



Enhanced Anaerobic Bioremediation – Case Studies



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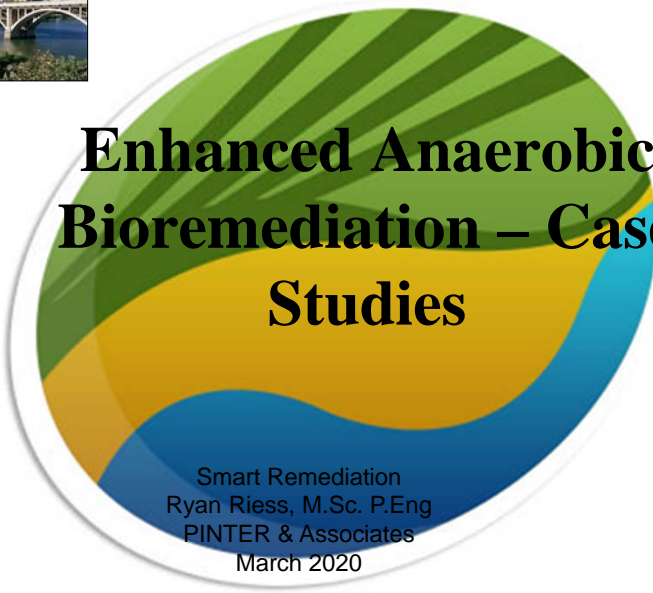

SMART Remediation
Edmonton, AB | March 11, 2020
Calgary, AB | March 12, 2020

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Enhanced Anaerobic Bioremediation – Case Studies

Smart Remediation
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PINTER & Associates
March 2020




PINTER & ASSOCIATES

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Overview

- Anaerobic Bioremediation Background
- Case Study 1
- Case Study 2
- Case Study 3
- Questions



PINTER & ASSOCIATES

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Learning



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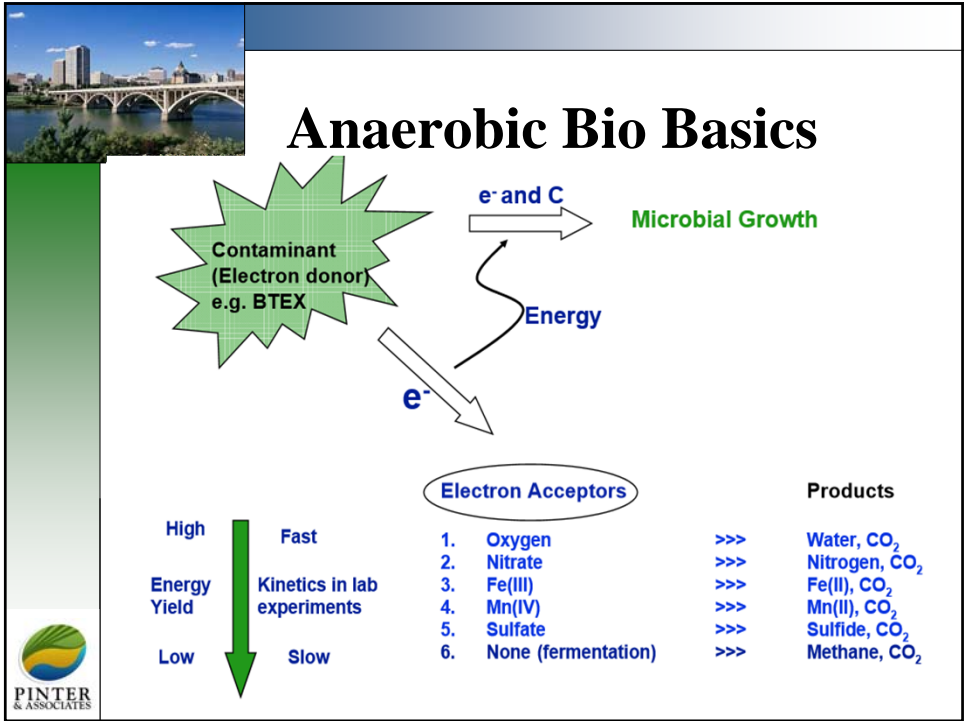


Anaerobic Bio Pros/Cons

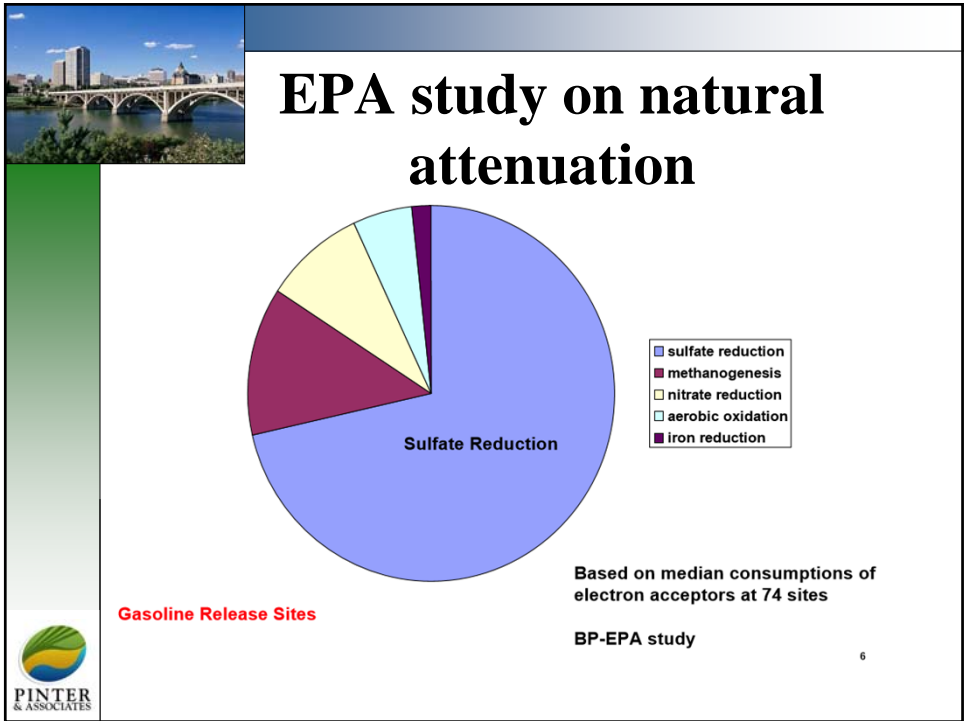
- Pros:
 - Generally cost effective
 - COCs removed naturally
 - Little energy/supervision required
- Cons
 - Timelines generally longer
 - potential for knowledge gaps
 - Permeability issues
 - Stakeholder buy in may be a hurdle



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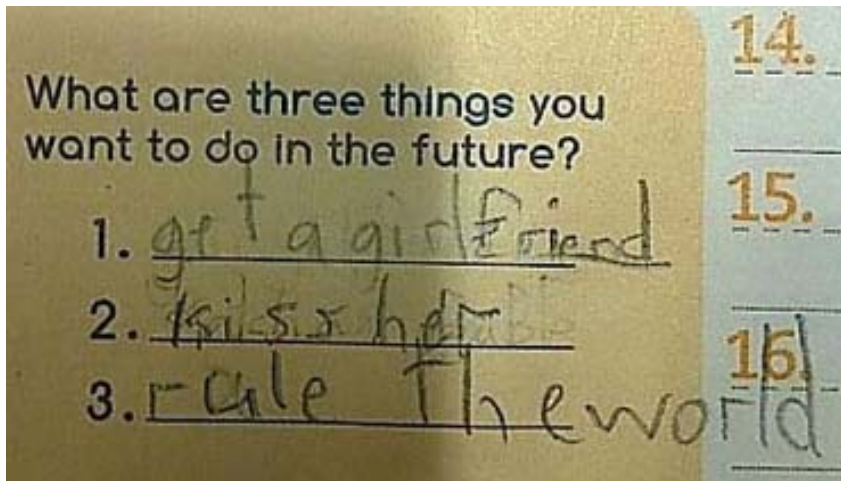
Accurate, Current Site Information



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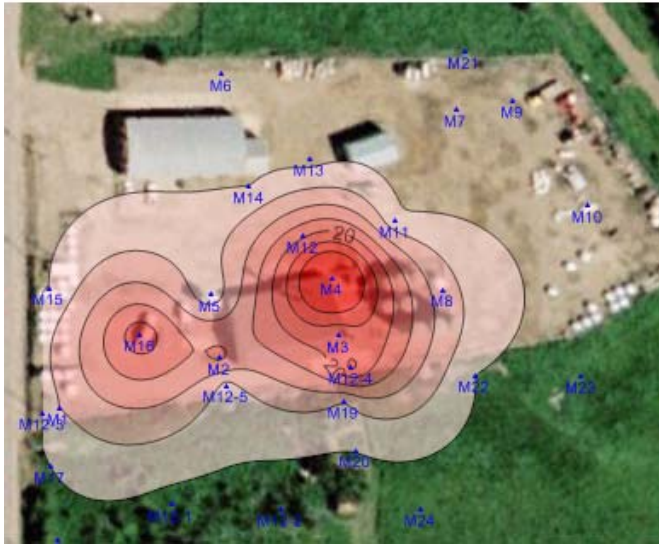
Careful planning and preparation



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Case Study – Northern AB



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PRB Construction for Anaerobic Bioremediation



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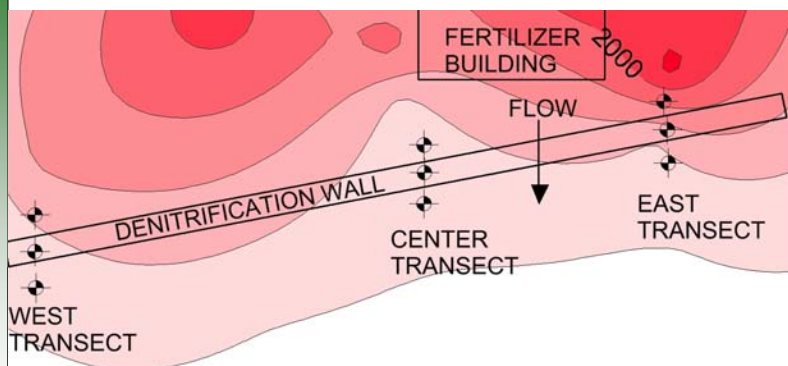
PRB Post Construction



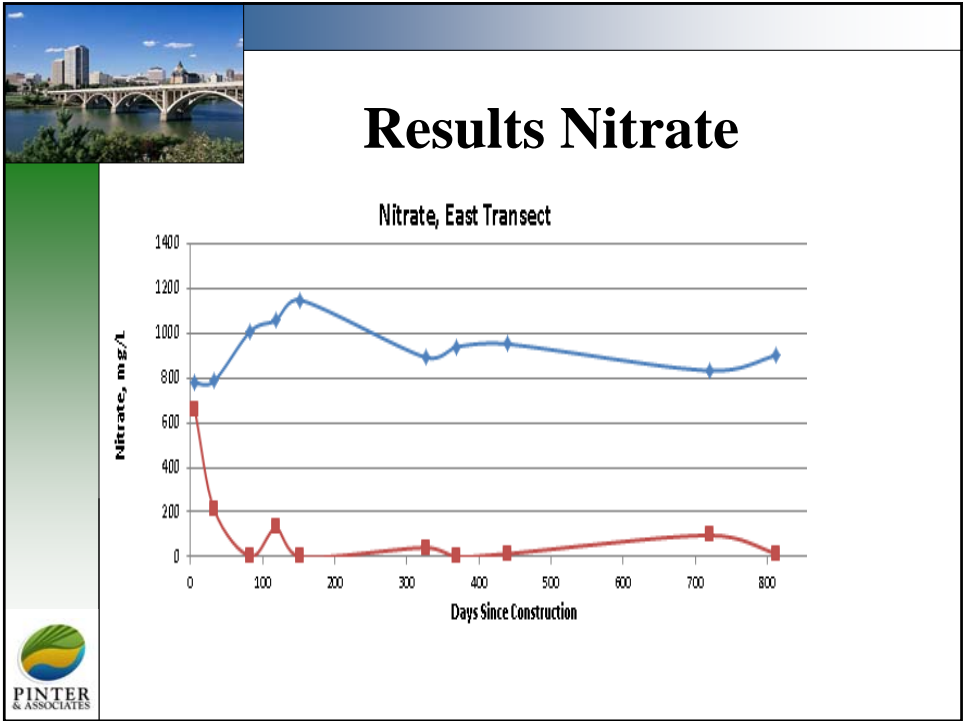
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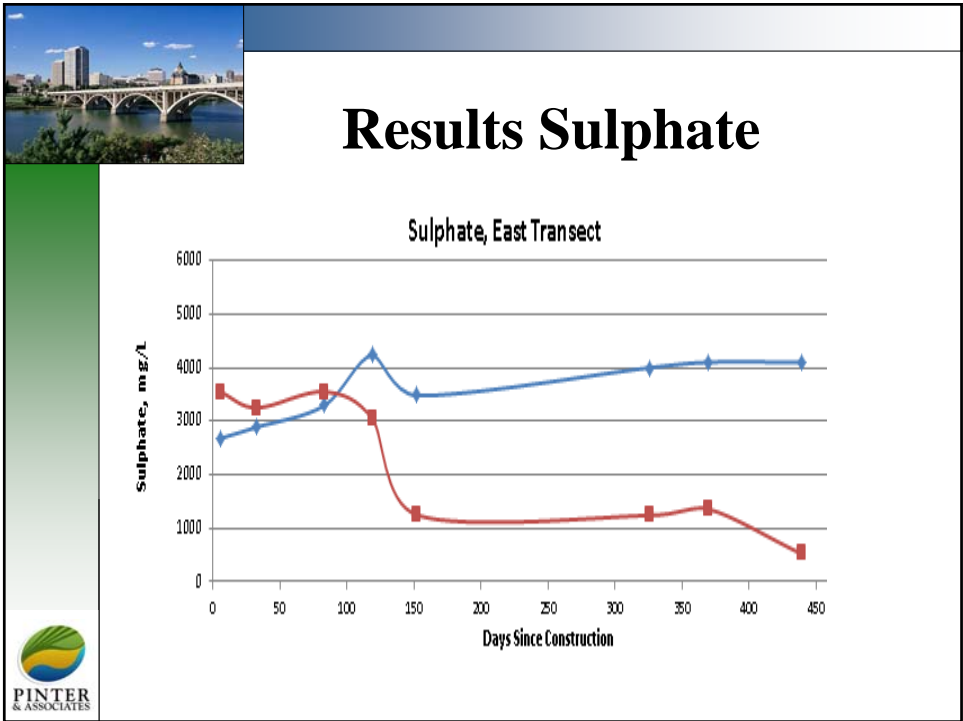
Results



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Conclusions Case Study 1

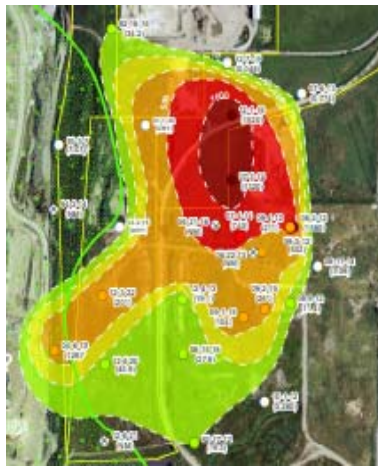
- Nitrate removal > 90%, Sulphate >80%
- Downstream well protected
- Installation cost of about \$190,000
 - PRB design life approximately 30 years
- Conventional bids were in the 3 – 5 million range
- Project won national Association of Consulting Engineers award of excellence in environmental Category



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Case Study 2



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Installation

- Installed depth between 9 and 11 m



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Results – Case Study 2

- Nitrate removal >99%
- Sulphate removal >95%
- PRB design life about 30 years
- River no longer at risk
- All in costs about \$350,000
- Full remediation estimates in excess of \$10 million, never seriously pursued

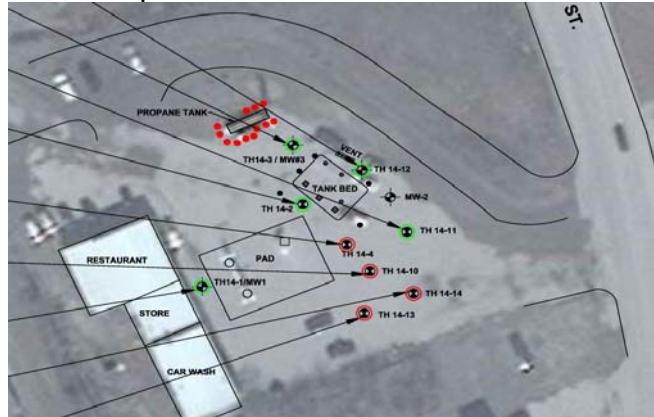


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CASE STUDY 3 - PHCs FULL REMEDIATION

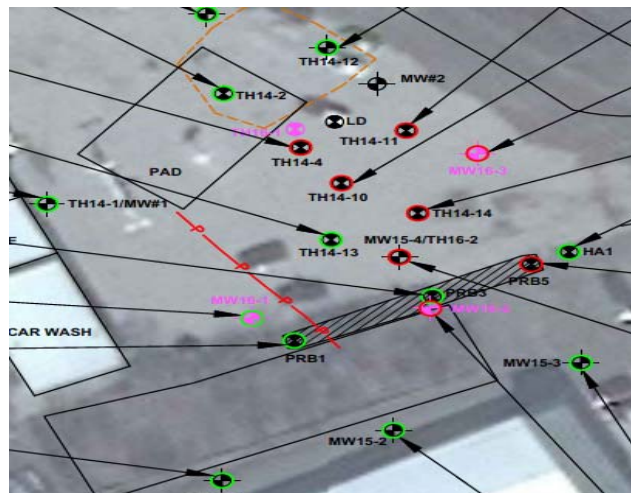
- BTEX, F1 - GW flow south, ~30 m/year
- Lake is present 300 m south



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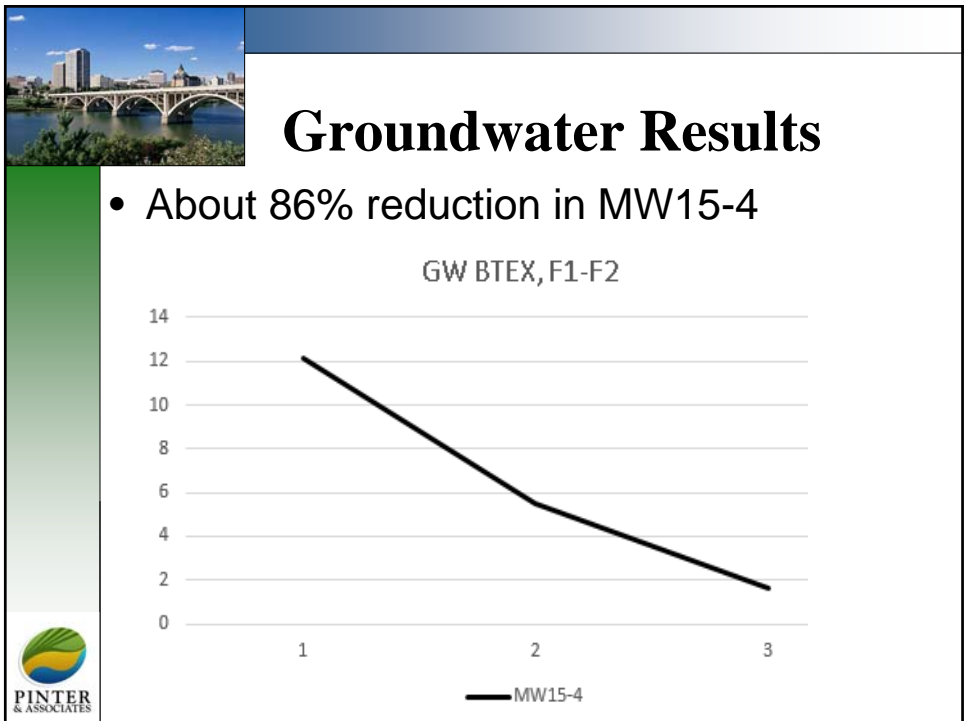
ANAEROBIC BIOREMEDIATION PLAN



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Worst Case Soil

- MW15-4, just north of PRB

15-4	Date Sampled	CVC	B	T	E	X	F1	F2	F3	F4
		ppm	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
15-4-4 @ 3.0m	22-Sep-15	1000	7.22	67.6	78.4	285	12500	<90	604	<90
15-4-2-4 @ 3.0m	25-Sep-17	120	0.145	<0.070	<0.023	<0.11	<40	<25	238	78

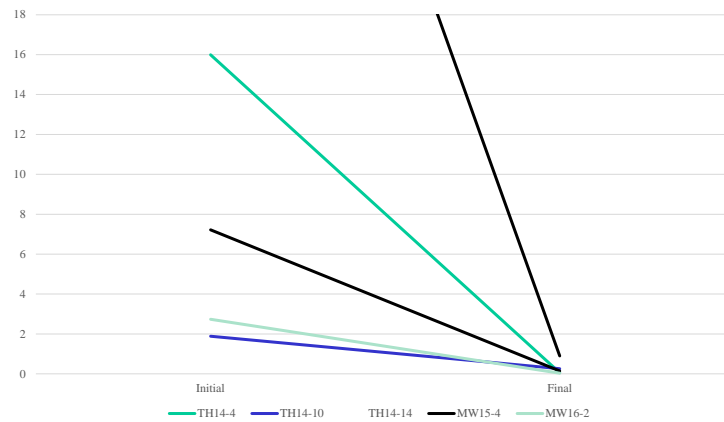


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Results - Soil

- Average Benzene Removal – 98%



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Case Study 3 Summary

- Site wide remediation in 2 years, closure from provincial regulators
- No Site downtime
- Costs of approximately \$50,000 compared to dig and dump estimates of \$500,000
- Project won national awards in 2018(ACEC) and 2019(Canadian Brownfield Network)



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Summary

- Anaerobic Bioremediation can be a cost effective tool
 - Careful Assessment, planning
 - Will need some time
- Not a magic bullet and ensuring all parties are cognizant of goals and timeframes throughout process are important



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QUESTIONS?

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