

Vapour Intrusion: A Legal and Technical Analysis of Risk Mitigation for Existing Buildings

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1. Part I: Technical Challenges

- Case Study
- Challenges

2. Part II: Legal Analysis of Risks

- Regulatory Liability
- Civil Liability



Retro Fit Vapour Mitigation System



- Available Data
 - Soil, groundwater, subslab soil vapour
- Limited construction details
- Access limitations
- Neighbouring tenants
- Maintain use of space, future demising of walls

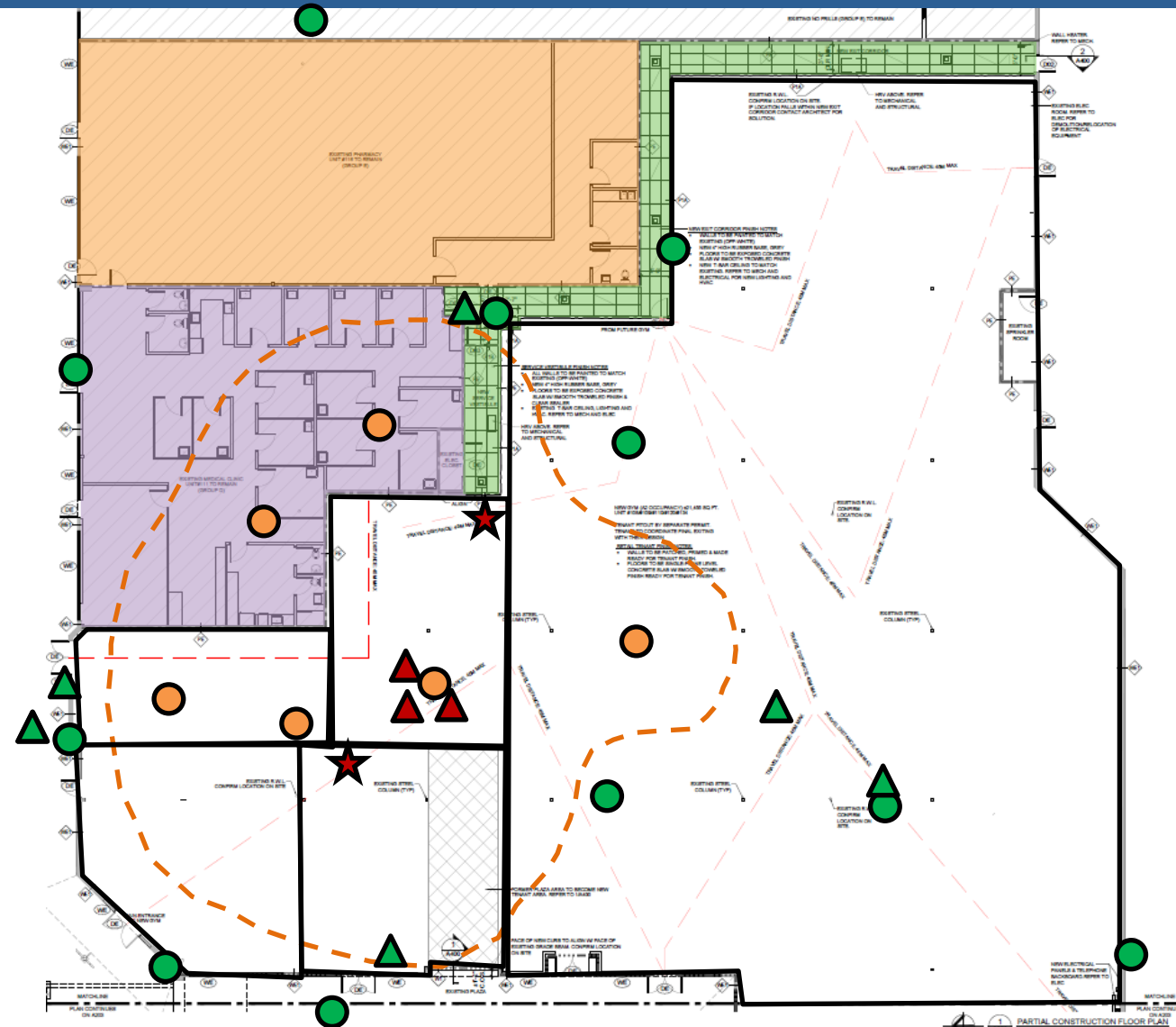
Site Challenges

- Former Dry Cleaner in strip mall
- Soil and groundwater contamination
- PCE concentrations
 - 5 mg/L groundwater
 - 160,000 $\mu\text{g}/\text{m}^3$ soil vapour
- Surrounding units are in use

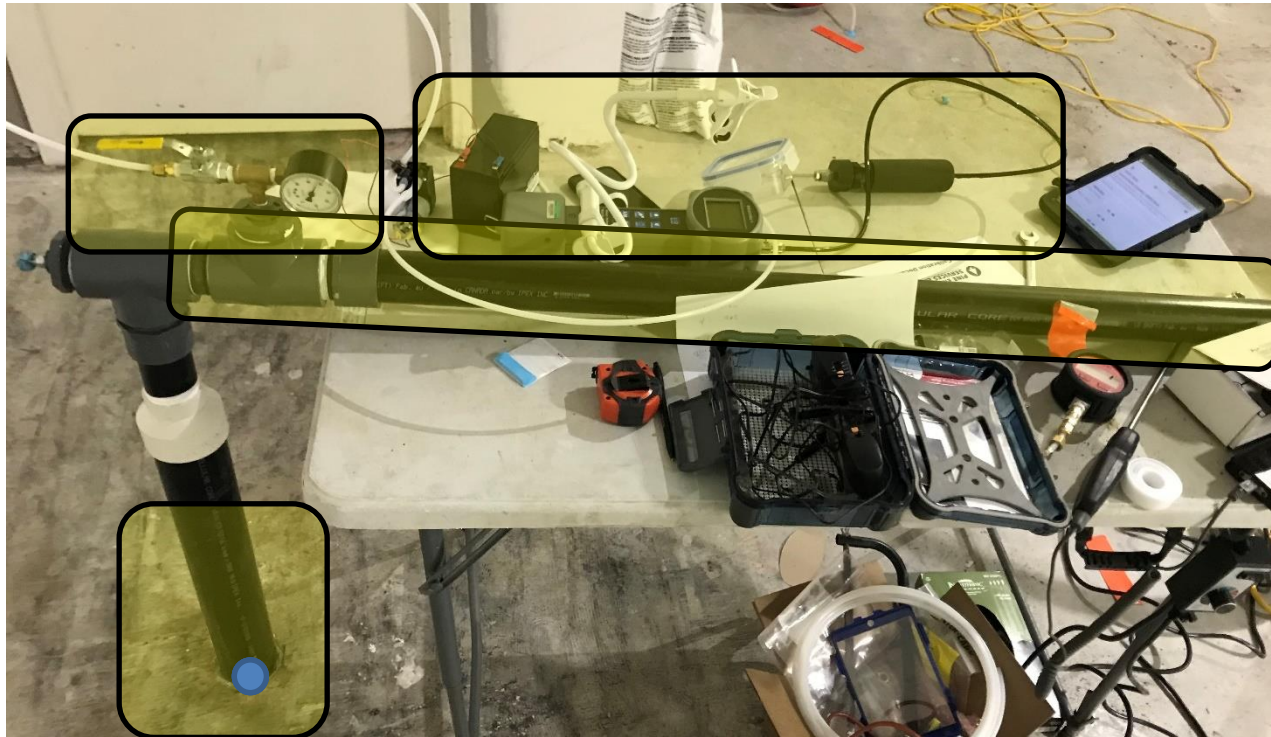


Investigation Approach

- Preliminary Investigation
 - Soil vapour probes
- Detailed Investigation
 - GW monitoring wells
 - Soil vapour in accessible locations
- HVS for mitigation design
 - Soil vapour delineation
- Soil and GW delineation

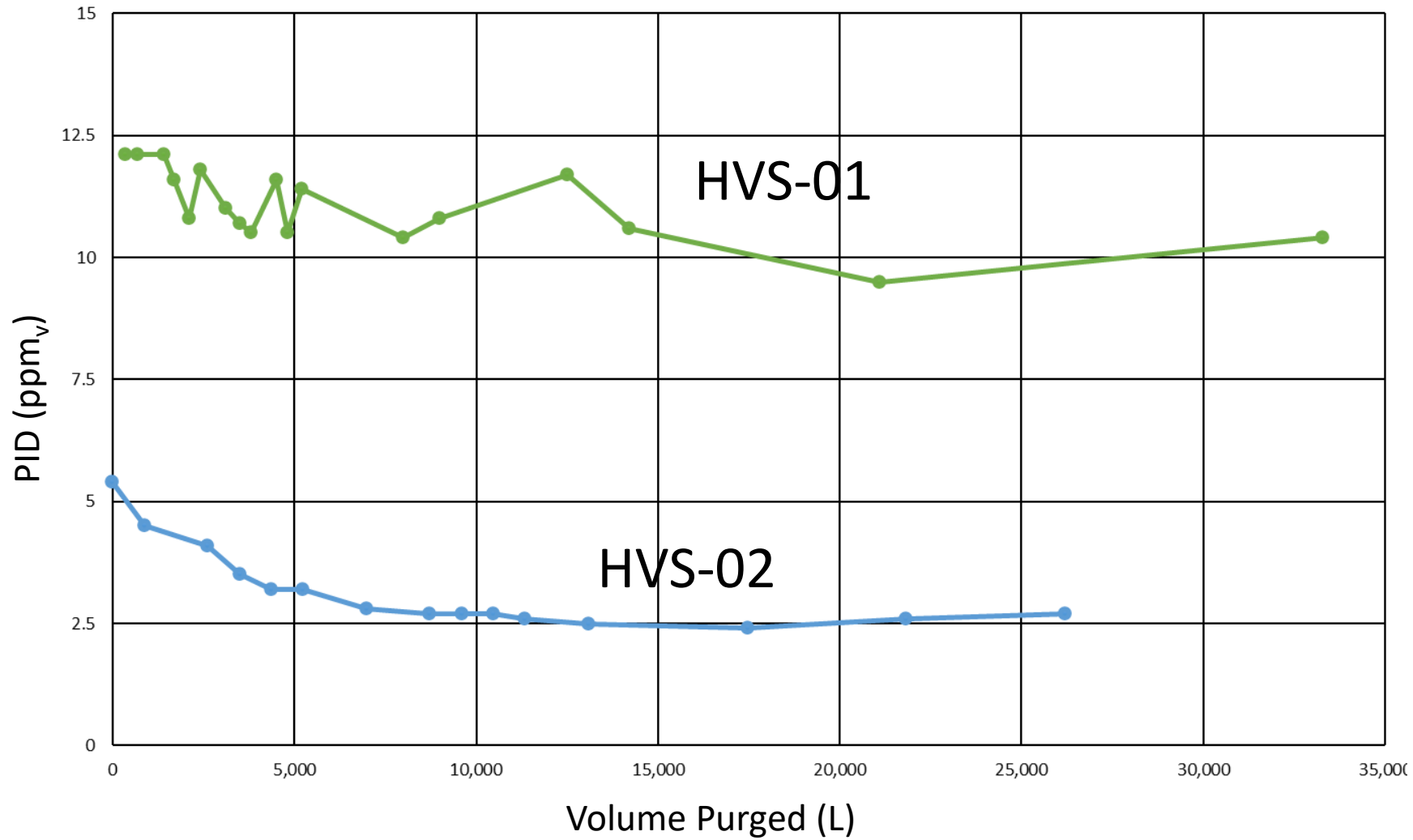


■ Borehole ▲ Monitoring well ● Vapour Probe



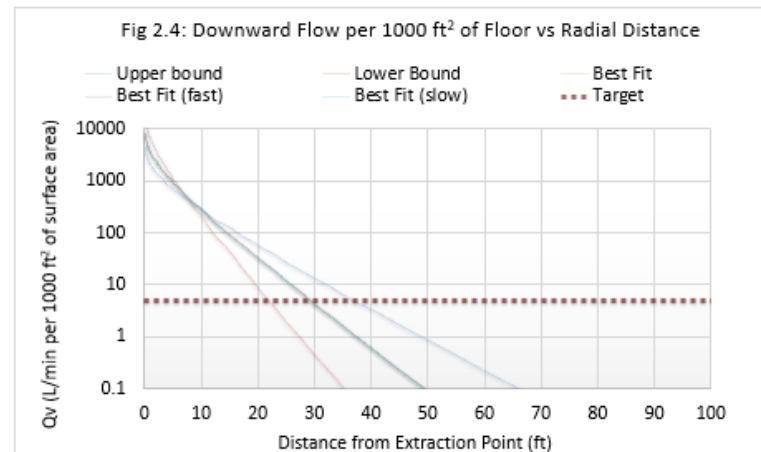
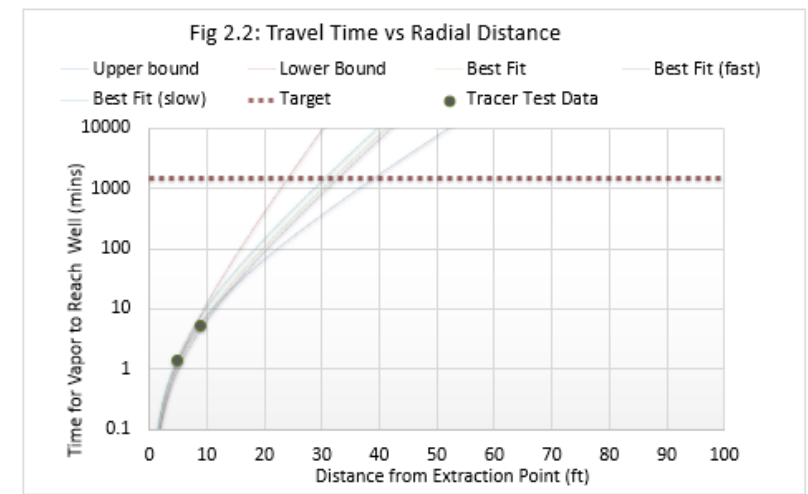
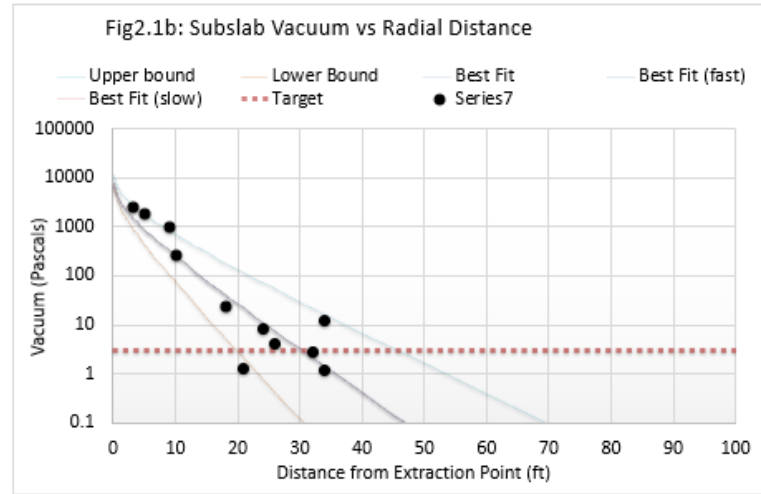
- ## High Volume Sampling (2-locations)
- Extract vapours at 12 cfm (HVS-01) and 31 cfm (HVS-02)
 - Screen vapours with PID, O₂, CO₂
 - Collect samples for lab analysis
 - Complete Pressure Field Extension (PFE) Testing
 - Helium tracer tests
 - Collect transient vacuum data

Pilot Testing



Mitigation Radius of Influence (ROI)

- VIM Model (Geosyntec, 2020)
- Data Inputs
 - Vacuum vs distance
 - Helium travel time
- Determine ROI based on vacuum and vapour capture



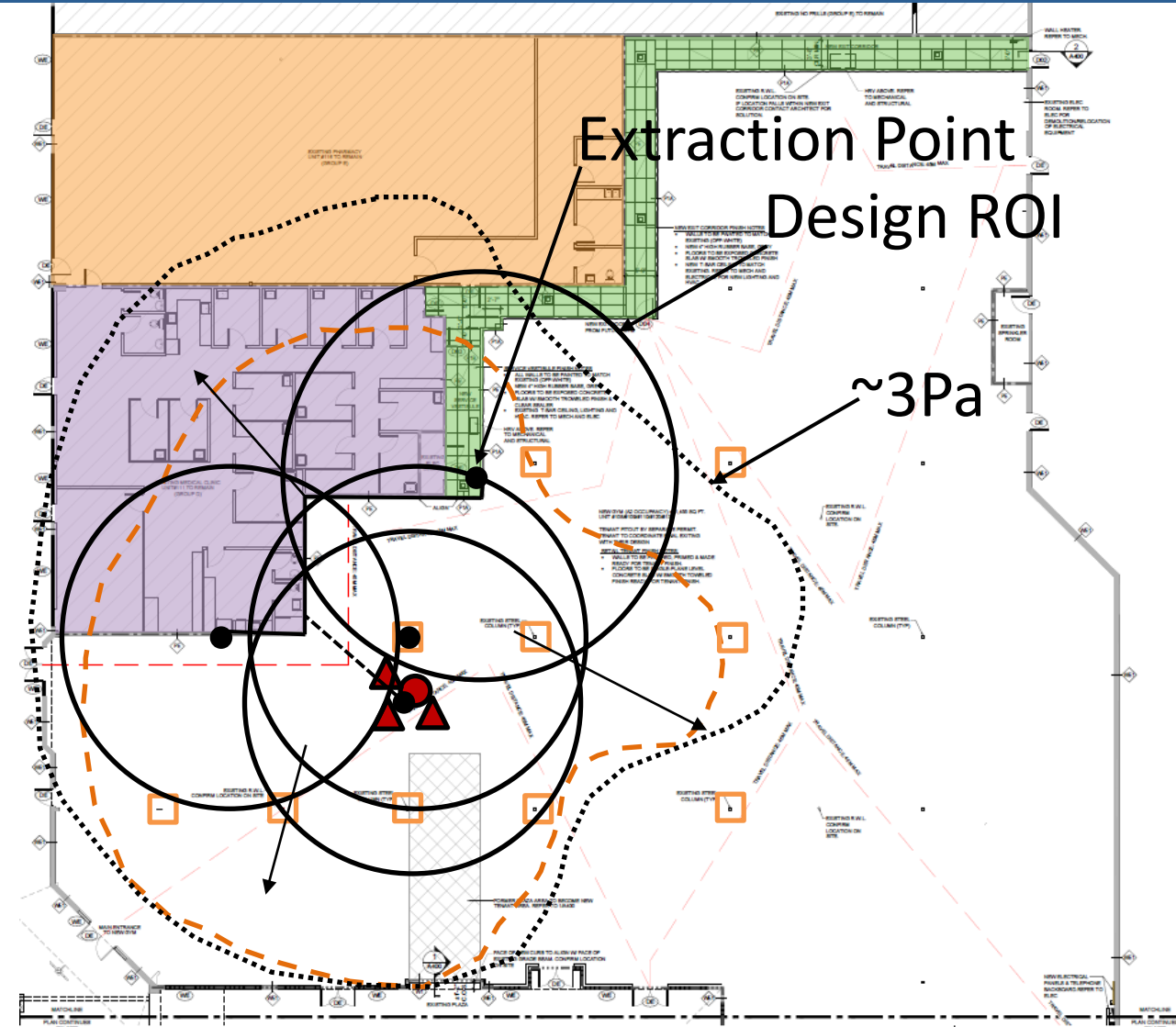
SENSITIVITY ANALYSIS						
Legend Label	Flow rate, Q (ft ³ /min)	Transmissivity, T (ft ² /d)	Leakance, E (ft)	Thickness, b (ft)	Effective Porosity, n (%)	ROI based on Flux (ft)
Upper bound	12.2	4	7.50+	0.8	0.25	41
Lower Bound	12.2	5.2	3.40+	0.5	0.25	20
Best Fit	12.2	5.2	5.20+	0.6	0.25	30
Best Fit (fast)	12.2	5.2	5.20+	0.5	0.25	30
Best Fit (slow)	12.2	5.2	5.20+	0.8	0.25	29

Radius (ft)	Target Level	Monitoring Point ID Number	Field Measurements radius (ft)	Vacuum (Pa)	Travel Time (min)	Reasonable Maximum Ambient Cross-Slab Pressure (ft)
0	3		3	2700		
500	3		10	273		
0	3		5	1900	1.42	3
500	3		3	332	5.3	
Travel Time (minutes)			21	1.3		3
0	1440		24	8.1		
500	1440		26	4.1		
0	5		32	2.8		
@soil/Area (L/min/1000ft²)			34	1.2		3
500	5		34	12		

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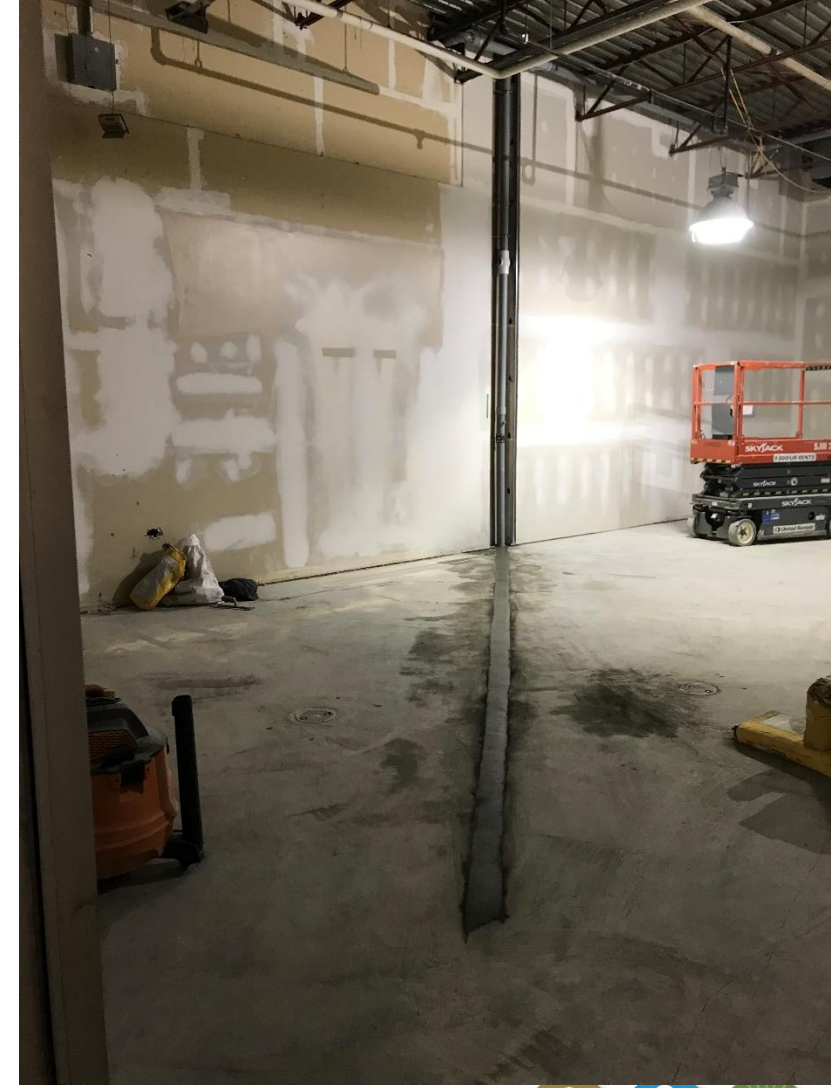
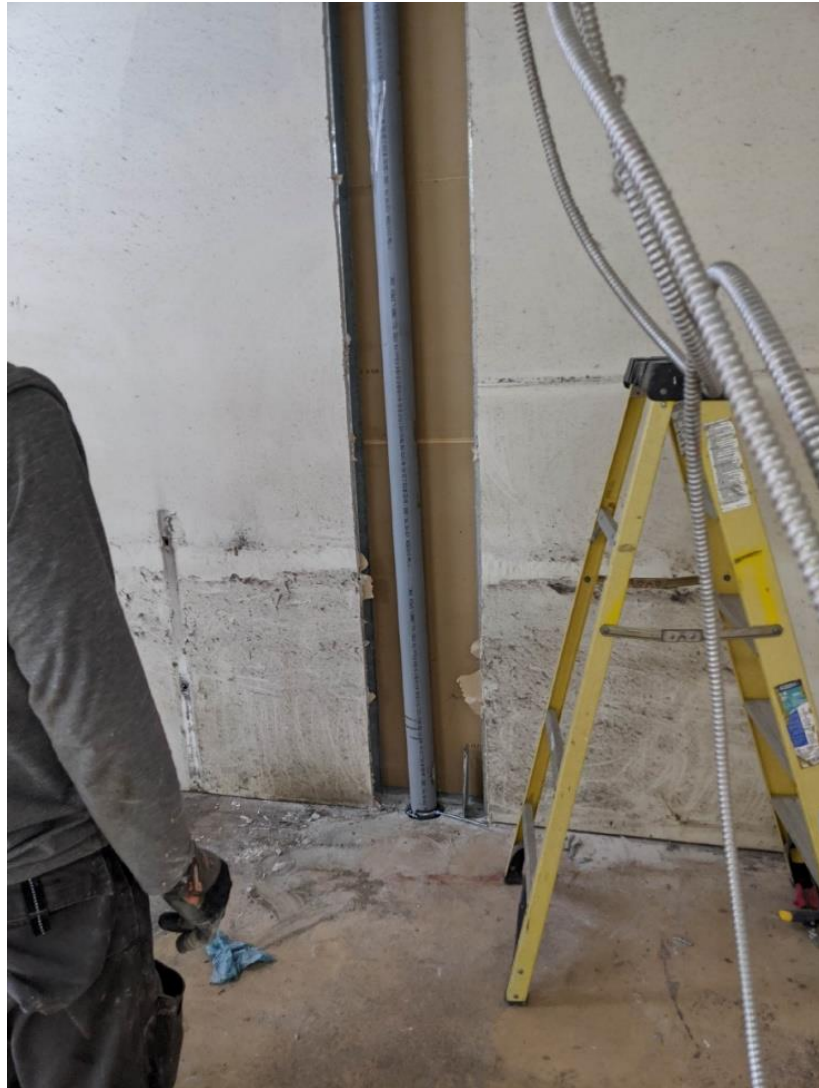
- ROI based on 3 Pa vacuum and vapour capture
- Current and Future building layout
- Maximize mass removal of system



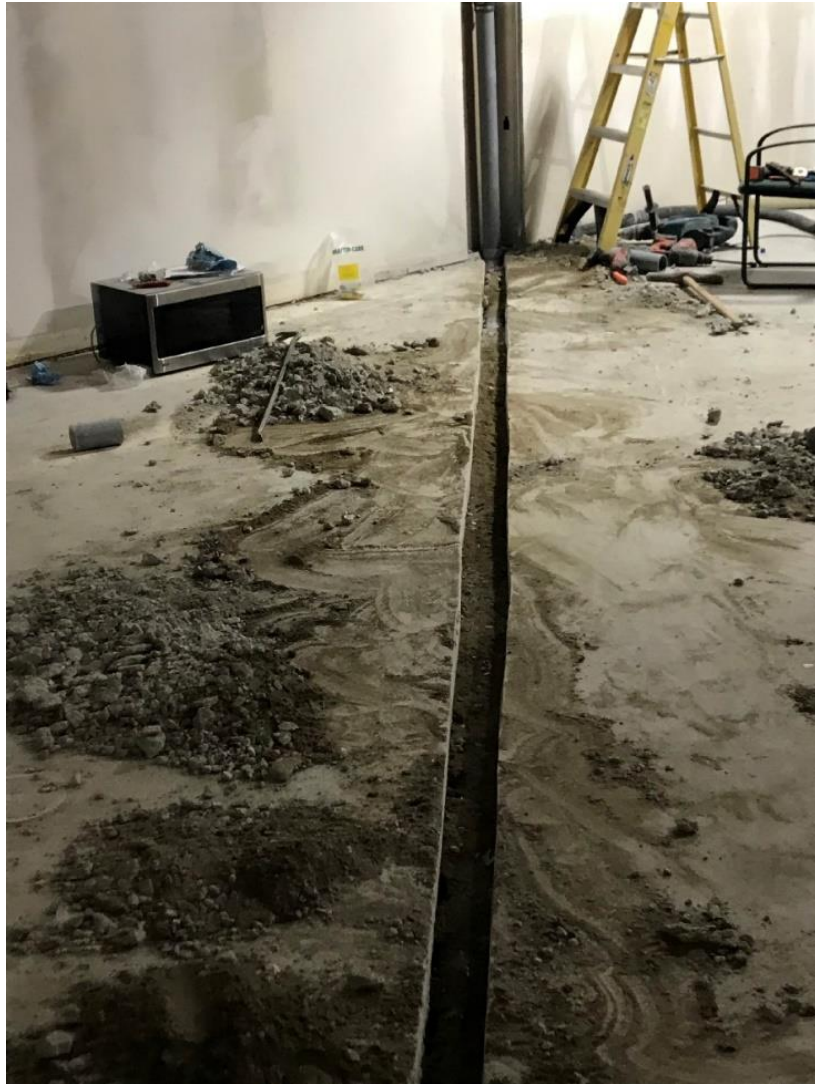
Extraction Point
Design ROI

~3Pa

Design Considerations



Design Considerations



- Design will be limited by use of space
- Access to monitoring points
- Maintaining tenant relationships
- Adapting to unknown building construction



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