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Summary of Potential
Project-related Effects and
Mitigation

SUMMARY OF POTENTIAL PROJECT-RELATED EFFECTS AND MITIGATION

BHP Potash Export Facility at Fraser Surrey Docks

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Attachment 4.2Y Summary of Potential Project-related Effects and Mitigation

The potential Project-related effects, along with the proposed mitigation measures to minimize these effects, are summarized in the table below. Additional mitigation measures that will be implemented during construction and operation (e.g., best management practices) are included in the Project Plans (i.e., Stormwater Pollution Prevention Plan, Construction Environmental Management Plan, Rail Operations Plan, Fire Safety Plan, and Spill Prevention and Emergency Response Plan) and are not summarized in this table.

Background Conditions	Potential Effects (Prior to the Implementation of Mitigation Measures)	Summary of Proposed Mitigation	Key Assessment Conclusions	Further Detail
Soil and Groundwater Management				
<p>The Project site was developed for use as a shipping facility in the 1960s. Pre-existing contaminated soil and groundwater has not been identified within the Project site.</p>	<ul style="list-style-type: none"> • Areas of unforeseen contamination (e.g., areas of unidentified soil contamination or debris) may be encountered during construction earthworks. • Portions of construction earthworks that extend below the groundwater table (approximately 2 metres (m) to 3 m below ground surface) may fill with potentially contaminated groundwater. • Contamination at the Project site may occur during construction due to spills or improper handling of hazardous materials. • Decommissioning of existing monitoring wells that are encountered may result in damage during Project earthworks. 	<p>The following mitigation measures are recommended to manage potential soil contamination or debris during construction:</p> <ul style="list-style-type: none"> • Conduct field screening of soil or debris suspected of being contaminated during all excavation activities, including visual and olfactory observations for evidence of contamination and direct measurements using appropriate field instruments/meters. • Segregate and stockpile soil that appears unsuitable for re-use onsite into potential contamination types. Characterise the soil (if required) and dispose at an appropriate offsite facility. • Follow the stockpile management and sample procedures in Section 4.2.2 of the Soil and Groundwater Management Plan (Appendix C of Attachment 4.3-B Construction Environmental Management Plan (CEMP)). • Inform the appropriate project manager and environmental monitor of suspect material to evaluate whether soil characterisation sampling is required for suspect material encountered. Follow the sampling procedures in Section 4.2.2 and Section 4.2.3 of the Soil and Groundwater Management Plan. • Prepare a figure showing where suspect material has been identified and excavated, including estimates of surface area, depth intervals, and total volumes. • Dispose of contaminated material following the disposal plan in Section 4.2.4 of the Soil and Groundwater Management Plan. <p>The following mitigation measures are recommended to manage suspected groundwater contamination during construction:</p> <ul style="list-style-type: none"> • Monitor excavations for suspect groundwater, as evidenced by visual and olfactory observations. • Stop work if groundwater is suspected of being contaminated while additional dewatering and water management planning, including sampling and rush lab analysis, is completed. • Have reasonably quick access (i.e., within the day) to either a vacuum truck or system of pumps, hoses, and holding tanks to remove the suspect groundwater from the excavation area, and conduct sampling and laboratory analysis. • Review analytical groundwater data collected from nearby groundwater wells, and collect groundwater samples from the excavation, determining appropriate disposal methods upon receipt of analytical results: either offsite treatment and disposal or sewer discharge (dependent upon permitting). • Backfill excavation with clean fill once it is completed to avoid excessive water management. • Do not transfer suspect groundwater to other excavations within the Project development area for temporary storage. <p>The following mitigation measures are recommended to minimise generation of potential contamination during construction:</p> <ul style="list-style-type: none"> • Keep appropriate spill containment and cleanup supplies available onsite whenever work is underway. • Train Project personnel to be familiar with implementing the spill cleanup plan and the deployment of spill response materials. • Implement a Spill Contingency Plan (included in a Health and Safety Plan), and keep it in close proximity to working machinery. • Keep machinery used onsite in good working condition, and conduct any major maintenance offsite or away from the Project development area. • Carefully and safely handle and store away fuel kept onsite away from open excavation areas to prevent spills from entering excavations. 	<p>Based on the information reviewed and sampling conducted, the Project has a low likelihood of contaminated soil or groundwater being encountered during construction, and adverse Project effects are unlikely with the application of proposed mitigation and management measures.</p>	<p>Phase I and II Environmental Site Assessment (Attachment 4.2-N)</p> <p>CEMP (Attachment 4.3-B)</p>

Background Conditions	Potential Effects (Prior to the Implementation of Mitigation Measures)	Summary of Proposed Mitigation	Key Assessment Conclusions	Further Detail
		<p>The following mitigation measures are recommended to decommission groundwater wells:</p> <ul style="list-style-type: none"> Decommission any monitoring wells during Project earthworks by removing the existing steel flush-mount covers and completely pulling the well casing from the ground using a tightly wrapped sling around the casing powered by an excavator. Fill any portion of a borehole that remains open or any broken casing that remains in the ground below the base of the excavation with bentonite. <p>Complete decommissioning records in accordance with Schedule 4 of the BC Groundwater Protection Regulation (BC Reg. 39/2016) for each monitoring well that is decommissioned.</p>		
Lighting				
<p>The Project site currently operates as a marine terminal that handles bulk and break bulk cargo, containers, and forestry products for import and export.</p> <p>The nearest resident that may be disturbed by lighting are located approximately 230 metres (m) from Project facilities that will be illuminated.</p>	<ul style="list-style-type: none"> The Project may cause disturbance to local residents from light spill and trespass. Urban sky glow from the Project may result in effects to local residents' view of the night sky and light-sensitive wildlife. 	<p>During construction, minimise adverse effects of lighting on sensitive receptors and reduce light spill by pointing lights downward and placing task lighting as close to the work area as possible.</p> <p>The following mitigation measures are recommended to minimise adverse effects of lighting on sensitive receptors during Project operation:</p> <p>Avoid lighting beyond minimum levels required for operations.</p> <ul style="list-style-type: none"> Use up-light shield to limit sky-glow and light trespass on supply conveyor lighting and aimable floodlights. Mount fixture Type A lights on buildings and use full cut-off optics. Use LED and neutral-coloured white lights (i.e., 4000K lights) for improved colour rendition on all light fixtures. Use timers, motion sensors, and photocell activation to automate exterior lighting controls during dusk-to-dawn operation. Minimise perimeter security lighting by using low light detection monitoring technologies. Dim lighting during periods of non-operation as set by the operators. Follow the general guidelines for shiploader lighting: Illuminate walkways for safety of personnel. Direct light from handrail fixtures to the grated walking areas only, and use automate controls to limit the time that they are turned on. Equip main access ways with automated lights and secondary access platforms with manually operated lights. Lighting should be switched on and off by operator. Turn on lights at the end of the loader spout only when loading is taking place. Mount lights on the shiploader rail wheel area to direct light downward to minimise light pollution. Limit lights at the top of the shiploader mast to aviation hazard indicator lights to avoid creating a nuisance. 	<p>Given the distance of Project lighting from local residences, light trespass due to Project lighting will be limited and will not add to existing light levels, given that the proposed lighting will be shielded and directed away from the residences.</p> <p>Based on Hemmera's assessment of wildlife potentially sensitive to lighting, no adverse effects have been identified.</p> <p>The lighting design for the Project is consistent with Vancouver Fraser Port Authority (VFPA) guidance and industry practice; utilises energy-efficient LED sources; and minimises the potential for adverse lighting effects to the greatest extent practical while considering worker safety requirements.</p>	<p>Lighting Impact Statement (Attachment 4.2-O)</p>

Background Conditions	Potential Effects (Prior to the Implementation of Mitigation Measures)	Summary of Proposed Mitigation	Key Assessment Conclusions	Further Detail
Noise¹				
<p>The Project site currently operates as a marine terminal that handles bulk and break bulk cargo, containers, and forestry products for import and export.</p> <p>The nearest noise sensitive receivers are residences located on Regal Drive, Royal Crescent, and River Road in Surrey, approximately 75 m from the Project site boundary.</p>	<ul style="list-style-type: none"> Operation-phase activities (in particular rail activity including rail squeal) may increase total noise levels at nearby residences. 	<p>The following mitigation measures will be considered to minimise noise during Project construction:</p> <ul style="list-style-type: none"> Select construction equipment to minimise noise, where possible. For example: Where practical, use electrical or hydraulic powered equipment as it is usually quieter than diesel-powered machines. Where practical, use diamond saws to cut concrete rather than jackhammers. For impact pile driving: <ul style="list-style-type: none"> Use vibratory drivers wherever practical. Use hydraulic impact hammers instead of diesel hammers. Use cast-in-place concrete piles instead of steel piles where practical. Construct bored piles by augering. Use equipment or processes that have additional noise control features, including high-performance mufflers and enclosures on diesel- or gas-powered equipment or exhaust silencers on air tools. Regularly maintain all equipment, including lubricating applicable components and replacing worn parts. Operate equipment at minimum engine speeds consistent with effective operation. Educate construction personnel (site supervisors, foremen, equipment operators, etc.) regarding particular noise issues and train workers to operate equipment as quietly as possible. Avoid unnecessary idling, revving, use of airbrakes, and banging of tail gates and front-end loader buckets. Turn off equipment when not in use. Where practical, use alternative back-up warning systems that meet the same safety requirements as tonal beepers, such as broadband reversing alarms. Where practicable, locate stationary work stations as far away as possible from noise-sensitive receivers. Schedule construction activities and limit equipment usage times to minimise noise when operating near sensitive receivers. Where possible, schedule periods of respite during noisy construction activities. Develop noise complaint procedures including providing details relating to how complaints will be documented and investigated as well as setting target timeframes for responding to complaints. Develop and implement a Community Consultation and Communication Plan to ensure the community is aware of and prepared for scheduled construction activities. Plan truck traffic routes to minimise idling time, reversing, and driving distances. <p>The following mitigation measures are recommended to be considered in order to minimise noise during Project operation:</p> <ul style="list-style-type: none"> Use the best available technology, not entailing excessive cost (BATNEEC), to minimise noise, such as: where practical, use alternative back-up warning systems that meet the same safety requirements as tonal beepers, such as broadband reversing alarms. Use the best available procedures, such as: Restrict use of rail car vibrator at the rail car unloading facility when not necessary. Operate vacuum trucks at minimum power required as vacuum truck noise tends to increase with operating power. Minimise openings in the rail car unloading station; baffle the opening facing South Westminster Heights, and install sound-absorbing materials inside building to reduce noise emission from openings, where practicable. <p>The Project design already incorporates the following low noise initiatives:</p> <ul style="list-style-type: none"> Operate conveyors at limited speeds. Unload incoming railcars in a continuous, steady action to eliminate most noise from shunting, knuckle slap, and locomotive acceleration. Increase rail track radius to maximum feasible distance to minimize rail squeal. Implement rail track lubrication program to minimize rail squeal. Use low impact and soft landing chutes to minimise noise from loading materials. Where feasible, limit non-emergency clean-up operations to daytime hours during weekdays. 	<p>The average increase in the noise rating level at residential receivers is predicted to be less than 1 A-weighted decibel (dBA). The change in the number percentage of people highly annoyed will be less than Health Canada's Noise Guideline of 6.5 percent (%) (2017).</p>	<p>Noise Assessment (Attachment 4.2-P)</p> <p>BATNEEC (Appendix A of Attachment 4.1-D)</p>

Background Conditions	Potential Effects (Prior to the Implementation of Mitigation Measures)	Summary of Proposed Mitigation	Key Assessment Conclusions	Further Detail
Air Quality¹				
<p>The nearest receivers to the Project for air quality are businesses located adjacent to the Project fenceline and residences located approximately 75 m from the Project site boundary.</p> <p>The local air quality is generally considered good based on monitoring stations in the Lower Fraser Valley and close to the Project. Air quality at these stations is below the ambient air quality objectives and standards with a few exceptions during episodic events, such as forest fires or stagnant meteorological conditions.</p>	<p>During Project operation, potential Project-related air emissions will be primarily fugitive dust from the handling of potash and combustion emissions associated with locomotives, ocean-going vessels, and other non-road equipment.</p>	<p>The following mitigation measures are recommended to manage air quality during Project construction:</p> <ul style="list-style-type: none"> • Turn equipment and vehicles off when not in use, and idle only if used within a reasonable amount of time (e.g., 5 minutes or less). Exceptions include mobile light plants for site lighting, mobile dewatering equipment, and any health and safety equipment required for safe operation of the site during construction. • Keep all construction equipment and vehicles well maintained. Complete maintenance logs and daily logs following inspections to document that equipment and vehicles are in good working order. • Monitor and manage dust-generating activities (e.g., earthworks, pre-loading) during dry periods and periods of high wind to avoid generation and transport of dust offsite. Following VFPA's acceptance of the suppression agent and application method prior to its use onsite, use suppression agents (e.g., watering and covering) when work cannot be rescheduled to a more appropriate time. Contain and treat run-off due to use of suppression agents as necessary; • Stockpile soil in an appropriate laydown area, cover with polyurethane sheeting, and secure active stockpiles (e.g., covered with anchored polyurethane sheet) at the end of each shift. If stockpiles will be left inactive for several weeks or more, the method of securing them shall be appropriate for preventing sedimentation and weed establishment (e.g., hydroseeding or more permanent cover). • Cover all trucks leaving the site with soil or pre-load to prevent dust generation and loose gravel release to the roadway. • Complete regular site cleaning with a water truck and sweeper to keep the onsite roads clear of dust-generating material. • Wash truck wheels prior to leaving the site to avoid tracking material (i.e. soil, debris, wastes) offsite. <p>The following mitigation measures are recommended to manage air quality during Project operation:</p> <ul style="list-style-type: none"> • Condition potash handled at the terminal with a dust mitigating (dedusting oil and anti-caking amine) mixture (this would be applied at the proposed Jansen mine, prior to transport to FSD). • Use the best available technology, not entailing excessive cost to minimise fugitive dust emissions including: <ul style="list-style-type: none"> ▫ A travelling shiploader with a cascading telescopic chute. ▫ Enclosed potash handling infrastructure that protects potash product from the elements and preserves product quality. • Use the best available procedures to minimise generation of Project emissions and fugitive dust, such as: <ul style="list-style-type: none"> ▫ Select Project on-road and off-road engines and vehicles that meet the latest applicable Canadian emissions standards and guidelines, where practical. ▫ Maintain equipment and engines to improve efficiency and keep documentation of the maintenance program. ▫ Turn off equipment and vehicles when not in use to avoid unnecessary idling, where under control of BHP. ▫ Train operators to monitor and measure opacity (indicator of fugitive dust), during conveying, unloading and shiploading operations. ▫ Conduct routine maintenance program and quality auditing to confirm that all dust collection equipment is operating consistently and as designed. ▫ Regular observation of the product handling stream and site-wide housekeeping to identify areas where dust mitigation measures may require maintenance. ▫ Maintain the product flow through the shiploader to be as consistent as possible to optimise steady-state operation of shiploading. ▫ Use an automated level indicator to keep the bottom flaps of the shiploader spout in contact with the potash, minimising drop height, dust creation, and release. ▫ Use of soft drop transfer points to minimize dust and degradation during conveying. 	<p>With the application of mitigation measures, there are no predicted exceedances of the ambient air quality objectives outside the immediate area of the Project fenceline for all air contaminants.</p> <p>The predicted air contaminant concentrations quickly diminish as emissions disperse further away from the Project.</p>	<p>Air Quality Assessment (Attachment 4.2-Q)</p> <p>CEMP (Attachment 4.3-B)</p>

Background Conditions	Potential Effects (Prior to the Implementation of Mitigation Measures)	Summary of Proposed Mitigation	Key Assessment Conclusions	Further Detail
View and Shade				
<p>The Project site is within an industrial zoned land use area, and currently operates as a marine terminal.</p> <p>Much of the Project site is surrounded by tall, dense vegetation to the east and southeast which shield most of the Project site from the residential slopes south of the site as well as the main roadways south of the site. Tall, mature deciduous and coniferous trees are abundant throughout the neighbouring residential areas, parks and roadways near the Project site.</p> <p>The Project site is visible from New Westminster and Queensborough waterfront areas.</p>	<ul style="list-style-type: none"> The constructed Project will likely have a minimal effect on views in surrounding communities. The most affected views to the site will likely be from the north, along the New Westminster and Queensborough waterfront areas facing south and southeast. The shade effects on the site and surrounding areas due to the Project are anticipated to be minimal, given the current industrial land use zone surrounding the site, as well as the large distances from the site to any public place, roadway, pathway, gathering space, or residence. 	<p>As part of detailed design, the following mitigation measures may be considered to minimise the effects of Project infrastructure on views and shade in surrounding communities during the operation phase:</p> <ul style="list-style-type: none"> Retain trees as much as possible within the Project site to provide screening of new facilities. As engineering design progresses, consider integrating fast-growing and robust deciduous trees (which will screen the facilities relatively quickly) and conifers to provide year-round screening in areas that do not conflict with facility operations. Use building materials and vegetative elements that reduce sun glare and visible weathering of materials. For example: <ul style="list-style-type: none"> Vertical architectural screens or elements against the infrastructure to improve aesthetics Vertical green screens against building facades and expansive walls, which will encourage vertical plant growth. Plant riparian trees and shrubs in select areas to create more variation in the view area, where feasible. Work with relevant stakeholders to explore opportunities to educate the public about the Fraser River's industrial heritage in unique, creative, and interactive ways such as through signage, education, child play, and public art. 	<p>The Project adheres to the View and Shade Guidelines (PMV 2015). In general, the Project will likely have a minimal impact on views and shading in surrounding communities, given the current industrial land use zone surrounding the site, and distances from the site to any public place, roadway, pathway, gathering space, or residence.</p> <p>Materials proposed for use on the Project and the sizes of the proposed conveyors, storage structures, and rail ramps are consistent with prior use at FSD, and are not considered as an adverse Project-related effect.</p>	<p>View and Shade Impact Analysis (Attachment 4.2-R)</p>
Traffic				
<p>Regional access to the Project is provided by Highway 17 (South Fraser Perimeter Road) via the Tannery Road Interchange.</p>	<ul style="list-style-type: none"> During operation, the Project will likely generate between 112 and 176 anticipated daily vehicle trips and will not result in any additional truck traffic. The Project layout will necessitate realigning Timberland and Robson Roads. Increased Project rail traffic results in delays due to rail blockages at road and rail crossings. For the road crossing across Robson Road at Elevator Road, road blockages will increase from approximately one hour per day without the Project, to up to five and a half hours per day, prior to mitigation being applied. 	<p>The construction of an overpass is recommended to minimise effects to traffic during operation. The following overpass options are being considered by VFPA:</p> <ol style="list-style-type: none"> The Gateway 2030 FSD overpass over the railway corridor. This overpass includes an overpass from South Fraser Perimeter Road onto FSD, over Robson Road near Plywood Road, and a second overpass over Elevator Road. The phased approach to the Gateway 2030 FSD overpass over the railway corridor. This overpass from FSD would extend over Elevator Road. 	<p>The Project will generate a minimal amount of additional road traffic, and will not warrant additional mitigation to that proposed.</p> <p>With the construction and operation of an overpass, all site-created rail/road blockages will be removed.</p>	<p>Traffic Impact Assessment (Attachment 4.2-S)</p>
Archaeology				
<p>No archaeological resources were identified during archaeological monitoring of geotechnical investigations at the Project site; however, areas shoreward of the original Fraser River shoreline and currently overlain with 2 m to 4 m of fill are rated as having high archaeological potential.</p>	<ul style="list-style-type: none"> During construction, there is a potential disturbance to archaeological resources by densifying soils when pre-loading materials on the surface and eventually loading product materials on site. Project-related construction activities may disturb or otherwise adversely affect archaeological resources during excavation, particularly if excavation depth is greater than fill depth (average 2 m). 	<p>The following mitigation measures are recommended to minimise effects to archaeological resources during construction:</p> <ul style="list-style-type: none"> Archaeological monitoring is recommended for all ground disturbances deeper than 2 m below the current surface. Monitoring should continue until maximum excavation depth is reached or a minimum of 50 cm of non-organic, sterile sediments have been observed by the supervising archaeologist on site, whichever occurs first. Once a minimum of 50 cm of non-organic, sterile sediments have been observed by the supervising archaeologist on-site monitoring can be discontinued. Implement the Chance Find Procedure for inadvertent discovery of heritage and archaeological resources. 	<p>With the application of recommended mitigation measures, no further archaeological investigation (i.e., Archaeological Impact Assessment) is recommended. Continued communications with involved First Nations will provide a forum for discussion of archaeological concerns, should any arise.</p>	<p>Archaeological Potential – Preliminary Assessment Report (Attachment 4.2-T)</p> <p>Archaeological Overview Assessment (Attachment 4.2-U)</p>

Background Conditions	Potential Effects (Prior to the Implementation of Mitigation Measures)	Summary of Proposed Mitigation	Key Assessment Conclusions	Further Detail
Flood Protection				
<p>The Project site is located primarily on a previously developed filled site on the Fraser River floodplain.</p>	<ul style="list-style-type: none"> During Project operation, the Fraser River could flood and inundate the Project site. Without mitigation, the occurrence of a flood could result in damage to infrastructure and product and potential environmental effects. Key infrastructure considered to be vulnerable to flooding are the potash storage building and the electrical rooms. 	<p>The product storage building includes a perimeter concrete wall, supporting the roof structure that protects the product against flood events. Electrical rooms will also be elevated.</p> <p>As the concrete wall surrounding the potash storage facility is only penetrated by service doors, potential mitigation options for the service doors could consist of providing water-tight flood doors, sand bags, water-filled flood barriers, or other temporary flexible membrane barriers.</p>	<p>With the application of the Project's design measures, the risks of damage to Project infrastructure and potential environmental effects due to a 200-year flood will likely be mitigated.</p>	<p>Flood Protection Assessment (Attachment 4.2-V)</p>
Aquatic Resources				
<p>The Fraser River, Gunderson Slough (south of the Project), and Manson Canal (northeast of the Project) provide direct habitat value for fish, including commercial, Aboriginal, and recreational species (e.g., salmonids).</p> <p>Several upland tributaries within and surrounding the Project site may provide food and nutrient values for fish; however, these watercourses have been highly modified from their pre-development state through channelisation, culverting, and/or isolation from fish-bearing habitat.</p>	<p>Construction</p> <p>Potential effects on Fraser River fish and fish habitat during construction are:</p> <ul style="list-style-type: none"> Fish mortality may occur in proximity to inwater sounds during inriver impact pile driving. Increased sedimentation may occur due to earthworks and contact water releases. Increased contaminant concentrations may occur from the use of industrial equipment and excavation equipment. Placement of material or structures in water may affect fish and fish habitat. 	<p>The following mitigation measures are recommended to minimise effects to Fraser River fish and fish habitat during construction:</p> <ul style="list-style-type: none"> Adhere to the following best management practices (BMPs) and guidelines: <ul style="list-style-type: none"> Measures to Avoid Causing Harm to Fish and Fish Habitat (DFO 2016) Fisheries Productivity Investment Policy: A Proponent's Guide to Offsetting (DFO 2013) Land Development Guidelines for the Protection of Aquatic Habitat (Chilibeck et al. 1993) Develop with Care 2012: Environmental Guidelines for Urban and Rural Land Development in British Columbia (MOE 2012) Standards and Best Practices for Instream Works (MWLAP 2004). Undertake the following measures during earthworks: <ul style="list-style-type: none"> Test contact water from deep excavations or surface water runoff prior to being discharged back into the environment to confirm that it meets water quality guidelines (e.g., in adherence to the British Columbia Water Quality Guidelines (Criteria): January 2017 Edition (MOE 2017)). Follow the Soil and Groundwater Management Plan (CEMP, Attachment 4.3-B, Appendix A). Retain a qualified environmental monitor to be available for activities within environmentally sensitive areas during construction and intrusive soil work onsite including soil excavation/movement. Undertake the following measures related to spill prevention and response: <ul style="list-style-type: none"> Store fuel and conduct maintenance activities a sufficient distance from the water to reduce the risk of deleterious substances entering the water in case of a spill. Keep emergency spill equipment available whenever working near or in water. Follow the Spill Prevention and Emergency Response Plan (Attachment 4.3-E), when required. Commence in-water activities slowly to encourage motile species (e.g., fish, seals, and sea lions) to leave the construction area. Undertake the following measures during pile driving: Follow <i>Best Management Practices for Pile Driving and Related Operations</i> (BCMPDCA and DFO 2003). <ul style="list-style-type: none"> Conduct pile driving from land-based equipment whenever possible. Use a vibratory hammer for pile driving, wherever feasible, as this method produces lower sound levels than a conventional impact driver. During impact pile driving, consider using bubble curtains or other acoustic barriers to dampen over-pressure waves and reduce sound levels emitted within the Fraser River. Undertake hydro-acoustic monitoring of underwater noise levels associated with pile-driving activities to prevent harmful inwater noise levels. <ul style="list-style-type: none"> Do not exceed 206 decibels (dB) per single strike immediately adjacent to pile driving activities to avoid injury to fish. Conduct construction activities within the Fraser River during the DFO Timing Window for the Protection of Fish and Fish Habitat (June 16 to February 28) for the region, unless otherwise agreed upon by DFO. Implement and maintain on land erosion and sediment control measures during construction. Dispose of construction waste at approved facilities on land, and not in the river. 	<p>The risk of serious harm to Fraser River fish from Project-related effects is anticipated to be low provided that the recommended mitigation measures are implemented during construction.</p>	<p>Aquatic Resources Assessment Report (Attachment 4.2-W)</p>

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<p>The Fraser River, Gunderson Slough (south of the Project), and Manson Canal (northeast of the Project) provide direct habitat value for fish, including commercial, Aboriginal, and recreational species (e.g., salmonids). Several upland tributaries within and surrounding the Project site may provide food and nutrient values for fish; however, these watercourses have been highly modified from their pre-development state through channelisation, culverting, and/or isolation from fish-bearing habitat.</p>	<p>Potential effects on upland fish and fish habitat during construction are:</p> <ul style="list-style-type: none"> Increased sedimentation may occur from earthworks, removal of instream and riparian features, and wastewater releases. Increased contaminant concentrations may occur from the use of industrial equipment and wastewater management. Change in food supply and nutrient concentrations for downstream fish populations may occur from the culverting and removal of riparian vegetation. Degraded water quality may occur from ditch culverting and riparian vegetation removal. 	<p>The following mitigation measures are recommended to minimise effects to upland fish and fish habitat during construction:</p> <ul style="list-style-type: none"> Implement the BMPs, guidelines, and mitigation measures described for earthworks and spill prevention and response described for Fraser River fish and fish habitat. Implement and maintain erosion and sediment control measures during construction. Conduct a salvage of fish on any wetted channel prior to instream work. Monitor water drawdown of ditches to confirm that no fish are present. Schedule any ditch culverting or removal to within DFO's Least Risk Timing Periods (if fish are present, or potentially present), or to when ditches are driest. Pump the water in the ditches to an approved vegetated area for infiltration prior to culverting. Dispose of construction waste at approved facilities offsite, or within appropriately labeled containers onsite. Test contact water prior to being discharged back into the environment to confirm that it meets water quality guidelines (e.g., in adherence to the British Columbia Water Quality Guidelines (Criteria): January 2017 Edition (MOE 2017)). 	<p>The risk of serious harm to upland fish and fish habitat from Project-related effects is anticipated to be low provided that the recommended mitigation measures are implemented during construction. Permanent residual adverse effects to upland fish or fish habitat are not anticipated from Project-related construction activities.</p>	<p>Aquatic Resources Assessment Report (Attachment 4.2-W)</p>
	<p>The primary potential effects on commercial, recreational, and Aboriginal (CRA) fish during construction, prior to mitigation, is interference with CRA fishing, in particular effects from increased marine traffic on salmon gill netting in the lower Fraser River when nets may be set across the active navigational channel.</p>	<p>In addition to the mitigation measures provided above, the following additional mitigation measures are recommended to minimise effects to CRA fishing during construction:</p> <ul style="list-style-type: none"> Undertake the following measures related to vessel use: <ul style="list-style-type: none"> Coordinate vessel movements outside of FSD to reduce conflict with fishing vessels engaged in net fisheries, as feasible. Abide by the <i>Canada Shipping Act, 2001</i> (SC 2001, c. 26), and associated regulations, including the Collision Regulations (CRC, c. 1416) and the Vessel Traffic Service Zone Regulation (SOR/89-98). Broadcast vessel movements on very high frequency (VHF) channel 74. Take early and substantial action to keep clear of all other vessels and fishing gear including reducing speeds around fishing vessels to prevent danger or injury by bow wave or wash to such craft (VFPA 2016). Consider CRA net fishery openings in Fisheries Management Area 29-13 of the Fraser River in scheduling of vessel movements. As directed by BHP and VFPA, engage with Aboriginal and stakeholder groups to clarify critical timing and location of fishing vessels with shipping activities to and from the Project site. Engage with Aboriginal and stakeholder groups to add clarity and precision to critical timing and spatial interaction of fishing vessels and Project-related shipping activities to and from the Project site. 	<p>The risk of serious harm to CRA fish from Project-related effects are anticipated to be low provided that the recommended mitigation measures are implemented during construction. Permanent residual adverse effects to CRA fish or fish habitat are not anticipated from Project-related construction or operation-phase activities.</p>	<p>Aquatic Resources Assessment Report (Attachment 4.2-W)</p>
	<p>Potential adverse effects on benthic invertebrates during construction prior to mitigation are:</p> <ul style="list-style-type: none"> Direct mortality Sediment re-suspension Potential entrainment, burial, or physical disturbance of these organisms. 	<p>The following mitigation measures are recommended to minimise effects to benthic resources during construction:</p> <ul style="list-style-type: none"> Follow the BMPs and guidelines described for Fraser River fish and fish habitat. Implement and maintain erosion and sediment control measures during construction. 	<p>Residual Project-related effects on benthic invertebrates are not anticipated from the installation of piles, and will be undetectable following implementation of the mitigation measures.</p>	<p>Aquatic Resources Assessment Report (Attachment 4.2-W)</p>

Background Conditions	Potential Effects (Prior to the Implementation of Mitigation Measures)	Summary of Proposed Mitigation	Key Assessment Conclusions	Further Detail
<p>The Fraser River, Gunderson Slough (south of the Project), and Manson Canal (northeast of the Project) provide direct habitat value for fish, including commercial, Aboriginal, and recreational species (e.g., salmonids). Several upland tributaries within and surrounding the Project site may provide food and nutrient values for fish; however, these watercourses have been highly modified from their pre-development state through channelisation, culverting, and/or isolation from fish-bearing habitat.</p>	<p>Potential effects on marine mammals during construction, prior to mitigation:</p> <ul style="list-style-type: none"> Increased construction-related vessel activity near the Project may result in an increased risk of collision with pinnipeds. Proposed construction activities will generate underwater noise that can potentially injure or result in behavioural disturbances to marine mammals. Project-related atmospheric noise could adversely affect pinnipeds hauled out onto land near the Project. 	<p>The following mitigation measures are recommended to minimise effects to marine mammals during construction:</p> <ul style="list-style-type: none"> Follow the CEMP (Attachment 4.3-B), which includes BMPs to reduce potential effects on marine mammals during Project-related underwater construction activities, and describe the measures to be followed to minimise underwater noise. Undertake the following measures during pile driving: <ul style="list-style-type: none"> Follow relevant BMPs for pile driving, as described in the Fraser River fish and fish habitat section. Conduct pile driving from land-based equipment whenever possible. Designate a marine mammal observer to be present during pile driving who shall have the authority to stop work when cetaceans or sea lions are within a 1,000-m radius (safety zone) of impact pile-driving operations. Work may resume when marine mammals have not been observed for 10 minutes, or have been observed leaving the safety zone. In conjunction with marine mammal monitoring, retain an AQP to undertake hydro-acoustic monitoring of underwater noise levels associated with pile-driving activities to prevent harmful in-water noise levels. Avoid unnecessary idling of marine-based equipment. Conduct construction activities within the Fraser River during the DFO Timing Window for the Protection of Fish and Fish Habitat (June 16 to February 28) for the region unless otherwise agreed upon by DFO. 	<p>Potential Project-related effects on marine mammals will be temporary, and spatially limited to those activities occurring near the Project footprint. Since the risk of vessel strikes due to Project-related construction is not likely to increase, residual Project-related effects from construction on marine mammals are not anticipated.</p>	<p>Aquatic Resources Assessment Report (Attachment 4.2-W)</p>
	<p>Operation</p>			
	<p>Potential effects on upland and Fraser River fish and fish habitat during operation, prior to mitigation include:</p> <ul style="list-style-type: none"> Change in salinity concentrations may occur from potash spillage. Change may occur in quality and quantity of stormwater discharge. 	<p>The following mitigation measures are recommended to minimise effects to Fraser River fish and fish habitat during operation:</p> <ul style="list-style-type: none"> Enclose transfer equipment to reduce the potential for potash spills. Routinely inspect onsite equipment and facilities to mitigate the potential for fuel spills and leaks. Dispose of waste at appropriate facilities. Follow the Spill Prevention and Emergency Response Plan (Attachment 4.3-E) when required. Follow the Stormwater Pollution Prevention Plan (Attachment 4.3-A), which includes BMPs to reduce stormwater volumes discharged, and reduce the pollutant loading of stormwater. The management strategy includes good housekeeping, preventive maintenance, containment, reduction, spill prevention and response, and treatment. 		
	<p>The potential effect on CRA fishing during operation, prior to mitigation, is interference with CRA fishing from an increase in marine traffic. In particular, salmon gill netting in the lower Fraser River will be affected by vessel traffic when the nets are set across the active navigational channel.</p>	<p>In addition to the mitigation measures provided for Fraser River fish and fish habitat, the following mitigation measures are recommended to minimise effects to CRA fishing:</p> <ul style="list-style-type: none"> Follow the Marine Traffic Information Requirements Report (Attachment 4.1-E), which addresses mitigation of potential effects from increased Project-related vessel traffic. This report includes measures such as ensuring vessels adhere to speed limits within port jurisdiction. Undertake the following measures related to vessel use: <ul style="list-style-type: none"> Coordinate vessel movements outside of FSD to reduce conflict with fishing vessels engaged in net fisheries. Abide by the <i>Canada Shipping Act, 2001</i> (SC 2001, c. 26), and associated regulations, including the Collision Regulations (CRC, c. 1416) and the Vessel Traffic Service Zone Regulation (SOR/89-98). Broadcast vessel movements on very high frequency (VHF) channel 74. Take early and substantial action to keep clear of all other vessels and fishing gear including reducing speeds around fishing vessels to prevent danger or injury by bow wave or wash to such craft (VFPA 2016). Consider CRA net fishery openings in Fisheries Management Area 29-13 of the Fraser River with respect to large vessel movements, and attempt to schedule around these openings as feasible. As directed by BHP and VFPA, engage with Aboriginal and stakeholder groups to clarify critical timing and location of fishing vessels with shipping activities to and from the Project site. Engage with Aboriginal and stakeholder groups to add clarity and precision to critical timing and spatial interaction of fishing vessels and Project-related shipping activities to and from the Project site. 	<p>Following the implementation of mitigation measures during Project operation, adverse residual effects are not anticipated.</p>	<p>Aquatic Resources Assessment Report (Attachment 4.2-W)</p>
<p>The potential effect on marine mammals during operation, prior to mitigation include an increase in the number of vessel movements associated with the Project's operation phase, which can increase the risk of vessel strikes for cetaceans and pinnipeds and may mask complex vocalisations from some cetaceans.</p>	<p>The following mitigation measures are recommended to minimise effects to marine mammals during Project operation:</p> <ul style="list-style-type: none"> BHP terminal management should participate in an environmental training program for vessel operations to reduce the risk of a marine mammal vessel strike by using guidance from similar programs produced for nearby port projects. 			

Background Conditions	Potential Effects (Prior to the Implementation of Mitigation Measures)	Summary of Proposed Mitigation	Key Assessment Conclusions	Further Detail
Terrestrial Resources				
<p>Approximately 98% of the site has been developed, and is currently paved and used for industrial/port terminal activities; therefore, the Project site provides little habitat for native plant and wildlife species. Wildlife species likely to be present are relatively mobile with high tolerance for human-related activities. The majority of the vegetated areas is sparsely vegetated and dominated by non-native and invasive plant species. Northwestern salamander could be present year-round in ditches.</p>	<p>Potential effects to vegetation during construction are:</p> <ul style="list-style-type: none"> Loss of native plant communities due to vegetation removal and construction of the Project rail loop. Introduction of invasive plant species. 	<p>The following mitigation measures are recommended to manage vegetation during construction:</p> <ul style="list-style-type: none"> Stage and minimise clearing to the extent practical. Survey and clearly demarcate (e.g., flag) clearing limits in the field prior to undertaking any clearing work to minimise vegetation removal and associated ground disturbance. Implement an invasive species management plan with the following general guidance: <ul style="list-style-type: none"> Dispose of invasive plant material appropriately. Control the spread of invasive species on and offsite through routine inspections of materials and vehicles entering and exiting the site. 	<p>The application of appropriate mitigation measures and adherence to best management practices (BMPs) is expected to avoid most residual effects.</p>	<p>Terrestrial Resources Assessment Report (Attachment 4.2-X) CEMP (Attachment 4.3-B)</p>
	<p>Potential effects to wildlife during construction:</p> <ul style="list-style-type: none"> Habitat loss or alteration for birds, mammals, and amphibians and reptiles may occur from building demolition, vegetation clearing, and other construction activities. Mortality of birds, mammals, and amphibians and reptiles may result from building demolition, vegetation clearing, excavation, and equipment operation. Sensory disturbance may occur to birds and mammals during various Project activities. 	<p>The following mitigation measures are recommended to manage wildlife during construction:</p> <ul style="list-style-type: none"> Implement the following nesting bird mitigation measures: <ul style="list-style-type: none"> Schedule vegetation removal to occur during the following least-risk work windows to avoid contravention of the <i>Wildlife Act</i> (RSBC 1996, c. 488) and the <i>Migratory Birds Convention Act</i>, 1994 (SC 1994, c. 22), to the extent practical (August 15 to March 15). Conduct pre-clearing nest surveys if vegetation removal / building demolition must occur during the nesting window, or at any time for nests protected year-round (i.e., bald eagle, peregrine falcon, osprey, and great blue heron nests). Engage a qualified environmental professional (QEP) to conduct pre-clearing nest surveys in accordance with BMPs. If an active nest is located, the QEP will propose appropriate mitigation measures (e.g., establishing 50-m nest buffers for songbirds). Monitor active nests found during pre-clearing surveys prior to construction to establish nest status. Engage a QEP to conduct environmental monitoring to determine if Project activities are causing substantial disturbance, and if so, devise and propose mitigation to minimise disturbance. Inspect steep-walled excavations if they occur onsite to protect against wildlife entrapment. If wildlife cannot escape unimpeded from excavations, develop measures with the QEP for the safe removal of wildlife. Inform the environmental monitor immediately if mammal presence is observed during building demolition. The QEP will propose appropriate mitigation measures to confirm the safe removal of wildlife. Keep work areas clear of wildlife attractants (e.g., garbage). Develop a Noise Management Plan as part of the CEMP (Attachment 4.3-B) with proposed noise mitigation measures. Confirm that mitigation measures provided for aquatic species in Section 4.2.12 Aquatic Resources Assessment will mitigate potential effects to amphibian habitat. 	<p>After the implementation of mitigation measures, the following residual effects are anticipated:</p> <ul style="list-style-type: none"> Construction activities will result in a permanent loss of up to 0.6 ha of low-quality vegetated areas that are dominated by invasive and weedy species. During construction, approximately 950 square metres (m²) of aquatic habitat will be permanently removed; however, this loss will be limited to ditches that provide marginal value to amphibians. 	
	<p>Potential effect to upland aquatic habitat during construction is habitat degradation (e.g., reduced water quality) as a result of increased erosion and sedimentation resulting from various construction activities.</p>	<p>The following mitigation measures are recommended to manage upland aquatic habitat during construction:</p> <ul style="list-style-type: none"> Engage a QEP to salvage amphibians prior to culverting Robson Ditch, Unnamed Ditch, and Bekaert South Ditch, in accordance with BMPs and standards. Due to the anticipated conditions, salvage methods will primarily focus on traps and visual observations during dewatering. Schedule ditch culverting when ditches are driest. Prior to culverting, dewater ditches using an approved area for infiltration. As a precaution, conduct fish salvage on any wetted channel prior to instream work. A QEP will monitor ditch dewatering for fish and amphibian presence. Test any contact water to ensure that it meets water quality guidelines and objectives prior to discharging it back into the environment. 	<p>The Project is unlikely to cause significant adverse residual effects to some vegetation and wildlife species.</p>	

Background Conditions	Potential Effects (Prior to the Implementation of Mitigation Measures)	Summary of Proposed Mitigation	Key Assessment Conclusions	Further Detail
	<p>During operation, potential effects to terrestrial resources are:</p> <ul style="list-style-type: none"> Invasive plant species may be introduced. Mortality of birds and mammals may result from increased rail traffic. Sensory disturbance of birds and mammals may occur from train and vessel traffic and unloading operations. <p>Degradation of amphibian habitat will result from a reduction in stormwater quality.</p>	<p>The following mitigation measures are recommended to minimise effects to terrestrial resources during operation:</p> <ul style="list-style-type: none"> Develop and implement a Vegetation Management Plan as part of the CEMP (Attachment 4.3-B) to protect native vegetation and ecosystems from the introduction / spread of noxious plant species. Develop measures to manage noxious plant species in accordance with the <i>Weed Control Act</i> (RSBC 1996, c. 487) and guidance documents. Work with rail service providers to restrict all rail movement within FSD and adjacent VFPA Rail Yard to 16 kilometres per hour (km/hr.) or less. Cover the conveyor systems between the railcar unloading system, the potash storage building, and the shiploader, which will limit the travel of noise. Develop a Noise Management Plan as part of the Operation Environmental Management Plan to effectively implement noise mitigation measures. Mitigation measures provided for aquatic species in Section 4.2.12 Aquatic Effects Assessment will mitigate potential effects to amphibian habitat. 	<p>No residual effects are anticipated following implementation of mitigation measures.</p>	
Species at Risk				
<p>The Project site contains critical habitat for streambank lupine, a plant species at risk, as designated under the <i>Species at Risk Act</i>, SC 2002, c. 29 (SARA). The critical habitat area overlaps with the Project's proposed terminal rail loop. The 2017 surveys conducted for BHP and for the SARA permit application found no individual streambank lupine plants in the critical habitat area.</p>	<p>Alteration will occur to streambank lupine critical habitat area during Project construction.</p>	<p>The following mitigation measures are recommended to minimise disturbance to the critical habitat area within the Project site, in accordance with the <i>Recovery Plan for Streambank Lupine (Lupinus rivularis) in British Columbia</i> (SLRT 2014):</p> <ul style="list-style-type: none"> Inform and train workers on the potential presence of streambank lupine and how to recognise the species. Follow the mitigation measures proposed for minimising effects to vegetation during construction. Flag and stake the construction zone in the critical habitat area to prevent accidental encroachment outside the construction zone. Should streambank lupine be identified onsite, notify a BHP representative immediately for further direction. Avoid storing or dumping fill, construction materials, or waste in the critical habitat area. Remove vegetation (trees and ground cover) in a manner to avoid the mixing of soils. Retain and separate topsoils from the zero centimetres (cm) to -3 cm and -3 cm to -6 cm layers excavated from the critical habitat area (to be used for offsite habitat enhancement). Comply with additional conditions of the SARA permit for the site. 	<p>Project-related construction is unlikely to result in direct effects on the current population. Mitigation measures will mitigate potential indirect effects to streambank lupine germination in the critical habitat area.</p>	<p>Terrestrial Resources Assessment Report (Attachment 4.2-X)</p>
<p>Alteration will occur to streambank lupine critical habitat area during Project operation.</p>	<p>Consistent with the <i>Recovery Plan for Streambank Lupine (Lupinus rivularis) in British Columbia</i> (SLRT 2014), during operation, the following mitigation measures are recommended, where feasible:</p> <ul style="list-style-type: none"> Avoid chemical herbicide use for vegetation control in areas where streambank lupine could be either directly or indirectly affected through wind drift. Undertake any maintenance activities on the railway in critical habitat following lupine seed set (typically July). Comply with additional conditions in the SARA permit for the site. Remove invasive and weedy species with potential to affect streambank lupine. Develop and implement an annual post-construction monitoring plan for streambank lupine critical habitat annually in late spring to determine population trends and monitor invasive species and vegetation succession. The monitoring plan will include: <ul style="list-style-type: none"> Purpose and scope Methods Results (distribution, relative age, vigour) Recommended mitigation. Explore streambank offsetting and enhancement opportunities with VFPA and Environment and Climate Change Canada (ECCC) as part of the SARA permitting process. 	<p>No residual effects are anticipated following implementation of mitigation measures.</p>		

Note: *Construction mitigation measures for noise and air quality are included in the CEMP.

REFERENCES

- British Columbia Ministry of Environment (MOE). 2017. British Columbia Water Quality Guidelines. British Columbia Approved Water Quality Guidelines: Aquatic Life, Wildlife & Agriculture. Summary Report. January 2017 Edition. Water Protection & Sustainability Branch. Available at https://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/waterquality/wqgs-wqos/approved-wqgs/wqg_summary_aquaticlife_wildlife_agri.pdf. Accessed October 2017.
- British Columbia Marine and Pile Driving Contractors Association (MPDCA) and Fisheries and Oceans Canada (DFO). 2003. Best Management Practices for Pile Driving and Related Operations. Available at https://buyandsell.gc.ca/cds/public/2016/08/17/f0fcf96f5bd08535ff8e81aac62bbd74/fp802-160141_bc_pile_driving_practices.pdf. Accessed July 2017.
- Chilibeck, B. and G. Norris. 1993. Land Development Guidelines for the Protection of Aquatic Habitat. Prepared for Fisheries and Oceans Canada. Available at <http://www.dfo-mpo.gc.ca/Library/165353.pdf>. Accessed August 2017.
- Fisheries and Oceans Canada (DFO). 2013. Fisheries Productivity Investment Policy: A Proponent's Guide to Offsetting. Available at <http://www.dfo-mpo.gc.ca/pnw-ppe/offsetting-guide-compensation/index-eng.html>. Accessed August 2017.
- Fisheries and Oceans Canada (DFO). 2016. Measures to Avoid Causing Harm to Fish and Fish Habitat Including Aquatic Species at Risk. Available at <http://www.dfo-mpo.gc.ca/pnw-ppe/measures-mesures/measures-mesures-eng.html>. Accessed August 2017.
- Health Canada. 2017. Guidance for Evaluating Human Health Impacts in Environmental Assessment: Noise. Healthy Environments and Consumer Safety Branch, Health Canada: Ottawa.
- Ministry of Environment (MOE). 2012. Guidelines and Best Management Practices (BMPs) in BC. Available at <http://www.env.gov.bc.ca/wld/BMP/bmpintro.html>. Accessed June 2017.
- Ministry of Water, Land and Air Protection (MWLAP). 2004. Standards and Best Practices for Instream Works. Available at http://www.env.gov.bc.ca/lower-mainland/electronic_documents/iswstdsbpsmarch2004.pdf. Accessed August 2017.
- Port Metro Vancouver (PMV). 2015. Project and Environmental Review (PER) Guidelines - View and Shade Impact. July 2015. Available at <https://www.portvancouver.com/wp-content/uploads/2015/05/PER-View-and-Shade-Impact-Guidelines-FINAL-2015-07-13.pdf>. Accessed August 2017.
- Streambank Lupine Recovery Team (SLRT). 2014. Recovery Plan for Streambank Lupine (*Lupinus rivularis*) in British Columbia. Prepared for the BC Ministry of Environment by the Streambank Lupine Recovery Team (SLRT), Victoria.
- Vancouver Fraser Port Authority (VFPA). 2016. Port Information Guide: Port of Vancouver, August 2016. Available at <https://www.portvancouver.com/wp-content/uploads/2015/03/Port-Information-Guide-12-Port-of-Vancouver-August-2016-amended.pdf>. Accessed August 2017.