

APPENDIX H – FINANCIAL ASSURANCE

Post-Closure Care Cost Estimate



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TECHNICAL MEMORANDUM

TO Mr. Eric Chavers
Luminant

BBA Project No. 23643-01-2024

FROM Dan Bullock, PE/Will Vienne, PG

MARTIN LAKE POWER PLANT PDP-5, ASH PONDS AND A1 AREA LANDFILL POST CLOSURE CARE COST ESTIMATES - REVISION 2

Luminant Generation Company, LLC (Luminant) owns and operates the Martin Lake Steam Electric Station (MLSES) located approximately five miles southwest of Tatum in Rusk County, Texas. Coal Combustion Residuals (CCR) including fly ash, bottom ash, and gypsum are generated as part of MLSES unit operation and managed in Permanent Disposal Pond No. 5 (PDP-5), the Bottom Ash Ponds and New Scrubber Pond (referred to collectively as the Ash Ponds) and in the A1 Area Landfill (A1 LF).

These CCR Units are regulated under 40 CFR 257, Subpart D (the "Federal CCR Rule") and 30 Texas Administrative Code (TAC) Chapter 352 (The "TCEQ CCR Rule"). In accordance with 30 TAC §352.201, Luminant is required to submit an application to TCEQ to obtain a registration for each of these CCR Units. Bullock, Bennett & Associates, LLC (BBA) was retained by Luminant to assist with preparation of Post Closure Care Cost Estimates (PCCEs) for PDP-5, the Ash Ponds and the A1 LF in accordance with §352.1101. This technical memorandum presents the PCCEs estimated by BBA for these units. The PCCEs were prepared using TCEQ Technical Guidance Documents TG-30 and TG-31 and related documents.

1.0 CCR Unit Closure Assumptions

The PCCEs were prepared based on the following closure assumptions for the MLSES CCR Units:

- PDP-5:
 - CCR Unit Closure:
 - Closure in Place with low permeability cap
 - Cap Area: 40 acres
 - Groundwater Closure:
 - No evidence of a release to groundwater to date
 - Continuation of Detection Monitoring for Groundwater
 - Nine (9) monitoring wells sampled semi-annually
 - Existing Leachate Collection System operated throughout post closure care period
- Ash Ponds:
 - West Ash Pond (WAP), East Ash Pond (EAP) and New Scrubber Pond (NSP) managed as one CCR Unit
 - CCR Unit Closure:
 - Closure in Place with low permeability cap
 - Cap Areas:
 - WAP and EAP Cap Area: 25 acres

- NSP Cap Area: 13 acres
 - Total: 38 acres
- Groundwater Closure:
 - Monitored Natural Attenuation (MNA) with MNA Groundwater Monitoring
 - Continuation of Detection and Assessment Monitoring for Groundwater
 - Seven (7) monitoring wells sampled semi-annually
- A-1 Area Landfill:
 - CCR Unit Closure:
 - Closure in Place with low permeability cap
 - Cap Areas:
 - Existing Cap Area: 464 acres
 - Future Cap Area: 321 acres
 - Total: 785 acres
 - Groundwater Closure:
 - Monitored Natural Attenuation (MNA) with MNA Groundwater Monitoring
 - Continuation of Detection and Assessment Monitoring for Groundwater
 - Twelve (12) monitoring wells sampled semi-annually

2.0 Post Closure Care Cost Assumptions

The following general assumptions were incorporated into the PCCEs:

- Post Closure Care Period. A post-closure care period of 30 years is assumed in accordance with 30 TAC §352.1241 and 40 CFR § 257.104(c).
- CCR Unit Inspections. Weekly and annual inspections of the CCR Units are required under §352.831 and §352.841. It is assumed that these inspections will continue throughout the Post Closure Care Period.
- Final Cover Maintenance. It is likely that some level of maintenance/repair will be required for the final cover systems used to close the CCR Units. The PCCEs include the following assumptions for final cover maintenance/repair:
 - Years 1-5 After Closure - it is assumed that erosion damage on 5% of the cap soil will be repaired each year. The thickness of each repair is assumed to average 6 inches of soil. In addition, the repaired areas will be revegetated.
 - Years 6-30 After Closure - it is assumed that erosion damage on 5% of the cap soil will be repaired three times during this period. The thickness of each repair is assumed to average 6 inches of soil. In addition, the repaired areas will be revegetated.
 - Estimated engineering/mobilization costs associated with the repairs/revegetation are included in the PCCEs.
 - Annual mowing costs for the final cover are included in the PCCEs.
- General Site Maintenance. Maintenance of run-off/drainage structures, access roads, fencing, signs, etc. are included in the PCCEs.
- Groundwater Monitoring. Semi-annual groundwater monitoring in accordance with the Federal/TCEQ CCR Rules (detection monitoring or assessment monitoring) is on-going for the units. It is assumed that the current groundwater monitoring program will continue throughout the Post Closure Care Period. It is

also likely that maintenance of the monitoring well system at the units will be required during the post closure care period. The PCCEs assume that one monitoring well will be replaced every 10 years at each CCR Unit.

In addition, the Ash Ponds and A1 LF incorporate MNA as a groundwater remedy as part of closure. For those CCR Units, it is assumed that MNA analyses will be included in the semi-annual groundwater monitoring events.

- One Time Post Closure Care Costs. The following one time activities associated with post closure care are included in the PCCEs:
 - Deed Notices/Surveys
 - Monitoring Well Plugging and Abandonment
- Leachate Collection – PDP-5. Martin Lake PDP-5 is constructed with a leachate collection system to remove leachate from the unit after closure. For the PDP-5 PCCE, it is assumed that all free liquids in PDP-5 will be removed during closure and the existing leachate collection system will be operated throughout the post closure care period to remove water that infiltrates through the low permeability cap. For the PCCE, the average annual volume of leachate generated following closure was estimated to be approximately 1,000 gallons per year using the Hydrologic Evaluation of Landfill Performance (HELP) Model (see Attachment A). Costs to dispose of this estimated volume of leachate as Class II Industrial Waste and maintain the leachate collection system through the post closure care period are included in the PCCE for PDP-5.
- Contingency. A 10% contingency factor is included in the PCCEs.
- All costs are in 2021 dollars.

3.0 Post Closure Care Cost Estimate

Based on the assumptions listed above, the 30-Year post closure care cost estimates for the MLSES CCR Units are as follows (see Tables 1, 2 and 3 for details):

- PDP-5: \$2,026,787
- Ash Ponds: \$2,058,214
- A1 LF: \$8,273,063

It should be noted that the PCCEs presented herein are considered Opinions of Probable Cost and represent BBA's best judgement based on the assumptions stated, information available at the time the estimates were prepared, and BBA's experience with similar sites. The PCCEs are susceptible to variations in future cost of materials, labor, and equipment and should not be considered guaranteed maximum prices for post closure care activities.

Please do not hesitate to contact us if you have any questions or comments.



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2/20/2024

TABLES

Table 1

Martin Lake Steam Electric Station - PDP-5
 Post Closure Care Cost Estimate - 30 TAC 352.1101

| Item | Unit | Rate | Quantity | Cost/Event | No. of Events | 30-Year Cost |
|--|------|----------|----------|------------|---------------|--------------------|
| <u>CCR Unit Inspections (Annually)</u> | LS | \$15,000 | 1 | \$15,000 | 30 | \$450,000 |
| <u>Final Cover Maintenance</u> | | | | | | |
| - Erosion Repair, 6-inch avg. thickness, 5% of cap per year, Years 1-5 | CY | \$5 | 1,613 | \$8,067 | 5 | \$40,333 |
| - Erosion Repair, 6-inch avg. thickness, 5% of cap, 3 times, Years 6-30 | CY | \$5 | 1,613 | \$8,067 | 3 | \$24,200 |
| - Revegetation, 5% of cap area per year, Years 1-5 | AC | \$1,500 | 2.0 | \$3,000 | 5 | \$15,000 |
| - Revegetation, 5% of cap area, 3 times, Years 6-30 | AC | \$1,500 | 2.0 | \$3,000 | 3 | \$9,000 |
| - Engineering/Mobilization for Final Cover Repairs/Revegetation Events | LS | \$5,000 | 1 | \$5,000 | 8 | \$40,000 |
| - Mowing, per year | AC | \$150 | 40 | \$6,000 | 30 | \$180,000 |
| <u>General Site Maintenance (Annually)</u> | | | | | | |
| - Run-off/Drainage Structures | LS | \$2,000 | 1 | \$2,000 | 30 | \$60,000 |
| - Access Roads, fencing, signs, etc. | LS | \$1,000 | 1 | \$1,000 | 30 | \$30,000 |
| <u>Leachate Management (Annually)</u> | | | | | | |
| - Leachate Disposal (Class II) | Gal | \$10 | 1,000 | \$10,000 | 30 | \$300,000 |
| - Leachate System Maintenance | LS | \$2,000 | 1 | \$2,000 | 30 | \$60,000 |
| <u>GW Monitoring (Annually)</u> | | | | | | |
| - Detection Monitoring - Semi-annual Collection/Analysis, (9 MWs, 1 Dup) | EA | \$500 | 10 | \$5,000 | 60 | \$300,000 |
| - Annual Report | LS | \$10,000 | 1 | \$10,000 | 30 | \$300,000 |
| - Monitoring Well Maintenance (1 MW replaced every 10 years) | EA | \$5,000 | 1 | \$5,000 | 3 | \$15,000 |
| <u>One Time Post Closure Care Costs</u> | | | | | | |
| - Deed Notices/Surveys | LS | \$10,000 | 1 | \$10,000 | 1 | \$10,000 |
| - Monitoring Well Plugging and Abandonment | EA | \$1,000 | 9 | \$9,000 | 1 | \$9,000 |
| Subtotal 30-Year Post Closure Care Costs: | | | | | | \$1,842,533 |
| Contingency (10%): | | | | | | \$184,253 |
| 30-Year Post Closure Cost Estimate: | | | | | | \$2,026,787 |

Notes:

1. All Costs in 2021 Dollars
2. SY - square yard
3. CY - cubic yard
4. EA - each
5. AC - acre
6. M - month
7. Gal - gallons
8. See Technical Memorandum for cost assumptions

Table 2

Martin Lake Steam Electric Station - Ash Ponds
Post Closure Care Cost Estimate - 30 TAC 352.1101

| Item | Unit | Rate | Quantity | Cost/Event | No. of Events | 30-Year Cost |
|--|------|----------|----------|------------|---------------|--------------------|
| <u>CCR Unit Inspections (Annually)</u> | LS | \$15,000 | 1 | \$15,000 | 30 | \$450,000 |
| <u>Final Cover Maintenance</u> | | | | | | |
| - Erosion Repair, 6-inch avg. thickness, 5% of cap per year, Years 1-5 | CY | \$5 | 1,533 | \$7,663 | 5 | \$38,315 |
| - Erosion Repair, 6-inch avg. thickness, 5% of cap, 3 times, Years 6-30 | CY | \$5 | 1,533 | \$7,663 | 3 | \$22,989 |
| - Revegetation, 5% of cap area per year, Years 1-5 | AC | \$1,500 | 1.9 | \$2,850 | 5 | \$14,250 |
| - Revegetation, 5% of cap area, 3 times, Years 6-30 | AC | \$1,500 | 1.9 | \$2,850 | 3 | \$8,550 |
| - Engineering/Mobilization for Final Cover Repairs/Revegetation Events | LS | \$5,000 | 1 | \$5,000 | 8 | \$40,000 |
| - Mowing, per year | AC | \$150 | 38 | \$5700 | 30 | \$171,000 |
| <u>General Site Maintenance (Annually)</u> | | | | | | |
| - Run-off/Drainage Structures | LS | \$3,000 | 1 | \$3,000 | 30 | \$90,000 |
| - Access Roads, fencing, signs, etc. | LS | \$1,500 | 1 | \$1,500 | 30 | \$45,000 |
| <u>GW Monitoring (Annually)</u> | | | | | | |
| - Detection Monitoring - Semi-annual Collection/Analysis, (7 MWs, 1 Dup) | EA | \$500 | 8 | \$4,000 | 60 | \$240,000 |
| - Assessment Monitoring - Semi-annual Analysis, (7 MWs, 1 Dup) | EA | \$350 | 8 | \$2,800 | 60 | \$168,000 |
| - MNA Monitoring - Semi-annual Analysis, (7 MWs, 1 Dup) | EA | \$200 | 8 | \$1,600 | 60 | \$96,000 |
| - Annual Report (Including MNA) | LS | \$15,000 | 1 | \$15,000 | 30 | \$450,000 |
| - Monitoring Well Maintenance (1 MW replaced every 10 years) | EA | \$5,000 | 1 | \$5,000 | 3 | \$15,000 |
| <u>One Time Post Closure Care Costs</u> | | | | | | |
| - Deed Notices/Surveys | LS | \$15,000 | 1 | \$15,000 | 1 | \$15,000 |
| - Monitoring Well Plugging and Abandonment | EA | \$1,000 | 7 | \$7,000 | 1 | \$7,000 |
| Subtotal 30-Year Post Closure Care Costs: | | | | | | \$1,871,104 |
| Contingency (10%): | | | | | | \$187,110 |
| 30-Year Post Closure Cost Estimate: | | | | | | \$2,058,214 |

Notes:

1. LF - linear foot
2. SY - square yard
3. CY - cubic yard
4. EA - each
5. AC - acre
6. M - month
7. Gal - gallons
8. See Technical Memorandum for cost assumptions
9. All Costs in 2021 Dollars

Table 3

Martin Lake Steam Electric Station - A1 Area Landfill
Post Closure Care Cost Estimate - 30 TAC 352.1101

| Item | Unit | Rate | Quantity | Cost/Event | No. of Events | 30-Year Cost |
|---|------|----------|----------|------------|---------------|--------------------|
| <u>CCR Unit Inspections (Annually)</u> | LS | \$15,000 | 1 | \$15,000 | 30 | \$450,000 |
| <u>Final Cover Maintenance</u> | | | | | | |
| - Erosion Repair, 6-inch avg. thickness, 5% of cap per year, Years 1-5 | CY | \$5 | 31,662 | \$158,308 | 5 | \$791,542 |
| - Erosion Repair, 6-inch avg. thickness, 5% of cap, 3 times, Years 6-30 | CY | \$5 | 31,662 | \$158,308 | 3 | \$474,925 |
| - Revegetation, 5% of cap area per year, Years 1-5 | AC | \$1,500 | 39.3 | \$58,875 | 5 | \$294,375 |
| - Revegetation, 5% of cap area, 3 times, Years 6-30 | AC | \$1,500 | 39.3 | \$58,875 | 3 | \$176,625 |
| - Engineering/Mobilization for Final Cover Repairs/Revegetation Events | LS | \$15,000 | 1 | \$15,000 | 8 | \$120,000 |
| - Mowing, per year | AC | \$150 | 785 | \$117,750 | 30 | \$3,532,500 |
| <u>General Site Maintenance (Annually)</u> | | | | | | |
| - Run-off/Drainage Structures | LS | \$8,000 | 1 | \$8,000 | 30 | \$240,000 |
| - Access Roads, fencing, signs, etc. | LS | \$4,000 | 1 | \$4,000 | 30 | \$120,000 |
| <u>GW Monitoring (Annually)</u> | | | | | | |
| - Detection Monitoring - Semi-annual Collection/Analysis, (12 MWs, 1 Dup) | EA | \$500 | 13 | \$6,500 | 60 | \$390,000 |
| - Assessment Monitoring - Semi-annual Analysis, (12 MWs, 1 Dup) | EA | \$350 | 13 | \$4,550 | 60 | \$273,000 |
| - MNA Monitoring - Semi-annual Analysis, (12 MWs, 1 Dup) | EA | \$200 | 13 | \$2,600 | 60 | \$156,000 |
| - Annual Report (Including MNA) | LS | \$15,000 | 1 | \$15,000 | 30 | \$450,000 |
| - Monitoring Well Maintenance (1 MW replaced every 10 years) | EA | \$5,000 | 1 | \$5,000 | 3 | \$15,000 |
| <u>One Time Post Closure Care Costs</u> | | | | | | |
| - Deed Notices/Surveys | LS | \$25,000 | 1 | \$25,000 | 1 | \$25,000 |
| - Monitoring Well Plugging and Abandonment | EA | \$1,000 | 12 | \$12,000 | 1 | \$12,000 |
| Subtotal 30-Year Post Closure Care Costs: | | | | | | \$7,520,967 |
| Contingency (10%): | | | | | | \$752,097 |
| 30-Year Post Closure Cost Estimate: | | | | | | \$8,273,063 |

Notes:

1. LF - linear foot
2. SY - square yard
3. CY - cubic yard
4. EA - each
5. AC - acre
6. M - month
7. Gal - gallons
8. See Technical Memorandum for cost assumptions
9. All Costs in 2021 Dollars

ATTACHMENT A
PDP-5 HELP MODEL RESULTS

| | | |
|----------------------------------|---|-----------------|
| Thickness | = | 720 inches |
| Porosity | = | 0.541 vol/vol |
| Field Capacity | = | 0.187 vol/vol |
| Wilting Point | = | 0.047 vol/vol |
| Initial Soil Water Content | = | 0.187 vol/vol |
| Effective Sat. Hyd. Conductivity | = | 5.00E-05 cm/sec |

Layer 5

Type 3 - Barrier Soil Liner

C (Moderate)

Material Texture Number 29

| | | |
|----------------------------------|---|-----------------|
| Thickness | = | 48 inches |
| Porosity | = | 0.451 vol/vol |
| Field Capacity | = | 0.419 vol/vol |
| Wilting Point | = | 0.332 vol/vol |
| Initial Soil Water Content | = | 0.451 vol/vol |
| Effective Sat. Hyd. Conductivity | = | 6.80E-07 cm/sec |

 Note: Initial moisture content of the layers and snow water were computed as nearly steady-state values by HELP.

General Design and Evaporative Zone Data

| | | |
|--------------------------------------|---|----------------|
| SCS Runoff Curve Number | = | 84.2 |
| Fraction of Area Allowing Runoff | = | 100 % |
| Area projected on a horizontal plane | = | 40 acres |
| Evaporative Zone Depth | = | 18 inches |
| Initial Water in Evaporative Zone | = | 5.037 inches |
| Upper Limit of Evaporative Storage | = | 8.298 inches |
| Lower Limit of Evaporative Storage | = | 3.654 inches |
| Initial Snow Water | = | 0 inches |
| Initial Water in Layer Materials | = | 171.343 inches |
| Total Initial Water | = | 171.343 inches |
| Total Subsurface Inflow | = | 0 inches/year |

 Note: SCS Runoff Curve Number was calculated by HELP.

Evapotranspiration and Weather Data

| | | |
|---------------------------------------|---|---------------|
| Station Latitude | = | 32.31 Degrees |
| Maximum Leaf Area Index | = | 5 |
| Start of Growing Season (Julian Date) | = | 0 days |
| End of Growing Season (Julian Date) | = | 367 days |
| Average Wind Speed | = | 6 mph |

| | | |
|---------------------------------------|---|------|
| Average 1st Quarter Relative Humidity | = | 1 % |
| Average 2nd Quarter Relative Humidity | = | 22 % |
| Average 3rd Quarter Relative Humidity | = | 88 % |
| Average 4th Quarter Relative Humidity | = | 22 % |

 Note: Evapotranspiration data was obtained for Dirgin, Texas

Normal Mean Monthly Precipitation (inches)

| <u>Jan/Jul</u> | <u>Feb/Aug</u> | <u>Mar/Sep</u> | <u>Apr/Oct</u> | <u>May/Nov</u> | <u>Jun/Dec</u> |
|----------------|----------------|----------------|----------------|----------------|----------------|
| 3.940712 | 3.384053 | 4.449471 | 3.632658 | 4.152557 | 5.603921 |
| 3.172363 | 2.83961 | 2.855806 | 4.403743 | 4.552789 | 4.108209 |

 Note: Precipitation was simulated based on HELP V4 weather simulation for:
 Lat/Long: 32.31/-94.55

Normal Mean Monthly Temperature (Degrees Fahrenheit)

| <u>Jan/Jul</u> | <u>Feb/Aug</u> | <u>Mar/Sep</u> | <u>Apr/Oct</u> | <u>May/Nov</u> | <u>Jun/Dec</u> |
|----------------|----------------|----------------|----------------|----------------|----------------|
| 51.6 | 52.5 | 64.1 | 73 | 79.7 | 89.4 |
| 92.3 | 89.7 | 84.1 | 74 | 66.1 | 57.1 |

 Note: Temperature was simulated based on HELP V4 weather simulation for:
 Lat/Long: 32.31/-94.55
 Solar radiation was simulated based on HELP V4 weather simulation for:
 Lat/Long: 32.31/-94.55

Average Annual Totals Summary

Title: Martin Lake PDP 5
Simulated on: 1/6/2022 8:32

| | Average Annual Totals for Years 1 - 30* | | | | |
|-------------------------------------|---|------------|--------------|--------------|-----------|
| | (inches) | [std dev] | (cubic feet) | (gallons) | (percent) |
| Precipitation | 47.10 | [5.76] | 6,838,323.4 | 51,154,215.3 | 100.00 |
| Runoff | 4.062 | [2.566] | 589,755.5 | 4,411,677.7 | 8.62 |
| Evapotranspiration | 42.959 | [5.448] | 6,237,618.8 | 46,660,632.2 | 91.22 |
| Subprofile1 | | | | | |
| Percolation/leakage through Layer 2 | 0.000690 | [0.000293] | 100.1 | 749.1 | 0.00 |
| Average Head on Top of Layer 2 | 2.5255 | [1.058] | --- | --- | --- |
| Subprofile2 | | | | | |
| Percolation/leakage through Layer 5 | 0.000690 | [0.000293] | 100.1 | 749.1 | 0.00 |
| Average Head on Top of Layer 5 | 0.0000 | [0] | --- | --- | --- |
| Water storage | | | | | |
| Change in water storage | 0.0747 | [1.8339] | 10,849.0 | 81,156.3 | 0.16 |

* Note: Average inches are converted to volume based on the user-specified area.

Peak Annual Totals Summary

| Year | Percolation/leakage through Layer 2 (cubic feet) | Percolation/leakage through Layer 2 (gallons) |
|------|--|---|
| 1 | 94.36 | 705.86 |
| 2 | 90.86 | 679.71 |
| 3 | 114.98 | 860.12 |
| 4 | 133.94 | 1001.98 |
| 5 | 68.53 | 512.66 |
| 6 | 72.73 | 544.05 |
| 7 | 65.14 | 487.29 |
| 8 | 129.67 | 969.97 |
| 9 | 145.04 | 1084.99 |
| 10 | 96.08 | 718.70 |
| 11 | 113.33 | 847.75 |
| 12 | 127.05 | 950.38 |
| 13 | 170.85 | 1278.05 |
| 14 | 110.62 | 827.46 |
| 15 | 176.37 | 1319.34 |
| 16 | 32.26 | 241.34 |
| 17 | 135.53 | 1013.81 |
| 18 | 114.29 | 854.96 |
| 19 | 124.03 | 927.84 |
| 20 | 9.75 | 72.90 |
| 21 | 36.21 | 270.86 |
| 22 | 65.90 | 492.99 |
| 23 | 79.54 | 594.98 |
| 24 | 31.83 | 238.14 |
| 25 | 99.15 | 741.70 |
| 26 | 78.99 | 590.87 |
| 27 | 111.77 | 836.07 |
| 28 | 180.88 | 1353.09 |
| 29 | 76.11 | 569.33 |
| 30 | 118.42 | 885.85 |