

Bulkhead Monitoring Report

Morgan Creek Harbor
Isle of Palms, South Carolina

June 6, 2014

Terracon Project No. 73055027

Prepared for:
Morgan Creek Harbor Association
Mt. Pleasant, South Carolina

Prepared by:
Terracon Consultants, Inc.
Columbia, South Carolina

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Geotechnical ■ Environmental ■ Construction Materials ■ Facilities

June 6, 2014



Morgan Creek Harbor Association
Property Management Services
1340-G Ben Sawyer Blvd.
Mt. Pleasant, South Carolina 29464

Attn: Ms. Laurie A. Schueler

Re: ***Bulkhead Monitoring Report***
Morgan Creek Harbor
Isle of Palms, South Carolina
Terracon Project No. 73055027

Dear Ms. Schueler:

Terracon Consultants, Inc. (Terracon) has completed an annual inspection of steel bulkhead at Morgan Creek Harbor and is submitting the findings herein. This work was performed in general accordance with the scope of work outlined in our master Proposal Number 12090301-G.R1, dated August 13, 2004. Included in this report are a summary of data collected, our field observations, and our general assessment about the overall performance of bulkhead. Additional data are included in the Appendix.

A. REPORT SUMMARY

Overall, the bulkhead is performing well considering its age and environmental factors. The measurements at the reference markers indicate no abnormal movement of the wall inward or outward. Further, we did not notice any unusual wall distress. The bulkhead coating, completed in 2012 is generally helping with rust and corrosion prevention and has also improved the overall appearance of the wall.

Patch plates used to fix the pinholes during coating of the wall have generally done well. New pinholes, either next to existing patch plates or in other parts of the wall have developed. Also there are many pinholes locations which were prepared to receive a patch plate, but the work was stopped due to dredging and other factors. In these areas, the bulkhead metal is exposed which has accelerated the rust. We recommend continual maintenance of wall which should include spot coating and repairing of pinholes and coating.

As indicated in the bulkhead monitoring reports, and as was evidenced during recent coating of the bulkhead wall, corrosion is an on-going issue that requires constant maintenance and attention. Corrosion appears to be more severe on the south side (A to J and Med Docks) as compared to the north side.



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The mechanism and cause(s) of observed corrosion on the bulkhead wall is not precisely known. Further, the extent of wall corrosion on the landside is not known but needs to be evaluated. A complete site investigation, including backfill soil sampling, corrosion product sampling, corrosion characteristics testing, metallurgical testing of samples, electrochemical testing and electrical continuity evaluation among others would be required to evaluate the corrosion damage and to provide repair/prevention recommendations. Terracon remains available to assist Morgan Creek on this effort. Our proposal dated September 16, 2013 outlines our approach and estimated fee to conduct such a study.

The tie back at 47 Water Way Island (WWI) was repaired in late December 2013 by TIC (The Industrial Company). During our current observation, we noted water leaks between the backer plates and also around the anchor rod nut/washer. In addition, there is some subsidence of backfill in this area. We recommend that TIC inspect the leak and backfill, and make the necessary repairs. Further, the disturbed area should be vegetated to prevent erosional losses.

The results of our observations were discussed with Ms. Laurie Schueler at the conclusion of field work. The following report sections provide a detail summary of field work, the wall measurements, a photo log, and our comments and recommendations.

B. SUMAARY OF FIELD OBSERVATIONS

On May 7, 2014, Terracon Consultant Inc. (Terracon) personnel performed measurements of movements of the steel bulkhead and observed the general conditions of the wall and its anchorage system. Observations of the wall conditions were made from the easement behind the wall, floating docks and from the water side by boat. A representative from Coastline Services, LLC (formerly Dirt Cheap) accompanied us during these activities, which also provided and operated a boat for viewing the bulkhead from the water side. Mike Pilley of Phillips Industrial Company was also present during the water side inspection and viewed the wall for rust and overall coating performance. He stated that he would provide a separate summary report of his observation to PMS. We should also note that Mr. Bobbitt previously accompanied us during these inspections to provide his opinion with respect to the tie backs and the structural conditions of the bulkhead. Mr. Bobbitt retired after 2011 inspections and is no longer available to conduct these inspections.

Wall measurements were made at all reference plate locations. Measurements were made to the reference plates which were originally installed in March, 2005. The data are shown on Table 1, attached. All of the locations were measured during this inspection program, except as noted in the table. The following is a summary of our observations:

1. The wall appears to be performing well with minor exceptions. The wall measurements were taken during mid-morning hours on a low tide on May 7, 2014. A woven metallic tape was used to measure the apparent wall movement

(deflection). The ambient temperature during field measurements was in the low 80's.

2. The wall measurements of May 7, 2014 generally indicate no unusual or unacceptable wall movements (inward or outward) when compared to readings recorded on April 19, 2013 and three-year running average. Where no readings were available from the April 19, 2013 inspections, the measurements have been compared to older available readings. Exceptions are noted in the table.
3. Several measurements indicate possible inward (top moving toward land) and outward (top moving outward toward water) of about 0.01 to 0.02 feet (1/8 to 1/4 inches). Movements of this magnitude are considered to be within the accuracy of measuring device. Temperature and tide stages also affect the readings. We did not notice any apparent signs of distress or movement of the wall, wall cap, and backfill subsidence in the area of these measurements. Nevertheless, these locations will be observed and/or measured during the next scheduled inspection program.
4. The tie back at 47 Water Way Island (Station 6+30) was repaired by TIC in December, 2013. It appears to be performing well. The measurements of reference plates up and down station from it do not show any wall movement. Further, the wall section appeared to be in alignment with adjacent sections with no noticeable bulging or other forms of distress. However, we noticed water leaks between the backer plates and also around the nut/washer. In addition, there is some subsidence of backfill in this area. We recommend that TIC inspect the leak and backfill and repair it as necessary. Further, the disturbed area behind the wall should be vegetated as soon as practical to prevent erosional losses (Photos 1 and 2).
5. The anchor rod at 40 Water Way Island (Station 14+00) was repaired by TIC in February 2014 and appears to be performing well.
6. Several other areas of minor backfill subsidence were noted during our inspections. The subsidences are minor in nature and appear to be due to the irrigation lines and/or yard inlets present in the area. Also at several locations landscape shrubs are very close to the edge of wall. These areas should be periodically inspected and filled as necessary. Consideration should also be given to locating future irrigation heads away from the bulkhead (Photo 3 and 4).
7. The wall measurements and other observations were made for the 11th time since the initial dredging was completed and for the 2nd time since the 2012/2013 dredging. It appears that the recent dredging, as of now, has not negatively impacted the wall. The pre- and post-dredging measurements as compared to the current readings do not indicate any abnormal wall performance as a result of the dredging.

8. It has been almost two years since completion wall coating. Phillips Industrial Company began a maintenance program in the form of pinhole repairs and touch ups soon after coating completion, but the work was halted due to dredging activities and other factors. New pinholes, either next to existing patch plates or in other parts of the wall have developed. Also there are many pinholes locations which were prepared to receive a patch plate, but were not completed due to work stoppage. It is important that pinholes are repaired in a timely manner to minimize its impact on the wall performance. Patch plates (6"x6" and 8"x8" sheet metal plates) have been used to seal pin-holes in the past and should continue be used to repair any additional pinholes identified during maintenance program. Continual maintenance is necessary to minimize the corrosion of the bulkhead (Photos 5, 6, 7 and 8)
9. Rust has developed on exposed flanges of cap beam beginning at Station 28+00 and ending near the end of bulkhead. The rust appears to be related to fertilization leachate of the golf course lawn. The flange should be washed/cleaned and coated to prevent further rust and/or damage. Further, all joints in the concrete cap beams should be sealed to minimize moisture penetration into beam web/flange (Photo 9).
10. The coating on a 50±-foot section of wall on the Morgan Creek side of the wall shows signs of peeling. Mike Pilley indicated he was aware of it and would be re-coating the area (Photo 10).
11. We recommend that inspections of the backfill conditions, flapper gates, etc. continue to be made by Coastline as these inspections are important to the long term performance of the bulkhead. Coastline is well qualified to do this work because they are familiar with the various issues related to the wall. Coastline reports should be sent to the Association and Terracon on a regular basis. The performance of the wall depends upon these inspections (among others) and must be performed on a regular basis.
12. The Association has a sizeable investment in the bulkhead, and in order to maintain it, periodic observations are necessary. It is recommended that continued maintenance along with periodic inspections continue to be conducted as it will help to extend the life of the bulkhead. Any unusual or suspicious conditions should be reported to Terracon immediately.

C. CLOSURE

Terracon appreciates providing this service to the Morgan Creek Harbor Association. If we can provide additional information or be of further service, we will be pleased to do so upon request.

Respectfully submitted,

Terracon Consultants, Inc.



Kevin Sohrabnia, P.E.

Senior Principal

SC Registration No. 16603

Attachments

Photo Log

Table 1 – Wall Measurements 5-7-2014

Photograph Log

Bulkhead Monitoring Report ■ Isle of Palms, South Carolina, SC
June 6, 2014 ■ Terracon Project No. 73055027

Terracon

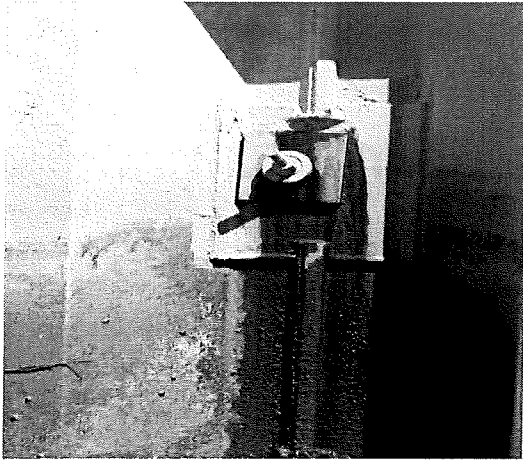


Photo 1. Tieback at 47 Water Way Island. Note the leak between plates/nut and washer. Some rust has developed.

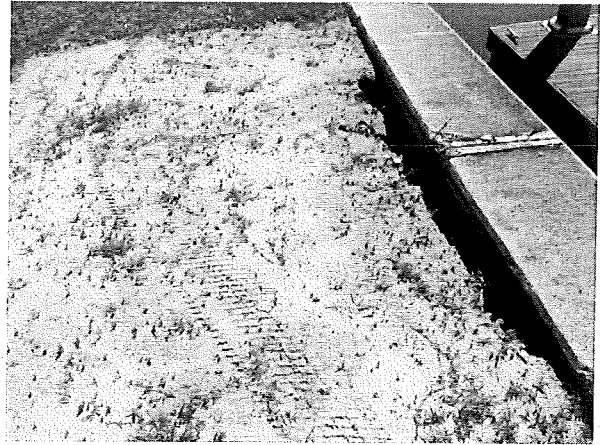


Photo 2. Subsidence of backfill at 47 Water Way Island tieback. No vegetation has been established in the excavated area.

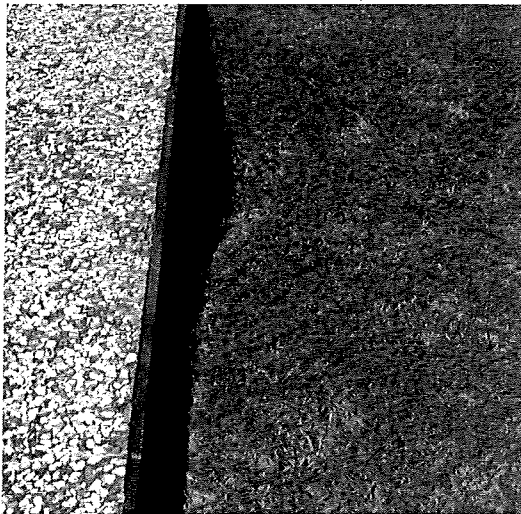


Photo 3. Typical minor subsidence of backfill next to wall cap. The subsidences are typically about 2 to 3 inches and 12 to 24 inches long.



Photo 4. Trees and shrubs have been planted very near to back side of the wall. The wall cap has completely been covered by overgrown shrubs and trees.

Photograph Log

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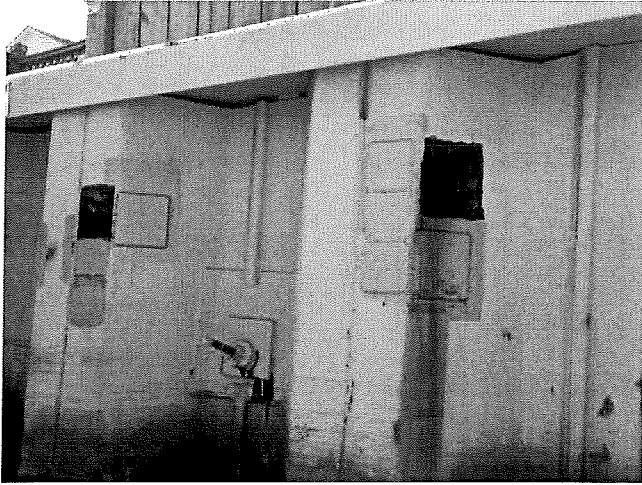


Photo 5. Pinhole prepared to receive a patch plate, but work not completed. Note rust in the exposed metal.

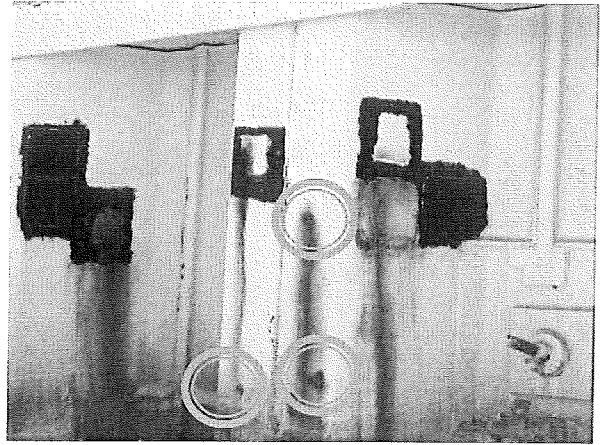


Photo 6. Same as Photo 5. Note additional pinholes being developed near previous locations. Corrosion is getting worst in these areas.

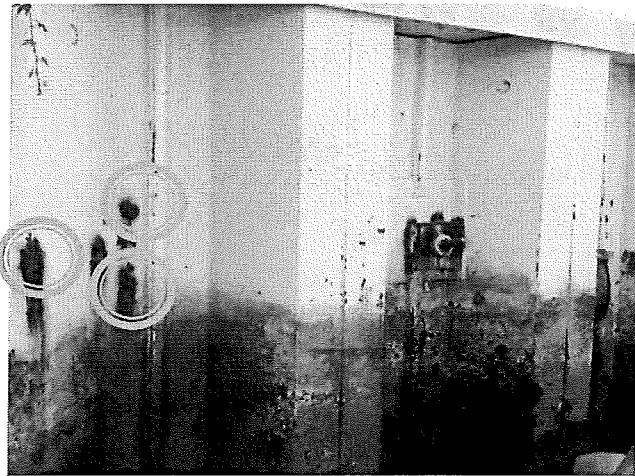


Photo 7. Pinholes in the wall. Also rust in the tieback has developed.

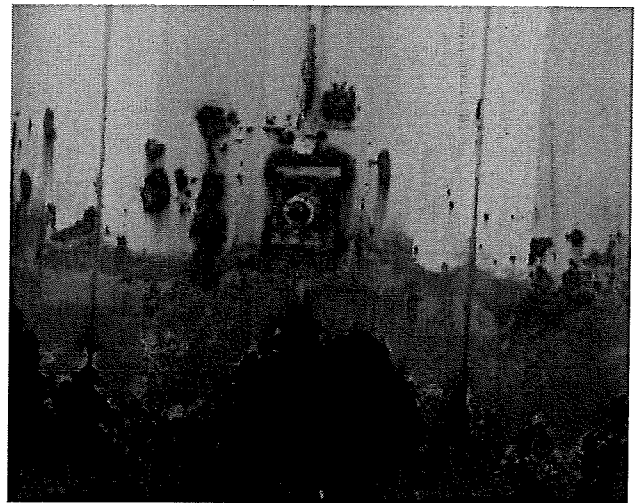


Photo 8. Widespread corrosion and pinholes.

Photograph Log

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Photo 9. Rust on exposed flanges of cap beam
Station 28+00 to near end of wall.

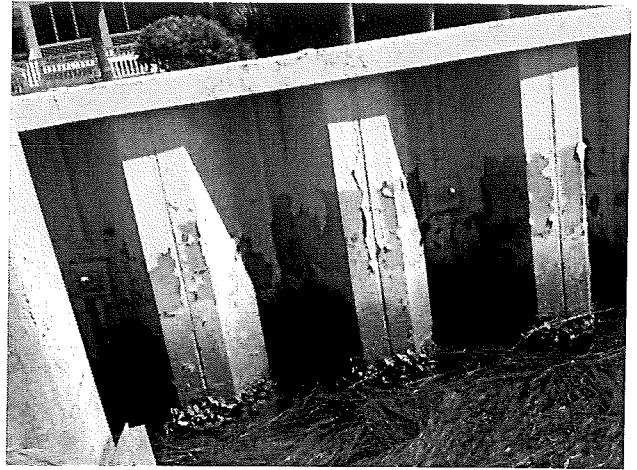


Photo 10. Peeling of the coating on a section of wall
on the Morgan Creek. The area is about
50 feet long and 3 feet wide.

Table 1 -Wall Measurements 5-7-2014

Table 1
MORGAN CREEK HARBOR - Bulkhead Wall Measurements
May 7, 2014
Terracon Project No. 73055027

Reference Plate No.	Station No.	Distance to Reference Plate March 10-11, 2005	Distance to Reference Plate February 4, 2010	Distance to Reference Plate March 22, 2011	Distance to Reference Plate March 15, 2012	Distance to Reference Plate April 19, 2013	Distance to Reference Plate May 7, 2014	Difference in feet since April 19, 2013	General Notes
1	60+75.00	52.42	52.43	52.44	52.44	52.44	52.44	0.00	
2	60+ 53.85	46.95	46.98	46.98	46.98	46.98	46.98	0.00	
3	59+53.93	56.90	56.90	56.91	56.92	56.91	56.92	0.01	
4	58+15.55	53.70	53.97	54.00	54.09	54.09	54.09	0.00	shrubs on alignment
4A	58+15.55	-	28.46	28.46	28.46	28.46	28.46	0.00	Note 1
5	57+32.40	56.22	56.48	56.50	56.50	56.50	56.50	0.00	
5A	57+32.40	-	26.19	26.21	26.21	26.21	26.21	0.00	Note 1
6	55+02.48	54.10	54.12	54.13	54.13	-	54.12	-	corner of house
7	53+79.00	62.00	61.91	61.89	61.87	61.88	-	-	Note 3
8	52+54.00	63.90	-	-	-	-	-	-	Note 3
8A	52+54.00	-	27.44	27.46	27.46	-	-	-	Note 3
8B	52+50.00	-	-	-	-	-	-	-	no reading, see 8B
9	51+45.00	69.10	69.10	69.13	69.10	27.23	27.23	0.00	note 4
9A	51+45.00	-	25.70	25.72	25.72	25.71	25.71	0.00	Note 3
10	50+08.42	63.80	63.78	63.81	63.81	63.81	63.82	0.01	Note 1
11	48+13.10	50.50	50.48	-	-	-	-	-	Note 2
11A	48+13.10	-	27.60	27.60	27.61	27.60	27.60	0.00	Note 3
12	46+45.00	28.40	28.40	28.42	28.41	28.41	28.41	0.00	Note 5
13	44+50.00	62.40	62.40	62.40	62.42	62.42	62.42	0.00	Note 6
14	43+50.00	47.50	-	-	-	-	62.42	0.00	corner of house
15	42+14.93	42.60	42.55	42.55	42.55	42.55	43.64	-	corner of concrete pier
16	41+25.11	43.60	43.61	43.61	43.61	43.62	43.62	0.00	
17	40+50.00	55.50	55.48	55.49	55.49	55.49	55.49	0.00	diff. to access
17A	40+50.00	-	44.51	44.49	44.49	44.49	44.49	0.00	To step column
18	40+00.00	137.50	137.50	137.50	137.44	-	-	-	no reading
18A(new)	39+78.00	-	44.50	-	-	-	-	-	Note 7
19	39+27.26	46.10	46.11	46.10	46.10	46.10	46.10	0.00	

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20	38+34.69	44.90	44.91	44.85	44.85	-	-	-	No reading
21A	38+34.69			44.64	44.64	44.65	44.65	0.00	Note 9
21	37+43.83	49.60	49.61	49.61	49.61	49.61	49.61	0.00	
22	37+00.00	51.60	51.60	51.60	51.60	51.59	51.61	0.02	questionable reading; shrubs, potting plants
23	36+50.00	48.10	48.13	48.16	48.16	48.16	48.16	0.00	
24	35+50.00	42.40	42.44	42.45	-	-	53.71	-	marker by window on wall
25	35+17.57	49.30	49.30	49.31	49.31	49.32	49.32	0.00	
26	34+44.28	47.00	46.99	47.00	47.01	47.00	47.00	0.00	
27	33+82.47	49.00	49.01	49.01	49.01	49.01	49.01	0.00	
28	33+37.63	46.20	46.20	46.21	46.20	46.20	46.20	0.00	
29	32+68.00	46.00	46.00	46.00	46.00	46.00	46.00	0.00	
30	31+91.55	47.00	47.10	47.12	47.12	-	46.92	-	above spigot
31	31+00.00	137.90	137.89	-	-	-	-	-	above spigot on column
32	30+39.00	45.40	45.38	45.39	45.39	-	-	-	Note 10
33	29+68.68	46.50	46.51	46.51	46.52	46.52	46.51	(0.01)	Note 10
34	28+63.00	45.80	45.77	45.79	45.79	45.78	45.78	0.00	shrubs
35	28+07.82	46.30	46.60	46.60	46.68	46.68	46.68	0.00	porch column
36	0+57.38	34.00	34.07	34.09	34.09	34.09	34.09	0.00	porch column
37	1+58.75	45.60	45.61	45.60	45.60	-	42.96	-	pool corner
38	2+89.23	44.00	43.95	43.95	43.95	43.96	43.97	0.01	
39	3+90.89	35.10	35.10	35.10	35.09	35.09	35.09	0.00	middle column
40	5+17.00	41.00	41.10	41.09	41.09	41.09	41.09	0.00	
41	7+94.37	71.00	-	-	-	-	-	-	
41A	-	-	36.89	36.89	36.89	36.88	36.88	0.00	corner
42	9+20.00	60.30	60.30	60.31	60.31	60.31	60.31	0.00	
43	10+20.00	31.00	30.97	30.97	30.97	30.97	-	-	silt fence, no reading, RT post

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44	12+00.00	45.00	45.05	45.05	45.05	-	45.01	-	
45A	13+10.00	-	36.77	36.77	36.77	36.77	36.77	0.00	5th post from RT
46	14+30.00	34.00	33.93	33.92	33.92	33.92	33.92	0.00	higher wall
47	15+10.00	63.70	63.70	-	-	-	-	-	
47A	15+10.00	-	-	-	35.71	35.71	35.70	(0.01)	corner, Note 12
48	16+86.00	35.00	34.96	34.96	34.96	34.96	-	-	shrubs
49	17+71.90	52.10	52.07	52.08	52.08	52.08	52.08	0.00	left post steps
50	18+30.00	72.30	72.31	72.31	72.32	72.31	72.31	0.00	left corner
51	19+00.00	34.10	34.14	34.16	34.16	34.16	34.16	0.00	Corner post
52	19+62.55	45.30	45.23	45.25	45.24	45.24	45.24	0.00	corner
53	20+00.00	54.00	53.85	53.85	53.86	53.85	53.85	0.00	4 th column from north
54	20+50.00	43.90	43.90	43.89	43.90	43.90	43.90	0.00	
55	21+00.00	45.30	45.22	45.22	45.22	45.22	46.06	-	New Marker, left column, cinder block
56	21+50.00	54.80	54.87	54.86	54.86	54.85	-	-	
57	22+25.00	32.50	33.44	33.44	33.44	33.44	33.44	0.00	
58	23+00.00	39.90	39.87	39.87	39.87	39.87	39.87	0.00	By door
59	23+50.00	34.10	34.11	34.10	34.10	34.10	34.10	0.00	
60	24+25.00	34.20	34.20	34.20	34.20	34.20	34.20	0.00	

Table Notes:

- 1) Measurements to the back of sidewalk
- 2) No visual signs of wall movement or distress. Measurement may be off due to difficulty in locating the reference mark.
- 3) Could not establish reading due shrubs and other obstructions.
- 4) Measurement from back of the sidewalk at joint to station marker 52+50. Marker was established in 2013.
- 5) Measurement to the back of sidewalk, tangent to east side of fence post.
- 6) Measurements to the back of sidewalk at the construction joint.
- 7) Could not locate the marker. No reading was taken. No visual signs of wall distress at location.
- 8) House appears to have been painted. Marker on wood next to brick marker on trim.
- 9) marker on trim.
- 10) No measurements taken.

Table 1
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11)		New marker to RT column of pool deck.							
12)		New marker to RT column of pool deck.							

General Notes

- Positive numbers indicate outward (toward the water) and negative numbers (<->) indicate inward (toward land) movement.
- Measurements were taken at low to mid tide, temperature in low seventies (» 80-85° F), very light wind.
- Measurements taken to bottom left corner of reference plate, unless noted otherwise.
- Measurements were taken using a 100' long woven metallic tape.

Dashes " - " in the table indicates no measurements were made during this inspection