

## Extraction System Optimization: The Importance of Proper Characterization of a Groundwater Plume

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Despite the up-front costs and time it takes to properly characterize a groundwater plume prior to the implementation of a remediation system, it is definitely worth the investment. This case study will demonstrate what can and did go wrong when an ad hoc environmental strategy was used to characterize and remediate a brine plume that was created near a lined brine pond back in the 80s. When Flint Environmental took over this site, a top-of-the-line groundwater extraction system had just been installed the year prior, which unfortunately was not successful in groundwater or salt concentration removal. A few key components were missing: a conceptual site model, an extraction system design diagram, an advanced understanding of the site hydrogeology and contaminant fate and transport, and a risk assessment. Flint Environmental will outline what was completed to step back from the site, make a holistic and thorough review of the site history and come up with a new plan that was going to be cost effective and appease the regulator and client.

The specific objectives for this project were to:

- Update the geological and hydrogeological framework and conceptual site model;
- Evaluate the historical brine source areas, spills and discharging leading to brine solution [i.e. chloride (Cl)] mass inputs into the subsurface;
- Develop 3D visualization models based on all current and historical soil and groundwater chloride chemical results to evaluate the source area distributions and chloride impact distributions, mass and plume architecture;
- Review and evaluate the groundwater geochemistry, fate and transport and chloride plume stability;
- Review and evaluate the groundwater extraction system, capture zones and volume recovery;
- Optimize the groundwater extraction system with an updated containment strategy; and
- Propose new supplemental extraction well locations to optimize groundwater plume recovery and groundwater monitoring wells for delineation.

3D data visualization soil and groundwater modelling and geochemical (Piper, Durov and Stiff Diagrams and chloride/bromide ratios) interpretations were completed to provide insight into the remedial extraction target zones, and new extraction wells were planned. Due to the complex stratigraphy and low permeability of the brine rich target zone, sand proppant fracture emplacement was completed to increase extraction volumes.

In this presentation, Flint Environmental will outline what was known about the site when they took it over and then describe the challenges and successes of the past year to get support by the client and regulator. Some unique strategies that will be described include salt forensics and sand proppant fracturing. Flint will also share their very satisfying and convenient solution to brine disposal.

### Janine Wildschut

Janine Wildschut is a Professional Biologist and Ph.D. graduate with over 13 years of environmental site assessment (ESA) experience for reclamation and remediation in the upstream and midstream oil and gas industry. She is the Southern District Manager of the Flint Environmental Services team and she is a well-rounded environmental scientist with experience in the management and mitigation of environmental risk at active midstream facilities with multi-million-dollar liabilities. Her current initiatives involve growing her team and building Flint Environmental's reputation in the environmental consulting industry of Western Canada.

### Stephen Livingstone

Stephen Livingstone, M.Sc., P.Geo., is the President to Geocentric Environmental Inc and is the Principal Hydrogeologist. He serves clients across industry and government sectors with over 30 years of experience managing multifaceted hydrogeological and environmental projects requiring innovative and novel approaches. Stephen brings deep expertise managing hydrogeological studies, environmental assessments, preparing remediation action plans, contaminant fate and transport evaluations, computer modeling, complex site remediation, site specific risk assessment projects, and strategic environmental policy and management systems across North America and internationally.