Associated Environmental

CANADA BEST MANAGED COMPANIES

Platinum member

Pillar Point Valley Landfill Restoration

Reducing Leachate Production through Groundwater Management

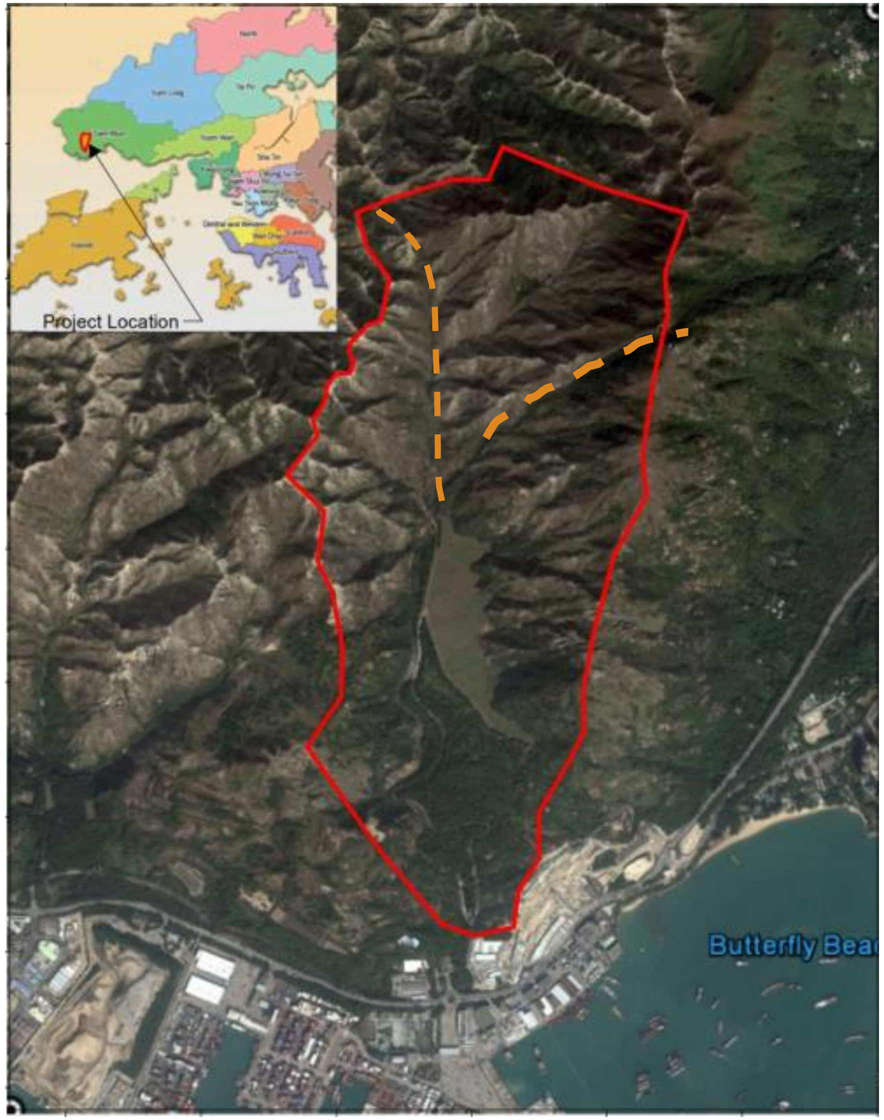
Neal Barretto, G.I.T
Jacques Groenewald, M.Sc., P.Geo.

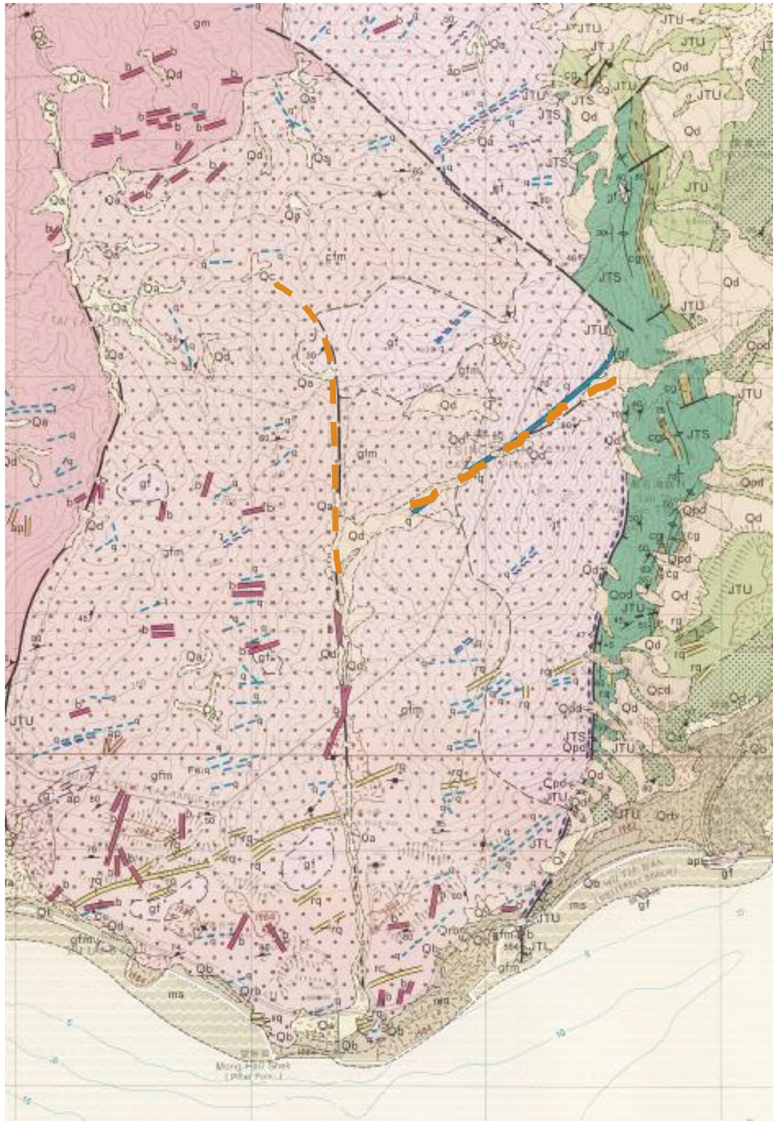
October, 2021

Outline

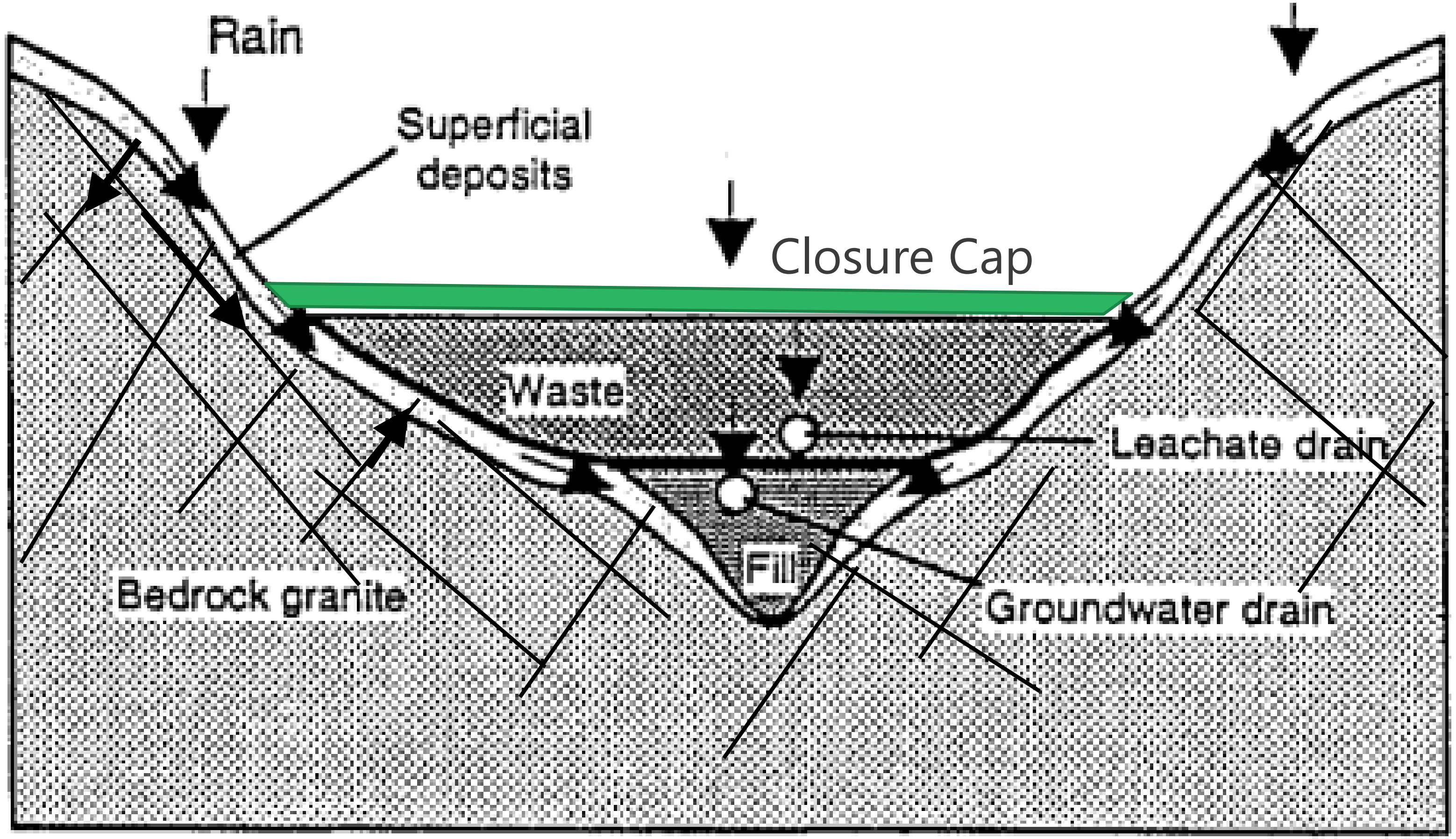
- Study Area
- Closure Challenges and Background Review
- Scope of Work
- Monitoring Data
- Challenges and Takeaways

Study Area



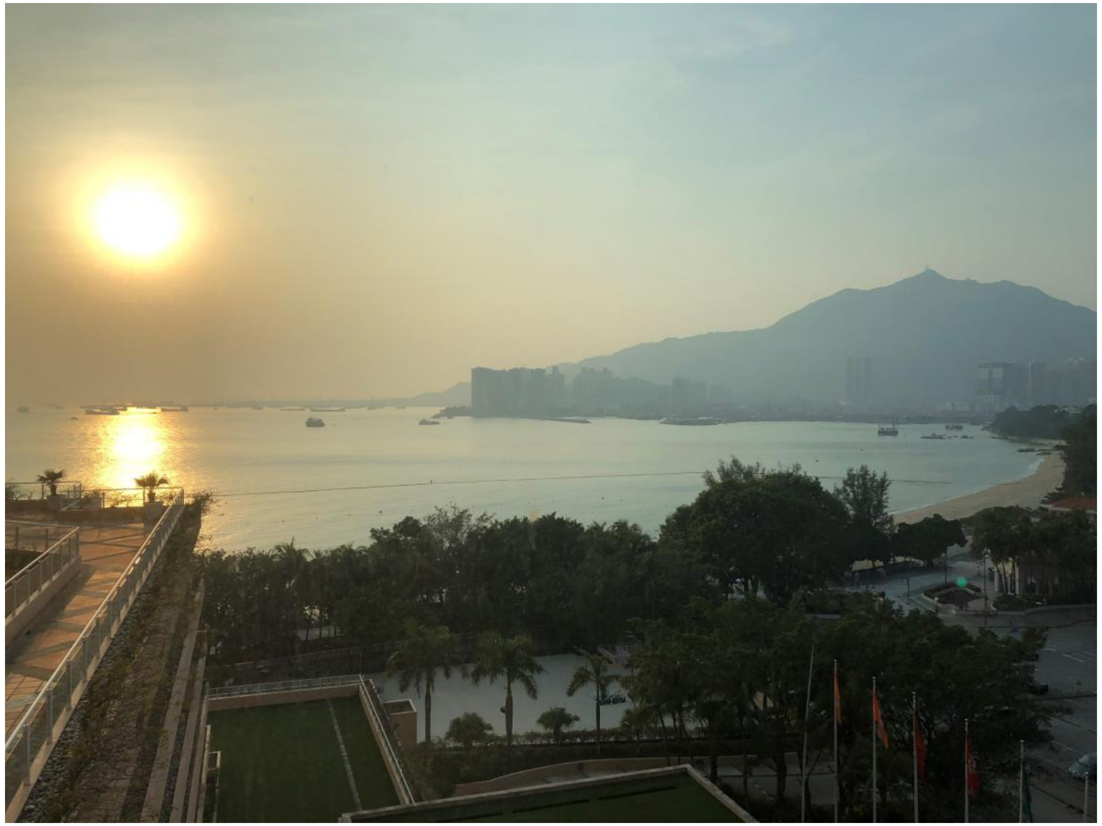


Landfill Original Design Cross Section



Closure Challenges

- Breached cap
- Leaking groundwater protection liner
- Main contaminant of concern: Ammonia and to lesser extent Chloride
- Treatment using heat stripping
- High diesel costs associated with the treatment as well as air contamination
- System not designed to handle high volumes and additional costs incurred to transport fluid to other landfills adding to the carbon footprint
- High storm/rainfall events.



Phased Scope of work

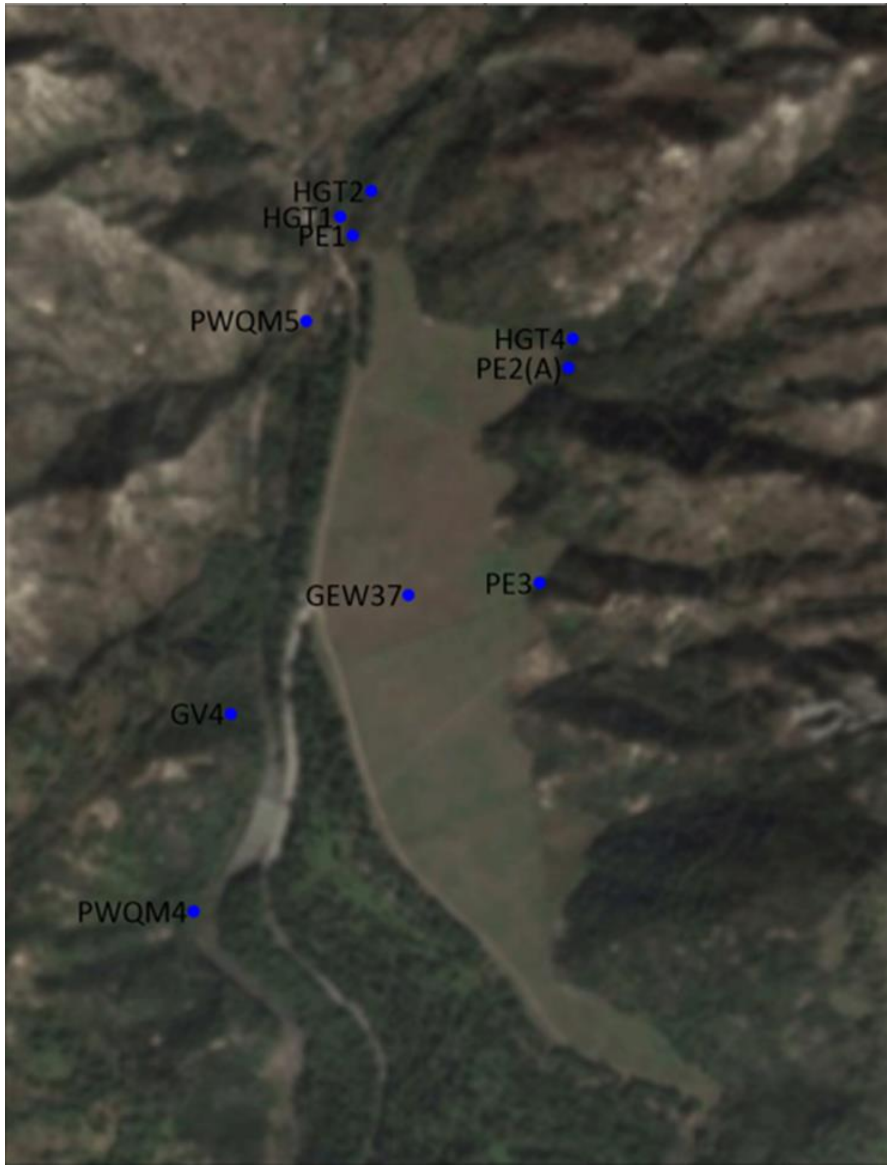
- Phase 1 – Desktop Study and Field Visit
- Phase 2 – Geophysical Surveys
- Phase 3 – Exploration Drilling Program, Pumping Tests and Well Design and Pump Installation
- Phase 4 – Ongoing Monitoring and Maintenance and Potential Improvements

Phase 1 Review and Evaluate

Phase 1

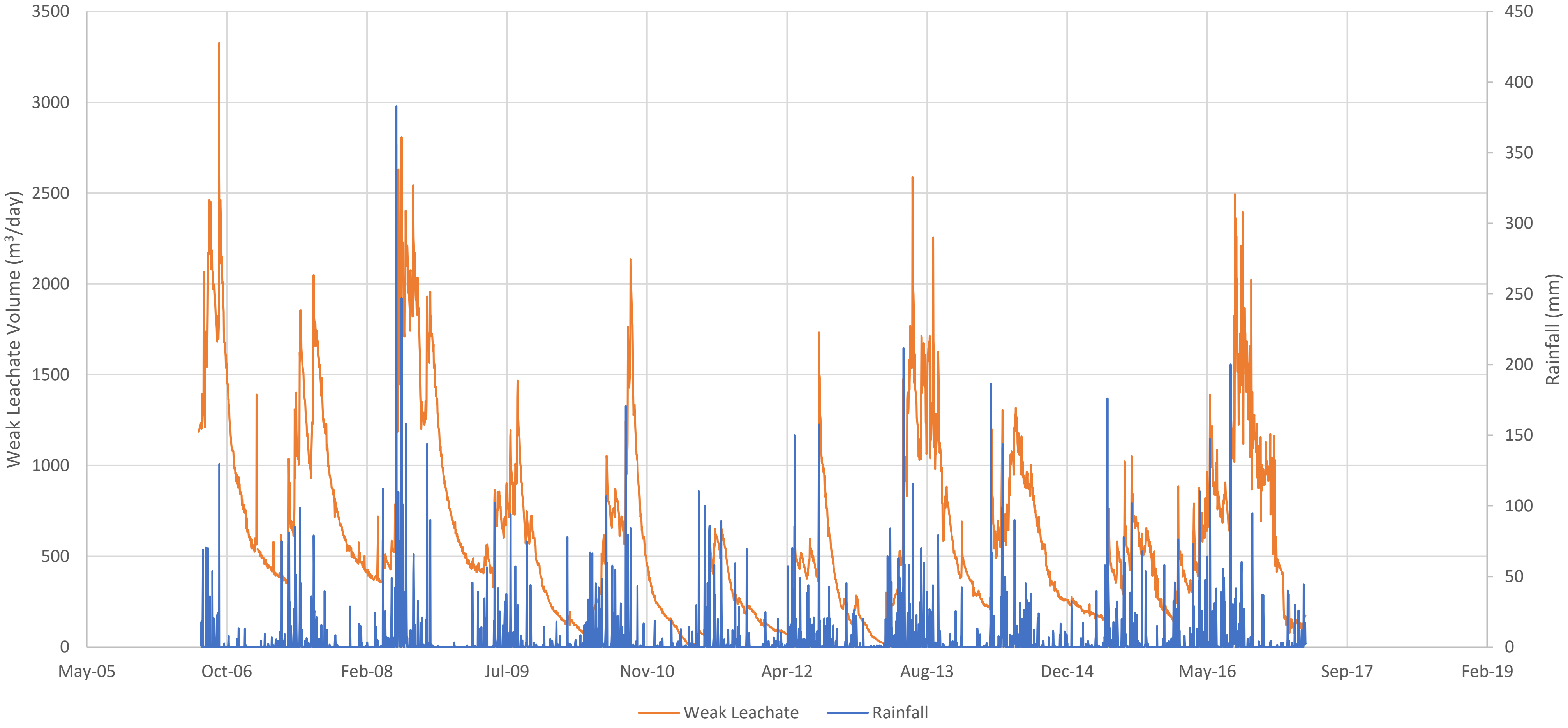
- Study Review
- Evaluate Operational Data (2006 – 2017)
- Field Visit

Historical Groundwater Monitoring Well Locations



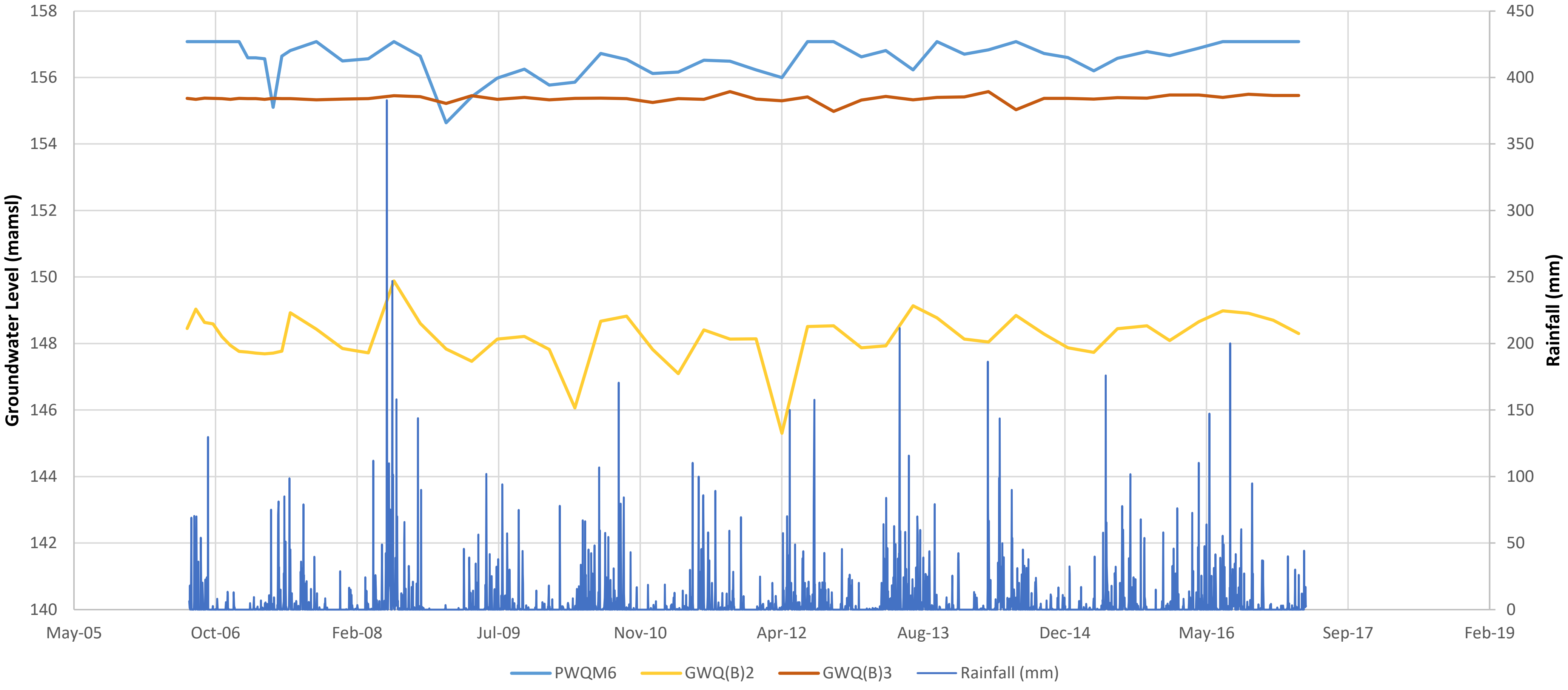
Phase 1

- Rainfall vs Weak Leachate Collection



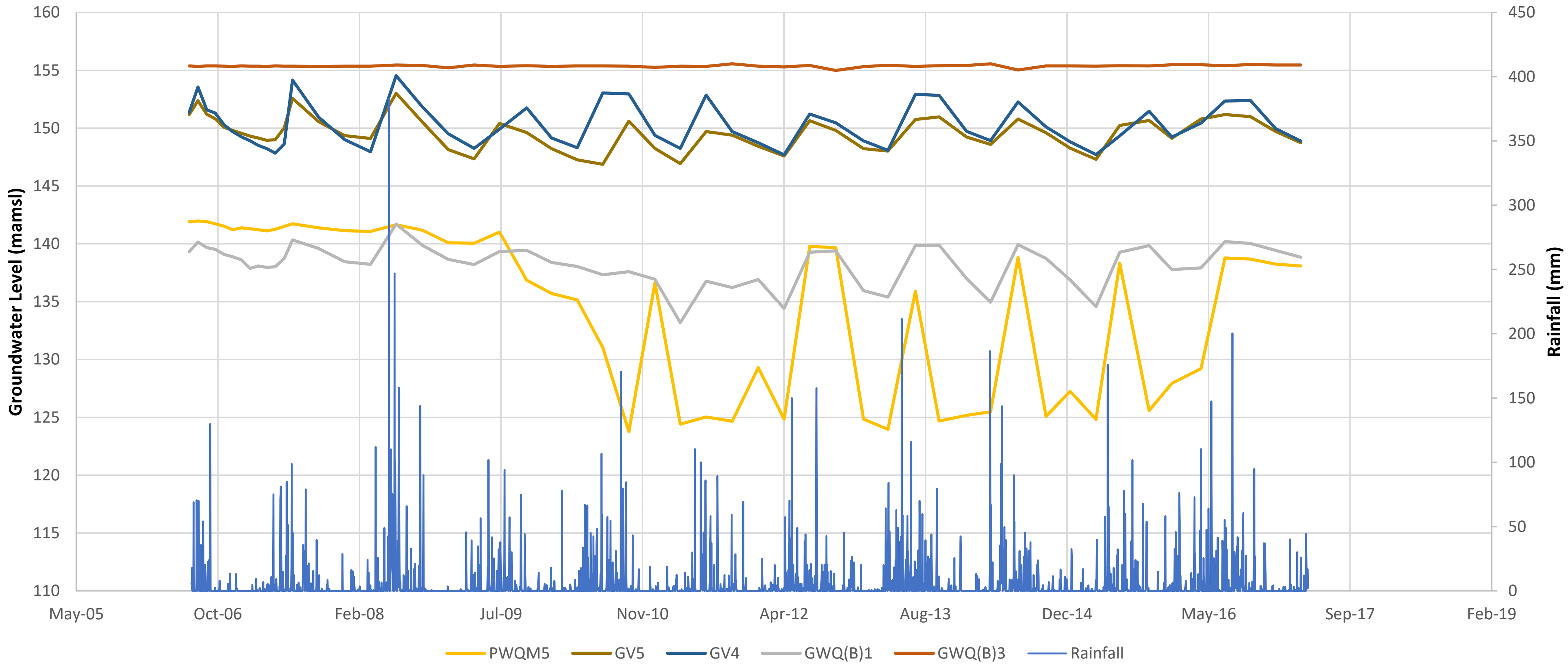
Phase 1

- Monitoring Wells (East Side) with Rainfall



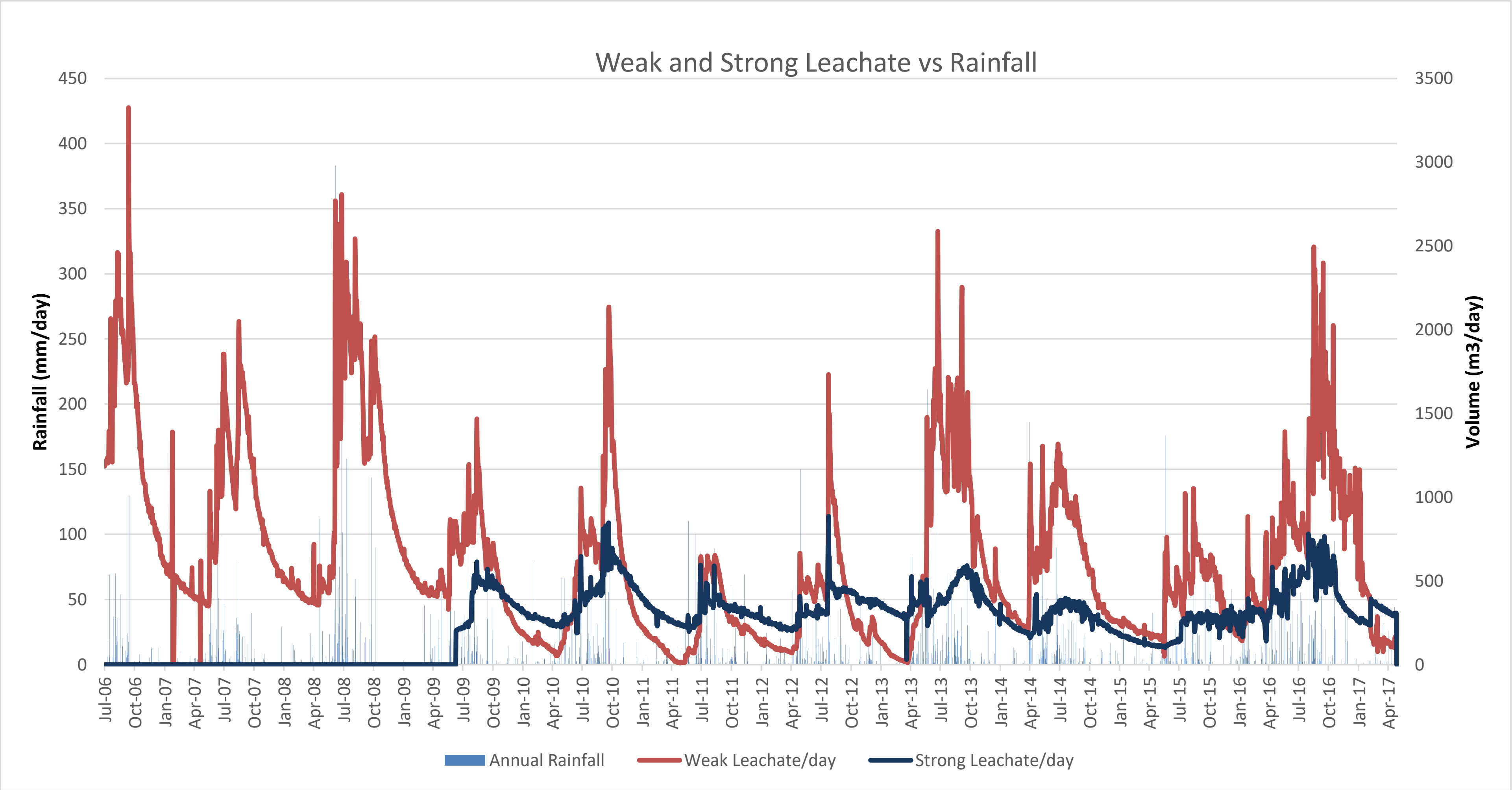
Phase 1

- Monitoring Wells (West Side) with Rainfall



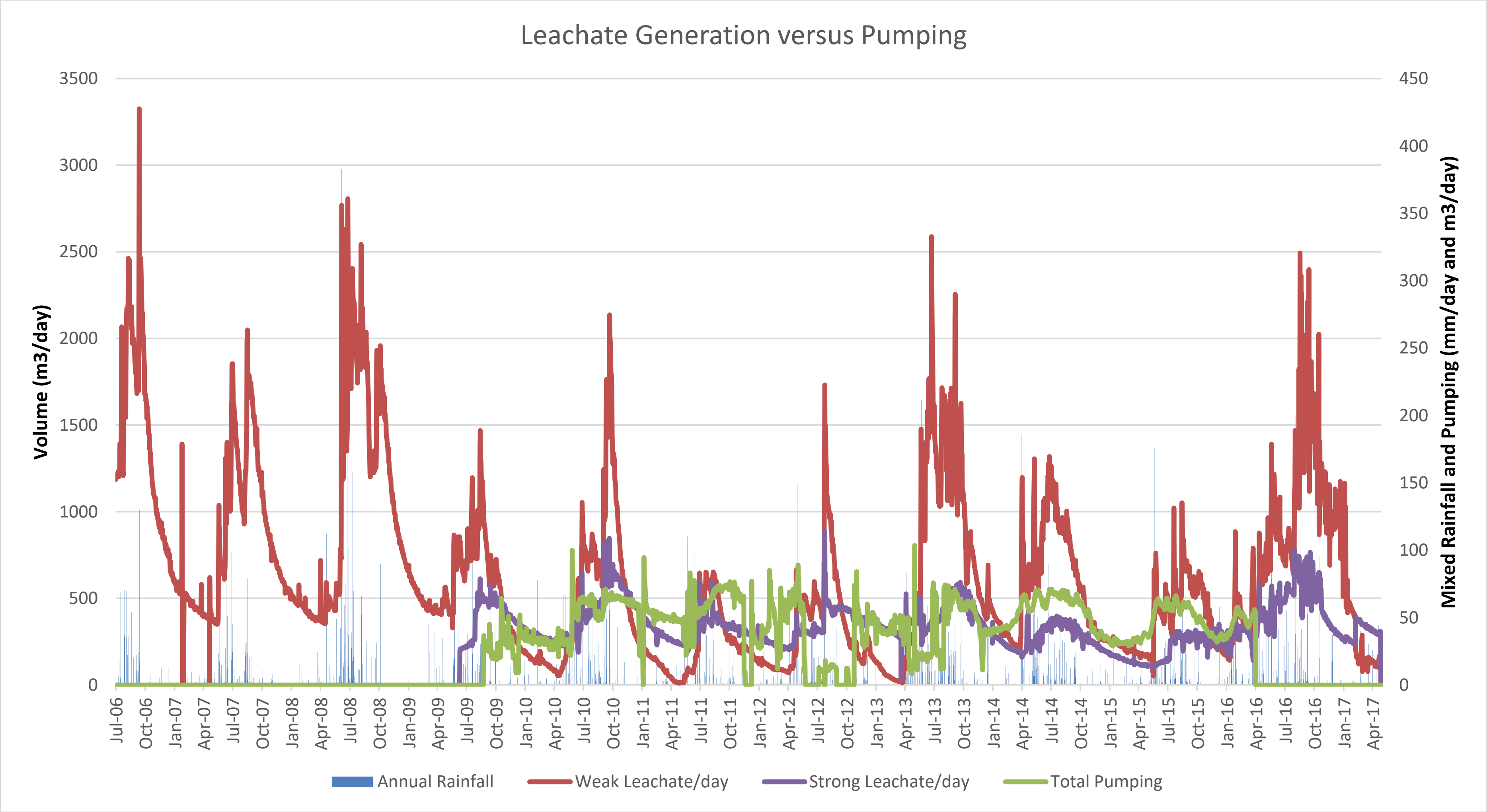
Phase 1

- Leachate Generation and Rainfall



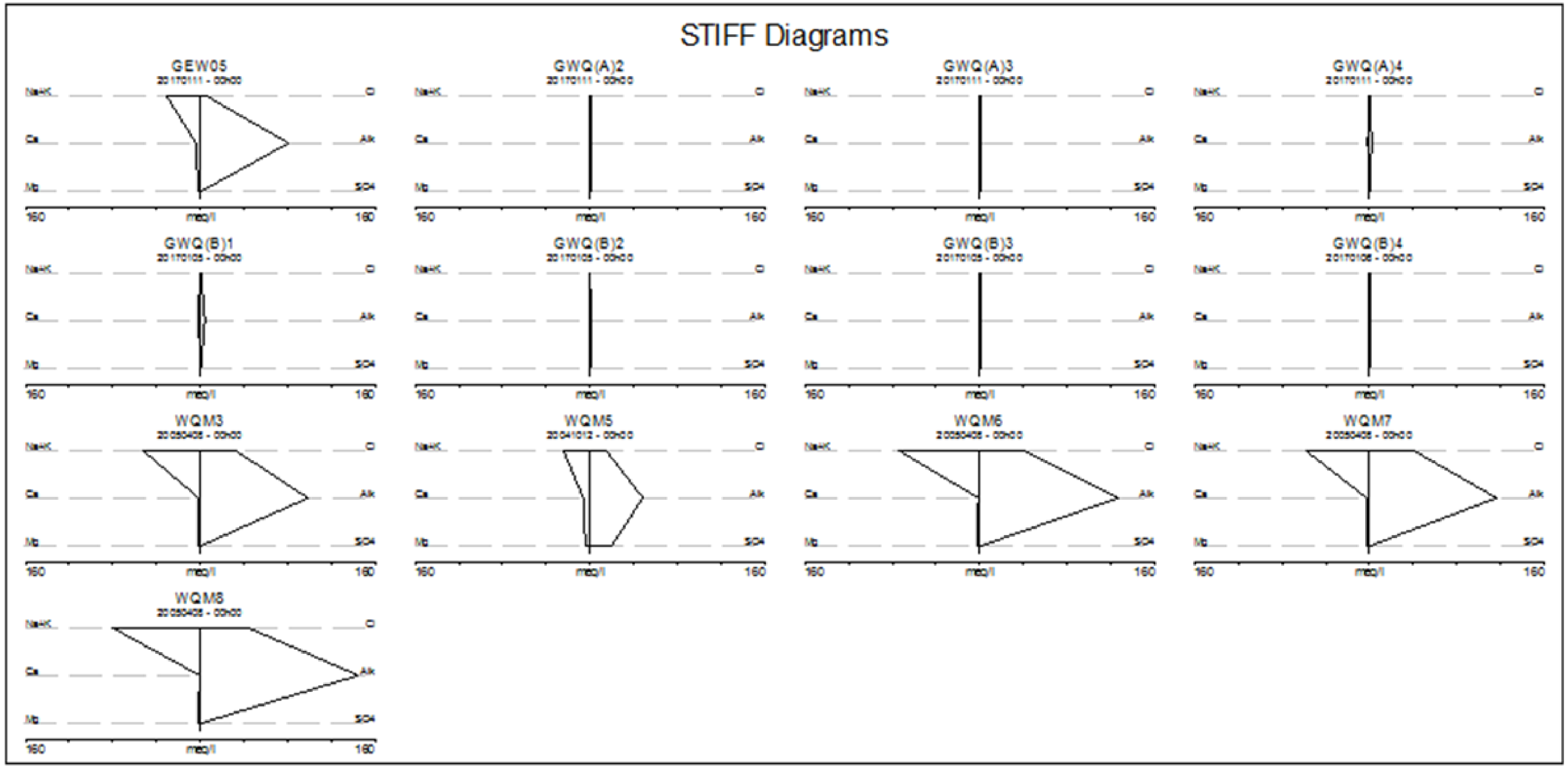
Phase 1

- Leachate Generation vs Groundwater Pumping



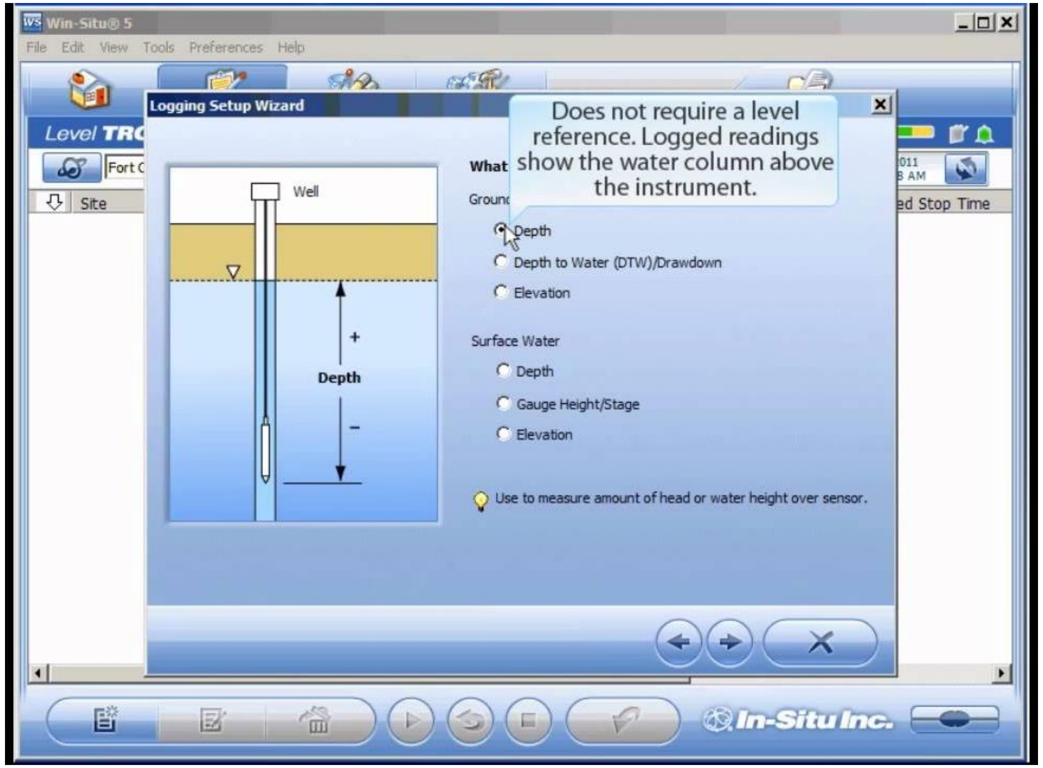
Phase 1

- Groundwater Chemistry



Phase 1

- Data Logger Installation



Phase 1

Summary of findings:

- 2005 Hydrogeological Study remain valid
- Rainfall influences leachate generation (weak and strong)
- Upgradient pumping is effective
- Upgradient pumping reduces weak leachate

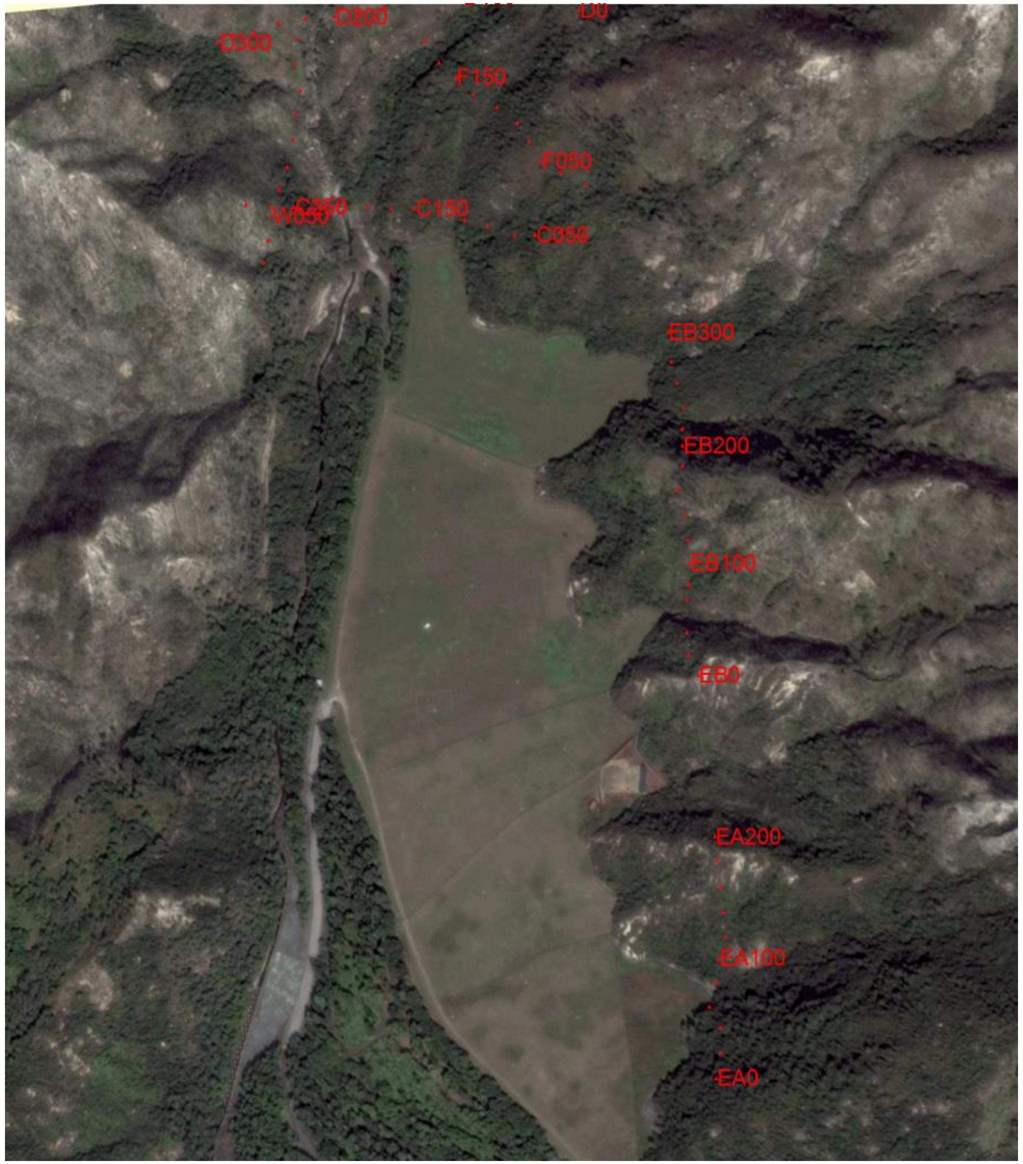
Phase 2 – Geophysical Surveys

Phase 2

- Three Geophysical Survey Methods Employed:
    - Magnetic
    - Electromagnetic
    - Resistivity

Phase 2


Line D
F225
D0
D240
Line F
W560
F0
C300
C0
Line C
E630
Line W
Line E
W0
E0


D200
D0
D300
F150
F050
C250
W050
C150
C050
EB300
EB200
EB100
EB0
EA200
EA100
EA0

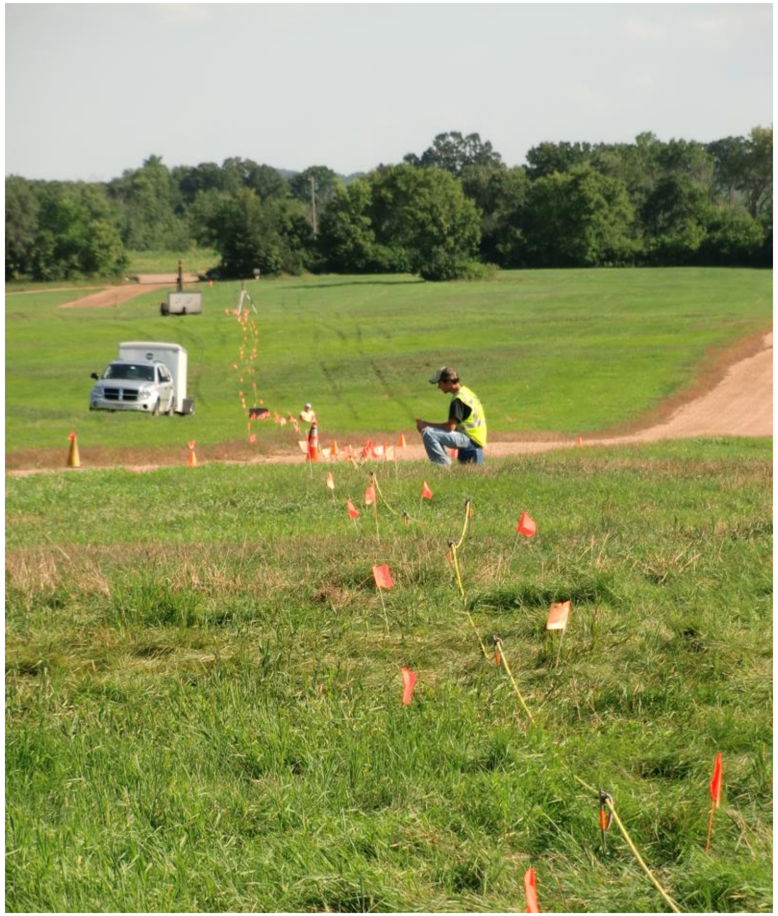
Phase 2

Phase 2

- Magnetic

- Electromagnetic

- Resistivity



Phase 2

Line D
F225
D0
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Line F
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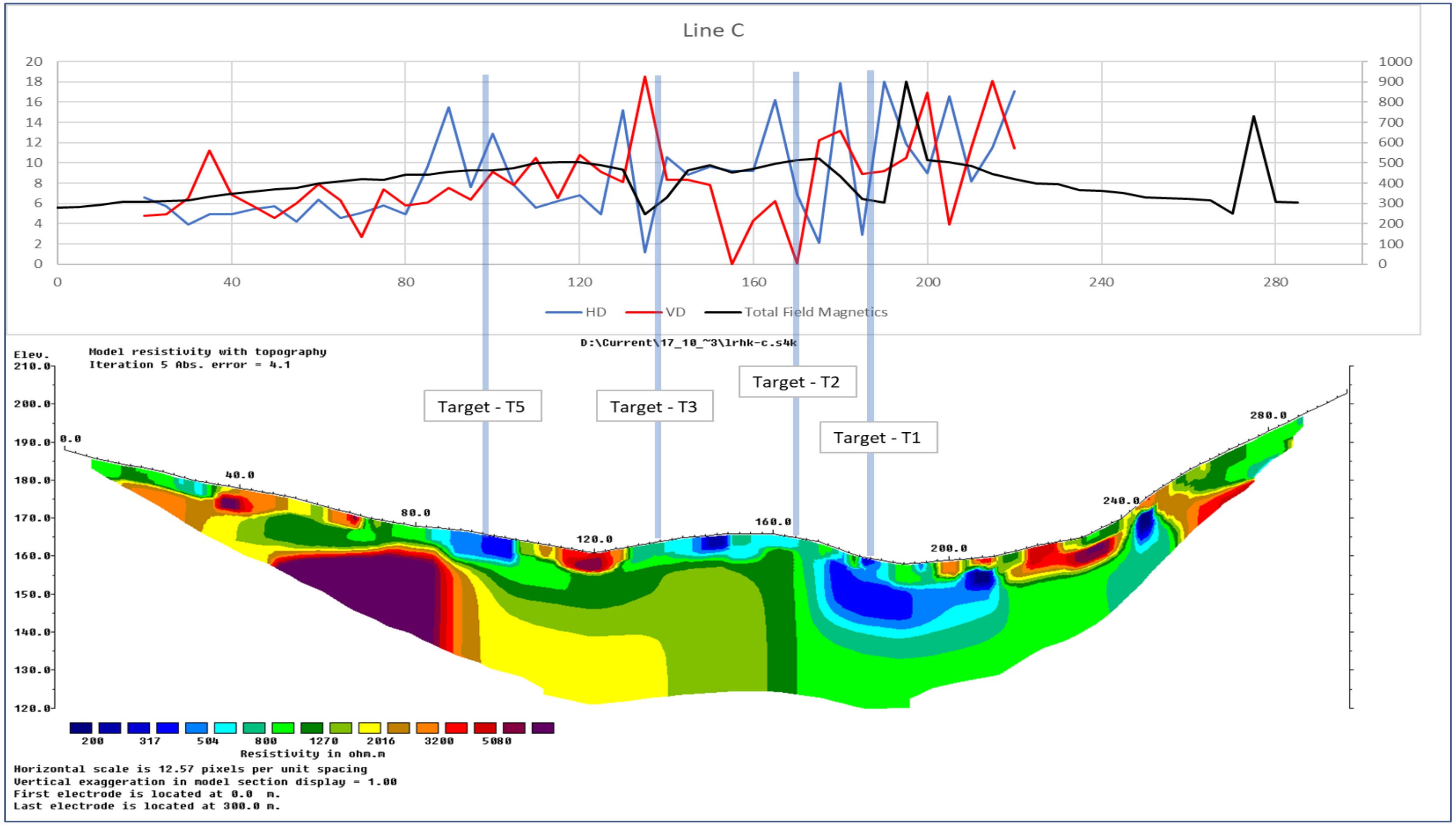
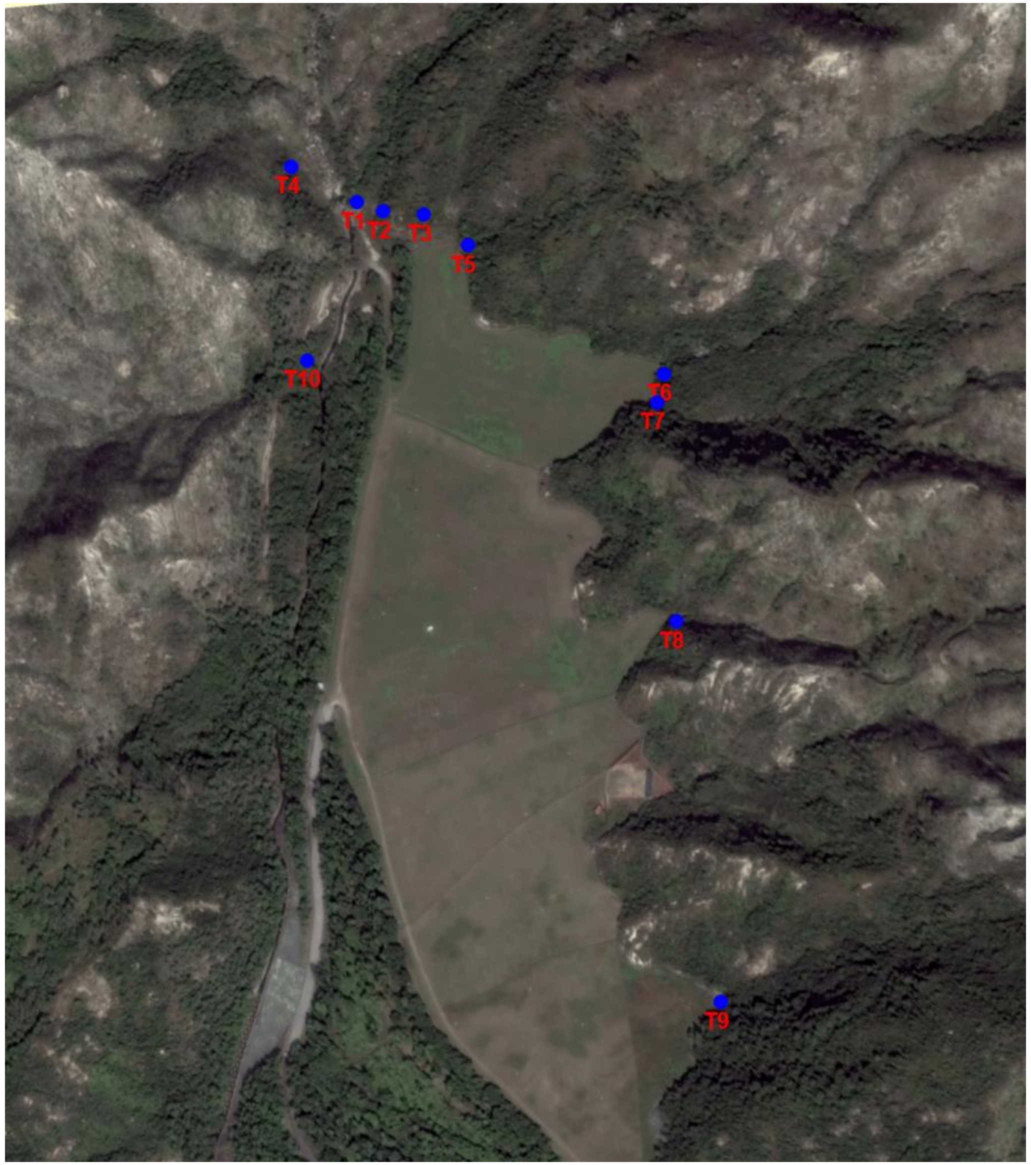


Line C
HD
VD
Total Field Magnetics
D:\Current\17_10_~3\lrhk-c.s4k
Elev.
Model resistivity with topography
Iteration 5 Abs. error = 4.1
Target - T5
Target - T3
Target - T2
Target - T1
200 317 504 800 1270 2016 3200 5080
Resistivity in ohm.m
Horizontal scale is 12.57 pixels per unit spacing
Vertical exaggeration in model section display = 1.00
First electrode is located at 0.0 m.
Last electrode is located at 300.0 m.

Phase 2

Line D
F225
D0
D240
Line F
W560
F0
C300
C0
Line C
E630
Line W
Line E
W0
E0



T4
T1
T2
T3
T5
T10
T6
T7
T8
T9

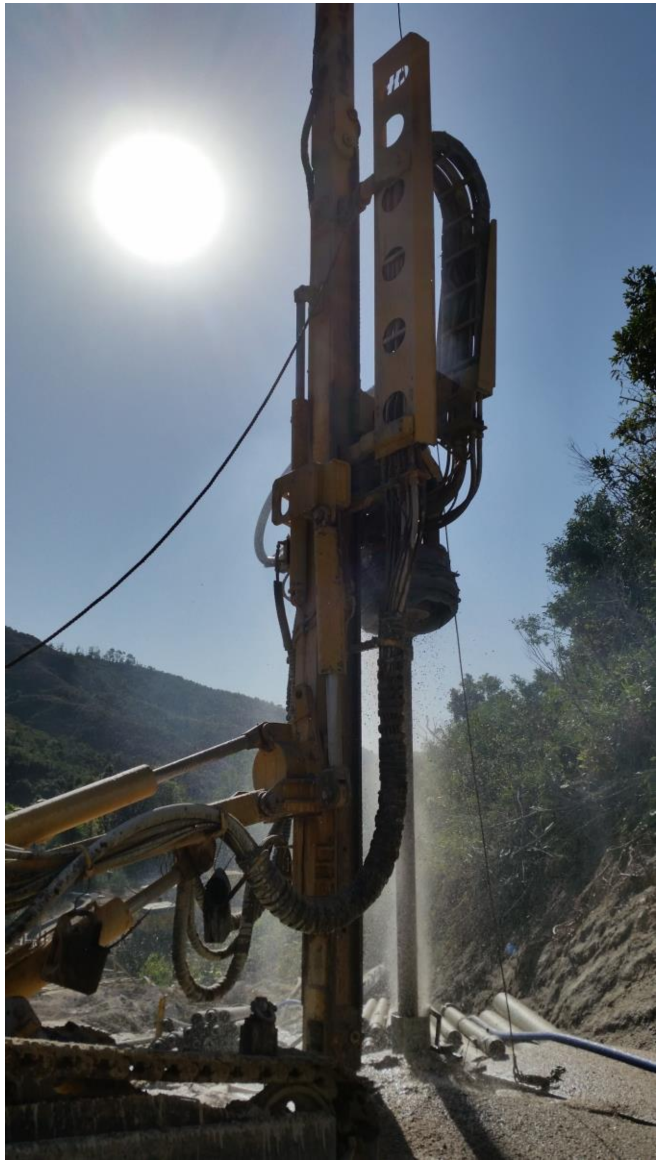
Phase 3 Drilling, Camera Inspections, Well Installs, Pumping Tests and Well Design

Phase 3

Exploration Drilling:

- The project team supervised and logged the lithology during drilling
- 18 exploration wells were drilled between January and November 2018
- 2 existing wells were drilled deeper

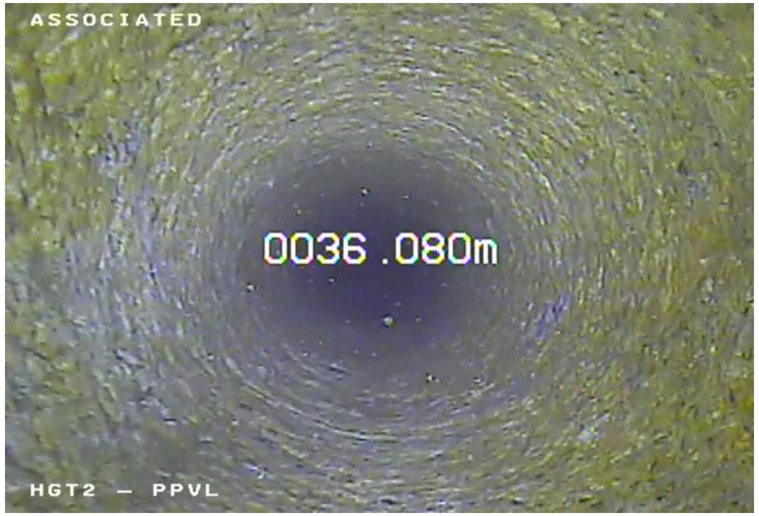
Phase 3

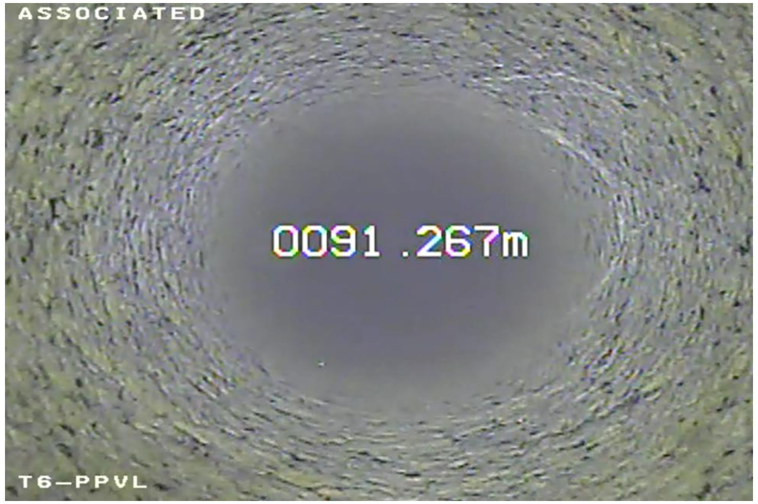


Phase 3

Phase 3

Well Camera Logging:





Phase 3

Phase 3

Phase 3

Pump Test Summary:

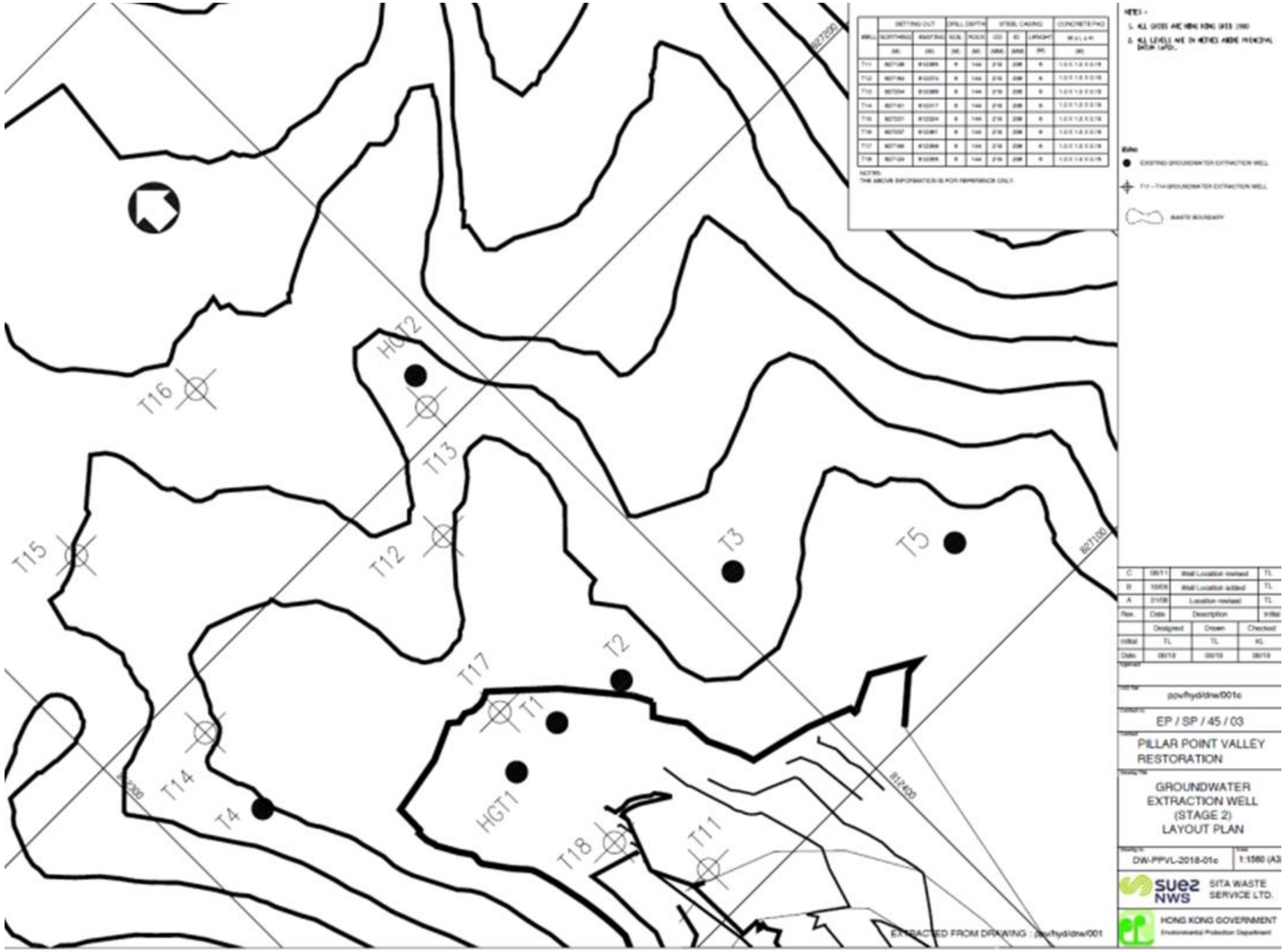
- Completed tests on eight wells with reasonable blow out yields
- Constant rate test duration varied between 12 and 72 hours
- Final pump sizes based on testing analyses
- Estimated yield after testing analysis was between 10 to 12 L/s for all holes
- Pumps were sized to maximize long-term pumping
- Pumps positioned at average depth of 140 m in order to maximize dewatering potential

Phase 3

- Permanent Pump Installations

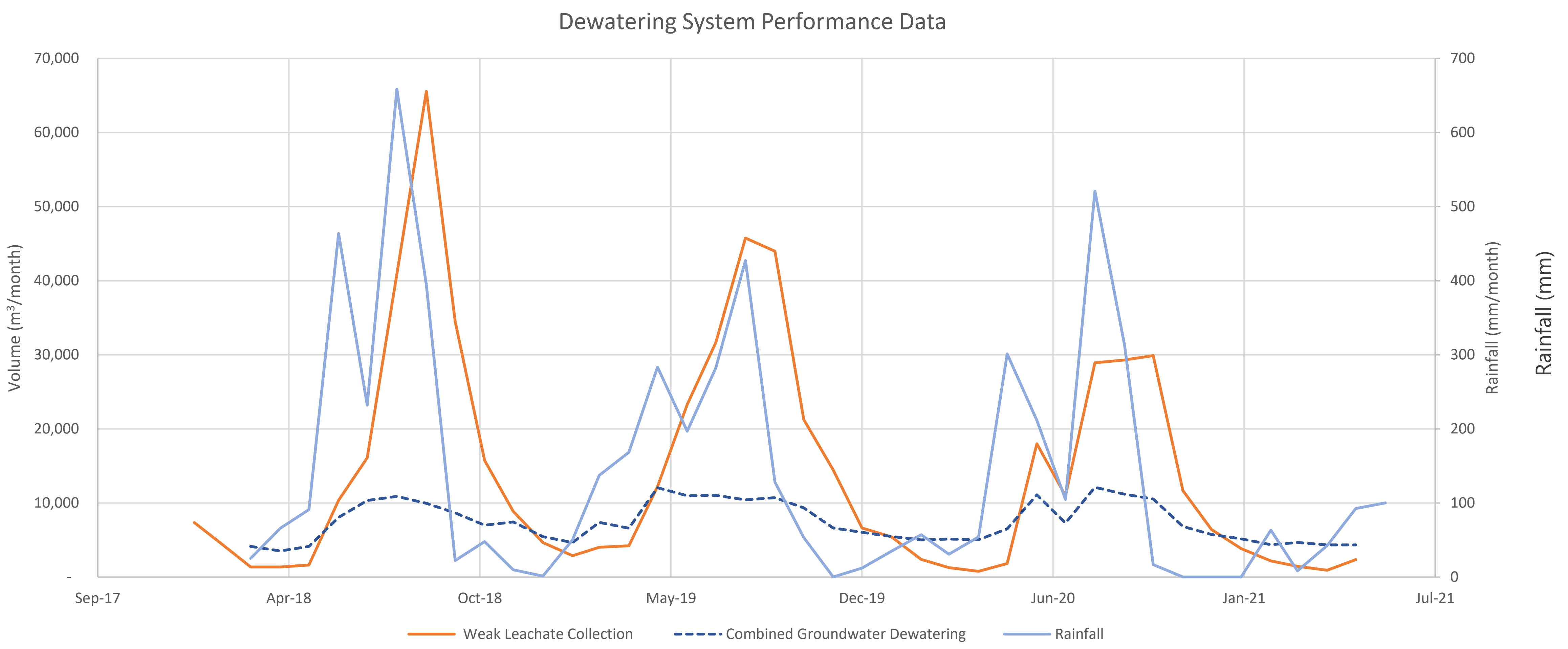
Phase 3

Phase 3



Increase in pumping volume from 4,000 m^3 /month to 10,000 m^3 /month

Phase 3



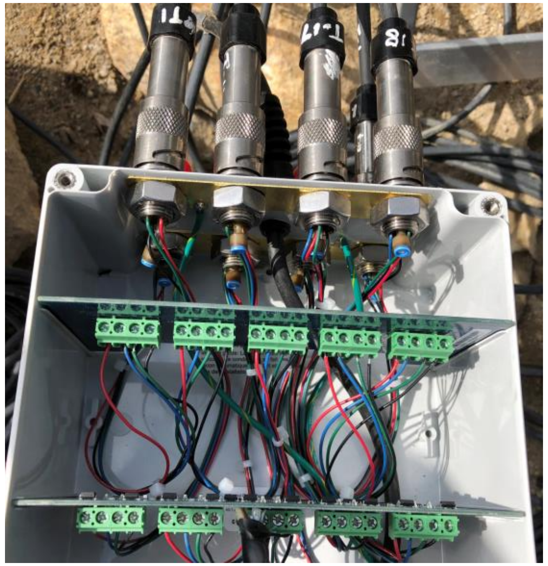
Dewatering System Performance Data
70,000
60,000
50,000
40,000
30,000
20,000
10,000
-
Volume (m³/month)
700
600
500
400
300
200
100
0
Rainfall (mm/month)
Rainfall (mm)
Sep-17
Apr-18
Oct-18
May-19
Dec-19
Jun-20
Jan-21
Jul-21
Weak Leachate Collection
Combined Groundwater Dewatering
Rainfall

Phase 3

Phase 4 Ongoing Monitoring and Maintenance and Potential Improvements

Phase 4

- Ongoing monitoring of groundwater levels, discharge volume and water quality by client staff before discharge into the ocean
- Maintaining groundwater level and pumping equipment



Challenges and Takeaways

Challenges

- Language barrier.
- Limited water records.
- Site conditions (removing vegetation for the geophysics and building bridges/platforms for the drilling)
- Few consultants and contractors locally which had the experience in designing and managing a project to this scale.
- Not only did we act as consultants but we also worked as contractors

Takeaways

- Cost savings for the client.
- Reduced environmental impact.

In-Memory

Norman
Di Perno

1959-2019

Questions?

Contact: Neal Barretto, barretton@ae.ca