

A New Approach to Rapid Closure for Inactive Sites

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Outline

- Overview of Federal funding programs and other site closure programs
- Liability management and asset retirement
- Matrix Approach to Rapid Closure (MARC)
- Challenges and future improvements



End Goals:
Reclamation Certificates &
Liability Reduction

Federal Funding Programs

BC Dormant Sites Reclamation Program

- \$100 million

Saskatchewan Accelerated Site Closure Program

- \$400 million

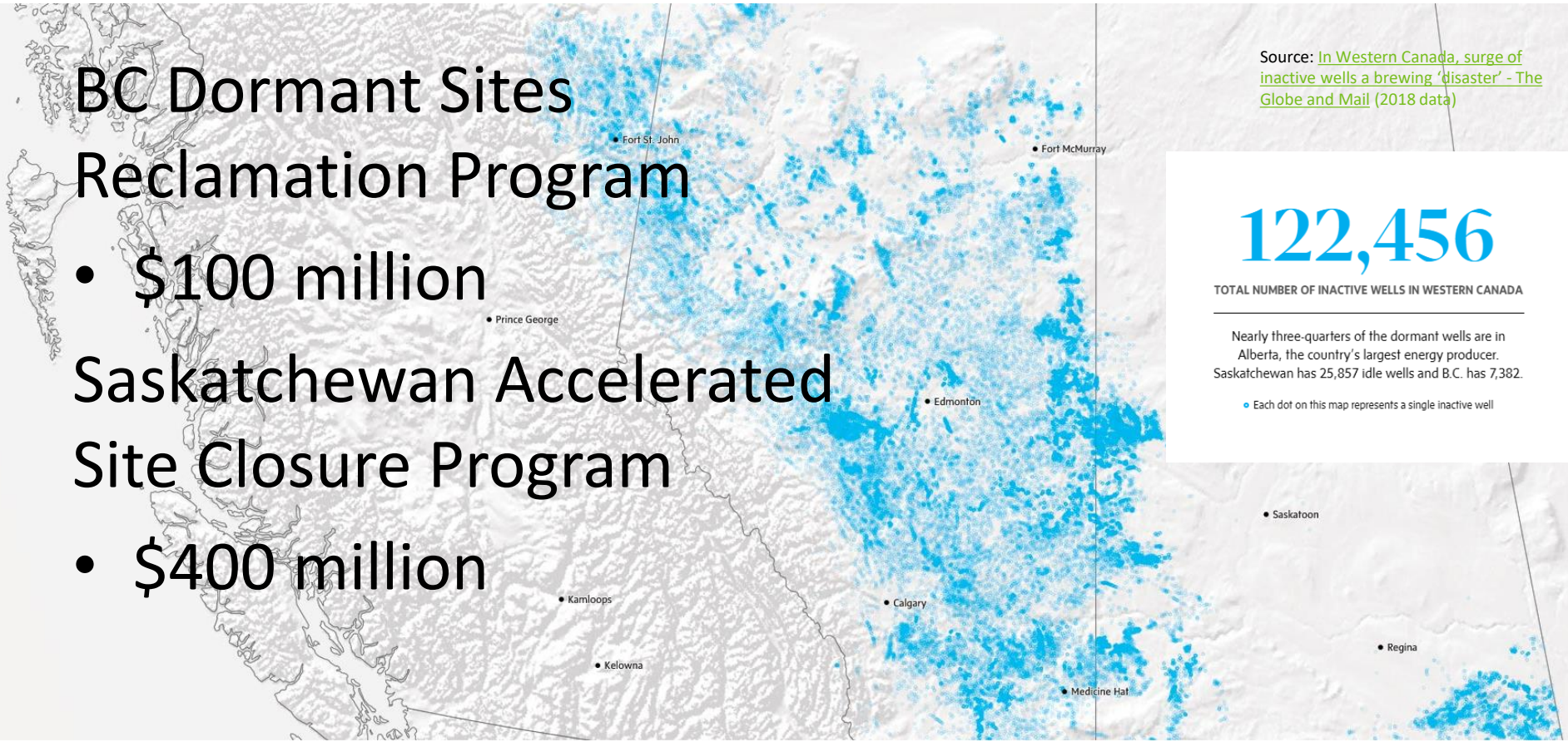
Source: [In Western Canada, surge of inactive wells a brewing 'disaster' - The Globe and Mail](#) (2018 data)

122,456

TOTAL NUMBER OF INACTIVE WELLS IN WESTERN CANADA

Nearly three-quarters of the dormant wells are in Alberta, the country's largest energy producer. Saskatchewan has 25,857 idle wells and B.C. has 7,382.

• Each dot on this map represents a single inactive well

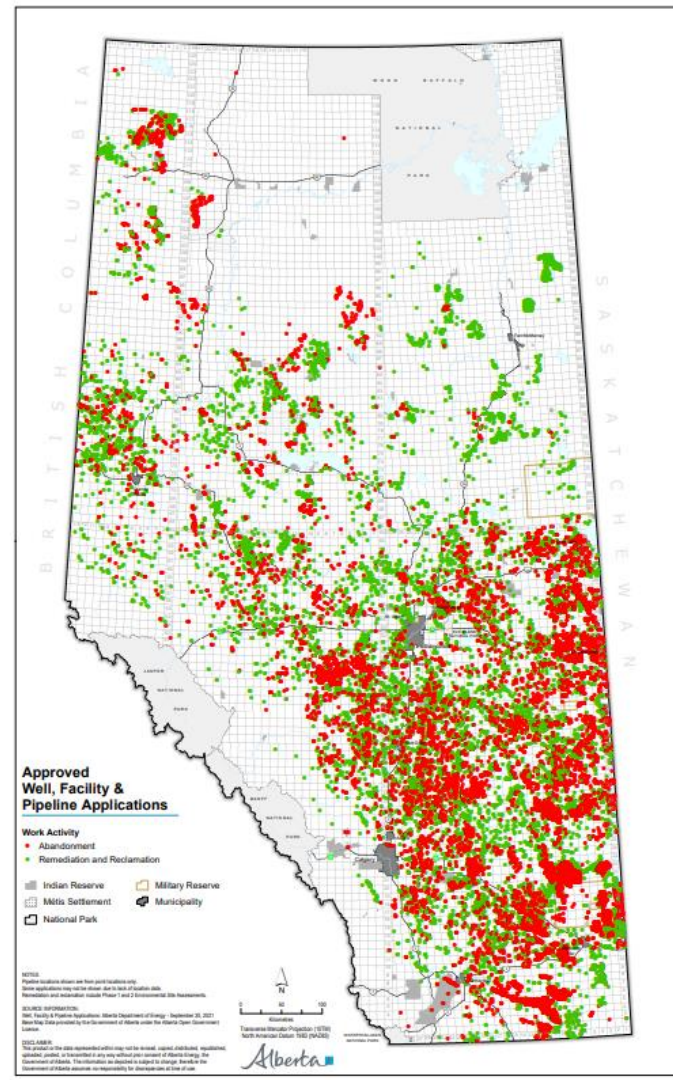


Federal Funding Programs

Alberta Site Rehabilitation Program

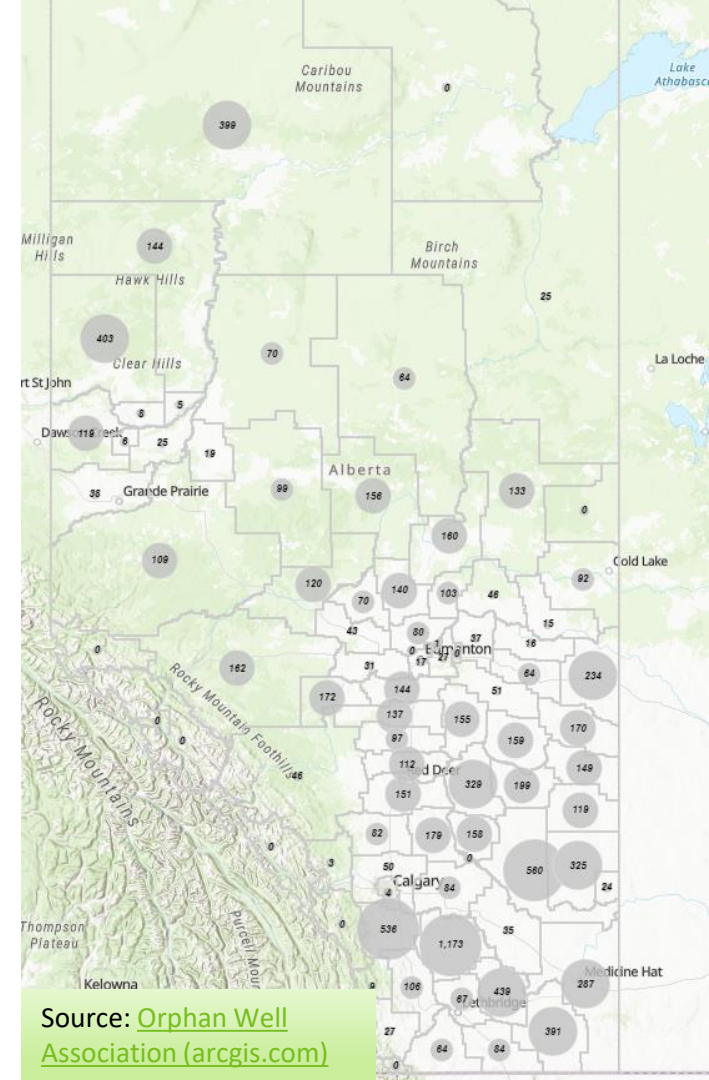
- \$1 billion for progressing inactive wellsites
- \$510.1 million grant funding approved to more than 500 Alberta-based companies

Source: [All Approved Applications Map - September 30, 2021 \(alberta.ca\)](#)



Orphan Programs

- Alberta (OWA), BC (OSRF), and Saskatchewan (SOGOF) also have active orphan well programs
- Separate from the federal funding programs; funded by industry and loans



Source: [Orphan Well Association \(arcgis.com\)](http://OrphanWellAssociation.com)

Liability Management

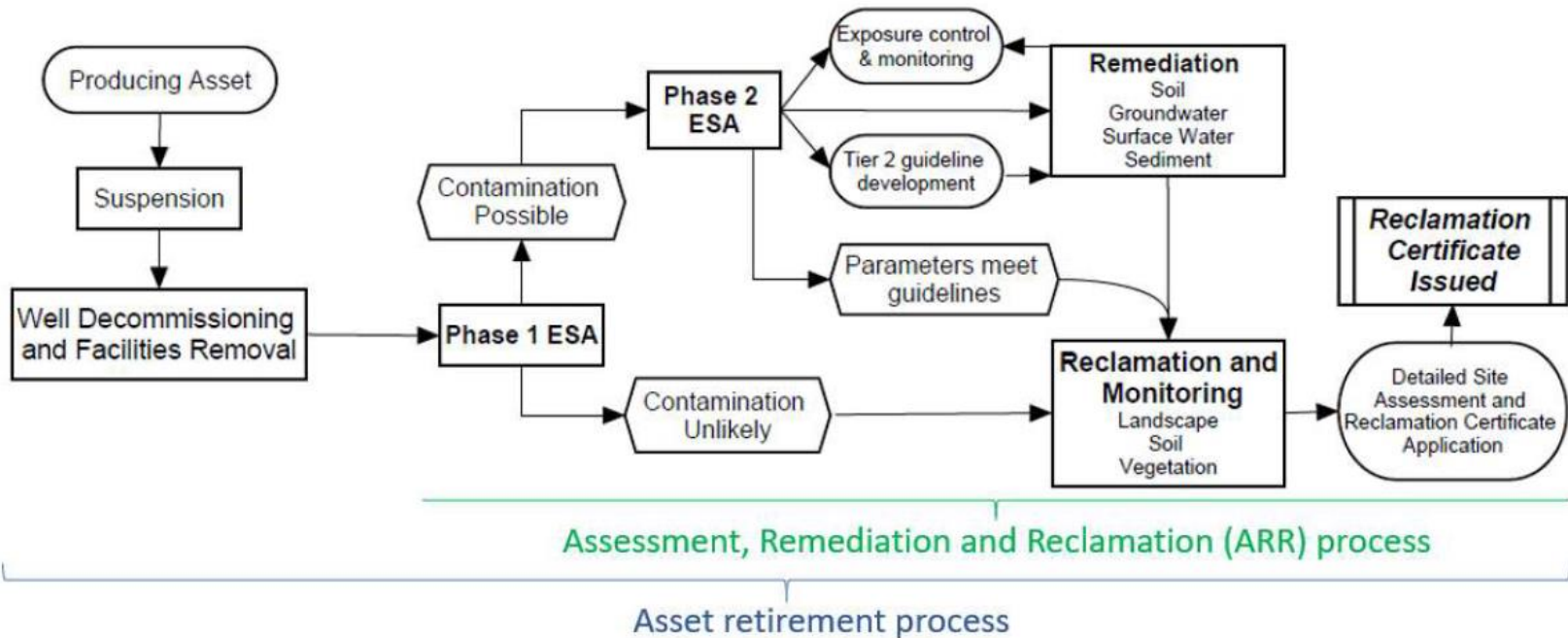
- Each jurisdiction implementing updated liability management
- In Alberta includes:
 - Licensee Special Action
 - Licensee Capability System
 - Inventory Reduction Program
 - Closure spending targets over a 5-year rolling period
 - Addressing legacy and post-closure sites
 - Expanding the mandate of the Orphan Well Association

Quick facts

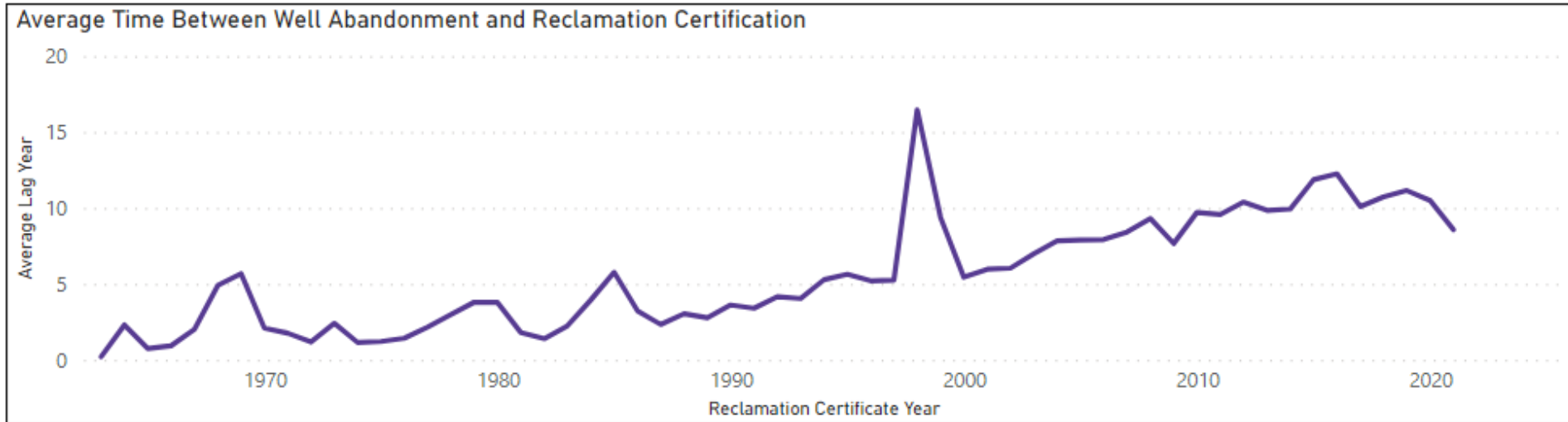
- Alberta has an estimated:
 - 159,000 active wells
 - 97,000 inactive wells
 - 73,500 abandoned wells
- As of June 1, 2021, the OWA had an inventory of 2,124 orphan wells for abandonment and 5,094 sites for reclamation.

Source: [Oil and gas liabilities management | Alberta.ca](#)

Asset Retirement Process



Time from Abandonment to Reclamation Certificate



Sources: Alberta well site data from Geoscout and the AER Well file

Data requirements

Phase 1

• Inputs:

- Client Files
- Public Info
- Tour Reports
- Aerial Photos
- Land Title
- Routine Disclosure
- ESAR
- Well/Facility File
- Water Well and Spill Searches
- Reclamation Certificates
- Previous reports
- Site access details

• Outputs:

- Drilling Mud Calculations
- Compliance option checklist
- Interviews (landowner, operator)
- Other communications details
- Site visit (details and photolog)
- APEC identification
- Compiled list of site characteristics (spills, infrastructure remaining, geology, soils, ground water flow direction, aquifer, well info, cut and cap date, access details, production details, etc.)
- Final report: OneStop (AB), Site screening (BC)
- Suggested next step

Phase 2

• Inputs:

- Phase 1 data compiled (output: site details)
- Proposed boreholes/wells/sampling plan and justification/scope
- Cost estimate
- Field documentation:
 - Agreements
 - Borehole/well/sampling instructions
 - Ground disturbance
 - Safety Paperwork
 - Journey Management Plan
 - Safety Paperwork
 - Methods and guidelines selection
- Subcontractor booking and management, and equipment requests

• Intermediate Outputs:

- Ground disturbance package (OneCall summary, figures and peer-reviewed documentation)
- Field package (workplan, site plan, safety documents)
- Final outputs:
 - Borehole logs (field data)
 - Updated communication logs
 - Updated site access details
 - Updated APEC list
 - Lab sample results and exceedances tables
 - EM figures
 - Final report (ROSC, Phase 2 submission, exceedance figures, sample results tables)
 - Recommendations and work plan for next step

Remediation

• Inputs:

- Phase 2 data compiled (from Phase 1 and field work)
- RAP/Work plan
- Cost Estimate
- Contractor bids
- Updated field documentation

• Intermediate Outputs:

- Ground disturbance package (OneCall summary, figures and peer Reviewed Documentation)
- Field package (work plan, site plan, safety documents)
- Final outputs:
 - Borehole logs (field data)
 - Updated communication logs
 - Updated site access details
 - Updated APEC list
 - New lab sample results and exceedance tables
 - Final report (ROSC, remediation submission, exceedances figures, sample result tables)
 - Recommendations and work plan for next step

Reclamation

• Inputs:

- Remediation data compiled (from phase 2 and field work) or Phase 1 data compiled
- Work plan
- Cost estimate
- Updated field documentation

• Intermediate Outputs:

- Ground disturbance package (OneCall summary, figures and peer-reviewed documentation)
- Field package (workplan, site plan, safety documents)
- Final outputs:
 - Interim Reporting
 - Recommendations and Work Plan for Next Step
 - Detailed Site Assessment Reporting
 - Reclamation Certificate Application in OneStop

Matrix Software Solutions Digital Tools

Apps

- Field Data Uploader
- Site Visit (Phase 1)
- Borehole Logging
- Groundwater Monitoring
- Field tickets
- Digital COC
- Image Management System (photologs)
- Mud Tables Workbook
- Equipment Request

Mapping

- GIS portal (Prometheus)
- Aerial Imagery
- Geophysics
- Georeferenced figures for field use
- Field data (Trimble, GPS, etc.)

Searches

- Water wells
- Public databases
- Air photos

Safety

- Ground disturbance package
- H&S Manual
- Standard Operating Guidelines
- Standard Operating Procedures
- Journey Management

Data and Tables

- Environmental Data Management System (EQuIS)
- Soil
- Groundwater
- Surface Water
- Air Quality
- Other
- Self-serve results tables with “choose-your-own” guidelines

Finance

- Consolidated Project Report
- Accounting (BST)
- Vendor Invoice Tool
- Field Cost and Activity Tracker (FCAT)

What is MARC?



Portfolio Management



Collaboration



Analytics & Insight



Automated Deliverables

- It is NOT just a database!
- MARC leverages the collection and use of digital data across all phases of site assessment.
- It helps to standardize data and work scopes centered around the lifecycle management of Areas of Potential Environmental Concern (APECs).
- It captures real-time data related to a portfolio of sites in one place, providing live insight across the entire portfolio.

MARC – User Interface

Refresh Clear all filters

Power BI Report

| | | | | | | | | | | | |
|-------------|-----------|----------------|-----------|--------------|-----|----------------|------------|---------------|----------|--------------------|-------------|
| Client Name | Portfolio | Financial Code | Site Code | ClientCoding | UWI | Legal Location | LicNo./WA# | Licensee Name | Province | Client Coordinator | Site Type |
| | | 165955 | 27279 | | | | | | AB | | Single Well |

Next Steps | Comments | Communications | Agreements/Notifications/Permits/Access Details | Guidelines | Site Information | LO Info/Shared Lease | Previous Assessments

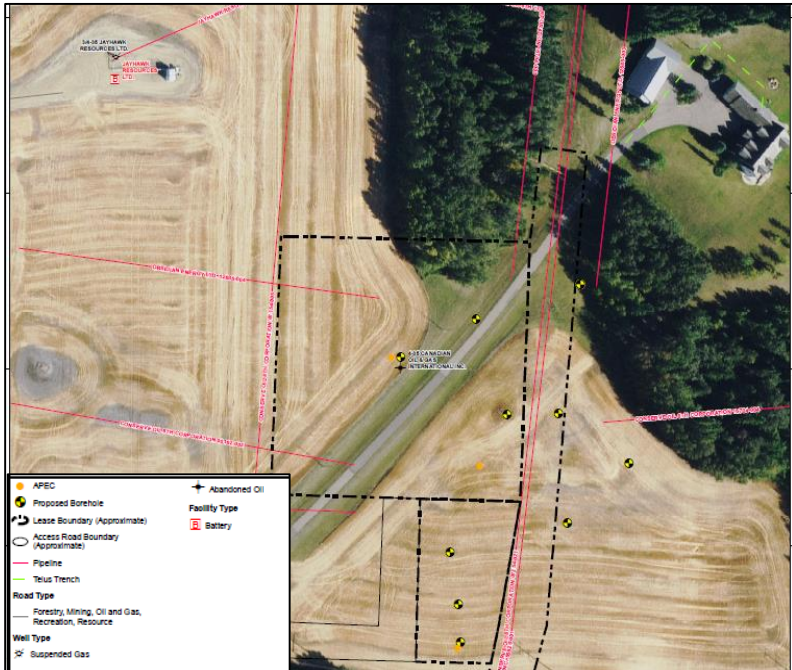
| Request Date | Work Type | Rational for recommendations | Scope | Aba | Budget Estim | AFE# | AFE Comments | Approval Date | Approval | Completed | Con |
|--------------|----------------------|--|--|-----|--------------|-------------|---|--|------------|------------|---|
| 2018-07-01 | Phase 1 | Initial work | Site needs to be abandoned before Phase 2. | | \$1,000.00 | | Initial work | 2018-07-01 | COMPLETE | 2018-10-09 | |
| 2020-05-11 | Phase 2 | Drilling waste disposal fails compliance option 2 for a salt zone; barrel UST in close proximity to well centre; above ground infrastructure included meter | DWDA (4 bhs), well centre (1 ha), UST/wellcentre stepout (1 bh); surface inspection of above ground infrastructure areas including meter shack (referred to as a | | \$9,000.00 | 20EAS0114 | Basic 5 borehole, one handauger Phase 2 ESA recommended. | 2020-04-23 | | 2020-07-27 | Needs Supplemental |
| 2020-07-02 | Phase 2 Supplemental | From initial phase 2: At former UST (20-B2), SAR exceeded the Tier 1 guideline in the top 3.0 m bgs. SAR exceedances were vertically delineated at 5.5 to 6.0 m bgs; | Supplemental Phase 2 to laterally and vertically SAR and chloride is required. Will include an EM survey (budgeted separately) followed by drilling 6 boreholes to | | \$17,890.00 | 20EAS0325 | Supplement of \$3740 to original \$14,150 budget requested for SST screening and work plan. | 2020-08-11 | | 2020-11-12 | Used salinity screening option. It is, but need Phase 2 supplement. |
| 2020-07-02 | EMSurvey | Known elevated soil chloride (160-440 mg/kg extending to maximum depth of sampling of 6 m) along with SAR with the potential for EC impacts at former UST | EM 31 | | \$750.00 | 20EAS0325 | | 2020-08-11 | | 2020-08-26 | |
| 2020-11-07 | Phase 2 Supplemental | The first supplemental Phase 2 ESA found chloride exceeding 100 mg/kg to the max depth of drilling (9 m bgs). Also the lateral extent of EC impacts and chloride | Drill 8 boreholes (1BH to 15m, 7BH to between 9 and 12 m) and collect soil samples for salinity analysis to help refine the delineation and allow development of | | \$23,813.00 | 20EAS0568 | AFE request sent Nov 12, 2020 | 2020-11-16 | | 2021-02-03 | remediation next |
| 2021-02-03 | Remediation | see workplan here: F:\27279\546\WP&CE | | | | \$82,600.00 | 21REM0225 | AFE request sent Feb 3, 2021, but requested start date of Apr 1, 2021. | 2021-05-20 | | |

Record: 1 of 6 | No Filter | Search

| | | | | | | | |
|-------------------------------------|----------------------------|--------------|--------------------|--------------------|--------------|---------------|-------------|
| Phase/Stage 1 - SiteVisit/Interview | Phase/Stage 2 - Field Work | Aerial Photo | Proposed boreholes | Prometheus Viewer | CPR | Result Tables | GIS request |
| Phase/Stage 1 - Reporting | Phase/Stage 2 - Reporting | APECs | Actual boreholes | Compiled Site Data | APECs Report | DS request | EDS request |

Automated and Data-Driven Deliverables

Ground Disturbance Figures



Field Reports

| Field Lead | TA | Last OneCall Ticket No. | Lines Locates Compl |
|------------------|-------------------|-------------------------|---------------------|
| Anakin Skywalker | Emperor Palpatine | 20213912733 | |

| Surf Loc | UWI | Licensee Name | Landown |
|----------------|----------------------|------------------------|----------|
| 02-22-022-20W4 | 00/02-22-022-20W4/00 | Death Star Enterprises | Han Solo |

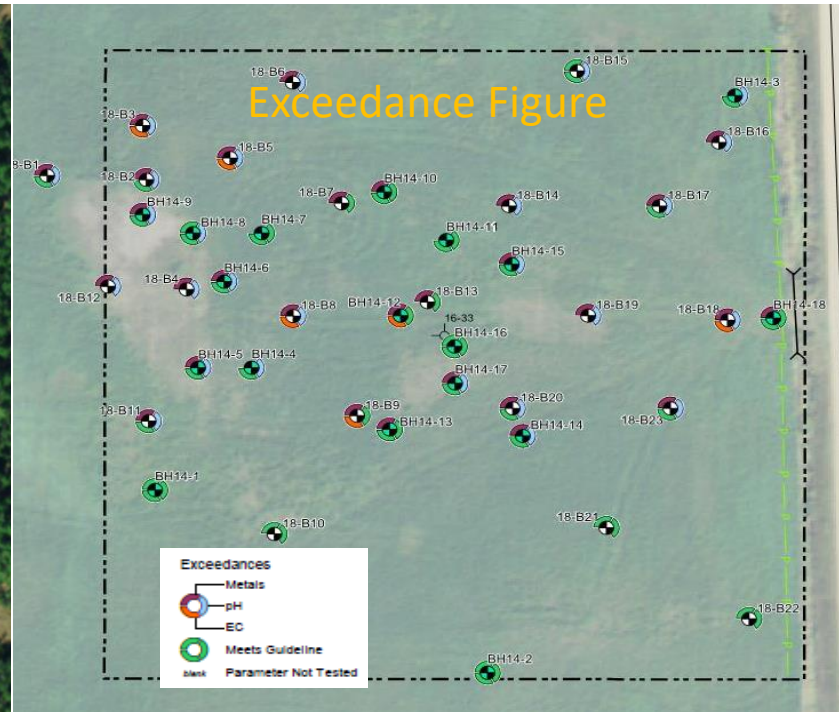
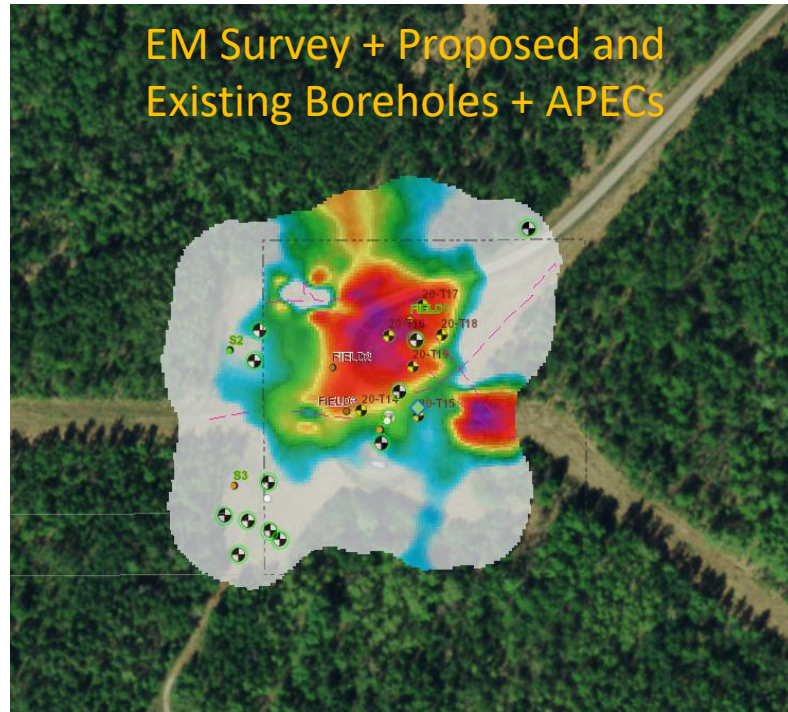
| Site Access Type | Site Access Details |
|------------------|--|
| Truck | Road can be rutted, high clearance recommended. code to lock is 1013 |

| Well Details | | | | | | |
|--------------|------------|------------------|-----------------|------------|------------|-------|
| Well Status | Spud Date | First production | Last production | Total | Water (m3) | Oil(m |
| ABD GAS | 1969-06-05 | | 1984-11-01 | 2016-06-30 | 2598 | 28503 |

| AFE Request | | | |
|-------------|--|---|----|
| Work | Scope | Rational For Recommendations | Ap |
| Phase 2 | 5 hand augers to maximum depth of 1.2 m bgs to investigate well centre and former infrastructure areas; 6 boreholes to 3 m bgs to assess well centre, potential DWDA and flare pit and one borehole to 4.5 m to assess the UST. Includes analysis for grain size, detailed salinity, metals, and PHCs. | A Phase 2 is recommended because the well produced gas and water, the drilling waste does not comply with Compliance Option checklist 2, infrastructure included ASTs, line heater and separator. A flare pit was used during testing of the well. AL | |

| Communication Log | | | | | | |
|-------------------|-----------|-----------------|----------------------|-------------------|--|--|
| Date | Role | Contact Name | Contact Phone Number | Contacted By | Purpose | Details |
| 2021-09-25 | Other | Unknown Locator | 555-555-5555 | Marlaina Knowlton | Locator responding to one call could not get past locked gate. | Called me asking for the gate permission to access the site. Locator said he would wait a track down the gate code. G/ |
| 2021-09-25 | Landowner | Han Solo | 222-222-2222 | Marlaina Knowlton | Ask for gate code so locators can | I called the LO to ask for a first didn't remember there v remember the code and ask |

GIS and Automated Field and Report Figures



Automated Tables

Next Steps | Comments | Communications | Agreements/Notifications/Permits/Access Details | Guidelines | Site Infor

Site specific guideline available: BackgroundCondition

Contact EDS for details.

| Matrix Code | Guideline Name | Land Use | Grain Size | Exposure Pathway |
|-------------|----------------|------------|------------|-------------------------------|
| Soil | Alberta Tier 2 | Industrial | Fine | Direct soil contact (eco) |
| Soil | Alberta Tier 2 | Industrial | Fine | Direct soil contact (human) |
| Soil | Alberta Tier 2 | Industrial | Fine | Management limit |
| Soil | Alberta Tier 2 | Industrial | Fine | Nutrient energy cycling check |
| Soil | Alberta Tier 2 | Industrial | Fine | Offsite migration (eco) |
| Soil | Alberta Tier 2 | Industrial | Fine | Offsite migration (human) |
| Soil | Alberta Tier 2 | Industrial | Fine | Protection of DUA |
| Soil | Alberta Tier 2 | Industrial | Fine | Vapour inhalation (slab) |

Soil Tables

| | |
|------------------------|----------------------------------|
| Water Well Search | Physical Characteristics |
| Salinity (mg/kg) | Salinity (mg/L) |
| Petroleum Hydrocarbons | Polycyclic Aromatic Hydrocarbons |
| Metals | Glycols |
| Exceedances by APEC | Exceedances – results summary |
| QA/QC results | |

- Data is uploaded directly to EQUIS and results tables can be immediately accessed through MARC.
- Generic or site-specific guidelines can be applied.
- Can group data by APEC, or customize table templates.

Automated Reports

1 BACKGROUND

TABLE A Site Details Summary

| Item | Description |
|---|---|
| Job Order No. | 123456 |
| UWI(s) | 00/00-00-000-0W4/00 |
| Defunct Company | Demo Oil and Gas Corporation |
| Landowner | John Doe |
| Spud Date | August 1, 1989 |
| Drilling Waste Disposal Method | The waste disposal method was assumed to be onsite mix-bury-cover (Matrix 2018). |
| Outcome of Drilling Waste Disposal Assessment | Failed Compliance Option 2 – Drilling Waste Disposal Assessment Checklist because a salt zone was encountered, and the salt calculations did not meet the applicable criteria (Matrix 2018). |
| Well Production Dates | 00/00-00-000-00W4/00: produced 70,400 m ³ of gas, 36.5 m ³ of condensate, and 256.5 m ³ of water in 2005 (Abacus 2019). |
| Alberta Energy Regulator Well Status | Suspended Gas/Suspended Oil (Abacus 2019). |
| Depth of Well | 1,900 m |
| Land Use | Agricultural (Abacus 2019) |
| Current Onsite Facilities | Historical facilities included aboveground storage tank, pump jack, support beams, wellhead, and two pipeline risers (Matrix 2018). At the time of this assessment, only one pipeline riser was present onsite. |

TABLE B Site Setting

| Feature | Description |
|-------------------------------------|--|
| Onsite Topography and Site Features | High relief, undulating topography (Abacus 2019) |
| Nearest Surface Water | The nearest surface water body is about 214.6 m from the well head (Abacus 2019) |
| Vegetation and Weeds | During the Phase 2 Environmental Site Assessment (ESA), vegetation stress was apparent. Canada thistle was observed throughout site. Foxtail barley was observed around well centre and throughout site. Shepherd's purse, clover, and stink weed were also observed onsite. |
| Regional Soils | <ol style="list-style-type: none">1. Benalto (Dark Gray Luvisol)2. Breton (Orthic Gray Luvisol)3. Falun (Orthic Dark Gray Chernozem; Abacus 2019) |

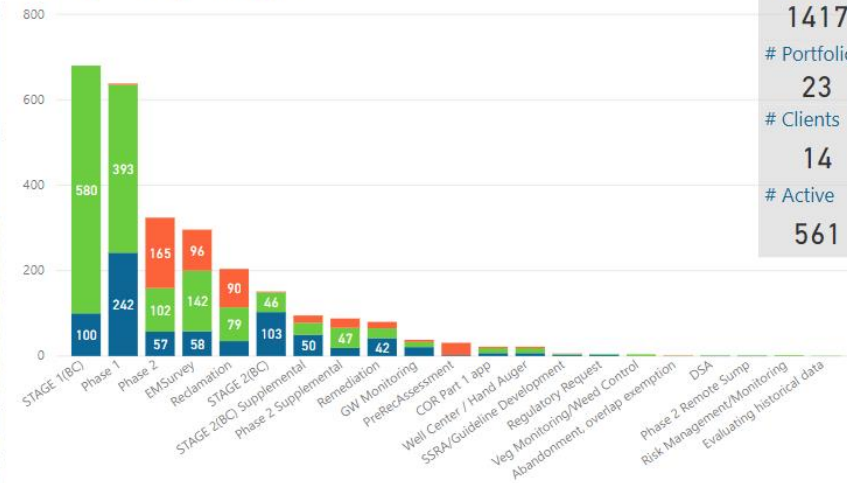
- Site details and background information is captured once.
- Can be updated and enhanced as assessment progresses.
- Minimizes transcription errors.
- **More time spent on results.**
- Templates customized and easily changed as client needs/regulations evolve.

Whole Portfolio Management: PowerBI

ActiveProjects ● NO ● YES

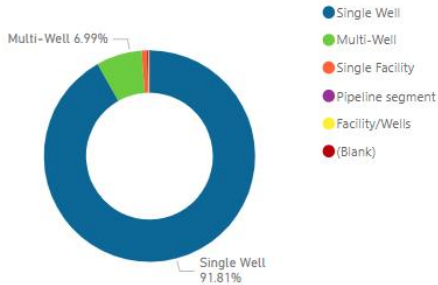


WorkStatus ● APPROVED ● COMPLETED ● NOT APPROVED

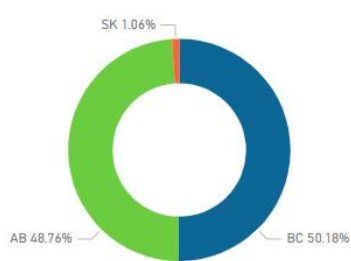


sites
1417
Portfolios
23
Clients
14
Active
561

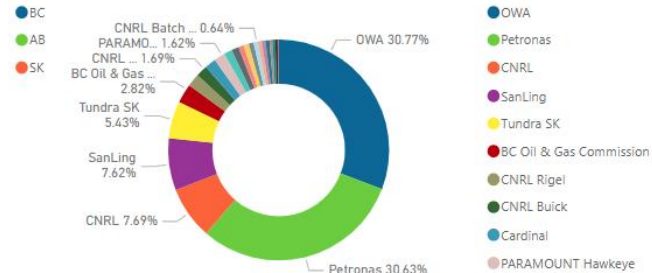
Count of ID by SiteType



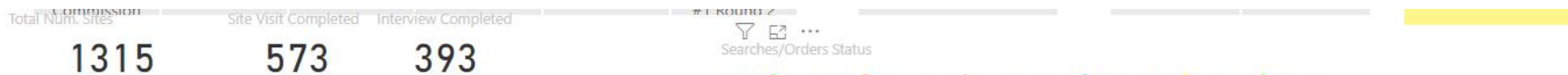
Count of ID by Province



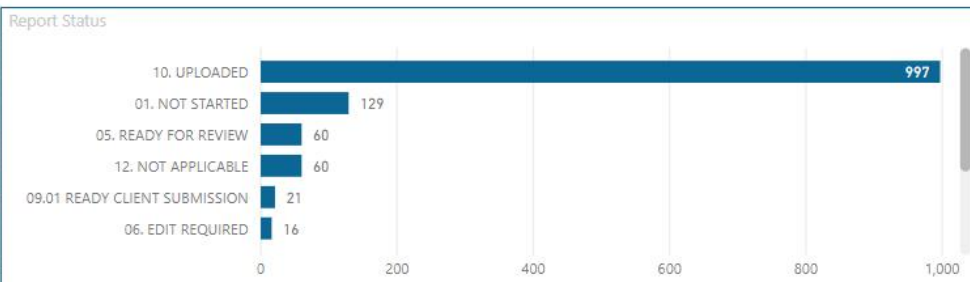
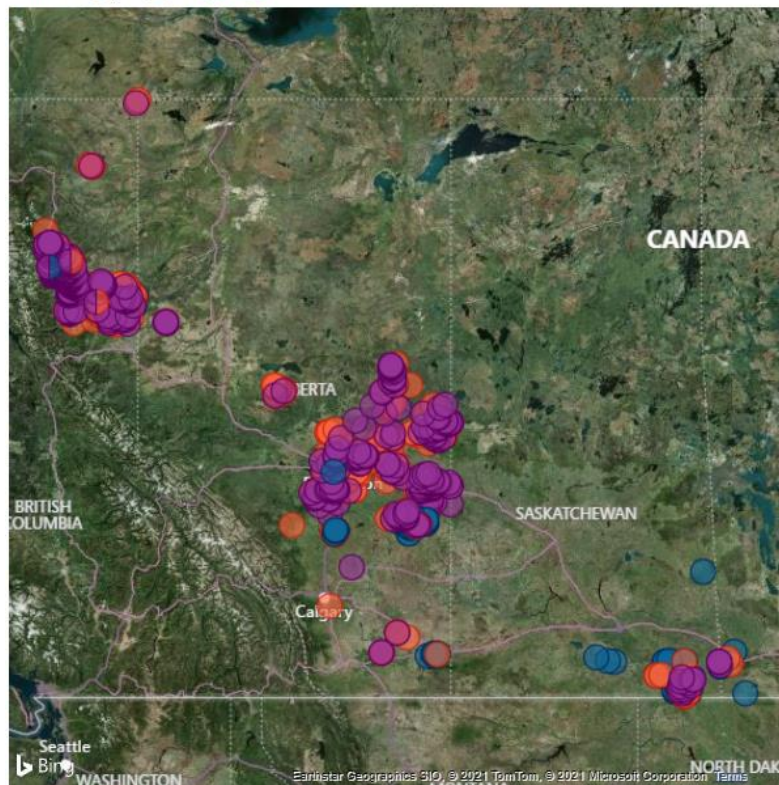
Count of ID by PortfolioName



Phase 1 ESA Tracking



DWDAPass (Blank) NA NO YES

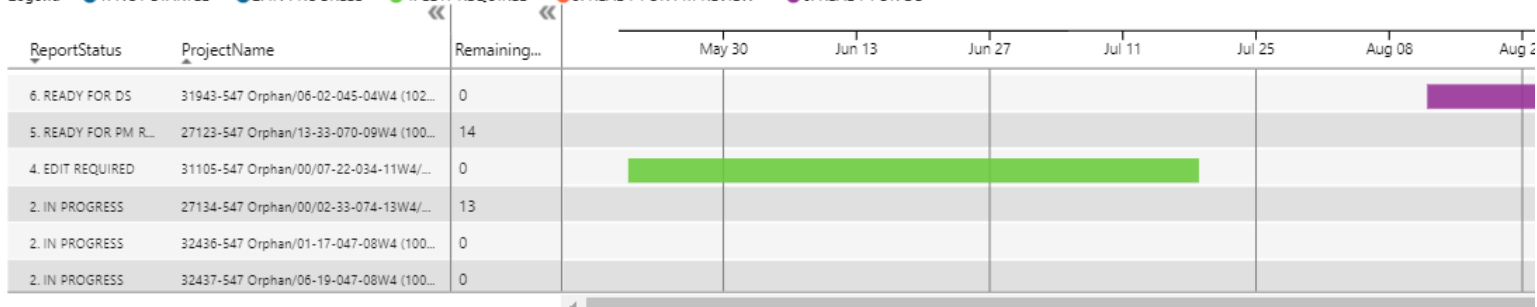


PowerBI: Report Tracking

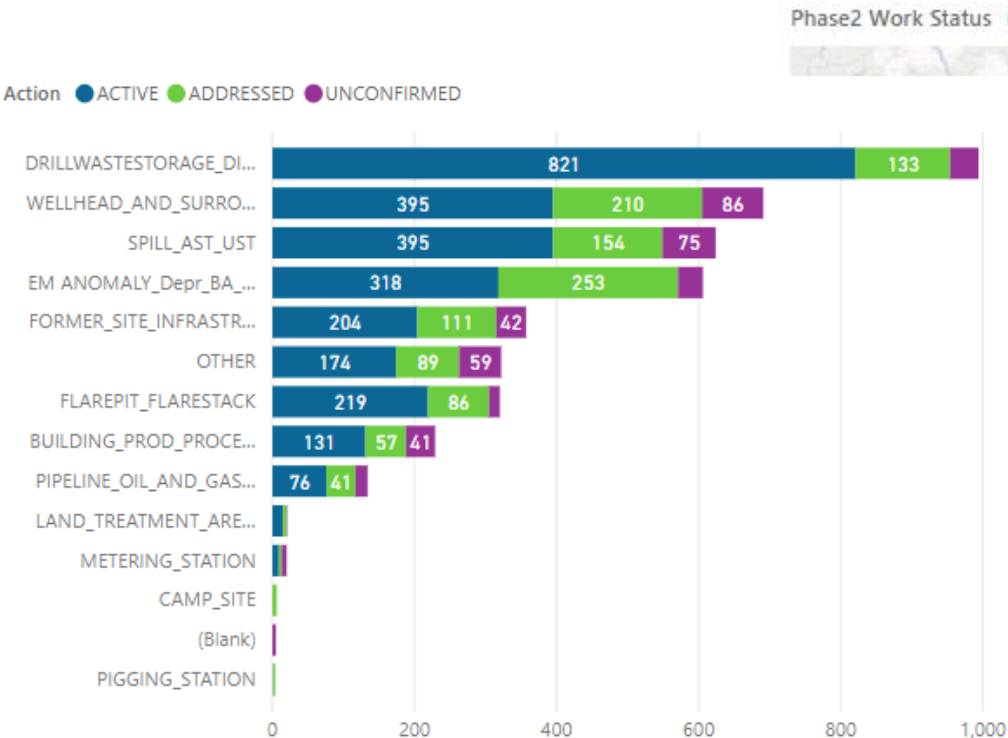
| Phase2 Work Status | Phase2Type | EM Survey Complete | Lines Locates Complete | Field Work Complete | Sample Submitted On | Sample Results Loaded On | Report Due Date | Report Complete Date | Remaining Days | Days Report completed before due date | Days Pass Due Date | Author |
|------------------------|--------------|--------------------|------------------------|---------------------|---------------------|--------------------------|-----------------|----------------------|----------------|---------------------------------------|--------------------|------------|
| 2. Not started | GENERIC | 11/01/2019 | | | | 05/06/2021 | | | 0 | 0 | 0 | Tara Murr |
| 4. Drilling Complete | | | | | | | | | | | | |
| 1. NOT STARTED | GENERIC | 08/26/2020 | 11/19/2020 | 05/21/2021 | 05/21/2021 | 07/19/2021 | 07/20/2021 | | 39 | 0 | 85 | Marlaina |
| 2. IN PROGRESS | | | | | | | | | | | | |
| 27134 | GENERIC | | | 08/26/2021 | 08/26/2021 | 09/08/2021 | 10/25/2021 | | 13 | 0 | 0 | Marlaina |
| 33551 | GENERIC | | | 08/25/2021 | 08/25/2021 | 09/03/2021 | 10/24/2021 | | 12 | 0 | 0 | Tara Rach |
| 4. EDIT REQUIRED | SUPPLEMENTAL | 10/09/2020 | 05/18/2021 | 05/20/2021 | 05/20/2021 | 07/16/2021 | 07/19/2021 | | 0 | 0 | 85 | Alissa Edu |
| 5. READY FOR PM REVIEW | | | | | | | | | | | | |
| 27123 | GENERIC | | | 08/27/2021 | 08/27/2021 | 09/07/2021 | 10/26/2021 | | 14 | 0 | 0 | Marlaina |
| 6. READY FOR DS | | | | | | | | | | | | |
| 31943 | SUPPLEMENTAL | | | 08/12/2021 | 08/12/2021 | 08/25/2021 | 10/11/2021 | | 0 | 0 | 1 | James Wh |

<

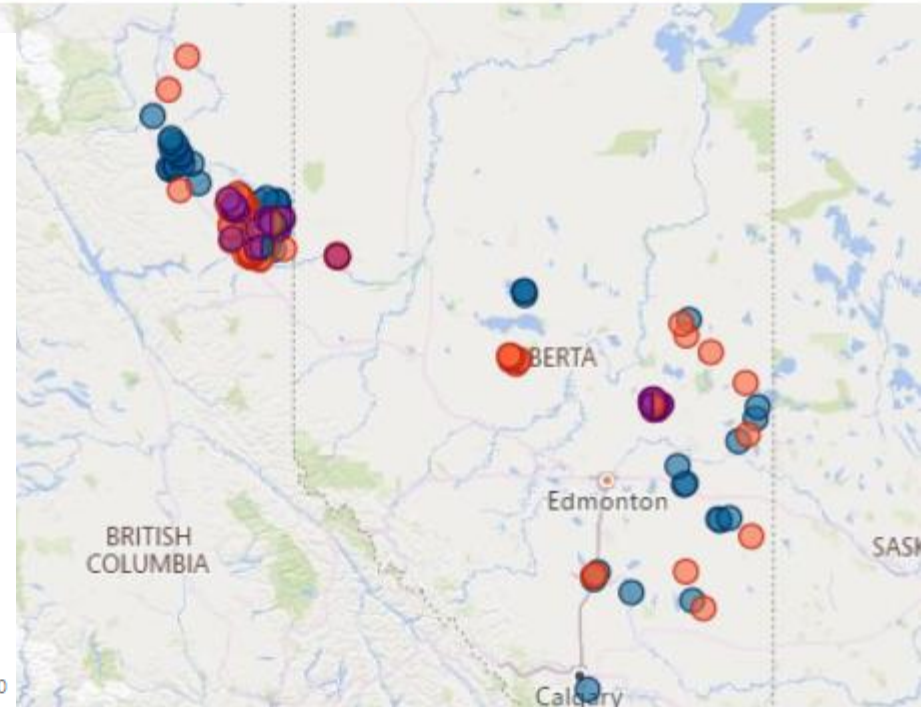
Legend ● 1. NOT STARTED ● 2. IN PROGRESS ● 4. EDIT REQUIRED ● 5. READY FOR PM REVIEW ● 6. READY FOR DS



PowerBI: Analytics and Mapping




Phase2 Work Status ● 2. Not started ● 3. Locates Complete ● 4. Drilling Complete ● 5. Report Complete



Challenges and Solutions

| Challenges | Solutions |
|--|---|
| Tight timelines and budget constraints | Improve processes and efficiencies |
| Learning curve | Training, identify “super-users” |
| Resistance to change/technology | Training, show staff the bigger picture |
| Assembly line approach | Everyone has to participate |
| Changing regulations and client needs | Easily adaptable system and tools |
| Technological change | Continuous improvement, honest feedback |



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