

NHDES Development of PFAS Soil Remediation Standards

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General Rulemaking Process

- Statute requires that rulemaking be initiated by November 1, 2023 for soil remediation standards for:
 - Perfluorononanoic acid (PFNA)
 - Perfluorooctanoic acid (PFOA)
 - Perfluorooctane sulfonic acid (PFOS)
 - Perfluorohexane sulfonic acid (PFHxS)
- These PFAS have AGQS (Ambient Groundwater Quality Standards) established in Env-Or 600
- Rulemaking required by RSA 485-H:13 (July 2022)

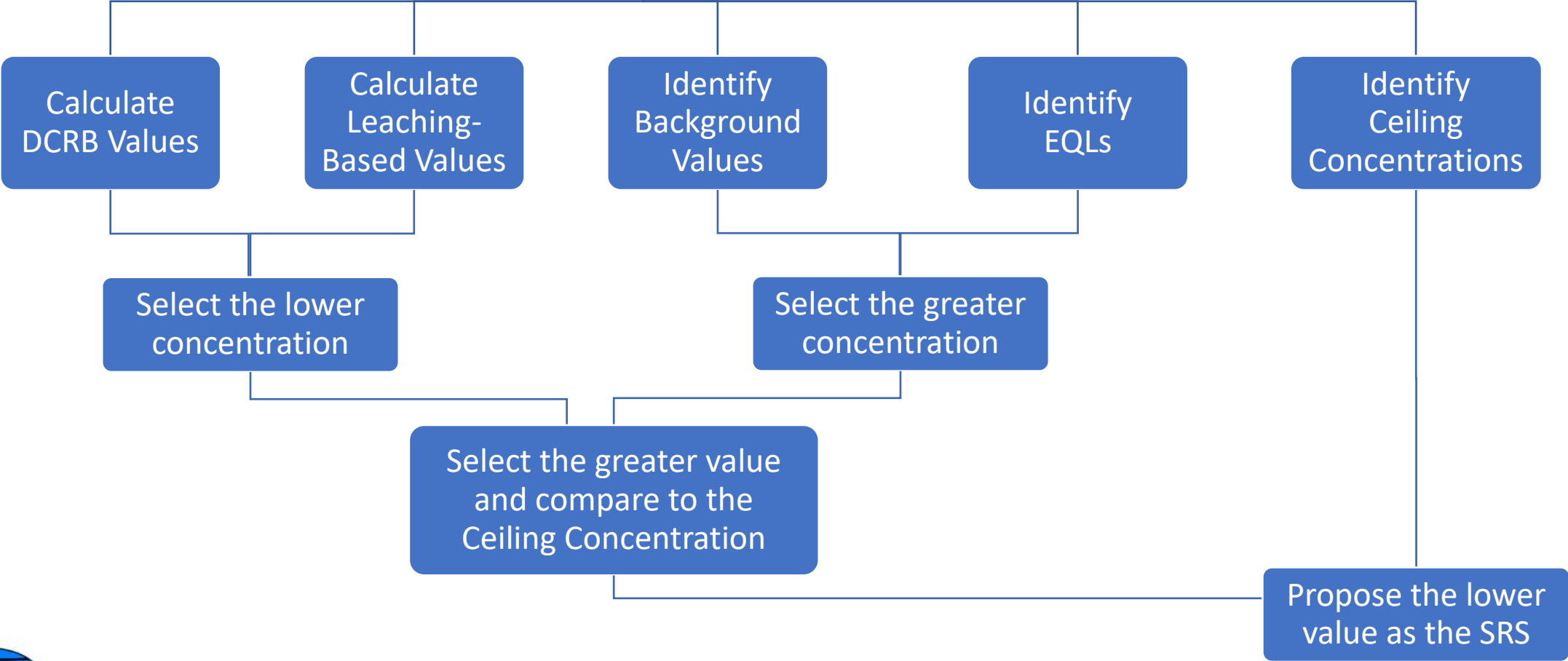
SRS Development Methodology

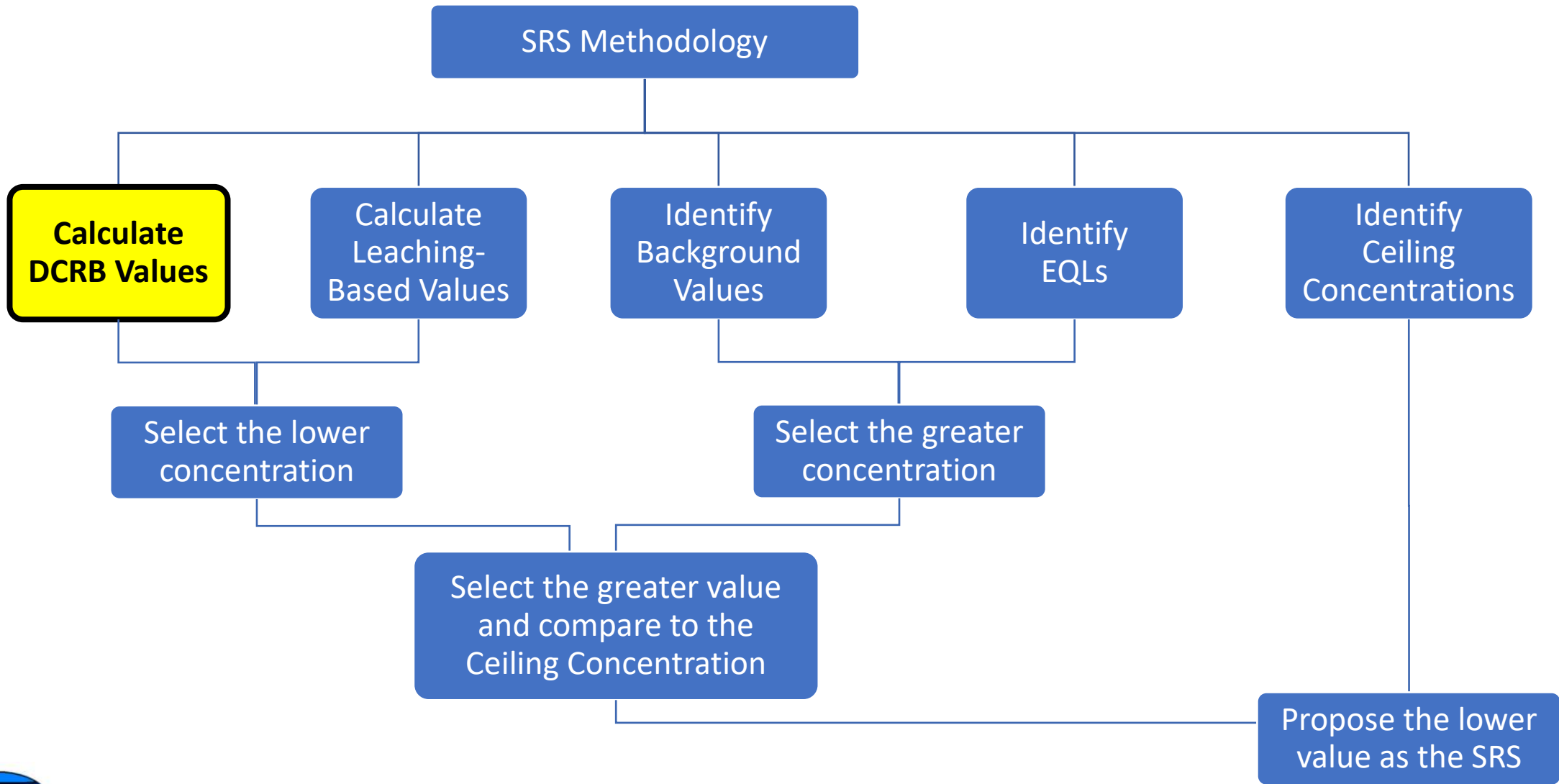
- Evaluate factors that influence standard selection and document in summary table (Risk Characterization Management Policy Appendix E)

Appendix E											
NHDES Risk Characterization and Management Policy											
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Chemical Name	CAS No.	NH S-1 (mg/kg)	NH S-2 (mg/kg)	NH S-3 (mg/kg)	Risk S-1 (mg/kg)	Risk S-2 (mg/kg)	Risk S-3 (mg/kg)	Leaching (GW-1) (mg/kg)	Back- ground (mg/kg)	EQL (mg/kg)	Ceiling Conc. (mg/kg)
Acetone	67-64-1	75	75	75	35,000	310,000	310,000	75		0.5	
Acrylonitrile	107-13-1	0.5	0.5	0.5	3	9	83	0.2		0.5	

- Direct Contact Risk-Based Soil Concentrations (RCMP Appendix A)
- Leaching-Based Soil Concentrations Protective of Groundwater Quality (RCMP Appendix B)
- Background Values
- Estimated Quantitation Limits (RCMP Appendix C)
- Ceiling Concentrations (RCMP Appendix D)

SRS Methodology





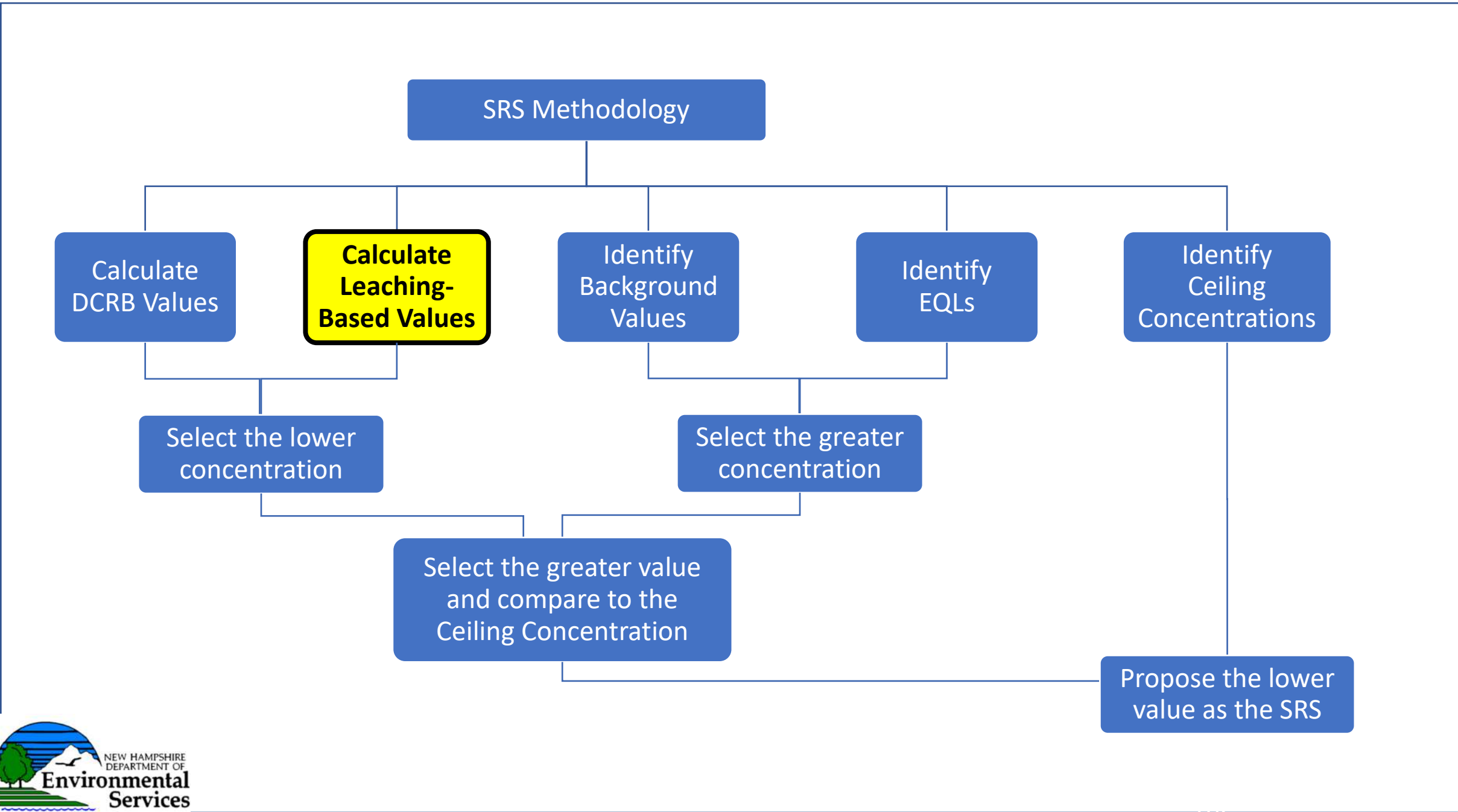
Direct Contact Risk-Based Soil Concentrations

- Methodology consistent with RCMP Appendix A
- Calculate protective values for three exposure scenarios
 - S-1: residential
 - S-2: outdoor worker/passive recreator
 - S-3: construction/utility worker
- Most recent DCRB values were for S-1 and S-2 (December 2019)
- Proposed revisions
 - Update adult body weight in S-2 scenario to be consistent with PFAS MCL development
 - Add S-3 exposure scenario

DRAFT Proposed Direct Contact Values

PFAS	Proposed SRS	Direct Contact			Leaching	Background	EQL	Ceiling		
	S-1/ S-2/ S-3	S-1	S-2	S-3	S-1/ S-2/ S-3	S-1/ S-2/ S-3	S-1/ S-2/ S-3	S-1	S-2	S-3
PFOA		200	1,400	1,400						
PFNA		100	1,000	1,000						
PFHxS		100	900	900						
PFOS		100	700	700						

Values are in nanograms per gram (ng/g), equivalent to parts per billion (ppb)

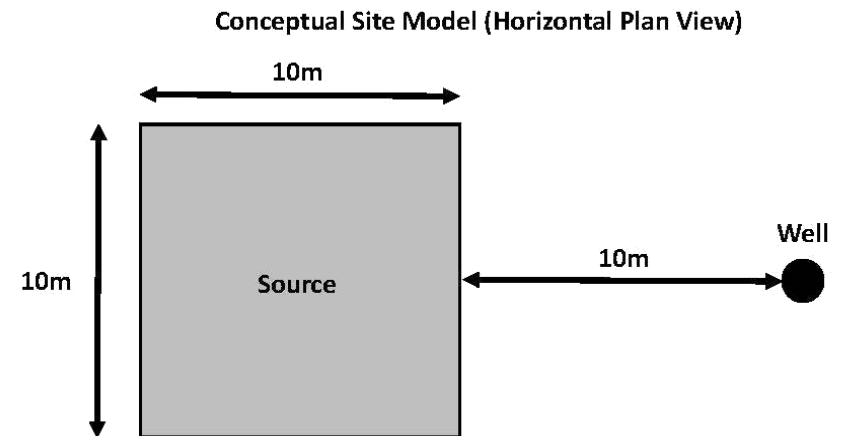
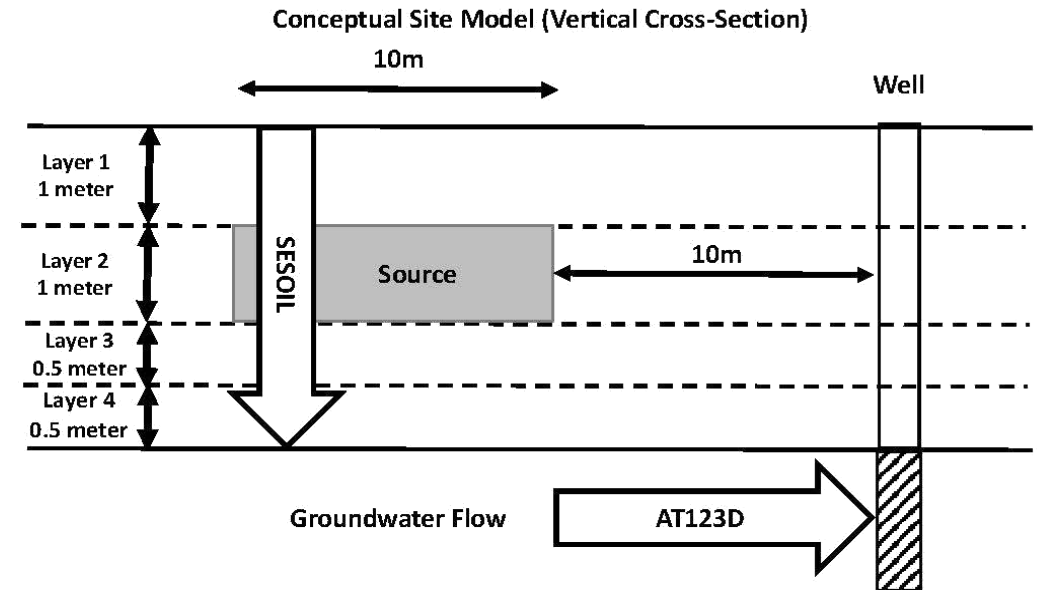


Leaching-Based Soil Concentrations Protective of Groundwater

- Selected computer leaching model: SEVIEW Transport and Fate Modeling Software by ESCI, LLC
 - Model selection and chemical-specific parameters based on NHDES' independent evaluation of consultant's review of potential leaching models
 - Consistent with historical derivation of leaching-based values
 - Used protective release site setting and parameters similar to the approach in RCMP Appendix B
 - Protective but representative of state hydrogeological conditions
 - Selected model limitations – used USGS data to address some uncertainty

Development of Leaching-based Soil Values – Modeling Approach

Subsurface release consistent with derivation of leaching based values for other contaminants (RCMP Appendix B)

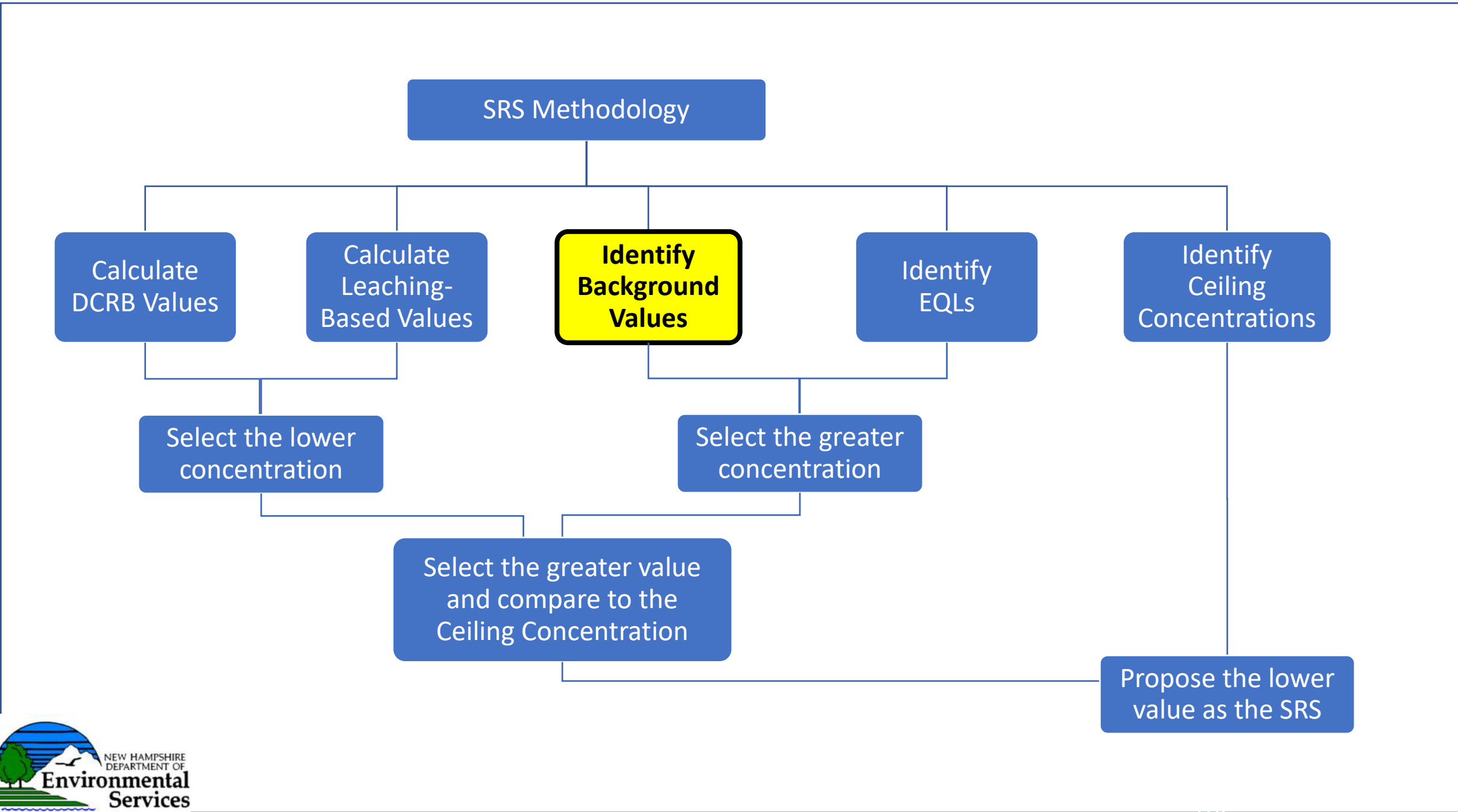


Draft from Sanborn, Head & Associates

DRAFT Proposed Leaching Values

PFAS	Proposed SRS	Direct Contact			Leaching	Background	EQL	Ceiling		
	S-1/ S-2/ S-3	S-1	S-2	S-3	S-1/ S-2/ S-3	S-1/ S-2/ S-3	S-1/ S-2/ S-3	S-1	S-2	S-3
PFOA		200	1,400	1,400	0.1					
PFNA		100	1,000	1,000	0.4					
PFHxS		100	900	900	0.2					
PFOS		100	700	700	0.5					

Values are in nanograms per gram (ng/g), equivalent to parts per billion (ppb)



Identify Background Values

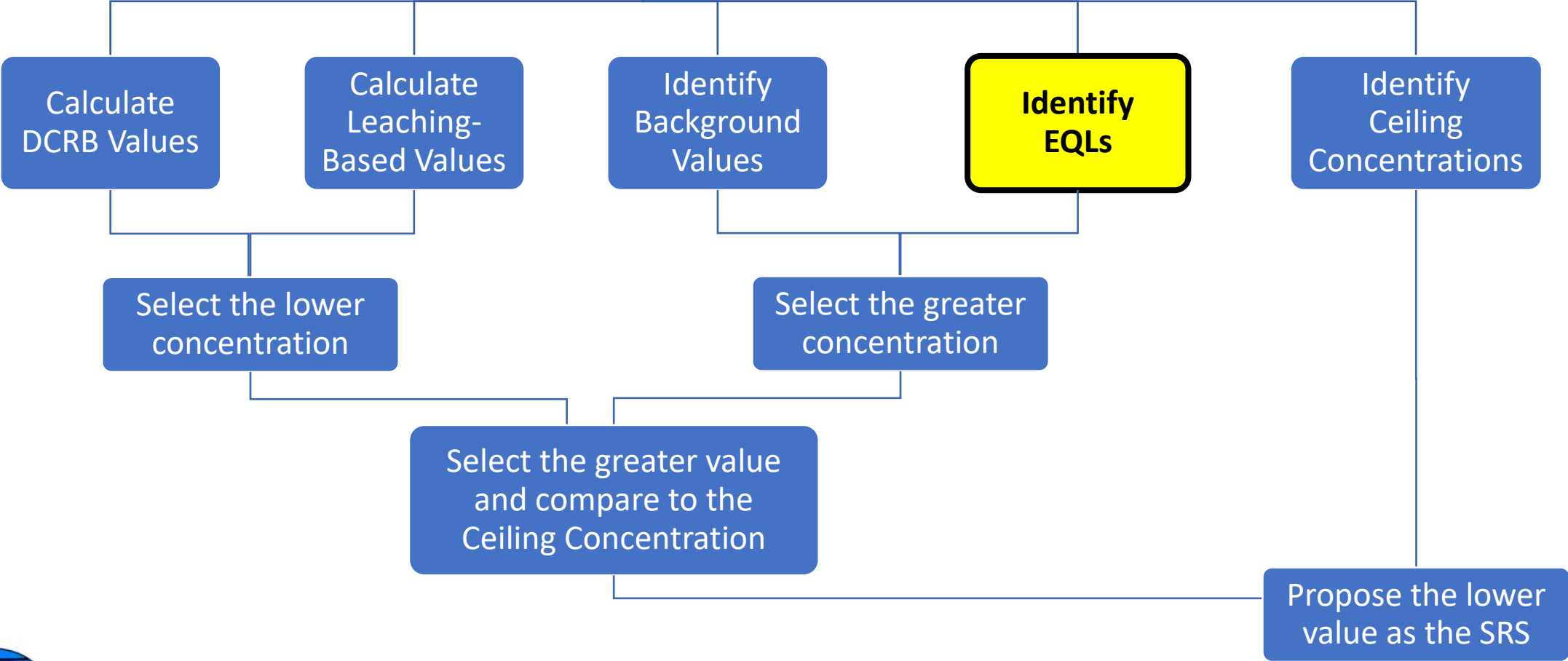
- PFAS are manmade, therefore no natural background concentrations are proposed for SRS derivation
- NHDES proposes to consider anthropogenic ambient background conditions in shallow soil on a site-by-site basis
 - Consistent with Env-Or 606.19(f), SRS will not apply to sites where contamination is at or below background levels
 - Site-specific background evaluations may be warranted, because shallow soil might be impacted based on the findings of the USGS Shallow Soil Study

DRAFT Proposed Background Values

PFAS	Proposed SRS	Direct Contact			Leaching	Background	EQL	Ceiling		
	S-1/ S-2/ S-3	S-1	S-2	S-3	S-1/ S-2/ S-3	S-1/ S-2/ S-3	S-1/ S-2/ S-3	S-1	S-2	S-3
PFOA		200	1,400	1,400	0.1	-				
PFNA		100	1,000	1,000	0.5	-				
PFHxS		100	900	900	0.2	-				
PFOS		100	700	700	0.8	-				

Values are in nanograms per gram (ng/g), equivalent to parts per billion (ppb)

SRS Methodology



Estimated Quantitation Limit (EQL)

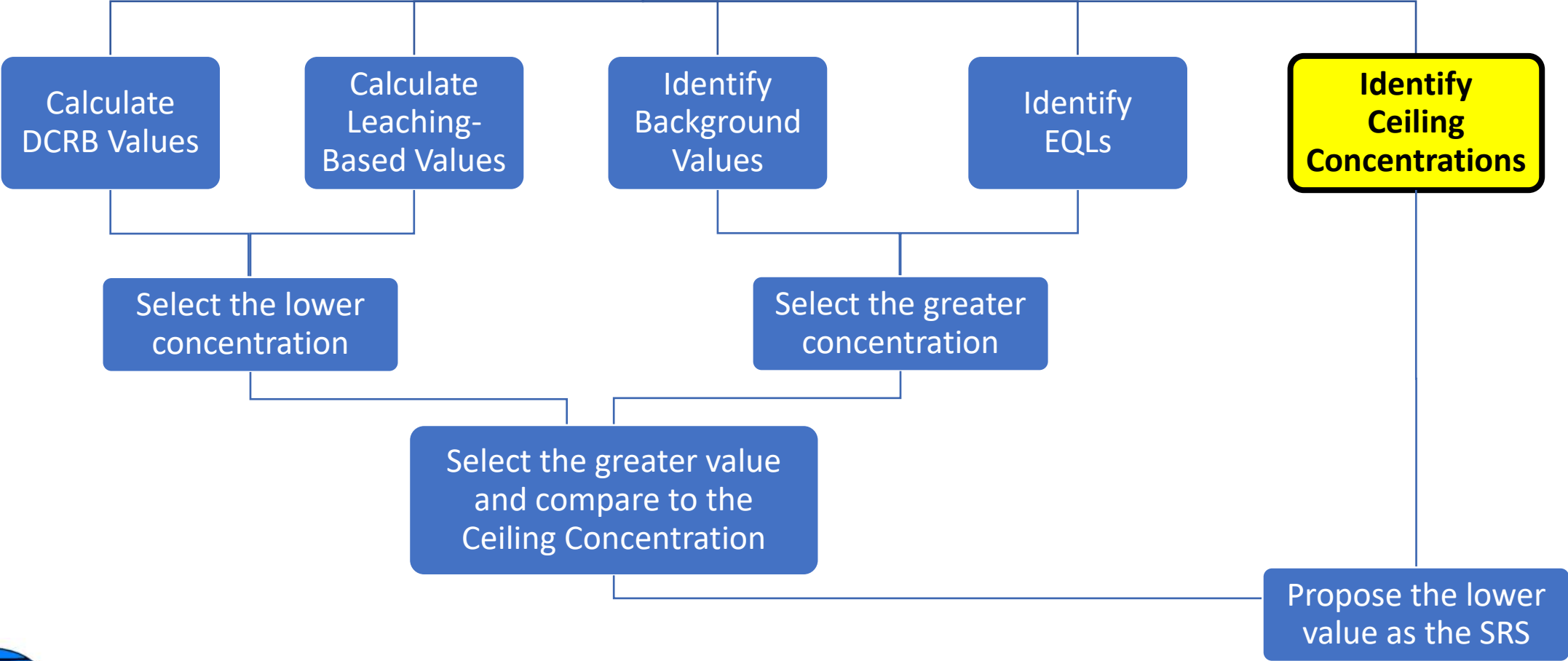
- How low can laboratories reasonably measure the contaminant?
- EQLs are typically tabulated in RCMP Appendix C
- For PFAS
 - Table 8 of EPA's Fourth Draft Method 1633, dated July 2023
 - Draft Method 1633 is currently the only EPA method validated for soil
 - EQLs are subject to change as the draft Method 1633 is finalized and with any future updates to the method

DRAFT Proposed EQL Values

PFAS	Proposed SRS	Direct Contact			Leaching	Background	EQL	Ceiling		
	S-1/ S-2/ S-3	S-1	S-2	S-3	S-1/ S-2/ S-3	S-1/ S-2/ S-3	S-1/ S-2/ S-3	S-1	S-2	S-3
PFOA		200	1,400	1,400	0.1	-	0.2			
PFNA		100	1,000	1,000	0.5	-	0.2			
PFHxS		100	900	900	0.2	-	0.2			
PFOS		100	700	700	0.8	-	0.2			

Values are in nanograms per gram (ng/g), equivalent to parts per billion (ppb)

SRS Methodology



Ceiling Concentrations

- Selected from a matrix in RCMP Appendix D based on the odor index and volatility of the chemical
- Odor index is the ratio of the vapor pressure (VP) for a chemical at ~20° to 30° Celsius (C) and the 50th percentile odor recognition threshold (ORT_{50%})

$$\text{Odor Index} = \text{VP}_{20^{\circ} - 30^{\circ} \text{C}} / \text{ORT}_{50\%}$$

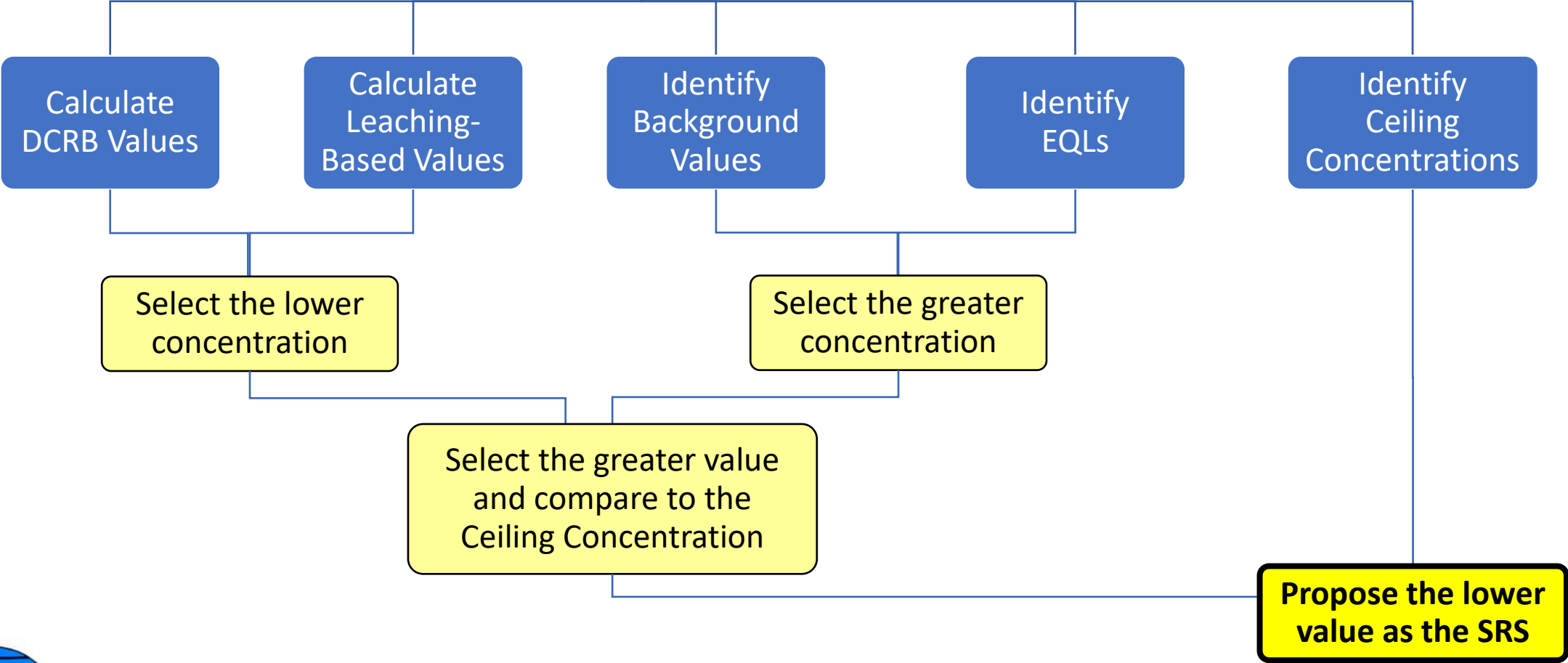
- Volatile chemicals (VP greater than 1 Torr) at ~20° to 30° C are assigned relatively low ceiling concentrations
- Limited PFAS data available

DRAFT Proposed Ceiling Concentrations

PFAS	Proposed SRS	Direct Contact			Leaching	Background	EQL	Ceiling		
	S-1/ S-2/ S-3	S-1	S-2	S-3	S-1/ S-2/ S-3	S-1/ S-2/ S-3	S-1/ S-2/ S-3	S-1	S-2	S-3
PFOA		200	1,400	1,400	0.1	-	0.2	100,000	500,000	1,000,000
PFNA		100	1,000	1,000	0.5	-	0.2	100,000	500,000	1,000,000
PFHxS		100	900	900	0.2	-	0.2	-	-	-
PFOS		100	700	700	0.8	-	0.2	-	-	-

Values are in nanograms per gram (ng/g), equivalent to parts per billion (ppb)

SRS Methodology



DRAFT Proposed SRS and Summary of Values

PFAS	Proposed SRS S-1/ S-2/ S-3	Direct Contact			Leaching	Background	EQL	Ceiling		
		S-1	S-2	S-3	S-1/ S-2/ S-3	S-1/ S-2/ S-3	S-1/ S-2/ S-3	S-1	S-2	S-3
PFOA	0.2	200	1,400	1,400	0.1	-	0.2	100,000	500,000	1,000,000
PFNA	0.4	100	1,000	1,000	0.4	-	0.2	100,000	500,000	1,000,000
PFHxS	0.2	100	900	900	0.2	-	0.2	-	-	-
PFOS	0.5	100	700	700	0.5	-	0.2	-	-	-

Values are in nanograms per gram (ng/g), equivalent to parts per billion (ppb)

On-going Work

- Development of written guidance from HWRB for:
 - Site-specific background assessments for PFAS
 - Site-specific leaching-based soil standards for PFAS
- Coordination with other NHDES programs that might consider SRS, such as:
 - Solid waste
 - Residuals
 - Drinking water
 - Air resources
- Incorporating concepts from public feedback

For Additional Information

[Second Technical Listening Session](#) – slides and recording

NHDES Risk Characterization and Management Policy (RCMP)

- [RCMP Appendices, 2013 update](#)
- [RCMP 2018 update of Appendix B and Appendix E](#)

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