Appendix B

Fire Protection Assessment Report

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FIRE PROTECTION ASSESSMENT REPORT

FOR THE

TESORO SAVAGE VANCOUVER ENERGY DISTRIBUTION TERMINAL

Prepared for:

STATE OF WASHINGTON

ENERGY FACILITY SITE EVALUATION COUNCIL

August 10, 2015

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Chapter 1

OVERVIEW

This document presents the findings of the Fire Protection Engineering Assessment for the Tesoro Savage Energy Distribution Terminal Project (Facility) proposed at the Port of Vancouver (Port) along the Columbia River in Vancouver, Washington. This document evaluates the various fire protection related engineering and operations requirements of the proposed Project, and provides a summary of identified fire protection gaps, including those of the onsite Facility, offsite rail operations, and the capabilities of Vancouver Fire Department (VFD) related to fire protection, safety, and response.

The proposed Facility would be located at the Port, specifically at Terminal 5 and in the parcels located behind Terminal 5 and Terminal 4. The Facility would be designed and constructed to unload Bakken crude oil, and possibly other heavier grades such as diluted bitumen crude oil, from railcars in Terminal 5. The crude would then be pumped through pipelines to storage tanks located in Parcel 1A, just east of Farwest Steel, where it would reside until a ship calls at the berth. From the storage tanks the crude would be pumped through pipelines to Berth 13 and onto tanker vessels, and from there the vessels would travel down the Columbia River and out to sea to various refinery destinations on the US West Coast.

Preliminary fire protection design information for the proposed Facility was obtained from Tesoro Savage (Applicant) and BergerABAM (the Applicant's consultant) prior to this assessment. The onsite Facility fire system engineering and design was reviewed in detail for compliance with applicable codes and good design practice, and the results are found in the Fire Protection System Review (Appendix A). This study focuses on the engineering details of the Facility fire system as presented by the Applicant and BergerABAM at a relatively early stage of design. Their documents appeared to be at about a 30 percent design level, and as such it is recognized that not all information and design detail was available to review. There was, however, sufficient design information to make a good determination of the adequacy of the onsite fire protection systems. The highlights are summarized herein and assessed along with offsite fire protection resources and proposed Facility impacts on those resources.

Offsite fire protection resources include the local VFD, neighboring fire departments with mutual aid agreements, and water supply systems as provided by the City of Vancouver (City). The combination of these various resources makes for the total fire protection system assessed in this report. Data were requested and provided by the Applicant on offsite resources, and VFD also provided pertinent information regarding their department's capabilities.

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Chapter 2

EXECUTIVE SUMMARY

Based on the documentation provided by the Applicant at this point of Facility design and Project development, the proposed Facility appears to be adequately designed and generally meets the normally accepted standards for similar marine oil transfer terminals, however, there are specific identified gaps in the design and operation related to the fire protection system. There are also identified gaps related to offsite utility systems and the response capabilities of the VFD.

A key aspect of this assessment was to identify the gaps in the fire protection system design, operation, or response capabilities that need to be resolved with the Applicant prior to final approval for proposed Facility construction. Offsite gaps were identified specific to the location and area of responsibility to the Facility, and include VFD's response capabilities.

The Applicant has divided the proposed Facility elements into various geographic and functional areas. These distinct areas are described as: Area 200 – Railcar Unloading and Office; Area 300 – Storage Area; Area 400 – Marine Terminal; Area 500 – Transfer Pipelines; and Area 600 – Boiler Building.

This review and assessment has identified the following gaps or potential gaps in these areas, which are discussed in more detail within the document.

2.1 FACILITY AREA 200 – RAILCAR UNLOADING AND OFFICE AREA

The Railcar Unloading Facility would include parallel unloading spurs dedicated for light crude oil or heavy crude oil with heating. The unloading spurs would be located inside an unloading building, and adjacent to this building would be a fire pump/foam skid building, and office building.

Identified proposed Facility fire protection gaps or potential gaps are as follows:

- Provide containment calculations and capacities of containment pans and tanks.
- Provide redundant auxiliary diesel fire pump in addition to the primary pump.
- Provide a second detection system to activate alarms prior to actual foam release, and to provide fire detection in areas not protected/covered by heat detection strips.
- Provide specific electrical hazard classification boundaries to confirm compliance with Class I Div 1 and Div 2 installation requirements.

2.2 FACILITY AREA 300 – STORAGE AREA

The Storage Area includes six crude oil storage tanks with a working storage capacity of 340,000 barrels (14,280,000 gallons) each. The storage tanks would be contained within an earthen dike system. This area would include other support structures and equipment such as a pump basin and pumps, a storage building, a control room, and a fire pump and foam building.

Identified fire protection gaps or potential gaps are as follows:

- Provide tank dike containment calculations and stormwater containment system details with block valves and isolation operation methods noted.
- Provide clarification of the operation of the dike location monitors.
- Provide redundant auxiliary diesel fire pump in addition to the primary pump.
- Provide additional fire detection systems to monitor and alarm tank external areas.
- Provide specific electrical hazard classification boundaries to confirm compliance with Class I Div 1 and Div 2 installation requirements.

2.3 FACILITY AREA 400 – MARINE TERMINAL

The Marine Terminal Area would be located at Berths 13 and 14 at Terminal 4, and would be able to accommodate vessels with a capacity of up to 380,000 barrels, with loading rates of up to 32,000 barrels per hour. This area would include other support structures and equipment such a control room/E-house, marine vapor combustion unit(s), a fire pump and foam building, and a dock safety unit.

Identified fire protection gaps or potential gaps are as follows:

- Provide revised foam monitor details including for proper height for the draft range of expected vessels.
- Provide locations of the manual release points, including some to be located on shore.
- Provide spill containment at the dock in addition to the floating boom for the vessels, including curbing around the platform, all-welded (no flanges) oil piping over the water, and a slop tank.
- Provide redundant auxiliary diesel fire pump in addition to the primary pump.
- Provide clarification on whether fire flow capacity is adequate considering comparable California standards (CA MOTEMS Chapter 31F, Section 8) would require 3,000 gallons per minute (gpm) fire flow for this terminal. If flow capacity is limited by the supply system, consider adding a vertical submersible river pump.
- Provide fire alarm detector type, locations, and functions.
- Provide emergency shutdown valve details on dock, and ensure that surge pressures stay within allowable piping pressure limits.
- Provide required life safety information including portable extinguishers, hose reels, egress ladders to the water, life rings, etc.
- Provide information and details for vessel drift envelope monitoring and protection.
- Provide specific electrical hazard classification boundaries to confirm compliance with Class I Div 1 and Div 2 installation requirements.

2.4 FACILITY AREA 500 – TRANSFER PIPELINES

The transfer pipelines include three 24-inch pipelines connecting Area 200 (Railcar Unloading Facility) to Area 300 (Storage Area), and one 36-inch vessel loading pipeline connecting Area 300 (Storage Area) to Area 400 (Marine Terminal).

Identified fire protection gaps or potential gaps are as follows:

- Provide locations of isolation valves and emergency shutdown valves on all main pipelines.
- Provide details on pipeline inspection and testing methods, including frequency of inspections and testing.
- Provide pipeline thermal stress analysis methods, surge analysis methods and protective measures.
- Provide piping design and welding specifications, welder qualifications, and weld inspection methods.

2.5 FACILITY AREA 600 – BOILER BUILDING

The Boiler Building Area would contain boilers that generate steam to heat the heavy crude oil in the Railcar Unloading Facility at Area 200.

Identified fire protection gaps or potential gaps are as follows:

- Provide information on any special fire detection systems required for boiler installations.
- Provide additional fire protection design information when available later in the design.

2.6 OFFSITE WATER SUPPLY SYSTEM

The offsite water supply system consists of the City's municipal water distribution network, which furnishes all fire water requirements to the proposed Facility site. The Facility is not proposing to use the Port water system during operation for any use, be it process water or fire protection. The proposed Facility would only rely on City water supply for fire response, and the City has provided the Applicant with a certification letter that the supply system is reliable and capable of 3,500 gpm. However, the City did not provide any further documentation supporting their statement.

Identified offsite water supply system gaps or potential gaps are as follows:

- Additional technical and supporting data from the City would be useful to support the City's claim.
- The water supply system from the City to the western area of the Port is not looped for redundancy.
- The City's single supply main to the proposed Facility area reduces to 12 inches before increasing again to 24 inches. This is a flow bottleneck for the high-volume flows required at the Facility.

2.7 FIRE DEPARTMENT RESOURCES

Several questionnaires and inquiries were forwarded to VFD to obtain information on VFD resources and response capabilities. VFD responses identified the need for additional resources in the areas of staffing; training; equipment (pumpers, trucks, and foam); station locations and distances to the Facility; and mutual aid.

VFD identified gaps or potential gaps are as follows:

- For train derailment oil spills, VFD reported being deficient in staffing levels, training, hard boom, sorbent boom, fire apparatus (unspecified), overhead support and equipment to support an extended operation, aqueous film-forming (AFF) foam, personal protective equipment, foam applicators, and appropriate air monitors.

- VFD reported that any incident on the rail line would have an impact on their ability to respond to and maintain the adopted level-of-service for the rest of their response area.

2.8 FIRE DEPARTMENT RESPONSE – PROPOSED FACILITY

This proposed Facility is different in both function and scale from VFD's previous experiences.

VFD response gaps, or potential gaps, for the proposed Facility are as follows:

- The Applicant needs to provide fire department connections on the Facility side of the fire protection system so that VFD can connect to and augment that system.
- The Applicant should be required to provide comprehensive instruction and training for VFD in the design, operation, and interaction with the Facility fire protection system.

2.9 FIRE DEPARTMENT RESPONSE - RAIL

Crude oil would be delivered to the proposed Facility via crude oil trains, which would enter the Vancouver area from the east along the Columbia River. Unlike the proposed Facility site fire protection systems, which are fixed in place, the crude oil trains would be moving, with no onboard fire protection systems in case of an accident. This presents a different and very challenging environment for VFD.

Identified VFD response gaps, or potential gaps, for the rail system are as follows:

- There are at least 27 at-grade rail crossings along the rail route within the VFD response area, which present identifiable risks for residents and industrial tenants along the rail route in Vancouver.
- Poor visibility for drivers combined with restrictions on sounding train horns creates additional crossing hazards for residents.
- Access by VFD to riverfront homes is at risk due to limited rail crossing locations, leading to the potential need for water access response methods in case of a rail derailment, or even a non-emergency stoppage of a train.
- VFD has reported the need for additional staff, training, and equipment to effectively respond to any size rail oil spill 100 barrels or larger.
- It is recommended that a formal at-grade crossing study be undertaken to analyze these risks in a detailed manner and to identify appropriate recommendations.
- It is also recommended that a study be undertaken to determine if a reduction in train speeds would be warranted for crude oil trains traveling through at-risk areas within the VFD response area.

2.10 FIRE DEPARTMENT RESPONSE - VESSELS

VFD may be required to respond to incidents at the Marine Terminal in Area 400, either for a fire on a ship at berth or for an incident with the vessel underway on the river. Vessel fires are more difficult for VFD to access, and the special nature of vessel incidents dictates specialized protection systems and firefighting methods.

Identified VFD response gaps, or potential gaps, for the vessel system are as follows:

- Specialized training for VFD for vessel fires would be necessary, particular related to the berth layout and operation at the Marine Terminal.

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Chapter 3

FACILITY FIRE SYSTEMS

The onsite fire protection systems were investigated and reviewed in detail in the Fire Protection System Review (Appendix A) and that document should be referenced for those details. The following are highlights of that review and are presented to provide a perspective on the total fire protection aspects of this Project. VFD is tasked with responding to all onsite and offsite Facility-related fire, accident, or spill incidents. As such, the complete system is addressed in this assessment to present a comprehensive view of all interrelated Project elements.

3.1 ONSITE WATER DISTRIBUTION SYSTEM

The Applicant has researched and stated that the onsite water supply and distribution system as available from the City to the Project site would be adequate to meet the flow demands of both the manual fire operations and the automatic fire suppression system. It was also stated that the City water system would be accessible at all Project site locations and according to the City has been determined to be reliable. Section 4.0 discusses various aspects of the City's offsite water supply network with regard to reliability and flow. Figure 3.1 depicts the onsite water mains and connection points to the Project fire water suppression systems. Figure 3.1 also illustrates the location of water system improvements to be constructed for the proposed Facility, including a new water transmission line along the south side of the railcar unloading facility and a section of replaced water distribution line near the Marine Terminal. Note that there are three primary connection points for the proposed Facility dedicated fire water system. All piping downstream of these points would be designed and installed by the Applicant, and those details are not yet available. Although there is an adjacent Port fire water distribution system, it would not be connected to the proposed Facility's fire protection system.

The onsite water system is composed of 12-inch and 16-inch ductile iron piping laid out in a network consistent with the varied industrial uses at the Port area. The City states that flow rates of up to 3,500 gpm are available at this location. The 16-inch mains are certainly capable of carrying that volume, but the 12-inch mains, while capable of that flow rate, are somewhat marginal due to large pressure drop at that rate. Specific network layout and looping of lines affects the final measured pressures at various points in the system. This is confirmed by the flow tests conducted by the City at the connection points to the proposed Facility fire system.

The Applicant requested fire flow tests from the City, and such tests were completed in 2013 at two existing hydrant locations in the Storage Area (Area 300) and the Marine Terminal (Area 400) (Figures 3.2 and 3.3). With respect to hydrant testing in the Rail Car Unloading and Office area (Area 200), the City provided the Applicant with data from testing that had been conducted in 2011. At Areas 300 and 400, the City tested and provided results for hydrants located at 3703 NW Gateway and 3309 NW Gateway. The City performed the hydrant flow tests and subsequent calculations in accordance with National Fire Protection Association (NFPA) Standard 291, dated 2002. No fire flow testing was requested by the Applicant from the Port as the Applicant is not relying on the Port water system for fire suppression needs. The results of these tests are detailed in the Fire Protection System Review (Appendix A).

FIGURE 3.1 – ONSITE WATER DISTRIBUTION SYSTEM

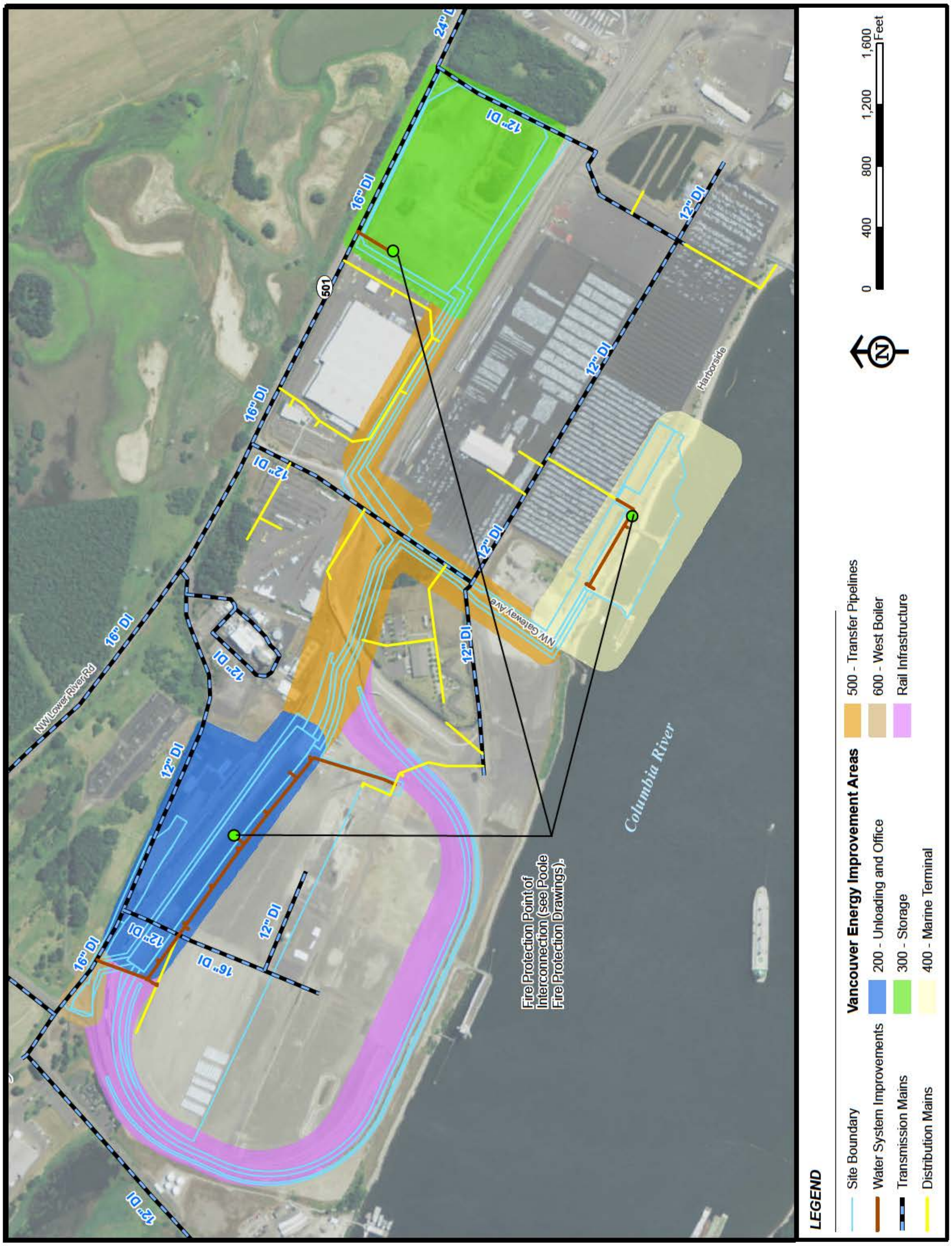


FIGURE 3.2 – WATER MAINS AND HYDRANTS, RAILCAR UNLOADING FACILITY

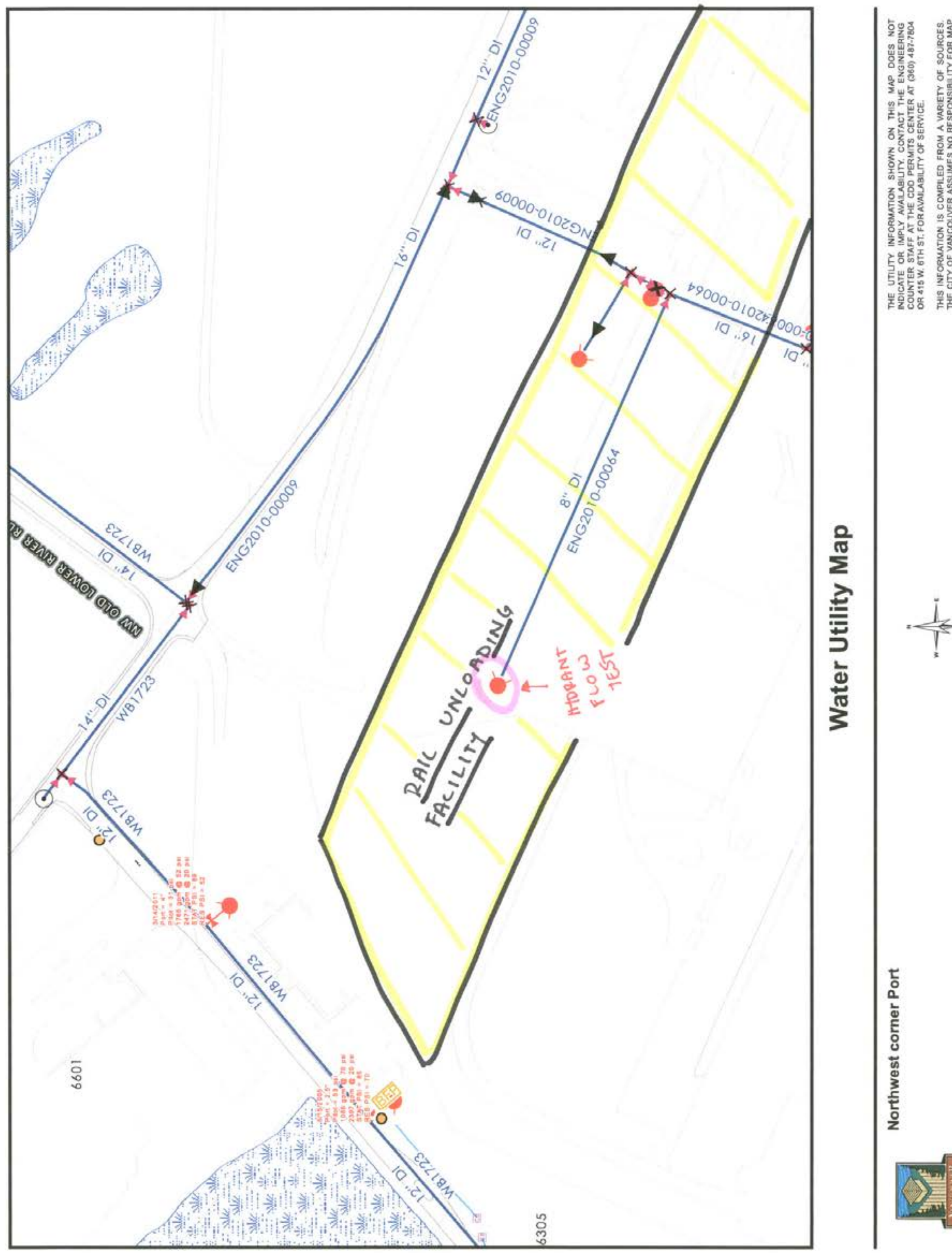
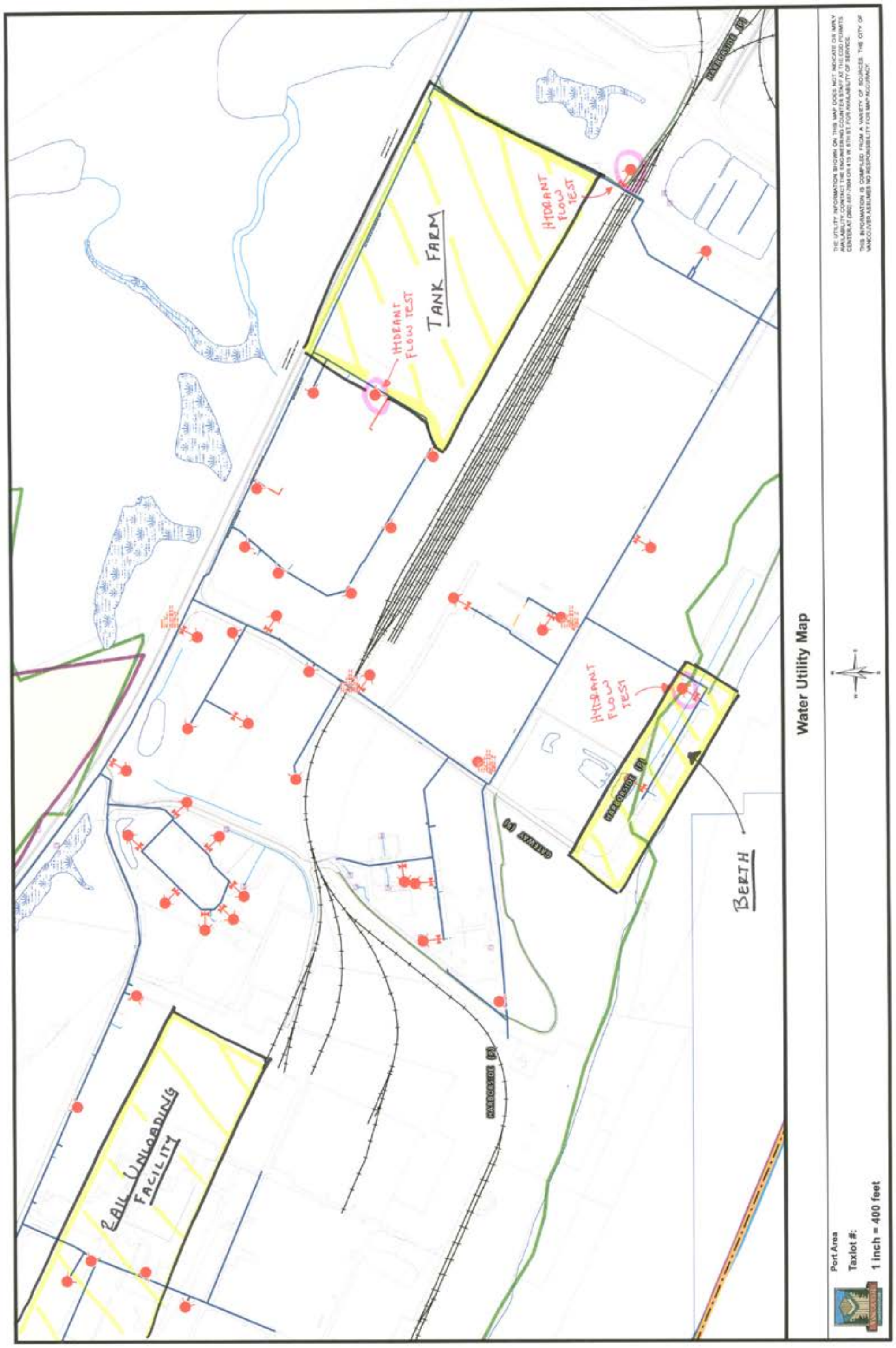


FIGURE 3.3 - WATER MAINS AND HYDRANTS, GENERAL FACILITY AREA



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3.2 ONSITE WATER SYSTEM HYDRAULICS

Following is a summary of the results of the hydrant flow testing at each area:

- Area 200 – Railcar Unloading Facility (assumed values from the City): Static Pressure = 50 psi (pounds per square inch), Residual Pressure = 20 psi, Flow = 2,500 gpm.
- Area 300 – Storage Area: Static Pressure = 84 psi, Residual Pressure = 63 psi, Flow = 2,005 gpm
- Area 400 – Marine Terminal: Static Pressure = 81 psi, Residual Pressure = 62 psi, Flow = 2,127 gpm

Note that although the flow rates and residual pressures appear to be adequate for standard hydrant distribution and fire department use, they are too low to operate the foam sprinkler and monitor systems at each area. A rigorous hydraulic analysis of the fire water system requirements and existing Project conditions was conducted by the Applicant's fire protection consultant (Pool Fire Protection 2014). The objective of the analysis was to define key components of the system and establish design criteria associated with the fire water system, as well as to document preliminary worst-case hydraulic demand scenarios for the systems. Thus it was determined that auxiliary fire pumps are required in the Applicant's fire system at each area to boost operating pressures.

3.3 FIRE PUMPS AND EMERGENCY POWER SUPPLY

Fire pumps would be required to supplement the City water supply pressure at all locations. The fire pumps would be diesel driven so that they are independent of the local electrical utility system, which is not considered total reliable according to the Applicant. There are no plans for the Project to have a backup power system. The pump sizes would be:

- Area 200 – Railcar Unloading Facility – 2,000 gpm at 125 psi
- Area 300 – Storage Area – 2,500 gpm at 125 psi
- Area 400 – Marine Terminal – 2,000 gpm at 125 psi

The plans and documents indicate that there would be (one) 100 percent capacity pump at each location. This is highly risky since if a pump fails to start for any reason, or is down for maintenance, there is no fire protection through the onsite fire system. It is recommended that a second backup pump be installed at each location.

At this time the Applicant has no plans for the Project to have a backup power system. As stated in the Fire Protection System Review (Appendix A), some emergency power must be provided for control and operation in order to monitor and allow safe shutdown of all systems, such as valves, pumps, boilers, etc. Emergency power is also required for critical lighting for safe personnel movement and egress.

3.4 ONSITE FIRE SUPPRESSION SYSTEMS

A variety of fire suppression systems would be used on this Project to address the different characteristics and functions of each area. The Railcar Unloading Facility (Area 200) has unique aspects associated with the long layout of the building and its multiple track configuration. The tank Storage Area (Area 300) is specialized due to the nature of the tanks with their large storage volumes, and the Marine Terminal area (Area 400) is unique to large vessel loading operations.

Following is a brief description of the fire suppression features and operation of each system:

- Automatic sprinkler systems of both the foam-water and wet-pipe are to be used on this Project. A closed-head foam-water pre-action sprinkler system would be provided in the railcar unloading facility, while a closed-head wet-pipe sprinkler system would be provided in all of the fire pump and foam buildings at each site. The E-houses, the operations/change trailer, and boiler building(s) do not require a sprinkler system to be installed. Instead, fire extinguishers would be provided and located in accordance with NFPA 10.

- Monitor nozzles mounted to fire hydrants would be located on the dike at the Storage Area. Remote control elevated monitor nozzles would be provided on the dock at the Marine Terminal area.

- The system riser for the Storage Area fire hydrant monitor nozzles would consist of a supervised control valve. The system riser for the monitor nozzles on the dock would consist of a foam proportioner and a single-interlock pre-action valve, as well as strainers and supervised control valves on all water, foam concentrate piping, and foam bladder tank. The monitors at the dock would be remotely controlled (aimed) from a station strategically located on shore near the fire pump and foam building.

Chapter 4
OFFSITE WATER SUPPLY SYSTEM

4.1 CITY OF VANCOUVER WATER SUPPLY

In support of the Application for Site certification, the Applicant requested technical information from the City regarding water availability for the proposed Facility. The City stated that they have sufficient water rights, storage, and distribution capacity to serve the Facility with a minimum of 3,500 gallons per minute of fire flow, and sufficient non-fire flow for the facilities anticipated instantaneous peak of 50 gallons per minute for non-fire protection water use. A letter of certification to these statements from the City was provided as Appendix E to the Application for Site Certification Supplement.

The City's water system is a Group A system and has a Washington Department of Health (WDOH) identification number 91200L, regulated by WAC 246-290. The City receives its water from the Orchards, Troutdale, and Sandy River Mudstone aquifers. The City's water rights total 108 million gallons per day (MGD). Maximum daily demands in mid-2013 were approximately 55 MGD. The City claims its current source development efforts allow it to provide a current capacity without storage of 80.6 MGD. The present municipal water supply has an additional 25.6 MGD of capacity above its maximum daily demand. Online system storage includes approximately 24.5 million gallons, which equates to roughly 11 hours of maximum day demand. Two additional emergency interties with Clark County Public Utilities (CPU) are also available. Figure 4.1 is a map showing the City's water distribution system. The map shows all of the City's water system extending from the nearest water source and reservoirs located at Water Station 1.

A formal study and technical evaluation of the City water supply system is beyond the scope of this assessment, and to perform such an evaluation would require additional information from the City. However, a cursory review of the supply system was done based solely on the information provided by the City. A review of the distribution map shows a system which appears to be logically laid out up to western boundary of exiting municipal development, roughly bordered by Fruit Valley Road. Up to this location the system consists of multiple 12-inch transmission mains which provide alternate water supply to the west side. Beyond this point, however, the system reduces down to a single 12-inch main which supplies the entire western Port area. As it progresses west, it increases up to a 24-inch main, which then reduces to a 16-inch main. From this main, various 12-inch and 10-inch lines branch into the Project area.

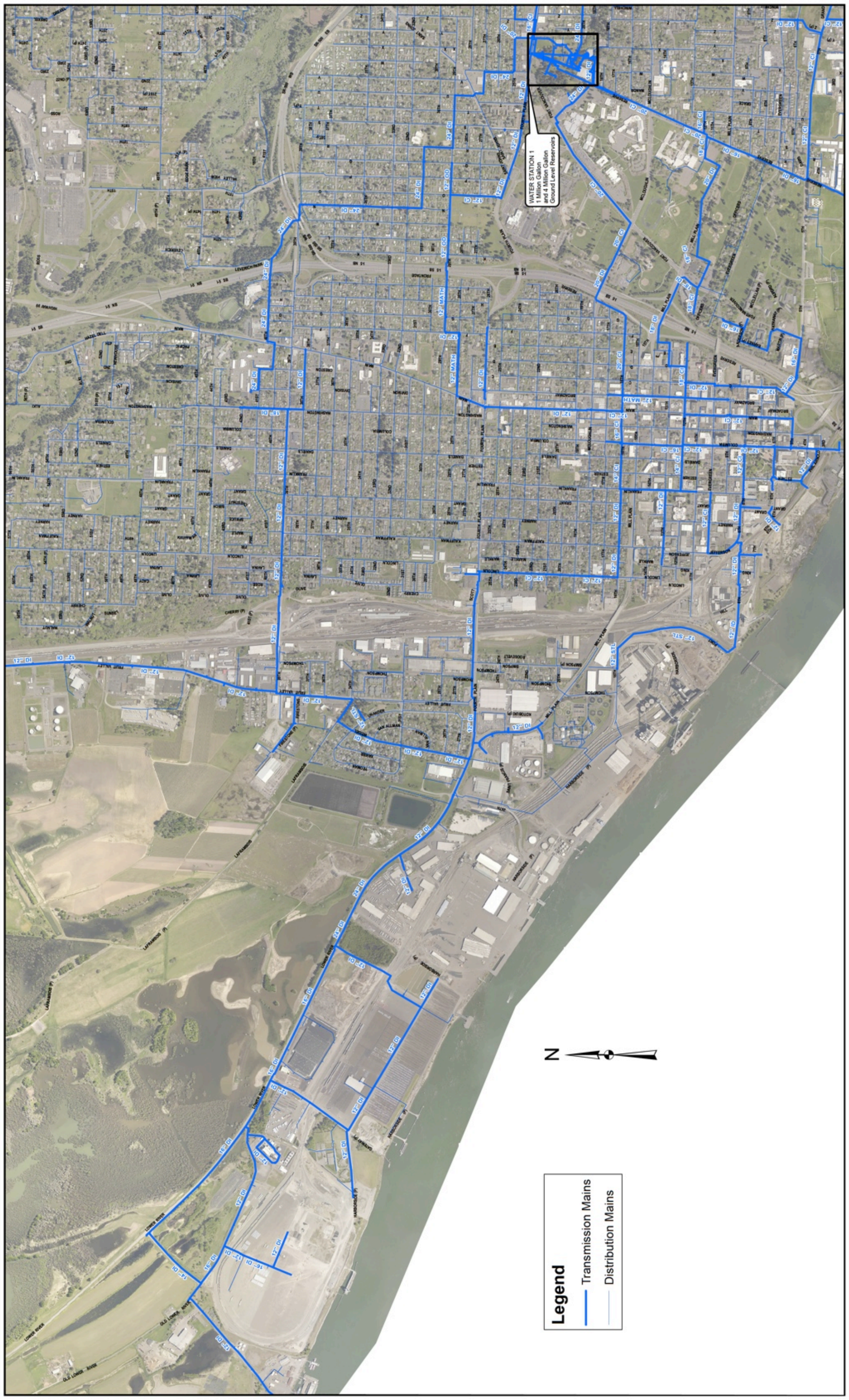
Several weak points in the system were noted. The first weak point in the system is the section of single 12-inch water main along NW Lower River Road which supplies the west Port area. This is a restriction of line size considering the demands of the Port area, and is evidenced by the fact that it increases again to 24-inch further west. This may also explain the somewhat low fire flow rates and pressures measured by the City testing. Note also that the Applicant added fire pumps to increase pressures at the different connection points. It is possible that the 12-inch line size shown on the map is an error and this should be confirmed with the City. It is also possible that the City intends to extend the northern 12-inch main at a later date to connect to the 24-inch or 16-inch main.

The second weak point is that the 12-inch and 24-inch supply mains along NW Lower River Road are dead end routes to the west side of the Port, thus there is no looped supply to provide redundancy in case of a water main failure or leak. Again, this may be resolved by the City at a later date with westward expansion and additional mains.

While these weak points do not necessarily invalidate the City's assertion of reliable 3,500 gpm supply, they do represent areas of concern, and should be considered when determining if auxiliary water supply is needed for the Facility fire system, such as a water pump in the Columbia River.

FIGURE 4.1 – OFFSITE WATER MAINS AND SUPPLY SYSTEM

Transmission Mains from Water Station 1 to POV Property



4.2 PORT OF VANCOUVER WATER SUPPLY

The Port owns and operates its own water supply system. The Port's system is not interconnected to the City's system and the proposed Facility is not proposing to use the Port's water system during operation of the facility for any use, be it process water or fire protection. Since VFD has access to the hydrants of the Port's system and may choose to access them for additional fire water supply, it is described as follows for reference.

The Port maintains a "Group A" Non-Transient/Non-Community potable water system, regulated under WAC Chapter 246-290 by the WDOH, Division of Drinking Water. The Port's water supply system consists of three wells located within the eastern portion of the Port property. These wells are approximately 100 feet deep and draw groundwater from the Troutdale aquifer. The Port also has two reservoirs that can hold a combined 200,000 gallons of drinking water. All drinking water supplied by the Port wells is treated with chlorine. The Port's water system provides potable water for industrial tenants, ships, washdown, irrigation, and fire protection. The City provides water for the remainder of Port operations.

Chapter 5

FIRE DEPARTMENT RESOURCES

The proposed Facility lies within the VFD's jurisdiction. In addition to the Facility, VFD also has responsibility for the crude oil rail traffic into the Facility within their response area boundary. To a lesser extent, they also have some responsibility for the crude vessels at berth and traveling down the Columbia River. With this in mind, the resources available to VFD are critical to their ability to respond adequately to spill and fire emergencies associated with this Project. Several questionnaires and inquiries were forwarded to VFD during the preparation of this report to evaluate their resources and response capabilities. Their responses are referenced in the following paragraphs. Some of the information is quantitative in nature, such as how many gallons of foam are available and where is it located. Other information is qualitative, such as how would the VFD respond to a hypothetical incident scenario. Following is a summary of VFD's relevant information and resources.

5.1 VFD STATISTICS

VFD staffing includes 200 total personnel which includes suppression, the Fire Marshal's office, and administrative staff. VFD staff are employees of the City of Vancouver. The Suppression staffing follows a 3-shift model, and daily minimum staffing is 38 firefighters and officers and 2 Battalion Chiefs, or a total of 40 suppression personnel per shift per day.

Population Served is 254,625 in the VFD response area, which includes the City of Vancouver and Clark County Fire District 5. In 2014 VFD responded to 23,195 calls, of which 3.59% were directly fire related and 72% were calls for medical assistance.

Vancouver was recently reviewed in 2014 by Washington Survey and Rating Bureau and retained its SRB rating of a Class 4.

5.2 VFD RESPONSE AREA AND STATION LOCATIONS

VFD's response area encompasses the City area and outlying rural areas bordering the north bank of the Columbia River. The proposed Facility would be located along the river centrally located within the Port area. VFD has 10 fire stations located throughout the City. Table 5.1 lists those stations with distances and response times to the proposed Facility.

TABLE 5.1 – DISTANCES & RESPONSE TIMES, VFD STATIONS TO FACILITY SITE

Vancouver Station	Road Miles to Gateway	Response Time to Gateway
Station 1 (Current)	3.0	8:36
Station 1 (Proposed)	2.9	8:16
Station 2 (Current	3.5	9:25
Station 2 (Proposed)	4.6	11:37
Station 3	6.0	13:49
Station 4	11.4	18:41
Station 5	8.3	15:19
Station 6	10.4	17:52
Station 7	10.8	18:48
Station 8	11.0	18:57
Station 9	14.0	21:47
Station 10	12.9	23:35

As shown in Table 5.1, all of the stations are relatively close to the Facility due to the rather compact nature of the city and the central location of the proposed Facility within the city. Response times on the average appear to be adequate.

5.3 VFD ASSETS BY LOCATION

VFD provided the following list of equipment and personnel assets at each station.

TABLE 5.2 – VFD ASSETS LISTED BY LOCATION

Station 1

Type	Staffing	Pump	Other
Engine 1	3	1250 GPM pump	500 gallons
Truck 1	4	None	100 foot ladder
Battalion Chief 1	1	None/ Suburban	Command Vehicle
Engine 16 (Reserve)		1500	750

Station 2

Type	Staffing	Pump	Other
Engine 2	3	1250 GPM pump	500 gallons

Station 3

Type	Staffing	Pump	Other
Engine 3	3	1250 GPM pump	500 gallons
Rescue 3	2	None/ Tahoe	Peck Staffing

Station 4

Type	Staffing	Pump	Other
Engine 4	3	1250 GPM pump	750 gallons
Rehab	Not Staffed	None	
Battalion Chief	1	None/ Suburban	Command Vehicle
Water Tender	Cross Staffed with E4	400 GPM pump	1850 gallons
Engine 19 (Reserve)	Not Staffed	1500 GPM pump	750 gallons

Station 5

Type	Staffing	Pump	Other
Engine 5	3	1500 GPM pump	500 gallons
Truck 5	4	None	100 foot ladder
Engine 11 (Reserve)		1250	500
Truck 16 (Reserve)		None	100 foot ladder
Heavy Rescue	Cross staffed with E5	None	USAR/Confined Space
Fire Investigation Unit	Not Staffed		

Station 6

Type	Staffing	Pump	Other
Engine 6	3	1250 GPM pump	500 gallons
Air Unit	Not Staffed		
Brush 6	Cross Staffed	250 GPM pump	250 gallons

Station 7

Type	Staffing	Pump	Other
Engine 7	3	1250 GPM pump	750 gallons
Water Tender 7	Cross Staffed with E7	400 GPM pump	1850 gallons
Engine 15 (Reserve)	Not Staffed	1500 GPM pump	750 gallons

Station 8

Type	Staffing	Pump	Other
Engine 8	3	1250 GPM pump	500 gallons
Brush	Cross Staffed with E8	250 GPM pump	250 gallons

Station 9

Type	Staffing	Pump	Other
Engine 9	3	1500 GPM pump	500 gallons
Water Tender 9	Cross Staffed with E9	400 GPM pump	1850 gallons

Station 10

Type	Staffing	Pump	Other
Engine 10	3	1250 GPM pump	500 gallons
HazMat	Cross Staffed with E10	None	Chemical Response
Foam Tender	Cross Staffed with E10	None	1062 gal Foam Cons.
High Pressure Pump	Towed with Foam Unit	4000 GPM	

5.4 VFD FOAM RESOURCES

VFD provided the following list of foam concentrate sources, one of which is their own foam located at Station 10. Although the distances vary and the specific contract rules are not known, this does indicate a reasonable amount of foam in the area. However, VFD indicated that they would need additional foam resources for certain rail incident scenarios as discussed later herein.

TABLE 5.3 – FOAM RESOURCES

Location	Unit	Gallons of Concentrate	Container	Notes
Portland Fire	Foam Unit 24	540	88 buckets (5gal ea)	
			100 gal tank	Re-purposed fire engine
Portland Fire Logistics	Stored on pallets	540	108 buckets (5gal ea)	
Portland (MFSA)	Foam POD	1700	55 gal drums and 5 gal buckets	Contained MFSA POD. The POD is a steel container that can be moved with a chain truck (Garbage Truck) or flat bed capable of self lodaing and off loading
Portland Airport	Stored in totes	825	275 gallon totes (3 ea)	Delivered by flatbed truck
Vancouver Fire	Foam Tender	1060	265 gal totes (4ea)	Swap Hook truck and trailer with 4000 gpm pump available
Cowlitz County Fire Dist 5	Foam POD	1700	55 gallon drums (31 ea)	Contained MFSA POD. The POD is a steel container that can be moved with a chain truck (Garbage Truck) or flat bed capable of self lodaing and off loading
		6365		
Boeing	Stored in a tank	6000	On sight Tank	Portland Fire Tender 10 would need to respond to Boeing load available foam and respond to the scene
		12365		
Boeing	Stored	6000		**Available with permission**
		18365		

Foam from **Boeing** and **Portland Airport** is not compatable with blended fuels or alcohols

5.5 MUTUAL AID AND OTHER OUTSIDE RESOURCES

In the event of a major incident, VFD has mutual aid agreements with Clark County Fire agencies, for automatic response within certain areas and by mutual aid upon request, and limited mutual aid with Portland Fire.

VFD is a participant of Homeland Security Region 4 and has access to specialty equipment through the agreement. Most equipment that might be available is already housed at VFD. Any requests for other resources can be made when initial mutual aid agreements are exhausted or specialized equipment is needed.

VFD is a participant of the Clark County Department of Emergency Management (DEM). In the event an incident exceeded the resources and capabilities of VFD and their mutual aid agencies, the DEM can initiate an Emergency Operations Center which would assist in coordinating acquisition of additional regional resources that might be requested by the Incident Command. DEM would also be in contact with Washington State Emergency Management Division (WDEM) which is the connection to the Governor and Federal resources. In addition DEM would be the agency to notify Washington Department of Ecology.

VFD is a regular participant with the Local Emergency Planning Committee (LEPC) and represented by the Special Operations Chief at the meetings.

5.6 VFD QUICK RESPONSE VESSEL

VFD recently put into service a quick response vessel for the Columbia River. The vessel has firefighting capability and is rated as an NFPA, Type IV vessel. The boat is currently moored at Christensen shipyards at approximately river mile 109. Terminal 5 is approximately river mile 106, which is about 3 river mile down river from VFD's boat. City of Portland Fire also has a rescue boat at Hayden Island at approximately river mile 107, and a Type IV vessel in the North Portland Harbor. Other Portland assets are on the Willamette River at roughly Willamette river mile 10.

VFD's quick response vessel is cross staffed by Station 1. When a marine call is initiated, Station 1 responds to the mooring area of the boat. This in effect takes Station 1 out of service for other calls while the boat is responding to a marine call.

Portland also follows a similar staffing model for their boats. The boats are cross staffed by the crew from their station and respond accordingly.

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Chapter 6

FIRE DEPARTMENT RESPONSE - FACILITY

The proposed Facility would be somewhat unique and new to VFD, both in operation and scale. Because the proposed Facility would be designed with a modern and purpose suited onsite fire protection system, the task of response for VFD somewhat eased. This section identifies several issues which are important to VFD's ability to adequately respond to fire and emergencies at the proposed Facility. Details on the proposed Facility fire protection system are described in the Fire Protection System Review (Appendix A).

6.1 QUICK RESPONSE AND ACCESS TO THE FACILITY

The closest station to the proposed Facility site is just over 8 minutes away from time of call, the farthest just over 23 minutes, with the average time around 18 minutes. Overall, the aggregate of stations are in relatively close proximity to the proposed Facility.

The Port has improved access to Terminal 4 and 5 by adding a new access to the proposed Facility site with an overpass at Gateway Ave. The Port has indicated another overpass is planned from Gateway that would drop inside of the rail loop for direct access to the proposed Facility.

A second access to Terminal 5 would be available at the west end of the loop track. This access may be either a staffed security gate or operated remotely, but this has not yet been confirmed. Access to the inside of the rail loop from this location would need to be built into the design. Track crossings may be available, but this needs to be confirmed during additional design review.

6.2 COMPATIBILITY OF HOSE AND HYDRANTS, HYDRANT LOCATIONS

The Port maintains a private water system which is also part of their fire suppression system. Port hydrants are painted "red" to indicate they are part of the private water system. City hydrants are painted "yellow". VFD's five inch supply hoses can be connected to a Port hydrant using a quick connect locking connection.

Hydrant locations are marked on Figures 3-2 and 3-3, but these locations are not necessarily confirmed on official maps. It is assumed (subject to verification) that these are all City hydrants, although Port hydrants also exist near these areas. Assuming that the hydrants indicated on these figures are reasonably accurate, there appears to be adequate hydrant coverage for VFD's response needs.

One area of concern that was noted in the Fire Protection System Review (Appendix A) was that there was no clear indication that the Applicant was providing fire department connections on the Facility side of the fire protection system which would allow VFD to augment that system with back-up water and/or foam supply.

6.3 TRAINING FOR LARGE OIL FIRES, FACILITY SPECIFIC PLANS

VFD has sent members of the Hazmat Team to industrial fire training over the years, but there is no regular schedule for sending people to this kind of training. This level of training is typically delivered in areas that can support "live fire training", such as Texas and Colorado, but these are quite expensive for tuition and travel costs which VFD must budget. VFD would also be responsible for overtime and backfill for their personnel that attend this type of training. The last training exercise VFD sent staff to which was sponsored and paid for by industry, was around 2007.

An important aspect of being prepared for any potential incident at the proposed Facility would be the preparation of site specific response plans, training, and regular site visits. VFD emphasized this during meetings with EFSEC staff and EFSEC's consultants on the topic of proposed Facility response requirements. It is expected, and should be required, that the Applicant provide comprehensive instruction and training for VFD in the design and operation of the proposed Facility fire protection system to the extent that VFD can effectively interface and assist with that system.

6.4 LEAD AGENCIES FOR LARGE INCIDENT AT FACILITY

VFD would be the initial response and lead agency and incident command for fires or industrial incidents. This would also include developing a Unified command with the proposed Facility, Port and other response agencies that might be involved, depending on the type of incident.

In the event an incident exceeded the resources and capabilities of VFD and their mutual aid agencies, the County DEM can initiate the Emergency Operations Center which would assist in coordinating acquisition of additional regional resources that might be requested by the Incident Command.

Chapter 7

FIRE DEPARTMENT RESPONSE - RAIL

The crude oil would be delivered to the proposed Facility via crude oil trains which would enter the Vancouver area from the east along the Columbia River. Unlike the proposed Facility fire protection systems, which are fixed in place, the crude oil trains are moving, with no onboard fire protection systems in case of an accident. This presents a totally different and very challenging fire protection responsibility to VFD. This has been born out with the recent number of derailments and fires across the country and the continuing difficulty of local agencies to deal with these incidents. This is a complex situation to understand and deal with, and fire protection agencies are very often underprepared when responding to these types of incidents. VFD has expressed concern about their current readiness and capability to respond to certain rail incidents during meetings and exchanges of communication during the preparation of this report.

VFD must respond to any rail incident within their jurisdiction, and possibly outside if needed by other agencies. This encompasses approximately 20 miles of rail line starting in lightly populated rural areas east of the City and continuing westward toward the proposed Facility within gradually increasing residential and business density.

7.1 RAIL ROUTE CONDITIONS AND NEIGHBORING POPULATION

At the eastern boundary of VFD's jurisdiction the rail route travels through a mostly rural area with few homes or businesses along the route. As the rail route travels west along the banks of the Columbia River the density of residences increases on both sides of the railroad right-of-way. In many locations, homes are located directly between railroad tracks and the river. Along this same segment of track are numerous controlled and uncontrolled at-grade road and driveway crossings. Figure 7-1 is a map showing road crossings located between the proposed Facility and Interstate 5, which are primarily located in industrial areas. Figures 7-2 and 7-3 show the crossings from that location and to the east, where they become more urban and rural as they progress to the east.

FIGURE 7-1 RAIL CROSSINGS IN VANCOUVER – SHEET 1

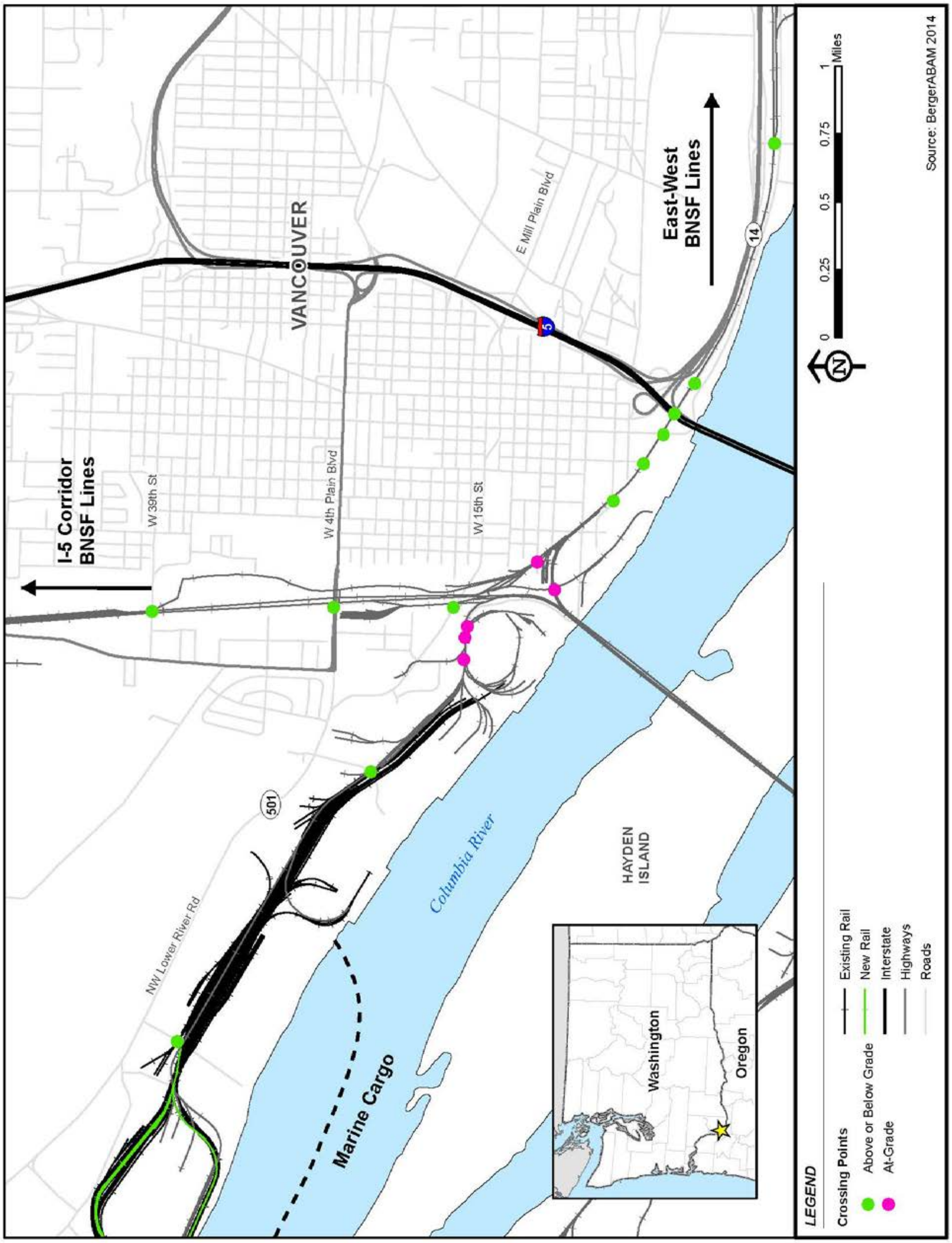


FIGURE 7-2 RAIL CROSSINGS IN VANCOUVER – SHEET 2

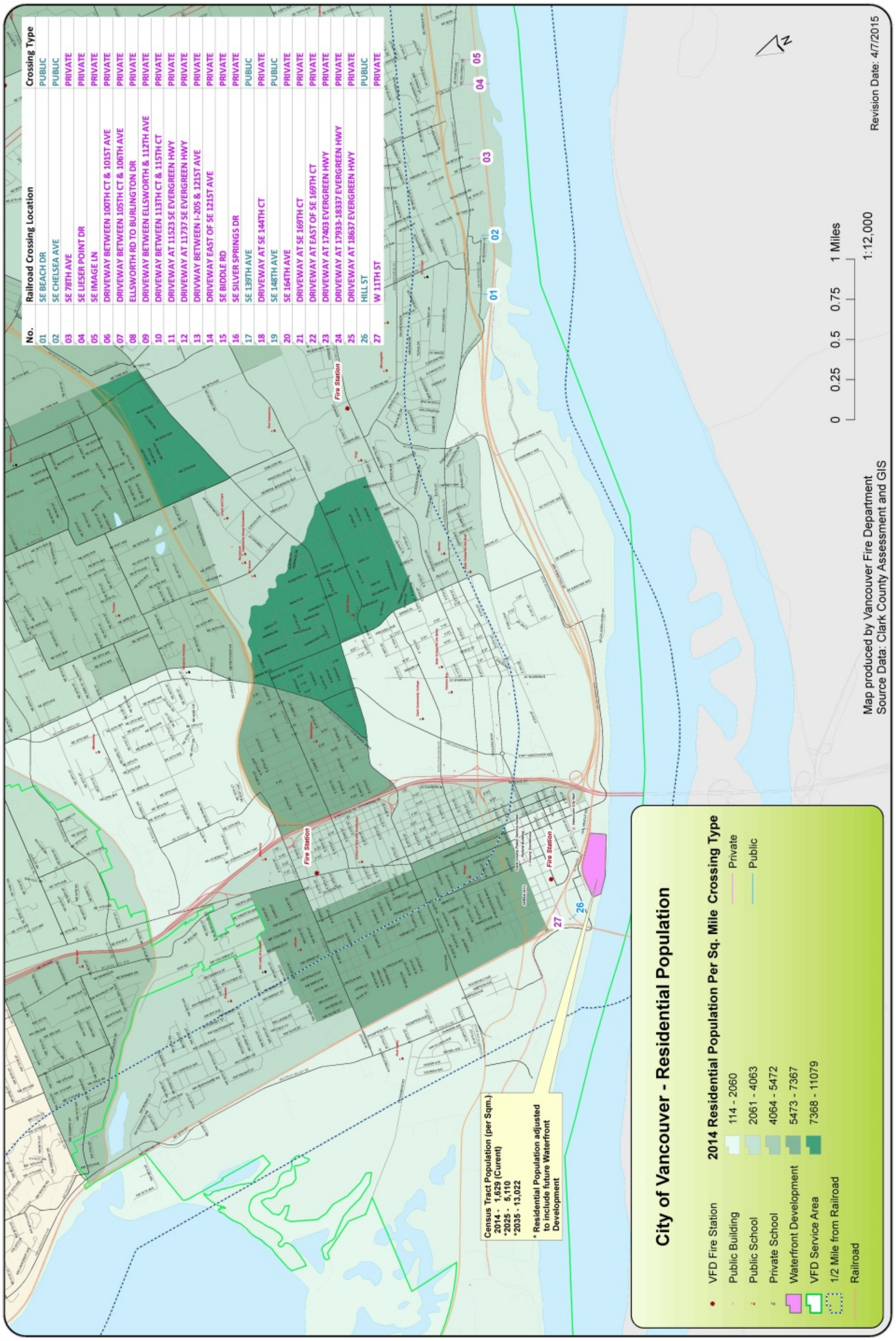
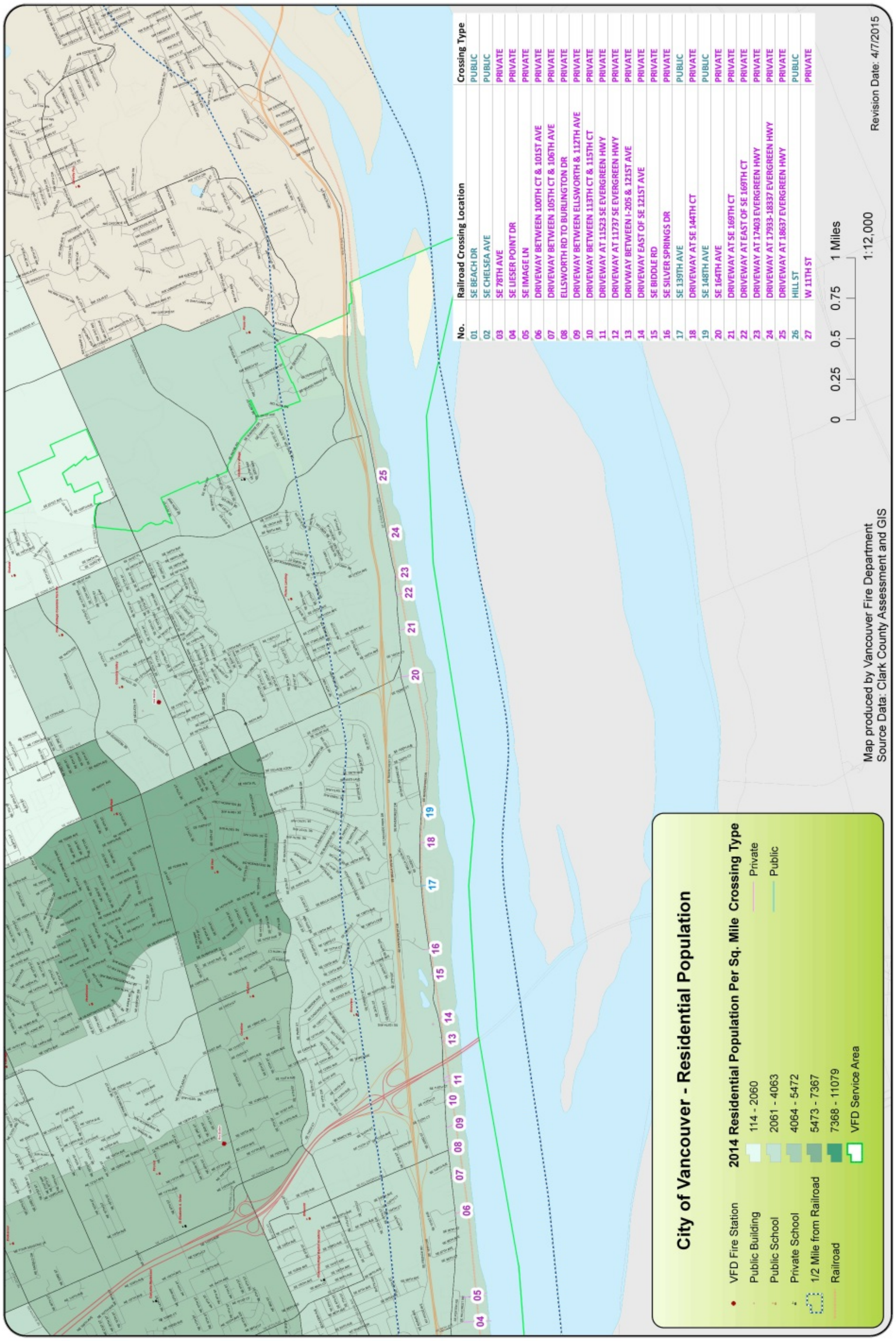


FIGURE 7-3 RAIL CROSSINGS IN VANCOUVER – SHEET 3



7.2 RAIL CROSSINGS

The uncontrolled at-grade rail crossings along the rail route present particular risk as these are in many cases the only access route for residences located on the south side of the rail line. Some crossings have poor visibility for drivers, and lack of attention by the driver or engineer could easily cause an accident. This is compounded by the restriction on sounding the train's horn in some locations for noise control. There are also infrequent access points, which can cause a problem for VFD to access the south side of the tracks for emergency response. Should a train stop, become disabled, or an accident occur at one of these crossings, it is possible that there would be no alternate crossing point for VFD to access residences south of the rail line. VFD might have to resort to water-side access to these residences in an emergency. VFD does not have readily available resources for that type of response, other than the newly acquired fire boat, but typically a fire boat is not equipped for evacuation and the draft of the boat may be too great to maneuver into shore for that purpose.

Some crossings are not even large enough to provide access for a large vehicle, such as a fire truck or rescue vehicle. One example is a tunnel under the railroad tracks with just over 7 feet of clearance. At this location the fire department had an over-the-track roadway built next to the tunnel for their equipment access (see Figure 7-4). This crossing is gated and is kept locked, not available to residents who must use the tunnel.

7.3 RIGHT-OF-WAY, HOME AND BUSINESS PROXIMITIES

The segment of track coming into Vancouver has a narrow right-of way with homes pressed in on both sides (see Figure 7-5). The desirability of the locations along the Colombia River for homes is apparent both by the number of homes and value of the properties. An accident occurring in this location would have very serious consequences. Improving the geometry and visibility of at-grade crossings, adding crossing control, and reducing train speeds through these areas would be effective strategies to reduce risk.

Closer into the City the properties become more industrial in nature, but equally at risk if an accident should occur. Because these locations are in close proximity to the proposed Facility entrance at the Port, the train speeds should be greatly reduced and with that, the risk.

7.4 IMPACT OF RAIL LINE INCIDENT ON VFD RESPONSE CAPABILITY

According to information provided by VFD, a train derailing in their response area would have major impacts on infrastructure, neighborhoods, and transportation. Vancouver is an urban city, and VFD's response area incorporates neighborhoods, the City Center, and industrial areas, as well as the Columbia River. Any incident on the rail line would have an impact on VFD's ability to respond and maintain a level-of-service to the rest of their response area. The rail corridor through Vancouver is located near a State highway, next to the Columbia River, near neighborhoods and industrial areas, and the City Center. An incident anywhere on the rail line within the VFD response area would be cause for major concern and immediate response.

VFD has only 40 responders on duty at any time to respond to an incident, and would still need to respond to other service needs in their response area. In addition, Vancouver is the "regional response" for southwest Washington and is the primary service provider for "specialty services" hazmat, tech rescue and marine. VFD relies heavily on call-back of the specialty teams to provide response to incidents involving hazardous materials, and technical rescue and staffing the marine response vessel.

The above information was provided by VFD in response to a survey question asking: "Which of the following would your jurisdiction need above and beyond what is currently available through your department and through mutual aid to adequately respond to the incident and other calls for service within the community?" These question were posed considering several hypothetical rail oil spill scenarios, including small (100 barrels), medium (700 barrels), large (2,200 barrels), and very large (20,000 barrels) spill incidents.

VFD reported they would require additional staff, training, and equipment to respond to any size rail oil spill 100 barrels or larger and identified the following needs to effectively respond to a rail car spill or fire:

- Additional Staff
- Additional Training
- Logistical Support
- PPE
- AFF Foam
- Foam Applicators
- Appropriate Air Monitors
- Hard Boom
- Sorbent Boom
- Fire Apparatus (unspecified)
- Overhead support and equipment to support an extended operation.

The following summarizes the gaps, or potential gaps, for the rail system response by VFD:

- There are at least 27 at-grade rail crossings along the rail route within the VFD response area which present identifiable risks for residents and industrial tenants along the rail route in Vancouver.
- Poor visibility for drivers combined with restrictions on sounding the train's horn creates additional crossing hazards for residents.
- Access by VFD to riverfront homes would be at risk due to limited rail crossing locations, leading to the potential need for water access response methods in case of a rail derailment, or even a non-emergency stoppage of the train.
- VFD has reported the need for additional staff, training, and equipment to effectively respond to any size rail oil spill 100 barrels or larger.
- It is recommended that a formal at-grade crossing study be undertaken to analyze these risks in a detailed manner and to identify appropriate recommendations.
- It is also recommended that a study be undertaken to determine if a reduction in train speeds would be warranted for crude oil trains traveling through at-risk areas within the VFD response area.

FIGURE 7-4 - UNDERGRADE CROSSING, 7' CLEARANCE

FIGURE 7-5 – AT-GRADE CROSSING AND HOMES

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Chapter 8

FIRE DEPARTMENT RESPONSE - VESSELS

VFD would be required to respond to incidents at the Marine Terminal in Area 400. This could occur with a fire on the ship at berth, or, less likely, with an incident where the vessel is underway on the river. Vessel fires are very specialized due to the nature of the vessel and its transfer methods, the size of the cargo, and the difficult access to the vessel. The special nature of vessel incidents dictates specialized protection systems and firefighting methods. Similar to the special training for a large oil fire, vessel fires require special knowledge and training also. Due to the limited access from the shore, vessels fires are especially dependent on the specialized onsite protection equipment. Fire crews with VFD may be limited to applying hose streams and foam from a long distance and with restricted access. The exception is the recently acquired fire boat which VFD can use to attack the fire from the waterside, and can also approach the vessel while it is free of the berth.

8.1 TRAINING AND EQUIPMENT FOR VESSEL ACCIDENTS

Training for VFD is typical of any municipal fire department, in that their primary fire training is directed at structure fires and emergency medical response. VFD has experience with response to vessel incidents on the Columbia, but not with crude oil vessels, and vessels of the size likely to call at the proposed Facility. As is the case for rail response, additional training and familiarization would be required for VFD for this type of vessel response. Any such training should be coordinated through the Applicant.

There would be special operations component of any incident for a vessel that might involve a technical rescue or hazmat incident. VFD special operations has a performance measure of 60 minutes to respond enough people with the necessary skills. There is no minimum staffing for hazmat or tech rescue, VFD relies on cross staffing and call back to respond to these call types.

8.2 RESPONSE TO INCIDENTS ON THE COLUMBIA RIVER

According to VFD, when a marine call is initiated, Station 1 would get the call, move from their location to the mooring area of the boat and respond. This effectively takes Station 1 out of service while the boat is responding and on a call. Portland also follows a similar staffing model for their boats. The boats are cross staffed by the crew from the station and respond accordingly.

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Chapter 9

CONCLUSIONS

9.1 VFD CAPABILITIES TO RESPOND TO FACILITY INCIDENTS

While the proposed Facility would be designed with a modern onsite fire protection system, which would somewhat ease the task of response, VFD would still require specialized training to respond to the wide variety of fire and emergency incidents that could occur at the proposed Facility. The Applicant should provide comprehensive instruction and training for VFD in the design, operation, and interaction with the proposed Facility's fire protection system. Additional specific training needs include: annual training crude in oil transshipment response at a marine terminal, industrial rescue, water response, industrial fire suppression, flammable liquids handling and fire suppression, and foam application in a live fire event.

9.2 VFD CAPABILITIES TO RESPOND TO RAIL INCIDENTS

The anticipated increase in crude oil trains operating within VFD's response area is a serious concern to the VFD. They have little direct experience with this type of response and have reported through survey responses and in meetings and communication during the preparation of this report that they would require considerable additional training, staffing, and equipment to be able to adequately respond to an incident involving a crude oil train. The Applicant and BNSF should provide VFD with this training, but it will take time and expense for VFD to free up staff and resources to acquire this training. It is not clear how this financing would be provided to VFD. The rail issues are by far the most serious issues to be dealt with by VFD, and this will require further communication with VFD, the Applicant, and involvement by BNSF.

It is also recommended that a study be undertaken to assess the risk to public safety posed by the numerous existing at-grade crossings in the VFD response area to determine if additional crossing controls or grade separations are warranted. The study should also investigate whether a reduction in train speed would be warranted for crude oil trains traveling through known high-risk areas.

9.3 VFD CAPABILITIES TO RESPOND TO VESSEL INCIDENTS

Specialized training for VFD would be required to familiarize them with the special conditions associated with crude oil vessel incidents. VFD does not have existing experience in vessel response of this type, and requires additional training for the large crude oil vessels of the type expected to call at the Marine Terminal. The Applicant should provide training for VFD on the important aspects of the vessels.

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Chapter 10

REFERENCES

BergerABAM. 2014a. Tesoro Savage Vancouver Energy Distribution Facility Preliminary Draft EIS, July.

BergerABAM. 2015. Response to EFSEC Draft EIS Data Request 3, February 26, 2015.

Pool Fire Protection. 2014. Fire System Operation Description, Vancouver Energy, Vancouver, Washington, February 26, 2014.

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Appendix A
FIRE PROTECTION SYSTEM REVIEW

FOR THE

TESORO SAVAGE VANCOUVER ENERGY DISTRIBUTION TERMINAL

Prepared for:

STATE OF WASHINGTON
ENERGY FACILITY SITE EVALUATION COUNCIL

March 23, 2015
Rev. 1 April 23, 2015

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Chapter 1

OVERVIEW

This document presents the findings of EnerSource Engineering's Technical Review of the Fire Protection System for the Tesoro Savage Energy Distribution Terminal project (Facility) proposed along the Columbia River in Vancouver, Washington.

The proposed Facility would be located at the Port of Vancouver in the City of Vancouver; specifically at Terminal 5 and in the parcels located behind Terminal 5 and Terminal 4. The Facility would be designed and constructed to unload Bakken crude oil, and possibly other heavier grades such as diluted bitumen crude oil, from railcars in Terminal 5. The crude would then be pumped through pipelines to storage tanks located in Parcel 1A just east of Farwest Steel, where it would reside until a ship calls at the berth. From the storage tanks the crude would then be pumped through pipelines to Berth 13 and onto tanker vessels, and from there the vessels would travel down the Columbia River and out to sea to various refinery destinations on the U.S. West Coast.

Preliminary fire protection design information for the proposed Facility was obtained from the Applicant and BergerABAM (the Applicant's consultant). These documents appear to be at about a 30% design level and as such it is recognized that not all information may be included for this review. The review has been carefully performed to confirm the level of compliance with applicable codes, standards and good design practice.

Data was provided, such as basis of design documents, studies and preliminary drawings, and it is recognized that much more detail will be forthcoming as the design progresses. At that time additional review can be done to confirm what this review has determined---that the proposed design appears quite sound and robust at this point in the design, but details of systems and methods are incomplete.

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Chapter 2

EXECUTIVE SUMMARY

Based on the documentation that we have seen to this point, the terminal appears to meet the normally accepted standards for similar marine oil transfer terminals, and the fire protection engineer appears to have experience with similar facilities. The level of detail at this stage of design is sufficient enough to provide the reviewer with a good sense of the architecture of the planned fire protection system. There are some deficiencies noted herein as a result of this review, and these are itemized throughout this document. In some cases these deficiencies may be a result of lack of information at this stage of design, but they are noted nonetheless to ensure that they are accounted for by the applicant at the 100% design stage.

The fire protection standards for the Facility established at this stage of design need to be carried through detailed design, construction, and operations. It is expected that continuing review of the project during these phases will be conducted to confirm this expectation.

This review and assessment included a detailed review of all Applicant furnished documents which included:

- Fire Protection Basis of Design dated July 14, 2014
- Fire Suppression Hydraulic Analysis dated July 14, 2014
- Life Safety Analysis Report dated July 14, 2014
- Life Safety Basis of Design Engineering Evaluation Report dated July 14, 2014
- Fire and Gas Detection drawings for each area
- Life Safety Analysis drawings for each area
- Life Safety Construction drawings
- Fire Alarm drawings

In addition to the document review, a site visit was conducted on February 25, 2015. All areas of the proposed facility were visited in the presence of Port of Vancouver and Vancouver Fire Department representatives.

The Applicant has divided the facilities reviewed into various geographic and functional areas. These distinct areas are described as: Area 200 – Rail Car Offloading and Office; Area 300 – Storage Area; Area 400 – Marine Terminal; Area 500 – Transfer Pipelines; and Area 600 – West Boiler. Following is our summary of the findings for each area, as well as an overall assessment of the various aspects of the fire protection system.

2.1 AREA 200 – RAIL CAR OFFLOADING AREA AND OFFICE

The Rail Offloading Area would include two parallel unloading spurs dedicated for light crude oil with a third spur capable of unloading heavy crude oil with heating. The unloading spurs would be located inside an unloading building, and each would accommodate 30 cars for a total length of approximately 1,800 feet. Located adjacent to this building would be a fire pump/foam skid building, and other appurtenances that would be located on the south side of the building. There would be two pipe trenches and 10 pump basins along the rail spurs which would be used for transferring the crude oil out of the Offloading Building to the Tank Area through three 24-inch pipelines. The Office Area contains the Office Building and two change rooms.

Fire protection and related safety features which were reviewed and found to be adequate in concept at this stage of design include the following:

- The Unloading Building would be completely protected by a closed-head foam-water pre-action system.
- A backflow prevention system would be provided to isolate the foam system from the potable water supply.
- Complete life safety features (portable extinguishers, eyewash stations, egress, etc.) have been analyzed and appear adequate.
- Fire detection and activation methods include linear heat detection strips mounted overhead along the sprinkler headers (automatic activation), and smoke detectors located in the non-rail buildings. Manual activation stations are located throughout the unloading building. No other fire detectors or alarms were indicated.
- Spill containment would be provided under the rail spurs in the form of pans which would run the length of the building and discharge into containment tanks. The concept of the system is adequate, although specific sizing calculations have not been provided.
- Electrical Hazard Classification rules would be applied to this location and are adequate in concept.
- Fire department access appears adequate from review of site roadways and from observation during a site visit on February 25, 2015. Port of Vancouver representatives informed us that a bridge would be constructed to provide access to the interior of the rail loop.

Fire protection and related features which were inadequate or for which additional verification will be required once the design has progressed to a more detailed level, such as 100% design, are as follows:

- Review and confirm containment calculations and capacities of containment pans and tanks. Evaluate overflow volumes, direction and mitigation measures in case system capacity is exceeded.
- Provide overall facility water supply analysis including independent verification of: source points of water onto the property, distinguishing between City of Vancouver provided water supplies and Port of Vancouver provided water supplies; provide water main map showing source points, fire hydrants, loops in system for redundant supply; provide updated supply system hydraulic analysis for flow and pressure; show specific fire hydrant sizes, type and location for all project specific locations. Fire hydrants were mentioned external to the building, but they are not shown on plans at this time.
- The water supply system testing and hydraulic analysis as provided indicates that an auxiliary diesel fire pump is needed to provide adequate flow and pressure for the suppression system at Area 200. This single pump concept is considered inadequate due to the lack of redundancy in case of an engine or pump problem. This is discussed in more detail in section 3.3, “Fire Pumps and Emergency Power Supply”.
- Fire detection system only appears to utilize heat detection strips in critical areas. These automatically start foam flow to sprinklers and alarm at same time. There should be a second

detection system to activate alarms prior to actual foam release, and to provide fire detection in areas not protected/covered by heat detection strips, such as areas outside building, in “dead zones” in building, etc.

- Review and confirm the specific electrical hazard classification boundaries, and that Class I Div 1 and Div 2 installation requirements are followed correctly.
- Review specific catalogue cut sheets for all fire protection equipment and systems.
- Review design drawings when they are at the 100% design stage.

2.2 AREA 300 – STORAGE AREA

The Storage Area has been designed for six crude oil storage tanks with a working storage capacity of 340,000 barrels (14,280,000 gallons) each. The Storage Area would be located in parcel 1A of the Port of Vancouver property east of the Offloading Area. The tanks would be contained within an earthen dike system. This area would include other support structures and equipment such as a pump basin and pumps, a storage building, a control room, and a fire pump and foam building.

Fire protection and related safety features which were reviewed and found to be adequate in concept at this stage of design include the following:

- The tanks would be protected by an automatic fixed foam system placed inside each tank to protect the seal area of the internal floating roof. This system would be a pre-action system activated by the linear heat detection system installed at the foam dam of the floating roof, or by the manual foam release stations located at each tank.
- Additionally there would be fire hydrants located on the dike which would be equipped with monitor nozzles and foam eductors. These would be capable of providing cooling streams to tanks during a fire.
- A backflow prevention system would be provided to isolate the foam system from the potable water supply.
- Complete life safety features (portable extinguishers, eyewash stations, egress, etc.) have been analyzed and would be adequate.
- Fire detection and activation systems appear adequate to protect the internal floating roof area of the storage tanks, but external detection and activation methods need further development, as discussed below in the list of inadequacies.
- Spill containment would be provided by an earthen dike system surrounding the group of tanks. It would be sized for 110% of the largest tank plus the rain from a 24-hour, 100-year storm. Lower interior dikes would separate the tanks from each other for minor spill events, about 10% of each tank’s capacity. The concept of the system is adequate, although specific basin topography and sizing calculations have not been provided. Tanks would be double-bottom design and an impervious membrane would line the containment basin to prevent percolation through the soil.
- Electrical Hazard Classification rules would be applied to this location and are adequate in concept.
- Fire department access appears adequate from review of site roadways and from observation during a site visit on February 25, 2015.

Fire protection and related features which were inadequate or for which additional verification will be required once the design has progressed to a more detailed level, such as 100% design, are as follows:

- Review and confirm tank dike containment calculations. Evaluate overflow volumes, direction and mitigation measures in case system capacity is exceeded. Review storm water containment system, block valves and isolation operation methods.
- Provide overall facility water supply analysis including independent verification of: source points of water onto the property, distinguishing between City of Vancouver provided water supplies and Port of Vancouver provided water supplies; provide water main map showing source points, fire hydrants, loops in system for redundant supply; provide updated supply system hydraulic analysis for flow and pressure; show specific fire hydrant sizes, type and location for all project specific locations. There was no mention of fire hydrants to be located upstream of the fire pump for fire department access.
- It is not clear if the dike location monitors are pre-aimed, or if they are remote controlled. This needs to be verified later in the design. The proposed use of hand carried “buckets” of foam to these monitors is not a desirable approach. Suggest installing drums or cans of foam at each monitor.
- The water supply system testing and hydraulic analysis as provided indicates that an auxiliary diesel fire pump is needed to provide adequate flow and pressure for the suppression system at Area 300. This single pump concept is considered inadequate due to the lack of redundancy in case of an engine or pump problem. This is discussed in more detail in section 3.3, “Fire Pumps and Emergency Power Supply”.
- Provide additional fire detection systems and alarms in addition to the linear heat strips within the tank roof annular spaces. These are needed to monitor and alarm tank external areas.
- Review and confirm specific electrical hazard classification boundaries, and that Class I Div 1 and Div 2 installation requirements are followed correctly.
- Review specific catalogue cut sheets for all fire protection equipment and systems.
- Review design drawings when they are at the 100% design stage.

2.3 AREA 400 – MARINE TERMINAL

The Marine Terminal Area would be located at Berths 13 and 14 at Terminal 4. Crude oil would be pumped from the Storage Area through a 36-inch pipe to Berth 13. The berth would be able to accommodate vessels with a capacity of up to 380,000 barrels, with loading rates of up to 32,000 barrels per hour. Safety measures would include automatic shutoff valves, a return and stripping line for the crude to return back to the storage tanks, a marine vapor combustion system, floating booms and manual fire protection features. Berth 14 would be used for storage of and access to a boat that would be used to deploy the booms in the water around the ship. Other structures located at the Marine Terminal Area would include a control room/E-house, vapor recovery combustion unit(s), a fire pump and foam building, and a dock safety unit.

Fire protection and related safety features which were reviewed and found to be adequate in concept at this stage of design include the following:

- Two remote controlled elevated foam monitor nozzles would be provided on the dock for firefighting purposes. The monitor nozzles would be supplied from the fire pump and foam building with foam-water.

- A backflow prevention system would be provided to isolate the foam system from the potable water supply.
- Complete life safety features (portable extinguishers, eyewash stations, egress, etc.) have been analyzed and would be adequate for the onshore buildings. However, similar information for the dock platforms and trestles was not provided.
- Electrical Hazard Classification rules would be applied to this location and are adequate in concept.
- Fire department access to the foot of the trestle appears adequate from review of site roadways and from observation during a site visit on February 25, 2015. It is understood that a new fireboat was recently acquired by the VFD and would available from the waterside.

Fire protection and related features which were inadequate or for which additional verification will be required once the design has progressed to a more detailed level, such as 100% design, are as follows:

- The foam monitors should be checked for proper height considering the height range of the vessel from loaded draft to ballast draft. They may be too low.
- The location of the manual release points is unclear, but in any case they should be located on shore since locating on the dock structure will be potentially too close to the fire.
- There does not appear to be any spill containment provided at the dock, other than the floating boom which would be placed around the vessel during transfer operations. Other spill containment and prevention measures should include curbing around the platform manifold working area, all-welded (no flanges) oil piping over the water, a slop tank for hose draining after loading is complete and maintenance of strainers, etc.
- Provide overall facility water supply analysis including independent verification of: source points of water onto the property, distinguishing between City of Vancouver provided water supplies and Port of Vancouver provided water supplies; provide water main map showing source points, fire hydrants, loops in system for redundant supply; provide updated supply system hydraulic analysis for flow and pressure; show specific fire hydrant sizes, type and location for all project specific locations.
- The water supply system testing and hydraulic analysis as provided indicates that an auxiliary diesel fire pump is needed to provide adequate flow and pressure for the suppression system. This single pump concept is considered inadequate due to the lack of redundancy in case of an engine or pump problem. This is discussed in more detail in section 3.3, “Fire Pumps and Emergency Power Supply”.
- Applicant indicates adding a fire pump will provide 2000 GPM flow at 125 PSIG. Confirm if this is adequate considering that, according to California Standards (CA MOTEMS Chapter 31F, Section 8), this would be classified as a “High Hazard” Terminal, requiring 3000 GPM fire flow, 6x20 lb portable dry chemical fire extinguishers, and 4x165 lb wheeled dry chemical extinguishers.
- No fire alarm detectors were indicated on plans or documents. Provide information on the type, locations and functions.
- Review and evaluate emergency shutdown valves on dock for closing speed, activation methods, fail safe operation, and check that surge pressures stay within allowable piping pressure limits. The 6-inch return line is intended as a pressure relief route in case of emergency shutdown of the loading pipeline.

- Check that additional life safety information is added to dock and trestle structures, including portable extinguishers, hose reels, egress including ladders to the water, life rings, etc.
- Review and confirm what vessel drift envelope protection (if any) is provided to prevent over-stressing the loading hoses (limit switches with alarms, mooring line load measurement and alarms, etc.).
- Review and confirm specific electrical hazard classification boundaries, and that Class I Div 1 and Div 2 installation requirements are followed correctly.
- Review specific catalogue cut sheets for all fire protection equipment and systems.
- Review design drawings when they are at the 100% design stage.

2.4 AREA 500 – TRANSFER PIPELINES

The transfer pipelines would consist of three 24-inch pipelines connecting the Area 200 Offloading Building to the Area 300 Storage, and one 36-inch vessel loading pipeline connecting the Area 300 Storage to the Area 400 Marine Terminal. There would also be a 6-inch return and relief pipeline between the Storage and the Terminal. There would be miscellaneous smaller lines at each area serving as secondary oil piping. The transfer pipelines would be mainly aboveground and on supports, but where necessary to avoid interferences or cross over rail track, the pipelines go underground and would be encased in a secondary containment pipe.

Fire protection and related safety features which were reviewed and found to be adequate in concept at this stage of the design include the following:

- Pipelines would be equipped with pressure relief valves to prevent thermal over-pressure, and pipeline operation would be monitored for flow and pressure limitations (Check at 100%).
- Pipeline shutdown would be initiated if any flow or pressure excursions were to occur outside design limits. Emergency shutdown initiation would typically close all remotely operated valves to minimize spill and fire potential (Check at 100%).
- Above ground sections of piping would not normally require secondary containment because they would be at low risk of damage or leaks. They could also be readily maintained and visually inspected on a daily basis. Belowground sections would require secondary containment and some means of leak detection, and would require cathodic protection if in contact with soil.
- Electrical Hazard Classification rules would be applied to all pipeline equipment and instrumentation, and are adequate in concept.
- Annual pressure testing of pipelines and loading hoses is required and would be performed to insure integrity. Internal inspection with a smart tool (also referred to as a smart “pig” in pipeline jargon) would be an option to pressure testing the steel pipelines, but this would require piping designed specifically for these long, articulated and instrumented tools.

Fire protection and related features which were inadequate or for which additional verification will be required once the design has progressed to a more detailed level, such as 100% design, are as follows:

- Review and evaluate location of isolation valves and emergency shutdown valves on all main pipelines for closing speed, activation methods, fail safe operation, and check that surge pressures stay within allowable piping pressure limits.
- Review proposed pipeline inspection and testing methods and frequency.

- Review proposed pipeline thermal stress analysis methods, surge analysis methods and protective measures.
- Review all piping design and welding specifications, welder qualifications, weld inspection methods.

2.5 AREA 600 – WEST BOILER

Within the West Boiler area is the building containing boilers that generate steam to heat the heavy crude in the Offloading Building at Area 200. Other than the E-house, no other buildings would be located at the Area 600 location. The west boiler building would not include an automatic fire suppression system. Very little information is available for this area at this stage of the design.

Fire protection and related safety features which were reviewed and found to be adequate in concept at this design stage include the following:

- Complete life safety features (portable extinguishers, egress, etc.) have been analyzed and are adequate.

Fire protection and related features which were inadequate or for which additional verification will be required once the design has progressed to a more detailed level, such as 100% design, are as follows:

- Only smoke detectors were observed for detection. Review later to see what special systems may be used for boilers.
- Review this location in more detail when additional design information is available later in the design.

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Chapter 3

WATER SUPPLY SYSTEM

3.1 CITY OF VANCOUVER WATER SUPPLY

The Applicant has researched and stated that the on-site water supply and distribution system as available from the City of Vancouver to the Port of Vancouver project would be adequate to meet the flow demands of both the manual fire operations and the automatic fire suppression system. Hydrant flow testing was conducted on May 30, 2013, to establish system flowrates and pressures at the each of the operational areas. It was also stated that the City of Vancouver water system would be accessible at all project site locations and has been determined to be reliable.

Following is a summary of the results of the hydrant flow testing at each area:

- Area 200, Railcar Offloading Building, assumed values from the City:
- Static Pressure = 50 psi (power per square inch), Residual Pressure = 20 psi, Flow = 2,500 gpm (gallons per minute).
- Area 300, Storage: Static Pressure = 84 psi, Residual Pressure = 63 psi, Flow = 2,005 gpm
- Area 400, Marine Terminal: Static Pressure = 81 psi, Residual Pressure = 62 psi, Flow = 2,127 gpm

Note that although the flowrates and residual pressures appear to be adequate for standard hydrant distribution and fire department use, they are too low to operate the foam sprinkler and monitor systems at each area. Thus the need for auxiliary fire pumps is required at each area to boost operating pressures.

To protect the potable water system from possible contamination from the foam systems, reduced pressure backflow prevention assemblies would be provided upstream of each fire pump and foam system at each area.

The review of this section has found the following items deficient or otherwise requiring additional verification or information at a later state of design, such as at 100% design:

- Provide overall facility water supply analysis including independent verification of: source points of water onto the property, distinguishing between City of Vancouver provided water supplies and Port of Vancouver provided water supplies; provide water main map showing source points, fire hydrants, loops in system for redundant supply; provide updated supply system hydraulic analysis for flow and pressure; show specific fire hydrant sizes, type and location for all project specific locations. Except at Area 200, there was no mention of fire hydrants to be located upstream of the fire pumps for fire department access. This is important to allow the fire department to access fire water and provide independent support.
- Applicant must provide independent documentation from the City of Vancouver for the tests on May 30, 2013. This should include statements by the City that the water supply system is reliable and adequate.

3.2 FIRE SYSTEM HYDRAULIC ANALYSIS

A rigorous hydraulic analysis of the fire water system requirements and existing project conditions was conducted by the Applicant's fire protection consultant (Pool Fire Protection 2014). The objective of the analysis was to define key components of the system and establish design criteria associated with the fire water system, as well as to document preliminary worst-case hydraulic demand scenarios for the systems. The report presents basic calculated hydraulic demands for three separate scenarios to address hazard events in Area 200 – Offloading and Office Area; Area 300 – Storage Area; and Area 400 – Marine Terminal Area. The report also outlines performance criteria associated with fire water equipment specified for the facility. The results of the analysis provide the hydraulic data necessary to size the fire water booster pumps described below. The analysis was conducted using a commercially available computer design program for fire protection systems.

The hydraulic analysis of the fire water system requirements provided the following results:

- The largest overall calculated fire water supply flow would be at Area 300 - Storage. The crude oil storage tanks, combined with the hydrants for exposure protection, would have the largest suppression system demand of 3,025 gpm at 117.3 psi.
- The Marine Terminal Area would have the largest requirement for foam concentrate, which is 1,500 gallons, driven by the overall duration of flow, which is 30 minutes

While the hydraulic analysis method and approach itself is not questioned, some of these design assumptions themselves are questioned for application at this facility. They include the following:

- As previously discussed in the Executive Summary, the water supply conditions must be verified and detailed, including supply points (City of Vancouver or Port of Vancouver), the water main distribution system with main sizes, maps, hydrant locations, supply pressures and flows, possible impacts on other users in this port area, and reliability/redundancy of the system.
- The maximum water flow requirement of 2000 GPM at the marine terminal should be considered the minimum required for this location. As a point of reference, California requirements for a similar marine terminal are 3000 GPM, but this includes flows for the fire monitors, hose reels, and fire department demands. It is recommended that this be considered in the hydraulic calculations. That is, if 2000 GPM is to be pumped for the two 750 GPM monitors and 500 GPM for hose allowance, check that 1000 GPM is available in the system at this area through fire hydrants for Vancouver Fire Department connection to their pumpers.
- It is expected that all hydraulic calculations will be re-run and updated once all supply conditions, distribution system and area demands are confirmed.

3.3 FIRE PUMPS AND EMERGENCY POWER SUPPLY

Fire pumps would be required to supplement the city water supply pressure at all locations. The fire pumps would be diesel driven so that they are independent of the local electrical utility system as it is not considered, according to the Applicant, to be totally reliable, and there are no plans for the project to have a backup power system. The fire pumps would be located in a skid enclosure that would also contain the fire suppression system risers as well as fire alarm equipment. The fire pump and foam buildings would be completely sprinklered and separated from any other occupancies/structures as required by NFPA 20. The Storage Area fire pump and foam building would also include a jockey pump to maintain the pressure of the underground water piping system around the dike. The pump sizes would be:

- Railcar Unloading Building Area – 2000 gpm at 125 psi
- Storage Area – 2500 gpm at 125 psi
- Marine Terminal Area – 2000 gpm at 125 psi

Fire protection and related features which were found inadequate or for which additional verification will be required once the design has progressed to a more detailed level, such as the 100% design stage, includes the following:

- The comment that "There are no plans for the project to have a backup power system", while not solely a fire protection issue, is none the less a deficiency which needs to be addressed by the Applicant. At a minimum, some emergency power must be provided for control and operation. For control, to monitor and shutdown in a safe manner all critical systems. For operation, to allow safe shutdown of all systems, such as valves, pumps and boilers, etc. Emergency power is also required for critical lighting for safe personnel movement and egress.
- The plans and documents tend to indicate that there will be (one) 100% capacity pump at each location. This is highly risky since if a pump fails to start for any reason, or is down for maintenance, there is no fire protection through the onsite fire system. It is recommended that either of the following changes be made:
    - Install a second 100% capacity electric pump at each location as the primary device, with the 100% diesel serving as a back-up in case of power failure.
    - Install two 100% capacity electric pumps at each location, with one diesel serving as a back-up in case of maintenance or failure to start.
    - In addition either of the above recommend installing fire hydrants upstream of pump suctions for fire department connection for additional redundancy.

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Chapter 4

SUPPRESSION SYSTEMS

A variety of fire suppression systems would be used on this project to address the different nature of each area. The Railcar Offloading Area has unique aspects associated with the long layout of the building and its railcar occupants, the Storage Area is specialized due to the nature of the tanks with their large storage volumes, and the Marine Terminal Area is unique to large vessel loading operations. Following is a brief description of the fire suppression features and operation of each system.

4.1 AREA 200 - RAILCAR OFFLOADING AREA

Fire hydrants would be located on the south side of the Railcar Offloading Building and spaced at every 300 feet. A closed-head foam-water pre-action sprinkler system would be installed inside the Railcar Offloading Building at the roof level, under walkways and in the pump basin areas. The structure would be divided into five zones, each zone being activated either manually from the foam manual release stations or automatically from the linear heat detection that would be installed at the roof level and at the pump basin level for that associated zone. The pump pits are located in the center of each zone respectively between the tracks. This system is a closed-head pre-action foam-water system, therefore, foam-water solution would only be discharged once the fire is large enough to activate the linear heat detection, trip the valve and then activate the sprinklers above the fire. Foam would be used to control and extinguish the crude oil pool fire and would also provide cooling to the railcars and any adjacent equipment or building elements. A closed-head wet-pipe sprinkler system would be provided for the fire pump and foam buildings.

In the Executive Summary fire protection and related features which were considered inadequate or for which additional verification will be required were listed. These should be provided at least by the 100% design stage. Assuming that this project continues at a normal pace, this could be anywhere form 6 months to 12 months after the 30% design level is reached. Since we do not know where the Applicant reached the 30% design stage, it is hard predict when 100% will be achieved.

A quick recap of inadequacies found in Area 200 are as follows:

- Review and confirm containment calculations and capacities.
- Provide overall facility water supply analysis including independent verification of source points, water main maps, revised system hydraulic analysis, and recommendations.
- Consider installing (2) 100% fire pumps at this location.
- Provide emergency power backup control and operation capability.
- Update and supplement the fire detection system components.
- Review and confirm the specific electrical hazard classification boundaries.
- Review specific catalogue cut sheets for all fire protection equipment and systems.
- Review design drawings when they are at the 100% design stage.

4.2 AREA 300 – STORAGE TANKS

All fire suppression equipment for the Storage Area would be supplied from the fire pump. The preliminary pump size would be 2,500 gpm at a rated pressure of 125 psi. The fire pump and foam building would be located adjacent to the Storage Tank Area. Minimum flow to two monitor nozzles for exposure protection is 750 gpm at 50 psi each (FM DS 7-88, 2.3.3) and 1,250 gpm at 50 psi for the tank involved in fire. The monitor nozzles would activate when the hand wheel on the top of the fire hydrant is operated and water is allowed to flow. The drop in pressure (as maintained by the jockey pump) would activate the start of the fire pump increasing the pressure to achieve the designed flow.

The internal floating roof tank would be protected by a Type II Discharge Outlet (i.e. foam chamber) which delivers foam onto the burning liquid at the seal area of the foam dam. The foam makers would be supplied from piping that loops the exterior of the tank at the top which in turn would have a single supply riser from the fire pump. These would be single interlocked pre-action systems with automatic activation provided through linear heat detection and manual activation through the foam release stations. The floating roofs would have a 12-inch tall foam dam 12 inches from the shell wall.

An automatic fixed foam system would be placed inside each tank to protect the seal area of the internal floating roof. This system would be a pre-action system activated by the linear heat detection system installed at the foam dam of the floating roof or by the manual foam release stations associated with that tank. In addition, fire hydrants would be located on the dike spaced every 300 feet along with two fire hydrants located inside the dike area near the intersection of the intermediate dikes. Each hydrant would be equipped with a monitor nozzle and foam eductor capable of reaching the neighboring tank of the one in incident. The flow of water from these monitor nozzles are provided to create a cooling effect on the tank wall.

The automatic fixed foam system would be activated when the linear heat detection signals a fire or when a manual release station has been activated. The linear heat detection cables would be installed inside the tank around the seal on the internal floating roof. Manual release stations would be provided at the base of the stairs, at the top of the dike at the nearest hydrant, and at the Fire Pump and Foam Building. Upon either activation, the pre-action suppression valve would be tripped and the automatic fixed foam system would be flooded/filled with foam-water solution and begin applying foam to the seal area.

The foam eductor provided on each monitor nozzles would allow the hydrant to spray a foam water solution and control a small pool fire within the dike area. A predetermined size of foam concentrate stored in bucket or other portable device would be kept in the fire pump and foam building. When the need arises for its use, such as a small spill or rubbish fire, the foam concentrate would be taken to the appropriate fire hydrant and the hose placed in the bucket. The nozzle would draw the foam in at the manufacturer determined proportioning rate to achieve the desired concentration. A monitor nozzle supplied with foam-water from the fire pump and foam building would be located near the crude oil pump basin with the primary purpose of providing manual fire suppression to the pump basin. A closed-head wet-pipe sprinkler system would be provided for the fire pump and foam building.

A quick recap of inadequacies found in Area 300 are as follows:

- Review and confirm tank dike containment calculations.
- Provide overall facility water supply analysis including independent verification of source points, water main maps, revised system hydraulic analysis, and recommendations.
- Consider installing (2) 100% fire pumps at this location.
- Provide emergency power backup control and operation capability.

- Verify if the dike location monitors are pre-aimed, consider installing drums or cans of foam at each monitor.
- Update and supplement the fire detection system components.
- Review and confirm specific electrical hazard classification boundaries.
- Review specific catalogue cut sheets for all fire protection equipment and systems.
- Review design drawings when they are at the 100% design stage.

4.3 AREA 400 – MARINE TERMINAL

The Marine Terminal Area includes Berths 13 and 14, and the crude loading equipment and hoses would be installed on Berth 13. Crude oil would be pumped from the Storage Area in a single 36-inch pipe to Berth 13 at loading rates of up to 32,000 barrels per hour. Safety measures include emergency shutoff valves, a return and stripping line for the crude to return back to the storage tanks which also serves as a surge relief line in the event of emergency valve closure, floating booms and manual fire protection features. Berth 14 would be used for storage of and access to the boat that would be used to deploy the boom in the water around the ship. Local control and monitoring of all loading operations would be done from a control room/Ehouse. Vapors displaced from the ship's hold during loading would be captured and routed to a vapor combustion unit to control emissions and promote a safer environment. A fire pump and foam building would provide suitable water pressure and foam to protect this area, and the preliminary pump size would be 2,000 gpm at a rated pressure of 125 psi.

There is an existing manual fire suppression system at the dock loading area which would be removed and replaced with a new fire main supply line from the fire pump and foam building. The monitor nozzles are currently designed be located at an elevation of ten feet above the dock to prevent obstructions from blocking the effective reach of the nozzle. Each nozzle would be designed to flow 750 gpm for a total demand of 1,500 gpm with a 500 gpm hose allowance for the fire department shore side, taking into consideration the recommendations of NFPA 30, Appendix 29.3.28. The current design spacing of the monitor nozzles is limited by the relatively small space available on the dock. The monitor nozzles would be strategically located, taking into consideration the spacing requirements of NFPA 307, Section 7.2. The monitor nozzles on the dock would activate when a manual release station has been activated. Manual release stations would be provided strategically on the dock and shore side at the fire pump and foam building. Upon activation, the pre-action suppression valve would be tripped and the automatic fixed foam system would be flooded/filled with foam-water solution and begin flowing foam through the remote controlled elevated monitor nozzles.

A quick recap of inadequacies found in Area 300 are as follows:

- Check the foam monitors for proper height.
- Check for proper spill containment features at the dock.
- Provide overall facility water supply analysis including independent verification of source points, water main maps, revised system hydraulic analysis, and recommendations.
- Consider installing (2) 100% fire pumps at this location.
- Provide emergency power backup control and operation capability.
- Confirm if 2000 GPM flow is adequate at the dock.
- Update and supplement the fire detection system components.

- Review and evaluate functions of emergency shutdown valves on the dock.
- Check for additional life safety information at the dock.
- Check for vessel drift envelope measurement and protection.
- Review and confirm specific electrical hazard classification boundaries.
- Review specific catalogue cut sheets for all fire protection equipment and systems.
- Review design drawings when they are at the 100% design stage.

4.4 SPRINKLERS

Automatic sprinkler systems of both the foam-water and wet-pipe are to be used on this project. A closed-head foam-water pre-action sprinkler system would be provided in the Railcar Offloading Building while a closed head wet-pipe sprinkler systems would be provided in all of the fire pump and foam buildings at each site. The E-houses, the Operations/Change Trailer, and Boiler Building(s) do not require a sprinkler system to be installed. Instead, fire extinguishers would be provided and located in accordance with NFPA 10.

The foam-water suppression system risers would consist of a foam proportioner and a single-interlock pre-action valve, as well as a strainer and supervised control valves on all water, foam concentrate piping, and foam bladder tank.

All valves controlling water supply to the sprinkler system would be FM approved and rated for the maximum expected working pressure. All valves controlling flow to the sprinklers, including the foam concentrate piping, would be provided with an electronic tamper switch connected to the respective structure fire alarm system.

4.5 MONITORS

Monitor nozzles mounted to fire hydrants would be located on the dike at the Storage Area. Remote control elevated monitor nozzles would be provided on the dock at the Marine Terminal area.

The system riser for the Storage Area fire hydrant monitor nozzles would consist of a supervised control valve. The system riser for the monitor nozzles on the dock would consist of a foam proportioner and a single-interlock pre-action valve, as well as strainers and supervised control valves on all water, foam concentrate piping, and foam bladder tank. The monitors at the dock would be remotely controlled (aimed) from a station strategically located on shore near the fire pump and foam building.

Chapter 5

LIFE SAFETY ANALYSIS

Life Safety (LS) requirements for this project were researched and quantified by the Applicant's fire protection consultant. An LS Basis of Design, an LS Analysis Report, and a series of LS drawings were developed. The purpose was to establish the requirements and determine the necessary life safety devices needed for the proposed facility to be compliant with code. This covers such things as portable fire extinguishers, exit signs, egress illumination, eye wash stations, Occupancy Classification considerations, fire department access, stairways, means of egress, fire resistive requirements, etc.

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Chapter 6

CONCLUSIONS

6.1 ASSESSMENT OF FIRE PROTECTION DESIGN DOCUMENTS

This review of documents indicates that the fire protection engineer of record has a comprehensive understanding of the fire protection needs for this proposed facility, and has done a thorough job of documenting the fire system design at this stage of the project. We would expect this level of expertise to continue on through the later project design stages, and look forward to seeing further evolution of the design. There are some important deficiencies noted as a result of this review, and these have been itemized throughout this document. In some cases these deficiencies may be a result of lack of information at this stage of design, but in any case they need to be addressed to ensure that they are accounted for by the applicant at the 100% design stage.

Equally important with good fire protection design, proper education and training of the operators to maximize the features of this system is vital. This documentation may not be available at this time, but should be provided for review sometime prior to final design, and in a timely matter so as to not delay the final review and approval process.

6.2 NEXT STEPS

This initial review should be followed up at a future date with a second, possibly at the 100% design stage, or when the Applicant is ready to submit the design to EFSEC for project design review and approval.

Vancouver Fire Department has been presented with similar documentation which was used for this technical review, and we will hopefully receive some feedback from VFD after they have had a chance to review. An in-person meeting with VFD was conducted on April 16, 2015, to summarize and introduce VFD to the technical aspects of the proposed Terminal. Once they respond to the document review and provide answers to the separately provided survey questionnaires, we will be able to formulate a gap analysis between onsite fire protection systems and VFD’s ability to provide support and response services.

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Chapter 7
REFERENCES

BergerABAM. 2014a. Tesoro Savage Vancouver Energy Distribution Facility Preliminary Draft EIS, July.

BergerABAM. 2015. Response to EFSEC Draft EIS Data Request 3, February 26, 2015.

Pool Fire Protection. 2014. Fire System Operation Description, Vancouver Energy, Vancouver, Washington, February 26, 2014.

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