

Data Driven – Risk Informed
ARO Portfolio Management
Case Studies from the Orphan Well Association
and
CNOOC International Ltd.



2021 ESAA RemTech Conference, Banff, Alberta



About Our Company

Azurite Insights represents the coming together of two firms with a long history of environmental management and assisting our clients with the stewardship of their operations throughout Western Canada and across the world.

Our Origin Story

While working together to provide solutions to mutual clients, Waterline and DXD realized there were significant benefits to be had from the merging of our systems and processes. As a result we've created a teamed organization called Azurite Insights to allow our clients to leverage that expertise along with the vast amounts of data and technology that are available to them.



DATA DRIVEN – RISK INFORMED

Using case studies from two distinct points of view we will discuss:

- Benefits of coupling data automation and subject matter expertise:
 - ✓ Capital efficiency
 - ✓ Partner alignment
 - ✓ Executional excellence
 - ✓ Transparency
- Data sets that empower decision makers:
 - ✓ Public/Industry
 - ✓ Internal site specific
 - ✓ Geo-referenced, mapped and web-accessible
- Unlocking value by combining subject matter expertise with data to reveal key risks and opportunities



Capital Efficiency still a priority in a world of **ESG**

60%

of companies rely on gut feel and experience rather than data and information

83%

of companies said that using data had made their existing offerings more profitable

Driving Value

Understanding the science behind the data is critical to extracting maximum value from our clients' data collection and management efforts.

Listening to our clients and their stakeholders allows us to identify corporate risks and opportunities and to use data to validate the CAPEX and OPEX expenditures to manage them.





First Case Study: CNOOC

This case study is intended for those organizations with the benefit of deep institutional memory and the data to match. Sites have unusually been under the same operator from spud to closure.



CNOOC Case Study:

Situation

- Balzac Abandonment and Reclamation (BAR) program represented 100s of sites within a ~400km² area ENE of Calgary
- Wellsites and junctions represented over 60 years of joint venture agreements with numerous working interest partners (WIPs)
- Spectrum of Phase I, II and enhanced Phase II assessments conducted since the 1990s
- Vast amounts of site data collected for a field that varied from the simple re. geology, land use/developer pressure, working interest ownership and COCs to the complex on every front
- The low commodity price environment after 2014 created sustained in-house and WIP requirements to demonstrate capital efficiency



CNOOC Case Study:

Task

- Develop a transparent, WIP aligned process to reliably and equitably manage remediation and reclamation activities in the BAR Field
- Maximize capital efficiency while delivering schedule certainty and minimizing environmental, regulatory, and commercial risk



CNOOC Case Study:

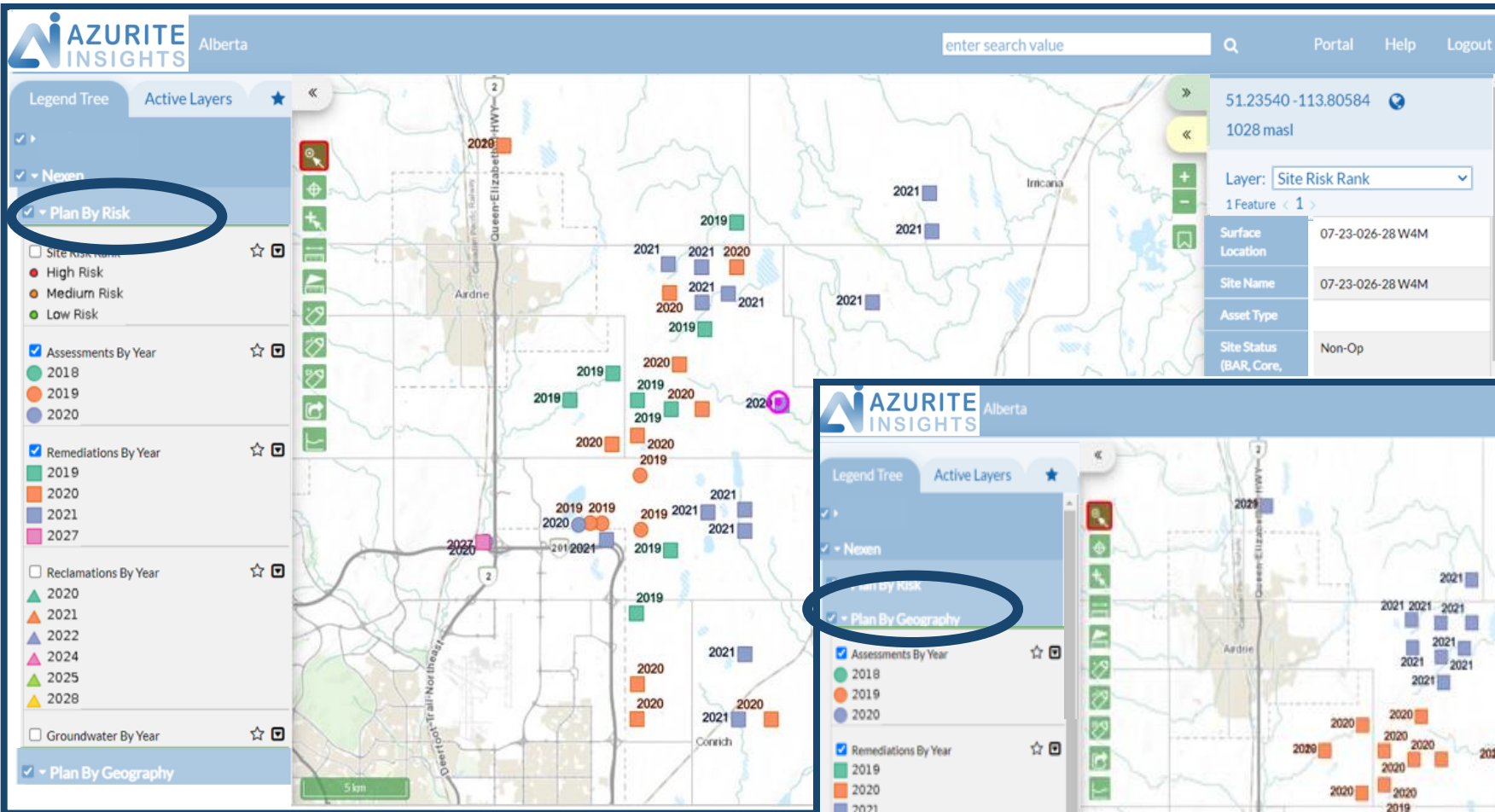
Actions

- Reviewed sites and compiled relevant site specific data
- Categorized sites based on required steps to closure
- Created custom tool to risk rank sites on various parameters including partners, location, timeline to closure, cost, environment risk, and human health risk
- Mapped database information for interactive decision making
- Created several different scenarios for presentation to senior management and stakeholders

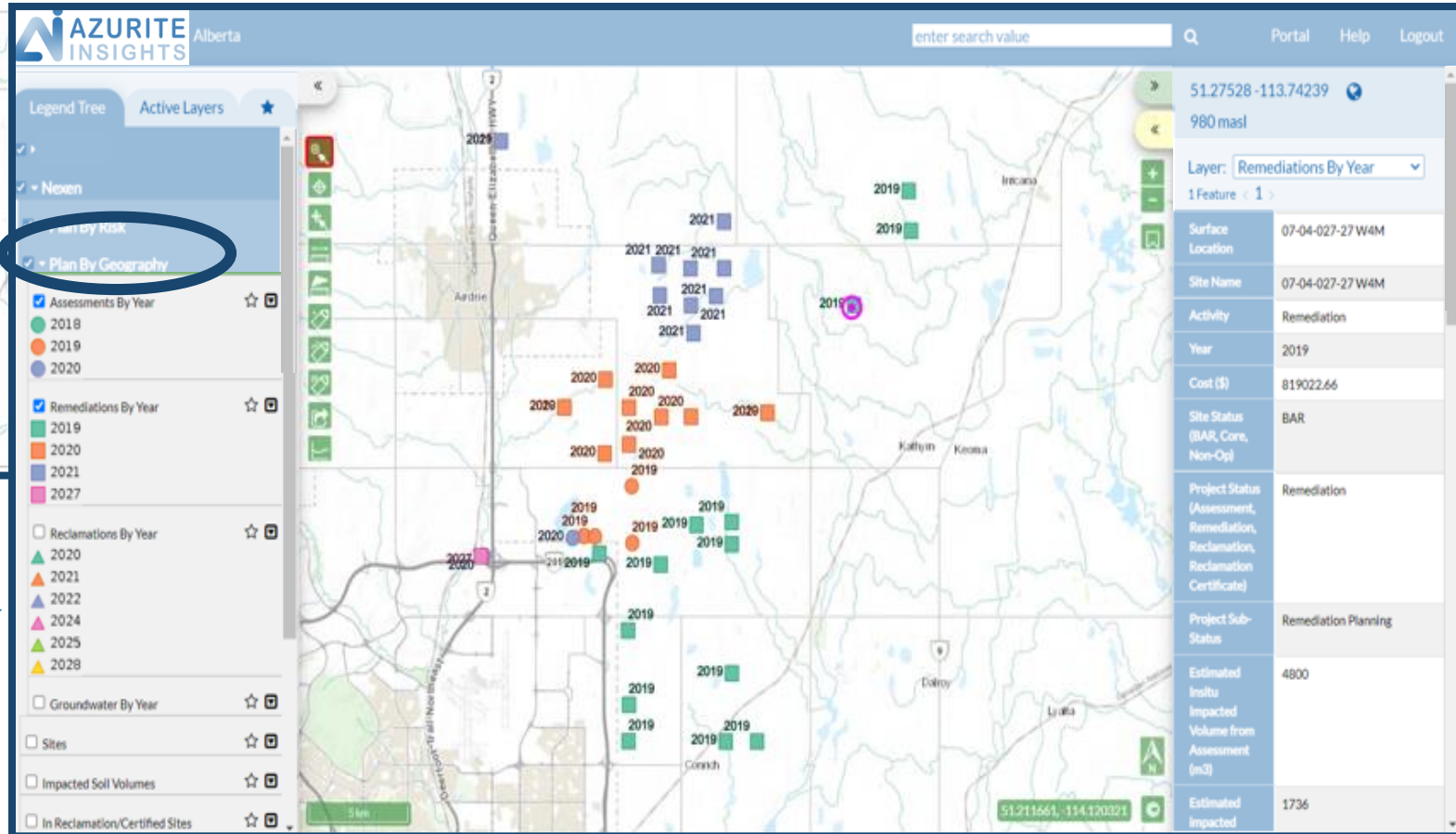


CNOOC Case Study: Results

Plan by Risk



Plan by Location



CNOOC Case Study: Discussion



Data Driven – Results Focused

Program Benefits That Can Be Realized By Coupling Subject Matter Expertise with Rich Internal and Public Data Sets



Stakeholders

- Predictable multi-year spend
- Clear path to closure
- Ready access to critical site data

Leadership

- Reduce schedule and cost uncertainty
- Ability to stress test scenarios quickly
- Contribute to procurement of all site closure services



Second Case Study: OWA

The next case study is intended for those organizations without the benefit of deep institutional memory and the data to match.

For example, new acquisitions or site transfers with little or no accompanying operator-historians or operational and environmental data.



**Orphan Well
Association**

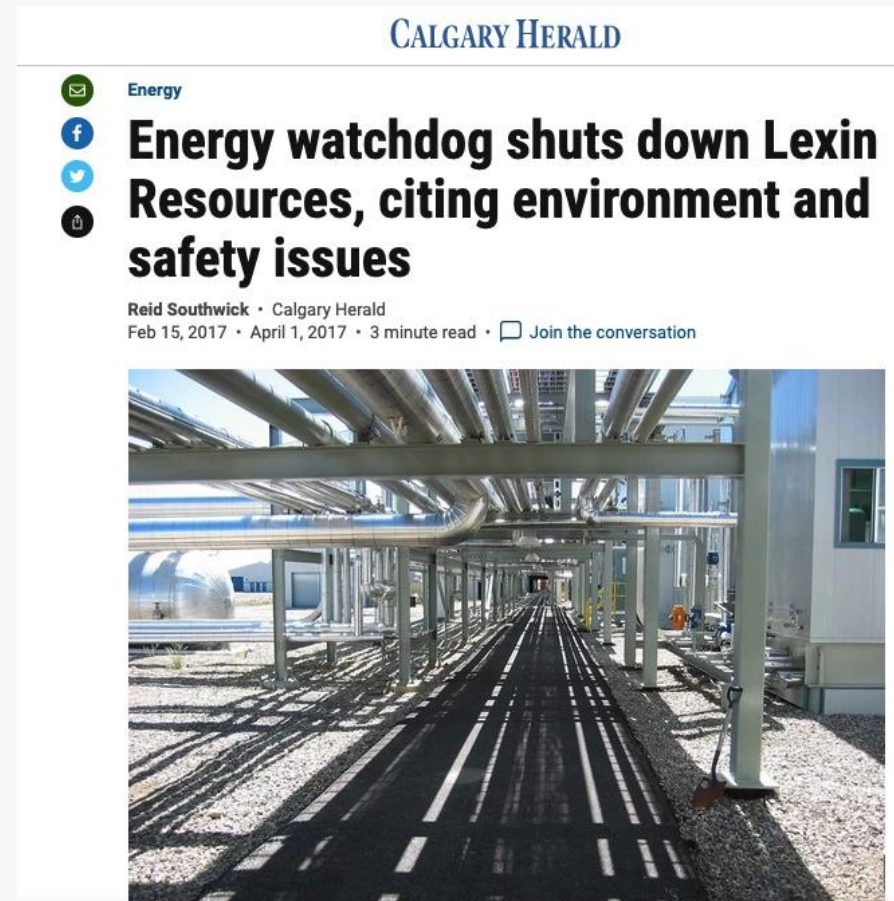


OWA Case Study: Situation

- Intakes of 100's to 1000's of sites
- Multistep intake process involves several technical and commercial disciplines
- Little to no information accompanies the orphan sites
- Require an efficient yet comprehensive identification and evaluation of risks to human health and the environment

Task

- Develop an automated risk assessment and ranking tool that aligns multiple internal stakeholder objectives
- Identify and secure access to all risk- relevant public data sets
- Ensure compatibility with existing OWA data management platforms e.g. Siteview
- Provide validated intake evaluation regardless of scale in less than one business week



Orphan Well
Association



OWA Case Study: Action

- Conducted a framing session with multiple OWA disciplines – reviewed and augmented existing risk review framework
- Identified and selected the parameters to consider for the risk assessment of three asset categories
- Executed a pilot project to determine the weightings for each parameter and calibrate the model
- 8 parameters were selected to characterize downhole risk, 7 were selected for pipeline decommissioning risk and 9 for facility decommissioning risk
- All heavily weighted to H₂S risk



Data Driven – Results Focused



OWA Case Study: Results – Rapid Risk Assessment Project



Downhole Risk Ranking							
Parameter	Source/Data Layer	Rational	Ranking			Weighting	N
			Low = 1	Medium = 3	High = 5		
AER Energy Well Data							
H2S Content	Sour Gas Well list, info integrated into AER Wells layer, status_fluid_field "acid gas" goes to high ranking	H2S content	no reported H2S = 0, not 1	<5%, C - Trace Sour, Gas Analysis Trace	>5%, D - Significantly Sour, E - High Risk Sour,	45	Sour wells ta inspection of
Well Depth	AER Energy Well depth (well_total_depth)	Well Depth. Prob encountering iss during abandon					
Well Type	AER Energy Well type (status_category_derived)	Current well type Probability of encountering iss					
Well Status	AER Energy Well status (status_mode)	Current state of v Work requiremen level of effort to a well.					
SCVF/GM	AER Energy Well Surface Casing Vent Flows and Gas Migration	SCVF and GM					
Casing Failure	AER Energy Well Integrity failures	Casing Integrity					
Site Setting							
Proximity to Settlements	Altis culture points, First Nations Lands, Municipalities	Distance to Nearest Settlement					
Proximity to Groundwater Wells	AEP Water wells	Proximity to grou receptors					
AER Incident Information							
Complaints to AER	AER Incident List	Complaints					

Pipeline Risk Ranking					
Parameter	Source/Data Layer	Rational	Ranking		Weighting
			Low = 1	Medium = 3	
AER Pipeline Data					
H2S Content	AER Pipeline layer (H2S_cont)	Primary risk driver for O/WA is H2S content	no H2S gives a 0	>0 mol/kmol <50 mol/kmol	
Substance in Pipeline	AER Pipeline layer (substance_1,2,3)	Pipeline content	air, butane, fresh water, glycol, ML and MG Carbon Dioxide, ML Other, MG other, Misc Gasses, Natural Gas, Nitrogen, steam, polymer, propane	crude oil, diesel fuel, ethylene, fuel gas, gasoline, HV Other, HVP products, kerosene, LV Other, LVP Products, liquid ethane, Misc Liquid pentanes	
Pipeline Material	AER Pipeline layer (pip_mat)	Pipeline material - probability of corrosion	composite, aluminum, fiberglass, polybutylene, polyethylene, polyvinyl chloride	stainless steel, poly (not certified)	
Water Crossing	AER Pipeline layer (pipe_envir)	crossing of water body as noted in AER pipeline dataset	no crossing = 0		
Pipeline Age	AER Pipeline layer (last_occyr)	Facility age	>2012	1996 - 2012	
AER Incident Information					
Spills and Complaints	AER Incident List	Spills and complaints noted for that pipeline license segment	1 incidents related to pipeline segment = 1, zero incidents related to pipeline segment = 0	2 incidents related to pipeline segment	
Site Setting					
Proximity to Settlements	Altis culture points, First Nations Lands, Municipalities	Distance to Nearest Settlement measured from anywhere along the pipeline	>250 m <1.6 km, >1.6 km = 0	50 to 250 m	

Facility Decommissioning Risk Ranking						
Parameter	Source/Data Layer	Rational	Ranking			Weighting %
			Low = 1	Medium = 3	High = 5	
AER/Petrinex Facility Data						
H2S Content	AER Facility (ST102 list coupled with ST97 from AER), Directive 56	Primary risk driver is H2S content	"B" EDCT categorized facilities (0 to 200 Type facilities) and "max H2S concentrations" 0 or null	"C" EDCT categorized facilities or <1t/day at inlet (300 to 399 type facilities) or "max H2S concentrations" <=50 mol/kmol	"D" and "E" facilities or >1t/day, plus sulphur recovery facilities (400 and above) or "max H2S concentrations" >50 mol/kmol	45
Facility Type	AER Facility Type from EDCT info ST102 list	Facility type (EDCT category), see accompanying spreadsheet	battery, gas gathering, meter station, water source, satellite	compressor station, tank farm/terminal, waste plant	injection/disposal, refinery, gas plant, custom treatment facility	10
Facility Status	AER Facility Status	Facility status (ST102), else use license status from ST97	abandoned, permitted, cancelled, new, rec certified	discontinued, rec exempt, retired	active, nonreporting, unknown, suspended, if no status and "issued" from ST97	5
Facility Age	Petrinex Facility Age	Facility age (Petrinex list, facility start date)	>2012 (if no age indicated then 0)	1996 - 2012	<1996	10
AER Incident Information						
Spills	AER Incident List	Spills based on location (not licence)	1-2 releases within 100 m, zero releases = 0	2 to 5 releases within 100 m	> 5 releases within 100 m	5
Complaints	AER Incident List	Complaints based on location (no licence)	1-2 complaints within 100 m, zero complaints = 0	2 to 5 complaints within 100 m	> 5 complaints within 100 m	5
Site Setting						
Closest Water	Stream Network, Water Polygons	Closest Water Feature	> 250 m	50 to 250 m	<50 m	10
Proximity to Settlement	Altis culture points, First Nations Lands, Municipalities	Distance to Nearest Settlement	>250 m <1.6 km, >1.6 km = 0	50 to 250 m	<50 m	5
Proximity to residence	AEP Water wells	Use distance to closest domestic or agricultural water well as proxy to possible closest resident.	>250 m <1.6 km, >1.6 km = 0	50 to 250 m	<50 m	5
Total						100

Risk Ranking

OWA Risk

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[Download Upload Template](#)

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OWA Case Study: Results – Rapid Risk Assessment Project



Input Sites Data										Risk Ranking			Input Sites Data			Data Returns
UWI	Well Lic	H2S Cont	Well Dep	Well Ty	Well St	SCVFIG	Casing Fai	Proximity to Settle	Proximity to Groundwater	Complaints to	Total Risk	Risk Rank	Risk L	UWI2	Well Lic	Surface Locati
10011-14-034-27w4/00	49967	5	5	1	3	0	0	0	5	0	320	1	high	10011-14-034-27w4/00	49967	11-14-034-27w4
10005-11-044-22w4/02	5293	5	3	3	5	0	0	0	5	0	320	2	high	10005-11-044-22w4/02	5293	05-11-044-22w4
10011-26-029-27w4/02	384054	5	5	1	1	0	0	0	5	0	310	3	high	10011-26-029-27w4/02	384054	11-26-029-27w4
10016-19-038-23w4/02	216259	5	3	3	3	0	0	0	5	0	310	4	high	10016-19-038-23w4/02	216259	15-19-038-23w4
10009-21-031-28w4/00	349663	3	5	3	3	3	0	0	5	0	285	5	high	10009-21-031-28w4/00	349663	09-21-031-28w4
10001-31-063-05w5/00	352080	3	3	5	3	0	0	0	5	1	235	6	medium	10001-31-063-05w5/00	352080	01-31-063-05w5
10014-14-032-27w4/04	312585	3	5	1	3	0	0	0	5	0	230	7	medium	10014-14-032-27w4/04	312585	14-14-032-27w4
10012-14-056-12w5/00	357755	3	5	1	3	0	0	0	5	0	230	8	medium	10012-14-056-12w5/00	357755	04-23-056-12w5
10004-36-063-06w5/00	343557	3	3	5	3	0	0	0	5	0	230	9	medium	10004-36-063-06w5/00	343557	04-36-063-06w5
10013-11-055-09w5/02	319927	3	3	1	5	0	0	0	5	1	225	10	medium	10013-11-055-09w5/02	319927	13-11-055-09w5
10014-25-039-28w4/00	364857	3	3	1	5	0	0	0	5	0	220	11	medium	10014-25-039-28w4/00	364857	14-25-039-28w4
10002-20-058-06w5/00	141630	3	3	1	5	0	0	0	5	0	220	12	medium	10002-20-058-06w5/00	141630	02-20-058-06w5

Downhole Risk Ranking Summary:

Date of last Data Run: August 16, 2021

Total Number Sites	617	% of total
High Risk (Score >250)	5	0.8%
Medium Risk (Score 126 to 250)	57	9.2%
Low Risk (Score of 0 to 125)	555	90.0%

Downhole Risk Ranking Analysis:

Rank	H2S Content	Well Depth	Well Type	Well Status	SCVFIGM	Casing Failure	Proximity to Settlement	Proximity to Groundwater Wells	Complaints to AER
0	562	0	0	0	564	614	597	0	591
1	0	320	419	142	0	0	20	204	26
3	51	237	170	309	53	3	0	87	0
5	4	60	28	166	0	0	0	326	0
Check Sum	617	617	617	617	617	617	617	617	617

Risk Score Distribution by Range

Parameter Ranking Frequency by Risk Level

Risk Level	Risk Level Description
0	Null/No Effect on Risk Ranking
1	Low Risk
3	Medium Risk
5	High Risk

OWA Case Study: Results – Interactive Mapping Output



Alberta

Q

Portal
Help
Logout

Legend Tree
Active Layers ★

▶ OWA

OWA Downhole Risk

● High Risk

● Medium Risk

● Low Risk

OWA Facility Risk

▲ High Risk

▲ Medium Risk

▲ Low Risk

OWA Pipeline Risk

— High Risk

— Medium Risk

— Low Risk

▶ Land

▶ Water

Surface Water

Groundwater

▶ Geology

▶ Energy

Shale Gas Formations

Reservoir Pressure +/- BGWP

AER Energy Data

52.21531 -114.14724 🌐

997 masl

Layer: OWA Downhole Risk

1 Feature < 1 >

UWI	103/10-36-037-02W5/00
Well Licence	0358605
Load Name	20210322
Risk Level	Low
Total Risk	85
H2S Risk	0
Well Depth Risk	3
Well Type Risk	1
Well Status Risk	5
SCVF/GM Risk	0
Casing Failure Risk	0
Proximity to Settlements Risk	0
Proximity to Groundwater Wells Risk	5
Complaints to AER Risk	0

OWA Case Study Results

- a) Rapidly assess risk
- b) Efficiently deploy resources
- c) Supports digital well file creation
- d) Ready integration with ARO database
- e) Transparency and process certainty

Discussion:

- Can extrapolate to surface reclamation/closure risk
- Easily modify and customize
- Data augmentation with public and private data sets
- Web-based access maximizes in-house and third-party collaboration

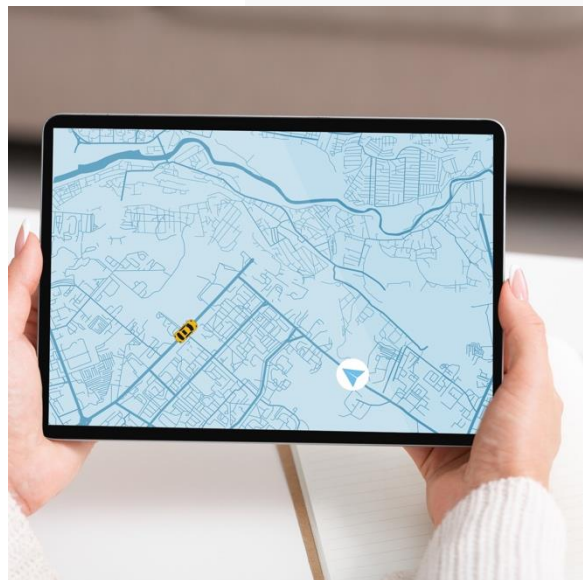
Opportunity:

- “Digital duo-tang” creation including figures, and automated reporting
- Tool can be extrapolated to other workflows including ABC campaign development and A&D liability evaluations





If you'd like to get a deeper understanding of the full offerings of Azurite Insights and ESG Performance Management on offer, see the Innotech Alberta video seminar “Cutting Edge Technology in Asset Retirement” [Tech in Asset Retirement](#)



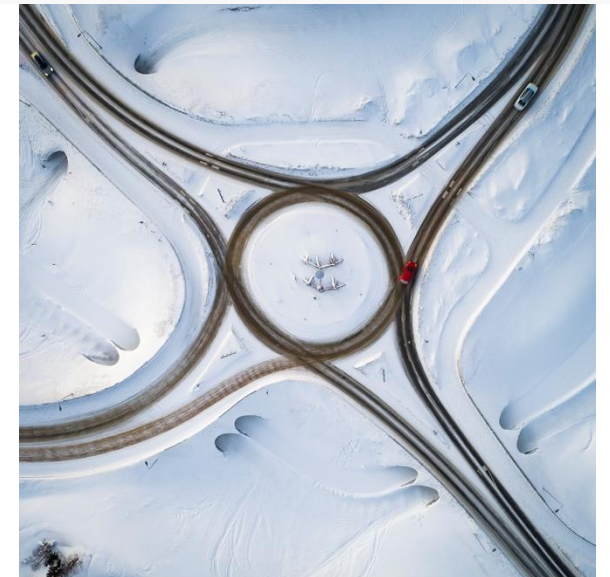
Demonstration

Contact us for a live demonstration of the tools we've presented today or some of our other offerings including ESG reporting, or ARO Project management.

mtaylor@waterlineresources.com

Project Management Insights

Combine your existing cost tracking, scheduling and management solutions with our web enabled platform or use our integrated ARO project management tools to seamlessly guide your projects from budgeting to delivery.



Thank You:



Greg Denham
Lawrence Tulissi



**Orphan Well
Association**

Dave Marks
Cliff Pybus
North Shore Environmental



Contact Us

Reach out to us if you want to drive operational efficiencies and leverage available data and technologies to create opportunity and value.

Data Driven – Results Focused

phone : **403-830-4715, 403-971-2137**

email : **solutions@azuriteinsights.com**

Web : **[Azurite Insights](#)**

