1 BACKGROUND

WSP has been commissioned by the Community of Wellington to review the condition of the existing lift station located on Ellis River Drive. The intent of the review is to identify deficiencies and upgrades required to meet current regulatory standards and to accommodate future growth of the Community.

The station was commissioned in 1978 and upgraded in 1999 and 2009. The station collects the majority of the Community's wastewater flow, from the area on the north side of the Ellis River, which is then pumped from the station across the river to the Community's wastewater lagoon.

A site visit was completed on February 9, 2015 to visually inspect the station's components and assess its operation.

2 EXISTING SYSTEM

The existing station is a 3-phase duplex submersible pumping station equipped with two 3.0hp pumps, housed within a fiberglass chamber which is enclosed by a small wooden building. (See photos in Appendix A.) The chamber is the original installed prefabricated unit, 1.8 meters in diameter and 3.8 meters deep. Sewage enters the station via two gravity inlet pipes, a 200mm diameter and a 250mm diameter. The pumps both discharge through 100mm diameter piping within the chamber. The piping joins together with a tee connection and then increases to 150mm diameter as it leaves the chamber. A check valve and a ballcentric valve are located on each of the 100mm diameter discharge piping within the chamber.

Upgrades to the station in 1999 included:

- → providing 3-phase power to the station;
- → replacing the single-phase 2.4hp pumps with 3-phase 3.0hp pumps;
- → replacing the control panel; and
- → providing an automatic dialer for the alarm system.

Further upgrades performed more recently are as follows:

- → standby emergency power was added to the station in 2009, including a 30kW generator equipped with a 475 litre fuel tank, and an automatic transfer switch; and
- → one pump was replaced in February 2012. This newer pump is equipped with a flushing valve.

The 150mm diameter forcemain conveys sewage from the station to the lagoon on the south side of the Ellis River. As no record drawings were available, for the purpose of this review it has been estimated that the length of the 150mm diameter forcemain is approximately 150 meters and that there are no valves or 90 degree bends on the pipe between the lift station and the receiving manhole at the lagoon.

3 SITE REVIEW

As mentioned previously, the lift station is enclosed in a small wooden building, hence creating a confined space atmosphere. The gases released from the raw sewage could accumulate within the building and potentially cause harm if inhaled, or create an explosion from a spark. The building is equipped with a ventilation fan; however, there is no on-site monitoring of air quality. Anyone wanting to enter the building must test the air quality prior to doing so, as per the Occupation Health and Safety Act. A safe work procedure must be in place and followed by all persons entering the building. The only electrical components in the building are the ventilation fan and a light fixture, both of which are explosion proof devices, therefore meeting code.

The fiberglass chamber appears to be in good condition however, the guide rail supports for the pumps are loose and should be stabilized. Discussions with the station operator revealed that the pumps have not been lifted since he has been overseeing the station (2 - 3 years), and Xylem has reported that there are no records of maintenance or repair done to the pumps. One pump was not operating efficiently during the visit, and was turned off by the operator, as discussed in more detail below.

There is a back-up pump inside the building, and a junction box for the power supply to the pumps to facilitate the disconnect of either pump and the connection of the back-up pump, if required. The junction box and cable are sitting on the floor beside the chamber. (see photo in Appendix A) The power supply for the pumps was extended from inside the chamber out over the top of the chamber and into the junction box, then it runs back down into the chamber. This presents a tripping hazard and a fire hazard and does not meet code requirements. The proper installation method would be to have the power supply running through a hazard isolation junction box on the exterior of the building below the control panel.

It was noted that the cables entering the control panel do not have proper fittings, such as EYS, to prevent the passage of gasses from the pump station to the panel. This presents a risk of explosion within the panel if a spark were to ignite these explosive gasses. Proper fittings are required on all cable entering the panel from the pump station.

It was noted that there is no flow meter in the station and that there is an overflow pipe present with an open discharge to the Ellis River. The station is equipped with an auto dialer alarm system and a red light on the exterior of the building, but no signage alerting the public to call if the red light is on. The fuel tank capacity of the standby generator is sufficient to run the existing station from the generator for approximately four days. The generator is of sufficient size to accommodate upgrades to the station, if required.

4 EXISTING STATION CAPACITY

4.1 CALCULATED FLOW

Theoretical flow calculations were performed to determine the expected flow into the lift station. In order to complete the calculations, population data had to be projected from the Statistics Canada Census information. Using census information from 2001 to 2011, it was concluded that a 1.0% annual population growth rate would be used for this assessment. Based on a population in the Community in 2011 of 409, the projected value for 2014 is 422.

Figure 1 in Appendix B shows the area of the Community serviced by a municipal sanitary sewer. As mentioned earlier, only the north side of the Ellis River flows to the lift station; therefore, calculations

were done to consider only the population within the north portion of this catchment area, to be used in determining the flow to the lift station. Street view imagery from August 2013, provided by Google Earth, was used to count the number of dwellings within the catchment area south of the Ellis River. The number of dwellings, combined with census data showing 2.3 persons per dwelling in the Community of Wellington, was used to determine that the population within the catchment area flowing to the lift station is 334.

Average dry weather flow, peak dry weather flow and peak wet weather flow to the station was calculated using the Atlantic Canada Wastewater Guidelines Manual (ACWGM). When considering the wet weather factor for inflow and infiltration (I/I) into the system, only the catchment area north of the Ellis River was used, with the highest allowance for I/I incorporated into the calculation based on the fact that Wellington is a very wet area.

The existing theoretical flows to the lift station, calculated based on a population of 334, are as follows:

Average Dry Weather Flow	= 1.31 L/s (21 USgpm)
Peak Dry Weather Flow	= 6.75 L/s (107 USgpm)
Peak Wet Weather Flow	= 21.76 L/s (345 USgpm)

4.2 MEASURED FLOW

A pump draw down test was conducted the morning of February 9, 2015 to determine the actual pumping rate of the station. It was noted prior to the testing that one pump was not functioning properly as it was unable to draw the level down in the station and only kept up with the inflow; therefore, it was turned off for the test period.

The test was performed under dry weather conditions, and consisted of three (3) timed cycles of fill and draw down with one pump. The average pumping rate was determined to be 21.8 L/s (345 USgpm) with an inflow rate during the test period of 1.87 L/s (30 USgpm).

The test confirms that one pump is capable of conveying the existing theoretical peak wet weather flow without requiring the second pump to run simultaneously. This is a requirement of the ACWGM for a duplex station, as the purpose of the second pump is simply to provide redundancy.

4.3 FORCEMAIN/SYSTEM CAPACITY

The system curve for the 150mm diameter PVC forcemain with the 3.0hp pump is plotted on Figure 2 in Appendix B. This curve represents the lift station operating under normal conditions, i.e. the inlet pipes are not submerged. This shows that one pump is capable of pumping 25.5 to 27.5 L/s (404 to 436 USgpm) through the forcemain. The range in the pump rates is based on assumed conditions of the forcemain, assuming normal efficiency from the pumps.

As the pump draw down test indicates a slightly lower pump rate, this may be attributed to human error in the timing and measuring of the cycles for the test, may indicate that the pump is not operating efficiently and could require maintenance, or may be from poor assumptions of the forcemain.

The ACWGM recommends velocities in a forcemain ranging from 0.8 to 2.0 m/s, where velocities at the low end are preferred. Velocities in the 150mm diameter forcemain resulting from the flows under normal operating conditions, as mentioned above, are 1.45 m/s with one pump running and 1.90m/s with both pumps running, therefore within the recommended limits.

4.4 STORAGE CAPACITY

The ACWGM stipulates that adequate storage volume be provided within the lift station, to decrease the risk of backflow in the inlet pipes if the pumps should stop running for any given reason. Computations were done for the existing station and results indicate that there is not sufficient storage volume in the station, which can only be rectified by adding 1.4 meters to the depth of the station.

5 FUTURE GROWTH

The zoning map for the Community of Wellington (Figure 3 in Appendix B), indicates that there is potential for residential growth within the Community, although council has indicated that significant growth is unlikely in the near future.

In 2011, the Community's wastewater treatment system was upgraded to provide treatment capacity for a population of 500. Using the projected population in the Community for 2014 of 422, and applying the annual growth rate of 1.0%, it will be 17 years before the Community reaches a population of 500. Assuming that the entire population growth of 78 people are living on the north side of the Ellis River, this would increase the sewage flow to the lift station to that produced by 412 people. The resulting calculated flows would be as follows:

Average Dry Weather Flow	= 1.62 L/s (26 USgpm)
Peak Dry Weather Flow	= 8.10 L/s (128 USgpm)
Peak Wet Weather Flow	= 27.13 L/s (430 USgpm)

In this scenario, the existing lift station is not capable of handling the growth that the lagoon has been designed for, without both pumps running simultaneously to convey the peak wet weather flow, which is not permitted for a duplex station under the ACWGM.

6 REVIEW OF CURRENT STANDARD REQUIREMENTS

Referral to the ACWGM, and consultation with the Department of Environment, Labour and Justice (DELJ) have concluded that the Wellington lift station requires the following upgrades in order to meet today's standards:

- → A valve chamber separate from the wet well;
- → The wet well should be 1.4 meters deeper to meet the recommended storage capacity;
- → A flow meter installed on the forcemain;
- → The overflow discharge removed, or a method of measuring emergency bypass installed;
- → Communication system that will report alarms, loss of power and loss of communication; and
- → Signage posted on the station indicating a phone number to call if the red light is on.

The DELJ have categorized these items in terms of what is required to be addressed immediately and what should be addressed at such time as an upgrade to the station is undertaken:

Short-Term Upgrade Requirements:

- Removal of the overflow;
- Upgrade to the communication system; and
- Signage on exterior of building.

Long-Term Upgrade Requirements:

- New wet well and valve chamber; and
- Installation of a flow meter.

7 RECOMMENDATIONS

Based on the visual inspection performed, and the draw down test and flow calculations completed, it has been found that the station is in good working condition, and meets existing capacity requirements. The pumps and control panel are in good condition and are operating within their life expectancy, therefore it is not recommended nor required to upgrade these at this time.

As required by DELJ, the following upgrades are recommended to be completed at this time, at an estimated cost of $31,00.00, plus taxes, as detailed in Appendix C:

- → Install EYS fittings and a hazard isolation junction box at the control panel;
- → Stabilize guide rail supports;
- → Have pumps serviced;
- → Upgrade communication system to include remote monitoring;
- → Install gate valve on overflow pipe and keep closed; and
- → Post signage on outside of building.

As the station is operating at capacity now, consideration should be given to replacement of the station within the next 5 years to accommodate the annual projected growth of the community. The new station would require a separate valve chamber, a new wet well providing sufficient storage capacity, and a flow meter. The system should be designed to accommodate a flow of 27.13 L/s (430 USgpm), which would require upgrades to the pumps and control panel. The estimated cost of these upgrades is $280,200.00, plus taxes, as detailed in Appendix C.

PRELIMINARY COST ESTIMATE
WELLINGTON SEWAGE LIFT STATION
SHORT-TERM UPGRADE REQUIREMENTS
2015

Item	Description		Amount
1	Electrical Items -installation of EYS fittings and hazard isolation junction box		$8,000.00
2	Wet Well Items -stabilize guide rail supports and pump maintenance		$5,000.00
3	Upgrade Communication System		$7,000.00
4	Install Valve on Overflow		$4,000.00
5	Post Signage on Building		$500.00
		Subtotal	$24,500.00
6	Contingency (15%)		$3,675.00
		Subtotal	$28,175.00
7	Engineering (10%)		$2,817.50
		Total	**$30,992.50**

Rounded to $31,00.00

Note: Estimate excludes taxes and any legal survey work, if required.

PRELIMINARY COST ESTIMATE
WELLINGTON SEWAGE LIFT STATION
LONG-TERM UPGRADE REQUIREMENTS
2015

Item	Description		Amount
1	Misc Pipe Work -including gravity sewer main, forcemain and manholes		$10,000.00
2	Lift Station -including control panel, pumps, and flow meter		$200,000.00
3	Demolition of Existing Station		$8,000.00
4	Topographical Survey		$3,500.00
		Subtotal	$221,500.00
5	Contingency (15%)		$33,225.00
		Subtotal	$254,725.00
6	Engineering (10%)		$25,472.50
		Total	**$280,197.50**

Rounded to $280,200.00

Note: Estimate excludes taxes and any legal survey work, if required.