Establishing and Updating Water Quality Objectives for Burrard Inlet

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Art by Olivia George

Tsleil-Waututh Nation
PEOPLE OF THE INLET

KERR WOOD LEIDAL
consulting engineers

Outline

səlilwətaɬ and səlilwət

Colonial impacts on səlilwət

Burrard Inlet Water Quality Objectives

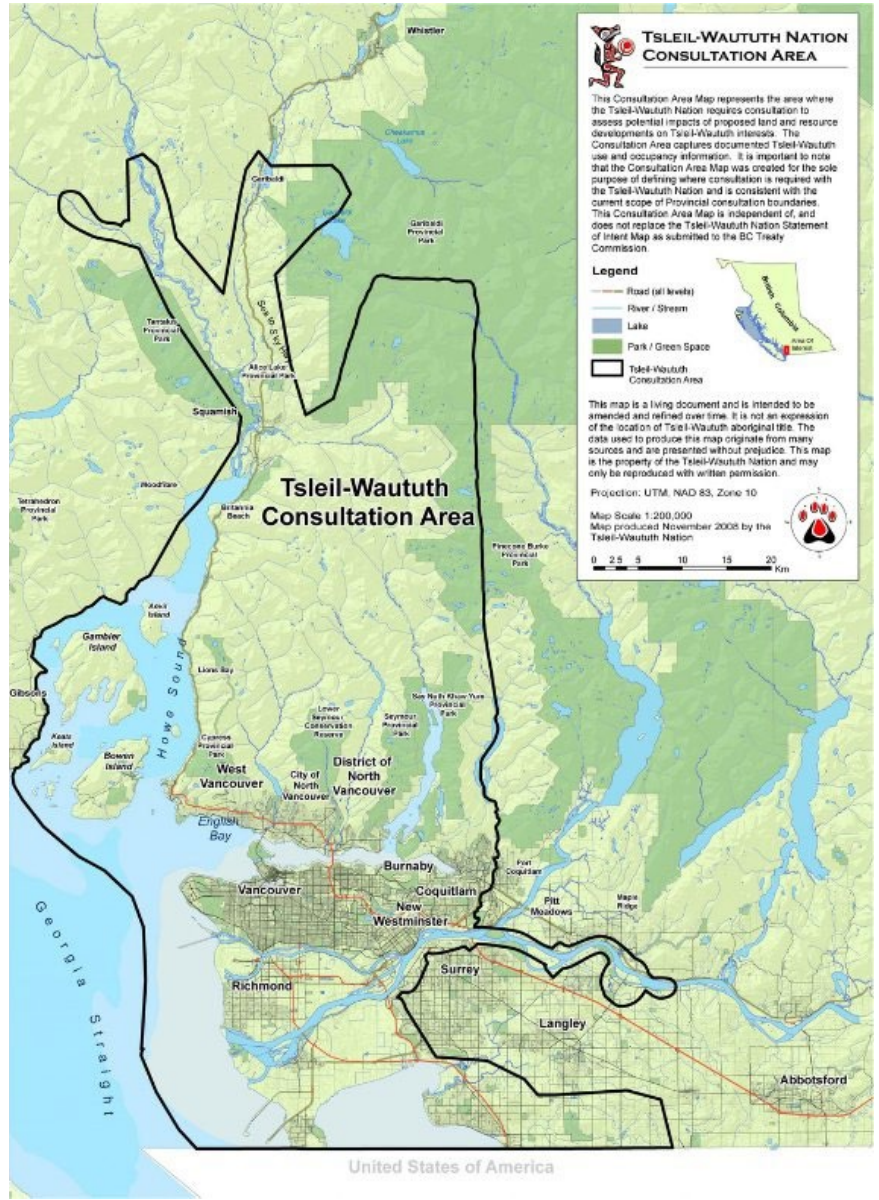
Data Analysis and Deriving Objectives

Next steps

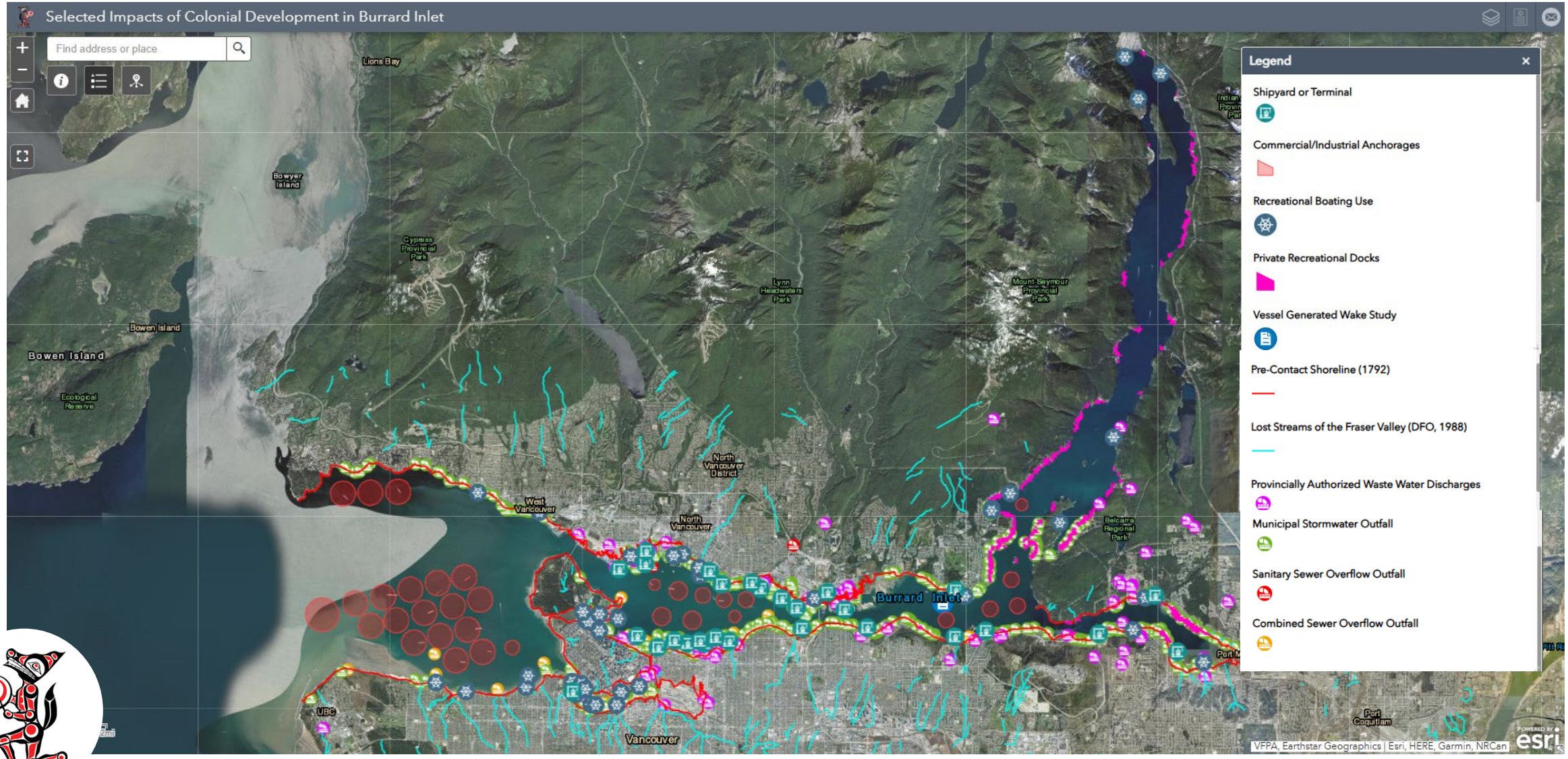
Tsleil-Waututh Nation
PEOPLE OF THE INLET

KERR WOOD LEIDAL
consulting engineers

Tsleil-Waututh: People of the Inlet

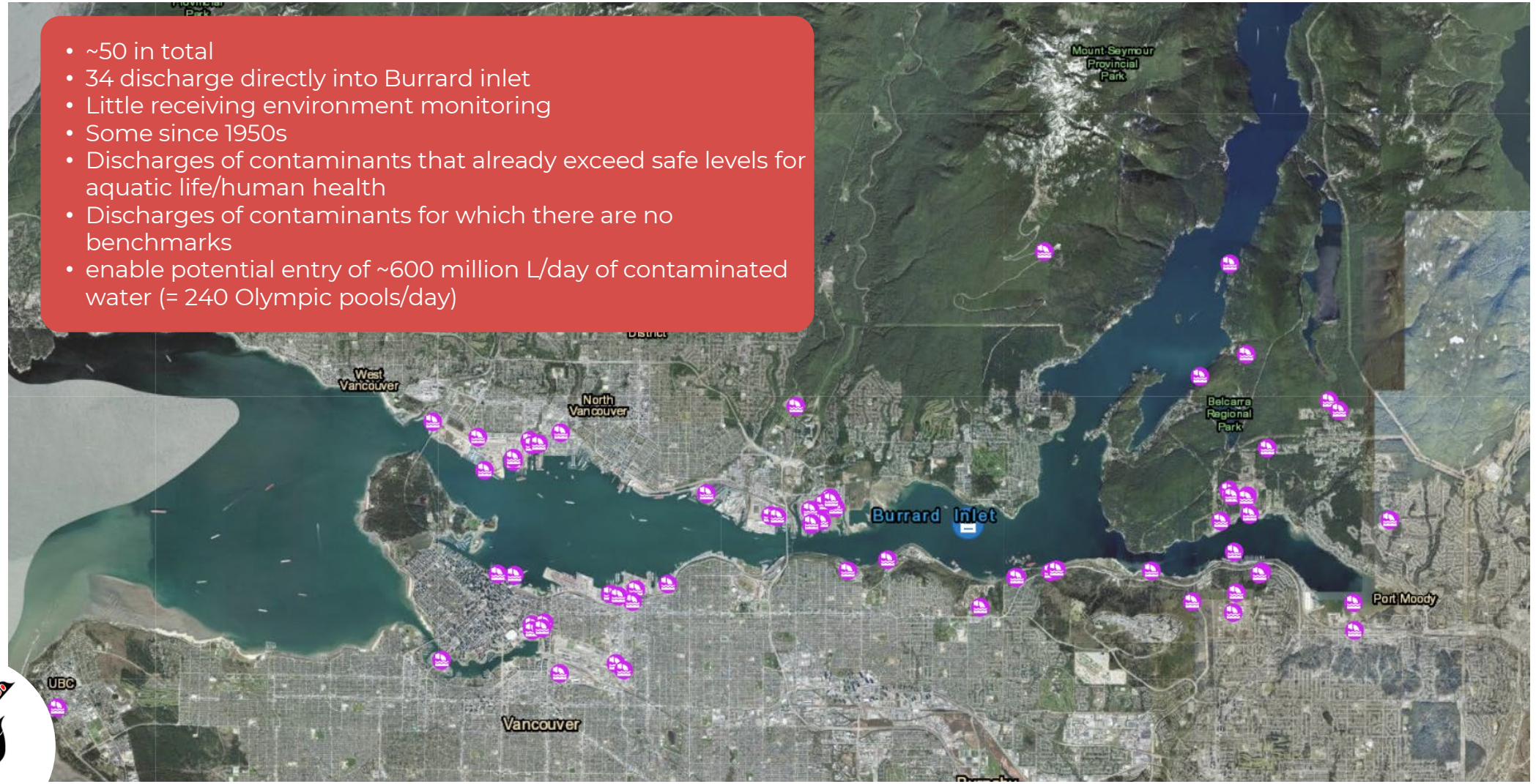

Tsleil-Waututh Nation
Consultation Area
This Consultation Area Map represents the area where the Tsleil-Waututh Nation requires consultation to assess potential impacts of proposed land and resource developments on Tsleil-Waututh interests. The Consultation Area captures documented Tsleil-Waututh use and occupancy information. It is important to note that the Consultation Area Map was created for the sole purpose of defining where consultation is required with the Tsleil-Waututh Nation and is consistent with the current scope of Provincial consultation boundaries. This Consultation Area Map is independent of, and does not replace the Tsleil-Waututh Nation Statement of Intent Map as submitted to the BC Treaty Commission.
Legend
Road (all levels)
River / Stream
Lake
Park / Green Space
Tsleil-Waututh Consultation Area
This map is a living document and is intended to be amended and refined over time. It is not an expression of the location of Tsleil-Waututh aboriginal title. The data used to produce this map originate from many sources and are presented without prejudice. This map is the property of the Tsleil-Waututh Nation and may only be reproduced with written permission.
Projection: UTM, NAD 83, Zone 10
Map Scale 1:200,000
Map produced November 2008 by the Tsleil-Waututh Nation
0 2.5 5 10 15 20 Km
Tsleil-Waututh Consultation Area
Whistler
Squamish
Howe Sound
Gambier Island
Gibsons
West Vancouver
City of North Vancouver
District of North Vancouver
English Bay
Burnaby
Vancouver
Coquitlam
New Westminster
Port Coquitlam
Pitt Meadows
Maple Ridge
Richmond
Surrey
Langley
Abbotsford
Georgia Strait
United States of America

Cumulative Effects



BC-Authorized Discharges

- ~50 in total
- 34 discharge directly into Burrard inlet
- Little receiving environment monitoring
- Some since 1950s
- Discharges of contaminants that already exceed safe levels for aquatic life/human health
- Discharges of contaminants for which there are no benchmarks
- enable potential entry of ~600 million L/day of contaminated water (= 240 Olympic pools/day)



Burrard Inlet Action Plan

Goal A:
Improve water quality and reduce contamination

Strategy A-1:
Review and update water quality objectives for Burrard Inlet

A science-based, First Nations-led initiative to improve the health of the Burrard Inlet ecosystem by 2025

*****BIAP update in progress*****

INPUTS

Aerial Deposition

Industrial products and activities

Vehicles

Household products and activities

Domestic animals

Fraser River, other Tributaries

Stormwater outfalls and sewer overflows

WWTP and other authorized discharges

Dumping / Leaks / Leaching / Spills / Accidents

Boats, float homes, yacht clubs, marinas

Dredging

Wildlife

Natural inputs

RECEIVING ENVIRONMENT

OTHER FACTORS

Historical / Legacy / Bioaccumulation

Circulation

Climate change

AMBIENT WATERS

VALUES

Artwork by Olivia George and Candace Thomas

Burrard Inlet Water Quality Objectives

1 - Gathering

- people
- data
- input

2 - Processing

- work together
- analyze data

3 - Creating

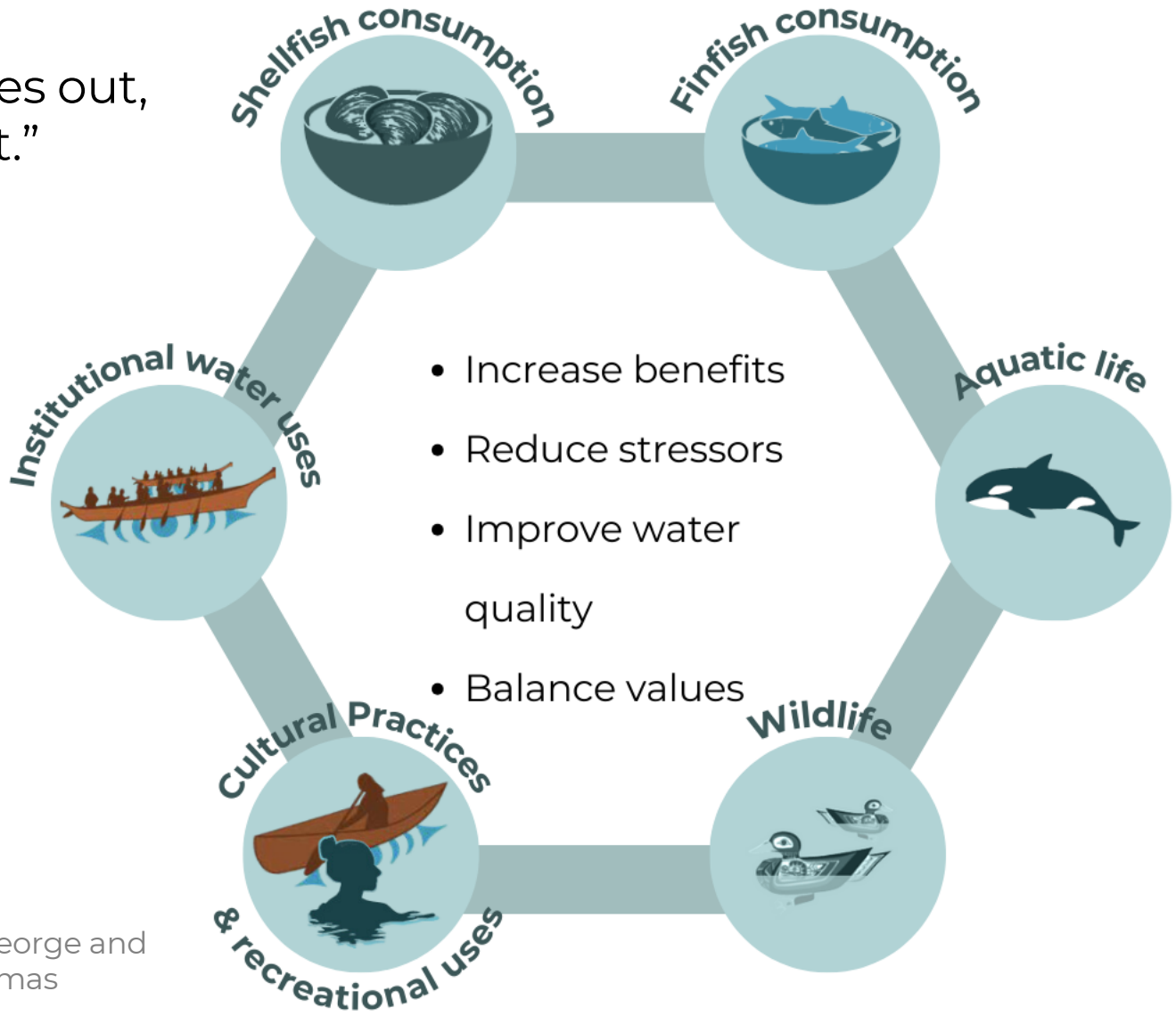
- maps
- reports
- policy
- partnerships

4 - Implementing

- BC
- TWN
- everyone

Burrard Inlet Water Quality Vision & Values

"When the tide goes out, the table is set."



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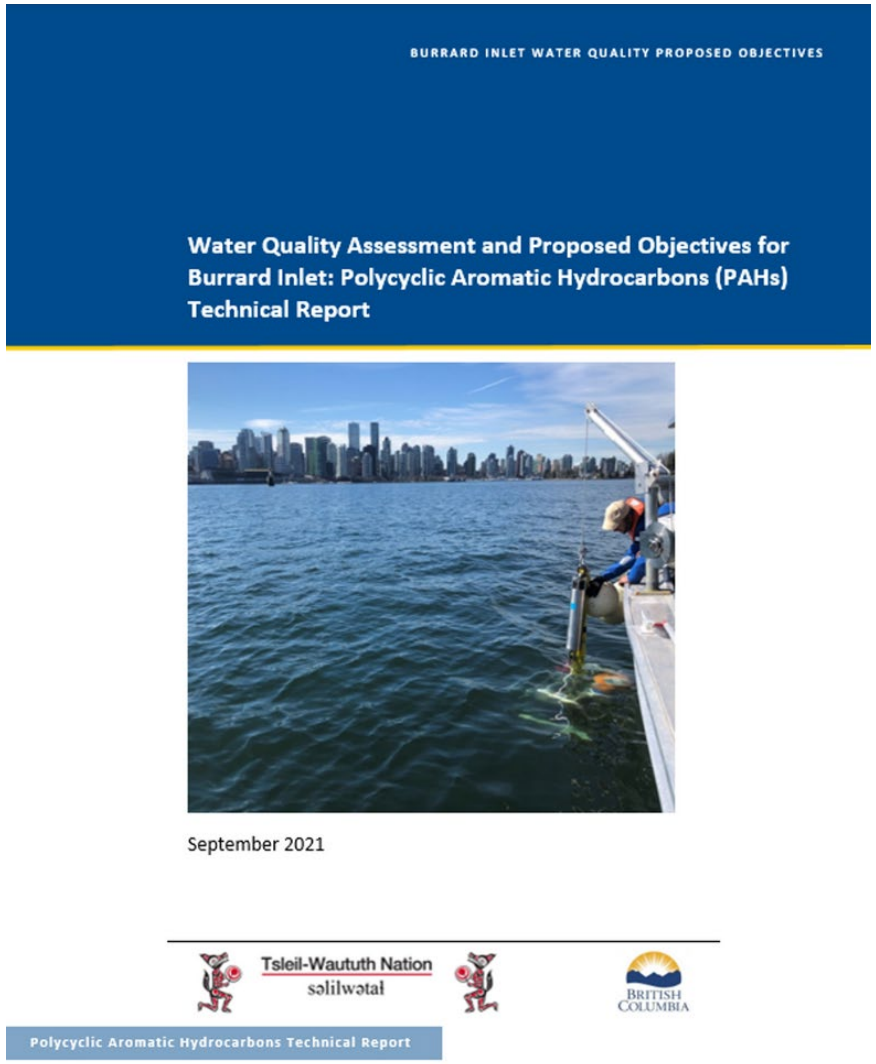
Based on BIAP, adapted by Roundtable



Technical Report Content

- Effects
- Potential Sources and Fate
- Data Analysis:
  - compare to benchmarks
  - develop tissue screening values
  - identify knowledge gaps
- Objectives and Rationale
- Monitoring Recommendations
- Management Options (100+)

COLLECTION AND ASSEMBLY

CLEANING AND PROCESSING

VISUALIZING AND SCREENING

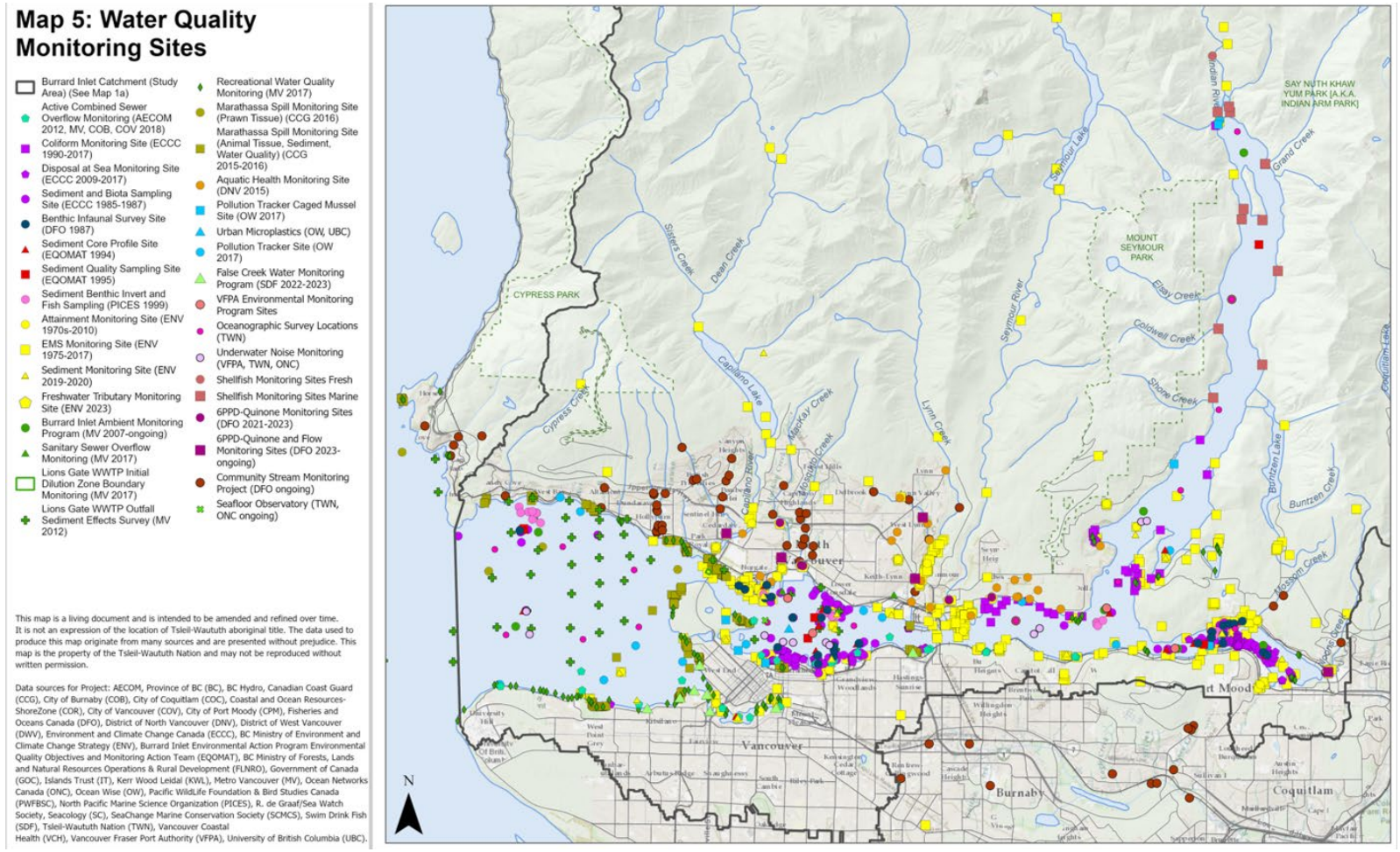
DATA!

ASSESSMENT

OBJECTIVES AND REPORTING

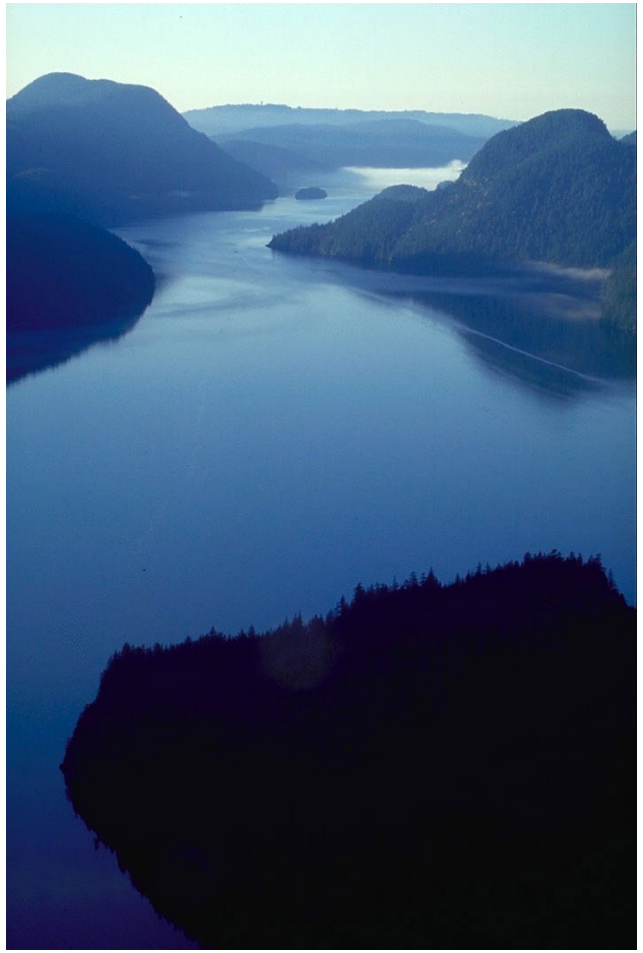
Data Collection and Assembly

- Call out to gather data from government, NGOs, industry
- Prioritized high quality data sets
  - Federal, provincial, and municipal government agencies
  - Ocean Wise, Tsleil-Waututh
  - Lower detection limits, standard protocols for collection/analysis



Benchmarks to Assess Potential Effects

- Assigned screening benchmarks using most conservative numerical values from provincial, federal, or relevant international guidelines
- Worked with a team of scientists to calculate tissue screening benchmarks:
  - derived by BC using Health Canada toxicological reference values (TRV) for effects of contaminants consumed in tissue



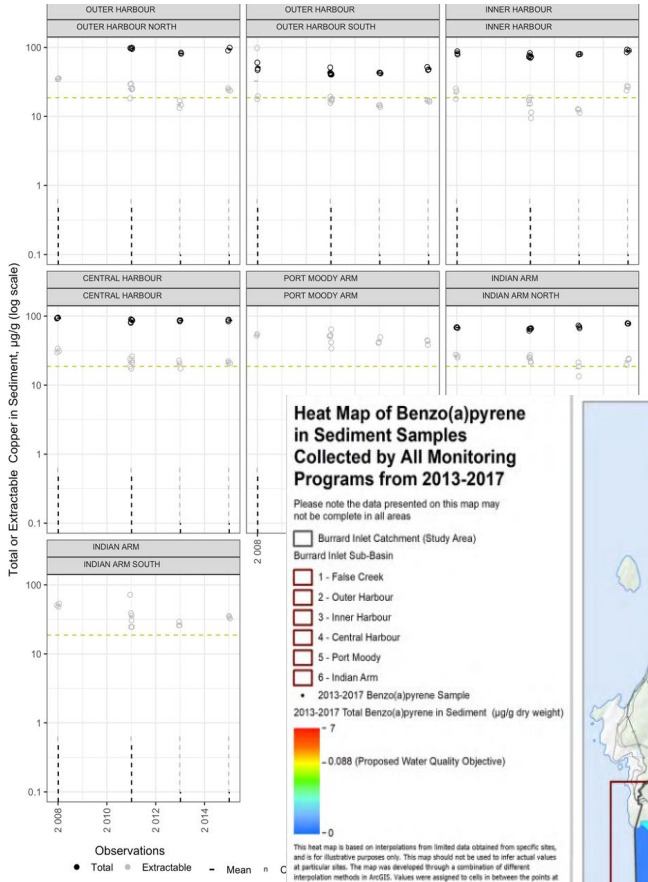
Cleaning and Screening the Data

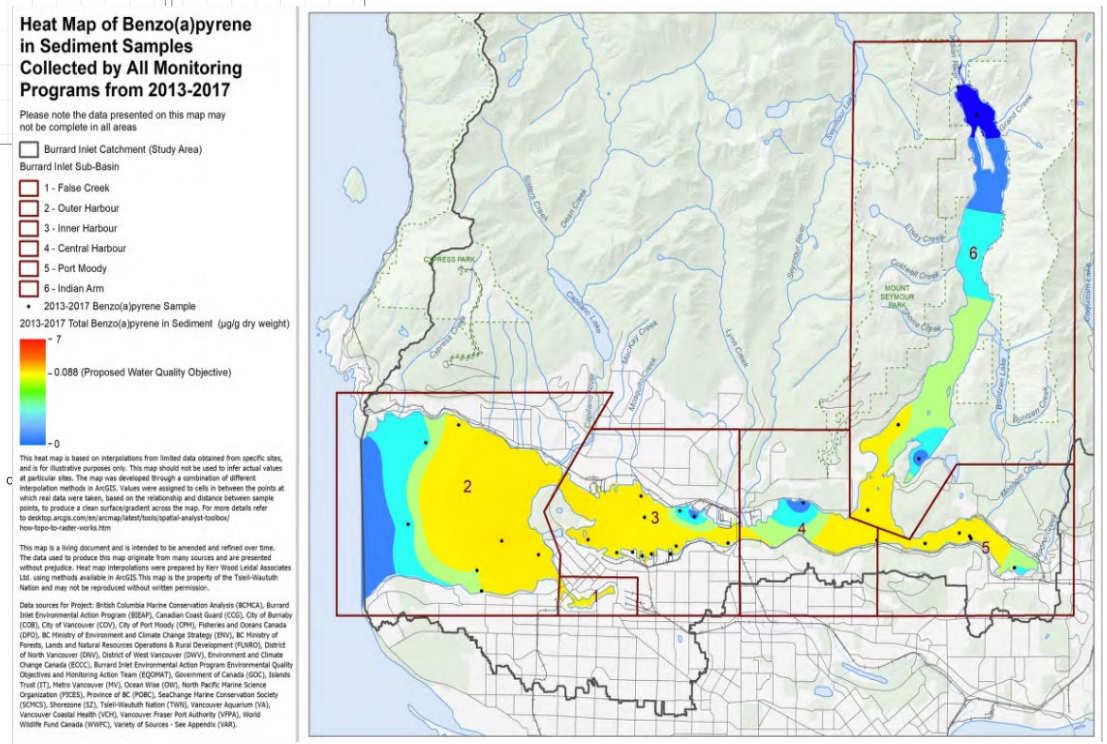
- > 600,000 data points
- 8 marine, 12 freshwater datasets
- 950 unique parameters
- 1971 onwards
- Built codes (in R) for rapid data screening and contaminant prioritization for objectives reports

03_3454022_BIDat_Import.R | BIdat

Filter | Cols: « < 1 – 50 > »

	dataSourceID	ownerSiteID	sampleDate	stateName	resultLetter	value	locationName	parameterName	units	speciesCommon
93830	MOE-EMS-MUL-001-2017	300082	1975-06-03	MARINE WATER	=	1.500e+01	FALSE CREEK CAMBIE ST	COLOR TR	Rel Unit	NA
93831	MOE-EMS-MUL-001-2017	300082	1975-06-03	MARINE WATER	=	1.600e+01	FALSE CREEK CAMBIE ST	T SAMPLG	DEG.C	NA
93832	MOE-EMS-MUL-001-2017	300082	1975-06-03	MARINE WATER	=	1.820e+01	FALSE CREEK CAMBIE ST	RESF 105	G/L	NA
93833	MOE-EMS-MUL-001-2017	300082	1975-06-03	MARINE WATER	=	1.800e+04	FALSE CREEK CAMBIE ST	SPF COND	UMHO/CM	NA
93834	MOE-EMS-MUL-001-2017	300082	1975-06-03	MARINE WATER	=	1.920e+05	FALSE CREEK CAMBIE ST	POTASIUM DISSOLVED	µg/L	NA
93835	MOE-EMS-MUL-001-2017	300082	1975-06-03	MARINE WATER	=	2.000e+00	FALSE CREEK CAMBIE ST	TURBIDTY	J.T.UNIT	NA
93836	MOE-EMS-MUL-001-2017	300082	1975-06-03	MARINE WATER	=	2.560e+04	FALSE CREEK CAMBIE ST	SPF COND	UMHO/CM	NA
93837	MOE-EMS-MUL-001-2017	300082	1975-06-03	MARINE WATER	=	5.000e+00	FALSE CREEK CAMBIE ST	EXT.DEPH	FEET	NA
93838	MOE-EMS-MUL-001-2017	300082	1975-06-03	MARINE WATER	=	5.250e+06	FALSE CREEK CAMBIE ST	SODIUM DISSOLVED	µg/L	NA
93839	MOE-EMS-MUL-001-2017	300082	1975-06-03	MARINE WATER	=	6.250e+05	FALSE CREEK CAMBIE ST	MGNESIUM DISSOLVED	µg/L	NA
93840	MOE-EMS-MUL-001-2017	300082	1975-06-03	MARINE WATER	=	7.600e+00	FALSE CREEK CAMBIE ST	PH	Rel Unit	NA
93841	MOE-EMS-MUL-001-2017	300082	1975-06-03	MARINE WATER	=	7.800e+03	FALSE CREEK CAMBIE ST	OXY DISS	µg/L	NA
93842	MOE-EMS-MUL-001-2017	300082	1975-06-03	MARINE WATER	=	7.820e+04	FALSE CREEK CAMBIE ST	ALKALI T	µg/L	NA
93843	MOE-EMS-MUL-001-2017	300082	1975-06-03	MARINE WATER	=	8.000e+00	FALSE CREEK CAMBIE ST	PH	Rel Unit	NA
93844	MOE-EMS-MUL-001-2017	300082	1975-06-03	MARINE WATER	=	8.000e+03	FALSE CREEK CAMBIE ST	RESNF 105	µg/L	NA
93845	MOE-EMS-MUL-001-2017	300082	1975-06-03	MARINE WATER	<	1.000e+00	FALSE CREEK CAMBIE ST	COPPER DISSOLVED	µg/L	NA
93846	MOE-EMS-MUL-001-2017	300082	1975-06-03	MARINE WATER	<	1.000e+00	FALSE CREEK CAMBIE ST	COPPER TOTAL	µg/L	NA
93847	MOE-EMS-MUL-001-2017	300082	1975-06-03	MARINE WATER	<	5.000e+00	FALSE CREEK CAMBIE ST	IRON DISSOLVED	µg/L	NA
93848	MOE-EMS-MUL-001-2017	300082	1975-06-03	MARINE WATER	=	6.000e+00	FALSE CREEK CAMBIE ST	NITRITE	µg/L	NA
93849	MOE-EMS-MUL-001-2017	300082	1975-06-03	MARINE WATER	=	1.300e+01	FALSE CREEK CAMBIE ST	PHOS ORT	µg/L	NA
93850	MOE-EMS-MUL-001-2017	300082	1975-06-03	MARINE WATER	=	1.400e+01	FALSE CREEK CAMBIE ST	CHROMIUM TOTAL	µg/L	NA
93851	MOE-EMS-MUL-001-2017	300082	1975-06-03	MARINE WATER	=	2.100e+01	FALSE CREEK CAMBIE ST	MANGNESE TOTAL	µg/L	NA
93852	MOE-EMS-MUL-001-2017	300082	1975-06-03	MARINE WATER	=	2.200e+01	FALSE CREEK CAMBIE ST	ZINC DISSOLVED	µg/L	NA
93853	MOE-EMS-MUL-001-2017	300082	1975-06-03	MARINE WATER	=	2.200e+01	FALSE CREEK CAMBIE ST	ZINC TOTAL	µg/L	NA
93854	MOE-EMS-MUL-001-2017	300082	1975-06-03	MARINE WATER	=	4.000e+01	FALSE CREEK CAMBIE ST	NITRATE	µg/L	NA
93855	MOE-EMS-MUL-001-2017	300082	1975-06-03	MARINE WATER	=	7.400e+01	FALSE CREEK CAMBIE ST	PHOS TOT	µg/L	NA





Comparing to Screening Benchmarks

- Assessed programs individually due to methodology differences
- Filtered out non-detects
- Produced summary statistics and exceedance counts
- Prepared heat maps for contaminant hot spots

Deriving Objectives

- Identifying parameters of greatest concern to water values
- Screening, prioritization, data assessment, identification of exceedances
- If data exceeded the benchmark, adopted the most conservative benchmark
- If no exceedances, derived numerical objectives (e.g., no change from current low value)

Sub-basin	Outer Harbour	False Creek	Inner Harbour	Central Harbour	Port Moody Arm	Indian Arm
Total Arsenic in Water (Interim)	2.4 µg/L mean[1]					
Total Arsenic in Sediment	7.24 µg/g dry weight single-sample maximum[2]					
Total Arsenic in Tissue (Interim)	0.0258 µg/g wet weight single-sample maximum (all tissue types)[3]					

[1] Minimum of 5 samples in 30 days collected during the wet season. No more than 20% of samples > 2.4 µg/L.
[2] Based on at least 1 composite sample consisting of at least 3 replicates.
[3] Applies to all tissue types. Based on at least 1 composite sample consisting of at least 5 fish or 25 bivalves. See Rao et al. (in prep) for additional details. Assumes that 10% of total arsenic is present as inorganic arsenic.

Deriving Objectives

Proposed Water Quality Objectives for Contaminants of Emerging Concern

Sub-basin	False Creek	Outer Harbour	Inner Harbour	Central Harbour	Port Moody Arm	Indian Arm
All media	**All CECs** Decreasing trend in concentrations					
Water	**Alkylphenols and their Ethoxylates** Nonylphenol and its Ethoxylates: 0.7 µg/L (total toxic equivalent of nonylphenolic compounds)					
	Bisphenols Bisphenol A (BPA): 0.9 µg/L					
	Phthalates Di-methyl phthalate (DMP): 2000 µg/L Di-ethyl phthalate (DEP): 600 µg/L Di-(n)-butyl phthalate (DnBP): 30 µg/L Benzyl butyl phthalate (BBP): 0.1 µg/L Di-(2-ethylhexyl) phthalate (DEHP): 0.37 µg/L Di-n-butyl phthalate (DnOP): Do not detect* and/or decrease in current levels					
	6PPD and 6PPD-Quinone 6PPD and 6PPD-Quinone: Do not detect* and/or decrease in current levels					
	Organotins Tributyltin (TBT): 0.001 µg/L					
	Brominated Flame Retardants Hexabromocyclododecane (HBCD): 0.56 µg/L Tetrabromobisphenol A (TBBPA): 3.1 µg/L Hexabromobenzene (HBB): Do not detect* and/or decrease in current levels					
	Perfluoroalkyl and Polyfluoroalkyl Substances Perfluorooctanoic acid (PFOA): Do not detect* and/or decrease in current levels Perfluorooctanesulfonic acid (PFOS): 3.4 µg/L					

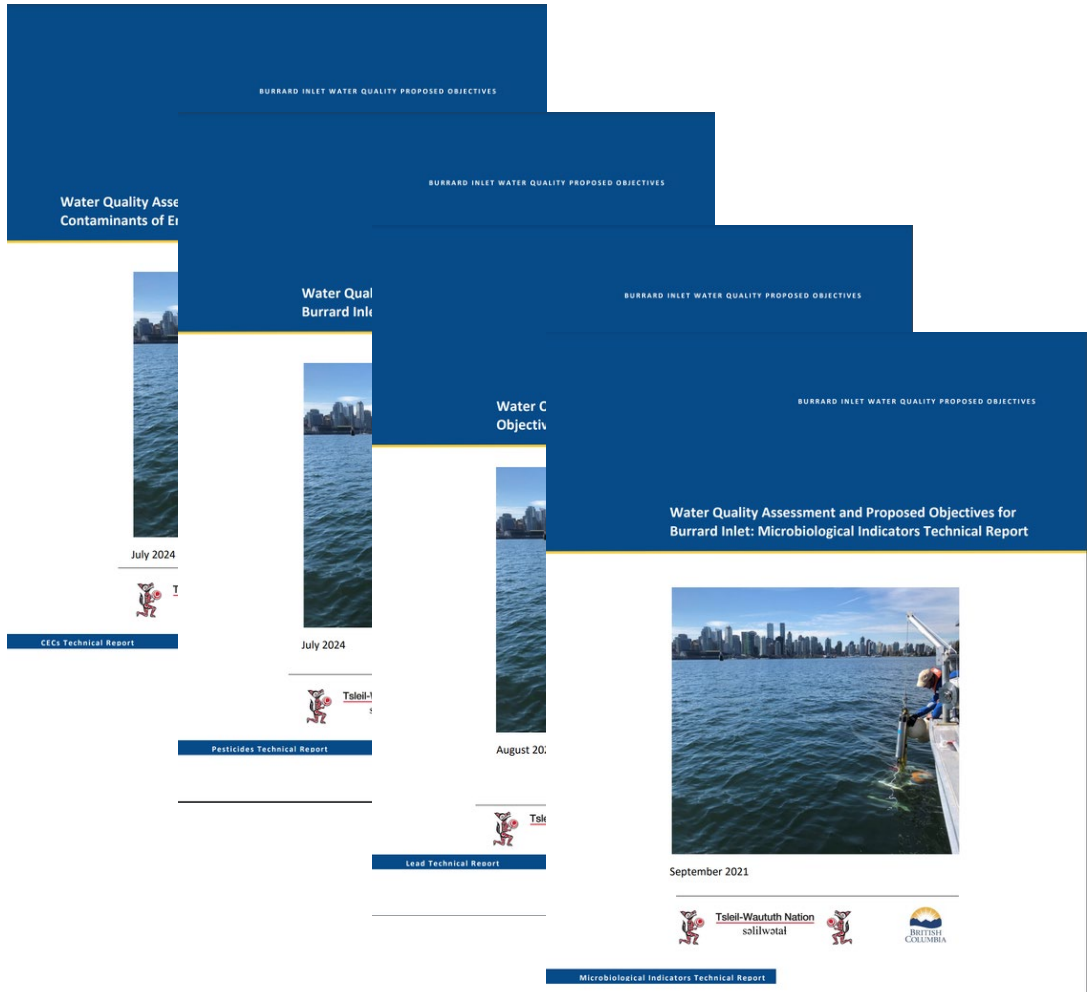
Preparing Monitoring and Management Actions

- Data gaps or limitations informed monitoring recommendations
  - Coordinated monitoring approach
  - Consistent methodologies, detection limits
  - Unknowns, missing data, under-monitored areas
  - Potential hot spots, sources, or risks

- Initiatives or activities that could be enhanced
  - Identified practices used elsewhere that could be applied
  - Prioritize source controls and stormwater treatment
  - Encourage widespread adoption

Existing Objectives

- Contaminants of Emerging Concern (CECs)
- Metals
- Microbiological indicators
- Microplastics
- Persistent organic pollutants (POPs)
- Pesticides, current use and legacy
- Physical parameters
- Pharmaceuticals and personal care products (PPCPs)



In progress: Freshwater tributaries, Remaining Marine Parameters

Contaminants in Burrard Inlet

700

Contaminants detected in Burrard Inlet between 1971 and 2016

>600

Contamination direct entry points

>56

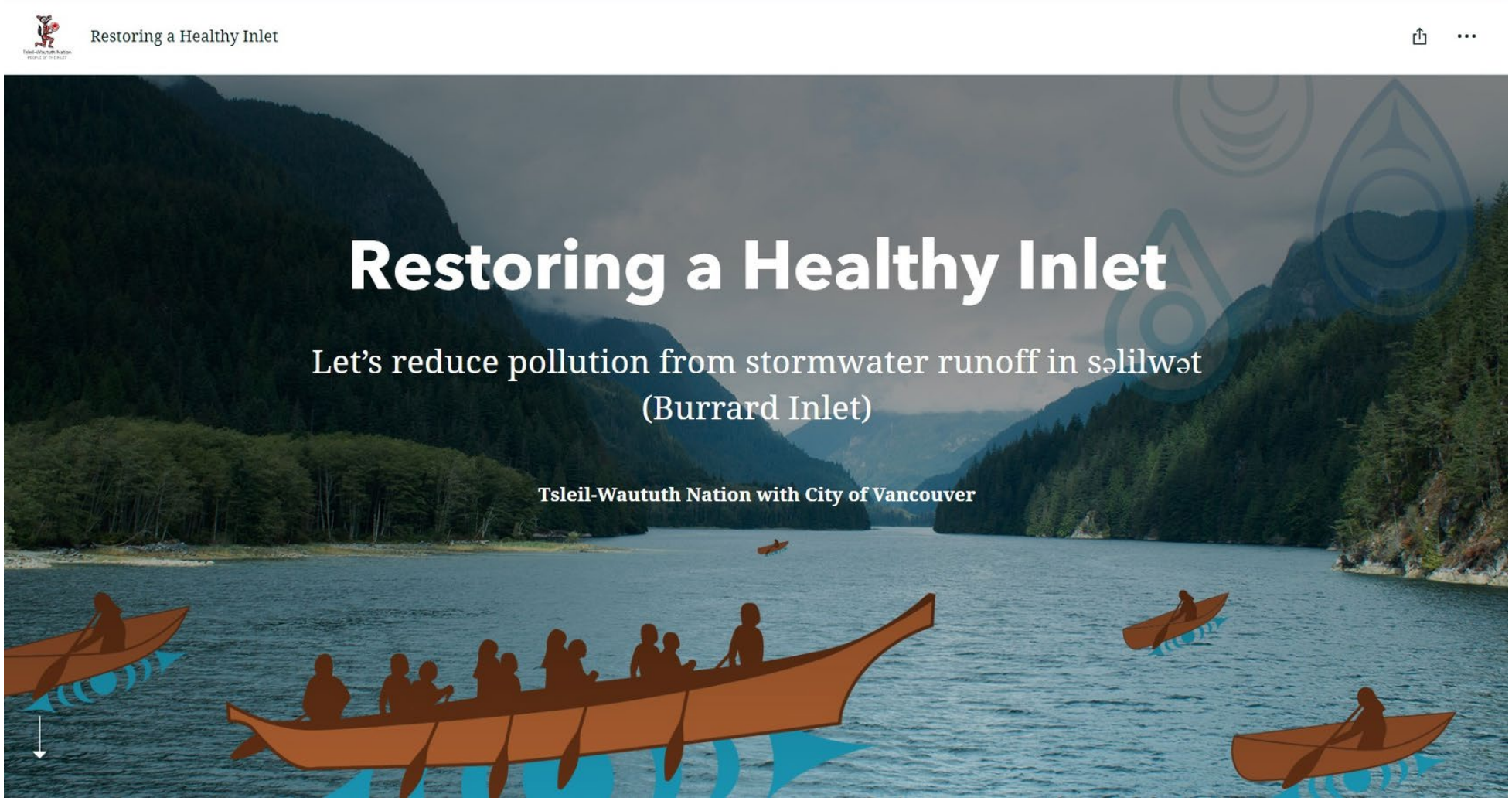
Contaminants exceeded benchmarks for water, sediment and/or tissue

27

Other contaminants with exceedances included in BC wastewater discharges

https://twnsacredtrust.ca/wp-content/uploads/2022/03/20220210_Contaminants-impacts-on-TWN_Formatted.pdf

twnation.ca/stormwater



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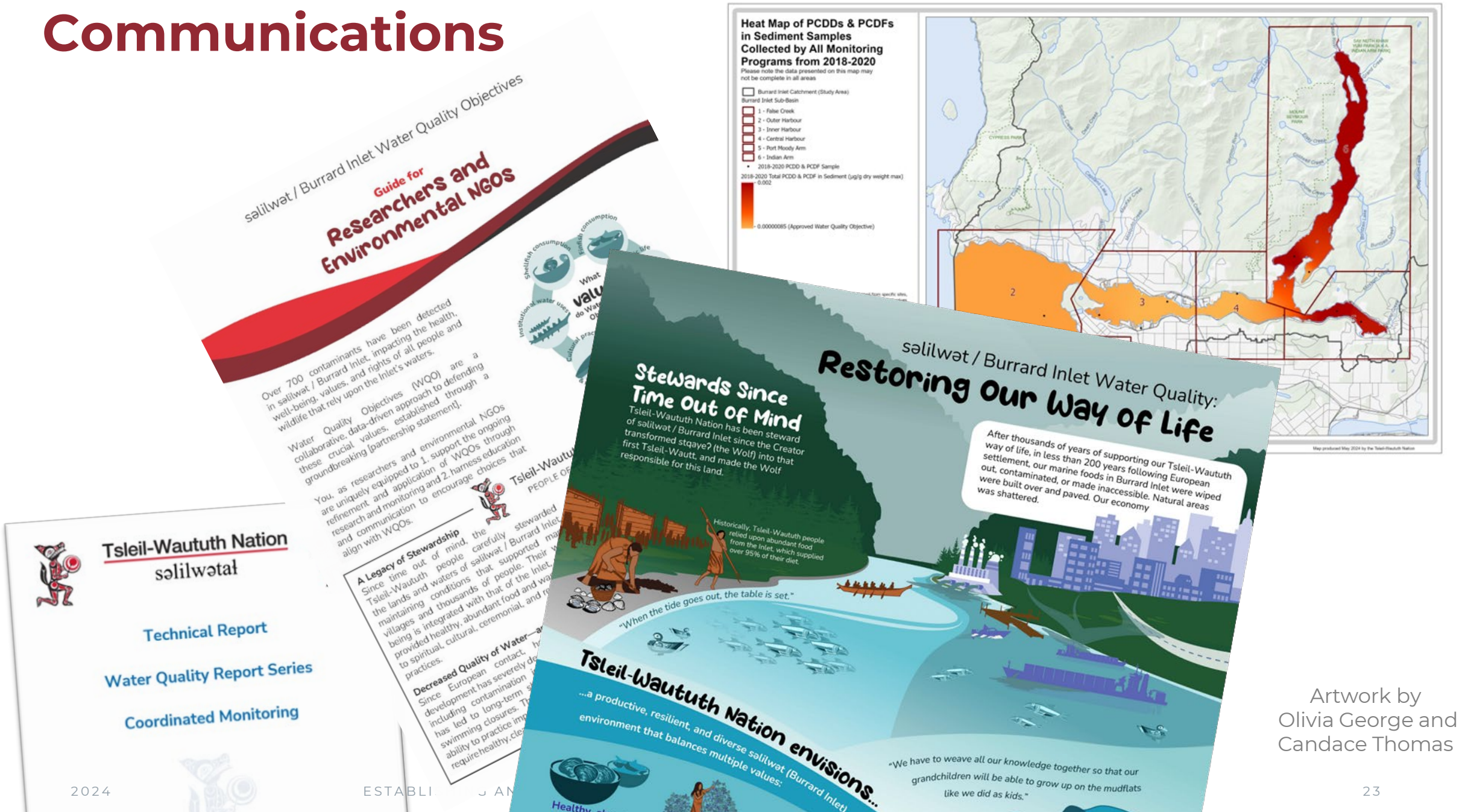
Communications



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Olivia George and
Candace Thomas

Groundbreaking Work

- **First** BC-First Nation co-approved water quality policy
- **Founded** on Indigenous values
- **Protects** collectively-identified water values
- **Merges** Indigenous and western science
- **Tissue** objectives to protect Indigenous seafood consumers
- **Convened** multiple sectors: input and review
- **Holistic** Burrard Inlet basin-wide scale

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Thank you all

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