

# WASTEWATER SYSTEM CAPACITY REVIEW

COMMUNITY OF AYR  
WASTEWATER SYSTEM

PREPARED FOR:

GREEN SCHEELS PIDGEON

July 31, 2001

Green Scheels Pidgeon  
72 Victoria Street, Suite 201  
Kitchener, Ontario  
N2G 4Y9

Attention: Mr. Tim McCabe, M.C.I.P., R.P.P.  
Senior Associate

Dear Sir:

**Re: Wastewater System Capacity Review  
Community of Ayr  
Our Project No. 01030**

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We are pleased to present herewith our Wastewater System Capacity Review on the Community of Ayr wastewater system. This review is intended to report, in general terms, the existing capacity of the trunk sewers in the Community of Ayr and state the capacities of the related works. The review was commissioned by Green Scheels Pidgeon in conjunction with the Township of North Dumfries as part of the Ayr Urban Area community planning process.

Both the Region of Waterloo and The Township of North Dumfries jointly administer the Community of Ayr wastewater system, with the Township currently responsible for the operation and maintenance of the sewage collection system and the Region responsible for the operation and maintenance of the pumping stations and treatment works. This capacity review encompasses the wastewater system as a whole.

Should you have any questions with regard to this review, please feel free to contact the undersigned.

Yours truly,

**SRM ASSOCIATES**

Charlie Tompsett, P.Eng.  
Project Engineer

Mark S. Lenters, P.Eng.  
General Manager

CT/ct

Attch.

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**S1** COMMUNITY OF AYR - SANITARY SEWAGE SYSTEM

## **1.0 INTRODUCTION AND BACKGROUND**

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### **1.1 GENERAL**

This review provides a summary of the existing sanitary sewage collection system with regard to future servicing requirements for the Ayr Community Plan. The contents of the following summary have been prepared for Green Scheels Pidgeon as part of a Master Community Plan to identify and evaluate a wide variety of issues prior to the next stage of development approvals.

Specifically, the sanitary sewage collection system was reviewed in terms of documenting the existing pipe networks, the capacities of the existing systems and an evaluation of the present system conditions in terms of servicing proposed future community growth. The next stage of this review will encompass an evaluation of future sanitary sewer servicing requirements once the preferred land use scenario for the community has been determined. The Township is currently responsible for the operation and maintenance of the sewage collection system and the Region is responsible for the operation and maintenance of the pumping stations and treatment works.

### **1.2 BACKGROUND TO THE PROJECT**

The community of Ayr has experienced considerable residential growth since the mid 1980's. As a result, the Ayr Wastewater Treatment Plant has reached over 100% of its capacity, leading the Township to evaluate a future growth plan before additional development is approved.

On November 23, 2000 the first Open House Public Meeting for the Ayr Community Plan was held. At this meeting several consultants led by Green Scheels Pidgeon answered questions relating to the Ayr Community Plan. As part of the open house, plans of the existing sewage collection system were prepared noting the location of existing sewers, pumping stations and the wastewater treatment plant. This review continues the process of evaluating the existing sewage collection system in terms of the capacities of the main trunk sewers.

## 2.0 EXISTING CONDITIONS

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### 2.1 SITE LOCATION AND TOPOGRAPHY

The community of Ayr is located east of the County of Oxford and north of the County of Brant in the Township of North Dumfries. Highway 401 stretches across the northwest area of the Township with Ayr located to the southwest.

Current population of the community is approximately 3,770 with a forecast of 5,060 by the year 2016.

Regional Road 58 runs centrally through the community and provides access to Kitchener to the north and Paris and Brantford to the south. Regional Road 49 provides access to Cambridge to the east. A Canadian Pacific Railway line runs east/west through the northerly portion of the community.

Cedar Creek flows southwesterly into the central portion of the community through the Jedburgh and Watson Ponds respectively. It connects to the Nith River which winds itself through the western half of the community.

Topography varies within the Ayr Urban area from approximately 310m on the eastern side of Northumberland Street to approximately 280m on the western side of Northumberland Street near the Nith River and Piper Street. The land surface slopes naturally inwards towards the Nith River and Cedar Creek located near the central area of the community. Sewage flow generally follows the natural slope of the land towards the Nith River and Cedar Creek.

### 2.2 EXISTING WASTEWATER SERVICES

The existing sanitary sewage collection system consists of approximately 22 km of gravity sewer pipe with trunk sewer mains combining near the centre of the community at Stanley Street and Northumberland Street. The main trunk sewer takes flow from this intersection westward along Piper Street to Church Street and William Street where it flows south to Water Street. Flows then continue west along Water Street to the Rose Street Sewage Pumping Station at the northeast corner of Water Street and Rose Street.

For the purpose of this review, six (6) trunk mains were identified for the accumulation of flows to the Rose Street Sewage Pumping Station which is then pumped to the Ayr Wastewater Treatment Plant.

The north/west trunk (T1) runs on Northumberland Street from 375m south of Greenfield Road south to Stanley Street and includes flows from Northumberland Street, Nith River Way, Broom Street, Seylor Street, Simone Place, Melissa Court, Nith River Court, Douglas Drive, Robson Street, Bute Street, McCrae Street, Thompson Street, Elliot Street, Colquhoun Street, Manley Street, McDonald Street, Gibson Street, the western length of Inglis Street and the western length of Hall Street.

The central trunk (T2) runs on Stanley Street from Swan Street to Northumberland Street, taking in local flows along Stanley Street.

The south trunk (T3) runs along the southwest length of Hilltop Drive from Wilson Street to the west leg of Watson Crescent then north to Swan Street and north to Stanley Street. Flows from Burnside Drive, Watson Crescent, Mitchell Street, Field Street, Hunt Street, Jones Court, Fowler Street, St. Andrews Street, Hilltop Drive and Swan Street are included with this trunk.

The east trunk main (T4) runs on Stanley Street from Main Street to Swan Street and takes in local flows from Stanley Street and trunk flow from the north/east trunk sewer (T5).

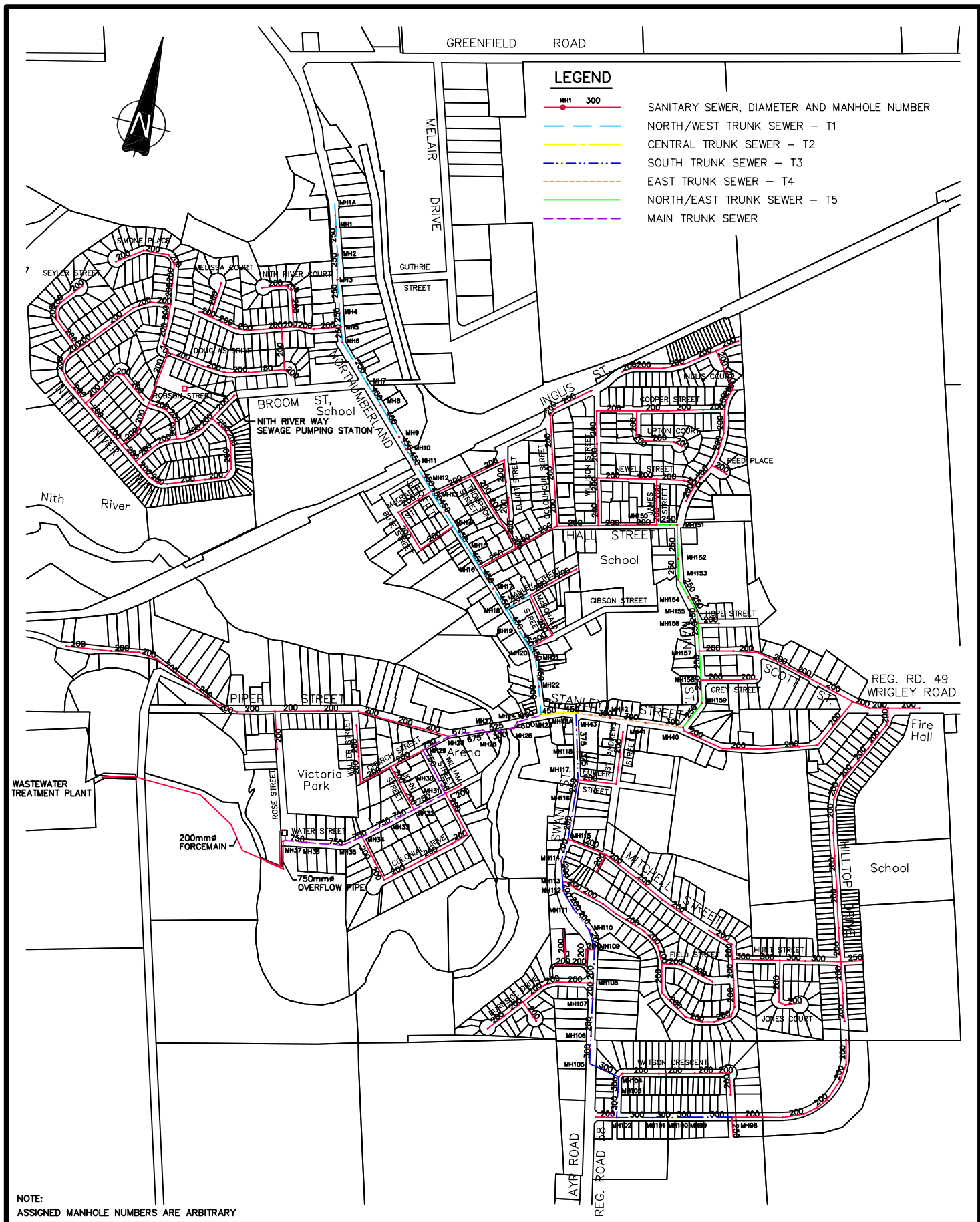
The north/east trunk sewer (T5) runs along Hall Street and Main Street from James Street east to Main Street and then south to Stanley Street. It takes in flows from Main Street, Scott Street, Cooper Street, Upton Court, Reed Place, Newell Street, James Street, Willison Street, Hope Street, Grey Street, the east length of Hall Street, the northern tip of Hilltop Drive and the northeast leg of Stanley Street.

The main trunk sewer carries the confluence of trunk flows T1-T5 to the Rose Street Sewage Pumping Station.

These trunk mains are shown on the enclosed plan of the existing sewage system and on Figure 1.

There are two (2) sewage pumping stations within the community of Ayr. The Rose Street Sewage Pumping Station is located on the northeast corner of Water Street and Rose Street. The Nith River Way Pumping Station is located on the north side of Broom Street at the intersection of Broom Street and Nith River Way. The Rose Street Pumping Station is the main pumping station which receives flows from all areas of the community and pumps through a 200 mm forcemain directly to the Ayr Wastewater Treatment Plant.

The Ayr Wastewater Treatment Plant is located on Township Road #11 approximately 300m southwest of the west limit of Piper Street on the Nith River.



NOTE:  
ASSIGNED MANHOLE NUMBERS ARE ARBITRARY

DATE  
JULY, 2001

SCALE  
1:12,500

COMMUNITY OF AYR  
SANITARY SEWAGE SYSTEM – FIGURE 1

**S R M**  
ASSOCIATES  
MUNICIPAL ENGINEERING

## 3.0 EXISTING WASTEWATER SYSTEM CAPACITY

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### 3.1 SANITARY SEWAGE COLLECTION SYSTEM

The sanitary sewage collection system in the community of Ayr was reviewed in terms of flows within the existing sewer pipe network. Flows were estimated using standard design methods for the existing land uses within the community. Design parameters including infiltration values, sewage flows, peaking factors, pipe slopes and sizes, and population density were obtained from the Region of Waterloo, Township of North Dumfries, Ontario Clean Water Agency (OCWA), Earthtech Canada and the Ministry of the Environment Guidelines for the Design of Sanitary Sewage Works.

Standard design spreadsheets were used to estimate design flows that would approximate those flows used in determining the sizes of the existing sewage collection pipes. Actual flows are less than the design flows used in the spreadsheet calculations. For calculation purposes manhole numbers were arbitrarily assigned. Design parameters are noted on the enclosed sanitary sewer design sheets in Appendix A.

Results of the review using design flows indicate that there is capacity remaining in trunk sewers T1, T2, T4, T5 and the main trunk. Trunk T3 is nearing the limit of its capacity because of a restriction in pipe diameter on Swan Street at Mitchell Street.

The east trunk sewer (T4) receives flow from the north/east trunk sewer (T5) and local flows from Stanley Street. Including these flows, the remaining capacity of this trunk sewer is 39.5 L/s or 800 housing units. If required the capacity of this sewer could be increased by upgrading its entire 270 m length from 300 mm to 400 mm diameter pipe. This would increase the available capacity to 103.3 L/s or 2,090 housing units and would only be necessary following corresponding upgrades to the north/east trunk sewer and local sewers feeding T5.

As per the attached sanitary sewer design sheets there is remaining capacity in the north/east trunk sewer (T5) at Stanley Street and Scott Street of 26.36 L/s. Development to the north of Scott Street and east of Main Street could connect to this main through local sewers adjacent to Scott Street or Main Street. Depending on where the connection or connections are made for additional development, flows would be limited by the capacities of the existing 200 mm and 250 mm sewers along Inglis Street, Inglis Court, Newell Street, James Street, Main Street north, Scott Street and Hope Street. Typical capacities of sewers of this diameter are 23 L/s for 200 mm pipe at a slope of 0.45% and 34 L/s for 250 mm pipe at a slope of 0.30%. As up to 6 L/s of design capacity is presently unavailable in these sewers from existing development, it follows that only 17 L/s is conservatively available for new development for the land area north of Scott Street and east of Main Street, assuming no improvements are made to the existing sewer system in this area. Based on a residential per capita design flow of 0.0037 L/s (323.6 L/c/d), peaking factor of 2.7, infiltration of 0.0064 L/s/capita and population density of 3.013 per housing unit, a capacity of 17 L/s covers to 344 housing units that could potentially be connected. If improvements are made to the local sewers where additional development flows will pass, the number of serviceable housing units could be increased to 534 (26.36 L/s) in this area. This, however, would not leave any remaining design flow capacity in the north/east trunk sewer (T5). Upgrading the entire 585 m length of this sewer from 250 mm to 300 mm diameter pipe would increase its remaining capacity to 50.31 L/s or 1,018 housing units.

The capacity remaining in the north/west trunk (T1) is limited by the 250 mm diameter sewer along Northumberland Street south of Nith River Way. An additional 17.67 L/s of flow could be allowed through this section of the sewer under existing conditions. However, replacing this 165 m length of 250 mm diameter sewer with a larger 400 mm diameter pipe would increase the available capacity of the remaining downstream length of sewer to 96.3 L/s. In terms of the foregoing design parameters, approximately 1,949

housing units could then be connected to this trunk sewer at or south of Nith River Way and Northumberland Street. The current remaining capacity of the north/west trunk sewer (T1) north of Nith River Way is 32.9 L/s. If additional development were to be connected to the north limit of the existing sanitary sewer on Northumberland Street, capacity would be limited again to 17.67 L/s by the 250 mm sewer south of Nith River Way. Increasing the diameter of this same 165 m section of sewer to 400 mm would allow a full 32.9 L/s to be connected at the north limit of the north/west trunk sewer or allow a flow of 96.3 L/s to be connected at or south of Nith River Way. If a full 32.9 was connected at the north limit, it follows that only 63.4 L/s could be connected at or south of Nith River Way. To increase the available capacity of the entire north/west sewer to 96.3 L/s would involve increasing the diameter of the 310 m of 250 mm sewer north of Nith River Way to 400 mm diameter pipe and increasing the diameter of the 165 m of sewer south of Nith River Way to 400 mm diameter.

The remaining capacity in the central trunk sewer (T2) is 103.45 L/s which could easily accommodate additional flow from development north of Scott Street and east of Main Street. Additional flows to this trunk would not be from local development, but from the potential additional flows from the north/east (T5), east (T4) and/or south (T3) trunk sewers. In terms of development, an additional 2,094 residential units could at present potentially be connected to this sewer from the east or south trunk sewers before it would reach its capacity. If this 85 m length of 450 mm sewer was replaced by a 600 mm diameter sewer, the remaining capacity would increase to 271.55 L/s allowing a potential 5,597 residential units to be connected. However, as discussed below this flow would be limited by the downstream capacity of the main trunk sewer to the Rose Street Pumping Station.

Based on the attached sanitary sewer design sheets, the available capacity remaining in the south trunk (T3) is limited by the 200 mm diameter sewer on Swan Street between the north and south legs of Mitchell Street. Present capacity of this section of 200 mm diameter sewer is 26.5 L/s. Peak design flows at 21.27 L/s indicate only 5.23 L/s of capacity remains in this area. Increasing 110 m of this 200 mm diameter sewer on Swan Street between the north and south legs of Mitchell Street to a 300 mm diameter sewer would allow an additional capacity of approximately 12.4 L/s or 250 residential units to be connected to this trunk for development south of Hilltop Drive. Further capacity increases could be achieved by increasing 130m of the 200 mm diameter on Swan Street south of Burnside Drive to 135 m north of Burnside Drive. Upgrading this 265 m length of 200 mm sewer to a 300 mm sewer in conjunction with upgrading the 110 m of 200 mm sewer on Swan Street at Mitchell Street would allow additional capacity of approximately 37.7L/s or 1,156 residential units to be connected to the south trunk sewer.

A review of the main trunk sewer, which receives T1 to T5 flows, through the western portion of the urban area indicates that there is no foreseeable deficiency in pipe size for this sewer from Northumberland Street and Stanley Street through to the Rose Street Sewage Pumping Station. The present capacity available in the main trunk sewer is 173.3 L/s (3,508 housing units) based on the 90 m length of 750 mm sewer on Water Street between William Street and John Street. Potential flows include 103.45 L/s from T2 and 96.3 L/s from T1 for a total of 199.75 L/s. However, this is equivalent to approximately 4,044 additional residential units or 12,185 people, which is well beyond the forecast population of 5,060 by 2016. As the present capacity of the main trunk sewer is 173.3 L/s or 3,508 residential units, replacement oversizing of any lengths on this sewer are not required in the foreseeable future. The previously noted trunk sewer upgrades or oversizing will not present a problem because the downstream main trunk sewer is adequate to handle the additional flow.

## 3.2 SEWAGE PUMPING STATIONS

The previous potential residential developments are theoretical and are limited by the existing capacity of the Rose Street Sewage Pumping Station and the Ayr Wastewater Treatment Plant. From information

gathered from the Region of Waterloo and OCWA, the Rose Street Sewage Pumping Station presently has a firm capacity of 2,000 m<sup>3</sup>/day (23.15 L/s) provided by 2 centrifugal raw sewage pumps that operate in a lead/lag mode to provide equal wear on each pump. Improvements this year are planned by the Region of Waterloo to increase the capacity of each pump to 4,250 m<sup>3</sup>/day (49.19 L/s) for future growth of the Community and to better handle peak instantaneous flows. The increased capacity of the pumping station will be capable of sustaining peak flows for the forecast population of 5,060 by 2016. Further capacity increases to the Rose Street Sewage Pumping Station will be required beyond a population of 5,060.

The Nith River Way Pumping Station has a firm capacity of 22.08 L/s provided by 2 raw sewage pumps operating in a lead/lag mode.

### **3.3 WASTEWATER TREATMENT FACILITY**

The Ayr Wastewater Treatment Facility is an extended aeration plant operated by OCWA on behalf of the Region of Waterloo. The treatment plant has a rated capacity of 1,180 m<sup>3</sup>/day. Based on the 2001 Water and Wastewater Monitoring Report published by the Region of Waterloo in June 2001, the flows at the plant averaged 1,220 m<sup>3</sup>/day for the year 2000 which is up approximately 13% from 1999 flows. This plant has now exceeded its rated capacity with no remaining capacity for additional development (i.e. approved draft plans and infilling of available land).

Interim measures to upgrade the pumping station capacity and plant capacity to 1,500 m<sup>3</sup>/day including a water efficiency program are presently being implemented, but will not affect the plant until 2002. The estimated cost of the current upgrades is \$700,000.00. After 2006, the Region of Waterloo has budgeted for additional expansion in their 10 year capital forecast.

A Class EA was completed by Hydromantis Inc. and XCG Consultants Limited in October 2000 to determine a means of providing interim capacity for approved development within Ayr including an investigation of infiltration flows. It was determined in the Class EA that infiltration flows are of typical values for an urban area. The Class EA also noted that the upgrades to the wastewater treatment plant will service the Community to an approximate population of 4,314 (including the water efficiency program) when forecast flows are expected to reach 1,500 m<sup>3</sup>/d. This is predicted to occur somewhere in the time period from year 2004 to year 2007 depending on the growth rate of the of the current population of 3,770 and the success of the water efficiency program. The Class EA states that the upgrades will service an additional 80 to 200 housing units above the current population. However, the Region of Waterloo's 2001 Water and Wastewater Monitoring Report states that current commitments including building permits, unbuilt registered units, servicing agreements and draft approvals total 129 units. It follows that including current commitments, the upgrades to the plant can sustain a maximum of 71 additional residential units.

There has been some regional discussion involving the requirements for the ultimate expansion of the Ayr Wastewater Treatment Facility for the year 2026. Ultimate expansion plans could accommodate the Official Plan projected population of 5,000 people plus oversizing for an ultimate capacity of 3,000 m<sup>3</sup>/day. The expanded plant would include tertiary treatment including effluent polishing to maintain low levels of phosphorous. The expansion would require an environmental assessment of assimilative capacity of the Nith River and MOE re-certification. The estimated cost of this project is \$4,300,000.00.

Actions to improve the wastewater capacity of the treatment plant are being taken in conjunction with a review of the capacity of the water treatment facility.

## 4.0 CONCLUSIONS

Upgrades currently being implemented at the Ayr Wastewater Treatment Facility will increase the capacity of the plant to 1,500 m<sup>3</sup>/day. The additional capacity above the current capacity of 1,180 m<sup>3</sup>/d including the water efficiency program is forecast to service the Community to a population of 4,314 with up to 200 additional housing units. As present commitments total 129 residential units, it follows that a maximum of 71 additional units beyond current commitments can be allowed to connect to the sewage collection system. The 320 m<sup>3</sup>/d of additional average day capacity equates to an average day sewer flow of 3.7 L/s/c or a peak sewer design flow including infiltration of 16.4 L/s. Sewer capacity in all of the trunk sewers can presently handle this additional flow except for the south trunk sewer. Continued development in the south end of the community near Hilltop Drive beyond sewage flows of 5.23 L/s will result in the south trunk sewer reaching its design capacity at Mitchell Street. To resolve this problem and to allow for additional expansion will require oversizing of this sewer as noted in Table 1 below.

Ultimate expansion of the Ayr Wastewater Treatment Facility to 3,000 m<sup>3</sup>/day would allow an additional 1,820 m<sup>3</sup>/day (21 L/s) of flow beyond the present average day flow of 1,220 m<sup>3</sup>/day. This equates to a peak sewer design flow including infiltration of 93 L/s. If all of this flow was connected to the east, south, north/east or north/west trunk sewer, upgrades to the related restricting sewers would be required as noted in Table 1. However, as it is unlikely that all of this flow would be connected to any one trunk sewer (eg. T1, T3, T4 or T5), the upgrades indicated in the following table will be adequate up to the capacities noted.

<b>TABLE 1 SUMMARY OF TRUNK SANITARY SEWER CAPACITY</b>							
Trunk	Present Capacity			Effect of Potential Upgrades on Trunk Capacity			
	Existing Diameter (mm)	Available Capacity (L/s)	Theoretical Additional Housing Units	Replacement Diameter (mm)	Replacement Length (m) and Location	Available Capacity After Replacement (L/s)	Theoretical Additional Housing Units After Replacement
North/West – T1 (Northumberland Street)	250	17.67	358	400	475 (310 m north of Nith River Way + 165 m south of Nith River Way)	96.3	1949
Central – T2 (Stanley Street between Swan & Northumberland)	450	103.45	2094	600	85 (between Swan & Northumberland)	271.55	5597
South – T3 (Swan Street & 300 m of Hilltop Drive)	200	5.23	106	300	110 (between north and south legs of Mitchell St.)	12.4	250

**TABLE 1  
SUMMARY OF TRUNK SANITARY SEWER CAPACITY**

Trunk	Present Capacity			Effect of Potential Upgrades on Trunk Capacity			
	Existing Diameter (mm)	Available Capacity (L/s)	Theoretical Additional Housing Units	Replacement Diameter (mm)	Replacement Length (m) and Location	Available Capacity After Replacement (L/s)	Theoretical Additional Housing Units After Replacement
South – T3 (Swan Street & 300 m of Hilltop Drive)	200	5.23	106	300	265 (135 m north of Burnside Drive and 130 m south of Burnside Drive)	37.7 <sup>2</sup>	763
East – T4 (Stanley Street between Main & Swan Street)	300	39.5	344	400	270 (between Main Street and Swan Street)	103.3	2090
North/East – T5 (Main Street from James St. to Stanley Street)	250	26.36	534	300	585 (from James Street to Stanley Street)	50.31	1018
Main Trunk (from Northumberland Street to the Ayr Wastewater Treatment Plant)	750	173.3	3508	N/A <sup>3</sup>	N/A	N/A	N/A

1. Limited by the capacity of the Rose Street Sewage Pumping Station and the Ayr Wastewater Treatment Plant.
2. Assumes upgraded sewer on Swan Street between north and south legs of Mitchell Street. To further increase the capacity of T3 would require increasing the sewer diameter from the north leg of Mitchell Street to Stanley Street.
3. N/A – not applicable since Main Trunk is adequate for any foreseeable sewage flows.