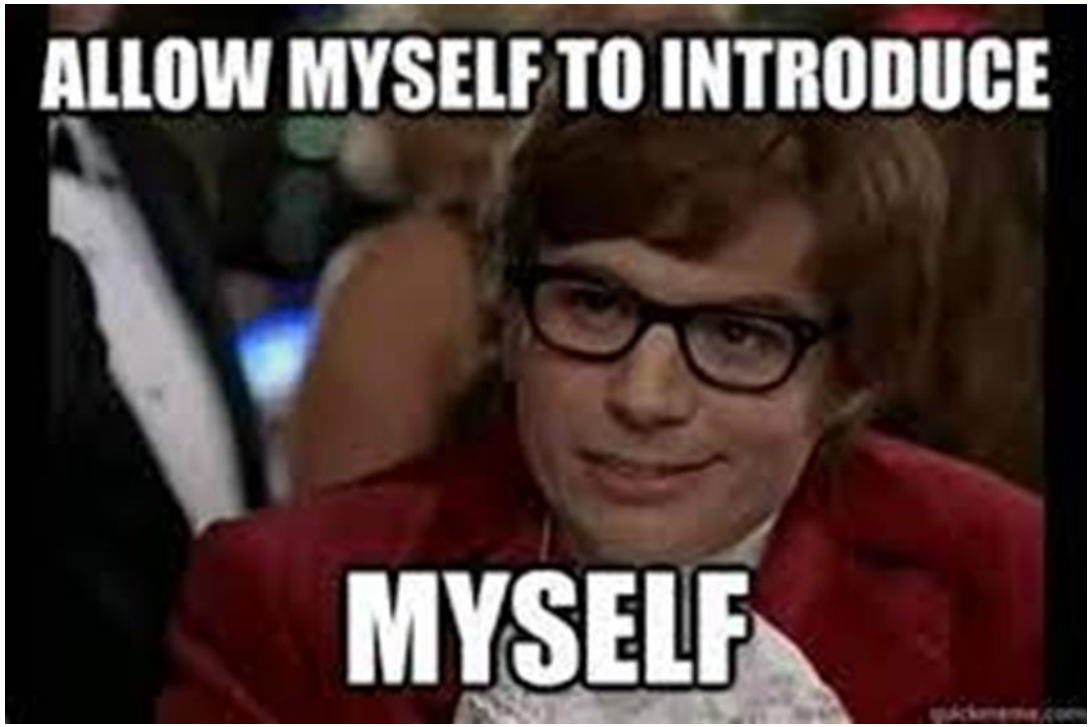
Acknowledgement of Reclamation of Sodium Chloride Impacted Sites Directive Development

For the Leisure and Consumption For the Attendees of RemTech

Outline

- Jonas reading 5 slides of only words outlining the why we created a new directive
- Jonas takes 15 seconds to explain what is Produced water and NaCl
- UAV photos of sterilized rooting zone. Most of which were captured by concerned landowners
- Explanation on why we should consider not remediating to generic criteria
- Who is involved in the directive development
- The Tiers
- The Orphan Case Study



Introduction

- The new directive is intended is to provide guidance on an environmentally responsible path to obtain Acknowledgement of Reclamation (AOR) and eliminate deemed reclamation liability for oil and gas sites that have Sodium Chloride (NaCl) concentrations exceeding the criteria established in the Directive PNG033: Phase II Environmental Site Assessment (PNG033).
- Where possible, effort was made to ensure that the methods adopted are harmonized with the Saskatchewan Environmental Code (code).
- A risk based approach that manages NaCl, often referred to as “salinity impacts” or “produced water impacts”, utilizing site specific criteria or risk assessment will be used.

Intro Con't

- NaCl is a contaminant of concern in upstream oil and gas well and facility sites (sites).
- Saskatchewan has numerous salinity impacted sites, the majority of which are located on agricultural lands. The Ministry of Energy and Resources (ER) recognizes that salinity impacts are complex and that a generic numerical criterion may not be sufficient to address impacted sites, for a variety of reasons including, the conservative nature of the criteria, naturally elevated salinity, and site specific risk to receptor.
- A substantial financial burden to oil and gas licensees and and unacceptable risk to the Saskatchewan Oil and Gas Orphan Fund (SOGOF) has resulted due to a lack of technical understanding of NaCl related adverse effects and a lack of an environmentally responsible closing mechanism.
- The lack of technical understanding has led to, but not limited to:
  - implementing monitoring programs into perpetuity
  - inefficient remediation systems
  - large, wasteful surface excavations in order to satisfy Saskatchewan's Salinity and Sodicity remediation criteria.

Into Con’t

- The regulatory closure of NaCl impacted sites goal is intended to allow for more options in oil and gas industry management of sites with salinity and sodicity issues.
- This shift in site management philosophy is intended to challenge ER and industry to develop environmental standards that are protective of human health and ecological receptors, while simultaneously achieving the secondary objectives of soil conservation and fiscal responsibility.
- The last objective of this directive is to provide licensees and their environmental practitioners the necessary tools to support sound management recommendations and improve provincial consistency in the management of salinity impacted sites.

Yet More Intro

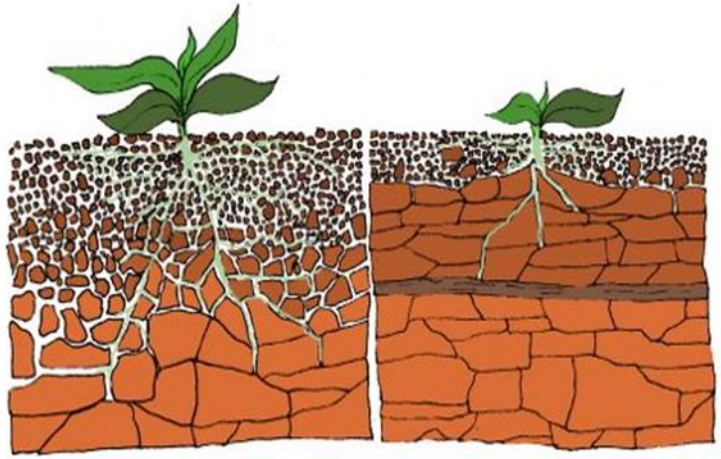
As NaCl represents minimal risk to human health and sometimes limited risk to ecological receptors it's difficult to reconcile performing large, expensive, intensive remedial programs that often include a significant carbon footprint. It's for that reason that a directive such as this one is necessary as it involves cost, liability and effort but it also includes environmental sustainability and responsibility. It is important to identifying that there is an environmental impact in conducting a remediation program, when that remediation program is intended to mitigate existing environmental impact.

What is Risk?

- Risk is the chance or probability that the environment will be harmed or experience an adverse effect if exposed to NaCl.
- There is also a risk that if we do not develop a pragmatic method to remediate NaCl impacted sites that they will not be cleaned up before oil and gas is no longer on the landscape

What is NaCl?

- Produced water is a by product of oil and gas production
- Generally the dominant salt in produced water is NaCl
- Cl is essentially inert as it is not readily used in biological systems and does not degrade over time. Therefore once it is released to the environment it does not disappear but rather just moves about. This movement is facilitated by ground water/surface water, as it being a salt it is very soluble and moves where the water moves.
- Cl messes with plants osmosis
- Na causes soil to loose its structure, dispersion and a corresponding hard pam



How Big is The Issue?

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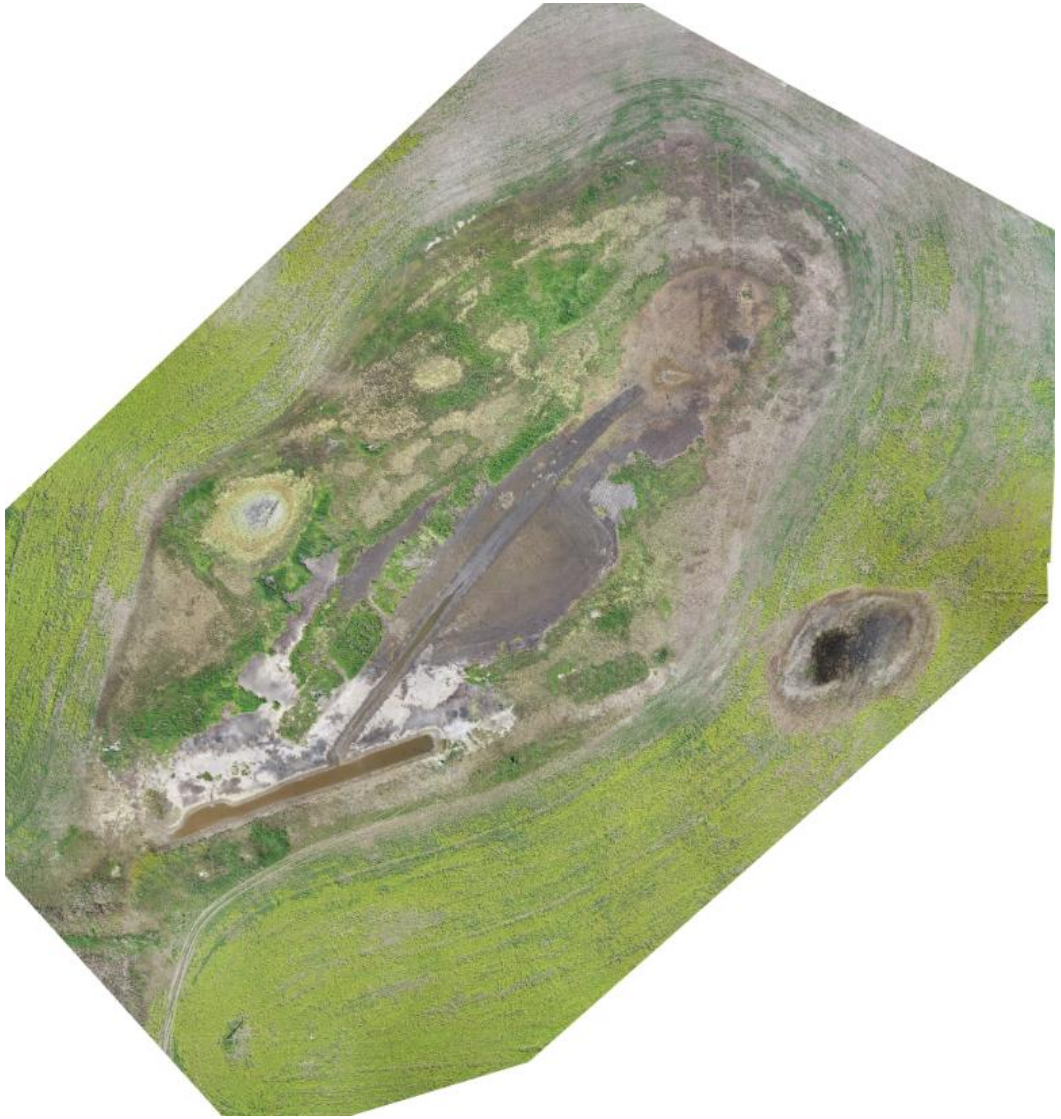
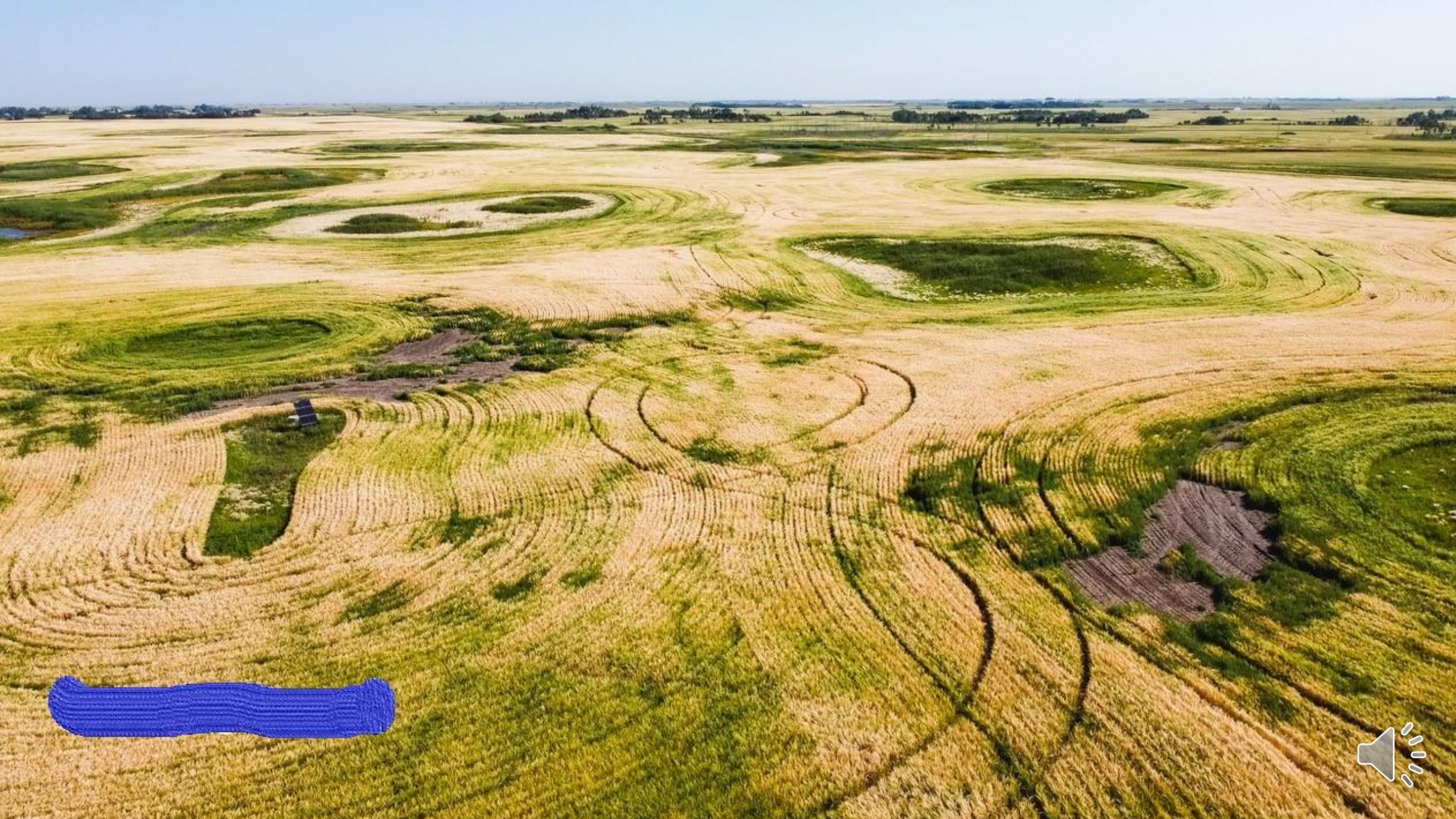
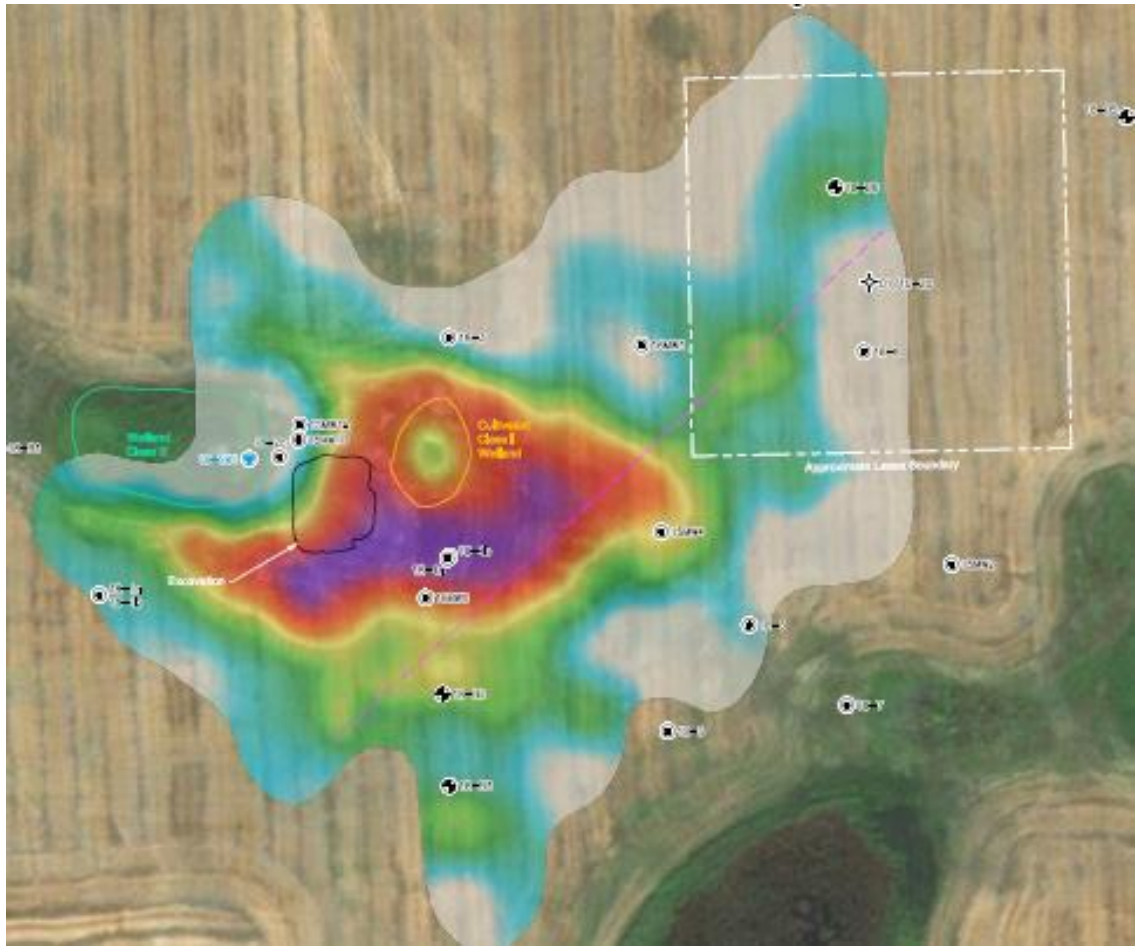


Saskatchewan



Why Should We Consider Not Remediating to The Current Remediation Standards?

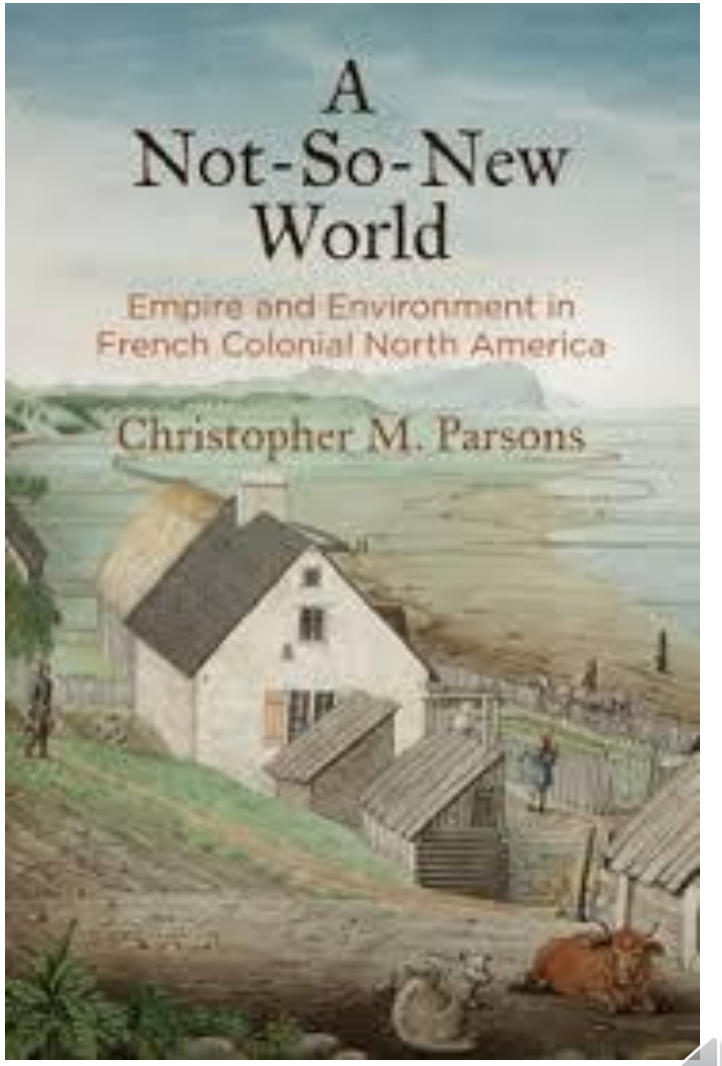
- Impacted areas can be very large
- Depth of impacts can be very deep
- There are numerous sites with smaller foot prints than when combined can be a large amount of material being transported to landfill
- In-Situ Remediation like ground water recovery takes too long/ineffective
- No really good way for Ex-Situ treatment
- Not enough resources to remediate all of the NaCl impacted sites in the province.
- Excavations are just transporting the problem to a different location to be managed.
- The Contaminant of concern is table salt = low health risk.



This Is Not a Novel Approach

- Building off of:
  - SPIGEC IV
  - Phase II Directive PNG 033
  - Amendment to Acknowledgement of Reclamation Directive PNG016 newly created risk assessment section
  - The Saskatchewan Environmental Code
  - Subsoil Salinity Tool
  - Native Prairie Protocol
  - Low Probability of Receptor

* please appreciate the word play, get it, the image is a novel and this is not a novel approach and the title of the book says its not new which is the point of the slide

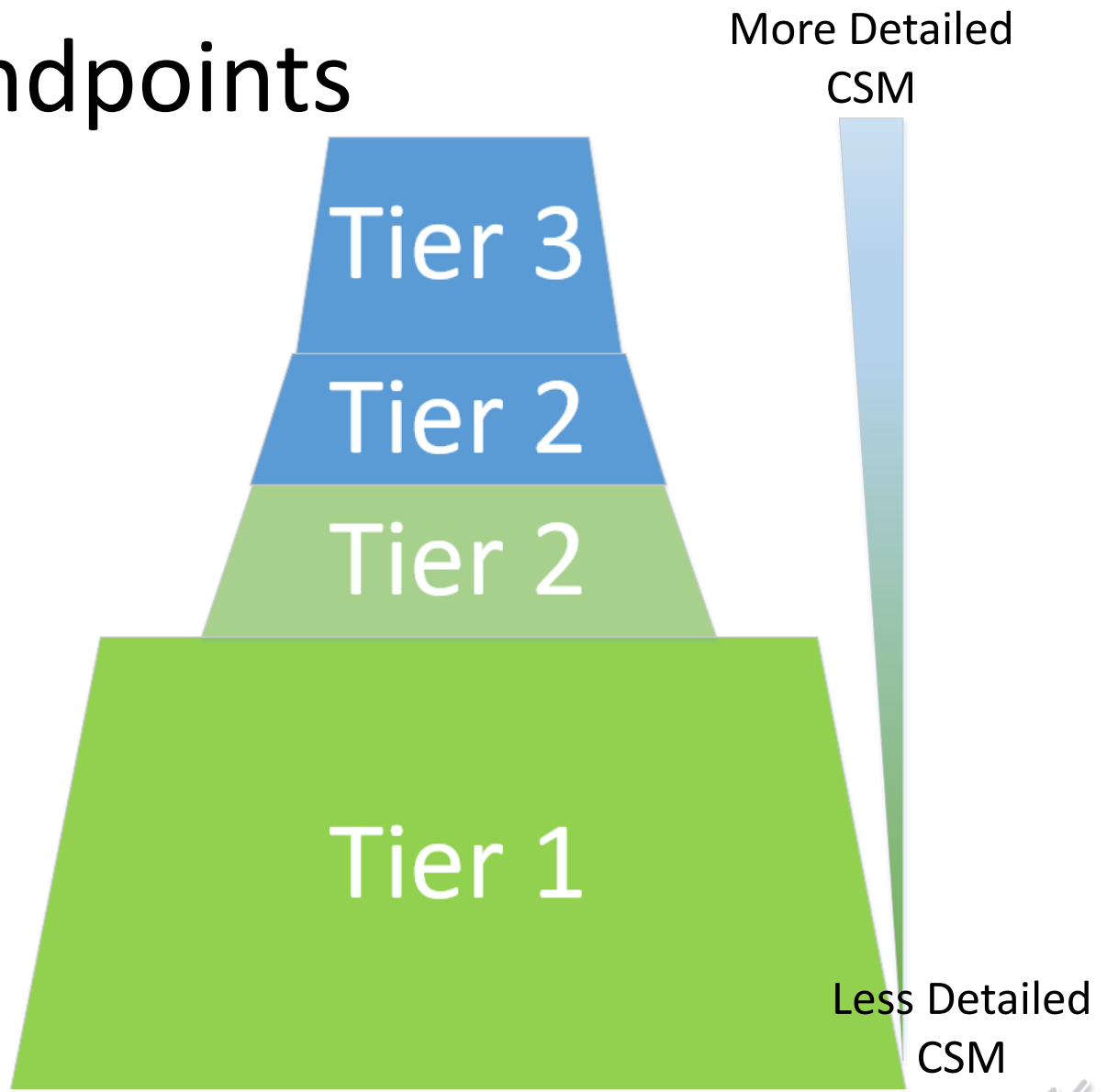


Directive Development

- A working group was created including representatives from the Canadian Association of Petroleum Producers (CAPP) and Explorers and Producers Association of Canada (EPAP)
  - 12 Representatives from Husky, CNRL, ~~NAL~~, Vermilion, Crescent Point, White Cap, Teine, Cardinal, ~~Torc~~, Baytex, CAPP, and Shell
- A technical committee was created to support the working group in directive development:
  - 7 Representative from Equilibrium, Matrix, Good Lands, SNC Lavalin, Ministry of Environment, Water Security Agency, Ministry of Agricluture, Millennium EMS, and SWAT

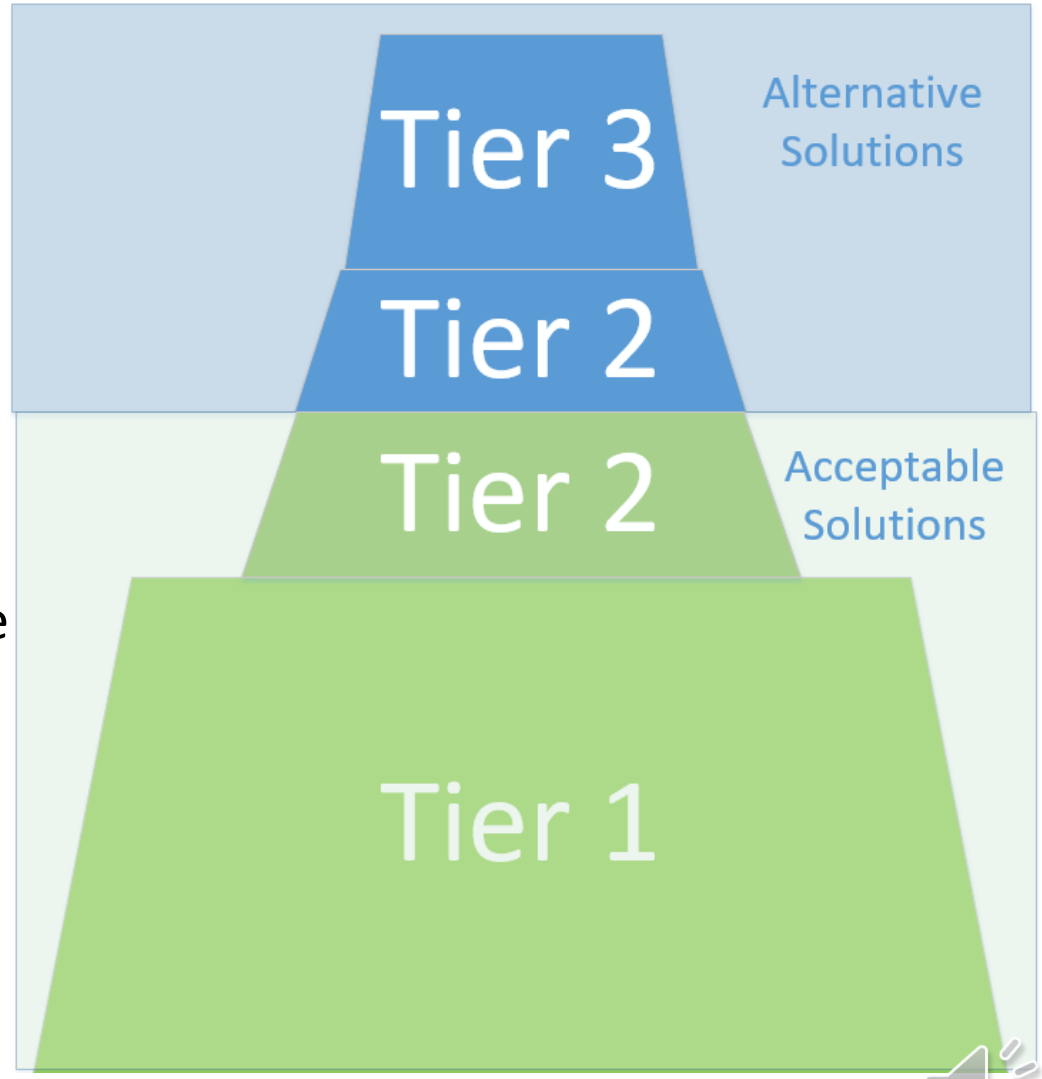
Tiered Endpoints

- **Tier 1** = Generic guidelines obtained from PNG 033
- **Tier 2** = Two options; an increased numerical criteria for soil and a structured pathway modification for other environmental receptors
- **Tier 3** = Risk Assessment. Endpoints are developed by the environmental practitioner



Acceptable and Alternate Solutions

- The tiers are further broken into acceptable and alternative solutions, where:
  - Acceptable Solutions are all tier 1 and some tier 2 solutions that fall within a numerical criteria and are completed utilizing an industry accepted remediation method, like excavation
  - Alternative Solutions are some tier 2 and all tier 3 and are either pathway modification, risk assessment or utilizing a non-industry accepted remediation method, like electrolysis.
- Even though alternative solutions are indicated to be some tier 2 and tier 3, an alternative solution can also be tier 1 if it is utilizing a remediation technique that is not the norm.
- If an environmental practitioner completes enough alternative solutions it can be considered acceptable.



Qualified Person's

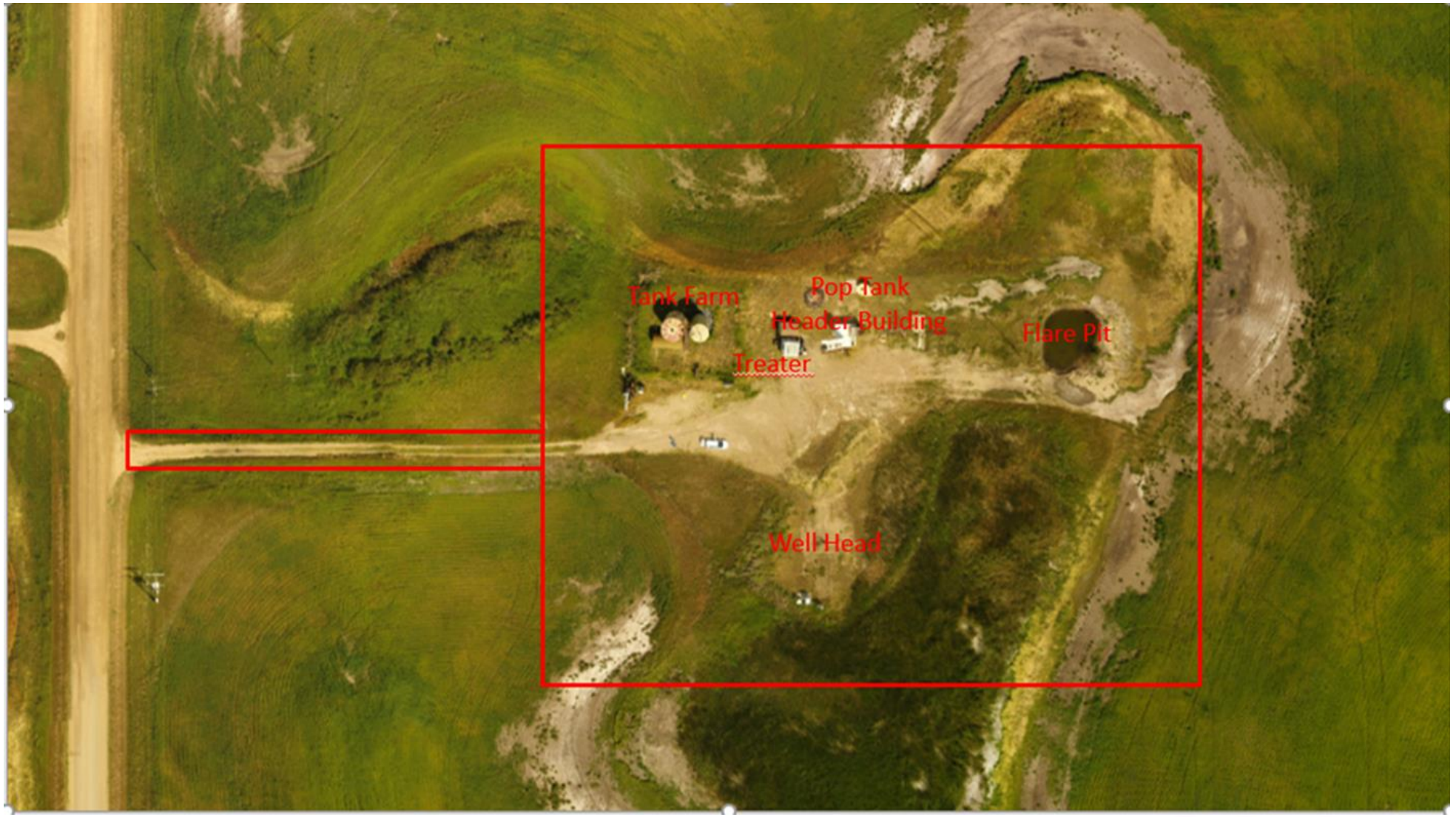
- All acceptable solutions need to be completed by professionals as listed in PNG 016. These individuals do not need ER approval
- All alternative solutions professionals need to be preapproved through ER
  - Qp's through Ministry of Environment will be grandfathered as long it is in an applicable discipline

The Orphan

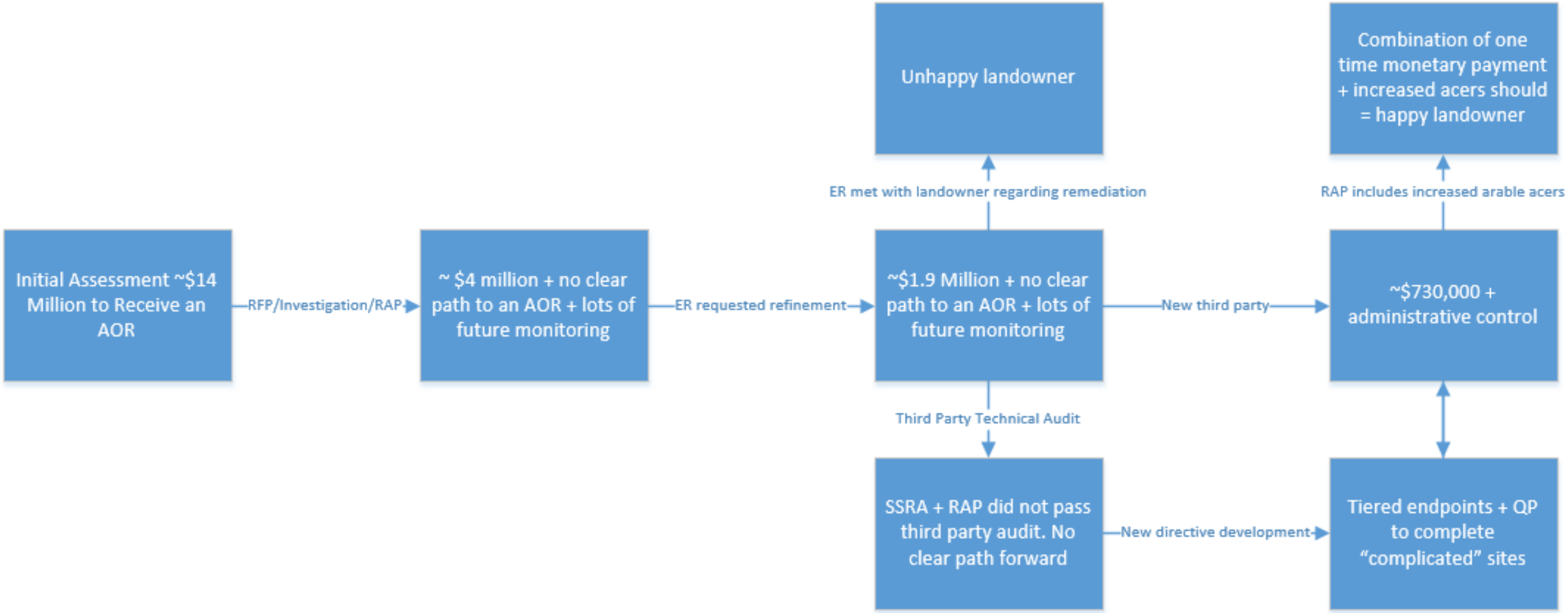
- The well was drilled in 1958
- There was a flare pit
- There were spills
- The produced water is > 170,000 mg/l chlorides
- Extremely elevated natural salinity

Photo 2. Site location in 1958 (not to scale)

The Orphan


Tank Farm
Pop Tank
Header Building
Flare Pit
Treater
Well Head

The Money

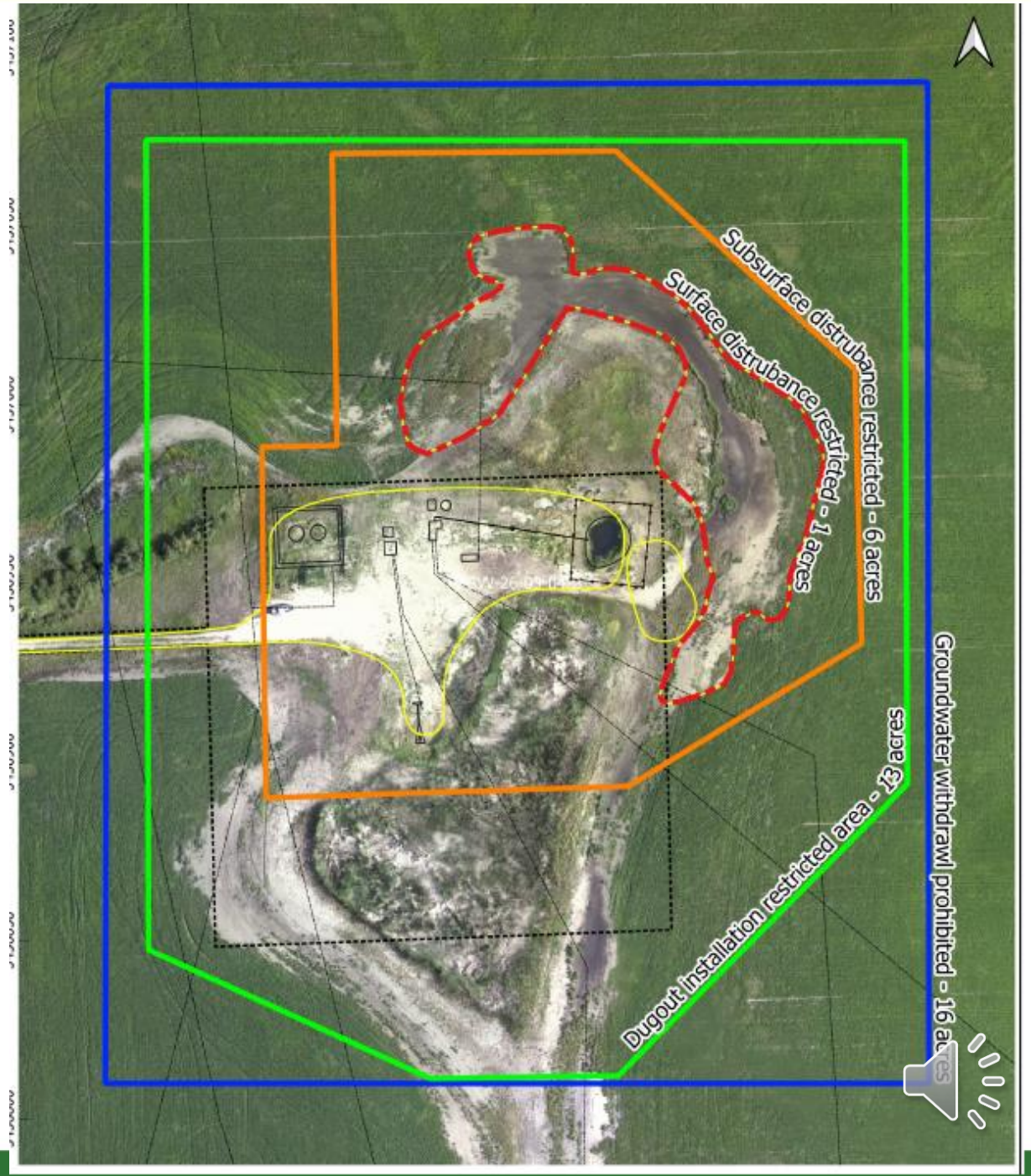

Initial Assessment ~$14 Million to Receive an AOR
RFP/Investigation/RAP
~ $4 million + no clear path to an AOR + lots of future monitoring
ER requested refinement
~$1.9 Million + no clear path to an AOR + lots of future monitoring
ER met with landowner regarding remediation
Unhappy landowner
New third party
~$730,000 + administrative control
RAP includes increased arable acers
Combination of one time monetary payment + increased acers should = happy landowner
Third Party Technical Audit
SSRA + RAP did not pass third party audit. No clear path forward
New directive development
Tiered endpoints + QP to complete "complicated" sites

Cast Study, The Orphan Continued

- SOGOF is utilizing
  - Engineering Control in the form of a clay cap to encapsulate remaining impacts
  - Administrative Controls restricting certain activates on a 16 acer area
    - One time monetary payment for the administrative controls
  - Registering a miscellaneous interest on title to ensure that the administrative controls passes along with ownership of the land.
  - Reclaiming the area in such a way that the landowner is able to utilize more land for agricultural related crops and will limit the wetland from flooding

The Misc. Interest

- The area
  - The entire area is 16 acres (no ground water withdraw to 25 m below ground surface)
  - 13 acres (dugout installation restricted)
  - 6 acres (sub-surface)
  - 1 acres (ground disturbance excluding seeding crops
  - No ditching, draining or incorporating the wetland into the adjacent agricultural utilized lands



Oil and Gas Conservation Regulation

- 56(2) On decommissioning of a facility, the licensee or the operator shall:
  - (a) conduct an environmental site assessment in a manner specified by the minister;
  - (b) decommission the facility site to standards specified by the minister;
  - (c) reclaim the facility site to standards specified by the minister;
  - (d) reclaim any area that is beyond the boundaries of the facility site and that, in the opinion of the minister, has been damaged, contaminated or otherwise adversely affected by the operations of the facility; and
  - (e) conduct a detailed site assessment in the manner specified by the minister.

Monetary Payment

- A one time monetary payment will be made to the landowner
  - This is not for loss of agricultural land use (surface soil) as ER is not endorsing a system for oil and gas companies to purchase themselves out of their environmental liability
  - This is for a possible reduction in a future land sale due to the misc interest, and the subsoil restrictions on the area impacted

Have to define between impacts due to a landowner not following the administrative controls vs errors in the risk assessment

- 56(7) The issuance of an acknowledgement of reclamation does not relieve a licensee, operator or working interest participant of his or her past, present or future environmental liability associated with the well or facility site that is the subject of the acknowledgement of reclamation.

Main Consideration

There are thousands of NaCl impacted sites.

- *How can we ensure that these NaCl impacted sites are retired in the most responsible way possible?*
  - *Keep sites progressing by supplying solutions*
  - *Ensure it doesn't appear that oil and gas is buying their way out of their environmental liability by applying good science to the problem*

Plugables

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