



# VILLAGE OF BELCARRA

## WATER SYSTEM CAPACITY FOR FIRE PROTECTION COMMITTEE

### MAY 2019 INTERIM REPORT



The primary goal of the Water System Capacity for Fire Protection Committee is to assess the existing water system in Belcarra and its capabilities to support all fire-fighting efforts.

Due to an absence of records at the Municipal Hall offices, the Committee faced numerous challenges in meeting the designated objectives. There does not appear to be any signed and sealed documentation from a licensed Engineer that attests that the current water supply system meets professional standards or regulatory requirements. The findings of the Committee regarding the design basis for the water supply system and fire protection requirements as of May 2019 are summarized as follows:

1. The Village of Belcarra (VOB) water supply system does not currently meet the Fire Underwriters Society (FUS) recommended fire flow requirements. As indicated in an Aug 8 2010 FUS correspondence to VOB, the reviewed design (which includes expanding the Tatlow reservoir volume) barely meets the FUS minimum fire flow requirements. FUS states that the proposed design is **“absolutely minimalistic with respect to providing water supplies for fire-fighting”**.
2. The enlargement or replacement of the Tatlow reservoir as required in the FUS reviewed design to meet the FUS minimum fire flow requirements was never performed. OPUS (firm involved in the design of the water supply system), confirmed to the Committee that further discussions were held between the VOB and FUS. The Committee has requested the VOB Chief Administrative Officer to provide all correspondence between VOB and FUS to clarify the terms of a possible agreement with the Fire Underwriter's Society.
3. Based on the 2010 review, the FUS advised VOB that **“steps should be taken to improve the water supply system on an ongoing basis to ensure that as the risk within the community increases (with new buildings, etc.) that the capacity of the water supply system also increases to match the increased demand, both in terms of domestic needs (increased Max Day) and in terms of increased required fire flows”**. Both of these water demand terms have increased in an appreciable way since the 2010 design.
4. The Committee reports that yearly inflows from District of North Vancouver (DNV) have increased by a significant 70% since 2013. A supplemental increase in water demand is also expected in 2019 with the recent hook up of the Belcarra Parks picnic area. After recent fire events (loss of 3 residences in 2017), residents have expressed concerns on the fire-fighting capabilities of the current water system. It is becoming evident that time has come to consider the steps requested by FUS in 2010 (see item 3).

5. The FUS also concluded that **“knowing that the water supply system as designed would not provide the recommended fire flows for the type of structures being protected, fire prevention and mitigation measures are strongly encouraged to reduce the risk of loss of life and property when fire occurs”**. The Committee consequently recommends mandatory sprinkler requirements in all new residential construction and in residences requesting permits for major renovations.
6. In the early phases of the VOB water supply design (1990), the fire flow requirement for VOB was assessed as 60L/s for 1.5hrs. The Village of Belcarra who is the Authority having Jurisdiction consequently reduced the requirement to a lower value of 30 L/s for 1hr. The Committee acknowledges that at the time of the initial design, water supply options from DNV, Port Moody or other GVRD sources may have been limited. Maintaining the higher design fire flow requirements as per earlier studies would have entailed the need to replace the Tatlow reservoir with a larger tank at significant additional costs.
7. The Committee consequently makes the following recommendations to Council:
  - a. Request an engineering consultant to evaluate and recommend fire flow requirements for the Village of Belcarra based on recognized municipal standards for fire protection.
  - b. Proceed with an engineering evaluation of the current VOB water supply system, storage facilities and distribution system based on both current and future potable water needs and recommended fire flows of the community.
  - c. Identify and evaluate alternatives for additional water supply, funding models and government grants.

Attachments:

1. Committee questions and OPUS responses, April 2019.
2. Water Supply System Improvements in Belcarra, Letter from Fire Underwriters Society dated August 8 2010.
3. SCADA Summary Report with Recommendations
4. District of North Vancouver Memo re: Belcarra Water Supply Scenarios, March 1, 2019

Water System Capacity for Fire Protection Committee meeting held April 16, 2019

### Questions for Walt Bayless (OPUS)

The Water Supply for Fire Protection Committee is exploring options to address fire flow requirements for the Village of Belcarra (VOB) and seeks advice and guidance from OPUS on design issues related to the VOB water supply system.

The VOB has provided the 2006 Dayton Knight *Potable Water Pre-Design Preferred Option Study Report* to the Committee as the only available background information on the VOB Water Supply system's design.

#### 1. Codes, Standards and Design Guidance for Water Supply systems

- a) The Committee understand that there are no imposed Code or Standard mandatory fire flow requirements for municipalities. Designers rely on experience, current practice and design guidelines such as the 1999 *Fire Underwriters Society Water Supply for Public Fire Protection* (FUS) guidelines or the 2012 *BC Design Guidelines for Rural Residential Community Water systems*.

Is this a correct understanding? Significant discussions were held with the FUS and the Village to discuss the volume requirements for this relative to the affordability threshold of the project. To mitigate this the 30 L/s level was applied with consideration for the continuous feed from NV.

- b) It appears that many surrounding municipalities have the infrastructure to provide continuous 60 L/s fire flow capabilities and that the 60 L/s flowrate is commonly used as an evaluation criterion for current or future water supply systems. Examples are:

- a. *Village of Lions Bay – Water Distribution System, Model Development and Capacity Analysis*, Geoadvice Engineering Inc., Port Moody.
- b. Village of Belcarra – Dayton Knight (or Beesley Engineering?) *Options Study*.

Can OPUS elaborate on current design practice? 30 L/s is very low and typically 60 L/s would be used. This would have required a new reservoir as the original intent of raising the tanks was no longer viable due to the impact of steel strength and reservoir buckling in a seismic event if it was raised. Funds were insufficient to replace the tank.

- c) The 2006 Dayton Knight Pre-Design Report states: In the "Potable Water Supply Sources and Design Options" Study a fire flow requirement of 60L/s for 1.5 hrs was used. Based on discussions with the Village this can be reduced to 30L/s for 1 hr".

Can OPUS clarify the reasons why VOB reduced this fire flow requirement at that time? Costs. It would have required a full replacement rather than a raising.

#### 2. Design Basis for Tatlow Reservoir

The Committee understands that the actual potable water system is not as per the design described in the pre-design document and request clarifications on the impact of the following changes:

- a) Based on the 2006 forecast residential demand and on the agreed upon 30L/s minimum flow requirements, the storage requirements for Tatlow reservoir was evaluated at 350,000 L. The pre-design consequently concluded that modifications to the 270,000 L capacity reservoir were required. As indicated on the record drawings, these modifications were never implemented. A second noted change is that the VOB staff have informed the Committee that the Tatlow reservoir cannot be filled to the 270,000 L level indicated on the record drawings. The actual maximum reservoir capacity appears to be limited to 244,600 L. **It was due to the clearance between the underside of the roof and the level monitoring equipment. A 0.3 m clearance is required otherwise the instruments lose monitoring capacity.**

Can OPUS clarify why the Tatlow reservoir is limited to 244,600 L? Is the limitation due to hydrostatic pressure, structural or other equipment constraints?

- b) What is impact of having a 244,600 L limited capacity versus the pre-design requirements of 350,000 L? Is there a final design report which reflects the current installed water supply system? **There was a letter with the FUS agreeing on the lower levels. The decision to drop down was managed with the Village and FUS directly.**
- c) If Tatlow reservoir is indeed limited to 244,600 L capacity, the pre-design report and the BC guidelines referenced in 1a) suggests that the reservoir has already attained or exceeded its design capacity. This assessment is based on:
- i. agreed upon 30 L/s fire flow requirements
  - ii. current average consumption of 3.5 to 4.1 L/s (monthly average in July and August 2018)
  - iii. assumed 2 L/s for 2019 maximum peak daily average of newly connected Belcarra Parks Picnic Area

Is this assessment correct? If this is not the case, can OPUS provide guidance for a revised assessment? **Will have to run some numbers to evaluate it.**

### 3. Pumps

Can Opus clarify the intent and operating conditions of the VOB potable water system distribution and fire pumps? **The domestic pumps were designed to meet MDD and operate in either a continuous pressure control mode, or when demand was much lower the system would cycle off the pressure tank. Issues around the installation of significant irrigation demand on several residential properties resulted in a rapid drop in pressure and as such the two pumps are run together under higher flows to respond faster to the irrigation demand. Occasionally the fire pump has had to back stop the domestic pumps due to rapid pressure drop.**

### 4. FUS recommended minimum fire flow requirements

The Committee has been informed that the FUS recommended 30L/s for 1 hr minimum fire flow requirements are based on a common house size of under 2,500 to 3,000 sqft. The BC

guidelines referenced in 1a) indicate in turn, a 80 L/s for 1.7hr recommended FUS fire flow requirement for a 3,000 sqft wood frame residential house in a rural setting.

Can OPUS clarify the large difference between the two recommendations? **The Village coordinated this directly with the FUS.**



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The typical VOB house can be described as follows:

- significantly larger than 3,000 sqft
- of wood frame construction
- with floor heights which often exceed 10ft-15ft
- commonly built on slopes/hillsides.

The FUS guidelines appear to suggest amplification factors to the recommended fire flows for this typical VOB house. Is this a correct interpretation?

**Again this was discussed directly between FUS and the Village. FUS accepted the Village 30 L/s request for the community. They stressed this was an absolute minimum.**

#### 5. Water inflows from DNV

VOB staff have confirmed that DNV have been providing  $\pm 19.2$  L/s since at least 2016. As per attached recent March 2019 correspondence (pages 13-14 of April 8 Council Agenda), DNV now indicate that they can possibly increase the VOB water supply to 60 L/s.

- a) Committee requests clarification on the context of the May 2 2017 OPUS letter which states “OPUS and the Village met with DNV on May 2 2017 to review the additional flow option. The District stated that providing more flow than the agreed upon 14 L/s would likely compromise the District’s fire protection capabilities and therefore, is not considered a viable option. Does OPUS have any knowledge to clarify the contradictions with the actual 19.2 L/s? **The assessment was completed by DNV in 2006 who provided the 14 L/s recommendation. This is based on a theoretical operating condition in DNV under MDD and FD simultaneously. DNV would be required to comment on any changes to this value, however based on their acceptance of the new values they may have**



appendix b.PDF

**offset this limit or revised their assessment.**

- b) Can the VOB water supply / distribution infrastructure handle 60 L/s from DNV and if this is the case, what possible upgrades are required for the current coverage area? Does the DNV \$2.5M cost estimate of the required VOB

upgrades appear to be accurate? The hydraulic capacity of the supply is the limiting factor to total flow. The two submerged lines have a capacity to provide approximately 30 L/s maximum, however some field testing would need to be done to validate this value as it does not contain a safety factor. I can't comment on the \$2.5M as I do not know the extent of that work. The flow would again be limited by the Village pipe sizes.

#### 6. Questions on the SCADA System

- a) Are there online resources/tutorials, for VOB version of SCADA, providing instruction on running summary reports related to water management that they would recommend?

We can provide that. We also have previously recommended that the data be extracted to Excel for monitoring historic operations.

- b) What is the most cost-effective way to expand our knowledge and use of SCADA?

With a bit of training the best way is to explore the software. Essentially the trending is the important part and how to move data from SCADA to excel for manipulation. So the main lesson is how to plot trends and select data and apply time limits. Likely we can draft up a short how to Word file which can be used to see how to do this.

## 7. Discussion on SCADA issues (Tom Kim)

### SCADA Summary

Through discussions with VOB staff, review of documentation and on-site system, the Committee provides the following summary of its findings related to the VOB SCADA (Supervisory Control and Data Acquisition) system (software and hardware) which allows the VOB to do the following (inductiveautomation.com):

- Control industrial processes locally or at remote locations
- Monitor, gather, and process real-time data
- Directly interact with devices such as sensors, valves, pumps, motors, and more through human-machine interface (HMI) software
- Record events into a log file

#### **Key Details of the VOB SCADA System:**

- Data backup limited to after July 2016
- There appears to be no Operating Manuals/User Guide for VOB staff to reference
- Since November 2018, the system is hosted through a virtual server instead of an on-site server
- When the SCADA system loses connectivity with the server or with devices, there is no alert sent to VOB staff
- The VOB system is currently unable to measure water inflow from the City of North Vancouver, rendering the VOB entirely dependant on monthly outflow reports from North Vancouver for billing purposes.
- Certain graphs and charts have labels that appear to not accurately reflect the displayed information or do not have proper titles and labels.

#### **Recommendations:**

- Ensure the backup process preserves the SCADA log/data going forward and does not overwrite after 3 years as previously done.
- Given the periodic outage of power and internet connectivity in the VOB and the greater dependency on connectivity since going to a virtual server, consider additional redundancies such as internet backup through a cellular data plan and other cable/optical provider.
- Look into how an alert/alarm can be sent to VOB operation staff when the SCADA system is down to avoid a water supply outage like the failure that occurred in January 2019, when the SCADA system was offline due to a software license issue unknow to the operators and a seismic valve was somehow triggered closing flow into the main reservoir tank.
- Engage a SCADA expert to review the VOB SCADA system to verify and program as needed the system to ensure reports and graphs are accurately pulling the correct data from the linked devices.
- In the absence of proper operating documentation, engage a SCADA expert to help develop a VOB specific operating manual including key reports that should be reviewed regularly.



# FIRE UNDERWRITERS SURVEY

A SERVICE TO INSURERS AND MUNICIPALITIES

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c/o Risk Management Services

August 8, 2010

Larry Scott, Public Works Superintendent  
Village of Belcarra  
4084 Bedwell Bay Road  
Belcarra BC, V3H 4P8

**Subject: Water Supply System Improvements in Belcarra**

Dear Sir,

At your request, Fire Underwriters Survey has reviewed the potential impacts of the improvements to the water supply system servicing the Village of Belcarra. The improvements have been considered from the perspective of compliance with Fire underwriters Survey "Water Supplies for Public Fire Protection" and the fire insurance grading and classification system used in Canada.

**Background**

The Village of Belcarra has not in the past provided a potable water system but has operated several non-potable water reservoirs, distribution pipes and hydrants for the purpose of public fire protection. These efforts have been recognized as minimally achieving the requirements to be recognized for fire insurance grading purposes and as such, published fire insurance grades have indicated the recognition of water supplies for fire protection within the Village.

**Current Situation**

The Village of Belcarra is currently considering making alterations to water supplies that would allow the Village to provide a potable water supply to constituents. Fire Underwriters Survey has been asked to comment on design considerations with respect to potential changes to fire insurance grade status.

**Comments**

We have briefly reviewed the report "VILLAGE OF BELCARRA POTABLE WATER STUDY PREFERRED OPTION PRE-DESIGN" authored by Dayton and Knight Ltd. And dated December, 2006.



Key details we have considered are as follows:

1. The area is currently serviced by two reservoirs,
  - a. Tatlow Road Reservoir (270 cubic metres @ TWL=87.44m)
  - b. Dutchman Creek Reservoir (246 cubic metres @ TWL=39.074m)
2. The Dutchman Creek Reservoir will be decommissioned
3. The Tatlow Road Reservoir will be expanded to a volume of 371 cubic metres
4. Domestic demand on the potable water system have been estimated at:
  - a. 14LPS total demand including parks and all domestic uses
  - b. This value is suggested as an estimate of Max Day Demand for the community
5. Proposal includes a supply main from the District of North Vancouver capable of providing 14LPS that would refill Tatlow Road Reservoir
6. The Tatlow Road Reservoir would feed the distribution piping and hydrants
7. Distribution piping and hydrants to be expanded
8. All service areas would be able to achieve a minimum of 30LPS flow rate through hydrants with a minimum residual pressure of 20psi (except at the east end of Main Avenue)
9. The service areas that cannot through gravity achieve the minimum flow rate of 30LPS with a minimum residual pressure of 20psi are proposed to be serviced by an inline booster pump.

The proposed design would meet the minimum requirements of Fire Underwriters Survey and the recognized fire insurance grade of the Village of Belcarra would not be adversely affected by this project. However, it is important to note several things:

1. The fundamental minimum design requirement is for the system to be capable of providing 30LPS + Max Day Demand simultaneously for 1 hour with a minimum residual pressure in the system of 20 psi.
2. The system design is absolutely minimalistic with respect to providing water supplies for fire fighting that would be recognized for fire insurance grading purposes.
3. Steps should be taken to improve the water supply system on an ongoing basis to ensure that as the risk within the community increases (with new buildings, etc.) that the capacity of the water supply system also increases to match the increased demand, both in terms of domestic needs (increased Max Day) and in terms of increased required fire flows.
4. The system must be maintained and tested in accordance with relevant standards to maintain its fire insurance grade status. Fire Underwriters Survey will periodically request to review documentation of maintenance and flow testing.
5. Knowing that the water supply system as designed would not provide the recommended fire flows for the types of structures being protected, fire prevention and mitigation measures are strongly encouraged to reduce the risk of loss of life and property when a fire occurs. Particularly, provision of the earliest possible fire suppression response is recommended, as the earlier the response, the greater the chance of successful outcome with limited resources.

Michael Currie, GFireE, ASCT  
Fire Protection Specialist  
Fire Underwriters Survey



## Memo

March 1, 2019

TO: Laurna Dysart, CAO Belcarra  
Park and Facilities

DNV GM Engineering,

FROM: Manager Utilities.

**SUBJECT:** Belcarra Water Supply Scenarios

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This memo provides an overview of potential water servicing scenarios to and for the Village of Belcarra (VOB).

The VOB system was designed to meet current and future customer peak demands and fire flow of 30 L/s for 1 hour. A water servicing agreement permits the VOB to draw up to a maximum flow rate of 21 L/s from the DNV system at a facility on Strathcona Road. In this manner the DNV is a bulk water supplier to the VOB

With regard to recent discussion about exploring increasing DNV supply and expanding the VOB system I have listed some concepts and comments.

### Development Impact.

1. **Addition of 50-100 SFR within existing served area.** The original design criteria included projected population growth from 700 in 2006 to 1,200 in 2025. It appears the existing VOB system at the existing DNV supply rate is sufficient to accommodate an additional 100 SRF with little to no VOB or DNV capital upgrade impact.
2. **Supply Extension to Ferrer Cove.** Ferrer Cove was not considered in the original design criteria. If supplied from the VOB system there will likely be VOB capital upgrades (piping, pumping and reservoir) estimated at \$2.5 – 3.5M. A new submarine feed from DNV Woodlands community to Ferrer Cove would require significant DNV and VOB capital works estimated at \$8-12M.

### Parks Impact.

3. **Metro Belcarra Park demand increase fourfold.** The original design criteria included Metro park use but did not include projected future increases. A fourfold increase in peak demand would likely trigger the need for VOB

system capital upgrades likely in the form of reservoir and servicing expansions. The estimated upgrades are valued at \$0.75 – 1.5M.

4. **Service Extension to Camp Sasamat & White Pine Beach.** The original design criteria included anticipated demands for Camp Sasamat and White Pine Beach, (and Belcarra Picnic A, Picnic Area Restaurant and Woodhaven Camp) therefore the existing system likely could accommodate the demand without significant capital upgrades to the existing VOB or DNV system.

#### **Fire Fighting.**

5. **Increase DNV peak supply flow to 30L/s or 60 L/s.** Preliminary modeling shows that the DNV system is likely capable of supplying 30 or 60 L/s at the existing VOB feed without immediate impact to the DNV system. Upgrades to the VOB system would be required. Further modeling is required to identify long term capital upgrade impacts to DNV system. Preliminary estimated capital upgrades to the VOB system is \$2-3M.
6. **Marine Salt Water Fire Fighting System.** An independent marine supplied system dedicated to fire fighting while technically feasibly could entail a parallel system with estimated costs of \$5-10M. A 'portable' system (fixed pumping with piping assembled when and where needed) would be less expensive but has response time and service reach limitations.
7. **Marine Support:** Membership in the local ship to shore support service could be explored. Response time and reach limitations would be a consideration. While not a first response solution it may augment the existing system and offer options. Annual membership begins at \$40k.

Assumptions have been made when considering these concepts which will likely impact technical feasibility and costs estimates.

#### **Reference:**

EDOC # 778047. Village of Belcarra Potable Water Study Preferred Option Pre-Design. Final Draft October 2006.