Town of Petawawa

Infrastructure Study Update

2013

Jp2g Consultants Inc.
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TABLE OF CONTENTS

CHAPTER 1 - OVERVIEW

TABLE OF CONTENTS

Appendices

1.0 INTRODUCTION

1.1 Study Background

The Town of Petawawa was formed on July 1, 1997 through the amalgamation of the former Village of Petawawa and the Township of Petawawa. Through this amalgamation the infrastructure components of roads, sanitary sewage systems, water distribution systems and storm sewer systems were consolidated under the jurisdiction of the new municipal structure of the Town of Petawawa. Of these infrastructure systems, the water, sanitary sewer and storm sewer systems are shared in part with CFB Petawawa, through the Canadian Forces Housing Authority (CFHA) North and South Townsites.

In February of 2011 the Town of Petawawa commissioned Jp2g Consultants Inc. to undertake an update of the Town's 2003 Infrastructure Study Update which would:

- note the work that had been completed in the eight intervening years;
- assess the potential for extended growth;
- develop a comprehensive plan for the repair, replacement and/or upgrading of the various infrastructure components.

This study aims to establish an infrastructure master plan that will meet these objectives.

1.2 Physical Characteristics of the Study Area

The primary urban area of the geographic Town of Petawawa is situated at the confluence of the Petawawa and Ottawa Rivers. This primary urban area is comprised of the former Village of Petawawa and the Federal Department of National Defence Canadian Forces Base Petawawa. This overall urban area is serviced by a single communal water treatment plant and water distribution system, and a sanitary sewage collection and treatment system. The water and sewage plants are owned by the Town of Petawawa and operated by the Ontario Clean Water Agency, under an operating agreement with the Town. The original water distribution system in the Village was installed beginning in 1961. The installation of the sanitary sewage collection system began in 1971.

Both the Town of Petawawa and CFB Petawawa are bisected by an existing Canadian Pacific Railway right-of-way. The former Provincial Highway 17 paralleled this railway right-of-way and once served as the main connecting link between Ottawa and North Bay, via Pembroke. Within the former Township of Petawawa, the Highway 17/CPR Railway right-of-way facilitated a substantial amount of semi-urban growth, in the form of small businesses and semi-urban residential subdivisions. As development progressed, problems with the supply of water in this area became more prevalent. In order to address servicing constraints related to the provision of a potable water supply, a water supply system was installed in the early 1990's to service the higher density areas of the Township.

The infrastructure systems in the balance of the municipality consist primarily of a municipal road system, and limited drainage systems where required.

Subsurface conditions within the Town consist of a variety of materials. The urban area and the northern part of the municipality are comprised primarily of sand and gravel deposits. These deposits transform, as one progresses south through the Town and easterly along the Ottawa River to silty sand and eventually to clay. In many of the rural areas, rock outcrops and organic deposits exist.

The Town of Petawawa is bordered on the north by Canadian Forces Base Petawawa, on the east by the Ottawa River, to the south by the existing primarily rural municipality of Laurentian Valley and to the west, in part, by Algonquin Park. The topography varies from shallow to moderately sloping along the Ottawa and Petawawa Rivers, to the flat plains in which the former Highway 17 and CPR Railway were located and, as one progresses to the west, to hilly and rocky terrain.

2.0 STUDY OBJECTIVES

The purpose of this study is to complete an update to the inventory of the existing infrastructure systems within the geographic Town. As portions of these systems are shared with CFB Petawawa, the inventory must take into account those sections of the CFB Petawawa systems that directly affect the Town's municipal infrastructure system.

Although a number of discussions have occurred regarding the possible Municipal operation and maintenance of the infrastructure within CFB Petawawa, this study is not intended to be a comprehensive inventory of the infrastructure for CFB Petawawa.

Since this study involves "Master Planning", and recommendations resulting from the study will involve the construction of municipal infrastructure, the study is structured to meet the requirements of Phase 1 and Phase 2 of the Municipal Class Environmental Assessment process (Municipal Engineers Association, 2007). Where the preferred alternatives identified in this study involve upgrading infrastructure systems on publicly owned land, within existing road allowances or utility corridors, this Master Plan will have satisfied the requirements of a Schedule 'A' and 'A+' Projects. Should the preferred alternatives involve construction on lands other than the aforementioned locations, this document will become the basis for, and be used in support of, future investigations for the specific Schedule B projects.

2.1 Primary Study Objectives

The Primary Study Objectives are as follows:

1. To update "As Built" information on existing infrastructure systems within the municipality.
2. To identify the relevant design criteria that are applicable to the infrastructure.
3. To plan for full and efficient use of existing infrastructure systems.
4. To identify and implement an overall infrastructure improvement program.
5. To assess the impacts of new development on the existing infrastructure systems.
6. To identify the areas that are most suitable for development based on the availability of the infrastructure.
7. To determine approximate costs and priorities for the identified infrastructure improvements and upgrades.

2.2 Study Process

In order to assess the various infrastructure components, existing information, consisting of "As Built" drawings, the original design criteria and recorded observations of system performance will be used to document the system. The study also utilizes supplementary information including land use planning, (Official Plan, comprehensive zoning By-law), existing infrastructure studies, development charges studies, etc. to identify the anticipated infrastructure needs and requirement to accommodate growth. As part of the information collection process, interviews were conducted with municipal staff as well as the operating

authority for the sewage and water systems (Ontario Clean Water Agency), in order to determine the needs and deficiencies within the system.

The analysis of the four major infrastructure components (roads, sanitary sewers, watermains and storm sewers) has been divided into separate chapters for this report. Each chapter will assess infrastructure components by first documenting the existing systems. The study will then evaluate and assess the existing condition of the systems, identify the need for improvements to accommodate growth and finally, provide a logical program for the implementation of recommended improvements.

3.0 PLANNING AND GROWTH

The growth of the municipality is directly affected by the scope and intensity of the activities within CFB Petawawa and less directly by the continued operation of the Atomic Energy of Canada facility at Chalk River. These two facilities provide the major employment and economy for the area. The potential for growth, and potential changes in the rate of growth, are dependent on these two major employers.

In order to establish a reasonable forecast of the impact of growth on the infrastructure, it is first necessary to assess the assumptions that have been made through the existing planning documents. The following provides a brief summary of the planning documents that apply to the Town.

3.1 Official Plan County of Renfrew

The Official Plan for the County of Renfrew was approved by the MMAH on June 16th, 2003. The purpose and objective of this plan is to provide a policy framework for growth and development in the County of Renfrew until the year 2015. Some of the primary objectives of the plan include the following:

1. To maintain and enhance the quality of natural, built and human environments in the County.
2. To strengthen and diversify the County's economic base within municipal servicing limitations.
3. To facilitate compatibility between land uses and to provide policies to guide the establishment of uses in an integrated manner.
4. To identify and protect renewable and non-renewable resources.
5. To ensure that development occurs in a sustainable manner, which considers the natural water systems, environmentally sensitive areas and hazard lands.
6. To cooperate with local municipalities for the wise management of our resources and the well-being of the community.
7. To cooperate with adjacent municipalities, counties and senior levels of government to provide for the needs of the community.

The general development policies within the County Official Plan establish policies with respect to housing, minimum separation distance from non-compatible uses, buffering, commercial/industrial/institutional uses, etc.

The Official Plan establishes the hierarchy of services, being:

1. Full municipal sewage and water services as the preferred form of servicing for urban areas.
2. Communal services are the preferred means of servicing development in areas where full municipal sewage and water services are not, or cannot, be provided and where site conditions are suitable for the long term.
3. Development by individual on site systems, where the use of communal systems is not feasible, and where site conditions are suitable over the long term.
4. Partial services will be discouraged except where necessary to address failed services or because of physical constraints.

(It should be noted that the current Provincial Policy Statement from 2005 indicates that Partial services shall only be permitted in the following circumstances:

a) where they are necessary to address failed individual on-site sewage services and individual on-site water services in existing development; and
b) within settlement areas, to allow for infilling and rounding out of existing development on partial services provided that:
1. the development is within the reserve sewage system capacity and reserve water system capacity; and
2. site conditions are suitable for the long-term provision of such services.)

The Official Plan states that developers should be responsible for the cost of installing all services in the development and will be required to contribute to the cost of trunk mains and lighting for access roads. Where applicable, servicing easements shall be provided as necessary. Communal water and sewage systems may be permitted, subject to municipal approval under the County Official Plan.

The County Official Plan provides that towns, such as the Town of Petawawa, will benefit from a detailed local official plan, intended to guide the future social, economic and physical development of the specific community. The objectives of these specific official plans are:

1. To ensure that adequate land, municipal services and community facilities are available to serve the existing and future needs of the community.
2. To provide opportunities for adequate supply and diversity of housing, to satisfy the varied needs of a growing community.
3. To provide the opportunity for an adequate supply and diversity of commerce and industry, to serve the needs of the community.
4. To ensure that development proceeds in an environmentally responsible manner.
5. To encourage steady economic growth, in a carefully controlled manner, to provide employment.
6. To encourage economically viable and physically attractive central business districts.
7. To ensure that adequate parkland, open space, and recreational opportunities are available to meet the recreational needs of the community.

3.2 Town of Petawawa Official Plan

The Official Plan for the Town of Petawawa was adopted by the Town on January 21, 2002 and was approved by the Ontario Municipal Board on July 15th, 2004. This document is currently undergoing an update by the staff at the County of Renfrew.

The objectives of the current Town Official Plan are:

1. To strengthen and diversify the Municipality's economic base within the Municipality's servicing limitations.

2. To maintain and enhance the quality of the natural, built and human environments in the Municipality.

3. To facilitate compatibility between land uses and to provide policies to guide the establishment of uses in an integrated manner.

4. To identify and protect renewable and non-renewable resources.

5. To ensure that development occurs in a sustainable manner which considers the natural water systems, environmentally sensitive areas and hazard lands within the Municipality.

6. To coordinate the Town's long-term servicing plans with land use planning objectives.

The Official Plan contains several specific sections pertaining to transportation, sewage and water systems. Excerpts of these sections are contained in Appendix A and B. Some of the major items contained in this policy are as follows:

Transportation

Section 15 of the Official Plan deals with transportation; a copy of this section is included in Appendix A. This section provides guidance for the development of a safe and efficient road system. The objectives of the Plan of note are:

1) To maintain the safety and efficiency of the road system.
2) To prevent undue increases in the proportion of expenditures on roads.
3) To ensure that all new development has suitable and legal access.
4) To protect corridors and right-of-ways for significant transportation and infrastructure facilities.
5) To ensure that incompatible development does not locate adjacent to transportation corridors or facilities.

Sewage and Water Systems

Section 16 of the Official Plan deals with sewage and water systems. A copy of this section of the Official Plan is included in Appendix B. The objectives of this part of the Plan of note are:

1) To maintain sufficient capacity in both public water and sanitary systems and facilities to provide for anticipated growth.
2) To direct the majority of new growth in the Town to lands serviced by public water and sanitary systems, and except for minor infilling, discourage development on partial services.
3) To discourage incompatible development in areas surrounding water and sanitary systems and facilities.

4.0 DEFINITION OF SERVICE AREAS

As the level of service provided by the infrastructure in the Town of Petawawa is varied, there is a need to define the specific service areas.

For the purpose of this report, the service areas are defined as follows:

Urban Area

This area is defined as the area in the municipality where both communal sanitary and water systems are available, or planned. The lots in this area are generally 20m or less in width. Many of the roadways within the urban areas currently rely on surface drainage systems. For the purposes of this study, we have assumed that the majority of these local roads would continue to rely on surface drainage systems and only collector roadways would be upgraded with storm sewer systems, curb and gutter and sidewalks when they are in need of reconstruction. This is discussed in greater detail in Chapter 4, Section 3.3 of this report. All new development must include roadways with an urban cross section, (storm sewers, sidewalks, curbs and gutter). The urban area also includes roads that are under the jurisdiction of the County of Renfrew.

Suburban Area

This area is defined as the area of the municipality where only communal water service is provided. Sewage disposal is by means of private sewage systems. The roads in these areas are generally categorized as semi urban, relying on surface drainage systems. Some areas may, however, have storm drains and sidewalks. The frontage of the lots in these areas are generally more than 30 metres (100 feet). This area may include roads under the jurisdiction of the County of Renfrew.

Rural Areas

Rural areas include all remaining areas of the Town, where communal services are not provided for water or sewage. The municipal infrastructure located in this area is limited to the road system. The jurisdiction of the roads may be either through the County of Renfrew or the Town of Petawawa. Only those road systems under the jurisdiction of the Town of Petawawa are included in this report.

CFB Petawawa

CFB Petawawa is a Federal Military Base, located within the geographic Township of Petawawa. The Base is comprised of three principle components: the active area of the Base, the Canadian Forces Housing Authority (CFHA) North Townsite and the CFHA South Townsite.

The active portion of the Base includes numerous buildings and facilities which are connected to the communal sewage and water facilities of the Town. The roads, drainage, sewage collection and water distribution systems are under the jurisdiction of the Department of National Defence (DND), with the exception of the trunk watermain system from the water treatment plant to the Base boundary on Petawawa Boulevard.

The North and South Townsites are the residential, commercial and institutional areas of the Base. The roads are generally urban in nature and the area is connected to the communal water and sewage systems. The infrastructure in the area is under the jurisdiction of DND.

The North Townsite is located on the north side of the Petawawa River. The infrastructure for this area is generally independent of the Town of Petawawa infrastructure, with the exception of the interconnections to the overall sewage and water systems. The South Townsite is located within the Town of Petawawa and, as a result, shares the use of trunk sanitary and storm sewers as well as watermains.

For the purpose of this report, the infrastructure for the CFB Petawawa area is not addressed in detail (except for the water system). The impact of the Base on the capacity in the trunk lines is accounted for and included as an allowance. The estimate of required capacity is established from the most current information provided by DND for CFB Petawawa and through the existing infrastructure sharing agreements with the Town of Petawawa.

Unserviced Urban Areas

Certain areas within the designated urban area remain without a communal sewer and/or water supply. The largest of these areas is located at Petawawa Point. In 2003, a public meeting was held with the residents in this area to gauge their desire to fund the extension of full municipal services to their residences. Based on the negative feedback of the residents, the Town decided not to pursue this any further

CHAPTER 2

SANITARY SEWER SYSTEM

TABLE OF CONTENTS

Figures

Appendices

1.0 INTRODUCTION

The sanitary sewage system for the Town of Petawawa is comprised of two primary components, the sewage collection system and the sewage treatment facility. The sewage treatment facility is located within the former Village area of the Town of Petawawa, adjacent to the Ottawa River and downstream of Petawawa Point. The facility is an 8,730m^3 per day secondary treatment plant that was re-constructed and upgraded in 1998. The facility is designed to treat sewage originating from the Town of Petawawa as well as CFB Petawawa, including the CFHA North and South Townsites. The facility operates within the requirements of the Certificate of Approval.

The most recent sewage treatment plant capacity analysis was completed by Jp2g in February 2011 and this is contained within Appendix B. Within this report, it was noted that the plant is currently operating at about 63% of its rated capacity of 8,730 m^3/day, based on the average daily flow rates for the period of 2008 to 2010. Based on the assumptions of a per capita flow rate of 0.48 m^3/person/day and a projected household size of 2.4 persons, the report estimated that an additional 2,770 households (new CFHA units and new units within the Town of Petawawa sanitary service area) could be accommodated in the available reserve capacity of the sewage treatment facility. This is sufficient to accommodate the projected 10 year growth within the Municipality based on the latest projections from the County of Renfrew, which anticipates 600 additional homes over that period. **It should be noted however that plant expansions do take significant time to plan and implement. Therefore it is our recommendation that the Town should implement the EA process for the eventual plant expansion when the average daily flow rate for the plant reaches 75% of its rated capacity.**

The sewage collection system for the Town is comprised of a series of pipes, manholes, pumping stations and forcemains which collect the sewage from individual properties and convey it to the sewage treatment facility. The sewage collection system for greater Petawawa is approximately 40 years old. The original pipe system is comprised of cast-in-place and precast manholes with asbestos cement (Transite) pipes. Transite pipe is no longer in production due to the health and safety risks associated with its manufacture. More recent installations of sewage pipe have utilized PVC pipe with precast manholes. The collection system is generally categorized as being in good condition, with little evidence of pipe deterioration or infiltration of groundwater.

A significant portion of the sewage system that is connected to the sewage treatment facility is located within CFB Petawawa and the North and South Townsites. Much of the collection system in these areas was installed along with the original sewage treatment plant in 1960. In 1970 an agreement was made to share the facility with the Town. There was a subsequent agreement in 1998 that further detailed the sharing of both the sanitary and storm systems between the Base and the Town. Within Appendix C, there is a memo from Dan Patrick that notes the key items of this agreement. The Department of National Defence continues to operate the sewage collection system at CFB Petawawa. This report only focuses on the sanitary sewer collection system that is within the Town limits.

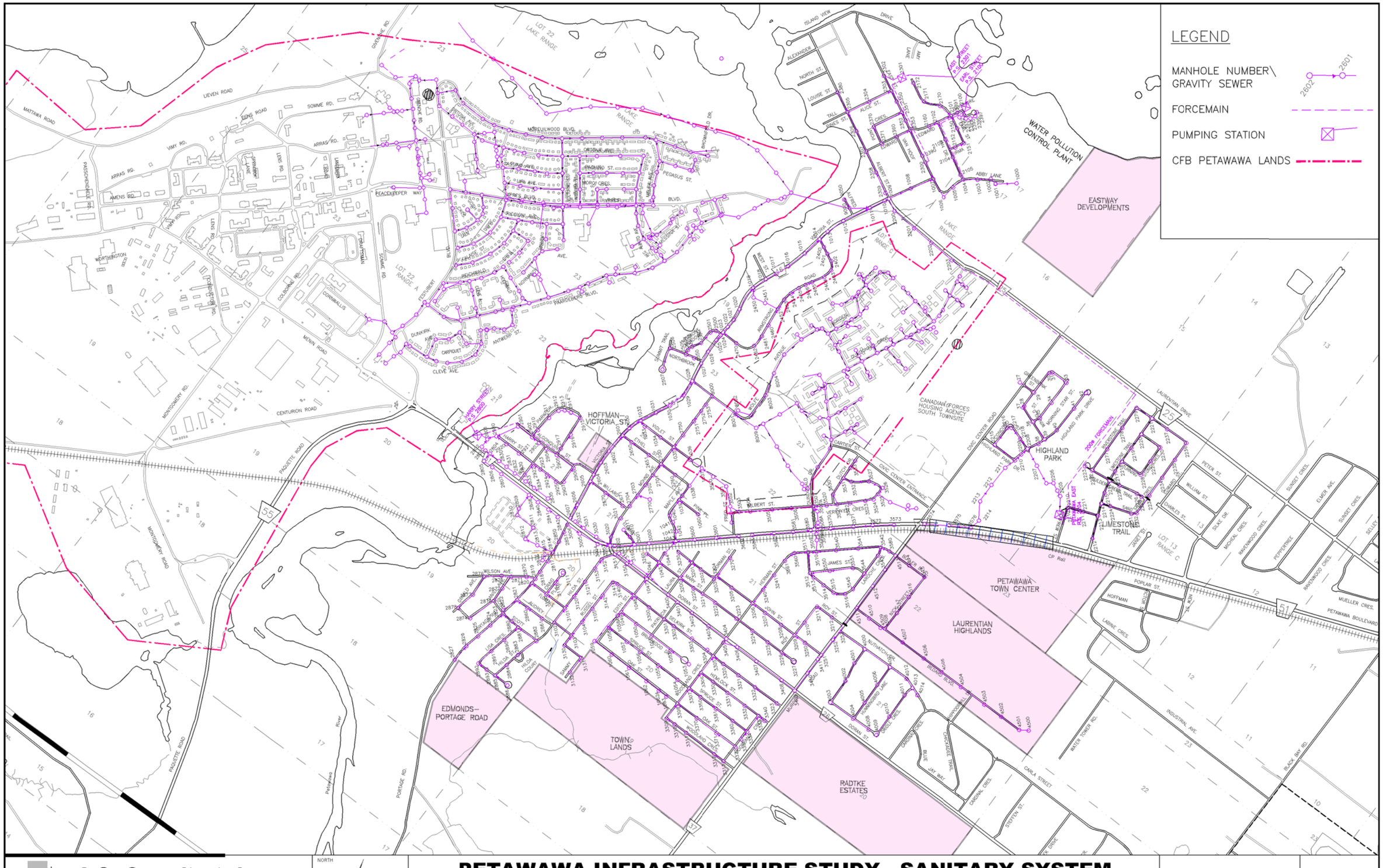
Figure 2-1 is a map showing the service area for the sanitary sewage system and the relative location of the major system components. To facilitate the identification of the sanitary sewer system, a numbering system was established for the manholes, which form the nodes to the system. This identification system is shown on Figure 2-1. The map also identifies major current and potential development areas where new housing units may be constructed and shows the relative locations of CFB Petawawa and the CFHA North and South Townsites.

The sanitary sewage system for the Town of Petawawa continues to evolve to address operational concerns and is continually being extended to accommodate identified growth areas. As stated in Chapter 1, the Town has an Official Plan which serves to identify and guide changes in land use and new development. The information provided therein is a key to understanding future needs for the system.

Within this report we will update the existing flow models for the sewage system to account for recent and proposed development. This update will also identify components or sections of the sewage collection system that may be deficient structurally or require an increase in capacity to address existing sewage flows. We will also undertake a review and costing of servicing alternatives, recommendations for improving the system and the development of an implementation plan for the upgrading and improvement of the system.

The analysis in this section of the study utilizes existing background information and reports where applicable. The flow model has retained land use assumptions based on the current Official Plan.

Although the analysis of the sanitary sewage collection system is limited to those portions of the system within the jurisdiction of the Town of Petawawa, it is necessary to account for the flows which are generated from the active Base area as well as the CFHA North and South Townsites. The sewage flows from the North and South Townsites have been calculated from population information provided by the Department of National Defense and MPAC. It should be noted that the actual sewage flow and water use in the Base is dependent on the type of training activities being carried out on the Base and the deployment of the troops that are stationed in Petawawa.



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NORTH

PETAWAWA INFRASTRUCTURE STUDY - SANITARY SYSTEM

EXISTING SANITARY SYSTEM

2-1

2.0 UPDATE OF EXISTING CONDITIONS MODEL

The existing conditions model is based on an update of the sewage flow model produced in the 2003 Town of Petawawa Infrastructure Study Update by Jp2g Consultants Inc. The flow model has been revised to reflect current development as of April 2012.

The residential sewage flow used in the existing condition model is based on an average flow of 340 L/cap day (liters per person per day), an average of 2.4 persons per household and an infiltration allowance of 0.12 L/s/ha. These assumptions were based on flow calibration work that was undertaken by Jp2g Consultants for the preparation of the June 2009 Petawawa East Sanitary Sewer System Capacity Analysis. These assumptions are within the specified ranges as set out in the Ministry of the Environment's 2008 Design Guidelines Sewage Works manual: section 5.5.2.1 notes domestic flow rates in the range of 225 to 450 L/cad day. For the Industrial / Commercial / Institutional lands (ICI), a flow rate of 10,000 L/ha/day with a peaking factor of 3 was utilized.

Appendix D contains of a copy of the updated existing conditions model for the sanitary collection system. The results of the model confirm that the existing collection system has capacity for the existing conditions, with the exception of six sections of sewer on Victoria Street. The on-going problems with this portion of the system have been identified in previous reports. Design work is currently underway to deal with all of these, with construction tentatively scheduled for the spring of 2012. These are noted on Figure 2-2.

Several other sewer sections on Victoria Street, as well as one section of Petawawa Boulevard are nearing capacity. Since these all currently have capacity to meet theoretical calculations, improvements would be considered as growth related. The updated conditions model forms the basis by which the alternative growth scenarios can be compared and allows the growth related needs to be identified and costed.

In addition to the sanitary sewers, the collection system contains four pumping stations:

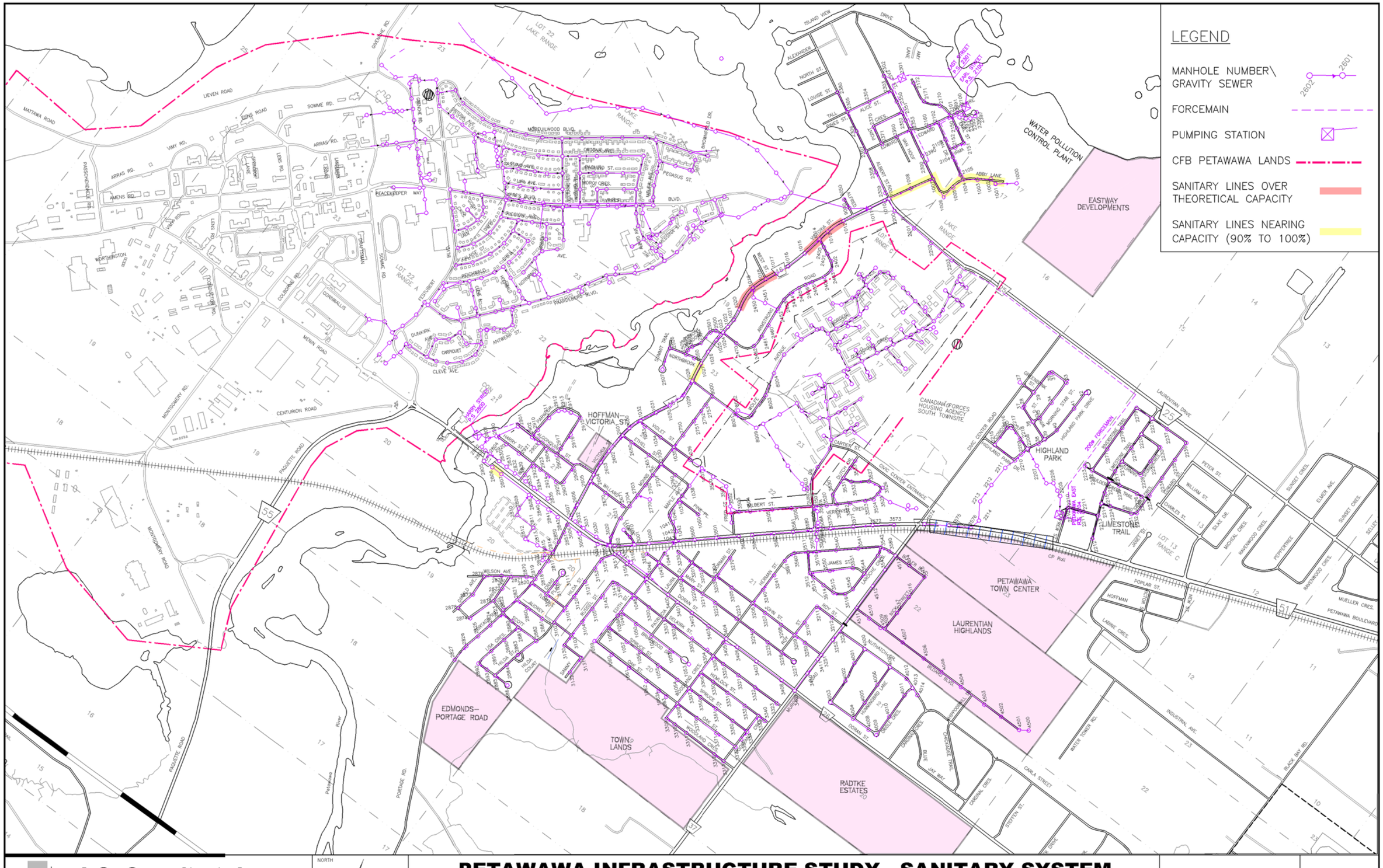
1. Harry Street Pumping Station – Harry Street
2. Petawawa East Pumping Station – Renfrew Street
3. East Street Pumping Station
4. Earl Street Pumping Station

The following is a brief description of each of these:

1. Harry Street Pumping Station

   The Harry Street Pumping Station was reconstructed in 2009/2010 with a new wet well, control building, back-up generator and outlet forcemain. The facility was designed to accommodate a proposed 10 year growth scenario that would accommodate a peak flow of 39.7 l/s with its current configuration of 2 - 20 hp (14.9 kW) Flygt pumps, each capable of pumping 43 L/s at 22 m head. These pumps discharge to a 250mm diameter forcemain that runs from the pumping station to Algonquin Street, then along Algonquin Street to Victoria Street and then along Victoria Street to the existing gravity sewer at Wolfe Avenue.

   The ultimate design capacity of this pumping station is 49.51 L/s, based on the projected 20 year build out. The wet well is currently designed to accommodate this additional flow rate. The wet well has been designed to accommodate a third 20 hp (14.9kW) pump. Under the three pump scenario, two pumps would be operating in parallel, each capable of discharging 25 L/s under 25m of head.



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PETAWAWA INFRASTRUCTURE STUDY - SANITARY SYSTEM

SANITARY SYSTEM - EXISTING CONDITIONS SCENARIO

2-2

The timing for the installation of the third pump will depend on the rate of development in the upstream drainage area. Also, the upstream drainage area is known to be an area where there is storm water entering the sanitary sewer system. This area is one of the few areas in the Town that is subject to a high groundwater table. It likely that there are a significant number of houses that have their sump pumps and/or foundation drains connected to the sanitary sewer system. Over the past year, a flow monitoring program has been implemented for the upstream area of the Harry Street Pumping Station to try and determine the source and type of storm water infiltration that is getting into the sanitary sewer system. While this program has not be finalized, the indications are that a majority of the flow is from sump pumps, foundation drains and roof water leaders that are connected to the sanitary sewer system. The Town has recently adopted By-law 694/11 to regulate waste discharges to municipal sewers. This By-law makes it illegal to have storm water discharge to a sanitary sewer system unless by agreement with the Town. Therefore, drainage from sump pumps, foundation drains and roof water leaders are prohibited from discharging into the sanitary collection system. The Town should implement a program wherein house inspections are undertaken in suspect areas to determine if indeed there are connections that contravene this By-law and require that homeowners take corrective measures if issues are found. If such an active program was put into place to reduce the discharge of storm and ground water from entering the sanitary collection system, it could free up additional capacity within the pumping station for additional development or prolong the timeline for the installation of the third pump.

As the Harry Street Pumping Station is a new installation, there are no required works recommended at this time.

2. Petawawa East (Renfrew Street) Pumping Station

This pumping station, located within the Hydro Corridor along Renfrew Street was designed in 1997 to accommodate a new development area bounded by Civic Centre Road, Laurentian Drive, the former Village/Township boundary to the east and Petawawa Boulevard.

The most recent analysis of this pumping station took place in June 2009, in a report completed by Jp2g Consultants Inc. entitled “Town of Petawawa, Petawawa East Sanitary Sewer System Capacity Analysis”, which is included in Appendix E.

The report illustrates how the pumping station was designed with a two stage scenario. Currently, under Stage 1, the station has the following capacity:

- Peak flow – 30.35 l/s
- Wet Well – Sized to accommodate Stage 1 flows only
- Pumps – 2 pumps each capable of pumping 32 l/s at 24m of head
- Forcemain – 200mm diameter capable of accommodating a flow rate of 55.23 l/s (Stage 2 flow rate)
- No back-up generator provided

With the current level of development in the upstream area, there is sufficient capacity in this pumping rate. However, as this is one of the most active areas for development, the flow rate at the station should be monitored and, once it nears the peak flow rate of 30.35 l/s, the upgrade to Stage 2 should be considered.

Based on the analysis completed in the June 2009 report, the following upgrades would be in order to increase the pumping capacity to the proposed Stage 2 flows of 55.23 l/s:

- The 2 existing Flygt pumps can only provide a pumping rate of 32 l/s and would have to be replaced with 2 new pumps. We have determined that 2 Flygt model 3170 pumps could provide a peak capacity of 57 l/s based on utilizing the existing 200mm diameter forcemain. These pumps are approximately the same size as the existing pumps and could easily be connected to the existing internal piping network.

- The new pumps will require new starters.

- The station should be equipped with an emergency generator.

- The floats would have to be raised in order to provide additional storage capacity between pump stop and duty pump start. This would result in the high level alarm being above the elevation of the inlet sewer, which is permissible under MOE guidelines as long as there is no concern about basement flooding. It is recommended that the floats be raised by 0.4 m, so that the high level alarm would then be 0.3 m above the inlet pipe (the float to start the standby pump would then be at the invert elevation of the inlet pipe). Additional storage capacity could also be provided by installing an additional wet well, in the form of a 3.0m diameter chamber next to the existing chamber and interconnecting the two chambers.

- The existing 200 mm diameter forcemain is large enough to handle the increased flows generated by the new pumps. The existing downstream gravity sewer system on Laurentian Drive is also sized to accommodate this peak flow of 57 l/s.

3. East Street Pumping Station

The East Street Pumping Station provides an outlet for the older streets within the Petawawa Point area including East Street, Alice Street, Albert Street (Victoria Street to Louise Street), Pine Crescent and Edward Street. We are currently not aware of any issues with this facility.

The 2003 Infrastructure Study did indicate that consideration should be given to extending sanitary services to the remaining part of the Petawawa Point, previously within the Township. If this were to occur, the additional area would have to drain to this pumping station. However, in April 2003, a public meeting was held with the residents in the area to gauge their interest in cost sharing on the installation of sanitary and water distribution systems. Based on the results of this meeting, the Town decided not to proceed with any further discussions on the extension of servicing to this currently unserviced area.

4. Earl Street Pumping Station

The Earl Street Pumping Station was constructed as part of the servicing for the new residential development area adjacent to the Town's Water Pollution Control Plant. We are currently not aware of any issues relating to this facility and there is no future development area that will be serviced by this facility.

3.0 REVIEW OF OPERATIONAL ISSUES

Based on input from OCWA staff, the following is a list of operational issues that presently impact the sanitary sewer collection system:

1. **Storm water infiltration into the sanitary sewer system in the areas surrounding Lisa, Scott and Hilda Streets, which are all upstream of the Harry Street pumping station.** This issue is talked about previously in this chapter under the discussion on the Harry Street pumping station.

2. **Root infiltration into the sanitary sewers on Norman Street.** OCWA staff is planning on fixing this problem in the spring of 2012, through the process of relining the affected sanitary sewer line.

3. **Grease build-up within the sanitary sewer line that runs along Petawawa Boulevard from Shoppers Drug Mart through the Moncion grocery store property to the Renfrew Street pumping station.** This is due to the restaurant uses in the area as well as the fact that the pipe is installed at a flat grade due to topography issues. OCWA staff will have to continue to monitor this situation and flush the line when necessary.

4. **Grease build up in the Renfrew Street pumping station.** This is related to the above noted issue. Improvements can be made to the pumping station to deal with this situation when the station is upgraded to accommodate additional flows. The exact timing for these Stage 2 upgrades as noted in Section 2.0 of this chapter are not known at this time, but will likely occur within the next 5 years.

5. **Sump within the sanitary sewer line under the CP tracks between Herman Street and Petawawa Boulevard.** In 2010, work was undertaken on the west side of the tracks to improve this situation; however, there is still a sump within the sanitary sewer that is installed within a casing under the CP tracks. It is hoped that when and if the CP tracks are removed, this casing and sanitary sewer can be reconstructed to eliminate the sump.

6. **Capacity constraints within the Victoria Street sanitary trunk sewer.** The upgrading of this sanitary sewer line is discussed in further detail in Section 5.0 of this chapter.

7. **Flow meters to determine sewage flow rates from CFB Petawawa are not operational.** Presently there is no means of determining the sewage flow that is being generated by CFB Petawawa, since the existing meters are not functioning properly. Steps are being taken to install new meters and this situation should be rectified by the end of 2012.

8. **Sewage gas smell along Laurentian Drive.** The forcemain for the Renfrew Street pumping station discharges into a gravity sanitary sewer in the vicinity of Dundonald Drive and Laurentian Drive. Over the past few years, there have been times where there is a sewage gas smell emanating from the sanitary sewer. This situation is caused by the fact the sewage has become septic as it sits in the pumping station and forcemain for a long period of time. Over time this situation will improve since, with increased development in the area, there will be greater flows to the pumping station, which in turn will cause the system to be "flushed" more frequently, reducing the chances of the sewage becoming septic.

9. **There is a by-pass valve that is seized in front of the sewage plant.** This issue is presently being reviewed and a proposed means of addressing it will be implemented in the short term (1 to 3 years).

4.0 EVALUATION OF IMPACTS DUE TO RESIDENTIAL AND COMMERCIAL GROWTH

Since the completion of the 2003 Infrastructure Study Update, the Town has experienced significant growth. Based on the development activity currently taking place in the Town, it is anticipated that growth will continue to occur over the foreseeable future. The impact of present and future growth on the sanitary collection system has to be evaluated in order to determine what upgrades and/or improvements are required. In the following sections we will analyze the impact that active and proposed developments will have on the sanitary collection system.

In reviewing the impact that growth will have on system, we must consider several aspects of the operation of the sanitary sewer system. These include:

- Capacity must be available within the existing system for growth.
- The cost to existing ratepayers to provide for growth in the municipality is minimized.
- New development will pay for the cost of new services (user pay) and provide funding for downstream system upgrades through development charges.
- The available capacity in the existing system will be optimized.
- Life cycle costs of the sewer system will be minimized.
- Expansion of the system beyond the current planning horizon will be provided for, where practical.
- Viable solutions, which are flexible, will be identified to allow variability in scheduling or sequencing of new developments.

4.1 All Subdivisions that are Registered and under Construction

The first scenario investigated was the impact currently approved developments would have on the system. For this scenario, we have looked at the full build-out of the following developments that were registered and under development in the spring of 2012:

- Limestone Trail – Phases 3 & 4 and Commercial lands
- Highland Park – Phase 4A
- Briarwood – Phase 3
- The Forest – Phase 4
- Vereyken Subdivision – Renfrew Street
- Laurentian Highlands – Phase 1A & 1B

The sanitary design sheets for this scenario are contained in Appendix F and the results of the analysis are noted on Figure 2-3. As noted on this figure, there would be 7 sections of sewer on Victoria Street that are over capacity (1 more than the “existing condition” model) and there are the same number of sections that are nearing capacity (8 at the lower end of Victoria Street and 1 on Petawawa Boulevard).

4.2 All Subdivisions that are Draft Approved

The second scenario investigated was the impact of all draft approved developments on the system. For this scenario, in addition to the developments noted in 4.1, we looked at the full build-out of the following developments, which were draft approved in the summer of 2012:

- Petawawa Town Centre – 78 townhouses and 17.48 ha. of Commercial lands
- Highland Park – Phase 4B & 5 – 80 residential units and the existing church
- Laurentian Highlands – Phase 2A, 2B & 2C – 332 residential units
- Hoffman Victoria Street – 12 residential units
- 2 schools on Leeder Lane

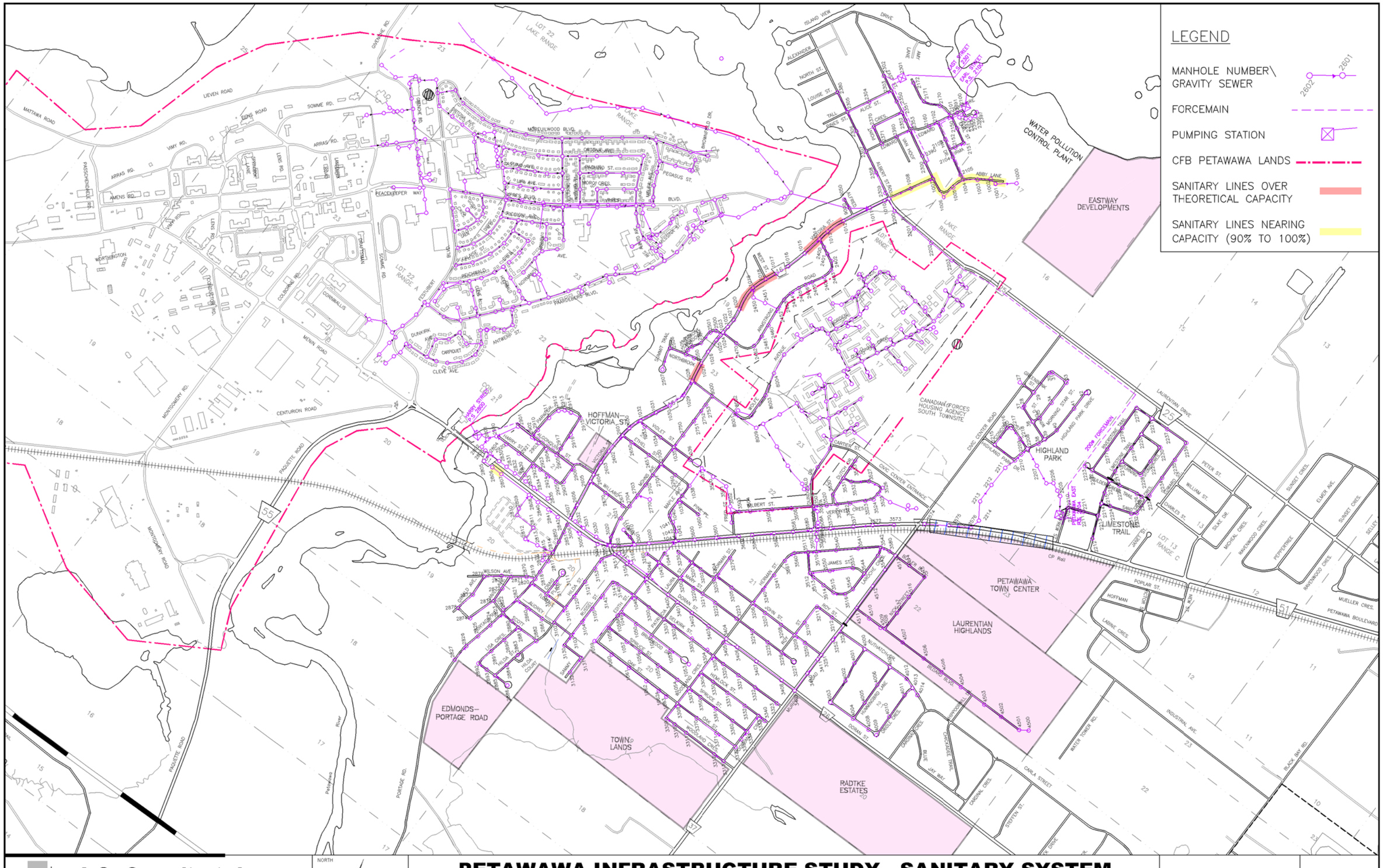
With regards to the sewage flows for Laurentian Highlands, we split the flows, with Phase 1A, 1B and 2A discharging to the Herman Street sanitary sewer and Phase 2B and 2C discharging through the Petawawa Town Centre development. It is noted that the manhole at the intersection of Butler Boulevard and Nick Street has been benched to allow the flows from Phase 1A, 1B and 2A to flow in either direction: through Herman Street or through the Petawawa Town Centre development. Our model shows flow discharging to Herman Street, thereby utilizing as much of the capacity of the gravity system as possible, rather than flowing to the Petawawa East Pumping Station.

The sanitary design sheets for this scenario are contained in Appendix G and the results of the analysis are noted on Figure 2-4. As indicated on this figure, there would be 16 sections of sewer on Victoria Street over capacity (9 more than the previous scenario) and only one section that is nearing capacity (the same one previously noted on Petawawa Boulevard). The big change under this scenario is that the entire section of sanitary sewer downstream of Laurentian Drive is now over capacity. This is attributed to the significant amount of development that is proposed within the Petawawa Town Centre Commercial development, Highland Park Subdivision and the Laurentian Highlands Phase 2 development, all of which primarily discharge to the Petawawa East Pumping Station.

4.3 All Subdivisions that are Draft Approved and All Lands in the Current Official Plan

The third scenario that we undertook was to determine what impact the full build-out of all the lands currently designated for residential development within the sanitary servicing area would have on the system. For this scenario, in addition to the developments noted in 4.2, we have included the following:

- Edmond Property – Portage Road – 135 residential units
- Radtke Estates –350 residential units
- Russell Street extension on Town owned lands – 35 residential units



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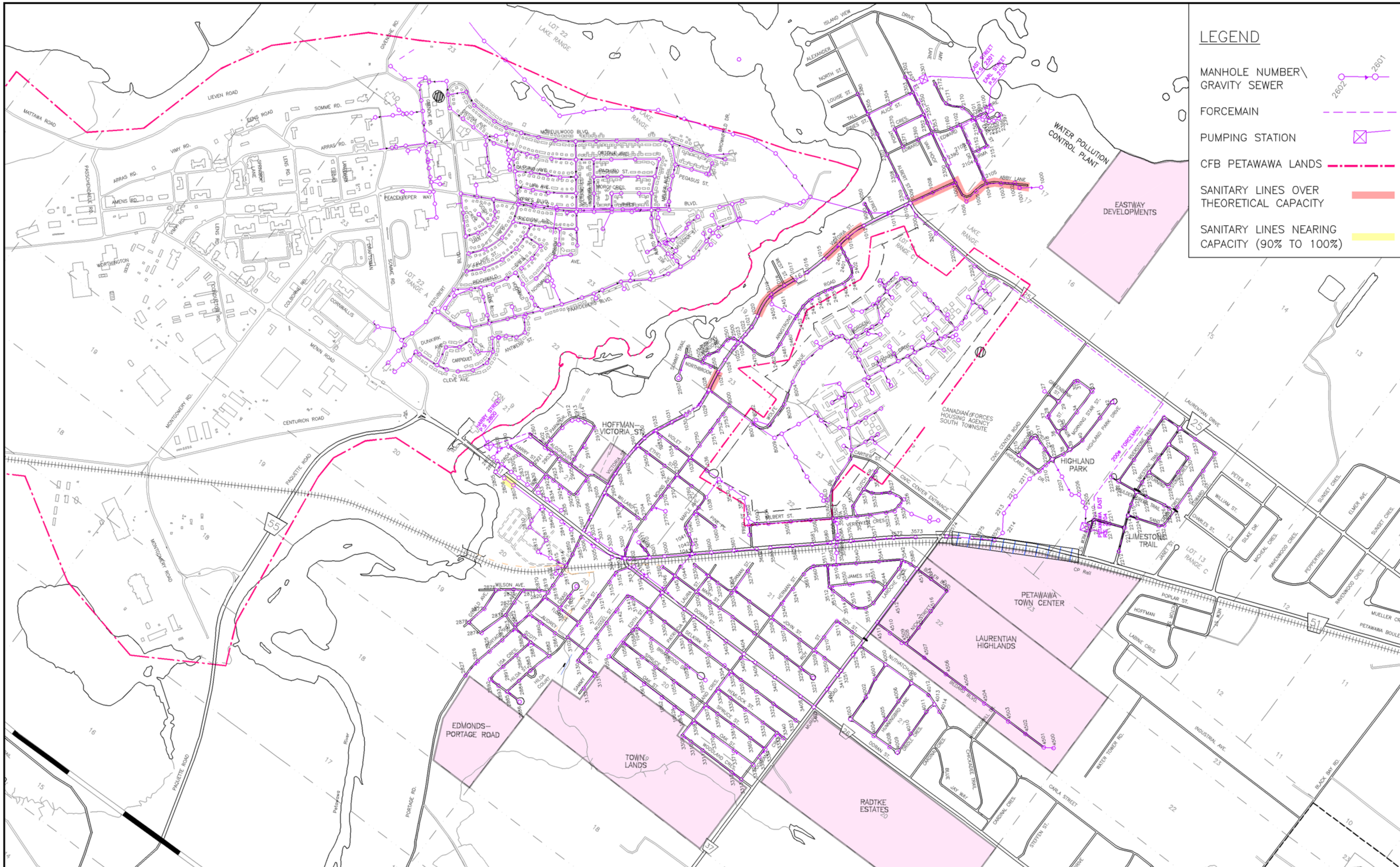
PETAWAWA INFRASTRUCTURE STUDY - SANITARY SYSTEM

SANITARY SYSTEM - WITH ALL REGISTERED SUBDIVISIONS FULLY DEVELOPED

2-3



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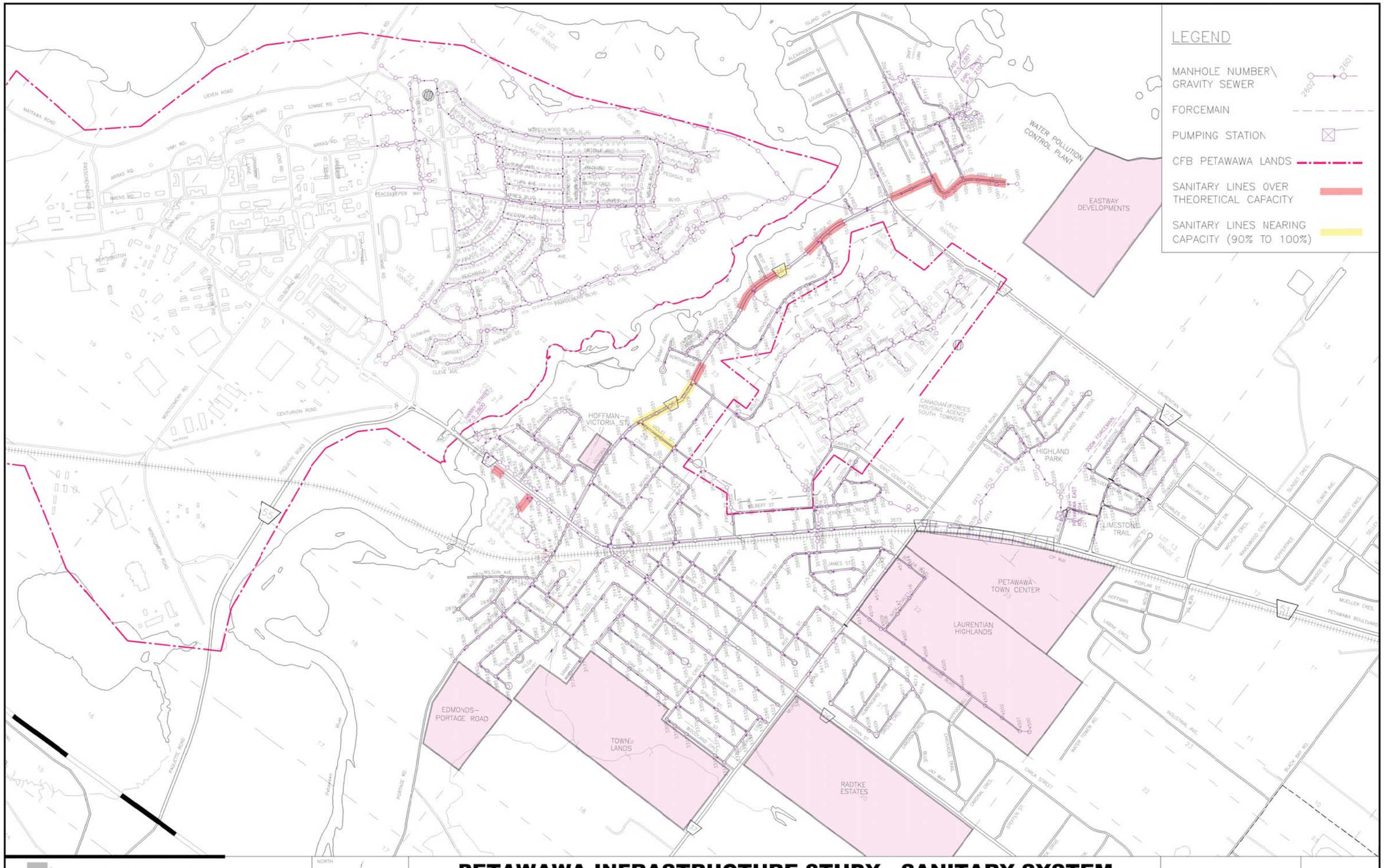
PETAWAWA INFRASTRUCTURE STUDY - SANITARY SYSTEM

SANITARY SYSTEM - WITH ALL DRAFT APPROVED SUBDIVISIONS FULLY DEVELOPED

2-4



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PETAWAWA INFRASTRUCTURE STUDY - SANITARY SYSTEM

SANITARY SYSTEM - ALL LANDS DEVELOPED WITHIN CURRENT OFFICIAL PLAN

2-5

The sanitary design sheets for this scenario are contained in Appendix H and the results of the analysis are noted on Figure 2-5. As indicated on this figure, the following upgrades would be required:

- 16 sections of sewer on Victoria Street need to be upsized and 5 sections are nearing capacity.
- 1 section of sewer on Petawawa Boulevard (just east of the bridge) needs to be upsized.
- 2 sections of sewer within the trailer park lands between Portage Road and Petawawa Boulevard need to be upsized.
- 1 section of sewer on Violet Street is nearing capacity.

4.4 Future Development Lands outside the Current Official Plan

While it is anticipated that there are sufficient lands currently designated residential to accommodate the projected 10 year growth based on recent analysis completed by the County of Renfrew's Planning Department, there is the need to review options to service additional lands in the future, outside of those currently designated. However, as noted by the analysis completed in the preceding sections, a significant portion of the existing sanitary sewer collection system is nearing capacity, as it was originally only designed to accommodate the urban land area of the former Village of Petawawa. As the areas to be serviced by sanitary sewers expand beyond the existing urban boundary, it becomes more difficult to find available capacity in the collection system to accommodate additional development.

Also, the topography of this area of Petawawa does make it more difficult to provide gravity connections to the sanitary sewer system, since significant areas around the perimeter of the urban area are relatively flat.

The most likely areas for future expansion of the sanitary service area would be to the south-west of the current urban area, in the corridor along both Portage Road and Murphy Road. Generally these lands are separated from the current urban area by an existing creek that flows under Murphy Road and northerly before discharging into an existing storm sewer system. Due to the presence of this creek, it will not be possible to extend a gravity sewer to this area. Development of this land will require the installation of a pumping station. However, at this time, there are no any sanitary sewers in the immediate area that could accommodate the additional flows.

Prior to developing any of these lands, a long term sanitary sewer servicing options study should be undertaken, specific to this area. It is anticipated that any option that is considered will have significant off-site works that should be paid for by the development, likely in the form of an area specific development charge. Some of the options that could be considered are:

1. Installation of a forcemain to the intersection of Doran Road and Murphy Road, then upgrades to the sanitary sewer system on Murphy Road from Doran Road to Petawawa Boulevard and the installation of a new sanitary sewer along the CP Rail corridor from Murphy Road to the existing sanitary sewer at Dundonald.

2. Installation of a new sanitary sewer within the CFB South Townsite between the Violet Street extension and Wolfe Avenue to by-pass the existing sewers on Violet Street and Victoria Street that are nearing capacity.

3. If the existing H & H pit along the north side of Portage Road is developed, review the option of installing a sanitary pumping station on that property that would have a forcemain installed parallel to the Petawawa River and discharge the forcemain into the sewer system on Petawawa Boulevard. This may require easements for installation on private property. The purpose of this routing would be to eliminate the need to discharge into the sewer on Portage Road that has limited capacity.

As noted above, we recommend that a detailed sanitary servicing study be undertaken in the future for this area. Since there will be a significant capital cost to develop these lands, it is anticipated that the lands will not be developed until such time as the inventory of readily serviced lots is reduced significantly. In the meantime, any reconstruction work that is completed in these areas should be mindful of the potential servicing options for these lands so that any of these options are not precluded.

5.0 SUMMARY OF EXISTING SYSTEM DEFICIENCIES

Recommended Improvements

In establishing the needs and priorities for the sanitary sewer improvements, it is assumed that those lands that are easiest to develop will proceed first. In addition, the Town will only fund those system improvements that are required to maintain the infrastructure. Improvements which are required as a result of growth or new development will be funded by the proponent(s) of that growth, either directly or through development charges. Where repairs must be made to the system, however, consideration will be given to increasing capacity or performance to accommodate growth if the additional costs are minimal. The recommended improvements are summarized as follows.

Victoria Street

As demonstrated by all of the scenarios evaluated, there are significant upgrades required to the Victoria Street sanitary sewer system. There are currently sections of the sanitary sewer that are at their rated capacity, particularly for those sections identified between Wolfe Avenue and Laurentian Drive. The design work for the upgrading on this section is currently underway and is scheduled to go to construction in 2012, subject to final funding allocation at both the Town and the County of Renfrew. The estimated cost for the proposed upgrades, including restoration costs, engineering and contingencies, is approximately $1,500,000 based on past contracts in the area.

For the section of sanitary sewer between Laurentian Drive and the Sewage Treatment Plant, our analysis shows that the sewer is currently nearing capacity and will be over capacity with the full build out of the development that is currently draft approved in the Town. The capacity of this sewer will be further affected by growth at CFB Petawawa, as the sewage discharge from the North Townsite enters the Town's sanitary collection system just upstream of Laurentian Drive. The Town should consider replacing and/or twinning this section of sanitary sewer within the next three years based on the anticipated levels of development within the Town as well as at CFB Petawawa. The cost of these improvements is estimated at $650,000 plus the cost of roadway improvements.

Petawawa East Pumping Station

As the majority of the proposed development is taking place within the upstream drainage area of the Petawawa East Pumping Station, there will be a need to undertake improvements to this pumping station to accommodate this growth. The flow rates at this station should be monitored by OCWA and, as it nears the peak flow capacity of 32 l/s, the design and implementation of the following upgrades should be undertaken:

- Replace the 2 existing Flygt pumps with 2 Flygt model 3170 pumps that can provide a peak capacity of 57 l/s, based on utilizing the existing 200mm diameter forcemain.
- There will be a need to upgrade the starters due to the new pumps.
- The station should be equipped with an emergency generator.
- The floats would have to be raised in order to provide additional storage capacity between pump stop and duty pump start. Additional storage capacity could also be provided by installing an additional wet well, in the form of a 3.0m diameter chamber next to the existing chamber and interconnecting the two chambers.

The estimated cost of these improvements is $463,050.

6.0 CONCLUSIONS

- The sewage treatment facility is currently operating at 63% of its rated capacity based on the February 2011 analysis conducted by Jp2g's offices. There is sufficient reserve capacity available within the facility to accommodate about 2,770 additional residential units on the Base and within the Town, which is sufficient for the current 10 year growth projections that have been produced by the County of Renfrew's Planning Department.

- The existing sanitary sewage collection system, with the exception of some of the Victoria Street system, has theoretical capacity for the existing Residential, Institutional, Commercial and Industrial flows being produced in the Town sanitary service area as well as from CFB Petawawa.

- The four existing Pumping Stations within the system are currently operating well and require no immediate upgrades. In the near term, upgrades will be required at the Petawawa East (Renfrew Street) station to accommodate projected growth in the upstream drainage area. In the longer term, a third pump will have to be added to the Harry Street station in order to provide additional capacity.

- OCWA staff have noted 9 operational issues within the sewage collection system. These are either currently being addressed, will be addressed in the short term or require on-gong maintenance work by OCWA staff.

- The proposed upgrading of sections of the sanitary sewer on Victoria Street, between Wolfe Avenue and Laurentian Drive in the 2012 construction season will address immediate and long term capacity issues with this part of the collection system.

- The proposed upgrading and/or twinning of the sanitary sewer on Victoria Street between Laurentian Drive and the Sewage Treatment Plant will provide capacity for additional growth within the Town, as well as at CFB Petawawa. This work should be considered in the short term (3 year period).

- Upgrades are required to a few sections of sanitary sewer on Petawawa Boulevard as well as within the existing trailer park to the west of Petawawa Boulevard in order to address projected growth in the Portage Road area.

- A sanitary servicing options report will be required in order to look at the long term servicing solution for future development lands that are located along Portage Road and Murphy Road to the south-west of the existing urban area. Some options have been noted in this report and if reconstruction work is to take place in the areas noted, the designer should be mindful of these and take them into account.

7.0 RECOMMENDATIONS

The following is a list of the primary recommendations in this chapter of the report:

- While the sewage treatment facility is projected to have sufficient reserve capacity for 2,770 additional residential units combined for both the Town and CFB Petawawa, the Town should initiate the Environmental Assessment for the upgrading of the plant when the facility reaches 75% of its rated capacity. As of February 2011, it was operating at 63% of the rated capacity.

- In the long term, there is a need to install a third pump in the Harry Street Pumping Station. The timing for its installation will be dependent on the rate of new development along the Portage Road corridor.

- The Town should implement a program wherein house inspections are undertaken in suspect areas of storm water infiltration into the sanitary sewer system in order to determine if indeed there are connections that contravene the Town's new By-law that regulates waste discharges to municipal sewers. If these connections are found then the homeowners should be instructed to take corrective measures.

CHAPTER 3

STORM DRAINAGE SYSTEM

TABLE OF CONTENTS

Figures

Appendices

1.0 INTRODUCTION

The existing drainage systems in the Town of Petawawa consist of a combination of shallow swales, ditches, storm sewers, dry wells, infiltration basins and storm water management ponds. These systems ultimately carry the surface water to the Petawawa or Ottawa Rivers, either via overland flow, pipe flow or through ground water recharge.

The original storm sewer systems within the urban area were designed to accommodate the existing residential areas only. In many instances, the drainage system had insufficient capacity to allow for drainage areas to be extended, or to allow for an increase in the rate of run-off from new development. The capacity of many of these older existing drainage systems have insufficient capacity to ensure adequate drainage during heavy rain events, leading to the potential for property damage as a result of flooding.

Since the 2003 Infrastructure Study Update, both the Town of Petawawa and the County of Renfrew have undertaken a number of capital works projects to address the inadequacies of storm sewer systems within the Town. These projects include:

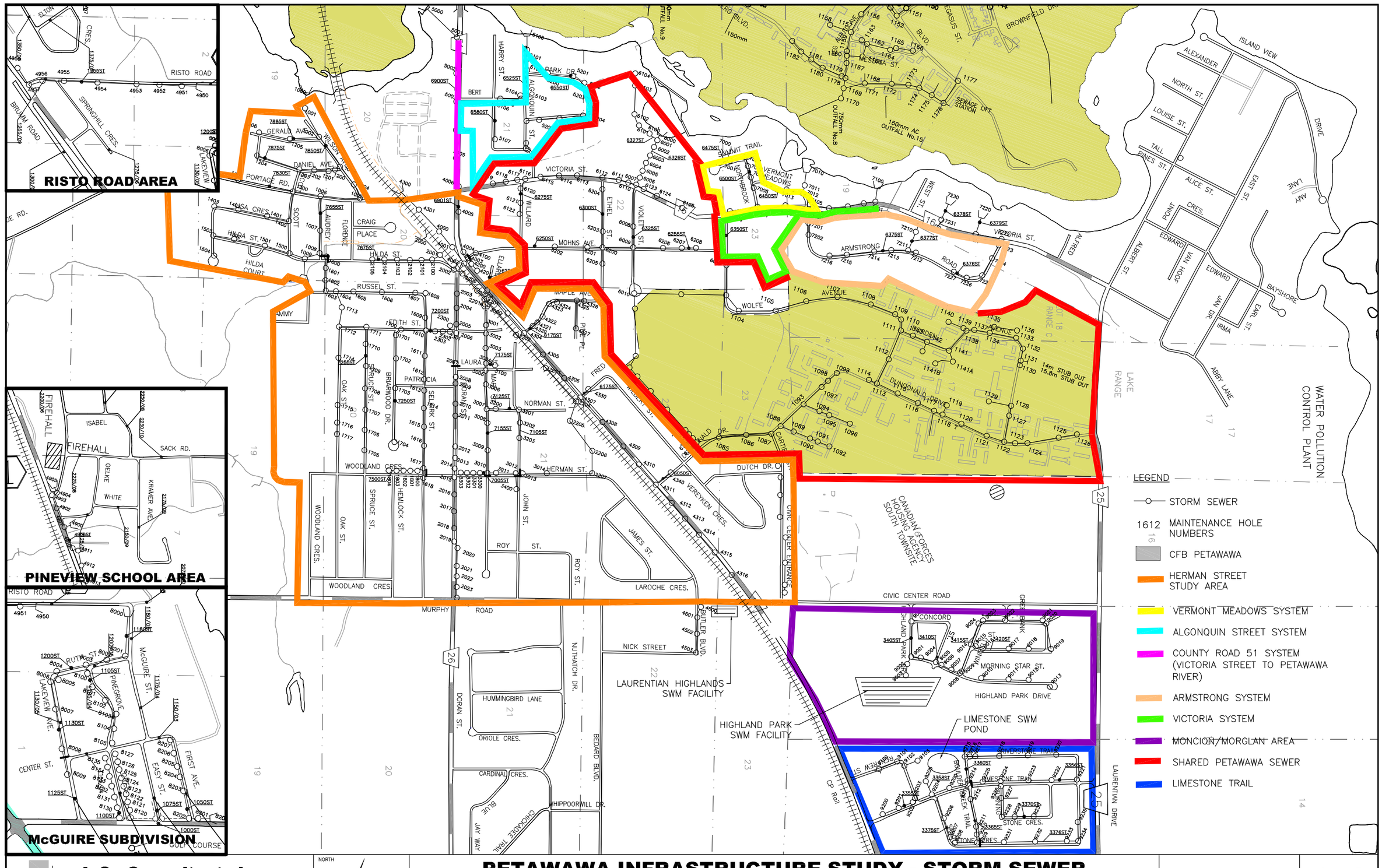
- A new storm sewer drainage system for Petawawa Boulevard from Murphy Road to Mohns Ave., including construction of a new outlet.
- A new storm sewer system for Maple Ave. and Pine Place.
- A storm infiltration system for the Civic Center entrance.
- Storm sewer systems on Audrey Street, Russell Street and Selkirk Street connected to the Hoffman Outlet.
- Commencement of the new Herman Street Outlet Storm Sewer project.
- Drainage improvements in the McGuire Subdivision.

These have addressed the majority, but not all, of the deficiencies that were noted in the 2003 Infrastructure Study update.

Over the past few years, there have been a significant number of new residential and commercial developments constructed within the Town. These have all been designed with some form of storm drainage system, generally sized to handle at least the 2 year storm event. These developments also have overland flow routes, to avoid the threat of flooding to residences.

The following sections provide a description of the various storm sewer systems that are located in the Town, note improvements that are required for these systems and also provide recommended design criteria for any future systems.

Figure 3-1 provides a snap shot of the storm sewer systems that are currently in place in the Town of Petawawa.



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PETAWAWA INFRASTRUCTURE STUDY - STORM SEWER

STORM DRAINAGE SYSTEMS

3-1

2.0 REGULATORY REQUIREMENTS AND OBJECTIVES

The regulation of surface water drainage in Ontario is currently governed by several Acts of Parliament. These include:

- The Drainage Act
- The Lakes and River Improvements Act
- The Public Lands Act
- The Federal Fisheries Act
- The Conservation Authority Act
- The Environmental Protection Act

In order to meet and address the intent of these regulations, it is necessary to develop a framework that integrates Water Management Strategies and Objectives into Municipal projects and that provides guidance for both future development and redevelopment. This framework will be established by documenting existing conditions, establishing a strategy for implementation of necessary drainage improvements and integrating strategies to allow development, redevelopment and infrastructure improvements, while protecting the environment.

The overall objectives of the Watershed Planning Process, carried forward to this study, include the following:

- Take a broad ecosystem approach to water, water related features, terrestrial resources, fisheries, water dependencies.
- Respect the ecological integrity and carrying capacity of existing drainage facilities and natural conveyances.
- Protection of valley streams and natural areas.
- Management of water quality and quantity.
- Management of ground water and aquifer.
- Fisheries management and protection.
- Rehabilitation and enhancement of features.
- Identification of opportunities and constraints.
- Documentation of servicing needs.
- Address local environmental issues.
- Identify Best Management Practices suitable for incorporation into new subdivision designs.
- Develop implementation schemes, identify responsibilities and an implementation strategy.
- Provide direction for future drainage plans and designs.
- Identify needs for specific environmental assessments.

3.0 STUDY OBJECTIVES

The purpose of this study is to develop a comprehensive drainage strategy that will identify and address drainage issues resulting from the increasing urbanization and redevelopment of the existing urban area. The study must also address the planned new development adjacent to the existing urban area, to confirm that capacity is available in the existing storm outlets. This study aims to resolve drainage issues and provide standards to guide development and redevelopment for all areas of the Town. The objectives of the drainage system analysis are as follows:

i) To update as-built information on existing drainage systems;
ii) To develop storm water drainage criteria that are applicable to the area;
iii) To identify alternative drainage systems that are compatible with existing streets, allow for urbanization, and have capacity to accommodate future development and in-filling;
iv) To prevent loss of life, minimize property damage and health hazards;
v) To protect receiving water courses;
vi) To utilize existing drainage systems where practical;
vii) To reduce overall cost of systems
viii) To meet current accepted design criteria;
ix) To identify required drainage improvements;
x) To develop an implementation plan.

3.1 Study Process

This drainage study will consist of the following activities:

i) Review available as-built information
ii) Prepare a plan showing the existing drainage systems and drainage boundaries
iii) Evaluate these drainage systems
iv) Identify the issues/constraints of these systems
v) Develop an implementation plan for upgrades/improvements to these systems.

3.2 Design and Evaluation Criteria

The ability of pipe and surface water collection systems to convey water is determined based on differing rainfall occurrences. As an example, a two year storm has a probability of occurring once every two years. A 100 year storm is a rare event, having a probability of occurring once every 100 years.

The design of conventional drainage systems generally provides for a minimum conveyance capacity for either a two year or five year storm (often described as the minor storm event). For the purpose of this study, both a two year and a five year return period are considered in evaluating the existing and proposed storm drainage systems. A detailed evaluation of the effect of storms with larger return periods, such as the 100 year major storm event, has not been undertaken.

Nonetheless, the detailed design of drainage systems must consider the potential effect of the larger storm and provide for the storage and conveyance of flows beyond the minor storm event. For such extreme storm events, designs normally rely on the storage of water in areas which do not threaten private property or structures, or allow for the conveyance of excess water through overland flow routes. The detailed design of all systems must consider the effects of flows in excess of the design storm and identify storage or conveyance measures to ensure that major damage does not occur for storms of up to the 1 in 100 year return period.

3.3 Inventory

Based on the work undertaken in the 2003 Infrastructure Study Update, the Town's existing storm drainage system has been mapped as noted on Figure 3-1. Since 2003, Jp2g has updated this inventory to denote the new storm systems that have either been added as part of the yearly capital works program or through subdivision development.

This plan does not note the size or grade of these existing pipes, however that information is available.

4.0 DESCRIPTION OF PRIMARY DRAINAGE AREAS

Several technical studies have been completed for the various storm drainage systems in the Town. The most recent study is the 2001 Herman Street Area Storm Sewer Study. The Herman Street Study provided a detailed analysis of several of the larger storm drainage systems in the urbanized area of the Town. In addition to the drainage systems in the Herman Street area, there are several other drainage systems that are part of the Town's overall system. Several of these systems have also been analyzed through a variety of reports and evaluations. This section will summarize the primary drainage systems in the Town.

These previous drainage studies have included a technical analysis of the drainage systems to confirm that sufficient capacity will be available for the ultimate development scenario. For those systems which had not previously been assessed, or for which the information contained in the existing analysis was out of date, capacity was determined based on current information. Copies of the analysis of the storm systems carried out for this study are contained in Appendix K.

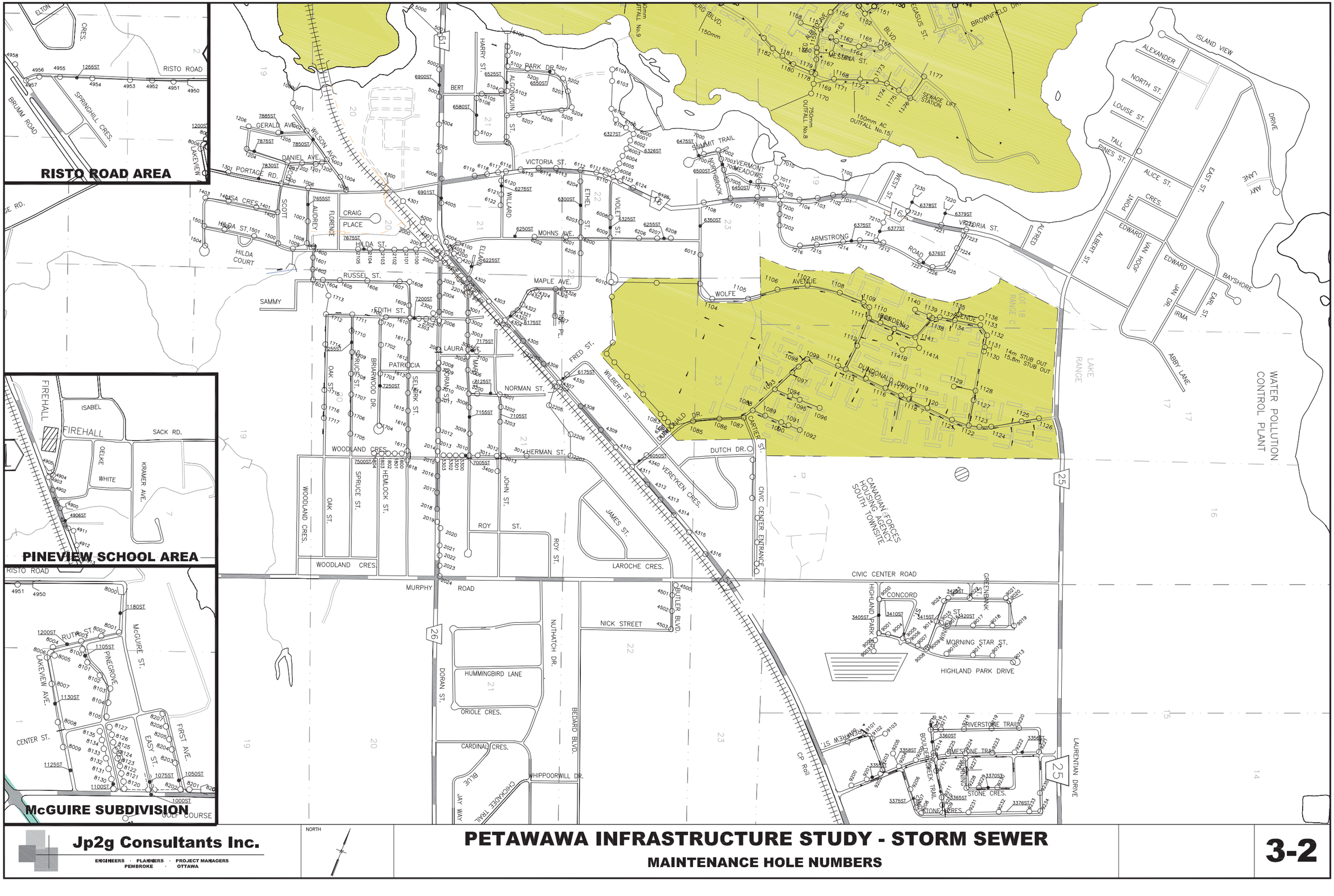
4.1 Herman Street Area Storm Sewer Study Drainage Areas

The 2001 Herman Street Study provided detailed evaluation of several drainage systems in the former Village area. These systems are identified on Figure 3-1. A brief description of each existing system within the Herman Street Study Area is provided below.

- **Hoffman Storm Sewer**

  The Hoffman Storm Sewer was installed in 1995. This storm sewer was designed with capacity to accommodate the urban drainage areas west of John Street, including several areas that remain to be developed. A portion of this designated area is directed to the Hilda Street storm sewer through the Doran Street system. To provide capacity for the developing areas, the storm sewer was oversized to accommodate growth, with the additional costs being assessed to the developing land owners.

  The Hoffman storm sewer has been designed to include the flows from the Unnamed Creek which provides drainage for approximately 420 ha. of rural land, consisting of a mixture of agriculture or vacant/forestry uses. This watershed also includes a large wetland area which serves to attenuate the flows from the rural area, providing added capacity for storage, passive storm water flow attenuation and water quality treatment. The existing storm sewer has sufficient capacity to accommodate a 2 year storm event


RISTO ROAD AREA
PINEVIEW SCHOOL AREA
McGUIRE SUBDIVISION
RISTO ROAD
BRUMM ROAD
SPRINGHILL CRES.
ELTON CRES.
LAKEVIEW
PORTAGE RD.
GERALD AVE.
WILSON AVE.
DANIEL AVE.
SCOTT
AUDREY
FLORENCE
CRAIG PLACE
HILDA ST.
HILDA COURT
SAMMY
RUSSEL ST.
EDITH ST.
LAURA ST.
PATRICIA
BRIARWOOD DR.
SELKIRK ST.
OAK ST.
SPRUCE ST.
HEMLOCK ST.
WOODLAND CRES.
NORMAN ST.
HERMAN ST.
JOHN ST.
ROY ST.
JAMES ST.
LAROCHE CRES.
MURPHY ROAD
HARRY ST.
BERT
ALGONQUIN ST.
PARK DR.
VICTORIA ST.
WILLARD
ETHEL
VIOLET ST.
MOHNS AVE.
MAPLE AVE.
FRED ST.
WILBERT ST.
VEREYKEN CRES.
DUTCH DR.
CIVIC CENTER ENTRANCE
CIVIC CENTER ROAD
SUMMIT TRAIL
NORTHBROOK
VERMONT MEADOWS
ARMSTRONG ROAD
WOLFE AVENUE
DUNDONALD DRIVE
DUNDONALD DR.
CARTIER ST.
MESSINA ST.
SEWAGE LIFT STATION
BROWNFIELD DR.
PEGASUS ST.
BLVD.
150mm OUTFALL No.9
750mm OUTFALL No.8
150mm AC OUTFALL No.15
WEST ST.
ALFRED
ALBERT ST.
ISLAND VIEW DRIVE
ALEXANDER
NORTH ST.
LOUISE ST.
TALL PINES ST.
ALICE ST.
POINT CRES.
EDWARD
VAN HOOF
EAST ST.
LANE
AMY
EDWARD
BAYSHORE
JAN DR.
IRMA
CAPE ST.
ABBY LANE
WATER POLLUTION CONTROL PLANT
LAKE RANGE
LOT 18 RANGE C
14m STUB OUT
15.8m STUB OUT
CANADIAN FORCES HOUSING AGENCY SOUTH TOWNSITE
CONCORD
GREENBANK ST.
HIGHLAND PARK
MORNING STAR ST.
HIGHLAND PARK DRIVE
RIVERSTONE TRAIL
BOULDER CREEK TRAIL
LIMESTONE TRAIL
STONE CRES.
LAURENTIAN DRIVE
NICK STREET
BUTLER BLVD.
NUTHATCH DR.
BEDARD BLVD.
DORAN ST.
HUMMINGBIRD LANE
ORIOLE CRES.
CARDINAL CRES.
BLUE JAY WAY
CHICKADEE TRAIL
WHIPPOORWILL DR.
CP Rail
RUTH ST.
McGUIRE ST.
PINEGROVE
CENTER ST.
EASY ST.
FIRST AVE.
GOLF COURSE
FIREHALL
ISABEL
SACK RD.
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MAINTENANCE HOLE NUMBERS
3-2

- **Hilda Street Storm Sewer System**

  This system is comprised of an existing 1350 mm diameter storm sewer and ditch which is located on the west side of the CPR railway tracks between Doran Street and Portage Road. It discharges into an existing ditch approximately 150 metres north of the intersection of Doran Street and Hilda Street. The ditch conveys flows northerly to Portage Road then crosses diagonally beneath the tracks and discharges into the Portage Road outlet ditch.

  This drainage system accepts flows from Mary Street, John Street and Doran Street. In 2011, the Town commenced construction of the Herman Street Storm Outlet project, which was noted in the 2001 Herman Street Area Storm Sewer Study. This will ultimately result in storm drainage from Herman Street, James Street and Laroche Crescent discharging into the Hilda Street outlet.

  The Hilda Street storm sewer system is owned by the County of Renfrew and it was installed as part of the upgrades to Doran Street in the 1970's. While the County's policy is to have their storm systems capable of conveying the 5 year event, this sewer is not able to convey the 5 year event from its entire drainage area. As noted in the following section, the Doran Street storm sewer can accommodate the 5 year event from its drainage area, which is in keeping with the County's criteria for their urban roadways. The Herman Street outlet sewer, which also outlets into the Hilda Street system, has only been designed to accommodate the 2 year event from its drainage area, in keeping with the Town's criteria. This is controlled by the outlet sewer through the Town's park that has a 900mm diam. sewer at 0.15% (see storm design sheets in Appendix K).

- **Doran Street Storm Sewer**

  The Doran Street storm sewer system has been sized to accommodate a storm with a five year return period. The original drainage area for this system included all of the developed areas to the west of Doran Street. With increasing development the catchment area has undergone substantial growth, resulting in available capacity being exceeded for the five year design storm. In order to address this situation, the Town has implemented one of the recommendations in the Herman Street study. This involved installing a new storm sewer on Audrey Street, Russell Street and Selkirk Street that intercepts the existing storm sewer at the intersection of Edith Street and Selkirk Street. Now flows from Selkirk Street and Edith Street west of Selkirk Street are redirected to the Hoffman Outlet via Russell Street and Audrey Street.

- **Petawawa/South Townsite Shared Sewer**

  This storm sewer system was designed to accommodate a two year storm event for the CFB Petawawa South Townsite. In addition, the sewer provides an outlet for sections of the former Village of Petawawa, including areas between the South Townsite and County Road 51. There are portions of this drainage area that are currently undeveloped. There are no plans for future development within Town lands; however, future development could take place within the Base property. Based on a 1998 agreement between DND and the Town of Petawawa, the Town owns and is to maintain this storm outlet from the Base property limit on Wolfe

Avenue, along Wolfe Avenue, through DND property to Violet Street and then along Violet Street to the outfall at the Petawawa River below the Town's Municipal Office.

- **Herman Street Outlet Sewer**

  Currently the Herman Street area does not have a defined drainage outlet. This is being addressed with the development of the Herman Street Storm Sewer Outlet project. There is, however, a small pipe system at the south end of the roadway that drains Herman Street into a storm system on Murphy Road. This storm sewer on Murphy Road then drains easterly and into the CP ditch. It is envisioned that this system will be removed and the flows redirected to the new Herman Street outlet when this portion of Herman Street is reconstructed.

- **Mary Street and John Street Storm Sewers**

  The Mary and John Street drainage system consists of a series of shallow swales and drywells at the south end of the drainage area, which allow water to infiltrate into the natural sandy soil. The north end of the drainage area, which is substantially lower in elevation, consists of a series of shallow concrete storm sewers. The existing system does not have capacity to accommodate the two year design storm for the entire drainage area. This shallow storm sewer system discharges into the newly constructed Herman Street Outlet sewer located within the south ditch line of the CP tracks.

- **Maple Avenue**

  In 2008, the Town undertook a capital works program to reconstruct Maple Avenue and Pine Place. As part of that project, a new storm sewer system was installed on these two streets, with outlets onto the County system along Petawawa Boulevard. This was designed to accommodate the 5 year event.

- **Fred Street, Veryeken Subdivision**

  The area of the Town of Petawawa between County Road 51 and the CFB Petawawa South Townsite includes Fred Street, Vereyken Crescent and Dutch Drive. These areas are currently drained by a system of shallow drainage swales and drywells. There is no defined surface outlet for this area. If the streets are to be urbanized it will be necessary to design a system which allows the infiltration of the surface water into the ground.

- **Civic Center Entrance**

  The Town recently urbanized the street known as the Civic Center Entrance. In order to accommodate the storm drainage from this roadway, a storm infiltration system was installed, consisting of catchbasins linked to a 300mm diameter perforated HDPE within the west boulevard.

- **County Road 51 Storm Sewer – Murphy Road to Mohns Avenue**

  A portion of County Road 51 between Mohns Avenue and Murphy Road has been reconstructed over the past 10 years. Part of this work included the construction of a new 5 year storm sewer and outlet. The new outlet was constructed on the east side of the CP tracks, north of Portage Road. At this point it enters into a ditch, which also provides outlet for the Hilda Street Storm Outlet (Doran Road/Herman Street systems) and discharges into the Petawawa River. This storm system was designed to only capture runoff from the County's right-of-way and from the front of lots fronting the right-of-way. The single exception is for Maple Avenue and Pine Place, which were included in the drainage area. The drainage area for this system is shown on Figure 3-2.

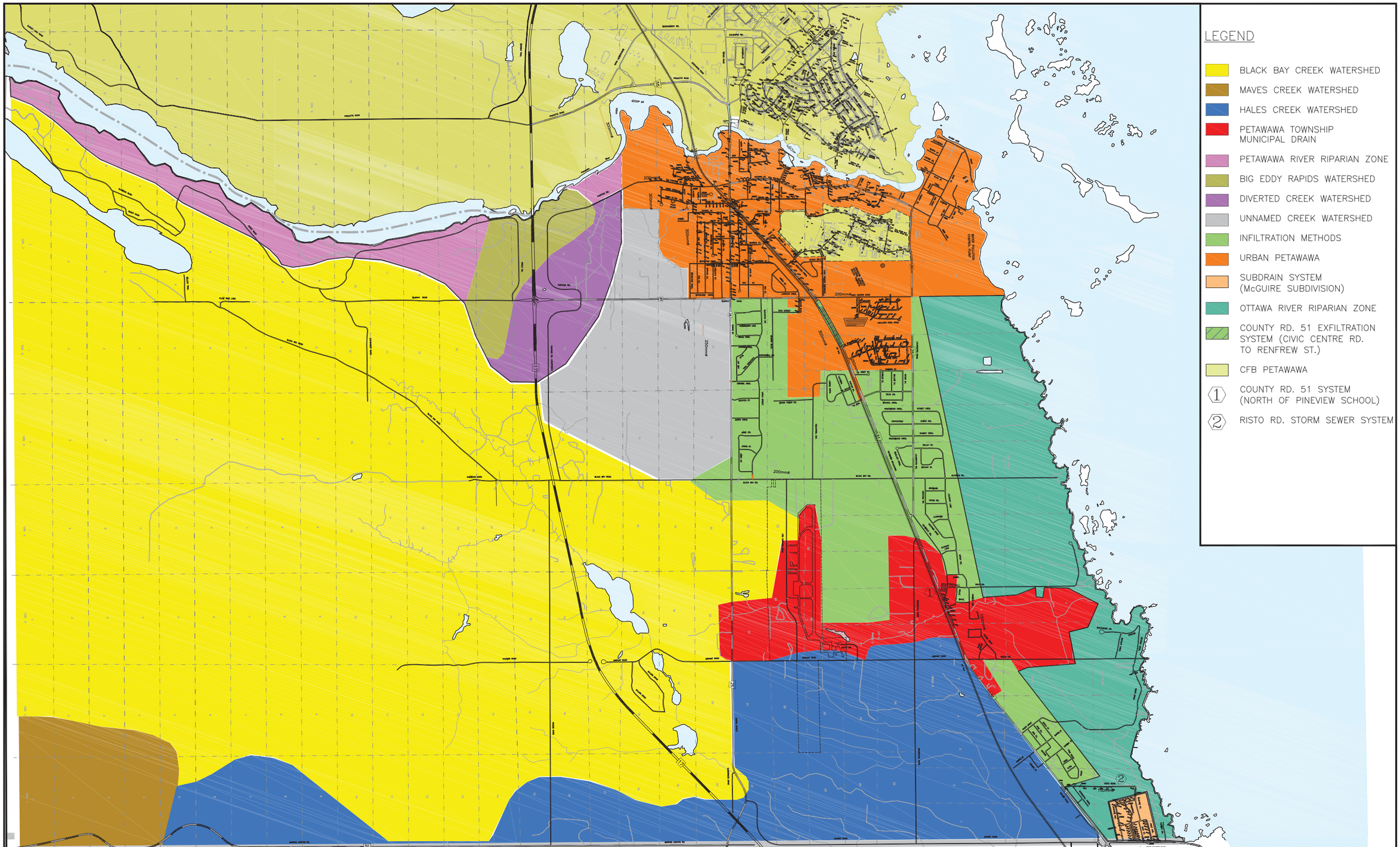
4.2 Other Drainage Areas

The Town of Petawawa has other drainage areas in addition to those contained in the Herman Street Study. The catchment areas are shown in Figures 3-1 and 3-3. The types of existing storm water infrastructure vary throughout the Town and include storm sewers, exfiltration and infiltration systems, road side ditches and swales, to any combination of the aforementioned in any given service area. Traditionally, it has been Council's direction to urbanize any of its roadways in the urban area (former Village) to an urban cross-section, complete with curb and gutters, storm sewers and sidewalk. If this policy continues, the repercussion is that all of the existing roads that currently rely on surface drainage systems in the urban area would be considered to have insufficient drainage systems.

For the storm sewer systems that currently exist, the systems were evaluated for capacity. Storm sewer design sheets used in the analysis of the various storm sewer systems are attached as Appendix K of this report. As with the Herman Street Study, storm sewers for the Town of Petawawa that convey a 5-year storm event are desirable, with the conveyance of the 2-year storm event as the minimum standard. The minimum standard for County of Renfrew storm sewers in the Town is the 5-year storm. The following is a brief description of the identified drainage systems.

- **Armstrong Road Storm Sewer System**

  This high density polyethylene piped system was constructed during the fall of 1999 and completed in the spring of 2000 during the reconstruction of Armstrong Road. This system was designed for the 2-year storm event. The system currently has three outlets to the Petawawa River. Two of the outlets for this system, which cross Victoria Street (County Road 16), were constructed on an interim basis. The west section of the Armstrong Road system empties into a County storm sewer along Victoria Street by means of a temporary hook-up. The middle outlet is temporary and currently carries storm water from the middle section of Armstrong Road and surface water from the road side ditches along Victoria Street. The outlet from the east leg of the system is permanent. The County of Renfrew and the Town are planning on reconstructing Victoria Street in 2012. This will result in permanent connections and outlets being built at that time for the entire Armstrong Road system.



No.	DATE	BY	REVISION DESCRIPTION
1	23/12/09	SGW	WOODLAND CRES BOOSTER REMOVED, LOOP ON DORAN ST (CARDINAL–DEREK)

NORTH

JOB: PETAWAWA STORM SYSTEM STUDY

TITLE: TOWN CATCHMENT AREAS

DATE: MAR.2011

PROJECT: 2115331A

PLOTTED: 02/24/11

SCALE: AS SHOWN

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3-3

- **Algonquin Street Storm Sewer System**

  The Algonquin Street storm system provides outlet for Park Drive, the south end of Harry Street and Bert Street east of Harry Street as well as Algonquin Street. It has been determined that it can accommodate the 2-year storm event based on current development. The outlet discharges to the Petawawa River. In 2009 minor upgrades to the system were undertaken when the roadway was reconstructed.

- **County Road 51 Storm Sewer System (Victoria Street to the Petawawa River)**

  This County system is comprised of concrete pipe except for a 24m CSP section at the outlet. This system was constructed in 1976 and is unable to accommodate the 5-year storm event that is the minimum standard for the County of Renfrew. This system is also unable to convey run-off from a minimum 2-year storm event, which is the Town's minimum design criteria. This system is the responsibility of the County of Renfrew and does not provide drainage to private buildings along the street. Due to the slope of the road, surcharging of the pipe is not a concern. Any water which does not enter into the pipe system is conveyed along the edge of the road to the river.

- **County Road 51 Exfiltration System (Civic Centre Road to Renfrew Street)**

  This section of County Road 51 is situated near the Moncion and Morglan properties and is identified in the Herman Street Study as an area of Petawawa with no practical outlet for storm water. It is for this reason that the County of Renfrew went with an exfiltration system during the reconstruction of this section of County Road 51 in 2000.

- **Moncion/Morglan Area**

  This area is bounded to the north by Civic Centre Road, to the east by Laurentian Drive, to the south by a Hydro corridor and to the west by Petawawa Boulevard. This area has been under development since 2003 with both urban residential and commercial development taking place. The area is sandy with a deep water table and has no natural surface drainage outlet. The developments have been completed utilizing underground infiltration galleries with shallow surface ponding areas for the major events. The storm systems feeding these galleries have been designed to accommodate the 2 year event and they are routed through a Stormceptor© oil/grit separator before entering the infiltration gallery. The infiltration galleries are sized to ensure that there is no surface water ponding during the 2 year event and the entire pond is designed to ensure that no buildings are flooded during back to back 100 year events.

  The infiltration system that is part of the Moncion commercial development is privately owned and maintained, while the two in the Morglan residential development are owned and maintained by the Town.

- **Limestone Trail Subdivision**

  The development of the Limestone Trail subdivision, which is bounded by Petawawa Boulevard, Hydro One Corridor, Laurentian Drive and the former Village/Township boundary, has taken place utilizing a 2 year storm sewer system that outlets into an extended detention water quality/quantity facility. The storm pond is a three cell facility consisting of a forebay, main cell and an infiltration cell. The forebay and main cell provide the water quality treatment, based on MOE's design criteria for an extended detention water quality facility. The infiltration cell receives "clean" water from the main cell via a reverse sloped pipe that outlets into a ditch inlet catchbasin. As the main cell fills up, water flows up the reverse slope pipe and then discharges onto the surface of the infiltration cell where it is allowed to infiltrate into the native sands. The forebay and main cell are lined with an impermeable clay liner in order to maintain a permanent pool of water in each of these cells.

  The pond has sufficient volume to accommodate back to back 100-year events without affecting any of the residential units.

  The drainage area for this pond also includes the townhouse and apartment development adjacent to the pond known as the "Vereyken Subdivision" as well as Renfrew Street.

  It should be noted that within the Limestone Trail Subdivision, there were two commercial blocks at the west end of the property. When these properties are developed, they will not require water quality treatment, as that was taken into consideration in the sizing of the storm water pond, however, they will have to undertake water quantity controls to ensure that the runoff is controlled to a 2 year event with a runoff coefficient of 0.45.

- **County Road 51 Storm Sewer System (North of Pine View Public School)**

  This conventional storm sewer was designed to convey the 25-year storm event and was constructed during the summer of 2001. It was designed to collect surface water from the nearby roadside ditches, including water from the northern section of Biesenthal Road. The storm water discharges to a water course which outlets into the Ottawa River via the Petawawa Municipal Drain.

- **Vermont Meadows Storm Sewer Systems**

  The Vermont Meadows system was installed in the early 1990's. This storm sewer was designed with capacity to accommodate the urban drainage areas of this subdivision under the 2-year storm event. The storm sewers for this subdivision are comprised of two separate lines; one runs along Northbrook and then Summit Trail before emptying at a concrete headwall and the other run is on Vermont Meadows and also spills out at a concrete headwall. Both outlets have rip rap downstream in order to minimize erosion of the soil as the water flows towards the Petawawa River.

- **McGuire Subdivision Storm Sewer System**

  The roads for this subdivision have a rural cross-section with storm sewers, which were installed in the 1980's, running underneath most of the ditches. The one exception to this is Pinegrove Crescent from Centre Street to Golf Course Road, which had a storm sewer installed in 2002. From Centre Street, the storm system flows north and outlets to a drainage course that crosses McGuire Street on its way to the Ottawa River. The south portion of the subdivision flows towards Golf Course Road and outlets to the open ditch on Golf Course Road approximately 65m west of First Avenue. In 2008, the majority of the roads in the subdivision were rehabilitated and, as part of that work, 150mm diameter subdrains were installed on both side of the road in order to help alleviate the groundwater conditions that affect the ditches in the area.

- **Victoria Street Storm System**

  This is a County storm sewer system commencing in the vicinity of the Wolfe Avenue and Victoria Street intersection. The storm sewer is capable of conveying the flow from the 5-year storm event. The system outlets to the Petawawa River via a County owned drainage easement between two existing houses.

- **Petawawa Point**

  The Petawawa Point area is a low lying area with sandy (beach-like) soil and is located at the mouth of the Petawawa River. Due to the sandy nature of the native soil, the surface drainage is directed to road side ditches and drywells where the water infiltrates into the ground. There are no known issues with the drainage system at this time.

- **Rural Petawawa**

  The rural area of the Town of Petawawa has drainage infrastructure, consisting primarily of roadside ditches. The surface water in this area is collected by various natural water courses and either infiltrated into the sandy soil or stored in the local lakes, rivers and wetlands. All of the drainage is ultimately conveyed to the Ottawa River with a large area being conveyed via the Petawawa River.

- **Petawawa Municipal Drain**

  The Petawawa Township Municipal Drain consists of an open ditch drainage system that was constructed in 1974 to relieve the flooding and excessive wet conditions on Lot 7, Lake Range and Part of Lot 7, Range B (former) Township of Petawawa. It was designed to convey the spring run-off.

  In 1977 the Pembroke and Area Airport Commission and the Department of National Defence undertook work to improve the airport and related facilities. Approximately 16.6 ha of developed land was added to the drainage area for the municipal drain. The capacity of the drain was confirmed with the additional work.

- **Risto Road**

  The storm sewer on Risto Road was constructed in 1995 to alleviate erosion problems behind the houses on River Road. The erosion was due to large volumes of water coming down the hill. This system was designed for the 10 year storm event. This storm sewer intercepts the existing creek at County Road 51 and conveys the water along County Road 51 and Risto Road to discharge at the bottom of the hill on Risto Road. The flow is then conveyed to the Ottawa River via an open ditch with no reported capacity problems.

5.0 RESULTS OF THE REVIEW OF EXISTING DRAINGE SYSTEMS

The review and evaluations carried out as part of this study have identified several characteristics of the drainage systems in Petawawa. With the upgrades to the storm system that have been completed by the Town over the past 8 years, the overall system is in very good condition. While the performance of the system in several locations may not meet the minimum theoretical standards set out for drainage in the Town, due to the specific location and/or conditions in the area, the system in these areas is adequate for the current use.

Based on our analysis, the following is a list of upgrades/improvements that are required for each of the Town's drainage systems.

Hoffman Storm Sewer

- No upgrades required. The drainage system can accommodate additional development based on the drainage area and runoff coefficient that is noted for each area.

Hilda Street Storm Sewer

- This is system is under the jurisdiction of the County of Renfrew, therefore the Town has no obligations with regards to its condition.
- No upgrades and/or improvements are required at this time.
- This system can accommodate the increased runoff from the potential urbanization of all of the roadways in the area bounded by Doran Street, Murphy Road and the CP tracks. Any storm sewers in that area should be designed to accommodate the 2 year event, in keeping with the available capacity in the outlet sewer.

Doran Street Storm Sewer

- This system is under the jurisdiction of the County of Renfrew, therefore the Town has no obligations with regards to its condition.
- It has been confirmed that it can accommodate the 5 year flows and therefore is adequately sized based on the County's criteria.

Petawawa/South Townsite Shared Sewer

- There are no upgrades or recommendations for the Town on this system. The only note is that DND should undertake flow controls if new development in the Base is to discharge to this system.

Herman Street Outlet Sewer (including Mary Street and John Street)

- The installation of the Herman Street Outlet sewer in 2011 resulted in a dedicated storm outfall for the upstream drainage area including Herman Street, James Street, Laroche Crescent, Laura Street, Mary Street, Norman Street and John Street. While there were storm sewer systems on some of these roadways, the new outlet sewer provides the ability to install a 2-year storm sewer on all of these roadways when they are reconstructed.

Maple Avenue

- As this system has only recently been constructed and can accommodate the 5 year storm event there is no requirement for upgrades at this time.

Fred Street, Vereyken Subdivision

- As there is no defined outlet for these roadways, infiltration techniques such as perforated pipes with interconnected drywells and/or catchbasins will have to be considered should there be a desire to reconstruct these roadways to urban standards in the future.

Civic Center Entrance

- As this system has only recently been constructed and can accommodate the 2 year storm event there is no requirement for upgrades at this time.

County Road 51 Storm Sewer – Murphy Road to Victoria Street

- As this system is under the jurisdiction of the County of Renfrew, the Town has no responsibility for upgrades. The only impact that this system has on the Town is that any development or redevelopment of the properties along this section of Petawawa Boulevard will have to take into consideration either infiltration techniques and/or flow controls in order to limit the storm discharge based on the drainage area and runoff coefficients that reflect the design criteria for the system.

Armstrong Road Storm Sewer System

- There are no required upgrades on the system at this time. The outlets for this system will be dealt with through the reconstruction of Victoria Street, which is slated to take place in 2012.

Algonquin Storm Sewer System

- As noted above, there were some minor upgrades to this system in 2009 as part of the reconstruction of Algonquin Street. There are no required improvements to the existing system.

- When Park Drive is reconstructed, the existing storm sewer system within the roadway should be reviewed via CCTV inspection and any repairs completed at that time.

Vermont Meadows Storm Sewer Systems

- There are erosion issues at the storm outlets down the bank to the Petawawa River. The cost to repair these is estimated at $60,000.

McGuire Subdivision Storm Sewer System

- While the 2003 Infrastructure Study noted drainage issues in the McGuire Subdivision, these were rectified with the improvements that took place in 2008. While the area is still subject to the issue of high ground water table, the ongoing drainage issues appear to have been addressed. The area should be monitored and any necessary drainage improvements implemented as necessary.

Petawawa Municipal Drain

- There are no known issues/upgrades required on this drainage system at this time.

Risto Road

- There are no known issues/upgrades required on this drainage system at this time.

6.0 RECOMMENDATIONS FOR NEW DRAINAGE SYSTEMS

As new areas are developed in the Town or as others areas are redeveloped or roads urbanized, there will be the need to develop new drainage systems. The following is the recommended design criteria for both public and private developments.

i) Maximize natural infiltration of surface runoff on-site wherever practical for all new development (urban, semi-urban and rural). These can take the form of infiltration galleries, infiltration trenches and/or drywells depending on the application. These systems should be designed so that the system has the ability to store the 2 year storm event underground without any water ponding on the surface. Larger infiltration facilities should have a form of water quality treatment that will provide an *Enhanced* level of treatment based on current MOE guidelines.

ii) To implement site specific Best Management Practices (such as directing roof drainage onto grassed areas, using flat grading for lots and swales where appropriate and allowing minor ponding or puddling of water in ditches and swales) to promote water infiltration into the ground and to reduce the need for larger storm water control facilities, utilize end of pipe storm water facilities (such as oil/grit devices, silt and sediment control facilities and storm water control facilities) only where appropriate and necessary.

iii) Developments that plan to connect to existing storm water systems should maintain storm water run-off to predevelopment levels utilizing parking lot, surface and/or underground storage as necessary. This will be particularly relevant with any developments along the Petawawa Boulevard corridor due to the limited capacity in the County's storm sewer system.

iv) A condition for approval of all new commercial or residential developments is to include a requirement for a storm water management plan to meet regulatory requirements as well as the objectives of the Town of Petawawa.

v) Urbanization of the roadways in many areas of the urban area of Petawawa may have to implement infiltration techniques for the new storm drainage systems due to the lack of natural drainage outlets in these areas. The design of these systems should also consider the 2 year storm event and water quality treatment to *Enhanced* levels where practical.

vi) All new storm sewer systems shall be designed to accommodate the 2 year event.

vii) For new residential subdivisions that require stormwater ponds for quantity controls in conjunction with infiltration galleries (ie: no storm outlet to a natural drainage course), the ponding volume of back-to-back 100 year events must be considered when designing the facility. The resultant water level of these back-to-back events must not impact any adjacent commercial or residential building.

viii) For commercial developments, the stormwater management system must be self-contained unless there is a municipal storm sewer adjacent to the development that has been sized to accommodate the development. The storm sewer system must be designed to accommodate at least the 2 year event, with no ponding during for this event (ie. 2 year event must be stored underground). Water quality control measures must have sufficient storage to accommodate a single 100 year storm event. Storage can be via parking lot storage, (with maximum ponding depth 0.3m at catchbasins), rooftop storage, storage in pipes, underground storage and/or ponds. The areas of ponding must be clearly noted on the site grading and drainage plans for the development.

ix) All stormwater management ponds must be have signage, based on the current Town format, warning the public of the dangers of these facilites

x) Fencing of ponds is required along all adjacent property lines, but not along the side that abuts any municipal road allowance. The fence shall be a minimum of 1.2m in height and constructed of commercial grade chain link with black vinyl coating and painted posts.

xi) Exfiltration systems shall be designed based on a 50% reduction in the permeability of the native soils to take into account long-term sediment loading within the system.

TABLE OF CONTENTS

Tables

TABLE OF CONTENTS

Figures

Appendices

1.0 INTRODUCTION

The municipal road system in the Town of Petawawa is the most visible piece of the municipal infrastructure and is used daily by all residents, irrespective of the area of the Municipality in which they reside. The road system requires a significant allocation of the total budget of the Municipality for on-going construction, repair and maintenance. The cost effective and efficient day to day operation and maintenance of the system, particularly in winter months, will provide all residents with safe and reliable access to their homes and businesses.

The municipal road system, together with the road allowance network, provides service corridors for other municipal infrastructure such as watermains, sanitary sewers and storm sewers, as well as for various utilities. Year round access to infrastructure components allows for proper maintenance of services, ensuring a safe, reliable and efficient infrastructure system and minimizing the total cost of operation for all services. As the expected life span for a road is generally about 20 years, it is important to carefully identify and plan for the needs of all components of the infrastructure for that period.

The road system located within the geographic Town of Petawawa includes roads which fall under the jurisdictions of three other agencies. The Department of National Defence operates and maintains the roads located within CFB Petawawa, including the North and South Townsites. The County of Renfrew is responsible for the County Roads within the Town of Petawawa. These roads form the major collector and arterial system and are generally the most heavily travelled routes within the Municipality. The Ontario Ministry of Transportation is responsible for the operation and maintenance of Highway 17, which is a section of the Trans-Canada Highway system. The roads under these three agencies are not discussed in this chapter of the report.

The roadways under the jurisdiction of the Town of Petawawa are considered to be classified as either local or collector. The functioning and characteristic of each type of roadway and the associated mapping is contained in Section 3.1 of this Chapter.

In order to properly assess the road system within the Town it is necessary to complete an assessment of three issues. The first is to conduct an inventory of the existing system, secondly to evaluate the existing service standards provided and thirdly to address the effect of growth, both within the Municipality and in the adjacent areas such as CFB Petawawa; this will have a direct effect on traffic volumes. These three topics will be discussed through the following sections.

Road Management Plan

The Road Management Plan is a key tool in operating and maintaining the road system and related infrastructure. The Road Management Plan included as Section 2 of this Chapter is a stand-alone document which is intended to achieve the following:

- identify the existing road system
- determine the current condition rating of the existing roadways
- identify improvements to road segments to either meet existing or improved standards
- provide an estimate of the cost to maintain the existing standards or improvements that are being recommended
- identify equipment and housing needed to maintain the existing system

Evaluation of Service Standards

Section 3 of this Chapter will assess the current level of service provided by the existing road system and will provide background as to the level of service that may be provided by the system. This section will address the following key components:

- establish the minimum design requirements for urban, semi-urban and rural areas of the municipality
- determine the minimum requirements for the design of new subdivision roads within the municipality
- assess the changing needs or level of service to be provided
- provide an outline as to the minimum service levels to be provided

Growth and Growth Related Improvements

Section 4 of this Chapter will assess the impact of growth, both within the Municipality and on the adjacent road systems. This section will address the following key components:

- effect of an increase in traffic volumes on local roadways
- identification of problems related to increases in traffic volumes
- identification of operational issues

With proper assessment of these 3 primary topics, it will then be possible to develop a comprehensive set of conclusions and recommendations in relation to the road system. From this, a financial program for the development and maintenance of the system can be derived. In carrying out these overall objectives, it will be necessary to also compile and evaluate the anticipated improvements to other infrastructure components, such as the sewer systems and the water system, in order to properly plan for the needed road improvements. This more comprehensive program development will be contained in Chapter 6 of this report.

2.0 ROAD MANAGEMENT PLAN

2.1 Introduction

A substantial portion of a Municipality's annual budget goes towards its road system, for maintenance and construction improvements. The replacement value of the road system is significant. Roads, like equipment, wear out and must be replaced. Failure to properly maintain and replace the system at the appropriate time will result in ever increasing needs. To ensure that the Municipality is maximizing its investment, Council must be aware of the condition of the present road system and establish a maintenance and construction strategy for the future.

The Road Management Plan provides the following:

- Inventory of the road system by sections taking into account its condition, geometric elements and surface type.
- Identifies those road sections in need of improvement, the type of improvements and an estimate of cost.
- Inventory of existing equipment with replacement forecasts over the next 5 years.
- A 10 year maintenance and construction program for the road system within existing levels of municipal expenditures, being approximately $1,275,000 per annum.

2.2 The Town Road System

The Town's regularly maintained road system is 119.6 kilometers in length. This represents an increase of 6.5 km (7.9%) since the 2003 study.

The road system classifications are categorized as follows:

Urban	-	15.9 km (an increase of 10.2 km since the 2003 study)
Semi Urban	-	43.8 km (a decrease of 0.1 km since the 2003 study)
Rural	-	59.9 km (a decrease of 1.3 km since the 2003 study)

The road system surface types and corresponding lengths are:

HCB (High Class Bituminous)	-	110.0 km
LCB (Low Class Bituminous)	-	5.3 km
Gravel/Earth		4.3 km

2.3 Road System Inventory

Road Appraisal Forms have been prepared for each street in the road system. These forms contain geometric information, a condition rating, recommended improvements and improvement costs based on estimated benchmark costs. A particular street may have one or a number of section numbers assigned to it to distinguish variations in existing conditions, typically the condition rating.

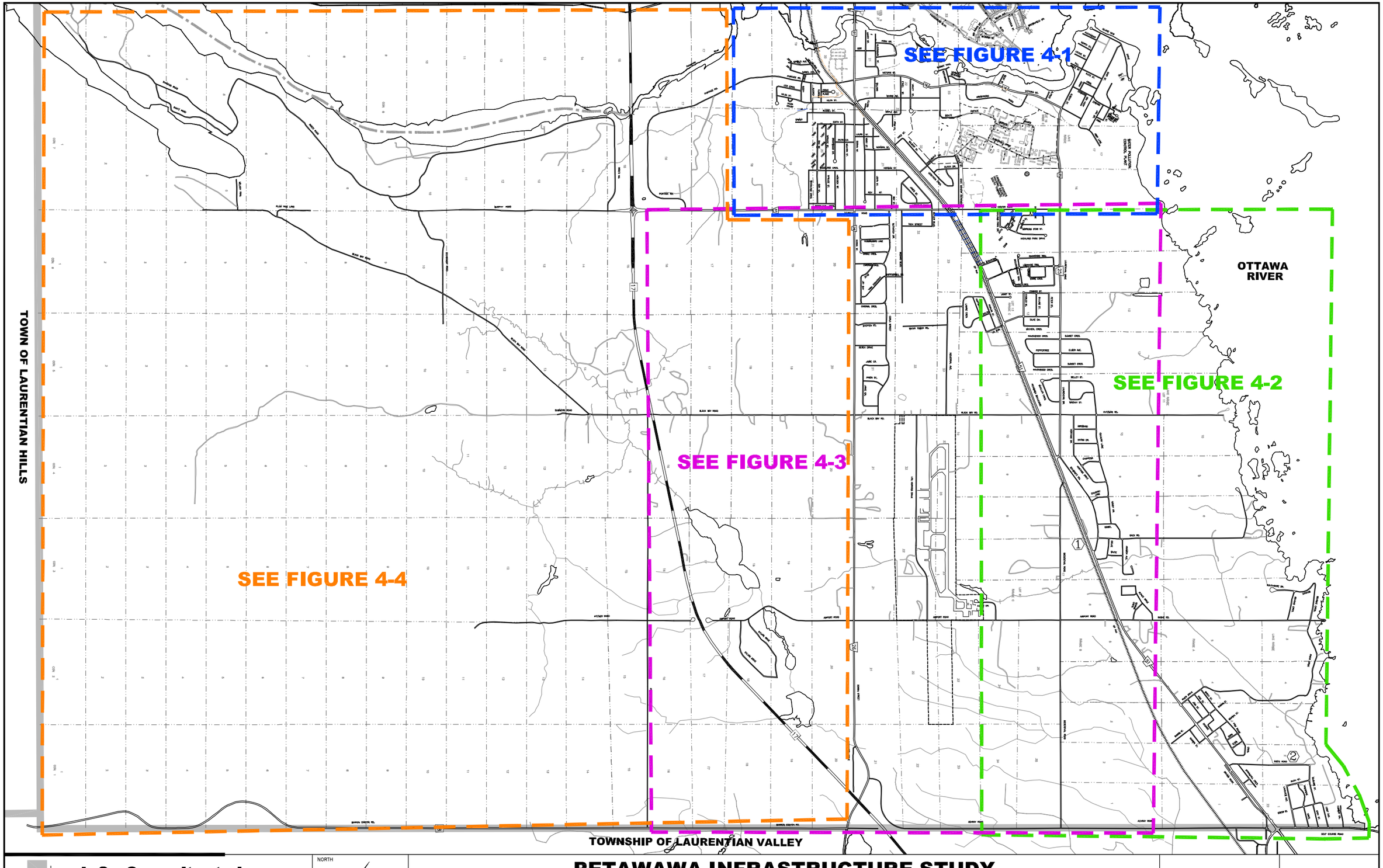
The completed Road Appraisal Forms are included as Appendix L.

2.4 Condition Ratings

A condition rating number from 1 to 10 is assigned to each road section. This number is a visual assessment of the existing surface and the structural condition of the street, with 10 being the best case.

The road system was travelled and each section assessed a condition rating in April 2011. This was completed by Dan Patrick, Tom Renaud and Steve Webster. Reviews are conducted in the spring, as the frost is leaving the ground at that time and the structural performance of a street is at its worst.

Maps of the Town Road System, including street section numbers and the 2011 condition rating, are provided as Figures 4-1 through 4-4 inclusive. It should be noted that any roadways that were improved during the summer of 2012, such as a section of Rantz Road, is noted as having a condition rating of 10 to represent the new asphalt surface completed after the review in April.



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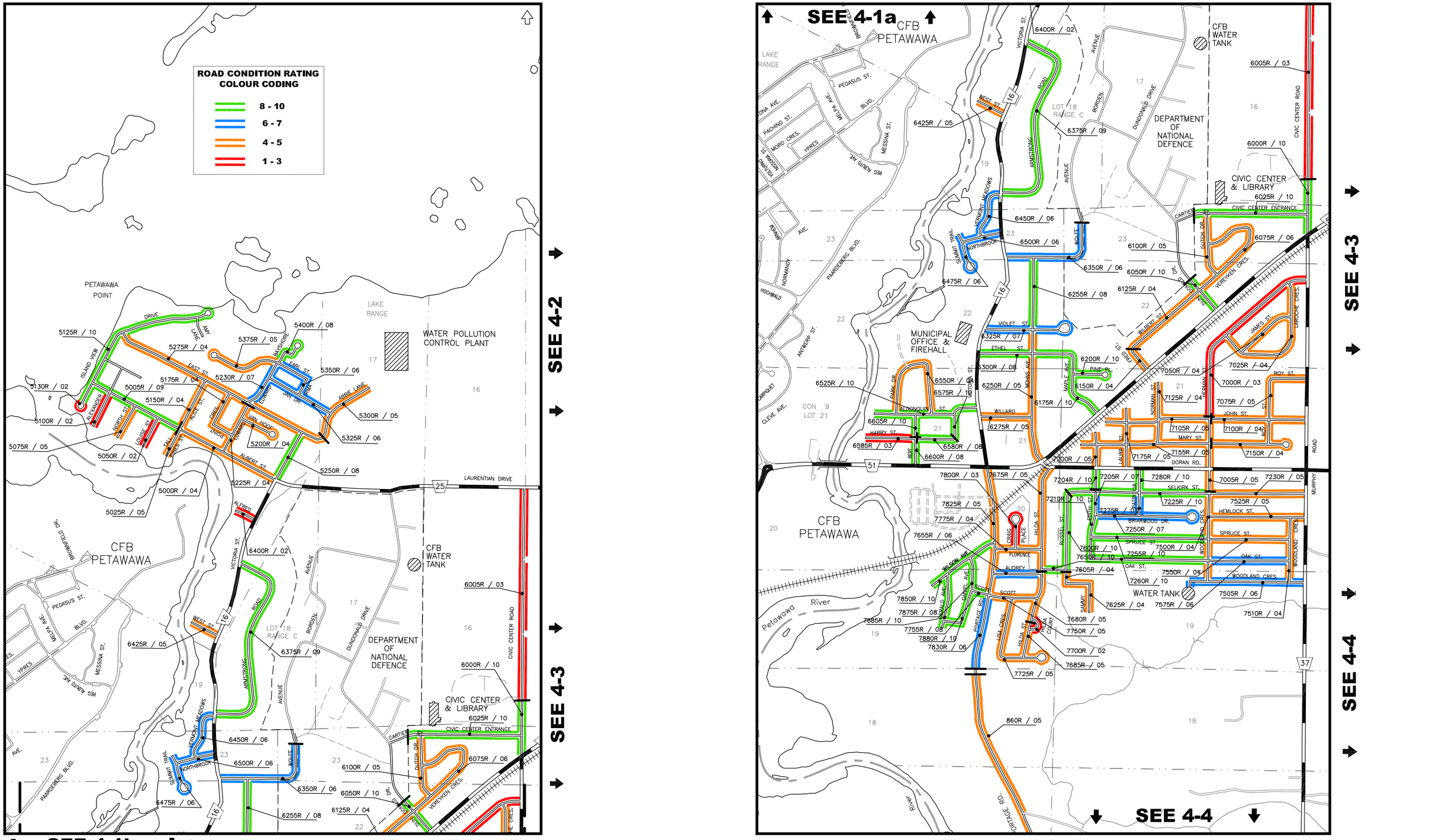
PETAWAWA INFRASTRUCTURE STUDY

ROAD MANAGEMENT STUDY - ROAD SECTION KEY PLAN

KEYPLAN



4-1a

4-1b

Legend:

ROAD SECTION NUMBER — 250R / 03 — CONDITION RATING

NORTH

JOB **Town of Petawawa Road Management Study**

TITLE **Road Section Map 4-1a 4-1b**

DATE **APRIL 2011**

PROJECT **2115331A**

REVISED **NOV 2011**

SCALE **N.T.S**

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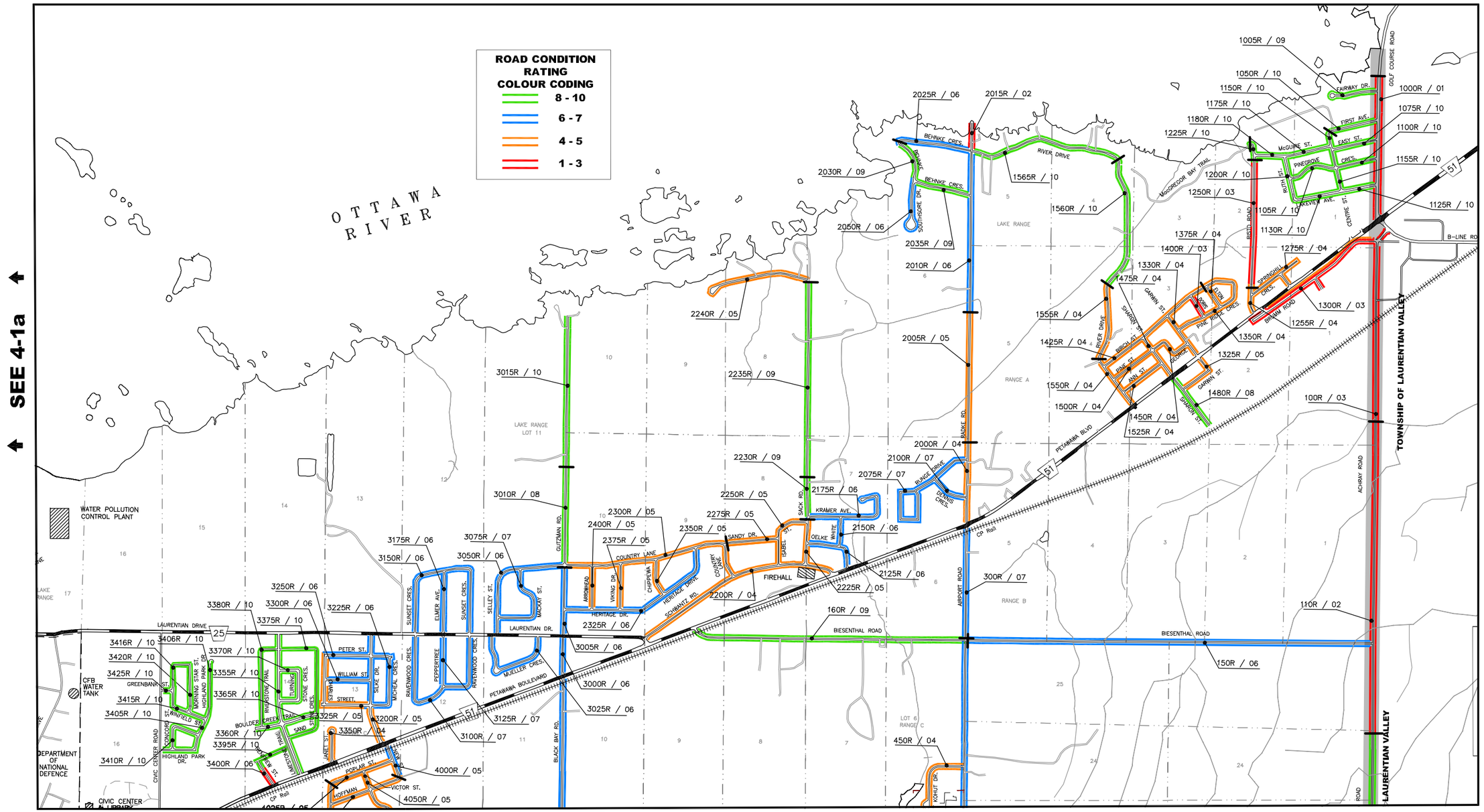
FIGURE **4-1**



NOTE:

ONLY NEW SUBDIVISION ROADS READY FOR TOWN ASSUMPTION ARE NOTED ON THIS DRAWING.

Legend:

ROAD SECTION NUMBER — 250R / 03 — CONDITION RATING

NORTH

JOB **Town of Petawawa Road Management Study**

TITLE **Road Section Map 4-2**

DATE APRIL 2011

PROJECT 2115331A

REVISION MAR 2012

SCALE N.T.S

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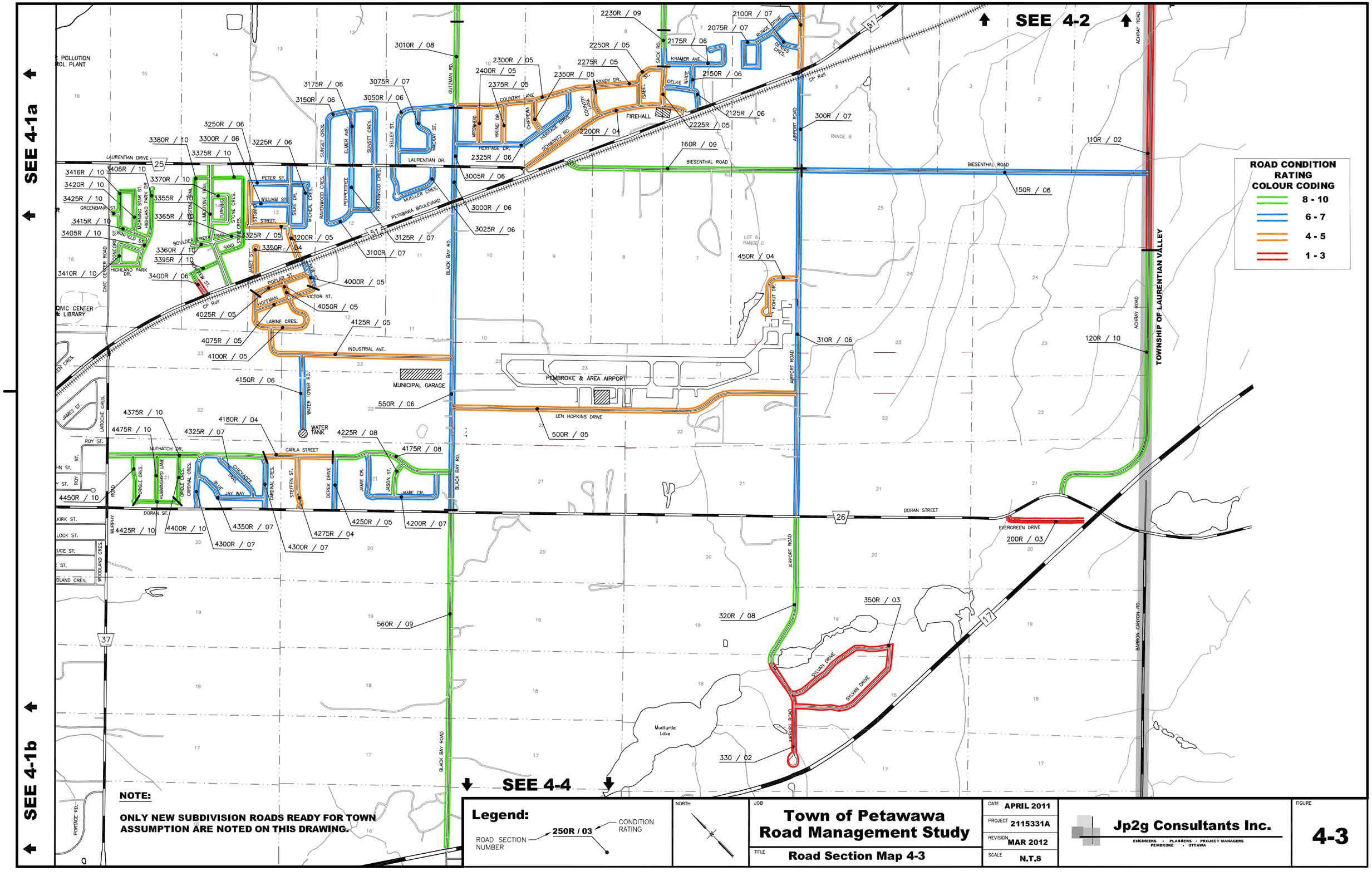
FIGURE **4-2**

SEE 4-1a

SEE 4-2

SEE 4-1b

SEE 4-4



NOTE:

ONLY NEW SUBDIVISION ROADS READY FOR TOWN ASSUMPTION ARE NOTED ON THIS DRAWING.

Legend:

ROAD SECTION NUMBER — 250R / 03 — CONDITION RATING

NORTH

JOB **Town of Petawawa Road Management Study**

TITLE **Road Section Map 4-3**

DATE **APRIL 2011**

PROJECT **2115331A**

REVISION **MAR 2012**

SCALE **N.T.S**

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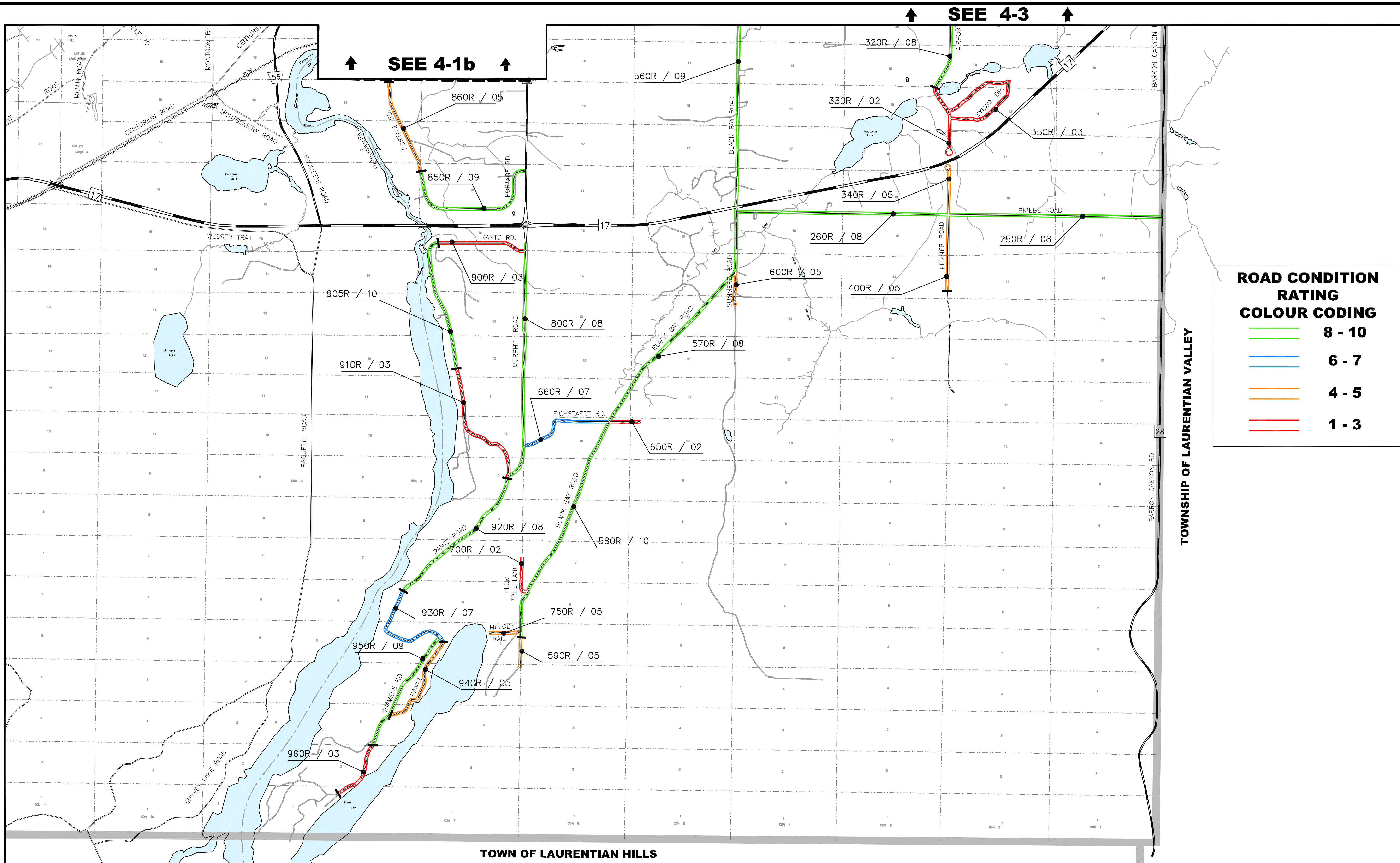
FIGURE **4-3**



Legend:

ROAD SECTION NUMBER — 250R / 03 — CONDITION RATING

NORTH

JOB

Town of Petawawa Road Management Study

TITLE

Road Section Map 4-4

DATE	APRIL 2011
PROJECT	2115331A
REVISION	NOV 2011
SCALE	N.T.S

Jp2g Consultants Inc.

ENGINEERS · PLANNERS · PROJECT MANAGERS
PEMBROKE · OTTAWA

FIGURE

4-4

HCB (asphalt) and LCB (surface treated) road surfaces have different life expectancies and should be resurfaced within their life cycles, before the roads are allowed to deteriorate and suffer structural damage. For the purpose of this report, under normal conditions, the HCB surface roads will be assumed to have a life cycle of 20 years and LCB surface roads a life cycle of 15 years. The volume of truck traffic, overall traffic volumes, existing road base construction and roadside drainage have a bearing on the road surface life cycle. Gravel road condition ratings generally will not change due to continued routine upgrading of the granular top surface.

The condition rating of each street section is decreased annually by an amount proportionate to its life expectancy. For example, the condition rating of a street with a 20 year life cycle will decrease by 0.25 per year. This is calculated as follows:

$$\frac{\text{5 point condition rating}}{\text{20 year life cycle}} = 0.25 \text{ per year}$$

Roads with a condition rating of 5 or less have reached their life cycle and are in need of improvement.

The 2011 Road System Inventory Summary and Condition Ratings are summarized in three ways in the Appendix as follows:

- Appendix M – Sorted by Section Number
- Appendix N – Sorted Alphabetically
- Appendix O – Sorted by Condition Rating (1 to 10)

Road sections with a condition rating of 5 or less are in need of improvement in the form of either reconstruction or rehabilitation and are costed on the Appraisal Sheets. These sections are listed in the Cost Improvements Table 4.1.

Table 4.1 - Cost Improvement Table

ROAD SECTION #	DESCRIPTION	FROM	TO	LENGTH	URBAN	SEMI-URBAN	RURAL	CONDITION RATING	RECONSTRUCTION / REHABILITATION COSTS
1000	**Golf Course Road**	Petawawa Blvd (Co. Rd. 51)	Laurentian Valley Twp	0.30			x	**1**	$117,000
110	**Achray Road**	1.0 Km west of B Line	pipe line x-ing	1.50			x	**2**	$585,000
330	**Airport Road**	0.8km W of Doran (Co. Rd. 26)	Cul de Sac	0.70			x	**2**	$189,000
650	**Eichstaedt Road**	Black Bay Road	End	0.30			x	**2**	$81,000
700	**Plum Tree Lane**	Black Bay Road	End	0.40			x	**2**	$108,000
2015	**Radke Road**	River Drive	End	0.10			x	**2**	$64,000
5050	**Louise Street**	Albert Street	End	0.10		x		**2**	$42,000
5100	**Alexander Street**	Albert Street	End	0.10		x		**2**	$42,000
5130	**Island View Drive**	North Cul-de-Sac	North Cul-de-Sac	0.10			x	**2**	$27,000
6400	**Alfred Street**	Victoria Street	North End	0.10		x		**2**	$42,000
7700	**Hilda Court**	Hilda Street	Hilda Street	0.10		x		**2**	$42,000
100	**Achray Road**	B Line	1.0 Km west	1.00			x	**3**	$390,000
200	**Evergreen Drive**	Doran St. (Cty Rd 26)	Dead End	0.30			x	**3**	$81,000
350	**Sylvan Drive**	Airport Road	Airport Road	1.50		x		**3**	$405,000
900	**Rantz Road - East Leg**	Murphy Road (east end)	1.0 km North of Murphy Road	1.00			x	**3**	$270,000
910	**Rantz Road - North Leg**	2.3 km N. Murphy Rd. (east end)	Murphy Road (west end)	1.00			x	**3**	$270,000
960	**Shamess Road**	1.3 km W Rantz Rd.	End	0.70			x	**3**	$448,000
1250	**Risto Road**	Springhill Court	McGuire Street	0.60			x	**3**	$246,000
1300	**Brumm Road**	Petawawa Blvd. (Co. Rd. 51)	Achray Road	0.80		x		**3**	$216,000
1400	**Doris Street**	Birch Street	Pineridge Cres.	0.20		x		**3**	$84,000
3400	**Renfrew Street**	Petawawa Blvd (Co. Rd. 51)	Beer Store	0.10		x		**3**	$125,000
6005	**Civic Center Road**	0.2km North of Petawawa Blvd.	Laurentian Drive (Co. Rd. 25)	0.80		x		**3**	$1,352,000

Table 4.1 - Cost Improvement Table

ROAD SECTION #	DESCRIPTION	FROM	TO	LENGTH	URBAN	SEMI-URBAN	RURAL	CONDITION RATING	RECONSTRUCTION / REHABILITATION COSTS
6585	**Harry Street**	Bert Street	North End	0.20		x		**3**	$84,000
7000	**Herman Street**	Murphy Road	John Street	0.80		x		**3**	$1,416,000
7800	**Craig Place**	Florence Street	Cul-de-sac	0.10		x		**3**	$42,000
450	**Kohut Drive**	Airport Road	Cul De Sac	0.40			x	**4**	$108,000
1255	**Risto Road**	Petawawa Blvd (Co. Rd. 51)	Springhill Court	0.10		x		**4**	$41,000
1275	**Springhill Court**	Petawawa Blvd (Co. Rd. 51)	Risto Road	0.20		x		**4**	$54,000
1330	**Garwin Street North**	Petawawa Blvd. (Co. Rd. 51)	Birch Street	0.30		x		**4**	$126,000
1350	**Pineridge Crescent**	Garwin Street	Birch @ Elton St.	0.50		x		**4**	$210,000
1375	**Elton Street**	Birch Street	Pineridge Cres.	0.20		x		**4**	$84,000
1425	**Birch Street**	Elton Street	River Drive	0.60		x		**4**	$252,000
1450	**George Street**	Pine Street	Garwin Street	0.20		x		**4**	$84,000
1475	**Sharon Street North**	Petawawa Blvd. (Co. Rd. 51)	Birch Street	0.20		x		**4**	$84,000
1500	**Pine Street**	River Drive	George Street	0.30		x		**4**	$126,000
1525	**Ann Street**	Sharon Street	River Drive	0.30		x		**4**	$126,000
1550	**River Drive**	Petawawa Blvd. (Co. Rd. 51)	Top of Hill	0.40		x		**4**	$168,000
1555	**River Drive**	Top of Hill	Bottom of Hill	0.20			x	**4**	$54,000
2000	**Radtke Road**	Petawawa Blvd. (Co. Rd. 51)	Bottom of Hill	0.70			x	**4**	$294,000
2200	**Schwantz Road**	Petawawa Blvd. (Co. Rd. 51)	Laurentian Dr. (Co. Rd. 25)	1.10		x		**4**	$462,000
3350	**Janet Street**	Petawawa Blvd. (Co. Rd. 51)	Cul de Sac	0.30		x		**4**	$126,000
4180	**Carla Street**	Derek Drive	Cardinal Crescent	0.30		x		**4**	$126,000
4275	**Steffen Street**	Doran St. (Co. Rd. 26)	Carla Crescent	0.30		x		**4**	$126,000
5000	**Albert Street**	Victoria St. (Co. Rd. 16)	Alice St./Tall Pines Rd.	0.40		x		**4**	$168,000

Table 4.1 - Cost Improvement Table

ROAD SECTION #	DESCRIPTION	FROM	TO	LENGTH	URBAN	SEMI-URBAN	RURAL	CONDITION RATING	RECONSTRUCTION / REHABILITATION COSTS
5150	**Alice Street**	Albert Street	East Street	0.20		x		**4**	$84,000
5175	**Point Crescent**	Edward Street	East Street	0.20		x		**4**	$84,000
5200	**Van Hoof Street**	Edward Street	S. End Cul-de-sac	0.10		x		**4**	$42,000
5225	**Edward Street**	East Street	Albert Street	0.20		x		**4**	$84,000
5275	**East Street**	Island View Drive	Abbie Lane	0.90		x		**4**	$378,000
6125	**Wilbert Street**	Fred Street	Dundonald Drive	0.40		x		**4**	$168,000
6150	**Fred Street**	Petawawa Blvd. (Co. Rd. 51)	Wilbert Street	0.10		x		**4**	$42,000
6550	**Park Drive**	Algonquin Street	Algonquin Street	0.50		x		**4**	$210,000
7025	**Laroche Crescent**	Herman Street	Herman Street	0.60		x		**4**	$252,000
7050	**James Street**	Laroche Street	Laroche Street	0.30		x		**4**	$126,000
7100	**John Street**	Murphy Rd. (Co. Rd. 37)	Herman Street	0.40		x		**4**	$708,000
7125	**Norman Street**	Mary Street	Railway Tracks	0.30		x		**4**	$126,000
7150	**Mary Street**	Herman Street	Cul-de-sac - south of Herman St.	0.30		x		**4**	$141,000
7500	**Woodland Cres. N. leg**	Selkirk Street	Woodland Cres. W. leg	0.40		x		**4**	$708,000
7510	**Woodland Cres. S. leg**	Hemlock Street	Woodland Cres. W. leg	0.20		x		**4**	$84,000
7550	**Spruce Street**	Woodland Cres. N. leg	Woodland Cres. S. leg	0.30		x		**4**	$126,000
7605	**Russell Street**	Audrey Street	Sammy Drive	0.20		x		**4**	$84,000
7625	**Sammy Drive**	Russell Street	End	0.20		x		**4**	$84,000
7775	**Florence Street**	Hilda Street	Portage Road	0.20		x		**4**	$84,000
500	**Len Hopkins Drive**	Black Bay Road	Airport Road	2.10			x	**5**	$567,000
600	**Summers Road**	Black Bay Road	0.3 km West	0.30			x	**5**	$0
860	**Portage Road**	1.3 km NW Murphy Rd.	Former Village Limits	1.20			x	**5**	$492,000

Table 4.1 - Cost Improvement Table

ROAD SECTION #	DESCRIPTION	FROM	TO	LENGTH	URBAN	SEMI-URBAN	RURAL	CONDITION RATING	RECONSTRUCTION / REHABILITATION COSTS
2005	**Radtke Road**	Bottom of Hill	0.5 km Easterly	0.50			x	**5**	$135,000
2225	**Sack Road**	Schwantz Road	Kramer Avenue	0.30		x		**5**	$126,000
2250	**Isabel Street**	Sack Road	Schwantz Road	0.30		x		**5**	$126,000
2275	**Sandy Drive**	Isabel Street	Country Lane	0.20		x		**5**	$84,000
2300	**Country Lane**	Schwantz Road	Gutzman Road	1.00		x		**5**	$420,000
2350	**Chippewa Road**	Country Lane	Heritage Drive	0.20		x		**5**	$84,000
2375	**Viking Road**	Country Lane	Heritage Drive	0.20		x		**5**	$84,000
2400	**Arrowhead Road**	Country Lane	Heritage Drive	0.20		x		**5**	$84,000
3200	**Silke Drive**	Petawawa Blvd. (Co. Rd. 51)	Laurentian Drive	0.50		x		**5**	$210,000
3325	**Charles Street**	Michael Street	Peter Street	0.40		x		**5**	$168,000
4000	**New Street**	Petawawa Blvd. (Co. Rd. 17)	Hoffman Street	0.20		x		**5**	$84,000
4025	**Poplar Street**	New Steet	Labine Crescent	0.30		x		**5**	$126,000
4050	**Victor Street**	Poplar Street	Hoffman Street	0.10		x		**5**	$42,000
4075	**Hoffman Street**	New Street	Labine Crescent	0.40		x		**5**	$168,000
4100	**Labine Crescent**	Hoffman Street	Poplar Street	0.70		x		**5**	$294,000
4125	**Industrial Avenue**	Black Bay Road	Labine Street	1.10			x	**5**	$451,000
4250	**Derek Drive**	Doran St, (Co. Rd. 26)	Carla Crescent	0.30		x		**5**	$126,000
5025	**Tall Pines Road**	Albert Street	End	0.10		x		**5**	$34,000
5075	**North Street**	Albert Street	End	0.10		x		**5**	$34,000
5300	**Abbie Lane**	East Street	East End	0.30			x	**5**	$123,000
5375	**Earl Street**	Irma Street	Cul-de-sac	0.40		x		**5**	$300,000
6075	**Vereyken Crescent**	Dundonald Drive	Dutch Drive	0.50			x	**5**	$375,000

Table 4.1 - Cost Improvement Table

ROAD SECTION #	DESCRIPTION	FROM	TO	LENGTH	URBAN	SEMI-URBAN	RURAL	CONDITION RATING	RECONSTRUCTION / REHABILITATION COSTS
6100	**Dutch Drive**	Cartier St. (Civic Centre Ent.)	Vereyken Cres.	0.20			x	**5**	$150,000
6250	**Mohns Ave**	Violet Street	Petawawa Blvd.	0.50	x			**5**	$130,000
6275	**Willard Street**	Mohns Avenue	Victoria St. (Co. Rd. 16)	0.20	x			**5**	$52,000
7005	**Herman Street**	John Street	Selkirk Street	0.30	x			**5**	$73,200
7075	**Roy Street**	Mary Street	Murphy Rd. (Co. Rd. 37)	0.40		x		**5**	$168,000
7105	**John Street**	Herman Street	RR tracks	0.50		x		**5**	$885,000
7155	**Mary Street**	Railway Tracks	Herman Street	0.50		x		**5**	$979,000
7175	**Laura Street**	Doran Street	Railway Tracks	0.20		x		**5**	$354,000
7200	**Edith Street**	Doran Road	Mary Street	0.30		x		**5**	$126,000
7230	**Selkirk Street**	Woodland Crescent	Murphy Rd. (Co. Rd. 37)	0.90		x		**5**	$378,000
7525	**Hemlock Street**	Murphy Rd. (Co. Rd. 37)	Woodland Cres. N.	0.40		x		**5**	$708,000
7675	**Hilda Street**	Audrey Street	Doran St. (Co. Rd. 26)	0.50		x		**5**	$885,000
7680	**Hilda Street**	Hilda Court	Audrey Street	0.20		x		**5**	$219,000
7685	**Hilda Street**	Lisa Crescent	Hilda Court	0.10		x		**5**	$42,000
7725	**Lisa Crescent**	Scott Avenue	End Cul-de-sac	0.40		x		**5**	$168,000
7750	**Scott Avenue**	Portage Road	Hilda Street	0.20		x		**5**	$354,000
7825	**Portage Road**	Petawawa Blvd. (Co. Rd. 51)	Florence Street	0.30		x		**5**	$531,000
									$24,141,200

As noted by these Cost Improvement Tables, there is a very significant cost implication in maintaining the roads within the Town. Based on our current road condition assessment, the following is the total cost of recommended improvements:

Table 4.2– Summary of Recommended Road Improvement Costs

Type of Existing Roadway	Total Length within the Town (km)	Reconstruction Costs	Maintenance Costs (see Note 2)	Spot Improvements	Total Recommended Costs
Rural	**60.0**	**$5,625,000**	**$374,250**	**$215,000**	**$6,634,250**
Semi-Urban	**43.8**	**$18,261,000**	**$189,000**	**$120,000**	**$18,570,000**
Urban	**15.9**	**$255,200**	**$61,750**	**$217,500**	**$534,450**
Grand Total	**119.7**	**$24,141,200**	**$625,000**	**$552,500**	**$25,738,700**

Note: 1) Reconstruction Costs are costs associated with either complete reconstruction of the roadway or the rehabilitation of the asphalt surface such as a pulverize and pave operation.

2) Maintenance Costs include routing and sealing the asphalt surface and granular shoulder work. This work is undertaken by the Public Works staff on an ongoing basis. These costs are associated with roadways that have a condition rating of 6 to 10

3) Spot Improvements are miscellaneous works that are required on the roadways such as ditching work, curb repairs, etc. that can be done without the need to undertake a complete reconstruction.

4) The reconstruction costs associated with some roadways will result in the classification of some roadway changes (ie: some roads that are currently semi-urban are proposed to be upgraded to urban roads).

2.5 Road and Drainage Improvements

Various types of road and drainage improvements have been recommended and costed in this study and are briefly described as follows:

Reconstruction

- Rural and Semi Urban
  - excavation of existing road to specified depth
  - replacement with granulars
  - roadside ditching
  - centerline and entrance culvert replacement
  - topsoil and seed ditch slopes
  - resurface with asphalt

- Urban
  - excavation of existing road to specified depth
  - replacement with granulars
  - installation of a storm drainage system
  - installation of concrete curb and gutter system

- installation of concrete sidewalk
- landscaping topsoil and sod boulevard areas
- resurface with asphalt

Base and Surface

- remove, pulverize or break up existing surface
- place granular pad over existing grade
- centerline and entrance culvert replacement
- topsoil and seed ditch slopes
- resurface with asphalt

Pulverize and Surface

- pulverize existing surface
- fine grade and add granulars as required
- resurface with asphalt
- ditch and replace culverts as required
- topsoil and seed as required

Resurface

- crack seal existing asphalt surface
- overlay existing surface with new asphalt
- add granulars to shoulders as required

Road Culvert Replacement

- usually necessary to remove a frost heave condition or replace culvert and excavate approaches to 20:1 slope frost tapers or flatten to suit conditions
- replace culvert and backfill with granulars
- asphalt or surface treatment finish

Ditching

- excavate roadside ditches to minimum depth of 0.5 metres to 0.8 metres below edge of road to drain storm water to an outlet or drywell
- topsoil and seed side slopes if required

Drywell Installation

- useful in sandy areas with low water table and no outlet for ditching
- excavate for and install crushed stone, inverted perforated culvert, grating
- ditch to drywell as required
- topsoil and seed as required

The type of improvements costed for each road section are recommended as a result of the conditions rating survey and a knowledge of the road system.

It is recommended that soils investigations be conducted on improvement sections identified for reconstruction or base and surface or for any other sections that are doubtful or start to deteriorate rapidly.

2.6 Benchmark Cost Estimate

Benchmark costs are the average cost to undertake a specific improvement. These costs have been developed based on average construction costs in the area and are used to determine the improvement costs for the deficient road sections. The benchmark costs used in this report have been included as Appendix P.

2.7 Equipment Needs

To maintain an efficient maintenance operation the equipment inventory must meet the needs of the Municipality.

Equipment, like roads, should be replaced at the appropriate time, before it becomes a maintenance burden. Historically, equipment has been forecasted for replacement based on life span projections provided by MTO.

The Petawawa Public Works Department places a high priority on equipment maintenance and has been able to prolong the replacement of equipment beyond the standard life span projections. Equipment replacement forecasts are therefore based on life span projections provided by Tom Renaud.

An Equipment Inventory and 5 Year Replacement Schedule is provided in Table 4-3. For comparison purposes both life span projections are shown in the Table.

2.8 10 Year Capital Plan – Roads

Based on all of the information gathered on the existing road network of the Town, our office, in consultation with staff of the Town, prepared a 10 year capital work plan for upgrading of the road system which is noted in Table 4-4. We have based this program on an average annual expenditure of approximately $1,250,000 per year. The reader will note that the yearly program fluctuates due to the size and scope of some of the projects.

Generally the program is based on reconstructing the roads with the lowest condition ratings, but it also puts a higher emphasis on the collector roads in the Town as well as trying to balance the rural versus urban split. Some of the road projects are also associated with upgrades to other infrastructure works such as watermain and sanitary sewer upgrades. These are discussed in more detail in Chapter 6 – Comprehensive Plan.

While it is recommended that this program be followed closely over the coming 10 year period, it is recognized that factors such as budget constraints, timing of developments and servicing issues may require that it be altered accordingly.

Table 4-3 **Vehicle/Equipment Replacement Schedule** **2012**

Equip #		Year Purchased	2012	2013	2014	2015	2016	Comments	Tom's Est. Life Span		Manual Est. Life Span
1-69	Wabco Grader	1969							44 yrs	2013	25 yrs
~~2-79~~	~~Case articulating loader 1 ¼ cy~~ (being replaced in 2012)	~~1979~~	$250,000						31 yrs	2010	10 yrs
9-94	Honda compact tractor	1994		$30,000					16 yrs	2010	10 yrs
10-94	580 Case tractor backhoe	1994							20 yrs.	2014	10 yrs
17-98	International 5 ton single axle c/w side dump	1998		$260,000					14 yrs	2012	10 yrs
19-99	Bandit chipper model 90xp	1999		**					12 yrs	2011	10 yrs
22-01	Trackless MT Municipal Tractor	2001	$170,000						10 yrs	2011	10 yrs
23-01	Trackless MT Municipal Tractor	2001			$170,000				10 yrs	2011	10 yrs
24-01	John Deere c/w 2 way plow and wing	2001	**						9 yrs	2010	10 yrs
26-01	RPM Teck Snowblower model L220	2001			$110,000				10 yrs	2011	10 yrs
25-02	International 6 ton tandem c/w spreader	2002				$260,000			10 yrs.	2012	10 yrs
27-04	International 6 ton tandem c/w spreader	2004					$260,000		10 yrs	2014	10 yrs
28-04	By-Law Van	2004		$50,000					8 yrs	2012	4 yrs
29-06	Volvo Tractor Backhoe	2006							14 yrs	2020	10 yrs
31-06	Ford F350 Service Van	2006							8 yrs	2014	4 yrs
30-07	Dodge 1500 Pickup	2006	$40,000						8 yrs	2014	4 yrs
32-08	Dodge Ram 1500	2008			$40,000				8 yrs	2016	4 yrs
33-08	International Plow Single Axle	2008							10 yrs	2018	10 yrs
34-08	Trackless MT Municipal Tractor	2008							10 yrs	2018	10 yrs
35-10	Dodge 1 ton dump	2010							19 yrs	2029	4 yrs
39-11	MT6 Municipal Tractor	2011							10 yrs	2021	10 yrs
40-11	Tandem Dump/Snow Plow	2011							10 yrs	2021	10 yrs
	Sundry Items/ Minor Equipment		$15,000	$15,000	$15,000	$15,000	$150,000				
		TOTALS	$475,000	$355,000	$335,000	$275,000	$410,000	$0			

TABLE 4-4
TOWN OF PETAWAWA
10 YEAR CAPITAL PLAN
2012 - 2022
Dec. 21, 2011
Updated April 12, 2013

PROJECT	Location	DESCRIPTION OF IMPROVEMENT	LENGTH OF PROJECT	ROAD SECTION #	ROAD CONDITION RATING	ROADS, STORM & SIDEWALK 2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
2012																
Victoria Street Reconstruction (Part 1)	Wolfe Ave. to Laurentian Dr.	Urban Road Reconstruction	600	N/A	County Road	$241,000										
Herman Street - Phase 2	John St. to Laroche Cresc. (n. leg)	Urban Road Reconstruction	360	7000	3 out of 10	$667,900										
Rantz Road - Phase 2 Stage 1	Phase 1 limit to Murphy Road (west end)	Rural Pulverize and Pave	600	910	3 out of 10	$140,000										
Sylvan Drive - Phase 1	East Leg	Rural Pulverize and Pave	700	350	3 out of 10	$199,000										
Evergreen Drive	Doran St. to dead end	Rural Pulverize and Pave	300	200	3 out of 10	$69,000										
Watermain Twinning	Petawawa Bridge	Watermain Installation														
2013																
Victoria Street Reconstruction (Part 2)	Wolfe Ave. to Laurentian Dr.	Urban Road Reconstruction	600	N/A	County Road		$242,800									
Herman St. - Phase 3	Laroche Cres. to Murphy Road	Urban Road Reconstruction	425	7000	3 out of 10		$435,000									
Janet St. watermain ext.	Limestone Trail to Janet St. Booster St.	Watermain Installation	125													
Sylvan Drive - Phase 2	West Leg	Rural Pulverize and Pave	800	350	3 out of 10		$180,000									
Plum Tree Lane	Black Bay Road to end	Rural Pulverize and Pave	400	700	2 out of 10		$115,000									
Syphon Chamber Flow Chamber																
Replace ex. 500mm watermain at plant																
Vermont Meadows		Storm Outfall Improvements		6450			$50,000									
2014																
Civic Center Road - Phase 1	Leeder Lane to Laurentian Drive	Urban Road Reconstruction	300	6005	3 out of 10			$507,000								
Park Drive - Phase 1	North Leg	Semi-Urban Pulverize and Pave	250	6550	4 out of 10			$105,000								
Shamess Road	1.3 km west of Rantz Road to end	Rural Reconstruction	700	960	3 out of 10			$448,000								
Airport Road	800m of Doran Road to cul-de-sac	Rural Pulverize and Pave	700	330	2 out of 10			$189,000								
Renfrew St. Pumping Station	Renfrew Street	Capacity upgrades, generator														
McGregor Hill Watermain	Petawawa Blvd.	Petawawa feed for McGuire Sub.														
Victoria Street	Laurentian Dr. to East St.	Sanitary Sewer Upgrades	200	5250	8 out of 10			$84,000								
East Street	Victoria St. to Abbie Lane	Sanitary Sewer Upgrades	100	5275	5 out of 10			$42,000								
Abbie Lane	East Street to Sewage Treatment Plant	Sanitary Sewer Upgrades	350	5300	4 out of 10			$123,000								
Rantz Road - Phase 2 Stage 1	Phase 1 limit to Murphy Road (west end)	Rural Pulverize and Pave	600	910	3 out of 10			$240,000								
2015																
Civic Centre Road - Phase 2	Civic Center entrancre to Leeder Lane	Urban Road Reconstruction	600	6005	3 out of 10				$845,000							
Park Drive - Phase 2	South Leg	Semi-Urban Pulverize and Pave	250	6550	4 out of 10				$105,000							
Craig Place	Florence St. to cul-de-sac	Semi-Urban Pulverize and Pave	100	7800	2 out of 10				$42,000							
Rantz Road - Phase 3	Murphy Road (east end) to 2011 limit	Rural Pulverize and Pave	900	900	3 out of 10				$270,000							
2016																
Risto Road	Springhill Court to McGuire St.	Rural Pulverize and Pave	600	1250	3 out of 10					$256,000						
James Street	Laroche Cres. to Laroche Cres.	Semi-Urban Pulverize and Pave	300	7050	4 out of 10					$126,000						
Laroche Crescent	Herman St. to Herman St.	Semi-Urban Pulverize and Pave	600	7025	4 out of 10					$252,000						
Mary Street - Phase 1	Railway Tracks to Herman Street	Urban Road Reconstruction	500	7155	5 out of 10					$979,000						
2017																
John St.	Herman St. to RR Tracks	Urban Road Reconstruction	500	7105	5 out of 10						$885,000					
Norman St.	Mary St. to RR Tracks	Semi-Urban Pulverize and Pave	300	7125	4 out of 10						$141,000					
Laura St.	Doran Road to RR Tracks	Urban Road Reconstruction	200	7175	5 out of 10						$369,000					
Edith	Doran Road to Mary St.	Semi-Urban Pulverize and Pave	300	7200	5 out of 10						$126,000					
2018																
Hilda (west of Audrey)	Hilda Court to Audrey St.	Urban / Semi-Urban Reconstruction	200	7680	5 out of 10							$332,000				
Hilda (west of Audrey) (see note 4)	Lisa Crescent to Hilda Court	Semi-Urban Reconstruction	100	7685	5 out of 10							$155,000				
Hilda Court (see note 4)	Hilda St. to Hilda St.	Semi-Urban Reconstruction	100	7700	2 out of 10							$155,000				
Lisa Cres. (see note 4)	Scott Ave. to Cul-de-sac	Semi-Urban Reconstruction	400	7725	5 out of 10							$620,000				
Scott Ave.	Portage Road to Hilda St.	Urban Road Reconstruction	200	7750	5 out of 10							$354,000				
2019																
Black Bay Road (see note 3)	Petawawa Blvd. to Doran Road	Rural Pulverize and Pave - 2 lifts	1,800	550	6 out of 10								$873,000			
Industrial Ave. (ssee note 3)	Labine Cres. to Black Bay Road	Rural Pulverize and Pave - 2 lifts	1,100	4125	5 out of 10								$533,500			
2020																
Pitzner Road	cul-de-sac	Rural Pulverize and Pave - 1 lift	1,300	340 & 400	5 out of 10									$351,000		
Mohns	Petawawa Blvd.	Urban Resurfacing	500	3250	5 out of 10									$267,500		
Achray Road	Biesental Road	Rural Reconstruction	1,500	110	2 out of 10									$585,000		
Petawawa Blvd	sanitary sewer upgrade just upstream of Harry St. PS															
Petawawa Blvd	sanitary sewer upgrade - line to trailor park															
2021																
Garwin St. North	Petawawa Blvd. to Birch St.	Semi-Urban Pulverize and Pave	300	1330	4 out of 10										$126,000	
Pineridge Cresc.	Garwin St. to Birch @ Elton St.	Semi-Urban Pulverize and Pave	500	1350	4 out of 10										$210,000	
Elton St.	Birch St. to Pineridge Crescent	Semi-Urban Pulverize and Pave	200	1375	4 out of 10										$84,000	
Doris St.	Birch St. to Pineridge Crescent	Semi-Urban Pulverize and Pave	200	1400	3 out of 10										$84,000	
Birch St.	Elton St. to River Drive	Semi-Urban Pulverize and Pave	600	1425	4 out of 10										$252,000	
George St.	Pine St. to Garwin St.	Semi-Urban Pulverize and Pave	200	1450	4 out of 10											
Sharon St. North	Petawawa Blvd. to Birch St.	Semi-Urban Pulverize and Pave	200	1475	4 out of 10										$84,000	
Pine St.	River Dr. to George St.	Semi-Urban Pulverize and Pave	300	1500	4 out of 10										$126,000	
Ann St.	Sharon St. to River Drive	Semi-Urban Pulverize and Pave	300	1525	4 out of 10										$126,000	
2022																
Roy Street	Mary St. to Murphy Road	Semi-Urban Pulverize and Pave	400	7075	5 out of 10											$168,000
John St.	Murphy Road to Herman St.	Urban Road Reconstruction	400	7100	4 out of 10											$708,000
Mary St.	Herman St. to cul-de-sac (south)	Urban Road Reconstruction	300	7150	4 out of 10											$141,000
		TOTALS				$1,316,900	$1,022,800	$1,738,000	$1,262,000	$1,613,000	$1,521,000	$1,616,000	$1,406,500	$1,203,500	$1,092,000	$1,017,000

Average Cost/year = $1,346,245

Notes: 1. All costs based on 2011 construction values. Costs include engineering and contingecy allowance. Cost exclude HST.
2. Concrete sidewalks are to be installed for all "Urban Road Reconstruction" projects and included in the costs noted above.
3. Costing includes installation of asphalt sidewalk within boulevard.
4. The cost for the roadworks are based on "semi-urban reconstruction" as compared to "semi-urban pulverize and pave" that is noted in Infrasture Study

Table 4-4

3.0 EVALUATION OF STANDARDS

The standards utilized by the Town to define the minimum desired level of service are key components to the development of a road system. The Municipal Class Environmental Assessment document allows a Municipality to undertake improvements to municipal systems, providing that the improvements are intended to meet the established standards or needs. This section will serve to identify the minimum levels of service that are desired and generally accepted for municipalities.

3.1 The Road Classification System

A road classification system is required to group roads into a limited number of defined types in order to categorize the type of road and level of service to be provided. For urban and rural areas, the road systems are generally defined as Local, Collector, Arterial and Freeway. In the Town of Petawawa, the Ontario Ministry of Transportation is responsible for Highway 17, which is categorized as part of the Provincial Freeway System. Arterials and larger collector roads generally fall under the jurisdiction of the County of Renfrew. The Town of Petawawa is responsible for the local roads and the local collectors.

The main function of local roads is the provision of land access. The primary function of these roads is to provide direct access to private property. These roads are not intended to carry through traffic.

Collector roads provide both traffic service and land service. The purpose of these roads is to carry traffic between local roads and arterial roads. As an example, Mohns Avenue is a collector road that carries traffic from Ethel Street (a local road) to County Road 51 (an arterial road).

The environment of the road is also a factor in categorizing road design requirements. Urban areas are defined not only by Official Plan designation, but also according to existing land use and densities. For the purpose of categorizing a roadway in the Town as urban, areas in which the majority of lot frontages are less than 30 metres will be considered an urban environment, as well as those areas so designated in the Official Plan. In the suburban areas of the Town of Petawawa lot frontages are generally 30 metres or greater, owing to the need for larger lots to accommodate septic systems in combination with communal water services. In rural development areas there are no municipal services.

3.2 Design Requirements

In rural areas, the minimum design requirement for rural roads is clearly defined. Surface drainage systems are provided and designed to ensure adequate protection of the road base.

In urban areas, due to high population densities and traffic volume, other issues must be taken into consideration. In the urban area, all users of the system including pedestrians, cyclists and public transit, must be considered in conjunction with road surface and buried infrastructure requirements.

In rural design, providing as high a design speed as practical is often a primary objective. In urban design, this is not always the case and, in fact, the opposite may apply for the lower end of the street classification system. Choosing too high a design speed for a local or collector street in an urban environment can induce drivers to travel beyond the safe speed for their surroundings.

Local streets, in particular, are designed with the safety of all users, including pedestrians and cyclists, in mind. Local streets, by definition, accommodate highly conflicting uses and movements and provide a high degree of access. Thus, low design speeds are appropriate for local streets with low mobility requirements, frequent access and significant pedestrian and cyclist activity.

In order to provide the maximum level of safety and properly address the urban servicing constraints, it is often necessary to install storm sewers, curbs and sidewalks, especially for busy roadways. The creation of this urban environment has been, and will continue to be, the policy for new development in the urban area of the Town of Petawawa. Consideration must, however, be given to other issues related to growth and increased traffic volumes, such as the urbanization of existing semi-urban roads in the urban area and the identification of a collector road system in new developing areas.

3.3 Road Service Standards

For all new developments in the urban area, roadways shall be developed with an urban cross-section including a storm drainage system, mountable curbs and sidewalks along at least one side of the roadway. Collector roadways should include sidewalks installed on both sides of the road.

For new developments in the suburban area, semi-urban roadways with shallow ditches, drainage by means of drywells and concrete sidewalks on one side of the roadway are the standard requirements that have been implemented over the past few years and it is recommended that these continue to be the standards utilized.

In the past, Council's policy has been to upgrade all roadways within the urban area to an urban standard when they are due for reconstruction. Since a significant number of roadways in the urban area currently have a semi-urban cross section, upgrading to an urban standard involves introducing a storm drainage system, curbs and sidewalks to areas that currently do not have these features within the roadway. The cost involved with adding the new features as well as reconstructing the driving surface itself is very expensive. Typically, the cost to reconstruct a semi-urban roadway by means of pulverizing and paving and adding 2 new lifts of asphalt is $560,000 /km. The cost to upgrade a roadway to urban standard complete with storm sewer, curb and sidewalk is in the neighborhood of $1,770,000 /km, which is over 3 times the cost of the semi-urban alternative.

It is our recommendation that only certain roadways be upgraded to urban standard within the Town's urban area for the following reasons:

- The cost to urbanize an existing semi-urban roadway is 3 times to cost as compared to simply rehabilitating the roadway and maintaining it as a semi-urban cross section.

- For the most part, there are no drainage issues within the existing semi-urban roadways due to the sandy soil in Petawawa.

- The residents in the neighbourhoods that have semi-urban roadways have been living with this level of surface for a number of years and generally do not lodge

complaints about this to the Town.

In this regard, Figure 4-5 indicates the roadways in the urban area of the Town that we recommend:

1. Be classified as collector roadways (these are noted in pink). These roadways would be upgraded to an urban standard when they are in need of reconstruction and they would also be reviewed for enhanced pedestrian and cycling considerations at the time.

2. Be upgraded to urban standard (these are noted in green). These are roadways that currently have a semi-urban cross section that should be upgraded to urban standard complete with concrete sidewalks on one side of the road. These are roadways that provide links between collector and/or arterial roadways within the older, fully developed subdivisions.

3. The roadways that are already developed to an urban standard are noted in blue. These are typically all the new subdivision roadways as well as roads that have been reconstructed within the past few years.

Town of Petawawa

Legend

- Collector
- Existing Urban
- Proposed Upgrade to Urban
- Provincial
- County
- Municipal
- Private
- Seasonal
- Railway
- Township Boundary
- Water Area, Permanent
- Wetland Area, Permanent
- Water Line, Permanent
- Property Fabric
- Provincial_Parks
- Federal_Land
- CrownLand

N

0 375 750 1,500 2,250 3,000 Meters

Figure 4-5 Road Network Classification

3.3.1 Road Standards

For the purpose of facilitating the costing and design of roads, and to ensure that the safety of the public is maintained, the following is a summary of the design requirements for new roads. Typical cross sections and associated costing is contained within Appendix P.

Local Urban Roads

- full urban standards including storm sewers (2 year), mountable concrete curb and concrete sidewalk on one side of the roadway
- buried utilities including hydro
- minimum right-of-way 20.0 m
- minimum asphalt surface width 6.5 m (2 lifts of asphalt)
- minimum granular depth 300mm Granular B and 150 mm Granular A (unless otherwise verified by a Geotechnical Investigation)
- day lighting 3 x 3 m triangles to be provided at all intersections (new roads)

Local Urban Collector Roads

- full urban standards including storm sewers (2 year), mountable concrete curb and concrete sidewalk both sides of the road (sidewalk subject to Town's review)
- buried utilities including hydro
- minimum right-of-way width 20.0 m
- minimum asphalt surface width 6.5 m (2 lifts of asphalt)
- minimum granular depth 300mm Granular B and 150 mm Granular A (unless otherwise verified by a Geotechnical Investigation)
- day lighting 5 x 5 m triangles to be provided at all intersections (new roads)

Local Semi-urban Roads

- drainage by open ditch (surface) and/or dry wells; storm sewers are required where depth of ditch is excessive
- concrete sidewalk on one side of the road
- buried utilities (hydro)
- minimum right-of-way width 23.0 m
- minimum asphalt surface width 6.5 m (2 lifts of asphalt)
- minimum granular depth 300mm Granular B and 150 mm Granular A (unless otherwise verified by a Geotechnical Investigation)
- minimum shoulder width 1.5 m
- day lighting 3 x 3 m triangles to be provided at all intersections (new roads)

Local Semi-urban Collector Roads

- drainage by open ditch (surface) and/or dry wells
- concrete sidewalk on one side of the road
- buried utilities (hydro)
- minimum right-of-way width 23.0 m
- minimum asphalt surface width 6.5 m (2 lifts of asphalt)
- minimum granular depth 300mm Granular B and 150 mm Granular A (unless otherwise verified by a Geotechnical Investigation)
- minimum shoulder width 1.5 m
- day lighting 5 x 5 m triangles to be provided at all intersections (new roads)

Rural Subdivision Roads

- drainage by open ditch (surface) and/or dry wells
- buried utilities (hydro)
- right-of-way 20.0 m
- minimum asphalt surface width 6.5 m (2 lifts of asphalt)
- minimum granular depth 300mm Granular B and 150 mm Granular A (unless otherwise verified by a Geotechnical Investigation)
- minimum shoulder width 1.5 m
- day lighting 5 x 5 m triangles to be provided at all intersections (new roads)

Rural Roads

All rural collector roads to be designed to meet current Transportation Association of Canada (TAC) Standards, which are established based on traffic volumes

- drainage by open ditch
- minimum asphalt surface width 6.5 m
- minimum granular depth 300mm Granular B and 150 mm Granular A (unless otherwise verified by a Geotechnical Investigation)
- minimum shoulder width 1.5 m
- utilities may be overhead or underground

3.4 Sidewalks

The sidewalk network in the Town is also considered to be part of the road system. The Town's sidewalk network comprises both concrete and asphalt sidewalks, typically 1.5m in width. Within the urban area the sidewalks are usually located in a grassed boulevard behind the curb, are predominately concrete and follow the grade of the roadway. Within rural settings, the sidewalk is generally asphalt and is installed in a rolling nature to follow the natural contours of the ditches. Figure 4-6 indicates the location and material of sidewalks that are currently in place in the Town. In prioritizing where new sidewalks are the to be installed in the Town, the following planning criteria should be considered;

i. within 1.5 kms of a school;
ii. within 1.5 kms of a community facility or park, health care facility and shopping centres;
iii. sidewalks should be constructed on both side of the street for arterial streets and commercial areas where there is commercial properties fronting both sides of the road.
iv. sidewalks should be constructed on one side of urbanized local and collector roadways,
v. sidewalks are not required on cul-de-sacs unless they lead directly to features noted above in i. and ii.
vi. sidewalks shall be installed on all streets in new subdivisions.

Figure 4-6 notes the location of proposed new sidewalk installations that meet this planning critiera.

3.5 Active Transporation

When planning for road rehabilitation or reconstruction work, the design should, wherever feasible, incorporate provisions to allow for safe and comfortable access for pedestrians, bicyclists and mobility impaired individuals. The design should recognize that needs of all street users and not just motorists. It should address the needs, safety and convenience of all users in the review of design features such as the placement of sewer grates, maintenance hole covers, signage and intersection treatments.

4.0 GROWTH RELATED IMPROVEMENTS

Population growth in the Town of Petawawa and in the adjacent municipalities will have a significant effect on the road systems in the Municipality. Not only will the length of the road system increase, but the number of vehicles using the existing roads will also increase. The need to identify growth related improvements and to identify the potential impact of the growth is a key consideration of this report.

4.1 Growth Related Improvements on Existing System

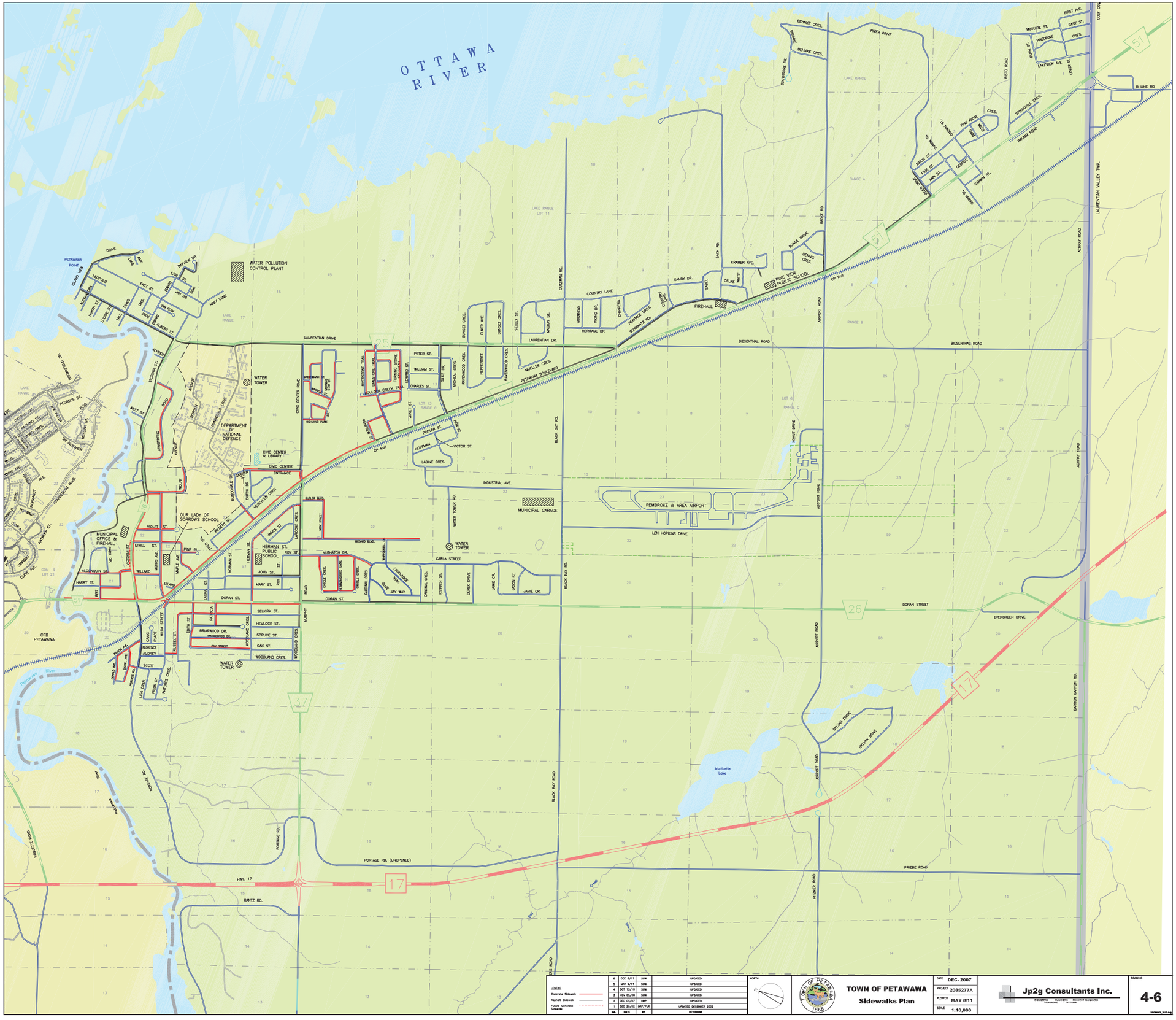
There is no doubt that new development will have a significant impact on the road systems. Most growth is, however, concentrated along the County Road System, particularly Murphy Road and County Road 51.

Of the roads which fall under the jurisdiction of the Town of Petawawa, it is anticipated that only Civic Centre Road, Portage Road and Industrial Drive will experience significant increases in traffic volumes due to new development. Consideration should be given to future traffic volumes on these roads and the alignment and cross-sections adjusted accordingly. It should be noted that both the urban and rural components of Portage Road will experience significant increases in traffic volumes as Portage Road becomes a more important link to Highway 17 for the new subdivisions.

4.2 Extension of the Road System - New Development

The growth of the municipal road system will be primarily accomplished through the construction of new roads in new residential developments. It is important that the standards established for these developments meet the minimum requirements of the Town for the foreseeable future. The roads must be designed and constructed such that the roads will not require operational or structural improvements within a minimum 20 year lifespan. This will require an assessment of the existing subsurface conditions for the road and confirmation of the pavement structure, including granular depths.

In order to ensure that the operational concerns are identified and addressed for all growth areas, it will be necessary to conduct an evaluation of the road system in the immediate vicinity of a proposed development. The new roads must consider the interlinking of neighbourhoods. Local collector roads with wider road allowances to accommodate turning lanes and day lighting triangles can be used to provide a safer environment to residents. The design of road systems for new subdivisions should be supported with a technical analysis of traffic flows and should also provide recommendations for signage. Intersections should be designed in accordance with current Transportation Association of Canada (TAC) Standards where applicable



LEGEND					
Concrete Sidewalk	6	DEC 6/11	SDN	UPDATED	
Asphalt Sidewalk	5	MAY 5/11	SDN	UPDATED	
Future Concrete Sidewalk	4	OCT 13/10	SDN	UPDATED	
	3	NOV 05/08	SDN	UPDATED	
	2	DEC 05/07	DRP	UPDATED	
	1	DEC 20/02	DRP/PLR	UPDATED DECEMBER 2002	
	No.	DATE	BY	REVISIONS	

NORTH

TOWN OF PETAWAWA
Sidewalks Plan

DATE	DEC. 2007
PROJECT	2085277A
PLOTTED	MAY 8/11
SCALE	1:10,000

Jp2g Consultants Inc.
PEMBROKE PLANNERS PROJECT MANAGERS OTTAWA

DRAWING 4-6

5.0 CONCLUSION

This report has been compiled to provide Council with a list of present and projected road and drainage improvements associated with the Town road system. It should be used as a reference document to plan future road improvements and to ensure that the maximum benefit is being achieved from the roads' budget funding. Road improvements that can be directly attributed to growth or new development should be funded by the development or constructed as part of the new subdivision.

The following is a summary of the main conclusions in this chapter:

- The Town should continue to utilize the road management program to assist with the planning and prioritization of road improvements.
- The road management plan also includes a program for the replacement of equipment.
- A properly planned and maintained road system allows for efficient and cost effective maintenance of the municipal road network.
- Population growth in the Town will result in increases in the traffic volumes on some roads, such as Civic Centre Road, Portage Road and Industrial Drive. Specific design considerations to account for this increased traffic should be implemented with any program associated with road upgrades for these three roadways.
- There is a need to improve pedestrian and cycling access throughout the Town
- The categorization of the road system will assist in the establishment of the needs and priorities for road improvements.

6.0 RECOMMENDATIONS

The following is a list of the primary recommendations in this chapter of the report:

- That the recommendations of the Road Management Plan and the 10 Year Capital Plan – Roads be reviewed and adopted by Council and that the program be carried forward as the basis for planning for road improvements for the Town.
- That the recommendations regarding equipment inventory and replacement be implemented to ensure that the road system will continue to provide a safe and efficient transportation system.
- That, wherever feasible, provisions be incorporated into the design of the roadway to facilitate the needs of pedestrians, bicyclists and mobility impaired individuals.
- That the minimum road standards for reconstruction be used for the planning of future road reconstruction work in the Town.
- That all new development be required to construct roads in accordance with the minimum standards established by the Town.

CHAPTER 5

WATER DISTRIBUTION SYSTEM

TABLE OF CONTENTS

1.0 INTRODUCTION

1.1 Background

In order to accommodate population growth and development, both in the Town of Petawawa and in CFB Petawawa, the Town of Petawawa Water System (which serves both populations) has been expanding.

Many of the water system improvements recommended in the Petawawa Infrastructure Study 2003 have been implemented. These improvements include:

- Integration of pressure zones at CFB Petawawa and Town of Petawawa including:
  - Replacement of the water meter at Main Gate with an electromagnetic flow meter
  - Replacement of existing check valve on Wolfe Avenue with a motorized valve
  - Installation of a second electromagnetic flow meter to measure flow to the South Townsite/Town area
- Construction of a new 1 million gallon water storage facility
- Removal of North Townsite and South Townsite Elevated Storage tanks (slated for 2012)
- Construction of a 200 mm diameter watermain on Nuthatch Drive to link pressure zones between the former Village and Township systems. This eliminated the need for the booster pump at the base of the Village water tower on Woodland Crescent.
- Upgrading of existing watermains to improve fire flow and water distribution capacity, including :
  - The extension of a 250mm diameter watermain from the South Townsite to the Janet Street Booster Pumping Station
- Construction of loops at existing dead end watermains including:
  - A watermain extension on Dutch Drive to loop the watermain at the Civic Center
  - Construction of watermains along Doran Road to eliminate four dead-end lines
- Construction of feedermains to extend water into new development areas

The on-going population growth and development is expected to continue over the next 20 year planning horizon and, as a result, the existing water supply and distribution system needs to be assessed in order to identify improvements required to satisfy the needs of the Town of Petawawa over the next 20 year planning period.

In order to help clarify the ownership of the water distribution system within CFB Petawawa, we have provided a copy of memo from Dan Patrick dated January 12, 2010, which outlines his understanding of the Town's obligations based on his review of the 1993 agreement between the Town and the Base. This is contained in Appendix Q.

1.2 Study Scope

The assessment of the water system component for this Infrastructure Study Update was conducted in 3 steps as follows:

Step 1 Assess Current Conditions

- Obtain/review current operational data
  - Water treatment plant performance records; trend logs; water meter records; per capita flow rate
  - Chlorine residual issues
- Update CAD drawings of water system
  - Watermain addition
- Existing water distribution system
- Update WaterCad model
- Calibrate WaterCad model (to current condition and to model/simulate existing operational conditions based on trend logs/system demands)
- Conduct hydraulic analysis of existing system
- Review any deficiencies in the existing system (excluding CFB Petawawa)

Step 2 Assess Future Development and Servicing Requirements

- Identify future areas to be serviced in the Town as well as CFB Petawawa
- Establish flow rates to service future developments
- Assess impacts on water treatment plant capacity
- Conduct computer/hydraulic modeling to evaluate requirements for servicing future development areas (excluding CFB Petawawa)
- Assess water storage requirements for future conditions

Step 3 Recommendations

- Summarize recommendations

2.0 ASSESS CURRENT CONDITIONS

2.1 Collection and Review of Current Operational Data

2.1.1 Current Per Capita Water Flow Rates

The estimated current population for the water service area is as follows:

Town population	10,015	
CFB Petawawa		
- North Townsite	4,165	
- South Townsite	1,820	
Total	16,000	persons

Water flow data for the years 2009 and 2010 were obtained from the Town Operators (OCWA) and can be summarized as follows:

Table 5-1 Three Year Water Flow Data

	2008	2009	2010	3 Year Average
Total Annual flow (m^3)	2,215,642	2,211,144	2,458,857	2,295,214
Average Day Flow (m^3/day)	6,054	6,056	6,737	6,282
Max. Day Flow (m^3/day)	8,935	11,492	11,881	10,769
Peaking Factor	1.5	1.9	1.8	1.8

Service Population: 16,000
Per capita average daily flow: 0.42 m^3/cap/day
Per capita maximum day water flow: 0.74 m^3/cap/day

MOE guidelines allow water plant flows to be averaged over the previous 3 years in order to establish the current flow rate used to determine available plant capacity for servicing future population growth. However, because of the relative rapid growth in the Town of Petawawa over the past few years, we have used water plant flow data for the most current year (2010) to calculate per capita flow rates for average day and maximum day demand conditions.

Furthermore, we have adjusted the per capita flow rate for maximum day demand to account for the fact that part of the Petawawa water service is supplied from the City of Pembroke, as well as the fact that some of the Base population has been overseas for parts of the last three years. As a result, the per capita maximum day water flow has been adjusted from 0.74 to 0.90 m^3/cap/day for purposes of determining the hydraulic reserve capacity at the Petawawa water treatment plant for servicing future population growth and development.

2.1.2 Water Treatment Plant Capacity

The rated capacity of a water plant is based on the maximum day flow rate. In accordance with the MOE Certificate of Approval, the rated capacity for the Petawawa Water Treatment Plant is 21,500 m^3/day. The maximum day water flow for 2010 for the Petawawa WTP was recorded to be 11,881 m^3/day. This indicates that, currently, the

water plant is operating at approximately 55% capacity and therefore, the hydraulic reserve capacity available, as of 2010, is 45% or approximately 9,675 m^3/day.

2.1.3 Trend Logs

The following trend logs were obtained from OCWA and examined:

- Water tower level (Base and Town towers).
- Plant discharge flow, pressure, chlorine residual

The plant log trends were reviewed for the plant effluent flow and tower levels for the period June 26 through July 2, 2011. The following issues were noted:

South Town Site Tower

There is very little turnover of the water in the South Town Site tower, as the tank is "full" before the Town tower is full or reaches "pump off" level. This is demonstrated by:

- The tank remains more or less full with very small level changes during normal operation, even with significant level changes in the Town and Base towers
- The tank was "full" approximately two hours before the pumps turned off at 10:00 am June 27, 2011
- The tank appeared to continue to fill even though pumps were off at approximately 6:00 am July 3, 2011

The lack of "turnover" of the water can cause problems with water quality due to aging (ie: loss of free chlorine) and could cause significant damage by freezing of the water in the tank during the winter. It is recommended that the South Townsite tower be taken off line and drained before winter conditions occur.

Petawawa River Crossing (Town Tower)

The Town and Base tower water levels went up and down together as the duty high lift pump cycled on and off. The changes to the Town tower water level are smaller than the Base tower, which is likely due to a restriction in the piping network between the Town and Base towers. As indicated elsewhere, computer modeling indicates the restriction is due to the river crossings, which consist of a 300 mm diameter pipe on the Petawawa Boulevard Bridge and a 300 mm diameter pipe under the river at Alfred Street.

2.1.4 Chlorine Residual Issues

Representative free chlorine residual measurements for various locations in the Town of Petawawa for the period from June 2010 through November 2010 were obtained from OCWA. The data is representative for maximum day conditions during the summer where water temperature is approximately 15^o C and average day conditions during November where water temperature can approach 0^o C.

2.2 Update CAD Drawings of Water System

CAD drawings of the water system were upgraded to current conditions by:

- Modifying and updating pipe type and size where changed (ie: replacing asbestos cement pipe on Petawawa Boulevard between bridge and main gate with PVC pipe)
- Adding watermains for subdivisions completed since 2003 (ie: near Doran and Murphy Roads)
- Adding watermains servicing commercial and industrial areas near airport
- Adding new schools between Civic Centre Road and Dundonald Drive
- Adding new watermain on Centurion Road to CFB Petawawa system
- Adding 300 mm branch to existing helipad (CC102 previously modeled as a demand on a node near water plant)
- Adding new 4,500 m^3 water tower located near Festubert/Petawawa Boulevard intersection

2.3 Existing Water Distribution System

The current water distribution system is illustrated on Figure 5-1. As shown on this figure there are 3 main pressure zones in the existing water system configuration as follows:

- Town of Petawawa – urban area (including CFB Petawawa)
- Town of Petawawa – semi-urban area (former Township system)
- McGuire Subdivision area (supplied from the City of Pembroke)

2.4 Update and Calibrate Computer Model

The computer model was upgraded to current conditions by:

- Modifying and updating pipe type and size where changed (ie: replacing asbestos cement pipe on Petawawa Boulevard between bridge and main gate with PVC pipe)
- Adding subdivisions completed since 2003 (ie: near Doran and Murphy Roads)
- Adding commercial and industrial areas near airport
- Adding new schools between Civic Centre Road and Dundonald Drive
- Adding addition to Field Hospital, Range Control Building, etc. to CFB Petawawa system
- Adding 300 mm branch to existing helipad (CC102 previously modeled as a demand on a node near water plant)
- Modifying demand patterns for Town and Base use to reflect usage pattern for the week of January 11 through 18, 2011
- Adding new 4,500 m^3 water tower located near Festubert/Petawawa Boulevard intersection

The schematic layout of the updated WaterCad model is contained in Appendix R.

A number of fire flow tests were carried out by Vipod Inc. on behalf of CFB Petawawa during the latter part of 2010 on the watermain branch feeding Building CC102 and on Centurion Road.

The 'C' factors for the various types of piping material were adjusted until the plant discharge pressure and water tower elevations approximated SCADA results.

The fire flow at the hydrant near Building CC102 was modeled by imposing test flows and adjusting 'C' factors of the piping until resulting pressure during test flow was equivalent to measured pressure. The resulting 'C' factors used are:

Material	'C' factor	Diameter Range
PVC	150	200 to 300 mm
Asbestos Cement	125	300 to 500 mm
Ductile iron	110	150 mm
Cast iron	90	150 mm

The reaction coefficients for free chlorine decay were estimated for summer and winter conditions by running the computer model in Extended Period Simulation[1] (EPS) mode until calculated values reached steady state for each trial, and adjusting the reaction coefficients until calculated free chlorine values approximated measured values. The resulting coefficients are:

Condition	Bulk	Wall (first order)	Water Temperature
Winter	-0.69 (mg/L) $^{(1-n)/day}$	-0.95 ft/day	0.1 C
Summer	-2.0 (mg/L) $^{(1-n)/day}$	-0.19 ft/day	15 C

"n" is reaction order used to calculate the rate of consumption of a chemical species. For free chlorine in drinking water, first order (i.e. n =1) or reaction rate proportional to concentration, best fits actual conditions.

Bulk reaction rate is the rate at which free chlorine is consumed by organic or other material left in the water by the water plant treatment process.

Wall reaction rate is the rate at which biofilm on pipe wall consumes free chlorine.

1 Extended Period Simulation: System conditions are computed over a given duration in regular time increments to permit Engineer to observe tank level changes, pump start/stop and run times, variations in demand, pressure, chlorine residual, etc.

EXISTING PRESSURE ZONES

1. **TOWN OF PETAWAWA - URBAN AREA (INCLUDING CFB PETAWAWA) (KNOWN AS VILLAGE SYSTEM)**
2. **TOWN OF PETAWAWA - SEMI-URBAN AREA (KNOWN AS TOWNSHIP SYSTEM)**
3. **MCGUIRE SUDIVISION AREA (SUPPLIED FROM CITY OF PEMBROKE)**

300mm DIA. PETAWAWA RIVER CROSSING #2
NORTH TOWNSITE 150,000 U.S. GALLON ELEV. STORAGE TANK (NO LONGER IN USE)
C.F.H.A. METER #2
CLOSED VALVES
WATER TREATMENT PLANT 4,500,000 IMP. GALLON / DAY
TO HELIPAD
PRESSURE RELIEF VALVE
SOUTH TOWNSITE 500,000 U.S. GALLON ELEV. STORAGE TANK (TO BE REMOVED)
TOWN WATER METER #2 & CONTROL VALVE
METER
300mm DIA. PETAWAWA RIVER CROSSING #1
CHECK VALVE
CLOSED VALVE
TOWN OF PETAWAWA BOOSTER PUMP STATION #2
TOWN OF PETAWAWA BOOSTER PUMP STATION #1
CONNECTION TO LAURENTIAN VALLEY/PEMBROKE WATER SYSTEM
CFB PETAWAWA 1,000,000 IMP. GALLON ELEVATED STORAGE TANK (VILLAGE SYSTEM)
C.F.H.A. METER #1
TOWN WATER METER #1 & MOTORIZED VALVE
CLOSED VALVE
CHECK VALVE
TOWN OF PETAWAWA 1,000,000 IMP. GALLON ELEVATED STORAGE TANK (VILLAGE SYSTEM)
TOWN OF PETAWAWA 500,000 IMP. GALLON ELEVATED STORAGE TANK (TOWNSHIP SYSTEM)
1
2
3
0 0.5 1.0 Km

No.	DATE	BY	REVISION DESCRIPTION
1	23/12/09	SGW	WOODLAND CRES BOOSTER REMOVED, LOOP ON DORAN ST (CARDINAL-DEREK)

LEGEND

- Denotes Highlighted Items In Water System
- Pressure Zone Boundary
- Feedermains

NORTH

JOB: **PETAWAWA INFRASTRUCTURE STUDY - WATER SYSTEM**

TITLE: **EXISTING WATER DISTRIBUTION SYSTEM**

DATE: MAR.2011
PROJECT: 2115331A
PLOTTED: 09/15/11
SCALE: AS SHOWN

Jp2g Consultants Inc.
ENGINEERS · PLANNERS · PROJECT MANAGERS
PEMBROKE · OTTAWA

5-1

2.5 Hydraulic Analysis

2.5.1 Water Flow Rates Used in Computer Model

Average Day Flow Rates:

Residential:	450 L/person/day,
CFB Petawawa:	125 L/person/day (work place)
Institutional:	125 L/person/day (schools, etc.)
Commercial:	4 L/m^2/day

Using these numbers, the average day plant treated water flow rate calculated by the model is 6,537 m^3/day, which is in the range of measured average day demands in the last 3 years.

Maximum Day Demand:

Maximum day flows were modeled by multiplying average day demands by 2, for a total maximum day demand of 13,074 m^3/day. This is higher than measured; hence the results of calculations done at "maximum day" are conservative.

Fire Flow Rates:

The firefighting flow rate used for residential areas is 4,000 L/min, or 68 L/sec, calculated using the Fire Underwriters Survey Water Supply for Public Fire Protection. The required fire flow for the commercial area was calculated using the same guidelines and was based on building floor area and number of access routes and determined to be 88 L/sec.

Peak Hour Flow:

This is normally calculated by multiplying average day demand by 3, in accordance with MOE guidelines. For the purpose of this computer analysis, peak hour flow was modeled by adjusting usage pattern on maximum day so that in the "afternoon" water demand at each node was 3 times average day demand.

2.5.2 Summary of Computer Analysis

The computer analysis was carried out with the water supply from the City of Pembroke taken off-line in order to assess the issues associated with supplying the Town's entire water distribution system from the Town's water treatment plant.

All calculations related to pressures, flow and chlorine residual were performed using a version of the model where Booster Pumping Station (BPS) #1 was disabled and the McGuire Subdivision area was supplied from the Petawawa system using pressure reducing valves and a re-chlorination system in BPS 1.

Water System Pressures:

The distribution system as currently operated and as modeled appears to comply with MOE guidelines for operating pressures under normal and peak water demand conditions.

Booster Pumping Station 2:

Several runs of the model were completed to evaluate the effect of shutting down BPS 2 and having one pressure zone throughout the system. It is possible to fill the Township tower from the Petawawa water plant; however, either the pressures in the Town and Base distribution systems significantly exceeded the MOE guidelines (ie: as high as 700kPa on Victoria Street near the Town Office) or the Township tower needed to run near "empty", leaving the area without any firefighting reserve. Shutting down of BPS 2 should only be undertaken under emergency conditions in conjunction with a notice to the public that water restrictions are in place for purposes of carrying out repairs on BPS 2.

The results of the modeling indicate that when the watermain through the new Petawawa Town Center is completed, providing a 300 mm feedermain connection from Herman Street to the pump station suction header, it should be possible to operate BPS 2 without suction pressure controls if only one pump is operating at a time. The control system should be left in place until such time as it can be shown that the suction pressure control is no longer required in either single or multi-pump mode.

Petawawa River Bridge Crossing:

The pressure drop for the existing single 300 mm pipe across the Petawawa Blvd. bridge over the Petawawa River is estimated to be 1.5 m head (or approximately 2 psi) when two high lift pumps in the water plant are running. This occurs on maximum day conditions for both current and "future" conditions. The pressure gradient for this pipe is approximately 4 times higher than most other piping in the system and therefore represents a significant bottle neck in the piping. This restriction is also apparent based on the review of plant log trends as described in Section 3.1.3. Paralleling of the pipe on the bridge with another 300 mm pipe reduces the head loss to 0.5 m (or approximately 0.2 psi). Therefore, doubling up of the piping across the bridge to provide an additional 300 mm PVC pipe is recommended.

Booster Pumping Station 1:

With BPS 1 modeled as being shut down and the McGuire Subdivision being fed through pressure reducing valves located in the pump station, the system pressure along Petawawa Boulevard and in McGuire Subdivision, for all scenarios, was satisfactory and met MOE guidelines.

The watermain running along Petawawa Boulevard currently has two sources of water, one at each end (the Petawawa system and BPS 1/Pembroke system) and this provides adequate redundancy in case of a watermain break. However, if the supply from Pembroke is disconnected, there are a number of locations along Petawawa Boulevard where a parallel line does not exist (that is, a network to provide a parallel path watermain on Petawawa Boulevard). Should there be a watermain break in such a location, water cannot be supplied downstream of the break, which would include the McGuire Subdivision. Therefore, the connection to Pembroke should be maintained to allow for emergency supply and pipe line maintenance until such time as there is adequate by-pass capability.

Should the Pembroke water supply ever be disconnected, the Township of Laurentian Valley would need to be advised in advance so that the Township could implement

contingency measures to maintain chlorine residual in the 300 mm diameter watermain which would then be dead-ended at Golf Course Road.

Fire Flows

All zones can supply adequate water flow for fire protection purposes in accordance with MOE guidelines.

Chlorine Concentration

The reaction rates used in the model are aggressive, resulting in large swings in free chlorine concentration on a daily basis at any given location. These rates were used as they best modeled the data provided, but they are indicative of an active biofilm. OCWA should monitor the results of their flushing and modify as needed in order to ensure adequate chlorine residual concentration.

Currently, at average day demand or flow and summer reaction rates, the model indicates there are three areas that may have low chlorine residual concentrations (particularly early in the morning or in periods of low demand):

- Murphy Road between Herman Street and Roy Street (small demand on dead end)
- The loop formed by Hilda Street and Lisa Crescent, particularly at the intersection of Hilda and Lisa (water appears to move back and forth in the loop)
- The middle and end of watermain running along Petawawa Boulevard towards Pembroke (area is at the end of a long branch with low demand relative to watermain capacity and modeled with no service from Pembroke)

The first two areas should be monitored by the operators and, if the free chlorine concentration is low, appropriate mitigation measures should be taken.

The low free chlorine concentration along Petawawa Boulevard is a result of disconnecting the supply to the area from the Pembroke system and feeding water from the old Township system. Currently, the operators daily fill the Township elevated tank from the Pembroke system, for a period of not less than 90 minutes, to ensure adequate free chlorine residual. Should the Municipality choose to disconnect the Pembroke water supply, a combination of the following options should be considered to ensure adequate free chlorine:

- flushing program
- providing re-chlorination facility near Laurentian Drive/Petawawa Boulevard intersection and
- if possible, increasing demand in the McGuire Subdivision area

Not every dead-end watermain is modeled in WaterCad to save limited computing resources for accurately modeling critical area, mains, pumping networks, etc. As a result, the operators should monitor all dead-ends on a regular basis to ensure compliance with regulations.

South Townsite Elevated Tank:

The computer analysis indicates that there is little advantage in maintaining the South Townsite elevated tank in service. Under normal system operation, there is little turnover

of water in the tank, which can lead to water quality issues and the water levels in the Town and Base tanks are being maintained at a reduced level, thereby reducing the water storage available in the water system.

Therefore, the South Townsite elevated tank should be taken out of service.

3.0 ASSESS FUTURE DEVELOPMENT AND SERVICING REQUIREMENTS

3.1 Future Development Conditions

The computer model for current conditions was upgraded to "future" conditions, where future conditions included all known projected growth in the Town of Petawawa and CFB Petawawa. These changes include:

- Adding new Medium Heavy Lift Helicopter (MHLH) and related facilities near existing helipad, with loops to Brindle Road and to Highway 17/Centurion Road, and removing pressure reducing valve shown in the existing 300 mm supply line to the MHLH facility.
- Adding the new facilities identified in CFB Petawawa Sewer Servicing Study, completed by Jp2g Consultants Inc. in 2009 (new facilities around and near Centurion Road).
- Adding approved and known new subdivisions and commercial zones in Town of Petawawa.
- Disconnecting Pembroke water supply and feeding McGuire Subdivision and Petawawa Boulevard area from Petawawa water treatment plant.
- Turning "off" the South Townsite water tower (scheduled to be demolished in 2012).
- Upgrading watermains along Herman Street from Murphy Road to John Street to 300 mm PVC.

3.2 Future Water Supply Requirements

The average daily water demands and demand patterns used for modeling the future design conditions in the Petawawa water distribution system are the same as provided in Section 3.4.1

The addition of new areas to be serviced in the Town of Petawawa (including the new Town Center commercial area and the new schools on Petawawa Civic Centre Road) result in an increase of average day demand by 1,550 m^3/day.

The average day demand by CFB Petawawa was forecast to increase by 700 m^3/day

The peak hour flow requirements for the new MHLH facility were reported to be 44 L/sec. To model this, an "MHLH peak hour pattern" was added to the junction representing the MHLH facility. The pattern added 44 L/s to the "system peak hour" scenario.

The water supply requirements for the Petawawa water system are summarized in Table 5.2.

Table 5.2 Petawawa Water Supply and Distribution Storage Requirements

		Current Conditions	Future Design Conditions
Service Population		16,000	20,000
Estimated Average Day Demand per Capita	L/day	420	450
Average Day Demand	m^3/day	6,790	9,000
Maximum Day Factor		1.8	1.9
Maximum Day	m^3/day	12,825	17,100
Peak Hour Factor		2.85	2.85
Peak Hour Demand	m^3/day	19,350	29,450
Fire Flow Requirements (per MOE)	m^3/day	19,900	23,160
System Pressure Requirements Maximum Day			
Minimum during peak hour	kPa	275	275
Minimum during fire flow conditions	kPs	140	140
Required Fire Storage	m^3	2,990	4,240
Equalization Storage	m^3	3,206	4,275
Emergency Storage	m^3	1,549	2,129
Total Storage Required	m^3	7,745	10,644
Actual Storage	m^3	11,250	11,250
Surplus Storage	m^3	3,505	606

3.3 Water Treatment Plant Capacity Assessment

The water plant rated capacity is 21,500 m^3/day. The water demand for a future population of 20,000 is estimated to be 17,000 m^3/day, or approximately eighty percent (80%) of rated plant capacity. This is within reasonable operating range for the facility; nevertheless, the operators should monitor demand, and if growth or demand proves to be greater than anticipated, the Town should initiate an investigation into options to increase the water plant capacity.

3.4 Water Storage Requirements

Water storage is provided for water demands in excess of Maximum Day requirement, such as for flow equalization, peak hour, fire and emergency purposes.

With the treatment plant capacity sized to meet a minimum of Maximum Day Demand then MOE states that the required Water Storage facility can be calculated as follows:

Total Storage = A + B + C

Where
A = Fire Storage (Based on Table 8.1 MOE Design Guidelines for Drinking Water Systems)
B = Equalization Storage (25% of Maximum Day Demand)
C = Emergency Storage (25% of A + B)

At the various stages of increased connected population, the storage requirements change in accordance with MOE Guidelines, as noted above. Table 3.1 Petawawa Water Supply and Distribution Storage Requirements are in Section 3.2 above.

Current storage requirements are adequate; however, the surplus at the future 20,000 population projection is less than 6% of requirements. Under MOE guidelines, once the average day demand exceeds 7,650 m^3/day, the required storage increases quickly. For Petawawa, for an average day demand of 7,650 m^3/day, the storage surplus is 2,200 m^3. Then by adding 1,350 m^3/day to average day demand (ie: based on the future population demand), storage surplus drops to 600 m^3. Therefore, the Town should investigate options to increase water storage when it undertakes the study to expand the water plant.

3.5 Summary Computer Analysis of Future System

The computer analysis was carried out with the water supply from the City of Pembroke taken off-line in order to assess the issues associated with supplying the Town's entire water distribution system from the Town's water treatment plant.

All calculations related to pressures, water flow and chlorine residual were performed using a version of the model where BPS 1 was disabled and the McGuire Subdivision area was supplied from the Petawawa system using pressure reducing valves and a re-chlorination system in BPS 1.

Water System Pressures:

Except as noted below, the distribution system as modeled for the future growth projection scenario appears to meet the requirements of the MOE guidelines for operating pressure.

Additional River Crossing:

Currently there are two river crossings, one under the river from the North Townsite to Alfred Street and the second along Petawawa Boulevard on the Petawawa River Bridge. With the bridge crossing out of service (or closed) under "future" conditions (ie: 20 year horizon), calculations with the model indicate that it will not be possible to supply maximum day water demand in the Town at adequate pressures. Also, with the bridge crossing out of service, under maximum day conditions, modeling indicates it will not be possible to meet fire flow requirements along Portage Road, in most areas in the South Townsite, some areas of Laroche Crescent and in the new Town Centre commercial area. Therefore, to provide adequate redundancy, a third river crossing should be considered. Such a crossing could run from the end of Montgomery Road to the Hoffman Pit area (a potential future subdivision location); any proposed route would be subject to further study. The time required to provide a third river crossing is likely to be extensive, therefore, initiation of an environmental review and discussions with all stakeholders (such as CFB Petawawa, County of Renfrew, MNR, etc.) is suggested. Any such river crossing should be designed to avoid common mode failure with current bridge crossing.

Booster Pumping Station 1:

With BPS 1 modeled as shut down and the McGuire Subdivision fed through pressure reducing valves located in the pump station, the system pressure along Petawawa Boulevard and in McGuire Subdivision was satisfactory for all scenarios and met MOE guidelines.

Water is currently provided to the watermain running along Petawawa Boulevard from both ends (from the Petawawa system and BPS 1/Pembroke system); this provides adequate redundancy in case of a watermain break. However, there are a number of locations along Petawawa Boulevard where this would not be the case, should the supply from Pembroke be disconnected; this would include the McGuire Subdivision. In light of this, the connection to Pembroke should be maintained until there is adequate by-pass capability to allow for emergency supply and maintenance of pipe line.

If, in the future, water supply from Pembroke is disconnected, the Township of Laurentian Valley would need to be advised in advance so that they could implement contingency measures to maintain chlorine residual in the 300 mm diameter watermain, which would then be dead-ended at Golf Course Road.

Fire Flows:

In general, adequate fire flows can be supplied in accordance with MOE guidelines in all areas of the Town's water system. In this regard, a 300 mm diameter watermain loop is required through the new Town Centre development in order to supply adequate fire flows for the proposed commercial area within the new Town Centre development.

In addition, as noted previously, the water supply connection from the City of Pembroke should be maintained for emergency purposes, in which case water flow would be available from the City to augment fire flows in the event of a major fire in the easterly end of Petawawa Boulevard.

Chlorine Concentration:

The reaction rates used in the model are aggressive, resulting in large swings in free chlorine concentration on a daily basis at any given location. These rates were used as they best modeled the data provided but they are indicative of an active biofilm. The operators indicate the decay of free chlorine levels is most closely associated with the older iron and cement style piping and is not an issue with the new plastic piping. The operators should monitor the effectiveness of the current flushing program and make adjustments as needed.

Currently, at average day demand or flow and summer reaction rates, the model indicates there are three areas that may have low chlorine residual concentrations (particularly early in the morning or in periods of low demand):

- Murphy Road between Herman Street and Roy Street (small demand on dead end)
- The loop formed by Hilda Street and Lisa Crescent, particularly at the intersection of Hilda and Lisa (water appears to move back and forth in loop)
- The middle and end of watermain running along Petawawa Boulevard towards Pembroke (area is at the end of a long branch with low demand relative to watermain capacity and modeled with no service from Pembroke)

The first two areas should be monitored by the operators and if the free chlorine concentration is low, appropriate mitigation measures should be taken.

4.0 RECOMMENDATIONS

On the basis of our evaluation and computer modeling of the water distribution system, the following upgrades, actions or monitoring are recommended:

1. The Petawawa River Crossing on the Petawawa Boulevard Bridge should be upgraded by adding a second parallel run of 300 mm pipe (ie: two parallel pipes to match the capacity of the 450mm diameter mains installed on either side of the bridge along Petawawa Boulevard). The estimated cost of this project is $350,000 and it would be completed as part of a capital works project.
2. The System Operator should continue to monitor the effectiveness of the flushing program on the ability to maintain free chlorine residual in the water distribution system piping. This monitoring would be completed by OCWA.
3. In addition to the current monitoring program, OCWA should monitor free chlorine residual on:
    a. Murphy Road between Herman Street and Roy Street
    b. Loop formed by Hilda Street and Lisa Crescent, particularly at the intersection of Hilda Street and Lisa Crescent.
    c. Other dead ends as may exist in the system
4. The South Townsite elevated water tank should be taken off line and drained as soon as possible in order to optimize operation of the water system. This work is to be completed by DND and is currently scheduled to take place in 2012.
5. By installing a pressure reducing station along Petawawa Boulevard, either at Risto Road or Booster Pump Station 1, it is possible to supply water to McGuire Subdivision from the Petawawa water distribution system and no longer purchase water from Pembroke. However, the connection should remain available for emergency purposes, in which case an arrangement would need to be worked out with the Township of Laurentian Valley (who actually own the watermain connecting the Petawawa watermain to the Pembroke system) to make the supply of water available. Discussions should also take place about the possibility of replacing the existing check valve which only allows water to flow from the Laurentian Valley system into the Petawawa system to having a two way valve that would allow Petawawa to supply water to Laurentian Valley as well. The estimated cost of this project is $150,000 and it would be completed as part of a capital works project.
6. Provide 300 mm diameter watermain along Mary Street, Laura Street, John Street and Herman Street and extend the 300 mm watermain through the Town Centre development to connect at the 250 mm dia. watermain on Petawawa Boulevard near BPS 2. From this point, a 250mm watermain should be installed from Limestone Trail to BPS to parallel the existing 300mm watermain. When this watermain loop through the new Town Center is complete, the suction pressure control system in BPS 2 may become redundant. This system should be left in place until such time as it can be shown that the suction pressure control is no longer required in either single or multi-pump mode. The estimated overall cost of this project is $740,000 and it would be completed as part of a capital works project.
7. BPS 2 can be taken off-line in emergency conditions and water supplied by the water treatment plant to the entire distribution system. Taking BPS 2 off-line will result in excessive pressures in lower areas and reduced water storage for firefighting purposes, therefore the public should be notified to reduce water usage until BPS 2 is re-started.

8. Monitor service population and demand so that the Town can initiate an engineering study to evaluate options to increase water plant capacity and increase water system storage capacity once maximum day demand exceeds 17,000 m^3/day (currently at 11,881 or 70% of the 17,000 figure).

9. Initiate a project to add a third watermain across the Petawawa River. Should the current bridge crossing be closed or out of service. Under the future demand projection, the third river crossing is required to ensure adequate:

   - System pressure under maximum day scenario
   - Fire flow

   The estimated cost of this project is $1,500,000 and it would be completed as part of a capital works project.

10. Provide watermain loops through proposed development areas to provide adequate fire flow within the developments as well as providing additional circulation within the overall network. The cost of the installation of these watermains within plans of subdivision would be borne by the developer.

11. Install check valves to isolate the existing private water system contained within the trailer park to the west of Petawawa Blvd. The estimated cost of this project is $40,000 and would be completed as part of a capital works project.

12. Review options of looping watermains to eliminate dead-end lines for the following locations:

    a. Black Bay Road between Industrial Ave. and Carla Street (675m) – Estimated cost $303,750.
    b. Civic Center Road – Civic Center Entrance to Leeder Lane (700m) – Estimated cost $315,000.
    c. Risto Road – Springhill Crescent to McGuire St. (750m) – Estimated cost $210,000.
    d. Loop between Kramer Ave. and Runge Drive – Estimated cost of $75,000.

    The above noted works would be completed as part of a capital works project.

    The proposed capital works are illustrated on Figure 5-2.

OTTAWA RIVER

WATER POLLUTION CONTROL PLANT

HELIPAD (DEVELOPMENT AREA)

CFB PETAWAWA DEVELOPMENT AREA

CANADIAN FORCES HOUSING AGENCY SOUTH TOWNSITE

REMOVE STS TANK

LOOP DEAD END WATERMAINS

POTENTIAL WATERMAIN LOOP

POTENTIAL WATERMAIN LOOP

PARALLEL 300mmØ MAIN ON BRIDGE

CHECK VALVES TO ISOLATE PRIVATE SYSTEM

INSTALL NEW 300mm WATERMAIN TO IMPROVE FIRE FLOW CONDITIONS.

PROVIDE PRESSURE REDUCING VALVES (PRV'S) IN BPS#1 TO SUPPLY WATER TO MCGUIRE SUBDIVISION

NEW CONNECTION ACROSS PETAWAWA RIVER TO IMPROVE SUPPLY TO TOWN. VARIOUS OPTIONS NOTED. FINAL ALIGNMENT TO BE CONFIRMED.

UPGRADE EXISTING WATERMAINS TO IMPROVE FIRE FLOW CONDITIONS.

POTENTIAL WATERMAIN LOOP TO ELIMINATE TWO DEAD ENDS

UPGRADE EXISTING 150Ø TO 300Ø; WATERMAIN ALONG PORTAGE ROAD TO SERVICE FUTURE DEVELOPMENT AREAS.

CONSTRUCT NEW 250mmØ TO SERVICE FUTURE DEVELOPMENT AREAS

LEGEND

Future Development Areas

Watermains
Feeder Mains (over 200mmØ)
Proposed Water Works
Routing Options for Proposed Water Works

NORTH

JOB: PETAWAWA INFRASTRUCTURE STUDY

TITLE: RECOMMENDED CAPITAL WORKS

DATE: MAR 2011
PROJECT: 2115331A
PLOTTED: 09/15/11
SCALE: AS SHOWN

Jp2g Consultants Inc.
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PEMBROKE • OTTAWA

DRAWING: 5-2

CHAPTER 6

COMPREHENSIVE PLAN

TABLE OF CONTENTS

Tables

1.0 OBJECTIVES OF THE STUDY

In this report, each of the primary infrastructure components of roads, sanitary sewers, storm sewers and watermains were first evaluated for the ability to meet the existing requirements of the Town of Petawawa. The systems were evaluated based on accepted standards and performance requirements established by the Town and the regulating authority where applicable. As a second step, the systems were evaluated for their ability to meet the requirements for future growth as defined in the Official Plan. Where appropriate, the effect of the CFB Petawawa and the CFHA Townsites has been considered in the evaluations.

One of the primary objectives of the study is to provide guidance to Town Council in determining priorities for infrastructure improvements, particularly where road improvements must be considered in advance of other infrastructure needs. The information contained in this chapter will assist the Town of Petawawa to identify and undertake the necessary system improvements in a timely and efficient manner. Although needs are identified, and priorities established for the specific works, the report recognizes that flexibility is required in the recommendations in order to meet other related constraints within the Town. These may include changing regulations and policies as well as the annual fiscal constraints related to a balanced and fair municipal budget.

2.0 IDENTIFICATION OF INFRASTRUCTURE NEEDS

Developing a comprehensive and cost effective plan for the repair, replacement and/or upgrading of the infrastructure systems first required that each infrastructure system be inventoried and evaluated. As outlined in Chapters 2 through 5, the inventory process involved identifying the individual systems and components with a unique identification system which depends on the characteristics and performance of the type of system being inventoried. The identification systems therefore are independent of each other.

For the purpose of developing a comprehensive plan, it is necessary to group the infrastructure improvements in a common geographic area so that projects can be combined where appropriate.

Since the majority of the infrastructure systems are located within road allowances, it becomes most efficient to utilize the road system as a common element to locate the infrastructure components that must be upgraded.

Table 6-1 consists of a comprehensive list of the infrastructure improvements that were identified through the infrastructure analysis in Chapters 2 through 5. In order to group the improvements, they are identified and tabulated by location (road name and road section number). At the bottom of the table, we have listed the projects which have no associated road section numbers, such as for improvements located on County Roads and pumping stations. As noted in the chart, storm sewer installation has been costed out with the roadworks for those roads that are recommended to be urbanized.

Table 6.1 - Comprehensive List of Projects - Sorted by Road Section Number

										ROAD IMPROVEMENTS INCLUDING STORM SEWER INSTALLATION			SANITARY SEWER UPGRADES	WATER DISTRIBUTION UPGRADES
ROAD SECTION #	DESCRIPTION	FROM	TO	LENGTH	URBAN	SEMI-URBAN	RURAL	CONDITION RATING	PRIORITY	RECONSTRUCTION / REHABILITATION COSTS	SPOT IMPROVEMENTS COSTS	TOTAL ROAD COSTS		
100	**Achray Road**	B Line	1.0 Km west	1.00			x	**3**	**F**	$390,000	$0	**$390,000**		
110	**Achray Road**	1.0 Km west of B Line	pipe line x-ing	1.50			x	**2**	**F**	$585,000	$0	**$585,000**		
200	**Evergreen Drive**	Doran St. (Cty Rd 26)	Dead End	0.30			x	**3**	**B**	$81,000	$0	**$81,000**		
330	**Airport Road**	0.8km W of Doran (Co. Rd. 26)	Cul de Sac	0.70			x	**2**	**B**	$189,000	$0	**$189,000**		
350	**Sylvan Drive**	Airport Road	Airport Road	1.50		x		**3**	**B**	$405,000	$40,000	**$445,000**		
450	**Kohut Drive**	Airport Road	Cul De Sac	0.40			x	**4**	**D**	$108,000	$0	**$108,000**		
500	**Len Hopkins Drive**	Black Bay Road	Airport Road	2.10			x	**5**	**D**	$567,000	$30,000	**$597,000**		
550	**Black Bay Road**	Industrial Drive	Carla Street	0.70			x	**6**	**D**	$0	$0	**$0**		**$303,750**
600	**Summers Road**	Black Bay Road	0.3 km West	0.30			x	**5**	**D**	$0	$10,000	**$10,000**		
650	**Eichstaedt Road**	Black Bay Road	End	0.30			x	**2**	**C**	$81,000	$0	**$81,000**		
700	**Plum Tree Lane**	Black Bay Road	End	0.40			x	**2**	**B**	$108,000	$0	**$108,000**		
850	**Portage Road**	Murphy Rd. (Co. Rd. 37)	1.3 km. NW Murphy Rd.	1.30			x	**9**	**C**	$195,000	$0	**$195,000**		
860	**Portage Road**	1.3 km NW Murphy Rd.	Former Village Limits	1.20			x	**5**	**D**	$492,000	$0	**$492,000**		
900	**Rantz Road - East Leg**	Murphy Road (east end)	1.0 km North of Murphy Road	1.00			x	**3**	**B**	$270,000	$0	**$270,000**		
910	**Rantz Road - North Leg**	2.3 km N. Murphy Rd. (east end)	Murphy Road (west end)	1.00			x	**3**	**B**	$270,000	$25,000	**$295,000**		
920	**Rantz Road**	Murphy Road	1.8 km W. Murphy Rd.	1.80			x	**8**	**C**	$225,000	$100,000	**$325,000**		
960	**Shamess Road**	1.3 km W Rantz Rd.	End	0.70			x	**3**	**B**	$448,000	$0	**$448,000**		
1000	**Golf Course Road**	Petawawa Blvd (Co. Rd. 51)	Laurentian Valley Twp	0.30			x	**1**	**F**	$117,000	$0	**$117,000**		
1250	**Risto Road**	Springhill Court	McGuire Street	0.60			x	**3**	**B**	$246,000	$10,000	**$256,000**		**$210,000**
1255	**Risto Road**	Petawawa Blvd (Co. Rd. 51)	Springhill Court	0.10		x		**4**	**C**	$41,000	$0	**$41,000**		
1275	**Springhill Court**	Petawawa Blvd (Co. Rd. 51)	Risto Road	0.20		x		**4**	**C**	$54,000	$0	**$54,000**		
1300	**Brumm Road**	Petawawa Blvd. (Co. Rd. 51)	Achray Road	0.80		x		**3**	**C**	$216,000	$25,000	**$241,000**		
1330	**Garwin Street North**	Petawawa Blvd. (Co. Rd. 51)	Birch Street	0.30		x		**4**	**C**	$126,000	$0	**$126,000**		
1350	**Pineridge Crescent**	Garwin Street	Birch @ Elton St.	0.50		x		**4**	**C**	$210,000	$0	**$210,000**		
1375	**Elton Street**	Birch Street	Pineridge Cres.	0.20		x		**4**	**C**	$84,000	$0	**$84,000**		
1400	**Doris Street**	Birch Street	Pineridge Cres.	0.20		x		**3**	**C**	$84,000	$0	**$84,000**		
1425	**Birch Street**	Elton Street	River Drive	0.60		x		**4**	**C**	$252,000	$0	**$252,000**		
1450	**George Street**	Pine Street	Garwin Street	0.20		x		**4**	**C**	$84,000	$0	**$84,000**		
1475	**Sharon Street North**	Petawawa Blvd. (Co. Rd. 51)	Birch Street	0.20		x		**4**	**C**	$84,000	$0	**$84,000**		
1500	**Pine Street**	River Drive	George Street	0.30		x		**4**	**C**	$126,000	$0	**$126,000**		
1525	**Ann Street**	Sharon Street	River Drive	0.30		x		**4**	**C**	$126,000	$0	**$126,000**		
1550	**River Drive**	Petawawa Blvd. (Co. Rd. 51)	Top of Hill	0.40		x		**4**	**C**	$168,000	$0	**$168,000**		
1555	**River Drive**	Top of Hill	Bottom of Hill	0.20			x	**4**	**C**	$54,000	$10,000	**$64,000**		
2000	**Radtke Road**	Petawawa Blvd. (Co. Rd. 51)	Bottom of Hill	0.70			x	**4**	**C**	$294,000	$0	**$294,000**		
2005	**Radtke Road**	Bottom of Hill	0.5 km Easterly	0.50			x	**5**	**D**	$135,000	$0	**$135,000**		
2015	**Radke Road**	River Drive	End	0.10			x	**2**	**D**	$64,000	$0	**$64,000**		
2175	**Kramer Ave**						x	**6**	**D**	$0	$0	**$0**		**$75,000**
2200	**Schwantz Road**	Petawawa Blvd. (Co. Rd. 51)	Laurentian Dr. (Co. Rd. 25)	1.10		x		**4**	**C**	$462,000	$25,000	**$487,000**		

Table 6.1 - Comprehensive List of Projects - Sorted by Road Section Number

										ROAD IMPROVEMENTS INCLUDING STORM SEWER INSTALLATION			SANITARY SEWER UPGRADES	WATER DISTRIBUTION UPGRADES
ROAD SECTION #	DESCRIPTION	FROM	TO	LENGTH	URBAN	SEMI-URBAN	RURAL	CONDITION RATING	PRIORITY	RECONSTRUCTION / REHABILITATION COSTS	SPOT IMPROVEMENTS COSTS	TOTAL ROAD COSTS		
2225	**Sack Road**	Schwantz Road	Kramer Avenue	0.30		x		**5**	**D**	$126,000	$0	**$126,000**		
2250	**Isabel Street**	Sack Road	Schwantz Road	0.30		x		**5**	**D**	$126,000	$0	**$126,000**		
2275	**Sandy Drive**	Isabel Street	Country Lane	0.20		x		**5**	**D**	$84,000	$0	**$84,000**		
2300	**Country Lane**	Schwantz Road	Gutzman Road	1.00		x		**5**	**D**	$420,000	$0	**$420,000**		
2350	**Chippewa Road**	Country Lane	Heritage Drive	0.20		x		**5**	**D**	$84,000	$0	**$84,000**		
2375	**Viking Road**	Country Lane	Heritage Drive	0.20		x		**5**	**D**	$84,000	$0	**$84,000**		
2400	**Arrowhead Road**	Country Lane	Heritage Drive	0.20		x		**5**	**D**	$84,000	$0	**$84,000**		
3200	**Silke Drive**	Petawawa Blvd. (Co. Rd. 51)	Laurentian Drive	0.50		x		**5**	**D**	$210,000	$0	**$210,000**		
3325	**Charles Street**	Michael Street	Peter Street	0.40		x		**5**	**D**	$168,000	$0	**$168,000**		
3350	**Janet Street**	Petawawa Blvd. (Co. Rd. 51)	Cul de Sac	0.30		x		**4**	**D**	$126,000	$0	**$126,000**		
3400	**Renfrew Street**	Petawawa Blvd (Co. Rd. 51)	Beer Store	0.10		x		**3**	**A**	$125,000	$0	**$125,000**		
4000	**New Street**	Petawawa Blvd. (Co. Rd. 17)	Hoffman Street	0.20		x		**5**	**D**	$84,000	$0	**$84,000**		
4025	**Poplar Street**	New Steet	Labine Crescent	0.30		x		**5**	**D**	$126,000	$0	**$126,000**		
4050	**Victor Street**	Poplar Street	Hoffman Street	0.10		x		**5**	**D**	$42,000	$0	**$42,000**		
4075	**Hoffman Street**	New Street	Labine Crescent	0.40		x		**5**	**D**	$168,000	$0	**$168,000**		
4100	**Labine Crescent**	Hoffman Street	Poplar Street	0.70		x		**5**	**D**	$294,000	$0	**$294,000**		
4125	**Industrial Avenue**	Black Bay Road	Labine Street	1.10			x	**5**	**C**	$451,000	$0	**$451,000**		
4180	**Carla Street**	Derek Drive	Cardinal Crescent	0.30		x		**4**	**D**	$126,000	$0	**$126,000**		
4250	**Derek Drive**	Doran St, (Co. Rd. 26)	Carla Crescent	0.30		x		**5**	**D**	$126,000	$0	**$126,000**		
4275	**Steffen Street**	Doran St. (Co. Rd. 26)	Carla Crescent	0.30		x		**4**	**D**	$126,000	$0	**$126,000**		
5000	**Albert Street**	Victoria St. (Co. Rd. 16)	Alice St./Tall Pines Rd.	0.40		x		**4**	**D**	$168,000	$0	**$168,000**		
5025	**Tall Pines Road**	Albert Street	End	0.10		x		**5**	**D**	$34,000	$0	**$34,000**		
5050	**Louise Street**	Albert Street	End	0.10		x		**2**	**C**	$42,000	$0	**$42,000**		
5075	**North Street**	Albert Street	End	0.10		x		**5**	**C**	$34,000	$0	**$34,000**		
5100	**Alexander Street**	Albert Street	End	0.10		x		**2**	**C**	$42,000	$0	**$42,000**		
5130	**Island View Drive**	North Cul-de-Sac	North Cul-de-Sac	0.10			x	**2**	**C**	$27,000	$0	**$27,000**		
5150	**Alice Street**	Albert Street	East Street	0.20		x		**4**	**C**	$84,000	$0	**$84,000**		
5175	**Point Crescent**	Edward Street	East Street	0.20		x		**4**	**C**	$84,000	$0	**$84,000**		
5200	**Van Hoof Street**	Edward Street	S. End Cul-de-sac	0.10		x		**4**	**C**	$42,000	$0	**$42,000**		
5225	**Edward Street**	East Street	Albert Street	0.20		x		**4**	**C**	$84,000	$0	**$84,000**		
5250	**Victoria Street**	Albert Street	East Street	0.20		x		**8**	**B**	$84,000	$0	**$84,000**	**$200,000**	
5275	**East Street**	Island View Drive	Abbie Lane	0.90		x		**4**	**B**	$378,000	$0	**$378,000**	**$100,000**	
5300	**Abbie Lane**	East Street	East End	0.30			x	**5**	**B**	$123,000	$0	**$123,000**	**$350,000**	
5375	**Earl Street**	Irma Street	Cul-de-sac	0.40		x		**5**	**D**	$300,000	$0	**$300,000**		
6005	**Civic Center Road**	0.2km North of Petawawa Blvd.	Laurentian Drive (Co. Rd. 25)	0.80		x		**3**	**B**	$1,352,000	$0	**$1,352,000**		**$315,000**
6075	**Vereyken Crescent**	Dundonald Drive	Dutch Drive	0.50			x	**5**	**D**	$375,000	$0	**$375,000**		
6100	**Dutch Drive**	Cartier St. (Civic Centre Ent.)	Vereyken Cres.	0.20			x	**5**	**D**	$150,000	$0	**$150,000**		
6125	**Wilbert Street**	Fred Street	Dundonald Drive	0.40		x		**4**	**D**	$168,000	$0	**$168,000**		
6150	**Fred Street**	Petawawa Blvd. (Co. Rd. 51)	Wilbert Street	0.10		x		**4**	**D**	$42,000	$0	**$42,000**		
6250	**Mohns Ave**	Violet Street	Petawawa Blvd.	0.50	x			**5**	**C**	$130,000	$137,500	**$267,500**		
6275	**Willard Street**	Mohns Avenue	Victoria St. (Co. Rd. 16)	0.20	x			**5**	**D**	$52,000	$10,000	**$62,000**		
6400	**Alfred Street**	Victoria Street	North End	0.10		x		**2**	**C**	$42,000	$0	**$42,000**		
6450	**Vermont Meadows**	Victoria Street	Northbrook Road	0.20	x			**6**	**C**	$0	$50,000	**$50,000**		
6475	**Summit Trail**	West End cul-de-sac	East End	0.10	x			**6**	**C**	$0	$10,000	**$10,000**		
6550	**Park Drive**	Algonquin Street	Algonquin Street	0.50		x		**4**	**B**	$210,000	$0	**$210,000**		

Table 6.1 - Comprehensive List of Projects - Sorted by Road Section Number

										ROAD IMPROVEMENTS INCLUDING STORM SEWER INSTALLATION			SANITARY SEWER UPGRADES	WATER DISTRIBUTION UPGRADES
ROAD SECTION #	DESCRIPTION	FROM	TO	LENGTH	URBAN	SEMI-URBAN	RURAL	CONDITION RATING	PRIORITY	RECONSTRUCTION / REHABILITATION COSTS	SPOT IMPROVEMENTS COSTS	TOTAL ROAD COSTS		
6585	**Harry Street**	Bert Street	North End	0.20		x		**3**	**C**	$84,000	$0	**$84,000**		
7000	**Herman Street**	Murphy Road	John Street	0.80		x		**3**	**A**	$1,416,000	$0	**$1,416,000**	**$44,800**	**$415,300**
7005	**Herman Street**	John Street	Selkirk Street	0.30	x			**5**	**D**	$73,200	$0	**$73,200**		
7025	**Laroche Crescent**	Herman Street	Herman Street	0.60		x		**4**	**B**	$252,000	$0	**$252,000**		
7050	**James Street**	Laroche Street	Laroche Street	0.30		x		**4**	**B**	$126,000	$0	**$126,000**		
7075	**Roy Street**	Mary Street	Murphy Rd. (Co. Rd. 37)	0.40		x		**5**	**D**	$168,000	$0	**$168,000**		
7100	**John Street**	Murphy Rd. (Co. Rd. 37)	Herman Street	0.40		x		**4**	**C**	$708,000	$0	**$708,000**		
7105	**John Street**	Herman Street	RR tracks	0.50		x		**5**	**D**	$885,000	$0	**$885,000**		
7125	**Norman Street**	Mary Street	Railway Tracks	0.30		x		**4**	**D**	$126,000	$15,000	**$141,000**		
7150	**Mary Street**	Herman Street	Cul-de-sac - south of Herman St.	0.30		x		**4**	**D**	$141,000	$0	**$141,000**		
7155	**Mary Street**	Railway Tracks	Herman Street	0.50		x		**5**	**B**	$979,000	$0	**$979,000**		**$250,000**
7175	**Laura Street**	Doran Street	Railway Tracks	0.20		x		**5**	**D**	$354,000	$15,000	**$369,000**		
7200	**Edith Street**	Doran Road	Mary Street	0.30		x		**5**	**D**	$126,000	$0	**$126,000**		
7230	**Selkirk Street**	Woodland Crescent	Murphy Rd. (Co. Rd. 37)	0.90		x		**5**	**D**	$378,000	$0	**$378,000**		
7500	**Woodland Cres. N. leg**	Selkirk Street	Woodland Cres. W. leg	0.40		x		**4**	**D**	$708,000	$0	**$708,000**		
7510	**Woodland Cres. S. leg**	Hemlock Street	Woodland Cres. W. leg	0.20		x		**4**	**D**	$84,000	$0	**$84,000**		
7525	**Hemlock Street**	Murphy Rd. (Co. Rd. 37)	Woodland Cres. N.	0.40		x		**5**	**D**	$708,000	$0	**$708,000**		
7550	**Spruce Street**	Woodland Cres. N. leg	Woodland Cres. S. leg	0.30		x		**4**	**C**	$126,000	$0	**$126,000**		
7605	**Russell Street**	Audrey Street	Sammy Drive	0.20		x		**4**	**C**	$84,000	$0	**$84,000**		
7625	**Sammy Drive**	Russell Street	End	0.20		x		**4**	**C**	$84,000	$0	**$84,000**		
7675	**Hilda Street**	Audrey Street	Doran St. (Co. Rd. 26)	0.50		x		**5**	**D**	$885,000	$0	**$885,000**		
7680	**Hilda Street**	Hilda Court	Audrey Street	0.20		x		**5**	**D**	$219,000	$0	**$219,000**		
7685	**Hilda Street**	Lisa Crescent	Hilda Court	0.10		x		**5**	**D**	$42,000	$0	**$42,000**		
7700	**Hilda Court**	Hilda Street	Hilda Street	0.10		x		**2**	**C**	$42,000	$0	**$42,000**		
7725	**Lisa Crescent**	Scott Avenue	End Cul-de-sac	0.40		x		**5**	**D**	$168,000	$0	**$168,000**		
7750	**Scott Avenue**	Portage Road	Hilda Street	0.20		x		**5**	**D**	$354,000	$0	**$354,000**		
7775	**Florence Street**	Hilda Street	Portage Road	0.20		x		**4**	**D**	$84,000	$0	**$84,000**		
7800	**Craig Place**	Florence Street	Cul-de-sac	0.10		x		**3**	**B**	$42,000	$0	**$42,000**		
7825	**Portage Road**	Petawawa Blvd. (Co. Rd. 51)	Florence Street	0.30		x		**5**	**C**	$531,000	$0	**$531,000**	**$150,000**	**$150,000**
n/a	**Victoria Street**	Wolfe Ave.	Laurentian Drive	1.20					**A**	$225,000	$0	**$225,000**	**$1,500,000**	**$45,000**
n/a	**Petawawa East PS (Renfrew Street)**								**B**	$0	$0	**$0**	**$463,050**	
n/a	**Petawawa Bridge Watermain Twinnning**								**B**	$0	$0	**$0**		**$350,000**
n/a	**Harry Street Pumping Station**								**D**	$0	$0	**$0**	**$150,000**	
n/a	**McGregor Hill Watermain - BPS #1**								**A**	$0	$0	**$0**		**$150,000**

Table 6.1 - Comprehensive List of Projects - Sorted by Road Section Number

										ROAD IMPROVEMENTS INCLUDING STORM SEWER INSTALLATION			SANITARY SEWER UPGRADES	WATER DISTRIBUTION UPGRADES
ROAD SECTION #	DESCRIPTION	FROM	TO	LENGTH	URBAN	SEMI-URBAN	RURAL	CONDITION RATING	PRIORITY	RECONSTRUCTION / REHABILITATION COSTS	SPOT IMPROVEMENTS COSTS	TOTAL ROAD COSTS		
n/a	**Janet Street watermain extension**								**B**	$0	$0	**$0**		**$75,000**
n/a	**Additional Watermain crossing of Petawawa River**								**D**	$0	$0	**$0**		**$1,500,000**
n/a	**Isolation valves at existing trailor park on west side of Petawawa Blvd.**								**B**	$0	$0	**$0**		**$40,000**
n/a	**Sanitary Upgrades along Petawawa Blvd. and trailor park roadway**								**B**	$0	$0	**$0**	**$150,000**	
									Totals	$24,870,200	$512,500	$25,382,700	$3,107,850	$3,879,050

3.0 BASIS FOR THE DETERMINATION OF PRIORITIES

Background information and the findings of this report provide a basis by which the current and future needs of the sanitary sewer, storm sewer, road and water systems can be prioritized. The recommendations and priorities that are developed from each of these evaluations depend on different constraints and design criteria, some of which are more critical in nature as they pertain to the health and safety of the community.

Other infrastructure needs are development driven, in that the need or timing of the improvement is governed by the demand for new homes or businesses. The timing and costs for these growth related improvements are not directly in the control of the Town. Growth related improvements must, however, be anticipated in developing and evaluating the proposed work plan.

The identification of a current need for an infrastructure system improvement does not necessarily signify that the improvement is a high priority, but rather that the improvement is warranted or justified through the evaluation process. In many cases, by carefully monitoring the problem while allowing the identified deficiency to remain, the system deficiency can be tolerated without risk to public health and safety and without undue risk of property damage. Where the defect or deficiency does result in an unacceptable risk, the priority for the system improvement becomes greater. In the case of growth related requirements, the risk can be mitigated through the regulation of development and by delaying development approvals until the required infrastructure is in place.

It must be noted that several of the identified and costed improvements must be completed at specific times in order to provide cost effective services to the residents and ratepayers of Petawawa. Examples of this include the repair or upgrading of municipal infrastructure on County Road 16 (Victoria Street) that must be completed concurrent with the road reconstruction scheduled for 2012. In these cases, the priority to complete the required improvements is value driven, in that the costs are reduced by combining with other needed works and advancing the project.

It is recognized that the process of evaluating infrastructure and establishing the relative priorities is a fluid process. Forecasted needs and priorities change on a regular basis, often due to events, conditions and requirements that cannot be accurately forecast. It is intended to establish a comprehensive, logical program to utilize, maintain and develop the infrastructure systems in Petawawa in a fair, logical and responsible manner, to ensure that a safe, reliable and cost effective infrastructure system is available for the Community.

4.0 COST AND TIMING OF IMPROVEMENTS

In the previous chapters of this report, the improvements have been identified and costed without consideration of other related infrastructure works within the same area. When projects can be combined, construction costs can be substantially reduced, particularly when there are common elements in the work, such as road restoration or reconstruction involved. In order to identify and group improvements into common geographic areas, the projects listed in Chapters 2 through 5 have been carried forward into Table 6-1, which lists the identified improvements sorted by common road section numbers. The table also provides a column which states the recommended improvement and an expected time of need for the improvement.

The time for the improvements has been categorized in a more general time frame, in that the expected need will often develop over a period of several years. As previously stated, the need for an improvement does not necessarily require that the improvement must be undertaken within the time frame, but rather that a situation or condition exists where action is required to address the situation by additional maintenance or by repair or replacement of the infrastructure.

The following Rating System is used to establish the approximate time of the needed improvements:

A - High Priority -	the need for the improvement is now
B - Short Term -	the need for the improvement is expected to occur within the next 5 years
C- Medium Term -	the need for the improvement is expected to occur within the next 5-10 years
D- Long Term -	the need for the improvement is expected after 10 years
F -Indeterminate -	the need for the improvement is determined based on conditions that may vary and the requirements of the residents.

Several of the road sections that have been identified for road improvements also show costing for other infrastructure improvements such as for the installation of storm sewers or watermains.

The comprehensive plan which is proposed will attempt to establish a priority for the identified improvements as a means to reduce costs by undertaking all improvements forecast within the planning period simultaneously. Similarly, for works which may be scheduled by other jurisdictions, such as the reconstruction of County Road 16, the sanitary sewer and watermain improvements that are required should be undertaken in conjunction with the proposed road works. As an example, there will be a net savings to the project as the cost for the road reinstatement for a sewer replacement will not be required when the pipe is installed as part of the road contract

Table 6-2 contains the same list of projects that is identified in Table 6-1, however, in this case they have been sorted in order of priority. The projects that are noted as both High Priority ("A" projects) and Short Term ("B" projects) have been derived at based on the findings of this report along with discussions that have taken place with staff at both the Town and OCWA. Medium Term and Long Term projects were typically chosen based on the higher condition rating for the roadways or longer term servicing issues that are driven by longer term growth in the Town. A few projects were identified as Indeterminate, as they relied on project cost sharing with the Township of Laurentian Valley.

This Comprehensive Plan is intended as a guideline for Council, the recommendations contained in this plan have been established based on sound engineering and planning principles with the first priority being the safety of the public and ratepayers and with consideration for the principles for establishing priorities in scheduling of work as set out in this section. Unless specifically noted, the time for the improvements identified in this program are not considered as obligations but rather as suggested or warranted, based on the assumptions in the analysis of the various infrastructure components. The comprehensive plan should, therefore, be reviewed on an on-going basis in order to account for changes in physical conditions in the system and to account for changes in demand.

Table 6.2 - Comprehensive List of Projects - Sorted by Priority

										ROAD IMPROVEMENTS INCLUDING STORM SEWER INSTALLATION			SANITARY SEWER UPGRADES	WATER DISTRIBUTION UPGRADES
ROAD SECTION #	DESCRIPTION	FROM	TO	LENGTH	URBAN	SEMI-URBAN	RURAL	CONDITION RATING	PRIORITY	RECONSTRUCTION / REHABILITATION COSTS	SPOT IMPROVEMENTS COSTS	TOTAL ROAD COSTS		
3400	**Renfrew Street**	Petawawa Blvd (Co. Rd. 51)	Beer Store	0.10		x		**3**	**A**	$125,000	$0	**$125,000**		
6450	**Vermount Meadows**	Victoria Street	Northbrook Road	0.20	x				**A**	$0	$50,000	**$50,000**		
7000	**Herman Street**	Murphy Road	John Street	0.80		x		**3**	**A**	$1,416,000	$0	**$1,416,000**	**$44,800**	**$415,300**
n/a	**Victoria Street**	Wolfe Ave.	Laurentian Drive	1.20					**A**	$225,000	$0	**$225,000**	**$1,500,000**	**$45,000**
n/a	**McGregor Hill Watermain - BPS #1**								**A**	$0	$0	**$0**		**$150,000**
200	**Evergreen Drive**	Doran St. (Cty Rd 26)	Dead End	0.30			x	**3**	**B**	$81,000	$0	**$81,000**		
330	**Airport Road**	0.8km W of Doran	Cul de Sac	0.70			x	**2**	**B**	$189,000	$0	**$189,000**		
350	**Sylvan Drive**	Airport Road	Airport Road	1.50		x		**3**	**B**	$405,000	$40,000	**$445,000**		
700	**Plum Tree Lane**	Black Bay Road	End	0.40			x	**2**	**B**	$108,000	$0	**$108,000**		
900	**Rantz Road - East Leg**	Murphy Road (east	1.0 km North of	1.00			x	**3**	**B**	$270,000	$0	**$270,000**		
910	**Rantz Road - North Leg**	2.3 km N. Murphy Rd.	Murphy Road (west	1.00			x	**3**	**B**	$270,000	$25,000	**$295,000**		
960	**Shamess Road**	1.3 km W Rantz Rd.	End	0.70			x	**3**	**B**	$448,000	$0	**$448,000**		
1250	**Risto Road**	Springhill Court	McGuire Street	0.60			x	**3**	**B**	$246,000	$10,000	**$256,000**		**$210,000**
5250	**Victoria Street**	Albert Street	East Street	0.20		x		**8**	**B**	$84,000	$0	**$84,000**	**$200,000**	
5275	**East Street**	Island View Drive	Abbie Lane	0.90		x		**4**	**B**	$378,000	$0	**$378,000**	**$100,000**	
5300	**Abbie Lane**	East Street	East End	0.30			x	**5**	**B**	$123,000	$0	**$123,000**	**$350,000**	
6005	**Civic Center Road**	0.2km North of Petawawa Blvd.	Laurentian Drive (Co. Rd. 25)	0.80		x		**3**	**B**	$1,352,000	$0	**$1,352,000**		**$315,000**
6475	**Summit Trail**	West End cul-de-sac	East End	0.10	x				**B**	$0	$10,000	**$10,000**		
6550	**Park Drive**	Algonquin Street	Algonquin Street	0.50		x		**4**	**B**	$210,000	$0	**$210,000**		
7025	**Laroche Crescent**	Herman Street	Herman Street	0.60		x		**4**	**B**	$252,000	$0	**$252,000**		
7050	**James Street**	Laroche Street	Laroche Street	0.30		x		**4**	**B**	$126,000	$0	**$126,000**		
7155	**Mary Street**	Railway Tracks	Herman Street	0.50		x		**5**	**B**	$979,000	$0	**$979,000**		**$250,000**
7800	**Craig Place**	Florence Street	Cul-de-sac	0.10		x		**3**	**B**	$42,000	$0	**$42,000**		
n/a	**Petawawa East PS (Renfrew Street)**								**B**	$0	$0	**$0**	**$463,050**	
n/a	**Petawawa Bridge Watermain Twinnning**								**B**	$0	$0	**$0**		**$250,000**
n/a	**Janet Street watermain extension**								**B**	$0	$0	**$0**		**$75,000**
n/a	**Isolation valves at existing trailor park on west of Petawawa Blvd.**								**B**	$0	$0	**$0**		**$40,000**
n/a	**Sanitary Upgrades along Petawawa Blvd. and trailor park roadway**								**B**	$0	$0	**$0**	**$150,000**	
650	**Eichstaedt Road**	Black Bay Road	End	0.30			x	**2**	**C**	$81,000	$0	**$81,000**		
850	**Portage Road**	Murphy Rd. (Co. Rd.	1.3 km. NW Murphy	1.30			x	**9**	**C**	$195,000	$0	**$195,000**		
920	**Rantz Road**	Murphy Road	1.8 km W. Murphy	1.80			x	**8**	**C**	$225,000	$100,000	**$325,000**		
1255	**Risto Road**	Petawawa Blvd (Co. Rd. 51)	Springhill Court	0.10		x		**4**	**C**	$41,000	$0	**$41,000**		

Table 6.2 - Comprehensive List of Projects - Sorted by Priority

										ROAD IMPROVEMENTS INCLUDING STORM SEWER INSTALLATION			SANITARY SEWER UPGRADES	WATER DISTRIBUTION UPGRADES
ROAD SECTION #	DESCRIPTION	FROM	TO	LENGTH	URBAN	SEMI-URBAN	RURAL	CONDITION RATING	PRIORITY	RECONSTRUCTION / REHABILITATION COSTS	SPOT IMPROVEMENTS COSTS	TOTAL ROAD COSTS		
1275	**Springhill Court**	Petawawa Blvd (Co.	Risto Road	0.20		x		**4**	**C**	$54,000	$0	**$54,000**		
1300	**Brumm Road**	Petawawa Blvd. (Co.	Achray Road	0.80		x		**3**	**C**	$216,000	$25,000	**$241,000**		
1330	**Garwin Street North**	Petawawa Blvd. (Co. Rd. 51)	Birch Street	0.30		x		**4**	**C**	$126,000	$0	**$126,000**		
1350	**Pineridge Crescent**	Garwin Street	Birch @ Elton St.	0.50		x		**4**	**C**	$210,000	$0	**$210,000**		
1375	**Elton Street**	Birch Street	Pineridge Cres.	0.20		x		**4**	**C**	$84,000	$0	**$84,000**		
1400	**Doris Street**	Birch Street	Pineridge Cres.	0.20		x		**3**	**C**	$84,000	$0	**$84,000**		
1425	**Birch Street**	Elton Street	River Drive	0.60		x		**4**	**C**	$252,000	$0	**$252,000**		
1450	**George Street**	Pine Street	Garwin Street	0.20		x		**4**	**C**	$84,000	$0	**$84,000**		
1475	**Sharon Street North**	Petawawa Blvd. (Co.	Birch Street	0.20		x		**4**	**C**	$84,000	$0	**$84,000**		
1500	**Pine Street**	River Drive	George Street	0.30		x		**4**	**C**	$126,000	$0	**$126,000**		
1525	**Ann Street**	Sharon Street	River Drive	0.30		x		**4**	**C**	$126,000	$0	**$126,000**		
1550	**River Drive**	Petawawa Blvd. (Co. Rd. 51)	Top of Hill	0.40		x		**4**	**C**	$168,000	$0	**$168,000**		
1555	**River Drive**	Top of Hill	Bottom of Hill	0.20			x	**4**	**C**	$54,000	$10,000	**$64,000**		
2000	**Radtke Road**	Petawawa Blvd. (Co. Rd. 51)	Bottom of Hill	0.70			x	**4**	**C**	$294,000	$0	**$294,000**		
2200	**Schwantz Road**	Petawawa Blvd. (Co. Rd. 51)	Laurentian Dr. (Co. Rd. 25)	1.10		x		**4**	**C**	$462,000	$25,000	**$487,000**		
4125	**Industrial Avenue**	Black Bay Road	Labine Street	1.10			x	**5**	**C**	$451,000	$0	**$451,000**		
5050	**Louise Street**	Albert Street	End	0.10		x		**2**	**C**	$42,000	$0	**$42,000**		
5075	**North Street**	Albert Street	End	0.10		x		**5**	**C**	$34,000	$0	**$34,000**		
5100	**Alexander Street**	Albert Street	End	0.10		x		**2**	**C**	$42,000	$0	**$42,000**		
5130	**Island View Drive**	North Cul-de-Sac	North Cul-de-Sac	0.10			x	**2**	**C**	$27,000	$0	**$27,000**		
5150	**Alice Street**	Albert Street	East Street	0.20		x		**4**	**C**	$84,000	$0	**$84,000**		
5175	**Point Crescent**	Edward Street	East Street	0.20		x		**4**	**C**	$84,000	$0	**$84,000**		
5200	**Van Hoof Street**	Edward Street	S. End Cul-de-sac	0.10		x		**4**	**C**	$42,000	$0	**$42,000**		
5225	**Edward Street**	East Street	Albert Street	0.20		x		**4**	**C**	$84,000	$0	**$84,000**		
6250	**Mohns Ave**	Violet Street	Petawawa Blvd.	0.50	x			**5**	**C**	$130,000	$137,500	**$267,500**		
6400	**Alfred Street**	Victoria Street	North End	0.10		x		**2**	**C**	$42,000	$0	**$42,000**		
6585	**Harry Street**	Bert Street	North End	0.20		x		**3**	**C**	$84,000	$0	**$84,000**		
7100	**John Street**	Murphy Rd. (Co. Rd. 37)	Herman Street	0.40		x		**4**	**C**	$708,000	$0	**$708,000**		
7550	**Spruce Street**	Woodland Cres. N. leg	Woodland Cres. S. leg	0.30		x		**4**	**C**	$126,000	$0	**$126,000**		
7605	**Russell Street**	Audrey Street	Sammy Drive	0.20		x		**4**	**C**	$84,000	$0	**$84,000**		
7625	**Sammy Drive**	Russell Street	End	0.20		x		**4**	**C**	$84,000	$0	**$84,000**		
7700	**Hilda Court**	Hilda Street	Hilda Street	0.10		x		**2**	**C**	$42,000	$0	**$42,000**		
7825	**Portage Road**	Petawawa Blvd. (Co. Rd. 51)	Florence Street	0.30		x		**5**	**C**	$531,000	$0	**$531,000**	**$150,000**	**$150,000**
450	**Kohut Drive**	Airport Road	Cul De Sac	0.40			x	**4**	**D**	$108,000	$0	**$108,000**		
500	**Len Hopkins Drive**	Black Bay Road	Airport Road	2.10			x	**5**	**D**	$567,000	$30,000	**$597,000**		
550	**Black Bay Road**	Industrial Ave.	Carla Street	0.70			x	**6**	**D**	$0	$0	**$0**		**$303,750**
600	**Summers Road**	Black Bay Road	0.3 km West	0.30			x	**5**	**D**	$0	$10,000	**$10,000**		
860	**Portage Road**	1.3 km NW Murphy Rd.	Former Village Limits	1.20			x	**5**	**D**	$492,000	$0	**$492,000**		
2005	**Radtke Road**	Bottom of Hill	0.5 km Easterly	0.50			x	**5**	**D**	$135,000	$0	**$135,000**		
2015	**Radke Road**	River Drive	End	0.10			x	**2**	**D**	$64,000	$0	**$64,000**		
2175	**Kramer Ave.**						x	**6**	**D**	$0	$0	**$0**		**$75,000**
2225	**Sack Road**	Schwantz Road	Kramer Avenue	0.30		x		**5**	**D**	$126,000	$0	**$126,000**		
2250	**Isabel Street**	Sack Road	Schwantz Road	0.30		x		**5**	**D**	$126,000	$0	**$126,000**		
2275	**Sandy Drive**	Isabel Street	Country Lane	0.20		x		**5**	**D**	$84,000	$0	**$84,000**		
2300	**Country Lane**	Schwantz Road	Gutzman Road	1.00		x		**5**	**D**	$420,000	$0	**$420,000**		
2350	**Chippewa Road**	Country Lane	Heritage Drive	0.20		x		**5**	**D**	$84,000	$0	**$84,000**		

Table 6.2 - Comprehensive List of Projects - Sorted by Priority

										ROAD IMPROVEMENTS INCLUDING STORM SEWER INSTALLATION			SANITARY SEWER UPGRADES	WATER DISTRIBUTION UPGRADES
ROAD SECTION #	DESCRIPTION	FROM	TO	LENGTH	URBAN	SEMI-URBAN	RURAL	CONDITION RATING	PRIORITY	RECONSTRUCTION / REHABILITATION COSTS	SPOT IMPROVEMENTS COSTS	TOTAL ROAD COSTS		
2375	**Viking Road**	Country Lane	Heritage Drive	0.20		x		**5**	**D**	$84,000	$0	**$84,000**		
2400	**Arrowhead Road**	Country Lane	Heritage Drive	0.20		x		**5**	**D**	$84,000	$0	**$84,000**		
3200	**Silke Drive**	Petawawa Blvd. (Co. Rd. 51)	Laurentian Drive	0.50		x		**5**	**D**	$210,000	$0	**$210,000**		
3325	**Charles Street**	Michael Street	Peter Street	0.40		x		**5**	**D**	$168,000	$0	**$168,000**		
3350	**Janet Street**	Petawawa Blvd. (Co. Rd. 51)	Cul de Sac	0.30		x		**4**	**D**	$126,000	$0	**$126,000**		
4000	**New Street**	Petawawa Blvd. (Co. Rd. 17)	Hoffman Street	0.20		x		**5**	**D**	$84,000	$0	**$84,000**		
4025	**Poplar Street**	New Steet	Labine Crescent	0.30		x		**5**	**D**	$126,000	$0	**$126,000**		
4050	**Victor Street**	Poplar Street	Hoffman Street	0.10		x		**5**	**D**	$42,000	$0	**$42,000**		
4075	**Hoffman Street**	New Street	Labine Crescent	0.40		x		**5**	**D**	$168,000	$0	**$168,000**		
4100	**Labine Crescent**	Hoffman Street	Poplar Street	0.70		x		**5**	**D**	$294,000	$0	**$294,000**		
4180	**Carla Street**	Derek Drive	Cardinal Crescent	0.30		x		**4**	**D**	$126,000	$0	**$126,000**		
4250	**Derek Drive**	Doran St, (Co. Rd. 26)	Carla Crescent	0.30		x		**5**	**D**	$126,000	$0	**$126,000**		
4275	**Steffen Street**	Doran St. (Co. Rd. 26)	Carla Crescent	0.30		x		**4**	**D**	$126,000	$0	**$126,000**		
5000	**Albert Street**	Victoria St. (Co. Rd. 16)	Alice St./Tall Pines Rd.	0.40		x		**4**	**D**	$168,000	$0	**$168,000**		
5025	**Tall Pines Road**	Albert Street	End	0.10		x		**5**	**D**	$34,000	$0	**$34,000**		
5375	**Earl Street**	Irma Street	Cul-de-sac	0.40		x		**5**	**D**	$300,000	$0	**$300,000**		
6075	**Vereyken Crescent**	Dundonald Drive	Dutch Drive	0.50			x	**5**	**D**	$375,000	$0	**$375,000**		
6100	**Dutch Drive**	Cartier St. (Civic Centre Ent.)	Vereyken Cres.	0.20			x	**5**	**D**	$150,000	$0	**$150,000**		
6125	**Wilbert Street**	Fred Street	Dundonald Drive	0.40		x		**4**	**D**	$168,000	$0	**$168,000**		
6150	**Fred Street**	Petawawa Blvd. (Co. Rd. 51)	Wilbert Street	0.10		x		**4**	**D**	$42,000	$0	**$42,000**		
6275	**Willard Street**	Mohns Avenue	Victoria St. (Co. Rd. 16)	0.20	x			**5**	**D**	$52,000	$10,000	**$62,000**		
7005	**Herman Street**	John Street	Selkirk Street	0.30	x			**5**	**D**	$73,200	$0	**$73,200**		
7075	**Roy Street**	Mary Street	Murphy Rd. (Co. Rd. 37)	0.40		x		**5**	**D**	$168,000	$0	**$168,000**		
7105	**John Street**	Herman Street	RR tracks	0.50		x		**5**	**D**	$885,000	$0	**$885,000**		
7125	**Norman Street**	Mary Street	Railway Tracks	0.30		x		**4**	**D**	$126,000	$15,000	**$141,000**		
7150	**Mary Street**	Herman Street	Cul-de-sac - south of Herman St.	0.30		x		**4**	**D**	$141,000	$0	**$141,000**		
7175	**Laura Street**	Doran Street	Railway Tracks	0.20		x		**5**	**D**	$354,000	$15,000	**$369,000**		
7200	**Edith Street**	Doran Road	Mary Street	0.30		x		**5**	**D**	$126,000	$0	**$126,000**		
7230	**Selkirk Street**	Woodland Crescent	Murphy Rd. (Co. Rd. 37)	0.90		x		**5**	**D**	$378,000	$0	**$378,000**		
7500	**Woodland Cres. N. leg**	Selkirk Street	Woodland Cres. W. leg	0.40		x		**4**	**D**	$708,000	$0	**$708,000**		
7510	**Woodland Cres. S. leg**	Hemlock Street	Woodland Cres. W. leg	0.20		x		**4**	**D**	$84,000	$0	**$84,000**		
7525	**Hemlock Street**	Murphy Rd. (Co. Rd. 37)	Woodland Cres. N.	0.40		x		**5**	**D**	$708,000	$0	**$708,000**		
7675	**Hilda Street**	Audrey Street	Doran St. (Co. Rd. 26)	0.50		x		**5**	**D**	$885,000	$0	**$885,000**		
7680	**Hilda Street**	Hilda Court	Audrey Street	0.20		x		**5**	**D**	$219,000	$0	**$219,000**		
7685	**Hilda Street**	Lisa Crescent	Hilda Court	0.10		x		**5**	**D**	$42,000	$0	**$42,000**		
7725	**Lisa Crescent**	Scott Avenue	End Cul-de-sac	0.40		x		**5**	**D**	$168,000	$0	**$168,000**		
7750	**Scott Avenue**	Portage Road	Hilda Street	0.20		x		**5**	**D**	$354,000	$0	**$354,000**		

Table 6.2 - Comprehensive List of Projects - Sorted by Priority

										ROAD IMPROVEMENTS INCLUDING STORM SEWER INSTALLATION			SANITARY SEWER UPGRADES	WATER DISTRIBUTION UPGRADES
ROAD SECTION #	**DESCRIPTION**	**FROM**	**TO**	**LENGTH**	**URBAN**	**SEMI-URBAN**	**RURAL**	**CONDITION RATING**	**PRIORITY**	**RECONSTRUCTION / REHABILITATION COSTS**	**SPOT IMPROVEMENTS COSTS**	**TOTAL ROAD COSTS**		
7775	**Florence Street**	Hilda Street	Portage Road	0.20		x		**4**	**D**	$84,000	$0	**$84,000**		
n/a	**Harry Street Pumping Station**								**D**	$0	$0	**$0**	**$150,000**	
n/a	**Additional Watermain crossing of Petawawa River**								**D**	$0	$0	**$0**		**$1,500,000**
100	**Achray Road**	B Line	1.0 Km west	1.00			x	**3**	**F**	$390,000	$0	**$390,000**		
110	**Achray Road**	1.0 Km west of B Line	pipe line x-ing	1.50			x	**2**	**F**	$585,000	$0	**$585,000**		
1000	**Golf Course Road**	Petawawa Blvd (Co. Rd. 51)	Laurentian Valley Twp	0.30			x	**1**	**F**	$117,000	$0	**$117,000**		
									Totals	$24,870,200	$512,500	$25,382,700	$3,107,850	$3,779,050

5.0 10 YEAR CAPITAL PLAN

The final step in this report is to take the Comprehensive Plan and prepare a 10 Year Capital Plan for Council's consideration. Table 6-3 provides a 10 Year Plan that attempts to balance the needs of the Town with the anticipated budget allowance that will be available for infrastructure improvements on a yearly basis. The Plan is a result of a meeting that was held with the staff of the Town, OCWA and Jp2g.

While the projects identified in the table represent what the group felt were the most critical needs of the Town at this time, it is acknowledged that this list will need to be reviewed on a yearly basis and updated as needs and budget constraints may dictate.

TABLE 6-3
TOWN OF PETAWAWA
10 YEAR CAPITAL PLAN
2012 - 2022
Dec. 21, 2011
Updated April 12, 2013

						ROADS, STORM & SIDEWALK											SANITARY SEWER											WATERMAINS										
PROJECT	Location	DESCRIPTION OF IMPROVEMENT	LENGTH OF PROJECT	ROAD SECTION #	ROAD CONDITION RATING	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
2012																																						
Victoria Street Reconstruction (Part 1)	Wolfe Ave. to Laurentian Dr.	Urban Road Reconstruction	600	N/A	County Road	$241,000											$1,070,000											$10,000										
Herman Street - Phase 2	John St. to Laroche Cresc. (n. leg)	Urban Road Reconstruction	360	7000	3 out of 10	$667,900																						$288,150										
Rantz Road - Phase 2 Stage 1	Phase 1 limit to Murphy Road (west end)	Rural Pulverize and Pave	600	910	3 out of 10	$140,000																																
Sylvan Drive - Phase 1	East Leg	Rural Pulverize and Pave	700	350	3 out of 10	$199,000																																
Evergreen Drive	Doran St. to dead end	Rural Pulverize and Pave	300	200	3 out of 10	$69,000																																
Watermain Twinning	Petawawa Bridge	Watermain Installation																										$466,700										
2013																																						
Victoria Street Reconstruction (Part 2)	Wolfe Ave. to Laurentian Dr.	Urban Road Reconstruction	600	N/A	County Road		$242,800											$694,500											$57,640										
Herman St. - Phase 3	Laroche Cres. to Murphy Road	Urban Road Reconstruction	425	7000	3 out of 10		$435,000											$117,500											$335,000										
Janet St. watermain ext.	Limestone Trail to Janet St. Booster St.	Watermain Installation	125																										$115,000										
Sylvan Drive - Phase 2	West Leg	Rural Pulverize and Pave	800	350	3 out of 10		$180,000																															
Plum Tree Lane	Black Bay Road to end	Rural Pulverize and Pave	400	700	2 out of 10		$115,000																															
Syphon Chamber Flow Chamber		Capacity upgrades, generator																$135,000																				
Replace ex. 500mm watermain at plant																													$450,000									
Vermont Meadows		Storm Outfall Improvements		6450			$50,000																															
2014																																						
Civic Center Road - Phase 1	Leeder Lane to Laurentian Drive	Urban Road Reconstruction	300	6005	3 out of 10			$507,000																						$105,000									
Park Drive - Phase 1	North Leg	Semi-Urban Pulverize and Pave	250	6550	4 out of 10			$105,000																														
Shamess Road	1.3 km west of Rantz Road to end	Rural Reconstruction	700	960	3 out of 10			$448,000																														
Airport Road	800m of Doran Road to cul-de-sac	Rural Pulverize and Pave	700	330	2 out of 10			$189,000																														
Renfrew St. Pumping Station	Renfrew Street	Capacity upgrades, generator																	$463,050																			
McGregor Hill Watermain	Petawawa Blvd.	Petawawa feed for McGuire Sub.																												$150,000								
Victoria Street	Laurentian Dr. to East St.	Sanitary Sewer Upgrades	200	5250	8 out of 10			$84,000											$20,000																			
East Street	Victoria St. to Abbie Lane	Sanitary Sewer Upgrades	100	5275	5 out of 10			$42,000											$10,000																			
Abbie Lane	East Street to Sewage Treatment Plant	Sanitary Sewer Upgrades	350	5300	4 out of 10			$123,000											$350,000																			
Rantz Road - Phase 2 Stage 1	Phase 1 limit to Murphy Road (west end)	Rural Pulverize and Pave	600	910	3 out of 10			$240,000																														
2015																																						
Civic Centre Road - Phase 2	Civic Center entrancre to Leeder Lane	Urban Road Reconstruction	600	6005	3 out of 10				$845,000																														
Park Drive - Phase 2	South Leg	Semi-Urban Pulverize and Pave	250	6550	4 out of 10				$105,000																														
Craig Place	Florence St. to cul-de-sac	Semi-Urban Pulverize and Pave	100	7800	2 out of 10				$42,000																														
Rantz Road - Phase 3	Murphy Road (east end) to 2011 limit	Rural Pulverize and Pave	900	900	3 out of 10				$270,000																														
2016																																						
Risto Road	Springhill Court to McGuire St.	Rural Pulverize and Pave	600	1250	3 out of 10					$256,000																														
James Street	Laroche Cres. to Laroche Cres.	Semi-Urban Pulverize and Pave	300	7050	4 out of 10					$126,000																														
Laroche Crescent	Herman St. to Herman St.	Semi-Urban Pulverize and Pave	600	7025	4 out of 10					$252,000																														
Mary Street - Phase 1	Railway Tracks to Herman Street	Urban Road Reconstruction	500	7155	5 out of 10					$979,000																														
2017																																						
John St.	Herman St. to RR Tracks	Urban Road Reconstruction	500	7105	5 out of 10						$885,000																													
Norman St.	Mary St. to RR Tracks	Semi-Urban Pulverize and Pave	300	7125	4 out of 10						$141,000											$150,000																	
Laura St.	Doran Road to RR Tracks	Urban Road Reconstruction	200	7175	5 out of 10						$369,000																													
Edith	Doran Road to Mary St.	Semi-Urban Pulverize and Pave	300	7200	5 out of 10						$126,000																													
2018																																						
Hilda (west of Audrey)	Hilda Court to Audrey St.	Urban / Semi-Urban Reconstruction	200	7680	5 out of 10							$332,000											$80,000													$80,000				
Hilda (west of Audrey) (see note 4)	Lisa Crescent to Hilda Court	Semi-Urban Reconstruction	100	7685	5 out of 10							$155,000											$40,000													$40,000				
Hilda Court (see note 4)	Hilda St. to Hilda St.	Semi-Urban Reconstruction	100	7700	2 out of 10							$155,000											$40,000													$40,000				
Lisa Cres. (see note 4)	Scott Ave. to Cul-de-sac	Semi-Urban Reconstruction	400	7725	5 out of 10							$620,000											$160,000													$160,000				
Scott Ave.	Portage Road to Hilda St.	Urban Road Reconstruction	200	7750	5 out of 10							$354,000											$80,000													$80,000				
2019																																						
Black Bay Road (see note 3)	Petawawa Blvd. to Doran Road	Rural Pulverize and Pave - 2 lifts	1,800	550	6 out of 10								$873,000																									$262,500			
Industrial Ave. (ssee note 3)	Labine Cres. to Black Bay Road	Rural Pulverize and Pave - 2 lifts	1,100	4125	5 out of 10								$533,500																											
2020																																						
Pitzner Road	cul-de-sac	Rural Pulverize and Pave - 1 lift	1,300	340 & 400	5 out of 10									$351,000																										
Mohns	Petawawa Blvd.	Urban Resurfacing	500	3250	5 out of 10									$267,500																										
Achray Road	Biesental Road	Rural Reconstruction	1,500	110	2 out of 10									$585,000																										
Petawawa Blvd	sanitary sewer upgrade just upstream of Harry St. PS																																					
Petawawa Blvd	sanitary sewer upgrade - line to trailor park																																					
2021																																						
Garwin St. North	Petawawa Blvd. to Birch St.	Semi-Urban Pulverize and Pave	300	1330	4 out of 10										$126,000																								
Pineridge Cresc.	Garwin St. to Birch @ Elton St.	Semi-Urban Pulverize and Pave	500	1350	4 out of 10										$210,000																								
Elton St.	Birch St. to Pineridge Crescent	Semi-Urban Pulverize and Pave	200	1375	4 out of 10										$84,000																								
Doris St.	Birch St. to Pineridge Crescent	Semi-Urban Pulverize and Pave	200	1400	3 out of 10										$84,000																								
Birch St.	Elton St. to River Drive	Semi-Urban Pulverize and Pave	600	1425	4 out of 10										$252,000																								
George St.	Pine St. to Garwin St.	Semi-Urban Pulverize and Pave	200	1450	4 out of 10																																		
Sharon St. North	Petawawa Blvd. to Birch St.	Semi-Urban Pulverize and Pave	200	1475	4 out of 10										$84,000																								
Pine St.	River Dr. to George St.	Semi-Urban Pulverize and Pave	300	1500	4 out of 10										$126,000																								
Ann St.	Sharon St. to River Drive	Semi-Urban Pulverize and Pave	300	1525	4 out of 10										$126,000																								
2022																																						
Roy Street	Mary St. to Murphy Road	Semi-Urban Pulverize and Pave	400	7075	5 out of 10											$168,000																								
John St.	Murphy Road to Herman St.	Urban Road Reconstruction	400	7100	4 out of 10											$708,000																								
Mary St.	Herman St. to cul-de-sac (south)	Urban Road Reconstruction	300	7150	4 out of 10											$141,000																								
					TOTALS	$1,316,900	$1,022,800	$1,738,000	$1,262,000	$1,613,000	$1,521,000	$1,616,000	$1,406,500	$1,203,500	$1,092,000	$1,017,000	$1,070,000	$947,000	$843,050	$0	$0	$150,000	$400,000	$0	$200,000	$0	$0	$764,850	$957,640	$255,000	$210,000	$460,000	$210,000	$400,000	$262,500	$0	$0	$0
																	Average Cost/year =	$1,346,245										Average Cost/year =	$328,186.36										Average Cost/year =	$319,999.09									

Notes: 1. All costs based on 2011 construction values. Costs include engineering and contingecy allowance. Cost exclude HST.
2. Concrete sidewalks are to be installed for all "Urban Road Reconstruction" projects and included in the costs noted above.
3. Costing includes installation of asphalt sidewalk within boulevard.
4. The cost for the roadworks are based on "semi-urban reconstruction" as compared to "semi-urban pulverize and pave" that is noted in Infrasture Study

6.0 CLOSING

This report has been completed to provide background and guidance to the Town of Petawawa in making decisions regarding the infrastructure systems.

This document is respectfully submitted by Jp2g Consultants Inc. for the consideration of the Town of Petawawa Municipal Council.

Steven Webster, P.Eng.	J. M. Janota, M. Sc., P. Eng.
Principal, Pembroke Office Manager	President