Construction Environmental Management Plan

Highway 99 Corridor Improvement Projects

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Contents

List of Acronyms and Abbreviations

AAQO	Ambient Air Quality Objectives
BC ENV	B.C. Ministry of Environment & Climate Change Strategy
CALA	Canadian Association for Laboratory Accreditation
CCA	Canadian Construction Association
CCME	Canadian Council of Ministers of the Environment
CEMP	Construction Environmental Management Plan
CHR	Community Heritage Registers
CSR	B.C. Contaminated Sites Regulation
DFO	Fisheries and Oceans Canada
DO	Dissolved Oxygen
EIR	Environmental Incident Report
ESCP	Erosion and Sediment Control Plan
HCA	Heritage Conservation Act
HEPH	Heavy Extractable Petroleum Hydrocarbons
IEM	Independent Environmental Monitor
LEPH	Light Extractable Petroleum Hydrocarbons
MoF	B.C. Ministry of Forests
MOTI	B.C. Ministry of Transportation and Infrastructure
MWLRS	B.C. Ministry of Water, Land and Resource Stewardship
NTU	Nephelometric Turbidity Units
OHSR	Occupational Health and Safety Regulation
PAH	Polycyclic Aromatic Hydrocarbons
PCOC	Potential Contaminants of Concern
PHR	Provincial Heritage Register
ppm	parts per million
QEP	Qualified Environmental Professional(s)
SDS	Safety Data Sheet

TSS	Total Suspended Solids
WHMIS	Workplace Hazardous Materials Information System

1. Introduction

This document is the guiding Construction Environmental Management Plan (CEMP) to manage potential environmental impacts associated with construction for the Highway 99 Corridor Improvement Projects. This CEMP is a written and provided by the B.C. Ministry of Transportation and Infrastructure ("the Ministry").

This CEMP has been prepared as a key instrument in defining the environmental requirements for the contractors that will complete the Highway 99 Corridor Improvement Projects, and to assist them in meeting those requirements. This introduction provides a summary description of the construction activities, as well as information on the objectives, scope, and formatting of the CEMP.

1.1 Summary Description of the Project

Highway 99 is a provincial highway that runs from the Peace Arch Border Crossing, through municipalities in Lower Mainland, including Delta, Richmond, Vancouver and North Vancouver, to Cache Creek. The southern section of Highway 99 serves as a main artery to connect Lower Mainland and the US border crossing. Recognizing the critical need to address traffic congestion and safety challenges in the Highway 99 corridor, the Ministry has proposed a number of Corridor Improvement Projects. This version of the CEMP addresses only the surcharge placement and related activities between Blundell Road and Steveston Highway.

Construction activities associated with the Corridor Improvement Projects may include:

- Tree / vegetation clearing and grubbing;
- Topsoil striping, storage and disposal;
- Utility locates and protection;
- Preload/surcharge placement;
- Asphalt pavement removal;
- Excavation and subgrade preparation works;
- Temporary drainage works (catch basins, spillways, culvert installation, storm sewers);
- Embankment construction as required;
- Concrete works, including primarily the installation of concrete lock block walls;
- Protection of existing electrical/lighting infrastructure and relocation of roadway signage as required, and;
- Revegetation (topsoil placement and seeding).

1.2 CEMP Objectives

This Construction Environmental Management Plan is a practical tool to facilitate construction at the site level meeting environmental requirements. Environmental compliance is directed by:

- Conditions of any permits, licenses and approvals required;
- Applicable environmental legislation, regulations, standards, codes of practice and guidelines;
- Ministry Standard Specifications for Highway Construction;
- Agreements with the City of Richmond, and Metro Vancouver, and;
- Any other applicable environmental requirements.

The CEMP is intended to help achieve environmental compliance in two ways:

- Identification of both general and specific (i.e., activity specific and/or site specific) minimum environmental requirements that contractors must comply with, and;
- Providing tools to facilitate attainment of minimum environmental requirements and possibly enhanced (i.e., better than minimum required) environmental performance. The tools or resources include best management practices which are practices that, after problem assessment and examination of alternative solutions, are determined to be the most effective and practical means to achieve the relevant level or degree of environmental protection, i.e., taking account of technical, economic and institutional considerations.

1.3 CEMP Scope and Component Plans

The CEMP scope is limited to construction of the Project components as identified in Section 1.1. The CEMP has been prepared by Qualified Environmental Professionals (QEP) to meets the objectives (section 1.2). The CEMP has internal and external reporting requirements, see sections 1.8 and 18.0.

The Component Plans that are relevant for construction of the Project components listed in Section 1.1 are:

- Environmental Awareness and Education Plan;
- Health and Safety Plan;
- Air Quality and Dust Control Management Plan;
- Noise and Vibration Management Plan;
- Vegetation Management Plan;
- Wildlife Management Plan;
- Fish, Fish Habitat and Surface Water Quality Management Plan;
- Erosion and Sediment Control Plan;
- Drainage and Stormwater Management Plan;
- Concrete Management Plan;
- Contaminated Sites and Soil Management Plan;
- Hazardous Material and Fuel Management Plan;
- Solid Waste Management Plan;
- Spill Prevention and Emergency Response Plan;
- Heritage Resources Management Plan, and;
- Site Restoration Plan.

These Component Plans are described in Sections **Error! Reference source not found.** to Section **Error! Reference source not found.**.

The CEMP attempts to minimize redundancy by cross-referencing between the individual Component Plans in sections 4.0 – 17.0 where necessary or appropriate. Typically, Component Plans each contain the following subsections:

- Introduction;
- Potential Environmental Impacts — a brief summary of potential adverse impacts of construction;
- Regulatory/Institutional Requirements — List of reference documents that contain applicable environmental requirements and/or criteria;
- Environmental Management — includes two subsections:
    - Best Management Practices and Guidelines — best management practices that contractors must consider as a means of achieving required environmental protection;
    - Mitigation Measures — a list of recommended mitigation measures to be considered by contractors when preparing and updating erosion and sediment control plans;
- Key Environmental Performance Indicators — minimum requirements, in some cases expressed quantitatively, to which environmental performance will be monitored or audited at the site level, and;
- Monitoring — an outline of the expected focus of environmental monitoring.

Existing information from prior assessments, investigations, reports and engineering design is included in the CEMP where necessary to further define environmental requirements or otherwise aid in achieving environmental compliance.

1.4 Environmental Compliance Requirements

The contractors, and all parties engaged by or through the Ministry, will conduct all operations as to minimize Project-related adverse impacts to the biophysical, socio-economic, heritage and cultural, and human health environment, and will comply with all environmental compliance requirements:

- All applicable federal and provincial legislation;
- Regional bylaws;
- Permits, licences, approvals, and authorization (referred to herein as permits);
- The requirements of the CEMP, and;
- Any work- and activity-specific addenda to this CEMP that are developed by the contractors.

Municipal bylaws may apply when work is completed outside of the Ministry right-of-way.

1.4.1 Source Material & Relevant Legislation

Source material that was used in preparing the CEMP included applicable legislation, regulations, standards, guidelines, and codes of practice. The source material is listed at the end of this CEMP document, and in relevant locations within the text there are citations to these source documents.

Reference to the original source documents may be required for full implementation of mitigation measures included in this CEMP.

1.4.2 Prevention of Pollution

The contractors will provide all suitable resources and precautions required to prevent or minimize adverse impacts on the local community, control the discharge of contaminants, and prevent actions that may pollute or degrade the atmospheric, terrestrial, or aquatic environment or that may harm fish, wildlife, or their habitats.

1.5 CEMP Review and Revision

This CEMP is a "living" document. During construction of the Project, the CEMP will be reviewed at least every 12 months, or more often as it may be required.

Further information may become available that requires an update to the CEMP, including:

- Project design;
- Construction;
- Environmental conditions (e.g., pre-construction survey findings);
- Regulatory requirements;
- New best management practices and measures;
- Inputs received from Indigenous Groups, stakeholders and the public, and;
- Corrective measures implemented during construction in response to incidents.

A material revision of this CEMP is one related to that an adverse effect is more likely to occur, or become more adverse, and be significant, and would include, in particular:

- A reduction of monitoring or reporting requirements; or
- Removal of an environmental specification, or proposal of less stringent measures of a specification.

If a material revision of this CEMP is proposed the Ministry will provide the draft text of the proposed material revision for review and comment to who would potentially be affected by the proposed revision, including:

- City of Richmond, Ministry of Water, Land and Resource Stewardship (MWLRS), Metro Vancouver, and;
- Indigenous Groups.

The period of time provided for review and comment on a proposed material revision will depend on the nature or urgency of the revision and the relative interests or jurisdiction of regulatory agencies and of the rights and relative interests of potentially affected Indigenous Groups, and any legal requirement to consult.

When the CEMP is revised, it would be provided to the contractors, the Ministry Representative and Independent Environmental Monitor (IEM). Contractors will review all active work to ensure procedures

remain compliant, the Ministry Representative and IEM will use revised CEMP during their monitoring and reporting (section 18.0).

1.6 Environmental Setting and Considerations

Environmental considerations for the Project are briefly described below. Proposed mitigation measures and best management practices are presented in Sections 4.0 to 17.0 of the CEMP.

1.6.1 Air Quality

Air quality is of vital importance to ecosystem health because the atmosphere serves as pathway for the transport of contaminants to the environment. The air quality conditions near the Project area is monitored by the Richmond South station, located near the intersection of Aragon Road and Williams Road (Metro Vancouver, 2016). This station currently collects data on sulphur dioxide, nitrogen dioxide, carbon monoxide, and ozone, with the Air Quality Health Index calculated hourly. Construction activities may temporarily impact air quality through the release of criteria air contaminants (such as sulphur dioxide), hazardous pollutants (such as volatile organic compounds), and greenhouse gases (such as carbon dioxide), as well as through the production of dust.

1.6.2 Noise

The Project area is located in a region of Metro Vancouver which is utilized for residential, commercial, agricultural, and wildlife uses, which therefore currently experience high ambient noise levels. If not properly managed, noise and vibration have the potential to have adverse impacts on humans and ecological receptors in the Project area. Certain construction activities (e.g., heavy equipment operation) have the potential to temporarily increase noise or vibration levels near the Project work sites.

1.6.3 Vegetation

Construction activities have the potential to adversely impact vegetation within and adjacent to the construction and laydown areas. Vegetation within the Project area has been altered from its pre-disturbance state due past construction of infrastructure associated with transportation in the region. Vegetation to be removed from the Project area will likely be comprised of shrubs, bushes, and grasses; however, some existing trees may to be removed. Rare plant species (none expected) would require specific care and management if they are found to be present during the Project work. Invasive species will require active management throughout construction to prevent spread.

1.6.4 Wildlife and Wildlife Habitat

Existing development in and adjacent to the Project limits the potential and presence of wildlife and wildlife habitat to generalist species that are tolerant of human activity and small natural areas adjacent to the corridor. Construction activities have the potential to adversely impact wildlife (and their habitat), including species protected under the *Wildlife Act* and *Species at Risk Act* (S.C., 2002, C. 29). Potential environmental effects may be caused through habitat loss or alteration (e.g., construction infrastructure), sensory disturbance (e.g., noise and light), and direct mortality (e.g., collision or interaction with

equipment). Specific management will be required to minimize potential adverse impacts to wildlife and wildlife habitat.

1.6.5 Birds

Birds that frequent the Project area (such as songbirds, herons, and raptors, etc.) are generalists and tolerant of existing human activity. Regardless, there may be adverse impacts from Project construction activities. Birds including their eggs and active nests[1] are protected under the *Wildlife Act.* Most species are also protected by the *Migratory Birds Convention Act*. Birds and bird habitats will require management to minimize potential adverse impacts due to construction activities.

1.6.6 Fish

Fish in the vicinity of the Project area may be adversely impacted by Project construction activities. Low gradient highway ditches affected by the Project contain native three-spine stickleback, redside shiner and non-native catfish and pumpkinseed. No salmonid species have been observed present, though these ditches drain to the Fraser River where these and other species such as eulachon and sturgeon are present. Habitats for fish habitats may be adversely impacted by the degradation of water quality and the introduction of deleterious substances into waterways which flow to fish habitats. Fish and fish habitats will require management to minimize potential adverse impacts due to construction activities.

1.6.7 Watercourses and Waterbodies

Several watercourses and waterbodies are adjacent to or within the Project area and have the potential to be adversely impacted by the Project construction activities. The watercourses and their associated riparian areas have been largely disturbed or adjusted in the past due to installation of transportation infrastructure. Management measures must be established to ensure the integrity of watercourses and waterbodies in the Project area and minimize adverse impacts due to construction.

1.6.8 Archaeological and Heritage Resources

The Project area may contain archaeologically and culturally significant artifacts for Indigenous groups in the region. During design of the Project, archaeological management (including assessments) may be required to protect heritage resources in the Project area.

1.6.9 Soil and Bedrock Chemistry

Soil and bedrock chemistry alteration can have adverse impacts on the environment including watercourses, wildlife and wildlife habitats, and local vegetation. The Project area is located in areas which have been developed and disturbed for transportation infrastructure in the past, and bedrock is not anticipated to be encountered during the majority of construction activities. Fill/soil of unknown origin could be encountered and potential contaminants of concern (PCOC, e.g., Light Extractable Petroleum Hydrocarbons (LEPH), Heavy Extractable Petroleum Hydrocarbons (HEPH), Polycyclic Aromatic Hydrocarbons (PAH) and metals) may be present in soil and/or groundwater in all work areas, depending on the extent and type of proposed construction activities within each area. Contaminated sites and soil

[1] Inactive nests of certain raptor and heron species are also protected by s.35 of the *Wildlife Act*.

management will be required to minimize potential adverse impacts from construction to the environment.

1.7 Environmental Management System

The Project will implement an Environmental Management System that has as its main components:

- A qualified environmental management team;
- Environmental coordination and liaison (internal and external);
- Environmental reporting and submittals;
- Environmental education and awareness;
- Environmental permitting, and;
- Environmental quality management.

Environmental quality management is achieved through environmental compliance tracking of Key Performance Indicators. The Environmental Management Team consists of the following professionals:

- Environmental Manager;
- Environmental Monitor; and
- Specialty discipline Qualified Environmental Professionals (where required).

1.7.1 Environmental Manager

The contractor provides day-to-day environmental management services and reports to the Ministry's Representative (Ministry Environmental Manager / Project Manager / Construction Manager). The Contractor's Environmental Manager provides and oversees environmental compliance and management including that of the Environmental Monitor (sections 1.7.2 and 18.1). In addition to overseeing administrative functions, the Environmental Manager's role involves field visits and coordinating inspections and compliance audits.

The Environmental Manager will have the following qualifications:

- Qualified Environmental Professional (QEP);
- Experience on works that are comparable in scope, complexity, and nature to the Project;
- Experience in leading a multidisciplinary environmental team;
- Understanding of relevant environmental regulations and legislation;
- Demonstrated experience working with Indigenous groups; and;
- Effective communication, conflict resolution, and organization skills.

This role's responsibilities include, but are not limited to, the following:

- Providing overall environmental compliance tracking and reporting of general and specific environmental requirements contained in the applicable environmental permits, Ministry standard specifications and contract agreement;
- Providing high level integration of the environmental program with broader construction processes (e.g., traffic management, safety, incident command and other processes);

- Participating in environmental permit acquisition and permit tracking (including identification of necessary permits, coordination of permit applications, distribution of permits, etc.);
- Coordinating the review of environmental monitoring reports, identification and implementation of appropriate environmental performance indicators and other activities;
- Coordinating various environmental discipline consultants e.g., preparation of terms of reference and reviewing deliverables (including archaeological reports and other deliverables as needed);
- Managing the environmental budget (including assessment of an appropriate level of environmental monitoring effort and/or effort of discipline environmental consultants);
- Participating in resolution of permitting or compliance issues, including, but not limited to changes in original planned design or construction;
- Providing high level environmental liaison with regulatory agencies, municipalities and/or other authorities;
- Writing environmental management reports;
- Developing and implementing environmental training and education program (e.g., contribute to preparation of environmental training/orientation materials);
- Performing environmental audits of the relevant contractors, and;
- Resolving environmental issues that cannot be resolved by the Environmental Monitor(s) at the site level.

The responsibilities of the Environmental Manager role may be delineated between the Ministry and the contractors depending on delivery mechanism of the Project components and contract terms between the Ministry and the contractors.

1.7.2 Environmental Monitor

An environmental monitor (or team of environmental monitors) will support the work of the Environmental Manager by performing environmental monitoring activities as outlined in section **Error! Reference source not found.**.0 of the CEMP. These include, but are not limited to:

- Site- and activity-specific environmental observations and monitoring;
- Reporting of all spills and emergencies;
- Liaising with construction personnel on environmental issues; and
- Preparation of environmental monitoring reports.

The Environmental Monitor has the authority to stop works for the protection of the environment. More detail on the role and responsibility of the Environmental Monitor is in section 18.1.

The qualification requirements of the Environmental Monitor include an appropriate educational background, hands-on experience implementing and maintaining environmental programs on construction projects, and the ability to work with and train staff and trades on environmental compliance. The Environmental Monitor will either be a QEP or work directly under supervision of a QEP.

1.7.3 Specialty Discipline Qualified Environmental Professionals

Under the direction of the Environmental Manager, the specialty discipline QEP will provide services (as needed) to support environmental management of construction activities. It is anticipated that the following QEP may be needed to support the Project with example tasks:

- Air Quality Consultant (e.g., to provide air quality monitoring or prepare technical documentation needed to resolve air quality complaints);
- Archaeological/Heritage Consultant (e.g., to provide assessment as required and define procedures in the event that previously undisclosed heritage resource materials are encountered during construction);
- Contaminated Sites Consultant (e.g., to develop a protocol for managing possible encounters with previously unknown contamination, provide or review contaminated site assessments, coordinate remediation, waste management and other tasks including spill response);
- Noise Consultant (e.g., to provide specialized monitoring or technical information as may be necessary); and
- Vegetation and Wildlife Consultant (e.g., to conduct any necessary rare plant surveys, breeding bird surveys, raptor surveys and / or other tasks in advance of, and during, construction activities).

The Ministry may retain specialty discipline qualified environmental professionals to assist with audit or provide advisory services in support of the Ministry's Representative(s).

Qualified environmental professionals will be registered with a legislated and self-regulating association. Where there is no such association relevant to the discipline, QEP may be registered with a non-legislated or accredited association, and in all cases will have the necessary training and experience to exhibit competency in the discipline.

1.7.4 Independent Environmental Monitor

An Independent Environmental Monitor (IEM) will be retained by and reporting to the Ministry on this Project. The primary role of the IEM is to:

- Observe and record for, and report to the Ministry on compliance with the Certificate and deficiencies in respect to related environmental legislation (e.g., *Wildlife Act*, *Water Sustainability Act*); and
- Provide information to the Ministry.

The IEM will obtain and be granted permission from the Environmental Manager, or their delegate, prior to entering active construction areas, and will be accompanied by Project personnel during site monitoring. Other than for safety reasons (e.g., when specialty training is required) as determined by the designated Site Safety Officer, the IEM will be provided unfettered access to the Project site.

During the conduct of site visits, the IEM will, at their discretion, provide verbal observations regarding any instances of non-compliance or potential non-compliance with applicable environmental approvals directly to the Environmental Manager, the Environmental Monitor, and/or the Ministry's Environmental Manager.

If the IEM determines that the contractor has not, or may not have, complied fully with the requirements of the applicable environmental approvals, the IEM will have the authority to stop work on part or whole of the Project in the following situations:

- Continuing the work poses an immediate and substantive risk to the environment; and,
- Stopping work is necessary to prevent or reduce Project-related adverse environmental effects.

The IEM will provide monitoring reports to the Ministry on a monthly basis. As construction advances, the frequency of reporting may be adjusted at the discretion of the IEM to reflect the environmental risks of construction and hence the frequency of IEM monitoring activities.

1.7.5 Ministry Representative

An internal Ministry Representative will periodically audit the functioning of the Environmental Management System to ensure appropriate compliance with applicable permits, environmental regulations, Ministry standard specifications and contract agreement.

1.7.6 Adaptive Management

This CEMP provides effective and proven mitigation measures which are documented in government approved best management practices and guidance documents. The mitigation measures provide contractors with flexibility in the methods available to address the expected variety of environmental conditions, changes to construction methods, changes to site conditions, alteration to activity schedules, and emergency incidents. Selection of these mitigation by experienced and qualified environmental professionals is expected to address all the environmental mitigation needs of the project. Adaptation of mitigation that is already listed in the CEMP will be conducted by the Environmental Manager or Environmental Monitor(s) with consideration for (i) the results of monitoring (section 18.2.2) and (ii) any environmental incident or non-compliance reports (sections 18.2.3 and 18.2.4). The tracking of environmental issues via daily (section 18.2.1) and weekly (section 18.2.2) monitoring reports will be used to understand the efficacy of various mitigation methods used to address each situation / issue and track and record the results.

Should it be necessary to modify methodology and mitigation measures to address conditions not foreseen in this CEMP the Environmental Monitor, Environmental Manager and Construction Manager will work with the Ministry's Representative and QEP to develop alternative methods for mitigation or construction. Such adaptations will consider the objectives of this CEMP (section 1.2), requirements to adhere to relevant provincial and federal legislation and regulations (section 1.4.1), and current best management practices. Adaptations may also require consultation with regulatory agencies. The efficacy of any additional mitigation measures will be tracked as per the environmental issue tracking procedures in the daily (section 18.2.1) and weekly (section 18.2.2) monitoring reports and the IEM monitoring reports (section 1.7.4).

1.8 Environmental Coordination and Liaison

The Project will require liaison between contractors, regulatory agencies, Indigenous groups, municipalities, other stakeholders and the public on environmental management. The Contactor's

environmental team will provide support to these liaison efforts by providing relevant field level information (e.g., monitoring data or other information).

The environmental team will engage in more direct liaison, such as with environmental regulators, municipal planning and enforcement staff and other environmental professionals to address environmental concerns that arise at the site level.

1.8.1 Environmental Submittals and Reporting Protocol

The Environmental Manager prepares and coordinates any required environmental submittals and also contributes to any high-level environmental reporting required by the Ministry. The Environmental Manager conducts independent site level reporting and provides weekly summaries documenting potential and actual non-compliance issues, corresponding preventive and/or corrective measures and the status of environmental issue resolution (reporting frequency depends on regulatory agency requirements, the sensitivity of ongoing construction and other factors).

These weekly reports will be circulated to the relevant Ministry representatives, as well as key senior construction personnel and relevant authorities. Environmental deficiencies that cannot be resolved within a reasonable time will be resolved at a higher level through intervention by the Environmental Manager. Persistent non-compliance may trigger more severe response such as formal environmental audit, and/or issuance of a formal non-conformance report. Any reporting to regulatory agencies is driven by environmental permit conditions.

1.8.2 Environmental Education and Awareness

Environmental education and awareness within the Project will promote an understanding of the environmental requirements and expectations, including how these relate to personal and specific project tasks (see section 2.0). Construction personnel will have environmental education from their initial site orientations, and throughout the construction works other sources such as memorandums, tailgate meetings, and presentations from environmental personnel to maintain such awareness throughout the Project duration.

1.8.3 Environmental Permitting

The Environmental Manager participates in the management of any necessary environmental permits and undertakes tasks such as: primary identification of any necessary environmental permits, coordinating preparation of documentation in support of permit applications (or amendments to existing permits), arranging distribution of acquired permits, tracking permit expiration, and coordinating permit renewal.

1.9 Environmental Quality Management

Environmental Quality Management is the mechanism to track environmental compliance and to promptly correct and document compliance deficiencies, as follows:

- Establish environmental compliance objectives (i.e., mitigation in this CEMP);
- Define specific environmental compliance targets or indicators (i.e., performance indicators in this CEMP);

- Through environmental monitoring, assess environmental deficiencies by comparing performance to the required environmental compliance targets (see section 18.2.1);
- Promptly correct environmental deficiencies (see section 18.0);
- Record the status of deficiency resolution (see section 18.0), and;
- Undertake periodic management review to continuously improve both construction performance and the deficiency correction process.

The compliance tracking program is implemented at two different levels:

- Senior Management Level – The Environmental Manager will track overall environmental compliance of the contractors with the CEMP, and all permits. This is done through auditing, occasional site visits, and other checking methods as required; and
- Site Level – The Environmental Monitor will track and reports environmental compliance of contractors in the field with respect to the CEMP and permits.

Reporting will be overseen and delivered by the Environmental Manager to track compliance with environmental objectives per the requirements in section 18.0 Environmental Monitoring of this CEMP.

1.9.1 Assessment and Reporting of Environmental Performance

Environmental performance tracking occurs at both the senior management level and the construction site level. At the senior management level, compliance assessment consists of environmental review of design and construction plans, review of environmental monitoring reports, and internal environmental audits (including possible issuance of formal non-conformance reports). At the site level, compliance assessment consists of comparison of contractor performance with key environmental performance targets, or indicators, described in the CEMP's component plans. Assessment will involve:

- Scheduled and random site visits;
- Documentation of environmental protection measures implemented (see section 18.0);
- Water quality sampling and analysis;
- Other specific monitoring as required (e.g., air quality, noise, wildlife, archaeology, contaminated sites);
- Periodic checking of transportation manifests (e.g., for soil relocation, transport of dangerous goods) and inventories (e.g., equipment inventories, hazardous material inventories);
- Review of product labelling and signage;
- Review of equipment exhaust systems, and;
- Other activities as required by the CEMP and the ongoing construction activities.

1.9.2 Environmental Deficiency Correction and Reporting

At the project level, deficiency correction occurs through the following mechanisms:

- Non-compliance report(s) as described in section 18.2.4;
- Environmental incident reports (sections 15 and 18.2.1);
- Participation in meetings with concerned parties, and;
- Other methods as required.

At the site level, the Environmental Monitor will work directly with construction personnel in a pre-emptive fashion to resolve environmental deficiencies. The Environmental Monitor will notify the Environmental Manager or Construction Manager in writing of major deficiencies. If deficiencies cannot be resolved promptly, the Environmental Monitor and Environmental Manager have the responsibility to notify the Ministry's Representative, and the option to suspend non-compliant activities and/or notify regulators. Deficiency resolution may require higher-level intervention by the Ministry's Representative. Persistent deficiencies may trigger environmental audits and the possible issuance of formal non-conformance reports.

The Environmental Manager will use the daily (section 18.2.1) and weekly (section 18.2.2) reporting procedures to track issues and their resolution. This process will provide for:

- Identification of specific environmental issues (including how the issue originated);
- Identification and implementation of appropriate corrective action;
- Determination of the status of environmental issue resolution (after corrective actions), and;
- Identification and implementation of additional corrective actions in the event an identified environmental issue remains unresolved.

For any environmental issue, the cycle of identification, corrective action, and assessment of status will continue until the issue is resolved (at which point it will be recorded as "closed").

Internal auditing will periodically occur as part of the overall environmental management processes, and documentation will be prepared by the Environmental Manager.

1.9.3 Management Review and Continuous Improvement

The functioning of the overall Environmental Management System will be periodically assessed by senior management (see section 1.7.5). Changes in processes and documentation will be made as required to improve both the Environmental Management System and the CEMP.

2. Environmental Education and Awareness Plan

This component plan provides a description of the Environmental Education and Awareness Plan that will be implemented during construction. Training materials and specific requirements will be developed in conjunction with construction methods.

The Environmental Education and Awareness Plan will assure that each individual on the Project understands the environmental constraints and implications of their particular role, and also gains an understanding of the overall environmental sensitivity of the Project. Training will be mandatory, multiple training opportunities will be provided, and attendance records will be kept.

The Environmental Education and Awareness Plan will be comprised of the environmental education materials as indicated below:

Site level construction personnel will receive environmental training as part of the basic safety training (or "orientation") that each worker must receive. The Environmental Manager will work with the safety personnel of the contractors to develop appropriate environmental materials for safety training. The Environmental Manager will periodically attend safety sessions to check the quality of environmental presentations. As construction progresses, the Environmental Manager will assist safety personnel in developing new environmental materials required changing environmental requirements or priorities.

The Environmental Manager will attend regular construction meetings (e.g., at the site office), as well as participate in "toolbox" sessions to communicate specific environmental requirements to crews who are about to engage in environmentally sensitive construction on an ongoing basis.

The Environmental Manager will issue memorandums or conduct meetings with site personnel relating to specific environmental issues encountered during construction, new regulatory information, and environmental best practices. This ensures that environmental training and education is an ongoing process; construction personnel will sign off to indicate that they have received training when it occurs.

The Environmental Manager will provide site-specific, or activity-specific, environmental training and education to individual site personnel (including site supervisors, foremen, and workers) to facilitate compliance with environmental requirements and environmental monitoring activities. This training will include information from and reference to component plans prepared in compliance with the CEMP. Topics that may be addressed that target specific personnel include:

- General housekeeping practices — Clean-up of land clearing and construction waste/debris;
- Air quality management and mitigation — Best practices for controlling fugitive dust and harmful vapour emissions, and reporting on the condition of equipment exhaust systems;
- Contaminated sites — Best practices for potential encounter with previously unidentified contamination, stop work, and notification protocols;
- Noise management and mitigation — Location of sensitive receptors, and environmental best practices such as minimizing idling or revving of engines and minimizing use of airbrakes;
- Wildlife protections – vegetation and terrestrial and aquatic animals are protected by combinations of provincial and federal legislation;
- Vehicle fuelling requirements — Fuel storage and refuelling procedure (i.e., fueling not permitted in or near environmentally sensitive areas);

- Surface water quality and erosion control measures — Minimum water quality requirements and the implementation of measures such as silt fences, straw bales and sand bags;
- Storm Water best management practices — Minimum water quality requirements for discharging construction water to watercourses, open drainage ditches and municipal storm systems, plus environmental best practices (e.g., sediment ponds, check dams);
- Hazardous materials management — WHMIS labelling and storage requirements, on site information requirements (e.g., Safety Data Sheets (SDS)), and proper handling, transportation, storage and disposal of hazardous materials;
- Solid waste management — Garbage disposal, recycling requirements, solid waste pick-up scheduling and locations of disposal facilities;
- Management of heritage resources — Recognition of archeological or heritage materials (e.g., isolated artifacts, burial sites) and procedures for stopping work and notifying supervisory personnel in the event materials are encountered, and;
- Emergency response procedures
    - Responsibilities of construction personnel and the Environmental Manager;
    - Emergency contacts; and
    - Notification, containment, response protocols, clean-up or remediation, and reporting.

Training on Environmental Education and Awareness will include a component for Indigenous cultural awareness and recognition. The contents of the Indigenous component will include inputs from Indigenous groups through continuing engagement to identify, explore and plan for opportunities for cultural awareness and recognition. Indigenous Groups will be involved in implementation of the cultural awareness and recognition opportunity.

3. Health and Safety Plan

The contractor will prepare a site-specific Health and Safety Plan. The Health and Safety Plan will be consistent with the environmental requirements of the CEMP and relevant conditions of any environmental permits. In addition, all work will be performed in accordance with the B.C. Centre for Disease Control guidelines for mitigating the spread of COVID-19.

Project health and safety procedures will be implemented in compliance with the Occupational Health and Safety Regulation (OHSR) of the *Workers Compensation Act* (R.S.B.C., 2019, c. 1) and the Canada Labour Code (R.S.C., 1985, c. L-2). Compliance will be monitored by Project safety personnel and may be checked by WorkSafeBC. Safety aspects are addressed in separate documentation relating to occupational health and safety. Liaison will occur between safety personnel and environmental personnel to assure smooth coordination between health/safety requirements and environmental requirements.

The Health and Safety Plan will include the following information:

- Health & Safety policy or goals statement;
- List of responsible persons and titles;
- Local emergency and project telephone numbers;
- Map with directions to the nearest hospital;
- Field work preparation;
- Hazard identification procedure;
- Hazard controls and safe practices;
- Emergency preparedness and response (refer to Section 14.5 Spill and Emergency Response);
- Site evacuation and emergency routes;
- Template and procedure for reporting of incidents and near misses;
- List of required personal protective equipment;
- Employee training and communication required prior to start of work, and;
- Health & Safety record keeping template and procedure.

4. Air Quality and Dust Control Plan

Potential air quality emissions and impacts associated with the project will be limited to the immediate vicinity of the construction activities and will be temporary; limited to the period of construction. The major sources of emissions from construction are dust emissions from non-combustion sources (i.e., "fugitive dust") and exhaust emissions from construction vehicles and stationary combustion sources.

During some construction activity, for example when working in confined spaces, air quality may become an occupational health and safety hazard as well as an environmental issue. In that context, health and safety procedures will be implemented in compliance with the Occupational Health and Safety Regulation (OHSR) of the *Workers Compensation Act* (R.S.B.C., 2019, c. 1). Compliance with OHSR will be monitored by Project safety personnel and may be checked by WorkSafeBC. Safety aspects are addressed in separate documentation relating specifically to occupational health and safety. Liaison will occur between safety personnel and environmental personnel to assure smooth coordination between health/safety requirements and environmental requirements.

4.1 Potential Environmental Impacts

Air quality during construction may be temporarily affected by emissions from mobile and stationary diesel- and gas-powered equipment; particulate matter from land clearing and soil handling; and evaporation of volatile deleterious substances from asphalt paving. Dust and emissions can create visibility issues and affect worker health and may affect fish and wildlife habitat.

The key objective of the Air Quality and Dust Control Plan is to guide the contractors in in implementing protection measures to minimize the potential health, safety, nuisance, and other environmental air quality impacts of the project.

4.2 Regulatory/Institutional Requirements

Contractors will be required to comply with applicable legislation, regulations, bylaws, standards, codes of practice, guidelines, and other requirements as follows:

- Canadian Environmental Protection Act (S.C., 1999, c. 33);
- Environmental Management Act (S.B.C., 2003, c. 53), and;
- Relevant Occupational Health and Safety Requirements as outlined in B.C.'s Occupational Health and Safety Regulation (OHSR).

4.3 Environmental Management

4.3.1 Best Management Practices and Guidelines

The following standard industry practices and guidelines are recommended for all construction works with the potential to impact air quality and/or generate dust:

- Canadian Council of Ministers of the Environment, Canadian Ambient Air Quality Standards (CCME, 2020);

- Metro Vancouver, Ambient Air Quality Objectives (Metro Vancouver, 2020);
- Canadian Council of Ministers of the Environment, National Ambient Air Quality Objectives (CCME, 1999);
- B.C. Ministry of Environment and Climate Change Strategy, Provincial Air Quality Objective Information Sheet: British Columbia Ambient Air Quality Objectives (BC ENV, 2020a);
- Best Practices for the Reduction of Air Emissions from Construction and Demolition Activities (Environment and Climate Change Canada, 2005);
- B.C. Ministry of Transportation and Infrastructure, Environmental Best Practice for Highway Maintenance Activities (MOTI, 2018);
- B.C. Ministry of Transportation and Infrastructure, Standard Specifications for Highway Construction, s.165 Protection of the Environment (MOTI, 2018);
- B.C. Air Action Plan (Government of British Columbia, 2008); and
- Canadian Council of Ministers of the Environment, Guidance on Achievement Determination for Canadian Ambient Air Quality Standards, Fine Particulate Matter and Ozone (CCME, 2012).

4.3.2 Mitigation Measures

The following mitigation measures will be implemented at the direction of the QEP to reduce emissions of air contaminants and fugitive dust:

Control of Fugitive Dust:

- Minimize generation of road dust during construction by:
    - minimizing the time unpaved surfaces are exposed;
    - cleaning roadways regularly and removing debris;
    - providing tire washes to minimize mud tracking on paved roads and dust generation; and
    - covering dump truck loads that are hauling fine-grained materials.
- Apply water for dust suppression on unpaved haul roads using suitable equipment such as a tank truck with spray bars (consider prevailing weather, slope, proximity of watercourses);
- Use of dust suppression agents other than water shall be in compliance with the Ministry requirements in “Dust Management Environmental Best Practice for Highway Maintenance Activities” and “Maintenance Guidelines for Dust Palliatives and Gravel Road Stabilization”;
- Unless otherwise authorized, prohibit use of chemical suppressants and burning of refuse;
- Apply speed limits for mobile diesel equipment and adjust them if required;
- Minimize handling of soils and aggregates, and avoid double-handling of spoil;
- Manage storage piles, including sediment temporarily stockpiled by appropriately shaping, installing enclosures around them, or covering them;
- Minimize drop heights from loaders to haul trucks at material transfer locations; and
- Avoid activities that create fugitive dust (e.g., earthworks) during dry and windy periods.

Control of Emissions from Vehicles, Mobile Equipment, and Generators:

- Optimize truck loads to reduce the number of trips between the source and destination;
- Maintain fleet vehicles and equipment according to manufacturers’ guidelines;

- Operate equipment within load tolerances and ratings and minimize cold starts;
- Use ultra-low sulphur diesel fuel (maximum 15-ppm sulphur content), and catalyzed particulate traps / filters (for PM control) and/or a diesel oxidation catalyst (for NOx gas control) in all heavy-duty diesel on-road vehicles and other diesel construction equipment;
- Minimize double-handling of fill materials to limit the duration of machinery in operation;
- Use stationary emission sources, such as portable diesel generators or compressors, only as necessary and turn them off when not in use;
- Inspect diesel equipment to ensure emission control measures are present and in use;
- Inspect all heavy-duty on-road vehicles (i.e., licensed vehicles, such as dump trucks), and equipment on a regular basis and maintain them in good working order;
- Implement three-minute vehicle and equipment idling time restrictions;
- Effectively communicate and reinforce idle reduction opportunities;
- Use appropriate and practical idle reduction technologies; and
- Locate vehicle staging areas to minimize impact of emissions where possible.

4.4 Key Environmental Performance Indicators

The environmental performance of air quality management will be contractor's records of:

- Visual inspection of vehicles/equipment for visible smoke;
- Visible track-out and generation of road dust by vehicles (and corresponding sources);
- Idling reduction; and
- Addressing reports of non-compliance with the above mitigation within 48 hours from the:
    - Contractor's Environmental Manager;
    - Ministry's Representative; and
    - Independent Environmental Monitor (or the production of a plan within 48 hours to address non-compliances).

4.5 Monitoring

Air quality and dust conditions in the project will be visually inspected daily over the duration of construction. The Environmental Monitor will inspect the implementation of air quality mitigation and selectively check exhaust controls on mobile equipment, and dust suppression. Quantitative monitoring of air quality may be undertaken as needed to support Environmental Management System objectives. Monitoring of particulate matter using a portable monitor such as a DustTrak unit or a US EPA reference method field sampler (such as the PQ200) may be recommended by a QEP if persistent complaints are received during construction works that generate dust near sensitive receptors such as senior care homes. One-hour monitoring data from the portable sampler, scaled to be representative of 24-hour periods, will be compared to the Canadian Ambient Air Quality Standards (CCME 2020) for $PM_{2.5}$ and the BC provincial Ambient Air Quality Objectives (AAQO) for Total Suspended Particulates, PM10 and PM2.5. Should over-threshold air concentrations be measured with the portable sampler, the field sampler will be used to collect more-accurate data over full 24-hour periods.

- Environmental monitoring reporting requirements are further described in Section 18.0.

5. Noise and Vibration Management Plan

Construction noise and vibration associated with the Project will be created by use of on-site equipment and mobile construction vehicles or trucks. Traffic management (i.e., diversions) may also be a source of noise. Traffic Management Plans while distinct from this CEMP, will also consider environmental priorities such as noise sensitive receptors. Noise and vibration mitigation listed here, and traffic management plans will collectively address impacts.

During some construction activity, noise and vibration may become an occupational health and safety issue as well as an environmental issue. In that context, health and safety procedures will be implemented in compliance with the *Workers Compensation Act*: Occupational Health and Safety Regulation (OHSR, 1997). Compliance with Occupational Health and Safety Regulation will be monitored by Project safety personnel and may be checked by WorkSafeBC. Safety aspects are addressed in separate documentation relating specifically to occupational health and safety. Liaison between safety personnel and environmental personnel will assure smooth coordination between health/safety requirements and environmental requirements. Generally, there is reasonable confluence between occupational health and safety and environmental requirements.

The Highway 99 corridor has high levels of ambient noise from the existing highway, surrounding roads and industry. Noise monitoring at sensitive receptors outside the Project construction sites are up to 75 dB (daytime average noise levels). In the Project construction areas noise levels will be correspondingly higher as they are closer to the noise sources (highway traffic). Typical maximum noise levels for various types of construction equipment measured at 15 m from the source are shown in Table Error**! No text of specified style in document.**-1. The provision of these levels is meant for general information purposes and is not intended as a determination of whether the types of equipment referenced exceed applicable noise level limits or requirements.

- This Noise and Vibration Management Plan describes construction period noise management. During operation of the completed projects management of noise is described in the Ministry's noise policy (MOTI 2016), including the situations where the policy applies.

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Table Error! No text of specified style in document.**-1 Typical maximum noise levels of selected construction equipment measured at 15 m**

Noise Source	A-Weighted Sound Level (dBA)
Earth Moving	
Crawler tractors, dozers	81-85
Front end loaders	81-86
Graders	79-83
Earth haulers	88-90
Dump trucks	88
Material Handling	
Mobile cranes	83
Concrete mixers (truck)	85
Concrete pumps	82
Auxiliary Equipment	
Pumps	76
Generators	78
Compressors	87
Paging systems	80-92
Warning horns	98-102
Other Equipment	
Saws	78
Vibrators	76

Source: Holland, K.A. and K. Attenborough. 1981. Noise Assessment and Control. Construction Press, Essex, United Kingdom.

5.1 Potential Environmental Impacts

Certain construction activities (e.g., heavy equipment operation) have the potential to increase ambient noise levels and vibration in the immediate vicinity of Project work sites.

The objective of the Noise and Vibration Management Plan is to guide contractors in implementing measures to minimize the potential impacts of noise and vibration on human health and wildlife and to meet regulatory requirements and standards.

5.2 Regulatory/Institutional Requirements

Contractors will be required to comply with applicable legislation, regulations, standards, codes of practice, guidelines, and other requirements:

- Canadian Environmental Protection Act (S.C., 1999, c. 33);
- Environmental Management Act (S.B.C., 2003, c. 53);
- Relevant Occupational Health and Safety Requirements as outlined in B.C.'s Occupational Health and Safety Regulation (OHSR).
- B.C. Ministry of Transportation and Infrastructure, Policy for Assessing and Mitigating the Noise Impacts from New and Upgraded Numbered Highways (MOTI, 2016).

5.3 Environmental Management

5.3.1 Best Management Practices and Guidelines

The following standard industry practices and guidelines are recommended for all works with the potential to generate noise emissions:

- BC Oil and Gas Commission, BC Noise Control Best Practices Guideline (BC OGC 2021).
- Health Canada, Guidance for Evaluating Human Health Impacts in Environmental Assessment: Noise (HC 2017)
- British Standards Institution, Code of Practice for Noise and Vibration Control on Construction and Open Sites – Part 1: Noise (BSI 2008)
- B.C. Ministry of Transportation and Infrastructure, Policy for Assessing and Mitigating the Noise Impacts from New and Upgraded Numbered Highways (MOTI, 2016).
- B.C. Ministry of Transportation and Infrastructure, 2020 Standard Specifications for Highway Construction (MOTI, 2020a).

5.3.2 Mitigation Measures

Noise

The following mitigation measures will be implemented at the direction of the QEP to reduce noise:

- All work will be conducted in the Ministry right-of-way. Hours of work will generally be daylight between 0700 and 1900, except where work in active traffic lanes requires nighttime work during times with low-traffic volumes. In this situation the hours of work will be:
    - Summer weeknights (Sunday to Thursday from May 1 to August 31) 2300 – 0500
    - Summer weekends (Friday and Saturday from May 1 to August 31) 2330 – 0500
    - Winter weeknights (Sunday to Thursday from September 1 to April 30) 2200 – 0500
    - Winter weekends (Friday and Saturday from September 1 to April 30) 2300 – 0500
- If work is required outside the Ministry right of way, municipal bylaw work hours will be adhered to and prior approval obtained. Hours are; Delta 0700 to 1900 Monday to Friday and 0900 to 1700 Saturday, Richmond 0700 to 2000 Monday to Friday and 0900 to 1700 Saturday.

- Timing and Scheduling:
    - When working near residential areas, schedule noisiest activities during daytime period when noise sensitivity is lowest; and
    - Minimize the duration of construction activities and use short-term sessions to reduce the impacts of such activities when high-noise (i.e., > 100 dBA) emissions are necessary.
- Selection of Travel Routes:
    - Select travel routes that avoid noise sensitive sites or receptors;
- Equipment Operation:
    - Shut down idling equipment such as diesel engines when not in use (see section 4.3.2);
    - Fit all gas or diesel-powered equipment on site with intake (if appropriate) and exhaust silencers (i.e., mufflers) that meet manufacturer's recommendations for optimal attenuation, and maintain these silencers in effective working condition;
    - Use hydraulic-powered equipment instead of combustion engine powered equipment where and when appropriate/feasible;
    - Supply and operate all equipment with appropriate covers, hoods, shields, in place and latched shut;
    - Operate all equipment at minimum engine speeds consistent with effective operation;
    - Use the quietest equipment and construction methods available, including newer equipment and/or equipment fitted with noise suppression devices;
    - Equipment involved in any necessary night construction work near residential areas should be fitted with better-than-standard (i.e., "residential-rated") mufflers/silencers;
    - Position stationary equipment (e.g., compressors, generators) to take advantage of any inherent noise shielding available from the natural terrain, roadway fill, or shoulder or other large objects (equipment, buildings, material piles);
    - Plan one-direction on-site traffic flow to minimize the use of a back-up alarms; and
    - Install broadband back up alarms for on-site equipment.
- Temporary (Construction) Noise Attenuation in Highly Sensitive Areas:
    - Install temporary noise barriers if the QEP considers these offer worthwhile reduction of noise levels at previously identified sensitive receptors. Install noise barriers as close as possible to the noise source using proven, sound absorptive material. Noise barriers should be flush with one another or should overlap each other at access points to eliminate the direct line of sight between the noise generator and sensitive receptors;
    - Sound aprons can be useful when noise barriers have to be moved frequently, or when equipment needs only partial covering;

- Sound skins, which are similar to sound aprons but are close fitting and air-tight, can also be used but they should allow air cooling. Openings in sound skins should be fitted with mufflers or angled air ducts lined with sound absorptive materials; and
- Any temporary noise barriers should be built wider and higher than the noise source. Ideally, the barrier should be twice as long as the distance separating it from the source.

- Train all personnel on strategies planned for mitigating noise (see section 2.0);
- Worksite signage may include very low speed limits at work sites to reduce vehicle noise near residential or noise-sensitive areas.
- Community and stakeholder communication will inform potentially affected communities of construction schedules and activities that may create temporary increases in noise. The following approaches may be considered:
  - Hold information meetings with community representatives to identify construction activities that must be conducted outside of regular work hours, and the measures to be taken by contractors to minimize the noise produced and/or received in the community.
  - Communicate with affected communities on a regular basis to advise them well in advance of the types of future activities and to notify them of any changes in the estimated start and/or completion dates for the various phases of construction.
  - Communication can be achieved via information telephone line or updates on the Project website (e.g., construction schedule with scheduled detours & traffic delays, electronic postcard updates with photos and construction bulletins).

Vibration

The contractor's proposed construction methods will include means to adequately determine and manage (minimize) vibration effects on local residents and businesses. The contractor's procedures to minimize vibration generation during construction will include predicting the impact of high-vibration construction activities, identifying affected receptors, and establishing setback distances. These setbacks will assist with monitoring or communication planning. Vibration criteria relating to the potential for building damage and human response impact thresholds are provided Table **Error! No text of specified style in document.**-2.

Table Error! No text of specified style in document.**-2 Vibration criteria**

Vibration Category	Building Damage Criteria	Measurement Position
Building Damage from Continuous Vibration	Residential: 7.5 mm/s	Preferred position externally at the foundations, on the lowest storey of the building, either on the foundation of the outer wall, in the outer wall, or in the recesses in the outer wall
	Industrial: 25 mm/s	
Building Damage from Transient Vibration	Residential: 15 mm/s	
	Industrial: 50 mm/s	

Human Response	1.0 mm/s	

Notes: mm/s – millimetres per second peak particle velocity. Building damage criteria apply to all receptors. Human response criterion is relevant for healthcare, residential, and educational receptor. (Source: British Standard (BS 7385-2:1993))

- The following mitigation to address vibration-related impacts will be applied to the Project:
- Use construction vibration control techniques, such as the use of hand driven tampers near property lines with adjacent buildings, instead of vibratory rollers when grading sites.
- Communicate with anticipated affected receptors to inform when vibration generating activities will occur, how long the activities are expected to occur for, and the complaints processing procedure (as per noise procedures in 5.3.2.1 above).

5.4 Key Environmental Performance Indicators

The environmental performance of noise management will be contractor's implementation of:

- Temporary noise barriers;
- Noise monitoring measurements;
- Measures to respond to public enquiries or complaints; and
- Compliance with the above mitigation, as measured by responses within 48 hours to non-compliance reports from the:
    - Contractor's Environmental Manager;
    - Ministry's Representative; and
    - Independent Environmental Monitor (or the production of a plan within 48 hours to address non-compliances).

5.5 Monitoring

The Environmental Monitor will qualitatively monitor the implementation of noise mitigation measures during regular construction period visits and will selectively check exhaust and muffler systems of construction vehicles and equipment to ensure mitigation measures (section 5.3.2) are effective.

Contractors will communicate and work with businesses and residents affected by Project construction to address reasonable noise complaints. This will also be a conduit to provide information to the public on planned scheduling of noisy activities, including late evening or night-time construction works

Contractors will implement site level mechanisms to address reasonable noise complaints. This may include the use of complaint forms (to notify contractors of complaints) and response forms (to document corrective measures from contractors and/or to provide assessment or monitoring information confirming environmental compliance) in paper form or on Project website.

Under the direction of a QEP (noise specialist), quantitative noise monitoring may be occasionally undertaken to provide information on construction induced noise levels experienced by the community (such as for reasonable noise complaints that persist or are in clusters). The QEP will identify the need for quantitative noise monitoring at sensitive receptors (i.e., schools, places of worship, senior care homes).

As part of any noise or vibration issue response process, contractors may need to provide a written rationale to the Ministry regarding their equipment selection (particularly if it is perceived that the contractor may not have selected the quietest available equipment and construction methods).

- Environmental monitoring reporting requirements are further described in Section 18.0.

6. Vegetation Management Plan

Vegetation management for Project construction will focus on the protection of soils and vegetation at unaffected locations and providing the best possible conditions in support of restoration for affected locations. In general, the areas affected by the project are grass highway verges with modest to low vegetation values. No trees are anticipated to be affected. Input from Indigenous nations has been incorporated into the contents of this plan, specifically in relation to selection of / qualifications of environmental monitors with experience working with Indigenous nations, inclusion of Indigenous nation input to revegetation planning by using the knowledge of existing vegetation to guide restoration, a commitment to salvage of culturally significant vegetation (by Indigenous nations), and invasive species management. The Ministry and contractors remain open to the provision of additional advice, comments and traditional knowledge.

- The objective of the Vegetation Management Plan is to provide contractors with mitigation for implementation during construction to ensure that vegetation removal is kept to a minimum, soil values are intact and to prevent the spread of invasive species.

6.1 Potential Environmental Impacts

Construction of the Project will impact vegetation during clearing and grubbing activities. In addition, construction has the potential to introduce and spread invasive plant species. Vegetation in the Project area is dominated by invasive species including Himalayan blackberry (*Rubus armeniacus*), reed canary grass (*Phalaris arundinacea*) and creeping buttercup (*Ranunculus repens*) (McElhanney 2020). Two species of noxious weeds have previously been documented by the Ministry at Highway 99/Bridgeport Road Interchange: Himalayan knotweed (*Polygonum polystachyum*) and tansy ragwort (*Senecio jacobaea*). Species listed as Noxious in B.C. are required to be controlled to prevent further spread and site contamination.

6.2 Regulatory/Institutional Requirements

Contractors will be required to comply with applicable legislation, regulations, standards, codes of practice, and guidelines:

- *Species at Risk Act* (S.C., 2002, c. 29).
- Weed Control Regulation (B.C. Reg. 66/85).
- Organic Matter Recycling Regulation (B.C. Reg. 7/2019).
- Migratory Birds Convention Act (S.C. 1994, c. 22.).
- *Wildlife Act* (R.S.B.C. 1996, c. 488).

6.3 Environmental Management

6.3.1 Best Management Practices and Guidelines

The following standard industry practices and guidelines will be used to minimize adverse impacts on vegetation:

- B.C. Ministry of Transportation and Infrastructure, 2020 Standard Specifications for Highway Construction (MOTI, 2020a);
- Invasive Species Council of B.C., B.C. Ministry of Transportation and Infrastructure, Best Practices Guide for Managing Invasive Plants on Roadways (ISCBC, 2019a).
- Invasive Species Council of Metro Vancouver, Metro Vancouver, Best Management Practices for Himalayan Blackberry in the Metro Vancouver Region (ISCMV, 2019).
- Metro Vancouver, Invasive Species Council of Metro Vancouver, Best Management Practices for Knotweed Species in the Metro Vancouver Region (ISCMV, 2018).
- Invasive Species Council of B.C., Tansy Ragwort (*Senecio jacobaea*) Factsheet (ISCBC, 2019b).

Soil management guidance and mitigation is also listed in the Solid Waste Management Plan (section 14.0).

6.3.2 Mitigation Measures

The following mitigation measures will be implemented as directed by the QEP to avoid and minimize the potential impacts to vegetation and to prevent the spread of invasive species:

Clearing and Grubbing

- Prior to commencing clearing, the contractor will retain a QEP to assess the potential for red- and blue-listed plants and ecological communities identified by the B.C. Conservation Data Centre, and where there is a reasonable expectation of presence in clearing areas will conduct surveys for listed species. If a survey is conducted the results and mitigation will be provided to the ECCC, MWLRS, and Indigenous groups for review a minimum 30 days prior to the planned commencement of vegetation clearing;
- Vegetation clearing will occur outside the general breeding bird window of March 30 (or earlier, February 1, for raptors) to August 16 (Environment and Climate Change Canada Nesting Periods, 2023) in accordance with *Wildlife Act* and *Migratory Bird Convention Act* requirements. If this restriction is not feasible, nesting surveys will be conducted by a QEP in advance of clearing (see Section 7.0 for clearing windows and nest survey requirements).
- Limit clearing and/or grubbing to designated areas as defined in drawings and marked on site. Survey and clearly demarcate (flag) clearing areas in the field prior to undertaking clearing;
- Mark limits of environmentally sensitive areas in the field prior to clearing and grubbing taking place within 50 m of a watercourse;
- Protect all vegetation growing outside of the designated areas for clearing and grubbing;
- Avoid vegetation removal until ready to proceed with earthwork and stabilization to minimize soil exposure (also see section 14.0);
- Remove all felled and disturbed vegetation, debris, and other perishable materials from the cleared areas, except where used for rehabilitation purposes;
- Remove any vegetation or debris that fall into a watercourse in a manner that minimizes disturbance of the banks (supervision by the Environmental Monitor during any work within 50 m of a watercourse or wetland);
- Where no grubbing is required, cut vegetation to within 30 cm of the ground;
- Store machinery and construction materials at least 20m from the edge of marshes or wetlands;

- Replant exposed soil and reclaimed areas outside the right-of-way or in association with affected watercourses with native plant species, selection should consider knowledge of species that already thrive in the area and species of importance to Indigenous groups, such as cattails, and berry-producing species such as Vaccinium sp. Inside the right-of-way replant or hydroseed with grass seed mixes to cover exposed soil and avoid the attraction of wildlife to right-of-way areas where there is enhanced collision risk, and;
- Include Indigenous traditional knowledge and Indigenous traditional use information shared with the Project in the mitigation measures for protection of vegetation.

Invasive Plant Management

- Control invasive plant species during construction in accordance with the lists of the B.C. Weed Control Regulation and the Invasive Species Council of Metro Vancouver;
- Comply with the Best Practices Guide for Managing Invasive Plants on Roadways (ISCBC, 2019a), including cleaning, inspecting, removing, and safely disposing of propagules of invasive plants (e.g., roots, stems, segments) from vehicles and equipment prior to entering the Project construction area (tire wash requirements are detailed in s.4.3.2.1);
- Dispose of invasive species and soils contaminated with invasive species at appropriate facilities, in accordance with B.C. Organic Matter Recycling Regulation (B.C. Reg. 99/2020);
- Train employees to identify invasive and noxious weeds and require them to report occurrences to the Environmental Monitor so that the weeds can be removed;
- Minimize ground disturbance and vegetation removal within construction areas (see 6.3.2.1);
- Minimize bare soil exposure (e.g., cover stockpiled material with tarps, plant native species, cover with natural mulch/ground coverings) (also see 4.3.2.1);
- Stabilize and re-vegetate disturbed areas following the mitigation in 6.3.2.1 as soon as possible after the disturbance. If there is insufficient time remaining in the growing season, stabilize the site (e.g., covers / tarps) to prevent erosion and revegetate the following spring;
- Only use weed-free materials stockpiled from Project clearing for fill and/or reclamation work;
- Conduct routine inspections of soil stockpiles for noxious weeds and regularly wash equipment when working in areas where noxious weeds are known to occur;
- Use only herbicides approved by the Ministry for control of invasive plants. Do not use herbicides for control of vegetation that are not invasive (see s.7.3.2.1 for pesticide use), and;
- Comply with all federal and provincial regulations for storage, use, and disposal of herbicides.

Rare Plant Species and Ecosystem Management

Construction activities have the potential for adverse environmental impacts to rare plant species as defined by the *Species at Risk Act* (S.C., 2002, c. 29) and rare ecosystems as identified by the B.C. Conservation Data Centre. The highly developed nature of the Highway 99 corridor means that rare plants and ecosystems are largely absent. The following are mitigation for rare plants and ecosystems:

- Contractors will employ a QEP to review the rare plant and ecosystem studies previously conducted for the Project, and based on work site verification study will adapt the mitigation to reflect newly added species, the actual presence of rare plants and ecosystems and interactions with the Project, with reporting to ECCC, MWLRS and Indigenous groups; and

- Should a rare plant species be identified at any time during construction, the Environmental Monitor should be notified immediately for further direction, including stoppage of work activities or other management deemed appropriate by the QEP or Ministry.

6.4 Key Environmental Performance Indicators

The environmental performance of vegetation and invasive plant management will be contractor's implementation of:

- Visual inspections for disturbance to native vegetation outside of the Project footprint;
- Inspections of vehicles and mobile equipment for signs of excess soil and noxious weeds prior to arriving at site;
- Completion of rare plant and ecosystem studies and reporting.; and
- Compliance with the above mitigation as measured by responses within 48 hours to non-compliance reports from the:
    - Contractor's Environmental Manager;
    - Ministry's Representative; and
    - Independent Environmental Monitor (or the production of a plan within 48 hours to address non-compliances).

6.5 Monitoring

The Environmental Monitor will monitor the implementation of mitigation measures to minimize vegetation removal and the spread of invasive species and will selectively check vehicles and mobile equipment for signs of noxious weeds as part of their daily routine across the active areas of construction sites and at substrate storage locations. Monitoring of the effectiveness of mitigation in section 6.3.2 to manage the effects of clearing and grubbing, invasive species management and rare plants will be reported internally in daily monitoring logs, and externally in weekly, monthly and annual status reports that are distributed to the Ministry and the IEM.

- Environmental monitoring reporting requirements are further described in Section 18.0.

7. Wildlife Management Plan

- The Wildlife Management Plan summarizes processes and measures that will be used to mitigate potential Project impacts to existing terrestrial wildlife and to wildlife habitats within the Project area.

7.1 Potential Environmental Impacts

Highway 99 is an intensively developed transportation corridor with adjacent urban, industrial and agricultural development that limits the wildlife habitat available, and introduces continual visual, noise, vibration and collision risk effects. Collectively these activities limit the potential and presence of wildlife and wildlife habitat to generalist species that are tolerant of human activity and small natural areas adjacent to the corridor. The Projects associated with this CEMP do not interact with any of the natural areas. Input to this plan from Indigenous nations has been incorporated, specifically in relation to selection of environmental monitors with experience working with Indigenous nations, inclusion of small mammal trapping provisions, and wildlife noise mitigation considerations and methods. The Ministry and contractors remain open to the provision of additional advice, comments and traditional knowledge.

Potential impacts on terrestrial wildlife during Project construction include loss of terrestrial wildlife and wildlife habitat that might be present in the corridor due to clearing and grubbing, temporary sensory disturbance to terrestrial wildlife due to construction noise.

The key objective of the Wildlife Management Plan is to guide the contractors in implementing measures to minimize the potential impacts to wildlife.

7.2 Regulatory/Institutional Requirements

Contractors will be required to comply with applicable legislation, regulations, bylaws, standards, codes of practice, guidelines, and other requirements, including, but not limited to:

- *Species at Risk Act* (S.C. 2002, c. 29).
- Migratory Birds Convention Act (S.C. 1994, c. 22.).
- *Wildlife Act* (R.S.B.C. 1996, c. 488).

The *Wildlife Act* protects most vertebrates from direct harm or harassment. Section 34 of the *Wildlife Act* specifically protects birds and their eggs from possession, molestation, or destruction; the nests of eagles, peregrine falcons, gyrfalcons, ospreys, herons, and burrowing owls year-round (whether they are actively being used), and the nest of all other birds when the birds or their eggs are in the nest. Individuals, eggs and active nests of Article 1 migratory birds are protected by the *Migratory Birds Convention Act*.

7.3 Environmental Management

7.3.1 Best Management Practices and Guidelines

The following standard industry practices are recommended to minimize potential impacts on terrestrial wildlife:

- B.C. Ministry of Transportation and Infrastructure, 2020 Standard Specifications for Highway Construction (MOTI, 2020a).
- B.C. Ministry of Transportation and Infrastructure, Environmental Best Practice for Highway Maintenance Activities (MOTI, 2018).
- B.C. Ministry of Environment and Climate Change Strategy, Develop with Care 2014: Environmental Guidelines for Urban and Rural Land Development in British Columbia (BC ENV, 2014a).
- Environment and Climate Change Canada, Guidelines to Reduce Risk to Migratory Birds (ECCC, 2019).
- B.C. Ministry of Environment and Climate Change Strategy, Best Management Practices for Raptor Conservation during Urban and Rural Land Development in British Columbia (BC ENV, 2005b).
- B.C. Ministry of Forests, Best Management Practices for Amphibian and Reptile Salvages in British Columbia (MoF, 2016).
- B.C. Ministry of Environment and Climate Change Strategy, Recovery Plan for the Barn Owl (*Tyto alba*) in British Columbia (BC ENV 2014b).

7.3.2 Mitigation Measures

The following mitigation measures will be implemented as directed or adapted by the QEP to avoid and minimize the potential impacts to wildlife and wildlife habitat:

- Flag construction limits in the field and on Project plans to avoid accidental encroachment outside the construction area (see section 6.3.2);
- Pre-clearing surveys in and outside construction areas for nests that are protected year-round by s.34 of the *Wildlife Act* will occur before clearing work and regardless of the time of year;
- For the nests of birds afforded year-round protection (e.g., raptors and herons protected by s.34 of the *Wildlife Act*), the QEP will determine if there is potential for direct construction effects or indirect visual / aural disturbance:
    - If a protected nest is found and determined to be active, the QEP will develop mitigation measures prior to any construction activities commencing; mitigation may include having an on-site monitor to manage the potential for disturbance or delaying construction activities until the nest is determined to be inactive.
    - Trees hosting inactive nests will be identified in a way that avoids predation effects and prevents felling. Pre-nesting season surveys will be conducted to check for possible re-use.

- Avoid clearing vegetation during the general breeding bird window of March 12 to August 16 (Environment and Climate Change Canada Bird Nesting Periods, 2018 in accordance with *Wildlife Act* and *Migratory Birds Convention Act* requirements; (note related items below);
- Clearing and grubbing may only proceed during the bird breeding season if a QEP has conducted nest sweep surveys prior to the start of such works to confirm the presence/not detected status of breeding birds, and location nests;
- If an active nest of any bird protected under the *Migratory Birds Convention Act* or B.C. *Wildlife Act* is found within Project area during the pre-clearing surveys or during any clearing work, leave the vegetated area intact with a suitably sized buffer of shrubs/trees around it until the young have fledged and left the nest:
    - Consult a QEP to determine the size of buffer; which is species dependent and must consider the nest site context to provide a fledgling exit path beyond the buffer zone.
    - Flag the limits of the buffer zone to clearly identify the area, especially in the direction of approaching construction activities.
    - Refrain from marking individual nests with flagging tape or other similar material as this increases the risk of nest predation.
- Conduct wildlife salvages in locations of known small mammal, amphibian, and reptile occurrences prior to clearing and grubbing, in accordance with *Wildlife Act* permits;
- Flag sites important to wildlife species, including wildlife trees and nests, in the field and mark locations on Project plans to provide a visual barrier to contractors;
- Construction noise mitigation measures described in Section 5.3.2 controls noise impacts on wildlife by:
    - avoiding sensitive times for wildlife (hours of work restrictions avoid nighttime and early morning periods when most aural wildlife communication occurs);
    - controlling noise emissions at the source via the selection of appropriate equipment that is maintained and operated according to specifications;
    - the use of temporary noise barriers around equipment at sensitive locations;
- Apply air quality mitigation measures as described in Section 4.3.2;
- Construct the highway width in accordance with applicable geometric standards, and minimally vegetate the right-of-way, including road shoulders and adjacent slopes, to reduce the attractiveness of Project areas to barn owls;
- Install flight deflectors such as hedgerows in high-risk areas of the Project to reduce the increased collision risk for barn owls during operations. The required locations for installation of flight barriers to reduce the collision risk for barn owls will be determined through discussion with the Ministry and their expert consultants. Planting in advance of construction reduces the time to achieve the effective height of approximately 2-3 m, and;
- Include Indigenous traditional knowledge and Indigenous traditional use information shared with the Project in the mitigation measures for protection of wildlife and wildlife habitat.
- Store all food, food waste, fuels, oils and lubricants, sanitary waste, and other wildlife attractants in sealed, animal-proof containers;

- Avoid mixing food waste with construction waste; collect waste regularly for regular off-site disposal (see section 14.0 solid waste disposal);
- Provide training for site personnel and subcontractors in reporting procedures of incidental wildlife observations and techniques for minimizing interactions with wildlife and for proper conduct during an unavoidable interaction (see section 2.0);
- Do not allow feeding or harassment of livestock or wildlife in and adjacent to the Project area;
- Report significant wildlife encounters, observations (e.g., nuisance wildlife, or dead or injured animals), or incidents (e.g., worker injuries caused by wildlife, or vehicle collisions with wildlife) immediately to the Environmental Monitor and seek advice regarding mitigation. Bird mortalities can be reported to the Wild Bird Mortality hotline: 1-866-431-BIRD (2473);
- If it is necessary to remove wildlife from the work site, contact the appropriate environmental agencies and obtain any permits required prior to taking the approved action; and
- Avoid using poisons and pesticides to control rodents or other pests (see s.6.3.2.2 for herbicide use).

7.4 Key Environmental Performance Indicators

The environmental performance of wildlife management will be compliance with the above mitigation as measured by responses within 48 hours to non-compliance reports from the:

a. Contractor's Environmental Manager;

b. Ministry's Representative; and

c. Independent Environmental Monitor (or the production of a plan within 48 hours to address non-compliances).

7.5 Monitoring

Monitoring will be conducted by the Environmental Monitor to ensure terrestrial wildlife mitigation measures are implemented and expected outcomes are achieved. Adherence to flagging requirements and timing of vegetation clearing, wildlife salvages and air, noise and waste management will be checked as part of routine monitoring routine across the active construction sites. Monitoring of the effectiveness of mitigation (section 7.3.2) to manage the effects of vegetation clearing, and construction emissions and waste will be reported internally in daily monitoring logs, and externally in weekly, monthly and annual status reports that are distributed to the Ministry and the IEM.

- Environmental monitoring reporting requirements are further described in Section 18.0.

8. Fish, Fish Habitat and Surface Water Quality Management Plan

The Fish, Fish Habitat and Surface Water Quality Management Plan describes the general approach for watercourse habitat management, and run-off or discharge management from construction sites to ensure compliance with required water quality standards. The required standards will be attained through implementation of environmental best management practices. Surface flows from construction sites will be monitored to confirm compliance prior to discharge to the natural environment, or to the storm sewer system. If water quality objectives cannot practically be attained on site, affected surface water will be contained and treated on site, or pumped into tanker trucks and moved offsite to a suitable facility for further settling or treatment. No untreated wastewater will be discharged into storm sewer unless permission is otherwise requested and granted.

Environmental conditions, such as precipitation, may occasionally deteriorate to the point that environmental best practices (including possible sediment control ponds or other elaborate measures) can no longer keep up with the volume of sediment affected surface water needing containment and/or treatment. In such cases work will be suspended and emergency measures undertaken to restore the required level of environmental protection.

Water Sustainability Act Changes in and about a stream approval (Approval No. 2005092) and *Fisheries Act* request for review (File #21-HPAC-00810) have been completed, and mitigation required have been incorporated into this CEMP.

- Input from Indigenous nations to this plan have been incorporated, specifically in relation to selection of environmental monitors with experience working with Indigenous nations, and riparian revegetation. The Ministry and contractors remain open to the provision of additional advice, comments and traditional knowledge.

8.1 Potential Environmental Impacts

Works in and around watercourses or drainage ditches in the Project area have the potential to adversely impact fish, fish habit, and surface water quality. Concrete pouring may increase suspended solids and/or pH levels in surrounding waters. Clearing and grubbing of vegetation on drainage ditches have the potential to result in localized riparian disturbance, erosion, and sedimentation. Relocation of or modifications to ditches have potential to result in temporary increase in total suspended solids changes in ambient water quality, and alteration of fish habitat, including but not limited to:

- Removal of vegetation cover, potentially resulting in increased water temperatures and decreased food/nutrient inputs;
- Temporary flow diversion and ditch realignment, potentially resulting in impairment of ditch connectivity for fish, and;
- Temporary impairment of fish habitat functions within upland ditches, until replacement and/or relocated channels mature.

The key objective of the Fish, Fish Habitat and Surface Water Quality Management Plan is to guide contractors in implementing measures to minimize the potential impacts to fish, fish habitat and surface water quality. Per the 21 October 2021 DFO response to the Request for Review this will also maintain the existing value and function of fish habitat.

8.2 Regulatory/Institutional Requirements

Contractors will be required to comply with applicable legislation, regulations, bylaws, standards, codes of practice, guidelines, and other requirements, including, but not limited to:

- Fisheries Act (R.S.C., 1985, c F-14).
- Species at Risk Act (S.C., 2002, c. 29).
- Water Sustainability Act (S.B.C., 2014, c. 15) and Water Sustainability regulation.
- Wildlife Act (R.S.B.C., 1996, c. 488).
- Riparian Area Protection Act (SBC 1997), Riparian Areas Protection.

8.3 Environmental Management

8.3.1 Best Management Practices and Guidelines

The following standard industry practices are recommended to minimize potential impacts for all work with potential to impact fish, fish habitat, and surface water quality:

- B.C. Ministry of Transportation and Infrastructure, Environmental Best Practice for Highway Maintenance Activities (MOTI, 2018).
- B.C. Ministry of Transportation and Infrastructure, 2020 Standard Specifications for Highway Construction (MOTI, 2020a).
- Ministry of Water, Land and Resource Stewardship, Standards and Best Practices for Instream Works (MWLRS, 2004).
- B.C. Ministry of Environment and Climate Change Strategy, Develop with Care 2014: Environmental Guidelines for Urban and Rural Land Development in BC (BC ENV, 2014a).
- Department of Fisheries and Oceans, Land Development Guidelines for the Protection of Aquatic Habitat (DFO, 1993).
- B.C. Ministry of Environment and Climate Change Strategy, A User's Guide to Working in and Around Water (BC ENV, 2005a).
- B.C. Ministry of Environment and Climate Change Strategy, Riparian Restoration Guidelines (BC ENV, 2008).
- B.C. Ministry of Environment and Climate Change Strategy, Water Quality Guidelines: Aquatic Life, Wildlife & Agriculture (BC ENV, 2019a).
- B.C. Ministry of Environment and Climate Change Strategy, Water Quality Guidelines Policy (MOECSS, 2019b).
- Fisheries and Oceans Canada, Interim code of practice: End-of-pipe fish protection screens for small water intakes in freshwater (DFO 2020).

- Turbidity in runoff discharged from the Project to watercourses will be managed in accordance with the B.C. Water Quality Guidelines: Aquatic Life, Wildlife & Agriculture, and CCME Water Quality Guidelines for the Protection of Aquatic Life. The two sets of guidelines for selected parameters have almost identical requirements (Table Error**! No text of specified style in document.**-3)

Table Error! No text of specified style in document.**-3 Summary of guidelines for the protection of freshwater and aquatic life**

Parameter	Provincial and Federal Water Quality Guidelines for the Protection of Aquatic Life	
	B.C. Approved Water Quality Guidelines	**CCME Environmental Guidelines**
Conductivity µS/cm	N/a 400 µs/cm when discharging to City of Delta irrigation system during irrigation season (dates to be supplied).	N/a
DO (mg/L O2) Instantaneous minimum2 (in the water column):	5 mg/L for all life stages other than buried embryo/alevin; 9 mg/L for buried embryo/alevin life stages	5.5 mg/L to 9.5 mg/L (freshwater)
DO (mg/L O2) 30-day mean3 (in the water column)	8 mg/L for all life stages other than buried embryo/alevin; 11 mg/L for buried embryo/alevin life stages	N/a
pH (see note below)	6.5-9.0; Unrestricted change permitted within this range	6.5-9.0
Temperature °C	~1°C change beyond optimum temperature range for fish species	~1°C change
TSS (mg/L)	Allowance over background ("induced" TSS): 25 mg/L in 24 hours when background is ≤ 25; 25 mg/L when background is 25 to 250; 10% when background is ≥ 250 mg/L	N/a
Turbidity (NTU)	Allowance over background ("induced" turbidity): maximum increase of 8 NTU in 24 hours when background is ≤ 8; 8 NTU when background is 8 to 80; 10% when background is ≥ 80	N/a

Note: For concrete affected water, pH of discharge into any waterbody must be the same as the receiving waters or between pH 6.5 and 8.0, as per the Ministry's Standard Specifications for Highway Construction (MOTI, 2020a).

[2] For B.C. water quality guidelines, the instantaneous minimum level is to be maintained at all times (i.e. the values are not "allowances" over background). For the buried embryo/alevin stages these are in stream concentrations from spawning to the point of yolk sac.

[3] The mean is based on a least five approximately evenly spaced samples.

8.3.2 Mitigation Measures

The following mitigation measures will be implemented at the direction of the QEP to avoid and minimize the potential impacts to fish, fish habitat and surface water quality:

- Conduct all works in and around watercourses in accordance with the mitigation measures outlined in the Project's B.C. *Water Sustainability Act* Approval No. 2005092 and any amendments, the 21 October 2021 DFO response to the Request for Review, the Ministry's Environmental Best Practices for Highway Maintenance Activities (MOTI, 2018), the Ministry's 2020 Standard Specifications for Highway Construction (MOTI, 2020a), and Standards and Best Practices for In-stream Works (MWLRS, 2004);
- Conduct instream works within the least-risk fisheries timing windows (i.e., August 1 to September 15, WSA Approval No. 2005092), in isolation of water flows, and with fish and amphibian life salvages as required;
- Outside of the least-risk window instream works will only be conducted subject to:
    - QEP advice to the Ministry on the timing of the work based on: the nature of the works, environmental values (fish, amphibians, wildlife, any listed species present), water quality, channel stability, weather conditions, water levels, and any other relevant factors); and
    - QEP advice on additional construction mitigation, and daily or full-time supervision of all work in or near the stream; and
    - Work must be timed and planned appropriately, the stream must be completely dry or have marginal flows for the duration of the construction activities; and
    - QEP advice on construction timing and the presence of the Environmental Monitor, must be documented in writing. This documentation must be retained for at least 2 years following construction, and if requested by MWLRS. Environmental Monitoring reports are to be submitted to MWLRS monthly for the duration of construction.
- Conduct work in a manner that prevents the release of silt, sediment, sediment-laden water, raw concrete, concrete leachate or any deleterious substances to any watercourse;
- Minimize and restrict clearing and grubbing of riparian vegetation. Demarcate vegetation clearing limits on drawings and in the field;
- Delineate (flag or fence) environmentally sensitive no work areas in the field at buffer distances determined by the QEP giving consideration for potential effects and sensitivity of receptors;
- If dewatering or isolation of flow is required: (also see DFO interim codes of practice for end of pipe fish protection screens in freshwater and cofferdams and diversion channels)
    - retain a QEP to advise on and if necessary conduct fish and aquatic salvages prior to commencement of work in the stream, and in accordance with applicable permits;
    - Use pumps with fish friendly intakes to prevent entrainment and impingement and energy dissipation at outfall to minimize sediment mobilization.
- Conduct ditch realignment in accordance with applicable standards and guidelines (e.g., MWLRS, 2004; MOTI, 2020a);

- During preparation of stream diversions, culvert installations and other operations involving dewatering where drainage could reach a designated watercourse, monitor discharge against the thresholds in Table 8.1 and only discharge effluent and silt-laden water to a watercourse after treatment in a sediment control pond or vegetated area for removal of silt;
- If water quality objectives cannot practically be attained on site, affected surface water will be contained and treated onsite, or pumped into tanker trucks and moved offsite to a suitable facility for further settling or treatment;
- Clearly delineate sediment removal boundaries prior to commencement of work. All sediment excavation for removal purposes shall be completed in isolation of the stream flows;
- Remove all excavated material and debris from the site or place in a stable area above the high-water mark, and install erosion and sediment control measures as applicable to prevent erosion and reintroduction of sediment into the watercourse;
- Unless otherwise approved by the Ministry and permitted, culvert installation will be isolated from the stream and completed in the dry. Install rip rap and other protective works as soon as possible following culvert installation in order to prevent erosion and siltation;
- Riprap must be clean of any deleterious substances and suitable shaped and sized to resist movement by stream flow;
- Install, remove, or maintain culverts according to Section 39 of the Water Sustainability regulation;
- Apply erosion and sediment control measures as per s.9.3.2, including:
    - Minimizing the extent and duration of ground disturbance;
    - Installing functional erosion and sediment control measures at potentially affected watercourses prior to the onset of Project construction and operation activities;
    - Maintaining (repairing or replacing) functional erosion and sediment control measures throughout Project construction;
    - Operating construction equipment in-the-dry from the top top-of- watercourse bank, and;
    - Restoration, revegetation or hydroseeding of cleared areas and stream banks promptly after disturbance according to applicable riparian restoration guidelines (e.g., BC ENV, 2008). More details are presented in Section **Error! Reference source not found.** (Environmental Restoration Plan).
- Prohibit fuelling, refuelling, servicing or washing of machines or equipment within 30 m of any watercourse or surface water drainage, and as far as possible from sediment control facilities;
- Ensure a spill kit is readily available on-site and locate all fuel storage more than 30 m from a watercourse;
- Ensure all equipment and machinery working in or near any watercourse uses biodegradable hydraulic fluid and is in good working condition free of leaks, and steam cleaned of oil, grease and other contaminants deleterious to aquatic species, prior to commencing work; and
- Include Indigenous traditional knowledge and Indigenous traditional use information shared with the Project in the mitigation measures for protection of fish and fish habitat.

8.4 Key Environmental Performance Indicators

The performance of fish, fish habitat and surface water quality management will be contractor's:

- Records of compliance with BC and CCME Water Quality Guidelines for Protection of Aquatic Life (Table Error**! No text of specified style in document.**-3) and City of Delta irrigation season conductivity threshold;
- Records of completion of fish salvages prior to instream works that have potential to impact fish and fish habitat (i.e., dewatering, isolation of flow); and
- Compliance with the above mitigation as measured by responses within 48 hours to non-compliance reports from the:
    - Contractor's Environmental Manager;
    - Ministry's Representative; and
    - Independent Environmental Monitor (or the production of a plan within 48 hours to address non-compliances).

8.5 Monitoring

The Environmental Monitor will conduct full time monitoring for all activities conducted within an environmentally sensitive area or below the high-water mark of any watercourse. The Environmental Monitor will monitor to ensure that no fish or aquatic life are stranded and that there is minimal impact to fish, fish habitat, and surface water quality due to the Project construction.

Water quality will be monitored every day during instream works at locations upstream and downstream of work with potential to impact water quality, as well as at any discharge point. Water quality monitoring will be consistent with the B.C. and CCME Water Quality Guidelines as they apply to aquatic life and the B.C. Field Sampling Manual (LSQA, 2013).

Sampling locations will be identified by the Environmental Monitor with consideration for the activities conducted in the working areas, and the accessibility and suitability of the upstream and downstream sampling sites. Measurements will be taken immediately prior to works beginning, and then at regular intervals until the work is completed. The Environmental Manager (or designate) will determine the sampling effort considering permit conditions and the environmental risk of the construction activity.

Typical water quality parameter that the QEP may direct to be monitored include:

- Temperature (ºC);
- Dissolved oxygen (DO; mg/L);
- Total Suspended Solids (TSS), non-filterable residue (mg/L);
- Turbidity (NTU);
- pH;
- Conductivity (µs/cm), and;
- Other parameters (as directed by the QEP).

The contractor will notify any Project-caused exceedance of the applicable water quality guidelines to the Ministry immediately and to MWLRS within 24 hours, in accordance with the *Water Sustainability Act* Approval No. 2005092. In consultation with the Ministry and MWLRS as required, the contractor will

immediately undertake measures to eliminate the cause of a Project-caused exceedance of the applicable water quality guidelines and remedy the impacts, to the satisfaction of the Ministry and the contractor's QEP or Environmental Manager.

If the harmful alteration, disruption or destruction of fish or fish habitat is observed, the contractor is required to notify the Ministry and report to the Department of Fisheries and Oceans (DFO) immediately through the DFO-Pacific Observe, Record and Report phone line (toll free) at 1.800.465.4336.

Water quality monitoring will be summarized internally in daily reports that will include the current weather, time and location of measurements, upstream activities being conducted at the time, and the turbidity levels. External reporting will be in weekly, monthly and annual status reports that are distributed to the Ministry and the IEM. The IEM will provide updates and opinions on compliance to the Ministry and Indigenous groups.

- Environmental monitoring reporting requirements are further described in Section **Error! Reference source not found.**.

9. Erosion and Sediment Control Plan

- Construction activities may result in erosion and movement of sediment within the Project area, due to unplanned exposure of sediment during work. The key objective of this Erosion and Sediment Control Plan is to guide contractors in implementing measures for the prevention of erosion and sedimentation, and if necessary due to complex sediment management issues, to guide the preparation of site-specific and/or activity-specific erosion and sediment control plans (ESCP).

9.1 Potential Environmental Impacts

Exposed soil surfaces created during construction of the Project and transportation of excavation material may be eroded and introduce sediment through runoff into neighbouring waterbodies. Increased sediment input has an adverse impact on riparian aquatic habitats, as well as direct impacts on invertebrates, fish, and wildlife.

9.2 Regulatory/Institutional Requirements

Contractors will comply with applicable legislation, regulations, bylaws, standards, codes of practice, guidelines, and other requirements, listed below:

- Water Sustainability Act (S.B.C., 2014, c. 15) and Water Sustainability regulation.
- Fisheries Act (R.S.C., 1985, c F-14).
    - Section 35(1), no person shall carry on any work, undertaking or activity that results in the harmful alteration, disruption or destruction of fish habitat.
    - Section 36(3), no person shall deposit a deleterious substance of any type in water frequented by fish or in any place if the deleterious substance may enter any such water.
- Riparian Area Protection Act (SBC 1997), Riparian Areas Protection Regulation (Reg. 99/2020).
- B.C. Water Quality Guidelines for the Protection of Aquatic Life.
- CCME Water Quality Guidelines for the Protection of Aquatic Life.

9.3 Environmental Management

9.3.1 Best Management Practices and Guidelines

The following standard industry practices and guidelines to manage erosion or sedimentation will be used by contractors:

- B.C. Ministry of Environment and Climate Change Strategy, Develop with Care 2014: Environmental Guidelines for Urban and Rural Land Development in BC (BC ENV, 2014a).
- Ministry of Water, Land and Resource Stewardship, Standards and Best Practices for Instream Works (MWLRS, 2004).
- B.C. Ministry of Transportation and Infrastructure, Manual of Control of Erosion and Shallow Slope Movement (MOTI, 1997).

- Transportation Association of Canada, National Guide to Erosion and Shallow Slope Control on Roadway Projects (TAC, 2005).
- The mitigation in these guidance documents has been demonstrated as effective on Ministry projects, and as such is suitable as the basis for the QEP to choose the most-effective method for controlling erosion and sediment impacts.

9.3.2 Mitigation Measures

Sediment and Erosion Controls

The following mitigation measures will be used by contractors as the minimum needed to avoid and minimize the potential impacts of erosion and sedimentation. These measures are a suite of methods from which the Environmental Manager, Environmental Monitor or contractor's QEP may choose the most appropriate for each situation. In most cases the air (section 4.0) or water quality (section 8.0) thresholds will be used to dictate which combinations of the mitigation are necessary in a situation:

- Prevent overland water flow entering, or flowing through, construction areas. If this is not possible, ensure that sediment & surface water control equipment is adequate for the volume of flow encountered;
- Reduce soil stockpile areas and volumes, particularly during inclement weather and/or when working in environmentally sensitive areas. If this is not possible, divert surface water from stockpiles as indicated below;
- Divert surface water around disturbed construction areas, stockpiles or lay down areas by installing temporary curbs along road access points or erecting tarps over cut-and-cover construction areas.
- Cover soil stockpiles with polyethylene or geo textiles to minimize erosion;
- Do not place soil stockpiles on sloped terrain or near watercourses and avoid alteration of pre-existing down slope drainage;
- Minimize slopes / maintain natural angle of repose of disturbed areas and stockpiled material;
- Roughen the surfaces of compacted, disturbed and exposed soils to increase infiltration to ground and break up or slow down sheet flows (e.g., "cat tracking" or "rough and loose");
- Cover disturbed areas with hay, mulch, seeding or other stabilizing materials, and to do so ensure sufficient filter cloth, rock, seed, drain rock, culverts, staking, matting, polyethylene and other materials used for erosion prevention or control are readily available;
- Retain upper soil horizons and beneficially re-use same when stripping from agricultural areas;
- Install stream bank stabilization works or other instream erosion protection in isolation of stream flow;
- When installing or relocating utilities, minimize the length of trench exposed at any given time or ensure that adequate erosion protection equipment is ready prior to work
- Re-vegetate disturbed areas as soon as possible after construction. If immediate re-vegetation is not feasible due to seasonal timing or other limitations, stabilize soils with geo textiles, mulches or other suitable materials until re-vegetation can be completed;
- Check erosion control measures frequently and correct deficiencies promptly;
- Reduce the number of vehicle access routes into working areas, and apply gravel or crushed rock to the driveway area linking the work site to any paved roadway;

- Install and implement wheel washing to remove sediment from transportation vehicles and prevent offsite tracking of sediment;
- Install water collection structures, such as sumps, for collection of sediment laden water and removal of sedimentation from water flows;
- Install water velocity barriers in sediment laden water pathways/ditches to promote sediment deposition and settling (and reduce the erosive power of water within ditches); and
- Lengthen flow paths where depositional sedimentation is desired in ditches (i.e., use of finger dams) or sumps (i.e., chambers).

Site- or Activity-specific Sediment and Erosion Control Mitigation

Prior to the start of construction activities, the contractor and the Environmental Manager will identify sensitive areas and major construction activities which will require more detailed activity-specific erosion and sediment control. Additional mitigation if needed (see Adaptive Management section 1.7.6) will be developed from the Manual of Control of Erosion and Shallow Slope Movement (MOTI, 1997) and the National Guide to Erosion and Sediment Control on Roadway Projects (TAC, 2005). Such an activity-specific Erosion and Sediment Control Plan shall include the items identified in Section 165.04.01 (h) of the Standard Specifications for Highway Construction (MOTI, 2020a) and any others determined to be applicable by the Environmental Manager or the QEP:

- A schedule of proposed activities and construction staging as they pertain to the Erosion and Sediment Control Plan, including anticipated duration of construction;
- A description of construction procedures, including estimates of works areas, description of construction equipment, and staging of operations;
- Site-specific mitigation measures for runoff and drainage;
- Site-specific measures and design information for Erosion and Sediment Control measures (e.g., size of culverts, ditches or sediment/detention ponds, silt fence specifications, and dimensions of ditches and berms);
- A schedule that identifies the various sloped areas by location and the dates in which they will be protected using temporary and permanent re-vegetation measures, such as hydroseeding;
- A key plan and drawings, in suitable scale and detail, of the site and proposed mitigative measures and applicable construction procedures;
- A list of on-site equipment (e.g., water pumps) and materials (e.g., silt fence, hay bales, rock armouring, and ditch breakers) for erosion, sediment and drainage control to deal with emergency situations that may arise, and;
- A description of the specific environmental monitoring procedures and inspection frequencies prior to, during, and after completion of construction activities at this site. This shall include a description of water quality testing locations and testing frequencies.

These mitigations are an element in the management of accidents and malfunctions as described in the Projects Spill Prevention and Emergency Response Plan (section 15.0).

9.4 Key Environmental Performance Indicators

The environmental performance of erosion and sediment control management will be contractor's:

- Records of compliance with BC and CCME Water Quality Guidelines for Protection of Aquatic Life (Table Error**! No text of specified style in document.**-3), and;
- Compliance with the above mitigation as measured by responses within 48 hours to non-compliance reports from the:

    a. Contractor's Environmental Manager;
    b. Ministry's Representative; and
    c. Independent Environmental Monitor (or the production of a plan within 48 hours to address non-compliances).

9.5 Monitoring

The Environmental Monitor will inspect all temporary and permanent erosion and sediment control mitigation weekly, daily during adverse weather conditions and when during work in environmentally sensitive areas, to ensure that the measures are functioning as intended. Any deficiencies which are observed in erosion and sediment control measures will be immediately corrected by the contractor.

For activities in or near water where there is a risk to the aquatic environment, the Environmental Monitor will conduct environmental monitoring for turbidity/total suspended solid levels in adjacent waters to verify compliance with the B.C. and CCME Water Quality Guidelines for the Protection of Aquatic Life and any environmental permits held by the Project, per the process described in section 8.5. These standards represent the conditions against which mitigation efficacy will be tested. Reporting of water quality monitoring in daily monitoring logs, and externally in weekly, monthly and annual status reports that are distributed to the Ministry and the IEM.

- Environmental monitoring reporting requirements are further described in Section **Error! Reference source not found.**.

10. Drainage and Stormwater Management Plan

- Surface and wastewater drainage in the Project area during construction can have deleterious impacts on local terrestrial and waterbody environments if mitigation is not included. These impacts can be added to, and/or exacerbated, during precipitation events as stormwater can overwhelm catchment and drainage systems if they are not able to accommodate any increases in drainage or sediment volume caused by the Project (e.g., removal of vegetative cover). The Drainage and Stormwater Management Plan describes the requirements for minimizing risk and mitigating impacts of drainage and stormwater issues during construction. This plan is to be implemented in conjunction with mitigation and thresholds in the Fish and Surface Water Quality (section 8.0) and Erosion and Sediment Control (section 9.0) plans. During operations, guidance in the Ministry's *Environmental Best Practice for Highway Maintenance Activities* (MOTI, 2018) will be followed, aligning maintenance for newly constructed portions of Highway 99 with existing portions.

10.1 Potential Environmental Impacts

Project construction will involve re-establishment and modifications to existing drainage ditches and infrastructure (i.e., culverts, and catch-basins). When construction is complete for this Project, drainage patterns and discharge locations will be largely similar to the existing situation.

During construction, disturbed soils and demolition of on-site structures could interact with stormwater and divert stormwater away from the existing system. Stormwater is not considered wastewater by default unless it becomes contaminated from interaction with pollutants on site. Diverted stormwater from the construction site cannot enter a different storm sewer system unless adequate capacity analysis of the storm sewer network is completed, and approval is sought from the relevant municipality. To avoid risk of flooding, any peak flow increase due to alteration to land uses must be mitigated prior to discharging the flows into the drainage system.

The objective of the Drainage and Stormwater Management Plan is to guide contractors in managing the impacts of stormwater and maintaining drainage to prevent environmental effects. System specifications including design, performance and installation objectives are in the Ministry's 2006 standard specifications for highway construction, in this case SS 303.

10.2 Regulatory/Institutional Requirements

Contractors must comply with the following applicable legislation, regulations, bylaws, standards, codes of practice, guidelines, and other requirements:

- Canadian Environmental Protection Act (S.C., 1999, c. 33).
- Environmental Management Act (S.B.C., 2003, c. 53).
- *Water Sustainability Act* (S.B.C., 2014, c. 15) and Water Sustainability regulation.
- B.C. Water Quality Guidelines for the Protection of Aquatic Life.
- CCME Water Quality Guidelines for the Protection of Aquatic Life.
- *Fisheries Act* (R.S.C., 1985, c F-14).
- Transportation of Dangerous Goods Act (S.C., 1992, c. 34).

- City of Delta Drainage Bylaw NO. 7162 (only for work on City of Delta land)
- City of Richmond Bylaw #8475, amendment #9950 (only for work on City of Richmond land)

10.3 Environmental Management

10.3.1 Best Management Practices and Guidelines

The following standard industry practices and guidelines are recommended for all work with potential to impact drainage and stormwater:

- Ministry of Water, Land and Resource Stewardship, Stormwater Planning: A Guidebook for British Columbia (MWLRS, 2002).
- Greater Vancouver Sewerage and Drainage District, Best Management Practices Guide for Stormwater (GVSDD, 1999).
- B.C. Ministry of Transportation and Infrastructure, 2020 Standard Specifications for Highway Construction (MOTI, 2020a).

10.3.2 Mitigation Measures

The following mitigation measures will be implemented at the direction of the Environmental Manager or QEP to avoid and reduce the potential impacts of Project construction to drainage and stormwater:

- Place physical barriers (berms, swales) to minimize construction affected water from mixing with stormwater, using clean, non-erodible granular materials like concrete blocks, silt curtains, booms, straw wattles, sandbags or straw bales, etc. as appropriate to the situation and on the direction of a QEP;
- Direct sediment laden stormwater to stormwater detention ponds created using the same methods as for berms and swales (above);
- Maintain original drainage patterns throughout construction, except where interceptor ditches or berms are required to divert sediment laden runoff from the site to a sediment control pond or filtration area;
- Design and construct sediment control ponds and interceptor ditches in accordance with the Standard Specifications for Highway Construction (MOTI, 2020a);
- Cover aggregate or soil stockpiles as directed by the Environmental Monitor, and locate stockpiles to avoid overland flow and sediment inputs into watercourses, and;
- Conduct regular inspections of all areas where materials are stored or activities are conducted that have potential to contaminate stormwater including aggregate or soil stockpile areas, construction areas, chemical and fuel storage areas, areas where vehicle or equipment maintenance takes place, and waste disposal areas.

Mitigations from the Fish and Surface Water Quality (section 8.0), Erosion and Sediment Control (section 9.0) and Solid Waste (section 14.0) management plans are allied to and provide benefit to drainage and stormwater management by controlling sediment inputs at the source and providing thresholds.

These mitigations are a key element in the management of accidents and malfunctions as described in the Project's Spill Prevention and Emergency Response Plan (section 15.0).

10.4 Key Environmental Performance Indicators

The environmental performance of drainage and stormwater management will be contractor's:

- Records of compliance with BC and CCME Water Quality Guidelines for Protection of Aquatic Life (Table Error**! No text of specified style in document.**-3) and City of Delta irrigation season conductivity threshold;
- Records of visual inspections of stormwater collection systems, stormwater flows, quality (i.e., odours, silt, debris, or sheen), and volume; and
- Compliance with the above mitigation shown by addressing reports of non-compliance within 48 hours, from the:

    a. Contractor's Environmental Manager;
    b. Ministry's Representative; and
    c. Independent Environmental Monitor (or the production of a plan within 48 hours to address non-compliances)

Contractor's compliance with design specifications (i.e., drainage performance objectives) are checked during the Ministry's construction period inspections, and confirmed at final sign-off.

10.5 Monitoring

Monitoring will be conducted to ensure that the drainage and stormwater system impacted by Project construction maintains or improves water quality and pre-Construction flow regimes. In addition to regulator inspection and during periods of inclement weather, storm drainage systems will be inspected throughout the day for the purpose of correcting any storm drainage system deficiencies immediately. At minimum, inspections will be completed at the start of the workday, mid-workday, and one hour before end of the workday, and if necessary, during regular work stoppage periods (e.g., weekends).

Monitoring of efficacy will be conducted per the process described in sections 8.5 and 9.5, using water quality guidelines (standards) as a measure of efficacy. Operational efficacy of stormwater and drainage systems will be checked against design specifications. Conformance with drainage and stormwater system specifications will be managed through the Ministry's contract management processes.

- Environmental Monitoring reporting requirements including management of non-conformances are further described in Section **Error! Reference source not found.**.

11. Concrete Management Plan

Concrete and grouting are common materials used in construction activities, and their improper use and storage or release into the environment has adverse impacts on the terrestrial and aquatic environment.

- The Concrete Management Plan describes how contractors will implement measures to manage concrete transportation, handling and use during Project construction to minimize the potential impacts of concrete works on the environment.

11.1 Potential Environmental Impacts

Construction of the Project will require concrete works. Concrete and concrete-associated washout have the potential to cause detrimental impacts on aquatic habitat and fish. These can include increased turbidity, changes in pH, changes in water and soil chemistry, and toxicity to aquatic and terrestrial flora and fauna.

11.2 Regulatory/Institutional Requirements

The contractors will comply with applicable legislation, regulations, bylaws, standards, codes of practice, guidelines, and other requirements, including:

- *Fisheries Act* (R.S.C., 1985, c F-14).
    - Under section 35(1) of the *Fisheries Act*, no person shall carry on any work, undertaking or activity that results in the harmful alteration, disruption or destruction of fish habitat.
    - Under section 36(3) of the *Fisheries Act*, no person shall deposit or permit the deposit of a deleterious substance of any type in water frequented by fish or in any place under any conditions where the deleterious substance or any other deleterious substances that result from the deposit if the deleterious substance may enter any such water.
- B.C. Water Quality Guidelines for the Protection of Aquatic Life.
- CCME Water Quality Guidelines for the Protection of Aquatic Life.

11.3 Environmental Management

11.3.1 Best Management Practices and Guidelines

The following standard industry practices and guidelines are recommended for all concrete works with the potential to impact the environment:

- Canadian Ready Mixed Concrete Association, Recommended Guideline for Environmental Management Practices for Canadian Ready Mixed Concrete Industry (CRMCA, 2004).
- Department of Fisheries and Oceans, Land Development Guidelines for the Protection of Aquatic Habitat (DFO, 1993).
- B.C. Ministry of Environment and Climate Change Strategy, A User's Guide to Working in and Around Water (BC ENV, 2005a).

- B.C. Ministry of Transportation and Infrastructure, 2020 Standard Specifications for Highway Construction (MOTI, 2020a).

11.3.2 Mitigation Measures

The following mitigation measures will be implemented by the contractors at the direction of the QEP or Environmental Manager to minimize the impacts of concrete works on the environment:

- Conduct all concrete works and grouting in an area that is isolated from fish-bearing waters or waters connected to fish-bearing waters. If this is not possible, use secondary isolation when concrete is poured within 5 m of fish-bearing or connected waters;
- Where secondary isolation is not feasible, use carbon dioxide to lower pH to 8.0 or below;
- Direct surface runoff away from concrete that has been poured within the previous 72 hours. If this is not possible, ensure that all concrete poured within the previous 72 hours is adequately isolated from surface flow;
- Isolate fresh concrete or cement from any watercourse for 48 hours after placement;
- Use impervious covers to protect fresh concrete pours from precipitation until the concrete cures, to prevent run-off of concrete-laden water, and use accelerants to quicken curing if they can be used in an environmentally safe manner (use to be determined by the QEP);
- Cover open bags of cement mix to protect them from precipitation, moisture, and wind;
- Place small concrete mixers on tarps, polyethylene sheets or other containment surfaces;
- Make the following materials available on site at locations for immediate deployment, and ensure construction personnel are trained in the use of carbon dioxide to manage pH:
    - Carbon dioxide tanks with regulators and diffusers, and;
    - Other clean-up material for spills of concrete products (e.g., shovels, containment socks).
- During any concrete pour within 15 m of, or in work areas above, the high-water mark of any watercourse, ensure that carbon dioxide tanks and suitable application devices (i.e., weighted soaker hoses) are available and ready for immediate use in case of a spill or emergency;
- Conduct all activities involving the use of concrete, cement, mortars, and other Portland cement or lime-containing construction materials in a manner that does not deposit sediments, debris, concrete (cured or uncured), or concrete fines into the aquatic environment, either directly or indirectly;
- Prevent water that has contacted concrete (uncured or partly cured) or Portland cement or lime-containing construction materials (such as the water that may be used for exposed aggregate wash-off, wet curing, equipment and truck washing) from entering the aquatic environment;
- Provide containment facilities at the site for the wash-down water from concrete delivery trucks, concrete pumping equipment, and other tools and equipment;
- Prevent concrete wastewater generated from on-site works such as green cutting from being pumped or released into any storm drainage or watercourse;
- Contain water that comes into contact with concrete (uncured or partly cured) until the pH of that water is restored to between 6.5 and 8.0 pH units, and the induced turbidity in receiving waters is less than 8 NTU where background is between 8 and 80 NTU, and less than 10% of background where background is greater than or equal to 80 NTU. Avoid discharge of concrete wash water directly to ground. Use Canadian Ready Mixed Concrete Industry (2004) – Truck

Wash Down on the Job after Unloading procedures. Capture and remove wash water for disposal at an approved offsite facility. If this is not possible, direct the wash water to a designated on site containment area; and

- Dispose of all concrete waste materials, including wastewater, at approved and designated registered disposal sites.

These mitigations are an element in the management of accidents and malfunctions as described in the Projects Spill Prevention and Emergency Response Plan (section 15.0).

11.4 Key Environmental Performance Indicators

The environmental performance of concrete management will be measured by contractors addressing reports of non-compliance with the above mitigation within 48 hours from the:

a. Contractor's Environmental Manager;
b. Ministry's Representative; and
c. Independent Environmental Monitor (or the production of a plan within 48 hours to address non-compliances).

11.5 Monitoring

During concrete and grouting activities in or near water, where there is a risk to the aquatic environment, the Environmental Monitor will conduct environmental monitoring of pH levels and turbidity/total suspended solid levels in adjacent waters to verify compliance with the B.C. and CCME Water Quality Guidelines for the Protection of Aquatic Life and the Ministry's 2020 Standard Specifications for Highway Construction (MOTI, 2020a). These standards will be used to test the efficacy of mitigation. The precise testing locations in watercourses adjacent to concrete works and frequency of testing will be determined by the Environmental Manager.

Reporting of this aspect of water quality monitoring (see also sections 8.0, 9.0, and 10.0) will be presented in daily monitoring logs, and externally in weekly, monthly and annual status reports that are distributed to the Ministry and the IEM.

- Environmental Monitoring reporting requirements including management of non-conformances are further described in Section 18.0.

12. Contaminated Sites and Soil Management Plan

This Contaminated Sites and Soil Management Plan describes the management of known and/or caused contamination and potential contamination within the Project area, to ensure compliance with all applicable Provincial and Federal legislation, regulations, standards, and guidelines.

This plan will ensure that the quality of soil or fill imported or relocated between Project locations or off-site is conducted in accordance with the *Environmental Management Act* and Contaminated Sites Regulation. This plan will also ensure that any water that is discharged from the Project is conducted in accordance with the applicable regulatory requirements and/or permit conditions.

The identification and management of potentially contaminated soil will be guided by Technical Circular T03-20 *Identification and Characterization of Potentially Contaminated Soil*, 2020. In the situation where more detail is required than is available in this plan, contractors will prepare more detailed site-specific or activity-specific mitigation per adaptive management procedures (section 1.7.6) and using the objectives and mitigation in this plan as a minimum.

12.1 Potential Environmental Impacts

Pre-existing contaminated soil and groundwater in the Project area may be encountered during construction. There is also a possibility that construction could create new contamination through material handling and equipment use. Both may cause the release of deleterious substances to soil, groundwater, surface water, vapour and/or drainage utilities and may adversely impacts on human health and/or the ecosystem health.

12.2 Regulatory/Institutional Requirements

For management, handling, and disposal of imported and exported soil and discharge of groundwater the contractors will comply with all regulatory and institutional requirements described in the following:

- Environmental Management *Act* (S.B.C., 2003, c. 53).
- Environmental Management Act*,* Contaminated Sites Regulation (B.C. Reg. 375/96).
- Environmental Management Act Hazardous Waste Regulation (B.C. Reg. 63/88).
- Workers Compensation Act (R.S.B.C., 2019, c. 1), including the Occupational Health and Safety Regulation (OHSR).
- Municipal and Metro Vancouver discharge bylaws (if applicable).
- Transportation of Dangerous Goods Act (S.C., 1992, c. 34).
- Spill Reporting Regulation (B.C. Reg., 187/2017).
- Canadian Council of Ministers of the Environment (CCME, 2016), Environmental Quality Guidelines.
- Fisheries Act (RSC 1985, c. F-14).

12.3 Environmental Management

12.3.1 Best Management Practices and Guidelines

The best practices for managing soil and groundwater during construction activities are provided in:

- Technical Circular T03-20 *Identification and Characterization of Potentially Contaminated Soil*, 2020: and
- B.C. Ministry of Transportation and Infrastructure, 2020 Standard Specifications for Highway Construction (MOTI, 2020a).

If new contamination is created due to construction activities, the contractor will be responsible to promptly mitigate, remediate, document and report per the Spill Response and Emergency Management Plan (section 15.0).

The contractor will contact the Environmental Manager and/or Environmental Monitor in the event they need clarification on the protocol in technical circular T03-20 or on its interpretation with respect to specific contaminated or suspect materials encountered during construction.

12.3.2 Mitigation Measures

The following summarizes measures for managing and mitigating confirmed and suspected soil and groundwater contamination in the Project area.

Soil and Groundwater Monitoring

The contractors will monitor imported and excavated soil and groundwater requiring disposal/relocation on an ongoing basis during construction, observing visual and olfactory indicators of contamination. The Environmental Monitor will also periodically monitor by similar methods.

Common indicators of contamination include:

- Unusual appearance and odour: colour, texture, and ambient odour indicating contamination;
- Staining — Typically, stained soil is darker and may have a “wet” appearance, but should not be confused with naturally occurring organic soils. Stained soils may have an oily feel. Staining is often accompanied by characteristic odours;
- Buried debris or artifacts that may indicate the presence of contamination (e.g., chemical containers, drums, automotive parts, cleaning rags, tanks, barrels, bottles, timbers, boxes or other containers that may have contained or are associated with hazardous materials), and;
- Spent abrasives, batteries, and metal filings.

Actions based on monitoring findings include:

- **Suspected Contamination** - If such evidence is encountered, constructors will immediately contact the Environmental Manager and the soil will be managed as suspect contaminated material.
- **Non-Suspect** - If soil and groundwater is excavated from non-suspect areas and shows no visual or olfactory evidence of being impacted, it is to be managed as non-suspect material.

Management of Known Contaminants

Soil that has been characterized in accordance with BC Ministry of Environment and Climate Change Strategy (TG-1) and T03-20 and classified as contaminated based on the applicable land use standards, must be managed as contaminated in accordance with the EMA and CSR. The contaminated soil could be relocated off-site to a licenced facility, relocated off-site under a Contaminated Sol Relocation Agreement (CSRA) or relocated on-site under a Waste Discharge Authorization (WDA). If/once the contaminated soil is relocated, there are reporting requirements as per the CSR and EMA.

Groundwater with known contamination must be managed in accordance with the EMA, CSR and any applicable permits. The Ministry's Project team will make available to their contractors all characterization information (i.e., analytical results) for such areas if previous assessment has already confirmed the presence of contamination. Future testing may disclose additional contamination, and those results will also be forwarded to the Ministry's contractors.

Contractors will update procedures per this CEMP to manage and dispose of newly disclosed contaminated media on the provision of future study or information provided by the Ministry.

Contractors will develop and implement a health and safety plan to mitigate any specific risks associated with the presence of contaminated media (see section 3.0).

If contaminated media are encountered, the contractor will notify the Environmental Manager and record the following information when exporting or treating known contaminated media:

- Location of known contaminated media;
- Date, time, and volume/quantity of contaminated media managed;
- Hauler used to remove contaminated media from the site or used to treat media prior to appropriate disposal;
- Classification of soil and water as per above in relation to Contaminated Sites Regulation (B.C. Reg. 375/96) soil/groundwater standards or applicable discharge requirements;
- Details of soil disposal or water disposal/treatment costs;
- Name and BC ENV Permit Number of licensed receiving facility, and;
- Details of soil disposal/receiving site (if not disposed at a licenced facility).

Management of Suspect Contaminants

Soil and groundwater monitoring by visual and olfactory methods will be completed in accordance with this Contaminated Sites and Soil Management Plan during all excavation and fill placement activities.

If evidence of suspect materials is encountered during monitoring, the contractors should immediately contact the Environmental Manager.

Suspect contaminated soils will be characterized in accordance with TG-1, and managed accordingly.

Contractors who excavate or encounter suspected contaminated soil should assume that the groundwater may also be contaminated. Groundwater samples representative of discharge water will be collected and analyzed by a Canadian Association for Laboratory Accreditation (CALA) accredited laboratory for appropriate constituents of concern prior to discharge, to confirm discharge water quality

relative to applicable regulatory requirements or permit conditions. Analytical results will be considered in determining suitable treatment and disposal options if discharge criteria are exceeded.

The contractors will also be responsible for evaluating the potential for air quality issues related to suspect contamination that may be encountered. The issues related to worker and public health and safety will be dependent on several factors, such as the physical and chemical nature of the suspect contaminant, and cannot be assessed until such time as suspect material is encountered.

Management of "Non Suspect" Contaminants

Material that is confirmed through characterization to meet applicable criteria or is excavated from non-suspect areas as per T03-20, may be reused on-site for backfill, or relocated off-site at the contractors' discretion. Material that is relocated off-site may require additional characterization specific to the receiving site.

Contractors will record the following information when exporting non-suspect soils, aggregate or fill:

- Location of excavation;
- Date, time and volume of soil moved off-site;
- Identity of hauler used to remove soil from the site;
- Analytical characterization results, and;
- Name and location of receiving facility.

Groundwater requiring discharge in non-suspect areas may initially be considered non-suspect. Additional water sampling and assessment may be required as per conditions in any relevant discharge permits. Corrective measures will be implemented immediately if constituent concentrations in discharge water exceed applicable discharge criteria or permit conditions.

Management of Imported Soils

The contractor will document the source of soils, aggregates, or other fill materials imported and, subject to audit, confirm that imported material meets appropriate quality guidelines as per the B.C. Contaminated Site Regulation (B.C. Reg. 375/96).

Contractors may be required to sample imported soil for selected contaminants prior to use on site (it is preferable to have the supplier provide verification of soil quality through chemical analysis).

- Imported soils intended for restoration must also be compatible with native soils, site-specific growing conditions, and the requirements of restoration plans.
-
- Contractors must track and record the following information when receiving soils, aggregate or fill from offsite sources:
- Source of soil, aggregate or fill including:
    - Company name;
    - Location;
    - Soil origin (civic and/or legal address), and;
    - Contact person.

- Type and volumes of material received;
- Analytical evidence of soil quality;
- Date and time received, and;
- Location of soil placement.

Tracking of soil imported to Project sites will be completed using a manifest from the source site to confirm that trucks and their materials are from an approved source site and to prevent unauthorized dumping of material from unknown sources.

12.4 Key Environmental Performance Indicators

The environmental performance of appropriate contamination and soil management will be measured by contractors compliance with Technical Circular T03-20, as demonstrated by reporting per the requirements of Appendix A of T03-20. Performance will also be measured by addressing reports of non-compliance with the above mitigation within 48 hours from the:

a. Contractor's Environmental Manager;
b. Ministry's Representative; and
c. Independent Environmental Monitor (or the production of a plan within 48 hours to address non-compliances).

12.5 Monitoring

Contractors will monitor for suspected contaminated media during construction as per the process described in section 12.3.2.1. Standards are published in BC Ministry of Environment and Climate Change Strategy (TG-1) and T03-20, and contamination based on the applicable land use standards must be managed in accordance with the EMA and CSR. This process is mandated under provincial legislation (EMA and CSR) has been confirmed as effective mitigation via these published government standards.

- Reporting on management of known or suspect contaminated media is required under the EMA and CSR. Contractors will maintain the required reporting records.

13. Hazardous Material and Fuel Management Plan

- Handling and disposal of hazardous materials are regulated under the B.C. *Environmental Management Act* (S,B.C., 2003, c. 53), B.C. Hazardous Waste Regulation (B.C. Reg. 63/88), and the Occupational Health and Safety Regulation (OHSR). Hazardous materials from construction and demolition sites are prohibited from disposal through routine solid waste programs. Hazardous materials include:
  - Lead based paints;
  - Asbestos;
  - Asphalt degreaser;
  - Oils;
  - Concrete products;
  - Paints;
  - Contaminated soils;
  - Pesticides;
  - Sealers;
  - Solvents;
  - Gasoline;
  - Fuel storage tanks; and,
  - Concrete laden wash water
- The objective of this Hazardous Materials and Fuel Management Plan is to provide mitigation measures to minimize the environmental risks and impacts from improper use and handling of hazardous materials and waste products. Where additional site-specific or activity-specific procedures are required to describe hazardous material or fuel management, contractors will follow the Adaptive Management procedures in section 1.7.6 of this CEMP, which at a minimum will be based on these objectives and mitigation. These additional procedures will be reviewed by the Environmental Manager and approved by the contractor's QEP and the Ministry's Representative.

13.1 Potential Environmental Impacts

Improper storage, handling, transportation, and disposal of hazardous materials can result hazardous leaks, spills, and explosions affecting public or worker health and safety, result in lethal or sub-lethal impacts to plants and animals, contaminate soil and water, and destroy or degrade habitat. Project construction may require the use and dismantling of materials containing hazardous materials. Environmental and Occupational Health and Safety legislation requires that regulated materials be identified and managed properly prior to construction activities.

13.2 Regulatory/Institutional Requirements

Contractors will store, transport, and dispose of hazardous materials in compliance with the following:

- Transport of Dangerous Goods Act (R.S.B.C., 1996, c. 458);
- Transportation of Dangerous Goods Act (S.C., 1992, c. 34);
- Environmental Management Act, Hazardous Waste Regulation;
- Public Health Act (S.B.C., 2008, c. 28);
- Fire Services Act (R.S.B.C., 1996, c. 144) and BC Fire Code Regulation (B.C. Reg. 263/2012);

- Canada Labour Code (R.S.C., 1985, c. L-2), and;
- Workers Compensation Act (R.S.B.C., 2019, c. 1), including the Occupational Health and Safety Regulation (OHSR).

Prior to construction or demolition works, the contractor will review site history and conduct on-site inspections of areas where there is a possibility of hazardous material presence (*e.g.*, hazardous materials stored in structures, as components of structures, or buried on site). Hazardous waste must not be mixed with other waste materials during storage, or transport, and must not be diluted.

13.3 Environmental Management

13.3.1 Best Management Practices and Guidelines

Contractors will minimize the production of hazardous materials in construction areas by reducing the use of hazardous materials on site and by recycling hazardous materials (if allowable).

Contractors will implement site-specific hazardous material management for each construction site and ensure that personnel handling hazardous materials have received proper training.

Hazardous material management at site will include the following elements:

- Inventory of known and potentially hazardous materials that may be stored and used on site during all phases of construction, including:
    - Volumes of materials;
    - Location of onsite storage areas;
    - Spill equipment, prevention and response plans for hazardous materials;
    - Safety Data Sheets where required, and;
    - List of employees trained to handle hazardous materials with contact information.
- On site storage procedures and handling requirements including temporary covers or containment/secondary containment measures and security measures (including signage)
- Description of routine, on site inspection programs of storage and handling areas referencing a schedule of inspection and responsible personnel including contact information;
- Up to date list of hazardous materials that may be recycled or that are destined for disposal, and information regarding transportation and receiving facilities for such materials, and;
- List of site-specific environmental sensitivities and sensitive areas, and required hazardous materials handling procedures to protect sensitive areas.
- During construction, site supervisors will meet regularly (at least monthly) with construction personnel and the Environmental Manager to review the results of inspections, reassess the risks for environmentally sensitive areas as needed, and identify opportunities for improving procedures.

13.3.2 Mitigation Measures

These mitigations are an element in the management of accidents and malfunctions as described in the Projects Spill Prevention and Emergency Response Plan (section 15.0).

General

These measures will be incorporated into hazardous material management and implemented on site:

- Outdoor storage of hazardous or potentially hazardous materials will be ≥ 30 m from woody vegetation and ≥ 6 m from stored chemical products, uncontrolled grasses or weeds, and fuel dispensers, according to the B.C. Fire Code Regulation.
    - Cover outdoor storage devices (e.g., drums) to reduce external water contamination.
    - Outdoor storage areas should be fenced and secured with locked gates when unattended.
- Purchase and store only what is needed on site in the immediate future (to limit on site storage demand);
- Read and follow the directions for all hazardous or potentially hazardous products and ensure Safety Data Sheets (SDS) for all hazardous material are readily available on site;
- Products will be stored in their original containers and labels maintained in good condition; protect labels with transparent tape when water may be present to maintain legibility:
- Use only correctly sized funnels to transfer hazardous materials between containers;
- Avoid mixing chemicals unless specified by the manufacturer;
- When using hazardous chemicals, follow instruction specified on the labels and use only in outdoor areas; if this is not possible, ensure the area is well-ventilated;
- Ensure employees wear all required personal protection equipment and are trained as needed in the handling of specific hazardous materials;
- Keep corrosive chemicals away from flammable chemicals;
- Try to substitute non-hazardous chemicals for hazardous chemicals wherever possible;
- Do not discharge thinners and solvents into sanitary or storm sewers or any watercourse;
- Use high-pressure and -temperature water washes or steam cleaning instead of thinners and solvents;
    - Wash water discharged to sewer cannot exceed the discharge limits set by municipalities, regional districts, or the provincial government (as applicable) – see section 8.0, and;
    - Small parts can be cleaned with degreasing solvents that are reused or recycled.
- Sandblasting grits may contain hazardous material if they are used to strip lead, cadmium, or chrome based paints; they must be collected, and disposed of at a licensed facility, and;
- Routinely inspect storage areas and containers for leaks, and document all leaks, containers found in poor condition or improperly sealed, and any other problems that have the potential to result in the spill or release of a hazardous substance.

Petroleum Products

Petroleum products commonly used during construction include fuels (*e.g.,* gasoline, diesel, kerosene) and lubricating oils and grease. Oil and oily waste products generated at construction sites include crankcase oil, cans, rags, filters and leaking equipment (Gibb *et al.*, 1999). Waste oils should not be mixed with degreasers, solvents, antifreeze or brake fluid, but should be stored in leak proof containers (such as sealed drums) for off site disposal at a designated licensed facility.

The following guidelines must be followed when storing petroleum products:

- Store petroleum products in weather resistant facility, such as a shed or covered cage;

- Line the floor of the petroleum storage area with plastic sheeting, or a similar impermeable barrier material;
- Build an impervious barrier around the perimeter of the storage area; the capacity of the bermed area should be ≥ 110% of the largest container in storage;
- Keep storage tanks off the ground and keep all lids securely fastened, and;
- Post a visible spill response plan for petroleum products in the storage area and keep well-labelled spill response equipment nearby.

Fueling and Equipment Operation

Trucks and other machinery should be fuelled off site whenever feasible, on a concrete surface or an area of clay or till. Fuel dispensing must comply with the *Fire Services Act*, and the BC Fire Code Regulation. Shut-off nozzles will be installed on dispensers that have a capacity > 250 L. If fueling must be done on or near the site, it shall be prohibited in the following areas:

- Riparian areas, or within the maximum wetted perimeter of a watercourse;
- Environmentally Sensitive Areas;
- Inside established sediment control structures, and;
- Within the drip line of protected trees.

External equipment surfaces will be free of oil, diesel fuel, and all contaminants prior to use near ditches, watercourses, or other environmentally sensitive areas. Fuel-dispensing equipment will be checked for leaks and repaired or replaced if any are identified. Equipment should be serviced > 30 m away from any watercourse or catch basin. Containment devices such as drip pans will be used wherever possible to prevent spills of oils and other petroleum products during servicing. Fuel that is accidentally lost or leaked during fuelling or servicing of equipment will be contained, cleaned up, and disposed of off site in compliance with applicable regulations. Wash water used to clean equipment will be managed appropriately (e.g., captured and store or discharged to designated treatment areas).

Hazardous Waste Contaminated Soils

Soils classified as hazardous waste identified in construction areas will be managed and handled as per the Contaminated Sites and Soil Management Plan of the CEMP (section 12.0) and the Hazardous Waste Regulation (BC Reg. 64/2021).

13.4 Key Environmental Performance Indicators

The environmental performance of hazardous material and fuel management will be measured by contractors addressing reports of non-compliance with the above mitigation within 48 hours from the:

a. Contractor's Environmental Manager;
b. Ministry's Representative; and
c. Independent Environmental Monitor (or the production of a plan within 48 hours to address non-compliances).

13.5 Monitoring

Environmental audits conducted by the Environmental Manager or Monitor, the Ministry's Representatives or the IEM will check that the contractor is:

- Using properly located and secured storage areas with appropriate secondary isolation;
- Inspecting storage areas;
- Maintaining an updated inventory of hazardous substances on their respective sites;
- Making Safety Data Sheets (SDS) readily accessible on site;
- Using licensed haulers for transport of hazardous materials and other dangerous goods;
- Using qualified and reputable subcontractors for regulated building material abatement, and;
- Following all applicable procedures reflecting regulatory/institutional requirements and/or environmental best practices.

Reporting of hazardous waste management will be presented in daily monitoring logs, and externally in weekly, monthly and annual status reports that are distributed to the Ministry and the IEM. The IEM will provide updates and opinions on compliance to the Ministry and Indigenous groups.

- Further requirements for environmental monitoring are described in Section 18.0.

14. Solid Waste Management Plan

- Construction will produce various forms of solid waste including: land clearing debris, demolition debris, surplus or defective construction materials, waste concrete and garbage (e.g., waste food and paper produced by workers). This plan aims to reduce waste and to comply with relevant regulatory requirements (section 14.2). This plan includes commercially reasonable efforts to sort solid waste on-site for reusing and recycling. Hazardous materials and hazardous wastes are discussed in Section 13.0.

14.1 Potential Environmental Impacts

Construction waste, if not properly controlled, may be unsightly and potentially pose a risk to the environment, as well as to human health and safety. In addition, some solid wastes may attract wildlife to the Project site, putting the health and safety of wildlife and humans at risk.

14.2 Regulatory/Institutional Requirements

Contractors will be required to comply with applicable legislation, regulations, bylaws, standards, codes of practice, guidelines, and other requirements:

- Environmental Management Act (S.B.C., 2003, c. 53).
- Hazardous Waste Regulation (B.C. Reg. 64/2021).
- Recycling Council of British Columbia (various initiatives and publications).
- Greater Vancouver Sewerage and Drainage District (GVSDD) Municipal Solid Waste & Recyclable Material Regulatory By-law No. 181, 1996, as amended by By-law No. 183, 1996.

14.3 Environmental Management

14.3.1 Best Management Practices and Guidelines

The following industry practices and guidelines are recommended to manage solid waste generation:

- Canadian Construction Association, Best Practice Guide Solid Waste Reduction (CCA 2001).
- B.C. Recycles, British Columbia's Recycling Handbook (BCR, 2015).

14.3.2 Mitigation Measures

The following mitigation measures will be implemented at the direction the QEP to manage solid waste:

- Implement a waste minimization policy for procurement of construction materials and services (e.g., request suppliers to minimize packaging);
- Minimize clearing and grubbing activities to minimize the production of vegetative waste;
- Salvage and stockpile any stripped organic materials with potential for beneficial use (i.e., reclamation/vegetation) and properly stockpile it outside environmentally sensitive areas;
- Implement site security and/or individually secure bins to prevent public access to bins;

- Contain all garbage and construction wastes and dispose of them at a licensed disposal facility in compliance with applicable legislation and regulations of all authorities having jurisdiction;
- Appropriately and clearly label disposal containers for different types of salvageable, recyclable, and other waste, and place the containers throughout the site;
- Leave no trash, litter, or waste materials uncontained on or around the work site;
- Allow no waste including sanitary waste, to be disposed of, buried, dumped, or stockpiled on site or within any waterbody;
- Maintain site cleanliness (i.e., good housekeeping) by cleaning up and frequently disposing construction debris, garbage, and other non-hazardous solid waste materials;
- Collect domestic waste (including food) daily during construction and store in closed, animal-resistant containers to prevent access by bears, rodents, birds, and other wildlife;
- Provide portable toilets for workers. Secure these sanitary facilities to prevent toppling, and locate them at least 15 m from sensitive environmental features and waterbodies;
- Maintain cleanliness of and supplies in the sanitary facilities, and arrange for them to be emptied by a licensed waste contractor at regular intervals for the duration of construction;
- Manage concrete-related waste according to its characteristics (cured, uncured, wash-water) and according to the Concrete Management Plan (Section 11.0);
- Manage contamination per the Contaminated Sites and Soil Management Plan (section 12.0);
- Manage hazardous materials, fuel transportation, storage, and transport according to the Hazardous Material and Fuel Management Plan (Section 13.0), and;
- Recycle waste materials wherever possible / allowable.

These mitigations are an element in the management of accidents and malfunctions as described in the Projects Spill Prevention and Emergency Response Plan (section 15.0).

14.4 Key Environmental Performance Indicators

The environmental performance of solid waste management will be measured by contractors addressing reports of non-compliance with the above mitigation within 48 hours from the:

- Contractor's Environmental Manager;
- Ministry's Representative; and
- Independent Environmental Monitor (or the production of a plan within 48 hours to address non-compliances).

14.5 Monitoring

The Environmental Monitor will routinely (at least weekly for every active site) monitor the contractor's implementation of adequate "housekeeping" and prevention of excessive accumulation of solid waste (per mitigation in section 14.3). The Environmental Monitor will check that solid waste is being collected in designated areas or containers and removed to an approved facility and will track efforts to reduce, reuse and recycle solid waste. Reporting of waste management mitigation efficacy will be presented in daily monitoring logs, and externally in weekly, monthly and annual status reports that are distributed to the Ministry and the IEM.

- Environmental monitoring reporting requirements are further described in Section 18.0.

15. Spill Prevention and Emergency Response Plan

Contractors will implement this Spill Prevention and Emergency Response Plan to address regulatory and institutional requirements relating to spill reporting and other spill/emergency management requirements. The purpose of this plan is to:

- Identify planning processes and preventive measures that will be implemented to mitigate the risk of spills or other environmental incidents;
- Provide guidance for contractor's to develop contractor-specific or site-specific spill prevention & emergency response plans to address more complex situations;
- Facilitate effective response to environmental emergencies such as spills of hazardous materials to water, land, and air, and;
- Outline the responsibilities of environmental personnel that may be involved in spill and emergency management, including the Environmental Manager and Environmental Monitor.

The Spill Prevention and Emergency Response Plan addresses on-site construction activities as well as off-site transportation of dangerous goods or other hazardous chemicals. The Spill Prevention and Emergency Response Plan is the key means for preventative identification of, and management for, accidents and malfunctions. The implications of accidents and malfunctions are manifest most commonly on the environment due to spills and other non-intended inputs of deleterious materials to land, air or water. This plan, and many of the other component plans in this CEMP, address those needs.

15.1 Potential Environmental Impacts

Project construction presents the possibility of accidents and malfunctions that may create fuel and chemical spills. Such incidents can cause health and environmental concerns for soil, water, wildlife, vegetation, and human health & safety. This plan describes the contractor's spill prevention & emergency response requirements.

15.2 Regulatory/Institutional Requirements

Implementation of this Spill Prevention & Emergency Response Plans will meet regulatory requirements and will consider all applicable standards and codes of practice. Requirements are:

- Environmental Management Act (S.B.C., 2003, c. 53)
- Hazardous Waste Regulation (B.C. Reg. 63/88)
- Contaminated Sites Regulation (B.C. Reg. 375/96)
- Spill Reporting Regulation (B.C. Reg., 187/2017)
- Canadian Environmental Protection Act (S.C., 1999, c. 33)
- Emergency Management Act (S.C., 2007, c. 15)
- Fisheries Act (R.S.C., 1985, c F-14)
- Canada Navigable Waters Act (R.S.C., 1985, c. N-22)
- Transport of Dangerous Goods Act (R.S.B.C., 1996, c. 458)
- Transportation of Dangerous Goods Act (S.C., 1992, c. 34)

- B.C. Ministry of Environment and Climate Change Strategy, Guidelines for Industry Emergency Response Plans (BC ENV, 2020)
- *Workers Compensation Act* (R.S.B.C., 2019, c. 1), including the Occupational Health and Safety Regulation (OHSR).

Some regulatory requirements and codes of practice referred to in other component plans also apply to spill prevention.

15.3 Spill Prevention & Emergency Response Plan Components

This Spill Prevention and Emergency Response Plan contains the key components required for effective preventative identification and management. A policy statement; hazard identification; risk management (possibly including additional risk assessment, analysis and/or evaluation at the site level); reference to applicable legislation and industry standards; and emergency response team organization and responsibilities.

15.3.1 Policy Statement

This Spill Prevention and Emergency Response Plan represents a Project commitment to protecting the health and safety of workers, the public, and the environment.

15.3.2 Hazard Identification

Hazard identification has been pre-emptively conducted based on section 8.0 of the George Massey Tunnel Replacement Project effects assessment application, Project activities and likely incident types, and their interactions with the human and natural environment. Ongoing hazard identification / evaluation will be periodically completed when activities or conditions introduce new conditions.

The purpose of hazard identification is to identify potential on- and off-site hazards, including environmental damage or other consequences that may result from a spill or incident (taking into account the environmental setting, the type of construction activity, climate conditions, and non-project influences). Hazard identification for this Project was conducted as per MWLRS (2002) and included:

- Assessment of construction site conditions, focusing on:
    - Proximity of vehicles and equipment to watercourses and other environmentally sensitive areas, storm water conveyances, areas of known contamination, and the potential for contamination to spread offsite as a result of construction;
    - Pathways to the environment (air, land, water) in the event of a spill, the potential impacts of a spill on air and water quality, and identification of any risk to human or wildlife health;
    - Access/egress for emergency vehicles and available area on site for the mobilization of clean-up equipment in the event of a spill, and;
    - Security requirements to prevent the public from accessing construction sites and to protect vital information and resources that may be needed in the event of an emergency.
- Compilation of chemical, physical, and toxicological information on all chemicals that might be handled on site. The contractor will maintain SDS sheets for all chemicals in use on their site(s) as per section 13.0 of this CEMP.

- Three incident types relevant to the Project were identified:
    1. Incidents involving the release of contaminants or hazardous / deleterious materials from or due to vehicle accidents or malfunctions (hydrocarbon fuels, lubricants or concrete);
    2. Structural failure of a ditch, detention pond or sediment containment area – flooding, erosion, sedimentation or release of deleterious materials; or
    3. Damage to utilities resulting in release of deleterious materials and or danger to humans

15.3.3 Risk Management

An understanding of the risk associated with a potential spill or environmental emergency requires consideration of the likelihood or such an event occurring and its potential consequences. Risk management was conducted as per BC ENV (2020) and included:

- Identifying on-site and off-site hazards of anticipated construction activities (contaminant release / spill from or due to vehicles including accidents, ditch or detention pond failure, and damage to utilities);
- Identifying potential failures or accidents (including their anticipated frequency);
- Calculating the quantity of material that may be released in failures or accidents, and;
- Evaluating the consequences of such occurrences (to the environment as well as to the safety of construction personnel and the public).

Measures to reduce or otherwise mitigate risk were included in the analysis. Predictive environmental hazard identification and risk assessment/analysis has inherent uncertainty. Ongoing hazard identification and risk assessment/analysis to update this Spill Prevention and Emergency Response Plan will be conducted by contractors as part of development and formalization of work methods for specific construction activities. Such updates will include the mitigation in this plan at a minimum.

15.3.4 Applicable Legislation and Industry Standards

Relevant regulatory requirements are listed in section 15.2. Reportable spill volumes are listed in the Spill Reporting Regulation, and for all spills of hazardous or deleterious substances near or in water, and most elsewhere, must be reported.

15.3.5 Emergency Response Team Organization and Responsibilities

Each contractor will augment this Spill Prevention and Emergency Response Plan with a site-specific table and accompanying text that is not currently available and that identifies:

- The contractor's incident response organizational hierarchy, including organizational chart and call-out list with names and contact numbers, and;
- The role and responsibilities (e.g., decision-making authority and communication priorities) of all individuals or positions described in the organization chart.

The organizational chart will describe how the contractor will coordinate with the Ministry and the Environmental Manager for managing and reporting of spills and emergencies. The organizational chart will include names, telephone numbers, and email addresses of listed personnel.

15.4 Notification and Reporting

The contractor's procedures for prompt internal and external notification of spills and emergencies, as well as procedures for subsequent preparation of written incident reports are provided below.

15.4.1 Internal Notification

Notification within the contractor's own organization is predicated on prompt contact with internal safety and environmental personnel. Internal notification will include contractor call-out to the Ministry.

Contractors (either directly, or through safety personnel) will notify the Environmental Manager immediately of any "reportable spill". Generally, a "reportable spill" is one that must be reported to an outside agency by law, regulation, or agreement.

Once notified by the contractor, the Environmental Manager will notify the Ministry Representative and relevant personnel and authorities as per the external notification procedure below. Internal notification will provide information as below for external notification.

15.4.2 External Notification

The contractor will provide notification to regulatory agencies or other external authorities as required by law, regulation, agreement or other requirement. In addition, the contractor may need to contact external agencies to request assistance in providing suitable incident response.

All spills must be reported immediately to the Provincial Emergency Program's Spill Reporting Hotline:

- **Emergency Management BC (Spill Reporting Hotline): 1-800-663-3456**

If emergency response or assistance is required contact one or both of the following immediately:

- Fire, RCMP, and Ambulance Service: 911
- Canadian Coast Guard Hotline: 1-800-889-8852 (for marine incidents only)

Report to the applicable municipal authority in which the spill or affected area occurs:

- City of Richmond Hotline: 604-276-4316
- City of Delta Hotline : 604-946-4141
- Metro Vancouver Hotline (if the spill enters the regional sewer system): 604-299-2832

For incidents related to utilities contact the following:

- BC Hydro: 1 888 769 3766 (for electricity distribution interactions)
- Fortis BC: 1-800-663-9911 (for gas pipeline interactions)
- Metro Vancouver Hotline: 604-299-2832 (for water supply or sewer interactions)

Once the affected area is out of immediate danger, or within 24 hours, a report must be made to the appropriate Federal authorities:

- Environment and Climate Change Canada (24-hour hotline): 604-666-6100
- Department of Fisheries and Oceans (24-hour hotline): 604-666-3500

Contractors will be prepared to provide external agencies with the following information:

- Name and contact information of caller;
- Date and time of call;
- Estimated time of spill/release;
- Type of hazardous material spilled or released;
- Evacuation required (Yes/No);
- Estimated quantity of hazardous material spilled or released;
- Spill response completed prior to reporting, and;
- Assistance required, if any, to successfully contain and clean up the spill.

- Do not delay making an external notification contact while waiting for full information; follow-up contact to complete the information requirements is preferrable to a delay in incident response.

15.4.3 Incident Reporting Guidelines

Following initial notification, the Environmental Manager will provide timely written incident report(s) to the Ministry, Independent Environmental Monitor, and Identified Indigenous Groups. Incident reports identify the contractor, date, time, location, hazardous materials involved, owner of the substance, volume/quantity, source, and persons or organizations notified. Incident reports are expected to describe how the spill or release occurred, what remedial action was taken or is planned, and what actions will be implemented to prevent a recurrence. Reports to Emergency Management BC are required at least once every 30 days since the date of the spill, or when new information is available.

Contractors will also keep written records of "non-reportable" spills or environmental incidents and provide these to the Ministry and Independent Environmental Monitor upon request.

A sample spill report form with minimum requirements is provided below (**Error! Reference source not found.**); the contractor will ensure that all required information is reported on the spill report form during Project construction. Further details about the incident reporting responsibilities of the contractors and Environmental Monitor are described in Section 18.0.

- After the incident response is complete, a director under the *Environmental Management Act* may also order the responsible person to create a "lessons-learned" report if a spill meets certain criteria decided by the regulator. Reporting requirements also include submitting written spill update reports and a written end-of-spill report to the Ministry of Environment and Climate Change within 30 days of the emergency response completion date.

16. Heritage Resources Management Plan

The Heritage Resources Management Plan describes mitigation measures required to avoid or minimize potential adverse effects to archaeological and historical sites, features and objects during Project construction, as well as the Indigenous consultation, monitoring, and reporting activities to be undertaken in support of implementation of the plan.

This Heritage Resources Management Plan

- Identifies potential Project activities that could result in effects to heritage sites;
- Describes regulatory/institutional requirements for the management of heritage resources;
- Describes methods to avoid and minimize potential adverse effects; in particular, procedures to address the discovery of a previously unidentified heritage resource during construction (commonly referred to as a "late find"); and
- Details a monitoring and reporting program to be used in determining if these methods are effective and if any changes to these mitigation measures are required.

16.1 Potential Impacts to Heritage Resources

No heritage sites have been identified within the Project area. However, previously unassessed areas of the Project that are considered by the QEP to have archaeological potential, will be subject to inspection by the QEP under the terms and conditions of a Heritage Conservation Act (HCA) Inspection Permit (S. 12.2) and Heritage Investigation Permits issued by affected Indigenous communities. Areas of identified heritage potential which cannot be assessed prior to the commencement of Project work due to safety or logistical considerations will be assessed by the QEP concurrently during construction under the terms and conditions of an HCA Inspection Permit (S. 12.2) and heritage investigation permits issued by Indigenous communities, consistent with the B.C. Ministry of Forests, Archaeological Impact Assessment Guidelines (MoF, 1998) (see Section 16.3 below).

If present, Project site preparation activities including clearing and excavation have the potential to disturb or alter unrecorded heritage sites within the Project area.

16.2 Regulatory/Institutional Requirements

All heritage sites located on Provincial Crown or private land that predate or are assumed to predate AD 1846 are automatically protected under the HCA. Certain sites, including burials and rock art sites that have historical or archaeological value, are also protected under the HCA regardless of age. Heritage wrecks, consisting of the remains of vessels and aircraft after two or more years since they sank, crashed, or were abandoned, including being placed in terrestrial environment as part of landfill, are also protected.

Historical sites that are not protected by the HCA (i.e., post-1846) may be protected by municipal by-law, under the authority of the Local Government Act. These sites are usually documented on Municipally administered Community Heritage Registers (CHR), the Provincial Heritage Register (PHR), and the Canadian Register of Historic Places. A CHR entry generates a degree of recognition for these sites;

however, without a site-specific protection mechanism such as a heritage designation by-law, heritage revitalization agreement by law, or heritage restrictive covenant, inclusion on a CHR, the PHR, and/or the Canadian Register of Historic Places does not provide automatic protection for these sites.

Among the affected Indigenous communities, the xʷməθkʷəy̓əm (Musqueam Indian Band), səlilwətaɬ (Tsleil-Waututh Nation), Katzie First Nation, sə́y̓em̓ (Kwantlem First Nation) and Stó:lō have developed their own heritage policies and permitting system. The QEP has applied for heritage investigation permits from each of these groups and to the degree possible, will adhere to their terms and conditions, recognizing the Archaeology Branch is ultimately responsible for decisions concerning heritage resources in British Columbia.

Section 165.20 of the Ministry Standard Specifications for Highway Construction (MOTI 2020a) states that: includes impact mitigation requirements which are described in the following section.

16.3 Mitigation Measures

Should the pre-construction inspection of areas of archaeological potential result in a heritage site discovery, the terms and conditions of the HCA Inspection Permit and heritage investigation permits issued by affected Indigenous communities will be followed. Initial steps will include a temporary cessation of inspection work and the QEP will notify the Archaeology Branch, Indigenous communities, and the Ministry of the discovery.

Subsequent steps to characterize and assess the significance of the site will be discussed with all parties, then implemented by the QEP per the terms and conditions of the HCA Inspection Permit and heritage investigation permits issued by affected Indigenous communities. Following site characterization, the QEP will propose mitigation options to the Archaeology Branch that consider the views of affected Indigenous communities and will generally follow the mitigation hierarchy (i.e., enhance, avoid, minimize, restore, offset). Requirements for additional heritage work will be determined by the Archaeology Branch after considering the QEP's recommendations and the views of affected Indigenous communities.

Mitigation requirements may include no further archaeological work or actions consistent with the mitigation hierarchy and relevant to the circumstances of the discovery. Section 165.20 of the Ministry Standard Specifications for Highway Construction (MOTI 2020) describes mitigation options that may be considered, including the establishment of buffer zones, drainage or erosion control, slope stabilization measures, erecting fences, or other suitable barriers to protect archaeological sites. Additional options such as intentional site burial (i.e., capping) are described in a comprehensive technical report by English Heritage (2004). Mitigation design and implementation will be overseen by the QEP with participation from affected Indigenous communities and support from the contractor and Ministry.

As noted in Section 16.1, areas of identified heritage potential which cannot be assessed prior to the commencement of Project work due to safety or logistical considerations will be assessed by the QEP concurrently during construction under the terms and conditions of an HCA Inspection Permit and heritage investigation permits issued by affected Indigenous communities, consistent with the BC Archaeological Impact Assessment Guidelines (MoF, 1998). Should the monitoring of construction result in a site discovery, the process outlined above for the discovery of a heritage site during pre-construction inspection of areas of archaeological potential will be followed. Construction activities in the vicinity of

the site will need to be suspended until Archaeology Branch requirements have been met as outlined above.

Areas of the Project that are not considered to have archaeological potential will be subject to periodic spot checks by the QEP and affected Indigenous community representatives. The purpose of these spot checks is to confirm ground conditions and prior assumptions concerning archaeological potential. The timing, frequency and location of the spot checks will be at the discretion of the QEP, with due consideration of the wishes of affected Indigenous communities. Should a spot check lead to a site discovery, the process outlined above for the discovery of a heritage site during pre-construction inspection of areas of archaeological potential will be followed by the QEP. Should an area of archaeological potential be identified during a spot check, assessment concurrent with construction monitoring as outlined in the paragraph above will be followed by the QEP.

Consistent with Section 165.20 of the Ministry Standard Specifications for Highway Construction (MOTI 2020), mitigation measures will include the implementation of an Archaeological Chance Find Management Plan by the contractor (Appendix A). An archaeological chance find management plan provides the Contractor with general guidelines for the appropriate response to the discovery of known or suspected archaeological materials, including human remains, during Project activities while an archaeologist is not on site. The contractor's Environmental Monitor will receive training from the QEP on implementation of the Archaeological Chance Find Management Plan and the contractor's "on-boarding" process for site personnel will include Archaeological Chance Find Management Plan awareness training. The contractor's daily health and safety tailgate meeting will include menti0n of the potential for the discovery of chance finds during construction and steps to be followed consistent with the Archaeological Chance Find Management Plan (Appendix A).

16.4 Key Environmental Performance Indicators

The key Heritage Performance Indicators are records of:

- Previously unassessed areas of Project that are considered by the QEP to have archaeological potential, being subjected to inspection by the QEP under the terms and conditions of an HCA Inspection Permit and heritage investigation permits issued by Indigenous communities.
- Areas of identified heritage potential which cannot be assessed prior to the commencement of Project work due to safety or logistical considerations being assessed by the QEP concurrently during construction under the terms and conditions of an HCA Inspection Permit and heritage investigation permits issued by affected Indigenous communities.
- Areas of the Project that are not considered to have archaeological potential being subjected to periodic spot checks by the QEP and affected Indigenous community representatives.
- British Columbia Archaeological Site Inventory Forms being prepared by the QEP for newly discovered heritage sites;
- Conduct of Archaeological Chance Find Management Plan training for the contractor's Environmental Monitor by the QEP.
- Archaeological Chance Find "call-outs" documented by the QEP and detailed in technical memoranda which will be shared with affected Indigenous communities and the Archaeology Branch; and

- Non-compliance with the terms and conditions of HCA Permits or this Heritage Resources Management Plan documented by the QEP and reported to the Archaeology Branch and Indigenous communities, and with corrective actions proposed by the QEP. Approved corrective actions will be implemented by the QEP.

In addition to the indicators noted above, the effectiveness of the Heritage Resources Management Plan will be reviewed by the QEP on quarterly basis to confirm its efficacy and suitability in relation to ongoing construction activities. If considered necessary, the Heritage Resources Management Plan will be amended by the QEP to better safeguard and manage heritage resources.

16.5 Monitoring

- Mitigation for the management of heritage in association with development projects is developed on a site-specific basis when heritage resources are found. Any activities associated with the post-discovery management of heritage resources are subject to permitting requirements under the HCA, which includes monitoring and reporting to the Archaeology Branch and Indigenous communities per the requirements of permits and authorisations (see section 16.2).

17. Site Restoration Plan

Landscaping activities will range from simple site restoration, including hydro seeding and other simple re-vegetation, to design and implementation of ecological restoration (watercourses only). The following is a general description of restoration and soft landscaping requirements that are anticipated under the contractors' scope:

- Restoration of areas temporarily disturbed by construction (including interim site restoration of areas that will be handed to another contractor before construction is completed); and,
- Indigenous traditional knowledge and Indigenous traditional use information shared with the Project has been and will be further considered and incorporated in design and implementation of restoration. Specifically the suggestion to use existing vegetation in the project area to guide revegetation.

17.1 Potential Environmental Impacts

Construction activities will result in ground disturbance, including regrading as well as clearing and grubbing of vegetation. Areas that are disturbed during construction will be restored to their original functional intent to meet the Ministry's right-of way management or permit requirements (i.e. WSA).

17.2 Regulatory/Institutional Requirements

Landscape design and restoration requirements are driven by the requirements of the agreements with municipal authorities, requirements of relevant legislation, regulations or permits. Landscaping and arboricultural standards including the BC Landscape Standard (BCSLA, 2012) may be used.

17.3 Interim Site Restoration

Once work is completed at a location, and prior to demobilizing equipment and crews, contractors will implement interim site restoration measures. Depending on subsequent plans for the site, the contractors will either restore the site to original condition, or provide interim restoration until others can complete final restoration and/or landscaping. Interim site restoration prescriptions include some important substrate management methods that are needed before final landscaping begins:

- Contouring the site to make it free-draining (unless a wetland or pond is planned);
- Restoring functional drainage;
- Surface roughening, including stair-step grading, grooving and tracking to reduce overland flow and provide plant establishment sites. Stair-step grading or grooving can only be conducted in disturbed areas that will not require post-treatment mowing and is not suitable in mowed rights-of-way. Tracking with bulldozer treads is not recommended as it compacts soil and increases runoff rates and subsequent soil erosion;
- Slope breaks installed to reduce slope length and decrease erosion potential on slopes >2:1. Possible methods include installing wattles, creating grooves, or grading flat sections parallel to the contour. Graded areas should be seeded as soon as possible, and the slope should be

checked regularly for evidence of erosion e.g., rills. If there is evidence of erosion the slope should be re-graded and re-seeded, and;

- Revegetation hydro-seeding with Ministry approved erosion control seed mix, or another form of erosion protection (e.g., erosion control blanket, cover with poly). In most of the right-of-way, hydro seeding will be the final landscape treatment. Hydro-seeding prescriptions reduce the attractiveness for wildlife in an ecological sink with a high risk of vehicle collisions.

Temporary soil stabilization will be conducted in areas that may be unvegetated for more than seven days but where permanent restoration is not needed. Stabilization can be achieved by seeding with grasses and legumes, mulching, and protection from traffic and watering as needed (Gibb *et al.*, 1999):

- Seedbeds should be prepared prior to planting, with approximately 50 mm to 100 mm of topsoil applied to the planting area and texturing conducted perpendicular to the slope;
- Seeding should be completed between April 1 and June 30 and September 1 through October 31; planting conducted between November 1 and March 31 will likely require protection with mulching, and;
- Native seed mixes suited to site-specific conditions should be used wherever possible (example shown in Table Error**! No text of specified style in document.**-4). Seed mixes to be determined through discussion with the Ministry and their expert consultants. Observations of existing plants in the Project alignment will be used to inform prescriptions for planting.

Table Error! No text of specified style in document.**-4 Example South Coast standard seed mix recommended by the Ministry**

Common Name	Latin Name (native unless noted*)	% of Mixture
Perennial rye grass	*Lolium perenne L. **	37%
Creeping red fescue	*Festuca rubra L.*	29%
Hard fescue	*Festuca ovina*	17%
Timothy	*Phleum pratense*	9%
Canada Bluegrass	*Poa compressa L. **	5%
Redtop	*Agrostis alba **	3%

Note: for coastal locations with >90cm annual precipitation

Source: (MOTI, 2020b), Section 757: Revegetation Seeding

- Mulching and matting on newly seeded areas, or on slopes that cannot be seeded, could use straw, wood chips, bark, wood fibre, nets and mats, chemical mulches and soil binders (Gibb *et al.*, 1999). Use of straw (draws water into the soil surface) and wood chips (depletes nitrogen levels in soils during break down) may not be appropriate for all planting areas.
- Sod can be used to stabilize fine-grained, exposed soils in areas where more complex vegetation communities may be inappropriate due to safety and operational constraints. Sod placement should begin low on the slope , with strips of sod placed perpendicular to the direction of water flow. Sod should be fitted closely to eliminate gaps between the strips and should be anchored at the corners to prevent the sod from curling away from the soil surface.

17.4 Site Landscaping Measures

17.4.1 Top Soiling

Exposed surfaces that will be landscaped after construction typically require topsoil augmentation to support plant growth. Prior to applying topsoil, exposed areas should be raked to remove organic and construction debris that is >50 mm in diameter (MOTI, 2020b). Once these surfaces are raked, they should be scarified to ≥150 mm depth. These areas should then be covered by topsoil that is moist (25% to 75% field capacity). Topsoil should not be applied when it is wet or frozen.

17.4.2 Permanent Site Restoration Using Plants

Permanent seeding and planting plans will be incorporated into the final landscape designs for the Project. The following design criteria are recommended for final planting plans (Gibb et al., 1999):

- Seeding will be completed immediately after final shaping, except when final shaping occurs between November 1 and March 31, when mulching or protection with plastic covers are better suited to preventing soil erosion. Seed application rate will be approximately 136 kg/ha;
- Runoff control measures like gradient terraces, berms and level spreaders will be installed prior to planting the site;
- Compacted soil surfaces will be scarified to roughen the surface and promote plant growth;
- Apply soil amendments such as fully matured compost or nutrients to improve the success of seeding or re-planting. Work amendments into the soil to a depth of approximately 100 mm;
- Plant species will be selected on the basis of storm water management requirements, site-specific growing conditions, local provenance, Indigenous knowledge recommendations and sustainable landscaping principles; and
- Conduct post construction inspections (see section 17.6) of all planted areas and correct any problems or failures through re-seeding or re-planting, soil amendments or other measures.

17.5 Monitoring

Site restoration, including implementation of erosion control measures (section 9.0), will be monitored during the period of construction by the Environmental Monitor to track that erosion control and re-vegetation measures at sites disturbed by construction are performing effectively. Reporting of site restoration efficacy will be presented in daily monitoring logs, and externally in weekly, monthly and annual status reports that are distributed to the Ministry and the IEM. The IEM will provide updates and opinions on compliance to the Ministry and Indigenous groups

- Following construction, contractual requirements and/or agreements will address handover from the contractor to other relevant parties (Ministry or delegated contractors) to address warranty, maintenance (e.g., irrigation/watering, weeding, etc.), performance monitoring and deficiency correction.

18. Environmental Monitoring

Environmental monitoring is a key component of the Project's Environmental Management System (section 1.7). The contractors will provide the Ministry's Representative with reports on compliance with applicable legislation and with terms and conditions of regulatory permits per the key performance indicators listed in sections 4.0 to 17.0 of this CEMP.

The Environmental Manager will help identify and resolve potential issues by communicating with the Ministry's representative and the Independent Environmental Monitor. The Environmental Manager will advise both the Ministry's representative and applicable authorities when construction activities do not comply with regulatory requirements.

18.1 Construction Environmental Monitoring Program

Contractors will be committed to environmental monitoring to promote compliance with regulatory requirements, to monitor the effectiveness of control and mitigation measures, and to help in achieving a high standard of environmental management. To uphold this commitment contractors will:

- Engage qualified Environmental Monitor(s) with competencies as per section 1.7.2 to oversee and monitor all of the work for duration of construction.
- The roles and responsibilities of the Environmental Monitor include regular on-site availability to monitor environmental performance of the work against the mitigation listed in sections 4.0 to 17.0. During work involving significant environmental risk or when work is located in environmentally sensitive areas full-time presence is necessary;
- Give authority for the Environmental Manager and Environmental Monitor to suspend work if the mitigation requirements are not being met. Should this be necessary, the Environmental Manager / Monitor will immediately advise the contractors and the Ministry's representative of the circumstances and reasons, the actions taken to stabilize environmental conditions, and the tasks needed to rescind the work suspension;
- Develop a daily and weekly schedule with the type and frequency of observations and data collection to be employed, and protocols to be followed if these are not already described in this CEMP. Monitoring will be focused on determining whether the mitigation requirements / key performance indicators are being met. The schedule will include:
    - regular inspections of the sediment and erosion control effectiveness (section 9.0);
    - regular inspections of construction equipment for leaks or spills (sections 13.0 & 15.0);
    - visual and quantitative monitoring of water quality in local waterbodies upstream and downstream of construction areas (sections 8.0 through 10.0);
    - monitoring of air quality and atmospheric noise (sections 4.0 and 5.0);
    - monitoring and inspection of fuel deliveries, transfers and bulk fuel storage (section 13.0);
    - inspection of the adequacy of the emergency response and spill containment and recovery equipment, and spill response training (section 15.0);
    - inspection of the effectiveness of construction waste and water management (sections 11.0 through 14.0);

- Documentation of waste disposal facilities (section 14.0), and;
- Other site-specific or activity-specific monitoring required to ensure the efficacy of mitigation in sections 4.0 to 17.0 of this CEMP.

18.2 Environmental Monitoring Reporting

Members of the Project team, including the Environmental Manager, Environmental Monitor, the Ministry's Representative and the Independent Environmental Monitor, will have specific responsibilities for reporting on aspects of environmental performance and compliance.

18.2.1 Daily Environmental Monitoring Log

The Environmental Monitor will prepare and maintain an environmental monitoring daily log and, at the request of the Ministry, submit this for information or in support of investigations. The content of daily logs ("dailies") will include the following, at a minimum:

- Monitoring dates and times;
- Weather over the reporting period;
- Construction activities undertaken and monitoring activities conducted;
- Environmental monitoring data (i.e., water, noise, air quality) as applicable;
- Any issues identified;
- Any wildlife incidents;
- Environmental protection and mitigation measures recommended and implemented and an update regarding maintenance of these items;
- Outstanding items from previous reports (i.e., environmental issues tracking), including environmental incidents (section 18.2.3), non-compliances with recommendations from the Ministry, Independent Environmental Monitor, Indigenous Groups, or regulatory agencies (section 18.2.4), and;
- Monitoring plan for the following day.

18.2.2 Environmental Monitoring Reports

The Environmental Manager will be responsible for providing weekly, monthly and annual status reports to the Ministry's Representative and the IEM. The Environmental Manager will be responsible for providing weekly, monthly and annual status reports to the Ministry's Representative and the IEM.

Baseline information, where relevant for monitoring mitigation efficacy, will be drawn from the relevant sections of the George Massey Tunnel Replacement Project EA Application and Appendices as noted in the monitoring sub-sections in each of sections 4.0 to 17.0 of this CEMP. For some CEMP management plans, for example air quality and water quality / fish and fish habitat, monitoring of efficacy will use published standards as the baseline for testing mitigation efficacy. Where legislated processes followed by the project through permit requirements mandate the mitigation requirements there will be no testing of mitigation efficacy as this was completed prior to publication of the guidance and standards, e.g., contaminated media, waste, spill response management and heritage management.

The weekly environmental monitoring reports will report on-site inspections, identified deficiencies/non-compliance, and corrective actions/mitigations measures.

As per WSA Approval No. 2005092, monthly and annual summary reports will also be submitted for the duration of the construction.

Weekly reports and monthly and annual monitoring reports will include the following information:

- Project description:
    - Project name;
    - Environmental Monitors' names and credentials
    - Distribution list;
    - Site location with a map with clear labels of areas described in the monitoring report; and
    - Type of works and the person or organization undertaking the works.
- Site Inspections:
    - Frequency of monitoring;
    - Name and credentials of the Environmental Monitor conducting the inspection;
    - Dates and times of inspection;
    - Extent of inspection;
    - Summary description of each inspection visit or group of visits, and;
    - Weather on the days of inspection and for the period preceding the inspections.
- Construction Activity:
    - A brief description of the construction activities completed;
    - A brief description of planned future construction activities, and;
    - A description on any instream works undertaken, timing of those works, and the total affected in-stream area.
- Mitigation measures/structures:
    - Efficacy of mitigation; and
    - Recommended mitigation measures, including the maintenance of previously constructed measures, and the construction, installation, or implementation of new measures.
- Comments:
    - Description of any non-compliances and incidents related to environmental issues or emergencies and how they were monitored, mitigated, and remediated, and;
    - Description of any outstanding mitigative measures or monitoring programs needed for until the completion of site restoration.
- Photographs:
    - Representative date stamped photographs should be taken during each site inspection, and during and after all incidents.
- Environment meetings:

- A summary of meetings and key discussions (including with the IEM and regulators) that took place during the reporting period.

18.2.3 Environmental Incident Report

An environmental incident is one that has caused, or has the potential to cause, one or more of the following:

- Environmental damage including adverse impacts to fish, wildlife, or other environmental resources, not anticipated as an intended consequence of the scope of the work;
- Adverse publicity associated with impacts on the environment, and;
- Legal action with respect to violation of statutes, regulatory authorizations, or environmental damage.

Examples of environmental incidents include the following where related to project construction:

- Spills of oil, fuel, other hazardous chemicals or chlorinated / potable water;
- Discharges of unauthorized or deleterious substances into waterbodies;
- Landslides, erosion, or floods with the potential to adversely affect environmental quality;
- Unauthorized impacts to aquatic or terrestrial habitat;
- Wildfires related to construction activities;
- Discharge of construction waste at unauthorized facilities;
- Any activities that result in regulatory violations, and;
- Harm or disturbance to wildlife as a result of Project activities.

An Environmental Incident Report (EIR) will be developed by the Environmental Manager. The EIR will provide an accurate summary of information available at the time of the report. An initial EIR will be developed within 24 hours following an incident, and will characterize and document the following:

- Cause and nature of the incident;
- Approximate volume of release, area, or habitat affected;
- Aquatic, terrestrial, or cultural resources affected;
- Mitigation measures taken to control or limit the activity causing the incident;
- Additional recommended remedial or corrective actions;
- Communications held with Project personnel, and;
- Communications with regulatory agencies.

The initial EIR will be updated and a revised EIR created as additional information is obtained. For spills and emergency responses the reporting requirements per section 15.0 will suffice for EIR.

18.2.4 Environmental Non-Compliance Report

Environmental non-compliance is an instance where construction or other activities have caused the Project to be out of compliance with mitigation, applicable regulatory instruments (including permits), and legislation.

Examples of environmental non-compliance include:

- Repeated or serious non-adherence to mitigation listed in sections 4.0 to 17.0 of this CEMP;
- Exceedance of a legislated environmental guideline in waste or discharge water;
- In-stream activities not permitted under legislation or applicable permits;
- Construction activities other than those laid out in the project description described in a permit application, and;
- Violation of legislation which is applicable to the Project.

An Environmental Non-Compliance Report may be developed and submitted to the contractor by the Environmental Manager, IEM or Ministry Representative). The report will provide an accurate summary of information available at the time of the report. The non-compliance report will characterize and document the following:

- Nature and cause of the non-compliance issue;
- Applicable permit, legislation, or regulatory instrument under which the Project has been determined to be non-compliant;
- Aquatic, terrestrial, or cultural resources affected;
- Actions to remedy the non-compliance issue taken to date (including any adaptive management processes that are deemed necessary);
- Applicable legal actions initiated or undertaken to date;
- Administrative or other penalties issued to date (if relevant);
- Communications held with Project personnel, and;
- Communications with regulatory agencies, or designate.

The initial report will be updated and a revised version created as additional information is obtained.

18.2.5 Reporting Procedures

The Environmental Manager will be responsible for submitting to the Ministry's representative:

- Initial EIR and subsequent updates outlining any spills or other environmental incidents, and regulatory reporting details.
- Non-compliance reports and subsequent updates outlining any further incidents or regulatory actions taken.

The Environmental Manager will submit the initial reports to the Ministry's representative, with copy to the Independent Environmental Monitor, within 24 hours of occurrence. All subsequent reports will be submitted to the Ministry's representative, copied to the Independent Environmental Monitor, as soon as possible upon updating.

Where spills occur with the potential to enter adjacent watercourses or are of reportable volumes under the B.C. Spill Reporting Regulation (B.C. Reg. 187/2017), the Environmental Monitor or Manager will report the spill to the appropriate authorities in accordance with the regulations. See section 15.0 for details and procedures relating to reporting for spills or emergencies.

18.2.6 Construction Completion Environmental Monitoring Summary Report

At the conclusion of construction, the contractor will submit a Construction Completion Environmental Monitoring Summary Report to the Ministry within 60 days, which describes a summary of the weekly and monthly reports including:

- Implementation of mitigation measures applied throughout the construction period and their efficacy;
- Environmental incidents (both socio-economic and bio-physical);
- Adaptive management actions (section 1.7.6), and;
- Summary of the results of construction monitoring including those items that require post-construction monitoring (section 18.3) and the entity responsible for such ongoing monitoring – and if necessary, follow-up actions.

18.3 Post-construction Monitoring

- Post-construction monitoring of any environmental mitigation that is not closed at the end of construction is likely limited to the efficacy of reclamation (i.e., revegetation success and invasive species management). All post-construction monitoring programs and follow-up actions should these be necessary will be the responsibility of the Ministry.

19. Source Material

Provincial Acts and Regulations

- B.C. Fire Code Regulation (B.C. Reg. 263/2012).
- Contaminated Sites Regulation (B.C. Reg. 375/96).
- Declaration on the Rights of Indigenous Peoples Act (R.S.B.C 2019, c. 44).
- *Environmental Assessment Act* 2018 (S.B.C., 2002, c, 43).
- Environmental Management Act (S.B.C., 2003, c. 53).
- *Fire Services Act* (R.S.B.C., 1996, c. 144).
- Forest and Range Practices Act (S.B.C., 2002, c. 69).
- Hazardous Waste Regulation (B.C. Reg. 63/88).
- *Heritage Conservation Act* (R.S.B.C., 1996, c. 187).
- *Local Government Act* (R.S.B.C., 2015, c. 1).
- Organic Matter Recycling Regulation (B.C. Reg. 7/2019).
- *Public Health Act* (S.B.C., 2008, c. 28).
- Riparian Area Protection Act (SBC 1997).
- Riparian Areas Protection Regulation (B.C. Reg. 99/2020).
- Spill Reporting Regulation (B.C. Reg., 187/2017).
- Transport of Dangerous Goods Act (R.S.B.C., 1996, c. 458).
- Water Sustainability Act (S.B.C., 2014, c. 15).
- Weed Control Regulation (B.C. Reg. 66/85).
- *Wildlife Act* (R.S.B.C., 1996, c. 488).
- *Workers Compensation Act* (R.S.B.C., 2019, c. 1), including the Occupational Health and Safety Regulation (OHSR).

Federal Acts and Regulations

- Canadian Environmental Protection Act (S.C., 1999, c. 33).
- Canada Labour Code (R.S.C., 1985, c. L-2).
- Canada Navigable Waters Act (R.S.C., 1985, c. N-22).
- *Fisheries Act* (R.S.C., 1985, c F-14).
- Migratory Birds Convention Act (S.C., 1994, c. 22).
- *Species at Risk Act* (S.C., 2002, c. 29).
- Transportation of Dangerous Goods Act (S.C., 1992, c. 34).

Regional and Municipal Bylaws

- Greater Vancouver Sewerage and Drainage District Sewer Use Bylaw No. 299, 2007.
- Greater Vancouver Sewerage and Drainage District (GVSDD) Municipal Solid Waste & Recyclable Material Regulatory By-law No. 181, 1996, as amended by By-law No. 183, 1996.
- Metro Vancouver Air Quality Management Bylaw No. 1082, 2008.

Standards, Guidelines, and Best Management Practices

- British Standards Institution, Code of Practice for Noise and Vibration Control on Construction and Open Sites – Part 1: Noise (BSI 2008)
- B.C. Air Action Plan (Government of British Columbia, 2008).

- B.C. Marine and Pile Driving Contractors Association, Best Management Practices for Pile Driving and Related Operations (MPDCA, 2003).
- B.C. Ministry of Environment and Climate Change Strategy, A User's Guide to Working in and Around Water (BC ENV, 2005a).
- B.C. Ministry of Environment and Climate Change Strategy, Best Management Practices for Raptor Conservation during Urban and Rural Land Development in BC (BC ENV, 2005b).
- B.C. Ministry of Environment and Climate Change Strategy, Develop with Care 2014: Environmental Guidelines for Urban and Rural Land Development in BC (BC ENV, 2014a).
- B.C. Ministry of Environment and Climate Change Strategy, Guidelines for Industry Emergency Response Plans (BC ENV, 2020).
- B.C. Ministry of Environment and Climate Change Strategy, Protocol 4 for Contaminated Sites: Establishing Local Background Concentrations in Soil (BC ENV, 2021).
- B.C. Ministry of Environment and Climate Change Strategy, Provincial Air Quality Objective Information Sheet: British Columbia Ambient Air Quality Objectives (BC ENV, 2020a).
- B.C. Ministry of Environment and Climate Change Strategy, Recovery Plan for the Barn Owl (*Tyto alba*) in British Columbia (BC ENV 2014b).
- B.C. Ministry of Environment and Climate Change Strategy, Riparian Restoration Guidelines (BC ENV, 2008).
- B.C. Ministry of Environment and Climate Change Strategy, Technical Guidance 1 on Contaminated Sites: Site Characterization and confirmation Testing (BC ENV, 2009).
- B.C. Ministry of Environment and Climate Change Strategy, Water Quality Guidelines: Aquatic Life, Wildlife & Agriculture (BC ENV, 2019a).
- B.C. Ministry of Environment and Climate Change Strategy, Water Quality Guidelines Policy (BC ENV, 2019b).
- B.C. Ministry of Forests, Archaeological Impact Assessment Guidelines (MoF, 1998).
- B.C. Ministry of Forests, Archaeological Overview Assessments as General Land Use Planning Tools (MoF, 2009).
- B.C. Ministry of Forests, Report Finding an Archaeological Artifact or Human Remains (MoF, 2021).
- B.C. Ministry of Forests, Best Management Practices for Amphibian and Reptile Salvages in British Columbia (MoF, 2016).
- B.C. Ministry of Forests, Working on the Land Base: Archaeology in B.C. (MoF, 2021).
- B.C. Ministry of Transportation and Infrastructure, 2020 Standard Specifications for Highway Construction (MOTI, 2020a).
- B.C. Ministry of Transportation and Infrastructure, Environmental Best Practice for Highway Maintenance Activities (MOTI, 2018).
- B.C. Ministry of Transportation and Infrastructure, Manual of Control of Erosion and Shallow Slope Movement (MOTI, 1997).
- B.C. Ministry of Transportation and Infrastructure, Policy for Assessing and Mitigating the Noise Impacts from New and Upgraded Numbered Highways (MOTI, 2016).
- B.C. Ministry of Transportation and Infrastructure, Technical Circular for Management of Contamination in Highway right-of Way (MOTI, 2020b).
- B.C. Ministry of Environment and Climate Change Strategy, Water Quality Guidelines Policy (MOECSS, 2019).

- BC Oil and Gas Commission, British Columbia Noise Control Best Practices Guideline (BC OGC 2021).
- B.C. Recycles, British Columbia's Recycling Handbook (BCR, 2015).
- B.C. Society of Landscape Architects, B.C. Landscape and Nursery Association, British Columbia Landscape Standard (BCSLA, 2012).
- Environment and Climate Change Canada, Best Practices for the Reduction of Air Emissions from Construction and Demolition Activities (ECCC, 2005).
- Canadian Construction Association, Best Practices Guide to Solid Waste Reduction (CCA, 2001).
- Canadian Council of Ministers of the Environment, Canadian Ambient Air Quality Standards (CCME, 2020).
- Canadian Council of Ministers of the Environment, Canadian Environmental Quality Guidelines (CCME, 2003a).
- Canadian Council of Ministers of the Environment, Canadian Water Quality Guidelines for the Protection of Aquatic Life (CCME, 2003b).
- Canadian Council of Ministers of the Environment, Guidance Document on Achievement Determination for Canadian Ambient Air Quality Standards for Fine Particulate Matter and Ozone (CCME, 2012).
- Canadian Council of Ministers of the Environment, National Ambient Air Quality Objectives (CCME, 1999).
- Canadian Ready Mixed Concrete Association, Recommended Guideline for Environmental Management Practices for Canadian Ready Mixed Concrete Industry (CRMCA, 2004).
- Department of Fisheries and Oceans, Land Development Guidelines for the Protection of Aquatic Habitat (DFO, 1993).
- English Heritage. Mitigation of Construction Impact on Archaeological Remains, Volume 1 (English Heritage. 2004).
- Environment and Climate Change Canada, Guidelines to Reduce Risk to Migratory Birds (ECCC, 2019).
- Fisheries and Oceans Canada, Interim code of practice: End-of-pipe fish protection screens for small water intakes in freshwater (DFO 2020).
- Government of British Columbia, Laboratory Standards & Quality Assurance, B.C. Field Sampling Manual (LSQA, 2013).
- Metro Vancouver, Invasive Species Council of Metro Vancouver, Best Management Practices for Knotweed Species in the Metro Vancouver Region (ISCMV, 2018).
- Greater Vancouver Sewerage and Drainage District, Best Management Practices Guide for Stormwater (GVSDD, 1999).
- Guidelines for the Use of Explosives in or Near Canadian Fisheries Waters (Wright and Hopky, 1998).
- Invasive Species Council of B.C., B.C. Ministry of Transportation and Infrastructure, Best Practices Guide for Managing Invasive Plants on Roadways (ISCBC, 2019a).
- Invasive Species Council of Metro Vancouver, Metro Vancouver, Best Management Practices for Himalayan Blackberry in the Metro Vancouver Region (ISCMV, 2019).
- Invasive Species Council of B.C., Tansy Ragwort (*Senecio jacobaea*) Factsheet (ISCBC, 2019b).
- Health Canada, Guidance for Evaluating Human Health Impacts in Environmental Assessment: Noise (HC 2017)

- Metro Vancouver, Ambient Air Quality Objectives (Metro Vancouver, 2020).
- Metro Vancouver, Best Management Practices Guide for Stormwater (Gibb et al., 1999).
- Ministry of Water, Land and Resource Stewardship, Stormwater Planning: A Guidebook for British Columbia (MWLRS, 2002).
- Ministry of Water, Land and Resource Stewardship, Standards and Best Practices for Instream Works (MWLRS, 2004).
- Transportation Association of Canada, National Guide to Erosion and Shallow Slope Control on Roadway Projects (TAC, 2005).
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Appendix A

Archaeological Chance Find Procedure