

PER No.:	17-164
Tenant:	Metro Vancouver
Project:	Water Supply Tunnel at Second Narrows – Metro Vancouver
Project Location:	The north shore of Burrard Inlet on a spit located approximately 375 m east of the Second Narrows Bridge
VFPA SID No.:	DNV078
Land Use Designation:	Port Water and Industrial
Applicant(s):	Metro Vancouver
Applicant Address:	4730 Kingsway St, Burnaby, BC V5H 4J5
Category of Review:	B
Date of Approval:	June 21, 2018
Date of Expiry:	December 31, 2023

1 INTRODUCTION

The Vancouver Fraser Port Authority (VFPA), a federal port authority, manages lands under the purview of the *Canada Marine Act*, which imparts responsibilities for environmental protection. VFPA accordingly conducts project and environmental reviews of works and activities undertaken on these lands to ensure that the works and activities will not likely cause significant adverse environmental effects. This project and environmental review report and project permit (the Permit) documents VFPA's project and environmental review of PER No. 17-164: Water Supply Tunnel at Second Narrows – Metro Vancouver (the Project) proposed by Metro Vancouver (the Applicant).

This project and environmental review was carried out to address VFPA's responsibilities under the *Canada Marine Act*, and to meet the requirements of the *Canadian Environmental Assessment Act, 2012* (CEAA 2012), as applicable. The proposed Project is not a CEAA 2012 "designated project" and an environmental assessment as described in CEAA 2012 is not required. However, VFPA authorization is required for the proposed Project to proceed and in such circumstances, where applicable, Section 67 of CEAA 2012 requires federal authorities to assure themselves that projects will not likely cause significant adverse environmental effects. This review provides that assurance. In addition, VFPA considers other interests, impacts and mitigations through the project and environmental review.

The project and environmental review considered the application along with supporting studies, assessments and consultations carried out or commissioned by the Applicant, as well as other information provided by the Applicant. In addition, this project and environmental review considered other information available to VFPA and other consultations carried out by VFPA. A full list of information sources germane to the review is provided in the following pages of this report.

This Permit is the authorizing document allowing the Applicant to proceed with the Project subject to the listed project and environmental conditions.

2 PROJECT DESCRIPTION

Metro Vancouver currently conveys drinking water from the Seymour and Capilano watersheds, to municipalities south of Burrard Inlet via three marine crossings that run between the District of North Vancouver and Burnaby. The three crossings are located between 422 and 558 m (1,386 - 1,832 ft.) east of the Second Narrows Bridge. They were built in 1948, 1954 and 1978 respectively. The crossings were trenched in the bed of the inlet and covered with rip rap, and are now considered susceptible to failure during a moderate earthquake. The two older crossings, No 1 and No 2, are also nearing the end of their service lives and are expected to be removed following the commissioning of a new proposed crossing. Crossing No 3 is proposed to be retained as an alternate. Removals would be subject to a separate application under PER.

Metro Vancouver proposes to construct a 1,100 m (3,610 ft.) long replacement supply tunnel between two shafts situated on either side of Burrard Inlet. The new tunnel would be designed to meet current seismic standards. The project is proposed to extend north to south under the Burrard Inlet from the Metro Vancouver works yard in the District of North Vancouver to Second Narrows Park (formerly Montrose Park) in the City of Burnaby. Approximately 700 m (2,297 ft.) of the tunnel is located within VFPA jurisdiction. The tunnel is proposed to be located 30 m beneath the sea floor, approximately 400 m (1,312 ft.) east of the Second Narrows Bridge and constructed using a Tunnel Boring Machine (TBM). The outer diameter of the tunnel is proposed to be 6.3 m (21 ft.) and the inner diameter 5.8 m (19 ft.).

Although the vertical shafts at each end are located outside VFPA jurisdiction, the proposed north shaft excavation requires localized dewatering to Burrard Inlet. Groundwater is proposed to be discharged via surface pipe, over a spit situated to the east of the Seymour River mouth, within VFPA jurisdiction. The proposed discharge pipe would end approximately 70 m north of the north boundary of the deep sea navigation channel. A temporary anchor and float system may be required to maintain position and depth of the proposed discharge pipe.

To minimize the risk of a TBM breakdown under Burrard Inlet, the creation of a “safe haven” is also proposed at the midpoint of the tunnel, which is north of the channel but within VFPA jurisdiction. At this location, below grade soils would be reinforced or improved. As the TBM advances from the base of the north shaft towards the south, it will bore into the soil-reinforced safe haven, undergo maintenance from within the safe haven, and then advance under Burrard Inlet to the south shaft.

Two possible methodologies are proposed for reinforcing the soils at the safe haven: jet grouting or soil freezing. The former involves vertical drilling, and the injection of a high pressure cement/air/water slurry from the surface, via drill pipe, into the soil. The latter involves vertical drilling, the insertion of hollow tubes from the surface into the ground, and the conveyance of a contained coolant (liquid nitrogen or brine) through the tubes, and back to the surface. This would freeze the soil and provide sufficient reinforcement to conduct the proposed maintenance works in a safe manner.

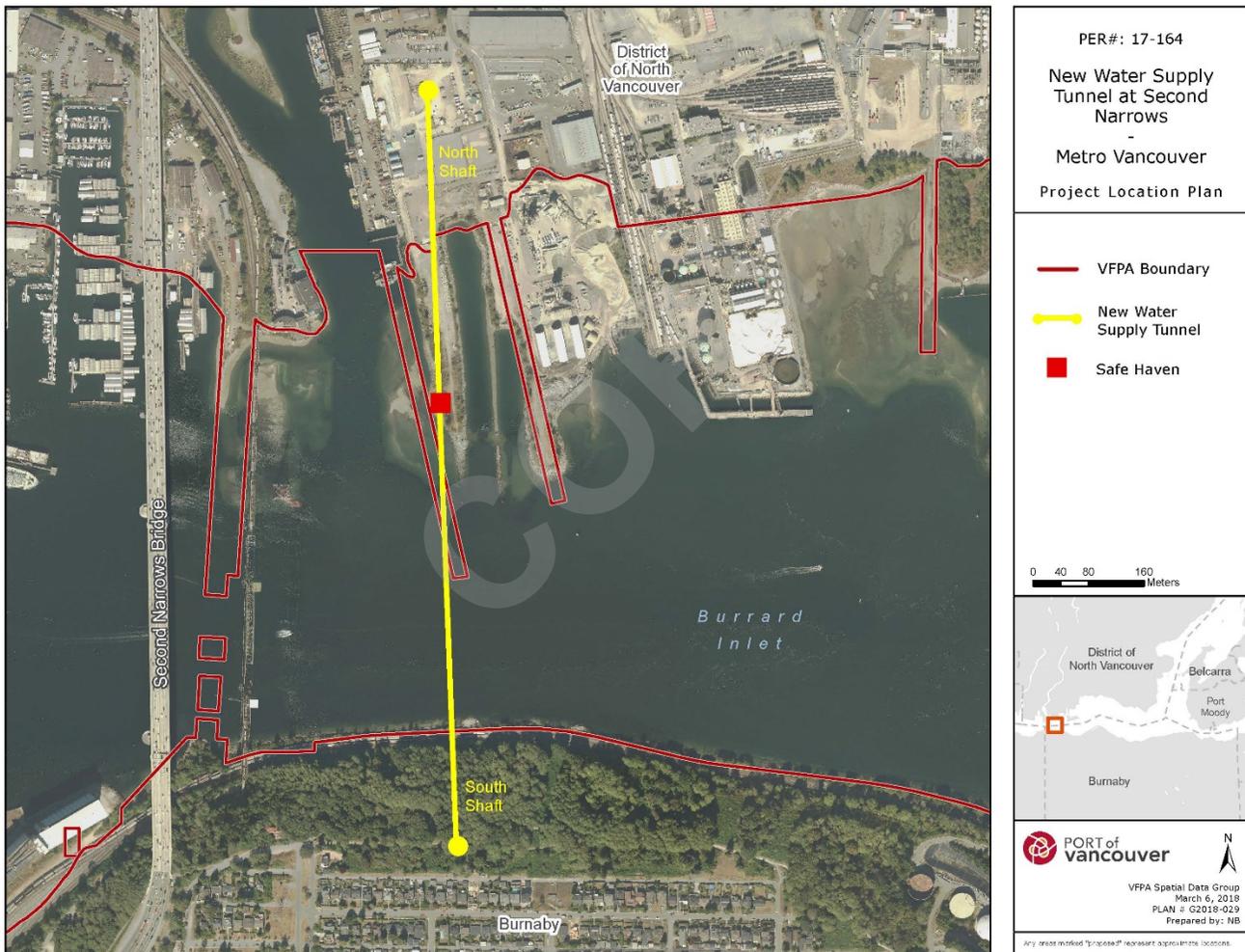
If ground freezing is selected for the preparation of the safe haven, it is anticipated that holes about 100 mm in diameter, spaced roughly 1 m apart with a grouted metal casing, would be left behind in the ground. For the anticipated size of the safe haven, this would be approximately 250 total holes and associated casings. The depth of each hole is anticipated to be between 65 and 70 m deep. The upper portion of the casing will be cut off at a depth of 1 to 1.5 m and removed as necessary.

At the northern end of the spit, north of the ground improvements where the safe haven is to be constructed Metro Vancouver is also proposing a temporary workspace 4200 m² (45,208 ft²). The spit can only be accessed via road through a Metro Vancouver works yard which borders the spit to

the north. The temporary workspace is proposed to be used for the storage of tunnel material, including precast concrete segmental tunnel lining and steel conveyance pipe.

There is the potential for a temporary barge ramp to be constructed if the contractor selected to complete the project elects to use this proposed method for spoil removal. This ramp would require vegetation removal and mooring dolphins. If this method is selected, a project permit for the additional works would be required.

In this project permit, the Project means the physical activities authorized by VFPA to be carried out pursuant to **PER No. 17-164**, as described below. All quantities and measurements are approximate.



2.1 Proposed Works

1. Establishment of a 4,200 m² (45,208 ft²) “temporary workspace” at the north end of the spit measuring approximately 120 m x 35 m (393 ft. x 115 ft.). The “temporary workspace” is to be utilized for storage of tunnel material, including precast concrete segmental tunnel lining and steel conveyance pipe;

2. Installation of a temporary groundwater discharge pipe from the north shaft to the south end of the spit and into Burrard Inlet, ending approximately 70 m (230 ft.) north of the north boundary of the deep sea channel;
3. Creation of an underground TBM safe haven approximately 400 m (1,312 ft.) south of the north shaft, 50 m - 66 m (166 ft. - 216 ft.) underground, and measuring approximately 16 m high x 13 m wide x 18 m long (53 ft. x 43 ft. x 59 ft.). Ground improvement to be realized via jet grouting or ground freezing;
4. Depending on the selected safe haven ground improvement methodology, either:
 - a. For jet grouting: vegetation removal and temporary disturbance of an area of 1,200 m² (12,917 ft²) to accommodate the jet grouting assembly including: jet grouting block, jet grout spoil bin and jet grout batch plant or;
 - b. For ground freezing: vegetation removal and temporary disturbance of an area of 1,500 m² (16,146 ft²) to accommodate the freezing assembly including: ground freezing block, drill rig, power plant, freeze plant, storage tank, pump, and header for freeze blocks;
5. Boring of 1,100 m (3,610 ft.) long water supply tunnel between two shafts. Inner diameter is anticipated to be 5.8 m (19 ft.), outer diameter is 6.3 m (21 ft.).
6. Construction of concrete encased tunnel containing three steel conveyance pipes, and soil infill;
7. Removal of freeze assembly/jet grouting and associated equipment, infilling of safe haven drill holes;
8. Grading and replanting of vegetation with native species in areas disturbed on the spit.

Overall project duration is anticipated to be approximately 5.5 years, with general mobilization in November 2018 and substantial completion by summer 2023. Anticipated timelines are as follows:

- North shaft boring and segmental lining - 14 months (January 2019 to February 2020);
- South shaft excavation and segmental lining – 16 months (January 2019 to April 2020);
- Safe haven construction – 2 months (July 2019 to September 2019);
- Tunnel boring and segmental lining – 10 months (February 2020 to December 2020);
- Tunnel and steel carrier pipe and backfill - 22 months (December 2020 to September 2022);
- North valve chamber – 12 months (August 2022 to July 2023);
- South valve chamber – 15 months (February 2022 to April 2023);
- North valve chamber dewatering discharge to Burrard Inlet - 3 months (August 2022 to October 2022).

All general construction and physical activities related to the Project are proposed to be conducted within regular VFPA construction hours.

Temporary lights will likely be required by the drilling/grouting contractor when reinforcing the soil for the safe haven. This would likely consist of several sets of trailer-mounted light towers.

Overall project cost is approximately \$235,000,000, and the cost of the works in VFPA jurisdiction is approximately \$84,000,000.

3 VANCOUVER FRASER PORT AUTHORITY INTERNAL REVIEWS

The following VFPA departments have reviewed the application and support approval of the Project subject to the listed project and environmental conditions.

- | | | |
|-------------------------------------------------------|------------------------------------------------------------|----------------------------------------------------|
| <input checked="" type="checkbox"/> Planning | <input checked="" type="checkbox"/> Environmental Programs | <input checked="" type="checkbox"/> Engineering |
| <input checked="" type="checkbox"/> Marine Operations | <input checked="" type="checkbox"/> Project Communications | <input checked="" type="checkbox"/> Transportation |

The proposed works are in keeping with the VFPA Land Use Plan designations of Port Water and Industrial.

It is anticipated that in the future, dredging within the existing deep sea channel east of the Second Narrows Bridge will be required to keep the navigation channel clear. To ensure that potential dredging activities in Burrard Inlet are not limited by the installation of the new water supply tunnel, the ground conditions of the seabed in the narrows were analyzed.

Analysis of the ground conditions in the potential dredging area indicate that the area is almost entirely soil consisting of marine bottom sediments. It is expected that there may be a small amount of weak sandstone intersected on the south side of the Narrows, at which point the tunnel is at least 25 m (82 ft.) below the area of dredging. It is anticipated that potential future dredging operations at the narrows are unlikely to result in the excavation of substantial amounts of rock, and even if encountered, it is likely the rock can be removed using conventional dredging methods (no blasting would be required). The dredging may require the use of an impact hammer to loosen the rock, but the use of such equipment is not expected to have an impact on the supply tunnel.

Should blasting be required to assist dredging, given the depth of the proposed tunnel relative to the area of potential dredging, the ground conditions, and the potential use of modern blasting practices (the use of timed, delayed blasting patterns which minimize the amount of explosive on each delay), it is expected that blasting could be conducted without impacts to the tunnel.

Noise is expected during project construction activities. However, activities on the spit including loading and unloading of materials at the temporary workspace and construction of the safe haven are expected to have minimal impacts as they are adjacent to an existing industrial area. The nearest residence or park on the north shore is roughly 850 m away from the safe haven. The nearest residence on the south shore is 680 m away from the safe haven. All construction activities are expected to take place during regular construction hours of Monday to Saturday between 7am and 8pm.

Construction of the project is expected to increase traffic volumes in the adjacent jurisdictions of the City of Burnaby and the District of North Vancouver. Metro Vancouver is developing a Traffic Management Plan to minimize disturbances to businesses and residents in the surrounding communities. The contractor will apply to the respective jurisdictions for traffic related permits. Metro Vancouver is also in the process of securing the necessary utility crossing permit and agreement with Canadian Pacific Railway who operate a rail line on the south shore of Burrard Inlet, and under which the tunnel would pass.

The north end of the spit is proposed to be utilized for tunnel segment lining storage. Traffic flow to the spit is estimated to generate 4-5 b-train trucks per day, Monday to Friday for a period of roughly 8 months. Construction of the safe haven, depending on the methodology proposed is anticipated to generate roughly 8-10 vehicles (b-train, cement, hydrovac and crew vehicles) per day including mobilization, construction and demobilization for jet grouting over a period of approximately 2 ½ months. Alternatively, ground freezing would generate roughly 8-16 vehicles (b-train and crew vehicles) per day including mobilization, construction and demobilization over a period of approximately 2 ½ months.

Dewatering for the construction of the north shaft is anticipated to be temporary (approximately 3 months duration). The outfall of the temporary dewatering pipe is proposed to be sited greater than 10 m from a kelp bed and other sensitive fish habitat that may be present near the spit, and discharge away from (i.e. to the south of) any sensitive habitats. The outfall is proposed to be located greater than 1 m above the seabed to avoid scouring from the water discharge.

Based on toxicity testing (i.e., rainbow trout 96-hour LC₅₀ test) of groundwater collected during pump tests in the proposed north shaft excavation area, the discharge is not likely to be acutely toxic to fish at the point of discharge, and is predicted to meet applicable water quality guidelines within a dilution zone of 100 m radius or less from the point of discharge. In addition, the discharge location is proposed to be greater than 5 m below the water surface to avoid water depths typically used by juvenile salmon during their out-migration from March to August. Water quality monitoring will be conducted during the discharge to confirm that water quality meets applicable guidelines.

The submission and approval of a Dewatering Plan is a condition of the permit. The Dewatering Plan is required to include the final discharge location selected, expected discharge rate and duration, treatment (if any) and details of the proposed monitoring to confirm that water quality meets applicable guidelines.

Metro Vancouver has requested that crossing No 3 be retained as a back-up line and for existing crossings No 1 and No 2 be decommissioned and removed as soon as possible following the new supply tunnel being commissioned and fully operational. Property negotiations related to retention and removals are currently underway.

As Metro Vancouver is clearing vegetation on the spit to accommodate the construction of the safe haven, they are required to grade and contour the site to for replanting of vegetation. Metro Vancouver is required to submit a Vegetation Mitigation Plan including the location, species, numbers and sizes of vegetation to be removed, trees that will be protected (if any), proposed replanting including the species, numbers and size, and a schedule for post-planting assessments.

The permit is valid for approximately 5.5 years, which is reflective of the construction phasing identified by Metro Vancouver.

4 ABORIGINAL CONSULTATION

Aboriginal Affairs has reviewed the proposed works and determined that adverse impacts to Aboriginal or Treaty rights are not expected.

5 NOTIFICATIONS

5.1 Municipal Notification

The Project was assessed by VFPA to have potential impacts to municipal interests. A notification letter was sent to the City of Burnaby and the District of North Vancouver (DNV) on March 12, 2018 notifying them of the Project. The City of Burnaby had no comments.

The DNV responded in an email on March 27, 2018, raising concern over the potential traffic impacts of construction activities in the District. The Applicant acknowledges that the Project will temporarily increase traffic during construction. Condition No 21 of the Permit requires the Applicant to submit a Traffic Management Plan to consider the impacts from construction activities and ways to mitigate those impacts. The Traffic Management Plan will outline access and parking

procedures to minimize disturbance to the businesses and residents in the surrounding communities. The plan will be provided to the DNV for comment.

The DNV also confirmed that they support the possibility of barging materials to and from the site to reduce potential traffic impacts. The DNV has also offered to provide assistance to Metro Vancouver through the tendering process by providing tendering language to make barging a viable transport option. The Applicant is considering this option, and VFPA has noted that should works be required to facilitate this activity, this would trigger a review under PER.

5.2 Adjacent Tenant Notification

The Project was assessed by VFPA to have potential impacts to adjacent tenant interests. A notification letter was sent to Canadian Pacific Railway on March 12, 2018, notifying them of the Project. Canadian Pacific Railway did not respond.

5.3 Community Notification

The Project was assessed by VFPA to have minimal or no potential impacts to community interests in the surrounding area once the project is completed. Therefore no community consultation was required to be conducted by the Applicant.

The Project was assessed by VFPA to have potential impacts to community interests during construction. These include impacts such as traffic and noise from construction activities. The Applicant has indicated that they will be distributing various construction communication materials, including newspaper ads and email updates, to residents and businesses in the District of North Vancouver and City of Burnaby. Also, the Applicant has indicated they will produce traffic advisories to provide information on traffic impacts along arterial roads. Condition No 20 requires the Applicant to share final communications materials with VFPA and to confirm when they have been distributed.

6 INFORMATION SOURCES

VFPA has relied upon the following sources of information in its review of the Project.

- Application form and materials submitted by Applicant on January 26, 2018, April 26, 2018, May 23, 2018 and May 28, 2018.
- All Project correspondence from January 10, 2018 to June 6, 2018.
- All plans and drawings labelled PER No.17-164-A to E.
- "Environmental, Socio-Economic and Archaeological Assessment", January 17, 2018, Golder Associates
- "Drawing Set", December 6, 2017, McMillen Jacobs Associates
- "Environmental Management Plan", January 17, 2018, Golder Associates
- "Project Construction Schedule", November 28, 2017, Metro Vancouver
- "North Site Emergency Vehicle Access", December 18, 2017, McMillen Jacobs Associates
- "Environmental Site Assessment", n.d. Metro Vancouver
- "First Nations Engagement Report", January 19, 2018, Metro Vancouver
- "Public Engagement Objectives and Summary", December 12, 2017, Metro Vancouver
- "Technical Memorandum - Metro Vancouver: Second Narrows Water Supply Tunnel Project Response to Application Submission Requirement (PER No. 17-164) – Proposed Future Dredge Area", April 25, 2018, Golder Associates.
- "Technical Memorandum – Second Narrows Water Supply Tunnel (SNWST) North Valve Chamber Groundwater Toxicity Assessment", May 23, 2018, Golder Associates.

- “Technical Memorandum – Second Narrows Water Supply Tunnel Responses to VFPA Comments on NVC Groundwater Toxicity Assessment (PER No. 17-164)”, May 28, 2018, Golder Associates.

7 PROJECT AND ENVIRONMENTAL CONDITIONS

VFPA has undertaken and completed a review of the Project in accordance with the *Canada Marine Act* and Section 5 of the Port Authorities Operations Regulations and, as applicable, Section 67 of the *Canadian Environmental Assessment Act, 2012*.

If at any time Metro Vancouver (the Permit Holder) fails to comply with any of the project and environmental conditions set out in the project permit (the Permit) below, or if VFPA determines that the Permit Holder has provided any incomplete, incorrect or misleading information in relation to the Project, VFPA may, in its sole and absolute discretion, cancel its authorization for the Project or change the project and environmental conditions to which such authorization is subject.

Pursuant to Section 29 of the Port Authorities Operations Regulations, VFPA may also cancel its authorization for the Project, or change the project and environmental conditions to which such authorization is subject, if new information is made available to VFPA at any time in relation to the potential adverse environmental and other effects of the Project.

The following are the minimum conditions that must be followed by the Applicant to mitigate potential or foreseeable adverse environmental and other effects.

No.	GENERAL CONDITIONS
1.	The Permit Holder must have a valid lease, licence, or access agreement for the Project site prior to accessing the Project site or commencing construction or any other physical activities on the Project site. This Permit shall in no way limit any of the Permit Holder's obligations, or VFPA's rights, under such lease, licence, or access agreement.
2.	The Permit Holder shall at all times and in all respects, comply with and abide by all applicable statutes, laws, regulations and orders from time to time in force and effect, including all applicable environmental, labour and safety laws and regulations.
3.	This Permit in no way endorses or warrants the design, engineering, or construction of the Project and no person may rely upon this Permit for any purpose other than the fact that VFPA has permitted the construction of the Project, in accordance with the terms and conditions of this Permit.
4.	The Permit Holder shall indemnify and save harmless VFPA in respect of all claims, losses, costs, fines, penalties or other liabilities, including legal fees, arising out of: (a) any bodily injury or death, property damage or any loss or damage arising out of or in any way connected with the Project; and (b) any breach by the Permit Holder of its obligations under this Permit.
5.	The Permit Holder is responsible for locating all existing site services and utilities including any located underground. The Permit Holder is responsible for repair or replacement of any damage to existing site services and utilities, to the satisfaction of VFPA, that result from construction and operation of the Project.

6.	If there is potential to affect birds and/or their active nests and eggs, the Permit Holder shall conduct nest surveys. For any nests identified in surveys, a qualified environmental professional shall confirm that the nest is not occupied by a species protected at that time of year under applicable legislation. To reduce the risk of Project-related harm, the Permit Holder should avoid certain physical activities during the general bird breeding season, which falls between April 1 and July 31, or outside of this time span if occupied nests are present
7.	The Permit Holder shall undertake and deliver the Project to total completion in a professional, timely and diligent manner in accordance with applicable standards and specifications set out in the sections above entitled Project Description and Information Sources, including the attached plans and drawings numbered PER No. 17-164-A to E . The Permit Holder shall not carry out any other physical activities unless expressly authorized by VFPA.
8.	The Permit Holder shall cooperate fully with VFPA in respect of any review by VFPA of the Permit Holder's compliance with this Permit, including providing information and documentation in a timely manner, as required by VFPA. The Permit Holder is solely responsible for demonstrating the Permit Holder's compliance with this Permit.
9.	The Permit Holder shall strictly comply with all enforcement actions issued by VFPA in response to the Permit Holder's failure to comply with this Permit.
10.	The Permit Holder shall review the Permit with all employees, agents, contractors, licensees and invitees working on the Project site, prior to such parties participating in any construction or other physical activities on the Project site. The Permit Holder shall be solely responsible for ensuring that all such employees, agents, contractors, licensees and invitees comply with this Permit.
11.	The Permit Holder shall make available upon request by any regulatory authority (such as a Fishery Officer) a copy of this Permit.
12.	Unless otherwise specified, the Permit Holder shall provide all plans, documents, and notices required under this Permit to the following email address: per@portvancouver.com and referencing PER No. 17-164 .
13.	Unless otherwise specified, all plans, schedules, and other Project-related documentation that the Permit Holder is required to provide under this Permit must be to VFPA's satisfaction.
14.	VFPA shall have unfettered access to environmental compliance documentation and the Project site at all times during construction without notice.
15.	The Permit Holder must maintain and retain any records associated with, or produced by, actions or activities undertaken to achieve compliance or that indicate non-compliance with project permit conditions. These records must be made available at the request of VFPA.
16.	All conditions in this Permit which expressly or by their nature survive expiration or termination of this Permit will remain in effect after the expiration or termination of this Permit.

17.	In accordance with the tenure agreements between VFPA and the Permit Holder, the three existing crossings, indicated as "Existing Second Narrows Crossings No 1, No 2 and No 3" on attached PER No. 17-164-A, are to be removed by the Permit Holder at its sole cost and expense by September 30, 2020. The Permit Holder may apply to VFPA for an extension to the timelines for removal of Crossings No 1 and 2, and for Crossing No 3 to remain in place as a backup system under a tenure agreement until such time as VFPA may require its removal.	
18.	If the Permit Holder receives VFPA approval from Real Estate to remove Crossings No 1 and No 2 after the required removal date of September 30, 2020, the Permit Holder shall ensure that a complete project permit application is accepted by VFPA for the removal of Crossings No 1 and 2 one year prior to the completion of the Project.	
	CONDITIONS – PRIOR TO COMMENCING CONSTRUCTION OR ANY PHYSICAL ACTIVITIES	SUBMISSION TIMING (business days)
19.	The Permit Holder shall submit signed and sealed drawings for proposed works approved for construction by a professional engineer licensed to practice in the Province of British Columbia.	5 business days before commencing construction or any physical activities
20.	The Permit Holder shall provide VFPA with a copy of construction communications materials to residents and businesses in the District of North Vancouver and City of Burnaby, and confirm when such materials have been distributed.	5 business days before distribution of materials
21.	The Permit Holder shall submit a Traffic management plan to the satisfaction of VFPA. The Permit Holder shall carry out the Project in accordance with the construction parking and Traffic management plan, and any subsequent amendments approved by VFPA.	20 business days before commencing construction or any physical activities
22.	Prior to commencing construction or any physical activities, the Permit Holder shall have in place a spill prevention, containment and clean-up plan for hydrocarbon products (including fuel, oil and hydraulic fluid) and any other deleterious substances. Appropriate spill containment and clean-up supplies shall be available on the Project site at all times and all personnel working on the Project shall be trained on the spill prevention, containment and clean-up plan. The Permit Holder shall carry out the Project in accordance with the spill prevention, containment and clean-up plan.	N/A
23.	Prior to the commencement of any vessel-related activities, the Permit Holder must contact the appropriate Canadian Coast Guard (CCG) Marine Communications and Traffic Services (MCTS) centre regarding the issuance of a Notice to Shipping (NOTSHIP) to advise the marine community of potential hazards associated with the Project.	As per Coast Guard requirements

24.	The Permit Holder shall submit a final Dewatering Plan to the satisfaction of VFPA. The Dewatering Plan shall include the final discharge location selected, expected discharge rate and duration, treatment (if any), mitigation measures to reduce potential for erosion of the seabed at the discharge point and details of the proposed monitoring to confirm that water quality meets applicable guidelines and reporting of the monitoring results to VFPA.	30 days before commencing dewatering
CONDITIONS – DURING CONSTRUCTION OR ANY PHYSICAL ACTIVITIES		
25.	The Permit Holder shall notify VFPA upon commencement of construction, or any physical activities (e.g., mobilization to the Project site).	
26.	All general construction and physical activities related to the Project shall be conducted from Monday to Saturday between the hours of 7:00 am and 8:00 pm . No construction and physical activities shall take place on Sundays or holidays. These hours shall not be modified without prior approval of VFPA. To request permission to conduct activities outside these hours, the Permit Holder must submit a written request no less than 20 business days prior to the desired start date.	
27.	The Permit Holder shall carry out the Project in accordance with the Environmental Management Plan provided by the Permit Holder, and any subsequent amendments approved by VFPA.	
28.	<p>The Permit Holder shall not permit sediment, sediment-laden waters, or other deleterious substances to enter the water during the Project. The Permit Holder shall carry out all physical activities in a manner that prevents induced sedimentation of foreshore and near shore areas and induced turbidity of local waters, and the release of sediment, sediment-laden waters, and turbid waters to the aquatic environment. The Permit Holder shall manage turbidity in compliance with the following water quality criteria:</p> <ul style="list-style-type: none"> a) when background is less than or equal to 50 nephelometric turbidity units (NTU), induced turbidity shall not exceed 5 NTU above the background values; and b) when background is greater than 50 NTU, induced turbidity shall not exceed the background values by more than 10% of the background value. <p>For the purposes of this condition, “background” means the level at an appropriate adjacent reference site (as determined to the satisfaction of VFPA) that is affected neither by physical activities at the project site, nor sediment-laden or turbid waters resulting from physical activities at the project site.</p>	
29.	Without limiting the generality of permit condition #2, the Permit Holder shall not, directly or indirectly: (a) deposit or permit the deposit of a deleterious substance of any type in water frequented by fish in a manner contrary to Section 36(3) of the <i>Fisheries Act</i> ; or (b) adversely affect fish or fish habitat in a manner contrary to Section 35(1) of the <i>Fisheries Act</i> .	

30.	The Permit Holder shall engage a qualified environmental professional to monitor the Project in order to ensure that the works are carried out in compliance with this Permit. Monitoring events shall take place as required by the environmental monitor, the Environmental Management Plan and any other environmental plans (e.g., Dewatering Plan, Vegetation Mitigation Plan) or VFPA, provided that monitoring will be full time when works are under way that have the potential to adversely affect fish or fish habitat.
31.	The Permit Holder shall provide environmental monitoring reports to the satisfaction of VFPA, as specified in the Environmental Management Plan or more frequently if VFPA requires. In addition, a summary report for the whole monitoring period shall be forwarded to VFPA within six weeks of the conclusion of the monitoring period.
32.	The Permit Holder shall not operate machinery or equipment on the intertidal foreshore. All equipment working on or near the top of bank shall not disturb intertidal areas or the river/seabed.
33.	The Permit Holder shall not disturb the river/seabed outside the Project site including the temporary discharge pipe location.
34.	The Permit Holder shall repair and/or remediate any damage or erosion resulting from disturbance to the intertidal foreshore during the Project.
35.	The Permit Holder shall contain any drilling fluids or mud used during the Project within drill casings. Drill cuttings and drilling fluids/mud shall not be discharged to the aquatic environment.
36.	The Permit Holder shall maintain equipment in good mechanical condition and free of fluid leaks, invasive species, and noxious weeds.
37.	The Permit Holder shall manage invasive plants in a manner that prevents their spread. Invasive plants and potentially affected materials, such as soil, shall be appropriately contained, collected and disposed of.
38.	The Permit Holder shall use reasonable efforts to retain existing native riparian vegetation and native soil. Disturbance or clearing of vegetation shall be staged and strictly limited to that required for the Project.
39.	The Permit Holder shall grade and contour any disturbed areas following project construction for replanting of vegetation.
40.	The Permit Holder shall provide a Vegetation Mitigation Plan to VFPA's satisfaction. The Vegetation Mitigation Plan shall include the location of replanting, the species of plants to be protected, and a schedule for post-planting assessments.
41.	The Permit Holder shall dispose of any soils excavated from the project site that are not suitable for backfill at appropriate off-site facilities and maintain records of off-site disposal.
42.	Without limiting the generality of permit condition #2, if suspect contaminated materials are encountered, the Permit Holder shall contain, test and dispose of such materials at appropriate licensed off-site facilities and maintain records of off-site disposal. VFPA shall be notified of such activities and provided relevant documentation upon completion.

43.	Without limiting the generality of permit condition #2, the Permit Holder shall decommission any groundwater monitoring wells encountered within the Project footprint in compliance with the requirements set out in Appendix C of VFPA's Construction Environmental Management Plan Guideline, available online at: http://www.portvancouver.com/development-and-permits/project-and-environmental-reviews/technical-guidelines/ .
44.	The Permit Holder shall conduct all activities involving the use of concrete, cement, mortars and other Portland cement or lime-containing construction materials in a manner that shall not deposit sediments, debris, concrete (cured or uncured), and concrete fines into the aquatic environment, either directly or indirectly. Water that has contacted uncured or partly cured concrete 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) shall not be permitted to enter the aquatic environment. The Permit Holder shall provide containment facilities at the site for the wash-down water from concrete delivery trucks, concrete pumping equipment, and other tools and equipment, as required.
45.	Without limiting the generality of permit condition #2, materials brought onto the project site to be used for backfilling, site preparation, or other uses shall be from sources demonstrated to be clean and free of environmental contamination, invasive species and noxious weeds. The Permit Holder shall maintain records to verify this.
46.	Air emissions from vehicle/equipment exhaust, dust and vapours shall be minimized and managed to avoid effects on and off the Project site. More detailed guidance is available in Best Practices for the Reduction of Air Emissions from Construction and Demolition Activities prepared for Environment Canada (Cheminfo Services Inc. March 2005).
47.	All non-road diesel equipment in use within VFPA jurisdiction shall be reported as required under the Non-Road Diesel Equipment Program (http://www.portvancouver.com/environment/air-energy-climate-action/cargo-handling-equipment/nrde/).
48.	No in-water works or activities below the top of bank shall be conducted as part of the Project other than temporary discharge pipe installation and groundwater discharge.
49.	The Permit Holder shall contain and collect debris and waste material in the immediate working area within the Project site. The Permit Holder shall dispose of waste material at suitable upland locations and maintain records of off-site disposal.
50.	During upland construction activities, the Permit Holder shall not conduct refuelling or maintenance activities on nonroad equipment within 30 metres of any waterbody, or in an area where run-off may potentially reach surface waterbodies. Fuel and other hydrocarbon inventories shall not be stored in such areas, temporarily or otherwise.
51.	The Permit Holder shall notify VFPA within two business days of any complaints received from the community and stakeholders during construction and indicate how the Permit Holder has responded to such complaints.

52.	<p>If the Permit Holder encounters, expects to encounter, or should expect to encounter an actual or potential archaeological resource, the Permit Holder shall:</p> <ul style="list-style-type: none"> a) Immediately stop any activities that may disturb the archaeological resource or the site in which it is contained (Site); b) Not move or otherwise disturb the archaeological resource or other remains present at the Site; c) Stake or flag the Site to prevent additional disturbances; and, d) Immediately notify VFPA by email and phone. 	
53.	<p>The Permit Holder may place temporary construction trailers on the Project site while this Permit remains in effect, provided that the Permit Holder does not connect such trailers to any underground utilities without the prior written consent of VFPA which may require, at VFPA's discretion, a VFPA Building Permit.</p>	
54.	<p>During any vessel-related activities, the Permit Holder shall:</p> <ul style="list-style-type: none"> a) Position vessels and equipment associated with the Project in such a manner so as not to obstruct line of sight to navigational aids or markers; b) Exhibit the appropriate lights and day shapes at all times; c) Monitor the VHF channel used for MCTS communications in the respective area at all times and participate as necessary; d) Be familiar with vessel movements in areas affected by the Project. e) Plan and execute the Project in a manner that will not impede navigation or interfere with vessel operations; and, f) During night hours, unless working 24 hours per day, ensure that the rig and associated equipment is moored outside the navigation channel and lit in accordance with all applicable regulations. 	
CONDITIONS – UPON COMPLETION		SUBMISSION TIMING (Business Days)
55.	<p>The Permit Holder shall notify VFPA upon completion of the Project.</p>	<p>Upon substantial completion</p>
56.	<p>The Permit Holder shall provide record drawings in accordance with VFPA's Record Drawing Standards (available at: http://www.portvancouver.com/development-and-permits/project-and-environmental-reviews/technical-guidelines/), in both AutoCAD and Adobe (PDF) format to VFPA, including a Project site plan that clearly identifies the location of works.</p>	<p>Within 40 business days of completion</p>
VFPA reserves the right to rescind or revise these conditions at any time that new information warranting this action is made available to VFPA.		
LENGTH OF PERMIT VALIDITY		
<p>The Project must be completed no later than December 31, 2023 (the Expiry Date).</p>		

AMENDMENTS

- Details of any material proposed changes to the Project, including days and hours when construction and any physical activities will be conducted, must be submitted to VFPA for consideration of an amendment to this Permit.
- For an extension to the Expiry Date, the Permit Holder must apply in writing to VFPA no later than 30 days prior to that date.

Failure to apply for an extension as required may, at the sole discretion of VFPA, result in termination of this Permit.

8 ENVIRONMENTAL REVIEW DECISION

In completing the environmental review, VFPA has reviewed and taken into account relevant information available on the proposed Project, has considered the information and proposed mitigations provided by the Applicant and other information as listed elsewhere in this document, and concludes that with the implementation of proposed mitigation measures and conditions described in the project and environmental conditions section above, the Project is not likely to cause significant adverse environmental effects.

ORIGINAL COPY SIGNED

CHRIS BARLOW
MANAGER, ENVIRONMENTAL PROGRAMS

June 19, 2018

DATE OF DECISION

9 CONCLUSION

In completing the project and environmental review, VFPA concludes that with the implementation of proposed mitigation measures and conditions described in the project and environmental conditions section above, the Project has appropriately addressed all identified concerns.

PROJECT AND ENVIRONMENTAL REVIEW DECISION

Project Permit PER No. 17-164 is approved by:

ORIGINAL COPY SIGNED

CHRIS BISHOP
MANAGER, PLANNING

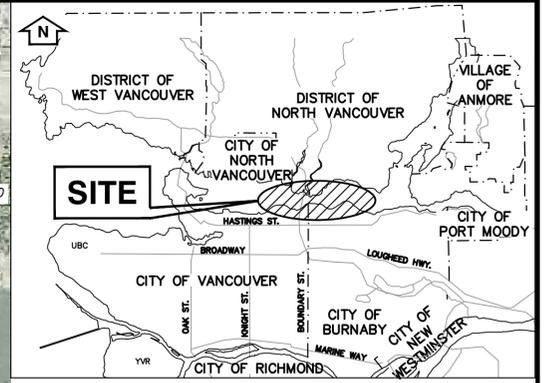
June 20, 2018

DATE OF APPROVAL

CONTACT INFORMATION

Vancouver Fraser Port Authority (VFPA)
100 The Pointe, 999 Canada Place
Vancouver BC V6C 3T4 Canada

Project & Environmental Review
Tel.: 604-665-9047
Fax: 1-866-284-4271
Email: PER@portvancouver.com
Website: www.portvancouver.com



SITE PLAN
NTS

- NOTES:**
1. FOR GENERAL NOTES SEE DRAWING G-006.
 2. FOR TUNNEL PLAN AND PROFILE, SEE DRAWING S-301.

PLAN
1:10000



PREPARED BY
McMILLEN JACOBS ASSOCIATES
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PHONE: 604-336-6638

CHECK PRINT
THIS DRAWING HAS NOT BEEN APPROVED, AND MAY CONTAIN ERRORS AND OMISSIONS.

Issue	Date	Desn	Dr'n	Chkd	Appd	Description
P1	DEC. 17	KGR	KGR	SES	JAM	ISSUED FOR TENDER - DRAFT
A	NOV. 17	KGR	KGR	SES	JAM	ISSUED FOR QUALIFICATION

Design: KGR
Drawn: KGR
Checked: SES
JAM Approved
JAM Manager

GREATER VANCOUVER WATER DISTRICT
SECOND NARROWS WATER SUPPLY TUNNEL
BURRARD INLET CROSSING

SCALE:
1:10000
DISTRICT FILE
W-3092

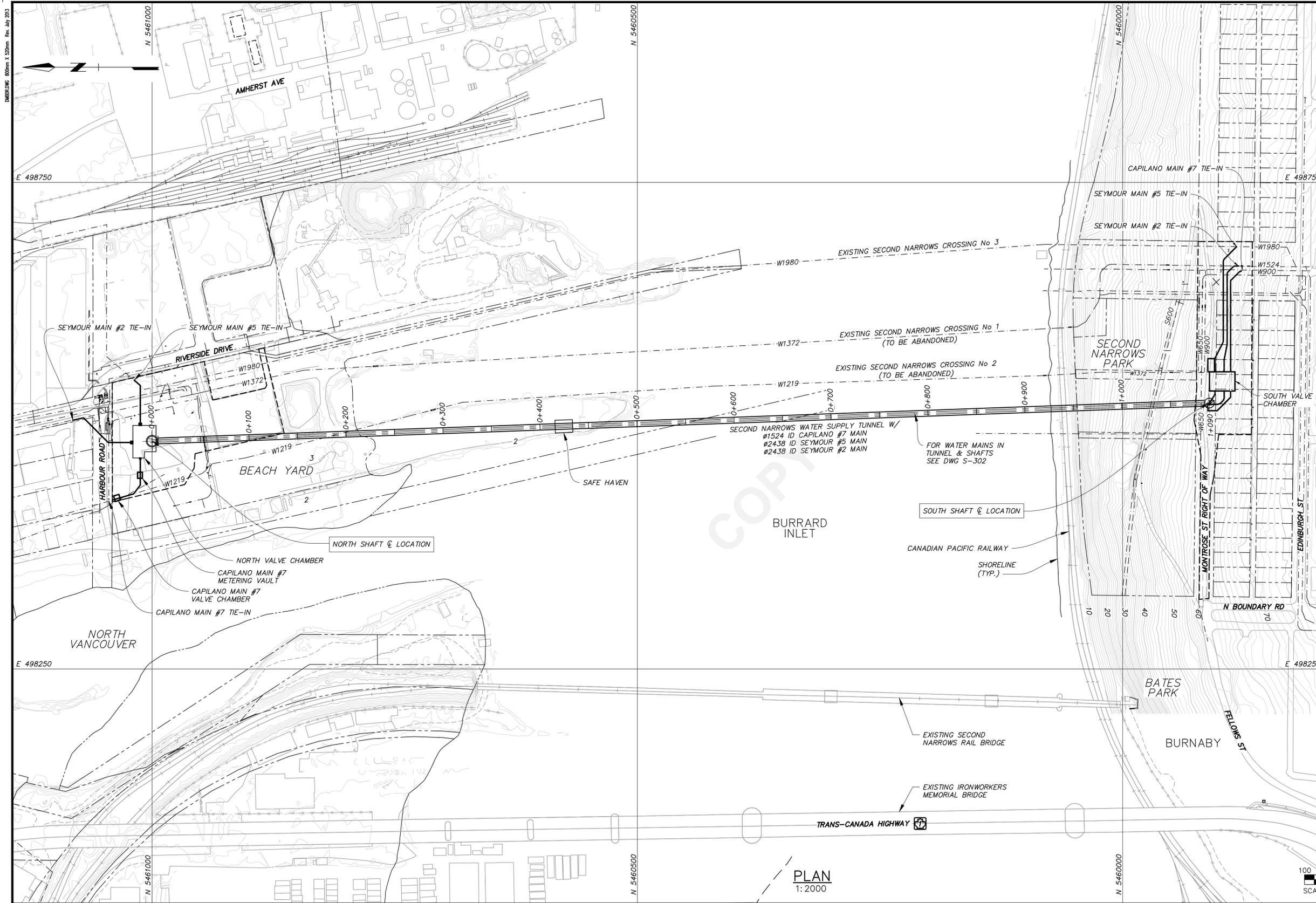
PLAN
PROJECT LOCATION

DRAWING NUMBER
G-002

Professional Seal

Bar is 20mm On Original Drawing. If Not On This Sheet, Adjust Scales Accordingly.

SUPERSEDES PRINTS OF THIS DRAWING NUMBER WITH LETTERS PREVIOUS TO P1



- NOTES:**
- FOR GENERAL NOTES SEE DRAWING G-006.
- NORTH SITE (BEACH YARD)**
CONSTRUCTION REQUIREMENTS
 X-C-014 TO X-C-016 NORTH SHAFT SITE CONSTRUCTION AREA CIVIL
 C-101 EXISTING TOPOGRAPHIC SURVEY SHEET 1 - PLAN
 C-102 EXISTING TOPOGRAPHIC SURVEY SHEET 2 - PLAN
 C-103 DEMOLITION, CLEARING & GRUBBING - PLAN
 C-106 SITE LAYOUT
 C-107 CAPILANO MAIN No.7 - PLAN & PROFILE
 C-108 SEYMOUR MAIN No.2 - PLAN & PROFILE
 C-109 SEYMOUR MAIN No.5 - PLAN & PROFILE
 C-116 STORM DRAINAGE - PLAN
 C-118 SITE GRADING - PLAN
 C-120 TO C-122 TIE-IN SEQUENCING
 C-131 SITE LAYOUT - GWVD CONSTRUCTION
 C-132 CAPILANO MAIN No.7 GWVD CONSTRUCTION-PLAN & PROFILE
 C-133 SEYMOUR MAIN No.2 GWVD CONSTRUCTION-PLAN & PROFILE
 C-134 SEYMOUR MAIN No.5 GWVD CONSTRUCTION-PLAN & PROFILE
STRUCTURAL
 S-103 TO S-123 NORTH VALVE CHAMBER
 S-124 TO S-127 CAPILANO MAIN No.7 VALVE CHAMBER
 S-128 TO S-130 CAPILANO MAIN No.7 METER CHAMBER
 S-401 TO S-405 NORTH SHAFT INITIAL LINING - SLURRY WALLS
 S-420 TO S-426 NORTH SHAFT INITIAL LINING - VSM
 S-460 TO S-469 NORTH SHAFT FINAL LINING
PROCESS MECHANICAL
 M-101 TO M-107 NORTH VALVE CHAMBER
 M-108 TO M-109 CAPILANO MAIN No.7 VALVE CHAMBER
 M-110 TO M-112 CAPILANO MAIN No.7 METER CHAMBER
PROCESS
 DF W-3092 P-001-01 GLOBAL OVERVIEW DIAGRAM
HVAC
 H-101 TO H-106 NORTH VALVE CHAMBER
EIC
 DF W-3092 E-001-01 SINGLE LINE DIAGRAM
- TUNNEL**
 S-301 - PLAN & PROFILE
 S-302 - FINAL PIPE LINING IN TUNNEL AND SHAFTS - PROFILE
- SOUTH SITE (SECOND NARROWS PARK)**
CONSTRUCTION REQUIREMENTS
 X-C-011 TO X-C-013 SOUTH SHAFT SITE CONSTRUCTION AREA CIVIL
 C-201 EXISTING TOPOGRAPHIC SURVEY - PLAN
 C-206 SITE LAYOUT
 C-207 SEYMOUR MAIN No.5 - PLAN & PROFILE
 C-208 SEYMOUR MAIN No.2 - PLAN & PROFILE
 C-209 CAPILANO MAIN No.7 - PLAN & PROFILE
 C-211 STORM DRAINAGE - PLAN
 C-219 GRADING & EARTHWORKS - PLAN
 C-231 SITE LAYOUT - GWVD CONSTRUCTION
 C-232 SEYMOUR MAIN No.5 GWVD CONSTRUCTION-PLAN & PROFILE
 C-233 SEYMOUR MAIN No.2 GWVD CONSTRUCTION-PLAN & PROFILE
 C-234 CAPILANO MAIN No.7 GWVD CONSTRUCTION-PLAN & PROFILE
STRUCTURAL
 S-203 TO S-216 SOUTH VALVE CHAMBER
 S-217 TO S-219 SOUTH VALVE CHAMBER-ELECTRICAL BUILDING
 S-500 TO S-506 SOUTH SHAFT
PROCESS MECHANICAL
 M-201 TO M-207 SOUTH VALVE CHAMBER
PROCESS
 DF W-3166 P-001-01 GLOBAL OVERVIEW DIAGRAM
HVAC
 H-201 TO H-204 SOUTH VALVE CHAMBER
EIC
 DF W-3166 E-001-01 SINGLE LINE DIAGRAM

DRAWING SYMBOLS

---	EXISTING PROPERTY LINE
- - -	CONSTRUCTION EXTENTS

PR: PAR: D BY: **McMILLEN JACOBS ASSOCIATES**

1188 W GEORGIA STREET, SUITE 1850
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 PHONE: 604-336-8639

CHECK PRINT

THIS DRAWING HAS NOT BEEN APPROVED, AND MAY CONTAIN ERRORS AND OMISSIONS.

Issue	Date	Desn	Dr'n	Chkd	Appd	Description
P1	DEC. 17	SES	KGR	FM	JAM	ISSUED FOR TENDER - DRAFT
A	NOV. 17	SES	KGR	FM	JAM	ISSUED FOR QUALIFICATION

GREATER VANCOUVER WATER DISTRICT
SECOND NARROWS WATER SUPPLY TUNNEL
BURRARD INLET CROSSING

Design: SES
 Drawn: KGR
 Checked: FM
 JAM Approved
 JAM Manager

GENERAL ARRANGEMENT OVERALL SITE LAYOUT

SCALE: 1:2000
 DISTRICT FILE W-3092
 DRAWING NUMBER G-007

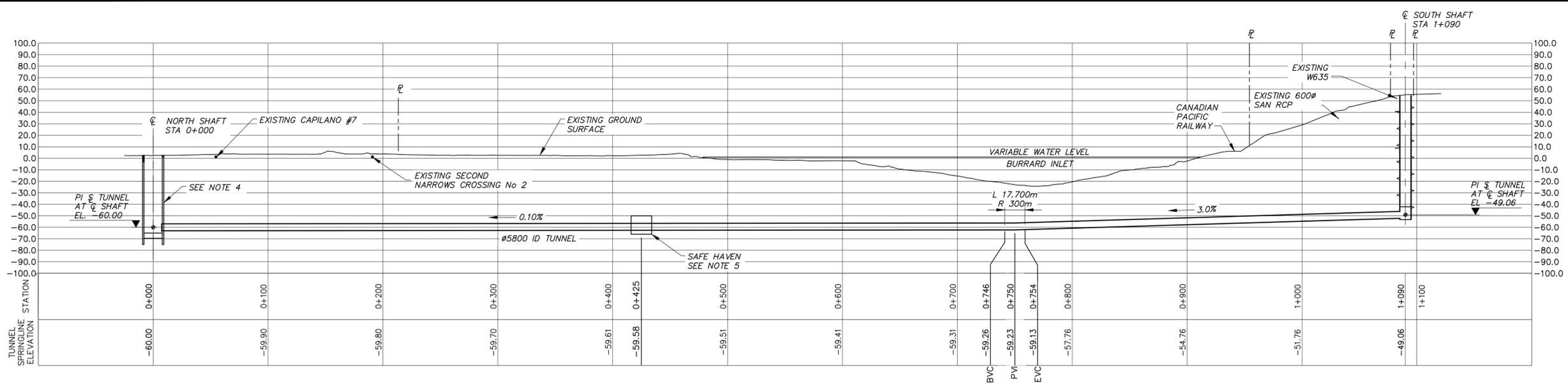
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Bar is 20mm On Original Drawing. If Not On This Sheet, Adjust Scales Accordingly.

SUPERSEDES PRINTS OF THIS DRAWING NUMBER WITH LETTERS PREVIOUS TO P1

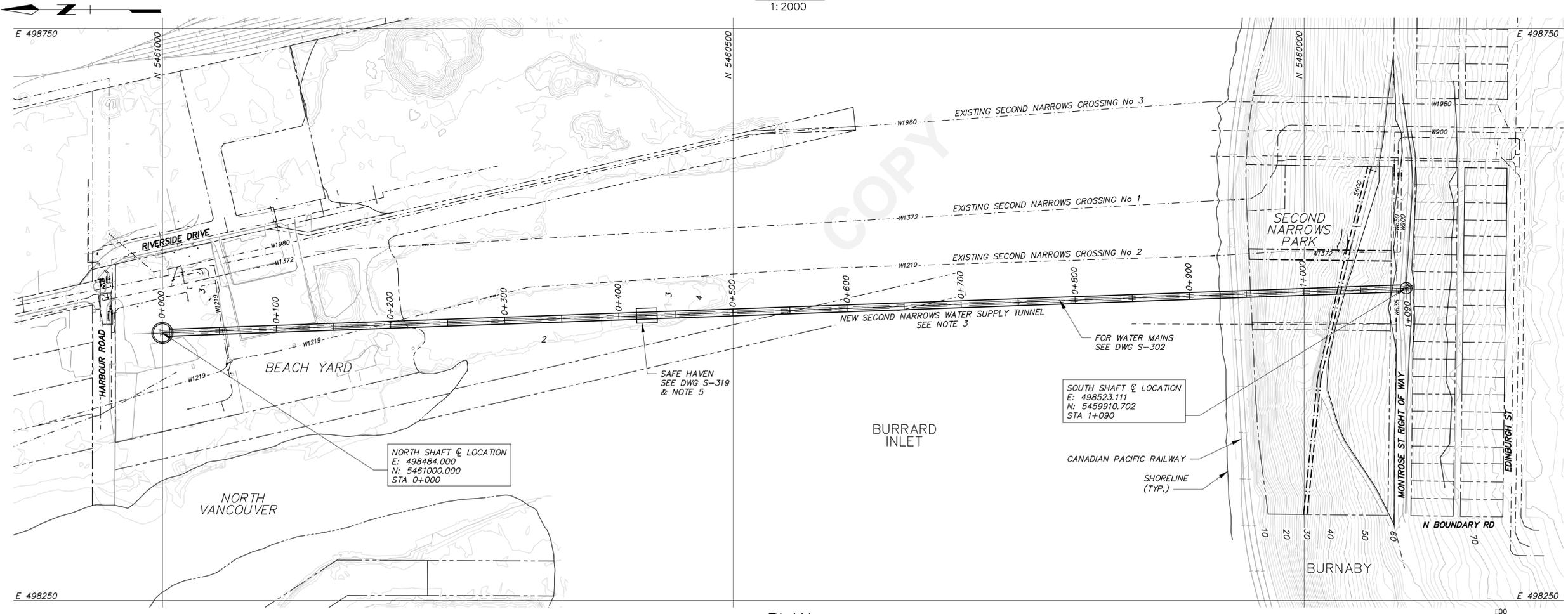
DRAWING: 80mm X 100mm Rev. July 2013

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- NOTES:**
- FOR GENERAL NOTES SEE DRAWING G-006.
 - FOR STRUCTURAL NOTES SEE DRAWING S-001 AND S-002.
 - FOR TUNNEL CROSS SECTION SEE DRAWING S-303.
 - INITIAL LINING SLURRY WALL OPTION SHOWN (NORTH SHAFT). ALTERNATIVE INITIAL LINING VSM OPTION NOT SHOWN. CONTRACTOR TO DETERMINE EXCAVATION SUPPORT.
 - SAFE HAVEN LOCATION IS INDICATIVE ONLY.

PROFILE
1:2000



PLAN
1:2000

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Issue	Date	Desn	Dr'n	Chkd	App'd	Description
P1	DEC. 17	FM	KGR	MM	JAM	ISSUED FOR TENDER - DRAFT
A	NOV. 17	FM	KGR	SES	JAM	ISSUED FOR QUALIFICATION

Professional Seal

Bar is 20mm On Original Drawing. If Not On This Sheet, Adjust Scales Accordingly.

GREATER VANCOUVER WATER DISTRICT
SECOND NARROWS WATER SUPPLY TUNNEL
BURRARD INLET CROSSING

Design: FM
Drawn: KGR
Checked: MM
JAM Approved
JAM Manager

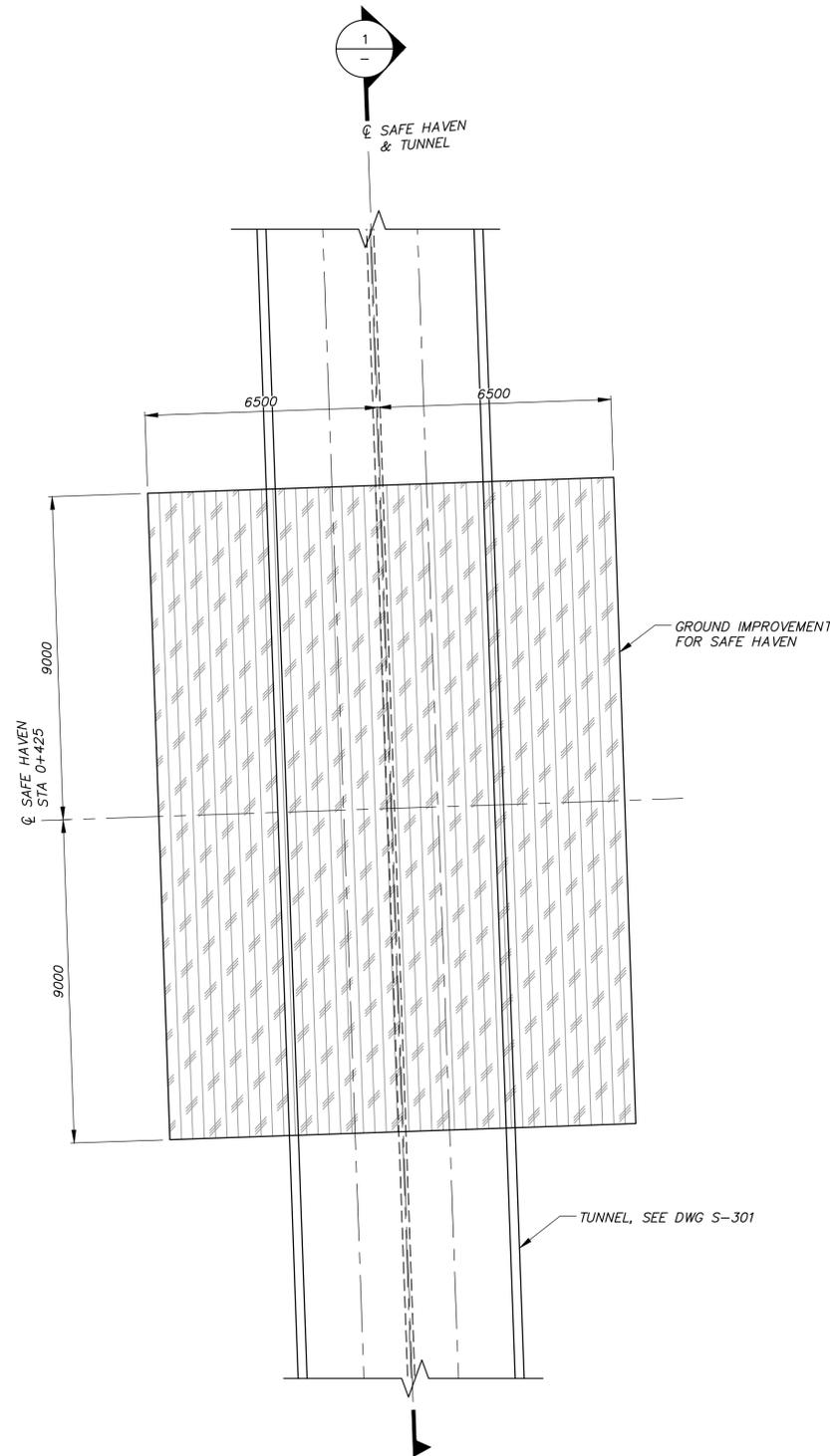
TUNNEL PLAN AND PROFILE

SCALE: 1:2000
DISTRICT FILE W-3092
DRAWING NUMBER S-301

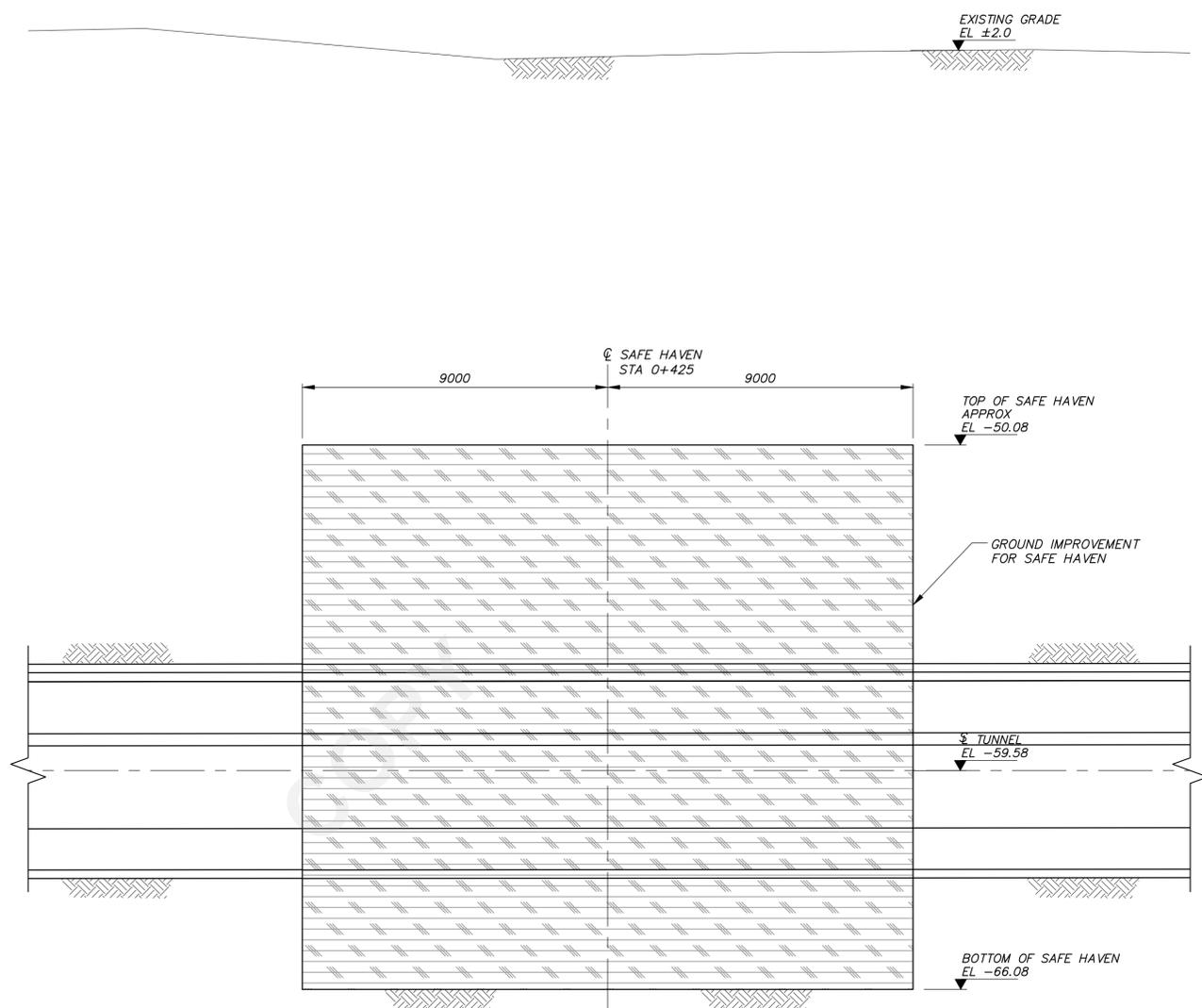
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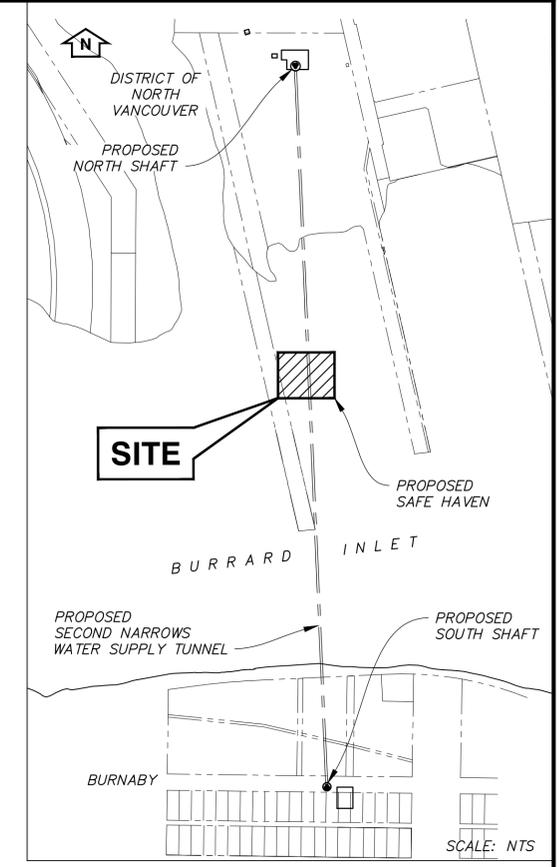
DRAWING 80mm x 250mm Rev. July 2013



SAFE HAVEN PLAN
1:100



SECTION 1-1
1:100



NOTES:

1. FOR GENERAL NOTES SEE DRAWING G-006.
2. DIMENSIONS SHOWN ARE BASED UPON EXCAVATED DIAMETER OF APPROX. 6500, AND A TBM LENGTH OF APPROX. 12000. DIMENSIONS SHALL BE ADJUSTED PER ACTUAL TBM DIMENSIONS.



PREPARED BY:
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VANCOUVER BC V6E 4A2
PHONE: 604-335-9639

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Professional Seal

Issue	Date	Desn	Dr'n	Chkd	Appd	Description
P3	DEC. 17	FM	KR	SR	JAM	ISSUED FOR TENDER - DRAFT
P2	JUN. 17	FM	KR	SES	JAM	ISSUED FOR 90% DESIGN REVIEW
P1	DEC. 16	FM	KR	SES	JAM	ISSUED FOR 60% DESIGN REVIEW

Design: FM
Drawn: KR
Checked: SR
JAM Approved
JAM Manager

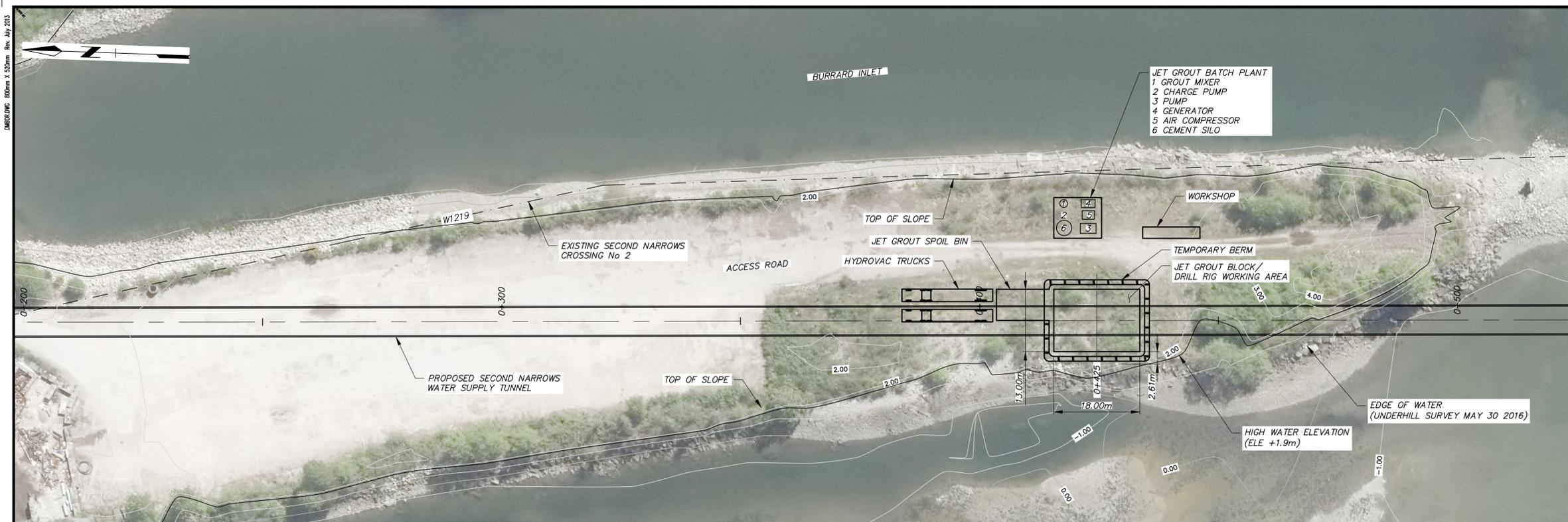
GREATER VANCOUVER WATER DISTRICT
SECOND NARROWS WATER SUPPLY TUNNEL
BURRARD INLET CROSSING

TUNNEL SAFE HAVEN PLAN AND SECTION

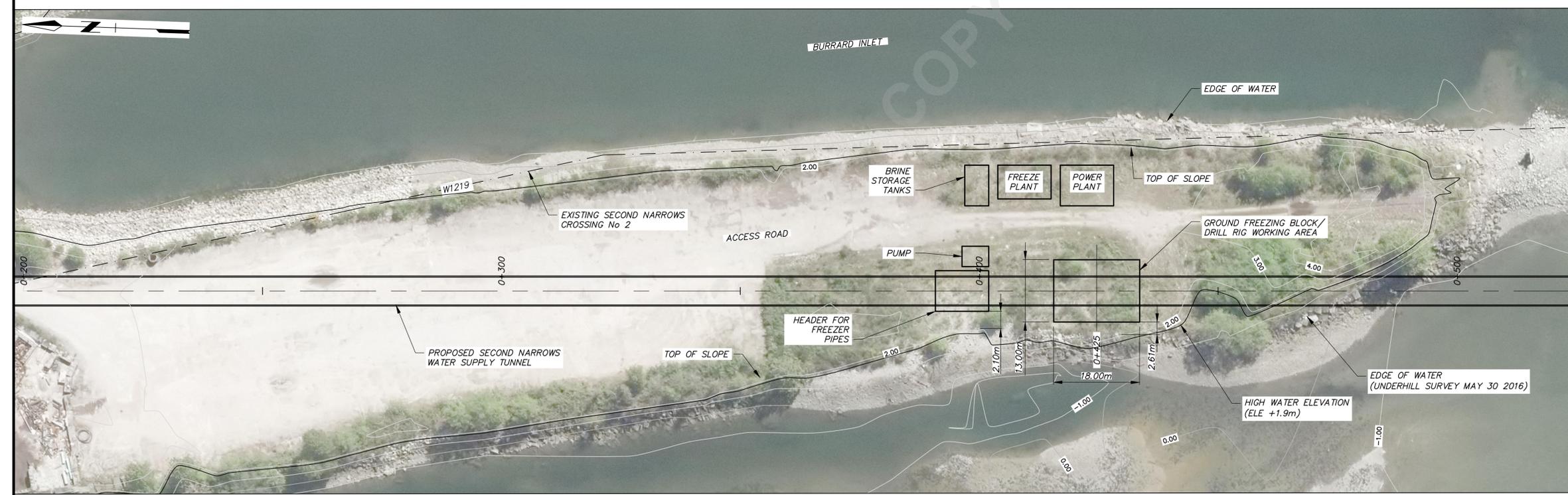
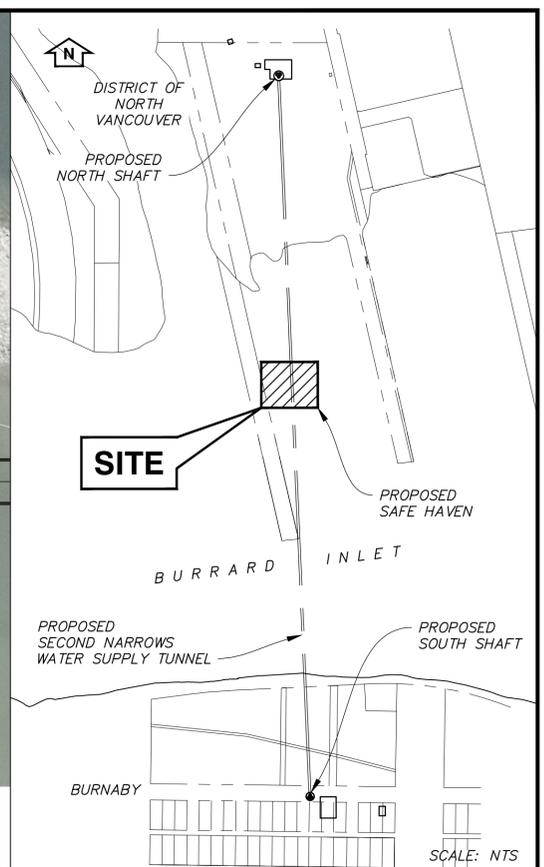
SCALE: 1:100
DISTRICT FILE W-3092
DRAWING NUMBER S-319

SUPERSEDES PRINTS OF THIS DRAWING NUMBER WITH LETTERS PREVIOUS TO → P.3

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PLAN - JET GROUTING OPTION
1:1000



PLAN - GROUND FREEZING OPTION
1:1000

NOTES:

- JET GROUTING AND GROUND FREEZING LAYOUT OPTIONS SHOWN ARE EXAMPLES ONLY. CONTRACTOR WILL DETERMINE LAYOUT TO SUIT MEANS AND METHODS.



PREPARED BY:
McMILLEN JACOBS ASSOCIATES
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VANCOUVER BC V6E 4A2

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Issue	Date	Desn	Dr'n	Chkd	Appd	Description
P1	DEC. 17	GE	KGR	SS	JAM	ISSUED FOR PORT OF VANCOUVER PER SUBMISSION

DESIGN: GE DRAWN: KGR CHECKED: SS JAM Approved JAM Manager		GREATER VANCOUVER WATER DISTRICT SECOND NARROWS WATER SUPPLY TUNNEL BURRARD INLET CROSSING SAFE HAVEN LAYDOWN PLAN	SCALE: 1:500 DISTRICT FILE W-3092 DRAWING NUMBER X-S-319
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Professional Seal

Bar is 20mm On Original Drawing. If Not On This Sheet, Adjust Scales Accordingly.

SUPERSEDES PRINTS OF THIS DRAWING NUMBER WITH LETTERS PREVIOUS TO P1

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