2019 PPI INTERNSHIP COMPASS MINERALS LYONS EVAPORATION PLANT

By: Isaac Wright

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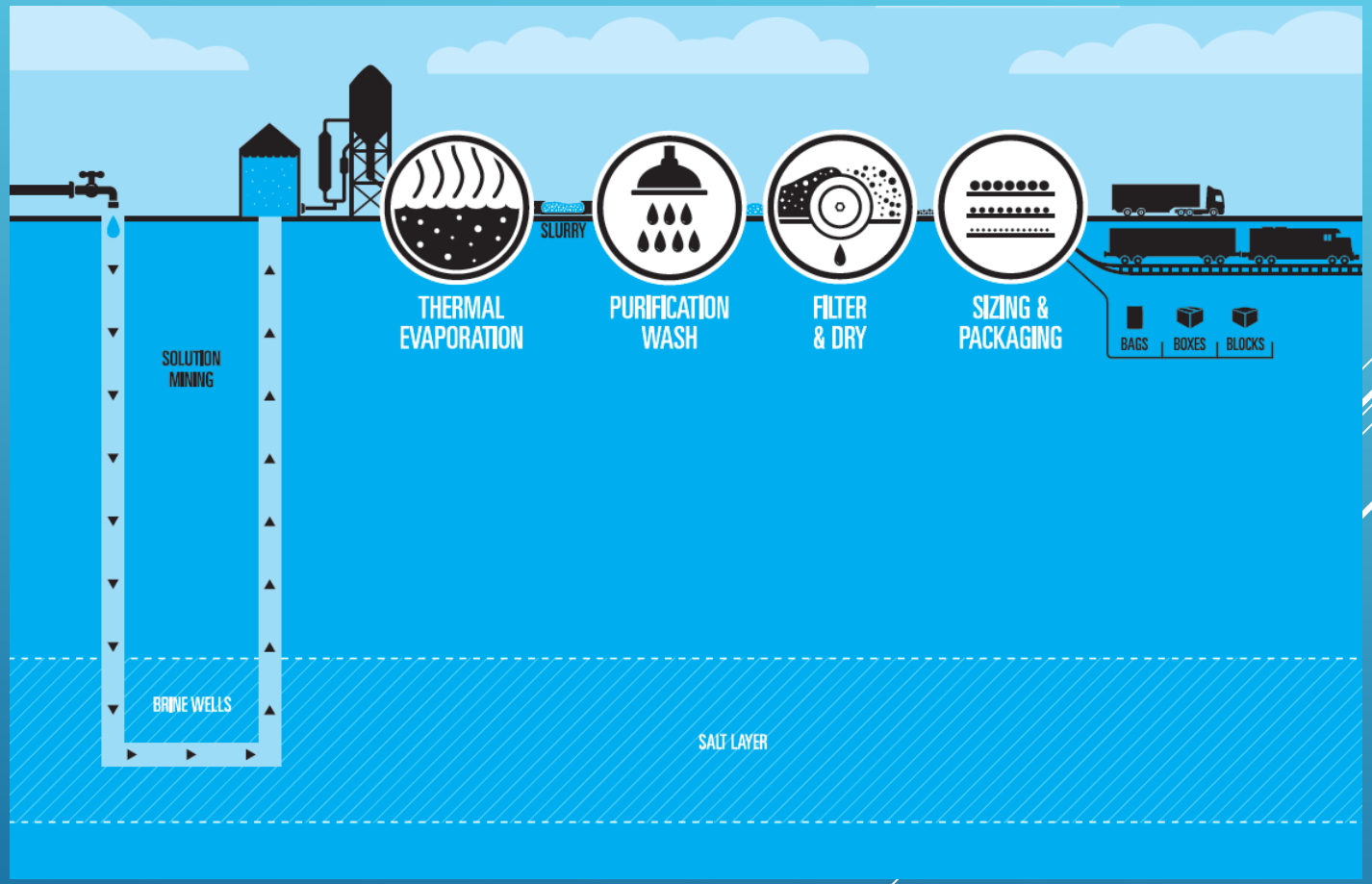
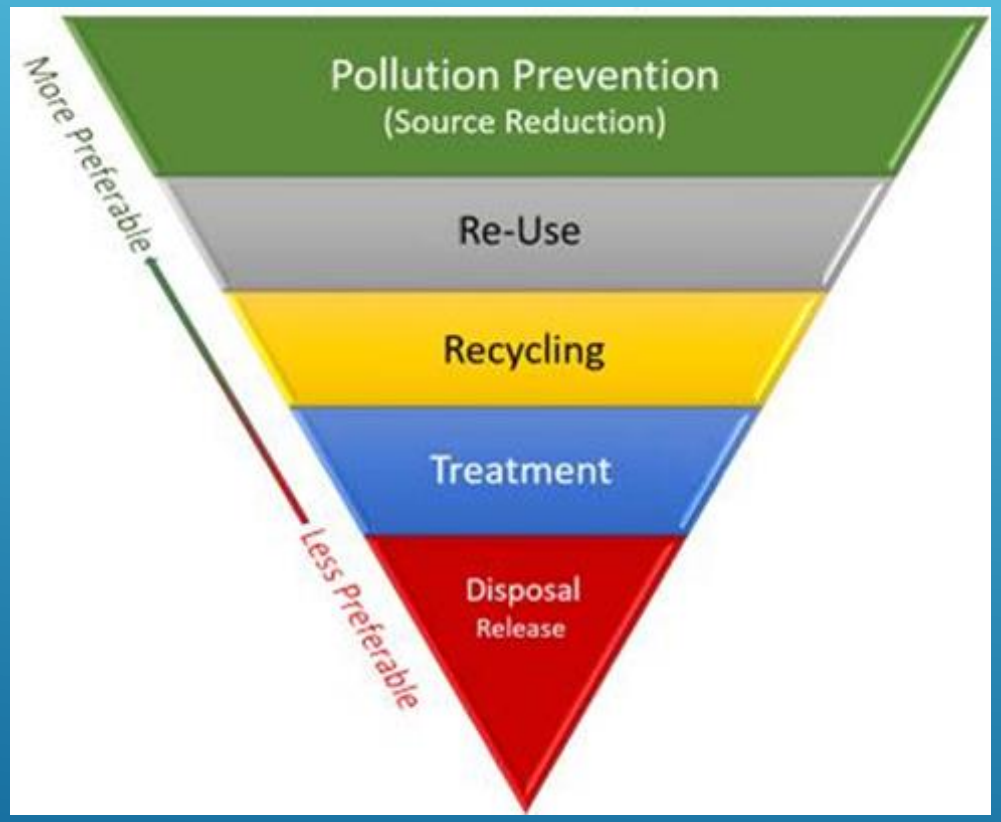
Site Background

- Solution mining since 1908
- Saturated brine evaporated
- Salt sorted by size
- Variety of products produced



K-State Pollution Prevention Institute



- Source Reduction if at all possible
- "Change the material, change the process, change the technology"

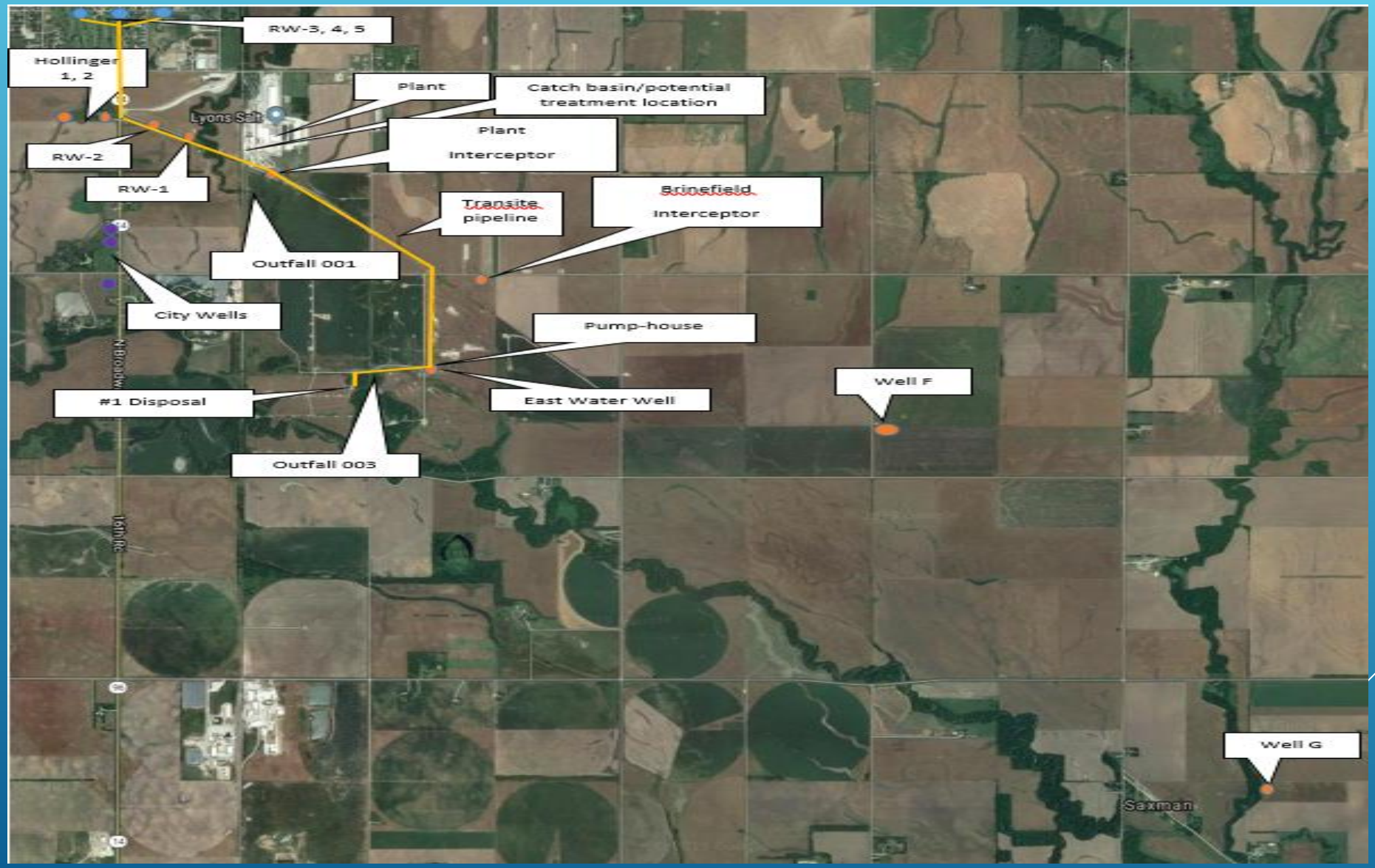
Pollution Prevention Institute

Deep Well Injection

Incentives for Change:

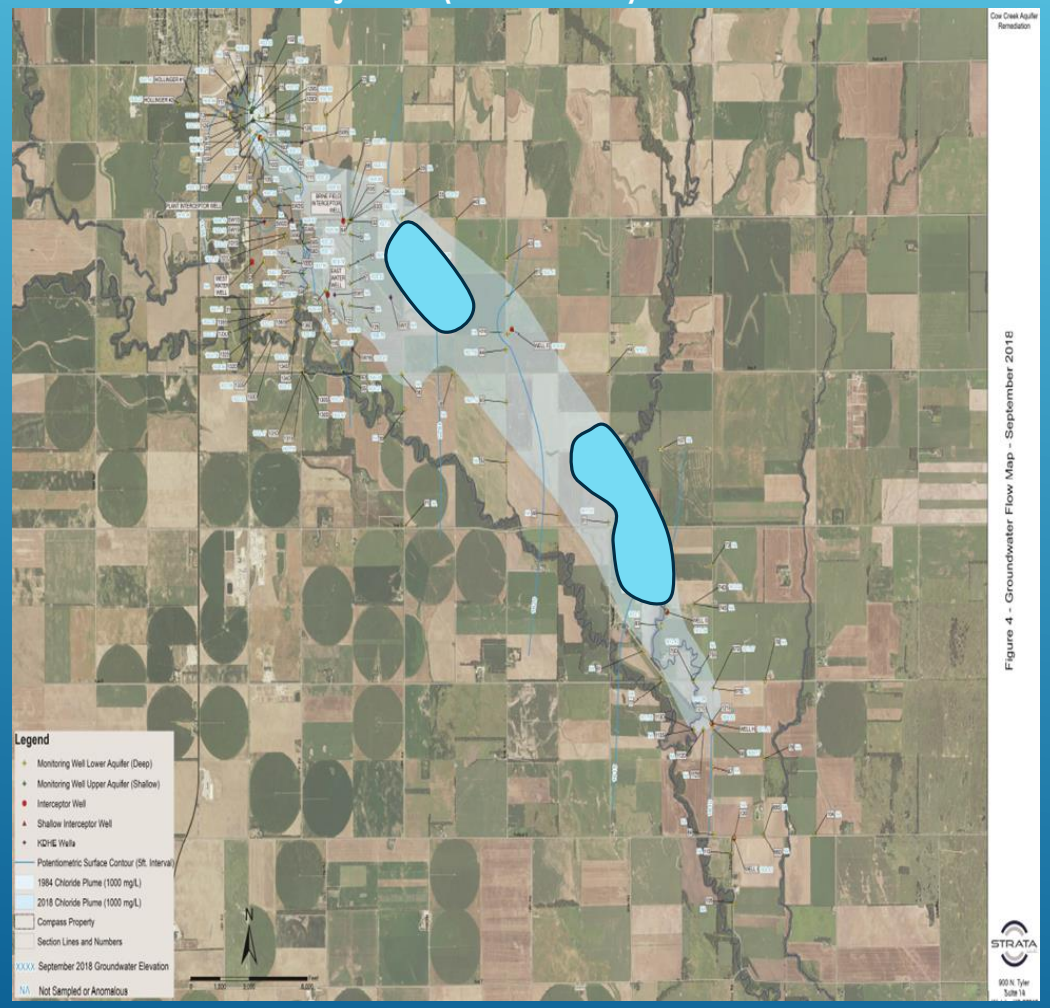
1. UIC Class 1 non-hazardous waste minimization guide and reporting for new and renewed permits
2. Increased Water remaining in the hydrological cycle
   - -water for 4,486 families of 4 per year (80 gallons/person/day)
   - -160 acre pond 10 feet deep
3. Man-made seismicity
4. Future disposal space for hazardous waste

Geography of the site

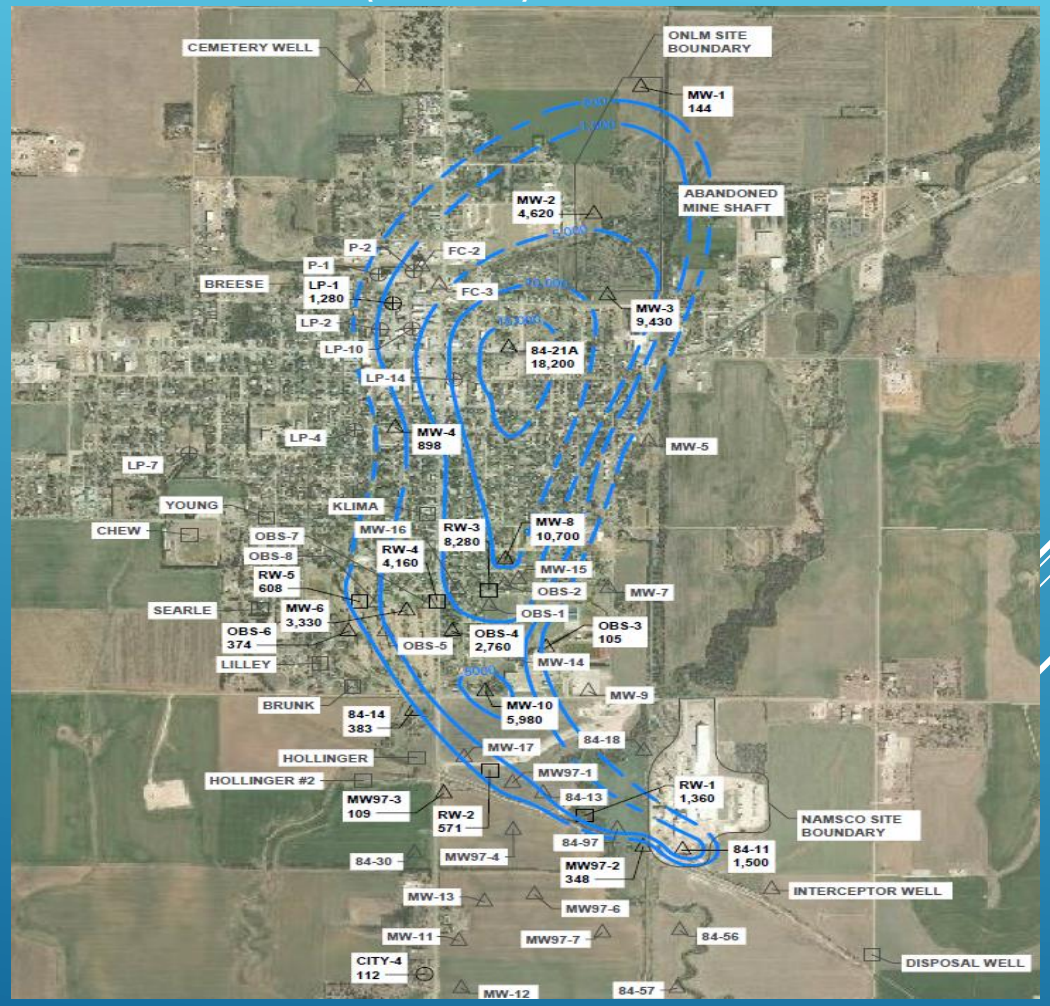


Two Separate Chloride Plumes

Cow Creek Aquifer Remediation Project (CCARP)



Old North Lyons Mine Plume (ONLM)



Historical Agreements

CCARP

1. Proposed remedial action plan in 1985 by Eder associates.

ONLM

1. 1997 agreement with KDHE for RW-1 and RW-2
2. 2005 agreement with KDHE and City of Lyons for RW-3, 4, 5

Diversion Options

Untreated Options:

1. Process use
2. Golf course use
3. Wetland restoration/creation
4. Reduce overall pumping

Treated Options:

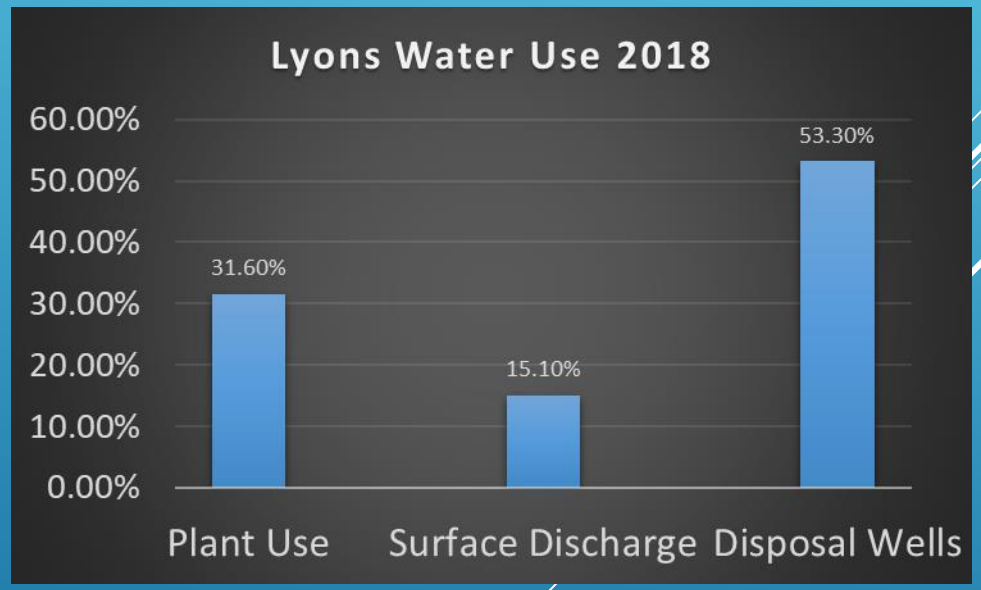
1. NPDES discharge
2. Irrigation
3. Aquifer Recharge

Process Use-untreated

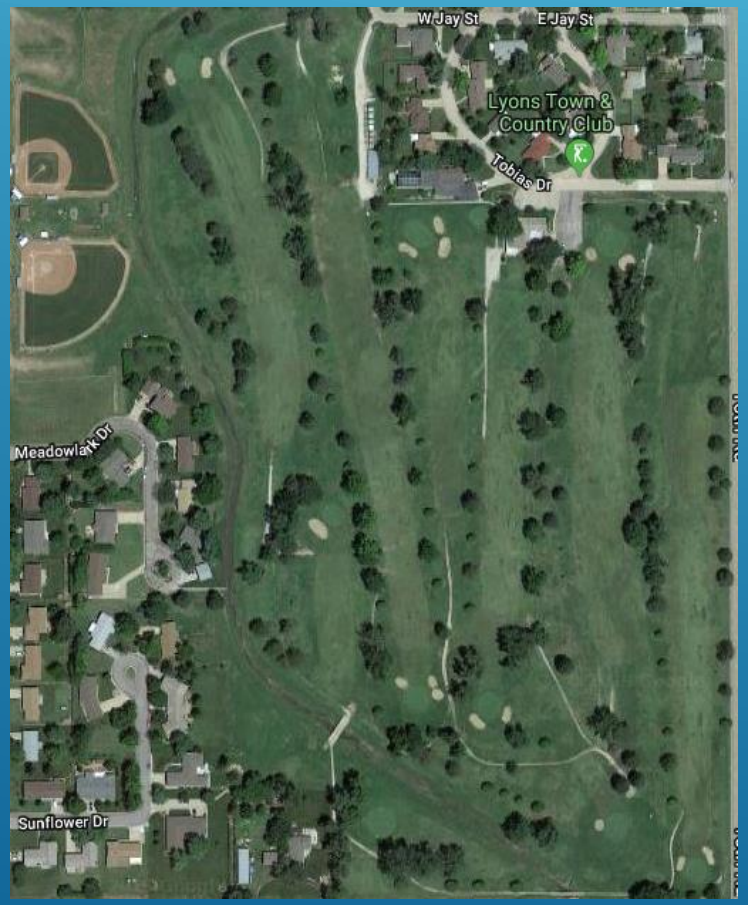
1. ONLM water could be used to aid in dust collection and pump cooling to limit Hollinger reliance

Pump	Design Rate (GPM)	Current Rate (GPM)	2018 Chloride (mg L)	Use
Hollinger 1	50	133	165	Power and Process
Hollinger 2	200	203	85	Power and Process
Plant Interceptor	180	248	514	Mill
Brine-Field Interceptor	160	152	311	Owl Creek
East Water Well	120	131	299	Owl Creek
Well F	350-400	395	718	Disposal
Well G	350-400	402	727	Disposal
Well 126	0.5	0.5	6617	Brine makeup
Well 128	0.5	0.5	2650	Brine makeup
ONLM Wells	200	200	1515	Disposal
sum------->	1611-1711	1865		

Well	Rate (2018 GPM)	Chlorides (mg/L)
Plant Interceptor Well	248	514
RW-2	85	571



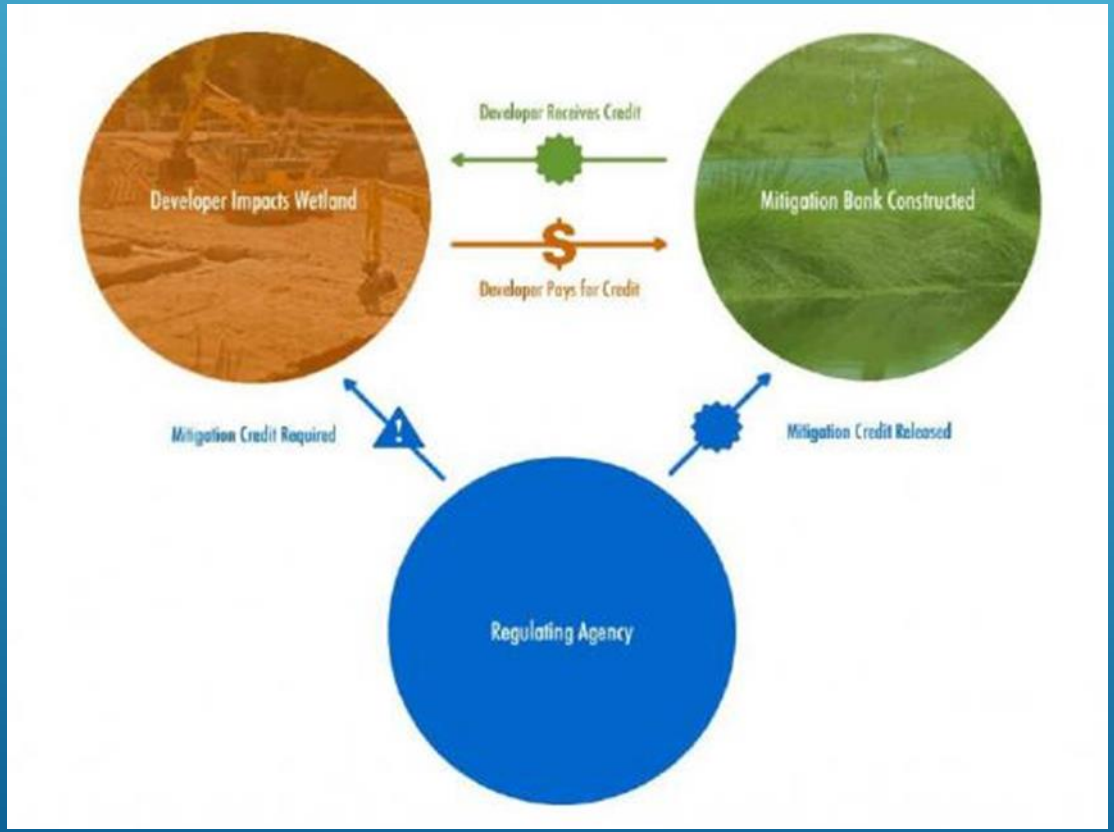
Golf Course Use



- Lyons public golf course lies in the midst of ONLM Plume
- Reliant upon city water to irrigate because groundwater is contaminated
- Had looked into drilling well to bring in water but cost is too high
- Could utilize RW-5 or RW-2 water to decrease city water usage. Bermuda grass is drought/saline tolerant
- Would need to change piping to bring water to course

Wetland Creation/Restoration

Options
1. Creation of wetland mitigation bank
2. Supply water to Quivira Reserve to relieve impairment claim



The Value of Water in GMD 5

December 20, 2018

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Options

- Treat and use all ONLM remediation water (200 GPM) and supplement Hollinger water use in vacuum building processes.
- Assuming a 70% permeate flow 140 GPM could be used in vacuum building
- Reuse condensate water currently being discharged at Outfall 001 in mineral scrubber (30 GPM).
- According to 2017 PPI intern warm water keeps buildup from forming on mineral scrubber extending the time between periodic maintenance.

Options-Cont.

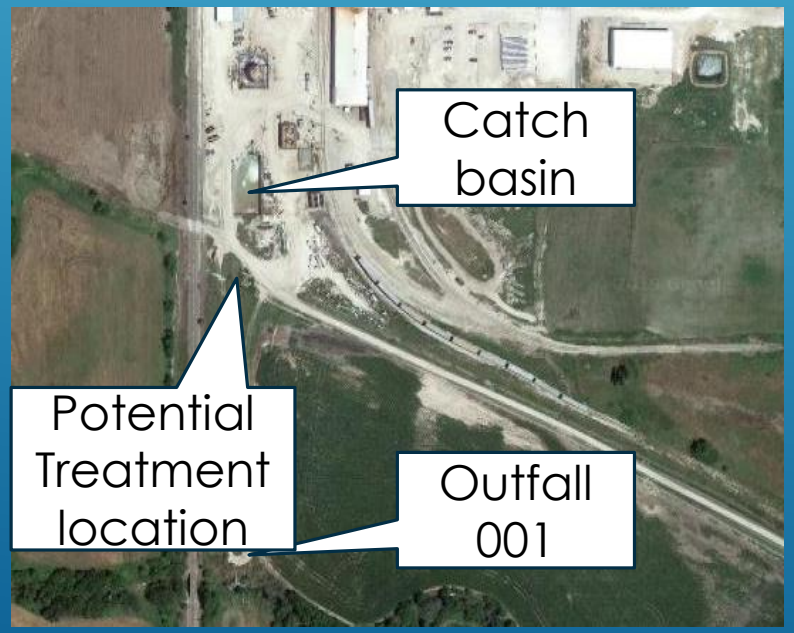
- Deep aquifer screening could lower the pumping rates of remediation wells. While still removing chlorides, a smaller volume of water could be pumped and disposed of.
- Reduces electricity costs and greenhouse gas production rates while still remediating the aquifer.
- PLC units to control Hollinger rate
- Dust collection systems and pump cooling systems in Vacuum building do not require Hollinger quality water, but Hollinger and city water are the only sources available.
- Remediation or Plant interceptor quality water could replace Hollinger water in these capacities to decrease usage

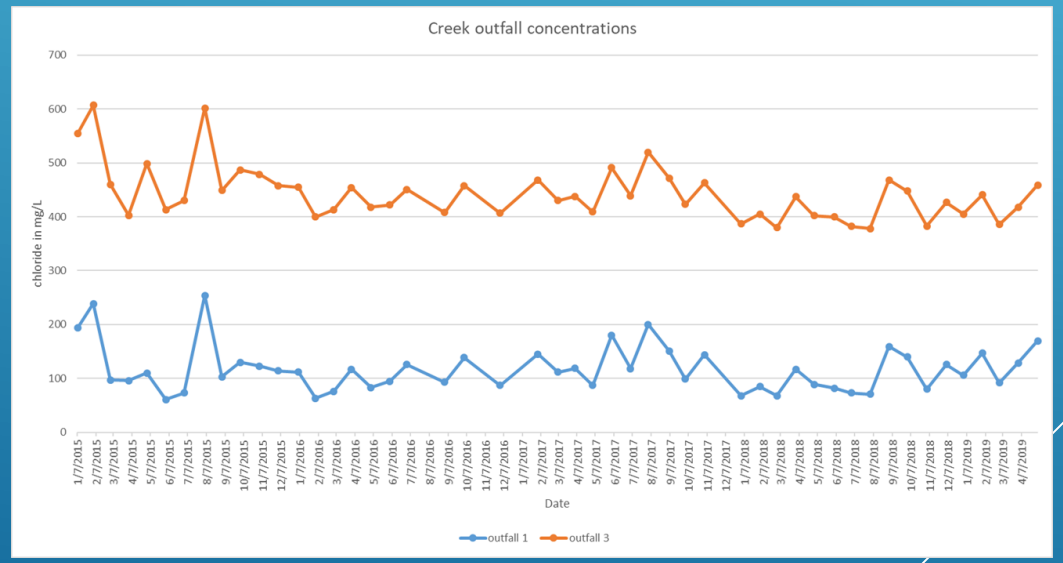
Treatment Technology Review

1. Reverse osmosis-recommended by most vendors, energy intensive
2. Membrane Distillation- need waste heat source for feed, but cold source needs to be clean
3. Electrodialysis- high electricity demands and low treatment volume
4. Forward Osmosis- concept technology not yet widely commercially available in US
5. Ion-exchange- excessive fouling of resins (anion and cation) make this unlikely
6. Nano-filtration- less energy intensive alternative to reverse osmosis

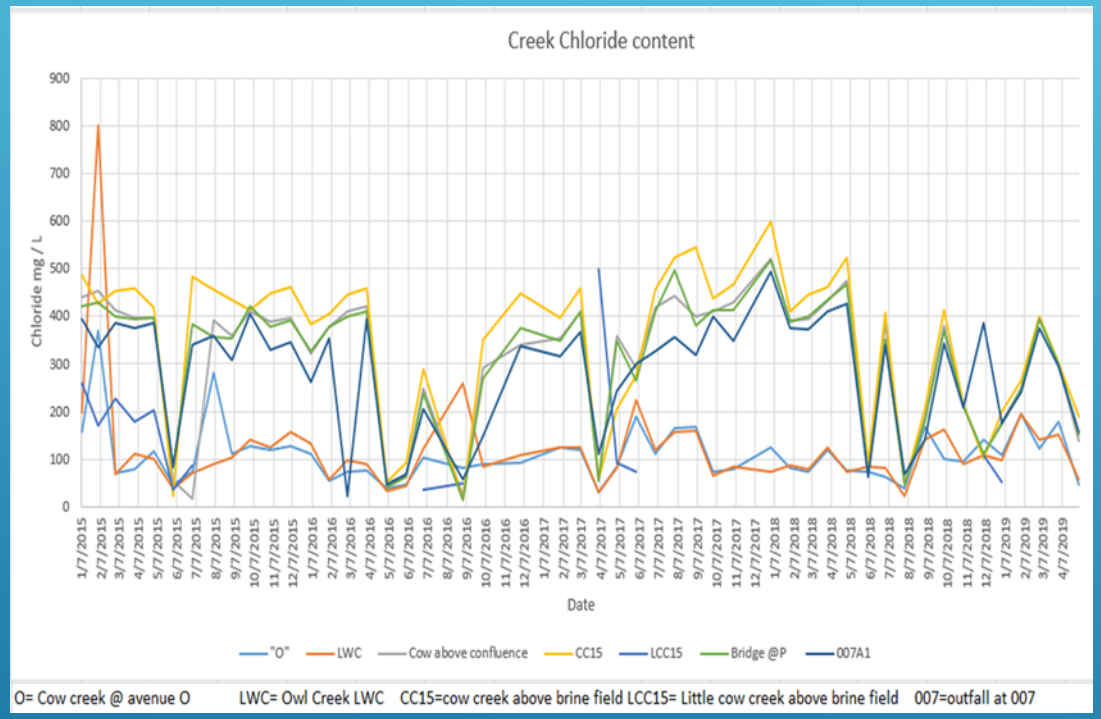
NPDES Discharge

1. Outfall 001 governed by 400 mg/L chloride limit
2. Outfall 003 and Outfall 001 quarterly limit of 335,000 lbs. chloride

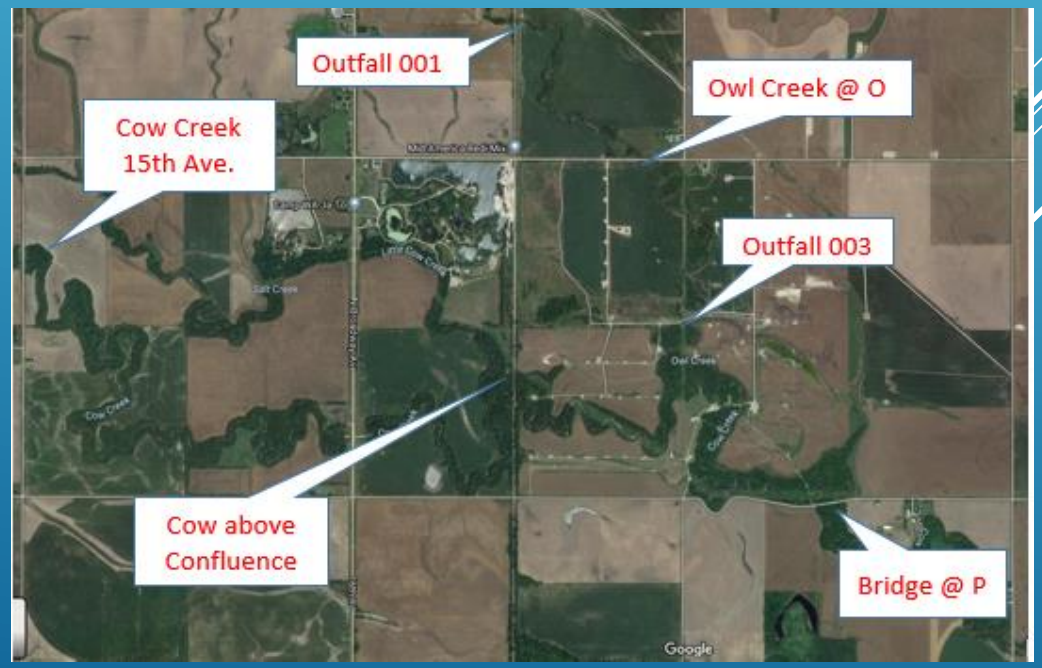




NPDES cont.

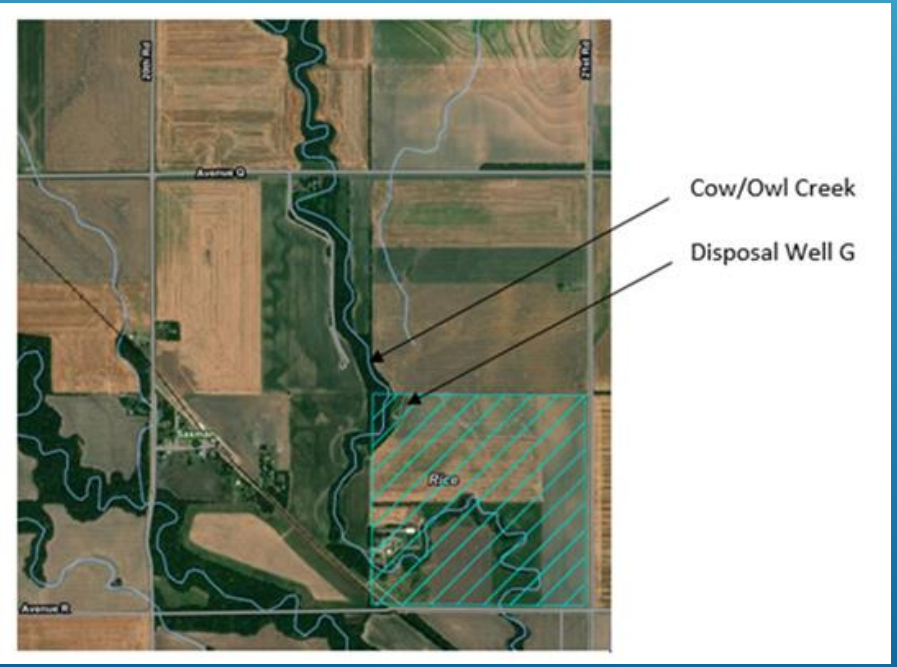


- Current NPDES outfalls lowering Chlorides in Cow Creek
- Yellow line is before Property
- 007 and Bridge @ P after property



Irrigation

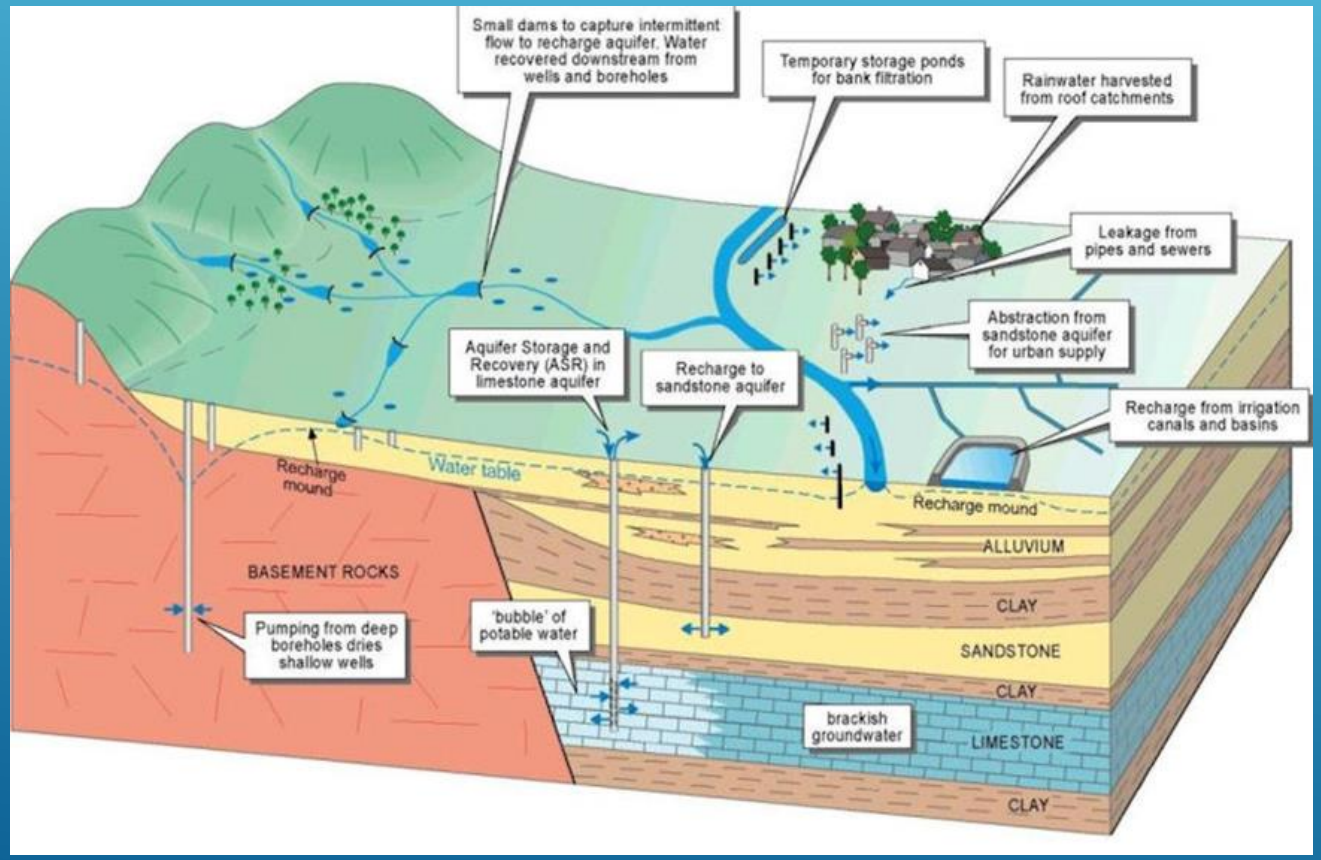
-Land values rise 1-2 thousand dollars per acre when irrigated
-assuming 80% recovery and use of 1.4 feet of water per acre
-910 acres could be irrigated with 524 million gallons of Class 1 disposal water
-Alfalfa is more tolerant to slightly higher salt levels than Corn or Soybeans



-holding ponds and additional pumps likely needed to meet current center pivot irrigation rates (~6 GPM/acre)

Aquifer Recharge

-Can be used to avoid Class 1 injection and create plume barrier
-line of treated injection wells to stop migration
-local success with equus bed recharge in Sedgwick County



Conclusion

1. 524 Million gallons of water to use
2. 250 mg/L chloride ultimate goal
3. How long is the water right available
4. Costly treatment versus limited use
5. Waiting until surface discharge is viable versus treating and using now

Questions???