SMART Remediation

Soil Management Technology at the Toronto Portlands

Sajid Alimohamed
QM Environmental
SMART Toronto and Ottawa

Toronto, ON | January 25, 2024
Ottawa | February 8, 2024

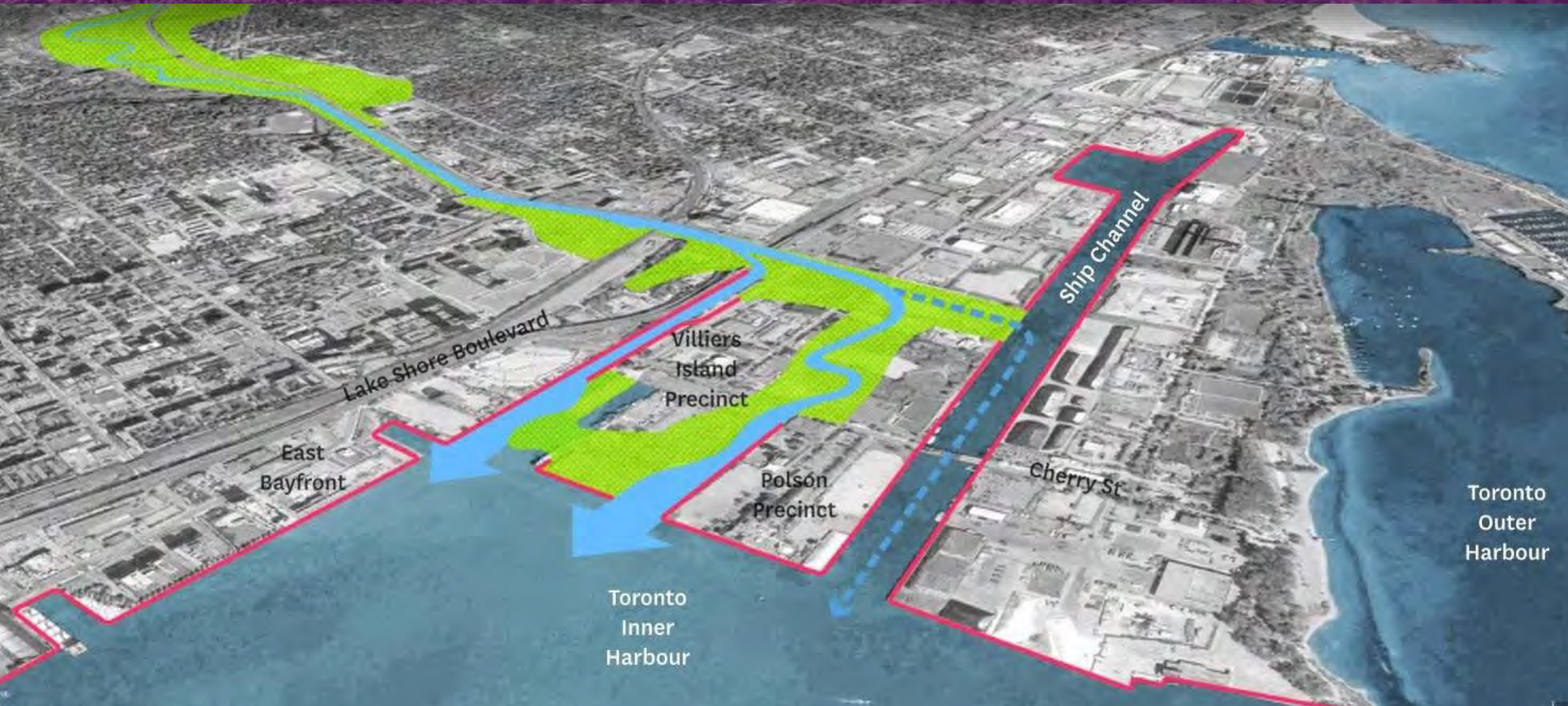
SMART is Powered by: VERTEX Environmental Inc.

www.vertexenvironmental.ca

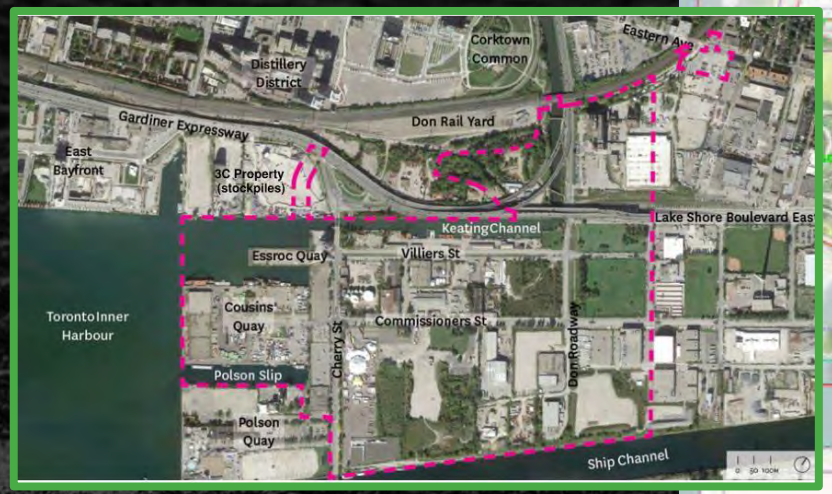
SOIL MANAGEMENT TECHNOLOGY

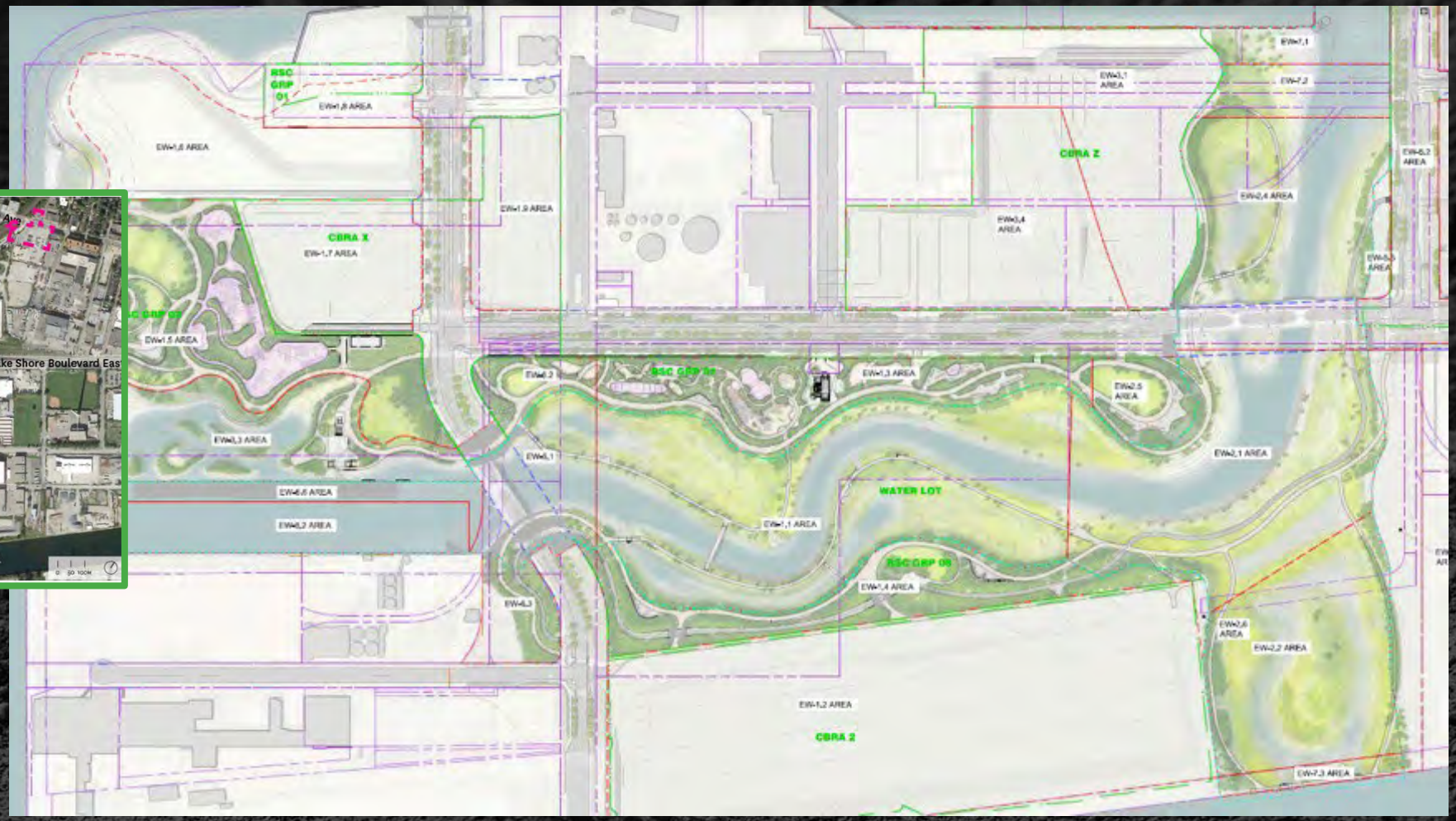
AT THE TORONTO PORT LANDS

PORT LANDS FLOOD PROTECTION ENABLING INFRASTRUCTURE PROJECT OBJECTIVES



THE DESIGN


Corktown Common
Eastern Ave
Distillery District
Gardiner Expressway
Don Rail Yard
East Bayfront
3C Property (stockpiles)
Keating Channel
Lake Shore Boulevard East
Essroc Quay
Villiers St
Toronto Inner Harbour
Cousins Quay
Commissioners St
Cherry St
Don Roadway
Polson Slip
Polson Quay
Ship Channel


RSC GRP 01
CBRA X
CBRA Z
CBRA 2
WATER LOT
RSC GRP 05

SOIL REUSE OBJECTIVES

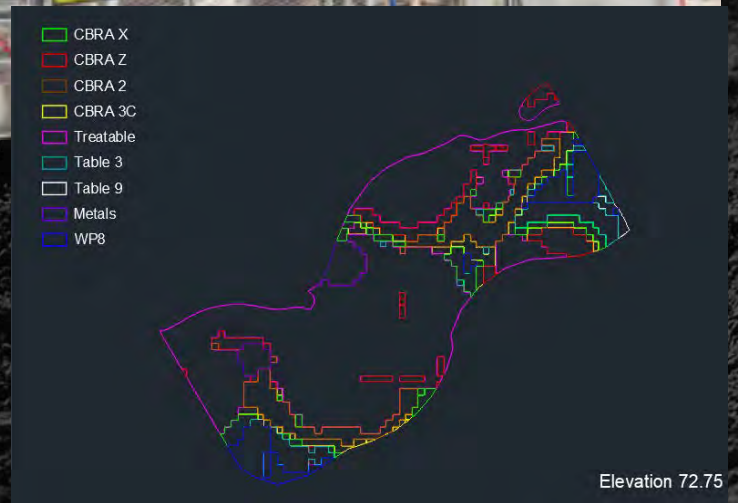
- *O.Reg 406/19 promotes the 'beneficial reuse of soil' and diversion from landfill.*
- *Total Excavated ~ 1,354,000 m3*
- *Soil Disposed 310,500 m3*
- *Soil reused or stockpiled for reuse 1,043,500 m3*
- *~78% reuse*

SOIL REUSE OBJECTIVES

BENEFIT OF 1,000,000m3 OF SOIL SAVED/REUSED?

- ✓ 100,000 round trips to landfill
- ✓ 6,000,000 km at avg. 60 km round trip
- ✓ ~ 150 TRIPS AROUND THE EARTH!
- ✓ ~ 875 Tonnes in CO_2 Emissions Saved

SOIL REUSE CRITERIA & REUSE AREAS

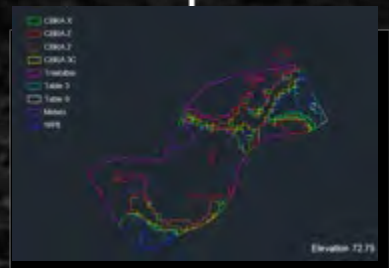


"Digital tracking will include, at a minimum, the following time-stamped criteria for each truck used to move soil or debris material from or within the excavation area shown in the drawings or otherwise identified, commencing with the excavation of source material from the excavation area, and/or the placement of material in a temporary stockpile:

.1 Unique haul truck identification such as license plate number, registration number or Ministry approval number.
.2 Load source location (GPS with submeter accuracy coordinates or origin identification), including depth and/or elevation range.
.3 Load volume.
.4 Qualitative assessment by Subcontractor of the moisture content (e.g., wet, dry, moist, etc.)
.5 Load soil type (e.g., sand, fill, silt, etc.)
.6 Load source soil excavation category as defined on Drawing 4-E-1
.7 Drop location (spatial coordinates of fill placement) and approximate lift thickness and elevation."

CONSTRUCTION METHODOLOGY

SOIL EXCAVATION



EXCAVATED SOIL CLASSIFICATION

UNSUITABLE SOIL OFFSITE

FILL NEEDS ASSESSMENT

SOIL MATCHING

PROCESSING AT SOIL MANAGEMENT FACILITY

DIRECT REUSE

AMENDMENT

REMEDIATION

EXCESS SOIL STOCKPILE/OFFSITE

FILL QUALITY ASSESSMENT

SOIL USE

USE AS SOFT OR HARD CAP BARRIER FILL

USE AS CONTROLLED FILL

USE AS ENGINEERED FILL

UNSUITABLE SOIL TO LICENSED OFFSITE RECEIVER

PLFPEI Soil Management Plan, Jacobs (2019)

APPROACH: ENVIRO & GEOTECH STEWARDSHIP

Inputs:

- PLFP Topo Survey
- PLFP 33.2 Design Limits
- PLFP Geo-Env Model
- PLFP Geotech Model
- Soil Movement Identifiers
- Geofence Extents

GPS BASED SYSTEM

- Uses PLFP design models to generate Excavation, Stockpile and Backfill x,y,z coordinates
- Generates unique source identifier ID (reuse & imported materials)
- Maintains unique source ID and adds stockpile identifier ID (soil, non-soil debris, peat, waste)
- Maintains unique source ID and stockpile ID and adds backfill identifier ID
- Generates Daily As-Built reports
- Date & Time stamped truck tracking
- Load Reports
- Movement Productivities

EQuIS™ DATABASE/WEBAPP

- Compares GeoEnv results to 14 PLFP Bulk Reuse or Imported Soil Criteria and SPLP Leachate Criteria
- Compares Geotechnical results to 4 PLFP soil type criteria
- Compares Horticultural results to PLFP horticultural criteria
- Retains unique stockpile identifier ID adds sample IDs
- Includes Subcontractor QPESA approval recommendations to Consultant QPESA
- Date & Time stamped

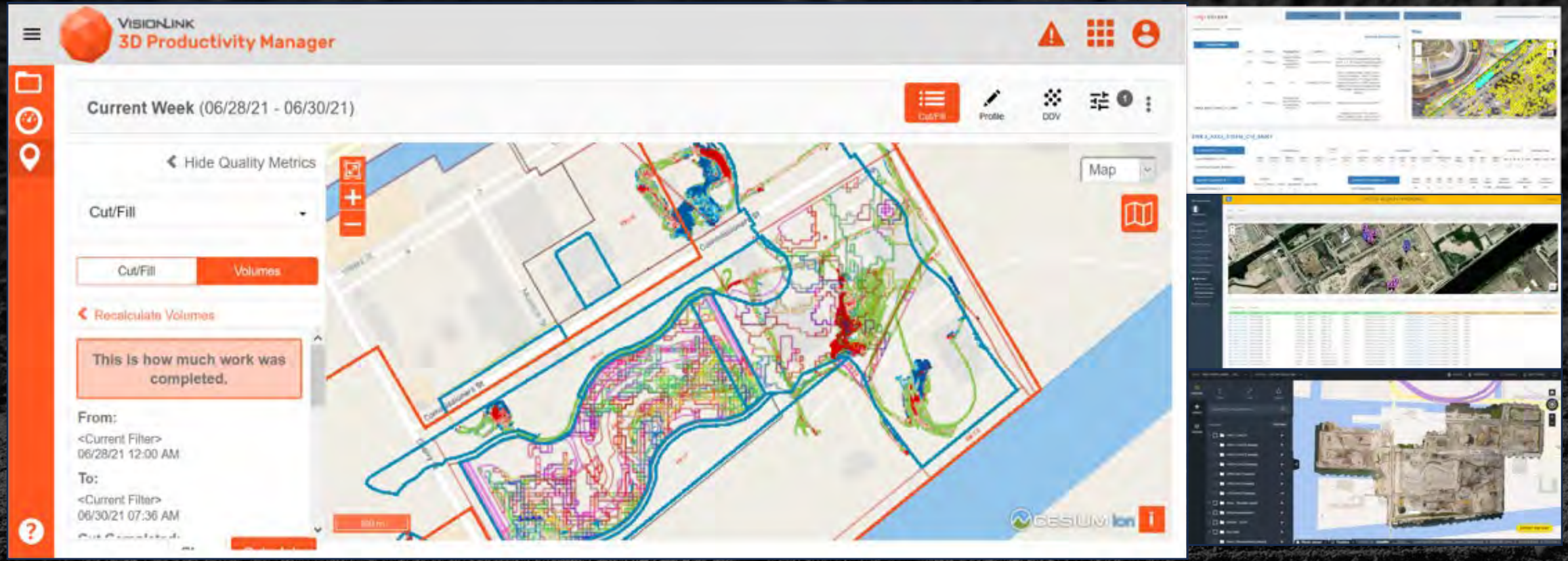
Inputs:

- Lab EDD files for GeoEnv Reuse /Imported/Treated Soil Sample Results
- Golder Laboratory Geotech Reuse / Imported/Treated Soil Sample Results
- Imported Soil Background Environ Reports/Data
- Horticultural Soil Quality Reports/Soil Sample Results
- Subcontractor QPESA Field Observations and Data (EQuIS™ Collect)

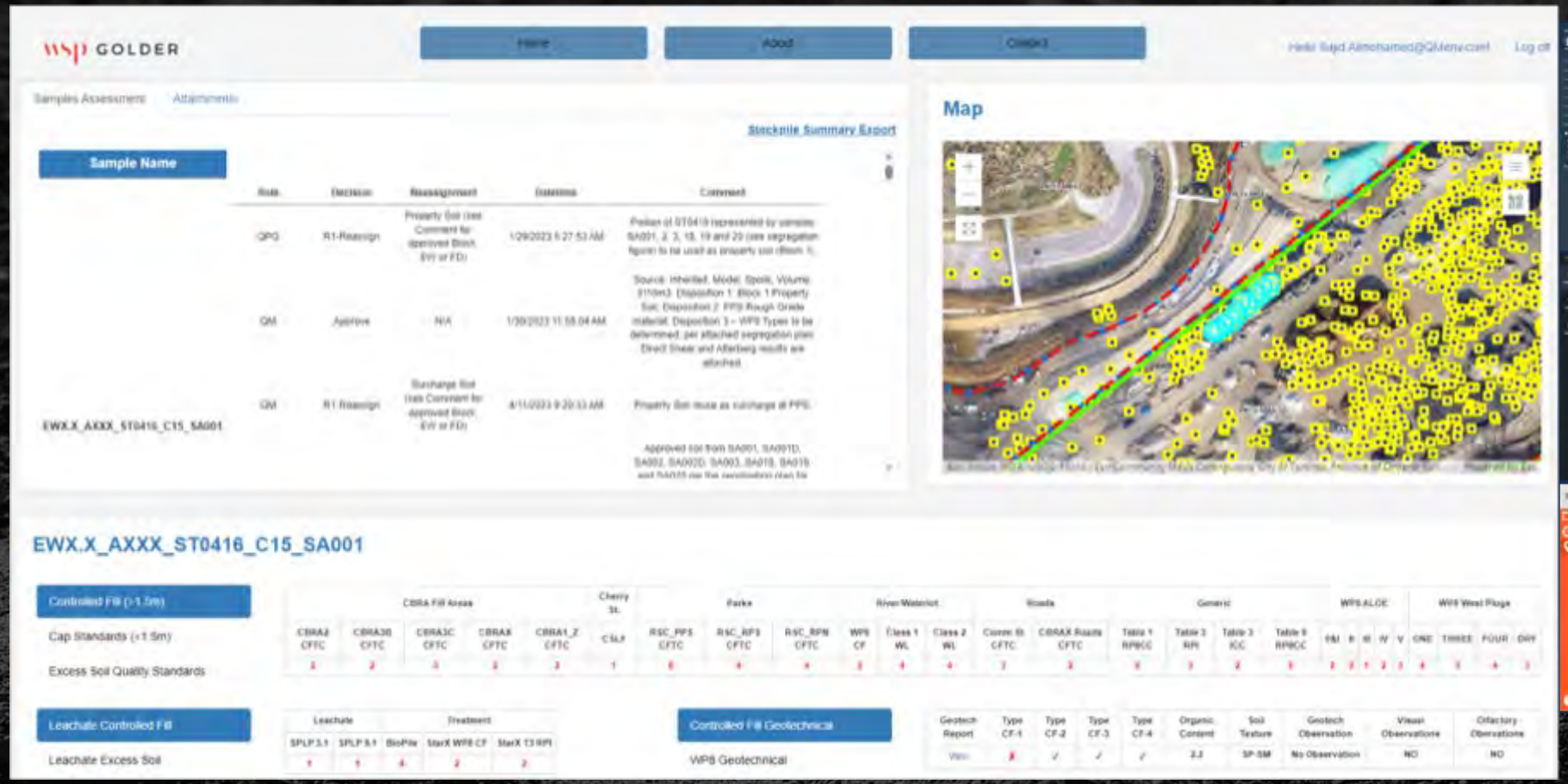
STAKEHOLDER ACCESSIBILITY PLATFORM

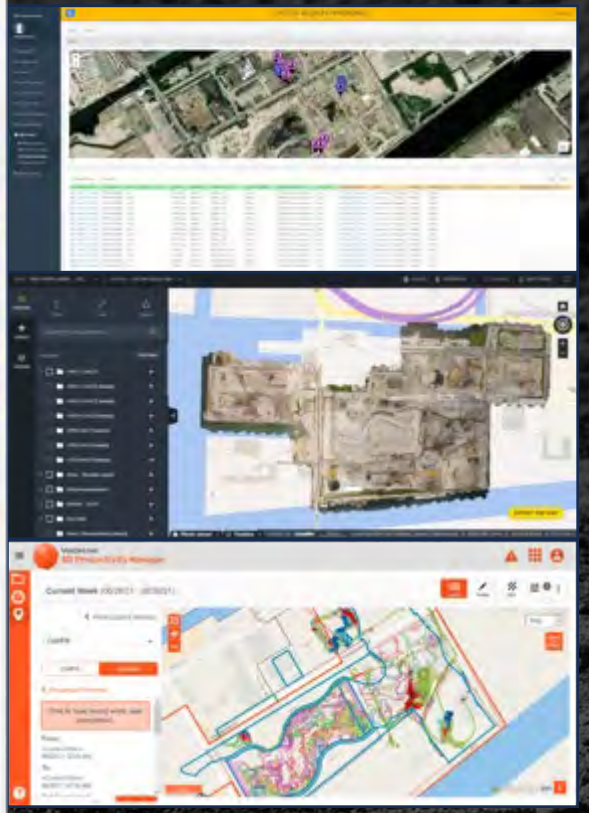
- Consultant QPESA (Final Approvals)
- Consultant QPRA
- Owner (Waterfront Toronto)
- Construction Manager (EllisDon) – QA Results

SOIL MANAGEMENT: GRADE CONTROL

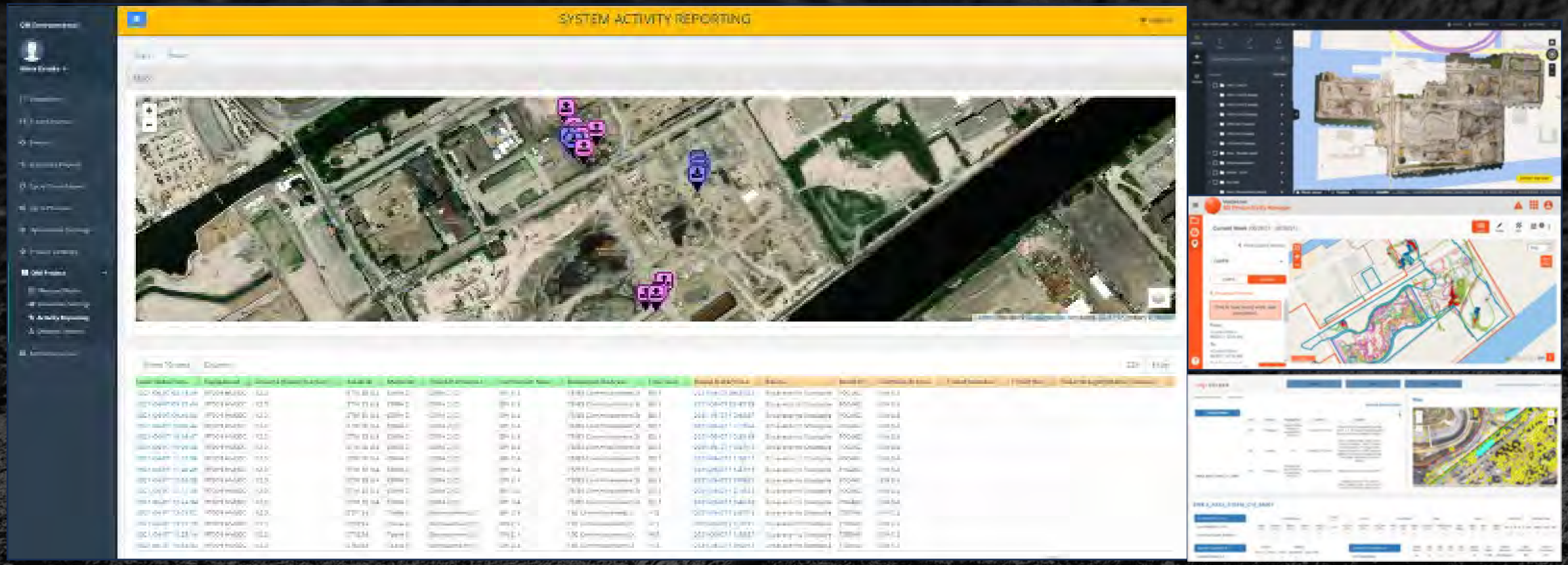


SOIL MANAGEMENT: DATABASE

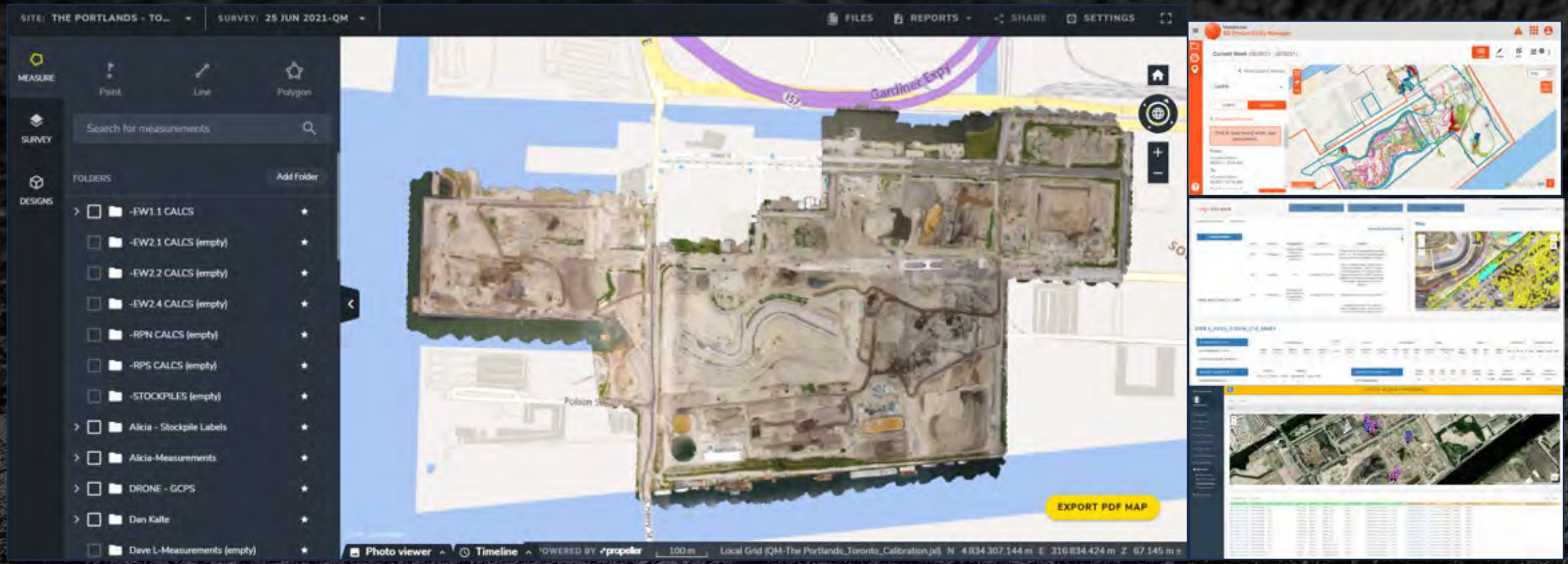




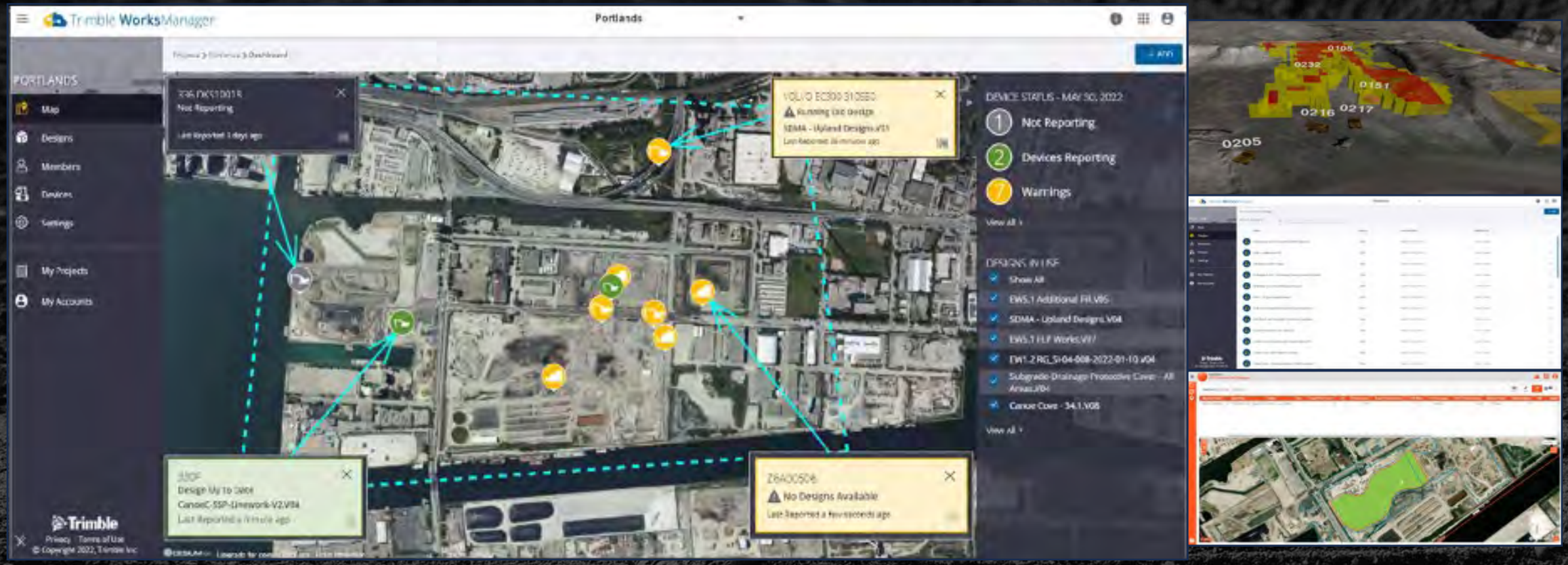
SOIL MANAGEMENT: TRACKER



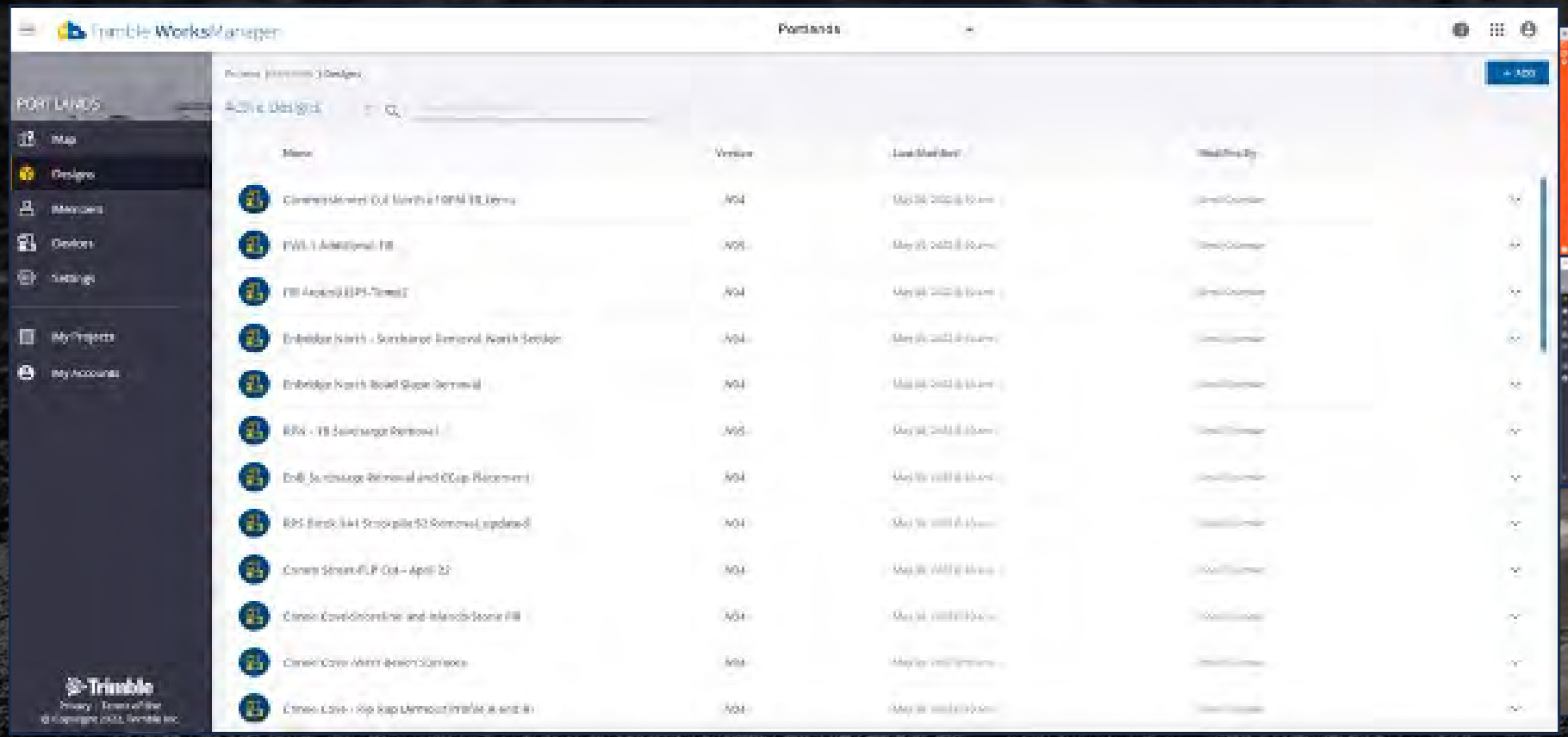
SOIL MANAGEMENT: ANALYZER



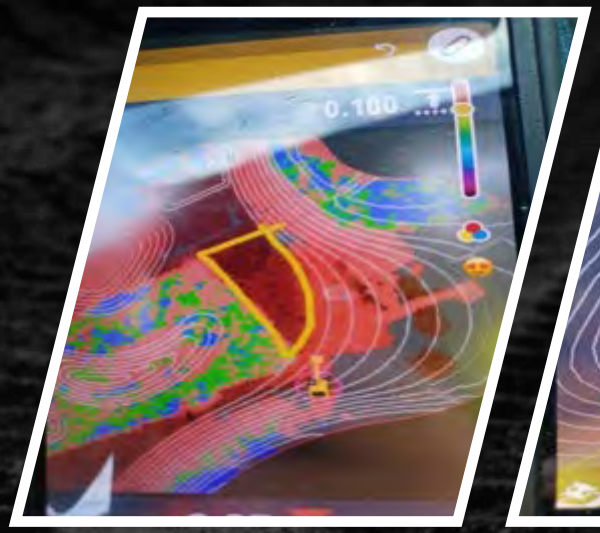
SOIL MANAGEMENT BY GRADE CONTROL

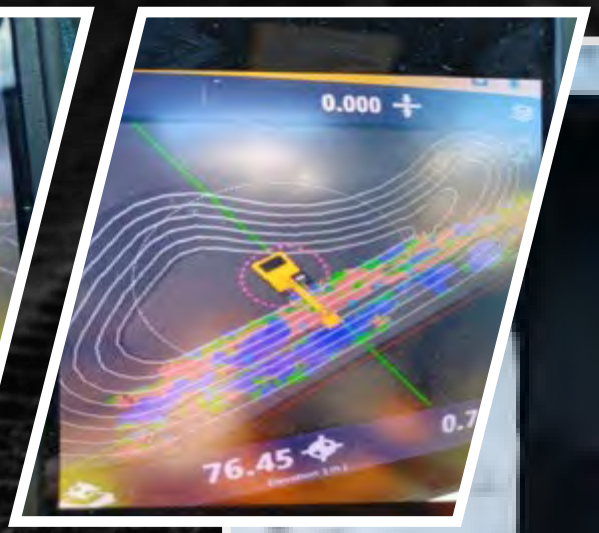


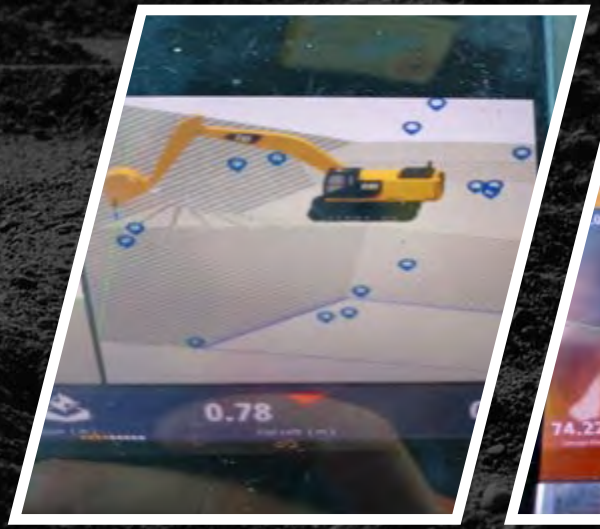
SOIL MANAGEMENT BY GRADE CONTROL



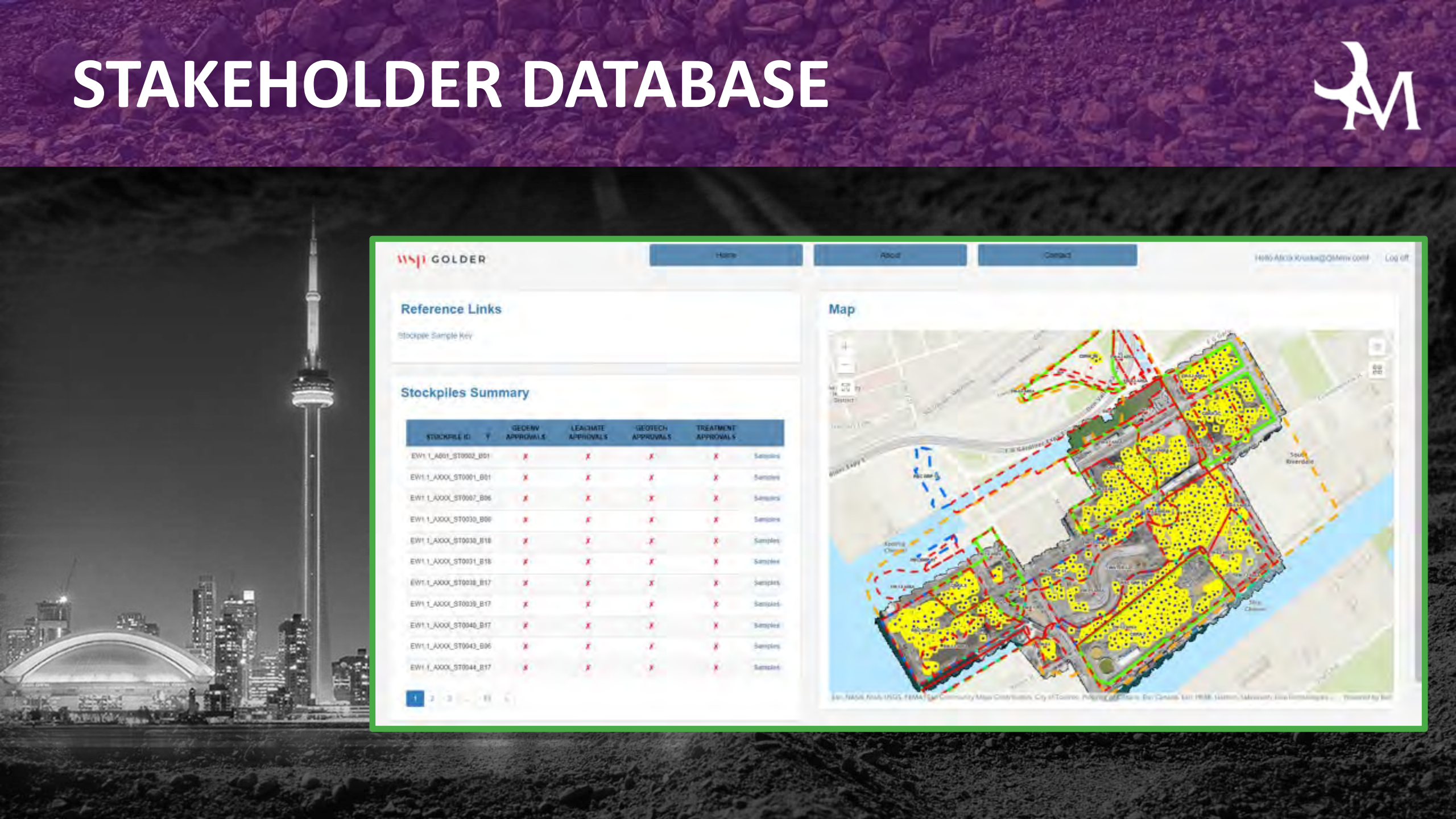
SOIL MANAGEMENT BY GRADE CONTROL







STAKEHOLDER DATABASE



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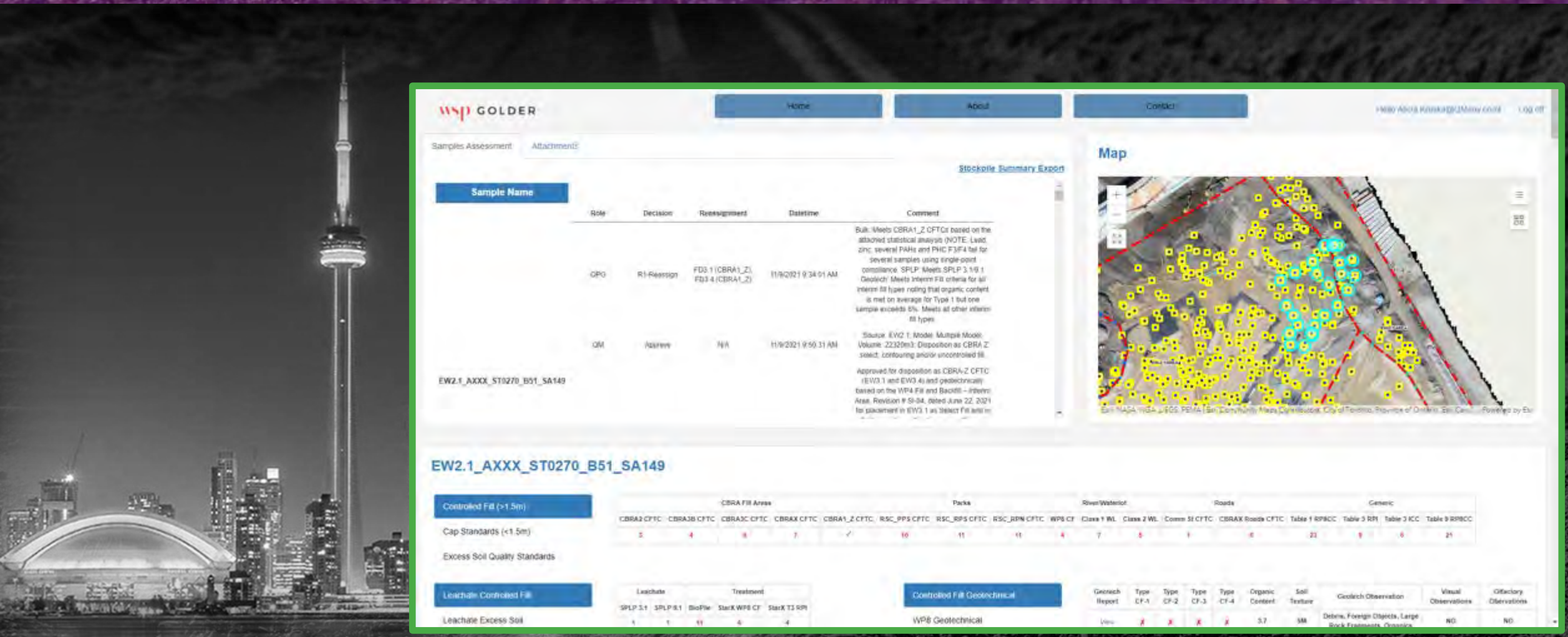

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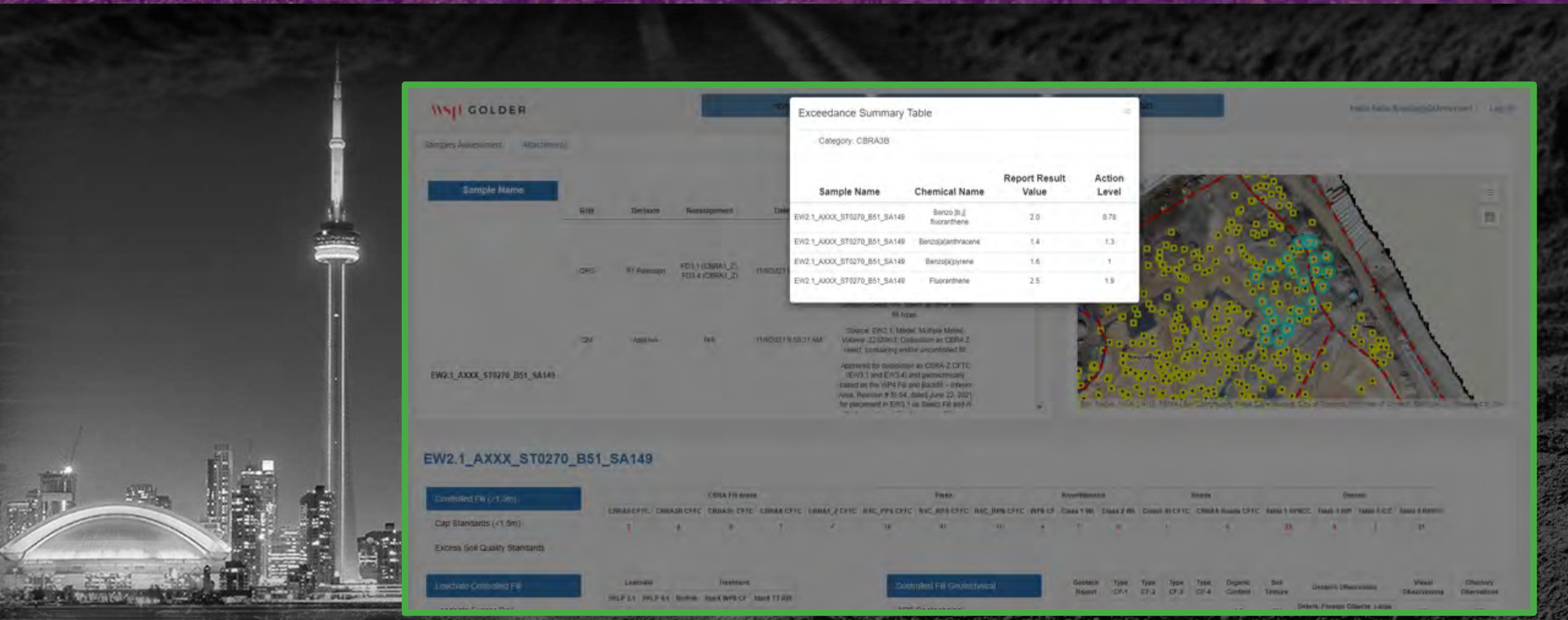

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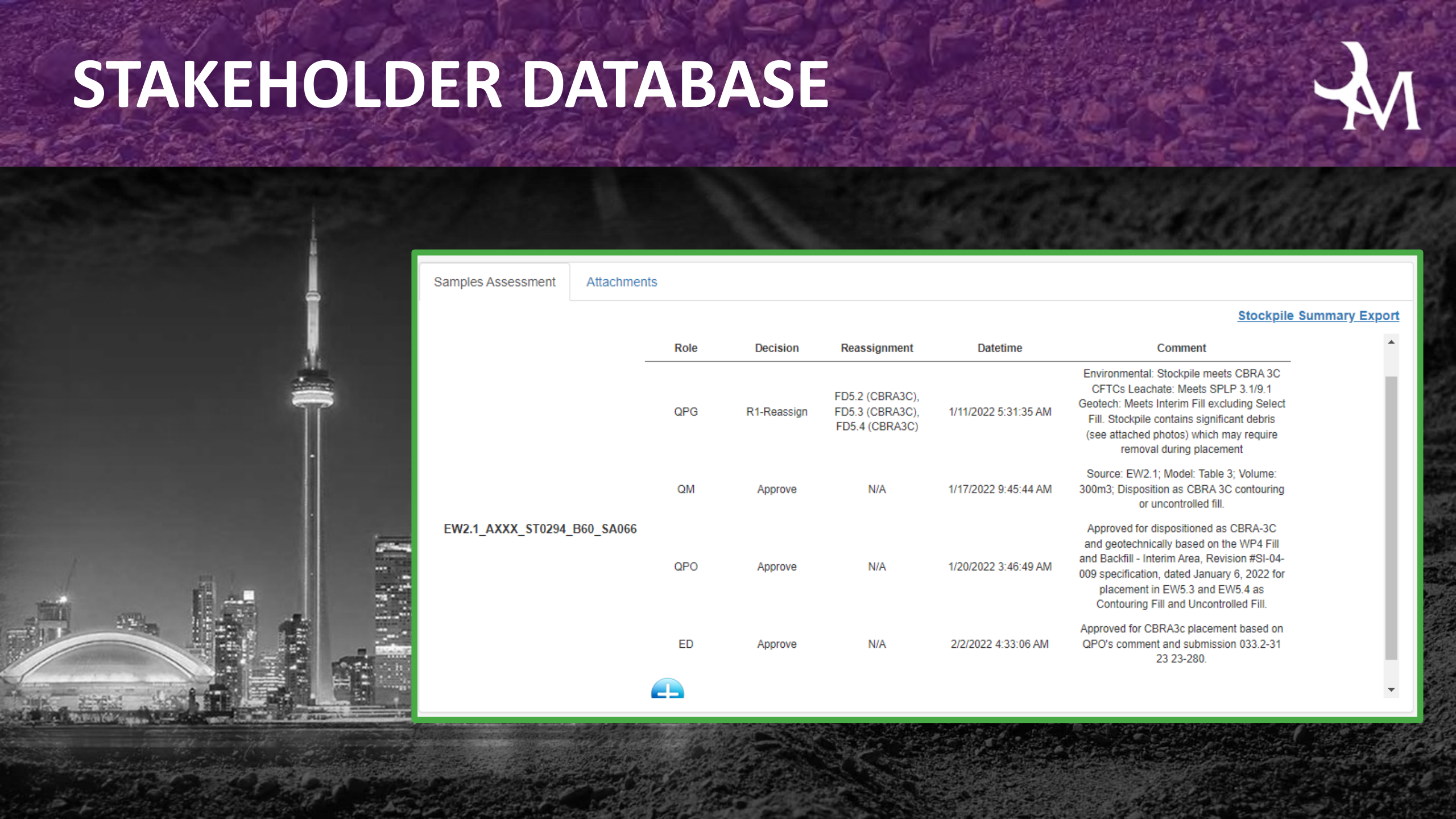


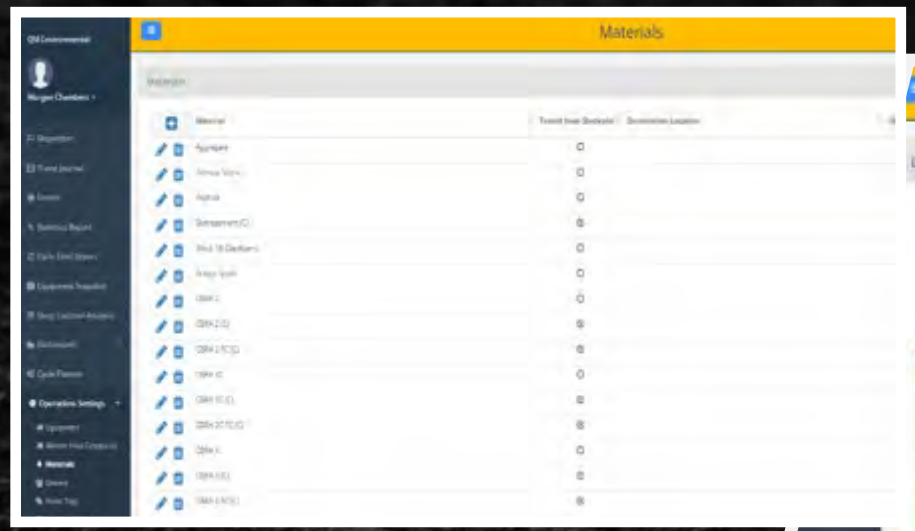
Samples Assessment | Attachments

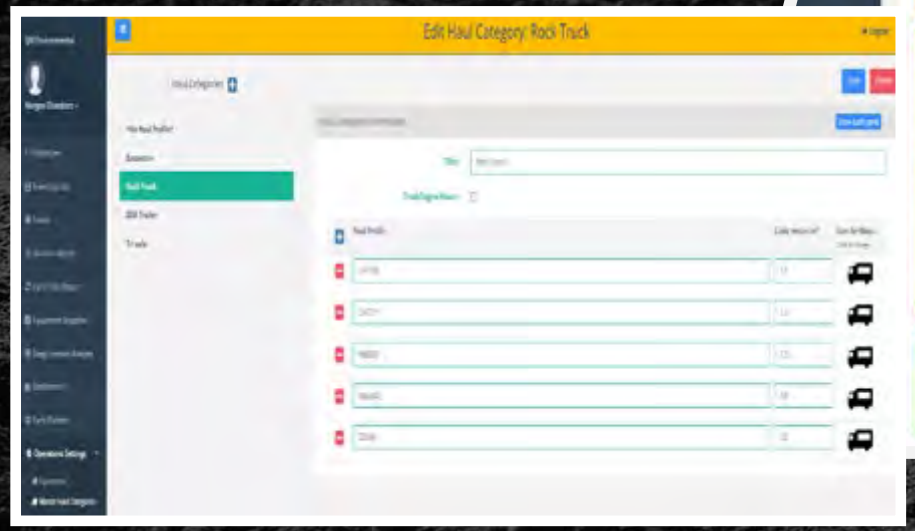
Stockpile Summary Export

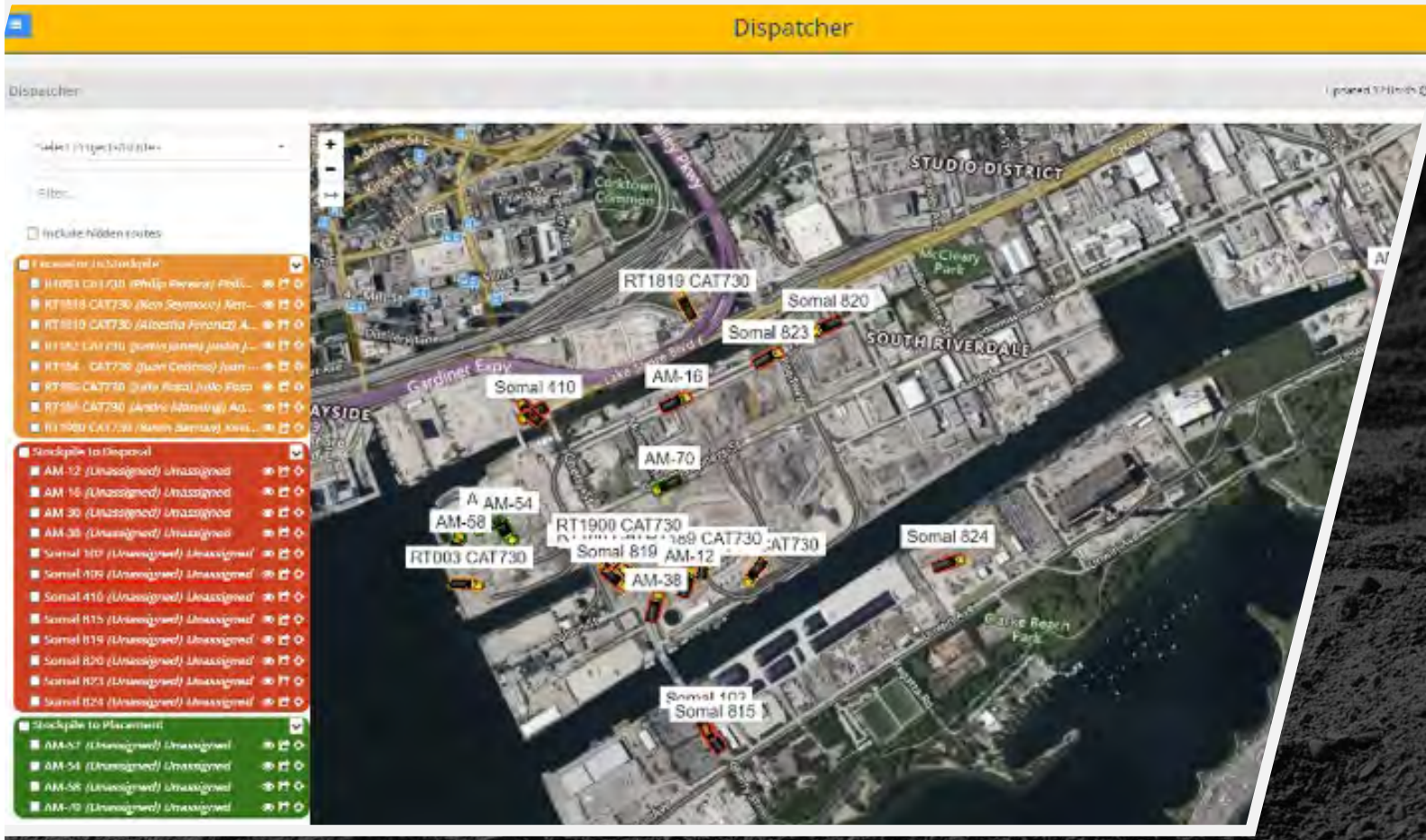
EW2.1_AXXX_ST0294_B60_SA066

Role	Decision	Reassignment	Datetime	Comment
QPG	R1-Reassign	FD5.2 (CBRA3C), FD5.3 (CBRA3C), FD5.4 (CBRA3C)	1/11/2022 5:31:35 AM	Environmental: Stockpile meets CBRA 3C CFTCs Leachate: Meets SPLP 3.1/9.1 Geotech: Meets Interim Fill excluding Select Fill. Stockpile contains significant debris (see attached photos) which may require removal during placement
QM	Approve	N/A	1/17/2022 9:45:44 AM	Source: EW2.1; Model: Table 3; Volume: 300m3; Disposition as CBRA 3C contouring or uncontrolled fill.
QPO	Approve	N/A	1/20/2022 3:46:49 AM	Approved for dispositioned as CBRA-3C and geotechnically based on the WP4 Fill and Backfill - Interim Area, Revision #SI-04-009 specification, dated January 6, 2022 for placement in EW5.3 and EW5.4 as Contouring Fill and Uncontrolled Fill.
ED	Approve	N/A	2/2/2022 4:33:06 AM	Approved for CBRA3c placement based on QPO's comment and submission 033.2-31 23 23-280.

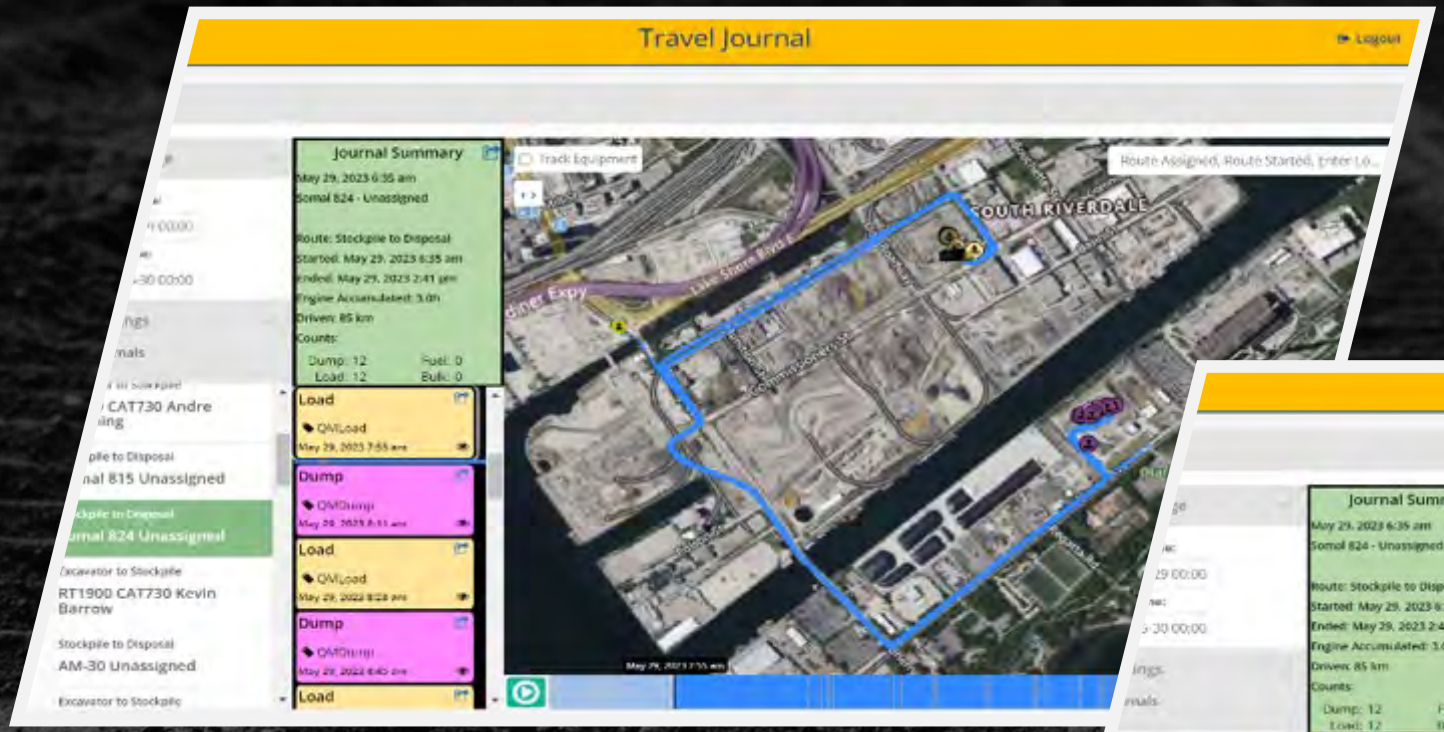
SOIL MOVEMENT TRACKING







SOIL MOVEMENT TRACKING



SOIL MOVEMENT TRACKING

System Activity Reporting

Logout

Filters Reset

Map

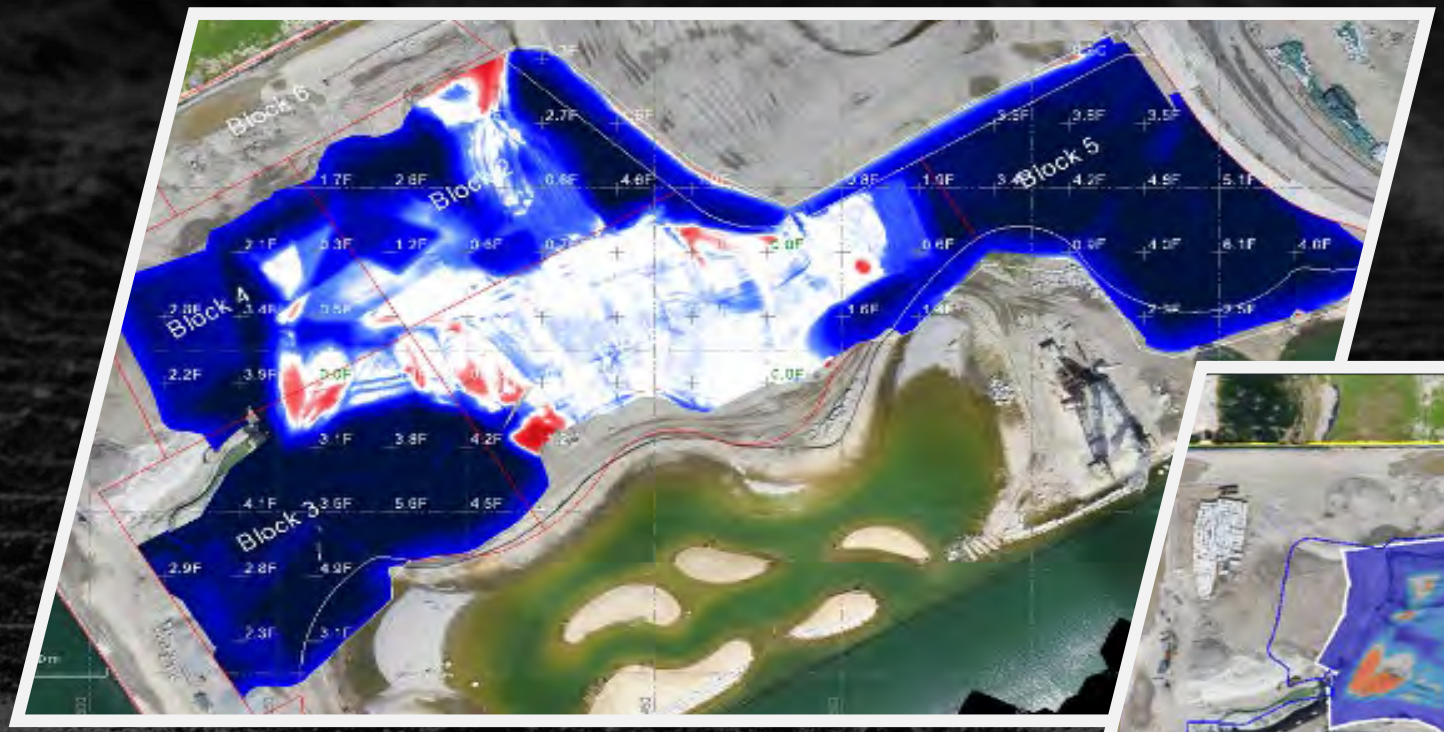
Shows 15 rows Columns Bulk Edit CSV Excel

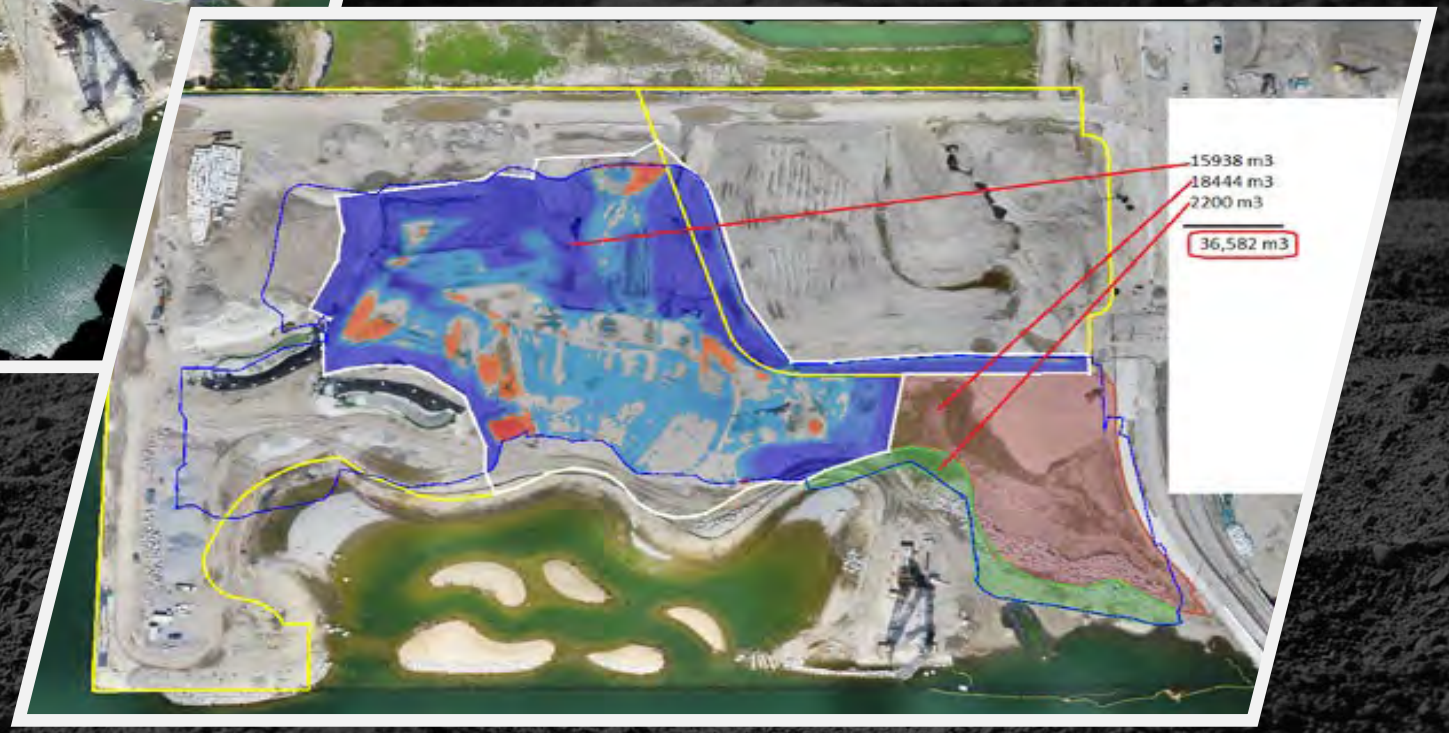
Load Date/Time	Equipment	Volume (Cubic meters)	Block ID	Material	Characterization	Earthwork Area	Municipal Address	Line Item	Dump Date/Time	Reuse	Block ID	Earthwork Area	Ticket Number	Ticket SoL	Ticket Weight (Metric Tonnes)
2023-04-04 08:11:46	RT184 - CAT730	12.0	E90019	Impacted Soil		EW 6.1	225 Cherry St	C5	2023-04-04 08:19:40	Excavator to Stockpile	ST0447	EW 1.2			
2023-04-04 08:13:41	Somal 824	11.0	ST0454	Dredging	Waste (C)	EW 8.1	Keating Channel	K2	2023-04-04 08:26:06	Stockpile to Disposal	GFL Unwin		252113	051457	20.05
2023-04-04 08:14:06	RT1835 CAT730	12.0	E90017	Property Soil		EW 6.1	225 Cherry St	C5	2023-04-04 08:19:41	Excavator to Stockpile	ST0445	EW 1.2			
2023-04-04 08:14:50	RT1819 CAT730	10.0	E70002	Dredging		EW 4.2	SDMA	A37	2023-04-04 08:28:24	Excavator to Stockpile	ST0435	EW 8.1			
2023-04-04 08:20:30	Somal 821	11.0	ST0454	Dredging	Waste (C)	EW 8.1	Keating Channel	K2	2023-04-04 08:35:52	Stockpile to Disposal	GFL Unwin		252116	043120	20.73
2023-04-04 08:23:00	RT1900 CAT730	12.0	E90017	Property Soil		EW 6.1	225 Cherry St	C5	2023-04-04 08:28:06	Excavator to Stockpile	ST0445	EW 1.2			
2023-04-04 08:24:12	RT184 - CAT720	12.0	E90019	Impacted Soil		EW 6.1	225 Cherry St	C5	2023-04-04 08:38:21	Excavator to Stockpile	ST0447	EW 1.2			
2023-04-04 08:28:01	RT1835 CAT730	12.0	E90017	Property Soil		EW 6.1	225 Cherry St	C5	2023-04-04 08:31:22	Excavator to Stockpile	ST0445	EW 1.2			

SOIL MANAGEMENT SURVEY ANALYZER

SOIL MANAGEMENT BY DRONE: VOLUMES

SOIL MANAGEMENT BY DRONE: PROGRESS SURVEYS





SOIL MANAGEMENT BY DRONE: PROGRESS SURVEYS

CHALLENGES TO SOIL REUSE

1. Stockpiling Space and Balancing Excavation with Fills

2. Environmental AND Geotechnical Considerations, Changing Goal Posts and Stakeholder Buy-in

3. Barriers of Entry to Sophisticated Tracking Technology and Future Expectations

STOCKPILING SPACE

STOCKPILING SPACE

GEOTECHNICAL CHALLENGES

Geotech Summary Comparisons

Sample ID: EW2.1_AXXX_ST0241_B60_SA063

Controlled Fill

Soil Classification	Gradation	Proctor	Organic Content
Type CF-1 Limits	Fail	1.765	Fail > 3
Type CF-2 Limits	Fail		Fail > 3
Type CF-3 Limits	Fail		Fail > 3
Type CF-4 Limits	Fail		Fail > 3

Interim Fill

Soil Classification	Gradation	Proctor	Organic Content
Select Fill Limits	Pass	Pass > 1.6	Pass < 6
Contouring Fill Limits	Pass	--	Pass < 15
Uncontrolled Fill Limits	Pass	--	Pass < 25
Oversized Limits	Pass	--	--

Wetland & Upland Soils

Soil Classification	Gradation	Saturated Proctor	Organic Content
Type WS-1 Limits	Fail	Pass > 1.82	Pass 3-12
Type WS-2 Limits	Fail	Fail < 1.82 @85%	Pass < 12
Type WS-3 Limits	Fail	Fail < 1.99 @95%	Fail > 2
Type U-I Limits	Fail	--	Pass > 1.5

Work Package 8 Soils

Soil Classification	Gradation	Proctor	Organic Content
Type WP8-1 Limits	Fail	Fail < 1.8	Fail > 2
Type WP8-2 Limits	Pass	Fail < 1.8	Fail > 3
Type WP8-LVB Limits	Pass	Pass > 1.7	Fail > 1

GOLDER

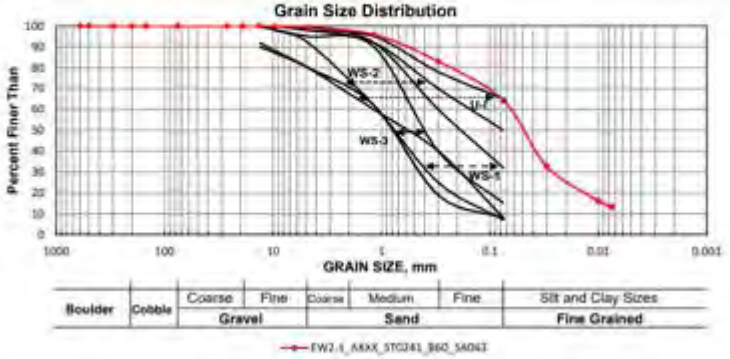
WETLAND UPLAND INTERIM SOIL (WS UI)
PARTICLE SIZE ANALYSIS OF SOILS (MTO LS-702)

Project Number: 19130936-0032 — July 23, 2021
Sample ID: EW2.1_AXXX_ST0241_B60_SA063 — Golder Lab No.: 21-1935
Soil Classification: Silt — Gradation Type WS-1 Pass/Fail: Fail
Date Sampled: July 15, 2021 — Gradation Type WS-2 Pass/Fail: Fail
Date Received: July 16, 2021 — Gradation Type WS-3 Pass/Fail: Fail
Date Tested: July 19, 2021 — Gradation Type U-I Pass/Fail: Fail

Particle Size (mm)	Percent Retained	Percent Passing	Type WS-1 Limits	Type WS-2 Limits	Type WS-3 Limits	Type U-I Limits	Acceptable			
							Type WS-1	Type WS-2	Type WS-3	Type U-I
600.0	0.0	100.0	--	--	--	--	--	--	--	--
200.0	0.0	100.0	--	--	--	--	--	--	--	--
150.0	0.0	100.0	--	--	--	--	--	--	--	--
75.0	0.0	100.0	--	--	--	--	--	--	--	--
26.5	0.0	100.0	--	--	--	--	--	--	--	--
19.0	0.0	100.0	--	--	--	--	--	--	--	--
13.2	0.0	100.0	100	90 - 100	90 - 100	92 - 100	Y	Y	Y	Y
9.5	0.2	99.8	98 - 100	87 - 100	87 - 98	88 - 100	Y	Y	N	Y
4.75	0.8	99.2	92 - 100	80 - 98	80 - 95	80 - 98	Y	N	N	N
1.18	4.1	95.9	62 - 92	62 - 92	62 - 90	60 - 95	N	N	N	N
0.300	17.0	83.0	25 - 60	19 - 70	19 - 40	40 - 78	N	N	N	N
0.075	35.7	64.3	7 - 32	8 - 50	8 - 15	8 - 65	N	N	N	Y
0.030	67.3	32.7	--	--	--	--	--	--	--	--
0.010	83.8	16.2	--	--	--	--	--	--	--	--
0.0075	86.7	13.3	--	--	--	--	--	--	--	--

Tested By: L. Brown — Data Input By: J. Norris

Grain Size Distribution

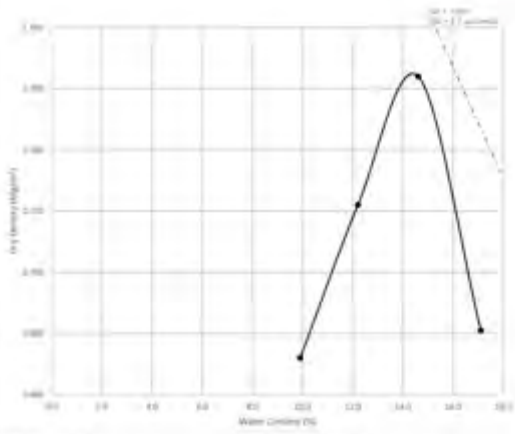


GOLDER

MOISTURE DENSITY RELATIONSHIP OF SOILS (MTO LS-706)

Project Number: 19130936-0032 — July 23, 2021
Sample ID: EW2.1_AXXX_ST0241_B60_SA063 — Golder Lab No.: 21-1935
Date Sampled: July 15, 2021 — Date Received: July 16, 2021
Date Tested: July 19, 2021

Max Dry Density (Mg/m³)	1.765	Optimum Water Content (%)	14.4
Max Wet Density (Mg/m³)	2.019		
Corrected Max Dry Density (Mg/m³)	Not Applicable	Natural Water Content (%)	Not Available



Furnace Temperature During Test (°C)	440
Duration of Test (nearest 15 minutes)	4470
Mass of Crucible With Lid (g)	57.64
Moist Mass of Specimen Plus Crucible With Lid (g)	161.81
Oven Dry Mass of Specimen Plus Crucible With Lid (g)	134.12
Mass of Crucible With Lid Plus Ash (g)	131.52
Water Content (%)	36
Ash Content (%)	96.6
Organic Material (%)	3.4

STAKEHOLDER BUY-IN!

within 3 m of proposed infrastructures.

(Geotech): Reference to discussion with ED and WT on 27-Oct-23 regarding conditional approval of ST0462, it is recommended by WSP that this material not be used as part of the PLFP project infrastructure (i.e., catch basins and leads, sidewalk, cycle track, etc.); however, it may be used within transitway corridors along new Cherry Street or any other provided environmental suitability. Within transitway corridor, it is recommended that this fill not be placed within 3 m of the proposed infrastructures. We note that if this material is placed within the transitway corridor, it may have to be sub-excavated and replaced by the future transitway team. It is recommended that the locations where this material is placed is

STAKEHOLDER BUY-IN!

RESPOND. RECLAIM. RENEW.

WP8 environmental reuse criteria are among the most stringent criteria to meet on the project and a limited number of stockpiles meet the environmental criteria. While reviewing the stockpiles that meet the WP8 environmental reuse criteria alongside the WP8 geotechnical specifications the project stakeholders realized that only a small portion of soils would be approved for reuse unless adjustments to the geotechnical specifications were made.

On April 13, 2021, QM received Site Instruction SI-08-017, dated April 13, 2021 that includes revisions to the Work Package 8 Fill and Backfill geotechnical specifications, allowing for a greater ability to reuse soil that meets WP8 environmental reuse criteria. The revisions also translate into the following additional geotechnical tests for stockpiled soils considered for WP8 reuse:

- Direct Shear tests – One per material source
- Atterberg Limit test – On samples with greater than 35% finer than 0.075mm – One per material source

This CCN request provides costs and schedule impacts associated with this incorporation.

BARRIERS OF ENTRY

THANK YOU

SAJID ALIMOHAMED *P.Eng. PMP*

Senior Project Manager

QM ENVIRONMENTAL

416-272-4111

Sajid.Alimohamed@QMEnv.com