

Design & Consultancy for natural and built assets

## UTILIZING NUMEROUS TECHNOLOGIES IN SYNERGY DURING AN ACCELERATED SITE CLEAN UP

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# The Team

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- ~12 acre site
- Old CSX Rail Yard
- No documented spills
- Slated for Sale and redevelopment
- Fast track clean up





#### Assessment Stats (Phase I, II, III)

- Completed ~ 4 years
- 377 soil borings
- 149 monitoring wells
- 1,346 soil samples
- 294 groundwater samples
- ~ 77 samples/acre

#### Site Contaminants of Concern

- Metals (Sb, Pb, Zn & Hg)
- PCBs
- CVOCs
- Methane associated with petroleum



(Units - mg/kg or ppm)



# Remedial Goals

Water

- 5 ug/L trichloroethene (TCE)
- 20 ug/L 1,2-cis-dichloroethene (DCE)
- 2 ug/L vinyl chloride (VC)

# Soil (ERH)

- Total concentration of TCE, DCE and VC less than 50 ug/kg
- No sample greater than 100 ug/kg for TCE, DCE or VC





#### Areas of Impact & Remedial Technologies

- Soil Excavation ~ 33,500 tons requiring remediation
  - Petroleum, PCBs, CVOC, metals
- GW ~ 12 acre CVOC plume
  - Extends beneath public road
  - Electric Resistance Heating (ERH)
    - ~ 2 acres
  - Directed Groundwater Recirculation (DGR)



ERH Stats -

331 electrode locations with 576 total installed electrodes 104 Multi-Phase Extraction (MPE) Wells 70 Temperature Monitoring Points (TMPS) Up to ~4,500 KW energy input into the electrodes Estimated Power usage ~13 million kWh Vapor extraction rate ~1500SCFM Groundwater Extraction Rate ~50 gpm Target soil treatment temperature 100C



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#### From Energy Delivery to Extraction and Treatment





### **ERH** Construction





### H System Monitoring









#### **Excavation**

- Total Estimated Targeted Tonnage ~ 33,500
- Soil Removed to Date ~ 33,300

Soil Management				
On-Site Treatment	Off-Site Disposal (Tons)			
(Tons)	Non-Hazardous	Hazardous		
3,000	27,600	2,700		

Water Management (Gallons)					
Dewatering Volume	On-Site Treat Dschg	Off-Site Disposal			
	Non-Hazardous	Non-Hazardous	Hazardous		
78,600	54,100	23,000	1,500		

Construction & Demolition (Tons)				
Concrete	Asphalt	Scrap Metal		
1,300	2,800	48		

- ~ 18 CSX rail cars Hazardous soil
- ~ 900 Trucks Other off-site disposal
- Recycle Rate (Solids) 92%  $\succ$
- Unknowns 9 USTs & structures; new haz-waste streams, increased  $\geq$ disposal volumes, clay surface variability.





**Directed Groundwater Recirculation (DGR)** 

- 58 injection wells
- 29 extraction wells ۲
- Metals treatment •
- O2 stripping (to prevent iron fouling)
- VOC treatment (Air-stripper and LGAC)

# Groundwater Treatment System

- ➤Heat Exchangers to cool water
- Pre-Treatment Sand filtration & iron removal
- >VOC Treatment Air Stripping, vapor and liquid GAC,
- ➢O₂ Removal for reinjection Nitrogen sparging





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## **DGR System Monitoring**





# **Overall Construction Stats**

Excavation	DGR System	ERH System
~33,500 tons targeted	~10 Acre Area	~2 acre area
~3,000 tons treated on-site	~1.6 miles of Trenching	~ 25,926 feet (5 miles) well drilling
34,600 tons of backfill	~5.4 miles of piping	331 electrode wells
Temp GW Treatment System	~ 3,900 ft. directional drill	104 GW extraction wells
~78,000 gal of water treated	~12.3 miles of wiring	70 sensor wells
~ 25,000 VSF sheeting	58 injection wells	576 electrodes
	29 extraction wells	~ 5,000 ft of steel extraction piping installed
	135 gpm design flow rate	~ 6,000 yard <sup>3</sup> of cellular concrete
	Mobile GW treatment system	~17 miles of high pressure water hose
		~15 miles of 1/0 electrode lead wire
		~ 6 miles of Teck cable



- All work done in parallel; Completed ~7 months
- Daily on-site management & coordination  $\succ$ 
  - ~ 70 people/day; 4 union trades , Union stewards/reps & city inspectors
- Air/dust monitoring programs work areas and perimeter  $\succ$
- Over 60,000 hours worked No reportable incidents  $\succ$
- $\succ$ Key factors of success
  - Communication, planning and more communication (all levels)



### **Design Construction and Operational Challenges**

- **Construction Coordination**
- Varying Clay Depths
- Unknown USTs •
- Iron Fouling
- Temperature and cooling issues
- Contract terminology
- Snow





# **CSX** Romar

### **Groundwater Analytical Plumes**

#### **Plume Boundaries**

- VOC Plume Prior to November 2014 Baseline
- Flushing Zones Boundaries
- ERH Footprint

#### **Groundwater Analytical Data**

Groundwater monitoring well 

#### **GW2 Exceedances**





SCALE IN FEET

#### **Groundwater Plumes**

Comparison to GW2 for Cis-1,2-DCE, TCE, VC



#### Note:

Groundwater analytical plumes represent the most recent data for sampling locations; however, only samples collected on designated dates are shown.

Constituent concentrations were normalized to GW2 exceedances; groundwater analytical plumes and sample data represent the maximum GW2 exceedance at each location for a given sampling event.





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#### November 2014 Baseline Groundwater Data

GW2 Exceedances

Figure 1

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### Pesign & Consultancy for natural and built assets

#### July 30–August 3, 2015 Groundwater Data; July-August Yield Up

GW2 Exceedances

Figure 2



## Pesign & Consultancy for natural and built assets

September 14–September 18, 2015 Groundwater Data; September Yield Up

GW2 Exceedances

Figure 3

### November 2015 Baseline July-August 2015 Yield Up September 2015 Yield Up 1.235. ..... DGR and ERH Reduction DGR and ERH Reduction TCE DGR: 98%; ERH: 19% Cis-1,2-DCE DGR: 95%; ERH: 68% VC DGR: 76%; ERH: 82% TCE DGR: 97%; ERH: 5% Cis-1,2-DCE DGR: 96%; ERH: 60% VC DGR: 87%; ERH: 72%

#### **GW2 Exceedances**

Extraction well data is from the August 27 – September 1, 2015 groundwater sampling event.



## Where we are Today

Final Groundwater sampling event slated for Week of October 19<sup>th</sup> Soil sampling event expected to occur first week in November Shutdown end of November!





### ARCADIS Design & Consultancy for natural and built assets

- Integration of numerous systems lead to a successful project
- Communication amongst the remedial remedies was vital
- Flexibility to adapt operational changes was key to ensure both systems remained operational and meet the remedial goals.



# **Questions?**