Report

Rural Municipality of Blucher #343

Industrial Servicing Study

June 2010

ASSOCIATION OF PROFESSIONAL ENGINEERS
AND GEOSCIENTISTS OF SASKATCHEWAN
CERTIFICATE OF AUTHORIZATION
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NUMBER
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ASSOCIATED ENGINEERING

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Executive Summary

According to the Saskatchewan Regional Economic and Co-operative Development, the Rural Municipality of Blucher #343 is the fastest growing municipality in the province. Saskatoon's proximity to the RM's nine townships including the urban centres of Allan, Bradwell, Clavet, Elstow, Blucher, and Sunset Estates Mobile Home Park has resulted in the RM being viewed as a favourable alternative to the high real estate and tax prices found in the City. Over the years the RM of Blucher has attracted a number of large agricultural related industries including:

- Agrium Inc. (anhydrous ammonia-bulk fertilizer distribution center),
- Cargill Ltd. (anhydrous ammonia-bulk fertilizer distribution center, canola crushing plant, and inland grain terminal),
- Potash Corp. (two potash mines), and
- Westco (anhydrous ammonia-bulk fertilizer distribution center).

With progressive development initiatives, the RM of Blucher anticipates continued success of existing industries and multiple opportunities to expand the existing industrial base. As such, the RM of Blucher contracted Associated Engineering to conduct an Industrial Servicing Study on two (2) specific corridors within the RM limits in efforts to identify the infrastructure necessary to accommodate industrial growth. The two industrial corridors that were included in the study are:

- the industrial corridor along Highway 316, extending north from the Village of Clavet to Highway No. 5, approximately six miles east of the City of Saskatoon limits; and
- the industrial corridor along Highway 16 and the CP Rail line, approximately three miles west of the Village of Elstow, and twenty miles southeast of the City of Saskatoon limits.

The work involved compiling a detailed site plan that identified the existing infrastructure for the industrial corridors, identifying current infrastructure capacity and outlining options available to meet potential future infrastructure demand. This plan will be an invaluable tool to assist the RM, stakeholders and AE to identify what and where specific infrastructure is required.

The report contains detailed mapping of existing services located within the study corridors that was compiled from relevant background data. Various facility plans and relevant background data were obtained as required and input into one comprehensive AutoCAD base drawing. This drawing includes, but is not limited to: satellite imagery, cadastral mapping data, topographical data, roads, rail, water and wastewater facilities, natural gas mains, and power supply lines.

Stakeholders that have a vested interest in the RM were identified and meetings were held with each individual stakeholder to present the RM's existing services mapping and begin a collaborative process to aid in the development of a detailed plan for the future expansion of services. Stakeholders were invited to identify current and anticipated future water supply and treatment, sewage treatment and disposal, utility, and transportation needs. This information was used to determine if any of the existing services are of concern and to develop projections and priorities for potential Industrial Services Expansion Projects.

Each Crown corporation was contacted to determine if there are any upgrades within the RM planned in the near future. This information, along with the infrastructure services mapping developed by AE, has been used to identify the existing electrical, natural gas, telephone and data services, and the potential for expansion if necessary. Also, the stakeholders were asked to identify what, if any, upgrades and expansions are required for future land development with respect to their operations. The methods of utility expansion through the Crown Corporations have also been identified in detail.

The location of railways, highways and roads have been identified and assessed in some detail. Saskatchewan Highways, CN Rail, and CP Rail were contacted to determine if there are any changes within the RM planned in the near future. This information, along with the infrastructure services site plan, has been used to identify whether the existing transportation methods are sufficient to meet projected demands or if upgrades or expansions are required.

In general, the RM's industrial corridors are in close proximity to strong transportation infrastructure; primary highways No. 11 (Regina – Prince Albert) and 16 (Winnipeg – Edmonton), as well as secondary highways No. 41 (Melfort/Tisdale) and No. 5 (Humboldt). There is also potential access to both CN and CP rail lines, with CP Rail lines located within both corridors and the CN Rail accessing the south portion of the Clavet corridor. Another form of transportation would be the use of the John G. Diefenbaker International Airport, which provides air access for both people and cargo.

Saskatoon has a well developed industrial service area as a result of services provided to Saskatchewan's mining sector. Also, skilled personnel are available from Saskatoon and the surrounding area, as there is an existing track record of people commuting to potash mines located up to thirty-five miles east of Saskatoon.

Water supply and treatment is a significant factor when considering development. There are currently both City of Saskatoon treated water supply lines, as well as South Saskatchewan River raw water supply lines located within the study corridors that service existing industries. Both of these water supply lines have been or will be upgraded, which has increased the capacity for the R.M. of Blucher. Additionally, there are significant potential groundwater resources within the vicinity of the study corridors. The study assesses the location and capacities of existing water supplies, pipelines, and treatment facilities and identifies options for providing adequate raw and treated water to meet projected water demands.

Current and projected water demands were estimated by location using Saskatchewan Community Water Use Records, land development plans for the RM, Industrial water use records for industries that have potential to enter the corridors, and information provided by stakeholders. These water demands were compared to the location and capacities of existing water supply and treatment facilities. Upgrades and expansions required to utilize existing infrastructure, alternate ground and surface water sources, and new supply and treatment construction required to meet the projected water demands have been identified.

Sewage treatment and disposal can be very industry specific. The objective of this report is to assess the location and capacity of potential sewage treatment and disposal facilities and identify potential options for providing adequate services to meet projected demands. The current and projected water demands by location were used to determine potential sewage treatment and disposal demands by location. As industrial sources of wastewater often require specialized treatment processes, several different types of sewage treatment and disposal methods have been identified. The study area offers wastewater management options not normally found in urban settings. The areas contain groundwater discharge lakes that have potential to be utilized/developed for integrated wastewater treatment and wetlands development, as well as adjacent crop land for wastewater utilization as irrigation water.

The RM of Blucher contains a significant amount of industry, and is likely to see growth in the future. Overall, the infrastructure found in the RM of Blucher appears to be able to facilitate growth of present and future industry.

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1 Introduction

1.1 BACKGROUND

According to the Saskatchewan Regional Economic and Co-operative Development, the Rural Municipality (RM) of Blucher #343 is the fastest growing municipality in the province. Saskatoon's close proximity to the RM's nine townships, including the urban centres of Allan, Bradwell, Clavet, Elstow, Blucher, and Sunset Estates Mobile Home Park, has resulted in the RM being viewed as a favourable alternative to the high real estate and tax prices found in the City of Saskatoon.

Over the years the RM of Blucher has attracted a number of large agricultural related industries including:

- Agrium Inc. (anhydrous ammonia-bulk fertilizer distribution center),
- Cargill Ltd. (anhydrous ammonia-bulk fertilizer distribution center, canola crushing plant, and inland grain terminal),
- Potash Corp. (two potash mines), and
- Westco (anhydrous ammonia-bulk fertilizer distribution center).

With progressive development initiatives, the RM of Blucher anticipates continued success of existing industries and multiple opportunities to expand the existing industrial base. As such, the RM of Blucher has requested that Associated Engineering (AE) conduct an Industrial Servicing Study on two (2) specific corridors within the RM limits in efforts to identify the infrastructure necessary to accommodate the RM's industrial vision of the future.

The first corridor is located along Highway #316 between Clavet, Saskatchewan and the Patience Lake Potash Mine. The second corridor is located west of Elstow, Saskatchewan. See Figure 1-1 below for details.

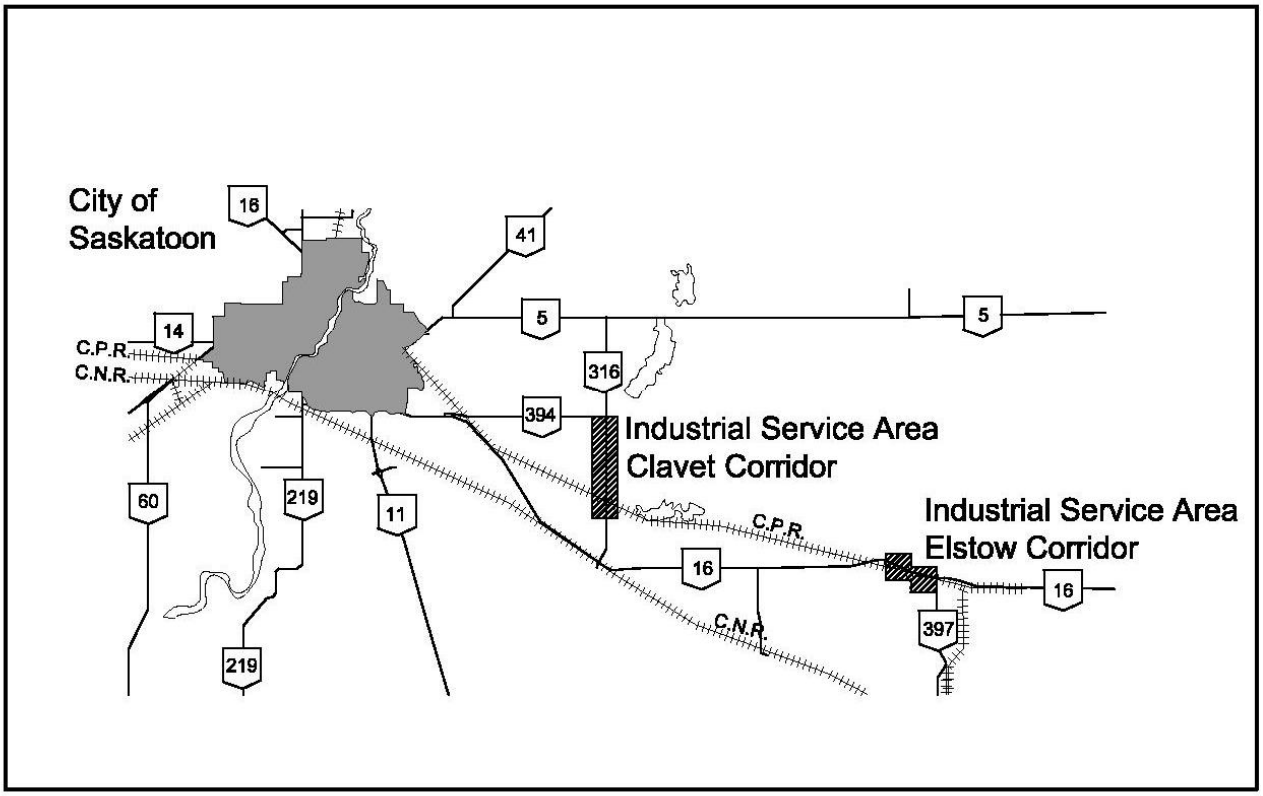

Figure 1-1: Industrial Corridor Location Map

1.2 STUDY PROCESS

In general, the work involved compiling a detailed site plan that identified the existing infrastructure for the industrial corridors. This plan will be an invaluable tool to assist the RM, stakeholders and AE to identify what and where specific infrastructure is required.

The following section presents the study as it was carried out in a task-based format. The tasks were developed based on our understanding of the RM's needs and modified as the project proceeded through meetings and discussions with the municipality and stakeholders. The individual tasks provide a description of the activities that were undertaken throughout the project. The objective, the proposed approach and the outcome or deliverable, where applicable, are stated for each task.

1.3 PROJECT INITIATION

Objective: To compile relevant background data in order to develop a detailed map of existing services located within the RM of Blucher.

Approach: Various facility plans were obtained as required and relevant background data was compiled and inserted into one comprehensive AutoCAD base drawing. This drawing includes, air satellite imagery, cadastral mapping data, topographical data, roads, rail, water and wastewater facilities, natural gas line(s), power supply, and voice/data communication lines.

Deliverable: A complete set of drawings illustrating the existing infrastructure within the municipality with particular emphasis on the industrial corridors. See Appendix A for a complete set of drawings.

1.4 STAKEHOLDER MEETINGS

Objective: To present to stakeholders the RM's existing services mapping and begin a collaborative process to aid in the development of a detailed plan for the future expansion of services.

Approach: Stakeholders that have a vested interest in the RM were identified. On a one on one basis, stakeholders were presented with the scope of the Study and given the opportunity to identify current and anticipated future water supply and treatment, sewage treatment and disposal, utility, and transportation needs. This information was used to determine if any of the existing services are of concern and to develop projections and priorities for potential Industrial Services Expansion Projects.

Deliverable: Section 2 of this report outlines the needs and comments regarding municipal services of each existing major stakeholder that was contacted.

1.5 WATER SUPPLY & TREATMENT

Objective: To assess the location and capacities of existing water supplies, pipelines, and treatment facilities and identify options for providing adequate raw and treated water to meet projected water demands.

Approach: Current and projected water demands were estimated by location using Saskatchewan Community Water Use Records, land development plans for the RM, Industrial water use records for industries that have potential to enter the corridors, and information provided by stakeholders. These water demands were compared to the location and capacities of existing water supply and treatment facilities. Upgrades and expansions required to utilize existing infrastructure, alternate ground and surface water sources, and new supply and treatment construction required to meet the projected water demands have been identified.

Deliverable: Section 3 of this report outlines projected water demands, existing facility capacities, expansion requirements, and expansion options.

1.6 SEWAGE TREATMENT AND DISPOSAL

Objective: To assess the location and capacity of potential sewage treatment and disposal facilities and identify potential options for providing adequate services to meet projected demands.

Approach: The current and projected water demands by location were used to determine potential sewage treatment and disposal demands by location. As industrial sources of wastewater often require specialized treatment processes, several different types of sewage treatment and disposal methods have been identified. Industry specific information must be used to determine the type of sewage treatment and disposal that may be required. Potential demands will be compared to the capacity and location of existing and potential sewage treatment facilities, and upgrades and expansions necessary to utilize and/or increase the efficiency of existing infrastructure will be identified.

Deliverable: Section 4 of this report outlines sewage treatment and disposal demands, existing facility capacities, expansion requirements, and expansion options.

1.7 CROWN UTILITY INFRASTRUCTURE

Objective: To assess the location and capacity of Crown utility services and identify what, if any, upgrades and expansions are required for future land development.

Approach: Each Crown corporation was contacted to determine if there are any upgrades within the RM planned in the near future. This information, along with the infrastructure services mapping developed by AE, has been used to identify the existing electrical, natural gas, telephone and data services, and the potential for expansion if necessary.

Deliverable: Section 5 of this report outlines existing Crown utility services, and possible expansion options.

1.8 TRANSPORTATION

Objective: To assess the location of railways, highways and roads, and identify what, if any, upgrades and expansions are required for future land development.

Approach: Saskatchewan Highways, CN Rail, and CP Rail have been contacted to determine if there are any changes within the RM planned in the near future. This information, along with the infrastructure services site plan, was used to identify whether the existing transportation methods are sufficient to meet projected demands or if upgrades or expansions are required.

Deliverable: Section 6 of this report outlines transportation demands, existing and planned highway and rail changes, expansion requirements, and possible expansion options.

2 Stakeholder Meetings

As part of the Industrial Servicing Study, questionnaires were distributed to stakeholders who have a vested interest in the development of an industrial corridor. These groups include the Rural Municipality of Blucher, the Saskatoon Regional Economic Development Authority (SREDA), Patience Lake Potash Corporation of Saskatchewan (PCS), and Cargill Limited. The questionnaires were sent out July 5, 2007. Terry Fonstad, Ph.D., P. Eng., and Jeff Ruzicka held meetings with the stakeholders to discuss the questionnaire responses. The meetings were completed as follows:

- October 11, 2007 at 10:00am – SREDA Boardroom, 345 3rd Avenue South.
- October 11, 2007 at 1:00pm – PCS Mine Site, RM of Blucher, Highway 316.
- October 23, 2007 at 8:00am – Cargill Boardroom, RM of Blucher, Highway 316 (Terry only).

The stakeholders meetings had the same general outcomes with respect to services, and potential development. The potential for development in these corridors is excellent, provided that adequate services are available. A potential investor will be able to look more seriously at an area if the services that the potential industry requires are available. Service requirements will vary from industry to industry, the main requirements of roads, water supply, wastewater treatment and disposal, power, gas and communications systems will be necessary for every industry. Other considerations such as rail are very industry dependant but would be available if it is required. Another common consensus of the stakeholder meetings included the need for a residential buffer zone from the industrial site. The current municipal bylaws indicate that a Country Residential development must have a buffer zone of anywhere from 305m to 1000m from an industrial site depending on the intensity of the industrial activity in the area.

Water service to the area from SaskWater is a concern as the supply is limited and the price is not guaranteed; a larger supply with a reasonable long term price for raw water would be a desirable service to many investors. The possibility of a pipeline from Blackstrap Lake was considered positively by the current industries in the Highway 316 corridor.

Sewage treatment and disposal appears to be adequate in the area for the present users; however, expansion of the existing facilities or the consideration for new facilities for greater capacity is paramount to the success of an industrial corridor.

Other utilities such as Power, Gas and Data Communication appear to be satisfactory at the present time; however, a large increase of power usage (due to expansion of existing or new industry) would need to be assessed for upgrades to SaskPowers system.

The existing roadways in the areas are satisfactory for the current operations; however, as other industries migrate to the corridors there may be a need to upgrade the roads to handle the extra traffic volumes or increase the maintenance in order to ensure the roads remain in relatively good condition.

A list of the possible industries that could be attracted to the area is noted below. This list is provided as a guideline and results from the meeting with SREDA. There is potential for other industries beyond the list.

- Metal fabrication
- Transport companies
- Food processing plants
- Modular structure manufacturing
- Equipment manufacturing industries,
- UofS and synchrotron related operations
- Biofuel plants, etc.

Appendix B contains information gathered from the questionnaires and meetings with SREDA, Patience Lake Potash Corporation, and Cargill Limited. Appendix C includes the meeting minutes.

3 Water Supply and Treatment

The objective of the Water Supply and Treatment section of the study was to determine the current capacities and potential future demand from existing water supplies, pipelines and treatment facilities. Beyond the scope of this study, a detailed water study is required as the corridor develops in order to provide detailed design drawings and cost estimates to ensure future water supply needs are met.

Existing systems in the area were investigated including a private raw water supply main to the PCS Patience Lake Potash Mine (PCS), a SaskWater raw water supply main to Cargill Limited's (Cargill) Canola Processing Plant, a SaskWater potable main that is in the vicinity of both corridors, and the Bradwell Reservoir and Black Strap Lake Reservoir for potential surface water supply. The possibility of using a groundwater supply was also investigated by Beckie Hydrogeologists Ltd.

3.1 EXISTING INFRASTRUCTURE

3.1.1 Private Infrastructure

The only current private infrastructure within the surrounding area of the industrial corridors belongs to PCS. This 250 mm diameter raw water supply main is fed from the South Saskatchewan River and follows the Canadian Pacific Railway (CPR) line from the train bridge in Saskatoon, through Sutherland and follows the line until it reaches Highway No.394. The line then follows Highway No.394 going east until it reaches the potash mine. The location of the line can be seen on Drawing 20074249-101 in Appendix A.

A meeting was held with representatives from Associated Engineering (AE) and PCS Patience Lake Potash Mine. One of the objectives of this meeting was to determine the current and future water supply and demand for the operations of the mine. Mr. Jim Couch, the general superintendent for PCS, indicated that the mine has been reducing the water usage required for mining operations. Water consumption is expected to be reduced from what they currently use even with the recent expansion of the mine. It has been indicated that the mine uses anywhere from 6.3L/s to 47.3L/s (100 to 750 USgal/min) depending on operations at the mine. The 250mm diameter pipe would be near maximum capacity at 47.3 L/s (750 USgal/min).

PCS has indicated that water sharing may be a possibility as the demand for water decreases at the mine. At the time of writing this report, the mine has seen a decrease in water pumped from the river. However, in years previous the mine has had to run the pumps at full capacity to keep up with mining operations. Any other users that were to attach to this line would be required to recognize the fact that the mine may experience fluctuations in water usage and work around it.

One option may be for a potential user to install a storage basin for raw water pumped through this pipeline that could be filled at down times from the mine. An agreement would have to be reached with PCS Patience Lake on the water demand to the storage basin. This option has the potential to become feasible if the mine decreases water consumption to a point where they can guarantee a predetermined flow rate to the end user.

3.1.2 SaskWater

SaskWater has both potable and non potable water supply mains that run in the Clavet Industrial Corridor and a potable main near the Elstow Industrial Corridor. SaskWater also operates a system of non potable reservoirs from Gardiner Dam at Lake Diefenbaker to the Bradwell Reservoir and beyond. Appendix D contains the information on receiving service from SaskWater. The location of the SaskWater lines can be seen on Drawing 20074249-101 in Appendix A.

3.1.2.1 Raw Water Clavet Corridor

The raw water pipeline located in the Clavet Corridor currently services the Cargill Canola Crushing Plant. The pipeline also services golf courses that are on the line prior to Cargill. This line starts out as a 400mm diameter steel pipeline at the pump station on the South Saskatchewan River and reduces to a 200mm HDPE pipe that extends to Cargill. SaskWater recently upgraded this line by constructing a booster station, located where the line crosses Highway #11. This addition to the system doubles the capacity along the line to a peak of 150 L/s (2430 USgal/min). This increased Cargill's capacity from their pre-crushing plant expansion flow of 9.26 L/s (150 USgal/min) to their current peak capacity of 18.52 L/s (300 USgal/min).

The entire new additional capacity of the 200mm HDPE pipe has been allocated to Greenbryre Golf and Country Club and Cargill as apart of the expansion agreement. Cargill is also entitled to Greenbryre's flow during the winter months. SaskWater would be able to increase the flow by approximately 25 L/s before affecting the pressure and capacity of the HDPE section. There are also ongoing projects to move some municipal subdivisons that have connections on the 400mm steel pipeline to a potable system which may free up some additional volume on the line. As of right now, there are no additional flows available on the HDPE section without further upgrades.

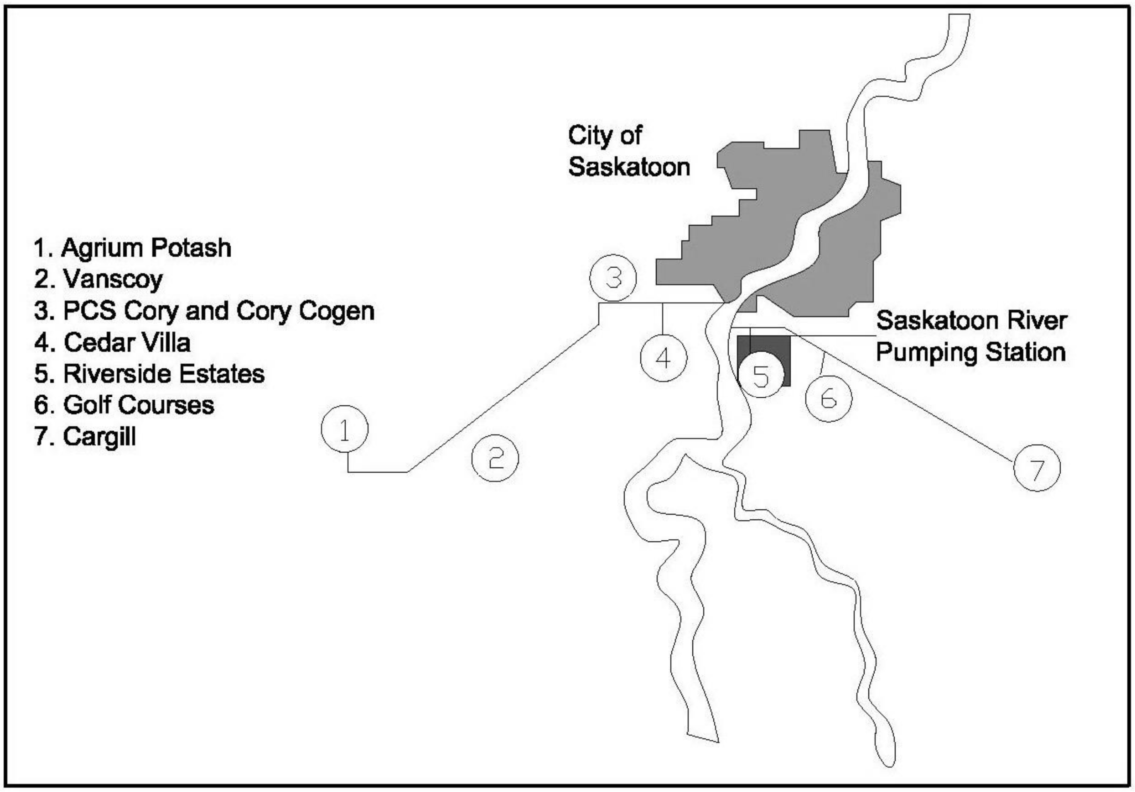

Figure 3-1: Non- Potable Water Supply System

3.1.2.2 Raw Water Elstow Corridor

There are no known raw water supply pipelines in the Elstow corridor at the time this report was written. There is a 300 mm SaskWater supply main to PCS Allen from the Bradwell Reservoir that may be possible to tap in to if the capacity on the line is available. This line is located approximately 6 kilometres from the corridor.

3.1.2.3 Potable Water

Locations in the RM of Blucher that receive potable water do so from the City of Saskatoon Water Treatment Plant via a SaskWater pipeline that is transferred from the City distribution system at the Clarence Avenue pumping station. The Clarence Avenue pumping station is the only current connection point from the City of Saskatoon to the areas in the RM of Blucher. The current pipeline is a combination of steel and plastic pipe with very little excess capacity. SaskWater is in the process of designing a new Clarence Avenue booster station, with the construction expected to be completed in the fall of 2011. The new pumping station will increase the system capacity from 50 L/s to 120 L/s (810 USgal/min to

1944 Usgal/min). This will allow for additional users in the R.M. of Blucher and along the Clavet corridor.

SaskWater has also completed construction of the Saskatoon Northeast pipeline system that supplies water to the community of Aberdeen. As a part of this project, the Highway #41 Rural Pipeline Association is constructing a pipeline that will parallel the North side of Highway #5. This line would lead to the booster station located 1 mile west of the corner of Highway #5 and Highway #316. This would increase the capacity from the current 8 L/s to 33 L/s. of the new 25 L/s flow, 12L/s is allocated for the Highway #41 Rural Pipeline Assocation and their plans for development further east of Highway #316 and Highway #5. The remaining 11 L/s of the new flow is expected to serve subdivision expansions along SaskWater's existing pipeline west of Highway #316.

SaskWater should be contacted prior to development in order to receive up to date information on the capability of the infrastructure to supply water.

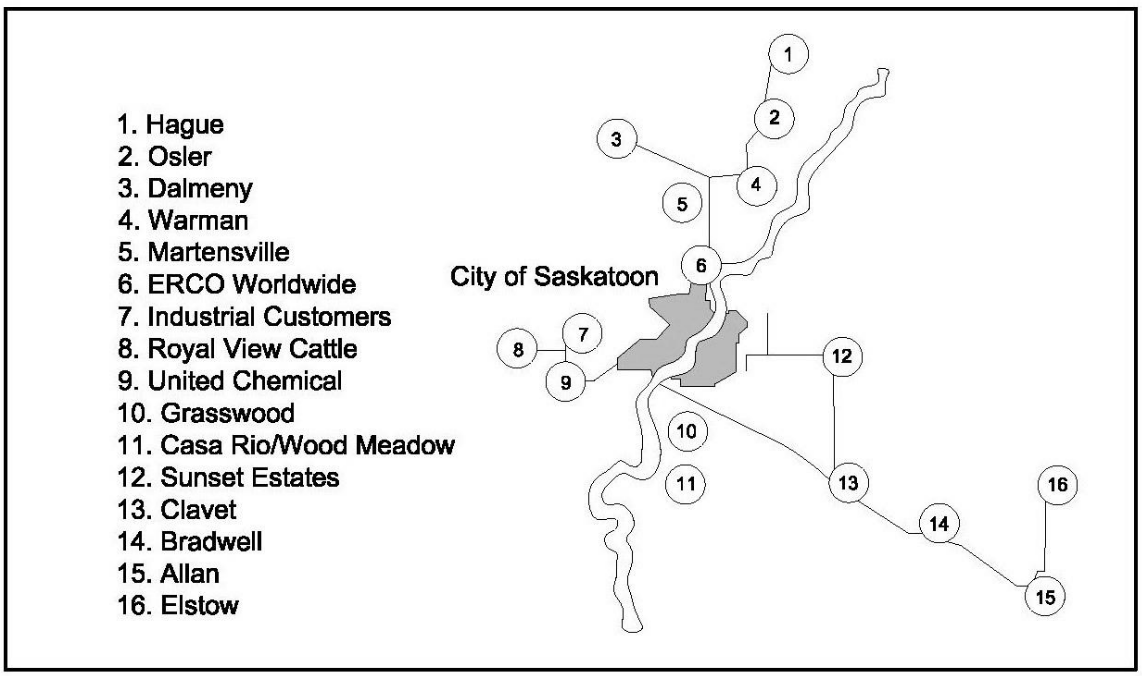

Figure 3-2: SaskWater Potable Supply System

3.1.3 Surrounding Community Water Supply and Demand

The surrounding communities of Clavet, Bradwell, Allan, Elstow and Sunset Estates are supplied with water from the SaskWater potable water pipeline. The Town of Clavet is currently expanding with new lots and increasing water usage. The communities of Bradwell, Allen and Elstow will be limited to expansion as the sewage lagoons in these towns are over capacity and require expansion according to Lee Reinhart from Saskatchewan Environment. This will limit the amount of water expansion as well. The SaskWater line supplying those areas is over 40 years old and is in need of an upgrade due to the compromised integrity of the line.

3.2 CURRENT AND FUTURE WATER DEMAND

3.2.1 Current Water Demand

The current water demand for the two areas in question has been touched on in the previous sections. The main water demand in the Clavet Corridor comes from PCS Patience Lake and the Cargill crushing plant. These two users have the potential to consume 65.8 L/s (1050USgal/min) if they are at maximum capacity with Cargills expansion.

The Elstow area has a smaller water demand from the industries present in the area. The two industries that currently operate in the area are Combine World, an agricultural machinery parts recycling business, and a Westco fertilizer storage and distribution center. The two industries would consume an estimated average of 0.05 L/s (1USgal/min) combined water usage. Combine World and Westco Fertilizer Storage are on the SaskWater potable supply system.

3.2.2 Future Water Demand

Future water demand has been estimated in three phases. Each phase consists of a 10 year period until 2030; the water demand is an estimate only assuming that industry would move into these areas if the infrastructure were available or potential to construct the infrastructure exists. A list of potential industries was produced as a result of meetings with SREDA and the continued expansion of the Province of Saskatchewan into the agricultural, mining and manufacturing sectors. A document produced by SREDA in 2007 lists manufacturing as the largest goods producing industry sector in the Saskatoon Region. The report also lists the region as home to world leaders in potash and uranium mining, and indicates that there is an increased interest in Saskatchewan mineral resources such as oil, gas, diamonds and gold deposits, with many exploration companies headquartered in Saskatoon. The SREDA report can be found on line at http://www.sreda.com/resources/pdfs/2007SREDAIndustrySurveyReport_28Sept07.pdf

The following list is an estimate used to determine potential growth within the municipality. The water consumption numbers are averaged over several businesses within there respective industries. Numbers have been compiled from “Industrial Water Use, 1996” published by Authority of the Minister of Environment and “Advanced Water Distribution Modeling and Management” published by Haested Methods Inc. 2003-2004. See Appendix E for a breakdown of the potential water demand by industry.

Elstow Industrial Zone:

Phase I 2010 -Combine World
-Westco Fertilizer Storage and Distribution
Estimated water consumption – 4 m^3/day

Phase II 2020 -Combine World
-Westco Fertilizer Storage and Distribution
-Food Processor
-Machinery Manufacturer
Estimated water consumption – 900 m^3/day

Phase III 2030 -Combine World
-Westco Fertilizer Storage and Distribution
-Food Processor x 2
-Machinery manufacturer
-Chemical manufacturer
-Ethanol plant
Estimated water consumption – 3300 m^3/day

Clavet Industrial Zone:

Phase I 2010 -PCS Patience Lake Potash Mine
-Cargill Canola Processing Plant
Estimated water consumption – 4600 m^3/day

Phase II 2020 -PCS Patience Lake Potash Mine
-Cargill Canola Processing Plant
-Food processor
-Fabricated metals manufacturer
-20,000/week livestock slaughter facility
Estimated water consumption – 7400 m^3/day

Phase III 2030 -PCS Patience Lake Potash Mine
-Cargill Canola Processing Plant
-Food processor
-Fabricated metals manufacturer
-20,000/week livestock slaughter facility
-Chemicals manufacturer (410.7 m3/day)
-Non-metallic products manufacturer (72.4 m3/day)
-Primary metals manufacturer (1515.1 m3/day)
Estimated water consumption – 9600 m^3/day

3.3 EXPANSION OF EXISTING FACILITY OPTIONS

The existing facilities have been outlined above. PCS Patience Lake could potentially have raw water to share, but it is unlikely they would guarantee any amount of water to a new user as the demand for the mining operation fluctuates from year to year. This option could be investigated if necessary.

According to SaskWater, the newly upgraded raw water pipeline to Cargill has no additional flow available to other users without further upgrades.

After the Highway #41 water line expansion in 2010, there will be an additional capacity of 12 L/s of potable water available to supply users along the line, east of Highway #316 along Highway #5, which includes the increasing demand from surround communities and acreage developments. An agreement would have to be made with the Highway 41 Rural Pipeline Association for use of the rural pipeline.

3.4 GROUNDWATER OPTIONS

A cursory hydrogeologic assessment was completed on the study areas by Beckie Hydrogeologists Ltd. (BHL). The report indicates that there appears to be several separate aquifer systems within the study area that may be suitable for water supply in the industrial corridor. Use of these aquifers will depend on end user requirements for water quantity and quality.

Four aquifers were identified in the study area; these aquifers include the Judith River Aquifer, Patience Lake Valley Aquifer, Meacham Aquifer, and Forestry Farm Aquifer. Most of the information in the report is estimated based on BHL previous experience in the area and data collected from external reports and Saskatchewan Watershed Authority water well data base.

Pertinent information is listed below in Table 3-1.

Table 3-1: Ground Water Information

Aquifer	Location	Aquifer Depth	Aquifer Thickness	Water Quantity (Max Day)	Water Quantity (Max Day)	Water Quality (TDS)
		(m)	(m)	(L/s)	(USgal/min)	(mg/L)
Judith River	Clavet and Elstow	90	30	*1.6 to 4.1	25 to 65	*2000-3500
Patience Lake Valley	Clavet	75	30	*16.6	260	*2500-3700
Meacham	Clavet and Elstow	90	30	*16.6	260	**3700
Forestry Farm	Clavet and Elstow	20 Clavet 10 Elstow	30	*8.3	140	**3100

Notes: *BHL Estimates
**Data from Sask Watershed Authority observation wells

The data in the BHL report is a preliminary study of the potential for groundwater in the area. If groundwater is being considered as an option for water supply in high volumes, a more detailed study and test wells examining the sustainability of the source quantity and quality is recommended. The cursory report from BHL from February 2008 is found in Appendix F. A Saskatchewan Watershed Authority fact sheet, published in 2006, for the ground water approval process is found in Appendix G.

3.5 SURFACE WATER OPTIONS

Water allocated from SaskWater on the Saskatchewan South East Water Supply (SSEWS) canal system to the industrial corridors may be a potential option for both areas. For the Clavet corridor; a pipeline direct from Blackstrap Lake has been cost estimated, and for Elstow; a pipeline from the Bradwell Reservoir has been cost estimated.

In order for water to be taken from the Bradwell Reservoir or Blackstrap Lake the water must be allocated to SaskWater for industrial use. SaskWater has an allocation of water that is designated for industrial, irrigation, municipal and wildlife use in the SSEWS canal system. This water is allocated by the Saskatchewan Watershed Authority. According to Dennis Frey of SaskWater and Gord Hagen from Saskatchewan Watershed Authority, these allocations were licensed in 1976 and can be increased if the demand for water exists and the system can handle the increased demand.

The current allocations for the SaskWater Saskatoon South East non-potable water supply are shown in Table 3-2. A diagram of the reservoirs included in the SSEWS system is shown below Figure 3-3).

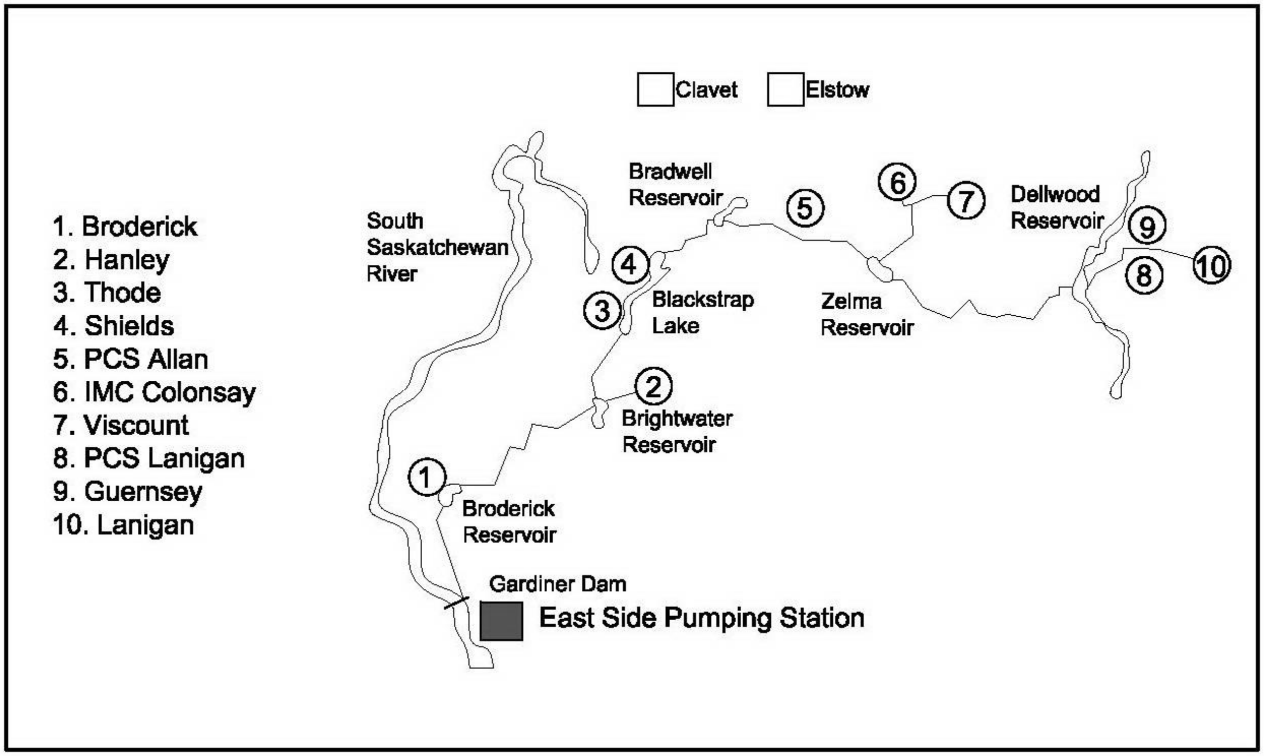

Figure 3-3: SSEWS System

Table 3-2: **SaskWater, SSEWS Canal System Annual Water Allocations**

Water Use	Acre-ft/year	dam^3/year
Industrial	9300	11500
Irrigation	32800	40500
Municipal	2100	2600
Wildlife	4000	5000
Recreation	9200	11300

The annual allocation for industrial water use is 11500 dam^3 (9300 acre-ft), however, of that 11500 dam^3 approximately 7200 dam^3 (5800 acre-ft) is currently being used along the South East System by various users. This leaves an additional 4200 dam^3 (3500 acre-ft) of water to be taken from the system under the current allotments.

3.5.1 Clavet Surface Water

A 400 mm pipeline from Blackstrap Lake to the Clavet corridor has been cost estimated. This pipeline would allow for an increase in raw water of up to 126L/s (2000USgal/min) through a 400mm HDPE pipeline. The pump house could be expanded as the demand for water increases as an initial cost savings method. The location of the proposed line can be seen on drawing 20074249-101 in Appendix A.

A preliminary cost estimate was completed on the construction of a pipeline from Blackstrap. The cost estimate is located in Appendix H. The estimated cost to complete the project is approximately $4.5 million. The cost estimate details include potential water use and pay back of the infrastructure for three different scenarios. The pay back scenarios include payback periods for one user of 18.5 L/s (290USgal/min), two users of 18.5 L/s (290USgal/min) and a scenario where the line is operating at full capacity.

The unit prices do not include operation and maintenance costs or the cost of purchasing water from Saskatchewan Watershed Authority. A SaskWatershed Authority fact sheet published in 2008 can be found in Appendix I; the fact sheet outlines the cost for using surface water as well as a fact sheet for a surface water use approval process.

A pipeline with a capacity of 126L/s (2000 USgal/min) running at full capacity all year would use a total of nearly 4,000,000 m^3 of water which equates to approximately 4,000 dam^3 (3,220 acre-ft). The current capacity of the lake for Industrial use is in the range of 5,000 dam^3/yr (4,000 acre-ft/yr) according to SaskWater. Given the current situation, this may be a feasible option for an industry(s) that would require a large amount of water.

3.5.2 Elstow Surface Water

A pipeline could also be constructed from the Bradwell Reservoir, which is fed by Blackstrap Lake, to the Elstow Corridor. A cost estimate for a 400mm pipeline has been completed and can be seen in Appendix H.

The source of SaskWater raw water currently available in the nearest vicinity of the Elstow Corridor is the Bradwell Reservoir. This reservoir is fed through a series of reservoirs on the SSEWS system originating from Lake Diefenbaker. The main users of the water in this reservoir are the Allen Potash Mine and the other reservoirs downstream which provide water to two more potash mines and three towns. Water usage upstream of the Bradwell Reservoir consists mainly of irrigation users.

One of the factors that must be considered with respect to increasing water demand from the Bradwell Reservoir is the capacity of the reservoir at full supply level and its ability to supply users during the winter months without drawing it down too low prior to being refilled in the spring.

If the Bradwell Reservoir was to be used for industrial purposes, a pipeline would have to be constructed from the reservoir to the property in the Industrial Corridor. The pipeline from the reservoir to the corridor would be approximately 12km depending on the route taken to get to the corridor.

3.6 WATER TREATMENT

As demand for potable water increases in the industrial corridor and the surrounding communities, there may be potential to construct a water treatment plant to supply potable water to these communities and industrial users. A source of raw water for treatment has potential to come from the above mentioned surface water supplies or groundwater supplies. As distribution systems for potable water are installed or upgraded the demand for more potable water may exist.

Locations for water treatment plants would be determined by the area with the greatest need for potable water. The Town of Clavet may be a good location as the town expands and water usage increases. As new subdivisions are created and water distribution systems are installed with increased pressure on the existing potable water supply a new water treatment plant may be a feasible option.

3.7 WATER USE OPTIONS

Most water use options will require an agreement with the existing infrastructure owner or an approval to construct water works infrastructure. Appendices D through I have been described above and give preliminary information for getting started. Appendix J contains additional information on obtaining approvals such as application forms and instructions for completing the application forms with examples.

3.7.1 Industry Requiring Small Amounts of Water (0-1.2L/s (0-20USgal/min))

3.7.1.1 Option #1 – SaskWater

The SaskWater pipeline in the Clavet or Elstow corridors would be a feasible option given the close proximity and quality of water being delivered from the City of Saskatoon. This water line is currently reaching or at maximum capacities according SaskWater officials, however upgrades to the service are expected to be completed in 2010 and 2011. Potential users can contact SaskWater directly to request service. Wherever possible, SaskWater encourages individual consumers to join or form a local rural water association, cooperative or utility board to access water services. In cases where this is not possible or feasible, SaskWater connects individual customers to both potable and non-potable systems. See Section 3.1.2 and Appendix D for more information on connecting to a SaskWater Rural water pipeline.

3.7.1.2 Option #2 – Groundwater Supply

Groundwater supply is an option for both locations with small amounts of water to be used. Groundwater may require some treatment prior to drinking or use in plumbing fixtures in order to maintain the life of the plumbing fixtures. See Section 3.4 and Appendix F for more information and the Report from Beckie Hydrogeologists. A more detailed study on the quality and quantity of the ground water in the area may be necessary depending on the use of water. Appendix G contains a fact sheet for groundwater use approval.

3.7.2 Industries Requiring Moderate Amounts of Water (0-9.5L/s (150USgal/min))

3.7.2.1 Option #1 – SaskWater

SaskWater has potential options in each corridor for moderate amounts of non-potable water as well. The Clavet corridor has a SaskWater line running to Cargill that could potentially be expanded to accommodate these moderate amounts as described in Section 3.1.2. See Appendix D for more information on connecting to a SaskWater Rural water pipeline.

3.7.2.2 Option #2 – Groundwater Supply

The aquifers within the industrial servicing areas are capable of producing flows up to 16 L/s, however these numbers are preliminary estimates and more detailed investigation should be completed to confirm that anything above 9.5L/s can be sustained. In the Clavet area the Patience Lake Valley, Meacham, and Forestry Farm Aquifer are capable of producing flows up to 9.5L/s. In the Elstow area Meacham and Forestry Farm aquifers have the same capacity. See Section 3.4 and Appendix F for more information and the Report from Beckie Hydrogeologists. A more detailed study on the quality and quantity of the ground water in the area may be necessary depending on the use of water. Appendix G contains a fact sheet for groundwater use approval. It should be noted that quality can be an issue with groundwater sources as they can be highly mineralized.

3.7.3 Industries Requiring Large Amounts of Water (0-126L/s (2000USgal/min))

At the time of writing this report there is no infrastructure in either corridor to accommodate this type of water demand; however, options exist to install pipelines from Blackstrap Reservoir to the Clavet corridor and from the Bradwell Reservoir to the Elstow Corridor as outlined in Section 3.5.

4 Wastewater Treatment and Disposal

The industrial corridors are located in rural settings which offer several wastewater treatment and disposal options not available in an urban location. It is important to give a brief characterization of the environmental settings of the sites to understand the options available. Due to the rural setting and the vicinity of existing groundwater discharge lakes, developers in these areas may be able to utilize effluent irrigation, wetlands treatment or discharge to the groundwater discharge lakes. These options would likely be combined with some onsite pre-treatment that would depend on the nature of the effluent created by the facility.

The following sections give a brief characterization of the environmental settings of the industrial corridors as well as an explanation of some of the various wastewater treatment systems available.

4.1 REGIONAL ENVIRONMENTAL SETTINGS

The Industrial corridors are located in the Moist Mixed Grassland Ecoregion of the Prairie Ecozone. The section of the ecoregion called the Elstow Plain includes both of the industrial corridors.

4.1.1 Topography

The Elstow Plain is a glacial lake plain that slopes from approximately 550 meters at the base of the Minichanas and Allan Hills to 520 metres in the southern part of the area and 490 metres at the South Saskatchewan River near Saskatoon. Surface drainage is limited to Blucher and Blackstrap Lakes and large sloughs.

Local topography in the Clavet corridor drains mainly to Cheviot Lake from the northwest to the southeast.

Local topography in the Elstow corridor is a gentle slope from north to south through the corridor. Drainage from the corridor will go to two large sloughs west of Elstow.

4.1.2 Geology

Hummocky and kettled glacioluacustrine landscapes are most common in the eastern part of the area, indicating the presence of a former glacial lake resting on glacial ice. The channel of the present Lewis Creek served as a spillway for this glacial lake. In the remainder of the area the landscapes are very gently undulating glaciolacustrine plains. Dark brown loamy soils prevail on the various landscapes. Clay soils occur, locally, east of Saskatoon.

4.1.3 Hydrogeology

A cursory hydrogeologic assessment was completed on the study areas by Beckie Hydrogeologists Ltd. (BHL). The report indicates that there appears to be several separate aquifer systems within the study area that may be suitable for water supply in the industrial corridor. Use of these aquifers will depend on requirements of water quantity and quality requirements of the end user.

Four aquifers were identified in the study area; these aquifers include the Judith River Aquifer, Patience Lake Valley Aquifer, Meacham Aquifer, and Forestry Farm Aquifer. Three of these aquifers are present in both the Elstow and Clavet corridors. The exception is the Patience Lake Aquifer which is only present in the Clavet corridor.

4.2 POTENTIAL SEWAGE FLOWS BY INDUSTRY

In the water section of this study the potential for expansion within the corridors was discussed. Several industries were looked at with respect to water consumption. These same industries have been used for the potential wastewater generation for the corridors.

Elstow Industrial Zone:

Phase I 2010 -Combine World
-Westco Fertilizer Storage and Distribution
Estimated water consumption – 4 m^3/day

Phase II 2020 -Combine World
-Westco Fertilizer Storage and Distribution
-Food Processor
-Machinery Manufacturer
Estimated water consumption – 900 m^3/day

Phase III 2030 -Combine World
-Westco Fertilizer Storage and Distribution
-Food Processor x 2
-Machinery manufacturer
-Chemical manufacturer
-Ethanol plant
Estimated water consumption – 7300 m^3/day

Clavet Industrial Zone:

Phase I 2010 -PCS Patience Lake Potash Mine
-Cargill Canola Processing Plant
Estimated water consumption – 4600 m^3/day

Phase II 2020 -PCS Patience Lake Potash Mine
-Cargill Canola Processing Plant
-Food processor
-Fabricated metals manufacturer
-20,000/week hog slaughter facility
Estimated water consumption – 7400 m^3/day

Phase III 2030 -PCS Patience Lake Potash Mine
-Cargill Canola Processing Plant
-Food processor
-Fabricated metals manufacturer
-20,000/week hog slaughter facility
-Chemicals manufacturer
-Non-metallic products manufacturer
-Primary metals manufacturer
Estimated water consumption –9600 m^3/day

4.3 TREATMENT DESIGN CRITERIA

Treatment design criteria should be categorized in a minimum of two different ways: the first category being municipal waste, and the second category being industrial waste. Both Types of waste are regulated by Saskatchewan Environment, however, the difference is that municipal waste is easily categorized and there are several methods for treatment of municipal waste that would be sufficient for the industrial corridors. Industrial waste, on the other hand, is much more difficult to categorize as its characterization is unclear and often industry specific. Several publications give ranges of industrial wastewater quality, however, until the specific source is known it is difficult to assess the capacity for treating industrial waste.

It is anticipated that industrial wastewater treatment will be the responsibility of the producer, however, municipal wastewater treatment may lend to a centralized treatment system as the corridors develop. Treated wastewater could be utilized or disposed of in several ways including evaporation ponds, effluent irrigation, land injection, discharge to local saline groundwater discharge lakes or other methods depending on the volumes and quality of the treated waters.

Wastewater treatment is regulated by the Saskatoon Health Region or the Government of Saskatchewan Ministry of the Environment depending on the facility type and volumes produced. The Saskatchewan Watershed Authority may have jurisdiction for land application, irrigation and discharge to water bodies. Additionally, the federal Department of Fisheries and Oceans may have requirements if water is to be discharged to fish bearing environments. Finally, the Rural Municipality of Blucher may have development permits and public process requirements.

4.4 MUNICIPAL WASTE WASTEWATER WORKS

The following section discusses feasible wastewater treatment technologies suitable to service the potential wastewater generation from the study area; however, this list is somewhat extensive with a broad range of treatment options as it is currently unknown as to how the wastewater will be handled. A summary of the options is provided in Section 4.10.

Choice of a wastewater treatment alternative is highly dependent on the wastewater to be treated, as the quality of the wastewater is the primary differing factor between technologies. For more information on Sewage Works Design and Application, refer to Appendix M.

4.4.1 Lagoons

4.4.1.1 Conventional Stabilization (Facultative) Lagoon

Facultative waste stabilization ponds (lagoons) are earthen ponds that rely on the natural processes of bacteria and algae to reduce organic matter to acceptable levels. Facultative lagoons are not mechanically mixed or aerated. They typically consist of a treatment cell followed by one or more storage cells, with appropriate inlet and outlet structures to maximize effectiveness of treatment volume. The lack of mechanical mixing and aeration maintains three distinct layers:

(1) Aerobic Zone: The layer of water near the surface contains dissolved oxygen from the atmosphere (surface re-aeration) and from algal respiration. The oxygen is used by aerobic and facultative bacteria to stabilize organic material in the upper layer of water.
(2) Facultative (Anoxic) Zone: The intermediate anoxic zone ranges from aerobic near the top to anaerobic at the bottom.
(3) Anaerobic Zone: The bottom layer of the lagoon includes sludge deposits and supports anaerobic organisms.

During cold weather, biological activity under ice cover is significantly reduced, and the treatment process is essentially reduced to settling of the solids. As a result, discharge from facultative lagoons in winter is prohibited. Temperature fluctuations in the spring and fall can cause the surface water layer to have a higher density than lower layers, resulting in inversions. This higher density water sinks during these unstable periods, increasing turbidity, and often producing objectionable odours.

To prevent leakage of wastewater into the soil, a low-permeability compacted clay or synthetic liner is placed along the bottom and sloped sides of the lagoon. This is necessary to prevent pollution of the groundwater table and any nearby wells.

The design standard for conventional lagoons requires at least 2 cells, operating in series.

The treatment (primary) cell has a typical retention time of 180 days, and a max treatment rate of 30 kg/ha-d of BOD. The depth of the treatment cell can not be greater than 1.5m; this, along with the max treatment rate, governs the size that the cell needs to be to maintain proper treatment.

The storage (secondary) cell should have sufficient volume to provide a minimum of 180 days storage, based on hydraulic loading including infiltration and inflow with due allowances for potential evaporation and exfiltration losses. The treatment cell can not be deeper than 2.1m, unless provisions are made to maintain aerobic conditions in the cell during the ice free period.

There is a possibility of having a larger storage cell, designed to have a 12 month retention time. The purpose of such a large storage cell is to provide additional wastewater treatment (including nutrient removal) under facultative conditions, and to reduce the environmental impact on the receiving drainage course by facilitating the annual discharge of high quality effluent wastewater. Wastewater treated in this fashion can achieve very good nutrient removal, as long as the effluent is discharged during a period of high effluent quality in the fall.

4.4.1.2 Conventional Aerated Lagoon System

Aerated lagoon systems typically consist of two or more moderately sized ponds. Unlike conventional waste stabilization ponds (facultative lagoons), aerated ponds are mechanically aerated to supply oxygen for biological treatment of the wastewater and to keep more of the biosolids in suspension. Air blowers are typically used to force air through an air diffusion system near the bottom of the pond. This type of lagoon treatment provides a more consistent level of treatment throughout the year typically enabling continuous discharge, consumes less land (no large ponds), and rarely produces noticeable odour.

The design standard for aerated lagoons requires:

- A minimum of two partially mixed aerated cells, having a total retention time of at least 28 days based on maximum monthly design flow.; and
- A storage pond may also be required if the effluent receiving watercourse does not provide constant flow through the winter months.

4.4.2 Mechanical Treatment

Another effective wastewater treatment technology is a wastewater treatment plant. While all of the mechanical treatment plants require mechanical means to treat the incoming waste water, they can also incorporate nutrient removal. This nutrient removal can be achieved either through the addition of chemicals and/or with biological nutrient removal, which involves additional biological reactor tanks in a specific sequence.

4.4.2.1 Conventional Activated Sludge Treatment

The activated sludge process is so named because treatment is accomplished by the stabilization of organic material in the wastewater by an “activated” mass of micro organisms. A conventional activated sludge treatment system consists of:

- primary clarification for removal of readily settleable solids and floating material;
- aeration to provide oxygen to the micro-organisms responsible for treatment, and keep them suspended; and
- secondary clarification for final solids/liquid separation.

To keep the micro-organisms activated, a portion of the solids from the secondary clarifier is returned to the aeration tank through the return activated sludge (RAS) process.

4.4.2.2 Extended Aeration

In the Extended Aeration process, wastewater is screened and then aerated in a large capacity reactor for a long period of time (in the order of 24 hours), before progressing to a secondary sedimentation tank for solid/liquid separation. The settled water flows out of the tank for final disposal. The majority of the settled sludge in the bottom of the settling tank is drawn off and returned to the aeration tank. Some of the settled sludge is periodically directed into a holding tank where it is stabilized and thickened prior to final disposal.

4.4.2.3 Rotating Biological Contactor (RBC)

This process typically consists of a flow equalization chamber, a Rotating Biological Contactor (RBC) unit, and final settling tank. Removal of some settleable solids takes place in the flow equalization chamber upstream of the RBC.

The RBC includes a shaft with rotating plastic discs set in an open tank filled with wastewater. The discs rotate slowly in the tank and as they pass through the wastewater, organics are removed by biological growth on the rotating discs. The build-up of biological growth on the discs increases in thickness, forming a slime layer. When the discs pass through the air, oxygen is absorbed, further promoting the growth of this slime layer. When the slime layer on the discs gets thick enough, some of it sloughs off and settles in the bottom of the RBC while the rest enters the final settling tank, where it is removed before the treated water is discharged. Settled solids in the RBC and the final settling tank are often pumped back to the equalization/sedimentation chamber for storage and digestion.

RBC systems require pre-treatment, consisting of primary clarification or fine screens. Secondary clarification is required for liquid/solids separation. A large biofilm surface area is developed on the discs, and the process relies on mass transfer of oxygen and substrates from the bulk liquid to this biofilm.

The RBC process typically consists of a number of units operated in series. The number of stages depends on the treatment goals, with two to four stages for BOD removal and six or more stages for nitrification.

It should be noted that RBC's have fallen into disuse due to mechanical problems, as well as odour and moisture issues in buildings.

4.4.2.4 Sequencing Batch Reactor

The Sequencing Batch Reactor (SBR) process typically utilizes at least two fill-and-draw reactors operating in five steps:

- Fill: the receiving of raw wastewater
- React: the full reactor is mixed and aerated so that the reactions can occur
- Settle: a motionless period during which reactor contents are allowed to settle by gravity
- Draw: the clarified supernatant in the reactor is drawn off and discharged without disturbing the settled solids blanket
- Idle: no aeration or mixing takes place in the period between the end of Draw and the beginning of Fill

For continuous flow applications, at least two SBR tanks must be provided so that one tank receives flow while the other completes its treatment cycle. Since both aeration and settling occur in the same chamber, no sludge is lost in the React step and none has to be returned to maintain the solids content in the aeration chamber. Therefore, the SBR system does not need a return activated sludge (RAS) system.

4.4.3 Advanced Mechanical Treatment

4.4.3.1 Membrane Bio Reactor (MBR)

Membrane biological reactors (MBRs) consist of a biological reactor (bioreactor) containing suspended biomass, with integrated solids separation provided by microfiltration or ultrafiltration membranes immersed directly in or after the bioreactor. Membrane filtration negates the need for the solids separation process of secondary clarification and tertiary filtration, found in conventional activated sludge wastewater treatment plants. The MBR process provides an effluent quality suitable for water reuse following disinfection. In addition, depending on effluent requirements, the process can readily incorporate nutrient removal.

There are several different membrane manufacturers who offer membrane bioreactor treatment for wastewater. The following description of the MBR process is based on Zenon Environmental's description of their technology, although it applies to the MBR process in general.

Membranes are synthetic polymers with nanoscopic pores that, when vacuum or pressure is applied as a driving force, can effectively filter a water or wastewater stream. In low-pressure membrane applications using MF and UF, these pores range from 0.1 um down to 0.01 um. Over time, some small organic and inorganic particles can penetrate the pores of the membrane and cause membrane fouling. MBR manufacturers have systems in place to minimize fouling and to periodically reverse the fouling. Membrane cleaning can take place in four ways: aeration of the membranes, periodic backpulses through the membranes (similar to backwashing of conventional filters), maintenance cleans, and in-situ flux recovery cleans. The frequency and duration of each type of clean are based on site specific factors. Maintenance cleans involve backflushing strong solutions of (typically) citric acid or sodium hypochlorite through the membrane at frequencies up to once per day. The combination of air scour, backflushing, and maintenance cleaning is not completely effective in controlling membrane fouling, and as a result the permeability of the membrane decreases over time (or the pressure required for filtration increases with time). If necessary, the membranes are removed from the aeration basin for a recovery clean, during which they are soaked in a chemical bath for several hours. Eventually, however, fouling will occur to an extent that is irreversible, at which point the membranes must be replaced. Effective membrane life appears to be improving, and expected membrane life has risen from about five to ten years.

The membranes are typically submerged in the aeration tank, in direct contact with the mixed liquor. Through the use of a suction pump, the membranes are subjected to a vacuum that draws water through the membrane while retaining solids in the reactor. Treated water is drawn by the vacuum through the hollow fibre membranes, into the pump and then discharged. The energy associated with permeate pumping is relatively small, due to the use of a vacuum rather than positive pressure. Air is introduced to the bottom of the membrane module, producing turbulence which scours and cleans the external surface of the hollow fibres. This airflow also provides a portion of the biological process oxygen requirements; the remainder is provided by a diffused aeration system. Waste sludge is pumped directly from the aeration tank.

The MBR technology overcomes the problems associated with poor settling of sludge in conventional activated sludge processes. The technology permits bioreactor operation with considerably higher mixed liquor solids concentrations than conventional activated sludge systems, which are limited by sludge settling. The process is typically operated at a mixed liquor suspended solids (MLSS) concentration much higher than in the conventional activated sludge process. The elevated biomass concentrations allow for highly effective removal of both soluble and particulate biodegradable material in the waste stream. The process combines the unit operations of aeration, secondary clarification and filtration into a single process, simplifying operation and greatly reducing space requirements.

The process is readily adapted for biological denitrification and chemical phosphorus removal if the removal of total nitrogen and/or phosphorous is required. Where nitrogen removal is required, an upstream anoxic zone is incorporated in the bioreactor tank design. The elevated levels of biomass become readily anoxic in the absence of aeration, helping to achieve high denitrification rates. Also, the process is ideally suited for phosphorus removal, where required. Through the addition of metal coagulants, such as alum or ferric chloride, to the raw wastewater or mixed liquor, soluble phosphorus in the waste stream can be precipitated. The membranes have a pore size that provides an absolute barrier to the discharge of precipitated phosphorus. The phosphorus is retained in the mixed liquor and removed with the waste activated sludge. The MBR process can reliably achieve significantly lower effluent phosphorus concentrations than conventional municipal treatment processes.

4.5 ON SITE SEWAGE DISPOSAL

The Saskatchewan Onsite Wastewater Disposal Guidelines by the Saskatoon Health Region (Appendix K) indicate the range of potential wastewater generation by industry that would potentially use an onsite wastewater disposal system. Onsite wastewater disposal system is only recommended if a communal or municipal wastewater works are not available and are usually for small sources of wastewater. Permits in Saskatchewan for constructing an onsite wastewater system are available through the local health region and are regulated by The Plumbing and Drainage Regulations published 1997 (Appendix L). In the case of the RM of Blucher Industrial Corridors the Saskatoon Health Region has the jurisdiction.

Options for onsite sewage disposal include holding tanks, septic tanks, chamber systems, absorption field systems, mounds, jet type disposal systems, lagoons and package treatment systems. The type of system to be chosen from the list depends on several factors ranging from density of parcels in the corridor to the sensitivity of the land and water tables with respect to the surface. The intention of the guideline is too minimize the impact to water supplies, communities and neighbours. The sensitivity of the area can more easily be determined by consulting the section 4 of the wastewater disposal guidelines in Appendix K. The sensitivity criteria from the guidelines have been transferred to this document and are noted below.

4.5.1 Types of Onsite Disposal Systems

An outline of the different types of onsite sewage disposal systems has been presented below. This is an overview of the available systems in Saskatchewan as described in the 2007 Saskatchewan Onsite Wastewater Disposal Guidelines. A qualified geotechnical engineer and the Saskatoon Health Region should be consulted with prior to the construction of any on site sewage disposal system.

4.5.1.1 Holding Tanks

Holding tanks are used for temporary storage of wastewater to be transported to a treatment facility that would be located off-site. Holding tanks are primarily used in areas that are high sensitive areas. Holding tanks must be watertight and constructed of sound and durable materials. An off-site location for disposal of the wastewater should be secured prior to installation of a holding tank.

4.5.1.2 Septic Tanks

A septic tank is a two or more compartment system where the solids settle into the first compartment and the liquids spill over into the second compartment. The septic tank is designed to reduce the turbidity of the effluent so that it can be readily percolated into the subsoil of the ground. The septic tank reduces the Biological Oxygen Demand of the effluent by removing the solids. The solids are subject to biological activity in the holding compartment which reduces the volume of solids over time. The holding compartment of a septic tank may need to be cleaned once every one to four years depending on the application and size. The effluent from the septic tank is disposed of in one of the following systems.

4.5.1.3 Chamber Systems (From Septic Tank)

Chamber systems consists of pipe or open bottom plastic chambers in trenches or beds. These chambers receive the effluent from the septic tank and transmit it into the soil. The soil classification will determine the size of system to be used with the amount of effluent that will be produced.

4.5.1.4 Absorption Field Systems

An absorption field system is similar to a chamber system in that effluent is discharged form the septic tank into a series of perforated pipes laid in trenches. The effluent is spread over a medium of stone for treatment prior to entering the soil in this type of system.

4.5.1.5 Mounds

There are two types of mounds, Type 1 and Type 2 Mounds. A Type 1 mound consists of a series of perforated laterals on a rock bed above the natural soil surface. These perforated laterals receive wastewater from a septic tank through a distribution box. The effluent is transmitted into the rock bed and natural soil for final treatment and disposal

Type 2 mounds are considered to be the system of choice in large rural subdivisions as it can be used where other sewage disposal systems are not possible. This mound is a wastewater treatment system that is raised above the natural soil surface in a specific graded clean sand media. Wastewater from the septic tank is distributed to the perforated laterals over a gravel bed and clean sand media. The sand is overlain with a gravel layer to assist with the distribution of the effluent and to provide a brief storage area. Covering soil must be porous in order to ensure good aerobic conditions in the sand layer.

4.5.1.6 Jet Type Disposal Systems

A jet type disposal system is a system that pumps the effluent out in to a grassy or wooded area from a septic tank. This system can be used where relatively low rates of effluent will be discharged into an area of sufficient size to handle the discharge.

4.5.1.7 Lagoons

Lagoons are discussed in detail in the Municipal Wastewater Works section 4.4.1.

4.5.1.8 Package Sewage Treatment Plants

Package sewage treatment plants are aerobic treatment plants that use various methods to expose sewage to oxygen. An increased level of oxygen in the sewage provides for the establishment of large aerobic bacteria populations. These aerobic bacteria populations accelerate the decomposition of suspended solids in sewage. Resulting effluent can then be pumped or drained in to a system that is approved by the local health region.

4.5.2 Area Sensitivity

4.5.2.1 Low Sensitivity Area

- No more than two parcels (dwellings) are located on a ¼ section; and
- The installation is 1 km or greater from the boundary of an urban municipality.
- In these low sensitivity areas a homeowner or non-certified contractor may apply for a permit. In most cases holding tanks, chamber systems, absorption fields, Types I and II mounds, jet disposal systems, lagoons and package treatment plants are acceptable. Certain site conditions may

restrict the type of on-site sewage treatment system for a building site. Consult your local public health inspection office to determine which system will be approved for your proposed construction

4.5.2.2 Medium Sensitivity Area

- More than 4 parcels are located on a ¼ section or
- The installation is less than 1 km from an urban municipality boundary unless otherwise approved by the local health region only holding tanks, Types I and II mounds, chamber systems, absorption fields, lagoons and package treatment plants are permitted in medium sensitive areas.

4.5.2.3 High Sensitivity Area

- A land area containing subsurface water which is 1.5m or less below natural ground surface elevation.
- An area that the local health region considers to be highly sensitive due to the number of existing or proposed private sewage works.
  - The local health region must be consulted to determine the appropriate types of sewage disposal system. Unless otherwise approved by the local health region only holding tanks, pressure chamber systems, Type II mounds or package treatment plants and effluent disposal method are generally permitted in highly sensitive areas.

4.6 REGULATORY REQUIREMENTS

4.6.1 Saskatchewan Environment

Information regarding the design and construction of municipal wastewater works in the province of Saskatchewan can be found in the Guidelines for Sewage Works Design EPB 203 published January 2008 by Saskatchewan Environment. This document can be found in Appendix M. Applications for approval can be obtained from Saskatchewan Environment. An approval to construct, extend or alter any sanitary sewage works must be obtained prior to commencing construction of any works.

Information regarding Industrial works can be found in the Industrial Works Construction Application Standards EPB 204 published December 2007 by Saskatchewan Environment (Appendix M). These guidelines follow the Environmental Management and Protection Act (2002), The Water Regulations (2002), as well as others including the Hazardous Substances and Waste Dangerous Goods Regulations (1989, amended 2000), the Clean Air Regulations (1989) and the Clean Air Act (1898, amended 2003). These documents can be found in Appendix N. Drawings and plans for

Industrial works must conform to good engineering practices and be prepared pursuant to the Engineering and Geoscience Professions Act. Drawings and plans will require a sign-off by a Professional Engineer.

Regulations regarding surface water quality and effluent discharge objectives can be found in the Surface Water Quality Objectives EPB 356, published in July 2006, in Appendix O. This document lists applicable effluent discharge quality guidelines based on the location and use of the discharge area.

4.6.2 Department of Fisheries and Oceans

The Department of Fisheries and Oceans (DFO) may become aware of a project through a direct request or through a "referral" from a provincial agency or other organization. DFO will review the information to determine if there is fish habitat affected by the project. There are three possible processes:

1. No fish habitat – no concern. If there is no fish habitat, DFO will advise you that there are no habitat concerns with respect to the Fisheries Act.
2. Fish habitat – but harmful alteration, disruption or destruction (HADD) can be avoided – Letter of advice issued. If there is fish habitat but HADD can be avoided, DFO may be able to make recommendations or suggestions on ways to avoid the alteration, disruption or destruction.
3. Fish Habitat – HADD – may be subject to an Environmental Assessment. If DFO determines that the HADD is unavoidable they may not grant authorization of the project. In some cases DFO may consider the HADD to be acceptable and grant authorization with a requirement that a plan be in place to compensate for the loss of fish habitat. In these cases an Environmental Assessment will likely be required prior to granting authorization

A list of documents that Fisheries and Oceans Canada will require to assess your project is listed below. The more complete the list is the quicker the turn a round time from DFO will be.

- Description of your project (including how works or undertaking will be carried out and any temporary structures necessary to complete the project) with construction schedule and confirmation of compliance with local by-laws
- Property ownership status (if you are not the owner, attach a signed letter of permission from the owner)
- Map or chart to show location of project
- A sketch or drawing of your project, including side and top view and showing dimensions of the project
- Survey plan or sketch with dimensions indicating the location of existing buildings, shoreline structures, property lines, adjacent properties (include names), and low and high water marks

- Current photographs of the proposed project site, taken from a variety of perspectives, displaying the shoreline, the shoreline vegetation and the watercourse bottom (top view)
- List of any materials that will be used in the proposed project
- List of any equipment that will be used during the project
- Description of fish habitat that may be affected by the project (migratory route, spawning, rearing areas, fish present at the site, etc.)

It is our understanding that Cheviot Lake is not considered a fish bearing water body according to DFO; however, it will be the responsibility of any developer to determine the requirements with respect to any potential use of Cheviot Lake.

4.6.3 Saskatoon Health Region

Septic permits and Plumbing Permits are required by the Saskatoon Health Region in order to operate, construct, extend or alter any sanitary sewage works or to allow a qualified personnel to make a connection to an established communal sewage works. Sewage works are defined on the Saskatoon Health Region webpage www.saskatoonhealthregion.ca as “any works for the collection, storage, transmission, treatment or disposal of any sewage”.

4.6.4 Irrigation Certification

Irrigation in Saskatchewan is regulated by Saskatchewan Agriculture under the Irrigation Act of 1996. Every irrigation project in Saskatchewan must have an irrigation certificate which confirms that the land is suitable for irrigation from a suitable water source. Appendix P includes the Irrigation Certification process and the Irrigation Act of 1996.

4.7 COLLECTION OPTIONS

Several collection options could be used in the event of an intensive commercial subdivision in the industrial corridors. All of the options listed below have the potential for use with small high density industrial subdivisions. Larger subdivisions with relatively small wastewater disposal amounts would likely utilize an onsite sewage disposal system.

4.7.1 Gravity Collection

A gravity collection system is comprised of a sewer main laid to grade, to move a specific volume of sewage by gravity. Each user is connected to the sewer through a service main. Sewage from the property flows directly by gravity through the service main.

The sewage collected will eventually end up at a wastewater treatment facility or in some cases, at a sewage pumping station. A sewage pumping station would be located at the low end of the gravity system, and lift sewage to its final destination - either to the treatment facility or another gravity section.

Manholes are strategically located along the sewer main to provide access for cleaning, inspection and other maintenance purposes.

The most common materials used in gravity systems include: Polyvinyl chloride (PVC) for the pipe, and concrete for manholes. Therefore, the gravity system is not a “closed” or a watertight system, and subject to infiltration and inflow. As such, gravity systems generate more sewage flow and require increased treatment capacity. However, the advantage of the gravity system is that it has no operating cost and low maintenance cost to the municipality and users (excluding required sewage pumping stations), which is why gravity systems are typically the system of choice, if topography allows.

4.7.2 Low Pressure Collection

A low pressure system is comprised of individual users pumping into a common low pressure main. The main typically varies from 75 mm to 200 mm pipe sizes. The most common pipe material used in the low pressure system is high density polyethylene (HDPE) pipe. The pipe can be fused together for watertight joints; therefore the system is not subjected to infiltration or inflow.

In some low pressure systems the service (individual) pump pressure is adequate to transport the sewage to the treatment facility. However, for the RM of Blucher, regional booster stations would likely be required if this type of system were to be used due to the distance between the potential users.

Generally, each property would be equipped with a grinder pump or septic tank effluent pump (STEP). The pump grinds the sewage into a fine slurry to pump through a service pipe, which then ties into a common pressure sewer header pipe.

Without the need for extensive sewage pumping stations, the low pressure system typically offers a much lower municipal capital cost; however, it can present much higher operating, maintenance and replacement costs than a gravity system, particularly for users.

4.7.3 Combination Low Pressure and Gravity Collection

A combined system generally consists of gravity and pressure sewer systems servicing developments adjacent to a gravity trunk sewer line. Adjacent development can then implement either system based on specific desires and constraints.

A combined system works well for a community that is highly undulating, whereas a full gravity system may require several lift stations, deep mains, and/or pressure sewer cannot pump over high terrain. Therefore, a combined system may be more suitable in this application.

4.7.4 Pressurized Forcemain

As previously noted, the potential service area is large with undulating terrain. A regional forcemain would be required to transport the wastewater to a regional treatment facility location. Pump stations, placed in low-lying areas, would collect wastewater from the local collection system(s) and pump it through the forcemain to the treatment facility.

Selection of a collection system (gravity or low pressure) has direct impact on the routing, sizing and location of pumping stations. Additionally, the location of the treatment facility will also impact the number of pumping stations and alignment of a regional transmission system. Therefore, an analysis of the effects of each collection system and treatment location options on the transmission system is required.

4.8 EFFLUENT MANAGEMENT OPTIONS – WATER REUSE

4.8.1 Industrial Reuse

There is a potential for industrial reuse currently within the RM. PCS Patience Lake currently uses solution mining in their industrial process to extract the potash from the earth. While this is intriguing, the mine would require a very high quality of water in order to accept the water for reuse.

In the future the mine may not be the only candidate as many industries require process cooling water. If a new industry were to enter the municipality, wastewater could be used in this manner. Public health dangers and aesthetic concerns can be eliminated because of the use of closed cycle processes.

4.8.2 Agricultural Reuse

Water to be used for effluent irrigation would be required to be treated to the levels indicated in the Saskatchewan Surface Water Quality Guidelines from July 2006 (Appendix O) prior to discharge and use for irrigation purposes. Two major factors should be considered concerning the reuse of water for irrigation purposes; they include salinity and sodium adsorption ratio. The Irrigation Development Branch of Saskatchewan Agriculture should be contacted prior to the use of wastewater for irrigation purposes. Appendix P includes the Irrigation Certification process and the Irrigation Act of 1996.

4.9 EFFLUENT MANAGEMENT OPTIONS – CHEVIOT LAKE DISCHARGE

The use of Cheviot Lake to discharge treated wastewater into has been explored for both of the corridors. Cheviot Lake, at the time of writing this report, is not considered a fish bearing lake according to the Department of Oceans and Fisheries. The lake is estimated to be 280 ha (690 acres) in area, but the exact depth is not known. There are several options with respect to the use of the lake. It should be noted that

Saskatchewan Environment will regulate the discharge of water into the lake on a case by case basis. Therefore it is not the intention of this report to indicate that all options will satisfy Saskatchewan Environments requirements as it is impossible to know the exact requirements of any future contributors of wastewater discharge into the lake. The following options have been provided as a guideline only.

It is expected that Saskatchewan Environment would not allow discharge of any water into the lake unless it was treated to a minimum standard of the Saskatchewan Surface Water Quality Guidelines (Appendix O). This guideline provides limits for aquatic life, agricultural uses and objectives for recreation and aesthetics. The document also indicates that there are some instances where natural water quality does not meet some of the above objectives and that on a case by case basis the objectives may not apply in these circumstances. However, if the existing natural water quality is inferior to desirable objectives, it would be unwise to permit further deterioration of the water.

4.9.1 Direct Discharge

There is a possibility of directly discharging wastewater into Cheviot Lake. It is estimated that if wastewater was to be discharged to Cheviot Lake, it would run north from the lake, through various wetlands, until it reached Patience Lake, approximately 6.5km North of Cheviot Lake. Patience Lake is considered to be a groundwater discharge area due to the saline condition of the lake. Discharge of treated wastewater into Patience Lake would likely be considered an excellent area option as well.

4.9.2 Evaporation

Cheviot Lake could potentially be bermed and used for an evaporative pond. It is expected that with the current area of the lake it could evaporate approximately 1.47 million m^3 per year. This is an estimate based on the mean annual precipitation in the Saskatoon area for the standard 30 year period being 375mm and the mean annual gross evaporation in Saskatoon for the standard 30 year period being 900mm (Saskatchewan Onsite Wastewater Disposal Guideline Appendix K). According to this data, the area should evaporate 525mm per year over the 693 acres of Cheviot Lake. These numbers should be used conservatively as conditions from year to year can change based on above average precipitation and less than favourable conditions for evaporation.

A case could be made to Saskatchewan Environment to allow for a discharge quality with inferior water quality as the lake would then become an evaporative treatment cell. This option would require more research to determine the feasibility of the option. This option could also be combined with the agricultural reuse option of effluent irrigation.

4.10 INDUSTRIAL USERS TREATMENT AND DISPOSAL OPTIONS

4.10.1 Industry Requiring Small Amounts of Sewage Disposal and Treatment

Users in this category are likely to be single users on a large parcel of land that would not create any process wastewater. These users would have the potential to create small amounts of domestic wastewater and should fall under the Saskatchewan Onsite Wastewater Regulations.

4.10.2 Industries Requiring Moderate Amounts of Sewage Disposal and Treatment

This category is considered to be a group of small users in an industrial subdivision or similar application where only domestic wastewater is created. A group of users in a small subdivision may use the Saskatchewan Onsite Wastewater guidelines for individual wastewater treatment and disposal. If it is feasible, and there is a high density of users in an industrial subdivision, a local collection system and treatment facility could be employed. The most common application for this type of treatment would be a facultative or aerated lagoon.

4.10.3 Industries Requiring Large Amounts of Sewage Disposal and Treatment

It is expected that users in this category would be producing a considerable amount of industrial process wastewater. Users falling under this application will be required to have a wastewater treatment and disposal plan designed to suit their specific application. This report has touched on several of the potential options for effluent treatment and disposal for such a user. However, it is impossible to determine all of the potential solutions to all of the potential scenarios for industrial wastewater disposal. It is expected that a form of mechanical treatment would be employed onsite of the wastewater producer and the effluent would be disposed of within the regulations that have been set out by the applicable governing bodies. This report has made an attempt to cover most of this information; however there may be other authorities with jurisdiction depending on the application. It is the responsibility of the user and the municipality to ensure that all the regulations are followed and the wastewater disposal guidelines are met.

5 Crown Utility Infrastructure

The objective of the Crown Utility Infrastructure section of the study was to determine the current location, capacity, and demand for existing power, gas, and telecommunications/data transfer facilities. Once the capacities and demand are known, a detailed plan for servicing the future needs of the industrial corridors can be put into place. This plan will serve as a guide for future investors or developers to ensure that their need for these services can be met.

In most circumstances the crown corporations will look at expansion of the existing infrastructure on a case by case basis. Given the uncertainty of the type of industry that will be attracted to the area it would be difficult to gauge the need for an increase in capacity of the infrastructure.

Existing systems in the area were evaluated based on capacity and location. The attached drawings in Appendix A show the location and capacity of the existing infrastructure in the area.

5.1 EXISTING INFRASTRUCTURE

5.1.1 SaskEnergy

Mr. Brad Shotten, a SaskEnergy Distribution Engineer, was contacted in order to attempt to determine the existing capacity of the distribution systems in the Elstow and Clavet corridors. Mr. Shotton was uncertain of the exact capacity of each of the distribution systems and hesitant to comment on it as they are continually changing with new customers coming on board all the time. One positive attribute to the distribution systems capacity is that both corridors are located within less than 1km of a SaskEnergy Town Border Station (TBS). A TBS is a point where the natural gas line pressure is reduced from transmission pressures to distribution pressures. The close proximity to a TBS allows for more cost effective upgrades to the distribution system if they are required by an industry coming into the corridors.

The TBS in the Clavet corridor is located on the SW1/4 16-36-3-W3 which is adjacent to the northeast section of the corridor. The TBS in the Elstow Corridor is located on the East side of NE1/4 10-35-1-W3 which is also adjacent to the east section of the Elstow corridor. The TBS is shown on Fig 074249-110.

5.1.1.1 Elstow Corridor Distribution Piping

- Town Border Station – Location NE1/4 10-35-1-W3
- 33.4 mm Polyethylene 550 kPa distribution line to Combine World
- Minimal distribution piping surrounding corridor
- Distribution piping easily upgradeable due to close proximity of TBS

See drawings in Appendix A (DWG 074249-110) for approximate locations of distribution piping

5.1.1.2 Clavet Corridor Distribution Piping

- Town Booster Station – Location SW1/4 16-36-3-W3
- 88.9 mm High Pressure Steel Distribution Line to Cargill from TBS
- 2 – 48.3 mm Polyethylene 550 kPa distribution lines
- Distribution piping easily upgradeable due to close proximity of TBS

See drawings in Appendix A (DWG 074249-106) for approximate locations of distribution piping

5.1.2 SaskTel

SaskTel currently has service in the areas of both corridors with fibreoptic lines in the Elstow and Clavet corridors. SaskTel will provide services such as land line phones, high speed and dial up internet, cellular service, security systems and long distance service. See drawings 074249-105 and 109 in Appendix A for more details.

5.1.3 SaskPower

Mr. Howard Angus, the SaskPower Customer Service Business Manger for the Saskatoon Area, was contacted with respect to the current capacity of the SaskPower distribution systems. Mr. Angus indicated that it was very difficult to gauge the remaining capacity of the current infrastructure as it relates to the unknowns associated with the corridor. However, he did indicate that if an industry required power in excess of what was available in the area, SaskPower would be able to provide the required infrastructure to accommodate the industry. However the cost of upgrades is unknown at this time as it is unclear as to what extent of an upgrade would be required, if any.

5.1.3.1 Elstow Corridor Distribution Network

- There are currently several overhead power lines in and around the corridor (See drawing 074249-108 in Appendix A for locations);
  - a 138 kV overhead power line on the south side of the corridor,
  - a 14.4 kV overhead power line on the north side of the corridor,
  - and a 25 kV overhead power line along HWY 16, branching off from the 138 kV overhead power line.

5.1.3.2 Clavet Corridor Distribution Network

- There are currently several overhead power lines in and around the corridor (See drawing 074249-104 in Appendix A for locations);
  - a 72 kV overhead power line running through the East side of the corridor,

- a 14.4 kV overhead power lines running through the North, West and South portions of the corridor,
- and a 3 phase power line to the south of the corridor.

5.1.4 Internet and Data Communication

5.1.4.1 SaskTel Wireless Internet

SaskTel offers wireless high speed internet in both corridors. Download speeds of up to 3 Mbps can be achieved with upload speeds of up to 640 Kbps. Contact SaskTel for further information at 1-800-SaskTel or 1-800-727-5835 or on line at www.sasktel.com. SaskTel currently has celluar towers in Elstow, Clavet, and near Strawberry Hills approximately 10 km east of Saskatoon along Highway #5.

5.1.4.2 Your Link High Speed Internet

Your Link High Speed Internet has service in both of the industrial corridors. Your Link provides broadband internet services to rural areas which includes both of the industrial corridors in the RM of Blucher. Your Link currently has towers located along Highway #5 at Strawberry Hills, approximately 10 km East of Saskatoon and along Highway #16 near Elstow. You can visit the website for Your Link at www.yourlink.ca. Download speeds of up to 1.5Mbps can be expected and upload speeds of up to 512 Kbps.

5.2 EXPANSION OF EXISTING INFRASTRUCTURE

5.2.1 SaskEnergy

In order to expand natural gas service in the area to meet the needs of future development, SaskEnergy should be contacted directly. SaskEnergy will evaluate the existing supply conditions and determine if an upgrade to the system is required. SaskEnergy will provide a cost estimate to provide natural gas service. There is a document attached in Appendix Q with contact information for SaskEnergy.

All new facility requests and some alteration to existing facility requests may qualify for a SaskEnergy investment. SaskEnergy investment will reduce the cost of natural gas service. SaskEnergy should be contacted to determine how much of an investment they would be willing to put towards each individual project. Any costs associated with the project that exceed the SaskEnergy Investment would be the responsibility of the customer or developer.

Some basic information will be required by SaskEnergy at the time of requesting service for a new site. The basic information is as follows.

- Contact names, titles, addresses and telephone numbers of persons or firms involved with the customer's natural gas system and equipment design
- A plot plan, indicating the civic address or lot and block for urban applications, or land location for rural applications.
- Approved mechanical system drawing(s) showing proposed outside meter(s) location, and a designation of the following metering options is required:
  - a) Multiple meters for individual customers
  - b) Single meter for the entire building
- The total hourly load and delivery supply pressure requirement.
- Any special considerations that may impact the installation of the SaskEnergy facilities, such as pavement, obstacles, environmental concerns, meter signal requirements, or special routing.
- Subdivision Plans showing the location and number of lots to be serviced
- Development phasing plans

For further information refer to the document attached in Appendix Q.

5.2.2 SaskTel

For new service development SaskTel should be contacted directly by calling 1-800-SaskTel. SaskTel will complete the design and development of all new services on a case by case basis. A location plan of the intended service will be required.

5.2.3 SaskPower

For new service development with SaskPower there is a toll free number to call as well as a new service application form to fill out. The new service application form from November 2004 is attached in Appendix R. If it is for a larger service such as a subdivision development or larger industrial power requirement you will be directed to the correct department by calling the SaskPowers toll free number, 1-888-757-6937.

SaskPowers Electrical Service Requirements (ESR) from November 2004 is in Appendix S and lists the details that SaskPower requires to be met prior to servicing a new property or subdivision. The ESR is intended to ensure conformity to the Code, provide for protection of personnel and equipment, and recognize operational needs; while providing options for the connection of electrical service to SaskPowers facilities. The ESR covers general requirements, technical requirements for service up to 5kV as well as greater than 5 kV, and SaskPowers power quality requirements for consumer loads.

5.2.4 Internet and Data Communication

SaskTel and Your Link are currently the two options in both corridors for high speed internet service. These companies should be contacted directly in order to determine the level of service they can provide to best suit the needs of prospective developers or industries.

6 Transportation

6.1 STUDY PROCESS

An assessment of existing railways and highways was performed to identify what, if any, upgrades and expansions are required for future land development. Some of the items that were performed in order to produce this assessment are as follows:

6.1.1 Background Data Compilation

- Collection of existing traffic flow volumes and patterns
- Collection of data pertaining to surface type, road standards, and road classifications
- Collection of information needed to predict changes in traffic volume due to development in the area
- Contact made with CN Rail and CP Rail to inquire about future expansion in the area
- Investigation of upcoming transportation expansions and collection of timelines on the projects

6.1.2 Transportation Analysis

- Identification of problem areas and potential dangers associated with increased road and rail traffic
- Safety evaluation of the current transportation system within the industrial service site and surrounding area to determine if expansion or alteration is needed due to increased traffic
- Evaluation of possible upgrades

6.2 EXISTING HIGHWAY NETWORK

The R.M of Blucher contains over 500 kilometres of roadways. Of this total amount, just over 65 km's are provincial highways maintained and operated by the Saskatchewan Ministry of Highways and Infrastructure. The focus of this study involves the investigation of three main roadways, Hwy 316 (from Highway #16 at Clavet North to Highway #5), Hwy 394 (from Highway #316 west of Saskatoon, and reconnecting to Highway # 16 at the proposed intersection of the Highway #11 bypass), and Hwy 397 (from Highway #16 at Elstow, south to the Town of Allan).

Table 6-1: RM Highways

Highway	***From***	***To***	***Approximate Length***
316-01	Clavet	NW 32-36-3 W3M	15.96 km's
394-01	NW 7-36-3 W3M	NE 8-36-3 W3M	3.2 km's
397-01	Elstow	Allan	12.41 km's

6.2.1 Existing Right of Way

Existing highway Right of Way (ROW) widths were checked to ascertain if there may be issues caused if future construction upgrades were to happen on any of the roadway sections. All of the highways included in the study were found to have adequate ROW to facilitate future upgrades. Highway 397 has the widest existing ROW (62 m), followed by Hwy 316 and 394 (44 m). These ROW widths are typical of what might be found on similar highway sections throughout the province.

6.2.2 Geometrics

Plan drawings were provided by the Saskatchewan Ministry of Highways and Infrastructure for highways in the study area. In general, the roadways included in the study were found to have geometrics adequate to facilitate their respective design speeds. There were no unusual or substandard geometric elements found in the study of roadways during background data collection or site visits. In general sight distance was found to be adequate. There were no substandard junctions or railway crossings noted during site visits.

6.2.3 Traffic Analysis

Traffic volumes are expressed as Annual Average Daily Traffic, or AADT, which represents an average count of vehicles on the roadway in one day. Heavy haul traffic is expressed as Annual Average Daily Truck Traffic or AADTT. It is the heavy haul component that has a greater impact on the road surface and structure when compared to passenger vehicles. For this reason AADTT is given greater consideration when evaluating long term roadway performance.

Annual average daily traffic volumes and percent commercial traffic as well as traffic volume maps and vehicle classification data for RM 343 were obtained from Saskatchewan Ministry of Highways and Infrastructure (MHI). The traffic data collected from MHI dated back to 2005 for RM counts and 2006 for Highways counts. Million vehicle kilometre values (MVkm) are also displayed for both vehicle and truck traffic. These represent the AADT and AADTT values multiplied by 365 days per year multiplied by the travel distance.

Following are Tables 6-2 through 6-4, which show a summary of current existing traffic volumes and MVkm along each highway studied in the R.M. Ministry of Highways and Infrastructure Traffic count maps from 2006 can be seen in Appendix T.

Table 6-2: Traffic Volumes Hwy 316

FROM KM	*TO KM*	*LOCATION DESCRIPTION*	*AADT*	*TRAVEL (MVKM)*	*AADTT*	*TTRAVEL (MVKM)*
0.00	3.00	Hwy 16 to Hwy 316 Auxiliary (3160140LUA)	530	0.58	100	0.11
3.00	7.20	Hwy 316 Auxiliary (31640LUA) to Grid	390	0.60	100	0.15
7.20	9.60	Grid to Hwy 394	420	0.37	100	0.09
9.60	15.96	Hwy 394 to Highway No. 5	460	1.07	100	0.23
0.00	1.17	Cargill Plant Access at Km 3.0	280	0.12	75	0.03
			Totals	**2.74**		**0.58**

Table 6-3: Traffic Volumes Hwy 394

FROM KM	*TO KM*	*LOCATION DESCRIPTION*	*AADT*	*TRAVEL (MVKM)*	*AADTT*	*TTRAVEL (MVKM)*
0.00	10.91	Hwy 316 at Km 58.86	520	2.07	150	0.60

Table 6-4: Traffic Volumes Hwy 397

FROM KM	*TO KM*	*LOCATION DESCRIPTION*	*AADT*	*TRAVEL (MVKM)*	*AADTT*	*TTRAVEL (MVKM)*
0.00	2.00	Grid to Grid	1080	0.79	65	0.05
2.00	5.70	Grid to Grid 763	660	0.89	65	0.09
5.70	12.41	Grid 763 to Highway No. 16	720	1.76	65	0.16
			Totals	**3.44**		**0.30**

It is anticipated that industrial growth over the next number of years will lead to increases in traffic volumes, particularly truck traffic along these highways. It has been mentioned by Cargill that since their crushing plant expansion, they have on average 150 trucks on the roads per day, which has increased the traffic along the first several kilometres of Highway 316. There are also various other industries that have expressed interest in setting up business in the RM. As it is expected, this will happen relatively gradually, so there will be sufficient time to find out specific locations where heavy haul is expected, and to upgrade highway infrastructure in advance.

6.2.4 Accident Information

As part of the background data collection a review was performed of accidents along the study corridors. Accident rates can be a significant indicator of problem areas along any portion of roadway. Information for this study was obtained from the Traffic Accident Information System (TAIS) which is compiled and maintained by SGI. TAIS is a computer-based system that compiles information on traffic collisions occurring on Saskatchewan highways. This information is captured from traffic collision reporting by Saskatchewan police agencies and SGI claims in accordance with Section 83 of *The Highway Traffic Act*.

In order to ensure that only representative accident data is displayed, only data that was obtained for the last 5 years was used. As the newest information available from SGI was 2004 database values, the years of information included in the study were from 1999 to 2004. Using a 5 year window of accident information is standard practice among transportation agencies in order to ensure that effects such as roadway upgrades and previous problem issues are not taken into effect.

6.2.4.1 Hwy 316

Highway 316 has had 5 reported accidents in the last five years of accident data. As these accidents all occurred at separate locations it appears that geometric issues are not a significant contributing factor. One of the accidents occurred at a railway crossing located at Km 3.9 which has since been upgraded with railway crossing lights. Two of the accidents involved wildlife factors.

6.2.4.2 Hwy 394

There have been no reported accidents along this section of highway in the last 5 years of SGI accident data.

6.2.4.3 Hwy 397

Highway 397 has had 12 reported accidents in the last five years of accident data. Four of these accidents occurred in the area of Km 5.4, but as they all had different contributing factors it can be assumed that geometrics were not a factor. Five of the accidents involved wildlife, which has warranted the use of deer warning signs through this section. There were three accident involving drivers that either fell asleep, or were inattentive.

A tabular summary of TAIS accident data was compiled for each section of highway. This summary can be found in Appendix V.

6.2.5 Allowable Weights and Roadway Classifications

Saskatchewan Highways and Infrastructure has established allowable weights for all highways within the province. Maximum gross vehicle weight is dependant on highway classification, maximum registered gross vehicle weight for vehicles, tire size and axle spacing. In order to maximize the economic movement of goods and minimize the damage to road structures, Saskatchewan Highways and Infrastructure assigns special weights to some of our highways. In some cases certain highways are assigned higher allowable weights and in other cases, weights are reduced.

All provincial roads and highways are categorized into seven classes based on their social, economic, and connective function. Classes 1 and 2 carry the highest traffic volumes, and connect major cities and regional service centers with populations greater than 1000. Classes 3, 4, and 5 link communities with populations less than 1000, and give access to large parks and industrial sites. Classes 6 and 7 carry the least traffic and provide access only to individual sites, farmland, and other properties. Approximately 38% of Saskatchewan's Highways are designated class 1 or 2, and 62% as class 3, 4, or 5. Table 6.5 displays a summary of characteristics of the highways found in RM 343.

Table 6-5: Classification & Allowable Weights

HIGHWAY	*SECTION*	*ROAD CLASS*	*WEIGHT CLASSIFICATION*
316	North of Clavet	Class 4	Secondary
394	East of HWY 16 to HWY 316	Class 5	Secondary
397	Elstow to Allan	Class 3	Primary

It should also be noted that weight classifications may shift seasonally due to the influence of weather and ground water conditions on the roadway strength. During the spring, the roadway capacity decreases. Therefore, some primary highways may revert to secondary highways for a short period.

Primary weight loads are allowed on secondary highways under the following restrictions given by the Government of Saskatchewan, Ministry of Highways Special Restrictions, which states:

"A vehicle may travel a maximum total distance of 15 kilometres off primary highway:

1. *On to any secondary provincial highway (s) or provincial roads at primary weights during the regular season*
2. *A maximum distance of 15 kilometres on any provincial highway from its intersection with an urban municipality that:*
   a. *Has a population of 1,000 or more: and*
   b. *Has its boundary intersected by primary highway (Part V12(1) (a to z) of the Vehicle Weight and Dimension Regulation, 1999)*

Except:

- *The 15 km rule does not apply during the spring road restriction season*
- *The 15 km rule does not apply to rural municipal roads at any time*
- *The 15 km rule does not apply to highways under special ministerial orders"*

See: http://highways.gov.sk.ca/special-restrictions/ for more information. (site accessed May 2010)

Maps obtained from the Ministry of Highways and Infrastructure and SARM illustrating provincial highway weights can be found in Appendix U.

6.2.6 Construction History/Structural Thicknesses

Construction history can be used to provide valuable information to detail when, and what type of work was performed on a section of roadway. Construction history can also be used to present roadway structural thicknesses, and thus help to identify weak portions of roadway.

Table 6-6 to 6-8 were compiled to show a summary of the years and locations where construction has taken place for each Highway in the study during recent years.

Table 6-6: Construction History Hwy 316

YEAR	*FROM*	*TO*	*SEAL (mm)*	*AC (mm)*	*BASE (mm)*	*SUBBASE (mm)*
2005	9.4	15.96	13	0	0	0
1996	0	3.355	0	80	150	750
1996	3.355	9.4	26	0	150	750
1996	9.4	10	26	0	150	150
1996	10	15.96	26	0	150	190
1996	Cargill Road		0	80	200	750

Table 6-7: Construction History Hwy 394

YEAR	*FROM*	*TO*	*SEAL (mm)*	*AC (mm)*	*BASE (mm)*	*SUBBASE (mm)*
2000	0	2.25	0	80	200	295
1970	1.3	10.91	0	40	150	0
1967	0	1.39	0	100	150	165

Table 6-8: Construction History Hwy 397

YEAR	*FROM*	*TO*	*SEAL (mm)*	*AC (mm)*	*BASE (mm)*	*SUBBASE (mm)*
1987	0	12.41	13	0	0	0
1980	0	0.5	0	100	0	0
1980	0.5	0.8	0	100	160	110
1980	0.8	8.27	13	0	100	190
1980	8.27	12.25	13	0	100	140
1978	0	12.25	13	0	0	0
1971	12.25	12.41	0	76	165	0

A summary of construction history was compiled in order to obtain structural thicknesses along each section of roadway. Following is Table 6.9 which shows a summary of the current structural thicknesses of each highway included in the study.

Table 6-9: Current Structural Thicknesses Hwy 316

FROM KM	*TO KM*	*SEAL (mm)*	*AC (mm)*	*BASE (mm)*	*SUBBASE (mm)*
0	1.14	0	80	150	1000
1.14	3.20	0	80	150	750
3.20	3.36	26	80	150	750
3.36	10	26	0	150	150
10	15.96	26	0	150	190

Table 6-10: Current Structural Thicknesses Hwy 394

FROM KM	*TO KM*	*SEAL (mm)*	*AC (mm)*	*BASE (mm)*	*SUBBASE (mm)*
0	1.12	0	80	350	430
1.12	1.39	0	80	350	430
1.39	1.70	0	80	350	265
1.70	1.89	0	40	140	0
1.89	2.25	0	80	340	295
2.25	10.91	0	40	140	0

Table 6-11: Current Structural Thicknesses Hwy 397

FROM KM	*TO KM*	*SEAL (mm)*	*AC (mm)*	*BASE (mm)*	*SUBBASE (mm)*
0	0.13	0	100	0	0
0.13	0.47	0	100	0	0
0.47	0.64	0	100	160	110
0.64	0.80	13	0	100	190
0.80	12.25	13	0	100	190
12.25	12.41	0	75	165	0

As shown in the previous summary tables there are some variability in surfacing thicknesses throughout each section of roadway. This variability in surfacing thicknesses is quite typical of what is found in many highway sections in the province. Factors such as existing soil strength determines thicknesses used when constructing the roadway and long term roadway performance affects later maintenance rehabs. The amount and type of traffic also plays a large role when designers make recommendations for structural thicknesses. Many sections of roadway that were constructed in the past simply were designed to handle the quantity of traffic and types of loading experienced at the time, and may or may not be adequate for current conditions.

6.2.7 Current Condition Ratings

In 2007, the Saskatchewan Ministry of Highways and Infrastructure collected Rutting, Roughness (IRI) and Wise Crack readings for each highway. This information can be used to determine actual roadway conditions, and can be used to prioritize future work. Rutting values larger or approaching 10 mm, crack values larger or approaching 60 m, and IRI readings larger or approaching index reading of 2.5 are noted as these values are considered to be the threshold between good and poor.

The values in the following tables show the 60th Percentile of the readings over 50 m segments. The Rutting measurement takes the maximum rut depth measured from either the left or right wheel path within the 50 m segments. The mean IRI (MIRI) score is taken from both the left and right wheel paths within the 50 m. Cracking is measured by calculating the total length of cracks within the 50 m segment across both left and right lanes.

6.2.7.1 Hwy 316

This section of roadway has been rated as being in relatively good condition throughout. Rutting and ride values are good throughout, most likely due to relatively thick structural thicknesses. Cracking is also rated as good with the exception of the segment from Km 3.2 to 9.4, which could likely be improved with a granular seal coat application.

Table 6-12: Highway 316 Condition Ratings

FROM	*TO*	*SEGMENT TYPE*	*RUT60 (mm)*	*RUT60 (G/P)*	*IRI60*	*IRI60 (G/P)*	*CRACK60 (m)*	*WCX60 (G/P)*
0	3.2	AC	4.7	G	1.17	G	40.2	G
3.2	9.4	SEAL	6.1	G	1.86	G	64.9	P
9.4	15.96	SEAL	6.3	G	1.82	G	42.5	G

A site inspection was performed on March 11, 2008 to verify the condition ratings. Overall it was found that Highways 316 currently is in good condition. This roadway has a high gradeline, which has and will continue to assist in long term performance. The section that is indicated at having some cracking (km 3.2 to 9.4) was looked at in more detail. Longitudinal cracking was found in the wheelpaths from km 4 to 9. This cracking is likely due to a slightly lower gradeline in the area and a slightly thinner subbase thickness. A low area near km 4 where cattails can be seen alongside the highway may also be contributing to some of the cracking in that area.

6.2.7.2 Hwy 394

This section of roadway is currently rated in good overall condition. All three condition rating values are all within good/poor threshold limits. Good structural thicknesses are most likely aiding the long term performance of this roadway.

Table 6-13: Highway 394 Condition Ratings

FROM	TO	SEGMENT TYPE	RUT60 (mm)	RUT60 (G/P)	IRI60	IRI60 (G/P)	CRACK60 (m)	WCX60 (G/P)
Hwy 316	RM Bdry	SEAL	4.12	G	1.85	G	48.64	G

During a site inspection here on March 11, 2008 a few discrepancies were found between condition ratings and actual field conditions. There are numerous spot patches and crack sealing along this section. The ride, although subjective was not found to be as good as what is currently found along Highway 316. Overall this section of road was found to be in fair condition and will likely not be requiring significant rehab work in the near future.

6.2.7.3 Hwy 397

This section of roadway currently shows distress in all three condition ratings. An exception is the section from Km 8.15 to 12.41 where all ratings are good. Current poor ratings are most likely in part caused by limited granular thicknesses here and that no major construction has taken place here since 1987. This section of roadway currently provides primary haul weights, which is also most likely adding to current distress. Some heavy preservation/construction work will likely be required here in the near future if primary weights will continue to be hauled.

Table 6-14: Highway 397 Condition Ratings

FROM	TO	SEGMENT TYPE	RUT60 (mm)	RUT60 (G/P)	IRI60	IRI60 (G/P)	CRACK60 (m)	WCX60 (G/P)
0	0.85	SEAL	11.58	P	4.83	P	79.26	P
0.85	5.2	SEAL	6.86	G	2.68	P	59.88	G
5.2	8.15	SEAL	12.94	P	2.92	P	75.64	P
8.15	12.41	SEAL	6.84	G	2.42	G	59.38	G

During a site inspection here on March 11, 2008 data from the condition ratings were compared to actual conditions. Overall the condition ratings for this section were found to be relatively accurate. There are numerous spot patches and crack sealing areas along this section. The section that is currently in the worst condition is near the mine site, which is the same as what is indicated in the condition rating table.

6.2.8 Recent Highway Maintenance Costs

A significant factor used to determine when a section of roadway should be upgraded is maintenance costs. If a section of road is exhibiting high maintenance costs it is likely in poor condition, and there may be a long term cost savings to upgrade the road in order to lower long term maintenance costs. The Saskatchewan Ministry of Highways and Infrastructure was contacted in order to obtain the previous years maintenance cost for each section.

6.2.8.1 Hwy 316

Ongoing maintenance costs for Highway 316 in 2007 were very minimal. Most likely, work performed included a small amount of hand patching and spot sealing.

Table 6-15: Highway 316 Maintenance Costs

From Km	To Km	2007 Maintenance Cost
3.2	9.4	$1,847

6.2.8.2 Hwy 394

No maintenance cost information could be provided for this section of roadway. It was mentioned by Highways staff that maintenance costs in 2007 for this section were minimal. Because the highway is currently rated as being in good condition by Highways it can be reasoned that basic maintenance will be continued, and maintenance costs in the immediate future will not be significant.

6.2.8.3 Hwy 397

Maintenance costs for this section of road in 2007 were fairly significant. These maintenance costs are due to the current condition of the roadway, which is mostly rated as being in poor condition. These maintenance costs will likely continue to be significant in the future until a maintenance rehab is performed.

Table 6-16: Highway 397 Maintenance Costs

From Km	To Km	2007 Maintenance Cost
0.85	5.2	$13,574
5.2	8.15	$17,763
8.15	12.41	$11,949

6.3 EXISTING RAILWAY NETWORK

RM # 343 contains rail lines owned and operated by both CN and CP rail. These lines serve as a transportation corridor to move goods both through the RM, and from the RM to other areas. All types of freight ranging from grain, to lumber, to car parts are moved along this line. Railway staff indicated during discussions that average train lengths along their lines in this RM range from 100 to 125 cars.

6.3.1 Railway Crossing Locations

Several locations exist in the RM where railways intersect with Provincial highways (Figure 6-1 below). Following is some information about locations on each highway included in the study where crossings exist.

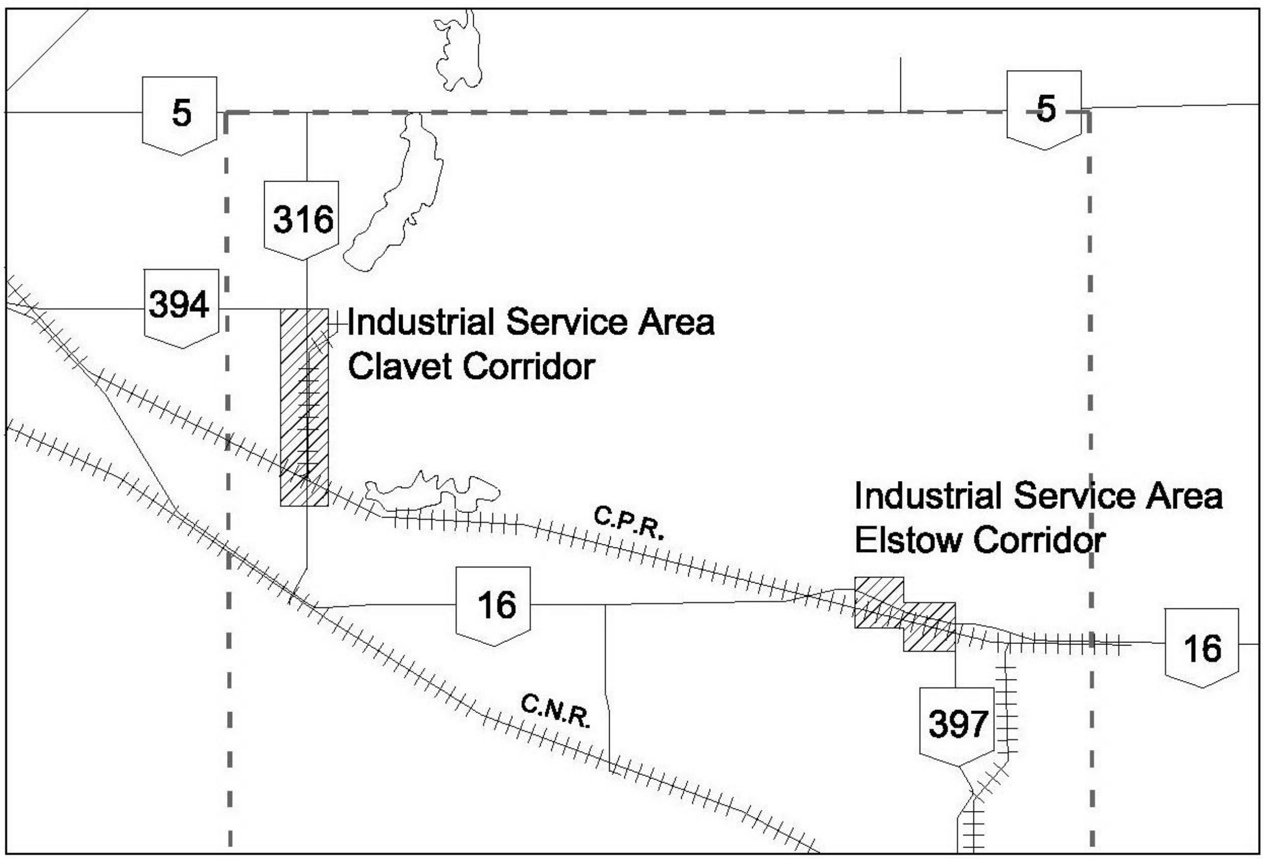

Figure 6-1: Railway Locations

6.3.1.1 Hwy 316

Highway 316 has railway crossings located at land location 17-35-03 W3M, The CPR main line crossing is at Km 3.91, and the CPR spur line crossing is at Km 4.15. Both crossings have a roadway average annual traffic amount of 500 vehicles per day, and an 80 km/hr speed advisory exists at each crossing. The train traffic volume along the spur line to the PCS Patience Lake Potash Mine varies, and the exact number is not known. Though, the known train traffic volume along the main line is 15 trains/day, so the traffic along the spur line would be a portion of that amount. Table 6-17 shows a summary of details pertaining to the main line crossing.

Table 6-17: Hwy 316 Railway Crossings

ROAD KM		LAND LOCATION	RAILWAY COMPANY	DESIGN SPEED	POSTED SPEED	TRAINS /DAY	ROAD AADT	MAX TRAIN SPEED	NOTES
3.91	N W of Clavet	17-35-03 W3	CPR	120	100	15	500	?	80 km/hr speed advisory

6.3.1.2 Hwy 394

There are no railway crossings located along Highway #394 within the limits of the R.M of Blucher. The CPR crosses Highway 394 @ km 0.26 with lights and arms, 5.8 km west of the R.M. boundary, near the intersection of Highway #16 and #394.

6.3.1.3 Hwy 397

Highway #397 has existing railway crossings located at roadway Km's 2.35, and 12.36. CNR currently operates the crossings at Km 2.35 and CPR operates the crossing at Km 12.36. Table 3.3.2 shows a summary of details pertaining to these crossings.

Table 6-18: Hwy 397 Railway Crossings

ROAD KM		LAND LOCATION	RAILWAY COMPANY	DESIGN SPEED	POSTED SPEED	TRAINS /DAY	ROAD AADT	MAX TRAIN SPEED	NOTES
2.35	W Of Allan	10-34-01 W3	CNR	110	100	28	520	15	Spur Mi. 0.35
12.36	46m S Hwy 16	10-35-01 W3	CPR	110	100	15	520	?	

A site visit to each of these crossings showed them to be in good functional condition. There has been one recorded accident in the last 5 years, which occurred at the CPR crossing at Km 3.91 on Highway 316, prior to the installation of crossing lights. All traffic control devices were found to be operational, and in a general ride across all of the crossings were found to be acceptable.

6.3.2 Inland Container Terminal

Discussions were undertaken with staff at both CN rail and CP rail regarding the possibility of a future inland container terminal in the RM of Blucher. Neither railway provided much information on this matter but discussed the possibility, though at this time the feasibility and location for such an endeavour is not known.

6.4 POTENTIAL FUTURE HIGHWAY UPGRADES

To obtain information regarding future highway upgrades in the area staff at the Ministry of Highways and Infrastructure office in Saskatoon were contacted. It was determined that there are no major improvements planned for any of these highway sections at this time other than routine maintenance. As Highway 316 and 394 are currently rated as being in good condition it can be reasoned that unless there is to be a significant change in traffic type or volume in the near future that the current infrastructure will be sufficient. It could be reasoned that Highway 397 could be assessed for a more substantial rehab in the near future if primary weights will continue to be hauled. Condition currently rated as poor along with relatively high maintenance costs make this roadway a candidate for a future rehab.

6.4.1 Highway 16 – Clavet Bypass

An upcoming change to the highway network in the RM will likely be coming in the form of a twinning project and highway bypass around Clavet in the next ten to fifteen years. The following image was provided by the Ministry of Highways and Infrastructure which illustrates the planned location.

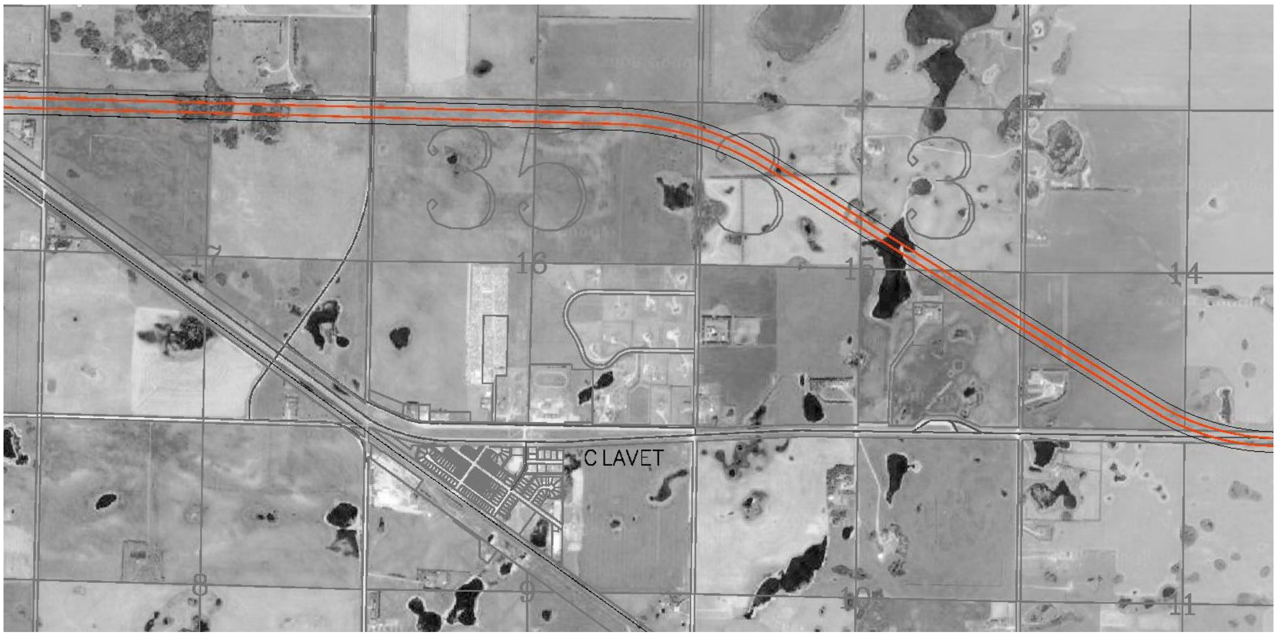

Figure 6-2: Planned Clavet Bypass

This bypass would effectively change traffic patterns in several ways in the RM. The location would bring Highway 16, which is a primary highway, within 1.6 kilometres of the industrial corridor. This creates an additional stretch of road down 316 that can utilize the heavy haul buffer coming off of a primary highway into the industrial corridor. The addition of a second lane to the junction of 316 and Highway 16 would help to increase the functional performance at that location, and would likely aid in reducing future accidents.

6.4.2 City of Saskatoon Bypass

There has been a large amount of discussion about an east bypass for the City of Saskatoon recently. The Ministry of Highways and Infrastructure commissioned a functional study to aid in determining the best location for this bypass. The following image was provided by the Ministry and illustrates the planned location of the bypass.

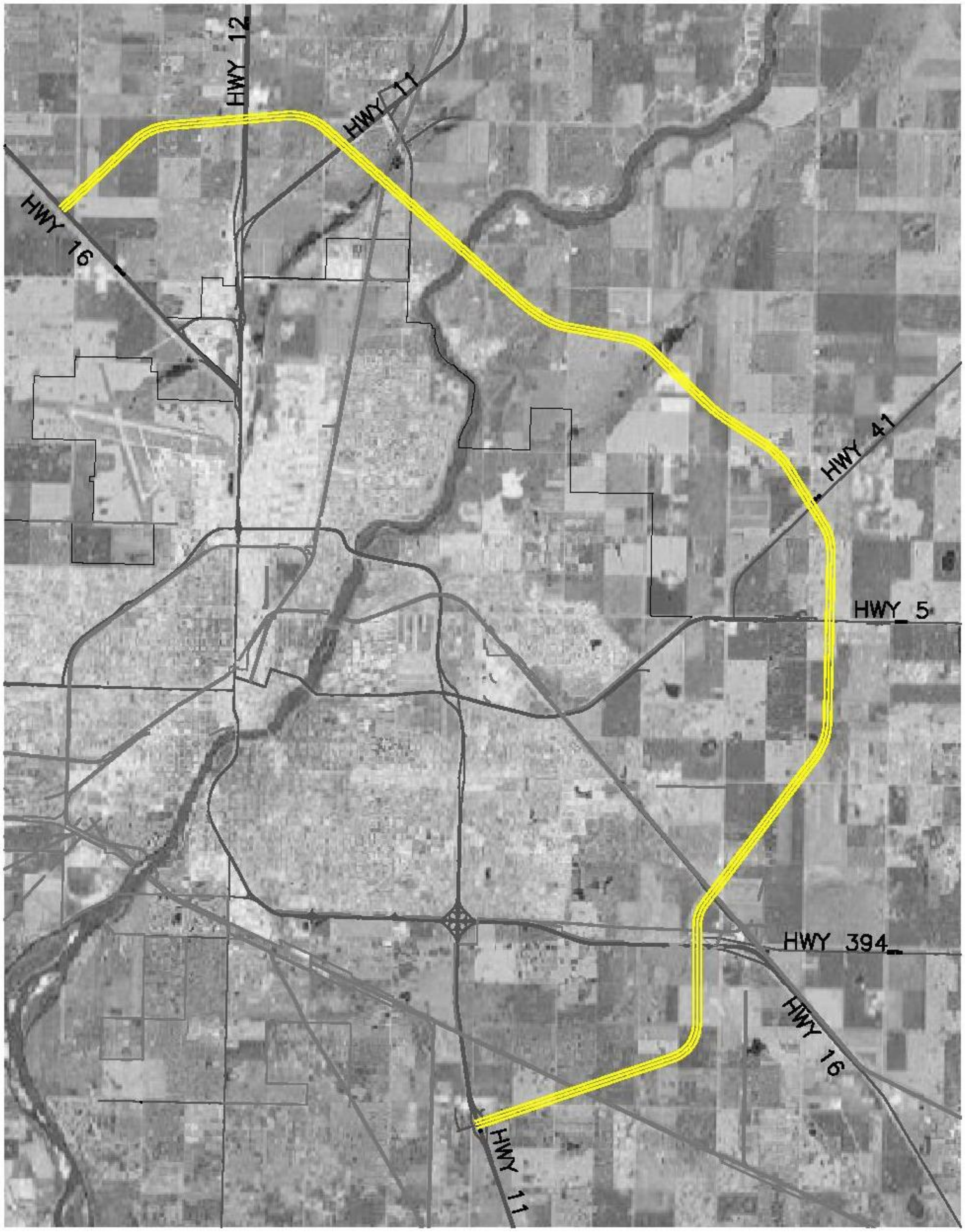

Figure 6-3: Planned City of Saskatoon Bypass

The city bypass as illustrated would tie into Highway 16 near Haight Road, which is relatively near the City limits. This bypass is not located inside the RM and it is anticipated that the construction of this roadway will not have significant effects on the type or volume of traffic along roadways in the RM of Blucher but will significantly improve access to the Clavet area corridor.

6.5 POTENTIAL FUTURE RAILWAY UPGRADES

Employees at CN and CP were contacted to obtain information regarding future railway upgrades or changes in the area. It was determined that there are no major improvements or maintenance projects planned for any of the railway network in the RM at this time, other than routine maintenance.

7 Conclusion

Industry is essential to sustain the growth of communities in an area. However, communities provide the infrastructure network required for industry to prosper. The roadways, railways, water, sewer and other utility infrastructure contribute to economic development that generates revenue in the industrial sector.

The RM of Blucher contains a significant amount of industry, and is likely to see growth in the future. In order to see this growth happen in a manageable and sustainable way it is important to have a planned network of infrastructure that can support the planned growth.

The initial steps of this study were to determine and create a site plan of the existing infrastructure within the corridors. The site plans were prepared and presented to current stakeholders in the RM. The main concern of most stakeholders was the fact that water supply has it's limitations within the industrial corridors; however this report has outlined several alternatives to increase supply of water to the subject areas.

Private and public water systems within the corridors were examined to determine current capacities and demand within the current infrastructure. There is a private non-potable water line that runs from the South Saskatchewan River to PCS Patience Lake Potash Mine. The pubic water lines that are in operation in the area are owned by SaskWater. There are both potable and non-potable SaskWater supply mains in the vicinity of both corridors. There is currently a non potable main to the Cargill Clavet and a non-potable main from the Bradwell Reservoir to the PCS Allen Potash Mine. SaskWaters Potable supply mains are located in close vicinity to the corridors as well, the capacity of these lines is changing as new customers are added and improvements to the infrastructure are made. SaskWater has up to date information for the addition of a new customer.

The current water infrastructure in the RM is suitable to meet the current demands and future demands in the short term. There are several options to increase the water capacity for both potable and non-potable water. SaskWater will look at options to supply water to a new user. Groundwater useage is an option and surface water can be allocated to the corridors by SaskWater and the Saskatchewan Watershed Authority on the SSEWS System. The SSEWS System starts at Gardiner Dam and travels through a series of reservoirs to the Lake Blackstrap and the Bradwell Reservoir which are both in the vicinity of the corridors. As water consumption in the area expands and the need for potable water increases the possibility of constructing a water treatment plant to supply the corridors and surrounding areas may become very attractive.

Sewage treatment has been split into two different categories, municipal and industrial waste. Municipal waste is easily categorized and there are several methods for treatment that would be sufficient for the industrial corridor. On the other hand, industrial waste is not categorized very easily as the treatment options depend heavily on the source of the waste. Several publications are available that will aid in the categorizing of industrial waste. However, until the source is known it is difficult to assess the capacity for treating it. Several options have been reviewed for municipal waste treatment, lagoons, mechanical treatment, and onsite wastewater disposal. These treatment methods may be applicable to industrial wastewater depending on the source of the waste.

Regulatory requirements involving wastewater treatment and disposal have been reviewed including Saskatchewan Environment, Department of Fisheries and Oceans, and the Irrigation Act requirements in the event that irrigation reuse of treated wastewater is an option for disposal.

There are several wastewater collection options for the corridors. The options will depend heavily on the nature of the businesses that enter the corridors and the type of layout that is used for businesses. For example if a developer intended to construct an industrial subdivision a local collection system would be feasible with a potential lift to a lagoon or some variation of that approach. On the other hand if an industry were to enter the corridors and utilize an entire quarter section a different approach may be considered involving on site treatment. In any case, once sufficient treatment has been achieved, wastewater effluent management options have been explored to provide examples of what is available.

In the Clavet area, there is, however, a relatively large groundwater discharge slough/lake (Cheviot Lake) that would be suitable for discharge of treated wastewater.

While the report attempts to give a review of the wastewater collection, treatment and discharge options available, it should be noted that other options may be available that have not been identified in this report. In the event that an industry is entering into the RM a detailed wastewater management plan should be implemented at that time to suit the needs of the developer and the municipality.

Section five of the report outlines the existing crown utility infrastructure in the municipality and in particular the corridors. The associated appendices outline the necessary steps that would be required to utilize the existing infrastructure or expand it to accommodate the requirements of a developing industry. Essentially all of the crown corporations are willing to work toward expanded infrastructure to accommodate a developing industry if required.

Highways 316, 394, and 397 were researched to determine if this system does indeed have the capacity and ability to sustain current and future industry. It was determined that Highways 316 and 394 are in good condition at this time. Both Highways have high gradelines and relatively thick structural thicknesses which aid in long term performance. Both of these sections of road illustrated good general performance through minimal maintenance costs. Most likely limited rehab work will be needed in the future to keep these sections in good condition. Although these are secondary highways, Saskatchewan Ministry of Highways currently allows primary haul weights on a secondary highway for a distance of 15km either direction off of a primary highway. One limiting factor may be that spring road bans still apply to secondary highways.

Highway 397 was found to be in worse condition than Highways 316 and 394. This section of roadway currently shows distress in all three condition ratings. Current poor ratings are most likely in part caused by limited granular thicknesses and that no major improvement has taken place since 1987. This section of roadway currently provides primary haul weights. Some preservation/construction work will likely be required for this section in the near future if primary weights continue to be hauled.

In general the railway network in the RM was found to be in good condition operationally. Neither railway company indicated that there were any significant issues in their network in this area that would prevent future development or growth.

Overall, the infrastructure systems found in the RM of Blucher appear to be capable of facilitating growth of present and future industry. Provided that stakeholders can be proactive, the infrastructure network should continue to function well in this RM into the future.

We recommend the RM consider developing a formalized land use plan that clearly identifies areas suitable for light, medium and heavy industrial development along the selected corridors.

A Appendix A - Drawings

B Appendix B - Questionnaires

C Appendix C - Meeting Minutes

D Appendix D - SaskWater Connection Information

E Appendix E - Future Water Demand Estimates

F Appendix F - Beckie Hydrogeologists Cursory Report

G Appendix G - Saskatchewan Watershed Authority Groundwater Approval Fact Sheet

H Appendix H - Raw Water Pipeline Cost Estimates

Appendix I - Saskatchewan Watershed Authority Surface Water Approval Fact Sheet

J Appendix J - Additional Saskatchewan Watershed Authority Information

K Appendix K - Saskatchewan Onsite Wastewater Disposal Guidelines

L

Appendix L - The Plumbing and Drainage Regulations

M Appendix M - Sewage Works Design and Application, EPB 203 and EPB 204

N Appendix N - Regulations and Acts Pertaining to Wastewater Disposal

O Appendix O - Surface Water Quality Objectives EPB 356

P Appendix P - Irrigation Certification and the Irrigation Act

Q Appendix Q - SaskEnergy Service Guide

R Appendix R - SaskPower New Service Application

S Appendix S - SaskPower Electrical Service Requirements

T Appendix T - Ministry of Highways and Infrastrucuture Traffic Count Maps

U Appendix U – Provincial Highway Weight Map (MHI, SARM)

V Appendix V - TAIS Accident Data Summary (SGI)