REPORT NO.: 161-02769-00-07

ARBORG BIFROST-RIVERTON SUSTAINABLE COMMUNITY PLAN

MUNICIPAL SERVICING ASSESSMENT

SEPTEMBER 2017

ARBORG BIFROST-RIVERTON SUSTAINABLE COMMUNITY PLAN

MUNICIPAL SERVICING ASSESSMENT

Arborg Bifrost Riverton CDC

Project No.: 161-02769-00-07
Date: September 2017

WSP
111-93 Lombard Avenue
Winnipeg, MB R3B 3B1

Phone: 204-943-3178
Fax: 204-943-4948
www.wsp.com

TABLE OF CONTENTS

TABLES

1 INTRODUCTION

The Municipal Servicing Assessment is one of four documents that support the Arborg Bifrost Riverton Sustainable Community Action Plan (the Plan). This document describes the infrastructure which serves the Arborg-Bifrost region, the capacity of that infrastructure and its ability to support sustainable development. It also describes the potential ways of servicing other settlement areas and rural districts. The information contained herein is based upon reports, plans, correspondence and data provided by the Municipality of Bifrost-Riverton, the Town of Arborg and WSP archives; and also upon site visits and meetings with the public works personnel of the two municipalities on 2016 09 07.

2 WATER

2.1 REGIONAL OVERVIEW

The Manitoba Interlake Region is underlain by a massive formation of limestone which is randomly fractured. This geological formation forms an aquifer known as the “fractured carbonate aquifer”. It is generally capable of supporting wells almost everywhere, but output capacity varies. Some districts benefit from significant degrees of fracturing which generate high volumes of groundwater. Water quality also varies, but generally it is potable (suitable for human consumption). Unfortunately, the water generally has high concentrations of calcium and magnesium, which constitute hardness, and moderately high iron. Varying concentrations of iron are also prevalent to a moderate degree. These dissolved minerals do not pose a health hazard but they do constitute an aesthetic challenge.

2.1.1 CARBONATE AQUIFER

The carbonate aquifer actually extends well beyond the Interlake. It stretches from the uplands in southeast Manitoba known as the Sandilands. This region is elevated by several hundred metres above the Arborg-Bifrost region. Consisting of over 100 m (metres) of alluvial and lacustrine sand deposits left behind as a remnant of Lake Agassiz and the last period of glaciation which preceded it, it absorbs most of the melting snow and rain which fall upon it. Gravity draws the water in a general northwestern direction. As the waters conveyed within this granular formation move northwest, they seep into the underlying limestone (known as the “Red River Formation”) and below that, into sandstone. The depth of these formations generally increases from east to west. While in the southeast, the carbonate aquifer’s primary recharge source is the Sandilands, there are secondary sources, through thin overburden in municipalities like Hanover and Springfield, where granular deposits are located. Local precipitation percolates through the surficial sands and gravels into the aquifers below. Bird’s Hill is the best known surficial granular deposit but there are other smaller ones which also contribute recharge waters to the aquifers. Also, in districts like Stony Mountain and Stonewall, the limestone bedrock – being the carbonate aquifer - extends to ground surface and above. Again, there are other areas in the Interlake where the bedrock comes to or close to the surface, providing a conduit for surface waters to enter the aquifer. There are numerous locations in and around Bifrost where either the bedrock or overlying granular deposits do the same. Gravel quarries are often located in such areas.

It may be noted that as one progresses west and north-west, the carbonate and sandstone geological formations are separated by solid, relatively impervious aquitards. This results in waters from the various formations having differing chemistry and variable quality.

2.1.2 VULNERABILITIES

While this sort of geology provides a useful means for aquifers to be recharged, there can be risks of surficial pollution entering the aquifers. This does not appear to create any general challenges for Bifrost but localized problems may occur where livestock operations are contiguous to locations where overburden is minimal and sand, gravel and/or bedrock are at or near the surface.

2.1.3 SUSTAINABILITY

The expansive nature of this massive aquifer, the multiple recharge zones, the relatively high transmissivity in most districts and the relative degree of environmental protection in most districts characterize the fractured carbonate formation as a highly sustainable water source, with generally high capacity and substantial reliability in terms of drought resistance. The relatively high "water table" – the extent to which groundwater can rise in a well casing which penetrates into the confined aquifer – does pose some challenges with respect to potential extraneous flows entering sewer systems. Unrestrained flow from artesian wells and natural springs, can also impact drainage courses, particularly in winter when those drains can be affected by ice dams.

2.1.4 WATER QUALITY

While the combination of surficial granular deposits and the fractured nature of the limestone provide a good water source from the perspective of quantity, the limestone itself, and much of the granular deposits, do affect the quality of water that passes through it. The very nature of the geology imparts specific characteristics to the water that passes through, as water is by its nature a pure solvent. The primary characteristic of the geology is that it is calcareous, which also affects the overlying soils. This reflects the primary mineral comprising the aquifer: calcium carbonate (explaining why it is called the "carbonate aquifer"). In the Interlake, the proportion of the rock which is magnesium carbonate is relatively high, as well. Calcium and magnesium carbonates are the major constituents of "hardness", which is characterized by scale formation in kettles, piping and plumbing fixtures. While iron is not a significant component of the rock, its nature is such that it still imparts certain characteristics to the water, namely its tendency to create orange, red or brown staining to porcelain, plumbing fixtures and laundry.

There are numerous other minerals present in water from the carbonate aquifer but hardness and iron have the main impacts on water quality. None is of concern from a human health perspective; these substances are benign and can even be considered essential to human health. However, the quantities present in the carbonate aquifer do constitute a nuisance, and are in sufficient concentrations that they exceed the aesthetic objectives set by the Guidelines for Canadian Drinking Water Quality (GCDWQ), which have been adopted by the Manitoba Drinking Water Safety Act. Hardness is deemed to be objectionable when its concentration (expressed as equivalent calcium carbonate, $CaCO_3$) exceeds 200 mg/L (milligrams per litre). Iron is deemed to be objectionable when it exceeds 0.3 mg/L, although long-term contact with iron exceeding 0.1 or 0.2 mg/L can still cause staining. In the Bifrost region, hardness ranges from about 400 mg/L to 500 mg/L, while iron is typically 0.3-1.0 mg/L.

Turbidity is another challenge which manifests itself in many wells. Turbidity is a measure to describe suspended, settleable particulate matter in water. In this aquifer, it consists mainly of particles of precipitated iron and limestone ("rock flour"). While not posing any direct health threats, turbidity may shield pathogenic organisms and interfere with the ability of chlorine to disinfect water.

2.2 ARBORG

Arborg developed its community water system in 1965, to designs prepared by Templeton Engineering. This public water system has been extended and upgraded a number of times over the past five decades. The water system consists of a well developing the fractured carbonate aquifer; a pipeline to a Water Treatment Plant (WTP); a WTP providing filtration and disinfection; a treated water reservoir; high lift pumps; a piped distribution system with nearly 100 fire hydrants; and service lines into most of the properties in the community. As of the time of preparation of the latest water utility rate report (2015), there were 552 water service customers, 524 of which were served by 15 mm (millimetres) water meters on 20 mm service lines. The balance are commercial and institutional services, consisting of 20 mm to 75 mm meters on service lines of up to 100 mm.

2.2.1 CURRENT WATER DEMAND

The population of Arborg as reported by Statistics Canada census data in 2011 was 1,152 people. At the time this report was written, the estimated population for 2016 was 1,200. The 2016 Statistics Canada census data was released during this study and the reported population is 1,232 people.

Historic water data provided by the community is not reliable, as there have been meter malfunctions in recent years. Apparent average daily gross consumption data follows (“gross” means water delivered by the WTP into the distribution system; “net” water consumption is the cumulative total registered on individual consumer meters):

Table 2-1 Average Daily Water Demand

YEAR	2011	2012	2013	2014	2015	2016*	2016**
Water Use	343,600	227,400	241,300	145,500	157,800	243,600*	300,000**

Notes:
Average daily water demand (in litres)
*2016: 7 months’ data
**Estimate based on replacement meter

The distribution meter was replaced on March 9, 2016. Recorded apparent consumption more than doubled between March and April. This data discrepancy makes it difficult to ascertain actual water demand. There is no way of knowing whether the meter had a consistent error, where a relatively constant degree of under-recording was occurring; or whether the problem was of an erratic nature. Looking back over the longer term, there is a note in our 1997 Infrastructure study that there had been “occasional total failures of the plant meter in the last few years of operation….an average 209,000 litres per day (L/d) were metered leaving the plant (in the previous decade, while) an average 325,000 L/d was registered on consumer meters”. Thus, it appears that meter inaccuracy has been a long-standing problem.

There was detailed analysis done of data at the time of our study. In 1996-1997, consumer meters were registering an average net water demand of 231,000 L/d. The estimated gross demand (water pumped into distribution) was 295,000 L/d, with the 22% difference attributable to consumer meter inaccuracies, leakage, iron watermain breaks, fire suppression, watermain flushing and sewer cleaning, etc. To the extent that population has grown by over 18% from 1996 (StatsCan: 1,012 residents) to 1,232 people today, it might be prudent to assume that water demand has increased proportionately. However, water rates have increased, which likely dampened demand and encouraged conservation. New housing stock has been built, and numerous studies have shown up to 50% reduction in water demand by residents in new homes. Also, there have been far fewer watermain breaks as more iron mains have been replaced. The most recent data indicates that since the plant meter was replaced, average demand has been 305,500 L/d. To the extent that the data is skewed toward the spring/summer period, it will be assumed that 300,000 L/d (equivalent to 3.5) is the most prudent estimate of average water demand. On the basis of 1,200 residents, the average gross demand per person would be 250 L/c.d (litres per capita per day). This is slightly lower compared with similar communities elsewhere in Manitoba.

Records since the meter was replaced suggest that peak day demand can reach 680,000 L/d, but this appears to be an anomalous result, reflecting a watermain break or filling a recreational pool. The highest “normal” demand appears to be about 405,000 L/d, which is equivalent to 4.7 L/s (litres per second). This is the criterion upon which water supply and treatment capacities must be based (i.e., ability to meet the consumer demand on the highest-use day of the year). Peak hour demand, which distribution pumping capacities must be based, is not recorded as there is no instrumentation or control system in place to do so. Based upon conventional criteria (Harmon peaking factor), the peak hour demand is statistically likely to be 3.7 times the average day demand, it is estimated that peak hour demand is 13 L/s.

For planning purposes, it is useful to express water demand in terms of equivalent dwelling units. StatsCan reports that there were 467 resident-occupied dwelling units in 2011. The East Interlake Planning District reports 14 new dwelling units were constructed since then, raising the total to 481. Peak day water demand has been estimated to be 4.7 L/s. The equivalent peak day water demand per dwelling unit is then calculated to be 0.01 L/s.

2.2.2 WATER SUPPLY

Originally, Arborg’s water system drew from a well located in the water treatment plant. This well produced “typical” hard water. In addition to excessive hardness (typically close to 700 mg/L compared to GCDWQ objective of 200 mg/L), the sulphate concentration was also high (375 mg/L compared to GCDWQ objective of 150 mg/L). The well was rated as being capable of sustained 20 L/s output although the dual (electric/gasoline engine) drive vertical turbine pump was capable of delivering 30 L/s directly into the distribution system.

In 1993, a hydrogeological study by the Manitoba Water Services Board (MWSB) indicated that relocating the supply source to a site four kilometres west would produce water with only about half the hardness (350-400 mg/L) and about half of the sulphates (under 200 mg/L) of the original WTP well. The total dissolved solids concentration (550-600 mg/L) is slightly above the GCDWQ objective of 500 mg/L. Dissolved organic carbon is also low, under 2 mg/L, indicating a low potential for formation of potentially carcinogenic disinfection byproducts. Iron is about 1.0 mg/L, which is manageable.

Turbidity is about 7 NTU (nephelometric turbidity units), whereas the objectives require turbidity to be under 0.3 NTU. Other parameters are within GCDWQ objectives.

A well was developed at this site in 1994, drilled to a depth of 94 m and provided with a casing to 46 m. The casing is provided for the portion of the borehole which passes through 6 m of clay and clay till overburden, approximately 40m of less desirable strata of the carbonate aquifer. Once the well penetrates the appropriate stratum of limestone bedrock which produces the desired quantity and quality of water, it is an open borehole. A 200 mm PVC Series 160 pipeline connects the well to the WTP. The 200 mm diameter well has a capacity of 20 L/s and the pipeline has a capacity of 20 L/s. The pump which was originally installed in the well was a 25 hp unit which was capable of delivering 13 L/s at 415 kPa residual pressure, far more than was needed to drive the water through the WTP's pressure filters. It was subsequently recommended that a 7.5 hp pump rated at 8.3 L/s be installed but the recent water system assessment report by JRCC indicates there is a 5 hp submersible well pump installed in the well with a capacity of 5 L/s. This would be barely adequate for today's demand and short of what is needed to sustain growth. The public works manager indicated that it is in fact a 7.5 hp pump. For the longer term, the well was designed for a much larger pump, so a 10 hp pump can easily be installed, for medium-term growth, and a larger 20-25 hp pump can be used in the more distant future.

The original 1965 well and pump in the WTP remain in service to supply a tanker truck fill standpipe, but they are disconnected from the rest of the WTP process piping. In an emergency, there is provision for a pipe spool to be bolted into place to reconnect the old well pump back into the plant piping. That pump can also feed directly into distribution under emergency circumstances.

In terms of ability to sustain growth, current peak day demand is 4.7 L/s, while the well and pipeline capacity is 20 L/s. As noted above, the well pump is believed to be rated at 8.3 L/s. Therefore, there is about 15 L/s spare capacity in the well and pipeline, which is equivalent to 1,500 dwelling units (DU), and 3.6 L/s spare for the well pump (360 DU). As noted, the well pump does not have as much spare capacity as the well itself, or the pipeline, but it can be easily replaced to match the well and pipeline capacity.

2.2.3 WATER TREATMENT

Originally, the WTP was provided with sodium ion exchange softening equipment. This form of treatment process incorporates pressure vessels containing polystyrene resin beads which have a specific ability to remove hardness ions from water and replace them with sodium. The resin has a high affinity to adsorb (i.e., attract and hold on its surface) sodium, so the resin is soaked in salt brine prior to use. When hard water passes through, the resin's higher affinity for calcium and magnesium ions (and iron) results in those ions being retained on the resin surface while the sodium is released into the water. The challenge is that the resulting treated water is high in sodium, often to a degree which can be harmful to persons suffering hypertension and restricted to low-sodium diets. When the resin has exhausted its supply of sodium, it is regenerated with salt brine which strips off the calcium, magnesium and iron and replaces the sodium on the resin. There is significant salt content in the waste brine which is discharged to the sewer, and eventually finds its way to the effluent receiving stream. In the case of

Arborg, that is the Icelandic River and then Lake Winnipeg. After the new well was commissioned and the plant was expanded in 1995, Arborg removed ion exchange softening for many reasons, including the better quality of water from the new well; the negative health and environmental impacts of salt; and the cost of operation, which included not only salt but also resin replacement from time to time, as resin has a finite life before regeneration efficiency is reduced to the point that the process is impaired. This action was a positive step toward a more sustainable, environmentally-friendly water system.

The current treatment process consists of chlorination using calcium hypochlorite followed by triple media sand filtration. Prefiltration chlorination precipitates iron from its soluble state in the water, to a solid state capable of being filtered out. Chlorination is also applied after the filters, to ensure good disinfection of the water. This inactivates pathogenic organisms as may typically exist in the well waters, although the aquifer in this location is not known to harbour these. A minimum 0.5 mg/L free chlorine residual is maintained in water pumped into distribution, in accordance with Manitoba Drinking Water Safety Act regulations, to inactivate opportunistic pathogens which may enter the distribution system through things like water piping breaks.

The two filters are 1.1 m diameter. The triple media bed consists of filter coal over quartz sand over garnet sand, supported by a gravel bed, to provide a theoretically high degree of filtration capability. The filters have a combined nominal filtration capacity of 4.8 L/s (litres per second), or 345,000 L/day based upon the standard criterion of a 20 hour operating day. “Nominal” filtration capacity is based upon the conservative criterion of 9.5 m/h (metres per hour). In reality, the filters could operate at a higher rate, particularly since the iron concentration is not high, although a polymer-based filtration aide would be useful to enhance removal of fine particulates. Based upon the well pump operating at 8.3 L/s, the current operating limit is 600,000 L/d. The plant has sufficient space for either larger replacement filters or addition of another filter, to increase capacity. The filters operate effectively, meeting drinking water quality objectives by reducing turbidity to 0.3 NTU or less and reducing iron to 0.3 mg/L or less (usually less than 0.1 mg/L).

Since the filters could operate at 8.3 L/s (assuming the well pump is replaced with a larger unit), there is 1.2 L/s spare filtration capacity which is equivalent to 360 additional dwelling units.

2.2.4 WATER STORAGE & PUMPING

The treated water produced by the WTP is stored in a 2.0 ML (million litre) three cell concrete above-ground reservoir adjacent to the treatment room. This is an impressively large reservoir for a community of this size. Reservoirs are intended to provide equalization capacity (i.e., making up the difference between treatment capacity and peak domestic demand which can exceed treatment capacity by 50% or more). They also provide water for extreme emergency events such as fires. The guideline used by MWSB stipulates that minimum storage capacity be set on the basis of 1.25 times the sum of equalization storage (defined as one quarter of peak day demand) and fire storage (defined for a community like Arborg as two hours of a 120 L/s fire flow). Based on current peak demand, the Arborg reservoir should provide a minimum 1.2 ML of storage, which is far exceeded by the existing 2.0 ML capacity. By the MWSB standard, this reservoir is suitable for a population twice as large as Arborg.

The distribution pumps draw from the pump chamber of this reservoir and convey the water under pressure into the distribution piping system. There are three duty pumps which are intended to meet domestic water demand. One duty pump is a 5 hp unit capable of delivering 4.4 L/s. The other two duty pumps are 10 hp, 8.8 L/s units. One of the larger pumps acts in a standby unit, with the intent that the 5 hp and other 10 hp unit are capable of meeting peak hour demand while the remaining pump is in place to step in if one of the others is out of service for maintenance or repair. The firm output of (4.4 + 8.8 =) 13.2 L/s compares with estimated peak demand of 13.0 L/s, indicating that there is no spare capacity. However, there is another scenario which may be considered, detailed below.

In addition to the duty pumps providing domestic service, there is a 150 hp high capacity emergency standby pump, which is intended to provide fire protection flows up to 126 L/s. It was originally provided with a diesel engine drive but this is planned to be converted to electric motor drive, now that there is a high capacity standby generator at the plant, which makes the diesel engine redundant. When this high capacity standby ("fire") pump is equipped with a 100 hp electric motor, it can be considered as a backup for domestic service as well. Then the combined capacity of all three domestic duty pumps can be used to meet peak hour demand. The combined output of all three is 22 L/s, which is 70% greater than current estimated peak hour demand. Therefore, in this scenario, the pumping system can support about 335 additional dwelling units. It should be noted that a pump driven by a 150 hp internal combustion engine needs an electric motor of only 100 hp to achieve the same performance, due to the inherent mechanical inefficiencies of internal combustion drivers.

2.2.5 WATER DISTRIBUTION

The original water distribution system consisted of iron mains and copper service tubing. The mains began to experience breaks due to corrosion after about 15 years after installation. Due to the electrical conductivity of most Manitoba soils, iron pipe is not suited to our environment, as galvanic corrosion cells are set up. At this point over 50% of the iron mains have been replaced with thermoplastic piping, PVC, which is also used for all new extensions. Overall, the water mains are now 67% PVC pipe.

Arborg continues to replace sections of older iron pipe, on a regular but intermittent basis, especially when provincial grants or federal-provincial infrastructure funds are available.

A water distribution system needs to meet two capacity criteria: peak domestic demand and fire protection. Distribution systems are usually analyzed by means of computerized network analyses. The Arborg system was analyzed in1997 by Cochrane Engineering, a predecessor of WSP, and updated by Wardrop in 2011. It identified some shortcomings which are being addressed as older mains are being replaced. The primary constraints were determined to be in mains servicing outlying districts, and especially south of the river. The central business district fire flows were determined to be over 100 L/s; at the schools and Lodge (elderly persons housing) 65-68 L/s; and many residential districts 55-64 L/s, all of which are quite reasonable by the standards of what is available in most Manitoba communities of similar size. It does fall somewhat short of MWSB guidelines which suggest 120 L/s for business districts and institutional buildings, and 60 L/s for residential neighbourhoods. The one area where improvement is needed is where water mains are dead-ended (unlooped) at the further edges of the community.

The 1997 report indicated difficulty achieving even 30 L/s which is the minimum MWSB objective for low density residential in smaller villages. Looping is proceeding on a progressive basis, with two loops being completed on the west side this year plus one to the personal care home site. This alleviates many fire protection deficiencies, except on the east side where five loops remain to be done.

As noted previously, older iron mains are being progressively replaced as they age. Two mains were replaced in 2015 (WTP to hospital; and River Road). Another two short stretches are being replaced currently. Some years ago, upwards of two dozen breaks might be experienced in a year. The rate of replacements in recent years has reduced that to seven or eight. In 2015, only one break was experienced. The size of new mains is being selected with a view to delivering higher levels of flow and pressure throughout the community. This contributes to the sustainability of the system.

The distribution system can be extended considerably in all directions if fire protection is not an issue. Many Manitoba communities have extended domestic service into rural districts far beyond the urban boundaries. Fire protection requires flow rates far in excess of what rural lines can deliver with adequate residual pressure. However, extension of appropriate sized mains into urban fringe areas will allow fire flows to be delivered. In general, given the present line sizing, the Arborg distribution system generally should be able to provide low density single family residential-level fire flows (30 L/s) within 500 m of the current urban area, provided that looping is completed. Higher levels of fire flows to outlying areas will require extension of larger diameter mains from the centre of the community, which is where the WTP is located.

2.2.6 SERVICE AREA EXPANSION CAPABILITY

The keys to being able to accommodate growth and development are as follows:

- Supply: The groundwater source (well) and supply pipeline can provide service for up to 1,500 additional dwelling units. The well pump is limited to growth of about 360 DU but can be easily be upgraded to match the 1,500 DU limit;
- Treatment: As per the well pump, the filters are limited to about 360 additional dwelling units. To accommodate greater growth, there is space in the plant for additional or larger replacement filters;
- Water Storage & Pumping: The reservoir is sufficient for at least 500 additional dwelling units. Based on an electric motor drive being installed on the 126 L/s standby pump so that it can act as a backup to the domestic distribution pumps, those pumps are adequate for 335 additional dwelling units; and
- Water Distribution: The distribution grid can be extended by at least 500 m if appropriate main sizing and looping are provided, to meet low-density residential fire protection needs. Higher levels of fire protection will require larger mains connecting to larger mains nearer the centre of the community. There is a need to provide fire protection with hydrants and the ability to supply high pressure water to building sprinkler systems, to businesses in the Industrial Park. A main of at least 200 mm diameter should extend into the park to deliver 60 L/s flows; a 250 mm main running from the WTP would be able to deliver 125 L/s flows.

2.3 RIVERTON

The community of Riverton does not have a public water system. Residents, businesses and institutions are served by private wells which are mostly drilled into the ubiquitous carbonate aquifer or the sands and limestone rubble overlying that aquifer. The water quality in the area is not particularly good by carbonate aquifer standards, being harder than most other districts. The sandstone underlying the limestone has low hardness but very high sodium. This led the municipal council to request that the MWSB undertake a study into a potential public water system for the community. This study was completed in early 2016. The aquifer output capacity appears to be relatively high but there has been little demand for high-output wells so there is minimal data to quantify the limits.

2.3.1 EXISTING WATER QUALITY

The existing wells are mostly drawing from the sands and limestone rubble overlying the carbonate aquifer, and from various strata within the carbonate aquifer itself. The rubble tends to produce poorer quality water. Quality generally improves with depth, but the water in this area is consistently hard. A test taken by MWSB's hydrogeologist of a test well drilled to 36m depth indicated hardness was 526 mg/L, much above the 200 mg/L objective set by the GCDWQ. Total dissolved solids were 629 mg/L, again above the 500 mg/L objective. Iron was only 0.14 mg/L but staining is prevalent. This may be more due to manganese which is high at 0.078 mg/L, above the proposed new aesthetic objective of 0.02 mg/L, and very close to the recently proposed GCDWQ maximum acceptable concentration of 0.1 mg/L. Aside from a potential problem with manganese, there are no known health-based quality issues.

2.3.2 ESTIMATED WATER DEMAND

As Riverton has no system, there are no meters to record water usage in homes and other buildings. The MWSB report anticipated that the community would grow from 538 residents to 609, using an average 300 L/c.d, with a 2:1 peak day factor, for an estimated peak day demand of 365,000L (4.3 L/s).

2.3.3 PROPOSED SUPPLY, TREATMENT, STORAGE AND PUMPING SYSTEMS

MWSB has recommended that two wells be drilled to approximately 36 m depth in the vicinity of the test well site on municipally-owned land at the north end between Thorvaldson Street and Main Street. A plant would be constructed there. Water would be treated by means of reverse osmosis (RO) membrane technology, to reduce the concentration of the various minerals which are at objectionable levels. Plant treatment output would be 5.1 L/s to allow production of peak day demand in a 20-hour operating day. The reservoir capacity was proposed to be 400,000 L, to allow for domestic demand equalization as well as fire protection to MWSB Class 2 levels (30 L/s, suitable for low density residential neighbourhoods). A jockey distribution pump would be provided for low demand periods; two duty pumps for medium- to high-demand periods; and a standby pump for emergencies and fires.

2.3.4 DISTRIBUTION SYSTEM

The distribution system was proposed to consist of a combination of 200 mm, 150 mm and 100 mm mains, with a total length of about 9000 m, plus 50 hydrants, 47 isolating gate valves and 352 service lines to connect the community's homes and buildings.

2.3.5 SERVICE AREA EXPANSION CAPABILITY

The proposed wells will likely have far more capacity than needed, and more wells may be developed in the area if needed by growth. The treatment process is modular in nature so if more capacity is needed, more reverse osmosis treatment skids can be added and the plant building extended. Pumps can be replaced as needed with larger units and reservoirs are modular in nature, with more cells capable of being added as needed.

The proposed distribution system would have some ability for expansion beyond current urban limits. Significant extensions (250 m +) would probably be unable to provide the same level of fire protection unless larger diameter mains are extended back closer to the WTP.

2.3.6 SUMMARY

New developments in Riverton can be serviced with private wells as currently used for existing homes and buildings. If residents are unhappy with water quality, they can invest in a personal treatment systems, either in the form of sodium ion-exchange softeners or home RO units. There are no significant constraints on available capacity for domestic, commercial, institutional or light industrial use. Lack of a municipal public water system can limit the ability to attract growth, especially for developments requiring fire protection. There is a requirement for many types of new or expanded public buildings to be equipped with sprinkler systems, which are most conveniently supplied with water from municipal systems. The alternative is for institutional and industrial facilities to construct their own treatment and fire protection systems. The most common outcome is for these facilities to relocate elsewhere, to larger communities with municipal water systems.

The MWSB study suggested that the budget for a reverse osmosis treatment plant, including wells, reservoir and pumping system, would be $3.6M, while a distribution system would be $4.0M, plus another $1.0M to bring water lines from the property line into the house or building. As attractive as a public water system may be to Riverton, the $8.6M cost of constructing a system may be prohibitive unless significant government grant funding is available. The current federal-provincial Small Community program provides up to 75% grants, which if available for Riverton, would make such a system more affordable and sustainable.

Another alternative is to focus the proposed system on “domestic-only” service, eliminating fire protection, as that would allow significant reductions in distribution pipe sizing, saving in the order of $1.0M. Another alternative would be to stage construction by deferring treatment equipment to the future, saving another net $1.0M. However, the point of municipal waterworks is to provide better quality water and fire protection so these alternatives are unlikely to be attractive.

2.4 RURAL DISTRICTS

2.4.1 WATER SUPPLY

Currently, there are no municipal public water systems in the Bifrost region except for Arborg. Private wells are the source of supply for rural residents, farms, recreational/seasonal developments and rural commercial establishments. The foregoing commentaries on the groundwater availability and quality (Sec 2.1 & 2.3.1) generally apply. For rural residents and developments within a reasonable distance of Arborg, rural pipelines can be contemplated. Tens of thousands of kilometres of pipelines have been constructed throughout rural Manitoba in recent decades, but the plentiful availability of groundwater in the Bifrost region may reduce the interest of residents in such systems.

2.4.2 RURAL PIPELINE STANDARDS

In the event that there is interest in rural pipelines, it should be emphasized that in general, the levels of service generally will not match that received in urban districts. Flow is generally limited to 0.3-0.5 L/s at pressures as low as 250 kPa, whereas urban residential service connections can receive three times as much flow at double the pressure. This is a simple reflection that higher levels of service would require much larger pipes and/or numerous booster pumping stations for sparsely populated areas.

Rural systems may be designed in the first instance to provide higher levels of service for major specific agricultural operations or recreational/commercial/industrial developments, but again, costs will be higher. In the case of Bifrost, it would likely be more economic for major rural developments to develop their own carbonate aquifer-based wells and treatment systems, since availability of groundwater from the carbonate aquifer is good.

3 WASTEWATER

3.1 ARBORG

Arborg developed its community sewer system in 1965-1966, to designs prepared by Templeton Engineering. This sewer system has been extended and upgraded a number of times over the past five decades. The Arborg sewer system is a conventional gravity-flow sanitary system, whereby wastewater from homes and buildings run “downhill” through service lines to main lines in the streets, then to a central pumping (“lift”) station for conveyance to a treatment facility, which is in the form of a three cell facultative stabilization pond (“lagoon”).

3.1.1 WASTEWATER COLLECTION

The Arborg sewers consist primarily of 200 mm sewermains, with some 250 mm collectors. The original pipe was concrete but more recent extensions have been PVC. Where closed circuit television (CCTV) inspection has been undertaken, the piping system has been found to be in good condition. Exceptions include areas downstream of restaurants where grease build-up is found. Sewers are cleaned on a two year cycle (one half of the community each year). This is a good maintenance practice which helps extend the life of concrete piping; PVC is an inert material not subject to deterioration when sludge and grease build up.

The sewers throughout the community generally have significant spare capacity. The 1997 Infrastructure study found that except for the main lines running to the lift station (LS), most pipes had significant spare capacity. That data has been reviewed in the context of more recent information, which indicates peak wastewater flows are higher than previously believed in 1997. However, most branch lines appear to be able to accommodate about 300-500 additional dwelling units. The exceptions are the main line on River Road from St. Peters Street to the lift station; St. Peter’s Street to David Street has approximately 200 DU spare capacity and David Street to the lift station has approximately 100 DU spare capacity. To the extent that this line is deep and can be surcharged, the practical limit before basement flooding may be expected, is probably about 200 DU. This is still good, providing an allowance for growth, but some sewer upgrading on St. Philips in the form of an interceptor sewer, running parallel to the existing on St. Philips, should be considered within the next five years. Our firm has completed similar projects in Killarney, Morris, Altona, Morden and Lorette, Manitoba. The most recent, in Lorette, took the form of an overflow which operates only at peak periods. Its design allowed installation by directional drilling, greatly minimizing construction impacts and reducing costs.

The depth of most existing sewers does allow for gravity extensions to accommodate additional growth. The 1997 study delineated the limits to which sewers may be extended before additional lift stations are needed. In the northwest, about half of the area is serviceable. In the southwest, most of the area east of the Government Road and north of PTH #68 can be serviced. South of PTH #68, there is an area east of Main Street which can be serviced. However, extension of sewers into the RM of Bifrost, particularly to service the industrial park, involved construction of a lift station which essentially opens up the whole south side of PTH #68 for development. The RM sewer extension does in fact run 800 m south. The northeast triangular half of the east of David Street and north of Crosstown Avenue is unserviceable unless a lift station is built. The southwest of that area is serviceable. Sewers can be extended eastward on St. Philips for about 700 m and the area north of the east end of St. Philips can be serviced to a limit delineated by a line running northwest from St. Philips to the intersection of Palm Avenue and David Street, As such, there is a fair ability to extend service to new development neighbourhoods. In some circumstances, extensions may require careful grading of serviced properties, and limitations to basement depths.

3.1.2 WASTEWATER PUMPING

The Town of Arborg is served by a single lift station to which all wastewaters flow. There is also a lift station within the RM, on the south side of town, which services commercial properties and the industrial park, which will be described in a subsequent section.

The Arborg station has been upgraded several times, and the original 150 mm iron force main which conveys wastewater to the treatment facility, was replaced with a new 200 mm HDPE line 17 years ago. The current capacity of the station is 30 L/s. The current estimated peak flow is also about 30 L/s, as indicated by the fact that in peak flow periods – typically when wet weather contributes significantly to infiltration, weeping tile flows and street gutters are contributing through manhole covers – the lift station can barely keep up with one pump running. When a station has total pump running time of 18 hours per day, that suggests that at the peak of the event, a pump is running continuously, which is the definition of “no spare capacity”. The design intent of a two pump station such as this is that one pump must be capable of handling peak station inflow, with the second pump being a standby in the event the other pump is out of service for repair or maintenance.

The current pumps are 12 hp Flygt NP3153HT units. For more capacity, they may be replaced by 20 hp Flygt NP-3170HT pumps which should fit both the station barrel and the existing slide-away pump discharge piping connections. Electrical panel upgrading would be needed. The upgraded capacity would be about 40 L/s, adequate for about 250-300 additional dwelling units. This is proportionately more than extrapolating on the basis of the current use/capacity because new dwelling units will not contribute weeping tile flows.

3.1.3 WASTEWATER TREATMENT – CAPACITY

Arborg’s sanitary wastewater is treated in a conventional three cell facultative stabilization pond (“lagoon”). Lagoon primary cells are designed to reduce organic (biological) loading in wastewater. Secondary cells are provided to ensure adequate retention capacity during the mandated winter storage period (see Sec 3.2.4). Primary cells must be large enough that organic loading does not exceed 56 kg/ha.d (kilograms of BOD_5 per hectare of cell surface area per day, where BOD_5 is the biochemical oxygen demand exerted over a five day testing period; a measure of the organic strength of wastewater). The Arborg primary cell provides a surface area of 3.3 ha. As such, the cell has the capacity to assimilate 185 kg of BOD_5 per day. The standard criterion is that humans produce 0.077 kg of BOD_5 per day. Therefore, the primary cell has capacity for an equivalent contributing population of

2,400 people. The original intent was to allow for a population of 1,500 people (115 kg of BOD_5 per day) plus an allowance of 70 kg BOD_5 per day from external sources (septage and holding tanks). This includes wastewaters hauled in from rural tanks in Bifrost and Armstrong. Data provided by the Town indicates that the heaviest septage loading occurs in the third quarter of the year (Q3), with 377 loads in total. Historical data suggests that the breakdown of loads is 20% high strength septage (sludge removed annually from septic tanks) and 80% domestic wastewaters from holding tanks. Septage loads have an organic loading averaging 5000 mg/L BOD_5 whereas domestic wastewater from holding tanks is typically 300 mg/L BOD_5.

At a 20/80 split, the weighted average is 4.5 kg BOD_5 per 3000 L load. During Q3, there are about 60 workdays with an average of 6.5 loads/day. At the typical 4.5kg of BOD_5 per load, the average daily trucked-in loading is 29.3 kg of BOD_5. Based upon a 2:1 peak day factor, the maximum loading would be about 60 kg/d. This is within the limits of the design (70 kg BOD_5).

The secondary cells provide 147,700 m^3 (cubic metres; 1000 litres) of storage capacity. In addition, Manitoba Sustainable Development (formerly "Conservation" and "Environment") allows half of a primary cell's capacity to be factored into assessment of a lagoon system's storage capacity. The primary cell provides an allowable storage capacity of 23,250 m^3. Thus the total volume available to meet the mandated 227 day winter-spring storage period (November 1 - June 15) during which effluent may not be discharged, is about 171,000 m^3. Both the 1997 report and recent data indicate that the average winter-spring period inflows to the lagoon are in the order of 650 m^3/d, equivalent to about 148,000 m^3 over the 227 day winter-spring storage period. In addition, an average of 15 m^3 of trucked wastewater are discharged to the lagoon daily during the 227 day winter-spring storage period, for a total 3,400 m^3. This indicates a spare capacity of 19,600 m^3, equivalent to about 86 m^3 per day. Since growth will occur in new developments with water-conserving plumbing and appliances, and watertight sewer piping and no weeping tiles, this spare capacity is equivalent to about 350 residents, or 110 dwelling units. The lagoon was sized in 1999 for a total future residential population of 1,500 people, which appears to be holding true. The lagoon currently does not allow for significant long-term growth beyond that, but if the Town encourages water conservation to reduce sanitary sewer flows, and takes steps to reduce extraneous inflows (sealing manhole covers etc.), expansion of the lagoon may be deferred. It may be noted that the existing cells cover about 26 ha (hectares) of the 32 ha site owned by the Town. Future facility expansion will require acquisition of more land, unless consideration is given to aerated primary cells, which can be three times deeper than conventional facultative cells, and which can assume irregular shapes.

3.1.4 WASTEWATER TREATMENT - ENVIRONMENTAL ISSUES

Facilities such as Arborg's conventional three cell facultative stabilization pond ("lagoon") are very effective in reducing the organic strength of wastewater as measured by biochemical oxygen demand exerted over a five day period (BOD_5). BOD_5 of raw domestic (i.e., non-industrial) wastewater is typically 250-350 mg/L. Properly designed, constructed and operated lagoons will typically reduce treated effluent BOD_5 to 20-25 mg/L.

Arborg's treated effluent is discharged to the Icelandic River in accordance with its Environment Act Licence. The river provides reasonably good assimilative capacity. The effluent ultimately reaches Lake Winnipeg. Environmental licencing prohibits effluent discharges from November 1 to June 15, inclusive, because treatment efficiency declines during the winter when ice cover prevents contact with the oxygen in the atmosphere. While lagoons can normally achieve the 25 mg/L BOD_5 mandated by environmental licencing, by the middle of May, the earliest discharge in mid-June reflects the need to protect aquatic biota, particularly fish fry, which are especially sensitive to elevated un-ionized ammonia which tends to build up under the winter ice, and which does not substantially convert to nitrates until mid-June.

The Arborg lagoon was last upgraded in 1999, before the recent adoption of limits for phosphorus in effluent, predicated on the need to reduce nutrient loading which promote algae blooms, especially on Lake Winnipeg. As such, Arborg's environmental licencing does not stipulate the 1 mg/L limit imposed on new licences (like Riverton's). Any future expansions will trigger the need to reduce phosphorus. This may be done by constructing an engineered wetland which uses aquatic plants to draw phosphorus out of the effluent, or by applying a coagulant such as aluminium sulphate (alum), ferric sulphate or ferric chloride to precipitate the phosphorus. This is commonly done by many Manitoba municipalities by broadcasting powdered alum from a boat, or spraying liquid alum from a boat or barge, onto a lagoon secondary cell.

As noted above in Sec 3.1.3, consideration may be given to expanding the Arborg lagoon using mechanically aerated primary cells which may fit the irregular shape of the remaining 6 ha of land owned by the Town. Combined with phosphorus precipitation/filtration, the lagoon would then sustainably achieve a very high degree of treatment efficiency to address environmental issues.

3.1.5 SERVICE AREA EXPANSION CAPABILITY

The sewers throughout the community generally have significant spare capacity. The 1997 Infrastructure study found that except for the main lines running to the lift station, most pipes had spare capacity to accommodate about 400-500 additional dwelling units. The main line on River Road from Benson Street to the lift station, had spare capacity for 300 dwelling units. This is still very good, providing a significant allowance for growth.

The depth of existing sewers does allow for additional extensions to support growth without additional lift stations. The 1997 study delineated the limits to which sewers may be extended before additional lift stations are needed. In the northwest, about half of the area is serviceable. In the west, most of the area east of Gislason Drive (Government Road) and north of PTH #68 can be serviced, except for the extreme northwest corner of Town. South of PTH #68, there is an area east of Main Street which can be serviced. The extension of sewers into the RM of Bifrost, particularly to service the industrial park, involved construction of a lift station which essentially opens up the whole south side of PTH #68 for development. The RM sewer extension does in fact run 800m south, which opens up the whole area south of Town limits for development. The northeast triangular half of the area east of David Street, west of Arborg Avenue and north of Crosstown Avenue is unserviceable unless a lift station is built. The southwest of that area is serviceable. Sewers can be extended eastward from Main Street on River

Road for about 300 m. The area north of the east end of River Road can be serviced to a limit delineated by a line running northwest from River Road to the intersection of Palm Avenue and David Street, as such, there is a fair ability to extend service to new development neighbourhoods.

In the course of this study, several specific areas were identified for potential development, with the issue of serviceability being raised. One is the Gudmundson properties north of Crosstown Avenue near Benson Street; this appears to be serviceable. Another is west of Gislason Drive (Government Road) between St. Phillips and PTH #68; it appears to be serviceable, although care must be taken in setting surface grading and basement elevations. Another is south of St. Phillips, east of Gislason Drive, west of Sunset Drive; this appears to be serviceable. The area between William Street and Gislason Drive is mostly serviceable except for the extreme northwest corner. Again, the degree to which surface and basement elevations can be designed to maximize the ability to extend gravity sewers, will be key to determining how far sewers can be extended before a lift station is required.

3.2 RIVERTON

The Riverton sewer system was designed by provincial government engineers (Water Resources Branch) in 1974 and built in 1975 under an MWSB contract. It consists of 200 mm concrete gravity mains, three sewage pumping (lift) stations and a three cell wastewater stabilization pond (“lagoon”) for treatment.

3.2.1 WASTEWATER COLLECTION

The Riverton sewer system includes about 350 service connections, covering virtually the entire community, excepting some outlying homes. The gravity flow piping starts at relatively shallow depths at the edges of the community (2.5-3.0 m) and piping is graded downward from there toward three lift stations (LSs). The southwest district flows into LS #3 on Park Avenue. It pumps the sewage into a manhole immediately east of the station, from which sewage flows eastward. All of the sewage on the west side of the Icelandic River flows into LS #2, located on Riverton Avenue just east of the former CPR railway tracks. LS #2 pumps into force main running eastward across the river into LS #1 which also receives all wastewaters on the east side of the river. LS #1 pumps through a 1325 m long 150 mm force main to the sewage lagoon.

Compared to the larger community of Arborg, Riverton has proportionately more lift stations. This is because of the high water table in the community, which made it difficult to install sewers at depths exceeding 4 m. There are no sewers at 5 m depth whereas in most communities, sewers reach 6 m or more before lift stations are installed.

The sewer system is believed to be in reasonably good condition. All homes have weeping tiles, which contributes substantial groundwater into the system. Some manholes are located in roadways and ditches at elevations which allow entry of surface water. Some manholes have been caulked to seal joints, and some cover units have been raised, to reduce inflows. The system operator reported that some people abuse the system, citing a contractor who was constructing a building, and using the sewer service line underneath to drain the construction site.

There have been only a few sewer extensions constructed since 1975, primarily at the west end. This includes the Coghill Bay subdivision. There is minimal sewer depth to extend sewers further to the south, west or north but some extensions are possible east of Queen Street since the main lift station (LS #1) is sufficiently deep. Short extensions may be contemplated in all directions if sewers are insulated; carefully designed surface grading is provided; basements are shallow; or buildings and homes are constructed without basements.

3.2.2 WASTEWATER PUMPING

Lift station LS #1 is equipped with two Flygt FP3012-181-LT491 pumps with 5 hp motors, which are theoretically capable of discharging 12 L/s in this application. LS #2 has identical pumps, but due to lower vertical lift and a shorter force main, it is theoretically capable of discharging 18 L/s. LS #3 is equipped with two Flygt FP3085-183-LT493 pumps with 2.4 hp motors, theoretically capable of discharging about 7 L/s.

There are obvious problems when LS #2 discharges into LS #1 at 18 L/s but #1 is only capable of pumping at 12 L/s. LS #1 was previously hampered by worn impellors which reduced capacity to about 9 L/s. At present, it appears from information provided by the public works operator who maintains the system that both pumps in LS #1 have to run to keep up with peak inflows. Analysis of the pump/force main hydraulic performance curves suggests that the two pumps running together discharge a net 14 L/s. Obviously, when LS #2 is pumping in at 18 L/s, it is only running part-time, and excess wastewaters beyond LS #1's capacity are being stored within the sewers until the LS #2 operating cycle is complete.

Since about 15% of the flow emanates from east of the river, and 85% from the west, it can be determined that approximately 12 L/s of the peak wastewater flow is generated on the west side. The capacity of LS #2 is 18 L/s, so there is 6 L/s spare capacity at LS #2; its catchment area can grow by 50%, or about 150 dwelling units. About 15% (2 L/s) is generated within the area served by LS #3, so it is running at about 30% of its capacity. It should be capable of supporting about 150 additional dwelling units. Since LS #1 appears to be loaded beyond its capacity (14 L/s > 12 L/s), it cannot support any development, and that becomes a bottleneck for the whole system. LS #1 should be upgraded with larger pumps at the earliest possible time.

3.2.3 WASTEWATER TREATMENT – CAPACITY

The lagoon was expanded in 2011 with construction of a third cell. This secondary storage cell is almost twice as large as the original two-cell lagoon, which was seriously overloaded prior to expansion.

The primary cell is sized for organic loading from a population of 1,030 persons, a 50% increase over the current population. As such, it can accommodate about 175 additional dwelling units. The two secondary cells were sized for modest growth of 150 additional people or 75 additional dwelling units.

3.2.4 WASTEWATER TREATMENT – ENVIRONMENTAL ISSUES

The treated lagoon effluent is discharged into a drain directed into the Icelandic River, which conveys it to Riverton Harbour on Lake Winnipeg. There is significant dilution of effluent but the key issue is the reduction of nutrients, particularly phosphorus, in order to protect Lake Winnipeg from the effects of algae proliferation. The facility theoretically can meet all its licence limits but as noted above, difficulties in dosing alum make phosphorus reduction a challenge.

The Environment Act Licence for the expanded facility is more stringent than what has traditionally been applied to small community lagoons. It stipulates not only the usual criteria applied in the past two decades (227 day storage instead of the previous 196 days; both effluent organic strength as BOD_5 and suspended solids of 25 mg/L instead of the previous 30 mg/L) but also 1.0 mg/L of phosphorus. The operator has had difficulty meeting those limits, using the coagulant alum which is broadcast over the secondary cell surfaces to precipitate phosphorus, which then settles in the sludge to the bottom of the cell. A more effective means of applying alum is needed. This could involve a chemical feeding station, or simply an appropriate watercraft designed for effective alum dispersal.

3.2.5 SERVICE AREA EXPANSION CAPABILITY

The sewer system can be expanded to serve new developments, as there is generally spare capacity in the sewer mains. However, due to topography and limited sewer depths, there are limits on extensions. This must be addressed by means of additional lift stations or by prohibition on basements, if service extensions are contemplated.

Lift station capacity is an issue: while LS #2 and LS #3 have spare capacity, LS #1 appears to be overloaded and needs immediate upgrading.

3.3 RURAL DISTRICTS

Over the past four decades, the traditional means of managing wastewater in rural districts throughout Manitoba has been collection of sewage from each home or building in an individual septic tank with effluent disposal in a tile drainage field. This has been the norm in Bifrost. Accumulated sludge from septic tanks is typically removed by tanker truck annually for disposal at a treatment facility, although rural farm residents may apply the sludge to agricultural lands. The field disposal systems have evolved with revised regulations being applied, which stipulate more stringent standards for field size, design details, construction methods and above all, limitations applied where soil and groundwater conditions are not ideal. In addition, large areas have been designated as being environmentally sensitive, with field disposal being prohibited. This is particularly the case in the Red River corridor and in the vicinity of the Lake Winnipeg shore.

Where septic fields are prohibited in low density developments, the alternative is usually use of holding tanks, in which all the wastewater is collected, to be pumped out several times per month by a tanker truck that conveys the sewage to a treatment facility. In some higher density developments, low pressure sewer (LPS) systems have been implemented, whereby the liquid from a septic tank is conveyed by small diameter piping to a treatment facility. It is theoretically possible for such LPS systems to convey wastewaters to existing facilities such as the Arborg or Riverton lagoons, to the extent that capacity may be available. If capacity is inadequate, these facilities may be expanded, to the extent that lagoons are modular with more cells being added as needed if the land base is available.

Currently, the Arborg lagoon provides a disposal and treatment facility for rural Bifrost residents, as well as for the RM of Armstrong.

3.3.1 SUSTAINABILITY

While some consider septic tank and lagoon systems to be “low tech”, they have evolved over time and more sophisticated variations have been developed. Aerated lagoons can significantly reduce the land needed compared to conventional cells, as they can be three times as deep. The effluent quality is also improved, and odour is negligible year-round.

Coagulant-enhanced filtration systems can be added to reduce phosphorus effectively. Filtration also provides better control over suspended solids in the effluent.

Septic systems have also advanced, with proprietary aeration and filtration steps being available. Disposal fields may not be suitable under any circumstances in sensitive areas, but LPS can be extended over great distances. The RMs of Gimli, St Andrews and St Clements each have dozens of kilometres of trunk LPS mains to collect wastewater effluent from rural residential and seasonal developments, for treatment at central facilities.

4 DRAINAGE

4.1 REGIONAL - BIFROST

The drainage in the region is generally challenging. The topography is relatively flat, with little grade to facilitate ditch drainage. The water table is relatively high in many areas, and in some locations, there are flowing (artesian) wells which help keep the local environment relatively saturated. A specific review of rural drainage issues is presented elsewhere in this report.

4.2 ARBORG

The Town is primarily drained via surface ditches. There are a number of paved streets with curb and gutter drainage including Main Street, but only that street has a fully developed storm sewer system, as it has been under provincial highways' jurisdiction. Some other streets which had steep, deep ditches were upgraded by installing Big-"O" drainage piping, a lower cost alternative to conventional storm sewers, used in a growing number of rural communities. Generally, all drainage is directed toward the Icelandic River. That river provides a useful point of discharge in that it is generally at a level which facilitates reasonable ditch and storm sewer grades.

4.2.1 SPECIFIC ISSUES

Runoff from heavy precipitation is generally contained within the drainage system and localized ponding is rare except in the heaviest rainstorm events, and in springtime when all local drainage infrastructure can be overwhelmed with overland flow from surrounding farmlands. This requires a regional approach, and the Town has suggested a diversion channel be built around the periphery of the community to intercept overland flow and divert it to the river. There were no other specific drainage challenges identified during our site visit except in random areas where settlement has occurred, after excavation for utility installations and repair.

4.2.2 DEVELOPMENT CONSTRAINTS

It has become a standard criterion applied by the province and many growing municipalities to require that any new development limit the rate of post-development runoff to the rate which existed prior to development. The challenge is that when raw land is developed, the construction of roads, driveways and buildings with roofs substantially increases the proportion of land which is impervious. When precipitation cannot be absorbed into impervious surfaces, it increases the rate at which water runs into drainage courses. To limit the discharge from new developments to pre-development rates, on-site retention or detention is needed, either in the form of a pond, enhanced ditch or rarely, buried storage chambers, which sometimes take the form of multiple pipes. Retention infers that a certain amount of water remains, such as in the ornamental ponds in larger urban centres. Detention means that the pond or ditch drains out completely at some point after the precipitation event. Either storage facility would have a controlled discharge point, usually in the form of a pipe with an outlet restrictor.

For smaller developments, the enhanced ditch is most common. This takes the form of a wider ditch designed with enough capacity to store excess runoff until the storm passes. For larger developments, ponds are the norm for commercial, institutional or multi-family developments, the parking area can be designed for short-term water storage although that can inconvenience drivers who have to wade through water to access their vehicles. Regardless of the form which the water storage takes, the implementation of “zero net increase in runoff” is an important one to maintain the sustainability of existing drainage infrastructure when development occurs.

4.3 RIVERTON

The village is primarily drained via surface ditches. There are a limited number of paved streets as most are gravel surfaced, with ditch drainage. The only curb and gutter drainage is on Main Street, and only that street has a fully developed storm sewer system, as it has been under provincial highways' jurisdiction. Generally, all drainage is directed toward the Icelandic River. That river provides a useful point of discharge in that it is generally at a level which facilitates reasonable ditch and storm sewer grades. Heavy precipitation is generally contained within the drainage system and localized ponding is rare except in the heaviest rainstorm events.

4.3.1 SPECIFIC ISSUES

There was a recent survey done of the drainage in the village but as of the time of our site visit, no report has been completed. There are a number of driveways with no apparent culverts to connect the ditches on either side. There are occasional problems with waters backing up from the Icelandic River into the village drainage system. Much of this occurs due to ice jams. The availability of the Amphibex appears to be having a positive effect on the management of bottlenecks on the river. There were no other specific drainage challenges identified during our site visit except in random areas where settlement has occurred, after excavation for utility installations and repair.

4.3.2 DEVELOPMENT CONSTRAINTS

These will follow the pattern set in Arborg except that the likelihood of significant development needing retention ponds is minimal. To the extent that zero net increase in runoff must be achieved post-development, the prime solution is enhanced ditches with outlet controls on discharge culverts. The recent drainage survey will identify specific upgrading needed in the village.

4.3.3 SERVICE AREA EXPANSION CAPABILITY

Until such time as the drainage report is prepared, there can be no definitive commentary on the ability of the drainage system to support growth. At a minimum, it is useful to direct drainage from all new development to the river in the most expedient manner possible, avoiding existing village drains.

5 ROADS

5.1 REGIONAL - BIFROST

Transportation issues, including traffic and rural roads, are covered elsewhere in this report. However, it is important to note that there is a significant concern and effort to have PR #326 paved from the Town of Arborg to the Okno/Vidir manufacturing area.

5.2 ARBORG

Roads in Arborg are paved with asphalt. They are generally in good condition as the Town undertakes repaving and reconstruction programs from time to time to address any serious deterioration. The streets are generally of adequate width to support on-street parking and traffic. Traffic control signage is adequate.

5.2.1 SPECIFIC ISSUES

There were no instances reported on any significant traffic issues in Town, although traffic volumes at the intersection of PTH #68 and Main Street are frequently high, with significant conflict possible due to the numbers of vehicles wanting to make left turns.

In addition to an effort for PR #326 to be paved, there is concern with truck traffic going through the Town of Arborg and it is believed that a new bridge that connects PR #326 to PTH #68 would alleviate the risk of any potential accidents from truck traffic in town.

5.3 RIVERTON

Roads in Riverton are generally gravel-surfaced. The exceptions are Main Street, Park Avenue, King Street and Thompson Drive, which is PR #329. The streets were found to be in generally fair condition with adequate traffic control signage.

5.3.1 SPECIFIC ISSUES

No issues were raised by Public Works staff.

6 SOLID WASTE

6.1 SOLID WASTE COLLECTION

The Town of Arborg provides garbage and recycling collection services for residents within the town limits on a weekly basis. Private sector garbage collection is provided in Riverton. Rural residents are responsible for disposing of their waste at the regional disposal facility (below).

6.2 SOLID WASTE DISPOSAL

The region currently operates a Class 2 Waste Disposal Ground situated at NE 08-22-03 EPM in the RM of Bifrost and is known as the BAR Waste Disposal Ground. In accordance with the Waste Disposal Grounds Regulation, made under The Environment Act, the BAR Waste Disposal Ground operates under Permit No. 37083.

The BAR Waste Disposal Ground is managed by a cooperative made up of representatives from the RM of Bifrost-Riverton and the Town of Arborg, known as the B.A.R. Waste Authority CO-OP Incorporated.

Residents of Arborg, Bifrost and Riverton are permitted to dispose of household waste at no charge during regular hours of operation.

Typical of waste disposal sites developed in the past two decades, the BAR Waste Disposal Ground provides segregation of different waste types, including wood (typically from demolition of old structures), shingles and tires, metal (old appliances, etc.) as well as the usual household refuse. It also accepts E-Waste (computers, monitors, televisions, fax machines, circuit boards, cell phone batteries, regular phones, cell phone batteries, etc.). The facility also accepts Household Hazardous Waste, such as paint and paint aerosols, corrosives, some flammable liquids, pesticides & toxics. Segregated recycling containers are also provided to divert reusable products out of the disposal cells.

The facility is provided with monitoring wells to confirm environmental integrity. The facility is constructed on a site underlain with a substantial relatively impervious clay soil base to protect the underlying aquifer. The site was designed by WSP and constructed in a manner which is compliant with Manitoba waste disposal site regulations.

6.3 EXPANSION CAPABILITY

Currently, the developed portion of the BAR Waste Disposal Ground covers about 8ha (hectares) and after two decades of operation, it is reaching capacity. The BAR Waste Authority owns the quarter section of land (over 50 ha) so there is significant expansion capability. At current rates of development, the site will be adequate for over a century. BAR has initiated a Landfill Expansion Design that includes two new waste cells, an additional evaporation pond and the extension of the access road. Expansion will be located adjacent to the existing cells on the east side of the site. Projected completion for the expansion is scheduled for September 2017.

6.4 SUSTAINABILITY

In terms of both operation and ability to support future expansion, waste management in the region appears to be sustainable.