REINHOLD ENVIRONMENTAL Ltd.

2017 APC & Wastewater Round Table & Expo Presentation

July 17 & 18, 2017 in Charlotte, NC / Hosted by Duke Energy

WorleyParsons
resources & energy

Southern Company

Case Study of Treating Coal Fines in Coal Pile Runoff

2017 APC & Wastewater Round Table

Le Meridien Hotel

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Charlotte, NC **July 17-18, 2017**

Outline

- Introduction
- Project Description
- Plan
- Data Collection
- Pilot Testing
- Treatability
- Design Basis
- Full Scale Treatment

Introduction

- Southern Company Facility
  - Coal Pile
    - PRB Coal
    - 75 acres
  - Coal Pile Runoff Pond
    - 5 acres
    - 49.6 acre-ft
    - 16.16 Mgals
  - Rainfall Data
    - 2-yr 3.8 inch (50%)
    - 10-yr 5.3 inch (10%)
    - 25-yr 6.4 inch (4%)
    - 100-yr 8.1 inch (1%)
  - Additional Process Flow
    - 2,800 gpm (8 hrs in every 24 hours)
  - Precip Wash Water
    - Outage Maintenance – Non-chemical Metal Cleaning Waste (NCMCW)

Project Description

- Coal Pile Runoff
  - Discharge to Ash Pond
  - Need to redirect flow
  - 6,000 gpm
  - 24 hour 25-year storm event
  - Peak runoff flow during 8 hour period
- Nonchemical Metal Cleaning Waste (NCMCW)
  - Precip Wash Water
  - Discharge to Ash Pond
  - Need to redirect flow
  - 400 gpm (6 continuous days – 24 hours per day operation)

Project Description

- Not an NPDES permitted facility for outfall discharge
- Internal process treatment only
- Alternative processing to the ash pond

Project Description

- Project Objectives
  - Evaluate the ability of various wastewater treatment systems to remove coal fines and ash and residual oil and grease from wastewater.
  - Optimize coagulant and polymer addition.
  - Adjust the pH into the range of 6.0 to 9.0 if required.

Project Description

- Project Objectives
  - Demonstrate that sludge:
    - Dewater efficiently, effectively
    - Achieve a solids content that optimizes handling properties of the solids and
    - Return coal fines to coal pile for combustion and ash to landfill.
  - Record process measurements and conduct sampling to demonstrate the ability of the process equipment to function as intended in a sustainable fashion.

Project Description

- Testing Targets

Effluent Turbidity NTU	< 10 NTU
Effluent TSS	< 30 mg/l
Effluent O&G Excursions	< 10 mg/l
pH Range	6.0 - 9.0

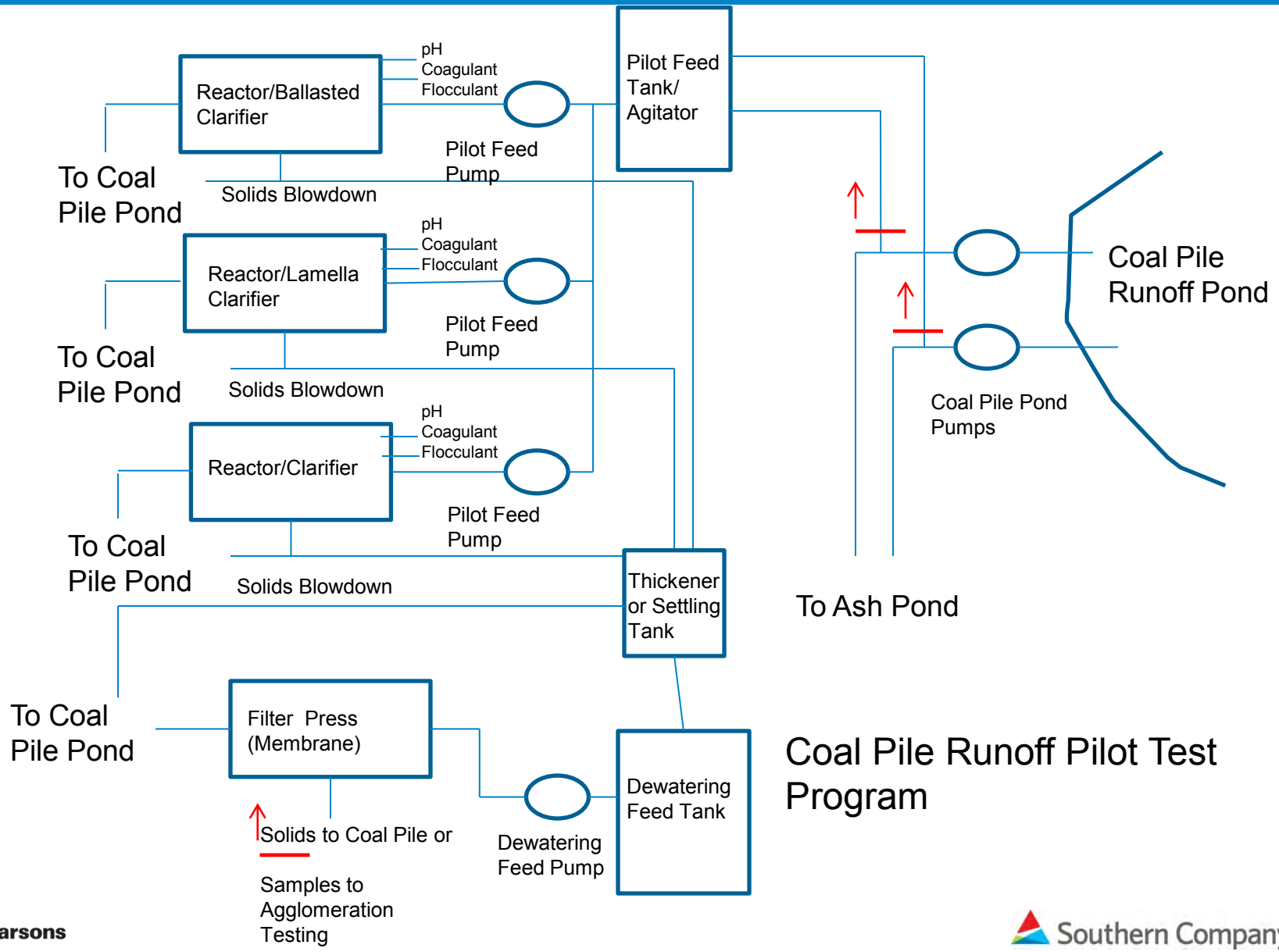
Plan

- Parametric Test Plan
  - Liquid Solids Separation Equipment
    - Sludge blanket clarifier
    - Lamella clarifier
    - Ballasted clarifier
    - Thickener/Settling
  - Chemicals
    - pH Adjustment, if required
    - Coagulant/Flocculant
  - Operations (Process)
    - Ballast loading
    - Sludge Recirculation rates

Plan

- Parametric Test Plan
  - Dewatering Equipment
    - Filter press
    - Membrane filter press
  - Chemicals
    - Flocculant
  - Operations (Process)
    - Slurry feed pressure
    - Membrane squeeze pressure
    - Membrane squeeze duration
    - Membrane cycles

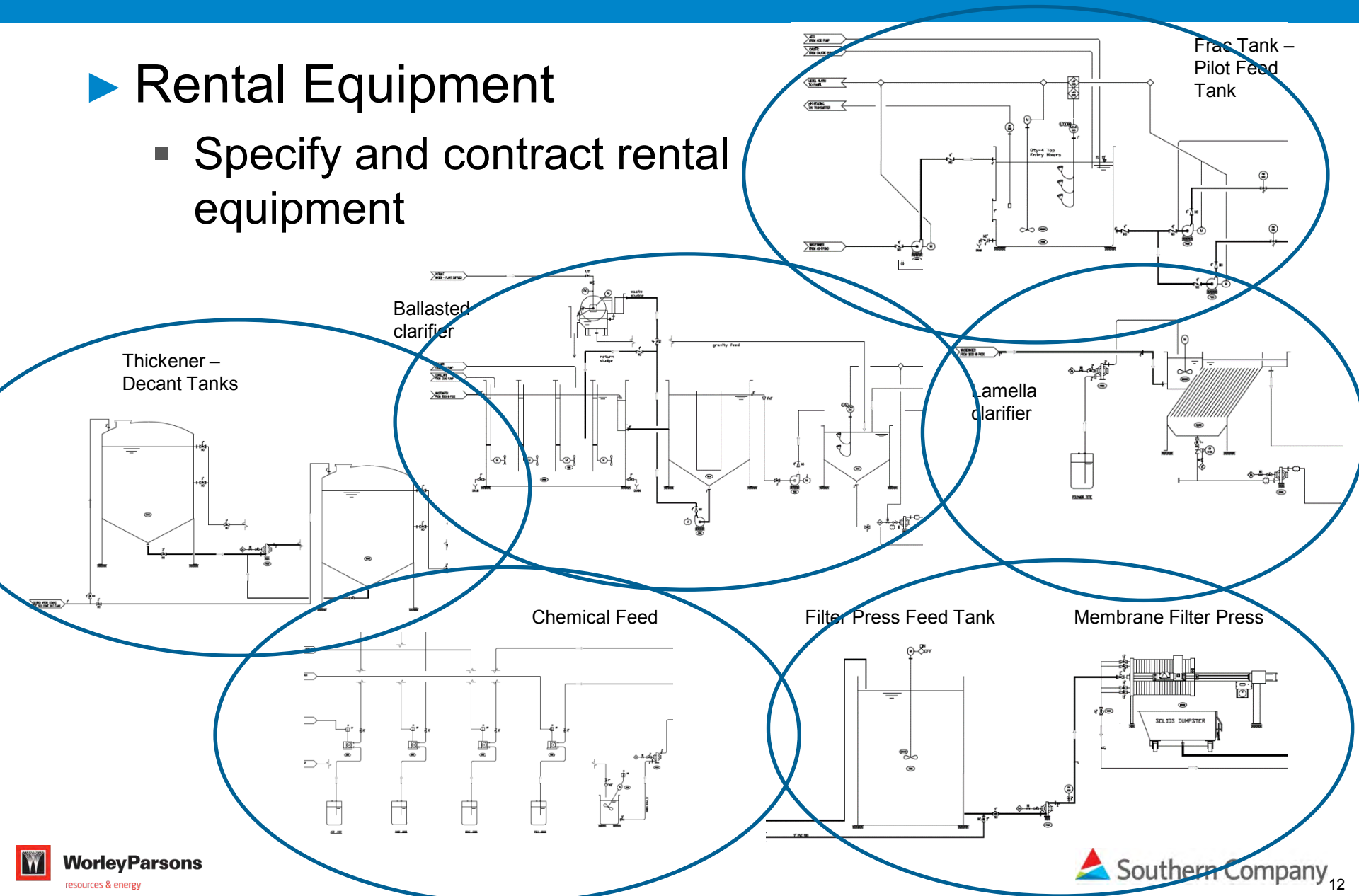
Plan



Coal Pile Runoff Pilot Test Program

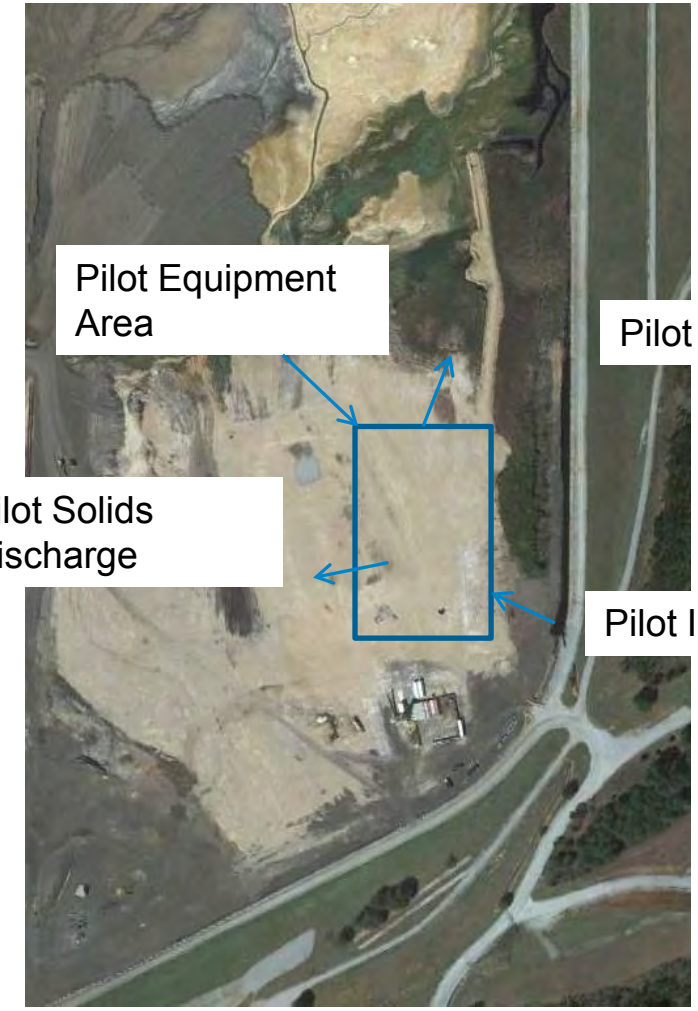
Plan

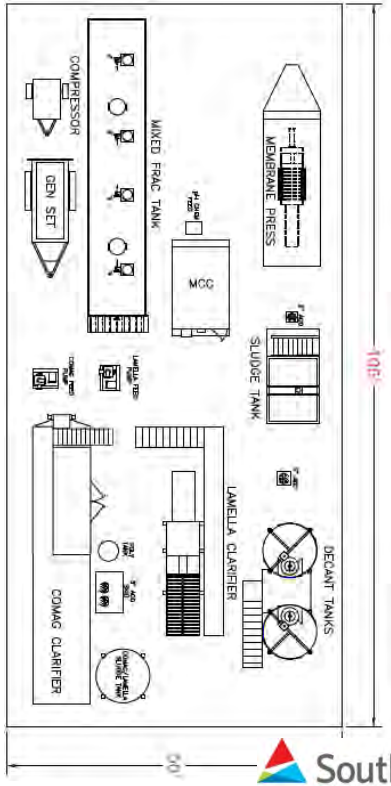
- Rental Equipment
  - Specify and contract rental equipment



Plan

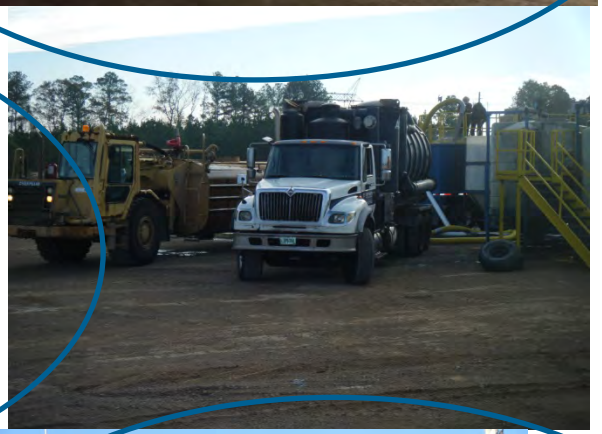
- Plot Plan

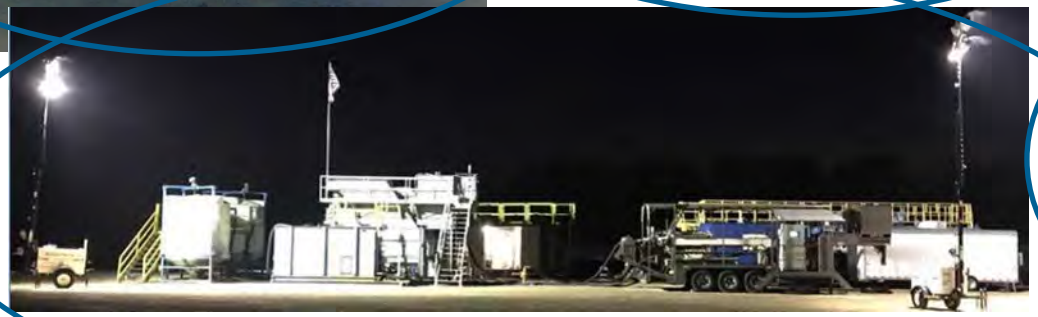




Plan

- Plot Plan





Data Collection

- Sampling / Analysis
  - PRB Coal Pile Runoff
  - Bituminous Coal Pile Runoff
  - Coal Pile Runoff wastewater not the same

ANALYTE	UNITS	PRB Coal Pile Runoff	Bituminous Coal Pile Runoff
Alkalinity, Total	mg/l	35	0.00
Aluminum	ug/L	300	74866.67
Antimony	ug/L	<0.85	0.00
Arsenic	ug/L	1.4	12.03
Barium	mg/l	0.14	0.00
Boron	ug/L	1300	936.33
Cadmium	ug/L	<0.085	11.67
Calcium	mg/l	53	641.67
Chloride	mg/l	22	659.00
Chromium	ug/L	1.1	21.50
Copper	ug/L	<2.1	62.27
Field pH	SU	7.48	2.16
Fluoride	mg/l		
Hardness as calcium carbonate	mg/l	190	2290.00
Hexavalent chromium	mg/l	<0.0065	0.00
Iron, Dissolved	mg/l	0	638.43
Lead	ug/L	<0.33	0.83
Magnesium	mg/l	15	166.67
Manganese	ug/L	8.1	11933.33
Mercury	ng/l	27	4.85
Molybdenum	ug/l	22	0.27
Nickel	ug/l	<0.70	994.00
Nitrate as N	mg/l	0.091	0.04
Phosphorus, Total	mg/l	0.1	0.06
Potassium	mg/l	8.4	1.97
Selenium	ug/l	4.8	13.07
SiO2, Silica	mg/l	6.9	50.33
Sodium	ug/l	95	535.00
Specific Conductance	umhos/cm	0.547	6216.67
Sulfate	mg/l	330	5443.33
Thallium	ug/l	<0.026	1.60
Total Dissolved Solids	mg/l	520	7060.00
Total Suspended Solids	mg/l	1000	10.10
Vanadium	ug/l	8.7	8.31
Zinc	ug/l	7.9	2806.67

Data Collection

- Sampling / Analysis
  - Precip Wash Water

ANALYTE	UNITS	
Alkalinity, Total	mg/l	2500
Aluminum	mg/l	2000
Ammonia	mg/l	3.6
Antimony	ug/L	20
Arsenic	ug/L	730
Barium	ug/L	3900
Boron	mg/l	17000
Cadmium	ug/L	39
Calcium	mg/l	4600
Chloride	mg/l	26
Chromium	ug/L	1700
Copper	mg/l	4.8
Field pH	SU	10.55
Fluoride	mg/l	
Hardness as calcium carbonate	mg/l	15000
Hexavalent chromium	mg/l	0.17
Iron	mg/l	730
Iron, Dissolved	ug/L	<25
Lead	ug/L	390
Magnesium	mg/l	800
Manganese	mg/l	5
Mercury	ng/L	820
Molybdenum	ug/l	290
Nickel	ug/l	1300
Nitrate as N	mg/l	1.4
Oil & Grease (HEM)	mg/l	1.6
Orthophosphate as P	mg/l	<0.10
Percent Solids	%	5.60
pH	SU	11.2
Phosphorus, Total	mg/l	2.1
Potassium	mg/l	33
Selenium	ug/l	560
SiO2, Silica	mg/l	130
Sodium	mg/l	200
Specific Conductance	umhos/cm	1.58
Sulfate	mg/l	370
Thallium	ug/l	20
Total Dissolved Solids	mg/l	740
Total Suspended Solids	mg/l	56000
Vanadium	ug/l	6200
Zinc	ug/l	4400

Data Collection

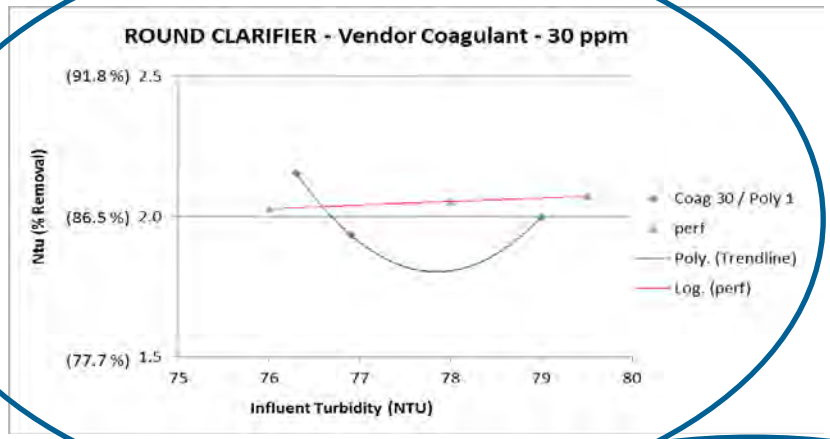
- Jar Testing
  - pH Adjustment
    - Not necessary for treatment of coal pile runoff
    - Necessary for treatment of Precip Wash Water after removal of suspended solids
  - Coagulant
    - Vendor Supplied
    - Bulk (Alum)
  - Flocculant
    - Vendor Supplied

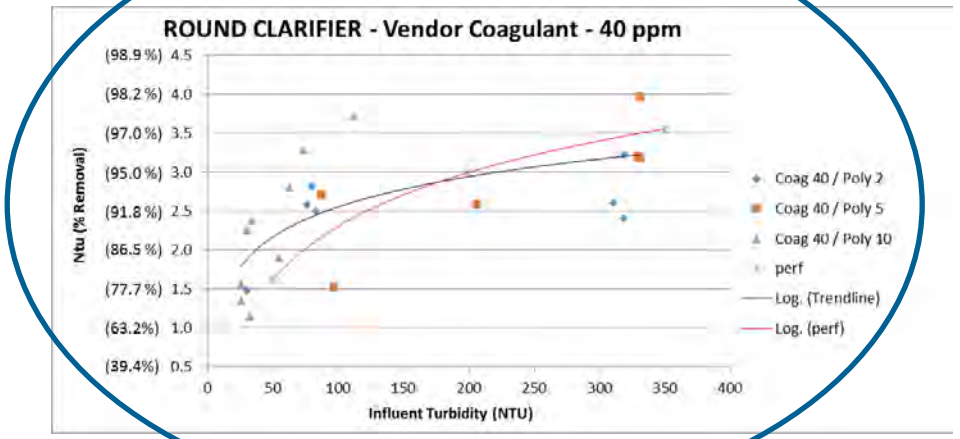
Pilot Testing

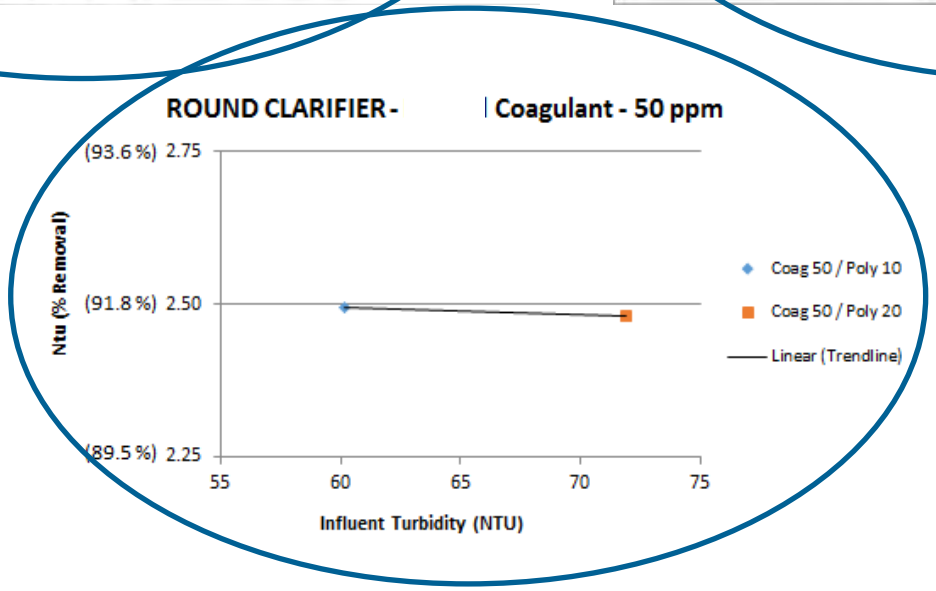
- Sludge Blanket Clarifier
  - Tested by not loading ballast material in ballasted clarifier
  - Sludge recirculation 15%
  - Sludge blowdown to sludge transfer tank
  - Coagulant
    - Vendor only aluminum chloride based product range 30, 40, 50 ppm
  - Polymer
    - Vendor supplied anionic polymer range 1, 2, 5, 10, 20 ppm

Pilot Testing

- Sludge Blanket Clarifier





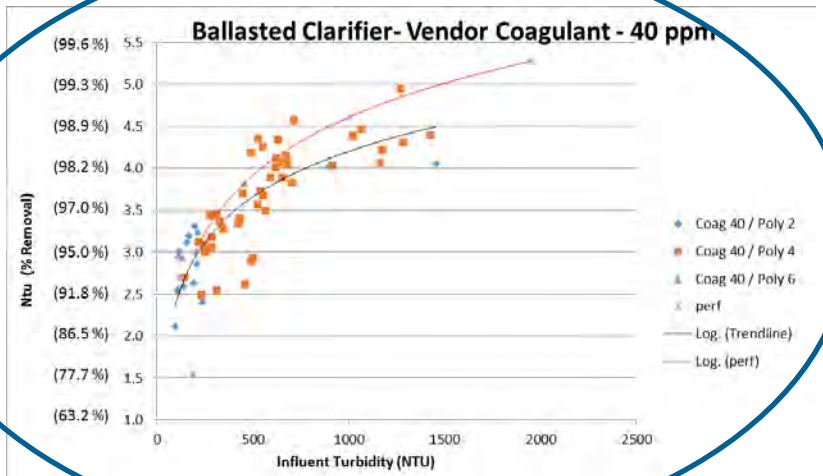


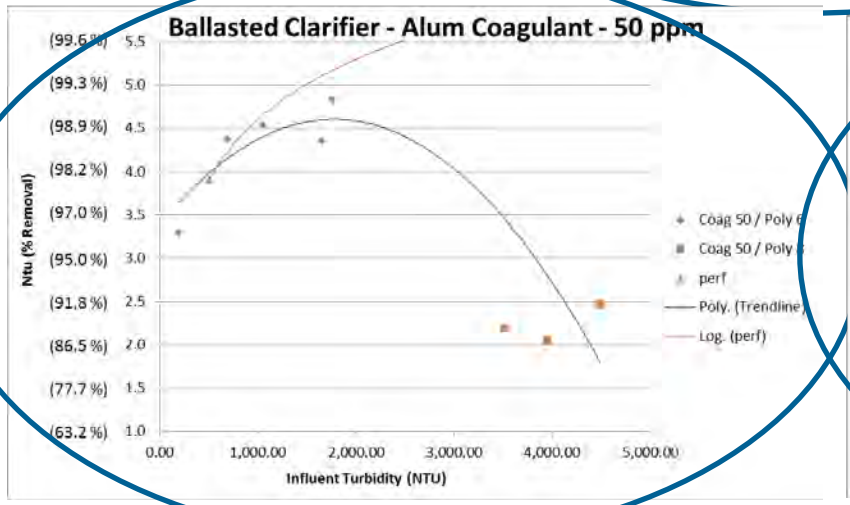
Pilot Testing

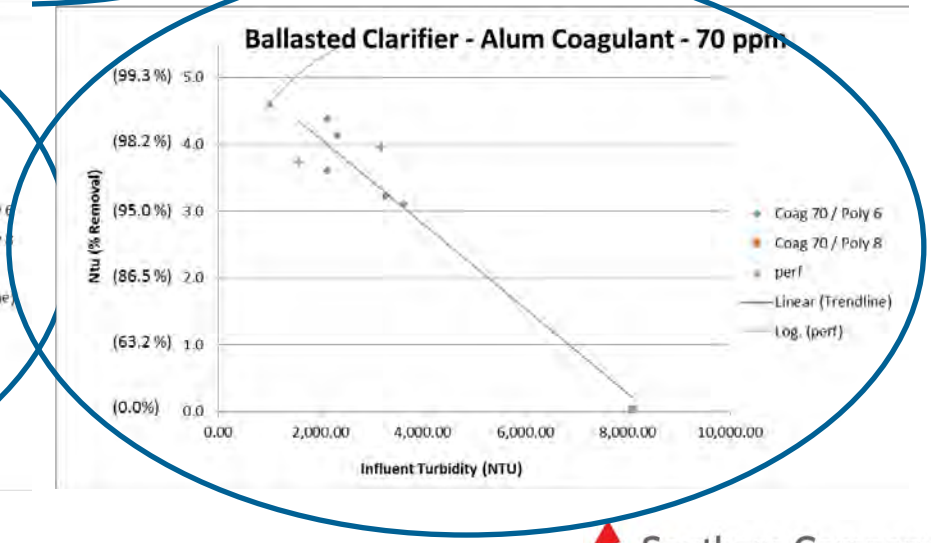
- Ballasted Clarifier
  - Ballast loading range 1, 3, 5 g/l
  - Sludge recirculation 15%
  - Sludge blowdown to sludge transfer tank
  - Coagulant
    - Vendor aluminum chloride based product 40 ppm
    - Alum range 50, 70 ppm
  - Polymer
    - Vendor supplied anionic polymer range 2, 4, 6, 8 ppm

Pilot Testing

- Ballasted Clarifier





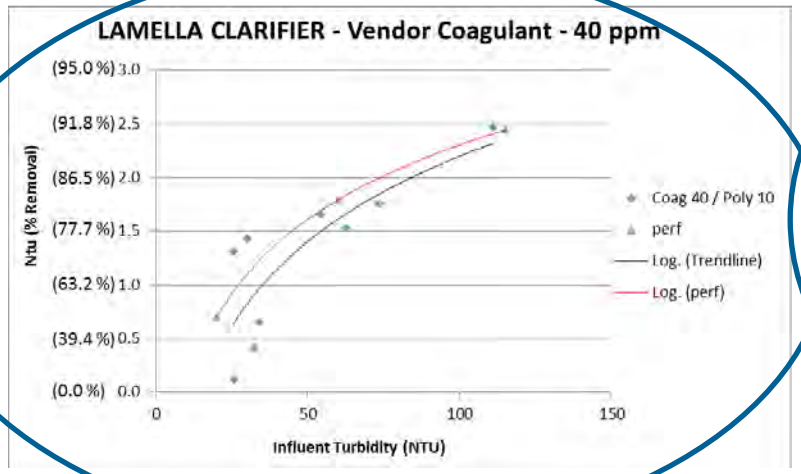


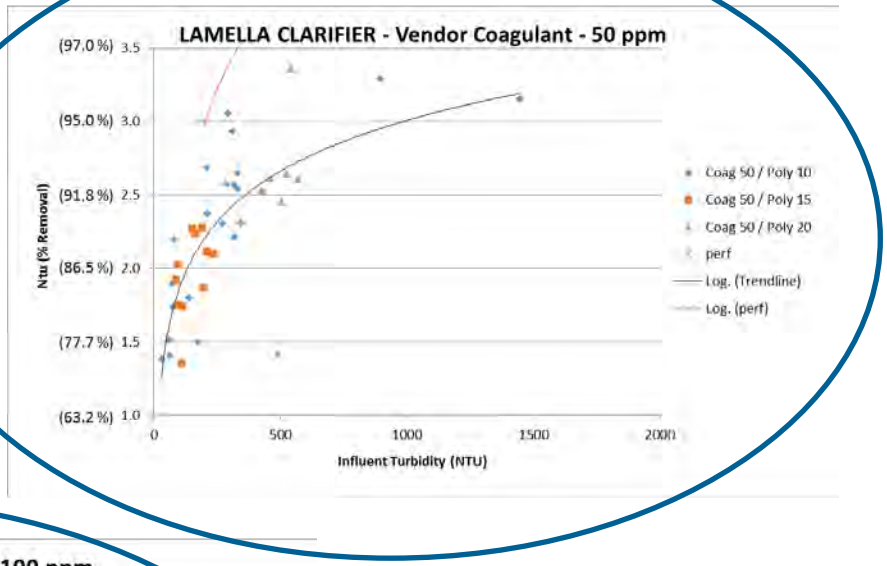
Pilot Testing

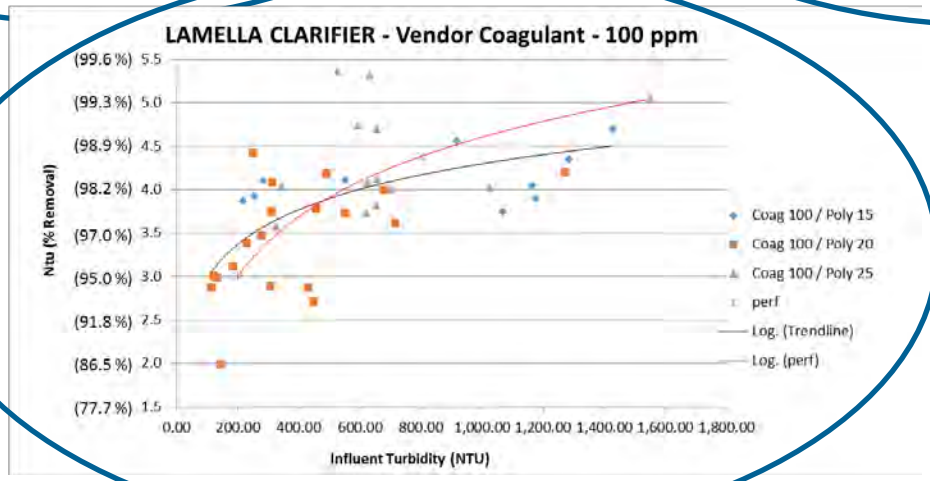
- Lamella Clarifier
  - Sludge recirculation 15% on low solids influent
  - Sludge blowdown to sludge transfer tank
  - Coagulant
    - Vendor only aluminum chloride based product range 40, 50, 100 ppm
    - Alum range 60, 70, 80, 100 ppm
  - Polymer
    - Vendor supplied anionic polymer range 10, 15, 20, 25, 30 ppm

Pilot Testing

- Lamella Clarifier

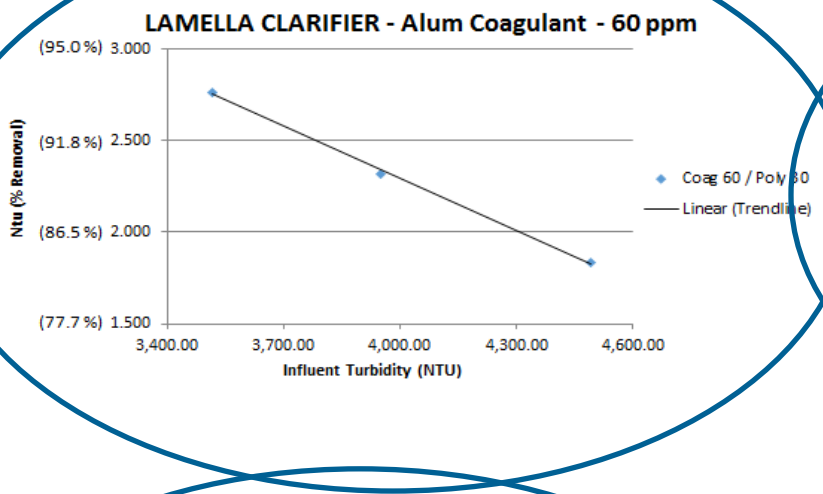


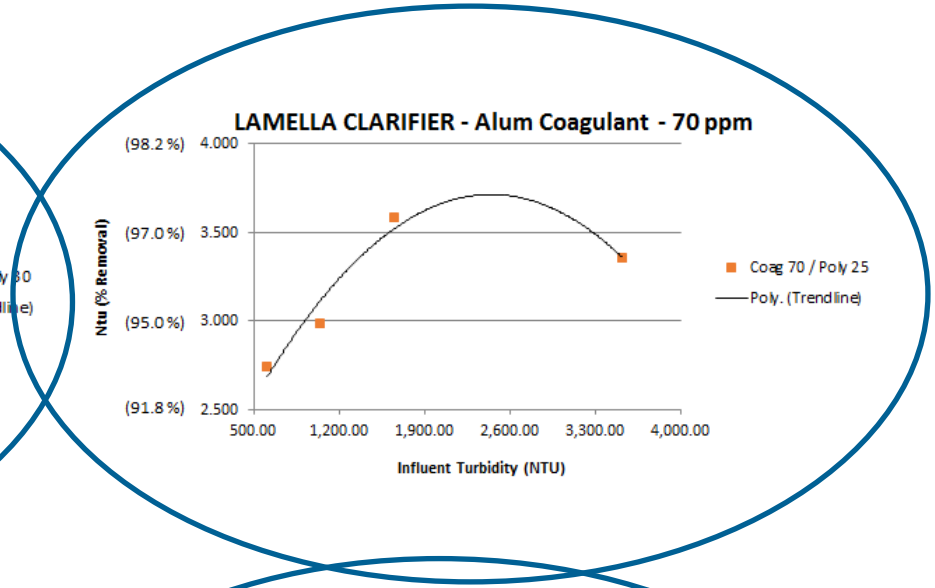


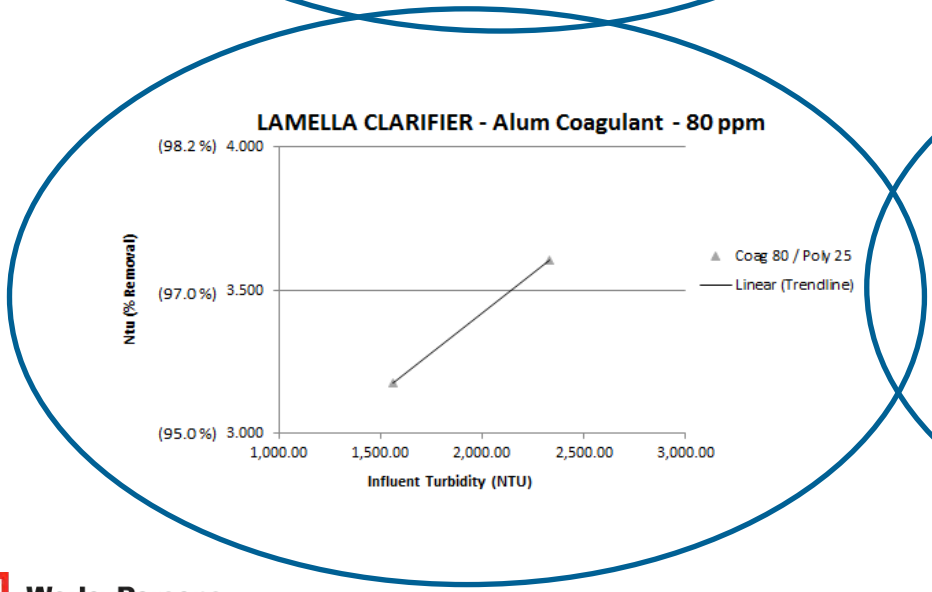


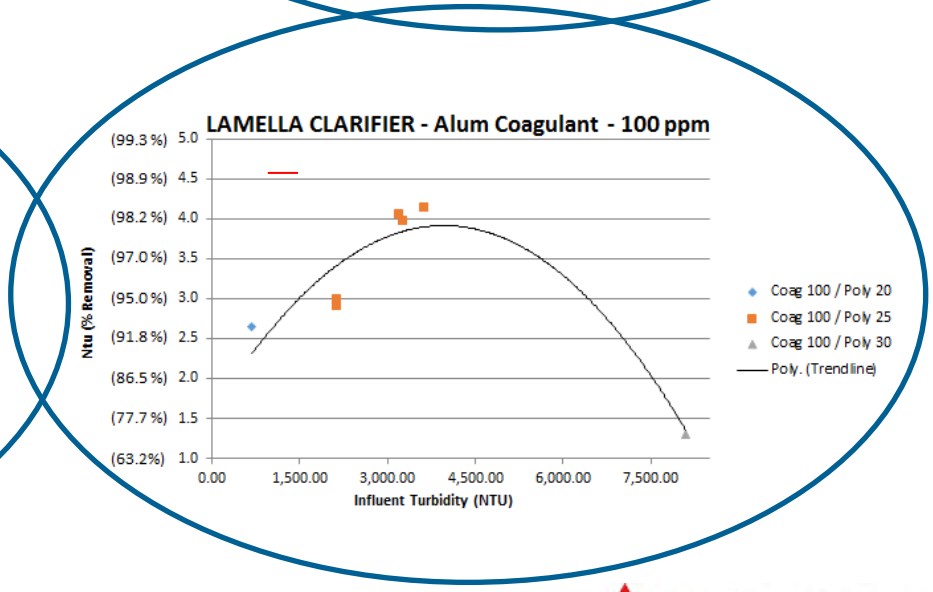
Pilot Testing

- Lamella Clarifier









Pilot Testing

- Filter Press
  - Cycle Time range 35 – 155 minutes
  - Feed Time range 25 – 90 minutes
  - Feed Pressure range 90 – 160 psig
  - Membrane Squeeze 225 psig
- Coal Pile Runoff Results
  - Solids range 45 – 61 wt%
  - Solids average 55 wt%
  - Handling properties - acceptable

Pilot Testing

- Precip Wash Water
  - Feed solids loading 5.6 wt%
  - Feed pH 11.5
  - Significant solids settling Lamella hopper area and plugging flow in sludge blowdown
  - High sludge blowdown rates (>70%) reduces issues
  - Conclusion - Feed filter press directly with no clarification
  - Coagulant and polymer added to filter press feed tank
  - Filter press cake 71 wt% solids

Treatability

Clarification

Equipment	Ballasted Clarifier	Lamella Clarifier	Round Clarifier (Un-ballasted)
Coagulant Dosage Range (ppm)	40 - 70	40 - 100	30 - 50
Coagulants Used	Vendor supplied & Alum	Vendor supplied & Alum	Vendor supplied
Polymer Dosage Range (ppm)	2 - 8	10 - 30	1 - 20
Did process require pH adjustment?	No	No	No
Optimal Coagulant / Polymer Dosages	40 / 4	100 / 15 & 25	40 / 5
Average Percent Reduction in Turbidity (at above conditions) (%) with Vendor supplied	97	98	92
Optimal Coagulant / Polymer Dosage using Alum (ppm)	50 / 6	100 / 25	N/A
Average Percent Reduction in Turbidity (at above conditions) (%) with Alum	99	97	N/A

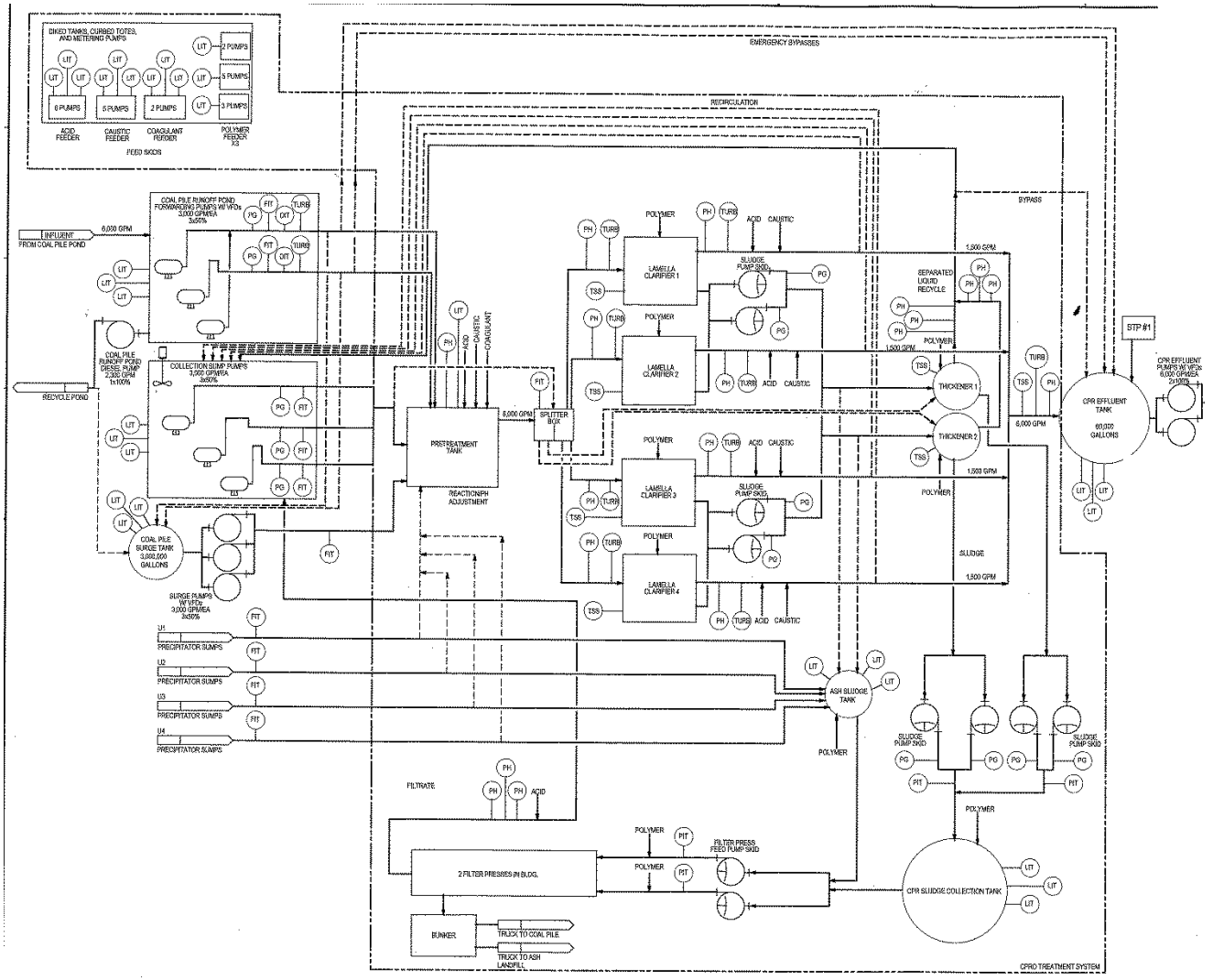
- Vendor supplied coagulant more continuous, reliable performance, less sensitive to process solids loading
- Alum sensitive to process solids loading and susceptible to overfeeding
- No pH adjustment required for clarification
- Increased coagulant/polymer consumption for Lamella/Sludge blanket clarifier versus ballasted clarifier

Treatability

- Dewatering
  - Coal pile runoff
    - Filter cake solids 55 wt%
    - Membrane filter press provided repeatable, reliable results
    - Good material handling properties for returning to coal pile
    - No need for further processing coal pile runoff solids
  - Ash wash water
    - Feed filter press directly no pre-treatment clarification
    - Filter cake solids 71 wt%
    - Membrane press provided repeatable, reliable results
    - Good material handling properties for landfill

Design Basis

- Process Flow Diagram
- Plot Plan
- Plant Integration
- Operations
  - Shift Schedule
  - Staffing
  - Automation
  - Controls
- Sparing
- Redundancy

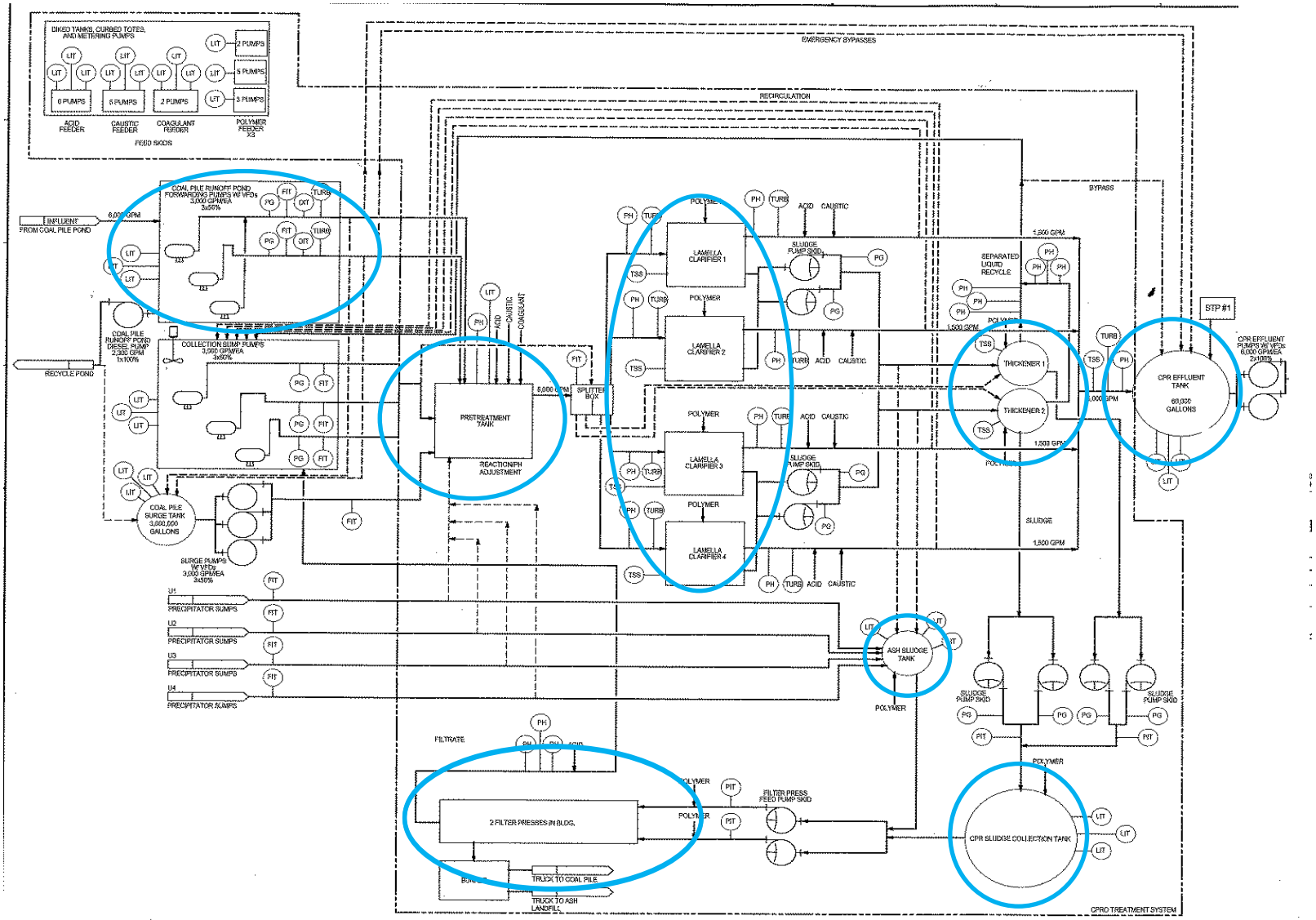


Design Basis

- Process Flow Diagram
  - Flow
    - Coal Pile Runoff – 6,000 gpm
    - Precip Wash Water – 400 gpm
  - TSS
    - Coal Pile Runoff
      - Low - 200 ppm
      - High - 15,000 ppm
      - Average - 1,000 ppm
    - Precip Wash Water
      - Average - 5.6 wt%
  - pH
    - Coal Pile Runoff - 7.48
    - Precip Wash Water - 11.2

- Equipment Sizing
  - Pre-Treatment Tank
    - 20 minute retention
  - Lamella Clarifier
    - 4 x 1,500 gpm
  - Thickener
    - 2 x 3,000 gpm
  - Filter Press
    - Qty 2
    - Total 270.5 tpd (D.S.)

Design Basis



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Design Basis

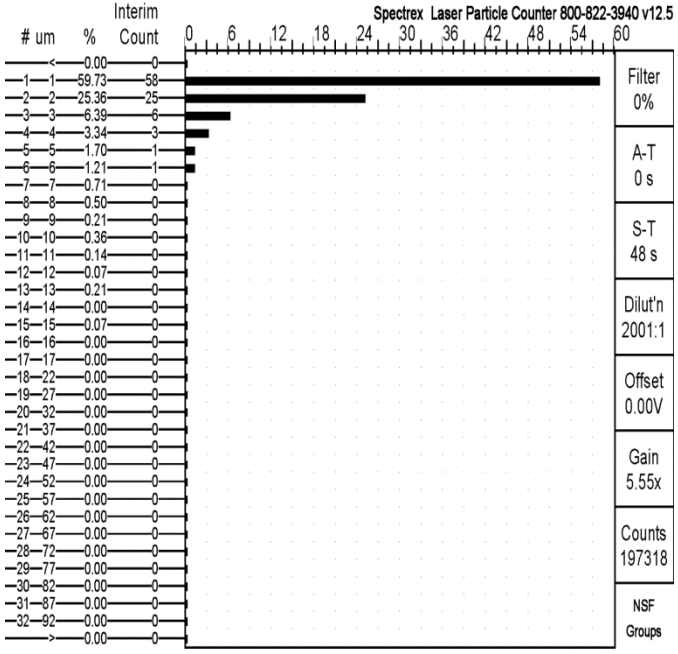
- Coal Pile Runoff
  - Analysis

Constituent / Parameter	Average Value	Low Value	High Value	Units
Alkalinity, Total as CaCO3	35			mg/l
Aluminum, as Al	692	300	889	µg/l
Ammonia	0.06	0.02	0.11	mg/l
Antimony, as Sb	52.5	51.9	53	µg/l
Arsenic	53.6	53.4	53.8	µg/l
Barium, as Ba	184	140	208	µg/l
Biological Oxygen Demand	<2.0			Mg/l
Boron, as B	1,527	1,300	1,790	µg/l
Cadmium, as Cd	51.2	50.9	51.5	µg/l
Calcium, as Ca	61	60.9	61.4	mg/l
Chemical Oxygen Demand	48			mg/l
Chloride, as Cl	22			mg/l
Chromium, as Cr	49.6	49.3	49.9	µg/l
Chromium, Hexavalent	0.0065			mg/l
Conductance, Specific	0.547			µS/cm
Copper, as Cu	52.5	52.4	52.5	µg/l
Hardness as CaCO3	153	152	153	mg/l
Hardness, Magnesium	86.1	86	86.2	mg/l
Iron	215	190	240	µg/l
Iron, Dissolved	5,625	5,610	5,640	µg/l
Lead, as Pb	44	39.2	48.7	µg/l
Magnesium, as Mg	17,925	15,000	20,900	µg/l
Manganese, as Mn	504	502	505	µg/l
Mercury	27			ng/l
Molybdenum, as Mo	72.6	71.6	73.5	µg/l
Nickel, as Ni	52.7	51.6	53.7	µg/l

Constituent / Parameter	Average Value	Low Value	High Value	Units
Nitrate, as N	0.09			mg/l
Nitrate Nitrate, as N	0.09			mg/l
Nitrite, as N	0.021			mg/l
Oil & Grease (HEM)	1.6			mg/l
Oxidation Reduction Potential	41			mV
Orthophosphate as P	0.10			mg/l
Oxygen, Dissolved	7.61			mg/l
pH	6.9	6.9	6.9	SU
pH, Field	7.48			SU
Phosphorus, Total as P	0.1			mg/l
Potassium	14,500	14,500	14,500	µg/l
Selenium	56.5	56.1	56.8	µg/l
Silica, Total	6.9			mg/l
Sodium, as Na	104,000	104,000	104,000	µg/l
Sulfate, as SO_4	330			mg/l
Temperature	21.1			°C
Temperature, Field	31.41			°C
Thallium, as Tl	11.9	10.6	13.2	µg/l
Total Dissolved Solids	520			mg/l
Total Organic Carbon	3.6			mg/l
Total Suspended Solids	1,000	200	15,000	mg/l
Vanadium, as V	59.4	59.4	59.4	µg/l
Zinc, as Zn	55.8	55.4	56.2	µg/l

Design Basis

- Coal Pile Runoff
  - PSD



Bin	Size	Total counts /cc	Counts percent	Surface area percent	Volume percent	Mass/bin ppm
	< 1	0.00	0.00%	0.00%	0.00%	0.0000
1	1-5	187,087.47	94.82%	48.85%	26.28%	0.5295
2	5-15	10,090.11	5.11%	48.28%	67.48%	1.3595
3	15-30	140.14	0.07%	2.87%	6.25%	0.1258
4	30-50	0.00	0.00%	0.00%	0.00%	0.0000
	50-100	0.00	0.00%	0.00%	0.00%	0.0000

Total counts: 197,317.72/cc
Total suspended solids: 2.01ppm (mg/liter)
Dilution factor: 2001.00:1
Spec. gravity: 1.00
Mean size: 1.79um
Standard dev: 1.53um

Bin	Size	Total counts /cc	Counts percent	Surface area percent	Volume percent	Mass/bin ppm
	<	0.00	0.00%	0.00%	0.00%	0.0000
1	1um	117,858.10	59.73%	10.72%	3.06%	0.0617
2	2um	50,030.13	25.36%	18.21%	8.75%	0.1762
3	3um	12,612.64	6.39%	10.33%	6.72%	0.1355
4	4um	6,586.60	3.34%	9.59%	7.75%	0.1561
5	5um	3,363.37	1.70%	7.65%	7.31%	0.1472
6	6um	2,382.39	1.21%	7.80%	8.54%	0.1722
7	7um	1,401.40	0.71%	6.25%	7.68%	0.1547
8	8um	980.98	0.50%	5.71%	7.76%	0.1564
9	9um	420.42	0.21%	3.10%	4.60%	0.0927
10	10um	700.70	0.36%	6.38%	10.24%	0.2063
11	11um	280.28	0.14%	3.09%	5.32%	0.1073
12	12um	140.14	0.07%	1.84%	3.38%	0.0681
13	13um	420.42	0.21%	6.47%	12.64%	0.2547
14	14um	0.00	0.00%	0.00%	0.00%	0.0000
15	15um	140.14	0.07%	2.87%	6.25%	0.1258
16	16um	0.00	0.00%	0.00%	0.00%	0.0000
17	17um	0.00	0.00%	0.00%	0.00%	0.0000
18	22um	0.00	0.00%	0.00%	0.00%	0.0000
19	27um	0.00	0.00%	0.00%	0.00%	0.0000
20	32um	0.00	0.00%	0.00%	0.00%	0.0000
21	37um	0.00	0.00%	0.00%	0.00%	0.0000
22	42um	0.00	0.00%	0.00%	0.00%	0.0000
23	47um	0.00	0.00%	0.00%	0.00%	0.0000
24	52um	0.00	0.00%	0.00%	0.00%	0.0000
25	57um	0.00	0.00%	0.00%	0.00%	0.0000
26	62um	0.00	0.00%	0.00%	0.00%	0.0000
27	67um	0.00	0.00%	0.00%	0.00%	0.0000
28	72um	0.00	0.00%	0.00%	0.00%	0.0000
29	77um	0.00	0.00%	0.00%	0.00%	0.0000
30	82um	0.00	0.00%	0.00%	0.00%	0.0000
31	87um	0.00	0.00%	0.00%	0.00%	0.0000
32	92um	0.00	0.00%	0.00%	0.00%	0.0000
	>	0.00	0.00%	0.00%	0.00%	0.0000
	TOTALS	197,317.72	100.00%	100.00%	100.00%	2.0148

Design Basis

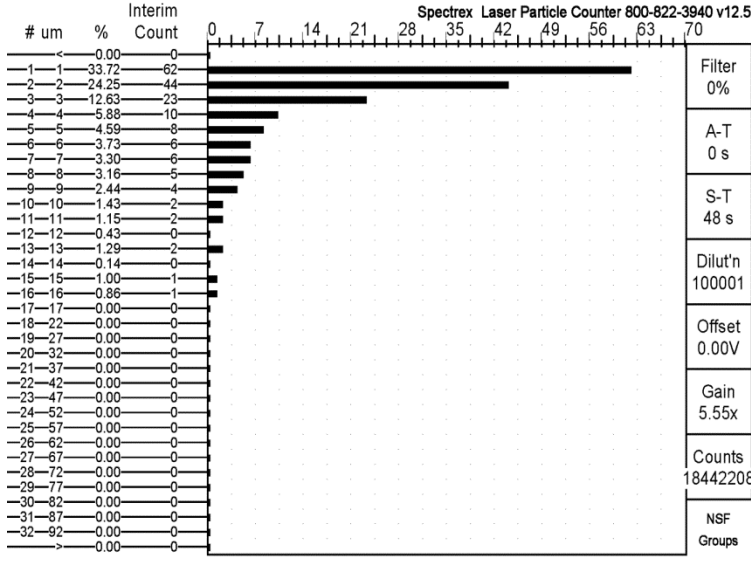
- Precip Wash Water
  - Analysis

Constituent / Parameter	Average Value	Units
Alkalinity, Total as CaCO3	2,500	mg/l
Aluminum, as Al	2,000,000	µg/l
Ammonia	3.6	mg/l
Antimony, as Sb	20	µg/l
Arsenic	730	µg/l
Barium, as Ba	3,900	µg/l
Biological Oxygen Demand	<2.0	mg/l
Boron, as B	17,000	µg/l
Cadmium, as Cd	39	µg/l
Calcium, as Ca	4,600,000	µg/l
Chemical Oxygen Demand	76	mg/l
Chloride, as Cl	26	mg/l
Chromium, as Cr	1,700	µg/l
Chromium, Hexavalent	0.17	mg/l
Conductance, Specific	1.58	µS/cm
Copper, as Cu	4,800	µg/l
Hardness as CaCO3	15,000	mg/l
Iron	730,000	µg/l
Iron, Dissolved	<25	µg/l
Lead, as Pb	390	µg/l
Magnesium, as Mg	800,000	µg/l
Manganese, as Mn	5,000	µg/l
Mercury	820	ng/l
Molybdenum, as Mo	290	µg/l
Nickel, as Ni	1,300	µg/l

Constituent / Parameter	Average Value	Units
Nitrate, as N	1.4	mg/l
Nitrate Nitrate, as N	1.8	mg/l
Nitrite, as N	0.39	mg/l
Oil & Grease (HEM)	1.74	mg/l
Oxygen Reduction Potential	140	mV
Ortho-phosphate as P	<0.10	mg/l
Oxygen, Dissolved	6.03	mg/l
pH	11.2	SU
pH, Field	10.55	SU
Phosphorus, Total	2.1	mg/l
Potassium	33,000	µg/l
Selenium	560	µg/l
Silica, as SiO_2	130	mg/l
Sodium, as Na	200,000	µg/l
Sulfate, as SO_4	370	mg/l
Temperature	20.9	°C
Temperature, Field	21.7	°C
Thallium, as Tl	20	µg/l
Total Dissolved Solids	540	mg/l
Total Organic Carbon	6.7	mg/l
Total Suspended Solids	56,000	mg/l
Vanadium, as V	6,200	µg/l
Zinc, as Zn	4,400	µg/l

Design Basis

- Precip Wash Water
  - PSD



Bin	Size	Total counts /cc	Counts percent	Surface area percent	Volume percent	Mass/bin ppm
	< 1	0.00	0.00%	0.00%	0.00%	0.0000
1	1-5	14,102,864.76	76.47%	15.48%	6.26%	69.7237
2	5-15	3,995,370.69	21.66%	64.10%	63.52%	707.2996
3	15-30	343,972.31	1.87%	20.42%	30.22%	336.5529
4	30-50	0.00	0.00%	0.00%	0.00%	0.0000
	50-100	0.00	0.00%	0.00%	0.00%	0.0000

Total counts: 18,442,207.77/cc
Total suspended solids: 1113.58ppm (mg/liter)
Dilution factor: 100001.00:1
Spec. gravity: 1.00
Mean size: 3.39um
Standard dev: 3.22um

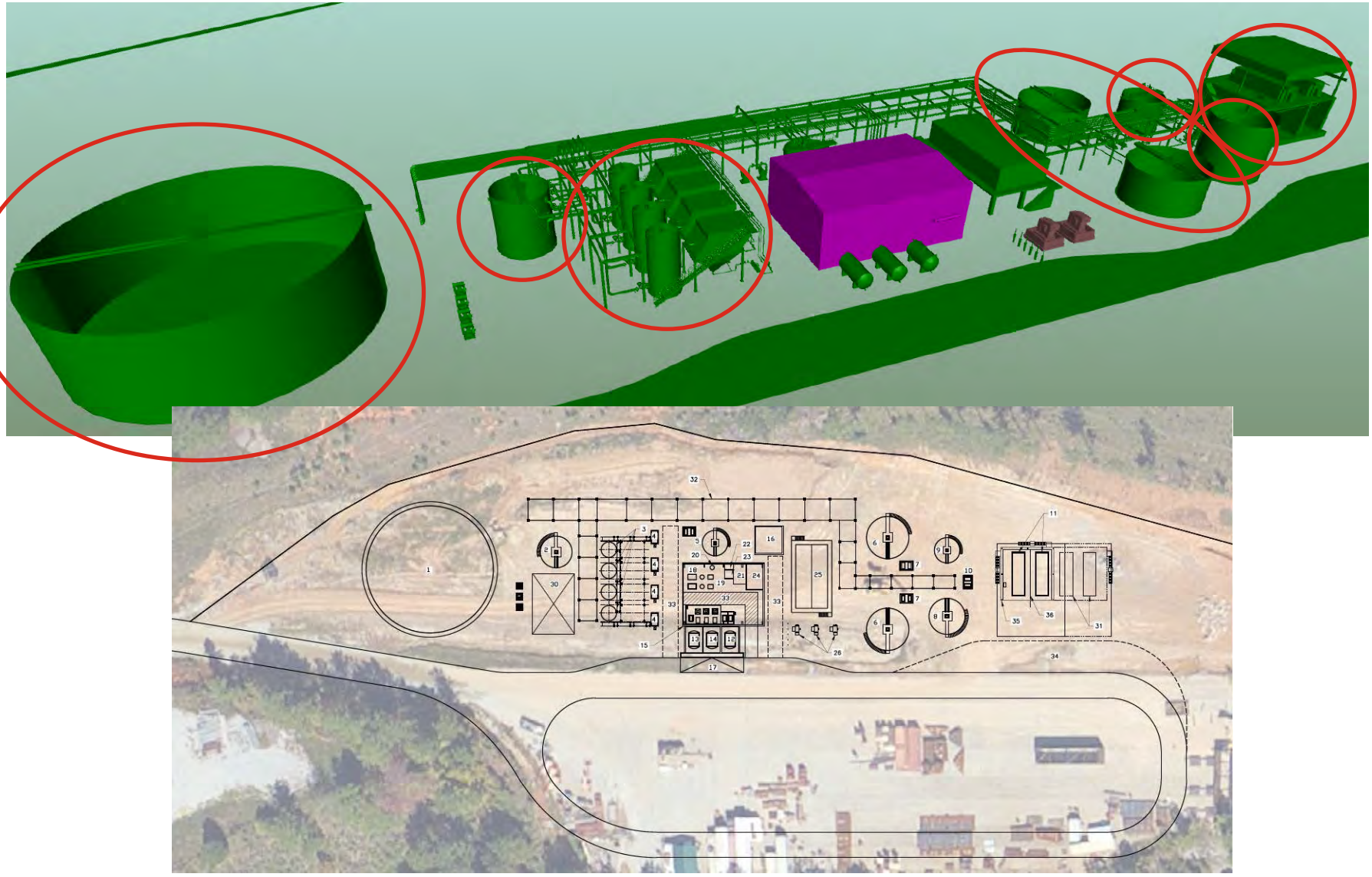
Bin	Size	Total counts /cc	Counts percent	Surface area percent	Volume percent	Mass/bin ppm
	<	0.00	0.00%	0.00%	0.00%	0.0000
1	1um	6,217,961.01	33.72%	1.54%	0.29%	3.2557
2	2um	4,471,640.05	24.25%	4.44%	1.41%	15.7506
3	3um	2,328,427.95	12.63%	5.20%	2.25%	25.0118
4	4um	1,084,835.75	5.88%	4.31%	2.31%	25.7056
5	5um	846,701.07	4.59%	5.25%	3.33%	37.0592
6	6um	687,944.62	3.73%	6.14%	4.46%	49.7128
7	7um	608,566.40	3.30%	7.40%	6.03%	67.1933
8	8um	582,106.99	3.16%	9.24%	8.33%	92.7895
9	9um	449,809.95	2.44%	9.04%	8.90%	99.1276
10	10um	264,594.09	1.43%	6.56%	7.00%	77.9074
11	11um	211,675.27	1.15%	6.35%	7.27%	81.0025
12	12um	79,378.23	0.43%	2.84%	3.47%	38.5877
13	13um	238,134.68	1.29%	9.98%	12.96%	144.2665
14	14um	26,459.41	0.14%	1.29%	1.76%	19.6531
15	15um	185,215.86	1.00%	10.34%	14.94%	166.3136
16	16um	158,756.45	0.86%	10.08%	15.29%	170.2393
17	17um	0.00	0.00%	0.00%	0.00%	0.0000
18	22um	0.00	0.00%	0.00%	0.00%	0.0000
19	27um	0.00	0.00%	0.00%	0.00%	0.0000
20	32um	0.00	0.00%	0.00%	0.00%	0.0000
21	37um	0.00	0.00%	0.00%	0.00%	0.0000
22	42um	0.00	0.00%	0.00%	0.00%	0.0000
23	47um	0.00	0.00%	0.00%	0.00%	0.0000
24	52um	0.00	0.00%	0.00%	0.00%	0.0000
25	57um	0.00	0.00%	0.00%	0.00%	0.0000
26	62um	0.00	0.00%	0.00%	0.00%	0.0000
27	67um	0.00	0.00%	0.00%	0.00%	0.0000
28	72um	0.00	0.00%	0.00%	0.00%	0.0000
29	77um	0.00	0.00%	0.00%	0.00%	0.0000
30	82um	0.00	0.00%	0.00%	0.00%	0.0000
31	87um	0.00	0.00%	0.00%	0.00%	0.0000
32	92um	0.00	0.00%	0.00%	0.00%	0.0000
	>	0.00	0.00%	0.00%	0.00%	0.0000
	TOTALS	18,442,207.77	100.00%	100.00%	100.00%	1113.5763

Design Basis

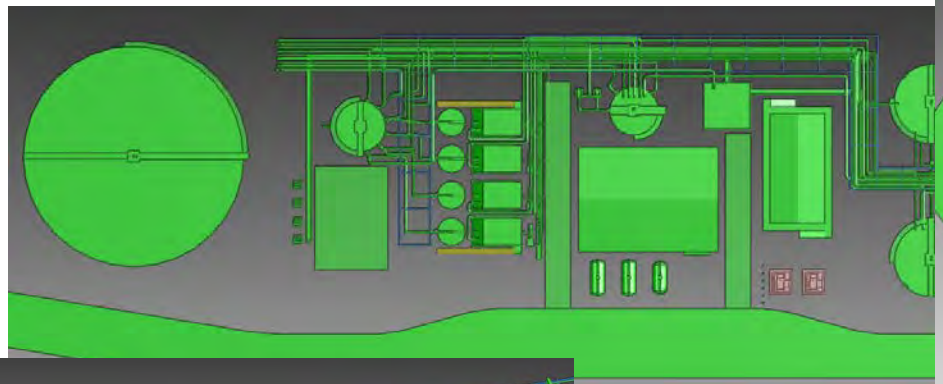
- Performance Requirements

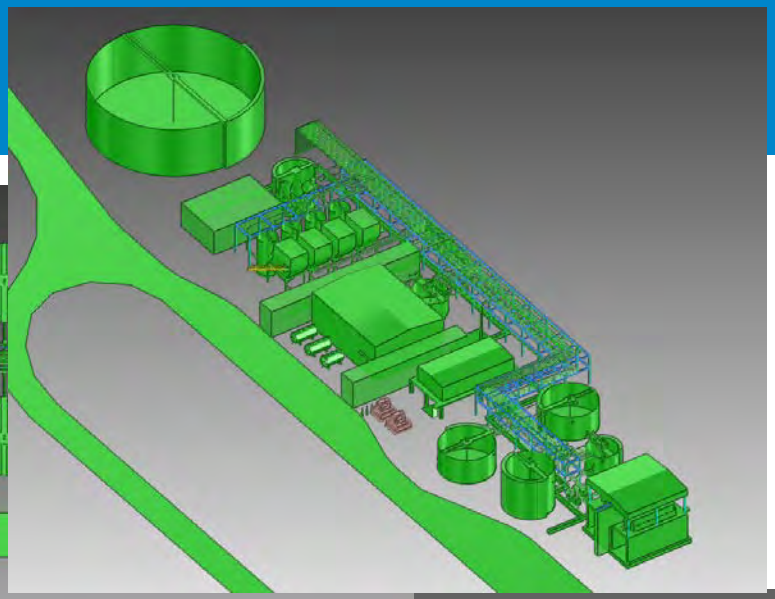
GUARANTEED PERFORMANCE		
Sample Point	Units	Range
CPRO WWT Effluent pH	Std. Units	6 to 9
CPRO WWT Effluent TSS	mg/l	≤ 25
CPRO WWT Effluent Oil & Grease	mg/l	≤10
CPRO Filter Press Daily Production	tons/day	270.5 tpd, D.S.
CPRO Filter Press Solids		Paint filter test

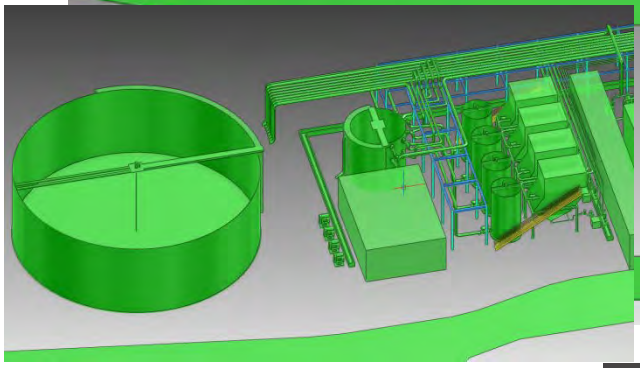
Full Scale Treatment

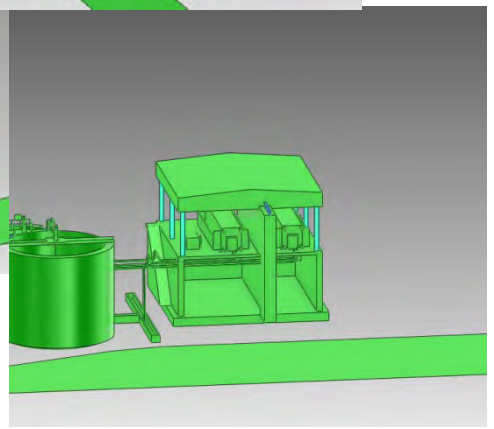


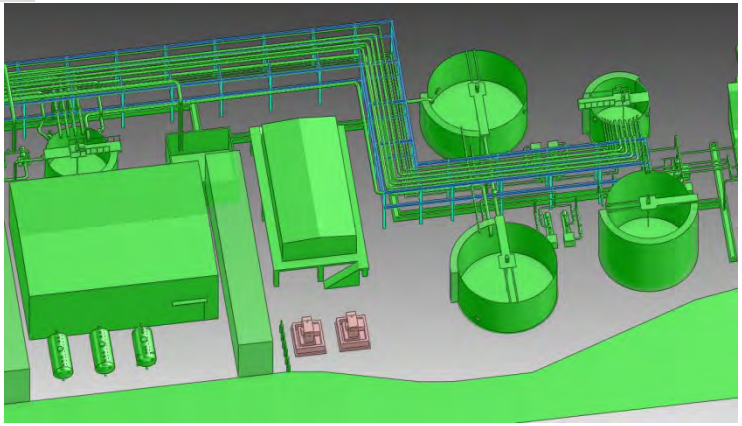
Full Scale Treatment











Full Scale Treatment