Appendix D

Calculations and Key Equations

Equations used in Cost Spreadsheet

EQUATIONS USED IN CAPITAL COST SPREADSHEET

Sheet #4 Earthwork:

Bank Volume (bcy)= Loose Volume(cy)/(1+Swell Factor)

*Loose Volume (lcy)= Area (ac)*Cover Depth (in)*43560 (ft^2/ac)/(12 (in/ft)*27 (cy/ft^3))*

*** Swell Factor only applies to the cover material volume calculations*

Sheet #5 Dozer (Grading):

Productivity Example for D11T CD:

*Normal productivity (cy/hr) = 162,758.76 * Centroid to Centroid Push Distance(ft)$^{-0.866691}$*

(Caterpillar Performance Handbook Edition 47 page 19-51)

$$Productivity\ (cy/hr) = Normal\ Production\ (cy/hr) * Operator * Material * \frac{Work\ Hour\ (min/hr)}{60\ (min/hr)} * Grade\ Factor * \frac{2300\ (lbs/cy)}{Material\ Weight\ (lbs/cy)} * Prod.\ Method * Visibility * Elev. * Drive\ Trans.$$

$$Total\ Task\ Time\ (hr) = \frac{Loose\ or\ Stockpile\ Volume\ (cy)}{\text{Productivity}\ (cy/hr)}$$

$$Grade\ (Dozing\ Factor) = -0.02 * Grade\ (\%) + 1$$

$$(Caterpillar\ Performance\ Handbook\ Edition\ 48\ page\ 19-55)$$

Sheet #7 Ripper:

$$\text{Productivity } (acres/hr) = \frac{Work\ Hour\ (min/hr)}{\left[\left(\frac{Ripping\ Length\ (ft)}{5280(ft/mi) * \frac{Speed\ (mi/hr)}{60\ (min/hr)}}\right) + Turn\ Time\ (min/pass)\right] * Passes/Acre^{*}}$$

$$Task\ Time\ (hr) = \frac{Area\ (acres)}{\text{Productivity } (acres/hr)}$$

$$Passes/Acre^{*} = \frac{43560\ (ft^2/acre)}{Ripping\ Length\ (ft) * Ripped\ Width\ Plus\ Distance\ b/n\ Passes\ (ft)}$$

**Passes are 1000 ft for large surface areas and 100 ft for reservoirs*

$$Ripped\ Width\ Plus\ Distance\ b/n\ Passes\ (ft) = ((Pocket\ Spacing\ (in) + Distance\ Between\ Passes\ (in)) * No. Shank\ Pockets)/(12(in/ft))$$

Sheet #8 Excavator:

$$Task\ Time\ (hr) = (Cycle\ Time\ (min))/(60(min/hr)) * (Area\ (ac) * 0.5 * 43560(ft^2/ac))/(Sheepsfoot\ Roller\ Width\ (ft) * Maximum\ Reach\ (ft))$$

Sheet #9 Trucks:

$$Truck\ Cycle\ Time\ (min) = Haul\ Time\ (min) + \text{Return } Time\ (min) + Loading\ Time\ (min) + Truck\ Exchange\ Time\ (min) + Dump/Maneuver\ Time\ (min)$$

$$\text{Productivity } (cy/hr) = Work\ Hour\ (min/hr) * Loader/Shovel\ Cycles\ Per\ Truck * Loader/Shovel\ Net\ Bucket\ Cap\ (cy) * \frac{Optimum\ Number\ of\ Trucks}{Truck\ Cycle\ Time\ (min)}$$

$$Task\ Time\ (hr) = Maximum\ \left[\frac{Volume\ (cy)}{\text{Productivity } (cy/hr)}, Loader\ Task\ Time\ (hr)\right]$$

$Loader/\ Shovel\ Cycles\ Per\ Truck$

$$= Maximum\ \left[\frac{Truck\ Struck\ Capacity\ (cy)}{Loader/Shovel\ Net\ Bucket\ Capacity\ (cy)}, \frac{Truck\ Heaped\ Capacity\ (cy)}{Loader/Shovel\ Net\ Bucket\ Capacity\ (cy)}\right]$$

$$Total\ Haul\ \text{Distance}\ (ft) = \sum Segment\ Haul\ \text{Distance}\ (ft)$$

$$Haul\ \text{Distance}\ Segment\ (m) = Haul\ \text{Distance}\ (ft) * 0.3048\ \left(\frac{m}{ft}\right)$$

$Haul\ Effective\ Grade\ (\%) = If(Haul\ Grade\ (\%) \geq$
$Rolling\ Resistance\ (\%), \big(Haul\ Grade\ (\%) +$
$Rolling Resistance\ (\%)\big), Absolute\ Value(Haul\ Grade\ (\%) + Rolling Resistance\ (\%))$

$\text{Return}\ Effective\ Grade\ (\%) = If(-Haul\ Grade\ (\%) \geq$
$Rolling\ Resistance\ (\%), \big(-Haul\ Grade\ (\%) +$
$Rolling Resistance\ (\%)\big), Absolute\ Value(-Haul\ Grade\ (\%) + Rolling Resistance\ (\%))$

Travel Time Loaded and Empty (Uphill)Example for 777F:

$777F\ Segment\ Travel\ Time\ Loaded\ Uphill\ (min/\ m) =$
$6.43 * Haul\ Effective\ Grade\ Segment\ (\%)\ ^4$
$- 3.2933 * Haul\ Effective\ Grade\ Segment\ (\%)\ ^3$
$+ 0.6548 * Haul\ Effective\ Grade\ Segement\ (\%)\ ^2$
$- 0.005 * Haul\ Effective\ Grade\ Segment\ (\%) + 0.0009$

$777F\ Segment\ Travel\ Time\ Empty\ Uphill\ (min/\ m) =$
$- 0.0197 * \text{Return}\ Effective\ Grade\ Segment\ (\%)\ ^4$
$+ 0.0276 * \text{Return}\ Effective\ Grade\ Segment\ (\%)\ ^3$
$+ 0.011 * \text{Return}\ Effective\ Grade\ Segement\ (\%)^2$
$+ 0.0008 * \text{Return}\ Effective\ Grade\ Segement\ (\%) + 2.147$
$(Caterpillar\ Performance\ Handbook\ Edition\ 41\ page\ 9 - 39)$
$This\ is\ repeated\ for\ loaded\ and\ empty\ downhill\ travel\ times$

$$Haul\ Time\ (min) = \sum (Segment\ Travel\ Time\ Loaded\ (min/\ m) * Segment\ Haul\ Dist\ (m))$$

Return $Time\ (min)$

$$= \sum (Segment\ Travel\ Time\ Empty\ (min/\ m) * Segment\ Haul\ Dist\ (m))$$

$$Loading\ Time\ (min) = Loader/Shovel\ Cycle\ Time\ (min)$$

Sheet #10 Loader or Shovel:

$$Net\ Bucket\ Capacity\ (cy) = Struck\ (Rated)\ Bucket\ Capacity\ (cy) * Bucket\ Fill\ Factor$$

$$\text{Productivity}\ (cy/hr) = \frac{Net\ Bucket\ Capcity\ (cy) * Work\ Hour\ (min/\ hr)}{Loader/Shovel\ Cycle\ Time\ (min)}$$

$$Task\ Time\ (hr) = \frac{Volume\ (cy)}{\text{Productivity}\ (cy/hr)}$$

Sheet #11 Scraper:

$$Effective\ Grade\ Uphill\ (\%) = If(Haul\ Grade\ (\%) + Rolling\ Resistance\ (\%) > 0, \left(Absolute\ Value\ (Haul\ Grade\ (\%)) + Rolling\ Resistance\ (\%)\right), 0)$$

$$Effective\ Grade\ Downhill\ (\%) = If(Haul\ Grade\ (\%) - Rolling\ Resistance\ (\%) < 0, 0, \left(Absolute\ Value\ \left(Haul\ Grade\ (\%)\right) - Rolling\ Resistance\ (\%)\right))$$

Travel Time/Speed Loaded Speed (Downhill & Uphill) Example for 657G:

*Loaded Downhill Speed (mph) = 1/(0*Effective Grade Downhill^4 - 0.1612* Effective Grade Downhill ^3+0.1031* Effective Grade Downhill ^2 - 0.0081* Effective Grade Downhill +0.0016)*1609.344 m/mi/60 min/hr)*

(unless speed <0 then 0 or unless speed>maximum speed then maximum speed)

*Loaded Uphill Speed (mph) = 1/(0.3036*Effective Grade Uphill^4 - 0.4512* Effective Grade Uphill ^3+0.2181* Effective Grade Uphill ^2 - 0.0034* Effective Grade Uphill +0.0013)*1609.344 m/mi/60 min/hr)*

(unless speed <0 then 0 or unless speed>maximum speed then maximum speed)

$(Caterpillar\ Performance\ Handbook\ Edition\ 47\ page\ 24-30)$

$This\ is\ repeated\ for\ empty\ downhill\ and\ uphill\ travel\ times$

$$Scraper\ Return\ Cycle\ Task\ Time\ (min) = \frac{Total\ Haul\ Distance\ One\ Way(ft)}{Empty\ Scraper\ Return\ Speed\ (mph)*88\left(\frac{ft}{mi}\right)\left(\frac{hr}{min}\right)} + \frac{Total\ Haul\ Distance\ One\ Way(ft)}{Full\ Scraper\ Haul\ Speed\ (mph)*88\left(\frac{ft}{mi}\right)\left(\frac{hr}{min}\right)} + LoadTime(min) + Maneuver\&\ Spread\ Time(min)$$

$$Cycles\ Per\ Scraper\ Per\ Hour = Work\ Hour\ (min/hr)/ Scraper\ Return\ Cycle\ Task\ Time\ (min)$$

$$Productivity\ Per\ Heaped\ Scraper\ (cyhr) = \ Cycles\ Per\ Scraper\ Per\ \ Hour * Minimum(Heaped\ Capacity\ (cy), Rated\ Load\ (lb)/Soil\ Weight\ (lb/cy)\ )$$

$$Total\ Task\ Time(hr) = Volume(cy)/(Productivuty\ Per\ Heaped\ Scrapper\ (cy/hr))$$

$$Task\ Time\ All\ Scrapers\ (hrs) = (Total\ Task\ Time\ (hr))/(Number\ of\ Scrapers)$$

Sheet #12 M'grader

$$Grader\ Shaping\ Productivity\ (acre/hr) = WorkHour(min/hr)/(60\ (min/hr)) * MaterialFactor * ((2300\ (lb/cy))/MaterialWeight(lb/cy)\ ) * ProductionMethod, Blade * OperatorFactor * GradeFactor * Speed\ (mph) * (Eff.Blade\ Width(ft) - Pass\ Overlap(ft)) * 5280(ft/mi)/43560(ft\hat{}2/ac)$$

(Motor Grader Productivity, Caterpillar Performance Handbook Edition 48)

$$Task\ Time(hr) = Area(acre)/(GradingShapingProductivity(acre/hr))$$

$$Grade\ Factor = -0.02 * \%\ Final\ Grade + 1$$

Sheet #13 Earth Sum:

$$Direct\ Equipment\ Cost\ (\$) = [Lube, Tires, GEC, \&\ Field\ Parts\ Adjusted\ Rental\ Cost\left(\frac{\$}{hr}\right) + \ Labor\ Cost\ \left(\frac{\$}{hr}\right) + \ Field\ Cost\ \left(\frac{\$}{hr}\right)] * \ TimeRequired\ (hr) * \ Number\ of\ Units\ of\ Equipment$$

Sheet #14 Reveg:

$$Direct\ Fuel\ Cost\ (\$) = Fuel\ Unit\ Cost(\$/acre) * Area(acre)$$

$Direct\ Reveg.Cost\ (\$) = Reveg.Unit\ Cost(\$/acre) * Area(acre)$

Sheet #15 Other:

$Fuel\ Direct\ Cost\ (\$/units) = Quantity\ (units) * Fuel\ Unit\ Cost(\$/unit)$

$Direct\ Cost(\$) = Quantity\ (units) * \ Unit\ Cost(\$/unit)$

Sheet #16 Sum:

$$\begin{aligned} Subtotal\ Direct\ Costs\ (\$) \\ &= \ Facility\ and\ Structure\ Removal\ Total\ Direct\ Cost\ (\$) \\ &+ \ Earthmoving\ Total\ Direct\ Cost\ (\$) \ + Reveg.Total\ Direct\ Cost\ (\$) \\ &+ \ Other\ Total\ Direct\ Cost\ (\$) \end{aligned}$$

$$\boldsymbol{Subtotal\ Indirect\ Costs}(\$) = \boldsymbol{SubTotal\ Direct\ Cost}\ (\$) * \frac{\boldsymbol{Indirect\ Costs}\ (\%)}{\mathbf{100}}$$

$$\boldsymbol{Total\ Cost}\ (\$) = \boldsymbol{Subtotal\ Direct\ Cost}\ (\$) + \boldsymbol{Subtotal\ Indirect\ Cost}\ (\$)$$

Sheet #18 Truck Optimization:

$Loader/Shovel\ Time\ Per\ Truck = (Loader/Shovel\ Cycles\ per\ Truck) * (Loader/Shovel\ Cycle\ Time)$

$Maximum\ Number\ of\ Trucks\ Per\ Loader/Shovel = (Truck\ Cycle\ Time\ Per\ Truck)/(Loader/Shovel\ Time\ per\ Truck)$

$$\begin{aligned} \text{Productivity}\ (cy/hr) &= \\ & Work\ Hour\ (min/hr) * Loader/Shovel\ Cycles\ Per\ Truck \\ & * Loader/Shovel\ Net\ Bucket\ Capacity\ (cy) * \frac{Number\ of\ Trucks[n]}{Truck\ Cycle\ Time\ (min)} \end{aligned}$$

$Task\ Time\ (hr) = (Haul\ Volume(cy))/Productivity(cy/hr)$

$$Cost\ of\ [n]\ Trucks\ per\ Loader\ (\$) = MAX(Truck\ Task\ Time, Loader\ Task\ Time) * (Loader\ Cost\ (\$/hr) + [n] * Truck\ Cost\ (\$/hr))$$

Sheet #19 Scraper Optimization:

$$Max\ No. Scrapers\ Per\ Dozer = (Scraper\ Return\ Cycle\ Task\ Time\ (min))/ (Pusher\ Cycle\ Time\ (min/cycle)\ )$$

$$Task\ Time\ per\ [n]Scrapers\ (hr) = Task\ Time\ for\ 1\ Scraper\ (hr)/[n]$$

$$\begin{aligned} Cost\ of\ [n]\ Scrapers\ per\ Dozer\ (\$) \\ &= (Task\ Time\ per\ [n]Scrapers\ (hr) * [n] * Scraper\ Cost(\$/hr)) \\ &+ (Task\ Time\ per\ [n]Scrapers * Dozer\ Cost\ (\$/hr)) \end{aligned}$$

Earthwork RCE Calculation Summary

Calculation Documentation

Problem Statement:

Freeport-McMoRan's Chino Mines Company has utilized a spreadsheet developed by the New Mexico Mining and Minerals Division (MMD) to estimate the earthwork's closure costs associated with the Chino Mine Closure/Closeout Plan (CCP). The spreadsheets are intricate and complex and require careful study to master their structure. Each worksheet groups similar activities, and each line on each worksheet documents one construction step required to complete reclamation. All lines totaled equal the entire earthworks for the CCP. The sheer amount of information in the spreadsheet makes review of the cost estimate difficult for a site as complex as the Chino Mine.

Objective:

1. Provide a guide to the earthwork spreadsheets.
2. Note that this calculation set presents the approach, data and assumptions, and calculations and results for developing the unit cost. It is intended to serve as a guide/example even if the actual quantities and/or cost data used in these calculations change due to updates or application to a different Freeport NM Operations mine.

Approach:

1. Identify worksheets within the spreadsheet.
2. Provide a general equation or explanation of the calculation performed in each worksheet.
3. Use a graphic of each worksheet to illustrate the equations and augment the explanations pertaining to the specific worksheet.

Results:

The following worksheets are included within the earthwork RCE spreadsheet and covered in this calculation documentation:

Databases:

1. Quantities
2. Activity-Material Codes
3. Unit Rates
4. Equipment

Earthwork Calculations:

1. General
2. Demo
3. Material
4. Earthwork
5. Dozer
6. Site Maint
7. Ripper
8. Excavator
9. Trucks
10. Shovel
11. Scrapers
12. M'grader
13. Earth Sum
14. Revegetation
15. Other
16. Summary
17. Facility Characteristics

Results:

The following worksheets are included within the earthwork RCE spreadsheet and covered in separate calculation documentations:

Equipment Optimization:

1. Truck Optimization
2. Scraper Optimization

O&M:

1. Full Site Vegetation Maintenance
2. Full Site O&M
3. Full Site O&M Summary

Building Demolition:

1. Building Demo
2. Building Cover
3. Building Vegetation
4. Building Hazardous Waste
5. Building Summary

Unit Costs:

1. Bench Grading
2. Bench Channel
3. Top Channel
4. Downdrain
5. Haul Road
6. Pipeline
7. Revegetation

Results Cont'd

Sheet 1 – General: A summary of the overall costs (before escalation and discounting for the time-value of money) are included on this sheet along with the applicant's information.

	A	B	C
1			Chino
2			Stockpile Spreadsheet Worksheet #1
3	***General Information***		2/12/2019
4			
5	Applicant	Chino Mines Company	
6		Hurley, New Mexico 88043	
7			
8			
9			
10			
11	Disturbed Surface Area (acres)	6,657	
12			
13	Type of Operation	Existing/Surface/Copper	
14			
15			
16			
17	*Current value of earthwork and O&M before escalation and discounting*	**$217,256,147**	
18			
19			
20			
21			
22			**Stockpiles, Tailing,**
23	*Based on Golder 2018 Closure/Closeout Plan*		**Reservoirs, Haul Roads**
24			**and Disturbed Areas**

Quantities Sheet: This sheet assigns an item code to a facility and corresponding sub-area code with a description of the facility and sub-area. This sheet provides raw data and factors (such as area, volume, distances, grades, etc.) to be used in calculations within all the other worksheets. Each facility is broken down into sub-areas to account for differing reclamation quantities to more accurately determine the amount of work required for each facility. The Quantities sheet includes 42 columns of hard-wired (hand entered) data associated with each facility. Columns A through R for Triangle Stockpile and South Stockpile are shown as an example:

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
1																		
2	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
3	Item	Facility	Sub Area	Description	Area (sf)	Volume (cy)	Push Distance (ft)	Current Grade (%)	Coarse Regrading and Fine Grading (%)	Scraper Haul (ft)	Scraper Grade (%)	Down Drains (ft)	Downdrain ACB (sf)	Downdrain Dissipater (ea)	Bench Channels (ft)	Bench Grading (ft)	Top Area (sf)	Outslope Area (sf)
4	1000	Triangle Stockpile	T-0	Entire Stockpile	3,551,587										13,831	13,831	209,232	3,342,355
5	1001	Triangle Stockpile	T-1	Outslope	3,342,355	3,074,286	703	0.0%	-28.6%							-		
6	1002	Triangle Stockpile	T-2	Top	209,232				-1.0%							-		
7	1100	South Stockpile	S-0	Entire Stockpile	25,465,254							6,474	202,067	2	95,487	95,487	3,729,480	21,735,774
8	1101	South Stockpile	S-1	Outslope	280,820	348,051	389	-37.4%	-28.6%	4,809	7.2%					-		
9	1102	South Stockpile	S-2	Outslope	3,784,164	4,690,126	1,550	-38.5%	-28.6%	5,418	8.4%					-		
10	1103	South Stockpile	S-3	Outslope	3,309,641	4,101,997	1,840	-36.9%	-28.6%	2,633	7.6%					-		
11	1104	South Stockpile	S-4	Outslope	1,649,617	2,044,550	1,204	-35.5%	-28.6%	2,316	12.7%					-		
12	1105	South Stockpile	S-5	Outslope	3,599,540	4,461,300	2,025	-37.0%	-28.6%	1,969	11.8%					-		
13	1106	South Stockpile	S-6	Outslope	3,971,949	4,922,868	2,017	-37.4%	-28.6%	1,927	14.3%					-		
14	1107	South Stockpile	S-7	Outslope	2,075,308	2,572,155	1,206	-37.2%	-28.6%	1,927	14.3%					-		
15	1108	South Stockpile	S-8	Outslope	2,953,650	3,660,779	893	-41.3%	-28.6%	1,761	10.6%					-		
16	1109	South Stockpile	S-9(1)	Outslope	111,085	137,679	158	-43.8%	-28.6%	479	7.5%					-		
17	1110	South Stockpile	S-9(2)	Top	1,996,950	115,155	809	-0.5%	-1.0%							-		
18	1111	South Stockpile	S-9(3)	Top	1,732,530	99,907	648	-0.2%	-1.0%							-		

For example use only. Values may not match the current spreadsheet.

Results Cont'd

Activity-Material Codes Sheet: This sheet assigns an activity code (column A) to each activity (column B)

	A	B	C
1	**Item**	**Activity**	**Description**
2	A	Grade	Rough grading original material or fine grading cover material
3	B	Dozer Assist	Dozer is used to assist loader or shovel at cover stockpile or assist scrapers during rough grading
4	C	Load	Cover material is loaded at borrow areas onto haul trucks
5	D	Haul	Haul trucks transport cover material from borrow areas to destination stockpiles
6	E	Rip	Tops of stockpiles are ripped before placing cover to compensate for compaction of soil during rough grading. Stockpiles are also ripped before rough grading with a scraper. Borrow stockpiles are ripped before revegetation.
7	F	Grade Benches	Benches are graded at stockpiles and tailings after fine grading
8	G	Construct Downdrains	Downdrains are constructed after fine grading and consist of articulated concrete blocks (ACB's)
9	Gb	Construct Downdrain Dissipators	Energy dissipators are specified as part of the downdrains
10	H	Construct Bench Channels	Bench channels are constructed along benches after bench grading. Construction includes excavation and wasting, riprap production, riprap and filter placement, and final grading.
11	I	Construct Top Channels	Top channels are constructed after final grading. Construction includes excavation, wasting, and final grading.
12	J	Revegetate	Occurs after final grading and channel construction and includes tractor rental and maintenance, fuel, scarifying, discing, drill seeding, mulching, crimping, seed, and mulch
13	K	Perforate Liner	Reservoir liners are perforated prior to reclamation
14	L	Replace Infrastructure	Replacing infrastructure is not part of this RCE
15	M	Post-Closure O&M	Includes vegetation maintenance for 12 years after reclamation and erosion control, road maintenance, and groundwater monitoring for 100 years after reclamation
16	N	Plug and Abandon Well	Well borehole is backfilled with cement grout
17	O	Replace Well	Includes borehole drilling, casing, and cementing
18	P	Closure O&M	Dust suppression and site maintenance with water truck and motor grader
19	Q	Construct Haul Road	Upgrade or construct new haul road for cover placement
20			
21	**Item**	**Material**	**Description**
22	a	Existing Facility	Existing ground before rough grading
23	b	Cover	Cover material from cover stockpiles, before being placed at destination location
24	c	Graded Facility	Exisiting ground after rough grading
25	d	Placed Cover	Cover material after being placed at destination location
26	e	Final Grade	Facility material and cover material after rough grading and fine grading

The same is done by assigning a material code (column A) to differentiate the materials used in the spreadsheet.

	A	B	C
21	**Item**	**Material**	**Description**
22	a	Existing Facility	Existing ground before rough grading
23	b	Cover	Cover material from cover stockpiles, before being placed at destination location
24	c	Graded Facility	Exisiting ground after rough grading
25	d	Placed Cover	Cover material after being placed at destination location
26	e	Final Grade	Facility material and cover material after rough grading and fine grading

These codes are used to assign an ID to each task, on the Materials sheet. The codes dictate which earthwork calculation is used for each row of work.

For example use only. Values may not match the current spreadsheet.

TELESTO SOLUTIONS • INCORPORATED

Job No: 200371d-001-01 | Client: Freeport NM Operations |

Task: Earthwork RCE | Computed By: Taryn Tigges | Date: 2/19/19

Checked By: Fred Charles | Date: 2/21/19

Results Cont'd

Unit Rates Sheet: This sheet applies the same concept as the Quantities and Activity-Material Codes sheets whereby unit rates for particular activities utilized in the development of costs within the spreadsheet are identified and assigned a unit rate code. The unit rates are used throughout the RCE spreadsheet and are referenced from this sheet.

	A	B	C	D	E	F	G
10	Code	Activity	Base Per Unit Cost	Fuel Per Unit Cost	Units	Source	Reference
11	U1	Fuel	$ 2.34	-	gal	N/A	Diesel fuel cost is estimated based on a predictive equation developed by correlating U.S. No. 2 diesel retail prices (U.S. Energy Information Administration) and FMI local fuel quotes, as agreed upon in November 2018 discussions with the agencies. The correlation is based on a dataset for the period from 1995-2018. Fuel cost includes direct and indirect costs at $2.34/gal.
12	U2	Revegetation	$ 816.92	$ 3.85	ac	N/A	See unit rates calculations - Cost is based on a calculated unit rate that includes tractor rental and maintenance, fuel, scarifying, discing, drill seeding, mulching, crimping, seed, and mulch.
13	U2-1	Revegetation - Seed Only	$ 210.00	-	ac	N/A	Rocky Mountain Reclamation, April 2018
14	U2-2	Revegetation - Mulch Only	$ 490.00	-	ac	N/A	Rocky Mountain Reclamation, April 2018: $245 per ton applied at 2 tons per acre
15	U3	Bench Grading Stockpile	$ 1.52	$ 0.37	ft	N/A	See unit rates calculations
16	U4	Bench Grading Tailings Pond	$ 1.58	$ 0.39	ft	N/A	See unit rates calculations
17	U5	Downdrain Construction	$ 374.38	-	ft	N/A	See unit rates calculations
18	U6	Downdrain Dissipater	$ 14,556.48	-	ea	N/A	See unit rates calculations
19	U7	Bench Channel Construction	$ 4.62	$ 0.98	ft	N/A	See unit rates calculations
20	U8	Top Channel Construction	$ 2.12	$ 0.46	ft	N/A	See unit rates calculations
21	U9	Erosion Control	$ 2,923.36	$ 382.26	day	Modified Crew B-13A	Erosion control for O&M - includes 1 foreman, 2 laborers, 1 equipment operator, 2 truck drivers, 1 loader (4 cy), 2 dump trucks (8 cy)
22	U10	Structure Demolition	$ 0.25	-	cf	Means Line Item 024116.13 0100	Structure Demolition, Building Demolition large urban projects includes 20 mile haul no foundation or dump fees mixture of types $0.29/cf volume standing building
23	U11	Concrete Slab Demolition	$ 0.62	-	sf	Means Line Item 024116.17 0400	Building footing and foundation demolition 6 in thick plain concrete
24	U12	Storage Tank Demolition	$ 1,005.97	-	ea	Means Line Item 130505.75 0530	Selective Demolition - Storage Tanks, steel tank, single wall, above ground, not including foundations, pumps or piping, 5,000 thru 10,000 gallon
25	U13	Power Line Demolition	$ 0.63	-	ft	Means Line Item 260505.10 0370	cost to overhead powerlines.
26	U14	Power Pole Demolition	$ 216.24	-	ea	Means Line Item 024113.80 0200	Selective Demolition - wood utility poles 35-45 ft high
27	U15	Pipeline (small HDPE pipe)	$ 2.29	-	ft	Means Line Item 024113.38 1700	excludes excavation
28	U16	Pipeline (medium HDPE pipe)	$ 3.82	-	ft	Means Line Item 024113.38 1800	excludes excavation
29	U17	Pipeline (large HDPE pipe)	$ 5.72	-	ft	Means Line Item 024113.38 1900	excludes excavation
30	U18	Well Plug & Abandon	$ 10.47	-	ft	N/A	Layne Christensen Company, 7/31/18 Tyrone estimate is $10,000 mobilization and demobilization plus $5,704.94 for one 1500 ft well
31	U19	Well Replacement	$ 66.43	-	ft	N/A	Wilcox Professional Services, 8/2011, est. cost for 5 ¼ in bore, $173,500 for 3000 ft total ($57.83/ft). Escalated 2% 2011-2018= $66.43/ft
32	U20	Reinforced Concrete Wall Demolition	$ 199.20	-	hr	Means Crew B-12C	Standard Union Crew: 1 equipment operator (crane), 1 laborer, 1 hydraulic excavator, 2 cy, approximately 40 hrs to demo 200 ft reinforced concrete dam.
33	U21	Cover Haul Road Construction	$ 7.47	$ 1.85	ft	UC Haul Road Sheet	Assume dozer construction, 1:1 original slope, 120 ft wide
34	U22	Rake, spring tooth, with tractor	$ 2,779.95	-	month	Means Line Item 015433.20 2900	Equipment rental costs
35	U23	Tractor, farm with attachment	$ 2,327.40	-	month	Means Line Item 015433.40 6465	Equipment rental costs
36	U24	Disc harrow attachment, for tractor	$ 616.33	-	month	Means Line Item 015433.20 1500	Equipment rental costs
37	U25	Mulcher, diesel powered, trailer mounted	$ 1,702.45	-	month	Means Line Item 015433.20 2860	Equipment rental costs
38	U26	Cast-In-Place Concrete	$ 254.97	-	cy	Means Line Item 033053.40 6200	reinforcement
39	U27	Hazardous Waste Cleanup & Disposal	$ 335.20	-	ton	Means Line Item 028120.10 1120/1130	Solid pickup; average of minimum and maximum
40	U28	Hazardous Waste Transportation	$ 4.78	-	mile	Means Line Item 028120.10 1260/1270	minimum and maximum
41	U29	Road Maintenance	$ 4,945.96	$ 1,240.32	month		water truck
42	U30	Groundwater Monitoring	$ 2,282.94	-	day		Groundwater monitoring for O&M - includes 1 foreman, 1 laborers, rental equipment, misc. field equipment, and aqueous chemistry

Unit rates are either derived from separate calculations, RSMeans pages, or direct quotes. The unit costs are broken into base per unit cost (column C) and fuel per unit cost (column D) when applicable. If a unit cost is obtained from RSMeans, the Las Cruces, New Mexico, area cost is utilized.

For example use only. Values may not match the current spreadsheet.

Results Cont'd

Equipment Sheet: This sheet assigns a code to the various types of heavy equipment (bulldozers, wheeled loaders, excavators, etc.) used for mine closure activities. It also delineates a multitude of equipment costs and factors as well as labor costs based on the 2019 New Mexico Department of Labor hourly labor rates associated with each piece of equipment.

Equipment Code

Rental & Operating Equipment Costs

See Dozer sheet (Sheet 5) for development of the Productivity Equation

$$Productivity_{normal} = C * (Distance_{Push}{}^{b})$$

C = Multiplier Constant and b = Exponent Constant

EARTHWORK AND O&M EQUIPMENT

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
2	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
3														Dozing Production (lcy/hr)[1]	
4														Production = C(Avg. dozing distance in ft)[b]	
5	Code	Equipment Description	Equipment Type	Fuel Consumption (gal/hr)	Fuel Cost ($/hr)	Lube Cost ($/hr)	Field Parts ($/hr)	Tire Cost ($/hr)	Ground Engaging Component Cost ($/hr)	Monthly Rental Rate ($/month)	Field Labor Time Cost ($/hr)	Rental Cost (w/o fuel, lube, tires, or field parts) ($/hr)[6]	Lube, Tires, GEC, & Field Parts Adjusted Rental Cost (w/o fuel) ($/hr)	C	b
6	Comb1	Cat 14M, Off-Hwy Water Tanker Truck,6,000-gal.	Combo 1	19.54	$ 45.72	$ 12.72	$ 3.75	$ 13.46	$ 1.16	$ 20,078.37	$ 9.23	$ 114.08	$ 154.40	-	-
7	Dz1	Cat D11T, U Blade	Dozer	29.75	$ 69.62	$ 26.23	$ 13.89	$ -	$ 12.22	$ 34,408.41	$ 6.60	$ 195.50	$ 254.44	155,881.59	-0.889952
8	Dz2	Cat D11T CD, U Blade	Dozer[7]	29.75	$ 69.62	$ 26.23	$ 13.89	$ -	$ 12.22	$ 34,408.41	$ 6.60	$ 195.50	$ 254.44	162,758.76	-0.866691
9	Dz3	Cat D9T, SU Blade	Dozer	14.35	$ 33.58	$ 11.22	$ 5.49	$ -	$ 3.98	$ 30,109.48	$ 6.60	$ 171.08	$ 198.37	52,161.03	-0.845532
10	Dz4	Cat D6T, SU Blade	Dozer	7.22	$ 16.89	$ 4.83	$ 2.10	$ -	$ 2.10	$ 8,939.42	$ 3.83	$ 50.79	$ 63.65	13,582.45	-0.74851
11	Dz5	Cat D6T XL, SU Blade	Dozer	7.80	$ 18.25	$ 5.28	$ 2.32	$ -	$ 2.36	$ 9,104.55	$ 3.83	$ 51.73	$ 65.52	13,582.45	-0.74851
12	Ex1	Cat 319D L	Excavator	5.25	$ 12.29	$ 3.47	$ 1.19	$ -	$ 0.84	$ 7,450.15	$ 4.55	$ 42.33	$ 52.38	-	-
13	Ld1	Cat 992K	Loader	25.63	$ 59.97	$ 22.35	$ 4.43	$ 35.39	$ 4.99	$ 25,527.98	$ 4.02	$ 145.05	$ 216.23	-	-
14	Ld2	Cat 988H	Loader	15.20	$ 35.57	$ 11.40	$ 2.11	$ 16.85	$ 1.93	$ 16,272.06	$ 4.02	$ 92.45	$ 128.76	-	-
15	Ld3	Cat 980H	Loader	10.80	$ 25.27	$ 6.70	$ 1.13	$ 7.69	$ 1.03	$ 10,030.76	$ 4.02	$ 56.99	$ 77.56	-	-
16	Ld4	Cat 966H	Loader	8.38	$ 19.61	$ 5.33	$ 0.84	$ 5.71	$ 0.75	$ 9,937.50	$ 4.02	$ 56.46	$ 73.11	-	-
17	Ld5	Cat 993K	Loader	30.40	$ 71.14	$ 26.70	$ 5.32	$ 42.47	$ 4.73	$ 25,527.98	$ 4.02	$ 145.05	$ 228.29	-	-
18	Mg1	Cat 16M	Motor Grader	9.50	$ 22.23	$ 8.69	$ 3.26	$ 10.13	$ 1.76	$ 11,906.70	$ 2.02	$ 67.65	$ 93.51	-	-
19	Mg2	Cat 14M	Motor Grader	8.29	$ 19.40	$ 6.57	$ 2.27	$ 7.04	$ 1.16	$ 11,906.70	$ 2.02	$ 67.65	$ 86.71	-	-
20	Rp1	Cat D11T CD Multi-shank (w/ MSR-359H)	Ripper	29.75	$ 69.62	$ 26.60	$ 14.20	$ -	$ 1.56	$ 36,753.56	$ 8.16	$ 208.83	$ 259.35	-	-
21	Sc1	Cat 637G	Scraper	38.00	$ 88.92	$ 17.07	$ 6.27	$ 7.57	$ 1.28	$ 25,070.00	$ 12.80	$ 142.44	$ 187.43	-	-
22	Sc2	Cat 657G	Scraper	42.86	$ 100.29	$ 20.41	$ 7.73	$ 9.34	$ 2.31	$ 25,070.00	$ 12.80	$ 142.44	$ 195.03	-	-
23	Sh1	Hitachi EX3600-5	Shovel[2]	82.72	$ 193.56	$ 59.15	$ 24.25	$ -	$ 16.56	$ 69,269.00	$ 14.45	$ 393.57	$ 507.98	-	-
24	Tc1	Deere 7430	Tractor	5.98	$ 13.99	$ 2.84	$ 0.61	$ 2.42	$ -	$ 5,210.05	$ 2.53	$ 29.60	$ 38.00	-	-
25	Tk1	Komatsu HD-1500 5	Truck[3]	28.12	$ 65.80	$ 19.90	$ 1.79	$ 25.19	$ -	$ 25,211.93	$ 7.47	$ 143.25	$ 197.60	-	-
26	Tk2	Cat 769D	Truck	9.74	$ 22.79	$ 8.77	$ 1.48	$ 13.72	$ -	$ 14,042.50	$ 4.25	$ 79.79	$ 108.01	-	-
27	Tk3	Cat 725	Truck	6.02	$ 14.09	$ 5.74	$ 0.94	$ 7.11	$ -	$ 9,849.60	$ 3.36	$ 55.96	$ 73.11	-	-
28	Tk4	Komatsu 730E	Truck[4]	33.48	$ 78.34	$ 20.49	$ 1.80	$ 21.21	$ -	$ 29,356.98	$ 11.49	$ 166.80	$ 221.79	-	-
29	Tk5	Cat 777F	Truck	18.76	$ 43.90	$ 19.31	$ 3.03	$ 26.81	$ -	$ 56,160.00	$ 6.38	$ 319.09	$ 374.62	-	-
30	Tw1	Off-Hwy Water Tanker Truck,6,000-gal.	WaterTruck	11.25	$ 26.33	$ 6.15	$ 1.48	$ 6.42	$ -	$ 8,171.67	$ 7.21	$ 46.43	$ 67.69	-	-
31	Tw2	Off-Hwy Water Tanker Truck,10,000-gal.	WaterTruck	15.43	$ 36.11	$ 9.04	$ 2.43	$ 10.47	$ -	$ 12,949.87	$ 10.30	$ 73.58	$ 105.82	-	-
32	X1	2 Deck Screening Plant (5X16, 48X60)	ScreenPlant	4.85	$ 11.35	$ 2.39	$ 1.15	$ 0.40	$ -	$ 5,738.88	$ 4.46	$ 32.61	$ 41.01	-	-
33	X2	3 Deck Screening Plant (5X16, 48X60)	ScreenPlant	4.85	$ 11.35	$ 2.43	$ 1.24	$ 0.39	$ -	$ 5,994.24	$ 4.62	$ 34.06	$ 42.74	-	-
34	X3	1 Deck Screening Plant (5X16, 48X60)	ScreenPlant	4.85	$ 11.35	$ 2.37	$ 1.14	$ 0.39	$ -	$ 5,671.66	$ 4.46	$ 32.23	$ 40.59	-	-
35	X4	3 Deck Screening Plant (5X16, 42X60)	ScreenPlant	4.85	$ 11.35	$ 2.38	$ 1.16	$ 0.37	$ -	$ 5,743.36	$ 4.62	$ 32.63	$ 41.16	-	-

The equipment sheet also contains the production equation coefficients for dozing (columns N-O) and scraper haul travel time coefficients (columns P-AI)

See Trucks sheet (Sheet 9) for development of the Haul Travel Time Equation

Haul Travel Time (min/m)*=A(Eff. Grade %)^4 + B(Eff. Grade %)^3 + C(Eff. Grade %)^2 + D(Eff. Grade %) + E*

where effective grade is the sum of the measured grade and rolling resistance

EARTHWORK AND O&M EQUIPMENT

	A	B	C	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI
2	1	2	3	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
3				Haul Travel Time (min/m) = A(Eff. Grade %)^4 + B(Eff. Grade %)^3 + C(Eff. Grade %)^2 + D(Eff. Grade %) + E																			
4				Loaded Uphill					Empty Uphill					Loaded Downhill					Empty Downhill				
5	Code	Equipment Description	Equipment Type	A	B	C	D	E	A	B	C	D	E	A	B	C	D	E	A	B	C	D	E
6	Comb1	Cat 14M, Off-Hwy Water Tanker Truck,6,000-gal.	Combo 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	Dz1	Cat D11T, U Blade	Dozer	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8	Dz2	Cat D11T CD, U Blade	Dozer[7]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9	Dz3	Cat D9T, SU Blade	Dozer	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10	Dz4	Cat D6T, SU Blade	Dozer	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11	Dz5	Cat D6T XL, SU Blade	Dozer	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12	Ex1	Cat 319D L	Excavator	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
13	Ld1	Cat 992K	Loader	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
14	Ld2	Cat 988H	Loader	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
15	Ld3	Cat 980H	Loader	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
16	Ld4	Cat 966H	Loader	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
17	Ld5	Cat 993K	Loader	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
18	Mg1	Cat 16M	Motor Grader	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
19	Mg2	Cat 14M	Motor Grader	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
20	Rp1	Cat D11T CD Multi-shank (w/ MSR-359H)	Ripper	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
21	Sc1	Cat 637G	Scraper	3.2483	-1.9562	0.4337	-0.0026	0.001	0	-0.3247	0.1601	-0.0038	0.0011	0.6464	-0.6147	0.1749	-0.0004	0.0011	0	0	0.0367	0.0018	0.0009
22	Sc2	Cat 657G	Scraper	0.3036	-0.4512	0.2181	-0.0034	0.0013	0	-0.1016	0.0774	-0.0013	0.0012	0	-0.1612	0.1031	-0.0081	0.0016	0	0.1668	-0.094	0.0207	0.0004
23	Sh1	Hitachi EX3600-5	Shovel[2]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
24	Tc1	Deere 7430	Tractor	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
25	Tk1	Komatsu HD-1500 5	Truck[3]	4.494	-2.4571	0.6319	-0.0051	0.0011	0	-0.2561	0.1351	-0.0004	0.001	0	0	0.0856	0.0135	0.0009	0	0	0	0.0143	0.0005
26	Tk2	Cat 769D	Truck	0.5429	-0.487	0.1823	0.0151	0.0007	0	0.0224	-0.0076	0.0141	0.0007	0	0	-0.0808	0.426	-0.0008	5.6146	-3.6353	0.7823	-0.0535	0.002
27	Tk3	Cat 725	Truck	0.1363	0.1636	-0.04	0.0342	0.0009	0	-0.024	0.0309	0.0099	0.001	0	2.5262	-0.7562	0.095	-0.002	0	0	0	0.0103	0.0009
28	Tk4	Komatsu 730E	Truck[4]	7.5599	-2.711	0.4209	0.005	0.0011	0	-0.0689	0.0501	0.0052	0.001	-	-1.1878	0.325	0.0042	0.001	-3.4907	2.4171	-0.55	0.0643	-0.0011
29	Tk5	Cat 777F	Truck	6.43	-3.2933	0.6548	-0.005	0.0009	0	-0.0197	0.0276	0.011	0.0008	2.147	-1.9812	0.5102	-0.0158	0.0009	0.7651	-0.3831	0.0898	-0.001	0.0008
30	Tw1	Off-Hwy Water Tanker Truck,6,000-gal.	WaterTruck	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
31	Tw2	Off-Hwy Water Tanker Truck,10,000-gal.	WaterTruck	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
32	X1	2 Deck Screening Plant (5X16, 48X60)	ScreenPlant	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
33	X2	3 Deck Screening Plant (5X16, 48X60)	ScreenPlant	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
34	X3	1 Deck Screening Plant (5X16, 48X60)	ScreenPlant	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
35	X4	3 Deck Screening Plant (5X16, 42X60)	ScreenPlant	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

For example use only. Values may not match the current spreadsheet.

Results Cont'd

Equipment Sheet cont'd:

Other equipment specifications listed in the equipment sheet can also be found in the Chino RCE report. It is important to note that each piece of equipment is assigned an operator group by which labor rates are assigned according to the most up to date labor rates from NMDOL.

50	**EARTHWORK AND O&M LABOR**	
51	NMDOL Type A	Rate
52	Operator Group	($/hr)
53	Equipment Operator IV	$ 27.41
54	Equipment Operator V	$ 27.52
55	Equipment Operator VI	$ 27.70
56	Laborer I	$ 23.09
57	Laborer II	$ 23.84
58	Truck Driver III	$ 24.27

Sheet 2 – Demolition: Costs are based on square footage (ex: buildings), linear footage (ex: pipeline or power line length), or lump sum per item (ex: power pole, well casing). The costs are derived from the 2019 R.S. Means Online Heavy Construction cost data or actual on-site experience and bids.

Example calculation: (1,825,711 feet of pipeline) x ($6.88 per linear foot)=$12,562,678

	A	B	C	D	E	F	G	H	I
1									Chino
2									Stockpile Spreadsheet Worksheet #2
3	***Demolition***								2/12/2019
4									
5	Building Demolition costs are calculated in "1 BuildingDemo", "2 BuildingCover", "3 BuildingVeg", and "4BuildingHazardousWaste" and summarized on the last line of this table.								
6	This sheet calculates miscellaneous demolition costs associated with the North Mine Area, Pipeline Corridor Area, and South Mine Area.								
7									
8									
9									
10	**Item**	**Activity**	**Quantity**	**Unit**	**Unit Cost[1] ($/unit)**	**Direct Item Cost ($)**	**Reference**	**Means Line Ite**	**Description**
11	NMA & SMA Reclamation	Pipelines Demolition	1,825,711	ft	$6.88	$12,562,678	Means and Other (See Pipeline Unit Cost Sheet)	02 41 13.38 1800	Water and sewer pipeline lengths from 2018 Chino Bluestake map. Unit cost for Selective Demolition - water piping (small = $2.34 per foot, medium = $3.88 per foot, large = $5.83 per foot based on Means (2018) adjusted for local labor and EquipmentWatch rates. Excludes excavation costs. See pipeline unit cost calculation.
12	NMA & SMA Reclamation	Pipeline Corridor Area Revegetation	8.2	ac	$820.77	$6,730	See Revegetation Unit Cost Sheet	N/A	See unit rates calculations. Area based on 30' corridor minus 12' for vehicles (18') multiplied by length of pipeline in Pipeline Corridor Area (length from pg. 249-250 of CCP).
13	NMA & SMA Utilities Reclamation	Power Poles Demolition	246	ea	$216.24	$53,195	Means	024113.80 0200	Number of power poles from 2018 Chino Bluestake map. Unit cost for Selective Demolition - wood utility poles 35-45 feet high.
14	NMA & SMA Utilities Reclamation	Power Lines Demolition	318,553	ft	$0.63	$200,688	Means	260505.10 0370	Wire and cable lengths from from 2018 Chino Bluestake map. Unit cost for Electrical Demolition - Nonmetallic sheathed cable 3 wire; assume similar enough in cost to overhead powerlines.
15	NMA & SMA Utilities Reclamation	Utility Corridors Revegetation	36.6	ac	$820.77	$30,011	See Revegetation Unit Cost Sheet	N/A	See unit rates calculations - Cost is based on a calculated unit rate that includes tractor rental and maintenance, fuel, scarifying, discing, drill seeding, mulching, crimping, seed, and mulch.
16	NMA Reclamation	Concrete Surface Containments	154	hr	$199.20	$30,756	Means	Means Crew B-12C	Standard Union Crew: 1 equipment operator (crane), 1 laborer, 1 hydraulic excavator, 2 cy, approximately 40 hrs to demo 200 ft reinforced concrete dam.
17	Building Demolition	See Building Demo Sheets	N/A	N/A	N/A	$8,374,878	See Building Demo Sheets	N/A	Direct costs only, 20% added to buildings with extra equipment removal.
18									
19									
20									
21									
22									
23					**Total Direct Cost:**	$21,258,937			

For example use only. Values may not match the current spreadsheet.

TELESTO SOLUTIONS • INCORPORATED	Job No: 200371d-001-01	Client: Freeport NM Operations	Page 8 of 24
	Task: Earthwork RCE	Computed By: Taryn Tigges	Date: 2/19/19
		Checked By: Fred Charles	Date: 2/21/19

Results cont'd:

Sheet 3 – Material: No calculations are included on this sheet. Four codes, which can be referenced from the Quantities, Activity-Material Codes, and Equipment or Unit Rates sheets, are entered by hand for each row in Columns A – D. The column labeled ID concatenates the codes. The ID contains the codes for facility location (with sub-area if applicable), work activity, material and equipment used for that particular row of work. This combination determines which equipment production and cost equations are used in the rest of the spreadsheet. The other columns on this sheet then reference the ID to lookup the description from the Activity Material Codes sheet, the source and destination locations from the Quantities sheet, the total haul or push distance and grade from the Quantities sheet, and the equipment (when applicable) from the Equipment sheet.

All activities for the Chino RCE are listed on this sheet and carried through the succeeding worksheets of the RCE. The description (F314) lists the activity, top or outslope (if applicable), and the material. The source location (G314) lists the stockpile name (or sub-area) for the location of the activity. If borrow material is involved, it is transported from a borrow stockpile to a destination stockpile (H314). Push or haul distance (I314) is used as part of calculating equipment production on Sheets 5, 9, and 11. Grade (J314 - haul grade or facility slope) is used as part of calculating equipment production on Sheets 5, 9, 11, and 12. Equipment (K314) lists the name of the equipment referenced in the ID. Blank cells indicate that that column is not relevant to a particular activity.

The ID for the example below is 2323-D-b-Tk4. This indicates that a Komatsu 730E truck (Tk4) will be used to haul (D) cover material (b) from STS2 to the Raffinate Pond (2323). The total haul distance from STS2 to the Raffinate Pond is 22,828 feet, with an average haul grade of 7.7%.

2300-Facility and 23-Sub-area

D-Activity and b-Material

Tk4-Equipment to be used

Chino
Stockpile Spreadsheet Worksheet #3
2/12/2019

Material Handling Plan Summary Sheet

All activities for the Chino RCE are listed on this sheet and carried through the succeeding worksheets of the RCE. The column labeled ID contains the codes for the facility location, activity, material and equipment used for that particular row of work. The description lists the activity, top or outslope (if applicable), and the material. The source location lists the stockpile name (or sub-area) for the location of the activity. If borrow material is involved, it is transported from a borrow stockpile to a destination stockpile. Blank cells indicate that that column is not relevant to a particular activity.

Assumptions:
1 - Haul/Push Distance based on Golder Take-Offs 1401129-004-MTO-RevG_07_Chino_MTOs_05SEP18.xlsx or measured as shown in calc set
2 - Weighted Average Haul Grades based on Golder Take-Offs 1401129-004-MTO-RevG_07_Chino_MTOs_05SEP18.xlsx or measured as shown in calc set
3 - Grade Factors from SOW

Groundhog #5 (Item 2400) previously reclaimed - add 1 ft of cover and continue O&M
Tailings Ponds #1, 2, B, C, 4E, 4W - continue O&M (no other activities)
Santa Rita (Item 1500) has already been rough graded
Slag pile (Item 3301) has already been rough graded

Row	Item	Activity	Material	Eq	ID	Description	Source Location 1	Destination Location 2	Total Haul/Push Distance (ft)[1]	Grade (%)[2,3]	Equipment
314	2323	D	b	Tk4	2323-D-b-Tk4	Haul-Cover	STS2	Raffinate Pond	22,828	7.7%	Komatsu 730E
315	2324	D	b	Tk4	2324-D-b-Tk4	Haul-Cover	STS2	Reservoir 2	8,173	2.3%	Komatsu 730E
316	2327	D	b	Tk4	2327-D-b-Tk4	Haul-Cover	STS2	Reservoir 6	25,168	0.8%	Komatsu 730E
317	2328	D	b	Tk4	2328-D-b-Tk4	Haul-Cover	STS2	Reservoir 7	25,168	0.8%	Komatsu 730E
318	2341	D	b	Tk4	2341-D-b-Tk4	Haul-Cover	STS2	Elmo's Pond	5,509	-0.2%	Komatsu 730E
319	2342	D	b	Tk4	2342-D-b-Tk4	Haul-Cover	STS2	Lower Lined Pond	5,509	-0.2%	Komatsu 730E
320	2343	D	b	Tk4	2343-D-b-Tk4	Haul-Cover	STS2	Upper Lined Pond	5,509	-0.2%	Komatsu 730E

For example use only. Values may not match the current spreadsheet.

Results cont'd:

Sheet 4 – Earthwork: Repeats the ID, Description, Source Location, and Destination Location for each row from the Materials sheet. The acreage (I325), cover depth (J325), swell factor (L325), and loose/stockpile volume (M325) are referenced from the Quantities sheet. The in-place (i.e., bank) volume (K325) is calculated from the loose/stockpile volume by dividing by the swell factor. Swell is assumed to occur when cover material is moved from the borrow stockpile to the haul truck. Material left in place is assumed to have no swell, meaning the bank and loose volumes are equal.

$$Volume_{loose\_cover} = area * depth_{cover}$$

I325*J325/12*43560/27

	E	F	G	H	I	J	K	L	M
9		*Earthwork Quantity Worksheet*							
10	Assumptions:								
11	1 - Acres and volumes Based on Golder Take-Offs 1401129-004-MTO-RevG_07_Chino_MTOs_05SEP18.xlsx								
12	2 - Cover Material Swell: The 'Loose Volume' is calculated based on the acreage to be covered, 3 ft of cover, and accounts for appropriate swell factor.								
13	3 - 8% swell factor is estimated for cover obtained from a mine stockpile because it is placed loose and is looser than cover borrowed from a natural deposit.								
14	ID	Description	Source Location 1	Destination Location 2	Area (ac)[1]	Cover Depth (in)	Bank/Stockpile Volume (bcy)[1]	Swell Factor (%)[3]	Loose/Stockpile Volume (lcy)[2]
325	3307-D-b-Tk6	Haul-Cover	West of Borrow E&H	35 Acre Misc. Area	35.0	36	156,852	8%	169,400

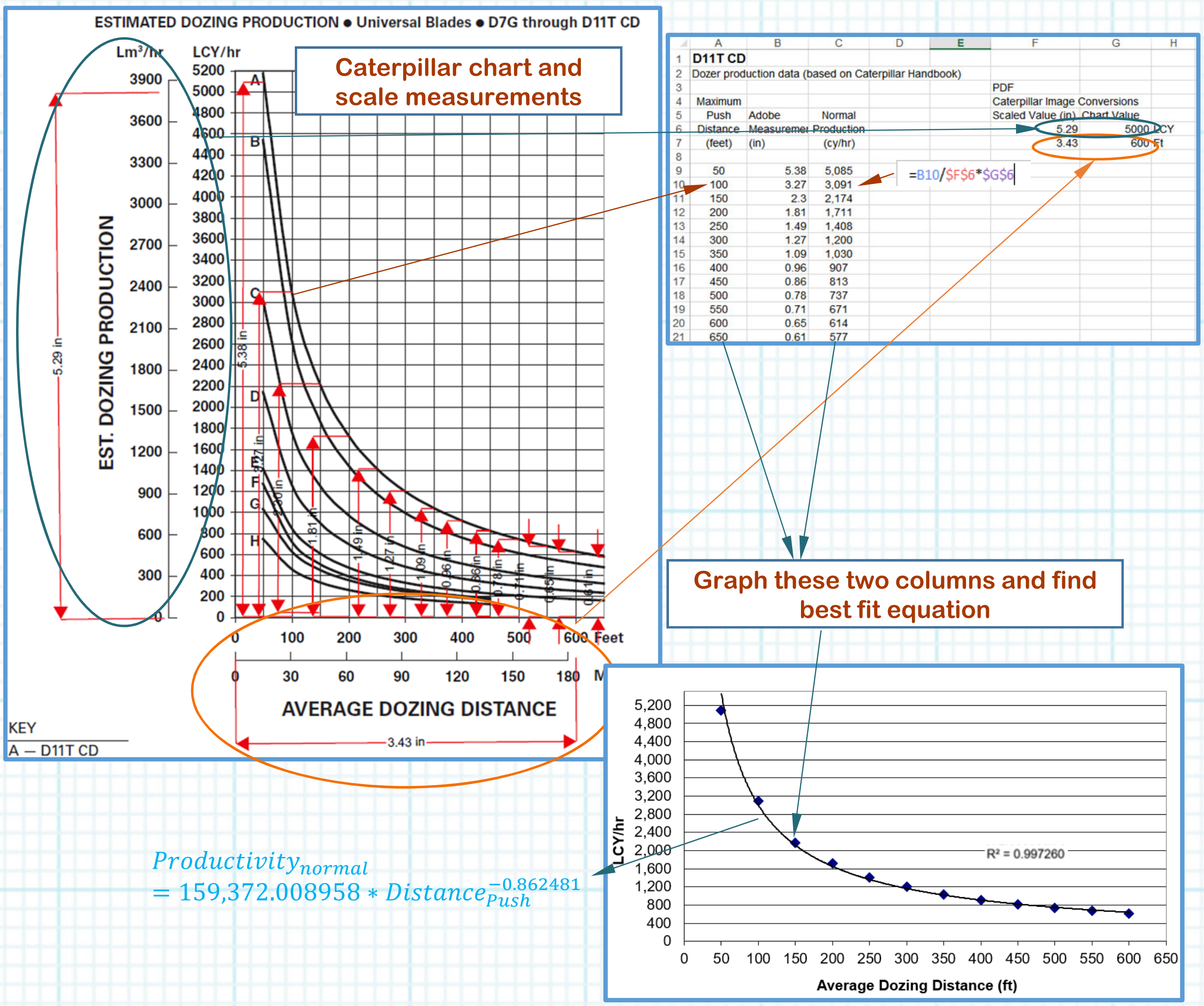
M325/(1+L325)

$$Volume_{bank} = \frac{Volume_{loose}}{(1 + F_{swell})_{bank}}$$

Sheet 5 – Dozer: Dozers are used for rough grading facilities, assisting loaders or shovels at borrow stockpiles, or pushing scrapers for grading facilities. See page 11 of this calculation documentation for a screenshot of the Dozer sheet. Columns E through J repeats ID, activity, locations, equipment from Sheet 3 (Material) and volumes from Sheet 4 (Earthwork). Columns K and U are the results of the dozer productivity calculations for grading (the multiplier and exponent coefficients C and b, respectively, for the normal productivity equation can be found in columns N and O of the Equipment sheet). Column O is the calculated task time. If the task is for dozer assist of scrapers or loaders/shovels, the dozer task time is equal to the task time of the scraper or loader/shovel, respectively. Columns L, M, and N are calculated on the scraper and loader sheets and repeated on the dozer sheet. The remaining columns are the input factors that produce the calculation result of bulldozer material handling productivity in cubic yards per hour based on material weight, grade, dozing type, push distance, and operating conditions such as visibility, operator experience, and elevation.

Results cont'd:

Sheet 5 – Dozer cont'd: Input values, power curves and capacities are taken from the 2017 and 2018 Caterpillar (Cat) Performance Handbook (CPH) (Editions 47 and 48) for the specific model dozer. Determining actual productivity starts by calculating the *normal* production factor using a formula derived by curve fit to productivity graphs provided in the CPH for the specific dozer. This is accomplished by scaling values from the figures and using the curve fitting tools within Microsoft Excel:



$$Productivity_{normal} = 159{,}372.008958 * Distance_{Push}^{-0.862481}$$

For example use only. Values may not match the current spreadsheet.

Results cont'd:

Sheet 5 – Dozer cont'd: The *normal* production curves assume a flat surface with a pushed material density of 2,300 lb/cy and a material that is not loose. To account for slope, operator experience, equipment specifications, and other site-specific factors, the CPH modifies the normal production curve by multiplying various factors to obtain the overall productivity:

$$Production_{normal} = C * Distance_{Push}^{b}$$

	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA
4		***Productivity and Hours Required for Dozer Use---Earthmoving***																					
5		Assumptions:																					
6		Uses volumes of outslope sections and dam breaches to calculate productivity																					
7		Uses push distances of outslope sections for grading productivity																					
8		Uses scraper push cycle time for dozer assist with scraper																					
9		Uses loader cycle time for dozer assist with loader at cover stockpiles																					
10		Grade Factor = -0.02(Grade %) + 1																					
11																							
12																							
13												PERFORMANCE FACTORS											
14	ID	Task Description	Source Location 1	Destination Location 2	Equipment	Loose /Stockpile Volume (cy)	Productivity (cy/hr)	Scraper Pusher Cycle Time (min)	Cycles per Scraper per Hr	Loader Cycle Time (hr)	Total Task Time (hrs)	Material Factor	Grade Factor	Material Weight (lb/cy)	Production Method/Blade	Centroid to Centroid Push Distance (ft)	Normal Production (cy/hr)	Operator Factor	Work Hour (min/hr)	Visibility Factor	Elevation Factor	Direct Drive Trans.	Cut to Fill Haul Grade (%)
54	1101-B-a-Dz3	Dozer Assist-Outslope-Existing Facility	South Stockpile S-1	-	Cat D9T, SU Blade	348,051	369	1.09	7.58	-	0.1	1.0	1.6	3,300	1.2	389	337	1.00	50	1.0	1.0	1.0	-28.6%

$$Productivity = F_{mat'l} * F_{grade} * F_{prod-method} * F_{operator} * F_{visibility} * F_{elev} * F_{drive} * \frac{WorkHour}{60min/hr} * \frac{2{,}300\ lb/cy}{Mat'l\ Weight} * Production_{normal}$$

=P54*Q54*S54*V54*X54*Y54*Z54*(W54/60)*(R54/2300)*U54

Sheet 6 –Road Maint: This sheet calculates the time required for a water truck and motor grader to be used for dust suppression and site maintenance during earthwork reclamation. Columns E through I repeats ID, activity, locations, and equipment. The Operational Maintenance Time (Column J) is assumed to be equal to the loader/shovel task time.

	E	F	G	H	I	J
1						Chino
2						Stockpile Spreadsheet Worksheet #6
3						01/10/19
4						
5		***Productivity and Hours Required for Dust Suppression and Site Maintenance***				
6						
7		Assumptions:				
8		6,000 gal water truck and 14M motor grader cost added with loader cost (water truck hours and 14M hours the same as loader hours) for dust suppression and site maintenance				
9						
10		**Sheet to which to tie hrs**	10 Loader			
11		**Equipment for hrs**	Sh1			
12						
13						
14	ID	Task Description	Source Location 1	Destination Location 2	Equipment	Operational Maintenance Time (hrs)
553	1000-P-b-Comb1	Operational Maintenance-Cover	Upper South	Triangle Stockpile	Cat 14M, Off-Hwy Water Tanker Truck,6,000-gal.	130

Equals loading time on Loader/Shovel sheet

For example use only. Values may not match the current spreadsheet.

Results cont'd:

Sheet 7 – <u>Ripper</u>: Rippers are used after rough grading, before placing cover, at all facilities (or before revegetation at borrow stockpiles) to promote revegetation. Rippers are also used to loosen the existing ground before rough grading with scrapers. Columns E through J repeat the ID, title of the activity, locations, equipment and areas from Sheets 3 & 4. Columns K and L are the results of the dozer ripper productivity calculations. The remaining columns are the inputs that allow the calculation of bulldozer ripper productivity in acres per hour based on ripper performance factors:

	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U
1																	Chino
2																Stockpile Spreadsheet Worksheet #7	
3		***Productivity and Hours Required for Ripper---Equipped Dozer Use***															01/10/19
4																	
5		**Assumptions:**															
6		Uses area to calculate task time															
7		88 ft/min = 1 mph															
13									PERFORMANCE FACTORS								
14	ID	Task Description	Source Location 1	Destination Location 2	Equipment	Area (ac)	Productivity (ac/hr)	Task Time (hrs)	Ripping Length (ft)	Ripper Penetration (in)	Pocket Spacing (in)	Number of Shank Pockets	Turn Time (min/pass)	Work Hour (min/hr)	Speed (mph)	1000 Foot Passes/Acre	Ripped Width Plus Distance b/n Passes (ft)
16	1102-E-a-Rp1	Rip-Outslope-Existing Facility	South Stockpile S-2	-	Cat D11T CD Multi-shank	86.9	3	25.5	1,000	18	69	3	0.25	50	1	1.3	35

=R16/((M16/(5280*S16/60)+Q16)*T16)

=J16/K16

=43560/(M16*U16)

=P16*2*O16/12

Unit conversion factors

Sheet 8 – <u>Excavator</u>: An excavator with a sheepsfoot attachment is used for perforating liners before reclamation of lined impoundments. Columns E through J repeat the ID, title of the activity, locations, equipment and areas from Sheets 3 & 4. Task time (column N) to complete compacting the entire area is calculated using the inputs from columns J-M, which are referenced from the Equipment sheet.

	E	F	G	H	I	J	K	L	M	N
3		***Productivity and Hours Required for Hydraulic Excavator***								
5		**Assumptions:**								
6		Uses area to calculate time for perforating liners								
7		3' sheepsfoot roller								
8		50% of area is perforated								
9										
14	ID	Task Description	Source Location 1	Destination Location 2	Equipment	Area (ac)	Sheepsfoot Roller Width (ft)	Maximum Reach at Ground Level (ft)	Cycle Time (min)	Task Time (hr)
45	2216-K-a-Ex3	Perforate Liner-Entire Facility-Existing Facility	Dams and Reservoirs Reservoir 17	-	Cat 319D L	3.4	3.0	31.7	0.16	2.1

=M45*(J45*0.5*43560)/(K45*L45)/60

50% of liner area is perforated

Unit conversion factors

For example use only. Values may not match the current spreadsheet.

Results cont'd

Sheet 9 – Trucks: Trucks are used to haul cover material from borrow stockpiles to destination facilities. Columns E through J repeat the ID, title of the activity, locations, equipment and volumes from Sheets 3 & 4. Column K sums the truck cycle, which includes the haul time loaded, return time empty, loading time, truck exchange time, and the dump/maneuver time. Column L reports the optimum number of trucks as limited by the number and size of loaders (calculated on the Truck Optimization sheet, as shown in the Equipment Optimization calculation summary). Column M lists the loader or shovel net bucket capacity, referenced from the Shovel sheet. Column O lists the loader or shovel task time, referenced from the Shovel sheet. Columns N and P calculate the overall productivity and time required of the load-haul-dump operations, respectively. Column P calculates the time for the truck to complete that task and compares that time to the loader task time, because the truck will have to idle while the loader/shovel finishes loading if the loader/shovel task time is longer than the truck task time (or vice versa). If the loader task time is longer, the loader task time is listed. If the truck task time is longer, the truck task time is listed.

Productivity and Hours Required for Truck Use

Assumptions:
Uses haul distance to calculate haul and return time (total task time includes loading, manuevering, dumping, hauling and return time) - moves from cover stockpile to destination stockpile
Volume of cover material based on area of destination
Cycles per truck = the greater of Heaped capacity or Struck capacity divided by Loader's per bucket capacity
1 mph = 88 ft/min
1 m/min = 0.03728227153424 mph
See Truck Optimization optimum number of trucks per loader
Haul Grade (%) assumes postive is uphill while the Effective Haul Grade (%) and Effective Return Grade (%) are postive for downhill and uphill

Row	E: ID	F: Task Description	G: Source Location 1	H: Destination Location 2	I: Equipment	J: Loose/Stockpile Volume (cy)	K: Truck Cycle Time (min)	L: Optimum Number of Trucks	M: Loader/Shovel Net Bucket Capacity (cy)	N: Productivity (cy/hr)	O: Loader/Shovel Task Time(hrs)	P: Truck Task Time (hrs)
297	1000-D-b-Tk4	Haul-Cover	Upper South	Triangle Stockpile	Komatsu 730E	394,621	8	3	27.4	2,569	129.6	153.6

K: =SUM(AK297:AO297)

N: =AP297*S297*M297*L297/K297

P: =IF(OR(J297=0,N297=0),0,IF(J297/N297<O297,O297,J297/N297))

Columns Q and R are equipment specifications from the CPH. Column S calculates the loader or shovel cycles per truck, based on loader/shovel bucket capacity and truck capacity. The total haul distance (column T) can be divided into three segments (columns U-W) if the route varies greatly in slope. The average grade for each segment is calculated and entered in Columns X-Z. Columns T through Z are obtained from the Quantities sheet. Column AA is the rolling resistance for the assumed underfooting and tires per the CPH. Columns AB-AD convert segment distances from feet to meters for application of the performance equations from the CPH.

Chino
Stockpile Spreadsheet Worksheet #9
02/12/19

PERFORMANCE FACTORS

Row	Q: Struck Capacity (cy)	R: Heaped Capacity (cy)	S: Loader/Shovel Cycles per Truck	T: Total Haul Distance (ft)	U: Haul Distance Segment 1 (ft)	V: Haul Distance Segment 2 (ft)	W: Haul Distance Segment 3 (ft)	X: Haul Grade Segment 1 (%)	Y: Haul Grade Segment 2 (%)	Z: Haul Grade Segment 3 (%)	AA: Rolling Resistance (%)	AB: Haul Distance Segment 1 (meters)	AC: Haul Distance Segment 2 (meters)	AD: Haul Distance Segment 3 (meters)
297	101	145	5	4,778	4,778	-	-	-4.2%	0.0%	0.0%	2.5%	1,456	-	-

S: =TRUNC(R297/ M297)

T: =SUM(U297:W297)

For example use only. Values may not match the current spreadsheet.

Results cont'd

Sheet 9 – Trucks cont'd: Columns AE through AJ calculate the effective grade of the segment (physical grade plus the rolling resistance). Haul time (column AK) and return time (column AL) are calculated by multiplying travel times (per distance) by haul/return distance. Loading time (column AM) is based on loader/shovel productivity (Sheet 10). Times in columns AN, AO, and AP are referenced from the Equipment sheet.

=AQ297*AB297+AR297*AC297+AD297*AS297 (Haul Time, column AK)

Row	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO	AP
14	Effective Haul Grade Segment 1 (%)	Effective Haul Grade Segment 2 (%)	Effective Haul Grade Segment 3 (%)	Effective Return Grade Segment 1 (%)	Effective Return Grade Segment 2 (%)	Effective Return Grade Segment 3 (%)	Haul Time (min)	Return Time (min)	Loading Time (min)	Truck Exchange Time (min)	Dump/Maneuver Time (min)	Work Hour (min/hr)
297	1.7%	2.5%	2.5%	6.7%	2.5%	2.5%	1.7	2.3	2.3	0.7	1.1	50

=IF(X297>=$AA297, X297+$AA297, ABS(X297+$AA297)) (column AE)

=IF(-X297>=$AA297, -X297+$AA297, ABS(-X297+$AA297)) (column AH)

=AT297*AB297+AU297*AC297+AD297*AV297 (Return Time, column AL)

Columns AQ through AV calculate the travel time (per distance) from a curve fit based on CPH production factors, as explained on the following page. Travel time is dependent on effective grade. If the haul grade is positive (uphill), the loaded or empty uphill travel time is calculated, within the maximum speed of the truck. If the grade is negative (downhill), the loaded or empty downhill travel time is calculated, within the maximum speed of the truck.

Chino
Stockpile Spreadsheet Worksheet #9
02/12/19

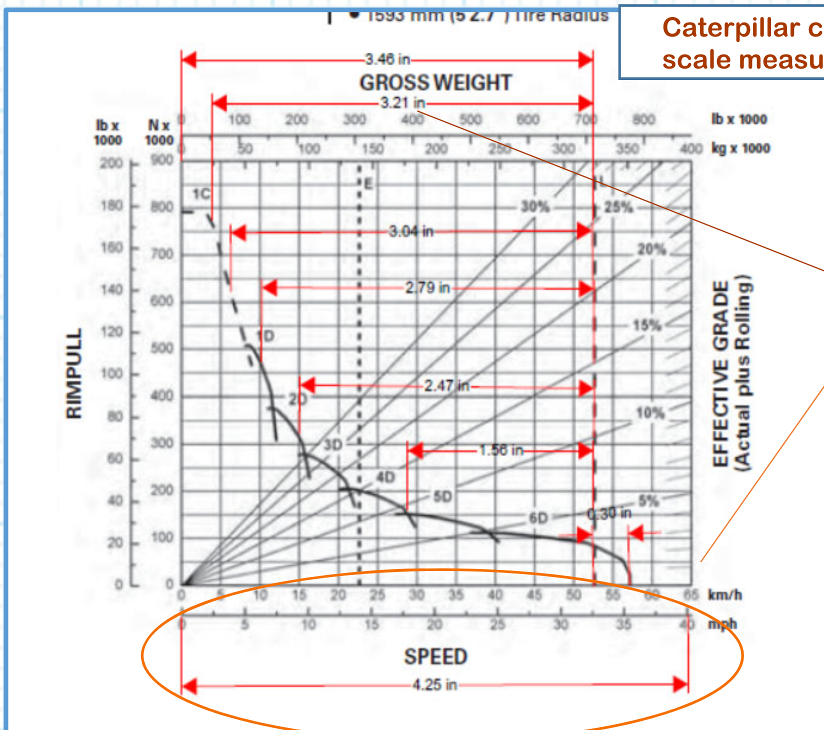
Row	AQ	AR	AS	AT	AU	AV
14	Travel Time Loaded Segment 1 (min/m)	Travel Time Loaded Segment 2 (min/m)	Travel Time Loaded Segment 3 (min/m)	Travel Time Empty Segment 1 (min/m)	Travel Time Empty Segment 2 (min/m)	Travel Time Empty Segment 3 (min/m)
297	0.0012	-	-	0.0016	-	-

For example use only. Values may not match the current spreadsheet.

Results cont'd

Sheet 9 – Trucks cont'd: Haul times are calculated for the trucks by using rimpull-speed-gradeability curves and retarding curves to create a relationship for travel time vs. effective resistance for travel uphill and downhill, respectively. A formula is derived by curve fit to the rimpull-speed-gradeability curves and retarding curves provided in the CPH for the specific truck. Similar to the dozer productivity curves, this is accomplished by scaling values from the figures and using the curve fitting tools within Microsoft Excel. Input values are taken from the 1998, 2011, 2017 and 2018 Caterpillar (Cat) Performance Handbook (CPH) (Editions 29, 41, 47, and 48) for the specific model truck. The example below shows how travel time is calculated for uphill routes, assuming a loaded truck:

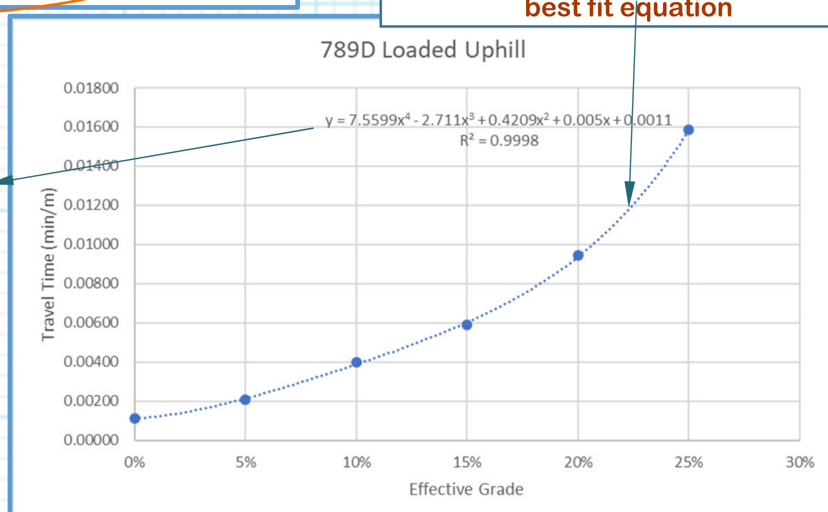
Caterpillar chart and scale measurements



	B	C	D	E	F
1	Loaded Up Hill				
2	Measurement	Speed (mph)			
3	4.25	40			
4	3.46	32.6			
5					
6	Measurement	Speed (mph)	Travel Time (min/m)	Effective Grade	
7	3.21	2.35	0.01585	25%	
8	3.04	3.95	0.00943	20%	
9	2.79	6.31	0.00591	15%	
10	2.47	9.32	0.00400	10%	
11	1.56	17.88	0.00209	5%	
12	0	32.56	0.00114	0%	

Graph these two columns and find best fit equation

Haul Travel Time (min/m)=7.5599(Eff. Grade %)⁴ + -2.711(Eff. Grade %)³ + 0.4209(Eff. Grade %)² + 0.005(Eff. Grade %) + 0.0011



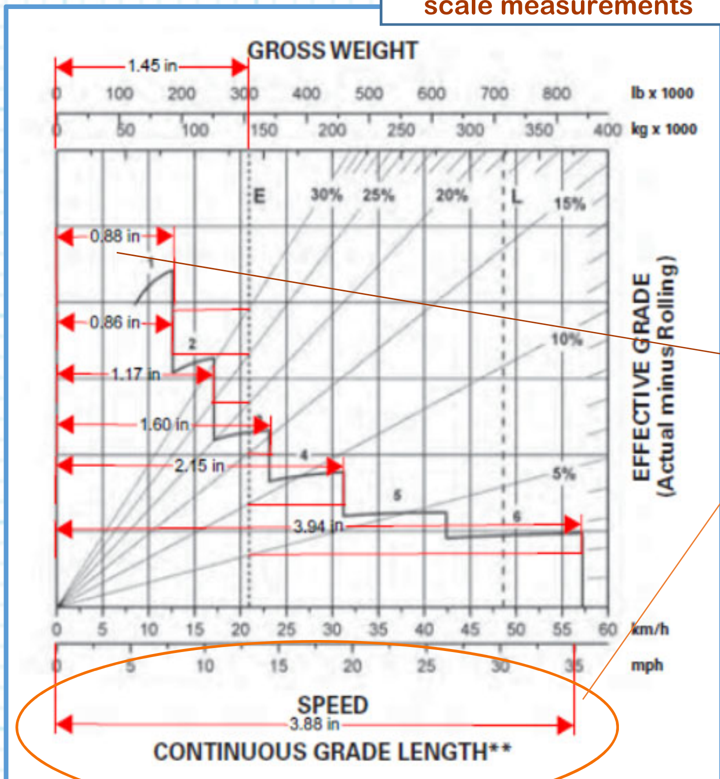
These coefficients are listed for each type of truck in columns P-AI of the Equipment sheet.

For example use only. Values may not match the current spreadsheet.

Results cont'd

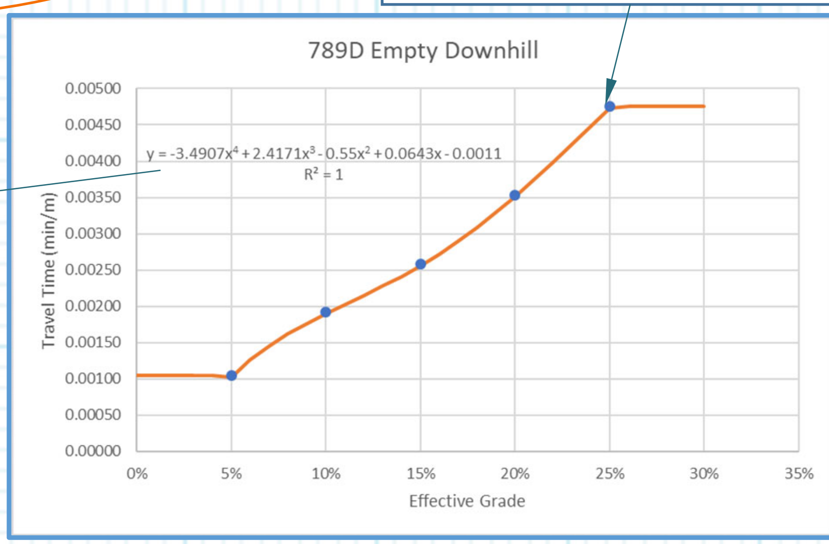
Sheet 9 – <u>Trucks cont'd</u>: The example below shows how travel time is calculated for downhill routes, assuming an empty truck:

Caterpillar chart and scale measurements



	B	C	D	E	F
1					
2	Measurement	Speed (mph)			
3	3.88	35			
4					
5	Measurement	Speed (mph)	Travel Time (min/m)	Effective Grade	
6	0.87	7.85	0.00475	30%	
7	0.87	7.85	0.00475	25%	
8	1.17	10.55	0.00353	20%	
9	1.6	14.43	0.00258	15%	
10	2.15	19.39	0.00192	10%	
11	3.95	35.63	0.00105	5%	
12	3.95	35.63	0.00105	0%	
13					

Graph these two columns and find best fit equation



Haul Travel Time (min/m)= -3.4907(Eff. Grade %)^4 + 2.4171(Eff. Grade %)^3 + 0.0643(Eff. Grade %)^2 + 0.0643(Eff. Grade %) + 0.0011

Fit has been adjusted to only include travel times for effective grades 5%-25%. If statements have been included in truck sheet to make travel time constant if effective grade is above 25% or below 5% for this truck type.

These coefficients are listed for each type of truck in columns P-AI of the Equipment sheet.

For example use only. Values may not match the current spreadsheet.

Results cont'd:

Sheet 10 –Shovel: Shovels (or loaders) are used to load cover material onto haul trucks at borrow stockpiles. Columns E through I repeat the ID, title of the activity, locations, and equipment from Sheet 3. Column J is from Sheet 4 and contains the total amount of material to be loaded/moved. Loader/shovel cycle time (column K), net bucket capacity (column O), and work hour (column P) are from the Equipment sheet. Per Loader/Shovel Productivity (cy/hr) (columns L) and Loader/Shovel Task Time (hrs) (column M) are calculated directly. Similar to the truck task time calculation, the maximum of either the loader/shovel task time or the truck task time is used (column N).

Chino
Stockpile Spreadsheet Worksheet #10
2/12/2019

Productivity and Hours Required for Front End Loader Use or Hydraulic Shovel Use

Assumptions:
Uses cover volume to calculate loading time of cover material

PERFORMANCE FACTORS

	E	F	G	H	I	J	K	L	M	N	O	P
13	1	2	3	4	5	6	7	8	9	10	11	12
14	ID	Task Description	Source Location 1	Destination Location 2	Equipment	Loose/Stockpile Volume (cy)	Loader/Shovel Cycle Time (min)	Per Loader/Shovel Productivity (cy/hr)	Loader/Shovel Task Time (hrs)	Max of Loader/Shovel or Truck Task Time (hrs)	Net Bucket Capacity (cy)	Work Hour (min/hr)
262	1000-C-b-Sh1	Load-Cover	Upper South	Triangle Stockpile	Hitachi EX3600-5	394,621	0.45	3,044	129.6	153.6	27.4	50

=O262/K262*P262

=J262/L262

Sheet 11 – Scrapers: Scrapers are used for rough grading existing ground or for hauling, placing, and fine grading cover material. Columns E through I repeat the ID, title of the activity, locations, and equipment from Sheet 3. Column J is from Sheet 4 and contains the total amount of material to be moved. Column K and L are the total travel distance and average grade of the task. Column M is the rolling resistance per the CPH. Columns N and O add the rolling resistance to the haul & scrape grade to calculate the effective uphill and downhill grades.

Productivity for Scrapers

Assumptions:
Uses volumes of stockpile or cover for hauling and grading times
Haul & Scrape Grade (%) assumes positive is downhill

Number of scrapers used for grading cover = 6
1609.344 meters/mile

	E	F	G	H	I	J	K	L	M	N	O
14	ID	Task Description	Source Location 1	Destination Location 2	Equipment	Loose/Stockpile Volume (cy)	Total Haul Distance One Way (feet)	Haul & Scrape Grade (%)	Rolling Resistance (%)	Effective Grade Uphill (%)	Effective Grade Downhill (%)
84	1101-A-a-Sc2	Grade-Outslope-Existing Facility	South Stockpile S-1	-	Cat 657G	348,051	4,809	7.15%	2.5%	9.7%	4.7%

For example use only. Values may not match the current spreadsheet.

Results cont'd

Sheet 11 – Scrapers cont'd: Columns P, Q, U, V, and X are equipment specifications from the CPH. Column Y assumes a 50 min work hour. The full scraper haul speed (column R) and the empty scraper return speed (column S) are calculated for the scraper in a similar way that haul/return times are calculated for the haul trucks. Rimpull-speed-gradeability curves and retarding curves are used to create an equation for travel time vs. effective resistance for travel uphill and downhill, respectively. Input values are taken from the 2014, 2017 and 2018 Caterpillar (Cat) Performance Handbook (CPH) (Editions 44, 47, and 48) for the specific model scraper. These coefficients are listed for each type of scraper in columns P-AI of the Equipment sheet. Total load, haul, maneuver and spread cycle time is calculated in column T while column Z calculates the number of scraper cycles per hour. Soil weight (column W) is referenced from the Quantities sheet. Productivity is calculated in column AA, assuming a heaped load capacity is used for the scraper. The total task time is calculated in column AB. However, during rough grading multiple scrapers are used per push dozer, with the optimum ratio calculated on the Scraper Optimization sheet (see Equipment Optimization calculation documentation). For fine grading of cover, the scrapers are not paired with a push dozer but 6 scrapers are assumed to be used per fine grading task. Column AD calculates the task time with the optimum number of scrapers.

	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD
1															Chino
2															Stockpile Spreadsheet Worksheet #11
3															2/12/2019
14	Load Time (min)	Maneuver & Spread Time (min)	Full Scraper Haul Speed (mph)	Empty Scraper Return Speed (mph)	Scraper R/T Cycle Task Time (min)	Pusher Cycle Time (min/cycle)	Rated Load (lb)	Soil Weight (lbs/cy)	Heaped Capacity (cy)	Work Hour (min/hr)	Cycles per Scraper per Hr	Productivity per Heaped Scraper (cy/hr)	Total Task Time (hrs)	Number of Scrapers	Task Time w All Scrapers (hrs)
84	0.9	0.7	26	22	6.1	1.4	104,000	3,300	44	50	8	252	1,380	5	276

T84: =(K84/(S84*88))+(K84/(R84*88))+P84+Q84 (Unit conversion factors)

Z84: =Y84/T84

AA84: =(TRUNC(Z84))*(MIN(X84,(V84/W84)))

AB84: =IF(AA84>0,J84/AA84,0)

AD84: =IF(AC84>0,AB84/AC84,0)

Unit conversion factors

For example use only. Values may not match the current spreadsheet.

Results cont'd:

Sheet 12 – M'Grader: Motor graders are used for rough grading tops of stockpiles or for fine grading cover material. Columns E through I repeat the ID, title of the activity, locations, and equipment from Sheet 3. Column J is from Sheet 4 and contains the area of material to be graded. The grade factor (Column M) is calculated based on percent grade. Column K, shaping productivity, is calculated from the speed and effective blade width. Column L is calculated directly. Column N is an assumed material handling factor and Column U is a factor based on operator experience. Columns O-T are based on material properties and equipment information.

	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U
4		***Productivity and Hours Required for Motorgrader Use---Grading***															
5		**Assumptions:**															
6		Productivity (based on area of overall stockpile) = Sq.ft per hour = Speed x (Eff. Blade L -Blade Overlap) x Efficiency (*Cat. Handbook Edition 47* pg 11-27)															
7		Max. safe slope for motor graders is 2:1 (50%), proposed final grade for Chino cover grading on stockpiles is 33%, therefore use of graders an option (Cat. Handbook Edition 46 pg 11-30)															
8		50 min work hour applied to productivity															
9		For comparison of motorgrader to dozer for grading on top of stockpiles change the equipment used in the '3 Material' sheet															
14	ID	Task Description	Source Location 1	Destination Location 2	Grading Equipment	Area (ac)	Grading Shaping Productivity (ac/hr)	Task Time (hrs)	Grade Factor	Material Factor	Material Weight (lb/cy)	Production Method/ Blade	Effective Blade Width (ft)	Pass Overlap (ft)	Speed (mph)	Work Hour (min/hr)	Operator Factor
115	1111-A-a-Mg1	Grade-Top-Existing Facility	South Stockpile S-9(3)	-	Cat 16M	40	3	13.2	1.0	1.0	3,300	1.20	16.00	2.00	2.50	50	1.00

=(T115/60)*N115*(2300/O115)*P115*U115*M115*S115 *(Q115-R115)*5280/43560

=IF(K115>0,J115/K115,0)

Soil weight (lb/cy) assumed in CPH

Unit conversion factors

Sheet 13 – EarthSum: This sheet summarizes all of the quantities and production rates on the individual sheets (5, and 7 through 12) and applies costs from Equipment Watch, the New Mexico labor rates table, fuel quotes, etc. Columns E through I repeat the ID, title of the activity, locations, equipment from Sheet 3. Columns J through L list the fuel, rental and maintenance, and labor unit costs from the Equipment sheet for the associated piece of equipment. The number of units of equipment is assumed to be one except for trucks and scrapers, which use an optimum number of units, calculated on the truck and scraper optimization sheets. The time required is taken from each of the equipment sheets (Sheets 5-12). The fuel, rental and maintenance, and labor costs are calculated by multiplying the unit costs by the time required for each task. The total equipment cost (column R) is the sum of the fuel, rental and maintenance, and labor costs. The total production volumes and areas are repeated from Sheet 4.

	E	F	G	H	I	J	K	L
1								
2								
3		***Summary Calculation of Earthmoving Costs***						
4								
5		Summarizes all earthmoving quantities and costs						
6								
7								
8								
9								
10								
11								
12								
13								
14	ID	Description	Source Location 1	Destination Location 2	Equipment	Fuel Cost ($/hr)	Lube, Tires, GEC, & Field Parts Adjusted Rental Cost (w/o fuel) ($/hr)	Labor Cost ($/hr)
15	1101-E-a-Rp1	Rip-Outslope-Existing Facility	South Stockpile S-1	-	Cat D11T CD Multi-shank (w/ MSR-359H)	$69.62	$259.35	$27.41

For example use only. Values may not match the current spreadsheet.

![TELESTO SOLUTIONS • INCORPORATED] Job No: 200371d-001-01	Client: Freeport NM Operations	Page 20 of 24	
Task: Earthwork RCE	Computed By: Taryn Tigges	Date: 2/19/19	
	Checked By: Fred Charles	Date: 2/21/19	

Results cont'd

Sheet 13 – <u>EarthSum</u> cont'd:

	M	N	O	P	Q	R	S	T
1								Chino
2								Stockpile Spreadsheet Worksheet #13
3								02/12/19
14	Number of Units (Equipment)	Time Req'd (hrs)	Direct Fuel Cost ($)	Direct Lube, Tires, GEC, & Field Parts Adjusted Rental Cost (w/o fuel) ($)	Direct Labor Cost ($)	Total Equipment Cost ($)	Total Production Volume (CY)	Total Production Area (AC)
15	1	2.2	$154	$573	$61	$788	-	6.4

=J15*N15*M15

=SUM(O15:Q15)

Sheet 14 – <u>Revegetation</u>: Columns E through I repeat the ID, title of the activity, locations, and areas from Sheets 3 & 4. The calculated unit rates for revegetation (reveg fuel cost and reveg cost without fuel) are multiplied by the corresponding areas to calculate the associated direct revegetation costs for each location. The total revegetation direct cost is then the sum of all direct costs related to each location.

	E	F	G	H	I	J	K	L	M
1									Chino
2									Stockpile Spreadsheet Worksheet #14
3		***Revegetation Costs***							02/12/19
5		**Description:**							
6		Includes scarifying (ripping), discing, rangeland drill seeding, mulching, crimping, and daily per diem							
14	ID	Description	Source Location 1	Destination Location 2	Area (ac)	Fuel Unit Cost ($/ac)	Reveg w/o Fuel Unit Cost ($/ac)	Fuel Direct Cost ($)	Reveg w/o Fuel Direct Cost ($)
472	1000-J-e-U2	Revegetate-Entire Stockpile-Final Grade	Triangle Stockpile	-	81.5	$ 3.85	$ 816.92	$ 314	$ 66,606
473	1100-J-e-U2	Revegetate-Entire Stockpile-Final Grade	South Stockpile	-	584.6	$ 3.85	$ 816.92	$ 2,250	$ 477,574
474	1200-J-e-U2	Revegetate-Entire Stockpile-Final Grade	West Stockpile	-	626.4	$ 3.85	$ 816.92	$ 2,411	$ 511,745
475	1300-J-e-U2	Revegetate-Entire Stockpile-Final Grade	Lambright Stockpile	-	785.4	$ 3.85	$ 816.92	$ 3,022	$ 641,589
476	1400-J-e-U2	Revegetate-Entire Stockpile-Final Grade	Southwest Lampbright	-	94.3	$ 3.85	$ 816.92	$ 363	$ 77,034
477	1500-J-e-U2	Revegetate-Entire Stockpile-Final Grade	Santa Rita Stockpile	-	60.6	$ 3.85	$ 816.92	$ 233	$ 49,466
478	1600-J-e-U2	Revegetate-Entire Stockpile-Final Grade	Northwest Stockpile	-	8.2	$ 3.85	$ 816.92	$ 32	$ 6,714
479	1700-J-e-U2	Revegetate-Entire Stockpile-Final Grade	LeeHill Stockpile	-	25.4	$ 3.85	$ 816.92	$ 98	$ 20,755
480	1800-J-e-U2	Revegetate-Entire Stockpile-Final Grade	Northeast Stockpile	-	12.2	$ 3.85	$ 816.92	$ 47	$ 10,005
481	1900-J-e-U2	Revegetate-Entire Stockpile-Final Grade	North Stockpile	-	6.9	$ 3.85	$ 816.92	$ 27	$ 5,644
482	2000-J-e-U2	Revegetate-Entire Stockpile-Final Grade	STS2	-	83.8	$ 3.85	$ 816.92	$ 322	$ 68,440
483	2100-J-e-U2	Revegetate-Entire Stockpile-Final Grade	Upper South	-	142.7	$ 3.85	$ 816.92	$ 549	$ 116,542
484	2200-J-e-U2	Revegetate-Entire Stockpile-Final Grade	9 Waste Rock	-	161.2	$ 3.85	$ 816.92	$ 620	$ 131,688
485	2309-J-e-U2	Revegetate-Entire Facility-Final Grade	Dams and Reservoirs Dam 15	-	0.1	$ 3.85	$ 816.92	$ 0	$ 82
486	2313-J-e-U2	Revegetate-Entire Facility-Final Grade	Dams and Reservoirs Dam 20	-	0.3	$ 3.85	$ 816.92	$ 1	$ 261
487	2316-J-e-U2	Revegetate-Entire Facility-Final Grade	Dams and Reservoirs Reservoir 17	-	3.4	$ 3.85	$ 816.92	$ 13	$ 2,745
488	2317-J-e-U2	Revegetate-Entire Facility-Final Grade	Dams and Reservoirs Rustler Canyon	-	1.4	$ 3.85	$ 816.92	$ 5	$ 1,111
489	2318-J-e-U2	Revegetate-Entire Facility-Final Grade	Dams and Reservoirs Fleming Pond	-	0.8	$ 3.85	$ 816.92	$ 3	$ 637
490	2320-J-e-U2	Revegetate-Entire Facility-Final Grade	Dams and Reservoirs PLS Feed Pond	-	0.5	$ 3.85	$ 816.92	$ 2	$ 400
491	2321-J-e-U2	Revegetate-Entire Facility-Final Grade	Dams and Reservoirs PLS Pond & Launder	-	0.3	$ 3.85	$ 816.92	$ 1	$ 212
492	2323-J-e-U2	Revegetate-Entire Facility-Final Grade	Dams and Reservoirs Raffinate Pond	-	0.1	$ 3.85	$ 816.92	$ 0	$ 90
493	2324-J-e-U2	Revegetate-Entire Facility-Final Grade	Dams and Reservoirs Reservoir 2	-	0.2	$ 3.85	$ 816.92	$ 1	$ 180
494	2326-J-e-U2	Revegetate-Entire Facility-Final Grade	Dams and Reservoirs Reservoir 5	-	6.4	$ 3.85	$ 816.92	$ 25	$ 5,228
495	2327-J-e-U2	Revegetate-Entire Facility-Final Grade	Dams and Reservoirs Reservoir 6	-	11.5	$ 3.85	$ 816.92	$ 44	$ 9,395
496	2328-J-e-U2	Revegetate-Entire Facility-Final Grade	Dams and Reservoirs Reservoir 7	-	2.4	$ 3.85	$ 816.92	$ 9	$ 1,969
497	2341-J-e-U2	Revegetate-Entire Facility-Final Grade	Dams and Reservoirs Elmo's Pond	-	1.2	$ 3.85	$ 816.92	$ 5	$ 1,013
498	2342-J-e-U2	Revegetate-Entire Facility-Final Grade	Dams and Reservoirs Lower Lined Pond	-	2.2	$ 3.85	$ 816.92	$ 9	$ 1,822
499	2343-J-e-U2	Revegetate-Entire Facility-Final Grade	Dams and Reservoirs Upper Lined Pond	-	0.4	$ 3.85	$ 816.92	$ 2	$ 335
500	2400-J-e-U2	Revegetate-Entire Facility-Previously Reclaimed-	Ground Hog #5	-	2.0	$ 3.85	$ 816.92	$ 8	$ 1,634
501	2502-J-e-U2	Revegetate-Entire Facility-Final Grade	Miscellaneous NMA Northwest Haul Road	-	4.8	$ 3.85	$ 816.92	$ 19	$ 3,946
502	2512-J-e-U2	Revegetate-Entire Facility-Final Grade	Miscellaneous NMA East Pit Access Disturbed Area	-	3.7	$ 3.85	$ 816.92	$ 14	$ 2,998
503	2513-J-e-U2	Revegetate-Entire Facility-Final Grade	Miscellaneous NMA Chino part of Cobre Haul Road	-	3.2	$ 3.85	$ 816.92	$ 12	$ 2,622
504	2514-J-e-U2	Revegetate-Entire Facility-Final Grade	Miscellaneous NMA Highway to Heaven Haul Road	-	9.0	$ 3.85	$ 816.92	$ 34	$ 7,314
505	2515-J-e-U2	Revegetate-Entire Facility-Final Grade	Miscellaneous NMA Filter Plant	-	17.0	$ 3.85	$ 816.92	$ 66	$ 13,920
506	2600-J-e-U2	Revegetate-Entire Facility-Final Grade	200 Acre Misc. Area	-	200.0	$ 3.85	$ 816.92	$ 770	$ 163,384
507	3000-J-e-U2	Revegetate-Entire Impoundment-Final Grade	Axiflo	-	97.1	$ 3.85	$ 816.92	$ 374	$ 79,321
508	3100-J-e-U2	Revegetate-Entire Impoundment-Final Grade	Tailings Pond 6	-	261.7	$ 3.85	$ 816.92	$ 1,007	$ 213,754
509	3200-J-e-U2	Revegetate-Entire Impoundment-Final Grade	Tailings Pond 7	-	1660.5	$ 3.85	$ 816.92	$ 6,390	$ 1,356,486
510	3301-J-e-U2	Revegetate-Entire Facility-Final Grade	Miscellaneous SMA Slag Pile Outslopes W side	-	8.2	$ 3.85	$ 816.92	$ 32	$ 6,699
511	3307-J-e-U2	Revegetate-Entire Facility-Final Grade	Miscellaneous SMA 35 Acre Misc. Area	-	35.0	$ 3.85	$ 816.92	$ 135	$ 28,592
518	5001-J-d-U2	Revegetate-Cover Source-Placed Cover	White House	-	62.5	$ 3.85	$ 816.92	$ 241	$ 51,064
519	5105-J-d-U2	Revegetate-Cover Source-Placed Cover	Borrow Area F	-	49.6	$ 3.85	$ 816.92	$ 191	$ 40,532
520	5106-J-d-U2	Revegetate-Cover Source-Placed Cover	North of Borrow Area F	-	67.9	$ 3.85	$ 816.92	$ 261	$ 55,461
521	5107-J-d-U2	Revegetate-Cover Source-Placed Cover	Borrow Area E	-	110.0	$ 3.85	$ 816.92	$ 423	$ 89,836
522	5108-J-d-U2	Revegetate-Cover Source-Placed Cover	Borrow Area H	-	165.2	$ 3.85	$ 816.92	$ 636	$ 134,920
523	5109-J-d-U2	Revegetate-Cover Source-Placed Cover	West of Borrow E&H	-	502.0	$ 3.85	$ 816.92	$ 1,932	$ 410,128
616	5005-J-e-U2	Revegetate-Haul Road-Final Grade	Upper South & White House	-	46.8	$ 3.85	$ 816.92	$ 180	$ 38,204
617	5006-J-e-U2	Revegetate-Haul Road-Final Grade	Upper South	-	47.7	$ 3.85	$ 816.92	$ 184	$ 38,983
618									
619				TOTAL	6,058			$ 23,313	$ 4,949,079

=I617*J617

=SUM(M15:M617)

For example use only. Values may not match the current spreadsheet.

Sheet 15 – Other: This sheet contains the direct costs associated with miscellaneous (other) earthwork tasks. These tasks include grading benches, constructing downdrains, constructing downdrain dissipators, constructing bench channels (including filter and riprap production and placement), constructing top channels, plugging and abandoning wells, replacing wells, and constructing haul roads. Columns E through H repeat the ID, description, and locations from Sheet 3. Columns I and J document the quantity and unit associated with each quantity for each task (referenced from the Quantities sheet). The unit costs (columns K and L) are referenced from the Unit Cost sheet. The quantity multiplied by the unit costs give the direct costs for each activity. The direct costs are totaled at the bottom of the sheet.

Other Reclamation Activity Costs

Assumptions:

1 - Downdrain lengths and bench channel lengths based on Golder Take-Offs 1401129-004-MTO-RevG_07_Chino_MTOs_05SEP18.xlsx
2 - Bench grading lengths equal to bench channel lengths
3 - There are no top channels
4 - Cost to construct drain or channel on re-graded stockpile
5 - The downdrain, ACB, well plug & abandon, and well replacement costs include fuel

Row	ID	Description	Source Location 1	Destination Location	Quantity[1]	Uni	Fuel Unit Cost ($/unit)	Unit Cost ($/unit)	Fuel Direct Cost ($/unit)	Direct w/o Fuel Cost ($)
426	1000-F-e-U3	Grade Benches-Entire Stockpile-Final Grade	Triangle Stockpile	-	13,831	ft	$ 0.39	$ 1.58	$ 5,339.36	$ 21,917
427	1100-F-e-U3	Grade Benches-Entire Stockpile-Final Grade	South Stockpile	-	95,487	ft	$ 0.39	$ 1.58	$ 36,862.20	$ 151,313
428	1200-F-e-U3	Grade Benches-Entire Stockpile-Final Grade	West Stockpile	-	108,831	ft	$ 0.39	$ 1.58	$ 42,013.43	$ 172,458
429	1300-F-e-U3	Grade Benches-Entire Stockpile-Final Grade	Lambright Stockpile	-	157,574	ft	$ 0.39	$ 1.58	$ 60,830.31	$ 249,697
430	1400-F-e-U3	Grade Benches-Entire Stockpile-Final Grade	Southwest Lampbright	-	-	ft	$ 0.39	$ 1.58	$ -	$ -
431	1500-F-e-U3	Grade Benches-Entire Stockpile-Final Grade	Santa Rita Stockpile	-	-	ft	$ 0.39	$ 1.58	$ -	$ -
432	1600-F-e-U3	Grade Benches-Entire Stockpile-Final Grade	Northwest Stockpile	-	-	ft	$ 0.39	$ 1.58	$ -	$ -
433	1700-F-e-U3	Grade Benches-Entire Stockpile-Final Grade	LeeHill Stockpile	-	-	ft	$ 0.39	$ 1.58	$ -	$ -
434	2000-F-e-U3	Grade Benches-Entire Stockpile-Final Grade	STS2	-	6,218	ft	$ 0.39	$ 1.58	$ 2,400.41	$ 9,853
435	2100-F-e-U3	Grade Benches-Entire Stockpile-Final Grade	Upper South	-	5,348	ft	$ 0.39	$ 1.58	$ 2,064.56	$ 8,475
436	3000-F-e-U4	Grade Benches-Entire Impoundment-Final Grade	Axiflo	-	3,350	ft	$ 0.39	$ 1.58	$ 1,293.24	$ 5,309
437	3100-F-e-U4	Grade Benches-Entire Impoundment-Final Grade	Tailings Pond 6	-	-	ft	$ 0.39	$ 1.58	$ -	$ -
438	3200-F-e-U4	Grade Benches-Entire Impoundment-Final Grade	Tailings Pond 7	-	42,224	ft	$ 0.39	$ 1.58	$ 16,300.11	$ 66,909
439	1000-G-e-U5	Construct Downdrains-Entire Stockpile-Final Grade	Triangle Stockpile	-	-	ft	-	$ 348.00	$ -	$ -
440	1100-G-e-U5	Construct Downdrains-Entire Stockpile-Final Grade	South Stockpile	-	6,474	ft	-	$ 348.00	$ -	$ 2,253,036
441	1200-G-e-U5	Construct Downdrains-Entire Stockpile-Final Grade	West Stockpile	-	4,493	ft	-	$ 348.00	$ -	$ 1,563,570
442	1300-G-e-U5	Construct Downdrains-Entire Stockpile-Final Grade	Lambright Stockpile	-	9,299	ft	-	$ 348.00	$ -	$ 3,236,065
443	1400-G-e-U5	Construct Downdrains-Entire Stockpile-Final Grade	Southwest Lampbright	-	-	ft	-	$ 348.00	$ -	$ -
444	1500-G-e-U5	Construct Downdrains-Entire Stockpile-Final Grade	Santa Rita Stockpile	-	-	ft	-	$ 348.00	$ -	$ -
445	1600-G-e-U5	Construct Downdrains-Entire Stockpile-Final Grade	Northwest Stockpile	-	-	ft	-	$ 348.00	$ -	$ -
446	1700-G-e-U5	Construct Downdrains-Entire Stockpile-Final Grade	LeeHill Stockpile	-	-	ft	-	$ 348.00	$ -	$ -
447	3000-G-e-U5	Construct Downdrains-Entire Impoundment-Final Grade	Axiflo	-	-	ft	-	$ 348.00	$ -	$ -
448	3100-G-e-U5	Construct Downdrains-Entire Impoundment-Final Grade	Tailings Pond 6	-	319	ft	-	$ 348.00	$ -	$ 111,094
449	3200-G-e-U5	Construct Downdrains-Entire Impoundment-Final Grade	Tailings Pond 7	-	2,280	ft	-	$ 348.00	$ -	$ 793,559
450	1100-Gb-e-U6	Construct Downdrain Dissipators-Entire Stockpile-Final Grade	South Stockpile	-	2	ea	-	$ 14,267.94	$ -	$ 28,536
451	1200-Gb-e-U6	Construct Downdrain Dissipators-Entire Stockpile-Final Grade	West Stockpile	-	4	ea	-	$ 14,267.94	$ -	$ 57,072
452	1300-Gb-e-U6	Construct Downdrain Dissipators-Entire Stockpile-Final Grade	Lambright Stockpile	-	4	ea	-	$ 14,267.94	$ -	$ 57,072
453	1000-H-e-U7	Construct Bench Channels-Entire Stockpile-Final Grade	Triangle Stockpile	-	13,831	ft	$ 1.48	$ 7.49	$ 20,525.66	$ 103,655
454	1100-H-e-U7	Construct Bench Channels-Entire Stockpile-Final Grade	South Stockpile	-	95,487	ft	$ 1.48	$ 7.49	$ 141,706.35	$ 715,622
455	1200-H-e-U7	Construct Bench Channels-Entire Stockpile-Final Grade	West Stockpile	-	108,831	ft	$ 1.48	$ 7.49	$ 161,508.81	$ 815,625
456	1300-H-e-U7	Construct Bench Channels-Entire Stockpile-Final Grade	Lambright Stockpile	-	157,574	ft	$ 1.48	$ 7.49	$ 233,845.04	$ 1,180,925
457	1400-H-e-U7	Construct Bench Channels-Entire Stockpile-Final Grade	Southwest Lampbright	-	-	ft	$ 1.48	$ 7.49	$ -	$ -
458	1500-H-e-U7	Construct Bench Channels-Entire Stockpile-Final Grade	Santa Rita Stockpile	-	-	ft	$ 1.48	$ 7.49	$ -	$ -
459	1600-H-e-U7	Construct Bench Channels-Entire Stockpile-Final Grade	Northwest Stockpile	-	-	ft	$ 1.48	$ 7.49	$ -	$ -
460	1700-H-e-U7	Construct Bench Channels-Entire Stockpile-Final Grade	LeeHill Stockpile	-	-	ft	$ 1.48	$ 7.49	$ -	$ -
461	2000-H-e-U7	Construct Bench Channels-Entire Stockpile-Final Grade	STS2	-	6,218	ft	$ 1.48	$ 7.49	$ 9,227.72	$ 46,600
462	2100-H-e-U7	Construct Bench Channels-Entire Stockpile-Final Grade	Upper South	-	5,348	ft	$ 1.48	$ 7.49	$ 7,936.61	$ 40,080
463	3000-H-e-U7	Construct Bench Channels-Entire Impoundment-Final Grade	Axiflo	-	3,350	ft	$ 1.48	$ 7.49	$ 4,971.51	$ 25,106
464	3100-H-e-U7	Construct Bench Channels-Entire Impoundment-Final Grade	Tailings Pond 6	-	-	ft	$ 1.48	$ 7.49	$ -	$ -
465	3200-H-e-U7	Construct Bench Channels-Entire Impoundment-Final Grade	Tailings Pond 7	-	42,224	ft	$ 1.48	$ 7.49	$ 62,661.17	$ 316,441
570	1200-N-e-U18	Plug and Abandon Well-Entire Stockpile-Final Grade	West Stockpile	-	1,700	ft	-	$ 10.47	$ -	$ 17,799
571	1200-O-e-U19	Replace Well-Entire Stockpile-Final Grade	West Stockpile	-	1,700	ft	-	$ 66.43	$ -	$ 112,935
605	5005-Q-c-U21	Construct Haul Road-Cover Source-Graded Facility	Upper South & White House	-	17,438	ft	$ 1.85	$ 7.15	$ [illegible]	$ 124,629
606	5006-Q-c-U21	Construct Haul Road-Cover Source-Graded Facility	Upper South	-	17,323	ft	$ 1.85	$ 7.15	$ 31,965.18	$ 123,807
613										
614								TOTAL	$ 873,629	$ 12,409,158

=I606*K606

=SUM(M15:M617)

For example use only. Values may not match the current spreadsheet.

Results cont'd

Sheet 16 – Sum: This sheet summarizes the direct costs from Sheets 2, 13, 14 and 15. The indirect costs are added as a percentage of the direct costs.

	A	B	C	D	E
1					Chino
2					Stockpile Spreadsheet Worksheet #16
3					2/12/2019
4					
5	***Chino Mine***				
6	DRAFT Reclamation Summary Stockpiles, Haul Roads, Reservoirs, and Disturbed Areas				
7	Based on Golder 2018 Closure/Closeout Plan				
8				**Current Value**	
9	**DIRECT COSTS**	Facility and Structure Removal		$21,258,937	
10		Earthmoving		$111,231,288	
11		Revegetation		$4,972,392	
12		Other		$12,924,307	
13		**Subtotal, Direct Costs**		**$150,386,924**	
14					
15	**INDIRECT COSTS[1]**	**Subtotal, Indirect Costs**	**30.0%**	**$45,116,077**	
16					
17					
18	**TOTAL COST**			**$195,503,001**	
19		Fifteen Year Annual Expenditure		$13,033,533.43	
20					
21					
22	Notes:				
23	Indirect costs are based on 2019 agreement between FMI and agencies				
24	Indirect costs include mobilization and demobilization, engineering redesign fee, contingencies, contractor				
25	profit and overhead, project management fee, and state procurement cost				

='2 Demo'!F23
='13 EarthSum'!R620
='14 Revegetation'!M619+'14 Revegetation'!L619
='15 Other'!N619+'15 Other'!M619
=SUM(D9:D12)
=C15*D13
=(D13+D15)
=D18/15

Total indirect costs of 30% are applied to the capital direct costs based on discussions involving the FA Work Group completed in December 2018. The FA Work Group involved representatives of Freeport-McMoRan New Mexico Operations (FNMO), MMD, NMED, and Gila Resources Information Project (GRIP). The indirect costs incorporate Mobilization and Demobilization, Contingencies, Engineering Redesign Fee, Contractor Profit and Overhead, Project Management Fee, and other administrative costs. The RCE report provides further information on the FA Work Group agreement.

For example use only. Values may not match the current spreadsheet.

Results cont'd:

Sheets 17-Facility Characteristics- This sheet summarizes direct and indirect cost for each facility in the Chino RCE spreadsheet. The first four facilities listed on this sheet are shown below:

	A	B	C	D	E	F
1						
2						
3	**Facility Characteristics**					
4	Facilities are categorized in this listing to meet the MMD reporting					
5	requirement					
6			1000	1100	1200	1300
7		**Facility**	**Triangle Stockpile**	**South Stockpile**	**West Stockpile**	**Lambright Stockpile**
8						
9		**Reclaimed Acres**	81.5	584.6	626.4	785.4
10						
11		**Item**	**Capital Cost**	**Capital Cost**	**Capital Cost**	**Capital Cost**
12	Direct Costs	Cover Material Excav, Haul, Grade[1]	$348,297	$2,871,554	$4,618,554	$6,954,185
13		Top/Outslope Adjustment Grading[2]	$1,779,123	$25,724,715	$12,316,669	$25,612,852
14		Scarify, Seed & Mulch, Reveg[3]	$66,920	$479,824	$514,155	$644,611
15		Channels & Benches[4]	$103,502	$3,167,496	$2,554,736	$4,718,769
16		Demolition				
17		Other[5]	$0	$0	$130,734	$0
18		**Capital Cost Totals**	**$2,297,842**	**$32,243,589**	**$20,134,849**	**$37,930,417**
19		**Capital Cost/Acre**	**$28,183**	**$55,155**	**$32,142**	**$48,296**
20						
21	Indirect Costs	Cover Material Excav, Haul, Grade1	$104,489	$861,466	$1,385,566	$2,086,256
22		Top/Outslope Adjustment Grading[2]	$533,737	$7,717,415	$3,695,001	$7,683,856
23		Scarify, Seed & Mulch, Reveg[3]	$20,076	$143,947	$154,247	$193,383
24		Channels & Benches[4]	$31,051	$950,249	$766,421	$1,415,631
25		Demolition	$0	$0	$0	$0
26		Other[5]	$0	$0	$39,220	$0
27		**Indirect Cost Totals**	**$689,353**	**$9,673,077**	**$6,040,455**	**$11,379,125**
28		**Indirect Cost/Acre**	**$8,455**	**$16,546**	**$9,643**	**$14,489**
29						
30						
31						
32		**Total Cost**	**$2,987,195**	**$41,916,666**	**$26,175,303**	**$49,309,543**
33		Total Cost Cover	$452,787	$3,733,021	$6,004,120	$9,040,441
34		Total Cost Top/Outslope Adjustment	$2,312,859	$33,442,130	$16,011,670	$33,296,708
35		Total Cost Earthwork	$2,765,646	$37,175,150	$22,015,790	$42,337,149
36		Capital Cost Re-Veg	$86,996	$623,771	$668,402	$837,995
37		Capital Cost Other[5]	$0	$0	$169,954	$0
38						
39		**Total Cost/Acre**	**$36,638**	**$71,701**	**$41,785**	**$62,785**
40		Total Cost/Acre Cover	5,553	6,386	9,585	11,511
41		Total Cost/Acre Top/Outslope Adjustment	28,367	57,205	25,560	42,396
42		Total Cost/Acre Earthwork	$33,920	$63,591	$35,145	$53,907
43		Capital Cost/Acre Re-Veg	1,067	1,067	1,067	1,067
44		Capital Cost/Acre Other[5]	$0	$0	$271	$0
45						

The Direct and Indirect Costs are each broken down into the following sections: Cover Material, Top/Outslope Adjustment Grading, Revegetation, Channels & Benches, Demolition, and Other. Demolition is not divided by location but is given as a total.

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Results cont'd:

Remaining Sheets: The remaining sheets and data supporting the earthwork calculations described in this calculation documentation are described in the following calculation summaries:

- Equipment Optimization
- O&M
- Building Demo
- Bench Grading Unit Cost
- Bench Channel Unit Cost
- Top Channel Unit Cost
- Downdrain Unit Cost
- Haul Road Unit Cost
- Pipeline Unit Cost
- Revegetation Unit Cost
- Fuel Unit Cost

Fuel Cost

Calculation Documentation

Problem Statement:
Freeport-McMoRan's (FMI's) Chino Mines Company utilizes fuel price information as part of earthwork closure cost estimation associated with the Chino Mine Closure/Closeout Plan (CCP). A reliable estimate of the local 2019 fuel price is needed, based on local and national data for past years.

Objective:

1. Develop an equation to predict the estimated 2019 local fuel price for use in estimating earthwork closure costs at FMI's mining operations in Grant County, NM.

Approach:

1. Identify existing data used for the calculation.
2. Correlate local and national data for fuel price, paired by year.
3. Estimate 2019 fuel price for use in the earthwork closure costs.

Data and Assumptions:

1. Data used for the calculations are shown below (1995-2018) and include (a) U.S. No. 2 Diesel Retail Prices (annual national) and (b) FMI quotes (for specific dates within a year) for the local Silver City area. All prices are in $/gallon.

Fuel Price Data

Data 1: U.S. No 2 Diesel Retail Prices (Dollars per Gallon)

Date	U.S. No 2 Diesel Retail Prices[1]
1995	1.109
1996	1.235
1997	1.198
1998	1.044
1999	1.121
2000	1.491
2001	1.401
2002	1.319
2003	1.509
2004	1.81
2005	2.402
2006	2.705
2007	2.885
2008	3.803
2009	2.467
2010	2.992
2011	3.84
2012	3.968
2013	3.922
2014	3.825
2015	2.707
2016	2.304
2017	2.65
2018	3.178

Date	U.S. No 2 Diesel Retail Prices[1]
Jan 2019	2.98

FMI Fuel Quotes[2]

Site	Date	Dyed, low-sulfur diesel	Notes
Continental	1/21/2005	$1.40	Tom Shelley - quote from fuel broker
Chino & Tyrone	5/9/2007	$2.41	Porter Oil Quote (7500 gal capacity)
Continental	1/23/2009	$1.80	Porter Oil Quote (7500 gal capacity)
Tyrone (Little Rock)	1/14/2010	$2.49	Porter Oil Quote (7500 gal capacity)
Tyrone	7/7/2012	$3.13	Western Refining Oil
Continental	6/18/2014	$3.22	Western Refining Oil
Chino (North Lampbright)	11/5/2015	$1.74	Western Refining Oil
Chino	5/20/2016	$1.66	Western Refining Oil
Tyrone (Little Rock)	4/24/2017	$1.90	Western Refining Oil
Continental	3/12/2018	$2.75	Griffin Propane
Chino	10/10/2018	$2.75	Griffin Propane

1. U.S. Energy Information Administration
http://tonto.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=PET&s=EMD_EPD2D_PTE_NUS_DPG&f=M
2. Quotes obtained from Freeport-McMoRan (FMI)

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Data and Assumptions (continued):

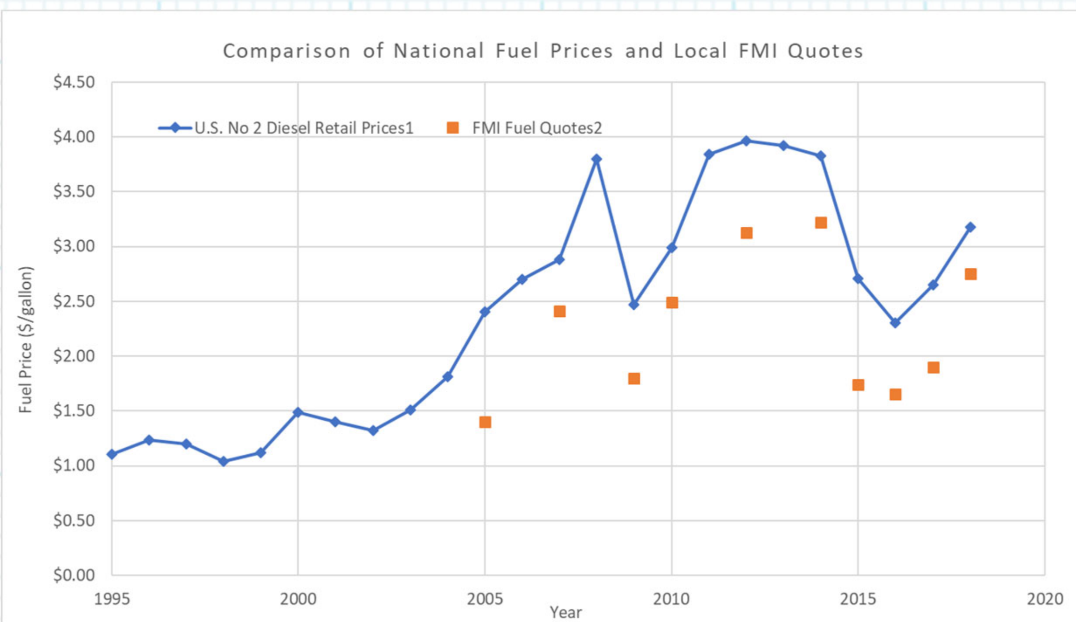
2. The local FMI fuel quotes and annual national retail fuel (U.S. No. 2) prices are assumed to trend similarly – if the national prices increase the local prices also increase.
3. A correlation between national and local fuel prices is assumed to be a reasonable predictor of local fuel prices for any time period (e.g., annual, monthly, etc).

Calculations and Results:

1. The annual national retail fuel prices (U.S. Energy Information Administration) dataset is tabulated and plotted for comparison with the available annual local FMI fuel quotes (note that quotes are not available for blank years).

Year	U.S. No 2 Diesel Retail Prices[1]	FMI Fuel Quotes[2]
1995	1.109	
1996	1.235	
1997	1.198	
1998	1.044	
1999	1.121	
2000	1.491	
2001	1.401	
2002	1.319	
2003	1.509	
2004	1.81	
2005	2.402	$1.40
2006	2.705	
2007	2.885	$2.41
2008	3.803	
2009	2.467	$1.80
2010	2.992	$2.49
2011	3.84	
2012	3.968	$3.13
2013	3.922	
2014	3.825	$3.22
2015	2.707	$1.74
2016	2.304	$1.66
2017	2.65	$1.90
2018	3.178	$2.75

1. U.S. Energy Information Administration
http://tonto.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=PET&s=EMD_EPD2D_PTE_NUS_DPG&f=M
2. Quotes obtained from Freeport-McMoRan (FMI)



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Calculations and Results (continued):

2. The annual national fuel retail prices are ranked from lowest to highest, and corresponding local FMI fuel quotes are listed for matching years in which they are available. (see Col. A and B, below)
3. The difference between the national fuel retail prices and FMI fuel quotes is calculated for each pairing. Note that FMI fuel quotes are all lower than the corresponding national fuel retail prices. The differences for all pairs are averaged. (Col. C)
4. For each year without an FMI quote, the average difference ($0.69) is subtracted from the national fuel retail prices. This results in a calculated FMI value for each unpaired data year. (Col. D)
5. The available FMI fuel quotes and calculated FMI values are combined into one column for a full listing of calculated FMI values and FMI quotes. (Col. E)
6. The annual national fuel retail prices (Col. A) are plotted vs FMI calculated values and quotes (Col. E), and a correlation is developed with national fuel prices as the independent variable and FMI values and quotes as the dependent (i.e., estimated) variable. (see Col. F and graph below)

A	B	C	D	E	F
U.S. No. 2 Diesel Retail Prices[1]	FMI Fuel Quotes[2]	Difference Between Retail Prices and FMI Quotes	Calculated FMI Values Based on Average Difference	Calculated FMI Values and Quotes	y = -0.0617x3 + 0.4659x2 - 0.0611x + 0.0148
$0.00				$0.00	$0.01
$1.11			$0.42	$0.42	$0.44
$1.24			$0.55	$0.55	$0.53
$1.20			$0.51	$0.51	$0.50
$1.04			$0.36	$0.36	$0.39
$1.12			$0.43	$0.43	$0.44
$1.49			$0.80	$0.80	$0.75
$1.40			$0.71	$0.71	$0.67
$1.32			$0.63	$0.63	$0.60
$1.51			$0.82	$0.82	$0.77
$1.81			$1.12	$1.12	$1.06
$2.40	$1.40	$1.00		$1.40	$1.70
$2.71			$2.02	$2.02	$2.04
$2.89	$2.41	$0.47		$2.41	$2.23
$3.80			$3.11	$3.11	$3.13
$2.47	$1.80	$0.67		$1.80	$1.77
$2.99	$2.49	$0.50		$2.49	$2.35
$3.84			$3.15	$3.15	$3.16
$3.97	$3.13	$0.84		$3.13	$3.25
$3.92			$3.23	$3.23	$3.22
$3.83	$3.22	$0.61		$3.22	$3.14
$2.71	$1.74	$0.97		$1.74	$2.04
$2.30	$1.66	$0.65		$1.66	$1.59
$2.65	$1.90	$0.75		$1.90	$1.98
$3.18	$2.75	$0.43		$2.75	$2.89
	Average	$0.69			

1. U.S. Energy Information Administration
http://tonto.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=PET&s=EMD_EPD2D_PTE_NUS_DPG&f=M
2. Quotes obtained from Freeport-McMoRan (FMI)

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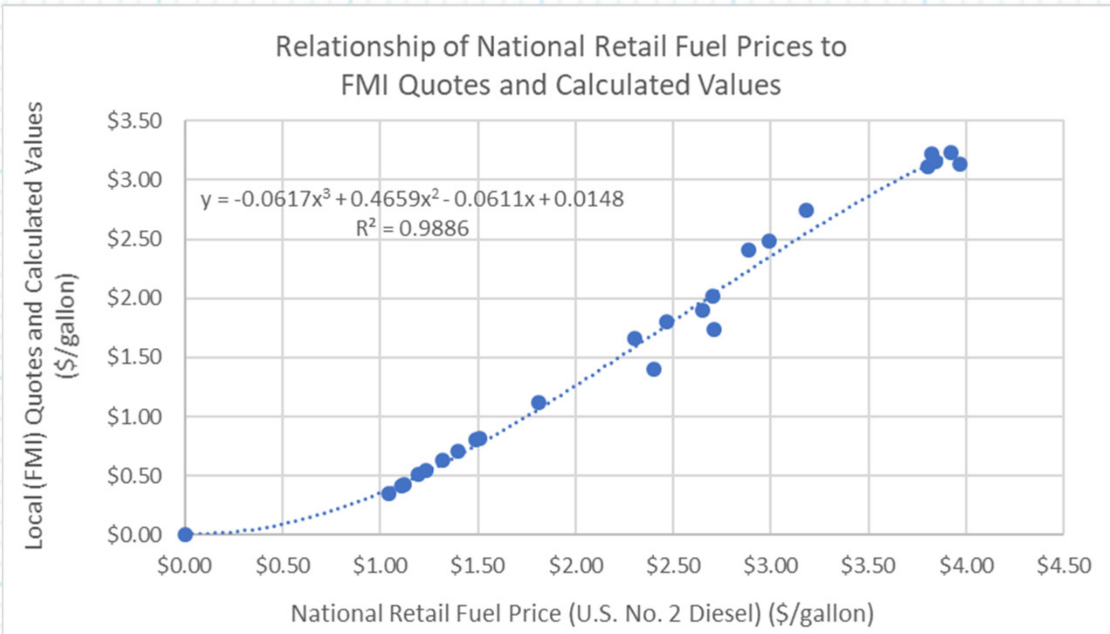
Calculations and Results (continued):



7. The prediction equation (and coefficient of determination, R^2) is shown in the above graph where x = national retail fuel price ($/gallon) and y = predicted local fuel price ($/gallon).
8. Based on this equation, and a national retail fuel price in January 2019 of $2.98, the predicted local FMI fuel price for U.S. No. 2 diesel (January 2019) is

$$Local\ fuel\ price = (-0.0617)(2.98)^3 + (0.4659)(2.98)^2 - (0.0611)(2.98) + 0.0148 = \$2.34/gallon$$

Summary and Conclusions:

1. National and local (FMI) fuel price data were used to develop a strongly-correlated (R^2 = 0.9886) prediction equation by which local FMI fuel prices can be predicted from national fuel price data. Note that the relationship developed in this analysis applies only to FMI operations in the Silver City (Grant County), NM area.
2. The following prediction equation developed in these calculations can be used to predict the estimated 2019 local fuel price for use in earthwork closure costs:

$$Local\ fuel\ price = -0.0617x^3 + 0.4659x^2 - 0.0611x + 0.0148$$

where x = national retail fuel price ($/gallon) and y = predicted local fuel price ($/gallon)

For example use only. Values may not match the current spreadsheet.

Bench Grading
Unit Cost

Calculation Documentation

Problem Statement:

Freeport-McMoRan's (FMI's) Chino Mines Company utilizes unit cost information for bench grading on side slopes of stockpiles and tailing ponds as part of earthwork closure cost estimation associated with the Chino Mine Closure/Closeout Plan (CCP). The unit costs need to account for the earthwork process and site-specific conditions, equipment productivity, equipment rental rates, and associated equipment maintenance, fuel costs, and labor rates.

This calculation set presents a summary of the approach and results for estimating the unit cost for bench grading. Detailed information is presented in the earthwork reclamation cost estimate (RCE) spreadsheet file.

This calculation set is intended to serve as a guide/example even if the actual quantities and/or cost data used in these calculations change due to updates or application to a different Freeport NM Operations mine.

Objective:

1. Develop a bench grading unit cost ($/ft) for stockpile side slopes and tailing pond side slopes for use in estimating earthwork closure costs at FMI's mining operations in Grant County, NM. Account for equipment and fuel costs in the estimate.

Approach:

1. The data, assumptions, calculations, and results for the bench grading unit cost estimate are presented within the earthwork RCE spreadsheet file "[YrMoDa]_Chino_Stockpile_Tailing_Earthwork_RCE.xlsx" in a sheet (tab) named "Bench Grading_UC".
2. The approach for estimating bench grading unit costs is as follows:
   - Compile data and assumptions used in the calculations. Data obtained from the CCP or Scope of Work include:
     - Material factors
     - Grade factors
     - Soil weight
     - Production method/blade factors
     - Centroid to centroid push distance
     - Operator factor
     - Work hour
     - Visibility factor
     - Elevation factor
     - Transmission factor
     - Number of passes to finish grade
     - Speed
     - Volume

Approach:

- Equipment costs are referenced from the Equipment Sheet
- Estimate the unit cost for bench grading on sides slopes of the stockpiles and tailing ponds. The unit cost for bench grading operations is calculated based on two construction steps: excavate and final grade.
  - Productivity in cy/hr is calculated for excavation using the following equation:

$$Productivity\ (cy/hr) = Normal\ Production\ (cy/hr) * Operator * Material * \frac{Work\ Hour\ (min/hr)}{60\ (min/hr)} * Grade\ Factor * \frac{2300\ (lbs/cy)}{Material\ Weight\ (lbs/cy)} * Prod.\ Method * Visibility * Elev. * Drive\ Trans.$$

  - Productivity in hrs/ft is calculated for finish grade by using the following equation:

$$Productivity\ (hrs/ft) = \left(Operator * Material * Grade\ Factor * \frac{Work\ Hour\ (min/hr)}{60\ (min/hr)} * \frac{2300\ \left(\frac{lbs}{cy}\right)}{Material\ Weight\ \left(\frac{lbs}{cy}\right)} * Prod.\ Method * Visibility * Elev. * Drive\ Trans. * Speed\ (mi/hr) * 5280\ (ft/mi) * \frac{1}{\#\ Passes} \right)^{-1}$$

Results:

1. The results of the bench grading unit cost calculations are shown below (some of the final results may vary from what is shown). These results are used in the overall earthwork RCE.

Bench Grading Unit Cost

Bench Grading - Stockpiles					
Task Description	Equipment	Bench Equipment Cost ($/ft)	Bench Fuel Cost ($/ft)		
Excavate	Cat D11T CD	$1.43	$0.35		
Finish Grade	Cat D6T XL, SU Blade	$0.09	$0.02		
		$1.52	$0.37	**$1.89**	**Total**

Bench Grading -Tailings					
Task Description	Equipment	Bench Equipment Cost ($/ft)	Bench Fuel Cost ($/ft)		
Excavate	Cat D11T CD	$1.43	$0.35		
Finish Grade	Cat D6T XL, SU Blade	$0.09	$0.02		
		$1.52	$0.37	**$1.89**	**Total**

For example use only. Values may not match the current spreadsheet.

Top Channel
Unit Cost

Calculation Documentation

Problem Statement:

Freeport-McMoRan's (FMI's) Chino Mines Company utilizes unit cost information for top channel construction on stockpiles as part of earthwork closure cost estimation associated with the Chino Mine Closure/Closeout Plan (CCP). The unit cost needs to account for the earthwork process and site-specific conditions, equipment productivity, equipment rental rates, and associated equipment maintenance, fuel costs, and labor rates.

This calculation set presents a summary of the approach and results for estimating the unit cost for channel construction. Detailed information is presented in the earthwork reclamation cost estimate (RCE) spreadsheet file.

This calculation set is intended to serve as a guide/example even if the actual quantities and/or cost data used in these calculations change due to updates or application to a different Freeport NM Operations mine.

Objective:

1. Develop a top channel construction unit cost ($/ft) for stockpiles for use in estimating earthwork closure costs at FMI's mining operations in Grant County, NM. Account for equipment and fuel costs in the estimate.

Approach:

1. The data, assumptions, calculations, and results for the top channel construction unit cost estimate are presented within the earthwork RCE spreadsheet file "[YrMoDa]_Chino_Stockpile_Tailing_Earthwork_RCE.xlsx" in a sheet (tab) named "Top Channel_UC".
2. The approach for estimating the top channel construction unit cost is as follows:
   - Compile data and assumptions used in the calculations. Data obtained from the CCP or Scope of Work include:
     - Material factors
     - Grade factors
     - Soil weight
     - Production method/blade factors
     - Centroid to centroid push distance
     - Operator factor
     - Work hour
     - Visibility factor
     - Elevation factor
     - Transmission factor

Approach (con'd):

- Equipment costs are referenced from the Equipment Sheet
- Estimate the unit cost for top channel construction on stockpiles. The unit cost for top channel construction operations is calculated based on three construction steps: excavate, waste, and final grade.
  - Calculate the unit volume (cy/ft) for excavation and wasting using top channel design drawings. The finish grade volume is assumed to be 40% of the excavation and wasting volume.
  - Productivity in cy/hr is calculated using the following equation:

$$Productivity\ (cy/hr) = Normal\ Production\ (cy/hr) * Operator * Material * \frac{Work\ Hour\ (min/\ hr)}{60\ (min/\ hr)} * Grade\ Factor * \frac{2300\ (lbs/cy)}{Material\ Weight\ (lbs/cy)} * Prod.\ Method * Visibility * Elev. * Drive\ Trans.$$

  - Productivity in hrs/ft is calculated by dividing the productivity in cy/hr by the unit volume in cy/ft.

Results:

1. The results of the top channel construction unit cost calculations are shown below (some of the final results may vary from what is shown). These results are used in the overall earthwork RCE.

Top Channel Unit Cost

Task Description	Equipment	Bench Equipment Cost ($/ft)	Bench Fuel Cost ($/ft)		
Excavate	Cat D11T CD	$0.68	$0.17		
Waste	Cat D11T CD	$0.75	$0.18		
Finish Grade	Cat D9T, SU Blade	$0.61	$0.09		
		$2.04	$0.44	$2.48	Total

For example use only. Values may not match the current spreadsheet.

Bench Channel Unit Cost

Calculation Documentation

Problem Statement:

Freeport-McMoRan's (FMI's) Chino Mines Company utilizes bench channel unit cost information as part of earthwork closure cost estimation associated with the Chino Mine Closure/Closeout Plan (CCP). The unit cost for bench channel construction needs to account for the earthwork process and site-specific conditions, equipment productivity, equipment rental rates, and associated equipment maintenance, fuel costs, and labor rates.

Objectives:

1. Develop a bench channel unit cost ($/ft) for use in estimating earthwork closure costs at FMI's mining operations in Grant County, NM.
2. Note that this calculation set presents the approach, data and assumptions, and calculations and results for developing the unit cost. It is intended to serve as a guide/example even if the actual quantities and/or cost data used in these calculations change due to updates or application to a different Freeport NM Operations mine.

Approach:

1. The data, assumptions, calculations, and results for the bench channel unit cost estimate are presented within the earthwork RCE spreadsheet file "[YrMoDa]_Chino_Stockpile_Tailing_Earthwork_RCE.xlsx" in the sheet (tab) named "Bench Channel_UC".
2. The approach for the calculations is as follows:
   - Using reclamation design quantities and calculations, for each facility determine volumes of excavation, bench channel filter, and bench channel riprap, and haul distances.
   - Calculate travel times for the equipment, incorporating distances and travel speeds.
   - Estimate the unit cost for each of the five following bench channel construction steps:
     - Earthwork excavate and waste
     - Load and transfer riprap and filter
     - Haul riprap and filter
     - Place riprap and filter
     - Finish grade channel and riprap
   - Estimate the cost to produce riprap and filter where these materials are obtained.
   - Combine equipment and fuel costs for the bench channel operations and riprap and filter production for a total bench channel unit cost.

Data and Assumptions:

1. Bench channel earthwork quantities for each facility are obtained from the reclamation design, with additional calculations presented below in Calculations and Results). Basic channel dimensions are shown in Table 1.

Table 1

BENCH CHANNELS

Dimensions:			
Left Side Slope:[1]	3.00	H:1V	
Left Side Slope:[1]	2.50	H:1V	
Depth:[1]	2.00	ft	
Left Side Slope Length:[1]	3.61		
Right Side Slope Length:[1]	3.20		
Bottom Width:	5.00	ft	
Left Anchor[1]	0.00	ft	
Right Anchor[1]	0.00	ft	
Perimeter:[1]	11.81	ft	
Excavation Area:[1]	21.00	sf	
Filter Area	5.90	sf	bench cross width* 6" thickness
RipRap Area	4.77	sf	(27* Total Riprap Volume)/Total Bench Length

2. Equipment and fuel cost information used for bench channel unit cost calculations is developed in the Equipment sheet of the separate Earthwork RCE spreadsheet calculation set.
3. Equipment rates from Equipment Watch include overhaul labor, parts, and time, and are corrected for a 50-minute work hour.
4. Other equipment parameters used in the calculations are from Tables 3 and 4 of the Process Summary (SOW), Nov 2017 (Telesto).
5. The work day is set at 8 hours/day, 50 minutes/hour.
6. The following assumptions/data inputs apply to riprap and filter production:
   - For riprap and filter production, the primary plant is fed directly by two 769D haul trucks, 300 to 400 yd haul.
   - 400 tons input/hr (per Rusty McCauley, equipment peak production is 900 tons/hr).
   - 30% - 60% waste depending on smallest rip rap size used. (per Rusty McCauley, consistent w/ Mc+C63Cain Springs waste rate of 43% - 1" minus).
   - 3650 lb/cy (Caterpillar Performance Handbook p. 27-4, consistent with 1.8 tons/cy riprap unit weight).

Data and Assumptions (continued):

6. Key assumptions/data inputs for riprap and filter production equipment and labor are shown in Table 2.

Table 2

Equipment & Labor	Rate ($/hr)	Comment
One 988H Loader with Operator (bucket = 8.3 cy)	$ 156.46	Used to load stockpiled material to 769D trucks and 777 haul trucks
Three 769D haul trucks with drivers (22 cy, 36 ton payload each)	$ 396.83	Option: Two used to directly feed primary screening plant, one used to move material from end of conveyor
One 1 Deck Portable Screening Plant w/ 5x16 screen & 48"x60' conveyor + 1 Operator	$ 63.68	Primary screening plant, grizzly used to split oversized, 6" - 12" and 6" minus (2 conveyers) One operator required in tower to run screening plant
		One operator required in tower to run screening plant
One 3 Deck Portable Screening Plant w/ 5x16 screen & 42"x60' conveyor + 1 Operator	$ 64.25	Fed with 6" minus, Produce 6" - 6", 1.5" - 3", 3/8" - 1.5", 3/8 minus One operator required in tower to run screening plant
Two Cat 980H Loaders with Operator (bucket = 7.5 cy)	$ 210.53	Used move material to conveyors or load trucks
Zero Cat 992K Loaders with Operator (bucket = 16 cy)	$ -	Unused loader option
One Cat 966H Loader with Operator (bucket = 5.5 cy)	$ 100.81	Used to move material from end of conveyors & load trucks
One Water Truck with Driver (10,000 gal)	$ 91.96	Dust suppression
One Foreman	$ 23.84	

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Calculations and Results:

1. Volumes of excavation, bench channel filter, and bench channel riprap for each facility and haul distances are presented in Table 3, with a summary of the calculations presented after Table 3.

Table 3

	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL
2		Bench Channels (ft)	Excavation (cy)	Bench Channel Filter (cy)	Bench Channel Riprap (cy)	Haul Dist (ft)	Weighted Filter	Weighted Riprap	Weighted Filter Haul (ft)	Weighted Riprap Haul (ft)
3										
4	South Stockpile	95,487	74,268	20,878	17,399	8,173	170,638,277	142,198,564	14,487.63	14,786.34
5	STS2	6,218	4,837	1,360	1,133	-	-	-		
6	Lambright Stockpile	157,574	122,557	34,454	28,711	17,438	600,801,207	500,667,673		
7	Southwest Lampbright	-	-	-	-	17,323	-	-		
8	West Stockpile	108,831	84,647	23,796	19,830	22,486	535,069,876	445,891,564		
9	Northwest Stockpile	-	-	-	-	23,749	-	-		
10	LeeHill Stockpile	-	-	-	-	25,168	-	-		
11	Northeast Stockpile	-	-	-	-	29,443	-	-		
12	North Stockpile	-	-	-	-	27,241	-	-		
13	Santa Rita Stockpile	-	-	-	-	21,949	-	-		
14	Upper South	5,348	4,160	1,169	975	-	-	-		
15	Triangle Stockpile	13,831	10,757	3,024	2,520	4,778	14,449,396	12,041,164		
16	9 Waste Rock	14,085	10,955	3,080	-	5,132	15,804,963	-		
17	Axiflo	3,350	2,606	732	591	5,128	3,756,252	3,032,979		
18	Tailings Pond 7	42,224	32,841	9,232	7,693	8,800	81,238,952	67,699,127		
19	Tailings Pond-6W	3,498	2,720	765	637	10,300	7,877,551	6,564,626		
20	Tailings Pond-6E	2,999	2,333	656	547	10,300	6,755,330	5,629,442		
21		453,446	352,680	99,146	80,055	237,408				

Bench channel length in Col. AD is from the reclamation design. Along with bench channel length, excavation area (see Table 1) is used to calculate the excavation volume (Col. AE) as follows, with an example calculation for South Stockpile shown:

$$Excavation\ Volume = Bench\ channel\ length\ x\ Excavation\ area$$

$$Excavation\ Volume\ (South\ Stockpile) =$$
$$95{,}487\ ft\ x\ 21\ square\ feet\ (sf)/(27\ cf/cy) = 74{,}268\ \text{cy}$$

Bench channel length and filter area (and riprap area) (see Table 1) are used to calculate the bench channel filter volume (and riprap volume) for each facility as follows, with an example calculation for filter volume for South Stockpile shown:

$$Filter\ or\ Riprap\ Volume = Bench\ channel\ length\ x\ Filter\ or\ Riprap\ area$$

$$Filter\ Volume\ (South\ Stockpile) =$$
$$95{,}487\ ft\ x\ 5.904\ square\ feet\ (sf)/(27\ cf/cy) = 20{,}878\ \text{cy}$$

For example use only. Values may not match the current spreadsheet.

Calculations and Results (continued):

1. Volumes and haul distances (continued)

Haul distances (Col. AH) are assumed to be equal to cover haul distances and are referenced from the Quantities Sheet.

The volume-weighted average filter and riprap haul distances are calculated (Col. AK and AL, respectively) for hauling of filter and riprap to facilitate bench channel unit cost calculation, rather than calculating hauling distances for each individual facility. To calculate the weighted haul distance for filter (same type of calculation for riprap also), first a weighted value is calculated for each facility (Col. AI and AJ, respectively) and then the weighted values are summed – South Stockpile is shown as an example:

$$Weighted\ Filter\ (South\ Stockpile) = Filter\ Haul\ Distance\ x\ Filter\ Volume =$$
8,173 ft x 20,878 cy = 170,638,277 ft-cy

$$Weighted\ Filter\ Haul\ (all\ facilities) =$$
$$(Sum\ of\ Weighted\ Filter\ Values)/(Total\ Volume\ of\ Bench\ Channel\ Filter) =$$
(1,436,391,805 ft-cy)/(99,146 cy) = 14,488 ft

2. Travel times are calculated for the equipment, incorporating distances and travel speeds, as shown in Table 4, with a summary of the calculations presented after Table 4.

Table 4

	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL
27	Cat 992K	Full	Tram Distance							
28			175	ft at	7.6	mph	11.15	ft/sec	0.26	min
29										
30	Komatsu 730E	Full	Haul Distance							
31			14488	ft at	12	mph	17.60	ft/sec	13.7	min
32										
33	Komatsu 730E	Empty	Haul Distance							
34			14488	ft at	35	mph	51.33	ft/sec	4.7	min
35										
36	Cat 725	Full	Haul Distance							
37			5153	ft at	10	mph	14.67	ft/sec	5.9	min
38										
39	Cat 725	Empty	Haul Distance							
40			5153	ft at	34	mph	49.87	ft/sec	1.7	min

For example use only. Values may not match the current spreadsheet.

Calculations and Results (continued):

2. Travel times (continued):

The equipment used for hauling is listed in Col. AC, and Full or Empty is listed in Col. AD.

Haul or tram travel distances (Col. AE) are calculated based on the equipment used and basis for the distance. Tram distance using the Cat 992K is assigned at 175 ft and the haul distance for the Komatsu 730E utilizes the weighted filter haul distance (14,488 ft). The riprap/filter placement distance calculation assumes an average of 7 bench channels and 2 downdrains per stockpile; riprap/filter material is hauled 1/4 of the length of a downdrain and then 1/4 of the length of a bench channel distance for an average placement distance:

$$Riprap/filter\ Placement\ Distance\ for\ Cat\ 725 =$$

$$0.5\ \mathrm{x}\frac{\text{Average bench channel length}}{\text{7 bench channels per stockpile}} + 0.25\mathrm{x}\text{Average downdrain length}/2$$

= 0.5 x (41,222 ft)/7 + 0.25 x (3419 ft)/2 = 1,380 ft

Travel speeds are shown in Col. AG:

- The tram speed of 7.6 mph is from equipment information.
- For the Komatsu 730E, the full speed is 12 mph and empty speed is 35 mph – the full speed is going uphill with 7.5% effective grade.
- For the Cat 725, the full speed is 10 mph and empty speed is 34 mph – the full speed involves dumping going uphill, and the empty speed is going downhill.

From the information discussed above, travel times (Col. AK) are calculated as follows, with an example calculation shown for the Cat 992K:

$$Travel\ time = (Travel\ distance)/Travel\ speed) =$$

(175 ft)/[(7.6 mile/hour)(1 hour/60 minutes)(5280 ft/mile)] = 0.26 minute

Calculations and Results (continued):

Next, the unit costs for each of the five following bench channel construction steps are developed:

- Earthwork excavate and waste
- Load and transfer riprap and filter
- Haul riprap and filter
- Place riprap and filter
- Finish grade channel and riprap

3. Excavate and waste (earthwork) operations comprise the first construction step. The unit cost is calculated based on both steps using a Cat D11T CD, U Blade dozer. Table 5 (split into 3 segments due to many columns) shows the progression of the calculations to estimate the cost for these operations. This table is followed by the calculations (or assigned parameters) for the "Excavate" row.

Table 5

	B	C	D	E	F	G	H	I	J
5		Task Description	Equipment	Volume (cy/ft)	Productivity (cy/hr)	Material Factor²	Grade Factor²	Material Weight² (lb/cy)	Production Method/ Blade Factor²
6	Bench Channels	Excavate	Cat D11T CD, U Blade	0.78	1123	1.20	1.0	2900	1.00
7	Bench Channels	Waste	Cat D11T CD, U Blade	0.78	1001	1.20	1.0	2900	1.00

	B	C	K	L	M	N	O	P	Q
5		Task Description	Centroid to Centroid Push Distance² (feet)	Normal Production (cy/hr)	Operator Factor²	Work Hour² (min/hr)	Visibility Factor²	Elevation Factor²	Transmission Factor²
6	Bench Channels	Excavate	175	1851	0.75	50	1.00	1.00	1.00
7	Bench Channels	Waste	200	1649	0.75	50	1.00	1.00	1.00

	B	C	R	S	T	U	V	W	X	Y
5		Task Description	Productivity (hrs/ft)	Fuel Cost ($/hr)	Equipment Cost ($/hr)	Operator Cost (IV) ($/hr)	Dozer Cost ($/hr)	Bench Equipment Cost ($/ft)	Bench Fuel Cost ($/ft)	Total $/ft
6	Bench Channels	Excavate	0.0007	69.62	254.44	27.41	281.85	0.20	0.05	
7	Bench Channels	Waste	0.0008	69.62	254.44	27.41	281.85	0.22	0.05	
8								0.41	0.10	$ 0.52

The following parameters used in the calculations are from Tables 3 and 4 of the Process Summary (SOW), Nov 2017 (Telesto) – also see Equipment sheet in the separate Earthwork RCE spreadsheet calculation set: Material Factor (Col. G), Grade Factor (Col. H), Material Weight (Col. I), Production Method/Blade Factor (Col. J), Centroid to Centroid Push Distance (Col. K), Operator Factor (Col. M), Work Hour (Col. N), Visibility Factor (Col. O), Elevation Factor (Col. P), and Transmission Factor (Col. Q).

Calculations and Results (continued):

3. Excavate and waste (earthwork) calculations (continued)

$$Volume(Col.E) = \frac{(Table\ 3\ Cell\ AE21)}{(Table\ 3\ Cell\ AD21)} = \frac{352{,}680\ cy}{453{,}446\ ft} = 0.78\ cy/ft$$

$$Productivity(Col.F) = \text{Col.}\,L\ x\ M\ x\ G\ x\left(\frac{N}{60}\right) x\ H\ x\left(\frac{2300}{I}\right) x\ J\ x\ O\ x\ P\ x\ Q =$$

$$1851\,\frac{cy}{hr}\ x\ 0.75\ x\ 1.20\ x\left(\frac{50\ min/hr}{60\ min}\right) x\ 1.0\ x\,\frac{2300\ lb/cy}{2900\ lb/cy}\ x\ 1.00\ x\ 1.00\ x\ 1.00\ x\ 1.00 =$$

1123 cy/hr

$Normal\ Production\ (Col.L){:}\ If\ Centroid\ to\ Centroid\ Push\ Distance\ is\ not\ 0,$ $then, for\ the\ equipment\ used, look\ up\ the\ production\ curve\ fit\ parameters\ C\ and\ b$ $for\ equation{:}\ C\ x\ (Average\ dozing\ distance\ [ft])^b = 162{,}758.76\ x\ (175\ ft)^{-0.86691} =$ *1851 cy/hr*

$$Productivity(Col.R) = \frac{\left(Volume, \frac{cy}{ft}[Col.E]\right)}{\left(Productivity, \frac{cy}{hr}[Col.F]\right)}$$ = (0.78 cy/ft)/(1123 cy/hr) = 0.00069 hr/ft (or 0.0007 hr/ft)

$Fuel\ Cost\ (Col.S), Equipment\ Cost(Col.T), and\ Operator\ (IV)\ Cost\ (Col.U)\ are\ from$ $Equipment\ cost\ calcs\ (presented\ in\ the\ Earthwork\ RCE\ spreadsheet\ calculation\ set).$

$$Dozer\ Cost\ (Col.\ V) = \frac{\$254.44}{hr}(equipment) + \frac{\$27.41}{hr}(operator) = \frac{\$281.85}{hr}$$

$Bench\ equipment\ cost\ (Col.W) =$

$$\left(Dozer\ cost, \frac{\$}{hr}[Col.V]\right) x\left(Productivity, \frac{hr}{ft}[Col.R]\right)$$ = ($281.85/hr) x (0.00069 hr/ft) = *$0.20/ft*

$Bench\ Fuel\ Cost\ (Col.\ X) =$

$$\left(Fuel\ cost, \frac{\$}{hr}[Col.S]\right) x\left(Productivity, \frac{hr}{ft}[Col.R]\right)$$ = ($69.62/hr) x (0.00069 hr/ft) = *$0.05/ft*

The total unit cost for the earthwork (excavate and waste) = $0.52/ft

Calculations and Results (continued):

4. Load riprap and filter, and transfer for placing, unit cost is calculated based on the following separate operations: load riprap, load filter, transfer riprap for placing, and transfer filter for placing. A Cat 992K is used for these operations. Table 6 (split into 3 segments due to many columns) shows the progression of the calculations to estimate the cost for these operations. This table is followed by the calculations (or assigned parameters) for the "Load Riprap" row.

Table 6

	B	C	D	E	F	G	H	I
11		Task Description	Equipment	Volume (cy/ft)	Load, Dump, Maneuver Time (min)	Delivery Travel Time (min)	Return Travel Time (min)	Total Time Per Load (min)
12	Bench Channels	Load riprap	Cat 992K	0.18	0.65	0.26	0.26	1.17
13	Bench Channels	Load filter	Cat 992K	0.22	0.65	0.26	0.26	1.17
14	Bench Channels	Transfer riprap for placing	Cat 992K	0.18	0.65	0.26	0.26	1.17
15	Bench Channels	Transfer filter for placing	Cat 992K	0.22	0.65	0.26	0.26	1.17

	B	C	J	K	L	M	N	O	P
11		Task Description	Work Time[2] (min)	Loads/ hr	Equipment Cost ($/load)	Net Bucket (cy/load)	Fuel Use Gal per Hour	Fuel Cost ($/hr)	Equipment Cost ($/hr)
12	Bench Channels	Load riprap	50	42.61	5.72	14.00	25.63	59.97	216.23
13	Bench Channels	Load filter	50	42.61	5.72	14.00	25.63	59.97	216.23
14	Bench Channels	Transfer riprap for placing	50	42.61	5.72	14.00	25.63	59.97	216.23
15	Bench Channels	Transfer filter for placing	50	42.61	5.72	14.00	25.63	59.97	216.23

	B	C	Q	R	S	T	U	V	W	X
11		Task Description	Operator Cost ($/hr)	Loader Cost ($/hr)	Equipment Cost ($/cy)	Fuel Cost ($/load)	Fuel Cost ($/cy)	Equipment Cost ($/ft)	Fuel Cost ($/ft)	Total $/ft
12	Bench Channels	Load riprap	27.70	243.93	0.41	1.41	0.10	0.07	0.02	
13	Bench Channels	Load filter	27.70	243.93	0.41	1.41	0.10	0.09	0.02	
14	Bench Channels	Transfer riprap for placing	27.70	243.93	0.41	1.41	0.10	0.07	0.02	
15	Bench Channels	Transfer filter for placing	27.70	243.93	0.41	1.41	0.10	0.09	0.02	
16								0.32	0.08	0.40

The following parameters used in the calculations are developed in the Equipment sheet as described for the separate Earthwork RCE spreadsheet calculation set: Load, Dump, Maneuver Time (min) (Col. F); Net Bucket (cy/load) (Col. M); Fuel Use Gal per Hour (Col. N); Fuel Cost ($/hr) (Col. O); Equipment Cost ($/hr) (Col. P); and Operator Cost ($/hr) (Col. Q).

$$Volume(Col.E) = \frac{(Table\ 3\ Cell\ AG21)}{(Table\ 3\ Cell\ AD21)} = \frac{80{,}055\ cy}{453{,}446\ ft} = 0.18\ cy/ft$$

$$Delivery\ Travel\ Time\ (Col.G) = \text{Return Travel Time (Col. H)}$$
$$= \text{Table 4 } Cell\ AK28\ (for\ Cat\ 992K) = 0.26\ min$$

$$Total\ Time\ Per\ Load\ (Col.I) = \text{Col. F + Col G. + Col. H} = 0.65 + 0.26 + 0.26 = 1.17\ min$$

For example use only. Values may not match the current spreadsheet.

Calculations and Results (continued):

4. Load/transfer riprap and filter (continued)

Work Time (Col. J) = 50 min per hour

Loads/hr (Col. K) = (Col. J)/(Col. I) = 50/1.17 = 42.61 loads/hr

Loader Cost/hr (Col. R) = Equipment Cost (Col. P) + Operator Cost (Col. Q)
= $216.23/hr + $27.70/hr = $243.93/hr

Equipment Cost/load (Col. L) = [Loader Cost, $/hr (Col. R)]/[Loads/hr (Col. K)]
= ($243.93/hr)/(42.61 loads/hr) = $5.72/load

Equipment Cost/cy (Col. S) = [Equipment Cost/load (Col. L)]/[(Net Bucket cy/load, Col. M)]
= ($5.72/load)/(14.00 cy/load) = $0.41/cy

Fuel Cost/load (Col. T) = [Fuel Cost/hr (Col. O)]/[Loads/hr (Col. K)]
= ($59.97/hr)/(42.61 loads/hr) = $1.41/load

Fuel Cost/cy (Col. U) = [Fuel Cost/load (Col. T)]/[Net Bucket cy/load (Col. M)]
= ($1.41/load)/(14.00 cy/load) = $0.10/cy

Equipment Cost/ft (Col. V) = [Equipment Cost/cy (Col. S)] x [Volume, cy/ft (Col. E)]
= ($0.41/cy) x (0.18 cy/ft) = $0.07/ft

Fuel Cost/ft (Col. W) = [Fuel Cost/cy (Col. U)] x [Volume, cy/ft (Col. E)]
= ($0.10/cy) x (0.18 cy/ft) = $0.02/ft

The total unit cost for the loading and transferring (for placing) riprap and filter = total for equipment + total for fuel = $0.32/ft + $0.08/ft = $0.40/ft

Calculations and Results (continued):

5. Haul riprap and filter unit cost is calculated based on the following separate operations: haul riprap and haul filter. A Komatsu 730E is used for these operations. Table 7 (split into 3 segments due to many columns) shows the progression of the calculations to estimate the cost for these operations. This table is followed by the calculations (or assigned parameters) for the "Haul Riprap" row.

Table 7

	B	C	D	E	F	G	H	I	J
19		Task Description	Equipment	Volume (cy/ft)	Exchange Time (min)	Delivery Travel Time (min)	Unload and Maneuver Time (min)	Return Travel Time (min)	Load Time (min)
20	Bench Channels	Haul riprap	Komatsu 730E	0.18	0.70	13.72	1.10	4.70	6.73
21	Bench Channels	Haul filter	Komatsu 730E	0.22	0.70	13.72	1.10	4.70	6.73

	B	C	K	L	M	N	O	P	Q	R
19		Task Description	Total Time (min)	Work Time[2] (min)	Loads/hr	Equipment Cost ($/load)	Heaped Capacity (cy/load)	Fuel Use Gal per Hour	Fuel Cost ($/hr)	Equipment Cost ($/hr)
20	Bench Channels	Haul riprap	26.96	50	1.85	132.65	145	33.48	78.34	221.79
21	Bench Channels	Haul filter	26.96	50	1.85	132.65	145	33.48	78.34	221.79

	B	C	S	T	U	V	W	X	Y	Z
19		Task Description	Operator Cost ($/hr)	Truck Cost ($/hr)	Equipment Cost ($/cy)	Fuel Cost ($/load)	Fuel Cost ($/cy)	Equipment Cost ($/ft)	Fuel Cost ($/ft)	Total $/ft
20	Bench Channels	Haul riprap	24.27	246.06	0.91	42.24	0.29	0.16	0.05	
21	Bench Channels	Haul filter	24.27	246.06	0.91	42.24	0.29	0.20	0.06	
22								0.36	0.12	0.48

The following parameters used in the calculations are developed in the Equipment sheet as described for the separate Earthwork RCE spreadsheet calculation set: Exchange Time (min) (Col. F); Unload and Maneuver Time (min) (Col. H); Heaped Capacity (cy/load) (Col. O); Fuel Use Gal per Hour (Col. P); Fuel Cost ($/hr) (Col. Q); Equipment Cost ($/hr) (Col. R); and Operator Cost ($/hr) (Col. S).

$$Volume(Col.E) = \frac{(Table\ 3\ Cell\ AG21)}{(Table\ 3\ Cell\ AD21)} = \frac{80{,}055\ cy}{453{,}446\ ft} = 0.18\ cy/ft$$

$$Delivery\ Travel\ Time\ (Col.G) = \text{Table 4}\ Cell\ AK31\ (for\ Komatsu\ 730E) = 13.72\ min$$

$$Return\ Travel\ Time\ (Col.I) = \text{Table 4}\ Cell\ AK34\ (for\ Komatsu\ 730E) = 4.70\ min$$

Calculations and Results (continued):

5. Haul riprap and filter (continued)

Load Time (Col. J)
= Dump, Maneuver Time (Col. F in load/transfer riprap)
x [Heaped Capacity, cy/load (Col. O)]/[Bucket, cy/load (Col. M in load/transfer riprap)]
= 0.65 min x (145 cy/load)/(14.00 cy/load) = 6.73 min

Total Time (Col. K) = Exchange Time (Col. F) + Delivery Travel Time (Col. G) + Unload and Maneuver Time (Col. H) + Return Travel Time (Col. I) + Load Time (Col. J)
= 0.70 + 13.72 + 1.10 + 4.70 + 6.73 = 26.96 min

Work Time (Col. L) = 50 min per hour

Loads/hr (Col. M) = [Work Time (Col. L)]/[Total Time (Col. K)] = 50/26.96 = 1.85 loads/hr

Equipment Cost/load (Col. N) = [Truck Cost/hr (Col. T]/[Loads/hr (Col. M)]
= ($246.06/hr)/(1.85 loads/hr) = $132.65/load

Truck Cost/hr (Col. T) = Equipment Cost/hr (Col. R) + Operator Cost/hr (Col. S)
= $221.79 + $24.27 = $246.06/hr

Equipment Cost/cy (Col. U)
= [Equipment Cost/load (Col. N)]/[(Heaped Capacity, cy/load (Col. O)]
= ($132.65/load)/(145 cy/load) = $0.91/cy

Fuel Cost/load (Col. V) = [Fuel Cost/hr (Col. Q)]/[Loads/hr (Col. M)]
= ($78.34/hr)/(1.85 loads/hr) = $42.24/load

Fuel Cost/cy (Col. W) = [Fuel Cost/load (Col. V)]/[Heaped Capacity, cy/load (Col. O)]
= ($42.24/load)/(145 cy/load) = $0.29/cy

Equipment Cost/ft (Col. X) = [Equipment Cost/cy (Col. U)] x [Volume, cy/ft (Col. E)]
= ($0.91/cy) x (0.18 cy/ft) = $0.16/ft

Fuel Cost/ft (Col. Y) = [Fuel Cost/cy (Col. W)] x [Volume, cy/ft (Col. E)]
= ($0.29/cy) x (0.18 cy/ft) = $0.05/ft

The total unit cost for the hauling riprap and filter = total for equipment + total for fuel = $0.36/ft + $0.12/ft = $0.48/ft

Calculations and Results (continued):

6. Place riprap and filter unit cost is calculated based on the following separate operations: place riprap and place filter. A Cat 725 is used for these operations. The sequence of calculations for the place riprap and filter unit cost is the same as for load/transfer riprap and filter calculations, above. Inputs to the calculations for placing riprap and filter are generally the same except that Cat 725 operating parameters and costs are used. This includes different delivery and return travel times (different equipment than for load/transfer riprap and filter) which are shown in Table 4, and different heaped capacity, among other operating parameters.

   Table 8 (split into 3 segments due to many columns) shows the progression of the calculations to estimate the cost for these operations.

   Table 8

	B	C	D	E	F	G	H	I	J
25		Task Description	Equipment	Volume (cy/ft)	Exchange Time (min)	Delivery Travel Time (min)	Unload and Maneuver Time (min)	Return Travel Time (min)	Load Time (min)
26	Bench Channels	Place riprap	Cat 725	0.18	0.70	5.86	1.10	1.72	0.87
27	Bench Channels	Place filter	Cat 725	0.22	0.70	5.86	1.10	1.72	0.87

	B	C	K	L	M	N	O	P	Q	R
25		Task Description	Total Time (min)	Work Time[2] (min)	Loads/ hr	Equipment Cost ($/load)	Heaped Capacity (cy/load)	Fuel Use Gal per Hour	Fuel Cost ($/hr)	Equipment Cost ($/hr)
26	Bench Channels	Place riprap	10.25	50	4.88	19.96	19	6.02	14.09	73.11
27	Bench Channels	Place filter	10.25	50	4.88	19.96	19	6.02	14.09	73.11

	B	C	S	T	U	V	W	X	Y	Z
25		Task Description	Operator Cost ($/hr)	Truck Cost ($/hr)	Equipment Cost ($/cy)	Fuel Cost ($/load)	Fuel Cost ($/cy)	Equipment Cost ($/ft)	Fuel Cost ($/ft)	Total $/ft
26	Bench Channels	Place riprap	24.27	97.38	1.06	2.89	0.15	0.19	0.03	
27	Bench Channels	Place filter	24.27	97.38	1.06	2.89	0.15	0.23	0.03	
28								0.42	0.06	0.48

For example use only. Values may not match the current spreadsheet.

Calculations and Results (continued):

7. Finish grade unit cost is calculated based on the following separate operations: finish grade channel and finish grade riprap. A Cat D6T, SU Blade is used for these operations. The sequence of calculations for the finish grade unit cost is the same as for the first operation for bench channel construction – earthwork (excavate and waste) (see those calculations, above, for details). Inputs to the finish grade channel and finish grade riprap calculations are generally the same with the following exceptions:
   - Cat D6T, SU Blade operating parameters and costs are used.
   - Volume per ft for finish grading is set at 40% (0.4) of the full material grading volume per ft because of the reduced grading required for finish grading.
   - Material Factor (Col. G) and Material Weight (Col. I) for riprap are used, which are different than for the excavate and waste, and channel grading, materials.

   Table 9 (split into 3 segments due to many columns) shows the progression of the calculations to estimate the cost for these operations.

   Table 9

	B	C	D	E	F	G	H	I	J
31		Task Description	Equipment	Volume (cy/ft)	Productivity (cy/hr)	Material Factor[2,3]	Grade Factor[2]	Material Weight[2] (lb/cy)	Production Method/ Blade Factor[2]
32	Bench Channels	Finish grade - Channel	Cat D6T, SU Blade	0.31	173	1.20	1.0	2900	1.00
33	Bench Channels	Finish grade - Riprap	Cat D6T, SU Blade	0.07	80	0.70	1.0	3650	1.00

	B	C	K	L	M	N	O	P	Q
31		Task Description	Centroid to Centroid Push Distance[2] (feet)	Normal Production (cy/hr)	Operator Factor[2]	Work Hour[2] (min/hr)	Visibility Factor[2]	Elevation Factor[2]	Transmission Factor[2]
32	Bench Channels	Finish grade - Channel	175	284	0.75	50	1.00	1.00	1.00
33	Bench Channels	Finish grade - Riprap	175	284	0.75	50	1.00	1.00	1.00

	B	C	R	S	T	U	V	W	X	Y
31		Task Description	Productivity (hrs/ft)	Fuel Cost ($/hr)	Equipment Cost ($/hr)	Operator Cost (IV) ($/hr)	Dozer Cost ($/hr)	Bench Equipment Cost ($/ft)	Bench Fuel Cost ($/ft)	Total $/ft
32	Bench Channels	Finish grade - Channel	0.0018	16.8948	63.65	27.41	91.06	0.16	0.03	
33	Bench Channels	Finish grade - Riprap	0.0009	16.8948	63.65	27.41	91.06	0.08	0.01	
34								0.24	0.05	0.29

For example use only. Values may not match the current spreadsheet.

Calculations and Results (continued):

8. Riprap and filter production costs (where the material source is located) are estimated according to Table 10, with a summary of the calculations provided after Table 10.

Table 10

	B	C	D	E	F	G	H	I
41	Equipment	Equipment Cost	Fuel Cost	# Equipment	Operator	# Operator	Total Equipment Cost	Total Fuel Cost
42		($/hr)	($/hr)		($/hr)		($/hr)	($/hr)
43	Cat 988H	$ 128.76	$ 35.57	1	$ 27.70	1	$ 156.46	$ 35.57
44	Cat 769D	$ 108.01	$ 22.79	3	$ 24.27	3	$ 396.83	$ 68.37
45	1 Deck Screening Plant (5X16, 48X60)	$ 40.59	$ 11.35	1	$ 23.09	1	$ 63.68	$ 11.35
46	3 Deck Screening Plant (5X16, 42X60)	$ 41.16	$ 11.35	1	$ 23.09	1	$ 64.25	$ 11.35
47	Cat 980H	$ 77.56	$ 25.27	2	$ 27.70	2	$ 210.53	$ 50.54
48	Cat 992K	$ 216.23	$ 59.97	0	$ 27.70	0	$ -	$ -
49	Cat 966H	$ 73.11	$ 19.61	1	$ 27.70	1	$ 100.81	$ 19.61
50	Off-Hwy Water Tanker Truck,6,000-gal.	$ 67.69	$ 26.33	1	$ 24.27	1	$ 91.96	$ 26.33
51	Supervisor	$ -	-	0	$ 23.84	1	$ 23.84	$ -
52								
53					Direct Costs	Equipment	Fuel	
54						$ 1,108	$ 223	$/hr
55						8	8	hr/work day
56						$ 8,867	$ 1,785	$/day
57								
58					Production			
59						400	tons input/hr (total)	
60						0.30	% waste	
61						0.70	% rip rap and gravel/filter	
62						280	tons produced/hr (net)	
63						560,000	lb/hr	
64						3,650	lb/cy	
65						153	cy/hr	
66						8	hr/day (net (60 min/hr))	
67						1,227	cy/day net production	
68								
69					Total	$ 7.22	$ 1.45	$/cy
70					Volume	0.40	0.40	cy/ft
71								
72					Total Cost	$ 2.85	$ 0.57	$/ft

For example use only. Values may not match the current spreadsheet.

Calculations and Results (continued):

8. Riprap and filter production calculations (continued):

For each type of equipment used, the costs calculated (see Earthwork RCE spreadsheet calculation set) are tabulated in Table 10, including Equipment Cost (Col. C), Fuel Cost (Col. D), and Operator Cost (Col. F).

The number of pieces of equipment (Col. E) and number of operators (Col. G) are assigned based on the logistical requirements for production. Pieces of equipment match the number of operators, except for addition of a Supervisor.

Total equipment cost (Col. H) is calculated as follows, with an example calculation shown for the Cat 988H:

$$Total\ Equipment\ Cost, \$/hr =$$
$$\{(Equip\ Cost\ [Col. C])\ x\ (\#\ Equipment\ [Col. E])\} +$$
$$\{(Operator\ Cost\ [Col. F])\ x\ (\#\ Operator\ [Col. G])\} =$$
$$\{(\$128.76)x(1)\} + \{(\$27.70)x(1)\} = \$156.46/hr$$

Total fuel cost (Col. I) is calculated as follows, with an example calculation shown for the Cat 988H:

$$Total\ Fuel\ Cost, \$/hr = \{(Fuel\ Cost\ [Col. D])\ x\ (\#\ Equipment\ [Col. E])\} =$$
$$\{(\$35.57)x(1)\} = \$35.57/hr$$

The daily cost is calculated for all equipment by summing the total equipment cost (Cell G56) and total fuel cost (Cell H56), as follows:

$$Daily\ Total\ Equipment\ Cost, \frac{\$}{day} = \left(Sum\ for\ all\ equipment, \frac{\$}{hr}\right) x \left(8\frac{hr}{day}\right) =$$
$$\left(\frac{\$1{,}108}{hr}\right) x \left(8\frac{hr}{day}\right) = \frac{\$8{,}867}{day}$$

$$Daily\ Total\ Fuel\ Cost, \frac{\$}{day} = \left(Sum\ for\ all\ fuel, \frac{\$}{hr}\right) x \left(8\frac{hr}{day}\right) =$$
$$\left(\frac{\$223}{hr}\right) x \left(8\frac{hr}{day}\right) = \frac{\$1{,}785}{day}$$

Calculations and Results (continued):

8. Riprap and filter production calculations (continued):

Next, the production calculations are summarized (see Rows 59-67 in Table 10). Daily net production is calculated via the following sequence:

- 400 tons input/hr (total) – see production assumptions
- 30% waste – see production assumptions
- 70 % riprap and gravel/filter = 100 minus % waste
- 280 tons produced/hr (net) = (400 tons input/hr) x (70%)
- 560,000 lb/hr = (280 tons) x (2,000 lb/ton)
- 3,650 lb/cy – see production assumptions
- 153 cy/hr = (560,000 lb/hr)/(3,650 lb/cy)
- 8 hr/day (net [60 min/hr]) – see production assumptions
- 1,227 cy/day net production = (153 cy/hr) x (8 hr/day)

The total cost for production (see Rows 69-70 in Table 10) is calculated separately for equipment and fuel as follows:

- Equipment portion of the cost = ($8,867/day)/(1,227 cy/day) = $7.22/cy
- Fuel portion of the cost = ($1,785/day)/(1,227 cy/day) = $1.45/cy
- This yields a total cost of $8.67/cy

Converting to units of $/ft of bench first requires cy/ft of filter and riprap to be calculated; these values are presented in Table 3 (filter cy in Cell AF21, riprap cy in Cell AG21, and bench length in Cell AD21):

- Filter cy/ft = (Filter Volume)/(Bench Length, ft) = (99,146 cy)/(453,446 ft) = 0.22 cy/ft
- Riprap cy/ft = (Riprap Volume)/(Bench Length, ft) = (80,055 cy)/(453,446 ft) = 0.18 cy/ft
- This yields a total volume per bench length of 0.40 cy/ft

Calculation of the total production cost per bench length is calculated as follows:

- Equipment portion of the cost = $7.22/cy x 0.40 cy/ft = $2.85/ft
- Fuel portion of the cost = $1.45/cy x 0.40 cy/ft = $0.57/ft

Summary and Conclusions:

1. The bench channel unit cost ($/ft) was calculated, as shown in this calculation set, for use in estimating earthwork closure costs at FMI's mining operations in Grant County, NM. The unit cost consists of calculations for each of the five following bench channel excavation and placement construction steps:
   - Earthwork excavate and waste = $0.41/ft (equipment) + $0.10/ft (fuel)
   - Load and transfer riprap and filter = $0.32/ft (equipment) + $0.08/ft (fuel)
   - Haul riprap and filter = $0.36/ft (equipment) + $0.12/ft (fuel)
   - Place riprap and filter = $0.42/ft (equipment) + $0.06/ft (fuel)
   - Finish grade channel and riprap = $0.24/ft (equipment) + $0.05/ft (fuel)
   - The total for all 5 construction steps is:
     - Equipment = $1.76/ft
     - Fuel = $0.40/ft
2. The riprap and filter production unit cost ($/ft) is
   - Equipment = $2.85/ft
   - Fuel = $0.57/ft
3. The total unit cost for bench channel construction is equal to the grand total of production cost + excavation and placement activities, as follows:
   - Equipment = $2.85/ft + $1.76/ft = $4.62/ft
   - Fuel = $0.57/ft + $0.40/ft = $0.98/ft

Downdrain/ Dissipater Unit Cost

TELESTO SOLUTIONS • INCORPORATED

Job No: 200371d-001-01	Client: Freeport NM Operations		Page 1 of 3
Task: Downdrain/Dissipater Unit Cost	Computed By: Fred Charles		Date: 2/19/2019
	Checked By: Taryn Tigges		Date: 2/19/2019

Calculation Documentation

Problem Statement:

Freeport-McMoRan's (FMI's) Chino Mines Company utilizes downdrain/dissipater unit cost information as part of earthwork closure cost estimation associated with the Chino Mine Closure/Closeout Plan (CCP). Downdrains are constructed on regraded side slopes of rock or tailing piles to convey runoff. Dissipaters are constructed as needed at the bottom end (downslope) of specific downdrains to dissipate the energy of the downdrain runoff flow. The unit cost needs to account for excavation/preparation of the subgrade, material and placement costs to install articulated concrete blocks (ACBs) in the downdrains and dissipaters, and installation of a concrete cutoff wall at the downslope end of each dissipater.

Objective:

1. Develop unit costs for downdrains ($/ft) and dissipaters ($/each) for use in estimating earthwork closure costs at FMI's mining operations in Grant County, NM.
2. Note that this calculation set presents the approach, data and assumptions, and calculations and results for developing the unit cost. It is intended to serve as a guide/example even if the actual quantities and/or cost data used in these calculations change due to updates or application to a different Freeport NM Operations mine.

Approach:

1. The data, assumptions, calculations, and results for the downdrain/dissipater unit cost estimate are presented within the earthwork RCE spreadsheet file "[YrMoDa]_Chino_Stockpile_Tailing_Earthwork_RCE.xlsx" in the sheet (tab) named "Downdrain_UC".
2. The approach for the calculations is as follows:
   - Identify locations and lengths required for downdrains. Use reclamation design drawings and quantities.
   - Identify excavation equipment and estimate cost to complete the rough grade where the downdrains and dissipaters will be constructed. Use equipment cost information and calculations as also developed for other earthwork operations in the overall earthwork cost estimate.
   - Estimate cost to finish grade and place ACBs in downdrains and dissipaters. Use available unit costs from Contech Engineered Solutions (Contech ES), the manufacturer and installer of ACBs in the area.
   - Estimate cost to install cast-in-place concrete cutoff wall at downslope end of dissipaters. Use online RS Means data.

Data and Assumptions (continued):

1. Locations and dimensions of downdrains and dissipaters are shown in Attachment A, as well as the following key quantity data used to develop unit costs (note that Attachment A also includes the calculations and results presented in this calculation set):
   - Downdrain base excavation area = 52 square feet/foot of length (sf/ft)
   - Downdrain ACB area coverage = 31 sf/ft
   - Dissipater area (middle [Area 2]) = 320 sf
   - Dissipater area (each side [Area 1 = Area 3]) = 253 sf
   - Cutoff wall concrete volume (each dissipater) = 14 cubic yards
2. Unit cost data from Contech ES (February 2019, see Attachment A) include the following:
   - Material costs for ACBs (includes non-woven geotextile and microgrid/geogrid) are as follows:
     - $7.42/sf (Block Class 40T, for the channel of each downdrain and both side areas of each dissipater)
     - $10.65/sf (Block Class 70T, for the center area of each dissipater)
   - Installation cost is $4.63/sf, which covers the following installation process for both sizes of ACBs: off-load the truck and place delivered ACBs in temporary storage area, fine grade base/subgrade soils, compact soils to 90% Standard Proctor (D698), place and secure filter fabric (non-woven geotextile), place 4- to 6-inch drainage layer overlaid by geogrid, place ACBs in final configuration, grout seams, and backfill ACBs with crushed stone. The installation cost includes crushed stone.
3. Cost data from RS Means for installation of a concrete cutoff wall at the downslope end of each dissipater are presented in Appendix A. The online RS Means cost is $254.97/cubic yard.

Calculations and Results:

1. The estimated cost to excavate the rough grade (where the downdrains will be constructed) is developed in the same manner as excavation costs prepared for bench channel unit costs. Therefore, see the bench channel unit cost calculation set for details. The downdrain rough grade cost = $0.83/ft.
2. The estimated cost to install ACBs in downdrains includes the finish grade and subsequent placement of ACBs. This estimated cost is developed from the Contech ES quotes (as listed above in Data and Assumptions), as follows:
   - Downdrain material cost for 40T ACBs is $7.42/sf
   - Downdrain installation cost for 40T ACBs is $4.63/sf
   - The cost per ft of downdrain ($/ft) = ($7.42/sf + $4.63/sf) x (31 sf/ft) = $12.05/sf x 31 sf/ft = $373.55/ft

$$\boldsymbol{Total\ downdrain\ installation\ cost\ (after\ rough\ grading) = \$373.55/ft}$$

For example use only. Values may not match the current spreadsheet.

Calculations and Results (continued):

3. Similarly, the estimated cost to install ACBs in dissipaters includes the finish grade and subsequent placement of ACBs. This estimated cost is developed from the Contech ES quotes (as listed above in Data and Assumptions), as follows:

   - Dissipater material cost for 40T ACBs is $7.42/sf
   - Dissipater material cost for 70T ACBs is $10.65/sf
   - Dissipater installation cost for 40T and 70T ACBs is $4.63/sf
   - For each dissipater, 40T ACBs cover 506 sf and 70T ACBs cover 320 sf
   - The cost for the 40T part of each downdrain ($/each) =
     ($7.42/sf + $4.63/sf) x (506 sf) = $12.05/sf x 506 sf = $6,097.30/each
   - The cost for the 70T part of each downdrain ($/each) =
     ($10.65/sf + $4.63/sf) x (320 sf) = $15.28/sf x 320 sf = $4,889.60/each
   - The total cost for ACBs in each dissipater = $6,097.30 + $4,889.60 = $10,986.90

4. The estimated cost for installing a cast-in-place concrete cutoff wall at the downslope end of each dissipater is based on on-line cost data from RS Means and the required concrete volume:

   - Cast-in-place concrete cutoff wall (RS Means) cost = $254.97/cubic yard
   - Each dissipater requires cutoff wall concrete volume of 14 cubic yard
   - The total cost for cutoff wall installation at each dissipater =
     ($254.97/cubic yard) x (14 cubic yard) = $3,569.58

   $\boldsymbol{Total\ dissipater\ installation\ cost\ (after\ rough\ grading) =}$
   $10,986.90 + $3,569.58 = $14,556.48

Summary and Conclusions:

1. Unit costs for installing downdrains ($/ft) and dissipaters ($/each) were developed for use in estimating earthwork closure costs at FMI's mining operations in Grant County, NM. Note that the estimated unit cost developed in this analysis applies only to FMI operations in the Silver City (Grant County), NM area.
2. Downdrain cost = $0.83/ft (rough grading) + $373.55/ft (after rough grading) = **$374.38/ft**
3. Dissipater cost **=** $10,986.90/each (rough grading is included in downdrain cost) + $3,569.58/each (cutoff wall) = **$14,556.48/each**

For example use only. Values may not match the current spreadsheet.

Downdrain Unit Cost

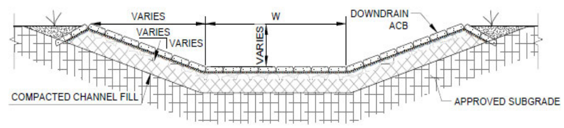
Rough Grade

Task Description	Equipment	Productivity (cy/hr)	Material Factor[5]	Grade Factor[5]	Soil Weight[5] (lb/cy)	Production Method/Blade Factor[5]	Centroid to Centroid Push Distance[5] (ft)	Normal Production (cy/hr)	Operator Factor[5]	Work Hour[5] (min/hr)	Visibility Factor[5]	Elevation Factor[5]	Transmission Factor[5]	Volume (cy/ft)	Productivity (hrs/ft)	Fuel Cost ($/hr)	Equipment Cost ($/hr)	Operator Cost (IV) ($/hr)	Dozer Cost ($/hr)	Equipment w/o Fuel Cost ($/ft)	Fuel Cost ($/ft)	Total Excavation Cost ($/ft)
Excavate	Cat D11T CD	1731	1.2	1.6	2900	1.0	175	1851	0.75	50	1.0	1.0	1.0	1.9	0.0011	$69.62	$254.44	$27.41	$281.85	$0.31	0.0774699	$0.39
Waste	Cat D11T CD	1542	1.2	1.6	2900	1.0	200	1649	0.75	50	1.0	1.0	1.0	1.9	0.0012	$69.62	$254.44	$27.41	$281.85	0.3521381	0.086975	$0.44
								.												$0.67	$0.16	$0.83

Finish Grade & Place ACB

	Area (sf/ft)	Unit Cost ($/sf)	$/ft
Downdrain ACBs			
40T[1]	31	$7.42	$230.02
Installation[1]	31	$4.63	$143.53
		ACB Cost/ft	**$373.55**

Total Downdrain Cost ($/ft)	**$374.38**



N.T.S AU 022A TYPICAL DOWNDRAIN SECTION

Place ACB

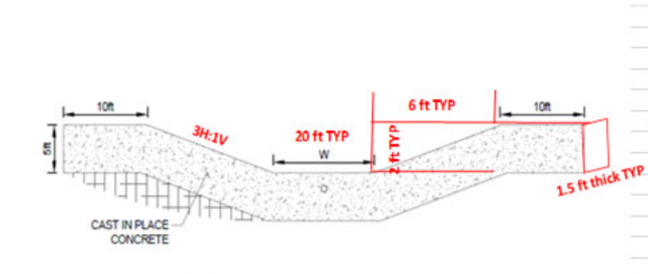
Dissipater ACBs	Area (sf)	Unit Cost ($/sf)	$/sf
70T[1]	320	$10.65	$3,408.00
Installation[1]	320	$4.63	$1,481.60
40T[1]	506	$7.42	$3,754.52
Installation[1]	506	$4.63	$2,342.78
		ACB Cost per Dissipater	**$10,986.90**

Install Cutoff Wall

Cutoff Wall (cast in p	cubic yard	$/cubic yard	**$/dissipater[3]**
RSMeans (2019)	14	$ 254.97	**$3,569.58**

Total Dissipator Cost ($/each)	**$14,556.48**

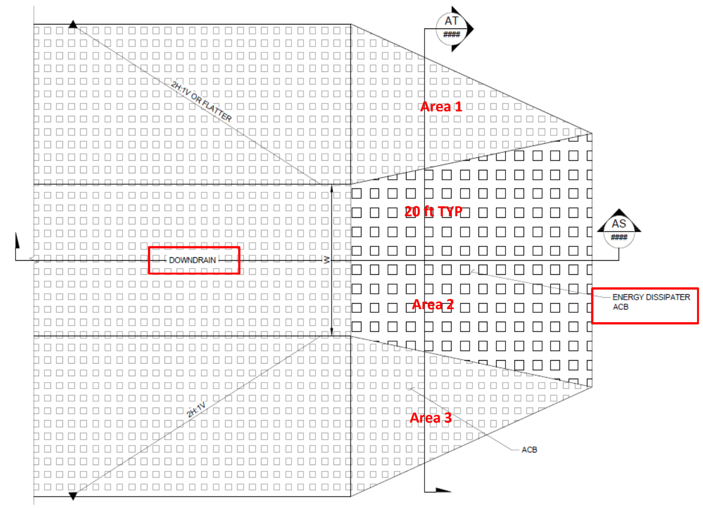
	Downdrains Lengths [2] (ft)	Downdrain Dissipators [2] (ft)
South	6474	2
STS2	0	0
Main LB	9299	4
South LB	0	0
West	4493	4
NW	0	0
LH	0	0
NE	0	0
N	0	0
3A	0	0
Santa Rita	0	0
Upper South	0	0
Triangle	0	0
Axiflow	0	0
TP7	2280	0
TP-6W & TP-6E	319	0
	22866	10



N.T.S. AX 022A TYPICAL CUTTOFF WALL SECTION

DOWNDRAIN Dimensions:		
Left Side Slope:[2]	3	H:1V
Left Side Slope:[2]	3	H:1V
Depth:[2]	2	ft
Perimeter:[2]	31	ft
Excavation Area[2]	52	sf
ACB Area[2]	31	sf

DISSIPATERS		ACB[2]				Cutoff Wall[2,4]		
		Surface Area 1	Surface Area 2	Surface Area 3	Total	Cross-Sectional Area	Thickness	Volume
		(sf)	(sf)	(sf)	(sf)	(sf)	(ft)	(cy)
Main Lampbright	1	253	320	253	825	260	1.5	14
	2	253	320	253	825	260	1.5	14
	3	253	320	253	825	260	1.5	14
	4	253	320	253	825	260	1.5	14
West Stockpile	1	253	320	253	825	260	1.5	14
	2	253	320	253	825	260	1.5	14
	3	253	320	253	825	260	1.5	14
	4	253	320	253	825	260	1.5	14
South Stockpile	1	253	320	253	825	260	1.5	14
	2	253	320	253	825	260	1.5	14



N.T.S 8 022A TYPICAL TOE ENERGY DISSIPATOR PLAN DETAIL

1. Quote from Contech ES 2018; Downdrain ACB installation includes fine grade base/subgrade soils (assuming subgrade at + 0.5 ft); equipment is D6 LGP dozer with Power Angle Tilt Blade (PAT) and GPS Blade Control
2. Data from Golder Takeoffs Spreadsheet 2018
3. One cutoff wall per dissipator
4. Typical flow depth is 2'; concrete depth is 5' (diagram is not drawn to scale); concrete thickness is 1.5'
5. Data from Table 3 and 4 of the Process Summary (SOW), Nov 2017 (Telesto)
6. Excavation volume is smaller than SOW because ACB's require less excavation than riprap

New Haul Road
Unit Cost

Calculation Documentation

Problem Statement:

Freeport-McMoRan's (FMI's) Chino Mines Company utilizes unit cost information for construction of a new haul road as part of earthwork closure cost estimation associated with the Chino Mine Closure/ Closeout Plan (CCP). The unit cost for new haul road construction needs to account for the earthwork process and site-specific conditions, equipment productivity, equipment rental rates, and associated equipment maintenance, fuel costs, and labor rates. The new haul road is constructed as a cost-saving measure to replace existing longer haul routes that would be used for hauling (in the absence of new routes) for reclamation of the Southwest Lampbright and Lampbright stockpiles.

Objectives:

1. Develop a new haul road construction unit cost ($/ft) for use in estimating earthwork closure costs at FMI's mining operations in Grant County, NM.
2. Note that this calculation set presents the approach, data and assumptions, and calculations and results for developing the unit cost. It is intended to serve as a guide/example even if the actual quantities and/or cost data used in these calculations change due to updates or application to a different Freeport NM Operations mine.

Approach:

1. The data, assumptions, calculations, and results for the new haul road unit cost estimate are presented within the earthwork RCE spreadsheet file "[YrMoDa]_Chino_Stockpile_Tailing_Earthwork_RCE.xlsx" in the sheet (tab) named "Haul Road_UC".
2. The approach for the calculations is as follows:
   - Prepare a comparison of the hauling costs for the existing and new haul road layouts to justify the cost to construct the new haul road.
   - Compile data for new haul road dimensions, in the portion of the new road requiring excavation, based on road length and surface area. Also, identify assumptions used in the calculations.
   - Estimate the unit cost to construct the new haul road where excavation is required.

Data and Assumptions:

1. The new haul road is laid out as shown in the map (Attachment A) and consists of a shared road (11,837 ft), used to haul to both stockpiles, that splits off separately to Southwest Lampbright (5,514 ft) and Lampbright (5,789 ft). Of the 11,837 ft of shared road, 9,996 ft requires excavation because it is routed along the pit bench.
2. The only length of new haul road layout requiring excavation is the 9,996-ft length along the pit bench. The new road layout outside of this excavation length occupies existing roads and, therefore, does not require additional excavation ($0 cost).

Data and Assumptions (continued):

3. Unit cost calculations for the portion of the new haul road layout requiring excavation is based on the following site-specific inputs or assumptions:
   - Road width = 120 ft
   - The 9,996-ft portion of new road is cut into a 1:1 slope (existing pit bench) area, with excavation area assumed to be represented by a triangular wedge with cross-sectional area = (120 ft x 120 ft)/2 = 7,200 square ft (sf)
   - The excavation volume per foot of road length for the portion of road requiring excavation into a 1:1 slope = 7,200 cubic ft (cf)/ft = 266.7 cubic yard (cy)/ft
   - Grading push distance = Centroid to Centroid Push Distance = 100 ft
4. Equipment and fuel cost information used for new haul road unit cost calculations is developed in the Equipment sheet as described in the separate Earthwork RCE spreadsheet calculation set.
5. Equipment rates from Equipment Watch include overhaul labor, parts, and time, and are corrected for a 50-minute work hour.
6. Other equipment parameters used in the calculations are from Tables 3 and 4 of the Process Summary (SOW), Nov 2017 (Telesto).
7. The work day is set at 8 hours/day, 50 minutes/hour.

Justification for Constructing a New Haul Road:

1. The existing haul lengths are 40,637 ft (Southwest Lampbright) and 41,478 ft (Lampbright), with total cumulative haul times over the duration of reclamation activities for each at 410 and 3,510 hours, respectively.
2. The new haul length is 17,351 ft (Southwest Lampbright) and 17,626 ft (Lampbright), with total cumulative haul times for each at 175 and 1,492 hours, respectively.
3. The hauling cost for the existing haul road layout is $7,929,533. Assuming the haul speeds for the existing haul road layout are the same for the new haul road layouts (only the haul lengths and therefore haul times are changed), and that the cost difference is proportional to these changes, the estimated hauling cost for the new haul road layout is $3,371,566. This represents a hauling cost savings of $4,557,967.
4. Therefore, an overall cost savings will result if the cost to construct the new haul road layout (i.e., excavate the 9,996-ft road length on the pit bench) is less than the hauling cost savings ($4,557,967).

Calculations and Results:

1. The unit cost for new haul road grading operations is calculated based on use of a Cat D11T CD dozer. Table 1 (split into 3 segments due to many columns) shows the progression of the calculations to estimate the cost for the grading operation. This table is followed by a description of the calculations for the new haul road where excavation is required on the pit bench.

Table 1

	B	C	D	E	F	G	H	I	J
10								Material	Production
11						Material	Grade	Weight	Method/
12		Activity	Equipment	Volume (cy/ft)[1]	Productivity	Factor	Factor[3]		Blade
13					(cy/hr)			(lb/cy)	
14	Lampbright & SouthWest Lampbright Haul Road	Grading	Cat D11T CD	266.67	2515	1.20	1.20	3300	1.00

	B	C	D	K	L	M	N	O	P	Q
10				Centroid to						Direct
11				Centroid	Normal	Operator	Work	Visibility	Elevation	Drive
12		Activity	Equipment	Push Distance[2]	Production	Factor	Hour	Factor	Factor	Trans.
13				(feet)	(cy/hr)		(min/hr)			
14	Lampbright & SouthWest Lampbright Haul Road	Grading	Cat D11T CD	100	3007	1.00	50	1.00	1.00	1.00

	B	C	D	R	S	T	U	V	W	X	Y
10					Fuel	Equipment	Operator	Dozer	Equipment	Fuel	Equipment + Fuel
11				Productivity	Cost	Cost	Cost (IV)	Cost	Cost	Cost	Cost
12		Activity	Equipment								
13				(hrs/ft)	($/hr)	($/hr)	($/hr)	($/hr)	($/ft)	($/ft)	($/ft)
14	Lampbright & SouthWest Lampbright Haul Road	Grading	Cat D11T CD	0.1060	69.62	254.44	27.41	281.85	29.88	7.38	37.26

2. The following parameters used in the calculations are from Tables 3 and 4 of the Process Summary (SOW), Nov 2017 (Telesto) – also see Equipment sheet in the separate Earthwork RCE spreadsheet calculation set: Material Factor (Col. G), Grade Factor (Col. H), Material Weight (Col. I), Production Method/Blade Factor (Col. J), Operator Factor (Col. M), Work Hour (Col. N), Visibility Factor (Col. O), Elevation Factor (Col. P), and Transmission (Direct Drive) Factor (Col. Q).

Calculations and Results (continued):

3. Also, as noted in the Data and Assumptions, the following equipment and fuel cost information (also described in the Equipment sheet in the separate Earthwork RCE spreadsheet calculation set) is used for the unit cost calculations: Normal Production (Col. L), Fuel Cost (Col. S), Equipment Cost (Col. T), and Operator Cost (Col. U).

Volume (cy/ft) (Col. E) = 266.7 cy/ft (see Data and Assumptions)

Productivity (cy/hr) (Col. F) = Col. $L\ x\ M\ x\ G\ x\left(\frac{N}{60}\right) x\ H\ x\left(\frac{2300}{I}\right) x\ J\ x\ O\ x\ P\ x\ Q$
= (3,007 cy/hr) x 0.75 x 1.20 x (50/60) x 1.60 x (2300/3300) x 1.00 x 1.00 x 1.00 x 1.00
= 2,515 cy/hr

Centroid to Centroid Push Distance (Col. K) = 100 ft (see Data and Assumptions)

Productivity (hrs/ft) (Col. R) = [Volume, cy/ft (Col. E)]/[Productivity, cy/hr (Col. F)]
= (266.7 cy/ft)/(2,515 cy/hr) = 0.1060 hr/ft

Dozer Cost/hr (Col. V) = Equipment Cost/hr (Col. T) + Operator Cost/hr (Col. U)
= $254.44 + $27.41 = $281.85/hr

Equipment Cost/ft (Col. W) = [Productivity, hr/ft (Col. R)] x [Dozer Cost/hr (Col. V)]
= 0.1060 hr/ft x $281.85/hr = $29.88/ft

Fuel Cost/ft (Col. X) = [Productivity, hr/ft (Col. R)] x [Fuel Cost/hr (Col. S)]
= 0.1060 hr/ft x $69.62/hr = $7.38/ft

Equipment + Fuel Cost/ft (Col. W) = Equipment Cost/ft (Col. W) + Fuel Cost/hr (Col. X)
= $29.88 + $7.38 = $37.26/ft

The costs to construct the new haul road (the 9,996-ft length requiring excavation because it is routed along the pit bench) are developed by multiplying the new road excavation length by Equipment Cost and by Fuel Cost, and summing these costs for the Total Cost:

Road Length	Equipment Cost	Fuel Cost	Total Cost
9,996	$ 298,716	$ 73,780	$ 372,497

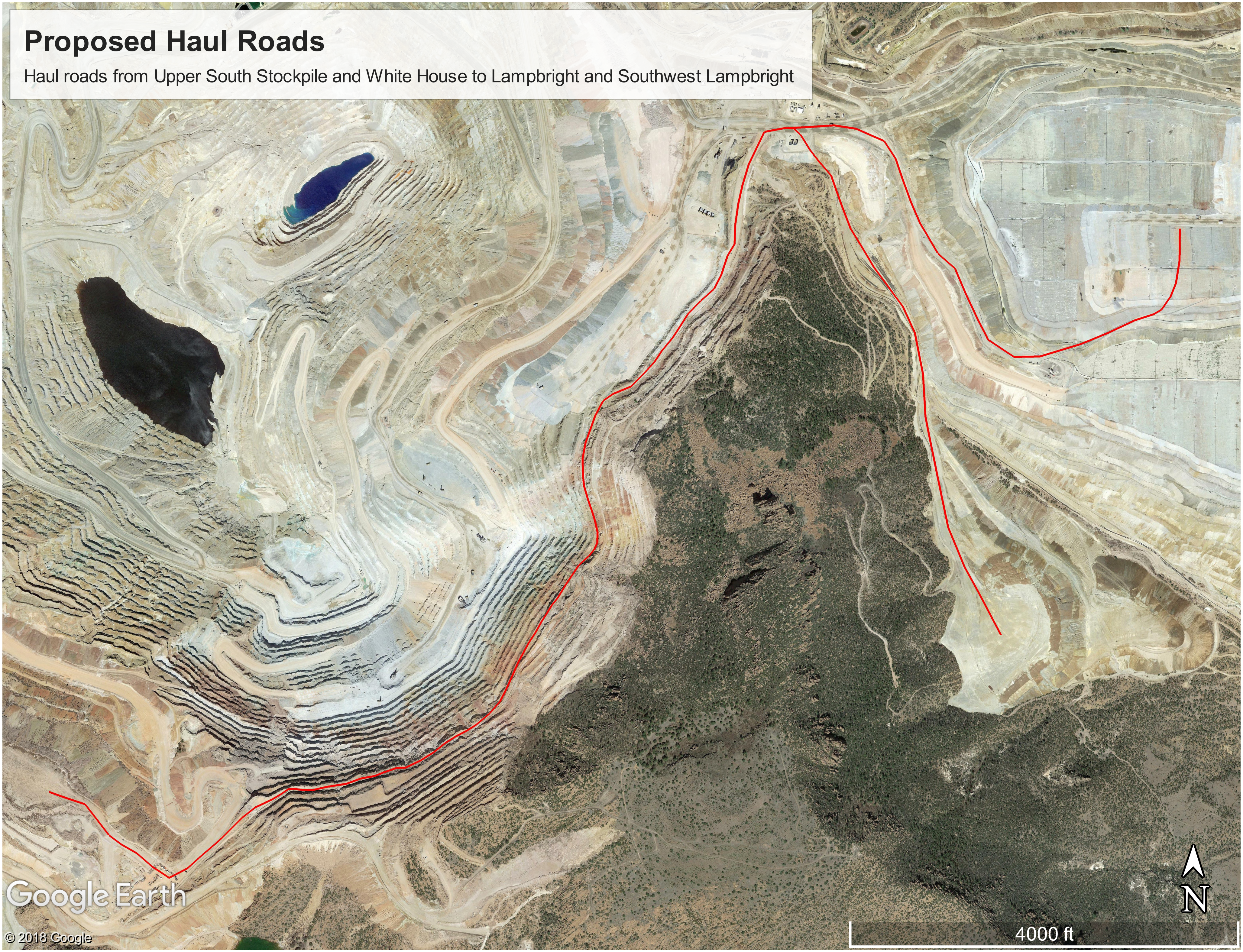
For example use only. Values may not match the current spreadsheet.

Summary and Conclusions:

1. The new haul road unit cost ($/ft) was calculated, as shown in this calculation set, for use in estimating earthwork closure costs at FMI's mining operations in Grant County, NM.
2. The total unit cost for new haul road construction (i.e., the 9,996-ft length requiring excavation because it is routed along the pit bench) is $37.26/ft, for a total construction cost of $372,497.
3. The construction cost of $372,497 is much less than the hauling cost savings of $4,557,967, thus representing an overall cost savings of $4,185,470 when considering the hauling cost savings and the cost to excavate the pit bench for the new haul road layout ($4,557,967 minus $372,497).

Proposed Haul Roads

Haul roads from Upper South Stockpile and White House to Lampbright and Southwest Lampbright



Truck and Scraper Optimization

Calculation Documentation

Problem Statement:
Freeport-McMoRan's (FMI's) Chino Mines Company utilizes truck optimization and scraper optimization information to develop the most efficient proportions of equipment as part of earthwork closure cost estimation associated with the Chino Mine Closure/Closeout Plan (CCP). Optimization needs to account for the time required and associated costs for truck loading and hauling operations for cover material and scraper/dozer productivity for rough grading.

Objectives:

1. Develop optimization calculations to determine the most efficient number of trucks (2 to 9 and a calculated maximum) per loader or shovel for loading cover material at borrow stockpiles, and the most efficient number of scrapers (2 to 9 and a calculated maximum) per dozer (the dozer assists scrapers for rough grading at waste rock stockpiles).
2. Note that this calculation set presents the approach and calculations and results for optimizing equipment for earthwork. It is intended to serve as a guide/example even if the actual quantities and/or cost data used in these calculations change due to updates or application to a different Freeport NM Operations mine.

Approach:

1. The data, calculations, and results for the optimization calculations are presented within the earthwork RCE spreadsheet file "[YrMoDa]_Chino_Stockpile_Tailing_Earthwork_RCE.xlsx" in two sheets (tabs) named "18 Truck Optimization" and "19 Scraper Optimization".
2. Truck optimization is calculated for each cover material source and destination based on
   - The truck cycle time for 1 roundtrip between a cover material source and destination and the maximum number of trucks per loader/shovel.
   - For X number of trucks (2 to 9 and a calculated maximum), the productivity, task time, cost of using X trucks per loader, the optimum number of trucks per loader/shovel, and the maximum number of trucks per loader/shovel.
3. Scraper optimization is calculated for each area requiring rough grading based on
   - The time required for 1 scraper to rough grade.
   - For X number of scrapers per dozer (2 to 9 and a calculated maximum), the task time, cost of using X scrapers per dozer, the optimum number of scrapers per dozer, and the maximum number of scrapers per dozer.

Calculations and Results:

1. The truck optimization calculations are set up as shown in Table 1, which is a snapshot of a row of data/calculations in the “18 Truck Optimization” sheet. Table 1 is shown in 6 parts due to the many columns in the spreadsheet. Key calculation steps are listed after Table 1, with referencing to the Column identifier in Table 1 (and the spreadsheet).

Table 1

	E	F	G	H	I	J	K	L
13								
14	ID	Task Description	Source Location 1	Destination Location 2	Equipment	Work Hour (min/hr)	Loader/Shovel Cycles per Truck	Loader/Shovel Cycle Time (min)
299	1200-D-b-Tk4	Haul-Cover	Upper South	West Stockpile	Komatsu 730E	50	5	0.45

	M	N	O	P	Q	R	S	T	U
13									
14	Loader/Shovel Time Per Truck (min)	Truck Cycle Time Per Truck (min)	Trucks Per Loader/ Shovel	Loader/ Shovel Type	Loader/ Shovel Cost ($/hr)	Loader Net Bucket Capacity (cy)	Haul Volume (cy)	Max Trucks Round Up	Max Trucks Round Down
299	2.25	22.7	10.1	Sh1	$ 535.68	27.4	3,031,924	3,317	3,016

	V	W	X	Y	Z	AA	AB	AC
13	Productivity for X Trucks (cy/hr)							
14	9	8	7	6	5	4	3	2
299	2,714	2,412	2,111	1,809	1,508	1,206	905	603

	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM
13	Task Time for X Trucks (hr)									
14	Max Trucks Round Up	Max Trucks Round Down	9	8	7	6	5	4	3	2
299	914.0	1,005.4	1,117.2	1,256.8	1,436.4	1,675.7	2,010.9	2,513.6	3,351.5	5,027.2

	AN	AO	AP	AQ	AR	AS	AT	AU
13			Cost of Using X Trucks per Loader ($					
14	Loader/ Shovel Task Time (hr)	Truck Cost ($/hr)	Max Trucks Round Up	Max Trucks Round Down	9	8	7	6
299	995.9	$ 246.06	$ 3,229,021	$ 3,012,613	$ 3,072,458	$ 3,147,264	$ 3,243,442	$ 3,371,681

	AV	AW	AX	AY	AZ	BA	BB
13	$)						
14	5	4	3	2	Lowest Cost ($)	Optimum Number of Trucks Per Loader/ Shovel	Optimum Number of Trucks Per Loader/ Shovel Within Max
299	$ 3,551,215	$ 3,820,515	$ 4,269,350	$ 5,167,019	$ 3,012,613	10	10

For example use only. Values may not match the current spreadsheet.

Calculations and Results:

1. Truck optimization (continued)

- Calculate the number of loader/shovel (or referred to as loader) cycles to load a truck and the loading time required per truck (Columns K, L, and M) – this calculation uses data from the "9 Trucks" and "10 Shovel" sheets.

Loader Time Per Truck (Col. M) =
[Loader Cycles per Truck (Col. K)] x [Loader Cycle Time, min (Col. L)]
= (5 cycles/truck) x (0.45 min/cycle) = 2.25 min/truck

- Using the truck cycle time for 1 roundtrip between a cover material source and destination (data from the "9 Trucks" sheet), calculate the maximum number of trucks per loader/shovel.

Max Number Trucks Per Loader (Col. O) = [Truck Cycle Time, min (Col. N)]/[Loader Time, min/truck (Col. M)]
= (22.7 min)/(2.25 loader min/truck) = 10.1 trucks/loader

- Calculate the productivity (cy/hr) for X number of trucks (2 to 9 and a calculated maximum).

For X=6 trucks, Productivity, cy/hr (Col. Y) =
(X) x Work Hour, min/hr (Col. J) x Loader Cycles/Truck (Col. K) x [Loader Net Bucket Capacity, cy (Col. R)]/[Truck Cycle Time Per Truck, min (Col. N)]
= [6 x (50 min/hr) x (5 loader cycles/truck) x (27.4 cy/loader cycle)]/(22.7 min/truck cycle) = 1,809 cy/hr

- Using the productivity and total volume of cover material to be hauled, calculate the task time for X trucks (2 to 9).

For X=6 trucks, Task Time, hr (Col. AI) =
[Haul Volume, cy (Col. S)]/[Productivity, cy/hr (Col. Y)]
= (3,031,924 cy)/(1,809 cy/hr) = 1,676 hr

For example use only. Values may not match the current spreadsheet.

Calculations and Results (continued):

1. Truck optimization (continued):

   - Calculate the cost of using X trucks per loader (2 to 9 and a calculated maximum) using data for loader/shovel task time in "9 Trucks" (for each cover material source and destination), loader/shovel cost ($/hr), truck cost ($/hr), and task time for the number of trucks.

   For X=6 trucks, Cost of Using X Trucks per Loader, $ (Col. AU) =
   [Max of Task Time for Trucks (Col AI) or Loader/Shovel Task Time (Col. AN)] x
   {(Loader Cost, $/hr (Col. Q) + [(X) x (Truck Cost, $/hr (Col. AO)]}
   = (1,675.7 hr) x {($535.68/hr + [6 x $246.06/hr]} = $3,371,681

   - The optimum number of trucks per loader is the lowest cost number of trucks per loader/shovel. This optimum number is compared with the maximum number of trucks per loader/shovel, to ensure the optimum number is within the maximum.

   For this row of data, the optimum number of trucks per loader = 10, which is the same within the max.

Calculations and Results (continued):

2. The scraper optimization calculations are set up as shown in Table 2, which is a snapshot of a row of data/calculations in the “19 Scraper Optimization” sheet. Table 2 is shown in 5 parts due to the many columns in the spreadsheet. Key calculation steps are listed after Table 2, with referencing to the Column identifier in Table 2 (and the spreadsheet).

Table 2

	E	F	G	H	I	J
13						
14	ID	Task Description	Source Location 1	Destination Location 2	Equipment	Scraper R/T Task Time (min)
84	1101-A-a-Sc2	Grade-Outslope-Existing Ground	South Stockpile S-1	-	Cat 657G	6.1

	K	L	M	N	O
13					
14	Pusher Cycle Time (min/cycle)	Max Number of Scrapers per Dozer	Dozer Type	Dozer Cost ($/hr)	Task Time for one Scraper (hr)

	P	Q	R	S	T	U	V	W	X	Y	Z
13			Task Time for X Scrapers (hr)								
14	Max Scrapers Round Up	Max Scrapers Round Down	9	8	7	6	5	4	3	2	Scrapers Cost ($/hr)
84	276	345	153	173	197	230	276	345	460	690	222.44

	AA	AB	AC	AD	AE	AF	AG	AH
13			Cost of Using X Scrapers per Dozer ($)					
14	Max Scrapers Round Up	Max Scrapers Round Down	9	8	7	6	5	4
84	$ 369,418	$ 385,002	$ 341,712	$ 346,041	$ 351,607	$ 359,028	$ 369,418	$ 385,002

	AI	AJ	AK	AL	AM	AN
13						
14	3	2	1	Lowest Cost ($)	Optimum Number of Scrapers Per Dozer	Optimum Number of Scrapers Per Dozer Within Max
84	$ 410,975	$ 462,922	$ 618,764	$ 341,712	9	5

For example use only. Values may not match the current spreadsheet.

Calculations and Results (continued):

2. Scraper optimization (continued)

- Calculate the maximum number of scrapers per dozer based on scraper roundtrip time and pusher cycle time.

Max Number of Scrapers per Dozer (Col. L) = [Scraper Roundtrip Task Time, min (Col. J)]/[Pusher Cycle Time, min/cycle (Col. K)]
= (6.1 min scraper/cycle)/(1.44 min pusher/cycle) = 4.2 scrapers/dozer (max)

- Using the task time required for 1 scraper (at a given rough grading area), calculate the task time for X number of scrapers (2 to 9 and a calculated maximum).

For X=6 scrapers, the Task Time for X Scrapers (Col. U) =
[Task Time for one Scraper, hr (Col. O)]/(X)
= (1,380 hr/scraper)/(6 scrapers) = 230 hr

- Calculate the cost of using X scrapers per dozer (2 to 9 and a calculated maximum) using task time for X scrapers, number of scrapers per dozer, scraper cost ($/hr), and dozer cost ($/hr).

For X=6 scrapers, the Cost of Using X Scrapers per Dozer (Col. AF) =
{[Task Time for X Scrapers, hr (Col. U)] x [X] x [Scraper Cost, $/hr (Col. Z)] +
{[Task Time for X Scrapers, hr (Col. U)] x [Dozer Cost, $/hr (Col. N)]
= [(230 hr) x (6 scrapers/dozer) x ($222.44/hr/scraper)] + [(230 hr) x ($225.78/hr/dozer)] = $359,028

- The optimum number of scrapers per dozer is the lowest cost number of scrapers per dozer. This optimum number is compared with the maximum number of scrapers per dozer, to ensure the optimum number is within the maximum.

For this row of data, the optimum number of scrapers per dozer = 9. However, the number of scrapers per dozer within the maximum = 5 (rounded up from the calculation for Max Number of Scrapers per Dozer [Col. L], see above).

For example use only. Values may not match the current spreadsheet.

Building Demolition Cost

Calculation Documentation

Problem Statement:
Freeport-McMoRan's (FMI's) Chino Mines Company utilizes cost information for demolition of buildings (including storage tanks) as part of earthwork closure cost estimation associated with the Chino Mine Closure/Closeout Plan (CCP). The demolition costs need to account for site-specific conditions including building dimensions and footprint areas which are used with available construction/earthwork unit rates to estimate the demolition cost.

This calculation set presents a summary of the approach and results for estimating the building demolition cost. Detailed information is presented in the earthwork reclamation cost estimate (RCE) spreadsheet file.

This calculation set is intended to serve as a guide/example even if the actual quantities and/or cost data used in these calculations change due to updates or application to a different Freeport NM Operations mine.

Objective:

1. Develop a cost estimate for demolition of buildings (including storage tanks) for use in estimating earthwork closure costs at FMI's mining operations in Grant County, NM.

Approach:

1. The data, assumptions, calculations, and results for the building demolition cost estimate are presented within the earthwork RCE spreadsheet file "[YrMoDa]_Chino_Stockpile_Tailing_Earthwork_RCE.xlsx" in a series of 4 sheets (tabs) named "1 BuildingDemo", "2 BuildingCover", "3 BuildingVeg", and "4 BuildingHazardousWaste ". An additional tab named "5 BuildingSum" presents a summary of the costs.
2. The approach for estimating building demolition costs is as follows:
   - Compile building and storage tank dimension/footprint area data and assumptions used in the calculations.
   - Estimate the cost for demolition to account for volume of structural materials, volume of cover material placement, area of revegetation, and tonnage of waste requiring special handling.

Results:

1. The results of the building demolition cost calculations are summarized below (some of the final results may vary from what is shown). These results are used in the overall earthwork RCE.
2. The indirect costs are set at 30% of direct costs, based on an agreement between FMI and the agencies in January 2019. Indirect costs include but are not limited to mobilization and demobilization, contingencies, engineering redesign fees, contractor profit and overhead, project management, administrative expenses, etc.

Chino Mine

DRAFT Facility Demolition Summary

			Current Value
DIRECT COSTS	Facility and Structure Removal		$666,916
	Cover		$24,132
	Ripping & Revegetation		$2,061
	Hazardouse Waste Removal		$2,534,217
	Subtotal, Direct Costs		**$3,227,325**
INDIRECT COSTS[1]	**Subtotal, Indirect Costs**	**30.0%**	**$968,198**
TOTAL COST			**$4,195,523**

For example use only. Values may not match the current spreadsheet.

Pipeline Demolition Unit Cost

Calculation Documentation

Problem Statement:

Freeport-McMoRan's (FMI's) Chino Mines Company utilizes unit cost information for pipeline demolition as part of earthwork closure cost estimation associated with the Chino Mine Closure/Closeout Plan (CCP). The unit costs need to account for site-specific conditions and pipeline information which are used with available construction/earthwork unit rates to estimate the pipeline demolition cost.

This calculation set presents a summary of the approach and results for estimating the unit cost for pipeline demolition (remove sludge/water, place cover). Detailed information is presented in the earthwork reclamation cost estimate (RCE) spreadsheet file.

This calculation set is intended to serve as a guide/example even if the actual quantities and/or cost data used in these calculations change due to updates or application to a different Freeport NM Operations mine.

Objective:

1. Develop a pipeline demolition unit cost ($/ft) for use in estimating earthwork closure costs at FMI's mining operations in Grant County, NM.

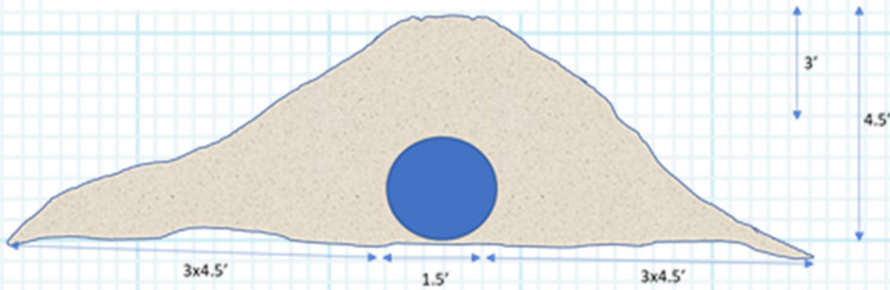
Approach:

1. The data, assumptions, calculations, and results for the pipeline demolition unit cost estimate are presented within the earthwork RCE spreadsheet file "[YrMoDa]_Chino_Stockpile_Tailing_Earthwork_RCE.xlsx" in a sheet (tab) named "Pipeline_UC".
2. The approach for estimating the pipeline demolition unit cost is as follows:
   - Compile pipeline data and assumptions used in the calculations.
   - Identify a unit rate for pipeline sludge/water removal from available construction/earthwork data. For the required sludge/water removal, use a similar operation for storage tank sludge/water removal from R.S. Means Online to develop a pipeline cost ($/ft).
   - Estimate the volume of cover (cubic yard [cy]) required and cost to excavate, haul, and grade the cover material over the pipeline areas. Calculate a site-wide average unit cost ($/cy) to excavate, haul, and grade cover material.
   - Based on an assumed cover volume per foot of pipeline, calculate a weighted cost ($/ft) for all pipeline areas.

Approach:

- For the Chino RCE, an 18" pipe is assumed to have 65 sf of cover per foot of pipeline based on 3 ft of cover over the pipeline with 3:1 side slopes:

$$3 \cdot 4.5\ ft \cdot 4.5\ ft + 3\ ft \cdot 1.5\ ft = 2.417\ \frac{yd^3}{ft}$$



- Calculate the total unit cost by adding the unit rate for sludge/water removal and the site-wide average cost to excavate, haul, and grade cover.

Results:

1. The results of the pipeline demolition unit cost calculations are shown below (some of the final results may vary from what is shown). These results are used in the overall earthwork RCE.
   - The total unit cost for pipeline demolition is $3.75/ft.
   - The total unit cost is the sum of the unit rate for removing sludge/water ($0.13/ft) and the calculated unit cost to cover the pipeline areas ($3.62/ft).

For example use only. Values may not match the current spreadsheet.

Revegetation Unit Cost

Calculation Documentation

Problem Statement:

Freeport-McMoRan's (FMI's) Chino Mines Company utilizes revegetation unit cost information as part of earthwork closure cost estimation associated with the Chino Mine Closure/Closeout Plan (CCP). The unit cost for revegetation needs to account for equipment rental rates and associated maintenance, fuel costs, and labor rates.

Objectives:

1. Develop a revegetation unit cost ($/acre) for use in estimating earthwork closure costs at FMI's mining operations in Grant County, NM.
2. Note that this calculation set presents the approach, data and assumptions, and calculations and results for developing the unit cost. It is intended to serve as a guide/example even if the actual quantities and/or cost data used in these calculations change due to updates or application to a different Freeport NM Operations mine.

Approach:

1. The data, assumptions, calculations, and results for the revegetation unit cost estimate are presented within the earthwork RCE spreadsheet file "[YrMoDa]_Chino_Stockpile_Tailing_Earthwork_RCE.xlsx" in sheet "Revegetation_UC".
2. The approach for the calculations is as follows:
   - Identify equipment types for scarifying, discing, drill seeding, mulching, crimping.
   - Obtain equipment information from EquipmentWatch (EQW) and RS Means, labor rates from NMDOL; revegetation material costs (seed, mulch) from FMI and/or their supplier; and the current fuel price from fuel cost calculations.
   - Determine the equipment traveling distance and time to cover 1 acre.
   - For each of the key operations, estimate the operating cost ($/hour).
   - Combine all operations and material costs, calculate the total unit cost.

Data and Assumptions:

1. Rental and operating cost information is accessed online from EQW for tractor (Deere 7340), ripper, and mulcher, and from RS Means for disc harrow (see Attachment A). Monthly rental rates are converted to hourly rates assuming 176 hours/month.
2. Equipment information is not available in EQW nor RS Means for drill seeding and crimping. Therefore, the drill seeder cost is assumed to be an average of the mulcher and disc (complexity is between the two, thus an average is assumed), and the crimper rental cost is assumed to be equal to the disc harrow (similar type of equipment).
3. Costs are included in the ripper and disc harrow (and drill seeder and crimper) to account for the ground engaging component (GEC) of these implements. The GEC cost for the ripper is applied to each of these other implements.
4. Local fuel price is developed from fuel cost calculations also prepared for earthwork closure cost estimates – the estimated 2019 fuel price is $2.34/gallon.
5. Revegetation material costs are from a quote by Rocky Mountain Reclamation, based on typical sources for seed and mulch (see Attachment A). The cost for seed is $210/acre and for mulch is $245/ton which, at 2 tons/acre, is $490/acre.

Data and Assumptions (continued):

6. Labor rates are from NMDOL (see Attachment A).
7. Equipment typical net coverage (width) is set at 12 feet, and equipment travel speed is set at 3 miles/hour (mph) for a 60-minute hour.

Calculations and Results:

1. The Deere 7340 tractor data, along with labor and fuel costs, are tabulated in the following table:

	B	C		D	E
5	**Tractor used for each operation is Deere 7430**	**Cost**		**Unit**	**Information or Calculation**
6	EQW base rate for tractor rental	$	5,210.05	$ per month	EQW for Deere 7430
7	EQW base rate for tractor rental	$	29.60	$ per hour	= ($/month)/176
8	EQW field labor rate per hour of operation	$	2.53	$ per hour	EQW for Deere 7430, which includes mechanic's wage of $23.09 (NMDOL, 2019)
9	EQW lube material cost	$	2.84	$ per hour	EQW for Deere 7430
10	EQW field parts cost	$	0.61	$ per hour	EQW for Deere 7430
11	EQW tire material cost	$	2.42	$ per hour	EQW for Deere 7430
12	EQW fuel burn rate		5.98	gallons per hour	EQW for Deere 7430
13	Local fuel cost	$	2.34	$ per gallon	Local quote
14	Fuel cost	$	13.99	$ per hour	= (EQW fuel burn rate) x (local fuel cost)
15	NM Department of labor equipment operator rate	$	24.27	$ per hour	NM Department of Labor (NMDOL)
16	**Total tractor cost**	**$**	**76.27**	**$ per hour**	**Sum of $ per hour costs shown in boxes**

Data in Rows 6 and 8-12 are from EQW, data in Row 8 also incorporates an NMDOL labor rate in the EQW cost, Row 13 is the estimated local fuel cost of $2.34/gallon, and Row 15 shows an NMDOL labor rate. Costs in other rows (7, 14, and 16) are calculated as follows:

$$EQW\ base\ rate\ for\ tractor\ rental = (\$5{,}210.05/\text{month})/(176\ \text{hours/month}) = \$29.60/\text{hour}$$

$$Fuel\ cost = (\text{EQW burn rate})\ \text{x}\ (\text{local fuel cost}) = (5.98\ \text{gallons/hour})\ \text{x}\ (\$2.34/\text{gallon}) = \$13.99/\text{hour}$$

$$Total\ tractor\ cost = \text{sum of rows } 7, 8, 9, 10, 11, 14, 15 =$$
$$29.60 + 2.53 + 2.84 + 0.61 + 2.42 + 13.99 + 24.27 = \$76.27/\text{hour}$$

2. Based on an equipment typical net width of 12 feet, and equipment net travel speed of 2.5 mph (3 mph x 50/60 to adjust for a 50-minute hour), each operation will travel a distance of 3,630 feet to cover 1 acre, and will require 0.275 hour to travel this distance (see calc steps in the table below). The resulting fuel cost is $3.85/acre.

	B	C		D	E
18	**Tractor coverage/rate of operation, fuel cost per acre**				
19	Tractor/equipment net width		12	feet	Assigned as a typical net width of coverage for each pass
20	Tractor/equipment travel speed		2.5	miles per hour	Assigned as approximate average speed of equipment (3 mph for 50 min/hr)
21	For 1 acre, total traveling distance		3630	feet per acre	= (43560 sf/ac)/(net width)
22	Time of travel over 1 acre		0.275	hour per acre	= [(traveling distance feet/acre)/(5280 ft/mile)]/(travel speed)
23	**Fuel cost per acre**	**$**	**3.85**	**$ per acre**	**Already included in total tractor cost... Fuel cost/acre = (fuel cost/hour) x (travel time hour/acre)**

For example use only. Values may not match the current spreadsheet.

Calculations and Results (continued):

3. Operating costs for each of the 5 revegetation operations are calculated as shown in the following table. Calculation equations are also noted in the table. Note the total cost for each operation includes fuel.

	B	C	D	E
25	**Operation**			
26	*Scarifying*			
27	Base rate for ripper rental	$ 898.90	per month	EQW Ripper, Miscellaneous MSR-189H, to 260 HP
28	Base rate for ripper rental	$ 5.11	$ per hour	= ($/month)/176
29	Lube labor rate per hour of operation	$ 0.57	$ per hour	EQW for ripper, incl mechanic's wage $23.09 (NMDOL, 2019)
30	Lube material cost	$ 0.15	$ per hour	EQW for ripper
31	Field parts cost	$ 0.16	$ per hour	EQW for ripper
32	Ground Engaging Component cost	$ 0.78	$ per hour	EQW for ripper
33	**Total cost with tractor+operator included**	**$ 83.03**	**per hour**	
35	*Discing*			
36	Disc harrow attachment, for tractor	$ 616.33	per month	RS Means 01 54 33 20 1500
37	Disc harrow attachment, for tractor	$ 3.50	per hour	= ($/month)/176
38	Ground Engaging Component (GEC) cost	$ 0.78	$ per hour	Assume similar to GEC cost for ripper (EQW)
39	**Total cost with tractor+operator included**	**$ 80.55**	**per hour**	
41	*Drill seeding (assume similar to discing)*			
42	Disc harrow attachment, for tractor	$ 616.33	per month	RS Means 01 54 33 20 1500
43	Disc harrow attachment, for tractor	$ 3.50	per hour	= ($/month)/176
44	Ground Engaging Component cost	$ 0.78	$ per hour	Assume similar to GEC cost for ripper (EQW)
45	**Total cost with tractor+operator included**	**$ 80.55**	**per hour**	
47	*Mulching*			
48	Mulcher, diesel powered, trailer mounted	$ 2,167.95	per month	EQW for trailer mounted mulcher (Finn B260)
49	Mulcher, diesel powered, trailer mounted	$ 12.32	per hour	= ($/month)/176
50	Lube labor rate per hour of operation	$ 1.25	$ per hour	EQW for trailer mounted mulcher (Finn B260), incl mechanic's wage $23.09 (NMDOL, 2019)
51	Lube material cost	$ 1.60	$ per hour	EQW for trailer mounted mulcher (Finn B260)
52	Field parts cost	$ 0.15	$ per hour	EQW for trailer mounted mulcher (Finn B260)
53	Tire material cost	$ 0.60	$ per hour	EQW for trailer mounted mulcher (Finn B260)
54	Fuel burn rate	4.13	gallons per hour	EQW for trailer mounted mulcher (Finn B260)
55	Local fuel cost	$ 2.34	$ per gallon	Local quote
56	Fuel cost	$ 9.66	$ per hour	= (EQW fuel burn rate) x (local fuel cost)
57	NM Department of labor equipment operator rate	$ 24.27	$ per hour	NM Department of Labor (NMDOL)
58	**Total cost with tractor+operator included**	**$ 126.12**	**per hour**	
60	*Crimping (assume similar to discing)*			
61	Disc harrow attachment, for tractor	$ 616.33	per month	RS Means 01 54 33 20 1500
62	Disc harrow attachment, for tractor	$ 3.50	per hour	= ($/month)/176
63	Ground Engaging Component cost	$ 0.78	$ per hour	Assume similar to GEC cost for ripper (EQW)
64	**Total cost with tractor+operator included**	**$ 80.55**	**per hour**	
65	Summary for operations			

For example use only. Values may not match the current spreadsheet.

Calculations and Results (continued):

5. The hourly operating cost for each operation (includes fuel) is summed for a total cost of \$450.79/hour. The cost for each operations is as follows:
   - Scarifying = \$83.03/hour
   - Discing = \$80.55/hour
   - Drill seeding = \$80.55/hour
   - Mulching = \$126.12/hour
   - Crimping = \$80.55/hour

6. The total combined equipment operating cost with fuel (\$/acre) is then calculated based on the operating cost per hour and the time of travel over 1 acre, as follows:

$$Total\ combined\ operating\ cost = \left(\frac{\$450.79}{hour}\right) x \left(0.275\frac{hour}{acre}\right) = \$123.97/acre$$

7. Seed and mulch costs are added to the total combined operating cost (\$/acre) to calculate the total revegetation unit cost as follows:
   - Total combined operating cost = \$123.97/acre
   - Seed = \$210/acre
   - Mulch = \$490/acre

Total revegetation unit cost = Total combined operating cost + Seed + Mulch = \$123.97/acre + \$210/acre + \$490/acre = \$823.97/acre (\$824/acre)

Summary and Conclusions:

1. A revegetation unit cost was developed for use in estimating earthwork closure costs at FMI's mining operations in Grant County, NM. Note that the estimated unit cost developed in this analysis applies only to FMI operations in the Silver City (Grant County), NM area.
2. The total revegetation unit cost is \$824/acre.

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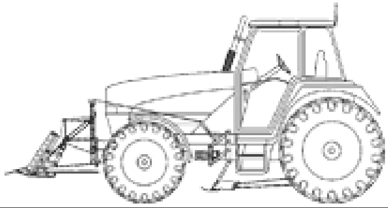
All prices shown in US$

Adjustments for MANDYLILLA27 in All Saved Models

January 17, 2019

Deere 7430 (disc. 2011)
Wheel Tractors

Size Class:
125 to 174 hp
Weight:
N/A



Configuration for 7430 (disc. 2011)

Power Mode **Diesel**

Hourly Ownership Costs

	Standard Value	User Adjusted Value	Variance
Depreciation	$12.48/hr	$11.70/hr	-6.3%
Cost of Facilities Capital (CFC)	$3.12/hr	$2.43/hr	-22.1%
Overhead	$4.42/hr	$3.35/hr	-24.2%
Overhaul Labor	$6.46/hr	$1.92/hr	-70.3%
Overhaul Parts	$5.55/hr	$4.20/hr	-24.3%
Total Hourly Ownership Cost:	**$32.03/hr**	**$23.60/hr**	**-26.3%**

User Defined Adjustments: Annual Use Hours (1,030hrs -> 1,359hrs) Sales Tax (5.1% -> 0%)

Hourly Operating Costs

	Standard Value	User Adjusted Value	Variance
Field Labor	$8.51/hr	$2.53/hr	-70.3%
Field Parts	$4.86/hr	$0.61/hr	-87.4%
Ground Engaging Component (GEC)	$0.00/hr	-	-
Tire	$2.42/hr	-	-
Electrical/Fuel	$19.54/hr	$5.98/hr	-69.4%
Lube	$2.84/hr	-	-
Total Operating Ownership Cost:	**$38.17/hr**	**$14.38/hr**	**-62.3%**

User Defined Adjustments: Annual Field Repair Parts Cost ($4,174.20 -> $0.20) Diesel Cost (3.27 -> 1) Mechanics Wage ($58.84 -> $23.09)

Total

	Standard Value	User Adjusted Value	Variance
Hourly Ownership Costs	$32.03/hr	$23.60/hr	-26.3%
Hourly Operating Costs	$38.17/hr	$14.38/hr	-62.3%
Total Hourly Cost	**$70.20**	**$37.98/hr**	**-45.9%**

Non-active use rates

	Standard Value	User Adjusted Value	Variance
Standby	$20.02/hr	$17.48/hr	-12.7%
Idle	$51.57/hr	$29.58/hr	-42.6%

Revised Date: 1st Half 2019

The equipment represented in this report has been exclusively prepared for MANDY LILLA (mlilla@fmi.com)

www.equipmentwatch.com

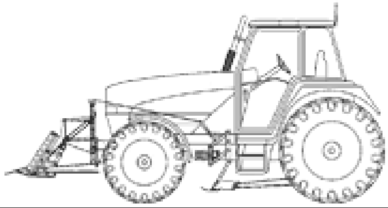
All prices shown in US$

Adjustments for MANDYLILLA27 in All Saved Models

January 17, 2019

Deere 7430 (disc. 2011)
Wheel Tractors

Size Class:
125 to 174 hp
Weight:
N/A



Configuration for 7430 (disc. 2011)

AED Rental Rates

These rental rates reflect an average for equipment of this type and size. Rates shown for specific brands or models are provided for convenience only. Rates charged by rental companies for specific brands or models will vary depending on many factors

	Monthly	Weekly	Daily
Published Rates	$3,891.00	$1,303.00	$463.00
Adjustments			
Region (New Mexico: 134%)	$1,319.05	$441.72	$156.96
User Defined			
Rental Rates (100%)	-	-	-
Total:	**$5,210.05**	**$1,744.72**	**$619.96**

Date Last Updated: Oct 01, 2018

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EquipmentWatch

www.equipmentwatch.com

All prices shown in US$

Custom Cost Evaluator

February 21, 2019

Miscellaneous MSR-189H
Crawler Tractor Multi-Shank Rippers

Size Class:
To 260 HP
Weight:
3,557 lbs.

Model Image

Configuration for MSR-189H

Engine Horsepower	**130 - 189**	Number of Shanks	**3**
Ripper Type	**Parallelogram**		

Hourly Ownership Costs

	Standard Value	User Adjusted Value	Variance
Depreciation	$2.64/hr	$2.50/hr	-5.3%
Cost of Facilities Capital (CFC)	$0.38/hr	$0.31/hr	-18.4%
Overhead	$0.66/hr	$0.52/hr	-21.2%
Overhaul Labor	$1.10/hr	$0.34/hr	-69.1%
Overhaul Parts	$0.95/hr	$0.75/hr	-21.1%
Total Hourly Ownership Cost:	**$5.73/hr**	**$4.42/hr**	**-22.9%**

User Defined Adjustments: Annual Use Hours (1,285hrs -> 1,629hrs) Sales Tax (5.1% -> 0%)

Hourly Operating Costs

	Standard Value	User Adjusted Value	Variance
Field Labor	$1.83/hr	$0.57/hr	-68.9%
Field Parts	$1.18/hr	$0.16/hr	-86.4%
Ground Engaging Component (GEC)	$0.99/hr	$0.78/hr	-21.2%
Tire	$0.00/hr	-	-
Electrical/Fuel	$0.00/hr	-	-
Lube	$0.15/hr	-	-
Total Operating Ownership Cost:	**$4.15/hr**	**$1.66/hr**	**-60%**

User Defined Adjustments: Annual Field Repair Parts Cost ($1,268.18 -> $0.18) Mechanics Wage ($58.84 -> $23.09)

Total

	Standard Value	User Adjusted Value	Variance
Hourly Ownership Costs	$5.73/hr	$4.42/hr	-22.9%
Hourly Operating Costs	$4.15/hr	$1.66/hr	-60%
Total Hourly Cost	**$9.88**	**$6.08/hr**	**-38.5%**

Non-active use rates

	Standard Value	User Adjusted Value	Variance
Standby	$3.68/hr	$3.33/hr	-9.5%
Idle	$5.73/hr	$4.42/hr	-22.9%

Revised Date: 1st Half 2019

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EquipmentWatch

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All prices shown in US$

Rental Rate Blue Book®

February 21, 2019

Miscellaneous MSR-189H
Crawler Tractor Multi-Shank Rippers

Size Class:
To 260 HP
Weight:
3,557 lbs.

Model Image

Configuration for MSR-189H

Engine Horsepower	**130 - 189**	Number of Shanks	**3**
Ripper Type	**Parallelogram**		

Blue Book Rates

** FHWA Rate is equal to the monthly ownership cost divided by 176 plus the hourly estimated operating cost.

	Ownership Costs				Estimated Operating Costs	FHWA Rate**
	Monthly	**Weekly**	**Daily**	**Hourly**	**Hourly**	**Hourly**
Published Rates	$1,010.00	$285.00	$71.00	$11.00	$4.15	$9.89
Adjustments						
Region (Las Cruces, New Mexico: 89%)	($111.10)	($31.35)	($7.81)	($1.21)		
Model Year (2019: 100%)	-	-	-	-		
Adjusted Hourly Ownership Cost (100%)	-	-	-	-		
Hourly Operating Cost (100%)					-	
Total:	**$898.90**	**$253.65**	**$63.19**	**$9.79**	**$4.15**	**$9.26**

Non-Active Use Rates	**Hourly**
Standby Rate	$3.52
Idling Rate	$5.11

Rate Element Allocation

Element	**Percentage**	**Value**
Depreciation (ownership)	50%	$505.00/mo
Overhaul (ownership)	31%	$313.10/mo
CFC (ownership)	7%	$70.70/mo
Indirect (ownership)	12%	$121.20/mo

Fuel cost data is not available for these rates.

Revised Date: 1st Half 2019

These are the most accurate rates for the selected Revision Date(s). However, due to more frequent online updates, these rates may not match Rental Rate Blue Book Print. Visit the Cost Recovery Product Guide on our Help page for more information.

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EquipmentWatch

www.equipmentwatch.com

All prices shown in US$

Custom Cost Evaluator

February 21, 2019

Finn B260
Trailer Mounted Mulchers

Size Class:
51 HP & Over
Weight:
4,880 lbs.

Model Image

Configuration for B260

Power Mode	**Diesel**	Horsepower	**115**

Hourly Ownership Costs

	Standard Value	User Adjusted Value	Variance
Depreciation	$5.80/hr	$5.45/hr	-6%
Cost of Facilities Capital (CFC)	$0.88/hr	$0.69/hr	-21.6%
Overhead	$1.18/hr	$0.90/hr	-23.7%
Overhaul Labor	$3.36/hr	$1.00/hr	-70.2%
Overhaul Parts	$2.54/hr	$1.92/hr	-24.4%
Total Hourly Ownership Cost:	**$13.76/hr**	**$9.96/hr**	**-27.6%**

User Defined Adjustments: Annual Use Hours (1,050hrs -> 1,388hrs) Sales Tax (5.1% -> 0%)

Hourly Operating Costs

	Standard Value	User Adjusted Value	Variance
Field Labor	$4.20/hr	$1.25/hr	-70.2%
Field Parts	$1.47/hr	$0.15/hr	-89.8%
Ground Engaging Component (GEC)	$0.00/hr	-	-
Tire	$0.60/hr	-	-
Electrical/Fuel	$13.50/hr	$4.13/hr	-69.4%
Lube	$1.60/hr	-	-
Total Operating Ownership Cost:	**$21.37/hr**	**$7.73/hr**	**-63.8%**

User Defined Adjustments: Annual Field Repair Parts Cost ($1,342.66 -> $0.66) Diesel Cost (3.27 -> 1) Mechanics Wage ($58.84 -> $23.09)

Total

	Standard Value	User Adjusted Value	Variance
Hourly Ownership Costs	$13.76/hr	$9.96/hr	-27.6%
Hourly Operating Costs	$21.37/hr	$7.73/hr	-63.8%
Total Hourly Cost	**$35.13**	**$17.69/hr**	**-49.6%**

Non-active use rates

	Standard Value	User Adjusted Value	Variance
Standby	$7.86/hr	$7.04/hr	-10.4%
Idle	$27.26/hr	$14.09/hr	-48.3%

Revised Date: 1st Half 2019

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All prices shown in US$

Rental Rate Blue Book®

February 21, 2019

Finn B260
Trailer Mounted Mulchers

Size Class:
51 HP & Over
Weight:
4,880 lbs.

Model Image

Configuration for B260

Power Mode	**Diesel**	Horsepower	**115**

Blue Book Rates

** FHWA Rate is equal to the monthly ownership cost divided by 176 plus the hourly estimated operating cost.

	Ownership Costs				Estimated Operating Costs	FHWA Rate**
	Monthly	**Weekly**	**Daily**	**Hourly**	**Hourly**	**Hourly**
Published Rates	$2,425.00	$680.00	$170.00	$26.00	$21.35	$35.13
Adjustments						
Region (Las Cruces, New Mexico: 89.4%)	($257.05)	($72.08)	($18.02)	($2.76)		
Model Year (2019: 100%)	-	-	-	-		
Adjusted Hourly Ownership Cost (100%)	-	-	-	-		
Hourly Operating Cost (100%)					-	
Total:	**$2,167.95**	**$607.92**	**$151.98**	**$23.24**	**$21.35**	**$33.67**

Non-Active Use Rates

	Hourly
Standby Rate	$6.16
Idling Rate	$25.82

Rate Element Allocation

Element	Percentage	Value
Depreciation (ownership)	37%	$897.25/mo
Overhaul (ownership)	50%	$1,212.50/mo
CFC (ownership)	6%	$145.50/mo
Indirect (ownership)	7%	$169.75/mo
Fuel (operating) @ 3.27	63%	$13.50/hr

Revised Date: 1st Half 2019

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RS Means Online Data
Accessed February 13, 2019

Revegetation

Line Number	Description	Unit	Material	Labor	Equipment	Total	Data Release	CCI Location
015433201500	Rent disc harrow attchment for tractor, Excl. Hourly Oper. Cost.	Month	$ -	$ -	$ 616.33	$ 616.33	Year 2019	NEW MEXICO / LAS CRUCES (880)

Labor Rates

NMDOL Type A Operator Group	Base rate	Fringe rate	Apprenticeship	Total 2019 Rate ($/hr)
Equipment Operator IV	20.87	5.94	0.6	$ 27.41
Equipment Operator V	20.98	5.94	0.6	$ 27.52
Equipment Operator VI	21.16	5.94	0.6	$ 27.70
Laborer I	16.86	5.63	0.6	$ 23.09
Laborer II	17.61	5.63	0.6	$ 23.84
Truck Driver III	16.15	7.52	0.60	$ 24.27

Labor rates based on NM Department of Labor Type H (Heavy Engineering) 2019 labor rates. Rates include base hourly wage, fringe benefit, and apprenticeship contribution rates.

https://www.dws.state.nm.us/Portals/0/DM/LaborRelations/Prevailing_Wage_Poster_H_2019_final.pdf

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FREEPORT MCMORAN – NEW MEXICO MINING OPERATIONS

PRICE ESTIMATES FOR REVEGETATION SERVICES FOR BUDGETING ESTIMATES

Table 1 –Freeport McMoRan, New Mexico Mining Operations – Price Estimates for Revegetation Services for Budgeting Estimates, prepared April, 2018.

	REVEGETATION OPERATION	ESTIMATED QUANTITY	UNITS	COST/UNIT ($)	TOTAL COST
I.	**OPERATIONS:**				
1	**SCARIFYING**	500	Acres	$30.00	$15,000.00
2	**DISCING**	500	Acres	$20.00	$10,000.00
3	**DRILL SEEDING (special Rangeland Drill)**	500	Acres	$80.00	$40,000.00
4	**MULCHING**	500	Acres	$148.00	$74,000.00
5	**CRIMPING**	500	Acres	$55.00	$27,500.00
6	**DAILY PER DIEM, ETC.**	50	Days	$385.00	$19,250.00
7	**MOBILIZATION**	1	Each	$13,500.00	$13,500.00
	Subtotal				**$199,250.00**
II.	**MATERIALS:**				
1	**SEED** at 8.9 PLS/acre	500	Acres	$210.00	$105,000.00
2	**HAY MULCH** - nox. weed free, native	1000	Tons	$245.00	$245,000.00
	Subtotal				**$350,000.00**
	TOTAL ESTIMATED REVEGETATION COST BEFORE TAX				**$549,250.00**
	Add New Mexico Gross Receipts Tax	5.9375	%		**$32,611.72**
	ESTIMATED REVEGETATION COST PER ACRE:			**$1,163.72**	
	TOTAL ESTIMATED REVEGETATION COST				**$581,861.72**

Estimate prepared by Ron Schreibeis, Rocky Mountain Reclamation, for use for Budgeting Estimates.

O&M Costs

Calculation Documentation

Problem Statement:

Freeport-McMoRan's (FMI's) Chino Mines Company utilizes cost information for operations and maintenance (O&M) as part of earthwork closure cost estimation associated with the Chino Mine Closure/Closeout Plan (CCP). The O&M costs need to account for vegetation maintenance costs for a 12-year period after completion of initial revegetation activities in each area, along with ongoing erosion control, road maintenance, and groundwater monitoring for a 100-year period.

This calculation set presents a summary of the approach and results for estimating O&M costs. Detailed information is presented in the earthwork reclamation cost estimate (RCE) spreadsheet file.

This calculation set is intended to serve as a guide/example even if the actual cost data used in these calculations change due to updates or application to a different Freeport NM Operations mine.

Objective:

1. Develop the estimated O&M costs for vegetation maintenance for a 12-year period after completion of initial revegetation activities in each area, along with ongoing erosion control, road maintenance, and groundwater monitoring activities for a 100-year period. The O&M costs are used as part of the earthwork RCE for FMI's mining operations in Grant County, NM.

Approach:

1. The data, assumptions, calculations, and results for the O&M cost estimate are presented within the earthwork RCE spreadsheet file "[YrMoDa]_Chino_Stockpile_Tailing_Earthwork_RCE.xlsx" in two sheets (tabs) named "1 Full SiteVeg Maint" and "2 Full Site O&M". Also, a summary of results is presented in the "3 Full Site O&M Summ" sheet.
2. The approach for estimating vegetation maintenance O&M costs is as follows:
   - For each facility (stockpile, tailing pond, reservoirs, etc), the total area is listed, along with approximate year of reclamation start, vegetation maintenance start, and vegetation maintenance complete. A 2% loss per year (i.e., 2% of vegetation fails each year) for 12 years is assumed to estimate the acreage requiring vegetation maintenance for each year.
   - Revegetation unit costs (equipment and fuel) are applied to the loss of acreage for each year to calculate the vegetation maintenance cost for each facility.

Approach (continued):

3. The approach for estimating erosion control, road maintenance, and groundwater monitoring ("Other") O&M costs is as follows:
   - For erosion control and road maintenance
     - Determine base costs ($/day) for equipment and fuel base. Also, estimate the number of days/yr for erosion control and road maintenance for three periods: Years 0-19, 20-39, and 40-99.
     - Calculate the annual equipment and fuel costs, based on days/yr, for the same three periods.
   - For groundwater monitoring
     - Determine base costs ($/day) for equipment and aqueous chemistry (lab analytical), and days/yr for groundwater monitoring for three periods: Years 0-19, 20-39, and 40-99.
     - Calculate the annual equipment and annual aqueous chemistry costs, based on days/yr, for the same three periods.
   - For all three "Other" O&M activities
     - While reclamation is ongoing (not completed in all areas) in Years 0-19, adjust the O&M costs accordingly based on the proportion of reclamation completed as of each year – when reclamation is complete, then the full annual cost applies.
     - For years after reclamation is complete, assign the O&M costs for each year based on the annual costs calculated for Years 0-19, 20-39, and 40-99.

Results:

1. The vegetation maintenance and "Other" O&M costs are summed for all years, as shown in the summary table below (some of the final results may vary from what is shown). These results are used in the overall earthwork RCE.
2. The indirect costs are set at 17.5% of direct costs, based on an agreement between FMI and the agencies in January 2019. Indirect costs include but are not limited to mobilization and demobilization, contingencies, engineering redesign fees, contractor profit and overhead, project management, administrative expenses, etc.

Chino Mine			
DRAFT Operations and Maintenance Summary			
			Current Value
DIRECT COSTS	Facility and Structure Removal		$0
	Earthmoving		$0
	Vegetation		$1,328,888
	Other		$6,202,825
	Subtotal, Direct Costs		**$7,531,713**
INDIRECT COSTS[1]	**Subtotal, Indirect Costs**	**17.5%**	**$1,318,050**
TOTAL COST			**$8,849,763**

For example use only. Values may not match the current spreadsheet.