Report for:

VILLAGE OF STIRLING

INFRASTRUCTURE MASTER PLAN

Prepared By:

Gavin Nummi, P.Eng.
Project Engineer

MPE Engineering Ltd.
Suite 300, 714 5th Ave. S
Lethbridge, AB
P: (403) 317-3658
Email: gnummi@mpe.ca

Date: September 15, 2020
Project #: 1407-001-00

Proud of Our Past... Building the Future

www.mpe.ca

Suite 300, 714 - 5 Avenue South
Lethbridge, AB T1J 0V1
Phone: 403-329-3442
1-866-329-3442
Fax: 403-329-9354

Engineering Ltd.

Village of Stirling
P.O. Box 360
Stirling, AB T0K 2E0

September 15, 2020
File: N:\1407-001\R01_FINAL.DOC

Attention: Scott Donselaar
Chief Administrative Officer

Dear Mr. Donselaar;

Re: Village of Stirling - Infrastructure Master Plan

We are pleased to submit a copy of the above noted study. We thank you for the opportunity to be of service and to have prepared this report on your behalf. We look forward to assisting you in implementing the recommendations within the report.

Should you have any questions or require additional information, please contact the undersigned at (403) 317-3658.

Yours truly,

MPE ENGINEERING LTD.

Gavin Nummi, P. Eng.
Project Engineer

:gn

CORPORATE AUTHORIZATION

This report has been prepared by MPE Engineering Ltd. under authorization of the Village of Stirling. The material in this report represents the best judgment of MPE Engineering Ltd. given the available information.

Any use that a third party makes of this report, or reliance on or decisions made based upon it is the responsibility of the third party. MPE Engineering Ltd. accepts no responsibility for damages, if any, suffered by a third party because of decisions made or actions taken based upon this report.

Should any questions arise regarding content of this report, please contact the undersigned.

MPE ENGINEERING LTD.

September 15, 2020

Gavin Nummi, P.Eng.
Project Manager

PERMIT TO PRACTICE
MPE ENGINEERING LTD.
PERMIT NUMBER: P 3680
The Association of Professional Engineers and Geoscientists of Alberta

Professional Seal

Corporate Permit

EXECUTIVE SUMMARY

The Infrastructure Master Plan provides an assessment of the Village of Stirling's potable water system, wastewater collection and treatment systems, stormwater management system, and transportation network. Upgrades and improvements to these systems have been recommended and order of magnitude cost estimates have been prepared in association with the proposed construction works.

The Village has experienced consistent growth over the past decade and a growth rate of 2.2% was utilized to determine projected populations for the 5, 10, and 25-year design horizons. Projected populations were utilized to determine the expected growth for the Village as well as future wastewater generation rates and potable water demands. These items were used to assess the ability of the Village's infrastructure to provide an acceptable level of service.

Projected Growth Rate (%/year)	Census Data			Projected Population			
2.2	2006	2011	2018	2020	2025	2035	2045
	1,090	978	1,269	1,326	1,478	1,648	2,284

POTABLE WATER SYSTEM

The Village is supplied with potable water from the Town of Raymond through a regional supply pipeline which fills the potable water reservoir. A potable water supply pipeline delivers water from the potable water reservoir to the Village boundary and the potable water distribution system.

An assessment of the potable water infrastructure and available water supply included a review of raw water license allocation, capacity of the regional and potable water supply pipelines, hydraulic analysis of the distribution system under current and projected potable water demands, and potable water reservoir. From the assessments, the following conclusions could be made:

- The Village has sufficient raw water allocation available for the projected 25-year water demands,
- Capacity in the regional supply pipeline can service the projected 25-year population,
- Inspections of the potable water reservoir revealed potential structural concerns,
- The potable water supply pipeline does not have capacity for the projected 25-year water demands and a pump station or pipe upgrade may be required in the future,
- Aged fittings on the regional and potable water supply pipelines require replacement,
- Available fire flow in the northwest and southeast portions of the Village do not meet Fire Underwriters Survey (FUS) recommended requirements,
- Aged Asbestos-Cement (AC) watermains should be scheduled for replacement and/or lining.

Recommended high priority upgrades for the potable water system, based on the conclusions noted above, are summarized in the following table along with their estimated costs.

Location	Project	Estimated Cost
Regional and Potable Water Supply Pipelines	Valve and Fitting Replacements	$320,000
Potable Water Reservoir	Structural Assessment	$7,500
Potable Water Distribution System	Additional Water Supply Connections	$120,000

WASTEWATER SYSTEM

The Village's wastewater infrastructure consists of a typical gravity collection system and a single lift station to convey wastewater to the wastewater treatment system. Conventional, evaporative wastewater lagoons are utilized to treat and store the collected wastewater.

The assessment of the wastewater infrastructure included a review of available video inspection reports, a hydraulic analysis of the collection system under current and projected wastewater generation rates, and inspection of the lift station. From this assessment, wastewater mains which require repairs/replacement, wastewater mains which require replacement with larger diameter mains to accommodate projected growth, and new wastewater mains to alleviate current and future capacity issues were identified.

From the assessment, the following conclusions regarding the wastewater system could be made:

- The wastewater collection system is subject to high inflow and infiltration rates and the lift station is unable to provide sufficient pumping capacity,
- Wastewater flows are approximately equal to 45% of the total water use based on the recorded volumes from the past 4 years (likely indicating erroneous wastewater flow data),
- Inspected wastewater mains are in fair or poor condition and should be replaced,
- Video inspections of the remaining wastewater mains are required to assess their condition,
- The lift station is in good operational condition; however, it was noted that pressure gauge assemblies and one of the check valves were not functioning properly,
- The condition of the forcemain is unknown, however, it is undersized for the available pumping capacity at the lift station,
- The wastewater lagoons will require upgrades to have capacity for the 25-year population,
- New and upsized wastewater mains along 1st Avenue, east of the lift station, are required to service future population growth.

Recommended high priority upgrades for the wastewater system, based on the conclusions noted above, are summarized in the following table along with their estimated costs.

Location	Project	Estimated Cost
Lift Station	Operation and Maintenance Upgrades	$90,000
Forcemain	250/300 mm Forcemain Installation	$1,290,000
3rd Street – 2nd Ave to 3rd Ave	Wastewater Main Replacement	$590,000
3rd Street – 3rd Ave to 4th Ave	Wastewater Main Replacement	$590,000

It is also highly recommended that the Village undertake video inspections of the remaining wastewater collection mains to determine their condition and determine the necessary rehabilitation work required.

STORMWATER MANAGEMENT SYSTEM

The stormwater portion of the assessment focused on drainage within the Village limits and any surrounding areas having direct impacts on the Village. The total area reviewed was 275 hectares and evaluates the existing stormwater infrastructure and overland flow paths.

The Village's stormwater infrastructure consists of a combination of surface drainage via ditches and gutters along roadways and localized underground piping. Generally, all areas within the Village boundary drain towards the Kipp Coulee with the northeast portions of the Village draining overland through the County and then into the Kipp Coulee. From the assessment of the stormwater management system, the following conclusions can be made:

- The major drainage system throughout the Village performs suitably despite issues with road and ditch grading causing localized ponding in certain areas,
- The minor drainage system does not provide an acceptable level of service for conveying runoff from a 1:5-year storm event,
- The minor drainage system does allow for drainage of areas throughout the Village after a rainfall event,
- There are no stormwater management facilities located within the Village.

Upgrades to the stormwater management system are not considered a high priority. As indicated above, and in discussions with Village staff, the current stormwater management system is sufficient to eventually convey stormwater runoff to Kipp Coulee. Ponding that occurs throughout the Village is capable of being addressed through other infrastructure and road rehabilitation projects.

The Village should ensure that developments to the northeast of the current Village boundary are constructed with a minor drainage system. The proposed minor drainage system should be designed to accommodate stormwater runoff from areas between 1st Avenue and 3rd Avenue, to the east of 3A Street or 4th Street, to allow for improved drainage in the northeast part of the Village.

TRANSPORTATION NETWORK

As part of assessing the Village's infrastructure, MPE completed a comprehensive evaluation of the transportation network. The evaluation included all paved roads, gravel roads, and concrete sidewalks. Based on the assessment completed, the following conclusions could be made:

- The Village's transportation network includes 10.5 km of paved roads, 6 km of gravel roads, and 3 km of concrete sidewalks,
- Average overall condition of the Village's paved roads is satisfactory and minimal roads are recommended for reconstruction,
- Average overall condition of the Village's gravel roads is fair. The long-term plan is to transition all gravel roads to paved surfaces, therefore all gravel roads which received a "failed" or "poor" condition rating were recommended to be upgraded to a paved local road standard,
- Average overall condition of the Village's concrete sidewalks is fair, however, 40% were assessed to be in poor condition,
- Inspections of bridge files within the Village boundary are out of date.

Transportation upgrades are not considered a high priority for the Village. Road and sidewalk improvements should coincide with, or take place after, underground improvement projects. If underground projects are completed or not required where "failed" and "poor" road and sidewalk segments exist, these projects should be undertaken as the Village's budget allows. The following table provides a summary of roads and sidewalks that received a "failed" condition rating and their costs for reconstruction.

Location	Project	Estimated Cost
6th Street – 3rd Avenue to 2nd Avenue	Paved Road Reconstruction	$171,300
6A Street – 3rd Avenue to 2nd Avenue		$345,000
3rd Street – 2nd Avenue to 1st Avenue		$350,000

In addition to the above "failed" road segments, there were 17 road segments and 13 sidewalk segments rated in "poor" condition.

SUMMARY

Based on the infrastructure assessment completed for the potable water system, wastewater system, the stormwater management system, and the transportation network, the following recommendations are made:

- **Potable Water System:**
  - Complete a structural assessment on the existing potable water reservoir immediately to address potential concerns,
  - Replace aged fittings on the regional and potable water supply pipelines,
  - Complete watermain upsizing and installations at select locations in the distribution system to improve the fire flows available throughout the Village,
  - Implement a schedule for replacing and/or lining aging AC watermains in the Village.
- **Wastewater System:**
  - Complete video inspections of all wastewater mains throughout the Village,
  - Repair and replace wastewater mains in poor or fair condition identified through video inspection reports,
  - Complete upgrades at the lift station to improve flow monitoring capabilities and replacement of existing valve assemblies,
  - Construct a new 250 mm or 300 mm forcemain to the wastewater lagoons to maximize the pumping capacity available at the lift station.
- **Stormwater System:**
  - The Village should undertake projects to reduce localized ponding throughout the Village. These projects can consist of grass swales, ditches, additional connections to the minor drainage systems, and improved road grading along with road restoration projects,
  - Construction of a minor drainage system for development to the northeast of the Village should be completed with allowances for improving drainage between 1st Avenue and 3rd Avenue,
  - All future developments should be designed with stormwater detention facilities capable of reducing stormwater runoff rates to pre-development 1:5-year release rates.
- **Transportation Network:**
  - The Village should schedule reconstruction of “failed” to “poor” road and sidewalk segments as their budget allows,
  - Road and sidewalk improvements should coincide with, or take place after, underground improvement projects,
  - The Village should continue to perform regular maintenance and rehabilitation on roads that have a condition rating greater than “fair” to prolong their life span,
  - The Village should complete updated inspections of all bridge files within their boundary.

TABLE OF CONTENTS

1 INTRODUCTION 1
1.1 Evaluation Background 1
1.2 Scope of Work 1

2 BACKGROUND 4
2.1 General Description 4
2.2 Population Projections 4
2.3 Projected Development 4

3 POTABLE WATER SYSTEM ANALYSIS 7
3.1 Assumptions 7
3.2 Current and Projected Water Demands 7
3.3 Potable Water Supply Assessment 9
3.4 Potable Water Distribution System Assessment 15
3.5 Potable Water System Upgrades 21
3.6 Potable Water System Cost Estimates 26

4 WASTEWATER SYSTEM ANALYSIS 28
4.1 Assumptions 28
4.2 Current Wastewater Flows 28
4.3 Projected Wastewater Flows 32
4.4 Wastewater Collection System Assessment 32
4.5 Wastewater Lift Station and Forcemain 37
4.6 Wastewater Treatment System 41
4.7 Wastewater System Upgrades 43
4.8 Wastewater System Cost Estimates 47

5 STORMWATER MANAGEMENT SYSTEM ANALYSIS 48
5.1 Stormwater Background 48
5.2 Existing Stormwater System 50
5.3 Stormwater System Condition Assessments 55
5.4 Stormwater Conveyance Analysis 57
5.5 Stormwater Management Upgrades 60
5.6 Stormwater System Cost Estimates 63

6 TRANSPORTATION NETWORK 64
6.1 Existing Transportation Network 64
6.2 Transportation Network Condition Assessments 69
6.3 Transportation Network Upgrades 76
6.4 Transportation Network Cost Estimates 79

7 CAPITAL PLANNING 81
7.1 Funding Opportunities 83

8 CONCLUSIONS & RECOMMENDATIONS 84
8.1 Potable Water System 84
8.2 Wastewater System 84
8.3 Stormwater Management System 85
8.4 Transportation Network 85

9 REFERENCES 87

APPENDIX A : POTABLE WATER COST ESTIMATES
APPENDIX B : WASTEWATER VIDEO INSPECTION REPORTS
APPENDIX C : WASTEWATER COST ESTIMATES
APPENDIX D : STORMWATER MODEL ATTRIBUTES
APPENDIX E : STORMWATER COST ESTIMATES
APPENDIX F : TRANSPORTATION TRAFFIC DATA
APPENDIX G : TRANSPORTATION CONDITION ASSESSMENT
APPENDIX H : BRIDGE FILE INSPECTIONS
APPENDIX I : TRANSPORTATION COST ESTIMATES

LIST OF TABLES

TABLE 2.1 – PROJECTED POPULATION FOR THE VILLAGE OF STIRLING 4
TABLE 3.1 – VILLAGE OF STIRLING HISTORICAL WATER DEMANDS 8
TABLE 3.2 – CURRENT AND PROJECTED WATER DEMANDS....8
TABLE 3.3 – FIRE FLOW AND DURATION REQUIREMENTS 9
TABLE 3.4 – TYPICAL BUILDING SIZES FOR CURRENT FIRE PROTECTION 14
TABLE 3.5 – HYDRAULIC ANALYSIS – 2020 DEMAND SCENARIOS 19
TABLE 3.6 – HYDRAULIC ANALYSIS – 2020 AVAILABLE FIRE FLOW....19
TABLE 3.7 – HYDRAULIC ANALYSIS – 2020 DEMAND SCENARIOS 20
TABLE 3.8 – ULTIMATE SUPPLY PIPELINE CAPACITY BY GRAVITY 20
TABLE 3.9– POTABLE WATER SYSTEM CAPITAL PLAN 26
TABLE 4.1 – HISTORICAL LIFT STATION FLOWS....29
TABLE 4.2 – COMPARISON OF WASTEWATER GENERATION RATES TO WATER USAGE RATES 31
TABLE 4.3 – CURRENT AND PROJECTED PEAK WASTEWATER FLOWS 32
TABLE 4.4 – ESTIMATED WASTEWATER LAGOON CAPACITY....42
TABLE 4.5 – 2045 REQUIRED WASTEWATER LAGOON CAPACITY....42
TABLE 4.6 – WASTEWATER SYSTEM CAPITAL PLAN 47
TABLE 5.1– IDF EQUATION COEFFICIENTS....57
TABLE 5.2 – STORMWATER RUN OFF (EXISTING)....59
TABLE 5.3– STORMWATER SYSTEM CAPITAL PLAN....63
TABLE 6.1 – ROADWAY CLASSIFICATION 65
TABLE 6.2 – EXISTING ROAD STRUCTURES....66
TABLE 6.3 – EXISTING PATHWAY STRUCTURES 66
TABLE 6.4 – DISTRESS TYPES FOR FLEXIBLE PAVEMENTS 69
TABLE 6.5 – DISTRESS TYPES FOR GRAVEL ROADS....72
TABLE 6.6 – DISTRESS TYPES FOR CONCRETE SIDEWALKS 74
TABLE 6.7 – TRANSPORTATION NETWORK CAPITAL PLANNING....79
TABLE 7.1 – HIGH PRIORITY UPGRADES FOR THE VILLAGE OF STIRLING 82
TABLE 7.2 – MEDIUM PRIORITY PROJECTS FOR THE VILLAGE OF STIRLING....82

LIST OF FIGURES

FIGURE 1.1 – LOCATION PLAN AND STUDY AREA 3
FIGURE 2.1 – PROJECTED DEVELOPMENT BY LAND USE AREA 5
FIGURE 2.2 – COUNTY LAND USE AREAS 6
FIGURE 3.1 –POTABLE WATER SUPPLY OVERVIEW 11
FIGURE 3.2 – STIRLING POTABLE WATER RESERVOIR – VIDEO INSPECTION PHOTOS 12
FIGURE 3.3 – STIRLING WATER PLANT FACILITY AND PIPING 13
FIGURE 3.4 – EXISTING POTABLE WATER DISTRIBUTION SYSTEM PIPE MATERIALS 16
FIGURE 3.5 – EXISTING POTABLE WATER DISTRIBUTION SYSTEM PIPE SIZES 17
FIGURE 3.6 – BULK FILL STATION EXTERIOR 18
FIGURE 3.7 – POTABLE WATER SYSTEM PROPOSED UPGRADES – POTABLE WATER SUPPLY 22
FIGURE 3.8 – KIOSK TYPE ENCLOSURE FOR POTABLE WATER PIPING 23
FIGURE 3.9 – POTABLE WATER SYSTEM PROPOSED UPGRADES – DISTRIBUTION SYSTEM 25
FIGURE 4.1 – EXISTING WASTEWATER COLLECTION SYSTEM PIPE MATERIALS AND SIZES 33
FIGURE 4.2 – EXISTING WASTEWATER COLLECTION SYSTEM – CONDITION ASSESSMENT 35
FIGURE 4.3 – VILLAGE WASTEWATER LIFT STATION 37
FIGURE 4.4 –WASTEWATER LIFT STATION, FORCEMAIN ALIGNMENT, AND WASTEWATER LAGOONS 38
FIGURE 4.5 – VILLAGE WASTEWATER LIFT STATION – PUMPING CONFIGURATION 39
FIGURE 4.6 – LIFT STATION WET WELL 40
FIGURE 4.7 – WASTEWATER COLLECTION SYSTEM PROPOSED UPGRADES 44
FIGURE 4.8 – WASTEWATER LIFT STATION, FORCEMAIN, AND WASTEWATER LAGOONS PROPOSED UPGRADES 46
FIGURE 5.1 – PONDING AT SOCCER FIELDS AT THE INTERSECTION OF 2ND STREET AND 5TH AVENUE 48
FIGURE 5.2 – LOCALIZED PONDING ALONG 4TH AVENUE, WEST OF 5TH STREET 49
FIGURE 5.3 – LOCALIZED PONDING NEAR INTERSECTION OF 5TH AVENUE AND 5TH STREET 49
FIGURE 5.4 – EXISTING OVERLAND DRAINAGE 51
FIGURE 5.5 – MINOR DRAINAGE SYSTEMS 54
FIGURE 5.6 – MINOR DRAINAGE SYSTEM COMPONENTS 56
FIGURE 5.7 – STORMWATER SYSTEM UPGRADES 61
FIGURE 6.1 – EXISTING ROAD STRUCTURES AND BRIDGE FILES 67
FIGURE 6.2 – EXISTING CONCRETE STRUCTURES 68
FIGURE 6.3 – EXISTING ROAD STRUCTURE CONDITION 70
FIGURE 6.4 – EXISTING CONCRETE SIDEWALK CONDITION 71
FIGURE 6.5 – PAVED ROAD CONDITION ASSESSMENT SUMMARY 72
FIGURE 6.6 – GRAVEL ROAD CONDITION ASSESSMENT SUMMARY 73
FIGURE 6.7 – CONCRETE SIDEWALK CONDITION ASSESSMENT SUMMARY 74
FIGURE 6.8 – TRANSPORTATION NETWORK PROPOSED UPGRADES 77

1 INTRODUCTION

1.1 EVALUATION BACKGROUND

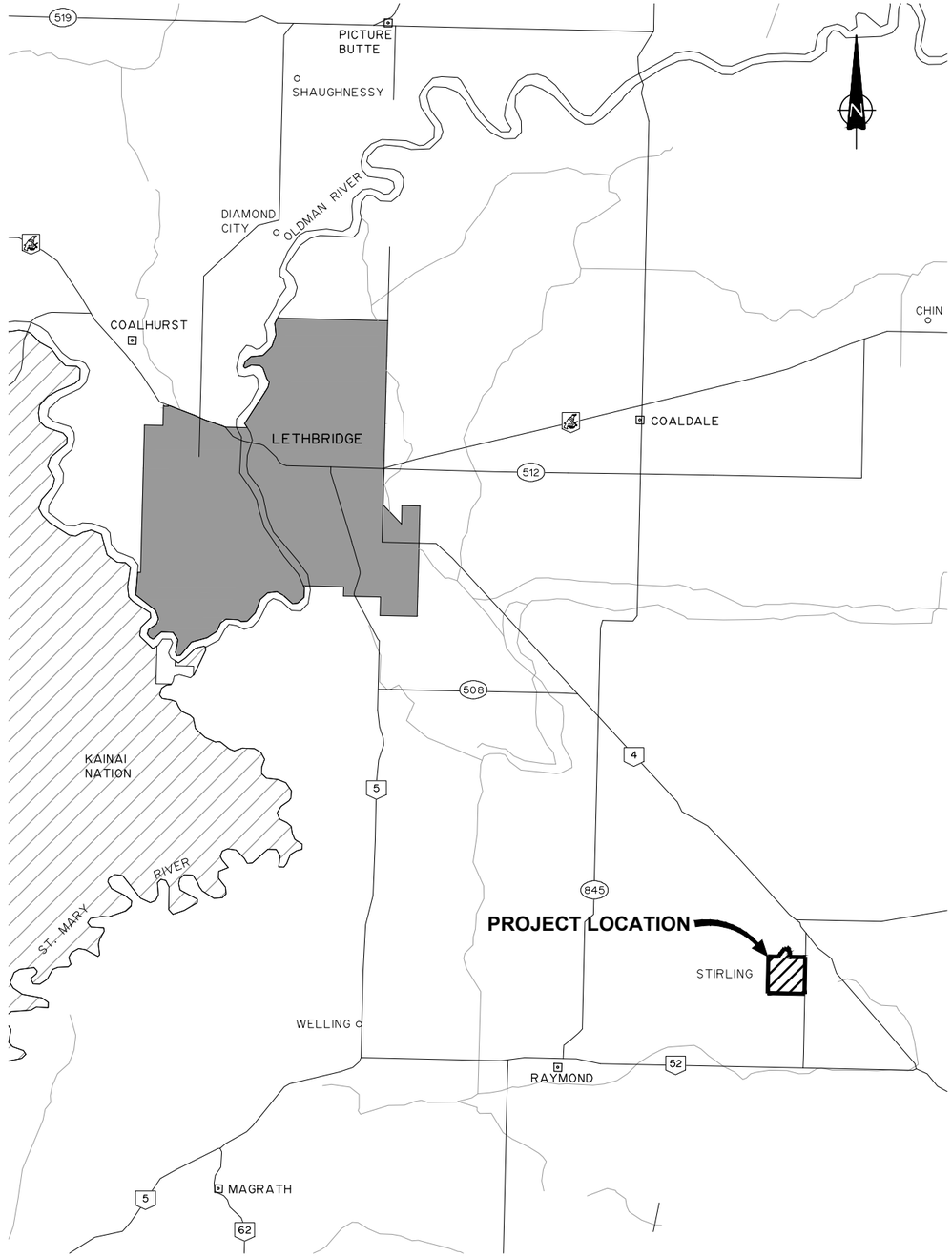
The Village of Stirling (Village) retained MPE Engineering Ltd. (MPE) to complete an evaluation of the potable water, wastewater, stormwater, and transportation infrastructure owned and operated by the Village. The purpose of this study is to identify deficiencies, develop plans to correct those deficiencies, and identify upgrades to service potential development. Figure 1.1 is a location plan showing the Village in relation to other communities in southern Alberta and the overall Village boundary.

1.2 SCOPE OF WORK

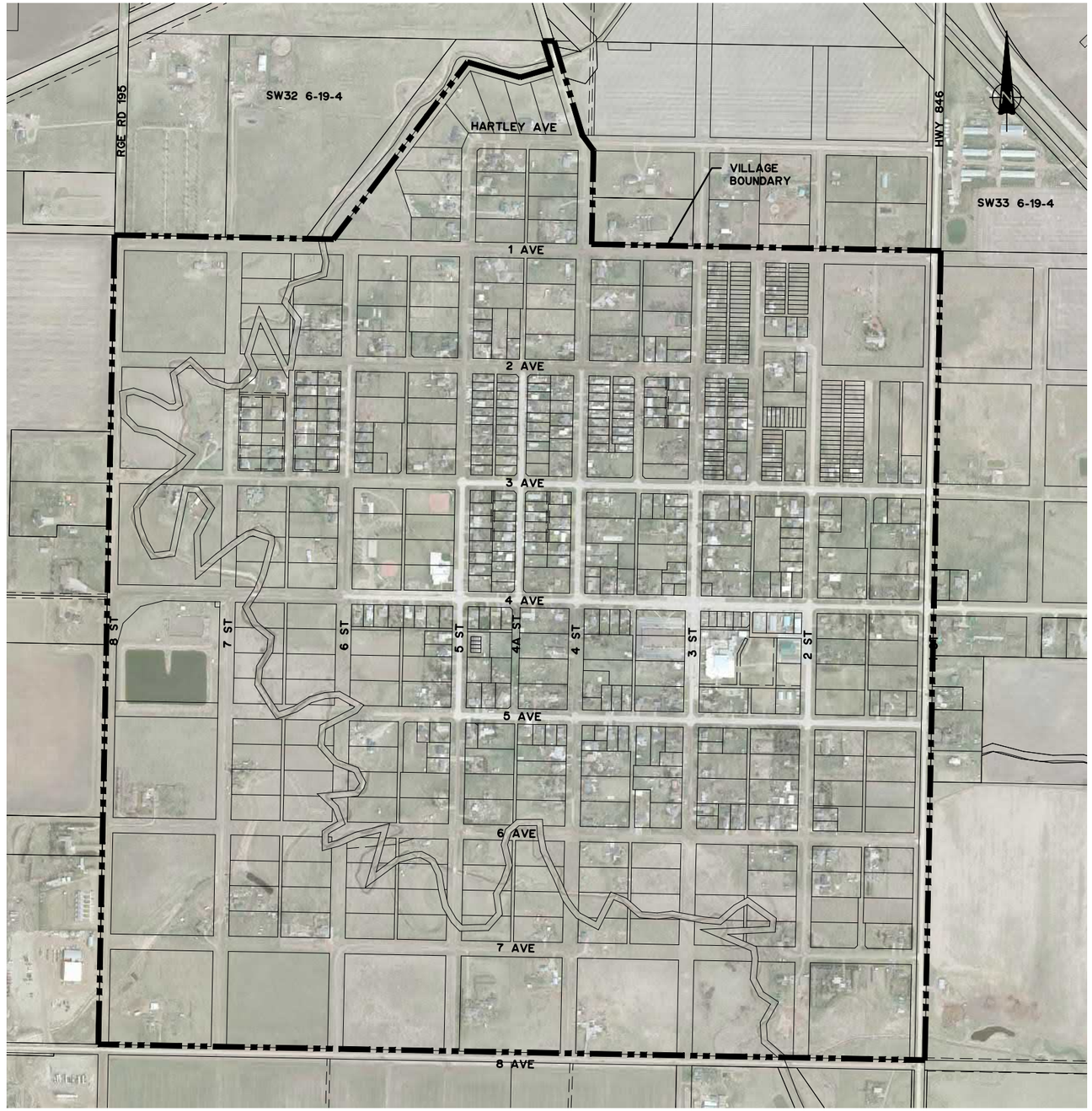
In general, the tasks included in this study are the following:

- Collection and review of all reports, data, plans, drawings, digital base maps, air photos, etc., available from the Village and others,
- General field inspection and discussion with Village staff to review all infrastructure and gather any anecdotal information that may assist the project,
- Identify future growth areas and population growth expectations for the Village,
- Potable Water System:
    - Review of the potable water reservoir facility,
    - Review of water distribution system pipe capacity, repair and replacement history, and condition based on pipe material and installation history,
    - Update the existing WaterCAD model to reflect recent upgrades/additions and current water usage/demands,
    - Review hydrant locations and utilize WaterCAD model to determine estimated fire flow capacities,
- Wastewater System:
    - Review of the wastewater lift station,
    - Review of wastewater collection system pipe capacity, repair and replacement history, and condition based on video inspection data provided by the Village,
    - Update the existing computer model of the wastewater collection system network to identify capacity issues,
- Stormwater Management System:
    - Review of existing drainage basins and catchment areas,
    - Review of stormwater collection system pipe capacity, repair and replacement history, and condition based on video inspection data provided by the Village,
    - Review historic stormwater flooding, potential cross connections, etc. with Village staff,
    - Update the existing computer model of the stormwater management system to identify capacity issues,

- Transportation Network:
    - Complete a visual inspection of the existing roads, sidewalks, curb and gutter, and swales,
    - Assess the condition of all infrastructure (pavement, gravel roads, concrete work, etc.),
    - Establish a road condition rating system and rate the condition of each road,
    - Review any geometric issues with existing road infrastructure and provide recommendations for improvements,
    - Quantify required repair and enhancement work,
- Develop proposed upgrades/improvements for existing infrastructure that does not meet the Village's minimum level of service standards,
- Develop cost estimates for budgeting purposes of all recommended upgrades or improvements,
- Incorporate recommended upgrades into a capital plan for each system based on priority.



LOCATION PLAN
1:250 000



MPE Engineering Ltd.		VILLAGE OF STIRLING	
		INFRASTRUCTURE MASTER PLAN LOCATION PLAN AND STUDY AREA	
SCALE: 1:10 000	DATE: SEPTEMBER 2020	JOB: 1407-001-00	FIGURE: 1.1

2 BACKGROUND

2.1 GENERAL DESCRIPTION

The Village is located approximately 25 km southeast of the City of Lethbridge along Highway 4 in southern Alberta. The community was erected as the Village of Stirling in 1901 and has seen a steady increase in population over the last 100 years.

2.2 POPULATION PROJECTIONS

Historic population figures were obtained from Statistics Canada (www.statcan.ca) and Municipal Affairs. The census data available over the past 9 years was used to determine an average growth rate of 2.2% for the Village. This growth rate was used to project the population of the Village for the 5, 10 and 25-year design horizons reviewed in this report. The population data is presented in Table 2.1.

Table 2.1 – Projected Population for the Village of Stirling

Projected Growth Rate (%/year)	Census Data			Projected Population			
2.2	2011	2016	2018	2020	2025	2030	2045
	1,090	978	1,269	1,326	1,478	1,648	2,284

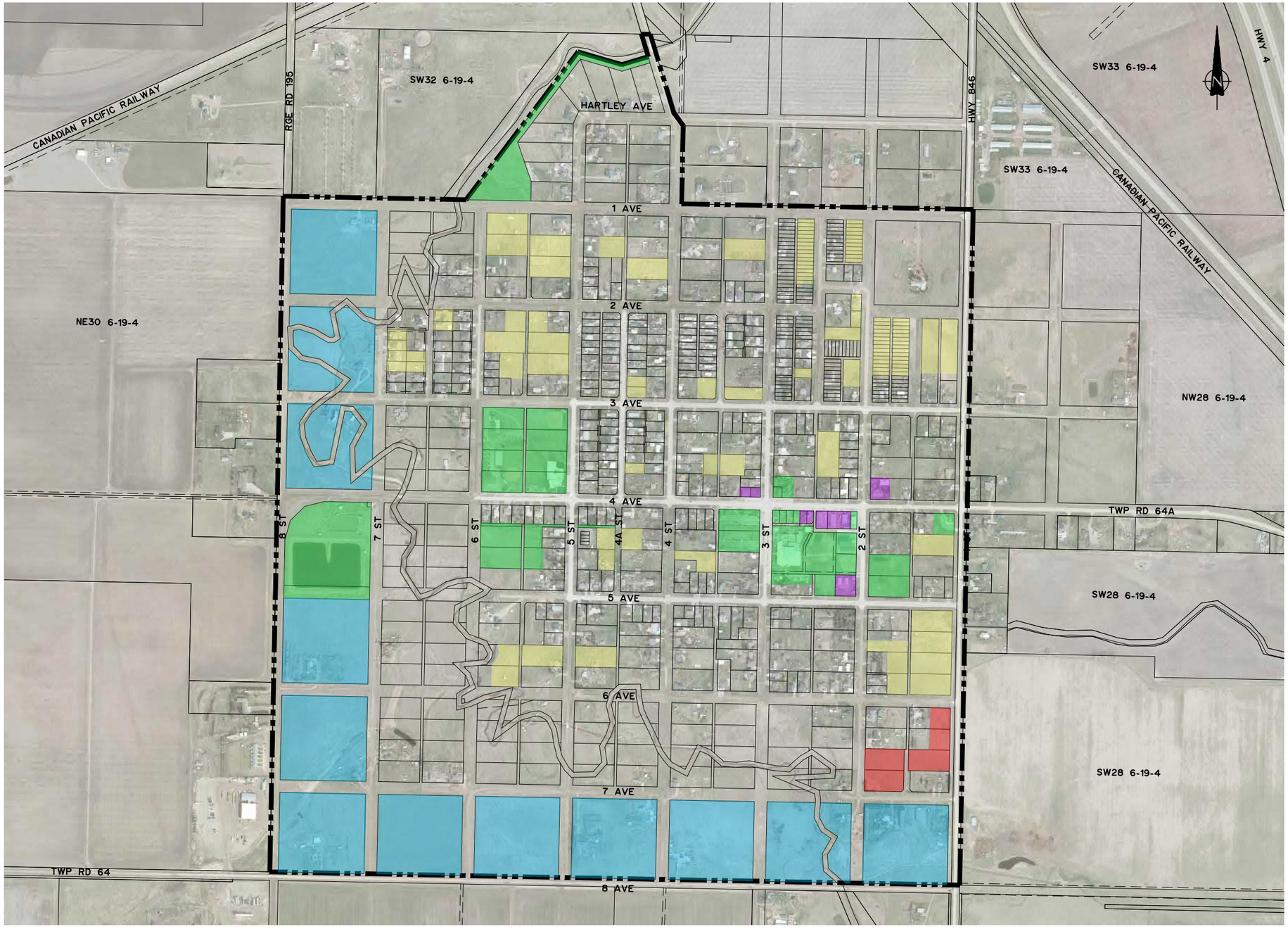
2.3 PROJECTED DEVELOPMENT

MPE reviewed potential growth areas with the Village in conjunction with available area structure plans. Figure 2.1 outlines the developable areas for residential growth while identifying areas that are designated for other land uses. The Village has a current population density of 14 people per hectare (P/ha) which was calculated based on the 2020 population shown in Table 2.1 and the residential land use area currently developed.

Based on a population density of 14 P/ha, an estimated 68 ha of undeveloped area would be required to service the 25-year growth. The additional area will likely be comprised of undeveloped areas within the Village boundary and areas obtained through annexation from County of Warner (County).

Annexed area is required for the future growth as existing undeveloped land within the Village boundary is limited by the Kipp Coulee flood boundary, historical designations, and/or is not feasible to service. The estimated annexation area discussed with the Village is shown on Figure 2.2 along with the land use areas identified in the *"Intermunicipal Development Plan" (IMDP)* between the County and Village. MPE reviewed the ability of the Village's infrastructure to service potential development in the County.

Due to the large lot sizes throughout the Village, the population density could increase over the projected timeframe as landowners subdivide their lots. Encouraging smaller lot sizes and increasing the population density may also be an approach taken by the Village to maximize the use of existing infrastructure, should the capacity of the existing systems allow for it.



LEGEND

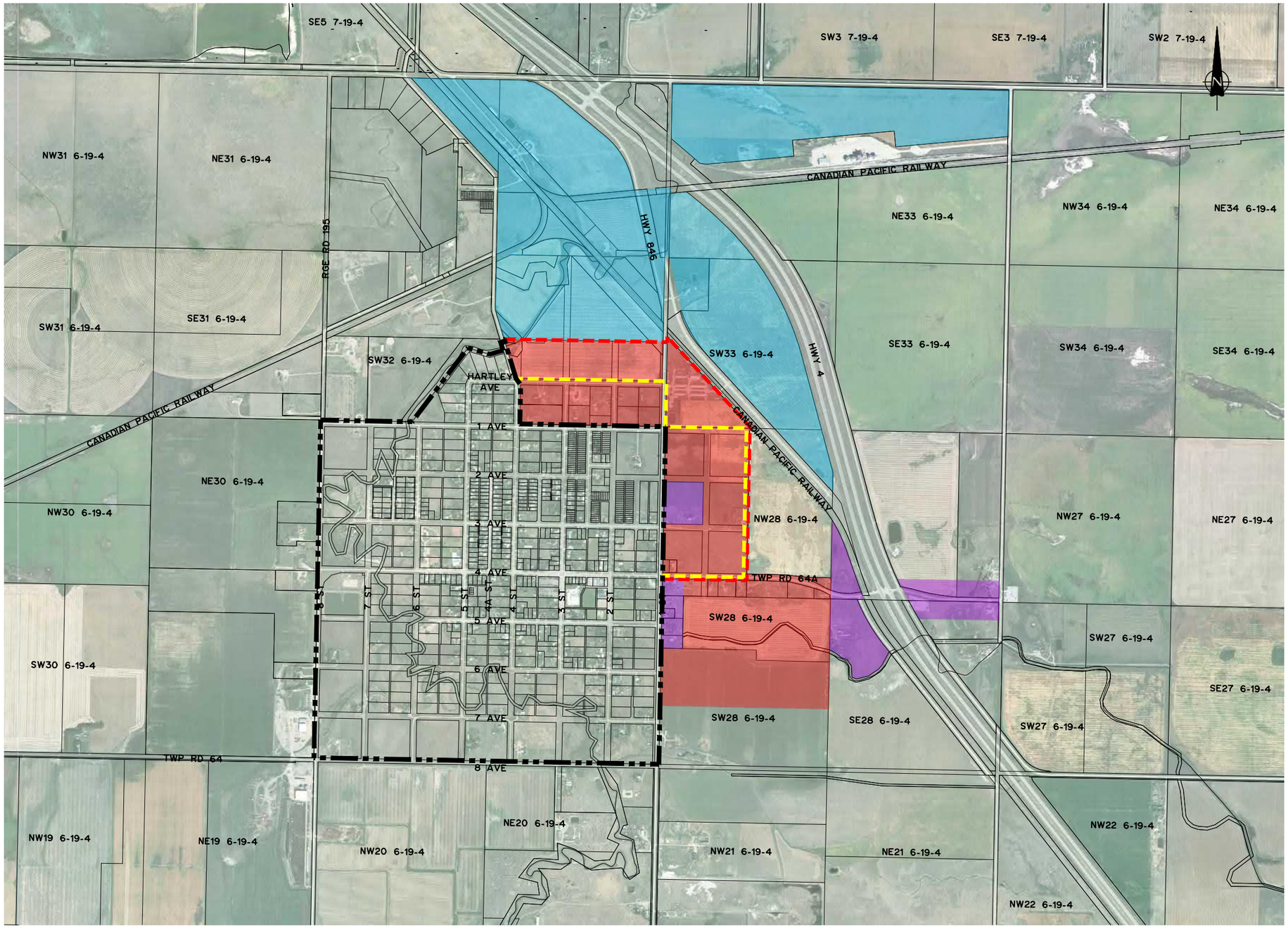
- VILLAGE BOUNDARY
- UNDEVELOPED RESIDENTIAL
- UNDEVELOPED RESIDENTIAL LARGE LOT
- COMMERCIAL LAND USE
- PUBLIC LAND USE
- AGRICULTURAL LAND USE

MPE Engineering Ltd.

VILLAGE OF STIRLING

INFRASTRUCTURE MASTER PLAN
PROJECTED DEVELOPMENT BY LAND USE AREA

SCALE: 1:10 000	DATE: SEPTEMBER 2020	JOB: 1407-001-00	FIGURE: 2.1



MPE Engineering Ltd.

VILLAGE OF STIRLING

INFRASTRUCTURE MASTER PLAN
COUNTY LAND USE AREAS

SCALE: 1:20 000	DATE: SEPTEMBER 2020	JOB: 1407-001-00	FIGURE: 2.2

3 POTABLE WATER SYSTEM ANALYSIS

MPE completed an analysis of the Village's potable water system including regional supply pipeline, potable water reservoir, potable water supply pipeline, existing potable water distribution system, and bulk fill station.

3.1 ASSUMPTIONS

The following assumptions were used in analyzing the Village's potable water system:

- Pipe sizes and materials are based on information provided by the Village,
- Hydraulic model of the distribution system has been generated based on information available from the Village,
- A minimum residual pressure of 345 kPa (50 psi) at maximum daily demand (MDD) and 310 kPa (45 psi) during peak hour demand (PHD) will be used as a guideline for assessing the hydraulic capacity of the system and utilized as the requirement for minimum level of service,
- Water demands for future commercial and industrial development are determined based on criteria outlined in the "*City of Lethbridge Design Standards 2016 Edition*"
    - Average day demand (ADD) of 20 m^3/ha/day for Commercial/Institutional areas,
    - ADD of 30 m^3/ha/day for Industrial areas,
- Water demands for future residential growth will be based on historical water consumption rates,
- The Village's potable water reservoir supplies a rural system that services an estimated 40 acreage lots and the estimated additional population serviced by the potable water reservoir to be 120 people.

3.2 CURRENT AND PROJECTED WATER DEMANDS

Historical water usage for the Village from 2016 to 2019 was reviewed. From the data it was determined that the average day demand is approximately 530 litres per capita per day (lpcd). The Maximum Day to Average Day demand ratio was calculated to be 2.79. Table 3.1 presents the data for the historical ADD, MDD and MDD/ADD ratio.

Table 3.2 presents the current and projected water demand for the Village within the 5, 10, and 25-year design horizons. For the purposes of this study, PHD was assumed to be equal to two times MDD.

The Village does operate a bulk fill station, which increases the total annual water usage recorded. A recorded volume was only available for the fall of 2019 and spring of 2020; the measured usage at the bulk fill station between September 2019 and August 2020 was approximately 12,000 m^3. This measured volume has little impact on the per capita rates and therefore the bulk fill station usage was not considered during the calculations of ADD, MDD, and PHD.

Table 3.1 – Village of Stirling Historical Water Demands

Month	Stirling Historical Water Usage				Average
	2016 (m^3)	2017 (m^3)	2018 (m^3)	2019 (m^3)	(m^3)
January	461	419	465	386	433
February	458	436	458	391	436
March	543	429	489	401	465
April	909	480	582	470	610
May	1,066	687	806	549	777
June	1,403	1,017	854	955	1,057
July	1,142	1,865	1,412	1,359	1,445
August	922	1,458	1,360	1,142	1,220
September	887	957	592	618	764
October	--	465	417	417	433
November	--	471	388	434	431
December	--	442	403	408	418
Total Year Usage	275,930	278,711	251,247	229,749	258,909
Population	1,330	1,359	1,389	1,420	--
ADD (m^3)	756	764	688	629	**709**
MDD (m^3)	1,745	2,152	1,888	1,835	**2,152**
ADD (lpcd)	620	562	496	443	**530**
MDD (lpcd)	1,661	1,583	1,359	1,292	**1,474**
MDD/ADD Ratio	2.68	2.82	2.74	2.91	**2.79**

Table 3.2 – Current and Projected Water Demands

Design Horizon	Population	Per Capita ADD (lpcd)	ADD (m^3/day)	Per Capita MDD (lpcd)	MDD (m^3/day)	PHD (m^3/day)
Current (2020)	1,446	530	766	1,478	2,137	4,274
5 Year (2025)	1,612		854		2,383	4,766
10 Year (2030)	1,798		953		2,657	5,314
25 Year (2045)	2,491		1,320		3,682	7,365

3.2.1 Fire Protection Requirements

The two main determinants of available fire protection are based on the effectiveness of the fire fighting force and on the adequacy of the water supply system. Only the adequacy of the water supply system is addressed in this report.

Based on the latest Fire Underwriters Survey (1999) (FUS) criteria, a water supply system is considered fully adequate if it can deliver the necessary fire flow at any point in the distribution system for the applicable time. It is further specified that the water supply system must be capable of delivering the necessary fire flow when water consumption is at the maximum daily rate of a normal year, i.e. maximum day demand plus fire flow. The typical flow rates noted in Table 3.3 were used as a basis to measure the ability of the distribution system to deliver water for fire protection throughout the Village.

Table 3.3 – Fire Flow and Duration Requirements

Facility Type	Fire Flow (L/min)	Fire Flow Duration (hr)
Residential	4,000	1.5
Commercial	8,000	2.0
Institutional	14,000	3.0

The commercial fire flows noted in Table 3.3 were based on the FUS recommendations for contiguous buildings. The commercial areas within the Village do not contain large buildings, and one of the primary contiguous buildings is the Village office, library, and bank.

The institutional fire flow indicated in Table 3.3 was calculated from the FUS based on an estimated building area of 6,250 m^2 and assumed non-combustible construction (unprotected metal structural components, masonry and/or metal walls) for the new school. It is understood that the school was constructed with a sprinkler system, this potentially lowers the fire flow requirements for institutional buildings in the Village. The fire flow requirement for the school needs to be confirmed with the engineer of record for the school.

3.3 POTABLE WATER SUPPLY ASSESSMENT

MPE completed an assessment of the Village's potable water supply infrastructure. The Village is suppled potable water from the Town of Raymond's (Raymond) Water Treatment Plant (WTP) via a regional supply pipeline. It is understood that the Village owns and operates the regional supply pipeline. MPE also assessed the water licenses currently held by the Village to determine the available raw water allocation.

3.3.1 Raw Water Allocation

The raw water license held by the Village (File No. 16060) states that the Village is licenced to divert up to 462,555 m^3/year (375 acre-feet per year) of raw water from the St. Mary River through the works of Raymond. Therefore, the existing raw water allocation held by the Village is sufficient for the projected demands outlined in Table 3.2 and beyond.

3.3.2 Regional Supply Pipeline

The regional supply pipeline from Raymond's WTP is 250 mm in diameter and operates by gravity. From record drawings, the supply pipeline is Series 125 polyvinyl chloride (PVC) and was installed in the early 1980s. An overview of the Village's potable water supply system can be seen on Figure 3.1.

3.3.2.1 CONDITION ASSESSMENT

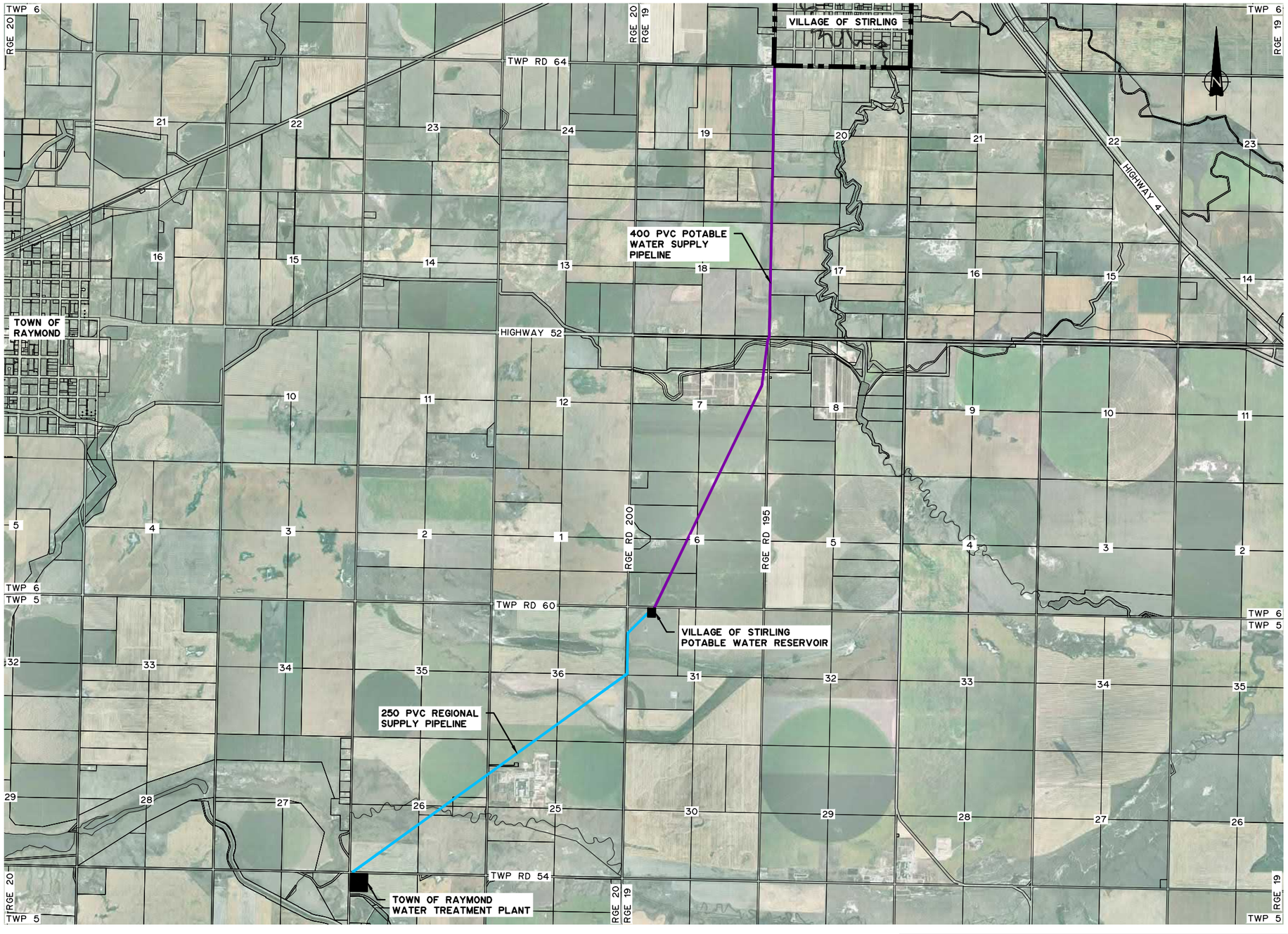
In the early 2000's, as part of the construction of the Raymond WTP, the regional supply pipeline was to undergo modifications to replace existing fittings. The modifications were to include the installation of three (3) new combination air release valves (CAVs), modifications to three (3) of the existing drains on the supply pipeline, and updated piping at the Village's existing building and reservoir to control water levels and flow. However, based on correspondence with the Village's operators, the CAVs and drains were not updated or replaced during the WTP upgrades. These fittings are now approaching 35 to 40 years old and should be replaced.

The PVC pipe materials along the regional supply pipeline are in relatively good condition, and when properly maintained, should have an expected life span of 100 years.

3.3.2.2 HYDRAULIC ANALYSIS

From available elevation data, there is 35 m of elevation difference between the Village's potable water reservoir and Raymond's WTP. The elevation difference is sufficient to provide flows up to 3,975 m^3/day to the Village's potable water reservoir. Therefore, the regional supply pipeline has sufficient capacity to meet the projected maximum day demands of the Village.

The capacity of Raymond's WTP was not assessed as part of this study. The Village should review the projected maximum day demands outlined in Table 3.2 with the WTP operators.



LEGEND

VILLAGE BOUNDARY

MPE Engineering Ltd.

VILLAGE OF STIRLING

INFRASTRUCTURE MASTER PLAN
POTABLE WATER SUPPLY OVERVIEW

SCALE: 1:50 000	DATE: SEPTEMBER 2020	JOB: 1407-001-00	FIGURE: 3.1

3.3.3 Potable Water Reservoir

The Village has one active potable water reservoir located at their old WTP site (NW 31-5-19 W4M). The potable water reservoir has one clearwell with 2,700 m^3 of storage based on available record information.

3.3.3.1 CONDITION ASSESSMENT

The potable water reservoir is a partially buried concrete structure that was constructed in the early 1980's along with the regional supply pipeline and potable water supply pipeline for the Village. The Village completes video inspections of the potable water reservoir every 5 years on average; the latest inspection videos were provided as part of this review.

The video inspections provided to MPE were completed in 2014 and below is a summary of MPE's review:

- The reservoir had an average amount of settlement and debris along the floor of the reservoir. Cleaning should be scheduled in 1 to 2 years,
- Concrete cover on reinforcing steel is minimal along locations of the reservoir walls. This could lead to deterioration in the structural integrity of the walls,
- A large crack is noticeable in the ceiling of the reservoir. The crack needs further investigation to determine the severity of the damage and potential repairs required,
- Piping within the reservoir has significant scaling and corrosion and should be scheduled for cleaning the next time the reservoir is drained.

A structural assessment of the potable water reservoir is recommended to determine the extent of the cracking in the ceiling, deterioration of the reinforcing steel, and identify concerns not noticeable in the videos.

Figure 3.2 – Stirling Potable Water Reservoir – Video Inspection Photos

Adjacent to the potable water reservoir is the old WTP building that encompasses the reservoir fill control piping and communications with Raymond's WTP. The buildings age, and large size lead to significant operation and maintenance costs for the minimal amount of equipment within. A smaller, more energy efficient alternative would be appropriate for the reservoir fill control equipment.

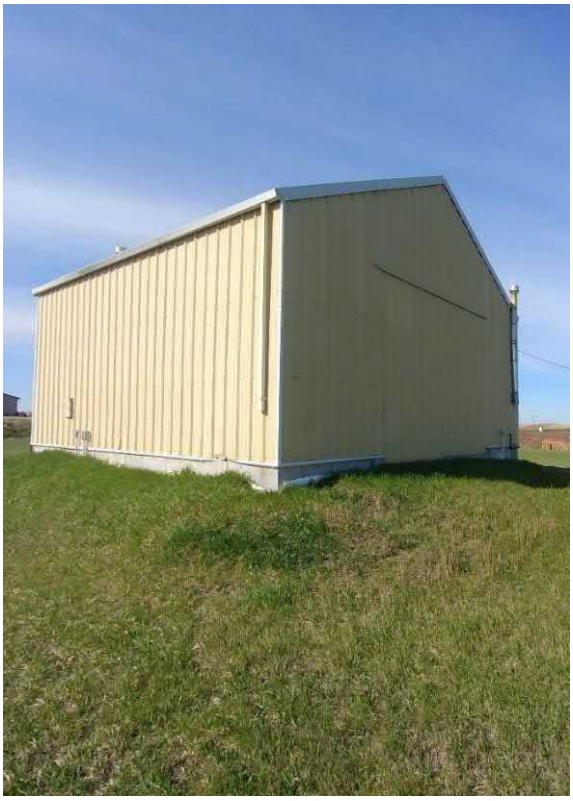


Figure 3.3 – Stirling Water Plant Facility and Piping

3.3.3.2 POTABLE WATER STORAGE ASSESSMENT

According to Alberta Environment and Park's (AEP) Standards and Guidelines for Municipal Waterworks, the potable water storage required for any community where a WTP can only provide the maximum daily design flow is determined by the following empirical relationship:

S = A + B + (the greater of C or D)

Where:
S = Total Storage Requirement (m^3)
A = Fire Storage (m^3)
B = Equalization Storage (m^3), equal to 25% of projected Max Day Demand
C = Emergency Storage (m^3), equal to 15% of projected Avg. Day Demand
D = Disinfection Contact Time (T_{10}) storage to meet CT Requirements

The level of fire protection is the responsibility of the municipality and the maximum calculated fire storage required for the Village was determined to be ***2,520 m³*** (14,000 L/min flow, 3 hr duration).

The projected maximum day and average day demands are outlined in Table 3.2 and were used to calculate the required equalization and emergency storage. Based on the projected demands, equalization storage is calculated to be ***920 m³*** and emergency storage is calculated to be ***200 m³***.

By applying these values to the AEP storage calculation, the recommended 25-year storage volume for the Village can be calculated.

S = A + B + (the greater of C or D)

S = 2,520 m^3 + 920 m^3 + 200 m^3

S = 3,640m^3

Utilizing the same formula, the current recommended storage volume for the Village is 3,170 m^3. These values are based on a maximum fire flow requirement of 14,000 L/min over 3 hours.

As the existing potable water reservoir does not have sufficient storage to meet the typical fire flow requirements outlined in Table 3.3, MPE calculated the maximum fire flow that there is sufficient storage for.

The existing storage for the Village can provide a maximum fire flow of 10,000 L/min over a 2.5-hour period plus the 25-year projected demands. The duration is based on FUS requirements for a flow between 10,000 L/min and 12,000 L/min. A flow of 10,000 L/min can provide protection to the following building sizes based on the FUS formula:

Table 3.4 – Typical Building Sizes for Current Fire Protection

Construction Type	Fire Flow (L/min)	Building Size (m^2)
Wood Frame	10,000	915
Ordinary		2,065
Non-Combustible		3,225
Fire-Resistive		5,735

Based on the values in Table 3.4, the Village has sufficient storage capacity to provide fire protection to its second largest building, the church located on the southeast corner of the intersection between 3rd Street and 4th Avenue. It was assumed the church has an estimated area of 2,000 m^2 and consists of ordinary construction (brick or other masonry walls, combustible floor, and interior).

Should the Village confirm that the newly constructed school requires 10,000 L/min or less for its sprinkler system, additional storage is not required for future development within the Village.

3.4 POTABLE WATER DISTRIBUTION SYSTEM ASSESSMENT

3.4.1 Potable Water Supply Pipeline

The potable water supply pipeline from the potable water reservoir to the Village boundary is 400 mm diameter PVC and was installed in the 1980s.

The air releases and valves located along the potable water supply pipeline have not been replaced and are approximately 40 years old. There are 3 isolation valves, 6 air release valves, and 1 surge relief valve located on the supply pipeline.

The PVC piping is in relatively good condition based on notes from the operators.

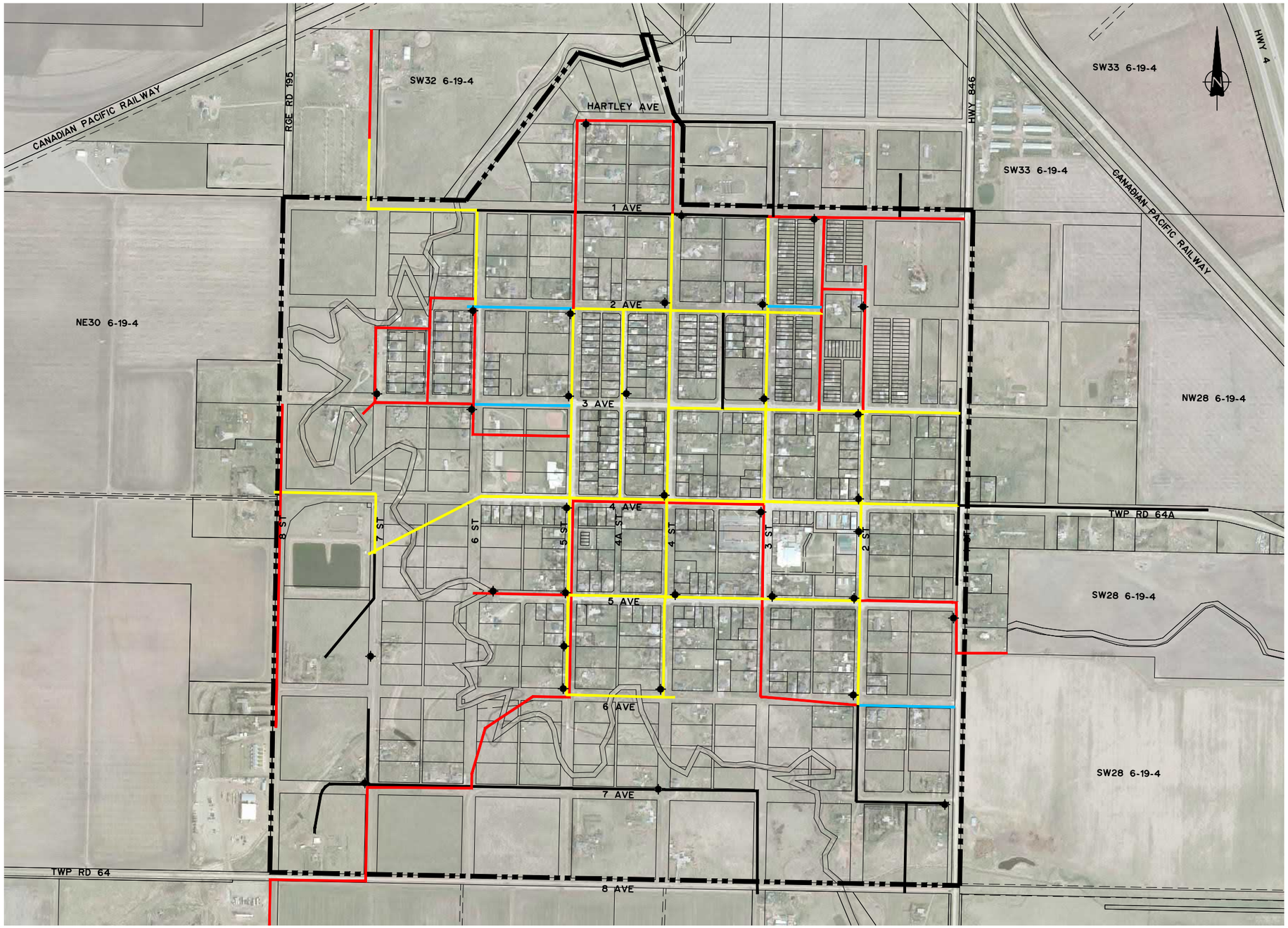
3.4.2 Existing Potable Water Distribution System

The Village's distribution system consists of pipes ranging from 50 mm to 150 mm. The primary pipe type in the Village's system is asbestos cement (AC). Figures 3.4 and 3.5 provide an overview of the existing pipe materials and sizes throughout the Village.

AC pipe typically has an average life span of 50 to 70 years; the life span of AC pipe can vary depending on the quality of water being transported. Based on a review of the information provided, it is recommended that the Village begin replacing the AC watermains. AC watermains should be upgraded to a minimum size of 150 mm, and 200mm where required for additional fire flows; the replacement should coincide with replacement of the vitrified clay tile (VCT) wastewater mains that are in poor condition if possible to be most economical.

As an alternative to pipe replacements, advancements in trenchless technologies now allow for cured-in place pipe (CIPP) lining to be utilized on watermains. This is an excellent alternative to pipe replacements where adjacent utilities are not in need of repair, the watermain is below a paved surface, and capacity upgrades are not required. Many of the Village's existing AC watermains are in areas that match this criterion.

PVC pipe is expected to have a life span more than 100 years if properly installed and maintained. There are no recommendations to replace portions of the PVC pipe unless there are maintenance or capacity concerns.



LEGEND

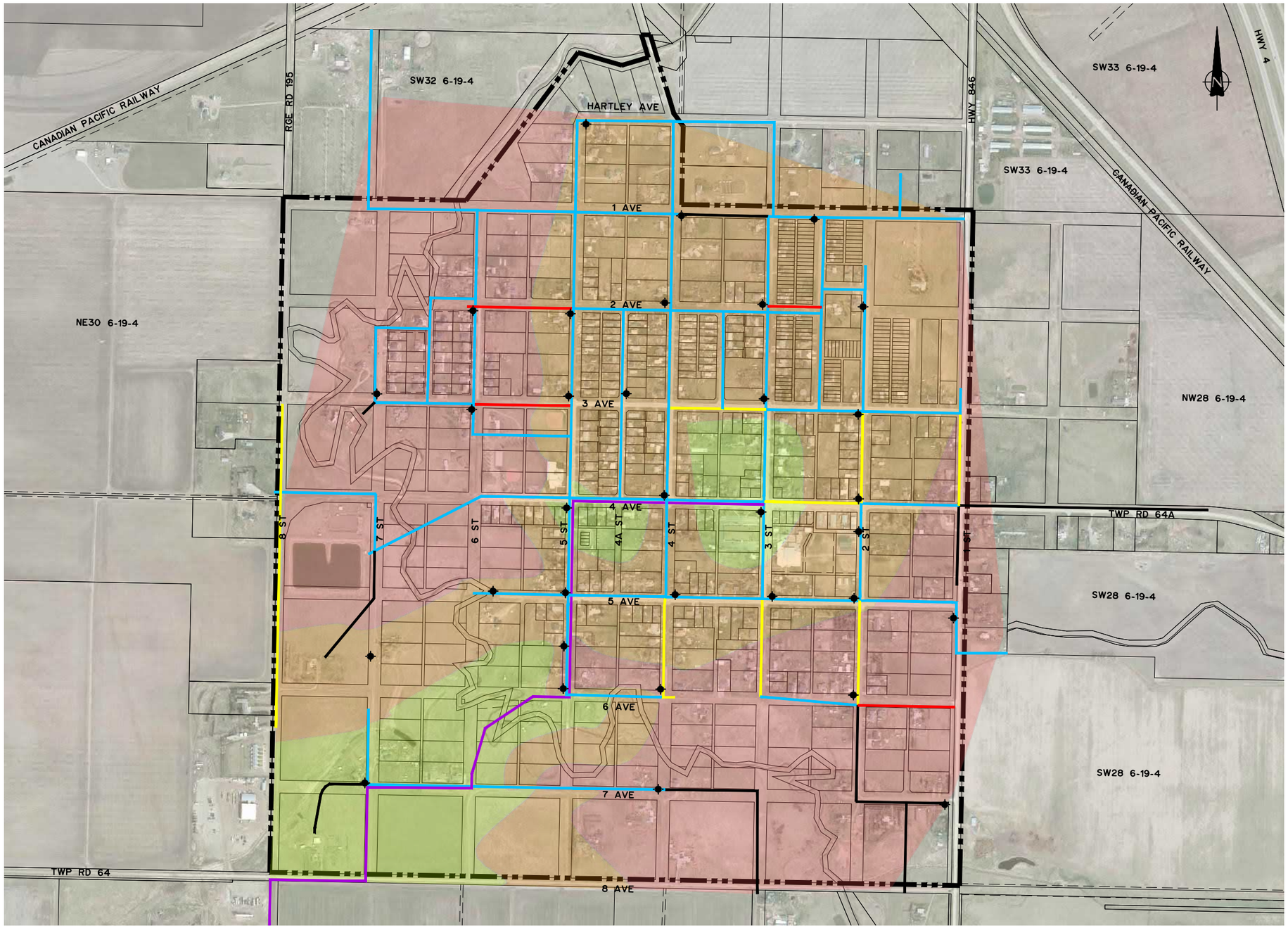
- VILLAGE BOUNDARY
- EXISTING POTABLE WATER MAIN - PVC
- EXISTING POTABLE WATER MAIN - ASBESTOS CEMENT
- EXISTING POTABLE WATER MAIN - HDPE
- EXISTING POTABLE WATER MAIN - UNKNOWN MATERIAL
- EXISTING FIRE HYDRANT

MPE Engineering Ltd.

VILLAGE OF STIRLING

INFRASTRUCTURE MASTER PLAN
EXISTING POTABLE WATER DISTRIBUTION SYSTEM
PIPE MATERIALS

SCALE: 1:10 000	DATE: SEPTEMBER 2020	JOB: 1407-001-00	FIGURE: 3.4



LEGEND

- VILLAGE BOUNDARY
- EXISTING POTABLE WATER MAIN - 50mm
- EXISTING POTABLE WATER MAIN - 100mm
- EXISTING POTABLE WATER MAIN - 150mm
- EXISTING POTABLE WATER MAIN - 400mm
- EXISTING POTABLE WATER MAIN - UNKNOWN SIZE
- EXISTING FIRE HYDRANT
- AVAILABLE FIRE FLOWS - LESS THAN 60L/S
- AVAILABLE FIRE FLOWS - 60 TO 90L/S
- AVAILABLE FIRE FLOWS - GREATER THAN 90L/S

MPE Engineering Ltd.

VILLAGE OF STIRLING

INFRASTRUCTURE MASTER PLAN
EXISTING POTABLE WATER DISTRIBUTION SYSTEM
PIPE SIZES

SCALE: 1:10 000	DATE: SEPTEMBER 2020	JOB: 1407-001-00	FIGURE: 3.5

3.4.3 Bulk Fill Station

The Village operates a bulk fill station located to the east of the Stirling Memorial Cemetery along 1st Avenue. The bulk fill station consists of a metal cladded building complete with mechanical piping and Flowpoint Environmental Systems controls (Flowpoint). The electronic payment and controls system from Flowpoint was installed in the fall of 2019.

Figure 3.6 – Bulk Fill Station Exterior

The Village operators did not express any concerns with the bulk fill station, and it appeared to be in good condition. No upgrades are recommended for the bulk fill station.

3.4.4 Hydraulic Analysis

A hydraulic analysis of the Village's water distribution system was completed using Bentley WaterCAD Connect Edition computer modelling software. The hydraulic model was created based on pipe size and pipe material information provided by the Village. The existing pipe materials and sizes provided by the Village are shown on Figures 3.4 and 3.5. MPE also reviewed historical flow testing completed by the Village and adjusted variables in the model to best represent the available data.

Scenarios were developed in the model for both current and future populations and for the various demands placed on the system (i.e. MDD, PHD, and MDD plus fire flow demand). The hydraulic analysis was used to determine if the existing facilities can provide the required level of service standards. If the level of service standards were not met, modifications to the model were made to determine upgrade alternatives based on the condition assessment.

3.4.4.1 2020 Demand Scenarios

MPE reviewed the ADD, MDD, PHD and fire flow scenarios for the 2020 values indicated in Table 3.5. The following table summarizes the results of these scenarios:

Table 3.5 – Hydraulic Analysis – 2020 Demand Scenarios

Demand Scenario	Total Flow (m^3/day)	Minimum System Pressure (kPa)	Maximum System Pressure (kPa)
ADD	766	378 (55 psi)	445 (65 psi)
MDD	2,137	365 (53 psi)	434 (63 psi)
PHD	4,274	316 (46 psi)	400 (58 psi)

Overall, the existing system can provide a suitable level of service based on current demands. The lowest calculated pressures are at the ends of smaller diameter watermains.

Estimates for the available fire flow were calculated during the 2020 MDD scenario and are outlined in Table 3.6.

Table 3.6 – Hydraulic Analysis – 2020 Available Fire Flow

Location	Calculated Available Fire Flow (L/min)
3rd Street and 4th Avenue	~ 6,300
3rd Street and 5th Avenue	~ 4,700
3rd Street and 2nd Avenue	~ 5,100
6th Street and 2nd Avenue	~ 2,600

MPE reviewed historical flow testing completed with previous reports undertaken by the Village and adjusted variables in the model to best represent the available data. The available flow testing data was completed in 2009, changes in water use and the increased age of the watermains may have impacted the available fire flow over the past 11 years.

Figure 3.5 provides a visual representation of the areas that have sufficient fire flow available for residential areas (4000 L/min). Recommended upgrades are included in Section 3.5 to improve the available fire flow in areas where the current recommended level of service is not met. Future maximum day demands were also incorporated into determining the recommended fire flow upgrades.

3.4.4.2 2030 Demand Scenarios

MPE reviewed the ADD, MDD, PHD and fire flow scenarios for the 2030 values indicated in Table 3.7. The following table summarizes the results of these scenarios:

Table 3.7 – Hydraulic Analysis – 2020 Demand Scenarios

Demand Scenario	Total Flow (m^3/day)	Minimum System Pressure (kPa)	Maximum System Pressure (kPa)
ADD	953	365 (53 psi)	445 (65 psi)
MDD	2,657	365 (51 psi)	434 (62 psi)
PHD	5,314	296 (43 psi)	380 (55 psi)

Overall, the existing system can continue to provide a suitable level of service for the projected demands in 2030. Although pressures during peak hour demand drop below the recommended values, they are within an acceptable range to be determined sufficient and upgrades are not required.

3.4.4.3 Distribution System Limitations

As seen in the previous section, the capacity of the existing distribution system can provide a suitable level of service for the 2030 projected demands. However, increased demands beyond the 2030 projections will result in the minimum level of service not being met. This is due to the limited capacity of the supply pipeline between the potable water reservoir and the Village. The following table outlines the ultimate MDD and PHD that the supply pipeline can continue to service the Village while meeting the minimum level of service.

Table 3.8 – Ultimate Supply Pipeline Capacity by Gravity

Demand Scenario	Pressure at Village Boundary (kPa)	Maximum Demand (m^3/day)
MDD	360 (50 psi)	3,283
PHD	310 (45 psi)	5,788

Based on the existing gravity distribution system, the existing potable water supply pipeline can provide an ultimate maximum day and peak hour demands of 3,283 m^3/day and 5,788 m^3, respectively. This is equivalent to a population of approximately 2,200 (20-year growth) based on current per capita demands.

3.4.4.4 HYDRAULIC ANALYSIS SUMMARY

Overall, the existing potable water supply pipeline to the Village boundary and the distribution system should be capable of meeting the minimum level of service requirements outlined in Section 3.1 until 2040 based on current and projected water demands and growth rates. However, historical data suggests that water usage throughout the Village is becoming more efficient and per capita demands are decreasing. If per capita demands continue to decrease, upgrades to the potable water supply pipeline may not be required in the next 25 years. The Village should continue to monitor their annual usage rates to determine when the upgrades will be required.

The existing distribution system can provide typical residential fire flows (4,000 L/min) throughout a large portion of the Village. However, upgrades are required to increase the available fire flows around the Village boundary. Fire flow upgrades are identified in Section 3.6 and were determine based on the ultimate maximum day demand capacity of the system.

3.5 POTABLE WATER SYSTEM UPGRADES

3.5.1 Regional and Potable Water Supply Pipelines

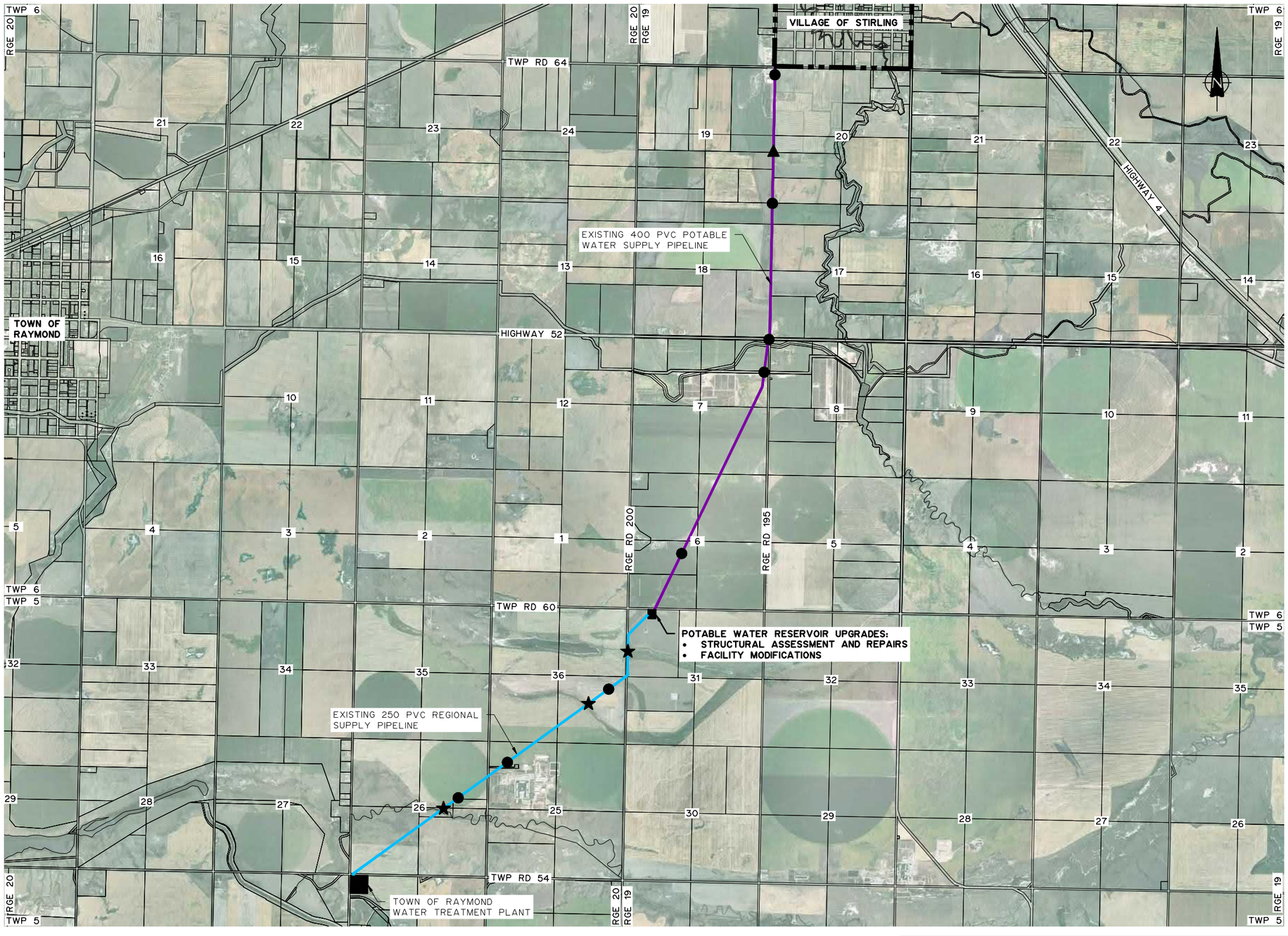
The Village's regional supply pipeline and potable water supply pipeline have sufficient capacity for the foreseeable future, however, the existing valves and fittings along both pipelines need to be replaced.

The estimated number of fittings to be replaced and/or modified are as follows:

- 3 drain chambers and associated equipment to be decommissioned.
- 9 air release valves and associated chambers,
- 4 isolation valves,
- 1 surge relief valve.

Replacing the aged fittings will provide the operators the ability to properly operate and maintain the regional supply pipeline. Upgrades related to the regional supply pipeline, potable water reservoir, and potable water supply pipeline are indicated shown on Figure 3.7.

The regional supply pipeline and potable water supply pipeline are critical pieces of infrastructure for the Village and the replacement of failed/aging valves and fittings should be a high priority. Critical failures would result in loss of water supply for the Village.



LEGEND

- VILLAGE BOUNDARY
- AIR RELEASE REPLACEMENT
- SURGE RELIEF VALVE REPLACEMENT
- DECOMMISSION DRAIN CHAMBER

MPE Engineering Ltd.

VILLAGE OF STIRLING

INFRASTRUCTURE MASTER PLAN
POTABLE WATER SYSTEM PROPOSED UPGRADES
POTABLE WATER SUPPLY

SCALE: 1:50 000	DATE: SEPTEMBER 2020	JOB: 1407-001-00	FIGURE: 3.7

3.5.2 Potable Water Reservoir

Per the video inspections provided by the Village, large cracking in the roof and a deterioration of the concrete along the reservoir walls was noted and a structural inspection of the reservoir is recommended immediately. The Village should also plan to complete all, if any, recommended upgrades to the potable water reservoir that arise from the structural assessment.

An optional upgrade that the Village may consider as well, is the replacement of the old WTP building with a smaller enclosure to reduce maintenance costs associated with the fill piping at the potable water reservoir. Figure 3.8, below, shows an example of a smaller enclosure that would be suitable for housing the equipment currently located in the large, unused building.

Figure 3.8 – Kiosk Type Enclosure for Potable Water Piping

Constructing a smaller enclosure to house the equipment required for filling the potable water reservoir would allow the Village to abandon the old WTP or utilize it for another function to reduce operational costs.

3.5.3 Potable Water Distribution System

3.5.3.1 Existing Pipe Replacements

It is recommended that the Village begin replacing and/or rehabilitating AC watermains throughout the distribution system. AC watermains should be upgraded to a minimum size of 150 mm, and 200mm where required for additional fire flows; the replacement projects are to coincide with replacement of the VCT wastewater mains that are in poor condition, if possible. Cost estimates for the recommended replacements have been provided in Section 3.6 and are shown on Figure 3.9.

3.5.3.2 WATERMAIN LINING PROJECTS

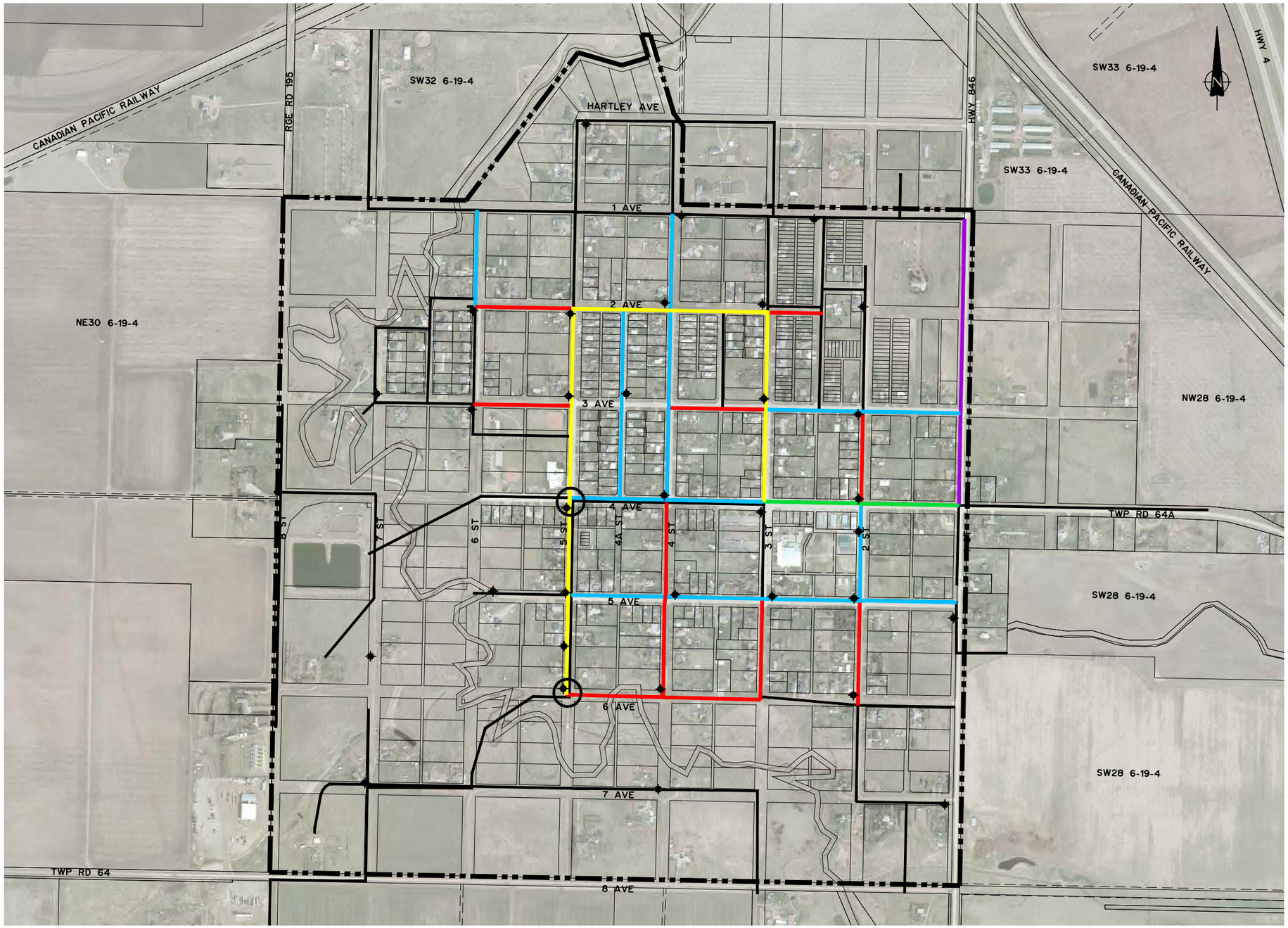
Many of the watermains throughout the central portion of the Village are in areas where it is not cost effective to complete full replacements and CIPP lining is recommended. A phased approach, as outlined in Section 3.6, could see that all existing AC watermains that do not need to be replaced are lined over the next 25 years. During the CIPP lining of AC watermains, all valves and hydrants will be replaced, and leaking services will be repaired. Locations recommended for CIPP lining can be seen on Figure 3.9.

3.5.3.3 FIRE CAPACITY UPGRADES

The existing distribution system can provide residential fire flows throughout most of the Village. As shown on Figures 3.5, perimeter areas of the Village cannot provide a recommended fire flow of 4,000 L/min (66.7 L/s). Recommended upgrades to improve the overall level of fire protection are shown on Figure 3.9. Watermain replacements for improving fire flow capacity throughout the Village will coincide with the recommendations to replace existing/aged AC watermains.

The recommended upgrades to the distribution system to improve the overall fire flow include additional connections to the potable water supply pipeline, and the following watermain installation and replacement projects:

- Replacement of AC watermains along 5th Street, 2nd Avenue, and 3rd Street with 200 mm diameter PVC watermains,
- Replacement of watermains on 2nd Avenue and 3rd Avenue, between 5th Street and 6th Street with 150 mm diameter PVC watermains,
- Replacement of watermains on 2nd Street and 3rd Street, between 5th Avenue and 6th Avenue with 150 mm diameter PVC watermains,
- Installation of a 150 mm diameter PVC watermain one 6th Avenue from 5th Street to 3rd Street.



LEGEND

- VILLAGE BOUNDARY
- EXISTING POTABLE WATER MAIN
- EXISTING FIRE HYDRANT
- 150mm WATER MAIN INSTALLATION
- 200mm WATER MAIN INSTALLATION
- 300mm WATER MAIN INSTALLATION
- WATER MAIN LINING PROJECT
- NORTHWEST SERVICING PROJECT
- ADDITIONAL SUPPLY LINE CONNECTION

MPE Engineering Ltd.

VILLAGE OF STIRLING

INFRASTRUCTURE MASTER PLAN
POTABLE WATER SYSTEM PROPOSED UPGRADES
DISTRIBUTION SYSTEM

SCALE: 1:10 000	DATE: SEPTEMBER 2020	JOB: 1407-001-00	FIGURE: 3.9

3.5.3.4 FUTURE SERVICING UPGRADES

As outlined in Section 2.3, the Village has the potential to accommodate significant population growth within the existing developed areas based on the current population density and lot sizes. The existing distribution system can provide the minimum level of service to the expected growth based on the upgrades required for additional fire capacity and replacement of AC watermains.

Areas for growth within potential annexation areas and the County, per the IMDP, are capable of being serviced by the Village's distribution system once upgrades for fire capacity are completed. However, the Village's existing system is not capable of providing sufficient fire protection to development in the County without further upgrades. These upgrades would include extending the potable water supply pipeline to 1st Street with a 300 mm diameter PVC watermain, and installing a 200 mm diameter PVC watermain down 1st Street to connect dead ends and create a looped distribution system down to 1st Avenue.

3.6 POTABLE WATER SYSTEM COST ESTIMATES

Order of magnitude cost estimates have been prepared for the upgrades recommended in Section 3.5. Detailed cost estimates can be found in Appendix A, and Table 3.9 provides a summary of the estimated costs.

Table 3.9– Potable Water System Capital Plan

Location	Project	Estimated Cost
Regional and Potable Water Supply Pipeline	Valve and Fitting Replacements	$320,000
Potable Water Reservoir	Structural Assessment	$7,500
	Structural Repair Allowance	$200,000
	Pump Station	$1,210,000
Distribution System	Additional Water Supply Connections	$120,000
3rd Street – 5th Ave to 6th Ave	150 mm Watermain Installation	$290,000
3rd Ave – 6th Street to 5th Street		$280,000
3rd Street – 3rd Ave to 2nd Ave	200 mm Watermain Installation	$440,000

Location	Project	Estimated Cost
6th Ave – 5th Street to 3rd Street	200 mm Watermain Installation	$570,000
1st Street – 4th Ave to 1st Ave		$1,150,000
3rd Street – 4th Ave to 3rd Ave		$440,000
5th Street – 4th Ave to 2nd Ave		$740,000
2nd Ave – 5th Street to 3rd Street		$640,000
2nd Ave – 6th Street to 5th Street	150 mm Watermain Installation	$280,000
4th Street – 6th Ave to 5th Ave		$320,000
2nd Street – 5th Ave to 6th Ave		$300,000
4th Street – 4th Ave to 5th Ave		$310,000
2nd Ave – 3rd Street to 2A Street		$760,000
2nd Street – 3rd Ave to 4th Ave		
3rd Ave – 3rd Street to 4th Street		
5th Street – 4th Ave to 6th Ave	200 mm Watermain Installation	$620,000
4th Ave – 3rd Street to 1st Street	300 mm Watermain Installation	$850,000
Watermain Lining Program: Phase 1 – 5th Ave and 2nd Street		$1,500,000
Watermain Lining Program: Phase 2 – 4th Avenue & 4th Street		$1,500,000
Watermain Lining Program: Phase 3 – Various Locations		$1,500,000

4 WASTEWATER SYSTEM ANALYSIS

The Village's wastewater infrastructure consists of a typical gravity collection system and utilizes one lift station to convey wastewater to the treatment system. Conventional wastewater lagoons are utilized to treat and store the collected wastewater.

4.1 ASSUMPTIONS

The following assumptions were used in analyzing the Village's wastewater system:

- Pipe sizes and materials are based on information provided by the Village,
- Hydraulic model of the Village's system has been generated based on available information from the Village and survey data collected by MPE,
- Modelled wastewater generation rates for future residential, commercial, and industrial development are determined utilizing criteria outlined in the City of Lethbridge 2016 Design Standards,
    - Population density of 30 persons/ha for Residential areas, with a Dry Weather Flow (DWF) rate of 400 litres per capita per day (lpcd),
    - DWF rate of 20 m^3/ha/day for Commercial/Institutional areas,
    - DWF rate of 30 m^3/ha/day for Industrial areas,
    - Wet weather inflow and infiltration rates of 500 lpcd for all new residential areas and 7.5 m^3/ha/d for Commercial/Institutional/Industrial areas.

4.2 CURRENT WASTEWATER FLOWS

Historical wastewater records for the Village from 2016 to 2019 were reviewed. From the data, Average Day Flow (ADF), Dry Weather Flow (DWF), Peak Wet Weather Flow (PWWF), and Inflow/Infiltration (I/I) values were determined.

Wastewater flows during the dry weather periods, typically the fall and winter months (October to February), were used to determine the average DWF. From the data it was determined that the average DWF is 199 lpcd. The ADF was determined to be 216 lpcd. Based on the wet weather periods, typically the spring and summer months, the PWWF was calculated to be approximately 619 lpcd. The difference between PWWF and DWF provides an indication of I/I into the wastewater system. Table 4.1 presents the data for the historical ADF, DWF, PWWF, and I/I.

Table 4.1 – Historical Lift Station Flows

Month	Average Daily Flows				Average
	2016 (m^3)	2017 (m^3)	2018 (m^3)	2019 (m^3)	(m^3)
January	277	242	191	216	231
February	254	234	146	205	210
March	276	253	287	215	258
April	472	263	384	219	335
May	461	286	302	233	321
June	418	304	317	249	322
July	437	261	262	245	301
August	419	243	228	233	281
September	363	246	285	220	278
October	240	270	217	235	240
November	232	276	214	224	236
December	236	259	217	231	236
Total Year Usage	124,057	95,352	91,444	82,953	98,914
Population	1,215	1,242	1,269	1,297	--
ADF (m^3)	340	261	251	227	**300**
DWF (m^3)	284	256	197	222	**270**
PWWF (m^3)	752	416	667	545	**752**
ADF (lpcd)	280	210	197	175	**216**
DWF (lpcd)	234	207	186	170	**199**
PWWF (lpcd)	619	335	526	420	**619**
I/I (lpcd)	385	128	339	250	**420**

4.2.1 Inflow/Infiltration

Discussions with the Village indicate that the wastewater collection system is susceptible to significant I/I due to household sumps and foundation drains having direct connections. Based on the historical wastewater records reviewed between 2016 and 2019, the theoretical I/I rate was calculated to be 420 lpcd. However, it can be assumed that the actual I/I rate is much higher due to the following:

- During significant rainfall events, the Village's lift station is incapable of matching the PWWF,
- Due to limited pumping capacity, the wet well surcharges and the Village utilizes portable pumps to divert wastewater to a nearby low area,
- Once lift station capacity is available (reduced wastewater flows), the Village pumps the previously diverted wastewater back into the wet well.

The above sequence of events would cause flow monitoring to record a reduced I/I rate as wastewater flow is diverted out of the wet well, then back in later. Flow monitoring throughout the Village would need to be completed over a long period of time to accurately evaluate I/I rates. I/I rates are discussed in following sections during the assessment of available capacity in the wastewater system.

Although actual I/I rates are not known, it is recommended that the Village take the following actions to reduce the I/I potential:

- Complete stormwater improvements and road projects throughout the Village to allow for adequate drainage from private residences,
- Prohibit all new developments from having direct connections from sumps and foundation drains to the wastewater system,
- Work towards the removal and disconnection of all existing sump and foundation drain connections to the wastewater system.

It is also expected that improvements completed throughout the wastewater collection system will reduce the I/I potential throughout the Village.

4.2.2 Water Use and Wastewater Generation

Upon reviewing the current and projected wastewater flows, the historical values for both water use and wastewater generation were compared to provide additional insight on both systems.

As outlined in Table 4.2, the Village's average wastewater generation rate is equal to 40% of the average water use for the past 4 years (2016 to 2019). For perspective, current design standards and many municipalities often target a ratio of 0.8 to 0.9; meaning that wastewater generation rates are equal to 80% to 90% of water use.

Table 4.2 – Comparison of Wastewater Generation Rates to Water Usage Rates

Year	Water Average Day Demand (lpcd)	Wastewater Average Daily Flow (lpcd)	Ratio
2016	620	280	0.45
2017	562	210	0.37
2018	496	197	0.40
2019	443	175	0.40

The average ratio outlined in Table 4.2 is equal to 0.41; however, considering an average usage at the bulk fill station of 15,000 to 25,000 m^3 annually, the ratio may be closer to 0.45.

The Village's ratio of 45% could be indicative of the following, within both the water and wastewater systems:

- **Water:**
  - Significant water use is for recreational and lawn maintenance purposes,
    - This is reasonable to expect given the large lot sizes throughout the Village,
  - Leaks throughout the water distribution system,
    - A potential cause due to the amount of existing AC watermains throughout the Village, however, operators did not indicate a concern with numerous leaks.
- **Wastewater:**
  - Inaccurate wastewater flow monitoring,
    - A potential cause of the discrepancy as the type of flow monitoring equipment utilized at the lift station is susceptible to errors if not properly installed or calibrated,
    - Using the theoretical design capacity of the pumps, the ratio of measured flow to calculated theoretical flow based on the pump operating hours was equal to 89% for 2016 and 2017, and 70% for 2018 and 2019.

The items listed above are potential causes for the significant variation between water use and wastewater generation, but additional investigation is required to verify the direct cause.

4.3 PROJECTED WASTEWATER FLOWS

Table 4.3 presents the current and projected wastewater flows for the Village within the proposed design horizons. All values are calculated using the average values outlined in Table 4.1.

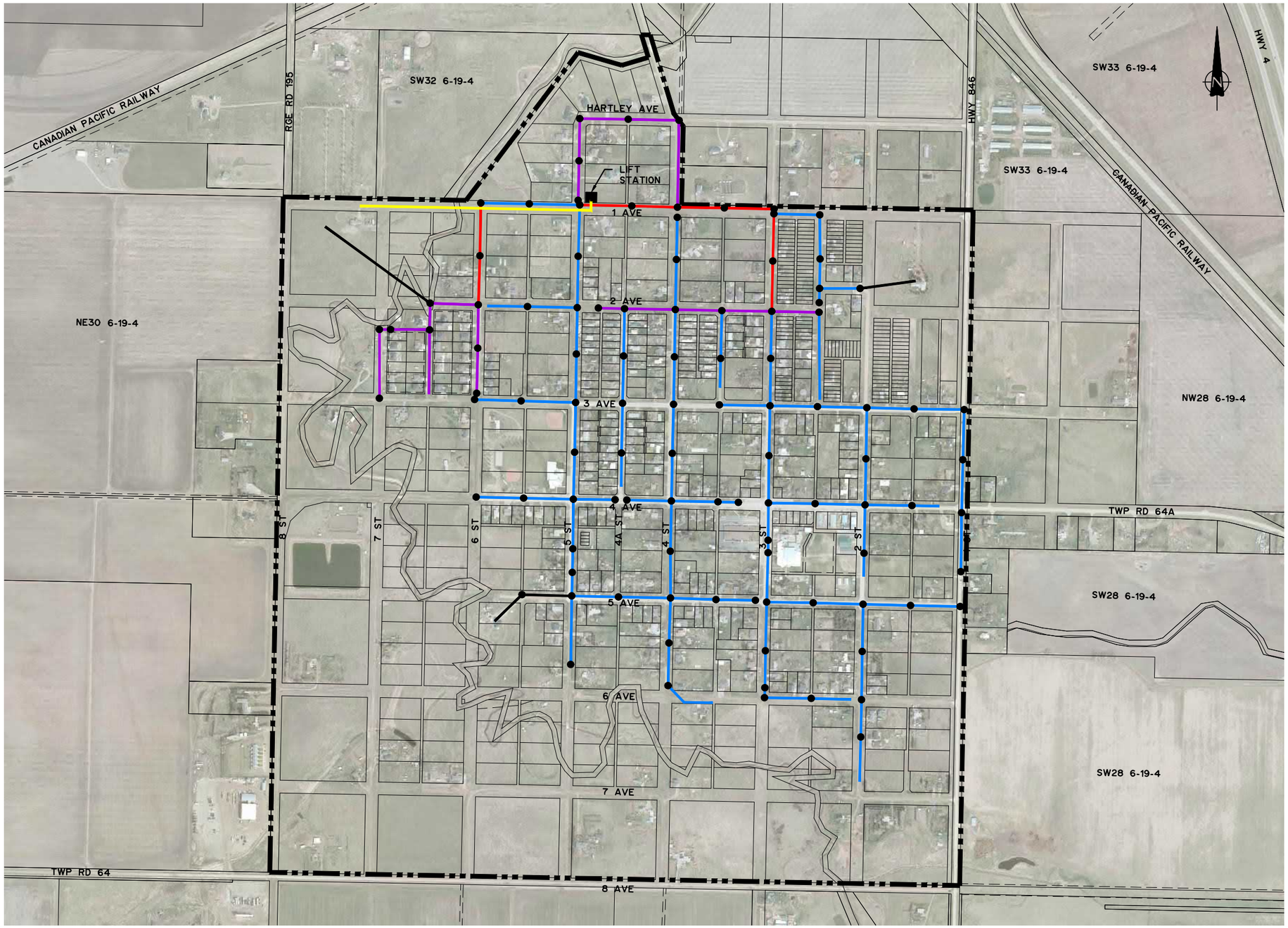
Table 4.3 – Current and Projected Peak Wastewater Flows

Design Horizon	Population	Dry Weather - Residential				Inflow / Infiltration	Total Peak Wet Weather Flow (m^3/day)
		Per Capita Flow (Lpcd)	Average Day (m^3/day)	Harmon Peaking Factor	Peak Flow (m^3/day)	Inflow Allowance (m^3/day)	
Current (2020)	1,326	199	264	3.72	982	2,122	3,104
5 Year (2025)	1,478		294	3.68	1,085	2,365	3,450
10 Year (2030)	1,648		328	3.65	1,198	2,637	3,835
25 Year (2045)	2,248		448	3.55	1,588	3,597	5,185

As discussed in previous sections, the measured I/I rate indicated in Table 4.1 is likely inaccurate. Therefore, an I/I rate of 1600 lpcd has been used in the calculation of projected wastewater flows. This value was selected based on historical evidence that the existing lift station pumps have insufficient capacity to meet the current PWWF.

4.4 WASTEWATER COLLECTION SYSTEM ASSESSMENT

The wastewater collection system consists of pipes ranging in size from 200 mm to 250 mm diameter. Most wastewater mains in the Village are vitrified clay tile (VCT) pipe. The mains in the newer areas of the Village are PVC pipe. The existing wastewater collection system pipe materials and sizes are shown on Figure 4.1.



LEGEND

- VILLAGE BOUNDARY
- EXISTING WASTEWATER MAIN - 200mm VCT
- EXISTING WASTEWATER MAIN - 200mm PVC
- EXISTING WASTEWATER MAIN - 250mm PVC
- EXISTING WASTEWATER MAIN - UNKNOWN SIZE
- EXISTING WASTEWATER FORCE MAIN
- EXISTING WASTEWATER MANHOLE

MPE Engineering Ltd.

VILLAGE OF STIRLING

INFRASTRUCTURE MASTER PLAN
EXISTING WASTEWATER COLLECTION SYSTEM
PIPE MATERIALS AND SIZES

SCALE: 1:10 000	DATE: SEPTEMBER 2020	JOB: 1407-001-00	FIGURE: 4.1

4.4.1 Wastewater Collection System Condition Assessment

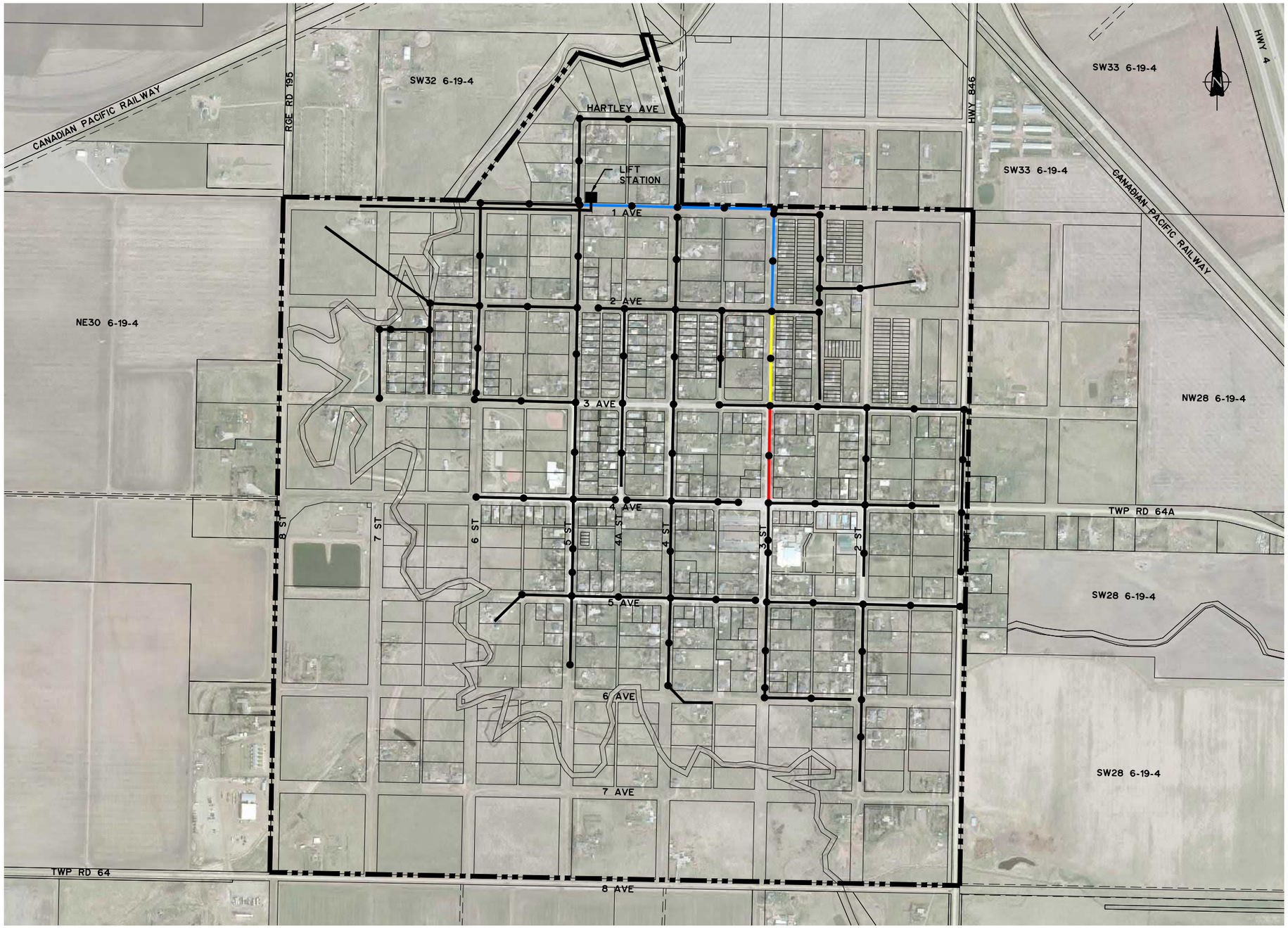
The Village completed video inspections on 6 blocks of wastewater mains. The areas that were inspected included 3rd Street from 5th Avenue to 1st Avenue, and 1st Avenue from 3rd Street to the lift station wet well. The following summarizes the results of the video inspections:

- 3rd Street – 5th Avenue to 4th Avenue (Poor Condition):
    - The Village undertook a project to replace this length of wastewater main in 2020,
- 3rd Street – 4th Avenue to 3rd Avenue (Poor Condition):
    - Structural defects, sags, and encrustations resulted in an incomplete video inspection,
- 3rd Street – 3rd Avenue to 2nd Avenue (Fair Condition):
    - VCT pipe with observed joint defects at select locations,
    - Cracking and intruding services were also observed,
- Remaining Inspected Wastewater Mains (Good Condition):
    - The remaining wastewater mains inspected along 3rd Street and 1st Avenue were PVC and considered in good condition. No structural defects or significant sags were noted.

As the Village is completing the replacement of VCT pipe along 3rd Street between 5th Avenue and 4th Avenue, it is recommended that the replacement of VCT pipe between 4th Avenue and 2nd Avenue is also completed. The wastewater mains along 3rd Street are some of the most critical throughout the Village, as they service the main commercial area and high school.

The Village should also complete video inspections of all wastewater mains in the future to determine the condition of the remaining wastewater mains. Video inspections completed in the future should follow the National Association of Sewer Service Companies (NASSCO) Pipeline Assessment Certification Program (PACP) standards which result in a more consistent method of pipeline condition evaluation. The PACP uses a numerical grading system to define the severity of defects identified by codes in the inspection videos and reports. Condition grades are given for both structural and operation and maintenance defects ranging from 1 to 5, with 1 being a minor defect, and 5 being a severe defect. The video inspections were reviewed in conjunction with the condition grades given in the reports to determine an equivalent “good”, “fair”, or “poor” rating comparable to the ratings given in past video inspection reports.

In general, mains with a rating of poor indicate that the main segment has failed or will likely fail within the next 5 years. Mains with a rating of fair have moderate to severe defects or will likely fail within the next 5 to 20 years. Mains with a rating of good have minor defects or will not likely fail for at least 20 years or in the foreseeable future. Figure 4.2 show the results of the condition assessments. Copies of the CCTV inspection reports can be found in Appendix B.



LEGEND

- VILLAGE BOUNDARY
- EXISTING WASTEWATER MAIN - GOOD CONDITION
- EXISTING WASTEWATER MAIN - FAIR CONDITION
- EXISTING WASTEWATER MAIN - POOR CONDITION
- EXISTING WASTEWATER MAIN - NOT INSPECTED
- EXISTING WASTEWATER MANHOLE

MPE Engineering Ltd.

VILLAGE OF STIRLING

INFRASTRUCTURE MASTER PLAN
EXISTING WASTEWATER COLLECTION SYSTEM
CONDITION ASSESSMENT

SCALE: 1:10 000	DATE: SEPTEMBER 2020	JOB: 1407-001-00	FIGURE: 4.2

4.4.2 Wastewater Collection System Hydraulic Analysis

A hydraulic analysis of the wastewater collection system was undertaken using PCSWMM computer modelling software. The model of the wastewater collection system was generated using information provided by the Village and surveys carried out by MPE. At locations where wastewater manholes could not be accessed to measure the inverts of incoming and outgoing pipes, inverts were calculated by interpolating the inverts of the two nearest measured inverts and/or a typical pipe slope of 0.4%.

The purpose of the analysis was to recreate the flow conditions in the system for both dry weather flow and wet weather flow. Several scenarios were modelled to analyse the current system as well as proposed infrastructure for servicing new development within the Village boundary. Wastewater flows for residential, industrial, commercial, and institutional development areas shown in Figure 2.1 and 2.2, were also added to the model to analyze the impacts of future growth.

From the hydraulic analysis of the system, no surcharging was monitored under current PWWF conditions. Any surcharging that is encountered under current conditions would be a result of the lift station wet well surcharging or defects within the existing mains causing blockages. This correlates to information provided by Village operators, who have indicated there have been no past concerns with surcharging in the collection system.

Additional wastewater generation from developments within the 10-year and 25-year growth boundaries were also modelled. Upgrades were determined based on the additional capacity required to accommodate the projected growth as surcharging was noted at the following location:

- Increased development in the core and eastern parts of the Village and County will lead to eventual surcharging in the wastewater mains near the intersection of 3rd Street and 1st Avenue,
    - Significant growth, nearing the projected 25-year population, could see surcharging reach the wastewater mains at 3rd Street and 2nd Avenue,

The computer model indicates that the wastewater mains in the west portion of the Village, along 5th Street and 6th Street, have sufficient capacity for the projected growth expected throughout these areas.

The recommended upgrades are discussed in Section 4.7. Incorporating the projected growth into the wastewater model indicated the following:

4.4.3 Wastewater Manholes

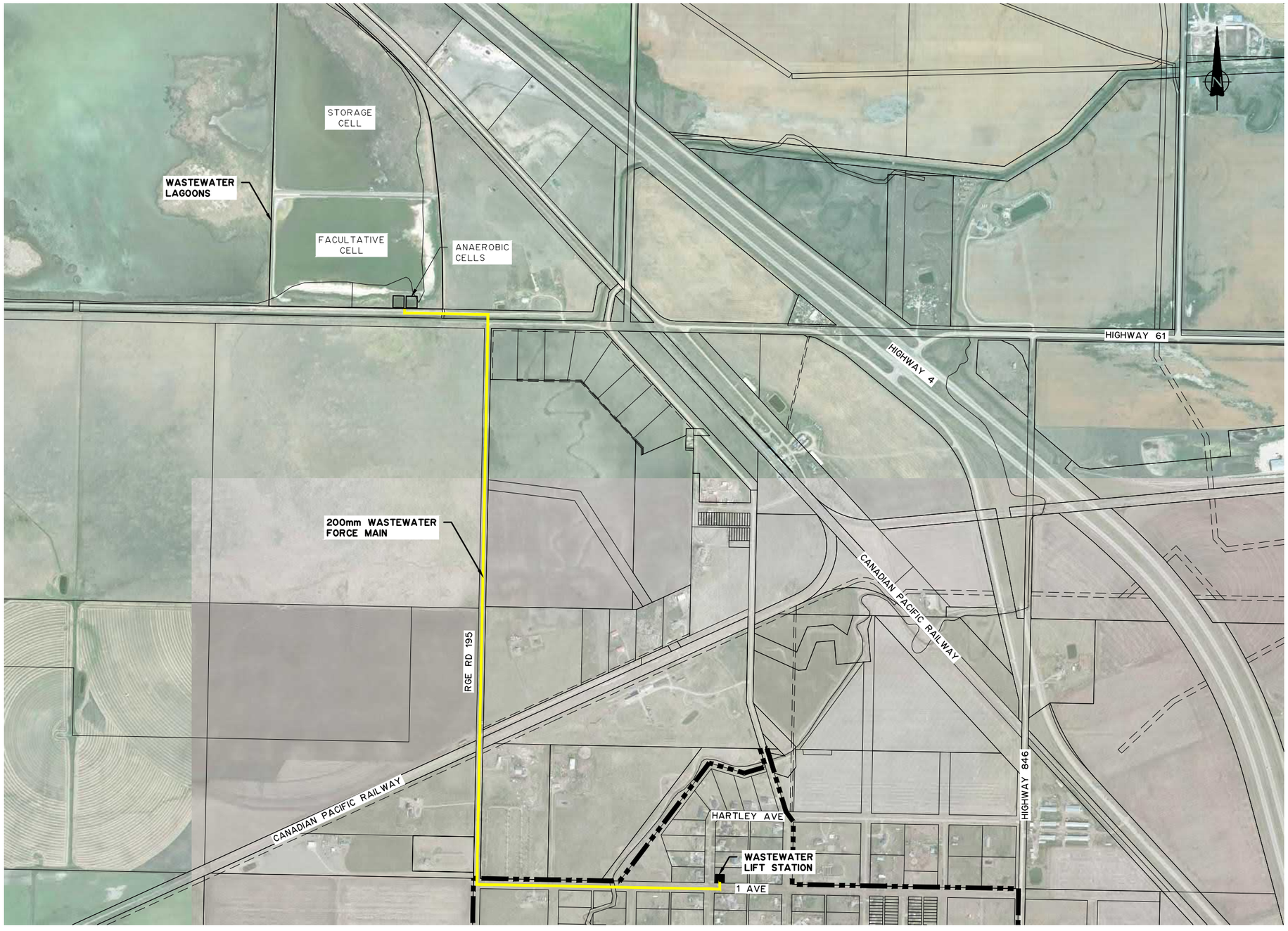
Wastewater manholes were not inspected as part of the scope of this project. It is recommended that all manholes be inspected and reviewed to assess the condition of the manholes and to schedule repairs and replacements as required.

4.5 WASTEWATER LIFT STATION AND FORCEMAIN

The Village's wastewater lift station is located at the northwest corner of the Village near the intersection of 1st Avenue and 5th Street. The wastewater is pumped to the Village's wastewater lagoons located approximately 2.8 km northwest of the Village. Figure 4.4, on the following page, provides an overview of the lift station, forcemain and wastewater lagoons.

Figure 4.3 – Village Wastewater Lift Station

The lift station was constructed in 2006 and consists of a pump building and exterior concrete wet well. The pump building contains the pumps, control system and back-up power generator; the building is constructed of wood framing supported by a shallow concrete foundation. The roof structure consists of wood trusses with asphalt shingles on the exterior and gypsum board on the interior ceiling. The main floor is a combination of fibreglass reinforced plastic (FRP) grating and a concrete slab on grade where the generator sits. A concrete dry well sits below grade and contains the pumps. The concrete flooring and walls inside the building have been epoxy coated and appear in good condition. Some cracks on the exterior concrete apron around the building were observed. The stairs, handrails, grating, and cladding appear to be in good condition.



LEGEND

VILLAGE BOUNDARY

Engineering Ltd.

VILLAGE OF STIRLING

INFRASTRUCTURE MASTER PLAN
WASTEWATER LIFT STATION, FORCE MAIN ALIGNMENT AND WASTEWATER LAGOONS

SCALE: 1:12 500	DATE: SEPTEMBER 2020	JOB: 1407-001-00	FIGURE: 4.4

The lift station is fitted with two (2) Gorman-Rupp Model T4A3S-B pumps, each equipped with a 25 HP, 230/460 VAC, 3 phase, 60 Hz electric motor. Each pump is rated for 22.7 L/s (360 USGPM) at a total dynamic head (TDH) of 18.3 m (60 ft). The pumps were installed in 2006 and are used regularly. The pumps are controlled by a Gorman-Rupp EPS 2000 Duplex Pump Controller which utilizes a level indicating transmitter. Each pump has a 100 mm suction line and a 100 mm discharge which includes a check valve. Each pump connects to a common 100 mm discharge header which includes a three-way plug valve. The pump discharge header is connected to a 200 mm forcemain which discharges to the wastewater lagoons. Back-up power consists of an Elliot MagneTek Power Systems 100 kW natural gas-powered generator.

Figure 4.5 – Village Wastewater Lift Station – Pumping Configuration

Overall, the lift station is in good operational condition with the operators having minimal concerns. The Village's operators have scheduled some repair work for 2020 including the following:

- Installation and modifications to level monitoring equipment and piping in the wet well,
- Replacement of wet well grating and platforms (previously corroded and unsafe) within the wet well.

Due to the age of the lift station and potential issues with capacity, it is recommended that the check valves, plug valve, and pressure assemblies are replaced along with a general servicing of the pumps which may include replacing the impellers. During site inspections, it was noted that one of the check valves appeared to not be functioning correctly and the pressure gauge assemblies on the suction lines were not working as well. The remaining upgrades would ensure that operation and maintenance items are not contributing to the decrease in flow rates that has been observed prior to undertaking a larger project.

The largest, and most significant concern the operators have, is the inability of the lift station to handle PWWFs during rainfall events. As discussed in previous sections, during PWWF, wastewater is often diverted to a nearby low area and pumped back into the wet well as flows subside. This is a significant operational concern and potential environmental hazard that must be addressed. Upgrades to the pumps or twinning the forcemain need to be considered.

The condition of the existing forcemain is generally unknown and detailed record information was unavailable; however, the Village did indicate that the forcemain is 200 mm in diameter. The recorded pump flows have decreased by 17% over the past 4 years which could be indicative of a blocked or failing forcemain or be a result of failing/uncalibrated flow monitoring equipment. There is no redundant system in place to be able to perform maintenance on the forcemain without shutting down the lift station and requiring temporary pumping and hauling of the wastewater.

Due to the suspected inaccuracies of the flow monitoring equipment, it is difficult to assess the pumping and forcemain capacities of the system and it is recommended that the Village replace the existing strap-on flow meters, with a single flow meter on the discharge line prior to undertaking further upgrades. Accurate flow measurement will ensure appropriate upgrades are completed to accommodate current and projected wastewater flows.

The Village may also want to consider improvements to the wet well and dry well ventilation systems. Based on conversations with the operators, when the wet well surcharges above the ventilation lines, wastewater enters the dry well through the lines. The rest of the heating and ventilation system appeared in good condition.

Figure 4.6 – Lift Station Wet Well

4.5.1 Lift Station and Forcemain Hydraulic Analysis

A hydraulic analysis of the lift station and forcemain was completed to determine the maximum capacity of the pumps and the ability of the forcemain to convey the flows to the wastewater lagoons.

As outlined previously, the lift station was constructed with 2 pumps, each with a designed duty point of 22.7 L/s. Running in parallel the pumps were intended to provide a design capacity of 45.4 L/s. In addition to the forcemain being 200 mm diameter pipe, it was assumed to be an estimated 2,750 m long and PVC pipe material based on information from the Village.

Based on the hydraulic analysis completed, the maximum theoretical pumping capacity of the lift station is approximately 34.7 L/sec (2,998 m^3/day) with both pumps operating at full speed (1750 RPM). The "firm" pumping capacity, or capacity with the largest pump out of service, is 31.8 L/sec. As the maximum theoretical pumping capacity does not equal the design capacity, it is evident that the current pumps are undersized given the conditions of the existing forcemain, or, that the forcemain is undersized for the current pumping arrangement and it's intended design.

Preferred velocity ranges for a wastewater forcemain are typically from 0.6 m/sec to 2.0 m/sec; the existing forcemain has a theoretical maximum velocity of 1.5 m/s. At velocities above 2.0 m/sec, pipe scouring can damage the walls of the pipe. Below 0.6 m/sec solid particles can separate from the wastewater and settle to the bottom of the pipe, building up over time causing reduced capacity and potential back-up. As a result of the theoretical maximum velocity being near the upper limit, increasing the design output of the current pumps is not preferred and a new larger diameter forcemain is recommended.

4.6 WASTEWATER TREATMENT SYSTEM

Minimal record information on the Village's existing wastewater lagoons was available. However, it is known that the lagoon system consists of 2 anaerobic cells, 1 facultative cell, and 1 storage cell. The Village currently utilizes evaporation as the means for discharging the lagoons. The following information on the various cells was obtained from the Village's previous infrastructure master plan (2010):

- Anaerobic Cells – total area of 900 m^2 each,
- Facultative Cell – total site area of 132,000 m^2,
- Storage Cell – total site area of 90,000 m^2.

A review of available aerial imagery reveals that the areas outlined in the previous infrastructure master plan are still applicable. Based on these areas, MPE completed a review of the estimated capacity of each cell based on the most recent standards and guidelines from Alberta Environment and Parks (AEP). This review is summarized in Table 4.4 below.

Table 4.4 – Estimated Wastewater Lagoon Capacity

Cell	Cell Number	Surface Area at Water Elevation (m^2)	Minimum Depth (m)	Maximum Depth (m)	Bank Slope	Estimated Capacity (m^3)
Anaerobic	1	900	3.0	4.5	3:1	1,450
	2					1,450
Facultative	N/A	132,000	--	1.5	3:1	193,000
Storage	N/A	90,000	--	3.0	3:1	250,000

To conservatively assess the capacity of the wastewater lagoons, MPE utilized the average daily operating hours of the lift station pumps and their theoretical design to determine average daily flow. The current average daily flow used for assessing the capacity of the lagoons was 337 m^3/day (or 260 lpcd) based on an average pump operating time of 4 hours per day and a theoretical design capacity of 85 m^3/hour. Table 4.5 provides a summary of the required lagoon cell capacities for the projected wastewater flows.

Table 4.5 – 2045 Required Wastewater Lagoon Capacity

Cell	No. Cells Required	2045 Population	Average Day Flow (lpcd)	Required Days of Storage	Required Storage Capacity (m^3)
Anaerobic	4	2,284	260	2	1,187
Facultative	1			60	35,630
Storage	1			365	217,000

Based on Table 4.5, the existing lagoon cells are sufficiently sized for the projected population and wastewater flow. However, some upgrades will be required in the future including the construction of 2 additional anaerobic cells once the population exceeds 1,923. Additional anerobic cells are required at this time because the average daily flow is expected to exceed 500 m^3/day and AEP's current standards and guidelines require 4 anaerobic cells when this criterion is met. Provisions for an annual release from the storage cell to Stirling Lake or utilizing effluent irrigation will also be required in the future as an evaporative discharge will no longer provide sufficient capacity in the storage cell.

Due to a lack of available record information, the Village should undertake a study to complete a full assessment of the wastewater lagoons and generate as-built drawings to assist with future projects and operations.

4.7 WASTEWATER SYSTEM UPGRADES

4.7.1 Collection System Upgrades

The proposed upgrades and recommendations for the wastewater collection system are divided into four categories:

- Operation and maintenance (O&M),
- Full replacements,
- Existing capacity upgrades,
- Future development upgrades.

Figure 4.7 provides a visual representation of the recommended upgrades to the wastewater collection system. Additional details of each improvement are provided in the following subsections as well as in Appendix B and the video inspection reports.

4.7.1.1 OPERATION AND MAINTENANCE

As shown in Figure 4.2 there are many wastewater mains in the Village where video inspections have not been completed. It is recommended that the balance of the mains in the Village are inspected and reviewed to assess the condition of the mains and schedule repairs and replacements as required.

4.7.1.2 FULL REPLACEMENTS

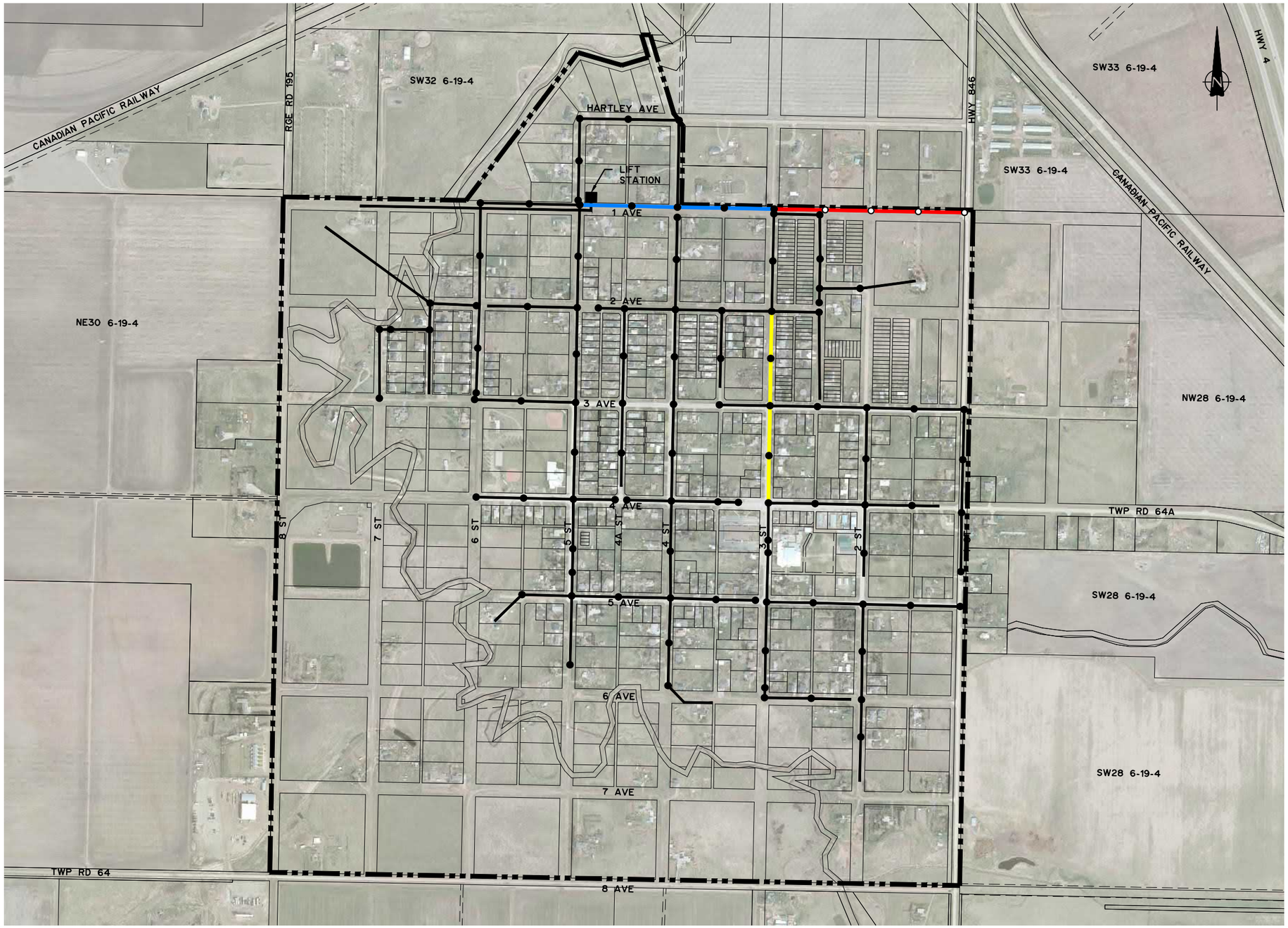
The review of the video inspections revealed wastewater mains rated in fair or poor condition and need full replacement. These sections have poor slope and/or structural damage in multiple locations. The wastewater mains rated in poor condition as shown in Figure 4.2 are recommended for full replacement. It is also recommended that the section of wastewater main rated "fair" also be replaced along 3rd Street between 3rd Avenue and 2nd Avenue.

Replacement of the wastewater main along 3rd Street between 5th Avenue and 4th Avenue was scheduled for replacement this year.

4.7.1.3 CIPP LINING

CIPP lining is a technology that utilizes the existing pipe as a host for a new structural pipe to be installed (a pipe within a pipe). The existing pipe is cleaned and prepped, a resin saturated felt tubing is then pulled into place, inflated, and cured. The advantage of CIPP lining is limited surface restoration and limited service disruption to the public. CIPP lining is generally recommended for VCT or concrete mains that have structural damage but a consistent grade. CIPP lining cannot fix sags or offset joints, nor fill in missing sections of mains. The CIPP lined pipe will mirror the existing pipe.

Based on the video inspections and assessments completed, no CIPP lining is currently recommended. Once video inspections are available for the remaining wastewater mains, it is recommended that the Village identify VCT wastewater mains in "fair" or "good" condition that are suitable for lining.



LEGEND

- VILLAGE BOUNDARY
- EXISTING WASTEWATER MAIN
- EXISTING WASTEWATER MANHOLE
- 450mm WASTEWATER MAIN UPSIZE
- 200mm WASTEWATER MAIN REPLACEMENT
- 250mm WASTEWATER MAIN INSTALLATION
- PROPOSED WASTEWATER MANHOLE

MPE Engineering Ltd.

VILLAGE OF STIRLING

INFRASTRUCTURE MASTER PLAN
WASTEWATER COLLECTION SYSTEM
PROPOSED UPGRADES

SCALE: 1:10 000	DATE: SEPTEMBER 2020	JOB: 1407-001-00	FIGURE: 4.7

4.7.1.4 EXISTING SYSTEM UPGRADES

From the hydraulic analysis of the system and discussions with the Village, no areas within the Village currently experience surcharging. Increased capacity in the wastewater collection system is not required. However, it is recommended that the Village undertake projects to reduce I/I:

- Complete lining of VCT wastewater mains once video inspections are available,
- Introduce a bylaw to prohibit foundation drain and sump connections to the wastewater system,
- Complete stormwater improvements to allow proper drainage from private residences.

4.7.1.5 FUTURE DEVELOPMENT UPGRADES

Most of the Village's future development is anticipated to be on the east side of the Village. As a result, wastewater mains along 1st Avenue and 3rd Street will begin to experience surcharging beyond the 10-year projected populations if I/I rates are not mitigated. Recommended projects to alleviate potential surcharging in the future include the following:

- Construction of a wastewater trunk main along 1st Avenue, from 3rd Street to 1st Street to service projected growth in the County and avoid inundating existing mains,
- Increase the pipe diameter along 1st Avenue from the lift station to 3rd Street to 450 mm.

4.7.2 Lift Station and Forcemain Upgrades

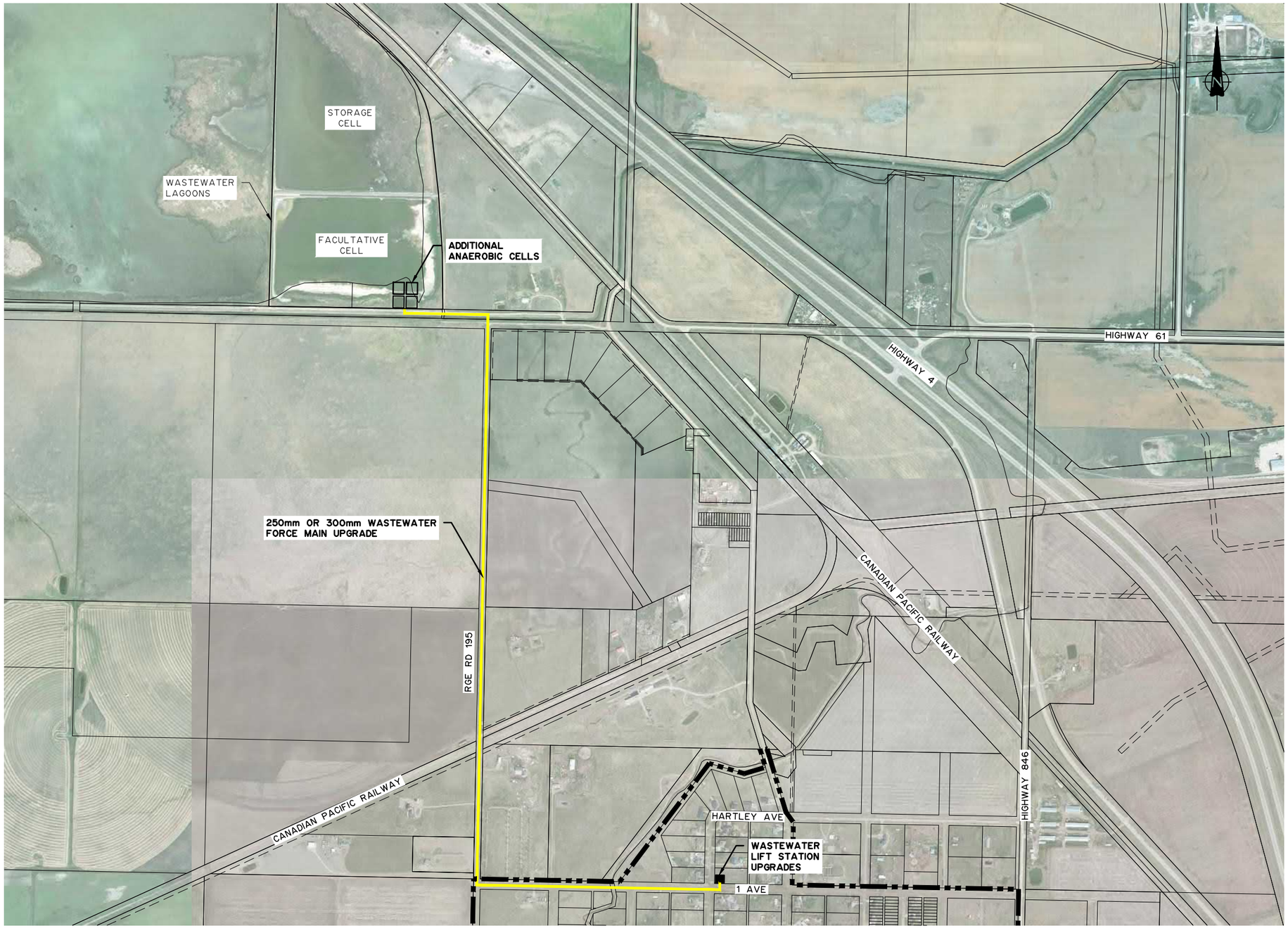
Based on the condition assessment and review of the Village's lift station and forcemain, MPE recommends several upgrades. Due to known operational concerns and the inability of the lift station to provide sufficient pumping capacity during PWWFs, the upgrades are considered a high priority. The upgrades include the following:

- Replacement of existing valves and pressure gauge assemblies on both pumps,
- Installation of a single flow meter on the discharge line connected to the forcemain,
- Complete a full pump servicing including impeller replacement, suction line cleaning, wear plate replacement, and v-belt replacement.

The above upgrades and maintenance will ensure that the lift station is brought back up to a condition where it should be capable of meeting its intended design flows with proper flow monitoring. After operating for a period with improved flow monitoring, the appropriate upgrades to the forcemain can be finalized. Based on the hydraulic analysis completed, a new 250 or 300 mm forcemain would be sufficiently sized to maximize the capacity of the current pumping arrangement.

4.7.3 Wastewater Treatment Upgrades

As outlined in Section 4.6, record information on the wastewater lagoon system was unavailable but a high-level review of the available capacity was completed. Based on the review, upgrades to the lagoons are not required until 2035, at which time 2 additional anaerobic cells will be required. Beyond 2035 it is also anticipated that wastewater flows will exceed the evaporative capacity of the lagoons and upgrades to the storage cell drain will be required.



LEGEND

VILLAGE BOUNDARY

Engineering Ltd.

VILLAGE OF STIRLING

INFRASTRUCTURE MASTER PLAN
WASTEWATER LIFT STATION, FORCE MAIN, AND WASTEWATER LAGOONS PROPOSED UPGRADES

SCALE: 1:12 500	DATE: SEPTEMBER 2020	JOB: 1407-001-00	FIGURE: 4.8

4.8 WASTEWATER SYSTEM COST ESTIMATES

Order of magnitude cost estimates were prepared for the upgrades recommended in Section 4.7. Detailed cost estimates can be found in Appendix B and the following tables provide a summary of the estimated costs.

Table 4.6 – Wastewater System Capital Plan

Location	Project	Estimated Cost
Wastewater Collection System	Video Inspections and Condition Assessment	$70,000
Lift Station	Operation and Maintenance Upgrades	$90,000
Forcemain	250/300 mm Forcemain Installation	$1,290,000
3rd Street – 2nd Ave to 3rd Ave	Wastewater Main Replacement	$590,000
3rd Street – 3rd Ave to 4th Ave	Wastewater Main Replacement	$590,000
1st Avenue – 3rd Street to 1st Street	250 mm Wastewater Main Installation	$1,550,000
Wastewater Lagoons	Anaerobic Cell Additions	$1,000,000
1st Avenue – Lift Station to 3rd Street	450 mm Wastewater Main Upsize	$1,620,000
Wastewater Lagoons	Storage Cell Drain Upgrades	$300,000

The recommended upgrades for the lift station and forcemain should be a high priority for the Village as they are two of the most critical pieces of infrastructure. Failure of the forcemain or lift station could have catastrophic consequences.

The replacement of existing wastewater mains in poor condition should also be a high priority for the Village as they could fail at any moment. The replacement of inspected wastewater mains should be followed by the inspection of the rest of the collection system to determine if and where other replacement projects are required.

5 STORMWATER MANAGEMENT SYSTEM ANALYSIS

This portion of the study focuses on drainage within the Village limits; the total study area is approximately 275 hectares and evaluates the existing stormwater infrastructure and overland flow paths.

5.1 STORMWATER BACKGROUND

The Village's stormwater infrastructure consists of a combination of surface drainage and localized underground piping. Generally, all areas within the Village boundary drain towards Kipp Coulee with the northeast portions of the Village draining overland through the County and then into the Kipp Coulee. The Village experiences minimal stormwater impacts from adjacent lands in the County due to the physical boundaries around the Village. Kipp Coulee along the south, west, and north borders of the Village, prevent stormwater runoff from adjacent lands from impacting developed areas, and Highway 846 (1st Street) provides a physical boundary on the east edge of the Village.

Throughout the duration of the study, the Village was subject to relatively large storm events which caused localized ponding throughout the Village. The rainfall was not comparable to a major event such as a 1:100-year event, but because it produced a large volume of runoff over 48 hours it provided valuable information for this assessment. Photos throughout the Village and the localized ponding are shown in Figures 5.1 to 5.3. The localized ponding throughout the Village was not a significant concern for Village staff as the existing infrastructure eventually allows for all ponding to drain away without having caused serious flooding in the past.

Figure 5.1 – Ponding at Soccer Fields at the Intersection of 2nd Street and 5th Avenue

Figure 5.2 – Localized Ponding Along 4th Avenue, West of 5th Street

Figure 5.3 – Localized Ponding Near Intersection of 5th Avenue and 5th Street

5.2 EXISTING STORMWATER SYSTEM

5.2.1 Major (Overland) Drainage

Most of the Village is reliant on the major drainage system, typically referred to as overland drainage, to remove stormwater runoff. The major drainage system typically relies on surface drainage along curb and gutters, swales, ditches, and culverts. As its name implies, the major drainage system is designed to carry runoff from larger, less frequent storms. Typically, major systems are designed for the 1:100-year storm event.

Survey data and contour maps were used to determine existing overland drainage patterns throughout the study area. The existing patterns and facilities are illustrated in Figure 5.4. The study area was divided into 16 sub-catchment areas.

5.2.1.1 SUB-CATCHMENT DEFINITIONS

5.2.1.1.1 Sub-catchment A

Sub-catchment A is a residential land use area that is relatively undeveloped to date. It is bounded by Highway 846 to the east, 8th Avenue to the south, and an elevation contour to the west. The sub-catchment drains directly into Kipp Coulee and has no underground infrastructure.

5.2.1.1.2 Sub-catchment B

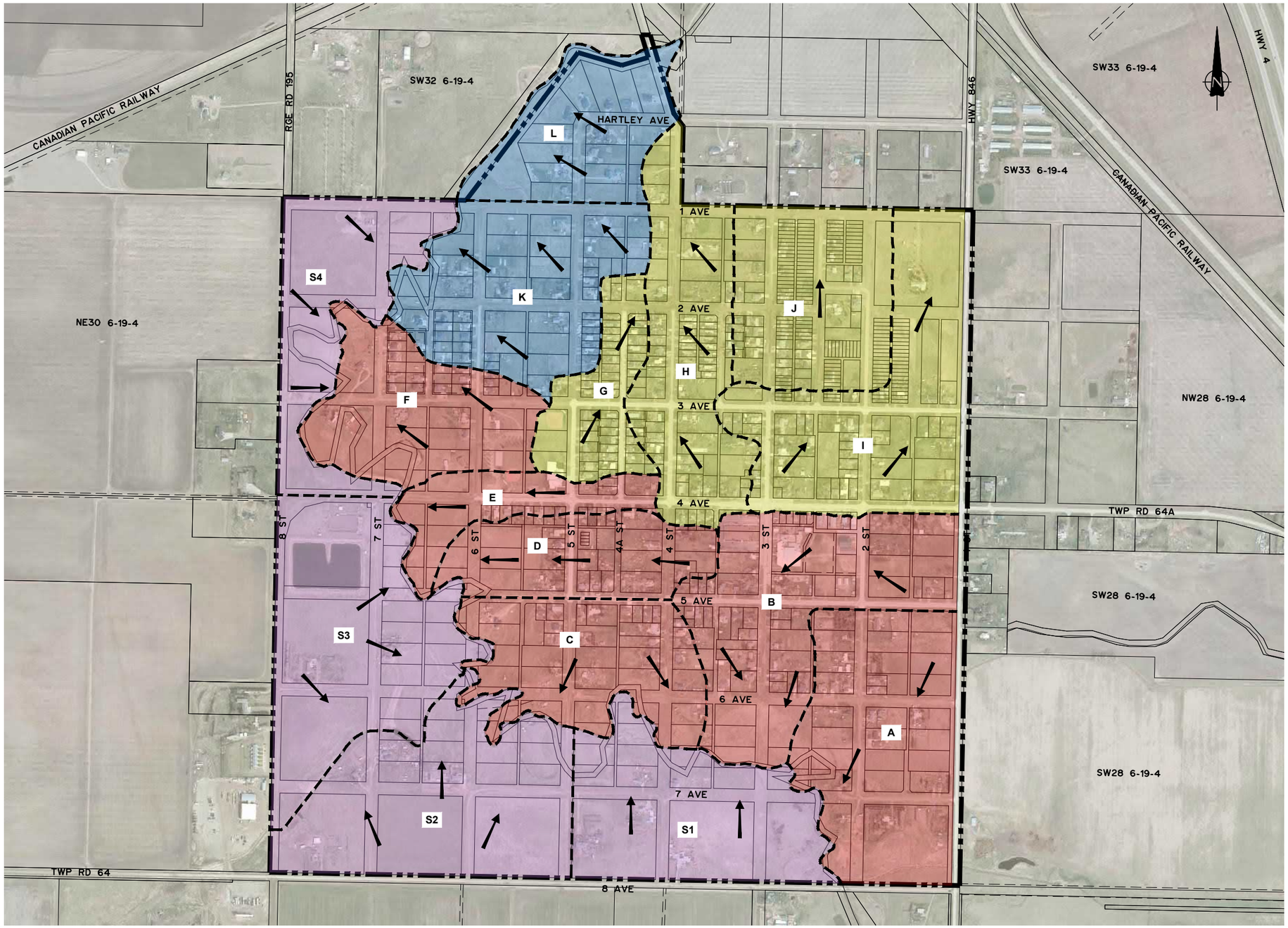
Sub-catchment B is a mixed land use area that is relatively undeveloped throughout its southern areas but contains residential and commercial development north of 5th Avenue. The sub-catchment is larger than its terrain would allow for due to the underground infrastructure installed within 3rd Street and throughout the school yard. Based on the data collected to date, the soccer fields are generally utilized as a surcharge pond during larger rainfall events until capacity in the underground infrastructure is available.

5.2.1.1.3 Sub-catchment C

Sub-catchment C is a residential land use area that is relatively undeveloped. It contains the area north of Kipp Coulee, west of 4th Street and south of 5th Avenue. The sub-catchment utilizes a small amount of underground infrastructure to assist drainage which outlets directly to Kipp Coulee.

5.2.1.1.4 Sub-catchment D

Sub-catchment D consists of the residential land use areas between 4th Avenue and 5th Avenue, to the west of 4th Street. A small area to the east of 4th Street drains into the catchment area via a ditch. The catchment utilizes a combination of overland drainage and underground piping to divert stormwater runoff to a naturally occurring low area near 6th Street prior to entering Kipp Coulee.



LEGEND

- VILLAGE BOUNDARY
- SUBCATCHMENT BOUNDARY
- DRAINAGE ARROW

SUBCATCHMENT NAME	AREA	OUTLET
A	22.21 Ha	KIPP COULEE
B	23.16 Ha	KIPP COULEE
C	16.01 Ha	KIPP COULEE
D	11.75 Ha	KIPP COULEE
E	7.57 Ha	KIPP COULEE
F	15.32 Ha	KIPP COULEE
G	8.18 Ha	4 STREET DITCH
H	17.82 Ha	4 STREET DITCH
I	22.86 Ha	COUNTY
J	16.35 Ha	COUNTY
K	20.02 Ha	KIPP COULEE
L	13.04 Ha	KIPP COULEE
S1	18.77 Ha	KIPP COULEE
S2	23.76 Ha	KIPP COULEE
S3	24.41 Ha	KIPP COULEE
S4	14.69 Ha	KIPP COULEE

MPE Engineering Ltd.

VILLAGE OF STIRLING

INFRASTRUCTURE MASTER PLAN
EXISTING OVERLAND DRAINAGE

SCALE: 1:10 000 | DATE: SEPTEMBER 2020 | JOB: 1407-001-00 | FIGURE: 5.4

5.2.1.1.5 Sub-catchment E

Sub-catchment E primarily consists of all drainage from 4th Avenue, west of 4th Street. Overland drainage along 4th Avenue and runoff from residential yards that front onto 4th Avenue, enter an underground system that eventually daylights into the ditch at the intersection of 4th Avenue and 6th Street.

5.2.1.1.6 Sub-catchment F

Sub-catchment F consists primarily of residential land use areas with some public/recreational area in the southeast corner of the catchment. The catchment utilizes a series of ditches, swales, and culverts to divert drainage to the northwest and eventually into Kipp Coulee at the west end of 3rd Avenue.

5.2.1.1.7 Sub-catchment G

Sub-catchment G consists primarily of residential land use areas with some public/recreational area in the southwest corner of the catchment. The catchment utilizes a series of ditches, swales, and culverts to divert drainage to the northeast and eventually into Sub-catchment K at the north end of 4A Street. The Village was currently undertaking a project to allow drainage north from the intersection of 2nd Avenue and 4A Street to reduce the amount of ponding within the intersection.

5.2.1.1.8 Sub-catchment H

Sub-catchment H consists of residential land use areas and utilizes underground piping to convey stormwater runoff from the intersection of 4th Avenue and 4th Street to an outlet point within the ditch along 4th Street to the north of 1st Avenue. The ditch along 4th Street also eventually outlets into Kipp Coulee north of the Village.

5.2.1.1.9 Sub-catchment I

Sub-catchment I consists of residential and commercial land use areas. The area utilizes a combination of overland drainage and underground piping to convey stormwater runoff to the northeast corner of the Village. Stormwater runoff from the catchment eventually enters the ditch along Highway 846 and then drains to the northwest towards Kipp Coulee.

5.2.1.1.10 Sub-catchment J

Sub-catchment J consists of residential land use areas and utilizes overland drainage to convey stormwater runoff north. A culvert across 1st Avenue at the intersection of 3rd Street allows drainage to continue north, eventually entering Kipp Coulee.

5.2.1.1.11 Sub-catchment K

Sub-catchment K consists of developed and undeveloped residential land use areas between 1st Avenue and 4th Avenue, west of 4A Street. Overland drainage to the northwest is utilized with all stormwater eventually entering Kipp Coulee.

5.2.1.1.12 Sub-catchment L

Sub-catchment L consists of a newer residential land use area to the north of 1st Avenue and west of 4th Street. Overland drainage to the northwest is utilized with a direct outlet to Kipp Coulee.

5.2.1.1.13 Sub-catchments S1 to S4

Sub-catchments S1 through S4 are located on the south and west sides of Kipp Coulee and generally consist of undeveloped, agricultural land use areas. These areas drain overland into Kipp Coulee and as development occurs, stormwater management infrastructure will need to be put in place.

5.2.1.2 RURAL STORMWATER IMPACTS

As previously indicated, stormwater runoff from nearby areas in the County is prevented from flowing through developed areas within the Village due to the surrounding physical boundaries (Kipp Coulee and Highway 846). However, areas within the County also utilize Kipp Coulee as a stormwater outlet which may reduce the available capacity for the Village's stormwater runoff. It is also known that the Raymond Irrigation District (RID) utilizes Kipp Coulee as a drain for their irrigation infrastructure in the area.

5.2.2 Minor (Underground) Drainage

The Village has five minor drainage systems as described below and illustrated in Figure 5.5. Minor systems are typically designed to convey stormwater runoff from a 1:5-year storm event.

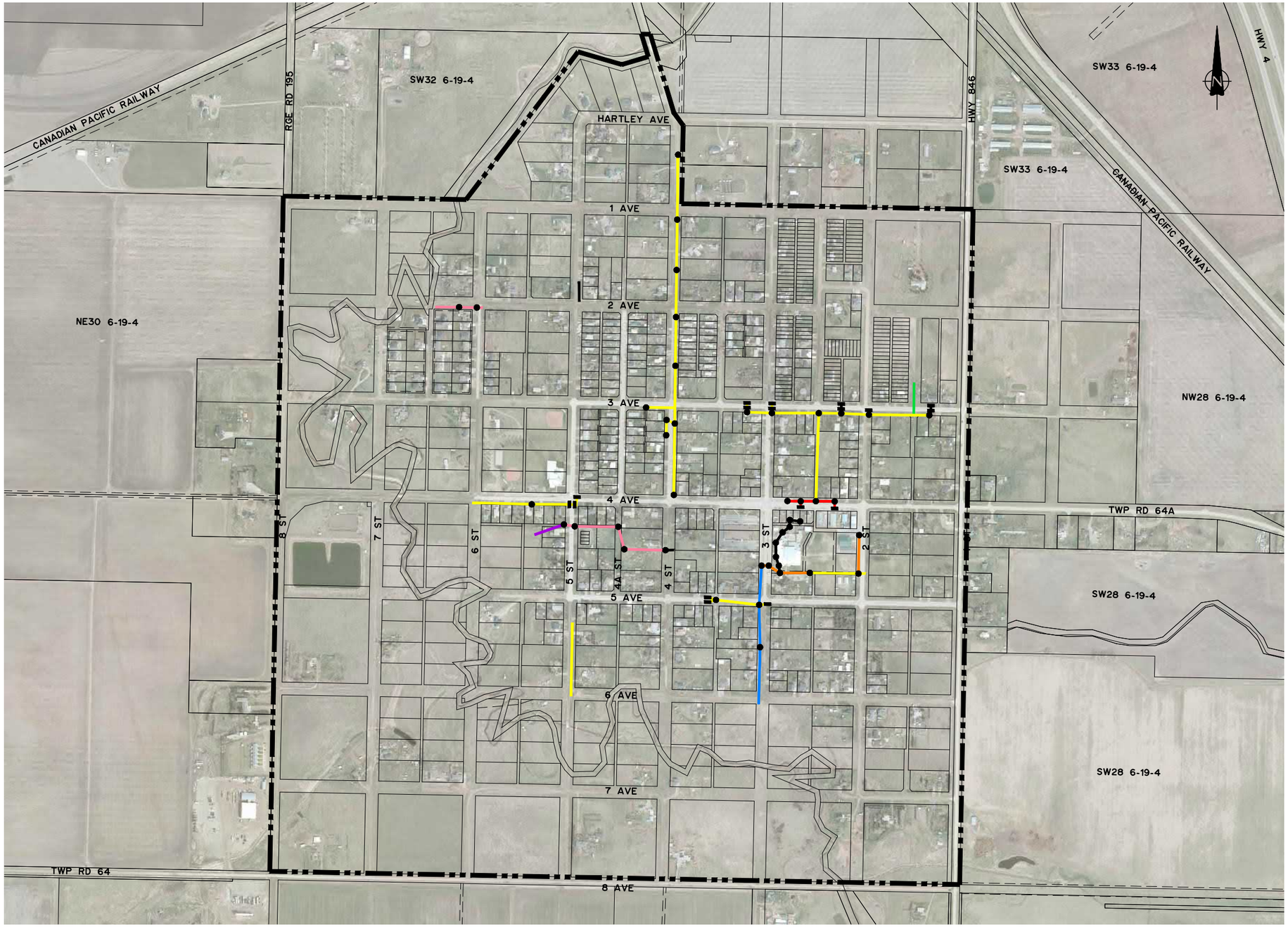
- **2nd Street and 3rd Street between 4th Avenue and 6th Avenue.** This underground system collects and conveys stormwater runoff from the northern portion of Sub-catchment B to Kipp Coulee,

- **4th Avenue and 3rd Avenue.** This storm system diverts runoff from the north side of 4th Avenue and throughout 3rd Avenue to an outlet located north of 3rd Avenue, between 1st Street and 2nd Street. This storm system services Sub-catchment I,

- **4th Avenue - West.** This underground storm system collects and conveys stormwater runoff from sub-catchment E. A series of catch basins at the intersection of 4th Avenue and 5th Street, as well as along 4th Avenue, collect and discharge stormwater runoff into the ditch at the intersection of 4th Avenue and 6th Street,

- **4th Street to 5th Street.** This underground storm system utilizes a series of large diameter pipes and catch basins to collect stormwater runoff from sub-catchment D that discharges into a naturally occurring low area,

- **4th Street from 4th Avenue to Hartley Avenue.** This system collects and conveys stormwater runoff from sub-catchment H. The stormwater runoff is collected through a series of catch basins adjacent to the roadways and is discharged into the ditch to the north of 1st Avenue.



LEGEND

- VILLAGE BOUNDARY
- EXISTING STORMWATER MAIN - 200mm
- EXISTING STORMWATER MAIN - 250mm
- EXISTING STORMWATER MAIN - 300mm
- EXISTING STORMWATER MAIN - 350mm
- EXISTING STORMWATER MAIN - 450mm
- EXISTING STORMWATER MAIN - 500mm
- EXISTING STORMWATER MAIN - 900mm
- EXISTING STORMWATER MAIN - UNKNOWN SIZE
- EXISTING STORMWATER CATCH BASIN MANHOLE
- EXISTING STORMWATER CATCH BASIN

MPE Engineering Ltd.

VILLAGE OF STIRLING

INFRASTRUCTURE MASTER PLAN
MINOR DRAINAGE SYSTEMS

SCALE: 1:10 000	DATE: SEPTEMBER 2020	JOB: 1407-001-00	FIGURE: 5.5

5.2.3 Stormwater Management Facilities

The Village does not currently have any stormwater management facilities within its boundary. As noted earlier, the soccer fields act as a surcharge pond during large rainfall events. The use of soccer fields as a surcharge pond mitigates the risk of flooding throughout the school yard and areas near the intersections of 2nd Street and 5th Avenue, and 3rd Street and 5th Avenue.

5.3 STORMWATER SYSTEM CONDITION ASSESSMENTS

5.3.1 Major Drainage System Condition Assessment

The Village's sub-catchments rely on the major drainage system to convey most of the stormwater runoff to Kipp Coulee. The minor system appears to have been installed to assist the major system with draining localized flat and low-lying areas. Overall, the major system performs satisfactorily, and the Village expressed no concerns with large scale flooding and past damages. The general comment received from the Village is that although ponding occurs throughout the Village, the infrastructure in place allows for the ponding to drain post-event.

Improvements can be made to the major drainage system to eliminate some of the ponding that occurs throughout the Village. During site inspections and discussions with Village staff, ponding typically occurs at the following locations:

- 2nd Avenue between 2A Street and 4A Street,
    - Localized ponding, primarily on the south side of the road is prevalent throughout,
- Areas to the south of 1st Avenue, between 1st Street and 3rd Street do not have a suitable outlet and stormwater runoff causes significant ponding throughout the area,
- 4th Avenue, west of 5th Street,
- Drainage towards the intersection of 4A Street and 2nd Avenue does not have an outlet,
    - The Village was undertaking a small project to all drainage to continue north,
- Local drainage issues south of the post office along 4th Avenue,
- Transitions from paved surfaces to gravel surfaces throughout the Village.

Improvements to these areas could be completed by constructing swales, ditches, additional underground infrastructure, and/or be incorporated into road reconstruction projects within the areas. Improved overland drainage will also allow the municipality and residences to disconnect their foundation drains and household sumps from the wastewater system.

The Village mentioned that Kipp Coulee has over topped its banks and flooded adjacent low-lying areas in the past. Despite this, flooding throughout the developed areas of the Village has not occurred due to its higher elevation relative to the banks of Kipp Coulee. To avoid further inundation of Kipp Coulee during large rain events, it is recommended that future developments and subdivisions include the construction of adequate stormwater management infrastructure to regulate stormwater runoff to the pre-development 1:5-year release rate.

5.3.2 Minor Drainage System Condition Assessment

CCTV video inspections were not available for the underground piping in the minor drainage system. Like the wastewater collection system, it is recommended that the Village undertake video inspections of the underground piping throughout the storm system to verify its condition. Based on visual site inspections, most of the underground piping is PVC and appeared to be in relatively good condition. The large diameter piping south of 4th Avenue, between 4th Street and the naturally occurring low area does consist of corrugated steel pipe (CSP) and would be a high priority for video inspection to determine its condition.

Figure 5.6 – Minor Drainage System Components

The Village also noted that the underground piping throughout the school yard does often become blocked with debris, grass clippings, and sediment. These issues could be a result of the relatively shallow slope throughout the piping.

A few other general comments on the condition of the minor drainage system include the following:

- The drainage outlet in Sub-catchment I, to the north of 3rd Avenue, is slightly blocked due to the grading of the existing swale. This may be impacting the capacity of the local minor system,
- The outlet at the west end of 4th Avenue, near 6th Street is blocked and was not visible during a site inspection,
- The grating on the 900 mm CSP outlet for Sub-catchment D is not properly secured. This is a potential safety hazard as the piping is large enough for people to access.

5.4 STORMWATER CONVEYANCE ANALYSIS

5.4.1 Stormwater Management Principles

Stormwater management is an integral part of land development. The general principle for stormwater management is that runoff from a developed area cannot exceed the runoff that occurred prior to development. Post-development runoff rates cannot exceed the pre-development 1:5-year runoff rates.

Runoff more than the pre-development 1:5-year runoff rate must be stored and later released at a controlled rate into a stormwater management facility (SWMF). Storage is required for runoff from all storms up to the 1:100-year design storm. The SWMF provides storage of runoff water as well as the required level of treatment. The outlet from the SWMF is designed to limit the release of stormwater into the downstream system or receiving watercourse. Currently, the Village does not operate any stormwater facilities and all stormwater runoff outlets directly into Kipp Coulee. Significant growth in undeveloped areas will require the construction of future stormwater management facilities.

5.4.2 Design Storms

The City of Lethbridge design storms were adopted for the present analysis as the weather patterns are like those experienced in the Village. The following formula defines the intensity-duration-frequency (IDF) curves for various storms, with the coefficients varying according to the return period (frequency), the storm intensity, and the storm duration. Rainfall intensity is calculated as:

$$i = \frac{a}{(t+b)^c}$$

Where:

i is the rainfall intensity (mm/hour),

t is time (minutes),

a, b, and ***c*** are the constants for the respective design storm return period.

The design storms used in this analysis are the 4-hour, 1:5-year storm and the 24-hour, 1:100-year storm. The coefficients for the design storms which were used in this study are presented in Table 5.1.

Table 5.1– IDF Equation Coefficients

Return Period	*a*	*b*	*c*
1 in 5 Year	440.69	0	0.696
1 in 100 Year	1019.20	0	0.731

The 4-hour, 1:5-year design storm for the City of Lethbridge produces approximately 39 mm of precipitation. The 24-hour, 1:100-year design storm produces approximately 120 mm of precipitation.

5.4.3 Computer Modelling

A stormwater analysis of the Village was undertaken using the hydrologic modelling program PCSWMM. The model was used to aid in determination of runoff volumes, peak flow rates, and to size stormwater management facilities for conveyance and storage of runoff. The computer model was also used to analyze the ability of the underground drainage system to convey flows from a 1:5-year storm event which is discussed in Section 5.4.4.

The following modelling parameters and assumptions were incorporated into the analysis:

- Specific modelling parameters used for the existing conditions can be found in Appendix D,
- The model was setup utilizing existing information available from the Village,
- Existing development conditions were reviewed from site visits, recent air photos, and relevant documents,
- To generate peak flows and stormwater runoff volumes, a Chicago storm was used in the analysis with a peak skew of 0.33,
- Soils were assumed to be a combination of Shallow Loess/Sandy Loams and Clay Loam/Shallow Sandy Loam based on SCS Classification Groups B and C,
- Soils were assumed to have an average antecedent moisture condition,
- Drainage from outside the Village boundary has not been considered,
- All current runoff is assumed to discharged directly into Kipp Coulee.

The peak flow rates for individual catchment areas calculated from the hydrologic modelling for the existing scenario are presented in Table 5.2.

5.4.4 Hydraulic Analysis

The PCSWMM computer model was utilized to review the capacity of the minor drainage system and its ability to service catchments throughout the Village. The stormwater information provided by the Village's current GIS was not up to date and lacked sufficient information for generating an accurate stormwater model of the minor drainage system. Although the Village was able to provide details on pipe locations and sizes, to generate a model and provide general comments on the system, the following assumptions were also made:

- Unknown piping invert elevations were assigned based on adjacent stormwater manholes and surveys completed by MPE,
- Manhole sub-catchments were assigned based on general topographic information and location of adjacent infrastructure.

Table 5.2 – Stormwater Run Off (Existing)

Catchment Area	Area	Peak Flow 1:5-year (4Hr)	Run Off Volume 1:5-year (4Hr)	Peak Flow 1:100-year (24Hr)	Run Off Volume 1:100-year (24Hr)
	(ha)	(m^3/s)	(m^3)	(m^3/s)	(m^3)
A	22.2	1.44	2,670	3.2	15,740
B	23.2	2.15	3,900	4.7	19,560
C	16.0	1.76	2,320	3.2	12,980
D	11.8	0.93	1,500	1.9	8,710
E	7.6	0.55	910	1.1	5,320
F	15.3	1.22	1,940	2.5	11,250
G	8.2	0.85	1,510	1.8	7,530
H	17.8	1.20	2,750	3.0	14,030
I	22.9	1.44	2,370	3.0	15,490
J	16.4	1.14	1,620	2.1	10,250
K	20.0	1.73	2,730	3.5	15,870
L	13.0	0.93	1,650	2.0	9,660
S1	18.9	0.71	990	1.3	11,970
S2	23.8	0.86	1,170	1.5	13,560
S3	24.4	0.92	1,260	1.7	14,170
S4	14.7	0.53	830	1.4	8,070
Total	***276.2***	***18.36***	***30,120***	***38.5***	***194,160***

Overall, the model indicates that the minor drainage systems are not sized to convey the 1:5-year stormwater runoff for their respective catchments. The hydraulic model indicated surcharging and flooding during 1:5-year storm events in the following areas:

- Catch basins located along 3rd Street out front of the school,
- The soccer fields located near the intersection of 2nd Street and 5th Avenue,
- Catch basin manholes located between 4th Street and 5th Street and 4th Avenue and 5th Avenue,
- Catch basin manholes along 4th Avenue,
- Catch basin manholes along 4th Street,
- Surcharging along 3rd Avenue, west of 2A Street.

The modelled flooding can be indicative of actual events; however, it is recommended that detailed surveys of intersections throughout the Village are also completed prior to and during detailed design of future stormwater and transportation projects to increase the level of accuracy of the overland drainage patterns. Accurately defining sub-catchments is critical to determining the actual time of concentration (ToC) of storm events which directly impacts the peak runoff rates. In addition to surveying these intersections, it is recommended that the Village spend the necessary resources ensuring the GIS information is up to date so that the hydraulic model can be refined.

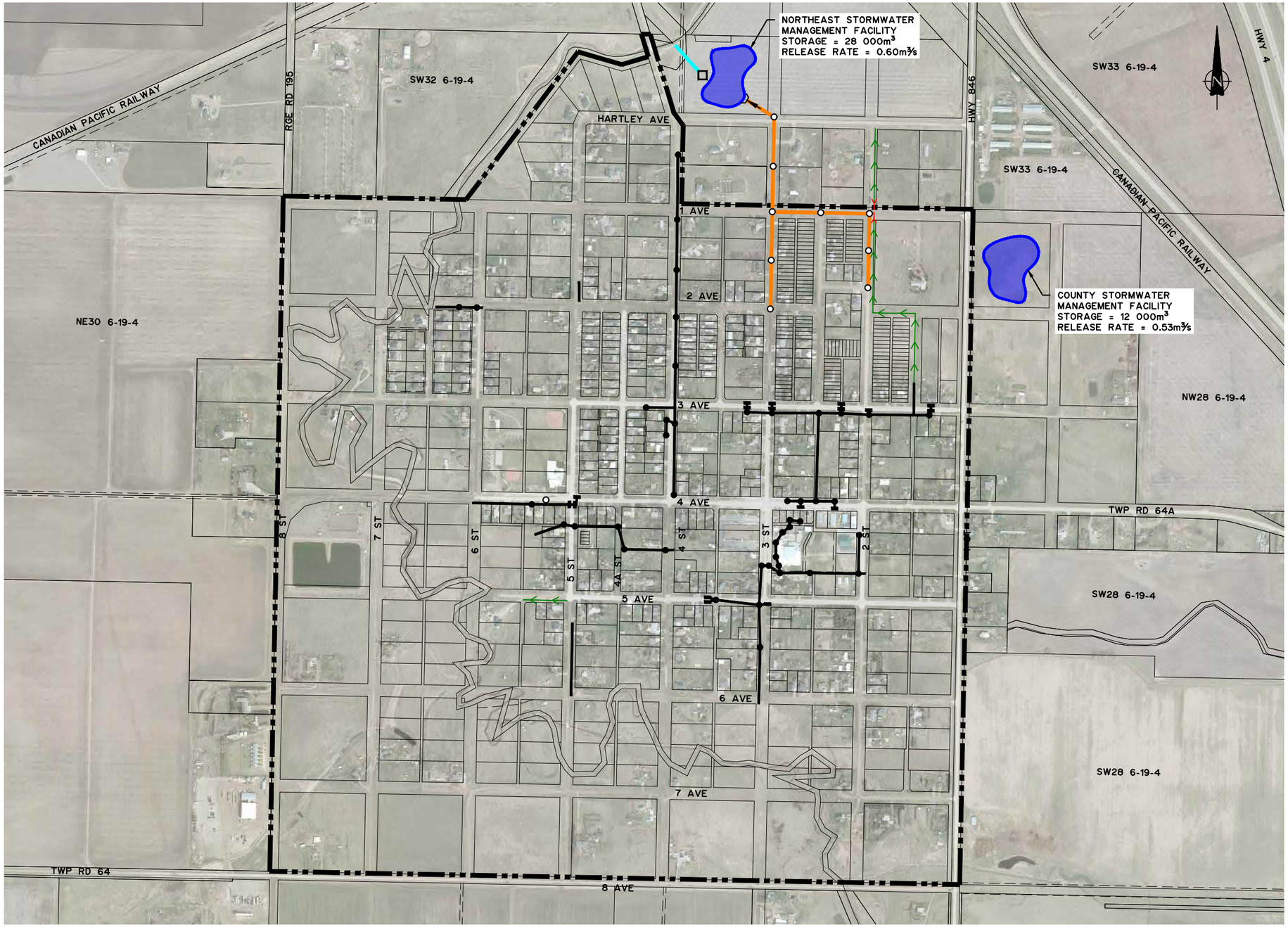
5.5 STORMWATER MANAGEMENT UPGRADES

From the completed analysis, recommended upgrades to the Village's stormwater management system will involve a combination of upgrades to the major and minor systems. Figure 5.7 illustrates the proposed stormwater management upgrades throughout the Village.

5.5.1 Ditch and Swale Grading Improvements

The Village should undertake localized ditch and swale improvements to eliminate ponding adjacent to and on roadways. Ponding near roads will have a negative impact on the structure and longevity of the road. Two identified locations for constructing and improving the existing ditches/swales are as follows:

- 5th Avenue to the west of 5th Street – Localized ponding occurs west of the intersection of 5th Street and 5th Avenue. A swale or ditch constructed along the south side of 5th Avenue to the west of 5th Street, would be capable of draining all stormwater from the intersection to Kipp Coulee,
- Drainage Improvements throughout Sub-catchment I – As outlined previously, the grading of the existing swale for the outlet north of 3rd Avenue is potentially limiting the capacity of the system. It also does not have a designated route. A constructed swale to the intersection of 1st Avenue and 2nd Street would ensure the area drains properly until an underground piping system can be constructed.



LEGEND

- VILLAGE BOUNDARY
- EXISTING STORMWATER MAIN
- EXISTING STORMWATER CATCH BASIN MANHOLE
- EXISTING STORMWATER CATCH BASIN
- PROPOSED STORMWATER MANAGEMENT FACILITY
- PROPOSED DITCH UPGRADES
- PROPOSED CULVERT
- PROPOSED CATCH BASIN AND STORMWATER LEAD
- PROPOSED STORMWATER PUMP STATION
- PROPOSED STORMWATER FORCEMAIN
- PROPOSED NORTHEAST STORMWATER MANAGEMENT PROJECT

MPE Engineering Ltd.

VILLAGE OF STIRLING

INFRASTRUCTURE MASTER PLAN
STORMWATER SYSTEM UPGRADES

SCALE: 1:10 000	DATE: SEPTEMBER 2020	JOB: 1407-001-00	FIGURE: 5.7

5.5.2 Localized Catch Basin Installation

It is recommended that the Village install a catch basin on the north side of 4th Avenue near the front entrance to the Stirling Swimming pool, connect to the existing minor drainage system on 4th Avenue. Although capacity is not available in the existing minor system, a catch basin will allow the low area on the north side of the road to drain after a rainfall event. Currently, collected stormwater runoff on the north side of 4th Avenue dissipates via evaporation and/or saturating the road which may be negatively impacting the road structure.

5.5.3 Northeast Stormwater Management System

The Village has significant drainage concerns throughout the areas between 1st Street and 3rd Street, and 1st Avenue and 3rd Avenue. Overland drainage is incapable of directing stormwater runoff to Kipp Coulee and localized ponding is prevalent throughout the area. As part of this assessment, MPE has generated a conceptual stormwater management system to service the northeast part of the Village, as well as the potential annexation areas to the north of 1st Avenue.

The proposed stormwater management system consists of a large SWMF facility at the existing low area north of the Village and a system of 600 to 1,200 mm diameter pipes. The underground piping would be sufficiently sized to convey stormwater runoff in a 1:5-year event from Sub-catchments I, J, and the potential developable area north of 1st Avenue, to the SWMF.

An order of magnitude cost estimate for the Northeast Stormwater Management System is provided in Section 5.6.

5.5.4 Road Reconstruction and Underground Storm Systems

As identified previously, localized ponding is prevalent throughout the Village, especially along 2nd Avenue. As the road is reconstructed, consideration should be given to improving the overall drainage. This could be achieved by extending the existing catch basin system at 6th Street further east, constructing a ditch along the south side of the road to divert stormwater runoff to the nearest outlet, or expanding the future northeast stormwater management system.

All future road construction and reconstruction projects should include extensive reviews of existing drainage issues along with provisions for addressing them. These costs should be considered at the time of the road projects and estimated costs are not provided.

5.5.5 Future Developments

It is recommended that all future developments include provisions for a stormwater management facility and associated stormwater infrastructure. Conceptual storage requirements for the SWMF linked to potential development of the area to the east of 1st Street is shown on Figure 5.7. Development of this SWMF is not included in the overall capital planning as this could be a developer related cost.

5.6 STORMWATER SYSTEM COST ESTIMATES

Table 5.3 presents the estimated cost for each of the improvements including construction, contingency allowance, and engineering services. Details of the estimates are included in Appendix E.

Table 5.3– Stormwater System Capital Plan

Location	Project	Estimated Cost
5th Avenue and 5th Street	Ditch Grading	$30,000
4th Avenue	Catch Basin Installation	$25,000
Sub-Catchment I	Drainage Swale Improvements	$90,000
Northeast Stormwater Management System	Stormwater Management Facility	$3,500,000
	Minor Drainage System	$1,900,000

The Northeast Stormwater Management System includes provisions for servicing undeveloped areas and portion of the cost could be recouped through appropriate off-site levies and/or development agreements.

6 TRANSPORTATION NETWORK

The Village is responsible for a transportation network consisting of local roads, bridges, and pathways. The transportation network is an asset to be managed in a cost-effective manner ensuring a minimum level of service is maintained for all users. MPE completed a comprehensive assessment and evaluation program. The evaluation program consisted of the following:

- Collection and assessment of the pavement surface distress data on the Village's paved road network,
- Collection and assessment of the gravel surface distress data on the Village's gravel road network,
- Collection and assessment of the surface distress data on the Village's concrete sidewalk pathway network,
- Review of previous assessments of the Village's bridge files.

6.1 EXISTING TRANSPORTATION NETWORK

A review of the Village's existing transportation network was completed and included available traffic data, road classification assumptions, road network inventory, and existing traffic control overview. The following subsections discuss these items in detail.

6.1.1 Traffic Volumes & Traffic Control

Alberta Transportation Traffic Count data was secured to aid in determining approximate traffic volumes anticipated in the Village. The traffic data is provided in Appendix F. Based on the traffic count data, the total Average Annual Daily Traffic (AADT) for the Village is 1,680. There are approximately 550 vehicles entering and exiting on Highway 4 and approximately 290 vehicles entering and existing on Highway 52. As the only available traffic data it can be inferred that the roadways within the Village have traffic volumes less then 1,000 vehicles per day.

In general, the traffic volumes identified within the Village do not indicate the need for a full traffic study or intersection analysis. Stop and yield signs have been placed at intersections on an as needed basis based primarily on local observations and public request. School zones appeared to be clearly signed within the Village during our site visits and no other notable traffic control issues were identified.

6.1.2 Road Classification

Identifying the road classifications within the study area provides an understanding of the traffic demand, movement, and usage of a specific section. A road may be classified based on the service it provides to its users, or for its intended use. Based on the anticipated traffic volumes on the road network all the roadways within the Village would be classified as local roads. There are some commercial and Industrial land uses within the Village as well. To better accommodate the likely road usage from these facilities the road classifications identified in Table 6.1 were utilized.

One of the key reasons for identifying the type of use (commercial/industrial or residential) is to aid in the rehabilitation and development of roadways to accommodate additional traffic loading that is anticipated with the different usage types.

Table 6.1 – Roadway Classification

Functional Class	Secondary Classification	AADT Method
Local	Commercial / Industrial	4th Avenue (1st Street to 8th Street)
		5th Avenue (3rd Street to 1st Street)
		2nd Street (4th Avenue to 5th Avenue)
		3rd Street (4th Avenue to 5th Avenue)
		8th Street (1st Avenue to 8th Avenue)
	Residential	All Remaining Roadways

Based on the road classifications, the following road cross sections are recommended to be utilized for new roadways and reconstruction works:

- Residential Local Road:
  - 10.2m Total Pavement Width including two 3.0m drive lanes and two parking lanes 2.1m (excluding gutter pan),
  - Local Road Structure including subgrade preparation, 250 mm base granular material and 90 mm asphalt,
  - Curb and Gutter on both sides.

- Commercial/Industrial Local Road:
  - 11.4m Total Pavement Width including two 3.3m drive lanes and two parking lanes 2.4m (excluding gutter pan),
  - Local Industrial Road Structure including subgrade preparation, 250 mm base granular material and 100 mm asphalt,
  - Curb and Gutter on both sides.

Geotechnical studies are recommended prior to undertaking detailed design of road projects to confirm assumed road structures and to provide site specific recommendations.

6.1.3 Network Inventory

In general, the Village's traffic network consists of two major components roadways and pathways. The following sections identify the existing inventory of these components. Figure 6.1 and Figure 6.2 provide an overview of the locations of existing road structures, bridge files and concrete structures.

6.1.3.1 ROAD NETWORK

The Village consists of two identifiable road structures, granular surfaces, and paved surfaces. The existing road network is summarized in the following table.

Table 6.2 – Existing Road Structures

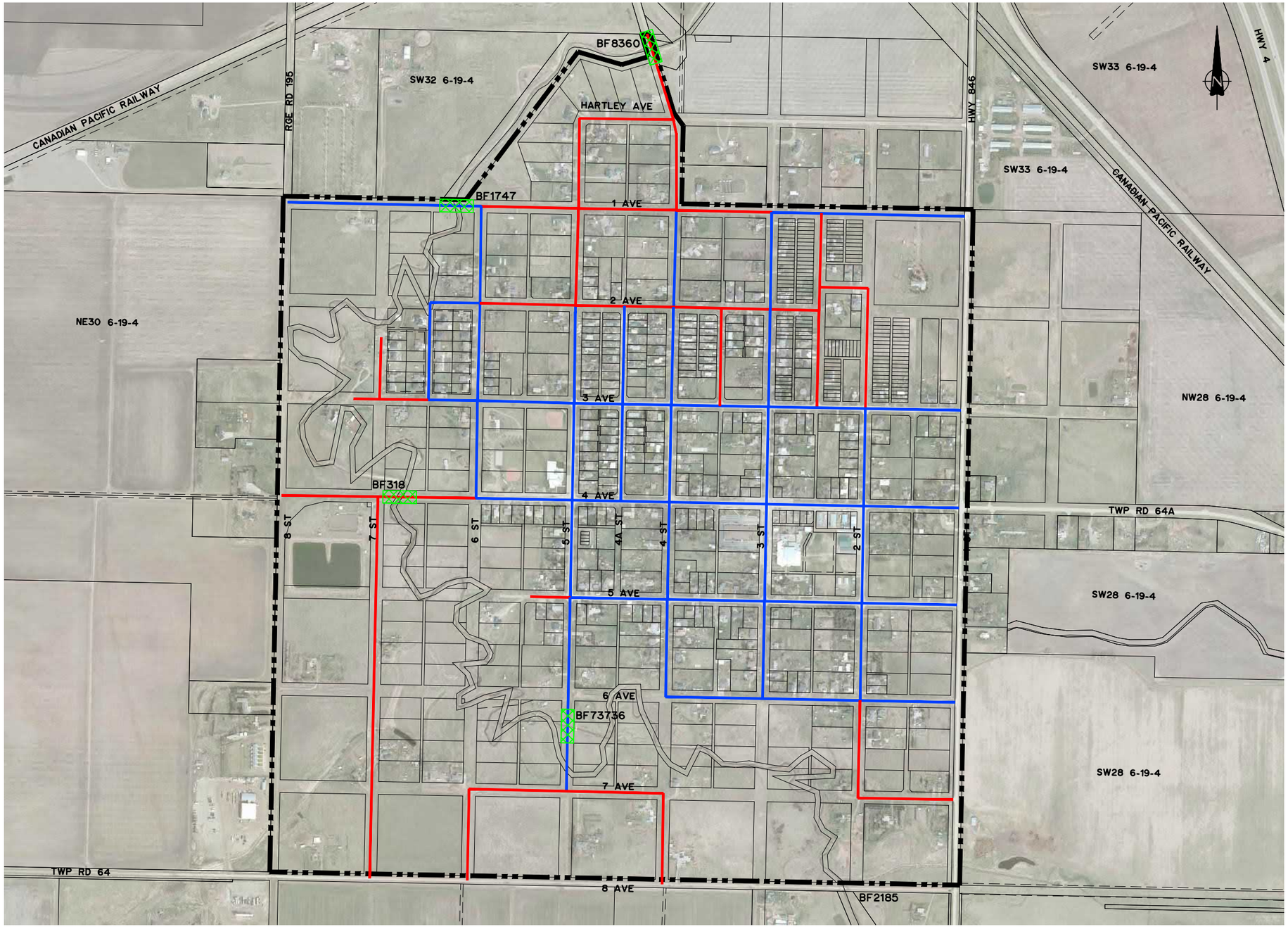
Pavement Type	Approximate Length (m)	Approximate Area (m)
Asphalt Pavement Roads	10,494	88,164
Gravel Roads	6,055	42,474
Total	***16,549***	***130,638***

6.1.3.2 PATHWAY NETWORK

The Village's pathway network is primarily concrete sidewalks and undefined grass pathways. Many pedestrians also appear to utilize the roadway surface to commute. The existing pathway network is summarized in the following table.

Table 6.3 – Existing Pathway Structures

Pavement Type	Approximate Length (m)
Concrete Sidewalk	2,980



LEGEND

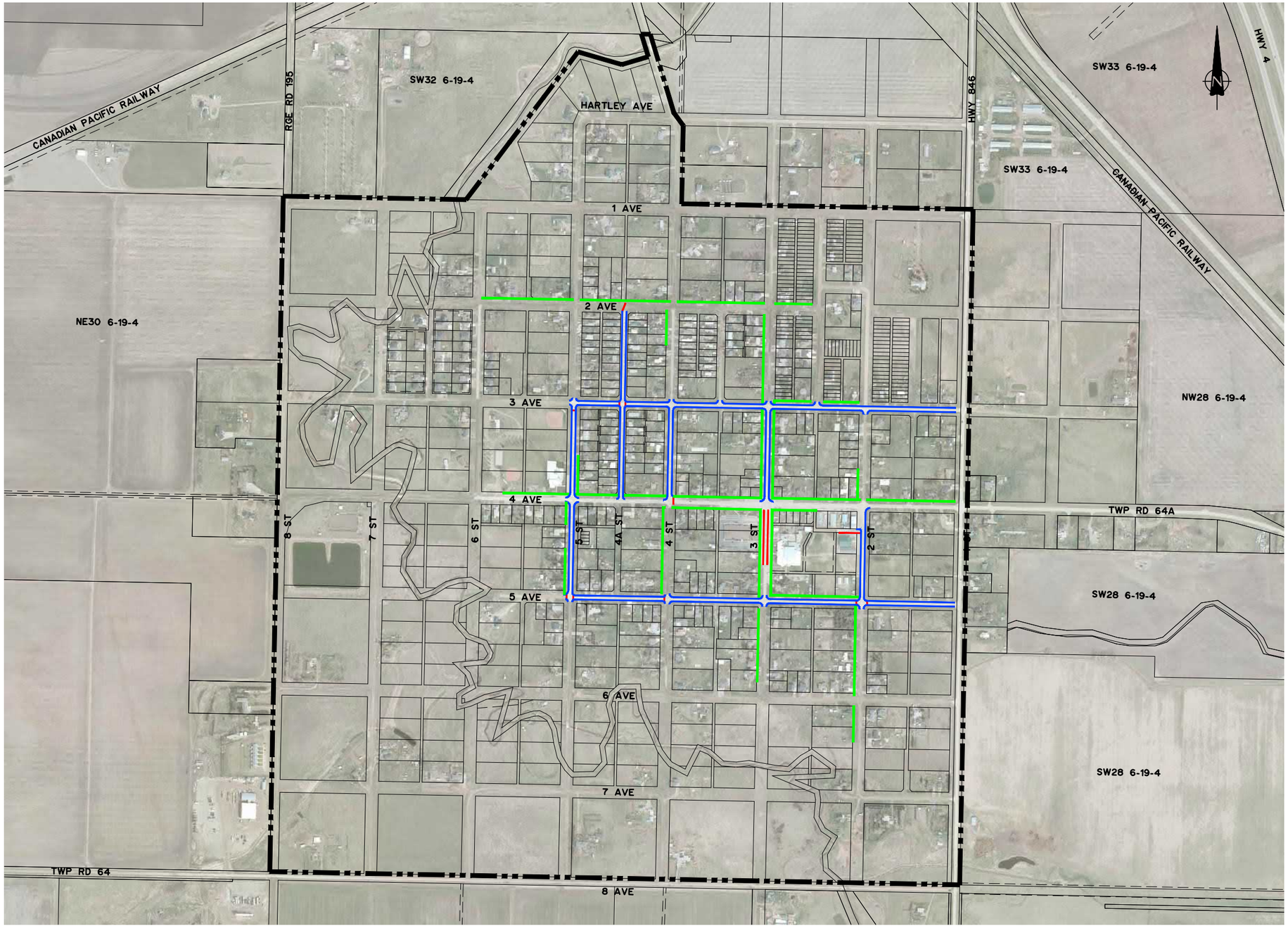
- VILLAGE BOUNDARY
- EXISTING ROAD STRUCTURE - PAVED
- EXISTING ROAD STRUCTURE - GRAVEL
- EXISTING BRIDGE AND FILE NUMBER

MPE Engineering Ltd.

VILLAGE OF STIRLING

INFRASTRUCTURE MASTER PLAN
EXISTING ROAD STRUCTURES AND BRIDGE FILES

SCALE: 1:10 000	DATE: SEPTEMBER 2020	JOB: 1407-001-00	FIGURE: 6.1



LEGEND

- VILLAGE BOUNDARY
- EXISTING CONCRETE CURB AND GUTTER
- EXISTING CONCRETE SIDEWALK
- EXISTING CONCRETE SWALE

MPE Engineering Ltd.

VILLAGE OF STIRLING

INFRASTRUCTURE MASTER PLAN
EXISTING CONCRETE STRUCTURES

SCALE: 1:10 000	DATE: SEPTEMBER 2020	JOB: 1407-001-00	FIGURE: 6.2

6.2 TRANSPORTATION NETWORK CONDITION ASSESSMENTS

MPE completed condition assessments for the paved roads, gravel roads, and concrete sidewalks. The condition assessments were completed based on relevant industry standards and the results are summarized in Figures 6.3 and 6.4.

6.2.1 Paved Road Condition Assessment

A field survey was completed to acquire pavement assessment data utilizing MPE's Data Collection Vehicle. The data collected by the vehicle included pavement surface distress data that was recorded with an automated onboard system. The system recorded the extent and severities of key distress classifications including load associated cracking, non-load associated cracking, surface deformations and surface defects. The following 12 distress types were inventoried:

Table 6.4 – Distress Types for Flexible Pavements

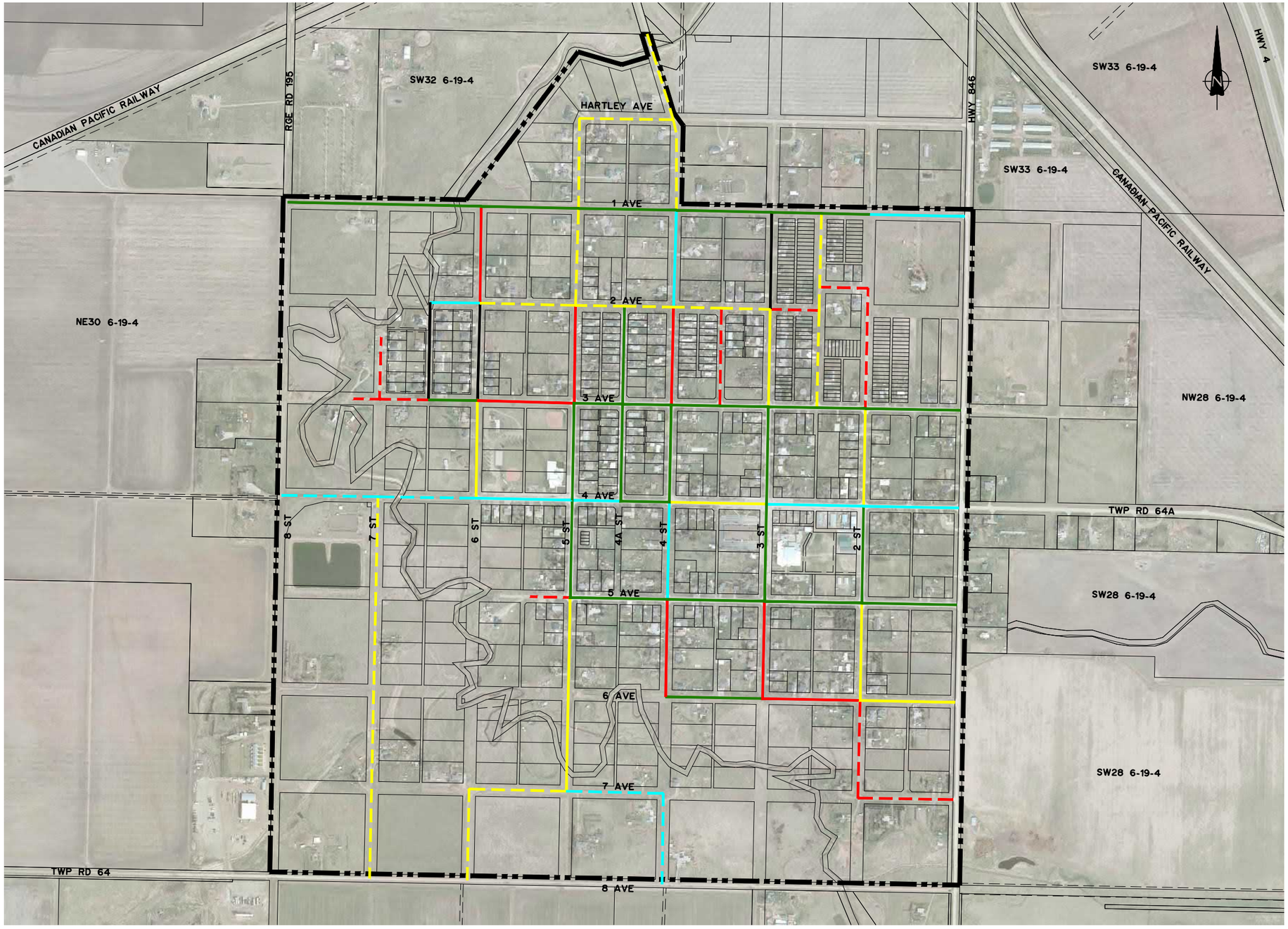
DISTRESS TYPES FOR FLEXIBLE PAVEMENTS		
Patching and Utility Patching	Edge Cracking	Rippling/Shoving
Alligator Cracking	Raveling/Weathering	Potholes
Bleeding	Block/Map Cracking	Distortions/Deformations
Longitudinal Cracking	Rutting	Transverse Cracking

The collected data was analyzed and quantified utilizing the Pavement Condition Index (PCI). The assessment represents the presence, severity, and extent of various surface distresses (e.g., cracking, potholes, etc.) occurring throughout a given pavement segment. The analysis of the paved roads was completed in accordance with ASTM D6433.

The PCI is summarized by values from zero (0) to one hundred (100); one hundred being a perfect score or being in excellent condition. For the assessment, the PCI scores of each road were broken down into a "Good to Failed" rating system.

The assessment identified the average pavement condition for the Village is at 70 which is considered a satisfactory rating. The Figure 6.3 provides a summary of the conditions based on the total paved lane lengths.

A detailed breakdown of each street in the Village is included in Appendix G.



LEGEND

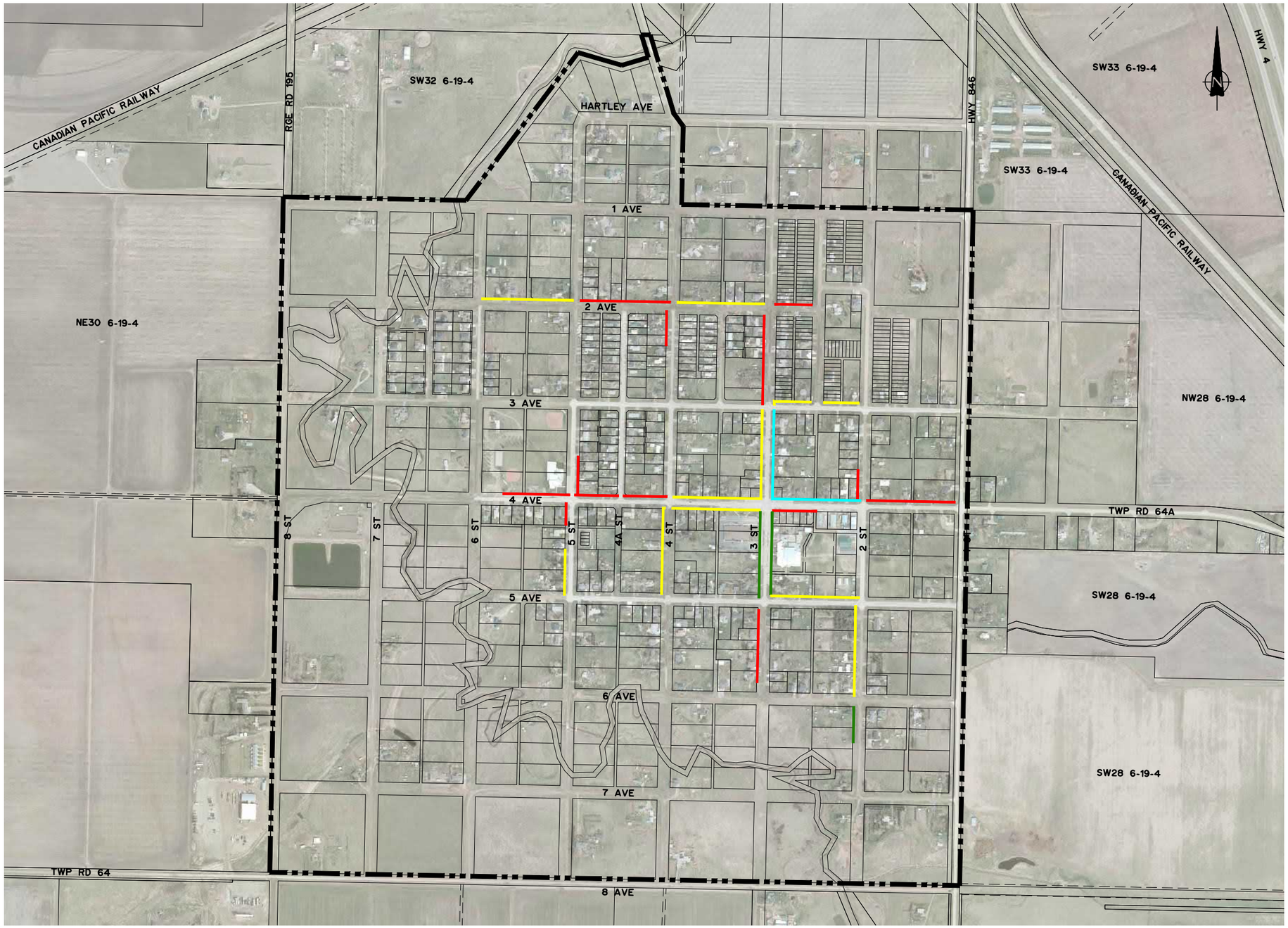
- VILLAGE BOUNDARY
- EXISTING PAVED STRUCTURE - GOOD
- EXISTING PAVED STRUCTURE - SATISFACTORY
- EXISTING PAVED STRUCTURE - FAIR
- EXISTING PAVED STRUCTURE - POOR
- EXISTING PAVED STRUCTURE - FAILED
- EXISTING GRAVEL STRUCTURE - SATISFACTORY
- EXISTING GRAVEL STRUCTURE - FAIR
- EXISTING GRAVEL STRUCTURE - POOR

MPE Engineering Ltd.

VILLAGE OF STIRLING

INFRASTRUCTURE MASTER PLAN
EXISTING ROAD STRUCTURE CONDITION

SCALE: 1:10 000	DATE: SEPTEMBER 2020	JOB: 1407-001-00	FIGURE: 6.3



LEGEND

- VILLAGE BOUNDARY
- EXISTING CONCRETE SIDEWALK - GOOD
- EXISTING CONCRETE SIDEWALK - SATISFACTORY
- EXISTING CONCRETE SIDEWALK - FAIR
- EXISTING CONCRETE SIDEWALK - POOR
- EXISTING CONCRETE SIDEWALK - FAILED

MPE Engineering Ltd.

VILLAGE OF STIRLING

INFRASTRUCTURE MASTER PLAN
EXISTING CONCRETE SIDEWALK CONDITION

SCALE:	DATE:	JOB:	FIGURE:
1:10 000	SEPTEMBER 2020	1407-001-00	6.4

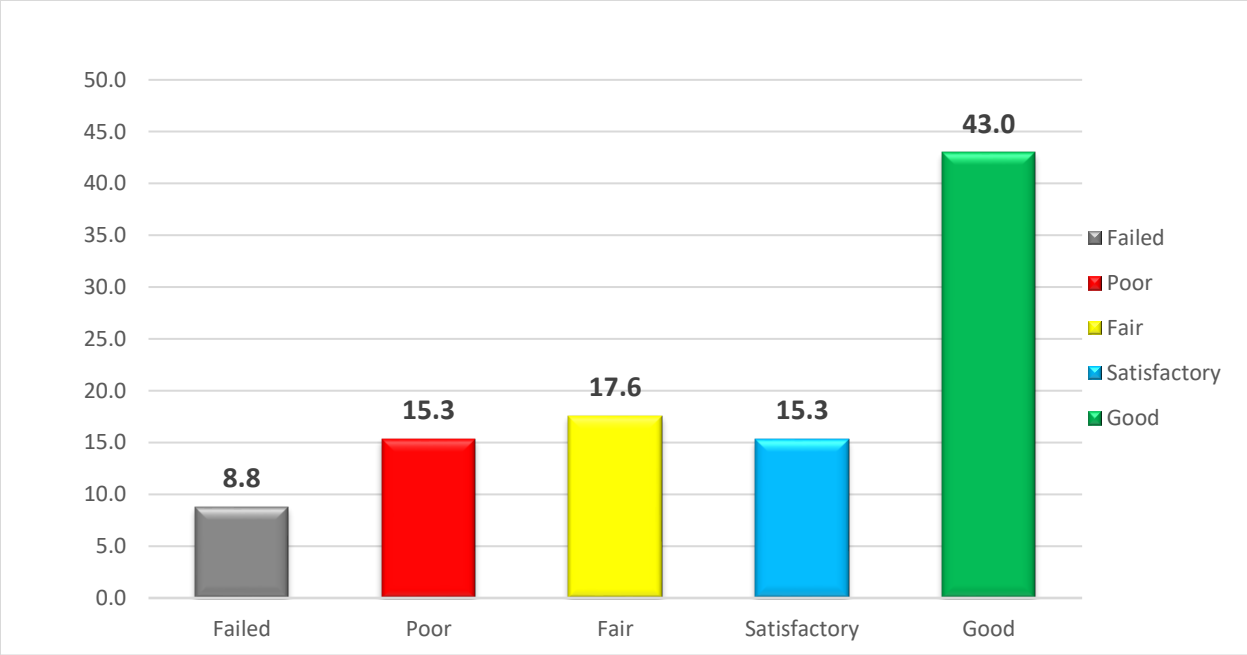


Figure 6.5 – Paved Road Condition Assessment Summary

6.2.2 Gravel Road Condition Assessment

A field survey was completed to acquire assessment data for the various gravel roads throughout the Village. Like paved roads, MPE's Data Collection Vehicle was utilized for surveys completed on the gravel roads and the collection system recorded the extent and severities of key distress classifications. The following distress types were inventoried for the gravel roads:

Table 6.5 – Distress Types for Gravel Roads

Distress Type	Distress Description
Crown	The height and condition of crown and an unrestricted slope of roadway from the center across the shoulders to the ditches.
Drainage	The ability of roadside ditches and under-road culverts to carry water away from the road.
Gravel Layer	Adequate thickness and quality of gravel to carry the traffic loads.
Surface deformation	Wash boarding, potholes, and ruts.
Surface Defects	Dust and loose aggregate.

The collected data was analyzed and quantified utilizing the Pavement Surface Evaluation and Rating (PASER) system. The assessment represents the presence, severity and extent of various surface distresses occurring throughout a given gravel segment. These PASER scores for each gravel road segment were classified from "Good" to "Failed".

The assessment identified the average gravel condition for the Village is 58 which is considered a fair rating. Standard gravel road maintenance is sufficient to maintain this rating while it is understood that, over time, the Village will look to pave all gravel roads.

A detailed breakdown of each street is included in Appendix G and the following figure provides a summary of the conditions based on the total gravel lane lengths.

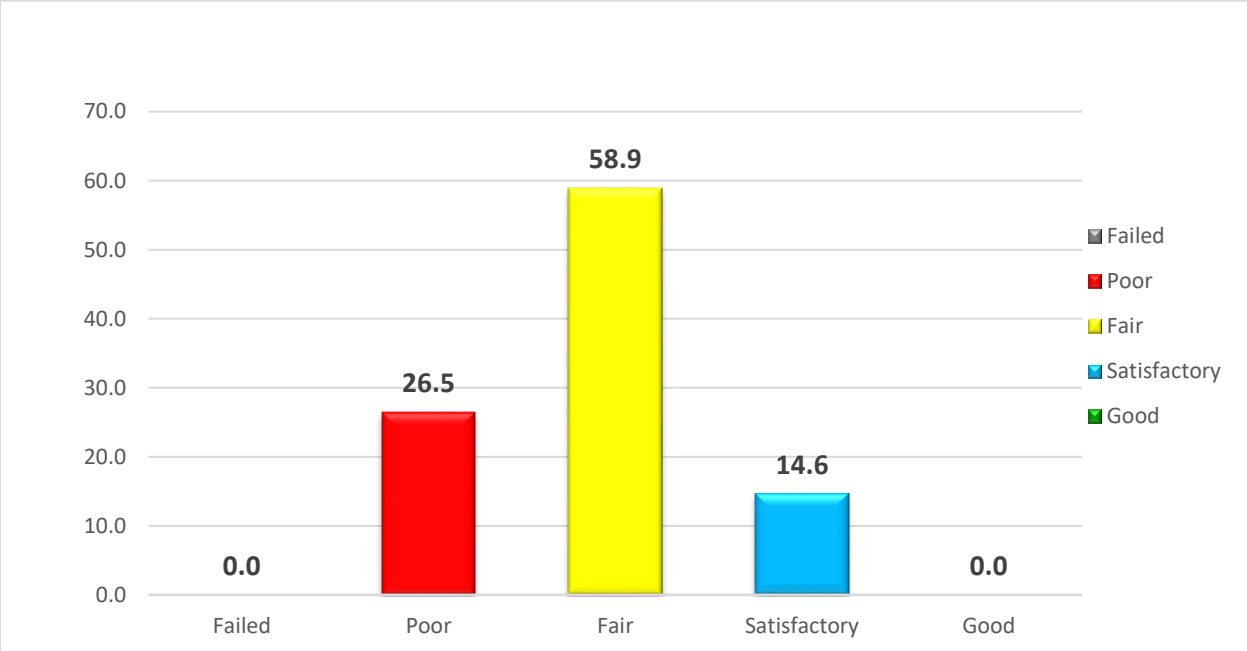


Figure 6.6 – Gravel Road Condition Assessment Summary

6.2.3 Concrete Sidewalk Condition Assessment

A field survey was completed to acquire concrete sidewalk assessment data. Collection was completed utilizing a handheld data collection device for sidewalk distress surveys. During the survey, surface distress data was collected, and the 9 distress types outlined in Table 6.6 were inventoried.

The collected data was analyzed in accordance with ASTM D6433. The assessment represents the presence, severity, and extent of various surface distresses (e.g., cracking, faulting, spalling, etc.) occurring throughout a given sidewalk segment.

Table 6.6 – Distress Types for Concrete Sidewalks

DISTRESS TYPES FOR CONCRETE SIDEWALKS		
Divided Slab	Joint Spalling	Small Patch
Corner Break	Linear Cracking	Large Patch
Corner Spalling	Faulting	Scaling/Map Cracking/Crazing

The analysis prepared performance indicators for each sidewalk segment that were summarized by values from zero (0) to one hundred (100); 100 being a perfect score or being in excellent condition. For simplicity, the performance indicators were also reduced to a rating from "Good" to "Failed". The assessment identified that average pavement condition for the village is at 57.6 which is considered a fair rating.

A detailed breakdown of each sidewalk segment is included in Appendix G and the following figure provides a summary of the conditions based on the total sidewalk length.

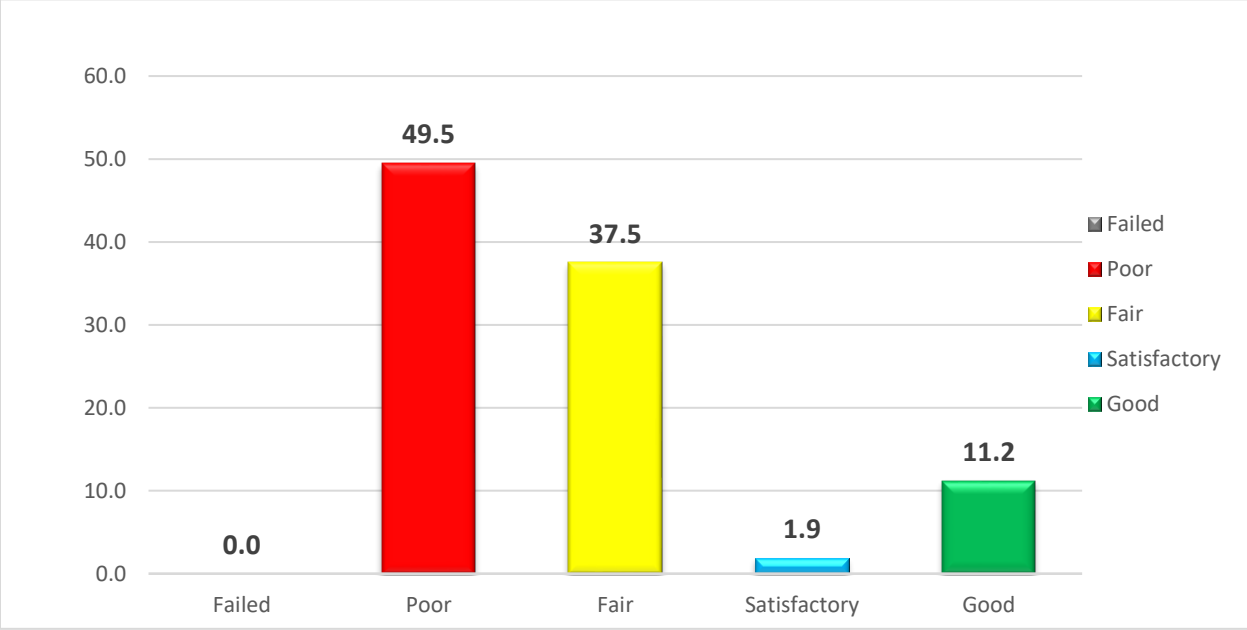


Figure 6.7 – Concrete Sidewalk Condition Assessment Summary

6.2.4 Bridge File Review and Findings

There are four bridge files (BF) within the Village's boundaries BF 00318, BF 01747, BF 08360, and BF 73736. Alberta Transportation hosts a Bridge Information System which inventories the Village's provided bridge inspection files. The latest available bridge file inspections were secured and are included in Appendix H. The following subsections outline MPE's findings from a review of the bridge files.

6.2.4.1 BRIDGE FILE 00318

Bridge File 00318 is located on 4th Avenue just east of the 7th Street intersection, bridging over Kipp Coulee, as shown in Figure 6.1. The bridge is Owned by Alberta Transportation and Managed by the Village.

The bridge is a single span standard bridge structure constructed in 1992. The latest bridge inspection was completed in August of 2012 and identified the following:

- Sufficiency Rating: 73.5,
- Condition Rating: 88.9,
- Estimated Replacement Year: 2035,
- Recommended updated inspection date: May 31, 2017,
- Maintenance Recommendations:
    - Install 1 A/B nut on bridge rail.

6.2.4.2 BRIDGE FILE 01747

Bridge File 01747 is located on 1st Avenue just west of the 6th Street intersection, bridging over Kipp Coulee, as shown in Figure 6.1. The bridge is Owned by Alberta Transportation and Managed by the Village.

The bridge is a 4,610 mm by 3,530 mm arch culvert structure constructed in 1986. The latest bridge inspection was completed in August of 2012 and identified the following:

- Sufficiency Rating: 77.8,
- Condition Rating: 77.8,
- Estimated Replacement Year: 2035
- Recommended updated inspection date: May 30, 2017,
- Maintenance Recommendations:
    - Install two missing bolts and 4 nuts at guardrails.

6.2.4.3 BRIDGE FILE 08360

Bridge File 08360 is located within the Village boundary. However, this bridge file is managed by the County of Warner No. 5. No further assessment was completed on this bridge file as the Village does not have maintenance obligations to this structure.

6.2.4.4 BRIDGE FILE 73736

Bridge File 73736 is located on 5th Street north of the 7th Avenue intersection, bridging over Kipp Coulee, as shown in Figure 6.1. The bridge is Owned by Alberta Transportation and Managed by the Village.

The bridge is a single span standard structure constructed in 1987. The latest bridge inspection was completed in August of 2012 and identified the following:

- Sufficiency Rating: 79.1,
- Condition Rating: 83.3,
- Estimated Replacement Year: 2035,
- Recommended updated inspection date: May 30, 2017,
- Maintenance Recommendations:
    - Install two hazard markers.

6.3 TRANSPORTATION NETWORK UPGRADES

From the completed analysis, the following recommendations were made for the paved roads, gravel roads, and concrete sidewalks located throughout the Village. Recommended upgrades are shown on Figure 6.8, and capital planning is discussed in the following section.

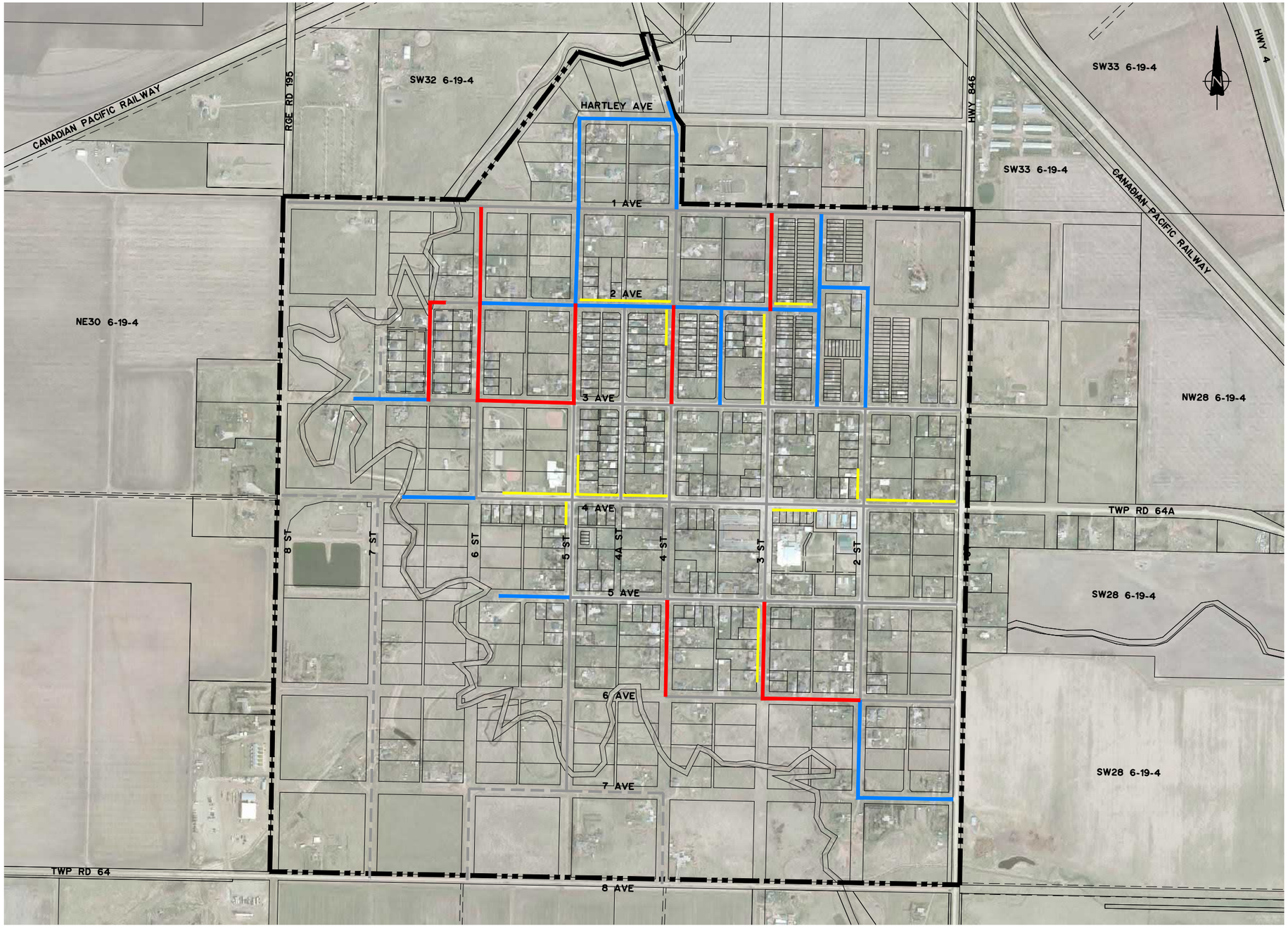
6.3.1 Paved Road Recommendations

It is recommended that paved roads which received a "failed" condition rating are reconstructed within the next 10 years and that paved roads which received a "poor" condition rating are reconstructed as funds become available. Estimated reconstruction costs are provided in Appendix G and summarized in Section 6.4.

For roads that received a "fair" or better condition rating, regular maintenance was determined to be sufficient to maintain the structure and longevity of the road over the next 25 years and reconstruction is only required if the replacement of underground utilities is to take place. Regular maintenance was assumed to include crack sealing, surface coats, and spot repairs, and is not included in the estimated costs provided. Should additional rehabilitation of these roads be required in the future, estimated costs for a 50 mm overlay were included in Appendix G for budgetary information.

It should be noted that the estimated costs provided in Appendix G are budgetary in nature and may not represent the exact project needs or values. Detailed cost estimates are recommended at specific sites prior to construction to ensure all project needs are addressed.

Figure 6.8 provides a visual representation of the paved roads that will require reconstruction.



LEGEND

- VILLAGE BOUNDARY
- EXISTING PAVED STRUCTURE
- EXISTING GRAVEL STRUCTURE
- PAVED ROAD RECONSTRUCTION
- PAVED ROAD CONSTRUCTION
- SIDEWALK REPLACEMENT

MPE Engineering Ltd.

VILLAGE OF STIRLING

INFRASTRUCTURE MASTER PLAN
TRANSPORTATION NETWORK
PROPOSED UPGRADES

SCALE: 1:10 000	DATE: SEPTEMBER 2020	JOB: 1407-001-00	FIGURE: 6.8

6.3.2 Gravel Road Recommendations

It is recommended that gravel roads which received a "failed" or "poor" condition rating are upgraded to a paved road standard. Upgrading these gravel roads in the future will increase the level of service provided by the transportation network and improve the drainage on and adjacent to the roadways. Estimated costs are included in the following section and Appendix G for the roads identified in Figure 6.8. The estimated costs are based on upgrading the gravel roads to the local road standard identified previously.

For all gravel roads, proper maintenance including grading, dust suppression, and additional granular materials are sufficient to maintain a suitable level of service until such time that the upgrades can be completed.

6.3.3 Concrete Sidewalk Recommendations

It is recommended that all concrete sidewalks which received a "failed" or "poor" condition rating are reconstructed as funds become available. In general, reconstruction is the primary rehabilitation measure for concrete aside from ongoing maintenance repairs such as joint grinding; "failed" and "poor" rated sidewalks are beyond a point where joint grading is a sufficient measure to improve their condition.

Estimated reconstruction costs are outlined in Section 6.4 and are included in Appendix G. Estimated costs for reconstructing sidewalks was based on an assumed cross section width of 1.2 m over the entire length required.

6.3.4 Bridge File Recommendations

Based on the information available, each of the bridge files within the Village's boundary was last inspected in 2012 and are past their recommended inspection date. It is recommended that updated bridge inspections be completed for each of the structures to confirm maintenance needs, re-assess bridge conditions and update estimated replacement dates.

Based on the conditions noted in previous inspections, it is unlikely that the bridge files will require replacement, but it is expected that some maintenance will be required.

6.4 TRANSPORTATION NETWORK COST ESTIMATES

Upgrades for the transportation network are based on reconstruction of paved roads, upgrading of gravel roads to a paved local road standard, and reconstruction of concrete sidewalks where a "poor" or worse condition rating was received. Estimates for all transportation projects are available in Appendix I, and Table 6.7 summarizes the estimated costs for the recommended projects on "poor" or worse road and sidewalk segments.

Table 6.7 – Transportation Network Capital Planning

Location	Project	Estimated Cost
6th Street – 3rd Avenue to 2nd Avenue	Paved Road Reconstruction	$171,300
6th Street – 2nd Avenue to 1st Avenue		$347,400
3rd Street – 6th Avenue to 5th Avenue		$345,750
	Concrete Sidewalk Replacement	$81,500
Bridge File 00318	Condition Assessment	$7,500
6A Street – 3rd Avenue to 2nd Avenue	Paved Road Reconstruction	$345,000
4th Street – 6th Avenue to 5th Avenue		$350,000
3rd Avenue – 6th Street to 5th Street		$175,000
3rd Street – 2nd Avenue to 1st Avenue		$350,000
2nd Avenue – 3rd Street to 2A Street	Concrete Sidewalk Replacements	$100,000
2nd Avenue – 5th Street to 4th Street		
4th Street – 3rd Avenue to 2nd Avenue		
Bridge File 01747	Condition Assessment	$15,000
Bridge File 73736		
4th Avenue – 6th Street to 7th Street	Paved Road Construction	$400,000
5th Avenue – 5th Street to 6th Street		$90,000
2A Street – 3rd Avenue to 2nd Avenue		$700,000
2A Street – 2nd Avenue to 1st Avenue		
4th Street – 3rd Avenue to 2nd Avenue	Paved Road Reconstruction	$350,000
2nd Avenue – 5th Street to 6th Street	Paved Road Construction	$345,000
5th Street – 3rd Avenue to 2nd Avenue	Paved Road Reconstruction	$175,000
5th Street	Concrete Sidewalk Replacements	$181,000

Location	Project	Estimated Cost
4th Avenue	Concrete Sidewalk Replacements	$435,500
5th Street – 2nd Avenue to 1st Avenue	Paved Road Construction	$350,000
2nd Avenue – 3A Street to 5th Street		$175,000
2nd Avenue – 2A Street to 3A Street		$350,000
2nd Street – 7th Avenue to 6th Avenue		$350,000
5th Street – 3rd Avenue to 2nd Avenue	Paved Road Reconstruction	$350,000
6th Avenue – 3rd Street to 2nd Street		$345,000
3rd Street – 3rd Avenue to 2nd Avenue	Concrete Sidewalk Replacement	$110,000
2nd Street – 4th Avenue to 3rd Avenue		
5th Street – 1st Avenue to Hartley Avenue	Paved Road Construction	$320,000
Hartley Avenue – 5th Street to 4th Street		$330,000
4th Street – 1st Avenue to Hartley Avenue		$330,000
2nd Avenue – 2nd Street to 2A Street		$180,000
3A Street – 3rd Avenue to 2nd Avenue		$350,000
3rd Avenue – 6A Street to 7th Street		$175,000
2nd Street – 3rd Avenue to 2nd Avenue		$430,000
7th Avenue – 1st Street to 2nd Avenue		$340,000

7 CAPITAL PLANNING

MPE has prepared a capital plan outline for the Village to use as a framework for scheduling capital projects in the future. The projects recommended throughout the report were provided a priority ranking of "high", "medium", or "low" based on the following criteria:

- High Priority:
  - Existing infrastructure lacks sufficient capacity to service the existing population,
  - The existing infrastructure is in "poor" or worse condition,
  - The infrastructure is critical to maintaining service to the residents of the Village,
- Medium Priority:
  - Existing infrastructure lacks sufficient capacity to service the 5 or 10-year projected population growth,
  - The existing infrastructure is in "fair" or worse condition,
  - The infrastructure is not critical to maintaining service to the residents of the Village,
- Low Priority:
  - Existing infrastructure has sufficient capacity to service the projected population beyond 15 years,
  - The existing infrastructure is in "fair" or better condition,
  - The infrastructure is not critical to maintaining service to the residents of the Village.

In general, projects that are considered a "high" priority should be undertaken as soon as possible and completed within the next 5 years, projects that are a "medium" priority should be completed within the next 10 years, and projects that are a "low" priority should be completed after all "high" and "medium" priority projects are completed and sufficient funds are available.

For this report, it was determined that road and stormwater projects are not considered a "high" priority for the Village. Despite several issues with the stormwater management system and localized ponding throughout the Village, there was not a significant concern with the stormwater system as the existing infrastructure does mitigate flooding and allow for eventual drainage of most areas. Road projects are considered a "medium" to "low" priority because they should be completed after underground utility projects take place and general maintenance can be sufficient to maintain an acceptable level of service over a short timeframe.

Projects related to servicing future growth in the County and potential annexation areas are considered a low priority but will need to be completed prior to development taking place.

The following tables summarize the "high" and "medium" priority projects recommended for the Village.

Table 7.1 – High Priority Upgrades for the Village of Stirling

Location	Project	Estimated Cost
Regional and Potable Water Supply Pipeline	Valve and Fitting Replacements	$320,000
Potable Water Reservoir	Structural Assessment	$7,500
Distribution System	Additional Water Supply Connections	$120,000
Lift Station	Operation and Maintenance Upgrades	$90,000
Forcemain	250/300 mm Forcemain Installation	$1,290,000
3rd Street – 4th Avenue to 3rd Avenue	Wastewater Main Replacement	$590,000
3rd Street – 3rd Avenue to 2nd Avenue		$590,000
	Estimated High Priority Expenditures	***$3,007,500***

Table 7.2 – Medium Priority Projects for the Village of Stirling

Location	Project	Estimated Cost
Potable Water Reservoir	Structural Repair Allowance	$200,000
3rd Street – 5th Ave to 6th Ave	150 mm Watermain Installation	$290,000
3rd Ave – 6th Street to 5th Street		$280,000
Wastewater Collection System	Video Inspections and Condition Assessment	$70,000
5th Avenue and 5th Street	Ditch Grading	$30,000
4th Avenue	Catch Basin Installation	$25,000
Sub-Catchment I	Drainage Swale Improvements	$90,000
6th Street – 3rd Avenue to 2nd Avenue	Paved Road Reconstruction	$171,300
6A Street – 3rd Avenue to 2nd Avenue		$345,000
3rd Street – 2nd Avenue to 1st Avenue		$350,000
	Estimated Medium Priority Expenditures	***$1,851,300***

7.1 FUNDING OPPORTUNITIES

The Government of Alberta, and Government of Canada, offer several avenues to assist smaller municipalities with funding infrastructure projects. Below is a summary of some of the available funding programs:

- Alberta Municipal Water/Wastewater Partnership (AMWWP):
    - The AMWWP program was launched in 1991 and provides cost-shared funding to eligible municipalities to help build municipal facilities for water supply and treatment, and wastewater treatment and disposal,
    - Eligible projects can receive up to 75% of project costs,
    - Eligible projects could include upgrades to the lift station and forcemain, and upgrades relative to the potable water supply system,
- Strategic Transportation Infrastructure Program (STIP):
        - The STIP program provides funding to municipalities under 4 funding streams: Community Airport Program, Local Road Bridge Program, Resource Road Program, Local Municipal Initiatives,
    - Program funding is determined each budget cycle and projects related to the various bridge files throughout the Village,
- Municipal Asset Management Program (MAMP):
    - MAMP is offered by the Federation of Canadian Municipalities and is focused on improving asset management practices,
    - Eligible projects could include the video inspections of remaining wastewater mains throughout the Village,
    - The program will cover 80% of eligible expenses up to a maximum of $50,000,
- Alberta Community Partnership (ACP):
    - The program is available for communities looking to partner and develop regional land use plans and service delivery frameworks,
    - The Village previously utilized this funding for the IMDP with the County of Warner,
    - Other eligible projects would include the preliminary design of regional stormwater infrastructure, and infrastructure planning studies (such as this study),
    - Funding is available for 100% of eligible costs up to a maximum of $200,000.

The Village should also consider a future off-site levy bylaw. Off-site levies are a tool that can be utilized by municipalities to recoup infrastructure costs associated with new growth. Off-site levies can be applied to new developments for the purpose of funding the following:

- New or expanded facilities for storage, transmission, treatment or supply of water,
- New or expanded facilities for treatment, movement or disposal of sanitary sewage,
- New or expanded storm sewer drainage facilities,
- New or expanded roads required for or impacted by a subdivision or development,
- Land required for or in connection with any facilities described in the off-site levy provisions of the Municipal Government Act.

8 CONCLUSIONS & RECOMMENDATIONS

8.1 POTABLE WATER SYSTEM

The following conclusions can be made based on the analysis of the Village's potable water system included in this report:

- The Village has sufficient raw water allocation available for the projected 25-year water demands,
- Capacity in the regional supply pipeline can service the projected 25-year population,
- Inspections of the potable water reservoir revealed potential structural concerns,
- The potable water supply pipeline does not have capacity for the projected 25-year water demands and a pump station or pipe upgrade may be required in the future,
- Aged fittings on the regional and potable water supply pipelines require replacement,
- Available fire flow in the northwest and southeast portions of the Village do not meet Fire Underwriters Survey (FUS) recommended requirements,
- Aged Asbestos-Cement (AC) watermains should be scheduled for replacement and/or lining.

The following recommendations can be made:

- Complete a structural assessment on the existing potable water reservoir immediately to address potential concerns,
- Replace aged fittings on the regional and potable water supply pipelines,
- Complete watermain upsizing and installations at select locations in the distribution system to improve the fire flows available throughout the Village,
- Implement a schedule for replacing and/or lining aging AC watermains in the Village.

8.2 WASTEWATER SYSTEM

The following conclusions can be made based on the analysis of the Village's wastewater system:

- The wastewater collection system is subject to high inflow and infiltration rates and the lift station is unable to provide sufficient pumping capacity,
- Wastewater flows are approximately equal to 45% of the total water use based on the recorded volumes from the past 4 years (likely indicating erroneous wastewater flow data),
- Inspected wastewater mains are in fair or poor condition and should be replaced,
- Video inspections of the remaining wastewater mains are required to assess their condition,
- The lift station is in good operational condition; however, it was noted that pressure gauge assemblies and one of the check valves were not functioning properly,
- The condition of the forcemain is unknown, however, it is undersized for the available pumping capacity at the lift station,
- The wastewater lagoons will require upgrades to have capacity for the 25-year population,
- New and upsized wastewater mains along 1st Avenue, east of the lift station, are required to service future population growth.

The following recommendations can be made:

- Complete video inspections of all wastewater mains throughout the Village,
- Repair and replace wastewater mains in poor or fair condition identified through video inspection reports,
- Complete upgrades at the lift station to improve flow monitoring capabilities and replacement of existing valve assemblies,
- Construct a new 250 mm or 300 mm forcemain to the wastewater lagoons to maximize the pumping capacity available at the lift station.

8.3 STORMWATER MANAGEMENT SYSTEM

The following conclusions can be made based on the analysis of the Village's stormwater management system included in this report:

- The major drainage system throughout the Village performs suitably despite issues with road and ditch grading causing localized ponding in certain areas,
- The minor drainage system does not provide an acceptable level of service for conveying runoff from a 1:5-year storm event,
- The minor drainage system does allow for drainage of areas throughout the Village after a rainfall event,
- There are no stormwater management facilities located within the Village.

The following recommendations can be made:

- The Village should undertake projects to reduce localized ponding throughout the Village. These projects can consist of grass swales, ditches, additional connections to the minor drainage systems, and improved road grading along with road restoration projects,
- Construction of a minor drainage system for development to the northeast of the Village should be completed with allowances for improving drainage between 1st Avenue and 3rd Avenue,
- All future developments should be designed with stormwater detention facilities capable of reducing stormwater runoff rates to pre-development 1:5-year release rates.

8.4 TRANSPORTATION NETWORK

The following conclusions can be made based on the analysis of the Village's transportation network included in this report:

- The Village's transportation network includes 10.5 km of paved roads, 6 km of gravel roads, and 3 km of concrete sidewalks,
- Average overall condition of the Village's paved roads is satisfactory and minimal roads are recommended for reconstruction,
- Average overall condition of the Village's gravel roads is fair. The long-term plan is to transition all gravel roads to paved surfaces, therefore all gravel roads which received a "failed" or "poor" condition rating were recommended to be upgraded to a paved local road standard,

- Average overall condition of the Village's concrete sidewalks is fair, however, 40% were assessed to be in poor condition,
- Inspections of bridge files within the Village boundary are out of date.

The following recommendations can be made:

- The Village should schedule reconstruction of "failed" to "poor" road and sidewalk segments as their budget allows,
- Road and sidewalk improvements should coincide with, or take place after, underground improvement projects,
- The Village should continue to perform regular maintenance and rehabilitation on roads that have a condition rating greater than "fair" to prolong their life span,
- The Village should complete updated inspections of all bridge files within their boundary.

9 REFERENCES

Alberta Environment and Sustainable Resource Development, “Standards and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage Systems,” Drinking Water Branch, Environmental Policy Branch, Environmental Assurance Division, March 2013.

City of Lethbridge. “City of Lethbridge Design Standards 2016 Edition”. 2016.

Fire Underwriters Survey. “Water Supply for Public Fire Protection”. 1999.

APPENDIX A:

POTABLE WATER COST ESTIMATES

Village of Stirling

Infrastructure Master Plan
Potable Water System Upgrades

UNIT PRICING

Potable Water Distribution System

Potable Water Distribution System			
	Description of Work	**Unit**	**Cost per unit**
1	Connection to Existing Water Distribution System	each	$8,000.00
2	Connection to Existing Water Distribution System (>400)	each	$10,000.00
3	Water main crossing	each	$10,000.00
4	Supply and Install 200mm DR18 PVC Water Pipe	m	$225.00
5	Supply and Install 250mm DR18 PVC Water Pipe	m	$250.00
6	Supply and Install 300mm DR18 PVC Water Pipe	m	$325.00
7	Supply and Install 400mm DR18 PVC Water Pipe	m	$375.00
8	Supply and Install 200mm Gate Valve	each	$2,500.00
9	Supply and Install 250mm Gate Valve	each	$3,000.00
10	Supply and Install 300mm Gate Valve	each	$3,500.00
11	Supply and Install Fire Hydrant and Hydrant Valve	each	$8,000.00

200mm Water Main Repair / Replacement per Meter - Local Asphalt Surface					
	Description of Work	**m2**	**m**	**Unit Cost**	**Cost**
1	Asphalt Road Restoration - Local Road	10		$100.00	$1,000.00
2	Supply and Install 200mm DR18 PVC Water Pipe		1	$225.00	$225.00
3	General Requirements (15%)				$200.00
				Total Unit Price	**$1,500.00**

300mm Water Main Repair / Replacement per Meter - Local Asphalt Surface					
	Description of Work	**m2**	**m**	**Unit Cost**	**Cost**
1	Asphalt Road Restoration - Local Road	10		$100.00	$1,000.00
2	Supply and Install 300mm DR18 PVC Water Pipe		1	$325.00	$325.00
3	General Requirements (15%)				$200.00
				Total Unit Price	**$1,600.00**

Unit pricing assuming the following:

- Assumed 10m wide trench
- no allowance made for curb & gutter and sidewalk work
- Assume no conflict with other utilities (pp's, etc)

Village of Stirling

Infrastructure Master Plan
Potable Water System Upgrades

UNIT PRICING

Hot Mix Asphalt

Asphalt Road Restoration - Local Road

	Description of Work	Cost per m^2
1	Remove and dispose of asphalt	$10.00
2	Waste excavation - assume 0.3 m depth	$6.00
3	Subgrade preparation or geotextile fabric	$10.00
4	250 mm base granular material	$25.00
5	Prime coat	$5.00
6	90 mm asphalt ($140 per tonne)	$30.00
7	Adjust manholes and valves	$10.00
	Total Unit Price	**$100.00**

Unit pricing based on 1 block, assuming the following:

- an average block is 12.0m wide and 225m long
- an average of 4 manholes and 6 valve adjustments per block
- no allowance made for curb & gutter and sidewalk work
- 15 mm of level course asphalt required to restore road shape

Asphalt Road Restoration - Industrial

	Description of Work	Cost per m^2
1	Remove and dispose of asphalt	$15.00
2	Waste excavation - assume 0.5 m depth	$10.00
3	Subgrade preparation or geotextile fabric	$10.00
4	250 mm sub-base granular material (Pit run gravel)	$25.00
5	100 mm base granular material	$20.00
6	Prime coat	$5.00
7	Tack Coat	$5.00
8	160 mm asphalt ($140 per tonne)	$55.00
9	Adjust manholes and valves	$2.00
	Total Unit Price	**$150.00**

Unit pricing based on 1 block, assuming the following:

- an average block is 12.0m wide and 225m long
- an average of 4 manholes and 6 valve adjustments per block
- no allowance made for curb & gutter and sidewalk work
- 15 mm of level course asphalt required to restore road shape

Village of Stirling

Infrastructure Master Plan
Potable Water System Upgrades

UNIT PRICING

Gravel

Gravel Road Restoration		
	Description of Work	**Cost per m^2**
1	Waste excavation - assume 0.4m depth	$7.00
2	Subgrade preparation or geotextile fabric	$8.00
3	300 mm sub-base granular material (Pit run gravel)	$25.00
4	100mm base granular material	$20.00
	Total Unit Price	**$60.00**

Unit pricing based on 1 block, assuming the following:

- an average block is 9.0m wide and 225m long

Grass

Grass Restoration			
	Description of Work	**Unit**	**Cost per unit**
1	Grass Restoration - Topsoil and Seed	m2	$5.00
2	Grass Restoration - Topsoil and Sod	m2	$10.00

Village of Stirling

Infrastructure Master Plan
Potable Water System Upgrades

UNIT PRICING

Concrete

Rolled Monolithic Sidewalk

	Description of Work	Cost per m
1	Breakout and dispose of monolithic sidewalk and 1.0 m width of asphalt	$10.00
2	Hand form monolithic sidewalk	$320.00
3	100 mm base granular material	$20.00
4	Boulevard restoration - assume 1.0 m width at back of sidewalk	$10.00
	Total Unit Price	**$360.00**

Rolled Curb & Gutter

	Description of Work	Cost per m
1	Breakout and dispose of curb & gutter and 1.0 m width of asphalt	$10.00
2	Hand formed curb & gutter	$250.00
3	100 mm base granular material	$20.00
4	Boulevard Restoration - assume 1.0 m width	$10.00
	Total Unit Price	**$290.00**

Concrete Swale (1.0m wide)

	Description of Work	Cost per m
1	Remove and dispose of asphalt	$10.00
2	Waste excavation - assume 0.3 m depth	$6.00
3	Subgrade preparation or geotextile fabric	$8.00
4	250 mm base granular material	$30.00
5	Concrete Swale	$300.00
	Total Unit Price	**$350.00**

Village of Stirling

Infrastructure Master Plan
Potable Water System Upgrades

ORDER OF MAGNITUDE COST ESTIMATE

Potable Water Supply Upgrades

	Regional and Potable Water Supply Pipelines - Valve and Fitting Replacements	QUANTITY	UNIT	UNIT PRICE	COST
1	Mobilization/Demobilization/Bonding & Insurance/Profit/Traffic Accommodation	1	L.S.	$ 30,000.00	$ 30,000.00
2	Hydroexcavation	40	hr	$ 350.00	$ 14,000.00
3	Dewatering	1	L.S.	$ 20,000.00	$ 20,000.00
4	Supply and Install 250mm Gate Valve	7	ea	$ 4,000.00	$ 28,000.00
5	Supply and Install Air Release Valves	10	ea	$ 7,500.00	$ 75,000.00
6	Decommission Drain Chambers	3	ea	$ 15,000.00	$ 45,000.00
7	Site Restoration	1	LS	$ 25,000.00	$ 25,000.00
				SUBTOTAL	$ 237,000.00
CONTINGENCY (20%)					$ 47,000.00
ENGINEERING (10%)					$ 29,000.00
				TOTAL	**$ 320,000.00**

	Potable Water Reservoir - Structural Repair Allowance	QUANTITY	UNIT	UNIT PRICE	COST
1	Mobilization/Demobilization/Bonding & Insurance/Profit/Traffic Accommodation	1	L.S.	$ 14,000.00	$ 14,000.00
2	Structural Repair Work - To be Determined.	1	LS	$ 135,000.00	$ 135,000.00
				SUBTOTAL	$ 149,000.00
CONTINGENCY (20%)					$ 30,000.00
ENGINEERING (10%)					$ 18,000.00
				TOTAL	**$ 200,000.00**

	Potable Water Reservoir - Pump Station	QUANTITY	UNIT	UNIT PRICE	COST
1	Mobilization/Demobilization/Bonding & Insurance/Profit/Traffic Accommodation	1	L.S.	$ 83,000.00	$ 83,000.00
2	Connection to Existing Potable Water Supply Line	2	ea	$ 10,000.00	$ 20,000.00
3	Supply and Install 300 mm Watermain	15	m	$ 325.00	$ 4,875.00
4	Supply and Install 300 mm Isolation Valves	2	ea	$ 3,500.00	$ 7,000.00
5	Pump Station Building (complete with Electrical, HVAC, Building Envelope)	1	LS	$ 500,000.00	$ 500,000.00
6	End Suction, Centrifugal Pumps	3	ea	$ 25,000.00	$ 75,000.00
7	Process/Mechanical Piping	1	LS	$ 75,000.00	$ 75,000.00
8	Electrical, Controls, and Instrumentation	1	LS	$ 100,000.00	$ 100,000.00
9	Programming and Commissioning	1	LS	$ 50,000.00	$ 50,000.00
				SUBTOTAL	$ 915,000.00
CONTINGENCY (20%)					$ 183,000.00
ENGINEERING (10%)					$ 110,000.00
				TOTAL	**$ 1,210,000.00**

Village of Stirling

Infrastructure Master Plan
Potable Water System Upgrades

ORDER OF MAGNITUDE COST ESTIMATE

Potable Water Distribution System Upgrades

Additional Potable Water Supply Connections		QUANTITY	UNIT	UNIT PRICE	COST
1	Mobilization/Demobilization/Bonding & Insurance/Profit/Traffic Accommodation	1	L.S.	$ 10,000.00	$ 10,000.00
2	Connection to Existing Water Distribution System (Less than 400 mm)	2	each	$ 8,000.00	$ 16,000.00
3	Connection to Existing Potable Water Supply Line	2	each	$ 15,000.00	$ 30,000.00
5	Supply and Installation 200 mm Isolation Valves	3	each	$ 2,500.00	$ 7,500.00
6	Gravel Road Restoration	1	LS	$ 7,500.00	$ 7,500.00
7	Asphalt Road Restoration	1	LS	$ 15,000.00	$ 15,000.00
				SUBTOTAL	$ 86,000.00
CONTINGENCY (20%)					$ 17,000.00
ENGINEERING (10%)					$ 10,000.00
				TOTAL	**$ 120,000.00**

3rd Ave - 5 Street to 6 Street		QUANTITY	UNIT	UNIT PRICE	COST
1	Mobilization/Demobilization/Bonding & Insurance/Profit/Traffic Accommodation	1	L.S.	$ 20,000.00	$ 20,000.00
2	Connection to Existing Water Distribution System	2	each	$ 8,000.00	$ 16,000.00
3	Supply and Install 150mm Watermain	225	m	$ 200.00	$ 45,000.00
4	Supply and Installation 150 mm Isolation Valves	2	each	$ 2,250.00	$ 4,500.00
5	Service Connections	2	each	$ 2,000.00	$ 4,000.00
6	Gravel Road Restoration	2000	m^2	$ 60.00	$ 120,000.00
				SUBTOTAL	$ 210,000.00
CONTINGENCY (20%)					$ 42,000.00
ENGINEERING (10%)					$ 25,000.00
				TOTAL	**$ 280,000.00**

2nd Ave - 5 Street to 6 Street		QUANTITY	UNIT	UNIT PRICE	COST
1	Mobilization/Demobilization/Bonding & Insurance/Profit/Traffic Accommodation	1	L.S.	$ 20,000.00	$ 20,000.00
2	Connection to Existing Water Distribution System	2	each	$ 8,000.00	$ 16,000.00
3	Supply and Install 150mm Watermain	225	m	$ 200.00	$ 45,000.00
4	Supply and Installation 150 mm Isolation Valves	2	each	$ 2,250.00	$ 4,500.00
5	Service Connections	3	each	$ 2,000.00	$ 6,000.00
6	Gravel Road Restoration	2000	m^2	$ 60.00	$ 120,000.00
				SUBTOTAL	$ 212,000.00
CONTINGENCY (20%)					$ 42,000.00
ENGINEERING (10%)					$ 25,000.00
				TOTAL	**$ 280,000.00**

Village of Stirling

Infrastructure Master Plan
Potable Water System Upgrades

ORDER OF MAGNITUDE COST ESTIMATE

6th Ave - 5th Street to 3rd Street		QUANTITY	UNIT	UNIT PRICE	COST
1	Mobilization/Demobilization/Bonding & Insurance/Profit/Traffic Accommodation	1	L.S.	$ 40,000.00	$ 40,000.00
2	Connection to Existing Water Distribution System	3	each	$ 8,000.00	$ 24,000.00
3	Supply and Install 200 mm Watermain	450	m	$ 225.00	$ 101,250.00
4	Supply and Installation 200 mm Isolation Valves	6	each	$ 2,500.00	$ 15,000.00
5	Service Connections	4	each	$ 2,000.00	$ 8,000.00
6	Gravel Road Restoration	4000	m^2	$ 60.00	$ 240,000.00
				SUBTOTAL	$ 428,000.00
CONTINGENCY (20%)					$ 86,000.00
ENGINEERING (10%)					$ 51,000.00
				TOTAL	**$ 570,000.00**

3rd Street - 5th Ave to 6th Ave		QUANTITY	UNIT	UNIT PRICE	COST
1	Mobilization/Demobilization/Bonding & Insurance/Profit/Traffic Accommodation	1	L.S.	$ 20,000.00	$ 20,000.00
2	Connection to Existing Water Distribution System	2	each	$ 8,000.00	$ 16,000.00
3	Supply and Install 150mm Watermain	225	m	$ 200.00	$ 45,000.00
4	Supply and Installation 150 mm Isolation Valves	2	each	$ 2,250.00	$ 4,500.00
5	Service Connections	7	each	$ 2,000.00	$ 14,000.00
6	Gravel Road Restoration	2000	m^2	$ 60.00	$ 120,000.00
				SUBTOTAL	$ 220,000.00
CONTINGENCY (20%)					$ 44,000.00
ENGINEERING (10%)					$ 26,000.00
				TOTAL	**$ 290,000.00**

2nd Street - 5th Ave to 6th Ave		QUANTITY	UNIT	UNIT PRICE	COST
1	Mobilization/Demobilization/Bonding & Insurance/Profit/Traffic Accommodation	1	L.S.	$ 20,000.00	$ 20,000.00
2	Connection to Existing Water Distribution System	2	each	$ 8,000.00	$ 16,000.00
3	Supply and Install 150mm Watermain	225	m	$ 200.00	$ 45,000.00
4	Supply and Installation 150 mm Isolation Valves	2	each	$ 2,250.00	$ 4,500.00
5	Service Connections	8	each	$ 2,000.00	$ 16,000.00
6	Gravel Road Restoration	2000	m^2	$ 60.00	$ 120,000.00
				SUBTOTAL	$ 222,000.00
CONTINGENCY (20%)					$ 44,000.00
ENGINEERING (10%)					$ 27,000.00
				TOTAL	**$ 300,000.00**

Village of Stirling

Infrastructure Master Plan
Potable Water System Upgrades

ORDER OF MAGNITUDE COST ESTIMATE

5th Street - 4th Ave to 2nd Ave		QUANTITY	UNIT	UNIT PRICE	COST
1	Mobilization/Demobilization/Bonding & Insurance/Profit/Traffic Accommodation	1	L.S.	$ 50,000.00	$ 50,000.00
2	Connection to Existing Water Distribution System	5	each	$ 8,000.00	$ 40,000.00
3	Supply and Install 200mm Watermain	450	m	$ 225.00	$ 101,250.00
4	Supply and Installation 200 mm Isolation Valves	5	each	$ 2,500.00	$ 12,500.00
5	Service Connections	15	each	$ 2,000.00	$ 30,000.00
6	Asphalt Road Restoration	2000	m^2	$ 100.00	$ 200,000.00
7	Gravel Road Restoration	2000	m^2	$ 60.00	$ 120,000.00
				SUBTOTAL	$ 554,000.00
CONTINGENCY (20%)					$ 111,000.00
ENGINEERING (10%)					$ 67,000.00
				TOTAL	**$ 740,000.00**

4th Street - 4th Ave to 5th Ave		QUANTITY	UNIT	UNIT PRICE	COST
1	Mobilization/Demobilization/Bonding & Insurance/Profit/Traffic Accommodation	1	L.S.	$ 20,000.00	$ 20,000.00
2	Connection to Existing Water Distribution System	3	each	$ 8,000.00	$ 24,000.00
3	Supply and Install 150mm Watermain	225	m	$ 200.00	$ 45,000.00
4	Supply and Installation 150 mm Isolation Valves	4	each	$ 2,250.00	$ 9,000.00
5	Service Connections	6	each	$ 2,000.00	$ 12,000.00
6	Gravel Road Restoration	2000	m^2	$ 60.00	$ 120,000.00
				SUBTOTAL	$ 230,000.00
CONTINGENCY (20%)					$ 46,000.00
ENGINEERING (10%)					$ 28,000.00
				TOTAL	**$ 310,000.00**

4th Street - 5th Ave to 6th Ave		QUANTITY	UNIT	UNIT PRICE	COST
1	Mobilization/Demobilization/Bonding & Insurance/Profit/Traffic Accommodation	1	L.S.	$ 20,000.00	$ 20,000.00
2	Connection to Existing Water Distribution System	4	each	$ 8,000.00	$ 32,000.00
3	Supply and Install 150mm Watermain	225	m	$ 200.00	$ 45,000.00
4	Supply and Installation 150 mm Isolation Valves	5	each	$ 2,250.00	$ 11,250.00
5	Service Connections	6	each	$ 2,000.00	$ 12,000.00
6	Gravel Road Restoration	2000	m^2	$ 60.00	$ 120,000.00
				SUBTOTAL	$ 240,000.00
CONTINGENCY (20%)					$ 48,000.00
ENGINEERING (10%)					$ 29,000.00
				TOTAL	**$ 320,000.00**

Village of Stirling

Infrastructure Master Plan
Potable Water System Upgrades

ORDER OF MAGNITUDE COST ESTIMATE

2nd Ave - 5th Street to 3rd Street		QUANTITY	UNIT	UNIT PRICE	COST
1	Mobilization/Demobilization/Bonding & Insurance/Profit/Traffic Accommodation	1	L.S.	$ 40,000.00	$ 40,000.00
2	Connection to Existing Water Distribution System	7	each	$ 8,000.00	$ 56,000.00
3	Supply and Install 200mm Watermain	450	m	$ 225.00	$ 101,250.00
4	Supply and Installation 200 mm Isolation Valves	6	each	$ 2,500.00	$ 15,000.00
5	Service Connections	16	each	$ 2,000.00	$ 32,000.00
6	Gravel Road Restoration	4000	m^2	$ 60.00	$ 240,000.00
				SUBTOTAL	$ 484,000.00
CONTINGENCY (20%)					$ 97,000.00
ENGINEERING (10%)					$ 58,000.00
				TOTAL	**$ 640,000.00**

3rd Street - 2nd Ave to 3rd Ave		QUANTITY	UNIT	UNIT PRICE	COST
1	Mobilization/Demobilization/Bonding & Insurance/Profit/Traffic Accommodation	1	L.S.	$ 30,000.00	$ 30,000.00
2	Connection to Existing Water Distribution System	3	each	$ 8,000.00	$ 24,000.00
3	Supply and Install 200mm Watermain	225	m	$ 225.00	$ 50,625.00
4	Supply and Installation 200 mm Isolation Valves	2	each	$ 2,500.00	$ 5,000.00
5	Service Connections	10	each	$ 2,000.00	$ 20,000.00
6	Paved Road Restoration	2000	m^2	$ 100.00	$ 200,000.00
				SUBTOTAL	$ 330,000.00
CONTINGENCY (20%)					$ 66,000.00
ENGINEERING (10%)					$ 40,000.00
				TOTAL	**$ 440,000.00**

3rd Street - 3rd Ave to 4th Ave		QUANTITY	UNIT	UNIT PRICE	COST
1	Mobilization/Demobilization/Bonding & Insurance/Profit/Traffic Accommodation	1	L.S.	$ 30,000.00	$ 30,000.00
2	Connection to Existing Water Distribution System	3	each	$ 8,000.00	$ 24,000.00
3	Supply and Install 200mm Watermain	225	m	$ 225.00	$ 50,625.00
4	Supply and Installation 200 mm Isolation Valves	2	each	$ 2,500.00	$ 5,000.00
5	Service Connections	10	each	$ 2,000.00	$ 20,000.00
6	Paved Road Restoration	2000	m^2	$ 100.00	$ 200,000.00
				SUBTOTAL	$ 330,000.00
CONTINGENCY (20%)					$ 66,000.00
ENGINEERING (10%)					$ 40,000.00
				TOTAL	**$ 440,000.00**

Village of Stirling

Infrastructure Master Plan
Potable Water System Upgrades

ORDER OF MAGNITUDE COST ESTIMATE

5th Street - 4th Ave to 6th Ave		QUANTITY	UNIT	UNIT PRICE	COST
1	Mobilization/Demobilization/Bonding & Insurance/Profit/Traffic Accommodation	1	L.S.	$ 40,000.00	$ 40,000.00
2	Connection to Existing Water Distribution System	4	each	$ 8,000.00	$ 32,000.00
3	Supply and Install 200 mm Watermain	450	m	$ 225.00	$ 101,250.00
4	Supply and Installation 200 mm Isolation Valves	4	each	$ 2,500.00	$ 10,000.00
5	Service Connections	20	each	$ 2,000.00	$ 40,000.00
6	Gravel Road Restoration	4000	m^2	$ 60.00	$ 240,000.00
				SUBTOTAL	$ 463,000.00
CONTINGENCY (20%)					$ 93,000.00
ENGINEERING (10%)					$ 56,000.00
				TOTAL	**$ 620,000.00**

Various 150 mm Watermain Installations		QUANTITY	UNIT	UNIT PRICE	COST
1	Mobilization/Demobilization/Bonding & Insurance/Profit/Traffic Accommodation	1	L.S.	$ 50,000.00	$ 50,000.00
2	Connection to Existing Water Distribution System	7	each	$ 8,000.00	$ 56,000.00
3	Supply and Install 150mm Watermain	575	m	$ 200.00	$ 115,000.00
4	Supply and Installation 150 mm Isolation Valves	4	each	$ 2,250.00	$ 9,000.00
5	Service Connections	20	each	$ 2,000.00	$ 40,000.00
6	Gravel Road Restoration	5000	m^2	$ 60.00	$ 300,000.00
				SUBTOTAL	$ 570,000.00
CONTINGENCY (20%)					$ 114,000.00
ENGINEERING (10%)					$ 68,000.00
				TOTAL	**$ 760,000.00**

Watermain Lining Program Phase 1 - 5th Ave and 2nd Street		QUANTITY	UNIT	UNIT PRICE	COST
1	Mobilization/Demobilization/Bonding & Insurance/Profit/Traffic Accommodation	1	L.S.	$ 100,000.00	$ 100,000.00
2	Connection to Existing Water Distribution System and Watermain Access	10	each	$ 8,000.00	$ 80,000.00
3	150 mm Valve Replacements	10	each	$ 5,000.00	$ 50,000.00
4	150 mm Watermain Lining	1125	m	$ 565.00	$ 635,625.00
5	Hydrant Replacements and Reconnections	10	each	$ 10,000.00	$ 100,000.00
7	Service Connections	35	each	$ 500.00	$ 17,500.00
8	Road Restoration	1500	m^2	$ 100.00	$ 150,000.00
				SUBTOTAL	$ 1,133,000.00
CONTINGENCY (20%)					$ 227,000.00
ENGINEERING (10%)					$ 136,000.00
				TOTAL	**$ 1,500,000.00**

Village of Stirling

Infrastructure Master Plan
Potable Water System Upgrades

ORDER OF MAGNITUDE COST ESTIMATE

	Watermain Lining Program Phase 2 - 4th Ave and 4th Street	QUANTITY	UNIT	UNIT PRICE	COST
1	Mobilization/Demobilization/Bonding & Insurance/Profit/Traffic Accommodation	1	L.S.	$ 100,000.00	$ 100,000.00
2	Connection to Existing Water Distribution System and Watermain Access	10	each	$ 8,000.00	$ 80,000.00
3	150 mm Valve Replacements	8	each	$ 5,000.00	$ 40,000.00
4	150 mm Watermain Lining	1125	m	$ 575.00	$ 646,875.00
5	Hydrant Replacements and Reconnections	10	each	$ 10,000.00	$ 100,000.00
7	Service Connections	25	each	$ 501.00	$ 12,525.00
8	Road Restoration	1500	m^2	$ 100.00	$ 150,000.00
				SUBTOTAL	$ 1,129,000.00
CONTINGENCY (20%)					$ 226,000.00
ENGINEERING (10%)					$ 136,000.00
				TOTAL	**$ 1,500,000.00**

	Watermain Lining Program Phase 3 - Various Locations	QUANTITY	UNIT	UNIT PRICE	COST
1	Mobilization/Demobilization/Bonding & Insurance/Profit/Traffic Accommodation	1	L.S.	$ 100,000.00	$ 100,000.00
2	Connection to Existing Water Distribution System and Watermain Access	12	each	$ 8,000.00	$ 96,000.00
3	150 mm Valve Replacements	10	each	$ 5,000.00	$ 50,000.00
4	150 mm Watermain Lining	1350	m	$ 425.00	$ 573,750.00
5	Hydrant Replacements and Reconnections	12	each	$ 10,000.00	$ 120,000.00
7	Service Connections	30	each	$ 501.00	$ 15,030.00
8	Road Restoration	1750	m^2	$ 100.00	$ 175,000.00
				SUBTOTAL	$ 1,130,000.00
CONTINGENCY (20%)					$ 226,000.00
ENGINEERING (10%)					$ 136,000.00
				TOTAL	**$ 1,500,000.00**

FUTURE SERVICING UPGRADES

	1st Street - 4th Ave to 1st Ave	QUANTITY	UNIT	UNIT PRICE	COST
1	Mobilization/Demobilization/Bonding & Insurance/Profit/Traffic Accommodation	1	L.S.	$ 79,000.00	$ 79,000.00
2	Hydroexcavation	40	hr	$ 350.00	$ 14,000.00
3	Dewatering	1	L.S.	$ 10,000.00	$ 10,000.00
4	Supply and Install 200 mm Watermains	700	m	$ 225.00	$ 157,500.00
5	Supply and Install 200 mm Isolation Valves	8	ea	$ 2,500.00	$ 20,000.00
6	Connection to Existing Water Distribution System	5	ea	$ 8,000.00	$ 40,000.00
7	Supply and Install Fire Hydrant and Hydrant Valve	4	ea	$ 8,000.00	$ 32,000.00
8	Asphalt Road Restoration	5,000	m^2	$ 100.00	$ 500,000.00
9	Grass Restoration	2,500	m^2	$ 5.00	$ 12,500.00
				SUBTOTAL	$ 865,000.00
CONTINGENCY (20%)					$ 173,000.00
ENGINEERING (10%)					$ 104,000.00
				TOTAL	**$ 1,150,000.00**

Village of Stirling

Infrastructure Master Plan
Potable Water System Upgrades

ORDER OF MAGNITUDE COST ESTIMATE

4th Ave - 3rd Street to 1st Street		QUANTITY	UNIT	UNIT PRICE	COST
1	Mobilization/Demobilization/Bonding & Insurance/Profit/Traffic Accommodation	1	L.S.	$ 58,000.00	$ 58,000.00
2	Supply and Install 300 mm Watermains	450	m	$ 325.00	$ 146,250.00
3	Supply and Install 300 mm Isolation Valves	5	ea	$ 3,500.00	$ 17,500.00
4	Connection to Existing Water Distribution System	4	ea	$ 8,000.00	$ 32,000.00
5	Supply and Install Fire Hydrant and Hydrant Valve	4	ea	$ 8,000.00	$ 32,000.00
6	Asphalt Road Restoration	3,500	m^2	$ 100.00	$ 350,000.00
7	Grass Restoration	1,000	m^2	$ 5.00	$ 5,000.00
				SUBTOTAL	$ 641,000.00
CONTINGENCY (20%)					$ 128,000.00
ENGINEERING (10%)					$ 77,000.00
				TOTAL	**$ 850,000.00**

APPENDIX B:

WASTEWATER VIDEO INSPECTION REPORTS

Sewer Condition Inspection Report

303 24 St North
Lethbridge, AB T1H 3T7
Phone: 403-328-8588
Fax: 403-328-6896
Email: video@drainmaster.ca

Surveyors name	Certificate Number	System Owner	Survey Customer	Drainage Area	Sheet
John Bosch	U-413-15621	Town of Stirling	MPE Engineering		1

P/O No.	Pipeline Segment Reference	Date	Time	Location (Street Name and number)	Locality
		20200423	15:46	1st Ave	Stirling

Further Location details	Upstream Manhole Number	Rim to Invert	Grade to Invert	Rim to Grade
	3 St			

Downstream Manhole Number	Rim to Invert	Grade to Invert	Rim to Grade	Use of Sewer	Direction	Flow Control	Height
3A St				Sanitary	Downstream	N	250

Width	Shape	Material	Ln. Method	Pipe Joint Length	Total Length	Length Surveyed	Year Laid	Year Rehabilitated	Tape / Media Number
	Circular	PVC				123.9			

Purpose	Sewer Category	Pre-Cleaning	Cleaned	Weather	Additional Information
G		Jetting			

Distance (Meters)	Code		Continuous defect	Value				Joint	Circumferential Location		Image Ref.	Struct. Grade	O&M Grade	Remarks
	Group/ Descriptor	Modifier/ severity		S/M/L	Inches 1st	Inches 2nd	%		At / From	To				
0.0	AMH										AMH@0			Starting Manhole: 3 St
0.0	MWL						50				MWL@0			
55.0	TS				200				12		TS@55			
87.8	TS				200				12		TS@87.8			
123.9	AMH										AMH@123.9			3A St

Segment	Structural								O & M								Overall							
	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index
Town of Stirling-1st Ave-3 St-3A St	0	0	0	0	0	0	0000		0	0	0	0	0	0	0000		0	0	0	0	0	0	0000	

Sewer Condition Inspection Report

303 24 St North
Lethbridge, AB T1H 3T7
Phone: 403-328-8588
Fax: 403-328-6896
Email: video@drainmaster.ca

Upstream MH	Downstream MH	Size	Material	Total Length	City
3 St	3A St	250	Polyvinyl Chloride		Stirling

Surveyor's Name	Certificate Number	Street Address	Location Details
John Bosch	U-413-15621	1st Ave	

Direction	Purpose	Weather	Date	Time	Length Surveyed
Downstream	Capital Improvement Program Assessment		20200423	15:46	123.9

Additional Information

Ftg.	Code	Description	Position	Comment
0.0	AMH	Access Point - Manhole		Starting Manhole: 3 St
0.0	MWL	Water Level		
55.0	TS	Tap, Saddle	12	
87.8	TS	Tap, Saddle	12	
123.9	AMH	Access Point - Manhole		3A St

Sewer Condition Inspection Report

303 24 St North
Lethbridge, AB T1H 3T7
Phone: 403-328-8588
Fax: 403-328-6896
Email: video@drainmaster.ca

Upstream MH	Downstream MH	Size	Material	Total Length	City
3 St	3A St	250	Polyvinyl Chloride		Stirling

Surveyor's Name	Certificate Number	Street Address	Location Details
John Bosch	U-413-15621	1st Ave	

Direction	Purpose	Weather	Date	Time	Length Surveyed
Downstream	Capital Improvement Program Assessment		20200423	15:46	123.9

Additional Information

AMH - Access Point - Manhole @ 0.0 m.
Starting Manhole: 3 St

MWL - Water Level @ 0.0 m.

TS - Tap, Saddle @ 55.0 m.

TS - Tap, Saddle @ 87.8 m.

Sewer Condition Inspection Report

303 24 St North
Lethbridge, AB T1H 3T7
Phone: 403-328-8588
Fax: 403-328-6896
Email: video@drainmaster.ca

Upstream MH	Downstream MH	Size	Material	Total Length	City
3 St	3A St	250	Polyvinyl Chloride		Stirling

Surveyor's Name	Certificate Number	Street Address	Location Details
John Bosch	U-413-15621	1st Ave	

Direction	Purpose	Weather	Date	Time	Length Surveyed
Downstream	Capital Improvement Program Assessment		20200423	15:46	123.9

Additional Information

AMH - Access Point - Manhole @ 123.9 m.
3A St

Sewer Condition Inspection Report

303 24 St North
Lethbridge, AB T1H 3T7
Phone: 403-328-8588
Fax: 403-328-6896
Email: video@drainmaster.ca

Surveyors name	Certificate Number	System Owner	Survey Customer	Drainage Area	Sheet
John Bosch	U-413-15621	Town of Stirling	MPE Engineering		1

P/O No.	Pipeline Segment Reference	Date	Time	Location (Street Name and number)	Locality
		20200423	16:24	1st Ave	Stirling

Further Location details	Upstream Manhole Number	Rim to Invert	Grade to Invert	Rim to Grade
	3A St			

Downstream Manhole Number	Rim to Invert	Grade to Invert	Rim to Grade	Use of Sewer	Direction	Flow Control	Height
4 St				Sanitary	Downstream	N	250

Width	Shape	Material	Ln. Method	Pipe Joint Length	Total Length	Length Surveyed	Year Laid	Year Rehabilitated	Tape / Media Number
	Circular	PVC				116.2			

Purpose	Sewer Category	Pre-Cleaning	Cleaned	Weather	Additional Information
G		Jetting			

Distance (Meters)	Code		Continuous defect	Value				Joint	Circumferential Location		Image Ref.	Struct. Grade	O&M Grade	Remarks
	Group/ Descriptor	Modifier/ severity		S/M/L	Inches 1st	Inches 2nd	%		At / From	To				
0.0	AMH										AMH@0			Starting Manhole: 3A St
0.0	MWL						40				MWL@0			
40.5	TS				200				12		TS@40.5			
73.5	TS				200				12		TS@73.5			
79.7	OBJ						5	J	2	4	OBJ@79.7		2	
116.2	AMH										AMH@116.2			4 St

	Structural								O & M								Overall							
Segment	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index
Town of Stirling-1st Ave-3A St-4 St	0	0	0	0	0	0	0000		0	2	0	0	0	2	2100	2.0	0	2	0	0	0	2	2100	2.0

Sewer Condition Inspection Report

303 24 St North
Lethbridge, AB T1H 3T7
Phone: 403-328-8588
Fax: 403-328-6896
Email: video@drainmaster.ca

Upstream MH	Downstream MH	Size	Material	Total Length	City
3A St	4 St	250	Polyvinyl Chloride		Stirling

Surveyor's Name	Certificate Number	Street Address	Location Details
John Bosch	U-413-15621	1st Ave	

Direction	Purpose	Weather	Date	Time	Length Surveyed
Downstream	Capital Improvement Program Assessment		20200423	16:24	116.2

Additional Information

Ftg.	Code	Description	Position	Comment
0.0	AMH	Access Point - Manhole		Starting Manhole: 3A St
0.0	MWL	Water Level		
40.5	TS	Tap, Saddle	12	
73.5	TS	Tap, Saddle	12	
79.7	OBJ	Obstacle - Object Wedged in Joint	2 to 4	
116.2	AMH	Access Point - Manhole		4 St

Sewer Condition Inspection Report

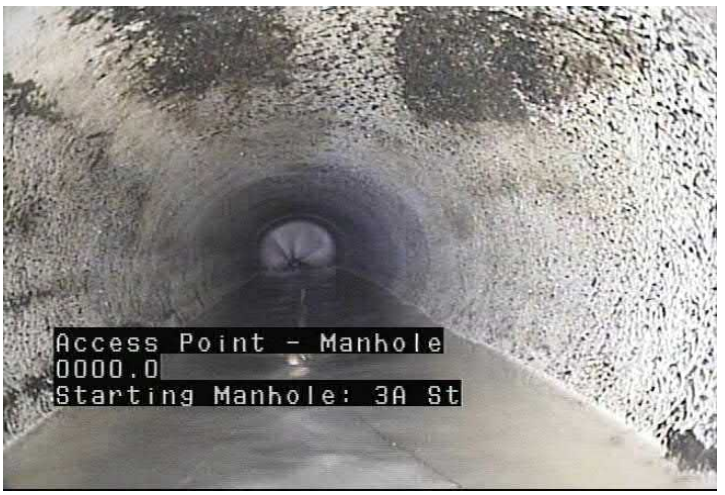
303 24 St North
Lethbridge, AB T1H 3T7
Phone: 403-328-8588
Fax: 403-328-6896
Email: video@drainmaster.ca

Upstream MH	Downstream MH	Size	Material	Total Length	City
3A St	4 St	250	Polyvinyl Chloride		Stirling

Surveyor's Name	Certificate Number	Street Address	Location Details
John Bosch	U-413-15621	1st Ave	

Direction	Purpose	Weather	Date	Time	Length Surveyed
Downstream	Capital Improvement Program Assessment		20200423	16:24	116.2

Additional Information



AMH - Access Point - Manhole @ 0.0 m.
Starting Manhole: 3A St

MWL - Water Level @ 0.0 m.

TS - Tap, Saddle @ 40.5 m.

TS - Tap, Saddle @ 73.5 m.

Sewer Condition Inspection Report

VIDEO INSPECTION SERVICES
403-328-8588
www.DrainMaster.ca

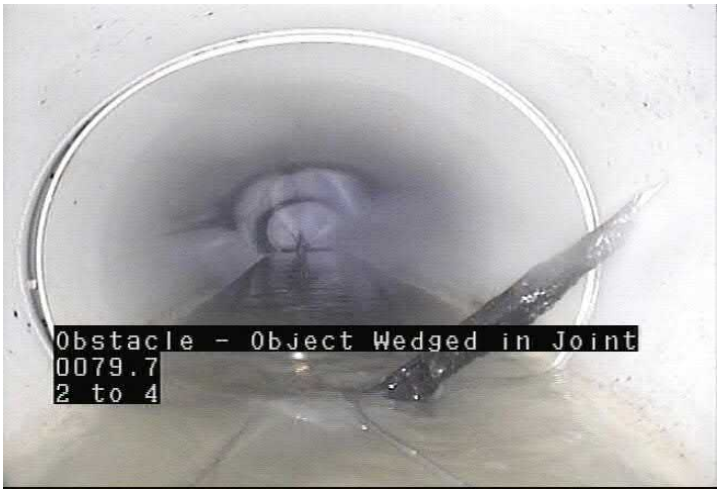
303 24 St North
Lethbridge, AB T1H 3T7
Phone: 403-328-8588
Fax: 403-328-6896
Email: video@drainmaster.ca

Upstream MH	Downstream MH	Size	Material	Total Length	City
3A St	4 St	250	Polyvinyl Chloride		Stirling

Surveyor's Name	Certificate Number	Street Address	Location Details
John Bosch	U-413-15621	1st Ave	

Direction	Purpose	Weather	Date	Time	Length Surveyed
Downstream	Capital Improvement Program Assessment		20200423	16:24	116.2

Additional Information



OBJ - Obstacle - Object Wedged in Joint @ 79.7 m.

AMH - Access Point - Manhole @ 116.2 m. 4 St

Sewer Condition Inspection Report

303 24 St North
Lethbridge, AB T1H 3T7
Phone: 403-328-8588
Fax: 403-328-6896
Email: video@drainmaster.ca

Surveyors name	Certificate Number	System Owner	Survey Customer	Drainage Area	Sheet
John Bosch	U-413-15621	Town of Stirling	MPE Engineering		1

P/O No.	Pipeline Segment Reference	Date	Time	Location (Street Name and number)	Locality
		20200423	14:52	1st Ave	Stirling

Further Location details	Upstream Manhole Number	Rim to Invert	Grade to Invert	Rim to Grade
	4 St			

Downstream Manhole Number	Rim to Invert	Grade to Invert	Rim to Grade	Use of Sewer	Direction	Flow Control	Height
4A St				Sanitary	Downstream	N	250

Width	Shape	Material	Ln. Method	Pipe Joint Length	Total Length	Length Surveyed	Year Laid	Year Rehabilitated	Tape / Media Number
	Circular	PVC				114.1			

Purpose	Sewer Category	Pre-Cleaning	Cleaned	Weather	Additional Information
G		Jetting			

Distance (Meters)	Code		Continuous defect	Value				Joint	Circumferential Location		Image Ref.	Struct. Grade	O&M Grade	Remarks
	Group/ Descriptor	Modifier/ severity		S/M/L	Inches 1st	Inches 2nd	%		At / From	To				
0.0	AMH										AMH@0			Starting Manhole: 4 St
0.0	MWL						40				MWL@0			
82.5	TS				200				12		TS@82.5			
114.1	AMH										AMH@114.1			4A St

	Structural								O & M								Overall							
Segment	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index
Town of Stirling-1st Ave-4 St-4A St	0	0	0	0	0	0	0000		0	0	0	0	0	0	0000		0	0	0	0	0	0	0000	

Sewer Condition Inspection Report

303 24 St North
Lethbridge, AB T1H 3T7
Phone: 403-328-8588
Fax: 403-328-6896
Email: video@drainmaster.ca

Upstream MH	Downstream MH	Size	Material	Total Length	City
4 St	4A St	250	Polyvinyl Chloride		Stirling

Surveyor's Name	Certificate Number	Street Address	Location Details
John Bosch	U-413-15621	1st Ave	

Direction	Purpose	Weather	Date	Time	Length Surveyed
Downstream	Capital Improvement Program Assessment		20200423	14:52	114.1

Additional Information

Ftg.	Code	Description	Position	Comment
0.0	AMH	Access Point - Manhole		Starting Manhole: 4 St
0.0	MWL	Water Level		
82.5	TS	Tap, Saddle	12	
114.1	AMH	Access Point - Manhole		4A St

Sewer Condition Inspection Report

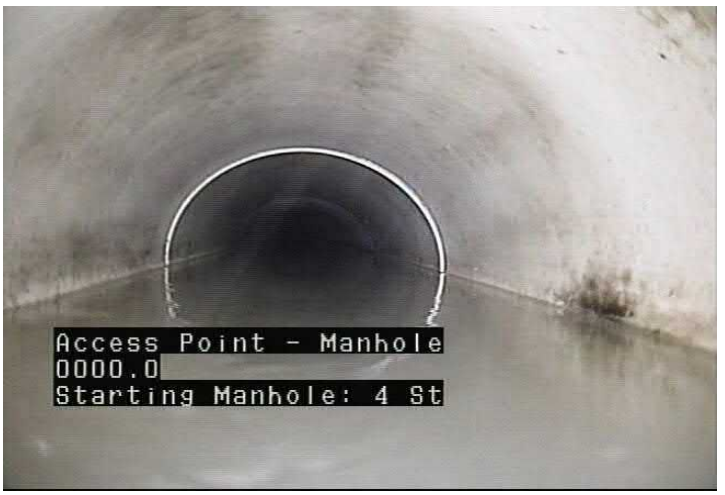
303 24 St North
Lethbridge, AB T1H 3T7
Phone: 403-328-8588
Fax: 403-328-6896
Email: video@drainmaster.ca

Upstream MH	Downstream MH	Size	Material	Total Length	City
4 St	4A St	250	Polyvinyl Chloride		Stirling

Surveyor's Name	Certificate Number	Street Address	Location Details
John Bosch	U-413-15621	1st Ave	

Direction	Purpose	Weather	Date	Time	Length Surveyed
Downstream	Capital Improvement Program Assessment		20200423	14:52	114.1

Additional Information



AMH - Access Point - Manhole @ 0.0 m.
Starting Manhole: 4 St

MWL - Water Level @ 0.0 m.

TS - Tap, Saddle @ 82.5 m.

AMH - Access Point - Manhole @ 114.1 m.
4A St

Sewer Condition Inspection Report

303 24 St North
Lethbridge, AB T1H 3T7
Phone: 403-328-8588
Fax: 403-328-6896
Email: video@drainmaster.ca

Surveyors name	Certificate Number	System Owner	Survey Customer	Drainage Area	Sheet
John Bosch	U-413-15621	Town of Stirling	MPE Engineering		1

P/O No.	Pipeline Segment Reference	Date	Time	Location (Street Name and number)	Locality
		20200423	15:34	1st Ave	Stirling

Further Location details	Upstream Manhole Number	Rim to Invert	Grade to Invert	Rim to Grade
	4A St			

Downstream Manhole Number	Rim to Invert	Grade to Invert	Rim to Grade	Use of Sewer	Direction	Flow Control	Height
5 St (Lift Station Vault)				Sanitary	Downstream	N	250

Width	Shape	Material	Ln. Method	Pipe Joint Length	Total Length	Length Surveyed	Year Laid	Year Rehabilitated	Tape / Media Number
	Circular	PVC				105.4			

Purpose	Sewer Category	Pre-Cleaning	Cleaned	Weather	Additional Information
G		Jetting			

Distance (Meters)	Code		Continuous defect	Value				Joint	Circumferential Location		Image Ref.	Struct. Grade	O&M Grade	Remarks
	Group/ Descriptor	Modifier/ severity		S/M/L	Inches 1st	Inches 2nd	%		At / From	To				
0.0	AMH										AMH@0			Starting Manhole: 4A St
0.0	MWL						40				MWL@0			
24.6	TS				200				12		TS@24.6			
57.7	TB				200				12		TB@57.7			
91.2	TS				200				12		TS@91.2			
105.4	AOC										AOC@105.4			5 St (Lift Station Vault)

Segment	Structural								O & M								Overall							
	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index
Town of Stirling-1st Ave-4A St-5 St (Lift Station Va	0	0	0	0	0	0	0000		0	0	0	0	0	0	0000		0	0	0	0	0	0	0000	

Sewer Condition Inspection Report

303 24 St North
Lethbridge, AB T1H 3T7
Phone: 403-328-8588
Fax: 403-328-6896
Email: video@drainmaster.ca

Upstream MH	Downstream MH	Size	Material	Total Length	City
4A St	5 St (Lift Station Vault)	250	Polyvinyl Chloride		Stirling

Surveyor's Name	Certificate Number	Street Address	Location Details
John Bosch	U-413-15621	1st Ave	

Direction	Purpose	Weather	Date	Time	Length Surveyed
Downstream	Capital Improvement Program Assessment		20200423	15:34	105.4

Additional Information

Ftg.	Code	Description	Position	Comment
0.0	AMH	Access Point - Manhole		Starting Manhole: 4A St
0.0	MWL	Water Level		
24.6	TS	Tap, Saddle	12	
57.7	TB	Tap, Break-in / Hammer	12	
91.2	TS	Tap, Saddle	12	
105.4	AOC	Access Point - Other Special Chamber		5 St (Lift Station Vault)

Sewer Condition Inspection Report

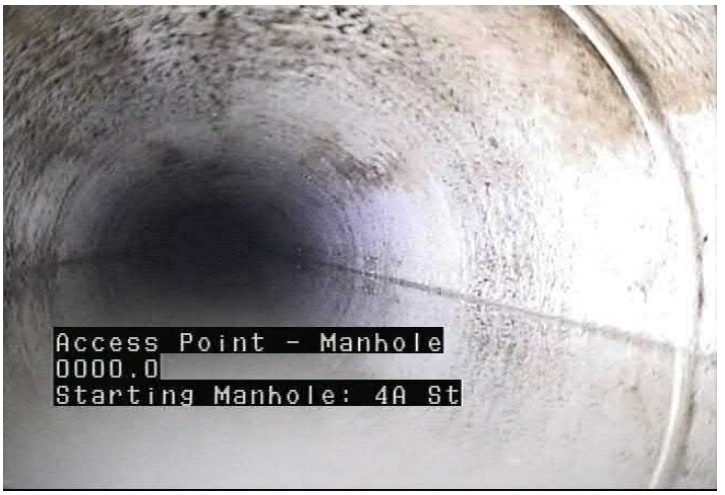
303 24 St North
Lethbridge, AB T1H 3T7
Phone: 403-328-8588
Fax: 403-328-6896
Email: video@drainmaster.ca

Upstream MH	Downstream MH	Size	Material	Total Length	City
4A St	5 St (Lift Station Vault)	250	Polyvinyl Chloride		Stirling

Surveyor's Name	Certificate Number	Street Address	Location Details
John Bosch	U-413-15621	1st Ave	

Direction	Purpose	Weather	Date	Time	Length Surveyed
Downstream	Capital Improvement Program Assessment		20200423	15:34	105.4

Additional Information



AMH - Access Point - Manhole @ 0.0 m.
Starting Manhole: 4A St

MWL - Water Level @ 0.0 m.

TS - Tap, Saddle @ 24.6 m.

TB - Tap, Break-in / Hammer @ 57.7 m.

Sewer Condition Inspection Report

303 24 St North
Lethbridge, AB T1H 3T7
Phone: 403-328-8588
Fax: 403-328-6896
Email: video@drainmaster.ca

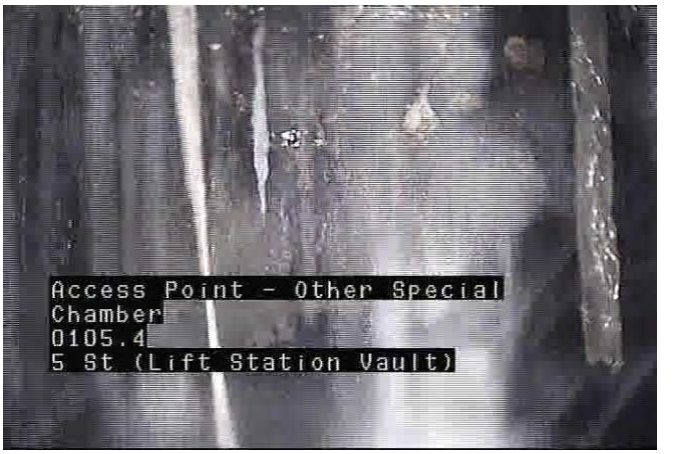
Upstream MH	Downstream MH	Size	Material	Total Length	City
4A St	5 St (Lift Station Vault)	250	Polyvinyl Chloride		Stirling

Surveyor's Name	Certificate Number	Street Address	Location Details
John Bosch	U-413-15621	1st Ave	

Direction	Purpose	Weather	Date	Time	Length Surveyed
Downstream	Capital Improvement Program Assessment		20200423	15:34	105.4

Additional Information

TS - Tap, Saddle @ 91.2 m.



AOC - Access Point - Other Special Chamber @ 105.4 m. 5 St (Lift Station Vault)

Sewer Condition Inspection Report

303 24 St North
Lethbridge, AB T1H 3T7
Phone: 403-328-8588
Fax: 403-328-6896
Email: video@drainmaster.ca

Surveyors name	Certificate Number	System Owner	Survey Customer	Drainage Area	Sheet
John Bosch	U-413-15621	Town of Stirling	MPE Engineering		1

P/O No.	Pipeline Segment Reference	Date	Time	Location (Street Name and number)	Locality
		20200423	10:25	3rd St	Stirling

Further Location details	Upstream Manhole Number	Rim to Invert	Grade to Invert	Rim to Grade
	2/1 Ave			

Downstream Manhole Number	Rim to Invert	Grade to Invert	Rim to Grade	Use of Sewer	Direction	Flow Control	Height
1 Ave				Sanitary	Downstream	N	250

Width	Shape	Material	Ln. Method	Pipe Joint Length	Total Length	Length Surveyed	Year Laid	Year Rehabilitated	Tape / Media Number
	Circular	PVC				129.8			

Purpose	Sewer Category	Pre-Cleaning	Cleaned	Weather	Additional Information
G		Jetting			

Distance (Meters)	Code		Continuous defect	Value				Joint	Circumferential Location		Image Ref.	Struct. Grade	O&M Grade	Remarks
	Group/ Descriptor	Modifier/ severity		S/M/L	Inches 1st	Inches 2nd	%		At / From	To				
0.0	AMH										AMH@0			Starting Manhole: 2/1 Ave
0.0	MWL						20				MWL@0			
31.9	TS				100				12		TS@31.9			
38.1	TS				100				2		TS@38.1			
65.2	TS				200				12		TS@65.2			
65.3	MGO										MGO@65.3			Looks like a service + cleanout
82.1	TB				100				2		TB@82.1			
129.8	AMH										AMH@129.8			1 Ave

	Structural								O & M								Overall							
Segment	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index
Town of Stirling-3rd St-2 1 Ave-1 Ave	0	0	0	0	0	0	0000		0	0	0	0	0	0	0000		0	0	0	0	0	0	0000	

Sewer Condition Inspection Report

303 24 St North
Lethbridge, AB T1H 3T7
Phone: 403-328-8588
Fax: 403-328-6896
Email: video@drainmaster.ca

Upstream MH	Downstream MH	Size	Material	Total Length	City
2/1 Ave	1 Ave	250	Polyvinyl Chloride		Stirling

Surveyor's Name	Certificate Number	Street Address	Location Details
John Bosch	U-413-15621	3rd St	

Direction	Purpose	Weather	Date	Time	Length Surveyed
Downstream	Capital Improvement Program Assessment		20200423	10:25	129.8

Additional Information

Ftg.	Code	Description	Position	Comment
0.0	AMH	Access Point - Manhole		Starting Manhole: 2/1 Ave
0.0	MWL	Water Level		
31.9	TS	Tap, Saddle	12	
38.1	TS	Tap, Saddle	2	
65.2	TS	Tap, Saddle	12	
65.3	MGO	General Observation		Looks like a service + cleanout
82.1	TB	Tap, Break-in / Hammer	2	
129.8	AMH	Access Point - Manhole		1 Ave

Sewer Condition Inspection Report

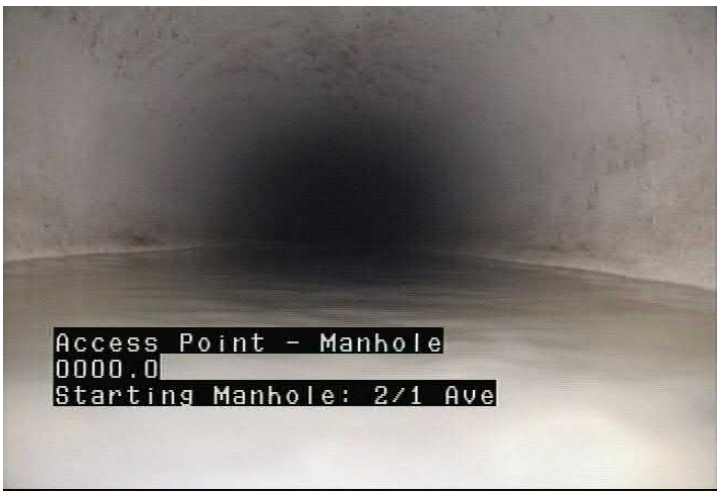
303 24 St North
Lethbridge, AB T1H 3T7
Phone: 403-328-8588
Fax: 403-328-6896
Email: video@drainmaster.ca

Upstream MH	Downstream MH	Size	Material	Total Length	City
2/1 Ave	1 Ave	250	Polyvinyl Chloride		Stirling

Surveyor's Name	Certificate Number	Street Address	Location Details
John Bosch	U-413-15621	3rd St	

Direction	Purpose	Weather	Date	Time	Length Surveyed
Downstream	Capital Improvement Program Assessment		20200423	10:25	129.8

Additional Information



AMH - Access Point - Manhole @ 0.0 m.
Starting Manhole: 2/1 Ave

MWL - Water Level @ 0.0 m.

TS - Tap, Saddle @ 31.9 m.

TS - Tap, Saddle @ 38.1 m.

Sewer Condition Inspection Report

303 24 St North
Lethbridge, AB T1H 3T7
Phone: 403-328-8588
Fax: 403-328-6896
Email: video@drainmaster.ca

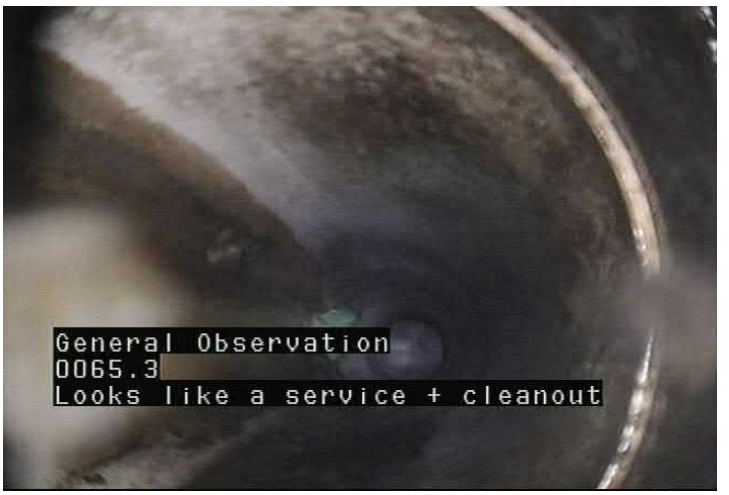
Upstream MH	Downstream MH	Size	Material	Total Length	City
2/1 Ave	1 Ave	250	Polyvinyl Chloride		Stirling

Surveyor's Name	Certificate Number	Street Address	Location Details
John Bosch	U-413-15621	3rd St	

Direction	Purpose	Weather	Date	Time	Length Surveyed
Downstream	Capital Improvement Program Assessment		20200423	10:25	129.8

Additional Information

TS - Tap, Saddle @ 65.2 m.



MGO - General Observation @ 65.3 m. Looks like a service + cleanout

TB - Tap, Break-in / Hammer @ 82.1 m.

AMH - Access Point - Manhole @ 129.8 m. 1 Ave

Sewer Condition Inspection Report

303 24 St North
Lethbridge, AB T1H 3T7
Phone: 403-328-8588
Fax: 403-328-6896
Email: video@drainmaster.ca

Surveyors name	Certificate Number	System Owner	Survey Customer	Drainage Area	Sheet
John Bosch	U-413-15621	Town of Stirling	MPE Engineering		1

P/O No.	Pipeline Segment Reference	Date	Time	Location (Street Name and number)	Locality
		20200423	10:48	3rd St	Stirling

Further Location details	Upstream Manhole Number	Rim to Invert	Grade to Invert	Rim to Grade
	2 Ave			

Downstream Manhole Number	Rim to Invert	Grade to Invert	Rim to Grade	Use of Sewer	Direction	Flow Control	Height
2/1 Ave				Sanitary	Downstream	N	250

Width	Shape	Material	Ln. Method	Pipe Joint Length	Total Length	Length Surveyed	Year Laid	Year Rehabilitated	Tape / Media Number
	Circular	PVC				125			

Purpose	Sewer Category	Pre-Cleaning	Cleaned	Weather	Additional Information
G		Jetting			

Distance (Meters)	Code		Continuous defect	Value				Joint	Circumferential Location		Image Ref.	Struct. Grade	O&M Grade	Remarks
	Group/ Descriptor	Modifier/ severity		S/M/L	Inches 1st	Inches 2nd	%		At / From	To				
0.0	AMH										AMH@0			Starting Manhole: 2 Ave
0.0	MWL						10				MWL@0			
33.0	TS				100				10		TS@33			
54.1	TS				100				12		TS@54.1			
92.7	TS				100				12		TS@92.7			
125.0	AMH										AMH@125			2/1 Ave

Segment	Structural								O & M								Overall							
	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index
Town of Stirling-3rd St-2 Ave-2 1 Ave	0	0	0	0	0	0	0000		0	0	0	0	0	0	0000		0	0	0	0	0	0	0000	

Sewer Condition Inspection Report

303 24 St North
Lethbridge, AB T1H 3T7
Phone: 403-328-8588
Fax: 403-328-6896
Email: video@drainmaster.ca

Upstream MH	Downstream MH	Size	Material	Total Length	City
2 Ave	2/1 Ave	250	Polyvinyl Chloride		Stirling

Surveyor's Name	Certificate Number	Street Address	Location Details
John Bosch	U-413-15621	3rd St	

Direction	Purpose	Weather	Date	Time	Length Surveyed
Downstream	Capital Improvement Program Assessment		20200423	10:48	125

Additional Information

Ftg.	Code	Description	Position	Comment
0.0	AMH	Access Point - Manhole		Starting Manhole: 2 Ave
0.0	MWL	Water Level		
33.0	TS	Tap, Saddle	10	
54.1	TS	Tap, Saddle	12	
92.7	TS	Tap, Saddle	12	
125.0	AMH	Access Point - Manhole		2/1 Ave

Sewer Condition Inspection Report

303 24 St North
Lethbridge, AB T1H 3T7
Phone: 403-328-8588
Fax: 403-328-6896
Email: video@drainmaster.ca

Upstream MH	Downstream MH	Size	Material	Total Length	City
2 Ave	2/1 Ave	250	Polyvinyl Chloride		Stirling

Surveyor's Name	Certificate Number	Street Address	Location Details
John Bosch	U-413-15621	3rd St	

Direction	Purpose	Weather	Date	Time	Length Surveyed
Downstream	Capital Improvement Program Assessment		20200423	10:48	125

Additional Information

AMH - Access Point - Manhole @ 0.0 m.
Starting Manhole: 2 Ave

MWL - Water Level @ 0.0 m.

TS - Tap, Saddle @ 33.0 m.

TS - Tap, Saddle @ 54.1 m.

Sewer Condition Inspection Report

303 24 St North
Lethbridge, AB T1H 3T7
Phone: 403-328-8588
Fax: 403-328-6896
Email: video@drainmaster.ca

Upstream MH	Downstream MH	Size	Material	Total Length	City
2 Ave	2/1 Ave	250	Polyvinyl Chloride		Stirling

Surveyor's Name	Certificate Number	Street Address	Location Details
John Bosch	U-413-15621	3rd St	

Direction	Purpose	Weather	Date	Time	Length Surveyed
Downstream	Capital Improvement Program Assessment		20200423	10:48	125

Additional Information

TS - Tap, Saddle @ 92.7 m.

AMH - Access Point - Manhole @ 125.0 m.
2/1 Ave

Sewer Condition Inspection Report

303 24 St North
Lethbridge, AB T1H 3T7
Phone: 403-328-8588
Fax: 403-328-6896
Email: video@drainmaster.ca

Surveyors name	Certificate Number	System Owner	Survey Customer	Drainage Area	Sheet
John Bosch	U-413-15621	Town of Stirling	MPE Engineering		1

P/O No.	Pipeline Segment Reference	Date	Time	Location (Street Name and number)	Locality
		20200423	12:06	3rd St	Stirling

Further Location details	Upstream Manhole Number	Rim to Invert	Grade to Invert	Rim to Grade
	3/2 Ave			

Downstream Manhole Number	Rim to Invert	Grade to Invert	Rim to Grade	Use of Sewer	Direction	Flow Control	Height
2 Ave				Sanitary	Downstream	N	200

Width	Shape	Material	Ln. Method	Pipe Joint Length	Total Length	Length Surveyed	Year Laid	Year Rehabilitated	Tape / Media Number
	Circular	VCP				125			

Purpose	Sewer Category	Pre-Cleaning	Cleaned	Weather	Additional Information
G		Jetting			

Distance (Meters)	Code		Continuous defect	Value				Joint	Circumferential Location		Image Ref.	Struct. Grade	O&M Grade	Remarks
	Group/ Descriptor	Modifier/ severity		S/M/L	Inches 1st	Inches 2nd	%		At / From	To				
0.0	AMH										AMH@0			Starting Manhole: 3/2 Ave
0.0	MWL						15				MWL@0			
1.2	JO			M							JOM@1.2	1		
1.2	CC								1	5	CC@1.2	1		
8.8	MGO										MGO@8.8			Visible lines on side of pipe show how much sediment/debris we removed with multiple flushes
10.3	TB				100				2		TB@10.3			
10.7	TB				100				10		TB@10.7			
27.0	DA	E					0	J	8	12	DAE@27		2	
39.6	TB				100				2		TB@39.6			
42.9	TB				100				11		TB@42.9			
59.9	TB	I			100	75			2		TBI@59.9		2	
60.0	MSA										MSA@60			Could not get by intruding service

	Structural								O & M								Overall							
Segment	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index
Town of Stirling-3rd St-3 2 Ave-2 Ave	2	0	0	0	0	2	1200	1.0	0	4	0	0	0	4	2200	2.0	2	4	0	0	0	6	2212	1.5

Sewer Condition Inspection Report

303 24 St North
Lethbridge, AB T1H 3T7
Phone: 403-328-8588
Fax: 403-328-6896
Email: video@drainmaster.ca

Upstream MH	Downstream MH	Size	Material	Total Length	City
3/2 Ave	2 Ave	200	Vitrified Clay Pipe		Stirling

Surveyor's Name	Certificate Number	Street Address	Location Details
John Bosch	U-413-15621	3rd St	

Direction	Purpose	Weather	Date	Time	Length Surveyed
Downstream	Capital Improvement Program Assessment		20200423	12:06	125

Additional Information

Ftg.	Code	Description	Position	Comment
0.0	AMH	Access Point - Manhole		Starting Manhole: 3/2 Ave
0.0	MWL	Water Level		
1.2	JOM	Joint Offset (displaced): Medium		
1.2	CC	Crack Circumferential	1 to 5	
8.8	MGO	General Observation		Visible lines on side of pipe show how much sediment/debris we removed with multiple flushes
10.3	TB	Tap, Break-in / Hammer	2	
10.7	TB	Tap, Break-in / Hammer	10	
27.0	DAE	Deposits Attached: Encrustation	8 to 12	
39.6	TB	Tap, Break-in / Hammer	2	
42.9	TB	Tap, Break-in / Hammer	11	
59.9	TBI	Tap, Break-in / Hammer: Intruding	2	
60.0	MSA	Survey Abandoned		Could not get by intruding service

Sewer Condition Inspection Report

303 24 St North
Lethbridge, AB T1H 3T7
Phone: 403-328-8588
Fax: 403-328-6896
Email: video@drainmaster.ca

Upstream MH	Downstream MH	Size	Material	Total Length	City
3/2 Ave	2 Ave	200	Vitrified Clay Pipe		Stirling

Surveyor's Name	Certificate Number	Street Address	Location Details
John Bosch	U-413-15621	3rd St	

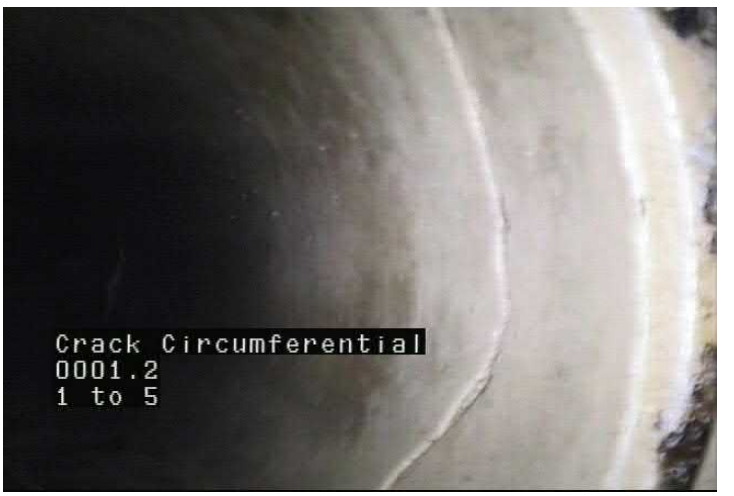
Direction	Purpose	Weather	Date	Time	Length Surveyed
Downstream	Capital Improvement Program Assessment		20200423	12:06	125

Additional Information

AMH - Access Point - Manhole @ 0.0 m.
Starting Manhole: 3/2 Ave

MWL - Water Level @ 0.0 m.

JOM - Joint Offset (displaced): Medium @ 1.2 m.



CC - Crack Circumferential @ 1.2 m.

Sewer Condition Inspection Report

303 24 St North
Lethbridge, AB T1H 3T7
Phone: 403-328-8588
Fax: 403-328-6896
Email: video@drainmaster.ca

Upstream MH	Downstream MH	Size	Material	Total Length	City
3/2 Ave	2 Ave	200	Vitrified Clay Pipe		Stirling

Surveyor's Name	Certificate Number	Street Address	Location Details
John Bosch	U-413-15621	3rd St	

Direction	Purpose	Weather	Date	Time	Length Surveyed
Downstream	Capital Improvement Program Assessment		20200423	12:06	125

Additional Information

MGO - General Observation @ 8.8 m. Visible lines on side of pipe show how much sediment/debris we removed with multiple flushes

TB - Tap, Break-in / Hammer @ 10.3 m.

TB - Tap, Break-in / Hammer @ 10.7 m.

DAE - Deposits Attached: Encrustation @ 27.0 m.

Sewer Condition Inspection Report

303 24 St North
Lethbridge, AB T1H 3T7
Phone: 403-328-8588
Fax: 403-328-6896
Email: video@drainmaster.ca

Upstream MH	Downstream MH	Size	Material	Total Length	City
3/2 Ave	2 Ave	200	Vitrified Clay Pipe		Stirling

Surveyor's Name	Certificate Number	Street Address	Location Details
John Bosch	U-413-15621	3rd St	

Direction	Purpose	Weather	Date	Time	Length Surveyed
Downstream	Capital Improvement Program Assessment		20200423	12:06	125

Additional Information

TB - Tap, Break-in / Hammer @ 39.6 m.

TB - Tap, Break-in / Hammer @ 42.9 m.

TBI - Tap, Break-in / Hammer: Intruding @ 59.9 m.

MSA - Survey Abandoned @ 60.0 m. Could not get by intruding service

Sewer Condition Inspection Report

303 24 St North
Lethbridge, AB T1H 3T7
Phone: 403-328-8588
Fax: 403-328-6896
Email: video@drainmaster.ca

Surveyors name	Certificate Number	System Owner	Survey Customer	Drainage Area	Sheet
John Bosch	U-413-15621	Town of Stirling	MPE Engineering		1

P/O No.	Pipeline Segment Reference	Date	Time	Location (Street Name and number)	Locality
		20200421	11:18	3rd St	Stirling

Further Location details	Upstream Manhole Number	Rim to Invert	Grade to Invert	Rim to Grade
	3/4 Ave			

Downstream Manhole Number	Rim to Invert	Grade to Invert	Rim to Grade	Use of Sewer	Direction	Flow Control	Height
3 Ave				Sanitary	Downstream	N	200

Width	Shape	Material	Ln. Method	Pipe Joint Length	Total Length	Length Surveyed	Year Laid	Year Rehabilitated	Tape / Media Number
	Circular	VCP				47.4			

Purpose	Sewer Category	Pre-Cleaning	Cleaned	Weather	Additional Information
G		Jetting			

Distance (Meters)	Code		Continuous defect	Value				Joint	Circumferential Location		Image Ref.	Struct. Grade	O&M Grade	Remarks
	Group/ Descriptor	Modifier/ severity		S/M/L	Inches 1st	Inches 2nd	%		At / From	To				
0.0	AMH										AMH@0			Starting Manhole: 3/4 Ave
0.0	MWL						20				MWL@0			
0.2	CC								8	4	CC@0.2	1		
3.3	DA	E					0	J	8	4	DAE@3.3		2	
9.2	DA	E					0	J	9	4	DAE@9.2		2	
14.4	TB	A			100				2		TBA@14.4			
14.4	DA	E					0		2	4	DAE@14.4		2	
36.4	TB				100				2		TB@36.4			
42.9	TB				100				10		TB@42.9			
47.3	TB	I			100	125			10		TBI@47.3		2	
47.4	MSA										MSA@47.4			Camera would not be able to go passed intruding service

	Structural								O & M								Overall							
Segment	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index
Town of Stirling-3rd St-3 4 Ave-3 Ave	1	0	0	0	0	1	1100	1.0	0	8	0	0	0	8	2400	2.0	1	8	0	0	0	9	2411	1.8

Sewer Condition Inspection Report

303 24 St North
Lethbridge, AB T1H 3T7
Phone: 403-328-8588
Fax: 403-328-6896
Email: video@drainmaster.ca

Upstream MH	Downstream MH	Size	Material	Total Length	City
3/4 Ave	3 Ave	200	Vitrified Clay Pipe		Stirling

Surveyor's Name	Certificate Number	Street Address	Location Details
John Bosch	U-413-15621	3rd St	

Direction	Purpose	Weather	Date	Time	Length Surveyed
Downstream	Capital Improvement Program Assessment		20200421	11:18	47.4

Additional Information

Ftg.	Code	Description	Position	Comment
0.0	AMH	Access Point - Manhole		Starting Manhole: 3/4 Ave
0.0	MWL	Water Level		
0.2	CC	Crack Circumferential	8 to 4	
3.3	DAE	Deposits Attached: Encrustation	8 to 4	
9.2	DAE	Deposits Attached: Encrustation	9 to 4	
14.4	TBA	Tap, Break-in / Hammer: Active	2	
14.4	DAE	Deposits Attached: Encrustation	2 to 4	
36.4	TB	Tap, Break-in / Hammer	2	
42.9	TB	Tap, Break-in / Hammer	10	
47.3	TBI	Tap, Break-in / Hammer: Intruding	10	
47.4	MSA	Survey Abandoned		Camera would not be able to go passed intruding service

Sewer Condition Inspection Report

303 24 St North
Lethbridge, AB T1H 3T7
Phone: 403-328-8588
Fax: 403-328-6896
Email: video@drainmaster.ca

Upstream MH	Downstream MH	Size	Material	Total Length	City
3/4 Ave	3 Ave	200	Vitrified Clay Pipe		Stirling

Surveyor's Name	Certificate Number	Street Address	Location Details
John Bosch	U-413-15621	3rd St	

Direction	Purpose	Weather	Date	Time	Length Surveyed
Downstream	Capital Improvement Program Assessment		20200421	11:18	47.4

Additional Information

AMH - Access Point - Manhole @ 0.0 m.
Starting Manhole: 3/4 Ave

MWL - Water Level @ 0.0 m.

CC - Crack Circumferential @ 0.2 m.

DAE - Deposits Attached: Encrustation @ 3.3 m.

Sewer Condition Inspection Report

303 24 St North
Lethbridge, AB T1H 3T7
Phone: 403-328-8588
Fax: 403-328-6896
Email: video@drainmaster.ca

Upstream MH	Downstream MH	Size	Material	Total Length	City
3/4 Ave	3 Ave	200	Vitrified Clay Pipe		Stirling

Surveyor's Name	Certificate Number	Street Address	Location Details
John Bosch	U-413-15621	3rd St	

Direction	Purpose	Weather	Date	Time	Length Surveyed
Downstream	Capital Improvement Program Assessment		20200421	11:18	47.4

Additional Information

DAE - Deposits Attached: Encrustation @ 9.2 m.

TBA - Tap, Break-in / Hammer: Active @ 14.4 m.

DAE - Deposits Attached: Encrustation @ 14.4 m.

TB - Tap, Break-in / Hammer @ 36.4 m.

Sewer Condition Inspection Report

303 24 St North
Lethbridge, AB T1H 3T7
Phone: 403-328-8588
Fax: 403-328-6896
Email: video@drainmaster.ca

Upstream MH	Downstream MH	Size	Material	Total Length	City
3/4 Ave	3 Ave	200	Vitrified Clay Pipe		Stirling

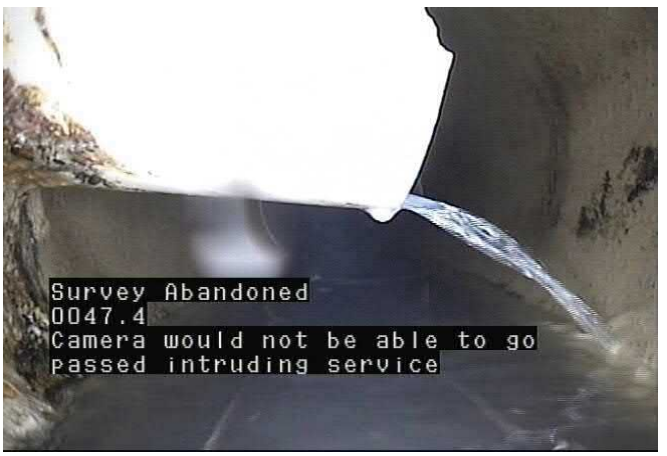
Surveyor's Name	Certificate Number	Street Address	Location Details
John Bosch	U-413-15621	3rd St	

Direction	Purpose	Weather	Date	Time	Length Surveyed
Downstream	Capital Improvement Program Assessment		20200421	11:18	47.4

Additional Information

TB - Tap, Break-in / Hammer @ 42.9 m.

TBI - Tap, Break-in / Hammer: Intruding @ 47.3 m.



MSA - Survey Abandoned @ 47.4 m. Camera would not be able to go passed intruding service

Sewer Condition Inspection Report

303 24 St North
Lethbridge, AB T1H 3T7
Phone: 403-328-8588
Fax: 403-328-6896
Email: video@drainmaster.ca

Surveyors name	Certificate Number	System Owner	Survey Customer	Drainage Area	Sheet
John Bosch	U-413-15621	Town of Stirling	MPE Engineering		1

P/O No.	Pipeline Segment Reference	Date	Time	Location (Street Name and number)	Locality
		20200421	14:37	3rd St	Stirling

Further Location details	Upstream Manhole Number	Rim to Invert	Grade to Invert	Rim to Grade
	3 Ave			

Downstream Manhole Number	Rim to Invert	Grade to Invert	Rim to Grade	Use of Sewer	Direction	Flow Control	Height
3/2 Ave				Sanitary	Downstream	N	200

Width	Shape	Material	Ln. Method	Pipe Joint Length	Total Length	Length Surveyed	Year Laid	Year Rehabilitated	Tape / Media Number
	Circular	VCP				71.4			

Purpose	Sewer Category	Pre-Cleaning	Cleaned	Weather	Additional Information
G		Jetting			

Distance (Meters)	Code		Continuous defect	Value				Joint	Circumferential Location		Image Ref.	Struct. Grade	O&M Grade	Remarks
	Group/ Descriptor	Modifier/ severity		S/M/L	Inches 1st	Inches 2nd	%		At / From	To				
0.0	AMH										AMH@0			Starting Manhole: 3 Ave
0.0	MWL						40				MWL@0			
38.1	TB				100				2		TB@38.1			
66.4	TB				100				10		TB@66.4			
70.8	LRU						20				LRU@70.8		2	Before the camera flips you can see that the line goes up and tpo the right by the pull line on the top right of the pipe
71.4	MSA										MSA@71.4			Camera flip[ped over because of debris in line and curve in line

	Structural								O & M								Overall							
Segment	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index
Town of Stirling-3rd St-3 Ave-3 2 Ave	0	0	0	0	0	0	0000		0	2	0	0	0	2	2100	2.0	0	2	0	0	0	2	2100	2.0

Sewer Condition Inspection Report

303 24 St North
Lethbridge, AB T1H 3T7
Phone: 403-328-8588
Fax: 403-328-6896
Email: video@drainmaster.ca

Upstream MH	Downstream MH	Size	Material	Total Length	City
3 Ave	3/2 Ave	200	Vitrified Clay Pipe		Stirling

Surveyor's Name	Certificate Number	Street Address	Location Details
John Bosch	U-413-15621	3rd St	

Direction	Purpose	Weather	Date	Time	Length Surveyed
Downstream	Capital Improvement Program Assessment		20200421	14:37	71.4

Additional Information

Ftg.	Code	Description	Position	Comment
0.0	AMH	Access Point - Manhole		Starting Manhole: 3 Ave
0.0	MWL	Water Level		
38.1	TB	Tap, Break-in / Hammer	2	
66.4	TB	Tap, Break-in / Hammer	10	
70.8	LRU	Line - Right/Up		Before the camera flips you can see that the line goes up and tpo the right by the pull line on the top right of the pipe
71.4	MSA	Survey Abandoned		Camera flip[ped over because of debris in line and curve in line

Generated on Tuesday, 21/04/2020 at 05:33 PM by the PipeTech® TV inspection system.

Sewer Condition Inspection Report

303 24 St North
Lethbridge, AB T1H 3T7
Phone: 403-328-8588
Fax: 403-328-6896
Email: video@drainmaster.ca

Upstream MH	Downstream MH	Size	Material	Total Length	City
3 Ave	3/2 Ave	200	Vitrified Clay Pipe		Stirling

Surveyor's Name	Certificate Number	Street Address	Location Details
John Bosch	U-413-15621	3rd St	

Direction	Purpose	Weather	Date	Time	Length Surveyed
Downstream	Capital Improvement Program Assessment		20200421	14:37	71.4

Additional Information

AMH - Access Point - Manhole @ 0.0 m.
Starting Manhole: 3 Ave

MWL - Water Level @ 0.0 m.

TB - Tap, Break-in / Hammer @ 38.1 m.

TB - Tap, Break-in / Hammer @ 66.4 m.

Sewer Condition Inspection Report

303 24 St North
Lethbridge, AB T1H 3T7
Phone: 403-328-8588
Fax: 403-328-6896
Email: video@drainmaster.ca

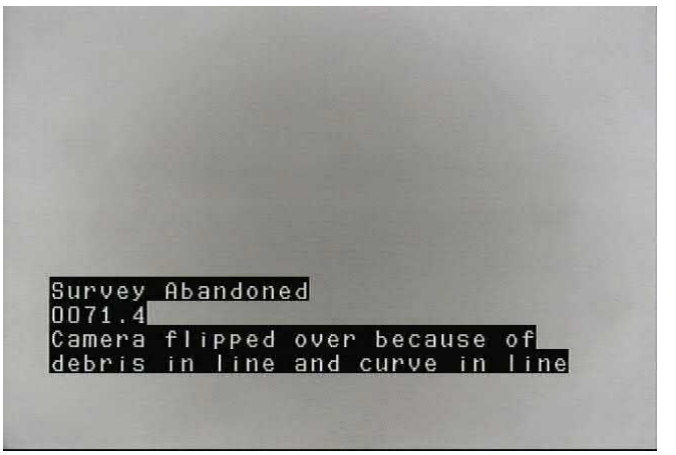
Upstream MH	Downstream MH	Size	Material	Total Length	City
3 Ave	3/2 Ave	200	Vitrified Clay Pipe		Stirling

Surveyor's Name	Certificate Number	Street Address	Location Details
John Bosch	U-413-15621	3rd St	

Direction	Purpose	Weather	Date	Time	Length Surveyed
Downstream	Capital Improvement Program Assessment		20200421	14:37	71.4

Additional Information

LRU - Line - Right/Up @ 70.8 m. Before the camera flips you can see that the line goes up and tpo the right by the pull line on the top right of the pipe



MSA - Survey Abandoned @ 71.4 m. Camera flip[ped over because of debris in line and curve in line

Sewer Condition Inspection Report

303 24 St North
Lethbridge, AB T1H 3T7
Phone: 403-328-8588
Fax: 403-328-6896
Email: video@drainmaster.ca

Surveyors name	Certificate Number	System Owner	Survey Customer	Drainage Area	Sheet
John Bosch	U-413-15621	Town of Stirling	MPE Engineering		1

P/O No.	Pipeline Segment Reference	Date	Time	Location (Street Name and number)	Locality
		20200421	12:59	3rd St	Stirling

Further Location details	Upstream Manhole Number	Rim to Invert	Grade to Invert	Rim to Grade
	4 Ave			

Downstream Manhole Number	Rim to Invert	Grade to Invert	Rim to Grade	Use of Sewer	Direction	Flow Control	Height
3/4 Ave				Sanitary	Downstream	N	200

Width	Shape	Material	Ln. Method	Pipe Joint Length	Total Length	Length Surveyed	Year Laid	Year Rehabilitated	Tape / Media Number
	Circular	VCP				10.2			

Purpose	Sewer Category	Pre-Cleaning	Cleaned	Weather	Additional Information
G		Jetting			

Distance (Meters)	Code		Continuous defect	Value				Joint	Circumferential Location		Image Ref.	Struct. Grade	O&M Grade	Remarks
	Group/ Descriptor	Modifier/ severity		S/M/L	Inches 1st	Inches 2nd	%		At / From	To				
0.0	AMH										AMH@0			Starting Manhole: 4 Ave
0.0	MWL						20				MWL@0			
0.1	DA	E					15	J	8	4	DAE@0.1		3	
3.2	MWL	S					100				MWLS@3.2	4		Could not even pull the water level down with heavy jetting
9.7	DA	E					40	J	8	4	DAE@9.7		5	
10.2	MSA										MSA@10.2			Camera would not go by deposit build up on joint

	Structural								O & M								Overall							
Segment	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index
Town of Stirling-3rd St-4 Ave-3 4 Ave	0	0	0	4	0	4	4100	4.0	0	0	3	0	5	8	5131	4.0	0	0	3	4	5	12	5141	4.0

Sewer Condition Inspection Report

303 24 St North
Lethbridge, AB T1H 3T7
Phone: 403-328-8588
Fax: 403-328-6896
Email: video@drainmaster.ca

Upstream MH	Downstream MH	Size	Material	Total Length	City
4 Ave	3/4 Ave	200	Vitrified Clay Pipe		Stirling

Surveyor's Name	Certificate Number	Street Address	Location Details
John Bosch	U-413-15621	3rd St	

Direction	Purpose	Weather	Date	Time	Length Surveyed
Downstream	Capital Improvement Program Assessment		20200421	12:59	10.2

Additional Information

Ftg.	Code	Description	Position	Comment
0.0	AMH	Access Point - Manhole		Starting Manhole: 4 Ave
0.0	MWL	Water Level		
0.1	DAE	Deposits Attached: Encrustation	8 to 4	
3.2	MWLS	Water Level: Sag		Could not even pull the water level down with heavy jetting
9.7	DAE	Deposits Attached: Encrustation	8 to 4	
10.2	MSA	Survey Abandoned		Camera would not go by deposit build up on joint

Sewer Condition Inspection Report

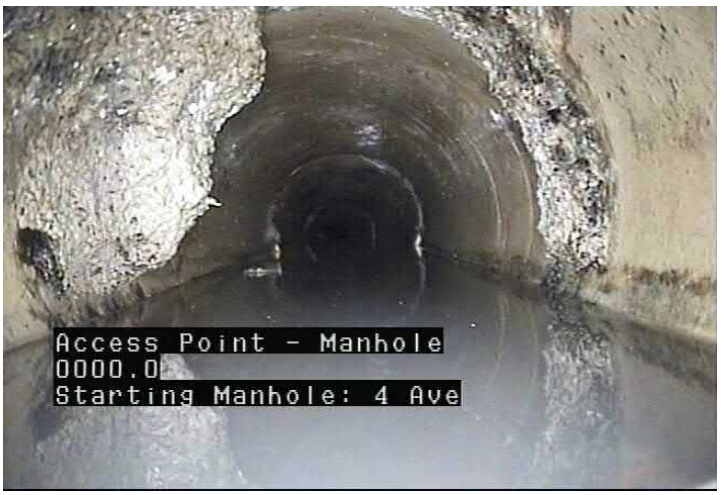
303 24 St North
Lethbridge, AB T1H 3T7
Phone: 403-328-8588
Fax: 403-328-6896
Email: video@drainmaster.ca

Upstream MH	Downstream MH	Size	Material	Total Length	City
4 Ave	3/4 Ave	200	Vitrified Clay Pipe		Stirling

Surveyor's Name	Certificate Number	Street Address	Location Details
John Bosch	U-413-15621	3rd St	

Direction	Purpose	Weather	Date	Time	Length Surveyed
Downstream	Capital Improvement Program Assessment		20200421	12:59	10.2

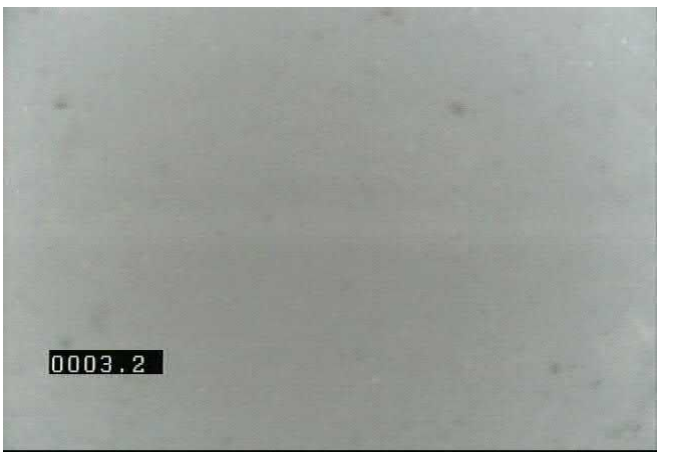
Additional Information



AMH - Access Point - Manhole @ 0.0 m.
Starting Manhole: 4 Ave

MWL - Water Level @ 0.0 m.

DAE - Deposits Attached: Encrustation @ 0.1 m.



MWLS - Water Level: Sag @ 3.2 m.
Could not even pull the water level down with heavy jetting

Sewer Condition Inspection Report

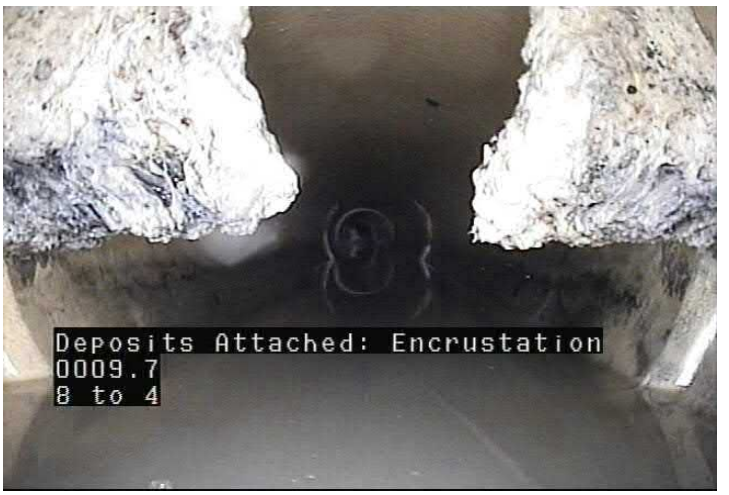
303 24 St North
Lethbridge, AB T1H 3T7
Phone: 403-328-8588
Fax: 403-328-6896
Email: video@drainmaster.ca

Upstream MH	Downstream MH	Size	Material	Total Length	City
4 Ave	3/4 Ave	200	Vitrified Clay Pipe		Stirling

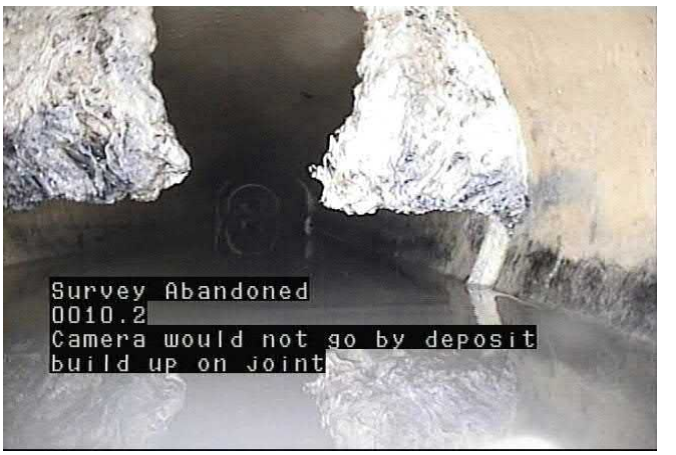
Surveyor's Name	Certificate Number	Street Address	Location Details
John Bosch	U-413-15621	3rd St	

Direction	Purpose	Weather	Date	Time	Length Surveyed
Downstream	Capital Improvement Program Assessment		20200421	12:59	10.2

Additional Information



DAE - Deposits Attached: Encrustation @ 9.7 m.



MSA - Survey Abandoned @ 10.2 m. Camera would not go by deposit build up on joint

Sewer Condition Inspection Report

303 24 St North
Lethbridge, AB T1H 3T7
Phone: 403-328-8588
Fax: 403-328-6896
Email: video@drainmaster.ca

Surveyors name	Certificate Number	System Owner	Survey Customer	Drainage Area	Sheet
John Bosch	U-413-15621	Town of Stirling	MPE Engineering		1

P/O No.	Pipeline Segment Reference	Date	Time	Location (Street Name and number)	Locality
		20200421	14:21	3rd St	Stirling

Further Location details	Upstream Manhole Number	Rim to Invert	Grade to Invert	Rim to Grade
	5/4 Ave			

Downstream Manhole Number	Rim to Invert	Grade to Invert	Rim to Grade	Use of Sewer	Direction	Flow Control	Height
High School Service MH				Sanitary	Downstream	N	200

Width	Shape	Material	Ln. Method	Pipe Joint Length	Total Length	Length Surveyed	Year Laid	Year Rehabilitated	Tape / Media Number
	Circular	VCP				11			

Purpose	Sewer Category	Pre-Cleaning	Cleaned	Weather	Additional Information
G		Jetting			

Distance (Meters)	Code		Continuous defect	Value				Joint	Circumferential Location		Image Ref.	Struct. Grade	O&M Grade	Remarks
	Group/ Descriptor	Modifier/ severity		S/M/L	Inches 1st	Inches 2nd	%		At / From	To				
0.0	AMH										AMH@0			Starting Manhole: 5/4 Ave
0.0	MWL						20				MWL@0			
1.0	CL								8		CL@0	2		
1.0	CL								5		CL@0_1	2		
11.0	AMH										AMH@11			High School Service MH

Segment	Structural								O & M								Overall							
	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index
Town of Stirling-3rd St-5 4 Ave-High School Service	0	4	0	0	0	4	2200	2.0	0	0	0	0	0	0	0000		0	4	0	0	0	4	2200	2.0

Sewer Condition Inspection Report

303 24 St North
Lethbridge, AB T1H 3T7
Phone: 403-328-8588
Fax: 403-328-6896
Email: video@drainmaster.ca

Upstream MH	Downstream MH	Size	Material	Total Length	City
5/4 Ave	High School Service MH	200	Vitrified Clay Pipe		Stirling

Surveyor's Name	Certificate Number	Street Address	Location Details
John Bosch	U-413-15621	3rd St	

Direction	Purpose	Weather	Date	Time	Length Surveyed
Downstream	Capital Improvement Program Assessment		20200421	14:21	11

Additional Information

Ftg.	Code	Description	Position	Comment
0.0	AMH	Access Point - Manhole		Starting Manhole: 5/4 Ave
0.0	MWL	Water Level		
1.0	CL	Crack Longitudinal	8	
1.0	CL	Crack Longitudinal	5	
11.0	AMH	Access Point - Manhole		High School Service MH

Sewer Condition Inspection Report

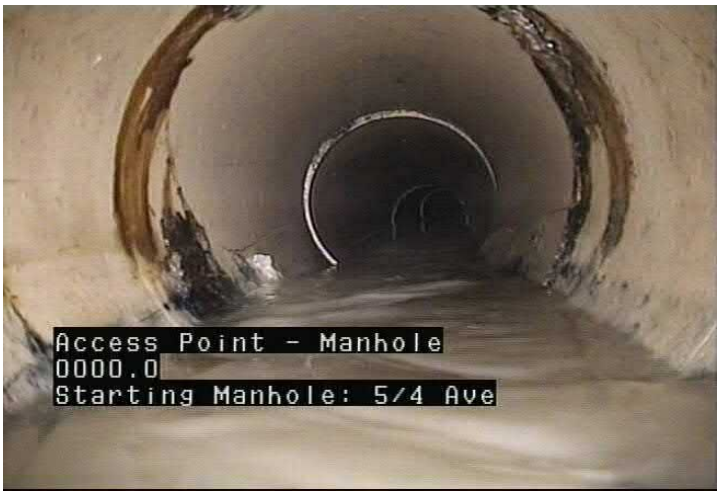
303 24 St North
Lethbridge, AB T1H 3T7
Phone: 403-328-8588
Fax: 403-328-6896
Email: video@drainmaster.ca

Upstream MH	Downstream MH	Size	Material	Total Length	City
5/4 Ave	High School Service MH	200	Vitrified Clay Pipe		Stirling

Surveyor's Name	Certificate Number	Street Address	Location Details
John Bosch	U-413-15621	3rd St	

Direction	Purpose	Weather	Date	Time	Length Surveyed
Downstream	Capital Improvement Program Assessment		20200421	14:21	11

Additional Information



AMH - Access Point - Manhole @ 0.0 m.
Starting Manhole: 5/4 Ave

MWL - Water Level @ 0.0 m.

CL - Crack Longitudinal @ 1.0 m.

CL - Crack Longitudinal @ 1.0 m.

Sewer Condition Inspection Report

303 24 St North
Lethbridge, AB T1H 3T7
Phone: 403-328-8588
Fax: 403-328-6896
Email: video@drainmaster.ca

Upstream MH	Downstream MH	Size	Material	Total Length	City
5/4 Ave	High School Service MH	200	Vitrified Clay Pipe		Stirling

Surveyor's Name	Certificate Number	Street Address	Location Details
John Bosch	U-413-15621	3rd St	

Direction	Purpose	Weather	Date	Time	Length Surveyed
Downstream	Capital Improvement Program Assessment		20200421	14:21	11

Additional Information

AMH - Access Point - Manhole @ 11.0 m.
High School Service MH

Sewer Condition Inspection Report

303 24 St North
Lethbridge, AB T1H 3T7
Phone: 403-328-8588
Fax: 403-328-6896
Email: video@drainmaster.ca

Surveyors name	Certificate Number	System Owner	Survey Customer	Drainage Area	Sheet
John Bosch	U-413-15621	Town of Stirling	MPE Engineering		1

P/O No.	Pipeline Segment Reference	Date	Time	Location (Street Name and number)	Locality
		20200310	10:58	3rd St	Stirling

Further Location details	Upstream Manhole Number	Rim to Invert	Grade to Invert	Rim to Grade
	5 Ave			

Downstream Manhole Number	Rim to Invert	Grade to Invert	Rim to Grade	Use of Sewer	Direction	Flow Control	Height
5/4 Ave				Sanitary	Downstream	N	200

Width	Shape	Material	Ln. Method	Pipe Joint Length	Total Length	Length Surveyed	Year Laid	Year Rehabilitated	Tape / Media Number
	Circular	VCP				103.4			

Purpose	Sewer Category	Pre-Cleaning	Cleaned	Weather	Additional Information
G		Jetting			

Distance (Meters)	Code		Continuous defect	Value				Joint	Circumferential Location		Image Ref.	Struct. Grade	O&M Grade	Remarks
	Group/ Descriptor	Modifier/ severity		S/M/L	Inches 1st	Inches 2nd	%		At / From	To				
0.0	AMH										AMH@0			Starting Manhole: 5 Ave
0.0	MWL						0				MWL@0			
0.0	MWL	S					30				MWLS@0	2		
7.5	JO			M							JOM@7.5	1		
7.9	JS			M							JSM@7.9	1		
14.1	MWL	S					40				MWLS@14.1	3		
17.8	DA	E					10	J	10	12	DAE@17.8		2	
22.5	DA	E					0	J	8	10	DAE@22.5		2	
26.8	DA	E					0	J	8	4	DAE@26.8		2	
33.0	TB				100				10		TB@33			
35.8	DA	E					0	J	8	11	DAE@35.8		2	
46.4	MWL	S					100				MWLS@46.4	4		Camera goes underwater - has to flush hard to pull the level down all the way to 65m
68.5	MWM						75				MWM@68.5		5	Marks show high water level without out flushing
75.3	TB				100				2		TB@75.3			
79.7	TB				100				2		TB@79.7			
103.4	MSA													Camera stuck in debris that camera was pushing

	Structural								O & M								Overall							
Segment	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index
Town of Stirling-3rd St-5 Ave-5 4 Ave	2	2	3	4	0	11	4131	2.2	0	8	0	0	5	13	5124	2.6	2	10	3	4	5	24	5141	2.4

Sewer Condition Inspection Report

303 24 St North
Lethbridge, AB T1H 3T7
Phone: 403-328-8588
Fax: 403-328-6896
Email: video@drainmaster.ca

Upstream MH	Downstream MH	Size	Material	Total Length	City
5 Ave	5/4 Ave	200	Vitrified Clay Pipe		Stirling

Surveyor's Name	Certificate Number	Street Address	Location Details
John Bosch	U-413-15621	3rd St	

Direction	Purpose	Weather	Date	Time	Length Surveyed
Downstream	Capital Improvement Program Assessment		20200310	10:58	103.4

Additional Information

Ftg.	Code	Description	Position	Comment
0.0	AMH	Access Point - Manhole		Starting Manhole: 5 Ave
0.0	MWL	Water Level		
0.0	MWLS	Water Level: Sag		
7.5	JOM	Joint Offset (displaced): Medium		
7.9	JSM	Joint Separated (open): Medium		
14.1	MWLS	Water Level: Sag		
17.8	DAE	Deposits Attached: Encrustation	10 to 12	
22.5	DAE	Deposits Attached: Encrustation	8 to 10	
26.8	DAE	Deposits Attached: Encrustation	8 to 4	
33.0	TB	Tap, Break-in / Hammer	10	
35.8	DAE	Deposits Attached: Encrustation	8 to 11	
46.4	MWLS	Water Level: Sag		Camera goes underwater - has to flush hard to pull the level down all the way to 65m
68.5	MWM	Water Mark		Marks show high water level without out flushing
75.3	TB	Tap, Break-in / Hammer	2	
79.7	TB	Tap, Break-in / Hammer	2	
103.4	MSA	Survey Abandoned		Camera stuck in debris that camera was pushing

Sewer Condition Inspection Report

303 24 St North
Lethbridge, AB T1H 3T7
Phone: 403-328-8588
Fax: 403-328-6896
Email: video@drainmaster.ca

Upstream MH	Downstream MH	Size	Material	Total Length	City
5 Ave	5/4 Ave	200	Vitrified Clay Pipe		Stirling

Surveyor's Name	Certificate Number	Street Address	Location Details
John Bosch	U-413-15621	3rd St	

Direction	Purpose	Weather	Date	Time	Length Surveyed
Downstream	Capital Improvement Program Assessment		20200310	10:58	103.4

Additional Information

AMH - Access Point - Manhole @ 0.0 m.
Starting Manhole: 5 Ave

MWL - Water Level @ 0.0 m.

MWLS - Water Level: Sag @ 0.0 m.

JOM - Joint Offset (displaced): Medium @ 7.5 m.

Sewer Condition Inspection Report

VIDEO INSPECTION SERVICES
403-328-8588
www.DrainMaster.ca

303 24 St North
Lethbridge, AB T1H 3T7
Phone: 403-328-8588
Fax: 403-328-6896
Email: video@drainmaster.ca

Upstream MH	Downstream MH	Size	Material	Total Length	City
5 Ave	5/4 Ave	200	Vitrified Clay Pipe		Stirling

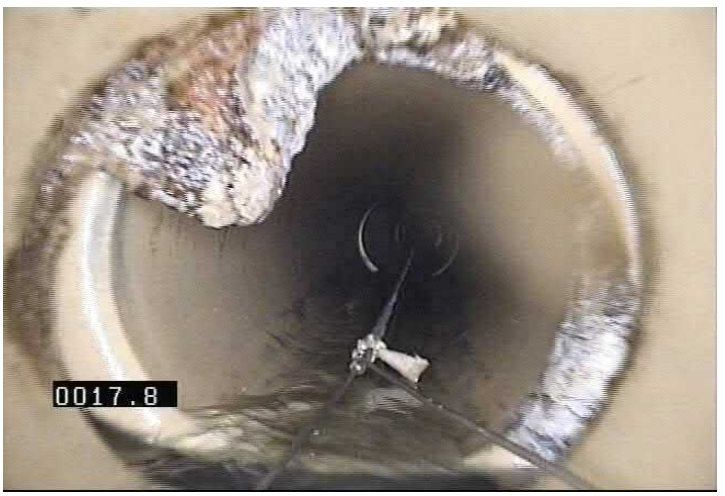
Surveyor's Name	Certificate Number	Street Address	Location Details
John Bosch	U-413-15621	3rd St	

Direction	Purpose	Weather	Date	Time	Length Surveyed
Downstream	Capital Improvement Program Assessment		20200310	10:58	103.4

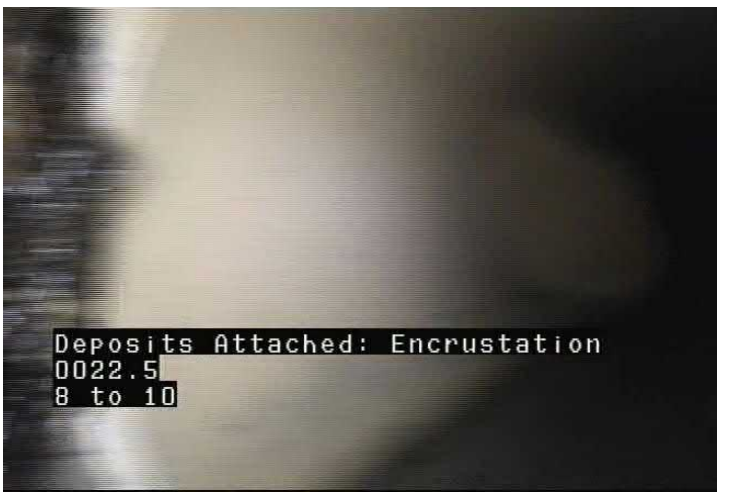
Additional Information

JSM - Joint Separated (open): Medium @ 7.9 m.

MWLS - Water Level: Sag @ 14.1 m.



DAE - Deposits Attached: Encrustation @ 17.8 m.



DAE - Deposits Attached: Encrustation @ 22.5 m.

Sewer Condition Inspection Report

VIDEO INSPECTION SERVICES
403-328-8588
www.DrainMaster.ca

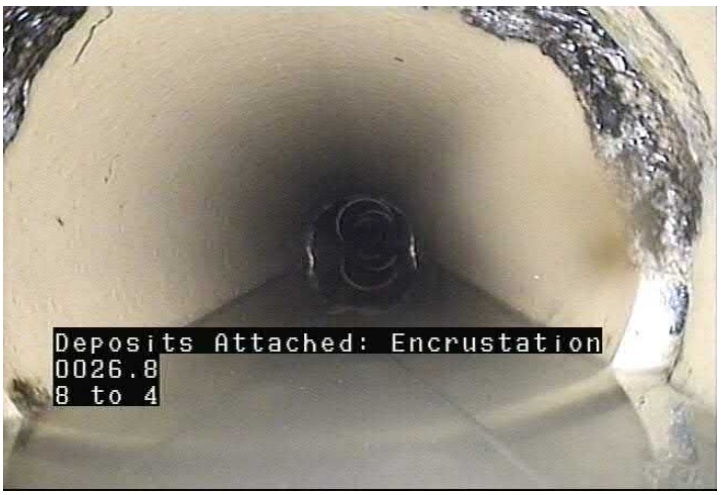
303 24 St North
Lethbridge, AB T1H 3T7
Phone: 403-328-8588
Fax: 403-328-6896
Email: video@drainmaster.ca

Upstream MH	Downstream MH	Size	Material	Total Length	City
5 Ave	5/4 Ave	200	Vitrified Clay Pipe		Stirling

Surveyor's Name	Certificate Number	Street Address	Location Details
John Bosch	U-413-15621	3rd St	

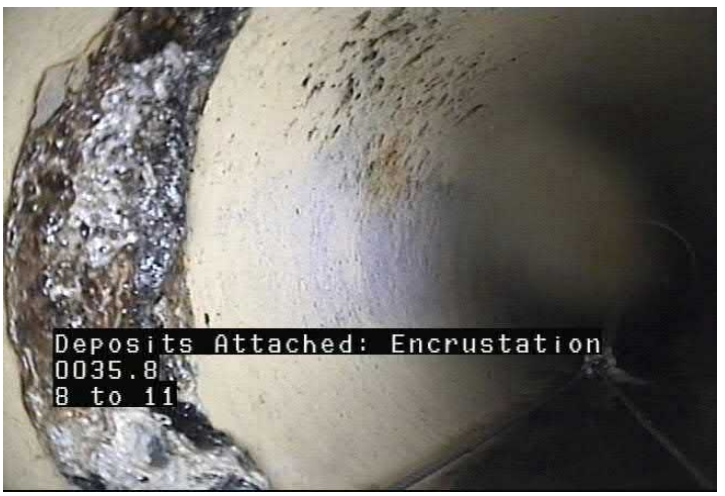
Direction	Purpose	Weather	Date	Time	Length Surveyed
Downstream	Capital Improvement Program Assessment		20200310	10:58	103.4

Additional Information



DAE - Deposits Attached: Encrustation @ 26.8 m.

TB - Tap, Break-in / Hammer @ 33.0 m.



DAE - Deposits Attached: Encrustation @ 35.8 m.

MWLS - Water Level: Sag @ 46.4 m. Camera goes underwater - has to flush hard to pull the level down all the way to 65m

Sewer Condition Inspection Report

303 24 St North
Lethbridge, AB T1H 3T7
Phone: 403-328-8588
Fax: 403-328-6896
Email: video@drainmaster.ca

Upstream MH	Downstream MH	Size	Material	Total Length	City
5 Ave	5/4 Ave	200	Vitrified Clay Pipe		Stirling

Surveyor's Name	Certificate Number	Street Address	Location Details
John Bosch	U-413-15621	3rd St	

Direction	Purpose	Weather	Date	Time	Length Surveyed
Downstream	Capital Improvement Program Assessment		20200310	10:58	103.4

Additional Information

MWM - Water Mark @ 68.5 m. Marks show high water level without out flushing

TB - Tap, Break-in / Hammer @ 75.3 m.

TB - Tap, Break-in / Hammer @ 79.7 m.

Invalid Frame

MSA - Survey Abandoned @ 103.4 m. Camera stuck in debris that camera was pushing

Sewer Condition Inspection Report

303 24 St North
Lethbridge, AB T1H 3T7
Phone: 403-328-8588
Fax: 403-328-6896
Email: video@drainmaster.ca

Surveyors name	Certificate Number	System Owner	Survey Customer	Drainage Area	Sheet
John Bosch	U-413-15621	Town of Stirling	MPE Engineering		1

P/O No.	Pipeline Segment Reference	Date	Time	Location (Street Name and number)	Locality
		20200421	14:26	3rd St	Stirling

Further Location details	Upstream Manhole Number	Rim to Invert	Grade to Invert	Rim to Grade
	High School Service MH			

Downstream Manhole Number	Rim to Invert	Grade to Invert	Rim to Grade	Use of Sewer	Direction	Flow Control	Height
4 Ave				Sanitary	Downstream	N	200

Width	Shape	Material	Ln. Method	Pipe Joint Length	Total Length	Length Surveyed	Year Laid	Year Rehabilitated	Tape / Media Number
	Circular	VCP				9.7			

Purpose	Sewer Category	Pre-Cleaning	Cleaned	Weather	Additional Information
G		Jetting			

Distance (Meters)	Code		Continuous defect	Value				Joint	Circumferential Location		Image Ref.	Struct. Grade	O&M Grade	Remarks
	Group/ Descriptor	Modifier/ severity		S/M/L	Inches 1st	Inches 2nd	%		At / From	To				
0.0	AMH										AMH@0			Starting Manhole: High School Service MH
0.0	MWL						20				MWL@0			
9.7	DA	E					55	J	8	12	DAE@9.7		5	
9.7	MSA										MSA@9.7			Camera would not be able to go by mineral deposit

	Structural								O & M								Overall							
Segment	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Rating	Quick	Index
Town of Stirling-3rd St-High School Service MH-4 A	0	0	0	0	0	0	0000		0	0	0	0	5	5	5100	5.0	0	0	0	0	5	5	5100	5.0

Sewer Condition Inspection Report

303 24 St North
Lethbridge, AB T1H 3T7
Phone: 403-328-8588
Fax: 403-328-6896
Email: video@drainmaster.ca

Upstream MH	Downstream MH	Size	Material	Total Length	City
High School Service MH	4 Ave	200	Vitrified Clay Pipe		Stirling

Surveyor's Name	Certificate Number	Street Address	Location Details
John Bosch	U-413-15621	3rd St	

Direction	Purpose	Weather	Date	Time	Length Surveyed
Downstream	Capital Improvement Program Assessment		20200421	14:26	9.7

Additional Information

Ftg.	Code	Description	Position	Comment
0.0	AMH	Access Point - Manhole		Starting Manhole: High School Service MH
0.0	MWL	Water Level		
9.7	DAE	Deposits Attached: Encrustation	8 to 12	
9.7	MSA	Survey Abandoned		Camera would not be able to go by mineral deposit

Sewer Condition Inspection Report

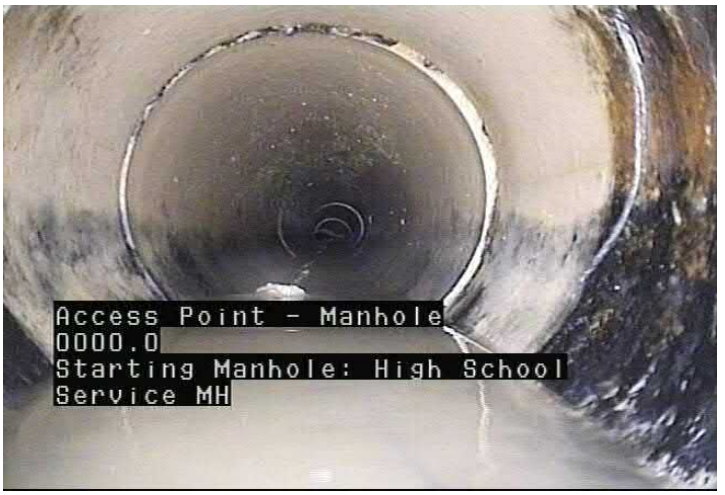
303 24 St North
Lethbridge, AB T1H 3T7
Phone: 403-328-8588
Fax: 403-328-6896
Email: video@drainmaster.ca

Upstream MH	Downstream MH	Size	Material	Total Length	City
High School Service MH	4 Ave	200	Vitrified Clay Pipe		Stirling

Surveyor's Name	Certificate Number	Street Address	Location Details
John Bosch	U-413-15621	3rd St	

Direction	Purpose	Weather	Date	Time	Length Surveyed
Downstream	Capital Improvement Program Assessment		20200421	14:26	9.7

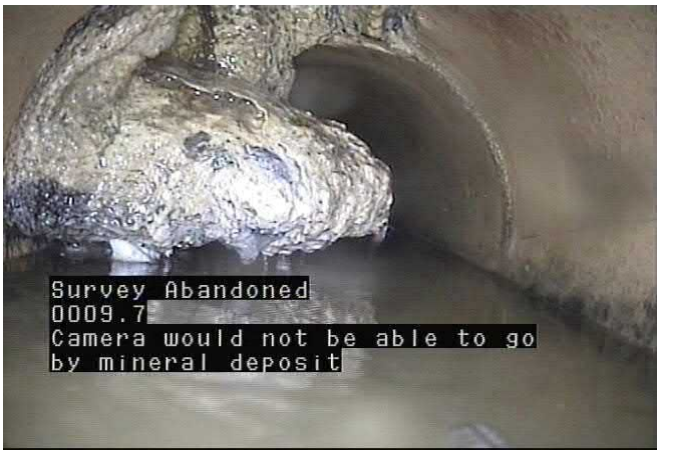
Additional Information



AMH - Access Point - Manhole @ 0.0 m.
Starting Manhole: High School Service MH

MWL - Water Level @ 0.0 m.

DAE - Deposits Attached: Encrustation @ 9.7 m.



MSA - Survey Abandoned @ 9.7 m.
Camera would not be able to go by mineral deposit

APPENDIX C:

WASTEWATER COST ESTIMATES

Village of Stirling
Infrastructure Master Plan
Wastewater System Upgrades

ORDER OF MAGNITUDE COST ESTIMATE

Wastewater Collection System

Wastewater Collection System

	Description of Work	Unit	Cost per unit
1	Supply and Install 200 mm SDR35 PVC Sanitary Sewer Pipe, complete	m	$350.00
2	Supply and Install 250 mm SDR35 PVC Sanitary Sewer Pipe, complete	m	$375.00
3	Supply and Install 300 mm SDR35 PVC Sanitary Sewer Pipe, complete	m	$400.00
4	Supply and Install 375 mm SDR35 PVC Sanitary Sewer Pipe, complete	m	$425.00
5	Supply and Install 450 mm SDR35 PVC Sanitary Sewer Pipe, complete	m	$475.00
6	Supply and Install 525 mm SDR35 PVC Sanitary Sewer Pipe, complete	m	$525.00
7	Supply and Install 600 mm SDR35 PVC Sanitary Sewer Pipe, complete	m	$600.00
8	Supply and Install 750 mm SDR35 PVC Sanitary Sewer Pipe, complete	m	$800.00
9	Supply and Install 200 mm cured-in-place pipe liner, complete	m	$325.00
10	Supply and Install 250 mm cured-in-place pipe liner, completed	m	$350.00
11	Supply and Install 375 mm cured-in-place pipe liner, complete	m	$475.00
12	Supply and Install Type 1 Standard Precast Manhole, complete	v.m.	$2,500.00
13	Tie-in Existing Sanitary Service Lines	ea	$5,000.00
14	New Sanitary Service Lines	ea	$7,500.00
15	Connect to Existing Sanitary Collection System	ea	$7,500.00

Point Repair From Manhole

	Description of Work	each	m	Unit Cost	Cost
1	Base	1		$3,000.00	$3,000.00
2	Repair Sleeve	1		$2,500.00	$2,500.00
3	General Requirements (15%)				$900.00
			Total Unit Price		**$7,000.00**

200mm Wastewater Main point Repair - Local Asphalt Surface

	Description of Work	m2	m	Unit Cost	Cost
1	Asphalt Road Restoration - Local Road	100		$100.00	$10,000.00
2	Supply and Install 200 mm SDR35 PVC Sanitary Sewer Pipe, complete		10	$350.00	$3,500.00
3	General Requirements (15%)				$2,100.00
			Total Unit Price		**$16,000.00**

300mm Wastewater Main point Repair - Local Asphalt Surface

	Description of Work	m2	m	Unit Cost	Cost
1	Asphalt Road Restoration - Local Road	100		$100.00	$10,000.00
2	Supply and Install 300 mm SDR35 PVC Sanitary Sewer Pipe, complete		10	$400.00	$4,000.00
3	General Requirements (15%)				$2,100.00
			Total Unit Price		**$17,000.00**

Village of Stirling
Infrastructure Master Plan
Wastewater System Upgrades

ORDER OF MAGNITUDE COST ESTIMATE

300mm Wastewater Main point Repair - Grass Surface					
	Description of Work	**m2**	**m**	**Unit Cost**	**Cost**
1	Grass Restoration - Topsoil and Seed	$ 20.00		$ 5.00	$100.00
2	Supply and Install 300 mm SDR35 PVC Sanitary Sewer Pipe, complete		10	$400.00	$4,000.00
3	General Requirements (15%)				$700.00
				Total Unit Price	**$5,000.00**

Unit pricing based on 1 block, assuming the following:

- Assumed 8x12 asphalt restoration
- Assumed 8m of pipe replacement
- no allowance made for curb & gutter and sidewalk work
- Assume no conflict with other utilities (pp's, etc)

200mm Wastewater Main Repair / Replacement per Meter - Local Asphalt Surface					
	Description of Work	**m2**	**m**	**Unit Cost**	**Cost**
1	Asphalt Road Restoration - Local Road	10		$100.00	$1,000.00
2	Supply and Install 200 mm SDR35 PVC Sanitary Sewer Pipe, complete		1	$350.00	$350.00
3	General Requirements (15%)				$300.00
				Total Unit Price	**$1,700.00**

250mm Wastewater Main Repair / Replacement per Meter - Local Asphalt Surface					
	Description of Work	**m2**	**m**	**Unit Cost**	**Cost**
1	Asphalt Road Restoration - Local Road	10		$100.00	$1,000.00
2	Supply and Install 250 mm SDR35 PVC Sanitary Sewer Pipe, complete		1	$375.00	$375.00
3	General Requirements (15%)				$300.00
				Total Unit Price	**$1,700.00**

300mm Wastewater Main Repair / Replacement per Meter - Local Asphalt Surface					
	Description of Work	**m2**	**m**	**Unit Cost**	**Cost**
1	Asphalt Road Restoration - Local Road	10		$100.00	$1,000.00
2	Supply and Install 300 mm SDR35 PVC Sanitary Sewer Pipe, complete		1	$400.00	$400.00
3	General Requirements (15%)				$300.00
				Total Unit Price	**$1,700.00**

375mm Wastewater Main Repair / Replacement per Meter - Local Asphalt Surface					
	Description of Work	**m2**	**m**	**Unit Cost**	**Cost**
1	Asphalt Road Restoration - Local Road	10		$100.00	$1,000.00
2	Supply and Install 375 mm SDR35 PVC Sanitary Sewer Pipe, complete		1	$425.00	$425.00
3	General Requirements (15%)				$300.00
				Total Unit Price	**$1,800.00**

Village of Stirling
Infrastructure Master Plan
Wastewater System Upgrades

ORDER OF MAGNITUDE COST ESTIMATE

450mm Wastewater Main Repair / Replacement per Meter - Local Asphalt Surface					
	Description of Work	**m2**	**m**	**Unit Cost**	**Cost**
1	Asphalt Road Restoration - Local Road	10		$100.00	$1,000.00
2	Supply and Install 450 mm SDR35 PVC Sanitary Sewer Pipe, complete		1	$475.00	$475.00
3	General Requirements (15%)				$300.00
				Total Unit Price	**$1,800.00**

525mm Wastewater Main Repair / Replacement per Meter - Local Asphalt Surface					
	Description of Work	**m2**	**m**	**Unit Cost**	**Cost**
1	Asphalt Road Restoration - Local Road	10		$100.00	$1,000.00
2	Supply and Install 525 mm SDR35 PVC Sanitary Sewer Pipe, complete		1	$525.00	$525.00
3	General Requirements (15%)				$300.00
				Total Unit Price	**$1,900.00**

600mm Wastewater Main Repair / Replacement per Meter - Local Asphalt Surface					
	Description of Work	**m2**	**m**	**Unit Cost**	**Cost**
1	Asphalt Road Restoration - Local Road	10		$100.00	$1,000.00
2	Supply and Install 600 mm SDR35 PVC Sanitary Sewer Pipe, complete		1	$600.00	$600.00
3	General Requirements (15%)				$300.00
				Total Unit Price	**$1,900.00**

750mm Wastewater Main Installation - Gravel Surface					
	Description of Work	**m2**	**m**	**Unit Cost**	**Cost**
1	Gravel Road Restoration	10		$50.00	$500.00
2	Supply and Install 750 mm SDR35 PVC Sanitary Sewer Pipe, complete		1	$800.00	$800.00
3	General Requirements (15%)				$200.00
				Total Unit Price	**$1,500.00**

450mm Wastewater Main Installation - Grass Surface					
	Description of Work	**m2**	**m**	**Unit Cost**	**Cost**
1	Grass Restoration - Topsoil and Seed	20		$5.00	$100.00
2	Supply and Install 450 mm SDR35 PVC Sanitary Sewer Pipe, complete		1	$475.00	$475.00
3	General Requirements (15%)				$100.00
				Total Unit Price	**$700.00**

600mm Wastewater Main Installation - Grass Surface					
	Description of Work	**m2**	**m**	**Unit Cost**	**Cost**
1	Grass Restoration - Topsoil and Seed	20		$5.00	$100.00
2	Supply and Install 600 mm SDR35 PVC Sanitary Sewer Pipe, complete		1	$600.00	$600.00
3	General Requirements (15%)				$200.00
				Total Unit Price	**$900.00**

750mm Wastewater Main Installation - Grass Surface

Village of Stirling
Infrastructure Master Plan
Wastewater System Upgrades

ORDER OF MAGNITUDE COST ESTIMATE

	Description of Work	m2	m	Unit Cost	Cost
1	Grass Restoration - Topsoil and Seed	25		$5.00	$125.00
2	Supply and Install 750 mm SDR35 PVC Sanitary Sewer Pipe, complete		1	$800.00	$800.00
3	General Requirements (15%)				$200.00
				Total Unit Price	**$1,200.00**

Hot Mix Asphalt

Asphalt Road Restoration - Local Road

	Description of Work	Cost per m^2
1	Remove and dispose of asphalt	$10.00
2	Waste excavation - assume 0.3 m depth	$6.00
3	Subgrade preparation or geotextile fabric	$10.00
4	250 mm base granular material	$25.00
5	Prime coat	$5.00
6	90 mm asphalt	$30.00
7	Adjust manholes and valves	$10.00
	Total Unit Price	**$100.00**

Unit pricing based on 1 block, assuming the following:

- an average block is 12.0m wide and 225m long
- an average of 4 manholes and 6 valve adjustments per block
- no allowance made for curb & gutter and sidewalk work
- 15 mm of level course asphalt required to restore road shape

Village of Stirling
Infrastructure Master Plan
Wastewater System Upgrades

ORDER OF MAGNITUDE COST ESTIMATE

Asphalt Road Restoration - Industrial		
	Description of Work	**Cost per m^2**
1	Remove and dispose of asphalt	$15.00
2	Waste excavation - assume 0.5 m depth	$10.00
3	Subgrade preparation or geotextile fabric	$10.00
4	250 mm sub-base granular material (Pit run gravel)	$25.00
5	100 mm base granular material	$20.00
6	Prime coat	$5.00
7	Tack Coat	$5.00
8	160 mm asphalt	$55.00
9	Adjust manholes and valves	$2.00
	Total Unit Price	**$150.00**

Unit pricing based on 1 block, assuming the following:

- an average block is 12.0m wide and 225m long
- an average of 4 manholes and 6 valve adjustments per block
- no allowance made for curb & gutter and sidewalk work
- 15 mm of level course asphalt required to restore road shape

Gravel

Gravel Road Restoration		
	Description of Work	**Cost per m^2**
1	Waste excavation - assume 0.4m depth	$8.00
2	Subgrade preparation or geotextile fabric	$8.00
3	300 mm sub-base granular material (Pit run gravel)	$25.00
4	100mm base granular material	$8.00
	Total Unit Price	**$50.00**

Unit pricing based on 1 block, assuming the following:

- an average block is 9.0m wide and 225m long

Grass

Grass Restoration			
	Description of Work	**Unit**	**Cost per unit**
1	Grass Restoration - Topsoil and Seed	m2	$5.00
2	Grass Restoration - Topsoil and Sod	m2	$10.00

Village of Stirling
Infrastructure Master Plan
Wastewater System Upgrades

ORDER OF MAGNITUDE COST ESTIMATE

Concrete

Rolled Monolithic Sidewalk

	Description of Work	Cost per m
1	Breakout and dispose of monolithic sidewalk and 1.0 m width of asphalt	$10.00
2	Hand form monolithic sidewalk	$320.00
3	100 mm base granular material	$8.00
4	Boulevard restoration - assume 1.0 m width at back of sidewalk	$10.00
	Total Unit Price	**$350.00**

Rolled Curb & Gutter

	Description of Work	Cost per m
1	Breakout and dispose of curb & gutter and 1.0 m width of asphalt	$10.00
2	Hand formed curb & gutter	$250.00
3	100 mm base granular material	$8.00
4	Boulevard Restoration - assume 1.0 m width	$10.00
	Total Unit Price	**$280.00**

Concrete Swale (1.0m wide)

	Description of Work	Cost per m
1	Remove and dispose of asphalt	$10.00
2	Waste excavation - assume 0.3 m depth	$6.00
3	Subgrade preparation or geotextile fabric	$8.00
4	250 mm base granular material	$20.00
5	Concrete Swale	$300.00
	Total Unit Price	**$340.00**

Village of Stirling

Infrastructure Master Plan
Wastewater System Upgrades

ORDER OF MAGNITUDE COST ESTIMATE

FULL REPLACEMENTS

	3rd Street - 4th Avenue to 3rd Avenue	QUANTITY	UNIT	UNIT PRICE	COST
1	Mobilization/Demobilization/Bonding & Insurance/Profit/Traffic Accommodation	1	LS	$ 50,000.00	$ 50,000.00
2	200mm Wastewater Main Repair / Replacement per Meter - Local Asphalt Surface	225	m	$ 1,700.00	$ 382,500.00
3	Wastewater Manhole Installation	2	each	$ 5,000.00	$ 10,000.00
				SUBTOTAL	$ 443,000.00
CONTINGENCY (20%)					$ 89,000.00
ENGINEERING (10%)					$ 53,000.00
				TOTAL	**$ 590,000.00**

	3rd Street - 3rd Avenue to 2nd Avenue	QUANTITY	UNIT	UNIT PRICE	COST
1	Mobilization/Demobilization/Bonding & Insurance/Profit/Traffic Accommodation	1	LS	$ 50,000.00	$ 50,000.00
2	200mm Wastewater Main Repair / Replacement per Meter - Local Asphalt Surface	225	m	$ 1,700.00	$ 382,500.00
3	Wastewater Manhole Installation	2	each	$ 5,000.00	$ 10,000.00
				SUBTOTAL	$ 443,000.00
CONTINGENCY (20%)					$ 89,000.00
ENGINEERING (10%)					$ 53,000.00
				TOTAL	**$ 590,000.00**

TRUNK MAIN UPGRADES

	1st Avenue - 3rd Street to 1st Street	QUANTITY	UNIT	UNIT PRICE	COST
1	Mobilization/Demobilization/Bonding & Insurance/Profit/Traffic Accommodation	1	LS	$ 125,000.00	$ 125,000.00
2	250mm Wastewater Main Repair / Replacement per Meter - Local Asphalt Surface	600	m	$ 1,700.00	$ 1,020,000.00
3	Wastewater Manhole Installation	5	each	$ 5,000.00	$ 25,000.00
				SUBTOTAL	$ 1,170,000.00
CONTINGENCY (20%)					$ 234,000.00
ENGINEERING (10%)					$ 140,000.00
				TOTAL	**$ 1,550,000.00**

	1st Avenue - Lift Station to 3rd Street	QUANTITY	UNIT	UNIT PRICE	COST
1	Mobilization/Demobilization/Bonding & Insurance/Profit/Traffic Accommodation	1	LS	$ 125,000.00	$ 125,000.00
2	Supply and Install 450 mm SDR35 PVC Sanitary Sewer Pipe, complete	600	m	$ 1,800.00	$ 1,080,000.00
3	Wastewater Manhole Installation	4	each	$ 5,000.00	$ 20,000.00
				SUBTOTAL	$ 1,225,000.00
CONTINGENCY (20%)					$ 245,000.00
ENGINEERING (10%)					$ 147,000.00
				TOTAL	**$ 1,620,000.00**

Village of Stirling

Infrastructure Master Plan
Wastewater System Upgrades

ORDER OF MAGNITUDE COST ESTIMATE

Lift Station and Forcemain Upgrades

	Operation and Maintenance Upgrades	QUANTITY	UNIT	UNIT PRICE	COST
1	Mobilization/Demobilization/Bonding & Insurance/Profit/Traffic Accommodation	1	LS	$ 12,000.00	$ 12,000.00
2	Discharge Pressure Gauge Assembly Replacement	2	each	$ 1,000.00	$ 2,000.00
3	Suction Pressure Gauge Assembly Replacement	2	each	$ 1,000.00	$ 2,000.00
4	Check Valve Replacement	2	each	$ 2,000.00	$ 4,000.00
5	3-way Valve Replacement	1	each	$ 15,000.00	$ 15,000.00
6	Impeller Replacement	2	each	$ 1,500.00	$ 3,000.00
7	Reduce Bore Flow Meter Installation on Discharge Line	1	each	$ 15,000.00	$ 15,000.00
8	Pump Servicing Requirements	1	LS	$ 10,000.00	$ 10,000.00
				SUBTOTAL	$ 63,000.00
CONTINGENCY (20%)					$ 13,000.00
ENGINEERING (10%)					$ 8,000.00
				TOTAL	**$ 90,000.00**

	250/300 mm Forcemain Installation	QUANTITY	UNIT	UNIT PRICE	COST
1	Mobilization/Demobilization/Bonding & Insurance/Profit/Traffic Accommodation	1	LS	$ 115,000.00	$ 115,000.00
2	Connection to Existing Discharge Header	1	LS	$ 10,000.00	$ 10,000.00
3	Abandon Existing Forcemain in Wet Well	1	LS	$ 5,000.00	$ 5,000.00
4	Connection to Existing 200 mm Forcemain	1	LS	$ 10,000.00	$ 10,000.00
5	250/300 mm HDPE Forcemain	2800	m	$ 250.00	$ 700,000.00
6	Kipp Coulee Crossing	1	LS	$ 30,000.00	$ 30,000.00
7	250/300 mm Plug Valves	3	each	$ 8,000.00	$ 24,000.00
8	200 mm Plug Valves	1	each	$ 5,000.00	$ 5,000.00
9	Wastewater Air Release Valves	1	each	$ 15,000.00	$ 15,000.00
10	Connection to Lagoon Inlet Structure	1	LS	$ 20,000.00	$ 20,000.00
11	Grass Restoration	1	LS	$ 15,000.00	$ 15,000.00
12	Gravel Road Restoration	1	LS	$ 25,000.00	$ 25,000.00
				SUBTOTAL	$ 974,000.00
CONTINGENCY (20%)					$ 195,000.00
ENGINEERING (10%)					$ 117,000.00
				TOTAL	**$ 1,290,000.00**

Village of Stirling

Infrastructure Master Plan
Wastewater System Upgrades

ORDER OF MAGNITUDE COST ESTIMATE

Wastewater Treatment System Upgrades

	Facultative Cell Additions	QUANTITY	UNIT	UNIT PRICE	COST
1	Mobilization/Demobilization/Bonding & Insurance/Profit/Traffic Accommodation	1	LS	$ 100,000.00	$ 100,000.00
2	Site Dewatering and Care of Water	1	each	$ 100,000.00	$ 100,000.00
3	Wastewater Flow Isolation and Bypass Pumping	1	each	$ 100,000.00	$ 100,000.00
4	300 mm DR35 Sanitary Piping	100	m	$ 500.00	$ 50,000.00
5	Transfer Structures	3	each	$ 75,000.00	$ 225,000.00
6	Strip and Stockpile Topsoil and Organic Material	5000	m^2	$ 5.00	$ 25,000.00
7	Common Excavation	750	m^3	$ 10.00	$ 7,500.00
8	Borrow Excavation	2500	m^3	$ 15.00	$ 37,500.00
9	Topsoil and Organic Material Placement c/w Dryland Seed	5000	m^2	$ 10.00	$ 50,000.00
				SUBTOTAL	$ 695,000.00
CONTINGENCY (20%)					$ 139,000.00
MATERIAL TESTING (5%)					$ 42,000.00
ENGINEERING (10%)					$ 88,000.00
				TOTAL	**$ 1,000,000.00**

	Storage Cell Drain Upgrades	QUANTITY	UNIT	UNIT PRICE	COST
1	Mobilization/Demobilization/Bonding & Insurance/Profit/Traffic Accommodation	1	LS	$ 20,000.00	$ 20,000.00
2	Site Dewatering and Care of Water	1	each	$ 25,000.00	$ 25,000.00
3	Wastewater Flow Isolation and Bypass Pumping	1	each	$ 25,000.00	$ 25,000.00
4	300 mm DR35 Sanitary Piping	25	m	$ 500.00	$ 12,500.00
5	Transfer Structures	1	each	$ 75,000.00	$ 75,000.00
6	Strip and Stockpile Topsoil and Organic Material	500	m^2	$ 5.00	$ 2,500.00
9	Topsoil and Organic Material Placement c/w Dryland Seed	500	m^2	$ 10.00	$ 5,000.00
				SUBTOTAL	$ 165,000.00
CONTINGENCY (20%)					$ 33,000.00
MATERIAL TESTING (5%)					$ 10,000.00
ENGINEERING (10%)					$ 21,000.00
				TOTAL	**$ 300,000.00**

APPENDIX D:

STORMWATER MODEL ATTRIBUTES

```
[TITLE]
Subcatchment properties

[OPTIONS]
;;Options            Value
;;------------------ ------------
FLOW_UNITS           CMS
INFILTRATION         CURVE_NUMBER
FLOW_ROUTING         DYNWAVE
LINK_OFFSETS         DEPTH
MIN_SLOPE            0
ALLOW_PONDING        NO
SKIP_STEADY_STATE    NO

START_DATE           3/23/2020
START_TIME           00:00
REPORT_START_DATE    3/23/2020
REPORT_START_TIME    00:00
END_DATE             3/24/2020
END_TIME             00:00
SWEEP_START          1/1
SWEEP_END            12/31
DRY_DAYS             0
REPORT_STEP          00:01:00
WET_STEP             00:05:00
DRY_STEP             00:05:00
ROUTING_STEP         5

INERTIAL_DAMPING     PARTIAL
NORMAL_FLOW_LIMITED  BOTH
FORCE_MAIN_EQUATION  H-W
VARIABLE_STEP        0.75
LENGTHENING_STEP     0
MIN_SURFAREA         0
MAX_TRIALS           8
HEAD_TOLERANCE       0
SYS_FLOW_TOL         5
LAT_FLOW_TOL         5
MINIMUM_STEP         0.5
THREADS              2

[EVAPORATION]
;;Type          Parameters
;;------------- ----------
CONSTANT         0.0
DRY_ONLY         NO

[RAINGAGES]
;;                  Rain      Time     Snow     Data
;;Name              Type      Intrvl   Catch    Source
;;----------------- --------- -------- -------- ----------
Lethbridge_24h_100yr INTENSITY 0:10     1.0      TIMESERIES Lethbridge_24h_100yr
Lethbridge_4h_5yr    INTENSITY 0:05     1.0      TIMESERIES Lethbridge_4h_5yr

[SUBCATCHMENTS]
;;                                          Total    Pcnt.            Pcnt.    Curb     S
;;Name           Raingage         Outlet     Area     Imperv   Width   Slope    Length   P
;;-------------- ---------------- ---------- -------- -------- ------- -------- -------- -
A                Lethbridge_24h_100yr A      21.3455  30       340     0.53     0
B                Lethbridge_24h_100yr B      23.6038  38       275     2.06     0
C                Lethbridge_24h_100yr C      17.0151  30       500     1.61     0
D                Lethbridge_24h_100yr D      11.6444  30       195     1        0
E                Lethbridge_24h_100yr E      7.1324   30       125     0.8      0
F                Lethbridge_24h_100yr F      15.0167  30       350     0.56     0
```

```
G                Lethbridge_24h_100yr G            9.0664   38       180      0.81     0
H                Lethbridge_24h_100yr H            17.2119  38       200      0.75     0
I                Lethbridge_24h_100yr I            21.8487  25       270      1.2      0
J                Lethbridge_24h_100yr J            14.1528  25       350      0.94     0
K                Lethbridge_24h_100yr K            21.1963  30       450      0.68     0
L                Lethbridge_24h_100yr L            13.0374  30       350      0.24     0
S1               Lethbridge_24h_100yr S1           21.3518  10       425      0.3      0
S2               Lethbridge_24h_100yr S2           23.417   10       500      0.65     0
S3               Lethbridge_24h_100yr S3           24.115   10       500      1.2      0
S4               Lethbridge_24h_100yr S4           13.2557  10       495      3.49     0

[SUBAREAS]
;;Subcatchment   N-Imperv   N-Perv     S-Imperv   S-Perv     PctZero    RouteTo    PctRouted
;;-------------- ---------- ---------- ---------- ---------- ---------- ---------- ----------
A                0.01       0.1        2          5          0          OUTLET
B                0.01       0.1        2          5          25         OUTLET
C                0.01       0.1        2          5          0          OUTLET
D                0.01       0.1        2          5          0          OUTLET
E                0.01       0.1        2          5          0          OUTLET
F                0.01       0.1        2          5          0          OUTLET
G                0.01       0.1        2          5          25         OUTLET
H                0.01       0.1        2          5          25         OUTLET
I                0.01       0.1        2          5          0          OUTLET
J                0.01       0.1        2          5          0          OUTLET
K                0.01       0.1        2          5          0          OUTLET
L                0.01       0.1        2          5          0          OUTLET
S1               0.01       0.1        2          5          0          OUTLET
S2               0.01       0.1        2          5          0          OUTLET
S3               0.01       0.1        2          5          0          OUTLET
S4               0.01       0.1        2          5          0          OUTLET

[INFILTRATION]
;;Subcatchment   CurveNum   HydCon     DryTime
;;-------------- ---------- ---------- ----------
A                72         0.5        7
B                75         0.5        7
C                72         0.5        7
D                72         0.5        7
E                72         0.5        7
F                72         0.5        7
G                75         0.5        7
H                75         0.5        7
I                72         0.5        7
J                72         0.5        7
K                72         0.5        7
L                72         0.5        7
S1               69         0.5        7
S2               69         0.5        7
S3               69         0.5        7
S4               69         0.5        7

[TIMESERIES]
;;Name           Date       Time       Value
;;-------------- ---------- ---------- ----------
;Chicago design storm, a = 1019.2, b = 0, c = 0.731, Duration = 1440 minutes, r = 0.333, rain uni
Lethbridge_24h_100yr            0:00       1.357
Lethbridge_24h_100yr            0:10       1.378
Lethbridge_24h_100yr            0:20       1.4
Lethbridge_24h_100yr            0:30       1.423
Lethbridge_24h_100yr            0:40       1.447
Lethbridge_24h_100yr            0:50       1.472
Lethbridge_24h_100yr            1:00       1.498
Lethbridge_24h_100yr            1:10       1.525
Lethbridge_24h_100yr            1:20       1.553
```

Lethbridge_24h_100yr	1:30	1.583
Lethbridge_24h_100yr	1:40	1.613
Lethbridge_24h_100yr	1:50	1.646
Lethbridge_24h_100yr	2:00	1.679
Lethbridge_24h_100yr	2:10	1.715
Lethbridge_24h_100yr	2:20	1.752
Lethbridge_24h_100yr	2:30	1.792
Lethbridge_24h_100yr	2:40	1.833
Lethbridge_24h_100yr	2:50	1.877
Lethbridge_24h_100yr	3:00	1.923
Lethbridge_24h_100yr	3:10	1.972
Lethbridge_24h_100yr	3:20	2.025
Lethbridge_24h_100yr	3:30	2.08
Lethbridge_24h_100yr	3:40	2.14
Lethbridge_24h_100yr	3:50	2.203
Lethbridge_24h_100yr	4:00	2.272
Lethbridge_24h_100yr	4:10	2.345
Lethbridge_24h_100yr	4:20	2.425
Lethbridge_24h_100yr	4:30	2.511
Lethbridge_24h_100yr	4:40	2.605
Lethbridge_24h_100yr	4:50	2.707
Lethbridge_24h_100yr	5:00	2.82
Lethbridge_24h_100yr	5:10	2.944
Lethbridge_24h_100yr	5:20	3.082
Lethbridge_24h_100yr	5:30	3.237
Lethbridge_24h_100yr	5:40	3.411
Lethbridge_24h_100yr	5:50	3.609
Lethbridge_24h_100yr	6:00	3.838
Lethbridge_24h_100yr	6:10	4.103
Lethbridge_24h_100yr	6:20	4.416
Lethbridge_24h_100yr	6:30	4.793
Lethbridge_24h_100yr	6:40	5.257
Lethbridge_24h_100yr	6:50	5.842
Lethbridge_24h_100yr	7:00	6.611
Lethbridge_24h_100yr	7:10	7.673
Lethbridge_24h_100yr	7:20	9.258
Lethbridge_24h_100yr	7:30	11.941
Lethbridge_24h_100yr	7:40	17.821
Lethbridge_24h_100yr	7:50	189.347
Lethbridge_24h_100yr	8:00	36.911
Lethbridge_24h_100yr	8:10	28.165
Lethbridge_24h_100yr	8:20	19.28
Lethbridge_24h_100yr	8:30	15.075
Lethbridge_24h_100yr	8:40	12.551
Lethbridge_24h_100yr	8:50	10.845
Lethbridge_24h_100yr	9:00	9.603
Lethbridge_24h_100yr	9:10	8.653
Lethbridge_24h_100yr	9:20	7.899
Lethbridge_24h_100yr	9:30	7.284
Lethbridge_24h_100yr	9:40	6.772
Lethbridge_24h_100yr	9:50	6.338
Lethbridge_24h_100yr	10:00	5.964
Lethbridge_24h_100yr	10:10	5.639
Lethbridge_24h_100yr	10:20	5.352
Lethbridge_24h_100yr	10:30	5.098
Lethbridge_24h_100yr	10:40	4.871
Lethbridge_24h_100yr	10:50	4.667
Lethbridge_24h_100yr	11:00	4.481
Lethbridge_24h_100yr	11:10	4.312
Lethbridge_24h_100yr	11:20	4.158
Lethbridge_24h_100yr	11:30	4.016
Lethbridge_24h_100yr	11:40	3.885
Lethbridge_24h_100yr	11:50	3.763
Lethbridge_24h_100yr	12:00	3.651

Lethbridge_24h_100yr	12:10	3.546
Lethbridge_24h_100yr	12:20	3.448
Lethbridge_24h_100yr	12:30	3.356
Lethbridge_24h_100yr	12:40	3.269
Lethbridge_24h_100yr	12:50	3.188
Lethbridge_24h_100yr	13:00	3.111
Lethbridge_24h_100yr	13:10	3.039
Lethbridge_24h_100yr	13:20	2.97
Lethbridge_24h_100yr	13:30	2.905
Lethbridge_24h_100yr	13:40	2.844
Lethbridge_24h_100yr	13:50	2.785
Lethbridge_24h_100yr	14:00	2.729
Lethbridge_24h_100yr	14:10	2.676
Lethbridge_24h_100yr	14:20	2.625
Lethbridge_24h_100yr	14:30	2.576
Lethbridge_24h_100yr	14:40	2.53
Lethbridge_24h_100yr	14:50	2.485
Lethbridge_24h_100yr	15:00	2.442
Lethbridge_24h_100yr	15:10	2.401
Lethbridge_24h_100yr	15:20	2.361
Lethbridge_24h_100yr	15:30	2.323
Lethbridge_24h_100yr	15:40	2.287
Lethbridge_24h_100yr	15:50	2.252
Lethbridge_24h_100yr	16:00	2.218
Lethbridge_24h_100yr	16:10	2.185
Lethbridge_24h_100yr	16:20	2.153
Lethbridge_24h_100yr	16:30	2.122
Lethbridge_24h_100yr	16:40	2.093
Lethbridge_24h_100yr	16:50	2.064
Lethbridge_24h_100yr	17:00	2.036
Lethbridge_24h_100yr	17:10	2.01
Lethbridge_24h_100yr	17:20	1.984
Lethbridge_24h_100yr	17:30	1.958
Lethbridge_24h_100yr	17:40	1.934
Lethbridge_24h_100yr	17:50	1.91
Lethbridge_24h_100yr	18:00	1.887
Lethbridge_24h_100yr	18:10	1.864
Lethbridge_24h_100yr	18:20	1.843
Lethbridge_24h_100yr	18:30	1.821
Lethbridge_24h_100yr	18:40	1.801
Lethbridge_24h_100yr	18:50	1.781
Lethbridge_24h_100yr	19:00	1.761
Lethbridge_24h_100yr	19:10	1.742
Lethbridge_24h_100yr	19:20	1.723
Lethbridge_24h_100yr	19:30	1.705
Lethbridge_24h_100yr	19:40	1.687
Lethbridge_24h_100yr	19:50	1.67
Lethbridge_24h_100yr	20:00	1.653
Lethbridge_24h_100yr	20:10	1.637
Lethbridge_24h_100yr	20:20	1.621
Lethbridge_24h_100yr	20:30	1.605
Lethbridge_24h_100yr	20:40	1.59
Lethbridge_24h_100yr	20:50	1.575
Lethbridge_24h_100yr	21:00	1.56
Lethbridge_24h_100yr	21:10	1.546
Lethbridge_24h_100yr	21:20	1.532
Lethbridge_24h_100yr	21:30	1.518
Lethbridge_24h_100yr	21:40	1.504
Lethbridge_24h_100yr	21:50	1.491
Lethbridge_24h_100yr	22:00	1.478
Lethbridge_24h_100yr	22:10	1.466
Lethbridge_24h_100yr	22:20	1.453
Lethbridge_24h_100yr	22:30	1.441
Lethbridge_24h_100yr	22:40	1.429

```
Lethbridge_24h_100yr            22:50      1.417
Lethbridge_24h_100yr            23:00      1.406
Lethbridge_24h_100yr            23:10      1.395
Lethbridge_24h_100yr            23:20      1.384
Lethbridge_24h_100yr            23:30      1.373
Lethbridge_24h_100yr            23:40      1.362
Lethbridge_24h_100yr            23:50      1.352
Lethbridge_24h_100yr            24:00      0

;Chicago design storm, a = 440.69, b = 0, c = 0.696, Duration = 240 minutes, r = 0.333, rain unit
Lethbridge_4h_5yr               0:00       3.02
Lethbridge_4h_5yr               0:05       3.164
Lethbridge_4h_5yr               0:10       3.326
Lethbridge_4h_5yr               0:15       3.509
Lethbridge_4h_5yr               0:20       3.719
Lethbridge_4h_5yr               0:25       3.963
Lethbridge_4h_5yr               0:30       4.25
Lethbridge_4h_5yr               0:35       4.593
Lethbridge_4h_5yr               0:40       5.013
Lethbridge_4h_5yr               0:45       5.541
Lethbridge_4h_5yr               0:50       6.229
Lethbridge_4h_5yr               0:55       7.172
Lethbridge_4h_5yr               1:00       8.563
Lethbridge_4h_5yr               1:05       10.88
Lethbridge_4h_5yr               1:10       15.812
Lethbridge_4h_5yr               1:15       143.764
Lethbridge_4h_5yr               1:20       31.763
Lethbridge_4h_5yr               1:25       25.239
Lethbridge_4h_5yr               1:30       17.484
Lethbridge_4h_5yr               1:35       13.798
Lethbridge_4h_5yr               1:40       11.573
Lethbridge_4h_5yr               1:45       10.061
Lethbridge_4h_5yr               1:50       8.955
Lethbridge_4h_5yr               1:55       8.106
Lethbridge_4h_5yr               2:00       7.43
Lethbridge_4h_5yr               2:05       6.876
Lethbridge_4h_5yr               2:10       6.414
Lethbridge_4h_5yr               2:15       6.02
Lethbridge_4h_5yr               2:20       5.681
Lethbridge_4h_5yr               2:25       5.385
Lethbridge_4h_5yr               2:30       5.124
Lethbridge_4h_5yr               2:35       4.891
Lethbridge_4h_5yr               2:40       4.683
Lethbridge_4h_5yr               2:45       4.495
Lethbridge_4h_5yr               2:50       4.325
Lethbridge_4h_5yr               2:55       4.169
Lethbridge_4h_5yr               3:00       4.027
Lethbridge_4h_5yr               3:05       3.895
Lethbridge_4h_5yr               3:10       3.774
Lethbridge_4h_5yr               3:15       3.662
Lethbridge_4h_5yr               3:20       3.557
Lethbridge_4h_5yr               3:25       3.459
Lethbridge_4h_5yr               3:30       3.368
Lethbridge_4h_5yr               3:35       3.282
Lethbridge_4h_5yr               3:40       3.202
Lethbridge_4h_5yr               3:45       3.126
Lethbridge_4h_5yr               3:50       3.054
Lethbridge_4h_5yr               3:55       2.986
Lethbridge_4h_5yr               4:00       0

[REPORT]
;;Reporting Options
INPUT      YES
CONTROLS   NO
```

SUBCATCHMENTS ALL
NODES ALL
LINKS ALL

[TAGS]

[MAP]
DIMENSIONS 388462.662609709 5483386.31527696 390280.683842546 5485582.69394107
UNITS Meters

[COORDINATES]
;;Node X-Coord Y-Coord
;;-------------- ---------- ----------

[VERTICES]
;;Link X-Coord Y-Coord
;;-------------- ---------- ----------

[POLYGONS]
;;Subcatchment X-Coord Y-Coord
;;-------------- ---------- ----------
A 390169.286 5484153.024
A 390182.471 5484156.94
A 390172.207 5483543.281
A 390052.905 5483544.803
A 390009.97 5483531.115
A 389949.035 5483515.553
A 389913.125 5483516.277
A 389888.437 5483516.775
A 389856.459 5483545.407
A 389866.114 5483578.795
A 389885.462 5483591.838
A 389852.498 5483627.205
A 389849.967 5483668.675
A 389846.36 5483712.404
A 389826.455 5483727.359
A 389792.656 5483721.325
A 389780.991 5483755.142
A 389777.51 5483783.513
A 389849.992 5483929.83
A 389834.713 5484010.195
A 389840.298 5484077.497
A 389861.048 5484163.452
A 389943.493 5484166.002
A 390067.707 5484144.537
A 390169.286 5484153.024
B 389952.01 5484403.813
B 390186.537 5484400.061
B 390182.471 5484156.94
B 390169.286 5484153.024
B 390067.707 5484144.537
B 389943.493 5484166.002
B 389861.048 5484163.452
B 389840.298 5484077.497
B 389834.713 5484010.195
B 389849.992 5483929.83
B 389777.51 5483783.513
B 389776.172 5483794.419
B 389753.503 5483783.683
B 389635.862 5483795.017
B 389581.078 5483815.944
B 389595.194 5483902.029
B 389601.184 5483987.804
B 389592.968 5484054.777

B	389580.351	5484114.416
B	389536.564	5484157.72
B	389529.724	5484187.549
B	389554.687	5484212.494
B	389597.593	5484230.712
B	389598.065	5484254.031
B	389613.738	5484397.925
B	389789.316	5484403.917
B	389952.01	5484403.813
C	388991.249	5484190.964
C	389531.157	5484181.297
C	389536.564	5484157.72
C	389580.351	5484114.416
C	389592.968	5484054.777
C	389601.184	5483987.804
C	389595.194	5483902.029
C	389581.078	5483815.944
C	389580.165	5483816.293
C	389534.407	5483829.532
C	389466.05	5483835.395
C	389450.975	5483867.043
C	389432.489	5483896.521
C	389403.564	5483909.42
C	389399.825	5483946.435
C	389381.18	5483968.081
C	389359.634	5483957.325
C	389353.365	5483924.99
C	389355.778	5483877.928
C	389336.249	5483855.936
C	389148.624	5483916.879
C	389102.02	5483889.872
C	389087.914	5483885.5
C	389087.386	5483859.553
C	389070.219	5483835.942
C	389053.373	5483860.911
C	389054.811	5483898.819
C	389074.511	5483915.723
C	389117.045	5483939.485
C	389137.425	5483957.041
C	389114.304	5483968.825
C	389074.165	5483964.317
C	388994.025	5483929.341
C	388976.255	5483941.683
C	389035.288	5483989.068
C	389020.525	5484017.988
C	388987.861	5484019.983
C	388992.134	5484033.208
C	389030.312	5484039.752
C	389062.909	5484034.43
C	389073.088	5484075.487
C	388985.017	5484115.801
C	388974.567	5484150.161
C	388989.348	5484172.096
C	388991.249	5484190.964
D	389494.636	5484377.868
D	389610.12	5484364.709
D	389598.065	5484254.031
D	389597.593	5484230.712
D	389554.687	5484212.494
D	389529.724	5484187.549
D	389531.157	5484181.297
D	388991.249	5484190.964
D	388995.336	5484231.534
D	388973.875	5484233.559

D	388963.647	5484226.337
D	388983.089	5484267.674
D	389014.656	5484350.731
D	389060.594	5484371.075
D	389136.107	5484376.633
D	389233.181	5484393.102
D	389267.338	5484393.827
D	389297.144	5484390.385
D	389331.1	5484381.184
D	389382.495	5484390.072
D	389463.667	5484394.101
D	389494.636	5484377.868
E	389306.747	5484457.532
E	389434.331	5484454.945
E	389433.821	5484452.69
E	389461.049	5484393.971
E	389382.495	5484390.072
E	389331.1	5484381.184
E	389297.144	5484390.385
E	389267.338	5484393.827
E	389233.181	5484393.102
E	389136.107	5484376.633
E	389060.594	5484371.075
E	389014.656	5484350.731
E	388983.089	5484267.674
E	388963.647	5484226.337
E	388899.539	5484181.072
E	388854.416	5484272.521
E	388886.283	5484351.283
E	388830.185	5484373.073
E	388832.392	5484403.203
E	388842.3	5484420.471
E	388849.95	5484444.138
E	388836.854	5484449.857
E	388907.179	5484463.392
E	389059.454	5484469.35
E	389152.662	5484474.249
E	389218.308	5484463.857
E	389306.747	5484457.532
F	389142.631	5484651.081
F	389190.658	5484646.6
F	389166.634	5484603.04
F	389163.98	5484472.457
F	389152.662	5484474.249
F	389059.454	5484469.35
F	388907.179	5484463.392
F	388836.854	5484449.857
F	388804.169	5484464.13
F	388685.56	5484507.005
F	388644.237	5484507.715
F	388612.697	5484556.161
F	388613.534	5484597.117
F	388649.731	5484651.008
F	388698.014	5484667.948
F	388707.699	5484765.058
F	388710.926	5484820.806
F	388667.076	5484881.653
F	388694.963	5484894.154
F	388709.945	5484894.252
F	388777.129	5484833.535
F	388801.386	5484831.829
F	388812.404	5484853.3
F	388855.679	5484833.545
F	388924.2	5484741.573

F	388985.579	5484744.852
F	389064.012	5484693.439
F	389142.631	5484651.081
G	389422.846	5484919.381
G	389465.995	5484919.638
G	389464.825	5484861.922
G	389462.715	5484757.804
G	389452.305	5484692.348
G	389392.736	5484666.383
G	389416.512	5484607.025
G	389456.27	5484551.872
G	389434.331	5484454.945
G	389306.747	5484457.532
G	389218.308	5484463.857
G	389163.98	5484472.457
G	389166.634	5484603.04
G	389192.569	5484650.066
G	389243.427	5484694.321
G	389307.582	5484722.456
G	389327.395	5484803.572
G	389335.536	5484869.072
G	389359.291	5484920.67
G	389422.846	5484919.381
H	389469.321	5485083.731
H	389467.011	5485114.502
H	389479.023	5485114.258
H	389480.923	5485208.028
H	389477.806	5485278.28
H	389525.149	5485292.958
H	389534.506	5485240.851
H	389522.926	5485119.739
H	389522.423	5485114.479
H	389679.592	5485108.359
H	389678.359	5484826.989
H	389671.802	5484753.743
H	389662.351	5484662.843
H	389637.281	5484615.274
H	389669.383	5484577.186
H	389695.34	5484524.175
H	389684.497	5484480.419
H	389684.058	5484400.325
H	389613.738	5484397.925
H	389610.12	5484364.709
H	389494.636	5484377.868
H	389463.667	5484394.101
H	389461.049	5484393.971
H	389433.821	5484452.69
H	389456.27	5484551.872
H	389416.512	5484607.025
H	389392.736	5484666.383
H	389452.305	5484692.348
H	389462.715	5484757.804
H	389464.825	5484861.922
H	389466.569	5484947.93
H	389459.003	5485022.805
H	389469.321	5485083.731
I	390018.757	5484855.25
I	390011.464	5485095.436
I	390198.047	5485088.171
I	390186.537	5484400.061
I	389952.01	5484403.813
I	389789.316	5484403.917
I	389684.058	5484400.325
I	389684.497	5484480.419

I	389695.34	5484524.175
I	389669.383	5484577.186
I	389637.281	5484615.274
I	389662.351	5484662.843
I	389663.61	5484674.954
I	389921.993	5484673.789
I	389993.137	5484710.848
I	390003.403	5484769.515
I	390018.757	5484855.25
J	389921.993	5484673.789
J	389663.61	5484674.954
J	389671.802	5484753.743
J	389678.359	5484826.989
J	389679.592	5485108.359
J	390011.464	5485095.436
J	390018.757	5484855.25
J	390003.403	5484769.515
J	389993.137	5484710.848
J	389921.993	5484673.789
K	388855.679	5484833.545
K	388812.404	5484853.3
K	388831.321	5484890.162
K	388828.073	5484909.606
K	388815.268	5484956.698
K	388827.697	5484970.574
K	388858.213	5484978.027
K	388902.036	5484963.004
K	388911.145	5484972.911
K	388919.227	5485011.906
K	388892.483	5485030.618
K	388914.852	5485041.071
K	388990.258	5485077.853
K	388994.994	5485122.114
K	388998.791	5485121.948
K	388999.638	5485123.997
K	389467.011	5485114.502
K	389469.321	5485083.731
K	389459.003	5485022.805
K	389466.569	5484947.93
K	389465.995	5484919.638
K	389422.846	5484919.381
K	389359.291	5484920.67
K	389335.536	5484869.072
K	389327.395	5484803.572
K	389307.582	5484722.456
K	389243.427	5484694.321
K	389192.569	5484650.066
K	389190.658	5484646.6
K	389142.631	5484651.081
K	389064.012	5484693.439
K	388985.579	5484744.852
K	388924.2	5484741.573
K	388855.679	5484833.545
L	389480.923	5485208.028
L	389479.023	5485114.258
L	388999.638	5485123.997
L	389022.162	5485178.451
L	389086.783	5485234.113
L	389152.753	5485356.22
L	389207.658	5485402.584
L	389253.494	5485471.289
L	389313.715	5485466.9
L	389361.309	5485465.934
L	389463.228	5485482.859

L	389517.391	5485336.158
L	389525.149	5485292.958
L	389477.806	5485278.28
L	389480.923	5485208.028
S1	389241.405	5483508.059
S1	389249.043	5483884.262
S1	389336.249	5483855.936
S1	389355.778	5483877.928
S1	389353.365	5483924.99
S1	389359.634	5483957.325
S1	389381.18	5483968.081
S1	389399.825	5483946.435
S1	389403.564	5483909.42
S1	389432.489	5483896.521
S1	389450.975	5483867.043
S1	389466.05	5483835.395
S1	389534.407	5483829.532
S1	389580.165	5483816.293
S1	389635.862	5483795.017
S1	389753.503	5483783.683
S1	389776.172	5483794.419
S1	389780.991	5483755.142
S1	389792.656	5483721.325
S1	389826.455	5483727.359
S1	389846.36	5483712.404
S1	389849.967	5483668.675
S1	389852.498	5483627.205
S1	389885.462	5483591.838
S1	389866.114	5483578.795
S1	389856.459	5483545.407
S1	389888.437	5483516.775
S1	389913.125	5483516.277
S1	389949.035	5483515.553
S1	390009.97	5483531.115
S1	390052.905	5483544.803
S1	390172.207	5483543.281
S1	390171.251	5483486.151
S1	389241.405	5483508.059
S2	388979.776	5483986.962
S2	389001.467	5484019.152
S2	389020.525	5484017.988
S2	389035.288	5483989.068
S2	388976.255	5483941.683
S2	388994.025	5483929.341
S2	389074.165	5483964.317
S2	389114.304	5483968.825
S2	389137.425	5483957.041
S2	389117.045	5483939.485
S2	389074.511	5483915.723
S2	389054.811	5483898.819
S2	389053.373	5483860.911
S2	389070.219	5483835.942
S2	389087.386	5483859.553
S2	389087.914	5483885.5
S2	389102.02	5483889.872
S2	389148.624	5483916.879
S2	389249.043	5483884.262
S2	389241.405	5483508.059
S2	388545.3	5483524.46
S2	388548.464	5483639.685
S2	388559.382	5483639.764
S2	388589.803	5483652.923
S2	388649.358	5483739.399
S2	388705.532	5483783.351

S2	388746.559	5483823.853
S2	388790.944	5483844.244
S2	388843.838	5483850.683
S2	388873.797	5483841.303
S2	388895.604	5483863.408
S2	388925.353	5483905.393
S2	388937.394	5483941.476
S2	388959.2	5483963.58
S2	388979.776	5483986.962
S3	388570.265	5484433.738
S3	388845.569	5484430.583
S3	388842.3	5484420.471
S3	388832.392	5484403.203
S3	388830.185	5484373.073
S3	388886.283	5484351.283
S3	388854.416	5484272.521
S3	388899.539	5484181.072
S3	388973.875	5484233.559
S3	388995.336	5484231.534
S3	388989.348	5484172.096
S3	388974.567	5484150.161
S3	388985.017	5484115.801
S3	389073.088	5484075.487
S3	389062.909	5484034.43
S3	389030.312	5484039.752
S3	388992.134	5484033.208
S3	388987.861	5484019.983
S3	389001.467	5484019.152
S3	388979.776	5483986.962
S3	388959.2	5483963.58
S3	388937.394	5483941.476
S3	388925.353	5483905.393
S3	388895.604	5483863.408
S3	388873.797	5483841.303
S3	388843.838	5483850.683
S3	388790.944	5483844.244
S3	388746.559	5483823.853
S3	388705.532	5483783.351
S3	388649.358	5483739.399
S3	388589.803	5483652.923
S3	388559.382	5483639.764
S3	388548.464	5483639.685
S3	388570.265	5484433.738
S4	388845.569	5484430.583
S4	388570.265	5484433.738
S4	388589.65	5485139.789
S4	388994.994	5485122.114
S4	388990.258	5485077.853
S4	388914.852	5485041.071
S4	388892.483	5485030.618
S4	388919.227	5485011.906
S4	388911.145	5484972.911
S4	388902.036	5484963.004
S4	388858.213	5484978.027
S4	388827.697	5484970.574
S4	388815.268	5484956.698
S4	388828.073	5484909.606
S4	388831.321	5484890.162
S4	388801.386	5484831.829
S4	388777.129	5484833.535
S4	388709.945	5484894.252
S4	388694.963	5484894.154
S4	388667.076	5484881.653
S4	388710.926	5484820.806

```
S4               388707.699       5484765.058
S4               388698.014       5484667.948
S4               388649.731       5484651.008
S4               388613.534       5484597.117
S4               388612.697       5484556.161
S4               388644.237       5484507.715
S4               388685.56        5484507.005
S4               388804.169       5484464.13
S4               388849.95        5484444.138
S4               388845.569       5484430.583

[SYMBOLS]
;;Gage           X-Coord          Y-Coord
;;-------------- ---------------- ----------------
```

APPENDIX E:

STORMWATER COST ESTIMATES

Village of Stirling

Infrastructure Master Plan
Stormwater Management System Upgrades

ORDER OF MAGNITUDE COST ESTIMATE

Ditch and Swale Grading Imrpovements

5th Street and 5th Avenue		QUANTITY	UNIT	UNIT PRICE	COST
1	Mobilization/Demobilization/Bonding & Insurance/Profit/Traffic Accommodation	1	LS	$ 2,000.00	$ 2,000.00
2	Hydroexcavation	4	hr	$ 350.00	$ 1,400.00
3	Ditch Grading	165	LS	$ 60.00	$ 9,900.00
4	Topsoil and Seed	1	LS	$ 1,500.00	$ 1,500.00
5	Paved Road Restoration	1	LS	$ 5,000.00	$ 5,000.00
6	Gravel Road Restoration	1	LS	$ 2,500.00	$ 2,500.00
				SUBTOTAL	$ 22,000.00
CONTINGENCY (20%)					$ 4,000.00
ENGINEERING (10%)					$ 3,000.00
				TOTAL	**$ 30,000.00**

Sub-Catchment I		QUANTITY	UNIT	UNIT PRICE	COST
1	Mobilization/Demobilization/Bonding & Insurance/Profit/Traffic Accommodation	1	LS	$ 6,000.00	$ 6,000.00
2	Hydroexcavation	8	hr	$ 350.00	$ 2,800.00
3	Grass Drainage Swale	500	m	$ 60.00	$ 30,000.00
4	Supply and Install 450 mm Diameter CSP Culvert	1	LS	$ 15,000.00	$ 15,000.00
5	Paved Road Restoration	1	LS	$ 5,000.00	$ 5,000.00
6	Topsoil and Seed	1	LS	$ 5,000.00	$ 5,000.00
				SUBTOTAL	$ 64,000.00
CONTINGENCY (20%)					$ 13,000.00
ENGINEERING (10%)					$ 8,000.00
				TOTAL	**$ 90,000.00**

Localized Catch Basin Installation

4th Avenue - West of 5th Street		QUANTITY	UNIT	UNIT PRICE	COST
1	Mobilization/Demobilization/Bonding & Insurance/Profit/Traffic Accommodation	1	LS	$ 2,000.00	$ 2,000.00
2	Hydroexcavation	4	hr	$ 350.00	$ 1,400.00
3	900 mm Catch Basin Manhole	1	LS	$ 5,000.00	$ 5,000.00
4	200 mm PVC Stormwater Lead	20	LS	$ 225.00	$ 4,500.00
5	Paved Road Restoration	1	LS	$ 5,000.00	$ 5,000.00
				SUBTOTAL	$ 18,000.00
CONTINGENCY (20%)					$ 4,000.00
ENGINEERING (10%)					$ 3,000.00
				TOTAL	**$ 25,000.00**

Village of Stirling

Infrastructure Master Plan
Stormwater Management System Upgrades

ORDER OF MAGNITUDE COST ESTIMATE

Northeast Stormwater Management System

	Northeast Stormwater Mangement Facility	QUANTITY	UNIT	UNIT PRICE	COST
1	Mobilization/Demobilization/Bonding & Insurance/Profit/Traffic Accommodation	1	LS	$ 237,000.00	$ 237,000.00
2	Hydroexcavation	16	hr	$ 350.00	$ 5,600.00
3	Topsoil Stripping and Stockpiling	40000	m^2	$ 3.00	$ 120,000.00
4	Common Excavation	50000	m^3	$ 8.00	$ 400,000.00
5	Waste Excavation	50000	m^3	$ 12.00	$ 600,000.00
6	Rip Rap Armoring	1	LS	$ 50,000.00	$ 50,000.00
7	Stormwater Pump Station and Forcemain	1	LS	$ 1,000,000.00	$ 1,000,000.00
8	Stormwater Control Structures (Inlet/Outler)	2	ea	$ 35,000.00	$ 70,000.00
9	Topsoil Placement and Seeding	40000	m^2	$ 3.00	$ 120,000.00
				SUBTOTAL	$ 2,603,000.00
CONTINGENCY (20%)					$ 521,000.00
ENGINEERING (10%)					$ 313,000.00
				TOTAL	**$ 3,500,000.00**

	Northeast Minor Drainage System	QUANTITY	UNIT	UNIT PRICE	COST
1	Mobilization/Demobilization/Bonding & Insurance/Profit/Traffic Accommodation	1	LS	$ 127,000.00	$ 127,000.00
2	Hydroexcavation	40	hr	$ 350.00	$ 14,000.00
3	600 mm PVC Stormwater Main	450	m	$ 500.00	$ 225,000.00
4	750 mm PVC Stormwater Main	250	m	$ 700.00	$ 175,000.00
5	1050 mm PVC Stormwater Main	250	m	$ 800.00	$ 200,000.00
6	1200 mm PVC Stormwater Main	125	m	$ 900.00	$ 112,500.00
7	1200 mm Stormwater Manhole	4	ea	$ 5,000.00	$ 20,000.00
8	1500 mm Stormwater Manhole	5	ea	$ 7,000.00	$ 35,000.00
9	Stormwater Catch Basin and Lead	10	ea	$ 5,000.00	$ 50,000.00
10	Grass Restoration	1	LS	$ 10,000.00	$ 10,000.00
11	Gravel Road Restoration	4000	m^2	$ 50.00	$ 200,000.00
12	Paved Road Reconstruction	2250	m^2	$ 100.00	$ 225,000.00
				SUBTOTAL	$ 1,394,000.00
CONTINGENCY (20%)					$ 279,000.00
ENGINEERING (10%)					$ 168,000.00
				TOTAL	**$ 1,900,000.00**

APPENDIX F:

TRANSPORTATION TRAFFIC DATA

Turning Movement Summary Diagram

Reference No.: 109030

Intersection of:
52 & 846 S OF STIRLING

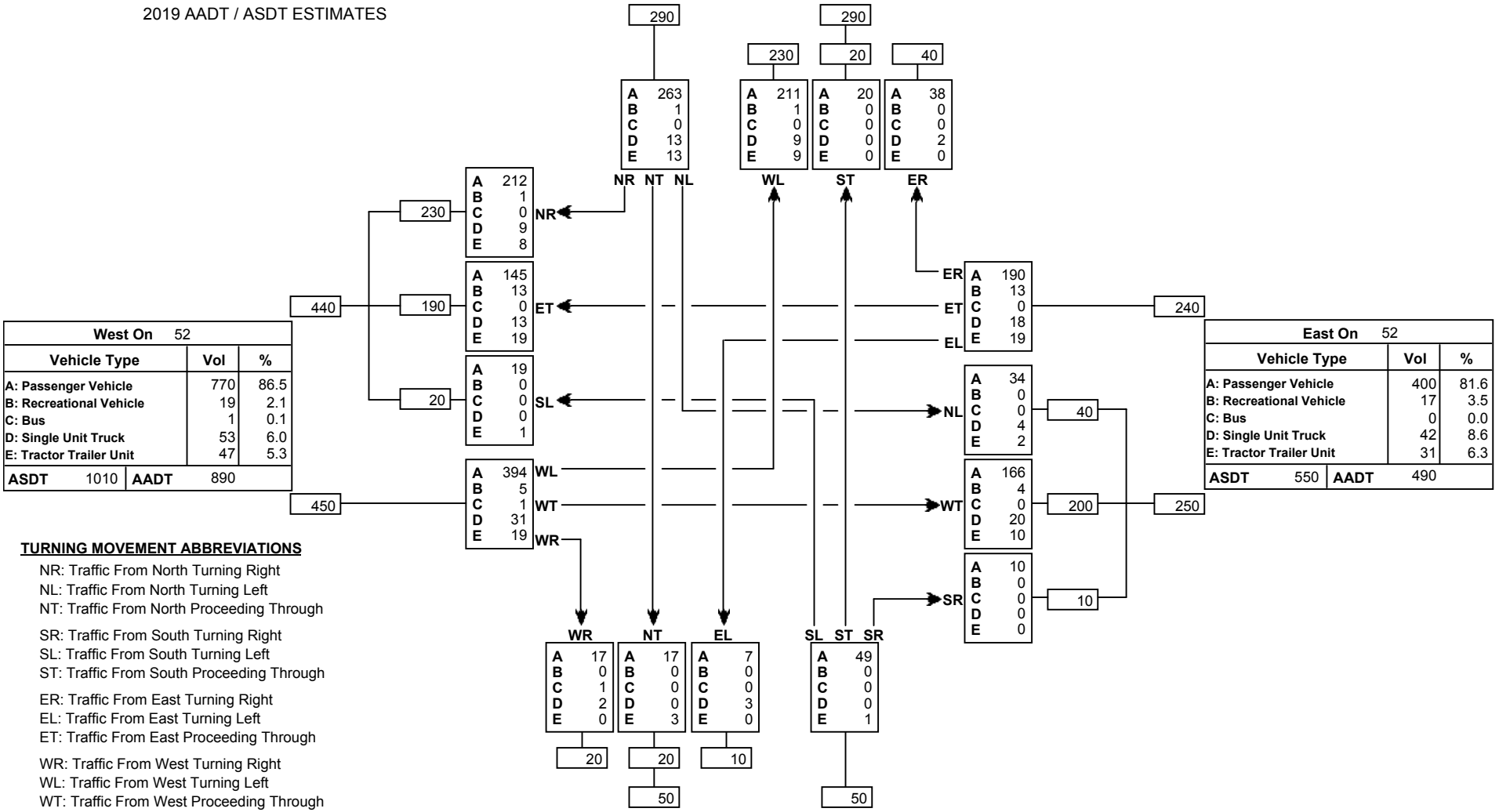
2019 AADT / ASDT ESTIMATES

North On 846		
Vehicle Type	**Vol**	**%**
A: Passenger Vehicle	532	91.7
B: Recreational Vehicle	2	0.3
C: Bus	0	0.0
D: Single Unit Truck	24	4.1
E: Tractor Trailer Unit	22	3.8
ASDT 640	**AADT** 580	

West On 52		
Vehicle Type	**Vol**	**%**
A: Passenger Vehicle	770	86.5
B: Recreational Vehicle	19	2.1
C: Bus	1	0.1
D: Single Unit Truck	53	6.0
E: Tractor Trailer Unit	47	5.3
ASDT 1010	**AADT** 890	

East On 52		
Vehicle Type	**Vol**	**%**
A: Passenger Vehicle	400	81.6
B: Recreational Vehicle	17	3.5
C: Bus	0	0.0
D: Single Unit Truck	42	8.6
E: Tractor Trailer Unit	31	6.3
ASDT 550	**AADT** 490	

South On Rge Rd 194		
Vehicle Type	**Vol**	**%**
A: Passenger Vehicle	90	90.0
B: Recreational Vehicle	0	0.0
C: Bus	1	1.0
D: Single Unit Truck	5	5.0
E: Tractor Trailer Unit	4	4.0
ASDT 110	**AADT** 100	



TURNING MOVEMENT ABBREVIATIONS

NR: Traffic From North Turning Right
NL: Traffic From North Turning Left
NT: Traffic From North Proceeding Through

SR: Traffic From South Turning Right
SL: Traffic From South Turning Left
ST: Traffic From South Proceeding Through

ER: Traffic From East Turning Right
EL: Traffic From East Turning Left
ET: Traffic From East Proceeding Through

WR: Traffic From West Turning Right
WL: Traffic From West Turning Left
WT: Traffic From West Proceeding Through

TURNING MOVEMENT ABBREVIATIONS

AADT: Annual Average Daily Traffic
Average daily traffic expressed as vehicles per day fo
period of January 1 to December 31 (365 days)

ASDT: Average Summer Daily Traffic
Average daily traffic expressed as vehicles per day fo
period of May 1 to September 30 (153 days)

Turning Movement Summary Diagram

Reference No.: 109030

Intersection of:
52 & 846 S OF STIRLING

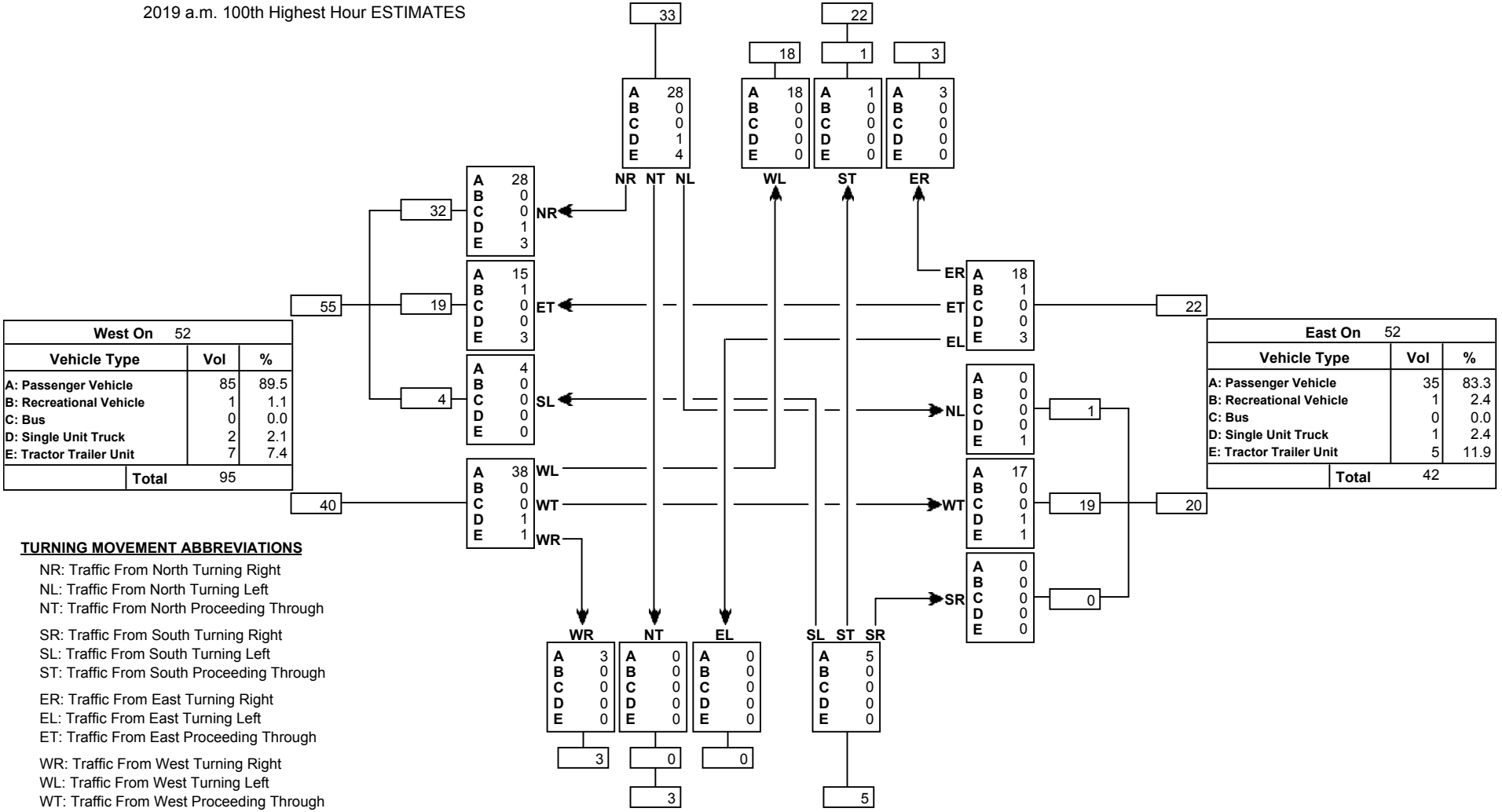
2019 a.m. 100th Highest Hour ESTIMATES

North On 846		
Vehicle Type	**Vol**	**%**
A: Passenger Vehicle	50	90.9
B: Recreational Vehicle	0	0.0
C: Bus	0	0.0
D: Single Unit Truck	1	1.8
E: Tractor Trailer Unit	4	7.3
Total	55	

West On 52		
Vehicle Type	**Vol**	**%**
A: Passenger Vehicle	85	89.5
B: Recreational Vehicle	1	1.1
C: Bus	0	0.0
D: Single Unit Truck	2	2.1
E: Tractor Trailer Unit	7	7.4
Total	95	

East On 52		
Vehicle Type	**Vol**	**%**
A: Passenger Vehicle	35	83.3
B: Recreational Vehicle	1	2.4
C: Bus	0	0.0
D: Single Unit Truck	1	2.4
E: Tractor Trailer Unit	5	11.9
Total	42	

South On Rge Rd 194		
Vehicle Type	**Vol**	**%**
A: Passenger Vehicle	8	100.0
B: Recreational Vehicle	0	0.0
C: Bus	0	0.0
D: Single Unit Truck	0	0.0
E: Tractor Trailer Unit	0	0.0
Total	8	



TURNING MOVEMENT ABBREVIATIONS

NR: Traffic From North Turning Right
NL: Traffic From North Turning Left
NT: Traffic From North Proceeding Through

SR: Traffic From South Turning Right
SL: Traffic From South Turning Left
ST: Traffic From South Proceeding Through

ER: Traffic From East Turning Right
EL: Traffic From East Turning Left
ET: Traffic From East Proceeding Through

WR: Traffic From West Turning Right
WL: Traffic From West Turning Left
WT: Traffic From West Proceeding Through

Turning Movement Summary Diagram

Reference No.: 109030

Intersection of:
52 & 846 S OF STIRLING

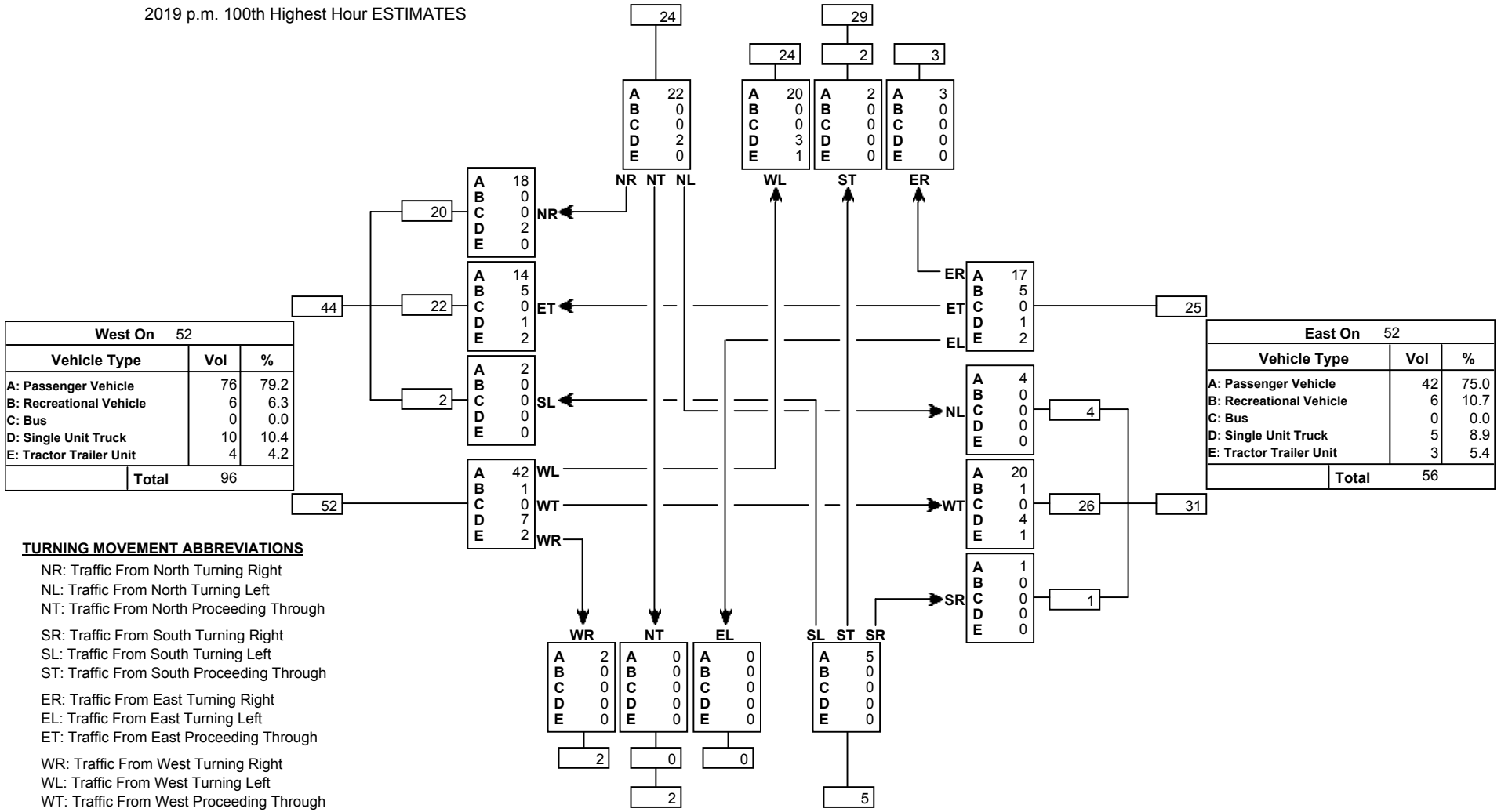
2019 p.m. 100th Highest Hour ESTIMATES

North On 846		
Vehicle Type	**Vol**	**%**
A: Passenger Vehicle	47	88.7
B: Recreational Vehicle	0	0.0
C: Bus	0	0.0
D: Single Unit Truck	5	9.4
E: Tractor Trailer Unit	1	1.9
Total	53	

West On 52		
Vehicle Type	**Vol**	**%**
A: Passenger Vehicle	76	79.2
B: Recreational Vehicle	6	6.3
C: Bus	0	0.0
D: Single Unit Truck	10	10.4
E: Tractor Trailer Unit	4	4.2
Total	96	

East On 52		
Vehicle Type	**Vol**	**%**
A: Passenger Vehicle	42	75.0
B: Recreational Vehicle	6	10.7
C: Bus	0	0.0
D: Single Unit Truck	5	8.9
E: Tractor Trailer Unit	3	5.4
Total	56	

South On Rge Rd 194		
Vehicle Type	**Vol**	**%**
A: Passenger Vehicle	7	100.0
B: Recreational Vehicle	0	0.0
C: Bus	0	0.0
D: Single Unit Truck	0	0.0
E: Tractor Trailer Unit	0	0.0
Total	7	



TURNING MOVEMENT ABBREVIATIONS

NR: Traffic From North Turning Right
NL: Traffic From North Turning Left
NT: Traffic From North Proceeding Through

SR: Traffic From South Turning Right
SL: Traffic From South Turning Left
ST: Traffic From South Proceeding Through

ER: Traffic From East Turning Right
EL: Traffic From East Turning Left
ET: Traffic From East Proceeding Through

WR: Traffic From West Turning Right
WL: Traffic From West Turning Left
WT: Traffic From West Proceeding Through

Turning Movement Summary Diagram

Reference No.: 70000058

Intersection of:
4 & 61 & 846 N OF STIRLING

2019 AADT / ASDT ESTIMATES

North On 4		
Vehicle Type	**Vol**	**%**
A: Passenger Vehicle	2939	76.7
B: Recreational Vehicle	145	3.8
C: Bus	10	0.3
D: Single Unit Truck	70	1.8
E: Tractor Trailer Unit	666	17.4
ASDT 4080	**AADT** 3830	

West On 846		
Vehicle Type	**Vol**	**%**
A: Passenger Vehicle	1044	94.9
B: Recreational Vehicle	4	0.4
C: Bus	0	0.0
D: Single Unit Truck	32	2.9
E: Tractor Trailer Unit	20	1.8
ASDT 1210	**AADT** 1100	

East On 61		
Vehicle Type	**Vol**	**%**
A: Passenger Vehicle	516	80.6
B: Recreational Vehicle	7	1.1
C: Bus	0	0.0
D: Single Unit Truck	34	5.3
E: Tractor Trailer Unit	83	13.0
ASDT 690	**AADT** 640	

South On 4		
Vehicle Type	**Vol**	**%**
A: Passenger Vehicle	1717	68.4
B: Recreational Vehicle	136	5.4
C: Bus	10	0.4
D: Single Unit Truck	32	1.3
E: Tractor Trailer Unit	615	24.5
ASDT 2770	**AADT** 2510	

1910: A 1468, B 71, C 4, D 33, E 334 — NR NT NL

1920: 460 (A 446, B 1, C 0, D 9, E 4) — WL; 1230 (A 836, B 69, C 6, D 20, E 299) — ST; 230 (A 189, B 4, C 0, D 8, E 29) — ER

460 (A 441, B 2, C 0, D 9, E 8) — NR

550 / 80 (A 67, B 1, C 0, D 6, E 6) — ET

10 (A 10, B 0, C 0, D 0, E 0) — SL

550 (A 526, B 1, C 0, D 17, E 6) — WL WT WR

ER (A 265, B 5, C 0, D 14, E 46) — ET EL — 330

NL (A 178, B 2, C 0, D 12, E 28) — 220

WT (A 70, B 0, C 0, D 8, E 2) — 80 — 310

SR (A 3, B 0, C 0, D 0, E 7) — 10

WR (A 10, B 0, C 0, D 0, E 0) — 10

NT (A 849, B 67, C 4, D 12, E 298) — 1230 — 1260

EL (A 9, B 0, C 0, D 0, E 11) — 20

SL ST SR (A 849, B 69, C 6, D 20, E 306) — 1250

TURNING MOVEMENT ABBREVIATIONS

NR: Traffic From North Turning Right
NL: Traffic From North Turning Left
NT: Traffic From North Proceeding Through

SR: Traffic From South Turning Right
SL: Traffic From South Turning Left
ST: Traffic From South Proceeding Through

ER: Traffic From East Turning Right
EL: Traffic From East Turning Left
ET: Traffic From East Proceeding Through

WR: Traffic From West Turning Right
WL: Traffic From West Turning Left
WT: Traffic From West Proceeding Through

TURNING MOVEMENT ABBREVIATIONS

AADT: Annual Average Daily Traffic
Average daily traffic expressed as vehicles per day fo
period of January 1 to December 31 (365 days)

ASDT: Average Summer Daily Traffic
Average daily traffic expressed as vehicles per day fo
period of May 1 to September 30 (153 days)

Turning Movement Summary Diagram

Reference No.: 70000058

Intersection of:
4 & 61 & 846 N OF STIRLING

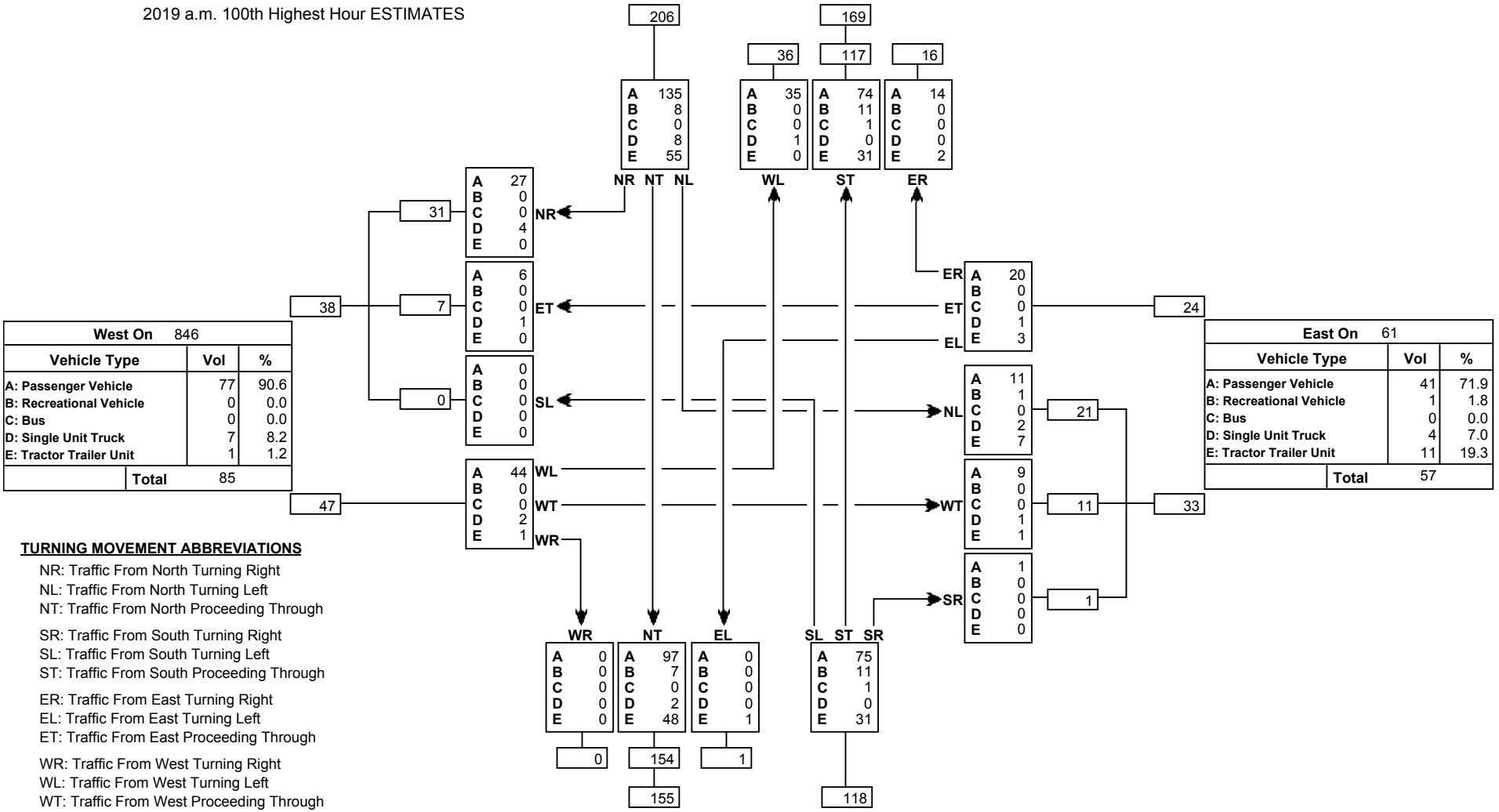
2019 a.m. 100th Highest Hour ESTIMATES

North On 4		
Vehicle Type	**Vol**	**%**
A: Passenger Vehicle	258	68.8
B: Recreational Vehicle	19	5.1
C: Bus	1	0.3
D: Single Unit Truck	9	2.4
E: Tractor Trailer Unit	88	23.5
Total	375	

West On 846		
Vehicle Type	**Vol**	**%**
A: Passenger Vehicle	77	90.6
B: Recreational Vehicle	0	0.0
C: Bus	0	0.0
D: Single Unit Truck	7	8.2
E: Tractor Trailer Unit	1	1.2
Total	85	

East On 61		
Vehicle Type	**Vol**	**%**
A: Passenger Vehicle	41	71.9
B: Recreational Vehicle	1	1.8
C: Bus	0	0.0
D: Single Unit Truck	4	7.0
E: Tractor Trailer Unit	11	19.3
Total	57	

South On 4		
Vehicle Type	**Vol**	**%**
A: Passenger Vehicle	172	63.0
B: Recreational Vehicle	18	6.6
C: Bus	1	0.4
D: Single Unit Truck	2	0.7
E: Tractor Trailer Unit	80	29.3
Total	273	



TURNING MOVEMENT ABBREVIATIONS

NR: Traffic From North Turning Right
NL: Traffic From North Turning Left
NT: Traffic From North Proceeding Through

SR: Traffic From South Turning Right
SL: Traffic From South Turning Left
ST: Traffic From South Proceeding Through

ER: Traffic From East Turning Right
EL: Traffic From East Turning Left
ET: Traffic From East Proceeding Through

WR: Traffic From West Turning Right
WL: Traffic From West Turning Left
WT: Traffic From West Proceeding Through

Turning Movement Summary Diagram

Reference No.: 70000058

Intersection of:
4 & 61 & 846 N OF STIRLING

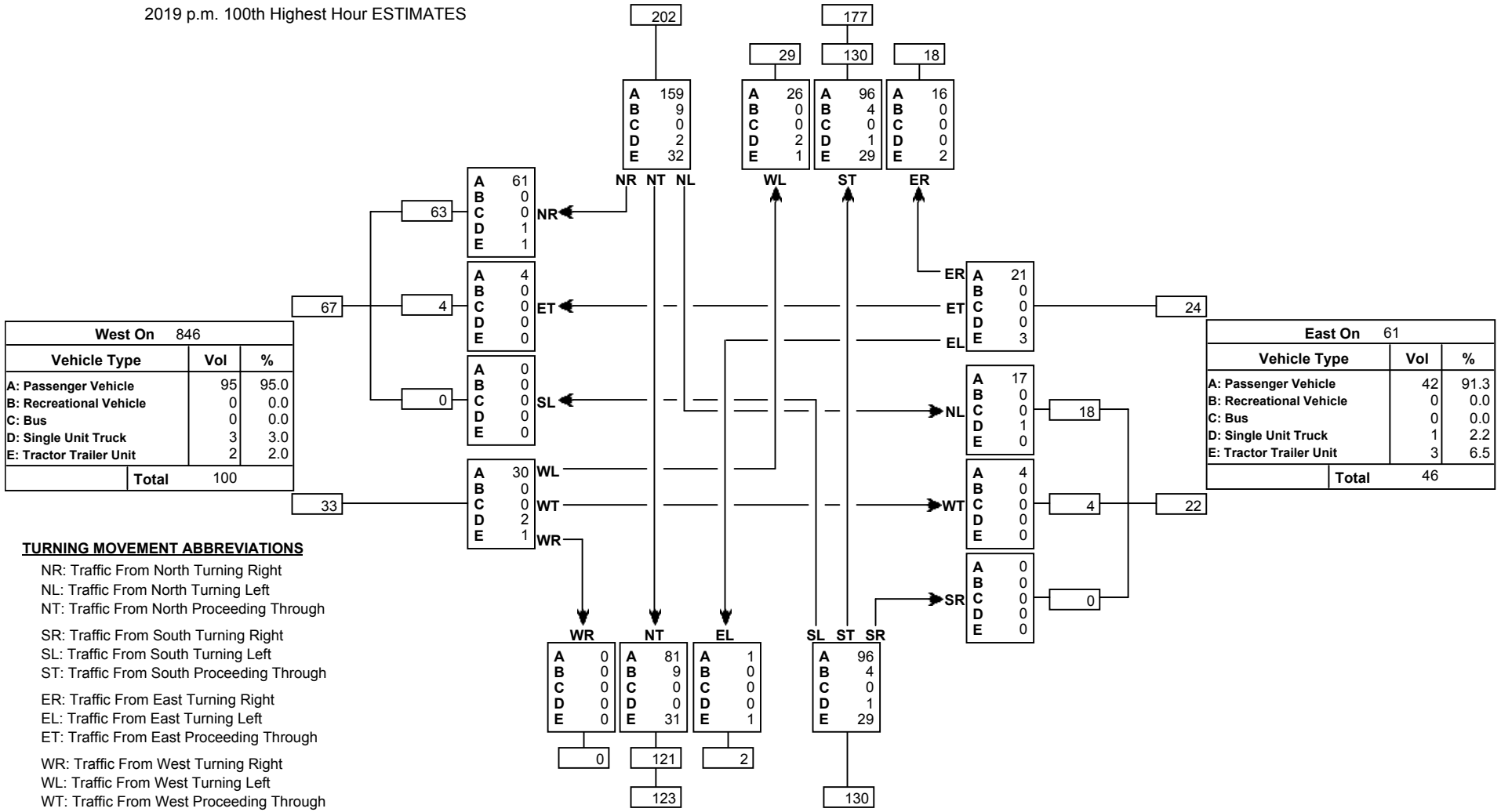
2019 p.m. 100th Highest Hour ESTIMATES

North On 4		
Vehicle Type	**Vol**	**%**
A: Passenger Vehicle	297	78.4
B: Recreational Vehicle	13	3.4
C: Bus	0	0.0
D: Single Unit Truck	5	1.3
E: Tractor Trailer Unit	64	16.9
Total	379	

West On 846		
Vehicle Type	**Vol**	**%**
A: Passenger Vehicle	95	95.0
B: Recreational Vehicle	0	0.0
C: Bus	0	0.0
D: Single Unit Truck	3	3.0
E: Tractor Trailer Unit	2	2.0
Total	100	

East On 61		
Vehicle Type	**Vol**	**%**
A: Passenger Vehicle	42	91.3
B: Recreational Vehicle	0	0.0
C: Bus	0	0.0
D: Single Unit Truck	1	2.2
E: Tractor Trailer Unit	3	6.5
Total	46	

South On 4		
Vehicle Type	**Vol**	**%**
A: Passenger Vehicle	178	70.4
B: Recreational Vehicle	13	5.1
C: Bus	0	0.0
D: Single Unit Truck	1	0.4
E: Tractor Trailer Unit	61	24.1
Total	253	



TURNING MOVEMENT ABBREVIATIONS

NR: Traffic From North Turning Right
NL: Traffic From North Turning Left
NT: Traffic From North Proceeding Through

SR: Traffic From South Turning Right
SL: Traffic From South Turning Left
ST: Traffic From South Proceeding Through

ER: Traffic From East Turning Right
EL: Traffic From East Turning Left
ET: Traffic From East Proceeding Through

WR: Traffic From West Turning Right
WL: Traffic From West Turning Left
WT: Traffic From West Proceeding Through

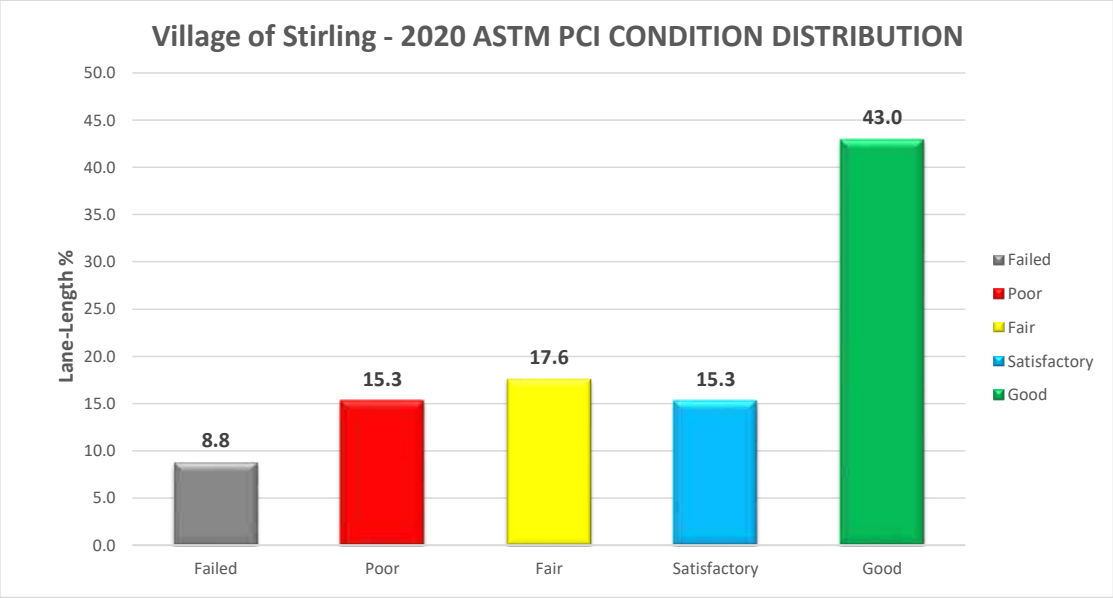
APPENDIX G:

TRANSPORTATION CONDITION ASSESSMENT

Paved Road Condition Assessment

ASTM D6433 PCI Condition Level Distribution						
	Failed	Poor	Fair	Satisfactory	Good	**Total**
%LL	**8.8**	**15.3**	**17.6**	**15.3**	**43.0**	**100**
LL-km	1.843	3.218	3.689	3.215	9.023	**20.988**

Paved Road Network PCI_{wavg} **70.2** PCI Condition Level **Satisfactory**



Condition Rating	PCI Range
Good	86 to 100
Satisfactory	70 to 85
Fair	56 to 70
Poor	26 to 55
Failed	0 to 25

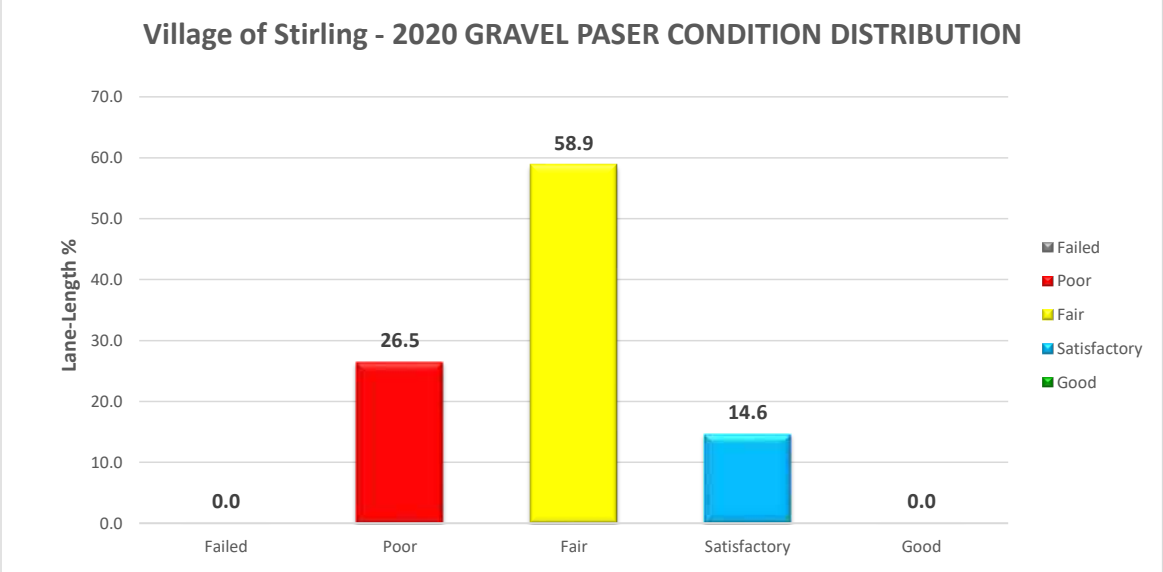
Paved Road Condition Assessment																
ASTM PCI CONDITION	SEG_ID	STREET	FROM	TO	FUNC	SURF	LANE-KM	PCI	LANES	LENGTH	WIDTH	AREA	ASTM RATSYS	DATA YEAR	CURB COND.	DRAINAGE COND.
Good	SRRC0005	3 Avenue	5 Street	4A Street	Local	Asphalt	0.235	**98.8**	2	117.6	10.0	1176	AC	2020	Good	Good
Satisfactory	SRRC0013	2 Avenue	6A Street	6 Street	Local	Cold Mix	0.238	**75.5**	2	118.9	7.0	832	AC	2020	None	Poor
Failed	SRRC0014	6A Street	3 Avenue	2 Avenue	Local	Cold Mix	0.463	**9.5**	2	231.4	7.0	1620	AC	2020	None	Poor
Satisfactory	SRRC0020	1 Avenue	2 Street	1 Street	Local	Cold Mix	0.447	**77.5**	2	223.5	8.0	1788	AC	2020	None	Good
Good	SRRC0021	1 Avenue	2A Street	2 Street	Local	Cold Mix	0.238	**95.6**	2	119.0	8.0	952	AC	2020	None	Fair
Good	SRRC0024	1 Avenue	3 Street	2A Street	Local	Cold Mix	0.232	**94.2**	2	115.8	8.0	927	AC	2020	None	Fair
Failed	SRRC0025	3 Street	2 Avenue	1 Avenue	Local	Cold Mix	0.458	**5.4**	2	228.9	8.0	1831	AC	2020	None	Poor
Fair	SRRC0027	3 Street	3 Avenue	2 Avenue	Local	Cold Mix	0.463	**69.9**	2	231.6	8.0	1852	AC	2020	None	Poor
Good	SRRC0029	3 Avenue	3 Street	2A Street	Local	Asphalt	0.232	**97.3**	2	115.8	10.0	1158	AC	2020	Good	Good
Good	SRRC0031	3 Avenue	2 Street	1 Street	Local	Asphalt	0.453	**97.0**	2	226.7	10.0	2267	AC	2020	Good	Good
Fair	SRRC0032	2 Street	4 Avenue	3 Avenue	Local	Cold Mix	0.463	**63.9**	2	231.5	7.5	1736	AC	2020	None	Poor
Satisfactory	SRRC0033	4 Avenue	2 Street	1 Street	Local	Asphalt	0.453	**78.1**	2	226.7	9.0	2040	AC	2020	None	Poor
Satisfactory	SRRC0034	4 Avenue	3 Street	2 Street	Local	Asphalt	0.463	**80.2**	2	231.5	9.0	2084	AC	2020	None	Poor
Good	SRRC0035	3 Street	4 Avenue	3 Avenue	Local	Asphalt	0.464	**96.0**	2	231.8	10.0	2318	AC	2020	Good	Good
Good	SRRC0036	3 Avenue	3A Street	3 Street	Local	Asphalt	0.232	**99.3**	2	115.8	10.0	1158	AC	2020	Good	Good
Fair	SRRC0037	4 Avenue	4 Street	3 Street	Local	Asphalt	0.463	**67.9**	2	231.6	9.0	2084	AC	2020	None	Poor
Good	SRRC0038	4 Street	4 Avenue	3 Avenue	Local	Asphalt	0.463	**93.6**	2	231.6	10.0	2316	AC	2020	Good	Good
Good	SRRC0039	3 Avenue	4 Street	3A Street	Local	Asphalt	0.232	**93.5**	2	115.8	10.0	1158	AC	2020	Good	Good
Poor	SRRC0042	4 Street	3 Avenue	2 Avenue	Local	Cold Mix	0.463	**31.1**	2	231.7	7.5	1738	AC	2020	None	Poor
Poor	SRRC0045	5 Street	3 Avenue	2 Avenue	Local	Cold Mix	0.463	**44.4**	2	231.6	7.5	1737	AC	2020	Poor	Poor
Satisfactory	SRRC0046	4 Street	2 Avenue	1 Avenue	Local	Cold Mix	0.461	**75.1**	2	230.5	7.5	1729	AC	2020	None	Fair
Good	SRRC0051	1 Avenue	8 Street	6 Street	Local	Cold Mix	0.927	**97.8**	2	463.6	8.0	3709	AC	2020	None	Fair
Poor	SRRC0052	6 Street	2 Avenue	1 Avenue	Local	Cold Mix	0.460	**27.3**	2	230.2	7.0	1611	AC	2020	None	Poor
Poor	SRRC0054	3 Avenue	6 Street	5 Street	Local	Cold Mix	0.459	**32.3**	2	229.4	7.5	1721	AC	2020	None	Poor
Failed	SRRC0055	6 Street	3 Avenue	2 Avenue	Local	Cold Mix	0.459	**0.0**	2	229.6	7.0	1607	AC	2020	None	Poor
Good	SRRC0058	3 Avenue	6A Street	6 Street	Local	Cold Mix	0.236	**91.5**	2	117.8	8.0	942	AC	2020	None	Poor
Fair	SRRC0059	6 Street	4 Avenue	3 Avenue	Local	Cold Mix	0.463	**58.5**	2	231.7	7.0	1622	AC	2020	None	Poor
Satisfactory	SRRC0060	4 Avenue	6 Street	5 Street	Local	Asphalt	0.458	**80.4**	2	229.0	9.0	2061	AC	2020	None	Poor
Satisfactory	SRRC0061	4 Avenue	5 Street	4A Street	Local	Asphalt	0.232	**78.0**	2	115.8	9.0	1043	AC	2020	None	Poor
Good	SRRC0062	4A Street	4 Avenue	3 Avenue	Local	Asphalt	0.463	**90.7**	2	231.6	8.0	1853	AC	2020	Good	Good
Good	SRRC0063	4 Avenue	4A Street	4 Street	Local	Asphalt	0.232	**89.3**	2	115.8	9.0	1042	AC	2020	None	Poor
Good	SRRC0064	3 Avenue	4A Street	4 Street	Local	Asphalt	0.228	**97.0**	2	114.2	10.0	1142	AC	2020	Good	Good
Good	SRRC0065	4A Street	3 Avenue	2 Avenue	Local	Asphalt	0.463	**96.5**	2	231.4	8.0	1851	AC	2020	Good	Good
Good	SRRC0066	5 Street	4 Avenue	3 Avenue	Local	Asphalt	0.463	**92.2**	2	231.6	10.0	2316	AC	2020	Good	Good
Good	SRRC0067	5 Street	5 Avenue	4 Avenue	Local	Asphalt	0.463	**92.3**	2	231.5	10.0	2315	AC	2020	Good	Good
Good	SRRC0068	5 Avenue	5 Street	4 Street	Local	Asphalt	0.467	**86.9**	2	233.5	10.0	2335	AC	2020	Good	Good
Satisfactory	SRRC0069	4 Street	5 Avenue	4 Avenue	Local	Cold Mix	0.463	**75.3**	2	231.4	7.0	1620	AC	2020	None	Fair
Good	SRRC0070	5 Avenue	4 Street	3 Street	Local	Asphalt	0.459	**94.1**	2	229.6	10.0	2296	AC	2020	Good	Good
Failed	SRRC0071	3 Street	5 Avenue	4 Avenue	Local	Asphalt	0.463	**4.5**	2	231.5	10.0	2315	AC	2020	Fair	Fair
Good	SRRC0072	5 Avenue	3 Street	2 Street	Local	Asphalt	0.463	**97.4**	2	231.6	10.0	2316	AC	2020	Good	Good

Paved Road Condition Assessment															
ASTM PCI CONDITION	SEG_ID	STREET	FROM	TO	FUNC	SURF	LANE-KM	PCI	LANES	LENGTH	WIDTH	AREA	ASTM RATSYS	DATA YEAR	CURB COND.	DRAINAGE COND.
Good	SRRC0073	2 Street	5 Avenue	4 Avenue	Local	Asphalt	0.466	**89.3**	2	233.1	10.0	2331	AC	2020	Good	Good
Good	SRRC0074	5 Avenue	2 Street	1 Street	Local	Asphalt	0.453	**98.3**	2	226.6	10.0	2266	AC	2020	Good	Good
Poor	SRRC0075	3 Street	6 Avenue	5 Avenue	Local	Asphalt	0.464	**40.7**	2	231.8	10.0	2318	AC	2020	None	Poor
Poor	SRRC0076	6 Avenue	3 Street	2 Street	Local	Cold Mix	0.457	**49.1**	2	228.4	6.8	1553	AC	2020	None	Poor
Fair	SRRC0077	2 Street	6 Avenue	5 Avenue	Local	Cold Mix	0.460	**60.2**	2	230.1	6.8	1565	AC	2020	None	Poor
Good	SRRC0078	6 Avenue	4 Street	3 Street	Local	Cold Mix	0.459	**94.5**	2	229.6	6.8	1562	AC	2020	None	Fair
Poor	SRRC0079	4 Street	6 Avenue	5 Avenue	Local	Cold Mix	0.451	**50.7**	2	225.7	7.0	1580	AC	2020	None	Poor
Fair	SRRC0081	6 Avenue	2 Street	1 Street	Local	Cold Mix	0.453	**62.4**	2	226.7	6.8	1541	AC	2020	None	Poor
Fair	SRRC0083	5 Street	7 Avenue	5 Avenue	Local	Cold Mix	0.923	**64.1**	2	461.4	7.0	3230	AC	2020	None	Fair
TOTALS							**20.987**			**10,493.5**		**88,164.0**				

Gravel Road Condition Assessment

	Gravel PASER Condition Level Distribution					
	Failed	Poor	Fair	Satisfactory	Good	**Total**
%LL	**0.0**	**26.5**	**58.9**	**14.6**	**0.0**	**100**
LL-km	0	3.204	7.133	1.773	0	**12.11**

Gravel Road Network PSR_{wavg} **58.0** PSR Condition Level **Fair**



Surface rating	*Visible distress**	*General condition/ treatment measures*
Good	No distress. Dust controlled. Excellent surface condition and ride.	New construction—or total reconstruction. Excellent drainage. Little or no maintenance needed.
Satisfactory	Dust under dry conditions. Moderate loose aggregate. Slight washboarding.	Recently regraded. Good crown and drainage throughout. Adequate gravel for traffic. Routine grading and dust control may be needed.
Fair	Good crown (3"-6"). Adequate ditches on more than 50% of roadway. Gravel layer mostly adequate but additional aggregate may be needed in some locations to correct washboarding or isolated potholes and ruts. Some culvert cleaning needed. Moderate washboarding (1"-2" deep) over 10%-25% of the area. Moderate dust, partial obstruction of vision. None or slight rutting (less than 1" deep). An occasional small pothole (less than 2" deep). Some loose aggregate (2" deep).	Shows traffic effects. Regrading (reworking) necessary to maintain. Needs some ditch improvement and culvert maintenance. Some areas may need additional gravel.
Poor	Little or no roadway crown (less than 3"). Adequate ditches on less than 50% of roadway. Portions of the ditches may be filled, over-grown and/or show erosion. Some areas (25%) with little or no aggre-gate. Culverts partially full of debris. Moderate to severe washboard-ing (over 3" deep) over 25% of area. Moderate rutting (1"-3"), over 10%-25% of area. Moderate potholes (2"-4") over 10%-25% of area. Severe loose aggregate (over 4").	Travel at slow speeds (less than 25 mph) is required. Needs additional new aggregate. Major ditch construction and culvert maintenance also required.
Failed	No roadway crown or road is bowl shaped with extensive ponding. Little if any ditching. Filled or damaged culverts. Severe rutting (over 3" deep), over 25% of the area. Severe potholes (over 4" deep), over 25% of area. Many areas (over 25%) with little or no aggregate.	Travel is difficult and road may be closed at times. Needs complete rebuilding and/or new culverts.

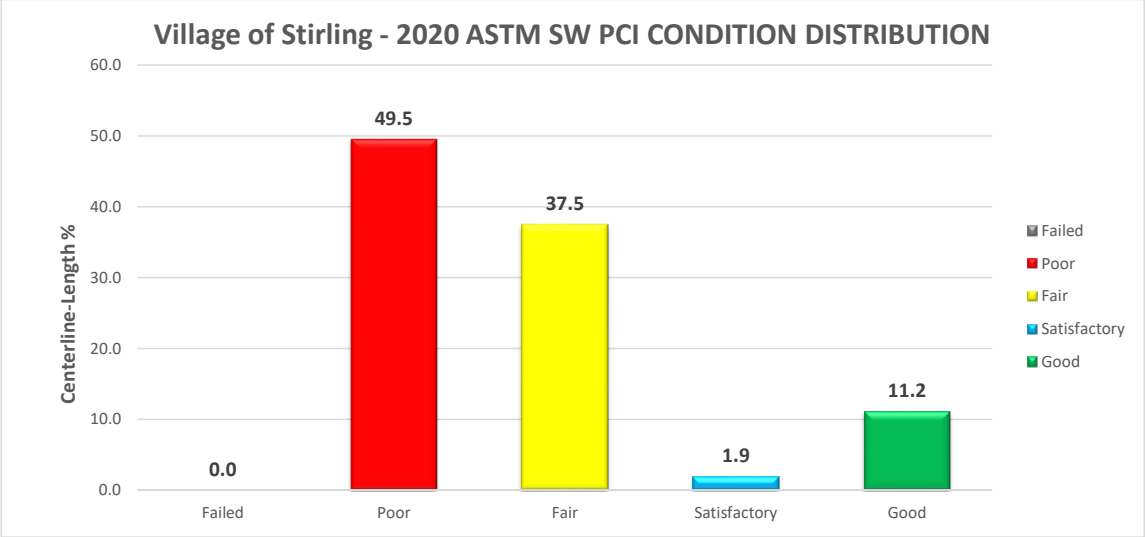
** Individual road sections will not have all of the types of distress listed for any particular rating. They may have only one or two types.*

Gravel Road Condition Assessment														
PASER CONDITION	SEG_ID	STREET	FROM	TO	FUNC	SURF	LANE-KM	PSR_{100}	PASER	LANES	LENGTH	WIDTH	AREA	DATA DATE
Fair	SRRC0007	2 Avenue	5 Street	4A Street	Local	GR	0.232	**58.2**	2.91	2	115.8	7.0	811	2020-05-07
Poor	SRRC0008	2 Avenue	2A Street	2 Street	Local	GR	0.234	**41.8**	2.09	2	117.1	7.0	820	2020-05-07
Poor	SRRC0011	5 Avenue	End	5 Street	Local	GR	0.117	**41.6**	2.08	2	58.4	8.0	467	2020-05-07
Poor	SRRC0012	7 Street	3 Avenue	End	Local	GR	0.326	**45.4**	2.27	2	162.8	7.0	1139	2020-05-07
Fair	SRRC0016	5 Street	1 Avenue	Hartley Avenue	Local	GR	0.426	**63.2**	3.16	2	213.2	7.0	1492	2020-05-07
Fair	SRRC0017	Hartley Avenue	5 Street	4 Street	Local	GR	0.435	**62.8**	3.14	2	217.7	7.0	1524	2020-05-07
Fair	SRRC0018	4 Street	Hartley Avenue	Village Limits	Local	GR	0.423	**58.8**	2.94	2	211.3	7.0	1479	2020-05-07
Fair	SRRC0019	4 Street	1 Avenue	Hartley Avenue	Local	GR	0.437	**58.6**	2.93	2	218.5	7.0	1530	2020-05-07
Fair	SRRC0022	2A Street	2 Avenue	1 Avenue	Local	GR	0.458	**52.8**	2.64	2	228.9	7.0	1602	2020-05-07
Poor	SRRC0026	2 Avenue	3 Street	2A Street	Local	GR	0.232	**47.0**	2.35	2	115.8	7.0	811	2020-05-07
Fair	SRRC0028	2A Street	3 Avenue	2 Avenue	Local	GR	0.463	**65.6**	3.28	2	231.6	7.0	1621	2020-05-07
Poor	SRRC0040	3A Street	3 Avenue	2 Avenue	Local	GR	0.463	**46.4**	2.32	2	231.5	8.0	1852	2020-05-07
Fair	SRRC0041	2 Avenue	4 Street	3A Street	Local	GR	0.232	**51.8**	2.59	2	115.8	7.0	810	2020-05-07
Fair	SRRC0043	2 Avenue	3A Street	3 Street	Local	GR	0.232	**51.8**	2.59	2	115.8	7.0	810	2020-05-07
Fair	SRRC0044	2 Avenue	4A Street	4 Street	Local	GR	0.231	**53.6**	2.68	2	115.7	7.0	810	2020-05-07
Fair	SRRC0048	5 Street	2 Avenue	1 Avenue	Local	GR	0.461	**61.2**	3.06	2	230.5	7.0	1614	2020-05-07
Fair	SRRC0053	2 Avenue	6 Street	5 Street	Local	GR	0.457	**50.6**	2.53	2	228.5	7.0	1599	2020-05-07
Poor	SRRC0056	3 Avenue	End	7 Street	Local	GR	0.119	**47.6**	2.38	2	59.3	6.0	356	2020-05-07
Poor	SRRC0057	3 Avenue	7 Street	6A Street	Local	GR	0.232	**43.6**	2.18	2	115.8	6.0	695	2020-05-07
Poor	SRRC0080	2 Street	7 Avenue	6 Avenue	Local	GR	0.465	**48.6**	2.43	2	232.6	5.2	1209	2020-05-07
Poor	SRRC0082	7 Avenue	2 Street	1 Street	Local	GR	0.448	**47.0**	2.35	2	224.1	4.6	1031	2020-05-07
Satisfactory	SRRC0084	4 Avenue	7 Street	6 Street	Local	GR	0.468	**84.0**	4.20	2	234.1	9.0	2107	2020-05-07
Satisfactory	SRRC0085	4 Avenue	8 Street	7 Street	Local	GR	0.461	**80.2**	4.01	2	230.3	9.0	2073	2020-05-07
Fair	SRRC0086	7 Street	8 Avenue	4 Avenue	Local	GR	1.799	**55.8**	2.79	2	899.4	7.0	6296	2020-05-07
Fair	SRRC0087	6 Street	8 Avenue	7 Avenue	Local	GR	0.423	**65.8**	3.29	2	211.6	7.0	1482	2020-05-07
Fair	SRRC0088	7 Avenue	6 Street	5 Street	Local	GR	0.424	**63.2**	3.16	2	212.2	7.0	1486	2020-05-07
Satisfactory	SRRC0095	4 Street	7 Avenue	8 Avenue	Local	GR	0.400	**78.2**	3.91	2	200.0	7.0	1400	2020-05-07
Satisfactory	SRRC0096	7 Avenue	5 Street	4 Street	Local	GR	0.444	**70.2**	3.51	2	222.2	7.0	1556	2020-05-07
Poor	SRRC0200	2 Street	3 Avenue	2 Avenue	Local	GR	0.569	**47.6**	2.38	2	284.6	7.0	1992	2020-05-07
TOTALS							**12.110**				**6,055.2**		**42,474.0**	

Concrete Sidewalk Condition Assessment

ASTM D6433 PCI Condition Level Distribution						
	Failed	Poor	Fair	Satisfactory	Good	Total
%CL	**0.0**	**49.5**	**37.5**	**1.9**	**11.2**	**100**
CL-m	0	1474.5	1117.1	55.9	332.3	**2979.8**

Sidewalk (PCC) Network PCI_{wavg} 57.6 PCI Condition Level Fair



Condition Rating	PCI Range
Good	86 to 100
Satisfactory	70 to 85
Fair	56 to 70
Poor	26 to 55
Failed	0 to 25

Concrete Sidewalk Conditon Assessment															
ASTM PCI CONDITION	SEGID	STREET	FROM	TO	BLOCK FACE	LENGTH	MATERIAL	SW PCI	TRIP HAZARDS	PED. ZONE	PED. LEVEL	CURB CONDITION	CURB MATERIAL	CURB TYPE	DATA DATE
Good	SRSWLK0001	2 Street	7 Avenue	6 Avenue	W	332.3	PCC	**92.0**	Low	Low	Low			None	2020-05-07
Fair	SRSWLK0002	2 Street	6 Avenue	5 Avenue	W	94.5	PCC	**57.5**	High	Low	Low			None	2020-05-07
Fair	SRSWLK0003	5 Avenue	3 Street	2 Street	N	35.9	PCC	**58.6**	High	Low	Low	Good	PCC	Cr_Gtt	2020-05-07
Poor	SRSWLK0004	3 Street	6 Avenue	5 Avenue	W	150.9	PCC	**53.9**	High	Low	Low			None	2020-05-07
Fair	SRSWLK0005	3 Street	5 Avenue	4 Avenue	E	46.0	PCC	**66.8**	Moderate	Medium	Moderate			None	2020-05-07
Fair	SRSWLK0006	3 Street	5 Avenue	4 Avenue	W	164.1	PCC	**67.9**	High	High	High	Good	PCC	Cr_Gtt	2020-05-07
Satisfactory	SRSWLK0007	3 Street	4 Avenue	3 Avenue	E	47.2	PCC	**73.9**	Moderate	Low	Low	Poor	PCC	Cr_Gtt	2020-05-07
Fair	SRSWLK0008	3 Street	4 Avenue	3 Avenue	W	91.7	PCC	**68.5**	High	Low	Moderate	Good	PCC	Cr_Gtt	2020-05-07
Poor	SRSWLK0009	3 Street	3 Avenue	2 Avenue	W	156.8	PCC	**48.0**	High	Low	Low			None	2020-05-07
Poor	SRSWLK0010	2 Avenue	3 Street	2A Street	N	83.8	PCC	**35.7**	High	Low	Low			None	2020-05-07
Fair	SRSWLK0011	2 Avenue	4 Street	3 Street	N	136.4	PCC	**57.3**	High	Low	Low			None	2020-05-07
Poor	SRSWLK0012	2 Avenue	5 Street	4 Street	N	16.7	PCC	**34.1**	Moderate	Low	Low			None	2020-05-07
Fair	SRSWLK0013	2 Avenue	6 Street	5 Street	N	125.0	PCC	**61.4**	Moderate	Low	Low			None	2020-05-07
Fair	SRSWLK0014	3 Avenue	3 Street	2A Street	N	17.9	PCC	**70.0**	High	Low	Low	Good	PCC	Cr_Gtt	2020-05-07
Fair	SRSWLK0015	3 Avenue	2A Street	2 Street	N	22.6	PCC	**59.1**	High	Low	Low	Good	PCC	Cr_Gtt	2020-05-07
Poor	SRSWLK0016	2 Street	4 Avenue	3 Avenue	W	41.6	PCC	**44.9**	Low	Low	Low			None	2020-05-07
Poor	SRSWLK0017	4 Avenue	2 Street	1 Street	N	155.2	PCC	**47.6**	High	Low	Low			None	2020-05-07
Satisfactory	SRSWLK0018	4 Avenue	3 Street	2 Street	N	8.7	PCC	**79.7**	Low	Low	Low			None	2020-05-07
Poor	SRSWLK0019	4 Avenue	3 Street	2 Street	S	14.0	PCC	**52.5**	Low	Medium	Moderate			None	2020-05-07
Fair	SRSWLK0020	4 Avenue	4 Street	3 Street	N	29.8	PCC	**55.2**	High	Low	Low			None	2020-05-07
Fair	SRSWLK0021	4 Avenue	4 Street	3 Street	S	48.4	PCC	**63.2**	High	High	High			None	2020-05-07
Poor	SRSWLK0022	4 Avenue	4A Street	4 Street	N	77.0	PCC	**43.0**	High	Low	Low			None	2020-05-07
Poor	SRSWLK0023	4 Avenue	5 Street	4A Street	N	462.3	PCC	**50.2**	High	Low	Low			None	2020-05-07
Poor	SRSWLK0024	4 Avenue	6 Street	5 Street	N	97.6	PCC	**48.9**	High	High	High			None	2020-05-07
Poor	SRSWLK0025	5 Street	5 Avenue	4 Avenue	W	48.8	PCC	**45.4**	High	Low	Low			None	2020-05-07
Fair	SRSWLK0026	5 Street	5 Avenue	4 Avenue	W	199.6	PCC	**57.0**	High	Low	Low			None	2020-05-07
Poor	SRSWLK0027	5 Street	4 Avenue	3 Avenue	E	85.9	PCC	**38.2**	High	Low	Low			None	2020-05-07
Fair	SRSWLK0028	4 Street	5 Avenue	4 Avenue	W	105.2	PCC	**61.7**	High	Low	Low			None	2020-05-07
Poor	SRSWLK0029	4 Street	3 Avenue	2 Avenue	W	83.9	PCC	**27.0**	High	Low	Low			None	2020-05-07
TOTALS						**2,979.8**									

APPENDIX H:

BRIDGE FILE INSPECTIONS

Bridge Inspection

Bridge File Number	00318 -1 Bridge	Form Type	PCS
Year Built/Year Supstr	1992/1992	Lot No.	3
Bridge or Town Name	STIRLING	Inspector Name	Garry Roberts
Located Over	KIPP COULEE, 11.9.6, WATERCRS-ST	Inspector Class	BR CLS A
Located On	LOCAL ROAD	Assistant Name	
Water Body Cl./Year		Assistant Class	
Navigabil. Cl./Year		Inspection Date	31-Aug-2012
Legal Land Location	NW SEC 29 TWP 6 RGE 19 W4M	Data Entry By	Lauren Korte
Longitude, Latitude	-112:32:07, 49:30:08	Data Entry Date	03-Oct-2012
Road Authority	STIRLING	Reviewer Name	Joel Wozney
Contract Main. Area	UNDEFINED CMA	Review Date	14-Sep-2012
Clear Roadway/Skew	8 / -30 deg. (LHF)	Dept. Reviewer Name	Tim Davies
AADT/Year	320 / 2012 (E)	Dept. Review Date	11-Oct-2012
Road Classification	RLU-208-100	Follow-Up By	
Detour Length (km)			

Allowable Load (t):	Single	CS1 28	Semi	CS2 49	Train	CS3 62	---> On Critical Spans --->Critical Member
Design Loading:		CS750					---> Primary Span

Posting Information

Required Load Posting (t)			Single		Semi		Truck Train	
Posted Loading (t)			Single		Semi		Truck Train	
Posted:	Lane	EB	At Junction (Y/N)	No	In Advance (Y/N)	No	At Bridge (Y/N)	No
Posted:	Lane	WB	At Junction (Y/N)	No	In Advance (Y/N)	No	At Bridge (Y/N)	No
Remarks	Not Required.							

Hazard Marker At Bridge (Y/N)	Yes
Remarks	
Other Sign Types	

Utilities (Located at)

Utility Attachments			
Telephone	North & South ditch.	Gas	10m south xing canal.
Power	4 line South ditch.	Municipal	
Others		Problem (Y/N)	No
Remarks			

Approach Road

		Last	Now	Explanation of Condition
Horizontal Alignment		7	7	4th ave. Stirling. Int. 40m South.
Vertical Alignment		8	8	
Roadway Width (m)	6.600			Gravel approaches.
Approach Bump		6	5	
Guardrail (Y/N)	Yes			Not thriebeam.
Guardrail		8	7	
Length (m)	12.000			
Current Standard (Y/N)	No			
Termination Type	TURNDOWN			
Drainage		6	6	
Approach Road General Rating		**7**	**7**	

Superstructure							
Bridge Component					**Last**	**Now**	**Explanation of Condition**
(Primary Span : **SC, 1 Spans, Lengths(m): 12, A-Ident Number:**)							
Special Features							
Special Feature						X	
(Type :)							
Special Feature						X	
(Type :)							
Wearing Surface/Deck Top Detail Ratings							
	N (%)	1 (%)	2 (%)	3 (%)			
Last							
Now	0.0	0.0	0.0	0.0			
Wearing Surface					X	X	
(Material Type :)							
(Thickness(mm) :)							
Lateral Connection Problem (Y/N)				No			
Deck Top					7	7	
Deck Rideability					8	7	
Deck Joints					7	7	Buffer angles.
Bump (Y/N)				No			
Deck Drainage					8	6	No drains.
Drains Clogged (Y/N)				No			
Curbs/Median					7	7	
(Curb Type : **Standard**)							
Scaling (Percent Area)				0			
Bridge Rail					8	8	Double layer. Missing A/B nut at 2nd post NE.
(Type : **GALVANIZED STEEL FLEX BEAM**)							
Bridge Rail Posts					8	3	
(Type : **GALVANIZED POST STEEL;GALVANIZED POST STEEL**)							
Bridge Rail/Posts Coating					8	7	
(Type : **GALVANIZED**)							
Sidewalk					X	X	
Girder Detail Ratings							
	N (count)	1 (count)	2 (count)	3 (count)			
Last							
Now	0	0	0	0			
Girders					8	8	
Last Complete Inspection Date				30-Aug-2012			
Cracking (Y/N)				No			
Spalling (Percent Area)				0			
Lift or Connector Pocket Grouted (Y/N)				Yes			
(Number Of Girders : **8**)							
Span Alignment Problems							
Vertical (Y/N)				No			
Horizontal (Y/N)				No			
Superstructure General Rating					**8**	**8**	

Substructure						
Bridge Component					**Last**	**Now**	**Explanation of Condition**
Abutments							
(Extended Backwall Piles (Y/N) : **Y**)							
(Extended Backwall Piles Spacing(mm) : **1500**)							
(Total Number of Caps/Corbels : **1:1**)							
Bearing Seats/Caps/Corbels Detail Ratings							
	N (count)	1 (count)	2 (count)	3 (count)			
Last							
Now	0	0	0	0			
Bearing Seats/Caps/Corbels					8	8	
(Type : **STEEL**)							
(Depth(mm) : **305**)							
(Width(mm) : **305**)							
Backwalls/Breastwalls					7	7	
Greatest Height (m)	1.90						
Wingwalls					7	7	T.T wings.
(Total Number of Bearing Piles : **6:6**)							
Piles Detail Ratings							
	N (count)	1 (count)	2 (count)	3 (count)			Steel piles.
Last							
Now	0	0	0	0			
Piles					7	8	
Paint/Coating					X	X	
Abutment Stability					8	8	
Scour/Erosion					8	7	
Piers/Bents							
(Type :)							
(Total Number of Caps/Corbels :)							
Bearing Seats/Caps/Corbels Detail Ratings							
	N (count)	1 (count)	2 (count)	3 (count)			
Last							
Now							
Bearing Seats/Caps/Corbels					X	X	
(Type :)							
(Depth(mm) :)							
(Width(mm) :)							
(Total Number of Bearing Piles :)							
Piles Detail Ratings							
	N (count)	1 (count)	2 (count)	3 (count)			
Last							
Now							
Pier Shaft/Piles					X	X	
Greatest Height (m)							
Bracing/Struts/Sheathing					X	X	
Nose Plate					X	X	
Paint/Coating					X	X	
(Colour Description :)							
(Colour Code :)							
Pier Stability					X	X	

Substructure				
Bridge Component		**Last**	**Now**	**Explanation of Condition**
Scour		X	X	
Debris (Y/N)	No			
Substructure General Rating		**7**	**8**	

Structure Usage				
		Last	**Now**	**Explanation of Condition**
Channel				
(U/S Direction : **S**)				Sharp curve u/s. Water likely to run East towards East wall in flood situations
(D/S Direction : **N**)				
Alignment		5	5	
Bank Stability		4	4	Channel erosion 20m U/S and D/S.
HWM (m below Top of Curb)				
Drift (Y/N)	No			
Slope Protection		6	5	
(Type : **RIP RAP; RIP RAP**)				
Guidebank/Spurs		X	X	
Adequacy of Opening		5	5	(channel fills to cap level regularly) 1992/11/27
(Fish Compensation Measure 1 : **NONE**)				
(Fish Compensation Measure 2 : **NONE**)				
Channel General Rating		**4**	**4**	

Maintenance Recommendations

Inspector Recommendations	Year	Inspector Comments	Department Comments	Target Year	Est. Cost	Cat #
REPAIR/REPLACE BRIDGE RAIL	2013	Install 1 A/B nut.				
SEAL CURBS						
PATCH DECK						
OVERLAY DECK						
STRAIGHTEN/REPLACE MEMBERS						
WASHING						
SHOTCRETE REPAIRS						
CORE TIMBER CAPS/CORBELS						
REPAIR/REPLACE TIMBER CAPS						
REPAIR ABUTMENT SCOUR/EROSION						
PLACE ADDITIONAL RIP RAP						
REMOVE DRIFT ACCUMULATION						
INSTALL STRUTS						
OTHER ACTION						
OTHER ACTION						
OTHER ACTION						
OTHER ACTION						

Structural Condition Rating (Last/Now) (%)	**83.3/88.9**	**Sufficiency Rating (Last/Now) (%)**	**80.7/73.5**	Est. Repl. Yr	2035	Maint. Reqd. (Y/N)	Yes

Special Comments for Next Inspection		Department Comments	

Maintenance Reviewed By		Date		Estimated Total	0
Proposed Long-Term Strategy					
On 3-Year Program (Y/N)					
Proposed Action					
Previous Inspector's Name	Tim Davies	Previous Assistant's Name			
Next Inspection Date	31-May-2017	Previous Inspection Date	25-Jan-2005		
Inspection Cycle (Default) (months)	57				
Comment					

Maintenance Recommendations						
Completed Work						
Planned Work						
	Work Type	Status	Rec. Year	Target Year	Inspector Comments	Department Comments
NEW	REPAIR/REPLACE BRIDGE RAIL	PRIORITY REQUIRED	2013		Install 1 A/B nut.	

Structural Condition Rating (Last/Now) (%)	**83.3/88.9**	**Sufficiency Rating (Last/Now) (%)**	**80.7/73.5**	Est. Repl. Yr	2035	Maint. Reqd. (Y/N)	Yes

Special Comments for Next Inspection		Department Comments	HUC6 BOUNDARY: ETZIKOM COULEE - PAKOWKI LAKE; RISK ZONE: WHITE

Previous Inspector's Name	Tim Davies	Previous Assistant's Name	
Next Inspection Date	31-May-2017	Previous Inspection Date	25-Jan-2005
Inspection Cycle (Default) (months)	57		
Comment			

Bridge Culvert Inspection

Bridge File Number	01747 -1 Bridge Culvert	Form Type	CUL1
Year Built	1986	Lot No.	3
Bridge or Town Name	STIRLING	Inspector Name	Garry Roberts
Located Over	KIPP COULEE, 11.9.6, WATERCRS-ST	Inspector Class	BR CLS A
Located On	LOCAL ROAD	Assistant Name	
Water Body Cl./Year		Assistant Class	
Navigabil. Cl./Year		Inspection Date	30-Aug-2012
Legal Land Location	NW SEC 29 TWP 6 RGE 19 W4M	Data Entry By	Lauren Korte
Longitude, Latitude	-112:32:01, 49:30:31	Data Entry Date	03-Oct-2012
Road Authority	STIRLING	Reviewer Name	Joel Wozney
Contract Main. Area	UNDEFINED CMA	Review Date	14-Sep-2012
Clear Roadway/Skew	9 /	Dept. Reviewer Name	Tim Davies
AADT/Year	300 / 2012 (E)	Dept. Review Date	11-Oct-2012
Road Classification	RLU-208-100	Follow-Up By	
Detour Length (km)	1		

Bridge Culvert Information

Number of Culverts	1

Pipe #	Barrel	Span	Rise (or Dia.)	Type	Length	Corr. Profile	Pl./Slab Thickness	Shape
1	MAIN	5690	3530	RPA	19.5	152X51		ARCH

Special Features	
Special Features Comment	

Utilities (Located at)

Utility Attachments			
Telephone		Gas	10m South xing drainage ditch.
Power	2 line power North ditch.	Municipal	2 manholes 30m East in North ditch.
Others		Problem (Y/N)	No
Remarks			

Approach Road / Embankment

		Last	Now	Explanation of Condition
Horizontal Alignment		8	7	On 1st Ave West of 6th St.
Vertical Alignment		9	8	
Roadway Width (m)	6.000			
Embankment		8	7	Concrete slab over pipe.
Sideslope (__:1)	6.0			
(Height of Cover(m) : **0.9**)				
Guardrail (Y/N)	Yes			Missing 1 bolt and also 1 nut at both South and North rails.
Approach Road / Embankment General Rating		**8**	**7**	

Upstream End

Culvert Component		Last	Now	Explanation of Condition
Direction		S		South.
End Treatment (Concrete, Steel, Others, None)	CONCRETE			
Headwall		8	8	Corrugated steel headwall- rest is concrete.
Collar		8	8	
Wingwalls		8	8	
(Shape : **FLARE**)				
Cutoff Wall		N	N	Buried.

Upstream End				
Culvert Component		**Last**	**Now**	**Explanation of Condition**
Bevel End		8	8	
Heaving (mm)	0			
Invert Above/Below Stream Bed	BELOW			
Above/Below (mm)	500			
Scour Protection		7	8	
(Type : **RIP RAP**)				
(Avg. Rock Size(mm) : **300**)				
Scour/Erosion		7	8	
Beavers (Y/N)	No			
Upstream End General Rating		**8**	**8**	

Bridge Culvert Barrel				
Culvert Component		**Last**	**Now**	**Explanation of Condition**
(Pipe # : **1, Primary Span, Location Code: MAIN, Span (mm): 5690, Rise (mm): 3530, Type: RPA**)				
Barrel Last Accessible Date	30-Aug-2012			Span 5710 - CL.
Special Features				
Special Feature				Wooden railing along the South headwall for a walkway between the guardrail & the headwall.
(Type :)				
Special Feature				
(Type :)				
Roof		7	7	
Measured Rise (mm)				
Measured At Ring No.				Est.
Sag (mm)	100			
Percent Sag	2			
Sidewall		7	7	
Measured Span (mm)	5793			
Measured At Ring No.	3			
Deflection (mm)	103			
Percent Deflection	2			
Floor		N	N	Rock and silt.
Bulge (mm)				
Measured At Ring No.				
Abrasion (Y/N)				
Circumferential Seams		7	8	
Separation (mm)	0			
Longitudinal Seams		7	7	
Total No. of Cracked Rings	0			
Total No. of Rings with Two Cracked Seams	0			
Min. Remaining Steel Between Cracks (mm)				On roof only.
Proper Lap (Y/N)	Yes			
Longitudinal Stagger (Y/N)	Yes			
Coating		7	5	
Corrosion By Soil (Y/N)	No			Minor corrosion on floor plates.
Corrosion By Water (Y/N)	Yes			
Camber POS/ZERO/NEG	ZERO			
Ponding (Y/N)	No			

Bridge Culvert Barrel				
Culvert Component		**Last**	**Now**	**Explanation of Condition**
(Pipe # : **1, Primary Span, Location Code: MAIN, Span (mm): 5690, Rise (mm): 3530, Type: RPA**)				
Fish Passage Adequacy		7	7	
Baffle		X	X	
(Type :)				
Waterway Adequacy		7	7	300-400mm silt d/s.
Icing (Y/N)	No			
Silting (Y/N)	Yes			
Drift (Y/N)	No			
Barrel General Rating		**7**	**7**	

Downstream End				
Culvert Component		**Last**	**Now**	**Explanation of Condition**
Direction		N		North.
End Treatment (Concrete, Steel, Others, None)	CONCRETE			
Headwall		8	8	Corrugated headwall- rest is concrete.
Collar		8	8	
Wingwalls		8	8	
(Shape : **FLARE**)				
Cutoff Wall		N	N	
Bevel End		8	8	
Heaving (mm)	0			
Invert Above/Below Stream Bed	BELOW			
Above/Below (mm)	500			
Scour Protection		7	7	
(Type : **RIP RAP**)				
(Avg. Rock Size(mm) : **300**)				
Scour/Erosion		8	7	
Beavers (Y/N)	No			
Downstream End General Rating		**8**	**7**	

Structure Usage				
		Last	**Now**	**Explanation of Condition**
Channel (U/S and D/S)				
Alignment		6	6	It curves up and down stream.
Bank Stability		6	5	
HWM (m below Top of Culvert)				HWM not visible.
Drift (Y/N)	No			
Channel Bottom Degrading/Aggrading	AGGRADING			
Beavers (Y/N)	No			
(Fish Compensation Measure 1 : **NONE**)				
(Fish Compensation Measure 2 : **NONE**)				
Channel General Rating		**6**	**6**	

Maintenance Recommendations						
Inspector Recommendations	Year	Inspector Comments	Department Comments	Target Year	Est. Cost	Cat #
SHOTCRETE REPAIRS						
PLACE ADDITIONAL RIP RAP						
REMOVE DRIFT ACCUMULATION						
INSTALL CONCRETE/STEEL LINING						
INSTALL STRUTS						
INSTALL CONCRETE COLLAR/CUTOFF						
REPAIR SEAMS						
OTHER ACTION	2013	Install 2 missing bolts and 4 nuts at guardrails.				
OTHER ACTION						
OTHER ACTION						
OTHER ACTION						
OTHER ACTION						

Structural Condition Rating (Last/Now) (%)	**77.8/77.8**	**Sufficiency Rating (Last/Now) (%)**	**79.3/77.8**	Est. Repl. Yr	2035	Maint. Reqd. (Y/N)	Yes

Special Comments for Next Inspection		Department Comments	

Maintenance Reviewed By		Date		Estimated Total	0
Proposed Long-Term Strategy					
On 3-Year Program (Y/N)					
Proposed Action					

Previous Inspector's Name	Tim Davies	Previous Assistant's Name	
Next Inspection Date	30-May-2017	Previous Inspection Date	25-Jan-2005
Inspection Cycle (Default) (months)	57		
Comment			

Maintenance Recommendations						
Completed Work						
Planned Work						
	Work Type	Status	Rec. Year	Target Year	Inspector Comments	Department Comments
NEW	OTHER ACTION	PRIORITY REQUIRED	2013		Install 2 missing bolts and 4 nuts at guardrails.	

Structural Condition Rating (Last/Now) (%)	**77.8/77.8**	**Sufficiency Rating (Last/Now) (%)**	**79.3/77.8**	Est. Repl. Yr	2035	Maint. Reqd. (Y/N)	Yes

Special Comments for Next Inspection		Department Comments	HUC6 BOUNDARY: ETZIKOM COULEE - PAKOWKI LAKE; RISK ZONE: WHITE

Previous Inspector's Name	Tim Davies	Previous Assistant's Name	
Next Inspection Date	30-May-2017	Previous Inspection Date	25-Jan-2005
Inspection Cycle (Default) (months)	57		
Comment			

Bridge Inspection

Bridge File Number	73736 -1 Bridge	Form Type	PCS
Year Built/Year Supstr	1987/1987	Lot No.	3
Bridge or Town Name	STIRLING	Inspector Name	Garry Roberts
Located Over	KIPP COULEE, 11.9.6, WATERCRS-ST	Inspector Class	BR CLS A
Located On	LOCAL ROAD	Assistant Name	
Water Body Cl./Year		Assistant Class	
Navigabil. Cl./Year		Inspection Date	30-Aug-2012
Legal Land Location	SW SEC 29 TWP 6 RGE 19 W4M	Data Entry By	Lauren Korte
Longitude, Latitude	-112:31:46, 49:29:51	Data Entry Date	03-Oct-2012
Road Authority	STIRLING	Reviewer Name	Joel Wozney
Contract Main. Area	UNDEFINED CMA	Review Date	12-Sep-2012
Clear Roadway/Skew	7.6 / -15 deg. (LHF)	Dept. Reviewer Name	Tim Davies
AADT/Year	60 / 2012 (E)	Dept. Review Date	11-Oct-2012
Road Classification		Follow-Up By	
Detour Length (km)	2		

Allowable Load (t):	Single	CS1 28	Semi	CS2 49	Train	CS3 62	---> On Critical Spans --->Critical Member
Design Loading:		MS23					---> Primary Span

Posting Information

Required Load Posting (t)			Single		Semi		Truck Train	
Posted Loading (t)			Single		Semi		Truck Train	
Posted:	Lane	NB	At Junction (Y/N)	No	In Advance (Y/N)	No	At Bridge (Y/N)	No
Posted:	Lane	SB	At Junction (Y/N)	No	In Advance (Y/N)	No	At Bridge (Y/N)	No
Remarks	Not required.							

Hazard Marker At Bridge (Y/N)	Yes
Remarks	SW and NW corner marker is missing.
Other Sign Types	

Utilities (Located at)

Utility Attachments			
Telephone		Gas	
Power	Crosses 60m North.	Municipal	
Others		Problem (Y/N)	No
Remarks	Unknown cables at NW.		

Approach Road

		Last	Now	Explanation of Condition
Horizontal Alignment		5	6	T-intersection South 200m.
Vertical Alignment		5	5	Rises to the North. on 5th St & North of 7th Ave.
Roadway Width (m)	6.000			Gravel approaches.
Approach Bump		6	5	
Guardrail (Y/N)	Yes			Wrong lap at SW and NE turndown ends. Not thriebeam.
Guardrail		8	5	
Length (m)	10.000			
Current Standard (Y/N)	No			
Termination Type	TURNED DOWN			
Drainage		8	7	
Approach Road General Rating		**5**	**5**	

Superstructure								
Bridge Component						**Last**	**Now**	**Explanation of Condition**
(Primary Span : **SM, 1 Spans, Lengths(m): 10, A-Ident Number:**)								
Special Features								
Special Feature							X	
(Type :)								
Special Feature							X	
(Type :)								
Wearing Surface/Deck Top Detail Ratings								
	N (%)		1 (%)	2 (%)	3 (%)			
Last								
Now	0.0		0.0	0.0	0.0			
Wearing Surface						X	X	
(Material Type :)								
(Thickness(mm) :)								
Lateral Connection Problem (Y/N)		No						
Deck Top						7	6	Moderate gravel abrasion.
Deck Rideability						7	7	
Deck Joints						7	7	Buffer angles.
Bump (Y/N)		No						
Deck Drainage						7	6	No drains.
Drains Clogged (Y/N)								
Curbs/Median						8	8	
(Curb Type : **Standard**)								
Scaling (Percent Area)		0						
Bridge Rail						8	8	Single layer.
(Type : **GALVANIZED STEEL FLEX BEAM**)								
Bridge Rail Posts						8	8	
(Type : **GALVANIZED POST STEEL;GALVANIZED POST STEEL**)								
Bridge Rail/Posts Coating						8	7	
(Type : **GALVANIZED**)								
Sidewalk						X	X	
Girder Detail Ratings								
	N (count)		1 (count)	2 (count)	3 (count)			
Last								
Now	0		0	0	0			
Girders						8	8	
Last Complete Inspection Date		30-Aug-2012						
Cracking (Y/N)		No						
Spalling (Percent Area)		0						
Lift or Connector Pocket Grouted (Y/N)		Yes						
(Number Of Girders : **7**)								
Span Alignment Problems								
Vertical (Y/N)		No						
Horizontal (Y/N)		No						
Superstructure General Rating						**8**	**8**	

Substructure

Bridge Component		Last	Now	Explanation of Condition
Abutments				
(Extended Backwall Piles (Y/N) : **Y**)				
(Extended Backwall Piles Spacing(mm) : **1200**)				
(Total Number of Caps/Corbels : **1:1**)				
Bearing Seats/Caps/Corbels Detail Ratings				
	N (count)	1 (count)	2 (count)	3 (count)
Last				
Now	0	0	0	0
Bearing Seats/Caps/Corbels		8	8	
(Type : **STEEL**)				
(Depth(mm) : **305**)				
(Width(mm) : **305**)				
Backwalls/Breastwalls		4	8	T.T breastwalls added and concrete filled.
Greatest Height (m)	2.60			
Wingwalls		8	7	
(Total Number of Bearing Piles : **8:8**)				
Piles Detail Ratings				
	N (count)	1 (count)	2 (count)	3 (count)
Last				
Now	0	0	0	0
Piles		8	7	
Paint/Coating		X	X	
Abutment Stability		8	8	
Scour/Erosion		4	6	
Piers/Bents				
(Type :)				
(Total Number of Caps/Corbels :)				
Bearing Seats/Caps/Corbels Detail Ratings				
	N (count)	1 (count)	2 (count)	3 (count)
Last				
Now				
Bearing Seats/Caps/Corbels		X	X	
(Type :)				
(Depth(mm) :)				
(Width(mm) :)				
(Total Number of Bearing Piles :)				
Piles Detail Ratings				
	N (count)	1 (count)	2 (count)	3 (count)
Last				
Now				
Pier Shaft/Piles		X	X	
Greatest Height (m)				
Bracing/Struts/Sheathing		X	X	
Nose Plate		X	X	
Paint/Coating		X	X	
(Colour Description :)				
(Colour Code :)				

Substructure				
Bridge Component		**Last**	**Now**	**Explanation of Condition**
Pier Stability		X	X	
Scour		X	X	
Debris (Y/N)	No			
Substructure General Rating		**4**	**7**	

Structure Usage				
		Last	**Now**	**Explanation of Condition**
Channel				
(U/S Direction : **E**)				Curves d/s 15m.
(D/S Direction : **W**)				
Alignment		6	6	
Bank Stability		4	5	
HWM (m below Top of Curb)				HWM not visible.
Drift (Y/N)	No			
Slope Protection		4	6	
(Type : **RIP RAP; RIP RAP**)				
Guidebank/Spurs		X	X	
Adequacy of Opening		7	6	
(Fish Compensation Measure 1 : **NONE**)				
(Fish Compensation Measure 2 : **NONE**)				
Channel General Rating		**4**	**6**	

Maintenance Recommendations

Inspector Recommendations	Year	Inspector Comments	Department Comments	Target Year	Est. Cost	Cat #
REPAIR/REPLACE BRIDGE RAIL						
SEAL CURBS						
PATCH DECK						
OVERLAY DECK						
STRAIGHTEN/REPLACE MEMBERS						
WASHING						
SHOTCRETE REPAIRS						
CORE TIMBER CAPS/CORBELS						
REPAIR/REPLACE TIMBER CAPS						
REPAIR ABUTMENT SCOUR/EROSION						
PLACE ADDITIONAL RIP RAP						
REMOVE DRIFT ACCUMULATION						
INSTALL STRUTS						
OTHER ACTION	2013	Install 2 hazard markers.				
OTHER ACTION						
OTHER ACTION						
OTHER ACTION						

Structural Condition Rating (Last/Now) (%)	**66.7/83.3**	**Sufficiency Rating (Last/Now) (%)**	**78.3/79.1**	Est. Repl. Yr	2035	Maint. Reqd. (Y/N)	Yes

Special Comments for Next Inspection		Department Comments	

Maintenance Reviewed By		Date		Estimated Total	0

Proposed Long-Term Strategy	
On 3-Year Program (Y/N)	
Proposed Action	

Previous Inspector's Name	Tim Davies	Previous Assistant's Name	
Next Inspection Date	30-May-2017	Previous Inspection Date	25-Jan-2005
Inspection Cycle (Default) (months)	57		
Comment			

Maintenance Recommendations						
Completed Work						
Planned Work						
	Work Type	Status	Rec. Year	Target Year	Inspector Comments	Department Comments
NEW	OTHER ACTION	PRIORITY REQUIRED	2013		Install 2 hazard markers.	

Structural Condition Rating (Last/Now) (%)	**66.7/83.3**	**Sufficiency Rating (Last/Now) (%)**	**78.3/79.1**	Est. Repl. Yr	2035	Maint. Reqd. (Y/N)	Yes

Special Comments for Next Inspection		Department Comments	HUC6 BOUNDARY: ETZIKOM COULEE - PAKOWKI LAKE; RISK ZONE: WHITE

Previous Inspector's Name	Tim Davies	Previous Assistant's Name	
Next Inspection Date	30-May-2017	Previous Inspection Date	25-Jan-2005
Inspection Cycle (Default) (months)	57		
Comment			

APPENDIX I:

TRANSPORTATION COST ESTIMATES

Village of Stirling

Infrastructure Master Plan
Transportation Network Upgrades

UNIT PRICE COST ESTIMATES

RESIDENTIAL LOCAL ROAD - PAVED ROAD RECONSTRUCTION

	ROAD RECONSTRUCTION (Per 1.0m of Length)	QUANTITY	UNIT	UNIT PRICE	COST
1	Mobilization/Demobilization/Bonding & Insurance/Profit/Traffic Accomr	1	LS	$ 240.00	$ 240.00
2	Asphalt Removal	11	m^2	$ 10.00	$ 110.00
3	Site Stripping	4	m^2	$ 2.00	$ 8.00
4	Waste Excavation	4	m^3	$ 20.00	$ 80.00
5	Subgrade Preparation	11.4	m^2	$ 5.00	$ 57.00
6	250mm Base Granular Material	10.2	m^2	$ 15.00	$ 153.00
7	Prime Coat	10.2	m^2	$ 1.15	$ 11.73
8	90mm Asphalt	10.2	m^2	$ 26.00	$ 265.20
9	Rolled Curb and Gutter	2	m	$ 90.00	$ 180.00
10	Topsoil and Sod	4	m^2	$ 15.00	$ 60.00
				SUBTOTAL	$ 1,160.00
CONTINGENCY (20%)					$ 230.00
MATERIAL TESTING (2.5%)					$ 30.00
ENGINEERING (10%)					$ 70.00
				TOTAL COST PER LINEAR METER OF ROAD RECONSTRUCTION	**$ 1,500.00**

COMMERCIAL/INDUSTRIAL LOCAL ROAD - PAVED ROAD RECONSTRUCTION

	ROAD RECONSTRUCTION (Per 1.0m of Length)	QUANTITY	UNIT	UNIT PRICE	COST
1	Mobilization/Demobilization/Bonding & Insurance/Profit/Traffic Accomr	1	LS	$ 260.00	$ 260.00
2	Asphalt Removal	11	m^2	$ 10.00	$ 110.00
3	Site Stripping	4	m^2	$ 2.00	$ 8.00
4	Waste Excavation	4.5	m^3	$ 20.00	$ 90.00
5	Subgrade Preparation	12.6	m^2	$ 5.00	$ 63.00
6	250mm Base Granular Material	11.4	m^2	$ 15.00	$ 171.00
7	Prime Coat	11.4	m^2	$ 1.15	$ 13.11
8	50mm Asphalt (Base Lift)	11.4	m^2	$ 14.40	$ 164.16
9	Tack Coat	11.4	m^2	$ 1.15	$ 13.11
10	50mm Asphalt (Surface Lift)	11.4	m^2	$ 14.40	$ 164.16
11	Rolled Curb and Gutter	2	m	$ 90.00	$ 180.00
12	Topsoil and Sod	4	m^2	$ 15.00	$ 60.00
				SUBTOTAL	$ 1,300.00
CONTINGENCY (20%)					$ 260.00
MATERIAL TESTING (2.5%)					$ 40.00
ENGINEERING (10%)					$ 80.00
				TOTAL COST PER LINEAR METER OF ROAD RECONSTRUCTION	**$ 1,700.00**

10.0m WIDE ROAD - PAVED ROAD REHABILITATION

	ROAD REHABILITATION (Per 1.0m of Length)	QUANTITY	UNIT	UNIT PRICE	COST
1	Mobilization/Demobilization/Bonding & Insurance/Profit/Traffic Accomn	1	LS	$ 60.00	$ 60.00
2	Mill Asphalt Edges	2	m	$ 10.00	$ 20.00
3	Leveling Course	0.2	tonne	$ 120.00	$ 24.00
9	Tack Coat	11.4	m^2	$ 1.15	$ 13.11
10	50mm Asphalt (Overlay)	11.4	m^2	$ 14.40	$ 164.16
				SUBTOTAL	$ 280.00
CONTINGENCY (20%)					$ 60.00
MATERIAL TESTING (2.5%)					$ 10.00
ENGINEERING (10%)					$ 20.00
				TOTAL COST PER LINEAR METER OF ROAD REHABILITATION	**$ 370.00**

1.4m WIDE SIDEWALK - CONCRETE SIDEWALK RECONSTRUCTION

	SIDEWALK RECONSTRUCTION (Per 1.0m of Length)	QUANTITY	UNIT	UNIT PRICE	COST
1	Mobilization/Demobilization/Bonding & Insurance/Profit/Traffic Accomn	1	LS	$ 90.00	$ 90.00
2	Concrete Removal	1.4	m^2	$ 20.00	$ 28.00
3	Site Stripping	1.2	m^2	$ 2.00	$ 2.40
4	Waste Excavation	0.2	m^3	$ 20.00	$ 4.00
5	130mm Thick Concrete Sidewalk	1.4	m^2	$ 200.00	$ 280.00
6	Topsoil and Sod	1.2	m^2	$ 15.00	$ 18.00
				SUBTOTAL	$ 420.00
CONTINGENCY (20%)					$ 80.00
MATERIAL TESTING (2.5%)					$ 10.00
ENGINEERING (10%)					$ 30.00
				TOTAL COST PER LINEAR METER OF SIDEWALK RECONSTRUCTION	**$ 540.00**

Paved Road Reconstruction and Rehabilitation Cost Estimates

ASTM PCI CONDITION	SEG_ID	STREET	FROM	TO	FUNC	SURF	LENGTH	RECONSTRUCTION ESTIMATED COST	REHABILITATION ESTIMATED COST
Good	SRRC0005	3 Avenue	5 Street	4A Street	Local R	Asphalt	117.6	$ 176,400.00	$ 43,512.00
Satisfactory	SRRC0013	2 Avenue	6A Street	6 Street	Local R	Cold Mix	118.9	$ 178,350.00	$ 43,993.00
Failed	SRRC0014	6A Street	3 Avenue	2 Avenue	Local R	Cold Mix	231.4	$ 347,100.00	$ 85,618.00
Satisfactory	SRRC0020	1 Avenue	2 Street	1 Street	Local R	Cold Mix	223.5	$ 335,250.00	$ 82,695.00
Good	SRRC0021	1 Avenue	2A Street	2 Street	Local R	Cold Mix	119.0	$ 178,500.00	$ 44,030.00
Good	SRRC0024	1 Avenue	3 Street	2A Street	Local R	Cold Mix	115.8	$ 173,700.00	$ 42,846.00
Failed	SRRC0025	3 Street	2 Avenue	1 Avenue	Local R	Cold Mix	228.9	$ 343,350.00	$ 84,693.00
Fair	SRRC0027	3 Street	3 Avenue	2 Avenue	Local R	Cold Mix	231.6	$ 347,400.00	$ 85,692.00
Good	SRRC0029	3 Avenue	3 Street	2A Street	Local R	Asphalt	115.8	$ 173,700.00	$ 42,846.00
Good	SRRC0031	3 Avenue	2 Street	1 Street	Local R	Asphalt	226.7	$ 340,050.00	$ 83,879.00
Fair	SRRC0032	2 Street	4 Avenue	3 Avenue	Local R	Cold Mix	231.5	$ 347,250.00	$ 85,655.00
Satisfactory	SRRC0033	4 Avenue	2 Street	1 Street	Local CI	Asphalt	226.7	$ 385,390.00	$ 83,879.00
Satisfactory	SRRC0034	4 Avenue	3 Street	2 Street	Local CI	Asphalt	231.5	$ 393,550.00	$ 85,655.00
Good	SRRC0035	3 Street	4 Avenue	3 Avenue	Local R	Asphalt	231.8	$ 347,700.00	$ 85,766.00
Good	SRRC0036	3 Avenue	3A Street	3 Street	Local R	Asphalt	115.8	$ 173,700.00	$ 42,846.00
Fair	SRRC0037	4 Avenue	4 Street	3 Street	Local CI	Asphalt	231.6	$ 393,720.00	$ 85,692.00
Good	SRRC0038	4 Street	4 Avenue	3 Avenue	Local R	Asphalt	231.6	$ 347,400.00	$ 85,692.00
Good	SRRC0039	3 Avenue	4 Street	3A Street	Local R	Asphalt	115.8	$ 173,700.00	$ 42,846.00
Poor	SRRC0042	4 Street	3 Avenue	2 Avenue	Local R	Cold Mix	231.7	$ 347,550.00	--
Poor	SRRC0045	5 Street	3 Avenue	2 Avenue	Local R	Cold Mix	231.6	$ 347,400.00	--
Satisfactory	SRRC0046	4 Street	2 Avenue	1 Avenue	Local R	Cold Mix	230.5	$ 345,750.00	$ 85,285.00
Good	SRRC0051	1 Avenue	8 Street	6 Street	Local R	Cold Mix	463.6	$ 695,400.00	$ 171,532.00
Poor	SRRC0052	6 Street	2 Avenue	1 Avenue	Local R	Cold Mix	230.2	$ 345,300.00	--
Poor	SRRC0054	3 Avenue	6 Street	5 Street	Local R	Cold Mix	229.4	$ 344,100.00	--
Failed	SRRC0055	6 Street	3 Avenue	2 Avenue	Local R	Cold Mix	229.6	$ 344,400.00	--
Good	SRRC0058	3 Avenue	6A Street	6 Street	Local R	Cold Mix	117.8	$ 176,700.00	$ 43,586.00
Fair	SRRC0059	6 Street	4 Avenue	3 Avenue	Local R	Cold Mix	231.7	$ 347,550.00	$ 85,729.00
Satisfactory	SRRC0060	4 Avenue	6 Street	5 Street	Local CI	Asphalt	229.0	$ 389,300.00	$ 84,730.00
Satisfactory	SRRC0061	4 Avenue	5 Street	4A Street	Local CI	Asphalt	115.8	$ 196,860.00	$ 42,846.00
Good	SRRC0062	4A Street	4 Avenue	3 Avenue	Local R	Asphalt	231.6	$ 347,400.00	$ 85,692.00
Good	SRRC0063	4 Avenue	4A Street	4 Street	Local CI	Asphalt	115.8	$ 196,860.00	$ 42,846.00
Good	SRRC0064	3 Avenue	4A Street	4 Street	Local R	Asphalt	114.2	$ 171,300.00	$ 42,254.00
Good	SRRC0065	4A Street	3 Avenue	2 Avenue	Local R	Asphalt	231.4	$ 347,100.00	$ 85,618.00
Good	SRRC0066	5 Street	4 Avenue	3 Avenue	Local R	Asphalt	231.6	$ 347,400.00	$ 85,692.00
Good	SRRC0067	5 Street	5 Avenue	4 Avenue	Local R	Asphalt	231.5	$ 347,250.00	$ 85,655.00
Good	SRRC0068	5 Avenue	5 Street	4 Street	Local R	Asphalt	233.5	$ 350,250.00	$ 86,395.00
Satisfactory	SRRC0069	4 Street	5 Avenue	4 Avenue	Local R	Cold Mix	231.4	$ 347,100.00	$ 85,618.00
Good	SRRC0070	5 Avenue	4 Street	3 Street	Local R	Asphalt	229.6	$ 344,400.00	$ 84,952.00

Paved Road Reconstruction and Rehabilitation Cost Estimates

ASTM PCI CONDITION	SEG_ID	STREET	FROM	TO	FUNC	SURF	LENGTH	RECONSTRUCTION ESTIMATED COST	REHABILITATION ESTIMATED COST
Failed	SRRC0071	3 Street	5 Avenue	4 Avenue	Local CI	Asphalt	231.5	$ 393,550.00	--
Good	SRRC0072	5 Avenue	3 Street	2 Street	Local CI	Asphalt	231.6	$ 393,720.00	$ 85,692.00
Good	SRRC0073	2 Street	5 Avenue	4 Avenue	Local CI	Asphalt	233.1	$ 396,270.00	$ 86,247.00
Good	SRRC0074	5 Avenue	2 Street	1 Street	Local CI	Asphalt	226.6	$ 385,220.00	$ 83,842.00
Poor	SRRC0075	3 Street	6 Avenue	5 Avenue	Local R	Asphalt	231.8	$ 347,700.00	--
Poor	SRRC0076	6 Avenue	3 Street	2 Street	Local R	Cold Mix	228.4	$ 342,600.00	--
Fair	SRRC0077	2 Street	6 Avenue	5 Avenue	Local R	Cold Mix	230.1	$ 345,150.00	$ 85,137.00
Good	SRRC0078	6 Avenue	4 Street	3 Street	Local R	Cold Mix	229.6	$ 344,400.00	$ 84,952.00
Poor	SRRC0079	4 Street	6 Avenue	5 Avenue	Local R	Cold Mix	225.7	$ 338,550.00	--
Fair	SRRC0081	6 Avenue	2 Street	1 Street	Local R	Cold Mix	226.7	$ 340,050.00	$ 83,879.00
Fair	SRRC0083	5 Street	7 Avenue	5 Avenue	Local R	Cold Mix	461.4	$ 692,100.00	$ 170,718.00
TOTAL RECONSTRUCTION OR REHABILITATION COST								$ 16,154,890.00	$ 3,116,732.00

Gravel Road Reconstruction Cost Estimates

PASER CONDITION	SEG_ID	STREET	FROM	TO	FUNC	LENGTH	RECONSTRUCTION ESTIMATED COST
Fair	SRRC0007	2 Avenue	5 Street	4A Street	Local R	115.8	$ 173,746.36
Poor	SRRC0008	2 Avenue	2A Street	2 Street	Local R	117.1	$ 175,723.69
Poor	SRRC0011	5 Avenue	End	5 Street	Local R	58.4	$ 87,574.69
Poor	SRRC0012	7 Street	3 Avenue	End	Local R	162.8	$ 244,125.05
Fair	SRRC0016	5 Street	1 Avenue	Hartley Avenue	Local R	213.2	$ 319,741.42
Fair	SRRC0017	Hartley Avenue	5 Street	4 Street	Local R	217.7	$ 326,560.20
Fair	SRRC0018	4 Street	Hartley Avenue	Village Limits	Local R	211.3	$ 316,884.22
Fair	SRRC0019	4 Street	1 Avenue	Hartley Avenue	Local R	218.5	$ 327,783.81
Fair	SRRC0022	2A Street	2 Avenue	1 Avenue	Local R	228.9	$ 343,361.20
Poor	SRRC0026	2 Avenue	3 Street	2A Street	Local R	115.8	$ 173,684.71
Fair	SRRC0028	2A Street	3 Avenue	2 Avenue	Local R	231.6	$ 347,445.03
Poor	SRRC0040	3A Street	3 Avenue	2 Avenue	Local R	231.5	$ 347,317.37
Fair	SRRC0041	2 Avenue	4 Street	3A Street	Local R	115.8	$ 173,677.65
Fair	SRRC0043	2 Avenue	3A Street	3 Street	Local R	115.8	$ 173,668.24
Fair	SRRC0044	2 Avenue	4A Street	4 Street	Local R	115.7	$ 173,606.26
Fair	SRRC0048	5 Street	2 Avenue	1 Avenue	Local R	230.5	$ 345,784.60
Fair	SRRC0053	2 Avenue	6 Street	5 Street	Local R	228.5	$ 342,727.09
Poor	SRRC0056	3 Avenue	End	7 Street	Local R	59.3	$ 88,933.68
Poor	SRRC0057	3 Avenue	7 Street	6A Street	Local R	115.8	$ 173,678.30
Poor	SRRC0080	2 Street	7 Avenue	6 Avenue	Local R	232.6	$ 348,829.34
Poor	SRRC0082	7 Avenue	2 Street	1 Street	Local R	224.1	$ 336,162.34
Satisfactory	SRRC0084	4 Avenue	7 Street	6 Street	Local CI	234.1	$ 397,930.89
Satisfactory	SRRC0085	4 Avenue	8 Street	7 Street	Local CI	230.3	$ 391,539.58
Fair	SRRC0086	7 Street	8 Avenue	4 Avenue	Local R	899.4	$1,349,124.37
Fair	SRRC0087	6 Street	8 Avenue	7 Avenue	Local R	211.6	$ 317,469.61
Fair	SRRC0088	7 Avenue	6 Street	5 Street	Local R	212.2	$ 318,323.94
Satisfactory	SRRC0095	4 Street	7 Avenue	8 Avenue	Local R	200.0	$ 299,936.79
Satisfactory	SRRC0096	7 Avenue	5 Street	4 Street	Local R	222.2	$ 333,370.81
Poor	SRRC0200	2 Street	3 Avenue	2 Avenue	Local R	284.6	$ 426,958.69
TOTAL RECONSTRUCTION TO PAVED ROAD STANDARD							**$ 9,175,669.91**

Concrete Sidewalk Reconstruction Cost Estimates

ASTM PCI CONDITION	SEGID	STREET	FROM	TO	BLOCK FACE	LENGTH (m)	RECONSTRUCTION ESTIMATED COST
Good	SRSWLK0001	2 Street	7 Avenue	6 Avenue	W	332.3	$ 179,442.00
Fair	SRSWLK0002	2 Street	6 Avenue	5 Avenue	W	94.5	$ 51,030.00
Fair	SRSWLK0003	5 Avenue	3 Street	2 Street	N	35.9	$ 19,386.00
Poor	SRSWLK0004	3 Street	6 Avenue	5 Avenue	W	150.9	$ 81,486.00
Fair	SRSWLK0005	3 Street	5 Avenue	4 Avenue	E	46.0	$ 24,840.00
Fair	SRSWLK0006	3 Street	5 Avenue	4 Avenue	W	164.1	$ 88,614.00
Satisfactory	SRSWLK0007	3 Street	4 Avenue	3 Avenue	E	47.2	$ 25,488.00
Fair	SRSWLK0008	3 Street	4 Avenue	3 Avenue	W	91.7	$ 49,518.00
Poor	SRSWLK0009	3 Street	3 Avenue	2 Avenue	W	156.8	$ 84,672.00
Poor	SRSWLK0010	2 Avenue	3 Street	2A Street	N	83.8	$ 45,252.00
Fair	SRSWLK0011	2 Avenue	4 Street	3 Street	N	136.4	$ 73,656.00
Poor	SRSWLK0012	2 Avenue	5 Street	4 Street	N	16.7	$ 9,018.00
Fair	SRSWLK0013	2 Avenue	6 Street	5 Street	N	125.0	$ 67,500.00
Fair	SRSWLK0014	3 Avenue	3 Street	2A Street	N	17.9	$ 9,666.00
Fair	SRSWLK0015	3 Avenue	2A Street	2 Street	N	22.6	$ 12,204.00
Poor	SRSWLK0016	2 Street	4 Avenue	3 Avenue	W	41.6	$ 22,464.00
Poor	SRSWLK0017	4 Avenue	2 Street	1 Street	N	155.2	$ 83,808.00
Satisfactory	SRSWLK0018	4 Avenue	3 Street	2 Street	N	8.7	$ 4,698.00
Poor	SRSWLK0019	4 Avenue	3 Street	2 Street	S	14.0	$ 7,560.00
Fair	SRSWLK0020	4 Avenue	4 Street	3 Street	N	29.8	$ 16,092.00
Fair	SRSWLK0021	4 Avenue	4 Street	3 Street	S	48.4	$ 26,136.00
Poor	SRSWLK0022	4 Avenue	4A Street	4 Street	N	77.0	$ 41,580.00
Poor	SRSWLK0023	4 Avenue	5 Street	4A Street	N	462.3	$ 249,642.00
Poor	SRSWLK0024	4 Avenue	6 Street	5 Street	N	97.6	$ 52,704.00
Poor	SRSWLK0025	5 Street	5 Avenue	4 Avenue	W	48.8	$ 26,352.00
Fair	SRSWLK0026	5 Street	5 Avenue	4 Avenue	W	199.6	$ 107,784.00
Poor	SRSWLK0027	5 Street	4 Avenue	3 Avenue	E	85.9	$ 46,386.00
Fair	SRSWLK0028	4 Street	5 Avenue	4 Avenue	W	105.2	$ 56,808.00
Poor	SRSWLK0029	4 Street	3 Avenue	2 Avenue	W	83.9	$ 45,306.00
TOTAL SIDEWALK RECONSTRUCTION VALUE							$1,609,092.00