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ENGINEERING A SUSTAINABLE REMEDIATION APPROACH

Remediation technologies symposium EAST
Niagara Falls | 2023

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Development Considerations

- Planning Objectives
- Market
- Environmental Quality
- Geotechnical
- Hydrogeology
- Regulatory Approvals
- Shoring Design
- Excess Soil
- Construction Timelines
- Costs
- Sustainability
- Dewatering

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The Sustainability Scorecard

✓	Water Conservation / Reuse	Less water use, taking, pumping
✓	Soil Conservation / Reuse	Stays on site, reused close to project
✓	Waste Reduction / Separation / Recycle	No landfilling, use of treatment
✓	Emissions Reduction	Focus on reduction of transportation, processes
✓	Land Use Density / Retrofit / Infill	Reuse of land, buildings and materials
✓	Material Use Reduction / Recycling	Less raw materials, repurpose in product cycle
✓	Energy Reduction	Transportation, fuels, processes

Case Study #1:
Filtering the Contaminant

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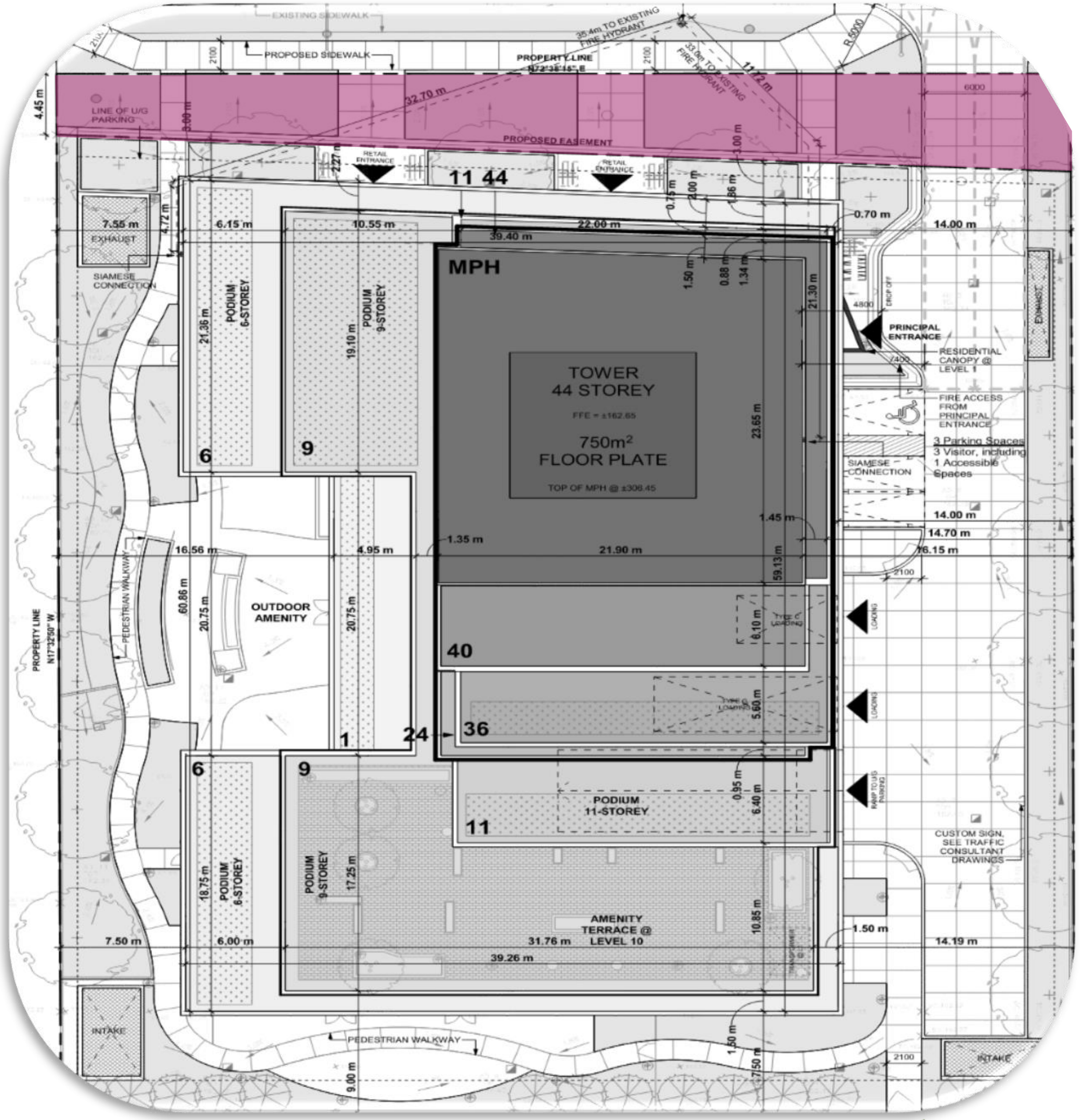
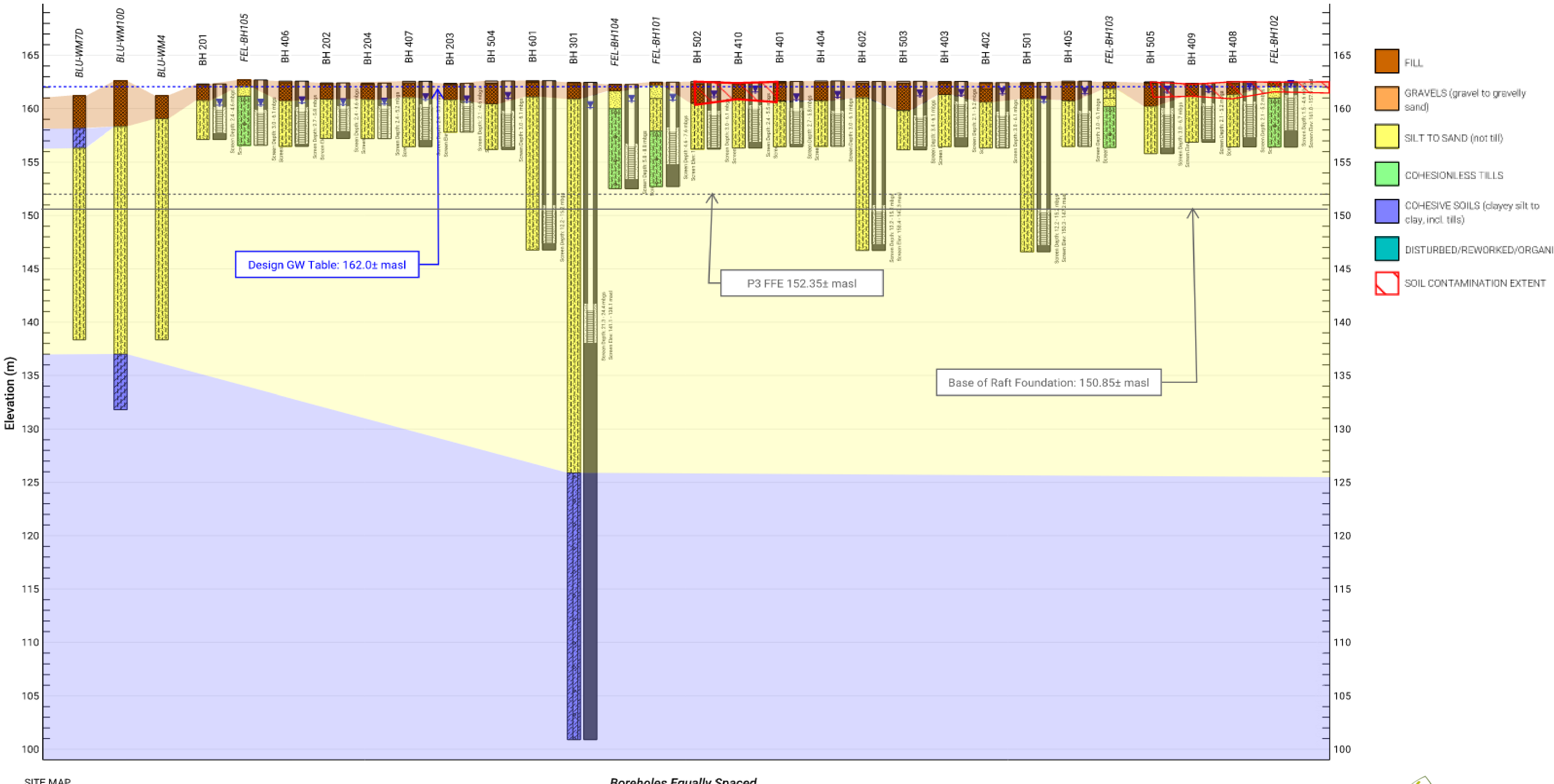
The Project


TOWER
44 STOREY
750m²
FLOOR PLATE
MPH
PODIUM
11-STOREY
AMENITY
TERRACE @
LEVEL 10
OUTDOOR
AMENITY
PROPOSED EASEMENT
PROPOSED SIDEWALK
EXISTING SIDEWALK
PROPERTY LINE
PEDESTRIAN WALKWAY
PRINCIPAL
ENTRANCE
RESIDENTIAL
CANOPY @
LEVEL 1
INTAKE
EXHAUST

Site Conditions



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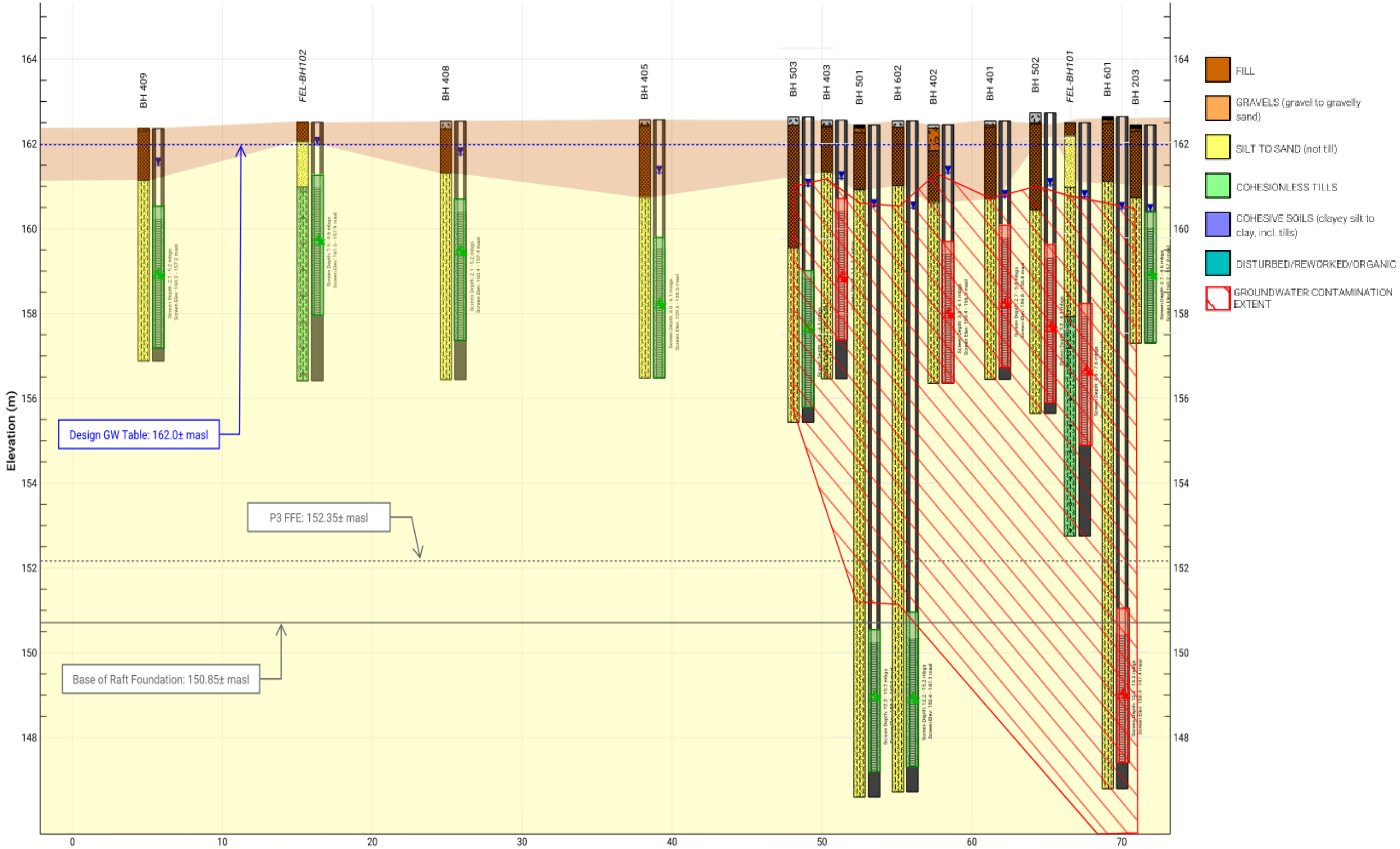
Development Constraints & Challenges

- 3 levels of U/G parking
- Groundwater control
- Raft foundation on caissons or CFAs
- Low level contamination below excavation
- Conveyance lands may be contaminated



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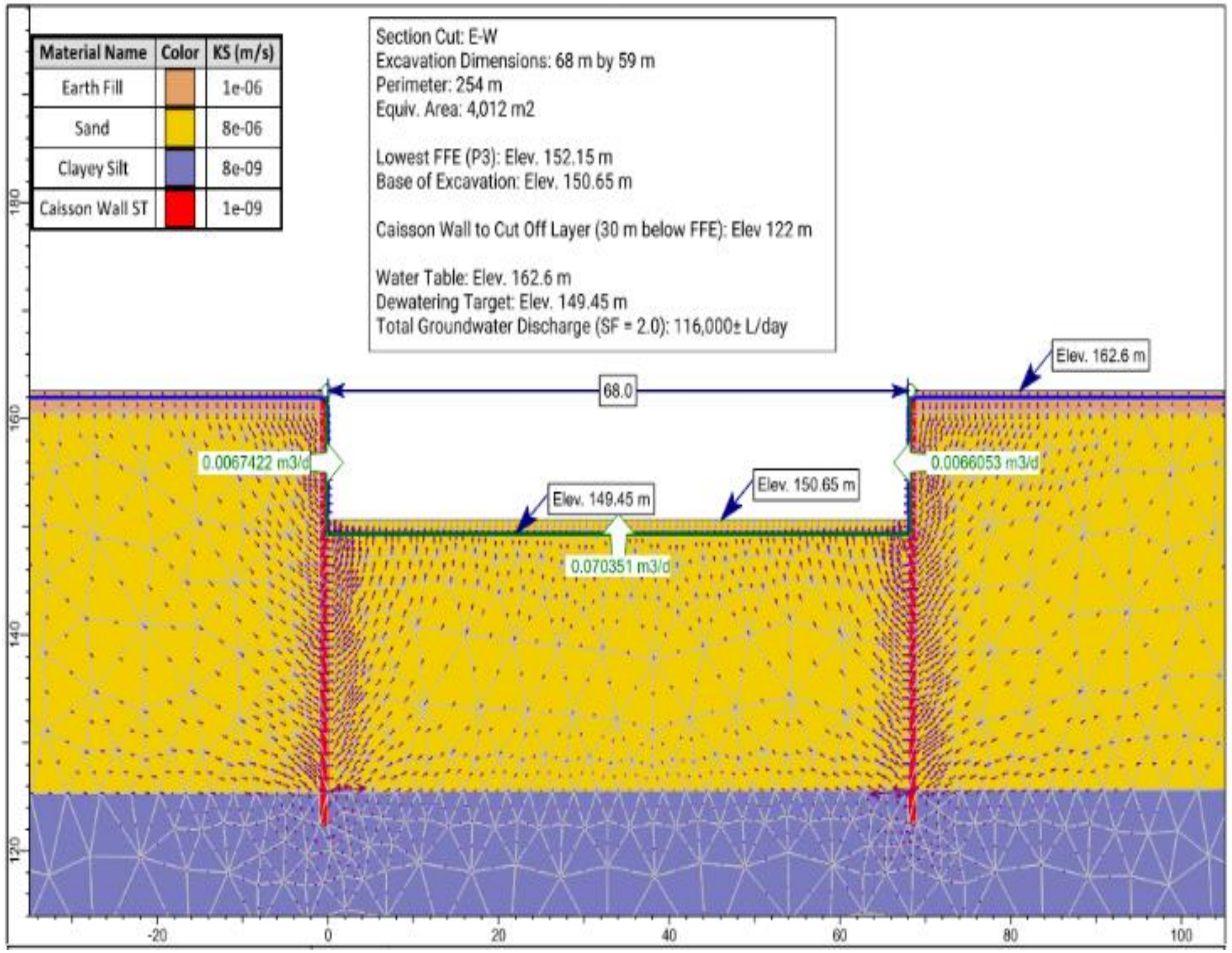
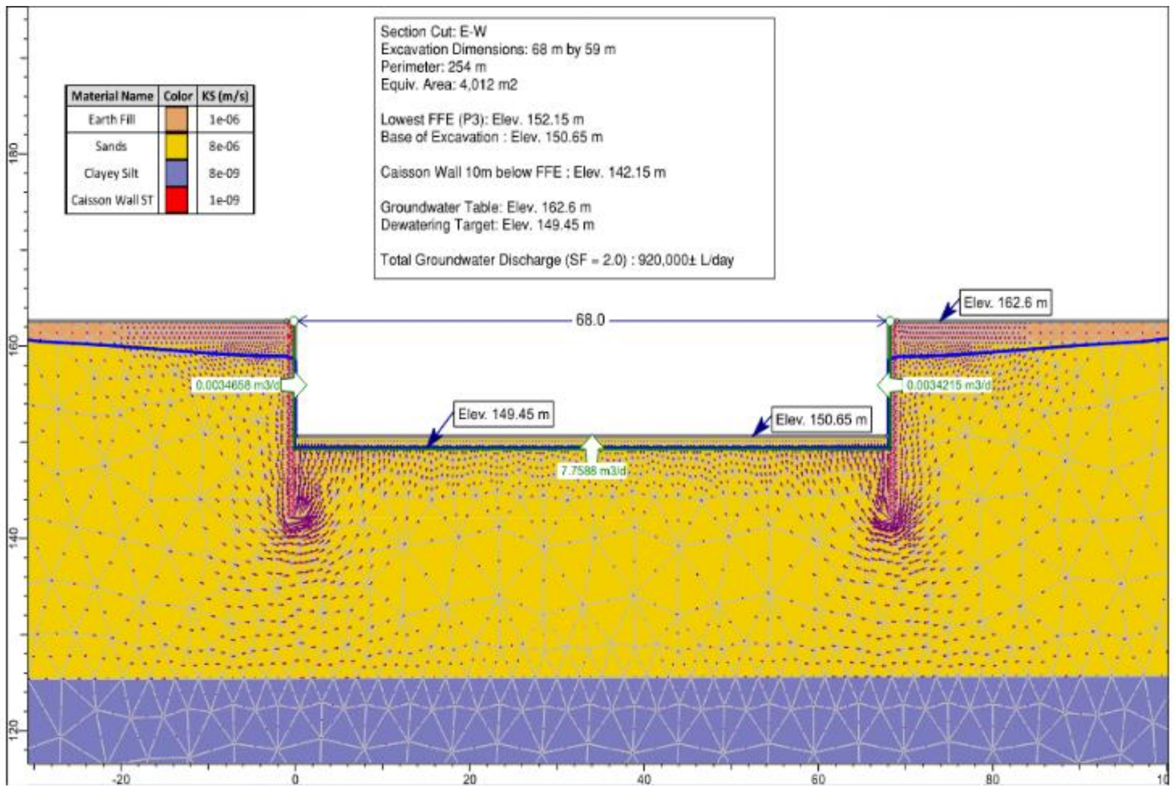
Engineering Options Assessment

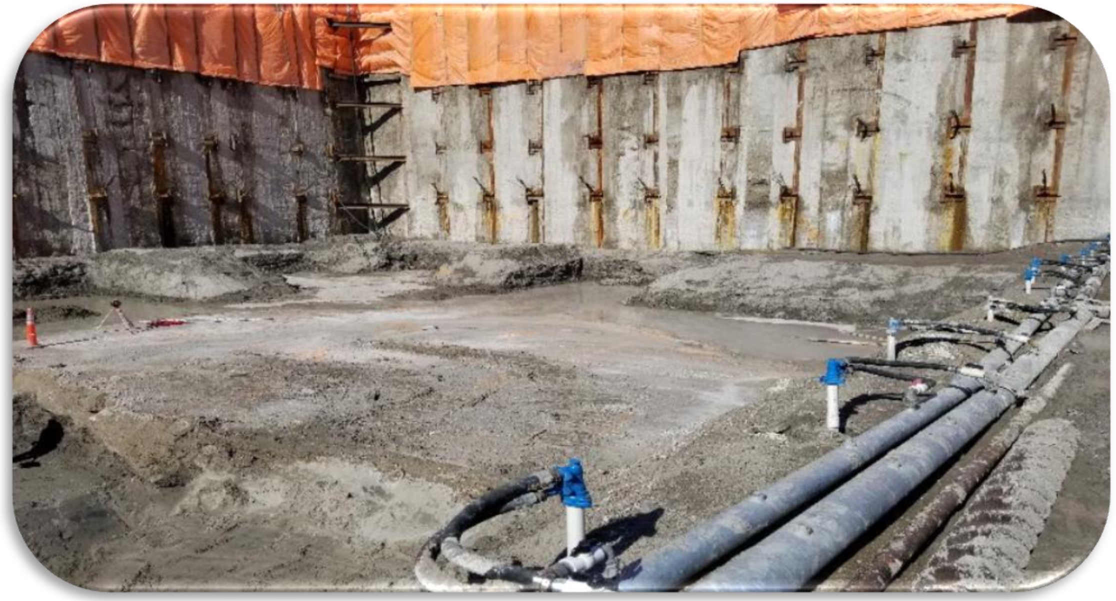
- Redesign above WT
- Deepen caisson wall to cut off layer
- Risk assessment
- Remediation (In/ex-situ)

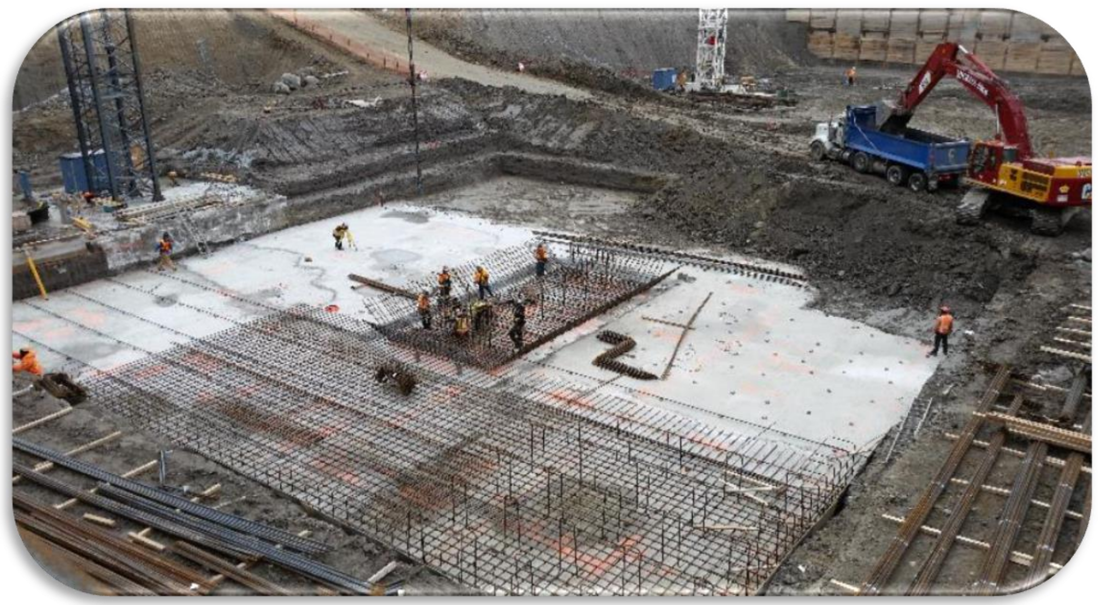


Solution – Contaminant Dewatering

- Hydrogeological conditions require:
  - Watertight raft with practicable caissons
  - Aggressive construction dewatering
  - Treatment required to discharge







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Sustainability Score Card

Preferred Option – Contaminant Dewatering

	Water Conservation / Reuse
✓	Soil Conservation / Reuse
✓	Waste Reduction / Separation / Recycle
	Emissions Reduction
✓	Land Use Density / Retrofit / Infill
	Material Use Reduction / Recycling
✓	Energy Reduction

Case Study #2:
The Dirt on Piles

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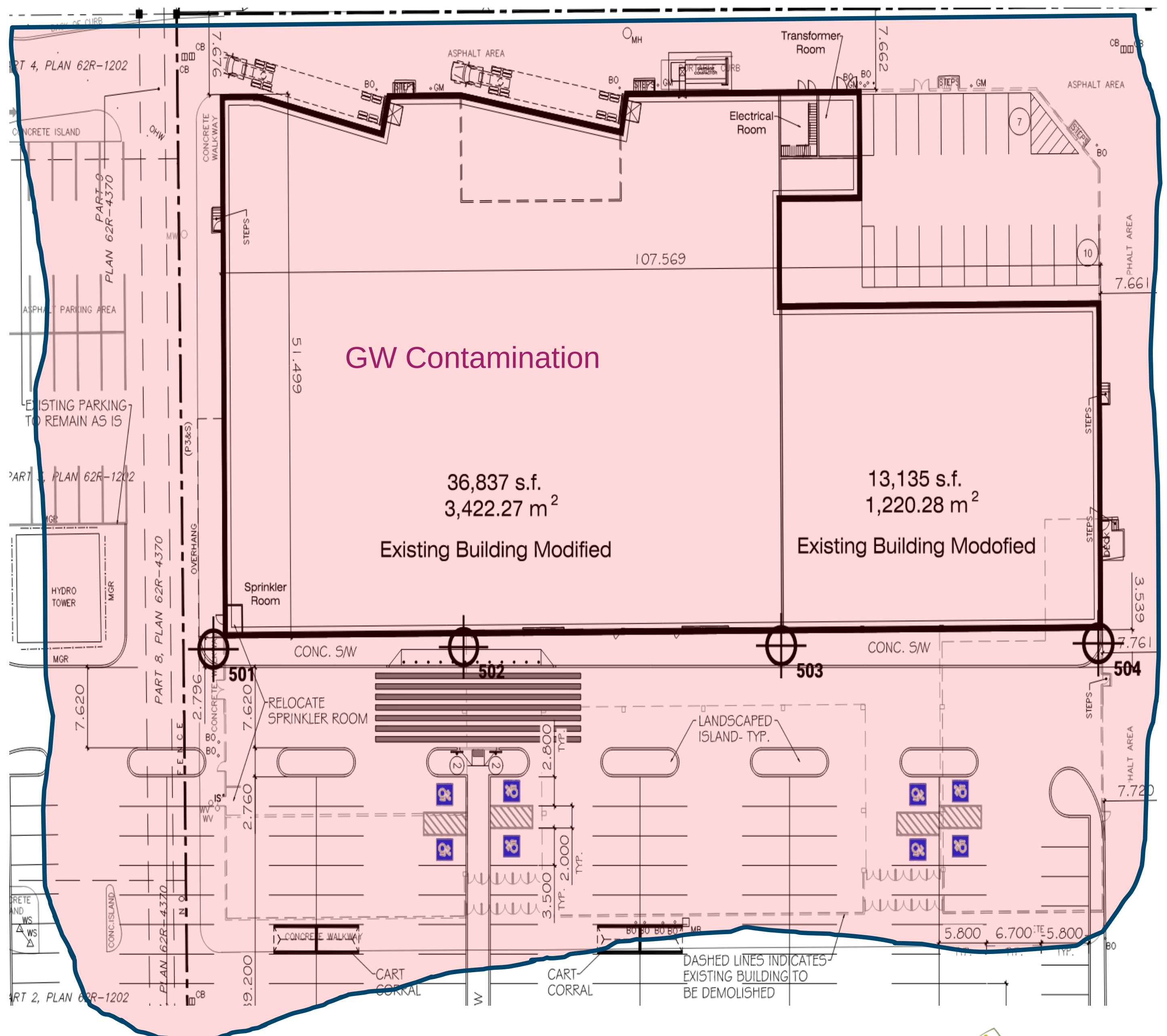
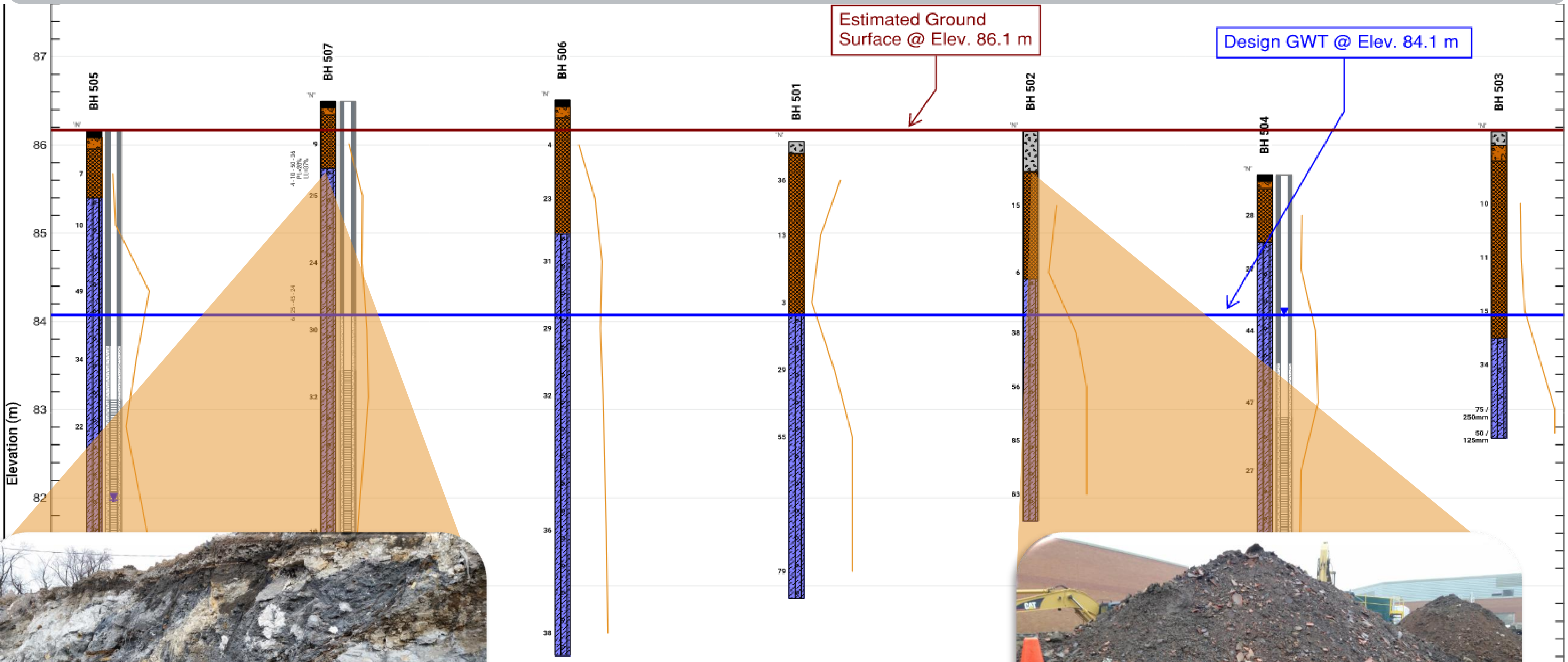
The Project

- Historical industrial land use
- Large existing building and parking – all hardscape
- Surrounding residential
- Re-purpose building to a new commercial use
- No basements
- New footings needed to support modified building



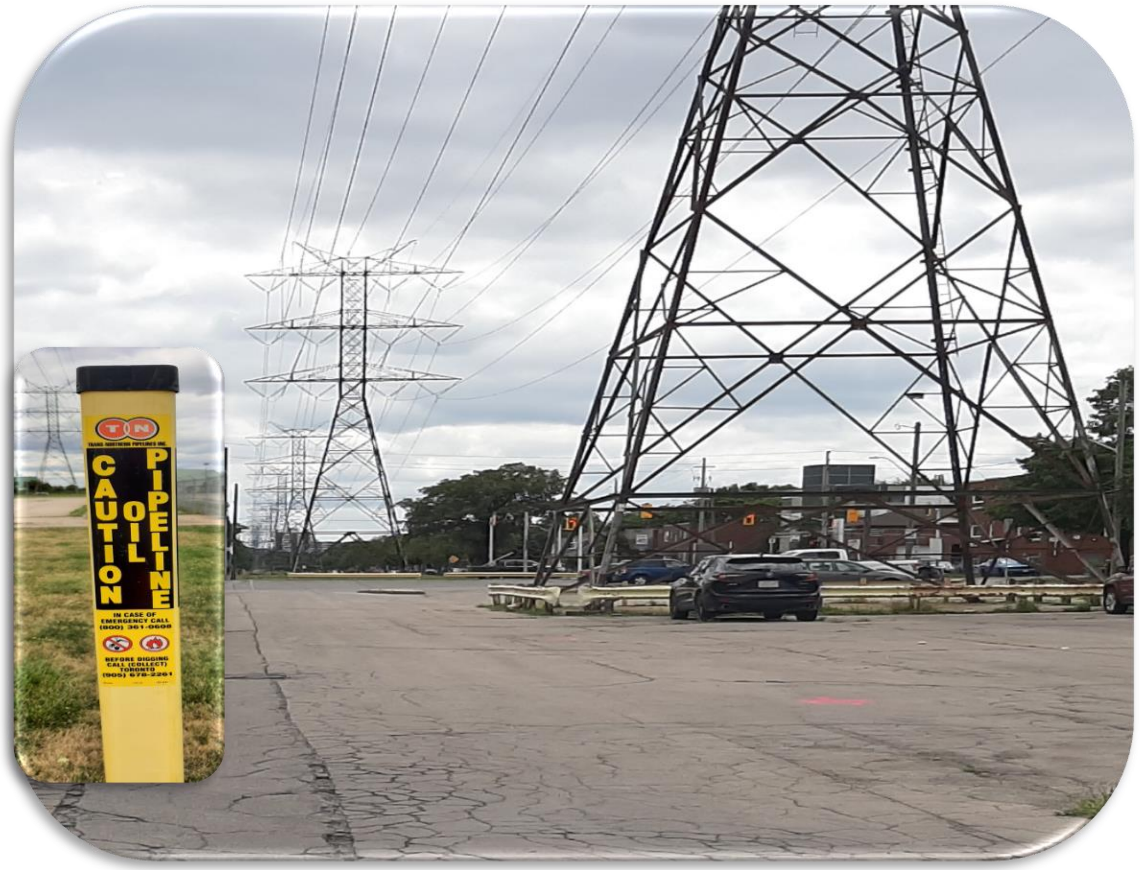
Site Conditions

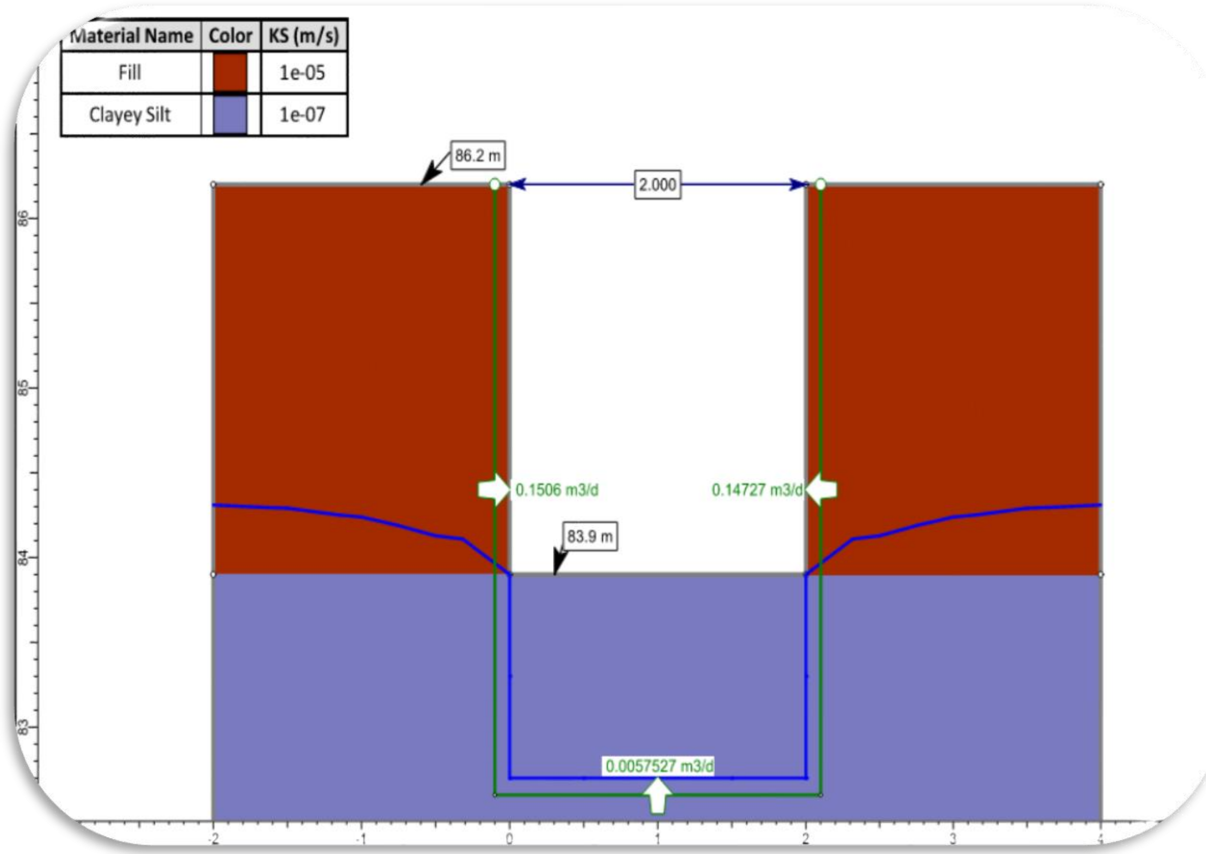


- Up to 2.3 m of heavily contaminated fill
- Contaminated groundwater
- Not competent for new footings
- PCBs and geotechnical - reuse issues

Development Constraints & Challenges

- ❑ Complex underground utilities
- ❑ Contamination everywhere
- ❑ Loose fill
- ❑ Saturated shallow conditions
- ❑ Free flowing groundwater





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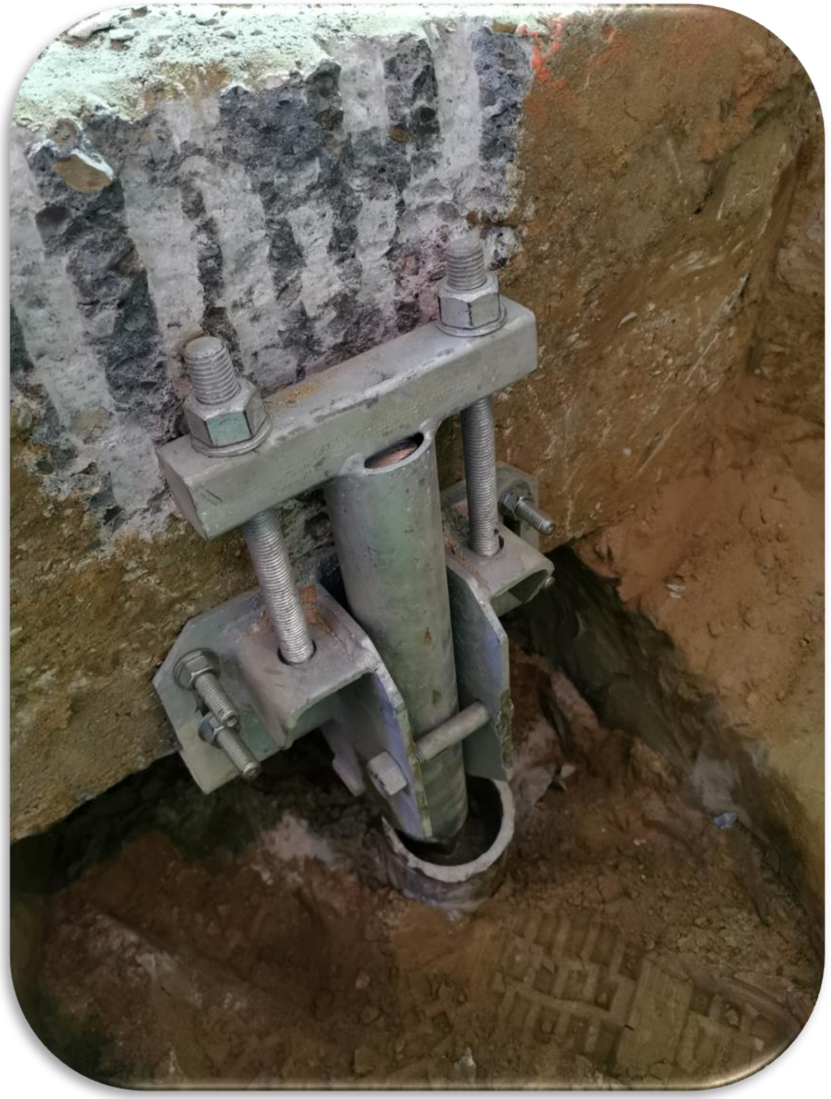
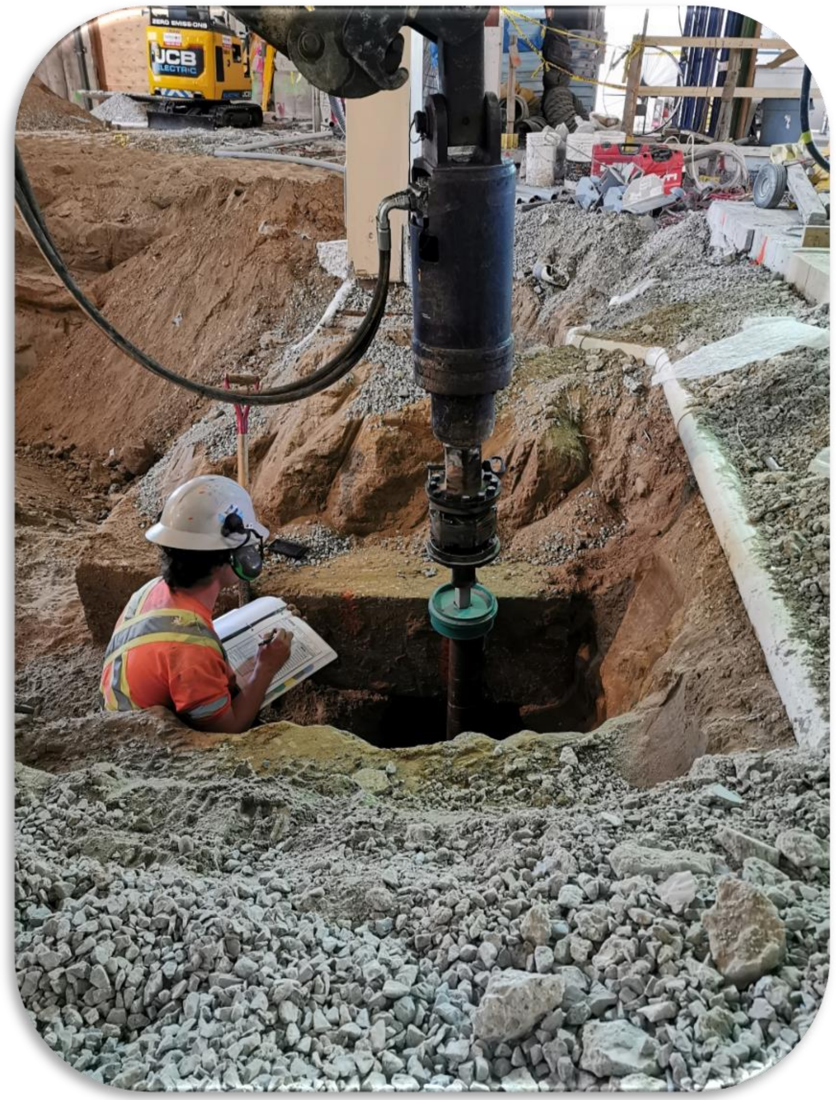
Engineering Options Assessment

- Conventional spread footings
  - Remove fill and replace with engineered fill
  - Fill Removal = cost prohibitive - PCBs
  - Disposal of groundwater
- Alternative engineering approach needed

Solution – Helical Piles



- Will support the required loads
- Easy to install in retrofit situations
- No significant excess soil vs. caisson spoils
- No importation of engineered fill
- No groundwater management



Solution – Helical Piles (Contd.)

- ❑ Cost Effective!

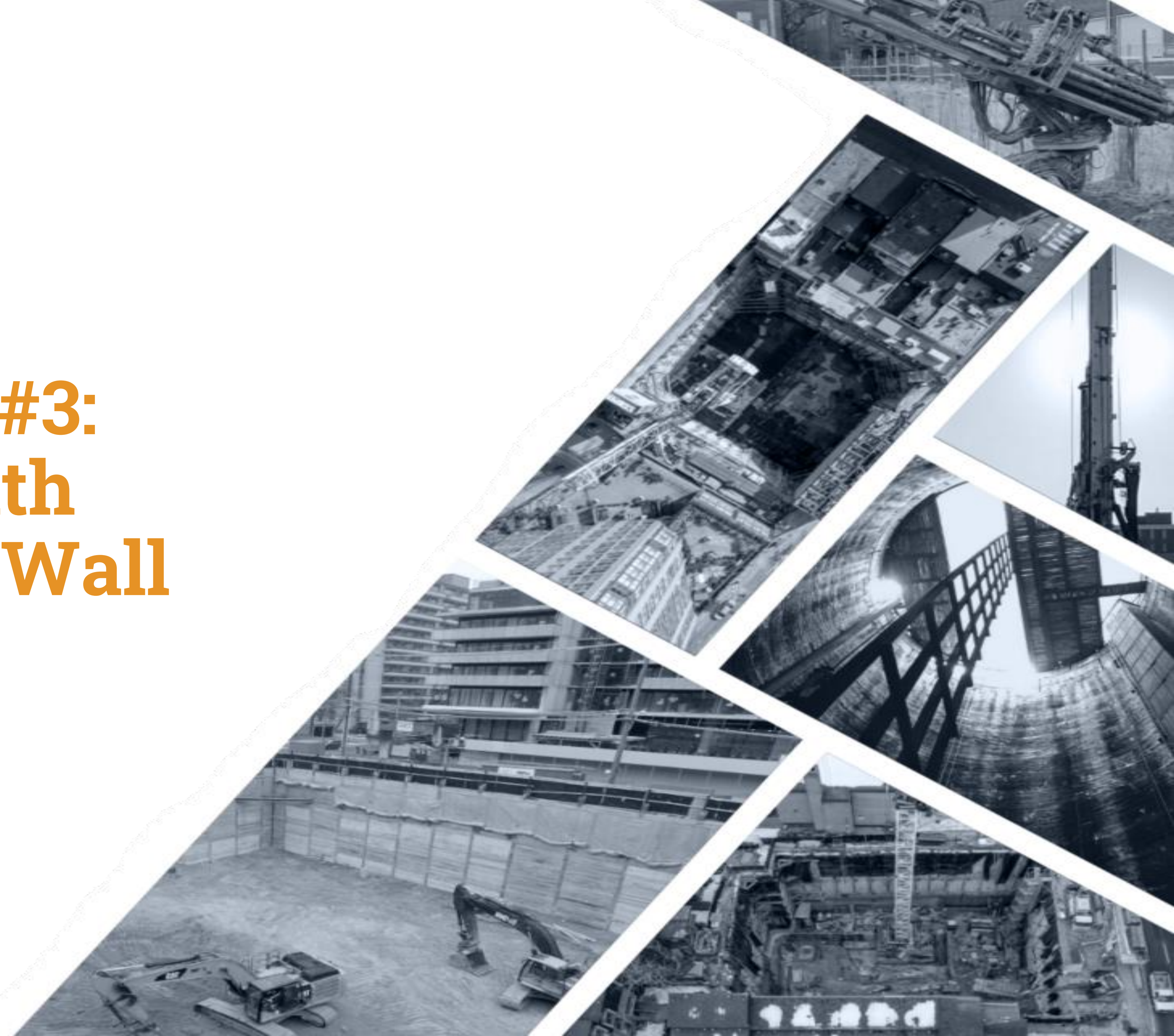
ITEM	SPREAD FOOTING	HELICAL PILES
SOIL DISPOSAL	$ 411,000	$ 64,500
WATER MANAGEMENT	$ 700,000	$ 11,000
BACKFILL	$ 33,750	$ 2,250
PILES	$ -	$ 275,000
TOTAL	**$ 1,144,750**	**$ 352,750**

Sustainability Report Card

Preferred Option – Helical Piles

✓	Water Conservation / Reuse
✓	Soil Conservation / Reuse
✓	Waste Reduction / Separation / Recycle
✓	Emissions Reduction
✓	Land Use Density / Retrofit / Infill
✓	Material Use Reduction / Recycling
✓	Energy Reduction

Case Study #3: Dam-ing with Diaphragm Wall



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The Project

PC: Waterfront Toronto

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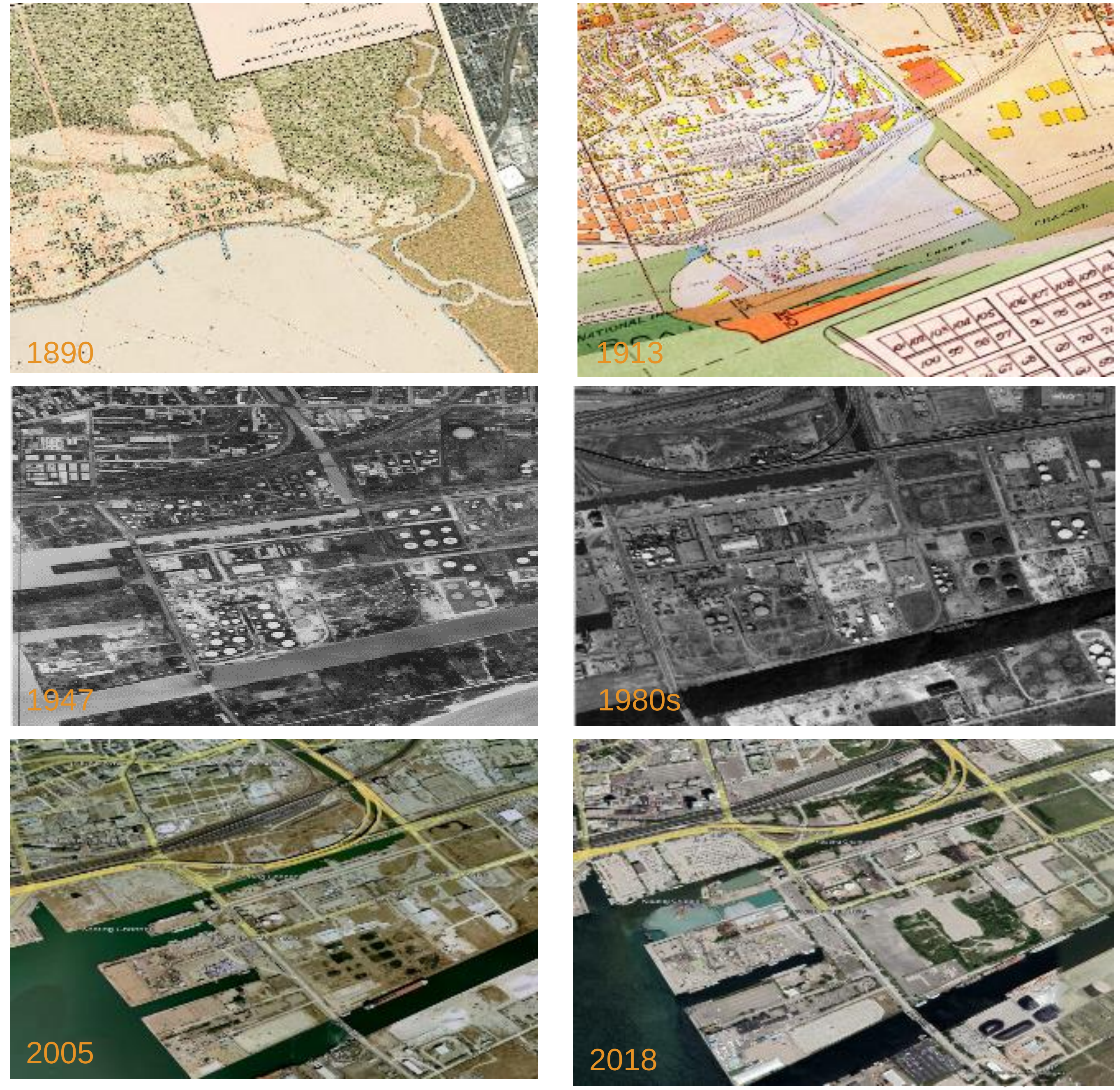
Site Conditions

- ❑ Reclaimed during the 1800s/mid-1900s
- ❑ Reclamation used different sources of fill
- ❑ Heavy industrial usage to date
- ❑ Sand and silt overburden, extensive areas of peat & non-soils.
- ❑ Variable Georgian Bay bedrock



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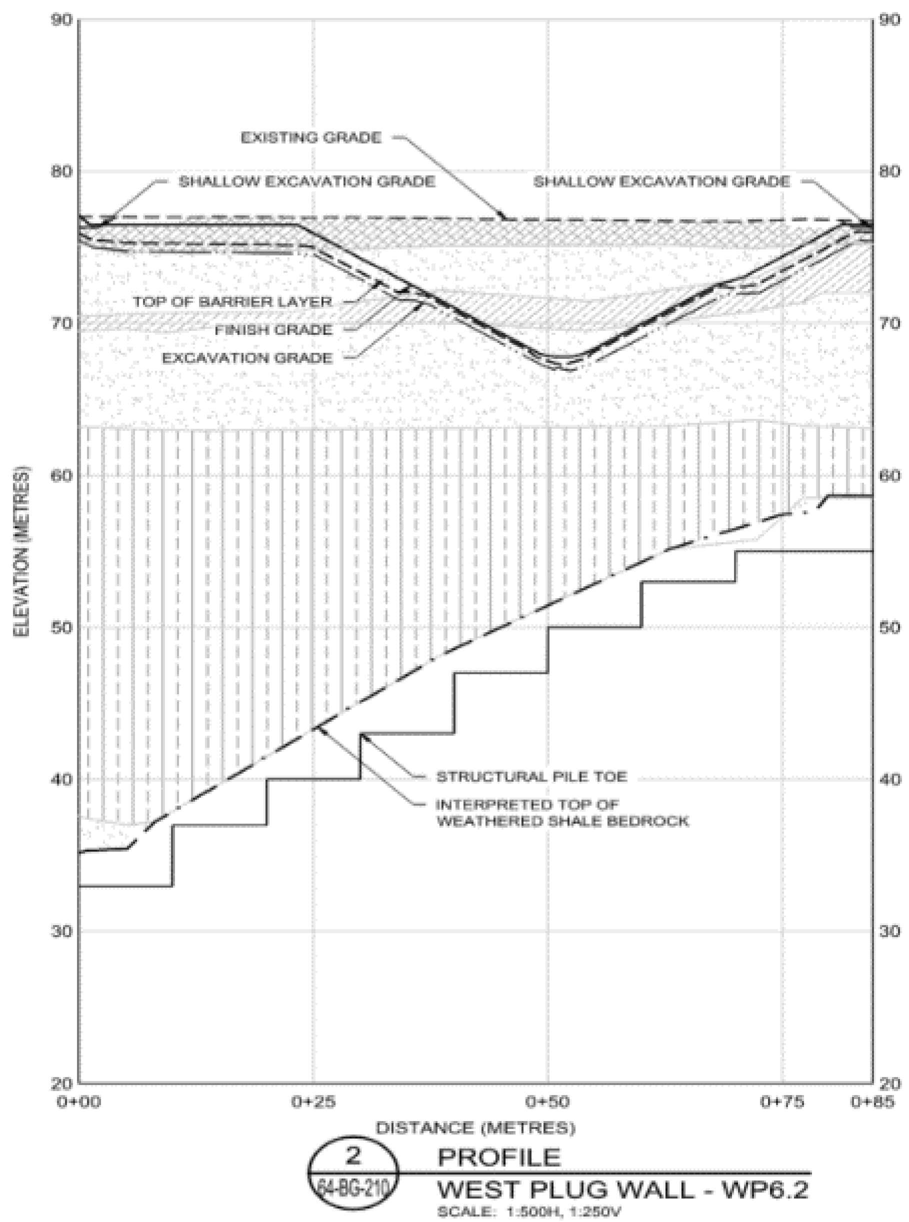
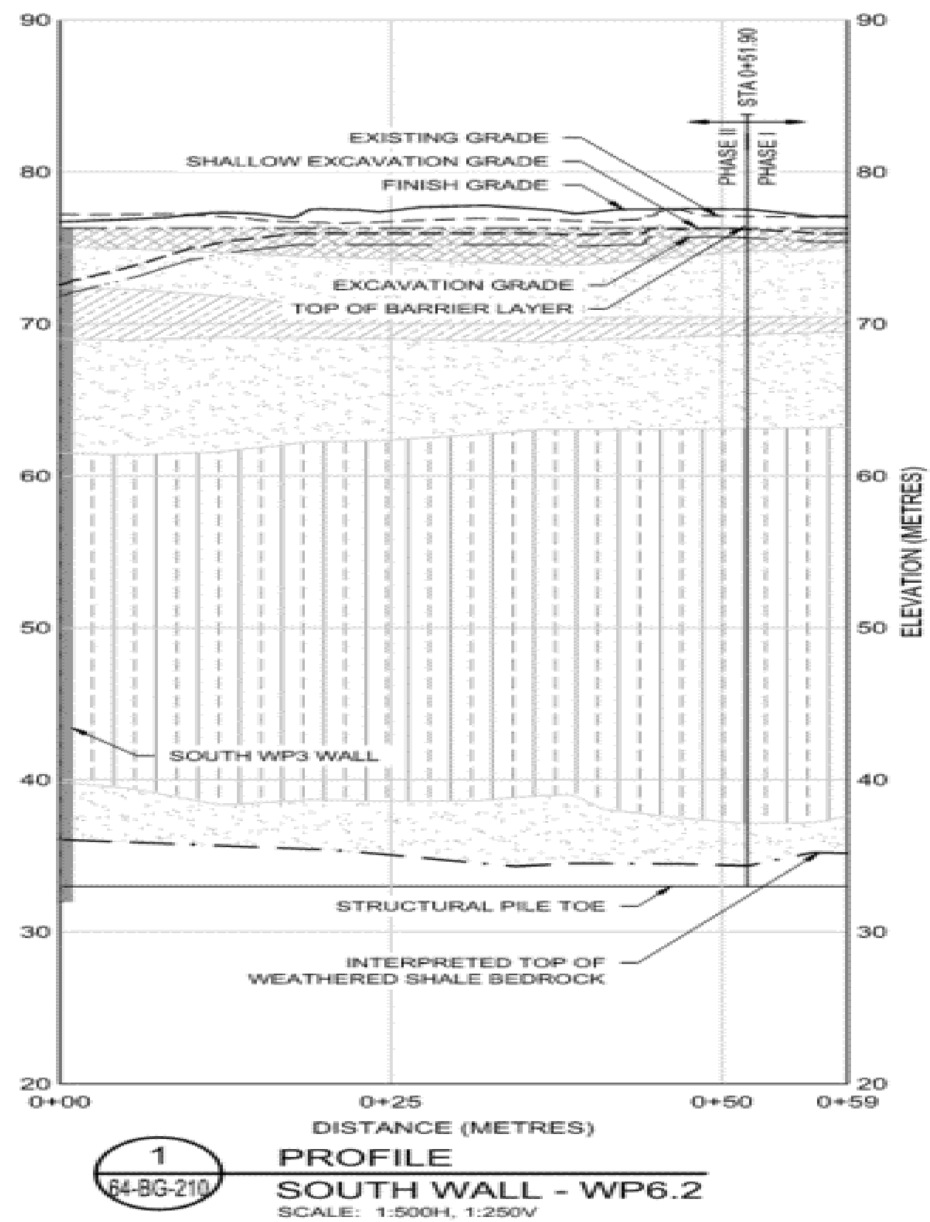
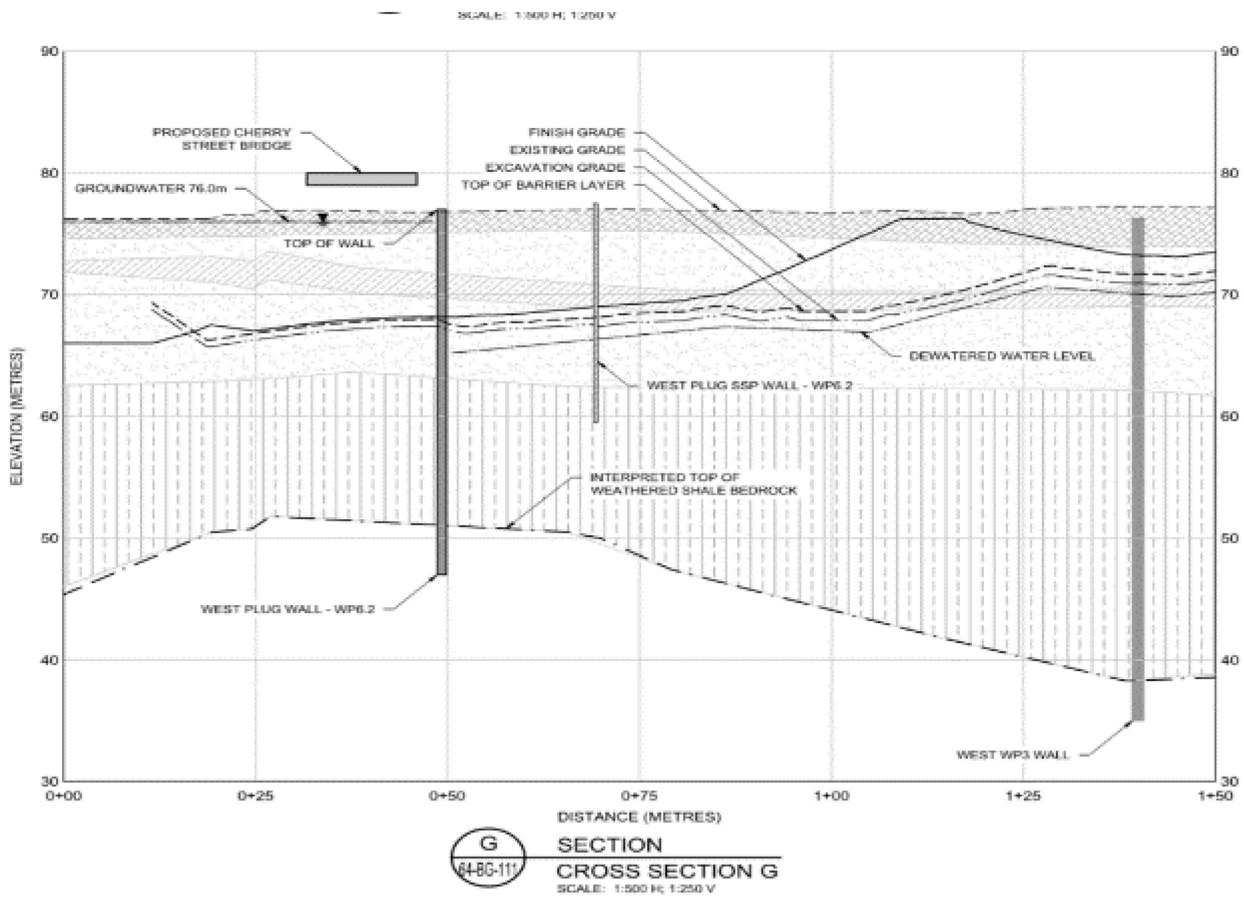
Development Constraints & Challenges

- River mouth design considerations
- Need a permanent barrier
- Need groundwater & contaminant control
- Schedule pressures



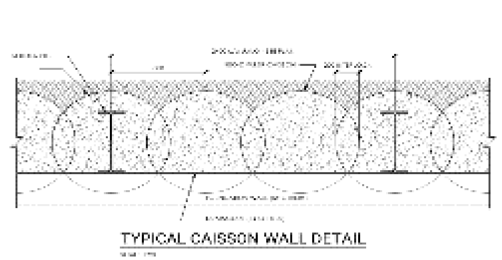
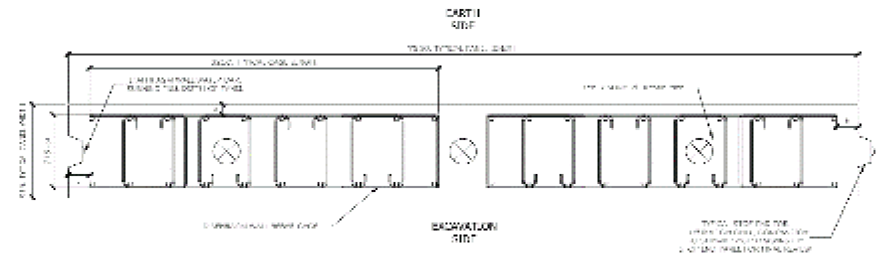
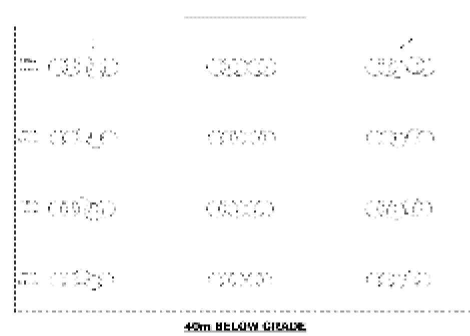


Engineering Options Assessment



- Structural capacity was insufficient to dam the Lake
- Required multi-stage construction, detailed sequencing

Solution – DWalls

Development Considerations		
Schedule	• Reduced number of excavations & concrete pours • Less than half the number of lateral support compared to secant wall.	 
Structural Design	• Huge increase in stiffness compared to secant wall. • Creativity shaft geometry often reduces (or eliminates) number of supports needed	
Leaktight-ness	• Cold joints are cleaned by hydromill • Improved vertical control • Minimized number of joints • Structural concrete designed for long-term durability	  
Costs Savings	• Less concrete since no shaving off caisson joints • Schedule • Less material ie no SSP	

D-Wall Installation

Sustainability Score Card

Preferred Option – D-Wall

	Water Conservation / Reuse
	Soil Conservation / Reuse
✓	Waste Reduction / Separation / Recycle
✓	Emissions Reduction
	Land Use Density / Retrofit / Infill
✓	Material Use Reduction / Recycling
✓	Energy Reduction

Conclusions

Filtering the Contaminant

	Water Conservation / Reuse
✓	Soil Conservation / Reuse
✓	Waste Reduction / Separation / Recycle
	Emissions Reduction
✓	Land Use Density / Retrofit / Infill
	Material Use Reduction / Recycling
✓	Energy Reduction

The Dirt on Piles

✓	Water Conservation / Reuse
✓	Soil Conservation / Reuse
✓	Waste Reduction / Separation / Recycle
✓	Emissions Reduction
✓	Land Use Density / Retrofit / Infill
✓	Material Use Reduction / Recycling
✓	Energy Reduction

Dam-ing with D-Wall

	Water Conservation / Reuse
	Soil Conservation / Reuse
✓	Waste Reduction / Separation / Recycle
✓	Emissions Reduction
	Land Use Density / Retrofit / Infill
✓	Material Use Reduction / Recycling
✓	Energy Reduction

QUESTIONS?

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