

Holding Pond Annual Inspection Report

Marquette Board of Light and Power
Shiras Steam Plant

Project Number: 60445171

January 9, 2019

Prepared for:

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

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1. Introduction

Coal Combustion Residual (CCR) surface water impoundments are required to have annual inspections by the 40 CFR 257.83 Rule published on April 17, 2015. The Marquette Board of Light and Power (MBLP) Shiras Steam Plant has a holding pond which is classified as a CCR surface water impoundment. The holding pond (WDS ID# 478988) is located on the north side of the plant property in the City of Marquette, Michigan. AECOM has been performing annual inspections of the holding pond since 2015.

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 reports from the annual inspections we have performed since 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 16, 2018. The majority of the sheet pile walls showed no significant lateral movement or settlement. This is a good indication that the sheet pile walls are generally stable.

Targets 6 and 7 showed a small but detectable amount of lateral movement. These targets are located on the interior sheet pile wall between cells 1 and 2. The total lateral movement from the 2015 baseline survey is relatively small with a maximum value of 1.5 inches. In addition, the rate of change in the movement decreased from 0.47 inches/year in 2017 to 0.17 inches/year in 2018. This indicates the lateral shifting of the wall may be starting to stabilize.

This wall movement is viewed as a minor finding since the movement is small and the interior walls are not critical for containment of the CCR residuals. Although the sheetpile wall is in poor condition, the lateral movement is not visually apparent and there does not appear to be any distress to the walkway mounted on top of the wall. We suggest continued monitoring of the points during subsequent annual inspections. Note that the perimeter sheet pile walls which provide containment do not show any signs of significant movement.

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 2018 calendar year:

Cell	Minimum Elevation	Maximum Elevation	Present Elevation
1	605.82	607.09	607.05
2	605.56	607.97	607.47
3	606.51	607.92	607.26
4	606.15	607.40	606.82
5	605.62	606.95	606.79

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 November 8, 2018. 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 5,808 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 2,202 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 3,406 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 by AECOM on November 8, 2018. 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, the 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 (Photo 4 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. 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 (Photo 5 in Appendix C). These internal walls, however, do not affect 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. Some minor lateral movement was detected to the interior wall between cells 1 and 2. This is viewed as non-critical for the reasons discussed above in section 2.2.

3. Conclusion

The sheet pile walls which form the north and east boundaries of the holding pond both appear to be stable and have ample structural capacity to contain the impounded water. The south and west boundaries of the holding pond are incised into the ground and pose no threat of failure which would result in a release of CCR materials. 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 to function in this condition as separators between the cells to improve the settlement of solids out of the process water.

Appendix A Report Drawings

DATE OF SURVEY: NOVEMBER 16, 2018
 ELEVATION DATUM IS NAVD88 AND ESTABLISHED BY DIFFERENTIAL LEVEL LOOP FROM NGS DISK LSC7B63 (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 TO FROM ABOVE.

Ash Pond CCR Compliance Movement Monitoring														
Point	10/15/2015		11/22/2016		12/15/2017		11/16/2018		10/15/2015		11/22/2016		12/15/2017	
	NORTHING	EASTING	NORTHING	EASTING	NORTHING	EASTING	NORTHING	EASTING	NORTHING	EASTING	NORTHING	EASTING	NORTHING	EASTING
1	5000.000	5000.000	5000.000	5000.000	0.000	0.000	5000.000	5000.000	0.000	0.000	5000.000	5000.000	0.000	0.000
2	5053.395	4885.493	5053.395	4885.493	0.000	0.000	5053.395	4885.493	0.000	0.000	5053.395	4885.493	0.000	0.000
3	5032.562	4987.579	5032.562	4987.578	0.000	-0.001	5032.571	4987.574	0.009	-0.005	5032.568	4987.579	0.006	0.000
4	5076.237	4960.903	5076.230	4960.876	0.007	-0.027	5076.239	4960.892	0.002	-0.011	5076.233	4960.880	-0.004	-0.023
5	5124.911	4931.078	5124.911	4931.083	0.000	0.005	5124.909	4931.078	-0.002	0.000	5124.911	4931.071	0.000	-0.007
6	5049.888	5011.443	5049.865	5011.409	-0.023	-0.034	5049.867	5011.385	-0.021	-0.058	5049.861	5011.381	-0.027	-0.062
7	5089.939	4987.426	5089.900	4987.363	-0.039	-0.063	5089.887	4987.325	-0.052	-0.101	5089.883	4987.311	-0.056	-0.115
8	5138.743	4957.869	5138.738	4957.866	-0.005	-0.003	5138.736	4957.858	-0.007	-0.011	5138.740	4957.848	-0.003	-0.021
9	5135.519	4922.879	5135.518	4922.877	-0.001	-0.002	5135.526	4922.881	0.007	0.002	5135.513	4922.873	-0.006	-0.006
10	5157.940	4943.954	5157.940	4943.955	0.000	0.001	5157.948	4943.955	0.008	0.001	5157.935	4943.949	-0.005	-0.005
11	5152.039	4966.800	5152.039	4966.799	0.000	-0.001	5152.044	4966.800	0.005	0.000	5152.034	4966.793	-0.005	-0.007
12	5202.844	4986.818	5202.842	4986.813	-0.002	-0.005	5202.848	4986.811	0.004	-0.007	5202.837	4986.805	-0.007	-0.013
13	5212.675	5003.027	5212.663	5003.041	-0.012	0.014	5212.673	5003.019	-0.002	-0.008	5212.672	5003.017	-0.003	-0.010
14	5181.111	5020.604	5181.105	5020.619	-0.006	0.015	5181.117	5020.600	0.006	-0.005	5181.115	5020.592	0.004	-0.012
15	5151.909	5036.356	5151.908	5036.367	-0.001	0.011	5151.917	5036.354	0.008	-0.002	5151.914	5036.349	0.005	-0.007
16	5126.503	5050.227	5126.501	5050.237	-0.002	0.010	5126.505	5050.226	0.002	-0.001	5126.506	5050.221	0.003	-0.006
17	5099.988	5064.660	5099.985	5064.666	-0.003	0.006	5099.995	5064.659	0.007	-0.001	5099.992	5064.656	0.004	-0.004
18	5080.634	5075.118	5080.635	5075.124	0.001	0.006	5080.632	5075.125	-0.002	0.007	5080.623	5075.116	-0.011	-0.002
19	5048.539	5048.415	5048.536	5048.413	-0.003	-0.002	5048.538	5048.412	-0.001	-0.003	5048.532	5048.413	-0.007	-0.002
20	5104.828	5013.673	5104.835	5013.695	0.007	0.022	5104.844	5013.690	0.016	0.017	5104.841	5013.683	0.013	0.010
21	5153.524	4983.690	5153.518	4983.701	-0.007	0.011	5153.519	4983.689	-0.005	0.001	5153.520	4983.682	-0.004	-0.008

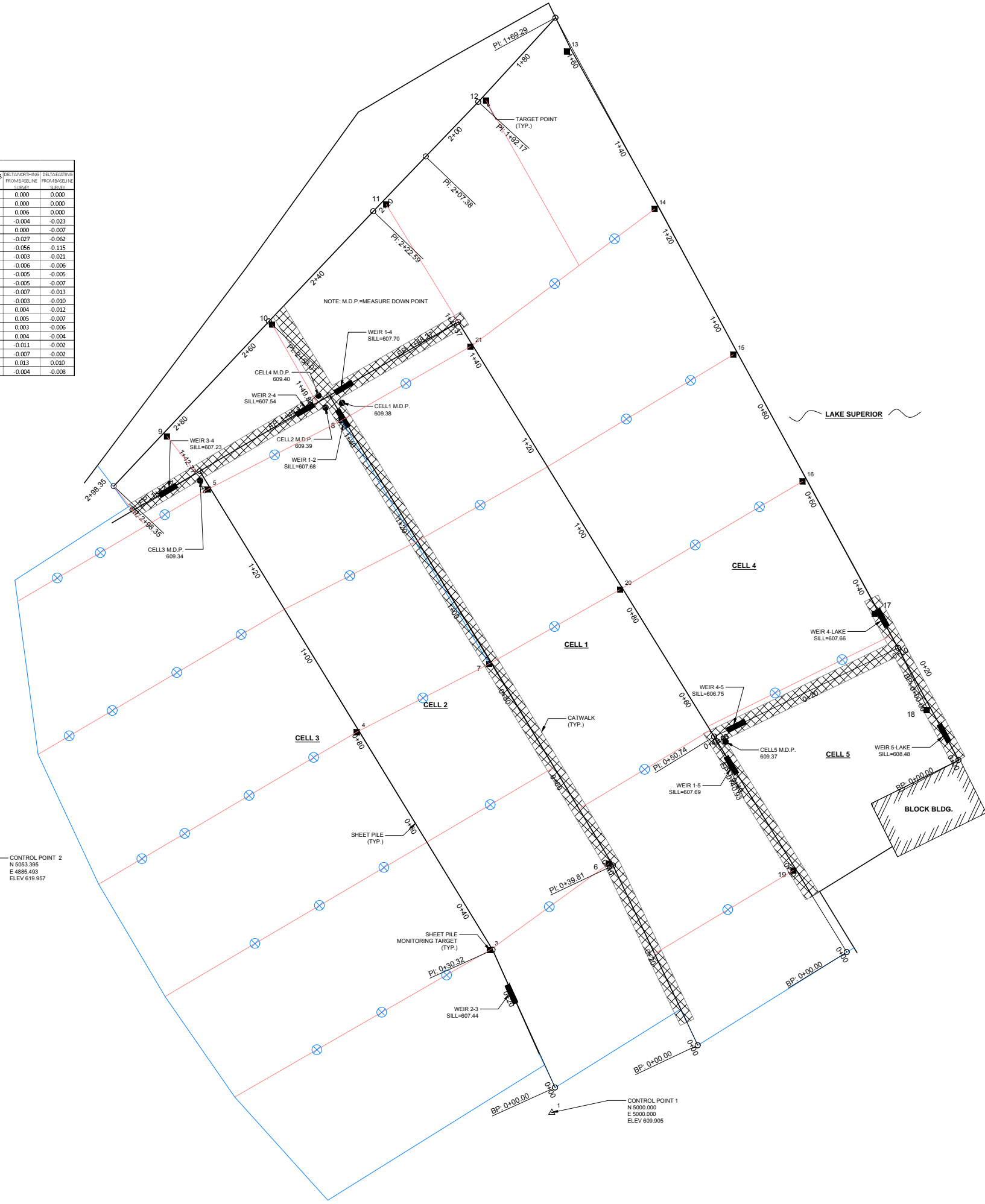
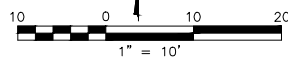
CCR Compliance Ash Pond Monitoring														
Point	10/15/2015		11/22/2016		12/15/2017		11/16/2018		10/15/2015		11/22/2016		12/15/2017	
	NORTHING	EASTING	NORTHING	EASTING	NORTHING	EASTING	NORTHING	EASTING	NORTHING	EASTING	NORTHING	EASTING	NORTHING	EASTING
1	5000.000	5000.000	5000.000	5000.000	0.000	0.000	5000.000	5000.000	0.000	0.000	5000.000	5000.000	0.000	0.000
2	5053.395	4885.493	5053.395	4885.493	0.000	0.000	5053.395	4885.493	0.000	0.000	5053.395	4885.493	0.000	0.000
3	5032.562	4987.579	5032.562	4987.578	0.000	-0.001	5032.571	4987.574	0.009	-0.005	5032.568	4987.579	0.006	0.000
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6	5049.888	5011.443	5049.865	5011.409	-0.023	-0.034	5049.867	5011.385	-0.021	-0.058	5049.861	5011.381	-0.027	-0.062
7	5089.939	4987.426	5089.900	4987.363	-0.039	-0.063	5089.887	4987.325	-0.052	-0.101	5089.883	4987.311	-0.056	-0.115
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10	5157.940	4943.954	5157.940	4943.955	0.000	0.001	5157.948	4943.955	0.008	0.001	5157.935	4943.949	-0.005	-0.005
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15	5151.909	5036.356	5151.908	5036.367	-0.001	0.011	5151.917	5036.354	0.008	-0.002	5151.914	5036.349	0.005	-0.007
16	5126.503	5050.227	5126.501	5050.237	-0.002	0.010	5126.505	5050.226	0.002	-0.001	5126.506	5050.221	0.003	-0.006
17	5099.988	5064.660	5099.985	5064.666	-0.003	0.006	5099.995	5064.659	0.007	-0.001	5099.992	5064.656	0.004	-0.004
18	5080.634	5075.118	5080.635	5075.124	0.001	0.006	5080.632	5075.125	-0.002	0.007	5080.623	5075.116	-0.011	-0.002
19	5048.539	5048.415	5048.536	5048.413	-0.003	-0.002	5048.538	5048.412	-0.001	-0.003	5048.532	5048.413	-0.007	-0.002
20	5104.828	5013.673	5104.835	5013.695	0.007	0.022	5104.844	5013.690	0.016	0.017	5104.841	5013.683	0.013	0.010
21	5153.524	4983.690	5153.518	4983.701	-0.007	0.011	5153.519	4983.689	-0.005	0.001	5153.520	4983.682	-0.004	-0.008

NOTE: 2015 ELEVATION FOR TARGET #14 WAS ORIGINALLY REPORTED AS BSM TOO HIGH

TYPICAL TARGET INSTALLATION



TARGET COORDINATE AND ELEVATION
 BENCHMARK ELEVATION



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

Issued
 Rev. Date Description

R-2 BDP 12/24/2018
 2018 ANNUAL INSPECTION
 R-2 BDP 12/1/2017
 2017 ANNUAL INSPECTION
 R-1 BDP 12/15/2016
 2016 ANNUAL INSPECTION

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

PROJECT NUMBER
 60445171

SHEET REFERENCE NUMBER

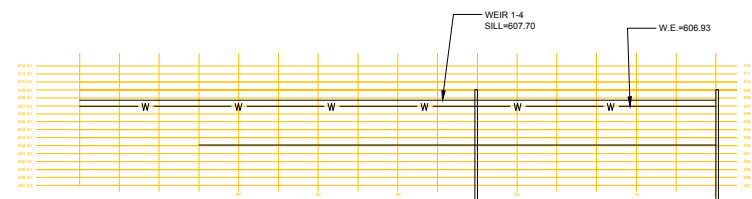
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SHEET 01 OF 06

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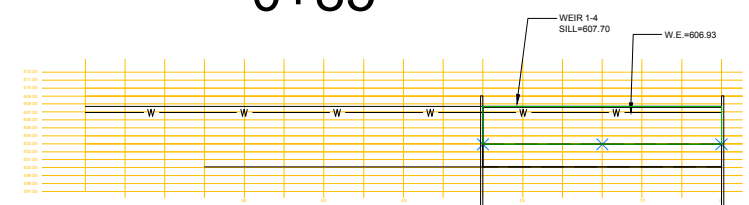
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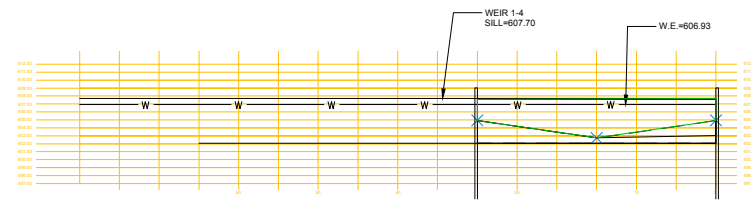
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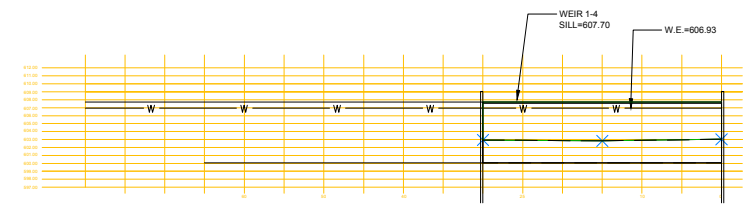
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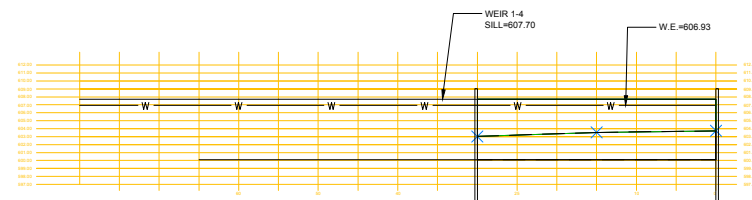
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TOTAL AREA = 168.6 SFT

1+15



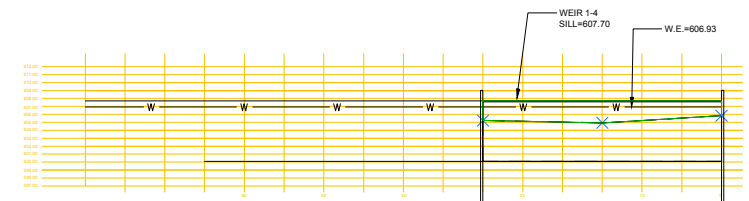
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MEASURED ADDITIONAL AREA= 143.8 SFT
TOTAL AREA = 228.6 SFT

0+52



MATERIAL AREA = 101.3 SFT
MEASURED ADDITIONAL AREA= 127.3 SFT
TOTAL AREA = 228.6 SFT

1+43



MATERIAL AREA = 154.5 SFT
MEASURED ADDITIONAL AREA= 74.1 SFT
TOTAL AREA = 228.6 SFT

Issued

Rev. Date
Description

- R-3 BDP 12/24/2018 2018 ANNUAL INSPECTION
- R-2 BDP 12/1/2017 2017 ANNUAL INSPECTION
- 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

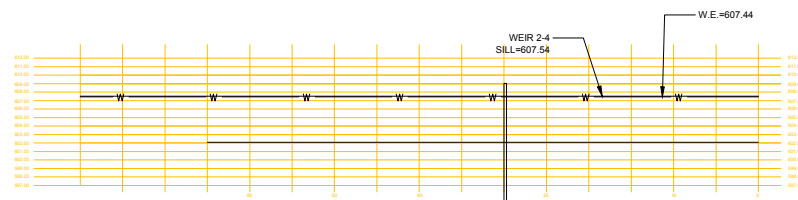
PROJECT NUMBER
60445171

SHEET REFERENCE NUMBER

G-02

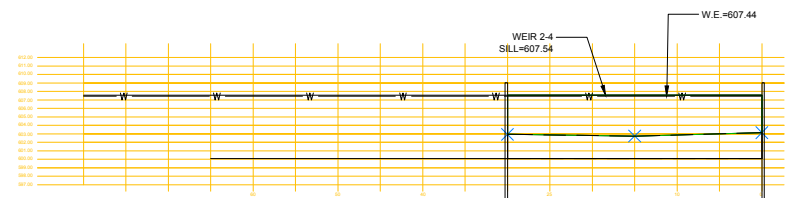
CELL 2

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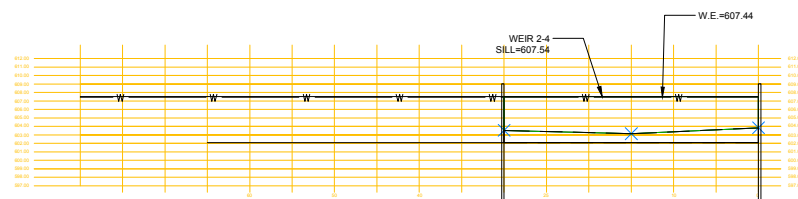
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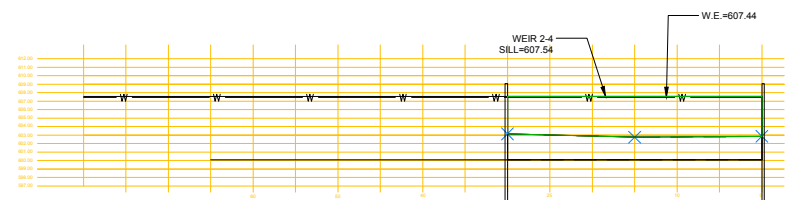
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 TOTAL AREA = 223.8 SFT

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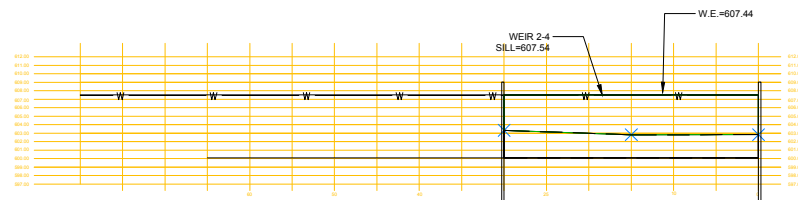
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1+16



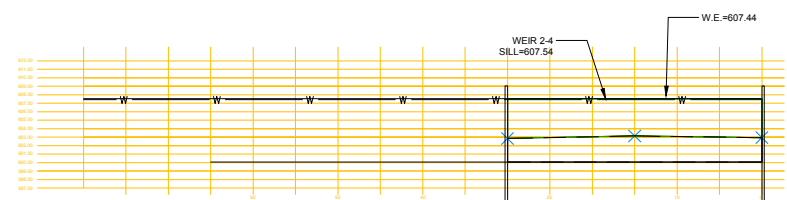
MATERIAL AREA = 83.6 SFT
 MEASURED ADDITIONAL AREA= 140.2 SFT
 TOTAL AREA = 223.8 SFT

0+63



MATERIAL AREA = 86.2 SFT
 MEASURED ADDITIONAL AREA= 137.6 SFT
 TOTAL AREA = 223.8 SFT

1+45



MATERIAL AREA = 88.1 SFT
 MEASURED ADDITIONAL AREA= 135.7 SFT
 TOTAL AREA = 223.8 SFT

Issued

Rev. Date
 Description

R-3 BDP 12/24/2018
 2018 ANNUAL INSPECTION
 R-2 BDP 12/1/2017
 2017 ANNUAL INSPECTION
 R-1 BDP 12/15/2016
 2016 ANNUAL INSPECTION

Designed: CLC 10/19/2015
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 60445171

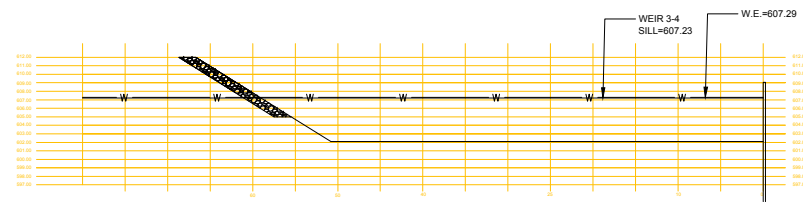
SHEET REFERENCE NUMBER

G-03

SHEET 03 OF 06

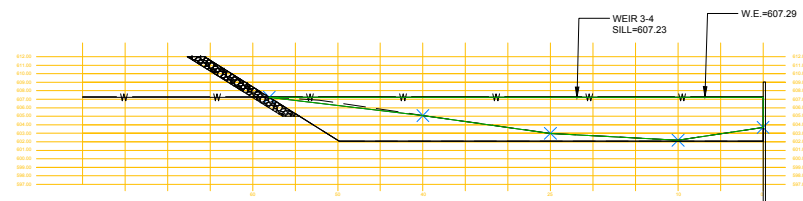
CELL 3

0+10



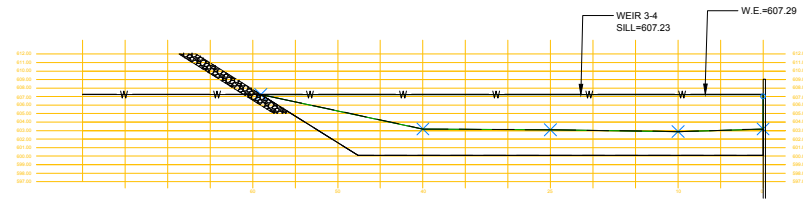
MATERIAL AREA = 0.0 SFT
 MEASURED ADDITIONAL AREA= 0.0 SFT
 TOTAL AREA = 0.0 SFT

0+30



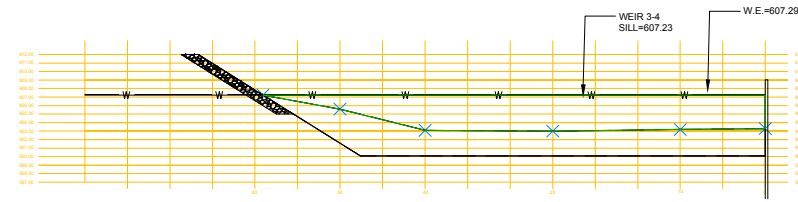
MATERIAL AREA = 101.4 SFT
 MEASURED ADDITIONAL AREA= 176.4 SFT
 TOTAL AREA = 277.8 SFT

0+55



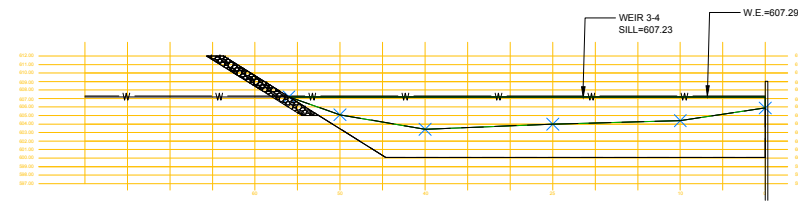
MATERIAL AREA = 176.2 SFT
 MEASURED ADDITIONAL AREA= 145.6 SFT
 TOTAL AREA = 381.4 SFT

0+81



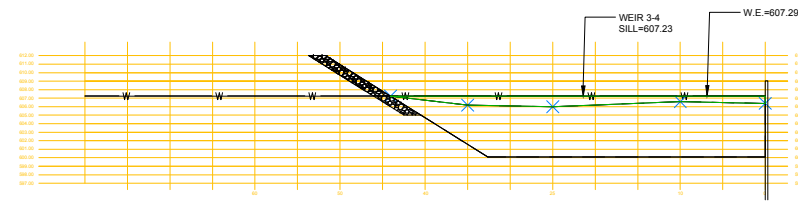
MATERIAL AREA = 180.2 SFT
 MEASURED ADDITIONAL AREA= 201.2 SFT
 TOTAL AREA = 381.4 SFT

1+10



MATERIAL AREA = 203.9 SFT
 MEASURED ADDITIONAL AREA= 154.3 SFT
 TOTAL AREA = 358.2 SFT

1+39



MATERIAL AREA = 236.5 SFT
 MEASURED ADDITIONAL AREA= 37.6 SFT
 TOTAL AREA = 274.1 SFT

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Issued

Rev Date Description

R-3 BDP 12/24/2018
 2018 ANNUAL INSPECTION
 R-2 BDP 12/1/2017
 2017 ANNUAL INSPECTION
 R-1 BDP 12/15/2016
 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

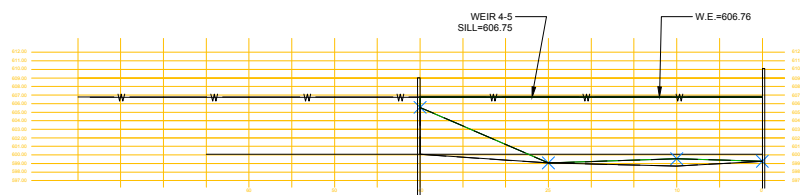
G-04

SHEET 04 OF 06

CELL 4

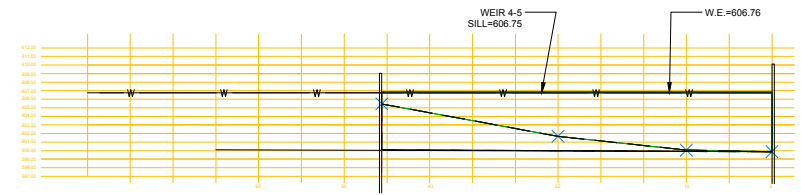
NOTE: CELL 4 BOTTOM HAS BEEN EXCAVATED BELOW 1990 SCA, CINDER POND IMPROVEMENT PROJECT, AT SOME LOCATIONS

0+28



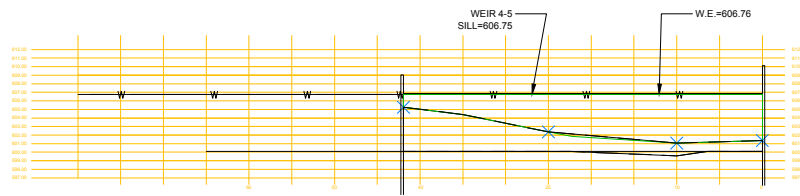
MATERIAL AREA = 51.8 SFT
MEASURED ADDITIONAL AREA= 241.5 SFT
TOTAL AREA = 293.3 SFT

1+26



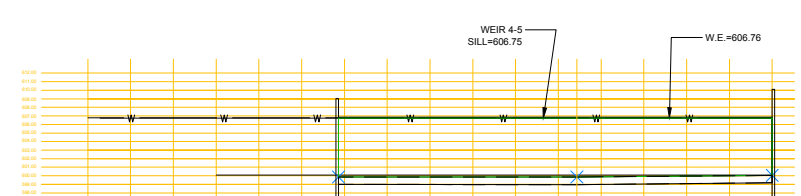
MATERIAL AREA = 87.5 SFT
MEASURED ADDITIONAL AREA= 216.7 SFT
TOTAL AREA = 304.2 SFT

0+64



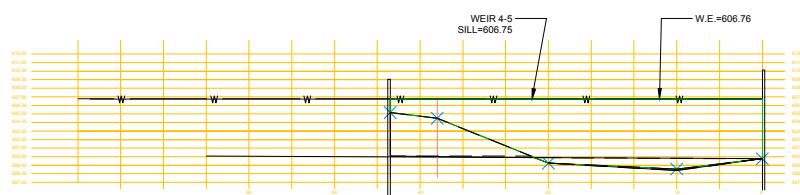
MATERIAL AREA = 105.9 SFT
MEASURED ADDITIONAL AREA= 177.9 SFT
TOTAL AREA = 283.8 SFT

1+69



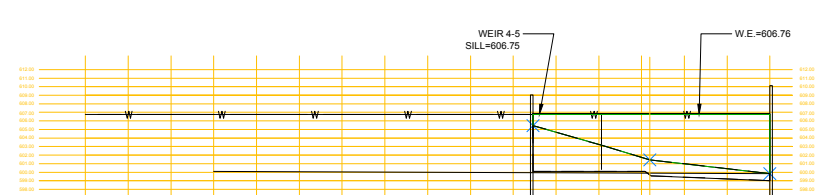
MATERIAL AREA = 45.0 SFT
MEASURED ADDITIONAL AREA= 347.1 SFT
TOTAL AREA = 392.1 SFT

0+93



MATERIAL AREA = 52.5 SFT
MEASURED ADDITIONAL AREA= 264.8 SFT
TOTAL AREA = 317.3 SFT

2+19



MATERIAL AREA = 65.3 SFT
MEASURED ADDITIONAL AREA= 130.5 SFT
TOTAL AREA = 195.8 SFT

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Issued

Rev. Date
Description

R-3 BDP 12/24/2018
2018 ANNUAL INSPECTION
R-2 BDP 12/1/2017
2017 ANNUAL INSPECTION
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

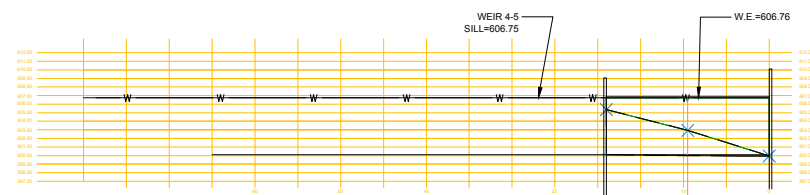
G-05

SHEET 05 OF 06

CELL 4 (Cont.)

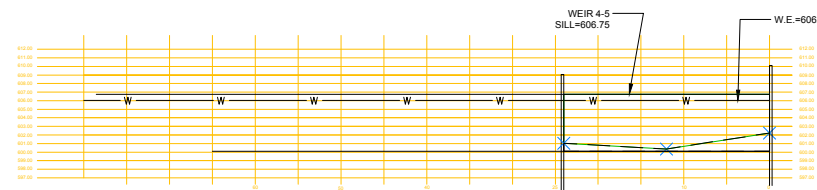
CELL 5

2+52



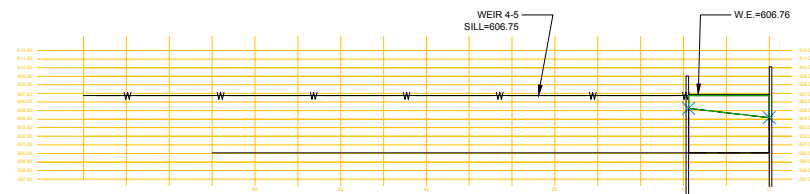
MATERIAL AREA = 53.3 SFT
MEASURED ADDITIONAL AREA= 76.6 SFT
TOTAL AREA = 129.9 SFT

0+00



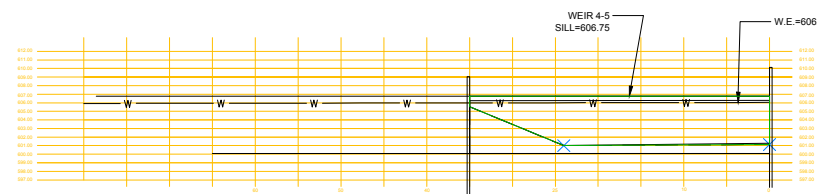
MATERIAL AREA = 22.1 SFT
MEASURED ADDITIONAL AREA= 138.0 SFT
TOTAL AREA = 160.1 SFT

2+83



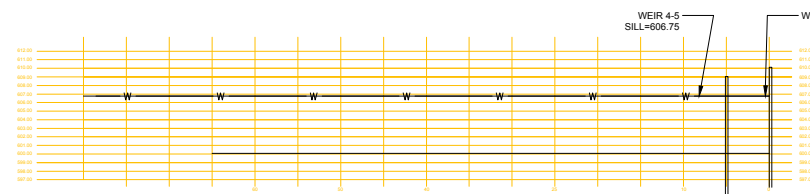
MATERIAL AREA = 43.5 SFT
MEASURED ADDITIONAL AREA= 19.2 SFT
TOTAL AREA = 62.7 SFT

0+20



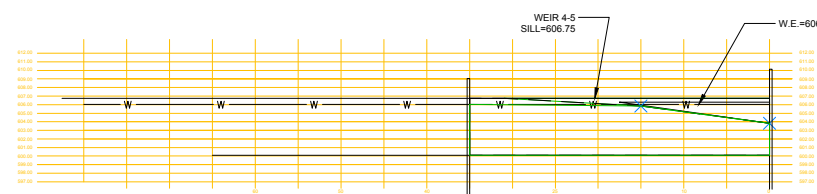
MATERIAL AREA = 58.8 SFT
MEASURED ADDITIONAL AREA= 174.7 SFT
TOTAL AREA = 233.5 SFT

2+98



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

0+40



MATERIAL AREA = 197.5 SFT
MEASURED ADDITIONAL AREA= 36.0 SFT
TOTAL AREA = 233.5 SFT

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

Issued

Rev. Date
Description

R-3 BDP 12/24/2018
2018 ANNUAL INSPECTION
R-2 BDP 12/1/2017
2017 ANNUAL INSPECTION
R-1 BDP 12/15/16
2016 ANNUAL INSPECTION

Designed: CLC 10/19/2015
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PROJECT NUMBER
60445171

SHEET REFERENCE NUMBER

G-06

SHEET 06 OF 06

Appendix B Volume Calculations

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



Date: 12/24/2018

CELL 1				
Station	Length (FT)	Occupied Area	Unoccupied	Total Area (SFT)
		(SFT)	Area (SFT)	
0+00	0	0.0	0.0	0.0
0+20	20	52.4	116.2	168.6
0+52	32	101.3	127.3	228.6
0+85	23	85.5	143.1	228.6
1+15	30	84.8	143.8	228.6
1+43	28	154.5	74.1	228.6

	CFT	CYD
Occupied Volume =	11036.1	408.7
Unoccupied Volume =	15521.7	574.9
Total Cell 1 Volume =	26557.8	983.6

CELL 2				
Station	Length (FT)	Occupied Area	Unoccupied	Total Area (SFT)
		(SFT)	Area (SFT)	
0+08	0	0.0	0.0	0.0
0+40	32	40.1	123.7	163.8
0+63	23	86.2	137.6	223.8
0+87	24	84.3	139.5	223.8
1+16	39	83.6	140.2	223.8
1+45	29	88.1	135.7	223.8

	CFT	CYD
Occupied Volume =	9903.8	366.8
Unoccupied Volume =	17764.1	657.9
Total Cell 2 Volume =	27667.8	1024.7

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	101.4	176.4	277.8
0+55	25	176.2	205.2	381.4
0+81	26	180.2	201.2	381.4
1+10	29	203.9	154.3	358.2
1+39	29	236.5	37.6	274.1

	CFT	CYD
Occupied Volume =	21072.5	780.5
Unoccupied Volume =	19754.5	731.6
Total Cell 3 Volume =	40827.0	1512.1

CELL 4

Station	Length (FT)	Occupied Area (SFT)	Unoccupied Area (SFT)	Total Area (SFT)
0+28	0	51.8	241.5	293.3
0+64	36	105.9	177.9	283.8
0+93	29	52.5	264.8	317.3
1+26	33	87.5	216.7	304.2
1+69	43	45.0	347.1	392.1
2+19	0	65.3	130.5	195.8
2+52	33	53.3	76.6	129.9
2+83	31	43.5	19.2	62.7
2+98	15	0.0	0.0	0.0

	CFT	CYD
Occupied Volume =	14077.7	521.4
Unoccupied Volume =	39080.9	1447.4
Total Cell 4 Volume =	53158.6	1968.8

CELL 5

Station	Length (FT)	Occupied Area (SFT)	Unoccupied Area (SFT)	Total Area (SFT)
0+00	0	22.1	138.0	160.1
0+20	20	58.8	174.7	233.5
0+40	20	197.5	36.0	233.5

	CFT	CYD
Occupied Volume =	3372.0	124.9
Unoccupied Volume =	5234.0	193.9
Total Cell 5 Volume =	8606.0	318.7

Total System

	CFT	CYD
Occupied Volume =	59462.0	2202.3
Unoccupied Volume =	97355.1	3605.7
Total Volume =	156817.1	5808.0

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 – Interior Walls in Poor Condition

