Data Management, Monitoring, and a Pandemic

A Giant Mine Story

Presenter: Morgan Schauerte

What is the Giant Mine?

- Open pit/underground gold mine that opened in 1948 in Yellowknife, N.W.T and closed in 2004.
- Used a specific roaster based refining process that resulted **arsenic trioxide** being produced from the arsenopyrite host rock, along with the typical contaminants produced by a gold mine of that era (e.g mercury).
- The arsenic trioxide was deposited primarily underground, where in approximately 237,000 tonnes reside in stopes and underground chambers. Elevated arsenic levels are also prevalent across the site, as a result of dust and sediment deposition.
- Currently the underground arsenic trioxide is kept immobile by constant pumping of the groundwater table below the relevant chambers.

Giant Ongoing Operations

- Giant Mine is in active reclamation.
- Active on site staff range from 5 to several dozen depending on time of year and project activities.
- Site activities are occurring in a phased approach.
- Site demolition and water treatment activities where the focus during this monitoring period.

The Importance of Getting it Right

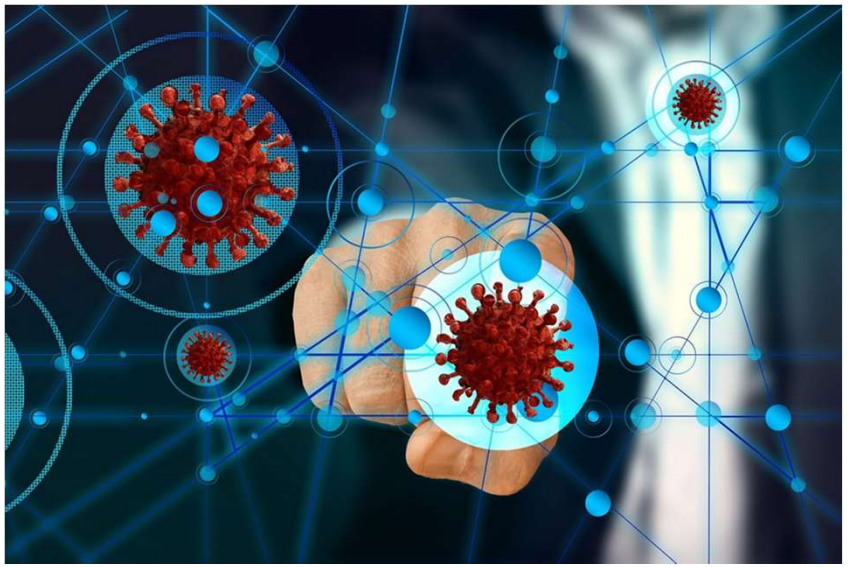
- **Client** - The Care and Maintenance manager, who reports directly to the government. They need accurate and timely data to manage the site and meet their own contractual requirements.
- **Stakeholders** - For the First Nations groups and local community the mines remediation has a potentially massive impact. The public wants to know they are protected through all phases of the project.
- **Regulators**
  - Site is regulated territorially through the water license process (which defines site activities related to water taking and discharge) and the conditions from the environmental impact assessment filed with the Mackenzie Valley Water Board
  - Metal and Diamond Mine Effluent Regulation is applied to the monitoring requirements and discharges at site.

A Unique Level of Review

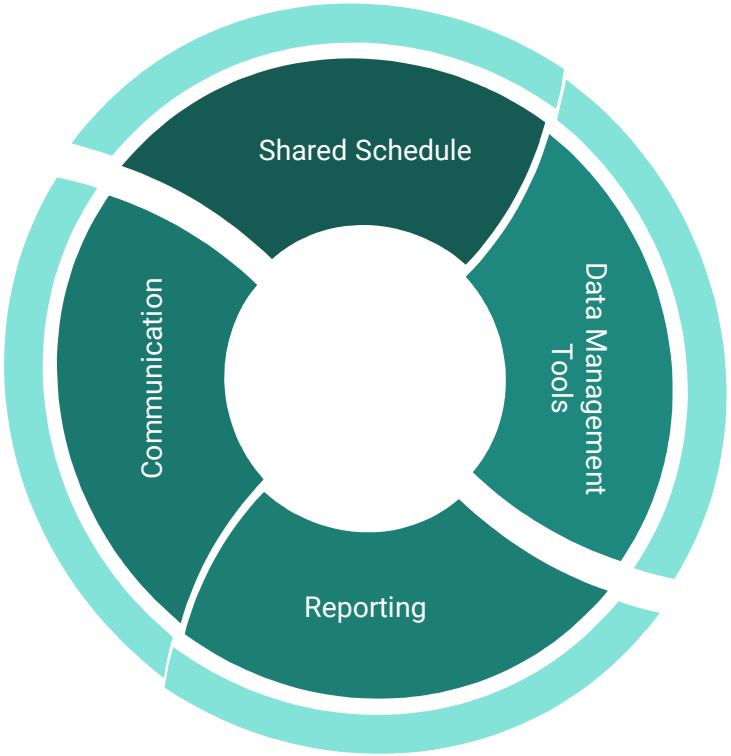
- New project setup the year we took over the monitoring duties at site.
- As a result, all data was scrutinized on a daily, weekly, and monthly schedule on a line by line basis.
- Data was verified by multiple consultants, regulators and stakeholders at each stage in the process, including daily, weekly and monthly reporting.

…and a Pandemic

- Lag time on equipment and laboratory testing was significant due to flight interruptions (and our timelines don't change)
- Site activities are limited, due to personal contact and exposure rules (e.g cannot have two staff in a single truck).
- Meetings and collaboration could not proceed as normal.



How do we balance these challenges?



Our Needs

- To track ongoing site activities internally and communicate the schedule externally.
- A way to import and review field data remotely on the same day
- A way to manage our environmental data, including legacy historical information, laboratory information and field data.

Our Selected Tools

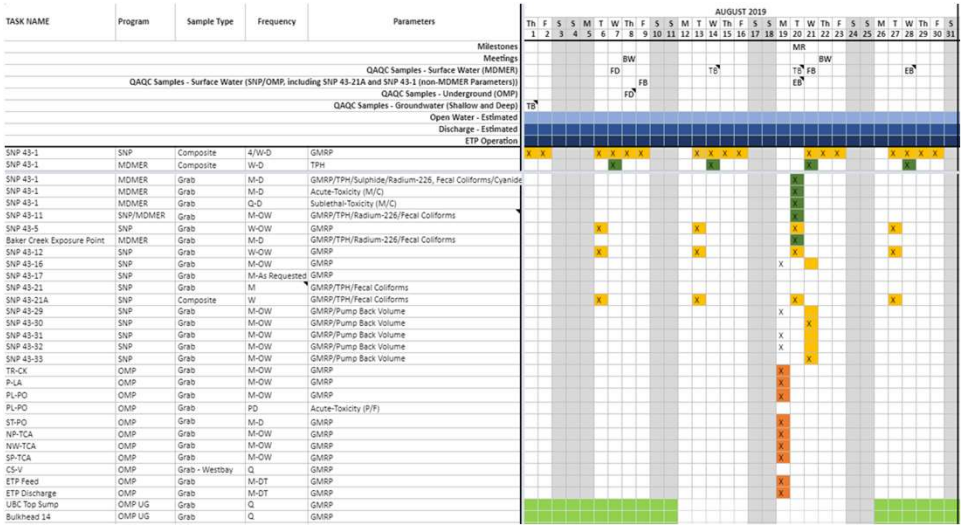
- **pLog Software**
  - Cloud Based Environmental Digital Data Collection Tool (Soil, Sed, GW, SW, and Air).
  - Field Data Input syncs directly with ESdat
- **ESdat Database Management**
  - Cloud Based Environmental Data Management Platform (Soil, Sed, GW, SW, and Air).
  - Imports historical and current laboratory and field data
  - Customized outputs & trigger notifications
- **Google Productivity Suite**
  - Information tracking and client communication
  - Automated daily reporting

Scheduling: The Challenge

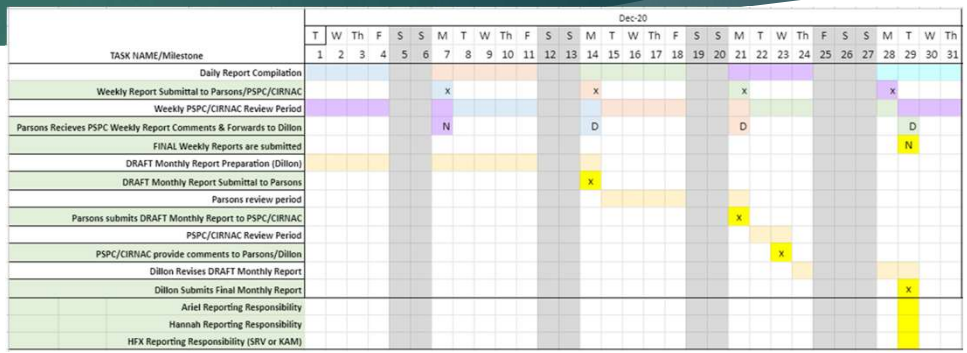
- Lots of schedule tools available (MS project, etc.)
- Generally access to advanced schedule software is limited for both consultants and clients.
- This results in an immovable PDF schedule that isn't accurate or up to date
- The site manager needs accurate schedule information for site management and to ensure we are doing our job, and we need accurate information to complete the work

Scheduling: The Two Part Solution

- A tool everyone has access too!
- Gantt chart schedule recreated in Google Sheets



TASK NAME	Program	Sample Type	Frequency	Parameters
Milestones				
Meetings				
QAQC Samples - Surface Water (MDMER)				
QAQC Samples - Surface Water (SNP/OMP, including SNP 43-21A and SNP 43-1 (non-MDMER Parameters))				
QAQC Samples - Underground (OMP)				
QAQC Samples - Groundwater (Shallow and Deep)				
Open Water - Estimated				
Discharge - Estimated				
ETP Operation				
SNP 43-1	SNP	Composite	4/W-D	GMRP
SNP 43-1	MDMER	Composite	W-D	TPH
SNP 43-1	MDMER	Grab	M-D	GMRP/TPH/Sulphide/Radium-226, Fecal Coliforms/Cyanide
SNP 43-1	MDMER	Grab	M-D	Acute-Toxicity (M/C)
SNP 43-1	MDMER	Grab	Q-D	Sublethal-Toxicity (M/C)
SNP 43-11	SNP/MDMER	Grab	M-OW	GMRP/TPH/Radium-226/Fecal Coliforms
SNP 43-5	SNP	Grab	W-OW	GMRP
Baker Creek Exposure Point	MDMER	Grab	M-D	GMRP/TPH/Radium-226/Fecal Coliforms
SNP 43-12	SNP	Grab	W-OW	GMRP
SNP 43-16	SNP	Grab	M-OW	GMRP
SNP 43-17	SNP	Grab	M-As Requested	GMRP
SNP 43-21	SNP	Grab	M	GMRP/TPH/Fecal Coliforms
SNP 43-21A	SNP	Composite	W	GMRP/TPH/Fecal Coliforms
SNP 43-29	SNP	Grab	M-OW	GMRP/Pump Back Volume
SNP 43-30	SNP	Grab	M-OW	GMRP/Pump Back Volume
SNP 43-31	SNP	Grab	M-OW	GMRP/Pump Back Volume
SNP 43-32	SNP	Grab	M-OW	GMRP/Pump Back Volume
SNP 43-33	SNP	Grab	M-OW	GMRP/Pump Back Volume
TR-CK	OMP	Grab	M-OW	GMRP
P-LA	OMP	Grab	M-OW	GMRP
PL-PO	OMP	Grab	M-OW	GMRP
PL-PO	OMP	Grab	PD	Acute-Toxicity (P/F)
ST-PO	OMP	Grab	M-D	GMRP
NP-TCA	OMP	Grab	M-OW	GMRP
NW-TCA	OMP	Grab	M-OW	GMRP
SP-TCA	OMP	Grab	M-OW	GMRP
CS-V	OMP	Grab - Westbay	Q	GMRP
ETP Feed	OMP	Grab	M-DT	GMRP
ETP Discharge	OMP	Grab	M-DT	GMRP
UBC Top Sump	OMP UG	Grab	Q	GMRP
Bulkhead 14	OMP UG	Grab	Q	GMRP



TASK NAME/Milestone	Dec-20
Daily Report Compilation	
Weekly Report Submittal to Parsons/PSPC/CIRNAC	x x x
Weekly PSPC/CIRNAC Review Period	
Parsons Recieves PSPC Weekly Report Comments & Forwards to Dillon	N D D D
FINAL Weekly Reports are submitted	N
DRAFT Monthly Report Preparation (Dillon)	
DRAFT Monthly Report Submittal to Parsons	x
Parsons review period	
Parsons submits DRAFT Monthly Report to PSPC/CIRNAC	x
PSPC/CIRNAC Review Period	
PSPC/CIRNAC provide comments to Parsons/Dillon	x
Dillon Revises DRAFT Monthly Report	
Dillon Submits Final Monthly Report	x
Ariel Reporting Responsibility	
Hannah Reporting Responsibility	
HFX Reporting Responsibility (SRV or KAM)	

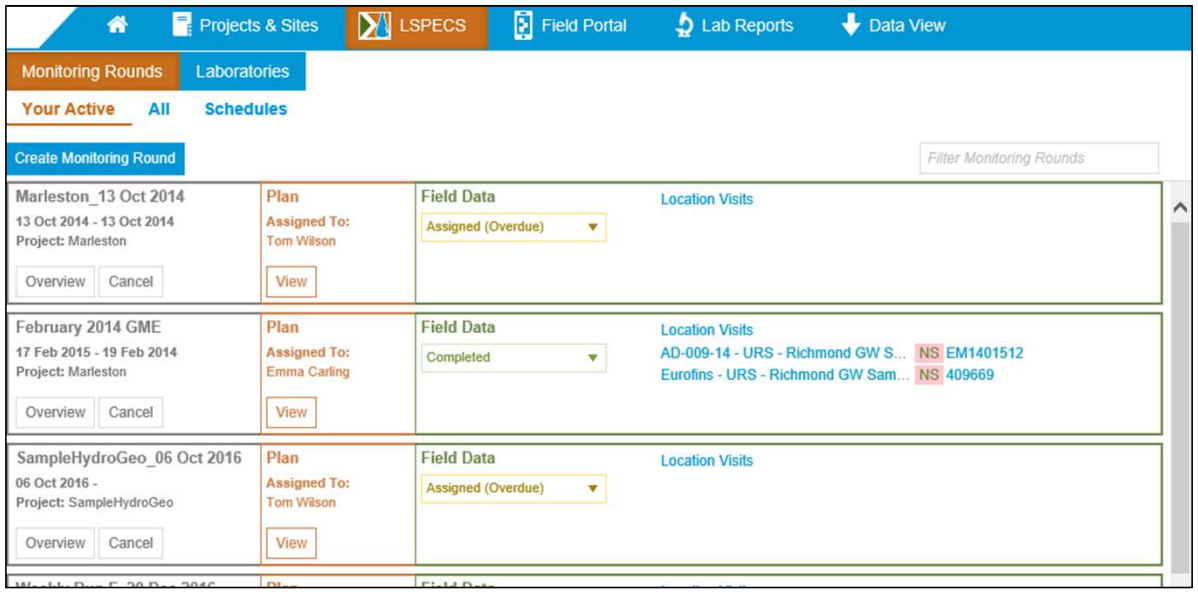
- Separate schedule for sample scheduling and deliverables.
- Accessible by staff, clients and their clients.
- Updatable in the field via tablets or browser

Slide 11

1 Picture of sample schedule.
-Morgan Schauerte
, 5/27/2021

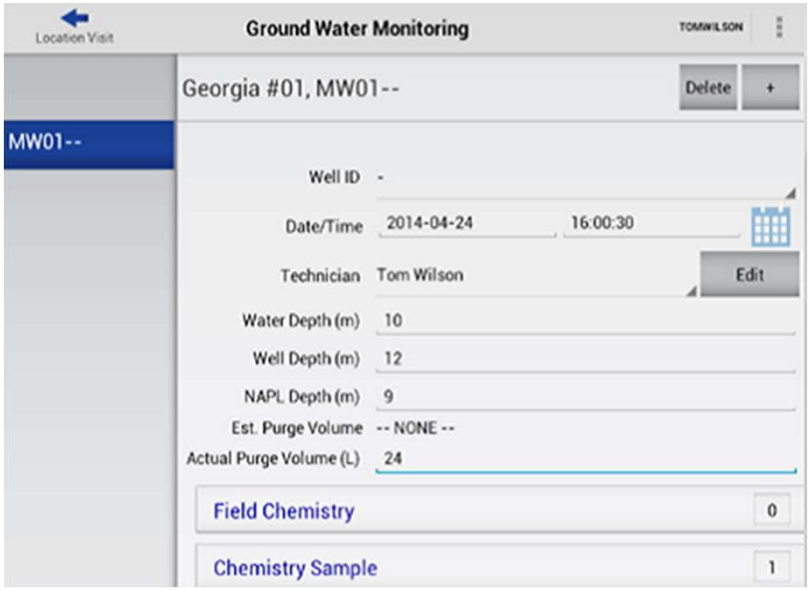
Scheduling: The Two Part Solution

- For specific field scheduling, the information from the Schedule Sheet was used to input field sampling schedules in Esdat.
- These schedules allowed staff to know upcoming samples, what parameters may be required and generally account for evolving conditions.



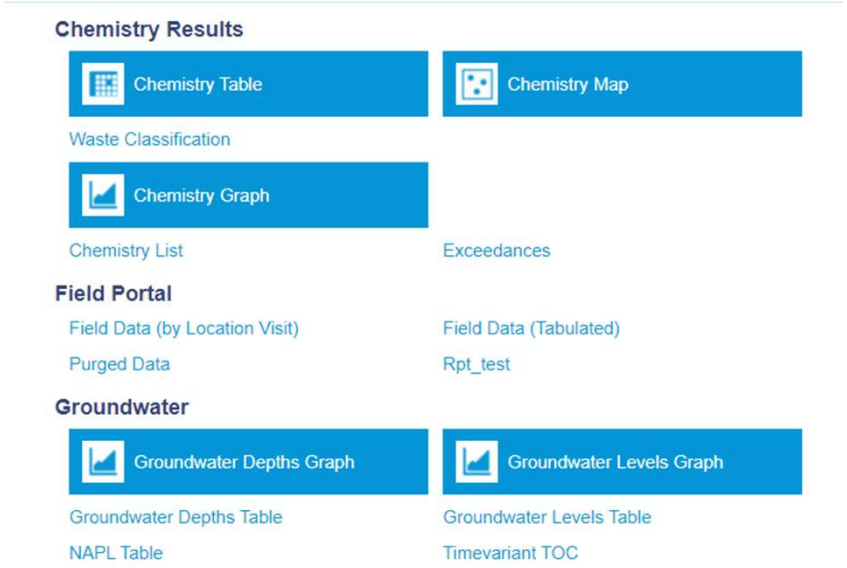
Field Data

- PLog is an offline tool for collecting field data related to soil, sediment, air surface water or groundwater samples.
- It operates fully offline and syncs back to ESdat on user demand.
- PLog allows collection of all sampling attributes, including laboratory analysis suites, containers and QA sample types.
- We used this system for two years at the Giant Mine.



Database Management

- ESdat is an environmental database system used to import, validate and analyse a broad spectrum of Environmental Data
- Users can import a broad range of data types including historical and current soil, sediment, groundwater, surface water and/or air data.
- Users can view and report data as exceedance tables, graphs, maps, statistics and more.
- Trigger notifications can be set up to alert users by email if a guideline or baseline range has been exceeded.
- Note: We do not have a stake in Esdat, it has just been useful for us.



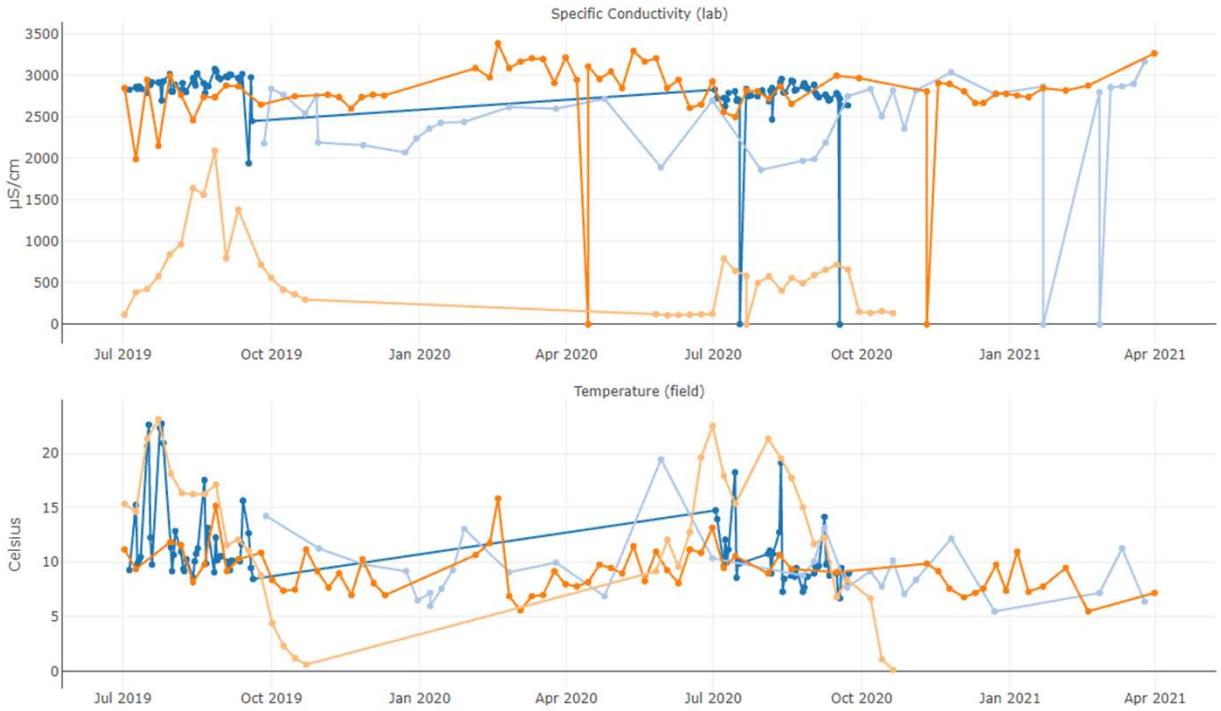
Chemistry Summary Tables

Chem Profile ▾ | Env Standards ▾ | Sample Information ▾ | Statistics ▾ | Results ▾ | Excel Export ▾

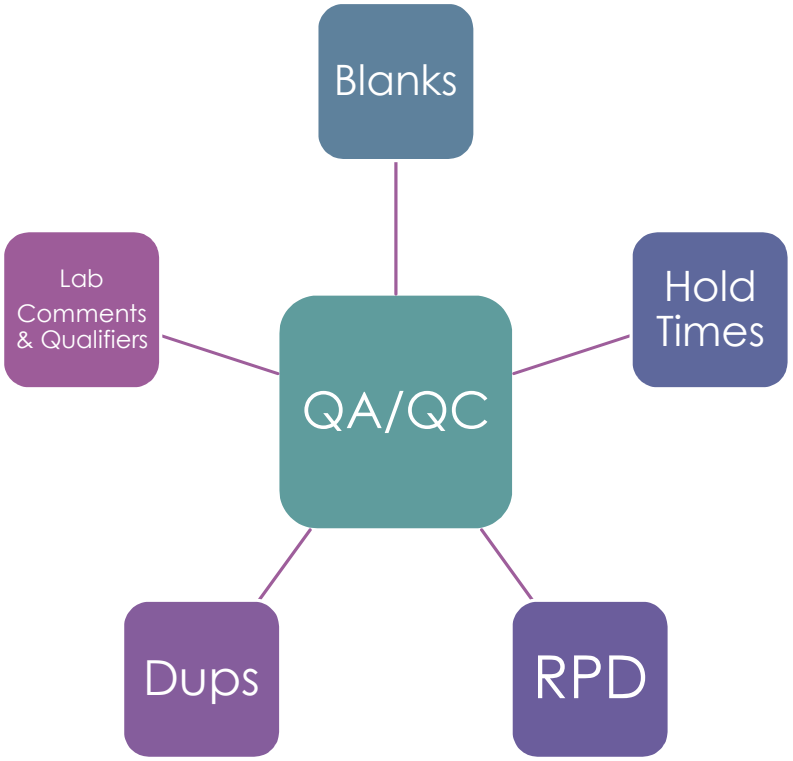
				Conventional (Routine) Parameters										Major Ions					
				pH (Lab)	Specific Conductivity (lab)	Hardness as CaCO3 (Measured)	Hardness as CaCO3 (Measured) (filtered)	Alkalinity (total)	Alkalinity (Bicarbonate as CaCO3)	Alkalinity (Carbonate as CaCO3)	Total Dissolved Solids (TDS) - Measured	Total Suspended Solids (TSS)	Total Organic Carbon (TOC)	Dissolved Organic Carbon (filtered)	Turbidity (Lab)	Bromide	Calcium	Calcium (filtered)	Chloride (filtered)	Fluoride	Magnesium
Environmental Standards				pH Units	µS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	NTU	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
EQL				0.1	1	10	10	1	1	1	15	1	0.5	0.5	0.1	0.25	10	10	2.5	0.1	1
Giant Mine Effluent Quality Criteria: Maximu...				6.5-8.5								15							660		
Giant Mine Effluent Quality Criteria: Maximu...				6.5-8.5								30							720		
Lab Report N...	Field ID	Date																			
YL2100200	GM-2021-511...	2021-03-23		5.77	4410	3460	3350	200	200	<1.0	12200	14.7	8.07	7.34	2.12	<1.00 DLDS	590	558	94.8	<0.400 DLDS	482
YL2100200	GM-2021-511...	2021-03-23		6.90	976	535	508	210	210	<1.0	1080	14.5	6.92	6.26	4.05	<0.250 DLDS	132	124	16.0	0.114	49.9
YL2100200	GM-2021-511...	2021-03-23		6.73	1160	661	653	160	160	<1.0	1180	1.3	8.62	8.45	0.90	0.350	158	157	43.2	0.123	64.7
YL2100200	GM-2021-511...	2021-03-23		5.94	3230	2360	2360	265	265	<1.0	8740	12.3	8.44	8.65	1.01	1.10	611	615	117	<0.400 DLDS	204
YL2100200	GM-2021-511...	2021-03-23		3.44	3460	2260	2340	<1.0	<1.0	<1.0	10300	18.1	9.73	9.25	1.96	1.80	618	632	154	<0.400 DLDS	175
Statistics																					
Number of Results				5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Number of Detects				5	5	5	5	4	4	0	5	5	5	5	5	3	5	5	5	2	5
Minimum Concentration				3.44	976	535	508	<1	<1	<1	1080	1.3	6.92	6.26	0.9	<0.25	132	124	16	0.114	49.9
Maximum Concentration				6.9	4410	3460	3350	265	265	<1	12200	18.1	9.73	9.25	4.05	1.8	618	632	154	<0.4	482

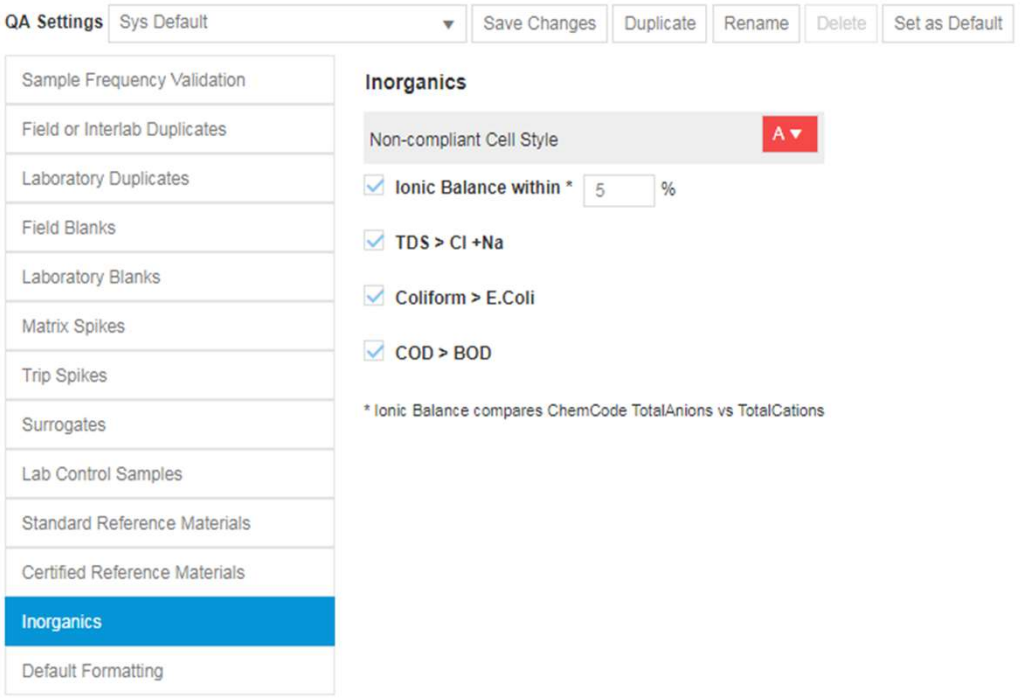
Graphing

- Users can easily navigate from the chemistry table view to a graph view to look for seasonal trends & outliers
- Further trend analysis can be completed by exporting the data to various data analysis applications such as ProUCL.



QA/QC


Blanks
Lab Comments & Qualifiers
Hold Times
QA/QC
Dups
RPD


QA Settings
Sys Default
Save Changes
Duplicate
Rename
Delete
Set as Default
Sample Frequency Validation
Field or Interlab Duplicates
Laboratory Duplicates
Field Blanks
Laboratory Blanks
Matrix Spikes
Trip Spikes
Surrogates
Lab Control Samples
Standard Reference Materials
Certified Reference Materials
Inorganics
Default Formatting
Inorganics
Non-compliant Cell Style
A
Ionic Balance within *
5
%
TDS > Cl +Na
Coliform > E.Coli
COD > BOD
* Ionic Balance compares ChemCode TotalAnions vs TotalCations

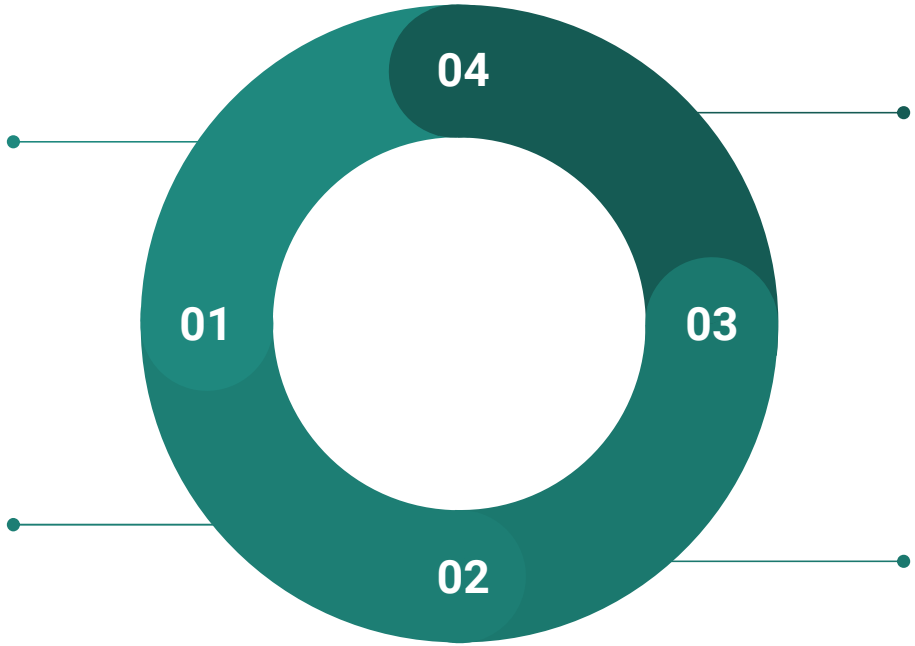
Our Workflow

Scheduling

Collaborative spreadsheet for general scheduling, P-Log specific schedule integrated with ESdat..

Field Input and Management

Field parameters, pictures and reporting are recorded, uploaded and managed.



Notices and Reporting

Any exceedances, upwards trending or outliers compared to historical data are provided via email to relevant staff. Daily/Weekly/Monthly reporting tables are autogenerated to an 85% standard. Staff complete there rest

Database Management

Information is received digitally from the laboratory, imported and compared to relevant historical trends, standards and site specific discharge criteria.

Reporting

- Information from collected in the field from P-Log is automatically put into weekly and daily report formats
- This auto-generation helps transcription errors, but importantly, allows the fast consistent generation of status reports for clients.

Dillon Weekly Consultant Report

Project Name: Giant Mine Remediation Project
Project No.: 19-9803
Contract No.: 476721-90016.00
Date: September 13- 19, 2020
Dillon Personn Ariel Greenblat
Other Personn Dwayne Bavard

Equipment Used:
Multimeter
Nitrile gloves
Calibration solution
Velocity meter
Westbay Equipment

General Site Comments:
No reportable incidents or animal sightings.
Dillon completed calibration of meters, records of calibration are appended to this report.

Location Visits:

Locations:	Sample Date:	Weather:	Sampled By:	Comments:
CS-V	09/14/2020 3:15 PM	Sunny 8 deg C	Ariel Greenblat	Visited to collect 1650L
SNP 43-21A	09/15/2020 12:30 PM	Sunny 0 deg C	Ariel Greenblat	
SNP 43-1	09/15/2020 12:45 PM	Sunny 0 deg C	Ariel Greenblat	
SNP 43-12	09/15/2020 1:15 PM	Sunny 0 deg C	Ariel Greenblat	
SNP 43-5	09/15/2020 1:30 PM	Sunny 0 deg C	Ariel Greenblat	
SNP 43-23	09/15/2020 1:40 PM	Sunny 0 deg C	Ariel Greenblat	
ETP Discharge	09/15/2020 2:00 PM	Sunny 0 deg C	Ariel Greenblat	
ETP Feed	09/15/2020 2:15 PM	Sunny 0 deg C	Ariel Greenblat	
CS-V	09/15/2020 3:45 PM	Sunny 0 deg C	Ariel Greenblat	Visited to collect 1500L
SNP 43-1	09/16/2020 12:45 PM	Sunny 10 deg C	Ariel Greenblat	
CS-V	09/16/2020 2:15 PM	Sunny 10 deg C	Ariel Greenblat	Visited to collect 1250L & 1100L
CS-V	09/17/2020 1:00 PM	Sunny 6 deg C	Ariel Greenblat	Visitied to collect 950L & 750L
SNP 43-1	09/17/2020 11:30 AM	Sunny 6 deg C	Ariel Greenblat	
SNP 43-1	09/18/2020 11:15 AM	Sunny 10 deg C	Ariel Greenblat	

Exceedances, Trending, and Alerts

The following results were outside the historical confidence ranges.

Site ID	Location Code	Well	Matrix Type	Chem Name	Result	Units	Historical Range	LCL - UCL*	Result Count
Giant Mine	SNP 43-21A	-	water	Hardness as CaCO3 (Measured)	1300	mg/L	1200 - 1210	1.2E+03 - 1.21E+03	4
Giant Mine	SNP 43-21A	-	water	Hardness as CaCO3 (Measured)	1430	mg/L	1200 - 1210	1.2E+03 - 1.21E+03	4
Giant Mine	SNP 43-21A	-	water	Calcium	358	mg/L	323 - 341	323 - 341	4
Giant Mine	SNP 43-21A	-	water	Calcium	408	mg/L	323 - 341	323 - 341	4
Giant Mine	SNP 43-21A	-	water	Zinc	0.0615	mg/L	0.0668 - 0.0743	0.0668 - 0.0743	4
Giant Mine	SNP 43-21A	-	water	Zinc	0.0855	mg/L	0.0668 - 0.0743	0.0668 - 0.0743	4
Giant Mine	SNP 43-21A	-	water	Cobalt	0.0404	mg/L	0.0375 - 0.0401	0.0375 - 0.0401	4
Giant Mine	SNP 43-21A	-	water	Cobalt	0.0408	mg/L	0.0375 - 0.0401	0.0375 - 0.0401	4
Giant Mine	SNP 43-21A	-	water	Copper	0.00421	mg/L	0.0025 - 0.00374	0.0025 - 0.00374	4
Giant Mine	SNP 43-21A	-	water	Boron	0.336	mg/L	0.282 - 0.316	0.282 - 0.316	4
Giant Mine	SNP 43-21A	-	water	Boron	0.362	mg/L	0.282 - 0.316	0.282 - 0.316	4
Giant Mine	SNP 43-21A	-	water	Cadmium	0.000322	mg/L	0.000259 - 0.00032	0.000259 - 0.00032	4
Giant Mine	SNP 43-21A	-	water	Cesium	0.000618	mg/L	0.000544 - 0.000606	0.000544 - 0.000606	4
Giant Mine	SNP 43-21A	-	water	Arsenic	34.5	mg/L	27.9 - 31.8	27.9 - 31.8	4
Giant Mine	SNP 43-21A	-	water	Arsenic	35.9	mg/L	27.9 - 31.8	27.9 - 31.8	4
Giant Mine	SNP 43-21A	-	water	Barium	0.0424	mg/L	0.0382 - 0.0417	0.0382 - 0.0417	4
Giant Mine	SNP 43-21A	-	water	Barium	0.0427	mg/L	0.0382 - 0.0417	0.0382 - 0.0417	4
Giant Mine	SNP 43-21A	-	water	Tungsten	0.00103	mg/L	0.0005 - 0.0005	0.0005 - 0.0005	4

Why is this so exciting?

- Information from collected in the field from P-Log is automatically put into weekly and daily report formats - Saving time and increasing accuracy.
- Immediate notice as soon as laboratory information is received - Notices, exceedances and trends are immediately provided to the PM
- Staff can see live field data as soon as it is uploaded

Lessons Learned

- New systems are hard to implement if the project has a short kickoff. While the systems paid off greatly after several months, getting everyone up to speed was difficult.
- Limited to local staffing, can't fly up more staff for busy periods. Far out scheduling allowed us to account for these issues, but still fundamentally hard to complete during a pandemic.

Lessons Learned

- Transcription errors are far more endemic than industry thinks, and databases and digital upload are key for reducing this error.
- Laboratory errors are far easier to identify with quick notice of errors, and applicable site history available in database format.
- The knowledge that automatic notice will be provided to me via email helped me sleep.

Closing

Questions?