



AGM and Spring Professional Development Workshop AGENDA

June 3, 2026

Vancouver Convention Centre East

Time	Agenda Item	Speaker / Presenter
8:30am – 9:00am	Registration	
CSAP Society Annual General Meeting		
9:00am – 9:05am	Welcome & Introduction to CSAP Society Annual General Meeting	Tara Siemens Kennedy , MET, P.Chem., AtkinsRéalis, CSAP President
9:05am – 10:15am	CSAP Society Annual General Meeting	CSAP Board of Directors
10:15am – 10:30am	Morning Break	
Spring Professional Development Workshop — Morning		
10:30am – 10:35am	Introduction to PD Workshop	Erin Robson , P.Eng., CSAP Chair, Professional Development Committee
10:35am – 10:50am	CSAP Scholarships Presentation	Travis Deeter , P.Ag., CSAP Co-Chair, CSAP Technical Review Committee
10:50am – 11:15am	PAC Lessons Learned	Jason Christensen , P.Eng., CSAP Chair, CSAP Performance Assessment Committee
11:15am – 11:55am	TRC Emerging Contaminants Project	Scott Steer , R.P.Bio., CSAP, Active Earth Engineering
11:55am – 1:00pm	Lunch Break	
Spring Professional Development Workshop — Afternoon		
1:00pm – 1:05pm	Welcome to the Ministry of Environment and Parks	Erin Robson
1:05pm – 1:15pm	Director Update	Carrie Nugent , Director, Site Remediation Program Ministry of Environment and Parks (ENV)

Time	Agenda Item	Speaker / Presenter
1:15pm – 1:25pm	Policy Update	Kelli Larsen , Senior Policy Analyst, Bonding & Site Remediation Policy, ENV Christa Zacharias-Homer , Director, Bonding & Site Remediation Policy, ENV
1:25pm – 2:15pm	Understanding Recent BC ENV Risk Guidance: What Numerical APs Need to Know	Blair King , R.P.Bio., CSAP, Parsons Inc. Jasen Nelson , Senior Risk Assessment Officer, Site Remediation Program, ENV
2:15pm – 2:55pm	TRC Soil Arsenic Background Project	Stephen Munzar , MSc., P.Geo., CSAP, Core 6 Environmental Daniel Schencks , P.Geo., Core 6 Environmental
<i>2:55pm – 3:10pm</i>	<i>Afternoon Break</i>	
3:10pm – 3:55pm	Interactive Discussion: Edge Cases	David Mitchell , P.Eng., CSAP, Active Earth Kerri Skelly , Manager Operations, Site Remediation Program, ENV
3:55pm – 4:00pm	Closing Remarks	Tara Siemens Kennedy

Please join us after the event for a no-host happy hour in the foyer at the Vancouver Convention Centre East.

CSAP members earn six (6) PD hours for attending the full day.

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SOCIETY OF CONTAMINATED SITES
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Spring PD Workshop

JUNE 3, 2026

This meeting is being conducted from the traditional, ancestral, and unceded territory of the Coast Salish peoples, including Squamish, Tseil-Waututh, Musqueam

Introduction

- Erin Robson, P.Eng., Chair, CSAP Professional Development Committee

Housekeeping

- Participants must attend the full duration of the PD workshop to receive the full 6 PD hours. Those who are absent for a significant portion of the session due to calls or meetings will not be eligible for the full credit.
- A reminder that the Annual Members' Survey now includes an additional question inviting your input for the Ministry. This question is intended to capture feedback on unclear wording, typos, or other issues in Protocols and related documents. The TRC will review and compile your responses to share with ENV. We encourage everyone to provide detailed comments so we can pass along meaningful input.
- Stay tuned for the post-event survey via email!
- **Wifi Network:** CSAPSocietyEvent 26
- **Password:** CSAPAGM2026

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CSAP Scholarships

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Travis Deeter, P.Ag.
Zayed Mohamed, P.Ag.
Co-Chairs, CSAP Technical Review Committee

CSAP Scholarships

- Each year, up to three scholarships are awarded to applied science and engineering graduate students whose studies are relevant to the assessment and remediation of contaminated sites.
- Applications are reviewed and successful applicants chosen by an independent selection panel comprised of Technical Review Committee members.

Mike MacFarlane Memorial Scholarship

- The Mike Macfarlane Memorial Scholarship was established in 2018 by the British Columbia Environment Industry Association (BCEIA) to honor the memory of Mike Macfarlane, the former Director of the Land Remediation Section of British Columbia's Ministry of Environment (MoE).
- During his tenure at MoE, Macfarlane was a central figure in developing and implementing provincial policies for identifying and cleaning up contaminated land.
- He was recognized for promoting innovation and forward-thinking research relevant to contaminated sites.
- The scholarship is awarded to students who mirror Macfarlane's dedication to groundbreaking research and the evolution of environmental policy.

CSAP Scholarship Recipients



Georgia Douglas (Mike Macfarlane Award) – Ph.D. Program; Chemistry; UVic

- Research Topic: Provide a thorough fundamental framework for an innovative trace contaminant assessment tool. The goal is to advance the field of arsenic detection, potentially preventing chronic exposure to arsenic to the millions affected and influencing the broader research area of low-cost field contaminant assessment tools.



An Duong – Graduate Student; Resource Environmental Management; SFU

- Research Topic: Investigates the application of food-web bioaccumulation models on sites that have been contaminated with per- and polyfluoroalkyl substances (PFAS). The goal is to develop a tool and methodology to support ecological risk assessments and establish guidelines for PFAS in water, sediments, and soil, ensuring protection of both aquatic and terrestrial organisms



Emily O – M.Sc. Program; Biology; SFU

- Research Topic: Characterizing polycyclic aromatic hydrocarbon (PAH) contamination across the habitats of two species of significant ecological and cultural concern in British Columbia: the Endangered Southern Resident killer whales (SRKWs; *Orcinus orca*) and their primary prey, Chinook salmon (*Oncorhynchus tshawytscha*).

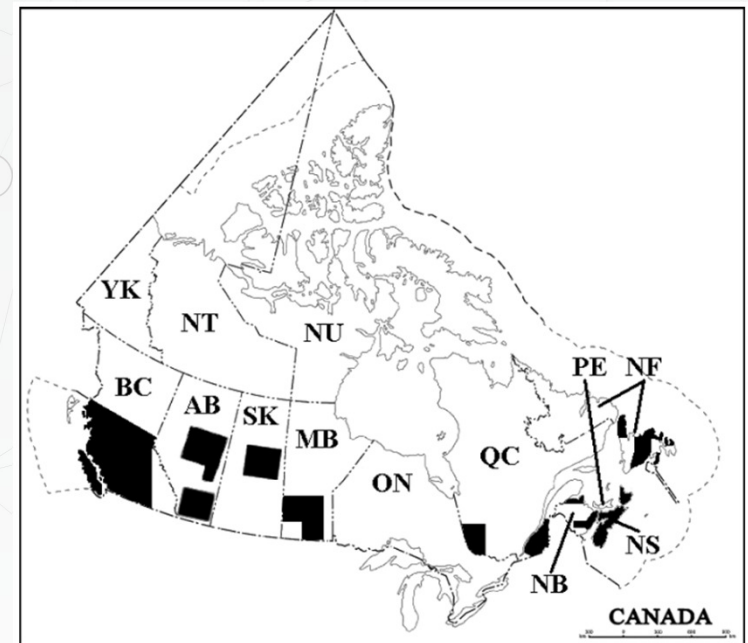
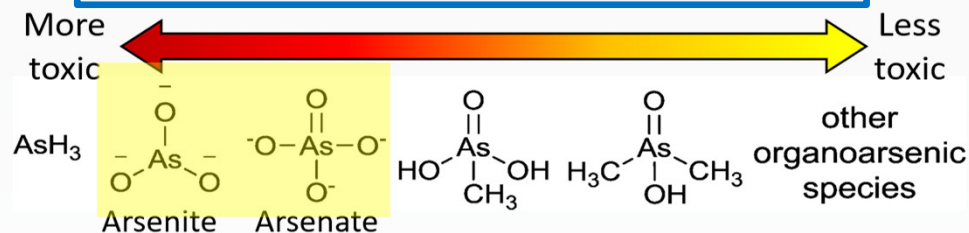
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Georgia Douglas
PhD Candidate, University of Victoria

Background on arsenic contamination

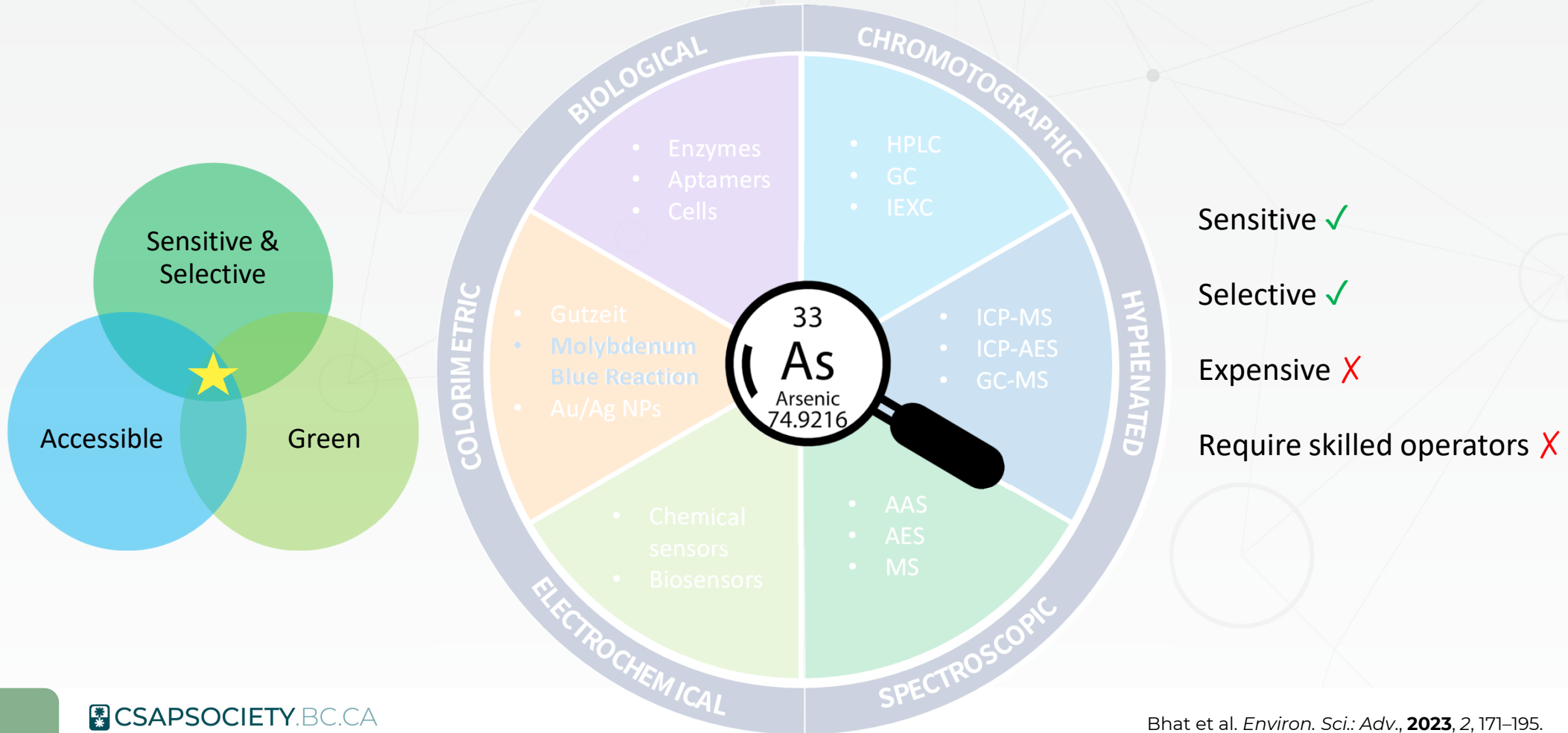
- 150 million people worldwide drink arsenic (As) contaminated water
- **Hotspots** create the need for on-site field-testing methods
- Groundwater contamination is primarily caused by leaching of arsenic containing mineral

World Health Organization recommended limit for arsenic in drinking water is **10 µg/L**

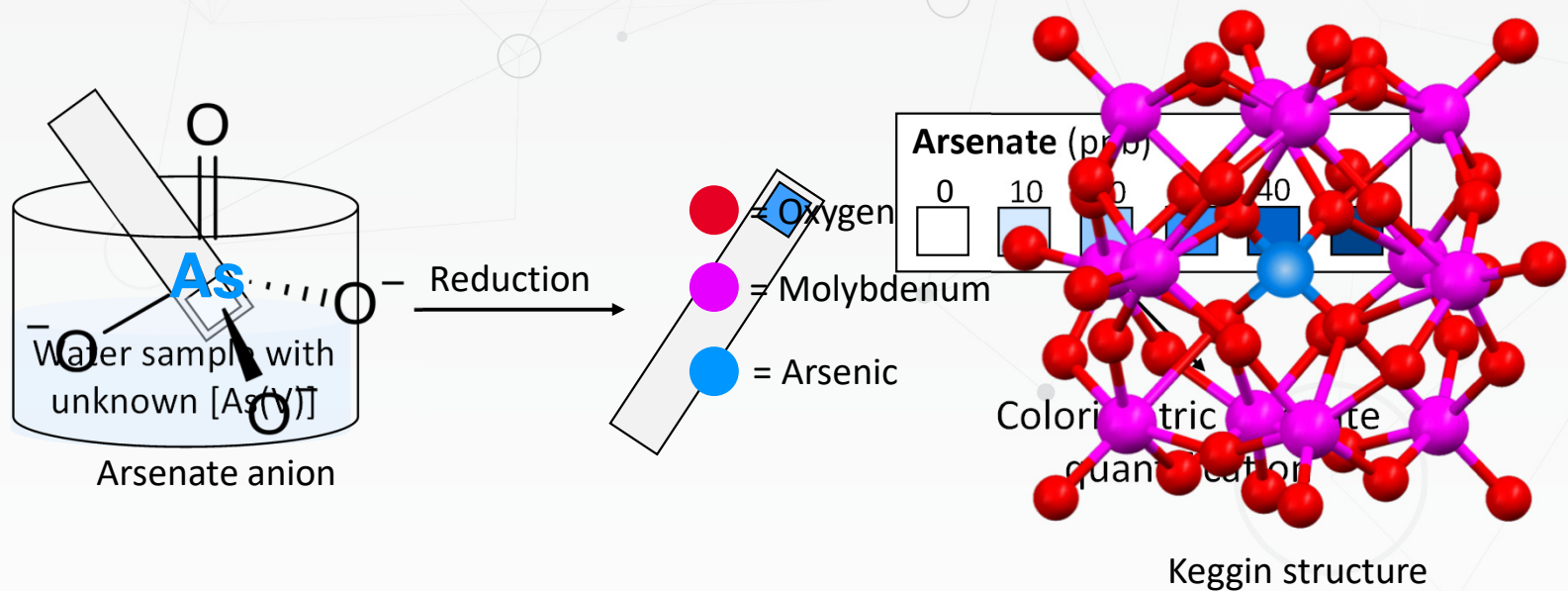
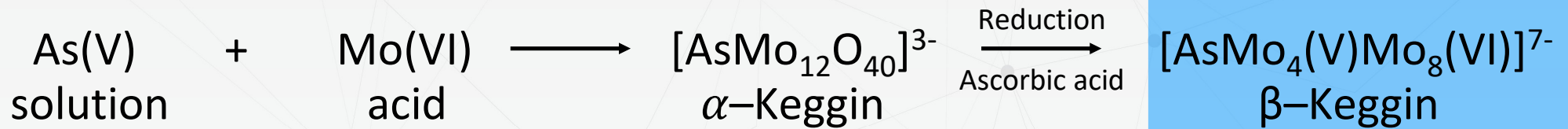


Areas of Canada with known arsenic **hotspots**

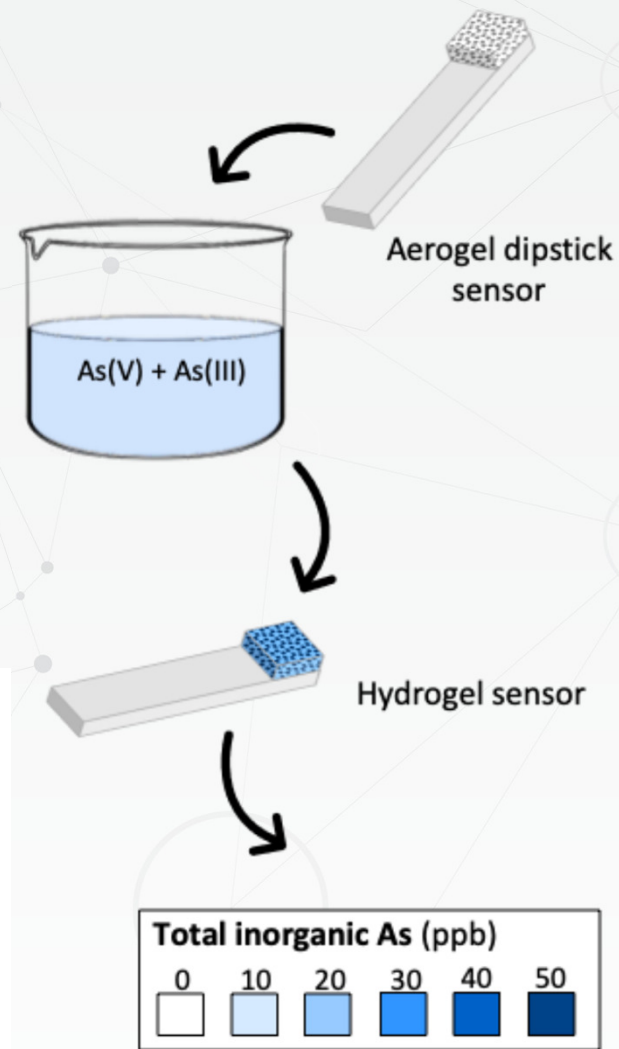
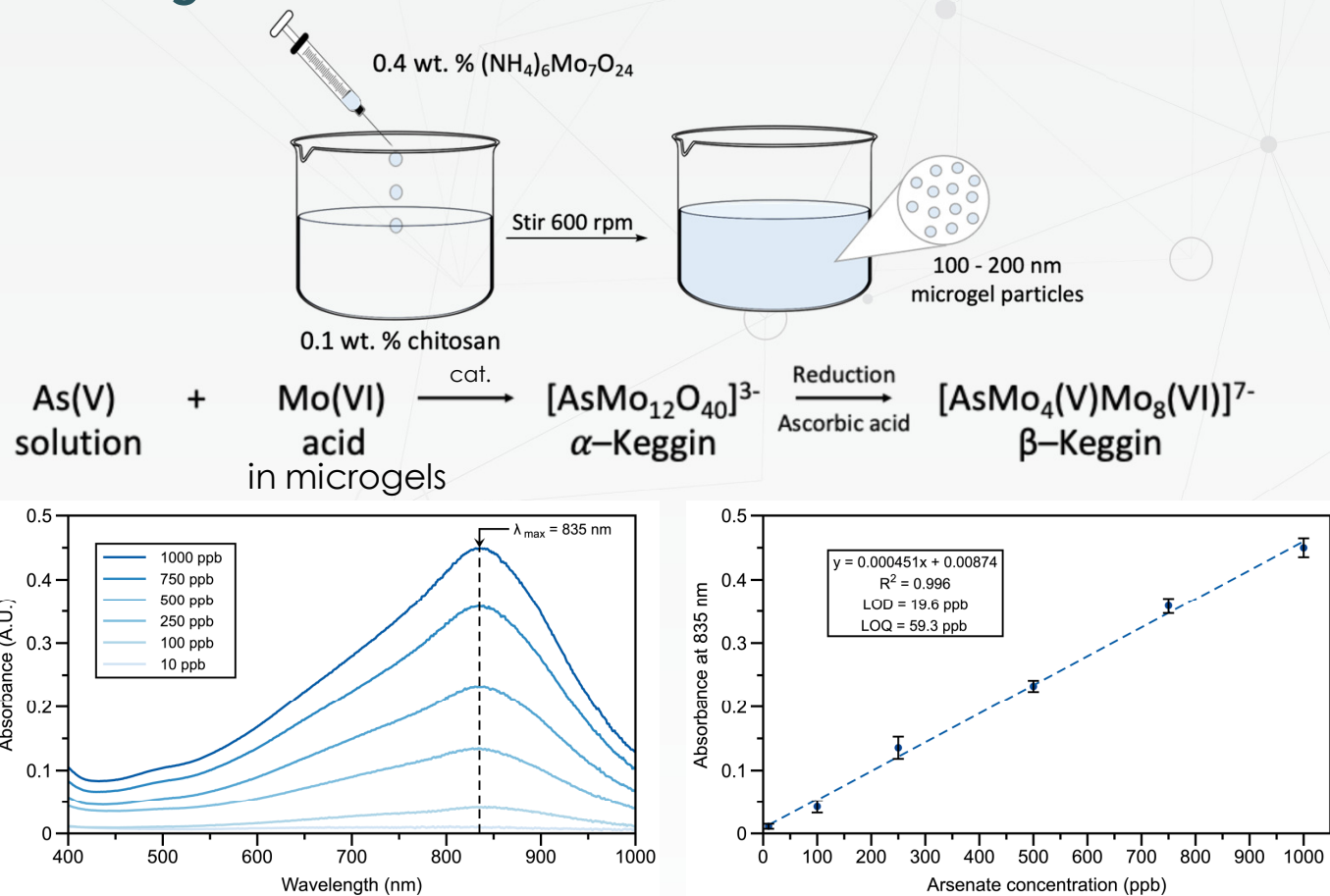
Arsenic determination methods



Molybdenum Blue Reaction



My current research





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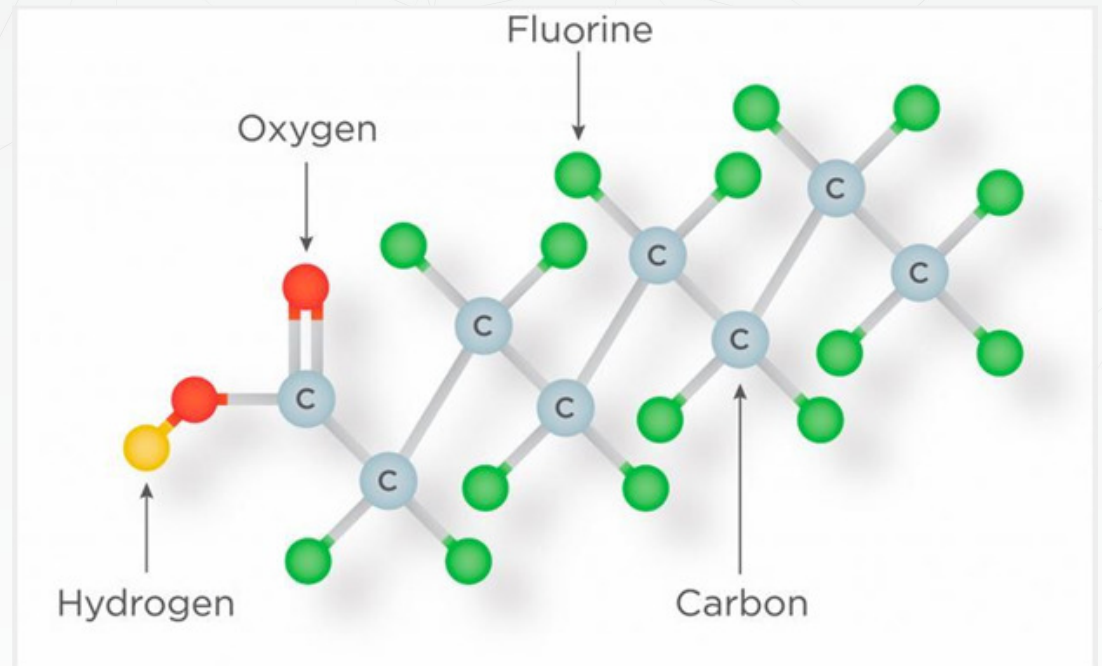
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An Duong

Graduate Student, Simon Fraser University

Per and polyfluoroalkyl substances (PFAS)



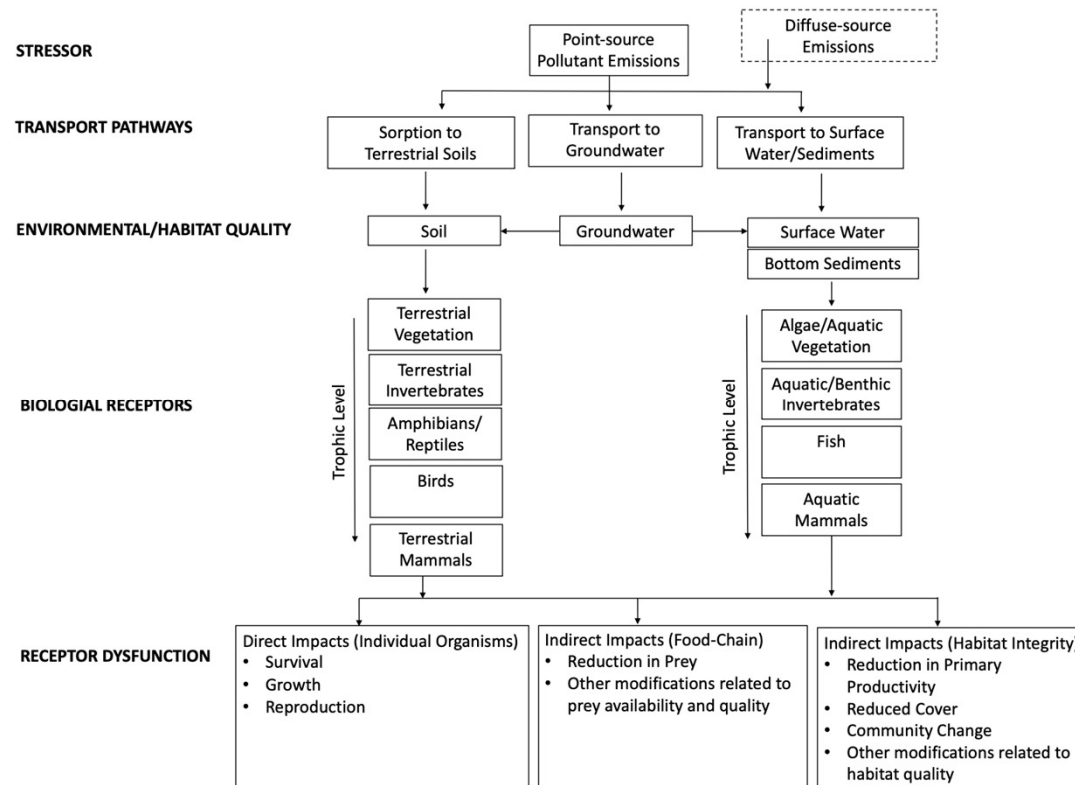
Molecular backbone of PFOA

1

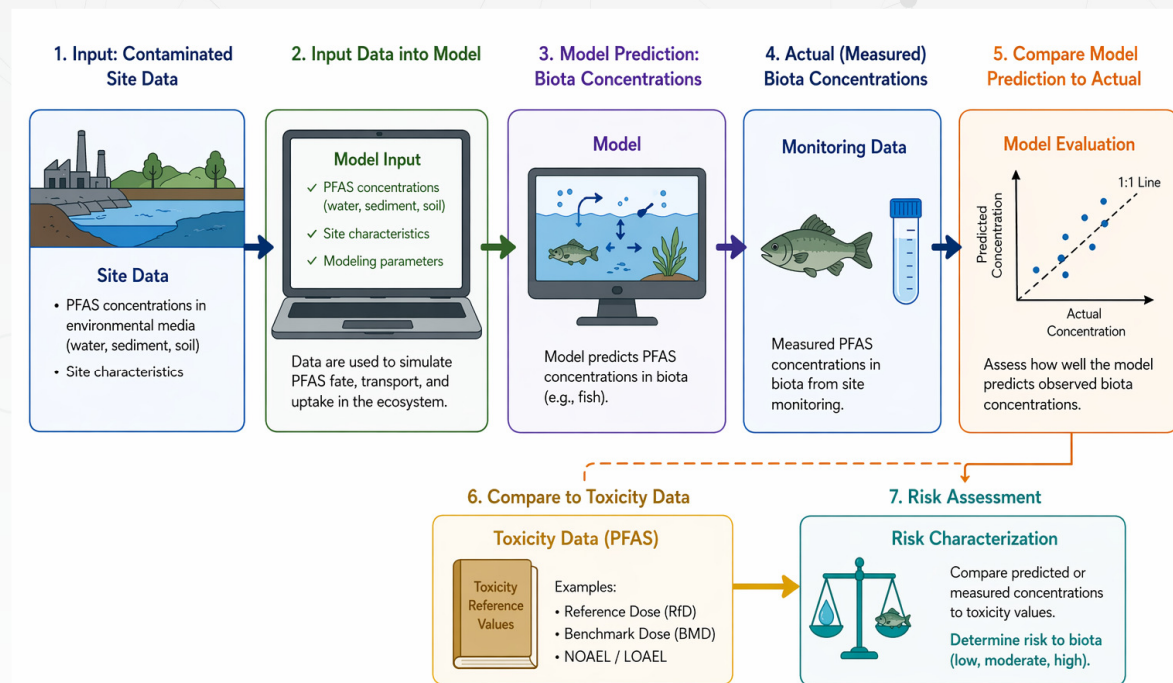
ECC?

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Pathways & Framework

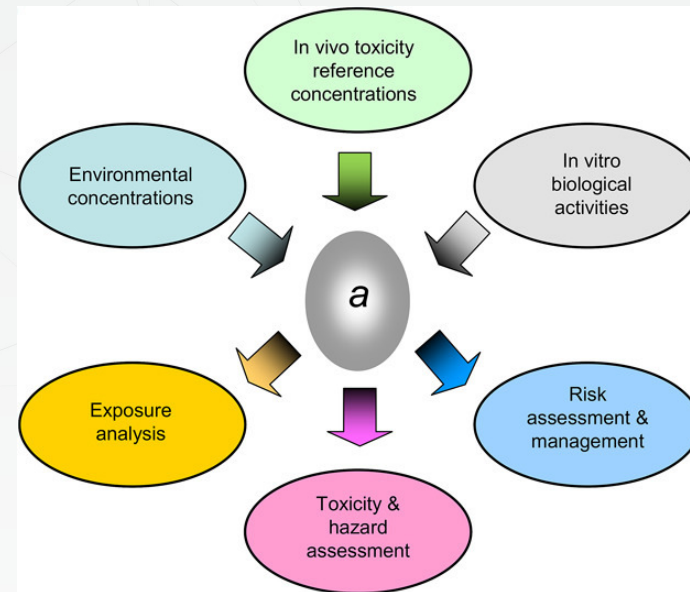


Bioaccumulation Model & Risk Assessment





- Mechanistic mass balance model uses specific uptake and elimination rates for both air breathing and water respiring organisms



- Chemical Activity is a thermodynamic framework which describes the distribution of chemicals in different phases and media

1 Chemical activity figure

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Conclusion



- PFAS are bioaccumulative, persistent, and mobile substances
- model validation from real site data
- contributes to reduce reliance on animal testing
- help prioritize contaminated sites for remediation

References

Kelly, B. C., Sun, J. M., McDougall, M. R., Sunderland, E. M., & Gobas, F. A. (2024). Development and evaluation of aquatic and terrestrial food web bioaccumulation models for per- and polyfluoroalkyl substances. *Environmental Science & Technology*, 58(40), 17828–17837. <https://doi.org/10.1021/acs.est.4c02134>

Gobas, F. A. P. C., Mayer, P., Parkerton, T. F., Burgess, R. M., van de Meent, D., & Gouin, T. (2018a). A chemical activity approach to exposure and risk assessment of Chemicals. *Environmental Toxicology and Chemistry*, 37(5), 1235–1251. <https://doi.org/10.1002/etc.4091>

Gobas, F., Kelly, B. C., & Kim, J. J. (2020). (rep.). A Framework for Assessing Bioaccumulation and Exposure Risks of Per- and Polyfluoroalkyl Substances in Threatened and Endangered Species at Aqueous Film Forming Foam (AFFF)- Impacted Sites.

Schneider, M. As Mounting Evidence Suggests PFAS May Cause Cancer, Experts Call for More Action. *Cancer Therapy* <https://www.cancertherapyadvisor.com/features/pfas-and-cancer/> (2025).

What are PFAS (forever chemicals)? Science for Georgia <https://scienceforgeorgia.org/knowledge-base1/what-are-pfas-forever-chemicals/>.

- 1 Add Gobas 2018 chemical activity
An Duong Hoang, 2026-05-10T13:04:35.280



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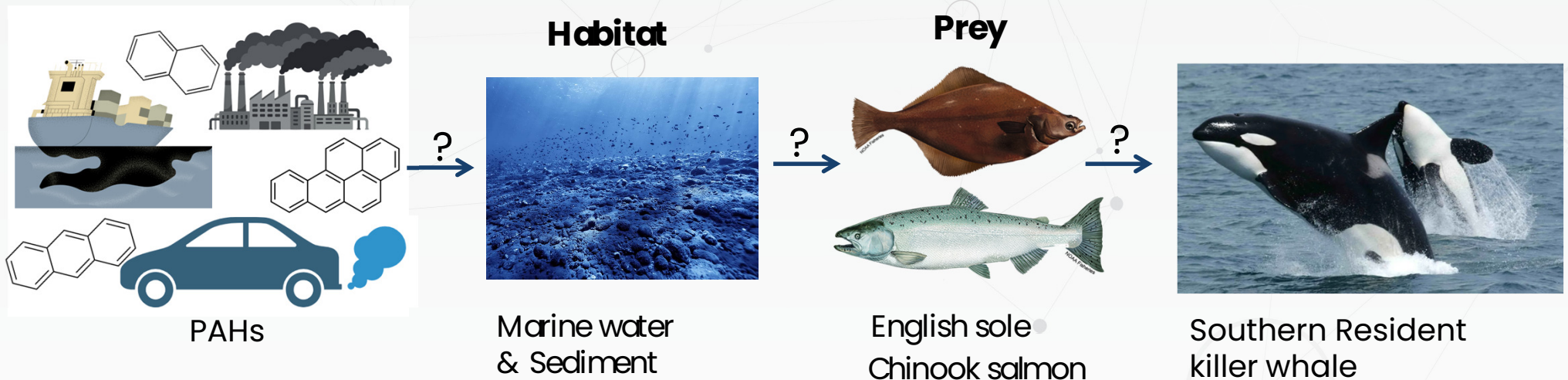
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Emily

M.Sc. Student, Simon Fraser University

Measuring hydrocarbon pollution across the Salish Sea: Assessing Risks to *Endangered* Southern Resident killer whales & their prey



Research question

What **risks do PAHs pose** to Southern Resident killer whales and their prey?

Objective

Identify current **PAH concentrations and sources** in SRKWs, their prey and habitat



1. Assessing sediment associated PAH contamination transfer to English sole

PAH bioavailability
PAH accumulation
Southern BC hydrocarbon contamination



2. Understanding PAH contamination in SRKW primary prey, Chinook salmon

PAH bioavailability
PAH accumulation
Freshwater hydrocarbon contamination
Primary prey to SRKWs



3. Investigating PAH contamination in freshwater and sediment across 11 BC watersheds

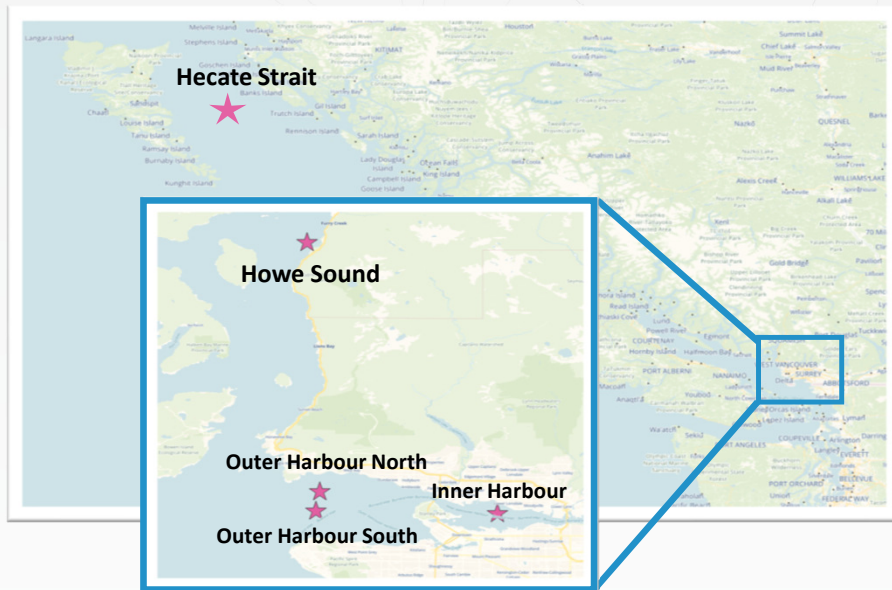
Freshwater hydrocarbon contamination
Source attribution
Risk Assessment



4. Understanding PAH contamination in SRKW and proxy species, Harbour seal fecal samples

PAH bioavailability
Recent Exposure
High Trophic Level organism effect

English sole & Sediment collection



- English sole PAH concentrations sampled from the Inner Harbour were **5.7x greater** than concentrations in Hecate Strait English sole
- Sources stem from petrogenic sources, fossil fuel emissions and wood combustion

Project Goals:

1. Assess **Biological Risks** of PAHs to Resident killer whales
2. Determine **Bioavailability** of PAHs from sediment to prey to Resident killer whales
3. Generate **Baseline PAH concentrations** across BC
4. Attribute PAH sources to hopefully inform source control regulations



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PAC Lessons Learned

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Jason Christensen, P.Eng.
Secretary & Treasurer
Chair, CSAP Performance Assessment Committee

Ground Rules using Kahoot

- The Lessons Learned should always be taken with a grain of Sodium and Chloride Ion.
- What you hear is not formal regulatory policy.
- Your situation may be different or unique.
- Do your own due diligence (DYODD).
- Consider Lessons Learned as a starting point, not end point.
- Consider consulting ENV or your colleagues.
- Things change. What's allowed today might not be tomorrow.

Kahoot Instructions



- Join Kahoot at **www.kahoot.it**
- **Enter game pin**
- **Enter your name / nickname**
- You have 30 seconds to answer each question. Answer the question by choosing the shape(s) on that correspond with the correct answer.
- There will be a variety of questions, some with one correct answer only, some with multiple correct answers, and true or false questions.

Kahoot Instructions



- After each question, a leaderboard will show the top 5 players.
- Points are awarded based on the speed you answer. The quicker you answer the question, the more points you get!
- You score higher points as you answer each question correct consecutively.
- There will be 3 prizes awarded at the end for the winner and 1st and 2nd runner up.

Note: correct answers are highlighted in yellow.

1. When does an AP need to be Arms Length for a submission?
 - a. SLRA AiP with Parkade Attenuation Divisor use
 - b. Numerical CoC and Determination for off-site Road Dedication
 - c. Detailed RA CoC with deep rooting vegetation
 - d. Numerical CoC for site and affected parcel

2. Who decides that off-site investigation is not required for a wide area site?
 - a. Submitting Numerical AP
 - b. Submitting Risk AP
 - c. Qualified Professional
 - d. BC ENV SDM

Note: correct answers are highlighted in yellow.

3. Under what conditions can shallow soil UCCs be non high risk?
 - a. COC is known to rapidly degrade under aerobic conditions
 - b. Area of COC has an area of 101 m²
 - c. COC is used for beneficial use
 - d. Only UCC during seasonal events

4. What are lines of evidence for biogenic toluene?
 - a. Anaerobic soil conditions
 - b. High toluene to BTEX ratio
 - c. Lack of petrogenic markers
 - d. Presence of para-cymene

Note: correct answers are highlighted in yellow.

5. What is a method to remove biogenic toluene as a potential contaminant?
 - a. Identification of only toluene in APEC area
 - b. Establish local background concentration
 - c. Muskeg soils present on site
 - d. Chromatogram doesn't look like toluene

6. What documents are to be included with a site risk classification with upper cap concentrations?
 - a. Cross section drawings
 - b. Contour maps
 - c. Exposure pathway questionnaire
 - d. Rationale that groundwater will not migrate within 10 m of receptor

Note: correct answers are highlighted in yellow.

7. Can modelling be used to delineate the extent of off-site contamination?
 - a. Definitely
 - b. Equivocally no
 - c. Maybe with ENV preapproval
 - d. Never

8. High risk submission with risk control of gw to not be used for drinking, what is the site type and is a PVP required?
 - a. Type I, no PVP required
 - b. Type II, no PVP required
 - c. Type I, PVP Required
 - d. Type II, PVP Required

Note: correct answers are highlighted in yellow.

9. Are cross-section drawings required for a PSI2 for a Determination?
- a. No, contamination is not present
 - b. Yes, for conceptual site model
 - c. No, not necessary
 - d. Yes, required on TG11 checklist
10. What exemptions within P21 allow no future DW use in an unconfined soil unit?
- a. TOC in soil greater than 30% by weight
 - b. TDS in groundwater greater than 4000 mg/L
 - c. Minimum saturated thickness of unit is less than 2 m
 - d. Unit is only imported fill unit

Note: correct answers are highlighted in yellow.

11. Which of the following spelling and CAS numbers are correct?
- a. benz(a)anthracene 56-56-3
 - b. benzo(a)anthracene 56-55-3
 - c. **benz(a)anthracene 56-55-3**
 - d. benzo(a)anthracene 56-56-3
12. If contamination is confirmed not present but the Registry indicates a NIR was filed, what instrument is applicable?
- a. AiP
 - b. CoC
 - c. **Determination**
 - d. None of the above

Note: correct answers are highlighted in yellow.

13. What constitutes wide area fill?
- a. No identifiable responsible person
 - b. Limited to upland areas
 - c. Not associated with historical activities
 - d. Fill applied across multiple properties with dredge sand
14. Can you get a Determination for a Schedule 2 site without data?
- a. WOE approach may be possible w/ strong argument
 - b. Yes, if Stage 1 indicates APECs are low risk
 - c. No, recommended that parameters be listed on Schedule C
 - d. Yes, if field screening indicates unlikely contamination



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TRC Emerging Contaminants Project

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Scott Steer, R.P.Bio., CSAP
Active Earth Engineering

Emerging Contaminants in British Columbia

Summary

2026-06-03



ACTIVE EARTH

Meredith Guest

- P.Eng.
- PMP
- CSAP
- 25+ years
- Project Manager



Lizzj Mos

- Senior Risk Assessor
- Former ENV SDM
- 20+ years
- NOT a CSAP!!
- Project Scientist



Scott Steer

- CSAP
- Senior risk assessor
- 25+ years
- Project Scientist



Project Objective

‘Provide information, context and opinion on emerging contaminants to the BC Ministry of Environment and Parks to support their decision-making process with regard to how such contaminants may be considered in future revisions of the Contaminated Sites Regulation’

Emerging Contaminant

'Substances that may cause or threatened to cause adverse effects on human health and the environment, and are currently non-prescribed substances, and could reasonably be expected at contaminated sites in BC due to Schedule 2 activities'

Project Approach

Task 1a

Candidate
ECs

Project Approach

Task 1b

ECs with
Schedule 2
Uses

Project Approach

Task 1c

Meet with TRC
and ENV

Project Approach

Task 2a

Prioritize ECs

Project Approach

Task 2b

Reporting

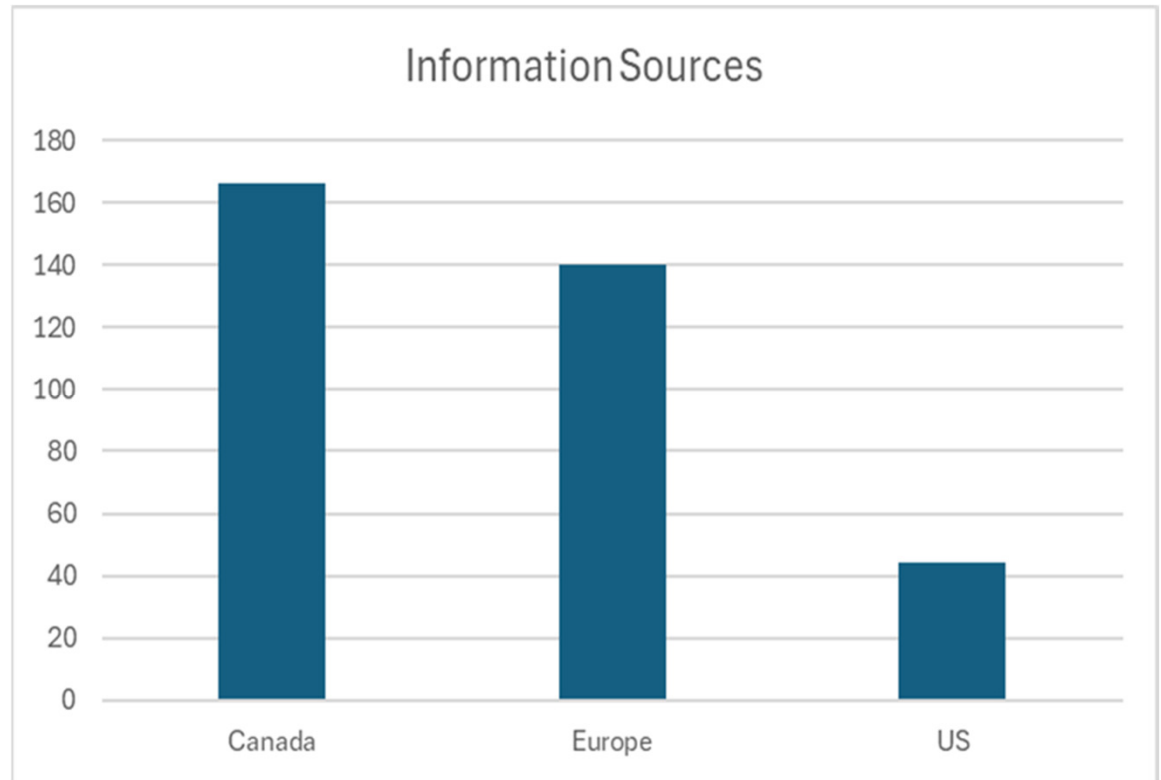
Project Approach

Task 2c

Presentation

Task 1a

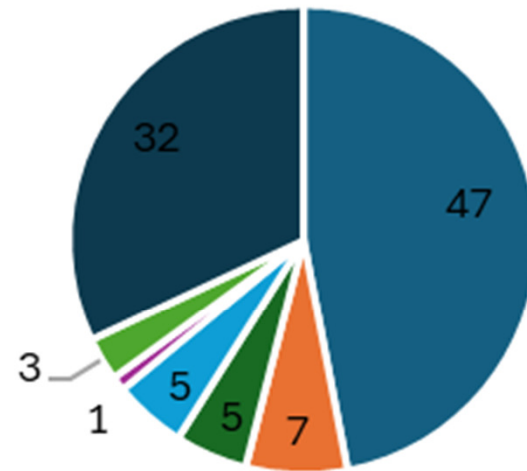
Candidate Emerging
Contaminants
n=311



Task 1a

Candidate Emerging Contaminants
n=311

Chemical Groupings



- Industrial Chemicals
- Biocides/Pesticides
- Pharmaceuticals
- Flame Retardants
- Tire Wear Products
- Micro/Nano
- Other

Task 1c: Prioritization Criteria

**Availability of
relevant scientific
information**

**Fate and effects in
the environment**

**New or novel
chemical properties**

**Current
representation by
chemical family in
the CSR**

**New Schedule 2
commercial/
industrial activities**

**Available analytical
method, quantifiable
units**

Task 2a – EC Prioritization

Priority	Characteristics
Priority 1	High toxicity, persistent, bioaccumulative, and/or carcinogenic
Priority 2	Moderate toxicity and/or key knowledge gaps
Priority 3	Low toxicity, low persistence and/or key knowledge gaps

Recommended for Standards Consideration

Priority	Characteristics
Priority 1 n=74	High toxicity, persistent, bioaccumulative, and/or carcinogenic

Other Recommendations

**Analytical methods
and detection limits
for P1 substances**

**Standards for
bioaccumulation/
biomagnification for
P1 substances**

**Standards for
partially regulated
high priority
substances**

**Consider new
Schedule 2 uses as
new CL and IL
activities arise**

**Re-evaluate P2 and
P3 substances
periodically**

**Regulate P1
substances ASAP**

More Resources Coming



ACTIVE EARTH

Emerging Contaminants in British Columbia



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Understanding Recent BC ENV Risk Guidance: What Numerical APs Need to Know

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Blair King, R.P.Bio., P.Chem, CSAP
Parsons Inc.

Jasen Nelson

Senior Risk Assessment Officer, Site Remediation
Program, Ministry of Environment and Parks

Background and Purpose

- BC ENV representatives and Risk APs met in March.
- Risk APs submitted questions in advance.
- While the meeting was not specific to the revised Protocol 1 (implementation date Jan 15, 2027) some changes were discussed.
- This presentation hopes to help numerical site investigators understand important learnings that apply to their investigations including:
 - potentially new/changed requirements that must be met prior to initiating risk-based remediation; and
 - potentially new/changed data needs from the site investigation phase that will feed into the risk-based remediation phase.

Plume Stability Assessment

- Plume Stability is critical for completion of a Detailed Site Investigation. Risk Assessment can only proceed on a Site where a plume stability assessment has been undertaken and reported.
- The requirements for establishing plume stability are presented in both Technical Guidance Document 8 (TG8) and Protocol 13 (P13).
 - TG8 provides general guidance for all risk assessments P13 provides specific guidance for Screening Level Risk Assessments.
- The assertion of plume stability must be explicitly stated in the DSI and confirmation of plume stability is the responsibility of the Numerical AP.

Plume Stability in Detailed Risk Assessment (DRA) Cont.

- The requirement for completing a signed Form C from P13 does not exist for a DRA.

Form C Professional Statements and Signatures. To be completed by Qualified Professional(s) – Part 3

Part 3 (to be completed by QPs responsible for Plume Stability Assessment) I, the undersigned certify as follows:

1. I am a qualified professional.
2. I have demonstrable experience in (a) assessment of groundwater flow, contaminant fate and transport, and aqueous geochemistry, and (b) trend analysis.

Print Name	Signature	Professional Designation	Date completed (yyyy-mm-dd)
<div style="border: 1px solid black; width: 150px; height: 100px; margin: 0 auto; display: flex; align-items: center; justify-content: center;"><p>Apply professional society stamp (if applicable)</p></div>			

If multiple Part 3 signatories, add additional Form C's as needed.

Value Averaging for Vapours: Current Protocol 22

- Value averaging is a useful modelling tool in risk assessment, but it is not a tool to be used in numerical assessment to exclude vapours from further consideration.
- Value averaging cannot be used for assessing vapours using standard Protocol 22 vapour attenuation factors (VAFs).
- When assessing vapours Protocol 22 is explicit:
“characterization of vapour contamination must capture worst-case vapour substance concentrations expected in the breathing zone.”

Vapour Attenuation Factors: What's new in Protocol 22

- Under the new Protocol 22 (implementation date Jan 15, 2027):
“Site-specific VAFs may be proposed by a Qualified Professional, but only in a Detailed Risk Assessment and only if sufficient detail is provided to allow a thorough review of how they were calculated.”
- As a professional, you can develop your own VAF...but...
- You need to do so in consultation with your Risk Assessment Professional.
- You need to develop the investigative plan with your Risk Assessment Professional.
- You need to show your work and it has to be in a detailed risk assessment and not in your DSI.

Vapour Attenuation Factors: What's new in Protocol 22 Cont.

- Under the new Protocol 22 when precluding conditions exist:
 - “***At the discretion of the Director, a QP may estimate vapour concentrations in breathing zone air using an alternate scientifically defensible rationale with sufficient detail to allow a thorough review***”
- This is NOT a new Pre-Approval but would be, like a P21 Water Use Determination, a case of the Approved Professional making a scientifically defensible argument in the DSI.

Bioaccumulation

- Both Protocol 1 and Protocol 13 define a “bioaccumulative substance.”
- Section 4.1.3 of Protocol 1 discusses when bioaccumulative substances need to be considered.
- Understanding which compounds are considered bioaccumulating matters for developing investigative plans. (you may need additional shallow samples as an example.)
- Understanding which compounds are considered bioaccumulative matters for establishing if an SLRA can be undertaken or whether you need to move to a detailed risk assessment.
- The CSAP Technical Review Committee produced a bioaccumulation guide in 2015, but that guidance is no longer considered fully current **so consult with your Risk Assessment professional before relying on any guidance.**

Habitat Assessment for Risk Assessment: Current Situation

- Currently the Habitat Assessment/receptor selection forms appear only in Protocol 13.
- If a Habitat Assessment is required, it is done using the form in Protocol 13 and in a manner consistent with the requirements of Protocol 13.

Habitat Assessment for Risk Assessment: Upcoming Changes

- The new version of Protocol 1 (implementation date Jan 15, 2027) includes the habitat assessment and receptor selection forms as a Protocol 1 appendix. This clarifies any confusion regarding when the forms must be filled out.
- In the revised Protocol 1, the first step of the relevant appendix is to determine whether potential terrestrial habitat is present. This step must be completed and documented in the form.

Habitat Assessment for Risk Assessment: Upcoming Changes Cont.

- The definition of “**undeveloped land**” will change to exclude railways and associated railway beds.
- The definition of “**potential terrestrial habitat**” no longer includes contiguous (i.e., if there is over 1000 m² of total undeveloped land at a CL/IL site, it is considered potential terrestrial habitat, even if it is not contiguous)
- The second step needs to be completed only if step 1 confirms the presence of potential terrestrial habitat on the site.
- Text has also been added:

In the case that ‘potential terrestrial habitat’ is identified, the entire site is covered (e.g. paved, building, etc.), and no complete exposure pathways have been identified, rationale may be provided to limit the ecological field study. Correspondingly, the ministry would also accept that identification of receptors within step 2 of the appendix would be reduced or eliminated under these circumstances.

Deep Rooting Vegetation – Part 1

- For Deep rooting plant scenarios practitioners must determine if the following exists:
 1. if contamination is present at depth,
 2. If deep-rooting vegetation is present or has the potential to establish in the future, and
 3. If the risk assessment results in unacceptable risks to the deep-rooting plants.
- If all three exist then the CoC must include a condition appropriate to the mitigating the risk.

Deep Rooting Vegetation – Part 2

- This does not mean you should be cutting down ornamental trees whenever you have deep contamination, but
 - If deep-rooting plants must be removed in the event they become established, the PVP should include direction regarding inspection frequency, actions to be taken, and reporting.
 - If there is concern about deep-rooting plants physically disrupting a risk control (e.g. cap) this should be added to the CoC to address the specific requirement. For example, “The cap must be maintained free of deep-rooting plants”, or “The engineered cap must be maintained to ensure that it is functioning as designed”, etc.
 - If this requirement only applies to a portion of the site, the physical limitations of this restriction (i.e. metes and bounds and a figure) should be provided for inclusion on the CoC.

Deep Rooting Vegetation Conclusion

- Historically the “Deep Rooting Vegetation” clause has been treated as a throwaway that could be put in a regulatory instrument without careful consideration of its necessity or oversight on long-term monitoring.
- Practitioners should be careful when they include restrictions on deep-rooting vegetation as performance verification may be challenging and costly

Non-scheduled Toxic Substances

- Under EMA s. 41 and s. 56, substances must be considered where they may cause or threaten adverse effects, even if not prescribed in the CSR.
- Professionals must also protect public and environmental health under the Professional Governance Act, which means using defensible science to evaluate non-scheduled toxic substances.

Non-scheduled Toxic Substances

Example:

- In 2025 Health Canada issued updated Soil Screening Values and Interim Toxicological Reference Values (TRVs) for Per- and Polyfluoroalkyl Substances (PFAS) for use at Federal Contaminated Sites.
- Because PFAS standards are limited in the CSR, PFAS must still be evaluated using best available science. In most cases this will require risk assessment.
- Health Canada Soil Screening Values/ TRVs may be good starting points for establishing site-specific standards.

Non-scheduled Toxic Substances

- ENV is in early stages of developing guidance.
- Guidance will be similar to 2016 bulletin from FCSAP:
 - FCSAP, 2016. How do you address emerging or known contaminants for which no guideline currently exists?
- CSAP will be consulted.
- Guidance release ~ 2027.

Non-scheduled Toxic Substances

- ENV expects that the inclusion of non-scheduled substances will be exceedingly rare.
- Investigation of non-scheduled substances is only required when they are PCOCs for the site.
- Ubiquitous global pollutants not tied to site use need not be considered.

Risk-based AiPs and PVPs

- PVPs are required when risk controls are necessary during the lifespan of the AiP.
- Whether they're needed depends on site conditions and the type and extent of contamination. If there is a reasonable chance that receptors could be exposed to harmful concentrations, such as people harvesting shellfish in a contaminated area, risk controls may be required while monitored natural attenuation or other long-term remedies are underway.
- The SDM reviewing the AiP application ultimately decides whether a PVP is needed
- When the CoC application is eventually submitted, the PVP will reflect post-remedial conditions and will likely differ from the one used for the AiP stage.
- For risk-based AiPs, when it is unclear whether a PVP is needed, it is advisable to meet with the ministry to confirm expectations.



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TRC Soil Arsenic Background Project

This meeting is being conducted from the traditional, ancestral, and unceded territory of the Coast Salish peoples, including Squamish, Tseil-Waututh, Musqueam



Stephen Munzar, M.Sc., P.Geo., CSAP
Daniel Schencks, P.Geo.
Core 6 Environmental



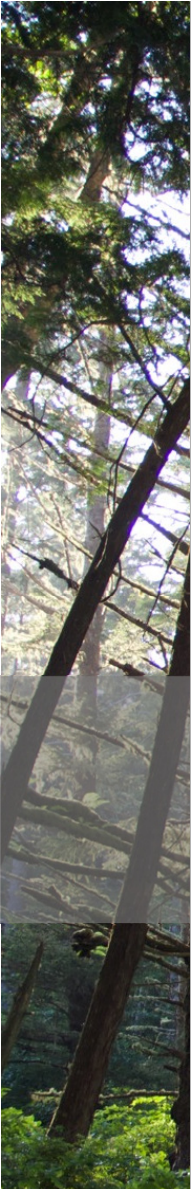
Review of Lower Mainland Soil Arsenic Background Concentrations

Daniel Schencks, P.Geo, PMP
Stephen Munzar, M.Sc., P.Geo, CSAP



Presentation Outline

1. Project Background
2. Project Objectives
3. Scope of Work
4. Results
5. Project Limitations & Next Steps
6. Questions & Comments



01

PART ONE



Project Background

Project Background

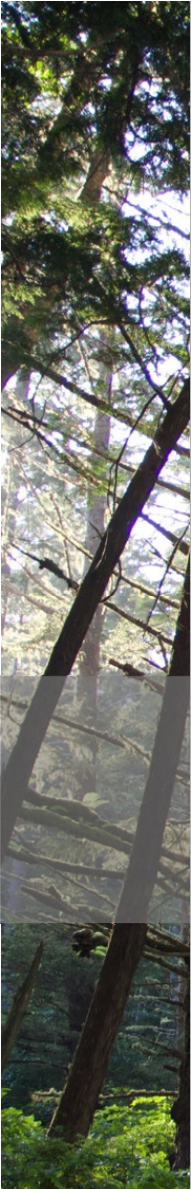
Previous study by Active Earth:

- 47.9% of P4 background release submissions are for arsenic
- High variability of natural metals concentrations in different geologic units within P4 regions, particularly Lower Mainland and Metro Vancouver
- Data for Salish Sediments and Fraser River Sediments were underrepresented, representing a data gap in units with high P4 incidence

Project Background (Cont'd)

This study is a continuation of work, with a focus on:

- Reviewing soil arsenic concentrations within the Lower Mainland and Metro Vancouver. Current P4 regional background estimates for Arsenic are not considered sufficiently high to represent natural conditions
- Collection of additional arsenic data within Fraser River and Salish Sediments



02

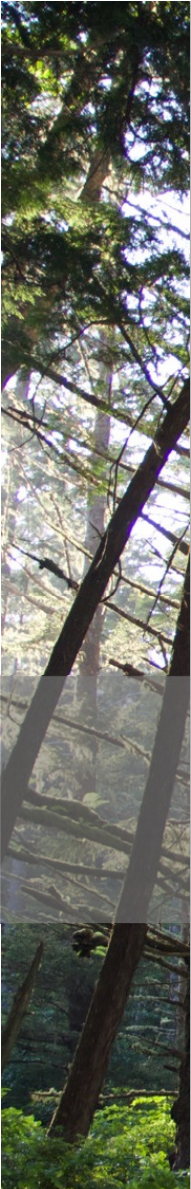
PART ONE



Project Objectives

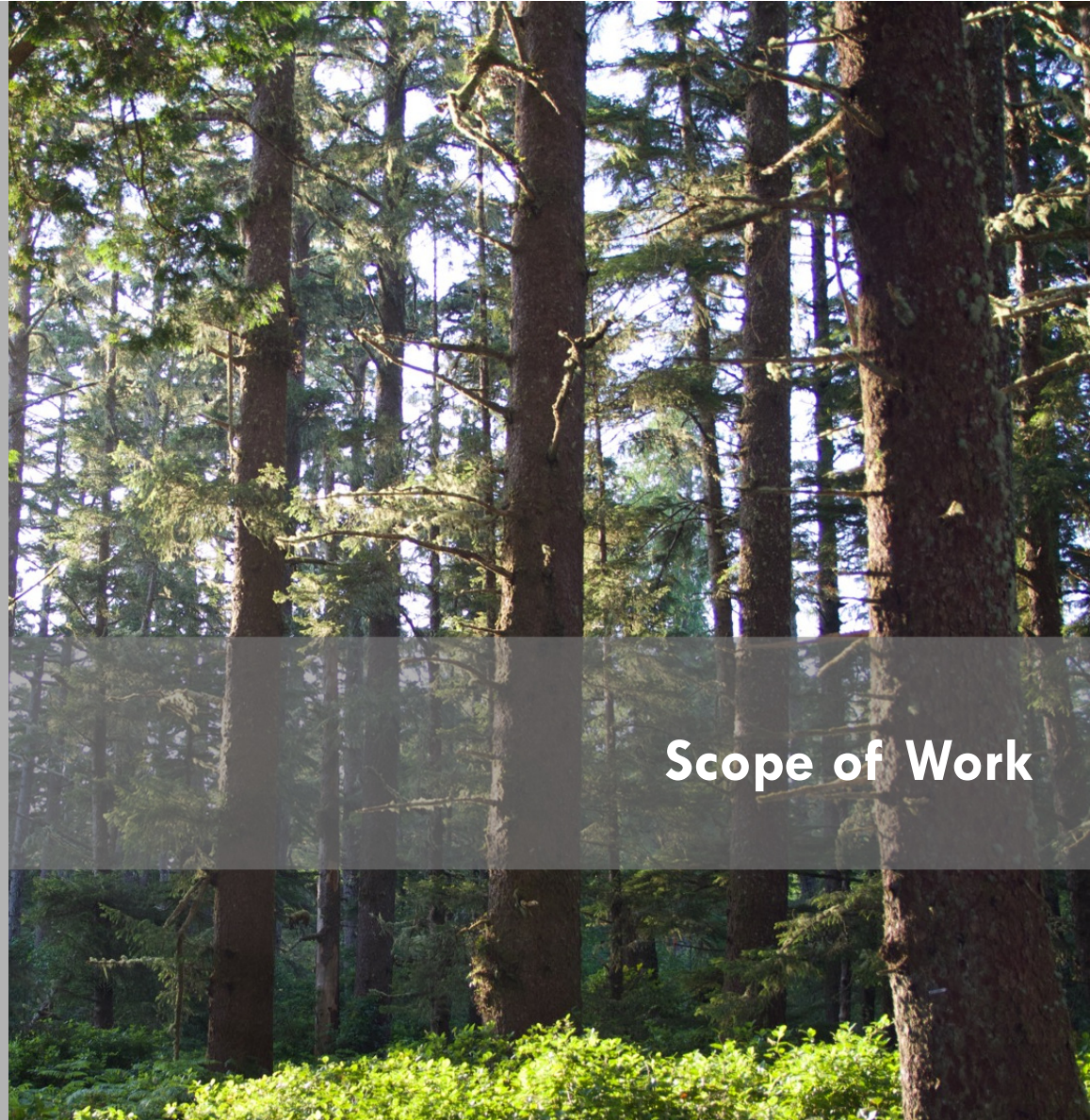
Project Objectives

- Evaluate if there is a geological and/or geochemical basis for variable soil arsenic concentrations in the Lower Mainland
- Determine if regional P4 background estimates for arsenic in the Lower Mainland/Metro Vancouver should be updated. Are subregions warranted?
- Recommended next steps in the study



03

PART ONE



Scope of Work

Scope of Work

Task 1 - Document Review

Task 2 – Data Compilation and Interpretation

Task 3 – Preliminary Statistics for Fraser River and Salish Sediments Dataset

Task 1 – Document Review

BC Mineral Inventory (MINFILES)

- Bedrock source evaluation

Literature

- Potential geological and geochemical source evaluation
 - *Marie Laura Goddard. The Baseline Arsenic Concentration in the Groundwater of the Fraser River Delta, British Columbia, Canada. March 2017.*
 - *Mark Bolton, Roger Beckie. Aqueous and Mineralogical Analysis of Arsenic in the Reduced, Circumneutral Groundwater and Sediments of the Lower Fraser River Delta, British Columbia, Canada. January 2011.*
 - *J.E. Wilson et al. Arsenic in Groundwater wells in Quaternary Deposits in the Lower Fraser Valley of British Columbia. 2008.*
 - *Suiling Wang and Catherine N. Mulligan. Arsenic in Canada. 2004.*

Task 2 – Data Compilation / Interpretation

Compilation of Arsenic Summary Data From:

1) P4 Background Release Submission Reports

- 28 available submissions in Lower Mainland / Metro Vancouver

2) Contaminated Sites Reports

- 7 sites selected within Fraser River Sediments and/or Salish Sediments
- Supplementary dataset for Task 3 statistics

Task 2 – Data Compilation / Interpretation (Cont'd)

Data Visualization

- GIS map preparation and incorporation of summary data with map layers for surficial geology and Protocol 9 Subregion 1

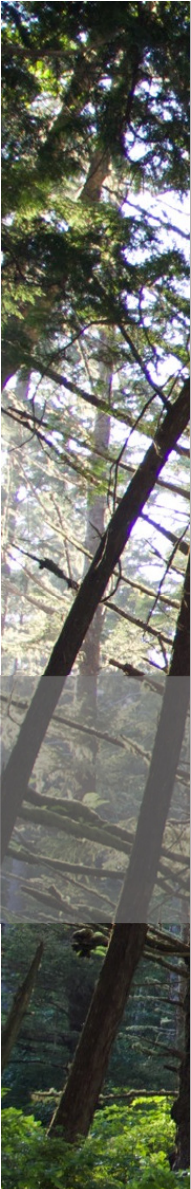
Task 3 – Preliminary Statistics for Fraser River and Salish Sediments

- Additional scope item completed for Fraser River and Salish Sediments based on:
 - Sufficiently sized dataset
 - Higher priority for further investigation based on P4 release frequency
 - Pre-existing geologic grouping (P9 Subregion 1)
- Statistics utilized 95th percentile As concentrations from P4 Sites and calculated 95th values from Contaminated Sites

Task 3 – Preliminary Statistics for Fraser River and Salish Sediments (Cont'd)

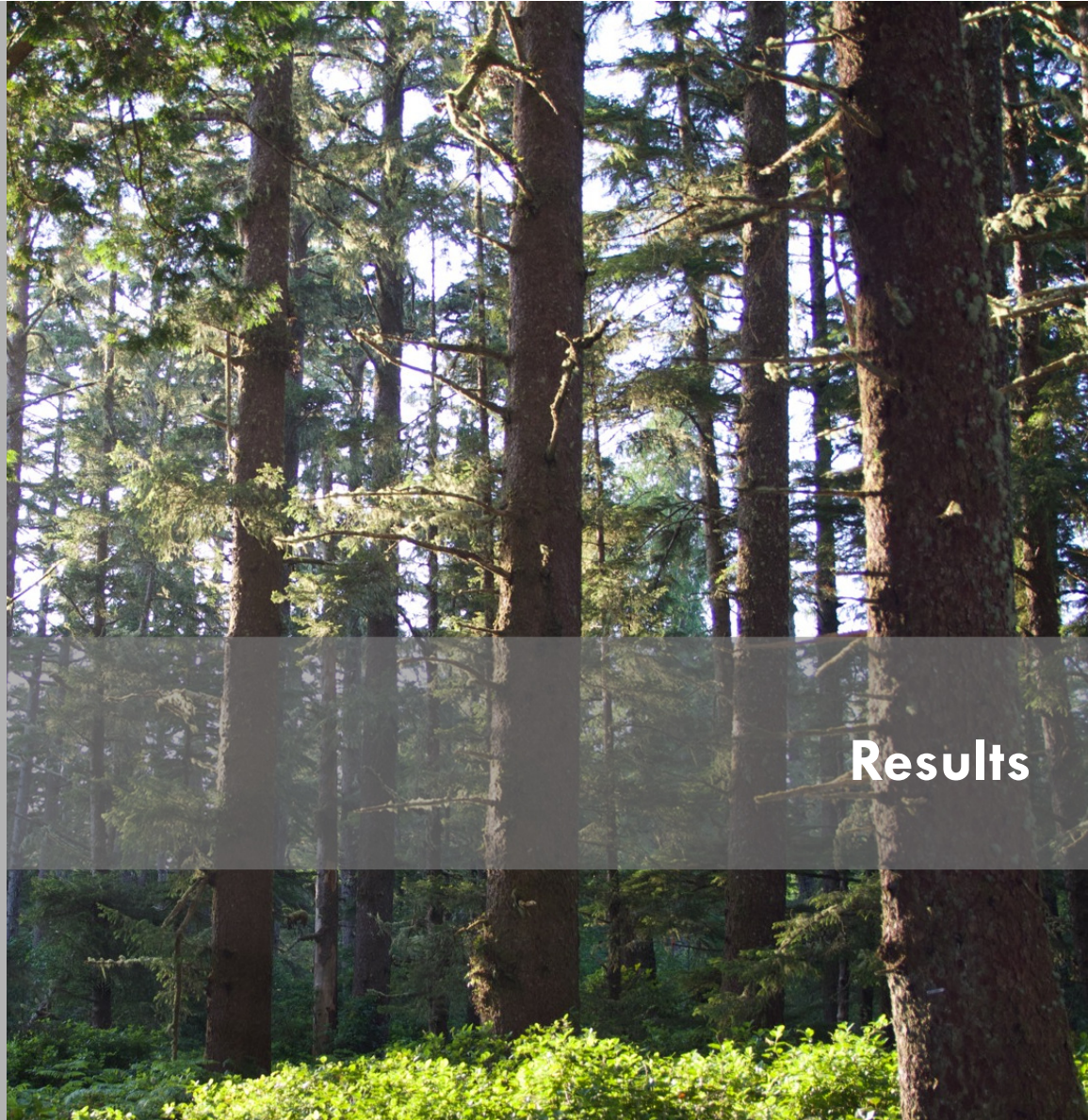
Use of Contaminated Sites Data with P4 Sites Data

- *Further increase the size of the Subregion 1 dataset*
- *Data from 2/7 contaminated sites from existing clients in Richmond*
- *Data from 5/7 contaminated sites added based on selection criteria*
 - *On the Site Registry w/ Certification Document*
 - *No P4 release*
 - *Native soil consistent with mapped geology*
 - *Native soil with As > 10 ug/g*
 - *Increase geographic distribution, if possible*
- *Statistical Comparison of Contaminated Sites dataset to P4 dataset to justify combination*



04

PART ONE



Results

Task 1 – Results

Arsenic Sources

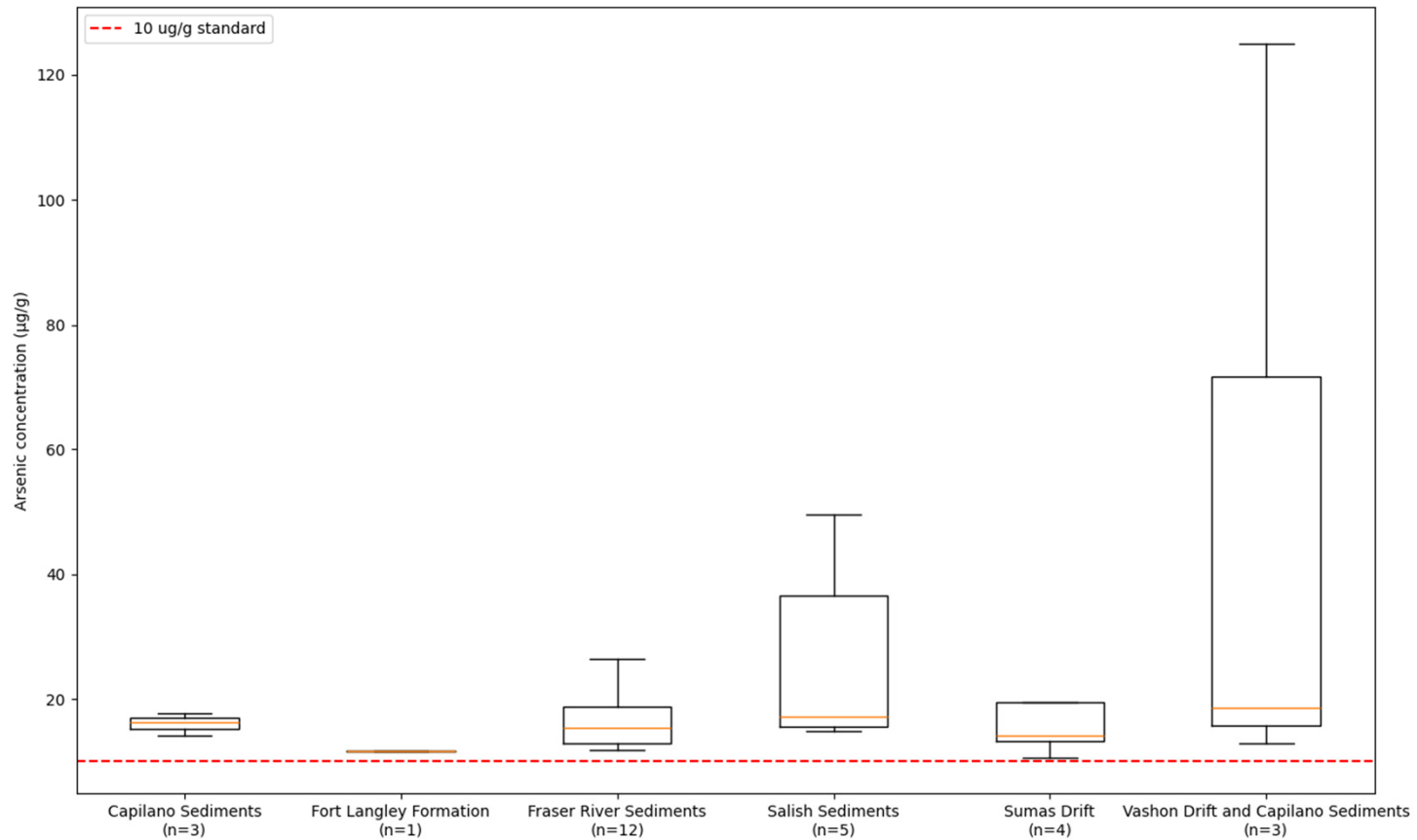
- **Primary Source:** erosion and deposition of arsenic-rich minerals from weathered bedrock. Paraglacial and fluvial (Fraser River) transport mechanisms
- **Secondary Source:** kinetic adsorption of aqueous phase arsenic to oxyanions, Fe and Al oxides/hydroxides in soils. Influenced by soil conditions including organic content, metals/metalloid content

Finding

- There is a geological / geochemical basis for natural As occurrence and therefore geology-based subregions may be warranted, similar to P9

Task 2 – Lower Mainland P4 Submissions by Geological Unit

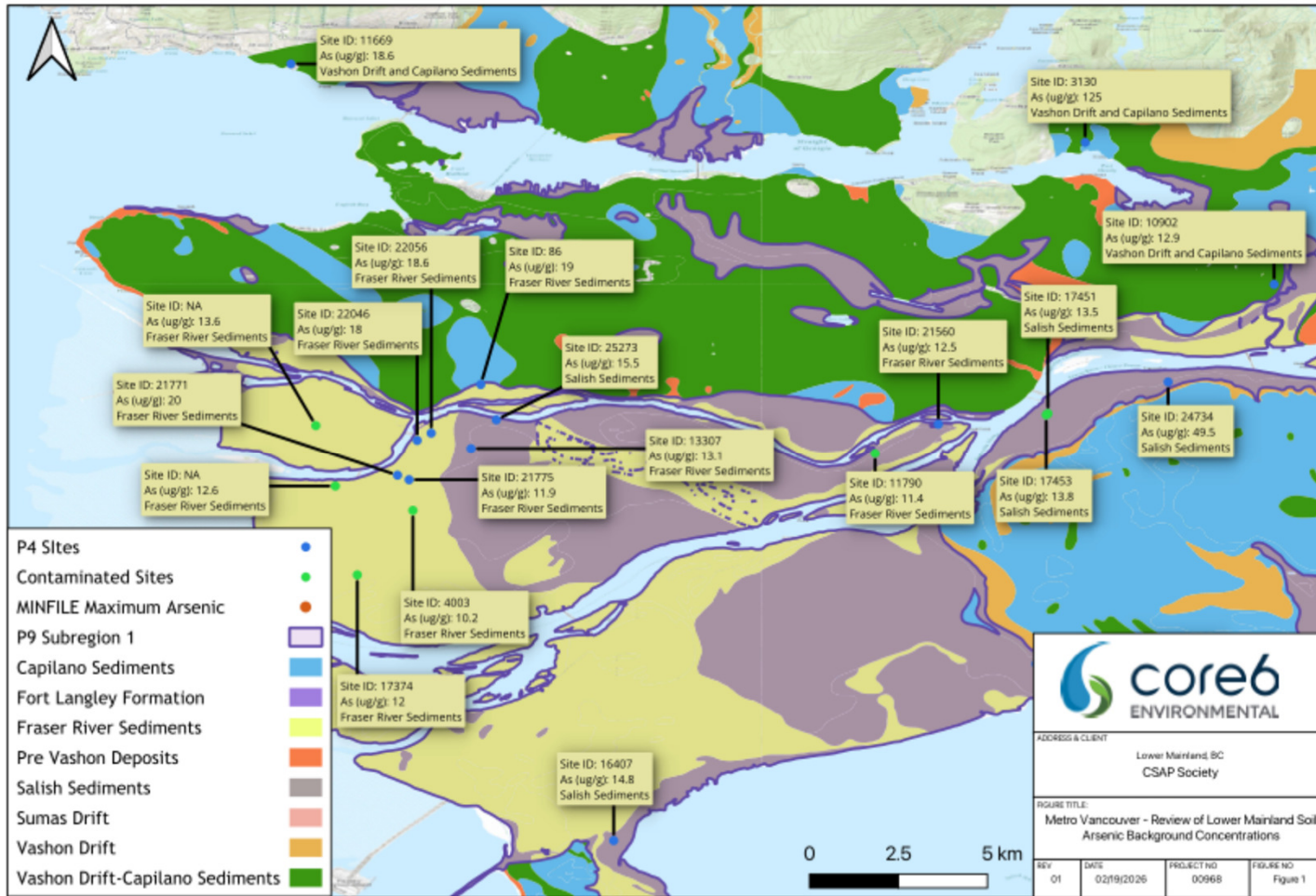
Distribution of P4 95th Percentile As Concentrations



Task 2 – Lower Mainland P4 Submissions by Geological Unit (Cont'd)

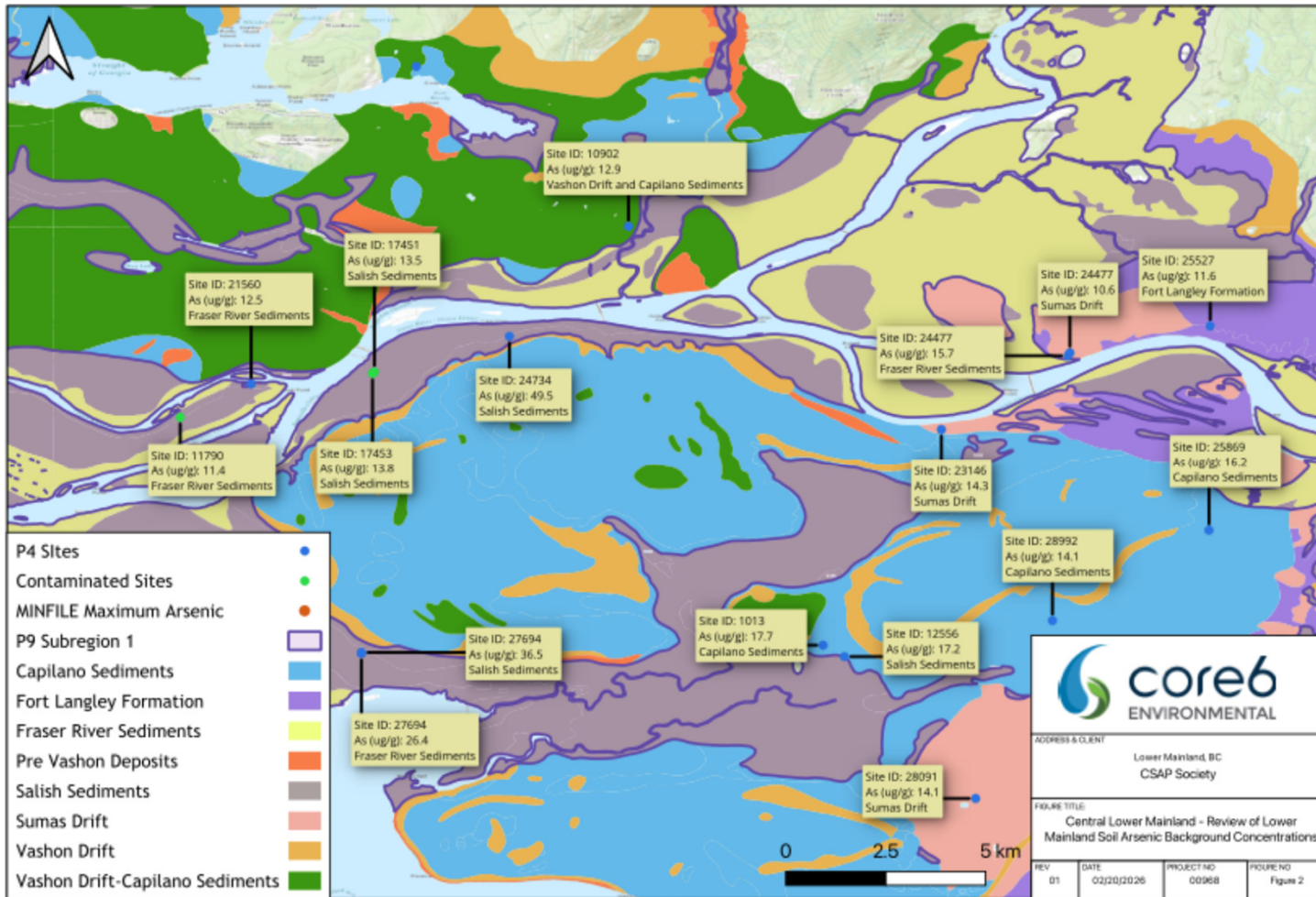
- *Fraser River Sediments (43%)*
- *Salish Sediments (18%)*
- *Sumas Drift (14%)*
- *Vashon Drift and Capilano Sediments (11%)*
- *Capilano Sediments (11%)*
- *Fort Langley Formation (3%)*

GIS Map 1/3 – Metro Van and Surrounding Area

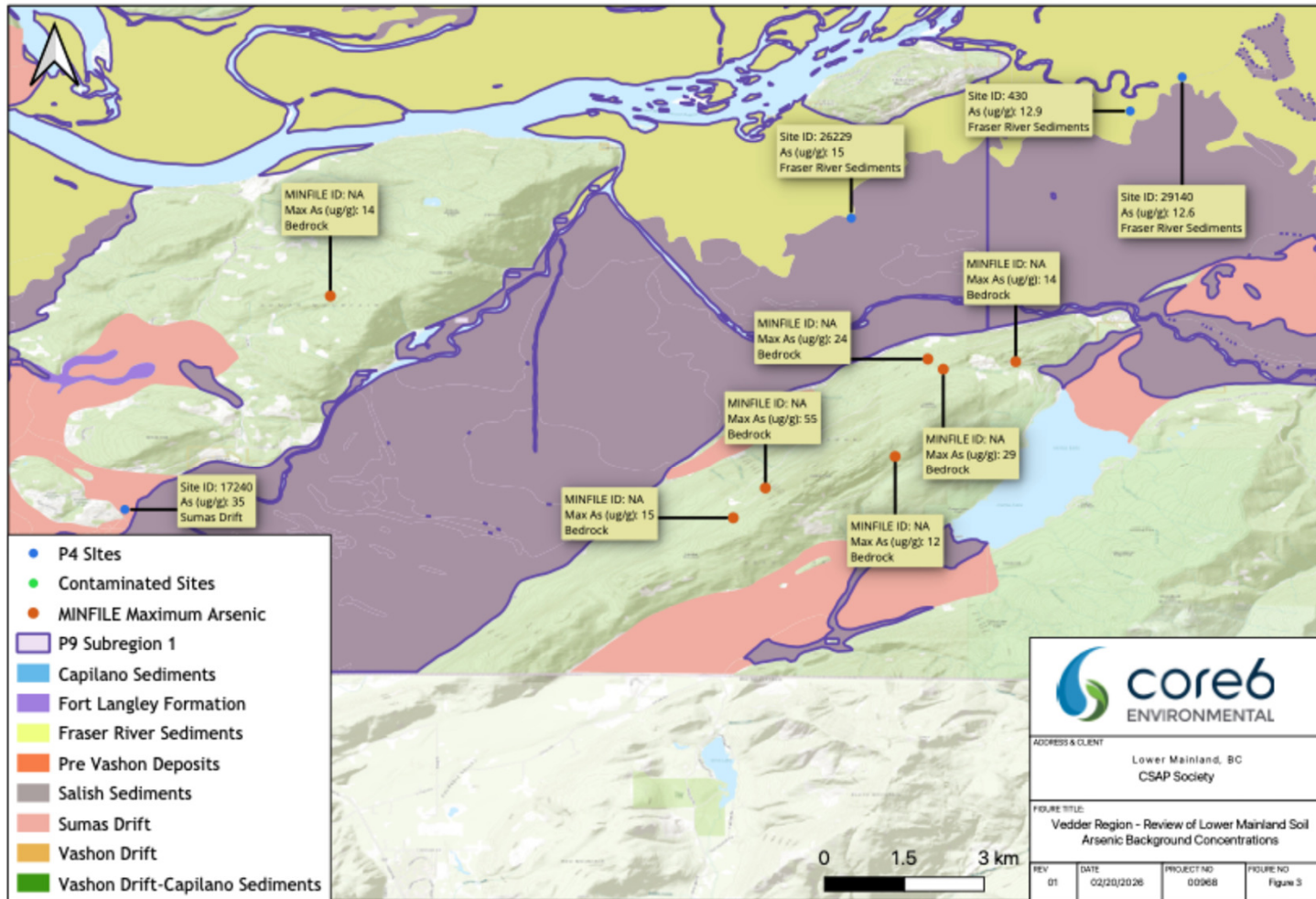


Created by: MC

GIS Map 2/3 – Central Lower Mainland



GIS Map 3/3 – Vedder Region



Task 2 – Results (Cont'd)

Summary Data

- 61% of available P4 release submissions for As are in Fraser River and Salish Sediments
 - Highest priority region for background update

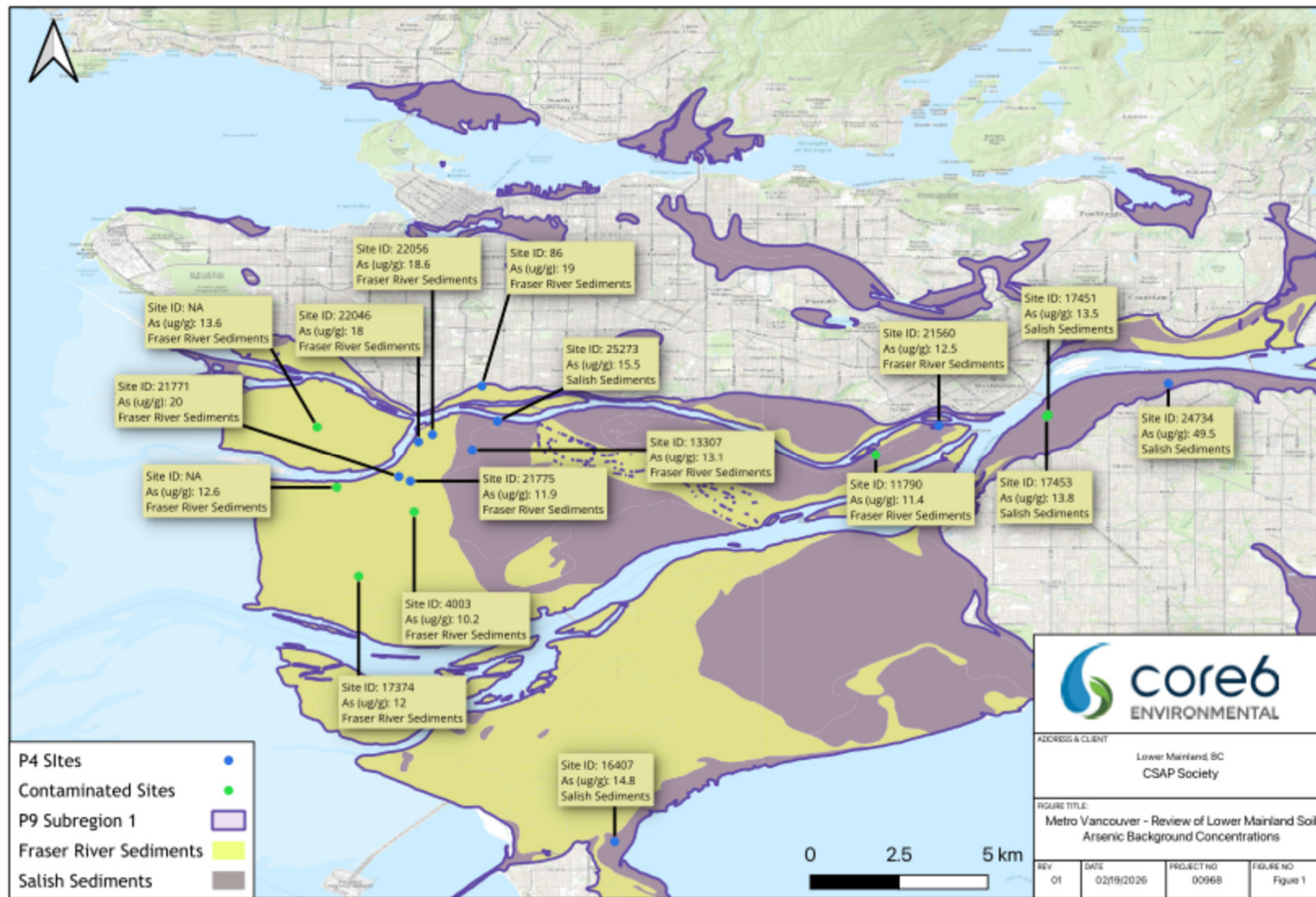
Referencing P9

- Pre-existing boundary (Subregion 1) defined by geology and adopted by ENV
- Subregion 1 soil dataset comparable in size to GW datasets used for P9 regional background

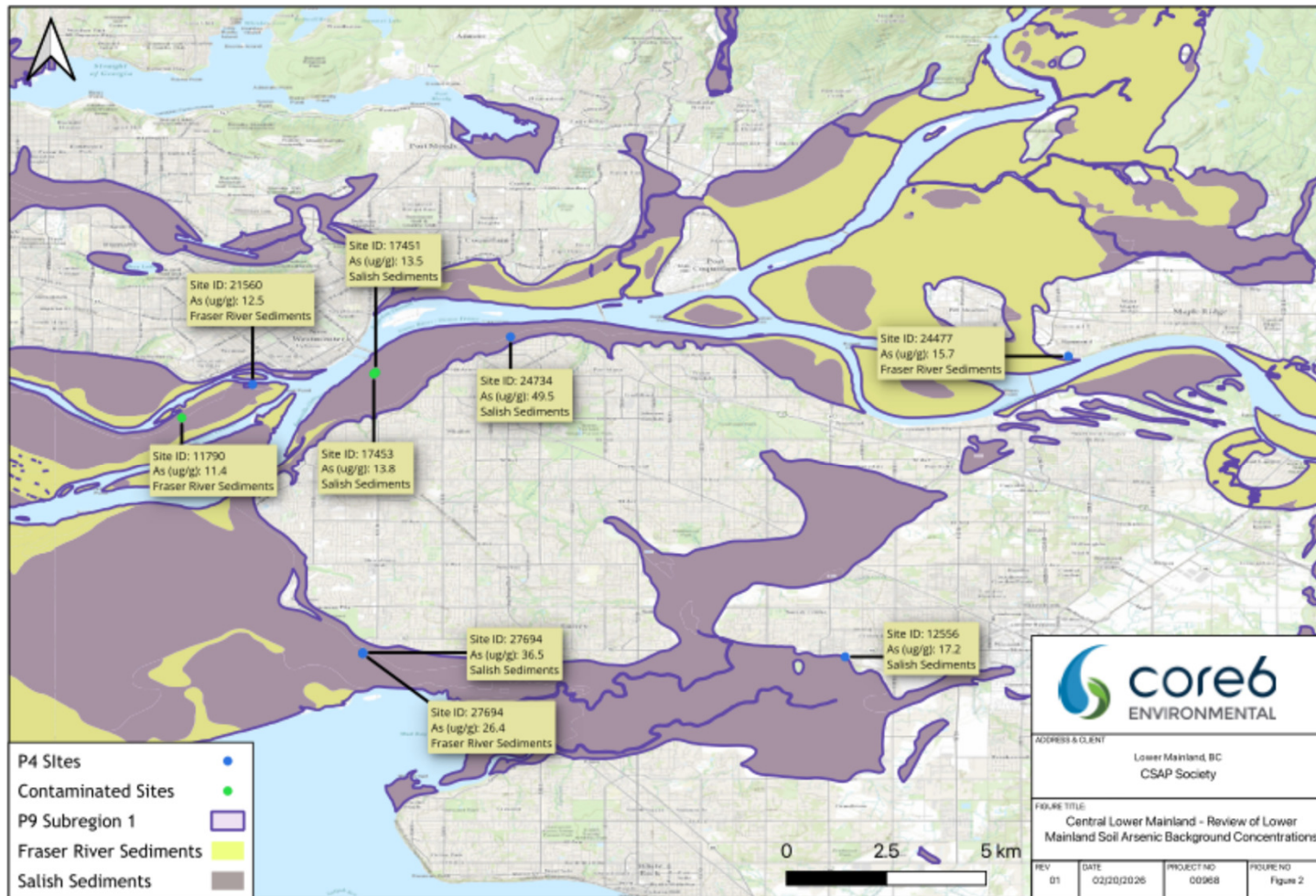
Task 3 – P4 Sites and Contaminated Sites General Statistics

Statistic	P4 Sites	Contaminated Sites	Combined Sites
N (95 th percentile values)	17	7	24
mean (ug/g)	19.36	12.47	17.35
std (ug/g)	9.87	1.33	8.86
min (ug/g)	11.89	10.23	10.23
50% (ug/g)	15.70	12.64	14.32
90% (ug/g)	30.44	13.69	24.48
95% (ug/g)	39.10	13.76	34.98
97.5% (ug/g)	44.30	13.80	42.03
max (ug/g)	49.50	13.83	49.50
geomean (ug/g)	17.79	12.40	16.01
variance (ug/g) ²	97.32	1.77	78.42
coefficient of variance	0.51	0.11	0.51

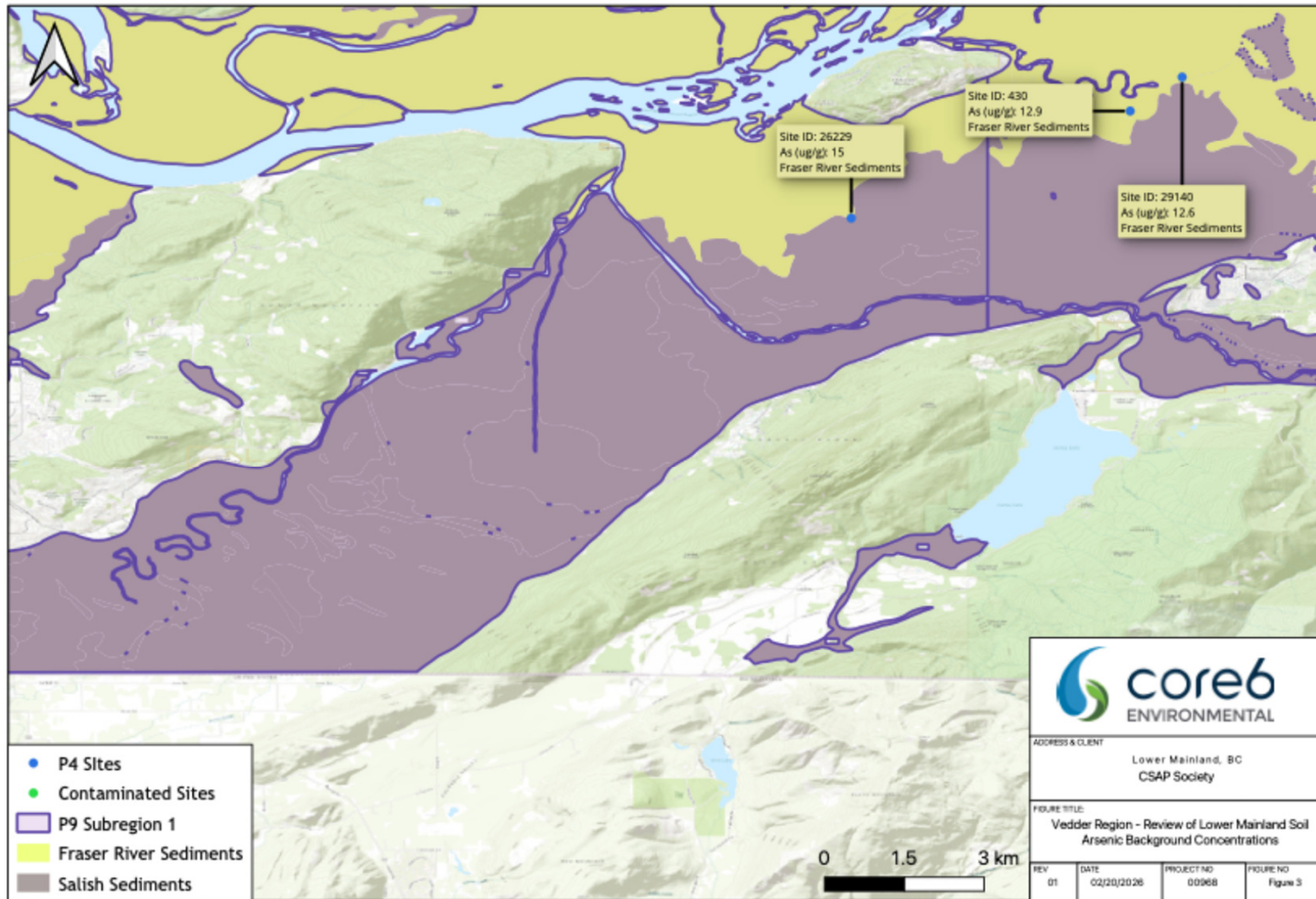
GIS Map 1/3 - Site Distribution in Subregion 1



GIS Map 2/3 - Site Distribution in Subregion 1



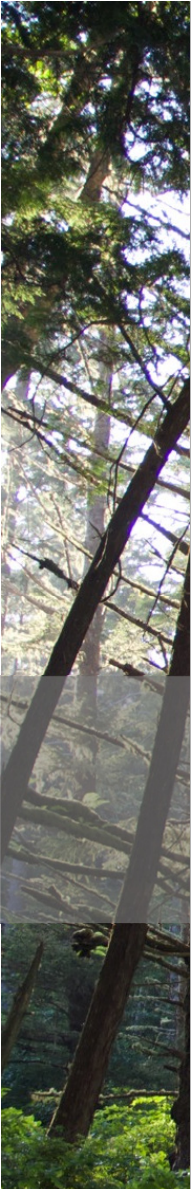
GIS Map 3/3 - Site Distribution in Subregion 1



Task 3 – Results (Cont'd)

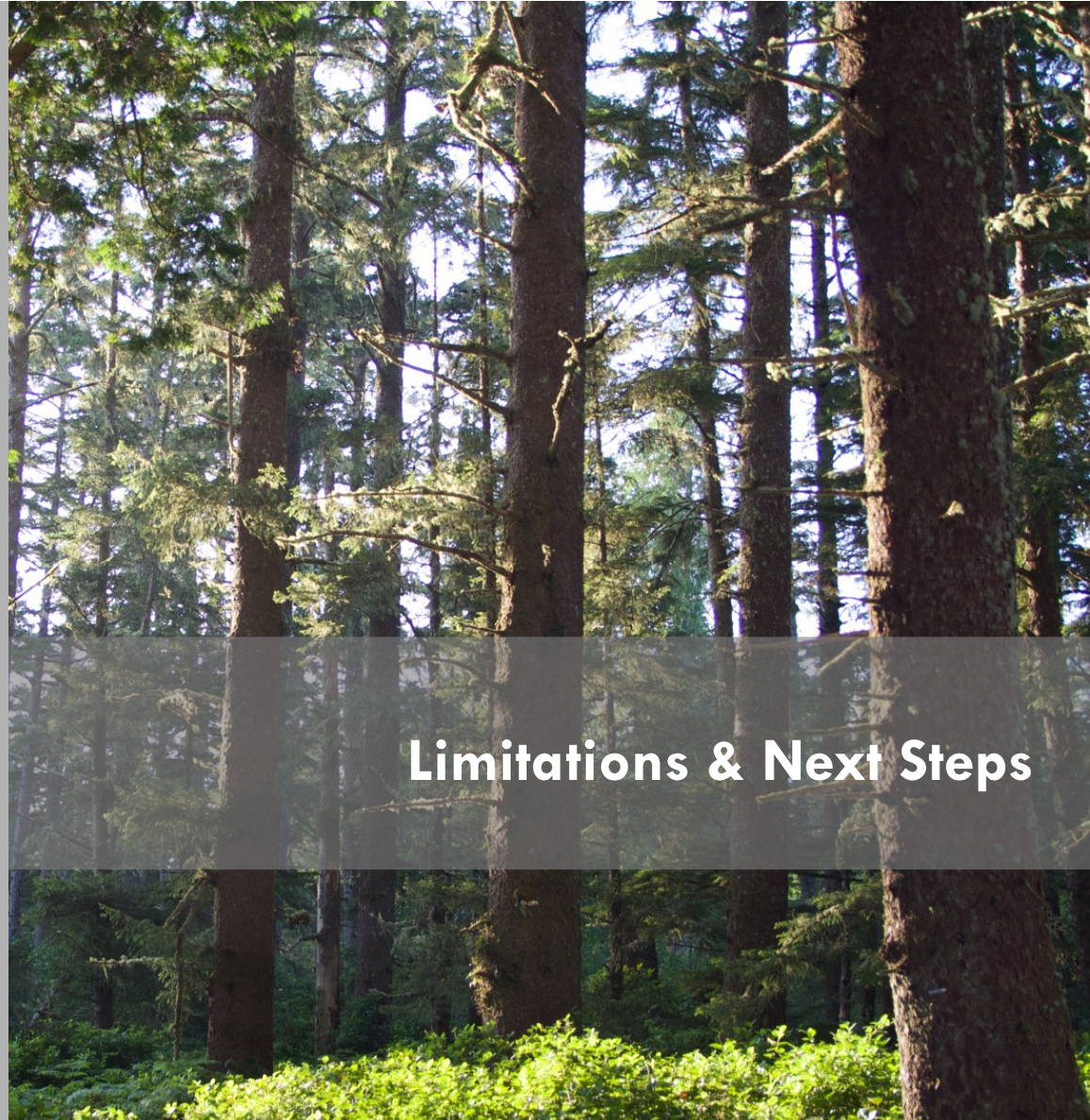
Findings

- *As concentrations > 10 ug/g are widely distributed throughout Subregion 1 in native soils*
- *Current dataset - mean (17.35 ug/g) and 95th Percentile (34.98 ug/g) As concentrations in Subregion 1 are significantly greater than the current regional background estimate for the Lower Mainland and Metro Vancouver (8.5 ug/g)*



05

PART ONE



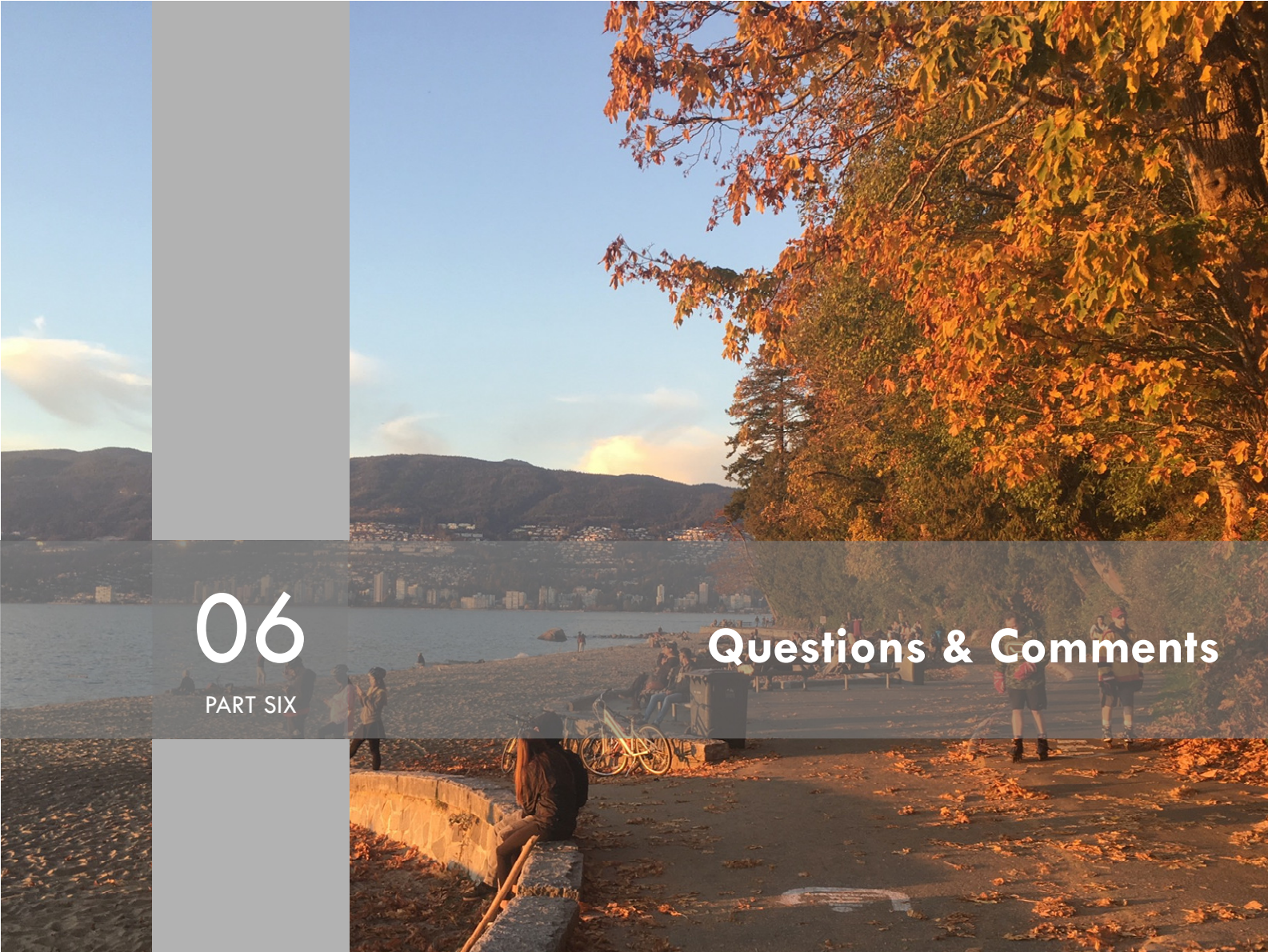
Limitations & Next Steps

Limitations

- Size of Subregion 1 supplemental contaminated sites dataset
- Selection criteria for contaminated sites dataset omits sites with maximum native soil arsenic concentrations $< 10 \text{ ug/g}$
- Potential influence of contamination in contaminated sites dataset
- Subregion 1 dataset and statistical (use of 95th percentile values instead of individual concentrations)

Next Steps (Incorporating ENV and TRC Feedback)

- Verify use of P9 Subregion 1 and 2 for P4 based on source evaluation and depositional distinction (fluvial vs glacial/paraglacial)
- Verify preferred statistical approach, dataset size, and adopted value (mean, 95th percentile etc.)
- Build representative native As datasets for Subregion 1 and Subregion 2 for background estimates
 - Develop approved data selection criteria for P4 and Contaminated Sites
 - Extract individual As concentrations from compiled P4 Sites
 - Extract native As data from additional Contaminated Sites reports
 - Evaluate need for distinction based on depth, peat content, contamination influence, etc. within mapped surficial geology



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PART SIX

Questions & Comments

Closing Remarks

- If you haven't physically sign-in at the registration table, please do so when you leave. Otherwise, you will **not** earn 6 PD hours!
- Please return your badges to the registration table.
- Stay tuned for the post-event survey via email.
- Join us after the event for a no-host happy hour in the foyer until 6:00 p.m.



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