BACKGROUND DETERMINATION

Process Update

Stephen Dankevy, ENV

CSAP
Society of Contaminated Sites Approved Professionals of British Columbia

PROTOCOL 9
BACKGROUND GROUNDWATER DETERMINATIONS UPDATE

CSAP PD WORKSHOP

NOVEMBER 16, 2017

Steve Dankevy
Ministry of Environment

Luca Malaguti
CSAP

BRITISH COLUMBIA | Ministry of Environment

OUTLINE

- P9 Policy Fundamentals
- P9 Methodology
- P9 Determination Location and Parameter Summary
- CSR Stage 10 Amendment Implications to P9 – Luca Malaguti
- P9 Related Policy Development
  - Interim Cobalt Background Groundwater Estimate
  - Regional Background Groundwater Development

P9 POLICY FUNDAMENTALS

Regulatory Authority:

Subsection 11(3) of the Contaminated Sites Regulation states that:

*A site is not a contaminated site with respect to a substance in the soil, surface water or **groundwater** if the site does not contain any substance with a concentration greater than the local background concentration of that substance in the soil, surface water or **groundwater** respectively.*

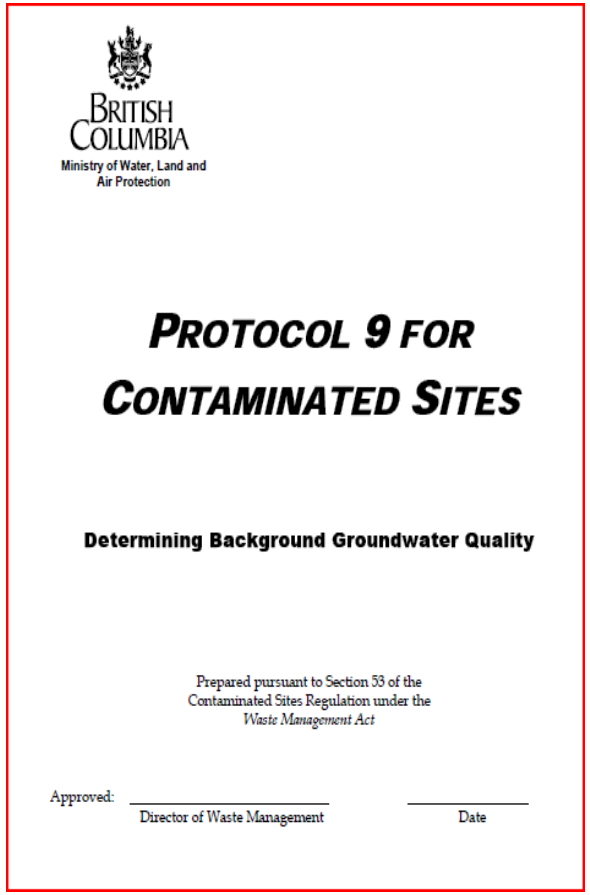
Subsection 17(2) of the Contaminated Sites Regulation in part states that:

A contaminated site is considered to have been satisfactorily remediated if:

*(b) the soil, surface water or **groundwater** at the site does not contain any substance with a concentration greater than or equal to the local background concentration of that substance in the soil, surface water or **groundwater** respectively.*

P9 POLICY FUNDAMENTALS

- **"background concentration"** means the concentration of a substance in an environmental medium in a geographic area, but does not include any contribution from *local human-made point sources*.
- **"local human - made point source"** means a location or area at a site where, as a result of human activity, a substance was introduced into the environment causing the substance concentration to exceed the local background concentration.



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Ministry of Water, Land and Air Protection

PROTOCOL 9 FOR CONTAMINATED SITES

Determining Background Groundwater Quality

Prepared pursuant to Section 53 of the Contaminated Sites Regulation under the *Waste Management Act*

Approved: _____ Director of Waste Management

_____ Date

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P9 POLICY FUNDAMENTALS

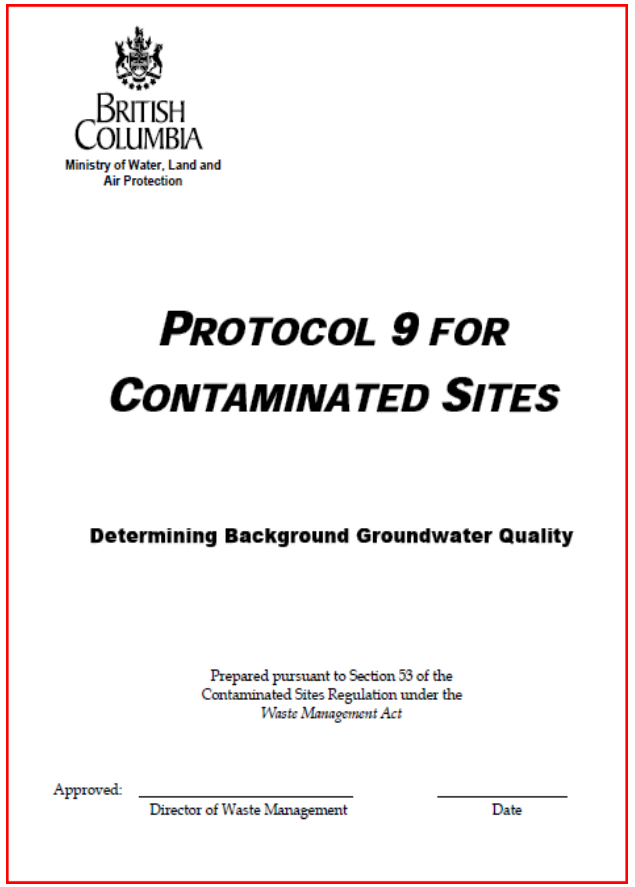
Plain Language Policy Intent:

- To establish a procedure for determining the local background concentration of a substance;
- Avoid remediating a substance that is naturally present;
- Creates a site specific standard for the parameter of interest at the Site; and
- Fundamental implications to issuance of legal instruments such as determinations and certificates of compliance.

P9 METHODOLOGY

Key Components

- High Level Approach;
- Minimum of 3 wells sited in areas away from human-made point sources of contamination
- Avoid fill areas of unknown soil quality;
- Minimum of 2 groundwater sampling events during different seasons;
- Calculate the 95th percentile; and
- Submit a Background Groundwater Investigation Report.



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PROTOCOL 9 FOR CONTAMINATED SITES

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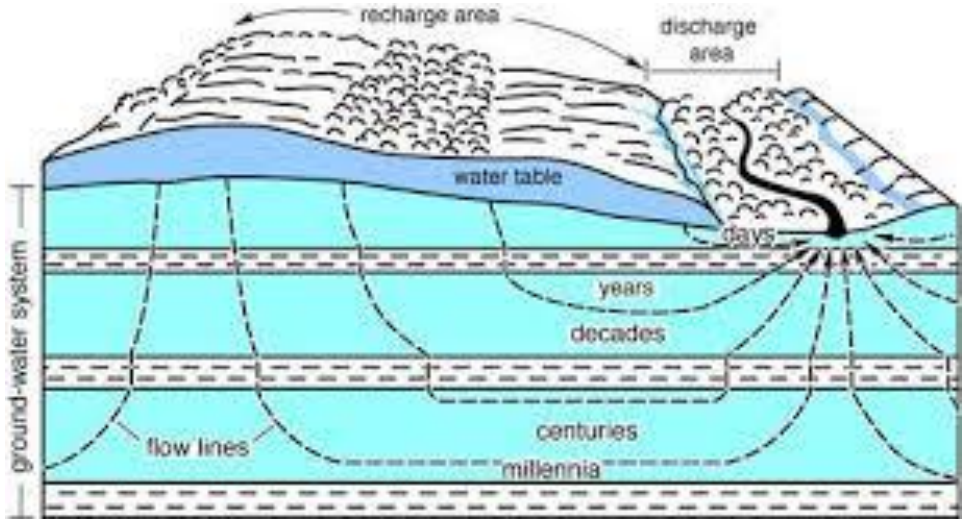
P9 METHODOLOGY

Background Groundwater Characterization:

- Part of the DSI process;
- Assessment groundwater chemistry;
- Lines of evidence approach:
  - Historical Site Use (APECs/PCOCs)
  - Hydrogeological
  - Geochemical
  - Mineralogical
- Ultimate goal is a conceptual site model for natural groundwater quality at a site.



P9 METHODOLOGY

Historical Site Use

- Where are AECs; What are COCs;
- Is background substance a COC at the Site; and
- Are there monitoring wells located in locations unaffected by historical site use.

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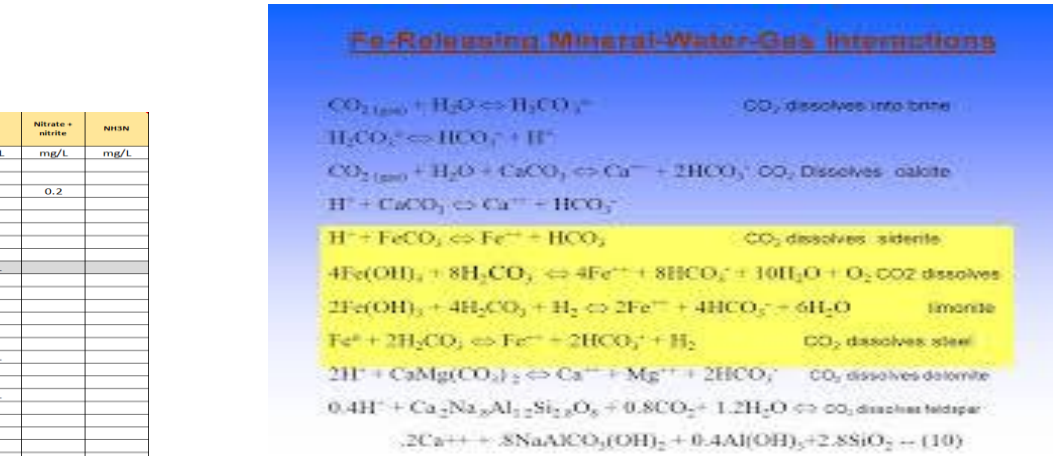
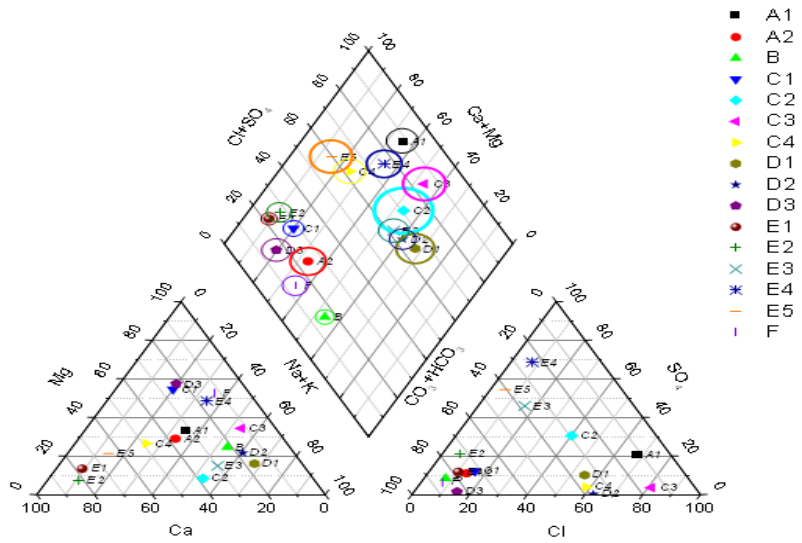
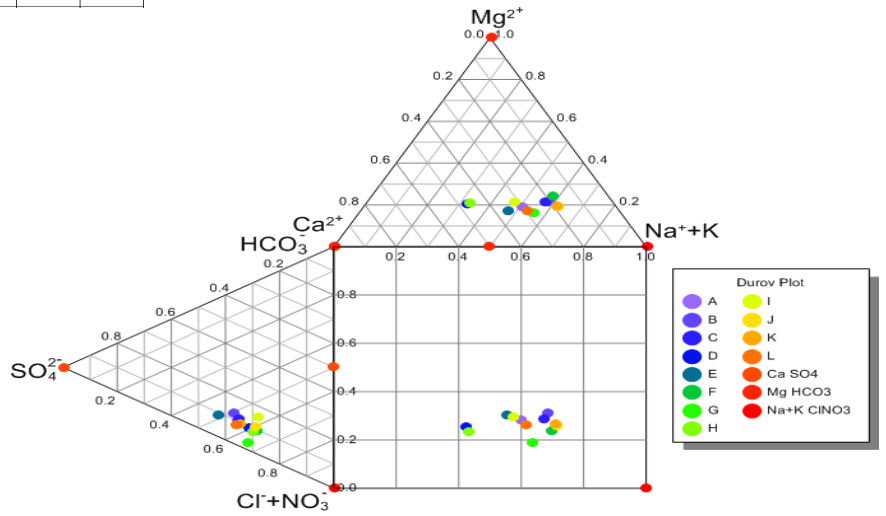
P9 METHODOLOGY

Geochemical:

Well ID	Sample Date	As detection limit	As	Fe	Mn	B	K	Mg	Na	Ca	S	SO_4	Nitrate + nitrite	NH3N
	dd-MMM-yy	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	mg/L	mg/L	mg/L	mg/L
BH05-21-D	9-Dec-05		7.0											
BH05-21-D	17-Jun-10		14.7											
BH05-21-D	12-May-11		19.8	67700	1740.000		2050	8820	18400	16600		5	0.2	
BH06-26	3-Apr-06		4.0											
BH06-26	30-Apr-09		8.0											
BH06-26	29-Jul-09		8.0											
BH06-26	17-Jun-10		5.6											
BH10-28-D	25-Aug-10		4.6											
BG7I	5-Mar-13		5.7	27700	3020.000	100	5800	11700	17600	5100		8.01		
BG7D	5-Mar-13		39.3	111000	##########	100	8200	29000	30700	107000		5		
BG7D	20-Mar-13		37.2											
BH8I	5-Mar-13		6.6	16000	5220.000	100	5100	16700	32900	72100		0.6		
BH8D	5-Mar-13		53.9	123000	9610.000	100	5000	19600	32200	72300		5		
BH8D	20-Mar-13		40.8											
BH8D	12-Jun-13		45.2											
BG9I	5-Mar-13		2.7	10800	160.000	100	9300	68000	44300	3910		15.1		
BG9D	5-Mar-13		21.8	19900	1830.000	100		66400	29300	29000		2.5		
BG9D	20-Mar-13		16.9											
MW11-01DE	5-Oct-11		6.2	10000	4270.000	61	2700	11700	105000	36900		4.81		
AEMW11-1DE	13-Jan-13		10.9	48500	4680.000	100		56900	32000	15200				
AEMW11-1DE	18-Mar-13		13.8											
MW11-03DE	5-Oct-11		3.8	5390	7590.000	50		9160	44100	29000				
AEMW11-3DE	13-Jan-13		9.7	42600	3730.000	100	14500	79800	11100	20200		5		
MW11-01SE	5-Oct-11		46.7	119000	##########	52	11400	44700	28000	146000		5		
AEMW11-1SE	13-Jan-13		57.5	122000	6280.000	100		32200	16600	105000				
AEMW11-1SE	18-Mar-13		50											







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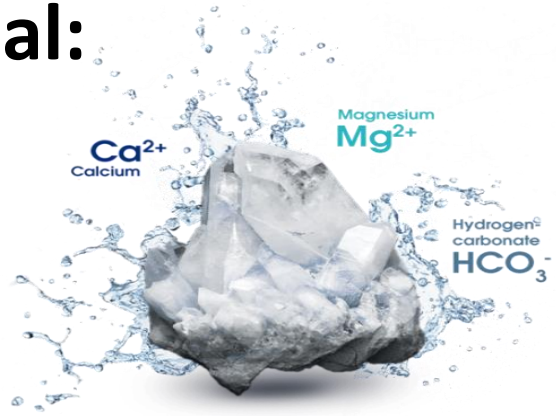
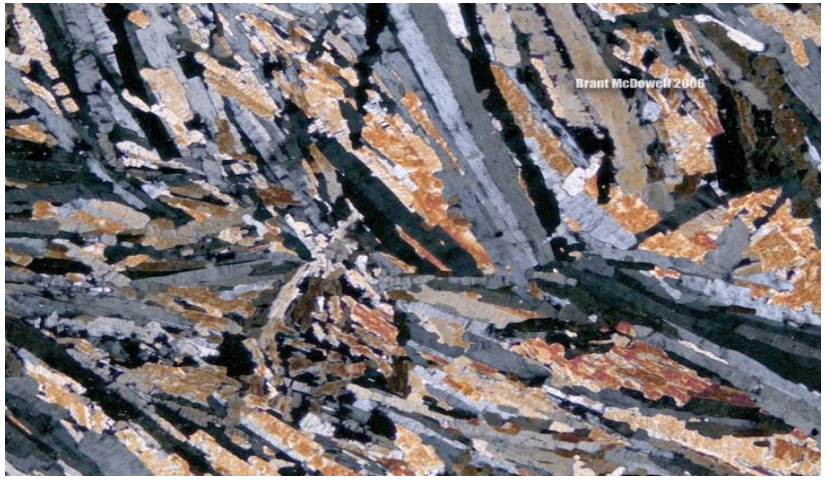
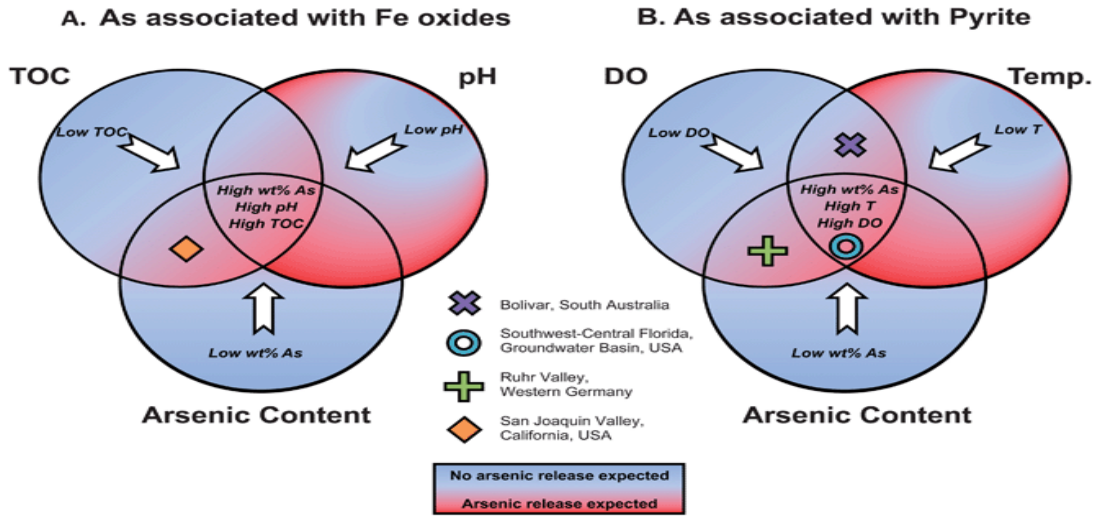
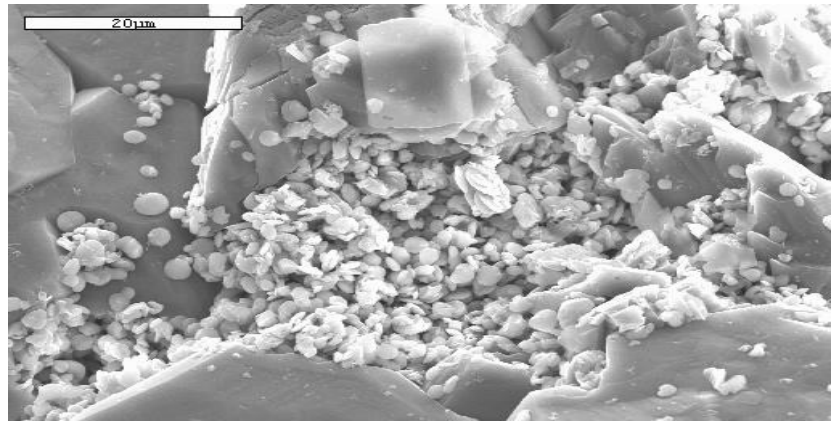
P9 METHODOLOGY

Mineralogical:









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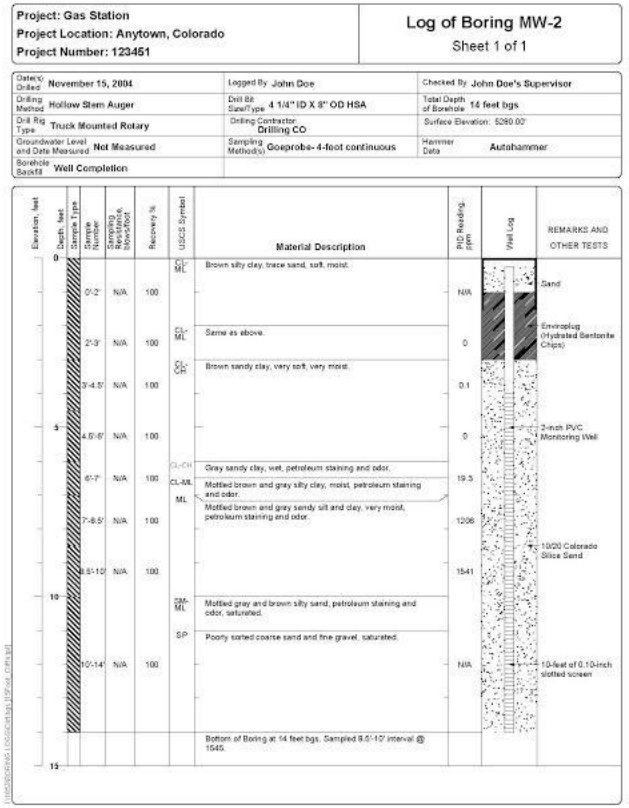
P9 METHODOLOGY

Hydrogeological:

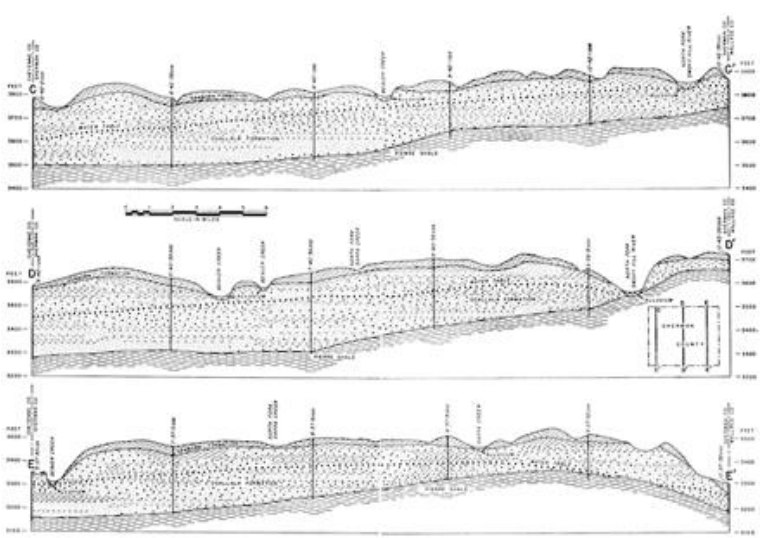


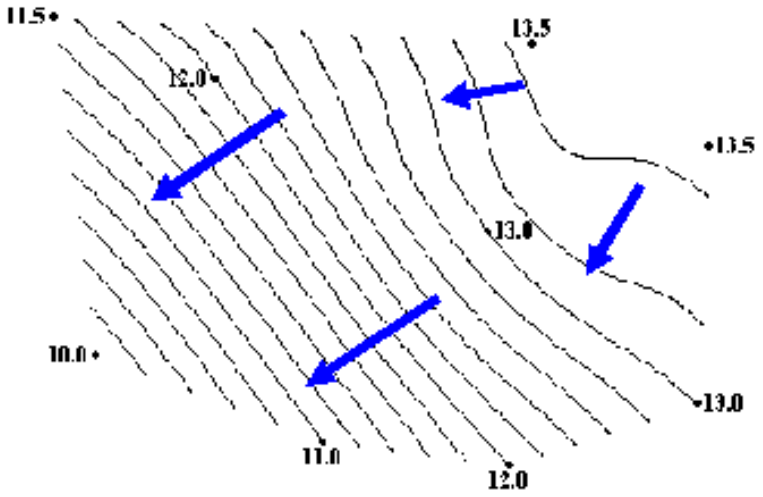
Project: Gas Station
Project Location: Anytown, Colorado
Project Number: 123451

Log of Boring MW-2
Sheet 1 of 1

Date(s) Drilled: November 15, 2004	Logged By: John Doe	Checked By: John Doe's Supervisor
Drilling Method: Hollow Stem Auger	Drill Bit Size/Type: 4 1/4" ID X 8" OD HSA	Total Depth of Borehole: 14 feet bgs
Drill Rig Type: Truck Mounted Rotary	Drilling Contractor: Drilling CO	Surface Elevation: 5280.00'
Groundwater Level and Date Measured: Not Measured	Sampling Method(s): Geoprobe- 4-foot continuous	Hammer Data: Autohammer
Borehole Backfill: Well Completion		

Elevation, feet	Depth, feet	Sample Type	Sample Number	Sampling Resistance, blows/foot	Recovery %	USCS Symbol	Material Description	PID Reading, ppm	Well Log	REMARKS AND OTHER TESTS
0	0-2'			N/A	100	CL-ML	Brown silty clay, trace sand, soft, moist.	N/A		Sand
	2-3'			N/A	100	CL-ML	Same as above.	0		Enviroplug (Hydrated Bentonite Chips)
	3-4.5'			N/A	100	CL-CH	Brown sandy clay, very soft, very moist.	0.1		
5	4.5-6'			N/A	100			0		2-inch PVC Monitoring Well
	6-7'			N/A	100	CL-CH	Gray sandy clay, wet, petroleum staining and odor.	19.3		
	7-8.5'			N/A	100	CL-ML / ML	Mottled brown and gray silty clay, moist, petroleum staining and odor. Mottled brown and gray sandy silt and clay, very moist, petroleum staining and odor.	1208		10/20 Colorado Silica Sand
	8.5-10'			N/A	100			1541		
10	10-14'			N/A	100	SM-ML	Mottled gray and brown silty sand, petroleum staining and odor, saturated.	N/A		10-feet of 0.10-inch slotted screen
						SP	Poorly sorted coarse sand and fine gravel, saturated.			
15							Bottom of Boring at 14 feet bgs. Sampled 8.5'-10' interval @ 1545.			





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P9 METHODOLOGY

Conceptual Site Model

- Culmination of the lines of evidence into an understanding of the natural chemical evolution of the groundwater at the site.

P9 METHODOLOGY

Background Monitoring Well Selection Criteria

- *Exclude* monitoring well data if contaminant of concern (COCs) are present in concentrations above detection limits;
- *Exclude* monitoring wells which could be influenced by secondary contaminant release processes such as redox reactions associated with, for example, hydrocarbon contamination. This includes monitoring well data located cross- gradient if they are in close proximity to a contaminant source or down-gradient; and
- *Flag* monitoring well data collected from monitoring wells with screens fully or partially installed in natural confining barriers (clays and silts). Suspended sediment in the sampled groundwater from these units can bias the data high.

P9 METHODOLOGY

Background Monitoring Well Selection Criteria (cont.)

- Keep the data in the database if value is above the detection limit. If value is below detection limit, but the detection limit is below the Stage 11 standard then keep the data in the data set. If the value is below the detection limit and the detection limit is above the Stage 11 standard, then remove the data from the database;
- Consider excluding monitoring wells screened within fill material. Exclude monitoring wells partially screened across fill material if material is of suspect quality (i.e. wood waste, asbestos, bricks or preload, etc.); and
- Exclude monitoring wells screened in recently backfilled excavations.

P9 METHODOLOGY

Updated Key Components Summary:

- PSI-Stage 1, Desktop research;
- Install/select wells representative of natural groundwater chemistry;
- Define and understand the hydrogeology/geochemistry at the site;
- Collect and use enough data from lines of evidence to build your conceptual site model; and
- Calculate Background Concentration

December 16, 2016
File: 663-067.04

BC Ministry of Environment
2nd Floor, 10470 152 Street
Surrey, BC V3R 0Y3

RECEIVED
FEB 10 2017
ENVIRONMENTAL EMERGENCIES AND LAND REMEDIATION BRANCH VICTORIA

Attn: Steve Dankevy, Contaminated Sites Officer

Cc – Peter Kickham, Janet Barrett

Dear Mr. Dankevy,

Re: Protocol 9 Application for Determination of Background Sulphide Concentrations in Groundwater

1.0 INTRODUCTION

1.1 SITE BACKGROUND

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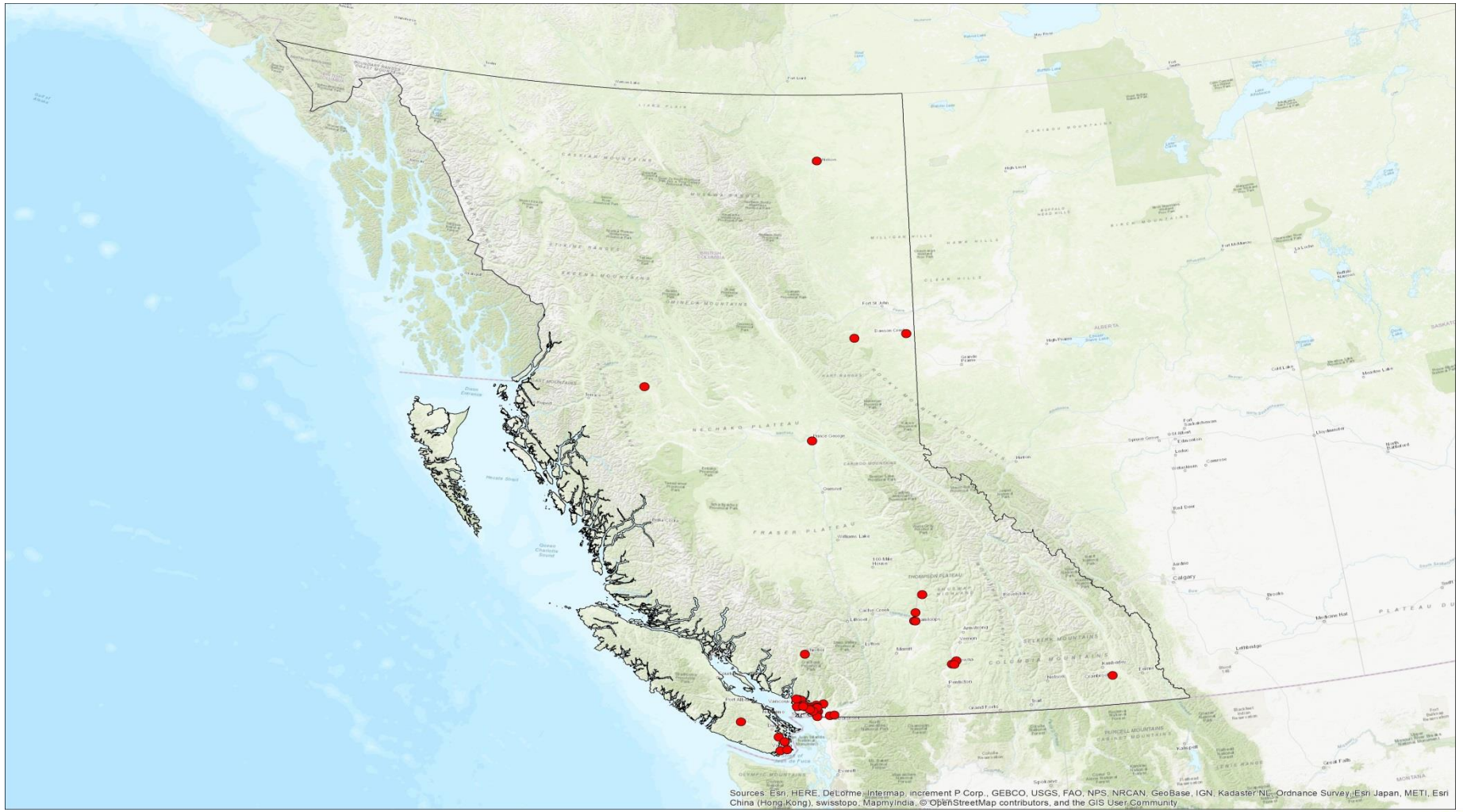
BACKGROUND GROUNDWATER CHARACTERIZATION

Tips

- On-site wells can be used even if AECs and COCs are present;
- Don’t analyze for substances that are not PCOCs;
- Avoid, if possible, installing monitoring wells in fine grained stratigraphy/aquitards;
- Consider involving qualified hydrogeologist/geochemist; and
- Do approach the ministry for guidance.

BACKGROUND GROUNDWATER DETERMINATION LOCATIONS



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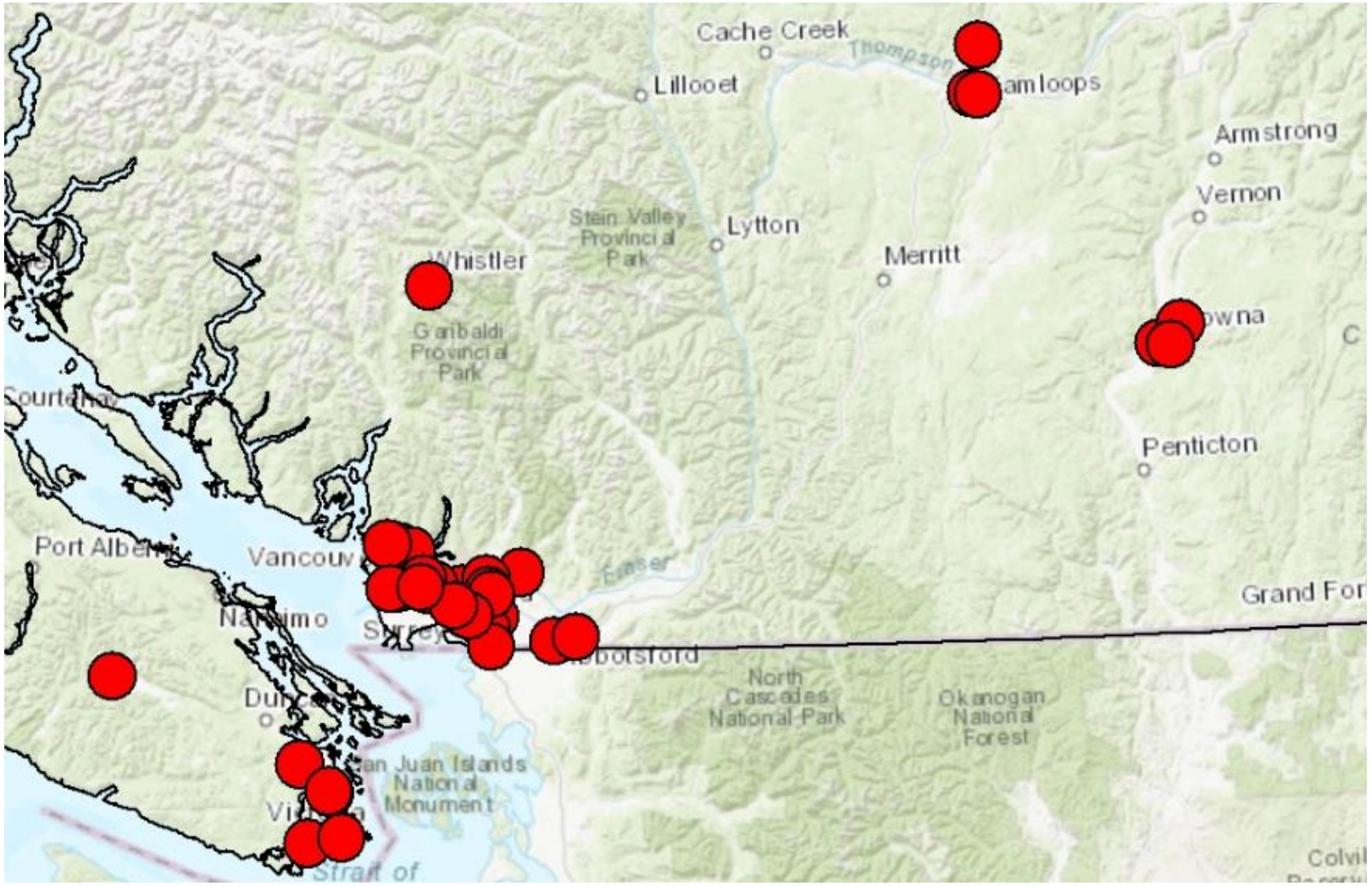
BACKGROUND GROUNDWATER DETERMINATION LOCATIONS



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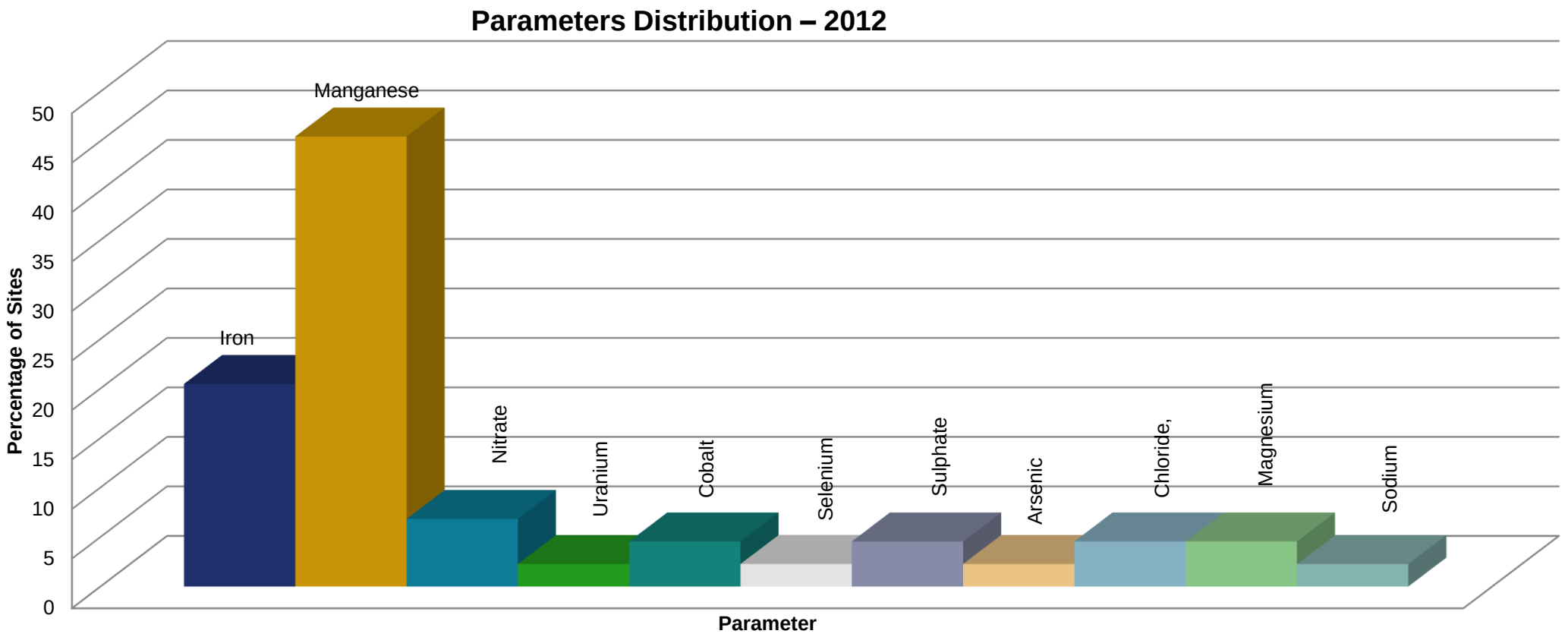
BACKGROUND GROUNDWATER PARAMETERS



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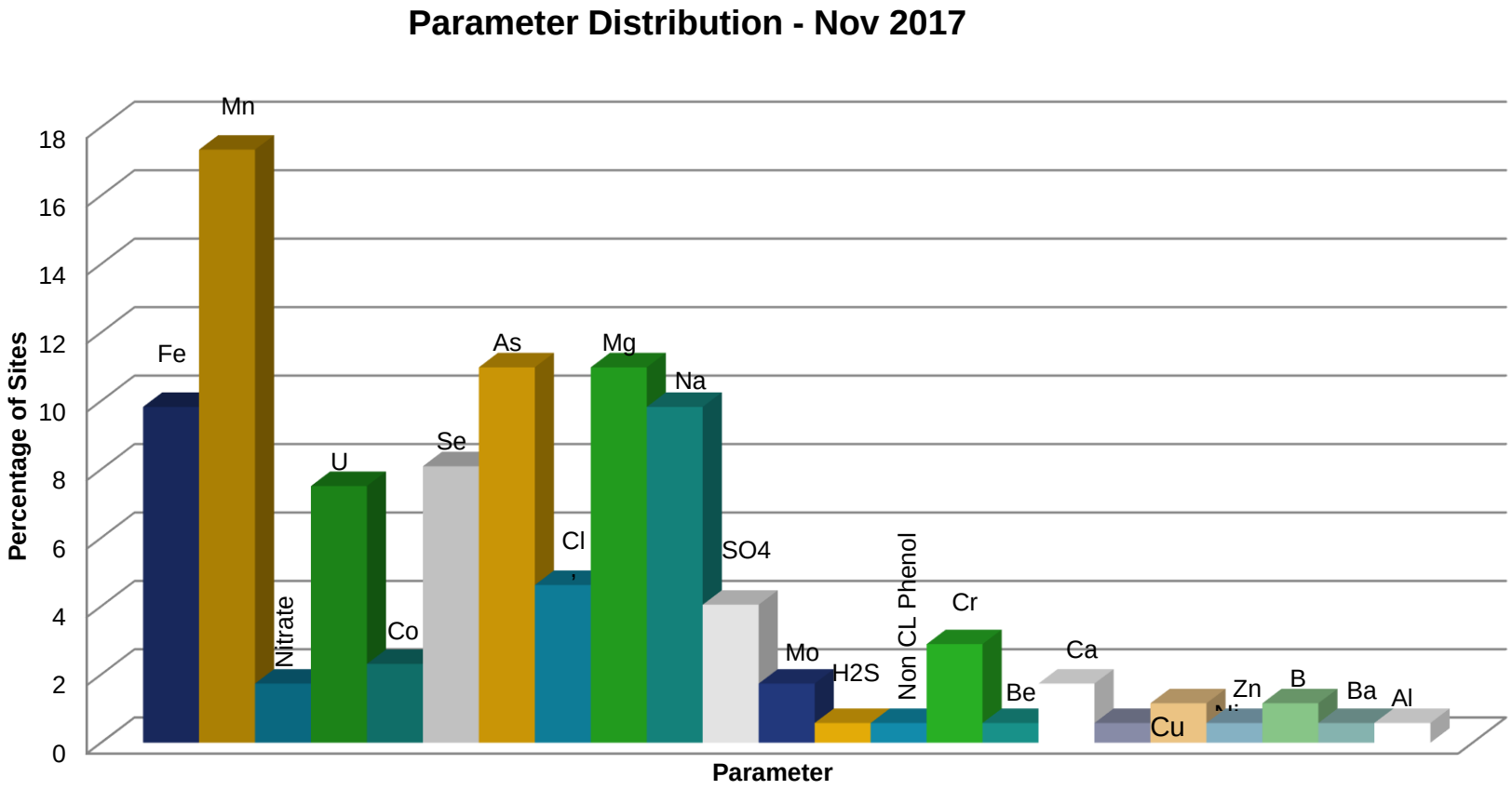
BACKGROUND GROUNDWATER PARAMETERS



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BACKGROUND GROUNDWATER PARAMETERS

Summary of Changes 2012 to 2017		
	2012	Nov 2017
No. Sites	30	90
No. Parameters	11	23
Most Common Parameters	Mn (45%) Fe (20%) NO_3 (7%) Co,SO_4,Cl,Mg (5%) U,Se,As, Na (2%)	Mn (17%) As, Mg (11%) Na, Fe (10%) Se,U,SO4 (7-8%) Cl,Co,Cd,Mo,Ni, Ba,Al,Zn,Cu,Cr, H_2S,NO_3 (<7%)
Trend	Metals other than Mn, Fe make up majority of parameters at sites	

CSAP STAGE 10 AMENDMENT IMPLICATIONS TO P9

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November 2nd, 2017
Vancouver, BC

Assessing Background Metals Concentrations in British Columbia's Groundwater

Prepared by: Luca Malaguti, M. Eng.

The background concentration of a substance is representative of the concentration of a substance in an environmental medium in a geographic area (i.e. in a defined local groundwater flow system), but does not include contributions from local human-made point sources.[1]

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P9 RELATED POLICY DEVELOPMENT

CS e-Link Message

Internet site: www.gov.bc.ca/siteremediation E-mail address: site@gov.bc.ca

Cobalt Interim Background Groundwater Estimate

- Nov 7, 2017 CS-elink extending the cobalt interim background groundwater concentration estimate of 20 µg/L established in 2002;
- Responsible persons may use the interim background groundwater concentration estimate for cobalt of 20 µg/L when assessing the presence of contamination at sites in the Province; and
- Applications for a Director's decision under Protocol 9 are not required. Rather, a statement in the site investigation report that cobalt concentrations in groundwater do not exceed the referenced cobalt interim background groundwater concentration estimate will suffice.

P9 RELATED POLICY DEVELOPMENT

Regional Background Groundwater Contract

- CSAP metals assessment indicated potential implications for CSR Stage 11 standards for cobalt and lithium;
- Competitive bid process for ministry contract ;
- Core 6 was successful bidder. Kickoff meeting Nov 1st.

P9 RELATED POLICY DEVELOPMENT

Contract Scope

- Develop a methodology for establishing regional numbers;
- Create a database of background groundwater chemistry for two regions: Lower Mainland and Okanagan;
- Data collected from various sources: Existing studies, FLNRO data, MOE SITE Database;
- Determine if sub-regions are appropriate;
- Calculate a 95th percentile concentration for each parameter of interest; and
- Ultimately will use this data to develop lookup tables for regions similar to Protocol 4.

QUESTIONS

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