

AREA B GROUNDWATER INVESTIGATION

Progress Report to the RAB
November 14 2012

Tim Llewellyn



Overview of Topics

- ❑ Work Completed Since July RAB Meeting
- ❑ Review Conceptual Site Model
- ❑ Summary of April 2012 Data
- ❑ Summary and Next Steps

Recent Progress

- Completed September 2012 groundwater and surface water sampling
- Surface water sampling included additional samples downstream in Carroll Creek

Recent Progress

- Developed and submitted Draft Conceptual Site Model Report to the Army
 - Comprehensive overview of the site conditions including nature and extent of contamination
 - Includes validated data from work completed through the April sampling round
 - Will be released to the RAB and public for review and comment by early 2013 and prior to the next RAB meeting

Status of Current Phase

- ✓ Existing well assessment and repair Feb 2011 to Apr 2011
- ✓ New well installation (onsite) April 2011 to Mar 2012
- ✓ Direct Push Investigation March 2012
- ✓ Spring and Seep Surveys March 2012
- ✓ Groundwater/Surface Water Sampling (Round 2 Sampling completed since last RAB) April 2012 /Sept 2012
- ▶ Vapor Intrusion Sampling Heating Season 2012
- ▶ Dye trace study Spring 2013

Status of CERCLA Process

Current
Phase

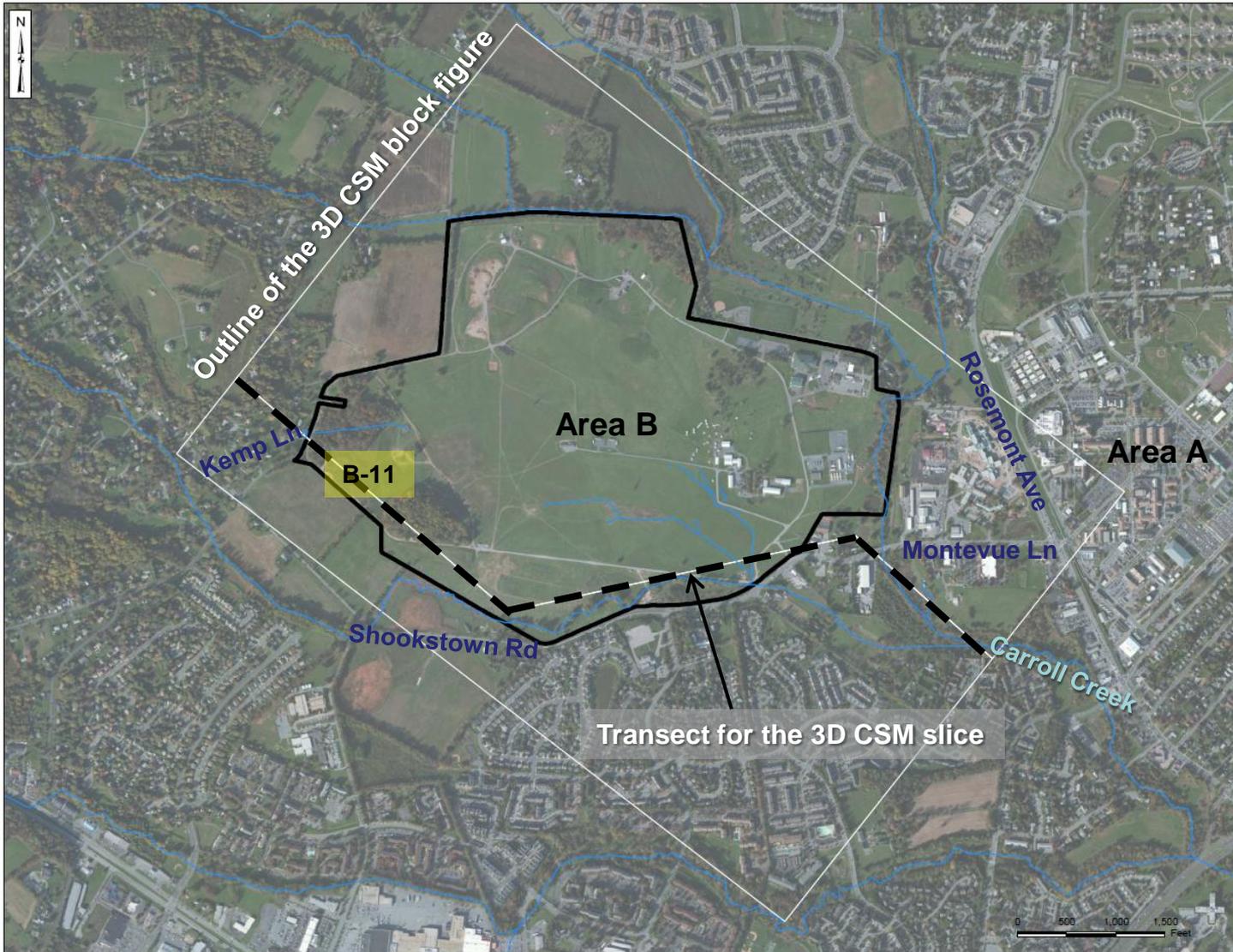
- Remedial Investigation
 - Data collection and development of CSM
 - ❑ Future phase will include a full risk assessment as required by CERCLA

Future
Phases

- ❑ Feasibility Study (Assessment of possible remedies)
- ❑ Proposed Plan (Public document to solicit input on preferred remedy)
- ❑ Record of Decision (Final legal document selecting remedy)
- ❑ Remedial Action (Implement Remedy)

Conceptual Site Model

Area B Conceptual Site Model



Summary of April 2012 Sampling Data



Area B Site-Wide Sampling (2012)

- Two site-wide sampling events have been completed in 2012:
 - Spring 2012
 - Draft results previewed during July RAB
 - Final validated results presented during tonight's RAB
 - Fall 2012
 - Results still undergoing validation

Samples Tested for an Extensive List of Chemicals

- 216 individual chemicals
- More than 45,000 data points



Chemical Group	Number of Data Points
Volatile Organic Compounds	18695
Semi Volatile Organic Compounds	13563
Inorganics (total metals)	4119
Pesticides	3576
Inorganics-(dissolved metals)	1824
PCBs	1190
Herbicides	1091
Dioxins	782
Other Water Quality Parameters	532
Radiochemistry	88

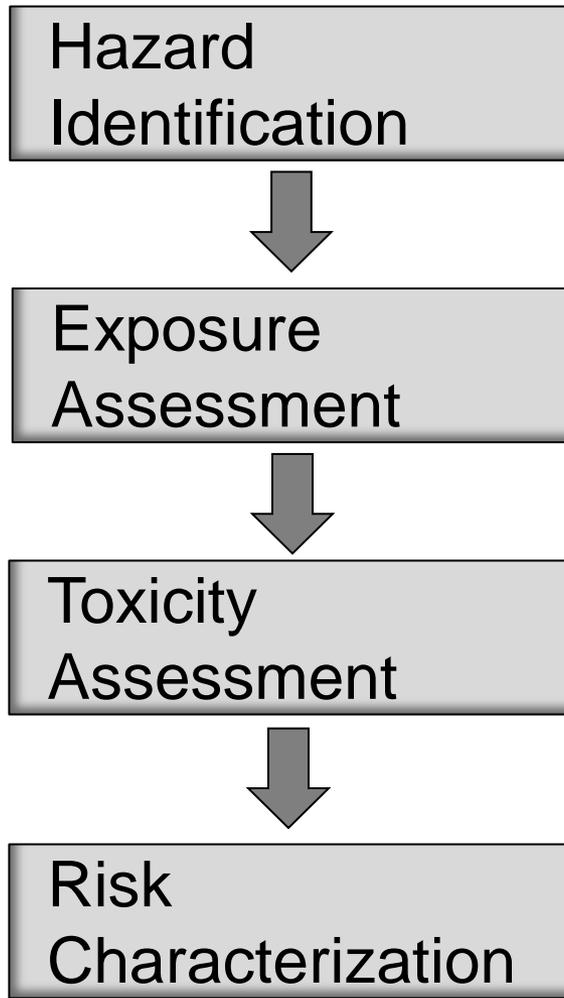
List of the
216
Chemicals
Tested
(See
handout)

1,1,1-Trichloroethane	2-Methylphenol	Bromodichloromethane	Hexachlorocyclopentadiene
1,1,2,2-Tetrachloroethane	2-Nitroaniline	Bromoform	Hexachlorocyclopentadiene
1,1,2-trichloro-1,2,2-trifluoroethane	2-Nitrophenol	Bromomethane	Hexachloroethane
1,1,2-Trichloroethane	3,3'-Dichlorobenzidine	Butylphenylphthalate	Indeno(1,2,3-cd)pyrene
1,1'-Biphenyl	3-Nitroaniline	Cadmium	Iron
1,1-Dichloroethane	4,4'-DDD	Calcium	Isophorone
1,1-Dichloroethane	4,4'-DDE	Caprolactam	Isopropylbenzene
1,2,3,4,6,7,8-HpCDD	4,4'-DDT	Carbazole	Lead
1,2,3,4,6,7,8-HpCDF	4,6-Dinitro-2-methylphenol	Carbon Disulfide	m&p-Xylene
1,2,3,4,7,8,9-HpCDF	4-Amino-3,5,6-Trichloropicolinic Acid	Carbon Tetrachloride	Magnesium
1,2,3,4,7,8-HxCDD	4-Bromophenyl-phenylether	Chloride	Manganese
1,2,3,4,7,8-HxCDF	4-Chloro-3-Methylphenol	Chlorobenzene	MCCPP
1,2,3,6,7,8-HxCDD	4-Chloroaniline	Chloroethane	Mercury
1,2,3,6,7,8-HxCDF	4-Chlorophenyl-phenylether	Chloroform	Methoxychlor
1,2,3,7,8,9-HxCDD	4-Methyl-2-pentanone	Chloromethane	Methyl acetate
1,2,3,7,8,9-HxCDF	4-Methylphenol	Chromium	Methyl tert-butyl ether
1,2,3,7,8-PeCDD	4-Nitroaniline	Chrysene	Methylcyclohexane
1,2,3,7,8-PeCDF	4-Nitrophenol	cis-1,2-Dichloroethene	Methylene Chloride
1,2,3-Trichlorobenzene	Acenaphthene	cis-1,3-Dichloropropene	Monuron
1,2,3-Trichloropropane	Acenaphthylene	Cobalt	Naphthalene
1,2,4-Trichlorobenzene	Acetone	Copper	Nickel
1,2,4-Trimethylbenzene	Acetophenone	Cyanide	Nitrate-N
1,2-Dibromo-3-chloropropane	Aldrin	Cyclohexane	Nitrobenzene
1,2-Dibromoethane	Alpha-BHC	Delta-BHC	N-Nitroso-di-n-propylamine
1,2-Dichlorobenzene	Alpha-Chlordane	Dibenzo(a,h)anthracene	N-Nitrosodiphenylamine
1,2-Dichloroethane	Aluminum	Dibenzofuran	Octachlorodibenzofuran
1,2-Dichloropropane	Anthracene	Dibromochloromethane	Octachlorodibenzo-p-Dioxin
1,3-Dichlorobenzene	Antimony	Dicamba	o-Xylene
1,4-Dichlorobenzene	Aroclor-1016	Dichlorodifluoromethane	Pentachlorophenol
1,4-Dioxane	Aroclor-1221	Dichloroprop	Percent Moisture
1,4-Naphthoquinone	Aroclor-1232	Dieldrin	Phenanthrene
2,2-Dichloropropionic Acid	Aroclor-1242	Diethylphthalate	Phenol
2,2'-Oxybis(1-Chloropropane)	Aroclor-1248	Dimethylphthalate	Potassium
2,3,4,6,7,8-HxCDF	Aroclor-1254	Di-n-Butylphthalate	Pyrene
2,3,4,7,8-PeCDF	Aroclor-1260	Di-n-Octylphthalate	Selenium
2,3,7,8-TCDD	Arsenic	Dinoseb	Silver
2,3,7,8-TCDF	Atrazine	Diuron	Simazine
2,4,5-T	Barium	Endosulfan I	Sodium
2,4,5-TP	Benzaldehyde	Endosulfan II	Styrene
2,4,5-Trichlorophenol	Benzene	Endosulfan Sulfate	Sulfate
2,4,6-Trichlorophenol	Benzo(a)anthracene	Endothall	Tetrachloroethene
2,4-D	Benzo(a)pyrene	Endrin	Thallium
2,4-DB	Benzo(b)fluoranthene	Endrin Aldehyde	Toluene
2,4-Dichlorophenol	Benzo(g,h,i)perylene	Endrin Ketone	Total Dissolved Solids
2,4-Dimethylphenol	Benzo(k)fluoranthene	Ethylbenzene	Toxaphene
2,4-Dinitrophenol	Benzoic Acid	Fenuron	trans-1,2-Dichloroethene
2,4-Dinitrotoluene	Benzyl Alcohol	Fluoranthene	trans-1,3-Dichloropropene
2,6-Dinitrotoluene	Beryllium	Fluorene	Trichloroethene
2-Butanone	Beta-BHC	Gamma-BHC (Lindane)	Trichlorofluoromethane
2-Chloronaphthalene	bis(2-Chloroethoxy)methane	Gamma-Chlordane	Vanadium
2-Chlorophenol	bis(2-Chloroethyl)ether	Gross Alpha	Vinyl Chloride
2-Hexanone	bis(2-Chloroisopropyl)ether	Gross Beta	Zinc
2-Methyl-4-Chlorophenoxyacetic Acid	bis(2-Ethylhexyl)phthalate	Heptachlor	
2-Methylnaphthalene	Boron	Heptachlor Epoxide	
	Bromide	Hexachlorobenzene	

Tonight's Data Presentation

- Water data has been compared against established drinking water standards (MCLs)
 - Maximum Contaminant Level (MCL) - The highest level of a contaminant that is allowed in drinking water. MCLs are federal enforceable standards.
- Drinking water standards are not established for all chemicals
- Sediment data compared to risk based screening levels
- Future phases of the RI will conclude with a quantitative evaluation of all validated data as part of the risk assessment process

What is the Risk Assessment?



Identifies all chemical of concern based on health based screening criteria

Assesses how populations (human and ecological) could be exposed to these chemicals

Assesses possible health effects based on toxicity and exposure (dose) to chemicals

Develops a quantitative assessment of site related risks and identifies key chemicals of concern

What is the Risk Assessment?

- Risk assessments are completed in accordance with USEPA requirements and oversight
- More information at the EPA website under:

http://www.epa.gov/oswer/riskassessment/risk_superfund.htm

Spring 2012 Data Summary

- Solvents are the main contaminant and are present at part per million (ppm) levels in the vicinity of B-11 in groundwater.
 - Note: 1 ppm = 1000 ppb or 1000 micrograms/liter (ug/L)
- All chemical data will be included in a Conceptual Site Model (CSM) report.
- Since the July 2012 RAB meeting, all Round 1 data has been validated by a third-party reviewer.

Groundwater Sampling Results

April 2012



VOC Sampling Results Summary

Monitoring Wells

39 chemicals detected

10 above their respective drinking water standards (MCLs)

TCE most commonly detected

Residential Wells

None detected above the drinking water standard (MCL)

No site related contaminants

MTBE (gasoline additive) detected in one well in April '12 below guidance criteria (0.2 J ug/L at DWELL-66)

No MTBE detected in groundwater at Area B

VOCs in Groundwater above MCL

VOC	Number of Locations above a Drinking Water Standard (MCL)	Drinking Water Standard – MCL (ug/L)	Maximum Concentration (ug/L)	Location with Max Conc.
TCE (trichloroethene)	35 wells 3 piezometers	5	15,000	B-11 (67C)
PCE (perchloroethene)	18 wells 2 piezos	5	320	B-11 (37D)
1,1-Dichloroethene	13 wells	7	1100	B-11 (67C)
cis-1,2-Dichloroethene	9 wells	70	1300	B-11 (67C)
Vinyl Chloride	8 wells	2	16	B-11 (56D)
Chloroform	11 wells	70	3000	B-11 (67A)
Methylene Chloride	2 wells	4	10	B-11 (67C)
1,2-Dichloroethane	10 wells	5	75	B-11 (67C)
1,1,1-Trichloroethane	2 wells	200	650	B-11 (67C)
1,2,4-Trichlorobenzene	2 wells	70	220	B-11 (67C)
1,1,2-Trichloroethane	1 well	5	13	B-11 (67B)
Benzene	8 wells	5	71	B-11 (67C)

TCE in Groundwater

(April 2012)



Legend

Fort Detrick Boundary
Stream

- Non-Detect
- 5 ug/L or less
- >5 to 80 ug/L
- >80 to 1,000 ug/L
- >1,000 ug/L

X = Exceeds drinking water standard

- Notes:
- 1) Aerial imagery accessed through BING Maps Aerial via ArcGIS Online Layer Packages by ESRI (12/1/2010) (c) 2010 Microsoft Corporation and its data suppliers accessed on 05/29/2012 through ArcGIS 9.3.1.
 - 2) ug/L = micrograms per liter
 - 3) TCE = Trichloroethene
 - 4) Drinking water standard for TCE = 5 ug/L

0 500 1,000
Feet

REFERENCE PROJECTION: Maryland State Plane, NAD 83, Feet



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Infrastructure Water Environment Buildings

Groundwater Sampling
TCE Concentrations
March/April 2012

Fort Detrick
Frederick, MD

SVOC Sampling Results Summary

Groundwater

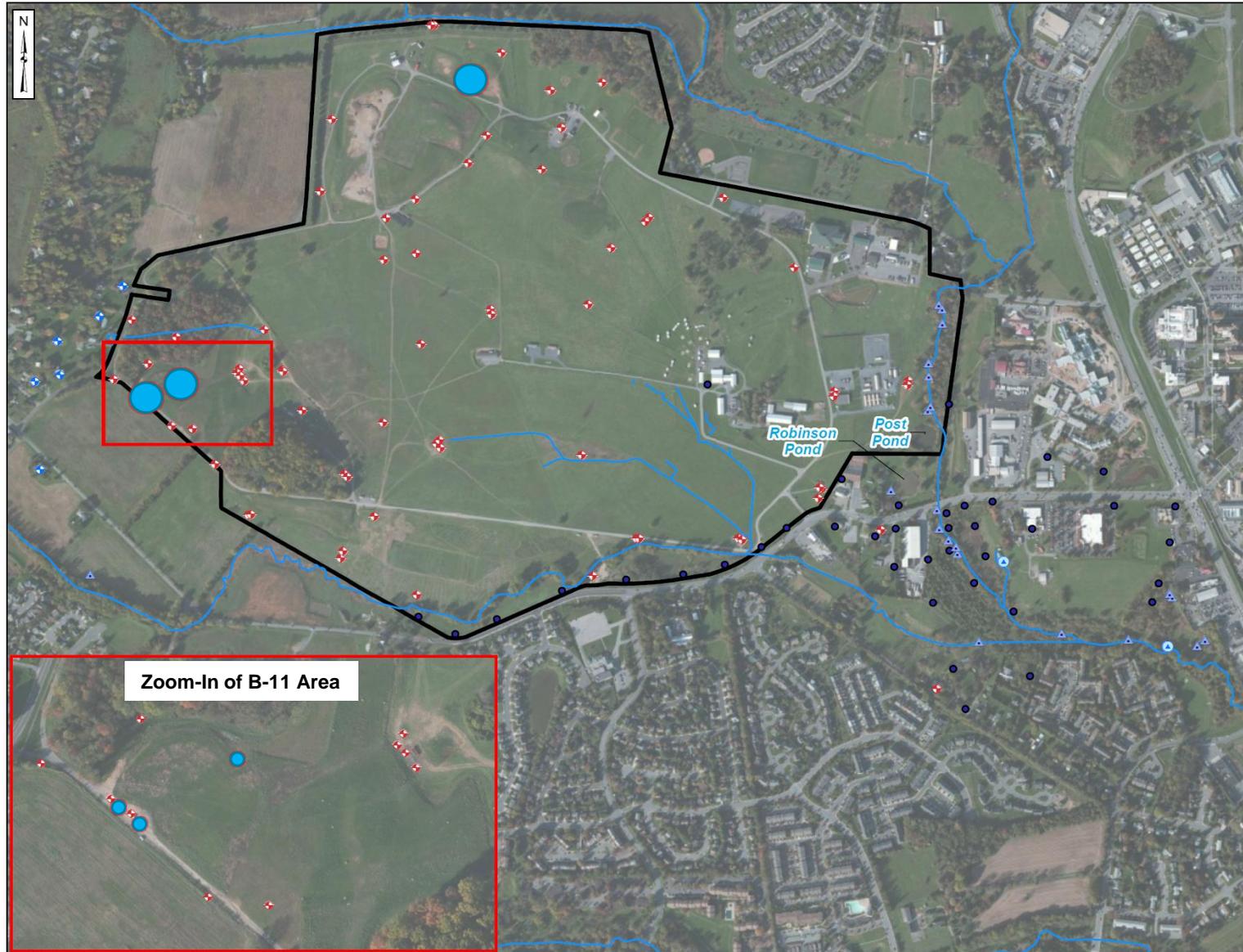
22 compounds detected

2 compounds above their respective drinking water standards (MCLs)

SVOC	Number of Locations with above Drinking Water Standard (MCL)	Drinking Water Standard - MCL (ug/L)	Maximum Concentration (ug/L)	Location with Max Conc.
1,2,4-Trichlorobenzene	3	70	240	B-11 (67C)
Pentachlorophenol	1	1	24	North (77)

SVOCs above MCLs in Groundwater

(April 2012)



Metals Sampling Results Summary

Groundwater

Multiple metals detected as is expected with naturally occurring elements

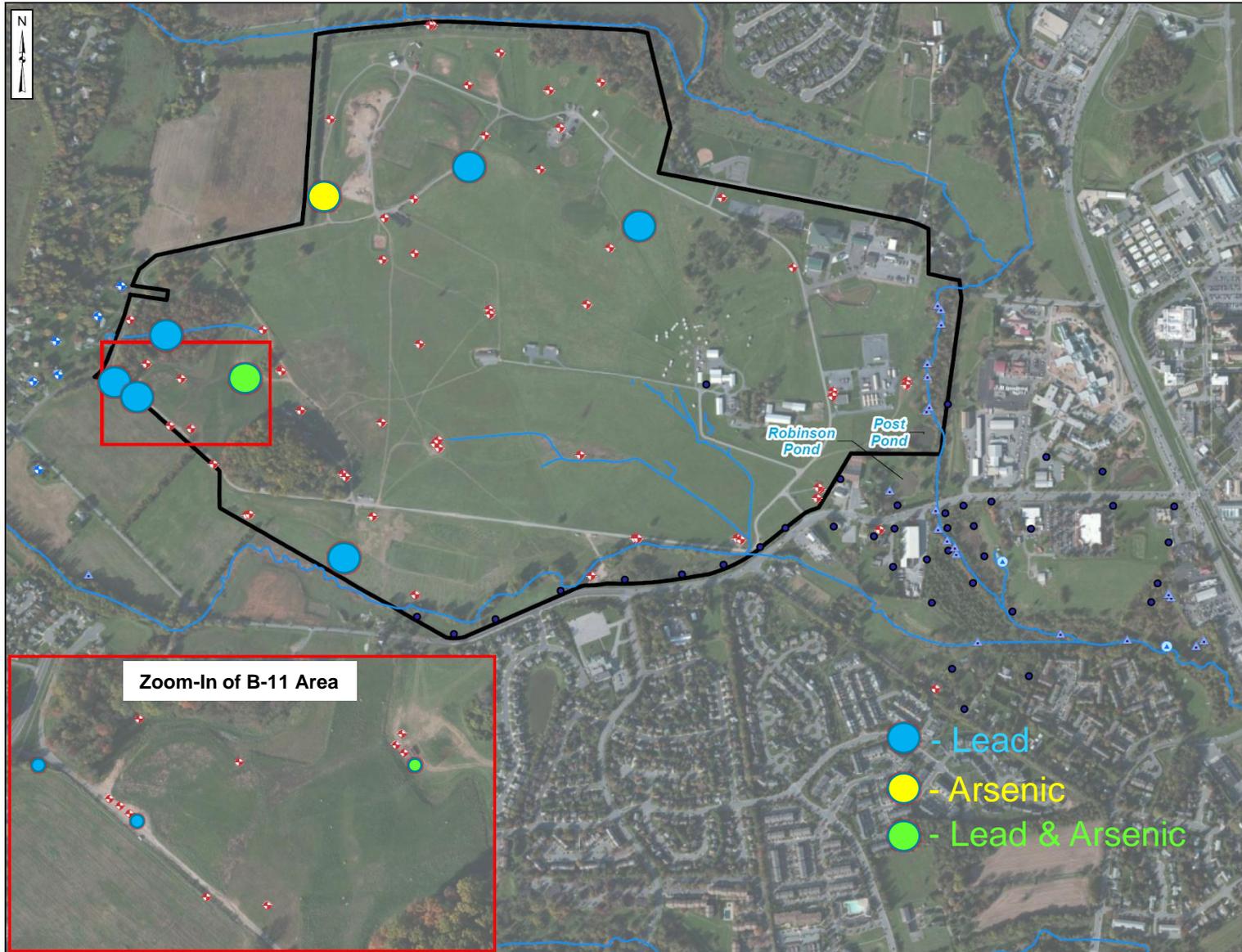
2 metals above their respective drinking water standards, but only in unfiltered samples; no exceedances in filtered/dissolved samples.

Metal	Number of Locations above Drinking Water Standard (MCL)	MCL or action level (ug/L)	Maximum Detected Concentration (ug/L)	Location with Max Conc.
Arsenic	2 wells	10	25	B-11 (68D)
Lead	7 wells	15*	138	B-11(68D)

* Lead has a 15 ug/L Action Level rather than an MCL.

Metals above MCLs in Groundwater

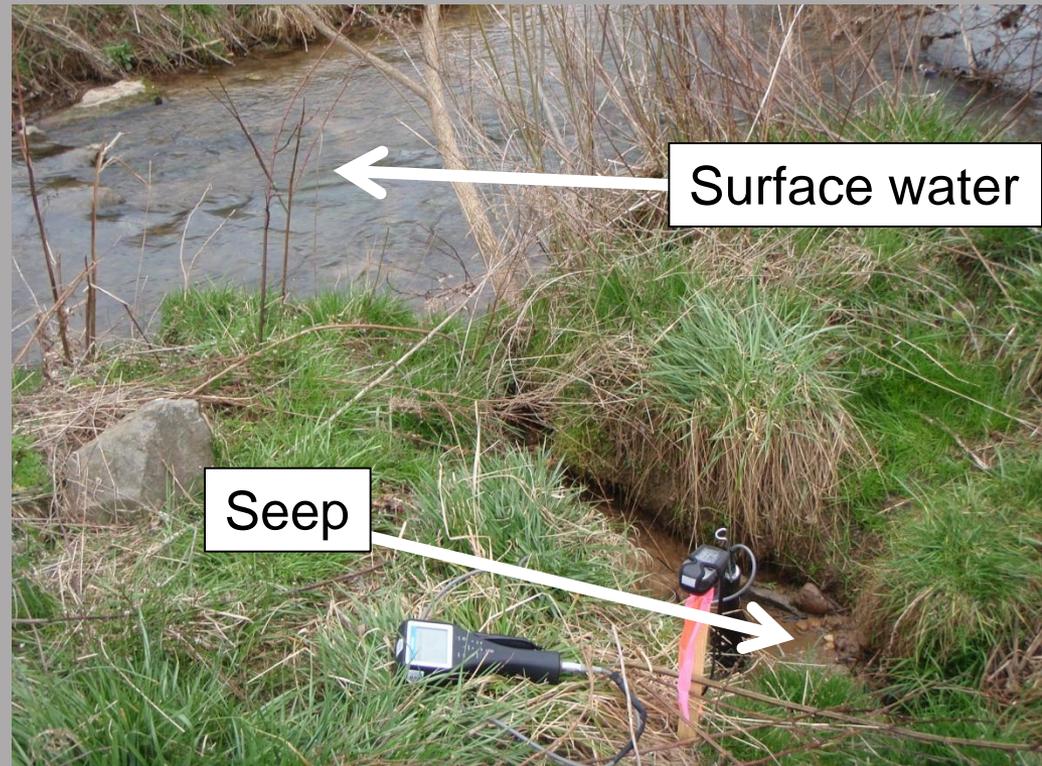
(April 2012)



April 2012 Sampling Results Summary

PCBs	None Detected
Herbicides	14 detected at concentrations near the detection limit. None above drinking water standards (MCLs)
Pesticides	11 detected at concentrations near the detection limit. None above drinking water standards (MCLs)
Dioxins	2 detected (2,3,7,8-TCDD and 2,3,7,8-TCDF) in the part per <u>trillion</u> level in the vicinity of B-11. None above drinking water standards (MCLs)
Radiological (Alpha/Beta)	No MCL exceedances of gross alpha. 2 MCL exceedances of gross beta at BMW67A (80.3 pCi/L) and BMW68E (126 pCi/L).

Seep and Surface Water Sampling Results Spring 2012



VOC Sampling Results Summary

Springs and Seeps

10 compounds detected

TCE detected at 13 ug/L (above the MCL drinking water standard) at several locations

No other VOCs above the respective standard (MCL)

Surface Water

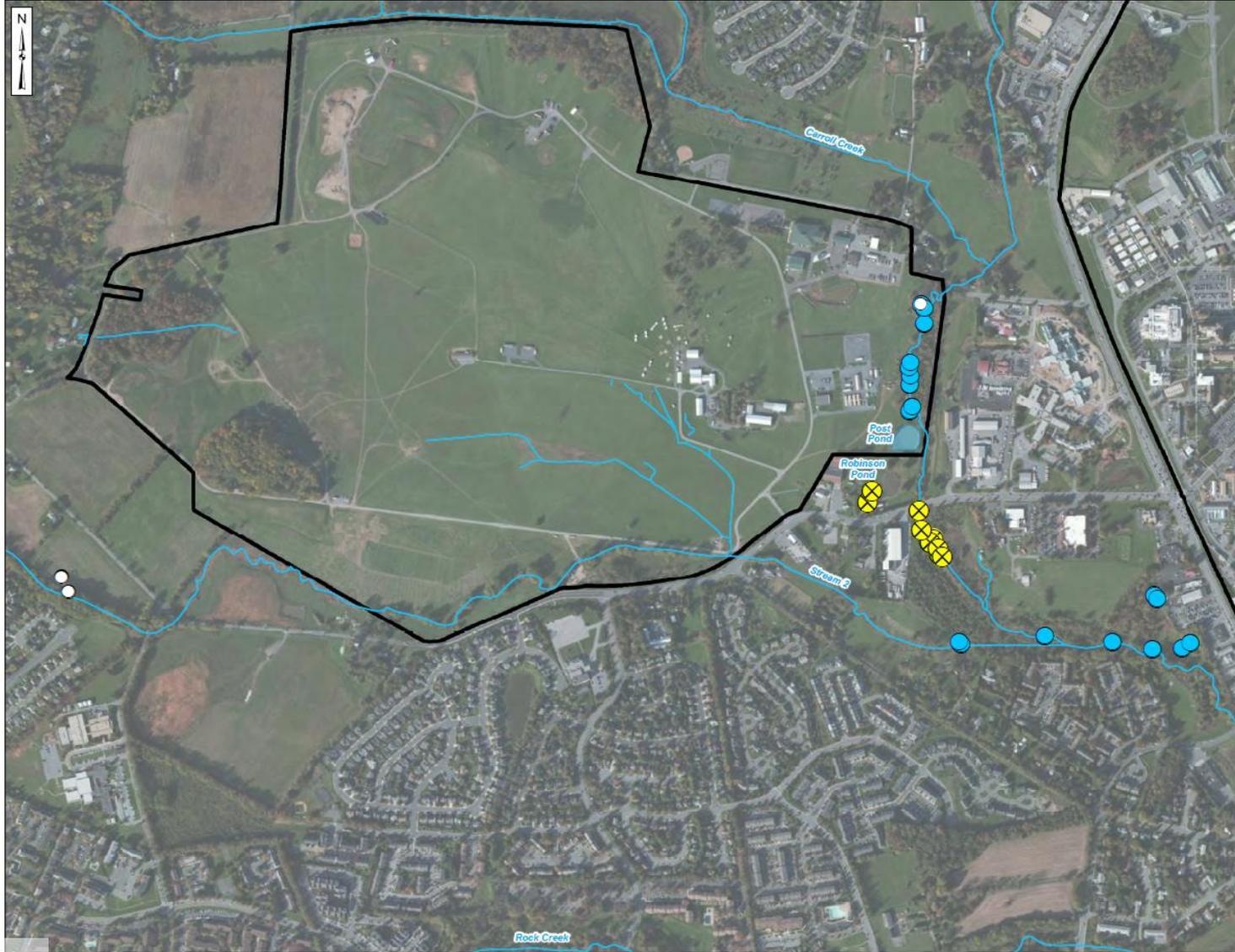
9 compounds detected

TCE above the drinking water standard (MCL) at 2 locations

- 11 ug/L near the center of Area B
- 5.5 ug/L at Robinson Pond

No other VOCs above the respective standard (MCL)

TCE in Seeps/Springs April 2012



Legend

Fort Detrick Boundary

Stream

TCE Concentration

Non-Detect

5 ug/L or less

>5 to 80 ug/L

>80 to 1,000 ug/L

>1,000 ug/L

X = Exceeds drinking water standard

Notes:

- 1) Aerial imagery accessed through BING Maps Aerial via ArcGIS Online Layer Packages by ESRI (12/1/2010) (c) 2010 Microsoft Corporation and its data suppliers accessed on 05/29/2012 through ArcGIS 9.3.1.
- 2) ug/L = micrograms per liter
- 3) TCE = Trichloroethene
- 4) Drinking water standard for TCE = 5 ug/L



REFERENCE PROJECTION: Maryland State Plane, NAD 83, Feet

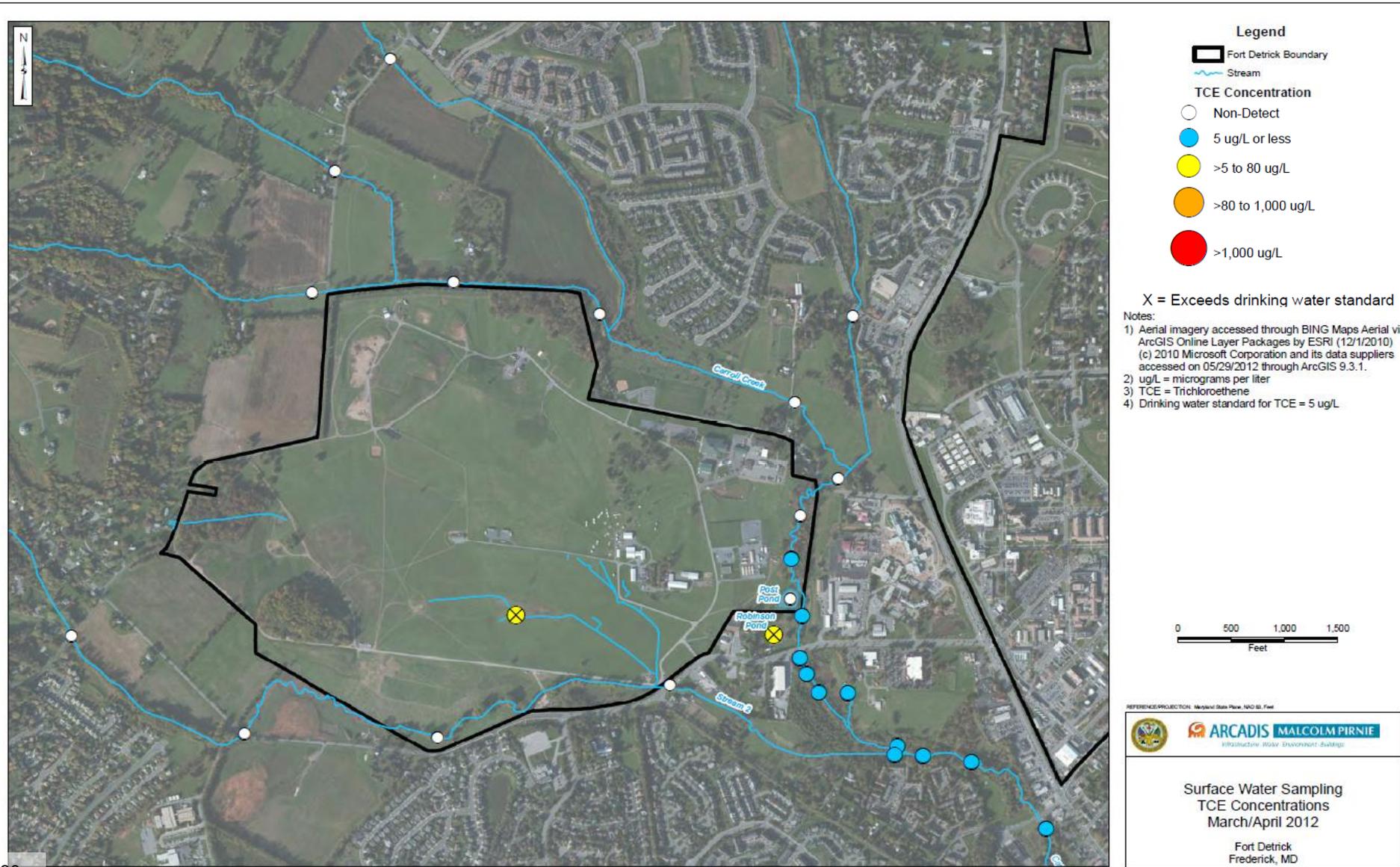


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Infrastructure Water Environment Building

Spring Sampling
TCE Concentrations
March/April 2012

Fort Detrick
Frederick, MD

TCE in Surface Water April 2012



Carroll Creek VOC Data

TCE concentrations in the Creek are:

- Below drinking water standards (MCLs)
- Below human health screening criteria for recreational use of the creek (for child or adult)
- Below human health screening criteria for ingestion of fish from the creek

-No risks for these activities

-Carroll Creek is not used as a drinking water source

Carroll Creek VOC Data

- The detections were communicated to EPA and MDE and discussed during the July 2012 RAB.
- Surface water sampling was expanded further downstream during Round 2 (September 2012)
- Will be discussed at the next RAB when validated data for round 2 is available

Metals Sampling Results Summary

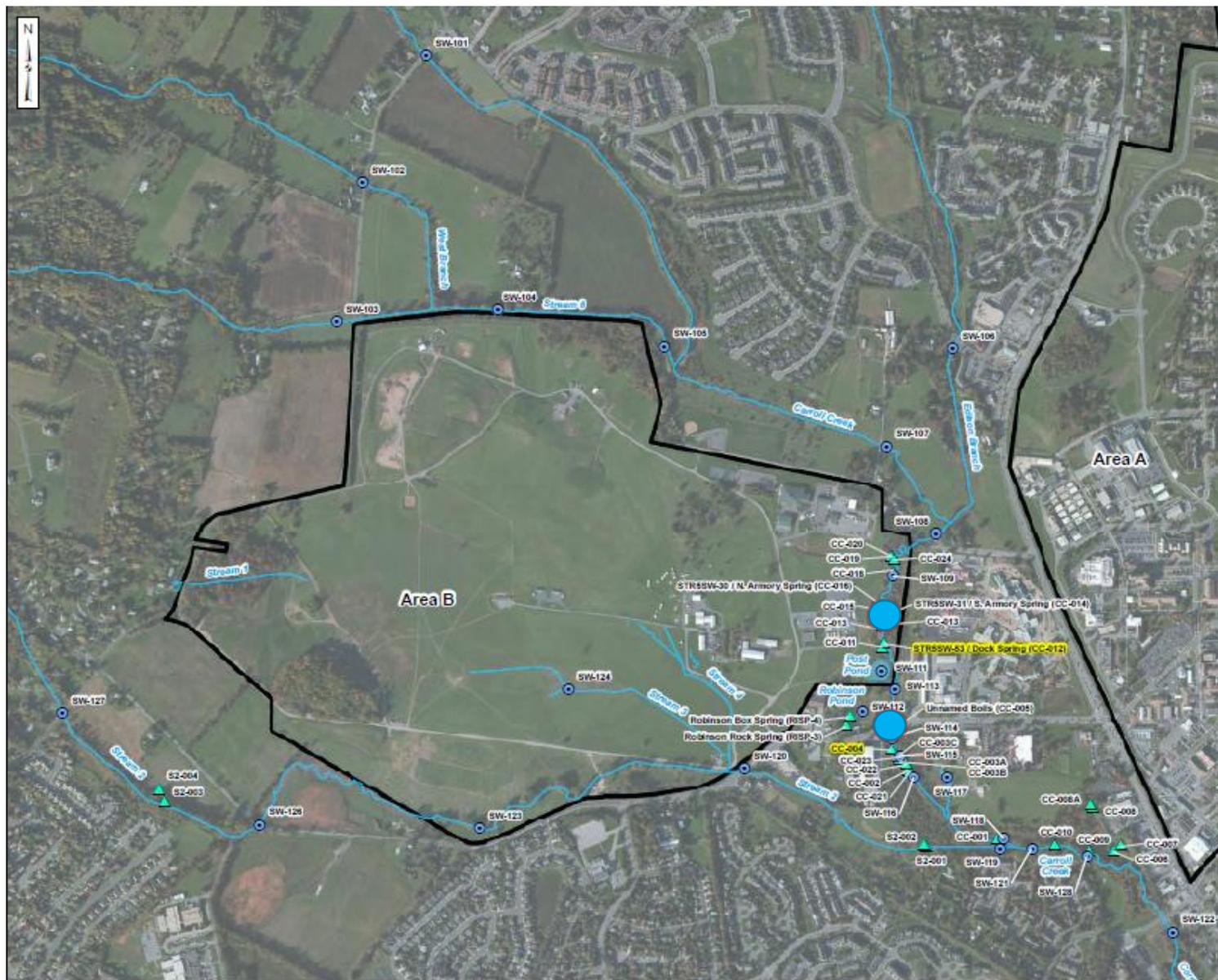
Springs and Seeps: 20 metals were detected in springs or seeps as is expected with naturally occurring elements

1 metal (lead) detected above the drinking water standard at 2 locations (CC-004 and Dock Spring) (but only in unfiltered samples; no exceedances in filtered/dissolved samples)

Surface Water 18 metals were detected in surface water as is expected with naturally occurring elements

None above their MCL

Lead Detections in Seeps/Springs



April 2012 Sampling Results Summary—Seeps/Springs

SVOCs	4 detected at concentrations near the detection limit. None above drinking water standards (MCLs)
PCBs	None Detected
Pesticides	None Detected

April 2012 Sampling Results Summary—Surface Water

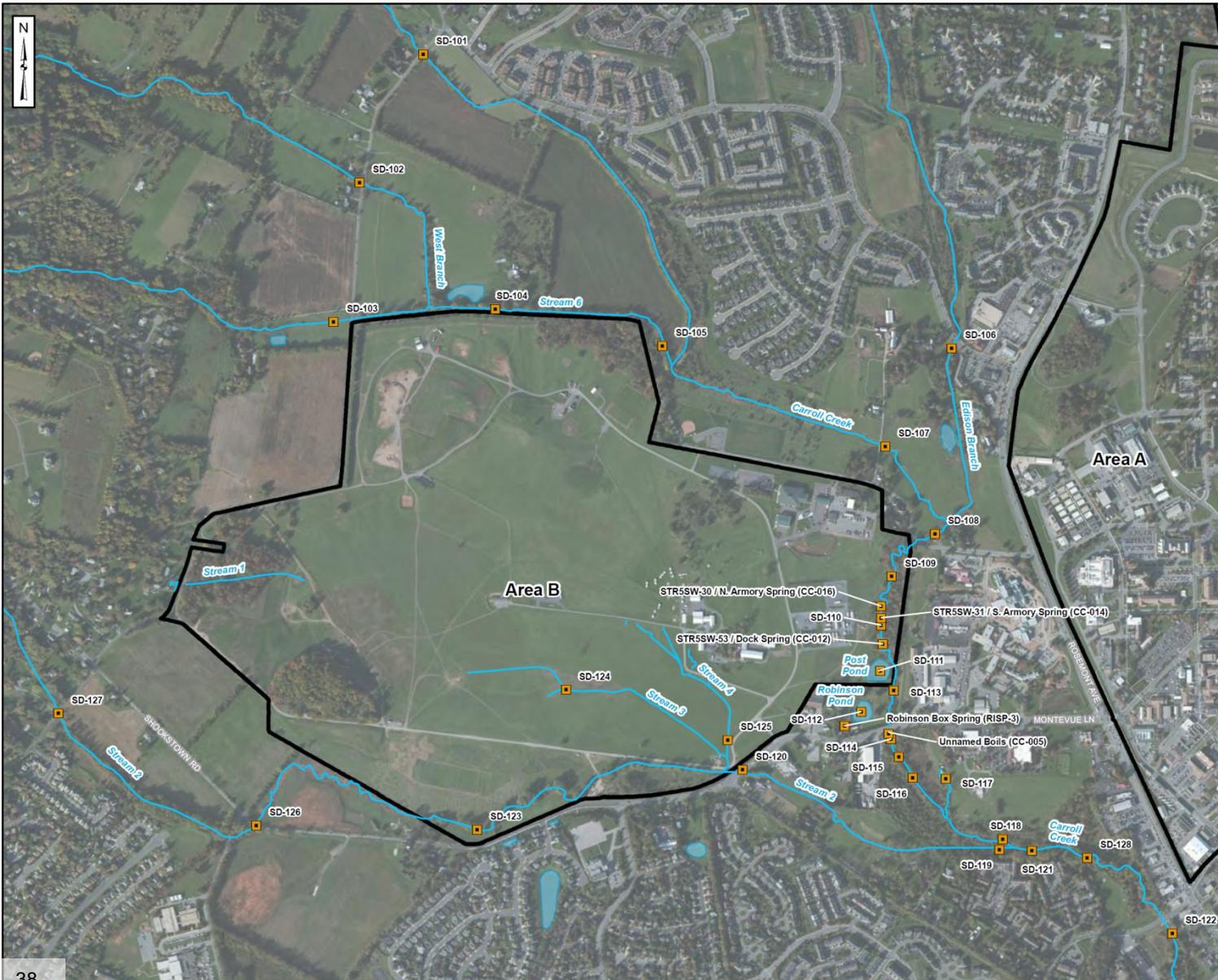
SVOCs	4 detected at concentrations near the detection limit. None above drinking water standards (MCLs)
PCBs	None Detected
Pesticides	1 pesticide (Beta-BHC) detected near the detection limit in Carroll Creek to the north of Area B (0.0038 J ug/L). None above drinking water standards (MCLs)

Sediment Sampling Results

Spring 2012

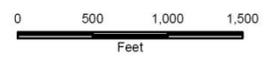


Sediment Sampling Locations



- Legend**
- Fort Detrick Boundary
 - Sediment Sample Location
 - Stream
 - Water Body

Notes:
 1) Aerial imagery accessed on 05/29/2012 through BING Maps Aerial via ArcGIS Online Layer Packages by ESRI (12/1/2010) ((c) 2010 Microsoft Corporation and its data suppliers).



CSM
 FIGURE 4
 Sediment Sample Locations
 March/April 2012
 Area B Groundwater Investigation
 Fort Detrick
 Frederick, MD

Comparison Criteria for Sediment: RSLs

Regional screening levels (RSLs) are risk based concentrations developed by EPA using CERCLA guidance documents.

RSLs are used to screen sites and are not cleanup standards.

Chemical concentrations above the RSLs do not designate a site as "dirty" or trigger a response action. Exceeding a RSL suggests that further evaluation of the potential risks by site contaminants is appropriate.

http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/faq.htm#FAQ1

Note: Sediment concentrations are reported in micrograms per kilogram (ug/kg).

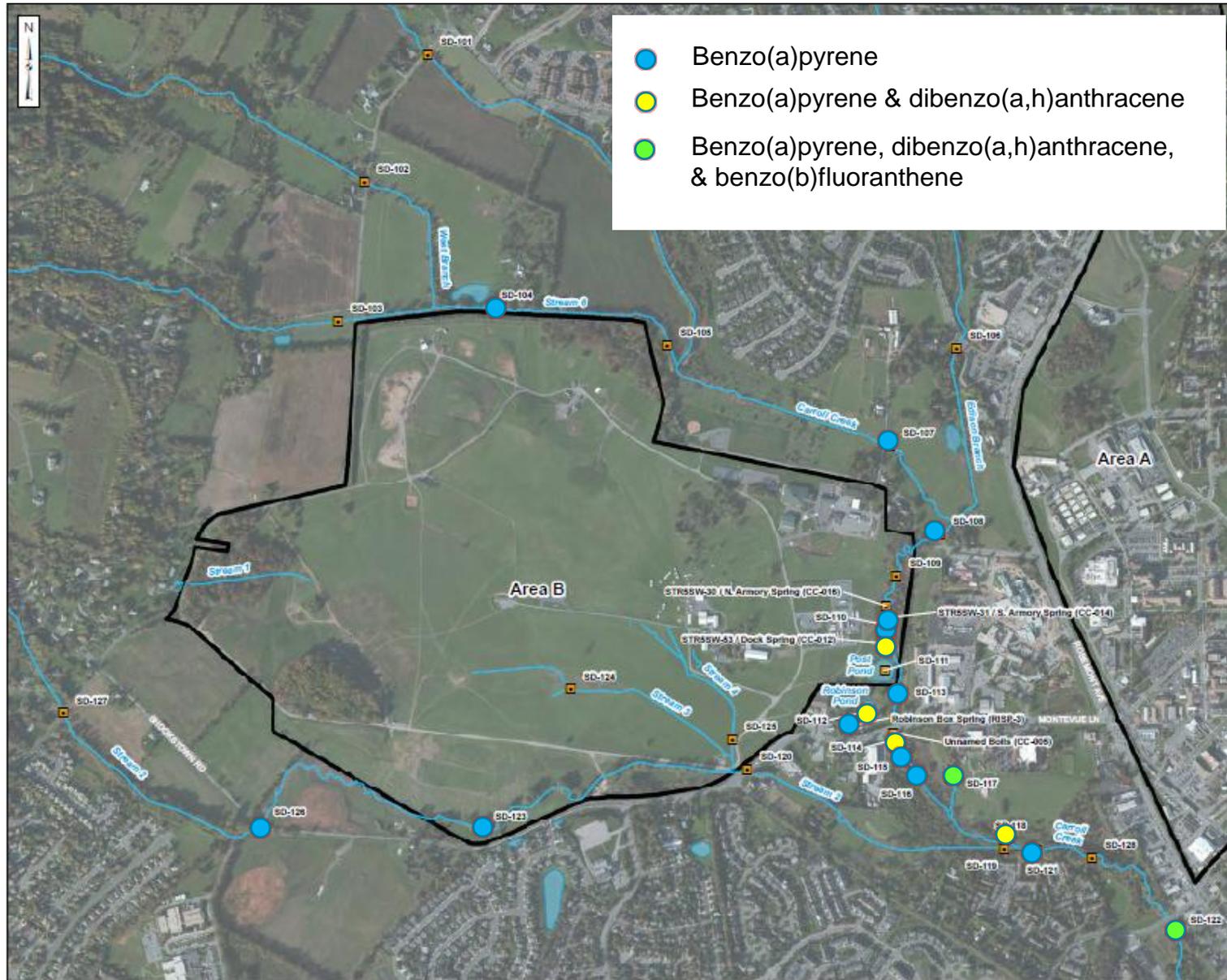
VOC Sampling Results Summary for Sediment

- 7 compounds detected in sediments
- TCE was detected most frequently at 10 of 34 sample locations, with a maximum concentration of 54 ug/kg
- No detections above the RSL for TCE which is 910 ug/kg

SVOC Sampling Results Summary for Sediment

- 19 SVOCs detected
- 3 compounds detected above RSL screening criteria
 - Benzop(a)pyrene (maximum concentration of 150 ug/kg at SD-117 and SD-122) (*RSL = 15 ug/kg*)
 - Dibenzo(a,h)anthracene (maximum concentration of 31 ug/kg at SD-117) (*RSL = 15 ug/kg*)
 - Benzo(b)fluoranthene (maximum concentration of 250 ug/kg at SD-122) (*RSL = 150 ug/kg*)

SVOCs in Sediment



Metals Sampling Results Summary

- Multiple metals were detected in sediment samples throughout the study area as is expected with naturally occurring elements
- The low concentrations and the widespread detections indicate the detections are unlikely to be related to activities at Area B.
- Arsenic, manganese, and thallium exceeded RSLs

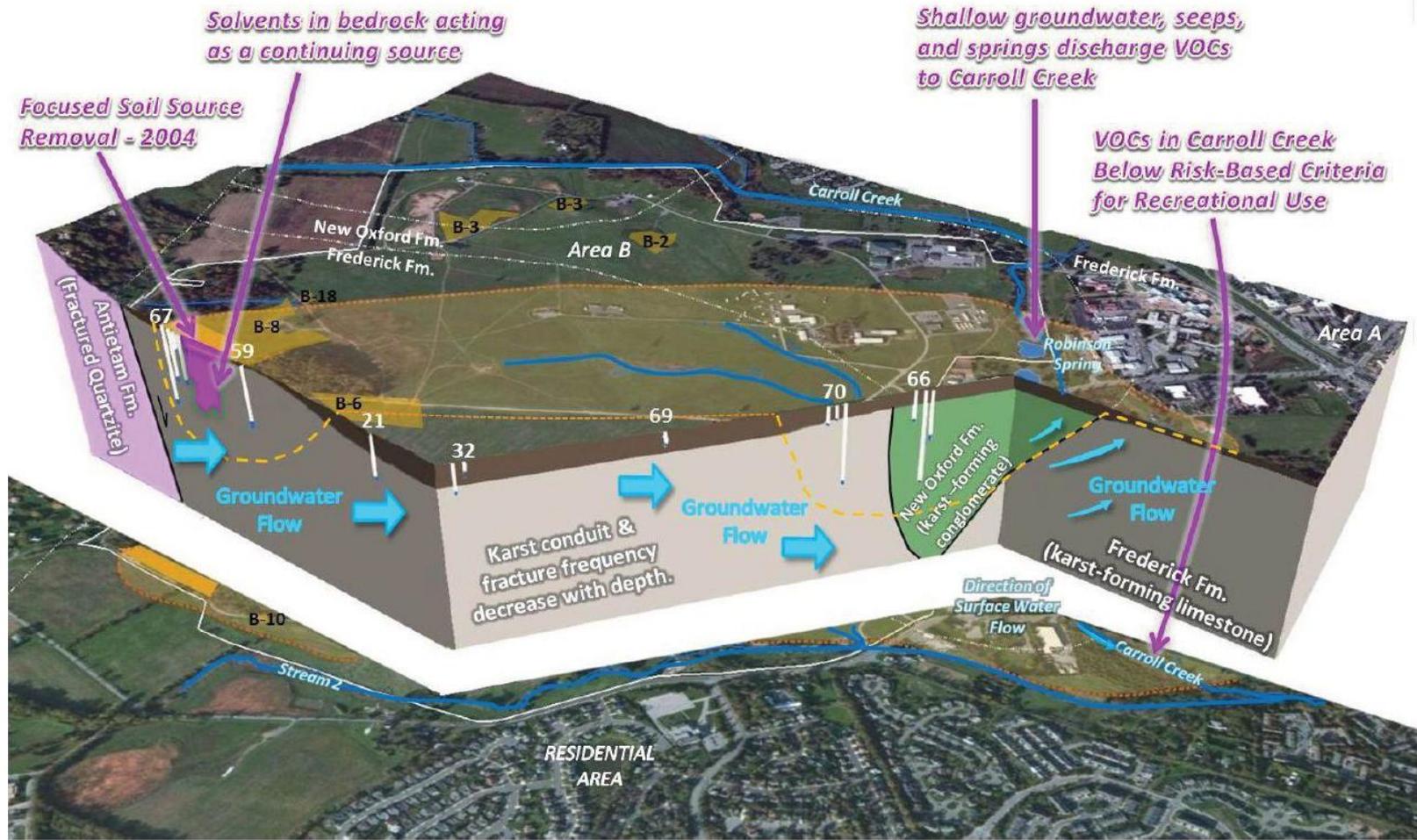
April 2012 Sampling Results Summary—Sediment

PCBs	None Detected above screening levels
Pesticides	2 detected above screening levels (aldrin and heptachlor epoxide) at Robinson Pond
Dioxins	None above screening levels
Herbicides	None detected above screening levels

Summary and Anticipated Path Forward

Area B Conceptual Site Model

DRAFT



- Legend**
- Streams
 - Spring
 - B-11 Boundary
 - Trichloroethene in Groundwater
 - Groundwater Flow Direction
 - Geologic Contact

Aerial Source: ArcGIS Online Bing Imagery accessed 6/13/2012 via ArcGIS 10.

FORT DETRICK
FREDERICK, MARYLAND

CONCEPTUAL SITE MODEL

FIGURE

PATH FORWARD

- Conduct dye trace studies to assess deep groundwater flow
- Follow-on drilling activities and supplemental investigations (2013)
- Conduct vapor intrusion sampling (Winter 2012)
- CSM report to EPA/MDE and public for review and comment (December/January)

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QUESTIONS AND DISCUSSION