The "Site of Things": Remediation in the Information Age-18088

Jeff Albee*, Robert Berger*, Everett Wesner* and Matthew Lee**
*Wood Environment and Infrastructure
** iVolve Inc.

Abstract

More than just a payload, machines now haul data as well.

Wood Environment and Infrastructure's maiden voyage into civil engineering automation at the Port Granby Project Long-Term Waste Management Facility demonstrated enormous potential for the remediation industry. The Port Granby Project will relocate approximately 450,000 cubic meters of historic low-level radioactive waste and marginally contaminated soils, located at an existing waste management facility on the shoreline of Lake Ontario, to a new, engineered aboveground mound to be built about a kilometer north of the current site.

Sounds simple, right? Just move a bunch of dirt up the road? Hardly, this is marginally contaminated soil situated near Lake Ontario in a beautiful little village an hour east of Toronto. We must relocate safely, meaning limiting the number of staff in the field and efficiently to deliver according to our agreed upon budget and schedule. As if that wasn't enough we were asked to keep track of where each truckload of dirt was excavated from (with a high degree of accuracy), where it was placed in the new engineered disposal facility, how much it weighed and the amount of radioactivity in each load…a virtual chain of custody for each load.

Presented is an overview of the Information Technology that supports the Port Granby Project and how the Data Management System (DMS) is being leveraged to make the project safer, more effective and efficient.

Figure 2: Port Granby, Ontario.

INTRODUCTION

The Port Hope Area Initiative (PHAI) is a community-based solution for the long-term management of historic low level radioactive waste (LLRW) resulting from 60 years of uranium and radium processing operations in the Town of Port Hope, Ontario. The Port Hope Area Initiative's Port Granby Project involves the construction of a new, secure long-term waste management facility (LTWMF) and supporting infrastructure, and the excavation and relocation of some 450,000 m^3 of LLRW and marginally contaminated soil from the former Port Granby Waste Management Facility (PGWMF) to the newly constructed LTWMF. (Figure 1).

The Project is governed under a license, granted by the Canadian Nuclear Safety Commission (CNSC), which is founded on recommendations of an Environmental Assessment Screening Report (EA) completed between 2001 and 2009 (2). The EA involved numerous studies designed to evaluate the potential impact of the project on the natural environment and included recommendations for measures to be taken to protect health, safety, security, and the environment. These measures and the means for their implementation have been described in general terms in a series of procedural documents prepared by the Port Hope Area Initiative Management Office. However, prior to project execution, it is imperative that the policies and procedures are established by the contractor to meet the contractual obligations inclusive of the measures to be implemented to ensuring, the protection of health, safety, security, and the environment

Simplistically the DMS includes hardware and software that interface with the Heavy Equipment, site instrumentation and the internet to collect and report activity onsite. As part of the overall remediation effort There are strict reporting requirements for a range of activities related to the physical relocation of soil and environmental conditions. Distilling the range of reporting requirements down we landed on the following key data elements that the system should capture:

- Truck ID
- Weigher ID
- Date/Time (required for: scale and portal monitor reading in each direction; nice-to-have for: load time and dump time)
- Waste type (LLRW, MCS, Incidental, Oversized)
- Radioactive values (empty measurement, loaded measurement and NET)
- Weight values (tare mass and loaded mass)
- Waste source location
- Waste dump location
- Load level / Depth of material on truck (from RSI) = bed fill height measurement – to calculate load volumes (in iVolve / or DMS?) for Weigh scale log

Collecting the above data elements allowed project staff to create reports that would satisfy internal and external reporting requirements such as:

- Weigh scale log (by truck)
- Portal monitor log (by truck)
- Chain of custody log (by load)

- Daily/weekly/monthly Waste Reports with specific requirements to provide:
  - Materials and quantities excavated
  - Materials and quantities placed within the mound / Daily summary of each type of waste materials placed
  - Net weight of material placed in the containment mound
  - Truck counts
  - Net radiological values from portal monitor of material placed within the Containment Mound
  - Location of placement of material within the Containment Mound

With the basic data capture elements defined we began to explore other uses for this data including optimization, efficiency, safety, performance and real-time tracking. When studied the data could give us clues on how to execute the job better.

THE DATA MANAGEMENT SYSTEM

The Port Granby Data Management System (DMS) was built to support the workflow onsite and refined to not hinder production when fully operational. The DMS manages a virtual "chain-of custody" for every haul cycle from the Southern Site where waste is excavated to the Northern Site where waste is dumped for storage.

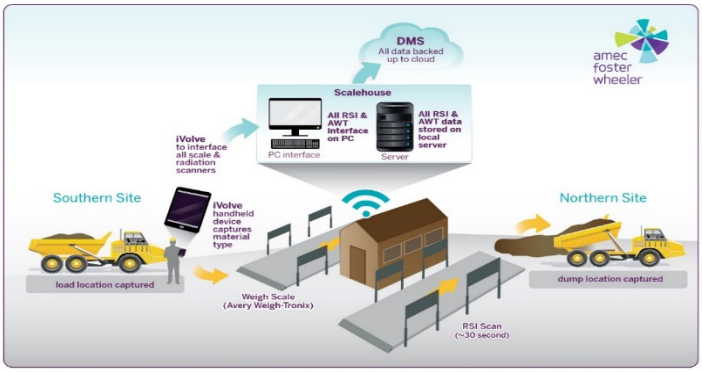

Figure 2: Data Flow at the Port Granby LTWMF.

At the heart of the system is an onboard computing platform responsible for communicating with its host machine to receive and record data. The machines swap production data including time and location in real-time. In addition to integrated GPS, it has communications interfaces including Wi-Fi, Ethernet, CANBus, RS232, RS485 and digital I/O to interface with the Avery Weigh-Tronix weigh scales and a Radiation Solutions Inc. monitoring and detection system.

Figure 3- Haul cycle begins with the excavator loading a dump truck.

Figure 4- Onboard iVolve computing platform.

When the machines pick-up a Wi-Fi signal from the centrally located scalehouse, data is transferred to the project's data management system (DMS) in Amazon's cloud computing environment.

Figure 6- Trucks constantly broadcast signals to constantly exchange data.

As the trucks pass both north & south across the site they pass a "scalehouse" where they are weighed and RAD scanned simultaneously, a process that takes about 30 seconds. Trucks are weighed both full and empty to ensure that the data record contains the weight of the media only. RAD counts are associated with each haul cycle and flagged if they are out of a range specified by the project.

Figure 5 - Trucks are weighed and scanned simultaneously, with data records being captured at the scalehouse.

.

Figure 7 – RAD scans are performed from above, targeting the soil in the truck bed below.

The scalehouse is the nerve-center of the operation, providing a Wi-Fi-signal that allows the data recorded by the iVolve system to be uploaded to the Amazon Cloud for storage, quality control and reporting.
Displays for the scales and the RAD scanners allow the operator to visually inspect the data being recorded in the system and insure the system captures a record for the event. The scalehouse operator uses a stop-light to hold the trucks in position as well as release them once the data record is complete.

TURNING DATA INTO INFORMATION

Trucks operating in the field constantly populate the Port Granby Data Management system and as of October of 2017 the system has recorded over 360,000 Metric Tons of waste. The virtual "chain-of-custody" data is the accessed by stakeholders through a custom portal equipped with a real-time map viewer to manage, query and generate reports. The data management system also includes a mobile format for on-site data collection using predeveloped forms, photos and site inspection applications. While still in the early stages the Port Granby Data Management system has proven to be very stable, provided the operators and scalehouse personnel have been properly trained. While designed to satisfy specific reporting requirement for the project the data collected from the system has been invaluable when analyzed for project efficiencies. Haul cycle data has been used for simple analysis such as operator efficiency all the way to the complex reporting on load volume correlated with site windspeed to reduce dispersion into the surrounding site & neighbourhood.

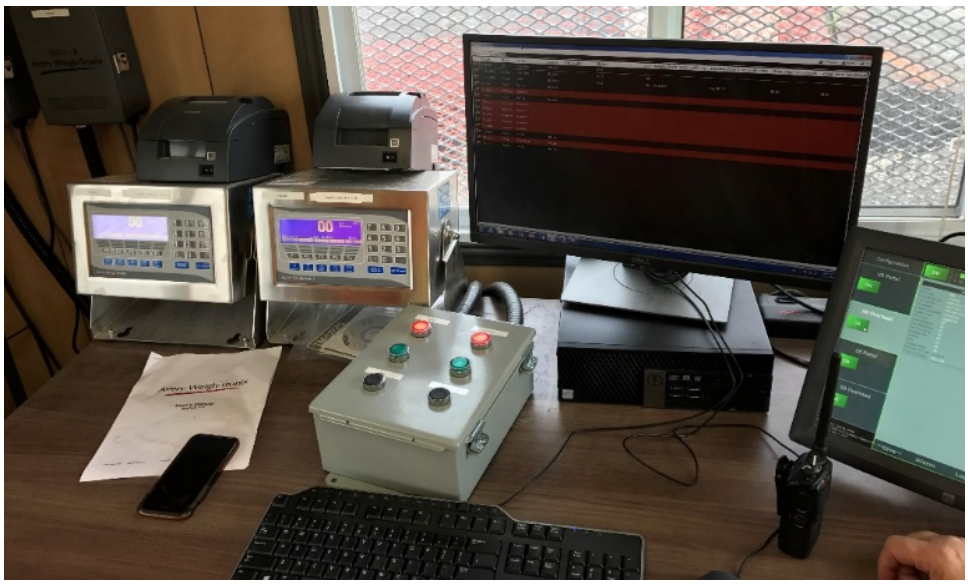

Figure 8 - Monitors in the scalehouse display the reading of the inbound & outbound trucks as they pass through the system.

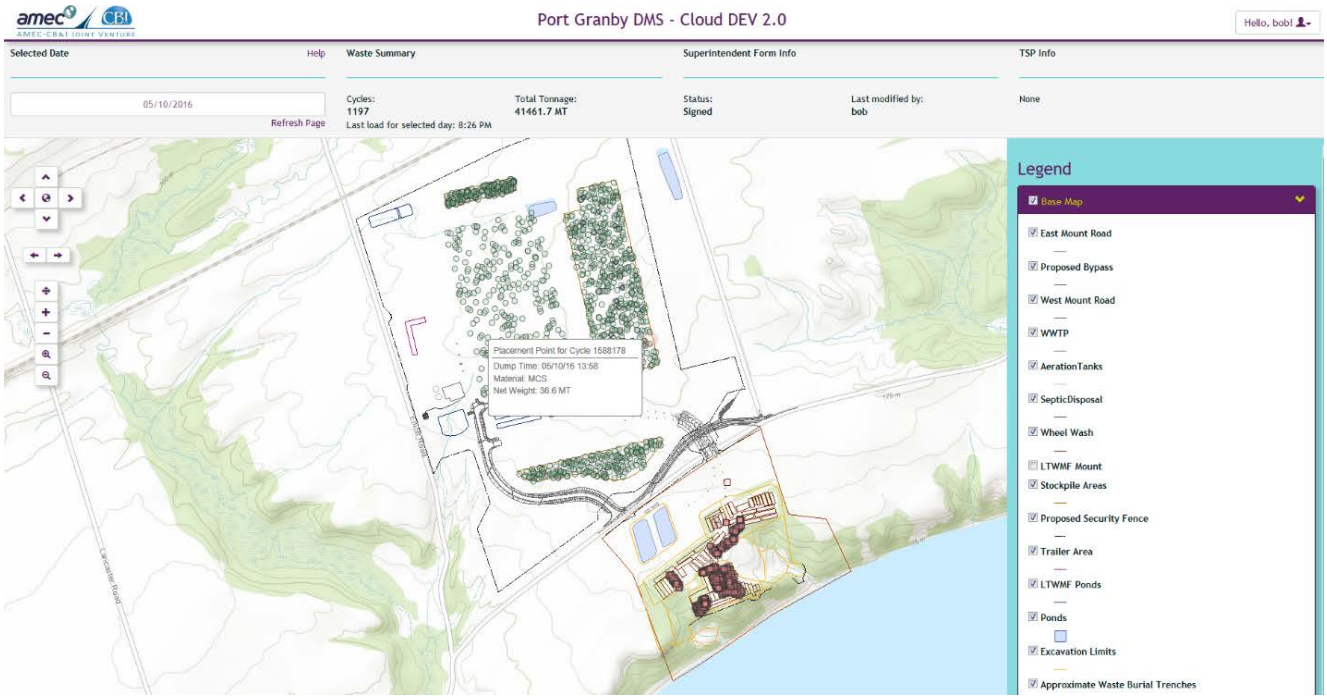

Figure 10 - Real-time dashboard to view trucks location onsite and the data being collected.

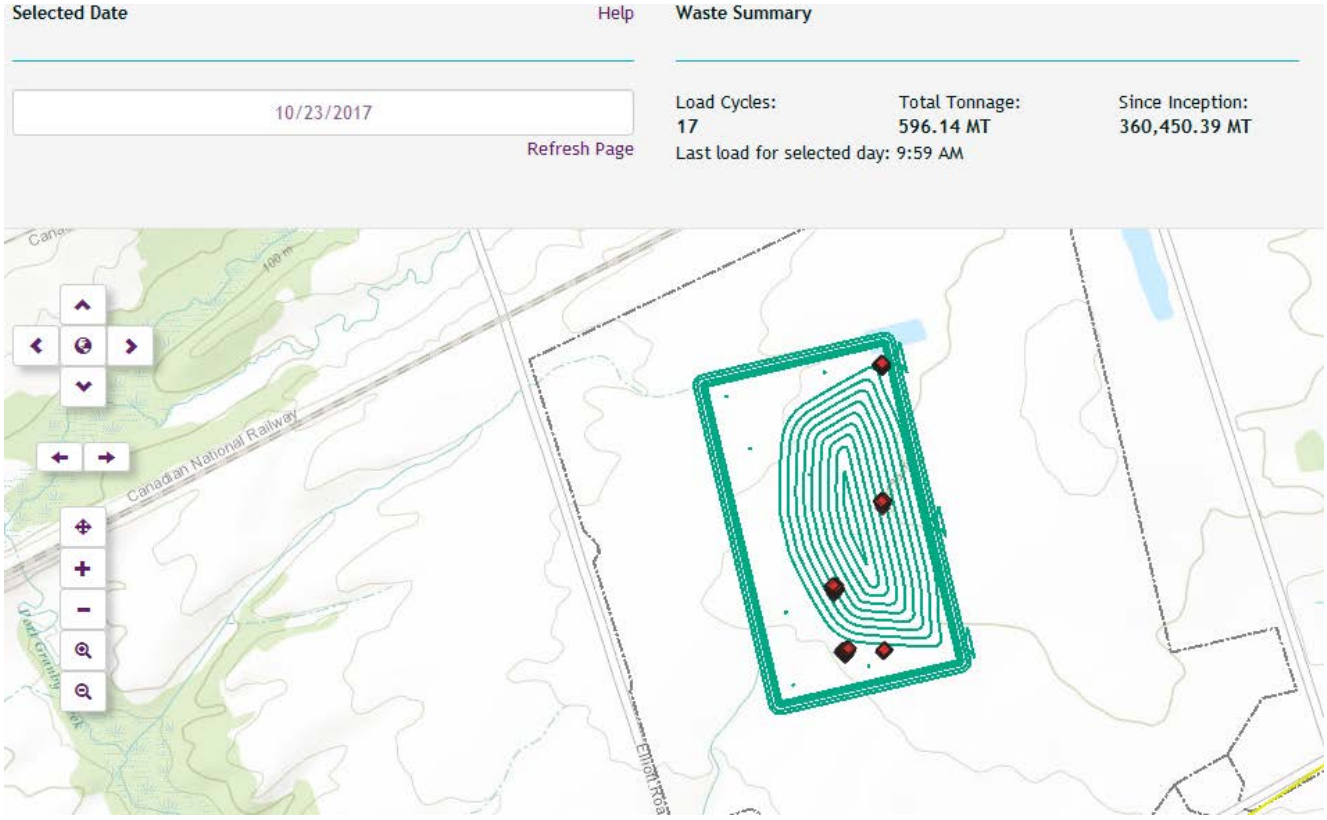

Figure 11 - Historic data can also be visualized related to source and destination of haul records.

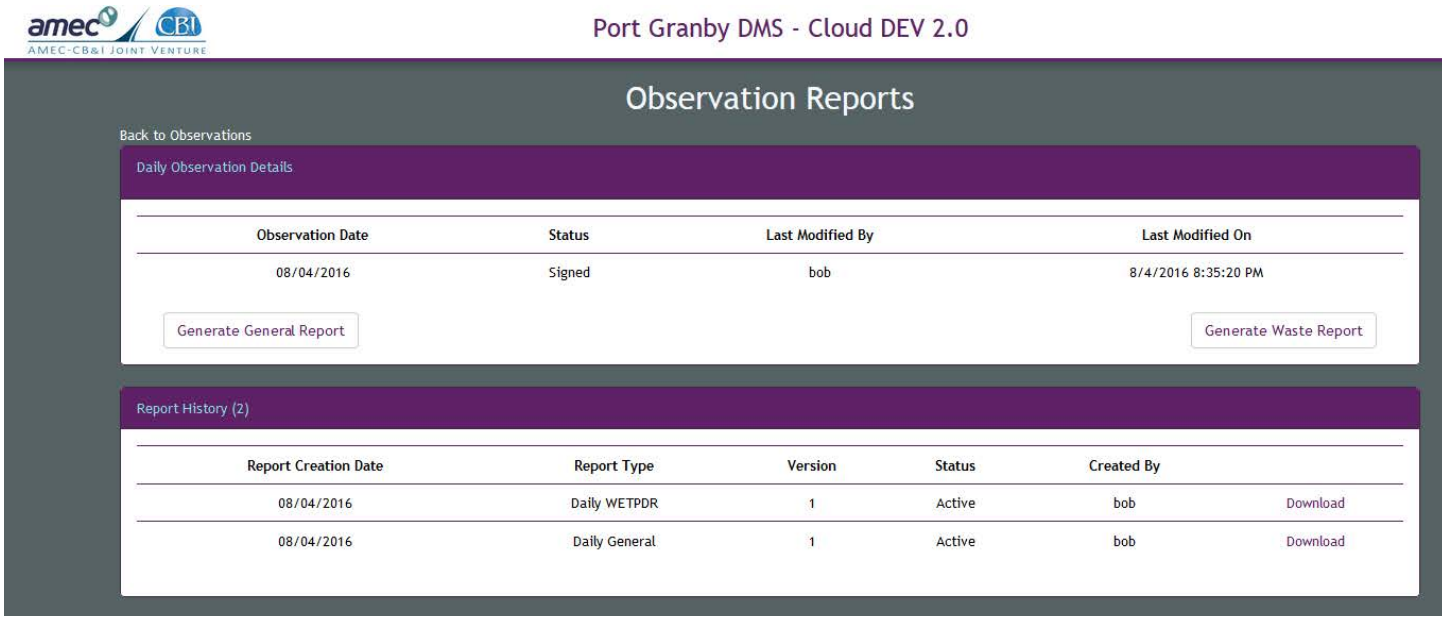

Figure 12 - Dailly, weekly and monthly reporting library can be accessed by users with the proper credentials.

SUMMARY

The Port Granby project is a complex undertaking involving the excavation and relocation of some 450,000 m^3 of LLRW and marginally contaminated soil from a series of historical disposal trenches located along the shores of Lake Ontario to a newly constructed, secure long-term waste management facility. To meet the reporting and compliance needs of the project we implemented a unique fleet tracking system to reduce the project risk, improve efficiency and streamline reporting. Overall cost for the system, including the hardware and customization remained well under $200k (USD) and has paid for itself in the first few months of operation, resulting in a ROI many times over throughout the life of the project. Leveraging the data collected to satisfy the project reporting requirements was the original goal, which was achieved. The unintended by-product of the wealth of data collected has been a benefit to the projects efficiency in measuring operator, environmental and overall site conditions. While still early in the process, through careful planning and an effective training program the system has proven to be extremely stable and should be expanded in functionality to include new data capture elements and similar project sites.

By the Numbers:

- 14 John Deere 410 E trucks
- Two John Deere 470 G LC excavators
- Currently hauling 6,000 – 7,000 tons a day
- System costs are approximately $10k per excavator, $6k per spotter, & $6k per truck (all USD, not including

support, excluding CAN bus connection).

- Each haul cycle takes approximately 15 minutes on average
- Each scan at the scalehouse takes approximately 30 seconds

Key Take-Aways:

- The future of civil engineering that is ready for primetime, it works!
- The system is expandable, almost any instrumentation can be added
- Rich data sets can optimize site performance
- Safer, more reliable and more efficient

REFERENCES

1. An Agreement for the Clean-up and Long-Term Safe Management of Low-Level Radioactive Waste Situate in the Town of Port Hope the township of Hope and the Municipality of Clarington 2001 (as amended 2006, 2009)
2. Government of Canada, Environmental Assessment Screening Report for the Port Granby Long-Term Low-Level Radioactive Waste Management Project, 2009 August.