Submitted to:
Marquette Board of Light and Power
Shiras Steam Plant
Marquette, Michigan

Submitted by:
AECOM
Marquette, Michigan
Project No. 60445171
January 15, 2016

Holding Pond Annual Inspection Report

Marquette Board of Light and Power
Shiras Steam Plant

Contents

Appendices

1.0 Introduction

The Coal Combustion Residual (CCR) Rule published on April 17, 2015 contains requirements for inspection of CCR surface water impoundments. This report has been prepared to satisfy the 40 CFR 257.83 annual inspection requirements for surface water impoundments for the Marquette Board of Light and Power (MBLP) Shiras Steam Plant located in the City of Marquette, Michigan. The plant has one surface water impoundment (WDS ID# 478988), which is a holding pond located on the north side of the plant property on the shore of Lake Superior. A previous inspection and structural evaluation of the holding pond was performed by AECOM in 2013. This is the first (initial) annual inspection of this impoundment to be performed under the CCR Rule.

2.0 Annual Inspection

2.1 Holding Pond Configuration

The holding pond is composed of 5 cells which are enclosed by steel sheet pile walls. Its overall configuration is shown in Drawing 1 in Appendix A, and an overall view is shown in Photo 1 in Appendix C. It has been expanded and modified a number of times since constructed. The south and west boundaries of the holding pond are formed by the shoreline of the lake. The east and north boundaries of the holding pond are formed by sheet pile walls which were constructed in 1981. Because of the poor condition of the north wall, an additional wall was constructed to replace it in 2013. The new wall was placed inside of the existing north wall, which remains but no longer provides containment (Photo 3 in Appendix C). The walls for the inner cells 1, 2, and 3 were constructed in 1990. There are also some abandoned sheet pile walls in place from previous configurations.

The original 1981 construction drawings and 1990 improvement drawings were reviewed as part of this inspection. We also reviewed the report AECOM provided for the structural inspection of the impoundment which we performed in 2013. The last change to the pond configuration was the addition of the north sheet pile wall in 2013 mentioned above.

There are several ramps on the south shore of the impoundment which allow loaders to enter the cells to remove solids which have settled out of the impounded water. The cells are periodically drained to allow this cleanout operation. The residuals are primarily composed of bottom ash but also contain components from other waste streams including coal pile runoff and storm water. The residuals are removed to an off-site landfill.

2.2 Instrumentation

Water levels in the holding pond cells are monitored by measuring down from points of known elevation on the cell access walkways. The location and elevation of each measure down point (M.D.P.) is shown on Drawing 1 in Appendix A. The elevations were determined by an AECOM survey crew on October 15, 2015.

Movement monitoring targets were also installed during the October 15, 2015 survey work. These reflectorized targets were installed near the top of the sheet pile walls at the locations shown on Drawing 1 in Appendix A. Initial coordinates of each target were determined using a total station laser survey instrument set-up over 2 control points which were established on the south and west shores of the pond. The targets will be used to check the sheet pile walls for horizontal movement that would indicate stability issues during future inspections. The walls were judged to be generally stable with regard to lateral movement based on our visual observations from previous inspections.

2.3 Water and CCR Ash Elevations

The water elevation in each of the cells is monitored periodically using the system described in section 2.2 of this report. The following table summarizes the variation in water elevations since the monitoring was begun on October 7, 2015:

Cell	Minimum Elevation	Maximum Elevation	Present Elevation
1	602.05	607.96	607.34
2	607.64	608.06	607.77
3	606.80	608.01	607.72
4	606.73	607.65	606.82
5	606.12	607.62	606.37

The elevation of the CCR ash deposit surface varies between cells. The ash surface elevation also varies across each cell and cannot be characterized by a single elevation. Water depth elevations to the top of the ash deposits were measured by AECOM using a boat on December 11, 2015. Cross sections of each cell showing the CCR ash bottom profiles were developed using these measurements and are included in Drawings 2 through 6 in Appendix A.

2.4 Storage Capacity

The storage capacity of the holding pond was calculated using the original design elevation of the pond bottom as the lower limit of the enclosed volume. The upper limit was assumed to be the current elevation of the outlet weir in each cell. The total storage volume was calculated to be 5,570 cubic yards. The calculations are included in Appendix B.

2.5 Current Volume of Impounded Water and CCR

The water depth measurements from our survey were used to calculate the current upper limit of CCR ash in the holding pond. The lower limit of CCR ash was assumed to be the original design elevation of the bottom of the pond. The volume of CCR ash was calculated to be 3,337 cubic yards. The calculations for the CCR ash volume are included in Appendix B.

The volume of impounded water was calculated using the results of our water depth survey for the lower limit of the water. The upper limit was assumed to be the current outlet weir elevation of each cell. The volume of impounded water was calculated to be 2,413 cubic yards. The calculations for the impounded water volume are included in Appendix B.

2.6 Structural Field Evaluation

The primary structural component of the holding pond is the exterior sheet pile walls on the east and north sides of the pond. A field evaluation of the outer sheet pile containment wall was performed on November 5, 2015 by AECOM employees, Brian Hintsala, P.E. and Bruce Peterson. The water was at normal elevation in all of the cells except cell 1 during the inspection. A boat was used to inspect the east wall which separates the holding pond from Lake Superior.

A structural inspection and analysis of the holding pond was performed by AECOM in 2013. The report from this inspection noted that the original design plans identified the sheet pile section used for this wall as “BZ-350”. We could find no information or specifications for this type of sheet pile. Based on our field observations, this sheet pile is a hot rolled Z-shaped section with a depth of 12-inches and a

3/8-inch nominal thickness. It appears to be similar to a PZ27 sheet pile section, which is a common type of sheet pile.

The steel surface on the Lake Superior side of the sheet pile was bare and the majority of the wall appeared to be in good condition (Photo 2 in Appendix C). There were a number of spots of localized corrosion which occurred primarily at the joints between the sheets (Photos 4 and 5 in Appendix C). Most of these had an appearance that suggested there may have been seepage through the joint at one time. No seepage was evident during this evaluation.

In order to get an overall view of the condition of the wall, thickness measurements were taken on each 18-inch wide sheet pile section along the 183 feet length of the wall. At least 2 thickness readings were taken on each section with an ultrasonic thickness measuring gage (UT gage). Generally speaking, the readings varied from 0.33-inches to 0.40-inches, indicating little to no loss of the original 3/8-inch steel thickness. There are small areas of more severe localized corrosion (Photo 5 in Appendix C). The minimum remaining thickness was found to be no less than 0.28-inches in these localized spots. We would regard this amount of steel loss as non-critical, since they are small 2-inch to 3-inch wide areas and will not materially reduce the structural capacity of the wall. In addition, our structural analysis of the wall performed in 2013 showed that this exterior wall had a large margin of reserve strength and could tolerate over 50% loss of steel thickness due to corrosion.

The north sheet pile wall was installed in 2013 and is in excellent condition. It is constructed of heavy gage sheet pile similar in size and structural capacity to the sheet pile used for the east wall.

The remaining sheet pile walls which form the internal boundaries between the cells are constructed of a lighter gage sheet pile. It was not possible to examine these walls closely because most of the cells were full of water and the walls were mostly submerged. The exposed portions appear to be in poor condition. These internal walls, however, do not affect to the structural ability of the pond to contain CCR ash and are only used as baffles to improve the settlement of ash out of the water.

3.0 Conclusion

The south and west sides of the holding pond are incised into the ground and pose no threat of failure, resulting in a release of CCR materials. The east steel sheet pile wall of the holding pond is currently in fairly good condition and has a good reserve of structural bending capacity. A new heavy gage sheet pile wall was installed in 2013 to replace the deteriorated north wall of the holding pond. The north and east sheet pile wall both appear to be stable and have ample structural capacity to contain the impounded water. The interior sheet pile walls are in poor condition, but are not required for containment integrity of the holding pond. The interior walls can continue in this condition to function as separators between the cells to improve the settlement of solids out of the process water.

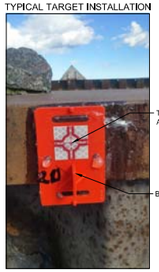
Appendix A

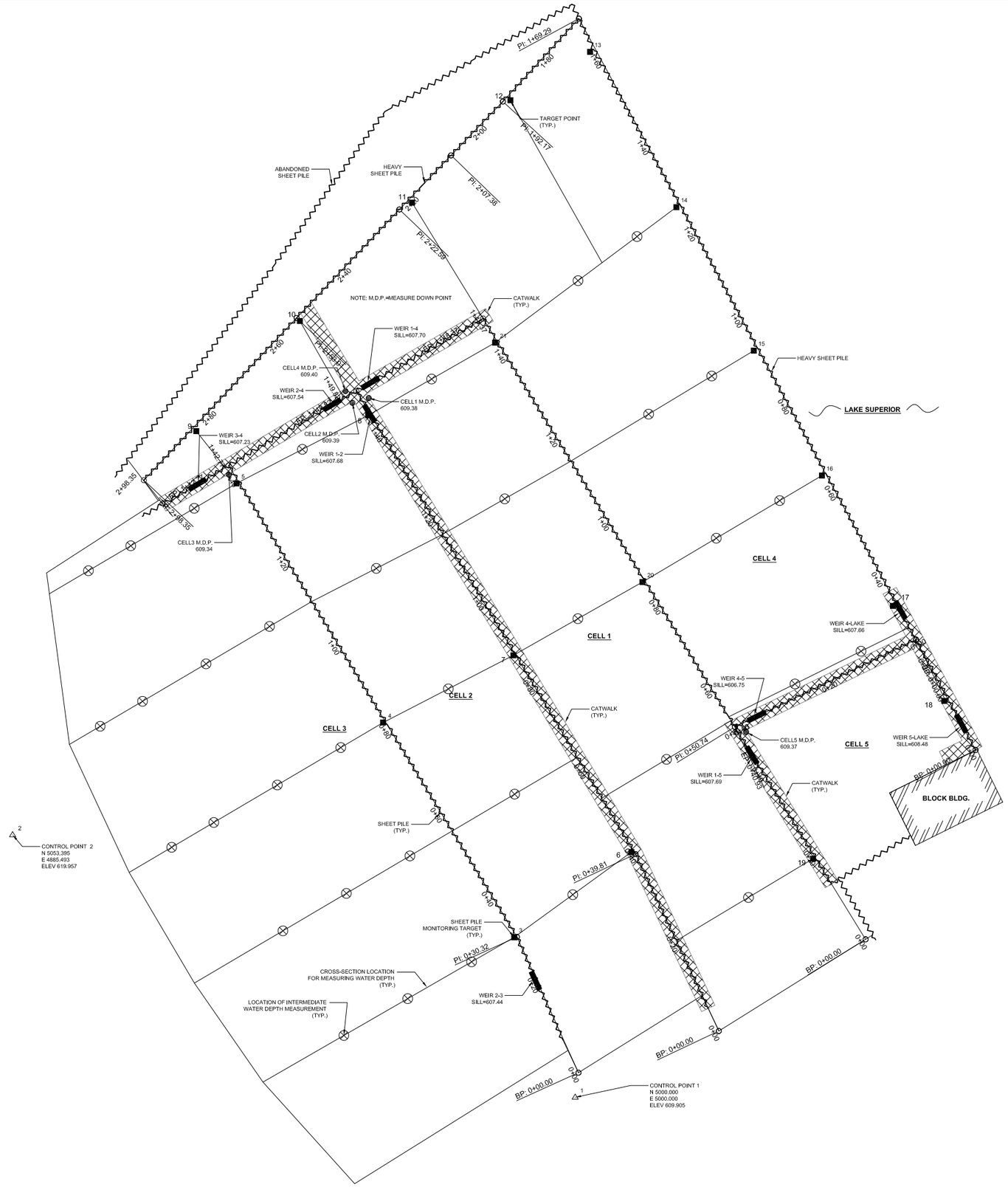
Report Drawings

DATE OF SURVEY: OCTOBER 15, 2015
ELEVATION DATUM IS NAVD88 AND ESTABLISHED BY DIFFERENTIAL LEVEL LOOP FROM NGS DISK LSC7B63 (RK0415) WHICH HAS A PUBLISHED ELEVATION OF 615.810'.
REFLECTIVE TARGET COORDINATES AND ELEVATIONS ESTABLISHED BY TURNING 2 SETS OF ANGLES FROM CONTROL POINTS 1 AND 2.
TARGET BENCHMARK ELEVATIONS ESTABLISHED BY DIFFERENTIAL LEVELING. SOME TARGET BENCHMARKS WERE INACCESSIBLE TO A LEVEL ROD AND HAD TO BE MEASURED DOWN TO FROM ABOVE.

TARGET	NORTH	EAST	TARGET ELEVATION	BENCH MARK ELEVATION
3	5032.562	4987.579	608.902	608.825
4	5076.237	4960.903	608.927	608.847
5	5124.911	4931.078	608.955	608.865
6	5049.888	5011.443	608.929	608.843
7	5089.939	4987.426	608.950	608.870
8	5138.743	4957.869	608.999	608.908
9	5135.519	4922.879	609.915	609.835
10	5157.940	4943.954	609.943	609.857
11	5182.039	4966.800	609.816	609.730
12	5202.844	4986.818	609.836	609.752
13	5212.675	5003.027	609.787	609.695
14	5181.111	5020.604	609.715	609.720
15	5151.909	5036.356	609.747	609.670
16	5126.503	5050.227	609.817	609.730
17	5099.988	5064.660	609.823	609.735
18	5080.634	5075.118	609.781	609.702
19	5048.539	5048.415	608.908	608.830
20	5104.828	5013.673	609.045	608.960
21	5153.524	4983.690	609.036	608.950

TYPICAL TARGET INSTALLATION





10 0 10 20
1" = 10'

X:\ADD_Settings_Autodeskempatesa\24x36.dwg 10/23/2008 11:28:29 AM AECOM4db

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MARQUETTE BOARD OF LIGHT AND POWER
SHIRAS STEAM PLANT
CCR COMPLIANCE

HOLDING POND PLAN

Issued

Rev	Date	Description

Designed:	CLC	10/19/2015
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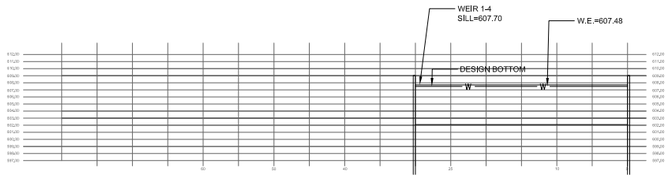
Approved:	JKL	XX/XX/2008

PROJECT NUMBER
60445171

SHEET REFERENCE NUMBER
1

CELL 1

0+00



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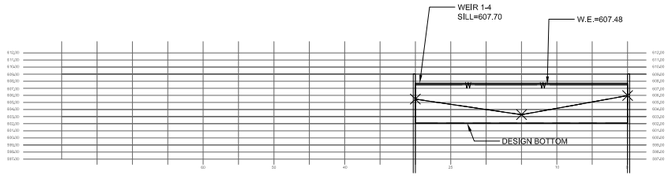

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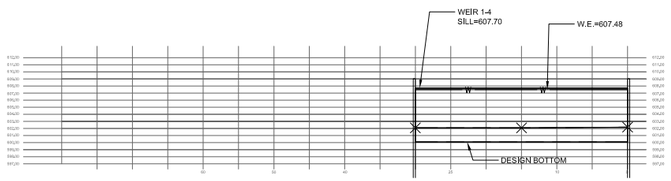
TOTAL AREA = 168,8 SFT

0+52



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TOTAL AREA = 228,7 SFT

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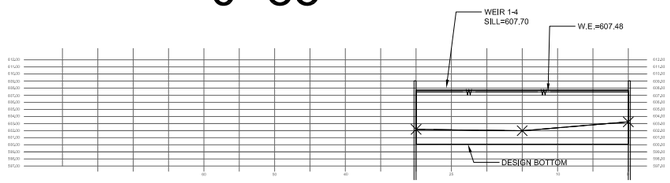

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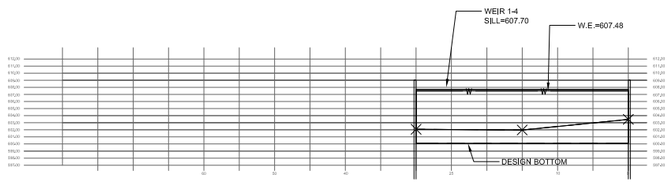
1+15



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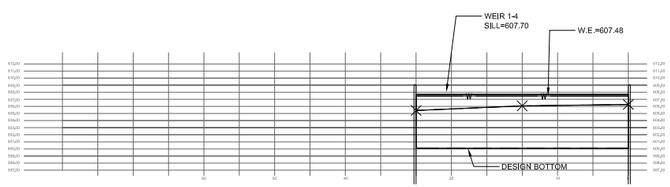
1+43



MATERIAL AREA = 176,6 SFT
MEASURED ADDITIONAL AREA= 52,0 SFT
TOTAL AREA = 228,6 SFT

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HOLDING POND CROSS-SECTIONS

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Approved:	JKL	XX/XX/2008

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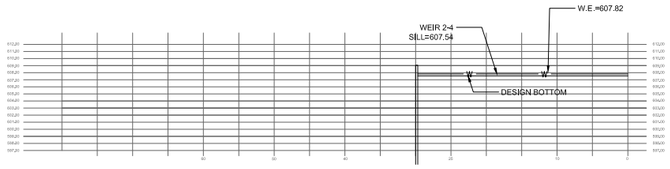
SHEET REFERENCE NUMBER
2

CELL 2

0+08



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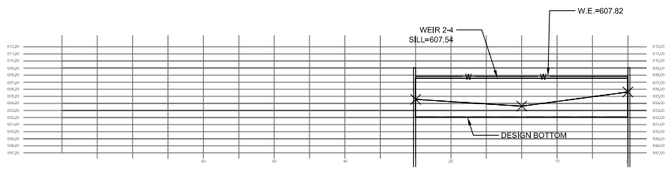

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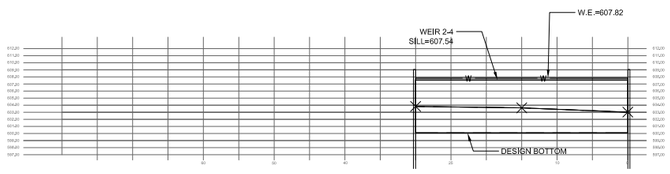

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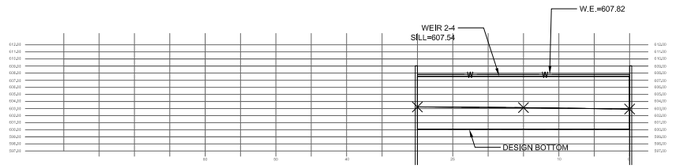

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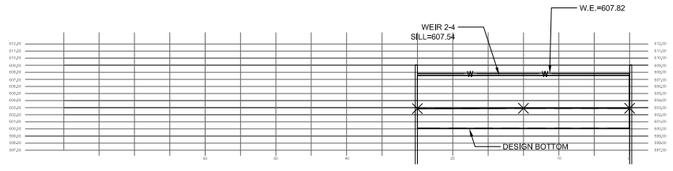
TOTAL AREA = 223,9 SFT

1+16



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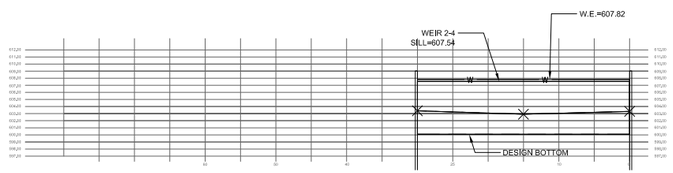
1+45



MATERIAL AREA = 91,8 SFT
MEASURED ADDITIONAL AREA= 132,0 SFT
TOTAL AREA = 223,8 SFT

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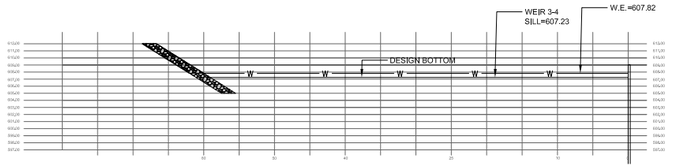
PROJECT NUMBER
60445171

SHEET REFERENCE NUMBER
3

SHEET 03 OF 06

CELL 3

0+10



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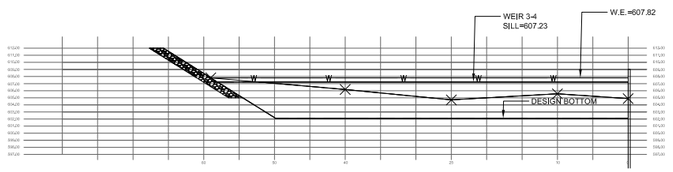

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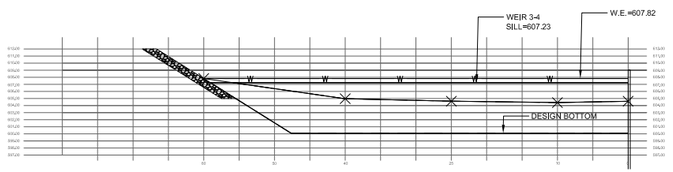
0+55



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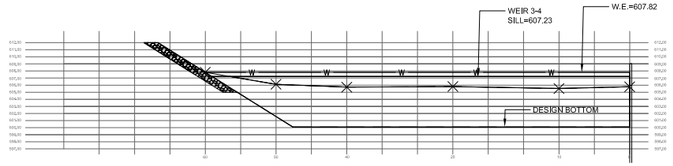
0+81



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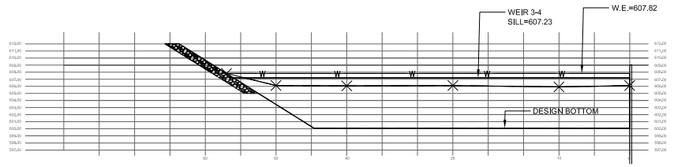
TOTAL AREA = 381.4 SFT

1+10



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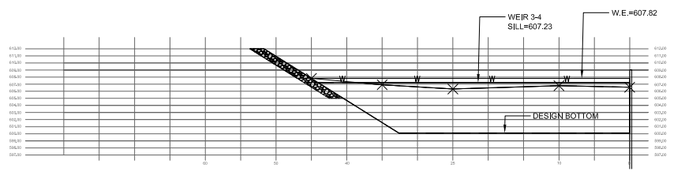
TOTAL AREA = 358.2 SFT

1+39



MATERIAL AREA = 251.8 SFT
MEASURED ADDITIONAL AREA= 22.3 SFT
TOTAL AREA = 274.1 SFT

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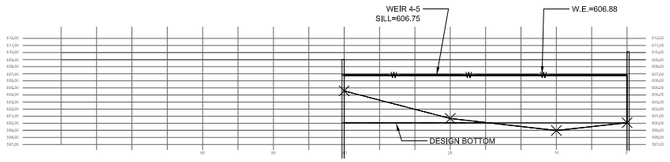
SHEET REFERENCE NUMBER
4

CELL 4

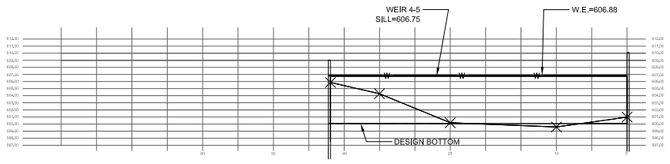
NOTE: CELL 4 BOTTOM HAS BEEN EXCAVATED BELOW 1990 SCA, CINDER POND IMPROVEMENT PROJECT, AT SOME LOCATIONS

0+28



MATERIAL AREA = 39.8 SFT
MEASURED ADDITIONAL AREA= 237.8 SFT
TOTAL AREA = 277.6 SFT

0+64



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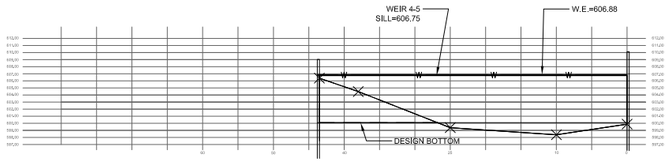
MEASURED ADDITIONAL AREA= 224.5 SFT
TOTAL AREA = 283.7 SFT

0+93



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TOTAL AREA = 318.3 SFT

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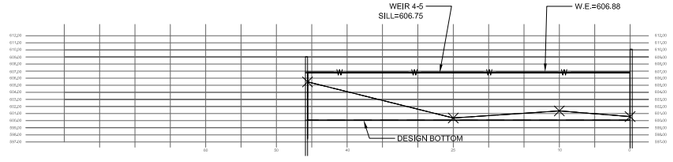

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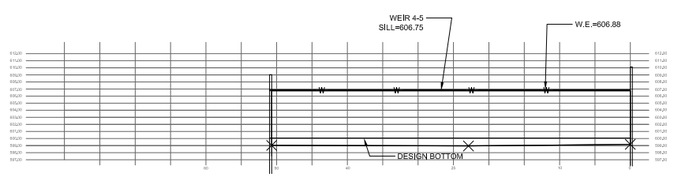
TOTAL AREA = 304.2 SFT

1+69



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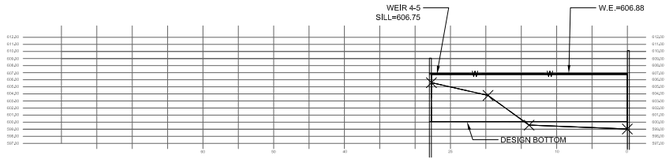
MEASURED ADDITIONAL AREA= 391.7
TOTAL AREA = 391.7 SFT

2+19



MATERIAL AREA = 46.3 SFT
MEASURED ADDITIONAL AREA= 149.5 SFT
TOTAL AREA = 195.8 SFT

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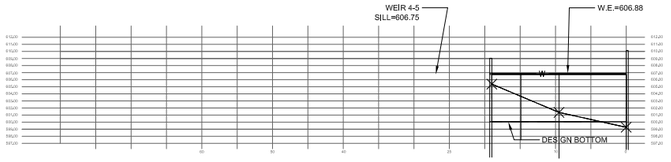
SHEET REFERENCE NUMBER
5

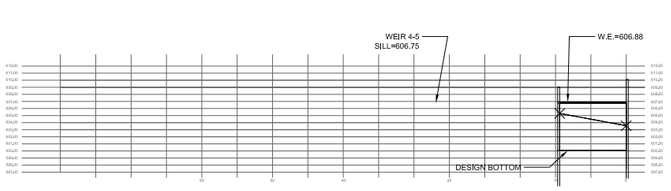
CELL 4 (Cont.)

2+52



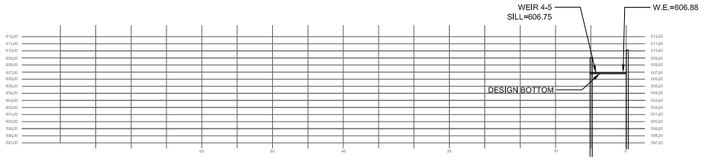
MATERIAL AREA = 35.2 SFT
MEASURED ADDITIONAL AREA= 93.0 SFT
TOTAL AREA = 128.2 SFT

2+83



MATERIAL AREA = 40.9 SFT
MEASURED ADDITIONAL AREA= 21.8 SFT
TOTAL AREA = 62.7 SFT

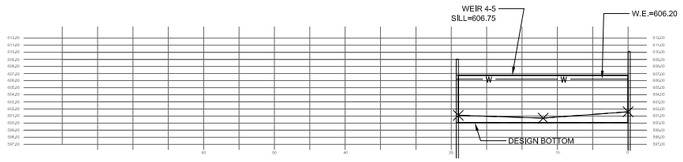
2+98



MATERIAL AREA = 0.0 SFT
MEASURED ADDITIONAL AREA= 0.0 SFT
TOTAL AREA = 0.0 SFT

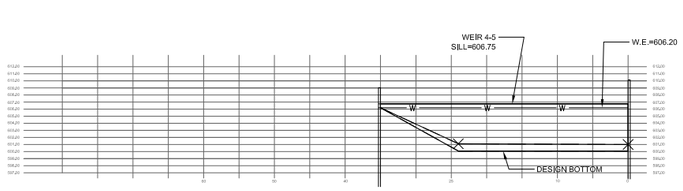
CELL 5

0+00



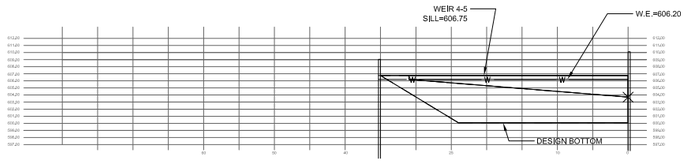
MATERIAL AREA = 23 SFT
MEASURED ADDITIONAL AREA= 137 SFT
TOTAL AREA = 160 SFT

0+20



MATERIAL AREA = 29 SFT
MEASURED ADDITIONAL AREA= 171 SFT
TOTAL AREA = 200 SFT

0+40



MATERIAL AREA = 141
MEASURED ADDITIONAL AREA= 56 SFT
TOTAL AREA = 197 SFT

AECOM

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MARQUETTE BOARD OF LIGHT AND POWER
SHIRAS STEAM PLANT
CCR COMPLIANCE

HOLDING POND CROSS-SECTIONS

Issued

Rev	Date	Description

Designed:	CLC	10/19/2015
Drawn:	CLC	10/19/2015
Checked:	GHI	XX/XX/2008
Approved:	JKL	XX/XX/2008

PROJECT NUMBER
60445171

SHEET REFERENCE NUMBER
6

Appendix B

Volume Calculations

Client: Marquette Board of Light and Power
Project No.: 60445171
Project : CCR Compliance : Ash Cell Volumes

AECOM

Date: 12/7/2015

CELL 1

Station	Length (FT)	Occupied Area (SFT)	Unoccupied Area (SFT)	Total Area (SFT)
0+00	0	0.0	0.0	0.0
0+20	20	72.8	95.9	168.7
0+52	32	60.8	167.9	228.7
0+85	22	68.0	160.7	228.7
1+15	30	69.0	159.6	228.6
1+43	28	176.6	52.0	228.6

	CFT	CYD
Occupied Volume =	9775.8	**362.1**
Unoccupied Volume =	16561.3	**613.4**
Total Cell 1 Volume =	26337.1	**975.4**

CELL 2

Station	Length (FT)	Occupied Area (SFT)	Unoccupied Area (SFT)	Total Area (SFT)
0+08	0	0.0	0.0	0.0
0+40	32	68.3	95.5	163.8
0+63	23	103.2	120.6	223.8
0+87	24	90.5	133.4	223.9
1+16	39	84.8	139.0	223.8
1+45	29	91.8	132.0	223.8

	CFT	CYD
Occupied Volume =	11368.5	**421.1**
Unoccupied Volume =	16302.5	**603.8**
Total Cell 2 Volume =	27671.0	**1024.9**

CELL 3

Station	Length (FT)	Occupied Area (SFT)	Unoccupied Area (SFT)	Total Area (SFT)
0+10	0	0.0	0.0	0.0
0+30	20	192.8	85.0	277.8
0+55	25	259.1	122.2	381.3
0+81	26	303.2	78.2	381.4
1+10	29	298.7	59.5	358.2
1+39	29	251.8	22.3	274.1

	CFT	CYD
Occupied Volume =	31596.5	**1170.2**
Unoccupied Volume =	9228.0	**341.8**
Total Cell 3 Volume =	40824.4	**1512.0**

CELL 4

Station	Length (FT)	Occupied Area (SFT)	Unoccupied Area (SFT)	Total Area (SFT)
0+28	0	39.8	237.8	277.6
0+64	36	59.2	224.5	283.7
0+93	29	54.1	264.2	318.3
1+26	33	79.7	224.4	304.1
1+69	43	0.0	391.7	391.7
2+19	0	46.3	149.5	195.8
2+52	33	35.2	93.0	128.2
2+83	31	40.9	21.8	62.7
2+98	15	0.0	0.0	0.0

	CFT	CYD
Occupied Volume =	10177.2	**376.9**
Unoccupied Volume =	42659.8	**1580.0**
Total Cell 4 Volume =	52836.9	**1956.9**

CELL 5

Station	Length (FT)	Occupied Area (SFT)	Unoccupied Area (SFT)	Total Area (SFT)
0+00	0	23.0	137.0	160.0
0+20	20	29.0	171.0	200.0
0+40	20	141.0	56.0	197.0

	CFT	CYD
Occupied Volume =	2220.0	**82.2**
Unoccupied Volume =	5350.0	**198.1**
Total Cell 5 Volume =	7570.0	**280.4**

Total System

	CFT	CYD
Occupied Volume =	65137.9	**2412.5**
Unoccupied Volume =	90101.5	**3337.1**
Total Volume =	155239.4	**5749.6**

Appendix C

Photo Log

Marquette Board of Light and Power, Shiras Steam Plant, Holding Pond

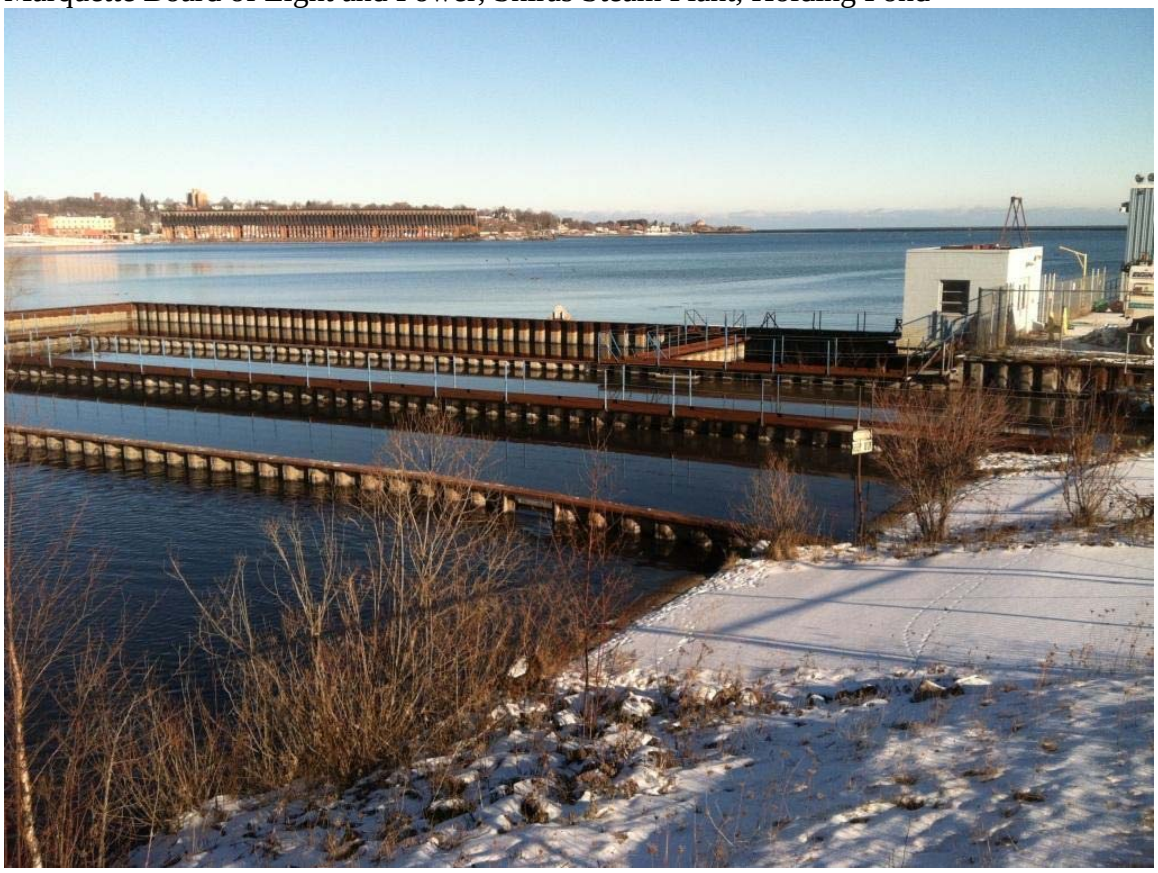

Photo1- Holding Pond

Photo 2 – Overall View of East Wall

Photo 3 – Recently Constructed North Sheet Pile Wall

Photo 4 – Corrosion at Joints

Photo 5 – Spot with Localized Corrosion

Photo 6 – Dewatered Cell 1