JOHN GRIM & ASSOCIATES
Civil Engineering Consultants

PO Box 955
407 State St.
Lyle, Washington 98635

Phone: (509) 365-5421
eFax: (509) 267-4202
E-mail: jga1@gorge.net

Memo

To: Marc Thornsbury, Executive Director, Port of Klickitat

From: John Grim P.E., John Grim & Associates

CC:

Date: June 22nd, 2009

Re: Dallesport Industrial Park, Fire Suppression System Analysis

Background

The Port of Klickitat owns and operates the Dallesport Industrial Park water system. This is a Group A Community water system, by definition, subject to the rules, regulations, and standard engineering practices for operation and improvement of public water systems.

The Underwood Fruit Co. recently completed the construction of a new fruit packaging facility within the water system service area. The fruit packing facility is connected to the water system for potable, industrial, and fire suppression service. The fire protection system (a pressurized water sprinkler system) for the fruit packing building was designed by the building contractor. In this design the contractor assumed the Port would provide an operating pressure in the dedicated fire distribution system that is much higher than actually available. The contractor has made the claim that the water system is not providing the expected and normal level of service for supplying the sprinkler system. The County has mandated that the fire sprinkler system be modified to operate as designed prior to issuance of a permanent occupancy permit.

The Port hired John Grim & Associates, an independent consulting firm specializing in public water system planning and design, to evaluate six key issues; as follows:

1. Identify the criteria and assumptions made by the contractor regarding the operating parameters for the sprinkler system and the Port's fire suppression supply system.

2. Identify the fire suppression criteria, policies, and performance as set forth in the Port's 2003 Water System Plan; approved by the State Department of Health.

3. Compare the contractor's fire suppression system design criteria assumptions as documented in No. 1 above to the criteria, policies, and performance of the fire suppression system as documented in the water system plan.

4. Identify standard fire suppression system planning and design criteria for typical municipal water systems serving industrial customers and compare this normal standard of practice with the criteria, policies, and performance of the fire suppression system as described in the water system plan.

5. Identify the level of service for each fire suppression system component in the existing water system and compare to the minimum required level of service based on normal standards of practice and based on the criteria identified in the plan.

6. Consider modifications to the existing fire suppression system to meet the needs of the customer.

Each of these areas is discussed below.

1. Contractor Design Assumptions[1]

Inland Fire Protection Inc., a subcontractor, designed the fire protection system for the new building. This subcontractor is claiming that the Port's water system is not supplying high enough pressure for the designed and constructed sprinkler system to operate properly. The subcontractor has argued that the Port should provide higher pressure because it is a common practice to do so when supplying industrial developments. They have also stated that the Port's failure to provide higher pressure would make it difficult if not impossible for the Port to attract further industrial development of a similar nature and size. Note, there is no question or claim regarding the water system's ability to provide the necessary fire suppression demand of the building (approximately 1,142 gpm).

I reviewed the sprinkler system hydraulic modeling results and the design plans. The modeling results are cryptic and lack adequate detail to clearly explain the assumptions made by the designer. However, it is clear that the design is based on the Port providing very high pressures (as high as 100 psi) for the sprinkler system to operate properly. The modeling reports and design plans identify the following sprinkler and supply system parameters:

Sprinkler Demand = 642 gpm at **88 psi**
Total Fire Demand = 1142 gpm (500 gpm hose)
Available Source Pressure = 50 psi (this parameter is not defined in the modeling results)
Fire Pump Pressure = **69 psi** at 1,142 gpm

[1] The sprinkler system design was not reviewed as part of this project. Only the design assumptions were evaluated.

Highest Node Pressure = ~**100 psi**
Fire Pump Pressure = **69 psi** at 1,500 gpm (design plans)

There is a clear disconnect in the fire system design report and plans. The sprinkler system was designed to operate based on a service pressure of **88 to 100 psi** yet the available pressure from the Port's water system is identified as between **50 and 69 psi**. Nothing in the design documents specifies how the pressure will be boosted to achieve the designed sprinkler pressure. Typically this would be done using a privately designed, owned, and operated fire booster pump.

2. Water System Plan Review

The Port's current Water System Plan was approved by the State Department of Health in 2003. The State's review includes an evaluation of planning criteria, policies, and standard practices. This approval naturally means that the fire suppression system planning is consistent with normal and expected engineering practice and is in compliance with State laws and guidelines.

The Plan specifies a fire flow demand of 1,500 gpm for four hours for this industrial service area. This demand must be met during the maximum day demand while providing a minimum pressure of **20 psi** throughout the water system.

Hydraulic modeling completed as part of the planning process indicates that the dedicated fire suppression system can provide between 3,000 and 3,600 gpm while maintaining the minimum required pressure. The modeling data also demonstrated that at 1,500 gpm the minimum pressure in the dedicated fire distribution system is **47 psi**.

The Plan recommends combining the fire flow and potable water distribution and storage systems.

The Plan identifies the fire suppression system components; including a 75 HP booster pump station (BPS) that operates in a pressure range of **48 to 50 psi**. The fire distribution piping is mainly 12-inch diameter asbestos concrete pipe installed in 1972.

3. Contractors Design Compared to Water System Plan

The contractor's sprinkler system design assumptions are not consistent with the approved water system planning criteria and standards with respect to fire suppression system pressure. The water system plan has specific pressure data related to this issue.

- Minimum required pressure at 1,500 gpm = **20 psi**
- Actual minimum pressure at 1,500 gpm = **47 psi** (based on computer modeling)

The contractors' design specifies a pressure of between **88 and 100 psi** at 1,142 gpm.

Based on this comparison it is obvious that the Contractor's design is not compatible with the Port's Plan.

4. Standard Water System Planning Practices

In this step I evaluated the Port's Plan with respect to the usual and customary planning standards for fire suppression in public water systems with industrial customers.

The State Department of Health Water System Design Manual is typically the basis for the planning and design of fire suppression facilities for public water systems in Washington State. This manual references laws in WAC 246-290 which regulates public water systems. There are two criteria in this manual which are related to this issue:

a) WAC 246-290-230(6) specifies that all public water systems must provide a minimum pressure of **20 psi** throughout the water system during a fire demand on the maximum demand day.

b) State planning rules specify that a water system must adopt a fire flow criteria based on the requirement of the Local Fire Protection Authority (LFPA). In this case the LFPA is the County building department which has chosen not to utilize its authority to set fire flow standards in Klickitat County water systems. Consequently, engineers developing water system plans in Klickitat County have based fire flow criteria on standard practice and the unique character of each water system. This criterion only applies to fire flow not pressure.

Based on this review and in my professional judgment, the Port's Plan meets or exceeds all usual and customary planning standards for fire suppression. The existing dedicated fire distribution system exceeds usual and customary planning standards. It provides pressure and flow in excess of the minimum standard pressure and the adopted flow rate criteria, respectively.

5. Actual Performance Compared to Planning Criteria

All components of this water system (with the exception of a dead-end line in the potable water distribution system) provide the required level of fire service and in fact exceed the standards set by the Plan and usual and customary standards for comparable water systems. The table below lists the minimum required fire flow level of service compared to that actually provided.

System Component	Required Minimum Level of Service	Actual Level of Service	Typical Water System Policies/Criteria
Storage System	360,000 gallons	492,000 gallons	Not applicable. Industrial fire flow storage criteria are unique to each water system.
Booster Pump Station	1,500 gpm	3000 – 3,600 gpm	See above.
Distribution system pressure	20 psi	47 psi	20 psi

6. Modifications to the Water System

In my discussions with the Port it is obvious that the Port wants to make certain it provides fire flow and pressure sufficient to meet the reasonable and customary demands of current and future tenants. The Port, after all, is in the business of facilitating new business growth and development on its properties. For this reason the Port requested that the existing fire suppression system be reviewed to determine if it should be modified in such a way to provide higher pressure now and in the future. There are several reasons this option is not feasible:

- The existing dedicated fire suppression distribution piping is old asbestos concrete pipe. This pipe material is notoriously vulnerable to high pressure surges especially when it is nearly 40 years old. It may not be capable of withstanding pressures as high as 88 to 100 psi or the much higher surge pressures that would occur during pump startup and shutdown. Surge pressure is a closed zone could easily approach 200 psi without the installation of very expensive surge control equipment.

- The Port does not intend to continue the practice of using a dedicated fire distribution system. The Port's Plan specifies that the fire distribution system piping should be looped into the potable water system and no longer be utilized for fire service only. Once this line is switched to potable water service, extreme pressure fluctuations could damage privately owned plumbing systems.

- It may be possible to modify the BPS to provide a higher discharge pressure. However this would likely require the installation of variable frequency drives with PID based pressure

control equipment. For a pump station of this size, the cost for these improvements would easily exceed six figures.

Conclusions

In my judgment the Port has no responsibility to provide a higher level of pressure to this customer. I have never encountered a water system that, as a matter of policy or standard practice, provided pressures of 88 to 100 psi to an industrial customer unless the water system already provided that level of pressure due to topographical and hydraulic characteristics.

Industrial customers are normally required to provide, operate, and maintain, any fire fighting facilities necessary to meet their needs if the needs exceed the capacity of the water system. It should be relatively simple for the contractor to design and install a fire booster pump to achieve the necessary pressure.

In this specific circumstance it appears that the contractor did not use due diligence in determining the level of service available from the Port's water system prior to designing the sprinkler system. In the future it would be prudent for the Port to consider utilizing the services of an engineer on retainer to evaluate the design of proposed connections to its water systems.

I don't believe the Port should modify its fire suppression system planning criteria. The Port's current and planned fire suppression system criteria and policies are sound. Sprinkler systems can be designed to operate effectively at pressures provided by the Port water system. These policies should in no way impact the Port's ability to attract new customers.