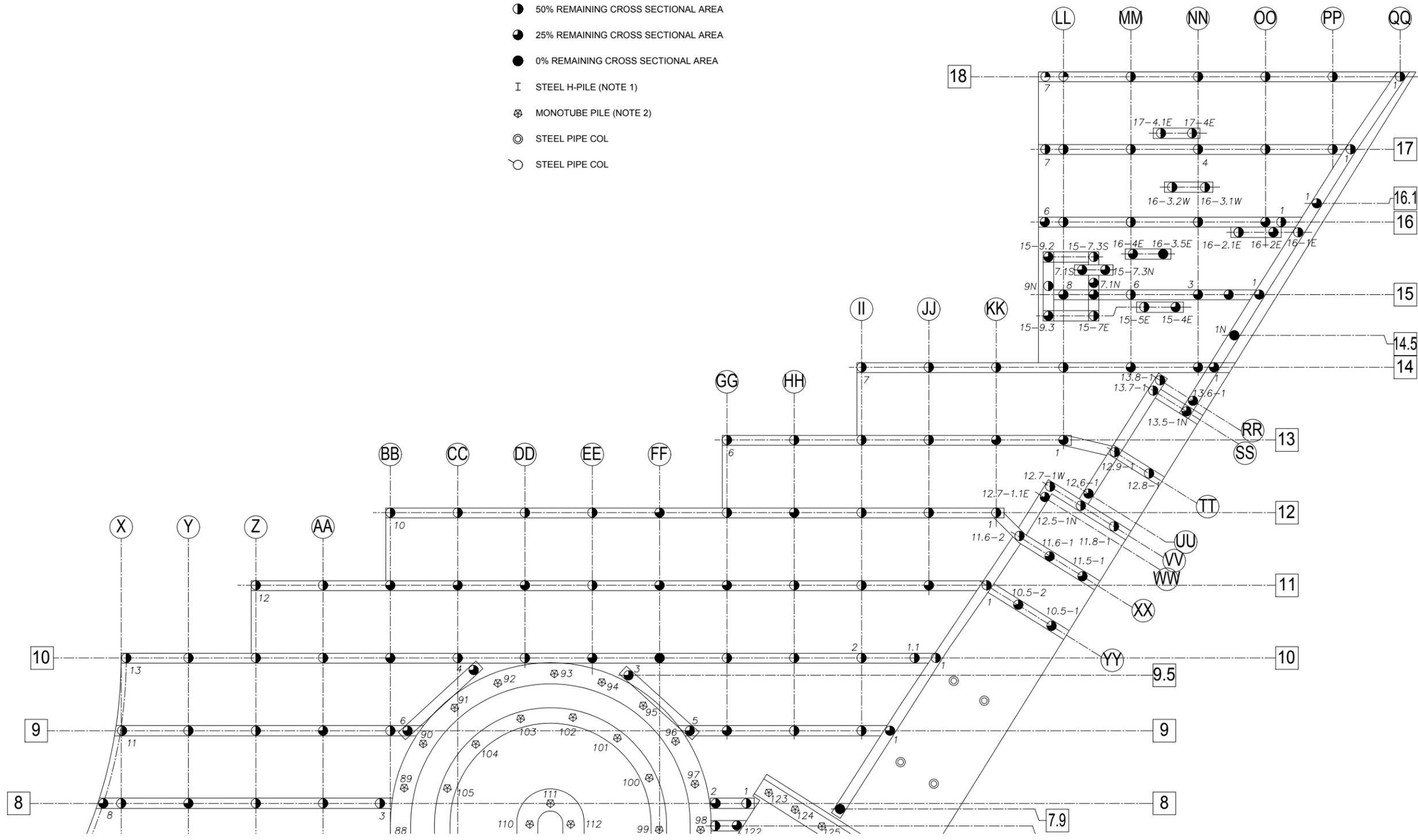
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LEGEND

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- 90% REMAINING CROSS SECTIONAL AREA
- 75% REMAINING CROSS SECTIONAL AREA
- 50% REMAINING CROSS SECTIONAL AREA
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- STEEL PIPE COL

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NO.	REVISION - AS BUILT	DATE

REVIEWED: _____
PARK ENGINEER DATE

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PIER 58

**2016 TIMBER PILING
CONDITION ASSESSMENT
(WC1741)**

DESIGNED MOB	DATE 9-12-2016
DRAWN BDS	SHEET OF
CHECKED	
ORDINANCE NO.	S1.3
JOB NO. P16028.00	
SCALE AS NOTED	

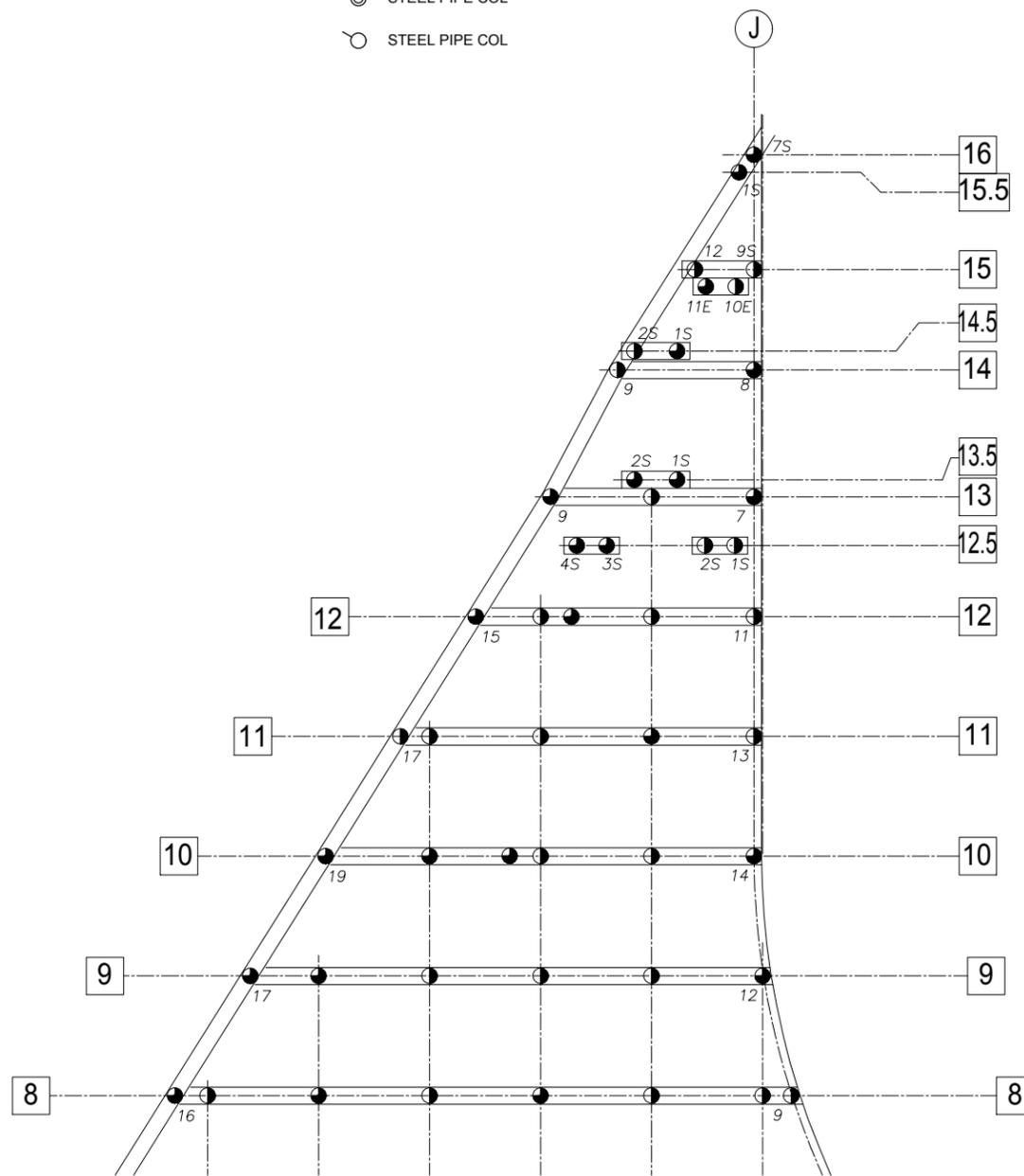
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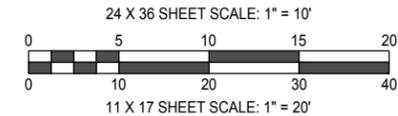
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- STEEL PIPE COL

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PLAN



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PIER 58

**2016 TIMBER PILING
CONDITION ASSESSMENT
(WC1741)**

DESIGNED MOB	DATE 9-12-2016
DRAWN BDS	SHEET OF
CHECKED	
ORDINANCE NO.	S1.4
JOB NO. P16028.00	
SCALE AS NOTED	

**>>>>CAUTION<<<<
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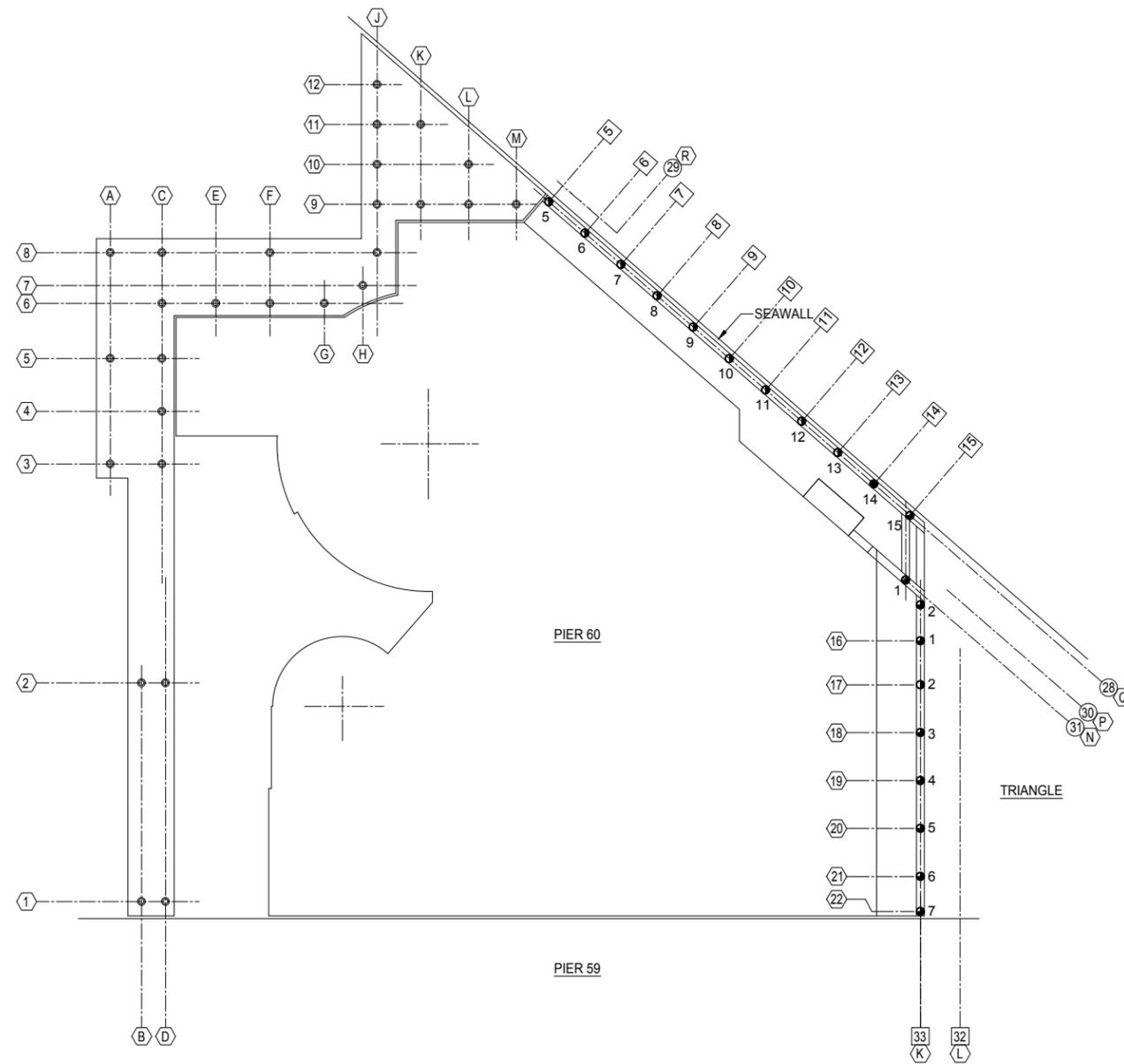
NOT LESS THAN TWO OR MORE THAN TEN BUSINESS DAYS PRIOR TO COMMENCING EXCAVATION OR DEMOLITION, SECURE THE SERVICES OF A COMMERCIAL UNDERGROUND UTILITIES LOCATOR SERVICE TO IDENTIFY BELOW-GROUND IMPROVEMENTS THAT MAY NOT BE INDICATED ON THE DRAWINGS. FOR IRRIGATION SYSTEMS, CALL SEATTLE PARKS PLUMBING SHOP (206 684 7070)

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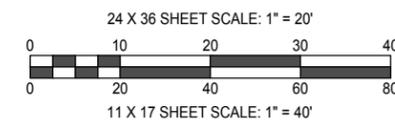


GRID SYMBOLS

- 10- ALL (2006, 2009, 2015)
- 10- TINNEA / SEATTLE STRUCTURAL (2006)
- 10- BERGER ABAM (2009, 2015)

LEGEND

- TIMBER BEARING PILE (NO DATA)
- ⊙ 100% REMAINING CROSS SECTIONAL AREA
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- ◑ 75% REMAINING CROSS SECTIONAL AREA
- ◒ 50% REMAINING CROSS SECTIONAL AREA
- ◓ 25% REMAINING CROSS SECTIONAL AREA
- ◔ 0% REMAINING CROSS SECTIONAL AREA
- BATTER PILE
- ⊕ UNDAMAGED FENDER PILE
- ⊖ DAMAGED FENDER PILE
- ⊙ STEEL PIPE PILE



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NO.	REVISION -- AS BUILT	DATE

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PARK ENGINEER DATE

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PIER 60

**2016 TIMBER PILING
CONDITION ASSESSMENT
(WC1741)**

DESIGNED MOB	DATE 9-12-2016
DRAWN BDS	SHEET OF
CHECKED	
ORDINANCE NO.	S2
JOB NO. P16028.00	
SCALE AS NOTED	

PLAN

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SEATTLE PARKS AND RECREATION

Seattle Structural

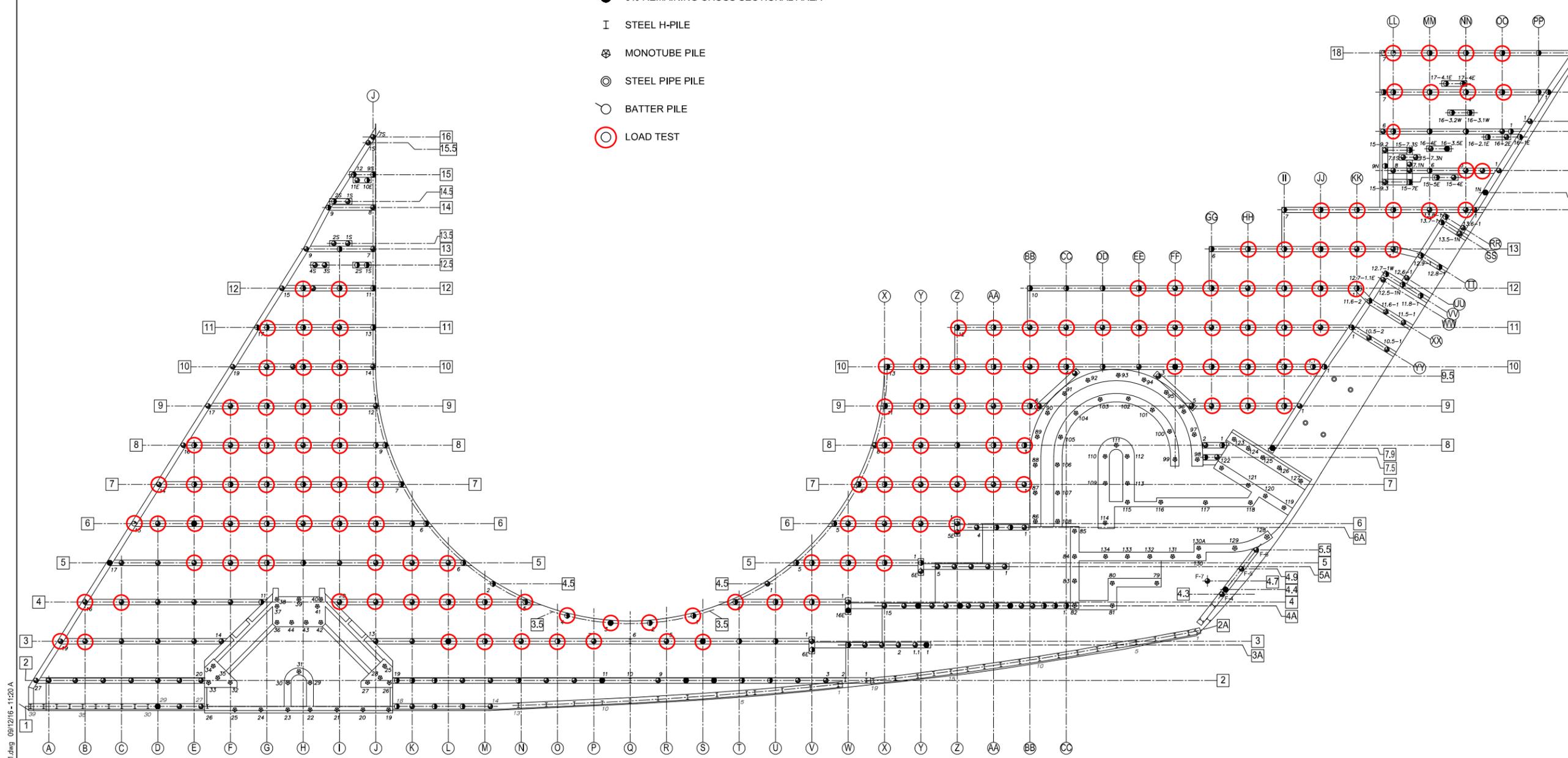
Seattle Structural PS Inc.
Civil and Structural Engineering
1420 Fifth Avenue, Suite 425
Seattle, WA 98101-4019
206-343-3000 phone 206-343-3013 fax

LEGEND

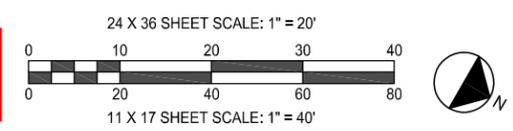
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- ◑ 75% REMAINING CROSS SECTIONAL AREA
- ◒ 50% REMAINING CROSS SECTIONAL AREA
- ◓ 25% REMAINING CROSS SECTIONAL AREA
- ◔ 0% REMAINING CROSS SECTIONAL AREA
- I STEEL H-PILE
- ⊗ MONOTUBE PILE
- ⊙ STEEL PIPE PILE
- BATTER PILE
- ⊙ LOAD TEST

NOTES

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SOURCE: 1973 RECORD DWGS
2. MONOTUBE PILES ARE 12"DIA x 7GA (0.179")
SOURCE: 1973 RECORD DWGS



**2016 LOAD TEST
LOCATIONS OF DISPLACEMENT MEASUREMENTS**



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NO.	REVISION	DATE

REVIEWED: _____ DATE _____
PARK ENGINEER

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PIER 58

**TIMBER PILING
CONDITION ASSESSMENT
(WC1741)**

DESIGNED MOB	DATE 9-12-2016
DRAWN BDS	SHEET OF
CHECKED	S3
ORDINANCE NO.	
JOB NO. P16028.00	
SCALE AS NOTED	

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PLAN

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The Miller/Hull Partnership, LLP
Architecture and Planning
Polson Building
71 Columbia
Sixth Floor
Seattle, WA 98104
Phone 206.682.6837
Fax 206.682.5692



Flock + Kurtz Inc.
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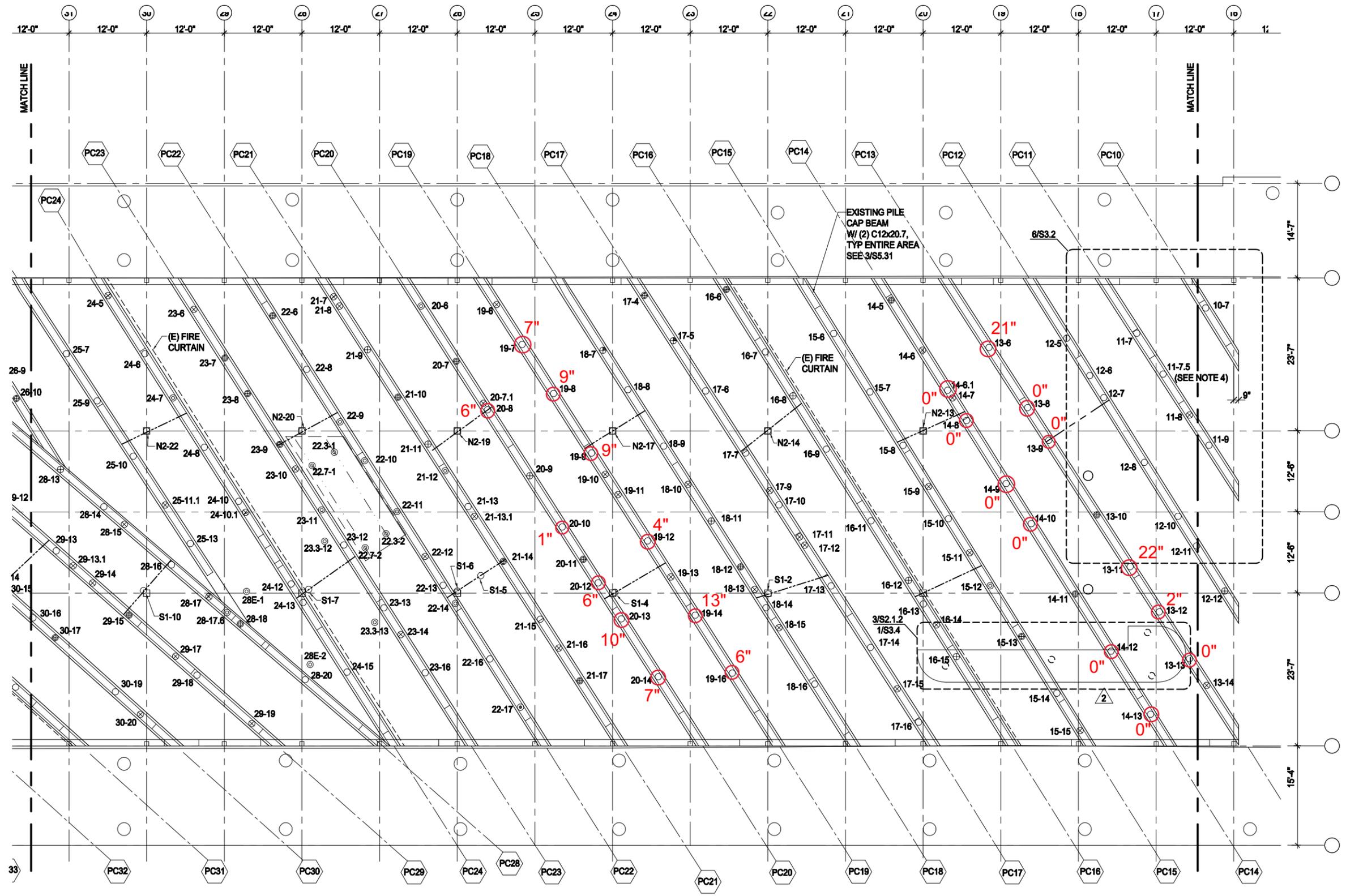
MARCH 14, 2005 - ORIGINAL ISSUE DATE
MARCH, 2007 - RECORD DRAWINGS

AQUARIUM PIER 59

PILING REPLACEMENT

PIER SUB-STRUCTURE FRAMING PLAN (ZONE 2)

DESIGNED	SHEET 12 OF 171
DRAWN	
CHECKED	
ORDINANCE NO. WC 2202	
CONTRACT NO. PR03-048	S2.0.2
SCALE AS NOTED	



LEGEND:
X" O MAXIMUM PROJECTION OF STEEL "CAN" OF REPLACEMENT PILE ABOVE MUDLINE MEASURED IN 2016 (INCHES)

- NOTES:**
1. THE PLANS SHOW UNDER PIER FRAMING UPON COMPLETION OF CONSTRUCTION.
 2. SEE S5.31 FOR CONSTRUCTION DETAILS.
 3. SEE S9.0 FOR CONSTRUCTION PHASE DETAILS.
 4. ADD A NEW REPLACEMENT PILE P11-7.5 OFF UNKNOWN EXISTING PILE STUB. NOTIFY CONSULTANT OF THE LOCATION OF EXISTING PILE STUB.
 5. SEE 12/S5.32 FOR TEMPORARY SUPPORT OF INTERIOR COLUMNS DURING PILE REPLACEMENT (TYP 21 PLCS).

PIER SUB-STRUCTURE FRAMING PLAN

1/8"=1'-0" 3

CAUTION
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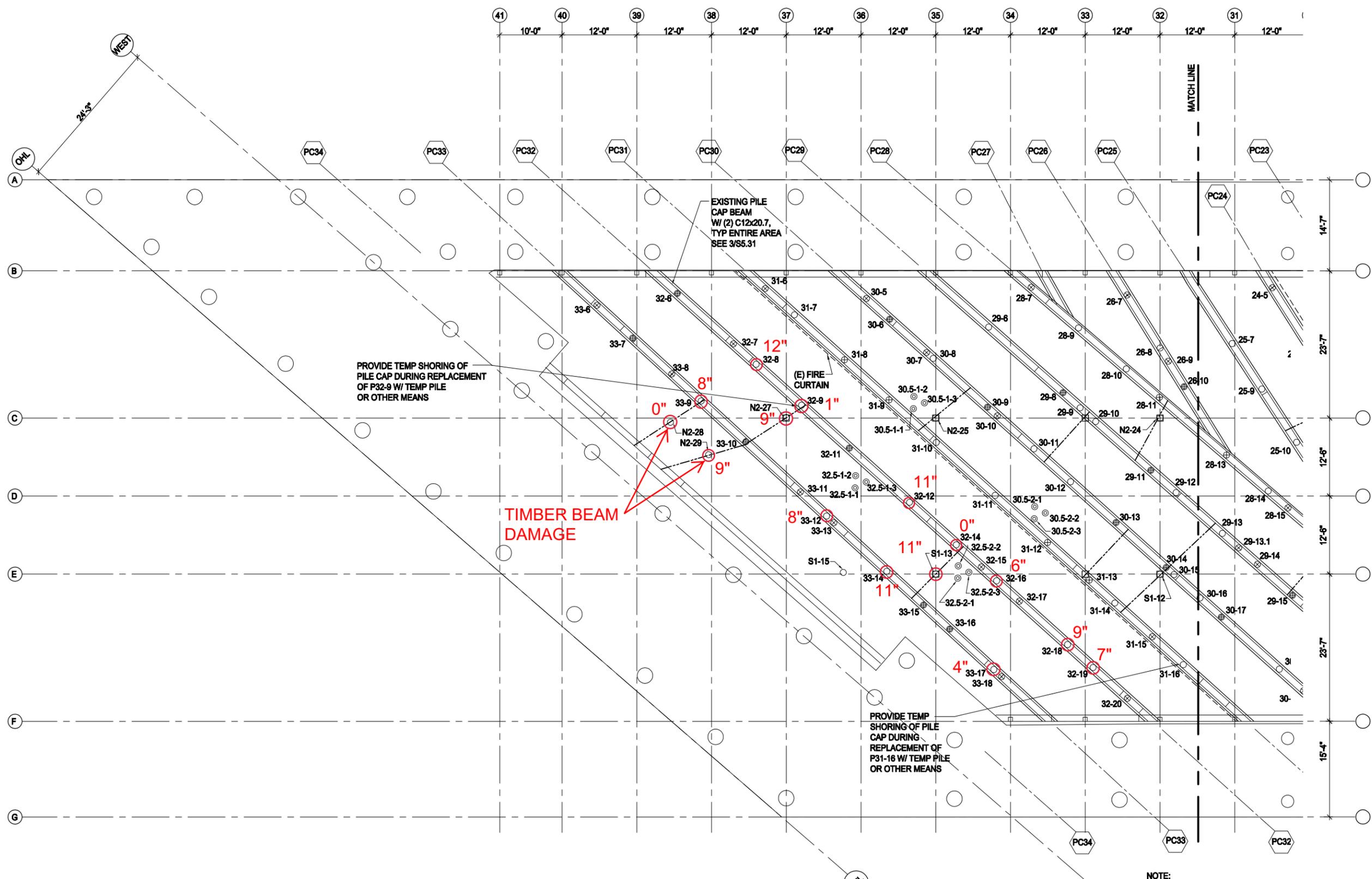
MARCH 14, 2005 - ORIGINAL ISSUE DATE
MARCH, 2007 - RECORD DRAWINGS

AQUARIUM PIER 59

PILING REPLACEMENT

PIER SUB-STRUCTURE FRAMING PLAN (ZONE 3)

DESIGNED		SHEET 13 OF 171
DRAWN		
CHECKED		S2.0.3
ORDINANCE NO. WC 2202		
CONTRACT NO. PR03-048		SCALE AS NOTED

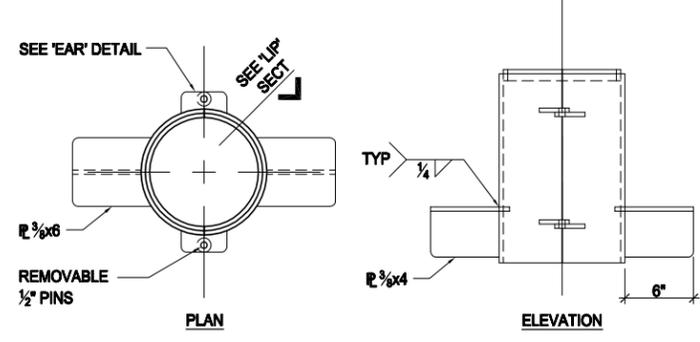
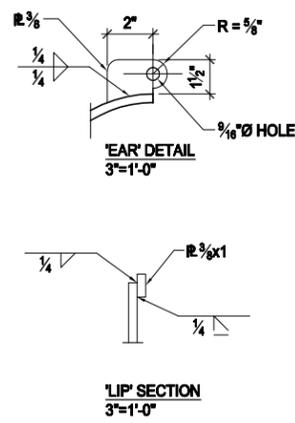


LEGEND:
X" O MAXIMUM PROJECTION OF STEEL "CAN" OF REPLACEMENT PILE ABOVE MUDLINE MEASURED IN 2016 (INCHES)

NOTE:
1. SEE S2.0 & S2.02 FOR NOTES & DRAWING LEGENDS.

PIER SUB-STRUCTURE FRAMING PLAN

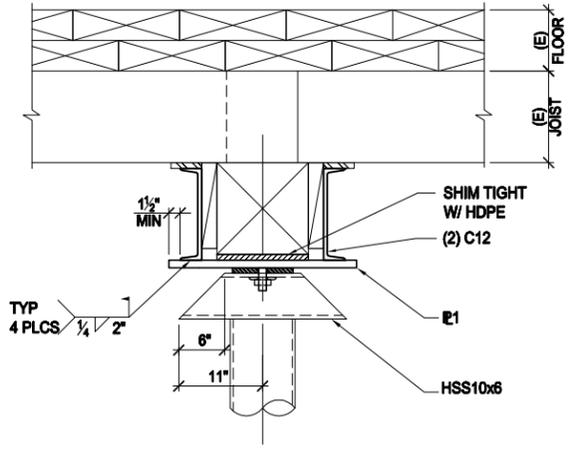
1/8"=1'-0" 3



NOTE:
JACK DEVICE SHOWN IS AT CONTRACTOR'S OPTION.
CONTRACTOR SHALL BE RESPONSIBLE FOR JACKING TECHNIQUE.

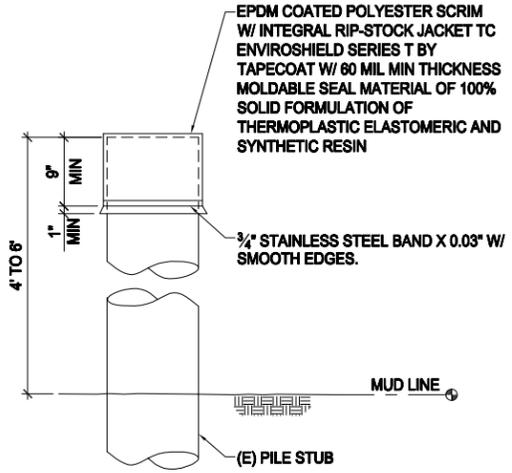
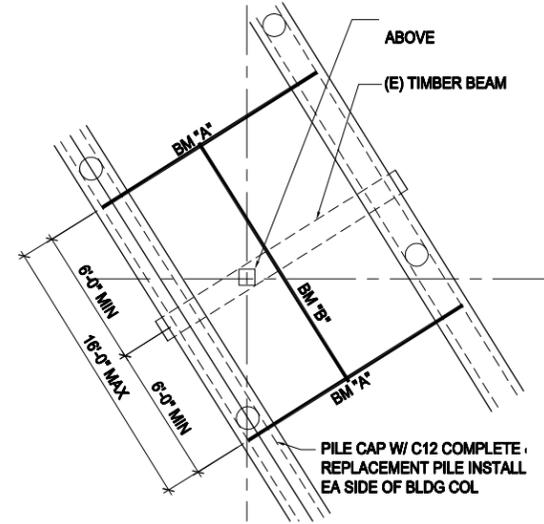
JACK DEVICE

1 1/2"=1'-0" 7



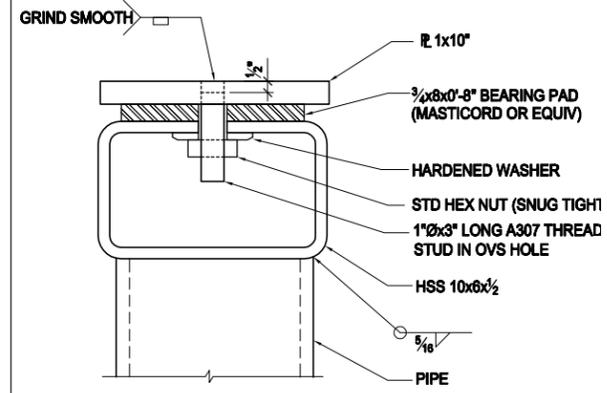
DETAIL

1"=1'-0" 4



TIMBER STUB CAP DETAIL

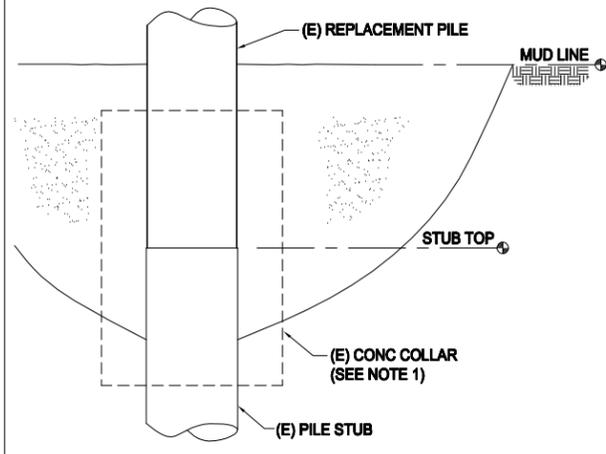
8



DETAIL

3"=1'-0" 5

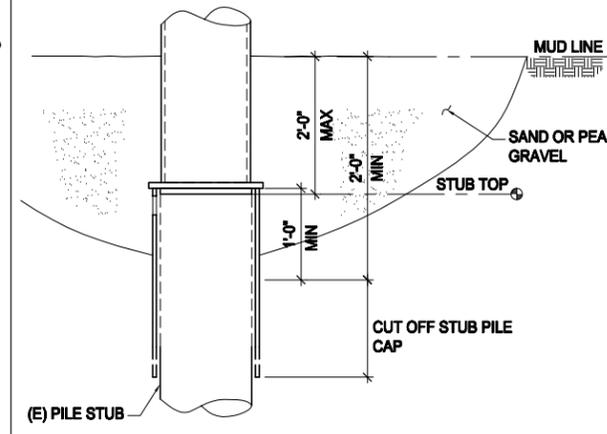
- NOTES:
- BMS 'A' AND 'B' ARE TEMPORARY SHORING BEAMS USED TO TEMPORARILY SUPPORT THE BUILDING COLUMN DURING THE INSTALLATION OF THE REPLACEMENT PILE. THE METHOD OF ATTACHING THE BEAMS TO THE EXISTING PILE CAPS AND JACKING THE REQUIRED PRELOAD INTO THE ASSEMBLY SHALL BE DETERMINED BY THE CONTRACTOR.
 - BM 'A' SHALL BE A W10x19, OR ANOTHER BEAM OF EQUAL SECTION MODULUS. BM 'B' SHALL BE A W14x30, OR ANOTHER BEAM OF EQUAL SECTION MODULUS.
 - ASSEMBLY SHALL BE CAPABLE OF LIFTING A 20,000# LOAD. BM 'B' SHALL BE POSITIONED WITHIN 1'-0" OF THE COLUMN ABOVE AND LOADED WITH A JACKING FORCE OF 10,000# PRIOR TO REMOVAL OF EXISTING PILE.
 - REPLACEMENT PILE SHALL BE LOCATED UNDER THE EXISTING COLUMN ABOVE.
 - THIS DETAIL SHALL BE USED AT ALL INTERIOR COLUMN LOCATIONS.



- NOTES:
- WHERE CONC COLLAR IS INDICATED IN THE SCHEDULE, CHIP OFF THE COLLAR TO EXPOSE (E) TIMBER PILE STUB AND MEASURE (E) PILE STUB DIAMETER PRIOR TO FABRICATION OF CAP.
 - SEE 6/S5.2 FOR STUB CAP, EXCAVATION AND BACK FILL INFO.

DETAIL

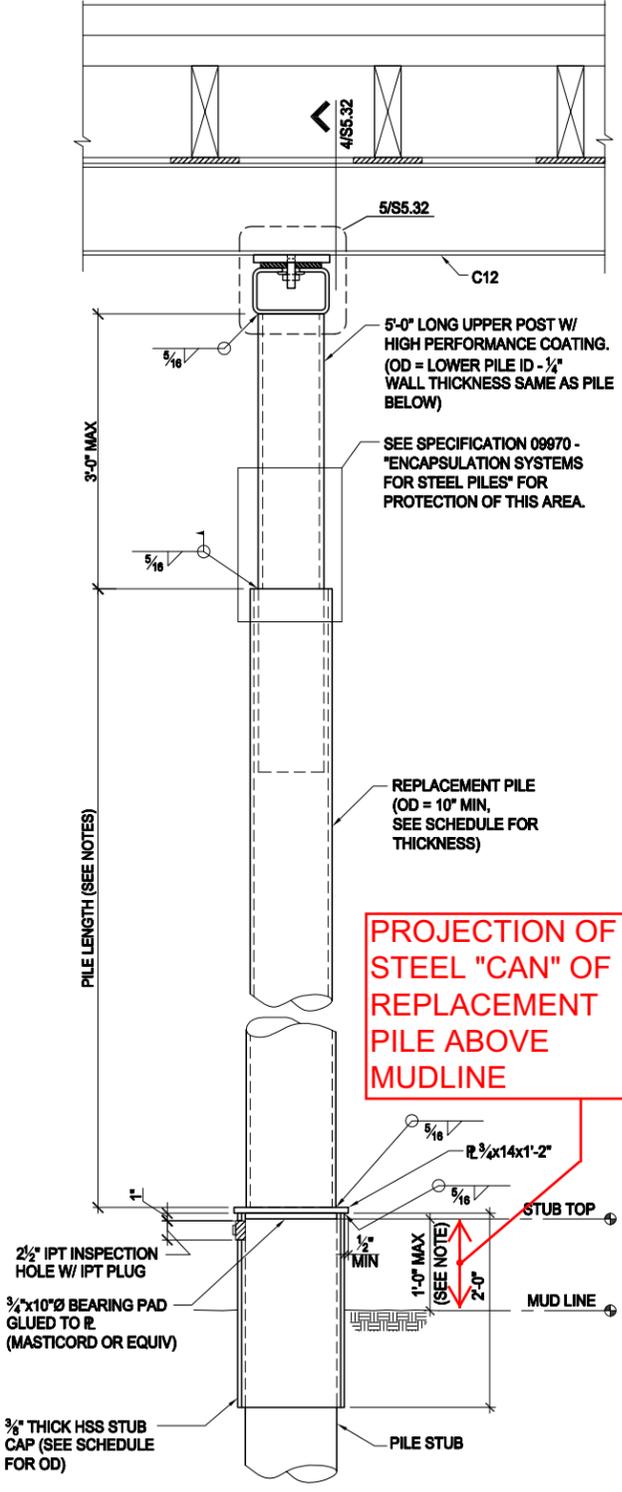
1/4"=1'-0" 12



- NOTES:
- WHERE EXCAVATION IS REQ'D TO OBTAIN A COMPETENT STUB, BACK FILL EXCAVATED AREA W/ CLEAN SAND OR PEA GRAVEL.
 - SEE 3/S5.2 FOR MORE INFO

DETAIL

1"=1'-0" 6



- NOTE:
- SEE S5.33 FOR SCHEDULE. PILE STUB SHALL BE CUT FLAT WITHIN 5" OF LEVEL.
 - CUT TOP OF PILE AFTER DETERMINATION OF STUB TOP ELEVATION.
 - SEE 6/S5.32 WHERE STUB IS BELOW MUD LINE.
 - SEE 9/S5.32 IF CONCRETE COLLAR IS INDICATED IN SCHEDULE.
 - PILES SHALL BE FABRICATED TO LENGTH SHOWN IN TABLE. TOP 22' OF PILE SHALL BE GALVANIZED AND EPOXY COATED (HIGH PERFORMANCE COATING). BOTTOM OF PILE SHALL BE EPOXY COATED.
 - PRELOAD REPLACEMENT PILE WITH 5000# LOAD.
 - STUB CAP DIAMETER SHALL BE MAX 3" LARGER THAN STUB WHERE NOT SHOWN IN TABLE.
 - CONTRACTOR SHALL INSPECT PILE TO CONFIRM BEARING ON STUB PILE.

TYPICAL REPLACEMENT PILE

1"=1'-0" 3

CAUTION
CALL BEFORE YOU DIG!
NOT LESS THAN TWO OR MORE THAN TEN BUSINESS DAYS PRIOR TO COMMENCING EXCAVATION OR DEMOLITION, SECURE THE SERVICES OF A COMMERCIAL UNDERGROUND UTILITIES LOCATOR SERVICE TO IDENTIFY BELOW-GROUND IMPROVEMENTS THAT MAY NOT BE INDICATED ON THE DRAWINGS. FOR IRRIGATION SYSTEMS, CALL SEATTLE PARKS PLUMBING SHOP (206 684 7070)
>>800 424 5555<<

Seattle Structural
Seattle Structural PS Inc.
Civil and Structural Engineering
1411 Fourth Avenue, Suite 760
Seattle, WA 98101-2231
206-343-3000 phone 206-343-3013 fax

MILLER HULL
The Miller/Hull Partnership, LLP
Architecture and Planning
Polson Building
71 Columbia
Sixth Floor
Seattle, WA 98104
Phone 206.682.6837
Fax 206.682.5692

Flock + Kurtz Inc.
1417 Fourth Ave. Suite 400
Seattle, WA 98101-2260
Tel. (206) 342-9900
Fax. (206) 342-9901
WSP A WSP Group company

RECORD DRAWINGS

THESE RECORD DRAWINGS HAVE BEEN PREPARED IN PART ON THE BASIS OF INFORMATION FURNISHED BY OTHERS. SEATTLE STRUCTURAL PS INC WILL NOT BE RESPONSIBLE FOR ANY ERRORS OR OMISSIONS WHICH HAVE BEEN INCORPORATED INTO THIS DOCUMENT AS RESULT OF INFORMATION FURNISHED BY OTHERS.

MARCH 13, 2005 - ORIGINAL ISSUE DATE
MARCH, 2007 - RECORD DRAWINGS

AQUARIUM PIER 59

**PILING REPLACEMENT
SUB-STRUCTURE REPAIRS
TYPICAL DETAILS**

DESIGNED		SHEET 57 OF 171
DRAWN		
CHECKED		S5.32
ORDINANCE NO. WC 2202		
CONTRACT NO. PR03-048		
SCALE AS NOTED		

APPENDIX B

Pier 58 Timber Pile Rating Data

Appendix B: Pier 58 Timber Pile Ratings

Pile		2011		Pile Rating					Remarks
Bent	Pile	Bent	Pile	2000	2006	2011	2014	2016	
1	14			100%	NR	25%	75%	25%	
	15			100%	NR	75%	90%	50%	
	16			100%	NR	75%	100%	50%	
	17			100%	NR	50%	75%	25%	
	18			100%	NR	90%	90%	50%	
	19			100%	NR	75%	90%	25%	2014 Label: 1-27
	20			90%	NR	75%	90%	25%	2014 Label: 1-28
	21			90%	NR	75%	25%	0%	2014 Label: 1-29
2	3			90%	75%	90%	90%	25%	
	4			100%	25%	50%	100%	25%	
	5			90%	50%	90%	100%	50%	
	6			90%	90%	90%	90%	50%	
	7			90%	90%	25%	0%	0%	
	8			75%	75%	0%	0%	0%	
	9			100%	90%	75%	100%	25%	
	11			50%	25%	25%	0%	0%	
	12			90%	75%	75%	90%	25%	
	13			90%	75%	75%	100%	25%	
	14			90%	90%	75%	100%	50%	
	15			90%	75%	75%	75%	25%	
	16			90%	50%	50%	0%	25%	
	17			90%	75%	90%	75%	50%	
	18			90%	90%	90%	90%	50%	
	19			90%	90%	90%	90%	50%	
	20			90%	75%	75%	75%	25%	
	21			90%	50%	25%	75%	25%	
	22			90%	75%	75%	75%	25%	
	23			90%	75%	50%	75%	25%	
	24			90%	75%	75%	75%	25%	
	25			90%	50%	25%	0%	25%	
	26			90%	75%	75%	75%	25%	
	27			100%	90%	90%	100%	25%	
3A	1	3A	1	90%	NR	50%	90%	0%	
	1.1		2	75%	90%	50%	90%	25%	
	2		3	100%	75%	75%	90%	25%	
	3		4	90%	90%	50%	100%	25%	
	4		5	90%	90%	50%	75%	25%	
	5		6	90%	90%	75%	90%	50%	
	6E		7	100%	90%	50%	90%	50%	
3	1			100%	90%	75%	100%	25%	

NR = not rated

Appendix B: Pier 58 Timber Pile Ratings

Pile Label		2011 Label		Pile Rating					Remarks
Bent	Pile	Bent	Pile	2000	2006	2011	2014	2016	
3	2			90%	90%	NR	75%	50%	
	3			100%	90%	NR	90%	50%	
	4			100%	90%	NR	25%	0%	
	5			90%	90%	NR	100%	25%	
	7			90%	90%	NR	75%	25%	
	8			90%	90%	NR	90%	50%	
	9			90%	75%	NR	90%	25%	
	10			100%	90%	NR	90%	50%	
	11			100%	100%	NR	0%	0%	
	12			90%	75%	NR	75%	25%	
	13			90%	75%	NR	90%	25%	
	14			90%	90%	NR	75%	25%	
	15			90%	75%	NR	75%	25%	
	16			90%	90%	NR	75%	25%	
	17			90%	50%	NR	25%	25%	
	18			75%	90%	NR	90%	25%	
	19			90%	90%	NR	75%	25%	
3.5	1			100%	90%	NR	NR	50%	
	2			100%	90%	NR	NR	50%	
	3			90%	90%	NR	NR	0%	
	4			100%	75%	NR	NR	50%	
4A	1			90%	90%	50%	90%	50%	
	2			90%	90%	75%	90%	50%	
	3			90%	90%	50%	100%	50%	
	4			90%	NR	50%	75%	25%	
	5			90%	75%	50%	75%	25%	
	6			90%	25%	75%	0%	0%	
	7			90%	90%	50%	90%	50%	
	8			90%	90%	50%	90%	25%	
	9			90%	90%	75%	75%	25%	
	10			90%	75%	75%	90%	0%	
	11			100%	90%	75%	90%	25%	
	12			90%	90%	50%	75%	25%	
	13			90%	75%	50%	0%	0%	
	14			100%	75%	50%	90%	25%	
	15			90%	75%	75%	50%	25%	
	16E			90%	25%	50%	75%	0%	
4	1			100%	90%	75%	NR	25%	
	2			100%	90%	NR	NR	50%	
	3			100%	90%	NR	NR	50%	

NR = not rated

Appendix B: Pier 58 Timber Pile Ratings

Pile Label		2011 Label		Pile Rating					Remarks
Bent	Pile	Bent	Pile	2000	2006	2011	2014	2016	
4	4			100%	90%	NR	NR	50%	
	5			100%	90%	NR	NR	50%	
	6			90%	90%	NR	NR	50%	
	7			100%	90%	NR	NR	50%	
	8			90%	90%	NR	NR	25%	
	9			90%	75%	NR	NR	25%	
	10			90%	75%	NR	NR	25%	
	11			100%	90%	NR	NR	50%	
	12			90%	75%	NR	NR	25%	
	13			90%	75%	NR	NR	25%	
	14			100%	90%	NR	NR	25%	
	15			90%	75%	NR	NR	25%	
	16			100%	75%	NR	NR	25%	
F	4	4.3	1	90%	NR	NR	90%	25%	
	5	4.9	1	90%	NR	NR	90%	25%	
	6	5.5	1	90%	NR	NR	NR	25%	
	7	4.7	1	90%	NR	NR	90%	25%	
4.5	1			100%	90%	NR	NR	25%	
	2			90%	90%	NR	NR	50%	
5A	1			90%	90%	50%	NR	25%	
	2			100%	75%	75%	NR	25%	
	3			100%	90%	75%	NR	25%	
	4			90%	75%	75%	NR	25%	
	5			90%	90%	75%	NR	25%	
	6E			90%	90%	75%	NR	25%	
5	1			90%	90%	75%	NR	50%	
	2			100%	90%	NR	NR	50%	
	3			90%	90%	NR	NR	50%	
	4			100%	90%	NR	NR	50%	
	5			100%	90%	NR	NR	50%	
	6			90%	90%	NR	NR	50%	
	7			100%	90%	NR	NR	25%	
	8			90%	90%	NR	NR	25%	
	9			100%	90%	NR	NR	25%	
	10			90%	90%	NR	NR	25%	
	11			90%	90%	NR	NR	50%	
	12			90%	75%	NR	NR	50%	
	13			90%	90%	NR	NR	25%	
	14			90%	75%	NR	NR	25%	
	15			100%	90%	NR	NR	25%	

NR = not rated

Appendix B: Pier 58 Timber Pile Ratings

Pile Label		2011 Label		Pile Rating					Remarks
Bent	Pile	Bent	Pile	2000	2006	2011	2014	2016	
5	16			90%	75%	NR	NR	25%	
	17			50%	0%	NR	NR	0%	
6A	1			90%	90%	50%	NR	25%	
	2			90%	90%	50%	NR	50%	
	3			90%	75%	50%	NR	50%	
	4			90%	75%	75%	NR	25%	
	5E			100%	90%	75%	NR	25%	
6	1			25%	50%	75%	NR	25%	
	2			90%	75%	50%	NR	25%	
	3			75%	75%	50%	NR	25%	
	4			90%	90%	50%	NR	25%	
	5			50%	90%	75%	NR	50%	
	6			100%	90%	75%	NR	50%	
	7			90%	90%	75%	NR	50%	
	8			100%	90%	75%	NR	50%	
	9			90%	90%	75%	NR	50%	
	10			100%	90%	50%	NR	25%	
	11			100%	90%	50%	NR	50%	
	12			90%	75%	50%	NR	25%	
	13			75%	25%	25%	NR	0%	
	14			90%	75%	50%	NR	25%	
	15			100%	100%	75%	NR	75%	
7	1			90%	75%	75%	NR	25%	
	2			90%	75%	75%	NR	25%	
	3			90%	90%	50%	NR	25%	
	4			100%	90%	50%	NR	25%	
	5			50%	90%	50%	NR	50%	
	6			100%	90%	50%	NR	50%	
	7			100%	75%	75%	NR	50%	
	8			100%	90%	75%	NR	50%	
	9			100%	90%	75%	NR	50%	
	10			100%	90%	75%	NR	50%	
	11			100%	90%	75%	NR	50%	
	12			100%	75%	75%	NR	50%	
	13			90%	90%	75%	NR	50%	
	14			90%	75%	50%	NR	25%	
7.5	1			90%	75%	NR	NR	25%	
	2			90%	75%	NR	NR	50%	
7.9	1			NR	75%	NR	NR	0%	
8	1			90%	90%	NR	NR	50%	

NR = not rated

Appendix B: Pier 58 Timber Pile Ratings

Pile Label		2011 Label		Pile Rating					Remarks
Bent	Pile	Bent	Pile	2000	2006	2011	2014	2016	
8	2			90%	90%	NR	NR	25%	
	3			90%	50%	NR	NR	50%	
	4			90%	75%	NR	NR	50%	
	5			90%	75%	NR	NR	50%	
	6			90%	90%	NR	NR	25%	
	7			90%	50%	NR	NR	50%	
	8			90%	50%	NR	NR	25%	
	9			100%	90%	NR	NR	50%	
	10			90%	90%	NR	NR	50%	
	11			100%	100%	NR	NR	50%	
	12			90%	90%	NR	NR	25%	
	13			90%	75%	NR	NR	50%	
	14			90%	90%	NR	NR	25%	
	15			90%	90%	NR	NR	50%	
	16			90%	90%	NR	NR	25%	
9	1			90%	75%	NR	NR	25%	
	2			75%	75%	NR	NR	50%	
	3			100%	100%	NR	NR	50%	
	4			75%	75%	NR	NR	25%	
	5			75%	75%	NR	NR	25%	
	6			90%	90%	NR	NR	25%	
	7			90%	75%	NR	NR	50%	
	8			100%	90%	NR	NR	25%	
	9			100%	90%	NR	NR	50%	
	10			90%	90%	NR	NR	50%	
	11			90%	90%	NR	NR	50%	
	12			90%	90%	NR	NR	25%	
	13			90%	90%	NR	NR	50%	
	14			100%	90%	NR	NR	50%	
	15			90%	100%	NR	NR	50%	
	16			100%	90%	NR	NR	25%	
	17			90%	90%	NR	NR	25%	
9.5	3			90%	90%	NR	NR	25%	
	4			90%	75%	NR	NR	25%	
10	1			75%	90%	NR	NR	50%	
	1.1			90%	90%	NR	NR	50%	
	2			75%	90%	NR	NR	50%	
	3			75%	90%	NR	NR	50%	
	4			100%	75%	NR	NR	50%	
	5			75%	90%	NR	NR	0%	

NR = not rated

Appendix B: Pier 58 Timber Pile Ratings

Pile Label		2011 Label		Pile Rating					Remarks
Bent	Pile	Bent	Pile	2000	2006	2011	2014	2016	
10	6			25%	90%	NR	NR	25%	
	7			100%	0%	NR	NR	50%	
	8			100%	75%	NR	NR	50%	
	9			50%	100%	NR	NR	25%	
	10			90%	75%	NR	NR	50%	
	11			100%	75%	NR	NR	50%	
	12			100%	90%	NR	NR	50%	
	13			100%	90%	NR	NR	50%	
	14			90%	75%	NR	NR	25%	
	15			90%	75%	NR	NR	50%	
	16			90%	90%	NR	NR	50%	
	17			90%	90%	NR	NR	25%	
	18			90%	75%	NR	NR	25%	
	19			90%	90%	NR	NR	25%	
10.5	1	YY	1	75%	75%	NR	NR	25%	
	2	YY	2	75%	75%	NR	NR	25%	
11	1			90%	90%	NR	NR	50%	
	2			90%	90%	NR	NR	25%	
	3			75%	90%	NR	NR	50%	
	4			90%	75%	NR	NR	50%	
	5			75%	50%	NR	NR	25%	
	6			90%	75%	NR	NR	25%	
	7			50%	90%	NR	NR	50%	
	8			100%	90%	NR	NR	25%	
	9			100%	50%	NR	NR	25%	
	10			90%	75%	NR	NR	25%	
	11			100%	90%	NR	NR	50%	
	12			90%	90%	NR	NR	50%	
	13			100%	100%	NR	NR	50%	
	14			90%	75%	NR	NR	25%	
	15			90%	75%	NR	NR	50%	
	16			90%	90%	NR	NR	50%	
	17			100%	100%	NR	NR	50%	
11.5	1	XX	1	75%	90%	NR	NR	25%	
11.6	1	XX	2	90%	75%	NR	NR	25%	
	2	XX	3	100%	100%	NR	NR	50%	
11.8	1	VV	1	90%	75%	NR	NR	50%	
12	1			90%	90%	NR	NR	50%	
	2			100%	90%	NR	NR	50%	
	3			75%	75%	NR	NR	50%	

NR = not rated

Appendix B: Pier 58 Timber Pile Ratings

Pile Label		2011 Label		Pile Rating					Remarks
Bent	Pile	Bent	Pile	2000	2006	2011	2014	2016	
12	4			75%	90%	NR	NR	25%	
	5			75%	90%	NR	NR	50%	
	6			100%	90%	NR	NR	25%	
	7			90%	90%	NR	NR	50%	
	8			100%	90%	NR	NR	50%	
	9			90%	75%	NR	NR	50%	
	10			90%	90%	NR	NR	50%	
	11			0%	90%	NR	NR	50%	
	12			90%	90%	NR	NR	50%	
	13			90%	75%	NR	NR	25%	
	14			90%	75%	NR	NR	50%	
	15			90%	90%	NR	NR	25%	
12.5	1N	VV	2	90%	75%	NR	NR	50%	
	1S			75%	90%	90%	NR	50%	
	2S			100%	90%	90%	NR	50%	
	3S			90%	90%	90%	NR	25%	
	4S			100%	90%	90%	NR	25%	
12.6	1	UU	1	75%	75%	NR	NR	25%	
12.7	1W	VV	3	75%	90%	NR	NR	50%	
	1.1E	WW	1	90%	75%	NR	NR	25%	
12.8	1	TT	1	100%	90%	NR	NR	50%	
12.9	1	TT	2	90%	90%	NR	NR	50%	
13	1			90%	90%	NR	NR	25%	
	2			90%	90%	NR	NR	25%	
	3			90%	90%	NR	NR	50%	
	4			90%	75%	NR	NR	50%	
	5			100%	90%	NR	NR	50%	
	6			90%	90%	NR	NR	50%	
	7			50%	90%	NR	NR	25%	
	8			90%	75%	NR	NR	50%	
	9			90%	NR	NR	NR	25%	
13.5	1N	SS	1	90%	75%	NR	NR	25%	
	1S	13.2	1	90%	90%	90%	NR	25%	
	2S	13.2	2	90%	90%	90%	NR	25%	
13.6	1	RR	1	75%	50%	NR	NR	25%	
13.7	1	SS	2	90%	90%	NR	NR	50%	
13.8	1	RR	2	90%	90%	NR	NR	50%	
14	1			90%	75%	NR	NR	25%	
	2			90%	75%	NR	NR	25%	
	3			90%	90%	NR	NR	25%	

NR = not rated

Appendix B: Pier 58 Timber Pile Ratings

Pile Label		2011 Label		Pile Rating					Remarks
Bent	Pile	Bent	Pile	2000	2006	2011	2014	2016	
14	4			90%	75%	NR	NR	50%	
	5			100%	90%	NR	NR	50%	
	6			90%	90%	NR	NR	50%	
	7			90%	75%	NR	NR	50%	
	8			90%	90%	NR	NR	25%	
	9			75%	50%	NR	NR	50%	
14.5	1N			90%	75%	NR	NR	0%	loose, not bearing under pile cap
	1S	14.2	1	90%	75%	90%	NR	25%	
	2S	14.2	2	90%	90%	90%	NR	50%	
15	1			75%	75%	50%	NR	25%	
	2			90%	50%	75%	NR	25%	
	3			90%	75%	50%	NR	25%	
	4E	14.7	1	90%	90%	NR	NR	25%	
	5E	14.7	2	100%	75%	NR	NR	50%	
	6			90%	75%	75%	NR	50%	
	7			75%	25%	90%	NR	25%	
	7E	14.7	3	0%	75%	NR	NR	50%	
	7.1N	15.1	1	90%	50%	NR	NR	25%	
	7.1S	15.3	2	90%	NR	NR	NR	25%	
	7.3N	15.3	1	90%	NR	NR	NR	25%	
	7.3S	15.5	3	75%	90%	NR	NR	50%	
	8			75%	75%	25%	NR	25%	
	9N			25%	75%	75%	NR	50%	
	9.2	15.5	4	100%	90%	NR	NR	25%	
9.3	14.7	4	90%	75%	NR	NR	25%		
9S			90%	90%	90%	NR	50%		
10E	14.8	1	90%	100%	90%	NR	50%		
11E	14.8	2	100%	100%	90%	NR	25%		
12			90%	100%	90%	NR	50%		
15.5	1S	15.8	1	90%	90%	NR	NR	25%	
16	1E	15.9	1	90%	50%	75%	NR	50%	
	1			90%	75%	75%	NR	50%	
	2E	15.9	2	75%	90%	NR	NR	25%	
	2			90%	50%	75%	NR	25%	
	2.1E	15.9	3	90%	50%	NR	NR	50%	
	3			90%	90%	75%	NR	50%	
	3.1W	16.5	1	90%	75%	NR	NR	50%	
	3.2W	16.5	2	75%	50%	NR	NR	50%	
	3.5E	15.5	1	75%	90%	NR	NR	0%	
	4			90%	50%	75%	NR	50%	

NR = not rated

Appendix B: Pier 58 Timber Pile Ratings

Pile Label		2011 Label		Pile Rating					Remarks
Bent	Pile	Bent	Pile	2000	2006	2011	2014	2016	
16	4E	15.5	2	75%	90%	NR	NR	25%	
	5			90%	75%	50%	NR	50%	
	6			75%	90%	50%	NR	25%	
	7S			75%	75%	NR	NR	25%	
16.1	1			90%	90%	NR	NR	25%	
17	1			75%	25%	50%	NR	50%	
	2			90%	50%	75%	NR	50%	
	3			90%	75%	75%	NR	50%	
	4			90%	50%	50%	NR	50%	
	4E	17.3	1	90%	75%	NR	NR	50%	
	4.1E	17.3	2	90%	50%	NR	NR	50%	
	5			90%	50%	50%	NR	50%	
	6			90%	75%	75%	NR	50%	
	7			100%	90%	75%	NR	50%	
18	1			25%	50%	50%	NR	50%	
	2			50%	75%	75%	NR	50%	
	3			90%	75%	75%	NR	50%	
	4			75%	50%	75%	NR	50%	
	5			90%	50%	50%	NR	50%	
	6			50%	75%	75%	NR	75%	
	7			50%	90%	75%	NR	75%	
N/A	N/A	4.4	1	NR	NR	NR	NR	NR	not on prior plans, broken at cap, not rated

NR = not rated

APPENDIX C

Pier 60 Timber Pile Rating Data

Appendix C: Pier 60 Timber Pile Ratings

Pile Label		BergerABAM		Pile Ratings			Remarks	
Bent	Pile	Bent	Pile	2000	2015	2016		
28	5	Q	5	0%	SV	0%	50%	
	6		6	0%		NR	50%	
	7		7	0%		NR	50%	
	8		8	0%		NR	50%	
	9		9	0%	MJ	50%	50%	
	10		10	50%		NR	50%	
	11		11	90%		NR	50%	
	12		12	90%		NR	50%	
	13		13	90%		NR	50%	
	14		14	50%	MJ	50%	0%	
	15		15	90%		NR	25%	
	31	1	N	1	90%		NR	25%
		2		2	50%		NR	25%
	33	1	K	16	90%		NR	25%
		2		17	75%		NR	50%
3			18	90%		NR	25%	
4			19	75%		NR	25%	
5			20	90%	MD	50%	25%	
6			21	90%	MD	50%	25%	
7			22	50%	NO	90%	25%	

NR = not rated

Berger ABAM Rating Descriptions:

Rating	Description	% Cross Section Remaining
NO	No Damage	90%-100%
MN	Minor Damage	75%-90%
MD	Medium Damage	50%-75%
MJ	Major Damage	25%-50%
SV	Severe Damage	0%-25%

APPENDIX D

Pier 58 Load Test Displacements

Appendix D: Pier 58 Load Test Displacements

Pile Label		2011 Label		Displacement (mm)		Remarks
Bent	Pile	Bent	Pile	2011	2016	
1	14					
	15					
	16					
	17					
	18					
	19					2014 Label: 1-27
	20					2014 Label: 1-28
	21					2014 Label: 1-29
2	3					
	4					
	5					
	6					
	7					
	8			0		
	9					
	11					
	12					
	13					
	14					
	15					
	16					
	17					
	18					
	19					
	20					
	21					
	22					
	23					
	24					
	25					
	26					
	27					
3A	1	3A	1			
	1.1		2			
	2		3			
	3		4			
	4		5			
	5		6			
	6E		7			
3	1			0		

Positive displacements are down, negative displacements are up.

Appendix D: Pier 58 Timber Pile Ratings

Pile Label		2011 Label		Displacement (mm)		Remarks
Bent	Pile	Bent	Pile	2011	2016	
3	2			1		
	3			1		
	4			2	0	
	5			1	0	
	7			0	0	
	8			0	2	
	9			1	0	
	10			1	0	
	11			1	0	
	12			1		
	13			1		
	14					
	15					
	16					
	17					
	18				0	
	19				0	
3.5	1			0	0	
	2			1	1	
	3			1	0	
	4			0	0	
4A	1					
	2					
	3					
	4					
	5					
	6					
	7					
	8					
	9					
	10					
	11					
	12					
	13					
	14					
	15					
	16E					
4	1			0		
	2			1	0	
	3			2	0	

Positive displacements are down, negative displacements are up.

Appendix D: Pier 58 Timber Pile Ratings

Pile Label		2011 Label		Displacement (mm)		Remarks
Bent	Pile	Bent	Pile	2011	2016	
4	4			0	0	
	5			0	0	
	6			1	0	
	7			0	0	
	8			0	0	
	9			0	0	
	10			0	0	
	11					
	12					
	13					
	14					
	15				0	
	16				0	
F	4	4.3	1			
	5	4.9	1			
	6	5.5	1			
	7	4.7	1			
4.5	1			0		
	2					
5A	1					
	2					
	3					
	4					
	5					
	6E					
5	1			0		
	2			0	0	
	3			2	0	
	4			0	0	
	5					
	6			0		
	7			1	0	
	8			1	0	
	9			2	0	
	10			1		
	11			1		
	12			1	1	
	13				0	
	14				1	
	15					

Positive displacements are down, negative displacements are up.

Appendix D: Pier 58 Timber Pile Ratings

Pile Label		2011 Label		Displacement (mm)		Remarks
Bent	Pile	Bent	Pile	2011	2016	
5	16					
	17					
6A	1					
	2					
	3					
	4					
	5E					
6	1			0	0	
	2			0	1	
	3			0	1	
	4			0	0	
	5					
	6					
	7			0		
	8			1	0	
	9			1	0	
	10			0	1	
	11			0	0	
	12			1	1	
	13			1	0	
	14			1	0	
	15			0	0	
7	1			0	0	
	2			0	1	
	3			0	0	
	4			0	0	
	5			1	0	
	6			0	0	
	7			0	0	
	8			0	0	
	9			0	0	
	10			1	0	
	11			1	0	
	12			0	0	
	13			1	0	
	14			0	0	
7.5	1					
	2					
7.9	1					
8	1					

Positive displacements are down, negative displacements are up.

Appendix D: Pier 58 Timber Pile Ratings

Pile Label		2011 Label		Displacement (mm)		Remarks
Bent	Pile	Bent	Pile	2011	2016	
8	2					
	3			0	0	
	4			2	1	
	5			0		
	6			2	1	
	7			0	0	
	8					
	9					
	10			1		
	11			2	0	
	12			2	0	
	13			1	1	
	14			1	0	
	15			1	0	
	16			0		
	9	1			0	
2				0	0	
3				0	0	
4				0	0	
5				0		
6						
7				1	1	
8				0	1	
9				1	0	
10				1	0	
11				0	0	
12				0		
13				1	0	
14				1	0	
15				1	0	
16				1	0	
17				0		
9.5	3					
	4					
10	1			0		
	1.1				0	
	2			1	1	
	3			1	0	
	4			1	1	
5			0	0		

Positive displacements are down, negative displacements are up.

Appendix D: Pier 58 Timber Pile Ratings

Pile Label		2011 Label		Displacement (mm)		Remarks
Bent	Pile	Bent	Pile	2011	2016	
10	6			1		
	7			0		
	8			0	0	
	9			0	1	
	10			1	1	
	11			1	1	
	12			1	0	
	13			1	1	
	14			1		
	15			1	0	
	16			2	1	
	17			2		
	18			1	0	
	19			1		
10.5	1	YY	1			
	2	YY	2			
11	1			1		
	2			0	1	
	3			1	1	
	4			1	1	
	5			1	1	
	6			1	0	
	7			0	1	
	8			0	2	
	9			1	1	
	10			0	0	
	11			2	0	
	12			1	0	
	13			0		
	14			1	1	
	15			1	1	
	16			1	0	
	17			1		
11.5	1	XX	1			
11.6	1	XX	2			
	2	XX	3			
11.8	1	VV	1			
12	1			0	1	
	2			2	1	
	3			0	1	

Positive displacements are down, negative displacements are up.

Appendix D: Pier 58 Timber Pile Ratings

Pile Label		2011 Label		Displacement (mm)		Remarks
Bent	Pile	Bent	Pile	2011	2016	
12	4			2	1	
	5			2	0	
	6			0	0	
	7			2	0	
	8					
	9					
	10					
	11			0		
	12			1	1	
	13			2		
	14			2	1	
	15			1		
12.5	1N	VV	2			
	1S					
	2S					
	3S					
	4S					
12.6	1	UU	1			
12.7	1W	VV	3			
	1.1E	WW	1			
12.8	1	TT	1			
12.9	1	TT	2			
13	1			1	1	
	2			0	1	
	3			0	0	
	4			0	1	
	5			0	1	
	6			0		
	7					
	8					
	9					
13.5	1N	SS	1			
	1S	13.2	1			
	2S	13.2	2			
13.6	1	RR	1			
13.7	1	SS	2			
13.8	1	RR	2			
14	1					
	2				0	
	3			0	0	

Positive displacements are down, negative displacements are up.

Appendix D: Pier 58 Timber Pile Ratings

Pile Label		2011 Label		Displacement (mm)		Remarks
Bent	Pile	Bent	Pile	2011	2016	
14	4			1	1	
	5			0	1	
	6			0	0	
	7					
	8					
	9					
14.5	1N					loose, not bearing under pile cap
	1S	14.2	1			
	2S	14.2	2			
15	1			1		
	2			1	0	
	3			1	0	
	4E	14.7	1			
	5E	14.7	2			
	6			0		
	7			0		
	7E	14.7	3			
	7.1N	15.1	1			
	7.1S	15.3	2			
	7.3N	15.3	1			
	7.3S	15.5	3			
	8			0		
	9N					
	9.2	15.5	4			
	9.3	14.7	4			
	9S					
	10E	14.8	1			
	11E	14.8	2			
	12					
15.5	1S	15.8	1			
16	1E	15.9	1			
	1					
	2E	15.9	2			
	2			0		
	2.1E	15.9	3			
	3			0		
	3.1W	16.5	1			
	3.2W	16.5	2			
	3.5E	15.5	1			
	4			1		

Positive displacements are down, negative displacements are up.

Appendix D: Pier 58 Timber Pile Ratings

Pile Label		2011 Label		Displacement (mm)		Remarks
Bent	Pile	Bent	Pile	2011	2016	
16	4E	15.5	2			
	5			1	0	
	6					
	7S					
16.1	1					
17	1			1		
	2			1		
	3			1	0	
	4			0	1	
	4E	17.3	1			
	4.1E	17.3	2		1	
	5			1	1	
	6			0	0	
	7					
18	1			0		
	2			1		
	3			1	1	
	4			0	1	
	5			-2	0	
	6			1		
	7				0	
N/A	N/A	4.4	1			not on prior plans, broken at cap, not rated

Positive displacements are down, negative displacements are up.

APPENDIX E

Pier 59 Projection of Steel “Can” of Replacement Piles Above Mudline

Appendix E: Pier 59 Projection of Steel “Can” of Replacement Piles Above Mudline

Pile Label	Maximum Projection (in)		Remarks
	2016		
P10-7	NM		
P11-7	NM		
P11-7.5	NM		
P11-9	NM		
P12-5	NM		
P12-6	NM		
P12-7	NM		
P12-8	NM		
P12-10	NM		
P12-11	NM		
P13-6	21"		
P13-8	0"		
P13-9	0"		
P13-11	22"		
P13-12	2"		
P13-13	0"		
P14-6.1	0"		
P14-8	0"		
P14-9	0"		
P14-10	0"		
P14-12	0"		
P14-13	0"		
P15-6	NM		
P15-7	NM		
P15-8	NM		
P15-10	NM		
P15-14	NM		
P16-7	NM		
P16-9	NM		
P16-11	NM		
P16-13	NM		
P17-6	NM		
P17-7	NM		
P17-10	NM		
P17-13	NM		
P17-14	NM		
P17-16	NM		
P18-8	NM		
P18-9	NM		
P18-14	NM		

NM indicates “not measured”

Appendix E: Pier 59 Projection of Replacement Pile Steel “Can” Above Mudline

Pile Label	Maximum Projection (in)		Remarks
	2016		
P18-16	NM		
P19-7	7"		
P19-8	9"		
P19-9	9"		
P19-12	4"		
P19-14	13"		
P19-16	6"		
P20-8	6"		
P20-10	1"		
P20-12	6"		
P20-13	10"		
P20-14	7"		
P21-13	NM		
P21-15	NM		
P22-8	NM		
P22-13	NM		
P22-16	NM		
P23-12	NM		
P23-13	NM		
P23-16	NM		
P24-6	NM		
P24-8	NM		
P24-10	NM		
P24-12	NM		
P24-13	NM		
P24-15	NM		
P25-7	NM		
P25-9	NM		
P25-10	NM		
P25-13	NM		
P26-8	NM		
P28-9	NM		
P28-10	NM		
P28-14	NM		
P28-16	NM		
P28-20	NM		
P29-6	NM		
P29-9	NM		
P29-10	NM		
P29-12	NM		

NM indicates “not measured”

Appendix E: Pier 59 Projection of Replacement Pile Steel “Can” Above Mudline

Pile Label	Maximum Projection (in)		Remarks
	2016		
P29-13	NM		
P29-18	NM		
P30-8	NM		
P30-11	NM		
P30-12	NM		
P30-15	NM		
P30-16	NM		
P30-19	NM		
P31-7	NM		
P31-10	NM		
P31-11	NM		
P31-14	NM		
P31-16	NM		
P32-8	12"		
P32-9	1"		
P32-12	11"		
P32-14	0"		
P32-16	6"		
P32-18	9"		
P32-19	7"		
P33-9	8"		
P33-12	8"		
P33-14	11"		
P33-17	4"		
N2-13	NM		
N2-14	NM		
N2-17	NM		
N2-19	NM		
N2-21	NM		
N2-22	NM		
N2-24	NM		
N2-25	NM		
N2-27	9"		
N2-28	0"		
N2-29	9"		
S1-2	NM		
S1-4	NM		
S1-5	NM		
S1-6	NM		
S1-7	NM		

NM indicates “not measured”

Appendix E: Pier 59 Projection of Replacement Pile Steel “Can” Above Mudline

Pile Label	Maximum Projection (in)			Remarks
	2016			
S1-10	NM			
S1-12	NM			
S1-13	11"			
S1-15	NM			

NM indicates “not measured”

APPENDIX F

Piers 58 & 60 Global Diving Timber Pile Inspection Logs



September 19, 2016

Seattle Structural PS, Inc.

1420 5th Ave.
Suite 425
Seattle, WA 98106

Attn: Mr. Michael Braun
Re: Seattle Parks Pier 58 Waterfront Park Condition Assessment

On August 30, 31 and September 15, 2016 **Global Diving & Salvage Inc.** performed an underwater inspection of selected piles on Pier 58 and 60, Waterfront Park, Seattle, WA. Inspecting Divers were Christopher Hume and Bradley Peterson. The purpose of the inspection was to ascertain the condition of the piles as compared to a previous survey conducted by Global Diving & Salvage in June of 2011. The divers inspected the piles as directed by the attending representative from Seattle Structural PS, Inc.

The diving operations were conducted from the dive support vessel "Titan" utilizing surface supplied diving gear with two-way communications and video/audio recording. Visibility at the time of the dive averaged approximately 6-10 feet.

The divers performed a Level 1 inspection, relying primarily on visual and/or tactile observations to make condition assessments. Individual observations on each pile inspected are included in the wood pile inspection logs attached. Bent and pile designation were determined using drawings supplied by Seattle Structural. Records of the dive are also provided in this report.

Submitted without prejudice
Global Diving & Salvage, Inc.

Dave Partlow
Diving Supervisor

Chris Hume
Bradley Peterson
Simon Cleasby
Inspecting Divers

3840 W Marginal Way SW • Seattle, WA 98106 • www.gdiving.com • 24hr: (206) 623-0621 • Fax: (206) 932-9036



Association of
Diving Contractors
International



The Associated
General Contractors
of America



American Salvage
Association



Bent	Pile	Date	Time	Diver	Remarks
18N	1	8/30/2016	829	CH	75%
	2	8/30/2016		CH	75%
	3	8/30/2016		CH	50%
	4	8/30/2016		CH	60%
	5	8/30/2016		CH	60%
	6	8/30/2016		CH	50% wear showing on West face
	7	8/30/2016		CH	60%
17N	1	8/30/2016	841	CH	40%
	2	8/30/2016		CH	50%
	3	8/30/2016		CH	50%
	4W	8/30/2016		CH	40% slight surface cracking
	4E	8/30/2016		CH	40% Boring on East Face
	5W	8/30/2016		CH	40%
	5E	8/30/2016		CH	50%
	6	8/30/2016		CH	45%
	7	8/30/2016		CH	40% minor boring
16N	1	8/30/2016	857	CH	30% cracking near mudline
	2	8/30/2016		CH	50%
	3	8/30/2016		CH	45%
	4	8/30/2016		CH	50% minor surface cracking
	4W	8/30/2016		CH	40% minor surface cracking
	5W	8/30/2016		CH	45% moderate cracking
	6	8/30/2016		CH	30% severe cracking with boring
	6NE	8/30/2016		CH	25% cracking and boring
	6NW	8/30/2016		CH	45%
	7	8/30/2016		CH	45%
	8	8/30/2016	915	CH	40%
15.5N	1	8/30/2016		CH	10% Severe cracking, major boring

Bent	Pile	Date	Time	Diver	Remarks
15.5N	2	8/30/2016	919	CH	30% Moderate boring
	3W	8/30/2016		CH	45%
	3E	8/30/2016		CH	15% Severe cracking near mudline
	3N	8/30/2016		CH	35% Boring and Cracking
	3S	8/30/2016		CH	35% Moderate cracking
	4	8/30/2016		CH	25% Moderate-Severe Boring
15N	1	8/30/2016	933	CH	40%
	2	8/30/2016		CH	20%
	1E	8/30/2016		CH	35%
	3E	8/30/2016		CH	40%
	3W	8/30/2016		CH	30%
	4E	8/30/2016		CH	45%
	4W	8/30/2016		CH	40% boring and cracking
	5W	8/30/2016		CH	45% Boring and minor surface cracking
	5E	8/30/2016		CH	25% moderate-severe boring and cracking
	6	8/30/2016		CH	15% Severe boring
	7	8/30/2016		CH	35% moderate boring
	8	8/30/2016		CH	25% moderate-severe boring
14.5N	1	8/30/2016	957	CH	20% rot near mudline moderate boring/pitting
14N	1	8/30/2016	1003	CH	45%
	2	8/30/2016		CH	40%
	3	8/30/2016		CH	40%
	4	8/30/2016		CH	40%
	5	8/30/2016		CH	35%
	6	8/30/2016		CH	35%
	7	8/30/2016		CH	20%
14.5	1SW	8/30/2016	1017	CH	40%
	1SE	8/30/2016	1018	CH	40%

Bent	Pile	Date	Time	Diver	Remarks
14.5	2NW	8/30/2016	1019	CH	15% severe delamination/rotting
	2NE	8/30/2016	1020	CH	20% moderate-severe cracking
13N	1	8/30/2016	1023	CH	40%
	2	8/30/2016		CH	40%
	3	8/30/2016		CH	35%
	4	8/30/2016		CH	35%
	5	8/30/2016		CH	40%
	6	8/30/2016		CH	40%
	7	8/30/2016		CH	40%
	8	8/30/2016		CH	40%
12N	1	8/30/2016	1101	CH	40%
	2	8/30/2016		CH	40% Moderate boring
	3	8/30/2016		CH	40% Moderate Boring
	4	8/30/2016		CH	40% Light Cracking
	5	8/30/2016		CH	35% light boring and cracking
	6	8/30/2016		CH	40%
	7	8/30/2016		CH	35% moderate cracking
	8	8/30/2016		CH	40% Light Boring
	9	8/30/2016		CH	40% moderate boring on South and East Face
	10	8/30/2016		CH	40% minor cracking at mudline
	11	8/30/2016		CH	40%
	12	8/30/2016		CH	35% minor cracking at mud line
	13	8/30/2016		CH	35%
12.5	1N	8/30/2016	1122	CH	40% Light cracking
	2E	8/30/2016		CH	40% Minor Boring
	2W	8/30/2016		CH	15% Severe boring and Cracking
	3W	8/30/2016		CH	40% Minor boring
	3E	8/30/2016		CH	35% minor-moderate boring

Bent	Pile	Date	Time	Diver	Remarks
11N	1	8/30/2016	1128	CH	35% Minor boring and Cracking
	2	8/30/2016		CH	35% minor delamination
	3	8/30/2016		CH	40% minor Cracking
	4	8/30/2016		CH	35% Minor Cracking
	5	8/30/2016		CH	40% minor cracking and boring
	6	8/30/2016		CH	40% minor boring
	7	8/30/2016		CH	30% moderate rot at mudline
	8	8/30/2016		CH	35%
	9	8/30/2016	1138	CH	40%
	10	8/30/2016		CH	35% minor-moderate cracking and boring
	11	8/30/2016		CH	25% moderate cracking
	12	8/30/2016		CH	35% moderate boring
	13	8/30/2016		CH	40%
	14	8/30/2016		CH	50%
10N	1	8/30/2016	1149	CH	50%
	2	8/30/2016		CH	45% minor boring
	3	8/30/2016		CH	45% minor surface cracking
	4	8/30/2016		CH	40%
	5	8/30/2016		CH	15% Pitting, boring, cracking and delamination
	6W	8/30/2016		CH	50%
	6E	8/30/2016		CH	30% boring and cracking
	7	8/30/2016		CH	40% minor boring and surface cracking
	8	8/30/2016		CH	35% minor cracking
	9E	8/30/2016		CH	30% moderate cracking and pitting
	9W	8/30/2016		CH	10% severe cracking
	11	8/30/2016		CH	45% Stubbed pile
	12	8/30/2016		CH	45% minor cracking
	13	8/30/2016		CH	45% minor surface cracks

Bent	Pile	Date	Time	Diver	Remarks
10N	14	8/30/2016		CH	40% pile rot at mudline
9N	1	8/30/2016	1250	CH	30% surface cracking
	2	8/30/2016		CH	40% minor pile rot at mudline
	3	8/30/2016	1256	CH	45% Stubbed Pile
	4	8/30/2016		BP	30% minor cracking and boring
	5	8/30/2016		BP	30% minor cracking with moderate boring
8N	1SW	8/30/2016		BP	35% light surface cracking
	2NE	8/30/2016		BP	40% minor delamination
	1SE	8/30/2016		BP	40% light surface cracking
8.5N	1	8/30/2016		BP	35% minor scaring
9N	1	8/30/2016		BP	45%
	2	8/30/2016		BP	45%
	3	8/30/2016		BP	40% minor cracking
	4	8/30/2016		BP	25% minor boring delamination and moderate cracking
	5	8/30/2016		BP	40% light surface cracking
	6	8/30/2016		BP	35% minor boring, minor cracking
8N	1	8/30/2016		BP	45% minor boring at mudline
	2	8/30/2016		BP	45%
	3	8/30/2016		BP	40% minor surface cracking
	4	8/30/2016		BP	35% minor boring at mudline, slight hollow sound when struck
	5	8/30/2016		BP	45%
	6	8/30/2016		BP	35% minor surface cracking at mudline, slight delamination
7N	1	8/30/2016		BP	40% minor boring
	2	8/30/2016		BP	45%
	3	8/30/2016		BP	35% minor cracking at mudline
	4	8/30/2016		BP	35% minor boring
	5	8/30/2016		BP	30% severe vertical cracking moderate boring at mudline
	6	8/30/2016		BP	25% minor surface crack, moderate cracking at mudline, moderate boring

Bent	Pile	Date	Time	Diver	Remarks
6N	1	8/30/2016		BP	15% minor delamination, surface cracking, major boring at mudline
	2	8/30/2016		BP	45%
	3	8/30/2016		BP	40% minor boring
	4	8/30/2016		BP	35% minor surface cracking, minor boring with slight delamination
	5E	8/30/2016		BP	30% minor boring, significant surface cracking
	5W	8/31/2016		BP	30% minor surface cracking, moderate boring to 2" deep
	6	8/31/2016		BP	35% minor boring, slight surface cracking
	7	8/31/2016		BP	30% slight boring, minor surface cracking, moderate delamination
	8	8/31/2016		BP	slight surface cracking, minor boring, moderate cracking at mudline
	9	8/31/2016		BP	40%
5N	1	8/31/2016		BP	40% slight surface cracking minor boring
	2	8/31/2016		BP	45%
	3	8/31/2016		BP	45%
	4	8/31/2016		BP	40% minor delamination and surface cracking
	5W	8/31/2016		BP	40%
	5E	8/31/2016		BP	30% moderate boring and surface cracking
16S	1	8/31/2016	812	CH	30% moderate boring, pile rot at mudline
15.5	1	8/31/2016		CH	35% moderate boring at mudline
15	1W	8/31/2016		CH	40% minor vertical cracking
	1E	8/31/2016		CH	40% minor vertical cracking
	2E	8/31/2016		CH	35% minor vertical cracking
	2W	8/31/2016		CH	40% minor wear to pile face
14.5	1	8/31/2016		CH	35%
	2	8/31/2016		CH	35% minor boring at mudline
	3W	8/31/2016		CH	40% minor boring and surface cracking
	3E	8/31/2016		CH	40% minor gouging to pile face
13.5	2SW	8/31/2016		CH	35% minor boring and surface cracking
	1	8/31/2016		CH	35% minor boring and surface cracking

Bent	Pile	Date	Time	Diver	Remarks
12.5S	1	8/31/2016	841	CH	35% minor boring and surface cracking
	2	8/31/2016		CH	35% minor boring and surface cracking
13.5S	2E	8/31/2016		CH	40% minor boring and surface cracking
	2NW	8/31/2016		CH	35% minor boring and surface cracking
	3	8/31/2016		CH	35% minor boring and surface cracking
12.5S	4	8/31/2016		CH	40% minor boring
	3	8/31/2016		CH	40% minor boring and surface cracking
12S	1	8/31/2016		CH	40% minor boring
	2	8/31/2016		CH	40% minor surface cracking
	3	8/31/2016		CH	35% 1" separation, minor boring and surface cracking
	4	8/31/2016		CH	40%
	5	8/31/2016		CH	35% minor surface cracking, moderate boring
11S	1	8/31/2016		CH	45% minor boring
	2	8/31/2016		CH	40% minor vertical surface cracking, minor boring
	3	8/31/2016		CH	40% minor boring, light surface cracking
	4	8/31/2016		CH	35% minor gouging, vertical surface cracking
	5	8/31/2016		CH	40% minor boring
10S	1	8/31/2016	916	CH	35% vertical surface cracking
	2	8/31/2016		CH	40% vertical surface cracking
	3	8/31/2016		CH	45% minor delamination and surface cracking
	4	8/31/2016		CH	35% minor vertical surface cracking
	5	8/31/2016		CH	35% minor boring
	6	8/31/2016		CH	35% minor vertical surface cracking
9S	1	8/31/2016		CH	35% minor vertical surface cracking
	2	8/31/2016		CH	35% minor vertical surface cracking and light boring
	3	8/31/2016		CH	40% minor surface cracking
	4	8/31/2016		CH	40% minor vertical cracking
	5	8/31/2016		CH	45% light surface damage to face of pile

Bent	Pile	Date	Time	Diver	Remarks
9S	6	8/31/2016	935	CH	35% minor vertical surface cracking and boring
8S	1	8/31/2016		CH	40% minor surface cracking and boring
	2	8/31/2016		CH	45% minor boring
	3	8/31/2016		CH	40% minor boring
	4	8/31/2016		CH	35% minor vertical surface cracking
	5	8/31/2016		CH	40% minor vertical surface cracking
	6	8/31/2016		CH	35% minor boring minor vertical surface cracking
	7	8/31/2016		CH	40% minor surface cracking and boring
	8	8/31/2016		CH	35% light boring and minor vertical surface cracking
7S	1	8/31/2016		CH	35% minor boring, ribbed appearance to pile
	2	8/31/2016		CH	40% minor boring
	3	8/31/2016		CH	40% minor vertical surface cracking
	4	8/31/2016		CH	40% minor vertical surface cracking
	5	8/31/2016		CH	45%
	6	8/31/2016		CH	40% minor boring
	7	8/31/2016		CH	40%
	8	8/31/2016		CH	40% minor vertical surface cracking
1S	3	8/31/2016	1022	CH	30% minor boring, hollow sound when struck
	2	8/31/2016		CH	35% minor boring
	1	8/31/2016		CH	0% Split and hollow
2S	1	8/31/2016		CH	30% minor boring, minor rot near mudline
	2	8/31/2016		CH	25% major cracking and boring
	3	8/31/2016		CH	30% moderate cracking and light boring
	4	8/31/2016		CH	30% moderate cracking
	5	8/31/2016		CH	30% moderate cracking and boring
	6	8/31/2016		CH	30% moderate boring
	7	8/31/2016		CH	30% moderate boring
	8	8/31/2016		CH	35%

Bent	Pile	Date	Time	Diver	Remarks
3S	1	8/31/2016	1030	CH	35% moderate cracking
	2	8/31/2016		CH	25% moderate boring and cracking with ribbed appearance
	3	8/31/2016		CH	40% light boring, light cracking
	4	8/31/2016		CH	40% ribbed appearance, light boring and minor cracking
	5	8/31/2016		CH	35% ribbed appearance minor boring light cracking
	6	8/31/2016		CH	35% ribbed appearance minor boring light cracking
4S	6	8/31/2016	1036	CH	40% minor delamination, minor cracking
	5	8/31/2016		CH	35% ribbed appearance minor boring light cracking
	4	8/31/2016		CH	25% moderate cracking, light boring
	3	8/31/2016		CH	35% moderate boring and cracking
	2	8/31/2016		CH	25% delamination with moderate boring and pile rot at mudline
	1	8/31/2016		CH	30% minor cracking, boring and delamination
5S	1	8/31/2016	1044	CH	0%
	2	8/31/2016		CH	30% moderate delamination, minor cracking
	3	8/31/2016		CH	35% minor delamination, ribbed appearance
	4	8/31/2016		CH	20% heavy cracking
	5	8/31/2016		CH	35% minor delamination, ribbed appearance
	6	8/31/2016		CH	40%
	7	8/31/2016		CH	40% minor delamination, minor cracking
	8	8/31/2016		CH	35% ribbed appearance minor boring light cracking
	9	8/31/2016		CH	35% ribbed appearance minor boring light cracking
	10	8/31/2016		CH	35% ribbed appearance minor boring light cracking
	11	8/31/2016		CH	35% moderate boring and cracking
	12	8/31/2016		CH	40% minor delamination, minor boring
6S	1	8/31/2016		CH	40% minor delamination, minor boring
	2	8/31/2016		CH	40% light boring, light cracking
	3	8/31/2016		CH	40% ribbed appearance, light boring and minor cracking
	4	8/31/2016		CH	40% ribbed appearance, light boring and minor cracking

Bent	Pile	Date	Time	Diver	Remarks
6S	5	8/31/2016	1104	CH	35% minor cracking, delamination with ribbed appearance
	6	8/31/2016		CH	40% ribbed appearance, minor delamination with minor boring
	7	8/31/2016		CH	25% Heavy boring, minor cracking and delamination
	8	8/31/2016		CH	0% Hollow
	9	8/31/2016		CH	20% moderate cracking and boring
	10	8/31/2016		CH	65% Stubbed Pile, concrete around stub slightly soft
1M	1	8/31/2016	1200	BP	40% minor delamination at mudline
	2	8/31/2016		BP	25% heavy boring light delamination and cracking
	3	8/31/2016		BP	35% cracking at mudline
	4	8/31/2016		BP	35% minor surface cracking
	5	8/31/2016		BP	35% Stubbed pile with minor delamination
2M	1	8/31/2016		BP	40% light surface cracking at mudline
	2	8/31/2016		BP	35% light delamination
	3	8/31/2016		BP	40%
	4	8/31/2016	1215	BP	25% significant boring at waterline to mudline
	5	8/31/2016		BP	30% moderate surface cracking and light boring
	6	8/31/2016		BP	40%
	7	8/31/2016		BP	20% Significant boring
	8	8/31/2016		BP	30% minor delamination and surface cracking
	9	8/31/2016		BP	0% Hollow
	10	8/31/2016		BP	20% moderate boring and surface cracking
	11	8/31/2016		BP	0% Hollow
	12	8/31/2016		BP	0% Hollow
3M	1	8/31/2016		BP	0% Hollow
	2	8/31/2016		BP	20% Heavy delamination and surface cracking
	3	8/31/2016		BP	25% Heavy Boring
	4	8/31/2016		BP	35% light surface cracking
	5	8/31/2016		BP	30% minor delamination and boring

Bent	Pile	Date	Time	Diver	Remarks
3M	6	8/31/2016	1230	BP	35% light surface cracking and minor boring
	7	8/31/2016		BP	0% Hollow
	8	8/31/2016		BP	30% minor boring and cracking
	9	8/31/2016		BP	20% minor surface cracking and delaminating, hollow sound when struck
4S	1	8/31/2016	1240	BP	25% surface cracking with delamination and moderate boring
	2	8/31/2016		BP	30% Boring to 3" delamination and vertical surface cracking
	3	8/31/2016		BP	25% surface cracking with delamination, hollow sound when struck
	4	8/31/2016		BP	40%
	5	8/31/2016		BP	40%
4.5S	1	8/31/2016		BP	40%
4S	6	8/31/2016		BP	40%
3.5M	1	8/31/2016		BP	40%
	2	8/31/2016		BP	10% major boring
	3	8/31/2016		BP	40%
	4	8/31/2016	1300	BP	40%
2M	13	8/31/2016		BP	40%
	14	8/31/2016		BP	40%
	15	8/31/2016		BP	30% significant cracking and delamination
	16	8/31/2016		BP	35% minor delamination near waterline
3M	10	8/31/2016		BP	30% moderate surface cracking and boring
	11	8/31/2016		BP	40%
	12W	8/31/2016		BP	35% minor boring and surface cracking
	12E	8/31/2016		BP	35%
	13	8/31/2016		BP	40%
	14	8/31/2016		BP	30% moderate surface cracking and boring at mudline
	15	8/31/2016		BP	30% moderate boring at mudline
	16	8/31/2016		BP	25% minor boring and surface cracking, hollow sound when struck
	17	8/31/2016		BP	25% minor delamination and surface cracking

Bent	Pile	Date	Time	Diver	Remarks
3M	18	8/31/2016	1326	BP	0% Hollow
4N	1	8/31/2016		BP	40%
	2	8/31/2016		BP	40%
	3	8/31/2016		BP	40%
	4W	8/31/2016		BP	25% Significant surface cracking and boring
	4E	8/31/2016		BP	10% Major Splits
	5	8/31/2016		BP	25% mjaor split near cap, minor delamination, minor surface cracking at mudline
	6	8/31/2016		BP	20% severe splitting near mudline
	7	8/31/2016		BP	0% Hollow
	8	8/31/2016		BP	20% moderate boring
	9	8/31/2016		BP	20% hollow sound when struck, no visible damage
	10	8/31/2016		BP	0% Hollow
	11	8/31/2016		BP	35% minor boring
	12	8/31/2016		BP	35% minor surface cracking at mudline
	13	8/31/2016	1343	BP	35% minor surface cracking
	14	8/31/2016		BP	0% Hollow
	15	8/31/2016		BP	30% surface cracking and minor delamination
	16	8/31/2016		BP	10% significant surface cracking, Hollow below water line
	17	8/31/2016		BP	35%
	18	8/31/2016		BP	35%
	19	8/31/2016		BP	35%
5N	10	8/31/2016		BP	35% Minor Boring
	9	8/31/2016		BP	30% minor surface cracking
	8	8/31/2016		BP	30% minor surface cracking
	7	8/31/2016		BP	35% moderate boring
	6	8/31/2016		BP	35% Light delamination
4.5N	1	8/31/2016		BP	30% Cracking at Cap, minor surface cracking
8N	3	8/31/2016		BP	10% Heavy Boring, 1/2 hollow

Bent	Pile	Date	Time	Diver	Remarks
5N	1	8/31/2016	1441	CH	35% slight delamination near mudline
	2	8/31/2016		CH	25% slight delamination and minor boring
	3N	8/31/2016		CH	20% broken away from cap, delamination with cracking and boring
	3S	8/31/2016		CH	25% surface cracking and delamination
	4	8/31/2016		CH	30% minor surface cracking
				CH	
1	3	9/15/2016	1044	CH	0% Light Cracking and boring, Split in middle
	2	9/15/2016		CH	10% Split boring and cracking
	1	9/15/2016		CH	35% Light cracking and boring
2	1	9/15/2016	1049	CH	35% minor boring and surface cracking
	2	9/15/2016		CH	35% Boring around surface and mudline
	3	9/15/2016		CH	10% heavy boring and cracking
	4	9/15/2016		CH	20% boring and cracking, heavy splitting
	5	9/15/2016		CH	light boring and delaminating vertical surface cracking
	6	9/15/2016		CH	25% light boring and cracking
	7	9/15/2016		CH	15% heavy splitting
	8	9/15/2016		CH	30% boring and splitting
3	1	9/15/2016	1056	CH	30% Splitting and boring
	2	9/15/2016		CH	30% Light Boring and splitting
	3	9/15/2016		CH	15% Cracking and heavy boring
	4	9/15/2016		CH	25% Moderate cracking and surface loss
	5	9/15/2016		CH	35% Moderate cracking and minor boring
	6	9/15/2016		CH	30% minor cracking and boring
1	1	9/15/2016		CH	40% minor boring and cracking
	2	9/15/2016		CH	25% heavy boring at mudline minor cracking
	3	9/15/2016		CH	40% cracking and boring
	4	9/15/2016		CH	40% minor boring and surface cracking
	5	9/15/2016		CH	35% Stubbed pile, large void in repaired area

2	1	9/15/2016	1134	CH	15% voids and cracking
	2	9/15/2016		CH	35% Heavy boring
	3	9/15/2016		CH	20% Large bore at waterline, cracking and boring
	4	9/15/2016		CH	45% Light cracking and minor surface loss
	5	9/15/2016		CH	35% minor cracking and surface loss
	6	9/15/2016		CH	15% Heavy cracking
33	1	9/15/2016	920	CH	15% Minor boring and severe cracking
	2	9/15/2016		CH	35% minor boring and surface cracking
	3	9/15/2016		CH	35% Minor boring and delamination, moderate cracking at mudline
	4	9/15/2016		CH	25% Minor boring and surface loss
	5	9/15/2016		CH	35% Minor boring and cracking
	6	9/15/2016		CH	40% minor boring and cracking
	7	9/15/2016		CH	35% Minor boring and cracking
	8	9/15/2016		CH	25% Splitting and vertical cracking
	9	9/15/2016		CH	35% Minor boring and cracking
28	1	9/15/2016	841	CH	60% minor boring
	2	9/15/2016		CH	50% minor boring and light surface cracking
	3	9/15/2016		CH	40% minor boring and light surface cracking
	4	9/15/2016		CH	40% minor boring, cracking and light delamination
	5	9/15/2016		CH	40% minor boring and cracking
	6	9/15/2016		CH	40% light surface delamination, boring and cracking
	7	9/15/2016		CH	40% light cracking and minor boring
	8	9/15/2016		CH	40% light cracking and minor boring
	9	9/15/2016		CH	40% light cracking and minor boring
	10	9/15/2016		CH	0% severe cracking
	11	9/15/2016		CH	35% Minor boring and cracking
2	7	9/15/2016	1141	CH	35% Light cracking and boring
	8	9/15/2016		CH	40% Light boring and surface loss
	9	9/15/2016		CH	40% light boring and cracking

Bent	Pile	Date	Time	Diver	Remarks
3	1	9/15/2016	1145	CH	40% light boring and cracking
	2	9/15/2016		CH	40% light boring and cracking
	3	9/15/2016		CH	10% Very large holes in pile
	4	9/15/2016		CH	45% Light cracking and minor surface loss
	5	9/15/2016		CH	40% light cracking and minor boring
	6	9/15/2016		CH	40% light cracking and minor boring
	7	9/15/2016		CH	35% Light boring and minor cracking
2N	1	9/15/2016	1211	CH	30% Light/moderate cracking
	2	9/15/2016		CH	0% Hollow
	3	9/15/2016		CH	0% Hollow
	4	9/15/2016		CH	45% Light vertical cracking
	5	9/15/2016		CH	40% light surface delamination, boring and cracking
	6	9/15/2016		CH	35% Light surface delamination, large crack
	7	9/15/2016		CH	25% Hollow sound when struck
3N	1	9/15/2016	1220	CH	40% Cracking and boring
	2	9/15/2016		CH	10% Cracking and boring
	3	9/15/2016		CH	45% Minor surface loss
	4	9/15/2016		CH	40% light cracking and boring
	5	9/15/2016		CH	40% light cracking and boring
	6	9/15/2016		CH	45% Light Surface loss
	7	9/15/2016		CH	15% Large holes, minor cracking
	8	9/15/2016		CH	40% Light cracking and boring
	9	9/15/2016		CH	40% minor boring and light surface cracking
	10	9/15/2016		CH	30% minor cracking and delamination
	11	9/15/2016		CH	0% Hollow
4N	1	9/15/2016	1234	CH	40% Minor vertical cracking
	2	9/15/2016		CH	40% light vertical cracking and minor boring
	3	9/15/2016		CH	45% Light boring

Bent	Pile	Date	Time	Diver	Remarks
4N	4	9/15/2016		CH	25% Boring
	5	9/15/2016		CH	40% Light boring and surface loss
	6	9/15/2016		CH	10% light boring and large void
	7	9/15/2016		CH	40% Light boring and cracking
	8	9/15/2016		CH	35% Delamination and light vertical cracking
	9	9/15/2016		CH	35% Vertical cracking and light boring
	10	9/15/2016		CH	15% Large void light cracking
	11	9/15/2016		CH	45% Light Surface loss
	12	9/15/2016		CH	35% Boring at base and knot holes
	13	9/15/2016		CH	0% Hollow
	14	9/15/2016		CH	30% Split on NE Face
	15	9/15/2016		CH	35% Light boring, minor surface loss and vertical cracking
	16	9/15/2016		CH	10% Rotten inside
	17	9/15/2016		CH	25% Rotten at mudline
	18	9/15/2016		CH	50% No noted damage
	19	9/15/2016		CH	40% Minor surface loss, minor delamination
	20	9/15/2016	1252	CH	45% Minor cracking
33	17	9/15/2016	1333	SC	4" west side
	14	9/15/2016		SC	11" West 3" East
	12	9/15/2016		SC	SW 8 1/2" NE 1"
	9	9/15/2016		SC	SE 1" SW 8"
2N	28	9/15/2016	1345	SC	Buried
	29	9/15/2016		SC	NW 9" SE 1"
32	8	9/15/2016	1349	SC	12" all around
	9	9/15/2016		SC	NW 6-8"
N2	27	9/15/2016	1354	SC	SW 9" NE 1"
32	12	9/15/2016	1356	SC	NW 11" SW 9"
32	14	9/15/2016		SC	Buried

Bent	Pile	Date	Time	Diver	Remarks
S1	13	9/15/2016		SC	SW 11 1/2" NE 1 1/2"
32	16	9/15/2016		SC	West 6"
32	18	9/15/2016		SC	West 9 1/2" At mudline on East
32	19	9/15/2016	1409	SC	West 7 1/2" at mudline on East
19	16	9/15/2016		SC	South 6" North at mudline
19	14	9/15/2016		SC	SW 13" NE 6"
19	12	9/15/2016		SC	South 4"
19	9	9/15/2016		SC	West 9 1/2" East 7"
19	8	9/15/2016		SC	9" all around
19	7	9/15/2016		SC	7" all around
20	8	9/15/2016	1428	SC	7 1/2" all around
20	10	9/15/2016		SC	SW 1 1/2"
20	12	9/15/2016		SC	SW 6 1/2" NE 2 1/2"
S1	4	9/15/2016	1436	SC	South 10" N 2 1/2"
20	13	9/15/2016	1437	SC	North 1 1/2" South 7"