

GEOSOLV
DESIGN > BUILD



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President

RemTech CBN Track

brown·field

/'broun,fēld/

adjective (OXFORD)

Denoting or relating to urban sites for potential building development that have had previous development on them

"a contaminated brownfield site in the inner city"

Noun (Mirriam Webster)

: a tract of land that has been developed for industrial purposes, polluted, and then abandoned



Soil Characterization



Whats the definition of "polluted"?



OUTLINE

What is a Brownfield?

What Brownfields Need

Why Ground Improvement?

Ground Improvement in Canada with Cases Studies

A yellow CAT 345C L tracked excavator is shown in a construction or industrial setting. It is equipped with a vertical drilling rig attachment, which is a tall, slender structure with a hopper at the top. The excavator's arm is extended towards the rig. The background shows a dark, overcast sky and some industrial structures. The overall scene is dimly lit, suggesting an overcast day or early morning/late evening.

Treatment Options for Brownfields

(What Brownfields Need)

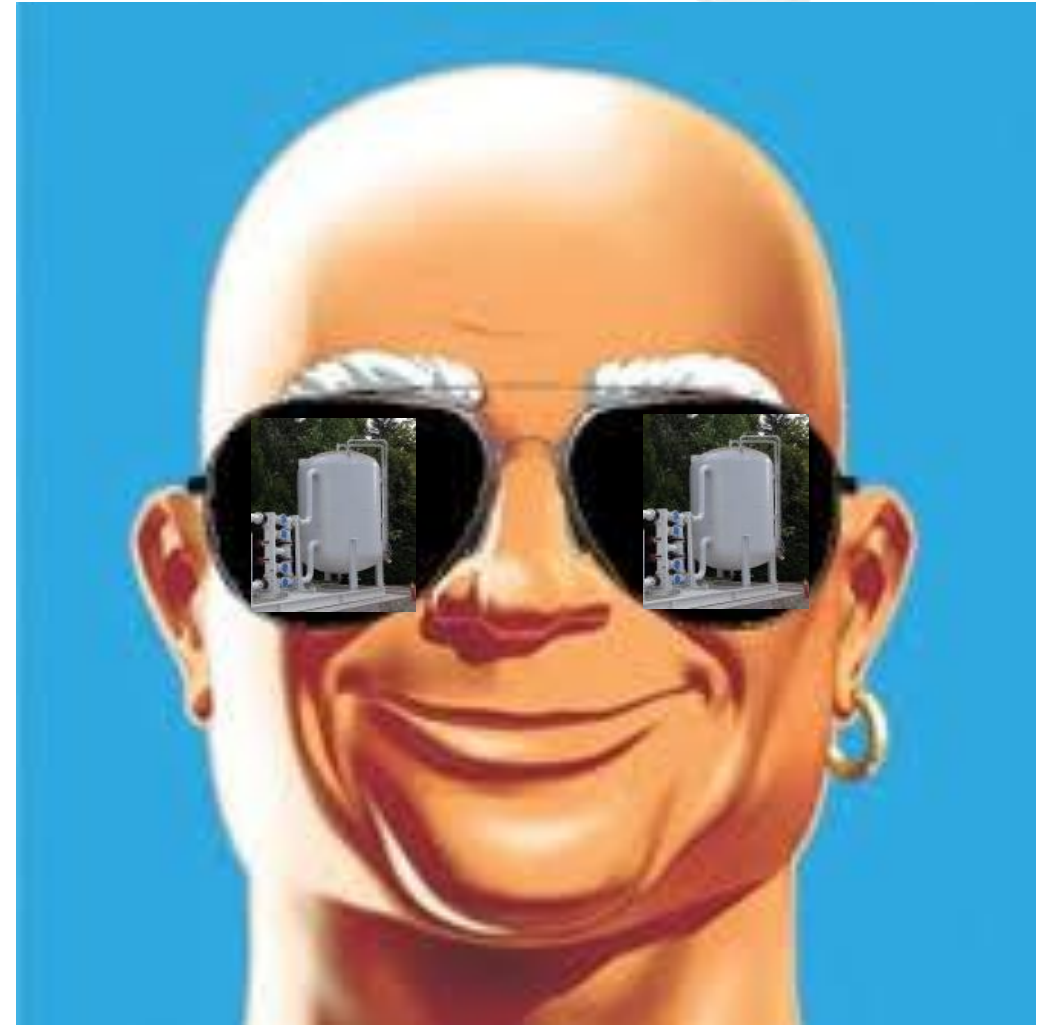
For Health, Brownfields Need to Get Clean...

RSC

Risk Assess

Clean up....

In-Situ Remediation!



For Development, Brownfields Need to Get Strong...

Dig-Replace (Remove It)

Piles/Caisson (Go Through It)

Improve It!



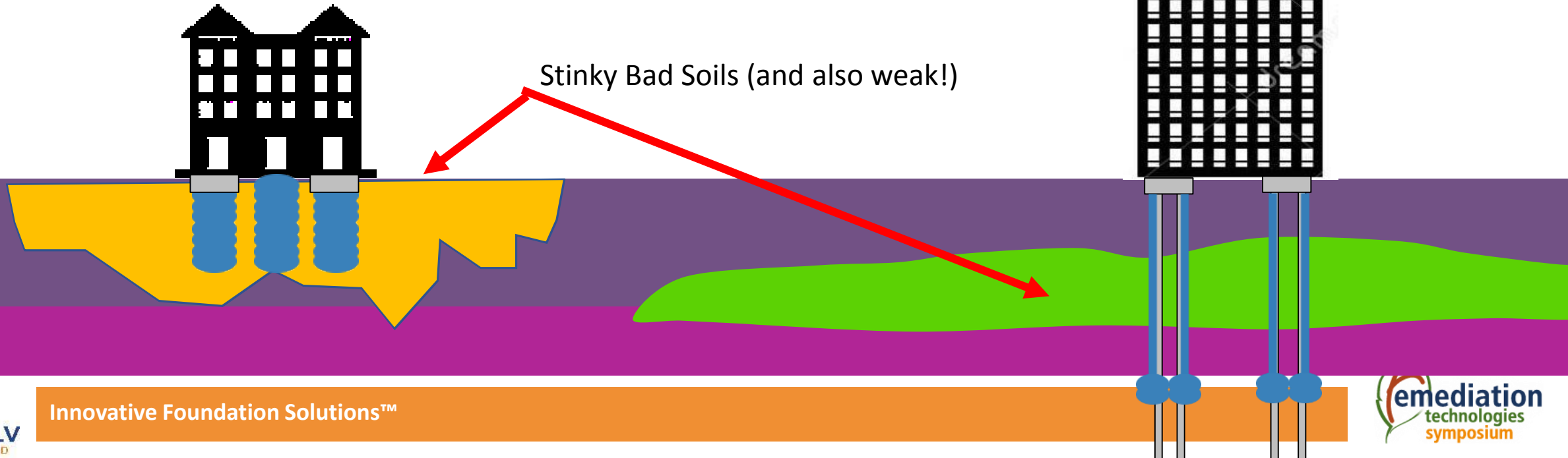
Got a Weak Brownfield?

You can "Improve It"

What if your brownfield soils cannot handle the load?

Remove It

Go Through It



When you Dig-Dump, what do you put back?

Dirty little Secret....

Remediated sites often aren't
engineered back

Extra Expense when Selling

Opportunity!



What Good is Fill and Peat?

Fill is not Air

Peat is not Air

Both can be Improved!!



Don't forget about your Natives

Loose Sand

Soft Clay

Silt

Contaminated/Impacted and
may still need improvement too



Ground Improvement Methods

Dynamic Compaction

Vibratory Methods

Rammed Aggregate Pier

Rigid Inclusion Systems



A yellow CAT 345C L tracked excavator is shown at a construction site. It is equipped with a vertical drilling rig attachment, which is a tall, thin structure with a hopper at the top. The excavator's arm is extended towards the rig. The background shows a construction site with a pile of gravel and some trees under a grey sky.

How Does Ground Improvement Improve on Dig-Dump

(Why Ground Improvement?)

Why Ground Improvement?

- Minimize excess soil
- Reduce / eliminate shoring and dewatering
- Increased bearing
- Leave Fill and Contaminants Lie!





Over \$800,000.00 in Project Savings!



Ground Improvement in Canada

Rapid Impact Compaction



Is this a Brownfield?

- Old burial site discovered During Dig-Replace Operation



Aggregate Reinforcement



Replacement Methods

GEOPIER®

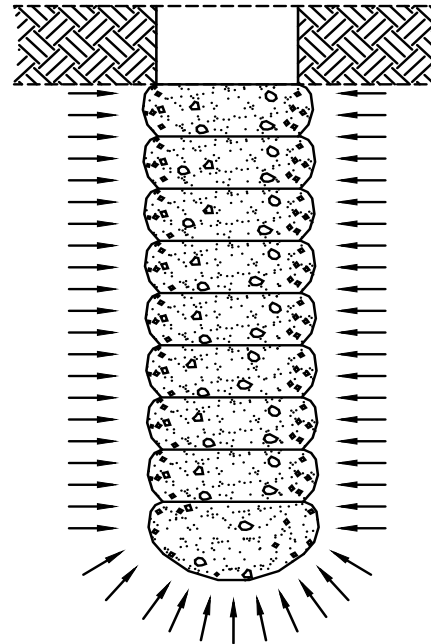
Displacement Methods

GEOPIER®

Rammed Aggregate Pier Method



Low void ratio



Lateral pressure



Spread Footings

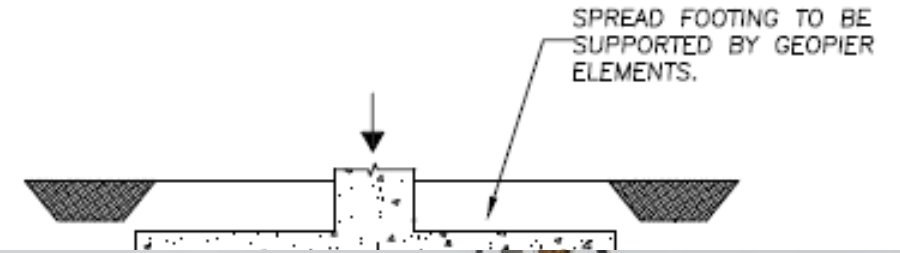
Supported by Rammed
Aggregate Pier soil
reinforcement

Now Your Brownfield Can Take the Load!



What if Soils are too Poor and Loads too High?

- Concrete or grout based soil reinforcing elements



Rigid Inclusion Systems

Controlled Modulus Column (CMCs) /
Controlled Stiffness Column (CSCs)

- Supports loads through friction

Grouted or cemented Rammed
Aggregate Piers

- friction with internal cohesion

Geopier GeoConcrete® Column (GCCs)

- Supports loads through end bearing



Geopier GeoConcrete Columns

GEOPIER®

Results of GCC Construction

Spread Footing

Still a spread footing
...But with a Load transfer cushion

- Typically 100-200 mm Granular



TTC LESLIE BARNNS

A MAJOR BROWNFIELD!

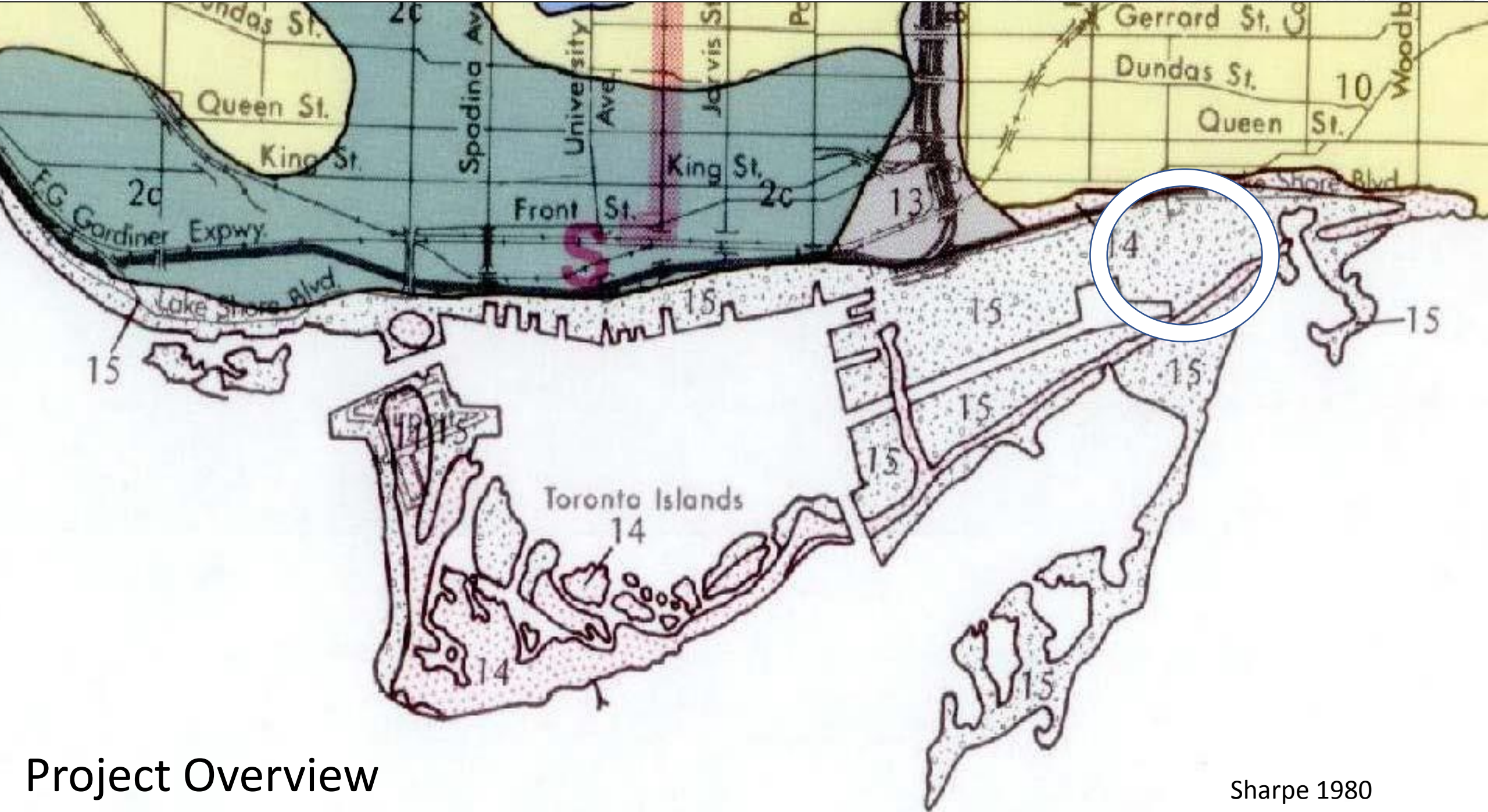
Project Overview



Project Overview



SITE

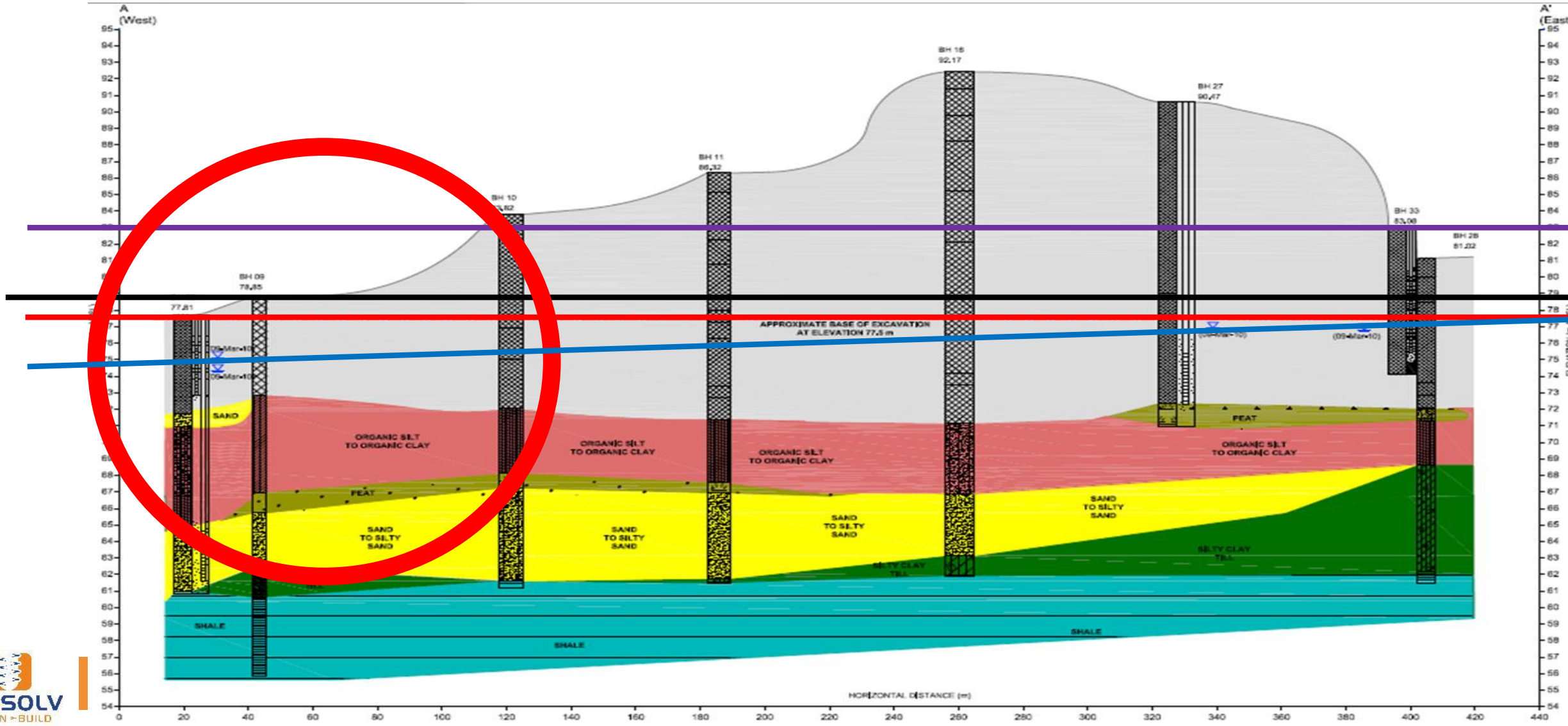


Project Overview

Sharpe 1980

An aerial photograph of a large-scale construction or industrial site. The central focus is a large, multi-story building under construction, with its concrete frame and some exterior walls visible. The building is surrounded by a network of roads and parking areas. In the foreground, a road with a red and white striped safety barrier runs diagonally across the frame. A large truck is visible on the road to the left. The background shows more industrial structures, including tall chimneys, and a line of trees under a clear sky. The overall scene depicts a complex and active construction project.

SOILS AND CHALLENGES



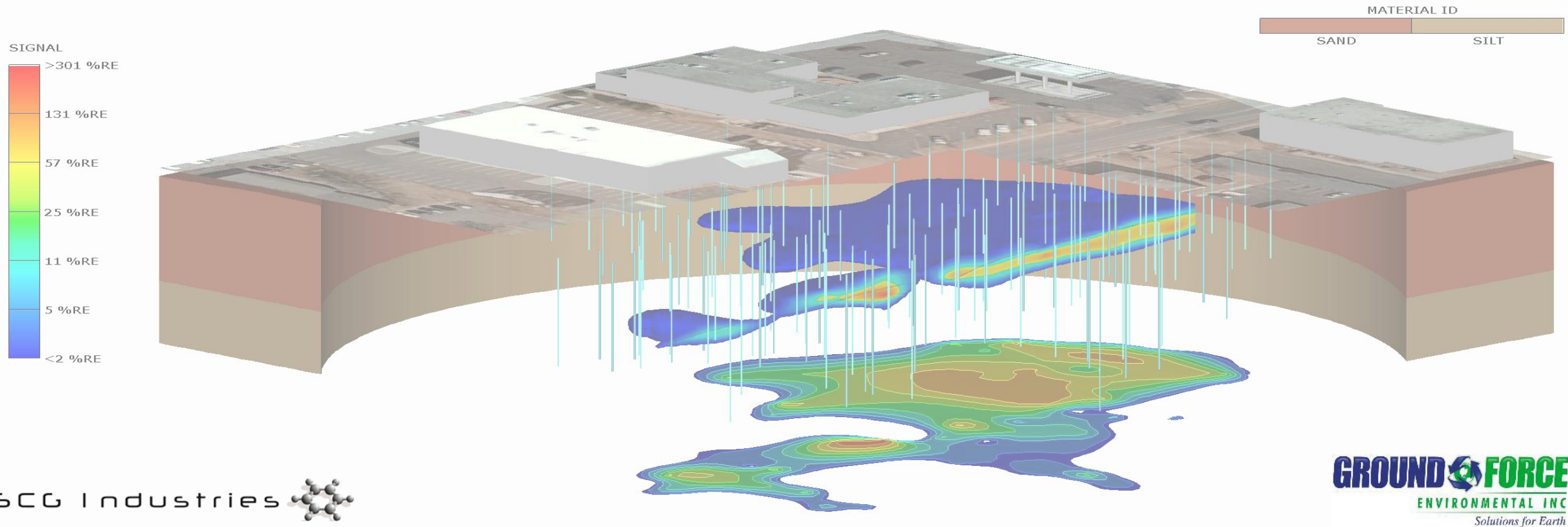
Soil Conditions



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Think High Resolution



Like an Exray/MRI to find whats wrong!

Cool Equipment to Get Info!



SCG Industries 



GROUND FORCE
ENVIRONMENTAL INC
Solutions for Earth



Geotech Equipment

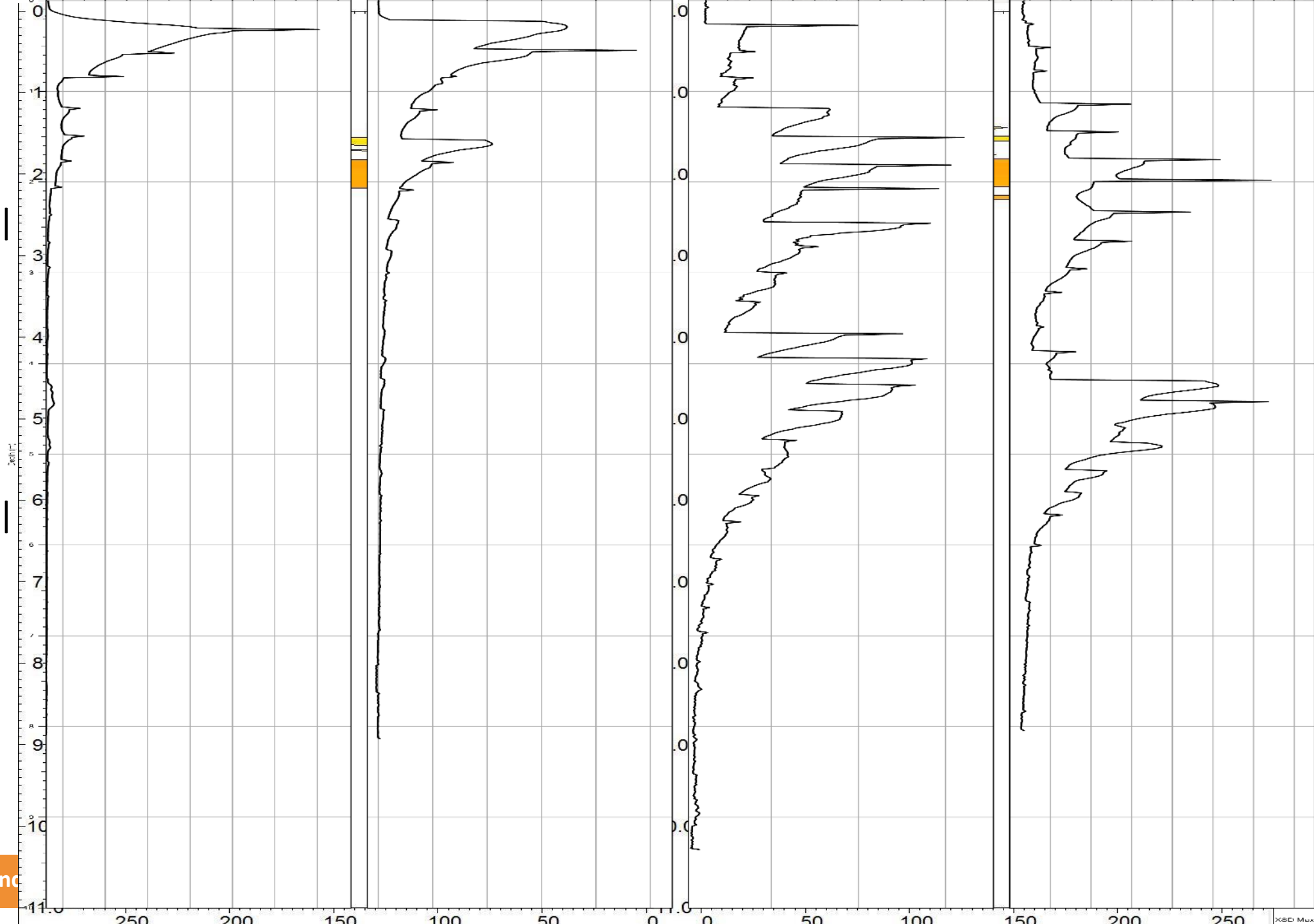


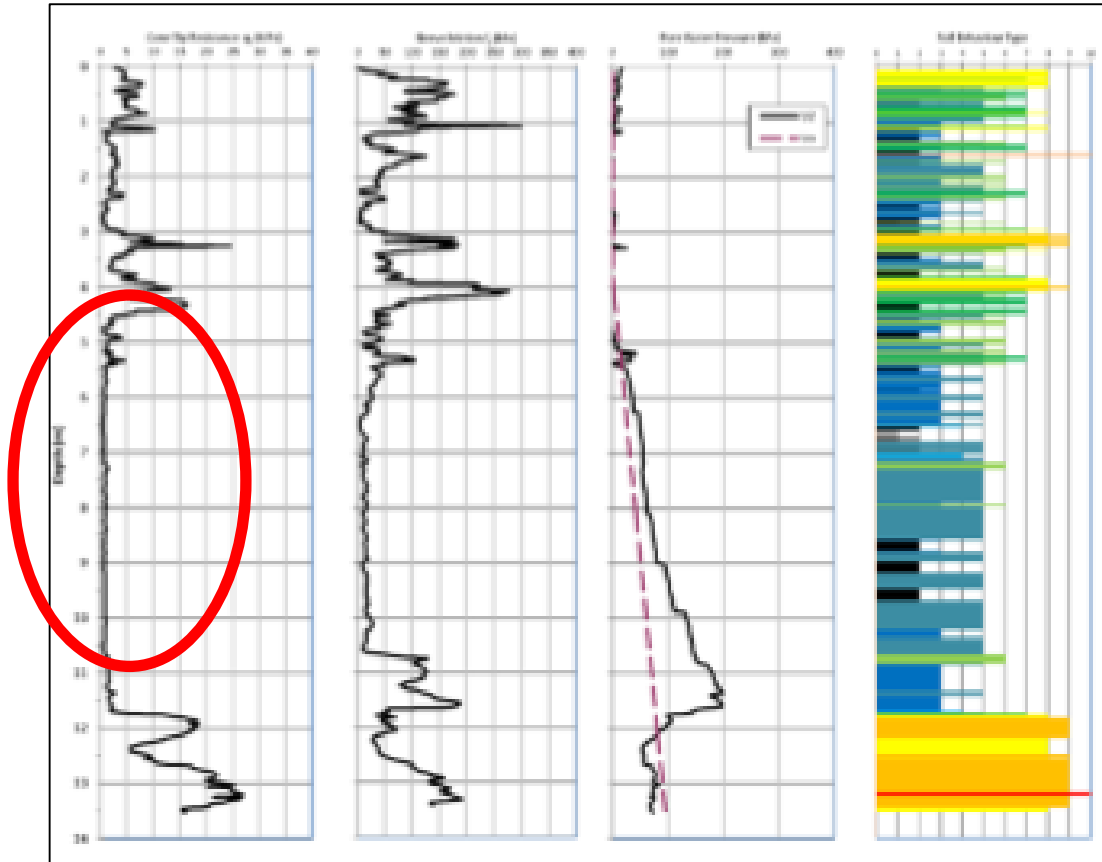
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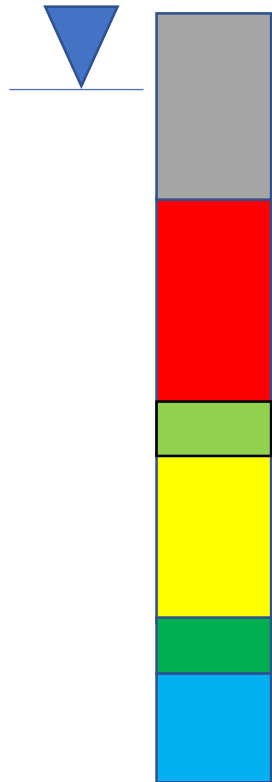
Environmental
Squiggly
Lines!

Environmental
Colourful
Graphs!





Our Very Own Geotechnical Squiggly colourful lines



2 to 6m Sandy Silt to Silty Sand Fill with debris
- loose to compact

5m Organic Silts and Clays
- soft to firm

1m fibrous Peat – soft to firm

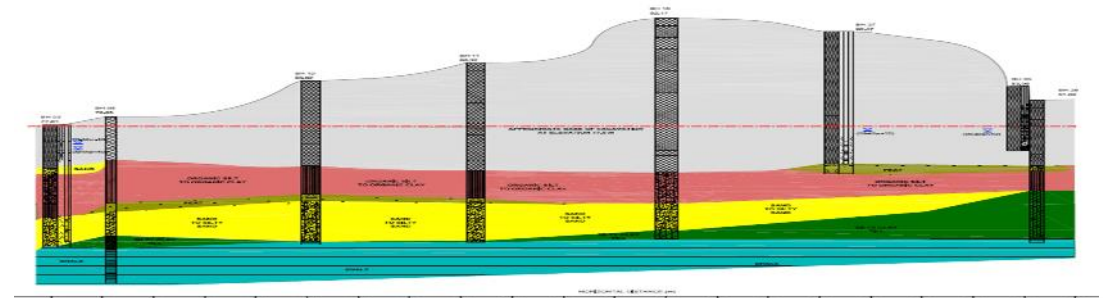
2 to 6m Sands – compact to dense

1m Silty Clay Glacial till – very stiff (discontinuous)

Shale Bedrock

Lots of geo-environmental challenges!

BROWNFIELD!!





RAMMED AGGREGATE PIER® APPROACH

Rammed Aggregate Pier Approach

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Geopier Impact to improve soil

Displacement Technology – no spoils





Rammed Aggregate Pier Approach

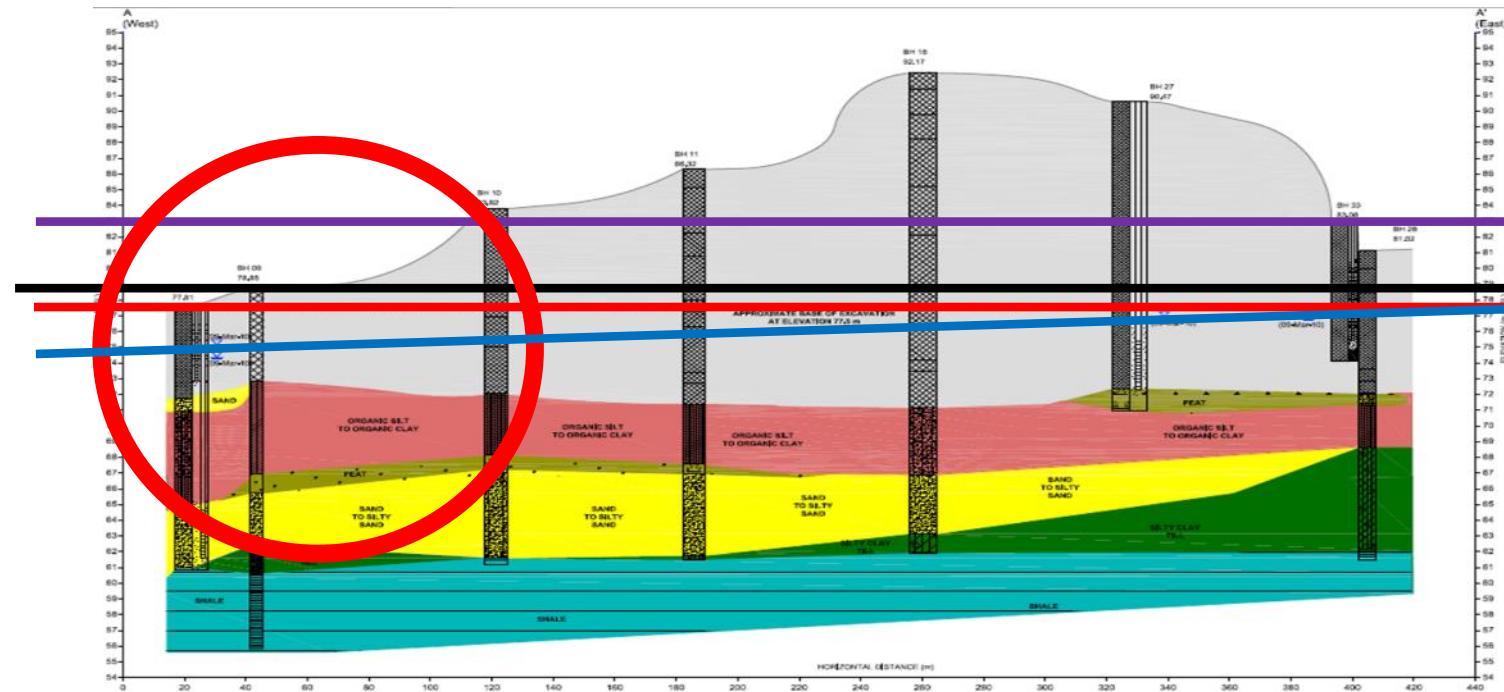
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Geopier Impact to improve soil

Displacement Technology – no spoils

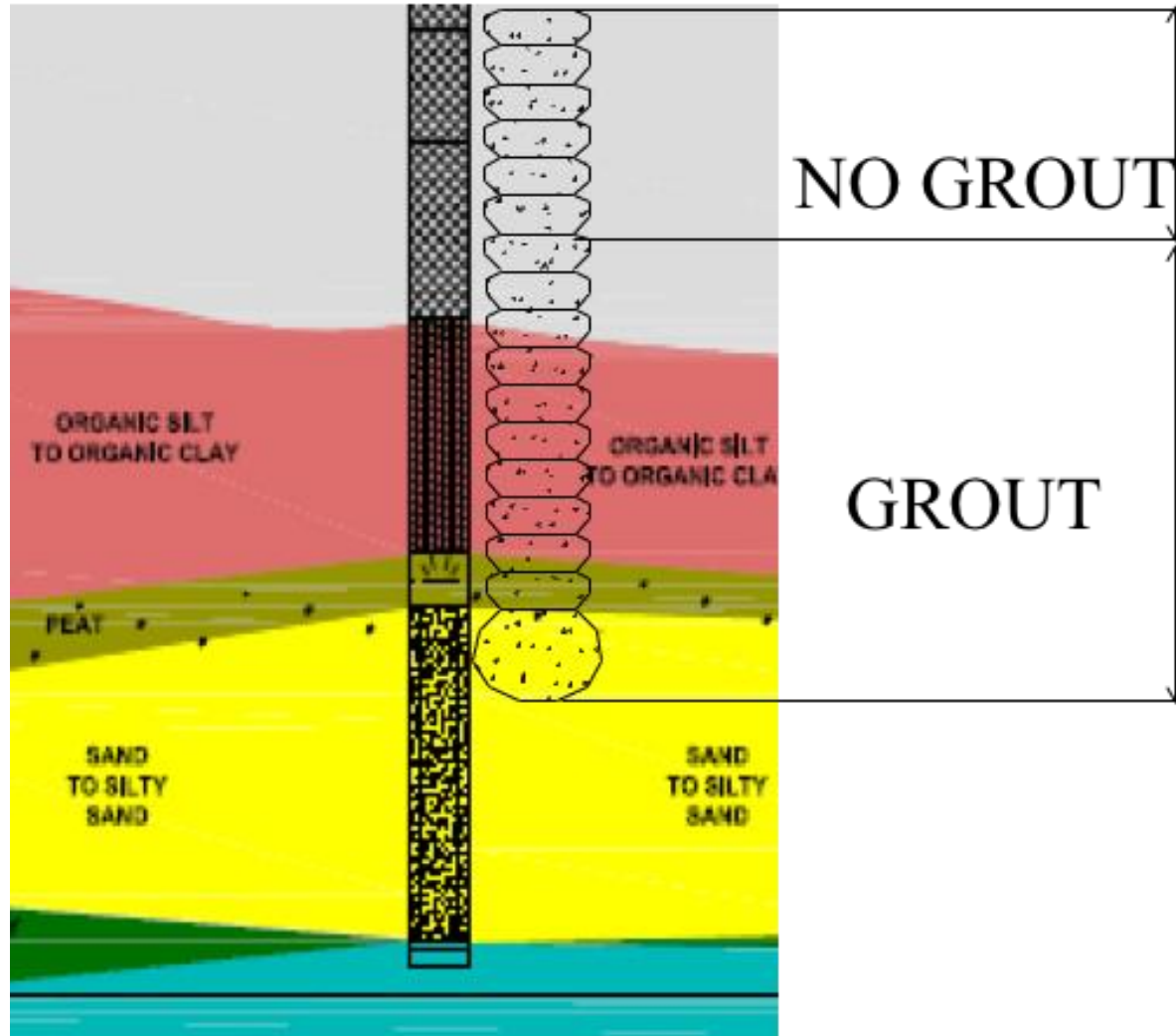
In Grade Raise Zone

- Grouted Impact for Footings
- Preload and Drainage for slab



Rammed Aggregate Pier System

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Rammed Aggregate Pier System

10 m to 12 m deep

7000 RAPS

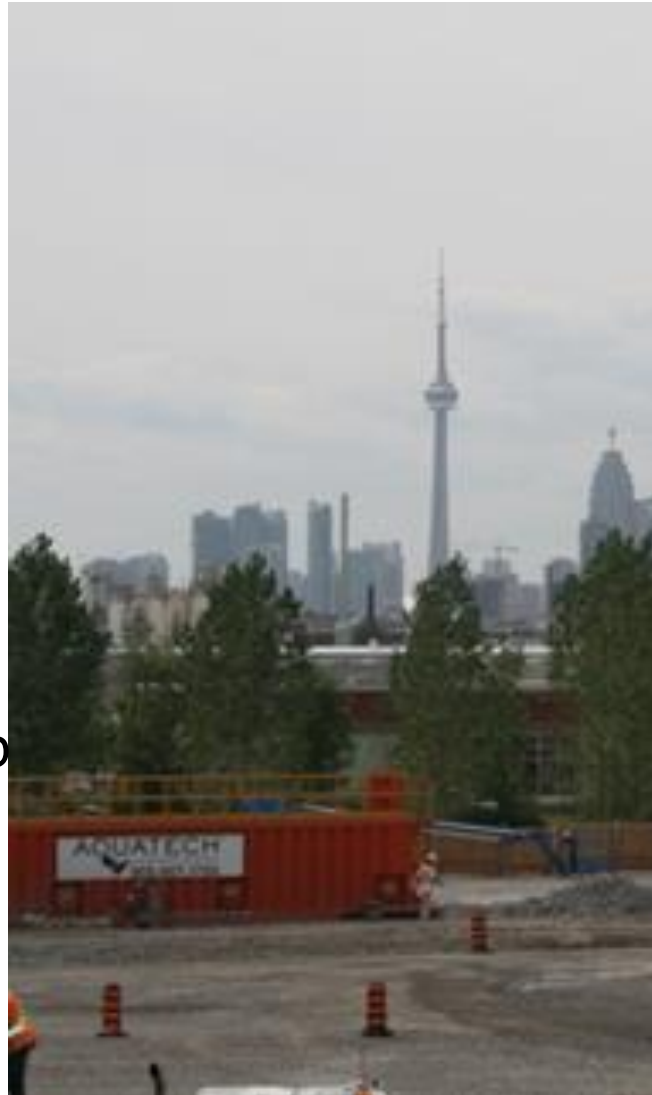
375 Grouted RAPS

Completed construction Phase 1
in Dec 2011

Phase 2 in 2012

Track slab and Part Building slab

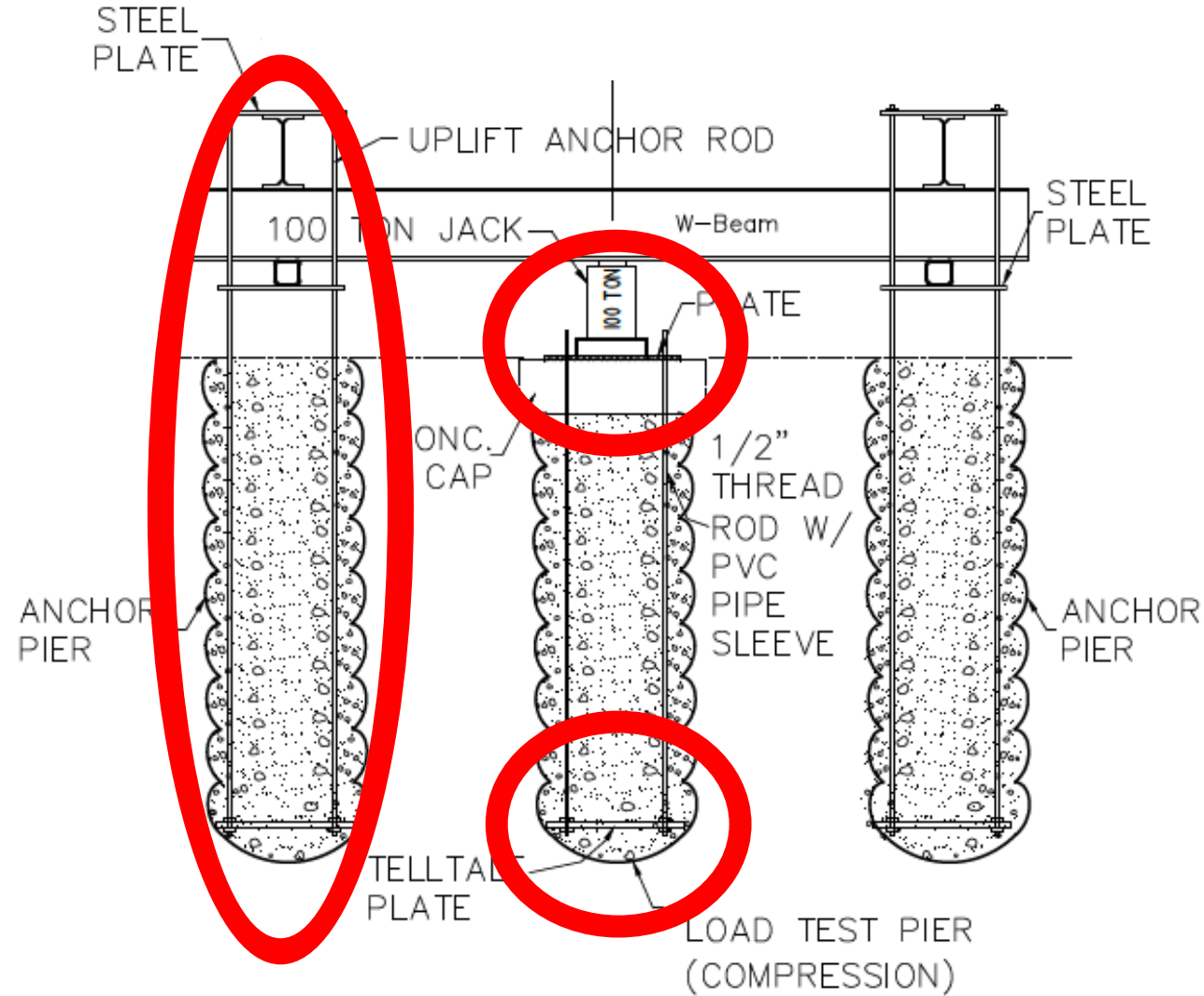
...All Footings



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An aerial photograph of a large industrial or construction site. The central focus is a large, rectangular building under construction, with its concrete frame and some interior walls visible. The building is surrounded by a parking lot and other smaller structures. In the background, there are more industrial buildings and a tall chimney stack. The sky is clear, and the overall scene is brightly lit. The text "TESTING AND VERIFICATION" is overlaid in white, bold, sans-serif font across the middle of the image.

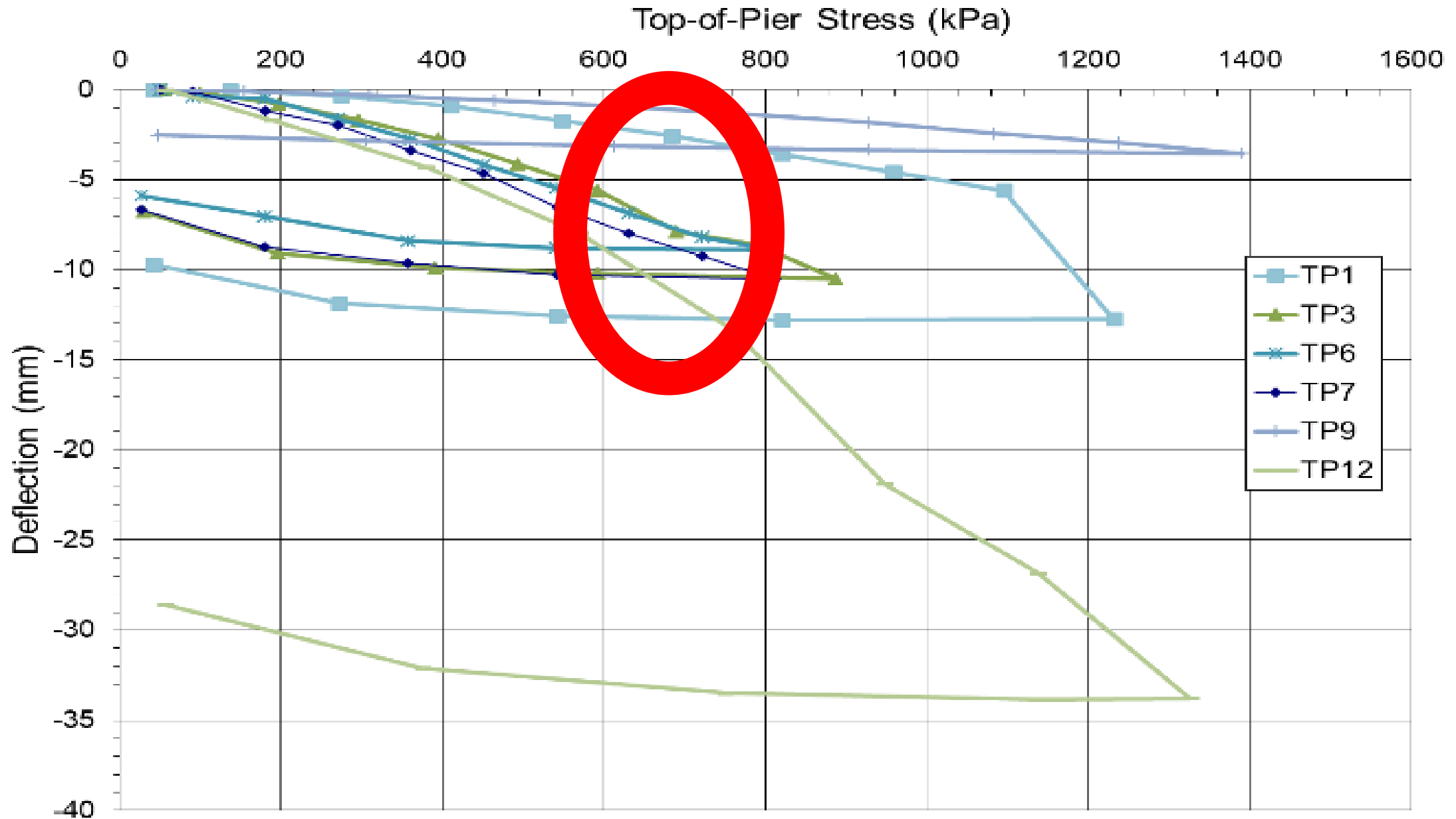
TESTING AND VERIFICATION



Load Testing – Modulus Testing

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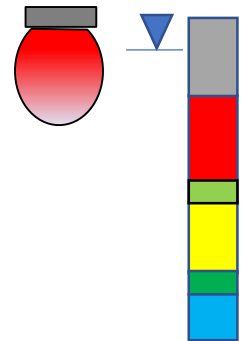






Load Testing- Plate and Group Footing

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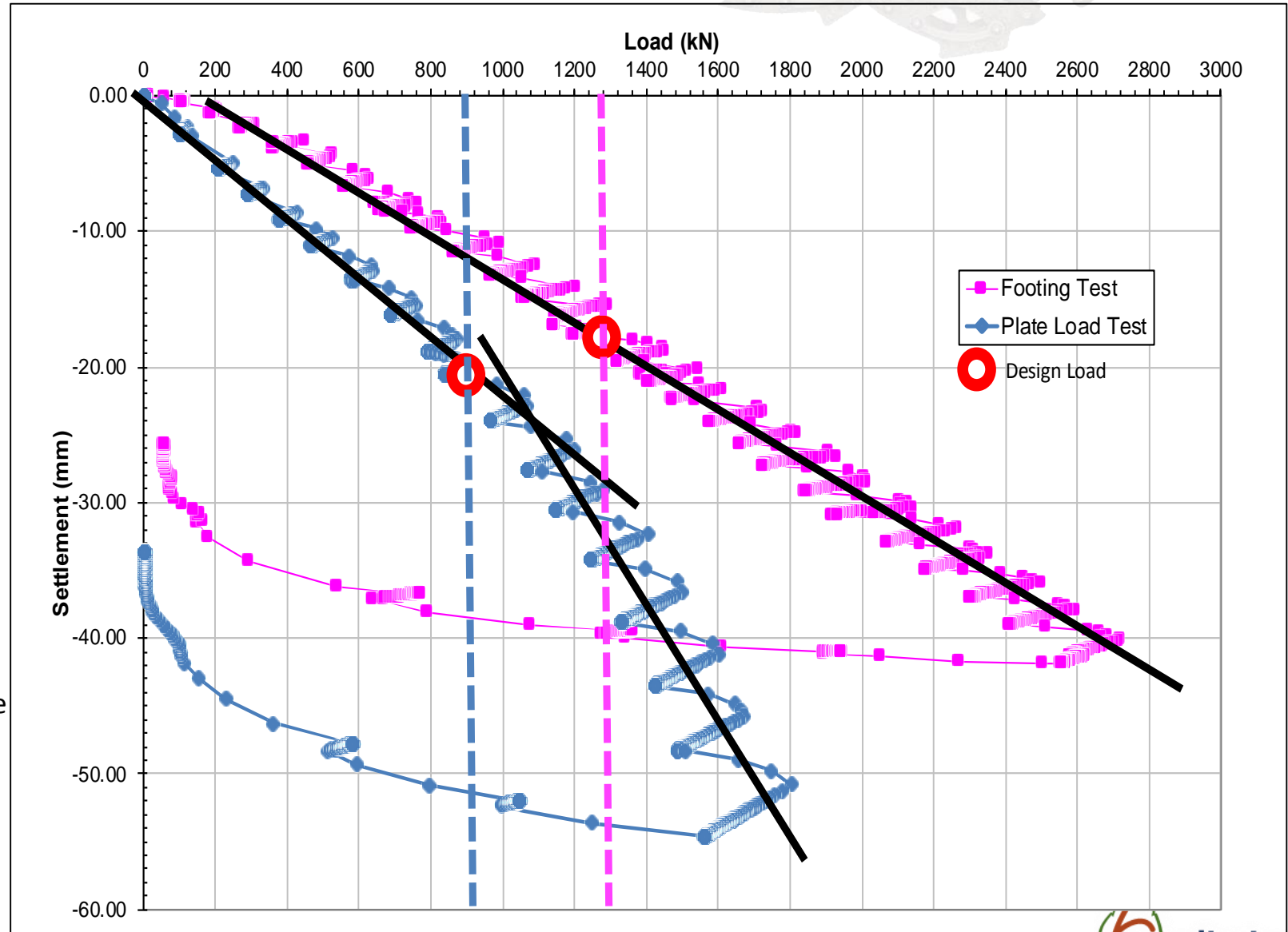
2 to 6m Fill

5m soft Organic Silts and Clays

1m fibrous Peat – soft to firm

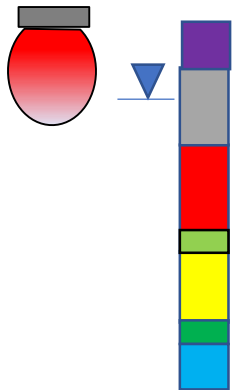
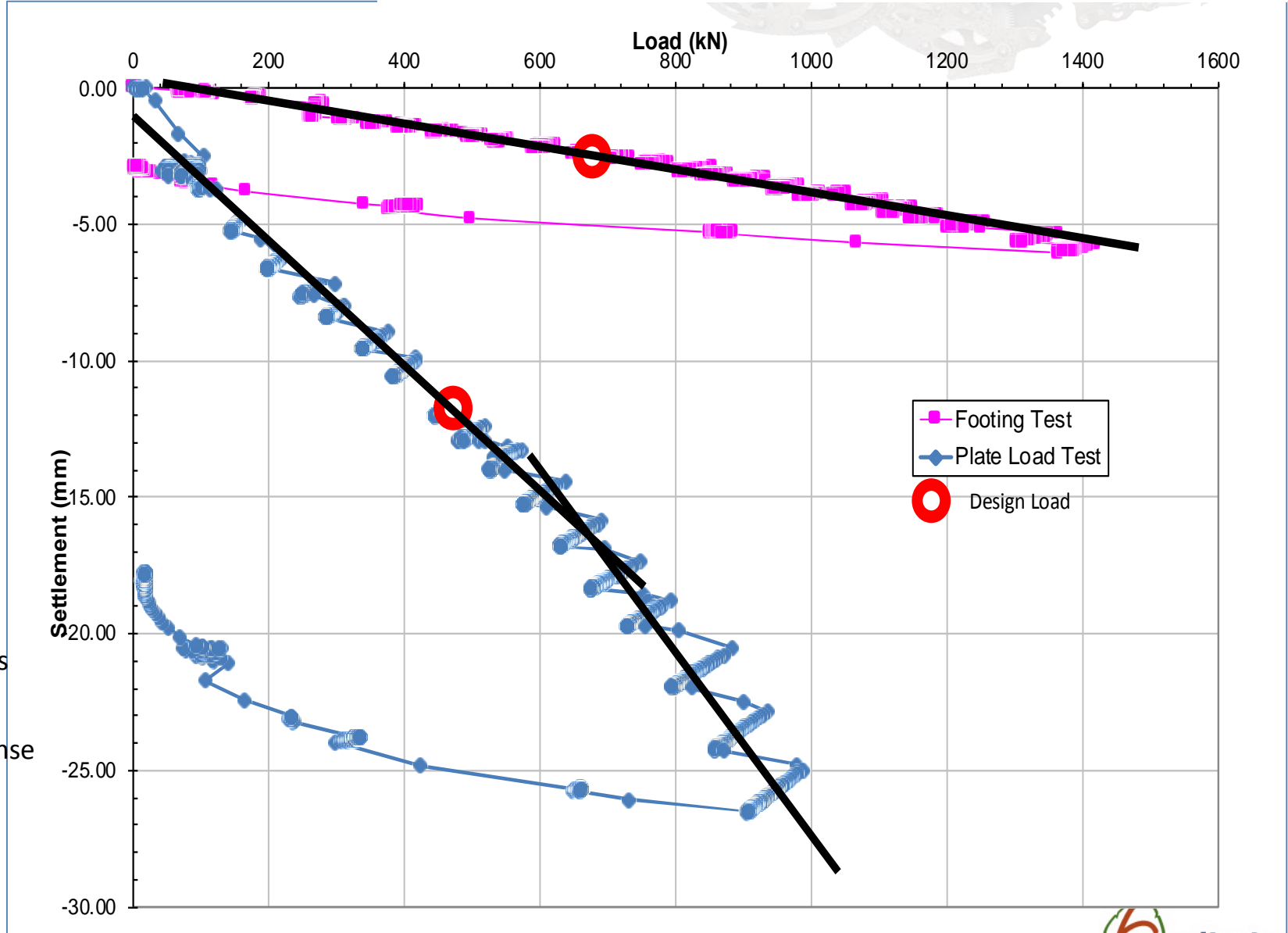
2 - 6m Sands – compact to dense

1m Silty Clay Glacial till
Shale Bedrock



Load Testing- Plate and Group Footing

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PRELOAD FILL
2 to 6m Fill
5m soft Organic Silts and Clays
1m fibrous Peat – soft to firm
2 - 6m Sands – compact to dense
1m Silty Clay Glacial till
Shale Bedrock

- Monitoring on several footings after footing construction and during building construction and for about 13 months total
- Results showed average of 20mm total settlement at the end of construction





GEOPIER
Tensar

 **GEOSOLV**
DESIGN → BUILD

SUMMARY

- Brownfields are not just “brown” based on environmental issues!
- Geotechnical issues often exist on these sites, some even created by the remediation that might have taken place to get rid of the impact!
- Great tools are available to assess soils in high resolution
- Fill and peat could be considered a pollutant, but they are not Air
- Tools are available for fixing soils environmentally
- Tools are also available for fixing soils geotechnically/structurally
- Ground Improvement is effective for treating brownfields
- Banff is Awesome!

THANK YOU!