Knife River Corporation

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KNIFE RIVER CORPORATION
AN MDU RESOURCES COMPANY

From the Industry…

- We understand and support the concept of better gravel.
- We also have trucks, equipment and our own people on gravel roads.
- Aside from the public safety aspect (very important); good gravel supports us as well:
  - Better results when using dust control
  - May lessen weight restrictions
  - Help control our maintenance costs

From the Industry…

- There are ways to improve gravel
- Must start with understanding the source
- Understand what you are specifying…
  - ¾” minus?
  - 1” minus?
  - Class 5?
- We should all support better gravel

Concerns From the Industry

- The industry is generally resistant to the PI specification.
- A primary concern is the PI testing procedure which can be very subjective.
- Splits going to different labs nearly always result in variations in PI results.
- Time required to run a test vs. field production.

From the Industry…

- What are the counties asking for???
  - Modified Class 13 with PI (no pit data, unknown locations, unknown quantity)
  - Modified Class 13 without PI (no pit data, unknown locations)
  - Own modified gradation spec, no PI spec, good maps, good test hole data including gradation and PI data, pit quantity supplied
  - Class 13, no PI spec, pit location and owner data provided, all interested bidders responsible to one-call then dig and test the pit themselves
  - Class 13 (3/4” minus), no PI spec (no pit data, unknown locations, estimated quantity)
  - Class 13 (no pit data, no pit locations, unknown quantity)
  - ¾” minus (no other data)
  - Class 13 with PI (pit location provided, gradation data provided, clay source option if needed)
  - Gravel Surfacing
  - Modified Gravel Surfacing

Making Gravel Better…

- In the spirit of partnership, we should not believe it is solely the crushing contractor's responsibility to provide good quality gravel.
- Have you ever had to "fix" gravel on the road?
  - Add clay/PI
  - Add rock
  - Add clean sand

Making Gravel Better…

- What SHOULD the counties provide?
  - Clear Specification Desired
  - Specific Pit Locations
  - Quantities per location
  - Options if you want something that is NOT there (like PI)
  - ***Better Pit Data…***

Making Gravel Better…

- Options (PI Example)…
  - If you spec PI, you should know if your pits have it or if they do not (Quote Steve…)
  - A tested and proven option for where exactly to go if add material is needed?
  - An agreement with the owner for add material?
  - Can the County bring the material to the crusher?
  - How can we give a proper bid without better or all the data?

Making Gravel Better…

- Pit Data we'd like to see…
  - Pit Location Map
  - Stripping Depth
  - Gravel Depth
  - Ends in…
  - Gradation Data
  - Pit Quantity Estimate
  - Landowner Contact Data (if we have permission to dig)
  - Access Road Data

Prospecting…

Initial Considerations:

1. Where do you need the gravel
2. Are there any known sources in the area
3. Some ideas on where to start looking
    - State Maps
    - Existing Pits
    - Road Cuts
    - Landowners
    - Soil Survey Data
    - Lidar Technology

Prospecting…

Prospecting Equipment:

- Drill Truck (Drill Rig)
  - Positives:
    - Non-destructive
    - Great for locating potential sources
    - Easy to close test holes
  - Negatives:
    - Can give false depth readings
    - Can give false gradation data
      - Tendency to push coarse rock aside
      - Tendency to make NF dirty (overburden)

Prospecting…

Prospecting Equipment:

- Backhoe/Excavator
  - Positives:
    - Best for accurate look at materials
    - Best representation of material layers
    - Good option for accurate gradation data
  - Negatives:
    - Reasonably destructive-leaves scars
    - Dry/Sandy pits = very large pits

Prospecting…

- Taking the Sample:

  - If drilling clean area around the drill stem.
  - Don’t include the topsoil or overburden
    - Consider testing the overburden!
  - Must mathematically represent the pit!

Inaccurate Info…

- Cost affect on variations in **stripping depths…**

(Assume base bid of 2’ of stripping, 8’ of gravel and 25,000 CY of production.)

	2.0’	3.0’	4.0’
CY of Stripping	6,228	9,344	12,459
@$1.50/CY	$9,344	$14,016	$18,689
$ Per CY	$0.37	$0.56	$0.75

Then DOUBLE this for reclamation!

Inaccurate Info…

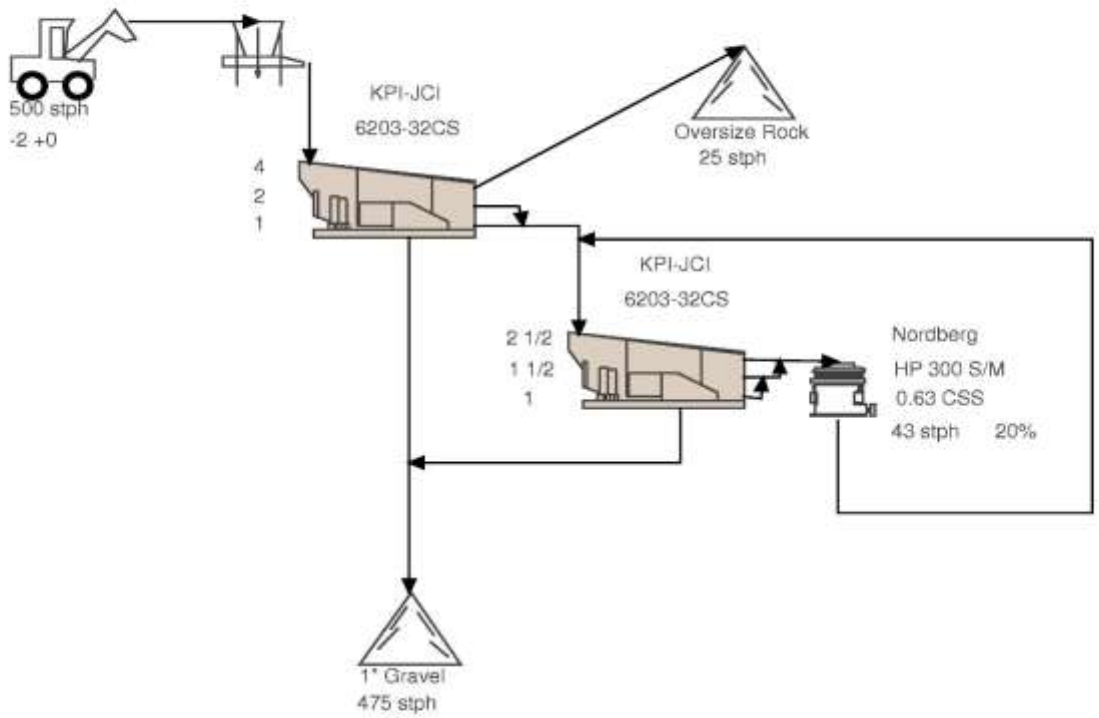
- Affects on variations in **gravel depth**…

(Assume base bid of 2’ of stripping, 8’ of gravel and 25,000 CY of production.)

	8.0’	6.0’	4.0’
Acres Needed	1.93	2.58	3.88
CY of Stripping	6,228	8,325	12,519
Stripping Cost/CY	$0.37	$0.50	$0.75

Crushing… Crushing Spread #1

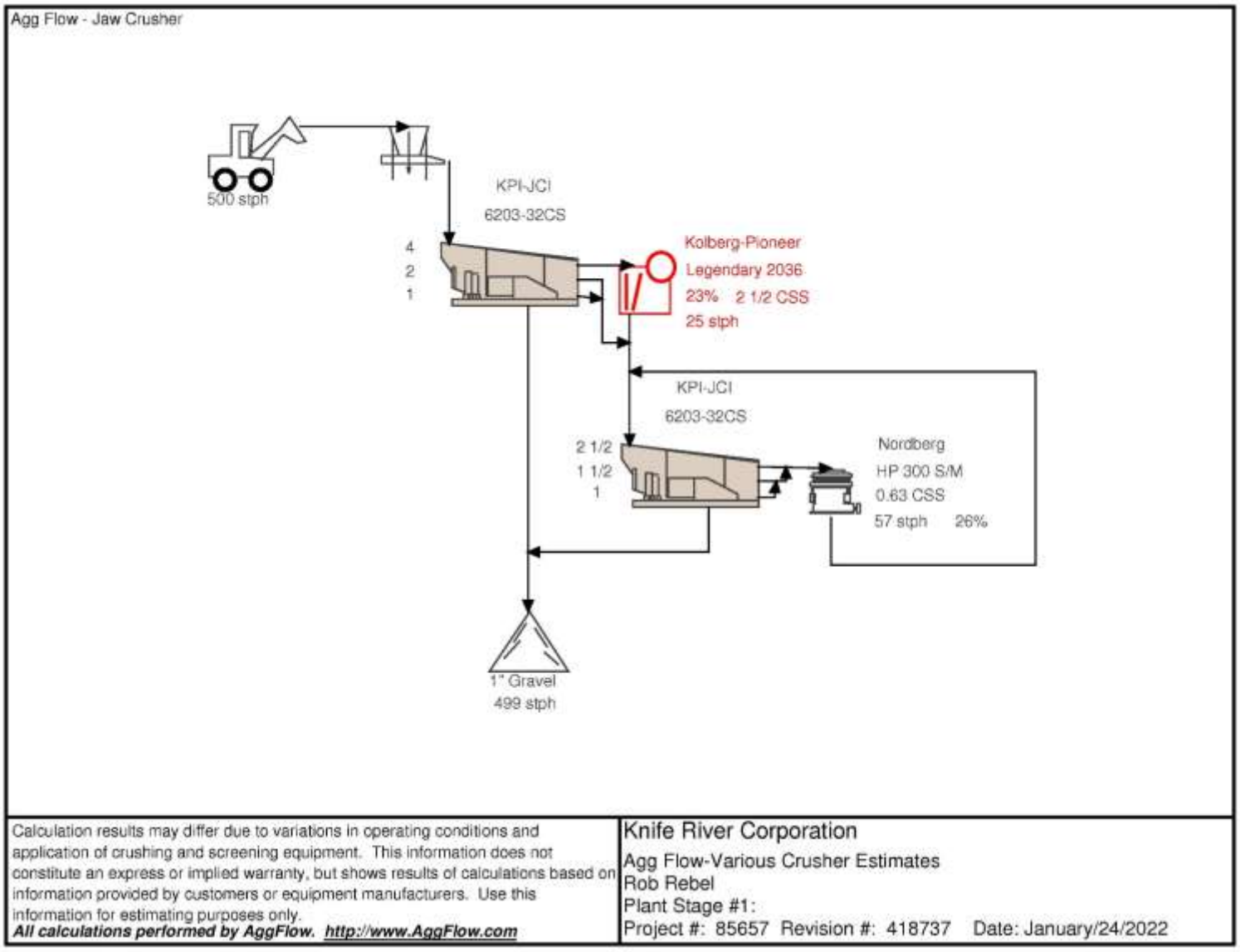
Drawings for Gravel Class-Cone Only



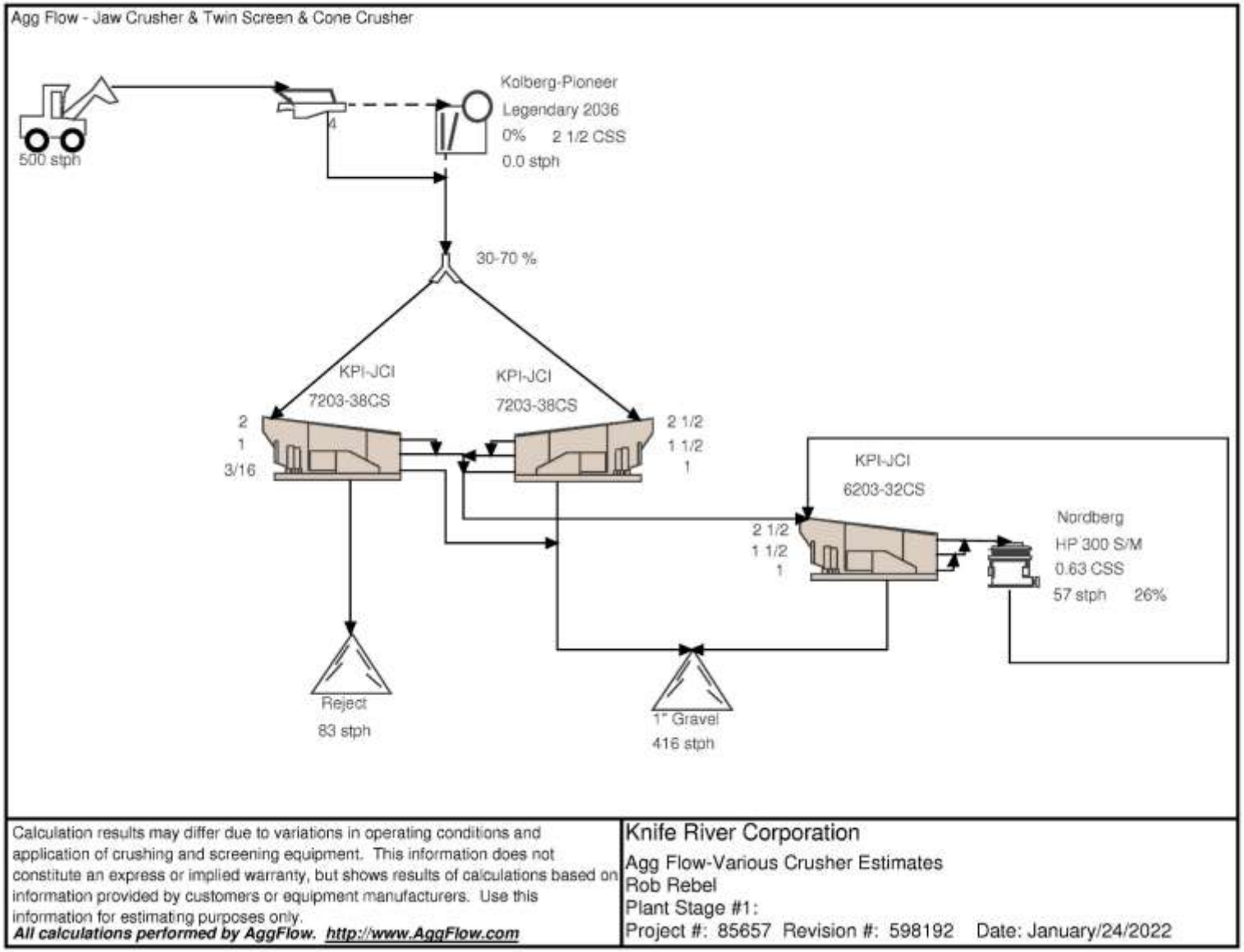
Calculation results may differ due to variations in operating conditions and application of crushing and screening equipment. This information does not constitute an express or implied warranty, but shows results of calculations based on information provided by customers or equipment manufacturers. Use this information for estimating purposes only.
All calculations performed by AggFlow. ***http://www.AggFlow.com***

Knife River Corporation
Agg Flow-Various Crusher Estimates
Rob Rebel
Plant Stage #1:
Project #: 85657 Revision #: 418728 Date: January/24/2022

Crushing… Crushing Spread #2



Crushing… Crushing Spread #3



Differences in Equipment

Item	Crusher 1	Crusher 2	Crusher 3
Generator	1	1	1
Feeder	1	1	1
Jaw Crusher	0	1	1
Cone Crusher	1	1	1
Screens	2	2	3
Conveyors	5	6	10
Stackers	1	1	2
Total Pieces	**10**	**13**	**20**

Common Gravel Specifications

Class 5 was commonly referred to as “Aggregate Base Course”… why?

Class 13 was commonly referred to as “Aggregate Surface Course”… why?

Common Gravel Specifications

Sieve Size	NDDOT Class 5	NDDOT Class 13	Gravel Surface
1”	100	100	100
¾”	90-100	70-100	70-100
#4	35-70	38-75	38-75
#8		22-62	22-62
#30	16-40	12-45	12-45
#200	4-10	7-15	7-15
Shale	12%	12%	12%
LAR	50	50	50
Fracture	10%	10%	10%
PI	10-(#40/10)		3-9

Common Gravel Specifications
#4 Material Size

Common Gravel Specifications
#8 Material Size

Common Gravel Specifications
#30 Material Size

Common Gravel Specifications
#200 Material Size

Thoughts on Improving Gravel Quality

You must first understand the reserve…

- Pit with little “crushing rock” (fine)
  - Crush finer to get more fractured rock?
  - Reject some sand?
  - Both?

- Pit with a lot of “crushing rock” (coarse)
  - Increase top size?
  - Reject rock?
  - Effect of crusher fines on gravel.
  - Implement jaw crusher?
  - Stockpile oversize (rip rap maybe)?

Thoughts on Improving Gravel Quality

You must first understand the reserve…

- Pit high on #200 (dirty):
  - Add clean sand (depending on rock content)?
  - Reject some sand (depending on rock content)?

- Pit low on #200 (clean):
  - Add dirty material if available (depending on rock content)?

Thoughts on Improving Gravel Quality

Typical challenges we see…

- Asking for Class 13 in a clean pit
- Asking for Class 5 in a dirty pit
- Specifying a high rock product in a fine pit
- Asking for PI in a pit that has none

Recent Example of making Gravel Surfacing – Slope County

Sieve	Feed Product	Reject 37%	Add OB 10%	Resulting Product	Spec
1”	97	100	100	100	100
¾”	95	99	100	99	70-100
#4	76	65	97	68	38-75
#8	63	53	92	57	22-62
#30	35	29	82	33	12-45
#200	9.6	7.7	42	11	7-15
PI	NP	NP	15	4	3-9

Recent Example of making Gravel Surfacing – Slope County

Sieve	Estimate	Day 1 Product	Day 2 Product	Day 3 Product	Spec
1”	100	100	100	100	100
¾”	99	97	96	95	70-100
#4	68	72	57	56	38-75
#8	57	63	52	55	22-62
#30	33	40	39	39	12-45
#200	11	13.8	15.7	15.8	7-15
PI	4	4	4	5	3-9
Reject	37%	37%	45%	50%	

Example of making Gravel Surfacing

Bid vs. Actual (Production Target 34,000 tons)

Item	Bid	Actual
Pit Consumed	50,500	80,555
Reject	37%	64%
Reject Tons	18,685	51,555
Tons OB Added	2,185	5,000
Product TPH	342	185
Crushing Hours	99	183
Crushing Days	10	18
Deduct	$0.00	$25,256

Gravel Surfacing

Notes on current SSP 6 for Testing

- PI is tested at the production site during production
- Shale & Fracture tested at the production site during production
- Gradation is tested out on the road from the windrow
- All deducts are applied to the fully placed gravel item… (including material production, loading, scaling, royalty, delivery, placing)

Gravel Surfacing

Industry Proposed Changes to SSP 6

- Opening up the gradation band to allow for the adding of fine material to achieve PI…

Sieve	Current	Proposed
1”	100	100
¾”	70-100	70-100
#4	38-75	38-78
#8	22-62	22-65
#30	12-45	12-50
#200	7-15	7-18

Gravel Surfacing

Industry Proposed Changes to SSP 6

Changes to PI & Fracture

PI	Current 3-9	Propose 2-9
Fracture	Current 10%	Propose 20%

Gravel Surfacing

Industry Proposed Changes to SSP 6

Changes to Lot Sizes/Frequency of Testing

<u>Gradation</u>

Current 3 samples for each 1,000 ton

Propose 3 samples for each 5,000 ton

Gravel Surfacing

Industry Proposed Changes to SSP 6

Changes to PI Sampling & Testing

- Joint selection of a single testing firm to perform PI tests
- PI testing performed ONLY during the production of aggregate
- PI results reported to engineer & contractor ASAP but within 24 hours
- Change lower PI spec limit for non-acceptance from 2 to 1
- Contract price adjustments for PI will be based on the cost of aggregate in the stockpile (as opposed to placed on the road)

Gravel Surfacing

Industry Proposed Changes to SSP 6

Changes to Price Adjustment Factors for PI

CURRENT			PROPOSED	
PI Average	Pay Adjustment		PI Average	Pay Adjustment
> 9.1	Non-Acceptance		> 9.0	Non-Acceptance
7.1 - 9.0	1.00		7.1 - 9.0	1.00
4.0 - 7.0	1.05		4.0 - 7.0	1.20
3.0 - 3.9	1.00		2.0 - 3.9	1.00
2.0 - 2.9	0.85		1.0 - 2.9	0.85
< 1.9	Non-Acceptance		< 1.0	Non-Acceptance

Final Note…

- I believe that the best possible business relationship can only exist when participants are honest with each other and all relevant data is disclosed. I believe this goes a long way to eliminate potential hard feelings, unexpected unfavorable financial issues and even legal action. Also, it seems it would be in the best interest of the counties to provide as much data as possible in order to secure responsible and competitive bids…