

**CITY OF CHATTANOOGA
ROSS'S LANDING**



Submitted by:

**UNDERWATER CONSTRUCTION CORPORATION
8494 Gulf View Drive
Soddy Daisy, TN 37379**

UCC JOB # 09226.56

Services Performed:

**Inspect and video designated piers to include:
Slope and condition of the rip rap, condition of the cap,
And document any failures concerning the
Structure and the rip rap embankment**

Dive Crew:

Ross McMillan– Dive Supervisor
Andrew Burnett - Diver
John Oheren - Diver
Mark Kreinhop - Diver
Keith Strong- Diver/Tender
Joe Zeleznick- Tender

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UNDERWATER CONSTRUCTION CORPORATION

City of Chattanooga

Dive Inspection Summary

UCC mobilized a six (6) person, commercially-trained dive team and related equipment on March 23, 2009 to Ross's Landing to perform an inspection on the designated piers beneath the river walk. The inspection was to include video and still picture documentation of the as-found condition of the rip rap embankment and the river walk structure below the water line. Plumbness of each designated pier was taken as well as the inside-to-inside measurement from the designated pier to the adjacent pier on either side. The location of drainage pipes and intake structures were to be inspected and documented as well.

The first task was to locate the intake structure and piping for the water feature. We began where the prints showed the intake structure to be however it was not in that location. After inspecting the up stream section of the river walk from the water feature, the structure was located in the SE corner adjacent to the installed Fender Ladder. The intake screen (1 ½" x 1 ½" sq mesh) is welded to a horizontal piece of channel iron. That channel iron has two (2) pieces of 5/8" all thread attached to it that run up and out of the water and attach to angle brackets anchored to the vertical wall. The screen and its hangers appear to be in good condition. The intake pipe was traced back to the pump vault and appears to be intact. It should also be noted that the pump vault is not in the location shown on the prints given to us.

Once the inspection of the intake was completed, we moved on to the inspection of the thirty (30) sets of piers that were identified for us. Two additional sets were added during the inspection. The sets were not inspected in numerical but were completed starting at the extreme upstream pile (set 15) and moving downstream inspecting every designated set as we went. In order to reflect the video, the report will also begin at set 15.

Set 15 is a pair of H-piles. The outside pile is in good shape and leans slightly SE (1/2" / 1' South, ¾" / 1' east). The bottom elevation at the pile is 619 based on a water elevation of 634. The rip rap builds at a 60 degree angle for about ten feet and then levels out at elevation 626 for about 8'. Eight feet of the back H-pile is exposed. The rip rap continues up at a 45 degree angle from the back of the rear H-pile stopping at the foot of the Market Street Bridge pier.

Set 16 (H-pile) leans slightly NE at 1/8" per foot. The front pile is in good condition as is the cap. The river bottom is a mix of mud and gravel. There was no large rip rap in this area. The bottom elevation remained level until approximately 3' from the back pile. At that point, there is a natural rock (ledge) wall that runs at a sharp angle up where the back cap is resting on it. The back H-pile was not located and is assumed to have been replaced by the rock ledge.

Set 17 (H-pile) leans SE at ½" per foot. The front pile and the cap have no deficiencies. The river bottom is at elevation 627' and is made up of mud and gravel. The bottom runs fairly level for about 12' towards the back pile before the rip rap climbs at a 75 degree angle before leveling out four feet in front of the rear cap. The rip rap is at the specified level and the rear pile is covered.

Set 18 (H-pile) leans South $\frac{3}{4}$ " per foot and to the west $\frac{1}{2}$ " per foot. The front pile and the cap have no deficiencies. The mud/rock line is at 622 and remains at that elevation for eight (8) feet towards the back pile. The grade then begins to increase over the next 12' to the 630' elevation. The back pile is exposed by four (4) feet and the top of the rip rap is one (1) foot below the bent cap then fills in behind the bent cap. The back pile has no deficiencies and is leaning south $\frac{1}{8}$ " per foot and east $\frac{1}{2}$ " per foot. Two separate cracks were identified on the ceiling running east to west and went through the entire thickness of the six (6) inch precast panel.

Set 2 (H-pile) leans north $\frac{3}{4}$ " per foot and east $\frac{1}{4}$ " per foot. The front pile and the cap have no deficiencies. The rip rap elevation at the bottom of the front pile is 619 and increases to an elevation of 630' approximately 4' from the back pile. Six (6) feet of the back pile is exposed and the pile is plumb. There is a 14" void behind the bent cap containing loose rip rap and some pea gravel. A four (4) foot ruler was placed behind the back bent cap vertically demonstrating the lack of back fill. This is the area that the dirt back fill is being washed out from. The geo-textile is present within the aforementioned void but is not covered and is not protecting the fill behind it. The bent cap and the pile cap have no deficiencies however, while inspecting the concrete supports running east-west (ref. drawing S-509-P2, cross section C) the smaller of the two supports (1'-6") extended from the back wall only 6' and was not completed. Four (4) pieces of rebar extend horizontally (one above the other) out from the pour about three (3) feet.

Set 1 includes only the H-pile on the corner. The H-pile leans SE $\frac{5}{8}$ " per foot. There were no deficiencies found on this pile and the bottom elevation was at 617'.

Set 3 (round column) leans south $\frac{3}{4}$ " per foot and west 1" per foot. There were no deficiencies found with the column or its cap. The grade of the rip rap was shallow, moving from the 619' elevation to a 627' elevation at the river side of the back battered pile. Approximately nine (9) feet of the battered pile is exposed. On the back side of the column, or the bank side, the rip rap is at elevation 630' where it remains just past the bent cap and then fills in. This void is directly on the inside corner of the river walk and is part of the previously discussed void on set 2.

Set 4 (round column) is plumb and contains no deficiencies. Rip rap climbs from elev. 618' to 631', one foot below the pile cap. The battered pile is exposed by 32" however, no deficiencies were observed.

Set 19 (H-pile) leans to the south 1/2" per foot. No deficiencies were evident and the rip rap elev. at the base of the pile was 622'. The rip rap was in place at the correct grade leveling out four (4) feet from the bank-side bent cap and flush with it.

Set 5 (round columns) supports the second Mooring Post from the east and has two (2) round columns on the river side and two (2) battered columns toward the bank. The upstream column is leaning east 1/4" per foot. The downstream column is plumb. Both columns enter the rip rap at elev. 624'. The rip rap is at the correct grade and is flush with the bent cap adjacent the upstream battered pile. As we moved down stream to the second battered pile, the rip rap drops off and exposes five (5) feet of that battered pile. Once past the pile, the rip rap comes back up to the bottom on the bent cap. No deficiencies were evident on the battered pile. Reference video tape 1 set 5. During the inspection, the unexpected exposure of the battered piles are seen and discussed. The area around the battered piles is higher than the bent cap by two (2) feet. This off set allows the battered columns to be exposed.

Set 20 (H-pile) leans to the north 1/4" per foot. No deficiencies were found on the h-pile or the pile cap. The rip rap grade is correct and is flush with the bent cap.

Set 6 (Round columns- 3rd mooring post). Both of the columns are plumb. The grade of the rip rap is correct and is flush with the bent cap. About nine (9) inches of both battered piles were exposed. A five (5) foot dia. pipe extends from directly below the bent cap towards the river approximately three (3) feet. The pipe did not have any deficiencies however the pipe did not have a screen on it.

Set 21 (H-pile) leans slightly to the west 1/8" per foot. No deficiencies were observed on both the h-pile and the pile cap. The rip rap was to grade and was flush with the bent cap.

Set 7 (Round columns- 4th mooring post from the east). The upstream column was leaning to the south a 1/2" per foot and to the west 1/4" per foot. The downstream column was leaning to the south 1/8" per foot. No deficiencies were found on either column however a crack on the upstream ceiling was observed. On the downstream side of the mooring post, approximately 15", there is a construction joint where two (2)

separate pour come together. The downstream side of this joint, just below the 634' elev. extending down to the bottom of the bent cap is in extremely bad shape. Reference video tape 2 after set 24. The aggregate in the area falls away to the touch and thru hole can be seen about the size of a softball. Some of the structural rebar can also be seen. We followed the bent cap downstream to the next H-pile where a spalled out area was found about 14" long and 4" high was found. A third spalled out area was found approximately eight (8) feet further downstream. This area is 16" long and 4" to 5" high.

Set 22 (H-pile) is plumb and no deficiencies were found on both the pile and the pile cap. The rip rap was to grade and was flush to the back bent cap.

Set 8 (Round column- 5th mooring post from the east). The upstream column leans to the south 3/8" per foot. The downstream column leans south 1/8" per foot and to the east 3/8" per foot. No deficiencies were found on the columns or the column caps. The rip rap was to grade and was flush to the back pile cap.

Set 23 (H-pile) leans north 1/8" per foot and east 1/2" per foot. No deficiencies were found. The rip rap was to grade and flush with the back pile cap.

Set 9 (Round columns- 6th mooring post from the east). Both columns were plumb and no deficiencies were noted. Rip rap was to grade and flush with the back pile cap. One (1) foot of the battered columns was exposed.

Set 24 (H-pile) leans slightly to the east 1/16" per foot. No deficiencies of the pile or the pile cap were found. Rip rap was approximately at a 75 degree angle and leveled out five (5) feet from the back pile cap. The rip rap was flush with the pile cap.

Set 10 (Round column- 7th mooring post from the east). The upstream column was plumb, the downstream column leans south 1/4" per foot and west 1/8" per foot. No deficiencies were noted on the columns or the column caps. Rip rap was to grade and flush with the back pile cap. Both battered piles were exposed by six (6) inches and the geo-textile could be seen behind the columns.

Set 25 (H-pile) leans slightly to the west 1/8" per foot. No deficiencies on the pile or the pile cap were seen. The rip rap began at the 621' elev. and was to grade. Rip rap was flush with the back pile cap.

Set 31 is an armored expansion joint and was added to the inspection. The joint has an H-pile on either side and both are plumb and no deficiencies were found. Ref. video tape 2. The support beam running perpendicular to the river is also supported by rip rap that is mounded up running perpendicular to the river also.

Set 11 (Round column- 8th mooring post from the east). Upstream column leans north ¼" per foot. The downstream column leans north 1/8" per foot. No deficiencies were found on the columns as well as the column cap. Rip rap was to grade and flush with the back pile cap. Twelve inches of both battered piles could be seen as well as the geo-textile material behind them. Spalling was observed on the river side bent cap extending downstream from set 31 and ending four (4) feet from the upstream column of set 11. Ref. video tape 2 set 11. Approximately 15" downstream of the downstream column of set 11 located at the joint there is a spalled out area. It appears during installation that a structural piece of rebar did not make it into the pour. The exposed rebar is two (2) feet long and should have been placed inside the form prior to pouring.

Set 26 (H-pile) is plumb and no deficiencies were seen on either the pile or the pile cap. Rip rap is to grade but is nine (9) inches short of the back pile cap.

Set 12 (Round column- 9th mooring post from the east). The upstream column leans to the east ¼" per foot. The downstream column is plumb. No deficiencies were noted concerning either column or the column cap. Rip rap is to grade but is 9" short of the back pile cap.

Set 27 (H-pile) leans slightly to the south 1/8" per foot. No deficiencies were noted. Rip rap is to grade and flush with the back pile cap.

Set 13 (Round column- 10th mooring post from the east). Both columns are plumb and no deficiencies were noted on the two columns or the cap. Rip rap is to grade and flush with the back pile cap. Approximately 38" upstream of the support column on the back pile cap we noted an area in the concrete that is soft with some slight spalling. Looking back towards the battered piles on the back wall we could see some pea stone. The area was too tight to get back to however it looks like the back wall might have failed and the hillside fill is beginning to spill into the river. The geo-textile material can also be seen.

Three feet downstream of set 13, there is a piece of rebar that was not placed into the form prior to pouring. The rebar is about two (2) feet long and because it began rusting, it cracked the concrete running downstream for about six (6) feet. Ref. video tape 3 set 13.

Set 28 (H-pile) leans to the south $3/8''$ per foot. No deficiencies were seen on the pile or the pile cap. The rip rap is to grade but is 3'' short of the back pile cap. Three inches of the back H-pile can be seen between the rip rap and the pile cap.

Set 14 (Round column- 11th mooring post from the east). The upstream column leans to the west $1/2''$ per foot and the downstream column is plumb. The rip rap is to grade on either side of the columns traveling towards the bank and is flush with the pile cap however the area between the columns has been washed out. The diver was able to touch the upstream battered pile that was exposed by 1 $1/2'$. Between the two columns is a gully filled with pea gravel that at one time was behind the back bent cap. The geo-textile material was there and was the only thing holding back the dirt back fill. The diver was able to reach around the geo-textile material and feel only mud. Ref. video tape 3 set 14 and set 32. Cracking was also noted on the ceiling and can be seen on tape 3, set 14.

Set 32 (H-pile) leans slightly to the east $1/8''$ per foot. This pile supports the NW corner of the river walk. No deficiencies were seen on the pile or the pile cap. Ref. video tape 3, set 32. Set 32 was added due to the proximity of set 14 and its failure and the damage found on the back pile cap in its area. This damaged area is where the NS pile cap meets the EW bent cap. Ref. the attached prints (S-505-P2) for clarification.

Set 29 (H-pile) leans to the south $1/4''$ per foot. No deficiencies were noted on the pile or the pile cap. Rip rap was to grade and flush with the back pile cap. A spalled out area of 25'' was noted on the back pile cap approximately 10' towards the bank (south) of the bent cap that runs East to West (parallel to the river).

Set 30 (H-pile) leans north $1/4''$ per foot. No deficiencies were noted on the pile or the pile cap. Rip rap was to grade and flush with the back pile cap.

A video inspection of the corner further south of set 30 was also taken to determine whether or not there were any failures in that area. Ref. video tape 3 following set 30. No deficiencies or failures were noted in this area.

In conclusion I would like to highlight the damaged and or failed areas noted during our underwater inspection. The first being Set 2, along the back pile cap there is a large void where the dirt back fill being added to the sinking area topside is being lost. The area needs to be secured and protected from the river flow if the loss of material is to be halted.

The second area of concern is the river side bent cap between mooring posts 7 and 8 counting from the east. The concrete mixture was very poor in this lift and the concrete fascia is falling apart rapidly. Rebar is exposed and extensive spalling is taking place. Also, on the downstream side of set 11 (mooring post 8) at the first construction joint there is an exposed piece of rebar that was never placed inside of the form before pouring. This exposed rebar is causing the concrete to break away. A second area with exposed rebar that was not placed inside of the form is located 3' downstream of set 13 (mooring post 10). In this area, water has run along the rebar back into the pour and has caused a six (6) foot horizontal crack along the fascia.

The third area that needs to be addressed is the possible failure of the geo-textile material and back bent cap that is holding back the hillside fill material on set 13. Pea sized gravel was noted coming from the area behind the battered piles however the area was too restrictive for diver access. Pea sized stone was used as fill on the hill side and should not be present in this area.

The fourth area was between the battered piles on set 14 (mooring post 11) where a washed out gully was discovered. The diver was able to follow the gully towards the bank and reach the upstream side battered pile. The gully was filled with pea sized gravel coming from the hill side. The diver was also able to physically reach around the geo-textile material and feel only mud. The material was bulging towards the river under the weight of holding back the dirt/mud back fill.

The fifth and final area discovered that needs immediate attention is the spalled out area associated with set 32. This area has exposed rebar and will only grow larger with out repairing.

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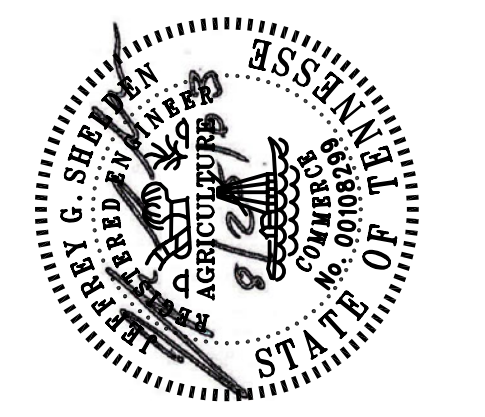
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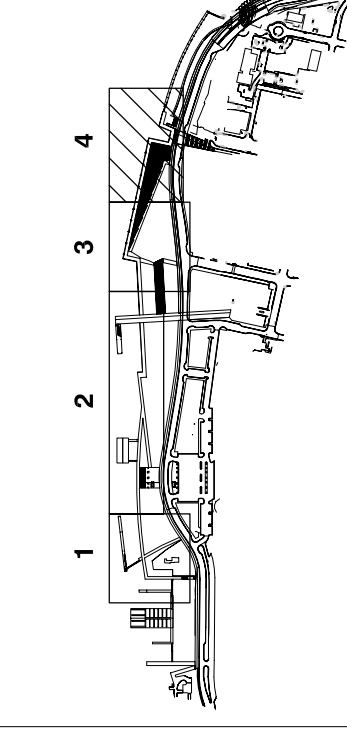
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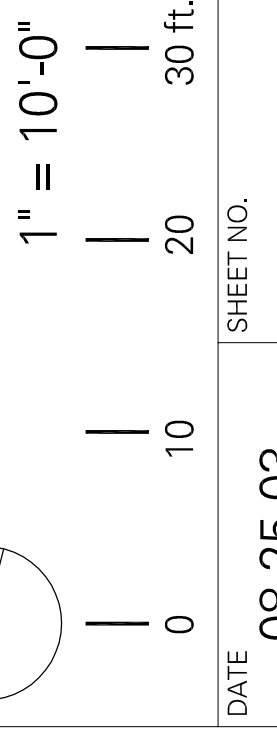
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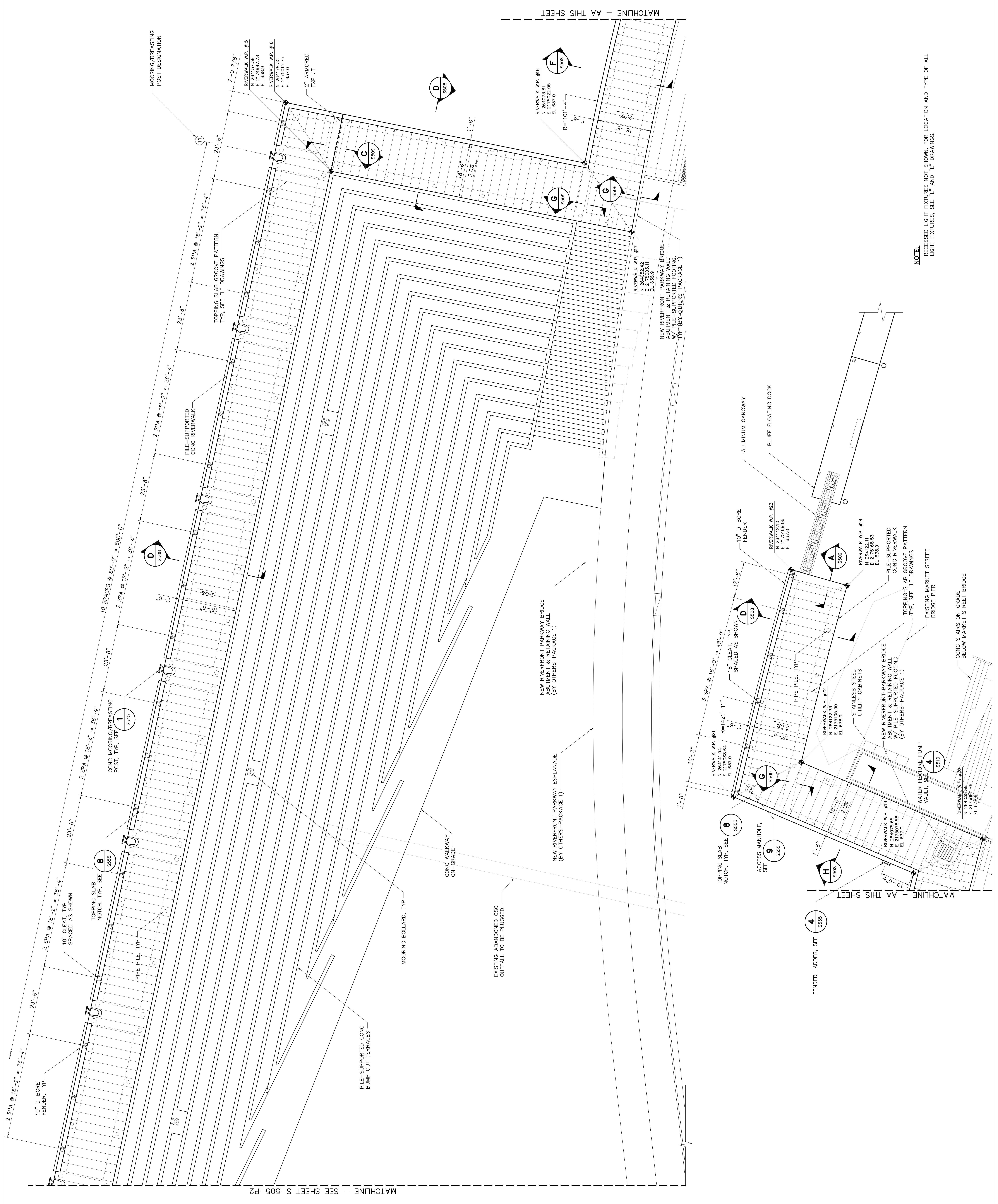
Ross's Landing
Riverwalk Deck Plan
Sheet 4 of 4

OWNER'S PROJECT NUMBER PROJECT NUMBER
 E-03-015 4948-02

SCALE
 1" = 10'-0"



DATE 08.25.03 SHEET NO.
 DRAWN BY DK
 CHECKED BY GM
 APPROVED BY JS



NOTE.
 RECESSED LIGHT FIXTURES NOT SHOWN FOR LOCATION AND TYPE OF ALL LIGHT FIXTURES. SEE "L" AND "E" DRAWINGS.

MATCHLINE - SEE SHEET S-505-P2

MATCHLINE - AA THIS SHEET

MATCHLINE - AA THIS SHEET

