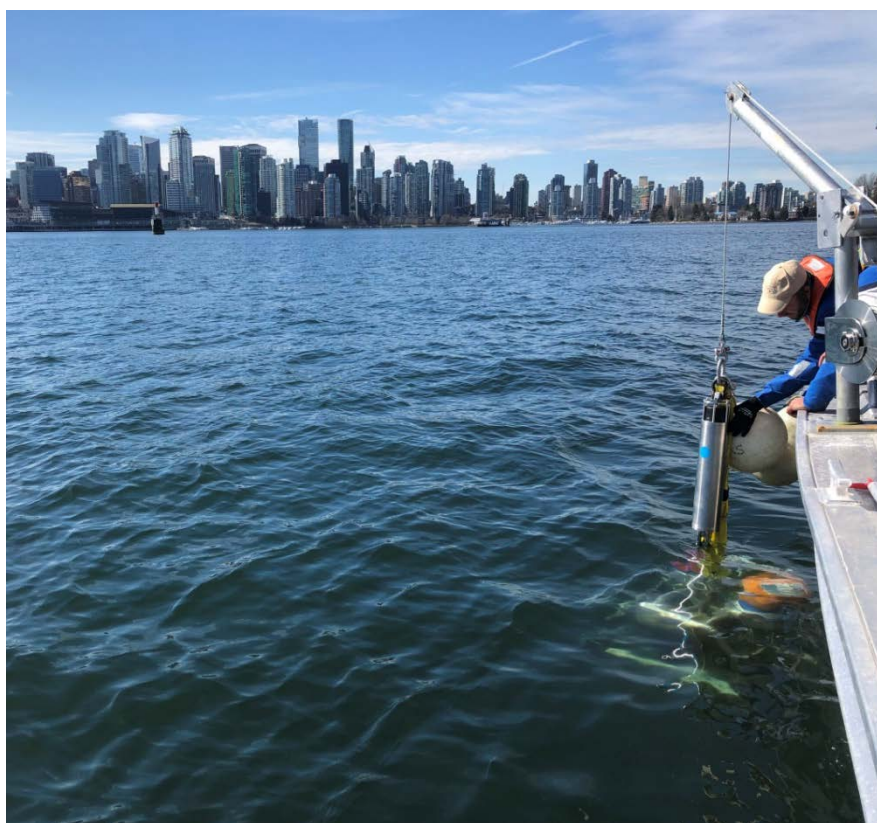


## Water Quality Assessment and Proposed Objectives for Burrard Inlet: Introduction - Appendices



November 2019



**Tsleil-Waututh Nation**  
səlilwətal



This Technical Report forms part of a series of water quality parameter reports whose purpose is to inform updates to the 1990 Provincial Water Quality Objectives for Burrard Inlet. This report and others in the series assess the current state and impacts of contamination in Burrard Inlet; incorporate new scientific research and monitoring of water quality; and reflect a broader understanding of goals and values, including those of First Nations, to improve the health of the marine waters of Burrard Inlet. Updating the 1990 [Provincial Water Quality Objectives](#) is a priority action identified in the Tsleil-Waututh Nation's [Burrard Inlet Action Plan](#) which has been an impetus for this work.

ISBN 978-0-7726-7927-7

**Citation:**

Rao, A., Sanchez, M., Sutherland, D. and P. Lilley. 2019. Water Quality Assessment and Updated Objectives for Burrard Inlet: Overview Report - Appendices. Prepared for Tsleil-Waututh Nation and the Province of B.C.

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**Cover Photograph:**

Underwater monitoring equipment is installed from the Tsleil-Waututh Nation boat in Burrard Inlet. Photo credit; Tsleil-Waututh Nation.

**Acknowledgements**

Work to update the Burrard Inlet Water Quality Objectives is being led by the Tsleil-Waututh Nation (TWN), in collaboration with the BC Ministry of Environment and Climate Change Strategy (BC ENV). Progress on this work and production of this Technical Report have been supported by the following:

The project Coordination Team including: Anuradha Rao (project manager, contractor to TWN), Deborah Epps and Diane Sutherland (ENV), Patrick Lilley (Kerr Wood Leidal, consultant to TWN), Sarah Dal Santo (TWN).

Multi-agency advisory bodies: Burrard Inlet Water Quality Technical Working Group and Roundtable (representatives of First Nations; local, provincial and federal governments; health authorities; industry; academics and NGOs).

Staff, specialists and consultants including:

- Adrienne Hembree, Andrew George, Bridget Doyle, Carleen Thomas, Ernie George, Graham Nicholas, John Konovsky, Stormy MacKay (TWN) and Allison Hunt (Inlailawatash)
- Angeline Tillmanns, Cindy Meays, Colleen Loguisto, Geneen Russo, Kevin Rieberger, Melany Sanchez, Sheldon Reddekopp and Sophia Goertsen (ENV).
- Daniel Brown, Jack Lau, Jessica LeNoble, Larissa Low, Luke Warkentin (Kerr Wood Leidal)

We would also like to acknowledge financial support from: Natural Resources Canada – Indigenous Projects Office-West, New Relationship Trust, BC Ministry of Environment and Climate Change Strategy, Vancouver Fraser Port Authority, and other industry and local government financial and in-kind contributions.

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## **CONTENTS**

APPENDIX A: BURRARD INLET WATER QUALITY ROUNDTABLE AND TECHNICAL WORKING GROUP	
TERMS OF REFERENCE .....	5
APPENDIX B: ROUNDTABLE AND TECHNICAL WORKING GROUP MEMBERS (AS OF APRIL 2019) .....	12
APPENDIX C: LISTS OF AQUATIC LIFE AND WILDLIFE SPECIES IN BURRARD INLET .....	14
APPENDIX D: MOST SENSITIVE SPECIES BY PARAMETER .....	55
Literature Cited in Appendix D .....	59
APPENDIX E: 1990 PROVISIONAL WATER QUALITY OBJECTIVES FOR BURRARD INLET .....	62
APPENDIX F: PROVINCIALLY-AUTHORIZED DISCHARGES IN THE BURRARD INLET WATERSHED.....	66
APPENDIX G: POINT SOURCES - PROVINCE OF BC AUTHORIZATIONS IN BURRARD INLET .....	87
1. False Creek.....	88
1.1 Ocean Construction Supplies (PE-2300) .....	88
1.2 BC Ministry of Environment, Lands, and Parks (RS-12224 and PR-11628) .....	89
1.3 Chinese Merchants Association Parking Association now Easy Park (PR-12912) .....	89
1.4 255-285 East 1 <sup>st</sup> Avenue Holdings Ltd. (RS-106230) .....	90
2. Outer Harbour.....	90
2.1 University of British Columbia (MWR Registration RE-104901).....	90
2.2 Greater Vancouver Sewerage and Drainage District (ME-30).....	90
3. Inner Harbour .....	92
3.1 Lafarge Canada Inc. (RE-107465).....	94
3.2 Pacific Site Constructors Inc. (RE-107213) .....	94
3.3 Lafarge Canada Inc. (RE-107468).....	94
3.4 Vancouver Shipyards Co. Ltd. (Seaspan) (HWR RS-17175) .....	95
3.5 Great Northern Packing Ltd. (PE- 7810) .....	99
3.6 B.C. Pavilion Corporation (RE-18362).....	99
3.7 Southcoast Petroleum Ltd. (RE-105286) .....	99
3.8 TMBC TreatMed BC Inc. doing business as TreatMed (HWR RS-107253).....	99
3.9 KM Canada Terminals ULC Operating as Kinder Morgan (Vancouver Wharves) .....	100
3.10 Domtar Inc. and Seaspan International Inc. (PE-17522) .....	102
3.11 Neptune Bulk Terminals Canada Ltd. (PE-6898) .....	103
3.12 Univar Canada—previously owned by Dow Chemical Canada Inc. (PE-5508).....	105
3.13 Lantic Inc. (PE-1668) .....	106
3.14 West Coast Reduction Ltd. (PE-8426).....	107
4. Central Harbour .....	108
4.1 Lehigh Hanson Materials Limited: doing business as Ocean Concrete (RE-107100) .....	110
4.2 Lafarge Canada Inc. (Kask Brother’s Site) (RE-107463) .....	110
4.3 Chemtrade Electrochem Inc. (PE-18 and PR-1698).....	110
4.4 Revolution ORS Acquisition doing business as Terrapure (PE-5748 and RS-8511) .....	112
4.5 ERCO previously Sterling Pulp Chemicals Ltd. (PE-395) .....	114
4.6 Parkland Refining (B.C.) Ltd.- previously Chevron (PE-4970 and PR-7112).....	114
4.7 Shell Canada Products Limited (RE-449) .....	116
4.8 Trans Mountain Pipeline ULC (PE-3678 and RE-14058) .....	117
5. Port Moody Arm .....	118
5.1 Crystal Creek (RE-17552) .....	120
5.2 Strata Corp LMS 3081 (PE-4606) .....	120

5.3	Simon Fraser University (RE-11883) .....	120
5.4	Chemtrade Chemicals Ltd. (PE-1133) .....	121
5.5	British Columbia Hydro and Power Authority (PE-7178) .....	121
5.6	Imperial Oil Ltd. (PE-445 and RS-8589) .....	122
5.7	Suncor Energy Products Partnership (PE-22, RE-14093, RE-14094, RS-8420, and PR-1453).....	124
6.	Indian Arm .....	126
6.1	Farrer Cove (PE-13446) .....	127
6.2	Countryside Village Ventures Ltd. (PE-4806).....	127
6.3	37852 B.C. Ltd. –Anmore Campgrounds Inc. (PE-5112) .....	127
6.4	Mt. Seymour Resorts Ltd. (PE-00027) .....	128
6.5	Evangelical Laymen’s Church of Canada—Vancouver (PE-8035).....	128
APPENDIX H: COMBINED SEWER OVERFLOW OUTFALLS IN BURRARD INLET.....		129

## **APPENDIX A: BURRARD INLET WATER QUALITY ROUNDTABLE AND TECHNICAL WORKING GROUP TERMS OF REFERENCE**

### **Burrard Inlet Water Quality Objectives<sup>1</sup> Update:**

#### **Water Quality Roundtable and Technical Working Group Terms of Reference**

**Finalized 8 March 2017**

Protecting and improving the environmental health and integrity of Burrard Inlet has been an ongoing focus of federal, provincial, regional, and local governments, First Nations, environmental non-governmental organizations, academics, and industry since the 1980s. Since the closure of the Burrard Inlet Environmental Action Program (BIEAP) in 2013, a coordinated, science-based approach to environmental stewardship in Burrard Inlet has been lacking. Environmental quality of water and sediments, and associated marine biota and human uses of the inlet, such as shellfish harvesting, have been a long-standing priority issue for action. Although some progress has been made toward improving water quality over the last 25 years, many issues persist, knowledge gaps remain and some key actions have not yet been taken or are progressing slowly.

To direct attention to and reinvigorate action on this issue, the BC Ministry of Environment (MOE) and Tsleil-Waututh Nation are coordinating efforts to update the BC MOE's 1990 *Ambient Water Quality Objectives for Burrard Inlet*. The establishment of water quality objectives is a provincial mandate under the BC Environmental Management Act. BC water quality objectives are developed based on BC water quality guidelines, or guidelines set by the Canadian Council of Ministers of the Environment if BC guidelines do not exist for a particular parameter. Water quality objectives provide guidance to set permit limits and assess performance and effectiveness of water quality management activities. For best results, they need to be integrated with other management activities such as Integrated Stormwater Management Plans.

The current objectives for Burrard Inlet are from the 1990s; an update is needed because of new science, new pollutants and a broader understanding of uses and values. The initiative will include development of a subsequent plan for integrated monitoring and assessment to inform objectives development and assess whether objectives are attained on an ongoing basis.

A formal process exists within the BC Ministry of Environment to review and adopt proposed water quality objectives, but collaborative approaches to proposing objectives are encouraged. Tsleil-Waututh Nation has identified updating the water quality objectives as the highest priority in their Burrard Inlet Action Plan and has obtained resources to coordinate the process, thus Tsleil-Waututh Nation is playing a leadership role in cooperation with the MOE.

A stakeholder Water Quality Roundtable (Roundtable) is being established to consider ways to improve water quality. The Roundtable's first priority will be to update the water quality objectives for Burrard Inlet. A Technical Working Group is being formed as a subcommittee of this Roundtable.

These Terms of Reference are intended to clarify the roles of the Water Quality Roundtable, Technical Working Group, Tsleil-Waututh Nation and MOE in this context.

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<sup>1</sup> In these Terms of Reference, the term "water quality objectives" refers broadly to the physical, chemical and biological characteristics of water, biota and sediment that protect the most sensitive designated water uses at a particular site. (From BC Ministry of Environment. 2013. Guidance for the derivation and application of water quality objectives in British Columbia, p.2.)

### 1) Purpose of the Water Quality Roundtable and Technical Working Group

- Provide and seek contextual, scientific and technical input to assess the state of water quality in Burrard Inlet
- Identify priority issues
- Update the BC Ministry of Environment's 1990 *Ambient Water Quality Objectives for Burrard Inlet*
- Develop recommendations for monitoring and management of water quality in Burrard Inlet to protect water uses and provide for ongoing sustainable management

### 2) Guiding Principles

- Maintenance and improvement of ecological integrity
- Management to support a variety of water uses, ecological, economic, cultural, and social sustainability and diversity
- Application of sustainability principles and protection of human health and the aquatic environment
- Ensure that lack of information does not inhibit decisions or the protection of the area's ecology
- To the extent possible, ensure decisions are based on sound science

### 3) Scope of the Water Quality Objectives Update Process:

**a) Geographic** – Burrard Inlet (Appendix A), which encompasses six sub-basins: False Creek, Outer Harbour, Inner Harbour (First Narrows to Second Narrows), Central Harbour, Port Moody Arm and Indian Arm, and contributing watersheds.

**b) Thematic** – The marine waters, sediment and biota of Burrard Inlet, including the watershed inputs that affect marine water quality. Water Quality Objectives will be developed or updated for both marine and select freshwater components.

### 4) Objectives and Activities

To work together to:

- develop a thorough understanding of uses and values to be protected in Burrard Inlet
- compile current and historical data on inputs and activities affecting water quality in Burrard Inlet
- update water quality objectives for Burrard Inlet, including objectives pertaining to the water column, sediment and biota
- develop an integrated water quality monitoring plan for Burrard Inlet and contribute to its implementation through shared resources and combined efforts to make recommendations to improve efficiency and achieve results, as feasible
- contribute to regular reporting on water quality in Burrard Inlet
- improve data comparability, reproducibility, and availability

#### a) Short Term (< 2 years)

- Receive direction from the MOE regarding scientific information required to update the Water Quality Objectives
- Provide current and historical water quality data for a review and assessment of current water quality conditions and trends, under data sharing agreements where required

- Identify data gaps and identify and contribute to efforts needed to address these gaps
- Implement or support the implementation of any required scientific studies, including necessary water quality monitoring and corresponding implementation schedules

#### **b) Medium Term (2-4 years)**

- Implement or support the implementation of efforts to fill data gaps
- Implement or support the implementation of any required scientific studies, including necessary water quality monitoring and corresponding implementation schedules
- Participate in scientific studies and water quality monitoring plan implementation
- Provide technical input to revise water quality objectives, informed by MOE requirements and guidance
- Report back on the achievement of beneficial management actions or adaptations

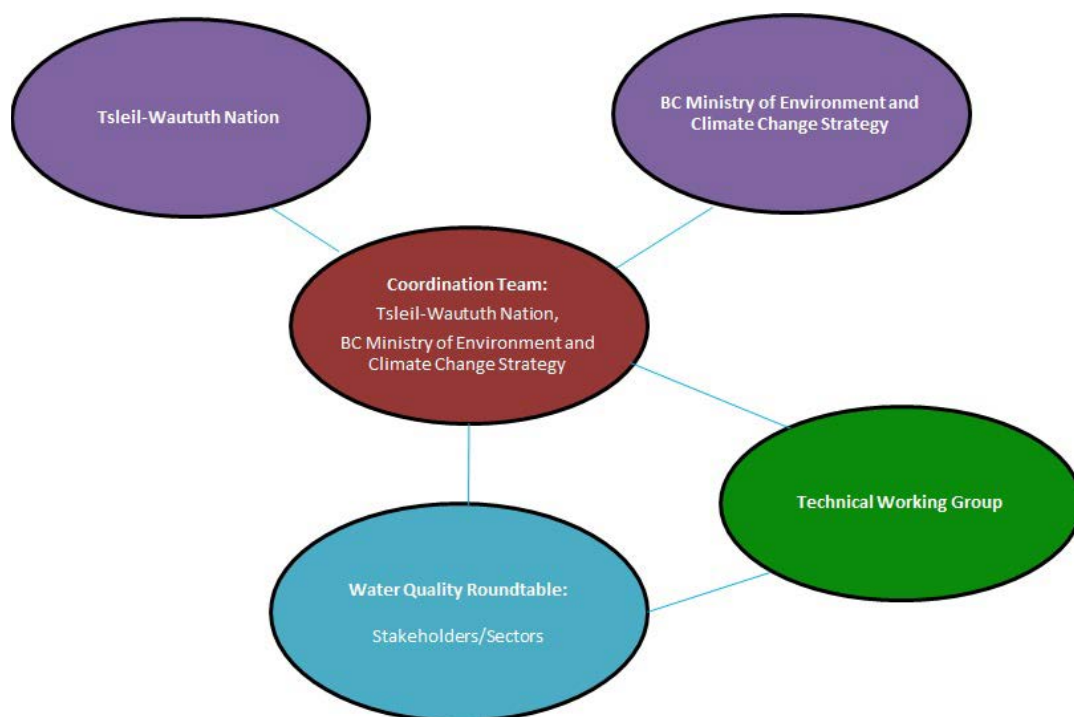
#### **c) Long Term (> 4 years)**

- Conduct ongoing water quality attainment monitoring and apply adaptive management principles to improve water quality in Burrard Inlet
- Report back on the achievement of water quality objectives (“attainment monitoring”) and beneficial management actions

### **5) Principles of Engagement**

- Ensure all discussions are cooperative and respectful
- Contribute professional opinions to the group
- Operate in an open and transparent manner
- Provide an opportunity for all active members to give input

### **6) Organizational Structure and Roles**



This organizational structure, as it pertains to water quality, is co-convened and coordinated by the BC Ministry of Environment and Tsleil-Waututh Nation, pending the emergence of other leadership. MOE has statutory responsibility for making final decisions with respect to setting and modifying provincial water quality objectives, but encourages the collaborative development of water quality objectives for its approval. A focused Technical Working Group will develop technical documents and updated water quality objectives for review by a broad stakeholder Roundtable. The Roundtable will review and discuss the recommended updates and propose them to the MOE for adoption. The Roundtable is also a forum for information sharing. The MOE will carry the Roundtable's proposed updates through its formal review process and decide whether to adopt the updated objectives.

**a) Coordinators (currently Tsleil-Waututh Nation and MOE):**

- co-chair and coordinate the Technical Working Group and Roundtable
- arrange facilitation of Technical Working Group and Roundtable discussions
- organize and participate in meetings
- seek funding, set budgets and manage project schedule
- seek and consider the input of Technical Working Group and Roundtable members when making decisions
- may seek input from resources external to the Technical Working Group and Roundtable when required
- distribute an agenda to meeting participants in advance of each meeting
- distribute summaries from meetings, including action items and decisions, to Technical Working Group and Roundtable members within two weeks of the meeting date
- prepare documents for review by the Technical Working Group and Roundtable with a reasonable turnaround time
- make documents available for review by Technical Working Group and Roundtable members on a shared website or file sharing service
- provide updates to interested external parties, as per the agreement of the Technical Working Group or Roundtable, and as defined by the Data Sharing Agreements
- send proposals put forward by the Roundtable to decision makers at the MOE, highlighting where consensus was and was not reached

**b) Water Quality Roundtable Members:**

- include individuals representing all major sectors with interests in Burrard Inlet, who are able to speak on behalf of their sector or organization
- may also include stakeholders who wish to stay informed about the process but do not intend to participate on a technical level
- provide contextual knowledge and guidance with respect to water quality and its management in Burrard Inlet
- share relevant data, under data sharing agreements where possible or necessary
- contribute to efforts to fill data gaps, as appropriate
- review Technical Working Group products and their implications, and make subsequent recommendations to be forwarded to the BC Ministry of Environment
- provide input to and receive feedback from Technical Working Group
- are advisors, and not responsible for making final decisions



- attend and actively participate in meetings
- contribute to mutual understanding among sectors
- seek input from and report back to their sectors as applicable
- provide input in a timely manner
- work within defined costs and scope
- will reach consensus where possible
- will recognize and put forward all viewpoints when consensus is not possible

**c) Technical Working Group Members:**

- include a small subset of stakeholders with an interest or operations in Burrard Inlet who are able to contribute to technical aspects of updating the provincial water quality objectives, for example data interpretation, proposed updates to objectives, proposed methods for filling data gaps, and improving monitoring efficiency, ongoing monitoring and research
- may include subject matter experts and people with broader expertise, including historical or local knowledge
- may change over time depending on the type of technical expertise required
- implement or support the implementation of tasks required to update the water quality objectives
- propose updated objectives and other products for Roundtable input
- attend and actively participate in meetings
- provide input in a timely manner
- review and provide technical feedback on draft documents, as requested, for example preliminary data assessment reports
- suggest technical work and develop work plans and budgets, if required, for specific tasks
- work within defined costs and scope
- are advisors, and not responsible for making final decisions
- will reach consensus where possible
- will recognize and put forward all viewpoints when consensus is not possible

**7) Membership**

Technical Working Group and Roundtable members are designated by their organizations or sectors. If a member is unable to participate in a meeting, it is incumbent upon her or him to arrange for an alternate to attend. If no one is available, that member should review meeting summaries and provide input into general agreements or action items within the specified timeline. Members' names and affiliations will be posted on a shared website or file sharing service.

**8) Meetings and Time Commitment**

Technical Working Group meetings will initially be held monthly or every two months at a location in Metro Vancouver; meeting frequency may decrease during the preparation or approval of technical documents. Roundtable meetings will be held at least twice per year. Members may be expected to do preparatory work or review and provide input on documents between meetings. External parties may be invited to meetings as approved by the Technical Working Group, Roundtable or Coordinators.

## **9) Internal Decision Making Process**

The Roundtable and Technical Working Group will make decisions by general agreement, ensuring all active members have the opportunity to provide input. In all cases, each member will make every effort to reach general agreement. In the very rare situation where this is not possible, the dissenting opinions will be recorded and shared with decision makers. General agreement implies a member can live with the decision while not necessarily being in full agreement with other members with respect to that decision.

If an active member is absent from the forum in which general agreement is proposed, general agreement will be sought by e-mail. General agreement is assumed if a response is not received within a specified reasonable timeline.

## **10) Funding**

Technical Working Group and Roundtable members or their organizations will cover the costs of their own transportation and time to participate in this process and attend meetings. In-kind or financial contributions to the process may be considered from a variety of sources including, but not limited to, Roundtable and Technical Working Group member organizations, as well as external parties.

## **11) Changes to the Terms of Reference**

Once adopted by the Technical Working Group and Roundtable members, these Terms of Reference will be reviewed annually and may be amended through general agreement of the members and Coordinators.

## **12) Authority**

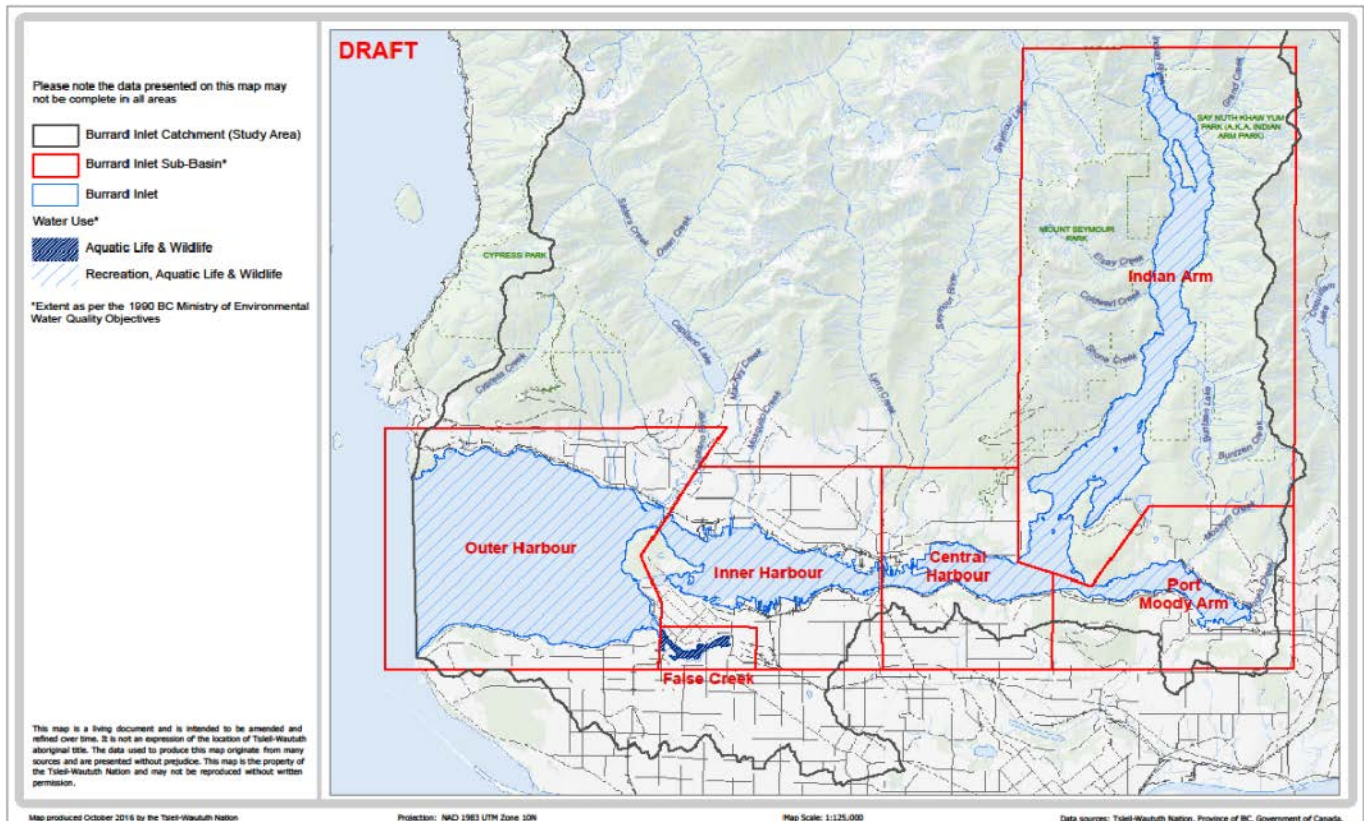
The Technical Working Group and Roundtable have no authority or role beyond that expressed in these terms of reference and are not legal or financial entities.

## **13) Agreement**

Agreement to these Terms of Reference will be confirmed by all participants on an annual basis informally via email (signature not required).

## Appendix A- Map of Burrard Inlet and its Sub-Basins

This map reflects sub-basins and water uses as defined in the BC Ministry of Environment's 1990 *Ambient Water Quality Objectives for Burrard Inlet*. 1990 Water Quality Objectives were set for each sub-basin, Capilano River, Lynn Creek and Schoolhouse Creek.



## **APPENDIX B: ROUNDTABLE AND TECHNICAL WORKING GROUP MEMBERS (AS OF APRIL 2019)**

Note: This list is only a snapshot; roundtable membership is fluid

*Table B.1 Roundtable Members*

<b>Name</b>	<b>Position</b>	<b>Organization</b>
Andjela Knezevic-Stevanovic	Director, Environmental Management and Quality Control	Metro Vancouver
Andre Olivier	Manager, Engineering	Pacific Coast Terminals
Angela Crampton	Sustainability Services	City of Port Moody
Angela Yeung	Environmental Technician	City of North Vancouver
Anu Rao	Marine Biologist and Project Manager (contractor)	Tsleil-Waututh Nation
Brian Wormald	Director	Port Moody Ecological Society
Carleen Thomas	Relationship & Protocol Coordinator	Tsleil-Waututh Nation
Christianne Wilhelmson	Executive Director	Georgia Strait Alliance
Christopher Boys	Environmental Specialist	Parkland Fuel Corporation
Daryl Lawes	Environmental Manager	Seaspan
David Duckworth	General Manager	Camp Jubilee
Dean Giles	General Manager	Columbia Containers
Deb Epps	Water Quality Section Head	BC Ministry of Environment and Climate Change Strategy (ENV)
Diane Sutherland	Environmental Impact Assessment Biologist	BC ENV
Emily Peterson	Environmental Scientist	Vancouver Coastal Health
Ernie George	Director, Treaty, Lands and Resources	Tsleil-Waututh Nation
Heather Keith	Environmental Protection Officer	District of West Vancouver
Holly Herald	Special Advisor	Environment and Climate Change Canada
James Mortimor	Biologist – Oceans Protection Plan	Fisheries and Oceans Canada
Joanne Chang	Environmental Health Officer	First Nations Health Authority
Kelsey Delisle	Pollution Tracker Coordinator	Ocean Wise
Lisa McCuaig	Environmental Specialist – Project Review and Development	Vancouver Fraser Port Authority
Matthew MacKinnon	Environmental Manager	District of West Vancouver
Michael Edmonds	Manager Environmental Affairs	Viterra
Nikki Wright	Executive Director	SeaChange Marine Conservation Society
Patrick Lilley	Biologist/Project Manager	Kerr Wood Leidal
Paul Covert	Physical Scientist – Oceans Protection Plan	Fisheries and Oceans Canada
Paul Leyen	Technical and Environmental Manager	ERCO Worldwide
Paul Lingl	Environmental Specialist	City of Vancouver
Paula Doucette	Senior Environmental Advisor, Oceans Protection Plan	Transport Canada
Paula Smith	Regional Environmental Assessment Coordinator, Environmental Health Program	Health Canada
Peter Ross	Director, Ocean Pollution Science Program	Ocean Wise
Randall Lewis	Environmental Officer	Squamish Nation

Richard Boase	Environmental Protection Officer	District of North Vancouver
Ron Sander	Vice President Major Projects & Environment	Neptune Terminals
Sandie Hollick-Kenyon	Community Advisor	Fisheries and Oceans Canada
Sarah Dal Santo	Natural Resources Planner	Tsleil-Waututh Nation
Sarah Gergel	Associate Professor and Assistant Dean of Diversity & Inclusion	UBC
Scott Brown	Maintenance Manager	Western Stevedoring
Shaun Hollingsworth	President	Seymour Salmonid Society
Simone Rousseau	Environmental Engineer	City of Burnaby
Steve Kachanoski	Resource Objectives Specialist	Ministry of Forests, Lands, Natural Resource Operations & Rural Development
Terry Curran	Advisor	Strait of Georgia Data Centre
Ute Pott	Senior Program Scientist, Environmental Protection Operations Directorate	Environment and Climate Change Canada
Yeganeh Asadian	Environmental Stewardship Manager	Musqueam Indian Band
Zoe Craig	Environmental Stewardship Coordinator	Musqueam Indian Band

*Table B.2 Technical Working Group Members*

<b>Name</b>	<b>Position</b>	<b>Organization</b>
Andjela Knezevic-Stevanovic	Director, Environmental Management and Quality Control	Metro Vancouver
Anu Rao	Marine Biologist and Project Manager	Tsleil-Waututh Nation
Deb Epps	Water Quality Section Head	BC ENV
Diane Sutherland	Environmental Impact Assessment Biologist	BC ENV
Emily Peterson	Environmental Scientist	Vancouver Coastal Health
Heather Keith	Environmental Protection Officer	District of West Vancouver
Holly Herald	Special Advisor	Environment and Climate Change Canada
Kelsey Delisle	Pollution Tracker Coordinator	Ocean Wise
Linda Eastcott	Environmental Services, Downstream West, Imperial	Esso
Lindsey Ogston	Environmental Programs Manager	Tsleil-Waututh Nation
Lisa McCuaig	Environmental Specialist	Vancouver Fraser Port Authority
Matthew MacKinnon	Environmental Manager	District of West Vancouver
Patrick Lilley	Biologist/Project Manager	Kerr Wood Leidal
Paul Covert	Physical Scientist – Oceans Protection Plan	Fisheries and Oceans Canada
Paul Lingl	Environmental Specialist	City of Vancouver
Peter Ross	Director, Ocean Pollution Science Program	Ocean Wise
Sarah Dal Santo	Natural Resources Planner	Tsleil-Waututh Nation
Stacy Bell	Environmental Systems Specialist	Neptune Terminals
Terry Curran	Advisor	Strait of Georgia Data Centre
Ute Pott	Senior Program Scientist, Environmental Protection Operations Directorate	Environment and Climate Change Canada
Yeganeh Asadian	Environmental Stewardship Manager	Musqueam Indian Band

## APPENDIX C: LISTS OF AQUATIC LIFE AND WILDLIFE SPECIES IN BURRARD INLET

(from Lamagna et al. 2011)

Legend
Confirmed
Unreferenced/Unverified
Conflicting Verification or Unlikely
Rare or Visiting
Introduced Species*
Invasive Species**
Species at Risk <sup>†</sup>

Table C.1 Mammals

Order	Family	Genus	Species	Common Name	Reference	Verification
Artiodactyla	Cervidae	<i>Odocoileus</i>	<i>hemionus</i>	Black-tailed Deer (Mule Deer)	E-Fauna BC	
Carnivora	Canidae	<i>Canis</i>	<i>latrans</i>	Coyote	E-Fauna BC	SPES
Carnivora	Canidae	<i>Canis</i>	<i>lupus</i>	Grey Wolf	E-Fauna BC	
Carnivora	Canidae	<i>Vulpes</i>	<i>vulpes</i>	Red Fox	E-Fauna BC	
Carnivora	Felidae	<i>Puma</i>	<i>concolor</i>	Cougar	E-Fauna BC	Alysha Martins
Carnivora	Felidae	<i>Lynx</i>	<i>rufus</i>	Bobcat	E-Fauna BC	
Carnivora	Mephitidae	<i>Mephitis</i>	<i>mephitis</i>	Striped Skunk	E-Fauna BC	SPES
Carnivora	Mephitidae	<i>Spilogale</i>	<i>gracilis</i>	Western Spotted Skunk	E-Fauna BC	
Carnivora	Mustelidae	<i>Lontra</i>	<i>canadensis</i>	River Otter	E-Fauna BC	SPES
Carnivora	Mustelidae	<i>Martes</i>	<i>americana</i>	Marten	E-Fauna BC	SPES

Carnivora	Mustelidae	<i>Mustela</i>	<i>erminea</i>	Ermine	E-Fauna BC	
Carnivora	Mustelidae	<i>Mustela</i>	<i>frenata</i>	Long-tailed Weasel	E-Fauna BC	
Carnivora	Mustelidae	<i>Neovison</i>	<i>vison</i>	American Mink	E-Fauna BC	SPES
Carnivora	Otariidae	<i>Eumetopias</i>	<i>jubatus</i>	Steller Sea Lion	E-Fauna BC	SPES
Carnivora	Otariidae	<i>Zalophus</i>	<i>californianus</i>	California Sea Lion	E-Fauna BC	SPES
Carnivora	Phocidae	<i>Phoca</i>	<i>vitulina</i>	Harbour Seal	E-Fauna BC	SPES
Carnivora	Procyonidae	<i>Procyon</i>	<i>lotor</i>	Raccoon	E-Fauna BC	SPES
Carnivora	Ursidae	<i>Ursus</i>	<i>americanus</i>	Black Bear	E-Fauna BC	Alysha Martins
Cetacea	Balaenopteridae	<i>Balaenoptera</i>	<i>acutorostrata</i>	minke whale	Taxonomy Browser	BCCSN
Cetacea	Balaenopteridae	<i>Megaptera</i>	<i>novaeangliae</i>	Humpback Whale	E-Fauna BC	SPES
Cetacea	Delphinidae	<i>Orcinus</i>	<i>orca</i>	Orca (Killer) Whale <sup>†</sup>	E-Fauna BC	SPES
Cetacea	Delphinidae	<i>Lagenorhynchus</i>	<i>obliquidens</i>	Pacific white-sided dolphin	Taxonomy Browser	BCCSN
Cetacea	Delphinidae	<i>Pseudorca</i>	<i>crassidens</i>	False Killer Whale	E-Fauna BC	SPES
Cetacea	Eschrichtiidae	<i>Eschrichtius</i>	<i>robustus</i>	Grey Whale	E-Fauna BC	SPES
Cetacea	Phocoenidae	<i>Phocoenoides</i>	<i>dalli</i>	Dall's porpoise	Taxonomy Browser	BCCSN
Cetacea	Phocoenidae	<i>Phocoena</i>	<i>phocoena</i>	Harbour Porpoise	E-Fauna BC	SPES
Chiroptera	Vespertilionidae	<i>Eptesicus</i>	<i>fuscus</i>	Big Brown Bat	E-Fauna BC	SPES
Chiroptera	Vespertilionidae	<i>Lasionycteris</i>	<i>noctivagans</i>	Silver-haired Bat	E-Fauna BC	SPES
Chiroptera	Vespertilionidae	<i>Lasiurus</i>	<i>cinereus</i>	Hoary Bat	E-Fauna BC	SPES
Chiroptera	Vespertilionidae	<i>Myotis</i>	<i>californicus</i>	California Myotis	E-Fauna BC	SPES
Chiroptera	Vespertilionidae	<i>Myotis</i>	<i>evotis</i>	Western Long-eared Myotis	E-Fauna BC	SPES
Chiroptera	Vespertilionidae	<i>Myotis</i>	<i>keenii</i>	Keen's Long-eared Myotis	E-Fauna BC	SPES
Chiroptera	Vespertilionidae	<i>Myotis</i>	<i>lucifugus</i>	Little brown Myotis	E-Fauna BC	SPES
Chiroptera	Vespertilionidae	<i>Myotis</i>	<i>volans</i>	Long-legged Myotis	E-Fauna BC	SPES
Chiroptera	Vespertilionidae	<i>Myotis</i>	<i>yumanensis</i>	Yuma Myotis	E-Fauna BC	SPES
Chiroptera	Vespertilionidae	<i>Corynorhinus</i>	<i>townsendii</i>	Townsend's Big-eared Bat <sup>†</sup>	E-Fauna BC	SPES
Insectivora	Soricidae	<i>Sorex</i>	<i>bendirii</i>	Pacific Water Shrew <sup>†</sup>	E-Fauna BC	SPES
Insectivora	Soricidae	<i>Sorex</i>	<i>monticolus</i>	Dusky Shrew	E-Fauna BC	SPES

Insectivora	Soricidae	<i>Sorex</i>	<i>vagrans</i>	Wandering/Vagrant Shrew	E-Fauna BC	SPES
Insectivora	Talpidae	<i>Neurotrichus</i>	<i>gibbsii</i>	Shrew-mole	E-Fauna BC	SPES
Insectivora	Talpidae	<i>Scapanus</i>	<i>orarius</i>	Coast Mole	E-Fauna BC	SPES
Lagomorpha	Leporidae	<i>Oryctolagus</i>	<i>cuniculus</i>	European Rabbit**	E-Fauna BC	SPES
Rodentia	Castoridae	<i>Castor</i>	<i>canadensis</i>	Beaver	E-Fauna BC	SPES
Rodentia	Cricetidae	<i>Clethrionomys</i>	<i>occidentalis</i>	Western Red-backed Vole <sup>†</sup>	Taxonomy Browser	SPES
Rodentia	Cricetidae	<i>Microtus</i>	<i>oregoni</i>	Creeping Vole	E-Fauna BC	SPES
Rodentia	Cricetidae	<i>Microtus</i>	<i>townsendii</i>	Townsend's Vole <sup>†</sup>	Taxonomy Browser	SPES
Rodentia	Cricetidae	<i>Ondatra</i>	<i>zibethiucus</i>	Muskrat	E-Fauna BC	SPES
Rodentia	Cricetidae	<i>Peromyscus</i>	<i>maniculatus</i>	North American Deermouse	E-Fauna BC	SPES
Rodentia	Dipodidae	<i>Zapus</i>	<i>trinotatus</i>	Pacific Jumping Mouse	E-Fauna BC	SPES
Rodentia	Erethizontinae	<i>Erethizon</i>	<i>dorsatum</i>	North American Porcupine	E-Fauna BC	
Rodentia	Muridae	<i>Mus</i>	<i>musculus</i>	House Mouse*	E-Fauna BC	SPES
Rodentia	Muridae	<i>Rattus</i>	<i>norvegicus</i>	Norway Rat**	E-Fauna BC	SPES
Rodentia	Muridae	<i>Rattus</i>	<i>rattus</i>	Roof Rat**	E-Fauna BC	SPES
Rodentia	Myocastoridae	<i>Myocastor</i>	<i>coypus</i>	Nutria**	E-Fauna BC	SPES
Rodentia	Sciuridae	<i>Neotamias</i>	<i>amoenus</i>	Yellow-Pine Chipmunk	E-Fauna BC	
Rodentia	Sciuridae	<i>Glaucomys</i>	<i>sabrinus</i>	Northern Flying Squirrel	E-Fauna BC	SPES
Rodentia	Sciuridae	<i>Sciurus</i>	<i>carolinensis</i>	Eastern Grey Squirrel**	E-Fauna BC	SPES
Rodentia	Sciuridae	<i>Tamiasciurus</i>	<i>douglasii</i>	Douglas' Squirrel	E-Fauna BC	SPES

Table C.2 Birds

Order	Family	Genus	Species	Common Name	Reference	Verification
Accipitriformes	Accipitridae	<i>Accipiter</i>	<i>gentilis</i>	Northern Goshawk	E-Fauna BC	MCA
Accipitriformes	Accipitridae	<i>Accipiter</i>	<i>striatus</i>	Sharp-shinned Hawk	E-Fauna BC	MCA



Accipitriformes	Accipitridae	<i>Aquila</i>	<i>chrysaetos</i>	Golden Eagle	E-Fauna BC	Unlikely: Rob Butler/MCA Likely: SPES
Accipitriformes	Accipitridae	<i>Buteo</i>	<i>jamaicensis</i>	Red-tailed Hawk	E-Fauna BC	MCA
Accipitriformes	Accipitridae	<i>Buteo</i>	<i>lagopus</i>	Rough-legged Hawk	E-Fauna BC	Unlikely: Rob Butler Likely: MCA
Accipitriformes	Accipitridae	<i>Haliaeetus</i>	<i>leucocephalus</i>	Bald Eagle	E-Fauna BC	MCA
Accipitriformes	Falconidae	<i>Falco</i>	<i>columbarius</i>	Merlin	E-Fauna BC	MCA
Accipitriformes	Falconidae	<i>Falco</i>	<i>peregrinus</i>	Peregrine Falcon <sup>†</sup>	E-Fauna BC	MCA
Accipitriformes	Falconidae	<i>Falco</i>	<i>sparverius</i>	American Kestrel	E-Fauna BC	Unlikely: Rob Butler Likely: MCA
Accipitriformes	Falconiformes	<i>Circus</i>	<i>cyaneus</i>	Northern Harrier	E-Fauna BC	Unlikely: Rob Butler Likely: MCA
Accipitriformes	Pandionidae	<i>Pandion</i>	<i>haliaetus</i>	Osprey	E-Fauna BC	MCA
Accipitriformes	Anatidae	<i>Aix</i>	<i>sponsa</i>	Wood Duck	E-Fauna BC	MCA
Accipitriformes	Anatidae	<i>Anas</i>	<i>acuta</i>	Northern Pintail	E-Fauna BC	MCA
Accipitriformes	Anatidae	<i>Anas</i>	<i>americana</i>	American Wigeon	E-Fauna BC	MCA
Accipitriformes	Anatidae	<i>Anas</i>	<i>clypeata</i>	Northern Shoveler	E-Fauna BC	MCA
Accipitriformes	Anatidae	<i>Anas</i>	<i>crecca</i>	Green-winged Teal	E-Fauna BC	MCA
Accipitriformes	Anatidae	<i>Anas</i>	<i>cyanoptera</i>	Cinnamon Teal	E-Fauna BC	MCA
Accipitriformes	Anatidae	<i>Anas</i>	<i>discors</i>	Blue-winged Teal	E-Fauna BC	MCA
Accipitriformes	Anatidae	<i>Anas</i>	<i>penelope</i>	Eurasian Wigeon	E-Fauna BC	MCA
Accipitriformes	Anatidae	<i>Anas</i>	<i>platyrhynchos</i>	Mallard	E-Fauna BC	MCA
Accipitriformes	Anatidae	<i>Anas</i>	<i>strepera</i>	Gadwall	E-Fauna BC	MCA
Accipitriformes	Anatidae	<i>Anser</i>	<i>albifrons</i>	Greater White- fronted Goose	E-Fauna BC	Unlikely: Rob Butler/MCA Likely: SPES
Accipitriformes	Anatidae	<i>Aythya</i>	<i>affinis</i>	Lesser Scaup	E-Fauna BC	MCA
Accipitriformes	Anatidae	<i>Aythya</i>	<i>americana</i>	Redhead	E-Fauna BC	Unlikely: MCA Likely: SPES
Accipitriformes	Anatidae	<i>Aythya</i>	<i>collaris</i>	Ring-necked Duck	E-Fauna BC	MCA

Accipitriformes	Anatidae	<i>Aythya</i>	<i>fuligula</i>	Tufted Duck	E-Fauna BC	Unlikely: MCA Likely: SPES
Accipitriformes	Anatidae	<i>Aythya</i>	<i>marila</i>	Greater Scaup	E-Fauna BC	MCA
Accipitriformes	Anatidae	<i>Aythya</i>	<i>valisineria</i>	Canvasback	E-Fauna BC	MCA
Accipitriformes	Anatidae	<i>Branta</i>	<i>bernicle</i>	Brant	E-Fauna BC	Unlikely: Rob Butler
Accipitriformes	Anatidae	<i>Branta</i>	<i>canadensis</i>	Canada Goose	E-Fauna BC	Rob Butler
Accipitriformes	Anatidae	<i>Branta</i>	<i>hutchinsii</i>	Cackling Goose	E-Fauna BC	Unlikely: MCA Likely: SPES
Accipitriformes	Anatidae	<i>Bucephala</i>	<i>albeola</i>	Bufflehead	E-Fauna BC	MCA
Accipitriformes	Anatidae	<i>Bucephala</i>	<i>clangula</i>	Common Goldeneye	E-Fauna BC	MCA
Accipitriformes	Anatidae	<i>Bucephala</i>	<i>islandica</i>	Barrow's Goldeneye	E-Fauna BC	MCA
Accipitriformes	Anatidae	<i>Cairina</i>	<i>moschata</i>	Muscovy Duck*	None found	Unlikely: Rob Butler
Accipitriformes	Anatidae	<i>Chen</i>	<i>caerulescens</i>	Snow Goose	E-Fauna BC	Unlikely: MCA Likely: SPES
Accipitriformes	Anatidae	<i>Clangula</i>	<i>hyemalis</i>	Long-tailed Duck	E-Fauna BC	MCA
Accipitriformes	Anatidae	<i>Cygnus</i>	<i>buccinator</i>	Trumpeter Swan	E-Fauna BC	MCA
Accipitriformes	Anatidae	<i>Cygnus</i>	<i>columbianus</i>	Tundra Swan	E-Fauna BC	MCA
Accipitriformes	Anatidae	<i>Cygnus</i>	<i>olor</i>	Mute Swan*	E-Fauna BC	Unlikely: MCA Likely: SPES
Accipitriformes	Anatidae	<i>Histrionicus</i>	<i>histrionicus</i>	Harlequin Duck	E-Fauna BC	MCA
Accipitriformes	Anatidae	<i>Lophodytes</i>	<i>cucullatus</i>	Hooded Merganser	E-Fauna BC	MCA
Accipitriformes	Anatidae	<i>Melanitta</i>	<i>fusca</i>	White-winged Scoter	E-Fauna BC	MCA
Accipitriformes	Anatidae	<i>Melanitta</i>	<i>americana</i>	Black Scoter	E-Fauna BC	MCA
Accipitriformes	Anatidae	<i>Melanitta</i>	<i>perspicillata</i>	Surf Scoter†	E-Fauna BC	MCA
Accipitriformes	Anatidae	<i>Mergus</i>	<i>merganser</i>	Common Merganser	E-Fauna BC	MCA
Accipitriformes	Anatidae	<i>Mergus</i>	<i>serrator</i>	Red-breasted	E-Fauna BC	MCA

Merganser						
Accipitriformes	Anatidae	<i>Somateria</i>	<i>mollissima</i>	Common Eider	E-Fauna BC	Unlikely: Rob Butler Likely: SPES
Accipitriformes	Anatidae	<i>Somateria</i>	<i>spectabilis</i>	King Eider	E-Fauna BC	Unlikely: Rob Butler Likely: SPES
Accipitriformes	Apodidae	<i>Chaetura</i>	<i>vauxi</i>	Vaux's Swift	E-Fauna BC	MCA
Accipitriformes	Apodidae	<i>Cypseloides</i>	<i>niger</i>	Black Swift	E-Fauna BC	MCA
Accipitriformes	Caprimulgidae	<i>Chordeiles</i>	<i>minor</i>	Common Nighthawk <sup>†</sup>	E-Fauna BC	MCA
Accipitriformes	Alcidae	<i>Brachyramphus</i>	<i>marmoratus</i>	Marbled Murrelet <sup>†</sup>	E-Fauna BC	MCA
Accipitriformes	Alcidae	<i>Cephus</i>	<i>columba</i>	Pigeon Guillemot	E-Fauna BC	MCA
Accipitriformes	Alcidae	<i>Cerorhinca</i>	<i>monocerata</i>	Rhinoceros Auklet	E-Fauna BC	
Accipitriformes	Alcidae	<i>Synthliboramphus</i>	<i>antiquus</i>	Ancient Murrelet	E-Fauna BC	Unlikely: Rob Butler/MCA Likely: SPES
Charadriiformes	Alcidae	<i>Uria</i>	<i>aalge</i>	Common Murre <sup>†</sup>	E-Fauna BC	MCA
Charadriiformes	Charadriidae	<i>Charadrius</i>	<i>vociferus</i>	Killdeer	E-Fauna BC	MCA
Charadriiformes	Charadriidae	<i>Charadrius</i>	<i>semipalmatus</i>	Semipalmated Plover	E-Fauna BC	MCA
Charadriiformes	Charadriidae	<i>Pluvialis</i>	<i>squatarola</i>	Black-bellied Plover	E-Fauna BC	MCA
Charadriiformes	Haematopodidae	<i>Haematopus</i>	<i>bachmani</i>	Black Oystercatcher	E-Fauna BC	MCA
Charadriiformes	Laridae	<i>Chroicocephalus</i>	<i>philadelphia</i>	Bonapartes Gull	E-Fauna BC	MCA
Charadriiformes	Laridae	<i>Chroicocephalus</i>	<i>ridibundus</i>	Black-headed Gull	E-Fauna BC	Unlikely: Rob Butler/MCA Likely: SPES
Charadriiformes	Laridae	<i>Hydrocoloeus</i>	<i>minutus</i>	Little Gull	E-Fauna BC	Unlikely: Rob Butler/MCA Likely: SPES
Charadriiformes	Laridae	<i>Hydroprogne</i>	<i>caspia</i>	Caspian Tern <sup>†</sup>	E-Fauna BC	MCA

Charadriiformes	Laridae	<i>Larus</i>	<i>argentatus</i>	Herring Gull	E-Fauna BC	Unlikely: MCA Likely: SPES
Charadriiformes	Laridae	<i>Larus</i>	<i>californicus</i>	California Gull <sup>†</sup>	E-Fauna BC	MCA
Charadriiformes	Laridae	<i>Larus</i>	<i>canus</i>	Mew Gull	E-Fauna BC	MCA
Charadriiformes	Laridae	<i>Larus</i>	<i>delawarensis</i>	Ring-billed Gull	E-Fauna BC	MCA
Charadriiformes	Laridae	<i>Larus</i>	<i>glaucescens</i>	Glaucous-winged Gull	E-Fauna BC	MCA
Charadriiformes	Laridae	<i>Larus</i>	<i>glaucoides</i>	Iceland Gull	E-Fauna BC	Unlikely: Rob Butler Likely: SPES
Charadriiformes	Laridae	<i>Larus</i>	<i>heermanni</i>	Heermann's Gull	E-Fauna BC	
Charadriiformes	Laridae	<i>Larus</i>	<i>hyperboreus</i>	Glaucous Gull	E-Fauna BC	Unlikely: MCA Likely: SPES
Charadriiformes	Laridae	<i>Larus</i>	<i>occidentalis</i>	Western Gull	E-Fauna BC	Unlikely: MCA Likely: SPES
Charadriiformes	Laridae	<i>Larus</i>	<i>occidentalis x glaucescens</i>	"Olympic Gull" (hybrid)	None found	
Charadriiformes	Laridae	<i>Leucophaeus</i>	<i>pipixcan</i>	Franklin's Gull	E-Fauna BC	MCA
Charadriiformes	Laridae	<i>Larus</i>	<i>thayeri</i>	Thayer's Gull	E-Fauna BC	MCA
Charadriiformes	Laridae	<i>Sterna</i>	<i>hirundo</i>	Common Tern	E-Fauna BC	MCA
Charadriiformes	Laridae	<i>Sterna</i>	<i>paradisaea</i>	Arctic Tern	E-Fauna BC	
Charadriiformes	Laridae	XEMA	<i>sabini</i>	Sabine's Gull	E-Fauna BC	Unlikely: Rob Butler Likely: SPES
Charadriiformes	Scolopacidae	<i>Actitis</i>	<i>macularius</i>	Spotted Sandpiper	E-Fauna BC	MCA
Charadriiformes	Scolopacidae	<i>Aphriza</i>	<i>virgata</i>	Surfbird	E-Fauna BC	
Charadriiformes	Scolopacidae	<i>Arenaria</i>	<i>interpres</i>	Ruddy Turnstone	E-Fauna BC	MCA
Charadriiformes	Scolopacidae	<i>Arenaria</i>	<i>melanocephala</i>	Black Turnstone	E-Fauna BC	MCA
Charadriiformes	Scolopacidae	<i>Calidris</i>	<i>alba</i>	Sanderling	E-Fauna BC	MCA
Charadriiformes	Scolopacidae	<i>Calidris</i>	<i>alpina</i>	Dunlin	BC Conservation Data Centre	MCA
Charadriiformes	Scolopacidae	<i>Calidris</i>	<i>bairdii</i>	Baird's Sandpiper	E-Fauna BC	MCA
Charadriiformes	Scolopacidae	<i>Calidris</i>	<i>himantopus</i>	Stilt Sandpiper	E-Fauna BC	MCA

Charadriiformes	Scolopacidae	<i>Calidris</i>	<i>mauri</i>	Western Sandpiper	E-Fauna BC	MCA
Charadriiformes	Scolopacidae	<i>Calidris</i>	<i>melanotos</i>	Pectoral Sandpiper	E-Fauna BC	MCA
Charadriiformes	Scolopacidae	<i>Calidris</i>	<i>minutilla</i>	Least Sandpiper	E-Fauna BC	MCA
Charadriiformes	Scolopacidae	<i>Calidris</i>	<i>ptilocnemis</i>	Rock Sandpiper	E-Fauna BC	
Charadriiformes	Scolopacidae	<i>Calidris</i>	<i>pusilla</i>	Semipalmated Sandpiper	E-Fauna BC	MCA
Charadriiformes	Scolopacidae	<i>Gallinago</i>	<i>delicata</i>	Wilson's Snipe	E-Fauna BC	MCA
Charadriiformes	Scolopacidae	<i>Limnodromus</i>	<i>griseus</i>	Short-billed Dowitcher <sup>†</sup>	E-Fauna BC	MCA
Charadriiformes	Scolopacidae	<i>Limnodromus</i>	<i>scolopaceus</i>	Long-billed Dowitcher	E-Fauna BC	MCA
Charadriiformes	Scolopacidae	<i>Numenius</i>	<i>phaeopus</i>	Whimbrel	E-Fauna BC	MCA
Charadriiformes	Scolopacidae	<i>Phalaropus</i>	<i>fulicarius</i>	Red Phalarope	E-Fauna BC	Unlikely: Rob Butler Likely: MCA/SPES
Charadriiformes	Scolopacidae	<i>Phalaropus</i>	<i>lobatus</i>	Red-necked Phalarope <sup>†</sup>	E-Fauna BC	MCA
Charadriiformes	Scolopacidae	<i>Phalaropus</i>	<i>tricolor</i>	Wilson's Phalarope	E-Fauna BC	
Charadriiformes	Scolopacidae	<i>Tringa</i>	<i>melanoleuca</i>	Greater Yellowlegs	E-Fauna BC	MCA
Charadriiformes	Scolopacidae	<i>Tringa</i>	<i>incana</i>	Wandering Tattler	E-Fauna BC	
Charadriiformes	Scolopacidae	<i>Tringa</i>	<i>solitaria</i>	Solitary Sandpiper	E-Fauna BC	MCA
Charadriiformes	Scolopacidae	<i>Tringa</i>	<i>flavipes</i>	Lesser Yellowlegs	E-Fauna BC	MCA
Charadriiformes	Stercorariidae	<i>Stercorarius</i>	<i>parasiticus</i>	Parasitic Jaeger	E-Fauna BC	MCA
Ciconiiformes	Ardeidae	<i>Ardea</i>	<i>alba</i>	Great Egret	E-Fauna BC	Unlikely: Rob Butler Likely: SPES
Ciconiiformes	Ardeidae	<i>Ardea</i>	<i>herodias</i>	Great Blue Heron <sup>†</sup>	E-Fauna BC	MCA
Ciconiiformes	Ardeidae	<i>Botaurus</i>	<i>lentiginosus</i>	American Bittern <sup>†</sup>	E-Fauna BC	MCA
Ciconiiformes	Ardeidae	<i>Butorides</i>	<i>virescens</i>	Green Heron <sup>†</sup>	E-Fauna BC	MCA
Ciconiiformes	Ardeidae	<i>Nycticorax</i>	<i>nycticorax</i>	Black-crowned Night Heron	BC Conservation Data Centre	Unlikely: Rob Butler Likely: SPES

Columbiformes	Columbidae	<i>Patagioenas</i>	<i>fasciata</i>	Band-tailed Pigeon <sup>†</sup>	E-Fauna BC	MCA
Columbiformes	Columbidae	<i>Columba</i>	<i>livia</i>	Rock Pigeon**	E-Fauna BC	MCA
Columbiformes	Columbidae	<i>Zenaida</i>	<i>macroura</i>	Mourning Dove	E-Fauna BC	MCA
Coraciiformes	Cerylidae	<i>Megaceryle</i>	<i>alcyon</i>	Belted Kingfisher	E-Fauna BC	MCA
Galliformes	Phasianidae	<i>Bonasa</i>	<i>umbellus</i>	Ruffed Grouse	E-Fauna BC	MCA
Gaviiformes	Gaviidae	<i>Gavia</i>	<i>adamsii</i>	Yellow-billed Loon	E-Fauna BC	Accidental - MCA Likely: SPES
Gaviiformes	Gaviidae	<i>Gavia</i>	<i>immer</i>	Common Loon	E-Fauna BC	MCA
Gaviiformes	Gaviidae	<i>Gavia</i>	<i>pacifica</i>	Pacific Loon	E-Fauna BC	MCA
Gaviiformes	Gaviidae	<i>Gavia</i>	<i>stellata</i>	Red-throated Loon	E-Fauna BC	MCA
Gaviiformes	Gaviidae	<i>Oxyura</i>	<i>jamaicensis</i>	Ruddy Duck	E-Fauna BC	Accidental - MCA Likely: SPES
Gruiformes	Rallidae	<i>Fulica</i>	<i>americana</i>	American Coot	E-Fauna BC	MCA
Gruiformes	Rallidae	<i>Porzana</i>	<i>carolina</i>	Sora	E-Fauna BC	MCA
Gruiformes	Rallidae	<i>Rallus</i>	<i>limicola</i>	Virginia Rail	E-Fauna BC	MCA
Incertae sedis	Cathartidae	<i>Cathartes</i>	<i>aura</i>	Turkey Vulture	E-Fauna BC	MCA
Passeriformes	Aegithalidae	<i>Psaltiriparus</i>	<i>minimus</i>	Bushtit	E-Fauna BC	MCA
Passeriformes	Bombycillidae	<i>Bombycilla</i>	<i>cedrorum</i>	Cedar Waxwing	E-Fauna BC	MCA
Passeriformes	Bombycillidae	<i>Bombycilla</i>	<i>garrulus</i>	Bohemian Waxwing	E-Fauna BC	MCA
Passeriformes	Certhidae	<i>Certhia</i>	<i>americana</i>	Brown Creeper	E-Fauna BC	MCA
Passeriformes	Cinclidae	<i>Cinclus</i>	<i>mexicanus</i>	American Dipper	E-Fauna BC	MCA
Passeriformes	Corvidae	<i>Corvus</i>	<i>caurinus</i>	Northwestern Crow	E-Fauna BC	MCA
Passeriformes	Corvidae	<i>Corvus</i>	<i>corax</i>	Common Raven	E-Fauna BC	MCA
Passeriformes	Corvidae	<i>Cyanocitta</i>	<i>stelleri</i>	Steller's Jay	E-Fauna BC	MCA
Passeriformes	Emberizidae	<i>Calcarius</i>	<i>mccownii</i>	McCown's Longspur	BC Conservation Data Centre	Unlikely: Rob Butler/MCA Likely: SPES
Passeriformes	Emberizidae	<i>Calcarius</i>	<i>lapponicus</i>	Lapland Longspur	Taxonomy Browser & E-	MCA

Fauna BC						
Passeriformes	Emberizidae	<i>Junco</i>	<i>hyemalis</i>	Dark-eyed Junco	E-Fauna BC	MCA
Passeriformes	Emberizidae	<i>Melospiza</i>	<i>lincolnii</i>	Lincoln's Sparrow	E-Fauna BC	MCA
Passeriformes	Emberizidae	<i>Melospiza</i>	<i>melodia</i>	Song Sparrow	E-Fauna BC	MCA
Passeriformes	Emberizidae	<i>Passerculus</i>	<i>sandwichensis</i>	Savannah Sparrow	E-Fauna BC	MCA
Passeriformes	Emberizidae	<i>Passerella</i>	<i>iliaca</i>	Fox Sparrow	E-Fauna BC	MCA
Passeriformes	Emberizidae	<i>Melospiza</i>	<i>georgiana</i>	Swamp Sparrow	Taxonomy Browser & E-Fauna BC	Unlikely: Rob Butler/MCA Likely: SPES
Passeriformes	Emberizidae	<i>Passerina</i>	<i>amoena</i>	Lazuli Bunting	E-Fauna BC	MCA
Passeriformes	Emberizidae	<i>Pheucticus</i>	<i>melanocephalus</i>	Black-headed Grosbeak	E-Fauna BC	MCA
Passeriformes	Emberizidae	<i>Pipilo</i>	<i>maculatus</i>	Spotted Towhee	E-Fauna BC	MCA
Passeriformes	Emberizidae	<i>Piranga</i>	<i>ludoviciana</i>	Western Tanager	E-Fauna BC	MCA
Passeriformes	Emberizidae	<i>Spizella</i>	<i>passerina</i>	Chipping Sparrow	E-Fauna BC	MCA
Passeriformes	Emberizidae	<i>Zonotrichia</i>	<i>albicollis</i>	White-throated Sparrow	E-Fauna BC	Accidental - MCA Likely: SPES
Passeriformes	Emberizidae	<i>Zonotrichia</i>	<i>atricapilla</i>	Golden-crowned Sparrow	E-Fauna BC	MCA
Passeriformes	Emberizidae	<i>Zonotrichia</i>	<i>leucophrys</i>	White-crowned Sparrow	E-Fauna BC	Unlikely: Rob Butler Likely: SPES/MCA
Passeriformes	Emberizidae	<i>Zonotrichia</i>	<i>querula</i>	Harris's Sparrow	BC Conservation Data Centre	Accidental - MCA Likely: SPES
Passeriformes	Fringillidae	<i>Acanthis</i>	<i>flammea</i>	Common Redpoll	E-Fauna BC	MCA
Passeriformes	Fringillidae	<i>Spinus</i>	<i>pinus</i>	Pine Siskin	E-Fauna BC	MCA
Passeriformes	Fringillidae	<i>Spinus</i>	<i>tristis</i>	American Goldfinch	E-Fauna BC	MCA
Passeriformes	Fringillidae	<i>Carpodacus</i>	<i>mexicanus</i>	House Finch	E-Fauna BC	MCA
Passeriformes	Fringillidae	<i>Carpodacus</i>	<i>purpureus</i>	Purple Finch <sup>†</sup>	E-Fauna BC	MCA
Passeriformes	Fringillidae	<i>Coccothraustes</i>	<i>vespertinus</i>	Evening Grosbeak	E-Fauna BC	MCA

Passeriformes	Fringillidae	<i>Loxia</i>	<i>curvirostra</i>	Red Crossbill	E-Fauna BC	MCA
Passeriformes	Fringillidae	<i>Loxia</i>	<i>leucoptera</i>	White-winged Crossbill	E-Fauna BC	MCA
Passeriformes	Fringillidae	<i>Pinicola</i>	<i>enucleator</i>	Pine Grosbeak	E-Fauna BC	MCA
Passeriformes	Hirundinidae	<i>Riparia</i>	<i>riparia</i>	Bank Swallow	E-Fauna BC	MCA
Passeriformes	Hirundinidae	<i>Hirundo</i>	<i>rustica</i>	Barn Swallow <sup>†</sup>	E-Fauna BC	MCA
Passeriformes	Hirundinidae	<i>Petrochelidon</i>	<i>pyrrhonota</i>	Cliff Swallow	E-Fauna BC	MCA
Passeriformes	Hirundinidae	<i>Progne</i>	<i>subis</i>	Purple Martin <sup>†</sup>	E-Fauna BC	MCA
Passeriformes	Hirundinidae	<i>Stelgidopteryx</i>	<i>serripennis</i>	Northern Rough-winged Swallow	E-Fauna BC	MCA
Passeriformes	Hirundinidae	<i>Tachycineta</i>	<i>bicolor</i>	Tree Swallow	E-Fauna BC	MCA
Passeriformes	Hirundinidae	<i>Tachycineta</i>	<i>thalassina</i>	Violet-green Swallow	E-Fauna BC	MCA
Passeriformes	Icteridae	<i>Agelaius</i>	<i>phoeniceus</i>	Red-winged Blackbird	E-Fauna BC	MCA
Passeriformes	Icteridae	<i>Euphagus</i>	<i>cyranocephalus</i>	Brewer's Blackbird	E-Fauna BC	MCA
Passeriformes	Icteridae	<i>Icterus</i>	<i>bullockii</i>	Bullock's Oriole	E-Fauna BC	MCA
Passeriformes	Icteridae	<i>Molothrus</i>	<i>ater</i>	Brown-headed Cowbird	E-Fauna BC	MCA
Passeriformes	Icteridae	<i>Sturnella</i>	<i>neglecta</i>	Western Meadowlark <sup>†</sup>	E-Fauna BC	MCA
Passeriformes	Icteridae	<i>Xanthocephalus</i>	<i>xanthocephalus</i>	Yellow-headed Blackbird	E-Fauna BC	MCA
Passeriformes	Laniidae	<i>Lanius</i>	<i>excubitor</i>	Northern Shrike	E-Fauna BC	MCA
Passeriformes	Motacillidae	<i>Anthus</i>	<i>rubescens</i>	American Pipit	E-Fauna BC	MCA
Passeriformes	Paridae	<i>Poecile</i>	<i>atricapillus</i>	Black-capped Chickadee	E-Fauna BC	MCA
Passeriformes	Paridae	<i>Poecile</i>	<i>gambeli</i>	Mountain Chickadee	E-Fauna BC	Unlikely: Rob Butler Likely: SPES
Passeriformes	Paridae	<i>Poecile</i>	<i>rufescens</i>	Chestnut-backed Chickadee	E-Fauna BC	MCA
Passeriformes	Parulidae	<i>Dendroica</i>	<i>coronata</i>	Yellow-rumped	E-Fauna BC	MCA



				Warbler		
Passeriformes	Parulidae	<i>Dendroica</i>	<i>nigrescens</i>	Black-throated Gray Warbler	E-Fauna BC	MCA
Passeriformes	Parulidae	<i>Dendroica</i>	<i>petechia</i>	Yellow Warbler	E-Fauna BC	MCA
Passeriformes	Parulidae	<i>Dendroica</i>	<i>townsendi</i>	Townsend's Warbler	E-Fauna BC	MCA
Passeriformes	Parulidae	<i>Geothlypis</i>	<i>trichas</i>	Common Yellowthroat	E-Fauna BC	MCA
Passeriformes	Parulidae	<i>Mniotilta</i>	<i>varia</i>	Black-and-white Warbler	E-Fauna BC	Unlikely: Rob Butler/MCA Likely: SPES
Passeriformes	Parulidae	<i>Oporornis</i>	<i>tolmiei</i>	MacGillivray's Warbler	E-Fauna BC	MCA
Passeriformes	Parulidae	<i>Dendroica</i>	<i>magnolia</i>	Magnolia Warbler	E-Fauna BC	John Reynolds - eBird
Passeriformes	Parulidae	<i>Oreothlypis</i>	<i>peregrina</i>	Tennessee Warbler	E-Fauna BC	MCA
Passeriformes	Parulidae	<i>Parkesia</i>	<i>noveboracensis</i>	Northern Waterthrush	E-Fauna BC	Unlikely: Rob Butler Likely: SPES
Passeriformes	Parulidae	<i>Setophaga</i>	<i>ruticilla</i>	American Redstart	E-Fauna BC	MCA
Passeriformes	Parulidae	<i>Oreothlypis</i>	<i>celata</i>	Orange-crowned Warbler	E-Fauna BC	MCA
Passeriformes	Parulidae	<i>Oreothlypis</i>	<i>ruficapilla</i>	Nashville Warbler	E-Fauna BC	MCA
Passeriformes	Parulidae	<i>Wilsonia</i>	<i>pusilla</i>	Wilson's Warbler	BC Conservation Data Centre	MCA
Passeriformes	Passeridae	<i>Passer</i>	<i>domesticus</i>	House Sparrow**†	E-Fauna BC	MCA
Passeriformes	Regulidae	<i>Regulus</i>	<i>calendula</i>	Ruby-crowned Kinglet	E-Fauna BC	MCA
Passeriformes	Regulidae	<i>Regulus</i>	<i>satrapa</i>	Golden-crowned Kinglet	E-Fauna BC	MCA
Passeriformes	Sittidae	<i>Sitta</i>	<i>canadensis</i>	Red-breasted Nuthatch	E-Fauna BC	Unlikely: Rob Butler Likely: MCA/SPES

Passeriformes	Sittidae	<i>Sitta</i>	<i>carolinensis</i>	White-breasted Nuthatch	E-Fauna BC	Unlikely: Rob Butler Likely: SPES
Passeriformes	Sturnidae	<i>Sturnus</i>	<i>vulgaris</i>	European Starling**	E-Fauna BC	MCA
Passeriformes	Troglodytidae	<i>Thryomanes</i>	<i>bewickii</i>	Bewick's Wren	E-Fauna BC	MCA
Passeriformes	Troglodytidae	<i>Troglodytes</i>	<i>pacificus</i>	Pacific Wren	E-Fauna BC	MCA
Passeriformes	Troglodytidae	<i>Troglodytes</i>	<i>aedon</i>	House Wren	E-Fauna BC	MCA
Passeriformes	Troglodytidae	<i>Cistothorus</i>	<i>palustris</i>	Marsh Wren	E-Fauna BC	MCA
Passeriformes	Turdidae	<i>Catharus</i>	<i>guttatus</i>	Hermit Thrush	E-Fauna BC	MCA
Passeriformes	Turdidae	<i>Catharus</i>	<i>ustulatus</i>	Swainson's Thrush	BC Conservation Data Centre	MCA
Passeriformes	Turdidae	<i>Ixoreus</i>	<i>naevius</i>	Varied Thrush	E-Fauna BC	MCA
Passeriformes	Turdidae	<i>Myadestes</i>	<i>townsendi</i>	Townsend's Solitaire	BC Conservation Data Centre	MCA
Passeriformes	Turdidae	<i>Turdus</i>	<i>migratorius</i>	American Robin	E-Fauna BC	SPES
Passeriformes	Turdidae	<i>Sialia</i>	<i>currucoides</i>	Mountain Bluebird	E-Fauna BC	MCA
Passeriformes	Tyrannidae	<i>Contopus</i>	<i>cooperi</i>	Olive-sided Flycatcher†	E-Fauna BC	MCA
Passeriformes	Tyrannidae	<i>Contopus</i>	<i>sordidulus</i>	Western Wood-pewee	E-Fauna BC	MCA
Passeriformes	Tyrannidae	<i>Empidonax</i>	<i>difficilis</i>	Pacific-slope Flycatcher	E-Fauna BC	MCA
Passeriformes	Tyrannidae	<i>Empidonax</i>	<i>hammondii</i>	Hammond's Flycatcher	E-Fauna BC	MCA
Passeriformes	Tyrannidae	<i>Empidonax</i>	<i>oberholseri</i>	Dusky Flycatcher	E-Fauna BC	
Passeriformes	Tyrannidae	<i>Empidonax</i>	<i>trillii</i>	Willow Flycatcher	E-Fauna BC	MCA
Passeriformes	Tyrannidae	<i>Sayornis</i>	<i>nigricans</i>	Black Phoebe	E-Fauna BC	Unlikely: Rob Butler Likely: SPES
Passeriformes	Tyrannidae	<i>Sayornis</i>	<i>saya</i>	Say's Phoebe	Taxonomy Browser	MCA
Passeriformes	Tyrannidae	<i>Tyrannus</i>	<i>tyrannus</i>	Eastern Kingbird	E-Fauna BC	John Reynolds - MCA

Passeriformes	Tyrannidae	<i>Tyrannus</i>	<i>verticalis</i>	Western Kingbird	E-Fauna BC	John Reynolds - MCA
Passeriformes	Vireonidae	<i>Vireo</i>	<i>cassinii</i>	Cassin's Vireo	E-Fauna BC	MCA
Passeriformes	Vireonidae	<i>Vireo</i>	<i>gilvus</i>	Warbling Vireo	E-Fauna BC	MCA
Passeriformes	Vireonidae	<i>Vireo</i>	<i>huttoni</i>	Hutton's Vireo	E-Fauna BC	MCA
Passeriformes	Vireonidae	<i>Vireo</i>	<i>olivaceus</i>	Red-eyed Vireo	E-Fauna BC	MCA
Pelecaniformes	Pelecanidae	<i>Pelecanus</i>	<i>erythrorhynchos</i>	American White Pelican	E-Fauna BC	Unlikely: MCA Likely: SPES
Pelecaniformes	Pelecanidae	<i>Pelecanus</i>	<i>occidentalis</i>	Brown Pelican	E-Fauna BC	
Pelecaniformes	Phalacrocoracidae	<i>Phalacrocorax</i>	<i>auritus</i>	Double-crested Cormorant <sup>†</sup>	E-Fauna BC	MCA
Pelecaniformes	Phalacrocoracidae	<i>Phalacrocorax</i>	<i>pelagicus</i>	Pelagic Cormorant	E-Fauna BC	MCA
Pelecaniformes	Phalacrocoracidae	<i>Phalacrocorax</i>	<i>penicillatus</i>	Brandt's Cormorant <sup>†</sup>	E-Fauna BC	MCA
Piciformes	Picidae	<i>Colaptes</i>	<i>auratus</i>	Northern Flicker	E-Fauna BC	MCA
Piciformes	Picidae	<i>Dryocopus</i>	<i>pileatus</i>	Pileated Woodpecker	E-Fauna BC	MCA
Piciformes	Picidae	<i>Picoides</i>	<i>pubescens</i>	Downy Woodpecker	E-Fauna BC	MCA
Piciformes	Picidae	<i>Picoides</i>	<i>villosus</i>	Hairy Woodpecker	E-Fauna BC	MCA
Piciformes	Picidae	<i>Sphyrapicus</i>	<i>nuchalis</i>	Red-naped Sapsucker	E-Fauna BC	Unlikely: Rob Butler/MCA Likely: SPES
Piciformes	Picidae	<i>Sphyrapicus</i>	<i>ruber</i>	Red-breasted Sapsucker	E-Fauna BC	MCA
Podicipediformes	Podicipedidae	<i>Aechmophorus</i>	<i>clarkii</i>	Clark's Grebe	E-Fauna BC	
Podicipediformes	Podicipedidae	<i>Aechmophorus</i>	<i>occidentalis</i>	Western Grebe <sup>†</sup>	E-Fauna BC	MCA
Podicipediformes	Podicipedidae	<i>Podiceps</i>	<i>auritus</i>	Horned Grebe	E-Fauna BC	MCA
Podicipediformes	Podicipedidae	<i>Podiceps</i>	<i>griseogen</i>	Red-necked Grebe	E-Fauna BC	MCA
Podicipediformes	Podicipedidae	<i>Podiceps</i>	<i>nigricollis</i>	Eared Grebe	E-Fauna BC	
Podicipediformes	Podicipedidae	<i>Podilymbus</i>	<i>podiceps</i>	Pied-billed Grebe	E-Fauna BC	MCA
Strigiformes	Strigidae	<i>Aegolius</i>	<i>acadicus</i>	Northern Saw-	E-Fauna BC	MCA

				whet Owl		
Strigiformes	Strigidae	<i>Asio</i>	<i>flammeus</i>	Short-eared Owl <sup>†</sup>	E-Fauna BC	MCA
Strigiformes	Strigidae	<i>Bubo</i>	<i>scandiacus</i>	Snowy Owl	E-Fauna BC	
Strigiformes	Strigidae	<i>Bubo</i>	<i>virginianus</i>	Great Horned Owl	E-Fauna BC	MCA
Strigiformes	Strigidae	<i>Glaucidium</i>	<i>gnoma</i>	Northern Pygmy-Owl	E-Fauna BC	MCA
Strigiformes	Strigidae	<i>Megascops</i>	<i>kennicotti</i>	Western Screech-Owl <sup>*†</sup>	E-Fauna BC	
Strigiformes	Strigidae	<i>Strix</i>	<i>nebulosa</i>	Great Grey Owl	Taxonomy Browser	MCA
Strigiformes	Strigidae	<i>Strix</i>	<i>varia</i>	Barred Owl	E-Fauna BC	MCA
Strigiformes	Tytonidae	<i>Tyto</i>	<i>alba</i>	Barn Owl	E-Fauna BC	Accidental - MCA Likely: SPES
Trochiliformes	Trochilidae	<i>Calypte</i>	<i>anna</i>	Anna's Hummingbird	E-Fauna BC	Accidental - MCA Likely: SPES
Trochiliformes	Trochilidae	<i>Selasphorus</i>	<i>rufus</i>	Rufous Hummingbird	E-Fauna BC	MCA
Trochiliformes	Trochilidae	<i>Stellula</i>	<i>calliope</i>	Calliope Hummingbird	E-Fauna BC	MCA

Table C.3 Fish

Order	Family	Genus	Species	Common Name	Reference	Verification
Batrachoidiformes	Batrachoididae	<i>Portichthys</i>	<i>notatus</i>	Plainfin Midshipman	Murray Manson	Murray Manson
Chondrichthyes	Chimaeridae	<i>Hydrolagus</i>	<i>coliei</i>	Spotted Ratfish	Isabelle Côté & Glenn Wagner	Murray Manson
Chondrichthyes	Rajidae	<i>Raja</i>	<i>rhina</i>	Longnose Skate	Glenn Wagner	Murray Manson
Chondrichthyes	Squalidae	<i>Squalus</i>	<i>acanthias</i>	Pacific Dogfish	Isabelle Côté & Glenn Wagner	Murray Manson
Clupeiformes	Clupeidae	<i>Alosa</i>	<i>sapidissima</i>	American Shad <sup>*</sup>	Murray Manson	Murray Manson

Clupeiformes	Engraulidae	<i>Engraulis</i>	<i>mordax</i>	Northern Anchovy	Murray Manson	Murray Manson
Cypriniformes	Cyprinidae	<i>Cyprinus</i>	<i>carpio</i>	Common Carp**	Murray Manson	Murray Manson
Clupeiformes	Clupeidae	<i>Clupea</i>	<i>pallasii</i>	Pacific Herring	Murray Manson	Murray Manson
Gadiformes	Gadidae	<i>Gadus</i>	<i>macrocephalus</i>	Pacific Cod	E-Fauna BC	Malissa Smith
Gadiformes	Gadidae	<i>Theragra</i>	<i>chalcogramma</i>	Walleye Polloch	Murray Manson	Murray Manson
Gadiformes	Merlucciidae	<i>Merluccius</i>	<i>productus</i>	Pacific Hake	Murray Manson	Murray Manson
Gasterosteiformes	Gasterosteidae	<i>Aulorhynchus</i>	<i>flavidus</i>	Tubesnout	Murray Manson	Murray Manson
Gasterosteiformes	Gasterosteidae	<i>Gasterosteus</i>	<i>aculeatus</i>	Threespine Stickleback	Murray Manson	Murray Manson
Osmeriformes	Osmeridae	<i>Spirinchus</i>	<i>thaleichthys</i>	Longfin Smelt	Murray Manson	Murray Manson
Osmeriformes	Platyroctidae	<i>Hypomesus</i>	<i>pretiosus</i>	Surf Smelt	Murray Manson	Murray Manson
Perciformes	Ammodytidae	<i>Ammodytes</i>	<i>hexapterus</i>	Pacific Sand Lance	Murray Manson	Murray Manson
Perciformes	Bathymasteridae	<i>Ronquilus</i>	<i>jordani</i>	Northern Ronquil	Murray Manson	Murray Manson
Perciformes	Centrarchidae	<i>Micropterus</i>	<i>dolomieu</i>	Smallmouth Bass*	Murray Manson	Murray Manson
Perciformes	Centrarchidae	<i>Micropterus</i>	<i>salmonides</i>	Largemouth Bass*	Murray Manson	Murray Manson
Perciformes	Embiotocidae	<i>Brachyistius</i>	<i>frenatus</i>	Kelp Surfperch	Murray Manson	Murray Manson
Perciformes	Embiotocidae	<i>Cymatogaster</i>	<i>aggregata</i>	Shiner Perch	Murray Manson	Murray Manson
Perciformes	Embiotocidae	<i>Embiotoca</i>	<i>lateralis</i>	Striped Seaperch	Murray Manson	Murray Manson
Perciformes	Embiotocidae	<i>Phanerodon</i>	<i>furcatus</i>	White Seaperch	E-Fauna BC	Malissa Smith
Perciformes	Embiotocidae	<i>Rhacochilus</i>	<i>vacca</i>	Pile Perch	Murray Manson	Murray Manson
Perciformes	Gobiesocidae	<i>Gobiesox</i>	<i>maeandricus</i>	Northern Clingfish	Murray Manson	Murray Manson
Perciformes	Gobiidae	<i>Clevelandia</i>	<i>ios</i>	Arrow Goby	Murray Manson	Murray Manson
Perciformes	Gobiidae	<i>Lepidogobius</i>	<i>lepidus</i>	Bay Goby	Murray Manson	Murray Manson
Perciformes	Gobiidae	<i>Rhinogobiops</i>	<i>nicholsii</i>	Blackeye Goby	Murray Manson	Murray Manson
Perciformes	Stichaeidae	<i>Anoplarchus</i>	<i>purpurescens</i>	High Cockscomb	Murray Manson	Murray Manson
Perciformes	Stichaeidae	<i>Chirolophis</i>	<i>decoratus</i>	Decorated Warbonnet	Murray Manson	Murray Manson
Perciformes	Stichaeidae	<i>Lumpenus</i>	<i>sagitta</i>	Pacific Snake Prickleback	Murray Manson	Murray Manson

Perciformes	Stichaeidae	<i>Xiphister</i>	<i>atropurpureus</i>	Black Prickleback	Murray Manson	Murray Manson
Perciformes	Stichaeidae	<i>Xiphister</i>	<i>mucosus</i>	Rock Prickleback	Murray Manson	Murray Manson
Perciformes	Zoarcidae	<i>Lycodes</i>	<i>pacificus</i>	Blackbelly Eelpout	Murray Manson	Murray Manson
Petromyæontiformes	Petromyæontidae	<i>Lampetra</i>	<i>richardsoni</i>	Western Brook Lamprey	Murray Manson	Murray Manson
Petromyæontiformes	Petromyæontidae	<i>Lampetras</i>	<i>tridentata</i>	Pacific Lamprey	Murray Manson	Murray Manson
Pholidae	Pholidae	<i>Apodichthys</i>	<i>flavidus</i>	Penpoint Gunnel	Murray Manson	Murray Manson
Pholidae	Pholidae	<i>Pholis</i>	<i>laeta</i>	Crescent Gunnel	Murray Manson	Murray Manson
Pholidae	Pholidae	<i>Pholis</i>	<i>ornata</i>	Saddleback Gunnel	Murray Manson	Murray Manson
Pholidae	Pholidae	<i>Xerepes</i>	<i>fucorum</i>	Rockweed Gunnel	Murray Manson	Murray Manson
Pleuronectiformes	Paralichthyidae	<i>Citharichthys</i>	<i>sordidus</i>	Pacific sanddab	Murray Manson	Murray Manson
Pleuronectiformes	Paralichthyidae	<i>Citharichthys</i>	<i>stigmaeus</i>	Speckled sanddab	Murray Manson	Murray Manson
Pleuronectiformes	Pleuronectidae	<i>Atheresthes</i>	<i>stomias</i>	Arrowtooth Flounder	Murray Manson	Murray Manson
Pleuronectiformes	Pleuronectidae	<i>Glyptocephalus</i>	<i>zachirus</i>	Rex Sole	Murray Manson	Murray Manson
Pleuronectiformes	Pleuronectidae	<i>Hippoglossoides</i>	<i>elassodon</i>	Flathead Sole	Murray Manson	Murray Manson
Pleuronectiformes	Pleuronectidae	<i>Lepidopsetta</i>	<i>bilineata</i>	Rock Sole	Murray Manson	Murray Manson
Pleuronectiformes	Pleuronectidae	<i>Lyopsetta</i>	<i>exilis</i>	Slender Sole	Murray Manson	Murray Manson
Pleuronectiformes	Pleuronectidae	<i>Microstomus</i>	<i>pacificus</i>	Dover Sole	Murray Manson	Murray Manson
Pleuronectiformes	Pleuronectidae	<i>Parophrys</i>	<i>vetulus</i>	English Sole	Murray Manson	Murray Manson
Pleuronectiformes	Pleuronectidae	<i>Platichthys</i>	<i>stellatus</i>	Starry Flounder	Murray Manson	Murray Manson
Pleuronectiformes	Pleuronectidae	<i>Pleuronichthys</i>	<i>coenosus</i>	C-O sole	Murray Manson	Murray Manson
Pleuronectiformes	Pleuronectidae	<i>Pleuronectes</i>	<i>vetulus</i>	English Sole	E-Fauna BC	Malissa Smith
Pleuronectiformes	Pleuronectidae	<i>Psettichthys</i>	<i>melanostictus</i>	Sand Sole	Murray Manson	Murray Manson
Salmoniformes	Salmonidae	<i>Onchorhynchus</i>	<i>mykiss</i>	Steelhead Trout	Murray Manson	Murray Manson
Salmoniformes	Salmonidae	<i>Oncorhynchus</i>	<i>clarkii clarkii</i>	Coastal Cutthroat Trout*†	Murray Manson	Glenn Wagner
Salmoniformes	Salmonidae	<i>Oncorhynchus</i>	<i>gorbuscha</i>	Pink Salmon	Murray Manson	Murray Manson
Salmoniformes	Salmonidae	<i>Oncorhynchus</i>	<i>keta</i>	Chum Salmon	Murray Manson	Murray Manson
Salmoniformes	Salmonidae	<i>Oncorhynchus</i>	<i>kisutch</i>	Coho Salmon	Murray Manson	Murray Manson

Salmoniformes	Salmonidae	<i>Oncorhynchus</i>	<i>nerka</i>	Sockeye Salmon	Murray Manson	Murray Manson
Salmoniformes	Salmonidae	<i>Oncorhynchus</i>	<i>tshawytscha</i>	Chinook Salmon	Murray Manson	Murray Manson
Scorpaeniformes	Agonidae	<i>Bathyagonus</i>	<i>nigripinnis</i>	Blackfin Poacher	E-Fauna BC	Malissa Smith
Scorpaeniformes	Agonidae	<i>Podothecus</i>	<i>acipenserinus</i>	Sturgeon Poacher	E-Fauna BC	Murray Manson
Scorpaeniformes	Cottidae	<i>Artedius</i>	<i>fenestralis</i>	Padded Sculpin	Murray Manson	Murray Manson
Scorpaeniformes	Cottidae	<i>Artedius</i>	<i>harringtoni</i>	Scalyhead Sculpin	Murray Manson	Murray Manson
Scorpaeniformes	Cottidae	<i>Artedius</i>	<i>lateralis</i>	Smoothhead Sculpin	Murray Manson	Murray Manson
Scorpaeniformes	Cottidae	<i>Blepsias</i>	<i>cirrhus</i>	Silverspotted Sculpin	Murray Manson	Murray Manson
Scorpaeniformes	Cottidae	<i>Clinocottus</i>	<i>acuticeps</i>	Sharpnose Sculpin	Murray Manson	Murray Manson
Scorpaeniformes	Cottidae	<i>Cottus</i>	<i>asper</i>	Prickly Sculpin	Murray Manson	Murray Manson
Scorpaeniformes	Cottidae	<i>Enophrys</i>	<i>bison</i>	Buffalo Sculpin	Murray Manson	Murray Manson
Scorpaeniformes	Cottidae	<i>Hemilepidotus</i>	<i>hemilepidotus</i>	Red Irish Lord	Murray Manson	Murray Manson
Scorpaeniformes	Cottidae	<i>Hemilepidotus</i>	<i>spinosus</i>	Brown Irish Lord	E-Fauna BC	Malissa Smith
Scorpaeniformes	Cottidae	<i>Icelinus</i>	<i>tenuis</i>	Spotfin Sculpin	Murray Manson	Murray Manson
Scorpaeniformes	Cottidae	<i>Jordania</i>	<i>zonope</i>	Longfin Sculpin	Murray Manson	Murray Manson
Scorpaeniformes	Cottidae	<i>Leptocottus</i>	<i>armatus</i>	Staghorn Sculpin	Murray Manson	Murray Manson
Scorpaeniformes	Cottidae	<i>Malacocottus</i>	<i>kincaidi</i>	Blackfin Sculpin	E-Fauna BC	Malissa Smith
Scorpaeniformes	Cottidae	<i>Myoxocephalus</i>	<i>polyacanthocephalus</i>	Great Sculpin	Murray Manson	Murray Manson
Scorpaeniformes	Cottidae	<i>Nautichthys</i>	<i>oculofasciatus</i>	Sailfin Sculpin	Murray Manson	Murray Manson
Scorpaeniformes	Cottidae	<i>Oligocottus</i>	<i>maculosus</i>	Tidepool Sculpin	Murray Manson	Murray Manson
Scorpaeniformes	Cottidae	<i>Oligocottus</i>	<i>snyderi</i>	Fluffy Sculpin	Murray Manson	Murray Manson
Scorpaeniformes	Cottidae	<i>Radulinus</i>	<i>asprellus</i>	Slim Sculpin	Murray Manson	Murray Manson
Scorpaeniformes	Cottidae	<i>Rhamphocottus</i>	<i>richardsonii</i>	Grunt Sculpin	Murray Manson	Murray Manson
Scorpaeniformes	Cottidae	<i>Scorpaenichthys</i>	<i>marmoratus</i>	Cabazon	Murray Manson	Murray Manson
Scorpaeniformes	Cottidae	<i>Synchirus</i>	<i>gilli</i>	Manacled Sculpin	Murray Manson	Murray Manson

Scorpaeniformes	Hexagrammidae	<i>Hexagrammos</i>	<i>decagrammus</i>	Kelp Greenling	Murray Manson	Murray Manson
Scorpaeniformes	Hexagrammidae	<i>Hexagrammos</i>	<i>lagocephalus</i>	Rock Greenling	Murray Manson	Murray Manson
Scorpaeniformes	Hexagrammidae	<i>Hexagrammos</i>	<i>octogrammus</i>	Masked Greenling	Murray Manson	Murray Manson
Scorpaeniformes	Hexagrammidae	<i>Hexagrammus</i>	<i>stelleri</i>	Whitespotted Greenling	Murray Manson	Murray Manson
Scorpaeniformes	Hexagrammidae	<i>Ophiodon</i>	<i>elongates</i>	Lingcod	Murray Manson	Murray Manson
Scorpaeniformes	Hexagrammidae	<i>Oxylebius</i>	<i>pictus</i>	Painted Greenling	Murray Manson	Murray Manson
Scorpaeniformes	Psychrolutidae	<i>Psychrolutes</i>	<i>paradoxus</i>	Tadpole Sculpin	Murray Manson	Murray Manson
Scorpaeniformes	Scorpaenidae	<i>Sebastes</i>	<i>auraculatis</i>	Brown Rockfish	E-Fauna BC	Malissa Smith
Scorpaeniformes	Scorpaenidae	<i>Sebastes</i>	<i>caurinus</i>	Copper Rockfish	Murray Manson	Murray Manson
Scorpaeniformes	Scorpaenidae	<i>Sebastes</i>	<i>emphaeus</i>	Puget Sound Rockfish	Murray Manson	Murray Manson
Scorpaeniformes	Scorpaenidae	<i>Sebastes</i>	<i>flavidus</i>	Yellowtail Rockfish	Murray Manson	Murray Manson
Scorpaeniformes	Scorpaenidae	<i>Sebastes</i>	<i>melanops</i>	Black Rockfish	Murray Manson	Murray Manson
Scorpaeniformes	Scorpaenidae	<i>Sebastes</i>	<i>maliger</i>	Quillback Rockfish	Murray Manson	Murray Manson
Scorpaeniformes	Scorpaenidae	<i>Sebastes</i>	<i>ruberrimus</i>	Yelloweye Rockfish	Murray Manson	Murray Manson
Syngnathiformes	Syngnathidae	<i>Leptorynchus</i>	<i>griseolineatus</i>	Pipefish	Murray Manson	Murray Manson

Table C.4 Reptiles

Order	Family	Genus	Species	Common Name	Reference	Verification
Squamata	Anguidae	<i>Elgaria</i>	<i>coerulea</i>	Northern Alligator Lizard	Taxonomy Browser	SPES
Squamata	Colubridae	<i>Thamnophis</i>	<i>elegans</i>	Western Terrestrial Garter Snake	Taxonomy Browser	SPES
Squamata	Colubridae	<i>Thamnophis</i>	<i>ordinoides</i>	Northwestern Garter Snake	Taxonomy Browser	SPES
Squamata	Colubridae	<i>Thamnophis</i>	<i>sirtalis</i>	Common Garter Snake	Taxonomy Browser	SPES
Testudines	Emydidae	<i>Chrysemys</i>	<i>picta</i>	Western Painted Turtle <sup>†</sup>	Taxonomy Browser	SPES
Testudines	Emydidae	<i>Trachemys</i>	<i>scripta</i>	Red-eared Slider <sup>**</sup>	Taxonomy Browser	SPES



Table C.5 Amphibians

Order	Family	Genus	Species	Common Name	Reference	Verification
Anura	Bufo	<i>Bufo</i>	<i>boreas</i>	Western Toad	Taxonomy Browser	
Anura	Hyla	<i>Hyla</i>	<i>regilla</i>	Pacific Tree Frog	Taxonomy Browser & Efauna	
Caudata	Ambystomatidae	<i>Ambystoma</i>	<i>gracile</i>	Northwestern Salamander	Taxonomy Browser	SPES
Caudata	Ambystomatidae	<i>Ambystoma</i>	<i>macrodictylum</i>	Western Long-toed Salamander	Taxonomy Browser	SPES
Caudata	Plethodontidae	<i>Ensatina</i>	<i>eschscholtzii</i>	Ensatina Salamander	Taxonomy Browser	SPES
Caudata	Plethodontidae	<i>Plethodon</i>	<i>vehiculum</i>	Western Red-backed Salamander	Taxonomy Browser	SPES
Anura	Ranidae	<i>Rana</i>	<i>aurora</i>	Red-Legged Frog <sup>†</sup>	Taxonomy Browser	SPES
Anura	Ranidae	<i>Rana</i>	<i>catesbeiana</i>	American Bullfrog**	Taxonomy Browser	SPES
Anura	Ranidae	<i>Rana</i>	<i>clamitans</i>	Green Frog**	Taxonomy Browser	SPES
Caudata	Salamandridae	<i>Taricha</i>	<i>granulosa</i>	Rough-Skinned Newt	Taxonomy Browser	SPES

Table C.6 Tunicates

Order	Family	Genus	Species	Common Name
Phlebobranchia	Ascidiidae	<i>Ascidia</i>	<i>callosa</i>	Sea Blister
Phlebobranchia	Ascidiidae	<i>Ascidia</i>	<i>columbiana</i>	Sea Blister
Phlebobranchia	Corellidae	<i>Chelyosoma</i>	<i>productum</i>	Disc-top Tunicate
Phlebobranchia	Corellidae	<i>Corella</i>	<i>willmeriana</i>	Transparent Tunicate
Pleurogona	Pyuridae	<i>Halocynthia</i>	<i>aurantium</i>	Pacific Sea Peach
Pleurogona	Pyuridae	<i>Halocynthia</i>	<i>igaboja</i>	Bristly Tunicate
Stolidobranchia	Pyuridae	<i>Boltenia</i>	<i>villosa</i>	Hairy Tunicate
Stolidobranchia	Pyuridae	<i>Pyura</i>	<i>haustor</i>	Warty Tunicate
Stolidobranchia	Styelidae	<i>Cnemidocarpa</i>	<i>finmarkiensis</i>	Broadbase Tunicate
Stolidobranchia	Styelidae	<i>Styela</i>	<i>gibbsii</i>	Brown Tunicate

Table C.7 Crustaceans

Class	Order	Family	Genus	Species	Common Name	Reference	Verification
Brachiopoda	Cladocera	Bosminidae	<i>Bosmina</i>		Water Fleas		SPES
Brachiopoda	Cladocera	Daphniidae	<i>Daphnia</i>		Water Fleas		SPES
Malacostraca	Amphipoda	Ampithoidae	<i>Ampithoe</i>	<i>Valida</i>	square-tooth sea flea	E-Fauna BC	SPES
Malacostraca	Amphipoda	Gammaridae	<i>Gammarus</i>		Amphipods	Taxonomy Browser	SPES
Malacostraca	Decapoda	Cancridae	<i>Cancer</i>	<i>Magister</i>	Dungeness Crab	E-Fauna BC	SPES
Malacostraca	Decapoda	Cancridae	<i>Cancer</i>	<i>Productus</i>	Red Rock Crab	E-Fauna BC	SPES
Malacostraca	Decapoda	Cancridae	<i>Cancer</i>	<i>Gracilis</i>	Graceful Rock Crab	E-Fauna BC	Isabelle Côté
Malacostraca	Amphipoda	Caprellidae	<i>Caprella</i>	<i>Alaskana</i>	Alaskan Skeleton Shrimp	ITIS	
Malacostraca	Decapoda	Grapsidae	<i>Hemigrapsus</i>	<i>oregonensis</i>	Green Shore Crab	E-Fauna BC	SPES
Malacostraca	Decapoda	Hippolytidae	<i>Heptacarpus</i>	<i>brevirostris</i>	Stout Coastal Shrimp	E-Fauna BC	
Malacostraca	Decapoda	Hippolytidae	<i>Heptacarpus</i>	<i>Stylus</i>	Stiletto Coastal Shrimp	E-Fauna BC	
Malacostraca	Decapoda	Lithodidae	<i>Acantholithodes</i>	<i>Hispidus</i>	Spiny Lithode Crab	E-Fauna BC	
Malacostraca	Decapoda	Lithodidae	<i>Hapalogaster</i>	<i>Mertensii</i>	Hairy Crab	E-Fauna BC	
Malacostraca	Decapoda	Lithodidae	<i>Lopholithodes</i>	<i>forminatus</i>	Brown Box Crab	E-Fauna BC	
Malacostraca	Decapoda	Lithodidae	<i>Rhinolithodes</i>	<i>wosnessenskii</i>	Rhinoceros Crab	E-Fauna BC	
Malacostraca	Decapoda	Majidae	<i>Chorilia</i>	<i>Longipes</i>	Longhorn Decorator Crab	E-Fauna BC	
Malacostraca	Decapoda	Paguridae	<i>Elassochirus</i>	<i>tenuimanus</i>	Widehand Hermit Crab	E-Fauna BC	
Malacostraca	Decapoda	Paguridae	<i>Labidochirus</i>	<i>splendescens</i>	Splendid Hermit Crab	E-Fauna BC	
Malacostraca	Decapoda	Paguridae	<i>Pagurus</i>	<i>beringanus</i>	Bering Hermit Crab	E-Fauna BC	
Malacostraca	Decapoda	Paguridae	<i>Pagurus</i>	<i>granosimanus</i>	Grainy-hand Hermit Crab	E-Fauna BC	
Malacostraca	Decapoda	Paguridae	<i>Pagurus</i>	<i>hirsutiusculus</i>	Hairy Hermit Crab	E-Fauna BC	SPES
Malacostraca	Decapoda	Paguridae	<i>Pagurus</i>	<i>Stevensae</i>	Stevens' Hermit Crab	E-Fauna BC	
Malacostraca	Decapoda	Pandalidae	<i>Pandalus</i>	<i>Danae</i>	Coonstripe/Dock Shrimp	E-Fauna BC	

Malacostraca	Decapoda	Pandalidae	<i>Pandalus</i>	<i>Stenolepis</i>	Rough Patch Shrimp	E-Fauna BC	
Malacostraca	Decapoda	Pandalidae	<i>Pandalopsis</i>	<i>lucidirimicola</i>	Sparkling Shrimp	E-Fauna BC	
Malacostraca	Decapoda	Panopeidae	<i>Lophopanopeus</i>	<i>bellus bellus</i>	Black-clawed Crab	E-Fauna BC	SPES
Malacostraca	Decapoda	Varunidae	<i>Hemigrapsus</i>	<i>Nudus</i>	Purple Shore Crab	E-Fauna BC	SPES
Malacostraca	Isopoda	Idoteidae	<i>Idotea</i>	<i>wosnesenskii</i>	Rockweed Isopod	E-Fauna BC	SPES
Malacostraca	Isopoda	Ligiidae	<i>Ligia</i>	<i>Pallasii</i>	Sea Slater/Woodlice	E-Fauna BC	SPES
Maxillopoda	Cyclopoida				Copepods	Taxonomy Browser	SPES
Maxillopoda	Harpacticoida		<i>Nauplii</i>		Copepod larvae		SPES
Maxillopoda	Sessilia	Archaeobalanidae	<i>Semibalanus</i>	<i>cariosus</i>	Thatched Acorn Barnacle	E-Fauna BC	SPES
Maxillopoda	Sessilia	Balanidae	<i>Balanus</i>	<i>glandula</i>	Common Acorn barnacle	E-Fauna BC	SPES
Maxillopoda	Sessilia	Balanidae	<i>Balanus</i>	<i>nubilis</i>	Giant Acorn Barnacle	E-Fauna BC	
Maxillopoda	Sessilia	Balanidae	<i>Solidobalanus</i>	<i>engbergi</i>	Hydrocoral Barnacle	E-Fauna BC	

Table C.8 Insects (aquatic associated only)

Class	Order	Family	Genus	Species	Common Name	Reference	Verification
Insecta	Coleoptera	Dytiscidae	<i>Agabus</i>	<i>anthracinus</i>	Predacious Diving Beetle	E-Fauna BC	SPES
Insecta	Coleoptera	Dytiscidae	<i>Agabus</i>	<i>perplexus</i>	Predacious Diving Beetle	E-Fauna BC	SPES
Insecta	Coleoptera	Dytiscidae	<i>Agabus</i>	<i>seriatus</i>	Predacious Diving Beetle	E-Fauna BC	SPES
Insecta	Coleoptera	Dytiscidae	<i>Agabus</i>	<i>strigulosus</i>	Predacious Diving Beetle	E-Fauna BC	SPES
Insecta	Coleoptera	Dytiscidae	<i>Hydaticus</i>	<i>aruspex</i>	Predacious Diving Beetle	E-Fauna BC	SPES
Insecta	Coleoptera	Dytiscidae	<i>Hydroporus</i>	<i>mannerheimi</i>	Predacious Diving Beetle	E-Fauna BC	SPES
Insecta	Coleoptera	Dytiscidae	<i>Hydroporus</i>		Predacious Diving Beetle	Taxonomy Browser	SPES
Insecta	Coleoptera	Dytiscidae	<i>Hygrotus</i>	<i>sayi</i>	Predacious Diving Beetle	E-Fauna BC	SPES
Insecta	Coleoptera	Dytiscidae	<i>Ilybius</i>	<i>quadrimaculatus</i>	Predacious Diving Beetle	E-Fauna BC	SPES
Insecta	Coleoptera	Hydrophilidae	<i>Anacaena</i>	<i>lutescens</i>	Water Scavenger Beetle	Taxonomy Browser	SPES
Insecta	Coleoptera	Hydrophilidae	<i>Cymbiodyta</i>	<i>acuminata</i>	Water Scavenger Beetle	E-Fauna BC	SPES
Insecta	Coleoptera	Hydrophilidae	<i>Cymbiodyta</i>	<i>vindicata</i>	Water Scavenger Beetle	E-Fauna BC	SPES
Insecta	Coleoptera	Hydrophilidae	<i>Enochrus</i>	<i>californicus</i>	Water Scavenger Beetle	E-Fauna BC	SPES
Insecta	Coleoptera	Hydrophilidae	<i>Hydrobius</i>	<i>fuscipes</i>	Water Scavenger Beetle	E-Fauna BC	SPES
Insecta	Diptera	Chironomidae	<i>Orthocladiinae</i>		Non-Biting Midges		SPES
Insecta	Diptera	Chironomidae	<i>Tanytarsini</i>		Non-Biting Midges		SPES
Insecta	Diptera	Culicidae			Mosquitoes		SPES
Insecta	Diptera	Tipulidae			Crane Flies		SPES
Insecta	Ephemeroptera	Heptageniidae	<i>Cinygma</i>		Mayfly		SPES
Insecta	Ephemeroptera	Leptophlebiidae	<i>Paraleptophlebia</i>		Mayfly		SPES
Insecta	Hemiptera	Corixidae	<i>Callicorixa</i>	<i>vulnerata</i>	Water Boatman	E-Fauna BC	SPES
Insecta	Hemiptera	Corixidae	<i>Cenocorixa</i>	<i>blaisdelli</i>	Water Boatman	E-Fauna BC	SPES
Insecta	Hemiptera	Corixidae	<i>Hesperocorixa</i>	<i>atopodonta</i>	Water Boatman	E-Fauna BC	SPES
Insecta	Hemiptera	Corixidae	<i>Hesperocorixa</i>	<i>laevigata</i>	Water Boatman	E-Fauna BC	SPES
Insecta	Hemiptera	Corixidae	<i>Sigara</i>	<i>omani</i>	Water Boatman	E-Fauna BC	SPES
Insecta	Hemiptera	Gerridae	<i>Aquarius</i>	<i>remigis</i>	Water Strider	E-Fauna BC	SPES
Insecta	Hemiptera	Gerridae	<i>Buenoa</i>	<i>confusa</i>	Water Strider	E-Fauna BC	SPES
Insecta	Hemiptera	Gerridae	<i>Gerris</i>	<i>buenoi</i>	Water Strider	E-Fauna BC	SPES

Insecta	Hemiptera	Gerridae	<i>Gerris</i>	<i>incognitus</i>	Water Strider	E-Fauna BC	SPES
Insecta	Hemiptera	Gerridae	<i>Limnoporus</i>	<i>notabilis</i>	Water Strider	E-Fauna BC	SPES
Insecta	Hemiptera	Nepidae	<i>Ranatra</i>	<i>fusca</i>	Water Scorpion	E-Fauna BC	SPES
Insecta	Hemiptera	Notonectidae	<i>Notonecta</i>	<i>undulata</i>	Backswimmer	E-Fauna BC	SPES
Insecta	Megaloptera				Dobsonflies and Alderflies		SPES
Insecta	Odonata	Aeshnidae	<i>Aeshna</i>	<i>canadensis</i>	Canada Darner	E-Fauna BC	SPES
Insecta	Odonata	Aeshnidae	<i>Aeshna</i>	<i>interrupta</i>	Variable Darner	E-Fauna BC	E-Fauna BC
Insecta	Odonata	Aeshnidae	<i>Aeshna</i>	<i>palmata</i>	Paddle-tailed Darner	E-Fauna BC	E-Fauna BC
Insecta	Odonata	Aeshnidae	<i>Anax</i>	<i>junius</i>	Green Darner	E-Fauna BC	E-Fauna BC
Insecta	Odonata	Aeshnidae	<i>Rhionaeschna</i>	<i>californica</i>	California Darner	E-Fauna BC	E-Fauna BC
Insecta	Odonata	Aeshnidae	<i>Rhionaeschna</i>	<i>multicolor</i>	Blue-eyed Darner	E-Fauna BC	E-Fauna BC
Insecta	Odonata	Coenagrionidae	<i>Enallagma</i>	<i>carunculatum</i>	Tule Bluet	E-Fauna BC	E-Fauna BC
Insecta	Odonata	Coenagrionidae	<i>Enallagma</i>	<i>annexum</i>	Northern Bluet	E-Fauna BC	E-Fauna BC
Insecta	Odonata	Coenagrionidae	<i>Ischnura</i>	<i>cervula</i>	Pacific Forktail	E-Fauna BC	E-Fauna BC
Insecta	Odonata	Coenagrionidae	<i>Ischnura</i>	<i>perparva</i>	Western Forktail	E-Fauna BC	E-Fauna BC
Insecta	Odonata	Libellulidae	<i>Leucorrhinia</i>	<i>proxima</i>	Belted/Red-waisted Whiteface	E-Fauna BC	E-Fauna BC
Insecta	Odonata	Libellulidae	<i>Libellula</i>	<i>forensis</i>	Eight-spotted Skimmer	E-Fauna BC	E-Fauna BC
Insecta	Odonata	Libellulidae	<i>Libellula</i>	<i>quadrimaculata</i>	Four-spotted Skimmer	E-Fauna BC	E-Fauna BC
Insecta	Odonata	Libellulidae	<i>Pachydiplax</i>	<i>longipennis</i>	Blue Dasher <sup>†</sup>	E-Fauna BC	E-Fauna BC
Insecta	Odonata	Libellulidae	<i>Plathemis</i>	<i>lydia</i>	Common Whitetail	E-Fauna BC	E-Fauna BC
Insecta	Odonata	Libellulidae	<i>Sympetrum</i>	<i>corruptum</i>	Variegated Meadowhawk	E-Fauna BC	E-Fauna BC
Insecta	Odonata	Libellulidae	<i>Sympetrum</i>	<i>illotum</i>	Cardinal Meadowhawk	E-Fauna BC	E-Fauna BC
Insecta	Odonata	Libellulidae	<i>Sympetrum</i>	<i>pallipes</i>	Striped Meadowhawk	E-Fauna BC	E-Fauna BC
Insecta	Odonata	Libellulidae	<i>Sympetrum</i>	<i>vicinum</i>	Autumn/Yellow-legged Meadowhawk <sup>†</sup>	E-Fauna BC	E-Fauna BC
Insecta	Plecoptera				Stoneflies		SPES
Insecta	Trichoptera	Lepidostomatidae	<i>Lepidostoma</i>		Caddisfly		SPES
Insecta	Trichoptera	Limnephilidae	<i>Halesochila</i>	<i>taylori</i>	Caddisfly	E-Fauna BC	SPES
Insecta	Trichoptera	Limnephilidae	<i>Limnephilus</i>		Caddisfly		SPES
Insecta	Trichoptera	Limnephilidae	<i>Psychoglypha</i>		Caddisfly		SPES

Table C.9 Molluscs

Class	Order	Family	Genus	Species	Common Name	Reference	Verification
Bivalvia	Myoida	Myidae	<i>Cryptomya</i>	<i>californica</i>	California Softshell Clam	E-Fauna BC	SPES
Bivalvia	Myoida	Myidae	<i>Mya</i>	<i>arenaria</i>	Eastern Softshell Clam**	E-Fauna BC	
Bivalvia	Myoida	Pholadidae	<i>Zirfaea</i>	<i>pilsbryi</i>	Rough Piddock	E-Fauna BC	SPES
Bivalvia	Mytiloida	Mytilidae	<i>Musculista</i>	<i>senhousi</i>	Date Mussel**	E-Fauna BC	
Bivalvia	Mytiloida	Mytilidae	<i>Mytilus</i>	<i>trossulus</i>	Pacific Blue Mussel	E-Fauna BC	SPES
Bivalvia	Ostreoida	Anomiidae	<i>Pododesmus</i>	<i>macrochisma</i>	Alaska Jingle	E-Fauna BC	
Bivalvia	Ostreoida	Ostreidae	<i>Crassostrea</i>	<i>gigas</i>	Pacific Oyster**	E-Fauna BC	
Bivalvia	Ostreoida	Ostreidae	<i>Crassostrea</i>	<i>virginica</i>	Eastern Oyster**	E-Fauna BC	SPES
Bivalvia	Ostreoida	Pectinidae	<i>Chlamys</i>		Pink Scallop		
Bivalvia	Ostreoida	Pectinidae	<i>Pecten</i>	<i>groenlandicus</i>	Bivalve	E-Fauna BC	
Bivalvia	Veneroida	Cardiidae	<i>Clinocardium</i>	<i>nuttallii</i>	Nuttall's Cockle	E-Fauna BC	SPES
Bivalvia	Veneroida	Mactridae	<i>Tresus</i>	<i>capax</i>	Fat Gaper	E-Fauna BC	SPES
Bivalvia	Veneroida	Pisidiidae	<i>Pisidium</i>		Pea Clams	E-Fauna BC	SPES
Bivalvia	Veneroida	Psammobiidae	<i>Nutallia</i>	<i>obscurata</i>	Varnish Clam**	E-Fauna BC	SPES
Bivalvia	Veneroida	Tellinidae	<i>Macoma</i>	<i>balthica</i>	Baltic Macoma	E-Fauna BC	
Bivalvia	Veneroida	Tellinidae	<i>Macoma</i>	<i>nasuta</i>	Bent-nose Macoma	E-Fauna BC	SPES
Bivalvia	Veneroida	Veneridae	<i>Protothaca</i>	<i>staminea</i>	Pacific Littleneck Clam	E-Fauna BC	SPES
Bivalvia	Veneroida	Veneridae	<i>Saxidomus</i>	<i>gigantea</i>	Butter Clam	E-Fauna BC	SPES
Bivalvia	Veneroida	Veneridae	<i>Venerupis</i>	<i>philippinarum</i>	Manila Clam**	E-Fauna BC	SPES
Cephalopoda	Octopoda				Octopuses		SPES
Cephalopoda	Octopoda	Octopodidae	<i>Enteroctopus</i>	<i>dofleini</i>	Giant Pacific Octopus	E-Fauna BC	SPES
Cephalopoda	Teuthida				Squids		SPES
Gastropoda	Archaeogastropoda	Fissurellidae	<i>Diodora</i>	<i>aspera</i>	Rough Keyhole Limpet	E-Fauna BC	SPES
Gastropoda	Archaeogastropoda	Trochidae	<i>Margarites</i>	<i>pupillus</i>	Puppet Margarite	E-Fauna BC	
Gastropoda	Mesogastropoda	Trichotropidae	<i>Turritropis</i>	<i>cancellata</i>	Checkered	E-Fauna BC	

					Hairysnail		
Gastropoda	Neogastropoda	Columbellidae	<i>Amphissa</i>	<i>columbiana</i>	Wrinkled Amphissa	E-Fauna BC	
Gastropoda	Neogastropoda	Muricidae	<i>Nucella</i>	<i>lamellosa</i>	Frilled Dogwinkle	E-Fauna BC	SPES
Gastropoda	Neogastropoda	Muricidae	<i>Ceratostoma</i>	<i>inornatu</i>	Japanese Rocksnailed**	E-Fauna BC	
Gastropoda	Neogastropoda	Muricidae	<i>Urosalpinx</i>	<i>cinerea</i>	Atlantic Oyster Drill**	E-Fauna BC	
Gastropoda	Neogastropoda	Muricidae	<i>Ceratostoma</i>	<i>foliata</i>	Leafy Hommouth	E-Fauna BC	
Gastropoda	Neotaenioglossa	Littorinidae	<i>Littorina</i>	<i>scutulata</i>	Checkered Periwinkle	E-Fauna BC	SPES
Gastropoda	Neotaenioglossa	Littorinidae	<i>Littorina</i>		Sea Snails		SPES
Gastropoda	Neotaenioglossa	Naticidae	<i>Euspira</i>	<i>lewisii</i>	Lewis' Moon Snail	E-Fauna BC	SPES
Gastropoda	Neotaenioglossa	Ranellinae	<i>Fusitriton</i>	<i>oregonensis</i>	Oregon Hairy Triton/Gastropod	E-Fauna BC	SPES
Gastropoda	Nudibranchia	Arminidae	<i>Armina</i>	<i>californica</i>	Striped Nudibranch	E-Fauna BC	
Gastropoda	Nudibranchia	Chromodorididae	<i>Cadlina</i>	<i>luteomarginata</i>	Yellow-edge Cadlina	E-Fauna BC	
Gastropoda	Nudibranchia	Dironidae	<i>Dirona</i>	<i>albolineata</i>	White-line Dirona	E-Fauna BC	SPES
Gastropoda	Nudibranchia	Discodorididae	<i>Diaulula</i>	<i>sandiegensis</i>	Leopard Dorid	E-Fauna BC	SPES
Gastropoda	Nudibranchia	Discodorididae	<i>Peltodoris</i>	<i>nobilis</i>	Noble Dorid	E-Fauna BC	
Gastropoda	Nudibranchia	Dorididae	<i>Doris</i>	<i>montereyensis</i>	Monterey Sea Lemon	E-Fauna BC	SPES
Gastropoda	Nudibranchia	Facelinidae	<i>Hermisenda</i>	<i>crassicornis</i>	Opalescent Nudibranch	E-Fauna BC	SPES
Gastropoda	Nudibranchia	Flabellinidae	<i>Flabellina</i>	<i>triophina</i>	Red Flabellina	E-Fauna BC	
Gastropoda	Nudibranchia	Onchidorididae	<i>Acanthodoris</i>	<i>nanaimoensis</i>	Nanaimo Dorid	E-Fauna BC	SPES
Gastropoda	Nudibranchia	Onchidorididae	<i>Onchidoris</i>	<i>bilamellata</i>	Rough-mantled Doris	E-Fauna BC	
Gastropoda	Nudibranchia	Proctonotidae	<i>Janolus</i>	<i>fuscus</i>	White-and-Orange-Tipped Nudibranch	E-Fauna BC	
Gastropoda	Patellogastropoda	Acmaeidae	<i>Acmaea</i>		Sea Snails		SPES
Gastropoda	Patellogastropoda	Calyptraeoidea	<i>Crepidula</i>	<i>fornicata</i>	Common Atlantic Slippersnail**	E-Fauna BC	

Gastropoda	Patellogastropoda	Galatheoidea	<i>Tectura</i>	<i>scutum</i>	Plate Limpet	E-Fauna BC	
Gastropoda	Patellogastropoda	Lottiidae	<i>Lottia</i>	<i>digitalis</i>	Ribbed Limpet	E-Fauna BC	SPES
Gastropoda	Patellogastropoda	Lottiidae	<i>Lottia</i>	<i>pelta</i>	Shield Limpet	E-Fauna BC	SPES
Gastropoda	Patellogastropoda	Lottiidae	<i>Niveotectura</i>	<i>funiculata</i>	Corded White Limpet	E-Fauna BC	
Gastropoda	Patellogastropoda	Lottiidae	<i>Tectura</i>	<i>fenestrata</i>	Chocolate Limpet	E-Fauna BC	
Gastropoda	Patellogastropoda	Lottiidae	<i>Tectura</i>	<i>persona</i>	Masked Limpet	E-Fauna BC	SPES
Polyplacophora	Ischnochitonida	Mopaliidae	<i>Mopalia</i>	<i>muscosa</i>	Mossy Chiton	E-Fauna BC	SPES
Polyplacophora	Neoloricata	Mopaliidae	<i>Cryptochiton</i>	<i>stelleri</i>	Giant Pacific Chiton	E-Fauna BC	SPES
Polyplacophora	Neoloricata	Ischnochitonidae	<i>Tonicella</i>	<i>insignis</i>	White-lined Chiton	E-Fauna BC	
Polyplacophora	Neoloricata	Ischnochitonidae	<i>Tonicella</i>	<i>lineata</i>	Red-lined Chiton	E-Fauna BC	SPES
Polyplacophora	Neoloricata	Ischnochitonidae	<i>Tonicella</i>	<i>undocaerulea</i>	Blue-lined Chiton	E-Fauna BC	SPES
Polyplacophora	Neoloricata	Mopaliidae	<i>Katherina</i>	<i>tunicata</i>	Black Katy Chiton	E-Fauna BC	SPES
Cephalopoda	Nudibranchia	Dendronotidae	<i>Dendronotus</i>	<i>iris</i>	Giant Dendronotid Nudibranch	E-Fauna BC	Isabelle Côté

Table C.10 Annelids

Class	Order	Family	Genus	Species	Common Name	Reference	Verification
Clitellata	Lumbriculida	Lumbriculidae			Blackworms		SPES
Polychaeta	Aciculata	Nereididae	<i>Nereis</i>	<i>vexillosa</i>	Banner Sea-nymph		SPES
Polychaeta	Canalipalpata	Serpulidae	<i>Serpula</i>	<i>columbiana</i>	Red-trumpet Calcareous Tubeworm		SPES
Polychaeta	Phyllodocida	Glyceridae	<i>Glycera</i>		Bloodworm		SPES
Polychaeta	Phyllodocida	Nephtyidae	<i>Nephtys</i>	<i>punctata</i>	Goddess-worm		SPES
Polychaeta	Phyllodocida	Nereididae	<i>Nereis</i>	<i>brandti</i>	Giant Pilling Sea-Nymph		
Polychaeta	Phyllodocida	Polynoidae	<i>Halosydna</i>	<i>brevisetosa</i>	Eighteen-Scaled Worm		
Polychaeta	Sabellida	Sabellidae	<i>Bispira</i>		Twin-eyed Feather Duster		
Polychaeta	Sabellida	Sabellidae	<i>Chone</i>	<i>aurantiaca</i>	Orange Feather Duster		
Polychaeta	Sabellida	Sabellidae	<i>Eudistylia</i>	<i>vancouveri</i>	Northern Feather Duster Worm		SPES
Polychaeta	Sabellida	Sabellidae	<i>Myxicola</i>	<i>infundibulum</i>	Slime-tube Feather-Duster		
Polychaeta	Scolecida	Maldanidae	<i>Axiiothella</i>	<i>rubrocincta</i>	Red-banded Bamboo-worm		



Polychaeta	Terebellida	Terebellidae	<i>Pista</i>	<i>elongata</i>	Basket-top Spaghetti-worm
Polychaeta	Terebellida	Terebellidae	<i>Thelepus</i>		Spaghetti Worm

Table C.11 Cnidarians

Class	Order	Family	Genus	Species	Common Name	Reference	Verification
Anthozoa	Actiniaria	Actiniidae	<i>Anthopleura</i>	<i>artemisia</i>	Burrowing Green Anemone	E-Fauna BC	SPES
Anthozoa	Actiniaria	Actiniidae	<i>Anthopleura</i>	<i>elegantissima</i>	Aggregating Anemone	E-Fauna BC	SPES
Anthozoa	Actiniaria	Actiniidae	<i>Anthopleura</i>		Anemones Burrowing		SPES
Anthozoa	Actiniaria	Actiniidae	<i>Anthopleura</i>	<i>xanthogrammica</i>	Giant Green Anemone	E-Fauna BC	SPES
Anthozoa	Actiniaria	Actiniidae	<i>Tealia</i>	<i>coriacea</i>	Leathery Anemone		SPES
Anthozoa	Actiniaria	Actiniidae	<i>Urticina</i>	<i>crassicornis</i>	Northern Red Anemone	E-Fauna BC	
Anthozoa	Actiniaria	Actiniidae	<i>Urticina</i>	<i>felina</i>	Christmas Anemone Giant		No - Isabelle Côté; Yes - SPES
Anthozoa	Actiniaria	Actinostolidae	<i>Stomphia</i>	<i>coccinea</i>	Spotted Swimming Anemone	E-Fauna BC	
Anthozoa	Actiniaria	Actinostolidae	<i>Stomphia</i>	<i>didemon</i>	Cowardly Anemone	E-Fauna BC	
Anthozoa	Actiniaria	Metridiidae	<i>Metridium</i>	<i>farciimen</i>	Giant Plumose Anemone	E-Fauna BC	SPES
Anthozoa	Actiniaria	Metridiidae	<i>Metridium</i>	<i>senile</i>	Frilled Anemone	E-Fauna BC	SPES
Anthozoa	Anthoathecata	Stylasteridae	<i>Stylantheca</i>		Encrusting Hydrocoral		
Anthozoa	Ceriantharia	Cerianthidae	<i>Pachycerianthus</i>	<i>fimbriatus</i>	Tube Anemone	E-Fauna BC	
Anthozoa	Pennatulacea	Pennatulidae	<i>Ptilosarcus</i>	<i>gurneyi</i>	Sea Pen/Pennatulacean	E-Fauna BC	SPES
Anthozoa	Scleractinia	Caryophyllidae	<i>Caryophyllia</i>	<i>alaskensis</i>	Stony Coral	E-Fauna BC	
Anthozoa	Zoanthidea	Epizoanthidae	<i>Epizoanthus</i>	<i>scotinus</i>	Orange Zooanthid	E-Fauna BC	SPES
Hydrozoa	Anthoathecata	Hydraciniidae	<i>Clava</i>		White hydroid		
Hydrozoa	Hydroida	Campanulariidae	<i>Obelia</i>		Wine Glass Hydroid/Jellyfish	E-Fauna BC	SPES

Hydrozoa	Hydroida	Tubulariidae	<i>Pseudanarta</i>	<i>crocea</i>	Cutworm Moth	E-Fauna BC	
Hydrozoa	Hydroida	Tubulariidae	<i>Ectopleura</i>	<i>marina</i>	Solitary Pink-mouth Hydroid		
Hydrozoa	Hydroida	Tubulariidae	<i>Tubularia</i>	<i>marina</i>	Hydroids		SPES
Hydrozoa	Leptomedusae	Aequoreidae	<i>Aequorea</i>		Crystal/Water Jelly	E-Fauna BC	
Hydrozoa	Leptothecata	Aglaopheniidae	<i>Aglaophenia</i>	<i>struthionides</i>	Ostrich Plume Hydroid		SPES
Hydrozoa	Leptothecata	Plumulariidae	<i>Plumularia</i>		Delicate Plume Hydroid		
Hydrozoa	Leptothecata	Sertulariidae	<i>Abietinaria</i>		Coarse Sea Fir Hydroid		
Hydrozoa	Leptothecata	Sertulariidae	<i>Selaginopsis</i>		Fish-bone Hydroid		
Scyphozoa	Semaeostomeae	Cyaneidae	<i>Cyanea</i>	<i>capillata</i>	Lion's Mane Jellyfish	E-Fauna BC	
Scyphozoa	Semaeostomeae	Ulmaridae	<i>Aurelia</i>	<i>labiata</i>	Moon Jellyfish	E-Fauna BC	
Anthozoa	Actiniaria	Actiniidae	<i>Urticina</i>	<i>lofotensis</i>	White-spotted Rose Anemone	E-Fauna BC	Isabelle Côté

Table C.12 Ctenophores

Class	Order	Family	Genus	Species	Common Name
Tentaculata	Cydidippida	Pleurobrachiidae	<i>Pleurobrachia</i>	<i>bachei</i>	Sea Gooseberry
Tentaculata	Lobata	Bolinopsidae	<i>Bolinopsis</i>	<i>infundibulum</i>	Lobed Sea Gooseberry

Table C.13. Echinoderms

Class	Order	Family	Genus	Species	Common Name	Reference	Verification
Asteroidea	Forcipulatida	Asteriidae	<i>Evasterias</i>	<i>troschelii</i>	Mottled Star	E-Fauna BC	SPES
Asteroidea	Forcipulatida	Asteriidae	<i>Leptasterias</i>	<i>hexactis</i>	Six-armed Star	E-Fauna BC	SPES
Asteroidea	Forcipulatida	Asteriidae	<i>Pisaster</i>	<i>brevispinus</i>	Giant Pink Star	E-Fauna BC	
Asteroidea	Forcipulatida	Asteriidae	<i>Pisaster</i>	<i>ochraceus</i>	Purple or Ochre Sea Star	E-Fauna BC	SPES
Asteroidea	Forcipulatida	Asteriidae	<i>Pycnopodia</i>	<i>helianthoides</i>	Sunflower Star	E-Fauna BC	SPES

Asteroidea	Forcipulatida	Curculionoidea	<i>Orthasterias</i>	<i>koehleri</i>	Rainbow Star	E-Fauna BC	
Asteroidea	Forcipulatida	Curculionoidea	<i>Stylasterias</i>	<i>forreri</i>	Long-rayed Star	E-Fauna BC	
Asteroidea	Spinulosida	Curculionoidea	<i>Crossaster</i>	<i>papposus</i>	Rose Star	E-Fauna BC	
Asteroidea	Spinulosida	Curculionoidea	<i>Pteraster</i>	<i>tesselatus</i>	Slime Star	E-Fauna BC	
Asteroidea	Spinulosida	Echinasteriade	<i>Henricia</i>	<i>aspera aspera</i>	Ridged Blood Star	E-Fauna BC	
Asteroidea	Spinulosida	Echinasteriade	<i>Henricia</i>	<i>leviuscula</i>	Blood Star	E-Fauna BC	SPES
Asteroidea	Spinulosida	Poraniidae	<i>Dermasterias</i>	<i>imbricata</i>	Leather Star	E-Fauna BC	SPES
Asteroidea	Valvatida	Goniasteridae	<i>Mediaster</i>	<i>aequalis</i>	Vermilion Star	E-Fauna BC	
Asteroidea	Velatida	Solasteridae	<i>Solaster</i>	<i>dawsoni</i>	Morning Sun Star	E-Fauna BC	
Asteroidea	Velatida	Solasteridae	<i>Solaster</i>	<i>stimpsoni</i>	Striped Sun Star	E-Fauna BC	
Crinoidea	Comatulida	Curculionoidea	<i>Florometra</i>	<i>serratissima</i>	Feather Star	E-Fauna BC	
Echinoidea	Echinoida	Strongylocentrotidae	<i>Strongylocentrotus</i>	<i>droebachiensis</i>	Green Sea Urchin	E-Fauna BC	SPES
Echinoidea	Echinoida	Curculionoidea	<i>Strongylocentrotus</i>	<i>franciscanus</i>	Red Sea Urchin	E-Fauna BC	
Holothuroidea	Apodida	Synaptidae	<i>Leptosynapta</i>	<i>clarki</i>	Burrowing Sea Cucumber	E-Fauna BC	SPES
Holothuroidea	Aspidochirotida	Stichopodidae	<i>Parastichopus</i>	<i>californicus</i>	Giant Red Cucumber	E-Fauna BC	SPES
Holothuroidea	Aspidochirotida	Curculionoidea	<i>Parastichopus</i>	<i>leukothele</i>	Giant Orange Sea Cucumber	E-Fauna BC	
Holothuroidea	Dendrochirotida	Cucumariidae	<i>Cucumaria</i>	<i>miniata</i>	Orange Sea Cucumber	E-Fauna BC	SPES
Holothuroidea	Dendrochirotida	Curculionoidea	<i>Eupentacta</i>	<i>quinquesemita</i>	White Sea Cucumber	E-Fauna BC	
Holothuroidea	Dendrochirotida	Psolidae	<i>Psolus</i>	<i>chitonoides</i>	Creeping Pedal Sea Cucumber	E-Fauna BC	SPES
Ophiuroidea	Ophiurida	Curculionoidea	<i>Ophiura</i>	<i>luetkenii</i>	Banded Brittle Star	E-Fauna BC	
Ophiuroidea	Ophiurida	Curculionoidea	<i>Ophiura</i>	<i>sarsii</i>	Common Grey Brittle Star	E-Fauna BC	
Ophiuroidea	Ophiurida	Ophiactidae	<i>Ophiopholis</i>	<i>aculeata</i>	Atlantic Daisy Brittle Star	E-Fauna BC	
Holothuroidea	Dendrochirotida	Cucumariidae	<i>Cucumaria</i>	<i>piperata</i>	Peppered Sea Cucumber	E-Fauna BC	

Table C.14 Bryozoans

Class	Order	Family	Genus	Species	Common Name	Reference	Verification
Gymnolaemata	Cheilostomata	Bugulidae	<i>Bugula</i>		Bryozoa		SPES
Gymnolaemata	Cheilostomata	Bugulidae	<i>Dendrobeatia</i>	<i>murrayana</i>	Fan Bryozoan		
Gymnolaemata	Cheilostomata	Membraniporidae	<i>Membranipora</i>	<i>serrilamella</i>	Kelp-encrusting Bryozoan		SPES
Gymnolaemata	Cheilostomata	Schizoporellidae	<i>Schizoporella</i>	<i>unicornis</i>	Orange-encrusting Bryozoan		
Gymnolaemata	Ctenostomata	Alcyonididae	<i>Alcyonidium</i>	<i>gelatinosum</i>	Gelatinous Leather Bryozoan		

Table C.15 Ribbon worms

Class	Order	Family	Genus	Species	Common Name	Reference	Verification
Enopla	Hoplunemertea	Emplectonematidae	<i>Cerebratulus</i>	<i>montgomeryi</i>	Rose Ribbon Worm	E-Fauna BC	
Enopla	Hoplunemertea	Emplectonematidae	<i>Emplectonema</i>	<i>gracile</i>	Green Ribbon Worm	E-Fauna BC	
Enopla	Hoplunemertea	Emplectonematidae	<i>Paranemertes</i>	<i>peregrina</i>	Mud Nemertean	E-Fauna BC	SPES
Enopla	Palaeonemertea	Tubulanidae	Tubulanus	polymorphus	Orange Ribbon Worm		
Enopla	Palaeonemertea	Tubulanidae	Tubulanus	sexlineatus	Six-lined Ribbon Worm		

Table C.16 Sponges

Class	Order	Family	Genus	Species	Common Name	Verification
Calcarea	Leucosolenida	Sycettidae	<i>Sycon</i>		Tiny Vase Sponge	
Demospongiae	Axinellida	Axinellidae	<i>Syringella</i>	<i>amphispicula</i>	Tough Yellow Branching Sponge	
Demospongiae	Hadromerida	Clionidae	<i>Cliona</i>	<i>californiana</i>	Yellow Boring Sponge	
Demospongiae	Halichondrida	Halichondriidae	<i>Halichondria</i>		Yellow Intertidal Sponge	
Demospongiae	Halichondrida	Halichondriidae	<i>Halichondria</i>	<i>bowerbankia</i>	Bowerbank's Crumb of Bread Sponge**	SPES
Demospongiae	Poecilosclerida	Hymedesmiidae	<i>Hamigera</i>		Orange Cratered Encrusting Sponge	
Demospongiae	Poecilosclerida	Isodictyidae	<i>Neoesperiopsis</i>	<i>rigida</i>	Orange Finger Sponge	
Demospongiae	Poecilosclerida	Microcionidae	<i>Ophlitaspongia</i>	<i>pennata</i>	Velvety Red Sponge	
Demospongiae	Poecilosclerida	Myxillidae	<i>Myxilla</i>	<i>incrustans</i>	Rough Scallop Sponge	

Table C.17 Seagrasses

Class	Order	Family	Genus	Species	Common Name	Reference	Verification
Monocotyledonae	Alismatales	Zosteraceae	<i>Zostera</i>	<i>marina</i>	Eelgrass*	SPES	SPES
Monocotyledonae	Alismatales	Zosteraceae	<i>Zostera</i>	<i>japonica</i>	Japanese Eelgrass**	SPES	SPES

Table C.18 Green algae

Class	Order	Family	Genus	Species	Common Name	Reference	Verification
Bryopsidophyceae	Bryopsidales	Codiaceae	<i>Codium</i>	<i>fragile</i>	Sea Staghorn		
Bryopsidophyceae	Bryopsidales	Codiaceae	<i>Codium</i>	<i>setchellii</i>	Spongy Cushion		
Bryopsidophyceae	Bryopsidales	Derbesiaceae	<i>Derbesia</i>	<i>marina</i>	Sea pearls	Elfora	
Trebouxiophyceae	Prasiolales	Prasiolaceae	<i>meridionalis</i>	<i>prasiola</i>	Short Sea Lettuce	Taxonomy Browser	UBC Herbarium
Trebouxiophyceae	Prasiolales	Prasiolaceae	<i>Rosenvingiella</i>	<i>polyrhiza</i>		Taxonomy Browser	UBC Herbarium & Eflora
Ulvophyceae	Cladophorales	Cladophoraceae	<i>Chaetomorpha</i>	<i>cannabina</i>	Green Excelsior	Taxonomy Browser & MlotPNW	UBC Herbarium
Ulvophyceae	Cladophorales	Cladophoraceae	<i>Cladophora</i>		Sea Moss	SPES	SPES
Ulvophyceae	Cladophorales	Cladophoraceae	<i>Lola</i>	<i>lubrica</i>		Taxonomy Browser	UBC Herbarium & Eflora
Ulvophyceae	Ulotrichales	Chlorocystidaceae	<i>Halochlorococcum</i>	<i>moorei</i>		Taxonomy Browser	UBC Herbarium
Ulvophyceae	Ulotrichales	Gomontiaceae	<i>Eugomontia</i>	<i>sacculata</i>		SPES	SPES
Ulvophyceae	Ulotrichales	Ulotrichaceae	<i>Acrosiphonia</i>	<i>coalita</i>	Tangle Weed	SPES	SPES
Ulvophyceae	Ulvaes	Ulvaceae	<i>Blidingia</i>	<i>minima</i>	Tiny-tube Sea Lettuce	Taxonomy Browser & MlotPNW	Eflora
Ulvophyceae	Ulvaes	Ulvaceae	<i>Ulva</i>	<i>compressa</i>		Taxonomy	UBC Herbarium

						Browser	
Ulvophyceae	Ulvaes	Ulvaceae	<i>Ulva</i>	<i>intestinalis</i>	Maiden Hair Sea Lettuce	SPES	SPES
Ulvophyceae	Ulvaes	Ulvaceae	<i>Ulva</i>	<i>lactuca</i>	Common Sea Lettuce	SPES	SPES
Ulvophyceae	Ulvaes	Ulvaceae	<i>Ulva</i>	<i>linza</i>	Flat-tube Sea Lettuce	SPES	SPES
Ulvophyceae	Ulvaes	Ulvaceae	<i>Ulva</i>	<i>prolifera</i>		Taxonomy Browser	UBC Herbarium
Ulvophyceae	Ulvaes	Ulvaceae	<i>Ulvaria</i>	<i>obscura</i>		Taxonomy Browser	UBC Herbarium
Xanthophyceae	Vaucheriales	Vaucheriaceae	<i>Vaucheria</i>	<i>thuretii</i>	Black Felt Mat	Taxonomy Browser	UBC Herbarium

Table C.19 Brown algae

Class	Order	Family	Genus	Species	Common Name	Reference	Verification
Bacillariophyceae	Fragilariales				Diatoms	SPES	SPES
Phaeophyceae	Desmarestiales	Desmarestiaceae	<i>Desmarestia</i>	<i>ligulata</i>	Flat Acid leaf	Taxonomy Browser	UBC Herbarium
Phaeophyceae	Desmarestiales	Desmarestiaceae	<i>Desmarestia</i>	<i>viridis</i>	Stringy Acid Weed/Acid Kelp	SPES	SPES
Phaeophyceae	Dictyosiphonales	Punctariaceae	<i>Melanosiphon</i>	<i>intestinalis</i>	Dark Sea Tubes	Taxonomy Browser & MlotPNW	UBC Herbarium & Eflora
Phaeophyceae	Dictyotales	Dictyotaceae	<i>Syringoderma</i>	<i>abyssicola</i>		Taxonomy Browser & MlotPNW	UBC Herbarium
Phaeophyceae	Ectocarpales	Ectocarpaceae	<i>Ectocarpus</i>	<i>confervoides</i>	Brown Tuft	IT IS & MlotPNW	UBC Herbarium
Phaeophyceae	Ectocarpales	Ectocarpaceae	<i>Hincksia</i>	<i>granulosa</i>	Brown Tuft	ITIS & MlotPNW	UBC Herbarium
Phaeophyceae	Ectocarpales	Ectocarpaceae	<i>Pylaiella</i>	<i>littoralis</i>		Taxonomy	UBC

						Browser	Herbarium
Phaeophyceae	Ectocarpales	Leathesiaceae	<i>Leathesia</i>	<i>difformis</i>	Sea Cauliflower	Taxonomy Browser and Eflora	UBC Herbarium
Phaeophyceae	Fucales	Fucaceae	<i>Fucus</i>	<i>gardneri</i>	Rockweed	SPES	SPES
Phaeophyceae	Fucales	Fucaceae	<i>Pelvetiopsis</i>	<i>limitata</i>	Little Rockweed	SPES	SPES
Phaeophyceae	Fucales	Sargassaceae	<i>Sargassum</i>	<i>muticum</i>	Wireweed *	SPES	SPES
Phaeophyceae	Laminariales	Alariaceae	<i>Alaria</i>	<i>marginata</i>	Broad-winged Kelp	SPES	SPES
Phaeophyceae	Laminariales	Alariaceae	<i>Alaria</i>	<i>tenuifolia</i>	Winged Kelp	SPES	SPES
Phaeophyceae	Laminariales	Alariaceae	<i>Pterygophora</i>	<i>californica</i>	Old Growth Kelp	Taxonomy Browser	
Phaeophyceae	Laminariales	Costariaceae	<i>Agarum</i>	<i>fimbriatum</i>	Fringed Sea Colander Kelp	Taxonomy Browser	
Phaeophyceae	Laminariales	Costariaceae	<i>Costaria</i>	<i>costata</i>	Seersucker Kelp	SPES	SPES
Phaeophyceae	Laminariales	Laminariaceae	<i>Cymathaere</i>	<i>triplicata</i>	Three-ribbed Kelp	Taxonomy Browser	
Phaeophyceae	Laminariales	Laminariaceae	<i>Hedophyllum</i>	<i>sessile</i>	Sea Cabbage	SPES	SPES
Phaeophyceae	Laminariales	Laminariaceae	<i>Laminaria</i>	<i>setchellii</i>	Split Kelp	Taxonomy Browser	
Phaeophyceae	Laminariales	Laminariaceae	<i>Macrocystis</i>	<i>integrifolia</i>	Small Perennial Kelp	Taxonomy Browser	
Phaeophyceae	Laminariales	Laminariaceae	<i>Nereocystis</i>	<i>luetkeana</i>	Bull Kelp	SPES	SPES
Phaeophyceae	Laminariales	Laminariaceae	<i>Postelsia</i>	<i>palmaeformis</i>	Sea Palm	Taxonomy Browser	
Phaeophyceae	Laminariales	Laminariaceae	<i>Saccharina</i>	<i>latissima</i>	Kelp	SPES	SPES
Phaeophyceae	Laminariales	Lessoniaceae	<i>Egregia</i>	<i>menziesii</i>	Feather Boa Kelp	Taxonomy Browser	
Phaeophyceae	Scytosiphonales	Scytosiphonaceae	<i>Petalonia</i>	<i>fascia</i>	False Kelp	ITIS	UBC Herbarium & Eflora
Phaeophyceae	Scytosiphonales	Scytosiphonaceae	<i>Scytosiphon</i>	<i>lomentaria</i>	Whip Tube	ITIS	UBC Herb- arium & Eflora

Table C.20 Red algae

Class	Order	Family	Genus	Species	Common Name	Reference	Verification
Bangiophyceae	Bangiales	Bangiaceae	<i>Porphyra</i>		Nori or Red Laver	SPES	SPES
Compsopogonophyceae	Erythropeltidales	Erythrotrichiaceae	<i>Smithora</i>	<i>naiadum</i>	Red Fringe	Taxonomy Browser	Eflora
Florideophyceae	Ceramiales	Delesseriaceae	<i>Haraldiophyllum</i>	<i>mirabile</i>		ITIS	UBC Herbarium & Eflora
Florideophyceae	Ceramiales	Delesseriaceae	<i>Phycodrys</i>	<i>setchellii</i>		Taxonomy Browser	UBC Herbarium
Florideophyceae	Gigartinales	Areschougiaceae	<i>Opuntia</i>	<i>californica</i>	Prickly Pear Seaweed	Taxonomy Browser	UBC Herbarium
Florideophyceae	Gigartinales	Dumontiaceae	<i>Neodilsea</i>	<i>borealis</i>		ITIS & MlotPNW	UBC Herbarium & Eflora
Florideophyceae	Gigartinales	Endocladaceae	<i>Endocladia</i>	<i>muricata</i>	Nail Brush seaweed	Taxonomy Browser	
Florideophyceae	Gigartinales	Gigartinaceae	<i>Mazzaella</i>	<i>affinis</i>		ITIS	UBC Herbarium & Eflora
Florideophyceae	Gigartinales	Gigartinaceae	<i>Mazzaella</i>	<i>oregona</i>	Mottled Turkish Washcloth	Taxonomy Browser	UBC Herbarium & Eflora
Florideophyceae	Gigartinales	Gigartinaceae	<i>Mazzaella</i>	<i>roseum</i>		Taxonomy Browser	UBC Herbarium
Florideophyceae	Halymeniales	Halymeniaceae	<i>Grateloupia</i>	<i>americana</i>	Narrow Iodine Seaweed	ITIS & MlotPNW	UBC Herbarium & Eflora
Florideophyceae	Hildenbrandiales	Hildenbrandiaceae	<i>Hildenbrandia</i>	<i>occidentalis</i>	Red Rock Crust	Taxonomy Browser	UBC Herbarium
Florideophyceae	Gigartinales	Kallymeniaceae	<i>Pugetia</i>	<i>firma</i>		ITIS	UBC



							Herbarium
Florideophyceae	Gigartinales	Kallymeniaceae	<i>Pugetia</i>	<i>fragilissima</i>		Taxonomy Browser	UBC Herbarium
Florideophyceae	Nemaliales	Liagoraceae	<i>Cumagloia</i>	<i>andersonii</i>	Hairy Seaweed	Taxonomy Browser	
Florideophyceae	Gigartinales	Phylloporaceae	<i>Stenogramma</i>	<i>interrupta</i>	False Midrib Seaweed	ITIS & MlotPNW	UBC Herbarium & Eflora
Florideophyceae	Gigartinales	Pyraloidea	<i>Sarcodiotheca</i>	<i>gaudichaudii</i>	Succulent Seaweed	Taxonomy Browser	Eflora
Rhodophyceae	Bangiales	Bangiaceae	<i>Bangia</i>	<i>atropurpurea</i>	Bald Sea Hair	ITIS & MlotPNW	UBC Herbarium & Eflora
Rhodophyceae	Bangiales	Bangiophyceae	<i>Porphyra</i>	<i>brumalis</i>		ITIS	UBC Herbarium & Eflora
Rhodophyceae	Bangiales	Bangiophyceae	<i>Porphyra</i>	<i>cuneiformis</i>		ITIS	UBC Herb. & Eflora
Rhodophyceae	Bangiales	Bangiophyceae	<i>Porphyra</i>	<i>fucicola</i>		ITIS	UBC Herbarium
Rhodophyceae	Bangiales	Bangiophyceae	<i>Porphyra</i>	<i>nereocystis</i>	Bull-kelp Nori	ITIS & MlotPNW	UBC Herbarium
Rhodophyceae	Bangiales	Bangiophyceae	<i>Porphyra</i>	<i>perforata</i>		ITIS	UBC Herbarium & Eflora
Rhodophyceae	Ceramiales	Ceramiaceae	<i>Callithamnion</i>	<i>acutum</i>	Filamentous Red Seaweeds	ITIS & MlotPNW	UBC Herbarium & Eflora
Rhodophyceae	Ceramiales	Ceramiaceae	<i>Callithamnion</i>	<i>biseriatum</i>	Filamentous Red Seaweeds	ITIS & MlotPNW	UBC Herbarium
Rhodophyceae	Ceramiales	Ceramiaceae	<i>Ceramium</i>	<i>pacificum</i>	Hairy Pottery Seaweed	SPES	SPES

Rhodophyceae	Ceramiales	Ceramiaceae	<i>Ceramium</i>	<i>washingtoniense</i>		ITIS	UBC Herbarium
Rhodophyceae	Ceramiales	Ceramiaceae	<i>Hollenbergia</i>	<i>subulata</i>	Filamentous Red Seaweed	SPES	SPES
Rhodophyceae	Ceramiales	Ceramiaceae	<i>Microcladia</i>	<i>coulteri</i>	Delicate Sea Lace	ITIS & MlotPNW	UBC Herbarium & Eflora
Rhodophyceae	Ceramiales	Ceramiaceae	<i>Pleonosporium</i>	<i>vancouverianum</i>	Filamentous Red Seaweeds	ITIS & MlotPNW	UBC Herbarium & Eflora
Rhodophyceae	Ceramiales	Ceramiaceae	<i>Pterothamnion</i>	<i>pectinatum</i>	Filamentous Red Seaweeds	ITIS & MlotPNW	UBC Herbarium & Eflora
Rhodophyceae	Ceramiales	Ceramiaceae	<i>Pterothamnion</i>	<i>villosum</i>	Filamentous Red Seaweeds	Taxonomy Browser & MlotPNW	UBC Herbarium & Eflora
Rhodophyceae	Ceramiales	Ceramiaceae	<i>Scagelia</i>	<i>corallina</i>	Filamentous Red Seaweeds	ITIS & MlotPNW	UBC Herbarium
Rhodophyceae	Ceramiales	Delesseriaceae	<i>Asterocolax</i>	<i>gardneri</i>		ITIS	UBC Herbarium & Eflora
Rhodophyceae	Ceramiales	Delesseriaceae	<i>Delesseria</i>	<i>decipiens</i>	Winged Rib	ITIS & MlotPNW	UBC Herbarium
Rhodophyceae	Ceramiales	Delesseriaceae	<i>Membranoptera</i>	<i>platyphylla</i>	Feather-veined Red Seaweed	Taxonomy Browser & MlotPNW	UBC Herbarium & Eflora
Rhodophyceae	Ceramiales	Delesseriaceae	<i>Polyneura</i>	<i>latissima</i>	Network Red Seaweed	ITIS & MlotPNW	UBC Herbarium & Eflora
Rhodophyceae	Ceramiales	Rhodomelaceae	<i>Neorhodomela</i>	<i>larix</i>	Black Pine	SPES	SPES
Rhodophyceae	Ceramiales	Rhodomelaceae	<i>Odonthalia</i>	<i>floccosa</i>	Sea Brush	SPES	SPES

Rhodophyceae	Ceramiales	Rhodomelaceae	<i>Polysiphonia</i>	<i>hendryi</i>	Filamentous Red Seaweed	SPES	SPES
Rhodophyceae	Ceramiales	Rhodomelaceae	<i>Polysiphonia</i>	<i>pacifica gracilis</i>	Filamentous Red Seaweed	SPES	SPES
Rhodophyceae	Ceramiales	Rhodomelaceae	<i>Polysiphonia</i>	<i>paniculata</i>	Filamentous Red Seaweed	SPES	SPES
Rhodophyceae	Ceramiales	Rhodomelaceae	<i>Pterosiphonia</i>	<i>bipinnata</i>	Filamentous Red Seaweed	SPES	SPES
Rhodophyceae	Corallinales	Corallinaceae	<i>Bossiella</i>		Branching Coralline Algae	Taxonomy Browser	
Rhodophyceae	Corallinales	Corallinaceae	<i>Calliarthron</i>		Branching Coralline Algae	Taxonomy Browser	
Rhodophyceae	Corallinales	Corallinaceae	<i>Corallina</i>		Branching Coralline Algae	SPES	SPES
Rhodophyceae	Corallinales	Corallinaceae	<i>Lithothamnium</i>		Crustose Corallines	SPES	SPES
Rhodophyceae	Cryptonemiales	Choreocolacaceae	<i>Choreocolax</i>	<i>polysiphoniae</i>		ITIS	UBC Herbarium
Rhodophyceae	Cryptonemiales	Cryptonemiaceae	<i>Cryptonemia</i>	<i>borealis</i>		ITIS	UBC Herbarium & Eflora
Rhodophyceae	Cryptonemiales	Cryptonemiaceae	<i>Cryptonemia</i>	<i>obovata</i>		ITIS	UBC Herbarium
Rhodophyceae	Cryptonemiales	Cryptonemiaceae	<i>Cryptonemia</i>	<i>ovalifolia</i>		ITIS	UBC Herbarium
Rhodophyceae	Cryptonemiales	Cryptonemiaceae	<i>Grateloupia</i>	<i>doryphora</i>	Shaft-bearing	ITIS & MlotPNW	UBC Herbarium

					Iodine Seaweed	& Eflora
Rhodophyceae	Cryptonemiales	Cryptonemiaceae	<i>Halymenia</i>	<i>gardneri</i>	ITIS	UBC Herbarium
Rhodophyceae	Cryptonemiales	Cryptonemiaceae	<i>Halymenia</i>	<i>schizymenioides</i>	ITIS	UBC Herbarium
Rhodophyceae	Cryptonemiales	Cryptonemiaceae	<i>Prionitis</i>	<i>lyallii</i>	Borad Iodine Seaweed	Taxonomy Browser & MlotPNW UBC Herbarium & Eflora
Rhodophyceae	Cryptonemiales	Dumontiaceae	<i>Cryptosiphonia</i>	<i>woodii</i>	Dark Braching-tube Seaweed	ITIS & MlotPNW UBC Herbarium
Rhodophyceae	Cryptonemiales	Dumontiaceae	<i>Farlowia</i>	<i>mollis</i>	Tattered Red Seaweed	ITIS & MlotPNW UBC Herbarium & Eflora
Rhodophyceae	Cryptonemiales	Dumontiaceae	<i>Pikea</i>	<i>californica</i>	ITIS	UBC Herbarium
Rhodophyceae	Cryptonemiales	Hildenbrandiaceae	<i>Hildenbrandia</i>	<i>occidentalis</i>	Red Rock Crust	Taxonomy Browser & MlotPNW UBC Herbarium
Rhodophyceae	Cryptonemiales	Kallymeniaceae	<i>Callophyllis</i>	<i>flabellulata</i>	Beautiful Leaf Seaweeds	ITIS & MlotPNW UBC Herbarium & Eflora
Rhodophyceae	Cryptonemiales	Kallymeniaceae	<i>Callophyllis</i>	<i>violacea</i>	Beautiful Leaf Seaweeds	ITIS & MlotPNW UBC Herbarium & Eflora
Rhodophyceae	Cryptonemiales	Weeksiaceae	<i>Constantinea</i>	<i>subulifera</i>	Giant Cup and Saucer Seaweed	ITIS & MlotPNW UBC Herbarium & Eflora
Rhodophyceae	Cryptonemiales	Weeksiaceae	<i>Weeksia</i>	<i>coccinea</i>	Taxonomy Browser	UBC Herbarium & Eflora
Rhodophyceae	Gigartinales	Dumontiaceae	<i>Constantinea</i>	<i>simplex</i>	Cup and	SPES SPES

					Saucer Seaweed		
Rhodophyceae	Gigartinales	Gigartinaceae	<i>Chondrachanthus</i>	<i>corymbiferus</i>	Oval Turkish Towel	SPES	SPES
Rhodophyceae	Gigartinales	Gigartinaceae	<i>Chondrachanthus</i>	<i>exasperatus</i>	Turkish Towel	SPES	SPES
Rhodophyceae	Gigartinales	Gigartinaceae	<i>Chondrachanthus</i>			SPES	SPES
Rhodophyceae	Gigartinales	Gigartinaceae	<i>Mazzaella</i>	<i>splendens</i>	Iridescent Seaweed	SPES	SPES
Rhodophyceae	Gigartinales	Nemastomataceae	<i>Schizymenia</i>	<i>pacifica</i>		IT IS	UBC Herbarium & Eflora
Rhodophyceae	Gigartinales	Phylloporaceae	<i>Ahnfeltia</i>	<i>fastigiata</i>	Wiry Forked Seaweed	ITIS & MlotPNW	UBC Herbarium
Rhodophyceae	Gigartinales	Phylloporaceae	<i>Ozophora</i>	<i>latifolia</i>		ITIS	UBC Herbarium
Rhodophyceae	Gigartinales	Phylloporaceae	<i>Mastocarpus</i>	<i>papillatus</i>	Turkish Washcloth or Sea Tar	SPES	SPES
Rhodophyceae	Gigartinales	Solieriaceae	<i>Sarcodiotheca</i>	<i>furcata</i>	Furcated Fleshy Red Seaweed	ITIS & MlotPNW	UBC Herbarium & Eflora
Rhodophyceae	Goniotrichales	Goniotrichaceae	<i>Goniotrichopsis</i>	<i>sublittoralis</i>		ITIS	UBC Herbarium
Rhodophyceae	Gracilariales	Gracilariaceae	<i>Gracilaria</i>	<i>pacifica</i>	Red spaghetti	SPES	SPES
Rhodophyceae	Nemaliales	Acrochaetiaceae	<i>Audouinella</i>	<i>daviesii</i>		ITIS	
Rhodophyceae	Nemaliales	Acrochaetiaceae	<i>Audouinella</i>	<i>endophytica</i>		ITIS	UBC Herbarium & Eflora
Rhodophyceae	Palmiriales	Palmariaceae	<i>Halosaccion</i>	<i>glandiforme</i>	Sea Sacs	Taxonomy	

Brosner						
Rhodophyceae	Rhodymeniales	Rhodymeniaceae	<i>Botryocladia</i>	<i>pseudodichotoma</i>	Sea Grapes	ITIS & MlotPNW UBC Herbarium & Eflora
Rhodophyceae	Rhodymeniales	Rhodymeniaceae	<i>Fryeella</i>	<i>gardneri</i>	Arched Red Seaweed	ITIS & MlotPNW UBC Herbarium & Eflora
Rhodophyceae	Rhodymeniales	Rhodymeniaceae	<i>Fauchea</i>	<i>laciniata</i>	Blue Branching Seaweed	ITIS & MlotPNW UBC Herbarium & Eflora
Rhodophyceae	Rhodymeniales	Rhodymeniaceae	<i>Sparlingia</i>	<i>pertusa</i>	Red Eyelet Silk	SPES SPES

Table C.21 Plankton (Reference and verification for all = SPES)

Kingdom	Phylum	Class	Order	Family	Genus	Type
Animalia	Arthropoda	Branchiopoda	Cladocera	Daphniidae	<i>Daphnia</i>	Zooplankton
Animalia	Arthropoda	Maxillopoda	Cyclopoida	Cyclopidae	<i>Cyclops</i>	Zooplankton
Animalia	Rotifera	Eurotatoria	Ploima	Brachionidae	<i>Platyias</i>	Zooplankton
Chromalveolata*	Ciliophora	Oligohymenophorea	Sessilida	Vorticellidae	<i>Vorticella</i>	Zooplankton
Chromalveolata*	Heterokontophyta		Nostocales	Nostacaceae	<i>Anabaena</i>	Cyanobacteria
Chromalveolata*	Heterokontophyta		Poales	Fragilariaceae	<i>Asterionella</i>	Phytoplankton
Chromalveolata*	Heterokontophyta		Poales	Fragilariaceae	<i>Fragilaria</i>	Phytoplankton
Chromalveolata*	Heterokontophyta		Poales	Fragilariaceae	<i>Synedra</i>	Phytoplankton
Chromalveolata*	Heterokontophyta		Poales	Fragilariaceae	<i>Tabbellaria</i>	Phytoplankton
Excavata*	Euglenozoa	Euglenoidea	Euglenales	Euglenaceae	<i>Euglena</i>	Phytoplankton
Plantae	Chlorophyta	Chlorophyceae	Chaetophorales	Chaetophoraceae	<i>Protococcus</i>	Phytoplankton
Plantae	Chlorophyta	Chlorophyceae	Chlorococcales	Oocystaceae	<i>Ankistrodesmus</i>	Phytoplankton
Plantae	Chlorophyta	Chlorophyceae	Tetrasporales	Palmellaceae	<i>Physcia</i>	Phytoplankton
Plantae	Charophyta	Zygnemophyceae	Desmidiales	Desmidiaceae	<i>Closterium</i>	Phytoplankton
Plantae	Charophyta	Zygnemophyceae	Desmidiales	Desmidiaceae	<i>Pleurotaeium</i>	Phytoplankton
Plantae	Charophyta	Zygnemophyceae	Zygnematales	Zygnemataceae	<i>TribonEMA</i>	Phytoplankton

## APPENDIX D: MOST SENSITIVE SPECIES BY PARAMETER

Table D.1 Most Sensitive Species by Parameter

Parameter Class/Group	Parameter	Benchmark Species for Marine Water Quality Guidelines	Is Species Found in Burrard Inlet?	Reference
Alkylphenols	Nonylphenol (and its ethoxylates)	Water: mysid Americamysis bahia Sediment: polychaete Capitella sp.	mysid: no Capitella: maybe	CCME 2002
Benzene	Benzene	Dungeness crab	y	Interim CCME 1999; Nagpal 2007
Boron	Boron	coho salmon	y	Moss 2003
Chlorate	Chlorate	Fucus vesiculosus	y	Warrington 2002
Chlorinated benzenes	1,2,4-trichlorobenzene	Rainbow trout, fathead minnow, Selenastrum capricornutum (algae)	not marine	Water: CCME 1997a Sediment: WA State DoE 2013
Chlorinated benzenes	1,2-dichlorobenzene	Water: sole (Solea solea) Sediment: ?	not marine	Water: CCME 1997a Sediment: WA State DoE 2013
Chlorinated benzenes	Monochlorobenzene	sand crab Portunus pelagicus	n	CCME 1997a
Chlorinated ethanes	1,2-dichloroethane or ethylene dichloride	northwestern salamander (Ambystoma gracile)	y	CCME 1991
Chlorine	Chlorine-produced oxidants or total residual chlorine	coho salmon?	y	Singleton 1989
Chlorine	Total residual chlorine	coho salmon?	y	Singleton 1989
Chlorophenols	Pentachlorophenol (PCP)	Daphnia	y	Warrington 1996b
Chlorophenols	Total chlorophenols	Daphnia	y	Warrington 1996b
Chlorophenols	Total Dichlorophenols	Daphnia	y	Warrington 1996b
Chlorophenols	Total Tetrachlorophenols	Daphnia	y	Warrington 1996b

Chlorophenols	Total Trichlorophenols	Daphnia	y	Warrington 1996b
Cyanide	Cyanide (e.g. Weak acid dissociable)	Rock crab larvae	y	Singleton 1986
Dioxins and furans	Polychlorinated dibenzo-p-dioxins/dibenzo furans (PCDD/Fs)	Insufficient data set		CCME 2001
Ethylbenzene	Ethylbenzene	Mysid shrimp, Mysidopsis bahia	n	BC MOE 1999
Fluoride	Fluoride	Blue crab?, Callinectes sapidus	n	MOE 2011
Metals and metalloids	Antimony (III)	limited spp	n	ANZECC 2000a,b
Metals and metalloids	Arsenic	water: red alga Skeletonema costatum Sediment: ?	likely	Water: BC MOE 2002b (based on CCME 2001 guidelines) Sediment: CCME 1998
Metals and metalloids	Cadmium	Water: ? Sediment: Lepidactylus dytiscus	n	Water: CCME 2014 Sediment: CCME 1997b
Metals and metalloids	Chromium	Water: Dinoflagellate Prorocentrum mariae L Sediment: ?	?	Water: CCME 1997a Sediment: CCME 1998
Metals and metalloids	Copper	Water: Pacific oyster and blue mussel embryos Sediment: ?	y	Water: Singleton 1987 Sediment: CCME 1998
Metals and metalloids	Lead	Water: diatom Skeletonema costatum Sediment: ?	likely	Water: Nagpal 1987 Sediment: CCME 1998
Metals and metalloids	Manganese	Molluscs; no specific species	y	US EPA 1986
Metals and metalloids	Selenium	Water: westslope cutthroat trout, northern pike Sediment: lake benthos, NC Tissue: Chinook salmon Dietary: various, incl. mallard duck	most are FW, but in BC	Beatty and Russo 2014



		Egg/ovary: rainbow, brook, brown trout; northern pike; white sucker; bluegill sunfish; largemouth bass		
Metals and metalloids	Silver	Water: considered many spp, used lowest reliable value Sediment: ?		Water: Warrington 1996a Sediment: Long and Morgan 1990
Metals and metalloids	Vanadium	Used % spp protected (99%)		ANZECC 2000a,b
Metals and metalloids	Zinc	Water: marine algae <i>Schoederella schroederi</i> , <i>S. constatum</i> Sediment: ?	?	Water: MOE 1999 Sediment: CCME 1998
Microbiological	Enterococci	Bivalves, e.g. mussels, oysters		Warrington 2001
Microbiological	<i>Escherichia coli</i>	Bivalves, e.g. mussels, oysters	y	Warrington 2001
Microbiological	Fecal coliforms	Bivalves, e.g. mussels, oysters	y	Warrington 2001
Microbiological	<i>Pseudomonas aeruginosa</i>	Bivalves, e.g. mussels, oysters	y	Warrington 2001
Monocyclic aromatic compounds	Styrene	n/a		CCME 1999
MTBE (methyl tert-butyl ether)	MTBE	Mysidopsis bahia	n	Komex 2001
Nutrients and algae	Nitrogen-Nitrate	Nereis grubei	maybe (is in California)	Meays 2009
Nutrients and algae	Nitrogen-Nitrite	n/a		
Organotin compounds	Tributyl tin	clam <i>Mercenaria mercenaria</i>	n	CCME 1992
Pesticides: current use	Aldicarb	shrimp <i>Mysidopsis bahia</i>	n	CCME 1993
Pesticides: current use	Carbaryl	mysid <i>Mysidopsis bahia</i>	n	CCME 2009
Pesticides: current use	Chlorpyrifos (Organophosphate)	mysid shrimp	in general, maybe	CCME 2008
Pesticides:	Imidacloprid	mosquito <i>Aedes</i>	n	CCME 2007

current use		taeniorhynchus		
Pesticides: current use	Methylchlorophenoxyacetic acid (MCPA)	diatom Skeletonema costatum	likely	CCME 1995
Pesticides: legacy	Endosulfan	copepod Acartia tonsa	likely	CCME 2010
Pesticides: legacy	Organochlorine: Chlorothalonil (2,4,5,6-tetrachloro-1,3- benzenecarbonitrile, Daconil)	eastern oyster	n	CCME 1994
Phenols	Phenols	n/a		MOE 2002a
Physical	Colour	n/a		Moore and Caux 1997
Physical	Dissolved oxygen	Salmonids	y	BC MOE 1997
Physical	pH	<i>Mercenaria mercenaria</i> , <i>Crassostrea virginica</i>	n/a	McKean and Nagpal 1991
Physical	Suspended solids	Salmonids	y	Singleton 2001
Physical	Temperature	several, incl. salmonids	y	Oliver and Fidler 2001
Physical	Total gas pressure	Limited marine data, but same effects as on FW fish	n/a	MOE 2004
Physical	Turbidity	Salmonids	y	Singleton 2001
Polychlorinated biphenyls (PCBs)	Arochlor 1254	Large data set but effects dep on sp and physico- chemical properties of area		CCME 2001
Polychlorinated biphenyls (PCBs)	Total PCBs	Water: total - Sheepshead minnow, C. variegatus; Individual - Wistar rats? Fish tissue: mink Sediment: multiple		Approved: Nagpal 1992 Working: CCME 2001
Polycyclic aromatic hydrocarbons (PAHs)	acenaphthene	Water - FW: fathead minnow		Nagpal 1993 / CCME 1998
Polycyclic aromatic hydrocarbons (PAHs)	benzo(a)pyrene	Water - Sand sole		Nagpal 1993 / CCME 1998

Polycyclic aromatic hydrocarbons (PAHs)	chrysene	Water - pink shrimp		Nagpal 1993 / CCME 1998
Polycyclic aromatic hydrocarbons (PAHs)	fluorene	Water - FW: Daphnia magna		Nagpal 1993 / CCME 1998
Polycyclic aromatic hydrocarbons (PAHs)	methylated naphthalene	copepods		Nagpal 1993
Polycyclic aromatic hydrocarbons (PAHs)	naphthalene	Water: Mummichog	n	Nagpal 1993 / CCME 1998

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## APPENDIX E: 1990 PROVISIONAL WATER QUALITY OBJECTIVES FOR BURRARD INLET

Table E.1 1990 Provisional Marine Water Quality Objectives for Burrard Inlet

Water Body	False Creek	Outer Burrard Inlet	First to Second Narrows	Second Narrows to Roche Point	Port Moody area	Indian Arm
designated use	aquatic life, wildlife	recreation, aquatic life, wildlife				
microbiological indicators	fecal coliforms: ≤ 200/100 mL geometric mean enterococci: ≤ 20/100 mL geometric mean					
suspended solids	10 mg/L maximum increase					N/A
turbidity	5 NTU maximum increase					N/A
chlorine produced oxidants	N/A			≤ 3 µg/L average		N/A
total ammonia-nitrogen	≤ 1 mg/L average; 2.5 mg/L maximum	N/A	≤ 1 mg/L average; 2.5 mg/L maximum			N/A
dissolved oxygen	6.5 mg/L minimum					
weak acid dissociable cyanide	N/A				1 µg/L maximum	N/A
sulphide, undissociated H2S	N/A		2 µg/L maximum	N/A	2 µg/L maximum	N/A
pH	N/A			6.5 to 8.5	N/A	
total barium	N/A			0.5 mg/L	N/A	
total arsenic (in water)	N/A		10 µg/L maximum		N/A	
total cadmium (in water)	N/A		≤ 9 µg/L mean and 43 µg/L maximum			
total copper (in water)	≤ 2 µg/L mean and 3 µg/L maximum					
total chromium (in water)	50 µg/L maximum	N/A		50 µg/L maximum		N/A
total arsenic (in sediments)	20 µg/g dry weight maximum					N/A
total cadmium (in sediments)	1 µg/g dry weight maximum interim value: < 9 µg/g mean and 43 µg/g maximum	1 µg/g dry weight maximum				< 9 µg/g mean and 43 µg/g maximum
total chromium (in	60 µg/g dry weight maximum					N/A

sediments)			
total copper (in sediments)	100 µg/g dry weight maximum		N/A
total lead (in sediments)	30 µg/g dry weight maximum		N/A
total nickel (in sediments)	45 µg/g dry weight maximum		N/A
total mercury (in sediments)	0.15 µg/g dry weight maximum		N/A
total lead (in water)	≤ 2 µg/L mean and 140 µg/L maximum		
total lead (in fish muscle)	0.8 µg/g wet weight maximum		
total mercury (in water)	0.02 µg/L mean and 2 µg/L maximum		N/A
total mercury (in fish tissue)	0.5 µg/g weight wet maximum		N/A
total nickel (in water)	≤ 8 µg/L mean and 75 µg/L maximum	N/A	≤ 8 µg/L mean and 75 µg/L maximum
total zinc (in water)	≤ 0.086 mg/L mean and 0.095 mg/L maximum		
total zinc (in sediment)	150 µg/g dry weight maximum		N/A
PCBs (in sediment)	0.03 µg/g dry weight maximum		N/A
PCBs (in fish tissue)	0.5 µg/g wet weight maximum		N/A
Chlorophenols (in sediment)	N/A	0.01 µg/g dry weight maximum	N/A
Chlorophenols (in fish tissue)	N/A	0.1 µg/g wet weight maximum	N/A
Chlorophenols (in water)	N/A	0.2 µg/L maximum	N/A
tributyl tin	10 ng/L maximum		N/A
phenols	N/A		1 µg/L maximum
styrene	N/A		0.05 mg/L maximum
1,2-dichloroethane or ethylene dichloride	N/A	≤ 0.2 mg/L mean and 2 mg/L maximum	N/A
total LPAHs (in sediment)	0.5 µg/g dry weight maximum in sediment, long-term		N/A
naphthalene (in sediment)	0.2 µg/g dry weight maximum in sediment, long-term		N/A
acenaphthylene (in sediment)	0.06 µg/g dry weight maximum in sediment, long-term		N/A

acenaphthene (in sediment)	0.05 µg/g dry weight maximum in sediment, long-term	N/A
fluorene (in sediment)	0.05 µg/g dry weight maximum in sediment, long-term	N/A
phenanthrene (in sediment)	0.15 µg/g dry weight maximum in sediment, long-term	N/A
anthracene (in sediment)	0.1 µg/g dry weight maximum in sediment, long-term	N/A
total HPAHs <sup>2</sup> (in sediment)	1.2 µg/g dry weight maximum in sediment, long-term	N/A
fluoranthene (in sediment)	0.17 µg/g dry weight maximum in sediment, long-term	N/A
pyrene (in sediment)	0.26 µg/g dry weight maximum in sediment, long-term	N/A
benzo(a)anthracene (in sediment)	0.13 µg/g dry weight maximum in sediment, long-term	N/A
chrysene (in sediment)	0.14 µg/g dry weight maximum in sediment, long-term	N/A
benzo- fluoranthene (in sediment)	0.32 µg/g dry weight maximum in sediment, long-term	N/A
benzo(a)pyrene (in sediment)	0.16 µg/g dry weight maximum in sediment, long-term	N/A
indeno (1,2,3- c,d) pyrene (in sediment)	0.06 µg/g dry weight maximum in sediment, long-term	N/A
dibenzo (a,h) anthracene (in sediment)	0.06 µg/g dry weight maximum in sediment, long-term	N/A
benzo (g,h,i) perylene (in sediment)	0.07 µg/g dry weight maximum in sediment, long-term	N/A

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<sup>2</sup> The original document says “LHAHs”, however it is assumed that was a typographical error



Table E.2 1990 Provisional Water Quality Objectives for Tributaries to Burrard Inlet

Water bodies	Capilano River and Lynn Creek	School House Brook
<i>designated water uses</i>	<i>drinking water, recreation, aquatic life and wildlife</i>	<i>recreation, aquatic life and wildlife</i>
phenols	1 µg/L maximum	
total chromium	2 µg/L maximum	
total iron	3 µg/L maximum	
total zinc	15 µg/L maximum	
microbiological indicators	fecal coliforms: ≤ 200/100 mL geometric mean <i>Escherichia coli</i> : ≤ 77/100 mL geometric mean enterococci: ≤ 20/100 mL geometric mean	N/A
total ammonia-nitrogen	<u>ammonia tables</u>	N/A
total nitrite-nitrogen	<u>nitrite table</u>	N/A
periphyton chlorophyll- <i>a</i>	50 mg/m <sup>2</sup> maximum	N/A
dissolved oxygen	11 mg/L minimum for salmonid embryo and larval stages 8 mg/L minimum for all other salmonid life stages	N/A
total cadmium	0.2 µg/L maximum	N/A
total cobalt	2 µg/L average 0.094 (hardness) + 2 µg/L maximum	N/A
total mercury	0.5 µg/g wet weight in fish flesh	N/A
total mercury	0.02 µg/L average; 0.1 µg/L maximum in water	N/A
chlorophenols	0.2 µg/L in water 0.1 µg/g wet weight in fish tissue 0.01 µg/g dry weight in sediment	N/A
PCBs	1 ng/L in water 0.5 µg/g wet weight in fish flesh 0.03 µg/g dry weight in sediment	N/A
temperature	N/A	1o C increase over the u/s site
pH	N/A	6.5 to 9.0
total lead	N/A	see footnote #12

## **APPENDIX F: PROVINCIAL-AUTHORIZED DISCHARGES IN THE Burrard Inlet Watershed**

**Table F.1 Provincially-authorized discharges in the Burrard Inlet watershed: summary by sub-basin**

Authorization #	Permitee	Authorization Type	Latitude (°N)	Longitude (°W)	Discharge Type	Maximum Authorized Discharge (m <sup>3</sup> /day)	Status
False Creek							
PE-2300	Ocean Construction Supplies Ltd.	Effluent Permit	49.271294	-123.133352	No direct discharge: stormwater to sanitary	50	active
RS-12224	BC Ministry of Environment, Lands, and Parks	HWR Registration	49.277395	-123.10532	Contaminated soil	N/A	active
PR-11628	BC Ministry of Environment, Lands, and Parks	Refuse permit	49.278563	-123.105237	Contaminated soil	N/A	active
PR-12912	Chinese Merchants Association Parking Association	Refuse permit	49.279006	-123.10137	Contaminated soil	N/A	active
RS-106230	255-285 East 1st Avenue Holdings Ltd.	HWR Registration	49.268923	-123.097583	Contaminated soil	N/A	active
Outer Harbour							
RE-104901	The University of British Columbia	MWR Registration	49.2618	-123.2531	No discharge: Reclaimed water for reuse	N/A	active
ME-30	Metro Vancouver (Lions Gate)	Operational Certificate	49.319723	-123.136246	WWTP discharge to Burrard Inlet	318,000	active
Inner Harbour							
RE-107465 (Replaced PE-2440)	Lafarge Canada Inc. (North Vancouver RMX Plant)	COP for the Concrete and Concrete Products Industry	49.3123	-123.111	No direct discharge: Process and stormwater runoff to ground	There is no maximum discharge rate	active

Authorization #	Permitee	Authorization Type	Latitude (°N)	Longitude (°W)	Discharge Type	Maximum Authorized Discharge (m <sup>3</sup> /day)	Status
RE-107213	Pacific Site Constructors Inc.	COP for the Concrete and Concrete Products Industry	49.302461	-123.047139	No discharge: Process and stormwater is reused	N/A	active
RE-107468	Lafarge Canada Inc. (Vancouver Harbour RMX)	COP for the Concrete and Concrete Products Industry	49.2868	-123.0632	Process water and stormwater to Burrard Inlet	There is no maximum discharge rate	active
RS-17175	VANCOUVER SHIPYARDS CO. LTD.	HWR Registration	49.315849	-123.106077	No direct discharge: Treated process and runoff water to sanitary sewer	144	active
PE-7810 (cancelled in 2012)	Great Northern Packing Ltd.	Effluent permit	49.300364	-123.029054	Process to Burrard Inlet	900, only in emergency situations	cancelled
RE-18362	B.C. Pavilion Corporation	MWR Registration	49.2889	-123.1159	No discharge: reuse of reclaimed water	151	active
RE-105286	Southcoast Petroleum Ltd.	PSDFSWR Registration	49.2832	-123.0739645	Stormwater to storm drain	There is no maximum discharge rate	active
RE-107253	TMBC TreatMed BC Inc. doing business as TreatMed	HWR Registration	49.3175	-123.0963	No discharge: Process water to sanitary sewer	There is no maximum discharge rate	active
RE-14000	KM Canada Terminals ULC operating as Kinder Morgan Canada	PSDFSWR Registration	49.316653	-123.12215	Stormwater to Burrard Inlet	There is no maximum discharge rate	active
PE-1386	KM Canada Terminals ULC operating as Kinder Morgan Canada	Effluent permit	49.31	-123.11	Discharges of storm and process water to Burrard Inlet	Discharge 1.1: 10,900 Discharge 1.2: 13, 100	active

Authorization #	Permitee	Authorization Type	Latitude (°N)	Longitude (°W)	Discharge Type	Maximum Authorized Discharge (m <sup>3</sup> /day)	Status
PE-17522	Domtar Inc.	Effluent permit	49.315	-123.1053	Groundwater	1,020	active
PE-6898	Neptune Bulk Terminals Canada Ltd.	Effluent permit	49.305315	-123.0509522	Process and stormwater to Burrard Inlet	12,000	active
PE-5508	Univar Canada Ltd.	Effluent Permit	54.065532	-124.748956	Stormwater to Burrard Inlet	1,575	cancelled
PE-7944	Canada Place Corporation	Effluent permit	49.288691	-123.110819	Cooling water to Burrard Inlet	23,700	active
PE-1668	Lantic Inc.	Effluent permit	49.2848	-123.081	Cooling, process, and stormwater to Burrard Inlet	Discharge 1.1: 3,000 Discharge 1.2: 5,000 Discharge 1.3: 67,000	active
PE-8426	West Coast Reduction Ltd.	Effluent Permit	49.285793	-123.073182	Process and stormwater to Burrard Inlet	Maximum rate: 6300 Annual Average: 1,850	active
Central Harbour							
RE-107100	Lehigh Hanson Materials Limited doing business as Ocean Concrete - North Vancouver Plant	COP for the Concrete and Concrete Products Industry	49.2991	-123.0183	Process water and stormwater runoff to storm sewer	There is no maximum discharge rate	active
RE-107463 (replaces PE-6833)	Lafarge Canada Inc. (Kask Brother's site) (Decomissioned in 2016)	COP for the Concrete and Concrete Products Industry	49.2898	-122.9424	Process water and stormwater runoff to settling pond	There is no maximum discharge rate	active

Authorization #	Permitee	Authorization Type	Latitude (°N)	Longitude (°W)	Discharge Type	Maximum Authorized Discharge (m <sup>3</sup> /day)	Status
PE-18	Chemtrade Electrochem Inc.	Effluent permit	49.299676	-123.015203	Process water, cooling water, and domestic sewage to Burrard Inlet	Discharge 1.1: 90,000 Discharge 1.2: 140	active
PR-1698	Chemtrade Electrochem Inc.	Refuse permit	49.303142	-123.014764	Process refuse, solar salt	N/A	active
PE-5748	Revolution ORS Acquisition GP Inc. doing business as Terrapure	Effluent permit	49.304282	-123.01266	No direct discharge: Stormwater cooling and wash water to tile field	Maximum rate: 250 Annual average: 60	active
RS-8511	Revolution ORS Acquisition GP Inc. doing business as Terrapure	HWR Registration	49.30387	-123.012301	No direct discharge: Stormwater, cooling water, and wash water to tile field	N/A	active
PE-395	Sterling Pulp Chemicals Ltd. (ERCO)	Effluent permit	49.302219	-123.010799	Cooling water and stormwater to Burrard Inlet	7,160	active
PE-4970	Parkland Refining ( B.C) Ltd. (previously Chevron)	Effluent permit	49.289432	-123.007028	Stormwater, process water and contaminated groundwater to Burrard Inlet	Discharge 1.1: 19,550 Discharge 1.2: 18,000	active
PR-7112	Parkland Refining ( B.C) Ltd. (previously Chevron)	Refuse permit	49.291693	-122.994905	no discharge; stormwater regulated under PE-4970	N/A	active
RE-449	Shell Canada Products Limited	PSDFSWR Registration	49.28566	-122.962117	Stormwater to Burrard inlet	There is no maximum discharge rate	active
PE-3678	Trans Mountain Pipeline ULC	Effluent permit	49.288103	-122.954779	Stormwater to Burrard inlet	Maximum rate: 415 Annual average: 26	active

Authorization #	Permitee	Authorization Type	Latitude (°N)	Longitude (°W)	Discharge Type	Maximum Authorized Discharge (m <sup>3</sup> /day)	Status
RE-14058	Trans Mountain Pipeline ULC	PSDFSWR Registration	49.288103	-122.954779	Stormwater to Burrard inlet	There is no maximum discharge rate	active
Port Moody Arm							
RE-17552	0985381 B.C. Ltd. (Crystal Creek States)	MWR Registration	49.314422	-122.876509	No direct discharge: Wastewater to ground	35	active
PE-4606	Strata Corporation LMS 3081 (Anmore Green States)	Effluent permit	49.299879	-122.838623	No direct discharge: Wastewater to ground	61	active
RE-11883	Simon Fraser University	HWR Registration	49.278991	-122.919395	NA (contained PCB storage)	N/A	active
PE-1133	Chemtrade Chemicals Canada Ltd.	Effluent permit	49.2896	-122.912649	No direct discharge: Stormwater to infiltration pond	200	active
PE-7178 (Cancelled in 2016)	British Columbia Hydro and Power Authority	Effluent permit	49.299107	-122.89086	Storm and process water	Discharge 1.1: 1,650 Discharge 1.2: 550 Discharge 1.3: 1,700,000 Discharge 1.4: 72	cancelled
PE-445	Imperial Oil Limited	Effluent permit	49.304727	-122.882724	storm, process, STP	Discharge 1.1: 8,200 Discharge 1.2: 3,312.5	active
RS-8589	Imperial Oil Limited	HWR Registration	49.304251	-122.883196	Stormwater runoff, drainage and leachate	3,312.5 (included in 1.2 of PE-445)	active

Authorization #	Permitee	Authorization Type	Latitude (°N)	Longitude (°W)	Discharge Type	Maximum Authorized Discharge (m <sup>3</sup> /day)	Status
RE-14093	PETRO-Canada Products (Suncor Energy)	PSDFSWR Registration	49.287347	-122.895764	Stormwater to storm sewer	There is no maximum discharge rate	active
PE-22	PETRO-Canada Products (Suncor Energy)	Effluent permit	49.283515	-122.889426	Stormwater to Burrard Inlet	1,725	active
RE-14094	PETRO-Canada Products (Suncor Energy)	PSDFSWR Registration	49.291279	-122.89441	Stormwater to Burrard Inlet	There is no maximum discharge rate	active
RS-8420	PETRO-Canada Products (Suncor Energy)	HWR Registration	49.281046	-122.884435	No direct discharge: Stormwater to sanitary	1,725	active
PR-1453	PETRO-Canada Products (Suncor Energy)	Refuse permit	49.285	-122.8863	N/A	N/A	active
Indian Arm							
PE-13446	Farrer Cove Waste Water Management Assoc.	Effluent permit (not operational)	49.328889	-122.897778	Wastewater to Burrard Inlet	7.4	active
PE-4806	Countryside Village Ventures Ltd.	Effluent permit	49.3239	-122.8575	No direct discharge: wastewater to ground	44	active
PE-5112	37852 B.C. Ltd.	Effluent permit	49.322042	-122.854201	No direct discharge: wastewater to ground	30	active
PE-27	Mt. Seymour Resorts Ltd.	Effluent permit	49.3541	-122.946	Wastewater to Francis Creek	Jun 1-Sep 30: 100 Oct 1-May 31: 200	active
PE-8035	Evangelical Laymen's Church of Canada (Vancouver)	Effluent permit	49.3333	-122.8833	Wastewater to Burrard Inlet	24	active

**Table F.2 Provincially-authorized discharges in the Burrard Inlet watershed: details**

<sup>1</sup> COP = Code of Practice for the Concrete and Concrete Products Industry, B.C. Reg. 329/2007; EP = Effluent Permit; HWR = Hazardous Waste Regulation, B.C. Reg. 63/88; MWR = Municipal Wastewater Regulation, B.C. Reg. 87/2012; OMRR = Organic Matter Recycling Regulation, B.C. Reg. 18/02 (Environmental Management Act, Public Health Act); PSD = Petroleum Storage and Distribution Facilities Stormwater Regulation, B.C. Reg. 168/94

<sup>2</sup> CPIX is an environmental risk ranking system: L= low, M= medium, H=high

<sup>3</sup> Authorization 16030 was deregistered on March 30, 2012 and has been managed under RS-12224 since then.

Map label	Auth #	Auth Type <sup>1</sup>	Status	Company	Year Issued / Amended	CPIX <sup>2</sup>	Facility	Discharge type	Discharge to	Treatment	Relevant Water Quality Parameters
1	12224	HWR	Active	MINISTER OF ENVIRONMENT, LANDS AND PARKS	2004	L	Short-term Storage facility for hydrocarbon contaminated soil (soil contaminated with PAHs, lead and/or arsenic compounds and chlorophenols)	stormwater runoff and leachate	Vancouver Sanitary Sewer under Permit from City of Vancouver WDP 91001	collected in leachate sump and pumped out into temporary water treatment plant where it was tested before discharge to sanitary sewer	pH, temperature, TSS, toxicity, BOD5, Al, Ammonia-N, Sb, As, Ba, B, Cd, Cr, Co, Cu, CN-, F-, Pb, Mn, Hg, Mo, Ni, Se, Sn, Zn, Dioxin, oil, phenol, PCB, organic halogens (as Cl)
2	16030 <sup>3</sup>	HWR	Cancelled	BC MINISTRY OF ENVIRONMENT LANDS & PARKS		L	not available	not available	not available	not available	not available
3	106230	HWR	Active	255-285 EAST 1ST AVENUE HOLDINGS LTD.	2012	L	storage of soils with leachable lead and/or cadmium	no discharge	N/A	N/A	N/A
4	104901	MWR	Active	THE UNIVERSITY OF BRITISH COLUMBIA	2010	L	UBC Centre of Interactice Research on Sustainability (CIRS) use of reclaimed water for use in flushing toilets	reclaimed water: class A effluent	no discharge due to reuse alternate method of	advanced waste water treatment, ultra filtration, UV and	Flow, BOD5, turbidity, fecal coliform, pH



Map label	Auth #	Auth Type <sup>1</sup>	Status	Company	Year Issued / Amended	CPIX <sup>2</sup>	Facility	Discharge type	Discharge to	Treatment	Relevant Water Quality Parameters
							and urinals and to irrigate a green roof, green wall, and rain garden for the building.		disposal: UBC sewer collection system	chlorination disinfection	
5	14000	PSD	Active	KM Canada Terminals ULC	1994/2015	L	storage of ultra low sulphur diesel, biofuel, and jet aviation fuel in bulk storage tanks	treated stormwater	outfall to Burrard Inlet	oil water separators	TEH, TSS, Cu, Fe, Pb, Zn, oil and grease, TOC, toxicity, pH
6	107465	COP	Active	Lafarge Canada Inc. (North Vancouver RMX Plant)	2014	L	Ready-mix concrete batch plant. Process water and stormwater runoff collected in lined ponds for treatment and discharged to Burrard Inlet.	process water or establishment runoff	Burrard Inlet	lined pond	pH, TSS, TEH, toxicity
7	17175	HWR	Active	VANCOUVER SHIPYARDS CO. LTD.	2004/2011	M	Storage, treatment, and disposal of TDG class 3 flammable liquids, TDG class 4 and 4.1 flammable solids, TDG class 6.1 toxic, and TDG class 8 corrosives.	water containing waste oil originating from fuel oil storage tank decommissioning, oil refinery/bulk terminal wastewaters, concrete wash water, and captured construction site run-off	regional sanitary sewer system under Metro Vancouver waste discharge permit SC-100372-NSSA  no discharge to surface water or	waste water treatment plant on site that separates and concentrates contaminants from water using electro-coagulation and filtration techniques	Flow, pH, temperature, TSS, toxicity, BOD5, Al, Ammonia-N, Sb, As, Ba, B, Cd, Cr, Co, Cu, CN-, F-, Pb, Mn, Hg, Mo, Ni, Se, Sn, Zn, dioxin, oil, phenol, PCBs

Map label	Auth #	Auth Type <sup>1</sup>	Status	Company	Year Issued / Amended	CPIX <sup>2</sup>	Facility	Discharge type	Discharge to	Treatment	Relevant Water Quality Parameters
									stormwater sewer		
8	107253	HWR	Active	TMBC TreatMed BC Inc. doing business as TreatMed	2014/2015	M	Storage, treatment, disposal and recycling of biomedical waste, dangerous goods meeting criteria of TDG class 6.2. All hazardous waste is stored inside a secure warehouse/treatment facility accessible to authorized personnel only. Stormwater system is not exposed to hazardous materials.	condensate created during sterilization and cooling operation, cooling water	municipal sewer system	ECODAS treatment process	pH, temperature, TSS, toxicity, BOD5, Al, Ammonia-N, Sb, As, Ba, B, Cd, Cr, Co, Cu, CN-, F-, Pb, Mn, Hg, Mo, Ni, Se, Sn, Zn, Dioxin, oil, phenol, PCB, organic halogens (as Cl)
9	107213	COP	Active	Pacific Site Constructors Inc.	2014/2017	L	Ready-mix concrete plant. Process water and stormwater runoff is collected in lined ponds for treatment.	process water or establishment runoff	no discharge, concrete waste water is reused through a set up closed loop system	lined pond	pH, TSS, TEH, toxicity
10	18362	MWR	Active	B.C. Pavilion Corporation	2007/2010	L	Vancouver Convention Center unrestricted public access use of reclaimed water for flushing toilets, urinals and green roof irrigation	reclaimed water: class A effluent	no discharge due to reuse alternate method of disposal:	advanced secondary-tertiary waste water treatment plant ( Zenogem	Flow, BOD5, turbidity, fecal coliform, pH

Map label	Auth #	Auth Type <sup>1</sup>	Status	Company	Year Issued / Amended	CPIX <sup>2</sup>	Facility	Discharge type	Discharge to	Treatment	Relevant Water Quality Parameters
									City of Vancouver municipal sewer	WWTP and UV sterilization)	
11	106270	OMRR	Active	Strathcona Business Improvement Association		L	Composting facility of food and food processing waste and yard and garden waste.	leachate	collected and reused or disposed to sanitary sewer	N/A	N/A
12	14102	PSD	Cancelled	PETRO-CANADA PRODUCTS	1994/2011 (de-registration complete)	L	Fuel Storage facility	treated stormwater	storm sewer	oil water separators	TEH
13	108634	PSD	Withdrawn	CHEVRON CANADA LIMITED	2016	(not calculated)	Fuel storage facility	treated stormwater	storm sewer on 1st Ave.	oil water separators	TEH
14	105286	PSD	Active	Southcoast Petroleum Ltd.	2010	L	Fuel storage facility	treated stormwater	City of Vancouver storm drain on Powell Street	oil water separators	TEH
15	107468	COP	Active	Lafarge Canada Inc. (Vancouver Harbour RMX)	2014	L	Ready-mix concrete batch plant. Process water and stormwater runoff collected in lined ponds for treatment.	process water or establishment runoff	surface water, sea	lined pond	pH, TSS, TEH, toxicity
16	18061	OMRR	Active (planned cancellation)	INTERNATIONAL BIO RECOVERY CORPORATION	1993: registered under the OMRR in	L	Composting facility of biodegradable vegetable material and restaurant waste	no discharge	N/A	stormwater and leachate collected in catch basins	N/A

Map label	Auth #	Auth Type <sup>1</sup>	Status	Company	Year Issued / Amended	CPIX <sup>2</sup>	Facility	Discharge type	Discharge to	Treatment	Relevant Water Quality Parameters
					2006		that produced dried pelletized product			and pumped into filtrate tank for re-use in the process	
17	107100	COP	Active	Lehigh Hanson Materials Limited doing business as Ocean Concrete - North Vancouver Plant	2014	L	Ready-mix concrete batch plant. Process water and stormwater runoff collected in settling ponds and an oil water separator.	process water or stablishment runoff	treated water goes to storm sewer	2 large settling basins and an oil water separator	pH, TSS, TEH, toxicity
18	14056	PSD	Active	CXY CHEMICALS CANADA LTD.	1994	L	Chlor-alkali plant	not available	not available	oil water separators	TEH
19	8511	HWR	Active	Revolution ORS Acquisition GP Inc. doing business as Terrapure	2004	H	Storage, treatment, and recycling of waste oil, waste oil contaminated sludge and oil, waste TDG class 3	treated stormwater, cooling water, and wash water from hazrdous waste reprocessing faciliy	ground: tile field	oil and water separator, settling tanks, flocculation, pH adjustment, filter, tile field	Flow, oil and grease, phenols, sulphides, pH, Al, Sb, As, Ba, B, Cd, Cr, Co, Cu, CN-, F-, Pb, Mn, Hg, Mo, Ni, Se, Sn, Zn
20	11258	HWR	Cancelled	SHELL CANADA PRODUCTS LIMITED	2004	L	Passive storage of hydrocarbon contaminated soil, waste oil, and waste catalyst. No discharge.	N/A <sup>4</sup>	N/A	N/A	N/A
21	449	PSD	Active	SHELL CANADA PRODUCTS LIMITED	2005	L	Petroleum products finishing terminal	treated stormwater	Burrard Inlet	large tanks equipped with oil skimmers	TEH
22	14058	PSD	Active	TRANS MOUNTAIN PIPELINE CO. LTD.	1994/2010	L	jet fuel handling and crude oil storage	treated stormwater	surface water, outfall to Burrard	oil water separators, sumps	TEH

Map label	Auth #	Auth Type <sup>1</sup>	Status	Company	Year Issued / Amended	CPIX <sup>2</sup>	Facility	Discharge type	Discharge to	Treatment	Relevant Water Quality Parameters
									Inlet		
23	107463	COP	Active	Lafarge Canada Inc. (Kask Brother's site)	2014	L	Ready-mix concrete batch plant. Process water and stormwater runoff collected in lined ponds for treatment and discharged to creek that drains into Burrard Inlet.	process water or establishment runoff	surface water, Burrard Inlet	lined pond	pH, TSS, TEH, toxicity
24	13460	HWR	Active	IMPERIAL OIL LIMITED	1994	L	Temporary Contaminated Soil Storage Area (TCSSA) for hydrocarbon contaminated soil	no discharge	N/A	N/A	N/A
25	8589	HWR	Active	IMPERIAL OIL LIMITED	2004/2012	L	Storage and treatment of hazardous wastes TDG class 3, 4, 6, 8, & 9.	collected water from facility including stormwater runoff, drainage from stored materials and leachate collected from leak detection system	Burrard Inlet (as stated in subsection 1.2 in PE-445)	oil and water separator, lagoon	Flow, THE, BOD5, Ammonia-N, phenols, pH, toxicity
26	17552	MWR	Active	0985381 B.C. Ltd. (Crystal Creek States)	2005 /2016	L	Waste water facility serving 35 residential homes. Sewage treatment plant and two subsurface pressurized disposal fields	waste water, class B effluent	ground, pressurized to soil	high quality secondary waste water treatment plant	Flow, BOD5, TSS, fecal coliform

Map label	Auth #	Auth Type <sup>1</sup>	Status	Company	Year Issued / Amended	CPIX <sup>2</sup>	Facility	Discharge type	Discharge to	Treatment	Relevant Water Quality Parameters
27	11883	HWR	Active	SIMON FRASER UNIVERSITY	2004	L	Passive storage of decommissioned electrical equipment from campus facilities including waste PCB liquids, waste PCB solids, and waste PCB equipment. No discharge.	N/A	N/A	N/A	N/A
28	14093	PSD	Active	PETRO-CANADA PRODUCTS (Suncor Energy)	1994/2011	L	Fuel storage facility: Port Moody-Middle Plant	treated stormwater	Burrard Inlet	oil water separators	TEH
29	14094	PSD	Active	PETRO-CANADA PRODUCTS (Suncor Energy)	1994/2010	L	Fuel storage facility: large tank farm and distribution facility of fuel, Port Moody-Lowell Plant	treated stormwater	ditchline to Burrard Inlet	oil water separators	TEH
30	8420	HWR	Active	PETRO CANADA PRODUCTS	2004/2012	L	Short-term storage, and treatment of hazardous material such as hydrocarbon contaminated water and soil, and oil/water separator sludge. Hazardous wastes generated from operation at Burrard Products Terminal.	process and stormwater effluent	process water: sanitary sewer under GVRD permit SC-100086-FSA  stormwater: Burrard Inlet under permit PE-22	water treatment facility bio-reactor and oil/water separator	pH, temperature, TSS, toxicity, BOD5, Al, Ammonia-N, Sb, As, Ba, B, Cd, Cr, Co, Cu, CN-, F-, Pb, Mn, Hg, Mo, Ni, Se, Sn, Zn, oil, phenol
31	14746	OMR	Active	CITY OF PORT	1994	L	Composting facility of	no discharge	N/A	N/A	N/A

Map label	Auth #	Auth Type <sup>1</sup>	Status	Company	Year Issued / Amended	CPIX <sup>2</sup>	Facility	Discharge type	Discharge to	Treatment	Relevant Water Quality Parameters
		R		MOODY			clean green waste including branches < 4' long for forest/park dressing				
32	14363	HWR	Cancelled	TITAN RECYCLERS LTD.	1995	L	Temporary Storage of waste antifreeze	N/A	N/A	N/A	N/A
33	18	EP	Active	Canexus Chemicals Canada Limited Partnership	1957 / 2008		A chlor-alkali plant with discharge of process effluent, cooling water and domestic sewage. Septic tanks for domestic sewage, a chlorine stripper for direct contact cooling effluent, a submerged outfall and diffuser	Process, cooling, STP	Central Harbour (sea)	Chlorine stripper, septic tank	flow, pH, TSS, Chl Res, Cu, Ni, Zn, Temp, toxicity
34	18	EP	Active	Canexus Chemicals Canada Limited Partnership	1957 / 2008		A chlor-alkali plant discharge from a cathode washing operation	Process	Central Harbour (ground)	Infiltration pond	flow, pH
35	22	EP	Active	Petro Canada Products Refinery	1958 / 2014		A petroleum refinery discharging treated stormwater	Storm	Port Moody Arm (sea)	Oil separator	flow, oil and grease, pH, TSS, Phenols
36	27	EP	Active	Mt. Seymour Resorts	1958 / 1999		Sanitary from ski hill washrooms & restaurant	STP	Indian Arm (creek)	Secondary, chlorination	flow, BOD, TSS, Fecal
37	30	MWR	Active	Metro Vancouver (Lions Gate)	1905		A municipal sewage treatment plant serving the District of W. Vancouver, plus the District and the City of N. Vancouver.	STP	Outer Harbour (sea)	Primary, chlorination, dechlorination	flow, TSS, BOD, Chl Res, COD, Fecal, toxicity, NH <sub>4</sub> , pH, CaCO <sub>3</sub> , temp, fecal summer, chloride,

Map label	Auth #	Auth Type <sup>1</sup>	Status	Company	Year Issued / Amended	CPIX <sup>2</sup>	Facility	Discharge type	Discharge to	Treatment	Relevant Water Quality Parameters
											phenols, oil and grease, As, B, Hg, Se, cyanide, various heavy metals
38	395	EP	Active	ERCO	1905		A sodium chlorate manufacturing plant that discharges cooling water and stormwater.	Cooling, storm	Central Harbour (sea)	Submerged outfall	flow, pH, temp, NaClO <sub>3</sub> , Zn
39	445	EP	Active	Imperial Oil Ltd. (loco)	1971 / 2000		A petroleum storage and distribution terminal that discharges effluent from stormwater runoff, including ground and surface water; tank bottom draw-off waters' septic tank effluent; boiler blowdown; and water from deballasting and butterworth ships and or barges discharging into Burrard Inlet.	Storm, process, STP	Port Moody Arm (sea)	Oil separators, septic tank, deballasting and butterworth tank	flow, oil and grease, NH <sub>3</sub> , phenols, pH, toxicity, TSS, Sulphides, TOC, Fecal, PAH, TEH, BOD, metals
40	445	EP	Active	Imperial Oil Ltd. (loco)	1971 / 2000		A petroleum storage and distribution terminal that discharges effluent from stormwater runoff, including ground and surface	Storm, process	Port Moody Arm (creek)	Oil separators, oil skimmers, lagoon	flow, oil and grease, BOD, NH <sub>3</sub> , Phenols, pH, toxicity, TSS, Sulphides, TOC, PAH, TEH, metals,



Map label	Auth #	Auth Type <sup>1</sup>	Status	Company	Year Issued / Amended	CPIX <sup>2</sup>	Facility	Discharge type	Discharge to	Treatment	Relevant Water Quality Parameters
							water, collected water from the facility and tank bottom draw-off waters				temp, Sb, As, Ba, B, CN-, F-
41	1133	EP	Active	General Chemical Performance/Chemtrade	1972 / 2003		An alum manufacturing plant that discharges stormwater.	Storm	Port Moody Arm (ground)	Infiltration pond	flow, pH
42	1386	EP	Active	Kinder Morgan Terminals	1972 / 1996		A bulk loading terminal that discharges from the effluent treatment facility for the ore concentrated storage and loading area, northwest parking area, car wash, truck wash, and the diked methanol tank area.	Process	Inner Harbour (sea)	Neutralization, sedimentation	flow, pH, TSS, Cu, Fe, Pb, Zn, Ni, oil and grease, TOC, toxicity
43	1386	EP	Active	Kinder Morgan Terminals	1972 / 1996		A bulk loading terminal that discharges from the effluent treatment facility for the ore concentrated storage and loading area, northwest parking area, car wash, truck wash, and the diked methanol tank area.	Storm	Inner Harbour (sea)	Settling ponds, neutralization	flow, TSS, Cu, Fe, Pb, Zn, Ni, toxicity, Phosphate Phosphorus, pH, oil and grease, TOC
44	1386	EP	Active	Kinder Morgan Terminals	1972 / 1996		A bulk loading terminal that discharges from the effluent treatment facility for the ore	Storm	Inner Harbour (sea)	Oil separator	flow, oil and grease, pH, TSS, Cu, Fe, Pb, Zn, Ni, toxicity

Map label	Auth #	Auth Type <sup>1</sup>	Status	Company	Year Issued / Amended	CPIX <sup>2</sup>	Facility	Discharge type	Discharge to	Treatment	Relevant Water Quality Parameters
							concentrated storage and loading area, northwest parking area, car wash, truck wash, and the diked methanol tank area.				
45	1668	EP	Active	Rogers Sugar Ltd.	1975 / 2012		A sugar refinery (240,000 tonnes of sugar per year) that discharges effluent from cooling water from non-contact steam turbine oil coolers and stormwater to the Burrard Inlet.	Cooling, process	Inner Harbour (sea)	Submerged outfall	flow, TSS, BOD, temp, pH
46	1668	EP	Active	Rogers Sugar Ltd.	1975 / 2012		A sugar refinery (240,000 tonnes of sugar per year) that discharges effluent from cooling water condensates and condensates from liquid sugar operations and stormwater to Burrard Inlet	Cooling, process	Inner Harbour (sea)	Submerged outfall	flow, TSS, BOD, temp, pH
47	1668	EP	Active	Rogers Sugar Ltd.	1975 / 2012		A sugar refinery (240,000 tonnes of sugar per year) that discharges effluent from condenser cooling water and condensates from direct contact	---	Inner Harbour (sea)	Submerged outfall	flow, TSS, BOD, temp, pH

Map label	Auth #	Auth Type <sup>1</sup>	Status	Company	Year Issued / Amended	CPIX <sup>2</sup>	Facility	Discharge type	Discharge to	Treatment	Relevant Water Quality Parameters
							barometric condensers associated with evaporators and vacuum pans combined with cooling water to Burrard Inlet.				
48	2300	EP	Active	Ocean Construction Supplies Ltd.	1974 / 2005		A ready-mix plant that discharges stormwater.	Storm	False Creek (ground)	Infiltration pond	TSS, oil and grease, pH
49	2440	EP	Cancelled	LaFarge Canada Inc.	1974 / 2004		A ready-mix concrete batch plant that discharges truck wash water, batch plant wash water and stormwater.	Storm	Inner Harbour (ground)	Filtration bed, pH treatment system	pH
50	3678	EP	Active	Westridge Marine Terminal - Kinder Morgan / Trans Mountain Pipeline ULC / Terasen	1974 / 2014		A jet fuel storage facility that discharges effluent from a dyked tank farm area.	Storm	Central Harbour (sea)	Manually controlled discharge pump & spill detector, outfall	TEH, toxicity
51	3678	EP	Active	Westridge Marine Terminal - Kinder Morgan / Trans Mountain Pipeline ULC / Terasen	1974 / 2014		A jet fuel storage facility that discharges effluent from a dyked tank farm area.	Storm	Central Harbour (sea)	Manually controlled discharge pump & spill detector, outfall	TEH, toxicity
52	4970	EP	Active	Chevron Canada Ltd.	1978 / 2003		A petroleum bulk handling facility and refinery that discharges effluent from stormwater runoff, process effluent and contaminated	Storm, process	Central Harbour (sea)	Oil separators, settling basin	flow, pH, oil and grease, TSS, phenols, MTBE, toxicity, Btex - Benzene, BTEX -Ethylbenzene, BTEX -

Map label	Auth #	Auth Type <sup>1</sup>	Status	Company	Year Issued / Amended	CPIX <sup>2</sup>	Facility	Discharge type	Discharge to	Treatment	Relevant Water Quality Parameters
							groundwater from a petroleum handling area.				Toluene, VPHw, VHw6-10, groundwater treatment
53	4970	EP	Active	Chevron Canada Ltd.	1978 / 2003		A petroleum bulk handling facility and refinery that discharges effluent from stormwater runoff, non-contact cooling water and contaminated groundwater collection systems	Storm, cooling	Central Harbour (sea)	Impounding basins	flow, pH, oil and grease, TSS, MTBE, toxicity, Btex - Benzene, BTEX -Ethylbenzene, BTEX - Toluene, VPHw, VHw6-10, groundwater treatment
54	5508	EP	Cancelled	Univar Canada Ltd. / Dow Chemical	1976 / 2003		A bulk chemical loading facility that discharges effluent.	Storm	Inner Harbour (sea)	Neutralization	flow, pH, 1,2 Dichloroethane, Ethylene Glycol, toxicity
55	5748	EP	Active	Newalta Corporation / Revolution ORS Acquisition GP Inc / Terrapure	1980 / 2003		A lubricating oil reprocessing facility that discharges stormwater, cooling water and wash water to a tile field	Storm, cooling	Central Harbour (ground)	Oil sep, settling tks, flocculation, filter, tile fields	flow, oil and grease, Phenols, Sulphides, pH
56	6898	EP	Active	Neptune Bulk Terminals Canada Ltd.	1986 / 2004		A bulk loading and storage facility that discharges effluent from the coal loading and storage area.	Process, storm	Inner Harbour (sea)	Settling ponds, flocculation	flow, TSS, toxicity
57	7178	EP	Cancelled	Burrard Generating Station (BC Hydro)	1985 / 2001		The Burrard Thermal Generating Plant; discharges effluent of	Storm	Port Moody Arm (sea)	Oil separator	flow, oil and grease, pH, NH3

Map label	Auth #	Auth Type <sup>1</sup>	Status	Company	Year Issued / Amended	CPIX <sup>2</sup>	Facility	Discharge type	Discharge to	Treatment	Relevant Water Quality Parameters
							stormwater from a diked tank farm area.				
58	7178	EP	Cancelled	Burrard Generating Station (BC Hydro)	1985 / 2001		The Burrard Thermal Generating Plant; discharges effluent of stormwater from a diked tank farm area.	Process	Port Moody Arm (sea)	Dechlorination	flow, temp, TSS
59	7178	EP	Cancelled	Burrard Generating Station (BC Hydro)	1985 / 2001		The Burrard Thermal Generating Plant; discharges effluent of stormwater from a diked tank farm area.	Process	Port Moody Arm (sea)	Neutralization tank	flow, pH
60	7178	EP	Cancelled	Burrard Generating Station (BC Hydro)	1985 / 2001		The Burrard Thermal Generating Plant; discharges effluent of stormwater from a diked tank farm area.	Cooling	Port Moody Arm (sea)	---	flow, temp, Chl res, oil and grease
61	7178	EP	Cancelled	Burrard Generating Station (BC Hydro)	1985 / 2001		The Burrard Thermal Generating Plant; discharges effluent of stormwater from a diked tank farm area.	---	Port Moody Arm (sea)	---	oil and grease
62	7810	EP	Cancelled	Great Northern Packing Ltd.	1989 / 1999		A fish processing plant that discharges effluent from a fish canning and pouching operation.	Process	Central Harbour (sea)	60 mesh screens	flow, BOD, oil and grease, TSS, chl res
63	7944	EP	Active	Canada Place Corporation	1988 / 1996		A hotel and convention centre that discharges effluent of cooling water.	---	Inner Harbour (sea)	Outfall	flow, temp, chl res
64	8035	EP	Active	YMCA (Camp Howdy)	1989 / 2007		A summer camp that discharges effluent of secondary treatment	STP	Indian Arm (sea)	Septic tk, act sludge STP, aeration,	flow, BOD, TSS

Map label	Auth #	Auth Type <sup>1</sup>	Status	Company	Year Issued / Amended	CPIX <sup>2</sup>	Facility	Discharge type	Discharge to	Treatment	Relevant Water Quality Parameters
							effluent from a sewage treatment plant serving 150-beds.			sand filter	
65	8426	EP	Active	West Coast Reduction Ltd.	1993 / 2014		An animal and fish by-products reduction and rendering plant that discharges effluent from stormwater discharge from a grease interceptor and a sampling manhole.	Storm, process	Inner Harbour (sea)	Oil & grease interceptors	flow, pH, temp, BOD, TSS, oil and grease, Sulphide, NH3, chl res, toxicity
66	12879	EP	Cancelled	Indian Arm Investments Ltd.	1995 / 2005		Six strata residence; discharges effluent.	---	Indian Arm (sea)	Septic tank, sand filter	flow, BOD, TSS
67	13446	EP	Active	Farrer Cove Waste Water Management	1998 / 2017		3 residential units	---	Indian Arm (sea)	Secondary treatment	flow, BOD, TSS, toxicity, fecal
68	17522	EP	Active	Domtar Inc. / Seaspan	1905		Discharges treated groundwater from a pump-and-treat system	Process	Inner Harbour (ground)	Chemical oxidation (Fenton's Reagent Oxidation Process); controllers, rxn tanks, monitors	flow, toxicity, PAHs, pH, TSS, VPH, LEPH, suspended solids, impact on aquatic life

## **APPENDIX G: POINT SOURCES - PROVINCE OF BC AUTHORIZATIONS IN BURRARD INLET**

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(Citations refer to the Literature Cited in the main body of the Introduction chapter)

The authorizations presented in this document were by the Province of BC, and do not represent authorizations by TWN. The terms “authorization” and “permit” in this document are used to refer only to provincial authorizations and permits.

This report includes the provincial authorization history for all the facilities excluded from Chapter 1 (Introduction) of the Water Quality Assessment and Proposed Objectives for Burrard Inlet report due to their consideration as low risk to water quality in Burrard Inlet. Detailed summaries of the provincial authorizations contained in the report are also included.

The BC Ministry of Environment and Climate Change Strategy (ENV) is responsible for the protection, management, and conservation of BC’s water, land, air, and living resources. To achieve this mandate, ENV administers the *Environmental Management Act (EMA)*, which regulates the introduction of industrial and municipal waste into the environment and prohibits any discharge that may cause pollution.

*EMA* is a tiered-approach regulation that provides various regulatory tools depending on the risk of the prescribed activity. The Province of BC requires a permit for high-risk activities, and regulates medium-risk activities through codes of practice or industry-specific regulations. The Province does not require an authorization for low-risk activities, but those activities are subject to *EMA* section 6(4), the requirement to not pollute. These provincial regulatory tools are defined below:

- **Permit:** a site-specific authorization granting permission to discharge waste to the environment from a specific industry under a specific set of terms for a particular facility, activity, or operation.
- **Operational Certificate:** the approval of a waste management plan completed by regional government bodies to control disposal of municipal garbage/sewage (specific to regional governments).
- **Registration:** a registration under a Regulation or Code of Practice which sets out standard terms and conditions under which a specific type of industry, business, operation or activity may discharge waste.

Throughout this appendix, the term “authorization” can refer to any of these provincial regulatory tools. All of the authorizations regulated under *EMA* that are located within the Burrard Inlet watershed are mentioned in this appendix; those with a higher potential environmental risk, past problems, or more complicated histories are discussed in greater detail.

*Acronyms:*

<b>WQO</b>	Water Quality Objectives
<b>ENV</b>	Ministry of Environment and Climate Change Strategy
<b>EMA</b>	<i>Environmental Management Act</i>
<b>GVRD</b>	Greater Vancouver Regional District
<b>GVSD</b>	Greater Vancouver Sewerage and Drainage District
<b>HWR</b>	Hazardous Waste Regulation

<b>COP</b>	Code of Practice
<b>PSDFSWR</b>	BC Petroleum Storage and Distribution Facilities Storm Water Regulation
<b>PE-XX</b>	Province of BC Effluent Permit
<b>PS-XX</b>	Province of BC Special Waste Permit (Special Waste is now referred to as Hazardous Waste)
<b>PR-XX</b>	Province of BC Refuse Permit
<b>RS-XX</b>	Province of BC Registration under HWR (formerly Special Waste Regulation)
<b>RE-XX</b>	Province of BC Registration under a Regulation that regulates effluent discharges

## 1. False Creek

The Province of BC has permitted one effluent discharge to False Creek and has authorized four discharges of contaminated soil to the land surrounding False Creek. Table 1 lists the discharge details.

*Table 1: Provincially authorized Discharges in the False Creek Sub-basin*

Provincial Authorization Holder	Provincial Authorization Type	Provincial Authorization No.	Discharge Type	Provincially Permitted Volume
Ocean Construction Supplies Ltd.	Effluent Permit	PE-2300	No direct discharge: Stormwater to sanitary	50 m <sup>3</sup> /day
BC Ministry of Environment, Lands, and Parks	HWR Registration	RS-12224	Contaminated soil	Not applicable
BC Ministry of Environment Lands and Parks	Refuse Permit	PR-11628	Contaminated soil	Not applicable
Chinese Merchants Association Parking Association	Refuse Permit	PR-12912	Contaminated soil	Not applicable
255-285 East 1 <sup>st</sup> Avenue Holdings Ltd.	HWR Registration	RS-106230	Contaminated soil	Not applicable

### 1.1 Ocean Construction Supplies (PE-2300)

The Ocean Construction Supplies Ltd. ready-mix plant is located on Granville Island near the Granville Street Bridge. From 1974 to 1999, provincial effluent permit PE-2300 authorized three discharges from the site to False Creek: two storm water discharges and one from the air compressor cooling jacket. In 2005, the permit was amended to include only one storm water and effluent discharge as the discharges were combined. The amended permit authorizes a maximum annual average discharge of 50 m<sup>3</sup>/day with maximum total suspended solids of 75 mg/L, a maximum oil and grease content of 10 mg/L, and a pH range of 6.5 to 8.5. The treatment works include a settling pond and a pH control system.

In 1999, all storm water run-off and process water was directed to the effluent treatment system which discharges to the City of Vancouver sanitary sewer system under provincial Permit No. SC-980236. Since then, there has not been any direct discharge from the site to False Creek; however, the



Province has retained the permit to allow this discharge as a back-up in case of a severe rain or flooding event.

Prior to 1999, the discharges from this facility were in compliance with the permit effluent quality requirements. As there is no current discharge to the environment from this facility, the environmental risk to False Creek is low.

### **1.2 BC Ministry of Environment, Lands, and Parks (RS-12224 and PR-11628)**

The BC Ministry of Environment, Lands, and Parks, now the BC Ministry of Environment and Climate Change Strategy (ENV), holds two provincial permits for the discharge of contaminated soils to the land on the north shore of False Creek. The permits are part of the Pacific Place Remediation Project which has been underway for many years. The assessment and remediation started when the City of Vancouver embarked on a project to redevelop the former industrial lands around False Creek. In 1988, the Pacific Place site was sold to Concord Pacific Site Group Inc. as the master developer for the site. The responsibility for remediation, however, remained with the Province.

For the discharge of soil during the project to land assessed as being between commercial-industrial and hazardous waste levels, the Province required a permit under the Waste Management Act and the Special Waste Regulation, now the Environmental Management Act (EMA) and the Hazardous Waste Regulation (HWR) (ENV, 1992).

Through Special Waste permit PS-12224, the Province authorized the short-term storage of soil contaminated with polycyclic aromatic hydrocarbons (PAHs), oil and grease, leachable metals, chlorophenols and/or BTEX (benzene, toluene, ethylbenzene and xylene) on the trans-shipment facility located between Expo Blvd. and Pacific Blvd. The facility was used to store hazardous waste soil resulting from the historic industrial activities on the Pacific Place site before being shipped to appropriate disposal facilities. The site had sumps to collect storm water and leachate from the soils, which was then treated before being discharged to the City of Vancouver sanitary sewer. The permit expired in 2010; however, the Province registered it as a hazardous waste storage facility (RS-12224) under the Hazardous Storage Waste Regulation in 2012. Although there is limited information available for this facility, it is currently inactive and the risk of contamination to False Creek is low.

The second provincial permit, refuse permit PR-11628, authorized the discharge of non-hazardous waste soil contaminated with metals, oil and grease, and/or PAHs from Parcel 2 on the Pacific Place Site. In the first year of operation, 15,600,000 kg of soil were discharged to the land bridge on Carrall Street. All refuse was deposited above the water table and covered with a 40 mil high density polyethylene liner overlain with at least one meter of clean landscape fill. As there is no leachate or runoff from this site, it should not have an environmental impact on False Creek.

### **1.3 Chinese Merchants Association Parking Association now Easy Park (PR-12912)**

Through refuse permit PR-12912, the Province authorizes the discharge of non-hazardous waste materials consisting of soils, concrete, and debris contaminated with PAHs, BTEX and/or mineral oil and grease to the land at the SE corner of Keefer and Quebec Streets. The site on which the discharge is buried is now a parking lot managed by Easy Park. The lifetime volume of 3,150 tonnes of refuse, discharged between 1994 and 1995, was at least 0.5 m above the highest indicated water table and was covered with impervious material. The works authorized are four compacted refuse deposits, placed directly under ground level concrete floor slabs. The facility has sumps to collect and contain any leachate and prevent any discharge to the environment. The permit prescribes monitoring of soil vapour

quality, groundwater quality, and migration of dense non-aqueous phase liquids. The likelihood of contamination from this site reaching False Creek is low.

#### **1.4 255-285 East 1<sup>st</sup> Avenue Holdings Ltd. (RS-106230)**

The provincial Hazardous Waste Regulation registration RS-106230 is on a historically contaminated site, part of the Southeast False Creek lands. Although soil contamination on the site exceeded the HWR guidelines, the soil could not be removed as the Province considered it to be under a heritage building. Consequently, the site required a registration under the HWR. All hazardous waste consisting of contaminated soil with potential leachable lead and/or cadmium is buried and covered with asphalt pavement or building slabs. In order to register under the provincial Hazardous Waste Regulation, the permittee demonstrated that the soil was not leaching into the groundwater; therefore, there is no risk of contamination to False Creek (Jerade, *pers. com.*, 2018).

## **2. Outer Harbour**

The Province has authorized two discharges into the Outer Harbour as shown in Table 2.

*Table 2: Provincially Authorized Discharges in Outer Harbour Sub-basin*

Provincial Authorization Holder	Provincial Authorization Type	Provincial Authorization No.	Discharge Type	Provincially Permitted Volume
The University of British Columbia	MWR Registration	RE-104901	No discharge: Reclaimed water for reuse	Not applicable
Greater Vancouver Sewerage and Drainage District (Lions Gate Wastewater Treatment Plant)	Operational Certificate	ME-30	WWTP discharge to Burrard inlet	318,000 m <sup>3</sup> /day

### **2.1 University of British Columbia (MWR Registration RE-104901)**

The University of British Columbia's (UBC) Centre of Interactive Research on Sustainability (CIRS) registered under the provincial Municipal Wastewater Regulation (MWR) in September 2010. Through the registration (RE-104901), the Province authorizes the use of reclaimed water to flush toilets and urinals and to irrigate the green roof, green wall, and the rain garden in the building at a maximum rate of 10 m<sup>3</sup>/day. There is no discharge to the environment from this facility (nor has there ever been) as the water is reused and any water that is not used for irrigation is disposed to the sewer collection system. The Province requires the MWR registration for the site, however, due to the use of reclaimed water. An ENV inspection in 2016 confirmed that, since 2012, the advanced wastewater treatment system at the facility has been operating for research purposes only (ENV, 2017). Treated wastewater is sent back to the sewer at the completion of the treatment cycle. As there is no discharge, this site does not pose a risk to the water quality in Burrard Inlet.

### **2.2 Greater Vancouver Sewerage and Drainage District (ME-30)**

The Greater Vancouver Sewerage and Drainage District (GVSD) (also referred to as Metro Vancouver or MV) operates the Lion's Gate wastewater treatment plant located near First Narrows just

east of the Capilano River. The primary treatment plant opened in 1961 and services the Districts of West Vancouver and North Vancouver and the City of North Vancouver. The volume of effluent discharged from this plant far exceeds the volume discharged from any other authorized facilities into Burrard Inlet.

The Province of BC originally granted effluent permit PE-30 to the Vancouver Sewerage and Drainage District (GVSD) in 1959 and has amended it several times. In 1979, a major amendment by the Province upgraded the effluent quality to maximum concentrations of 130 mg/L for biological oxygen demand (BOD<sub>5</sub>) and total suspended solids (TSS) and increased the maximum discharge rate to 102,000 m<sup>3</sup>/day (ENV, 1998). This amendment also required the GVRD to carry out a detailed discharge monitoring program. Other minor amendments followed in 1993, 1995, and 1998 which added Facility and Operator Classification requirements, BOD<sub>5</sub> and TSS loading limits, and prohibited the discharge of sludge, which was allowed in the original permit (ENV, 1998). In April 2002, the Minister of Environment approved the Greater Vancouver Regional District (GVRD) Liquid Waste Management Plan (LWMP), a plan that had been in preparation since 1986. Subsequently, on April 23, 2004, the present provincial operational certificate ME-30 superseded permit PE-30 in accordance with GVRD's LWMP.

Through the operational certificate, the Province authorizes a maximum daily discharge rate of 318,000 m<sup>3</sup>/day to Burrard Inlet with maximum discharge BOD<sub>5</sub> and TSS concentrations of 130 mg/L. The daily discharge loading, which is the total amount of contaminants discharged per day, must not exceed 13.5 tonnes/day for BOD<sub>5</sub> and 14.5 tonnes/day for TSS. During the summer months, from May 1 to September 30, the effluent must be disinfected to ensure that the fecal coliform water quality objective (200 MPN/100 ml), is not exceeded at the edge of the initial dilution zone. The effluent monitoring requirements are listed in Table 3 below. Metro Vancouver monitors 25 additional parameters (including total and dissolved metals, hardness, and pH) monthly and posts the results on their website (Metro Vancouver, 2017).

Table 3: ME-30 Monitoring Requirements

Parameter	Monitoring Frequency	Sampling Type
Residual Chlorine * (mg/L)	Daily	Grab
Total Suspended Solids (TSS) (mg/L)	5 times/week	Composite
Biological Oxygen Demand (BOD <sub>5</sub> ) (mg/L)	5 times/week	Composite
Fecal Coliforms* (MPN/100 ml)	1 time/week	Grab
Ammonia, nitrogen (mg/L)	2 times/month	Grab
Fish Bioassay (rainbow trout), 96-hr LC50, %	Monthly	Grab
* Only between May 1 and September 30		

In February 2009, the Canadian Council of Ministers of Environment (CCME) developed the *Canada-Wide Strategy for the Management of Municipal Wastewater Effluent (CWS-MMWE)*. This “harmonized framework” requires all wastewater treatment facilities to achieve minimum National Performance Standards which address common pollutants in wastewater discharges. It also requires site-specific effluent discharge objectives (CCME, 2009).

A priority of the CWS-MMWE strategy is to upgrade all primary treatment plants to secondary treatment. Through Metro Vancouver's updated LWMP that was approved in 2011 (the Integrated Liquid Waste and Resource Management Plan (ILWRMP)), Metro Vancouver is committed to upgrading

the Lion's Gate Wastewater treatment plant to secondary treatment by December 31, 2020 (Metro Vancouver, 2018b). The construction of the new plant is currently in progress. Once construction is complete and the new plant is operational, the primary treatment plant will be decommissioned (Metro Vancouver, 2018b). The new plant will be located two kilometres east of the current site; however, the existing submerged outfall will continue to be used at its current location (a minimum of 228 meters offshore discharging at a minimum depth of 17.3 meters below mean low water).

The Province will amend the Operational Certificate to comply with the National Performance Standards (NPS) as shown in Table 4.

*Table 4: A comparison of current ME-30 requirements and National Performance Standards*

Parameter	Current Requirements ME-00030, 2004	National Performance Standards
Maximum BOD <sub>5</sub> daily concentration	130 mg/L	25 mg/L, monthly avg. (CBOD <sub>5</sub> )
Maximum TSS daily concentration	130 mg/L	25 mg/L , monthly avg.
Residual Chlorine (if chlorine is used as a disinfectant)	-	0.02 mg/L

### 3. Inner Harbour

The province has authorized fifteen facilities within the Inner Harbour sub-basin (see Table 5).

*Table 5: Provincially Authorized Discharges in the Inner Harbour Sub-basin*

Provincial Authorization Holder	Provincial Authorization Type	Provincial Authorization No.	Discharge Type	Provincially Permitted Volume
Lafarge Canada Inc. (North Vancouver Plant)	COP for the Concrete and Concrete Products Industry	RE-107465 (replaced PE-2440)	No direct discharge: Process and storm water runoff to ground	No maximum discharge rate
Pacific Site Constructors Inc.	COP for the Concrete and Concrete Products Industry	RE-107213	No discharge; waste water is reused	Not applicable
Lafarge Canada Inc. (Vancouver Harbour Plant)	COP for the Concrete and Concrete Products Industry	RE-107468	Process water and storm water to Burrard Inlet	No maximum discharge rate
Vancouver Shipyards Co. Ltd. (Seaspan Marine Corporation)	HWR Registration	RS-17175	No discharge: Process and runoff water to sanitary sewer	144 m <sup>3</sup> /day

Great Northern Packing Ltd.	Effluent Permit <b>(cancelled in 2012)</b>	PE-7810	Process to Burrard Inlet	900 m <sup>3</sup> /day, only in emergency situations
B.C. Pavilion Corporation	MWR Registration	RE-18362	No discharge: reuse of reclaimed water	151
Southcoast petroleum Ltd.	Petroleum Storage and Distribution Facilities Stormwater Regulation (PSDFSR) Registration	RE-105286	Stormwater to storm drain	No maximum discharge rate
TMBC TreatMed BC Inc. doing business as TreatMed	HWR Registration	RS-107253	No discharge: Process water to sanitary sewer	No maximum discharge rate
KM Canada Terminals ULC operating as Kinder Morgan Canada	PSDFSR Registration	RE-14000	Stormwater to Burrard Inlet	No maximum discharge rate
	Effluent Permit	PE-1386	Discharges of stormwater and process water to Burrard Inlet	Discharge 1.1: 10,900 m <sup>3</sup> /day Discharge 1.2: 13,100 m <sup>3</sup> /day
Domtar Inc.	Effluent Permit	PE-17522	Groundwater	1,020
Neptune Bulk Terminals Canada Ltd.	Effluent Permit	PE-6898	Process and storm water to Burrard Inlet	12,000 m <sup>3</sup> /day
Univar Canada Ltd.	Effluent Permit	PE-5508 <b>(cancelled in 2008)</b>	Storm water to Burrard Inlet	1,575 m <sup>3</sup> /day
Canada Place Corporation	Effluent Permit	PE-7944	Cooling water to Burrard Inlet	23,700 m <sup>3</sup> /day
Lantic Inc.	Effluent Permit	PE-1668	Cooling, process, and stormwater to Burrard Inlet	Discharge 1.1: 3,000 m <sup>3</sup> /day Discharge 1.2: 5,000 m <sup>3</sup> /day Discharge 1.3: 67,000 m <sup>3</sup> /day
West Coast Reduction Ltd.	Effluent Permit	PE-8426	Process and stormwater to Burrard Inlet	Maximum rate: 6,300 m <sup>3</sup> /day Annual average: 1,850 m <sup>3</sup> /day

### 3.1 Lafarge Canada Inc. (RE-107465)

Lafarge Canada operates a ready-mix concrete batch plant in North Vancouver, east of the Vancouver Wharves bulk terminal. The Province of BC authorized the plant to discharge effluent from its operations in May 1974 under permit PE-2440. The Province amended the permit several times to accommodate operation and discharge updates. From 1976 to 2004, the permit included a discharge of treated storm water to Burrard Inlet. The effluent had to meet a maximum TSS concentration of 100 mg/L and a pH range of 6.0 to 9.0. The most recent permit amendment by the Province was in 2004, through which the Province authorized one discharge of effluent from the plant to an infiltration trench. The maximum authorized rate of discharge was an annual average of 40 m<sup>3</sup>/day. The effluent discharged had to be within the pH range of 6.0 to 9.0. The treatment works included effluent recycling facilities, settling basins, pH neutralization facilities, and an infiltration trench.

In 2014, the Province cancelled the permit, and registered the facility under the Code of Practice for the Concrete and Concrete Products Industry (Concrete COP). Although the Code does not include a maximum discharge rate, the facility must meet all the requirements for effluent discharges to surface or marine waters under the Concrete COP as specified in Table 6. The four parameters listed in the table must be monitored monthly and the lab records are to be kept on site. To meet the requirements, this facility has a lined pond with an in-situ pH monitoring probe and pond water is recirculated and treated with CO<sub>2</sub>. All solid waste is disposed of by a licensed disposal contractor.

Table 6: Code of Practice for the Concrete and Concrete Products Industry Requirements for effluent discharges to surface or marine water

Parameter	Requirement	Monitoring Frequency
pH	6.5 - 9.0	Monthly
Total suspended solids (TSS)	≤ 75 mg/L	Monthly
Total Extractable Hydrocarbons (TEH)	≤ 15 mg/L	Monthly
Toxicity	50% mortality <sup>1</sup>	Monthly
<sup>1</sup> At 100% concentration, the process water or establishment runoff does not kill more than 50% of the rainbow trout in a 96-hr LC50 Bioassay.		

### 3.2 Pacific Site Constructors Inc. (RE-107213)

Since May 2014, Pacific Site Constructors Inc. has run a ready-mix concrete facility in North Vancouver registered by the Province of BC under the Code of Practice for Concrete and Concrete Products Industry. The facility must comply with the requirements specified in the Code. Process and storm water from the site operations is collected in lined ponds for treatment. A closed loop system is set up to reuse the concrete waste water; therefore, there is no effluent discharge from this facility (K. Dolan, *pers. comm.* 2018). The excess waste concrete solids are hauled off site to a recognized facility in Richmond and records are filed on site.

### 3.3 Lafarge Canada Inc. (RE-107468)

Lafarge Canada operates a ready-mix concrete batch plant in the Vancouver Harbour. In September 2014, the Province of BC registered the plant under the Code of Practice for the Concrete and Concrete Products Industry and the plant must meet all the requirements for effluent discharges to

surface or marine water under the COP. The storm water runoff is treated in a lined pond which has an in-situ pH monitoring probe. The pond water is recirculated and treated with CO<sub>2</sub> to maintain the required pH range. The Province requires that the four parameters listed in Table 6 be monitored monthly with the lab records kept on site. All solid waste is disposed of by a licensed disposal contractor.

### 3.4 Vancouver Shipyards Co. Ltd. (Seaspan) (HWR RS-17175)

Vancouver Shipyards Co. Ltd. (VSY) owns and operates a hazardous waste facility located within a larger property owned by Seaspan Marine Corporation in North Vancouver. The facility receives, stores, processes, treats, and disposes of hazardous wastes received from internal and external customers throughout British Columbia, Alberta, and Washington State. The types of hazardous substances stored include: flammable liquids, toxic substances, flammable solids, and corrosive substances from different industrial activities.

In 2003, through Special Waste Permit PS-17175, the Province of BC granted VSY authorization to manage the special waste facility in accordance with the requirements of the Waste Management Act and the Special Waste Regulation, now the Environmental Management Act (EMA) and the Hazardous Waste Regulation (HWR). In 2006, the Province transitioned permit PS-17175 to a registration (RS-17175) under the Hazardous Waste Regulation (HWR) due to regulatory changes. The types and maximum quantities of hazardous waste that the Province authorizes VSY to store and treat are listed in Table 7 (Keystone, 2014).

Table 7: Types and Quantities of Hazardous Waste Authorized by the Province of BC under RS-17175.

Waste Name	TDG Class	Maximum Storage	Treatment on Site (Y/N)	Treatment Rate (L/day)
Waste paint, paint thinners, Diesel or gasoline	TDG Class 3 Flammable Liquids	2,000 L (in drums)	N	Not applicable
Water containing Tetrachloroethylene or Trichloroethylene	TDG Class 6.1 Toxic Substances	500 L (in drums)	N	Not applicable
Water containing greater than 3% waste oil	Non-TDG regulated	460,000 L (in bulk)	Y	20,000
Paint sludge oily	TDG Class 4.1 Flammable Solids	7,500 kg	N	Not applicable
Treatment plant sludge	Non-TDG regulated	2,000 L (in bulk)	N	Not applicable
Lithium batteries	TDG Class 9 Packing Group II UN3090	100 kg	N	Not applicable
Lead acid batteries	TDG Class 8 Corrosives Packing Group III UN2794	3,000 kg	N	Not applicable
Alkaline batteries	TDG Class 8 Corrosives Packing Group III UN2795	2,000 kg	N	Not applicable
Fluorescent light bulbs	TDG Class 8 Corrosives Packing Group III UN2809	10 kg	N	Not applicable

The only treatment activity within the facility is the treatment of water containing waste oil in the Waste Water Treatment Plant (WWTP) located within the facility (see Table 7). In 2013, the plant was closed and relocated to a new location 30 meters to the northeast to allow for construction of shipyard upgrade works (ENV, 2014). The treatment method employed in the WWTP separates and concentrates contaminants from water using electro-coagulation and filtration techniques (Keystone, 2014). The concentrated contaminants that are removed from the water are removed from site by a licensed hazardous waste contractor.

There is no surface water discharge or discharge to the storm water system from the facility. The treated effluent is discharged to the Municipal Sewer under Greater Vancouver Sewerage and Drainage District (GVSD) waste discharge Permit No. SC-100372-NSSA, issued by the Province of BC in 2001. The Province requires the effluent quality to meet the requirements of both the GVSD permit (Table 8) and the Effluent Standards for Hazardous Waste Facilities specified in Schedule 1.2 of the HWR (Table 9). If requirements differ, the Province requires the effluent discharge to meet the most restrictive requirements. Discharged effluent is sampled and analyzed monthly to ensure it meets the criteria prescribed by Schedule 1.2 of the HWR and the permit.

Table 8: GVRDD Permit No. SC-100372-NSSA

Parameter	GVRDD Permit Requirements
pH	5.5-10.5
Total Suspended Solids	600 mg/L
Oil and Grease Hydrocarbons	15 mg/L
Total Oil and Grease	150 mg/L
Cyanide	1 mg/L
Sulphate	1500 mg/L
Sulphide	1 mg/L
Mercury, total	0.05 mg/L
Chlorophenols	0.05 mg/L
Phenols	1 mg/L
Polycyclic Aromatic Hydrocarbons	0.05 mg/L
Total BETX <sup>1</sup>	1 mg/L
Aluminum, total	50 mg/L
Arsenic, total	1 mg/L
Boron, total	50 mg/L
Cadmium, total	0.2 mg/L
Chromium, total	4 mg/L
Cobalt, total	5 mg/L
Copper, total	2 mg/L
Iron, total	10 mg/L
Lead, total	1 mg/L
Manganese, total	5 mg/L



Molybdenum, total	1 mg/L
Nickel, total	2 mg/L
Selenium, total	1 mg/L
Silver, total	1 mg/L
Zinc, total	3 mg/L
Biochemical Oxygen Demand	No limit
Ammonia, as nitrogen	60 mg/L
<sup>1</sup> Benzene, ethylbenzene, toluene, and xylenes	

Table 9. Provincial Effluent Standards for Hazardous Waste Facilities HWR Schedule 1.2

Column 1	Column 2	Column 3
Parameter	Discharges to the Environment or Storm Sewers	Discharges to Municipal or Industrial Effluent Treatment Works*
<b>Physical</b>		
pH	6.5 to 8.5	5.0 to 11.0
Temperature	32 °C	-
Total suspended solids	20 mg/L	-
Toxicity (96-h LC50, rainbow trout)	100% effluent	50% effluent
<b>Inorganics (mg/L)</b>		
Aluminum, dissolved	0.5	2.0
Ammonia, total (expressed as nitrogen)	2.0	-
Antimony, dissolved	0.25	0.5
Arsenic, dissolved	0.1	0.3
Barium, dissolved	1.0	2.5
Boron, dissolved	10.0	15.0
Cadmium, dissolved	0.05	0.1
Chromium, dissolved (hexavalent)	0.1	0.2
Chromium, total	0.5	1.0
Cobalt, dissolved	0.1	0.3
Copper, dissolved	0.1	0.3
Cyanide (weak acid dissociable)	0.1	0.2
Fluoride, dissolved	15.0	18.0
Lead, dissolved	0.1	0.3
Manganese, dissolved	0.5	1.0
Mercury, total	0.001	0.01
Molybdenum, dissolved	0.5	1.0
Nickel, dissolved	0.5	1.0
Selenium, dissolved	0.05	0.1
Tin, dissolved	0.5	1.0
Zinc, dissolved	0.2	0.5
<b>Organics (mg/L)</b>		
Biochemical oxygen demand (BOD5)	20	-
Dioxin TEQ	0.000 000 000 015	0.000 000 000 015
Oil	10	60
Phenol	0.2	0.5
Polychlorinated biphenyls, total	0.005	0.005
Total chlorinated phenol	0.006	0.05
Total organic halogens (as chlorine)	1.0	1.0

\* Local municipal requirements may be more restrictive.

Under the HWR, the Province of BC requires the owner of a hazardous waste facility to provide and maintain an spills containment system approved by the Province and inspect the facility monthly. The VSY hazardous waste storage facility is sheltered and protected from elements of the weather. Moreover, it is designed in a manner that contains all potential spills through grading of the ground floor and directing effluent to re-enter the holding tank (ENV 2017b). Due to these precautionary procedures and the fact that the effluent discharge from this facility is directed to the municipal sewer treatment works, there is no hazardous waste discharge into the environment from this facility. In the case of an emergency, VSY has a contingency plan approved by ENV, which documents the procedures to be followed as per HWR requirements.

### **3.5 Great Northern Packing Ltd. (PE- 7810)**

Great Northern Packing Ltd. operated a fish processing plant in North Vancouver. Under Permit PE-7810, issued in 1989, the Province of BC authorized the discharge of effluent from this fish canning and pouching operation to Burrard inlet. The permit authorized a discharge rate of 900 m<sup>3</sup>/day for emergency situations only and for a period of seven days per year. The effluent characteristics could not exceed concentrations of 45 mg/L for BOD<sub>5</sub>, 15 mg/L for oil and grease, 60 mg/L for TSS, and 0.05 mg/L for residual chlorine. The treatment works included 60 mesh screens, a submerged outfall and a pump discharging to Burrard Inlet at approximately 163 meters south of the northeast corner of the plant. The plant closed in August 2008 and the Province cancelled the permit on November 19, 2012.

### **3.6 B.C. Pavilion Corporation (RE-18362)**

The B.C. Pavilion Corporation operates the Vancouver Convention Center which is registered under the provincial Municipal Wastewater Regulation (MWR) for the use of reclaimed water for flushing toilets and urinals, and for green roof irrigation. The water is treated in an advanced secondary-tertiary waste water treatment plant before reuse. Under the MWR, the Province of BC authorized the B.C. Pavilion Corporation to reuse a maximum of 151 m<sup>3</sup>/day of reclaimed water which must meet the following characteristics: a maximum BOD<sub>5</sub> concentration of 10 mg/L, turbidity less than 2 NTU, a pH range of 6.0 to 9.0, and a maximum fecal coliform concentration of 14 MPN/100 ml. There is no discharge from this facility, and any water that is not used for reclamation is discharged into the City of Vancouver municipal sewer. There is consequently no risk to Burrard Inlet water quality from this site.

### **3.7 Southcoast Petroleum Ltd. (RE-105286)**

Southcoast Petroleum Ltd. operates a Petro-pass truck stop cardlock facility in Vancouver. The unattended fueling site serves commercial fleet vehicles such as large commercial trucks. Although operated by Southcoast Petroleum Ltd., the facility is owned by Suncor Energy Inc. The Province of BC has registered the site under the Petroleum Storage and Distribution Facilities Storm Water Regulation (PSDFSUR) since December 16, 2010. There are four underground tanks on site with a total of 110,000 litres of fuel. All site runoff is treated in two oil water separators before being discharged to a City of Vancouver storm drain. In order to be in compliance with the regulation, the Province requires that the effluent not exceed a total extractable hydrocarbon (TEH) concentration of 15 mg/L. Furthermore, the oil water separators and all operating equipment must be inspected and maintained regularly as specified in the regulation. The expected risk to water quality from this facility is low.

### **3.8 TMBC TreatMed BC Inc. doing business as TreatMed (HWR RS-107253)**

TMBC TreatMed BC Inc. (TreatMed) is a hazardous waste management and treatment facility for biomedical waste located in North Vancouver. The facility treats biomedical waste generated by veterinary, dental and medical clinics, hospitals, doctor's offices, blood labs, dialysis operations, and

various businesses that use needles, such as acupuncturists and tattoo artists. TreatMed treats biomedical waste using the ECODAS T-300 autoclave system which shreds and sterilizes waste. Neutralized waste from the ECODAS system is safe for disposal or recycling as ordinary municipal waste (ENTECH, 2014).

On November 21, 2014, ENV approved TreatMed's plans and specifications and registered the facility as a biomedical waste management facility under the HWR (RS-107253). The Province has authorized the facility to store a maximum 5,000 kg and treat a combined maximum of 1,800 kg of biomedical waste per day. The facility is prohibited from processing or treating any wastes with the potential to contaminate the discharge water from the processor such as chemotherapy waste, radioactive waste, chemical waste, or any hazardous waste not defined as biomedical waste.

Condensate from the steam used in the decontamination process is cooled down and disposed of to the sanitary sewer. The Province requires TreatMed to sample and analyze the effluent discharge to the sanitary sewer to ensure that it complies with Schedule 1.2 Column 3 of the HWR (Table 9). The entire Schedule 1.2 parameters are sampled every 2 years but the following parameters are sampled quarterly: pH, total and dissolved metals, phenol (as chlorinated phenol), total organic halogens, and oil.

There is no surface water or groundwater at risk of impact from this facility. All hazardous wastes are stored inside a secure warehouse/treatment facility accessible to authorized personnel only; therefore, hazardous materials are not exposed to storm water. Furthermore, the property has grated storm water interceptors in the asphalt parking lot that discharge to the Metro Vancouver storm water drainage interceptors (ENTECH, 2013).

### **3.9 KM Canada Terminals ULC Operating as Kinder Morgan (Vancouver Wharves)**

KM Canada Terminals ULC (KMCT), operating as Kinder Morgan Canada Terminals Limited Partnership, runs a marine bulk loading facility that transfers over four million tons of bulk cargo annually to offshore export markets and domestic markets. The main export products include sulphur, copper concentrates, diesel, bio-diesel, grain products, and imported zinc and lead concentrates (KM, 2018). The facility is located in North Vancouver, just east of the Lion's Gate Bridge.

Metals are contaminants of particular concern from this site. Environment Canada and ENV have previously raised concerns about metal contaminant loadings from this site affecting sediments in Burrard Inlet (ENV, 1993).

KMCT has two authorizations from the Province of BC for this site: an effluent permit (PE-1386) and a registration under the Petroleum Storage and Distribution Facilities Storm Water Regulation (RE-14000). These are both discussed below.

#### **PE-1386**

Under Permit PE-1386, first issued by in 1972 to Vancouver Wharves Ltd., the Province of BC authorizes the discharge of effluent from the bulk loading plant to Burrard Inlet. Since the last WQO update in 1990, the Province has amended the permit four times (in 1993, 1995, 1996, and 2015). The amendments reflected changes to the site configuration, outfall diversions, and discharge and monitoring requirements. On March 30, 2007, KMCT assumed the assets from the Vancouver Wharves business after a lease agreement with Vancouver Wharves Limited Partnership and Vancouver Wharves Ltd. (ENV, 2015). As a result, the Province transferred the permit from Vancouver Wharves Ltd. to Kinder Morgan Canada Terminal ULC in the permit amendment of 2015. In addition to the company name change, the 2015 permit amendment updated the standard clauses to reflect the current outfall diversions.

In 1990, there were six separate discharges with specific discharge rates and requirements, as shown in Table 10. Discharge diversions in 1993, 1996 and 2009 combined the six previous discharges to the two discharges specified in the 2015 amended permit. The two discharges will be discussed separately.

Table 10: Comparison of the provincial Permit PE-1386 discharge requirements in 1985 and 2015

Parameter	1985 Provincial Permit Requirements ( 1990 WQO Report)						2015 Provincial Permit Requirements	
	01	02	04	05	06	07	Discharge 1.1 <sup>1</sup> E105980	Discharge 1.2 <sup>2</sup> E105981
Discharge rate	3,500 m <sup>3</sup> /day	8,700 m <sup>3</sup> /day	6,000 m <sup>3</sup> /day	2,500 m <sup>3</sup> /day	3,000 m <sup>3</sup> /day	2,300 m <sup>3</sup> /day	10,900 m <sup>3</sup> /day	13,100 m <sup>3</sup> /day
pH	8.5-10.5	8.5-10.5	8.5-10.5	–	–	–	8.5-10.5	8.5-10.5
TSS, max.	75 mg/L	75 mg/L	–	–	–	–	50 mg/L	50 mg/L
Dissolved Lead, max.	0.2 mg/L	0.2 mg/L	–	–	–	–	0.2 mg/L	0.2 mg/L
Dissolved Copper, max.	0.3 mg/L	0.3 mg/L	–	–	–	–	0.3 mg/L	0.3 mg/L
Dissolved Zinc, max.	1.0 mg/L	1.0 mg/L	–	–	–	–	1.0 mg/L	1.0 mg/L
Dissolved Iron, max.	1.0 mg/L	1.0 mg/L	–	–	–	–	1.0 mg/L	1.0 mg/L
TOC, max.	–	–	–	10 mg/L	–	–	10 mg/L	10 mg/L
Oil and grease, max.	–	–	–	–	10 mg/L	10 mg/L	10 mg/L	10 mg/L
Toxicity, Rainbow Trout, 96-hr Single-Concentration Test	–	–	–	–	–	–	50% mortality*	50% mortality*

\*In a static bioassay on Rainbow Trout, there must be no more than 50% fish mortality in 100% (undiluted) effluent within 96 hours.

<sup>1</sup> In 1993, discharge 07 was diverted to discharge 01 (now 1.1). In September 30, 1996, discharge 05 (referred to as 1.2 in 1996) was also diverted to 01 (now 1.1).

<sup>2</sup> In September 30, 1996, discharge 04 (referred to as 1.4 in 1996) was diverted to discharge 02 (now 1.2). In 2006, discharge 06 (referred to as 1.3 in 1996) was diverted to discharge 02 (now 1.2).

1. Discharge 1.1 includes effluent from the treatment facility for the ore concentrate storage and loading area, the northwest railcar storage area, car wash, truck wash, the dyked bulk petroleum and biofuel tank area, and the Berth #1 groundwater recovery system. The effluent treatment works consists of an effluent neutralization, precipitation and sedimentation facility. Discharge 1.1 emerges from the foreshore at a submerged outfall located underneath the Berth #1 dock. The maximum daily discharge rate is 10,900 m<sup>3</sup>/day and the Province of BC requires that effluent quality meet the standards listed in Table 9.
2. Discharge 1.2 refers to storm water effluent from the sulphur, potash, break bulk, agricultural and wood products storage and loading area, the Berth #4 and #5 recovery system, and the yard area of the administrative office and maintenance shop. The effluent treatment system consists of settling basins, a neutralization facility, and other works to meet the requirements specified in Table 9. Discharge 1.2 emerges from a submerged outfall off the eastern edge of the site into a small inlet known as the L&K Bight. The maximum daily discharge is 13,100 m<sup>3</sup>/day.

Under Permit PE-1386, the Province also requires monthly effluent monitoring from both discharges as specified in Table 11.

*Table 11: PE-1386 Effluent Monitoring Requirements*

Parameter	Provincial Monitoring Requirements	
	Discharge 1.1	Discharge 1.2
pH	Continuous	Continuous
TSS	Monthly	Monthly
Dissolved Metals (Cu, Fe, Pb, and Zn)	Monthly	Monthly
Total Metals (Cu, Fe, Pb and ZN)	Monthly	Monthly
Oil and Grease	Monthly	Monthly
Total Organic Carbon	Monthly	Monthly
Total Phosphate Phosphorus	–	Monthly
Toxicity	Monthly	Monthly

During the 2015 permit review, it was not possible to determine whether the permit limits were appropriate and protective of the environment due to the lack of receiving environment monitoring data (ENV, 2015). A clause was therefore added to address this gap in the permit. This condition required a qualified professional to design and implement a study to evaluate existing effluent quality and conduct dilution modelling at the edge of the initial dilution zone for the two discharges. The intent of the study was to evaluate if the existing effluent criteria are fully protective of the marine receiving environment.

### ***RE-14000***

The Province of BC has also registered KMCT via RE-14000 under the Petroleum Storage and Distribution Facilities Storm Water Regulation (PSDFSWR) for its fuel storage tanks on site. The Province first issued the registration in September 1994 when the Regulation came into force and amended it in February 2015 to reflect the ownership change. The site stores ultra-low-sulphur diesel (ULSD) and biofuel. All storm water runoff is collected and directed to the four oil water separators on site before being directed to the discharge 1.1 treatment works authorized under provincial permit PE-1386. The Province requires effluent discharged from the separator systems to have a concentration of total extractable hydrocarbon below 15 mg/L, as required under the regulation.

### ***3.10 Domtar Inc. and Seaspan International Inc. (PE-17522)***

From the 1920's to the 1960's, Domtar Inc. and various predecessors operated a wood-preserving facility on the Vancouver Shipyards site in North Vancouver. The parcel is now owned by Seaspan ULC (BC Environmental Appeal Board, 2013). The historical use of the western part of the site as a wood-preserving plant resulted in highly contaminated soil, sediment, and groundwater, which have been shown to have migrated into Burrard Inlet. The primary contaminants of concern on the site are creosote, PAHs, metals, and tributyltin (TBT) (BC Environmental Appeal Board, 2013).

Domtar Inc. and Seaspan ULC are responsible for the remediation of the Vancouver Shipyards site. As part of the remediation plan, the Province of BC has authorized Domtar Inc. and Seaspan International Inc. under effluent permit PE-17522 (issued in November 2004) to discharge treated ground-water to Burrard Inlet from the pump-and-treat system located at the site. The maximum rate of

discharge that the Province has authorized under the permit is 1,020 m<sup>3</sup>/day and the effluent quality requirements are listed in Table 12. Domtar Inc. and Seaspac Inc. have been working on improving the treatment plant to meet permit limits for the past fourteen years. To date, the effluent treatment plant had not yet met the discharge quality required under PE-17522. However, they have been removing 95% of the PAH constituents prior to discharge to Burrard Inlet at a reduced discharge rate. Even though they have yet to consistently meet the permit limits, the partially treated discharge is still an improvement to the local receiving environment which has been impacted by this site (S. Dankevych, *pers. comm.*, 2019). They have requested suspension of the existing permit and issuance of an approval with less stringent discharge limits. The ministry is currently reviewing the application.

Table 12: Provincial Effluent Quality Requirements for PE-17522

Parameter	Maximum Permit Requirements
Discharge Rate	1,020 m <sup>3</sup> /day
pH	6.5-9.0
TSS	In year one, 45 mg/L for ten of twelve sampling events and 75 mg/L for remaining events. For subsequent year, 45 mg/L for three of four sampling events and 75 mg/L for remaining event.
Toxicity (rainbow trout)	96-hr LC50 ≥ 100%
Total PAH	<0.05 mg/L
Acenaphthene	0.06 mg/L
Acridine	0.0005 mg/L
Anthracene	0.001 mg/L
Benz(a)anthracene	0.001 mg/L
Benzo(a)pyrene	0.0001 mg/L
Fluoranthene	0.002 mg/L
Fluorene	0.12 mg/L
Naphthalene	0.01 mg/L
Phenanthrene	0.003 mg/L
Pyrene	0.0002 mg/L
Quinoline	0.034 mg/L
LEPH <sub>w</sub> <sup>1</sup>	0.5 mg/L
VPH <sub>w</sub> <sup>2</sup>	1.5 mg/L
<sup>1</sup> Light extractable petroleum hydrocarbons	
<sup>2</sup> Volatile petroleum hydrocarbons	

### 3.11 Neptune Bulk Terminals Canada Ltd. (PE-6898)

Neptune Bulk Terminals (Canada) Ltd. (NBT) has been operating a large multi-product bulk terminal since 1970. Located in North Vancouver, just west of the Iron Worker's Memorial Bridge. The terminal temporarily stores Canadian potash, steelmaking coal, and phosphate rock before it is transferred to rail and marine transit. There are two separate shipping areas; one for coal and one for dry bulk (potash and phosphate rock).

In 1986, the Province of BC issued a permit (PE-6898) to NBT to discharge wastewater from their bulk loading facility to Burrard Inlet. When the original permit was issued, they handled coal, potash, and specialty agricultural products such as Alfalfa pellets, peas, or lentils (ENV, 2004). The wastewater consisted of surface runoff and coal pile wash-down water. At the time, there was a treatment facility for the dry bulk area, but not for the coal handling area. The wastewater from the dry-bulk handling area was treated in settling basins before being discharged through a submerged outfall to Burrard Inlet. Table 13 below lists the original provincial permit requirements as well as the amendments.

The effluent generated from the dry bulk area caused elevated ammonia and BOD<sub>5</sub> levels in the receiving environment due to the handling of urea fertilizers and feed products (ENV, 2004). In November 1991, NBT redirected all wastewater from their potash and agricultural handling facilities to the Greater Vancouver Sewerage and Drainage District (GVS&DD) sanitary sewer under MV Permit No. SC-1000002-NSSA. As a result, the Province removed the BOD, pH, and ammonia requirements from the permit in the 1995 amendment; however, monitoring requirements for these parameters remained in place (ENV, 2004). In 2004, the Province amended the permit to include two oil water separators in the treatment works and update the site plan. During this amendment, the Province removed the BOD<sub>5</sub>, pH, and ammonia monitoring requirements as the levels demonstrated that the discharge was not contributing to elevated ammonia and BOD<sub>5</sub> levels. The changes in the permit are shown in Table 13.

*Table 13: Changes in Province of BC Requirements under PE-6898 through the years*

Parameter	1986 Provincial Permit Requirements	GVRD Provincial Permit <sup>1</sup> ("Dry Bulk" area discharge)	1995 Provincial Amendment	2004 Provincial Amendment
Maximum Discharge Rate	5,400 m <sup>3</sup> /day until 1989, then 12,000 m <sup>3</sup> /day	3,500 m <sup>3</sup> /day	12,000 m <sup>3</sup> /day	12,000 m <sup>3</sup> /day
pH	6.5-8.5	5.5-10.5	No limit, monthly monitoring <sup>2</sup>	No limit, no monitoring
96-hr LC50 fish bioassay	≥ 50% mortality	Not applicable	50%	50%
TSS	50 mg/L	600 mg/L	50 mg/L	50 mg/L
BOD <sub>5</sub>	45 mg/L	No limit	No limit, annual monitoring <sup>2</sup>	No limit, no monitoring
Ammonia (Nitrogen)	10 mg/L	60 mg/L	No limit, annual monitoring <sup>2</sup>	No limit, no monitoring
<sup>1</sup> The GVRD permit has additional requirements for total metals and total organic hydrocarbons not displayed on this table.				
<sup>2</sup> At the request of the Department of Fisheries and Oceans (DFO), monthly monitoring for pH and annual monitoring for BOD <sub>5</sub> and Ammonia remained in place in 1995.				

Currently, the source of the wastewater from this facility is generated from storm water and operations such as the wash down of trains during unloading, water sprayed on conveyor belts to remove accumulated coal from paved surfaces, and dust suppression of coal piles (KWL, 2006). All wastewater from the coal handling area is directed to the coal water treatment plant (CWTP), which uses oil water separators, chemical treatment with coagulation and flocculation, and multiple settling ponds. Treated water from the CWTP is discharged to Burrard Inlet via an outfall at the south end of Berth #3. The dry Bulk treatment system receives runoff from the potash and phosphate rock areas and various collection sumps and settling ponds on site. The effluent treatment includes multiple ponds and



oil skimmers before discharge to the MV sanitary sewer system. NBT has recently entered the provincial Pre-application phase for a Province of BC permit for the dry bulk treated runoff to be discharged to Burrard Inlet.

In the past three years, there have been some TSS exceedances and three failed fish toxicity tests from the permitted coal water discharge. In each case of an exceedance, NBT investigated the cause and took remedial actions to improve the results and meet the provincial permit limits.

### **3.12 Univar Canada—previously owned by Dow Chemical Canada Inc. (PE-5508)**

Univar Ltd., a large industrial and agricultural chemical distributor, operates the West Coast Distribution Centre in North Vancouver, just west of the Iron Workers Memorial Bridge. The bulk liquid chemical marine terminal stores caustic soda (NaOH) and ethylene glycol. These chemicals are transferred via truck, rail, or marine vessel. Until December 1, 2007, the bulk terminal was owned and operated by Dow Chemical Canada Inc.

The Province of BC issued Effluent Permit PE-5508 in July 1979 to Dow Chemical Canada Inc. and authorized the discharge of storm water effluent from the chemical loading facility to Burrard Inlet. Storm water directed to the chemical storage tank spill containment dykes was neutralized prior to discharge through a submerged outfall into Burrard Inlet. The permit discharge requirements are listed below in Table 14.

*Table 14: Provincial Discharge Requirements under PE-5508*

Parameter	Provincial Permit Requirements
Max. Discharge Rate	1,575 m <sup>3</sup> /day
pH	6.5-8.5
1,2 dichloroethane	60 mg/L
Ethylene glycol	90 mg/L
Toxicity, 96-hr LC50	100%

In 2008, Univar Canada Ltd. requested an amendment to permit PE-5508 as the ownership changed from Dow Chemical Canada Inc. to Univar Canada Inc. and the facility discontinued the storage of ethylene dichloride. The permit had not been reviewed since the introduction of the *Waste Discharge Regulation* (WDR) in 2004. After reviewing the WDR, Univar determined that the terminal's operation does not fall under the WDR definition of a "chemical and chemical products industry" as it did not manufacture or blend any products and would not require a permit under EMA. Univar requested cancellation of the permit. ENV assessed the request and cancelled the permit in December 2008 (ENV, 2009). Although the permit was cancelled, the discharge continues and Univar is therefore responsible for taking all measures to prevent pollution. Univar has advised that they will continue to monitor and treat the effluent discharges.

Limited historical data indicate that prior to the cancellation of the permit, the discharge was in compliance with the permit conditions. Significant impacts to the water quality of Burrard Inlet are therefore not expected from this discharge.

### **3.13 Canada Place Corporation (PE-7944)**

Under effluent permit PE-7944, the Province of BC has authorized the Canada Place Corporation (CPC) to discharge cooling water effluent from its hotel and convention center at Canada Place in

Vancouver to Burrard Inlet. Seawater is used to indirectly cool heat exchangers for air conditioning units in the hotel before being discharged back to the Inlet.

Through the permit issued in February 1988, the Province authorizes a maximum discharge rate of 23,700 m<sup>3</sup>/day with a maximum temperature of 24°C and a maximum chlorine residual of 0.1 mg/L (chlorine was added to seawater to prevent marine organisms from fouling the cooling system). In 1996, the Burrard Inlet Environmental Action Program (BIEAP) and the Department of Fisheries and Oceans (DFO) recommended lowering the residual chlorine limit because of its associated deleterious risks to fish (ENV, 1996). The Province consequently amended the permit in October 1997, with an adjusted maximum total chlorine residual limit of 0.02 mg/L.

The Province last amended the permit in 2017, removing the chlorine requirement altogether because CPC stopped adding chlorine to the cooling system. CPC switched to using digitally controlled copper anodes which inhibit bacteria and sea life from adhering to the cooling system.

The main contaminants of concern from this discharge were chlorine produced oxidants from the residual chlorine; however, that is no longer a concern. The data from the past five years indicates that CPC never exceeded the provincially permitted authorized discharge rate, temperature, or chlorine residual concentration. Data from 2017 to 2018 shows that the discharge rate is significantly lower than the permitted volume with an average discharge rate of 3,269 m<sup>3</sup>/day, and the average temperature at discharge for the past year was 15.3°C. As a result, the risk to water quality in Burrard Inlet from this discharge is low.

### **3.13 Lantic Inc. (PE-1668)**

The Lantic Inc. sugar refinery in Vancouver produces up to 240,000 tonnes of sugar per year from imported raw cane sugar (Lantic, 2018). There are three process waste water discharges from the refinery to Burrard Inlet that the Province of BC has authorized under effluent permit PE-1668. The majority of the effluent is saltwater from Burrard Inlet that is used for barometric condenser cooling during the refining process.

The Province first issued PE-1668 in July 1973 under the name of British Columbia Sugar Refining Company, Limited. The original permit authorized two cooling water discharges from the condensers in the refinery and condensate. The maximum rates were 5,500 m<sup>3</sup>/day and 11,235 m<sup>3</sup>/day with maximum TSS concentrations of 25 mg/L and BOD<sub>5</sub> of 30 mg/L. The maximum temperature of the discharges was 50°C.

In 1995, the British Columbia Sugar Refinery Company, Limited requested a name change to Rogers Sugar Ltd. During the provincial permit amendment process, it was noted that the temperature limit was higher than reasonable for a marine discharge. Various regulatory agencies such as Environment Canada, the Department of Fisheries and Oceans, the Burrard Inlet Environmental Action Program, and the Burrard Inlet Environmental Review Committee worked with Rogers to find the best solution to the high temperature discharge (ENV, 2001). Two options were discussed: a closed-loop cooling tower or additional cooling water; of which the latter was found most reasonable. Subsequently, Rogers applied to the Province for a major permit amendment to include a new discharge point and increase in discharge volume to accommodate the use of additional salt water to reduce the discharge temperature. The new discharge would include the pan-house cooling water from direct-contact saltwater barometric condensers combined with the additional sea-water for cooling purposes before being discharged into Burrard Inlet.

The Province of BC issued the amended permit on January 30, 2001. They added the new discharge (Discharge 1.3) to the permit and the temperature limits of the previous two discharges were

lowered from 50°C to 27°C. Under the permit, the company is also required to carry out semi-annual receiving environment monitoring to assess the growth of marine organisms such as bacteria and algae, as well as the condition of the marine environment and sea floor. Diving inspections of the receiving environment around the outfalls are conducted every six months to assess levels of marine organism growth.

On June 30, 2008 Lantic Sugar Limited and Rogers Sugar Ltd. merged into Lantic Inc. The Province amended the permit on April 10, 2012 to accommodate the name change and update the permit. The amended permit discharge quality requirements are listed in Table 15.

*Table 15: Province of BC PE-1668 Discharge Requirements*

Parameter	PE-1668 2012 Provincial Permit Requirements			Provincial Monitoring Requirements
	Discharge 1.1	Discharge 1.2	Discharge 1.3	
EMS ID	E208249	E208250	E243144	
Max. Discharge Rate	3,000 m <sup>3</sup> /day	5,500 m <sup>3</sup> /day	67,000 m <sup>3</sup> /day	Continuous
TSS	25 mg/L	25 mg/L	40 mg/L	Monthly
BOD <sub>5</sub>	30 mg/L	30 mg/L	10 mg/L	Monthly
Temperature	27°C	27°C	27°C	Continuous
pH	6.5-8.5	6.5-8.5	6.5-8.5	Monthly

1. Discharge 1.1: Cooling water from non-contact steam turbine oil coolers and storm water are discharged to Burrard Inlet from a submerged outfall on the west side of the plant. The maximum rate of discharge is 3,000 m<sup>3</sup>/day.
2. Discharge 1.2: Condenser cooling water and condensates from liquid sugar operations and storm water are discharged to Burrard Inlet from the east submerged outfall. The maximum discharge rate is 5,500 m<sup>3</sup>/day.
3. Discharge 1.3: Condenser cooling water and condensates from direct contact barometric condensers, associated with evaporators and vacuum pans, combined with cooling water are discharged to Burrard Inlet from the submerged outfall and diffuser on the northwest corner of the facility. Fresh seawater is drawn through an intake near the end of the wharf and mixed with the discharge ahead of the diffuser. The maximum rate of discharge is 67,000 m<sup>3</sup>/day.

The major risks to water quality in Burrard Inlet from this refinery are the high discharge temperatures and bacterial growths that may be promoted due to the sugar in the effluent. Discharges from the facility have exceeded flow, temperature, and TSS permit limits on several occasions in the past few years.

### **3.14 West Coast Reduction Ltd. (PE-8426)**

West Coast Reduction Ltd. (WCR) operates an animal and fish by-product reduction and rendering plant in Vancouver. Constructed in 1964, the plant converts inedible animal by-products to protein meals, fats, and oils used in the world's feed, oleo chemical and soap industries. WCR also collects cooking oil from thousands of restaurants in the Lower Mainland and refines it into a useable product.

The Province of BC has authorized WCR to discharge process effluent to Burrard Inlet from their rendering plant under effluent permit PE-8426. The Province issued the permit in July, 1993 and last amended it in December, 2014. Through the permit, the Province authorizes the discharge of process effluent from the air emissions scrubber and storm water from the site which is treated in two oil and grease interceptors before discharging to Burrard Inlet through the outfall. The annual average rate of discharge permitted by the Province is 1,850 m<sup>3</sup>/day and the maximum rate of discharge is 6,300 m<sup>3</sup>/day. The effluent quality and monitoring requirements are listed in Table 16.

The discharge of wash water from the truck wash bay and effluent from air emission chemical scrubbers to Burrard Inlet is prohibited and is discharged to the sanitary sewer.

Table 16: Province of BC PE-8426 Permit Requirements

Parameter	Provincial Permit Requirements	
	Discharge 1.1 (E219521)	Monitoring Frequency
Annual Average Discharge Rate	1,850 m <sup>3</sup> /day	Monthly
Max. Discharge Rate	6,300 m <sup>3</sup> /day	Monthly
pH	6.0-8.5	Monthly
Temperature, max.	32°C	Monthly
BOD, max. (mg/L)	45 mg/L	Monthly
TSS, max. (mg/L)	60 mg/L	Monthly
Oil and Grease, max	15 mg/L	Monthly
Total Sulfide, max.	0.5 mg/L	Monthly
Total Ammonia, Nitrogen	10 mg/L	Monthly
Chlorine Residual: free	0.05 mg/L	Monthly
Toxicity, % v/v	96-hr LC50 ≥ 100% <sup>1</sup>	Quarterly
<sup>1</sup> 96-hr LC50 ≥ 100% means that in a static bioassay on salmonid species, three-spined stickleback or Topsmelt ( <i>Atherinops affinis</i> ), at least 50% of the test fish must survive over 96 hours in undiluted effluent.		

A 2017 inspection of the facility affirms that WCR has not exceeded any of the provincial permit requirements in the previous two years. The treatment works and overall equipment was found to be in good order.

#### 4. Central Harbour

The Province of BC has authorized eight facilities within the Central Harbour sub-basin as shown in Table 17.

Table 17: Provincially authorized discharges in the Central Harbour Sub-basin

Provincial Authorization Holder	Provincial Authorization Type	Provincial Authorization No.	Discharge Type	Provincially Permitted Volume
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Lehigh Hanson Materials Limited- doing business as Ocean Concrete	COP for the Concrete and Concrete Products Industry	RE-107100	Process water and stormwater runoff to storm sewer	No maximum discharge rate
Lafarge Canada Inc. (Kask Brothers) <b>(Decommissioned in 2016)</b>	COP for the Concrete and Concrete Products Industry	RE-107463 (Replace PE- 6833)	Process water and stormwater runoff to settling pond	No maximum discharge rate
Chemtrade Electrochem Inc.	Effluent Permit	PE-18	Process water, cooling water, and domestic sewage to Burrard Inlet	Discharge 1.1: 90,000 m <sup>3</sup> /day Discharge 1.2: 140 m <sup>3</sup> /day
	Refuse Permit	PR-1698	Process refuse, solar salt	Not applicable
Revolution ORS Acquisition GP Inc. doing business as Terrapure	Effluent Permit	PE-5748	No direct discharge: Stormwater cooling and wash water to tile field	Maximum: 250 m <sup>3</sup> /day Annual average: 60 m <sup>3</sup> /day
	HWR Registration	RE-8511	No direct discharge: Stormwater, cooling water, and wash water	Not applicable
Sterling Pulp Chemicals Ltd. (ERCO)	Effluent Permit	PE-395	Cooling water and storm water to Burrard Inlet	7,160 m <sup>3</sup> /day
Parkland Refining (B.C) Ltd.	Effluent Permit	PE-4970	Storm and process water to Burrard Inlet	Discharge 1.1: 19,550 m <sup>3</sup> /day Discharge 1.2: 18,000 m <sup>3</sup> /day
	Refuse Permit	PR-7112	Leachate and Surface runoff	No maximum discharge rate
Shell Canada Products Limited	PSDFSR Registration	RE-449	Stormwater to Burrard inlet	No maximum discharge rate
Trans Mountain Pipeline ULC	Effluent Permit	PE-3678	Stormwater to Burrard Inlet	Maximum: 415 m <sup>3</sup> /day Annual Average: 26 m <sup>3</sup> /day
	PSDFSR Registration	RE-14058	Stormwater to Burrard Inlet	No maximum discharge rate

#### **4.1 *Lehigh Hanson Materials Limited: doing business as Ocean Concrete (RE-107100)***

Lehigh Hanson Materials Limited, doing business as Ocean Concrete, operates a ready-mix concrete batch plant in North Vancouver, just east of the Iron Worker's Memorial Bridge. The Province of BC registered the plant under the Code of Practice for the Concrete and Concrete Products Industry in March, 2014. The Province requires the facility to meet all of the requirements for effluent discharges to surface or marine water under the Code of Practice as shown in Table 6. All storm water and surface runoff from the site is treated in two large contained settling basins and an oil/water separator. The pH of the effluent is maintained through direct CO<sub>2</sub> injection. A pH probe is placed on the outflow pipe that goes to the storm sewer to continually monitor the pH. The parameters listed in Table 6 are monitored monthly with the lab records kept on site.

#### **4.2 *Lafarge Canada Inc. (Kask Brother's Site) (RE-107463)***

The Kask Brothers ready-mix concrete batch plant located in Burnaby was in operation from 1936 until 2016 when it closed its operations. The Province of BC issued Effluent Permit PE-6833 to Kask Bros. Ready Mix. Ltd. in 1984 and authorized the discharge of effluent from the ready-mix concrete plant to a ditch that flows into Burrard Inlet. The source of discharge included wash water, spray down, and storm water treated in settling and neutralization ponds. The permit authorized a maximum rate of discharge of 1,600 m<sup>3</sup>/day with a maximum suspended solids concentration of 50.0 mg/L and a pH range of 6.5 to 10.0. In the 1990's the facility was found to be out of compliance for discharging effluent with an elevated pH. Consequently, Kask Bros. installed a pH treatment facility to correct the situation in 1998 (ENV, 1998). The Province last amended the permit in 2007 to reflect the ownership transfer from Kask Bros. Ready Mix. Ltd. to Lafarge Canada Inc. doing business as Kask brothers, Division of Lafarge Canada.

In 2014, the Province cancelled permit PE-6833 and registered the facility under the Code of Practice for Concrete and Concrete Products (Concrete COP) and must therefore meet the requirements listed in Table 6. The storm water from the plant was treated in a concrete lined settling pond where water was re-circulated and treated with carbon dioxide to control the pH.

In 2016, the Province decommissioned the Kask Bros. ready-mix plant as all operations were transferred to the other Lafarge ready-mix concrete plants in North Vancouver and Vancouver Harbour. Currently, there are no discharges from this facility into Burrard Inlet and therefore no risk to water quality.

#### **4.3 *Chemtrade Electrochem Inc. (PE-18 and PR-1698)***

The chlor-alkali plant east of the Iron Worker's Memorial Bridge in North Vancouver has been operating since 1957. The plant manufactures sodium hydroxide (caustic soda), chlorine, hydrogen, and hydrochloric acid. Chemtrade Electrochem Inc. holds two permits from the Province of BC for the operations at the chlor-alkali plant in North Vancouver: an effluent permit PE-18 and a refuse permit PR-1698.

In the past, the plant used asbestos diaphragm electrolysis cells to convert sodium chloride to the various products. This process generated wet fibrous asbestos which was discharged to the landfill on site which was permitted under ENV permit PR-1698. In 2010, the plant implemented a Technology Conversion Project (TCP) to convert it from a diaphragm cell to an advanced membrane processing system (Canexus, 2006). The goal of the TCP was to eliminate the generation of hazardous waste asbestos, increase the quality of the product and efficiency of the plant, produce cleaner effluent, and reduce greenhouse gas emissions by approximately 80% (Golder, 2007). After the TCP, the diaphragm

cell rooms, the boiler building and the fuel storage area were abandoned and the brine area had a significant upgrade. The old equipment was cleaned to remove waste asbestos and sent offsite for proper disposal and recycling. All waste asbestos was removed to an authorized disposal facility.

#### **PE-18**

The manufacturing process in the plant requires approximately 2300-3400 m<sup>3</sup> of seawater per hour for cooling purposes. Seawater is pumped from Burrard Inlet and circulated through a closed loop system of indirect contact heat exchangers (Chemtrade, 2018). Under permit PE-18, the Province authorizes the discharge of effluent composed mostly of cooling water, to Burrard Inlet. The Province granted the original permit to Hooker Chemicals Ltd. when the plant was built in 1957 and it has since been amended numerous times; mostly to accommodate changes in ownership and minor changes in permit requirements. These name changes are listed below:

1957- Hooker Chemicals Ltd.

1969- Canadian Occidental Petroleum

1992- Canadianoxy Industrial Chemicals Limited Partnership

1995- CXY Chemicals Canada Ltd.

2001- Nexen Chemicals Canada Limited Partnership

2008- Canexus Chemicals Canada Limited Partnership

2014- Canexus Corporation

2018- Chemtrade Electrochem Inc.

The two discharges identified in the provincial permit are:

1. Discharge 1.1: includes process effluent, cooling water, and domestic sewage. The domestic sewage from the plant is treated in septic tanks while cooling water is treated with sodium bisulphite to remove chlorine from the effluent before discharge. Prior to the use of sodium bisulphite, cooling water was treated with a chlorine stripper (although this has been decommissioned). The combined effluent is discharged through a submerged outfall and diffuser at the south end of the docks. The maximum authorized discharge rate is 90,000 m<sup>3</sup>/day and the effluent quality requirements are specified in Table 18.
2. Discharge 1.2: applies to the discharge of effluent from the cathode washing operation infiltration ponds. Since the TCP was completed, the cathode washing operation has not been operational and there has been no recent discharge from the infiltration ponds. There are plans to decommission and remediate the infiltration/asbestos ponds. Until the ponds are completely decommissioned and remediated, daily pH monitoring is still required.

*Table 18: Effluent Quality and Monitoring Requirements under Provincial PE-18*

Parameter	Discharge 1.1 (E208263)		Discharge 1.2 (E208289)	
	Provincial Permit Limits	Monitoring Frequency	Provincial Permit Limits	Monitoring Frequency
Max. Discharge Rate	90,000 m <sup>3</sup> /day	Daily	140 m <sup>3</sup> /day, (70 m <sup>3</sup> /day avg.)	Daily
pH	6.0-9.0	Daily	6.0-11.0	Daily
TSS, max.	130 mg/L	Daily	-	-
TSS, avg.	20 mg/L	Daily	-	-
Temperature	32°C	Daily	-	-

Total Chlorine Residual, max.	1 mg/L	Daily	-	-
Total Chlorine Residual, avg.	0.2 mg/L	Quarterly	-	-
Copper, total	0.02 mg/L	Quarterly	-	-
Nickel, total	0.02 mg/L	Quarterly	-	-
Zinc, total	0.02 mg/L	Quarterly	-	-
Toxicity, ThreeSpine stickleback	50% mortality	Quarterly	-	-

This plant has one of the highest discharge rates authorized by the Province within Burrard Inlet. The effluent discharged from this site is comprised mostly of thermal cooling water but may also contain trace levels of chlorine, chlorates, suspended solids, copper, zinc, and nickel (Golder, 2007). The major concerns to water quality associated with the discharge are pH fluctuations associated with the handling of hydrochloric acid and caustic soda and chlorine residual values, which may result in chlorine produced oxidants or organochlorine compounds. In addition, the presence of metals in the effluent could potentially impact sediments or benthic organisms in the long-term.

Since 1994, the provincial permit has required receiving environment monitoring as described in Table 19.

*Table 19: Receiving Environment Monitoring Requirements under Provincial PE-18*

Parameter	Receiving Environment Monitoring		
EMS ID	E208291	E208292	E208293
Location Description	Surface of Burrard Inlet above the point of discharge	Groundwater monitoring well	Tide pool in the mudflat area at low tide
pH	-	Monthly	Monthly
Residual Chlorine (mg/L)	Monthly	-	-

A 2017 ENV inspection reported that for the period of 2016-2017 the flow did not exceed permit limits, with the exception of one shut-down in October 2016 for facility maintenance (ENV 2018c). The effluent met permit limits except for two zinc exceedances in March and May of 2017.

#### **PR-1698**

Through refuse permit PR-1698, the Province of BC authorizes the discharge of a maximum of 765 m<sup>3</sup>/year of wet fibrous asbestos and a maximum of 3210 m<sup>3</sup> of sludge from raw solar salt to the landfill. The Province issued the permit in 1972 and like the effluent permit, amended it several times due to the various ownership name changes. As described previously, the old chlor-alkali process produced waste asbestos; however, since the TCP, the discharge of asbestos waste has been eliminated. Chemtrade records indicate that asbestos has not been discharged to the landfill since 1993 (ENV, 2018c). Furthermore, in the new process, raw salt sludge is no longer discharged to the landfill, but rather dewatered before it is removed from site by an authorized disposal facility.

A groundwater monitoring program, required by the Province under the permit, has been ongoing since 1992. There are four groundwater monitoring wells around the landfill that are sampled twice a year for pH, and dissolved metals (barium, copper, lead, nickel, and zinc). Recent reports affirm that there is no indication of contamination migration from the landfill, nor any problems with respect to groundwater quality near the landfill (Opus, 2018).

#### **4.4 Revolution ORS Acquisition doing business as Terrapure (PE-5748 and RS-8511)**



Terrapure's Short Term Hazardous Waste Storage and Treatment Facility in North Vancouver maintains a tank farm for the bulk storage of hazardous waste and operates a hazardous waste treatment process for refining waste oil. The types and quantities of hazardous waste stored, treated, and recycled on site, as authorized by the Province of BC, are shown in Table 20.

Table 20: Provincially Authorized Types and Quantities of Hazardous Waste Storage

Waste Name	Maximum Quantity Stored	Treatment Rate	Recycling Rate
Waste Oil	4,500,000 L bulk	100,000 L/day	100,000 L/day
Waste Oil Contaminated Sludge and Soil	1,640 L bulk	-	-
Waste TDG class 3	150,000 L bulk	-	-

Previously owned by Mohawk Lubricants Ltd., the facility ownership was transferred to Newalta Corporation in 2003 and most recently to Terrapure Environmental in February 2015. The facility has been operating under a Province of BC effluent permit PE-5748 since 1980 and special waste permit PS-8511 since 1991. In 2006 the Province consolidated permit requirements for PE-5748 and PS-8511 into an Operational Plan under the Hazardous Waste Regulation (HWR) registration, now referred to as RS-8511. The Province scheduled the transition from the permits to the operational plan for July 2006. Since then, the Province has regulated the facility under both the operational plan and the permit (which has not yet been cancelled).

Storm water, cooling water, and wash water from the hazardous waste reprocessing facility is treated onsite before being discharged to a subsurface tile field around 290 meters north of Burrard Inlet. The treatment includes an oil water separator, gravity settling tanks, a flocculation system, a nutshell filter, and a tile field. Provincial effluent permit PE-5748 authorizes an annual average discharge of 60 m<sup>3</sup>/day and a maximum rate of 250 m<sup>3</sup>/day from the reprocessing facility to the land. HWR registration RS-8511 requires that storm water from the hazardous waste facility meet the effluent standards listed in Schedule 1.2 of the HWR (Table 9). The effluent quality from this facility must therefore currently meet both the effluent permit requirements, and the HWR registration requirements (Table 21).

Table 21: Provincial Effluent and Groundwater Standards and Monitoring Requirements

Storm Water Effluent				Groundwater	
Parameter	RS-8511 HWR Limit <sup>1</sup>	PE-5748 Permit Limit	Monitoring Frequency <sup>2</sup>	Parameter	Monitoring Frequency
pH	6.5-8.5	6.0-8.5	Quarterly	pH	Quarterly
Oil and Grease	10 mg/L	15 mg/L	Quarterly	Oil and Grease	Quarterly
Phenol	0.2 mg/L	0.5 mg/L	Quarterly	Dissolved metals <sup>3</sup>	Quarterly
Sulphide	-	0.1 mg/L	Quarterly	LEPHw/HEPHw <sup>4</sup>	Quarterly
Dissolved Metals	HWR Schedule 1.2 Column 2	-	Quarterly	Total PAHs	Quarterly

<sup>1</sup> The entire HWR Schedule 1.2 Column 2 parameters are monitored every two years.

<sup>2</sup> PE-5748 requires monthly monitoring for pH, oil and grease, phenol, and sulphide.

<sup>3</sup> Including dissolved cadmium, copper, lead, nickel, vanadium, and zinc.

<sup>4</sup> Light/heavy extractable petroleum hydrocarbons

The Operational Plan also includes quarterly environmental monitoring requirements for storm water effluent and groundwater (Table 21). Five groundwater monitoring wells are installed around the site to observe possible contaminant migration in the receiving environment. The provincial Contaminated Sites Regulation (CSR) groundwater standards for Drinking Water and Freshwater and Marine Aquatic Life Water Use are applied to the groundwater monitoring program to assess groundwater quality (Terrapure, 2018).

The main contaminants of concern from this facility are petroleum hydrocarbons. In the past three years, the storm water effluent has met the Schedule 1.2 Column 2 standards except for three exceedances of total oil and grease, and six occurrences when the pH values were below the provincially authorized range. Since the discharge from this facility is to ground at a distance from the shore, the risk to the water quality of Burrard Inlet from this facility is low.

#### **4.5 ERCO previously Sterling Pulp Chemicals Ltd. (PE-395)**

ERCO Worldwide, a division of Superior plus Inc., operates a sodium chlorate manufacturing plant in North Vancouver. Sodium chlorate ( $\text{NaClO}_3$ ) is produced in solution and crystal forms and shipped by rail, barge, or truck. The key process is the electrolysis of purified brine with large amounts of electric power to produce sodium chlorate and hydrogen gas. The plant was previously owned by Sterling Pulp Chemicals and was transferred to ERCO Worldwide in early 2003.

Under effluent permit PE-395, issued by the Province of BC in 1971, the Province authorizes the discharge of cooling water and storm water from the sodium chlorate manufacturing plant. The effluent requirements are listed in Table 22. The Province has made amendments to the permit to increase the maximum discharge rate from 6,850 m<sup>3</sup>/day to 7,160 m<sup>3</sup>/day, and to lower the sodium chlorate concentration from 100 mg/L to 75 mg/L.

*Table 22: Effluent Requirements under Provincial Permit PE-0395*

Parameter	Provincial Permit Limit	Monitoring Frequency
Max. Discharge Rate	7,160 m <sup>3</sup> /day	Monthly
pH	6.2-8.5	Monthly
Sodium Chlorate	75 mg/L	Monthly
Zinc, total	0.2 mg/L	Monthly
Temperature, max.	27°C	Monthly

The effluent from the plant has consistently met permit limits. The main contaminant of concern from this facility is sodium chlorate in the cooling water. Sodium chlorate is a strong oxidizing compound that dissolves easily in water and may produce chlorine-produced oxidants. Recorded flows and sodium chlorate concentrations in the past two years have been significantly lower than permitted limits.

#### **4.6 Parkland Refining (B.C.) Ltd.- previously Chevron (PE-4970 and PR-7112)**

Operating since 1935, this oil refinery and products terminal in Burnaby processes over 7,950 m<sup>3</sup>/day of crude oil into gasoline, jet, diesel fuel, asphalt, and light petroleum gas (Chevron, 2009). The site is divided into a bulk handling facility (tank farm) in Area 1 on the west side of the site and the oil refinery in Area 2 on the east of the site. Of the four historic refineries in the Burrard Inlet watershed, this is the only one still operating as a refinery. The other three have transitioned to bulk loading terminals.

The refinery was owned by Chevron Canada R&M ULC until October, 2017 when Parkland Refining (B.C.) Ltd. and Chevron Canada R&M amalgamated under the name Parkland Refining (B.C.) Ltd., a subsidiary of Parkland Fuel Corporation. The Province of BC has authorized two effluent discharges at this facility under permit PE-4970. The Province also authorizes the refinery to treat and store hazardous waste from its operations under permit PR-7112.

#### **PE-4970**

Under effluent permit PE-4970, first issued by the Province of BC in 1978, the Province authorizes two effluent discharges: one from the petroleum bulk handling area designated as Area 1 and one from the petroleum refinery designated as Area 2. The Province has amended permit PE-4970 four times (1986, 1992, 2003, and 2017) to reflect operational changes.

The amendment in 2003 included the addition of contaminated groundwater (with a maximum concentration of 4.4 mg/L of methyl tertiary-butyl ether (MTBE)) as one of the sources of discharge. Consequently, a limit of 0.44 mg/L MTBE was added to the effluent requirements. The monitoring program was modified to include MTBE, BETX, VPH<sub>w</sub>, and VH<sub>w6-10</sub>. In addition, under its permit, the Province required a report on the environmental fate and impact of Chevron's MTBE discharges to Burrard Inlet. The report was submitted in 2003. The last minor amendment reflected the name change of the permit holder to Parkland Refining (B.C.) Ltd. effective November 10, 2017.

The facility has a collection system that directs all site runoff to the treatment works. The two discharges authorized by the Province of BC are described below:

1. Discharge 1.1 consists of storm water, process effluent, and contaminated groundwater from collection systems in Area 1. The water is treated in an API oil water separator and a settling basin before being discharged to Burrard Inlet through a submerged outfall about 30m offshore. Before being combined with other effluent, the methyl tertiary-butyl ether (MTBE) concentration in the collected groundwater must not exceed 4.4 mg/L. The provincial requirements for effluent quality and monitoring for each discharge are specified in Table 23.
2. Discharge 1.2 consists of storm water, non-contact cooling water, and contaminated groundwater from collection systems, excluding process effluent, from the refinery in Area 2. The water is treated in an impounding basin before being discharged through a submerged outfall to Burrard Inlet.

*Table 23: Effluent Discharge Quality and Monitoring Requirements under Provincial PE-4970*

Parameter	Discharge 1.1 (E101251)		Discharge 1.2 (E208566)	
	Provincial Permit Limit	Monitoring Frequency	Provincial Permit Limit	Monitoring Frequency
Max. Discharge Rate	19,550 m <sup>3</sup> /day	Daily	18,000 m <sup>3</sup> /day	Daily
pH	6.0-8.5	Weekly	6.0-8.5	Weekly
Oil and Grease, max.	10 mg/L	Weekly	5.0 mg/L	Weekly
TSS	20 mg/L	Weekly	20 mg/L	Weekly
Phenols	0.5 mg/L	Weekly	-	-
MTBE(methyl tertiary-butyl ether)	0.44 mg/L	Monthly	0.44 mg/L	Monthly
96-hr LC50	100%	Quarterly	100%	Quarterly
Benzene <sup>1</sup>	1 mg/L	Monthly	1.0 mg/L	Monthly

Ethylbenzene <sup>1</sup>	2.5 mg/L	Monthly	2.5 mg/L	Monthly
Toluene <sup>1</sup>	3.3 mg/L	Monthly	3.3 mg/L	Monthly
VPH <sub>w</sub> <sup>1</sup>	1.5 mg/L	Monthly	1.5 mg/L	Monthly
VH <sub>w(6-10)</sub> <sup>1</sup>	15 mg/L	Monthly	15 mg/L	Monthly
<sup>1</sup> These limits are only included in the Discharge Monitoring requirements. If these limits are exceeded, the permittee shall increase the sampling frequency of the exceeded parameter from monthly to weekly to determine the cause of the exceedances. VPH <sub>w</sub> : volatile petroleum hydrocarbons with the exception of benzene, ethylbenzene, toluene, and xylenes VH <sub>w6-10</sub> : volatile petroleum hydrocarbons				

Process water from the refinery in Area 2 is treated in the wastewater treatment plant onsite before being discharged to the Metro Vancouver sanitary sewer under GVSD Permit No. SC-100010-VSA.

The major potential contaminants of concern from these discharges are petroleum hydrocarbons including BETX (benzene, ethylbenzene, toluene and xylenes) and volatile petroleum hydrocarbons.

#### **PR-7112**

The refinery operations generate hazardous wastes including biomass from the water treatment facility, clay from the crude oil processing units, tank bottoms, separator and holding pond sludges, used oil, and spent polycatalyst (Chevron, 2009). From 1985 to 2000, a landfill was used for the temporary storage and biological treatment of the generated hazardous waste. The Province of BC authorized the landfill under refuse permit PR-7112 which was issued in 1983. Leachate and surface runoff were collected and treated in the refinery wastewater treatment plant prior to discharge to the GVRD sewer. The land treatment facility has not been in use since 2000 and was completely decommissioned in October 2008. No waste or hazardous waste residues remain on the former landfill.

Currently, hazardous waste is temporarily stored onsite in designated areas prior to being shipped offsite to provincially-approved facilities for treatment and disposal. Parkland Refining (B.C.) is in the process of replacing PR-7112 with a registration by the Province of BC under the Hazardous Waste Regulation to reflect the updated operations. The risk to water quality from the current hazardous waste storage operations is low. Storm water runoff from the facility is monitored under PE-4970.

#### **4.7 Shell Canada Products Limited (RE-449)**

The Shell Canada petroleum products finishing terminal is located on the south shore of Burrard Inlet in Burnaby. The facility operated as an oil refinery from 1932 to 1993 when the refinery was decommissioned (ENV, 1993). Since 1993, the facility has operated as a distribution terminal (tank farm) for refined petroleum products.

Under effluent permit PE-449, the Province of BC authorized the discharge of treated storm water from the Shell facility to Burrard Inlet until January 31, 2005. The Province issued it in 1971 and last amended it in 1993. The permit effluent quality and monitoring requirements are shown in Table 24. In 1994, the provincial Petroleum Storage and Distribution Facilities Storm Water Regulation (PSDFSWR) came into force to regulate storm water quality from facilities that handle refined petroleum products such as the Shell Terminal. Subsequently, the Province registered the storm water discharge from the terminal under the PSDFSWR as RE-449 and cancelled the former effluent permit PE-449 in 2005.

Table 24: Province of BC Requirements under Effluent Permit (PE-449) (effective 1971-2005)

Parameter	Provincial Permit Limits	Monitoring Frequency	Sampling Type
Flow Rate, annual avg.	2,400 m <sup>3</sup> /day	Daily	Flow
Flow Rate, max.	5,600 m <sup>3</sup> /day	-	-
Oil and Grease, avg.	5 mg/L	Weekly	Composite
Oil and Grease, max.	10 mg/L	-	-
Styrene monomer	0.1 mg/L	Quarterly	Grab <sup>2</sup>
pH	6.0-8.5	Weekly	Composite
Toxicity <sup>1</sup>	100%	Quarterly	Grab
Phenols	-	Weekly	Grab
TSS	-	Weekly	Composite
<sup>1</sup> 96-hr LC50 static bioassay on salmonid species			
<sup>2</sup> Until June 30, 1993			

The major contaminants of concern from this discharge are hydrocarbons. The current authorized storm water treatment is the same as stated in the former permit. Storm water from the site is collected in a segregated storm water sewer system and treated in two large tanks with oil skimming facilities before being discharged on a batch basis to Burrard Inlet via a submerged outfall. Under the provincial Regulation, the effluent discharged must not exceed a concentration of Total Extractable Hydrocarbons (TEH) of 15 mg/L. Although the Regulation does not specify a sampling frequency, it does specify the sampling protocol method and Shell has committed to monitor each batch for total extractable hydrocarbons before discharge (ENV, 2005). The requirements under the former provincial permit are no longer applicable to this facility.

#### 4.8 Trans Mountain Pipeline ULC (PE-3678 and RE-14058)

The Westridge Marine Terminal, operated by Trans Mountain Pipeline ULC, is located in Burnaby on the southern shoreline of Central Harbour. The Terminal currently has one dock with one marine berth which covers approximately 13.8 ha of water lot area and reclaimed lands. The Terminal has been in operation since 1956 and handles a mix of crude oil, aviation jet fuel, and petroleum products. Crude oil is currently received through the pipeline and transferred to barges and tankers for shipping. There are three jet fuel storage tanks with secondary containment located at the Terminal. The Terminal receives jet fuel by tanker; the jet fuel is offloaded into the storage tanks, and delivered via a pipeline to a tank farm at the Vancouver International Airport terminal (Kinder Morgan 2015).

##### **PE-3678**

The Province authorizes the discharge of effluent from the Terminal to Burrard Inlet with effluent permit PE-3678, issued by BC in 1974. In 1990, this permit authorized the discharge of ballast water with a maximum rate of 9,092 m<sup>3</sup>/day, a pH range of 6.5 to 9.0, and a maximum oil and grease concentration of 5 mg/L. BC has amended the permit to reflect changes in the facility operations. The existing permit, last amended by BC in 2014, authorizes treated storm water collected from the area around the three jet fuel tanks to be discharged from two locations, east and west outlets, to Burrard Inlet. The provincial effluent requirements include total extractable hydrocarbons and a toxicity bioassay test as listed in Table 25.

Each tank bay has its own sump system with a manually controlled discharge pump, a siphon with a hydrocarbon spill detector, and a siphon break/discharge-stop device, which is automatically activated in the event of a spill. Storm water from each bay is directed from the siphon to an oil water separator before being discharged to Burrard Inlet through an outfall.

Table 25: Effluent Quality and Monitoring Requirements under Province of BC PE-3678

Parameter	Provincial Permit Requirements for Discharges 1.1 and 1.2	Monitoring Requirements			
		West Discharge Sump	East Discharge Sump	West Groundwater Site	East Groundwater Site
Discharge Rate, max. annual average	26 m <sup>3</sup> /day	-	-	-	-
Discharge Rate, max.	415 m <sup>3</sup> /day	-	-	-	-
Total Extractable Hydrocarbons (TEH)	5 mg/L	Monthly	Monthly	Monthly	Monthly
Toxicity, 96-hr single concentration test	50% mortality <sup>1</sup>	Annually	Annually	-	-
<sup>1</sup> In a static bioassay on Rainbow Trout, there must be no more than 50% fish mortality in 100% undiluted effluent within 96 hours.					

#### RE-14058

The Westridge Terminal also has a provincial registration under the Petroleum Storage and Distribution Facilities Storm Water Regulation (RE-14058) and must therefore comply with all its operations and maintenance requirements. The only effluent requirement under the PSDFSWR is for the total extractable hydrocarbon (TEH) concentration in the effluent to be below 15 mg/L; and thus the permit PE-3678 requirement of 5 mg/L is more protective.

The contaminants of concern to BC and TWN from this facility include hydrocarbons, petroleum by-products and other chemicals present in storm water discharges or accidental spills during the handling of crude oil. This is not a comprehensive list of current or potential contaminants of concern, however. Data from the past five years indicates that the effluent discharges from this facility have met provincial permit requirements.

As part of the Trans Mountain Expansion Project, Trans Mountain has proposed to expand the Terminal, berths, and offloading infrastructure capacity at the Terminal to handle increased volumes of various crude oil types (TM, 2017). While the expansion would increase operational capacity, it would not change the types of operational activities at the Terminal. The Province would require a permit amendment to capture the structural changes and to ensure their permit encompasses current legislation and guidelines.

## 5. Port Moody Arm

The Province of BC has authorized seven facilities in the Port Moody Arm sub-basin (Table 26).

Table 26: Provincially Authorized Discharges in the Port Moody Arm Sub-basin

Provincial	Provincial	Provincial	Discharge Type	Provincially Permitted
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Authorization Holder	Authorization Type	Authorization No.		Volume
0985381 B.C. Ltd. (Crystal Creek States)	MWR Registration	RE-17552	No direct discharge: wastewater to ground	35 m <sup>3</sup> /day
Strata Corporation LMS 3081 (Anmore Green Estates)	Effluent Permit	PE-4606	No direct discharge: wastewater to ground	61 m <sup>3</sup> /day
Simon Fraser University	HWR Registration	RE-11883	Not applicable (contained PCB storage)	Not applicable
Chemtrade Chemicals Canada Ltd.	Effluent Permit	PE-1133	No direct discharge: Stormwater to infiltration basin	200 m <sup>3</sup> /day
British Columbia Hydro and Power Authority	Effluent Permit	PE-7178 (Cancelled in 2016)	Stormwater and process water	Discharge 1.1: 1,650 m <sup>3</sup> /day Discharge 1.2: 550 m <sup>3</sup> /day Discharge 1.3: 1,700,000 m <sup>3</sup> /day Discharge 1.4: 72 m <sup>3</sup> /day
Imperial Oil Ltd.	Effluent Permit	PE-445	Stormwater and process water to Burrard Inlet	Discharge 1.1: 8,200 m <sup>3</sup> /day Discharge 1.2: 3,312.5 m <sup>3</sup> /day
	HWR Registration	RE-8589	Stormwater runoff, drainage and leachate	3,312.5 m <sup>3</sup> /day
Petro-Canada Products (Suncor Energy)	PSDFSUR Registration	RE-14093	Stormwater to storm sewer	There is no maximum discharge rate
	Effluent	PE-22	Stormwater to Burrard Inlet	1,725 m <sup>3</sup> /day
	PSDFSUR Registration	RE-14094	Stormwater to Burrard Inlet	There is no maximum discharge rate
	HWR Registration	RS-8420	No direct discharge: Stormwater to sanitary	1,725 m <sup>3</sup> /day
	Refuse Permit	PR-1453	Not applicable	Not applicable

### **5.1 Crystal Creek (RE-17552)**

Crystal Creek States has an MWR registration (RE-17552) through which the Province of BC authorizes the discharge to ground of wastewater treated in a secondary treatment plant. As the permitted volume is low and the facility is located far from Burrard Inlet, it is unlikely that this discharge poses a risk to the water quality in Burrard Inlet.

### **5.2 Strata Corp LMS 3081 (PE-4606)**

Anmore Green Estates (AGE) is a 51 unit residential strata property in the Village of Anmore (Anmore) near Port Moody. AGE operates a secondary sewage treatment plant that serves this strata. The Province of BC authorized Strata Corporation LMS 3081 to discharge wastewater to ground from this secondary treatment plant under effluent permit PE-4606. The wastewater is discharged to two subsurface disposal fields which are alternated every month.

The Province originally issued the effluent permit to High Green Enterprises Ltd. to authorize the discharge of septic tank effluent to the land from 36 mobile homes with a maximum discharge of 22.7 m<sup>3</sup>/day. In 1991, the mobile park expanded to 53 mobile homes. Consequently, the Province amended the permit to increase the discharge rate to 61 m<sup>3</sup>/day, with a maximum BOD<sub>5</sub> concentration of 45 mg/L and a maximum TSS concentration of 60 mg/L. In 1997 the trailer park closed and the site became a residential subdivision with 39 pre-manufactured 2-bedroom homes and 12 3-bedroom homes. In addition, the plant's treatment system was upgraded in 1997 resulting in the Province reducing the permit limits for both BOD<sub>5</sub> and TSS to 20 mg/L. The Province last amended the permit in 2002 to include the requirement for an operating plan as well as additional administration requirements. Through the current permit, the Province authorizes a maximum discharge rate of 61 m<sup>3</sup>/day with maximum concentrations of 20 mg/L for BOD<sub>5</sub> and TSS. The effluent quality must be monitored monthly and the flow measured at least twice a week.

Since the early 1990s the treatment plant has failed to meet the effluent permit limits. Records indicate that there have been occasions when the effluent surfaced in the disposal fields at the time of pumping in 1991 and 2001. On these occasions, upgrades to the plant treatment works remedied the issue, however an upgrade may not solve the more recent issues due to the expanded construction in the area which has replaced forest and parkland with significant urban growth in the area.

Despite the potential for bacterial contamination from this site, the risk to the water quality of Burrard Inlet from this discharge is low as it discharges to land one kilometre from the inlet. Testing of Turner Creek over the previous two years has shown that BC Water Quality Guidelines have not been exceeded for parameters related to municipal wastewater.

Currently, AGE, Anmore and Greater Vancouver Sewerage and Drainage District (GVSD) are in discussions to connect AGE to municipal sewer and for Anmore to become a member of the GVSD.

### **5.3 Simon Fraser University (RE-11883)**

The Province of BC issued Special Waste Permit (PS-11883) to Simon Fraser University (SFU) in 1994 to authorize the storage of 3,000 kg of waste PCB liquids, solids, and equipment. The PCB wastes came from the decommissioning of electrical equipment at the Burnaby campus. The original permit expired in 2004. Instead of extending the permit, the Province registered the storage facility under the Hazardous Waste Regulation (HWR) as a passive hazardous waste facility. The PCB waste is stored in a locked storage room on the lower level of the east parkade. SFU is responsible for maintaining an up-to-date inventory of all PCB wastes in storage. Since the waste is safely stored and protected from elements of the weather, there is no risk of contamination reaching surface water from this site.



#### **5.4 Chemtrade Chemicals Ltd. (PE-1133)**

Chemtrade Chemicals Ltd. operates a plant that produces aluminum sulphate on the south shore of Burrard Inlet near the entrance of Port Moody Arm. Under effluent permit PE-1133, the Province of BC authorizes the discharge of process and storm water from the plant to the land through an infiltration pond. The Province issued the permit in 1972 and has amended it several times to reflect ownership name changes and minor changes to the monitoring requirements. The latest amendment was in 2015 to change the name from General Chemical Performance Products Ltd. to Chemtrade Chemicals Ltd. The maximum discharge rate is 200 m<sup>3</sup>/day with a pH range of 6.5 to 8.5.

All storm water runoff from the facility is directed to a collection pond. Most of the collected effluent is recycled and used in the production of aluminum sulphate. If the volume entering the collection pond is greater than the volume of water recycled or exceeds the storage capacity of the pond, effluent is discharged to the infiltration pond using a manually controlled pump (ENV, 2010).

Historically, the facility has been in compliance with the provincial effluent discharge requirements. Although the maximum authorized rate is 200 m<sup>3</sup>/day, the maximum daily discharge from 2013 to 2017 was only 21.8 m<sup>3</sup>/day, much lower than the provincially authorized rate. This operation is considered a low-risk operation because the discharge is low and most of the process effluent is recycled.

#### **5.5 British Columbia Hydro and Power Authority (PE-7178)**

The Burrard Generating Station (BGS), operated by BC Hydro, is located on the North Shore of Burrard Inlet immediately west of the Imperial Oil Terminal. Built in 1960, the station had six turbine generating units on site with a total capacity of 950 MW (BC Hydro, 2000). With its nominal capacity, BGS operated primarily in times of water scarcity or emergency when hydroelectric plants could not supply enough electricity for the province. In 2015, the facility stopped generating electricity, but it continues to provide voltage support to the BC Hydro transmission and distribution system in the Lower Mainland.

The facility used natural gas as the main fuel with oil as an emergency backup until 1978, which was when the plant ceased burning fuel oil to reduce atmospheric pollution in the Lower Mainland (BC Hydro, 2000).

BGS operated under effluent permit PE-7178, issued by the Province of BC in 1985. Under the permit, the Province authorized four discharges from different operations at the plant. The four discharges and their respective discharge and monitoring requirements are shown on Table 27. The Province amended the permit several times to reflect changes in the operation and treatment works. The 1993 amendment required a receiving environment study and computer modelling to determine the environmental impact of the chlorinated cooling water in Port Moody Arm. The studies determined that the chlorinated cooling water led to levels of chlorine-produced oxidants (CPOs) above the marine water quality guidelines (ENV, 1995). Consequently in 1995, the Province amended the permit to reduce the allowable chlorine residual from 0.1 mg/L to 0.020 mg/L by December 31, 1996. The amendment also required a study on a dechlorination system plan and an environmental impact study. After various chlorination/dechlorination studies, sulphur dioxide injection was chosen as the dechlorination system.

BGS went through major upgrades from 1994 to 2003 under the Burrard Upgrade project to reduce its environmental impact.

Discharge 1.1 includes the discharge of storm water from the dyked tank farm area. Prior to the Burrard Upgrade Project, there were two oil storage tanks in this area. They were demolished to provide

space for the ammonia storage facility. Ammonia was used with the NO<sub>x</sub> emissions selective catalytic reduction units.

Table 27: Discharge and Monitoring Requirements under Province of BC PE-7178

Location	Source	EMS ID	Provincial Discharge Requirements	Monitoring Frequency
Discharge 1.1	Storm water from dyked tank farm area	E213910	Max. Flow Rate: 1,650 m <sup>3</sup> /day Oil & Grease: ≤ 5.0 mg/L Ammonia as Nitrogen: (unspecified)	pH: daily Oil & Grease: quarterly Total ammonia: daily
Discharge 1.2	Blowdown from boiler system and backwash effluent from sand and carbon filters	E213911 E222677	Max. Flow Rate: 550 m <sup>3</sup> /day Temperature: 32°C TSS: ≤ 50 mg/L	Temperature: monthly TSS: monthly
Discharge 1.3	Cooling water from the turbines and effluent from the turbine house sumps	E218421 E2180698	Max. Rate <sup>1</sup> : 1,700,000 m <sup>3</sup> /day Oil & Grease <sup>2</sup> : ≤10 mg/L Temperature: 27°C Total Residual Chlorine: ≤ 0.020 mg/L	TSS: daily Oil & Grease: monthly Total Residual Chlorine: daily
Discharge 1.4	Effluent from water treatment plant demineralizer	E213914	Max. Rate: 72 m <sup>3</sup> /day pH: 6.5-8.5	pH: daily
<sup>1</sup> Including a max of 3,000 m <sup>3</sup> /d from the turbine house sum				
<sup>2</sup> Effluent from the turbine house sumps before entering the cooling water discharge				

As of January 29, 2015, the plant is no longer generating electricity. In 2016, the cooling system was decommissioned as the plant transitioned from a generation to synchronous condenser operation. Since a synchronous condenser operation is not a specified industry in the provincial Waste Discharge Regulation, the Province cancelled the permit in 2016.

The major concern to water quality from this facility was the high volume of cooling water discharged into the Inlet. The cooling water's elevated temperatures and chlorine-produced oxidants (CPOs) from the chlorine residual could have impacted water quality and aquatic life in Port Moody Arm. Prior to 1993, the chlorinated cooling water was discharged without treatment which led to adverse CPO levels in Port Moody Arm. The results of the comprehensive studies conducted in the late 1990s to early 2000s (after the chlorination system was installed), however, showed no significant environmental impacts (DFO, 2001). Since the facility stopped operating as an electric generation facility in early 2015, there is no current risk to the water quality of Burrard Inlet from this site.

## 5.6 Imperial Oil Ltd. (PE-445 and RS-8589)

Imperial Oil Ltd. operates the IOCO bulk petroleum products terminal on the north shore of Port Moody Arm just east of the Burrard Generating Station. From 1915 to 1995, IOCO operated as an oil refinery that manufactured gasoline, butane, propane, diesel fuel, jet fuel, and fuel oil. The refinery operations were closed in July 1995. Since then, the facility no longer processes fuels but operates solely as a distribution terminal. The site has a complicated history due to changes to the operations, as well as the provincial hazardous waste regulations.

### PE-445

The Province of BC has authorized the IOCO facility to discharge storm water runoff, including groundwater and process water, from its operations to Burrard Inlet under effluent permit PE-445. The Province first issued the permit in 1971 and amended it several times to reflect upgrades to the facility as well as changes in operations. In 1998, the Province amended the permit to reduce the monitoring frequency and lower the concentration of the characteristics of the discharge to reflect the changes from a refinery to a terminal. The Province removed the sulphide effluent limit from the permit but the monitoring continued and anytime that the sulphide concentration exceeded 25 ug/L the company was to notify ENV. The most recent amendment in 2000 allowed the discharge of storm water runoff from a special waste facility on site (authorized under PS-8589) to be included in the original permitted discharges (more information on this below).

The IOCO site is divided into two drainage areas, north and south, reflecting the topography of the property. Storm water from the north part of the site drains to the #7 oil water separator, through the lagoon and partial flume before discharging to a creek and eventually into Burrard Inlet. Storm water from the southern drainage area drains to the #1 oil water separator before discharging directly into Burrard Inlet. The monitoring requirements under PE-445 are listed below in Table 28.

*Table 28: Discharge and Monitoring Requirements under Province of BC Permit PE-445*

Parameter	Discharge 1.1 - South		Discharge 1.2 - North	
	Provincial Permit Requirements	Monitoring Frequency	Provincial Permit Requirements	Monitoring Frequency
Discharge Rate, max.	8,200 m <sup>3</sup> /day annual avg.	Daily	3,312.50 m <sup>3</sup> /day annual avg.	Daily
Total Extractable Hydrocarbons (TEH)	10 mg/L	Monthly	15 mg/L, annual avg. of 5 mg/L	Monthly
BOD <sub>5</sub>	45 mg/L	Quarterly	45 mg/L	Quarterly
Ammonia, as Nitrogen	1.0 mg/L	Monthly	1.0 mg/L	Monthly
Phenols	0.15 mg/L	Monthly	0.15 mg/L	Monthly
pH	6.0-8.5	Monthly	6.0-8.5	Monthly
Toxicity 96-hr Trout LC50	100% or less toxic	Quarterly	100%	Quarterly
Non-filterable Residue (TSS) (mg/L)	-	Monthly	-	Monthly
TOC (mg/L)	-	Monthly	-	Monthly
Sulphides	0.025 mg/L	Monthly	-	Monthly
Fecal Coliforms (CFU/100 ml)	-	Monthly	-	-
PAH Total (mg/L)	-	Quarterly	-	Quarterly
Dissolved Metals (mg/L)	-	Quarterly	-	Quarterly
Schedule 1.2				

#### **PS-8589/RS-8589**

The Province also issued permit PS-8589 for the site in 1992 under the Special Waste Regulation. Through this, the Province authorized the company to store, manage, and treat special wastes, including

PCB wastes and special wastes originating from petroleum refining and petroleum product processing. Storm water generated from the special waste management facility was discharged to a biox plant and then to the sanitary sewer under GVRD jurisdiction.

After the refinery closed in 1995, the facility no longer generated the types of wastes it was designed for and the biox plant was closed.

Concurrent amendments by the Province to PE-445 and PS-8589 in 2000 allowed the discharge from a special waste facility authorized by the Province under PS-8589 to be included within its effluent permit PE-445 as Discharge 1.2. The Province considered the parameters listed in the permit to be adequate for the addition of this source; nevertheless, the provincial amendment added the requirement that the water discharged from the hazardous waste facility meet Schedule 1.2 of the HWR (as in Table 9). The amendment thus allowed the storm water runoff, drainage from stored materials, and leachate collected from the leak detection system to be directed to separator #7 before discharge to the environment.

In 2007, IOCO requested that permit PS-8589 be cancelled, since the facility meets the criteria of the HWR for short-term, on-site passive storage. Since treatment is no longer carried out and hazardous waste will only be passively stored at the facility, the Province considers the registration to be adequate for the facility. The Province thus cancelled the permit in 2007 and transitioned it into HWR registration RS-8589.

There is no risk of storm water coming in contact with the stored material, as the facility is no longer used for the treatment of special waste, but only for the storage of containerised materials. As stipulated by the HWR, the facility has submitted a contingency plan, which is regularly updated and maintained. Furthermore, the facility is equipped with curbs and berms to retain any accidentally spilled hazardous waste on site. There are four groundwater monitoring wells, one upgradient and three downgradient that are monitored to ensure that contaminants from the special waste facility are not entering the groundwater.

### ***5.7 Suncor Energy Products Partnership (PE-22, RE-14093, RE-14094, RS-8420, and PR-1453)***

The Suncor Burrard Products Terminal (BPT) is situated on 430 acres of land on the boundary of Port Moody and Burnaby. The facility used to be a petroleum refinery until 1993, when its operations were reduced to a petroleum products terminal. Terminal operations are divided among three sites: the Upper Terminal, the Middle Terminal and the Lower Terminal. Suncor Energy (previously Petro-Canada) has five separate authorizations for different aspects of the operations located across the three sites:

1. The Upper Terminal, located in Port Moody, contains the fuel processing units, main tank farm and the fuel blending facilities. The Province of BC has issued one effluent permit for stormwater (PE-22), one hazardous waste registration (RS-8420), and one refuse permit (PR-1453).
2. The Middle Terminal, located on the south side of Barnet Highway in Burnaby, contains the secondary tank farm and truck facilities. The Province has authorized the site's fuel storage operations under a Petroleum Storage and Distribution Facilities Stormwater Regulation (RE-14093).
3. The Lower Terminal, located in Burnaby, Port Moody, and along Burrard inlet, contains the marine and rail facilities. The Province has authorized the site's fuel storage operations under a Petroleum Storage and Distribution Facilities Stormwater Regulation (RE-14094).

#### ***PE-22***

The Province of BC issued effluent permit PE-22 in 1958, providing provincial authorization for the discharge of treated storm water run-off from the Upper Terminal. The Province has amended the permit several times to reflect ownership and operational changes. The amendment in 1986 removed the pH requirement of 6.5 to 8.5. The latest amendment was in 2014 to update the company name from Petro Canada (Suncor Energy Inc.) to Suncor Energy Products Inc.

The maximum rate of discharge authorized by the Province is an annual average of 1,725 m<sup>3</sup>/day. The oil and grease concentration of the effluent must not exceed 5 mg/L. Although the permit does not specify limits for all parameters, it requires weekly composite samples of TSS and oil and grease, and monthly grab samples for pH and phenols.

In the Upper Terminal, storm (uncontaminated) and process (contaminated) water are segregated. Storm water from the tank farms is directed to and treated in the north retention basin and oil water separator before discharge to Burrard Inlet through a submerged outfall. Process water is treated in the south retention basin and oil water separator prior to discharge to the Metro Vancouver sanitary system under GVRD Permit No. SC-100086-FSA.

*Table 29: Effluent and Monitoring Requirements under Province of BC PE-22 (E208256)*

Parameter	Provincial Permit Requirements	Monitoring Frequency	Sampling Type
Discharge Rate, max. annual avg.	1,725 m <sup>3</sup> /day	Daily	Flow
Oil & Grease	5 mg/L	Weekly	Composite
pH	-	Monthly	Grab
TSS (mg/L)	-	Weekly	Composite
Phenols (mg/L)	-	Monthly	Grab

A review of the effluent quality data from the past five years shows that the storm water effluent quality from the BPT has met the permit limits. The annual average daily flow has been below 1,725 m<sup>3</sup>/day. Overall, the major parameter of concern from this facility is hydrocarbons (oil and grease) and the maximum recorded oil and grease concentration has been 1.5 mg/L, which is lower than the permit limit.

#### ***RE-14093 and RE-14094***

The Middle and Lower Terminals, with 10 and 16 fuel storage tanks respectfully, are not covered under provincial permit PE-22. Therefore, the Province has registered the oil/water separators at these locations under the provincial Petroleum Storage and Distribution Facilities Stormwater Regulation. As specified in the regulation, the Province requires the stormwater effluent from these locations to have a total extractable hydrocarbon (TEH) concentration below 15 mg/L, monitored monthly.

The storm water from the Middle Terminal is directed to two oil water separators before being discharged to the Barnet Highway storm sewer. Data from this location shows that the TEH concentration in the storm water effluent has been quite low and near detection limits.

The storm water from the Lower Terminal is directed to two oil water separators before discharge to Burrard Inlet. Historical observations from this location state that the TEH concentrations have met the regulatory limits.

#### ***PS-8420/RS-8420***

The BPT also manages a short term hazardous waste storage and treatment facility in the Upper Terminal. Under the HWR registration RS-8420, the Province of BC has authorized Suncor to store hazardous waste consisting of hydrocarbon contaminated water, soils, and waste oil generated through the process operations on site. The facility also accepts oil water separator sludge and oily wastewater from operations at other Suncor sites in BC.

The Province originally authorized Suncor to manage the hazardous waste storage facility in the upper plant under Special Waste permit PS-8420 issued in 1990. In April 2007, the Province cancelled the permit and transitioned it to an operational plan under the HWR registration, RS-8420.

The facility treats hydrocarbon contaminated water at the water treatment facility bio-reactor. The treated and delisted water is discharged to the process water effluent treatment works and then to a municipal sanitary sewer under GVRD Permit No. SC-100086-FSA.

The operational plan includes effluent monitoring of the discharge to sewer and quarterly groundwater monitoring. Storm water effluent is monitored monthly and assessed in terms of Schedule 1.2 Column 3 in the HWR (Table 9).

#### **PR-1453**

The Province of BC has authorized Suncor Energy Products Inc. to discharge refuse from the petroleum products processing, storage, and distribution facility to a landfill located on the north side of the upper plant site. The industrial refuse is composed of inert materials including paper, wood, rags, iron, glass, concrete, insulation, and steel. The provincially authorized rate of discharge is 0.5 m<sup>3</sup>/day. Since the facility was reduced from a refinery to an oil storage and distribution terminal, the amount of refuse has decreased significantly. There is no expected risk to water quality from this landfill.

## **6. Indian Arm**

The Province of BC has issued five wastewater effluent discharge permits in the Indian Arm sub-basin, of which four are operational (Table 30).

*Table 30: Provincially Authorized Discharges in the Indian Arm Sub-basin*

Provincial Authorization Holder	Provincial Authorization Type	Provincial Authorization No.	Discharge Type	Provincially Permitted Volume
Farrer Cove Waste Water Management Assoc.	Effluent Permit (Not operational)	PE-13446	Wastewater to Burrard Inlet	7.4 m <sup>3</sup> /day
Countryside Village Ventures Ltd.	Effluent Permit	PE-4806	No direct discharge: wastewater to ground	44 m <sup>3</sup> /day
37852 B.C. Ltd. (Anmore Campgrounds)	Effluent Permit	PE-5112	No direct discharge: wastewater to ground	30 m <sup>3</sup> /day
Seymour Resorts Ltd.	Effluent Permit	PE-0027	Wastewater to Francis Creek	Jun 1- Sep 30: 100 m <sup>3</sup> /day Oct 1- May 31:

				200 m <sup>3</sup> /day
Evangelical Laymen's Church of Canada (Vancouver)	Effluent Permit	PE-8035	Wastewater to Burrard Inlet	24 m <sup>3</sup> /day

### **6.1 Farrer Cove (PE-13446)**

The treatment works described in Province of BC permit PE-13446 managed by the Farrer Cove Waste Water Management Association have not yet been constructed; however, the permittee intends to keep the permit in case they decide to proceed with construction.

### **6.2 Countryside Village Ventures Ltd. (PE-4806)**

Countryside Village Ventures Ltd., previously Parkland Ventures, operates a secondary wastewater treatment plant that originally served 65 rental mobile homes and one log house located in Anmore, BC. Some mobile homes have been gradually replaced by larger single family detached residences. The authorized works include a secondary sewage treatment plant, three sludge retention chambers, one gravel filter, and two subsurface disposal fields or filtration beds.

Under Effluent Permit PE-4806, the Province of BC authorizes the discharge of treated wastewater from this facility to the disposal fields. The maximum rate of discharge is 44 m<sup>3</sup>/day; with maximum concentrations of carbonaceous BOD<sub>5</sub> of 20 mg/L and suspended solids of 30 mg/L. Effluent data from January 2016-March 2018 indicates that discharge flow rates have exceeded the maximum authorized rate of discharge of 44 m<sup>3</sup>/day on six occasions. This is likely due to inflow and infiltration during heavy rainfall events as well as the construction of larger multi-bedroom homes on lots previously occupied by mobile homes.

A 2017 ENV inspection report affirmed that the sewage treatment plant was inspected weekly, maintained in good condition, and that the sewage disposal field did not demonstrate signs of failure, ponding or odours (ENV, 2017). This supports the assessment that inflow and infiltration are likely responsible for the flow rate exceedances. The facility is currently undertaking repairs to damaged pipes to decrease inflow and infiltration and thus ensure compliance with the permit (MSR Solutions Inc., 2018). If the maximum flows continue to exceed the permit, the treatment works may be altered and ENV will be notified.

As this facility is over two kilometres away from Indian Arm, the likelihood of this discharge impacting water quality in Burrard Inlet is low. The facility is located near Anmore Creek which discharges into Buntzen Lake, therefore, these waterbodies would be more likely to be impacted than Burrard Inlet.

### **6.3 37852 B.C. Ltd. –Anmore Campgrounds Inc. (PE-5112)**

Anmore Campgrounds Inc. (37852 B.C. Ltd.) operates Anmore's Camp and RV Park which hosts 100 campsites. Wastewater from the washrooms is treated in the secondary wastewater treatment plant onsite. The treatment works include the secondary sewage treatment plant with screening, aeration, and settling facilities, as well as two subsurface disposal fields. The campground is mostly used in the spring and summer months.

Under effluent permit PE-5112, the Province of BC authorizes the discharge of treated wastewater from the camp to the ground with a maximum flow of 30 m<sup>3</sup>/day, and with BOD<sub>5</sub> and TSS concentrations no greater than 45 mg/L and 60 mg/L, respectively. An ENV Compliance inspection in

2017 confirmed that the treatment plant is well run and maintained; however, there is limited historical effluent flow and discharge quality data (ENV, 2018). Recent data indicates that in the first two quarters of 2018, the effluent flow and quality has met permit limits. The average discharge rate for this period was 4.6 m<sup>3</sup>/day.

Due to the fact that this facility is over two kilometres away from Indian Arm, and that the discharge volume to ground is very low, it does not pose a risk to water quality in Burrard Inlet.

#### **6.4 Mt. Seymour Resorts Ltd. (PE-00027)**

The Province of BC has authorized Mt. Seymour Resorts Ltd., previously owned by E.H. Pletsch Holdings to discharge treated wastewater from its secondary treatment plant to Francis Creek under effluent permit PE-00027. The secondary sewage treatment plant was constructed and permitted by the Province in 1958 to treat the wastewater from the washrooms and restaurant of the ski facility. Due to increased flow, the Province has amended the permit several times. The most recent amendment was in 1999, which increased the maximum daily flow from 68.2 m<sup>3</sup>/day to 100 m<sup>3</sup>/day from June 1<sup>st</sup> to September 30<sup>th</sup> and 200 m<sup>3</sup>/day from October 1<sup>st</sup> to May 31<sup>st</sup>.

The wastewater treatment outfall pipe discharges to Francis Creek approximately one kilometre down slope from the treatment plant and then ultimately discharges to Deep Cove. A recent ENV inspection report states that the sewage treatment plant is being regularly inspected and maintained. In 2017, a report by a third party consulting company stated that “the plant is operating well beyond its intended service life and a plan for replacement should be developed as a matter of high priority” (ENV 2018e). The Province of BC would require a permit amendment for any plant modification.

Prior to discharge, the effluent quality must meet the requirements of the permit with maximum BOD<sub>5</sub> concentrations of 20 mg/L and total suspended solids of 30 mg/L. Analytical data from the past ten years indicate that suspended solids and BOD<sub>5</sub> limits were not met on a few occasions. In addition, fecal coliforms are monitored monthly although there is no prescribed limit for fecal coliforms in the permit. Data from the past ten years shows high fecal coliform concentrations on several arbitrary occasions.

The potential for high fecal coliform counts are a concern as shellfish harvesting in Indian Arm is one of the sub-basin values and goals of the updated Burrard Inlet WQOs. Furthermore, Deep Cove is a heavily used recreational area that may also be impacted by the discharge. Flows in Francis Creek are unknown however and thus the potential fecal concentrations reaching Indian Arm cannot be determined from current information.

#### **6.5 Evangelical Laymen’s Church of Canada—Vancouver (PE-8035)**

The Evangelical Laymen’s Church of Canada Vancouver manages Camp Howdy, a summer camp serving 150 beds, located near Farrer Cove, Belcarra. The camp ownership changed from the Young Men’s Christian Association (YMCA) of Greater Vancouver to Evangelical Laymen’s Church of Canada (Vancouver) in 2007. Wastewater from the camp is treated in a secondary wastewater treatment plant and sand filter before being discharged into Indian Arm from an outfall 466 metres west of Farrer Creek. Used mainly for seasonal and occasional events, the effluent discharge volume is typically low.

Under effluent permit PE-8035, the Province of BC authorizes a maximum discharge of 24 m<sup>3</sup>/day with maximum concentrations of 20 mg/L for CBOD<sub>5</sub> and 30 mg/L for total suspended solids.

During an ENV inspection in 2017, the treatment works were found to be well maintained and in excellent condition. Limited discharge data from recent years, however, makes it difficult to determine the effluent water quality and its potential impact to Indian Arm (ENV, 2018d).



## APPENDIX H: COMBINED SEWER OVERFLOW OUTFALLS IN BURRARD INLET

The table below is intended to be used alongside Map 3a: Combined Sewer Overflow Outfalls.

*Table H.1. Combined Sewer Overflow Outfalls in Burrard Inlet*

(COB = City of Burnaby, COV = City of Vancouver, MV = Metro Vancouver; UEL = University Endowment Lands)

Map Label	Name	Status (2017)	Owner	Year closed	Sub-basin	Note #
1	Gilmore Ave	Active	COB		Central Harbour	a
2	Westridge	Active	MV		Central Harbour	b
3	Willingdon Ave #2	Active	MV		Central Harbour	c
4	Willingdon Ave #1	Active	MV		Central Harbour	c
5	Carleton Ave	Historic	COB	2006	Central Harbour	d
6	Cassiar St (N)	Active	MV		Inner Harbour	e
7	Cassiar St (E)	Active	MV		Inner Harbour	e
8	Slocan St	Active	COV		Inner Harbour	
9	Victoria Drive	Active	COV		Inner Harbour	
10	Clark Drive No 1	Active	MV		Inner Harbour	
11	Clark Drive No 2	Active	MV		Inner Harbour	
12	Vernon	Active	MV		Inner Harbour	f
13	Harbour West	Historic	COV	?	Inner Harbour	g
14	Heatley Ave	Active	COV		Inner Harbour	
15	Columbia St 3	Historic	COV	?	Inner Harbour	
16	Columbia St 2	Historic	COV	?	Inner Harbour	
17	Columbia St 1	Historic	COV	?	Inner Harbour	
18	Terminal Ave	Active	COV		False Creek	
19	Columbia	Active	COV		Inner Harbour	
20	Crowe St Yard (E)	Historic	COV	2013	False Creek	
21	Burrard St	Active	COV		Inner Harbour	
22	Brockton Point	Active	MV		Inner Harbour	
23	Heather St	Active	MV		False Creek	
24	Drake St	Historic	COV	1995	False Creek	
25	Jervis St	Historic	COV	Unknown	Outer Harbour	f
26	Laurel St	Active	COV		False Creek	
27	Denman St	Historic	COV	2001	Inner Harbour	
28	Granville Island	Active	COV		False Creek	h
29	South Granville	Historic	COV	1999	False Creek	
30	Park Lane	Historic	MV	2004	Outer Harbour	i

31	Arbutus Street	Active	COV		Outer Harbour	j
32	Balaclava St	Active	MV		Outer Harbour	k
33	Alma Discovery (English Bay #2)	Active	MV		Outer Harbour	l
34	English Bay (English Bay #1)	Active	MV		Outer Harbour	
35		Active	UEL		Outer Harbour	

Notes:

- a) Separation estimated at the City street level and does not account for the number of combined systems remaining on private property (estimated ~80% of onsite combined systems remaining)
- b) CoB shares in the use of the Westridge CSO - and reports CSO volumes as part of Federal requirements.
- c) The Willingdon Outfalls branch off from each other downstream of a single monitor. For reporting purposes, it is assumed that half of the discharge volume is deposited via each outfall.
- d) Through completion of combined sewer separation in 2006, we have eliminated the Carleton CSO in favour of a stormwater only outfall, for this catchment area
- e) The Cassiar Outfalls branch off from each other downstream of a single monitor. For reporting purposes, it is assumed that half of the discharge volume is deposited via each outfall.
- f) At boundary of False Creek
- g) Changes in the system resulted in the Harbour West CSO outfall being transferred to the City of Vancouver likely well before 1992. Construction of Metro Vancouver's Harbour West Interceptor was in 1974 at which point the combined sewage from Metro Vancouver's Hawks Street sewer was intercepted for treatment. The remainder of that sewer (the outfall section) became an emergency overflow pipe referred to as the Harbour West CSO and was transferred to the City of Vancouver.
- h) Some Metro Vancouver reports refer to this site as "Hemlock"
- i) Closure sometime between 2002-2004
- j) Previously called Maple
- k) Metro Vancouver catchment separation is dependent upon upstream municipal catchment separation work. Consequently, depending upon how and where a combined catchment's sewer separation has occurred, this may or may not result in immediate benefits at a combined sewer outfall. Furthermore, as catchment are separated, property connections (service laterals) may or may not still be combined. Consequently, estimating catchment separation status is complicated and the estimates changing.
- l) The Alma-Discovery and English Bay Outfalls are connected and carry discharge from two monitoring points. For reporting purposes, it is assumed that discharges monitored by the 4th & Highbury monitoring site are deposited via the Alma-Discovery Outfall.