

Memorandum

Subject TDK Metro Terminals – Flood Vulnerability Assessment

To Tish Kumar, TDK Metro Terminals

From A. Kennedy

Our reference 514100592-MMD-00-P0-MO-CV-0002

Date 2023-Jan-31

1 Introduction

TDK Logistics Inc. (TDK) Metro Terminals is proposing to redevelop their existing site located at 480 Audley Blvd in Delta, British Columbia (Figure 1). To support the Vancouver Fraser Port Authority (VFPA) PER application, Mott MacDonald completed a desktop review to examine flood vulnerabilities of the project.

Figure 1: Facility Location



2 Basis of Assessment

The Fraser Basin Council (FBC) completed a flood modelling and mapping project in 2019 which estimates the extents and depths of flooding for various current and future scenarios, determined by freshet flood events resulting from heavy rain and spring thaw. These scenarios are based on a range of flood return periods, with the addition of different climate change-driven impacts (such as higher precipitation volumes and sea level

rise) to mid- and late-century. These freshet flood depth maps for the various scenarios are publicly available online via the FBC website and were used as the basis for Mott MacDonald's review.

2.1 Assessment Caveats

It should be noted that the FBC maps are based on a limited number of flood scenarios and are for regional planning purposes only. They are not to an adequate level of detail for use in local flood planning or analysis. The provided maps also do not show flooding from other rivers, streams and creeks except for backwater effects from a Fraser River flood.

This assessment is not an analysis or study, and only comments on the flood risks and vulnerabilities based on the information provided by the FBC. As the assessment is completed using the pdf maps provided by the FBC, the comments made herein are not definitive and have been inferred from the imagery available only. A full flood analysis requires working with a flood modelling consultant that has or is able to produce a detailed flood model for the project site.

3 Flood Horizons

3.1 Baseline Horizon Flood Levels

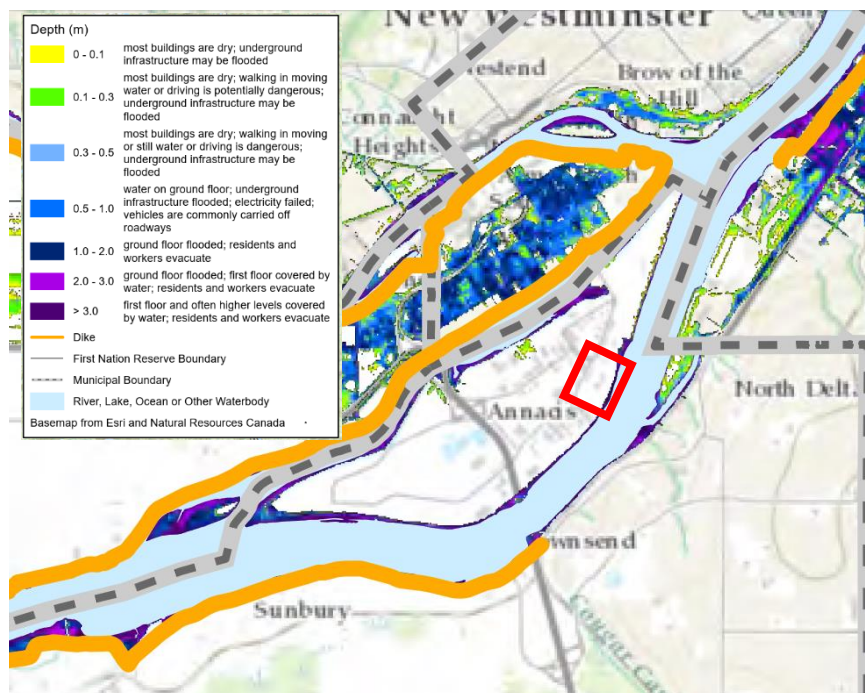
The baseline horizon is the FBC Fraser River Freshet (Spring) Flood Scenarios for Present Day, which is based on historical records and the present-day climate conditions.

The scenarios included in this base horizon are:

- 1% AEP (100-year) freshet flood;
- 0.5% AEP (200-year) freshet flood;
- 0.2% AEP (500-year) freshet flood; and
- 1894 freshet flood event.

For all four scenarios, the FBC maps indicate there will be no flooding within the project area except for some inundation around the shore of Annacis Island. The 1894 flood event is considered to be the worst-case scenario by FBC compared to the other mapped freshet flood scenarios for the base horizon. A screenshot of the project area for this 1894 scenario is shown below in Figure 2 to illustrate the estimated levels of flooding. The approximate location of the project is marked in red in the figure.

Figure 2: Screenshot of the Base Scenario Flood extent and levels



Source: https://www.fraserbasin.bc.ca/Library/LMFMS_Maps/Base_Freshet_1894_MaxDepth_Web.pdf, accessed 2023-Jan-26

3.2 2050 Horizon Flood Levels

The 2050 Horizon mapping comprises the FBC Fraser River Freshet (Spring) Flood Scenarios for the year 2050, which estimate flood levels under projected climate change conditions in 2050. This is inclusive of a 0.5m sea level rise and changes in peak river flows.

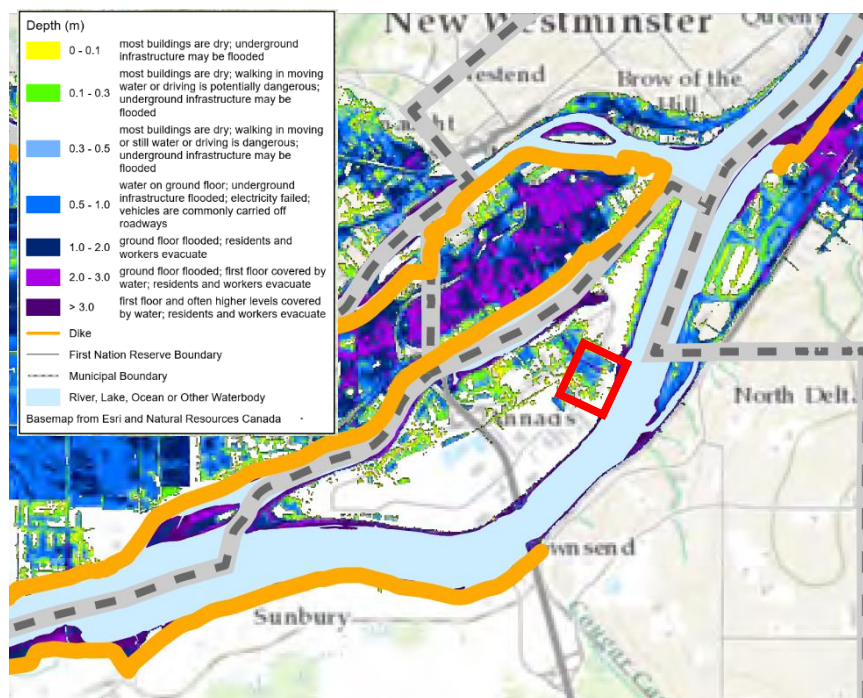
The scenarios included in this 2050 horizon are:

- 1% AEP (100-year) freshet flood;
- 0.2% AEP (500-year) freshet flood.

For the 100-year flood, the FBC flood map indicates the project area sees similar flooding to that of the base case, where there is only slight flooding around the shoreline.

The 500-year flood map indicates that there would be some flooding and possible inundation up to 0.5 to 1.0m in the project area. A screenshot of the 2050 500-year scenario map is included in Figure 3. The approximate location of the project is marked in red in the figure.

Figure 3: Screenshot of 2050 500-year Flood extent and levels



Source: https://www.fraserbasin.bc.ca/_Library/LMFMS_Maps/Base_Freshet_CC2050_pt2AEP_pt5mSLR_MaxDepth_Web.pdf , accessed 2023-Jan-26

3.3 2100 Horizon Flood Levels

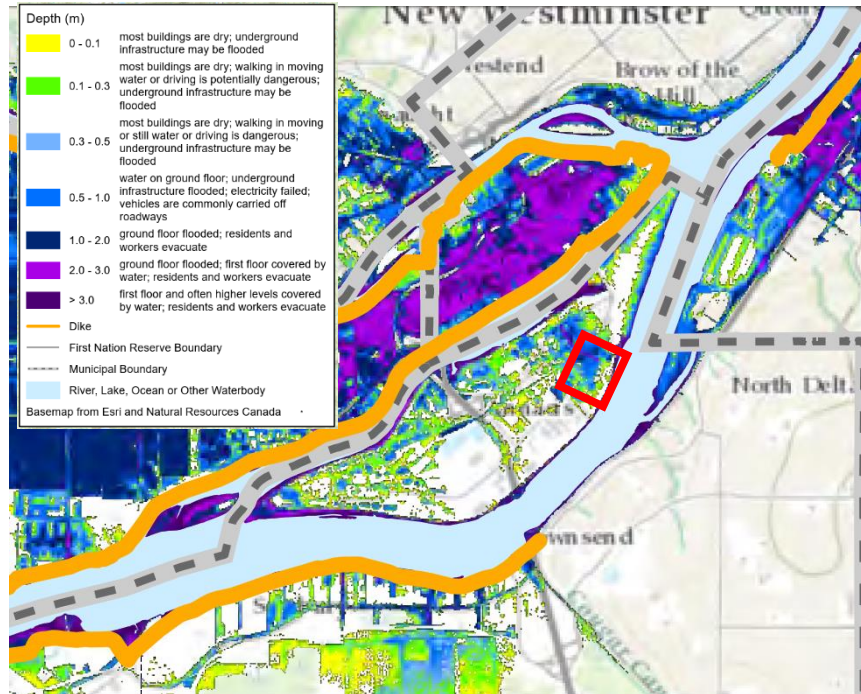
The 2100 Horizon encompasses the FBC Fraser River Freshet (Spring) Flood Scenarios for the year 2100, which estimate flood levels under projected climate change conditions in 2100. This is inclusive of 1m sea level rise and changes in peak river flows.

The scenarios included in this 2050 horizon are:

- 1% AEP (100-year) freshet flood;
- 0.5% AEP (200-year) freshet flood.
- 0.2% AEP (500-year) freshet flood.

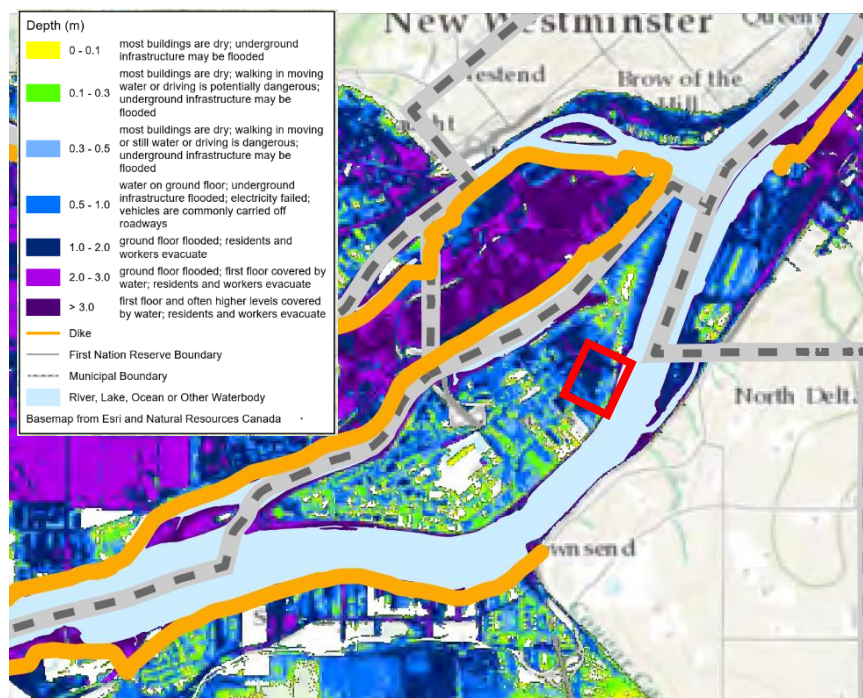
For all three 2100 Horizon scenarios, the FBC flood maps indicate the project area would see significant flooding and inundation. The levels of flooding increasingly worsen between the 100-year to the 500-year flood scenarios. Screenshots from the two maps are included in Figure 4 and Figure 5 below for reference - illustrating the increase in flooding between the scenarios.

Figure 4: Screenshot of 2100 100-year Flood extent and levels



Source: https://www.fraserbasin.bc.ca/_Library/LMFMS_Maps/Base_Freshet_CC2100_1AEP_1mSLR_MaxDepth_Web.pdf, accessed 2023-Jan-26

Figure 5: Screenshot of 2100 500-year Flood extent and levels



Source: https://www.fraserbasin.bc.ca/_Library/LMFMS_Maps/Base_Freshet_CC2100_1AEP_1mSLR_MaxDepth_Web.pdf, accessed 2023-Jan-26

3.4 Assessment Horizon

The 2050 horizon was selected for the assessment as it is most aligned with the current planned project asset lifespan. The following section reviews the risks and vulnerabilities of the 500-year flood scenario, as this modelled scenario considers the precautionary worst-case freshet flood that could potentially impact the project and its assets in future.

4 Areas of Flood Risk and Vulnerability

If the 2050 500-year flood were to occur, the north-east corner of the site would witness the highest levels of flooding. According the FBC map, the corner would reach flood levels of 0.5 – 1.0m. At this level, water would be on the ground floor of a modular building, underground infrastructure would be flooded, electricity would fail and vehicles are commonly carried off roadways. The flooding would gradually decrease towards the south-west corner (towards the shore) to no flooding. However, the map indicates there will be flooding along the shoreline.

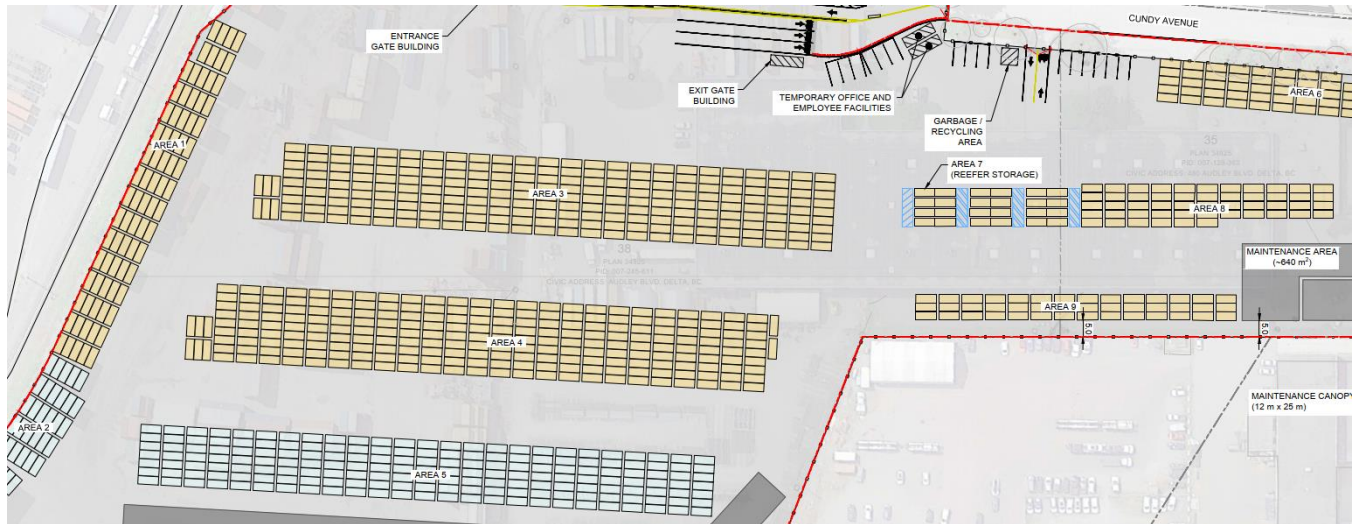
The following subsections review the effects of the 500-year flood on the various site and operations aspects.

4.1 Container Storage

The Area 6 container storage area is in the area of highest flooding (0.5 – 1.0m). Area 7 and Area 8 would be flooded next reaching similar levels of flooding. This would eventually reach Area 3,4 and 9 and finally Areas 1, 2 and 5.

As the standard height of a container is 8'-6" (2.59 m), the ground layer of containers will all be at risk of having the stored materials contaminated. Individual empty containers in the areas of heavier flooding (Areas 3,4, 6, 7, 8, 9) may be carried off by the water.

Figure 6: Screenshot of Container Areas



4.2 Reefer Storage

The reefer storage area (Area 7 of the container storage) is anticipated to reach flood levels of 0.5 to 1.0m. Reefers on the ground will be at risk of having the stored commodities contaminated. Furthermore, the reefer receptacle kiosk risks being damaged, resulting in the commodities inside the reefers being spoiled.

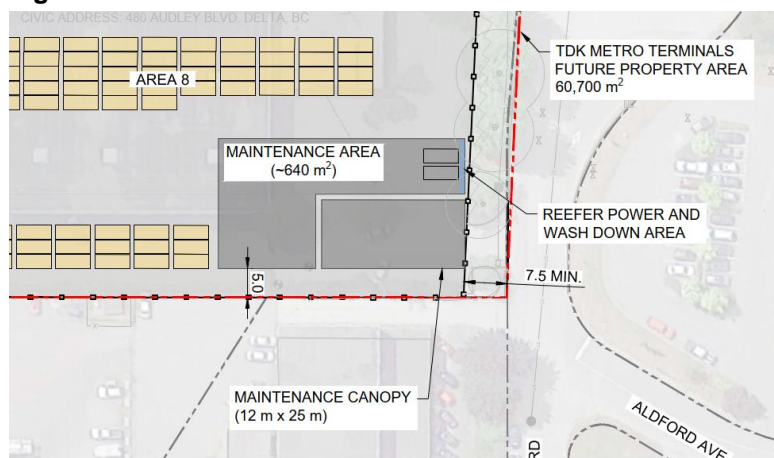
4.3 Maintenance Area

The maintenance area of the site is anticipated to reach flood levels of 0.5 to 1.0m. Equipment in this area are susceptible to being damaged from flooding and require being drained after. At these flood levels, they are also susceptible to being washed away with the water. Some examples of the equipment in this area that could be affected include the following:

- Reefer power and wash down
- Propane tanks
- Tidy tanks
- Container reach stacker repair equipment

Furthermore, maintenance in this area will need to be on hold due to the high levels of flooding.

Figure 7: Screenshot of Maintenance Area

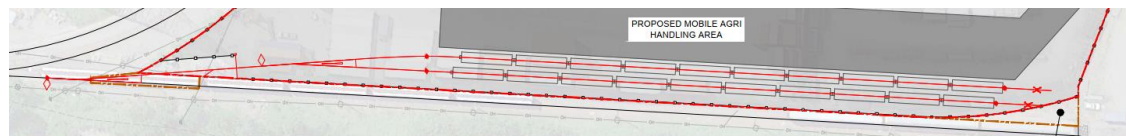


4.4 Railyard

The proposed railyard runs along the south-east border of the site parallel to the shore. The shoreline area is anticipated to flood up to 1.0 to 2.0m and as the site sits behind the existing berm at a lower elevation, it is expected the flood water would overtop over the berm.

Flood damage to the rail can include damage to the track itself. If a rail car is on the track during the time of flooding, the materials stored in the rail cars can be damaged (i.e. containers of grain). In the event of the 2050 500-year storm, the turnouts will not be able to be switched due to the flooding, thus railcars cannot be moved in or out of the site and SRY operations will be required to cease.

Figure 8: Screenshot of Proposed Railyard



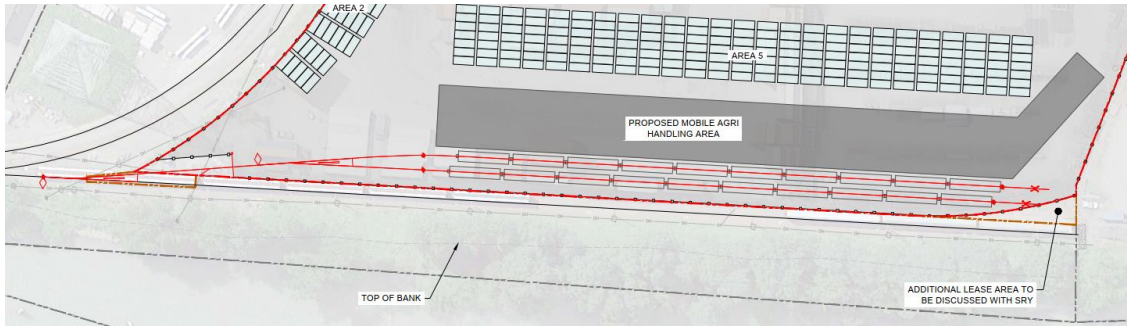
4.5 Site Facilities

The site includes four modular Britcos along the north-west edge of the site: an entrance gate office, an exit gate office, a temporary office and an employee facility. This area is anticipated to reach flood levels of 0.1 to 0.3m. At these flood heights, most modular buildings are dry, however walking in water or driving is potentially dangerous. Thus, in the event of such flooding, these buildings will not be able to be occupied by staff, meaning there be no staff to check in or check out trucks nor operate at the site.

4.6 Grain Unloading Equipment

Grain will be unloaded from the rail and onto containers just north of the railway yard. This area is anticipated to have 0.1 to 0.3m of flooding, which may affect how the equipment (mobile railcar unloader, grain belts and container tipper) can operate.

Figure 9: Screenshot of Proposed Agri Handling Area



4.7 Container Handling Equipment

Containers will be moved using reach stackers around the site. As some areas will reach high levels of flooding up to possibly 1.0m, the reach stacker may not be able to drive around the site and operations will not be able to continue. Reach stackers may also face water damage and required to be drained after.

4.8 Electrical

Portions of the electric system will be at ground level around the middle of site and will include equipment such as power lines and the electrical house. This area is anticipated to reach flood levels of 0.5 to 1.0m, leaving the equipment at risk of flood damage. In the event of flood damage, power will be cut off at the site and the commodities inside the reefers may be spoiled. Overall operations will also be affected without lighting and electricity for the staff facilities.