Chapter 2

Project Description

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2. Project Description

2.1 Project Summary

The proposed Project consists of terminal improvements to increase Centerm's container capacity by approximately two-thirds to a maximum annual capacity of 1.5 million TEUs, and an annual sustainable capacity of 1.3 million TEUs. This expansion would be achieved by increasing the Terminal footprint through infilling in Burrard Inlet, extending the main berth to 724 m and creating a larger intermodal yard. These improvements would allow larger vessel sizes to be unloaded more efficiently and increase the efficiency of moving containers across the berth. Associated Off-Terminal works, known collectively as the SSAP, would focus on improving connectivity and the movement of vehicles on the south shore and containers into and out of Centerm.

The proposed Project improvements are illustrated on Figure 1-2, Figure 1-3, and Figure 1-4. The proposed improvements are organized by geographical areas and grouped into upgrades that will take place on the Terminal (within the final DPWV lease adjustment) and upgrades to road and rail access Off-Terminal (within the port authority transportation corridor). All of the project components are within the port authority jurisdiction.

Terminal Improvements

- Westward expansion of Centerm
- Eastward expansion of Centerm
- Expansion of the intermodal yard
- Removal of the Heatley Avenue Overpass
- Reconfiguration of the container yard, with additional lighting
- Modernized truck gate system
- New Container Operations Facility building and parking
- Terminal outfitting
- Navigational Turning Basin for Cruise Ship Berth

Off-Terminal Improvements

- Waterfront Road extension and vehicle access control gates
- Construction of a Centennial Road Overpass

A summary description of these improvements is provided in Table 1-1.

2.2 Project Construction

2.2.1 Site Preparation

Site preparation activities prepare the ground for construction of buildings and infrastructure. Site preparation includes marine dredging, demolition, railway track removal or alteration, and utility relocations and protections.

2.2.1.1 Geotechnical Setting

Burrard Inlet is underlain by tertiary bedrock. Locally, bedrock may be covered by Vashon drift and Capilano sediments, consisting of a thin (less than 10 m thick) veneer of glacial drift consisting of till, glaciofluvial sand to gravel, and glaciolacustrine stony silt. Marine-derived lag gravel deposits form a less than 1 m thick mantle till. Salish sediments consisting of mountain stream marine deltaic deposits of medium to coarse gravel and minor sand derived from the rivers draining the North Shore Mountains may also mantle bedrock. Much of the shoreline along the southern shore of the harbour has been infilled with Salish sediments, including sand and gravel to establish shipping terminals. Till, crushed stone, and refuse such as broken concrete have also been used. Historical documentation reports dredging of moderately thick silt deposits during construction of the Ballantyne Pier.

Geotechnical investigations provide the information for planning site preparation activities. Geotechnical investigations to support Project planning were conducted by Klohn Crippen Berger (KCB) (KCB 2016). Based on geotechnical data from field observations and *in situ* tests, the land and seabed in the Project area consist of the following soil layers in sequence from surface to depth:

1. Asphalt and underlying gravels (fill in terminal area only)
2. Poorly-graded sand with some traces of fine to coarse gravel and fragments of sea shells
3. Sandy silt with broken sea shells
4. Low to medium plastic clay with traces of silt and sand, including sea shells
5. Very dense sand with blocky structure traces of silt
6. Sandstone bedrock

The geotechnical investigation supporting documentation determined that the existing seabed can be characterized by two main layers, a soft layer underlain by a dense layer. The soft layer comprises three layers: poorly-graded sand, sandy silt, and low to medium plastic clay. The soft layer has a resistance below 20 megapascals (MPa) with traces of organic material and is not suitable for supporting marine structures. The underlying dense layer comprises dense sand and sandstone layers and is considered a suitable foundation.

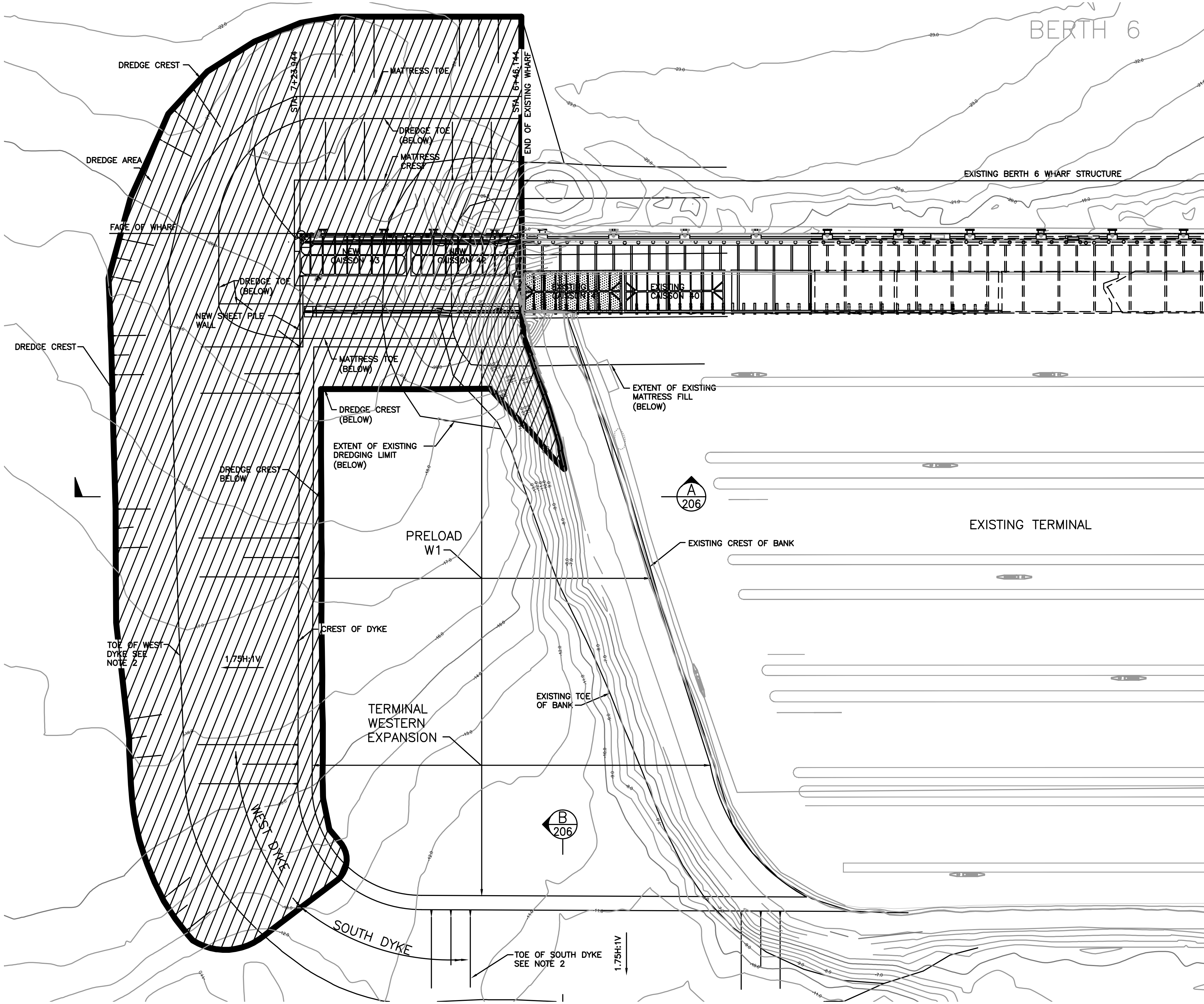
The thickness of the soft layer varies at different locations throughout the Site. On the west side the thickness of the soft layer varies from 9 m to 17.5 m in the area of the caissons and outer dyke. At the east end the geotechnical investigation encountered a layer of soft marine deposits in the area of the dyke, which are unlikely to have sufficient shear strength to support the weight of the new dyke section.

2.2.1.2 Dredging – Terminal

To ensure the stability of marine structures it is necessary to dredge the soft sediments and replace them with competent fill, such as river sand. To create a stable foundation for the west perimeter rock dyke and to expose competent soils for the mattress rock foundation that will support the caisson in this area, a dredging volume of approximately 235,000 cubic metres (m^3) and an area of 33,330 square metres (m^2) of compressible silty sands forming the upper layer of the seabed around the location for the caissons and the outer dyke to contain the infill would be required (Figure 2-1).

Current analysis at the east end indicates that a trench approximately 30 m wide, with cut slopes of approximately 1V:2H and approximate bottom elevation of -20 m chart datum (CD) (at mid-point of this trench), would need dredging under the east dyke footprint (Figure 2-2). This would result in a dredging volume of approximately 155,000 m^3 and an area of 30,300 m^2 of marine deposits down to the dense glacial till layer.

The total volume of dredging required is approximately 390,000 m^3 of fine sediments (235,000 m^3 for the west end and 155,000 m^3 for the east end). Additional geotechnical work is being undertaken to gather additional information on the existing material to be dredged, and inform subsequent design phases.



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NOTES:

1. ELEVATIONS ARE REDUCED TO CHS CHART DATUM WHICH IS 2.975m BELOW GEODETIC DATUM.
2. TOE OF DYKE AS SHOWN ON THIS DRAWING DOES NOT INCLUDE TOE APRON WIDTH.

PRELIMINARY
DO NOT USE FOR CONSTRUCTION

No.	Date	REVISION	Dr'n	Ch'd
C	2016-07-25	TERMINAL UPDATES	FY	NB
B	2016-07-19	TERMINAL UPDATES	FY	NB
A	2016-05-08	TERMINAL UPDATES	FY	NB

Klohn Crippen Berger

PBX ENGINEERING

LEAD CONSULTANT

AECOM

DP WORLD Vancouver

PORT of vancouver

DESIGN BY	G.B.A.C./K.G.
DRAWN BY	A.R.
APPROVED	NB
DATE	2016-05-03
SCALE	AS NOTED
PMV SITE	32-481

CENTERM EXPANSION PROJECT
WESTERN EXPANSION
TERMINAL – PLAN
DREDGE AREA

Figure 2-1

SIZE	DWG.	SHEET	REV.
B	32-481-203	1 of 1	C

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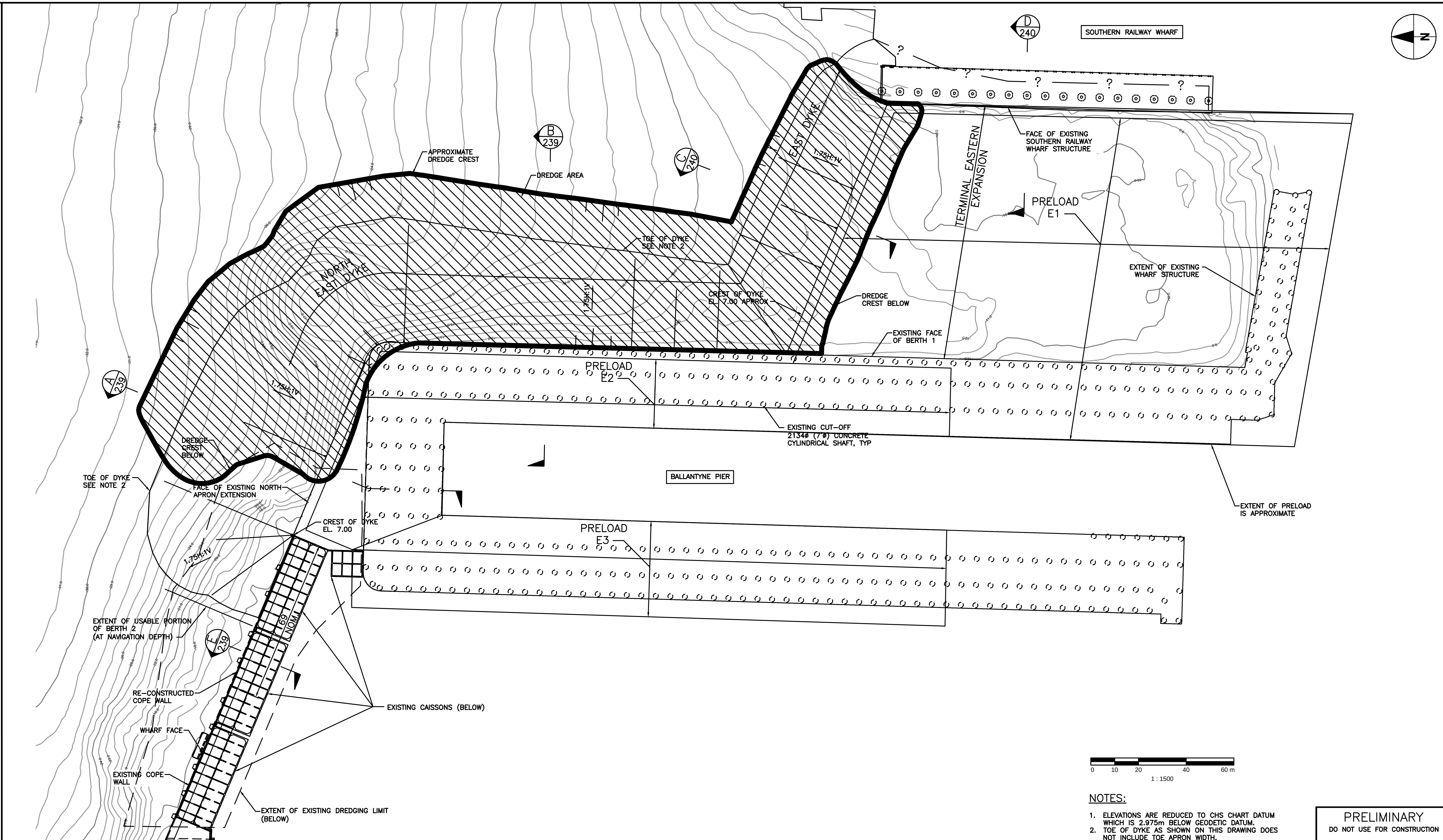

NOTES:

1. ELEVATIONS ARE REDUCED TO CHS CHART DATUM WHICH IS 2.975m BELOW GEODETIC DATUM.
2. TOE OF DYKE AS SHOWN ON THIS DRAWING DOES NOT INCLUDE TOE APRON WIDTH.

PRELIMINARY
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No.	Date	REVISION	Dr'n	Ch'd
C	2016-07-25	TERMINAL UPDATES	FY	NB
B	2016-07-19	TERMINAL UPDATES	FY	NB
A	2016-05-08	TERMINAL UPDATES	FY	NB

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DESIGN BY	G.B.A.C./K.G.
DRAWN BY	AR
APPROVED	NB
DATE	2016-05-03
SCALE	AS NOTED
PMV SITE	32-481

CENTERM EXPANSION PROJECT
EASTERN EXPANSION
TERMINAL – PLAN
DREDGE AREA

Figure 2-2

SIZE	DWG.	SHEET	REV.
B	32-481-238	1 of 1	C

The Project's preferred method of disposal of dredgeate is disposal at sea due to the volume of dredgeate that would be created. At these volumes, land disposal becomes inefficient to excavate and manage on-site with a large impact on traffic due to trucks hauling material to a landfill. To obtain approval for disposal at sea from ECCC, sediment sampling is required to determine whether the sediments meet disposal at sea criteria. Sediments that do not meet the disposal at sea criteria would have to be taken to an appropriate land-based disposal facility.

2.2.1.3 Dredging – Navigational Turning Basin

Dredging would also be needed to enhance a navigational turning basin in the area between the western extension and the SeaBus terminal. This dredging is needed due to a rise in the sea floor in this area, and the extension of Centerm requires an adjustment to the turning basin required for cruise ships using the east berth at Canada Place. The estimated area envisioned for navigational dredging is 3,300 m^2 and volume 6,800 m^3 and is included in the planning process for evaluating the option of disposal at sea. Unlike the other geotechnical dredge footprints, which will be backfilled with stable material, this navigational dredge footprint has no component of backfill/compaction. Once the initial dredging is complete, the port authority does not anticipate the need for any ongoing dredging to maintain the turning basin.

2.2.1.4 Hazardous Materials Investigations

Visual site investigations of the buildings that would be demolished or renovated were conducted to identify and assess potential issues with hazardous materials[1] and to provide recommendations for demolition planning (AECOM 2016b).

The site investigations identified the presence of hazardous materials, including:

- Materials containing asbestos
- Paint containing lead
- Polychlorinated biphenyls (PCBs)
- Ozone-depleting substances (ODSs)
- Mercury and other heavy metals
- Abandoned chemicals
- Silica

A sampling program was conducted to confirm the type of hazardous materials present (AECOM 2016b), and the DB Contractor will develop an Demolition Plan to address the hazards identified prior to demolition or renovation.

2.2.1.5 Demolition – Terminal

The proposed Project would require demolition and renovation of buildings on the Site. Existing structures, including the existing pulp shed (known as Shed 3) and the western extension of the Ballantyne Cruise terminal, would be demolished, including the concrete deck superstructure, and partial demolition of the concrete shaft foundations. The triangular-shaped, steel-piled deck north of Ballantyne Pier would also be demolished, and the piles removed. The existing Ballantyne Cruise Terminal heritage building would be retained and stripped of current internal walls and fittings to enable this structure to be renovated into the Container Operations Facility. The existing road network around the Ballantyne building would be altered to accommodate the new truck gates.

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[1] *As per WorkSafeBC's OHS Regulatory excerpt from section 20.112. Before work begins on the demolition or salvage of machinery, equipment, a building or a structure, or the renovation of a building or structure, all employers responsible for that work, and the owner, must ensure that a qualified person inspects the machinery, equipment, building or structure and the worksite to identify the hazardous materials, if any.*

https://www2.worksafebc.com/publications/OHSRegulation/GuidelinePart20.asp?ReportID=35098

Once the new Container Operations Facility and truck gates are operational, the Heatley Avenue Overpass and the area now occupied by the existing gates and main office building would be demolished and cleared to enable the eastern extension of the intermodal yard. The overpass is a post-tensioned concrete structure and is anticipated to be broken out with mechanical crushing machinery until the remaining sections can be lifted out of place and taken off-site for final deconstruction. The various small buildings currently spread across the Terminal that house lunchrooms and support space would be incorporated into the new Container Operations Facility.

2.2.1.6 Demolition – Off-Terminal

The introduction of the Waterfront Road extension requires the use of land to the south of the Terminal. This area is currently in use as a rail yard and the existing track, ties, and ballast would require removal before construction begins. Additionally, the Canfisco processing facility bordering Waterfront Road to the west of the Terminal (Figure 1-3) would require an adjustment to the boiler house to accommodate the proposed road cross-section.

Before construction of the Centennial Road Overpass, rail alterations and utilities diversions and protection measures would need to be completed. In particular, the existing Metro Vancouver Harbour West Interceptor would need to be diverted to the north by a few metres to position it away from the line of the overpass piers.

With the Vanterm West rail spur in its current position, there is insufficient clearance over the track to meet current rail standards. Therefore, the Vanterm West rail spur would require realignment closer to the Alliance Grain Terminal (AGT) rail spur.

2.2.2 Foundations and Structures

2.2.2.1 Marine

To create additional land for Terminal operations and to extend the length of the wharf at Berth 6, approximately 4.2 ha of marine area would be infilled on the west and 4 ha on the east of the existing Centerm site. The areas would be filled using fill (anticipated to be imported sand fill) contained by perimeter rock dykes. For the western landmass, the dykes would form the southern and western edges, with the northern edge comprising an extension to the existing berth through the placement of two 37 m long caissons. The eastern landmass would be contained by rock dykes to the north and northeast, connecting into existing adjacent fills and structures of the Southern Railway wharf.

Preloading of the reclamation fill surface is required to accelerate primary consolidation and settlement and reduce post-construction settlement. Initial estimates suggest that this preload material would reach a height of 4 m. The preload material would be deposited in two zones for the western landmass and four zones for the eastern landmass, and left in place for at least six and three months, respectively.

The perimeter dykes would be constructed directly on the seabed on native material or prepared substrates depending on location. The dykes would be built of crushed rock deposited in layers, matched to the placement of the fill material behind the dyke. The outer slope of the perimeter dyke would be sloped at 1V:1.75H and faced with riprap armouring for protection. The dyke, fill, and riprap are expected to be placed using in-water methods, either by hopper deposition or static barge and excavator placement. Behind the west/south dyke, the sandy sediment used for infill would be susceptible to liquefaction under a major seismic event; therefore, a 20 m wide zone behind the dyke would be densified. The fill behind the northeast portion of the east end perimeter dyke (i.e., at the Ballantyne Pier footprint) would require vibro-densification after the dyke is fully constructed.

The western berth extension would be achieved through two new concrete caissons (37.4 m long and 14.5 m wide), positioned to maintain the line of the berth face. Densification of the new fill materials would be required for the caisson wharf extension to reduce liquefaction hazard and settlement. The densification would be carried out in two stages (a marine stage and land stage). The first stage would consist of marine densification of the mattress rock fill below the caisson area. The marine densification would likely be carried out using a large crane mounted on a barge. Densification of fill for caisson wharves is typically done using a conventional vibro-flotation technique where a large electric- or hydraulic-powered vibrator is jetted into the fill and slowly withdrawn in stages to compact the granular material. Once the caissons are floated into place, they are filled with water and ballast rock to sink them into place. The second stage of fill densification would include densification of the rock berm placed behind the caisson to provide support. This work would likely be carried out from the fill surface using vibro-densification for compaction of the lower fill materials and dynamic compaction of upper fill materials. However, vibro-densification alone could be used to densify the entire fill zone. Dynamic compaction is carried out in a grid pattern and consists of repeated dropping of a heavy tamping weight from a height up to 25 m using a specially equipped crane. The caissons will be finished with fendering systems and mooring bollards to enable vessels to be secured.

2.2.2.2 Terminal

Once the western landmass is complete, the container yard and intermodal yard would be built on it. This would include paving the surface and extending the utility infrastructure, including stormwater control (see Section 2.2.6); high-mast lighting; fire suppression infrastructure at each high-mast light; and electrical and communications systems.

The berth extension would be completed with extended crane rails for the quay cranes, maintaining the same gauge as the existing rails.

The intermodal yard expansion would comprise three parts: approximately 152 m (500 ft) extension to the west; construction of an additional fifth yard track; and removal of the existing yard connection and extension of the yard tracks approximately 152 m (500 ft) eastward. The intermodal yard would also require rail runways for the new rail-mounted gantry cranes; these rails, cast into concrete grade beams, would run parallel to the tracks.

The Heatley Avenue Overpass would be removed to expand the Terminal. To maintain the grade-separated connectivity to the adjacent city streets, it would be replaced by a new overpass along the existing alignment of Centennial Road from Clark Drive to the truck gate area.

The existing entrance to the terminal area would be reconfigured. New truck gates would be installed adjacent to the Ballantyne heritage building. The Ballantyne building would be retrofitted and extended to create a new Container Operations Facility, consolidating many of the Terminal’s remote buildings into one location. The building would require structural and seismic retrofit works to enable its reuse as the new Container Operations Facility. Additionally, parking provision would be provided in the truck gate area for both terminal operations vehicles (internal transfer vehicles and light vehicles) and employee parking.

2.2.2.3 Off-Terminal

Access improvements are proposed to the adjacent road network on the south shore. Waterfront Road would be extended east from Dunlevy Avenue, with improvements to the existing roadway between Main Street and the intersection of Dunlevy Avenue. This roadway would parallel the CNR support yard and connect to Centennial Road. The extension to Waterfront Road would provide a two-lane collector road paralleling the rail right-of-way and associated track. The roadway would include a 1.5 m sidewalk for its entire length. To increase security, a vehicle access control system will be established immediately east of the Main Street Overpass intersection.

South of the Terminal, the existing rail support yard would be reconfigured to increase the length of tracks within the yard to offset the loss of existing tracks that will be removed for the Waterfront Road extension.

The proposed Centennial Road overpass is a 590 m long (end to end including ramps) elevated, nine-span structure mainly supported by pier drilled-shaft foundations, with twin column bents providing support where constraints prevent the drilled-shaft foundation. The superstructure would consist of a three-girder arrangement steel plate girder structure and concrete deck. The approach ramps would be supported by mechanically stabilized earth walls. The proposed design also includes a 50 m diameter roundabout at the intersection of Centennial Road/Stewart Street and Clark Drive. A sidewalk would be installed at-grade, routed beneath the structure as it passes the Lantic (Rogers Sugar) property.

2.2.3 Terminal Equipment

Currently six quay cranes operate the berth, with a seventh crane expected to be operation in late 2016/early 2017 (a separate project to be implemented by DPWV). Following completion of the proposed Project, there would be seven quay cranes in operation, with two of the existing cranes being replaced as part of the proposed Project. The seventh crane would enable the extended wharf to be operated with two ships at berth, with the largest ships, in Berth 6, operated with four and up to five quay cranes.

The existing complement of 19 rubber-tired gantry cranes would remain and would be deployed into the parallel container stacks (A-D) in the west-centre-east yard. The refrigerated container towers would be relocated from the north yard to locations under the rubber-tired gantry cranes, at the aisle between the centre and east stacks.

The intermodal yard would be expanded with an additional track to the south and extensions to the east and west. This would increase the capacity of the yard, reducing the number of train shunts and short trips needed to build unit trains of 3,658 m (12,000 ft) in length. Up to five new, electrified rail-mounted gantry cranes would be added to increase the productivity of the yard.

2.2.4 Construction Lighting

Construction lighting would be temporary and in keeping with the existing industrial lighting levels. Construction lighting would be managed according to CEMP Section 5.4.

2.2.5 Construction Hours

Construction activities would generally conform to established standard port authority construction hours of 7:00 a.m. to 8:00 p.m. from Monday to Saturday. However, two proposal Project elements are anticipated to occur on a 24-hour basis: marine construction and the Centennial Road Overpass construction.

Marine works to facilitate the proposed Project include dredging and subsequent marine reclamation work. These works are expected to take up to six months depending on the final volume that would need to be dredged. The published in-water work windows set by Fisheries and Oceans Canada (DFO) for Burrard Inlet to protect marine species are from August 16 to February 28. The construction schedule for in-water works will comply with timing restrictions established by DFO in the Fisheries Act Authorization for the proposed Project. However to, comply with timing restrictions and achieve the overall project target completion in 2020 work would need to take place on a 24-hour basis. A shorter work day would result in dredging (and associated backfilling) stretching over multiple years in order to respect the work window or would require work during the restricted work window.

Situated on a narrow road corridor, the construction of the Centennial Road Overpass would have effects on traffic movement along the south shore port area, particularly truck traffic serving Centerm. To minimize disruption to traffic during the terminal operating hours (7 a.m. to 1 a.m., Monday to Friday) when traffic flows on the south shore are busy, key activities that will cause noteworthy disruption such as lifting steel girders, foundation works, repositioning equipment, and utility diversions are anticipated to be undertaken overnight and on weekends, extending the construction hours to 24 hours per day for these activities. Similarly, works to the rail tracks adjacent to the south shore roadway will need to be scheduled at times when the tracks are available, and train movements are at their minimum; this is expected to include evenings, overnight, and on weekends.

2.2.6 Stormwater Management and Accidental Discharges

Centerm has an established stormwater management system that includes remote-controlled outfalls on each side of the Terminal (north, east, south, and west) with oil/water separators to prevent any contaminated run-off from entering the marine environment. The existing systems would be maintained and expanded during construction to handle the surface flow from all new land surfaces. The stormwater system would remain functional during all periods of construction.

During construction, soils would be excavated and exposed, creating the potential for erosion of sediment to the marine environment. A Stormwater Pollution Prevention Plan and Erosion and Sediment Control Plan would be developed to prevent sediment from entering the marine environment. The plans will prescribe the methods that will be used to contain stormwater and remove sediments and other contaminants (e.g., settling ponds) before any water is discharged from the Site. The Stormwater Pollution Prevention Plan and Erosion and Sediment Control Plan would be prepared by the DB Contractor prior to the start of construction. The plan will include mitigation measures for stormwater management and erosion and sediment control outlined in the CEMP (AECOM 2016a). In addition, the DB Contractor will be compliant with the DPWV Container Operations Spill Response safe operating procedures.

2.3 Project Operations

The Terminal is a facility where cargo containers are transshipped between container ships and land vehicles, including trains or trucks. Container traffic is two way, meaning that cargo containers are transferred from container ship to land vehicles and from land vehicles to container ships; however, containers are also exchanged between truck and rail. The Terminal functions as the hub for loading and unloading of containers, storage of containers awaiting shipment, and directing containers to the appropriate mode of transportation.

The Terminal currently operates 24 hours/day, using three shifts per day. The night shift is typically lower staffed unless there is a ship in dock or a train needs to be loaded/unloaded. Trucks service the Terminal for 18 hours/day, from 7 a.m. to 1 a.m., five days per week (Monday to Friday) with occasional truck service on Saturdays. These hours of operation would not change with the proposed Project.

After the expansion, an average of two trains would service the Terminal each day. This is consistent with the existing number of trains; however, the number of containers carried by each train would increase from 316 containers (530 TEUs) up to 500 containers (800 TEUs), and result in approximately 2,000 containers (3,200 TEUs) moving (both inbound and outbound) through the terminal by rail each day.

The number of trucks entering the Terminal is highly variable and dependant on the shipping requirements of the containers being moved. Modelling conducted to support the design of the gate entrance estimated up to 2,000 TEUs would move through the gate (both inbound and outbound) on a peak day during operation of the proposed Project.

In total the Terminal would be capable of handling in excess of 3,000 container moves (5,000 TEUs) per day.

2.3.1 Terminal Operations

The proposed Project consists of Terminal improvements to increase Centerm's container capacity by approximately two-thirds to a sustainable capacity of 1.3 million TEU/year (maximum capacity of 1.5 million TEU/year). This increased capacity would be achieved through the following key changes to the Terminal:

- Increase in berth length
- Expansion of the intermodal yard
- Optimization and expansion of the container yard

- New truck gate infrastructure
- Addition of five rail-mounted gantries
- Addition of quay crane

The expanded Terminal operations would be substantially similar to the current Centerm operations except that the intermodal yard would be converted to a cantilever rail-mounted gantry operation and expanded through the addition of a fifth rail track and rail track extensions to the west and east. Apart from the intermodal yard, the proposed design maintains existing modes of operation.

The various components and activities associated with operation of the existing and proposed Project are summarized in Table 2-1.

While the port authority advocates no-idling as part of its Truck Licencing System, there are many short-term stop-and-go activities associated with handling container movement. Therefore, the modelling conducted for the proposed Project assumed that on-road vehicles associated with the terminal idle for up to an hour per day during their operation.

Terminal operations consist of three main components: berth, container yard, and rail operations. These are discussed in the following sections along with marine operations and truck gates.

Table 2-1: Operational Components and Activities

Equipment/Activity Description		Existing Equipment Numbers	Proposed Equipment Numbers
Marine	Ocean going vessels – auxiliary engine	Total vessel calls up to per year: 240 (approximately 5 per week)	Total vessel calls up to per year: 300 (approximately 6 per week)
Rail	National rail, line haul	1-2 trains per day – 53 containers/hour	2-3 trains per day – 135 containers/hour
	National rail, switch	1-2 switch	2-3 switch
On-Road	Heavy commercial truck, highway on terminal grounds	59,130 vehicle idling hours on-site per year 354,780 km travelled on-site per year	98,115 vehicle idling hours on-site per year 588,935 km travelled on-site per year
	Terminal support vehicles (pickup trucks)	25,550 vehicle idling hours on-site per year 766,500 km travelled on-site per year	25,550 vehicle idling hours on-site per year 1,022,000 km travelled on-site per year
Non-Road: Container Handling Equipment	Top pick (full container handlers)	Loaders: Fantoozi or Hyster 10 total --> 7 used at once Includes 6 Tier 4, 3 Tier 2, and 1 Tier 1 engines	Loaders: Fantoozi or Hyster 10 total --> 8 used at once Includes 6 Tier 4, 3 Tier 2, and 1 Tier 1 engines
	Rail-mounted gantry	Currently not used on-site	Up to 5 electric Replaces 2 diesel RTGs from the rail yard into the intermodal yard
	Rubber-tired gantry (RTG)	19 RTGs in fleet --> 14 operated at once (including 2 in the intermodal yard) 16 Noell RTG Tier 2 engines 3 ZPMC Tier 3 engines	19 RTGs in fleet --> 16 operated at once 16 Noell RTG Tier 2 engines 3 ZPMC Tier 3 engines
	Quay crane	6 electric cranes -->Typically only 4 ever in use at once A seventh crane is expected to be in service in late 2016/early 2017 (separate DPWV project).	7 electric cranes -->Typically only 4 ever in use at once 2 existing cranes will be replaced as part of the proposed project.
	Forklift	Selection of seldom used forklifts	Selection of seldom used forklifts
	Internal transfer vehicles	60 trucks in fleet	60 trucks in fleet
Terminal	Container processing (TEU per year)	2015 Actual: 552,000 Sustainable Maximum: 750,000 Absolute Maximum: 900,000	Sustainable Maximum: 1,300,000 Absolute Maximum: 1,500,000

2.3.1.1 Berth Operation

Containers are moved between the container ship and quay using electrically powered quay cranes. The proposed design retains the existing effective mooring length (from the mooring dolphin to the east end of Berth 5), introducing additional caissons to form a working berth in the area currently occupied by the Centerm mooring dolphin. This would increase the length of the workable berth on which quay cranes can operate without increasing the vessel mooring length. This would also remove any need to reposition vessels mid-load cycle to access containers that would otherwise be unreachable.

Currently six quay cranes operate the berth, with a seventh crane expected to be operation in late 2016/early 2017 (a separate project by DPWV). Following completion of the proposed Project, there will be seven quay cranes in operation, with two cranes being replaced as part of the proposed Project.

Containers are moved between the berth and the container yard using internal transfer vehicles. These are dedicated tractor/trailer vehicles that move containers between locations throughout the Terminal.

2.3.1.2 Container Yard

The container yard is used to store cargo containers between passage on different modes of transport. For example, a container arriving at the Terminal onboard a vessel would be moved to the container yard for storage before subsequently departing the Terminal via either rail or road. All containers passing through the Terminal spend some time in storage at the container yard. The container yard is divided into two main areas. The primary import/export container stacks that run parallel to the berth and intermodal yard are used for short-term storage. The longer term and empty container storage is situated in the northern section of the container yard.

Containers are either handled by rubber-tired gantry cranes or container handling equipment such as top picks depending on where they are situated in the yard. The rubber-tired gantry cranes operate over the primary import/export container stacks and the longer term and empty container storage is operated by top picks. The container yard also accommodates refrigerated containers, storing them in dedicated stacks that provide a power connection to maintain refrigeration unit operation; these are located in the import/export area.

2.3.1.3 Rail Operations

The intermodal yard is where containers are loaded on and off rail cars for wider distribution. The intermodal yard would receive up to 3,658 m (12,000 ft) long unit trains that transport goods to destinations across Canada and beyond. An average of two trains would arrive at Centerm each day; each train will carry up to 500 containers (800 TEUs).

The intermodal yard would have five 914 m (3,000 ft) rail tracks. The proposed design increases the length of the four existing tracks from 607 m (1,993 ft) to 914 m (3,000 ft), adds a fifth track, and replaces the two current rubber-tired gantries with five cantilevered rail-mounted gantries. The rail-mounted gantries and increased rail tracks to accommodate longer trains would more than double the productivity of the intermodal yard.

When a train arrives at the terminal, the rail cars are staged in the adjacent rail yard south of Centerm until the intermodal yard is ready to receive the rail cars. This allows the engine to be repositioned at the rear of the train to push the cars into the terminal. Once the intermodal yard is ready to receive, sets of rail cars are then moved from the rail yard to the intermodal yard. When trains depart the terminal, the engine pulls the cars directly from the intermodal yard, maneuvering once each set of rail cars is attached to capture the next set of cars.

2.3.1.4 Truck Gate

Arriving trucks are required to hold a valid appointment with the Terminal prior to arrival at the Terminal. This appointment includes the hour of arrival, vehicle, and load to be delivered (or collected). Arriving trucks pass through an optical character recognition portal that scans the container and records its details. At the subsequent interface pedestal, trucks that do not meet these arrival criteria or have an incorrect container are rejected from the terminal gates back onto the port road network where they will travel to the staging lot at McGill before contacting their firm to rectify any issues.

If a truck passes the appointment criteria, it proceeds to the main in-gate where it is processed and the driver is given a ticket with instructions on where to proceed. Directly beyond the main in-gate is a small staging area where drivers can conduct pin unlocking activities to allow the container to be lifted from the chassis (the container is locked on for road travel). This staging area also serves as a short-term holding area should unforeseen Terminal operations necessitate a delay in servicing a truck movement.

Outbound trucks pass through an optical character recognition portal to confirm the outbound container details (including customs documentation). If there is a problem with the truck, container, or its contents, the truck is diverted to trouble parking stalls where issues can be rectified prior to the truck departing the terminal.

2.3.2 Shipping Activities

Vessel calls to the Terminal are predicted to gradually increase after the completion of the proposed Project from current levels of approximately 240 to approximately 300 calls per year when operating at full capacity. This represents an increase of approximately one vessel per week. The increased container handling capacity of the proposed Project is mostly attributable to the increase in the size of vessels that can be accommodated (from 8,000 to 10,000 TEUs and up to 14,000 TEUs) and the efficiencies that will be realized as a result of the expanded container yard and intermodal yard.

Vessels pass through the First Narrows at the Lions Gate Bridge from Howe Sound. As container ships are not highly weather-restricted for their loading/unloading operations, they proceed directly to the berth at Centerm. It is expected that at times the berth may be occupied by another vessel (often either stricken or running behind schedule), and therefore, the approaching vessel may need to proceed to an anchorage before calling at the terminal. Vessels stay at the berth to perform loading/unloading operations for an average of one to two days, depending on the cargo to be transferred. Once these are completed, the vessel heads to its next port of call.

Standard procedure is to cycle ballast water at sea to limit transfer of marine life from one port to another.

2.3.3 Lighting

The Site must be sufficiently lit to provide safe work conditions and security and meet applicable requirements under WorkSafeBC, building codes, and other standards such as the Illuminating Engineering Society of North America. Currently there are 38 existing light towers at the Site and there will be a total of approximately 60 following upgrades to the Terminal, rationalizing many of the smaller lighting installations currently on the Terminal. The new light towers are required to illuminate the expanded intermodal yard and container yard and the reconfigured truck gate. For the existing light towers that are staying in place, the pole structures would not change, only the luminaires on the existing poles.

DPWV is currently upgrading the existing high-mast lighting from high pressure sodium (HPS) fixtures to light-emitting diode (LED) fixtures, which are more energy efficient. Photograph 2-1 shows the difference in illumination between the new LED fixtures (white lights) and the older HPS fixtures (yellow lights).

Photograph 2-1: Centerm at Night

Preliminary lighting layouts for the proposed Project were developed by PBX Engineering Ltd. (2016a). Modelling and refinement of the lighting design will take place during the detailed design phase. Best management practices (BMPs) developed by organizations like the International Dark Sky Association (www.darksky.org) to eliminate light pollution will be taken into account in the final project design to minimize or eliminate lighting effects on neighbours and wildlife.

Measures integrated into the final design may include some or all of the following practices (International Dark Sky Association 2015):

- Only providing lighting where it is required (i.e., for conducting work, safety, or security).
- Turning off lights when not in use.
- Focussing lighting to the purpose, avoiding excessive illumination.
- Using timers, dimmers, and motion sensors whenever possible.
- Using only “full cut-off” or “fully shielded” lighting fixtures (i.e., no light above the 90-degree angle).
- Using energy-efficient lighting sources and fixtures.
- Only using lighting sources with correlated colour temperature (CCT) no higher than 3000K. Fixtures that are 3000K or less emit less blue light. Exposure to blue light at night has been shown to have harmful effects on people and wildlife.

2.3.4 Energy Use and Efficiency

PBX Engineering conducted a Project Energy Study for the Centerm facility (PBX Engineering Ltd. 2016b). The purpose of the study is to identify major electrical loads, potential power savings, and energy conservations measures to assist with determining equipment and operational practices for proposed works and activities. The energy study encompasses major existing electrical loads and major electrical loads planned to be added as a part of the proposed Project. The energy study follows the Port of Vancouver *Project and Environmental Review Guidelines – Project Energy Study* (PMV 2016c).

Energy savings for the proposed Project may be implemented through the following two energy conservation measures:

- High Efficiency Terminal Lighting – energy savings through the installation of LED lighting in place of HPS fixtures, specifically for the terminal’s outdoor high-mast area lighting.
- High Efficiency Building Lighting – energy savings through the use of LED lighting and advanced lighting controls such as programmable dimming, daylight harvesting, and occupancy sensors for the terminal administration and operations buildings.

The anticipated annual energy savings associated with these energy conservation measures is approximately 286 kWh/year. The Project Energy Study (PBX Engineering Ltd. 2016b) provides a detailed analysis of the load estimates.

2.3.5 Stormwater Management and Accidental Discharges

The storm water pollution management strategy will be to implement BMPs targeting the sources of potential pollutants (Stormwater Pollution Prevention Plan) (AECOM 2016d). The objectives will be to prevent accidental release of pollutants, contain any erosion or spills that do occur, and reduce the use of potential pollutants to the extent possible. The strategy will also include treatment of stormwater prior to release into the marine environment, where required.

Stormwater runoff from roads and buildings will drain to the existing stormwater management system, which will continue to operate in the same manner with an expanded network using the same number of outfalls. All outfalls will continue to be equipped with remote-controlled oil/water separators.

DPWV has Container Operations Spill Response safe operating procedures in place that will be updated to reflect the new layout and expanded area of Centerm to maintain safe operations. DPWV will update its Stormwater Pollution Prevention Plan to include the new areas and layout for the proposed Project.

2.4 Project Delivery

The proposed Project is expected to be delivered using the design-build procurement model where the DB Contractor provides the final design and construction based on the preliminary design and performance criteria. Works covering the supply and installation of the new cranes, technology for the new truck gate, plus the final fit out of the Container Operations Facility will be coordinated by DPWV and are anticipated to be procured through design-bid-build procurement methods.

2.5 Project Schedule

The permitting and procurement stage is anticipated to begin in the latter part of 2016, and extend through 2017. Should the proposed Project be approved, construction is anticipated to commence in 2017 with site preparation after completion of permitting and take approximately two years to complete. The published in-water work windows set by DFO for Burrard Inlet to protect marine species are from August 16 to February 28. The construction schedule for in-water works will comply with timing restrictions established by DFO in the *Fisheries Act* Authorization for the proposed Project. The additional capacity should be available once construction is completed at the end of 2020. The anticipated schedule for key project components is:

Marine Dredging and In-filling	3-6 months during the fall/winter of 2017 and 2018
Land Reclamation	12-18 months during 2018
Intermodal Yard works	approximately 2 years from late 2017
Container Yard alterations	6-9 months in late 2019
Container Operations Facility Building	approximately 2 years from late 2017
Truck Gates	6-9 months in early 2019
SSAP	approximately 2 years from late 2017

2.6 Land Use

2.6.1 Current Land Ownership

The Terminal is situated on federal land under the administration of the port authority. It is leased by DPWV as the terminal operator.

The proposed Off-Terminal improvements are on port lands, bounded by a rail right-of-way to the south. The alterations to the rail support yard will require amendment of existing agreements with CNR to accommodate the works. Where the Centennial Road Overpass follows the roadway adjacent to the rail right-of-way, there may be some airspace encroachment by the overpass structure on land owned by Lantic and Canadian Pacific Railway (CPR).

2.6.2 Land Use Plan

Under the port authority's 2014 *Land Use Plan* (PMV 2014a), the proposed Project area and the majority of the Burrard Inlet south shore is classified as "Port Terminal," which is primarily designated for deep-sea and marine terminals. The proposed Project is consistent with the port authority's land use designation of "Port Terminal." The area immediately to the west of the proposed Project area is designated as a "Special Study Area." South of the terminal, the area around CRAB Park at Portside is designated as "Recreational." The plan was the result of two years of consultation with municipalities, Aboriginal groups, government agencies, environmental organizations, businesses, industries, and members of the public.