



Hamilton

INFORMATION REPORT

TO:	Chair and Members Public Works Committee
COMMITTEE DATE:	August 17, 2017
SUBJECT/REPORT NO:	Woodward Avenue Facility Power Failure (PW17067) (Wards 4, 5 and 10) (Outstanding Business List Item)
WARD(S) AFFECTED:	Wards 4, 5 and 10
PREPARED BY:	Nick Winters (905) 546-2424, Extension 1474
SUBMITTED BY:	Nick Winters Acting Director - Water & Wastewater Operations, Public Works Department
SIGNATURE:	

Council Direction:

Public Works Committee at its meeting of February 27, 2017 approved the following:

“That staff be directed to investigate the cause of damage to both private and public property resulting from an adverse operating condition in the water system (outside of the Woodward Avenue Facility)”.

Information:

On October 29, 2016 at approximately 10:09 AM there was an unanticipated electrical surge, known as an ‘electrical transient’, at the Woodward Avenue Facility that resulted in the temporary loss of power for some processes in both the Water Treatment Plant (WTP) and the Wastewater Treatment Plant (WWTP). While the source of the electrical transient cannot be identified, staff’s analysis of electrical monitoring data indicates that the transient originated from the Alectra Utilities (Alectra) electrical distribution system. At the time of the power loss, the WTP was operating two pumps to supply water from the WTP to the water distribution system. In addition, pumps were operating at both the Greenhill and Kenilworth pumping stations to move water up the escarpment and into the storage facilities on the Hamilton Mountain.

In this scenario the effects of the temporary power loss were significant and damage occurred within the water distribution system, and also within the WWTP. However, there was no risk to the City’s drinking water supply from the WTP or to the City’s treatment of wastewater at the WWTP.

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OUR Mission: To provide high quality cost conscious public services that contribute to a healthy, safe and prosperous community, in a sustainable manner.

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**SUBJECT: Woodward Avenue Facility Power Failure (PW17067)
(Wards 4, 5 and 10) - Page 2 of 4**

The Woodward Avenue Facility has systems in place to protect both WTP and WWTP equipment from damage resulting from events like this, and these systems did function as intended on October 29, 2016. However, the existing systems were not able to completely disperse the effects of the transient or the resulting water pressure changes in the water distribution system.

As discussed below, in an effort to reduce the risk and impacts of future similar events, staff plan to update the communications protocol between the City and Alectra and complete improvements to the Woodward Avenue Facility data and electrical systems as part of the Woodward Electrical Upgrade Project (please note that these improvements were already planned prior to the October 29, 2016 event).

Damage & Financial Summary:

In total the October 29, 2016 event resulted in damage to City infrastructure including damage to an electrical cable at the WWTP and 7 watermain breaks, with repair costs totalling \$160,402.36. In addition, three private property water service lines were damaged as a result of the pressure surge, and some flooding occurred at another property.

❖ **Investigation Summary:**

➤ **Power Failure**

Staff's investigation indicates that a high speed electrical transient was the cause of the power failure at the Woodward Avenue Facility. Electrical monitoring data for the Woodward Avenue Facility indicates that the electrical transient was likely received from the Alectra electrical distribution system. It is important to note that the electrical monitoring data cannot identify the source of the electrical transient (e.g. whether it originated from a Transformer Station or from another customer connected to the supply, etc.).

The electrical transient interrupted the operation of the variable frequency drives (VFDs) for the pumps that were operating at both the WTP and the WWTP. The instantaneous non-controlled shutdown of the VFDs resulted in a power surge within the Woodward Avenue Facility that caused the damage at the WWTP.

➤ **WWTP Damage**

Staff believe that the power surge caused by the instantaneous non-controlled shutdown of the VFDs resulted in the failure of the insulation on a 4160V electrical feeder cable. Approximately 15 minutes after the power surge, a major phase to phase electrical short occurred which resulted in the failure of a 150m section of electrical feeder cable.

➤ **Watermain & Water Service Breaks**

Similar to the power surge that resulted from the instantaneous non-controlled shutdown of the VFDs, the resulting shutdown of the WTP pumps resulted in a water

**SUBJECT: Woodward Avenue Facility Power Failure (PW17067)
(Wards 4, 5 and 10) - Page 3 of 4**

pressure transient that travelled through the City's water distribution piping. This water pressure transient led to the seven watermain breaks and the three water service breaks. While the WTP has a water pressure surge protection tower in place, this structure is designed to protect the WTP itself from damage resulting from a pressure transient and not the entire water distribution system.

❖ Actions Taken to Prevent a Future Event:

➤ Consultation with Alectra Utilities

Staff recently met with representatives from Alectra to discuss the October 29, 2016 event. A productive dialogue was had about the design and operation of the Alectra electrical supply grid, about the design and operation of the Woodward Avenue Facility's electrical system, and about future communications between Alectra and Hamilton Water (HW) staff.

The possibility of a high speed electrical transient originating from the Alectra grid was discussed and Alectra staff felt that was unlikely based on their information (e.g. no response from Transformer Station switches, and no reports of adverse effects from other customers connected to the same electrical supply). Alectra staff further advised that based on their information they believe that there was an isolated fault on the City's side of the electrical supply system at the Woodward Avenue Facility. City staff have not been able to find any information to confirm this and are still of the view that the electrical transient originated from the electrical distribution system outside of the Woodward Avenue Facility.

Ultimately it was agreed by both HW and Alectra staff that there are opportunities for improvement for both communication between parties, and also potentially for the data systems that monitor the Alectra supply. Improving communication will provide HW staff with more timely information regarding emergency or planned work on the electrical supply, which will allow staff to take appropriate action to mitigate any potential impacts to HW infrastructure or service provision. Improvements to the data systems will allow HW and Alectra access to the same monitoring data at critical transition points, provide more robust system intelligence and the opportunity to closely monitor or investigate electrical system abnormalities.

Alectra staff advised that improvements to the data systems for the electrical supply are already being discussed with HW staff through Alectra's involvement with the Woodward Upgrade Program.

❖ Actions to be implemented by HW Staff:

The following actions will be implemented by HW staff to mitigate the possibility of a future electrical event similar to that of October 29, 2016:

1. Update the formal communication protocol between HW and Alectra regarding emergency and planned work for the Alectra system that could potentially affect

**SUBJECT: Woodward Avenue Facility Power Failure (PW17067)
(Wards 4, 5 and 10) - Page 4 of 4**

HW facilities and which would allow for the preventative measures to be taken, where possible.

2. Conduct operational de-brief/training regarding the October 29, 2016 event and identify opportunities for improvement with respect to emergency response and restoration of normal operating conditions.
3. Completion of the Electrical Upgrade Project under the Woodward Upgrades Program will address some of the suggested improvements to data systems for the electrical supply as previously mentioned.

Additional investigation and actions may stem from the operational de-brief and will be implemented as required.

❖ **Conclusion:**

The exact cause of the October 29, 2016 power failure that resulted in significant public and private property damage unfortunately remains unclear. However, discussions between Alectra and HW staff identified a number of opportunities for improvement that, once implemented, are intended to improve communications and decrease the likelihood of a similar event occurring in the future.

In addition, HW staff have completed or will complete a number of actions that will decrease the risk of electrical failures at the Woodward Avenue Facility and prevent the development of water pressure surges in the water distribution system.

Appendices and Schedules Attached:

N/A