

7.0 Existing System Assessment and Upgrading Requirements

7.1 Existing Collection System Deficiencies

Hydraulic modeling was conducted for the 1:25 year, 24 hour Huff rainfall event using the existing system model to assess the capacity of the collection system. The maximum simulated hydraulic gradeline was 2 m below grade within the Hamlet of Clairmont. These modeling results indicate that the risk of basement flooding under existing conditions is low. However, since the model has not been calibrated, accurately defining the risk of basement flooding is not possible at this time. This risk should be re-assessed once wet weather flow and rainfall data are obtained and the model is calibrated.

Based on the above, there are no identifiable deficiencies within the existing collection system based on the current level of development.

7.2 Existing Collection System Improvements

Since no deficiencies were noted in the existing collection system, no upgrades to the collection system can be recommended at this time. However, in subsequent studies, the type, age and condition of the existing pipes must also be considered in reviewing the needs for future collection system's improvements.

7.3 Existing Lagoon Improvements

No flow monitoring records are available to determine the volume of the existing wastewater in the study area, therefore water billing records were used for the assessment. In accordance with the three months of water billing records in winter, the daily wastewater volume would be approximately 750 m³. On this basis, the required capacity of the lagoon is shown in Table 7.3.1.

Table 7.3.1: Lagoon for Current Wastewater Flow

Cell	Existing Lagoon (m ³)	Required Lagoon for Current Wastewater Flow (m ³)
Anaerobic	8,000	1,500
Facultative	48,000	45,000
Storage	322,500	273,750

Table 7.3.1 shows that upgrading the existing lagoon will be required immediately.

In evaluating the required improvements to the existing lagoon for various growth contours, the following assumptions were used to determine the capacity of the lagoon for each growth contour:

- One hundred percent of wastewater from projected population for each of the growth contours
- One sixth of the wastewater flow for commercial and industrial developments for the five year growth contour

- One third of the wastewater flow for commercial and industrial developments for all other growth contours.

The wastewater flow for commercial and industrial areas is reduced because the projected water demand, based on the design criteria and projected growth, is so large that it appears to be unrealistic. Reducing the wastewater flow by one sixth for the five year growth contour would result in a flow that will be quite similar to the current wastewater flow condition.

On the basis of these assumptions, the total wastewater flow for the study area for each of the growth contours is tabulated in Table 7.3.2.

Table 7.3.2: Projected Lagoon Design Average Days Wastewater Flows

Growth Contours	Wastewater Flow (M ³)
2010	4,428
2015	10,205
2025	13,437
Ultimate	22,533

The required capacity of a conventional lagoon for each growth contours is shown in Table 7.3.3.

Table 7.3.3: Conventional Lagoon Projected Capacity

Cell	Existing Capacity (M ³)	2010 Capacity (M ³)	2015 Capacity (M ³)	2025 Capacity (M ³)	Ultimate Capacity (M ³)
Anaerobic	8,000	8,856	20,412	26,874	45,068
Facultative	48,000	265,680	612,360	806,220	1,352,040
Storage	322,500	1,616,200	3,725,190	4,904,505	8,224,910

The required capacity of an aerated lagoon for each growth contours is shown in Table 7.3.4.

Table 7.3.4: Aerated Lagoon Projected Capacity

Cell	2010 Capacity (M ³)	2015 Capacity (M ³)	2025 Capacity (M ³)	Ultimate Capacity (M ³)
Completely Mixed	8,856	20,412	26,874	45,068
Partially Mixed	123,984	285,768	376,236	630,952
Polishing	22,140	51,030	67,185	112,670
Storage (6 months)	808,110	1,862,595	2,452,253	4,112,455

It was understood that the County has assigned the entire SW ¼ Sec. 27-72-6-6 for the expansion of the existing lagoon. The land available for the lagoon expansion excluding the land for the existing ditch is approximately 87 hectare.

The land required for the lagoon expansion is shown in Table 7.3.5.

Table 7.3.5: Lagoon Expansion Land Requirement

Type of Lagoon	2010 Ha	2015 Ha	2025 Ha	Ultimate Ha
Conventional (one year storage)	75	171	224	374
Aerated Lagoon (6 months storage)	21	47	62	102

The major factor governing the requirement of expanding the lagoon or implementing other types of treatment facilities is the allowable frequency of discharging the effluent from the lagoon into the receiving water body. If the lagoon can discharge effluent into the receiving water body more frequently, it will require a smaller area for expansion due to the requirement of a smaller size storage cell. If continuous discharge is allowed, storage will not be required at all. Unfortunately, the existing creek and even the Bear Creek does not have sufficient flow to meet the 10:1 dilution factor for the design daily wastewater flow as stipulated by Alberta Environment. Continuous discharge into the existing creek will therefore not be allowed in accordance with the guideline. However, Alberta Environment may approve additional number of annual discharge if appropriate solution is implemented.

The following wastewater disposal options for the study areas were investigated on the basis of the dry weather flow in the study area. Since flow monitoring records are not available to assess the wet weather flow, the wet weather flow was not considered in determining the size of the wastewater disposal components for various growth scenarios. However, the evaluation was mainly for comparison purposes, the omission of the wet weather flow will not affect the comparison results significantly because the evaluations were carried out on the same basis for all potential options.

- **Expand the existing conventional lagoon**
As stated earlier, the land available for the expansion of the existing lagoon is approximately 87 hectares. As shown in Table 7.3.5, the existing lagoon can be expanded to service the study area for the next five years on the basis of the reduced wastewater flow. This option can therefore be considered as an interim servicing option only. It was understood that funding is available for the lagoon expansion in the near future.
- **Convert the existing lagoon into an aerated lagoon**
Alberta Environment stated that an aerated lagoon with six month storage is a viable wastewater disposal option for the study area. The wastewater will be discharged into the existing creek. As shown in Table 7.3.5, the available land permits the construction of a lagoon to service the area till 2025.
- **Construct a conventional wastewater treatment plant**
Alberta Environment stated that a conventional wastewater treatment plant will have the same requirement of an aerated lagoon. In other words, if the effluent from a conventional wastewater treatment plant will be discharged into the existing creek, a pond with six months storage is required. The required treatment plant capacity for various scenarios for the reduced wastewater flow is as follows:
 - 2010: 4,428 m³
 - 2015: 10,205 m³
 - 2025: 13,437 m³
 - Ultimate: 22,533 m³
- **Construct an advanced wastewater treatment plant**
An advanced wastewater treatment plant is a plant that provides nutrient removal and disinfection to the wastewater for the study area. Alberta Environment stated that the effluent from an advanced wastewater treatment plant can be discharged directly into the existing creek or Ferguson Lake without the provision of storage. The required treatment plant capacity for various scenarios for the reduced wastewater flow is identical to the conventional wastewater treatment plant.

- Discharging effluent from a conventional lagoon into the future City of Grande Prairie 116 Street sanitary trunk sewer as shown in Figure 7.3.1
This option is to utilize the storage cell of the existing lagoon as a flow equalization pond which stores wastewater when the average day flow exceeds the allowable discharge rate. Aquatera advised that the allowable discharge rate into the City of Grande Prairie 116 Street sanitary trunk sewer is 300 L/s.

The projected discharge rates from the lagoon into City of Grande Prairie 116 Street sanitary trunk sewer are shown in Table 7.3.6.

Table 7.3.6: Discharge Rate into 116 Street Sanitary Trunk Sewer

Growth Scenarios	With Flow reduction (L/s)	No Flow Reduction (L/s)
2010	59	263
2015	136	347
2025	179	416
Ultimate	300	557

The discharge rate shown in the table is 115% of the average day flow. The additional 15% flow is for the discharge of inflow and infiltration.

This option will require the construction of the following facilities:

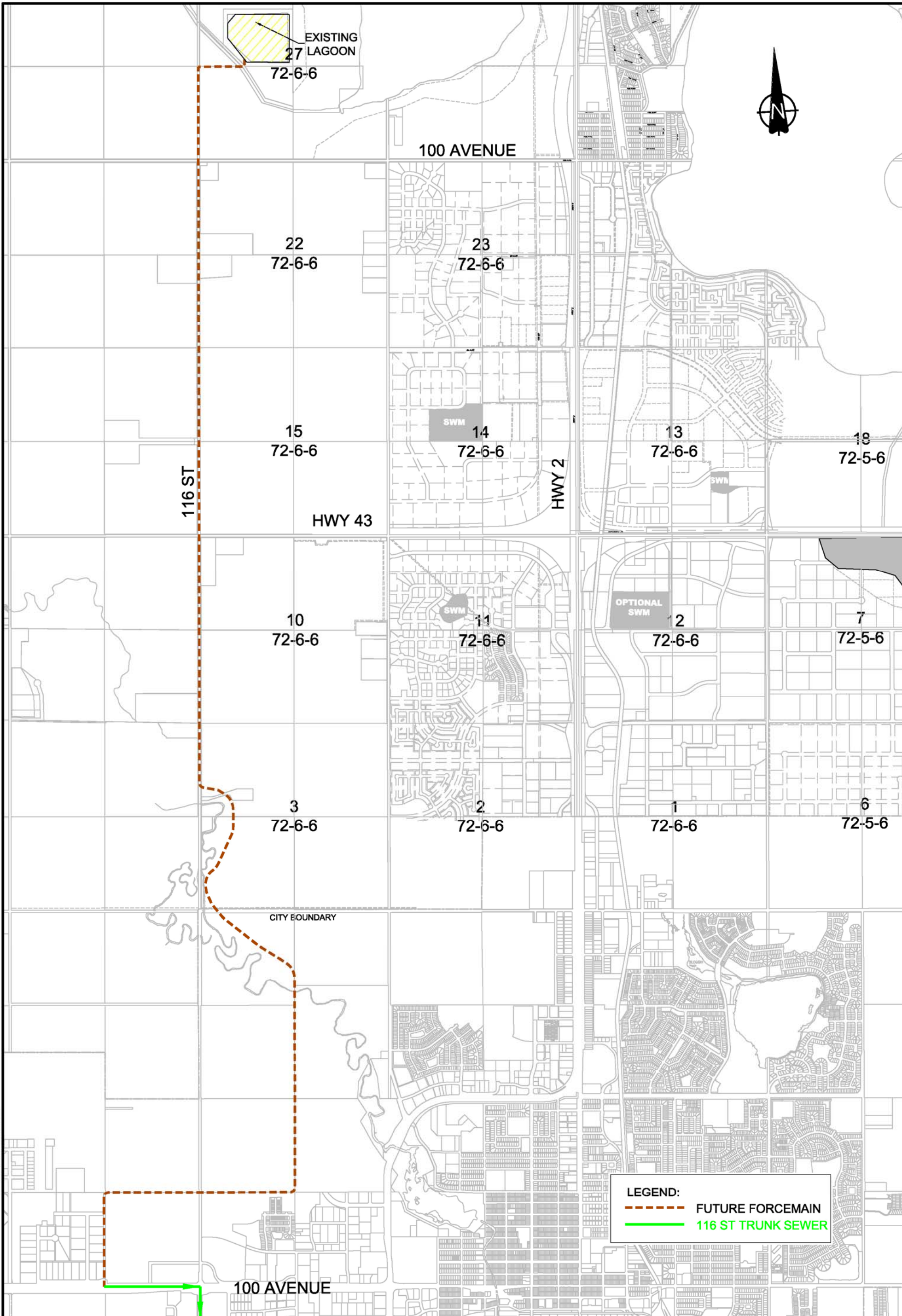
- One lift station
- One 450 mm diameter forcemain from the existing lagoon to the City of Grande Prairie 116 Street sanitary trunk sewer at 100 Avenue (12,100 m)
- One 450 mm diameter forcemain from the existing lagoon to Aquatera wastewater treatment plant (20,900 m)
- Improvements to upgrade Aquatera wastewater treatment plant to service the study area

Upgrading of Aquatera wastewater treatment plant has been proposed by other consultant and will be implemented in the near future. Aquatera should investigate the feasibility of incorporating the study area into the proposed improvements prior to carrying out the implementation.

Since the total required storage volume for the flow equalization pond is approximately 231,648 m³ which is less than the existing volume of the existing storage pond, improvement of the existing storage pond will not be required for the conversion into a flow equalization pond. For detail design, the daily average wet weather flow should be considered in the determination of the size and capacity of the forcemains and pumps.

Based on the discharge rate for the flow reduction option, the implementation of the forcemain from the lagoon to the City of Grande Prairie 116 Street sanitary trunk sewer is sufficient till 2018. After 2018, a second forcemain will be required from the lagoon to Aquatera wastewater treatment plant.

As shown above, the available land is not large enough for the construction of a conventional lagoon or an aerated lagoon to service the study area for the ultimate condition and therefore they are not potential options. The estimated construction cost of an aerated lagoon on a site large enough for the development of the aerated lagoon is approximately \$ 41.5 million. An aerated lagoon system when continuously discharge is allowed, will consist of one completely mixed cell, two partially mixed cells and one polishing cell. If a continuous discharge is not allowed, a storage cell will be required.



**2005 WASTEWATER SYSTEM MASTER GRANDE
PRAIRIE - CLAIRMONT CORRIDOR**

FORCEMAIN TO 116 STREET SANITARY TRUNK

Figure 7.3.1

SCALE: 1:30,000

The capacity requirements of these cells are stated in the Alberta Environment Standards and Guidelines for Municipal Waterworks, Wastewater and Storm drainage Systems. If Aquatera is interested in an aeration lagoon system, a further investigation including acquisition of additional land will be required.

For the comparison of the three potential options, construction costs were estimated and shown in Table 7.3.7.

Table 7.3.7: Potential Options Construction Cost Estimates

Options	Ultimate
Conventional WWTP (\$)	67,370,680
Advanced WWTP (\$)	175,749,600
Discharging into 116 Street Trunk (\$)	21,505,500*

*Excluding upgrading costs for the WWTP

The construction cost estimates for the discharging into the City of Grande Prairie 116 Street sanitary trunk sewer option include forcemains, lift station and road and river crossings except the improvement costs for Aquatera wastewater treatment plant. The estimate for the upgrading requirements of the wastewater treatment plant to accommodate the future flow equalization pond discharge is beyond the scope of the Master Plan. However, it should be considered as a cost sharing component when it is available.

As shown in Table 7.3.7, the option which discharging into the City of Grande Prairie 116 Street sanitary trunk sewer has the lowest construction cost without the consideration of the upgrading requirements of Aquatera Wastewater Treatment Plant. An investigation on the upgrading requirements of Aquatera treatment plant should be carried out prior to finalizing the decision.

The breakdown of the estimated construction costs for discharging into the 116 Street sanitary trunk option is shown as follows:

450 mm diameter forcemain	\$	13,160,000
Road Crossings	\$	600,000
River Crossings	\$	1,250,000
Lift Station	\$	920,000
Engineering and Contingencies (35%)	\$	5,575,500
Total	\$	21,505,500

Cost sharing should be considered for discharging the effluent from the lagoon into the City of Grande Prairie 116 Street sanitary trunk sewer and Aquatera wastewater treatment plant. Since the effluent discharged into these facilities continuously in a constant rate which consists of both dry and wet weather flow, it is recommended that the cost sharing should be based on the design capacity of the facilities.

In order to allow time for carrying out the feasibility study for the discharging into the City of Grande Prairie 116 Street sanitary trunk option, Alberta Environment advised that the existing lagoon can be converted into a temporary aerated lagoon to increase the annual discharge to twice a year. A feasibility study and preliminary design will be carried out in the near future and the improvements will be implemented in 2007.

7.4 Existing Lagoon Interim Improvements

A pre-design report for the Clairmont Sewage Lagoon Expansion was prepared in July, 2006. The pre-design report recommended that the ultimate option for the lagoon expansion is to convert the existing storage cell into a flow equalization pond and discharge the effluent into the 116 Street sanitary trunk sewer. In order to provide time to carry out a feasibility study for the recommended ultimate option, Aquatera decided to implement a temporary solution by converting the existing facultative cell into an aeration pond. Due to the poor condition of the existing control structures, the implementation of the aeration pond will be taken in the following three phases:

- Phase 1: Replace all existing control structures with new structures
- Phase 2: Desludge the existing facultative and storage cells and repair surface deficiencies as well as carry out drainage improvements as required.
- Phase 3: Installation of aeration system in the facultative cell

The ultimate construction cost is \$4.32 million.