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Developing Background Concentrations of Metals and PAHs in Soil in an Urban Railroad Right of Way

Objective

Challenges:

- Increasing Demand
- Aging Infrastructure
- Stricter Environmental Regulations

Goals:

Provide owners, operators, and project managers a means to:

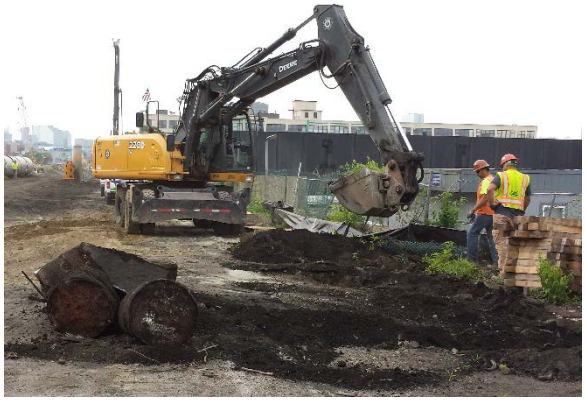
- Make better decisions
- Limit regulatory liabilities
- Predict and cost-effectively manage excavated soils

Presentation Outline

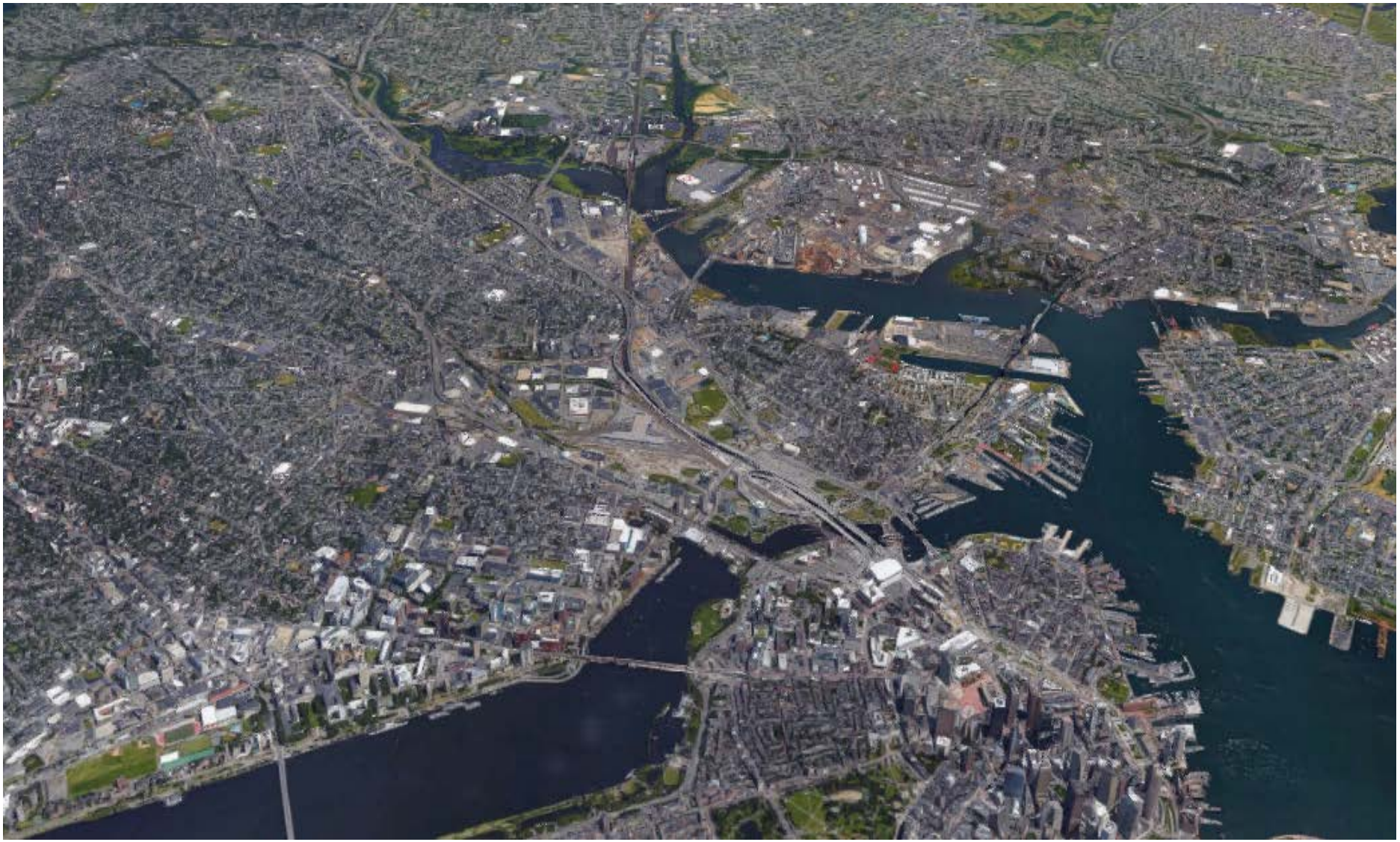
- Introduction
- Data Collection
- Statistical Evaluation
- Results
- Comparison with Published Values
- Implications and Possible Uses

Introduction

- Background Concentrations
- Sources of Contamination
  - Known Releases (spills)
  - Historical Land Management
  - Historical Filling
  - Naturally Occurring Elements
- Contaminants of Potential Concern (COPC)
  - Polycyclic Aromatic Hydrocarbons (PAHs)
  - Metals

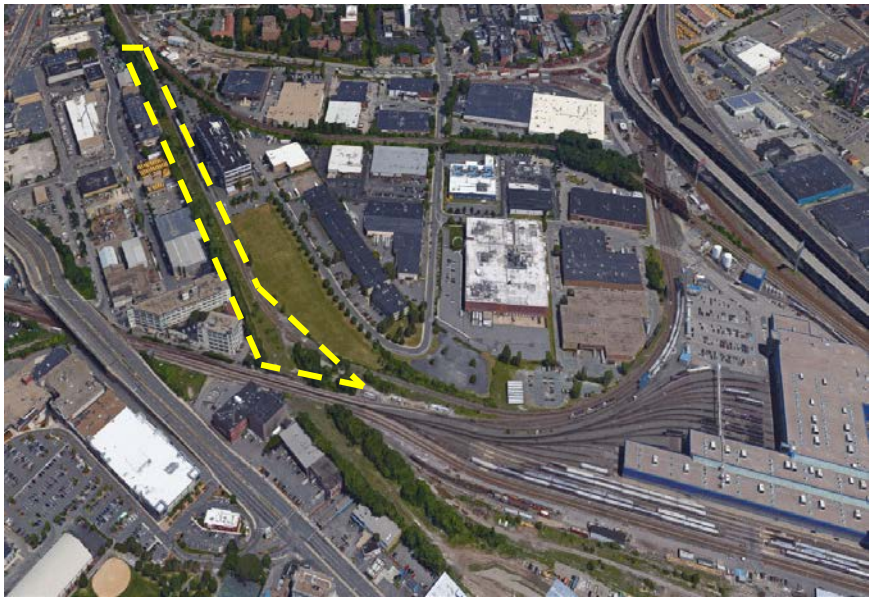


Site Setting



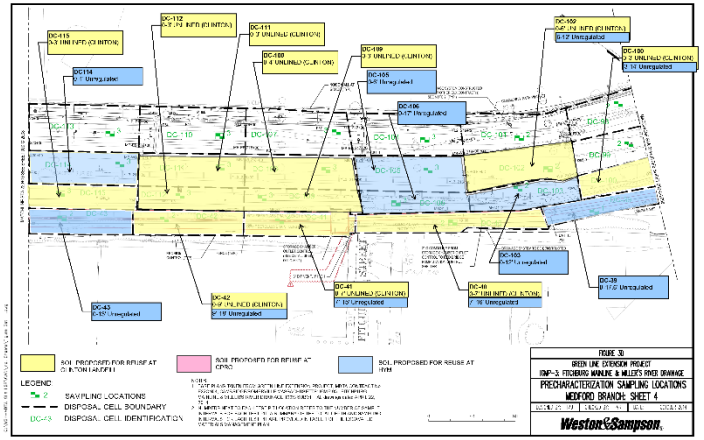
Data Collection

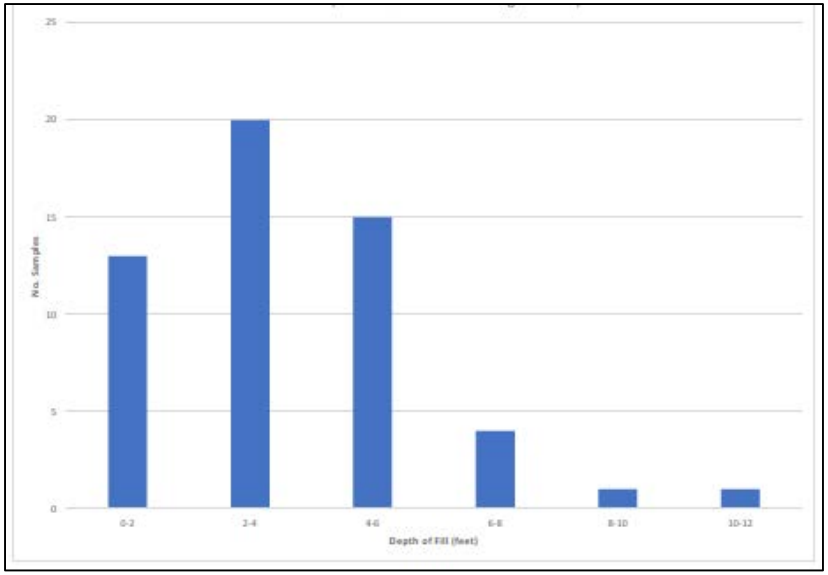
- 4.5-mile Metro Boston Urban Rail Expansion Project.
- Precharacterization of an approximately ½-mile section of ROW.
- Developed/Used as ROW since late 1800s.
- Historical fill of former river.
- Over 30 known disposal sites within ½-mile.



Data Set

- 48 Soil borings/test pits
- 98 Soil samples collected.
  - 54 historic fill samples
  - 44 native soil samples
- Samples analyzed for 14 Metals and SVOCs



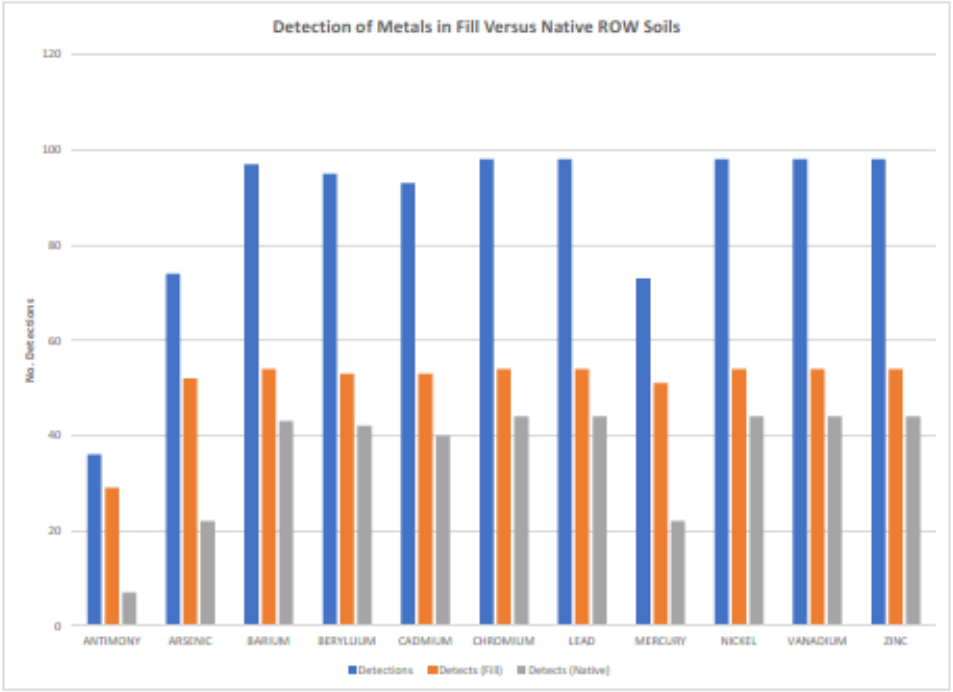


Statistical Evaluation

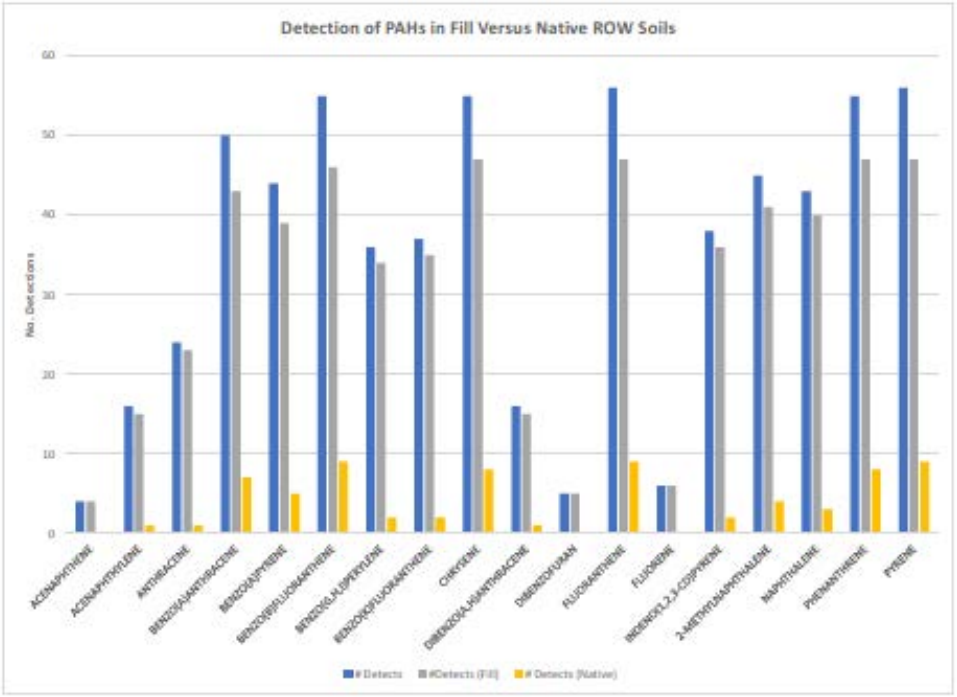
- Magnitude and Frequency of Detection
- Comparison of Fill versus Native Materials
- Reasonable Maximum (RME) and Central Tendency Estimates (CTE)
- Censored Data (non-detects)

Metals

- Uniformly Detected
- Fill v. Native Materials
- As, Sb, and Hg
- Pb notifications
- Surficial v. Deep Concentrations



PAHs



- Frequency and magnitude in fill
- Consistent concentration with depth
- Primary risk driver for controlled management of surplus soil during the project

Summary Statistics

Parameter	No. Samples	Mean	Minimum	Percentile			Maximum
				50th	90th	95th	
Arsenic							
All Data	98	13.6	2.70	8.7	23.4	29.4	130
Fill	52	16.9	3.50	11	24.9	36.1	130
Native	44	5.7	2.70	4.7	7.8	8.7	28
Lead							
All Data	98	72.0	4.8	57.5	176	203	310
Fill	54	111.3	9.7	99.5	197	224	310
Native	44	23.7	4.8	14.0	56.6	71.1	95
Benzo(a)pyrene							
All Data	98	2.02	0.22	0.68	3.54	5.19	30.00
Fill	54	2.15	0.22	0.70	3.74	5.39	30.00
Total PAHs							
All Data	98	20.39	0.48	6.45	44.66	75.45	321
Fill	54	23.18	0.48	7.82	46.49	77.97	321

So what…?

Comparison with Published Values

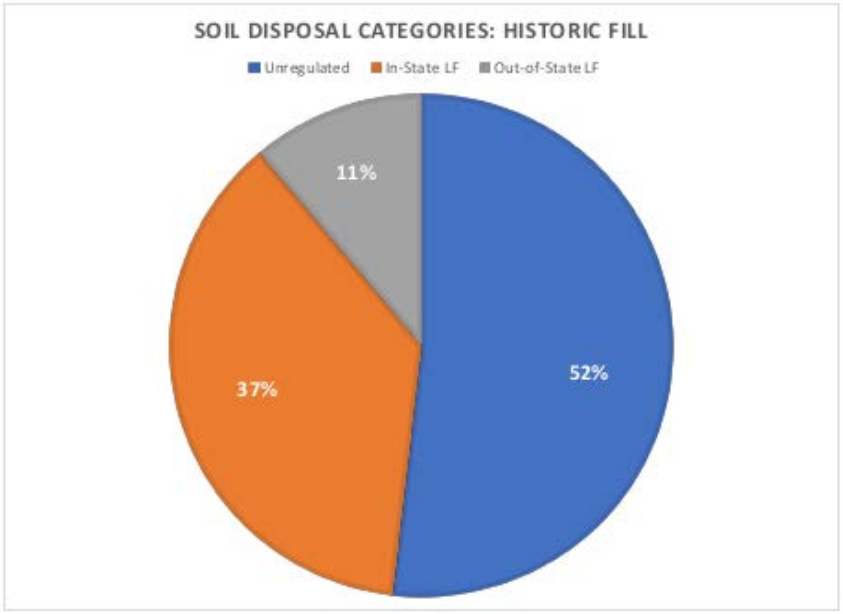
- Reportable Concentrations
- “Natural” Background
- “Urban” Background

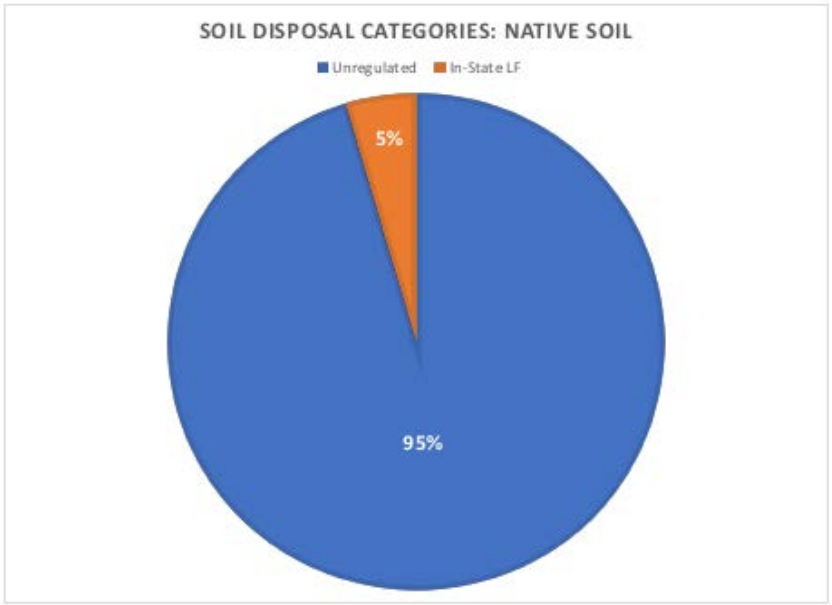
Parameter		No. Detections	Mean	MassDEP RCS-1	MassDEP "Backgroud"	MassDEP "Urban Background"
Arsenic						
	All Data	74	13.56			
	Fill	52	16.88	20	20	20
	Native	22	5.70			
Barium						
	All Data	97	47.09			
	Fill	54	54.61	1000	50	50
	Native	43	37.65			
Cadmium						
	All Data	98	0.79			
	Fill	53	1.05	70	2	3
	Native	40	0.47			
Chromium, Total						
	All Data	98	15.95			
	Fill	54	15.72	100	30	40
	Native	44	16.24			
Lead						
	All Data	98	71.99			
	Fill	54	111.33	200	100	600
	Native	44	23.70			
Mercury						
	All Data	73	0.15			
	Fill	51	0.17	20	0.3	1
	Native	22	0.11			

Parameter		No. Detections	Mean	MassDEP RCS-1	MassDEP "Backgroud"	MassDEP "Urban Background"
Benzo(a)anthracene						
	All Data	50	1.93	7	2	9
	Fill	43	2.09			
Benzo(a)pyrene						
	All Data	44	2.02	2	2	7
	Fill	39	2.15			
Indeno(1,2,3-cd)pyrene						
	All Data	38	1.64	7	1	3
	Fill	36	1.67			
2-Methylnaphthalene						
	All Data	46	0.58	0.7	0.5	1
	Fill	42	0.57			
Naphthalene						
	All Data	43	0.5	4.0	0.5	1
	Fill	40	0.51			
Phenanthrene						
	All Data	56	1.58	10	3	20
	Fill	47	1.76			
Pyrene						
	All Data	56	3.30	1000	4	20
	Fill	47	3.67			
Total PAHs						
	All Data	58	20.4	~	~	~
	Fill	48	23.18			

Soil Management

- Smarter soil management decisions
- Maximize reuse
- Reduced soil disposal costs





Conclusions

- Site-specific background limits regulatory responsibilities
  - Reporting exemptions
  - Site delineation
  - Feasibility of achieving background

- Site-specific background allows for better soil management
  - Baseline information to understand/predict costs
  - Segregation of contaminated materials for reuse
  - Lower soil management/disposal costs

Questions?

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thank you

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