



## **Appendix D**

Water and Wastewater Unit Rates and  
Projected Flows for UYSS Service Area



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## Section 1.0 Introduction

The purpose of the proposed undertaking is to develop a sustainable sewage servicing solution that can accommodate the growth forecasted to occur in the Upper York Sewage Solutions (UYSS) service area in accordance with both the provincial growth management policies outlined in the Growth Plan pursuant to the *Places to Grow Act, 2005* and applicable environmental statutes, including but not limited to, the *Lake Simcoe Protection Act, 2008*, the *Oak Ridges Moraine Conservation Act, 2001*, the *Greenbelt Act, 2005*, and the *Ontario Water Resources Act*.

This appendix presents the projected unit (per capita) water consumption rates and projected unit wastewater generation rates for the UYSS service area, as reported in the Unit Rates Report (York Region, 2008b) prepared as part of the Water and Wastewater Master Plan Update (York Region, 2009c). These rates were applied to residential and employment population projections to estimate future demands on the water supply and wastewater collection systems within the UYSS service area. The projected unit rates are applied to population projections for the UYSS service area to determine the projected water consumption and projected wastewater flow for the service area.

## Section 2.0 Unit Rates Development

The Unit Rates Report (York Region, 2008b) documents the unit water consumption and wastewater generation rates developed for the current Water and Wastewater Master Plan Update (York Region, 2009c).

### 2.1 Water Consumption Rates

The first comprehensive water system study undertaken in York Region was the Master Plan for Water Supply, completed in 1997. Unit water consumption rates for each of the Region's nine local municipalities were developed using IWR-MAIN software, which analyzed various inputs, including historical data, to forecast unit rates and estimate peak water usage. The following year, an optimization study proposed separate "population" (residential) and employment consumption rates based on field demand data, current and projected residential and employment populations, and assumptions about domestic and Institution/Commercial/Industrial (ICI) water use. As part of a 2004 Master Plan update, IWR-MAIN software was again used to generate revised residential and employment unit water consumption rates for each service area in the Region based on water use from 1996 to 2001.

During the current update of the 2009 Water and Wastewater Master Plan, annual residential and employment unit water consumption rates for each service area were calculated from water consumption data provided for 2001 to 2006. These rates were averaged to establish "base"

rates for each community. Maximum day peaking factors were also established based on historical data. Where historical data was unreliable due to past water restrictions or significant anticipated changes in population, the base rates and peaking factor were selected based on data from other communities.

Changes in unit water consumption rates over time are expected, but can be difficult to predict. Historically in York Region, significant changes to water consumption rates have been observed due to changes in water billing rates, the introduction of water metering, and changes to the plumbing code. The Region's Water Efficiency Program, which aims to increase awareness of water conservation and encourages the implementation of various water efficiency measures, has also impacted water consumption rates. An additional 7 percent reduction in water use due to the effects of the program is expected within a decade and base unit rates were adjusted to reflect this reduction.

## 2.2 Wastewater Generation Rates

The York-Durham Sewage System (YDSS) was constructed in the late 1970s and early 1980s, and originally served Newmarket, Aurora, Richmond Hill, Vaughan, and Markham. The unit wastewater generation rates upon which the design of the sewer system was originally based were revised in 1997 when a comprehensive analysis of flow data was completed as part of the York-Durham Trunk Sewer System Master Plan Class EA. The analysis involved about five years of flow data collected from permanent metering stations in the service area. A 2003 study to update the YDSS Master Plan included further revision of the approach to peak extraneous flow estimation.

In the 2009 Water and Wastewater Master Plan update, the decision was made to modify wastewater generation unit rates to better reflect actual water consumption on a community basis and to take into account the Region's water efficiency and conservation advancements. According to the 2009 Master Plan Unit Rates Report, this approach is desirable because it recognizes the linkage between water use and wastewater generation and considers the specific nature of each municipality.

In general, derivation of wastewater generation rates from water consumption rates should account for water loss due to leakage and outdoor use, and water entering the system from infiltration and inflow. As part of the Water and Wastewater Master Plan Update (York Region, 2009c), 2005 wastewater flow data collected from the Region's treatment plants was compared to 2005 water billing data. It was found that on average, monthly water consumption accounted for 92 percent of the wastewater generated, but monthly values ranged from 74 percent in May (during spring when high infiltration is expected) to 137 percent in August (during summer when outdoor water use is high). On this basis, it was decided that 100 percent of the average water demand would be utilized to represent the average wastewater generation rate for each system.

Wastewater generation rates were then adjusted to include a 90 L/ca/d allowance for average inflow and infiltration. This allowance is a typical design value and is conservative when compared to actual York Region data. Flow measurements from 2006 showed that on average,

wastewater generation by the serviced population was 12 percent greater than water consumption, equating to an average inflow/infiltration rate of only about 32 L/ca/d.

## Section 3.0 Projected Water Consumption and Unit Wastewater Generation Rates for the UYSS Service Area

### 3.1 Water Consumption Rates

**Table D.1** shows projected water consumption rates established as part of the Water and Wastewater Master Plan Update for Aurora, Newmarket, and East Gwillimbury (Holland Landing, Sharon, and Queensville).

As previously noted, the base rates for communities where historical data was unreliable due to past water restrictions or significant proposed changes in population were selected based on data from other communities. The base rates for East Gwillimbury (Holland Landing, Sharon, and Queensville) where the combined population is expected to increase more than five-fold by 2031, were based on data from Newmarket.

Additionally, the base rates for Aurora and Newmarket were adjusted to reflect the anticipated 7 percent reduction in water consumption owing to the Region’s Water Efficiency Program, but the decrease was not applied to new growth in East Gwillimbury (Holland Landing, Sharon, and Queensville).

**Table D.1: UYSS Service Area Projected Unit Water Consumption Rates**

Community		Unit Water Consumption Rate (L/ca/d)	
		Base (2006)	2031
Aurora	Res	241	224
	Emp	252	234
Newmarket	Res	229	213
	Emp	198	184
East Gwillimbury (Holland Landing, Sharon, Queensville)	Res	229	229
	Emp	198	198

### 3.2 Wastewater Generation Rates

**Table D.2** shows projected wastewater generation rates for Aurora, Newmarket, and East Gwillimbury.

**Table D.2: UYSS Service Area Projected Unit Wastewater Generation Rates**

Community		Unit Wastewater Generation Rate (L/ca/d)	
		Base (2006)	2031
Aurora	Res	331	314
	Emp	342	324
Newmarket	Res	319	303
	Emp	288	274
East Gwillimbury (Holland Landing, Sharon, Queensville)	Res	319	319
	Emp	288	288

## Section 4.0 Projected Unit Water Consumption and Wastewater Generation Rates for the UYSS Service Area

### 4.1 Population and Employment

The York Region Official Plan (ROP) December 2009 (approved by the Ministry of Municipal Affairs and Housing on September 7, 2010) locates growth within York Region boundaries to meet the directives of the Growth Plan. The ROP is based on a Regional residential population forecast of 1,500,000 and employment forecast of 780,000 by the year 2031. The numbers forecasted in the ROP form the basis for growth in the UYSS service area.

The boundaries of the UYSS service area do not directly correspond to the municipal boundaries of Aurora and Newmarket, and encompass only a portion of East Gwillimbury; thus the projected populations of these municipalities in the ROP does not precisely represent the UYSS service area population. Similar to a census tract, a traffic zone (TZ) is a small, relatively permanent statistical subdivision of geographic area. As such, a breakdown of population projections by TZ and a map of TZs within the Region was obtained in order to estimate the UYSS service area population. Within the Region, these boundaries are determined in coordination with the Planning and Development Services Department and the Transportation and Works Department. The population and employment projections for each traffic zone within the service area were added together to obtain population and employment projections for the service area. **Table D.3** summarizes the results of this analysis.

**Table D.3: Current and Forecasted Population and Employment for the UYSS Service Area**

Forecasted Item	Aurora		Newmarket		East Gwillimbury (HLQS)		UYSS Service Area	
	2006	2031	2006	2031	2006	2031	2006	2031
Population <sup>(1)</sup>	49,700	70,200	77,600	97,100	13,900	77,900	141,200	245,200
Employment <sup>(1)</sup>	20,300	34,200	42,100	49,400	4,200	31,700	66,600	115,300
<i>Total</i>	<b>70,000</b>	<b>104,400</b>	<b>119,700</b>	<b>146,500</b>	<b>18,100</b>	<b>109,600</b>	<b>207,800</b>	<b>360,500</b>
Service Area Growth (from 2006)	-	34,400	-	26,800	-	91,500		152,700

Sources: (1) York Region Official Plan, December 2009

## 4.2 Water Consumption

The projected annual average day water consumption in megalitres per day (MLD) for each community in the UYSS service area was calculated based on the unit rates given in **Section 3.1** and population projections for the service area presented in **Table D.3**. **Table D.4** shows current (2006) and forecasted water demand for the UYSS service area.

The 2031 unit rates for Aurora and Newmarket were adjusted to reflect the anticipated 7 percent reduction in water consumption owing to the Region's Water Efficiency Program, but the decrease was not applied to new growth in East Gwillimbury (Holland Landing, Sharon, and Queensville). The Region's Water Efficiency Program has had proven success to date and this reduction is expected to continue. However, to be conservative the anticipated 7 percent lower unit rate for water was only applied to growth between 2006 and 2031. As an example the 2031 annual average day water consumption for Aurora was calculated as follows:

$$24.9 \text{ (MLD)} = 49,610 \times 241 \text{ L/ca/d} + 20,204 \times 252 \text{ L/ca/d} + (70,350 - 49,610) \times 224 \text{ L/ca/d} + (34,144 - 20,204) \times 234 \text{ L/ca/d}$$



**Table D.4: UYSS Service Area Projected Water Consumption**

<b>Annual Average Day Water Consumption (MLD)</b>		
<b>Community</b>	<b>2006</b>	<b>2031</b>
<b>Aurora</b>	17.1	24.9
<b>Newmarket</b>	29.3	35.4
<b>East Gwillimbury</b> (Holland Landing, Sharon, Queensville)	11.3	32.1
<b>UYSS Service Area</b>	47.1	80.8

### 4.3 Wastewater Generation

The projected annual average day wastewater generation in megalitres per day (MLD) for each community in the UYSS service area was calculated based on the unit wastewater generation rates given above and population projections for the service area as presented in **Table D.3**. **Table D.5** shows current and forecasted wastewater generation for the UYSS service area. The base (2006) unit wastewater generation rate was used to calculate wastewater flow for the base 2006 population. The reduced unit wastewater generation rate, which takes in to account water conservation, was applied to the growth in population to 2031.

The 2031 wastewater unit rates for Aurora and Newmarket were adjusted to reflect the anticipated 7 percent reduction in water consumption owing to the Region’s Water Efficiency Program, but the decrease was not applied to new growth in East Gwillimbury (Holland Landing, Sharon, and Queensville). A reduction in water usage has an associated reduction in the wastewater generation rate. The Region’s Water Efficiency Program has had proven success to date and this reduction is expected to continue. However, to be conservative the anticipated 7 percent lower unit rate for wastewater was only applied to growth between 2006 and 2031. As an example the 2031 annual average day wastewater generation for Aurora was calculated as follows:

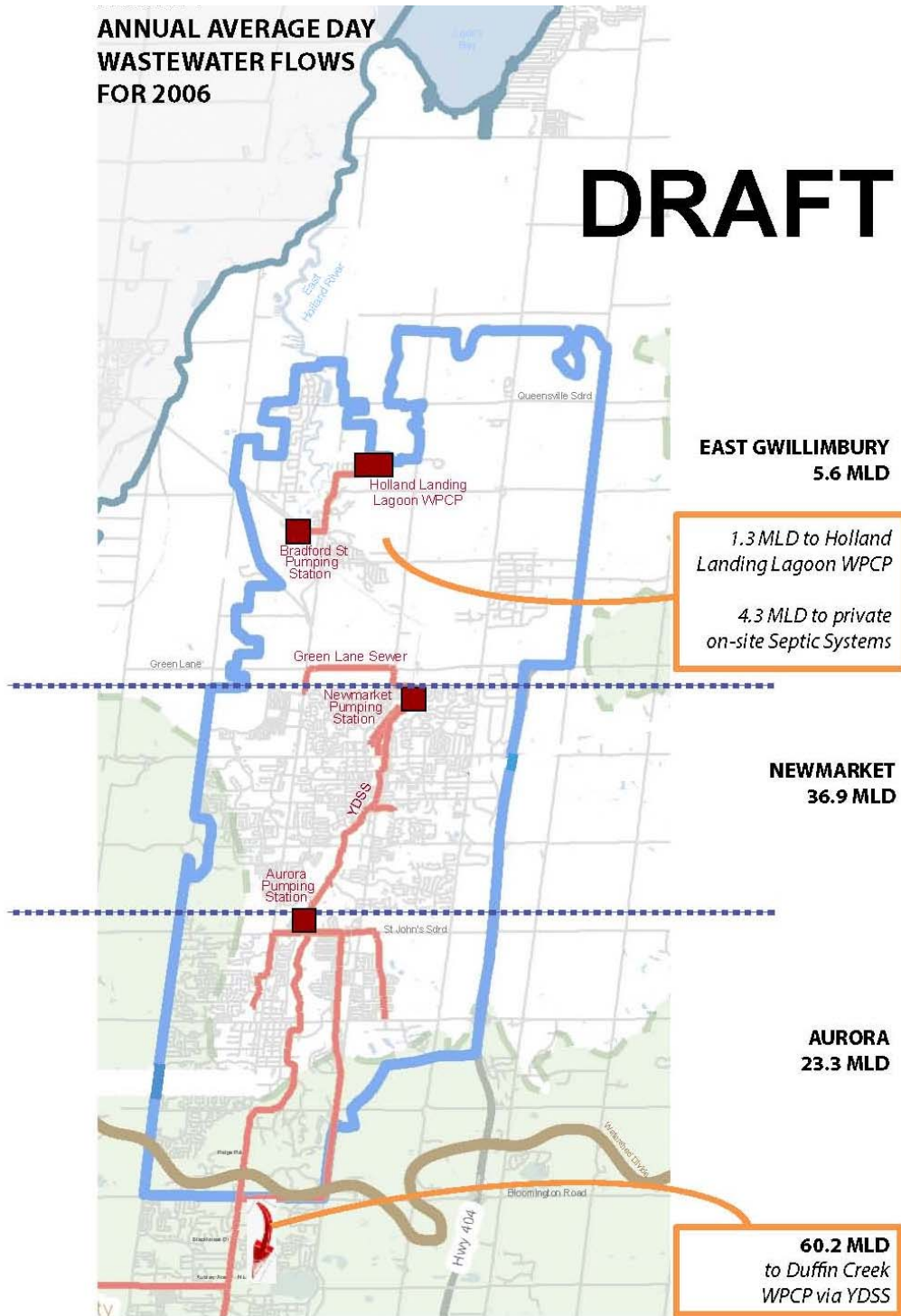
$$34.4 \text{ (MLD)} = 49,610 \times 331 \text{ L/ca/d} + 20,204 \times 342 \text{ L/ca/d} + (70,350 - 49,610) \times 314 \text{ L/ca/d} + (34,144 - 20,204) \times 324 \text{ L/ca/d}$$

**Table D.5: UYSS Service Area Projected Wastewater Generation**

<b>Annual Average Day Wastewater Generation (MLD)</b>		
<b>Community</b>	<b>2006</b>	<b>2031</b>
<b>Aurora</b>	23.3	34.4
<b>Newmarket</b>	36.9	44.9
<ul style="list-style-type: none"> <li>▪ Green Lane sewer (north west corner)</li> <li>▪ All other areas of Newmarket</li> </ul>	--	5.0
<b>East Gwillimbury</b> (Holland Landing, Sharon, Queensville)	5.6	34.0
<b>UYSS Service Area</b>	65.8	113.3

The 2006 annual average day (AAD) wastewater flows by community are shown in **Figure D.1**. The 23.3 MLD of wastewater from Aurora is conveyed by the existing YDSS to the Duffin Creek WPCP. The 36.9 MLD of wastewater from Newmarket is also conveyed by the YDSS to the Duffin Creek WPCP. The Newmarket sewage pumping station (PS) and forcemain conveys wastewater from Newmarket to the Aurora sewage PS. The Aurora sewage PS and forcemain transfers wastewater from Newmarket and Aurora to the YDSS gravity sewer on Yonge St. The total AAD wastewater flow from Newmarket and Aurora to the Duffin Creek WPCP is 60.2 MLD. The 5.6 MLD of wastewater from East Gwillimbury is treated by private on-site septic systems (approximately 4.3 MLD) and the Holland Landing Lagoons WPCP (approximately 1.3 MLD).

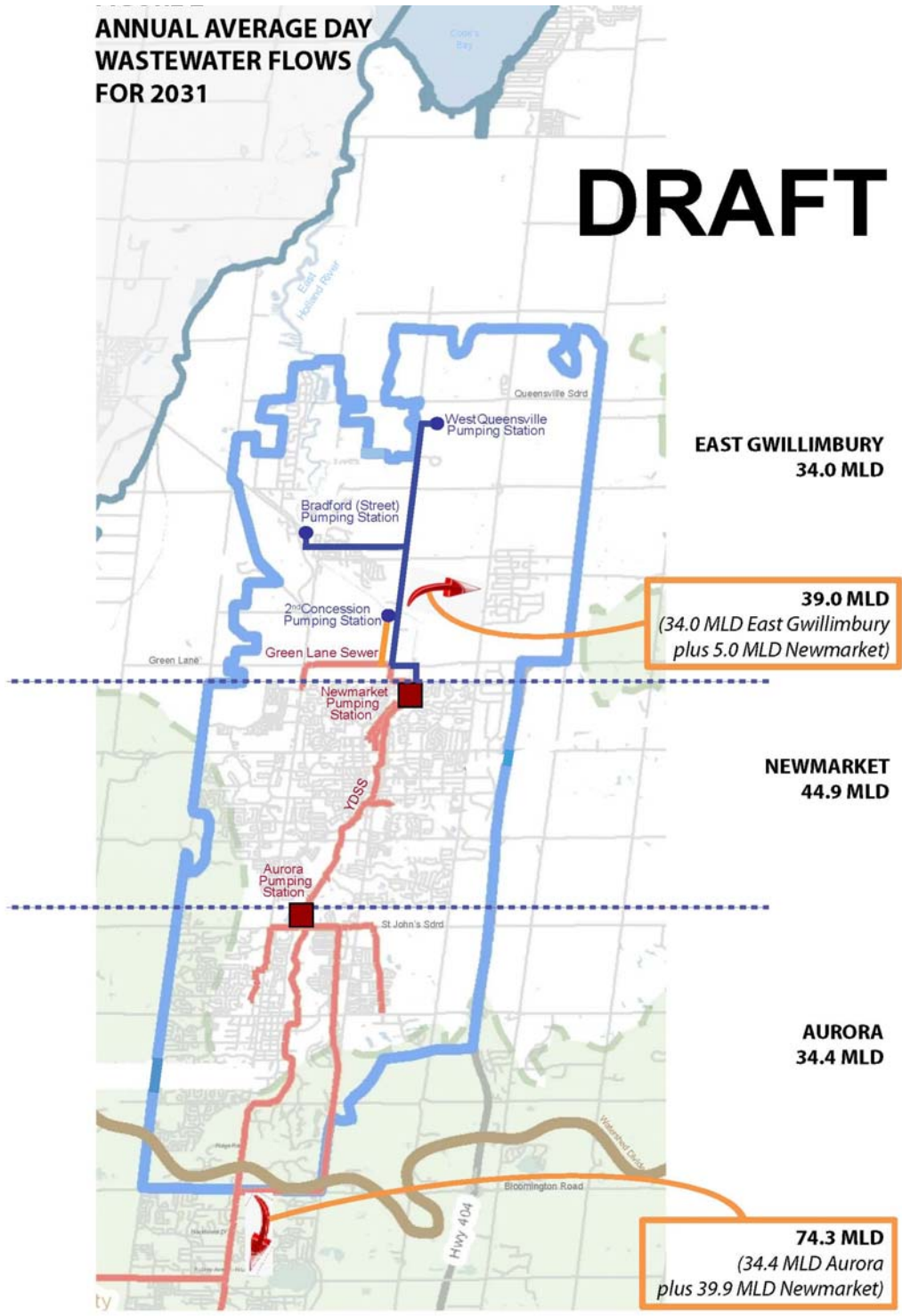
Figure D.1: Annual Average Day Wastewater Flows for 2006





The 2031 AAD wastewater flows by community are shown in **Figure D.2**. The projected wastewater flow from Aurora is 34.4 MLD and from Newmarket 44.9 MLD. Wastewater flows for East Gwillimbury (Holland Landing, Sharon, Queensville) are projected to be 34.0 MLD. This includes the 4.3 MLD that is currently serviced by private on-site septic systems. Wastewater flows from Aurora and Newmarket will continue to be conveyed to the Duffin Creek WPCP via the YDSS with the exception of the north-west corner of Newmarket that is serviced by the Green Lane trunk sewer. The Green Lane trunk sewer is currently connected to the Newmarket PS. It is proposed that this sewer will be redirected to the new Second Concession PS. The projected 2031 flow in the Green Lane trunk sewer from the north-west corner of Newmarket is 5.0 MLD. The total AAD wastewater flow from Newmarket and Aurora to the Duffin Creek WPCP via the YDSS is 74.3 MLD. The total AAD wastewater flow from East Gwillimbury and the north west corner of Newmarket (via the Green Lane Sewer) is 39.0 MLD.

Figure D.2: Annual Average Day Wastewater Flows for 2031



## Section 5.0 Peak Wastewater Flow

For the UYSS service area the peak day and peak hour flows were calculated based on the Duffin Creek WPCP design flow factors. A peak day flow equal to 1.6 times the average annual day flow was used to develop the peak day flows listed in **Table D.6**. A flow equal to 2.5 times the average annual day flow was used to calculate the peak hour flows in **Table D.6**. The design flow factors for Duffin Creek WPCP are considered to be representative for the UYSS service area since the towns of Aurora and Newmarket, which are located within the service area, are serviced by the YDSS and Duffin Creek WPCP.

**Table D.6: UYSS Service Area Peak Wastewater Flows**

Community	Peak Wastewater Flow (MLD)				
	Peak Day	2006		2031	
		Peak Hour	Peak Day	Peak Hour	
Aurora	37.3	58.3	55.0	86.0	
Newmarket	59.0	92.3	71.8	112.3	
East Gwillimbury	n/a	n/a	54.4	85.0	
<b>Flow to Duffin Creek WPCP via YDSS</b>	96.3	150.6	118.9	185.8	
<b>Flow to selected UYSS alternative</b>	n/a	n/a	62.4	97.5	

It is proposed that wastewater from Aurora and most of Newmarket will continue to be conveyed to the Duffin Creek WPCP via the existing YDSS. The rated capacity of the YDSS in Aurora is 1,820 L/s (157 MLD). The projected peak day flow in 2031 is 118.9 MLD which is less than the rated capacity of 157 MLD.

However, the peak hour flow in 2031 is 185.8 MLD which is 28.8 MLD above the rated capacity of the system. The current 20,000 cubic metres of off-line storage at the Newmarket PS and Aurora PS will provide 16.5 hours of capacity at peak hour flow.