

Holding Pond Annual Inspection Report

Marquette Board of Light and Power
Shiras Steam Plant

Project Number: 60445171

January 12, 2017

Prepared for:

Marquette Board of Light and Power
Shiras Steam Plant
Marquette, Michigan

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1. Introduction

The Marquette Board of Light and Power (MBLP) Shiras Steam Plant located in the City of Marquette, Michigan has a holding pond on the north side of the plant property on the shore of Lake Superior. The holding pond (WDS ID# 478988) is classified as a CCR surface water impoundment under the Coal Combustion Residual (CCR) Rule published on April 17, 2015. The rule 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. AECOM previously performed the initial annual inspection of this impoundment under the CCR Rule and provided a report dated January 15, 2016.

2. 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 original north wall, an additional wall was constructed to replace it in 2013. The new wall was placed inside of the original 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 last change to the pond configuration was the addition of the north sheet pile wall in 2013 mentioned above.

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 as well as the report from our initial annual inspection performed in 2015.

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 during our initial annual inspection 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 current coordinates of the targets were checked by an AECOM survey crew on November 22, 2016. No significant lateral movement or settlement of the sheet pile walls was detected. This is a good indication that the sheet pile walls are currently stable.

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 during the 2016 calendar year:

| Cell | Minimum Elevation | Maximum Elevation | Present Elevation |
|------|-------------------|-------------------|-------------------|
| 1 | 604.38 | 607.88 | 607.63 |
| 2 | 604.39 | 607.97 | 607.72 |
| 3 | 606.59 | 607.92 | 607.76 |
| 4 | 606.73 | 607.90 | 606.82 |
| 5 | 606.04 | 607.87 | 606.45 |

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 from a boat on December 2, 2016. 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 5,799 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 2,390 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 3409 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 December 2, 2016 by AECOM employees, Brian Hintsala, P.E. and Bruce Peterson. The water was at normal elevation in all of the cells during the inspection. A boat was used to inspect the north and east walls, which separate the holding pond from Lake Superior.

Based on our field observations, this sheet pile used for this wall 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 east sheet pile was bare and the majority of the wall appeared to be in good condition (Photo 2 in Appendix C). The north wall is newer and in very good condition. 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.

During our initial annual inspection performed in November of 2015, thickness measurements were taken in order to get an overall view of the condition of the wall. 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). 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 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 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. 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 and is in very good condition. 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

MARQUETTE BOARD OF LIGHT AND POWER
CCR COMPLIANCE
SHEET PILE MONITORING
SHIRAS COAL PLANT

DATE OF SURVEY: NOVEMBER 22, 2016
ELEVATION DATUM IS NAVD88 AND ESTABLISHED BY DIFFERENTIAL LEVEL LOOP FROM NGS DISK LSC7863 (RK0415) WHICH HAS A PUBLISHED ELEVATION OF 615.610'.
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 FROM ABOVE.

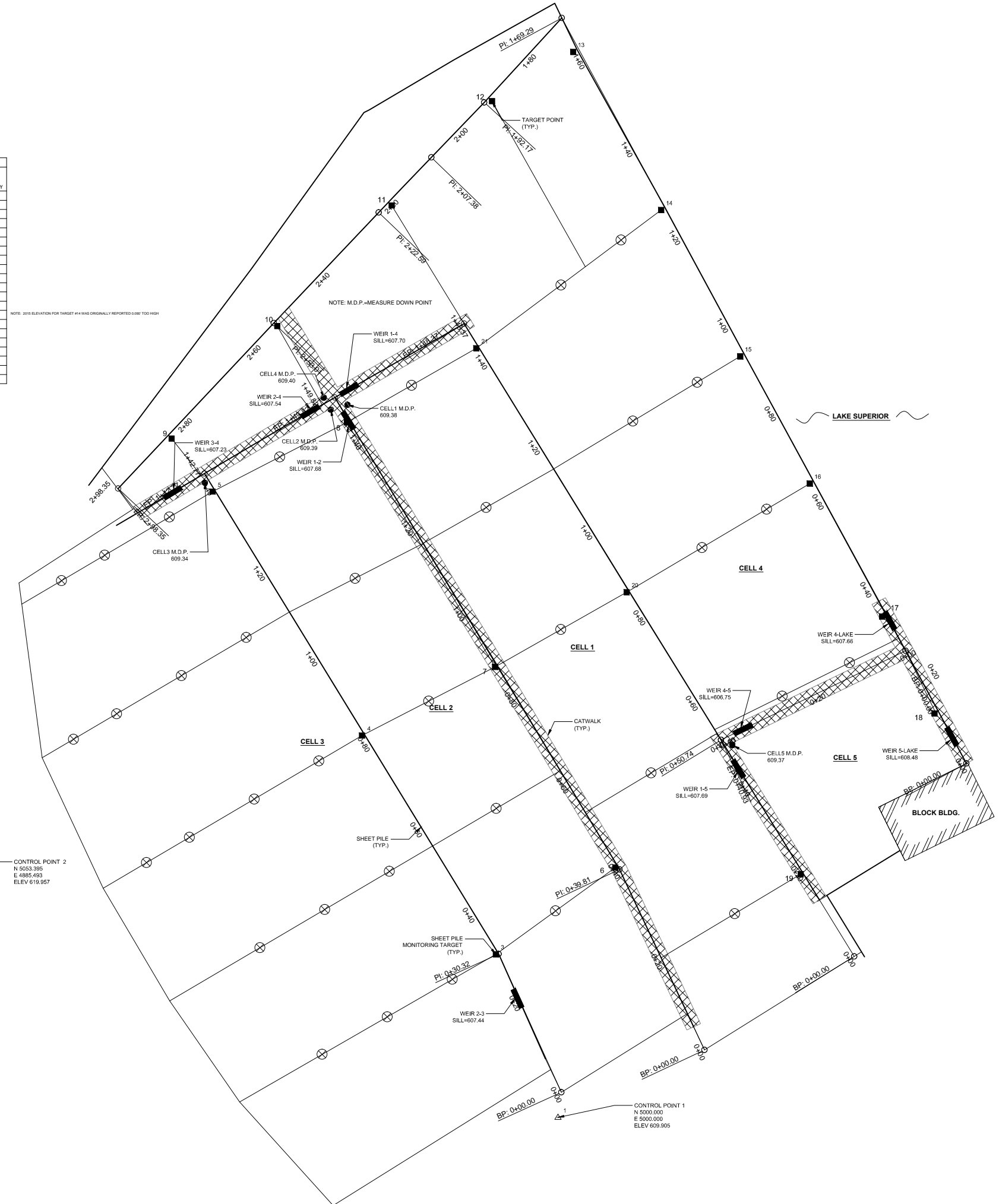
| Ash Pond CCR Compliance Movement Monitoring | | | | | | |
|---|---------------------|--------------------|---------------------|--------------------|-------------------------------------|------------------------------------|
| Point | 10/15/2015 NORTHING | 10/15/2015 EASTING | 11/22/2016 NORTHING | 11/22/2016 EASTING | DELTA NORTHING FROM BASELINE SURVEY | DELTA EASTING FROM BASELINE SURVEY |
| 1 | 5000.000 | 5000.000 | 5000.000 | 5000.000 | 0.000 | 0.000 |
| 2 | 5053.395 | 4885.493 | 5053.395 | 4885.493 | 0.000 | 0.000 |
| 3 | 5032.562 | 4987.579 | 5032.562 | 4987.578 | 0.000 | -0.001 |
| 4 | 5076.237 | 4960.903 | 5076.220 | 4960.876 | -0.017 | -0.027 |
| 5 | 5124.911 | 4931.078 | 5124.911 | 4931.083 | 0.000 | 0.005 |
| 6 | 5049.868 | 5011.443 | 5049.865 | 5011.409 | -0.033 | -0.034 |
| 7 | 5089.939 | 4987.426 | 5089.900 | 4987.363 | -0.039 | -0.063 |
| 8 | 5138.743 | 4957.869 | 5138.738 | 4957.866 | -0.005 | -0.003 |
| 9 | 5135.519 | 4922.879 | 5135.518 | 4922.877 | -0.001 | -0.002 |
| 10 | 5157.940 | 4943.954 | 5157.940 | 4943.955 | 0.000 | 0.001 |
| 11 | 5182.039 | 4966.800 | 5182.039 | 4966.799 | -0.001 | -0.001 |
| 12 | 5202.844 | 4986.818 | 5202.842 | 4986.813 | -0.002 | -0.006 |
| 13 | 5212.675 | 5003.027 | 5212.663 | 5003.041 | -0.012 | 0.014 |
| 14 | 5181.111 | 5020.604 | 5181.105 | 5020.619 | -0.006 | 0.015 |
| 15 | 5151.909 | 5036.356 | 5151.908 | 5036.367 | -0.001 | 0.011 |
| 16 | 5126.503 | 5050.227 | 5126.501 | 5050.237 | -0.002 | 0.010 |
| 17 | 5099.988 | 5064.660 | 5099.985 | 5064.666 | -0.003 | 0.006 |
| 18 | 5080.634 | 5075.118 | 5080.635 | 5075.124 | 0.001 | 0.006 |
| 19 | 5048.539 | 5048.415 | 5048.536 | 5048.413 | -0.003 | -0.002 |
| 20 | 5104.828 | 5013.673 | 5104.835 | 5013.695 | 0.007 | 0.022 |
| 21 | 5153.524 | 4983.690 | 5153.518 | 4983.701 | -0.007 | 0.011 |

| CCR Compliance Ash Pond Monitoring | | | |
|------------------------------------|----------------------|----------------------|----------------------------|
| POINT | 10/15/2015 ELEVATION | 11/22/2016 ELEVATION | DELTA FROM BASELINE SURVEY |
| 1 | 609.905 | 609.905 | N/A |
| 2 | 616.957 | 616.957 | N/A |
| 3 | 608.825 | 608.820 | -0.005 |
| 4 | 608.815 | 608.840 | 0.025 |
| 5 | 608.865 | 608.865 | 0.000 |
| 6 | 608.843 | 608.850 | 0.007 |
| 7 | 608.970 | 608.862 | -0.108 |
| 8 | 608.908 | 608.913 | 0.005 |
| 9 | 609.835 | 609.830 | -0.005 |
| 10 | 609.857 | 609.855 | -0.002 |
| 11 | 609.730 | 609.727 | -0.003 |
| 12 | 609.752 | 609.750 | -0.002 |
| 13 | 609.695 | 609.692 | -0.003 |
| 14 | 609.720 | 609.630 | -0.090 |
| 15 | 609.670 | 609.655 | -0.015 |
| 16 | 609.730 | 609.727 | -0.003 |
| 17 | 609.735 | 609.735 | 0.000 |
| 18 | 609.702 | 609.700 | -0.002 |
| 19 | 608.830 | 608.850 | 0.020 |
| 20 | 608.960 | 608.957 | -0.003 |
| 21 | 608.950 | 608.947 | -0.003 |

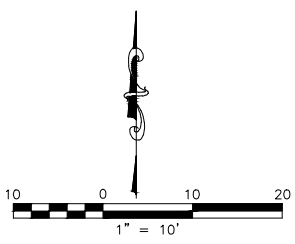
TYPICAL TARGET INSTALLATION



TARGET COORDINATE AND ELEVATION
BENCHMARK ELEVATION



NOTE: 2015 ELEVATION FOR TARGET #14 WAS ORIGINALLY REPORTED 0.002' TOO HIGH



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Rev Date Description

R-1 BDP 12/15/2016
2016 ANNUAL INSPECTION

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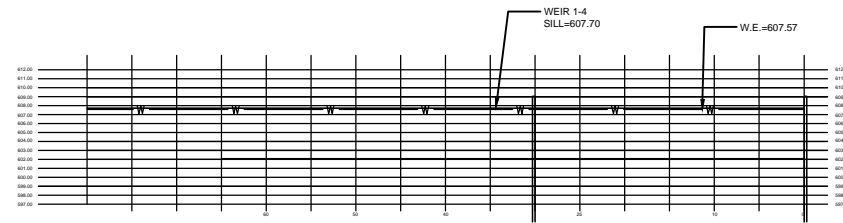
PROJECT NUMBER
60445171

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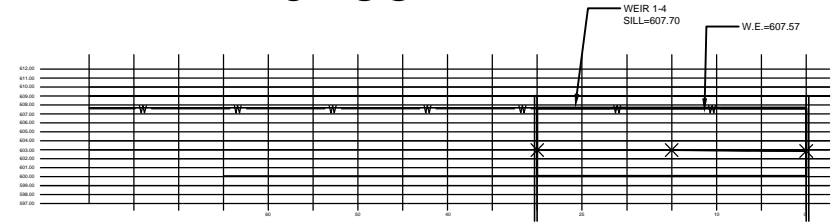
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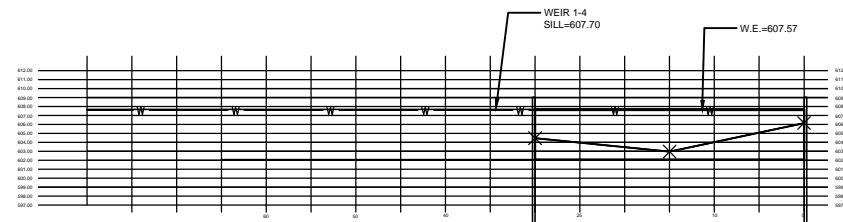
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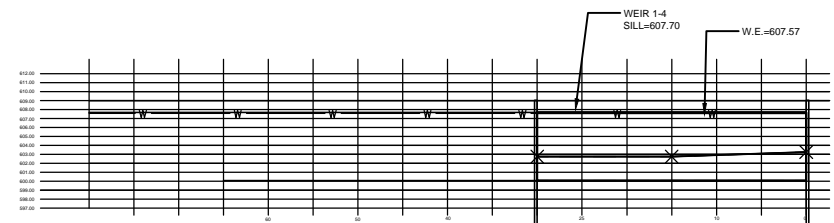
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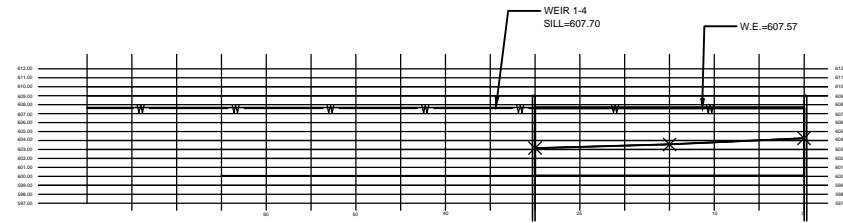
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1+15



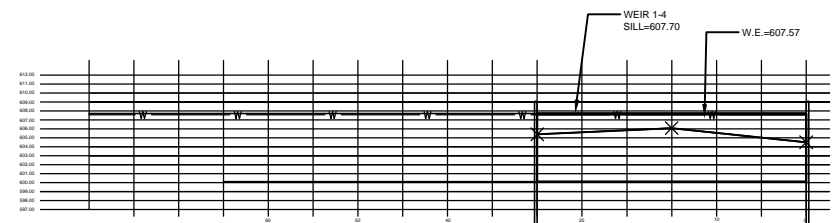
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0+52



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 TOTAL AREA = 228.6 SFT

1+43



MATERIAL AREA = 176.6 SFT
 MEASURED ADDITIONAL AREA= 52.0 SFT
 TOTAL AREA = 228.6 SFT

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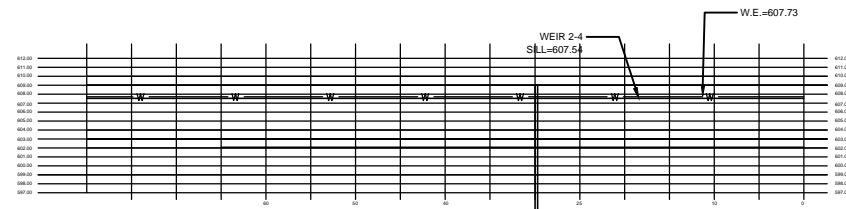
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 Checked: GHI XX/XX/2008
 Approved: JKL XX/XX/2008

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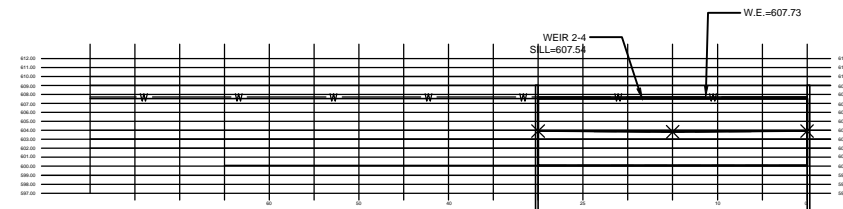
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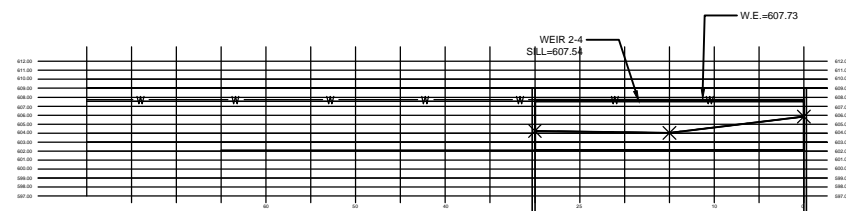
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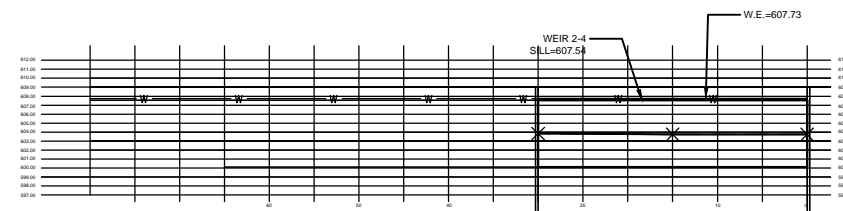
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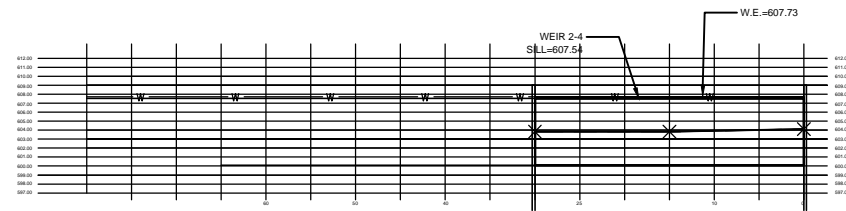
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1+16



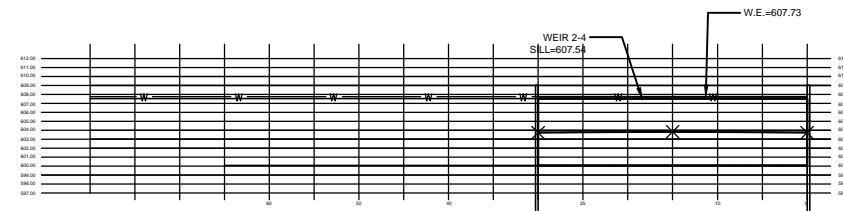
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0+63



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TOTAL AREA = 235.4 SFT

1+45



MATERIAL AREA = 111.0 SFT
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TOTAL AREA = 223.8 SFT

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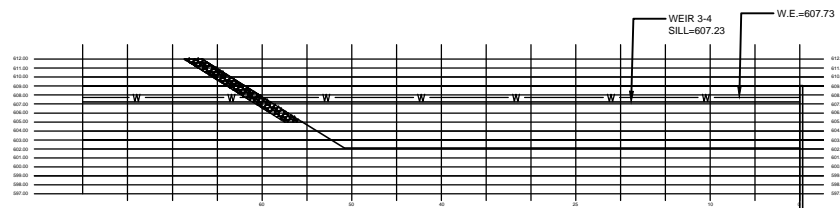
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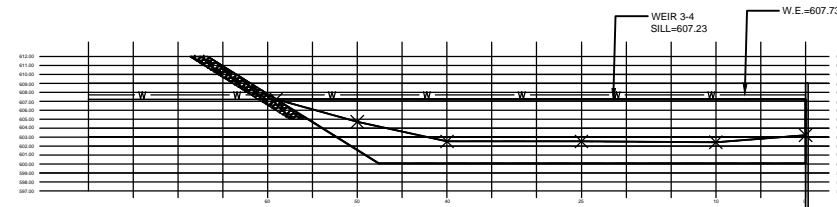
MARQUETTE BOARD OF LIGHT AND POWER
CCR COMPLIANCE
SHEET PILE MONITORING
SHIRAS COAL PLANT

0+10



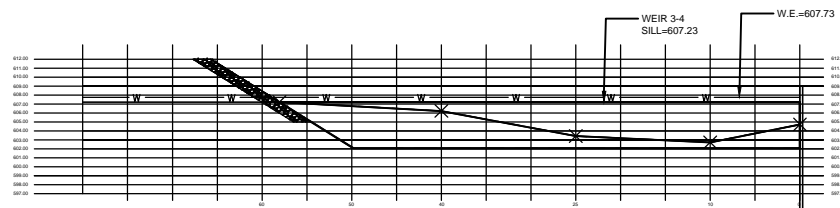
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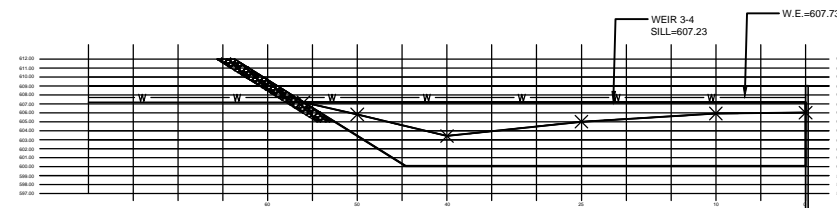
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0+30



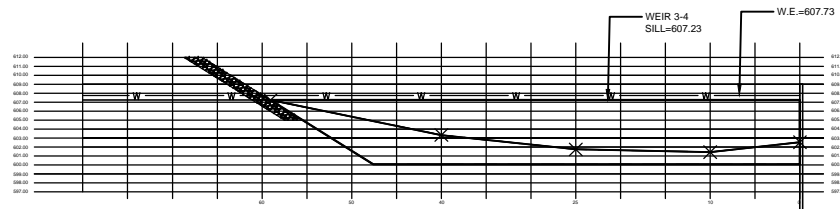
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1+10



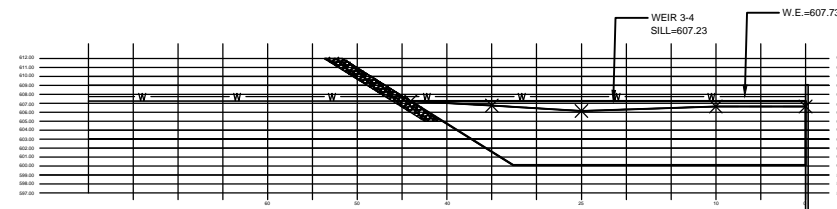
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0+55



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MEASURED ADDITIONAL AREA= 245.0 SFT
TOTAL AREA = 381.4 SFT

1+39



MATERIAL AREA = 245.1 SFT
MEASURED ADDITIONAL AREA= 29.0 SFT
TOTAL AREA = 274.1 SFT

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| Rev | Date | Description |
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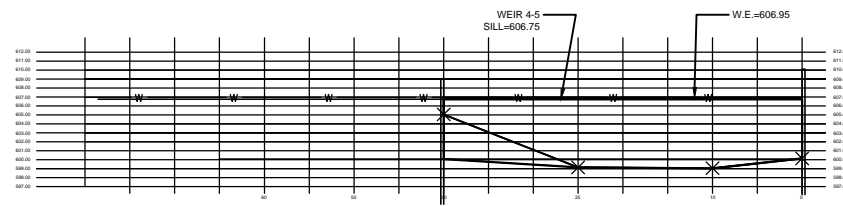
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CELL 4

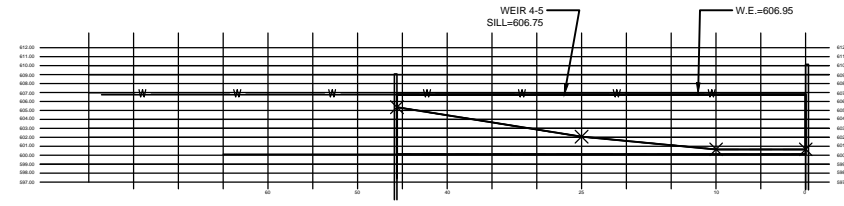
NOTE: CELL 4 BOTTOM HAS BEEN EXCAVATED BELOW 1990 SCA, CINDER POND IMPROVEMENT PROJECT, AT SOME LOCATIONS

0+28



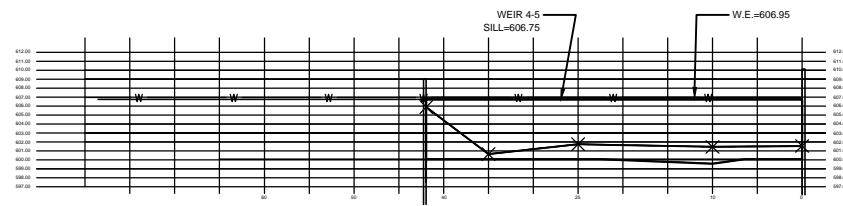
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1+26



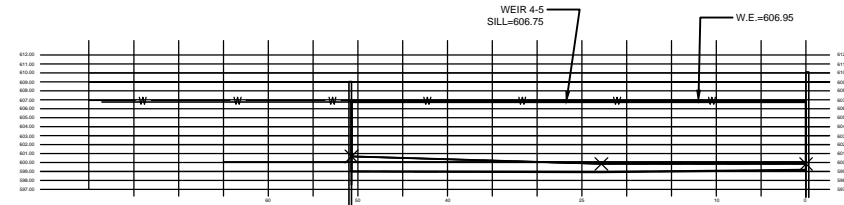
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0+64



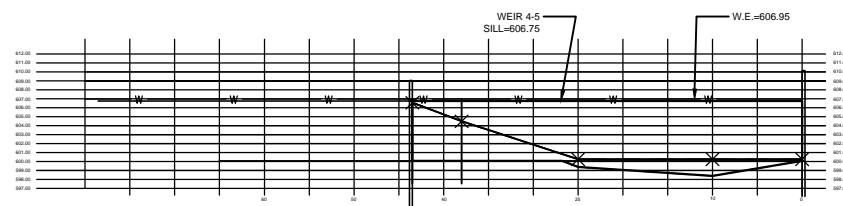
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1+69



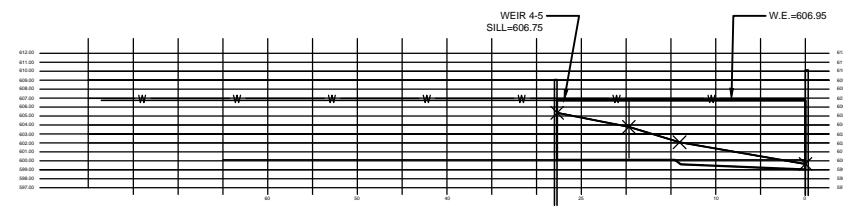
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TOTAL AREA = 392.1 SFT

0+93



MATERIAL AREA = 91.0 SFT
MEASURED ADDITIONAL AREA= 226.3 SFT
TOTAL AREA = 317.3 SFT

2+19



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

MARQUETTE BOARD OF LIGHT AND POWER
CCR COMPLIANCE
SHEET PILE MONITORING
SHIRAS COAL PLANT

| Rev | Date | Description |
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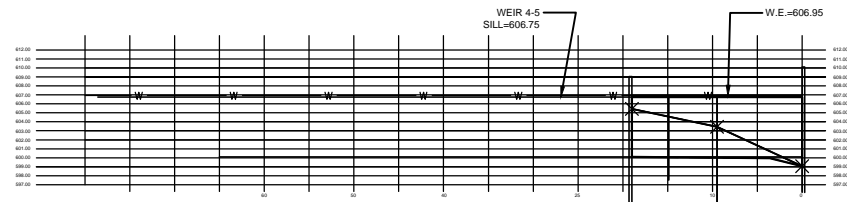
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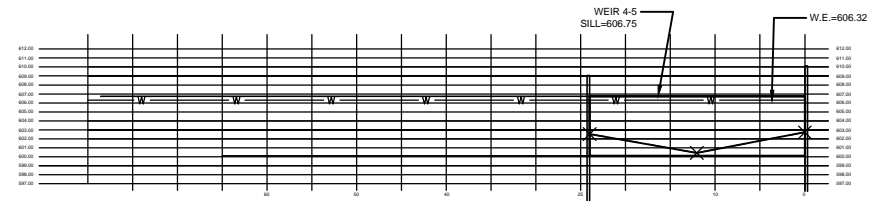
CELL 5

2+52



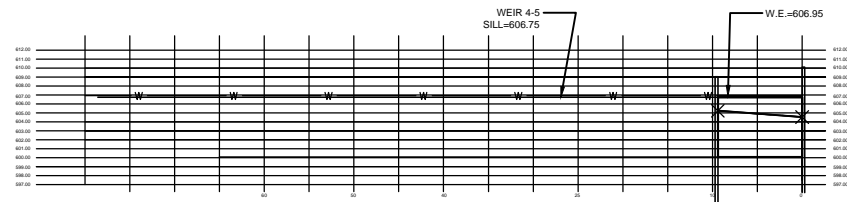
MATERIAL AREA = 55.8 SFT
MEASURED ADDITIONAL AREA= 74.1 SFT
TOTAL AREA = 129.9 SFT

0+00



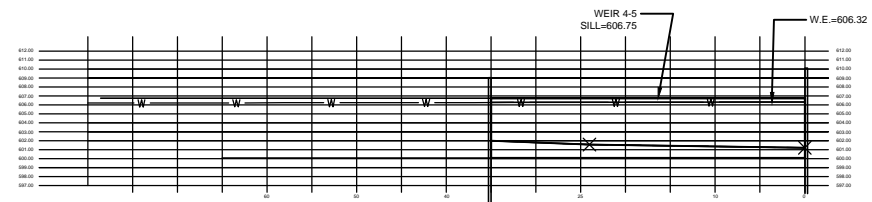
MATERIAL AREA = 34.6 SFT
MEASURED ADDITIONAL AREA= 125.5 SFT
TOTAL AREA = 160.1 SFT

2+83



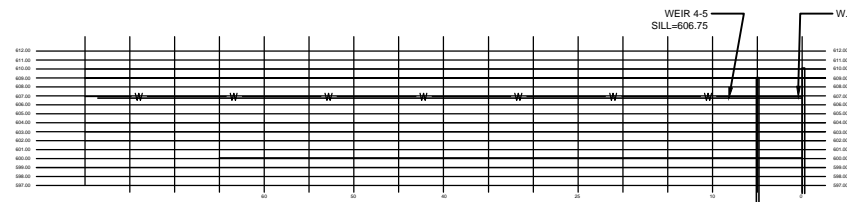
MATERIAL AREA = 40.9 SFT
MEASURED ADDITIONAL AREA= 21.8 SFT
TOTAL AREA = 62.7 SFT

0+20



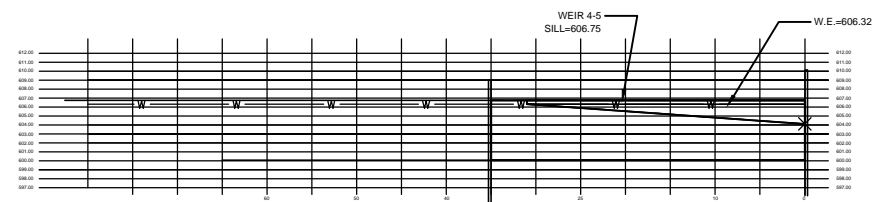
MATERIAL AREA = 50.6 SFT
MEASURED ADDITIONAL AREA= 182.9 SFT
TOTAL AREA = 233.5 SFT

2+98



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

0+40



MATERIAL AREA = 186.0 SFT
MEASURED ADDITIONAL AREA= 47.5 SFT
TOTAL AREA = 233.5 SFT

MARQUETTE BOARD OF LIGHT AND POWER
CCR COMPLIANCE
SHEET PILE MONITORING
SHIRAS COAL PLANT

| Rev | Date | Description |
|-----|------|-------------|
| | | |
| | | |
| | | |
| | | |

R-1 BDP 12/15/16
2016 ANNUAL INSPECTION

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



Date: 12/15/2016

| CELL 1 | | | | |
|----------------|--------------------|----------------------|-------------------|-------------------------|
| Station | Length (FT) | Occupied Area | | Unoccupied |
| | | (SFT) | Area (SFT) | Total Area (SFT) |
| 0+00 | 0 | 0.0 | 0.0 | 0.0 |
| 0+20 | 20 | 62.0 | 106.6 | 168.6 |
| 0+52 | 32 | 107.0 | 121.6 | 228.6 |
| 0+85 | 22 | 86.0 | 142.6 | 228.6 |
| 1+15 | 30 | 84.5 | 144.1 | 228.6 |
| 1+43 | 28 | 162.5 | 66.1 | 228.6 |

| | CFT | CYD |
|-----------------------|------------|--------------|
| Occupied Volume = | 11462.5 | 424.5 |
| Unoccupied Volume = | 14866.7 | 550.6 |
| Total Cell 1 Volume = | 26329.2 | 975.2 |

| CELL 2 | | | | |
|----------------|--------------------|----------------------|-------------------|-------------------------|
| Station | Length (FT) | Occupied Area | | Unoccupied |
| | | (SFT) | Area (SFT) | Total Area (SFT) |
| 0+08 | 0 | 0.0 | 0.0 | 0.0 |
| 0+40 | 32 | 73.5 | 90.3 | 163.8 |
| 0+63 | 23 | 114.8 | 109.0 | 223.8 |
| 0+87 | 24 | 114.0 | 109.8 | 223.8 |
| 1+16 | 39 | 110.3 | 113.5 | 223.8 |
| 1+45 | 29 | 111.0 | 112.8 | 223.8 |

| | CFT | CYD |
|-----------------------|------------|---------------|
| Occupied Volume = | 13669.8 | 506.3 |
| Unoccupied Volume = | 13998.1 | 518.4 |
| Total Cell 2 Volume = | 27667.8 | 1024.7 |

CELL 3

| Station | Length (FT) | Occupied Area | | Total Area (SFT) |
|---------|-------------|---------------|-----------------------|------------------|
| | | (SFT) | Unoccupied Area (SFT) | |
| 0+10 | 0 | 0.0 | 0.0 | 0.0 |
| 0+30 | 20 | 135.5 | 142.0 | 277.5 |
| 0+55 | 25 | 136.4 | 245.0 | 381.4 |
| 0+81 | 26 | 148.3 | 233.1 | 381.4 |
| 1+10 | 29 | 245.9 | 112.3 | 358.2 |
| 1+39 | 29 | 245.1 | 29.0 | 274.1 |

| | | |
|-----------------------|------------|---------------|
| | CFT | CYD |
| Occupied Volume = | 21290.3 | 788.5 |
| Unoccupied Volume = | 19530.0 | 723.3 |
| Total Cell 3 Volume = | 40820.2 | 1511.9 |

CELL 4

| Station | Length (FT) | Occupied Area | | Total Area (SFT) |
|---------|-------------|---------------|-----------------------|------------------|
| | | (SFT) | Unoccupied Area (SFT) | |
| 0+28 | 0 | 37.3 | 256.0 | 293.3 |
| 0+64 | 36 | 74.4 | 209.4 | 283.8 |
| 0+93 | 29 | 91.0 | 226.3 | 317.3 |
| 1+26 | 33 | 99.3 | 204.9 | 304.2 |
| 1+69 | 43 | 53.9 | 338.2 | 392.1 |
| 2+19 | 0 | 73.7 | 122.0 | 195.7 |
| 2+52 | 33 | 55.8 | 74.1 | 129.9 |
| 2+83 | 31 | 45.3 | 17.4 | 62.7 |
| 2+98 | 15 | 0.0 | 0.0 | 0.0 |

| | | |
|-----------------------|------------|---------------|
| | CFT | CYD |
| Occupied Volume = | 14886.2 | 551.3 |
| Unoccupied Volume = | 38270.7 | 1417.4 |
| Total Cell 4 Volume = | 53156.9 | 1968.8 |

CELL 5

| Station | Length (FT) | Occupied Area (SFT) | Unoccupied Area (SFT) | Total Area (SFT) |
|---------|-------------|---------------------|-----------------------|------------------|
| 0+00 | 0 | 34.6 | 125.5 | 160.1 |
| 0+20 | 20 | 50.6 | 182.9 | 233.5 |
| 0+40 | 20 | 186.0 | 47.5 | 233.5 |

| | CFT | CYD |
|-----------------------|--------|--------------|
| Occupied Volume = | 3218.0 | 119.2 |
| Unoccupied Volume = | 5388.0 | 199.6 |
| Total Cell 5 Volume = | 8606.0 | 318.7 |

Total System

| | CFT | CYD |
|---------------------|----------|---------------|
| Occupied Volume = | 64526.7 | 2389.9 |
| Unoccupied Volume = | 92053.4 | 3409.4 |
| Total Volume = | 156580.1 | 5799.3 |

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

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



Photo 3 – Recently Constructed North Sheet Pile Wall

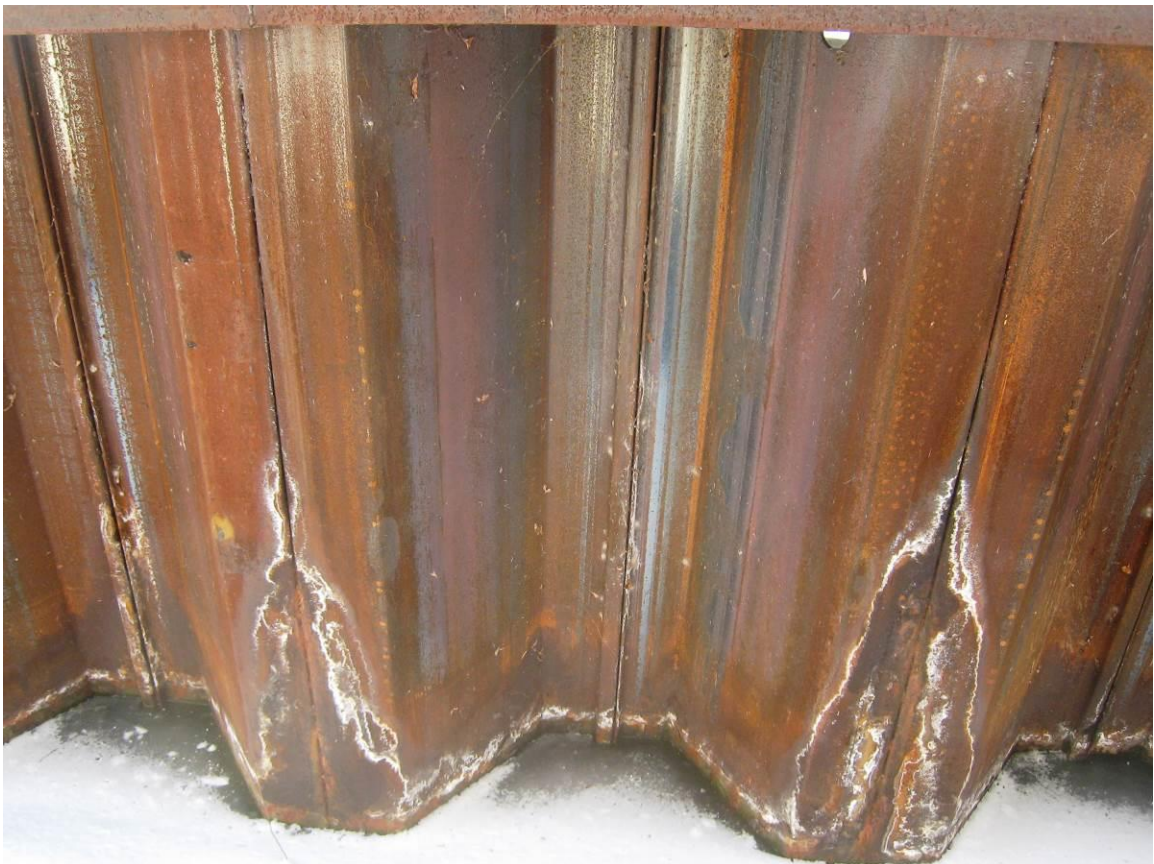


Photo 4 – Corrosion at Joints

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



Photo 5 – Spot with Localized Corrosion

