

# Risk Assessment Results



Prepared by



SMARTER ENVIRONMENTAL SOLUTIONS

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# Topics of Discussion

- Introduction & Background
- Human Health Risk Assessment
- Ecological Risk Assessment
- Conclusions & Recommendations

# Introduction & Background



- Mixture of coal combustion products (CCPs) and construction debris buried across much of the property.
- Primary compounds of concern are metals.

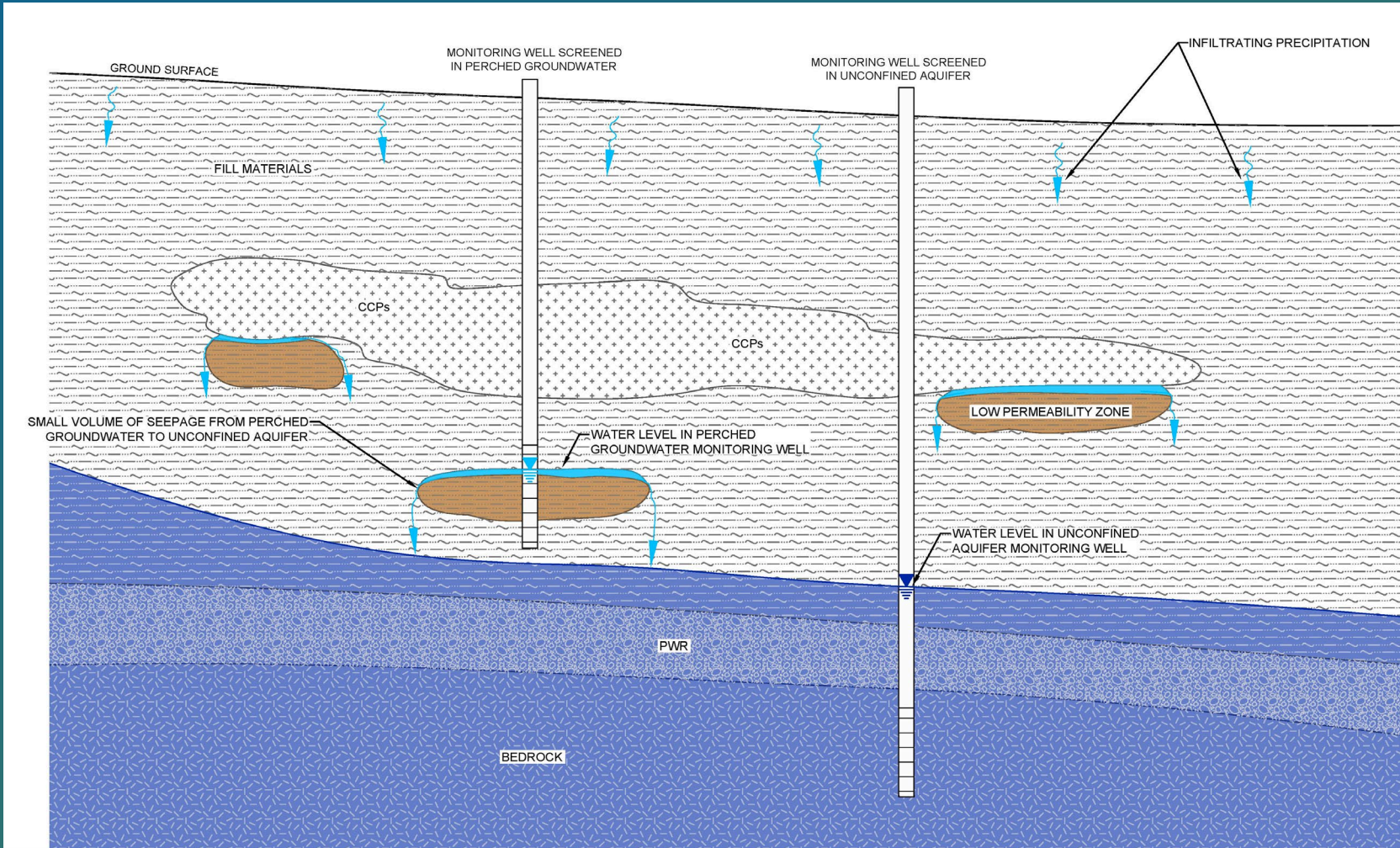
# Introduction & Background

2020 interim remedial measures:

- Excavation of coal combustion products (CCPs) along Bolin Creek Trail
- Stabilization of embankment and stormwater management controls



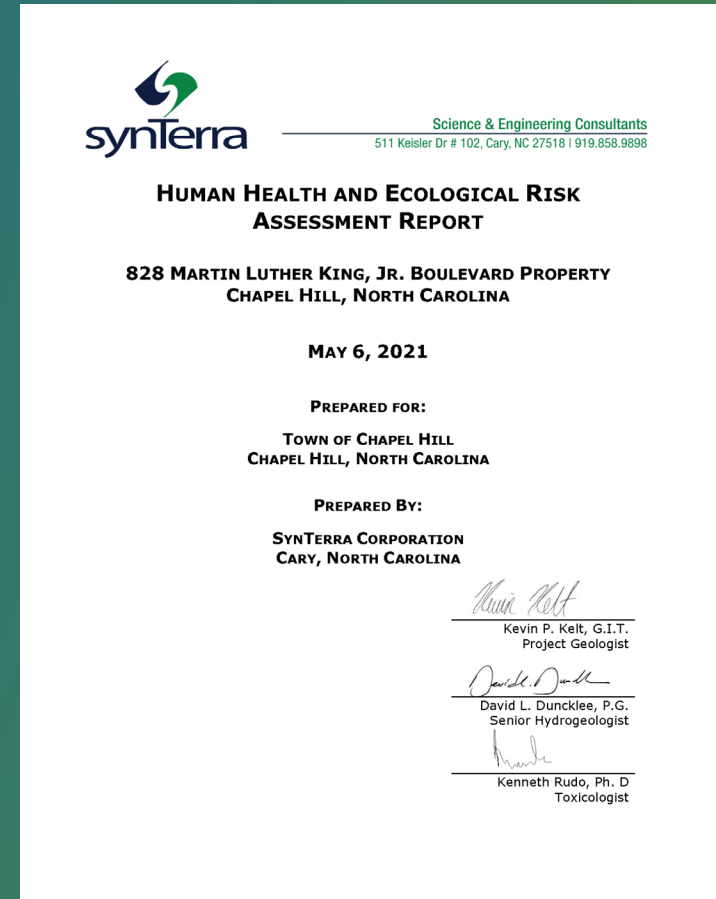
# Introduction & Background



- Some elevated concentrations of metals in perched water within fill materials, but limited or no groundwater impact in wells screened in non-fill zones in the underlying aquifer.
- No significant impact to surface water in Bolin Creek.
- No groundwater users (such as water supply wells) in the area.

# Introduction & Background

- Prior risk assessment focused on area of greenway. Concluded that interim remedial measures effectively reduced risk such that greenway trail is safe for use.
- More comprehensive human-health and ecological risk assessment recently performed for the site as a whole. Goal was to define the final measures recommended under the current land use scenario and possible future redevelopment scenarios.



# Topics of Discussion

- Introduction & Background
- **Human Health Risk Assessment**
- Ecological Risk Assessment
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# Human Health Risk Assessment

North Carolina Department of Environmental Quality  
Risk Calculator  
June 2021 Version

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Residential Vapor Intrusion Screening Levels (VISL) Table      Non-Residential VISL Table

DATA INPUT SHEETS

1. Exposure Pathways & Parameters

A. Complete Exposure Pathways      B. Exposure Factors and Target Risks      C. Contaminant Migration Parameters      D. Sample Statistics

2. Exposure Point Concentrations

A. Soil      B. Groundwater      C. Surface Water      D. Soil Gas      E. Air

DATA OUTPUT SHEETS

1. Summary Output for All Calculators

A. Risk for Individual Pathways      B. Site-wide Risk

2. Direct Contact Soil and Water Calculators

A. RESIDENT Soil      B. RESIDENT Groundwater Use      C. NON-RESIDENTIAL WORKER Soil      D. NON-RESIDENTIAL WORKER Groundwater Use      E. CONSTRUCTION WORKER Soil

F. RECREATOR/TRESPASSER Soil      G. RECREATOR/TRESPASSER Surface Water

3. Vapor Intrusion Calculators

A. RESIDENT Groundwater to Indoor Air      B. RESIDENT Soil Gas to Indoor Air      C. RESIDENT Indoor Air      D. NON-RESIDENTIAL WORKER Groundwater to Indoor Air      E. NON-RESIDENTIAL WORKER Soil Gas to Indoor Air      F. NON-RESIDENTIAL WORKER Indoor Air

4. Contaminant Migration Worksheets

A. Soil to Groundwater Forward Mode      B. Groundwater to Groundwater Forward Mode      C. Soil to Surface Water Forward Mode      D. Groundwater to Surface Water Forward Mode

E. Soil to Groundwater Backward Mode      F. Groundwater to Groundwater Backward Mode      G. Soil to Surface Water Backward Mode      H. Groundwater to Surface Water Backward Mode

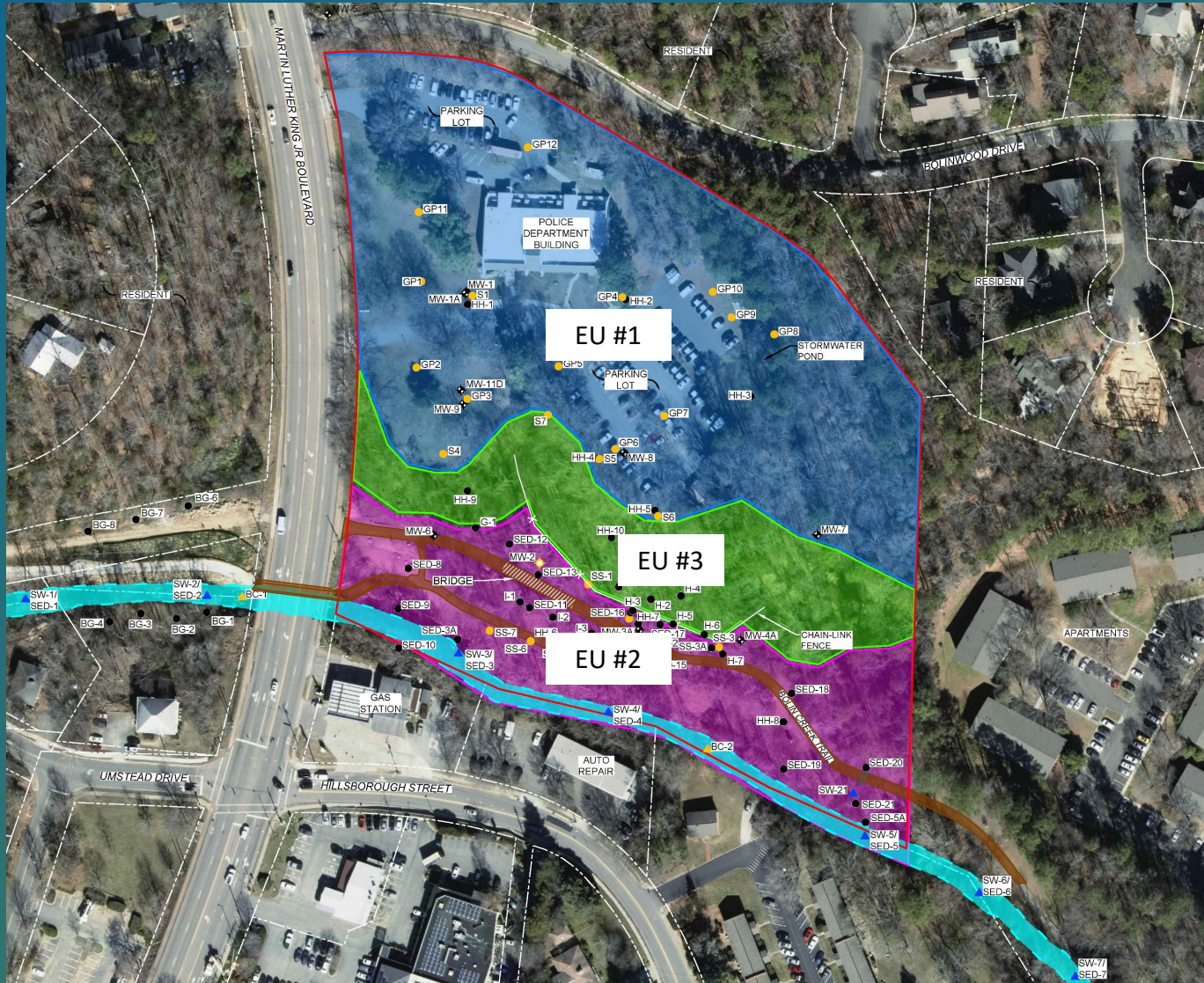
For NCDEQ Use Only

UNPROTECT ALL SHEETS      PROTECT ALL SHEETS

- Risk assessment calculations performed using the DEQ Risk Calculator.
- Recommendations to address exceedances of acceptable risk levels could include remediation, land-use restrictions (LURs), or other measures.

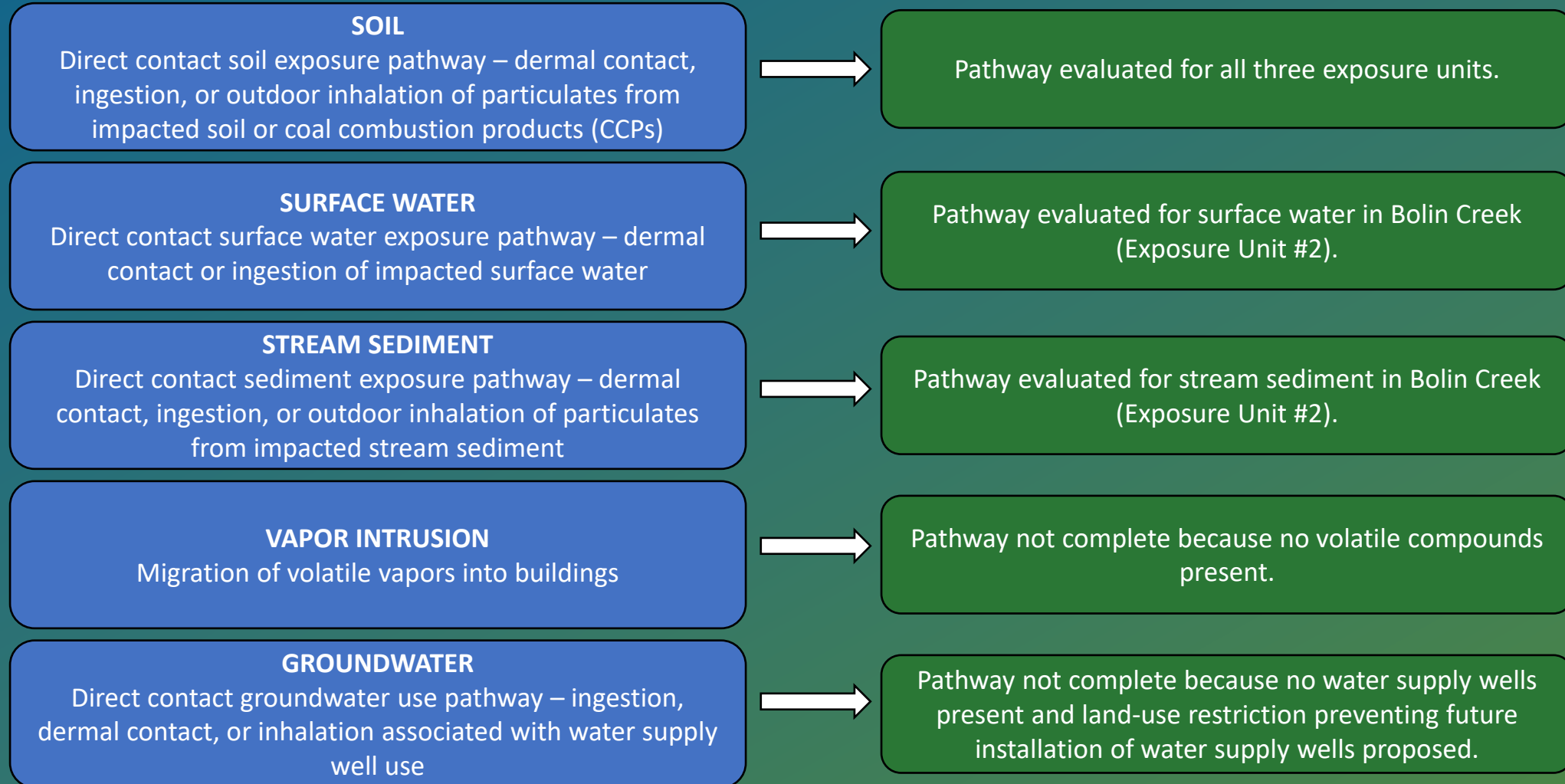


# Human Health Risk Assessment - Exposure Pathways Evaluation



- Exposure Unit (EU) = Areas of similar land-use and exposure characteristics
- Evaluated risk for both current and possible future site occupants.
- EU #1 – Upper Level
  - Residents
  - Non-residential workers
  - Construction workers
- EU #2 – Lower Level
  - Greenway user
  - Construction workers
- EU #3 - Embankment
  - Current exposure minimal, evaluated future risks for all possible users to identify whether additional measures needed.

# Human Health Risk Assessment - Exposure Pathways Evaluation



# Human Health Risk Assessment - Exposure Parameters

*Reasonable maximum exposure (RME) – the highest exposure reasonably likely to occur, generally assumed to be in the range of the 90th and 99.9th percentiles (US EPA, 2001).*

***90 to 99.9% of time people will be exposed at levels less than risk assessment assumes.***

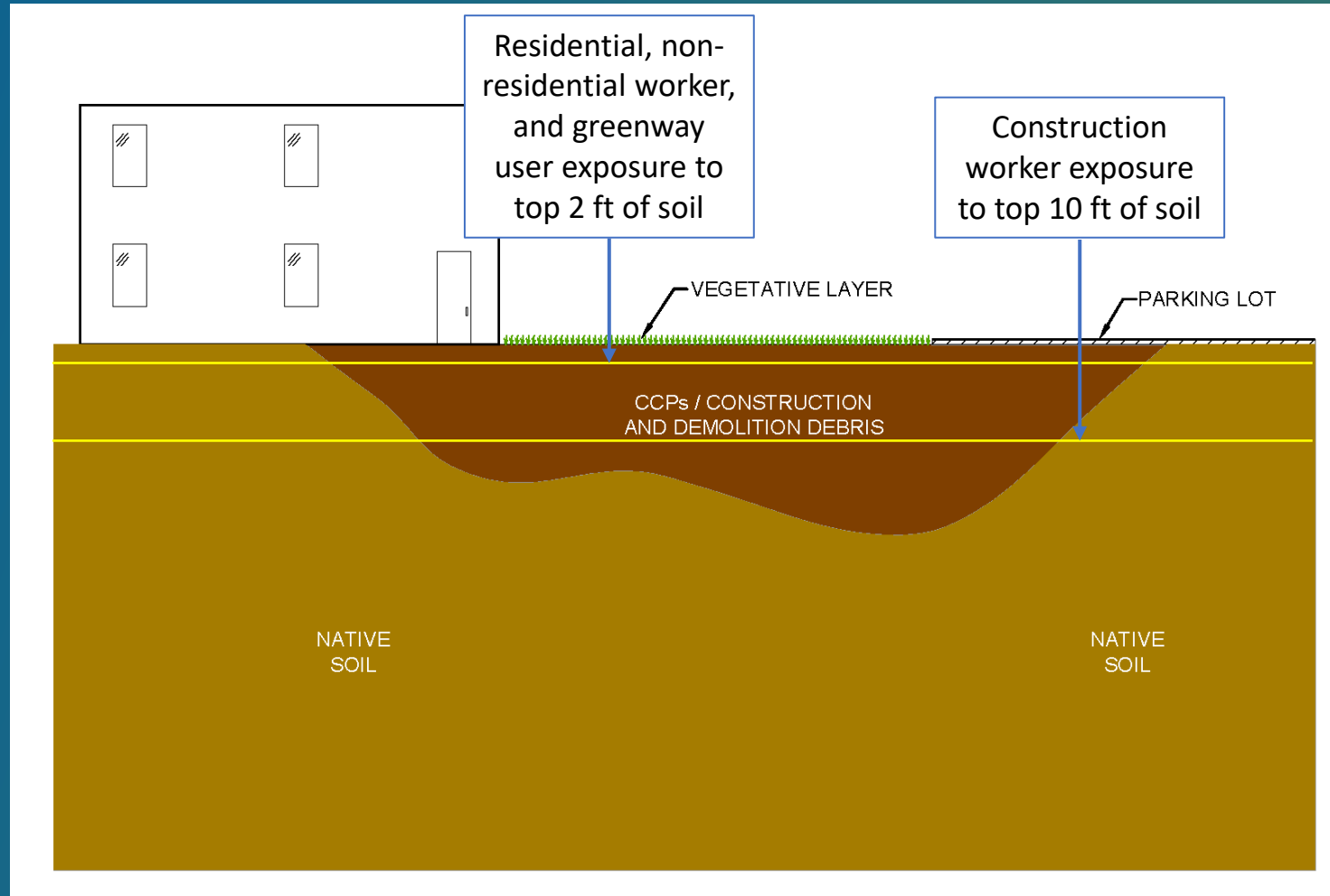
- DEQ default exposure parameters used for resident, non-residential worker, and construction worker, which represent RME.
- For greenway user, site-specific values calculated which represent 98<sup>th</sup> percentile based on trail survey.

# Human Health Risk Assessment - Exposure Point Concentrations

- Metals are naturally occurring in North Carolina soils.
- Metals representative of naturally occurring conditions removed for the purpose of defining areas where remediation or other measures needed to address risks.



# Human-Health Risk Assessment – Exposure Point Concentrations



- Risk calculations used maximum concentrations in designated depth zone.
- If deeper samples exposed during grading and not covered by impervious surfaces post-redevelopment, recommend additional risk evaluation or cover with 2 ft of clean fill.

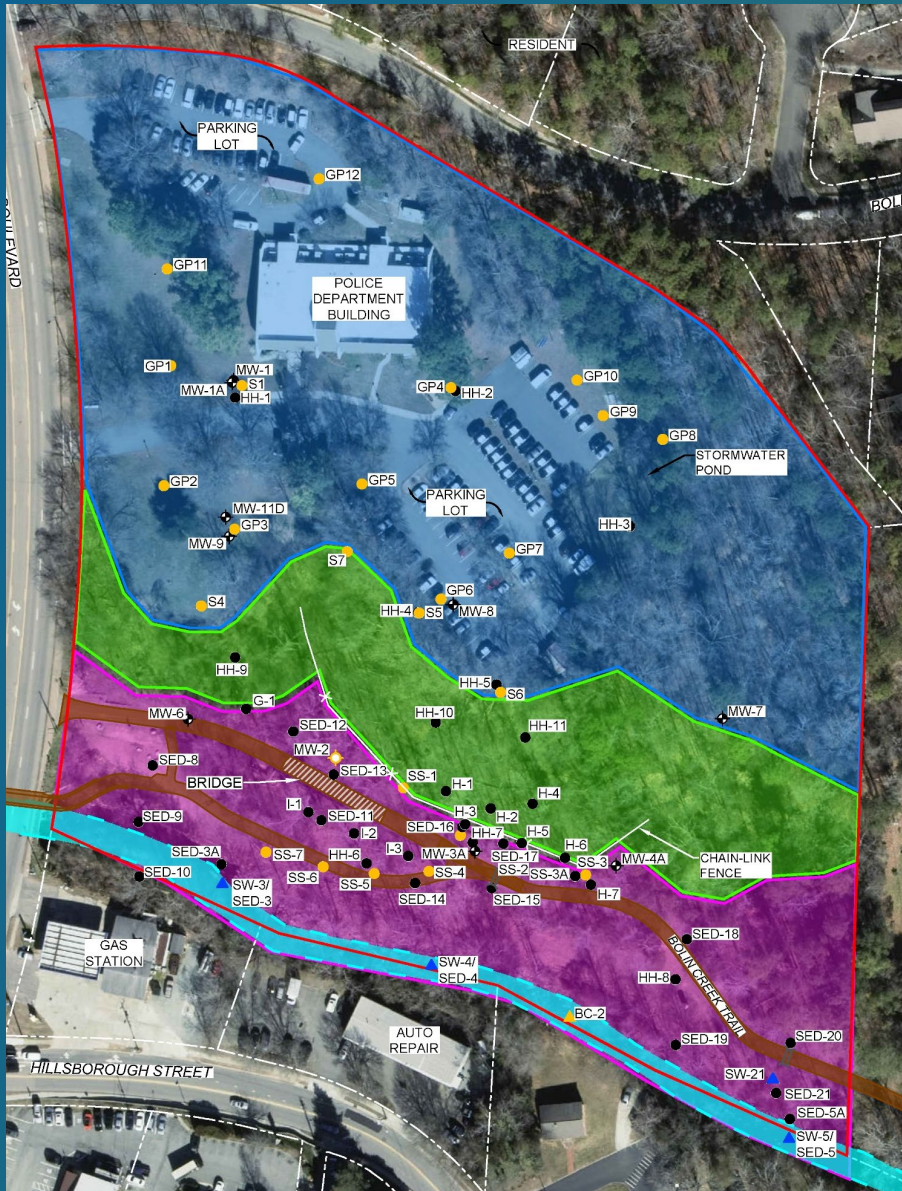
# Human Health Risk Assessment – Target Risk Levels

- Based on EPA and NCDEQ risk assessment guidance, exceedances of the following target risk levels will be considered “triggers” for additional action:
  - Non-cancer hazard index  $> 1$
  - Cancer risk  $> 1$  in 10,000 ( $10^{-4}$ )
- Per typical Brownfields redevelopment process, actions may be performed to minimize exposure even if target risk levels are not exceeded.

Non-cancer hazard index (HI) or hazard quotient (HQ) = The ratio of the amount of a contaminant a person is exposed to versus the amount that may cause non-cancer harmful effects.

Individual Excess Lifetime Cancer Risk (CR) = Increase over background in an individual’s probability of getting cancer over a lifetime due to exposure to a chemical.

# Human-Health Risk Assessment – Non-Residential Worker



## Exposure assumptions:

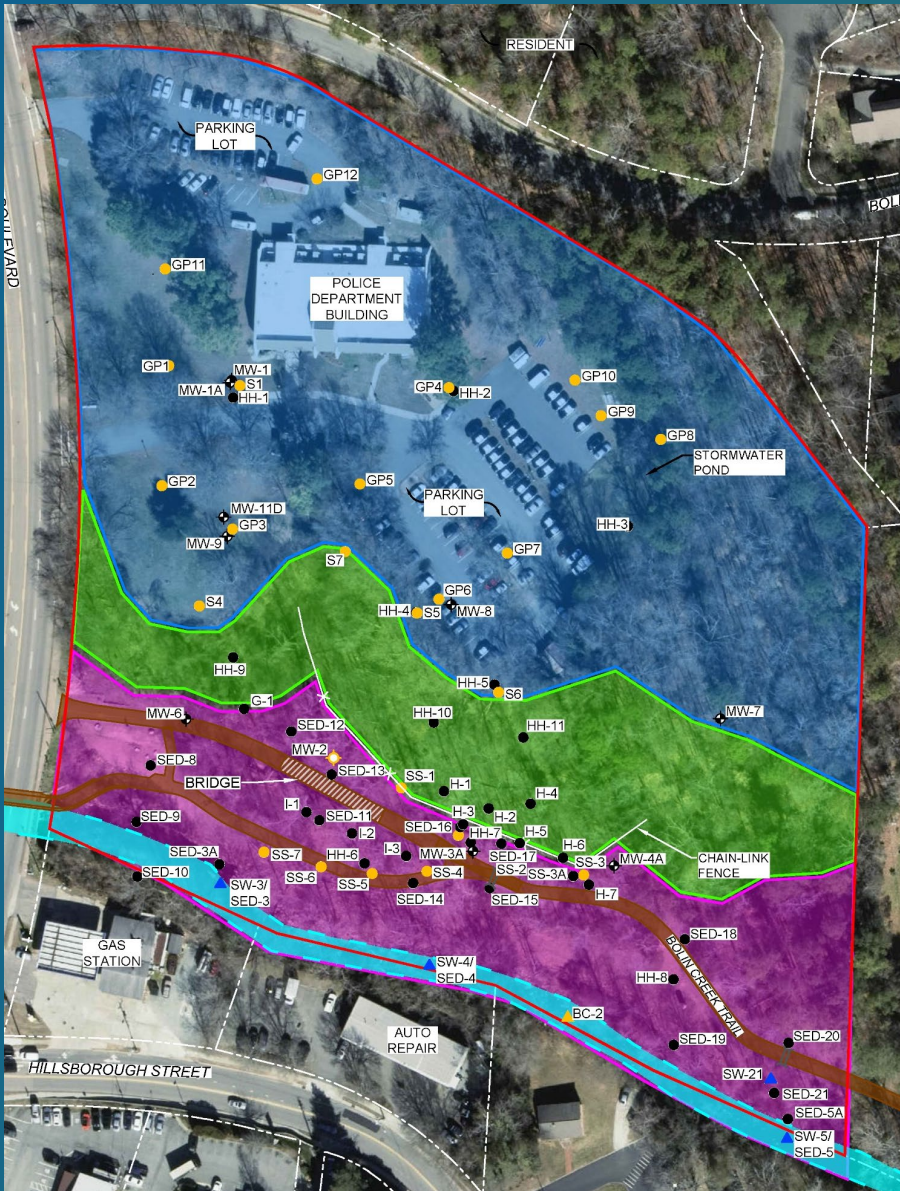
- Exposure for 25 yrs, 250 d/yr, and 8 hr/d.
- Dermal exposure of head, hands, and forearms.
- Ingestion of 100 mg/d of soil.

## Risk assessment results:

- No exceedances of acceptable risk levels.

***Site considered safe for current or future non-residential workers.***

# Human-Health Risk Assessment – Greenway User



## Exposure assumptions:

- Adult exposure for 20 yrs, 364 d/yr, and 1 hr/d.
- Child exposure for 6 yrs, 52 d/yr and 0.5 hr/d.
- Dermal exposure of head, hands, forearms, lower legs, and feet.
- Ingestion of 200 mg/d of soil by a child and 100 mg/d of soil by an adult.

## Risk assessment results:

- No exceedances of acceptable risk levels.

***Site considered safe for current or future greenway users.***



# Human-Health Risk Assessment - Resident

## Exposure assumptions:

- Exposure for 6 yrs as a child and 20 yrs as an adult, 350 d/yr, and 24 hr/d.
- Dermal exposure of head, hands, forearms, lower legs, and feet.
- Ingestion of 200 mg/d of soil by a child and 100 mg/d of soil by an adult.

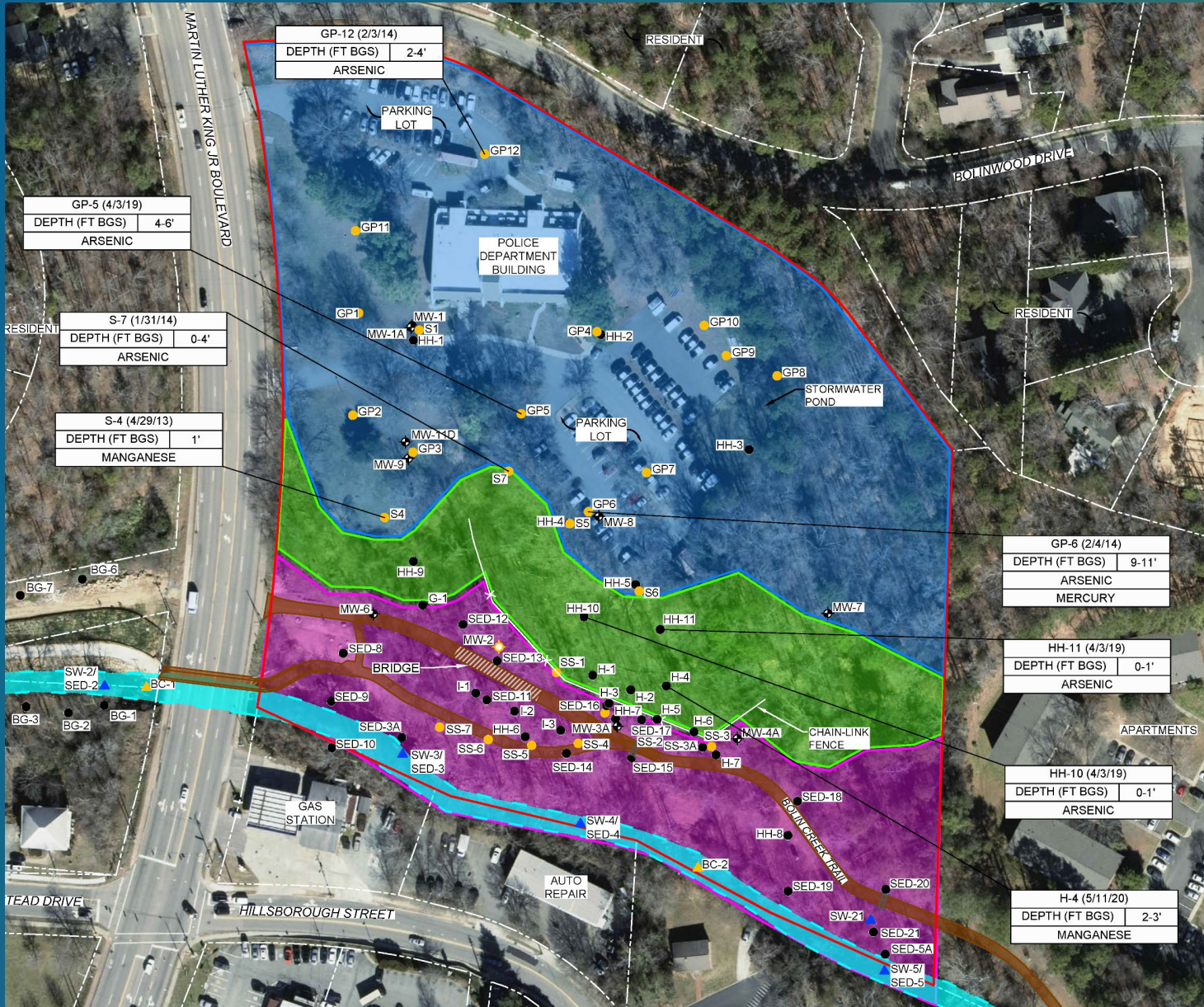
## Risk assessment results:

- Samples in yellow indicate coal combustion products (CCPs) in embankment area. Recommend addressing in conjunction with permanent measures for embankment.
- For sample in red (S-4), recommend remediation or other measures to address impacts.

***No current residents, risk management recommendations apply if site is redeveloped for residential use.***



# Human-Health Risk Assessment – Construction Worker



Exposure assumptions:

- Exposure for 1 yr, 250 d/hr, and 8 hr/d.
- Dermal exposure of head, hands, and forearms.
- Ingestion of 330 mg/d of soil.
- Significantly increased outdoor inhalation of particulates.

Risk assessment results:

- Several samples with exceedances.
- Recommend Environmental Management Plan (EMP) requiring personal protective equipment (PPE) and other measures to eliminate construction worker exposures.

***Future construction worker risk can be addressed via EMP.***

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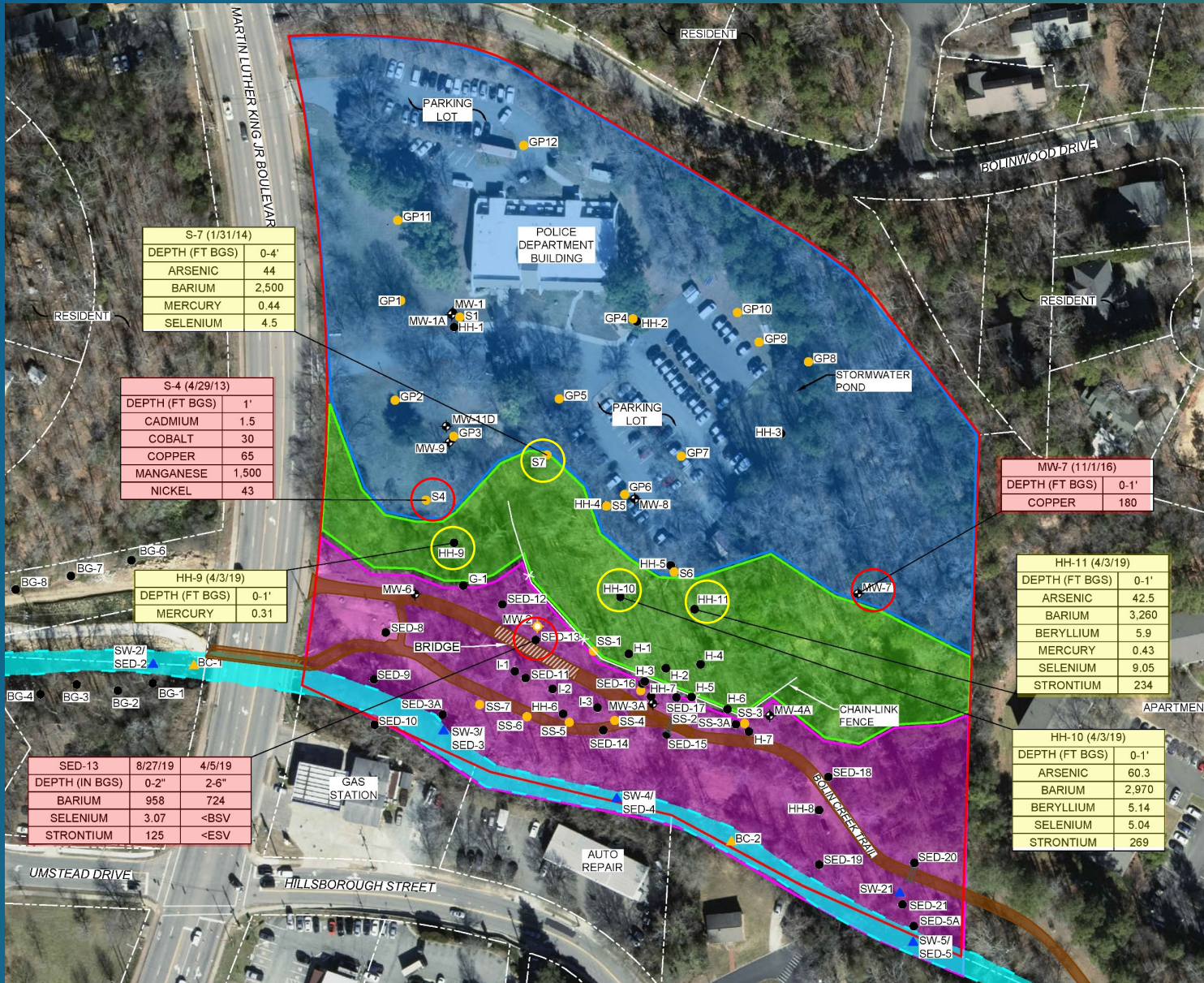
# Ecological Risk Assessment Results

- Initial screening level comparison of concentrations to EPA Ecological Screening Values (ESVs).
- EPA ESVs are based on conservative endpoints and ecological effects data, and represent preliminary screening criteria to evaluate the potential for ecological risk (or lack thereof). Not considered remediation goals.
- Compared concentrations of stream sediment, surface water, and soil (0-2 ft) above background levels to EPA ESVs.



Image reference: KY Department of Fish & Wildlife Resources

# Ecological Risk Assessment Results



- No exceedances of EPA Ecological Screening Values (ESVs) in surface water or stream sediment in Bolin Creek, which is most ecologically sensitive area.
- Samples in yellow indicate exceedances of ESVs in embankment area. Recommend addressing in conjunction with permanent measures for embankment.
- Samples in red indicate exceedances of ESVs in upper or lower level soil. DEQ does not commonly require evaluation of ecological risks for soil. If required by DEQ or if the Town wishes to take voluntary actions, H&H recommends remediation or other measures to address or further evaluate potential ecological risks in the area of these samples.

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# Conclusions & Recommendations

- Human-health risk is safe for current site uses (non-residential workers and greenway users).
- Ecological risk is acceptable for Bolin Creek.
- For the area of the embankment, recommend implementation of permanent measures to prevent erosion and address exposed coal combustion products (CCPs), which exceed acceptable risk levels for a resident, construction worker, and ecological receptors.
- If the site is redeveloped for residential use, recommend remediation or other measures to address impacts in the upper level in the area of sample S-4.
- Outside of the embankment area, ecological risk screening indicated localized exceedances of Ecological Screening Values (ESVs) at three sample locations. DEQ does not commonly require evaluation of ecological risks for soil. If required by DEQ or if the Town wishes to take voluntary actions, recommend remediation or other measures to address or further evaluate risks in the area of these samples.
- Recommend Environmental Management Plan (EMP) manage risks to construction workers.

# Conclusions & Recommendations

- Risk calculations based on 0-2 ft samples for residents, non-residential workers, and greenway users, and 0-10 ft samples for construction worker. If deeper samples exposed during grading and not covered by impervious surfaces post-redevelopment, recommend additional risk evaluation or cover with 2 ft of clean fill.
- Recommend land use restriction (LUR) preventing the future installation of water supply wells at the site.
- Final LURs will be detailed in a Brownfields Agreement (BFA). The BFA will be filed on the deed for the property, and requires annual certification that LURs are being complied with in perpetuity.





**Questions?**

**Smarter Environmental Solutions**