



City of Richmond

Report to Committee

To: Community Safety Committee
From: Jeff Day, P. Eng.
General Manager, Engineering & Public Works
Re: Emergency Water Supply In the Event of an Earthquake

To Community Safety July 15, 2003
Date: June 11, 2003
File: 5125-03-02

Staff Recommendation

1. That the City of Richmond – Emergency Water Supply in the Event of an Earthquake report, dated July, 2002, be endorsed.
2. That staff investigate the recommendations in detail and report back on an implementation strategy in June, 2004.

Jeff Day, P. Eng.
General Manager, Engineering & Public Works

Att. 2

FOR ORIGINATING DIVISION USE ONLY		
ROUTED TO:	CONCURRENCE	
Fire Rescue	Y <input checked="" type="checkbox"/> N <input type="checkbox"/>	
Engineering	Y <input checked="" type="checkbox"/> N <input type="checkbox"/>	
Director - Public Works Operations	Y <input checked="" type="checkbox"/> N <input type="checkbox"/>	
Transportation.....	Y <input checked="" type="checkbox"/> N <input type="checkbox"/>	

Staff Report

Origin

In June, 2001, the City's Emergency Planning Committee established a Task Force, led by the Manager – Engineering Planning, to develop strategies to address the provision of drinking water and water for fire protection in the event of an emergency.

This review was triggered by a number of studies undertaken by Richmond and other agencies which highlighted the need for a comprehensive review to develop both an immediate and long-term approach to this issue.

The final report "Emergency Water Supply In the Event of an Earthquake" (a copy of which is distributed separately), was completed in July, 2002. It is presented with this summary report for endorsement and commencement of an implementation strategy.

Analysis

Background

The Task Force focused on earthquakes as its planning scenario, recognizing the parallels and commonalities that exist between this and other potential emergencies that could occur, such as vandalism, major system failure, terrorism, loss of disinfection, etc. The report presents immediate, short-term (0–2 years) and long-term (2+ years) recommendations. The key findings from the study are presented with this report.

KEY FINDINGS

Water Distribution Network

Key findings regarding the manner in which water is conveyed to and within Richmond are summarized below:

- The City of Richmond is entirely reliant on the GVRD for its water supply. The water is conveyed through a series of pipes, storage reservoirs, and river crossings before entering Richmond.
- 80%-85% of Richmond's water comes from Capilano through a watermain which crosses from Vancouver at Oak Street and connects from Bridgeport to Shell Road.
- The City has its own internal distribution system made up of river crossings, PRV chambers and watermains. Richmond has no potable water storage reservoirs.
- Steel, reinforced ductile iron and high-density polyethylene (HDPE) pipes respond best to ground displacements caused by earthquakes.
- Richmond had used welded mild steel for large trunk mains in the past, however, no longer does due to corrosion caused by our soils and high water table.

- Only limited amounts of HDPE pipe have been used in Richmond (underwater applications), due to high costs for materials and installation.
- PVC pipe has been used in Richmond since the 1970's. The PVC pipe currently used has deep joints and mechanical restraints to improve seismic performance.

Reliability of Supply

The reliability of GVRD system components and Richmond system components, including critical facilities, was reviewed in each of two commonly used earthquake scenarios. The results indicate there is likely to be some water in a 1 in 100 year event (40% chance), although our PRV stations are not expected to perform well. Immediate measures would be required to capture, control and convey the water to emergency locations, as well as restore the water infrastructure. It is unlikely there would be any water in a 1 in 475 year event (10% chance). Immediate action would be required to commence restoration of the water infrastructure (including GVRD and Richmond sources) and secure alternative water supplies for drinking and firefighting purposes.

Sources

Given that water will be compromised in an earthquake event, the report identifies the following sources of water which could potentially be accessed more readily:

Potable Water

- Bottling companies located in Richmond have a total of 1.8 million litres of water on hand at any given time.
- Supplies of water and other beverages on many retail store shelves and in businesses.
- Home emergency water supplies, including hot water tanks, etc.

Firefighting Water

- Water in storage on the 9 fire trucks
- Mutual aid from other municipalities
- Drafting from storm sewer system and rivers
- Drafting from public swimming pools

These immediate sources are insufficient to meet demand requirements. Therefore, the report goes on to identify potential long-term sources. For potable water, these include storage reservoirs, wells, and treatment plants (to treat river water). For firefighting, some options include storage reservoirs, drafting stations, a fireboat, dedicated systems, and systems for flooding ditches.

Recommendations

The report recommendations are addressed in three key areas:

1. Immediate Actions

These are actions the City could carry out in the event our water system was compromised today. These actions include:

- Determine the location and intensity of the earthquake
- Undertake a damage assessment
- Establish the City's Emergency Operations Centre
- Enact Mutual Aid and supplier contacts
- Mobilize City staff to respond
- Contain fires to prevent spread as much as possible
- Secure water for critical facilities, i.e. hospital, shelters, etc.
- Engage public health to undertake public education on drinking water
- Activate Emergency Social Services to shelter/provide potable water to persons
- Mobilize equipment and resources

2. Short Term Recommendations

The recommendations are summarized in Attachment 1. They include:

- Establishing agreements with suppliers and mutual aid partners
- Undertaking inventory of supplies
- Reviewing design specifications for seismic resistance
- Developing a specific water emergency response plan
- Training staff and educating the public, liaising with other agencies, etc.

The key short-term recommendation arising from this study is to evaluate the feasibility of establishing a more secure water source within the core area, i.e. a "Ring" concept. This would involve seismically reinforcing a specified watermain network, from the main GVRD water source, between No. 2 Road and Shell Road, along Westminster Highway and Steveston Highway.

This concept is dependent on the integrity of the GVRD water supply, however, the "Ring" could be isolated and supplied by an alternative water supply source. If the GVRD water supply is secure, the "Ring" would provide water for drinking and fire protection purposes. If the GVRD supply is not secure, the "Ring" would provide a source to charge water for fire fighting to protect the core of Richmond. The "Ring" concept is shown in Attachment 2.

3. Long-Term Recommendations

The long-range recommendations will require further detailed technical and cost/benefit analysis. The key recommendations include:

- Undertaking an integrated seismic assessment of the City's water distribution network.

- Developing independent water supplies, such as through reservoirs, wells and treatment plants.
- Purchasing water storage bladders, portable hose, above-ground water tanks and water tankers, and a fireboat.
- Establishing a dedicated fire protection system that uses Fraser River water (similar to the City of Vancouver's).
- Establishing permanent drafting stations, with generators and pumps, to allow fire trucks the ability to draft water from the river.

Summary

Supply is expected to be compromised in Richmond in a seismic event scenario for both potable water and water for fire protection purposes. This report presents an overall strategy and approach toward securing sources of water through immediate actions, and short and long-term recommendations.

Each recommendation will be explored in more detail for technical feasibility and cost analysis. Some of the actions and recommendations will be implemented as part of normal City operations, others may be presented to Council for consideration as independent items or as part of the Capital Budget Process.

Engineering Planning will maintain overall responsibility for implementing the recommendations contained in the Emergency Water Supply report.

Financial Impact

The Emergency Water Supply report was prepared in-house with representation from various City departments and the GVRD. Therefore, there were no direct costs, other than minimal printing costs, incurred in its development.

The recommendations arising from the report could have significant cost impacts. While these costs are not known at this time, they will be evaluated and considered at appropriate times in the implementation aspect of this study.

Conclusion

This study represents a comprehensive look at water supply issues in the event of an earthquake. It establishes a strategic approach to address the challenges the City will face in ensuring adequate protection to people and infrastructure resulting from an interruption of water supply in a seismic event.



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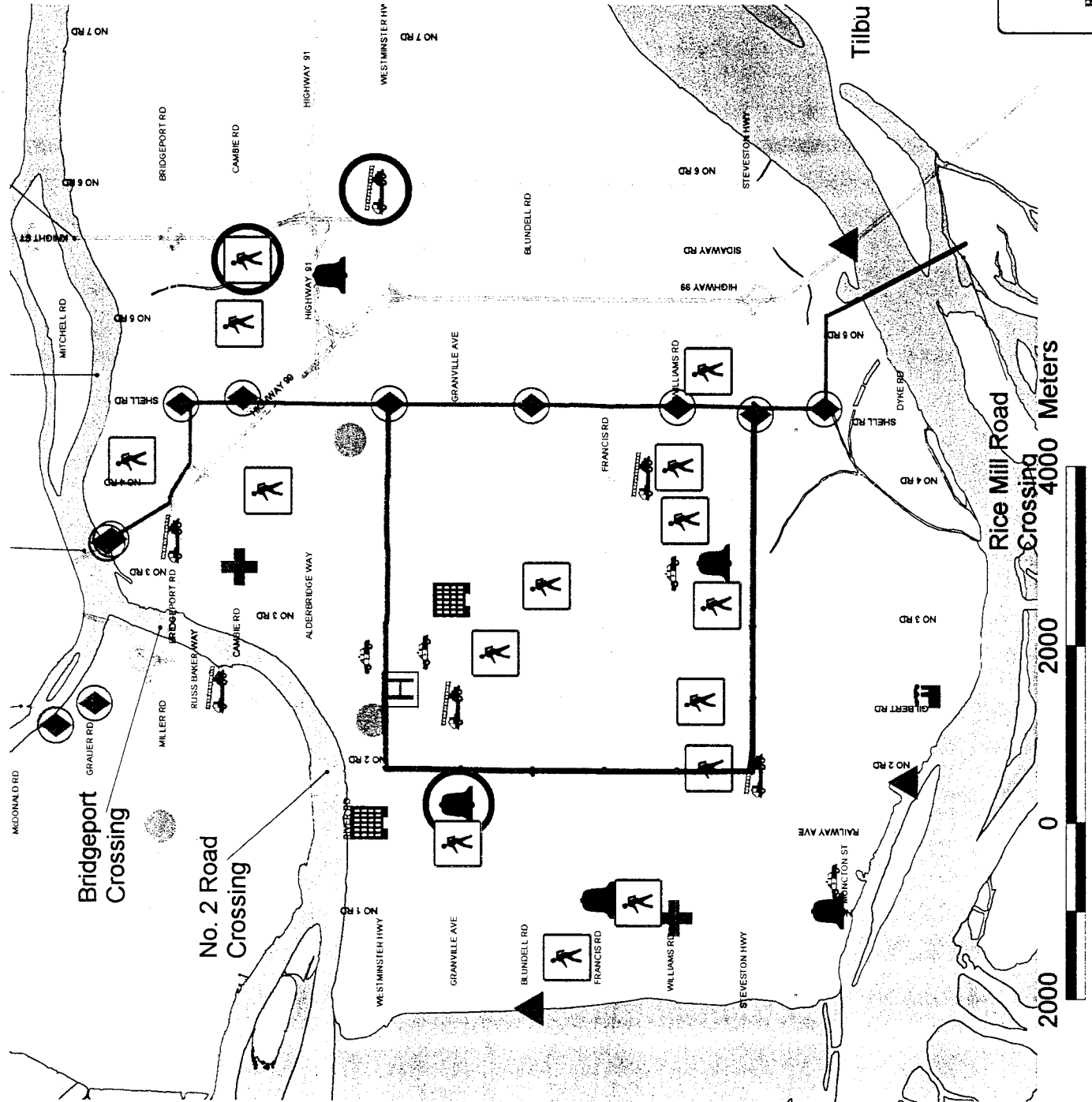
Emergency Water Supply Recommendations List

Item	Task	Duration	Start Date
	Short Term Recommendations		
1.1	<i>Procurement agreement with water bottling/warehouse companies</i>	8 months	June, 2003
1.2	<i>Establish mutual aid protocols with municipalites, YVR, GVRD</i>	1 year	January, 2004
1.3	<i>Initiate dialogue with RGH to convey water supply limitations</i>	3 months	October, 2003
1.4	<i>Initiate dialogue with extended care homes to convey water supply limitations</i>	3 months	October, 2003
1.5	<i>Contact School Board to confirm seismic integrity of all schools</i>	6 months	September, 2003
1.6	<i>Inventory repair supplies, equipment, etc. to ensure there are adequate emergency supplies</i>		Completed
1.7	<i>Develop training programs and train all designated emergency responders</i>		Clarification required
1.8	<i>Update infrastructure maps, valve books, GIS and As-Built drawings and make available to all emergency response departments</i>	18 months	May 2003
1.9	<i>Develop a public education program for emergency water supply</i>	6 months (Dec 2003)	Currently in Progress
1.10	<i>Review the City's design specifications and incorporate seismic resistant criteria.</i>	18 months	Aug 2003
1.11	<i>Evaluate the feasibility and cost/benefits of the "Ring" network</i>	12 months	Aug 2003
1.12	<i>Work with Health Region to ensure that there is a comprehensive and integral regional plan for response to water contamination, for loss of service, or both</i>		TBA (waiting for GVRD)
1.13	<i>Explore use of reservoirs to feed ring network.</i>	12 months	Aug 2003
1.14	<i>Explore feasibilty of constructing additional water features in Parks</i>		Currently in Progress

1.15	Research feasibility of water bombers for fire suppression.		Completed (not feasible)
	Long Term Recommendations		
	System Evaluations and Improvements		
2.1.1	Commission a seismic assessment of the City's water distribution system.	24 months	Jan 2004
	Explore Development of In-City water supplies		
2.2.1	Construct a storage reservoir	12 months	Aug 2003
2.2.2	Develop wells within City	12 months	Aug 2003
2.2.3	Construct a Reverse Osmosis plant	12 months	Aug 2003
	Explore additional purchases to aid in water distribution		
2.4.1	Portable inflatable bladders for water storage	3 months	Nov 2003
2.4.2	Portable hose for potable water purchase additional fittings and hoses		Complete Dec 2003
2.4.3	Large plastic above ground water tanks	3 months	Nov 2003
2.4.4	Water tankers	3 months	Nov 2003
2.4.5	Fireboat	12 months	Aug 2003
2.5	Explore feasibility of dedicated fire protection system	12 months	Aug 2003
2.6	Explore development of permanent drafting stations/dry hydrants	12 months	Aug 2003
2.7	Evaluate the reliability of transport links across Hwy 99 – identify potential locations for at-grade vehicular crossings for emergency response	6 months	July, 2003
	Assessment of Risk Due to Fire Following Earthquake (EQE 2001)		
3.1	Develop a regional earthquake plan with a detailed post earthquake fire element.		TBA (waiting for GVRD)

3.2	<i>Improved provision for alternative water sources.</i>	12 months	Aug 2003
3.3	<i>Installation of water cisterns in sprinkled high-rises and retrofitting of unsprinkled high-rises with sprinklers.</i>	12 months	Currently in Progress
3.4	<i>A regional effort at reducing post-earthquake fire ignitions.</i>		TBA (waiting for GVRD)
	Study of Seismic Upgrading Requirements for the PRV Station at Steveston Hwy and Shell Road (Sandwell, 2001)		
4.1	<i>Construct a reinforced concrete slab on top of existing basement slab.</i>	12 months	Jan 2004
4.2	<i>Provide lateral support to concrete block wall with new internal steel struts</i>	12 months	Jan 2004
4.3	<i>Install additional fasteners between the walls and the ceiling, the walls and the ground floor, and between the block wall and timber studs.</i>	12 months	Jan 2004
4.4	<i>Nail plywood ceiling</i>	12 months	Jan 2004
4.5	<i>Nail interior plywood wall panels</i>	12 months	Jan 2004
4.6	<i>Fasten inlet and outlet manifolds to the concrete support pedestals</i>	12 months	Jan 2004
4.7	<i>Construct supports for PRV gate valves and fasten down</i>	12 months	Jan 2004
4.8	<i>Install slip joints on both the inlet and outlet trunk watermain just outside the station.</i>	12 months	Jan 2004
4.9	<i>Install joint restraints on the coupled joints of the trunk watermain</i>	12 months	Jan 2004
4.10	<i>Conduct a comprehensive study of the water supply and distribution in South Richmond to determine the most suitable additional seismic upgrade measures</i>	12 months	Aug 2003
	Complete recommendations as per 1997 EQE Report		
5.1	<i>Provide floating, portable pump stations to move water from the Fraser River to a portable hose system being relayed by fire engines Or Fixed</i>		Jan 2004
5.2	<i>Consider an overland system to move water "in reverse" from the levees through the existing drainage system</i>	12 months	Aug 2003
5.3	<i>Provide more water storage such as water features in parks, large capacity tanks, or multiple cisterns associated with each new major building structure</i>		Currently in Progress

5.4	<i>Provide small treatment plants to treat Fraser River water</i>	12 months	Nov 2003
5.5	<i>Develop a mitigation plan for the GVRD FraserRiver North Arm crossings.</i>		TBA (waiting for GVRD)
5.6	<i>900mm No. 2 Road crossing (City-Owned)</i>	36 months	Aug 2003
5.7	<i>700mm Bridgeport Road Crossing (replaced in 2000)</i>		Completed
5.8	<i>Coordinate with Translink to include protection of water and gas mains in Knight Street Bridge upgrade program</i>	On-going	Currently in Progress
5.9	<i>Design all new facilities in accordance with applicable seismic codes for buildings</i>		Completed
5.10	<i>Use seismic vulnerability as consideration in prioritizing long-term capital projects</i>	12 months	Sep 2003



Ring Mains

Critical Facilities

AMBULANCE

CITY

COMMUNITY CENTRE

HOSPITAL

MISCELLANEOUS

POLICE

RFD

SCHOOL

TREATMENT PLANT

Post Disaster Buildings

PRV Chambers

GVRD Mains

City of Richmond
2017-2021
Richmond, B.C. V6V 1C1

Ring Mains