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# TECHNICAL MEMORANDUM

**DATE:** 29 January 2021      **Telesto #** 200541a-002  
**TO:** Mandy Lilla – Freeport McMoRan Tyrone, Inc.  
**FROM:** Jonathan Cullor, PE – Telesto Solutions, Inc.  
**SUBJECT:** Little Rock Mine Reclamation Cost Estimate – Highest Reclamation Cost Year Calculations

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## 1.0 BACKGROUND

Freeport McMoRan Tyrone, Inc. (Tyrone) is in the process of completing a 2020 Closure/Closeout Plan for the update and expansion of the Little Rock Mine. As part of the New Mexico Agencies<sup>1</sup> Closure/Closeout Plan process, Freeport-McMoRan New Mexico Operations is required to base their financial assurance reclamation cost estimate (RCE) upon the year with the highest reclamation cost for the upcoming 5-year mine plan period. This technical memorandum summarizes the approach, process, and results of the Little Rock 2020 RCE highest reclamation cost year calculations as completed by Telesto Solutions, Inc. (Telesto).

## 2.0 APPROACH

Highest reclamation cost year calculations are typically only based on the earthwork RCE since water treatment is typically a consistent cost irrespective of the closure year in a 5-year period. Rather than run a full RCE for each year of the 5-year mine plan, a screening method is used to determine the highest reclamation cost year. The screening method entails the application of a weighting factor (relative cost index; RCI) to the reclamation area acreages for each year of the 5-year mine plan in calculation of the reclamation cost index. Reclamation cost indexes for each mine plan year are then compared to determine the highest reclamation cost year.

The RCI method is effective in calculating the highest reclamation cost year because it gives more weight to areas that require more effort to close. Reclamation areas considered typically include:

- Flat areas & roads
  - Tops of stockpiles
  - Roads
  - Yards
- Sloped areas constructed near reclamation grades
  - Newer stockpiles constructed at 3:1 to 3.5:1 overall out-slope grade

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<sup>1</sup> New Mexico Environmental Department, Ground Water Quality Bureau, Mining Environmental Compliance Section, and New Mexico Mining and Minerals Division, Mining Act Reclamation Program.

- Tailings impoundment embankments
- Steeply sloped areas
  - Angle of repose stockpile out-slopes
  - Large cut embankments

The RCI values for each mine site are estimated based on previous RCE closure costs for each reclamation area type. Table 1 shows typical, historical RCI ranges and those utilized for the Little Rock 2020 RCE.

**Table 1 Relative Cost Index Values**

Area	Historical RCI Ranges	Little Rock 2020 RCI
Flat Areas & Roads	0.2 to 0.5	0.4
Reclamation Grade Slopes	0.4 to 0.9	0.7
Steep Slopes	1-2	1
Pit Lake	0	0

### 3.0 CALCULATIONS AND RESULTS

The first step in determining the highest reclamation cost year was to complete mine plans for each of the 5 subsequent mining years. These 5 mine plans were then used to determine reclamation acreages for each reclamation area type for the respective mining year. Existing conditions (end of 2019) and mine plans for the Little Rock Mine (years 2020-2024) are attached as Figures 1, 3, 5, 7, 9 and 11. Subsequent reclamation areas and acreages for each closure year are attached as Figures 2, 4, 6, 8, 10, and 12. The pit lake shown on Figures 2, 4, 6, 8, 10, and 12 was based on an assumed post-closure pit lake elevation of 5,765 ft which was calculated during the completion of the 2014 Closure/Closeout Plan. The 2014 post-closure pit lake elevation was later re-evaluated and lowered during the 2020 Closure/Closeout Plan process. However, for the purposes of this evaluation, since all mine plan years had the same pit lake elevation and therefore all mine plan years shared the same discrepancy, the differences between the 2020 highest reclamation cost year pit lake elevation and the modified Closure/Closeout Plan pit lake elevation was determined to play no factor in determining the highest reclamation cost year.

Reclamation acreages as shown in tables presented on Figures 2, 4, 6, 8, 10, and 12 were totaled, and weighted totals were calculated following Equation 1 (Table 2).

## Equation 1 Weighted Total

$$\begin{aligned} \text{Weighted Total} = & \text{Flat Area (ac)} \times \text{Flat Area (RCI)} \\ & + \text{Reclamation Grade Slopes (ac)} \times \text{Reclamation Grade Slopes (RCI)} \\ & + \text{Steep Slope (ac)} \times \text{Steep Slope (RCI)} + \text{Pit Lake (ac)} \times \text{Pit Lake (RCI)} \end{aligned}$$

The reclamation cost index for each mine plan year was then calculated following Equation 2 (Table 1).

## Equation 2 Reclamation Cost Index

$$\text{Reclamation Cost Index} = \frac{\text{Weighted Total}}{1,000}$$

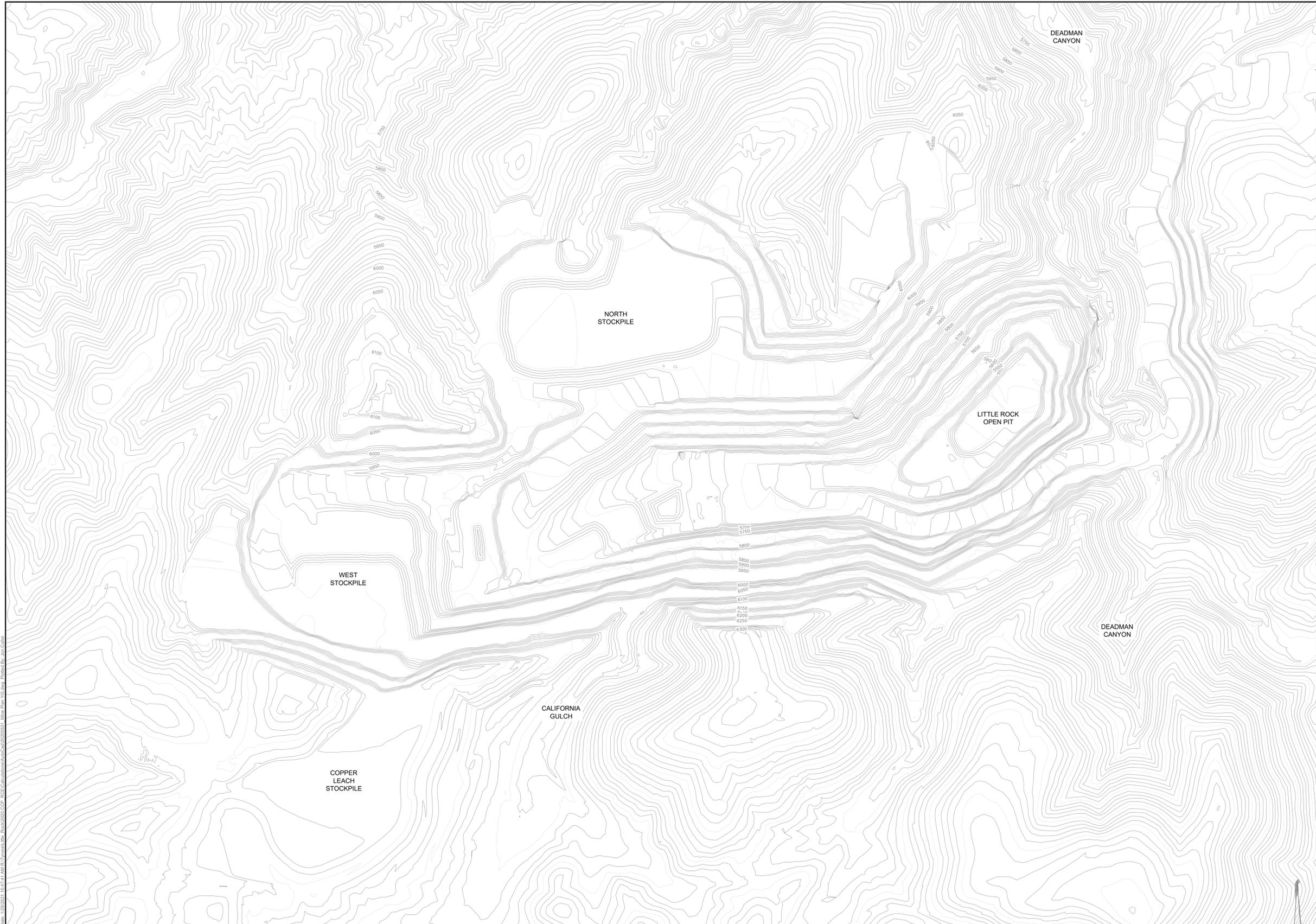
**Table 2 Highest Reclamation Cost Year Calculation Results**

Year	Flat Areas (ac)	Reclamation Grade Slopes (ac)	Steep Slopes (ac)	Pit Lake (ac)	Total Area (ac)	Weighted Total	Reclamation Cost Index
RCI -->	0.4	0.7	1	0			
2019	82.6	6.1	6.2	44.1	139.0	43.5	0.0435
2020	129.8	4.4	26.1	52.0	212.3	81.1	0.0811
2021	129.3	6.7	28.7	52.0	216.7	85.2	0.0852
2022	114.4	29.4	30.2	52.1	226.1	96.6	0.0966
2023	98.0	32.0	38.3	77.0	245.3	99.8	0.0998
2024	100.7	33.4	40.4	84.7	259.2	104.0	0.1040

A graphical representation of the values presented in Table 2 are shown on Figure 13 (attached).

## 4.0 DISCUSSION AND CONCLUSIONS

As shown in Table 2 and on Figure 13 mine plan year 5 (2024) had the highest reclamation cost index and was therefore determined to be the highest reclamation cost year. Since mine plan year 5 also had the largest total area of disturbance (259.2 acres) and the largest area of reclamation grade slopes (33.4 acres) and steep slopes (40.4 acres) which have been determined in earlier RCEs to have the highest relative reclamation costs, it would be expected that mine plan year 5 would be the highest reclamation cost year. Therefore, it was our opinion that reclamation year 5 is truly the highest reclamation cost year and the results of this analysis were valid.



**LEGEND / NOTES**

CHANGE BOUNDARY

0 250  
SCALE IN FEET

↑  
COORDINATE SYSTEM  
TYRONE LOCAL

REVISIONS				
#	DESCRIPTION	DATE	BY	APPROVED
1	1ST DRAFT FOR REVIEW	3/25/20	JC	JC
2	FINAL	5/1/20	JC	JC

DATE	5/1/2020
PROJECT	200540a
TASK NUMBER	001-01
DRAWN BY	JC
PROJECT ENGINEER	JC
CHECKED BY	-

2020 LITTLE ROCK CCP

**EXISTING CONDITIONS  
(END OF 2019)**

SHEET NUMBER:	REVISION NUMBER:
1	1

PREPARED BY:  
**TELESTO**  
SOLUTIONS CORPORATION

PREPARED FOR:  
**FREEMPORT-McMORAN**

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**LEGEND / NOTES**

CHANGE BOUNDARY

0 250  
SCALE IN FEET

COORDINATE SYSTEM  
TYRONE LOCAL

**REVISIONS**

#	DESCRIPTION	DATE	BY	APPROVED
1	1ST DRAFT FOR REVIEW	2/13/20	JC	JC
2	AS PER ML COMMENTS	3/17/20	JC	JC
3	AS PER ML COMMENTS	3/19/20	JC	JC
4	FINAL	5/1/20	JC	JC

DATE	5/1/2020
PROJECT	200540a
TASK NUMBER	001-01
DRAWN BY	JC
PROJECT ENGINEER	JC
CHECKED BY	-

2020 LITTLE ROCK CCP

**YEAR 2  
MINE PLAN  
(END OF 2021)**

SHEET NUMBER: 5	REVISION NUMBER: 3
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**TELESTO**  
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**FREEMPORT-McMORAN**

0:06 1/25/2021 11:18:39 AM R:\Projects\2020\200540a\2020\001\Mine Plan\Y2 Mine Plan.dwg Plotted By: jon cooke

CLOSURE AREAS (AC.)	
PIT LAKE	52.0
SLOPED AREA - ANGLE OF REPOSE	28.7
SLOPED AREA - BENCHED AT 3.5:1	6.7
FLAT AREA	129.3
<b>TOTAL</b>	<b>216.7</b>

LEGEND / NOTES

- PIT LAKE AREA
- SLOPED AREA - ANGLE OF REPOSE
- SLOPED AREA - BENCHED AT 3.5:1
- FLAT AREA



REVISIONS

#	DESCRIPTION	DATE	BY	APPROVED
1	1ST DRAFT FOR REVIEW	3/17/20	JM	JC
2	AS PER ML COMMENTS	3/29/20	JM	JC
3	FINAL	5/1/20	JM	JC

DATE	5/1/2020
PROJECT	2005400
TASK NUMBER	001-01
DRAWN BY	JM
PROJECT ENGINEER	JC
CHECKED BY	-

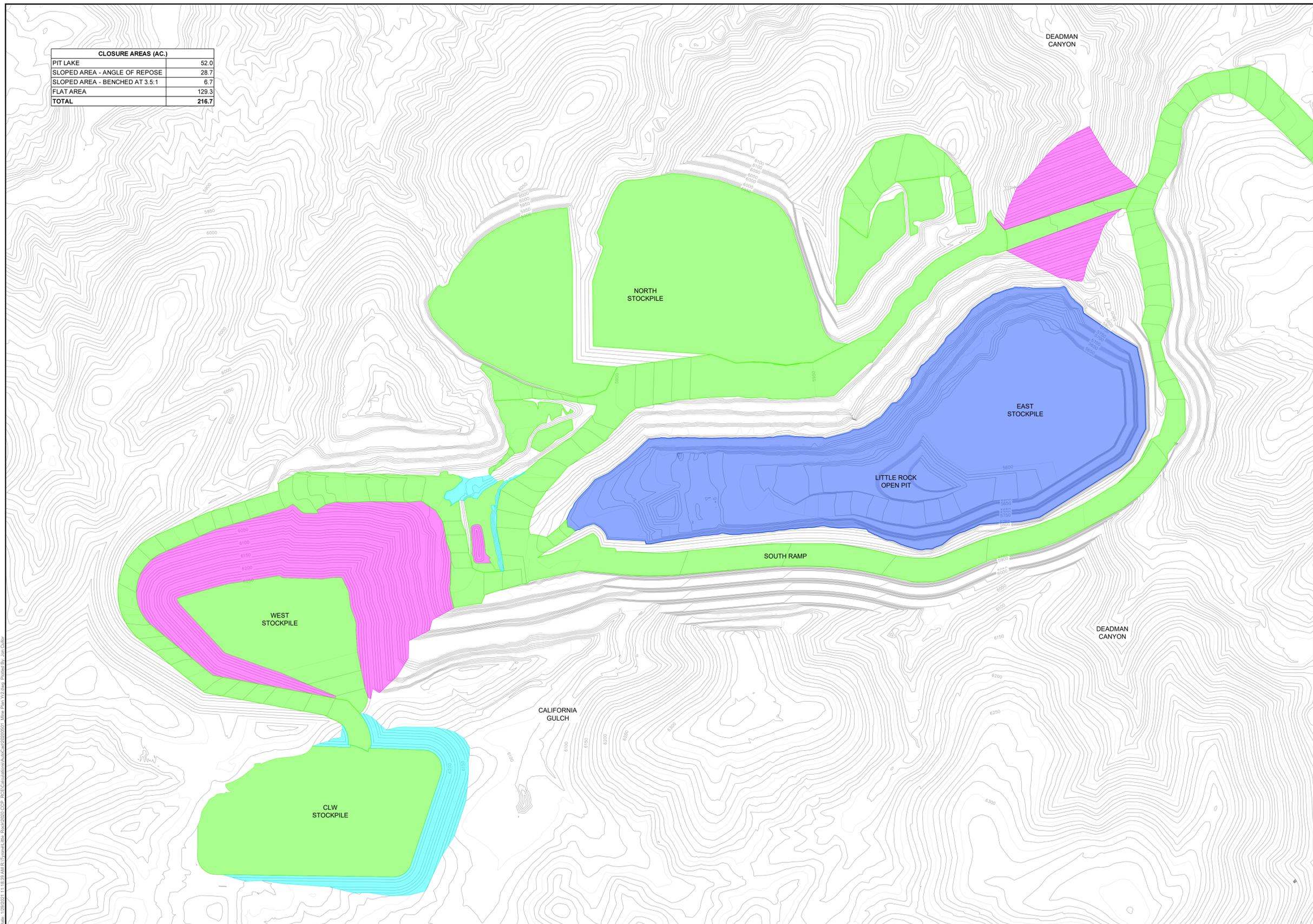
2020 LITTLE ROCK CCP

**YEAR 2 CLOSURE AREAS FOR HIGHEST RECLAMATION COST YEAR CALCS. (END OF 2021)**

SHEET NUMBER:	6	REVISION NUMBER:	2
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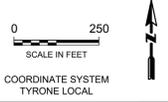
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CLOSURE AREAS (AC.)	
PIT LAKE	52.1
SLOPED AREA - ANGLE OF REPOSE	30.2
SLOPED AREA - BENCHED AT 3.5:1	29.4
FLAT AREA	114.4
<b>TOTAL</b>	<b>226.1</b>

**LEGEND / NOTES**

- PIT LAKE AREA
- SLOPED AREA - ANGLE OF REPOSE
- SLOPED AREA - BENCHED AT 3.5:1
- FLAT AREA



**REVISIONS**

#	DESCRIPTION	DATE	BY	APP'D
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2	AS PER ML COMMENTS	3/25/20	JM	JC
3	FINAL	5/1/20	JM	JC

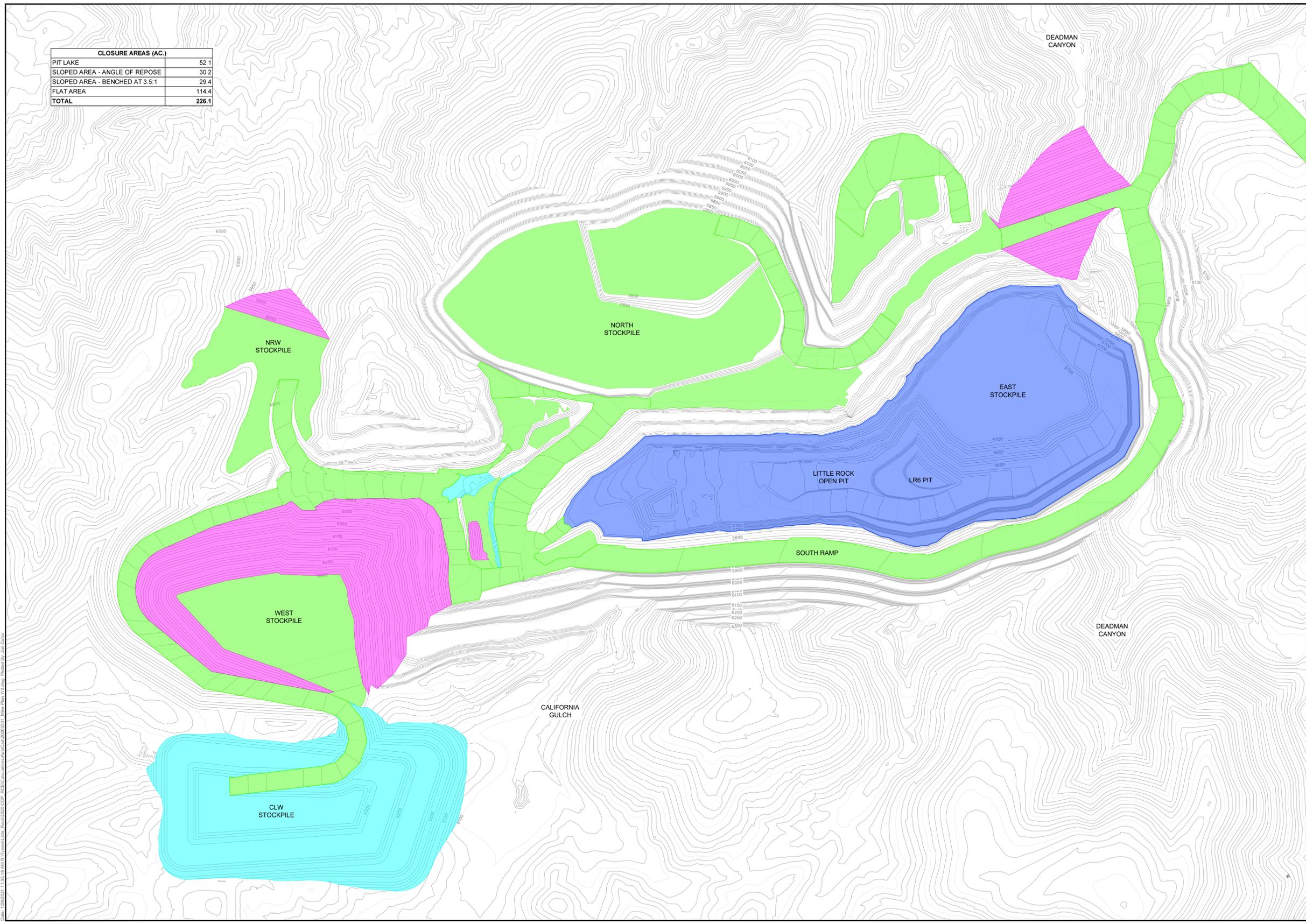
DATE	5/1/2020
PROJECT	2005400
TASK NUMBER	001-01
DRAWN BY	JM
PROJECT ENGINEER	JC
CHECKED BY	-

2020 LITTLE ROCK CCP

**YEAR 3 CLOSURE AREAS FOR HIGHEST RECLAMATION COST YEAR CALCS. (END OF 2022)**

SHEET NUMBER:	8	REVISION NUMBER:	2
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PREPARED BY:  
 TELESTO SOLUTIONS INC.  
 PREPARED FOR:  
 FREEPORT-McMORAN



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**LEGEND / NOTES**

CHANGE BOUNDARY

0 250  
SCALE IN FEET

COORDINATE SYSTEM  
TYRONE LOCAL

**REVISIONS**

#	DESCRIPTION	DATE	BY	APP'D
1	1ST DRAFT FOR REVIEW	2/13/20	JC	JC
2	AS PER ML COMMENTS	3/17/20	JC	JC
3	AS PER ML COMMENTS	3/25/20	JC	JC
4	FINAL	5/1/20	JC	JC

DATE	5/1/2020
PROJECT	200540a
TASK NUMBER	001-01
DRAWN BY	JC
PROJECT ENGINEER	JC
CHECKED BY	-

2020 LITTLE ROCK CCP

**YEAR 4  
MINE PLAN  
(END OF 2023)**

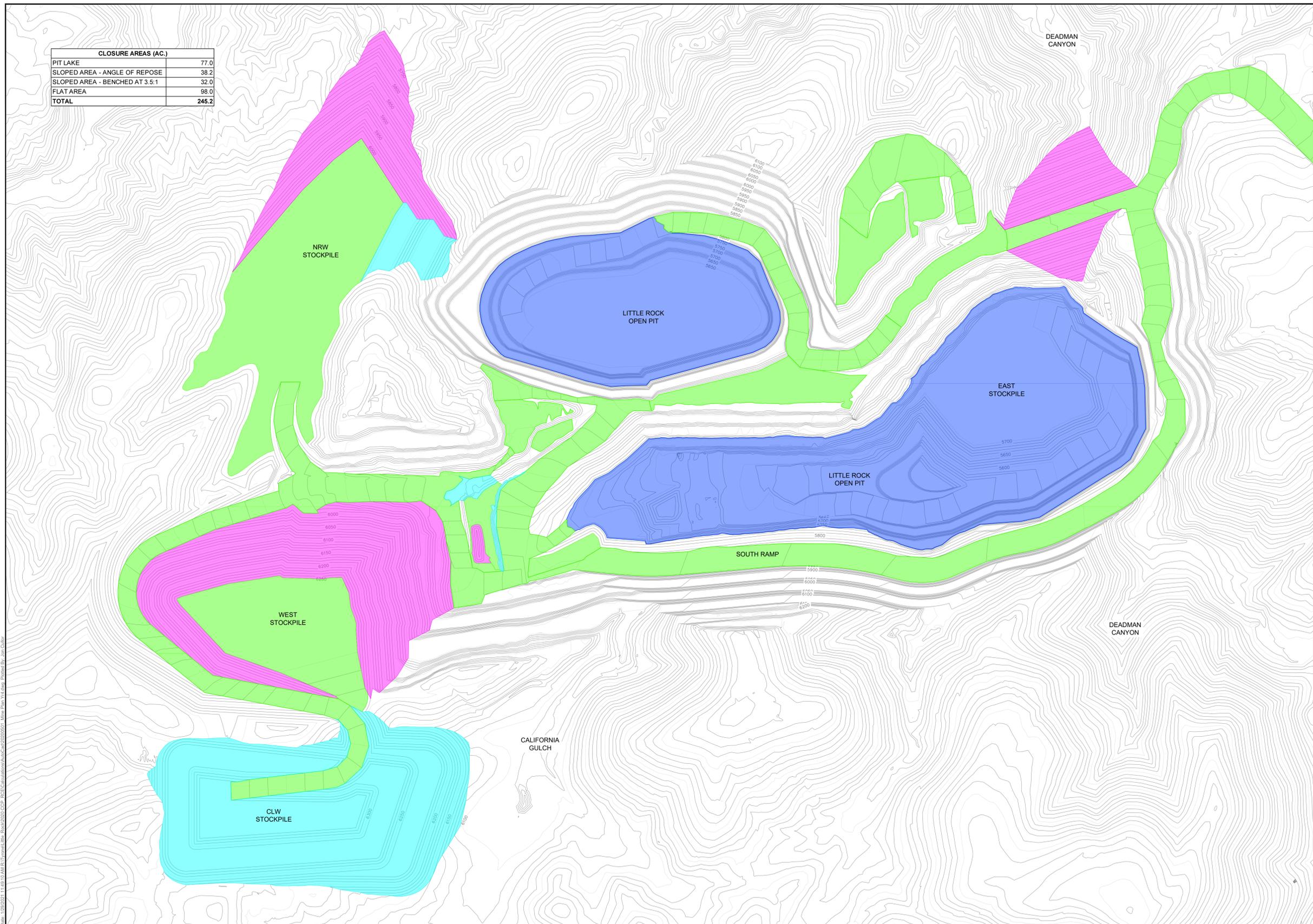
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PREPARED FOR:  
**FREEMPORT-McMORAN**

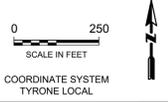
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CLOSURE AREAS (AC.)	
PIT LAKE	77.0
SLOPED AREA - ANGLE OF REPOSE	38.2
SLOPED AREA - BENCHED AT 3.5:1	32.0
FLAT AREA	98.0
<b>TOTAL</b>	<b>245.2</b>



LEGEND / NOTES

- PIT LAKE AREA
- SLOPED AREA - ANGLE OF REPOSE
- SLOPED AREA - BENCHED AT 3.5:1
- FLAT AREA



REVISIONS

#	DESCRIPTION	DATE	BY	APPROVED
1	FIRST DRAFT FOR REVIEW	3/17/20	JM	JC
2	AS PER ML COMMENTS	3/25/20	JM	JC
3	FINAL	5/1/20	JM	JC

DATE	5/1/2020
PROJECT	2005400
TASK NUMBER	001-01
DRAWN BY	JM
PROJECT ENGINEER	JC
CHECKED BY	-

2020 LITTLE ROCK CCP

**YEAR 4 CLOSURE AREAS FOR HIGHEST RECLAMATION COST YEAR CALCS. (END OF 2023)**

SHEET NUMBER:	10	REVISION NUMBER:	2
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SOLUTIONS CORPORATION

PREPARED FOR:  
**FREEMPORT-MCMORAN**

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CLOSURE AREAS (AC.)	
PIT LAKE	84.7
SLOPED AREA - ANGLE OF REPOSE	40.4
SLOPED AREA - BENCHED AT 3.5:1	33.4
FLAT AREA	100.7
<b>TOTAL</b>	<b>259.2</b>

**LEGEND / NOTES**

- PIT LAKE AREA
- SLOPED AREA - ANGLE OF REPOSE
- SLOPED AREA - BENCHED AT 3.5:1
- FLAT AREA

0 250  
SCALE IN FEET

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COORDINATE SYSTEM  
TYRONE LOCAL

**REVISIONS**

#	DESCRIPTION	DATE	BY	APP'D
1	1ST DRAFT FOR REVIEW	3/17/20	JM	JC
2	AS PER ML COMMENTS	3/25/20	JM	JC
3	FINAL	5/1/20	JM	JC

DATE	5/1/2020
PROJECT	2005400
TASK NUMBER	001-01
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PROJECT ENGINEER	JC
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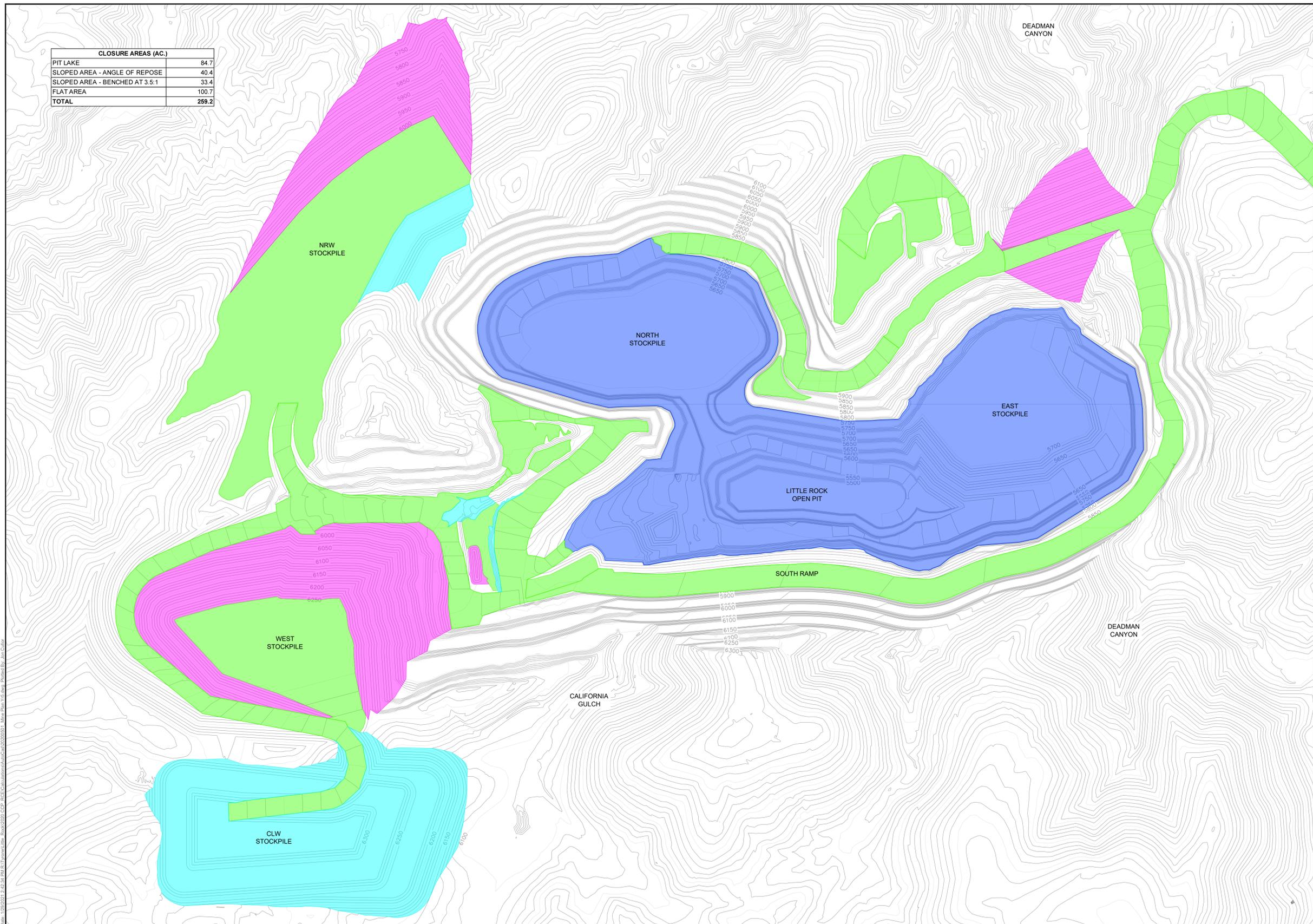
2020 LITTLE ROCK CCP

**YEAR 5 CLOSURE AREAS FOR HIGHEST RECLAMATION COST YEAR CALCS. (END OF 2024)**

SHEET NUMBER:	12	REVISION NUMBER:	2
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**FREEMORAN**



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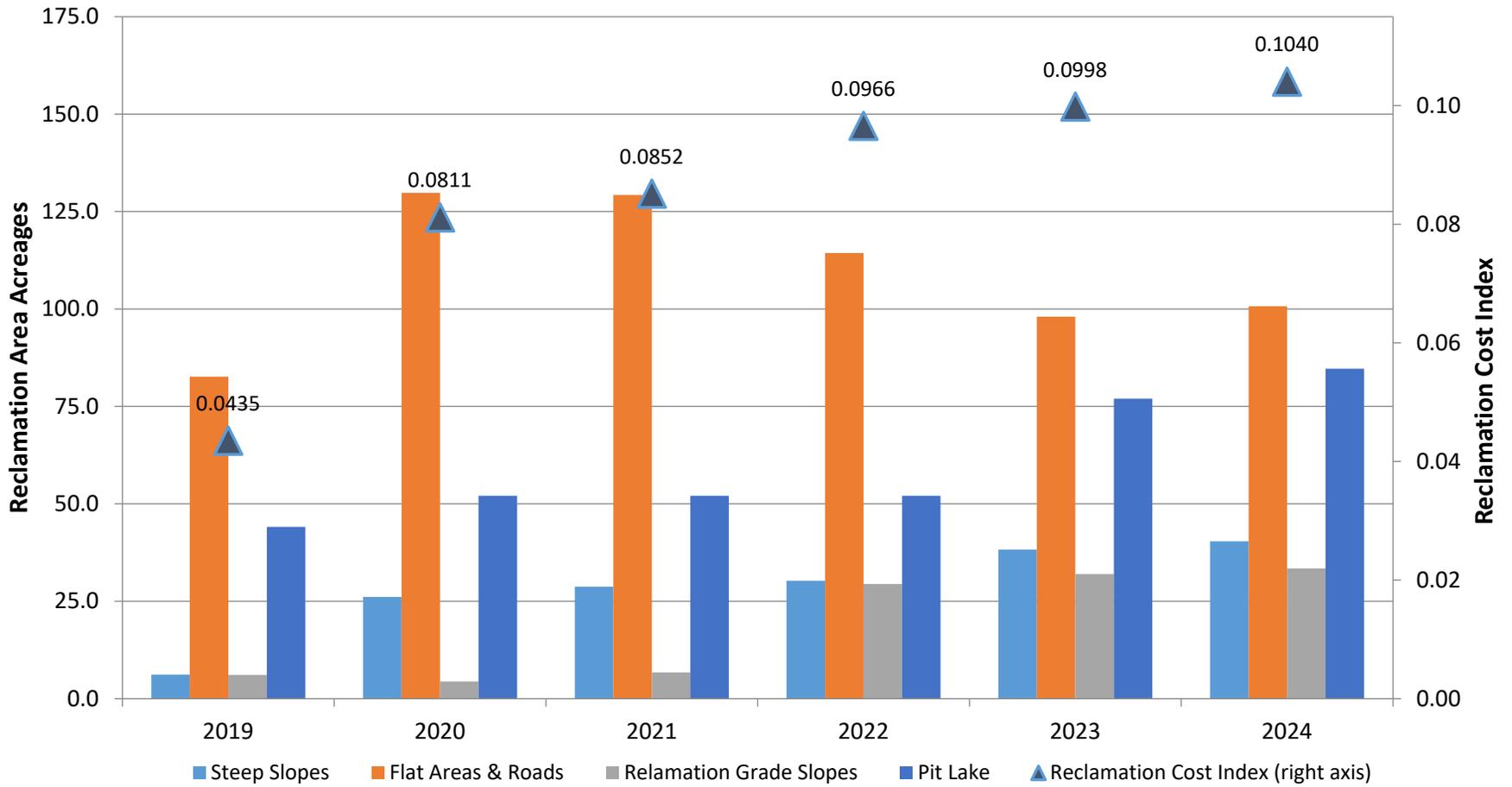


FIGURE 13  
HIGHEST RECLAMATION COST YEAR CALCULATION RESULTS