GSS ENGINEERING CONSULTANTS LTD

REPORT

Durham Water and Wastewater Treatment System Capacity Assessment

(Revised: September 28, 2021)
September 2021

21-036

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LIST OF ABBREVIATIONS

Cast Iron	CI
Ductile Iron	DI
Environmental Compliance Approval	ECA
Functional Servicing Report	FSR
Litres per capita per day	lcpd
Ministry of the Environment, Conservation & Parks	MECP
Ontario Provincial Standards Specifications	OPSS
Water Treatment Plant	WTP
Wastewater Treatment Plant	WWTP

1.0 INTRODUCTION

Durham town within the Municipality of West Grey is experiencing significant growth pressure due to its location and access by Provincial Highway 6 and Grey County Road #4. Developer's interest in Durham arises from its proximity to Kitchener-Waterloo, Guelph region as well as availability of communal water supply and wastewater treatment. Availability of these two utilities are important for large subdivision development. Due to this heightened interest, Municipality of West Grey intends to undertake an investigation to complete water and wastewater treatment plant capacity assessment and determine if West Grey can continue to engage with prospective developers and commit to water and wastewater treatment systems capacity availability for development. This report primarily addresses the water treatment and wastewater treatment capacity issues, and cursorily discuss water supply (distribution system) and wastewater collection (sanitary sewer) system.

2.0 RATED CAPACITY OF WATER AND WASTEWATER SYSTEMS

For information, water treatment plants are designed for “Maximum Daily Demand” on an annual basis. However, the wastewater treatment plants are designed for “Average Daily Demand” on an annual basis. Typically, high water demands occur during summer periods when water consumption goes up due to summer activities including but not limited to domestic lawn watering needs and swimming pools. Some towns/cities with aged and corroded watermains can experience higher water demand during winter and spring months when watermain break occurs due to frost movement. Sometimes, residents are allowed to leave their taps running to prevent freezing of water service pipes. This occurs where water services are poorly constructed and are shallow in depth. This can lead to high water demands in winter/spring. Typically, if such high water demands occur sparingly, such events can be ignored as “unusual events”, however if such events happen regularly, they cannot be ignored in rated capacity utilization calculations.

In case of wastewater systems, rated capacity of wastewater treatment plant (WWTP) is based on average daily wastewater flows treated at the plant. So, any abnormal peaks at certain times of the year due to inflow and infiltration, may not adversely impact the rated capacity utilization in a significant way. They however should not be ignored as such events can overwhelm sewage collection system leading to basement flooding or overflow of sewage pumping station(s) or bypass of treatment units at the WWTP leading to potential non-compliance of Environmental Compliance Approval (ECA) conditions.

In an ideal water supply and treatment system and wastewater collection and treatment system in a municipality, water supplied, and wastewater treated at plant shall be comparable. However, if water treated and supplied is much higher than wastewater collected and treated, it is an indication of water distribution system losses. Conversely, if wastewater collection and treatment is much larger than water supply, then it indicates larger extraneous flows (inflow and infiltration) into sanitary sewers. Both situations are undesirable.

The rated capacities are as follows and cannot be exceeded.

Water Treatment Plants (Well #1B and Well #2 & 2A Pumphouse)	3011 m³/day
Wastewater Treatment Plant	2184 m³/day

The rated capacity of WTP is a combination of rated capacity of Well 1B Pumphouse and Well #2 and 2A Pumphouses.

3.0 CAPACITY UTILIZATION IN EXISTING CONDITIONS

Durham currently has 1310 billable units for water and 1265 billable units for wastewater.

Annual Operations and Maintenance Reports for WWTP and daily water and wastewater records for recent years were also obtained from operating authority. The data was analysed to determine maximum day water demands and annual average day wastewater flow to WWTP. Water meter records for residential, commercial, institutional, etc. were also obtained from West Grey and analyzed. In order to assess the current capacity utilization, water and wastewater records were assessed from 2013 to 2020.

Table 3-1 provides a summary of Durham WWTP capacity utilization, as recorded in the Annual Operations & Maintenance Reports submitted to Ministry of the Environment, Conservation & Parks (MECP). The WWTP has a rated capacity of 2184 m³/day. The capacity utilization varies from a low of 28.8% to 51.4% and was highest in 2014, at 51.4% (1123 m³/day). The higher capacity utilization was attributed to a number of houses allowed to run the tap continually to prevent water service freezing and possibly other reasons. It could also be an indication of extraneous flows entering the collection system. The above noted water wastage to sanitary sewers does occur every year but with varying amounts and is dependent on weather.

Table 3-2 provides a summary of water use, as recorded by Veolia Canada.

The existing water treatment plants have a rated capacity of 3011 m³/day. In the last column of **Table 3-2,** percentage capacity utilization of water works has been provided. Year 2014 indicates a capacity utilization of 76% (2289 m³/day) and 2015 indicates a capacity utilization of 71.6% (2157 m³/day). The capacity utilization in 2014 & 2015 is much higher than other years. An investigation revealed that water consumption was higher in 2014 and 2015 due to a combination of watermain breaks and water loss by water customers who were permitted to leave a tap running in winter to prevent freezing of water service pipe. Therefore, highest capacity utilization of water works is 1603 m³/day in 2013 if we ignore 2014 and 2015 water consumption. Watermain breaks, etc. is <u>not</u> a regular feature, and can occur in some years but not others. Watermain breaks have not caused significant water loss since 2015. This water wastage can be reduced/controlled by replacing old cast iron (CI) or ductile iron (DI) watermains.

Based on the foregoing data analysis, “current surplus capacity” (not accounting for Sunvale and Broos Subdivisions) is computed as follows:

Table 3-1

Summary of Durham Wastewater Treatment Plant

Capacity Utilization

June 1, 2021 21-036

Year	Annual Avg. Day (m^3/day)	Max Day (m^3/day)	Month When A Max Occurred	% Capacity Utilization	Comments
2013	976	2202	April	44.7	
2014	1123	4390	April	51.4	Higher wastewater flow due to a number of hoses allowed to run to prevent freezing
2015	823	1309	April	37.7	
2016	880	3781	April	40.3	
2017	981	2037	March	44.9	
2018	705	2643	February	32.3	
2019	702	1536	April	32.1	
2020	629	1271	January	28.8	
Worst Case Scenario	**1123 m^3/day**				
Rated Capacity of Wastewater Treatment Plant:		**2184 m^3/day**			

Table 3-2

Summary of Durham Water Treatment Plant

Capacity Utilization

Durham Water Works (2013 - 2020)

June 1, 2021 21-036

Year	Max Day (m^3/day)	Max Day Occurrence Date	% Capacity Utilization	Comments
2013	1603	Feb. 14	53.2	
2014	2289	Apr. 13 & 14	76.0	High water consumption due to approximately 30 hoses allowed to run water to prevent water freezing.
2015	2157	Feb. 23	71.6	High water consumption due to combination of 2 watermain breaks and garden hoses allowed to waste the water.
2016	1455	June 6	48.3	
2017	1309	Jan. 14	43.5	
2018	1470	Dec. 29	48.8	
2019	1482	Jan. 6	49.2	
2020	1591	July 6	52.8	
Worst Case Scenario	**1603 m^3/day**			High water demands of 2014 and 2015 neglected.
Rated Capacity of Water Works:	**3,011 m^3/day**			

Note: Rated capacity of Well #1B pumphouse 1375 m^3/day

Rated capacity of Well #2 pumphouse 1636 m^3/day

Rated capacity of water works 3011 m^3/day

Current Surplus Capacity of Durham WTP = Rated capacity – current capacity utilization

= 3011 m³/day – 1603 m³/day

= 1408 m³/day

The surplus water treatment capacity without new development is 1408 m³/day or 46.7% of rated capacity.

Current Surplus Capacity of Durham WWTP = Rated capacity – current capacity utilization

= 2184 m³/day – 1123 m³/day

= 1061 m³/day

The surplus WWTP capacity without new development is 1061 m³/day or 48.5% of rated capacity.

4.0 NEW APPROVED SUBDIVISIONS

As per our understanding, West Grey has entered into an agreement and has allowed permission to develop two (2) subdivisions in northeast end of Durham The information from the Functional Servicing Report (FSR) for Subdivisions is as follows:

Sunvale Homes: This subdivision, when fully developed shall include approximately 247 units comprising of single family lots, semi-detached lots, townhome blocks as per the subdivision plans. Population of 765 people is forecasted to live in the subdivision.

The FSR determined the water demand based on Provincial "Design Guidelines for Drinking Water System, 2008" issued by MECP. The guideline recommends a water demand of 270 to 450 L/capita/ day. Developer's engineer utilized 450 lcpd (litres per capita per day) in the FSR. At 450 lcpd average day water demand is anticipated to be 344 m³/day.

Developer's engineer estimated maximum day demand of 947 m³/day based on Maximum Day Factor of 2.75 for a population of 765 people. In our opinion, maximum day shall be lower, because after integration of subdivision with town, maximum day factor shall be about 2.0 and not 2.75 as the overall population equivalent of town shall be close to 4670. Based on this, we estimate maximum day demand to be 688 m³/day as opposed to 947 m³/day calculated by developers engineer.

At 450 lcpd, average day wastewater flow to treatment plant is anticipated to be 344 m³/day. The report does not specify the amount of infiltration into sanitary sewer that will be collected and eventually reach the treatment plant.

Assuming that sanitary sewer construction shall be as per OPSS (Ontario Provincial Standard Specifications), we have estimated the infiltration amount for capacity assessment. At an infiltration rate of 0.075 L/mm ø of sewer/100 m of sanitary sewer, we estimate the infiltration in subdivision sewers to be 10 m³/day.

Therefore, Sunvale Homes subdivision is anticipated to contribute 354 m³/day of wastewater to the Wastewater Treatment Plant (WWTP) and generates a maximum day water demand of 688 m³/day.

Broos Subdivision: This subdivision when fully developed shall include approximately 205 units comprising of single family lots, semi-detached lots, townhome blocks in the subdivision plans. Population of 631 people is forecasted to live in the subdivision.

At 450 lcpd (litres per capita per day) and using a max day factor of 2.0 as opposed to 2.75 as utilized by developer's engineer, maximum water demand is anticipated to be 568 m³/day as opposed to 781 m³/day calculated by developers engineer.

At 450 lcpd, average day wastewater flow to treatment plant is anticipated to be 284 m³/day. The report does not specify the amount of infiltration into sanitary sewer that will be collected and eventually reach the treatment plant.

Assuming that sanitary sewer construction shall be as per OPSS (Ontario Provincial Standard Specifications), we have estimated the infiltration amount for capacity assessment. At an infiltration rate of 0.075 L/mm ø of sewer/100 m of sanitary sewer, we estimate the infiltration in subdivision sewers to be 5 m³/day.

Therefore, Broos Subdivision is anticipated to contribute 289 m³/day of wastewater to the Wastewater Treatment Plant (WWTP) and generates a maximum day water demand of 568 m³/day.

5.0 DETERMINE IMPACT OF SUNVALE AND BROOS SUBDIVISIONS

It is recognized that all 452 residential units in Sunvale and Broos subdivisions shall be built over a number of years and water demands and sewage flows to WWTP shall increase gradually rather than in a short span of 2-3 years. Nevertheless, it is important to determine impact of full development of subdivisions on rated capacity of water and wastewater treatment plants.

Water Treatment Plant

Current maximum day water demand	1603 m³/day
Maximum day water demand from fully developed Sunvale Homes	688 m³/day
Maximum day water demand from fully developed Broos Subdivision	568 m³/day
Total water demand	2859 m³/day < 3011 m³/day
Uncommitted reserve capacity of WTP	3011 – 2859 = 152 m³/day

The water demand exerted by fully developed Broos and Sunvale Subdivisions and existing water customers, shall not exceed rated capacity of 3011 m³/day, and leaves only 152 m³/day of water treatment capacity available to entertain requests from new developers.

Wastewater Treatment Plant

Current average day wastewater flow to treatment plant	1123 m³/day
Wastewater flow from fully developed Sunvale Homes	354 m³/day
Wastewater flow from fully developed Broos Subdivision	289 m³/day
Total wastewater flow	1766 m³/day
Uncommitted reserve capacity of WWTP	2184-1766= 418 m³/day

The wastewater that is anticipated to be treated from fully developed Broos and Sunvale Subdivisions and existing Durham customers is 1766 m³/day, which is less than rated capacity of 2184 m³/day. West Grey, therefore, shall have spare uncommitted capacity of 418 m³/day to handle wastewater flow at Durham WWTP, which can be offered to new development.

6.0 FUTURE DEVELOPMENTS

West Grey is receiving interest from future developers to develop lands within Durham's limits. Provincial policy change is also anticipated to further create pressure on Water and Wastewater Treatment capacities.

An outline of future developments in pipeline are as follows:

6.1 Rockwood Terrace Re-Development

Existing Rockwood Terrace complex that houses 100 units/beds is owned and operated by Grey County. The current proposal does not support reuse of the existing building due to type of construction needed and costs associated with renovation. It is anticipated that existing building shall be developed and replaced with a new building that will offer the following:

- 128 beds of long term care beds vs 100 existing beds.
- 40 senior assisted living units that will include kitchenette. Half of the units shall have double occupancy and other half shall have single occupancy.
- 15 units shall be added which shall offer affordable (subsidized) rentals.
- 45 units shall be added which shall be offered at market rental rate.

6.2 Un-named Subdivision 1

Based on discussions with prospective developers, municipal staff anticipate that a 100 units subdivision likely shall be started in 2024 and will be completed by 2028.

6.3 Un-named Subdivision 2

Based on discussions with prospective developers, municipal staff anticipate that a 200 units subdivision likely shall be started in 2026 and will be completed by 2030.

6.4 Infill/Redevelopment of Existing Properties

There has been a recent trend in West Grey as per municipal staff, where owners with a dwelling unit are removing existing unit and replacing them with multiple dwelling units. Existing vacant lots in the serviced area are also being provided with residential buildings.

It is hard to imagine how long and how many such changes in existing units shall continue to occurs. For this study and in consultation with staff, it has been assumed that overall, 6 additional single residential units shall be added over and above existing residential units every year and that this trend may continue for next 10 years.

6.5 Provincial Policy Impact

The province has introduced zoning changes which shall require municipalities to adopt zoning bylaw which will allow secondary and accessory dwellings built in existing dwellings.

No accurate data is currently available to determine how many existing buildings can be

transformed in the above manner. Arbitrarily, it has been assumed that 8% of existing 1145 service connections or 92 existing buildings over the next 10 years shall have secondary dwellings added to them. It has been further assumed that such dwellings shall house, on an average, 2 persons per dwelling unit.

7.0 SERVICING IMPACT OF FUTURE DEVELOPMENT

Water demands and wastewater generation rates have been estimated as follows:

7.1 Rockwood Terrace Re-Development

- 128 beds at 450 Litres/bed water demand, adjusted by maximum day factor of 2.0 and 128 beds at 450 Litres sewage/bed.
- 40 senior assisted living units:
  - 20 units (single occupancy) at 450 L/unit water demand adjusted by maximum day factor of 2.0
  - 20 units (double occupancy) at 900 L/unit water demand adjusted by maximum day factor of 2.0
  - 20 units (single occupancy) at 450 L sewage/unit
  - 20 units (double occupancy) at 900 L sewage/unit
- 60 rental units (15 units affordable rent and 45 units with market rent)
  - Each unit at 900 Litres/unit water demand, adjusted by maximum day factor of 2.0
  - Each unit at 900 Litres sewage/unit
- An infiltration allowance of 10 m^3/day for sewers on redeveloped site

The water demand and sewage generation rates are summarized in **Table 8.1 & 8.2** (in section 8.0 of this report)**.**

7.2 Un-named Subdivision 1

Water demands from this subdivision with 100 residences have been estimated based on an assumption of 3 persons per home (pph) and a water demand of 450 Lcpd, adjusted by maximum day factor of 2.0.

Sewage flow contribution to WWTP have been estimated based on an assumption of 3 pph and 450 litres sewage/person/day and an infiltration allowance of 10 m^3/day for extraneous flow.

7.3 Un-named Subdivision 2

Water demands from this subdivision with 200 residences have been estimated based on an assumption of 3 persons per home (pph) and a water demand of 450 Lcpd, adjusted by maximum day factor of 2.0.

Sewage flow contribution to WWTP have been estimated based on an assumption of 3 pph and 450 litres sewage/person/day and an infiltration allowance of 10 m^3/day for extraneous flow.

7.4 Infill/Redevelopment of Existing Properties

Water demand for infill units have been estimated assuming an occupancy of 3 pph, 450 Lcpd adjusted by a maximum day factor of 2.0.

Sewage generation rate for infill units have been estimated assuming an occupancy of 3 pph, 450 L sewage per person, without any additional infiltration allowance, as no new sanitary sewers are involved.

7.5 Provincial Policy Impact

Water demand for modified dwellings have been estimated assuming an occupancy of 2 pph, 450 Lcpd adjusted by a maximum day factor of 2.0.

Sewage generation rate for modified dwellings have been estimated assuming an occupancy of 2 pph, 450 L sewage per person, without any infiltration allowance, as no new sanitary sewers are involved.

8.0 CAPACITY ASSESSMENT: WATER AND WASTEWATER

As part of the investigation, impact of future developments on rated capacity of WTP and WWTP was undertaken to determine if West Grey can entertain development request from future developers. The assessment also included changes that would occur at existing properties due to zoning changes allowed by Province. The information is summarized in **Table 8.1** for WTP and **Table 8.2** for WWTP. Information included is self-explanatory.

Per **Table 8.1**, there will be a shortfall of approximately 1119.8 m³/day in water treatment capacity when approved subdivisions are fully developed and future development as anticipated by staff, does occur.

Per **Table 8.2**, there will be a shortfall of approximately 259.8 m³/day in wastewater treatment capacity when approved subdivisions are fully developed and future development as anticipated by staff, does occur.

It may , however, be noted that shortfall in treatment capacity both for WTP and WWTP shall not happen suddenly but rather gradually, thereby allowing West Grey time to reduce existing demands by reduction measures (promoting water conservation), improvements (undertaking elimination of leaking watermains and sanitary sewers) etc.

The pace of building of homes in approved subdivisions namely Sunvale and Broos shall largely depend on market conditions, state of economy and other unknown factors. It is therefore difficult to predict when WTP and WWTP shall run out of capacity. In consultation with staff, we have created a chart that shows decline in available capacity every year as a result of development equivalent to 50 residences every year. In other words, it has been assumed that every following year WTP capacity shall reduce by 135 m³/day per year and WWTP capacity shall reduce by approximately 70 m³/day per year. Impact of this growth is depicted in **Figure 8.1** for WTP and **Figure 8.2** for WWTP. It is noted that Durham WTP may run out of treatment capacity by 2031 and WWTP by 2037 if equivalent to 50 residences are built per year. This timeline will shorten if pace of construction is faster than 50 residences per year.

Table 8.1 - Capacity Assessment Summary

Water Treatment Plant, Durham

Revised: 9/28/21	(A)	(B)	(C)
Description	**Current Capacity Utilization (m^3/day)**	**Committed Capacity (m^3/day)**	**Future Demands (m^3/day)**
Maximum Day Water Demand (2013-2020)	1603		
Sunvale Subdivision: 765 persons at 450 Lcpd, maximum day factor 2.0		689	
Broos Subdivision: 631 persons at 450 Lcpd, maximum day factor 2.0		568	
Rockwood Terrace * Additional 28 beds (128 new - 100 existing) at 450 L/unit, maximum day factor 2.0			25.2
* 20 senior assisted living units (single) at 450 L/unit, maximum day factor 2.0			18
* 20 senior assisted living units (double) at 900 L/unit, maximum day factor 2.0			36
* 60 Rental units (15 affordable rent + 45 market rent) at 900 L/unit, maximum day factor 2.0			108
Unnamed Subdivision 1 100 residences (300 persons) at 450 Lcpd, maximum day factor 2.0			270
Unnamed Subdivision 2 200 residence (600 persons) at 450 Lcpd, maximum day factor 2.0			540
Infill/Redevelopment of Existing Properties 6 additional units (2pph) at 450 Lcpd, maximum day factor 2.0 per year for 10 years (10.8 m^3/day per year)			108
Provincial Policy Impact 92 units (2 pph) at 450Lcpd, maximum day factor 2.0			165.6
	1603	**1257**	**1270.8**

Total of Current and Future Water Demand (A+B+C) = 4130.8 (m^3/day)

Surplus (shortfall) in rated capacity 3011 m^3/day - 4130.8 m^3/day = (1119.8 m^3/day)

Table 8.2 - Capacity Assessment Summary
Wastewater Treatment Plant, Durham

Revised: 9/28/2021	(A)	(B)	(C)
Description	**Current Capacity Utilization (m^3/day)**	**Committed Capacity (m^3/day)**	**Future Demands (m^3/day)**
Average Day Sewage Flow (2013-2020)	1123		
Sunvale Subdivision: 765 persons at 450 Lcpd, + infiltration allowance		355	
Broos Subdivision: 631 persons at 450 Lcpd, + infiltration allowance		290	
Rockwood Terrace * Additional 28 beds (128 new - 100 existing) at 450 L/unit * 20 senior assisted living units (single) at 450 L/unit * 20 senior assisted living units (double) at 90.0 L/unit * 60 Rental units (15 affordable rent + 45 market rent) at 900 L/unit * Infilitration Allowance			12.6 9 18 54 10
Unnamed Subdivision 1 100 residences (300 persons) at 450 Lcpd, + infiltration allowance			145
Unnamed Subdivision 2 200 residence (600 persons) at 450 Lcpd, + infiltration allowance			290
Infill/Redevelopment of Existing Properties 6 additional units (2pph) at 450 Lcpd per year for 10 years			54
Provincial Policy Impact 92 units (2 pph) at 450 Lcpd			82.8
	1123	**645**	**675.4**

Total of Current and Future Water Demand (A+B+C) = 2443.4 (m^3/day)

Surplus (shortfall) in rated capacity 2184 m^3/day - 2443.4 m^3/day = (259.4 m^3/day)

Figure 8.1 Illustration of Depletion of WTP Capacity Based on 50 New Residences/Year
Durham WTP, West Grey

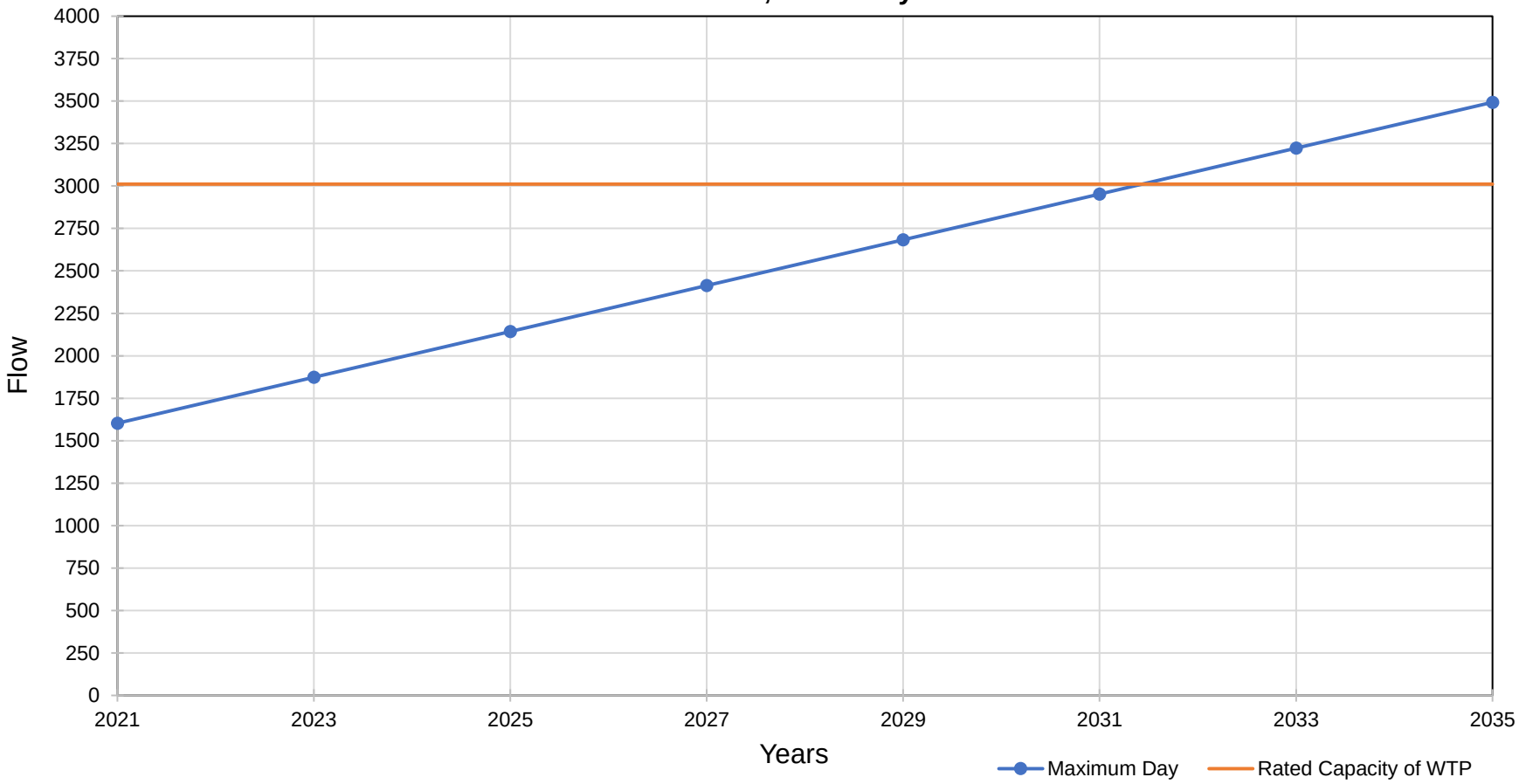
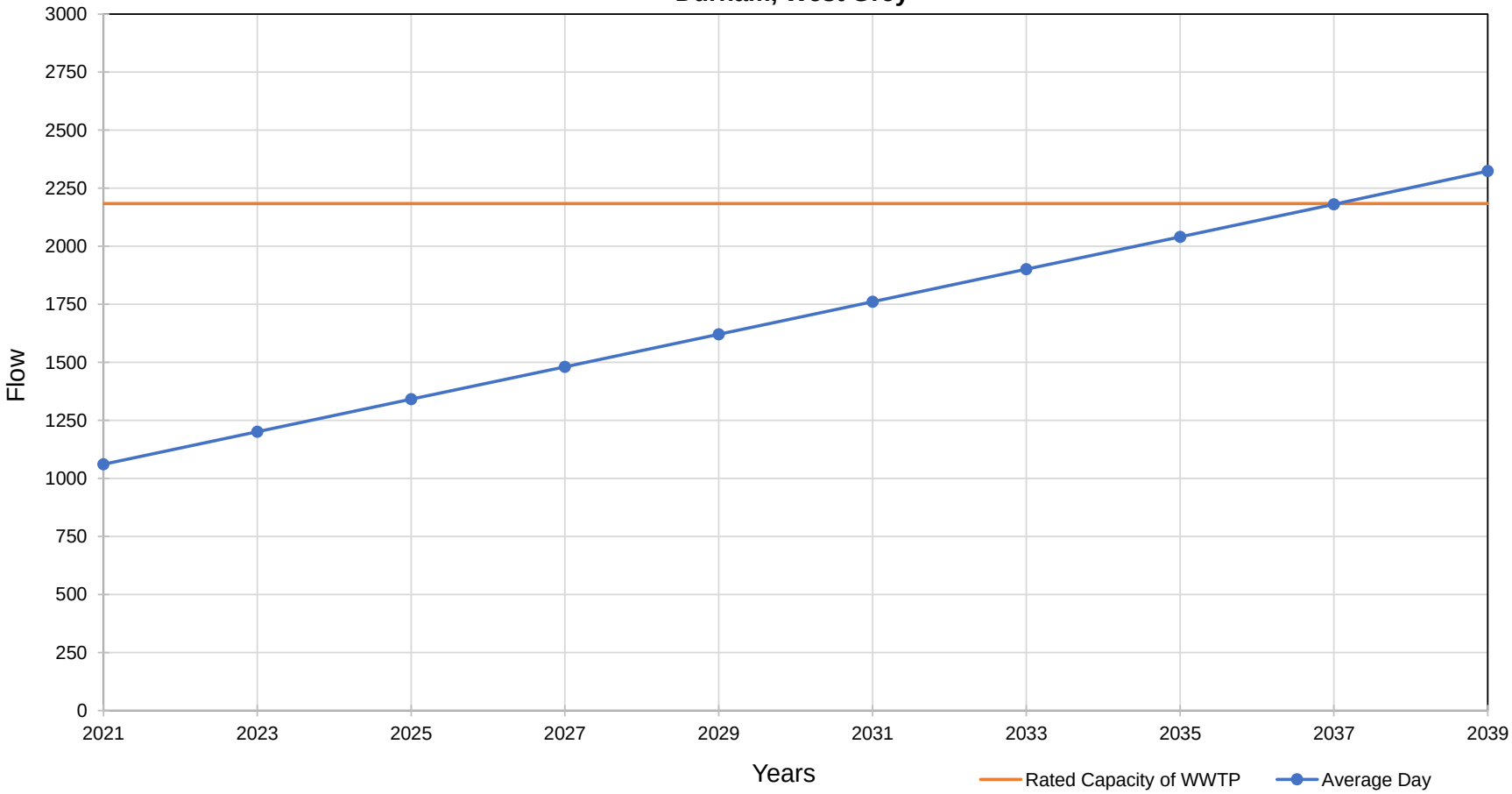


Figure 8.2 - Illustration of Depletion of WWTP Capacity Based on 50 New Residences/Year
Durham, West Grey



9.0 WATER AUDIT

During discussions with municipal staff, it was recognized that some residents are allowed to leave taps running during winter months to prevent water service from freezing. Staff also pointed out watermain breaks during winter and spring thaw events. It was also noted that Durham does have metered customers barring 10-15 property owners. It was, therefore, decided to analyze water and wastewater data in depth to determine any peculiarity in historical data. A brief discussion is as follows:

- Current maximum day water supply demand of 1603 m³/day translates into a 1224 litres per billable unit. Assuming average 2.5 person per house, water demand translates into 490 lcpd. This demand is 8.8% higher than provincial recommendation of 450 lcpd (250 – 450 lcpd) for water supplies.

  A higher per capita demand of ± 490 lcpd hints at possible distribution losses. Consequently, water supplied to distribution system was compared with wastewater collected in collection system. This comparison is provided in **Table 9-1**. While reviewing the information, it may be remembered that all water supplied to consumers does not reach WWTP as sewage (except in an ideal case). There could be water distribution losses by way of watermain breaks, watermain and water service leaks, lawn watering, filling pools, etc. which may not enter sanitary sewers. Also, sanitary sewers can collect additional water by way of inflow from rainfall and snow melt events and infiltration (due to poorly constructed sewers and manholes) and rise in water table. The followings are notable in **Table 9-1**:

  1) There is a disparity between water supplied vs. wastewater collected and disparity is increasing rapidly in recent years.
  2) Water supplied to distribution system, on average daily basis, is generally consistent, varying from a low of 929 m³/day average to high of 1196 m³/day average.
  3) Wastewater collected indicates a wider variation, from a low of 629 m³/day average to a high of 1123 m³/day average.
  4) Higher water supply than collected wastewater flows indicates potential water distribution losses, higher lawn water use, etc.
  5) Lower wastewater flows can be due to leakage from sewers into ground with seems unlikely. Generally, collection system suffers from infiltration rather than exfiltration.
  6) Continual decline in wastewater flows is positive development and may be due to low water use fixtures.
  7) Information in **Table 9-1** appear to hint of higher water distribution system losses.

Due to high water distribution system losses indication, water supplied data was further compared with water metered data. The information is summarized in **Table 9-2.** The analysis further confirms high

Table 9-1
Comparison of Water Supplied and Wastewater Generation
Durham, West Grey

Sept. 20, 2021 21-036

Year	Average Day Water Supplied to Distribution System (m^3/day)	Average Day Wastewater Collected in Collection System (m^3/day)	Difference between Water Supplied & Wastewater Collected (m^3/day)
2013	1054	976	78
2014	1196	1123	73
2015	1192	823	369
2016	1007	880	127
2017	929	981	-52
2018	1037	705	332
2019	1120	702	418
2020	1145	629	516

water losses from distribution system which varies from a low of 340 m³/day in 2017 to a high of 581 m³/day in 2015. The water loss amount varies from 36% to 46% of water supplied into distribution system.

The water loss from distribution system generally comprises of the followings:

- Annual hydrant flushing
- Watermain breaks
- Watermain leakages
- Water service leaks
- Running water to prevent water service freezing
- Water theft, and others

It may be noted that none of the above losses, as per collected data, appear to be contributing to wastewater flows at WWTP.

Table 9-2: Comparison of Water Supplied to Distribution System vs. Water Recorded by Water Meters

Sept. 20, 2021 21-036

Year	Average Day Water Supplied to Distribution System (m^3/day)	Average Day Estimated based on Water Metered Records (m^3/day)	Possible Leakage from Distribution System (m^3/day)
2014	1196	663	533 (44.6%)
2015	1192	641	551 (46.2%)
2016	1007	629	378 (37.5%)
2017	929	589	340 (36.6%)
2018	1037	622	415 (40%)
2019	1120	616	504 (45%)
2020	1145	649	496 43.3%)

10.0 OTHER IMPACTS OF FUTURE GROWTH

Preceding sections in the report had focused on growth impacts on capacities of water treatment and wastewater treatment plants. Other impacts of future growth include, but have not been addressed in this report, are:

- Capability of distribution system to supply adequate quantity of water at adequate pressure. Deficiencies could include inadequate watermain sizes and lack of looping. Other serious deficiency could be lack of water storage, and insufficient capacity of booster pumping station.
- Capability of Sewage Collection System to safely collect additional flows and transfer it to WWTP. Deficiencies could include inadequate sewer sizes, lack of pumping capacity, inadequate wet well sizes, etc.

11.0 NEXT STEPS

Based on the foregoing discussion in previous section of this report, it is amply clear that Durham's WTP and WWTP shall be unable to handle the demand generated by committed development and uncommitted future development. West Grey therefore, shall need to undertake a series of steps to enhance the capacity of WTP and WTTP to accommodate future growth. The treatment capacity of both WTP and WWTP is currently sufficient, but could exceed beyond rated capacity, if timely corrective steps are not implemented. The following steps can be adopted:

A. Water Treatment Capacity

A.1 Undertake a Leak Detection Survey to identify large water leakage areas. This step already has been completed during on-going investigation for preparation of this report. Larger leaks identified in survey have been corrected and consequently some reduction in water demand has been noted. There may be numerous small leaks, which have not been picked up by Leak Detection survey but are contributing to significant water loss from distribution system.

A.2. Implement immediately, lawn water restrictions during summer months to possibly reduce maximum day water demands. Also implement a water conservation education programme.

A.3 There is an existing drawing that indicates all Cast Iron (CI), Ductile Iron (DI), transite watermains by their age. It needs to be updated with history of watermain breaks, in order to help in identification of trouble areas.

A.4 Create a watermain and water services replacement programme based on age and condition of watermains. Old CI and DI watermains are likely fragile, prone to breakage and continuous small leakages. This programme will reduce water loss from distribution system gradually.

A.5 Reactivate the earlier project of finding new source of raw water supply. The writer had made a presentation to council in early 2013 identifying the area that could be explored by way of test well drilling. The area was identified by way of desk top hydrogeological study of several areas in Durham.

A.6 Monitor the "water supplied, and water consumed" data every two years to determine the efficacy of steps taken and modify the programme as needed to maximize benefit.

A.7 Undertake investigation and implement remedial measures to stop water loss by leaving taps open during winter periods. This problem occurs at ± 15 homes every year.

A.8 Undertake computer modelling of distribution system to identify area that could experience low flows and low pressures due to future growth.

B. Wastewater Treatment Plant

B.1 Undertake a smoke testing survey of entire collection system followed by CCTV inspection of "select" sanitary sewers and services to identify potential sources of inflow and infiltration.

B.2 Undertake manhole inspection programme to identify infiltration sources. Due to poor construction, during period of surcharged water table, they can collect significant amounts of "unwanted" water into collection system.

B.3 Create sanitary sewer maps showing pipe type, age and any known historical problems.

B.4 Create a sanitary sewer replacement/rehabilitation programme based on age and condition of sewers and historical problems.

B.5 Commence investigation for determining ways of enhancing capacity of WWTP and sewage pumping station.

B.6 Monitor sewage flows and compare with water suppled/metered every two years to determine the efficacy of steps taken and modify the programme as needed to maximize benefit.

B.7 Undertake computer modelling of collection system to identify existing sewers that could become deficient in capacity when new subdivisions are developed.

Respectfully Submitted,

GSS Engineering Consultants Ltd.

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RS/nc