Town of Strathmore

Master Servicing Study – Annexation 2006

Prepared by:
UMA Engineering Ltd.
2540 Kensington Road NW
Calgary AB T2N 3S3

Project Number: 0105-076-00

May 2007

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UMA ENGINEERING LTD.

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Project Manager, Sanitary, Water & Report Preparation

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Master Annexation Study Summary

In 2006, the Town of Strathmore (the Town) commissioned UMA Engineering to update the existing master servicing study (Town of Strathmore Master Drainage Plan, UMA, May 2002) to include the proposed annexation areas as shown in **Figure 2.1**. This study identified the proposed growth scenario and major servicing for the project population in terms of the following:

- Water Supply / Distribution, and Fire Protection System
- Sanitary Sewer System
- Stormwater Management
- Roadway Network Planning

Population Projections

The projected population of the Town and growth sequence was developed utilizing past population data and input from Town staff. The annexation land based on a 6 percent growth rate is found to support the Towns growth needs until 2037 or when the population is predicted to reach 62,351. The sequence of the growth is assumed as shown on **Figure 3.2**.

Water Supply and Distribution System

The objective of the water supply and distribution system evaluation was to create a plan for the existing and future water system for the town. The existing water system was assessed based on existing reports, models and the ultimate design population.

The existing system consists of water treatment plant, two treated water reservoirs with distribution pumps and piping as shown in **Figure 4.2**. Based on the analysis of the system, the following are our findings:

- The water treatment plant clarifiers and filters are under capacity and require immediate upgrading because they cannot supply the required calculated peak day demand of 99 L/s for a population of 10,336 for 2006.
- The existing treated water storage capacity of 8,270 m^3 will require upgrading when the population is predicted to reach 21,845 by 2019.
- The combined Brentwood and Westmount distribution pumping capacity of 227.6 L/s will require upgrading when the population is predicted to reach 11,507 by 2008.
- The exiting distribution system was found to have several areas of inadequate fire flows as shown in **Figure 4.3**.

The analysis consisted of modeling the existing system, the system at end of the design of East Calgary Regional Pipeline in 2030 and at the ultimate build out population in 2037. After modeling these scenarios, it was observed that:

- PRVs are required for low laying NW and SE areas and either existing pump station can be used to supplement the new east reservoir and pump station during peak day demand.
- Installation of the new east reservoir and pump station, plus either the Brentwood reservoir and pump station or the Westmount reservoir and pump station, can be used to supply peak day demands.

A SIZE 8.5" x 11" (215.9mm x 279.4mm)

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Service Area

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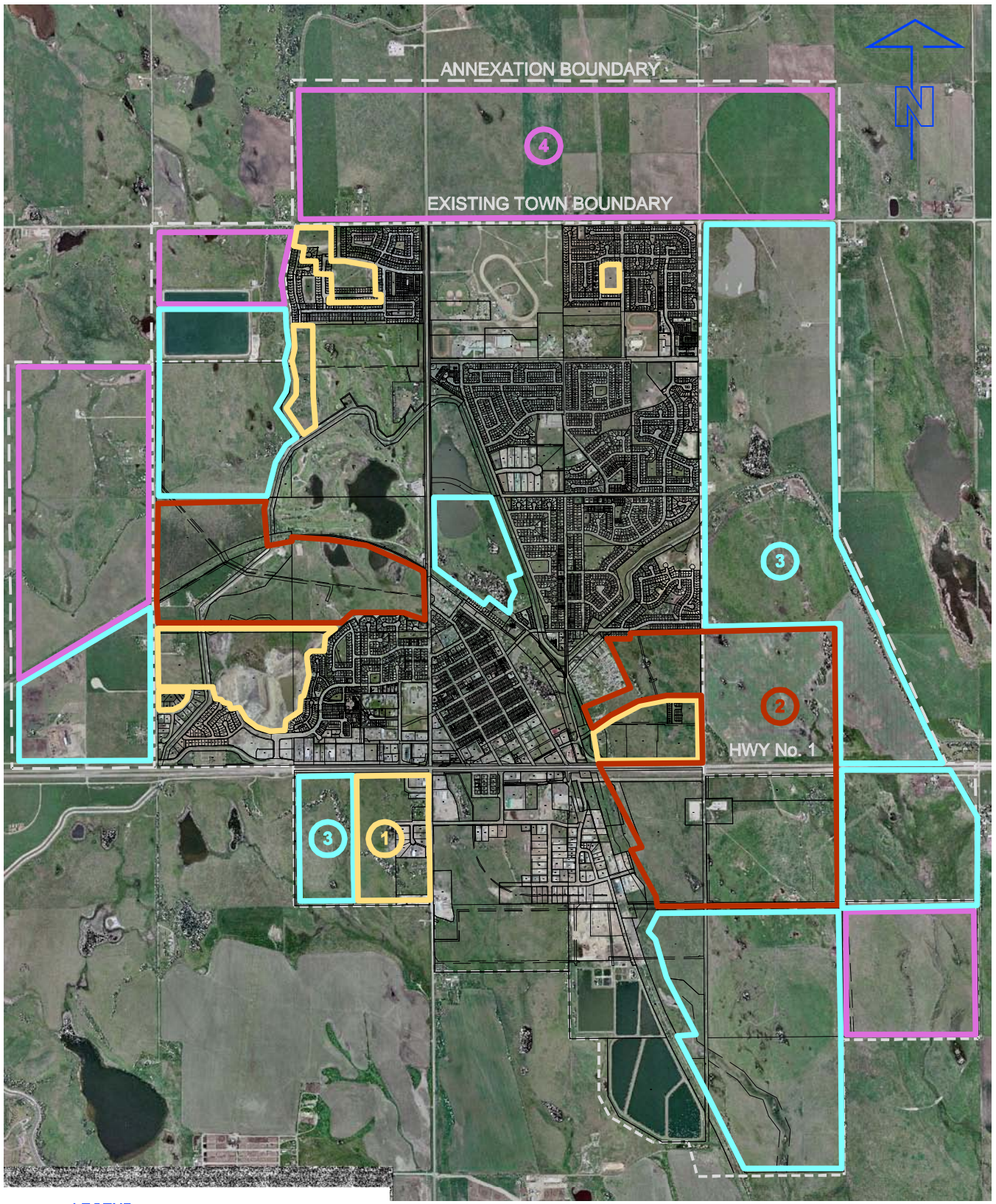
Figure - 2.1



LEGEND

1 0 TO 5 YEARS

2 5 TO 15 YEARS

3 15 TO 25 YEARS

4 25 TO 31 YEARS

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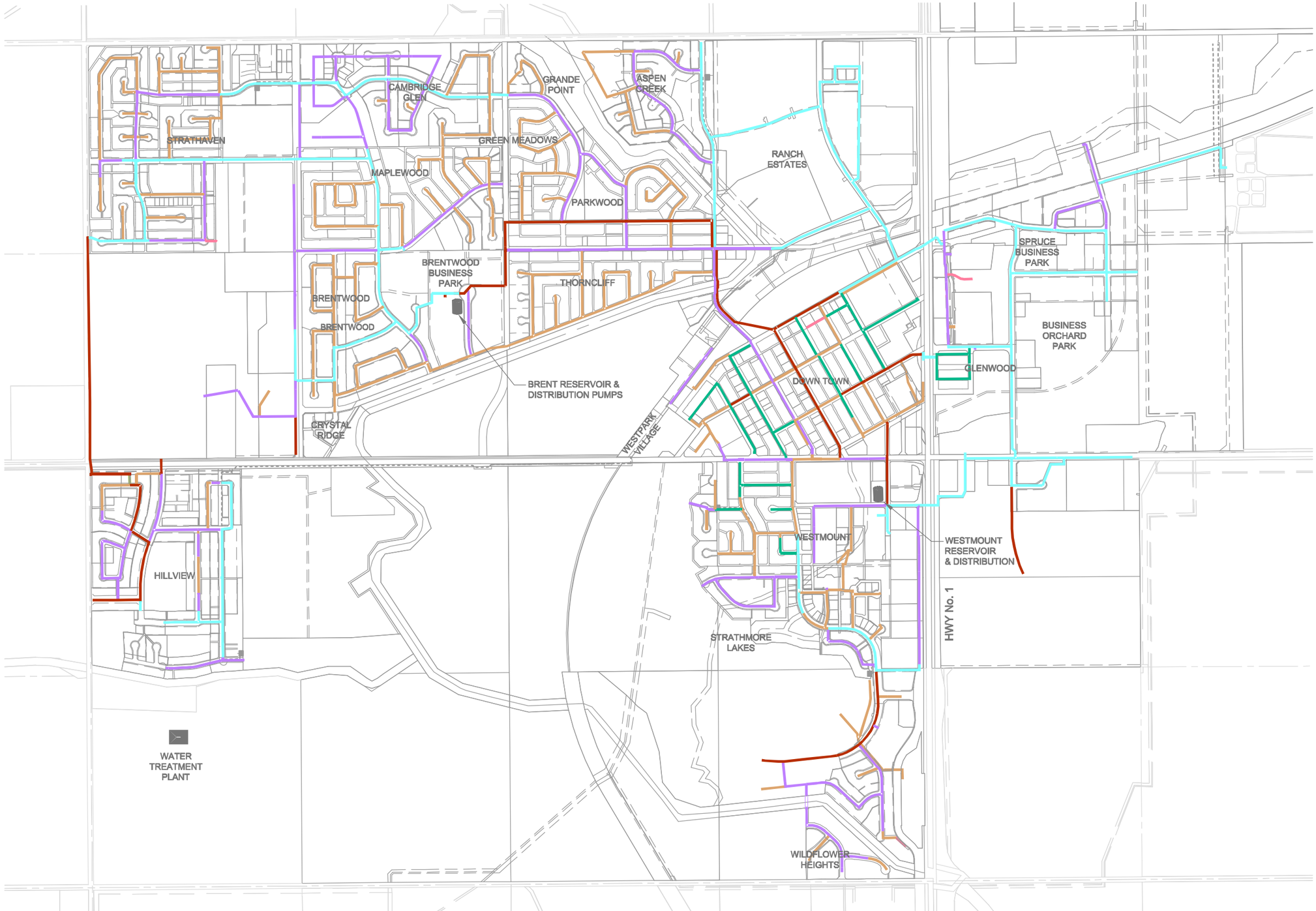
Figure - 3.2



LEGEND:

- 50mm
- 100mm
- 150mm
- 200mm
- 250mm
- 300mm

SCALE 1:15000

0 150 300

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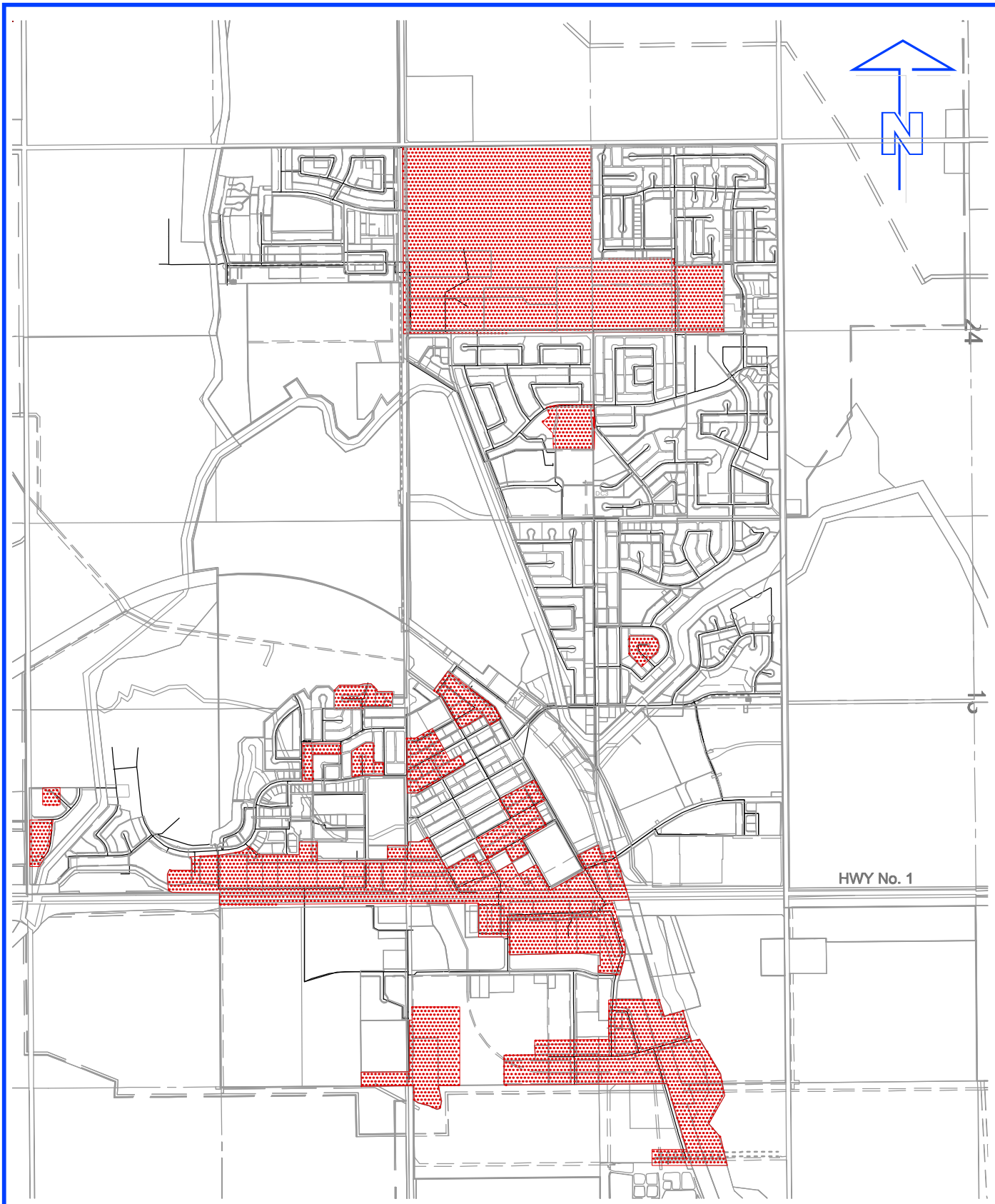
Existing Water Distribution Pipeline Sizes

Figure 4.2



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Inadequate Fire Flow Areas Before Upgrades

Figure - 4.3

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- The existing Westmount pump station has very little or no impact on the proposed distribution system due to its limited pumping capacity and would have to be upgraded significantly to adequately contribute to the distribution system. However, the existing storage capacity should be utilized in future by pumping water into the distribution system during low demand periods.
- The 400 mm and 300 mm loop around the Town should be a designated transmission main because pressures in this main exceed the required maximum of 56.30m (80psi). Pressure reducing stations need to be installed on branch-offs from the transmission main to reduce the pressures in the distribution system.
- The transmission main should not have any house service connections connected to it other than where existing mains are used for the transmission main loop. If service connections on the existing mains are used as transmission mains, then these service lines shall require individual PRVs.

The study identified the following upgrades to the system to meet the current and ultimate projected population:

- Provide upgrades to the existing water treatment plant until the East Calgary Regional Pipeline is operational.
- Upsize several existing distribution pipes as show in **Figure 4.4**.
- Piping modifications to the existing Brentwood and Westmount reservoirs and pump stations to increase their supply and distribution capacities.
- Construction of three new 12,000 m^3 reservoirs and associated distribution pump stations and associated piping and looping as shown in **Figure 4.6**.

The construction of the proposed improvements to service the Town and annexation areas should be staged as required to supply adequate demands to the Town and new development areas. The construction of the new east reservoir and pump station should coincide with the construction of the East Calgary Regional Water Pipeline. The capital costs are summarized in *Table 1*:

Table 1: Water Supply and Distribution Capital Cost Summary

Description	Estimated Costs
Distribution Capacity Upgrade Cost	$ 5,143,000
Distribution Connection Upgrade Cost	$ 3,026,000
Transmission System Cost	$ 11,899,000
Treated Water Reservoirs Cost	$ 12,400,000
Distribution Pump Stations Cost	$ 3,198,000
TOTAL	**$ 35,666,000**

Sanitary Sewer System

The sanitary sewer system evaluation provided a plan for the future annexation areas incorporating the existing collection system. Several reports and actual data from EPCOR's records were reviewed to come up with the design criteria and to evaluate the existing and proposed sanitary sewerage system requirements.

The Town's existing sanitary sewer collection system consists of central and eastern trunks. **Figure 5.1** shows the current area serviced by each trunk system and the general location including the trunk size.

The existing sanitary collection trunks were analyzed utilizing a static model of peak wet weather flows.

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300

LEGEND:

- 150mm WM UPGRADE
- 200mm WM UPGRADE
- 250mm WM UPGRADE
- 300mm WM UPGRADE

SCALE 1:15000

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Recommended Existing Water Main Capacity Upgrades

Figure 4.4

B SIZE 11" x 17" (279.4mm x 431.8mm)

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ANNEXATION BOUNDARY

EXISTING TOWN BOUNDARY

HWY No. 1

RESERVOIR

CAMBRIDGE GLEN

GRANDE POINT

ASPEN CREEK

STRATHAVEN

GREEN MEADOWS

MAPLEWOOD

PARKWOOD

RANCH ESTATES

LAGOON

SPRUCE BUSINESS PARK

BRENTWOOD BUSINESS PARK

THORNCLIFF

ORCHARD BUSINESS PARK

BRENTWOOD

CRYSTAL RIDGE

WEST PARK VILLAGE

DOWN TOWN

GLENWOOD

WESTMOUNT

HILLVIEW

STRATHMORE LAKES

WILDFLOWER HEIGHTS

TRANSMISSION MAIN TO BE INSTALLED IN 2030

RESERVOIR TO BE INSTALLED IN 2030

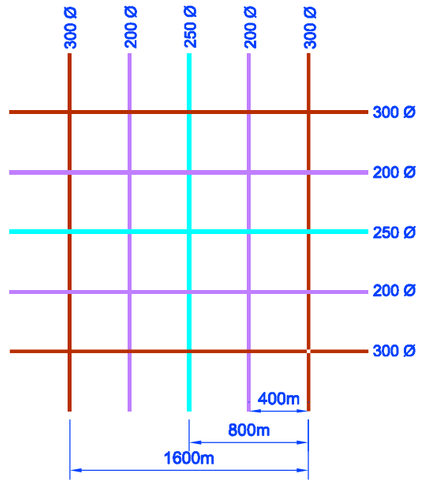
25 24 13 1 26 2 27 3 28 9

SCALE 1:25000

0 250 500

LEGEND:

- 150 Ø WATERMAIN
- 200 Ø WATERMAIN
- 250 Ø WATERMAIN
- 300 Ø WATERMAIN
- 300 Ø WATERMAIN TRANSMISSION
- 400 Ø WATERMAIN TRANSMISSION
- 600 Ø WATERMAIN TRANSMISSION
- EXISTING TOWN BOUNDARY
- ANNEXATION BOUNDARY
- 250 Ø WATERMAIN (DEVELOPERS RESPONSIBILITY)
- 300 Ø WATERMAIN (DEVELOPERS RESPONSIBILITY)
- EXISTING WATERMAIN



DETAIL 1

SCALE: N.T.S.

GRID MAIN NETWORK

NOTE : THIS STANDARD GRID NETWORK IS REQUIRED

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Water

Figure 4.6

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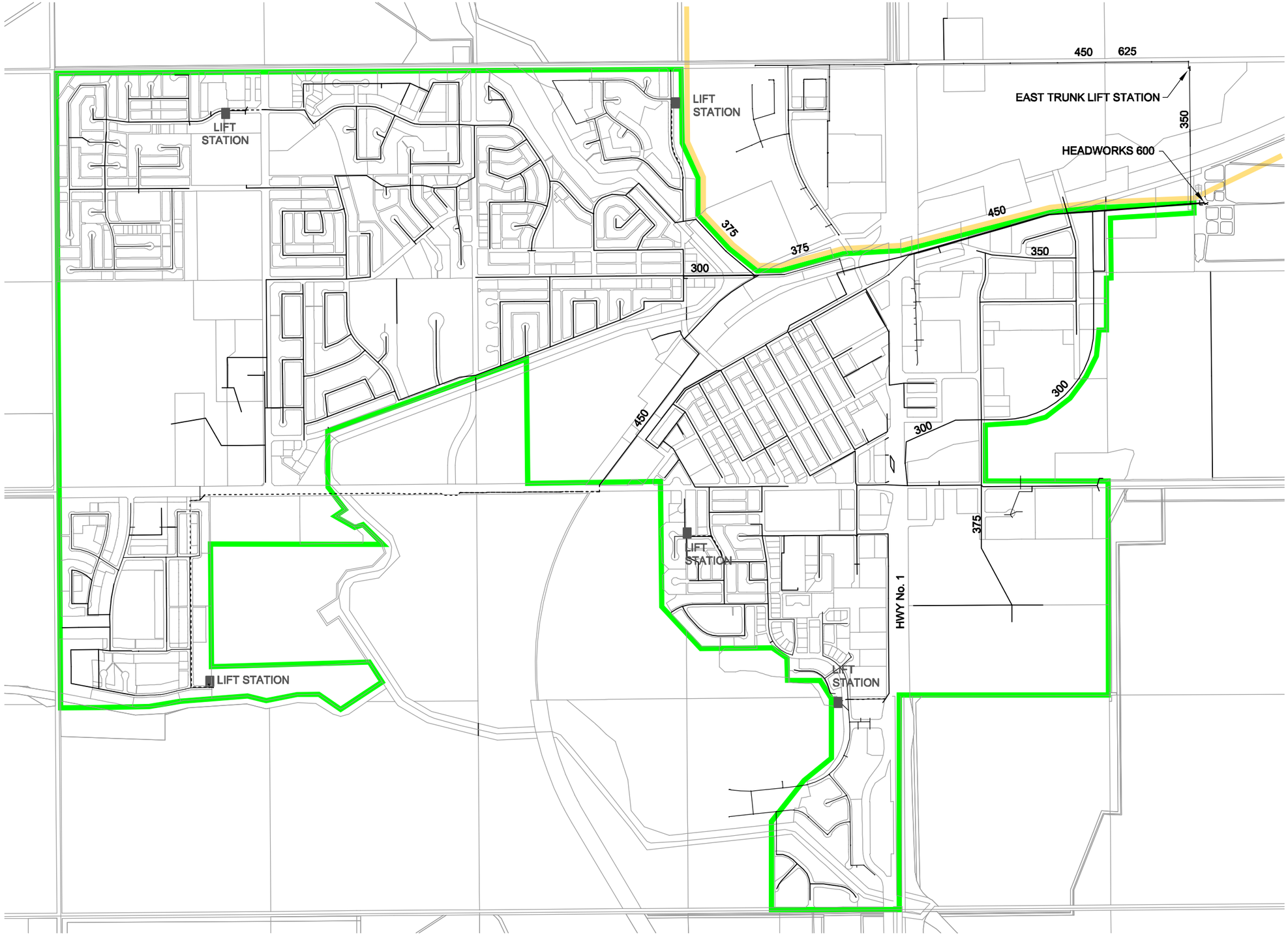

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Existing Sanitary East & Central Trunk Service Drainage

Figure 5.1

The model identified that some existing sections of sewers as shown in **Figure 5.2** are at or over capacity. Depending on the direction the Town would like to direct development, we catered for the following two options to improve servicing. The Town's actual growth patterns will dictate which option is selected.

- ***Option 1***, as shown on **Figure 5.4**, deals with servicing the entire northern part of the annexed area through the eastern sanitary trunks and the western part of the annexed area will be serviced through the southern sanitary trunks. The capital cost for this option is ***$28,135,000***.
- ***Option 2***, as shown on **Figure 5.5**, deals with servicing three ¼ sections of the northern part of the annexed area through the eastern sanitary trunks and the remaining two ¼ sections through the western part of the annexed area which are serviced through the southern sanitary trunks. The capital cost for this option is ***$26,864,000***.

Stormwater Management – Master Drainage Plan

The objectives of the Master Drainage Plan were:

- To assess the capacity, water quality and other related stormwater issues of the existing storm system
- To highlight current hydraulic concerns
- To provide stormwater management objectives to guide future development in the Town, up to the year 2037.

The underlying criteria for the Stormwater Master Drainage Plan for the Town provided by the WID is that the maximum allowable release rate to Eagle Lake Ditch is 1400 L/s (50 ft3/s) and the maximum allowable release rate to the WID Main 'A' Canal is also 1,400 L/s (50 ft3/s). Currently, neither of these allowable release rates are met by the Town and the existing rates are higher.

The total study area is 2,477 hectares (ha) which includes 1,566 ha contained within the existing town (not including WID land) boundary. The area within the existing town catchment (1,566 ha) was divided into 65 catchments (Catchments 1 - 39 and 50 – 75). The catchments are separated by subdivision names or area numbers and can be seen in **Figure 6.2**.

The primary concern for the Town was the excessive amount of stormwater currently discharging into the Eagle Lake Ditch. The 1999 Infrastructure Analysis Report by Urban Systems states that the allowable discharge rate into the Eagle Lake Ditch is 85 L/s. A new ditch under construction, allows the discharge rate to be increase to 1,400 L/s into Eagle Lake as per the Town agreement with the WID.

Other concerns highlighted by the Town are the areas that do not currently discharge into the Town's storm system. Prior to development, runoff from these areas must be directed into the Town's storm system. Areas that need to be diverted to discharge into the Town's storm system are illustrated in **Figure 6.7**.

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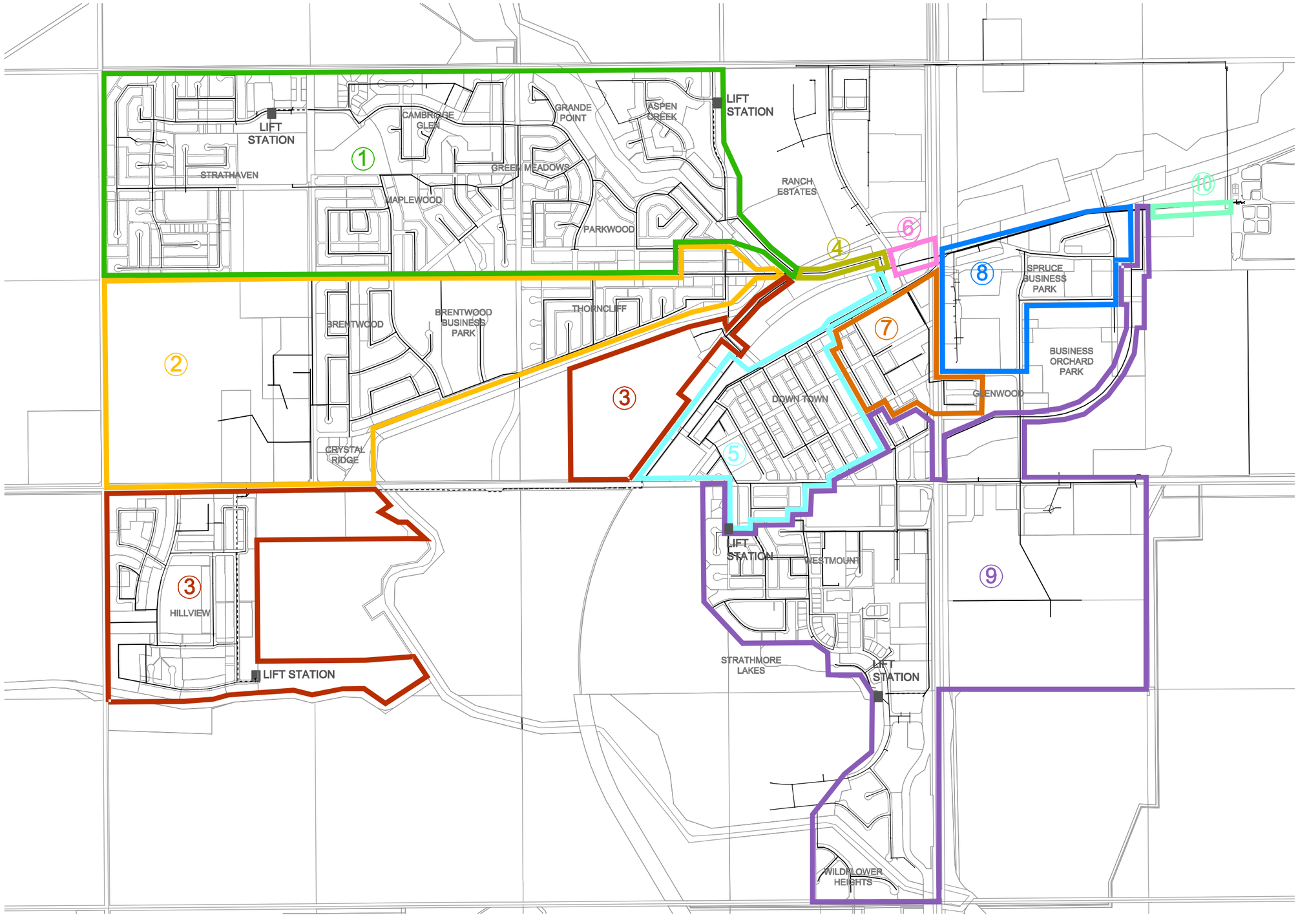

LEGEND

1. PARKWOOD TRUNK
2. THORNCLIFF TRUNK
3. LAKESIDE TRUNK
4. NORTH CENTER STREET TRUN
5. DOWNTOWN NORTH TRUNK
6. SOUTH CENTER STREET TRUN
7. DOWNTOWN SOUTH TRUNK
8. SPRUCE TRUNK
9. ORCHARD TRUNK
10. SLATER TRUNK

SCALE 1:15000

0 150 300

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Existing Sanitary Central Sub Trunk Drainage

Figure 5.2

B SIZE 11" x 17" (279.4mm x 431.8mm)

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LIFT STATION #3
150Ø FORCEMAIN
ANNEXATION BOUNDARY
HWY No. 1
LIFT STATION #4
EXISTING TOWN BOUNDARY
300Ø FORCEMAIN
LIFT STATION #5
MAIN LIFT STATION
LIFT STATION #2
LIFT STATION #1
LIFT STATION #6
250Ø FORCEMAIN
400Ø FORCEMAIN
700Ø FORCEMAIN
EX 350Ø FORCEMAIN
EX 450Ø SAN
525 Ø @ 0.4%
600 Ø @ 0.3%
600 Ø @ 1.0%
750 Ø @ 0.2%
300 Ø @ 0.9%
375 Ø @ 0.4%
STRATHAVEN UPGRADE
300 Ø @ 0.4%
ASPEN CREEK
UPGRADE
375 Ø @ 0.8%
TIE INTO EXISTING
900 Ø @ 0.2%
750Ø @ 0.2%
675Ø @ 0.2%
300 Ø @ 0.6%
300 Ø @ 0.8%
375 Ø @ 0.24%
300 Ø FORCEMAIN
525 Ø @ 0.3%
450 Ø @ 0.3%
900 Ø @ 0.1%
THOMAS PLACE UPGRADE
REPLACE 250Ø WITH 300Ø
OF THE SAME SLOPE
ORCHARD BUSINESS
PARK UPGRADE
525 Ø @ 0.2%
GOLF COURSE
450Ø @ 0.2%
STRATHMORE
LAKES UPGRADE
150Ø FORCEMAIN
750 Ø @ 0.2%
450 Ø @ 0.2%
375 Ø
@ 0.4%
300 Ø
@ 0.8%
300 Ø @ 0.6%
300 Ø @ 0.4%
TOWNSHIP 24
TOWNSHIP 23
CAMBRIDGE GLEN
GRANDE POINT
ASPEN CREEK
STRATHAVEN
GREEN MEADOWS
MAPLEWOOD
PARKWOOD
RANCH ESTATES
BRENTWOOD BUSINESS PARK
BRENTWOOD
THORNCLIFF
CRYSTAL RIDGE
WESTPARK VILLAGE
DOWN TOWN
SPRUCE BUSINESS PARK
ORCHARD BUSINESS PARK
GLENWOOD
LAGOON
HILLVIEW
WESTMOUNT
STRATHMORE LAKES
WILDFLOWER HEIGHTS
24
25
26
27
28
13
2
3
9

LEGEND:

- PROPOSED SANITARY SEWER
- PROPOSED FORCEMAIN
- EXISTING TOWN BOUNDARY
- ANNEXATION BOUNDARY
- EXISTING GRAVITY SEWER
- EXISTING FORCEMAIN

SCALE 1:25000

0 250 500

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Town of Strathmore
Master Servicing Study
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Option 1

Figure 5.4

B SIZE 11" x 17" (279.4mm x 431.8mm)

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LIFT STATION #3
150Ø FORCEMAIN
525 Ø @ 0.2%
600 Ø @ 0.2%
600 Ø @ 0.25%
600 Ø @ 1.0%
675 Ø @ 0.2%
ANNEXATION BOUNDARY
HWY No. 1
300 Ø @ 0.9%
375 Ø @ 0.4%
LIFT STATION #4
EXISTING TOWN BOUNDARY
300Ø FORCEMAIN
750 Ø @ 0.2%
750 Ø @ 0.25%
2 x 675Ø @ 0.2%
ASPEN CREEK UPGRADE
375 Ø @ 0.8%
TIE INTO EXISTING
STRATHAVEN UPGRADE
300 Ø @ 0.4%
300 Ø @ 0.6%
300 Ø @ 0.8%
300 Ø @ 0.8%
375 Ø @ 0.24%
LIFT STATION #5
MAIN LIFT STATION
EX 350Ø FORCEMAIN
650Ø FORCEMAIN
300 Ø FORCEMAIN
LAGOON
375 Ø @ 0.4%
STRATHAVEN
CAMBRIDGE GLEN
GRANDE POINT
ASPEN CREEK
GREEN MEADOWS
MAPLEWOOD
PARKWOOD
RANCH ESTATES
TIE INTO EXISTING
SPRUCE BUSINESS PARK
BUSINESS ORCHARD PARK
GLENWOOD
900 Ø @ 0.15%
525 Ø @ 0.2%
BRENTWOOD BUSINESS PARK
BRENTWOOD
THORNCLIFF
DOWN TOWN
THOMAS PLACE UPGRADE
REPLACE 250Ø WITH 300Ø
OF THE SAME SLOPE
WESTPARK VILLAGE
CRYSTAL RIDGE
LIFT STATION #2
250Ø FORCEMAIN
450 Ø @ 0.3%
HILLVIEW
WESTMOUNT
STRATHMORE LAKES
STRATHMORE LAKES UPGRADE
150Ø FORCEMAIN
750 Ø @ 0.2%
GOLF COURSE
450Ø @ 0.2%
450 Ø @ 0.3%
FORCEMAIN
LIFT STATION #1
WILDFLOWER HEIGHTS
525Ø @ 0.25%
500Ø FORCEMAIN
375 Ø @ 0.4%
300 Ø @ 0.8%
300 Ø @ 0.6%
LIFT STATION #6
500Ø FORCEMAIN
SCALE 1:25000
0 250 500
TOWNSHIP 24
TOWNSHIP 23
24
25
26
27
28
13
2
3
9
1

LEGEND:
- PROPOSED SANITARY SEWE
- PROPOSED FORCEMAIN
- EXISTING TOWN BOUNDARY
- ANNEXATION BOUNDARY
- EXISTING GRAVITY SEWER
- EXISTING FORCEMAIN

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Option 2

Figure 5.5

B SIZE 11" x 17" (279.4mm x 431.8mm)

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To Medicine Hat

Trans-Canada Highway

To Calgary

E1 168.34 Ha

E2 64.72 Ha

W1 42.58 Ha

W2 20.03 Ha

W3 36.60 Ha

W4 88.14 Ha

W5 95.21 Ha

W6 31.26 Ha

W7 65.48 Ha

W8 59.03 Ha

R1 96.80 Ha

R2 29.85 Ha

X1 19.59 Ha

X2 12.26 Ha

X3 23.54 Ha

1 24.45 Ha

2 28.05 Ha

3 3.20 Ha

4 3.65 Ha

5 6.43 Ha

6 32.40 Ha

7 32.11 Ha

8 37.72 Ha

9 10.00 Ha

10 13.98 Ha

11 11.57 Ha

12 10.41 Ha

13 8.99 Ha

14 61.47 Ha

15 19.56 Ha

16 18.98 Ha

17 17.98 Ha

18 59.15 Ha

19 42.01 Ha

20 25.15 Ha

21 18.84 Ha

22 23.53 Ha

23 32.46 Ha

24 9.54 Ha

25 1.31 Ha

26 13.00 Ha

27 6.52 Ha

28 19.67 Ha

29 51.93 Ha

30 41.53 Ha

31 6.50 Ha

32 26.82 Ha

33 10.91 Ha

34 119.36 Ha

35 15.31 Ha

36 36.06 Ha

37 39.56 Ha

38 36.16 Ha

39 31.71 Ha

50 11.97 Ha

51 9.36 Ha

52 15.71 Ha

53 36.63 Ha

54 46.49 Ha

55 10.68 Ha

56 15.62 Ha

57 2.28 Ha

58 16.82 Ha

59 22.51 Ha

60 14.95 Ha

61 7.18 Ha

62 12.49 Ha

63 2.02 Ha

64 2.47 Ha

65 3.33 Ha

66 23.18 Ha

67 7.18 Ha

68 14.56 Ha

69 2.90 Ha

70 4.08 Ha

71 6.43 Ha

72 63.72 Ha

73 115.36 Ha

74 32.98 Ha

75 44.35 Ha

POND 1

POND 2

POND 3

POND 4

POND 5

POND 6

WID MAIN 'A' CANAL

WID NORTH 'A' CANAL

WID 'A' CANAL

EAGLE LAKE DRAINAGE

EAGLE LAKE DITCH

UNNAMED WATER COURSE

FREEMAN SLOUGH

HILL VIEW

STRATHAVEN

STRATHAVEN HEIGHTS

CAMBRIDGE GLEN

GRANDE POINT

ASPEN CREEK

GREEN MEADOWS

MAPLEWOOD

PARKWOOD

THORNCLIFF

BRENTWOOD

BRENTWOOD BUSINESS PARK

SPRUCE BUSINESS PARK

ORCHARD BUSINESS PARK

GLENWOOD

CRYSTAL RIDGE

WESTMOUNT

CANAL CROSSING

STRATHMORE LAKES

WILDFLOWER HEIGHTS

LEGEND

- Town of Strathmore Boundary
- Annexation Boundary
- 35 — Catchment Reference
- 71.28 Ha — Catchment Area
- Overland Flow Direction

0 250 500 m

SCALE 1:25000

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Town of Strathmore
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Existing Catchments

Figure - 6.2

B SIZE 11" x 17" (279.4mm x 431.8mm)

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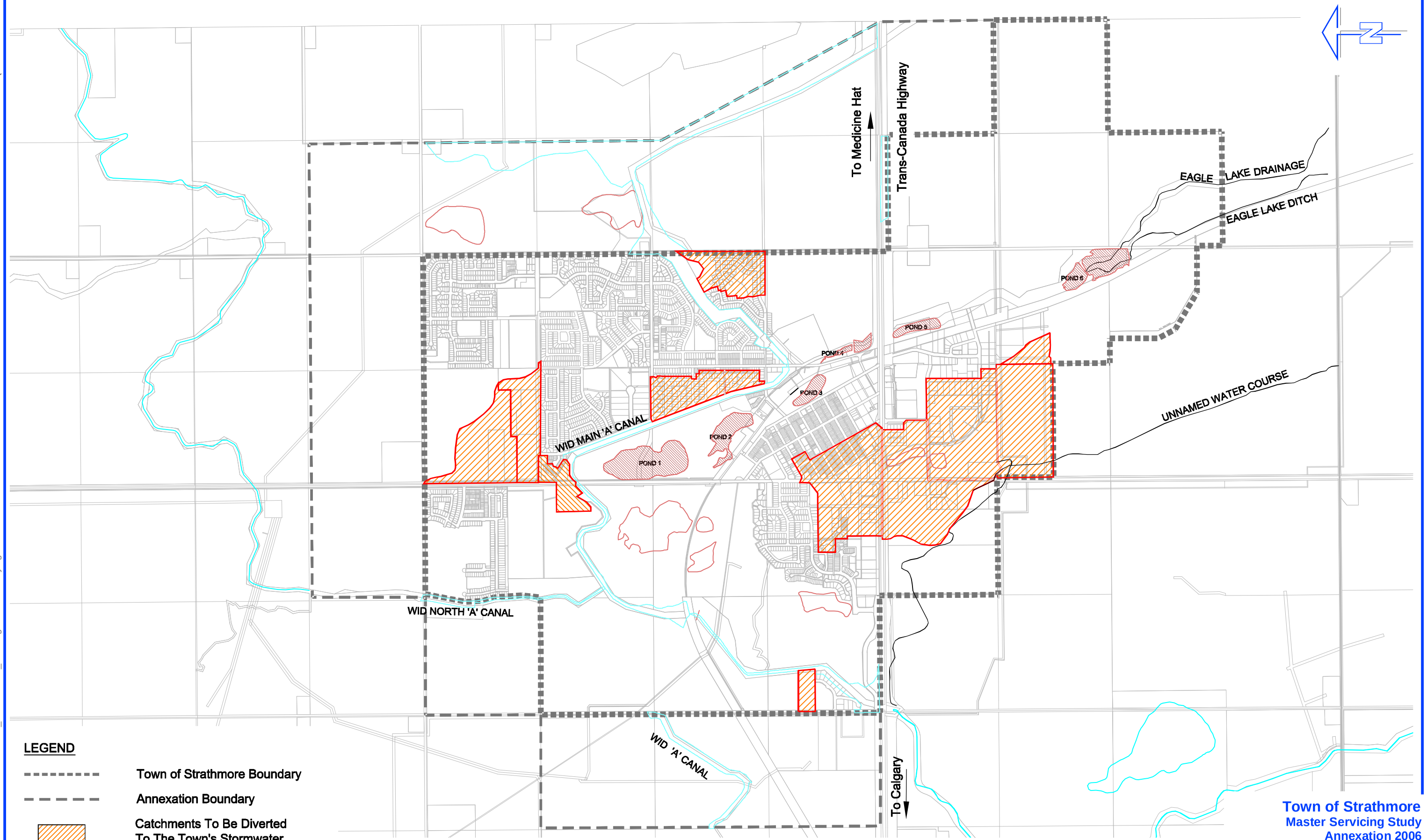

LEGEND

- Town of Strathmore Boundary
- Annexation Boundary
- Catchments To Be Diverted To The Town's Stormwater System

0 250 500 m SCALE 1:25000

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Town of Strathmore
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Catchment To Be Diverted To Eagle Lake Ditch

Figure - 6.7

Figure 6.8 shows the stormwater system recommendations that will facilitate drainage. The capital costs are summarized in *Table 2.*

Table 2: Stormwater Capital Cost Summary

Description	Estimated Costs
Brent Boulevard and Pond 1	$ 1,800,000
Strathmore Lake, West Strathmore, and Pond 2	$ 1,796,000
Westmount and South Strathmore	$ 1,845,000
Area 64 and 65	$ 348,000
Ponds 3, 4, 5, 6	$ 380,000
TOTAL	**$ 6,169,000**

Roadway Network Planning

The objective of the roadway network planning study exercise was to provide guidance in developing the future roadway system for Strathmore for the year 2037 when the annexation land is anticipated to be fully built out. The existing roadway network, shown in **Figure 7.1**, was assessed based on information from previous reports and a site visit.

The future roadway network, concept plan and traffic control recommendations were developed based on network connectivity and future traffic demands predicted from population projections of 62,351.

The purpose of the roadway classification is to direct roadway construction to meet the intended uses and right-of-way controls. In this study, the Town's future roadway system was divided into the following five classes based on the Alberta Urban Design Guide.

1. **Local Streets**

   Local streets transport traffic directly to/from properties. Local street locations depend on the development of detailed community plans. Since this did not fall within the scope of this study, and it is under the control of developers, local street locations are not included in this report.

2. **Collectors**

   The function of collectors is to equally provide for property access and traffic movement. The service roads are contained within this category, but may exceed the design traffic volumes and right-of-way widths in certain locations.

3. **Minor Arterials**

   The function of minor arterials is to provide traffic movement with some access control.

4. **Major Arterials**

   The function of major arterials is to provide traffic movement with rigid access control. The typical major arterial has a four-lane section; however, in certain locations, provisions for six lanes are required.

5. **Expressways**

   The function of expressways is to provide traffic movement with no private access permitted.

Figure 7.8 shows the proposed future roadway classifications.

B SIZE 11" x 17" (279.4mm x 431.8mm)

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ISS/REV: A

UMA FILE NAME:

To Medicine Hat

Trans-Canada Highway

To Calgary

POND 6

POND 5

POND 4

POND 3

POND 2

POND 1

WET POND

PROPOSED 525mmØ CON. STORM SEWER

OIL & GRIT SEPARATOR

PROPOSED 450mmØ CON. STORM SEWER

PROPOSED SEDIMENTATION FOREBAY

PROPOSED SEDIMENTATION FOREBAY

3# TYPE C CATCHBASINS

DITCH

DITCH

PROPOSED 750mmØ CON. STORM SEWER

Existing CSP Culvert

STORM SEWER TO PASS BELOW WID CANAL

PROPOSED 750mmØ CON. STORM SEWER

900 mmØ CON CULVERT

PROPOSED 600mmØ CON. STORM SEWER

PROPOSED 600mmØ CON. STORM SEWER

815m OF CONC. PIPE @ 0.4%

CONSTRUCT A DEDICATED DRAINAGE SWALE

REMOVE THIS POND

KEEP THIS WET POND AND OPTIMIZE IT

LEGEND

- ANNEXATION BOUNDARY
- TOWN OF STRATHMORE BOUNDARY
- MAJOR CATCHMENT BOUNDARY
- POND AREAS
- 1 BRENT BOULEVARD AND POND 1
- 2 STRATHMORE LAKE WEST STRATHCONA AND POND 2
- 3 WESTMOUNT AND SOUTH STRATHMORE
- 4 AREA 64 AND 65
- 5 POND 3, 4, 5 AND 6
- 6 ANNEXATION AREAS

0 250 500 m SCALE 1:25000

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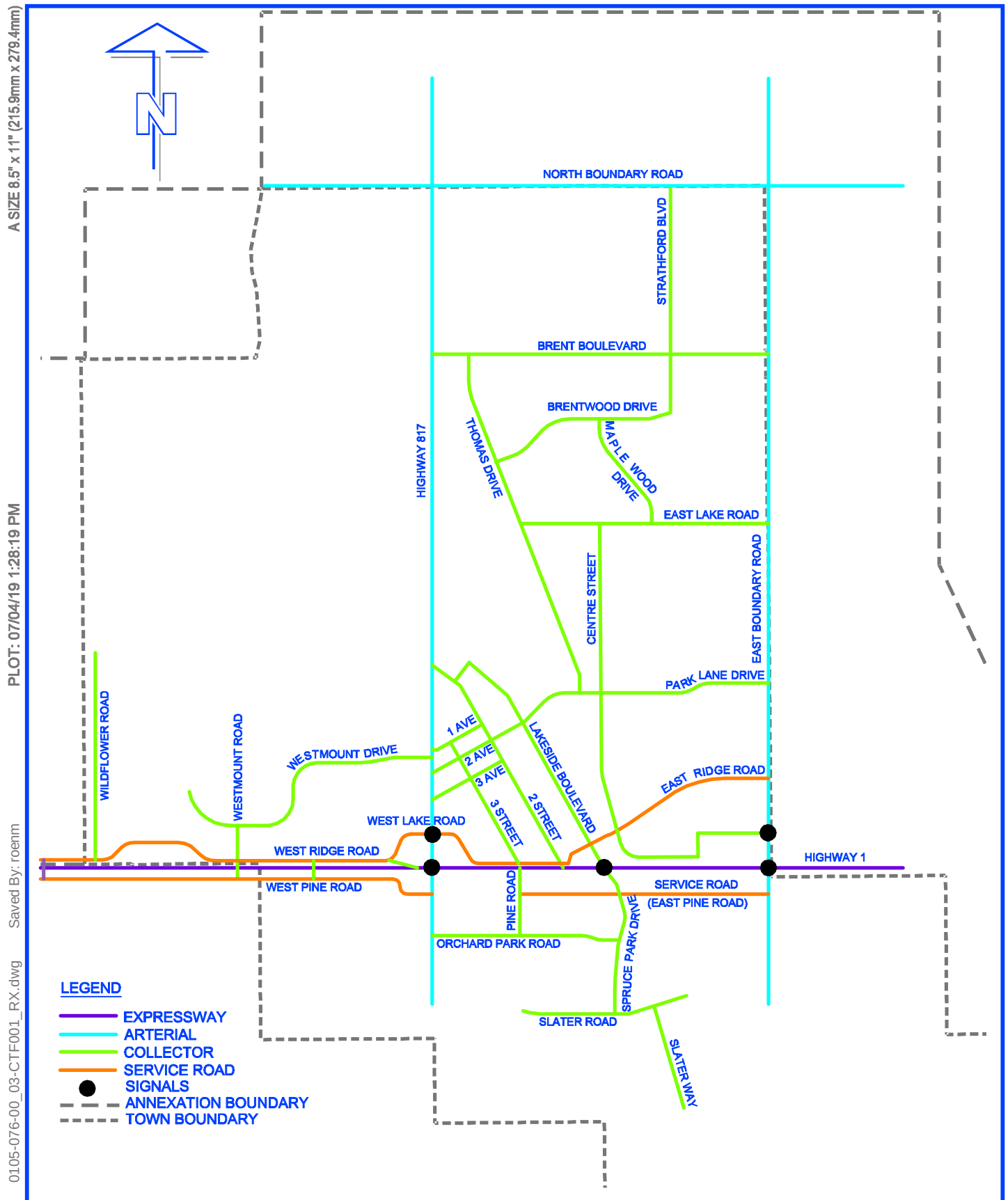
Stormwater Recommendations

Figure - 6.8



A SIZE 8.5" x 11" (215.9mm x 279.4mm)

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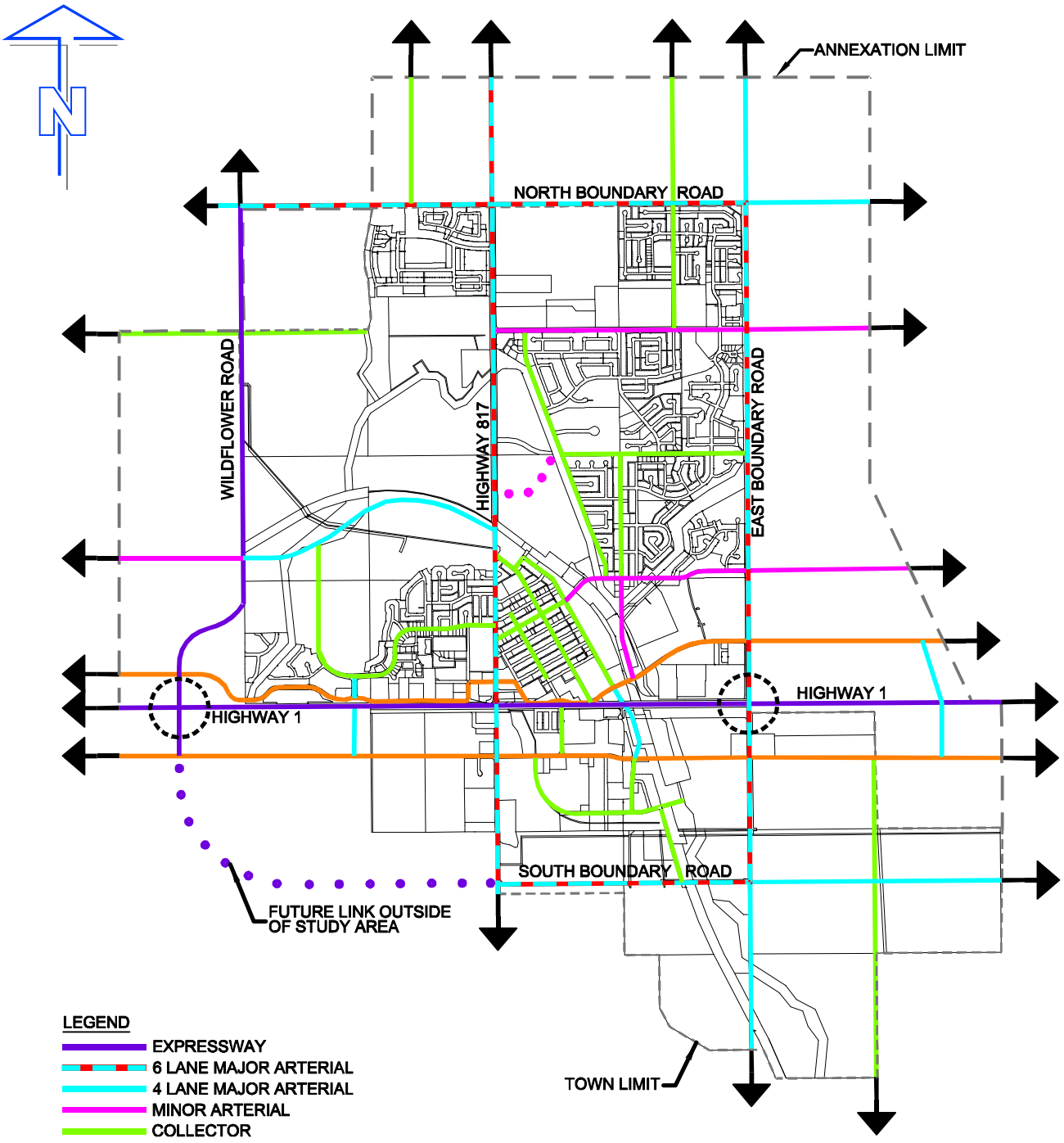
Annexation 2006

UMA | AECOM

Existing Roadway System
Figure 7.1



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Future Roadway Classification
Figure - 7.8

Based on the Alberta Urban Design Guide[1], the City's Design Guidelines for Roads[2] and predicted traffic volumes, the typical cross-sections used by the Town were modified for the proposed roadway classifications. The cross-sections are intended to serve as a guide for future development, but have some flexibility. *Tables 3 to 9* provide detailed descriptions of the roadway classifications with typical cross-sections. Figures of the cross-sections are included at the end of this section.

Table 3: Typical Characteristics of Local Streets

DAILY TRAFFIC VOLUME	NUMBER OF LANES	RIGHT-OF-WAY REQUIREMENTS	MINIMUM INTERSECTION SPACING
<1,000 vpd	2	15.5m or 17m	60m
FUNCTION:			
To provide direct access to abutting lands To collect and distribute traffic properties to Collectors			
ACCESS CONDITION:			
Permitted to Public Lanes, Other Local Roads, and Collectors			
TRAFFIC FEATURES:			
Posted Speed	50km/h	**Parking**	No Restrictions
Traffic Flow	Interrupted	**Transit Service**	Avoided
TYPICAL CROSS-SECTION			
For Residential (Sidewalk One Side), Refer to Cross-section L-R1 **(Figure 7.9)** For Residential (Sidewalk Two Sides), Refer to Cross-section L-R2 **(Figure 7.10)** For Industrial, Refer to Cross-section L-I **(Figure 7.11)**			

1 Highway Geometric Design Guide – Urban Supplement (Draft)", Alberta Transportation, Nov. 2003, Table U.A.1.
2 Design Guidelines for Subdivision Servicing", City of Calgary, June 2001, Section II: ROADS.

Table 4: Typical Characteristics of Collectors and Service Roads

DAILY TRAFFIC VOLUME	NUMBER OF LANES	RIGHT-OF-WAY REQUIREMENTS	MINIMUM INTERSECTION SPACING
<8,000 vpd	4	22m-24m	60m
FUNCTION:			
To collect and distribute traffic between Local Streets and Arterials To provide property access			
ACCESS CONDITION:			
Permitted to Local Roads, Other Collectors, and Arterials			
TRAFFIC FEATURES:			
Posted Speed	50km/h	**Parking**	Permitted with Restrictions
Traffic Flow	Interrupted	**Transit Service**	Permitted
TYPICAL CROSS-SECTION			
For Industrial (No Parking), Refer to Cross-section C-I1 **(Figure 7.12)** For Industrial (Undivided with parking on both sides), Refer to Cross-section C-I2 **(Figure 7.13)** For Residential (Undivided with parking on both sides), Refer to Cross-section C-R1 **(Figure 7.14)** For Residential (Divided with no parking), Refer to Cross-section C-R2 **(Figure 7.15)** For Service Road, Refer to C-I1 **(Figure 7.12)**			

Table 5: Typical Characteristics of Minor Arterials

DAILY TRAFFIC VOLUME	NUMBER OF LANES	RIGHT-OF-WAY REQUIREMENTS	MINIMUM INTERSECTION SPACING
3,000-20,000 vpd	4	30m	200m
FUNCTION:			
To provide traffic movement is the major purpose. To provide limited property access			
ACCESS CONDITION:			
Permitted to Collector Roads, other Arterials, and Expressways			
TRAFFIC FEATURES:			
Posted Speed	70km/h	**Parking**	Peak Hour Restrictions
Traffic Flow	Uninterrupted	**Transit Service**	Permitted
TYPICAL CROSS-SECTION			
For Minor Arterial (Undivided with no parking), Refer to Cross-section A-Minor **(Figure 7.16)**			

Table 6: Typical Characteristics of 4 Lane Major Arterials

DAILY TRAFFIC VOLUME	NUMBER OF LANES	RIGHT-OF-WAY REQUIREMENTS	MINIMUM INTERSECTION SPACING
5,000-30,000 vpd	4	36m	400m
FUNCTION:			
To provide traffic movement			
ACCESS CONDITION:			
Permitted to Collector Roads, other Arterials, Expressways, Freeways			
TRAFFIC FEATURES:			
Posted Speed	80km/h	**Parking**	Prohibited
Traffic Flow	Uninterrupted	**Transit Service**	Permitted
TYPICAL CROSS-SECTION			
For Major Arterial (Divided with no parking), Refer to Cross-section A-Major **(Figure 7.17)**			

Table 7: Typical Characteristics of 6 Lane Major Arterials

DAILY TRAFFIC VOLUME	NUMBER OF LANES	RIGHT-OF-WAY REQUIREMENTS	MINIMUM INTERSECTION SPACING
5,000-30,000 vpd	6	43.2m	400m
FUNCTION:			
To provide traffic movement, primarily as a alternate bypass route around the downtown core			
ACCESS CONDITION:			
Permitted to Collector Roads, other Arterials, Expressways, Freeways			
TRAFFIC FEATURES:			
Posted Speed	80km/h	**Parking**	Prohibited
Traffic Flow	Uninterrupted	**Transit Service**	Permitted
TYPICAL CROSS-SECTION			
For Major Arterial (Divided with no parking), Refer to Cross-section A-Major 6 Lane **(Figure 7.18)**			

Table 8: Typical Characteristics of Expressways

DAILY TRAFFIC VOLUME	NUMBER OF LANES	RIGHT-OF-WAY REQUIREMENTS	MINIMUM INTERSECTION SPACING
>10,000 vpd	>4	>45m	800m
FUNCTION:			
To provide traffic movement			
ACCESS CONDITION:			
Permitted to Arterials, other Expressways, and Freeways			
TRAFFIC FEATURES:			
Posted Speed	100 km/h	**Parking**	Prohibited
Traffic Flow	Uninterrupted	**Transit Service**	Express Bus Only
TYPICAL CROSS-SECTION			
Subject to INFTRA and TAC Guidelines			

In order to accommodate the forecasted traffic volumes for the 2037 design year, as well as for future town growth, additional infrastructure is required.

The recommendations, shown in **Figure 7.19**, are as follows:

Highway 1 (Trans Canada Highway)

Highway 1 through the Town of Strathmore is an east-west expressway that will require upgrading from four to six lanes. Highway 1 through the province of Alberta is planned to eventually be freeway status. The current plan to achieve this is to bypass Strathmore, however, it is anticipated that the current roadway will remain as an expressway designation. Presently there are three sets of lights located on Highway 1 at Highway 817, Lakeside Boulevard and East Boundary Road. Future provisions for three additional sets of lights are forecasted for Wildflower Road, Westmount Road (to the south), and east of East Boundary Road. All other accesses to and from the expressway are recommended for closure.

Highway 817 (Wheatland Trail)

Highway 817 is currently the primary north-south route through the Town of Strathmore. The desire lines are concentrated on this corridor as it travels through the centre of town. This results in the roadway operating at overcapacity conditions due to geometric limitations such as the number of lanes and the distance between intersections. The ability to widen Highway 817 is restricted due to the presence of buildings. The proposed classification of Highway 817 as a Multilane matches the INFTRA ultimate plan[3], and is recommended to be a major arterial with the provision to widen to six lanes in the future where possible. This classification would eventually require limiting the number of access points primarily through the downtown (CBD) region.

East Boundary Road

East Boundary Road makes up the eastern portion of the proposed ring road around the Town of Strathmore. As such, UMA recommends this corridor be classified as a major arterial with the provision for six lanes from South Boundary Road to North Boundary Road.

[3] *"Highway Geometric Design Guide"*, Alberta Transportation, *October 2005*, Figure I-1.2i.

North Boundary Road

North Boundary Road makes up the northern portion of the proposed ring road around the Town of Strathmore. As such, the recommendation is to classify the corridor as a major arterial with the provision for six lanes between East Boundary Road and West Boundary Road.

South Boundary Road

South Boundary Road makes up the southern portion of the proposed ring road around the Town of Strathmore. As such, the recommended classification for this corridor is as a major arterial with the provision for six lanes from East Boundary Road to Highway 817.

West Boundary Road (Wildflower Road)

West Boundary Road makes up the western portion of the proposed ring road around the Town of Strathmore. As such, the recommendation is that the corridor is classified as a six-lane expressway from North Boundary Road to Highway 1, with a four lane major arterial designation north of North Boundary Road. Realignment of West Boundary Road to the west at the junction of Highway 1 is recommended to put the intersection/interchange on the top of the hill. This will provide for profile sight distances, as well as moving the junction area away from the existing canal.

North Service Road (Ridge Road)

The North Service Road is comprised of the existing West Ridge Road, Ridge Road, and East Ridge Road. It is recommended that it remain as a service road designation with a four lane divided section.

South Service Road (Canal Boulevard, Orchard Park Road)

The South Service Road is comprised of the existing Orchard Park Road and Canal Boulevard. It is recommended that it remain as a service road designation with a four lane divided section.

West Avenue

It is recommended that West Avenue be classified as a major arterial from Highway 817 to West Boundary Road, and a minor arterial west of West Boundary Road.

Brent Boulevard

The recommendation is that Brent Boulevard be designated as a minor arterial from Highway 817 to east of East Boundary Road, and a collector roadway west of the golf course.

East Lake Road

The existing portion of East Lake Road is recommended to remain as a collector road, with a new link between Thomas Drive and Highway 817 being designated as a minor arterial.

Park Lane Drive

The classification of Park Lane Drive is recommended to be a minor arterial from Lakeside Boulevard to the east.

Second Avenue

It is recommended that Second Avenue remain as a collector.

Thomas Drive

It is recommended that Thomas Drive remain as a collector.

Centre Street

The recommendation is that Centre Street remains as a collector from East Lake Road to Park Lane Drive, but be upgraded to a minor arterial from Park Lane Drive to the North Service Road.

Lakeside Boulevard

UMA recommends that Lakeside Boulevard remain as a collector except between the North Service Road and Highway 1 where it should be a major arterial. Ideally, Lakeside Boulevard should be upgraded to a minor arterial to allow traffic to bypass the downtown area; however, with the road already existing, significant changes would be required, and the town will still function reasonably well without the link being upgraded.

Strathford Boulevard

Strathford Boulevard should remain as a collector.

Hillview Boulevard

Hillview Boulevard should remain as a collector.

In order to pull the primary desire line away from the downtown core, more specifically the intersection of Highway 1 and Highway 817, a ring road is recommended, comprised of East Boundary Road, North Boundary Road, West Boundary Road, and South Boundary Road. In order to attract trips to the ring road in the future, easy connectivity to and from Highway 1 is important. As such, there is a potential requirement for two interchanges to be incorporated, one at Highway 1 and West Boundary Road, and another at Highway 1 and East Boundary Road. This high-level study did not consider what the configuration or footprint of these interchanges would be. Realignment of East Boundary Road may be required. Further study is required to address additional details.

A future link outside the study area and connecting South Boundary Road and West Boundary Road is recommended. Regardless of the link's future designation as an expressway or major arterial, provisions should be made for six lanes, as this link is part of the ring road.

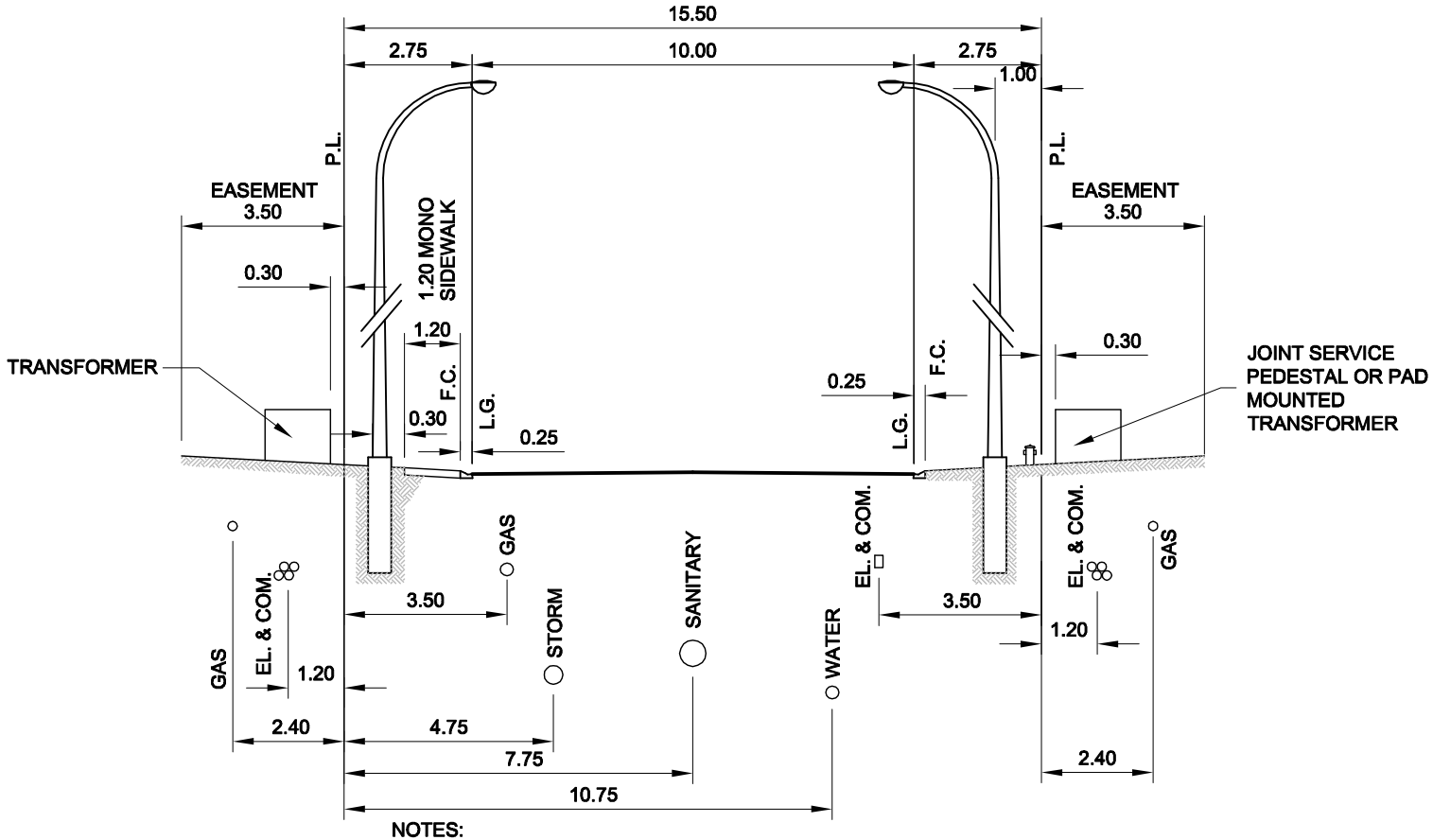
The extension of Brent Boulevard west through the existing golf course is desirable, but this link would cut through the middle of the golf course. Consideration should be given to develop this link in the future if the possibility arises.

A number of potential locations for signalization were identified. **Figure 7.19** shows the possible locations for signals. It is important to note that this study considered only potential signal locations; actual signal warrants must be based on field-collected traffic and pedestrian volumes that were not carried out as part of this study.

The capital costs for the recommended options are summarized in *Table 9*.

Table 9: Total Infrastructure Capital Cost

Description	Cost Estimate (in 2007 $)
Roadways	$ 104,091,000
Bridges and Structures	$ 7,407,400
Signal Lights	$ 9,350,000
Total	**$ 120,848,400**



NOTES:

-CARRIAGE WAY IS TO BE CROWNED
-CURB REQUIRED ON BOTH SIDES
-HYDRANT ON 0.75 M LINE
-HYDRANT VALVES ON 1 M FROM MAIN
-SERVICE VALVES ON 0.50 M LINE
-SHALLOW UTILITES TO BE IN EASEMENT IF WATER & SEWER SERVICES ARE IN STREET ROW
-ALL SURFACE STRUCTURES TO BE A MIN. OF 3.0 M FROM HYDRANTS.

Town of Strathmore
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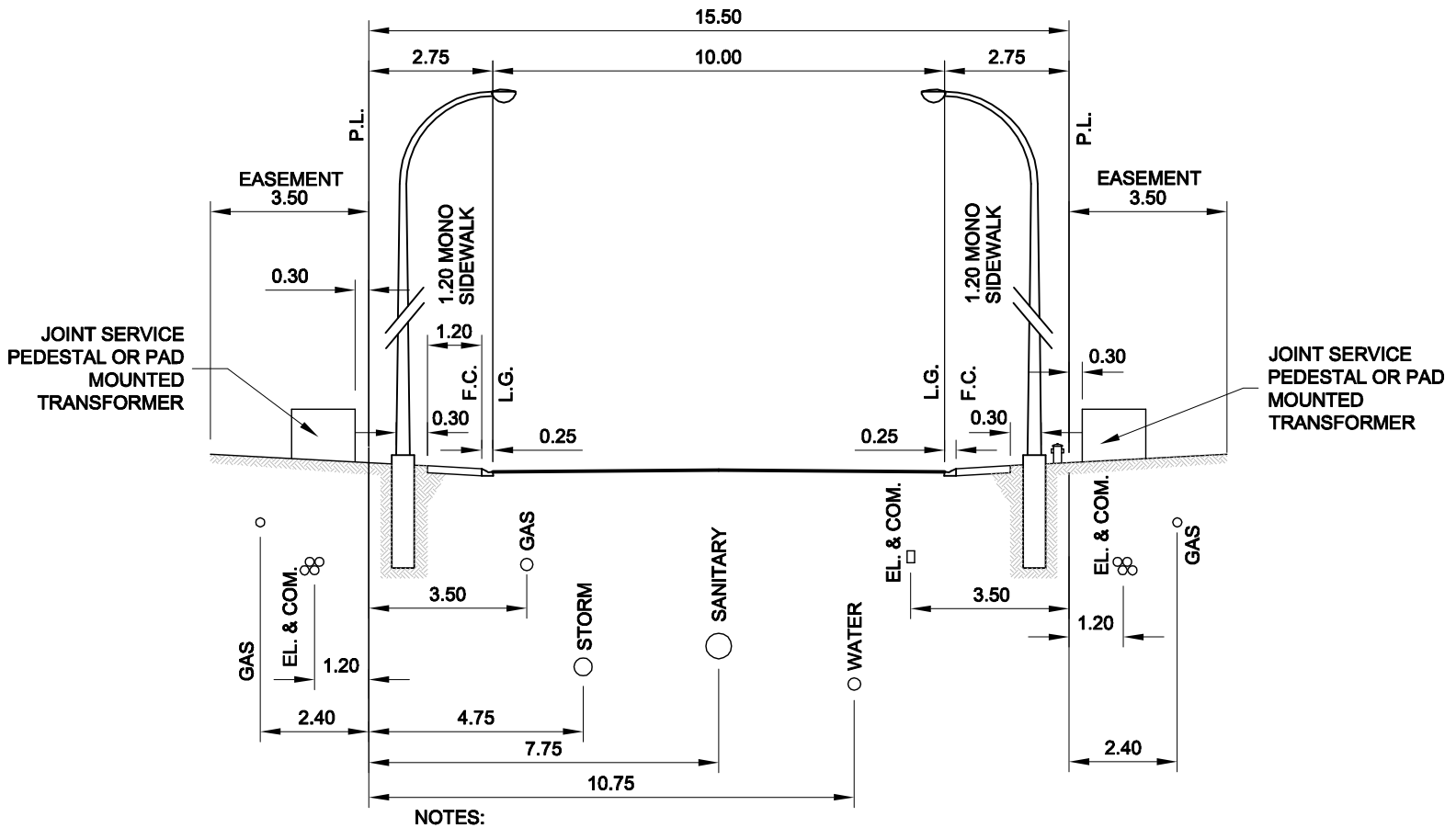
Residential Local Sidewalk One Side

L-R1

Figure - 7.9

UMA | AECOM



NOTES:

-CARRIAGE WAY IS TO BE CROWNED
-CURB REQUIRED ON BOTH SIDES
-HYDRANT ON 0.75 M LINE
-HYDRANT VALVES ON 1 M FROM MAIN
-SERVICE VALVES ON 0.50 M LINE
-SHALLOW UTILITES TO BE IN EASEMENT IF WATER & SEWER SERVICE ARE IN STREET ROW
-ALL SURFACE STRUCTURES TO BE A MIN. OF 3.0 M FROM HYDRANTS.

Town of Strathmore
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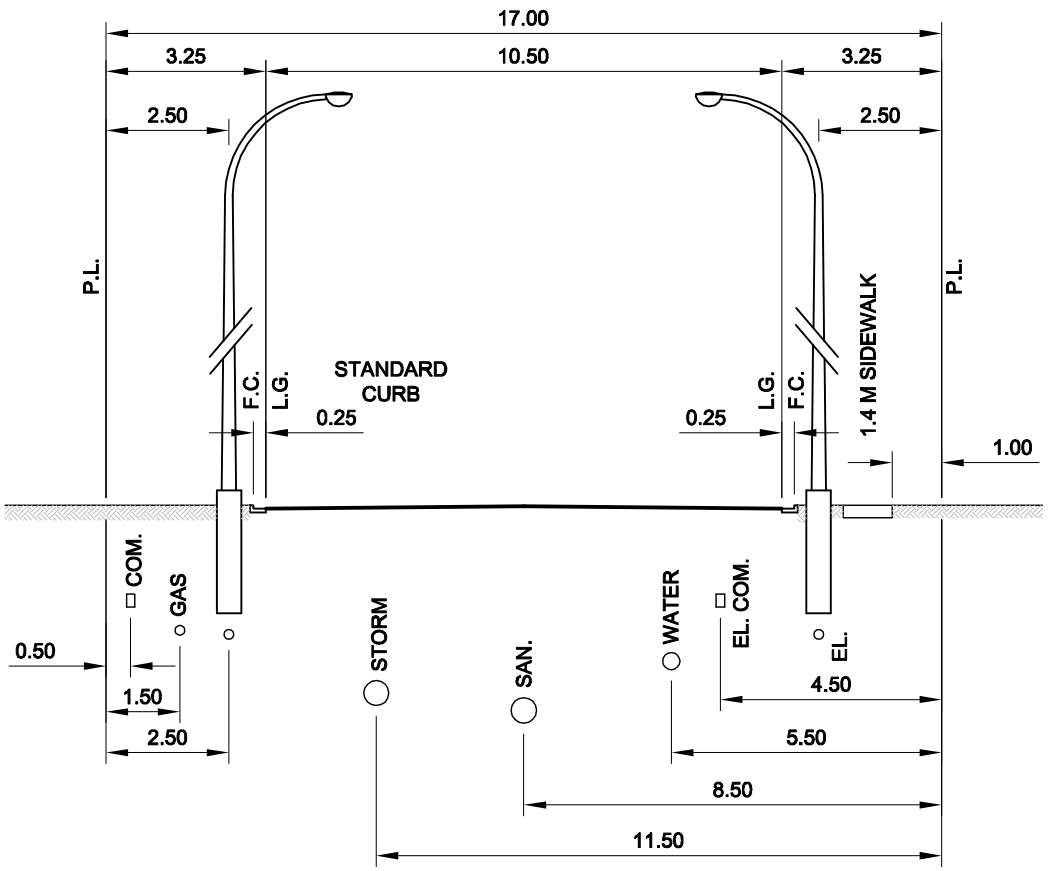
Annexation 2006

Residential Local Sidewalk Two Sides

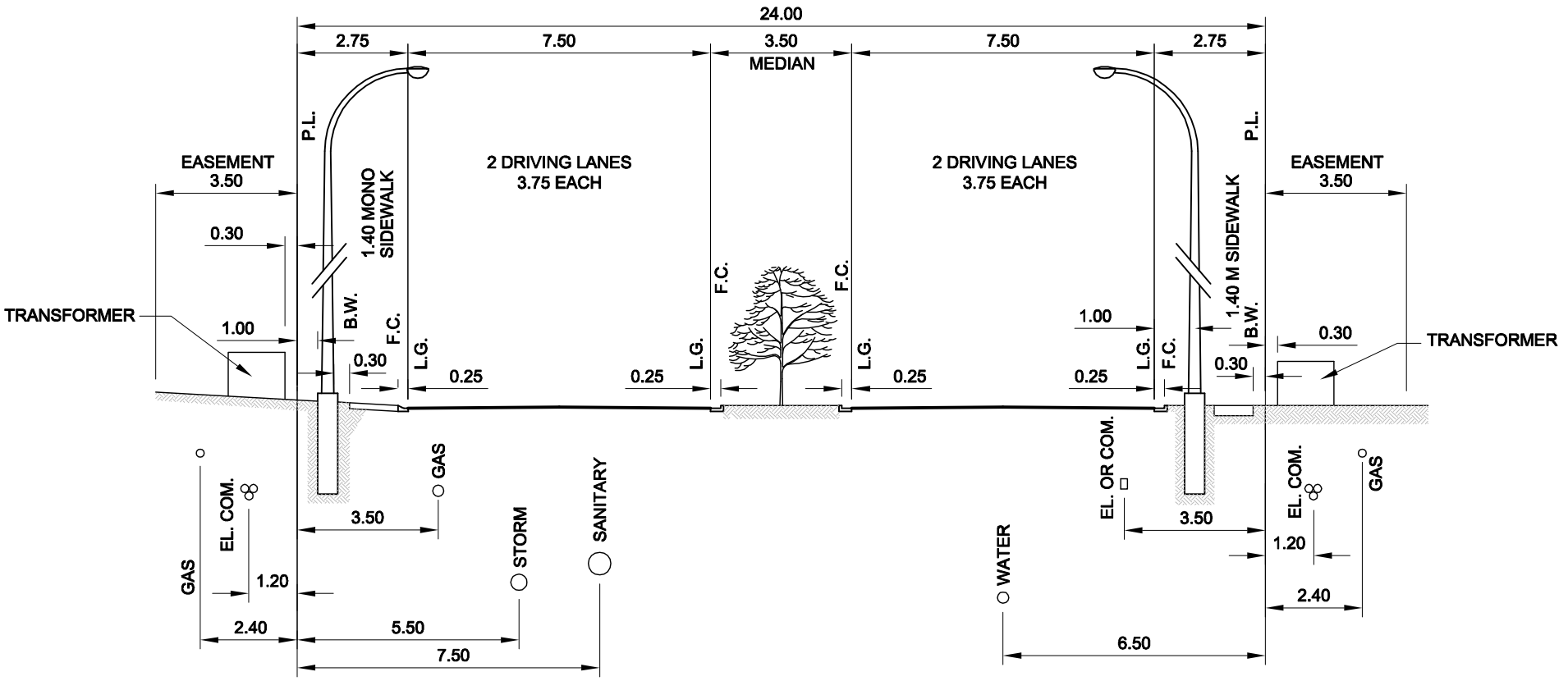
L-R2

Figure - 7.10



NOTES:
HYDRANT ON 2.50 LINE
HYDRANT VALVES 1.00 M FROM MAIN.
SERVICE VALVE IS ON 2.50 LINE
SERVICE VALVE IS ON 2.00 LINE WITH LIGHT STANDARD
ALL SURFACE FIXTURES TO MAINTAIN A 3.0 M CLEARANCE FROM HYDRANTS
1.2 M MONO SIDEWALK IS OPTIONAL

Town of Strathmore
Master Servicing Study
Annexation 2006
Industrial Local
L-1
Figure - 7.11



NOTES:

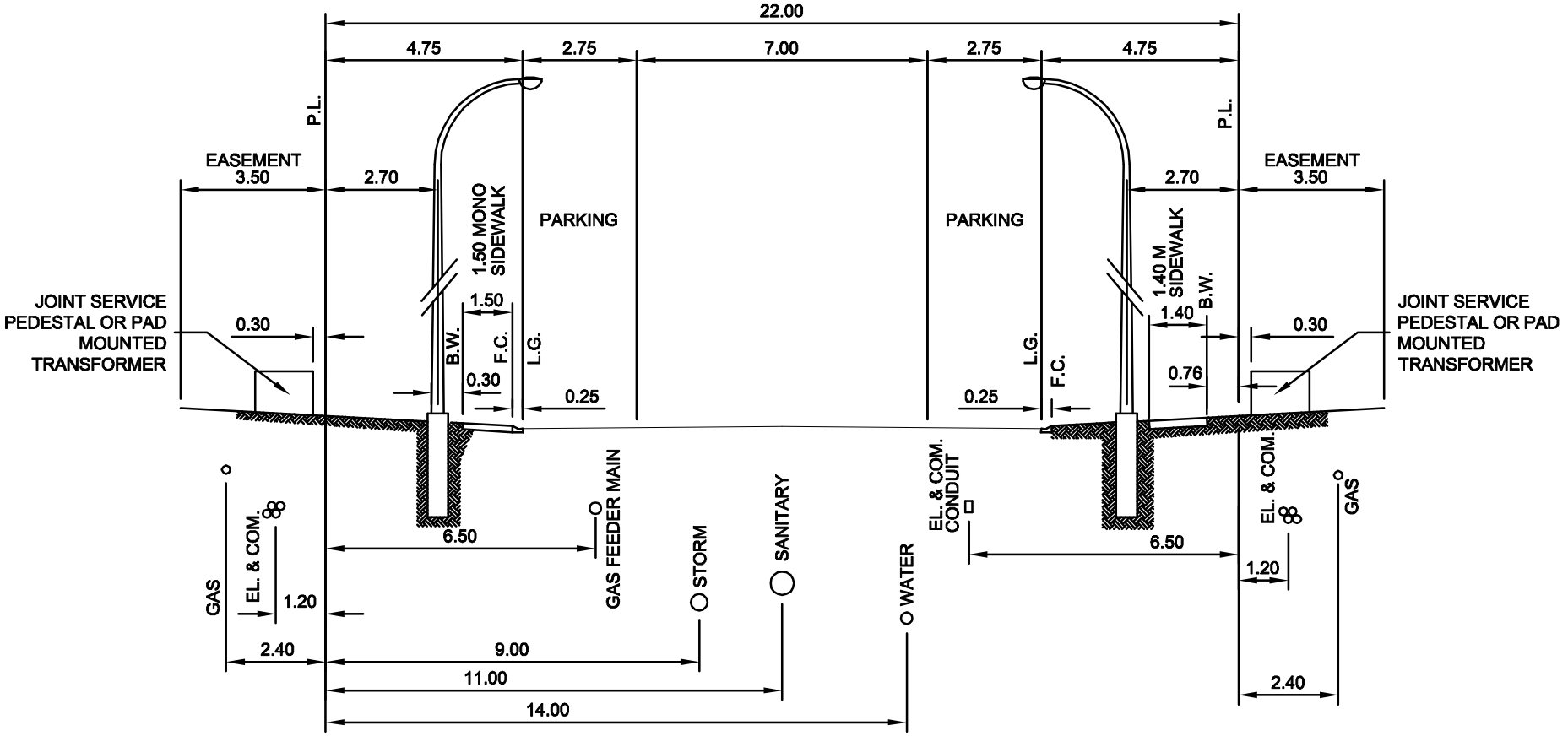
-CARRIAGE WAY IS TO BE CROWNED
-CURB REQUIRED ON BOTH SIDES
-HYDRANT ON 0.75 M LINE
-HYDRANT VALVES ON 1 M FROM MAIN
-1.2 M MONO SIDEWALK IS OPTIONAL
-SERVICE VALVES ON 0.50 M LINE
-SHALLOW UTILITES TO BE IN EASEMENT IF WATER & SEWER SERVICES ARE IN STREET ROW
-ALL SURFACE STRUCTURES TO BE A MIN. OF 3.0 M FROM HYDRANTS.

Town of Strathmore
Master Servicing Study
Annexation 2006

Industrial Primary Collector No Parking

C-I1

Figure - 7.12



NOTES:

-CARRIAGE WAY IS TO BE CROWNED
-CURB REQUIRED ON BOTH SIDES
-HYDRANT ON 0.75 M LINE
-HYDRANT VALVES ON 1 M FROM MAIN
-1.2 M MONO SIDEWALK IS OPTIONAL
-SIDEWALK ONE SIDE
-SERVICE VALVES ON 0.50 M LINE
-SHALLOW UTILITES TO BE IN EASEMENT IF WATER & SEWER SERVICES ARE IN STREET ROW
-ALL SURFACE STRUCTURES TO BE A MIN. OF 3.0 M FROM HYDRANTS.

Town of Strathmore
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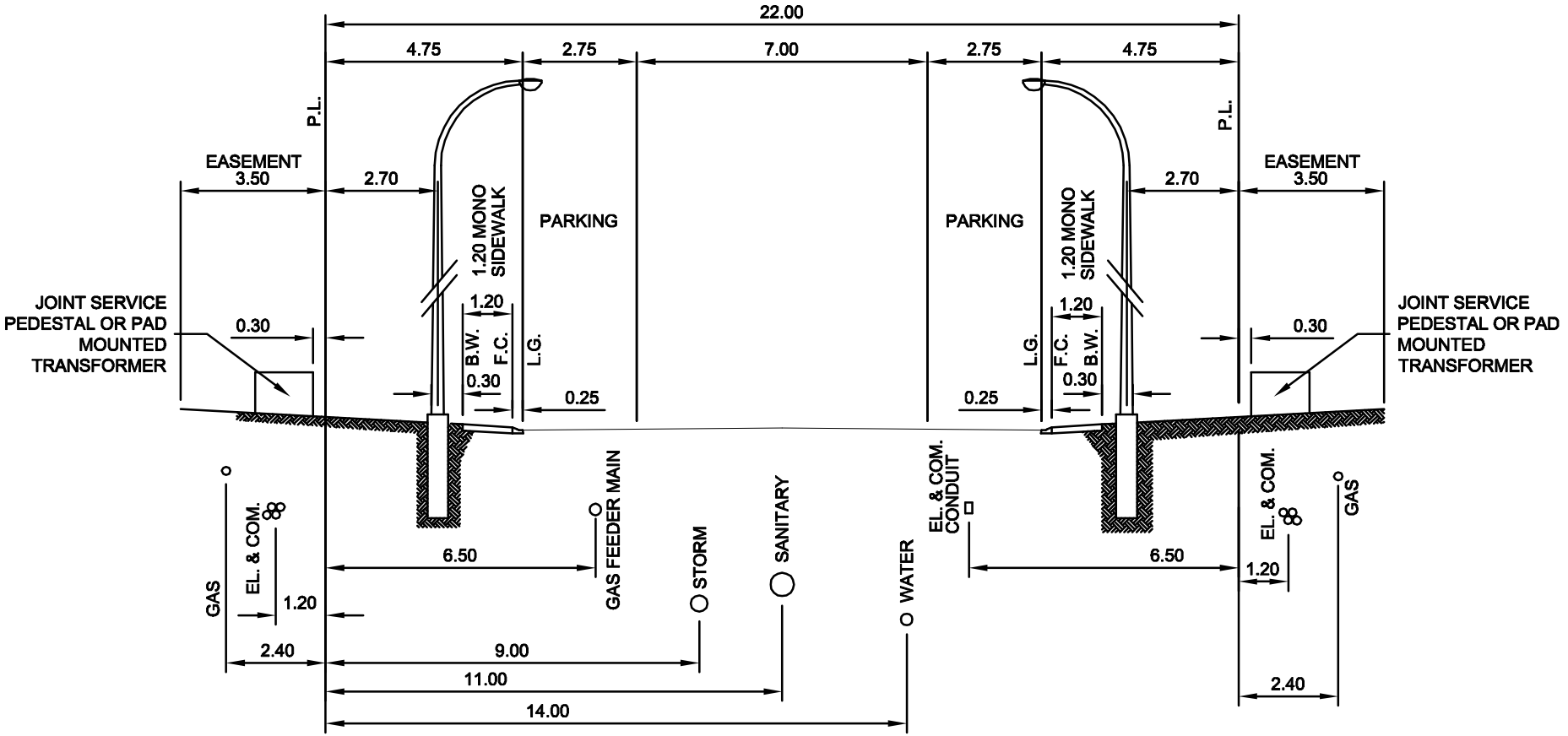
Annexation 2006

Industrial Collector Undivided

C-I2

Figure - 7.13



NOTES:

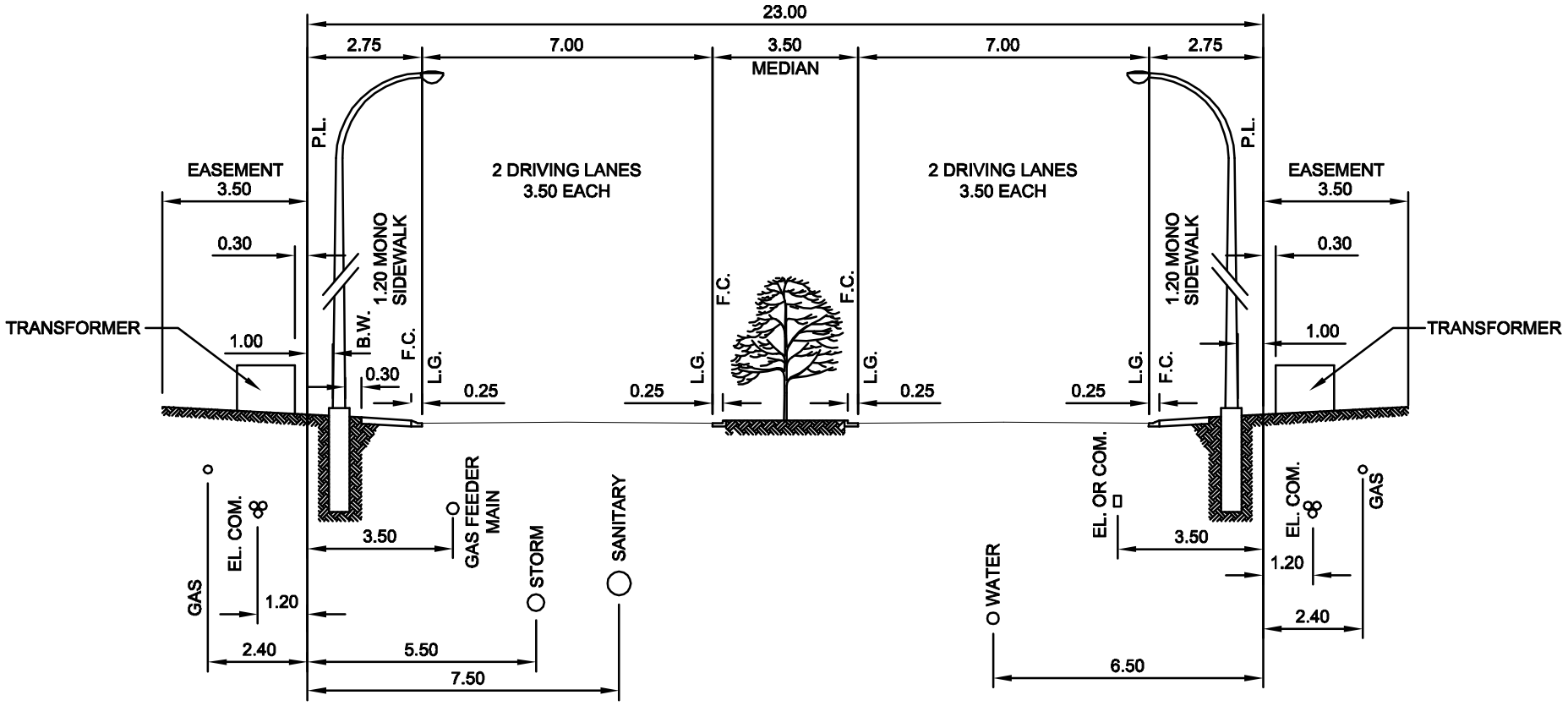
-CARRIAGE WAY IS TO BE CROWNED
-CURB REQUIRED ON BOTH SIDES
-HYDRANT ON 0.75 M LINE
-HYDRANT VALVES ON 1 M FROM MAIN
-SERVICE VALVES ON 0.50 M LINE
-SHALLOW UTILITES TO BE IN EASEMENT IF WATER & SEWER SERVICES ARE IN STREET ROW
-ALL SURFACE STRUCTURES TO BE A MIN. OF 3.0 M FROM HYDRANTS.

Town of Strathmore
Master Servicing Study
Annexation 2006

Residential Collector Undivided

C-R1

Figure - 7.14



NOTES:

-CARRIAGE WAY IS TO BE CROWNED
-CURB REQUIRED ON BOTH SIDES
-HYDRANT ON 0.75 M LINE
-HYDRANT VALVES ON 1 M FROM MAIN
-SERVICE VALVES ON 0.50 M LINE
-SHALLOW UTILITES TO BE IN EASEMENT IF WATER & SEWER SERVICES ARE IN STREET ROW
-ALL SURFACE STRUCTURES TO BE A MIN. OF 3.0 M FROM HYDRANTS.

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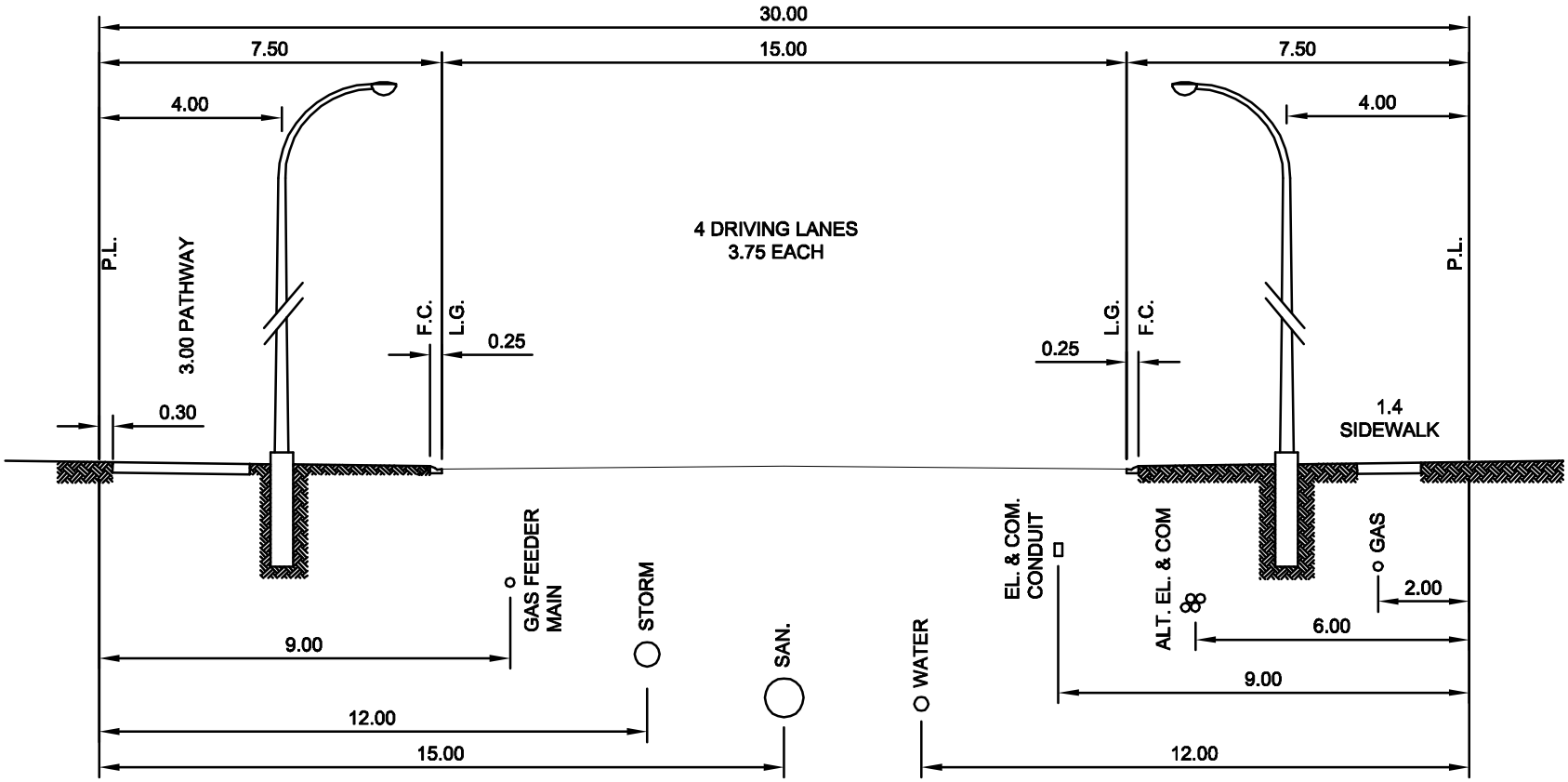
Master Servicing Study
Annexation 2006

Residential Primary Collector No Parking

C-R2

Figure - 7.15

UMA | AECOM



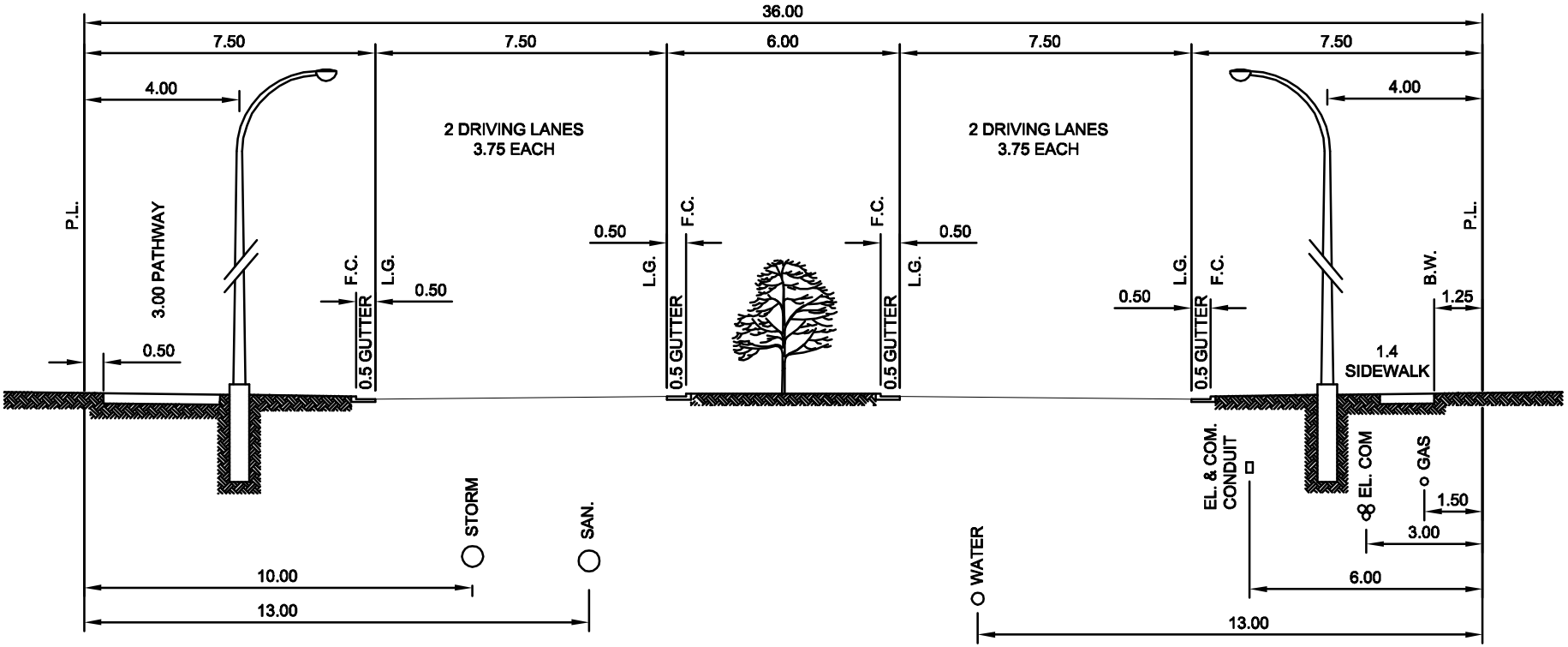
NOTES:

-CARRIAGE WAY IS TO BE CROWNED
-CURB REQUIRED ON BOTH SIDES
-HYDRANT ON 0.75 M LINE
-HYDRANT VALVES ON 1 M FROM MAIN
-SERVICE VALVES ON 0.50 M LINE
-SHALLOW UTILITES TO BE IN EASEMENT IF WATER & SEWER SERVICES ARE IN STREET ROW
-ALL SURFACE STRUCTURES TO BE A MIN. OF 3.0 M FROM HYDRANTS.

Town of Strathmore
Master Servicing Study
Annexation 2006

Arterial Undivided No Parking
A-MINOR
Figure - 7.16

UMA | AECOM

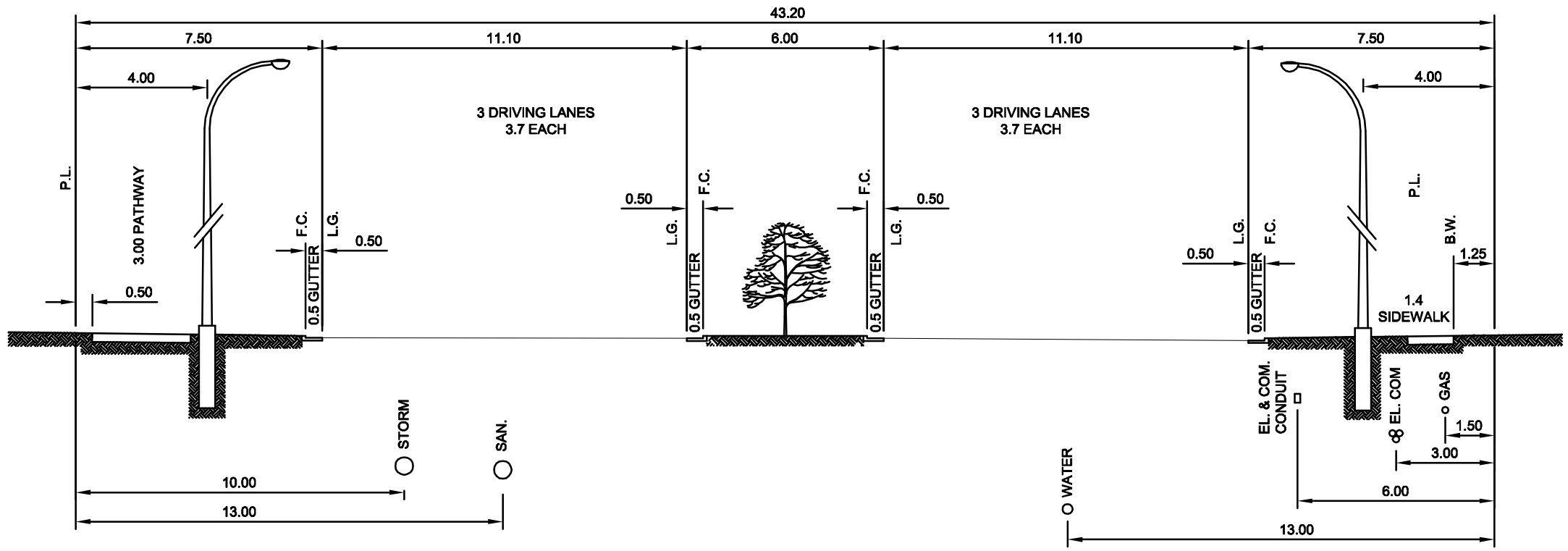


NOTES:

-CARRIAGE WAY IS TO BE CROWNED
-HYDRANTS ON 4.50 LINE
-SERVICE VALVES ON 4.00 LINE
-HYDRANT VALVES 1 M FROM MAIN
-SURFACE VALVES ON 0.50 M LINE
-SHALLOW UTILITES TO BE IN EASEMENT IF WATER & SEWER SERVICES ARE IN STREET ROW
-SURFACE FEATURES TO MAINTAIN A 3.00 CLEARACE FROM HYDRANTS

Town of Strathmore
Master Servicing Study
Annexation 2006

Arterial Divided No Parking
A-MAJOR 4 LANE
Figure - 7.17



NOTES:

-CARRIAGE WAY IS TO BE CROWNED
-HYDRANTS ON 4.50 LINE
-SERVICE VALVES ON 4.00 LINE
-HYDRANT VALVES 1 M FROM MAIN
-SURFACE VALVES ON 0.50 M LINE
-SHALLOW UTILITES TO BE IN EASEMENT IF WATER & SEWER SERVICES ARE IN STREET ROW
-SURFACE FEATURES TO MAINTAIN A 3.00 CLEARACE FROM HYDRANTS

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Town of Strathmore
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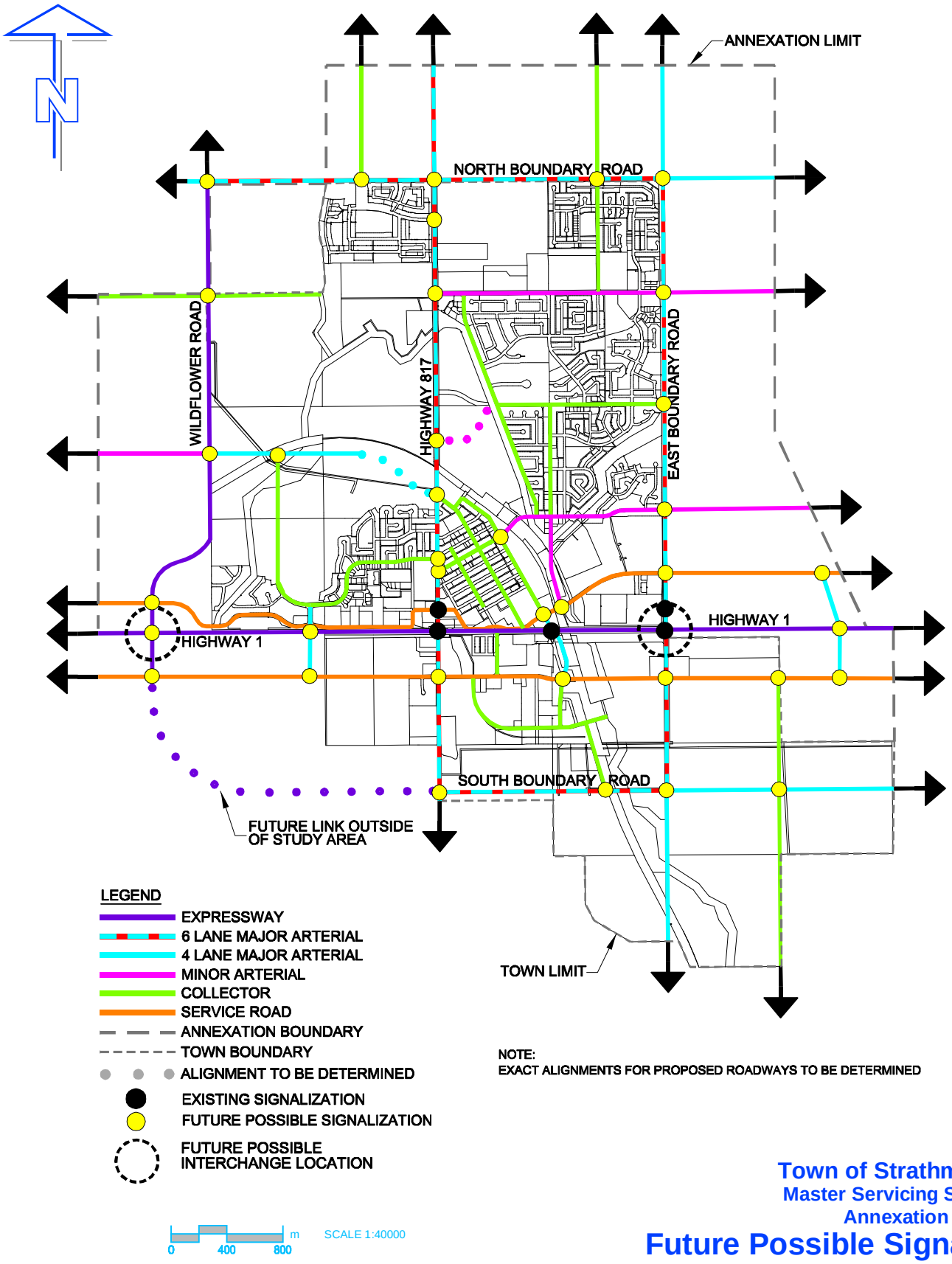
Annexation 2006

Arterial Divided No Parking
A-MAJOR 6 LANE
Figure - 7.18



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Town of Strathmore
Master Servicing Study
Annexation 2006

Future Possible Signals

UMA | AECOM

Figure - 7.19

1.0 Introduction

In 1999, an infrastructure study was completed that assessed the capacity for development within the Town's boundaries. Since that time, the Town has grown considerably and recent indications are that the Town's growth will continue at a rate higher than anticipated in the 1999 report. As a result, the Town commissioned this annexation study to explore the possibility of servicing the proposed annexation lands to the north, west, and east of the Town's boundaries north of Highway 1 and a reassessment of the existing infrastructure based on current and anticipated development.

The purpose of this study was to provide a master servicing plan update for annexation lands on the north, west, and east of the Town's boundaries north of Highway 1, and propose upgrades to the existing infrastructure based on the Town's current and anticipated development. This plan has identified major servicing for the land in terms of the following systems:

- Water Supply and Distribution System
- Sanitary Sewerage System
- Stormwater Management – Master Drainage Plan
- Roadway Network
- Fire Underwriter Study

This report presents the findings from the analysis of the above systems and the capital costs required for their implementation.

2.0 Study Area

The Town is located approximately 40 km east of the City of Calgary limits along Highway 1, the TransCanada Highway (TCH). The topography of the Town is generally flat with a maximum elevation difference of 27 m generally draining from north to southeast. The TCH bisects the Town from east to west and the main irrigation canal owned and maintained by the Western Irrigation District (WID) flows through the Town.

The study area includes area the area within existing Town boundaries and approximately 14-quarter sections (896 hectares) of annexation lands as shown in **Figure 2.1**.

A SIZE 8.5" x 11" (215.9mm x 279.4mm)

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Town of Strathmore
Master Servicing Study
Annexation 2006

Service Area

UMA | AECOM

Figure - 2.1

3.0 Population Analysis and Projections

3.1 Population Projections

Table 3.1 shows the population statistics for the Town for the last 36 years.

Table 3.1: Population of the Town from 1966 to 2004

Year	Population	% Growth
1966	1,016	-
1971	1,150	2.70%
1976	1,560	0.80%
1981	2,990	9.20%
1986	3,540	0.40%
1990	3,746	5%
1991	4,185	10%
1992	4,408	5%
1993	4,603	4%
1994	4,880	6%
1995	5,088	4%
1996	5,273	4%
1997	5,471	4%
1998	6,045	9%
1999	6,794	11%
2000	7,165	5%
2001	7,455	4%
2002	8,022	7%
2003	8,640	7%
2004	9,115	5%
2005	9,662	6%

The Town agreed to use an annual growth rate of 6% for projecting the future population. Consideration was given to the growth rates used in the following reports in coming up with this annual growth rate:

- UMA Bow Tertiary Outfall Pre-design Report, April 2005
- UMA Pipeline feasibility Study, November 2004
- Morasch Transportation Consultants Transportation Master Plan, March 2002
- EPCOR Water Treatment Plant Assessment Report, March 2004
- Urban Systems 1999 Infrastructure Analysis, February 2000.

Based on this growth rate, *Table 3.2* shows the annual population growth numbers to the year 2037.

Table 3.2: The Town's Population Projected from 2005 to 2037

Year	Total Population	Cumulative Population Growth	Population per growth period
2005	*9,662*	-	-
2006	10,242	580	
2007	10,856	1,194	
2008	11,507	1,846	
2009	12,198	2,536	
2010	12,930	3,268	
2011	13,706	4,044	**4,044 (0 to 5 years)**
2012	14,528	4,866	
2013	15,400	5,738	
2014	16,324	6,662	
2015	17,303	7,641	
2016	18,341	8,679	
2017	19,442	9,780	
2018	20,608	10,946	
2019	21,845	12,183	
2020	23,155	13,493	
2021	24,545	14,883	**10,839 (5 to 15 years)**
2022	26,017	16,355	
2023	27,578	17,916	
2024	29,233	19,571	
2025	30,987	21,325	
2026	32,846	23,184	
2027	34,817	25,155	
2028	36,906	27,244	
2029	39,120	29,459	
2030	41,468	31,806	
2031	43,956	34,294	**19,411 (15 to 25 years)**
2032	46,593	36,931	
2033	49,389	39,727	
2034	52,352	42,690	
2035	55,493	45,831	
2036	58,823	49,161	
2037	62,352	**52,690**	**18,396 (25 to 31 years)**

**** 2006 Population estimated using 2005 population***

3.2 Population Density

For the purposes of this study, the population density report of the current off-site levies calculation was used to determine the residential and industrial/commercial zone densities. The population density was based on 42 persons per gross hectare (17 persons/acre) for residential areas and 35 persons per gross hectare (14 persons/acre) for commercial/industrial zones.

As no planning documents were available for the annexation lands, the Town requested that we assume all annexation lands are residential urban reserve, excluding the area between the frontage road and the

TUC and an additional 15 percent of gross area for commercial/industrial zoning. For the purposes of this study, the current and future assumed land use is shown in **Figure 3.1**.

3.3 Development Cells

Approximately 14-quarter sections outside the Town's boundaries are to be included as future development cells to be serviced by the Town's systems. **Figure 3.2** shows the proposed development cells and estimated periods for development of these cells. The time frames have been divided into the following four phases:

- 0 to 5 years
- 5 to 15 years
- 15 to 25 years
- 25 to 31 years.

It is interesting to note that all development in the 0-5 year range can be handled on lands currently within the existing Town boundary.

The areas shown on **Figure 3.2** were reviewed from a development standpoint based on discussions with the Town's planning department. *Table 3.3* shows the projected population per development phase.

Table 3.3: Projected Population per Development Phase

Development Phase	Population
0 to 5 years	4,044
5 to 15 years	10,839
15 to 25 years	19,411
25 to 31 years	18,396
Total	**52,690**

Table 3.5 shows the areas of each phase to be annexed and the percentages of the commercial and residential split.

Table 3.4: Area of Development Cells

Development Phase	Residential Area	Commercial Area	Residential Area (ha)	Commercial Area (ha)	Total Area (ha)
0 to 5 years *	50%	50%	60	60	120
5 to 15 years	65%	35%	181	97	278
15 to 25 years	80%	20%	384	96	480
25 to 31 years	80%	20%	363	91	454
Total					**1,332**

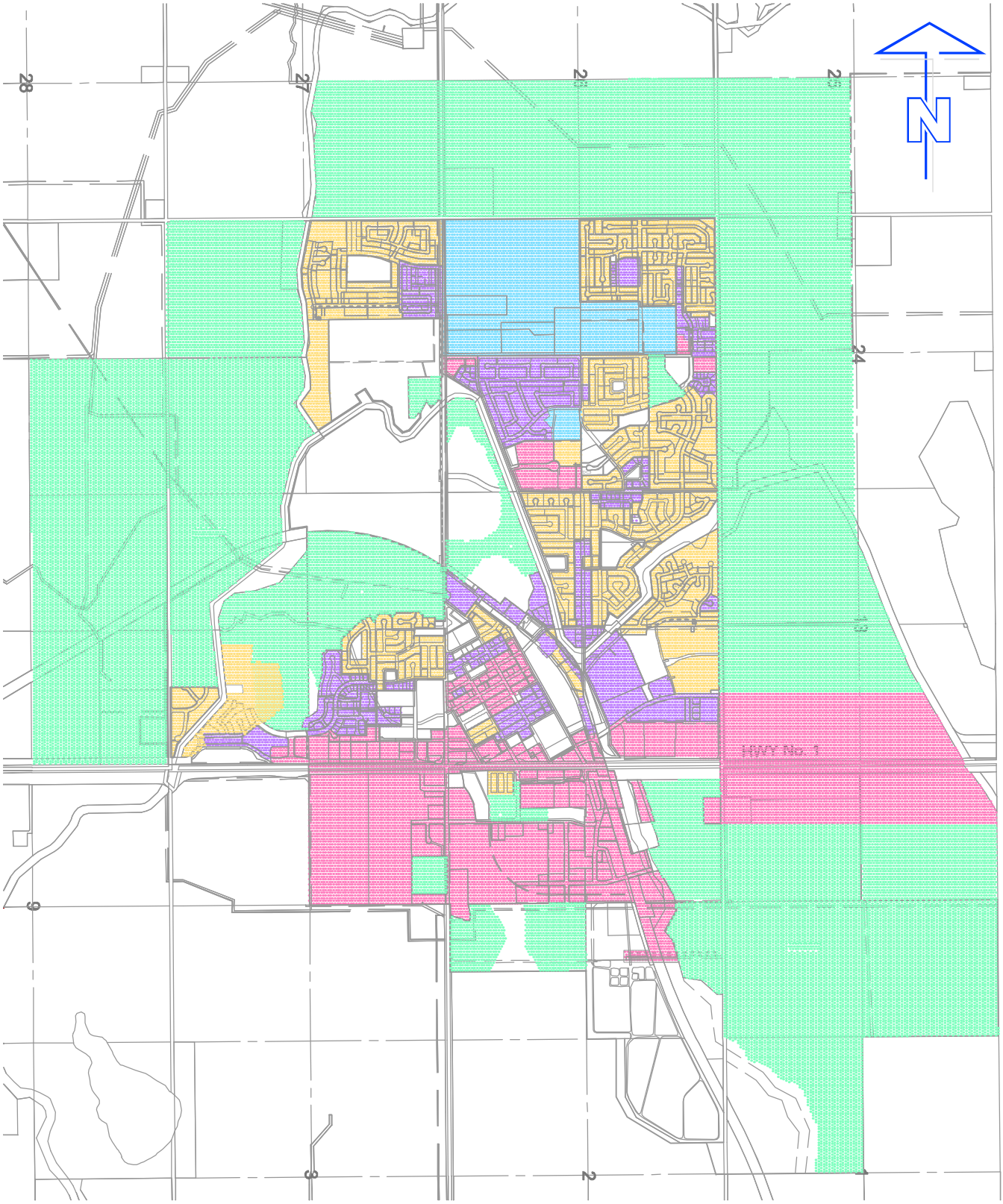
Table 3.5 shows the population carrying capacity of the development cells based on the area multiplied by the residential and commercial population densities.

Table 3.5: Population Carrying Capacity of Development Cells

Development Phase	Residential Population	Commercial Population	Total Population
0 to 5 years *	2,505	2,088	4,593
5 to 15 years	7,601	3,411	11,012
15 to 25 years	16,137	3,362	19,499
25 to 31 years	15,254	3,178	18,431
Total	**41,497**	**12,038**	**53,535**

* ***No annexation required because the area is within the Town boundary.***

From *Table 3.3*, the projected population is 52,690 and from *Table 3.5*, the population carrying capacity of the annexed areas is 53,535. Since the population carrying capacity of the annexed areas is greater than the projected population by 845, the annexed areas utilising an annual growth rate of 6 percent can carry the projected population of the Town of Strathmore until 2037.



A SIZE 8.5" x 11" (215.9mm x 279.4mm)
PLOT: 06/11/29 2:52:18 PM
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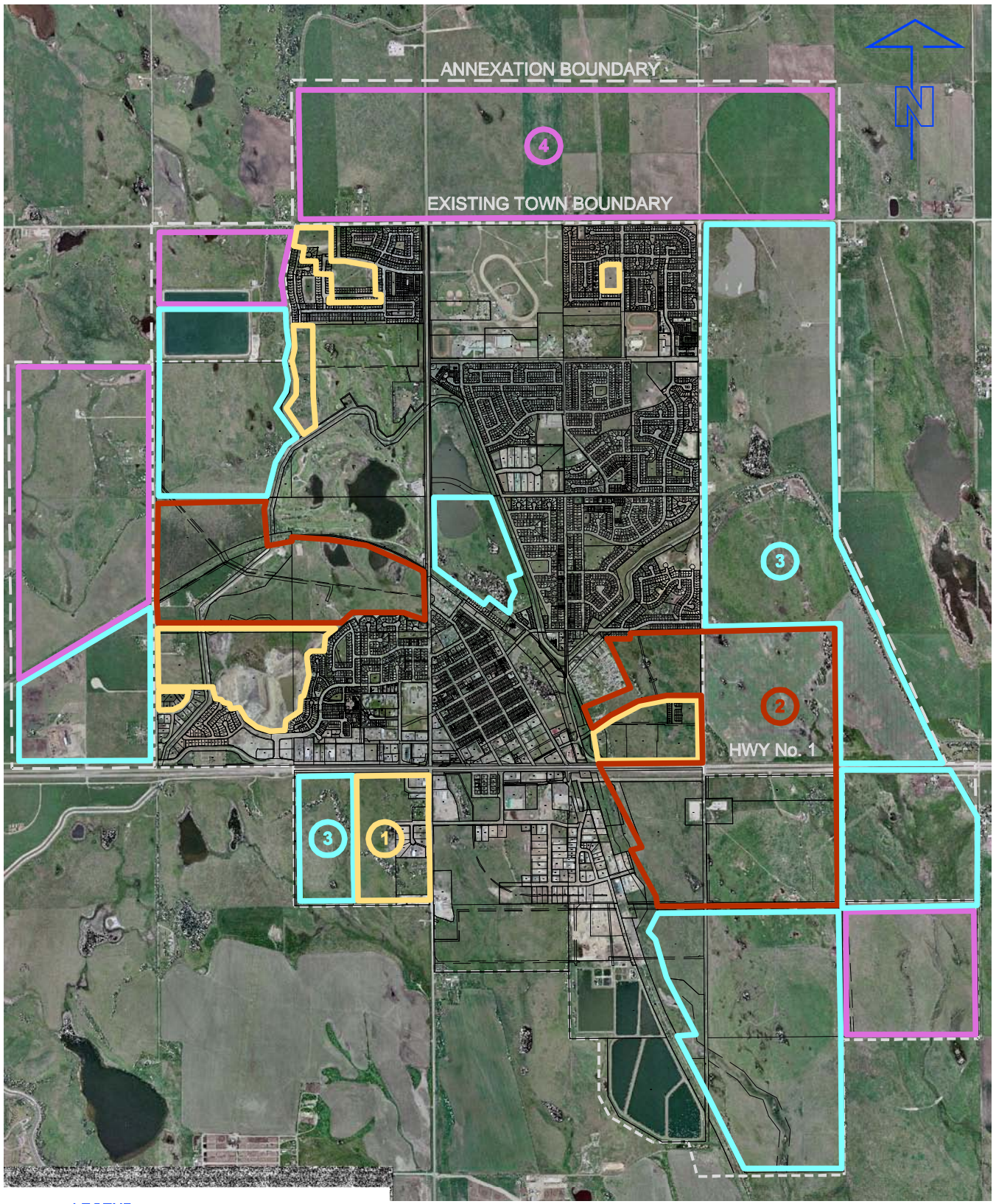
0105-076-00_01-C-F016_RX.dwg
ISS/REV: A
UMA FILE NAME:

UMA | AECOM

Town of Strathmore
Master Servicing Study
Annexation 2006
Land Use

Figure - 3.1



LEGEND

1 0 TO 5 YEARS

2 5 TO 15 YEARS

3 15 TO 25 YEARS

4 25 TO 31 YEARS

Town of Strathmore
Master Servicing Study
Annexation 2006

UMA | AECOM

Figure - 3.2

4.0 Water Supply and Distribution

4.1 Introduction

To enable the evaluation of the existing and proposed water supply and distribution requirements, the design criteria was developed after reviewing the following design reports and municipal documents:

- EPCOR Water Plant Assessment Strathmore Water Treatment Plant, March 2004
- EPCOR Town of Strathmore's 2001 Water Loss Audit, December 2002
- EPCOR Town of Strathmore's Distribution System Assessment and Five Year Capital Plan Final Report, December 2002 and data from the wastewater treatment plant
- Urban Systems 1999 Infrastructure Analysis, February 2000.

Water demand records from Urban Systems and EPCOR were reviewed to determine the per capita water demand.

4.2 Historical Water Usage and Design Criteria

Water demand records were based on EPCOR's annual reports and *Table 4.1* summarizes the past water demands.

Table 4.1: Past Water Demands

Year	Pop'n	Annual Demand m^3	Avg. annual per capita per day consumption L/c/d	Average Daily Demand m^3	Average Monthly Demand m^3	Peak Monthly Demand m^3	Peak Day Demand m^3	Peak Month Factor	Peak Day Factor
2002	8,022	1,213,847	415	3,326	101,154	176,981	7,487	1.75	2.25
2003	8,640	1,277,556	405	3,500	106,463	156,358	6,851	1.47	1.96
2004	9,115	1,320,417	397	3,618	110,035	146,908	6,655	1.34	1.84
2005	9,622	1,305,704	372	3,577	108,809	142,935	6,895	1.31	1.93
Average				**3,505**	**106,615**	**155,796**	**6,972**	**1.46**	**1.99**

The decline of the average per capita per day consumption over the past four years was more likely due to the past two years being above average wet years and, therefore, the peak demand during the summer months (lawn watering) was not as high as during an average wet year. Therefore, UMA used an average per capita consumption of 415 L/c/d (Year 2002) for projecting water demands for the annexation study. It should be noted that this consumption of 415 L/c/d includes residential and commercial/industrial demands.

Table 4.2 shows present and projected water demands for the Town of Strathmore for the 30 year design period, including average day demands, peak day demands, peak hour demands, and treated water storage requirements based on the current Alberta Environment Design Guidelines and a required fire flow of 200 L/s for 3 hours. Peaking factors of 2.0 and 4.0 were used to establish the peak day and peak hour demands respectively.

Table 4.2: Present and Projected Water Demands (m^3/day)

Year	Population	Average per capita per day consumption L/c/d	Average day demand L/s	Peak day demand PDF 2.0 L/s	Peak hour demand PHF 4.0 L/s	Treated Water Storage Requirement[1] m^3
2005	9,662	415	46	93	186	4,766
2006	10,424	415	50	99	199	4,923
2010	12,930	415	62	124	248	10,209
2015	17,303	415	83	166	332	12,931
2020	23,155	415	111	222	445	16,574
2025	30,987	415	149	298	595	21,450
2030	41,468	415	199	398	797	27,974
2035	55,493	415	267	533	1,066	36,704
2037	62,351	415	299	599	1,198	40,974

[1] Treated water storage requirements have been assumed to be 1.5 x average day + minimum fire flow when the Town goes to the regional supply system.

4.3 Existing Raw Water Storage and Transmission System

The Town has a water licence to withdraw 2.46M m^3/ yr (2,000 acre-feet/year) from the Bow River. The Town's raw water supply is transported to the 1,000,000 m^3 single cell raw water reservoir from the Bow River via the WID canal and is shown in **Figure 4.1**. Raw water is supplied when the WID canal is in operation, which is usually between May and September, and enough raw water is expected to be stored in the reservoir to last through the winter months when the WID canal is not in operation.

4.4 Existing Water Supply System

Raw water is pumped from the raw water reservoir to the treatment plant by low lift pumps. *Table 4.3* shows the output capacity of the water treatment plant components.

Table 4.3: Water Treatment Plant Data

Component	Production Capacity
Clarifiers	81 L/s
Dual Media Filters	95 L/s

Information from *Table 4.3* shows that the water treatment plant is under capacity because the clarifiers and filters cannot supply the required calculated peak day demand of 99 L/s for a population of 10,336 for 2006 as shown on *Table 4.2*. Based on this information, an immediate upgrade of the clarifiers and filters is required. No additional review was conducted, as EPCOR the Town and UMA have addressed this issue.

Treated water is pumped from the treatment plant to the Brentwood Reservoir through a 300 mm dia transmission main. A 99 Hp booster pump was installed at the rodeo grounds to increase the flow capacity of the transmission main from 67 L/s to 81 L/s. The Westmount Reservoir is fed from the distribution system through a bypass comprising of a pressure-reducing valve that allows water from the Westlake Road pressure zone to fill the reservoir.

Table 4.4 shows the current treated water storage capacity available to the Town. This information, combined with the information provided in *Table 4.2*, determines that an upgrade to increase the present treated water storage capacity will be required in 2010 when the population is predicted to reach 17,900.

Table 4.4: Present Treated Water Storage Capacity

Reservoir	Storage Capacity m^3
Brentwood Reservoir (usable storage)	6,000
Westmount Reservoir	2,270
Total Present Treated Water Storage	8,270

4.5 Existing Water Distribution System

Figure 4.2 shows the existing Town's distribution system consisting of two pump stations that house both distribution and fire pumps and a pipe network comprising distribution pipes ranging in dia from 50 mm to 300 mm, pressure-reducing valves, and isolation valves.

Table 4.5 shows the available flow from the existing distribution and fire pumps. Comparing the information from *Table 4.5* with peak hourly demand in *Table 4.2*, the pumping capacity numbers show that an upgrade to increase the peak hourly pumping capacity of the distribution system is required to be operational when a population of 11,507 is reached by 2008.

Table 4.5: Available Flow from the Existing Distribution of Fire Pumps (Based on EPCOR's records)

ID	Pump Operation	Pumping Capacity
Brentwood Distribution	Pump B1	56.9 L/s
	Pump B1 and B2	93.6 L/s
	Pump B1, B2 and B3	136 L/s
	Pump B1, B2, B3 and Fire Pump	280.2 L/s
Westmount Distribution	Pump W1	46.6 L/s
	Pump W1 and W2	91.6 L/s
	Pump W1, W2 and Fire Pump	224.9 L/s
Combined Brentwood and Westmount Distribution	Pump B1, B2, B3, W1 and W2	227.6 L/s

4.6 Water Supply and Distribution System Modelling

The main objective of modelling the water supply and distribution system was to assess the weaknesses of the present system and recommend upgrades to the system to enable the system to cater for the projected future population of Strathmore. We used WaterCAD® version 3.1 and EPANET® Version 2.0 to model the Town's water supply and distribution system. Data used in these models was imported from EPCOR's SynerGEE® water model Version 3.23.

4.7 Water Supply and Distribution System Modeling Parameters

The following modeling parameters were used:

- Projected demands as per *Table 4.2* (i.e. 6% growth rate, 415 L/c/d).
- Treated water storage requirement as per Alberta Environment guidelines = (fire flow + emergency + equalization). However, treated water storage requirement as per UMA's recommendations = (minimum fire flow + 1.5 x average day for regional system).
- Projected demands met peak hourly flows or minimum peak day demand plus fire flows during simulated fire events.
- Existing Westmount and Brentwood storage and pumping facilities were maintained with upgrading of distribution pumps to accommodate projected demands.
- Existing reservoirs were replenished through the distribution system with no designated supply mains.
- New reservoirs were replenished from the proposed East Calgary Region Water Pipeline at peak day demands.
- Required fire flow was 200 L/s for 3 hours.
- A Hazen-Williams friction factor of C=130 was used for all new pipes.
- A residential pressure range for water supply was maintained between 28.2 m (40 psi) and 56.3 m (80 psi).
- Maximum hydraulic grade of 1026 m for the ultimate population resulting in the installation of PRVs for any existing and proposed developments below elevation 969.70 m.
- Maximum hydraulic grade of 1028 for year 2030 population resulting in the installation of PRVs for any existing or proposed Developments below 971.70 m.
- For modeling the Town's 2030 projected demands, the west reservoir and the 300 mm and 400 mm south water transmission main were not included due to the assumption that no development south-west of the Trans-Canada Highway will have taken place.

4.8 Fire Flow Analysis and Water Distribution System Upgrades

EPCOR had conducted a fire flow assessment of the distribution system and proposed upgrades to ensure recommended fire flows were achieved by the distribution system. We updated EPCOR's model by including new pipes due to recent developments and upgraded pipes. *Table 4.6* shows the minimum fire flow guidelines recommended by EPCOR.

Table 4.6: Recommended Minimum Fire Flows

Land Use	Fire Flow
Single family residential	60 L/s
Multifamily residential	120 L/s
School	190 L/s
Commercial/industrial	200 L/s

Using WaterCAD® version 3.1, an analysis was conducted by simulating fires at all nodes in the distribution system to determine the maximum flow that could be obtained without going below the set residual pressure of 140 kPa (20 psi). Data used in this model was imported from EPCOR's SynerGEE® water model Version 3.23.

Figure 4.3 shows the areas with inadequate fire flows where no proposed upgrades are included. The results of this simulation are included in **Appendix A1**. Upgrades recommended to improve the fire flows are shown in **Figure 4.4**. **Figure 4.5** shows the available fire flows after the proposed upgrades are included **(see Appendix A2)**. The fire flows are color-coded based on the recommended minimum fire flows for ease of assessment.

4.9 Water Supply and Distribution System Improvements

In order to fulfill the demand and fire flow requirements for the Town, we considered the ultimate annexation population of 62,351 people. Through several iterations of the model, the following supply and distribution system improvements in the Town and annexation areas were developed as shown in **Figure 4.6**. Assuming the upgrades recommended to improve the fire flows as shown in **Figure 4.4** are installed, the following outlines the improvements:

- Construction of the west reservoir and distribution pump station with a total capacity of 12,000 m^3 (the first stage to be 6,000m^3 with a future expansion of 6,000m^3).
- Construction of the east reservoir and distribution pump station with a capacity of 12,000 m^3.
- Construction of the southern reservoir and distribution pump station with a capacity of 12,000 m^3.
- Construction of a 300 mm and 400 mm water transmission main loop around the Town with no direct service tie-ins.
- Piping modifications to the existing Brentwood and Westmount reservoirs and pump stations to separate reservoir inlet and outlet piping.
- 300 mm water main loop connecting Westmount to Downtown and Brentwood.
- 300 mm water main loop connecting Slater Road to the proposed east boundary water transmission main.
- Various looping of existing mains to the proposed 300 and 400 mm transmission main.
- Portions of the existing 300 mm dia water transmission main between the water treatment plant and Brentwood reservoir were abandoned.
- Future developments in the annexation area shall provide internal looping of their grid main network according to the City of Calgary's Design Guidelines for Subdivision Servicing as shown on **Figure 4.6**, detail 1.

4.10 Water Supply and Distribution System Modeling

4.10.1 Year 2037

This time horizon is when the Town's population at a growth rate of 6% from the present population is expected to reach its ultimate level of 62,351 and all the land within the Town's boundaries including the annexed areas will be fully built out.

The following are the modeling scenarios:

4.10.1.1 Ultimate peak hour demand scenario (1,199 L/s)

For the supply and distribution system to fulfill this water demand, the following are the system components and conditions that need to be met:

- I85
- Installation of new east, west and south reservoirs and pump stations.
- Discharge pressure at new east and west pump stations needs to at hydraulic grade 1026m to supply adequate pressures.
- Upgrading of the distribution pumps and pump discharge piping at the Brentwood reservoir.

As a result of modeling, the following observations were made:

- Westmount pump station has no impact, as the existing pump capacities are too small. May be used as water truck fill or low flow timer.
- Pressures of 28.20m (40 psi) and 56.30m (80 psi) can be maintained throughout existing and proposed distribution system.

For further information, see **Appendix A3**.

4.10.1.2 Ultimate peak day demand scenario (599 L/s)

For the supply and distribution system to fulfill this water demand, the following are the system components and conditions that need to be met:

- Installation of new reservoirs and pump stations
- Discharge pressure at new pump stations (excluding Westmount) needs to be at hydraulic grade 1026m to supply adequate pressures
- Upgrading of the distribution pumps and pump discharge piping at the Brentwood reservoir

As a result of modeling, the following observations were made:

- Westmount pump station has no impact, as the existing pump capacities are too small
- PRVs are required for low laying NW and SE Areas

For further information, see **Appendix A4.**

4.10.1.3 Ultimate peak day demand plus fire flow scenario (599 L/s + 200 L/s fire flow at Pine Road)

For the supply and distribution system to fulfill this water demand, the following are the system components and conditions that need to be met:

- Installation of new east, west and south reservoirs and pump stations.
- Discharge pressure at new east and west pump stations needs to at hydraulic grade 1026 m to supply adequate pressures.
- Upgrading of the distribution pumps and pump discharge piping at the Brentwood reservoir.

As a result of modeling, the following observations were made:

- Westmount pump station has no impact, as the existing pump capacities are too small.
- Pressures at the area where fire is simulated are less then 28.20 m (40 psi).

For further information, see **Appendix A5**.

4.10.2 Year 2030

This time horizon is when the proposed East Calgary Regional Water Pipeline pumps will require upgrading to increase water supply to the Town. To model this time horizon with a population of 41,468, the proposed southern reservoir is not yet constructed and the 300 mm and 400 mm water transmission mains from Wildflower Road to Orchard Park Road are not yet installed. Seven demand points were used to represent the annexed area for modeling purposes. The following scenarios assumed parts of the future northern and western annexed areas would not be fully built out by 2030.

4.10.2.1 2030 peak hour demand scenario (797 L/s)

For the supply and distribution system to fulfill this water demand, the following are the system components and conditions that need to be met:

- Installation of Stage 1 which comprises of the 6,00m^3 east reservoir and Stage 1& 2 which comprises of the phased construction of the two 6,000m^3 west reservoirs including distribution pump station at both reservoirs.
- Discharge pressure at the new pump station needs to be increased to hydraulic grade 1028 m to supply adequate pressures.
- Upgrading of the distribution pumps and pump discharge piping at the Brentwood reservoir.

As a result of modeling, the following observations were made:

- Westmount pump station has no impact as the existing pump capacities are too small.
- Pressures of 28.20 m (40psi) and 56.30 m (80 psi) can be maintained throughout the existing and proposed distribution system.

For further information, see **Appendix A6**.

4.10.2.2 2030 peak day demand scenario (398 L/s)

For the supply and distribution system to fulfill this water demand, the following are the system components and conditions that need to be met:

- Installation of the new west reservoir and pump station plus either Brentwood reservoir and pump station or Westmount reservoir and pump station can be used to supply peak day demands
- Discharge pressure at new west pump station needs to be increased to hydraulic grade 1028m to supply adequate pressures
- PRVs are required for low laying NW and SE areas.

As a result of modeling, the following observation was made:

- Either existing pump station can be used to supplement the new west reservoir and pump station.

For further information, see **Appendix A7.**

4.10.2.3 2030 peak day demand plus fire flow scenario (398 L/s + 200 L/s fire flow at Pine Road)

For the supply and distribution system to fulfill this water demand, the following are the system components and conditions that need to be met:

- Installation of the new west reservoir and pump station plus Brentwood reservoir and pump station can be used to supply peak day demands.

As a result of modeling, the following observation was made:

- Westmount pump station has no impact, as the existing pump capacities are too small.
- Adequate pressures are achieved throughout the distribution system.

For further information, see **Appendix A8**.

4.10.3 Modeling Results

- Similar to the modeling scenarios used for the ultimate flows, we also modeled scenarios in which eight demand nodes were used to simulate the Town's water supply and seven demand nodes to represent the annexed areas. The results of these models did not differ significantly from the above models but served to reinforce the results of the above model scenarios.
- Based on the above modeling, indications are that the proposed annexation areas including the existing Town can be serviced adequately with all demands and fire flows by constructing two new treated water storage reservoirs and by maintaining the existing Brentwood reservoir and Westmount reservoir in operation with improvements to the existing Brentwood distribution pump station as required to service the projected demands.
- The existing Westmount pump station has very little or no impact on the proposed distribution system due to its limited pumping capacity and would have to be upgraded significantly to adequately contribute to the distribution system. However, the existing storage capacity should be utilized in future by pumping water into the distribution system during low demand periods.
- The 400 mm and 300 mm loop around the Town should be a designated transmission main because pressures in this main exceed the required maximum of 56.30 m (80 psi). Pressure reducing stations need to be installed on branch-offs from the transmission main to reduce the pressures in the distribution system. The transmission main should not have any house service connections connected to it other than where existing mains are used for the transmission main loop to reduce risk of a major failure. If service connections on the existing mains are used as transmission mains, then these service lines shall require individual PRVs.
- The 2030 modeling is based on the new west reservoir and pump station, Brentwood reservoir and pump station, and Westwood reservoir and pump station during low demand periods. It is also assumed that a portion of the water transmission main loop between the Wildflower Heights and Wheatland Trail has not been constructed. However, all above indicated improvements to the present water distribution system are assumed to be constructed by 2030.

- The construction of the proposed improvements to service the Town and annexation areas should be staged as required to supply adequate demands to the existing Town and new development areas. The construction of the new east reservoir and pump station should coincide with the construction of the East Calgary Regional Water Pipeline.

4.11 Fire Underwriters Survey

In 2006, CGI Information Systems and Management Consultants Inc. (CGI) conducted a standardized Fire Underwriters Survey on behalf of UMA for the Town as part of this annexation study for fire insurance grading purposes. For the sake of consistency, *CGI's Executive Summary* was formatted to UMA standards, and it is included in **Appendix D**.

4.11.1 Fire Underwriters Survey Executive Summary

The study from CGI followed the standardized Fire Underwriters Survey methodology and this method includes reviews and calculated grades of the following areas:

- Community Risk Level (fire risk)
- Fire Department Operations
- Fire Prevention and Fire Safety Control Programs
- Emergency Communications
- Water Supplies for Fire Fighting

Each area reviewed is assigned a relative classification grade between 1 and 10, with 1 being the best possible score and 10 being the worst.

The level of risk in the community risk assessment was noted to have increased significantly in the Strathmore community since the last grading. The level of risk continues to increase at a rapid rate due to ongoing development and economic growth in the area.

The findings in the other areas of the survey are summarized as follows:

- The Fire Department Assessment contributes 40% to the total fire insurance grade of the community. This is the most heavily weighted portion of the grading and as such is considered the most significant indicator of a Community's overall preparedness for dealing with fire emergencies.
- Strathmore has been graded as fair to poor in the current fire department assessment. The lack of workers (particularly career) is the single most significant deficiency in the fire insurance grading of Strathmore. The Strathmore Fire Department has been assigned a relative classification of 7.
- Fire Prevention and Fire Safety Control Programs contribute 20%, to the total fire insurance grade of the community. Strathmore has been graded as fair to poor in fire prevention. Strathmore has started to develop a good fire prevention and inspection program but does not currently have adequate staffing resources to improve the effectiveness of the program.
- The Fire Prevention and Fire Safety Control Programs in place in Strathmore have been graded and assigned a relative classification of 8. The programs are considered deficient with respect to the level of risk within the community.

- Emergency Communications contribute 10% to the total fire insurance grade of the Community. The Emergency Communications systems and equipment employed and utilized by the Strathmore Fire Department have been graded and assigned a relative classification of 6. The communications systems are considered good for the level of risk within the community.
- Water supplies contribute 30% to the total fire insurance grade of the community. The water supplies available for fire fighting by the Strathmore Fire Department have been graded and assigned a relative classification of 7. The water supplies are considered reasonable for the level of risk within the community. The most significant weakness of the water system is the inability to provide adequate fire flows at various locations throughout the community.

As the key areas of Fire Department Operations and Water Supplies have relative classifications of 7, the community currently only qualifies for a fire insurance grading classification of 7. The community currently has a published grading of 7.

As the community continues to grow, the level of risk continues to increase. The Community should utilize all recommendations within this report to maintain the current fire insurance grading classification and work toward improving the relative classification.

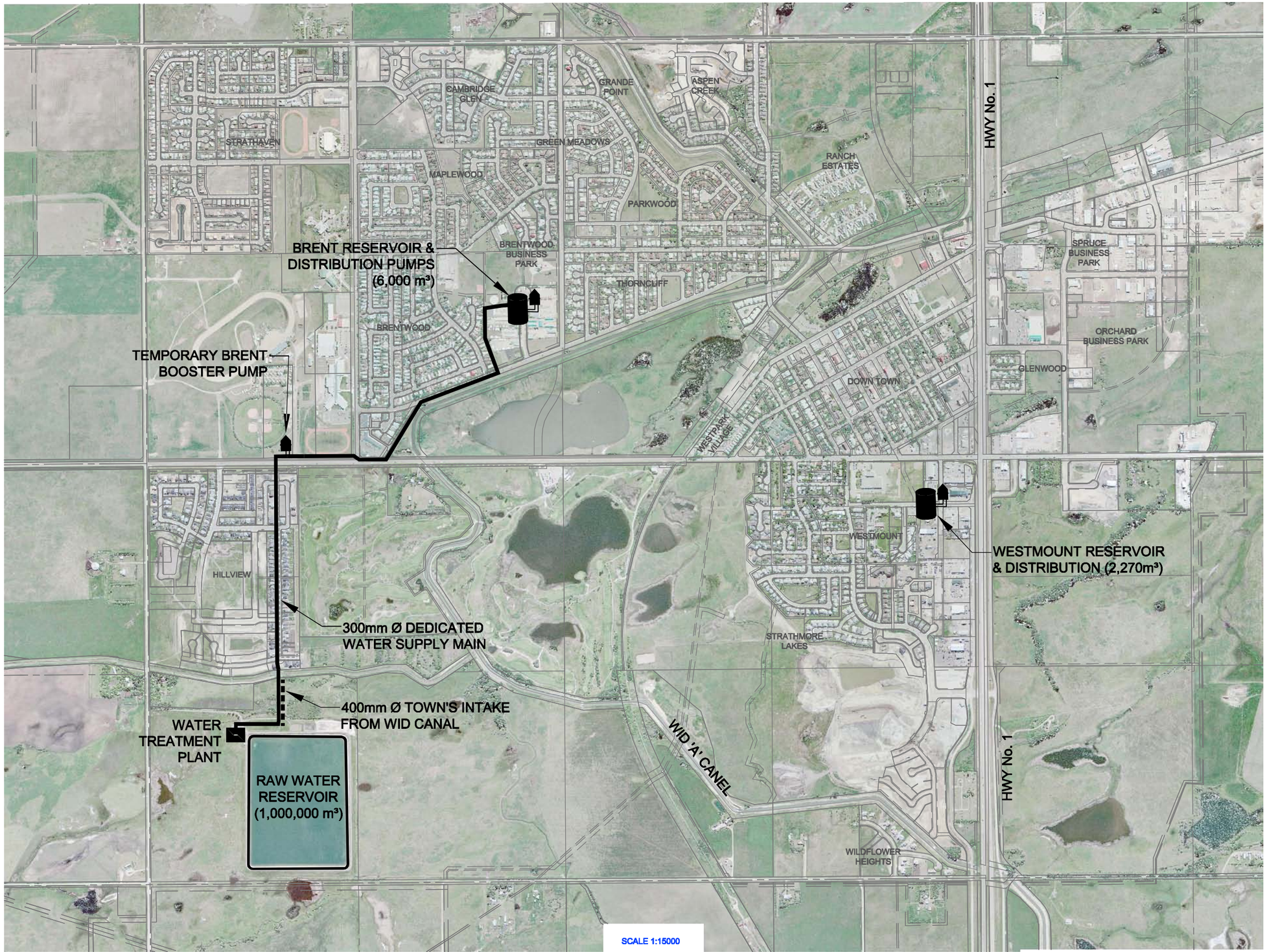
4.11.2 Summary of Recommendations

The following table summarizes the recommendations made during this assessment. The level of importance in the left column indicates the importance of the recommendation with regard to fire insurance grading and the potential for Strathmore to maintain/improve its fire insurance grading classification.

Table 4.7: Summary of Recommendations and Importance Level

Importance	Recommendation	Page
High	Recommendation 8.5.1 1 - Invest in Fire Protection Resources to Match Increasing Levels of Risk	25
Medium	Recommendation 8.5.1 2 - Improve Community Planning Methods with Regard to Fire Protection	26
Medium	Recommendation 8.5.1 1 - Invest in Fire Department Management Software	39
High	Recommendation 8.5.1 1 - Expand existing fire station to accommodate new apparatus	41
Medium	Recommendation 8.5.1 1 - Build a second fire station	42
High	Recommendation 8.5.1 1 - Provide Additional Apparatus and Improve Pumping Capacity	44
High	Recommendation 8.5.1 2 - Service Test all old apparatus	45
High	Recommendation 8.5.2 1 - Acquire an Aerial Apparatus Linder 20 years of age	46
Low	Recommendation 8.5.3 1 - Develop and implement hose testing program throughout all departments	47
Low	Recommendation 8. 5.3 2 - Develop and implement ladder testing program throughout all departments	47
High	Recommendation 8.8.1 1 - Provide Additional Staffing	49
High	Recommendation 8.9.1 1 - Hire/Assign a Training Officer	51
Medium	Recommendation 8.9.1 1 - Develop Pre-Incident Plan Program	51
Medium	Recommendation 9.1.1 1 - Implement Sprinkler Bylaw	53
High	Recommendation 9.1.1 1 - Provide Additional Staffing/Resources to Fire Prevention Inspections	54

Importance	Recommendation	Page
Low	Recommendation 9.2.1 1 - Implement Course of Construction Risk Reduction and Inspection Program	55
Medium	Recommendation 9.2.1 1 - Develop a Public Education Program	56
Low	Recommendation 9.2.1 1 - Develop a Strathmore Fire Department Web Site	57
High	Recommendation 9.2.1 1 – Use the FUS Standard Water Supply for Public Fire Protection to design water systems	61
High	Recommendation 9.2.1 1 – Improve Water System Ability to provide Required Fire Flows	62
High	Recommendation 9.2.1 1 – Implement UMA Engineering Recommendations for Water System Improvement.	71
Low	Recommendation 9.2.1 2 – Improve use of technology to manage, plan and optimize water system	71
High	Recommendation 9.2.1 3 – Design water systems to meet the Fire Underwriters Survey Standard – “Water Supplies for Public Fire Protection”	71
Low	Recommendation 9.2.1 4 – Provide additional water storage capacity	71
Medium	Recommendation 9.2.1 5 – Provide back-up pump for primary pump(s)	72
High	Recommendation 9.2.1 6 – Improve water system available fire flows to meet calculated Fire Flow Requirements	73
Medium	Recommendation 9.2.1 7 – Improve Hydrant Maintenance Program to meet standard	73



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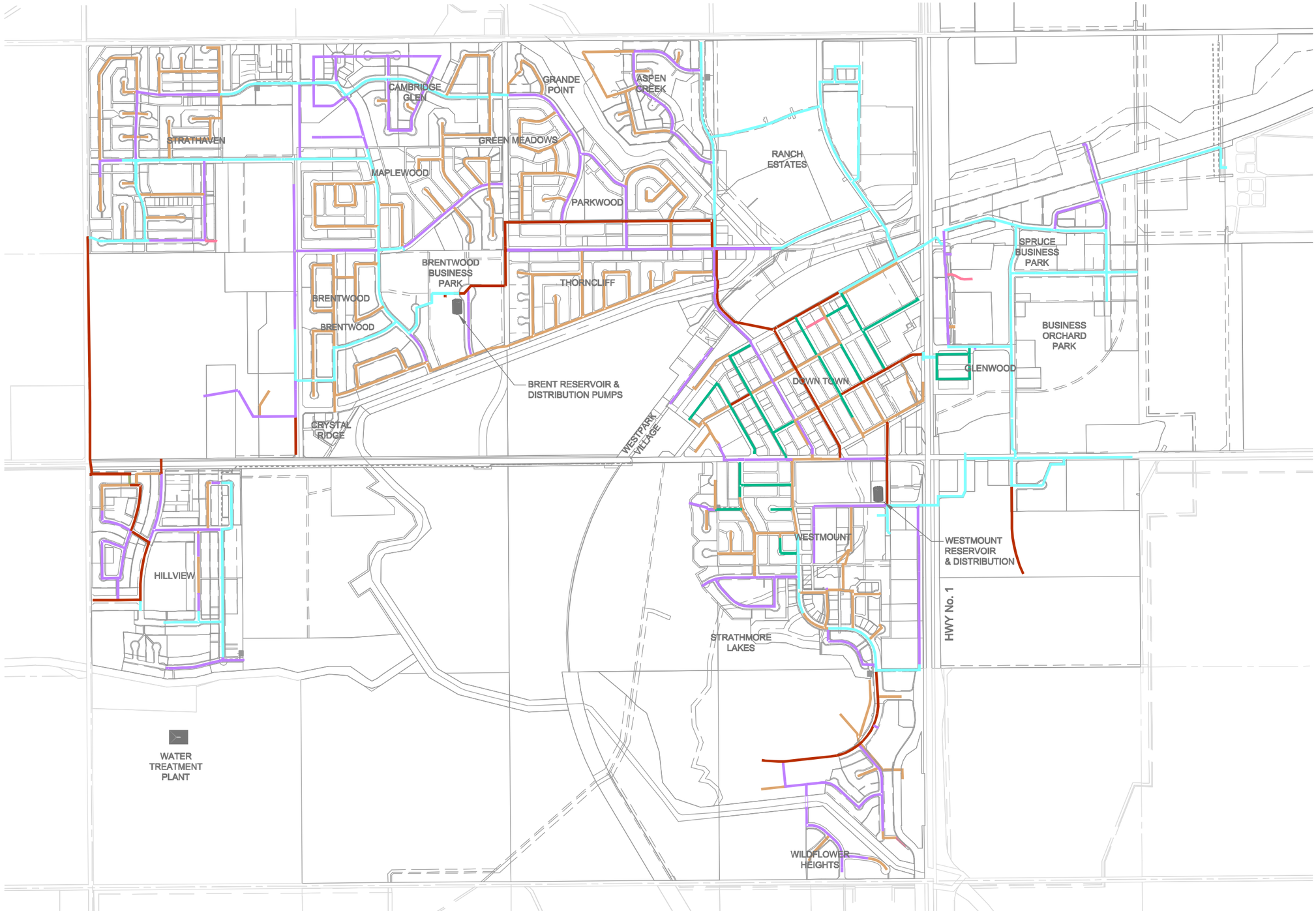
Existing Water Supply System & Storage

Figure - 4.1



LEGEND:

- 50mm
- 100mm
- 150mm
- 200mm
- 250mm
- 300mm

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0 150 300

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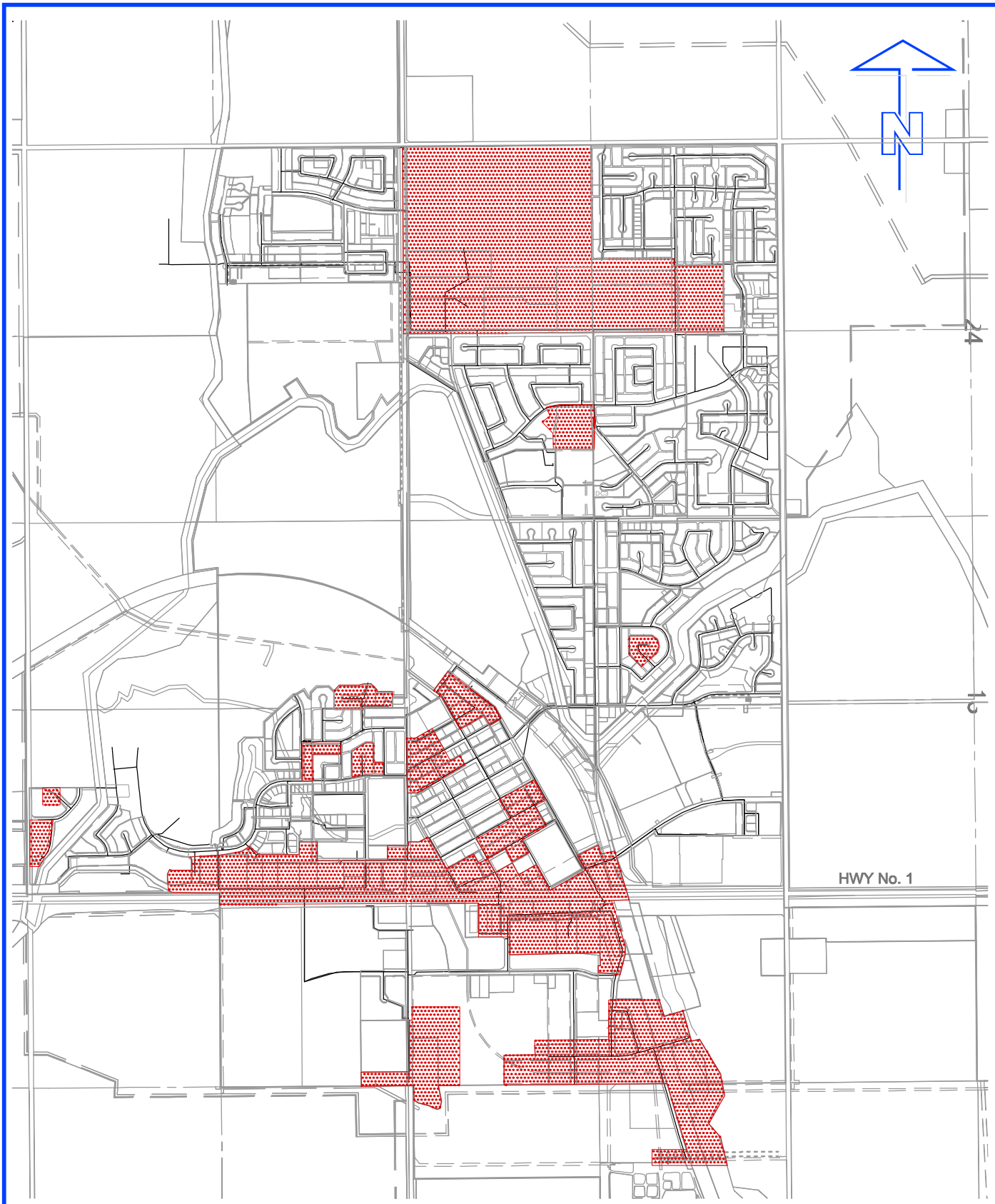
Existing Water Distribution Pipeline Sizes

Figure 4.2



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Inadequate Fire Flow Areas Before Upgrades

Figure - 4.3

UMA | AECOM

B SIZE 11" x 17" (279.4mm x 431.8mm)

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300

LEGEND:

- 150mm WM UPGRADE
- 200mm WM UPGRADE
- 250mm WM UPGRADE
- 300mm WM UPGRADE

SCALE 1:15000

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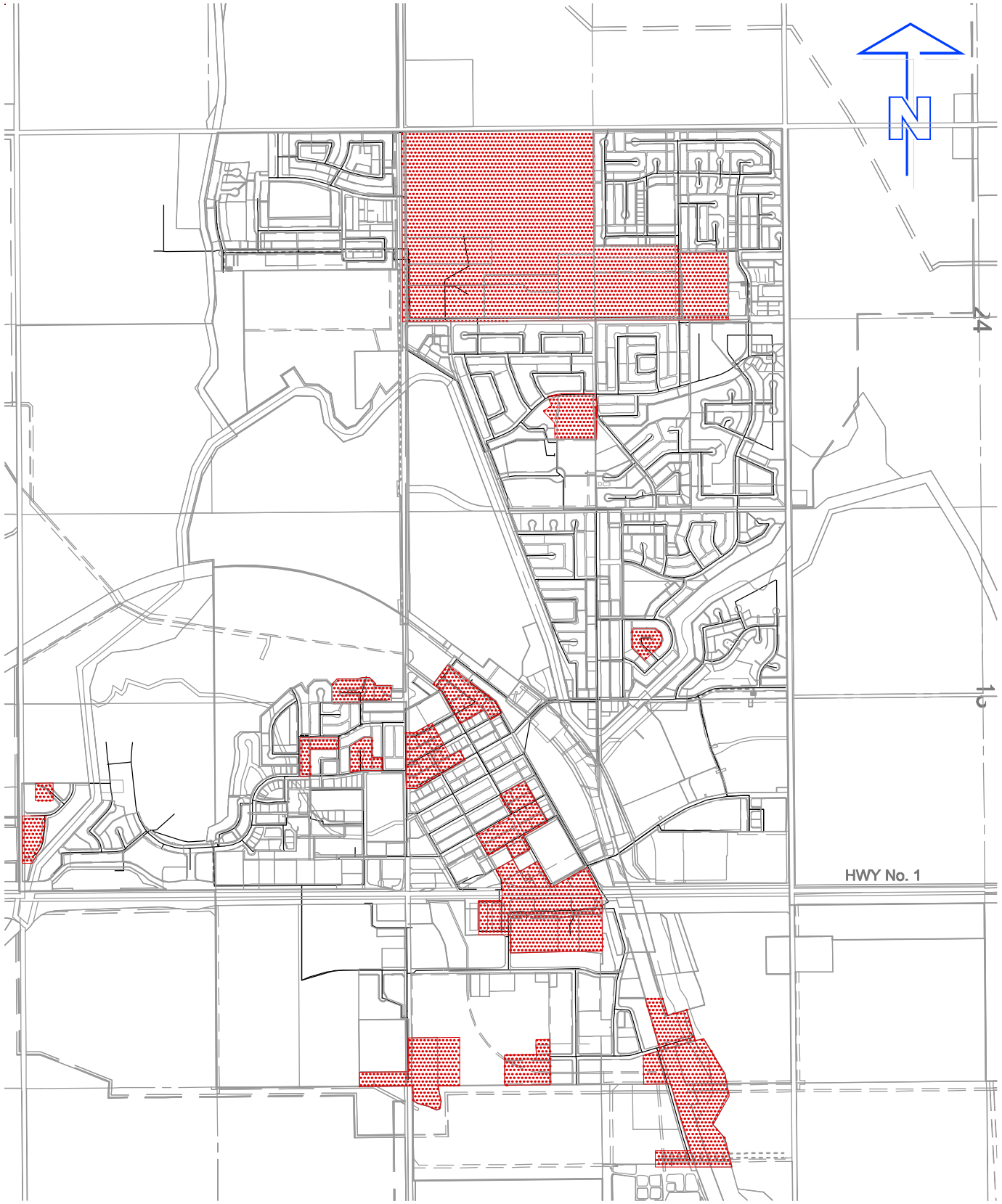
Recommended Existing Water Main Capacity Upgrades

Figure 4.4



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Inadequate Fire Flow Areas After Upgrades

Figure - 4.5

UMA | AECOM

B SIZE 11" x 17" (279.4mm x 431.8mm)

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ANNEXATION BOUNDARY

EXISTING TOWN BOUNDARY

HWY No. 1

RESERVOIR

CAMBRIDGE GLEN

GRANDE POINT

ASPEN CREEK

STRATHAVEN

GREEN MEADOWS

MAPLEWOOD

PARKWOOD

RANCH ESTATES

LAGOON

SPRUCE BUSINESS PARK

BRENTWOOD BUSINESS PARK

THORNCLIFF

ORCHARD BUSINESS PARK

BRENTWOOD

CRYSTAL RIDGE

WEST PARK VILLAGE

DOWN TOWN

GLENWOOD

WESTMOUNT

HILLVIEW

STRATHMORE LAKES

WILDFLOWER HEIGHTS

TRANSMISSION MAIN TO BE INSTALLED IN 2030

RESERVOIR TO BE INSTALLED IN 2030

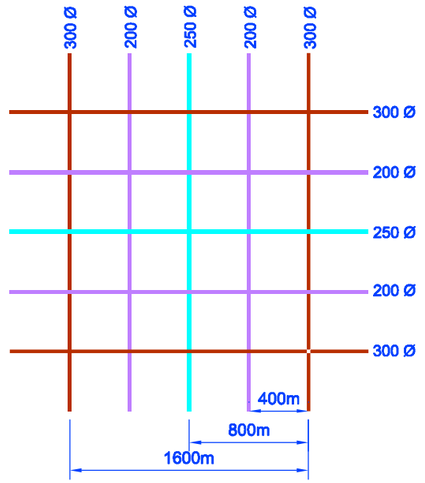
25 24 13 1 26 2 27 3 28 9

SCALE 1:25000

0 250 500

LEGEND:

- 150 Ø WATERMAIN
- 200 Ø WATERMAIN
- 250 Ø WATERMAIN
- 300 Ø WATERMAIN
- 300 Ø WATERMAIN TRANSMISSION
- 400 Ø WATERMAIN TRANSMISSION
- 600 Ø WATERMAIN TRANSMISSION
- EXISTING TOWN BOUNDARY
- ANNEXATION BOUNDARY
- 250 Ø WATERMAIN (DEVELOPERS RESPONSIBILITY)
- 300 Ø WATERMAIN (DEVELOPERS RESPONSIBILITY)
- EXISTING WATERMAIN



DETAIL 1

SCALE: N.T.S.

GRID MAIN NETWORK

NOTE : THIS STANDARD GRID NETWORK IS REQUIRED

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Water

Figure 4.6

UMA | AECOM

5.0 Sanitary Sewerage System

5.1 Introduction

To enable the evaluation of the existing and proposed sanitary servicing requirements, the design criteria was developed after reviewing the following design reports and municipal documents:

- Alberta Environment's Standards and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage Systems, January 2006
- City of Calgary's Design Guidelines for Subdivision Servicing, August 2004
- UMA Bow Tertiary Outfall Pre-design Report, April 2005
- EPCOR Town of Strathmore's *Distribution System Assessment and Five Year Capital Plan Final Report*, December 2002 and data from the wastewater treatment plant
- Urban Systems *1999 Infrastructure Analysis*, February 2000
- Stanley Associates Engineering Ltd *Town of Strathmore's Master Servicing Plan*, December 1986

A static model was developed using population numbers, slope, pipe diameter and roughness factors. This model was used to assess the peak flow rates of the existing and proposed sewerage system.

This design approach was used to size the proposed trunk mains to service the annexed areas and to recommend upgrades on the existing system. These upgrades were incorporated into the proposed annexation servicing network. A phased servicing plan was developed that follows the construction sequence of the development cells.

5.2 Design Criteria

Historical per capita sewage flow rate used in different design reports and EPCOR treatment plant data are summarized as follows:

- Alberta Environment's *Standards and Guidelines*, January 2006 gives a flow rate of 0.46 L/s/ha and an infiltration rate of 0.28 L/s/ha giving a combined flow rate of 0.74 L/s/ha
- UMA *Bow Tertiary Outfall Pre-design Report*, April 2005 gives a combined per capita flow rate of 400 L/c/day
- Urban Systems *1999 Infrastructure Analysis*, Feb 2000 gives a flow rate of 300 L/c/day and infiltration rates of 312 L/mm dia/km/day and 45 L/mm dia/km/day
- Stanley Associates Engineering Ltd *Master Servicing Plan*, Dec 1986 gives a flow rate of 385 L/c/day and an infiltration rate of 400,000 L/day
- EPCOR *Treatment Plant Data*, 2001 to 2005 gives a flow rate of 332 L/c/day and an infiltration rate of 100 L/c/day giving a combined flow rate of 432 L/c/day

Per capita flow rates were generated using data provided by EPCOR. EPCOR data is the most current and is based on actual flow measurements. It is assumed that sewage generated was 80% of actual flow measurements.

The method used to derive EPCOR's per capita flow and infiltration rates is summarized in *Tables 5.1 and 5.2*.

Table 5.1: Water Consumption Data

Year	Population	Water Consumption			
		Metered Water Consumption (m^3)	80% of Metered Water Consumption (m^3)	Per Capita Consumption (L/c/day)	Per Capita Sewage Flow Generated Based on 80% consumption (L/c/day)
2000	7,165	856,922	685,538	328	262
2001	7,455	924,565	739,652	340	272
2002	8,022	1,213,847	971,078	415	332
2003	8,640	1,277,556	1,022,045	405	324
2004	9,115	1,320,417	1,056,334	397	318
2005	9,653	1,305,704	1,044,563	371	296

From *Table 5.1*, a conservative figure of 332 litres/capita/day was used as the per capita sewage flow rate.

Table 5.2: Wastewater Treated Effluent Discharge Data

Year	Population	Wastewater Treated Effluent Discharge		
		Volume Released (m^3)	Effluent (L/c/day)	Per Capita Infiltration* (L/c/day)
2000	7,165	752,085	288	25
2001	7,455	737,593	271	-1
2002	8,022	1,102,584	377	45
2003	8,640	1,284,097	407	83
2004	9,115	1,322,335	397	80
2005	9,653	1,398,051	397	100

Obtained by subtracting the per capita sewage flow generated based on 80% consumption from the per capita wastewater effluent.

According to EPCOR's wastewater collection system evaluation report, very dry weather was experienced most of the time between 2000 and 2002. This may account for the low per capita infiltration rates for those years and our assumption of 80 % of metered water consumption being sewage generated does not work for the year 2001. From *Table 5.2*, a figure of 100 L/c/d is the highest average day per capita infiltration reading.

Combining these values for sewage generation and infiltration gives a combined flow rate of:

- 332 L/c/d + 100 L/c/d = 432 L/c/d

As there is insufficient data to provide a peak wet weather flow, *Alberta Environment's Standards and Guidelines* infiltration value of 0.28 L/s/ha will be taken as the design infiltration value, as this value is higher than EPCOR's.

Pipe roughness n = 0.013 as per the City of Calgary sewer design standards.

5.2.1 Peaking Factor

The peaking factor was derived from Alberta Environment's *Standards and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage Systems*, January 2006. The formula is as follows:

$$Q_{PDW} = \frac{GxPxP_f}{86.4}$$

Where Q_{PDW} = peak dry weather design flow rate (L/s).
G = per capita average daily design flow (L/d).
P_f = peaking factor.
P = population

The peaking factor (Pf) shall be the larger of 2.5 or Harmon's Peaking Factor where:

$$Harmon'sPF = 1 + \frac{14}{4 + P^{1/2}}$$

Where P = design contributing population in thousands.

5.3 Existing Sanitary Sewerage System Analysis

The Town's existing sanitary sewer collection system consists of central and eastern trunks. The central trunk consists of several trunks ranging in size from 300 mm and 450 mm dia gravity sewers. The central trunks service the entire Town excluding United's "The Ranch" development, which is serviced by the eastern trunk sewer. **Figure 5.1** shows the current area serviced by each trunk system and the general location including the trunk size.

5.3.1 Central Trunk System

The central trunk system has several service branches, which are shown on **Figure 5.2** and are described as follows:

5.3.1.1 Parkwood Trunk

This trunk consists of a 375 mm dia sewer pipe and the Strathaven Heights lift station that serves Strathaven and Strathaven Heights. This trunk provides service to:

- Strathaven
- Strathaven Heights
- Maplewood
- Cambridge Glen
- Green Meadows
- Parkwood
- Aspen Creek
- Ranch Estates.

The peak design flow generated by the developments served by this trunk is 109 L/s while the average actual pipe capacity is between 80 - 108 L/s. This indicates the possibility of surcharging the trunk during peak hour flows when the maximum design infiltration flows are present.

5.3.1.2 Thorncliff Trunk

This trunk consists of a 300 mm diameter sewer pipe. This trunk provides service to:

- Rodeo grounds
- Crystal Ridge
- Brentwood
- Brentwood Business Park
- Thorncliff.

The peak design flow generated by the developments served by this trunk is 53 L/s, while the average actual pipe capacity is between 43 - 145 L/s. This indicates a possibility of surcharging some sections of the trunk during peak hour flows when the maximum design infiltration flows are present.

5.3.1.3 Lakeside View Trunk

This trunk consists of a 450 mm dia sewer pipe and the Hillview lift station that serves Hillview. This trunk provides service to:

- Hillview
- Parklane Place.

The peak design flow generated by the developments served by this trunk is 36 L/s, while the average actual pipe capacity is between 85 - 194 L/s. This indicates that the trunk has sufficient capacity to serve these developments.

5.3.1.4 North Center Street Trunk

This trunk consists of a 375 mm dia sewer pipe. This trunk provides service to the following trunks:

- Parkwood Trunk
- Thorncliff Trunk
- Lakeside View Trunk.

The peak design flow generated by the developments served by this trunk is 183 L/s while the average actual pipe capacity is between 66 - 103 L/s. This indicates the possibility of surcharging the trunk during peak hour flows when the maximum design infiltration flows are present.

5.3.1.5 Downtown North Trunk

This trunk provides service to the northern part of downtown and consists of a 250 dia sewer pipe.

The peak design flow generated by the developments served by this trunk is 31 L/s while the average actual pipe capacity is between 30 - 48 L/s. This indicates the possibility of surcharging a minor section of the trunk during peak hour flows when the maximum design infiltration flows are present.

5.3.1.6 South Center Street Trunk

This trunk consists of a 450 mm dia sewer pipe. This trunk provides service to the following:

- North Center Street Trunk
- Downtown Waste Trunk

The peak design flow generated by the developments serviced by this trunk is 207 L/s while the average actual pipe capacity is between 96 L/s and 151 L/s.

5.3.1.7 Downtown South Trunk

This trunk provides service to the southern part of downtown and Glenwood and consists of a 200 dia sewer pipe.

The peak design flow generated by the developments served by this trunk is 15 L/s while the average actual pipe capacity is between 62 - 105 L/s. This indicates that the trunk has sufficient capacity to serve the southern part of downtown.

5.3.1.8 Orchard Trunk

This trunk consists of a 300 dia sewer pipe. The Orchard Business Park area is also served by the following lift stations:

- Westmount lift station that serves Westlake Glen and part of Westmount Drive.
- Wheeler Street lift station that serves Westview, Wheeler and parts of Strathmore Lakes Way and Willow Drive.

Coupled with these lift stations, this trunk provides service to:

- Wildflower Heights.
- Westmount.
- Strathmore Lakes.
- Orchard Business Park.

The peak design flow generated by the developments served by this trunk is 64 L/s while the average actual pipe capacity is between 25 - 95 L/s. This indicates the possibility of surcharging sections of the trunk during peak hour flows when the maximum design infiltration flows are present.

5.3.1.9 Spruce Business Park Trunk

This trunk consists of a west 350 mm and an east 450 mm dia sewer pipe, which are interconnected at several locations. This trunk provides service to:

- South Central Trunk
- Downtown South Trunk
- Spruce Business Park Trunk.

This trunk provides service to Spruce Business Park and consists of a 350 diameter sewer pipe. The peak design flow generated by the developments served by this trunk is 27 L/s while the average actual pipe capacity is between 49 - 132 L/s. This indicates that the trunk has sufficient capacity to serve this development.

5.3.1.10 West Trunk

This trunk is one of the two main trunks that lead directly to the wastewater treatment plant. This trunk consists of a 350 dia sewer pipe and provides service to the following trunks:

- Orchard Business Park Trunk.
- Spruce Business Park Trunk.

The peak design flow generated by the developments served by this trunk is 87 L/s while the average actual pipe capacity is between 68 - 154 L/s. This indicates the possibility of surcharging major sections of the trunk during peak hour flows when the maximum design infiltration flows are present.

5.3.1.11 East Trunk

This trunk is one of the two main trunks that lead directly to the wastewater treatment plant. This trunk primarily of a 450 mm dia sewer pipe and provides service to the following trunks:

- Downtown North Trunk.
- Downtown South Trunk.
- Center Street Trunk.

The peak design flow generated by the developments served by this trunk is 217 L/s while the average actual pipe capacity is between 112 - 140 L/s. This indicates the possibility of severe surcharging the trunk during peak hour flows when the maximum design infiltration flows are present.

5.3.2 Eastern Trunk System

This trunk provides service to United's "The Ranch" development and consists of a 450 mm and 675 mm dia sewer pipes. Sewage flows from north of the TCH along East boundary road to a lift station east of the wastewater treatment plant. The lift station is connected to the wastewater treatment plant by a 350 mm dia force main.

The peak design flow generated by the developments served by this trunk is 47 L/s while the average actual pipe capacity is 202 L/s. This indicates that the trunk has sufficient capacity to serve this development.

5.3.3 Headworks

Both the south central and eastern trunks flow into the wastewater treatment plant. The headworks consist of a 450 mm and 350 mm dia sewer pipes laid parallel to each other. These pipes discharge into a series of interceptor chambers that eventually discharge sewage via a 525 mm dia pipe into the wastewater treatment plant.

The last interceptor chamber has a 450 mm and 350 mm dia sewer pipes laid parallel to each other that acts as an overflow. However, it should be noted that the 450 mm dia overflow pipe could be considered to have a reduced hydraulic capacity due to the presence of a 200 mm dia overflow pipe from the wastewater treatment plant.

A peak flow of 1,355 L/s will be going into the wastewater treatment plant. A 750mm dia pipe at 1.5% slope with a full flow capacity of 1,363 L/s is required to convey this flow from the interceptor chamber and into the wastewater treatment plant.

5.4 Existing Sanitary Sewer System Upgrades

The existing sanitary collection trunks were analyzed utilizing a static model of peak wet weather flows and this data is included in the **Appendix B**. Based on the review of the existing system the following upgrades, as shown in **Figure 5.3,** are required in order to meet current capacity demands.

5.4.1 Centre Street/Spruce Business Park/South Centre Trunk

The analysis shows that the central trunk sewer system surcharges during peak conditions in the following sub-trunks:

- Center Street Trunk
- Spruce Business Park Trunk
- South Central Trunk
- Orchard Trunk.

The Center Street, Spruce Business Park and South Central trunks were analysed together to assess the bottleneck while orchard park was analysed separately.

The Centre Street, Spruce Business Park, and South Central trunks were modelled with three potential upgrades that would correct the current surcharging plus provide additional capacity for the undeveloped lands within the Town boundaries. The three options were:

- ***Option 1:*** Partial upgrades of bottlenecks of trunk
- ***Option 2:*** Twinning or upsizing existing central sewer, and
- ***Option 3:*** Bypassing.

Through the review of the models and topography, it was determined that point upgrades only provided temporary relief and may cause an unexpected flooding downstream due to surcharging. This option was determined not to be an effective solution.

The second option was to twin the central sewer with 1.8 km of 450 mm dia gravity sewer from the manhole at the intersection of Centre Street and Ranch Estates, to the Ranch Estates Waste Water Treatment Plant. Due to existing developments and limited right-of-way, this option was determined not to be cost effective.

The third option was to bypass flow from the Parkwood trunk from the Central Trunk System to the East Trunk Sewer, which currently has spare capacity. This would be accomplished by installing 850 metres of 375 mm dia gravity main running east from Parkland Drive, through the Ranch Development to East Boundary Road until it joins the 450 mm dia East Trunk Sewer. The diversion would enable the equivalent of three quarter sections to be added to the central trunk sewer system, which would account for all the undeveloped lands north of Highway 1, within the current Town boundary.

5.4.2 Rodeo Grounds

If the rodeo grounds are converted into residential property, then the flow generated from this proposed development can be channeled into the existing Central system, provide the Town sewage bypass and Thomas Place upgrades are constructed.

This will be accomplished by installing a 500 metre long 300 mm dia gravity main running east from the manhole that receives the 150 mm dia Strathhaven force main along Brent Boulevard to the 600 mm dia trunk main that serves the east annex area. This will divert flows from an equivalent of one ¼ section.

Replacement of the 150 metre long 250 mm dia Thomas Place sewer line located on the southern part of Thomas Drive with a 300 mm dia line is required to keep the line in size with the two 300 mm dia sewer lines following and preceding it. This will reduce the probability of surcharging during peak flow periods when the maximum design infiltration flows are present when the area served by this line becomes completely built out or developed.

5.4.3 Strathmore Lakes Upgrade

An extension of the 150 mm dia Strathmore Lakes Estates force main east by approximately 650 metres along West Ridge Road and south by approximately 350 metres to the existing 375 mm dia sewer located along Canal Garden Boulevard.

5.4.4 Orchard Business Upgrade

An upgrade to ease the Orchard Business Park bottleneck shall comprise of diverting all the flow from the existing 300 mm and 375 mm dia trunks by installing a 750 metre long 525 mm dia gravity main running south until it joins the proposed 900 mm dia gravity main. The installation of this main would replace the existing 300 mm trunk sewer, which is the oldest trunk in town.

5.4.5 Golf Course Upgrade

The installation of a 900 metre long 450 mm dia sewer line shall enable the servicing of two ¼ sections of land from the western side of the Town.

5.5 Proposed Sanitary Sewer System to Service Annexation Area

Depending on the direction the Town of Strathmore would like to direct development, we have developed two options. The first option services the entire northern part of the annexed area through the eastern sanitary trunks and services the western part of the annexed area through the southern sanitary trunks. The second option deals with servicing three ¼ sections of the northern part of the annexed area through the eastern sanitary trunks and the remaining two ¼ sections through the western part of the annexed area which are serviced through the southern sanitary trunks.

5.5.1 Option 1

Refer to **Figure 5.4.** The description of the servicing has been split into the following areas.

5.5.1.1 North

The northern ¼ sections shall be served by three lift stations. Lift stations No. 1 and No. 2 shall have 250 mm dia force mains as they will both be draining one and a half ¼ sections of sewage flow (78 L/s). Lift station No. 3 shall have a 150 mm dia force main as it only drains half a ¼ section of sewage flow (28 L/s).

These flows shall be drained out of the north via 450 mm and 525 mm dia to the east trunk sewer.

The flow from the northern annexed areas will be conveyed via a 525 mm dia trunk to a 600 mm dia trunk that the Strathaven upgrade sanitary main shall be connected to. The Strathaven trunk shall divert one ¼ section of equivalent sewage flow to this eastern trunk. ¼ sections shall progressively connect to this eastern trunk increasing the flows and as it approaches the Trans-Canada Highway, the pipe size increases to a 750 mm dia trunk.

After the trunk crosses the Trans-Canada Highway, approximately one and a half ¼ sections connect to it and coupled with slope restrictions, the pipe size increases to a 900 mm dia trunk. This trunk then connects to a manhole serving an existing 675 mm trunk. A 750 mm trunk shall be twinned to this trunk to convey combined flows to the main lift station.

To the extreme east are two ¼ sections that are to be served by a Lift Station No. 4 with a 300 mm dia force main (102 L/s). This force main shall pump the sewage to the main lift station.

To the south of the main lift station are two ¼ sections that are to be served by a Lift Station No. 5 with a 300 mm dia force main (102 L/s). This force main shall pump the sewage to the main lift station.

At the main lift station, a 350 mm dia force main has been installed. A 750 mm dia force main shall need to be installed as a twin to the 350 mm dia force main to take the total flow of 786 L/s to the wastewater treatment plant.

5.5.1.2 West

Flow from three consecutive ¼ sections located north of the Trans-Canada highway flows by gravity to Lift Station No. 6. The 450 mm gravity sewer located east of Lift Station No. 6 carries one ¼ section of equivalent sewage flow from within the Town and half a ¼ section adjacent to the 450 mm gravity sewer. Lift Station No. 6 therefore carries four ¼ sections of equivalent sewage flow (192 L/s) via a 450 mm dia force main and discharges sewage to a manhole located at the starting point of the 750 mm gravity sewer that crosses under the Trans-Canada Highway.

5.5.1.3 South

The 750 mm dia gravity sewer has the potential of carrying sewage flow from five ¼ sections adjacent to it although the ¼ sections are not part of the annexation area. As this sewer approaches the waste water treatment plant, the 525 mm Orchard Business Park Upgrade connects to it and this extra flow coupled with flow restrictions necessitates an upsizing to a 900 mm dia gravity sewer taking a total flow of 568 L/s to the wastewater treatment plant.

5.5.1.4 Wastewater Treatment Plant Inlet Pipe

A peak flow of 1,355 L/s will be going into the wastewater treatment plant. A 750mm dia pipe at 1.5% slope with a full flow capacity of 1,363 L/s is required to convey this flow from the interceptor chamber and into the wastewater treatment plant.

5.5.2 Option 2

Refer to **Figure 5.5**. The description of the servicing has been split into the following areas.

5.5.2.1 North

The northern ¼ sections shall be served by two lift stations. Lift Station No. 2 shall have a 250 mm dia force main as it drains one and a half ¼ sections of sewage flow (78 L/s) and Lift Station No. 3 shall have a 150 mm dia force main as it only drains half a ¼ section of sewage flow (28 L/s).

The flow generated from two ¼ sections to the immediate west of Lift Station No. 3 shall be drained out of the north via 375 mm and 525 mm dia trunks with the flows running east while the flow generated from the remaining two ¼ sections shall be drained out of the north via a 450 mm dia trunk to Lift Station No. 1 which has a 375 mm dia force main. Lift Station No. 1 with a 375 mm dia force main shall pump three ¼ sections of equivalent sewage flow (148 L/s) to the 525 mm dia trunk leading to Lift Station No. 6.

5.5.2.2 East

Flow from two ¼ sections of the northern annexed areas will be conveyed via a 375 mm dia trunk to a 525 mm dia trunk that the Strathaven upgrade sanitary main shall be connected to. The Strathaven trunk shall divert one ¼ section of equivalent sewage flow into this eastern trunk. ¼ sections shall progressively connect to this eastern trunk increasing the flows and as it approaches the Trans-Canada Highway, the pipe size increases to a 675 mm dia trunk.

After the trunk crosses the Trans-Canada Highway, approximately one and a half ¼ sections shall connect to it and coupled with slope restrictions, the pipe size increases to a 750 mm dia trunk. This trunk then connects to a manhole serving an existing 675 mm trunk. A 675 mm trunk shall be twinned with this 675 mm trunk to convey combined flows to the main lift station.

To the extreme east are two ¼ sections that are to be served by a Lift Station No. 4 with a 300 mm dia force main (102 L/s). This force main shall pump sewage to the main lift station.

To the south of the main lift station are two ¼ sections that are to be served by a Lift Station No. 5 with a 300 mm dia force main (102 L/s). This force main shall pump sewage to the main lift station.

At the main lift station, a 350 mm dia force main has been installed. A 675 mm dia force main shall need to be installed as a twin to the 350 mm dia force main to take the total flow of 711 L/s to the wastewater treatment plant.

5.5.2.3 West

Flow from three consecutive ¼ sections located north of the Trans-Canada Highway flows by gravity to Lift Station No. 6. The 525 mm gravity sewer located east of Lift Station No. 6 carries three ¼ sections of equivalent sewage flow from Lift Station No. 1 and #2, one ¼ section of equivalent sewage flow from within the Town and half a ¼ section adjacent to the 525 mm gravity sewer.

Lift Station No. 6 therefore carries seven ¼ sections of equivalent sewage flow (319 L/s) via a 500 mm dia force main and discharges sewage to a manhole located at the starting point of the 750 mm gravity sewer that crosses under the Trans-Canada Highway.

5.5.2.4 South

The 750 mm dia gravity sewer has the potential of carrying sewage flow from five ¼ sections adjacent to it although the ¼ sections are not part of the annexation area. As this sewer approaches the waste water treatment plant, the 525 mm Orchard Business Park upgrade connects to it and this extra flow coupled with flow restrictions necessitates an upsizing to a 900 mm dia gravity sewer taking a total flow of 644 L/s to the wastewater treatment plant.

5.5.2.5 Wastewater Treatment Plant Inlet Pipe

A peak flow of 1,355 L/s will be going into the wastewater treatment plant. A 750mm dia pipe at 1.5% slope with a full flow capacity of 1,363 L/s is required to convey this flow from the interceptor chamber and into the wastewater treatment plant.

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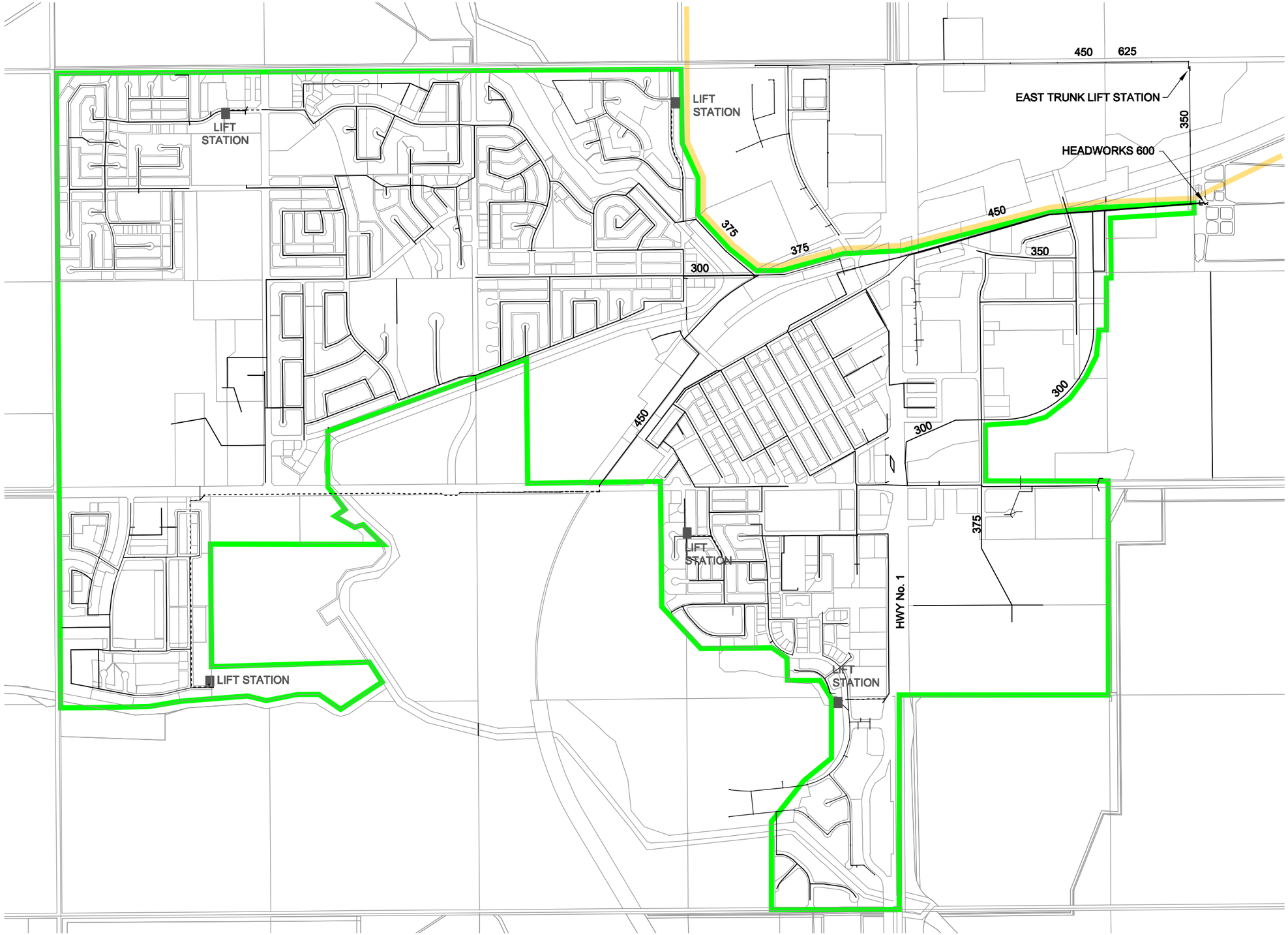

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Existing Sanitary East & Central Trunk Service Drainage

Figure 5.1

B SIZE 11" x 17" (279.4mm x 431.8mm)

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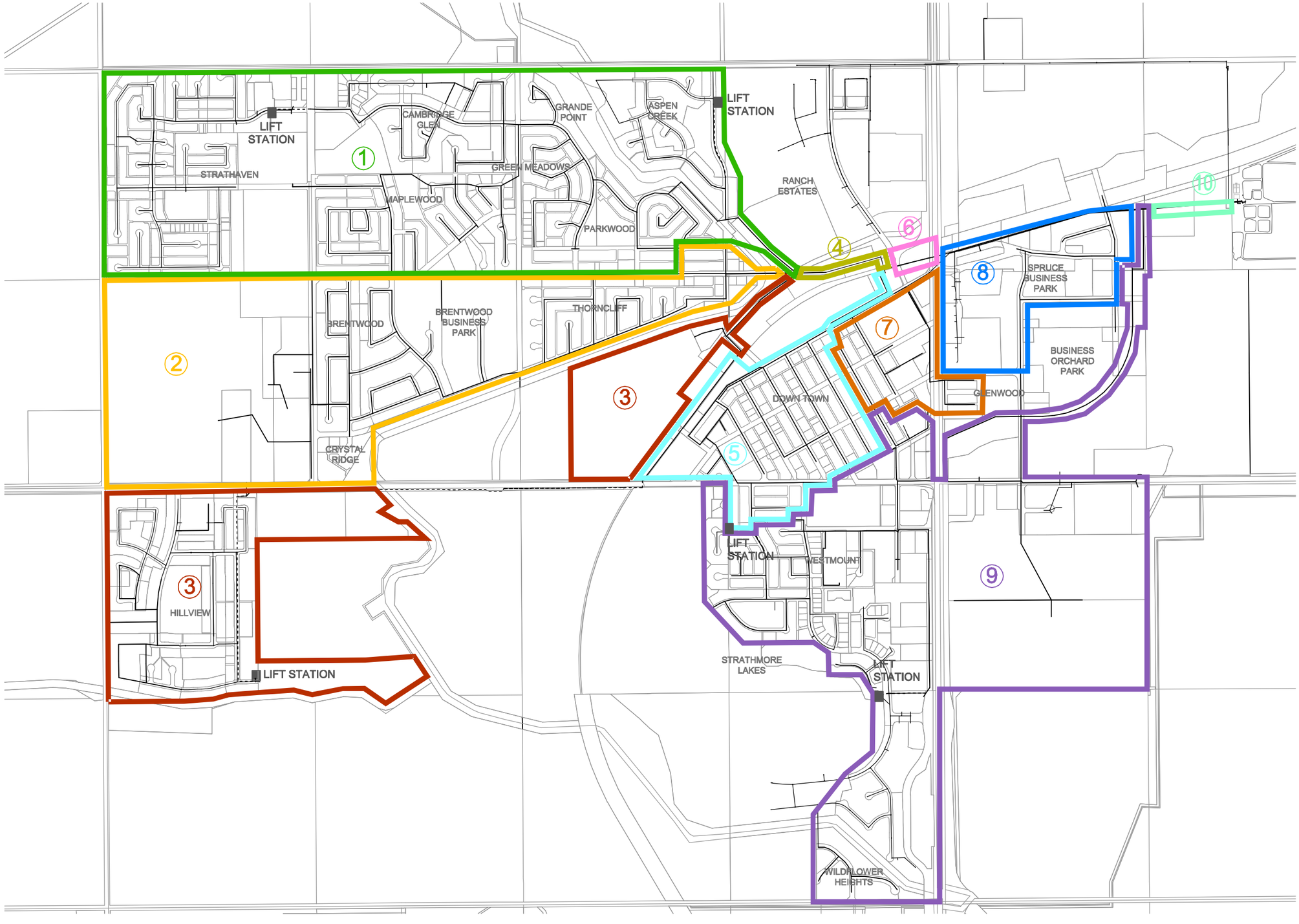

LEGEND

1. PARKWOOD TRUNK
2. THORNCLIFF TRUNK
3. LAKESIDE TRUNK
4. NORTH CENTER STREET TRUN
5. DOWNTOWN NORTH TRUNK
6. SOUTH CENTER STREET TRUN
7. DOWNTOWN SOUTH TRUNK
8. SPRUCE TRUNK
9. ORCHARD TRUNK
10. SLATER TRUNK

SCALE 1:15000

0 150 300

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Town of Strathmore
Master Servicing Study
Annexation 2006

Existing Sanitary Central Sub Trunk Drainage

Figure 5.2

B SIZE 11" x 17" (279.4mm x 431.8mm)

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UMA FILE NAME: 0105-076-00_01-C-F007_RX.dwg

LIFT STATION #3

ANNEXATION BOUNDARY

LIFT STATION #4

EXISTING TOWN BOUNDARY

LIFT STATION #5

HWY No. 1

EX MAIN LIFT STATION

LAGOON

CAMBRIDGE GLEN

GRANDE POINT

ASPEN CREEK

STRATHAVEN

GREEN MEADOWS

MAPLEWOOD

PARKWOOD

RANCH ESTATES

BRENTWOOD BUSINESS PARK

BRENTWOOD

THORNCLIFF

SPRUCE BUSINESS PARK

ORCHARD BUSINESS PARK

DOWN TOWN

GLENWOOD

WESTPARK VILLAGE

CRYSTAL RIDGE

LIFT STATION #2

HILLVIEW

WESTMOUNT

STRATHMORE LAKES

WILDFLOWER HEIGHTS

LIFT STATION #1

LIFT STATION #6

TOWNSHIP 24

TOWNSHIP 23

LEGEND:

- PROPOSED SANITARY SEWER
- PROPOSED FORCEMAIN
- EXISTING TOWN BOUNDARY
- ANNEXATION BOUNDARY
- TRUNK DRAINAGE BOUNDARY
- LIFT STATION BOUNDARY

SCALE 1:25000

0 250 500

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Town of Strathmore
Master Servicing Study
Annexation 2006

Proposed Sanitary Trunk Drainage

Figure 5.3

B SIZE 11" x 17" (279.4mm x 431.8mm)

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UMA FILE NAME: 0105-076-00_01-C-F003_RX.dwg Saved By: ecatton

LIFT STATION #3
150Ø FORCEMAIN
ANNEXATION BOUNDARY
HWY No. 1
LIFT STATION #4
EXISTING TOWN BOUNDARY
300Ø FORCEMAIN
LIFT STATION #5
MAIN LIFT STATION
LIFT STATION #2
LIFT STATION #1
LIFT STATION #6
250Ø FORCEMAIN
400Ø FORCEMAIN
700Ø FORCEMAIN
EX 350Ø FORCEMAIN
EX 450Ø SAN
525 Ø @ 0.4%
600 Ø @ 0.3%
600 Ø @ 1.0%
750 Ø @ 0.2%
300 Ø @ 0.9%
375 Ø @ 0.4%
STRATHAVEN UPGRADE
300 Ø @ 0.4%
ASPEN CREEK
UPGRADE
375 Ø @ 0.8%
TIE INTO EXISTING
900 Ø @ 0.2%
750Ø @ 0.2%
675Ø @ 0.2%
300 Ø @ 0.6%
300 Ø @ 0.8%
375 Ø @ 0.24%
300 Ø FORCEMAIN
525 Ø @ 0.3%
450 Ø @ 0.3%
900 Ø @ 0.1%
THOMAS PLACE UPGRADE
REPLACE 250Ø WITH 300Ø
OF THE SAME SLOPE
ORCHARD BUSINESS
PARK UPGRADE
525 Ø @ 0.2%
GOLF COURSE
450Ø @ 0.2%
STRATHMORE
LAKES UPGRADE
150Ø FORCEMAIN
750 Ø @ 0.2%
450 Ø @ 0.2%
375 Ø
@ 0.4%
300 Ø
@ 0.8%
300 Ø @ 0.6%
300 Ø @ 0.4%
TOWNSHIP 24
TOWNSHIP 23
CAMBRIDGE GLEN
GRANDE POINT
ASPEN CREEK
STRATHAVEN
GREEN MEADOWS
MAPLEWOOD
PARKWOOD
RANCH ESTATES
BRENTWOOD BUSINESS PARK
BRENTWOOD
THORNCLIFF
CRYSTAL RIDGE
WESTPARK VILLAGE
DOWN TOWN
SPRUCE BUSINESS PARK
ORCHARD BUSINESS PARK
GLENWOOD
LAGOON
HILLVIEW
WESTMOUNT
STRATHMORE LAKES
WILDFLOWER HEIGHTS
24
25
26
27
28
13
2
3
9

LEGEND:

- PROPOSED SANITARY SEWER
- PROPOSED FORCEMAIN
- EXISTING TOWN BOUNDARY
- ANNEXATION BOUNDARY
- EXISTING GRAVITY SEWER
- EXISTING FORCEMAIN

SCALE 1:25000

0 250 500

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Town of Strathmore
Master Servicing Study
Annexation 2006

Option 1

Figure 5.4

B SIZE 11" x 17" (279.4mm x 431.8mm)

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LIFT STATION #3
150Ø FORCEMAIN
525 Ø @ 0.2%
600 Ø @ 0.2%
600 Ø @ 0.25%
600 Ø @ 1.0%
675 Ø @ 0.2%
ANNEXATION BOUNDARY
HWY No. 1
300 Ø @ 0.9%
375 Ø @ 0.4%
LIFT STATION #4
EXISTING TOWN BOUNDARY
300Ø FORCEMAIN
750 Ø @ 0.2%
750 Ø @ 0.25%
2 x 675Ø @ 0.2%
ASPEN CREEK UPGRADE
375 Ø @ 0.8%
TIE INTO EXISTING
STRATHAVEN UPGRADE
300 Ø @ 0.4%
300 Ø @ 0.6%
300 Ø @ 0.8%
300 Ø @ 0.8%
375 Ø @ 0.24%
LIFT STATION #5
MAIN LIFT STATION
EX 350Ø FORCEMAIN
650Ø FORCEMAIN
300 Ø FORCEMAIN
LAGOON
375 Ø @ 0.4%
STRATHAVEN
CAMBRIDGE GLEN
GRANDE POINT
ASPEN CREEK
GREEN MEADOWS
MAPLEWOOD
PARKWOOD
RANCH ESTATES
TIE INTO EXISTING
SPRUCE BUSINESS PARK
BUSINESS ORCHARD PARK
GLENWOOD
900 Ø @ 0.15%
525 Ø @ 0.2%
BRENTWOOD BUSINESS PARK
BRENTWOOD
THORNCLIFF
DOWN TOWN
THOMAS PLACE UPGRADE
REPLACE 250Ø WITH 300Ø
OF THE SAME SLOPE
WESTPARK VILLAGE
CRYSTAL RIDGE
LIFT STATION #2
250Ø FORCEMAIN
450 Ø @ 0.3%
HILLVIEW
WESTMOUNT
STRATHMORE LAKES
STRATHMORE LAKES UPGRADE
150Ø FORCEMAIN
750 Ø @ 0.2%
GOLF COURSE
450Ø @ 0.2%
450 Ø @ 0.3%
FORCEMAIN
LIFT STATION #1
WILDFLOWER HEIGHTS
525Ø @ 0.25%
500Ø FORCEMAIN
375 Ø @ 0.4%
300 Ø @ 0.8%
300 Ø @ 0.6%
LIFT STATION #6
500Ø FORCEMAIN
SCALE 1:25000
0 250 500
TOWNSHIP 24
TOWNSHIP 23
24
25
26
27
28
13
2
3
9
1

LEGEND:
- PROPOSED SANITARY SEWE
- PROPOSED FORCEMAIN
- EXISTING TOWN BOUNDARY
- ANNEXATION BOUNDARY
- EXISTING GRAVITY SEWER
- EXISTING FORCEMAIN

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Town of Strathmore
Master Servicing Study
Annexation 2006

Option 2

Figure 5.5

6.0 Stormwater Management – Master Drainage Plan

6.1 Background and Introduction

The underlying criteria for the Stormwater Master Drainage Plan for the Town of Strathmore is provided by the Western Irrigation District (WID) in that the maximum allowable release rate to Eagle Lake Ditch is 1400 L/s (50 ft3/s), and the maximum allowable release rate to the WID Main 'A' Canal is also 1400 L/s (50 ft^3/s). Currently, the Town is meeting neither of these allowable release rates; the existing release rates are higher.

In 2002, UMA was engaged to provide a Master Drainage Plan update for the Town. The report evaluated the existing stormwater management plan and provided servicing requirements for the Town up to the year 2020.

The primary objectives of the 2006 Master Drainage Plan are to assess the capacity, water quality and other related stormwater issues of the existing storm system, to highlight current hydraulic concerns, and to provide stormwater management objectives to guide future development in the Town of Strathmore up to the year 2037 while meeting the criteria of the maximum allowable release rates to both the Eagle Lake Ditch and the WID Canal. A review of the previous report and all development permit applications received from the Town was conducted and as well as a review of the existing infrastructure in the Town. A survey was also conducted in the WID Canal to obtain missing invert and size information for the outfalls from the Town lands. The survey was not able to acquire any of this information as the outfalls could not be found due to overgrowth. In absence of the survey, assumptions were made as to the inverts by using the existing contours and the sizes of the outfalls were assumed.

This Master Drainage Plan provides an understanding of how the Town's stormwater network operates, and the impact development will have on the existing infrastructure. It is to be used as a planning document to provide a framework for future development, as well as provide an overview of the proposed system to meet the current stormwater objectives of the Town, the WID, and AENV. The report also outlines order-of-magnitude cost estimates for various upgrading recommendations for the overall system to improve treatment and reduce flooding downstream of the Town.

Generally, an urban drainage system is divided into two components, the minor system and the major system, which is often referred to as the "dual" drainage system. The minor system consists of local underground storm mains and trunk mains, designed to carry away water from frequent rainfall events, while the major system consists of overland flow paths designed to manage stormwater flows from major rainfall events. The Town of Strathmore's minor system uses a 1:5 year storm event, while the major system is designed to manage a 1:100 year event.

Further to the "dual" drainage concept within the watershed, it is desirable to limit the allowable discharge rate from the drainage basin to the receiving water body. According to the AE Storm Water Management Guidelines, 1999, the post-development discharge rate should equal the pre-development rate. Best Management Practice (BMP) should be incorporated in the drainage system to improve the quality of the storm effluent prior to discharging into adjacent streams. The BMP will be designed to current guidelines and standards at the time of development. The control of the stormwater quantity, as well as quality, is necessary in order to minimize the ecological changes downstream of the urbanized area.

According to the AE Storm Water Management Guidelines, 1999, it is necessary to detain the difference between the post- and pre-development runoff on-site.

As stated in the guidelines, "… the level of analysis and the effort to design facilities to transport major system flows must balance the relatively infrequent occurrence of such events and the seriousness of the damage they cause.'

6.2 Upgrades to the Stormwater System

Since the *2002 Master Drainage Plan* report was completed, there have been numerous upgrades to the Town's existing infrastructure. The following is a list of the significant changes that have occurred:

- Construction of Pond 6 to a volume of approximately 103,000 m^3. The pond includes a forebay and a dry pond.
- Partial Construction of Eagle Lake Ditch, starting from TWP 240 to Eagle Lake, this is approximately 2900 m in length
- Construction of Strathmore Lake, currently there is no existing release from the pond into the existing Town system
- Construction of the Hillview Subdivision Stormwater System, including a pipe and pond system with release to the WID North 'A' Canal.
- Construction of the south section of Pond 4, due to the development of the Ranch Market lands. The north section of Pond 4 is still a ditch with an 1800 mm dia pipe releasing to the south section which is a wet pond with two pipes allowing discharge south under the Trans Canada Highway (TCH).

All of these upgrades mentioned were taken into account when assessing the existing Town stormwater system.

6.3 Study Area Description

6.3.1 General

The topography of the Town is generally flat with a maximum elevation difference of 27 m generally sloping from north to southeast. The Town is bisected by the TCH and by the main irrigation canal owned and maintained by the WID. Overland drainage currently passes through a series of existing ponds within the Town boundary, crosses under the TCH on the east side of Town and discharges to Eagle Lake, approximately 5 km southeast of Strathmore via Eagle Lake Ditch **(see Figure 6.1).**

The study area includes the Town and the annexation lands. The total area is 2,477 hectares (ha). This includes 1,566 ha contained within the existing Town (not including WID land) boundary.

6.3.2 Existing Catchment Conditions

For the purpose of this study, the area within the existing Town catchment (1,566 ha) was divided into 65 catchments (Catchment 1 - 39 and 50 - 75). Descriptions of each catchment, including the status of current development, land use, and the existing storm system is presented below. The existing catchments in the annexation areas are discussed in Section 6.3.3 and total an area of 829 ha. The remaining 82 ha of the study area is occupied by the WID Canal. The catchments are separated by subdivision names or area numbers and can be seen in **Figure 6.2**. The catchments, with the exception of the catchments discharging to the WID Canal and the areas around the Trans Canada Highway, were divided into regions. Discussion of proposed stormwater release rates for each of these catchments is included in Section 6.8.

6.3.2.1 Trans-Canada Highway (Catchments 10, 24 & 31)

- Catchment 10 is currently undeveloped in southwest Strathmore and has an area of 14.0 ha. It is situated between the TCH to the north, and the 'B' leg of the WID Canal to the south. The average gradient of the site is 1%, sloping from an elevation of 980 m in the south to 978 m in the north. Overland flow from this area discharges through a culvert under the TCH and drains towards Strathmore Lake in Catchment 14. (A short length of the canal has recently been diverted for development purposes.)
- Catchment 24 is a commercial catchment alongside the TCH. It has an area of 9.5 ha and drains overland to Pond 4. The site slopes from 977 m in the west to 970 m alongside Pond 4.
- The TCH bisects Catchment 31, which has an area of 6.5 ha; it slopes from 969 m in the west to 965 m in the east. It flows overland to Area 32.

6.3.2.2 Western Irrigation District (Catchments 50, 51, 52, 53, 55, 59, 60, 61, 69)

- Catchment 50 is bordered by Wildflower Heights (Catchment 13) to the south, and the WID Canal to the east, this undeveloped 15.5 ha area currently discharges to the WID Canal.
- Catchment 51 & 52 border either side of the WID Canal in the west part of Strathmore. Catchment 51 is 9.4 ha and Catchment 52 is 15.7 ha. The overland drainage from both catchments discharges into the WID Canal.
- Catchment 53 has an area of 36.6 ha and is located on the west side of Strathmore. It is currently undeveloped and discharges to a secondary leg of the WID Canal and heads west away from the Town.
- In the northwest part of Strathmore, Catchment 55 with an area of 10.7 ha currently discharges to the WID Canal. The catchment is treed along its west boundary and the remainder of the catchment comprises the Strathmore Golf Course.
- Catchment 59 has an area of approximately 22.5 ha it includes the southwest half of the rodeo grounds. The catchment drains toward the southwest.
- Approximately 15.0 ha in size, Catchment 60 is situated along the north side of Brentwood Boulevard. The site contains a sports arena and a high school. Drainage from this catchment flows toward the southwest corner where it meets with flows from Catchment 59. A series of small culverts convey flows south through to Catchment 61 into the WID Canal.
- Catchment 61 contains a commercial area (Crystal Ridge) at the corner of Wheatland Trail and Brent Boulevard. This 3.4 ha site drains southwest into the WID Canal.
- Catchment 69 has an area of 2.9 ha it lies along the Town's eastern boundary and discharges into a branch of the WID Canal.

6.3.2.3 Northwest Strathmore (Catchments 11, 12, 13, 14, 15, 16, 17, 18, 36, 54, 56, 57, 58, 72)

Hillview (Catchment 54)

This catchment is the new development of Hillview, and is a residential subdivision under construction. The catchment area is 46.5 ha and contains many small stormwater detention ponds. The site discharges at a restricted release rate (5 ft^3/s – 142 L/s) into the irrigation canal along the catchments' west boundary, as per an agreement with the WID.

Strathmore Golf Club (Catchment 18, 56, 57 & 58)

Catchment 18 is located in the southern part of the Strathmore Golf Course. It has an approximate area of 59.2 ha. An existing pond constitutes 20% of the catchment area. Stormwater flows from other catchments do not directly enter the pond, but enter and exit the subcatchment in its southeast corner. The water from the pond is utilized for irrigation of the golf course. The pond is filled intermittently by water from the WID canal and acts as a balancing pond for the downstream culvert.

The following areas comprise the northern part of the Strathmore Golf Course. Catchments 56, 57, and 58 are 15.6 ha, 2.3 ha, and 20.5 ha respectively. The above catchments discharge south to the WID canal.

Wildflower Heights (Catchment 13)

This triangular catchment of approximately 5.4 ha is located along the Town's western boundary. The catchment has been developed into a residential subdivision named Wildflower Heights. The land slopes from 987 m in the southwest to 981 m in the northeast, and is bounded by the WID canal along the east edge and the Town boundary to the west. Stormwater flows are conveyed overland towards the northeast corner, where they are piped below the WID canal into Strathmore Lake (Catchment 14).

Strathmore Lakes (Catchment 11, 12 & 14)

Catchment 11 is on the western edge of the highway commercial area, which fronts West Ridge Road and the TCH. Only 0.5 ha of the total 11.6 ha catchment is serviced by a storm sewer. The rest of the storm flows are conveyed overland toward Strathmore Lake. This catchment gently slopes from 979 m in the east to 977 m in the west.

The existing Strathmore Lake residential subdivision and its current undeveloped surroundings are included in Catchment 14 and Catchment 12 and have areas of 61.5 ha and 10.4 ha respectively. Catchment 12 has an average gradient of 1% across the site, and ranges from 981 m in the east to 977 m in the west. The area is not serviced by a storm sewer system.

Strathmore Lake was constructed with no discharge into the Town stormwater system. When the pond reaches the HWL, a portable pump is used to discharge the flow into catchment 15.

Strathmore Lakes (North) (Catchment 15 & 17)

Catchment 15 is currently undeveloped and has an approximate area of 19.6 ha. It lies between the Canadian Pacific (CP) railway right-of-way (ROW) to the north and Strathmore Lake to the south. An unnamed body of water accounts for approximately 10% of the catchment area on the north boundary. The catchment slopes from 980 m in the south to 974 m in the north. Catchment 15 flows east overland to Catchment 17, which is a low-lying 18.0 ha undeveloped site that is bound by the old CP ROW to the north. The land is partially covered by small ponds and has a gentle slope from 974 m in the south to 972 m in the north. Catchment 17 picks up overland flow from Catchment 15 and piped flow from Catchment 16 (Westmount), and then discharges to Catchment 18 via an existing culvert under the old railway berm.

Westmount (Catchment 16 & 36)

Catchment 16 contains the existing Westmount residential subdivision, which is serviced by a storm sewer discharging to an unnamed water body in Catchment 17. The catchment totals 19.0 ha and ranges in elevation from 977 m in the south to 972 m in the north.

Catchment 36 is located in the south part of Westmount and contains Westmount School, the Town offices, Public Works, and the RCMP headquarters. Catchment 36 is 36.1 ha and slopes from 978 m in

the north to 975 m in the south. The area is serviced by storm sewers which direct flows south below the TCH into a pond in Catchment 37.

Catchment 72

This catchment has an area of 63.7 ha. It slopes from 973 m in the southeast to 963 m in the northwest. It currently discharges to an unnamed watercourse and then into the Red Deer River.

6.3.2.4 Northeast Strathmore (Catchments 1, 2, 3, 4, 5, 6, 7, 8, 9, 19, 20, 21, 22, 23, 25, 30, 64, 65, 66, 67, 68)

Strathaven (Catchment 1, 3, 66 & 67)

Catchment 1 and Catchment 3 comprise the Strathaven residential subdivision and have areas of 24.5 ha and 3.2 ha respectively. The land slopes gradually from 978 m in the northeast to 977 m in the southwest. Catchment 3 includes a dry pond, which captures stormwater from Catchments 1 and 2. The discharge from the dry pond is pumped to a manhole in Catchment 6.

Catchments 66 & 67 form the east half of the Strathaven Subdivision and have areas of 23.2 ha and 7.2 ha respectively. Both of the catchments discharge east via a culvert toward a permanent water body located outside the Town boundary referred to as Freeman Slough.

Rodeo Grounds (Catchment 2)

This catchment is located in the northeast half of the rodeo grounds and covers approximately 28.1 ha. The land drains from a high area of 985 m in the northwest corner to 980 m in the southeast. Stormwater flows from this catchment drain into Catchment 3's dry pond.

Hospital (Catchment 4 & 5)

Catchment 4 is a small area of approximately 3.7 ha and currently contains an ambulance station. As this is a local low point, stormwater is stored on private property, and eventually evaporates or overflows to Catchment 5.

A hospital and its grounds currently occupy the 6.4 ha of Catchment 5 which is bound by Brentwood Boulevard to the south and Strathford Boulevard to the east. The hospital building is situated in the western half of the catchment, and hospital grounds are located to the east. The southeast corner of the catchment is a local low point, which captures excess runoff from the north portion of the catchment. In the basement of the hospital, groundwater from underneath the parking area is pumped to a manhole in Catchment 5.

Brentwood (Catchment 19)

Catchment 19 has a total area of 42.0 ha and is bound by the WID canal to the west. The catchment contains the fully developed Brentwood Subdivision, which is a mix of residential and commercial land uses including Brentwood Business Park. The subdivision is serviced by storm sewers, which discharge through twin culverts under the WID canal into Pond 1 located in Catchment 20. Catchment 19 has elevations ranging from 981 m in the east to 976 m in the west.

Maplewood (Catchment 6)

This catchment is approximately 32.4 ha and consists of an older developed residential neighbourhood. The catchment is serviced by storm sewers, which discharge to the trunk sewer in Catchment 8. The land slopes from 979 m in the north to 976 m in the south.

Cambridge Glen (Catchment 7)

This catchment contains an existing residential development, and is approximately 32.1 ha in area. The catchment is serviced by a storm sewer, which discharges to the trunk sewer in Catchment 8. The area has a gentle gradient, from 979 m in the north to 976 m in the south.

Green Meadows & Grande Point (Catchment 8)

The existing residential subdivisions of Green Meadows and Grande Point make up the majority of catchment 8. Catchment 8 also includes a portion of the Parkwood subdivision. The catchment totals approximately 37.7 ha and is serviced by storm sewers. The land slopes from 980 m in the north to 975 m in the south.

Parkwood (Catchment 8, 64, 65)

Catchment 8 consists of the existing residential subdivision of Parkwood and is bound by the WID canal to the south.

The southwest portion of Parkwood Subdivision is comprised of Catchments 64 and 65 with areas of 2.0 ha and 1.3 ha respectively. Neither area is serviced by storm sewers. Drainage is conveyed overland southwards into the WID canal.

Thorncliff (Catchment 62 & 63)

These catchments comprise the Thorncliff residential subdivision. Catchment 62 and 63 have areas of 12.5 ha and 3.3 ha. Each catchment is serviced by storm sewers, which discharge into the WID canal.

Ponds 1 and 2 (Catchment 20, 21 & 22)

Catchment 20 has an area of 25.2 ha and includes Pond 1, which occupies nearly 50% of the total area. The Town of Strathmore owns the land north of the quarter section line while the remainder of the land is privately owned. Pond 1 lies on both of the properties north and south of the section line. The Town and the landowner reached an agreement to allow a maximum flood elevation in Pond 1 for stormwater purposes.

Catchment 21 is the north part of the downtown area. This 18.9 ha site is used for residential (Westpark Village), semi-institutional (seniors housing), and community purposes (community centre). The catchment is relatively steep, ranging in elevation from 977 m in the southwest to 972 m in the northeast.

Catchment 22 has an area of 23.5 ha and contains Pond 2, which occupies approximately 15% of the mostly flat site. Stormwater flows enter catchment 22 from Pond 1 in the north and from Catchment 21 in the southwest via the old railway ROW in the northeast part of catchment 21. Discharge from Pond 2 is via a culvert toward Pond 3 in Catchment 23.

Aspen Creek (Catchment 9 & 68)

Catchment 9 & Catchment 68 have areas of 10.0 ha and 14.6 ha respectively and consist of the partially developed Aspen Creek residential subdivision.

Catchment 68 is the eastern portion of the subdivision. This catchment currently discharges to Ranch Market (catchment 30) at a controlled rate of 198 L/s.

Catchment 9 is the western portion of Aspen Creek and is serviced by a relatively new storm sewer. There is a slight elevation change when moving across the site from the east (974 m) to the west (972 m). The storm sewer connects directly into the storm trunk from Catchment 8, which outfalls into Pond 4 in Catchment 25.

Pond 4 & Ranch Estates (Catchment 25)

This catchment consists of approximately half of the Ranch Estates Mobile Park and has an area of 9.3 ha. The mobile park flows to Pond 4, which receives flow from Pond 3 as well as from the main trunk sewer from northeast Strathmore. Pond 4 has been divided into two sections due to the construction of a new road for the Ranch Market development. The north section of Pond 4 is a long, narrow, and steep-sided valley, 4 m deep and does not have a permanent pool of water, the flow discharges through an existing 1800 mm dia pipe to the south section of the pond that is a wet pond. Discharge from Pond 4 is through twin culverts below the TCH at the south end of the site. These culverts discharge to Catchment 27.

Ranch Market (Catchment 30)

Located north of the TCH on the east side of Strathmore, this 41.5 ha site is partially developed. The existing development includes a Wal-Mart and the remaining half of the Ranch Estates Mobile Home Park, which occupies the northwest of the catchment. The catchment slopes from 970 m in the north to 965 m in the south. Some of the flow is conveyed through a partially constructed pipe system and the rest of the flow is overland toward Pond 4. This area also received flow from Aspen Creek at a controlled peak rate of 198 L/s.

Pond 3 & Downtown (Catchment 23)

This area of 32.5 ha includes the downtown core of Strathmore and Pond 3, otherwise known as Kinsmen Lake. Stormwater flows down the streets toward Lakeside Boulevard, where it flows into a pipe system and outfalls into Pond 3. The catchment slopes from 977 m in the southwest to 970 m at Lakeside Boulevard in the northeast portion. Pond 3's normal water level is 969 m and it receives flow from Pond 2. Discharge from Pond 3 is via a culvert to Pond 4 in Catchment 25.

6.3.2.5 South Strathmore (Catchments 26, 27, 28, 29, 37, 38, 39, 74, 75)

Canal Crossing & Glenwood (Catchment 37)

This largely undeveloped area totals 39.6 ha and fronts onto the south side of the TCH. The catchment contains a small residential subdivision of Glenwood (2.2 ha), public offices and a storm pond. The site slopes from 978 m in the west to 974 m at the pond in the east. The pond itself is long and narrow with steep sides and a permanent water level of 971 m. It captures flows from Catchment 36 to the north and discharges through a culvert toward Catchment 38 to the south.

Pond 5 & Pine Road Commercial Park (Catchment 26 & 27)

Catchment 26 is 13.0 ha strip of land zoned highway commercial which is partially developed. The catchment has a constant slope of 1 % from 977 m in the west to Pond 5.

Pond 5 and its surroundings is situated on a steep 6.5 ha site within Catchment 27. Pond 5 is a dry pond with the upper portion of the Eagle Lake Ditch flowing through it. Pond outflows are controlled by a weir at the south end of the pond, which is currently not operational.

Orchard Business Park (Catchment 38 & 39)

Catchment 38 (36.2 ha) is only partially developed by the business park in the northeast corner. The west half of the area is low-lying, where the groundwater is usually near or at the surface, but without forming a permanent body of water. The area receives stormwater from the pond in Catchment 37 to the north, and Catchment 38 has a small weir along its southern boundary. The Business Park at 980 m is the highest part of the catchment. The remainder of the site slopes from 971 m in the north to 965 m in the south. The WID has installed an inverted siphon along the catchment's southern boundary to convey irrigation water from the canal in Catchment 37 to the east side of Catchment 38.

Catchment 39 is currently undeveloped with an area of 31.7 ha situated along the Town's southern boundary. Most of the catchment area consists of the floodplain of an unnamed watercourse, which originates in Catchment 36. The ground slopes from 964 m in the north to 960 m in the south

Spruce Business Park (Catchment 28)

Catchment 28 includes the Spruce Business Park, which consists mainly of highway commercial and light industrial businesses. This catchment area of 19.7 ha is partially serviced by storm sewers. Runoff from the majority of the catchment area is conveyed overland toward Catchment 29. The site is relatively steep, sloping from 976 m in the west to 966 m in the east.

Catchment 74

Catchment 74 (33.0 ha) currently discharges into an unnamed watercourse. It is undeveloped and slopes from 980 m in the north to 971 m at the south boundary.

Wastewater Treatment Plant (Catchment 75)

Catchment 75 has an area of 31.5 ha which has no discharge and includes the Town of Strathmore Wastewater Treatment Plant.

Pond 6 (Catchment 29)

This 51.9 ha undeveloped area alongside the old CP right of way receives drainage from Catchment 1 to 28 and contains Eagle Lake Ditch. Pond 6 has been constructed with a forebay and a dry pond. The discharge from the pond is via two control structures, one an R70 ICD for release into Eagle Lake Ditch by the Town and the other is a manhole with a gate for irrigation purposes to be used by the WID.

6.3.2.6 Other Areas (Catchment 32, 33, 34, 35, 71, 73)

- ***Catchment 32*** has an area of 26.8 ha which is undeveloped land and is located to the south of the TCH. The catchment slopes from 964 m in the north to 959 m in the south. Storm flows enter this area from Catchments 30 and 31 to the north, and discharge toward Catchment 33 to the south.
- ***Catchment 33*** (10.9 ha) is undeveloped and captures flows from Catchments 31 to 32. The land slopes from 959 m in the north to 953 m in the south. Stormwater discharge is via Eagle Lake drainage course.
- ***Catchment 34*** is a large 119.4 ha, undeveloped tract of land along the Town's eastern boundary. The land was used as an irrigation area for the disposal of treated effluent from the Town's old wastewater lagoons. Stormwater flows are conveyed overland to the south, discharging into Eagle Lake Ditch along the southwest boundary. The ground slopes from 966 m in the north to 946 m in the south.
- ***Catchment 35*** is a 15.3 ha agricultural area located in the southeast corner of the Town. The catchment drainage is conveyed overland to the south and discharges into Eagle Lake Ditch along the southeast boundary. The ground slopes from 946 m in the north to 942 m in the south.

- *Catchment 71* has an area of 8.4 ha. The undeveloped area contains the old CP right of way and is located adjacent to the Town of Strathmore Wastewater Treatment Plant.
- *Catchment 73* discharges to an unnamed watercourse on the east side of Strathmore. Catchment 73 slopes from 967 m in the northwest to 944 m in the southeast. It is currently undeveloped and has an area of 115.4 ha.

6.3.3 Existing Conditions in Annexation Areas

The catchment areas below are shown on **Figure 6.2**.

6.3.3.1 Red Deer River Catchments

Table 6.1: Red Deer River Catchments

Area References	Area (Ha)	Length (m)	Slope (%)	Pre-Development 1:100 yr Flows (m^3/s)
R1	96.80	1450	0.8	1.020
R2	29.85	380	1.5	0.687
X3	23.54	840	1.5	0.371

- *R1* lies on the west edge of the Town and is part of the Red Deer River catchment. Flow runs overland to the north and enters a defined, but unnamed channel on the north edge of the catchment.
- *R2* lies on the northwest corner of town on the north edge of the reservoir. Flows from this catchment enter the south ditch of Twp Rd 244 before joining flows from area R1.
- *X3* is the raw water reservoir, located in the northwest of the Town. It is unlikely to be used for anything else in the near future, and as such does not discharge any significant amount of water offsite. If the reservoir were relocated, this catchment would discharge overland towards area R2 when developed.

6.3.3.2 WID Canal Catchments

Table 6.2: WID Canal Catchments

Area References	Area (Ha)	Length (m)	Slope (%)	Pre-Development 1:100 yr Flows (m^3/s)
W1	42.58	800	1.3	0.663
W2	20.03	350	2.6	0.550
W3	36.40	490	2.0	0.798
W4	109.91	780	1.5	1.376
W5	77.08	1150	0.3	0.705
W6	29.54	760	1.1	0.453
W7	36.33	900	0.4	0.402
W8	62.49	710	3.1	1.274
X1	19.59	500	2.0	0.425
X2	12.26	420	1.2	0.257

- *W1* lies between TCH and the old CPR right-of-way on the west side of the Town. Overland flow is directed towards the CPR line and north to area W2.
- *W2* lies north of the CPR line and south of the ‘A” branch of the WID canal. This area accepts flow from area W1 and discharges via overland flow into the WID canal.

- ***W3*** is located on the north Town boundary and has North 'A' branch of the WID canal as its west boundary. Twp Rd 244 forms the south boundary. The area drains west into the canal.
- ***W4*** is located on the north Town boundary and drains north across open land to the North 'A' branch of the WID canal. Twp Rd 244 forms the south boundary of this catchment.
- ***W5*** is located in the northeast corner of the Town and discharges overland towards a Freeman slough in area W7. This catchment is bisected by Twp Rd 244 and Rge Rd 251.
- ***W6*** lies in the northeast corner and discharges north into the North 'A' branch of the WID canal. Rge Rd 251 forms the west boundary.
- ***W7*** lies on the east edge of the Town and has a depression that contains water intermittently. This area has Rge Rd 251 as its west boundary, and it takes flow from area W6 and a small amount of the existing Town development. Discharge from this area is south toward area W8.
- ***W8*** lies on the WID canal 'A' branch on the east Town boundary. It accepts flow from W7 and discharges overland into the canal.
- ***X1*** and ***X2*** are located along the west Town boundary. X1 is a feedlot and is unlikely to be developed in the near future. Any discharge from this site flows north to area X2. X2 is currently undeveloped. Flow from these catchments discharge into the 'A' branch of the WID.

6.3.3.3 South East Annexation Area

Table 6.3: Southeast Annexation Area Catchments

Area References	Area (Ha)	Length (m)	Slope (%)	Pre-Development 1:100 yr Flows (m^3/s)
E1	165.67	1770	0.8	1.563
E2	64.72	850	1.1	0.940

- ***E1 & E2*** lie outside the eastern Town boundary. Area E1 discharges south below the Trans-Canada Highway into E2. Flows from E1 and E2 discharge into an unnamed watercourse (intermittent) toward Eagle Lake.

Figure 6.3 shows the existing drainage areas for the entire study area as related to their receiving water body.

6.4 Design Criteria

All Stormwater Management design was based on current City of Calgary and AENV guidelines that the Town of Strathmore has adopted.

6.4.1 Criteria for Non-Developable Areas

A review of the study area resulted in the definition of non-developable areas based on the following criteria: slope setbacks, creek setbacks, floodplains, utility right-of-ways and environmentally sensitive areas.

6.4.2 Land Use and Density of Developments

In accordance with the Municipal Development Plan, the developable areas are generally designated as Urban Reserve (UR) or General Agriculture (GA). Densities have been chosen for a mix of residential and commercial/industrial land use. A density of 42 persons/ha has been provided by the Town for residential use and 35 persons/ha for commercial/industrial land use. These values were used to

determine populations for the study area. This population density criterion was used to calculate percent imperviousness for the Town lands.

6.4.3 General Storm Drainage Design

In general, streets in developed areas are used to convey the overland (major) stormwater flows. To facilitate this option, a series of recommendations should be adhered to:

- Maximum ponding depth of local trapped lows should be within the limits recommended by Alberta Environment;
- Roof-leaders should not be connected to the minor system;
- A sump pump system should be implemented for foundation drain or weeping tile in areas where gravity connection to a piped storm sewer is not feasible. It is noted that the Town does not allow new weeping tile connections to sanitary sewers; and
- To minimize flooding downstream of the system, an inlet control device (ICD) should be considered at catch basins to control the inflow to the minor system.

Stormwater calculations performed in this study were based on a total average imperviousness of 40 percent. For areas such as industrial/commercial and high density residential development where impervious areas are higher, on-site detention with local restricted outflow to the main is recommended.

During detailed design, proposed drainage courses and facilities should be protected with registered easements. Geotechnical investigations are necessary to confirm the suitability of pond construction at proposed locations.

Best Management Practice (BMP) should be incorporated in the drainage system to improve the quality of the storm effluent prior to discharging into adjacent streams. The BMP will be to current guidelines and standards at the time of development. Current guidelines state a requirement of 85% removal of particles larger than 75 µm in size before release into the receiving body of water. The control of the stormwater quantity, as well as quality, is necessary in order to minimize the ecological changes downstream of the urbanized area.

6.4.4 Stormwater Management Design Parameters

6.4.4.1 Minor System

The Town of Strathmore uses the 1:5 year flow to design local storm mains and trunk mains. The Rational Formula in conjunction with Intensity-Duration-Frequency (IDF) curves is the most widely used method for design of minor storm systems. The peak flow relationship using the Rational Formula Method is defined as follows:

$$Q = 0.00278\ CIA$$

where:

- **Q** - peak flow (m^3/s)
- **C** - runoff coefficient
- **I** - rainfall intensity (mm/hr)
- **A** - subcatchment area (ha)

*The IDF curves for the City of Calgary were used in this study.

6.4.4.2 Major System

According to the AENV *Stormwater Management Guidelines*, 1999, it is necessary to detain on-site the difference between the pre-development and post-development runoff on-site.

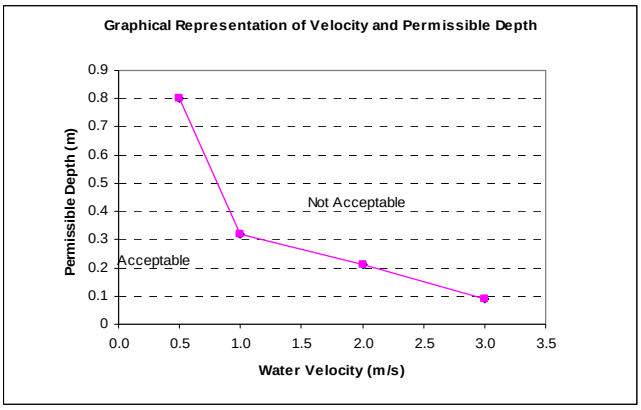
In accordance with the AENV guidelines, and based on protection of receiving streams in terms of erosion and sedimentation, the 1:100 year storm was adopted in this study for design of the major system storm water facilities.

When designing a major conveyance system, it is necessary to ensure that the rate and volume of over land flow along the drainage routes are acceptable and that the trapped lows do not create safety hazards. The allowable depth and velocity of flow in gutters and swales recommended by AENV are shown in *Table 6.5* and **Figure 6.4**.

Table 6.5: Allowable Velocity and Permissible Depths

Water Velocity (m/s)	Permissible Depth (m)
0.5	0.8
1.0	0.32
2.0	0.21
3.0	0.09

Figure 6.4: Graphical Representation of Velocity and Permissible Depth



For roadways, the AENV *Stormwater Management Guidelines* state:

> "… flow depths of no more than 0.30 m at the gutter are desirable. Standing water at low points should not exceed 0.50 m or extend to adjacent buildings. For arterial roads, the depths of flow should be less; typical criteria are that two lanes of traffic remain open and that the depth of flow be not greater than 0.05 m where major drainage flows across arterials. No buildings should be allowed in the area flooded by the major event unless they have been specially designed with flood proofing-techniques to withstand flood water."

6.4.4.3 Computer Modelling

For the existing developed areas, the computer model XP-SWMM 2000 was used to carry out the runoff simulation for this study. The single event model uses either an historic storm or a design storm to determine the storm runoff. The models' capabilities include generation of storm runoff hydrographs, runoff volumes, and routing of runoff through storage facilities and open channels. The model is commonly used in the design of stormwater management facilities in many Canadian municipalities. A detailed description of this model is included in the user manual XP-SWMM 2000.

For future development areas, continuous modelling using QHM is required. QHM simulates both water quantity and sediment removal in stormwater management facilities (SWMF) for several years of data. The results of this modelling show the water balance for each catchment both pre- and post-development.

6.4.4.4 Design Storm

A design storm can be either an historical storm that is considered critical for a given area, or a statistically derived synthetic design storm based on an acceptable limit of liability for a given statistical return storm. Synthetic storms are intended to simulate real storms where existing rainfall data is not available. Without historical data, quite often the 1:100 year synthetic storm is used to determine the peak runoff of a major storm event.

The most commonly used synthetic method for developing design storms is the Chicago Method. This method distributes the rainfall indicated by an intensity-duration-frequency (IDF) curve of a selected recurrence frequency (i.e., 1:100 year storm). The IDF data supplied by Atmospheric Environment Services for Calgary, included in **Appendix C**, was used to generate the Chicago design storm for this study. The 1:5 year 24 hour and the 1:100 year 24 hour design storm hyetographs are also included in **Appendix C**.

6.4.5 Model Development

There were four XP-SWMM 2000 models developed for this study, the models files can be found on CD in **Appendix C.** The following is a description of each one:

1. **ExTown2006.xp**

   The model represents the existing Town system as of 2006. All the areas that currently go to the Town system are included (1016.5 ha) and the imperviousness for each catchment is as per 2006 conditions. The existing Town infrastructure has also been modelled as well as all the ponds.

2. **ExWID2006.xp**

   The model represents the existing areas that currently discharges into the WID (297.0 ha). The imperviousness for each catchment is as per 2006 conditions. This was modeled to assess what discharge is actually being released to the WID Canal as of 2006.

3. **PropTown.xp**

   The model represents the proposed Town System with the future development. The maximum allowable release rate of 1400 L/s was used to size the pond system. The catchment area has increased to 1095.3 ha; the imperviousness is as per future development. The existing and proposed infrastructure was modeled as well as upgrades to the ponds as required.

4. **PropWID.xp**

   The model represents the areas that will continue to discharge into the WID Canal. The total area that will discharge to the WID Canal has decreased to 40.4 ha. The proposed storage requirements for the future development were also modeled.

6.4.6 Detention Ponds

The estimated storage volumes for the ponds included in the storage and pass-forward options are based on outlets with assumed multi-orifice sizes and configurations.

Both dry ponds and wet ponds can be used for stormwater detention. The design considerations are described below.

6.4.6.1 Option A - Wet Pond

Alberta Environment requires wet ponds or wetlands to be used for water quality improvement prior to the discharge to watercourses.

The general design criteria for wet ponds are:

- Minimum water surface area of 2 ha
- Maximum side slopes above active storage zone are 4:1 to 5:1
- Maximum interior side slopes in active storage zone are 5:1 to 7:1
- Length to width ratio from 4:1 to 5:1
- Minimum freeboard of 0.6 m
- Minimum permanent pool depth of 2.0 m, maximum 3.0 m
- Maximum active detention storage depth (above permanent pool) of 2.0 m.

It is essential to incorporate a sediment forebay at each pond inlet to capture the larger suspended contaminants and to improve the performance of the wet pond. In many incidences, wet ponds have been used as recreation facilities for non-body contact activities. With appropriate landscaping, the wetland or wet pond can be an amenity within a development. Backup water supply is required to turn over or maintain the permanent pool in the wet pond during dry seasons and aerators can be installed to increase water circulation. The edge of the pond will have to be designed properly to address riparian vegetation, safety, and maintenance concerns. Typically, the capital and the maintenance costs of the wet pond are higher than those of the dry pond. However, wet ponds have proven to be more effective stormwater enhancement facilities, relative to dry ponds.

6.4.6.2 Option B - Dry Pond

Dry ponds are acceptable for attenuating major flows and reducing the size of downstream piping and detention pond facilities. Generally, dry ponds are designed to only capture water for storm events larger than a 1:5 year event and preferably operate as an “off-line” (as opposed to a flow-through) type facility.

The general design criteria for the dry pond are:

- Maximum storage depth of 1.5 m
- Maximum interior side slopes of 4:1 to 5:1
- Minimum ratio of effective length to effective width of 4:1 to 5:1
- Minimum freeboard of 0.6 m
- Minimum pond bottom slope of 1% (2% is preferred)

Similar to the wet pond, a sediment forebay at each pond inlet is necessary. Dry ponds have been widely adopted and proven effective for quantity control; however, compared to wet ponds, they are generally less effective at pollutant removal. Typically, sports fields and other active recreation uses can be incorporated in the dry pond design. A low-flow bypass should be considered to reduce the frequency of inundation of the pond surface. To aid in the creation of dry ponds, the current AENV Protection Guidelines should be utilized.

6.4.7 Wetlands

Currently there is no adopted Wetland Policy for the Town of Strathmore. A study named *Town of Strathmore, Wetland Conservation Plan* by Thomas S. Sadler, P.Biol., was done in 2005 and Wetland Mapping was done by Wade Hawkins which defined the classification of the wetlands within the Town. The Town is currently reviewing their *Wetland Conservation Policy*; any future development that is to occur will have to adopt the current policy that the Town has implemented at the time of development.

AENV is also currently reviewing their wetland policy and a main topic being discussed is the issue of wetland restoration and compensation. In the case of development, this would mean that if a developer plans on removing existing wetlands, a new wetland would have to be created at a ratio determined by the policy i.e. 3:1, or the developer would have to compensate AENV monetarily for the construction of a wetland at a later date.

All the wetland policies are currently under review; as the development continues around the Town, a developer must discuss with the Town and AENV, to ensure the current guidelines are being used in their design.

6.5 Stormwater Management

6.5.1 General

The primary objectives of the stormwater management study are to identify the minor and major flows in the study area and to calculate the allowable discharge rates for future developments.

The result is a master drainage plan that identifies outfall requirements, water quality enhancement facilities, and storage facilities to temporarily store the difference between the pre- and the post development runoff.

The maximum allowable discharge rate of 1400 L/s from the Town lands to the Eagle Lake Ditch was an underlying criterion in this study, which shaped development of options for stormwater management within the study area. The maximum allowable discharge rate to the WID Main ‘A’ Canal is also 1400 L/s and the maximum allowable discharge into the North ‘A’ canal is 142 L/s.

6.5.2 Site Description

There are a few watercourses of interest within the study area. The main watercourse is the Eagle Lake Ditch on the southeast side the Town; just east of the ditch is Eagle Lake Drainage watercourse owned by WID which flows into Eagle Lake, as well there is another unnamed watercourse with intermittent flows on the west side of the Town. All three watercourses are tributary to Eagle Lake. The WID ‘A’ Canal is also of interest because the Town is releasing stormwater at uncontrolled rates from some areas within the Town into the canal. As well, the annexation areas outside the Town boundary to the north are contributing to two watercourses, the Red Deer River and the WID North Canal.

The general drainage within the study area is depicted in **Figure 6.5**, which identifies the following sources of stormwater discharge:

- Stormwater in depression storage / WID ‘A’ Canal areas is contained on-site by local ground depressions, which provide a significant amount of storage. These areas become temporary ponds, which may overflow to the WID canal. This also includes direct discharge to the WID canal. The total area of this source of discharge is 371.7 ha or 14.6% of the study area.
- Discharge to the Town’s storm system, which consists of 738.1 ha or 29.1% of the study area

- Other discharge, which consist of 1431.4 ha or 56.3% of the study area.

6.5.3 Current Stormwater Management System

The Stormwater Management system currently does not meet the criteria of 1400 L/s to Eagle Lake Ditch. Pond 1, 2 and 3 have been developed and limit the stormwater flows of the existing system to a rate of approximately 200 L/s. Pond 4 only has the south section of the pond developed as a wet pond with a limiting control of two pipes, a 1350 mm dia and a 1500 mm dia, which discharge south under the TCH. The north section of Pond 4 is currently a ditch that releases to the south side through an 1800 mm dia pipe. Pond 5 currently has a lot of overgrowth in it and no operational control structure. Pond 6 has been constructed with a forebay and a dry pond. Pond 6 limits all flows with an R70 ICD into Eagle Lake Ditch.

6.6 Current Flow Conditions 2006

Table 6.6 summarizes the 1:5 year and 1:100 year flows for all the catchments within the study area as per existing conditions and identifies the existing point of discharge for each catchment. These catchments are discussed in Section 6.3, and are shown in **Figure 6.2**.

The shaded portions of *Table 6.6* represent two types of areas:

- Partially developed catchments. Stormwater from these catchments should be directed toward Eagle Lake and not the WID canal system.
- Currently undeveloped catchments. For a development to take place, stormwater from these catchments should be directed toward Eagle Lake. Section 6.9 provides drainage improvement options for these catchments.

The catchments not shaded currently discharge to the Town's stormwater system. They will require a stormwater management plan that conforms to this report if further development is to take place in these areas. It is assumed that the golf course will remain for the foreseeable future.

Table 6.6: 1:100 and 1:5 Year Flows for All Catchments

Sub-catchment	Description	Point of Discharge	Area (ha)	Existing 1:100 Year Flows (m^3/s)	Existing 1:100 Year Flows ($m^3/s/ha$)	Existing 1:5 Year Flows (m^3/s)	Existing 1:5 Year Flows ($m^3/s/ha$)
1	R1, R3 & P1 in Strathaven subdivision	Dry pond near Strathaven	24.45	2.463	0.101	1.092	0.045
2	Part of rodeo grounds (P1 land)	Dry pond near Strathaven	28.05	0.474	0.017	0.082	0.003
3	Dry Pond near Strathaven (P1 land)	Dry pond near Strathaven	3.20	0.064	0.020	0.020	0.006
4	P1 Ambulance station	Pond 4	3.65	0.525	0.144	0.206	0.056
5	P1 Hospital grounds	Pond 4	6.43	0.790	0.123	0.338	0.053
6	R1, R2, R3, P1 Maplewood subdivision	Pond 4	32.40	5.300	0.164	2.185	0.067
7	R1, R2, P1, C1, UR Cambridge Glen subdivision	Pond 4	32.11	2.805	0.087	1.253	0.039

Sub-catchment	Description	Point of Discharge	Area (ha)	Existing 1:100 Year Flows (m^3/s)	Existing 1:100 Year Flows ($m^3/s/ha$)	Existing 1:5 Year Flows (m^3/s)	Existing 1:5 Year Flows ($m^3/s/ha$)
8	R1, R2, R3 Green Meadow & Parkwood subdivision	Pond 4	37.72	4.437	0.118	1.914	0.051
9	P1 land on eastside of Strathmore	Pond 4	10.00	0.942	0.097	0.398	0.040
10	Commercial highway property (CHWY) in SW Strathmore	Strathmore Lake	13.98	0.451	0.032	0.058	0.004
11	Commercial highway property (CHWY) in SW Strathmore	Strathmore Lake	11.57	2.266	0.196	0.978	0.085
12	R2, P1 land on westside of Strathmore	Strathmore Lake	10.41	1.663	0.160	0.689	0.066
13	CR1 Wildflower subdivision	Strathmore Lake	8.99	1.618	0.180	0.652	0.073
14	Strathmore Lake (GA land)	Strathmore Lake	61.63	5.292	0.086	1.725	0.028
15	UR land between Strathmore Lake and the golf course	Pond 1	19.56	0.563	0.029	0.077	0.004
16	R1, R3, P1 Westmount subdivision	Pond 1	18.98	2.940	0.155	1.226	0.065
17	UR land between Strathmore Lake and the golf course	Pond 1	17.98	0.396	0.022	0.061	0.003
18	Golf course pond (P1)	Golf Course Pond	59.15	2.169	0.037	0.263	0.004
19	MHS, P1, M1, M2 Brentwood subdivision	Pond 1	42.01	5.449	0.130	2.343	0.056
20	UR land & Pond 1	Pond 1	25.15	1.306	0.052	0.134	0.005
21	R1, R2, R3 Downtown & residential	Pond 2	18.84	3.779	0.201	1.476	0.078
22	UR land & Pond 2	Pond 2	23.53	1.091	0.046	0.118	0.005
23	R1, R3, P1 Downtown & Pond 3	Pond 3	32.46	6.432	0.198	2.773	0.085
24	Commercial highway property (CHWY) in SE Strathmore	Pond 4	9.54	1.753	0.184	0.741	0.078
25	P1 land (Pond 4)	Pond 4	9.28	1.286	0.139	0.463	0.050
26	Commercial highway property (CHWY) in SE Strathmore	Pond 5	13.00	2.097	0.161	0.927	0.071
27	P1 land (Pond 5)	Pond 5	6.52	0.480	0.074	0.040	0.006
28	Commercial highway property (CHWY) and light industrial in SE Strathmore	Pond 6	19.67	3.906	0.199	1.684	0.086
29	Mixed land use + Pond 6	Pond 6	40.56	7.591	0.187	2.824	0.070
30	Commercial highway property (CHWY) and light industrial in SE Strathmore	Pond 4	41.53	4.951	0.119	2.139	0.052
31	UR land on east side of Strathmore	Pond 6	6.50	0.836	0.129	0.370	0.057
32	UR land on east side of Strathmore	Pond 6	26.82	0.540	0.020	0.087	0.003
33	GA land	Pond 6	22.56	0.402	0.018	0.068	0.003

Sub-catchment	Description	Point of Discharge	Area (ha)	Existing 1:100 Year Flows (m^3/s)	Existing 1:100 Year Flows ($m^3/s/ha$)	Existing 1:5 Year Flows (m^3/s)	Existing 1:5 Year Flows ($m^3/s/ha$)
34	GA land in southeast Strathmore	Eagle Lake Ditch	119.36	1.500	0.013	0.289	0.002
35	GA land in southeast Strathmore	Eagle Lake Ditch	15.31	0.940	0.061	0.057	0.004
36	P1, CHWY Westmount	Unnamed watercourse/ Eagle Lake	36.06	5.154	0.143	2.259	0.063
37	M1, M2, CHWY, P1, R1, R3, UR	Unnamed watercourse/ Eagle Lake	39.56	4.978	0.126	2.121	0.054
38	M1, M2 and CHWY land in south Strathmore	Unnamed watercourse/ Eagle Lake	36.43	4.794	0.132	1.963	0.054
39	GA land in south Glenmore	Unnamed watercourse / Eagle Lake	31.71	0.791	0.025	0.115	0.003
50	GA land in west Strathmore	WID Canal	15.45	0.412	0.027	0.058	0.004
51	GA land in west Strathmore	WID Canal	9.36	0.356	0.038	0.042	0.004
52	GA land in west Strathmore	WID Canal	15.71	0.477	0.030	0.063	0.004
53	GA land in west Strathmore	WID Canal	36.63	0.827	0.023	0.126	0.003
54	R1, R2, R3, P1	WID Canal	46.49	5.873	0.126	2.535	0.055
55	R1 and P1 land in northwest Strathmore	WID Canal	10.68	0.374	0.035	0.047	0.004
56	P1 land in northwest Strathmore (Golf Course)	WID Canal	15.62	0.393	0.025	0.057	0.004
57	P1 land in northwest Strathmore (Golf Course)	WID Canal	2.28	0.112	0.049	0.012	0.005
58	P1 land in northwest Strathmore (Golf Course)	WID Canal	20.51	0.488	0.024	0.073	0.004
59	Rodeo ground	WID Canal	22.51	0.380	0.014	0.066	0.003
60	P1 land north side of Strathmore	WID Canal	14.95	1.308	0.087	0.582	0.039
61	R2, R3	WID Canal	3.36	0.057	0.017	0.010	0.003
62	R1, R2	WID Canal	12.49	2.527	0.202	0.984	0.079
63	R1	WID Canal	3.33	0.886	0.266	0.306	0.92
64	R3	WID Canal	2.02	0.510	0.252	0.181	0.090
65	R3	WID Canal	1.31	0.326	0.249	0.117	0.089
66	R1, R2, P1 Strathaven	Pond outside northeast Strathmore / WID Canal	23.18	3.234	0.140	1.375	0.059
67	Back of lots in Strathaven	Pond outside northeast Strathmore / WID Canal	7.18	0.097	0.014	0.018	0.003
68	R1, R2	Pond 4/WID Canal	14.56	2.356	0.162	0.973	0.067

Sub-catchment	Description	Point of Discharge	Area (ha)	Existing 1:100 Year Flows (m^3/s)	Existing 1:100 Year Flows ($m^3/s/ha$)	Existing 1:5 Year Flows (m^3/s)	Existing 1:5 Year Flows ($m^3/s/ha$)
69	GA land in southeast Strathmore	WID Canal	2.90	0.071	0.024	0.010	0.003
70	GA land in southeast Strathmore	WID Canal	16.48	0.314	0.051	0.051	0.003
71	GA land in southern Strathmore	Eagle Lake Ditch	8.43	0.187	0.022	0.029	0.003
72	UR land in northwest Strathmore	Unnamed Water Course/ Red Deer River	63.7	0.909	0.014	0.141	0.002
73	UR land in southeast Strathmore	Eagle Lake	115.36	1.344	0.012	0.229	0.002
74	Industrial land in southwest Strathmore	Unnamed Watercourse	32.95	1.002	0.030	0.101	0.003
75	Wastewater Treatment Plant	No Discharge	44.35	0.000	0.000	0.000	0.000

6.7 Post-Development Drainage

In adherence with current AENV and City of Calgary policies, stormwater management systems should be designed to restrict both water quality and quantity to pre-development rates. This can be achieved by a combination of source control and end-of-pipe techniques that allow a large proportion of post-development runoff to infiltrate or evaporate.

At this level of design, recommendations are put forward to encourage a developer to accommodate as many source control measures as possible into the design of a subdivision to reduce the amount of land required by a stormwater management facility (SWMF).

For the purpose of cost estimation, it is conservatively assumed that no source control measures will be constructed, and that all flow attenuation and quality enhancement will take place in the SWMF.

6.7.1 Proposed Stormwater Management System

The allowable release rate for the Town of Strathmore to Eagle Lake Ditch is 1400 L/s. The proposed total catchment area for the Town system is 1095.3 ha, therefore the allowable release rate for the Town is 1.28 L/s/ha (1400 L/s divided by 1095.3 ha). The proposed pond system has been developed to limit the flow through each pond to the allowable release rate. For example, Pond 1 has a proposed total area of 111.8 ha discharging to it; the allowable release rate is 143 L/s. The orifice for Pond 1 has been modified to only allow this allowable rate out.

Table 6.7: Proposed Pond Release Rates

Pond Name	Area (ha)	Allowable Release Rate L/s
1	111.8	143
2	392.1	501
3	424.5	543
4	677.5	866
5	697.0	891
6	960.7	1228

The remaining area of 134.7 ha does not discharge into any of the Town of Strathmore ponds but do discharge into Eagle Lake.

6.8 General Areas

The following is a discussion of post-development discharges for all catchments in the study area. These catchments are shown in **Figure 6.6**.

6.8.1 Catchments with no allowable increase in flows

The stormwater peak flows must not increase if there is any change to the development in the future for the areas in *Table 6.8*.

Table 6.8: Catchments with No Allowable Increase in Flow

Catchment Name	Description	Catchment Name	Description
1	Strathaven	54	Hillview
3	Strathaven	62	Thorncliff
4	Ambulance Station	63	Thorncliff
5	Hospital	64	Parkwood
6	Maplewood	65	Parkwood
7	Cambridge Glen	66 & 67	Strathaven
8	Green Meadows, Grande Point, Parkwood	E1	East Annex Area
9	Westside of Aspen Creek	E2	East Annex Area
11	Strathmore Lakes Commercial	R1	West Annex Area
12	Strathmore Lakes Eastside residential	R2	West Annex Area
13	Wildflower	W1	West Annex Area
16	Westmount	W2	West Annex Area
19	Brentwood	W3	North Annex Area
21	North side of Downtown	W4	North Annex Area
23	Downtown	W5	North East Annex Area
24	Commercial Highway, Pond 4	W6	North East Annex Area
26	Pine Road Commercial Park	W7	East Annex Area
28	Spruce Business Park	W8	East Annex Area
31	UR land bisected by HWY 1	X1	West Annex Area
32	UR land		
33			
35	UR land SE Strathmore	X2	West Annex Area
36	Westmount	X3	West Annex Area

6.8.1.1 Trans-Canada Highway (Catchment 10)

Currently grassland, this catchment discharges to the north below the TCH through a 700 mm dia corrugated steel pipe (CSP) culvert. When developed, this catchment may discharge at full runoff rates to Strathmore Lake, although the capacity of the existing culvert will limit the discharge to 640 L/s. A drainage easement may be required north of the TCH through S.W. ¼ Sec 15-24-25-4. (See Catchment 14).

6.8.1.2 Western Irrigation District (Catchment 50, 51, 52, 55, 59, 60, 61, 69)

- ***Catchment 50*** will continue to discharge to the WID 'A' Canal at rate of 29.8 L/s/ha. The total discharge from the area is therefore 356 L/s. An end of pipe SWMF will be required to control water quantity and quality.
- ***Catchment 51 & 52*** discharge to the WID canal. This will continue at an allowable rate of 29.8 L/s/ha. An end of pipe SWMF will be required to control water quantity and quality.

- ***Catchment 55*** currently discharges to the WID North 'A' canal. The total allowable discharge from the Town into this branch of the WID canal is being used by the Hillview Subdivision. Therefore, post-development runoff will need to be directed to the Hillview development to the north (catchment 54) and the SWMF for the subdivision as per the Hillview's developer's agreement with the Town.
- ***Catchment 59, 60, & 61*** consist of a mix of rodeo grounds, sports arena, high school and commercial area. Should any further development occur in these areas the runoff flows must not increase, these areas will now be directed to Pond 1 via a culvert under the WID.
- ***Catchment 69*** will be diverted to the unnamed watercourse to Eagle Lake if any development is to occur. The runoff flows for post-development must not increase from pre-development flows.

6.8.1.3 Northwest Strathmore (Catchments 14, 15, 17, 18, 53, 54, 56, 57, 58, 72)

Hillview (Catchment 54)

This catchment is currently under construction and is a residential subdivision. When catchment 54 is completed, the site will discharge to the WID at a restricted released rate already established, as per an agreement with the WID (5 ft3/s – 142 L/s). The area will also receive flows from catchment 55.

Strathmore Golf Club (Catchment 18, 56, 57& 58)

Catchment 18 comprises the southern part of the Strathmore Golf Course, and is not identified as being developable in the foreseeable future. However, if development were to take place, stormwater discharge would have to be limited to the existing flow rates.

Catchment 56, 57, & 58 shall remain as is, and the area will continue to flow overland to the WID canal. Due to existing depression storage, no outflow is expected up to the 1:100 year storm.

Strathmore Lakes (Catchment 14)

This catchment consists of Strathmore Lake and its surroundings. All stormwater from future development in this area will discharge to Strathmore Lake. The lowest pipe in the stormwater system for the Strathmore Lakes development has an elevation of 974 m. A permanent flow control structure will be required to direct flow from Strathmore Lake to the northeast towards Pond 2. The maximum allowable discharge rate from Strathmore Lake is set at 136 L/s, (1.28 L/s/ha), to fully utilize the storage potential of Strathmore Lake and to remove 90% of the total suspended sediment (TSS) entering the pond.

As this catchment area receives flow from Catchment 10, a drainage easement may be required when Catchment 10 is developed (See Catchment 10).

Strathmore Lakes (North) (Catchment 15 & 17)

An unnamed body of water covers approximately 10% of catchment 15 on the north boundary. This water body may be drained and backfilled during development. When developed, stormwater will be directed to the northeast to Pond 2 at a discharge rate of 1.28 L/s/ha, wetland compensation may be required as the area currently has a wetland designation on it.

Catchment 17 is a low area, partially covered by small ponds, which may be drained and backfilled during development, wetland compensation may be required. The catchment receives piped flows from Catchment 16. When this catchment is developed, flows from Catchment 16 will be directed through this area into the developed pond in Catchment 17 and release at a rate of 1.28 L/s/ha to the north toward Pond 2. A drainage easement may be required for flows from Catchment 16.

Area 53

Development of this area will comply with current SWM guidelines (see Section 6.4.5) and can either be developed independently or can be combined with the development of annexation areas W1 and W2. Post-development flows will enter the WID at pre-development rates.

Area 72

Development of this area will comply with current SWM guidelines (see Section 6.4.5). Post-development flows will travel west along the south ditch of Twp Rd 244, at pre-development rates, before discharging into an unnamed tributary of the Red Deer River.

6.8.1.4 Northeast Strathmore (Catchments 2, 20, 22, 23, 25, 30, 62, 63, 68)

Rodeo Grounds (Catchment 2)

As part of the rodeo grounds, this catchment is not identified as being developable in the foreseeable future. However, if development were to take place, stormwater discharge would have to be limited to the existing flow rates.

Thorncliff (Catchments 62 & 63)

It is proposed that flows from Catchments 62 and 63 (to the east) should discharge to Pond 2 in Catchment 22. These catchments currently discharge to the WID canal. An easement may be required through Catchment 22.

Ponds 1 and 2 (Catchment 20 & 22)

Pond 1 is contained in catchment 20. Sedimentation forebays are proposed for Pond 1 and will capture drainage from Catchments 59, 60 and 61. Directing flows from the above areas into a forebay has two benefits. Firstly, at the request of the WID, the flows will be diverted from the WID canal. Secondly, the forebay will provide a through-flow for Pond 1, which will enhance its water quality. In addition, making Pond 1 deeper will further enhance water quality.

If any of the land surrounding Pond 1 is developed, the stormwater system must discharge into Pond 1.

To optimize Pond 1, a control structure should be constructed at the south end of the pond. The operation of this structure should be assessed once the overall strategy for the stormwater system of the Town of Strathmore is determined.

Catchment 22 consists of Pond 2 and its surroundings. Upon development the stormwater flows from this area must enter Pond 2. It is proposed that flows from Catchments 62 and 63 (to the east) should discharge to Pond 2. These catchments currently discharge to the WID canal. An easement may be required through Catchment 22.

Aspen Creek (Catchment 68)

The area contains a stormwater pond that discharges to Catchment 30 at a controlled rate of 198 L/s, ultimately flowing into Pond 4. Aspen Creek is fully developed.

Pond 4 & Ranch Estates (Catchment 25)

The proposal for this catchment area is to create a permanent body of water in the valley and use it as a sedimentation forebay for downstream ponds for the following reasons:

- The catchment is located at the confluence of flows from the majority of Strathmore.
- The catchment is ideally shaped, i.e., long and narrow.
- There is a road ROW along side it for maintenance access.
- The forebay will provide a permanent body of water, which may be used for irrigation purposes during water shortages.

As Pond 4 has already been divided into two sections with the construction of the new road into Ranch Market development, the pond can be proposed to operate as a forebay and a main pond system. Two control structures will be required for Pond 4, one for the forebay and one for the main pond.

Ranch Market (Catchment 30)

This largely undeveloped catchment north of the TCH contains a part of the Ranch Estates Mobile Home Park in the northwest corner and the beginning of the Ranch Market Business Park.

Stormwater flows must be directed towards the southern section of Pond 4 at a combination of 115 L/s/ha for Commercial sites and 70 L/s/ha for all other sites.

Pond 3 & Downtown (Catchment 23)

Pond 3 will have a control structure limiting its discharge with an overflow weir 100 mm below its high water elevation.

6.8.1.5 South Strathmore (Catchments 26, 27, 29, 34, 35, 37, 38, 39, 70, 75, Area 71, Area 73, Area 74)

Canal Crossing & Glenwood (Catchment 37)

This catchment is partially developed, and all flows currently enter an unnamed pond located south of Highway 1 and west of the Glenwood Subdivision. The currently undeveloped sections of this catchment are permitted to discharge to this pond at 70 L/s/ha, as long as the discharge from the pond does not increase from its current discharge rate. This area will continue to discharge to Catchment 38.

Pond 5 (Catchment 26 & 27)

Up until 2000, Pond 5 and its surroundings were used as a wet pond for irrigation purposes. Due to the removal of the control structure, the pond is effectively a dry pond containing some cattails. If this area is to be optimized for stormwater storage, a control structure will be required at the downstream end of the pond.

Orchard Business Park (Catchment 38 & 39)

This area receives stormwater from the wet pond in Catchment 37. Along the southern boundary, WID has installed an inverted siphon. Post-development flows are allowed to discharge off site and a wet pond will be constructed along the southern boundary of Catchment 39.

The allowable release rate from the pond is 1.28 L/s/Ha for the entire area. The total catchment area of the pond would includes Catchments 36, 37, 38, 39 and 70; therefore the allowable release rate from the pond is 190 L/s The wet pond would require a volume of approximately 65,000 m^3.

Other Areas (Catchment 34, 35)

The development of catchment 34 & 35 will require an end of pipe SWMF to control water quantity and quality at a release rate of 1.28 L/s/ha if the area can be graded to discharge to Eagle Lake Ditch. If the re-grading cannot occur, than flow rates must be limited to pre-development rates for both catchments.

Water Treatment Plant (Catchment 70, 75)

Catchments 70 and 75 form the Town of Strathmore Wastewater Treatment Plant. As such, there is no discharge from both of these areas.

Pond 6 (Catchment 29)

Development of this area will comply with current SWM guidelines (see Section 6.4.5). Post-development flows will discharge into Pond 6, before flowing into Eagle Lake.

Area 71

Development of this area will comply with current SWM guidelines (see Section 6.4.5). Post-development flows will discharge into an unnamed watercourse, at pre-development rates, before flowing into Eagle Lake.

Area 73

Development of this area will comply with current SWM guidelines (see Section 6.4.5). Post-development flows will discharge into an unnamed watercourse, at pre-development rates, before flowing into Eagle Lake. See section 6.7 for development recommendation.

Area 74

Development of this area will comply with current SWM guidelines (see Section 6.4.5). Post-development flows will discharge into an unnamed watercourse, at pre-development rates, before flowing into Eagle Lake.

6.9 Recommended Development

The primary concern for the Town of Strathmore is the excessive amount of stormwater currently discharging into the Eagle Lake Ditch. The *1999 Infrastructure Analysis Report* by Urban Systems states that the allowable discharge rate into the Eagle Lake Ditch is 85 L/s. A new ditch under construction, allows the discharge rate to be increase to 1400 L/s into Eagle Lake as per the Town agreement with the WID.

Other concerns highlighted by the Town are the areas of Strathmore that do not discharge into the Town's storm system. Prior to development, runoff from these areas must be redirected into the Town's storm system. Areas, which currently do not discharge into the Town's storm system, are illustrated in **Figure 6.7**.

In light of the analysis completed for this study, UMA has created six stormwater system recommendations that will facilitate development in the Town of Strathmore. They include:

- Brent Boulevard and Pond 1
- Strathmore Lake, West Strathmore and Pond 2
- Westmount and South Strathmore
- Area 64 and 65
- Ponds 3, 4, 5 and 6
- Annexation Areas

For all the recommendations, refer to **Figure 6.8**.

6.9.1 Brent Boulevard and Pond 1

Catchments 59, 60 and 61 currently discharge through the same outfall into the WID canal, north of Pond 1. Catchment 19 (Brentwood) drains directly into Pond 1 at a maximum inflow of 2 m^3/s (approximately the 1:5 year flow). Flows in excess of 2 m^3/s will either enter the pond on Thomas Drive or discharge into the WID canal.

- Recommendation and Requirements

  To remove the stormwater connection into the WID canal and to improve the water quality in Pond 1, it is proposed that:

  - Flows from Catchments 59, 60 and 61 be directed below the WID canal into a new wet forebay of Pond 1.
  - Flows from Catchment 19 are directed into a new forebay on the southwest side of the WID canal or, flows are conveyed through a Vortechnics grit chamber or equivalent on the northeast side of the WID canal, prior to discharge into Pond 1.
  - The depth of permanent water in Pond 1 be increased.
  - The existing WID canal turnout structure at Pond 3 is closed.
  - A new WID canal turnout structure is built to the north of Pond 1 to act as a constant through-flow.
  - Refer to **Figure 6.8** for the proposed improvements.

- Implementation

  To complete the requirements listed above the following is necessary:

  - 1 high-capacity catch basin.
  - 360 m of 750 mm dia concrete pipe.
  - 1 Type C catch basin and 20 m of 300 mm dia lead.
  - 2 forebays to conform to AENV Guidelines (or 1 forebay and 1 Vortechnics Unit).
  - Removal of up to 113,000 m^3 of clay from Pond 1.
  - Removal of an existing irrigation turnout structure.
  - Construction of an irrigation turnout structure.
  - Pond 1 will have an outflow control structure to limit flow to 143 L/s.

6.9.2 Strathmore Lake; West Strathmore and Pond 2

Strathmore Lake requires a long-term drainage system to service Catchments 10, 11, 12, 13 and 14. Catchments 15, 16 and 17, which currently discharge overland to Pond 2, will require stormwater servicing when developed.

- Requirements
    - To address the outlined context, the following improvements will be required:
    - 870 m of 600 mm dia concrete pipe and six manholes from Strathmore Lake.
    - 120 m of 300 mm dia concrete pipe, 1 manhole and 1 ICD R30 from Area 15.
    - 235 m of 750 mm dia, 80 m of 600 mm dia concrete pipe, 2 manholes and 1 ICD R70 from Area 17.
    - Pond 2 will have a permanent water depth of 0.5 m to provide some sediment removal.
    - Discharge All Catchments to Pond 2 **(see Figure 6.8)**.

  The following improvements are required to facilitate discharge from all catchments to Pond 2:

    - 550 m of 600 mm concrete pipe and 4 manholes.
    - Pond 2 will require an outfall control structure to limit the high water elevation.

6.9.3 Westmount and South Strathmore

Catchment 36 (Westmount), and the area of Strathmore south of Highway 1 and west of Orchard Business Park, operates independently of the rest of the stormwater system in Strathmore. These areas discharge into an unnamed watercourse that flows south to Eagle Lake. Since the unnamed watercourse does not have a drainage easement, these flows must be diverted into Eagle Lake Ditch. The options for these areas are illustrated in **Figure 6.9.**

- **Existing Wet Pond Retention**

The unnamed wet pond in Catchment 37 will be retained. The pond in Catchment 38 will be removed and a wet pond will be constructed at the Town boundary. Below are the requirements for this option:

- A dedicated drainage swale from Catchment 37 to the wet pond in Catchment 39.
- 815 m of 525 mm dia concrete pipe and 65,000 m^3 storage. This new sewer diversion is required from the new pond toward the Eagle Lake Ditch and Pond 6.

Catchment 36 is fully developed, and Catchment 37 is partially developed. Catchment 38, 39 and 70 when developed, must not increase the stormwater flows beyond the Town boundary. A wet pond will be constructed at the south boundary of Catchment 39.

6.9.4 Area 64 and 65

Areas 64 and 65 currently discharge into the WID. The discharge is overland and is at an uncontrolled rate. The option proposed would limit the area's discharge to the existing 1:5 year flow of 298 L/s.

- Requirements (See **Figure 6.8)**.

  The following improvements are required to facilitate limiting the discharge from Areas 64 and 65:

  - Re-grade streets to provide 250 m^3 of storage.
  - Install 4 Type C catch basins and 70m of 300 mm dia lead.
  - Install 125 m of 450 mm dia concrete pipe and 2 manholes
  - Install 15 m of 525 mm dia concrete pipe and 1 manhole.
  - Install oil and grit separator.

6.9.5 Ponds 3, 4, 5, 6

- Context

  Using Best Management Practices, these ponds will provide the solution to stormwater issues within the Town of Strathmore.

  The storage will be maximized by using the existing ponds as well the downstream discharge rate will be prorated as per the allowable discharge rate of 1.28 L/s/ha.

- Storage Requirements

  The option to be considered is to optimise the amount of storage currently available in the existing ponds, and to determine if it is possible to limit the discharge rate from the pond system to the Eagle Lake Ditch to 1400 L/s.

  Volumetric calculations show this can be achieved. See **Figure 6.8** for option details.

  - ***Pond 2*** has a covenant placed upon it, limiting its maximum water elevation to 971 m. At ultimate development of Strathmore, this means the control structure should limit pond discharge to 503 L/s with an overflow weir at an elevation of 100 mm below high water level.
  - ***Pond 3*** will have an outflow control structure to limit the discharge to 544 L/s.
  - ***Pond 4*** lies at the confluence of two main drainage flows in Strathmore; flow from Pond 3 and flow from the northeast of Strathmore. This presents an ideal opportunity to use Pond 4 as a sediment forebay for the remaining downstream ponds. To utilize Pond 4 fully it would be necessary to create a permanent body of water. This means building a control structure, and may require lining the pond. As there is a great deal of clay in and around Strathmore, the pond liner could be made of local material, although this would have to be confirmed by a geotechnical engineer. As Pond 4 has already been divided into two sections with the construction of the new road into Ranch Market development, the pond can be proposed to operate as a forebay and a main pond system. There will be two control structures in operation. The first one would be located on the existing 1800 mm dia pipe located underneath the new road it would limit the flow to allow time for sediment removal. The north section of Pond 4 would have a permanent depth of water of 0.37 m. The south section of Pond 4 would have a permanent depth of 1.86 m and active depth of 2.14 m. The second control structure would limit the discharge from Pond 4 to 864 L/s. This will ensure the maximum amount of sediment removal. This permanent body of water would also benefit the WID as a source of irrigation water during dry periods. In order to make this feasible, a low-

level gate in the control structure should be installed to release the required discharge rate. Pond 4 would be kept 'topped-up' by the constant source of groundwater from the hospital located in the northeast corner of Strathmore. Confirmation on the volume provided for the existing configuration of Pond 4 is needed to ensure the option is valid.

- For ***Pond 5***, the derelict berm and gate structure at the south end of the pond should be reconstructed. The gate structure would limit the discharge rate to 890 L/s. This would allow for frequent water storage on the bottom of Pond 5 and will encourage the growth of wetland type vegetation such as cattails. Wetland vegetation will enhance the water quality and improve overall aesthetics of the pond.
- ***Pond 6*** has been constructed as a dry pond, with approximately 103,000 m^3 of storage. Two control structures limiting the outgoing flow with two orifices have also been built. One control is for use by the WID only when required. The other limits the flow with a R70 installed. It is recommended to revert this pond into a wet pond by reconstructing the berm and gate structure. Since Pond 6 is located at the end of the existing pond series, its discharge should be limited to 1171 L/s.

6.9.6 Annexation Areas

The stormwater servicing options for the annexed lands involve on-site stormwater management, as there are no existing outfalls. The areas currently flow overland through areas that are not included in the annexation. The areas discharge to the WID, the Red Deer River, Eagle Lake, or have no outlet. The following SWMF guidelines can be used to provide preliminary required storage volumes and land allocation required for other similar areas. The preliminary design details for the facilities are shown on **Figure 6.8** and **6.9.**

A QHM hydraulic computer model was developed to model existing and proposed conditions over a 38-year period. The SWMF is designed such that:

- The first 25 mm of runoff must be stored without release downstream.
- 85% of 75 micron particles must be removed in a forebay.
- There is to be no increase in downstream discharge peak flows.

Results show that for the existing areas only 2% of total precipitation or 291,000m^3 would have reached the WID over the 38 years. The remainder would have been lost through infiltration or evapo-transpiration. In order to replicate this in a SWMF, a large portion of the facility would have to allow infiltration.

Approximate areas for SWMFs and associated costs are shown in Table 6.9 below. The only area that may require a TCH crossing would be E1, the size of pipe would be a 675 mm dia, and 60 m in length, the approximate cost for construction would be $66,000.

Table 6.9: Cost Estimate for Annexation Areas

Area References	Area (Ha)	SWMF Area (Ha)	Cost Estimate ($)
E1	168.34	12.29	$2,000,000
E2	64.72	4.72	$770,000
R1	96.8	7.07	$1,150,000
R2	29.85	2.18	$360,000
W1	42.58	3.11	$510,000
W2	20.03	1.46	$240,000
W3	35.84	2.62	$430,000
W4	88.14	6.43	$1,050,000
W5	95.21	6.95	$1,140,000
W6	31.26	2.28	$380,000
W7	65.48	4.78	$780,000
W8	59.03	4.31	$710,000
X1	19.59	1.43	$240,000
X2	12.26	0.89	$150,000
X3	34.6	2.53	$420,000

Two or more of these facilities can be combined as development takes place in order to reduce costs. See Strategy Appraisal.

6.10 Strategy Appraisal

Section 6.9 has identified different servicing options for the continued development of the Town of Strathmore.

Within the 2003 Town boundary, these options are limited to stormwater storage facilities, a new ditch to Eagle Lake, or a combination of these. Within the 2006 boundary, there are other requirements, as increase in off-site flows is not permitted under current guidelines.

The areas listed in Section 6.9 can be divided up into growth horizons so that a development strategy can be produced.

6.10.1 Initial Period - (2006 –2011)

Strathmore Lake, West Strathmore and Pond 2

- West Strathmore trunk sewer must be constructed
- A control structure is required for Pond 2.
- Pond 4 must be developed as a forebay and wet pond and have its own control structure.

Brent Boulevard and Pond 1

This work can proceed independently of any option development strategy for the remainder of Strathmore, as the discharge rate from Pond 1 does not significantly increase.

Westmount and South Strathmore

The unnamed wet pond in Catchment 37 will be retained. The pond in Catchment 38 will be removed and a wet pond will be constructed at the Town boundary. It also requires the connection of a new storm sewer to Eagle Lake Ditch and Pond 6.

Area 64 and 65

This work involves the re-grading of some streets, installing a pipe system as well as an oil and grit separator. The flow discharging into the WID will be reduced to 1:5 year rates and the quality will be improved.

Hillview

Hillview will continue to develop and to discharge into its own pond. It will also accept stormwater flows from Catchment 55. There will be no increase in flow into the WID canal.

Eagle Lake Ditch

A new ditch has been constructed from TWP 240 to Eagle Lake.

6.10.2 Short-Term Period - (2011 to 2021)

- The areas identified for development within this time period are at the very east and west of the Town, bordering Highway 1.
- The west areas (areas W1 and X1 on Figure 6.8) can be developed independently of any work on the Town's existing pond system as it will discharge at pre-development rates into the WID canal.
- The east areas (area E1 on Figure 6.8) can also develop independently of the Town's pond system, as it will discharge into an unnamed tributary of Eagle Lake, at pre-development rates. An allowance must be made for pre-development flow rates for any external areas discharging through this area.

6.10.3 Mid-Term Period - (2021 to 2031)

- West Strathmore annexation area (X2 and R2 on Figure 6.8) will discharge to either a tributary of the Red Deer River, or the WID canal, at pre-development rates.
- East Strathmore annexation areas (E1 and E2 on Figure 6.8) will discharge through previously developed lands to the south at pre-development rates. The outfall will be Eagle Lake.
- South East Strathmore area 73 (on Figure 6.8) will discharge to an unnamed watercourse at pre-development rates.

6.10.4 Long-Term Period - (2031 to 2037)

There are three areas identified for development within this period:

- ***Area R2***, north of the water reservoir, will discharge to a tributary of the Red Deer River at pre-development rates.
- ***North Annexation areas (W3, W4 & W6)*** will discharge north to the WID canal at pre-development rates. It may be possible to discharge W3 below the North 'A' Canal into an existing watercourse.
- ***East Annexation areas (W5, W7 & W8)*** will discharge south below the WID canal at pre-development rates into Eagle Lake.

6.11 Summary Of Conclusions And Recommendations

- The underlying criterion used in this study for sizing of stormwater facilities is that the maximum allowable stormwater release rate of 1400 L/s (50 ft^3/s) from the Town to the Eagle Lake Ditch. As well, the maximum allowable stormwater release rate for the WID Main Canal is 1400 L/s (50 ft^3/s).

- The 1:5 year storm was used to determine the minor flows in the study area, and the 1:100 year storm was used to size the major system facilities including stormwater detention ponds. A multi-level control structure at the outlet of a detention pond is recommended to limit pond outflows to pre-development levels.

- The primary concerns for the Town of Strathmore are:
  - Areas within the Town discharging directly to the WID canal, and
  - Excessive amount of stormwater currently being discharged into the Eagle Lake Ditch.

- This report identified the Town's areas which currently discharge to the WID canal and presents recommendation for including these areas into the Town's storm system. The areas in question are:
  - Brent Boulevard and Pond 1. The cost of recommended improvements is $1,800,000.
  - Strathmore Lake, West Strathmore and Pond 2. The cost of recommended improvements is $1,381,900.
  - Westmount and South Strathmore. The cost of recommended improvements range from $1,796,000.
  - Area 64 and 65. The cost of recommended improvements is $348,000.
  - Ponds 3, 4, 5, 6. The cost of recommended improvements range is $380,000.
  - * Refer to the detailed costs breakdown in **Section 8.5**.

- The study investigated methods to limit the excessive discharge of the Town's drainage to the Eagle Lake Ditch.

- Other areas must discharge at predevelopment rates as per existing drainage patterns.

To Medicine Hat

Trans-Canada Highway

Eagle Lake Drainage

Eagle Lake Ditch

Pond 3

Pond 4

Pond 5

Pond 6

WID MAIN 'A' CANAL

Pond 2

Pond 1

WID NORTH 'A' CANAL

Strathmore Lake

To Calgary

LEGEND

Town of Strathmore Boundary

Annexation Boundary

0 250 500 m SCALE 1:25,000

UMA | AECOM

Town of Strathmore
Master Servicing Study
Annexation 2006

Location Plan

Figure - 6.1

B SIZE 11" x 17" (279.4mm x 431.8mm)

PLOT: 06-11-30 8:57:22 AM

Saved By: tgerritsen

0105-076-00_00-CWF602_RX.dwg

ISS/REV: A

UMA FILE NAME:

To Medicine Hat

Trans-Canada Highway

To Calgary

E1 168.34 Ha

E2 64.72 Ha

W1 42.58 Ha

W2 20.03 Ha

W3 36.60 Ha

W4 88.14 Ha

W5 95.21 Ha

W6 31.26 Ha

W7 65.48 Ha

W8 59.03 Ha

R1 96.80 Ha

R2 29.85 Ha

X1 19.59 Ha

X2 12.26 Ha

X3 23.54 Ha

1 24.45 Ha

2 28.05 Ha

3 3.20 Ha

4 3.65 Ha

5 6.43 Ha

6 32.40 Ha

7 32.11 Ha

8 37.72 Ha

9 10.00 Ha

10 13.98 Ha

11 11.57 Ha

12 10.41 Ha

13 8.99 Ha

14 61.47 Ha

15 19.56 Ha

16 18.98 Ha

17 17.98 Ha

18 59.15 Ha

19 42.01 Ha

20 25.15 Ha

21 18.84 Ha

22 23.53 Ha

23 32.46 Ha

24 9.54 Ha

25 1.31 Ha

26 13.00 Ha

27 6.52 Ha

28 19.67 Ha

29 51.93 Ha

30 41.53 Ha

31 6.50 Ha

32 26.82 Ha

33 10.91 Ha

34 119.36 Ha

35 15.31 Ha

36 36.06 Ha

37 39.56 Ha

38 36.16 Ha

39 31.71 Ha

50 11.97 Ha

51 9.36 Ha

52 15.71 Ha

53 36.63 Ha

54 46.49 Ha

55 10.68 Ha

56 15.62 Ha

57 2.28 Ha

58 16.82 Ha

59 22.51 Ha

60 14.95 Ha

61 7.18 Ha

62 12.49 Ha

63 2.02 Ha

64 2.47 Ha

65 3.33 Ha

66 23.18 Ha

67 7.18 Ha

68 14.56 Ha

69 2.90 Ha

70 4.08 Ha

71 6.43 Ha

72 63.72 Ha

73 115.36 Ha

74 32.98 Ha

75 44.35 Ha

POND 1

POND 2

POND 3

POND 4

POND 5

POND 6

WID MAIN 'A' CANAL

WID NORTH 'A' CANAL

WID 'A' CANAL

EAGLE LAKE DRAINAGE

EAGLE LAKE DITCH

UNNAMED WATER COURSE

FREEMAN SLOUGH

HILL VIEW

STRATHAVEN

STRATHAVEN HEIGHTS

CAMBRIDGE GLEN

GRANDE POINT

ASPEN CREEK

GREEN MEADOWS

MAPLEWOOD

PARKWOOD

THORNCLIFF

BRENTWOOD

BRENTWOOD BUSINESS PARK

SPRUCE BUSINESS PARK

ORCHARD BUSINESS PARK

GLENWOOD

CRYSTAL RIDGE

WESTMOUNT

CANAL CROSSING

STRATHMORE LAKES

WILDFLOWER HEIGHTS

LEGEND

- Town of Strathmore Boundary
- Annexation Boundary
- 35 — Catchment Reference
- 71.28 Ha — Catchment Area
- Overland Flow Direction

0 250 500 m

SCALE 1:25000

UMA | AECOM

Town of Strathmore
Master Servicing Study
Annexation 2006
Existing Catchments

Figure - 6.2

B SIZE 11" x 17" (279.4mm x 431.8mm)

PLOT: 06-11-30 8:57:00 AM

Saved By: tgerritsen

0105-076-00_00-CWF603_RX.dwg

ISS/REV: A

UMA FILE NAME:

NO DISCHARGE

NO DISCHARGE

To Medicine Hat

Trans-Canada Highway

EAGLE LAKE DRAINAGE

EAGLE LAKE DITCH

POND 4

POND 5

POND 6

POND 2

POND 3

POND 1

WID MAIN 'A' CANAL

UNNAMED WATER COURSE

WID NORTH 'A' CANAL

WID 'A' CANAL

NO DISCHARGE

NO DISCHARGE

To Calgary

Catchment Boundary

Eagle Lake

WID Main 'A' Canal

WID North 'A' Canal

Unnamed Water Course to Red Deer River

Unnamed Water Course to WID

Unnamed Water Course to Eagle Lake

Town Boundary

Annexation Boundary

0 250 500 m

SCALE 1:25000

Town of Strathmore

Master Servicing Study

Annexation 2006

Existing Drainage Areas

UMA | AECOM

Figure - 6.3

B SIZE 11" x 17" (279.4mm x 431.8mm)

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ISS/REV: A

UMA FILE NAME:

To Medicine Hat

Trans-Canada Highway

EAGLE LAKE DRAINAGE

EAGLE LAKE DITCH

POND 6

POND 5

POND 4

POND 3

POND 2

POND 1

WID MAIN 'A' CANAL

UNNAMED WATER COURSE

WID NORTH 'A' CANAL

WID 'A' CANAL

To Calgary

LEGEND

Annexation Boundary

Town of Strathmore Boundary

Depression Storage/WID 'A' Canal

Discharge to Town's System

Other Discharge

0 250 500 m

SCALE 1:25000

UMA | AECOM

Town of Strathmore

Master Servicing Study

Annexation 2006

Sub-area Outfalls

Figure - 6.5

B SIZE 11" x 17" (279.4mm x 431.8mm)

PLOT: 06-11-30 8:56:17 AM

Saved By: ecatton

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ISS/REV: A

UMA FILE NAME:

To Medicine Hat

Trans-Canada Highway

To Calgary

EAGLE LAKE DRAINAGE

EAGLE LAKE DITCH

UNNAMED WATER COURSE

WID MAIN 'A' CANAL

WID NORTH 'A' CANAL

WID 'A' CANAL

POND 1

POND 2

POND 3

POND 4

POND 5

POND 6

W1 42.58 Ha
W2 20.03 Ha
W3 36.60 Ha
W4 88.14 Ha
W5 95.21 Ha
W6 31.26 Ha
W7 65.48 Ha
W8 59.03 Ha
X1 19.59 Ha
X2 12.26 Ha
X3 23.54 Ha
R1 96.80 Ha
R2 29.85 Ha
E1 168.34 Ha
E2 84.72 Ha
1 24.45 Ha
2 28.05 Ha
3 3.20 Ha
4 3.65 Ha
5 6.43 Ha
6 32.40 Ha
7 32.11 Ha
8 37.72 Ha
9 10.00 Ha
10 13.98 Ha
11 11.57 Ha
12 10.41 Ha
13 8.99 Ha
14 61.47 Ha
15 19.56 Ha
16 18.98 Ha
17 17.98 Ha
18 59.15 Ha
19 42.01 Ha
20 25.15 Ha
21 18.84 Ha
22 23.53 Ha
23 32.46 Ha
24 9.54 Ha
25 1.31 Ha
26 13.00 Ha
27 6.52 Ha
28 19.67 Ha
29 51.93 Ha
30 41.53 Ha
31 6.50 Ha
32 26.82 Ha
33 10.91 Ha
34 119.36 Ha
35 15.31 Ha
36 36.06 Ha
37 39.56 Ha
38 36.16 Ha
39 31.71 Ha
50 11.97 Ha
51 9.98 Ha
52 15.71 Ha
53 36.63 Ha
54 46.49 Ha
55 10.68 Ha
56 15.62 Ha
57 2.28 Ha
58 16.82 Ha
59 22.51 Ha
60 14.95 Ha
61 7.18 Ha
62 12.49 Ha
63 3.33 Ha
64 2.02 Ha
65 9.28 Ha
66 23.18 Ha
67 7.18 Ha
68 14.56 Ha
69 2.90 Ha
70 4.08 Ha
71 8.43 Ha
72 63.72 Ha
73 115.36 Ha
74 32.98 Ha
75 44.35 Ha
1.23 Ha
2.47 Ha

LEGEND

- Catchment Boundary
- Town Boundary
- Annexation Boundary
- Eagle Lake
- Unnamed Water Course
- WID
- Red Deer River
- No Discharge

0 250 500 m

SCALE 1:25000

UMA | AECOM

Town of Strathmore
Master Servicing Study
Annexation 2006

Proposed Catchment Areas

Figure - 6.6

B SIZE 11" x 17" (279.4mm x 431.8mm)

PLOT: 06-11-30 8:55:57 AM

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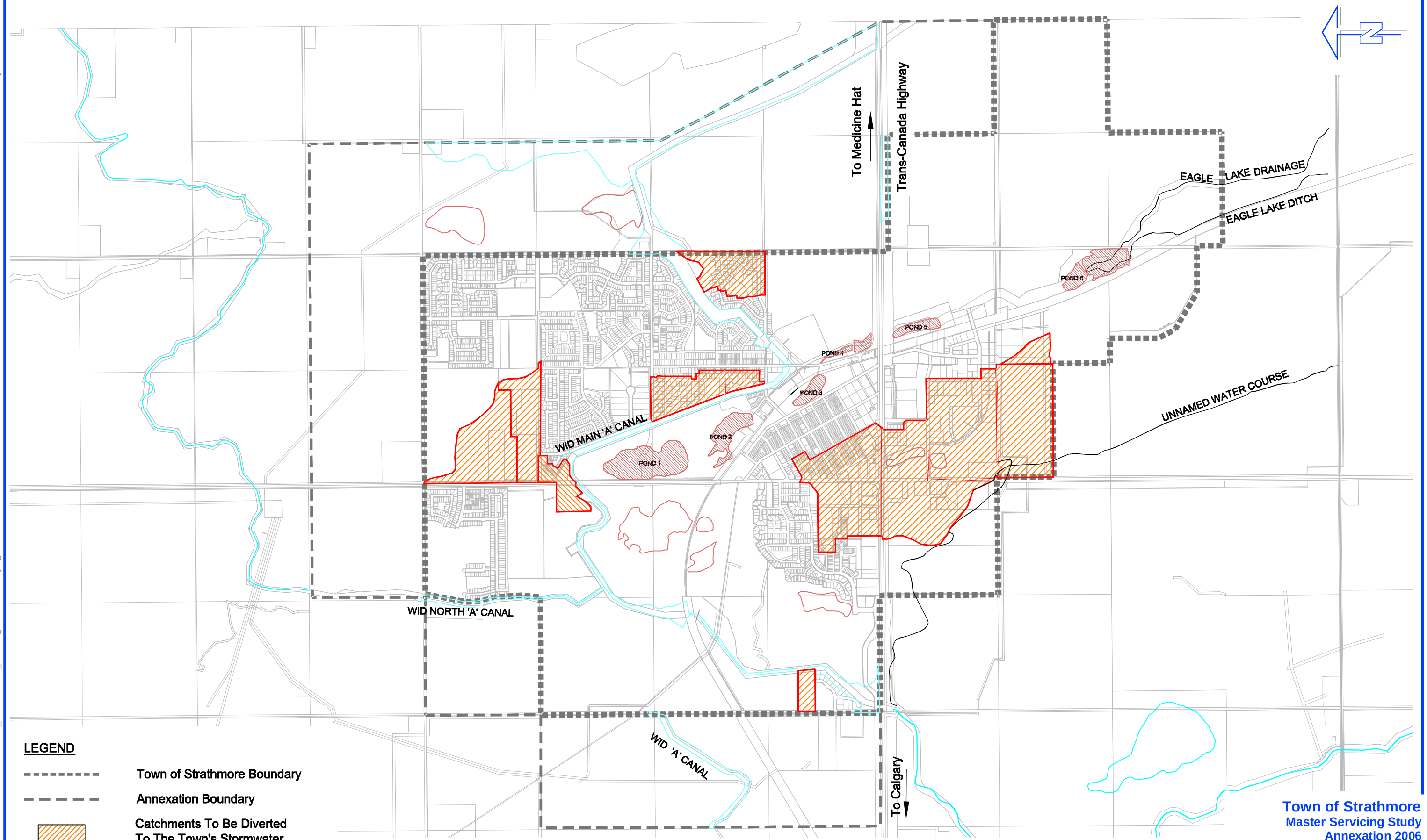
UMA FILE NAME: 0105-076-00_00-CWF608_RX.dwg Saved By: tgerritsen



LEGEND

- Town of Strathmore Boundary
- Annexation Boundary
- Catchments To Be Diverted To The Town's Stormwater System

0 250 500 m SCALE 1:25000

UMA | AECOM

Town of Strathmore
Master Servicing Study
Annexation 2006

Catchment To Be Diverted To Eagle Lake Ditch

Figure - 6.7

B SIZE 11" x 17" (279.4mm x 431.8mm)

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ISS/REV: A

UMA FILE NAME:

To Medicine Hat

Trans-Canada Highway

To Calgary

POND 6

POND 5

POND 4

POND 3

POND 2

POND 1

WET POND

PROPOSED 525mmØ CON. STORM SEWER

OIL & GRIT SEPARATOR

PROPOSED 450mmØ CON. STORM SEWER

PROPOSED SEDIMENTATION FOREBAY

PROPOSED SEDIMENTATION FOREBAY

3# TYPE C CATCHBASINS

DITCH

DITCH

PROPOSED 750mmØ CON. STORM SEWER

Existing CSP Culvert

STORM SEWER TO PASS BELOW WID CANAL

PROPOSED 750mmØ CON. STORM SEWER

900 mmØ CON CULVERT

PROPOSED 600mmØ CON. STORM SEWER

PROPOSED 600mmØ CON. STORM SEWER

815m OF CONC. PIPE @ 0.4%

CONSTRUCT A DEDICATED DRAINAGE SWALE

REMOVE THIS POND

KEEP THIS WET POND AND OPTIMIZE IT

LEGEND

- ANNEXATION BOUNDARY
- TOWN OF STRATHMORE BOUNDARY
- MAJOR CATCHMENT BOUNDARY
- POND AREAS
- 1 BRENT BOULEVARD AND POND 1
- 2 STRATHMORE LAKE WEST STRATHCONA AND POND 2
- 3 WESTMOUNT AND SOUTH STRATHMORE
- 4 AREA 64 AND 65
- 5 POND 3, 4, 5 AND 6
- 6 ANNEXATION AREAS

0 250 500 m SCALE 1:25000

UMA | AECOM

Town of Strathmore
Master Servicing Study
Annexation 2006

Stormwater Recommendations

Figure - 6.8

7.0 Roadway Network Planning

7.1 Existing Roadway Network Assessment

UMA reviewed and analyzed the existing roadway network with regard to existing traffic volumes, cross sections, and known transportation issues.

7.1.1 Existing Roadway System

As shown in **Figure 7.1**, the existing roadway system of Strathmore is comprised of a highway and rural road framework, which is the responsibility of Alberta Infrastructure and Transportation (INFTRA) and Wheatland County, and an internal collector roadway network, whose maintenance and upkeep is the responsibility of Wheatland County.

The highway and rural road framework includes an expressway, Highway 1 (Trans Canada Highway), and three arterial roadways, namely, Highway 817 (Wheatland Trail), East Boundary Road, and North Boundary Road.

The collector roadway system consists of a number of East-West roadways and a number of North-South roadways. The East-West major collector roadways include Brent Boulevard, East Lake Road, Park Lane Drive, Westmount Drive, North service roads (West Ridge Road and East Ridge Road), South service roads (West Pine Road and East Pine Road), and Orchard Park Road.

The North-South major collector roadways include Strathford Boulevard, Maple Wood Drive, Centre Street, Thomas Drive, Lakeside Boulevard, Second Street, Third Street, Westmount Road, and Wildflower Road. *Table 7.1* summarises the existing roadway inventory.

Table 7.1: Existing Roadway Inventory Summary

ID	Name of Road	From	To	Number of Lanes	Paved Width (m)	Right of Way (m)
1.0	**Highway Framework**					
1.1	Highway 1 (Expressway) Trans Canada Highway	East	West	4	14	43
1.2	Wheatland Trail (Major Arterial)	South	North			
1.2.1		South	Orchard Park Road	4	16.2	26
1.2.2		Orchard Park Road	West Pine Road	4	16.2	25
1.2.3		West Pine Road	Highway 1	4	16.2	22
1.2.4		Highway 1	Willow Drive	4	15.2	27
1.2.5		Willow Drive	Second Street	4	12	22.25
1.2.6		Second Street	WID Canal	2	11.4	22.25
1.2.7		WID Canal	Brent Boulevard	2	20	40.25
1.2.8		Brent Boulevard	Hillview Drive	2	16.7	40.25
1.2.9		Hillview Drive	North	2	11.6	40.25
1.3	East Boundary Road (Minor Arterial)	South	North	2	7	28
1.4	North Boundary Road (Minor Arterial)	East	West	2	7.5	24

ID	Name of Road	From	To	Number of Lanes	Paved Width (m)	Right of Way (m)
2.0	**East-West Collector Roadways**					
2.1	Brent Boulevard	East Boundary Road	Wheatland Trail	2	11.4	30.45
2.2	East Lake Road	East Boundary Road	Thomas Drive	2	11.4	20.12
2.3	Park Lane Drive	East Boundary Road	Lakeside Boulevard	2	11.9	20
2.4	Westmount Drive	Wheatland Trail	Westmount Road			
2.4.1		Wheatland Trail	Westlake Glen	2	11.9	22
2.4.2		Westlake Glen	Westmount Road	2	20	32
2.5	West Ridge Road (North Service Road)	Westchester Road	West			
2.5.1		Westchester Road	Westmount Road	2	9	20.12
2.5.2		Westmount Road	West	2	9	22
2.6	Ridge Road (North Service Road)	Wheatland Trail	Lakeside Boulevard			
2.6.1		Wheatland Trail	Husky Service Rd	2	10	14.8
2.6.2		Husky Service Rd	Third Street	2	8.7	12.8
2.6.3		Third Street	Second Street	2	8	12.8
2.6.4		Second Street	Lakeside Boulevard	2	8	12.2
2.7	West Pine Road (South Service Road)	Spruce Park Drive	Pine Road	2	8.6	20.12
2.8	East Pine Road (South Service Road)	East Boundary Road	Spruce Park Drive	2	8.6	12.8
2.9	Orchard Park Road	Pine Road	Wheatland Trail	2	10	22
3.0	**North-South Collector Roadways**					
3.1	Strathford Boulevard	Brent Boulevard	North Boundary Road			
3.1.1		Brent Boulevard	Strathford Place	2	10.6	22
3.1.2		Strathford Place	North Boundary Road	2	14	22
3.2	Maple Wood Drive	East Lake Road	Brent Boulevard	2	11.5	22
3.3	Centre Street	East Ridge Road	East Lake Road	2	11.5	20.12
3.4	Thomas Drive	Park Lane Drive	Brent Boulevard	2	11.5	20.12
3.5	Lakeside Boulevard	Highway 1	Village Way			
3.5.1		Highway 1	Third Avenue	2	12.8	20.12
3.5.2		Third Avenue	First Avenue	2	14.9	20.12
3.5.3		First Avenue	Waddy Lane	2	10.6	20.12
3.5.4		Waddy Lane	Village Way	2	11.5	20.12
3.6	Second Street	Ridge Road	Wheatland Trail			
3.6.1		Ridge Road	Fifth Avenue	2	10.7	20.12
3.6.2		Fifth Avenue	Fourth Avenue	2	12.8	20.12
3.6.3		Fourth Avenue	Wheatland Trail	2	12	20.12
3.7	Third Street	Ridge Road	First Avenue			
3.7.1		Ridge Road	Fourth Avenue	2	10	20.12
3.7.1		Fourth Avenue	First Avenue	2	10.8	20.12
3.8	Westmount Road	Highway 1	Westmount Drive	4	20	32
3.9	Wildflower Road	West Ridge Road	West Avenue	2	7	20.12

7.1.2 Existing Traffic Volumes

Between April 10 and April 14, 2006, ME2 Transportation Data Corporation conducted a traffic count program to obtain existing traffic volumes for the major roadways within the town. Using auto counters, ME2 obtained volumes at multiple locations over a 24-hour period, and at a few locations over a 48-hour period. Traffic volumes within a 24-hour continuous period were picked to represent daily traffic volumes. The existing average annual daily traffic (AADT) volumes obtained from the counts are shown in **Figure 7.2**.

7.1.3 Existing Roadway Cross-section and Traffic Volumes Description

Highway 1

- Highway 1 passes through the town in an east-west direction and currently exists as a four-lane divided highway. The posted speed limit on Highway 1 is 60 km/h.
- Nine at-grade intersections/accesses exist on Highway 1 within the town limits. There are three signalized intersections at Highway 817, Lakeside Boulevard, and East Boundary Road. Three unsignalized intersections are located west of Wildflower Road, at Westmount Road, and between Westmount Road and Highway 817; these intersections permit all turning movements.
- One right-in right-out access is located at Pine Road on the south side of Highway 1 and two right-out only ramps from Highway 1 exist, with one located just west of Lakeside Boulevard and one west of Highway 817.
- The existing AADT volume is about 12,700 vehicles per day (vpd) west of Strathmore and 8,600 vpd to the east.

Highway 817 (Wheatland Trail)

- Highway 817 passes through the town in a north-south direction and exists as a two-lane highway except at the intersection of Highway 1 where it widens to a four lane cross-section. The posted speed limit on Highway 817 is 50 km/h from the southern town limit to the downtown or Central Business District (CBD) area, and 60 km/h north of the CBD to North Boundary Road.
- Several streets intersect Highway 817; important ones include Westlake Road and Brent Boulevard. There are some residential properties located on the west side of Highway 817 near Westmount Drive that have direct access to Highway 817.
- The existing AADT volume is about 3,700 vpd north of the CBD and 10,100 vpd between the CBD and the Highway 1 intersection area.

East Boundary Road

- East Boundary Road, paved in 1994, is located on the eastern edge of the existing town limits. The road has a two-lane cross-section consisting of a 7 m pavement width and a 28 m right-of-way.
- The existing AADT volumes are approximately 3,000 vpd from North Boundary Road to Park Lane Drive, and 3,800 vpd from Park Lane Drive to Highway 1.

North Boundary Road

- North Boundary Road is located on the northern edge of Strathmore just outside the existing town limits. The road has a 7.5 m pavement width, and a right-of-way of 24 m.
- The existing AADT volume is about 1,700 vpd.

Brent Boulevard

- Brent Boulevard is an east-west collector within the town that connects the two primary north-south roads, Highway 817 and East Boundary Road. It is a four-lane roadway with two travel lanes in each direction; the paved width is approximately 14.5 m, and the right-of-way is 30.45 m.
- The existing AADT volume is about 4,800 vpd between Highway 817 and Maple Wood Drive, and approximately 2,550 vpd from Maple Wood Drive to East Boundary Road.

East Lake Road

- East Lake Road is a major east-west roadway connecting Thomas Drive and East Boundary Road. The road is two lanes with one travel lane in each direction. The paved width is approximately 11.4 m, and the right-of-way is 20.12 m.
- The existing AADT volume is 2,610 vpd.

Park Lane Drive

- Park Lane Drive is an east-west roadway that connects the CBD and the eastern portion of the town over the WID canal. It is a two-lane roadway with a paved width of 11.9 m, and a right-of-way of 20.0m.
- The existing AADT volume is around 9,500 vpd.

Orchard Park Road

- Orchard Park Road is a two-lane east-west roadway between Highway 817 and Spruce Park Drive. This road has a paved width of 10.0m, and a right-of-way of 22.0m.
- Traffic counts were not conducted for this roadway.

Strathford Boulevard

- Strathford Boulevard is a north-south roadway between North Boundary Road and Brent Boulevard. It is a two-lane roadway with a paved width which varies between 10.6 m to 14.0 m, and a right-of-way of 22.0 m.
- Traffic counts were not conducted on this roadway.

Maple Wood Drive

- Maple Wood Drive is a two-lane north-south roadway connecting East Lake Road and Brent Boulevard, with a paved width of 11.5 m, and a right-of-way of 22.0 m.
- Traffic counts were not conducted for this roadway.

Centre Street

- Centre Street is a two-lane roadway traveling north-south between East Lake Road and East Ridge Road. This road has a paved width of 11.5 m and a right-of-way of 20.12 m.
- The existing AADT volume is about 2,700 vpd.

Thomas Drive

- Thomas Drive is a north-south oriented two-lane roadway, which connects Park Lane Drive and Brent Boulevard. The paved width is 11.5 m and the right-of-way is 20.12 m.
- The existing AADT volume is about 4,200 vpd.

Lakeside Boulevard

- Lakeside Boulevard is the north and east boundary roadway of the CBD area between Village Way and Highway 1. This is a two-lane roadway, with a paved width of 10.6 m to 14.9 m, and a right-of-way of 20.12 m.
- The existing AADT volume is about 7,000 vpd.

Second Street

- Second Street runs through the CBD between Highway 817 and Ridge Road. It is a two-lane roadway, with a paved width of 10.7 m to 12.8 m, and a right-of-way of 20.12 m.
- Traffic counts were not conducted for this roadway.

Third Street

- Third Street parallels Second Street through the CBD between First Avenue and Ridge Road. This two-lane roadway has a paved width of 10.0 m to 10.8 m, and a right-of-way of 20.12 m.
- Traffic counts were not conducted for this street.

7.1.4 Known Transportation Issues

The following issues were noted in previous Town transportation reports, as well as having been raised in discussions with Town staff.

- **Signal Requirement at the Intersection of Westlake Road and Highway 817**

  According to the report on Highways 1:12 & 817:04[4], the existing stop-controlled approaches at the intersection of Westlake Road and Highway 817 operate at Level of Service (LOS) E or F. The study conducted a signal warrant analysis, resulting in the determination that signalization is warranted at this intersection. Signals became operational in 2006.

- **Pedestrian-Vehicle Conflict on Brent Boulevard**

  According to the Town of Strathmore Transportation Master Plan5, Brent Boulevard causes safety concerns because of its specific land uses. Strathmore High School, Strathmore Family Centre, a swimming pool, a curling rink, and Crowthier Memorial Junior High School are located on the north side of Brent Boulevard. There are two mid-block pedestrian crossings along the roadway.

  There is no sidewalk on the south side and only a partial sidewalk on the north side between the two pedestrian crossings. However, this sidewalk is discontinuous and causes significant pedestrian-vehicle conflicts. This issue was resolved with the completion of a continuous sidewalk on the north side of Brent Blvd.

[4] "Final Report – Highways 1:12 & 817:04 within the Town of Strathmore Operational & Planning Study", Earth Tech (Canada) Inc., 2003, page 10.
[5] *"Town of Strathmore – Transportation Master Plan"*, Morasch Transportation Consultants Ltd., 2002, pages 6-7.

- **Pedestrian-Vehicle Conflict on the Bridge of Park Lane Drive**

  An issue raised in the Town of Strathmore Transportation Master Plan was the safety concerns caused by pedestrians traversing the bridge over the Western Irrigation District (WID) Canal on Park Lane Drive. This conflict is due to a combination of high traffic volumes and the existence of a sidewalk only on the north side of the bridge. However, pedestrians normally cross the bridge on the south side. To date, this concern has not been resolved.

  Through a site visit and talking to the Town staff, the following new Town concerns were identified:

  - During the AM peak hour, buses traveling west on Brent Boulevard line up to make left turns onto southbound Highway 817 causing an excessive queue of vehicles. The Town feels that signals are required to improve this situation.
  - On East Boundary Road, from Parklane Drive to Highway 1, commercial and roadway construction causes traffic concerns, but construction is expected to be complete by August 2007.
  - The overall width of the bridge crossing the WID canal along East Boundary Road is of concern. Bridge widening and a speed reduction may be required if volumes reach 5,000 vpd.
  - The intersection of North Boundary Road and Highway 817 requires signalization.
  - Offset streets and residential driveways connecting directly to Highway 817 cause concerns that require attention by the Town.
  - The intersection of Orchard Park Road and Highway 817 is scheduled for signalization.

7.2 Traffic Projections

Traffic projections were generated on a zonal basis depending on existing and future land uses, and were distributed based on assumptions obtained from field data.

7.2.1 Trip Generation

In order to project future traffic demand, population projection information was used. The population projection procedure is discussed in the following section.

7.2.1.1 Population Projection

The current Town Transportation Master Plan[6] provided the 2000 census data by areas. The 2005 and 2006 census results were obtained from the Town of Strathmore website[7]. From the 2006 census results, the 2037 population distribution was forecasted for each zone based on the assumptions defined in **Section 3**.

Four development periods were used based on the annexation development with the periods of these four stages being 0 to 5 years, 5 to 15 years, 15 to 25 years, and 25 to 31 years.

[6] *"Town of Strathmore – Transportation Master Plan"*, Morasch Transportation Consultants Ltd., 2002, page 22.
[7] "*Town of Strathmore 2006 Census Results*", http://www.strathmore.ca/2005census.pdf

The ultimate annexation build out year is 2037 and the town's projected population at this horizon is 62,351. **Figure 7.3** shows the town's zoning map dividing the town for analysis and the ultimate population distribution details are shown in *Table 7.2*.

Table 7.2: Population Distribution

Zone #	Zone Descriptions	2000 Population	2005 Population	2006 Population	2037 Population
1	Strathhaven	858	1,669	1,870	2,212
2	Maplewood, Cambridge Glen	1,530	1,787	1,807	2,073
3	Parkwood, Green Meadows, Grande Point	1,143	1,168	1,164	1,350
4	Aspen Creek Ranch Estates	271	547	644	1,741
5	Spruce Business Park				7,303
6	SE1/4 S12 T24 R25 W4				2,794
7	Glenwood, Orchard, Downtown	1,012	1,058	1,105	1,275
8	Thorncliff	668	670	652	1,005
9	Brentwood	960	920	913	1,301
10	Hillview Estates	6	680	921	2,092
11	SW1/4 S22 T24 R25 W4				3,772
12	Westmount, Strathmore Lake, Wildflower Heights	717	1,154	1,260	5,665
13	Canal Crossing				102
A1	Annexation Zone 1				8,003
A2	Annexation Zone 2				1,404
A3	Annexation Zone 3				9,660
A4	Annexation Zone 4				4,071
A5	Annexation Zone 5				2,995
A6	Annexation Zone 6				1,932
A7	Annexation Zone 7				1,601
	Total	**7,165**	**9,653**	**10,336**	**62,351**

7.2.1.2 Trip Generation at Ultimate Stage (Year 2037)

In line with the 2000 census results, an average of 2.7 persons per dwelling unit was used to determine the number of dwellings for the anticipated population. From the 2006 census, the dwelling unit types consist of 63.57% single family houses (SF), 11.7% semi-detached/duplexes, 8.92% townhouses, and 11.13% apartments.

Using the 2006 dwelling unit composition, the assumption was that 65% of the dwelling units are single-family houses (SF), and 35% of the dwelling units are semi-detached/duplexes or townhouses combined under the multi-family house (MF) category. ITE[8] trip generation rates were used to generate the ultimate stage (Year 2037) daily trips by each zone for different residential types. For SF housing (ITE land use 210) an average trip generation rate of 9.57 trips per site was used. For MF housing (ITE land use 230) an average rate of 5.86 trips generated per site was used.

Specific land uses for the commercial and industrial zoned areas are unknown at this point. In order to accommodate the expected development of malls, big box stores, supermarkets, general business parks, general industrial parks, and light industrial land uses, a mixed trip generation rate was devised. This rate was developed by weighting the used ITE trip generation rates for each land use. It was assumed that 40% of the total land area available would be used for mixed commercial type uses, while the remaining 60% would be used for mixed industrial type uses. This assumption was based on existing cities in Alberta (2007) of similar population and composition to that forecasted for Strathmore around the 2037 time horizon.

For each trip that is generated using rates described above, there is an attraction and a production. For instance, each SF house produces (on average) 9.57 trips, therefore 9.57 productions and 9.57 attractions. For each of those 9.57 productions originating from the SF house, there are a corresponding 9.57 attractions in other locations (i.e. the destination, such as a store). For this example, some of those attractions are already accounted for as productions using the other land use category. If a simple sum of all productions plus attractions was taken, then divided by two to determine total trips, one would overestimate (double count) some of these trips.

To avoid this, a reduction was applied to the total network trips to account for cases such as that described above. The percentage reduction was determined by completing a tolerance test at a range of 20% to 40%.

A 20% reduction would require a more robust transportation network; however, based on a comparison to other Alberta cities of similar size, it was determined that this would result in the full infrastructure being underutilized.

A 40% reduction requires an incrementally smaller network. This offsets the possibility of small idiosyncrasies within the manually assigned origin-destination matrix, which is based on desire lines alone. “Desire Lines” represent the route people would choose if there was no congestion and delays due to congestion.

Based on the above assumptions, and a 40% reduction, the total trips generated by each zone are summarized in *Table 7.3* and displayed on **Figure 7.4**.

7.2.2 Trip Purpose

Town staff noted that the employment trips count for one-half of the total trips generated by Strathmore. The second half of all trips is comprised of other trip purposes. These are hereby referred to as “Other Trips” and include recreation, medical/dental, visiting, dining out, shopping trips, etc.

[8] *“Trip Generation – 7th Edition”*, Institute of Transportation Engineers (ITE), 2003.

7.2.3 Trip Distribution

According to the 2002 Transportation Master Plan[9], about 50% of the population within the town is employed. Of the employed population, approximately 45% are employed within the town, 45% are employed in other Alberta municipalities, 5% work from their homes, and 5% do not have a regular place of work. The City of Calgary (City) did a survey in December 2003, which shows that about 45% of employment trips stay within Strathmore, 40% are destined to/originated in Calgary, and 5% are distributed to each of the north, east, and south directions.

Other trips are distributed as follows: 15% to Calgary, 10% to each of the North, South, and East directions, and the remaining 55% within the town region.

Derived from these assumptions, and combining the assumed trip purposes, **Figure 7.5** shows the weighted percentages of employment trips, other trips, and the resulting total trip distribution for Strathmore used to assign traffic to the road network.

7.2.4 Trip Assignment

With the trip distribution known, an origin-destination matrix, shown as *Table 7.4*, was created to determine the desired path of travel from zone to zone. This then was used to create a hand-manipulated all-or-nothing assignment model, assigning all trips between zones on the skeletal network. After the first iteration was completed, the desire lines were known, and certain roadways stood out which somewhat or greatly exceeded their capacity (due to narrow cross sections, close intersection spacing, or limited intersection capacity). To accommodate this, the assignment model was updated to reroute some trips away from locations that were forecasted to be over capacity in the first iteration. This iterative process determined the most likely paths for trips accounting for both distance and travel time, rather than just assigning them on the shortest possible distance. The resulting AADT link volumes are shown on **Figure 7.6**.

7.3 Future Roadway Network

The future roadway network, concept plan, and traffic control recommendations are based on origin-destination desire lines and network connectivity.

7.3.1 Future Roadway Network Determination

To determine the future roadway network, four factors were considered:

- Roadway and network connectivity
- Provision for sufficient capacity to carry traffic
- Existing and future roadway function
- Maintaining planning consistency for roadway connections noted in previous reports

Taking into account all of the previous report sections, a preliminary future network was created and submitted to the Town for review. Using the proposed roadway network and the trip distribution shown in *Table 7.4*, the trips generated by the town were assigned to the proposed future roadway network.

The year 2037 traffic volumes on the proposed roadway network are shown on **Figure 7.6**. The proposed roadway network with an aerial image is shown in **Figure 7.7**.

[9] *"Town of Strathmore – Transportation Master Plan"*, Morasch Transportation Consultants Ltd., 2002, pages D-1.

7.3.2 Roadway Network Concept Plan

The roadway classifications and cross sections were determined based on traffic volumes, access management, and existing conditions.

7.3.2.1 Future Roadway Classification

The purpose of the roadway classification is to direct roadway construction to meet the intended uses and right-of-way controls for each roadway corridor. In this study, the town's future roadway system was divided into the following five classes based on the Alberta Urban Design Guide[10].

1. **Local Streets**

   Local streets transport traffic directly to/from properties. Local street locations depend on the development of detailed community plans. Since this did not fall within the scope of this study, and it is under the control of developers, local street locations are not included in this report.

2. **Collectors**

   The function of collectors is to equally provide for property access and traffic movement. The service roads are contained within this category, but may exceed the design traffic volumes and right-of-way widths in certain locations.

3. **Minor Arterials**

   The function of minor arterials is to provide traffic movement with some access control.

4. **Major Arterials**

   The function of major arterials is to provide traffic movement with rigid access control. The typical major arterial has a four-lane section; however, in certain locations, provisions for six lanes are required.

5. **Expressways**

   The function of expressways is to provide traffic movement with no private access permitted.

   By utilizing the forecasted traffic volumes, previous reports, network connectivity, and existing conditions, the proposed road network classifications were determined. These classifications are displayed on **Figure 7.8**.

7.3.2.2 Typical Cross-Sections

Based on the Alberta Urban Design Guide[11], the City's Design Guidelines for Roads[12] and predicted traffic volumes, the typical cross-sections used by the Town were modified for the proposed roadway classifications.

The cross-sections are intended to serve as a guide for future development, but have some flexibility.

Tables 7.5 to 7.10 provide detailed descriptions of the roadway classifications with typical cross-sections.

[10] "Highway Geometric Design Guide – Urban Supplement (Draft)", Alberta Transportation, Nov. 2003, Table U.A.1.
[11] Ibid.
[12] "Design Guidelines for Subdivision Servicing", City of Calgary, June 2001, Section II: ROADS.

Table 7.5: Typical Characteristics of Local Streets

DAILY TRAFFIC VOLUME	NUMBER OF LANES	RIGHT-OF-WAY REQUIREMENTS	MINIMUM INTERSECTION SPACING
<1,000 vpd	2	15.5m or 17m	60m
FUNCTION:			
To provide direct access to abutting lands To collect and distribute traffic properties to Collectors			
ACCESS CONDITION:			
Permitted to Public Lanes, Other Local Roads, and Collectors			
TRAFFIC FEATURES:			
Posted Speed	50km/h	**Parking**	No Restrictions
Traffic Flow	Interrupted	**Transit Service**	Avoided
TYPICAL CROSS-SECTION			
For Residential (Sidewalk One Side), Refer to Cross-section L-R1 **(Figure 7.9)** For Residential (Sidewalk Two Sides), Refer to Cross-section L-R2 **(Figure 7.10)** For Industrial, Refer to Cross-section L-I **(Figure 7.11)**			

Table 7.6: Typical Characteristics of Collectors and Service Roads

DAILY TRAFFIC VOLUME	NUMBER OF LANES	RIGHT-OF-WAY REQUIREMENTS	MINIMUM INTERSECTION SPACING
<8,000 vpd	4	22m-24m	60m
FUNCTION:			
To collect and distribute traffic between Local Streets and Arterials To provide property access			
ACCESS CONDITION:			
Permitted to Local Roads, Other Collectors, and Arterials			
TRAFFIC FEATURES:			
Posted Speed	50km/h	**Parking**	Permitted with Restrictions
Traffic Flow	Interrupted	**Transit Service**	Permitted
TYPICAL CROSS-SECTION			
For Industrial (No Parking), Refer to Cross-section C-I1 **(Figure 7.12)** For Industrial (Undivided with parking on both sides), Refer to Cross-section C-I2 **(Figure 7.13)** For Residential (Undivided with parking on both sides), Refer to Cross-section C-R1 **(Figure 7.14)** For Residential (Divided with no parking), Refer to Cross-section C-R2 **(Figure 7.15)** For Service Road, Refer to C-I1 **(Figure 7.12)**			

Table 7.7: Typical Characteristics of Minor Arterials

DAILY TRAFFIC VOLUME	NUMBER OF LANES	RIGHT-OF-WAY REQUIREMENTS	MINIMUM INTERSECTION SPACING
3,000-20,000 vpd	4	30m	200m
FUNCTION:			
To provide traffic movement is the major purpose. To provide limited property access			
ACCESS CONDITION:			
Permitted to Collector Roads, other Arterials, and Expressways			
TRAFFIC FEATURES:			
Posted Speed	70km/h	**Parking**	Peak Hour Restrictions
Traffic Flow	Uninterrupted	**Transit Service**	Permitted
TYPICAL CROSS-SECTION			
For Minor Arterial (Undivided with no parking), Refer to Cross-section A-Minor **(Figure 7.16)**			

Table 7.8: Typical Characteristics of 4 Lane Major Arterials

DAILY TRAFFIC VOLUME	NUMBER OF LANES	RIGHT-OF-WAY REQUIREMENTS	MINIMUM INTERSECTION SPACING
5,000-30,000 vpd	4	36m	400m
FUNCTION:			
To provide traffic movement			
ACCESS CONDITION:			
Permitted to Collector Roads, other Arterials, Expressways, Freeways			
TRAFFIC FEATURES:			
Posted Speed	80km/h	**Parking**	Prohibited
Traffic Flow	Uninterrupted	**Transit Service**	Permitted
TYPICAL CROSS-SECTION			
For Major Arterial (Divided with no parking), Refer to Cross-section A-Major **(Figure 7.17)**			

Table 7.9: Typical Characteristics of 6 Lane Major Arterials

DAILY TRAFFIC VOLUME	NUMBER OF LANES	RIGHT-OF-WAY REQUIREMENTS	MINIMUM INTERSECTION SPACING
5,000-30,000 vpd	6	43.2m	400m
FUNCTION:			
To provide traffic movement, primarily as a alternate bypass route around the downtown core			
ACCESS CONDITION:			
Permitted to Collector Roads, other Arterials, Expressways, Freeways			
TRAFFIC FEATURES:			
Posted Speed	80km/h	**Parking**	Prohibited
Traffic Flow	Uninterrupted	**Transit Service**	Permitted
TYPICAL CROSS-SECTION			
For Major Arterial (Divided with no parking), Refer to Cross-section A-Major 6 Lane **(Figure 7.18)**			

Table 7.10: Typical Characteristics of Expressways

DAILY TRAFFIC VOLUME	NUMBER OF LANES	RIGHT-OF-WAY REQUIREMENTS	MINIMUM INTERSECTION SPACING
>10,000 vpd	>4	>45m	800m
FUNCTION:			
To provide traffic movement			
ACCESS CONDITION:			
Permitted to Arterials, other Expressways, and Freeways			
TRAFFIC FEATURES:			
Posted Speed	100km/h	**Parking**	Prohibited
Traffic Flow	Uninterrupted	**Transit Service**	Express Bus Only
TYPICAL CROSS-SECTION			
Subject to INFTRA and TAC Guidelines			

7.3.3 Future Roadway Traffic Control Assessment

The main traffic control methods are signals, roundabouts, stop control, and yield control. Because this study primarily considers the major roadways, all intersections along assessed routes will have some form of control. The purpose of this analysis is to identify potential locations at which higher forms of control, such as signals or roundabouts, may be required. **Figure 7.19** shows the possible future locations of higher forms of control. UMA's assessment generally considered safety, operations, physical suitability, and special conditions.

Note that the installation of signals should be based on field-collected traffic and pedestrian count data. For this, the Transportation Association of Canada (TAC) Traffic Signal Warrant Matrix Procedure[13] needs to be followed.

7.4 Roadway Network Recommendations

In order to accommodate the forecasted traffic volumes for the 2037 design year, as well as for future town growth, additional infrastructure is required. Following are the classification and details of the major network links recommended for the Town of Strathmore.

7.4.1 Highway 1 (Trans Canada Highway)

- Highway 1 through the Town of Strathmore is an east-west expressway that will require upgrading from four to six lanes. Highway 1 through the province of Alberta is planned to eventually be freeway status. The current plan to achieve this is to bypass Strathmore, however, it is anticipated that the current roadway will remain as an expressway designation. Presently there are three sets of lights located on Highway 1 at Highway 817, Lakeside Boulevard and East Boundary Road. Future provisions for three additional sets of lights are forecasted for Wildflower Road, Westmount Road (to the south), and east of East Boundary Road. All other accesses to and from the expressway are recommended for closure.

[13] "Canadian Traffic Signal Warrant Matrix Procedure", Transportation Association of Canada, Nov. 2005.

- In order to pull the primary desire line away from the downtown core, more specifically the intersection of Highway 1 and Highway 817, a ring road or perimeter road is recommended. This ring road would be comprised of North Boundary Road, East Boundary Road, South Boundary Road, and West Boundary Road as shown in **Figure 7.8**. In order to attract trips to the ring road in the future, easy connectivity to and from Highway 1 is important. To achieve this, it is recommended that provisions be made for an interchange at the location of Highway 1 and West Boundary Road, as well as one at Highway 1 and East Boundary Road. This high-level study did not consider what the configuration or footprint of these interchanges would be. Further study is required to determine how this should develop.

7.4.2 Highway 817 (Wheatland Trail)

- Highway 817 is currently the primary north-south route through the Town of Strathmore. The desire lines are concentrated on this corridor as it travels through the centre of town. This results in the roadway operating at overcapacity conditions due to geometric limitations such as the number of lanes and the distance between intersections. The ability to widen Highway 817 is restricted due to the proximity of buildings. The proposed classification of Highway 817 as a Multilane matches the INFTRA ultimate plan[14], and is recommended to be a major arterial with the provision to widen to six lanes in the future where possible. This classification would eventually require limiting the number of access points primarily through the downtown (CBD) region.
- There are currently two sets of signal lights at Highway 1 and Ridge Road. Nine additional signal lights may be required at South Boundary Road, Orchard Park Road, Second Avenue, Westmount Drive, West Avenue, East Lake Road, Brent Boulevard, Hillview Drive, and North Boundary Road.

7.4.3 East Boundary Road

- East Boundary Road makes up the eastern portion of the proposed ring road around the Town of Strathmore. As such, UMA recommends this corridor be classified as a major arterial with the provision for six lanes from South Boundary Road to North Boundary Road. An interchange at Highway 1 and realignment of East Boundary Road may be required to improve traffic flow through the area, and to pull trips away from the Highway 1 and Highway 817 intersection.
- There are currently two sets of signal lights at Highway 1 and the existing north service road. Seven additional signal lights may be required at South Boundary Road, Orchard Park Road, Ridge Road, Park Lane Drive, East Lake Road, Brent Boulevard, and North Boundary Road.

7.4.4 North Boundary Road

- North Boundary Road makes up the northern portion of the proposed ring road around the Town of Strathmore. As such, the recommendation is to classify the corridor as a major arterial with the provision for six lanes between East Boundary Road and West Boundary Road.
- Five signal lights may be required at East Boundary Road, Strathford Boulevard, Highway 817, Hillview Gate, and West Boundary Road.

[14] *"Highway Geometric Design Guide"*, Alberta Transportation, *October 2005*, Figure I-1.2i.

7.4.5 South Boundary Road

- South Boundary Road makes up the southern portion of the proposed ring road around the Town of Strathmore. As such, the recommended classification for this corridor is as a major arterial with the provision for six lanes from East Boundary Road to Highway 817. A future link outside of the study area connecting South Boundary Road to West Boundary Road is recommended. Regardless of the link's future designation as an expressway or major arterial, provisions should be made for six lanes, as this link is part of the ring road.
- Four signal lights may be required at SE Road, East Boundary Road, Slater Way, and Highway 817.

7.4.6 West Boundary Road (Wildflower Road)

- West Boundary Road makes up the western portion of the proposed ring road around the Town of Strathmore. As such, the recommendation is that the corridor is classified as a six lane expressway from North Boundary Road to Highway 1, with a four lane major arterial designation north of North Boundary Road. A future link outside of the study area connecting West Boundary Road to South Boundary Road is recommended as discussed in **Section 7.4.5**. An interchange at Highway 1 may be required to improve traffic flow and attract trips from the Highway 1 and Highway 817 intersection. Realignment of West Boundary Road to the west at the junction of Highway 1 is recommended to put the intersection/interchange on the top of the hill. This will provide for profile sight distances, as well as moving the junction area away from the existing canal.
- Six signal lights may be required at North Boundary Road, Brent Boulevard, West Avenue, North Service Road, Highway 1, and South Service Road.

7.4.7 North Service Road (Ridge Road)

- The North Service Road is comprised of the existing West Ridge Road, Ridge Road, and East Ridge Road. It is recommended that it remain as a service road designation with a four lane divided section.
- There is currently one set of signal lights at Highway 817. Five additional signal lights may be required east of East Boundary Road, and at East Boundary Road, Centre Street, Lakeside Boulevard, and West Boundary Road.

7.4.8 South Service Road (Canal Boulevard, Orchard Park Road)

- The South Service Road is comprised of the existing Orchard Park Road and Canal Boulevard. It is recommended that it remain as a service road designation with a four lane divided section.
- Seven signal lights may be required east of East Boundary Road, and at SE Street, East Boundary Road, Spruce Park Drive, Highway 817, Westmount Road, and West Boundary Road.

7.4.9 West Avenue

- It is recommended that West Avenue be classified as a major arterial from Highway 817 to West Boundary Road, and a minor arterial west of West Boundary Road.
- Three signal lights may be required at Highway 817, Westmount Drive, and West Boundary Road.

7.4.10 Brent Boulevard

- The recommendation is that Brent Boulevard be designated as a minor arterial from Highway 817 to east of East Boundary Road, and a collector roadway west of the golf course. The extension of Brent Boulevard west through the existing golf course is desirable, but this link would cut through the middle of the golf course. Consideration should be given to develop this link in the future if further development takes place within the golf course.
- Three signal lights may be required at East Boundary Road, Highway 817, and West Boundary Road.

7.4.11 East Lake Road

- The existing portion of East Lake Road is recommended to remain as a collector road, with a new link between Thomas Drive and Highway 817 being designated as a minor arterial.
- Signal lights may be required at East Boundary Road and Highway 817.

7.4.12 Park Lane Drive

- The classification of Park Lane Drive is recommended to be a minor arterial from Lakeside Boulevard to the east.
- Signal lights may be required at East Boundary Road and Lakeside Boulevard.

7.4.13 Second Avenue

- It is recommended that Second Avenue remain as a collector.
- Signal lights may be required at Lakeside Boulevard and Highway 817.

7.4.14 Thomas Drive

- It is recommended that Thomas Drive remain as a collector.

7.4.15 Centre Street

- The recommendation is that Centre Street remain as a collector from East Lake Road to Park Lane Drive, but be upgraded to a minor arterial from Park Lane Drive to the North Service Road.
- Signal lights may be required at the North Service Road.

7.4.16 Lakeside Boulevard

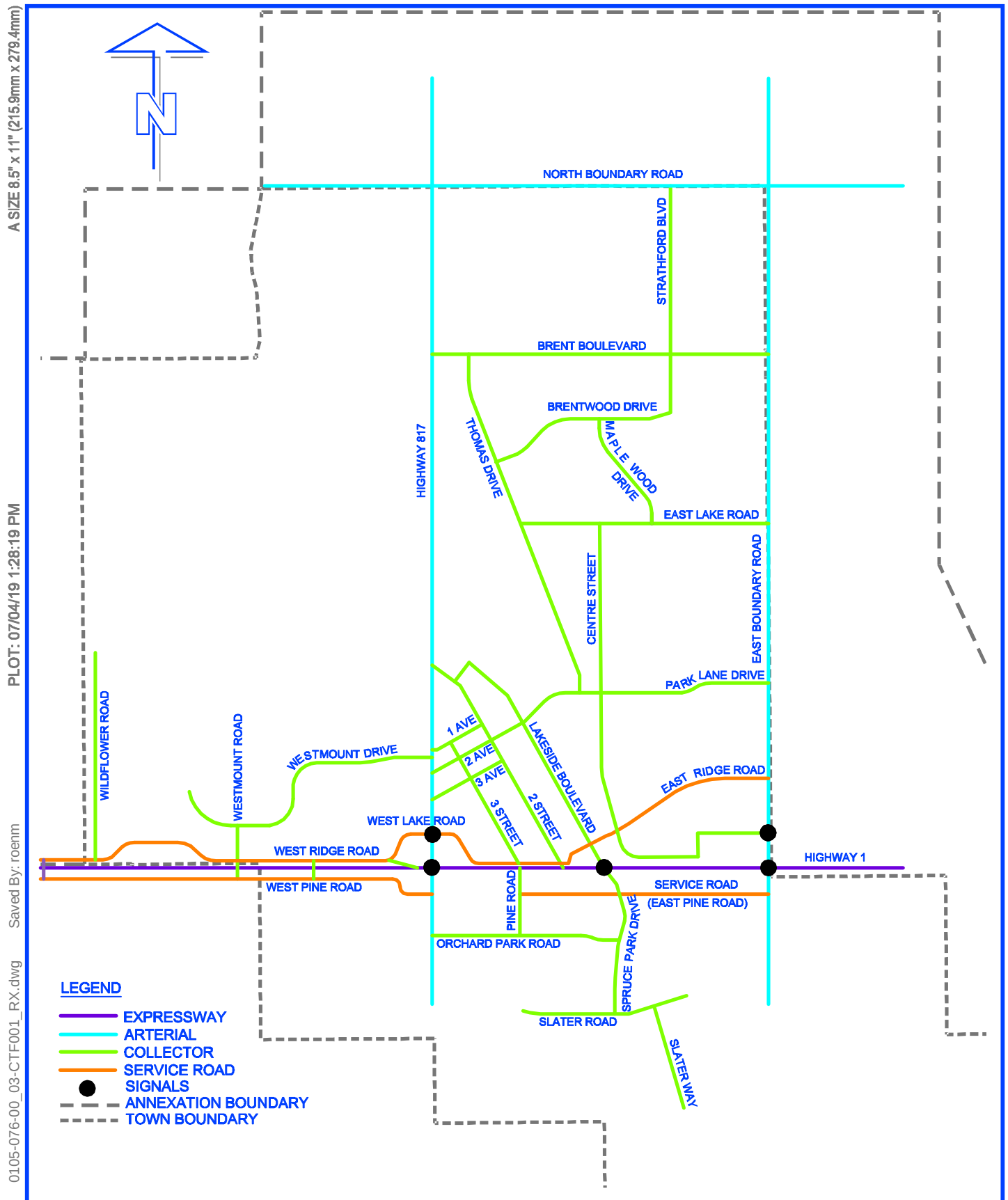
- UMA recommends that Lakeside Boulevard remain as a collector except between the North Service Road and Highway 1 where it should be a major arterial. Ideally, Lakeside Boulevard should be upgraded to a minor arterial to allow traffic to bypass the downtown area; however, with the road already existing, significant changes would be required, and the town will still function reasonably well without the link being upgraded.
- There is currently one set of signal lights at Highway 1. Additional signal lights may be required at Park Lane Drive and the North Service Road.

7.4.17 Strathford Boulevard

- Strathford Boulevard should remain as a collector.
- Signal lights may be required at North Boundary Road.

7.4.18 Hillview Boulevard

- Hillview Boulevard should remain as a collector.
- Signal lights may be required at North Boundary Road.



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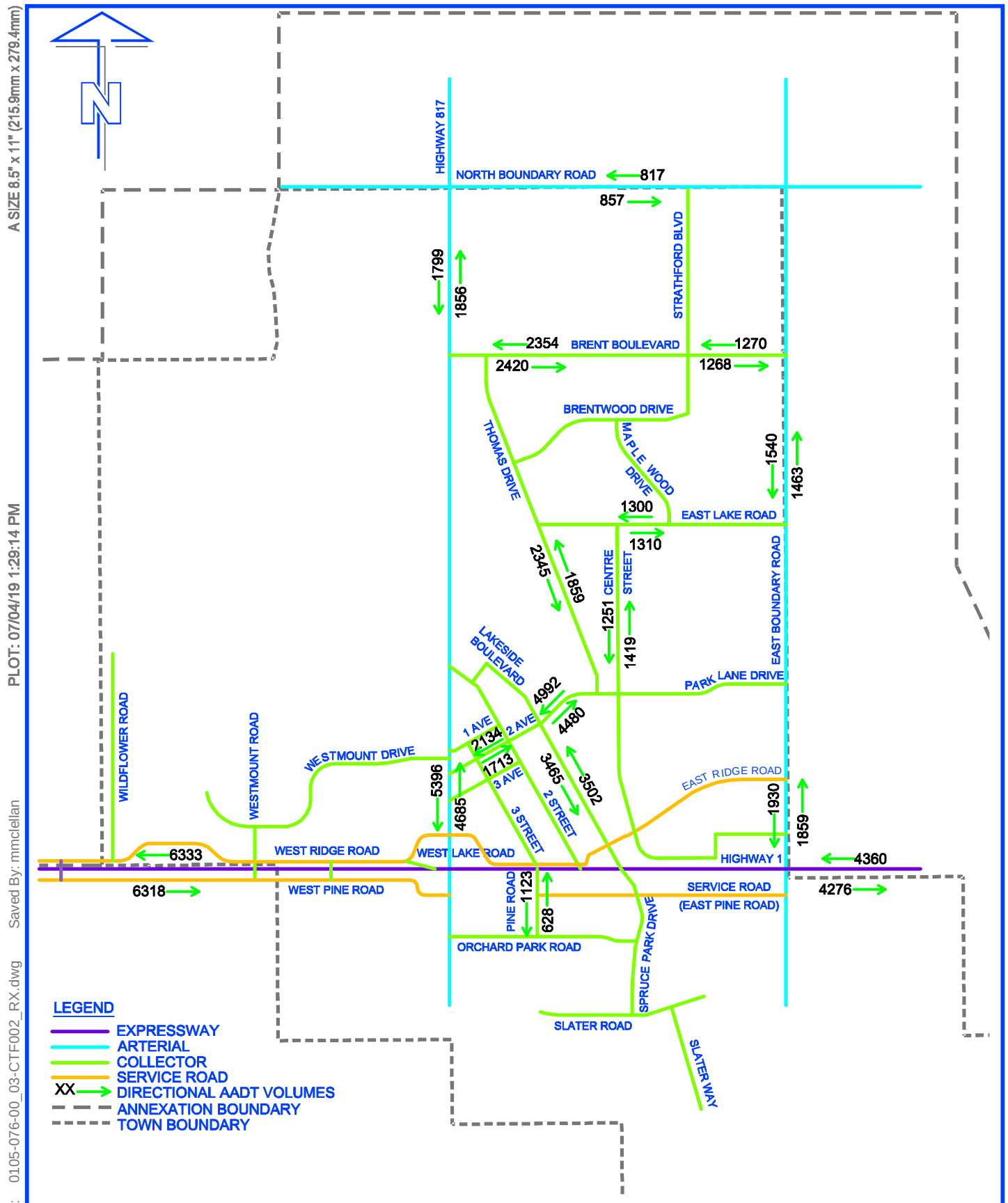
Town of Strathmore
Master Servicing Study
Annexation 2006

UMA | AECOM

Existing Roadway System
Figure 7.1



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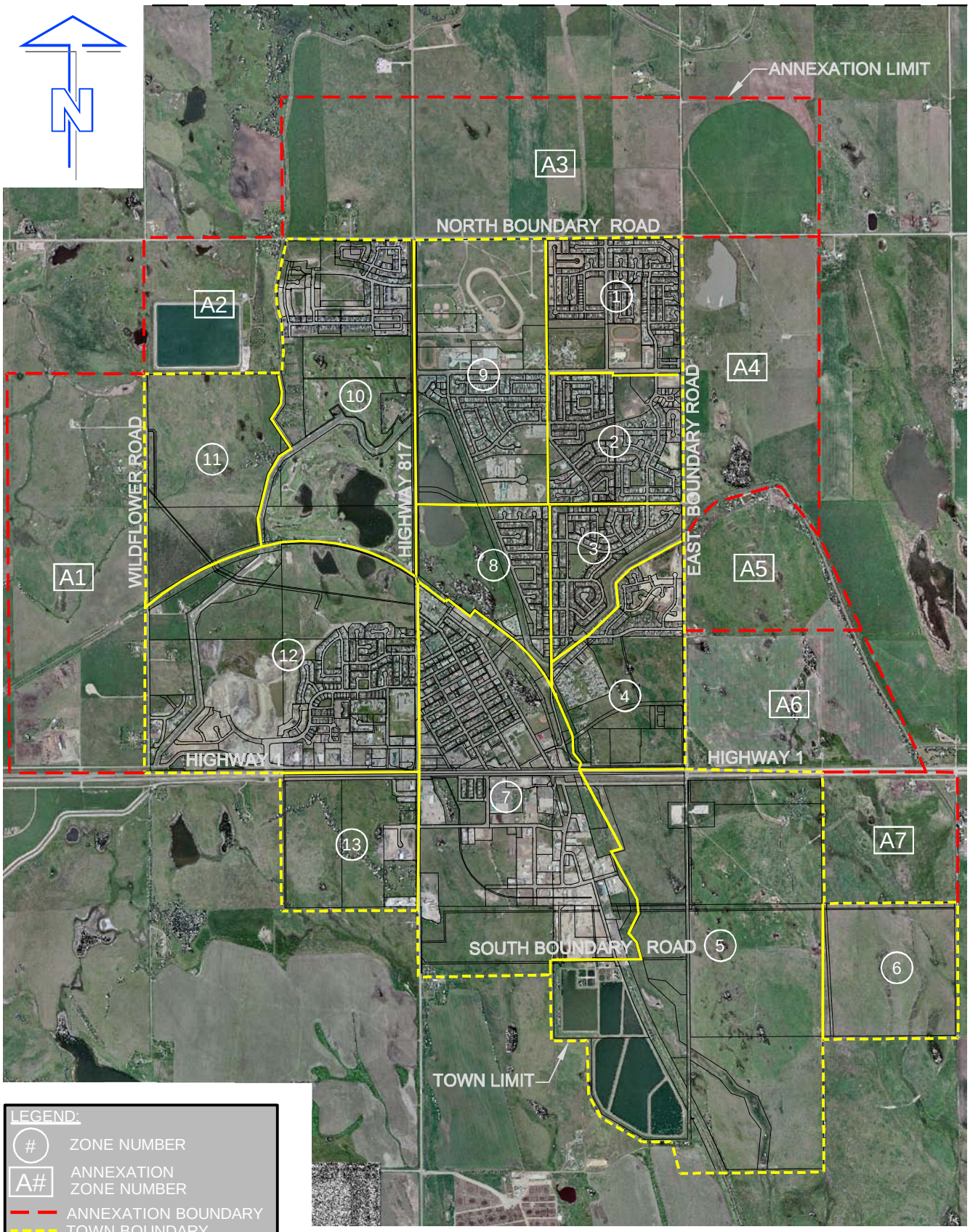
Town of Strathmore
Master Servicing Study
Annexation 2006

Existing AADT Traffic Volumes (2006)

Figure 7.2

UMA | AECOM



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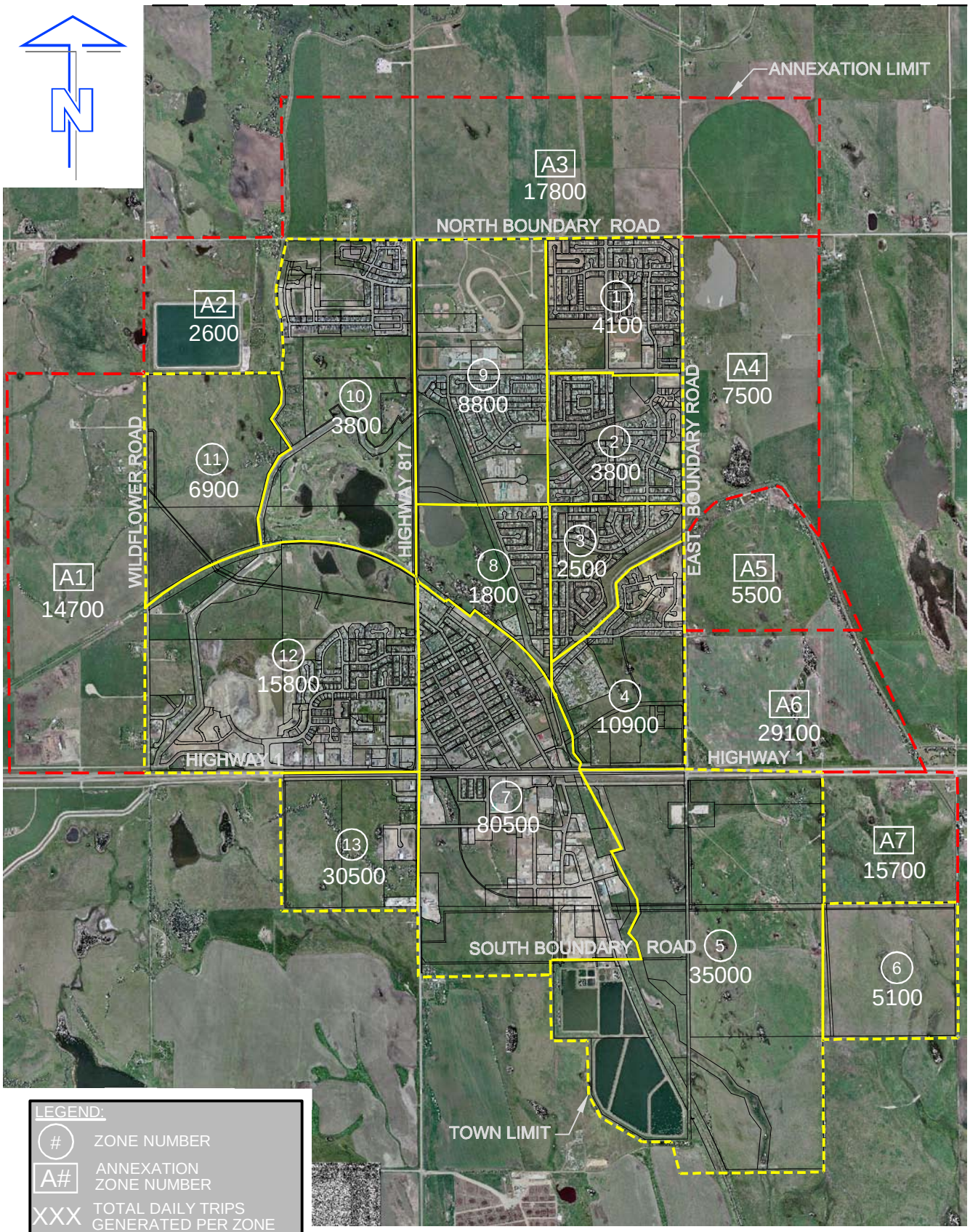
Town of Strathmore
Master Servicing Study
Annexation 2006

UMA | AECOM

Zoning Map
Figure 7.3



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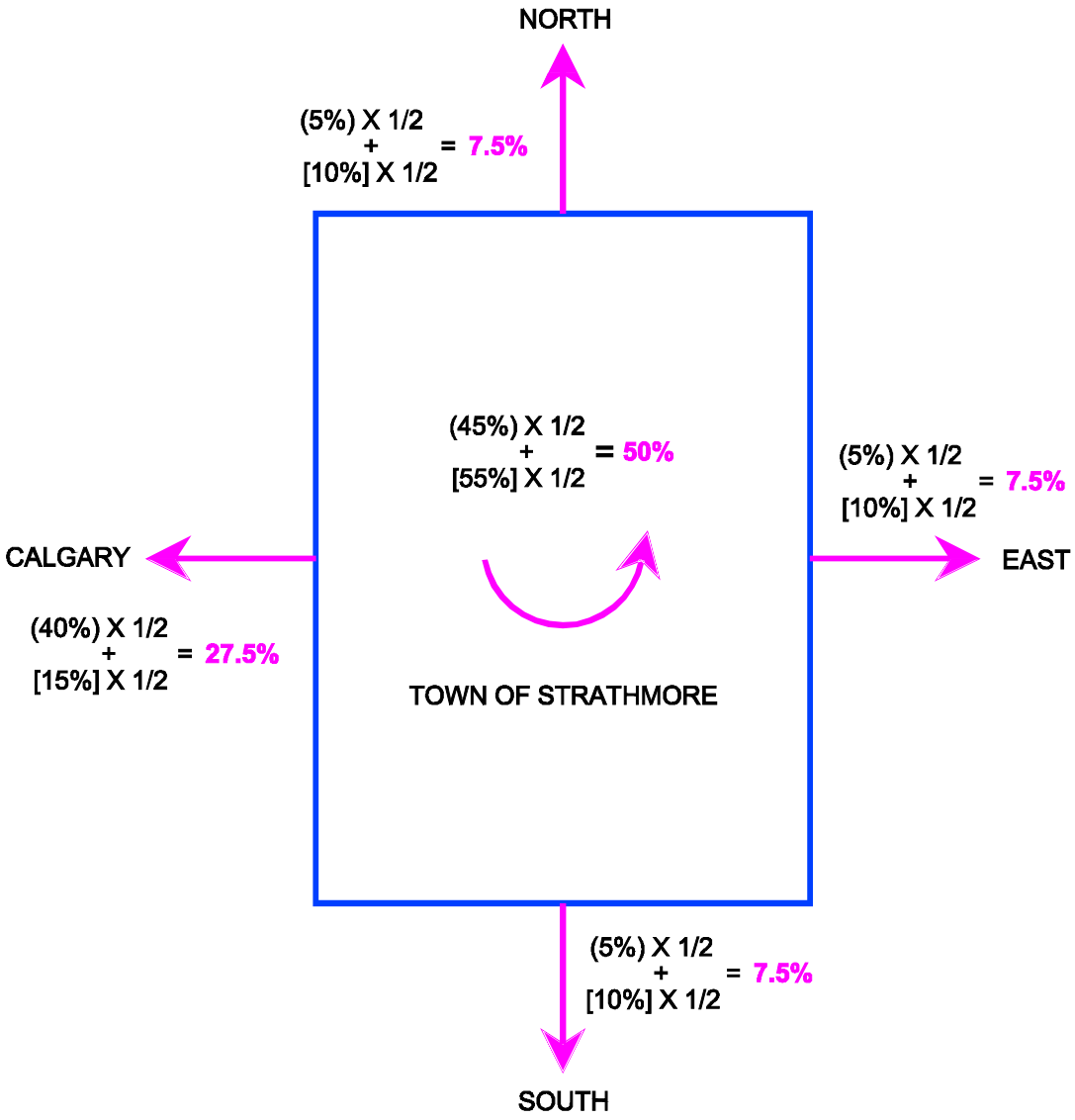
Town of Strathmore
Master Servicing Study
Annexation 2006

UMA | AECOM

2037 Ultimate Trip Generation by Zones
Figure 7.4



LEGEND

(XX%) - EMPLOYMENT TRIPS

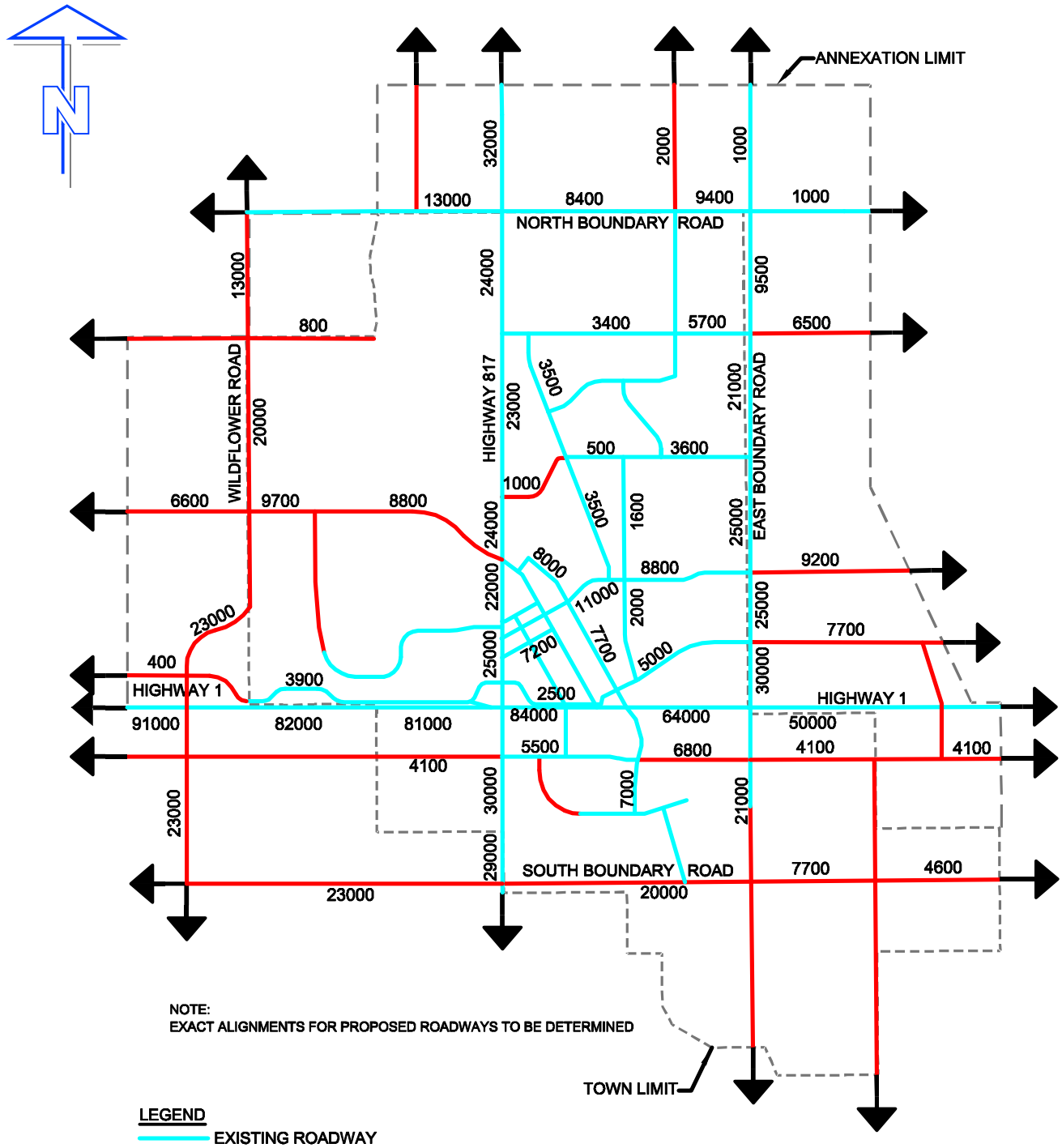
[XX%] - OTHER TRIPS

XX% - TOTAL TRIPS

Town of Strathmore
Master Servicing Study
Annexation 2006

UMA | AECOM

Total Trip Distribution
Figure 7.5



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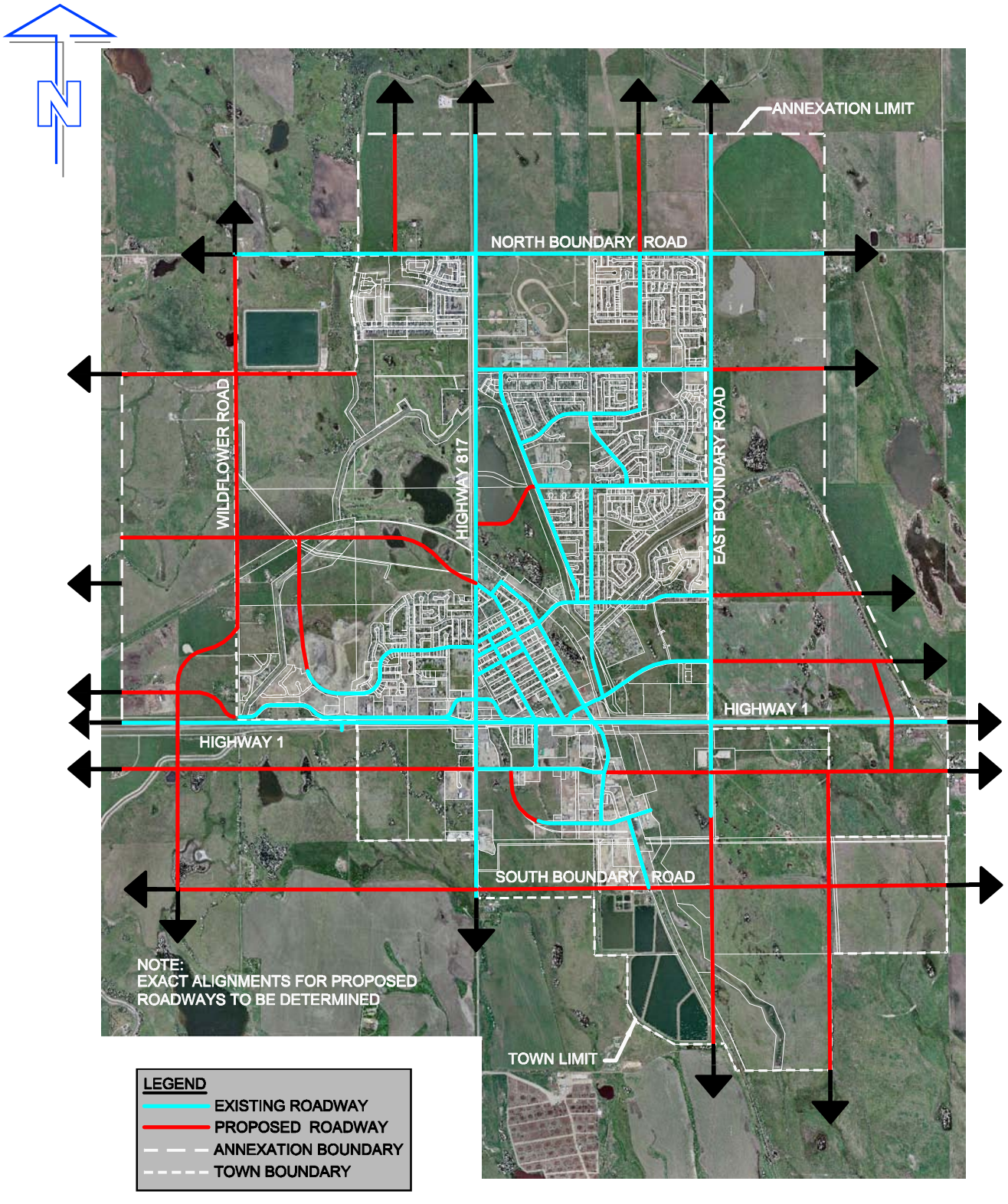
Town of Strathmore
Master Servicing Study
Annexation 2006

Estimated 2037 AADT Volumes With Proposed Roadway Network

Figure 7.6

UMA | AECOM



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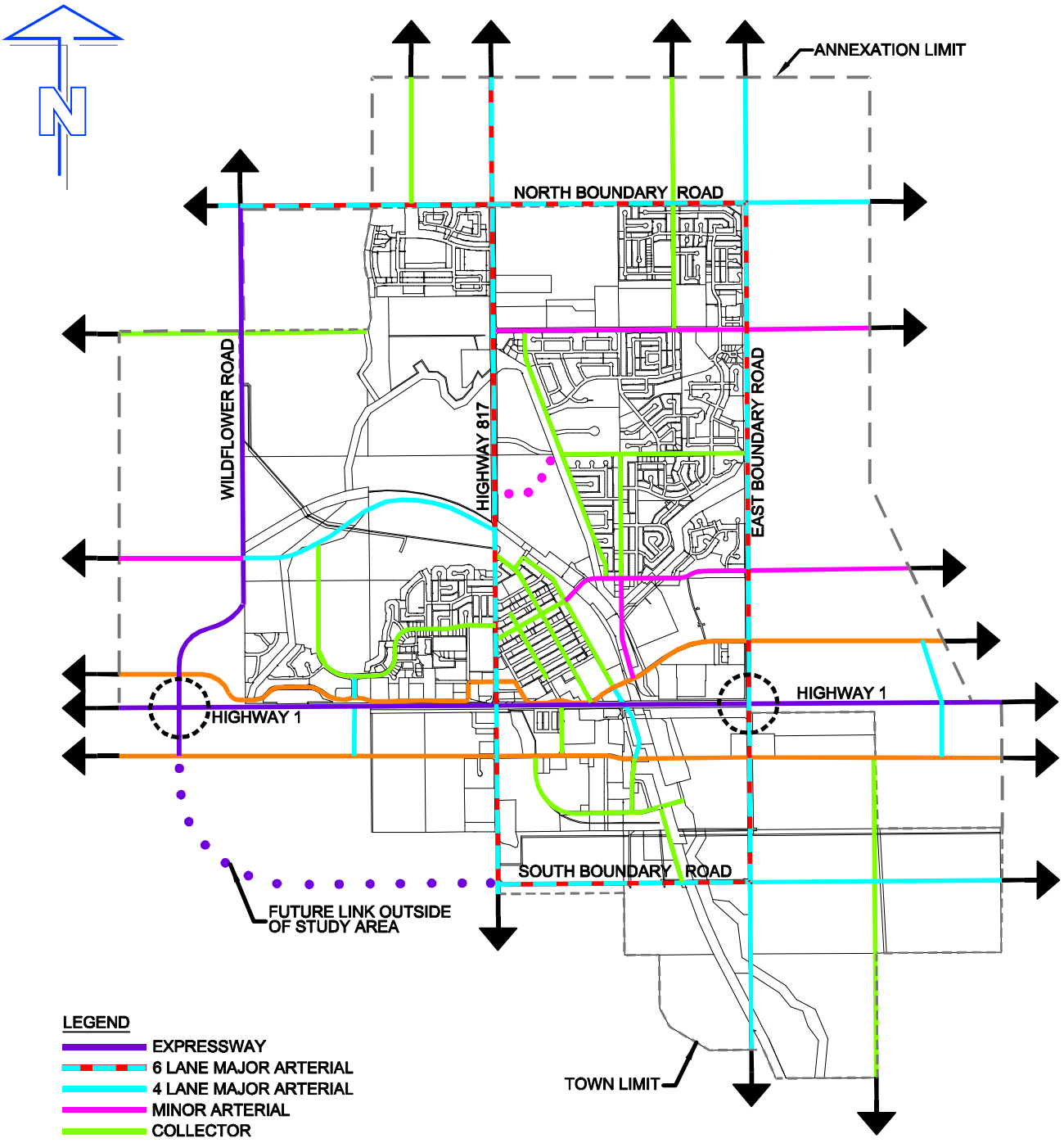
Town of Strathmore
Master Servicing Study
Annexation 2006

UMA | AECOM

Proposed Roadway Network
Figure 7.7



A SIZE 8.5" x 11" (215.9mm x 279.4mm)

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Town of Strathmore
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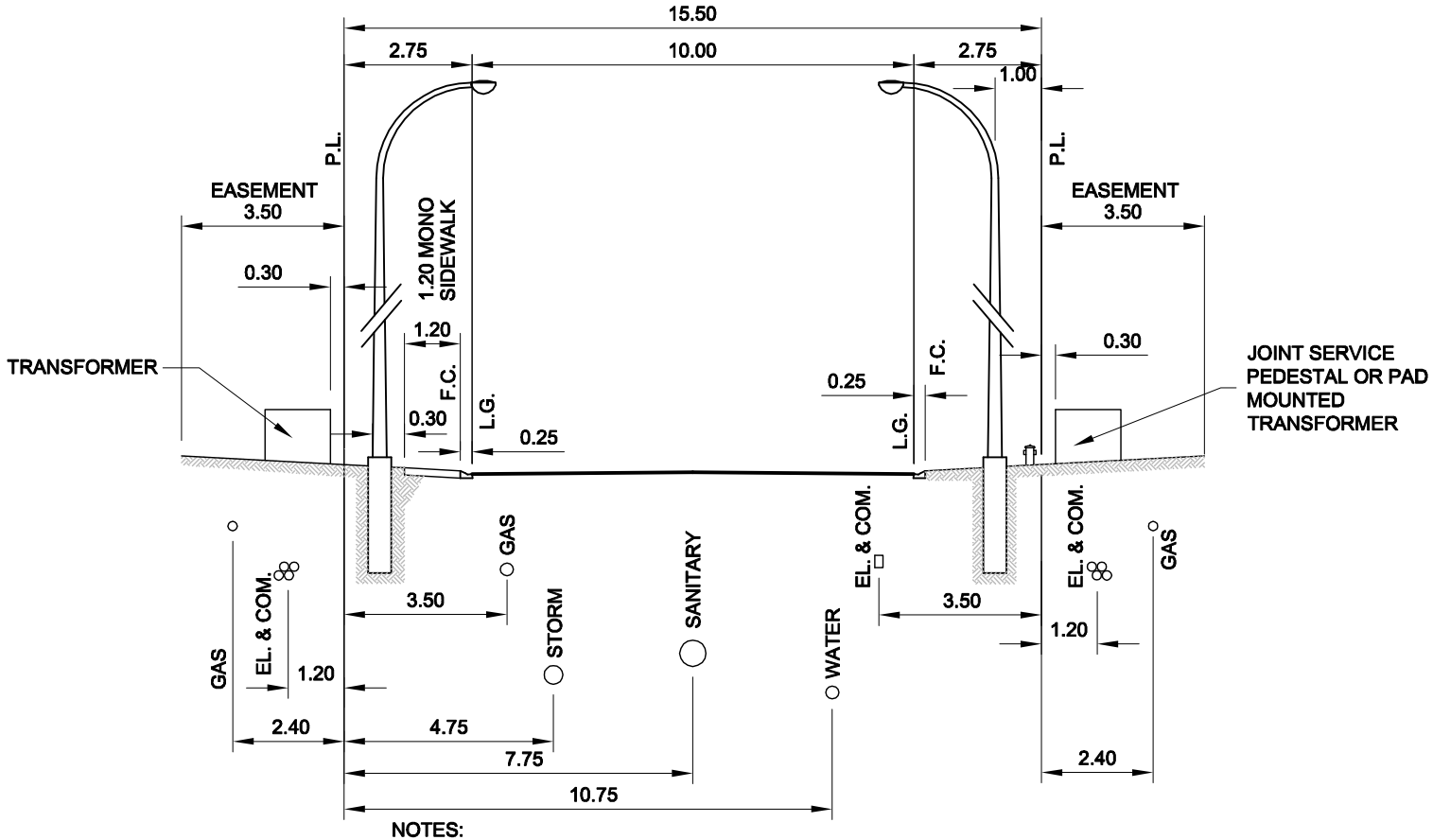
Future Roadway Classification
Figure - 7.8



NOTES:

-CARRIAGE WAY IS TO BE CROWNED
-CURB REQUIRED ON BOTH SIDES
-HYDRANT ON 0.75 M LINE
-HYDRANT VALVES ON 1 M FROM MAIN
-SERVICE VALVES ON 0.50 M LINE
-SHALLOW UTILITES TO BE IN EASEMENT IF WATER & SEWER SERVICES ARE IN STREET ROW
-ALL SURFACE STRUCTURES TO BE A MIN. OF 3.0 M FROM HYDRANTS.

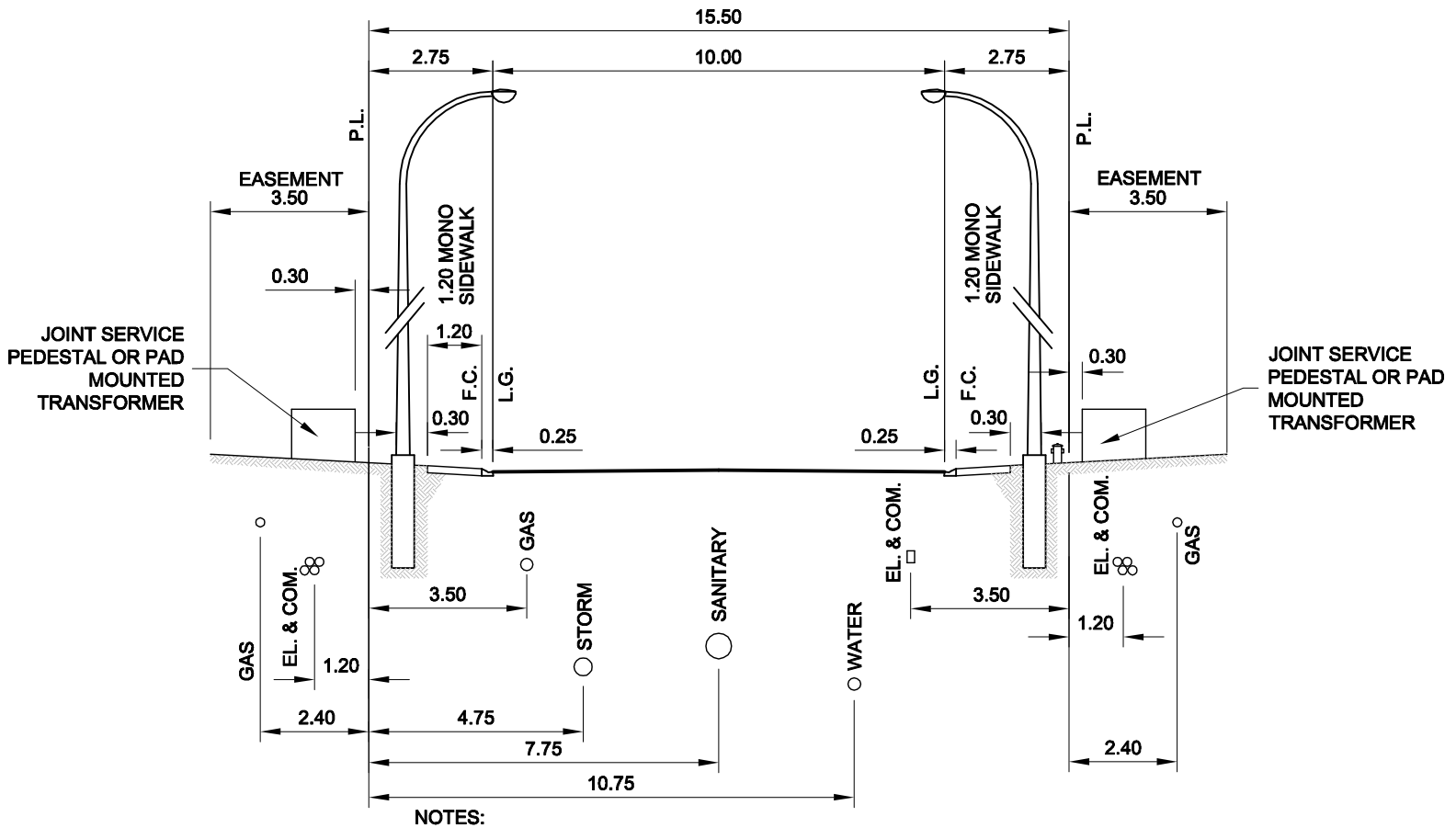
Town of Strathmore
Master Servicing Study
Annexation 2006

Residential Local Sidewalk One Side

L-R1

Figure - 7.9

UMA | AECOM



NOTES:

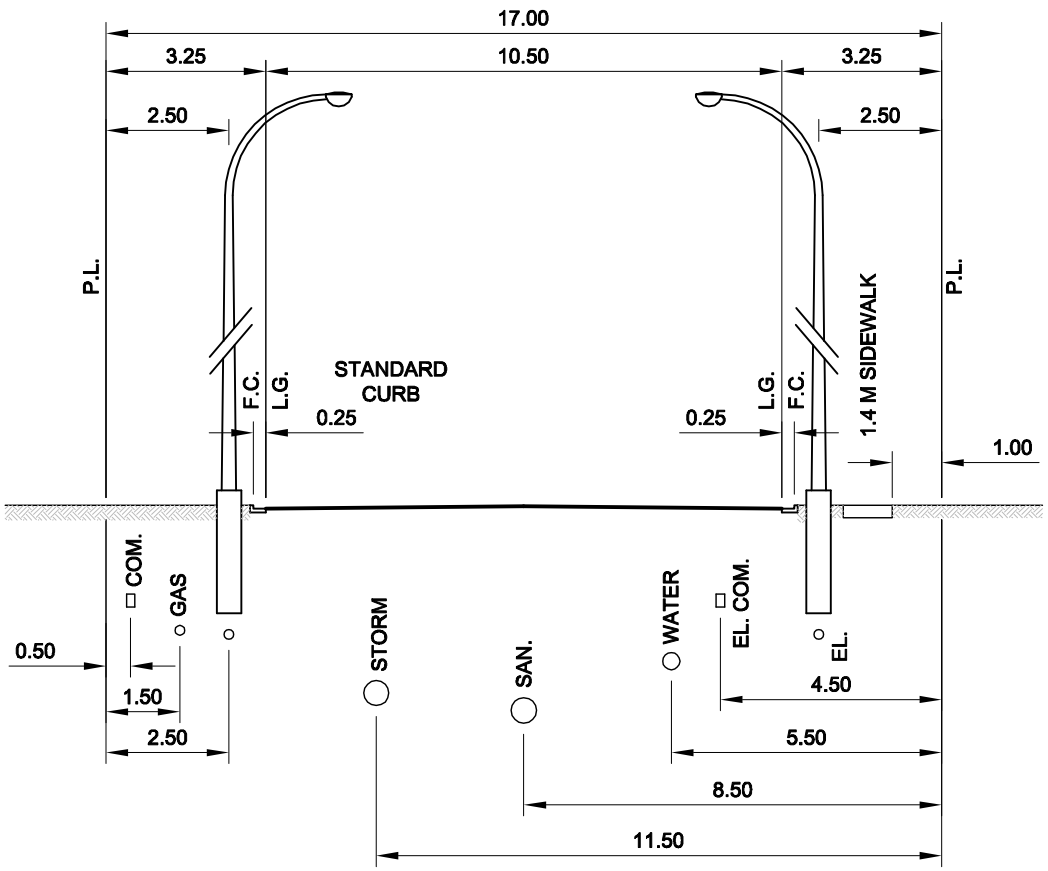
-CARRIAGE WAY IS TO BE CROWNED
-CURB REQUIRED ON BOTH SIDES
-HYDRANT ON 0.75 M LINE
-HYDRANT VALVES ON 1 M FROM MAIN
-SERVICE VALVES ON 0.50 M LINE
-SHALLOW UTILITES TO BE IN EASEMENT IF WATER & SEWER SERVICE ARE IN STREET ROW
-ALL SURFACE STRUCTURES TO BE A MIN. OF 3.0 M FROM HYDRANTS.

Town of Strathmore
Master Servicing Study
Annexation 2006

Residential Local Sidewalk Two Sides

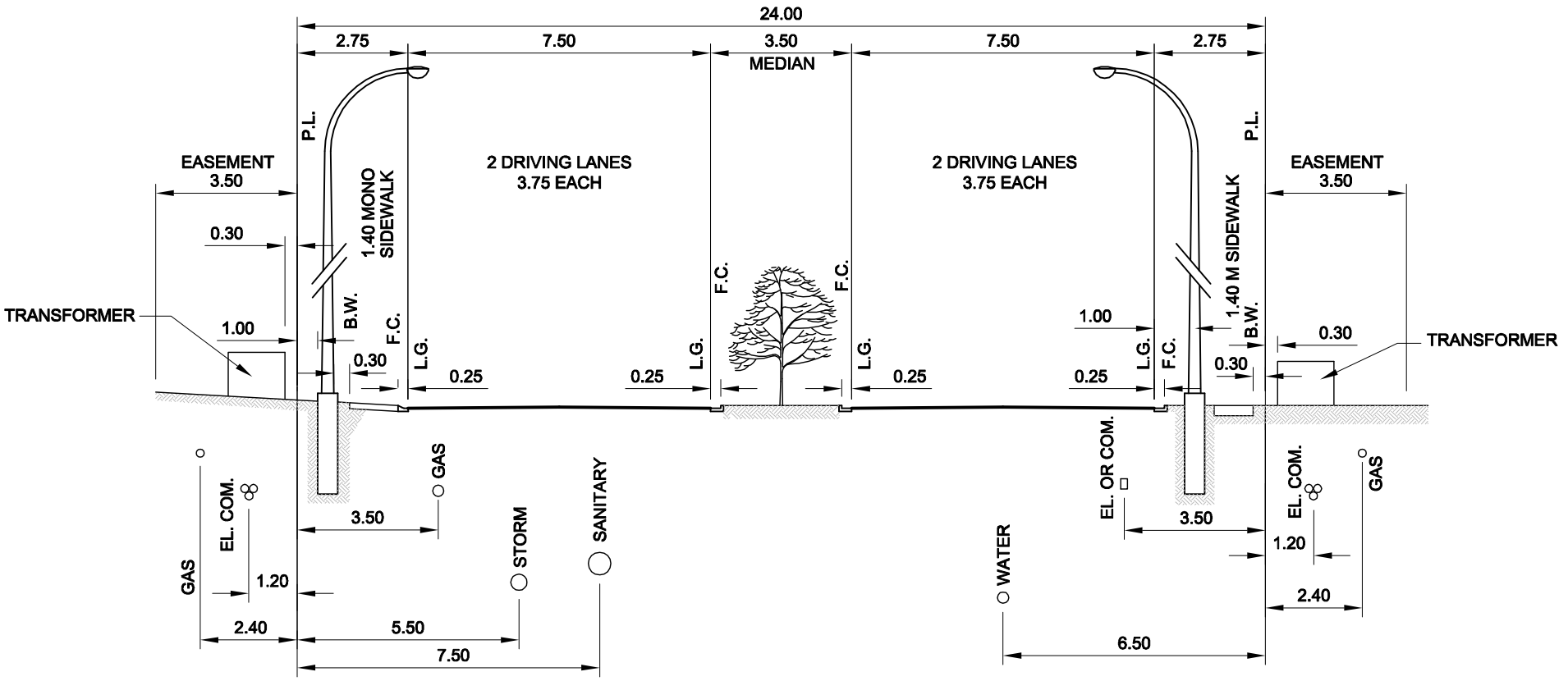
L-R2

Figure - 7.10



NOTES:
HYDRANT ON 2.50 LINE
HYDRANT VALVES 1.00 M FROM MAIN.
SERVICE VALVE IS ON 2.50 LINE
SERVICE VALVE IS ON 2.00 LINE WITH LIGHT STANDARD
ALL SURFACE FIXTURES TO MAINTAIN A 3.0 M CLEARANCE FROM HYDRANTS
1.2 M MONO SIDEWALK IS OPTIONAL

Town of Strathmore
Master Servicing Study
Annexation 2006
Industrial Local
L-1
Figure - 7.11



NOTES:

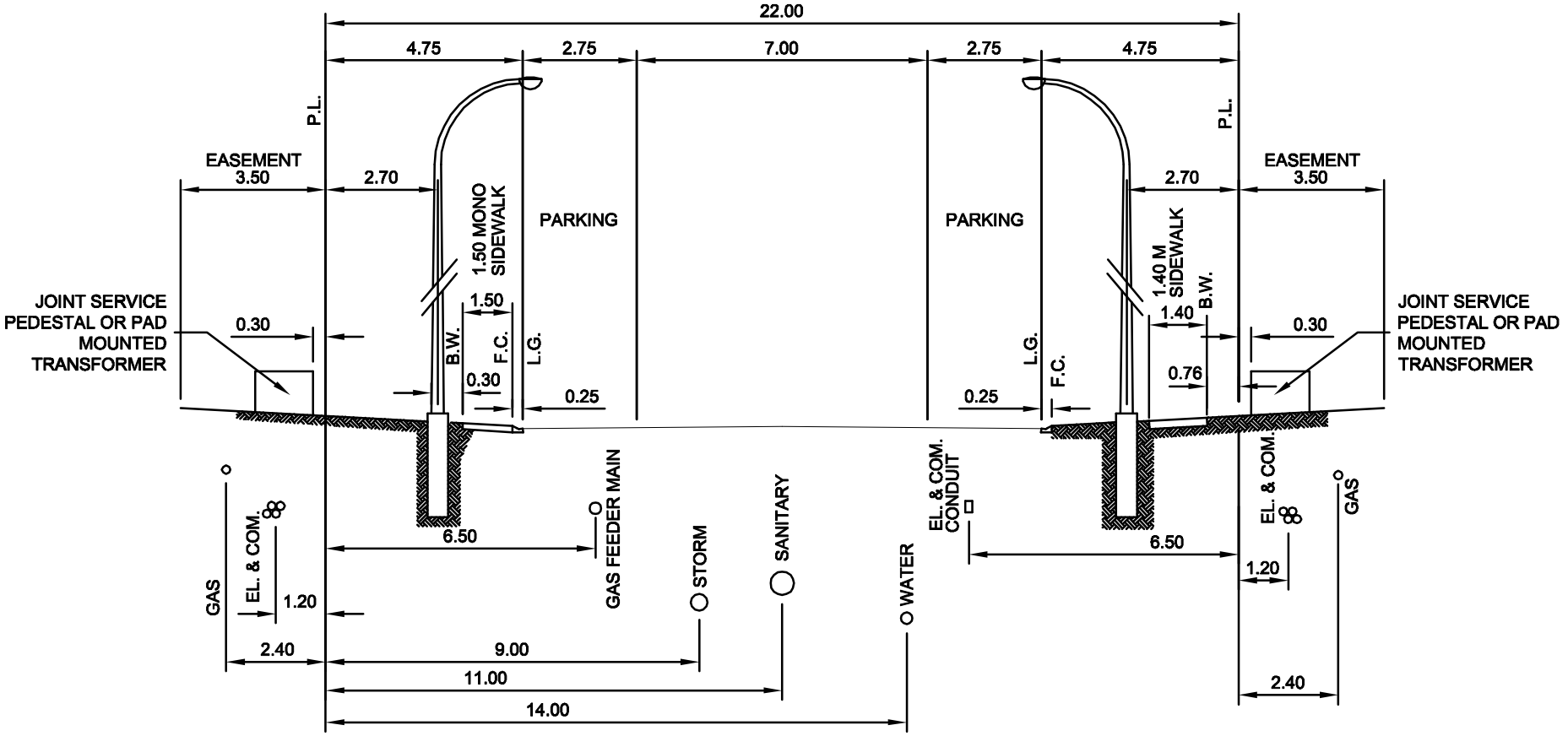
-CARRIAGE WAY IS TO BE CROWNED
-CURB REQUIRED ON BOTH SIDES
-HYDRANT ON 0.75 M LINE
-HYDRANT VALVES ON 1 M FROM MAIN
-1.2 M MONO SIDEWALK IS OPTIONAL
-SERVICE VALVES ON 0.50 M LINE
-SHALLOW UTILITES TO BE IN EASEMENT IF WATER & SEWER SERVICES ARE IN STREET ROW
-ALL SURFACE STRUCTURES TO BE A MIN. OF 3.0 M FROM HYDRANTS.

Town of Strathmore
Master Servicing Study
Annexation 2006

Industrial Primary Collector No Parking

C-I1

Figure - 7.12



NOTES:

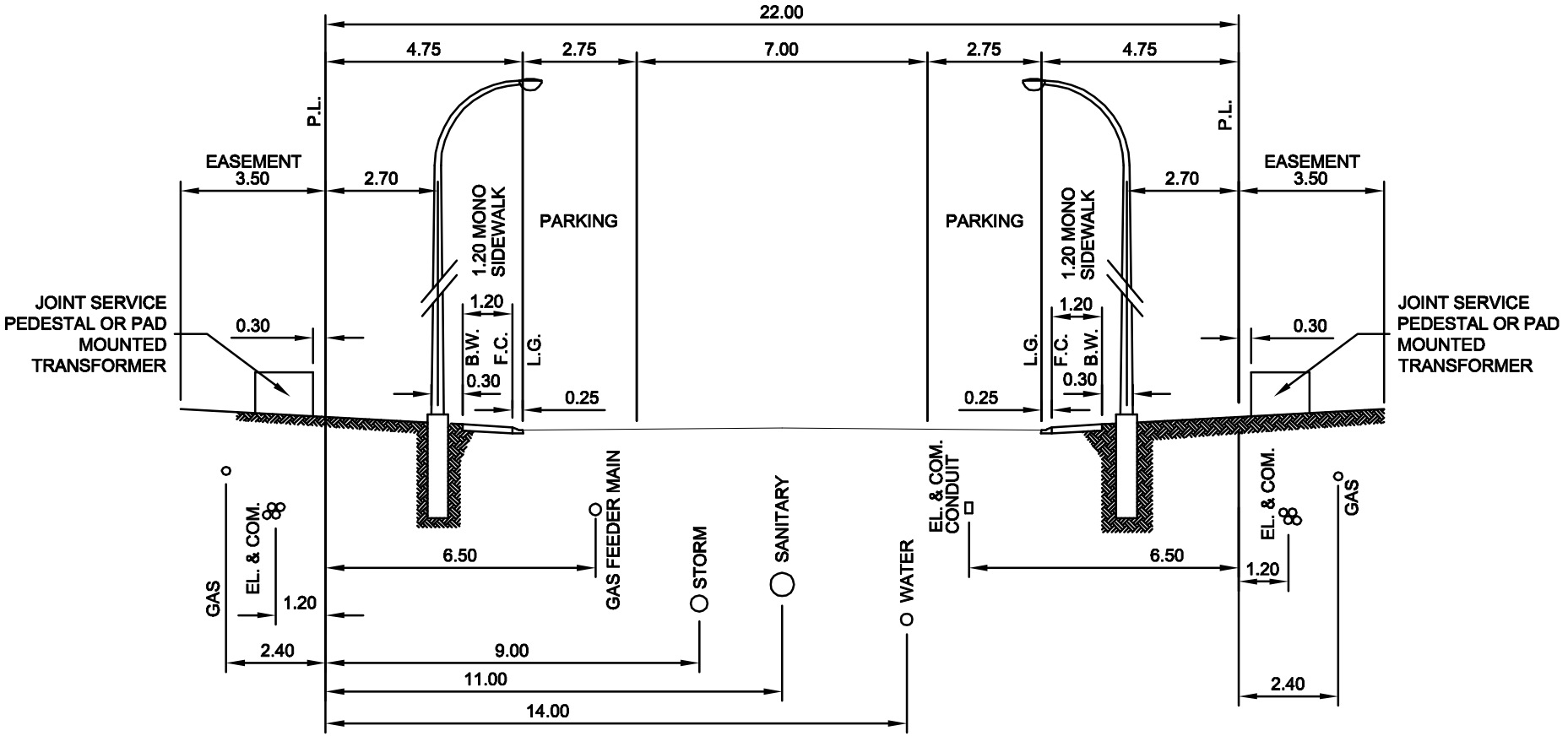
-CARRIAGE WAY IS TO BE CROWNED
-CURB REQUIRED ON BOTH SIDES
-HYDRANT ON 0.75 M LINE
-HYDRANT VALVES ON 1 M FROM MAIN
-1.2 M MONO SIDEWALK IS OPTIONAL
-SIDEWALK ONE SIDE
-SERVICE VALVES ON 0.50 M LINE
-SHALLOW UTILITES TO BE IN EASEMENT IF WATER & SEWER SERVICES ARE IN STREET ROW
-ALL SURFACE STRUCTURES TO BE A MIN. OF 3.0 M FROM HYDRANTS.

Town of Strathmore
Master Servicing Study
Annexation 2006

Industrial Collector Undivided

C-I2

Figure - 7.13



NOTES:

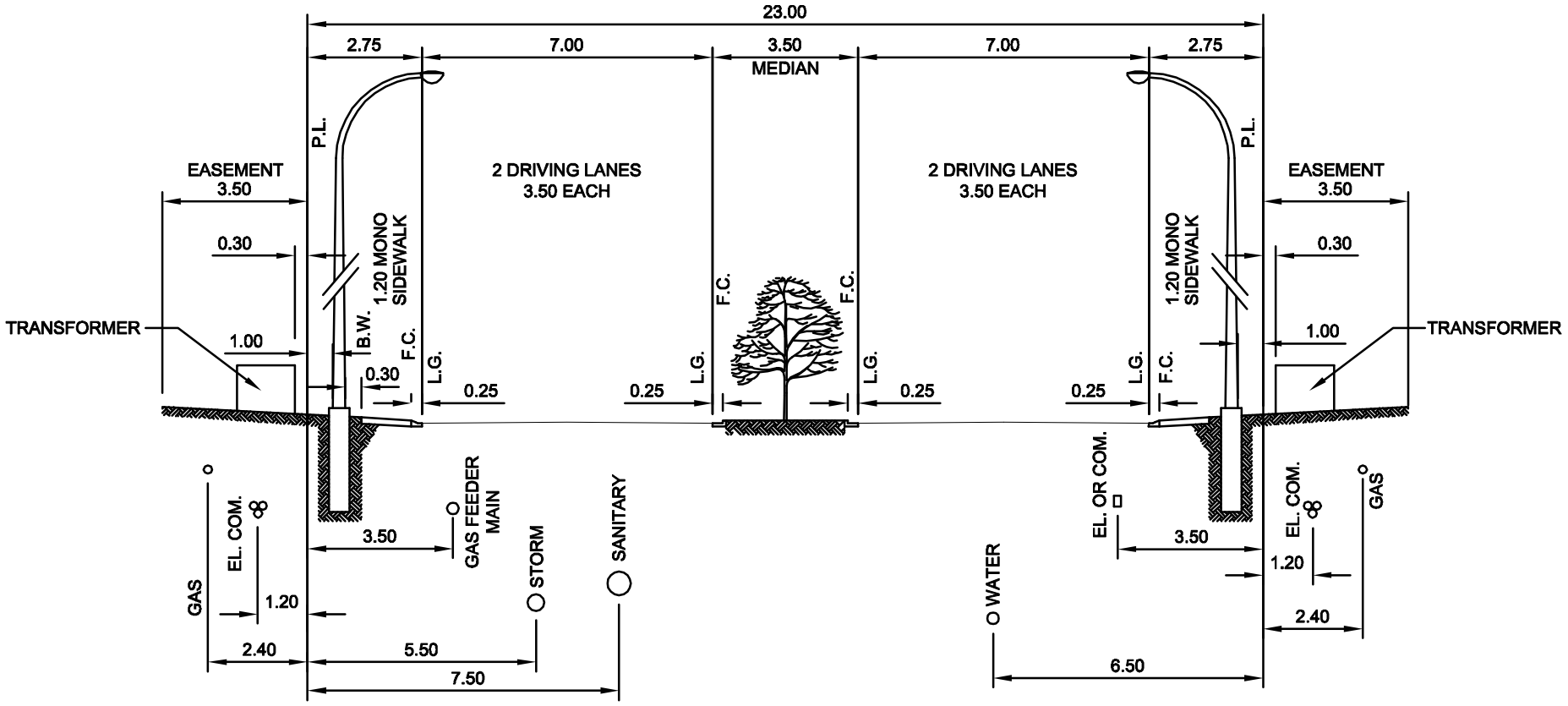
-CARRIAGE WAY IS TO BE CROWNED
-CURB REQUIRED ON BOTH SIDES
-HYDRANT ON 0.75 M LINE
-HYDRANT VALVES ON 1 M FROM MAIN
-SERVICE VALVES ON 0.50 M LINE
-SHALLOW UTILITES TO BE IN EASEMENT IF WATER & SEWER SERVICES ARE IN STREET ROW
-ALL SURFACE STRUCTURES TO BE A MIN. OF 3.0 M FROM HYDRANTS.

Town of Strathmore
Master Servicing Study
Annexation 2006

Residential Collector Undivided

C-R1

Figure - 7.14



NOTES:

-CARRIAGE WAY IS TO BE CROWNED
-CURB REQUIRED ON BOTH SIDES
-HYDRANT ON 0.75 M LINE
-HYDRANT VALVES ON 1 M FROM MAIN
-SERVICE VALVES ON 0.50 M LINE
-SHALLOW UTILITES TO BE IN EASEMENT IF WATER & SEWER SERVICES ARE IN STREET ROW
-ALL SURFACE STRUCTURES TO BE A MIN. OF 3.0 M FROM HYDRANTS.

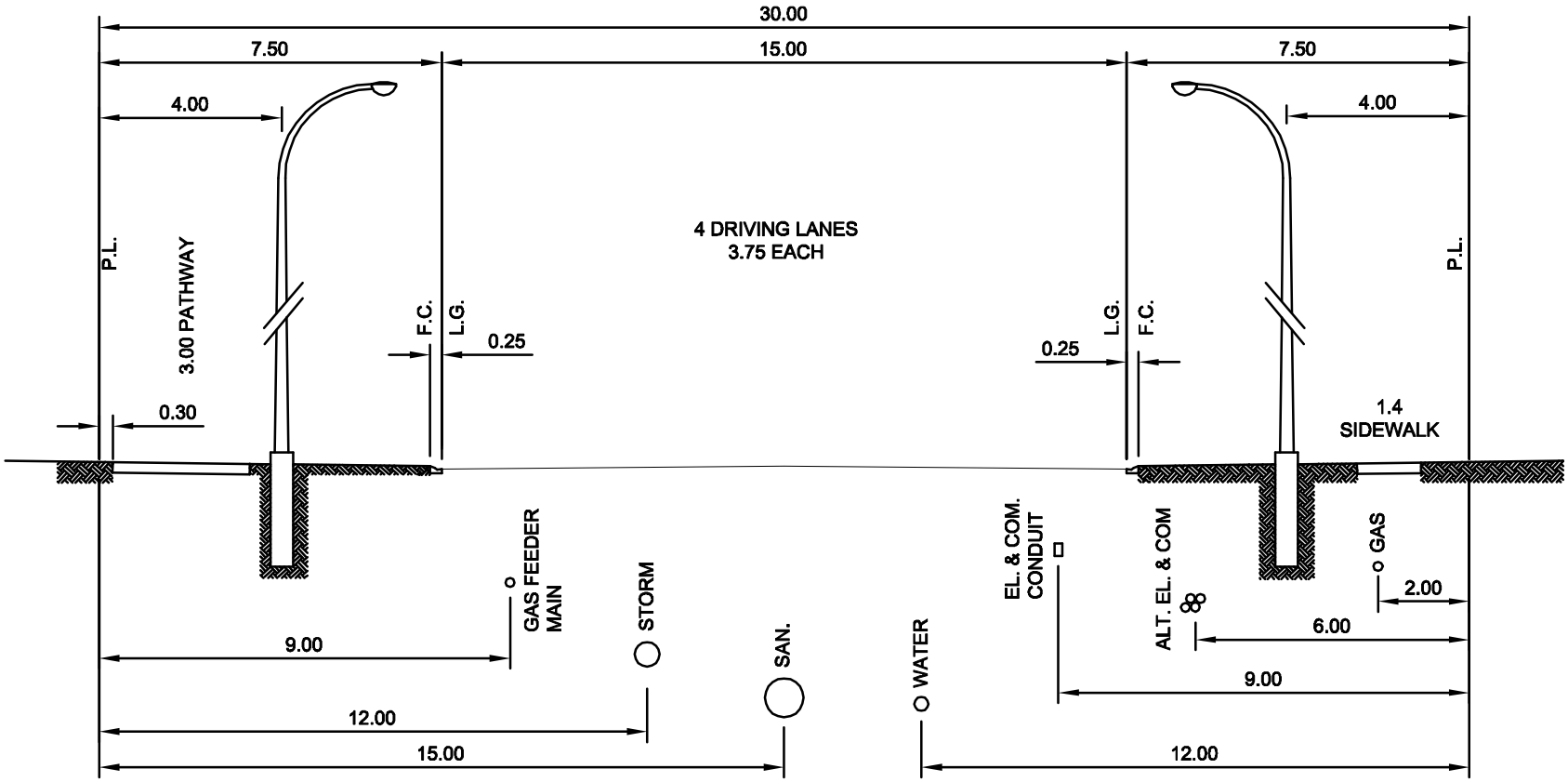
Town of Strathmore
Master Servicing Study
Annexation 2006

Residential Primary Collector No Parking

C-R2

Figure - 7.15

UMA | AECOM



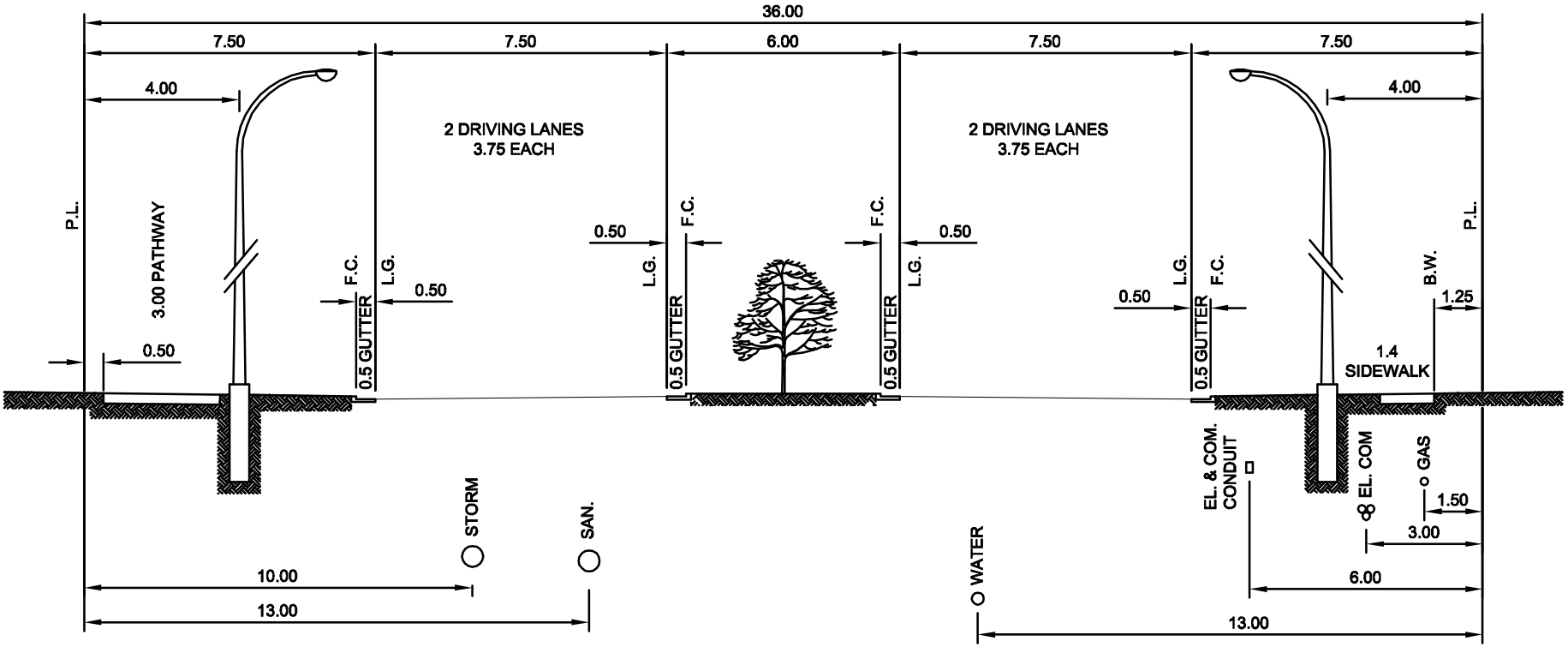
NOTES:

-CARRIAGE WAY IS TO BE CROWNED
-CURB REQUIRED ON BOTH SIDES
-HYDRANT ON 0.75 M LINE
-HYDRANT VALVES ON 1 M FROM MAIN
-SERVICE VALVES ON 0.50 M LINE
-SHALLOW UTILITES TO BE IN EASEMENT IF WATER & SEWER SERVICES ARE IN STREET ROW
-ALL SURFACE STRUCTURES TO BE A MIN. OF 3.0 M FROM HYDRANTS.

Town of Strathmore
Master Servicing Study
Annexation 2006

Arterial Undivided No Parking
A-MINOR
Figure - 7.16

UMA | AECOM

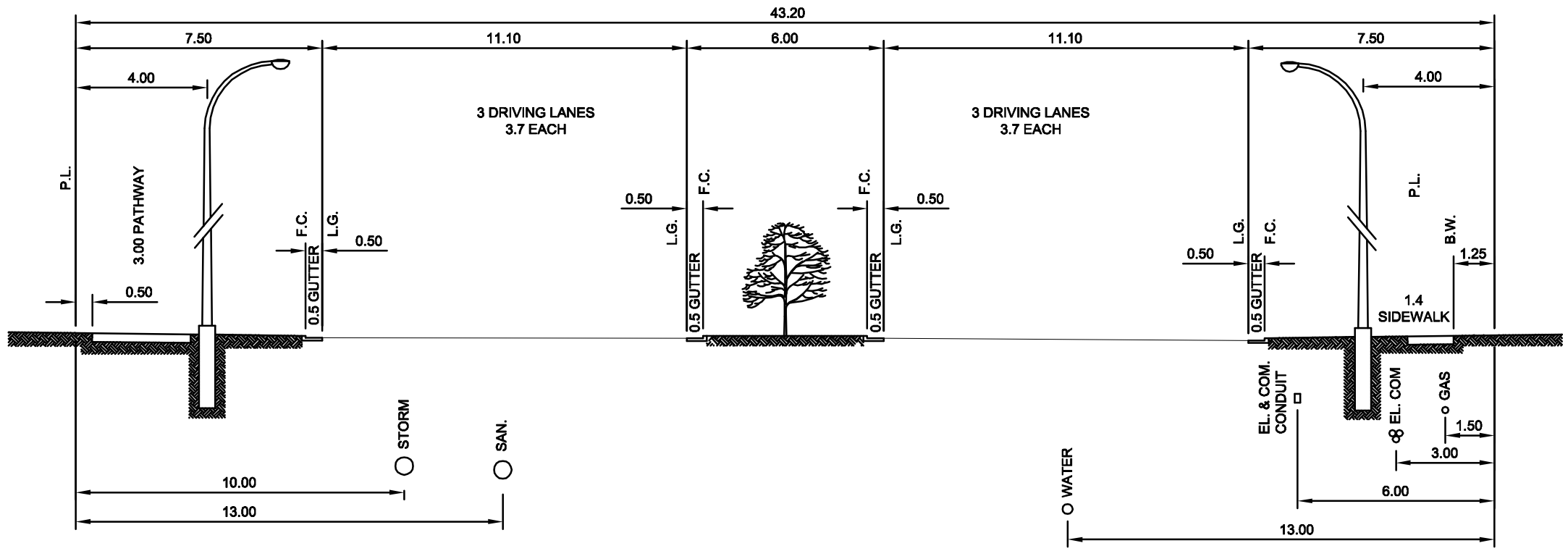


NOTES:

-CARRIAGE WAY IS TO BE CROWNED
-HYDRANTS ON 4.50 LINE
-SERVICE VALVES ON 4.00 LINE
-HYDRANT VALVES 1 M FROM MAIN
-SURFACE VALVES ON 0.50 M LINE
-SHALLOW UTILITES TO BE IN EASEMENT IF WATER & SEWER SERVICES ARE IN STREET ROW
-SURFACE FEATURES TO MAINTAIN A 3.00 CLEARACE FROM HYDRANTS

Town of Strathmore
Master Servicing Study
Annexation 2006

Arterial Divided No Parking
A-MAJOR 4 LANE
Figure - 7.17



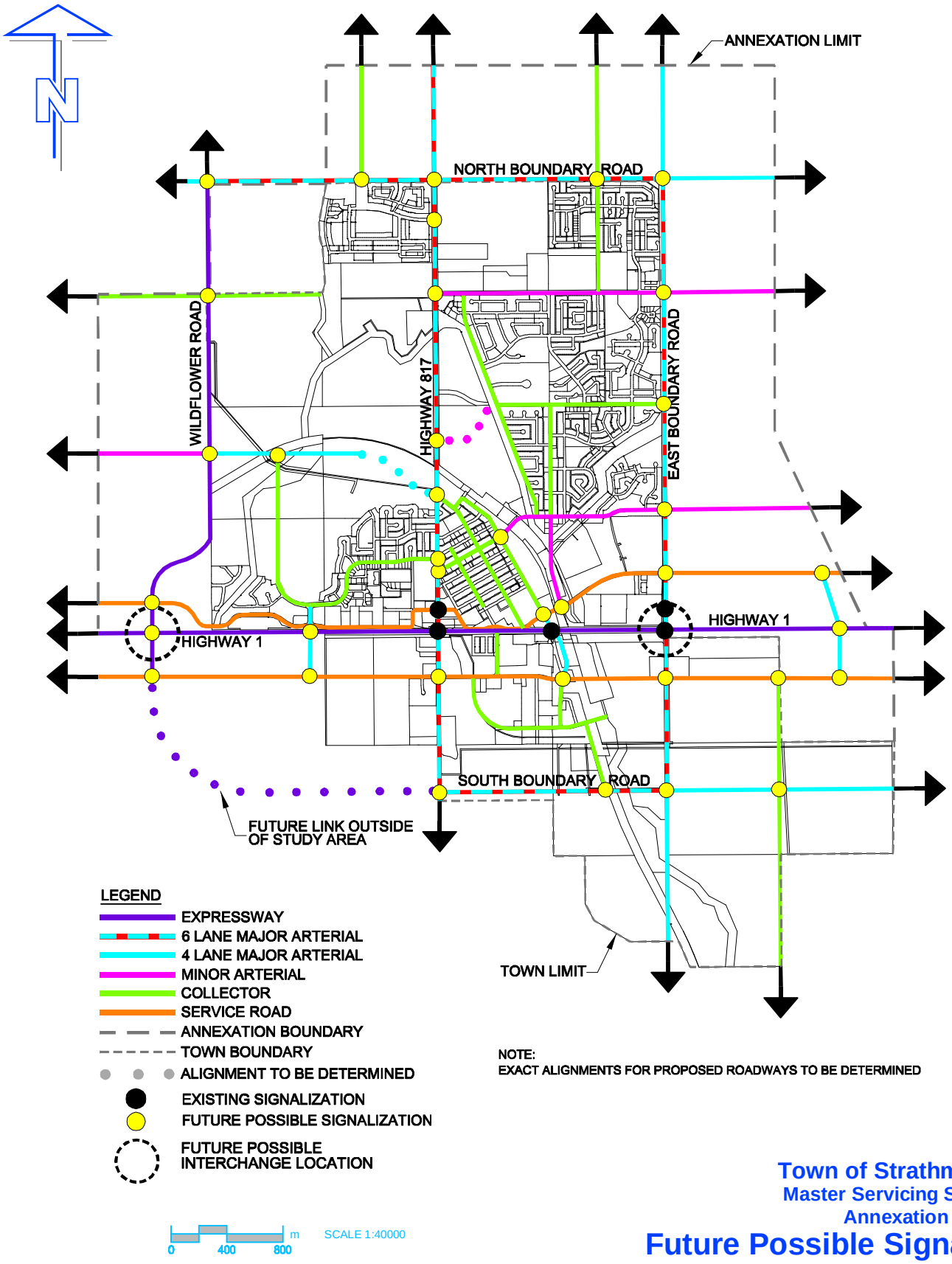
NOTES:

-CARRIAGE WAY IS TO BE CROWNED
-HYDRANTS ON 4.50 LINE
-SERVICE VALVES ON 4.00 LINE
-HYDRANT VALVES 1 M FROM MAIN
-SURFACE VALVES ON 0.50 M LINE
-SHALLOW UTILITES TO BE IN EASEMENT IF WATER & SEWER SERVICES ARE IN STREET ROW
-SURFACE FEATURES TO MAINTAIN A 3.00 CLEARACE FROM HYDRANTS

UMA | AECOM

Town of Strathmore
Master Servicing Study
Annexation 2006

Arterial Divided No Parking
A-MAJOR 6 LANE
Figure - 7.18



A SIZE 8.5" x 11" (215.9mm x 279.4mm)

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Town of Strathmore
Master Servicing Study
Annexation 2006

Future Possible Signals

UMA | AECOM

Figure - 7.19

8.0 Capital Analysis

8.1 Sanitary Sewerage System Capital Costs

8.1.1 Upgrades

Option 1

Table 8.1: Option 1 Lift Station Capital Cost

Description	Flow	Head (m)		Estimated Cost
		Geodetic	Total	
Lift Station No. 1, two 110hp pumps, one operational one standby with standby power	78 L/s	22	33.9	$780,00
Lift Station No. 2, two 35hp pumps, one operational one standby with standby power.	78 L/s	10	15.9	$585,000
Lift Station No. 3, two 20hp pumps, one operational one standby with standby power.	28 L/s	5	19.4	$579,000
Lift Station No. 4, two 90hp pumps, one operational one standby with standby power.	102 L/s	16	23.5	$767,000
Lift Station No. 5, two 100hp pumps, one operational one standby with standby power.	102 L/s	11	21.8	$780,000
Lift Station No. 6, two 160hp pumps, one operational one standby with standby power.	192 L/s	28	46.7	$910,000
Main Lift Station, three 150hp pumps, two operational one standby with standby power.	786 L/s	11	16.9	$975,000

Table 8.2: Option 1 Capital Costs

Option 1 East Trunk					
Type	From	To	Length (m)	Dia (mm)	Cost
Gravity Sewer	West of Hillview	Lift Station No. 1	800	450	$ 392,000
Lift Station No. 1					**$ 780,000**
Forcemain	Lift Station No. 1	Forcemain	1,600	250	$ 845,000
Lift Station No. 2					**$ 585,000**
Forcemain	Lift Station No. 2	Forcemain	800	250	$ 403,000
Gravity Sewer	East of Hillview	East of rodeo grounds	800	450	$ 392,000
Gravity Sewer	East of rodeo grounds	East of Strathaven	1300	525	$ 867,000
Lift Station No. 3					**$ 579,000**
Forcemain	Lift Station No. 3	Forcemain	1,200	150	$ 432,000
Gravity Sewer	East of Strathaven	South east of Strathaven	400	525	$ 228,000
Gravity Sewer	South east of Strathaven	South east of Cambridge Glenn	1200	600	$ 934,000
Gravity Sewer	South east of Cambridge Glenn	South east of Aspen Creek	900	600	$ 576,000

Option 1 East Trunk cont.					
Type	**From**	**To**	**Length (m)**	**Dia (mm)**	**Cost**
Gravity Sewer	South east of Aspen Creek	Trans Canada Hwy	800	750	$ 845,000
Gravity Sewer	Trans Canada Hwy	Town Boundary	800	750	$ 804,000
Gravity Sewer	Town Boundary	East-west easement	800	900	$ 1,114,000
Gravity Sewer	East-west easement	Main Lift Station	350	750	$ 352,000
Gravity Sewer	Trans Canada Hwy	Town Boundary	850	300	$ 349,000
Gravity Sewer	Town Boundary	Lift Station No. 4	800	375	$ 352,000
Lift Station No. 4					**$ 767,000**
Forcemain	Lift Station No. 4	Forcemain	1,400	300	$ 686,000
Gravity Sewer	East of main lift station	North of Lift Station No. 5	1000	300	$ 410,000
Gravity Sewer	North of Lift Station No. 5	Lift Station No. 5	350	375	$ 154,000
Lift Station No. 5					**$ 780,000**
Forcemain	Lift Station No. 5	WWTP	2,000	300	$ 1,028,000
East Trunk Lift Station					**$ 975,000**
Forcemain	East Trunk Lift Station	WWTP	550	750	$ 964,000
TOTAL					**$16,593,000**

Option 1 West Trunk					
Type	**From**	**To**	**Length (m)**	**Dia (mm)**	**Cost**
Gravity Sewer	Trans Canada Hwy	South of Lift Station No. 6	2000	300	$ 820,000
Gravity Sewer	South of Lift Station No. 6	Lift Station No. 6	400	375	$ 176,000
Gravity Sewer	Town Boundary	Lift Station No. 6	800	450	$ 392,000
Lift Station No. 6					**$ 910,000**
Forcemain	Lift Station No. 6	Highway 1	3,200	500	$ 3,040,000
Gravity Sewer	Trans Canada Hwy	East-west easement	800	750	$ 845,000
Gravity Sewer	East-west easement	South of canal crossing	2400	750	$ 2,045,000
Gravity Sewer	South of canal crossing	Waste water treatment plant	850	900	$ 927,000
TOTAL					**$ 9,155,000**

Option 1 Central Trunk Upgrades					
Type	**From**	**To**	**Length (m)**	**Dia (mm)**	**Cost**
Gravity Sewer	Strathaven Bypass Upgrade	East Trunk	600	300	$ 469,000
Gravity Sewer	Parkwood Bypass Upgrade	East Trunk	850	375	$ 384,000
Gravity Sewer	Thorncliff Trunk Upgrade		150	300	$ 135,000
Forcemain	Strathmore Lakes Estates	Orchard Trunk	450	150	$ 458,000
Gravity Sewer	Orchard Business Park Trunk Upgrade	West Trunk	750	525	$ 428,000
Gravity Sewer	Lakeside View Trunk Extension	Central Trunk	900	450	$ 513,000
TOTAL					**$ 2,387,000**

Table 8.3: Option 1 Capital Cost Summary

	Gravity Sewer	Forcemains	Lift Station	Total
East Trunk	$ 7,769,000	$ 4,358,000	$ 4,466,000	$ 16,593,000
West Trunk	$ 5,205,000	$ 3,040,000	$ 910,000	$ 9,155,000
Central Trunk	$ 1,929,000	$ 458,000	$ -	$ 2,387,000
Total	$ 14,903,000	$ 7,856,000	$ 5,376,000	$ 28,135,000

Option 2

Table 8.4: Option 2 Lift Station Capital Cost

Description	Flow	Head (m)		Estimated Cost
		Geodetic	Total	
Lift Station No. 1, two 90hp pumps, one operational one standby with standby power	148 L/s	6	11.3	$767,000
Lift Station No. 2, two 20hp pumps, one operational one standby with standby power.	78 L/s	7	11.8	$580,000
Lift Station No. 3, two 20hp pumps, one operational one standby with standby power.	28 L/s	5	19.4	$580,000
Lift Station No. 4, two 90hp pumps, one operational one standby with standby power.	102 L/s	16	23.5	$767,000
Lift Station No. 5, two 100hp pumps, one operational one standby with standby power.	102 L/s	11	21.8	$780,000
Lift Station No. 6, two 250hp pumps, one operational one standby with standby power.	319 L/s	28	43.5	$975,000
Main Lift Station, three 150hp pumps, two operational one standby with standby power.	711 L/s	11	15.9	$975,000

Table 8.5: Option 2 Capital Cost

Option 2 East Trunk					
Type	**From**	**To**	**Length (m)**	**Dia (mm)**	**Cost**
Gravity Sewer	West of Strathaven	East of Strathaven	1300	375	$ 644,000
Lift Station No. 3					**$ 580,000**
Forcemain	Lift Station No. 3	Forcemain	1,200	150	$ 432,000
Gravity Sewer	East of Strathaven	South east of Strathaven	800	525	$ 508,000
Gravity Sewer	Southeast of Strathaven	South east of Cambridge Glenn	800	600	$ 564,000
Gravity Sewer	South east of Cambridge Glenn	South east of Aspen Creek	900	600	$ 576,000
Gravity Sewer	South east of Aspen Creek	Trans Canada Hwy	800	675	$ 576,000
Gravity Sewer	Trans Canada Hwy	Town Boundary	800	750	$ 1,001,000
Gravity Sewer	Town Boundary	East-west easement	800	750	$ 861,000
Gravity Sewer	East-west easement	Main Lift Station	350	675	$ 321,000
Gravity Sewer	Trans Canada Hwy	Town Boundary	850	300	$ 349,000
Gravity Sewer	Town Boundary	Lift Station No. 4	800	375	$ 328,000
Lift Station No. 4					**$ 767,000**
Forcemain	Lift Station No. 4	Forcemain	1400	300	$ 686,000
Option 2 East Trunk					
Type	**From**	**To**	**Length (m)**	**Dia (mm)**	**Cost**
Gravity Sewer	East of main lift station	North of Lift Station No. 5	1000	300	$ 410,000
Gravity Sewer	North of Lift Station No. 5	Lift Station No. 5	350	375	$ 144,000
Lift Station No. 5					**$ 780,000**
Forcemain	Lift Station No. 5	WWTP	2,000	300	$ 1,028,000
East Trunk Lift Station					**$ 975,000**
Forcemain	East Trunk Lift Station	WWTP	550	675	$ 826,000
TOTAL					**$12,356,000**
Option 2 West Trunk					
Type	**From**	**To**	**Length (m)**	**Dia (mm)**	**Cost**
Lift Station No. 2					**$ 580,000**
Forcemain	Lift Station No. 2	Forcemain	650	250	$ 360,000
Gravity Sewer	North of Hillview	West of Hillview	850	450	$ 386,000
Gravity Sewer	West of Hillview	Lift Station No. 1	800	450	$ 328,000
Forcemain	Lift Station No. 1	Forcemain	800	375	$ 392,000
Gravity Sewer	Town Boundary	Lift Station No. 6	800	525	$ 497,000
Gravity Sewer	Trans Canada Hwy	South of Lift Station No. 6	2000	300	$ 820,000
Gravity Sewer	South of Lift Station No. 6	Lift Station No. 6	400	375	$ 164,000

Option 2 West Trunk cont.					
Type	**From**	**To**	**Length (m)**	**Dia (mm)**	**Cost**
Lift Station No. 6					**$ 975,000**
Forcemain	Lift Station No. 6	Highway 1	3,200	500	$ 3,040,000
Gravity Sewer	Trans Canada Hwy	East-west easement	800	750	$ 845,000
Gravity Sewer	East-west easement	South of canal crossing	2400	750	$ 2,045,000
Gravity Sewer	South of canal crossing	Wastewater treatment plant	850	900	$ 927,000
TOTAL					**$12,126,000**
Option 2 Central Trunk Upgrades					
Type	**From**	**To**	**Length (m)**	**Dia (mm)**	**Cost**
Gravity Sewer	Strathaven Bypass Upgrade	East Trunk	600	300	$ 469,000
Gravity Sewer	Parkwood Bypass Upgrade	East Trunk	850	375	$ 384,000
Gravity Sewer	Thorncliff Trunk Upgrade		150	300	$ 135,000
Forcemain	Strathmore Lakes Estates	Orchard Trunk	450	150	$ 458,000
Gravity Sewer	Orchard Business Park Trunk Upgrade	West Trunk	750	525	$ 428,000
Gravity Sewer	Lakeside View Trunk Extension	Central Trunk	900	450	$ 513,000
TOTAL					**$ 2,387,000**

Table 8.6: Option 2 Capital Cost Summary

Trunk	Gravity Sewer	Forcemains	Lift Station	Total
East Trunk	$6,282,000	$2,972,000	$3,102,000	$12,356,000
West Trunk	$6,012,000	$3,792,000	$2,322,000	$12,126,000
Central Trunk	$1,929,000	$458,000	$ -	$2,265,000
Total	**$14,223,000**	**$7,222,000**	**$5,424,000**	**$26,864,000**

8.2 Water Distribution System Upgrades

The following table describes the distribution system upgrade and its related capital cost.

Table 8.7: Existing Water Distribution Capacity Upgrades

Description	Upgrade Pipe Dia (mm)	Length (m)	Unit Cost	Estimated Cost
Westdale Street and Willow Drive	150	320	$1,320	$ 422,400
First Avenue	200	460	$1,360	$ 625,600
Third Street	200	100	$1,360	$ 136,000
Third Street	300	100	$1,590	$ 159,000
Fourth Avenue	200	520	$1,360	$ 707,200
Fourth Street and Third Street Connector	250	180	$1,430	$ 257,400
Fifth Avenue	200	350	$1,360	$ 476,000
Fifth Avenue	300	180	$1,590	$ 286,200
Sixth Avenue	300	520	$1,590	$ 826,800
West Ridge Road	300	640	$1,590	$1,017,600
Glenwood	250	160	$1,430	$ 228,800
Total				**$5,143,000**

8.3 Water Supply and Distribution

8.3.1 Reservoirs

Three treated water reservoirs are required to supply the Town with water. From the information derived from *Table 4.2*, additional storage is required by 2019 to increase the treated water storage capacity to serve the projected population. This additional storage will augment the storage capacity of water for the Town until 2030 where the construction of a more storage will be required to keep up with the growing population. The following table gives the capital cost breakdown.

Table 8.8: Treated Water Reservoir Capital Cost

Description	Construction Year	Estimated Cost
Three 6,000m3 two cell reservoir 71m x 18m x 6.5m high installed west of the Town	2019	$6,200,000
Three 6,000m3 two cell reservoir 71m x 18m x 6.5m high installed east of the Town	2030	$6,200,000
TOTAL		**$12,400,000**

8.3.2 Distribution Pump Stations

The distribution pump stations shall be built together with the aforementioned three reservoirs. The following table gives the capital cost breakdown.

Table 8.9 Distribution Pump Station Capital Cost

Description	Construction Year	Estimated Cost
Distribution pump station building	2019	$ 500,000
Two 250Hp VFD pumps	2019	$ 170,000
Three 125Hp constant speed pumps	2019	$ 150,000
Engineering & Contingency 30%		$ $46,000
Single Pump Station		**$ 1,066,000**
TOTAL FOR THREE PUMP STATIONS		**$ 3,198,000**

8.3.3 Distribution and Transmission Mains

The following table gives the capital cost breakdown.

Table 8.10: Water Distribution Connection Upgrades

Description	Pipe Dia (mm)	Length (m)	Unit Cost	Estimated Cost
Distribution Connection	150	270	$ 780	$ 210,600
Distribution Connection	200	550	$ 820	$ 451,000
Distribution Connection	250	400	$ 880	$ 352,000
Distribution Connection	300	1935	$1,040	$ 2,012,400
Total				**$ 3,026,000**

Table 8.11: Water Transmission Distribution System Upgrades

Description	Pipe Dia (mm)	Length (m)	Unit Cost	Estimated Cost
Transmission Pipeline	300	7590	$ 570	$ 4,326,300
Transmission Crossing	300	310	$1,140	$ 353,400
Transmission Pipeline	400	8060	$ 720	$ 5,803,200
Transmission Crossing	400	240	$1,440	$ 345,600
Transmission Pipeline	600	275	$1,470	$ 404,250
Transmission Crossing	600	25	$2,940	$ 73,500
Asphalt Restoration in Developed Areas		1600	$ 370	$ 592,000
Total				**$11,899,000**

8.4 Water Supply and Distribution Capital Cost Summary

Table 8.12: Water Supply and Distribution Capital Cost Summary

Description	Estimated Costs
Distribution Capacity Upgrade Cost	$ 5,143,000
Distribution Connection Upgrade Cost	$ 3,026,000
Transmission System Cost	$ 11,899,000
Treated Water Reservoir Cost	$ 12,400,000
Distribution Pump Station Cost	$ 3,198,000
TOTAL	**$ 35,666,000**

8.5 Stormwater Management

Table 8.13: Brent Boulevard and Pond 1

Item	Length (m) or Quantity	Unit Price	Cost ($)
4 Type C catchbasins	4	$ 6000	$ 24,000
20 m of 300 mm dia PVC pipe	20	$ 350	$ 7,000
360 m of 750 mm dia concrete pipe	360	$ 600	$ 216,000
2 sediment forebays			$ 205,400
Removal of 113,00 m^3 of clay from Pond 1	113000	$ 7.50	$ 847,500
Removal of existing irrigation turnout structure			$ 6,500
Construction of existing irrigation turnout structure			$ 32,500
Pond 1 control structure			$ 45,500
Engineering & Contingency 30%			$ 415,320
Total			**$ 1,800,000**

Table 8.14: Strathmore Lake, West Strathmore and Pond 2

Item	Length (m) or Quantity	Unit Cost	Cost ($)
871 m – 600 mm dia concrete pipe	870	$ 650	$ 565,500
119 m – 300 mm dia concrete pipe	120	$ 455	$ 54,600
ICD R30	1	$ 2600	$ 2,600
232 m – 750 mm dia concrete pipe	235	$ 780	$ 183,300
78 m – 600 mm dia concrete pipe	80	$ 650	$ 52,000
ICR R70	1	$ 2600	$ 2,600
9 – Type 1-S manhole (up to 900 mm dia)	9	$ 9100	$ 81,900
550 m – 600 mm dia concrete pipe	550	$ 650	$ 357,500
4 – Type 1-S manhole (up to 900 mm dia)	4	$ 9100	$ 36,400
Pond 2 control structure		$	$ 45,500
Engineering & Contingency 30%		$	$ 414,570
Total			**$ 1,796,000**

Table 8.15: Westmount and South Strathmore Alternatives

Item	Length (m) or Quantity	Unit Price	Cost ($)
815 m - 525 mm dia concrete pipe	815	$ 585	$ 476,775
Pond WID construction - 65000 m3	65000	$ 7.8	$ 507,000
Liner	30000	$ 13	$ 390,000
Pond WID control structure	1		$ 45,500
Engineering & Contingency 30%			$ 425,783
Total			**$ $1,845,000**

Table 8.16: Area 64 and 65

Item	Length (m) or Quantity	Unit Price	Cost ($)
Re-grade of streets			$ 26,000
4 Type C catchbasins	4	$ 7800	$ 31,200
71 m – 300 mm dia PVC pipe	70	$ 455	$ 31,850
123 m – 450 mm dia concrete pipe	125	$ 520	$ 65,000
15 m – 525 mm dia concrete pipe	15	$ 585	$ 8,775
3 – Type 1-S manhole (up to 900 mm dia)	3	$ 13300	$ 39,900
Oil & Grit Separator			$ 65,000
Engineering & Contingency 30%			$ 80,318
Total			**$ 348,000**

Table 8.17: Ponds 3, 4, 5, 6

Item	Length (m) or Quantity	Unit Price	Cost ($)
Control Structure for Pond 3			$ 45,500
Control Structure for Pond 4	2		$ 88,400
Pond 4 forebay construction			$ 154,700
Control Structure for Pond 5			$ 45,500
Control Structure for Pond 6			$ 45,500
Total			**$ 380,000**

Table 8.18: Stormwater Capital Cost Summary

Description	Estimated Costs
Brent Boulevard and Pond 1	$ 1,800,000
Strathmore Lake, West Strathmore, and Pond 2	$ 1,796,000
Westmount and South Strathmore	$ 1,845,000
Area 64 and 65	$ 348,000
Ponds 3, 4, 5, 6	$ 380,000
TOTAL	**$ 6,169,000**

8.6 Roadway Network

As future development occurs, the road network will need to be upgraded over time. The proposed road network within the existing town limit and proposed annexation limit is shown on **Figure 8.1**. On **Figure 8.1**, the road network is broken down into numbered segments, which correspond to numbered segments shown in *Table 8.19*. This table shows estimated road capital costs in 2007 Canadian dollars. The estimated bridge and traffic signal capital costs are shown in *Table 8.20* and *Table 8.21*, respectively. The total estimated capital costs for upgrading the road network to 2037 are shown in *Table 8.22*.

The capital costs shown do not include the cost of acquiring the additional right-of-way for road links to be built or upgraded. The costs associated with the two possible interchanges at East Boundary Road and Wildflower Road are not included in the capital costs.

Table 8.20: Bridge Infrastructure Capital Cost

Bridge ID	Description	Over	Proposed or Existing	Cost Estimate* (in 2007 $)
BR 1	Ridge Road near Wildflower over WID	WID "A" Canal	Existing	$ 800,800
BR 2	New Road (north of Westmount) over WID	WID "A" Canal	Proposed	$1,701,700
BR 3	Hwy 817	WID "A" Canal	Existing	$ -
BR 4	Lake Road	WID "A" Canal	Proposed	$1,601,600
BR 5	Lake Road	Pond 1 Drainage	Proposed	$ 313,950
BR 6	Park Lane Drive East	WID "A" Canal	Existing	$ 400,400
BR 7	Centre Street	WID "A" Canal	Existing	$ -
BR 8	Park Lane Drive West	WID "A" Canal	Existing	$ -
BR 9	East Boundary Road	WID "A" Canal	Existing	$ 910,000
BR 10	Orchard Park Drive East	Eagle Lake Drainage	Proposed	$ 327,600
BR 11	Orchard Park Drive	Unnamed Drainage WID Lands	Existing	$ 54,600
BR 12	Slater Road East	Eagle Lake Drainage	Proposed	$ 313,950
BR 13	South East West Connector	Eagle Lake Drainage	Proposed	$ 327,600
BR 14	East Boundary Road (south)	Eagle Lake Ditch	Proposed	$ 655,200
			TOTAL	**$7,407,400**

**** Cost Estimated includes a 30% Engineering and Contingency***

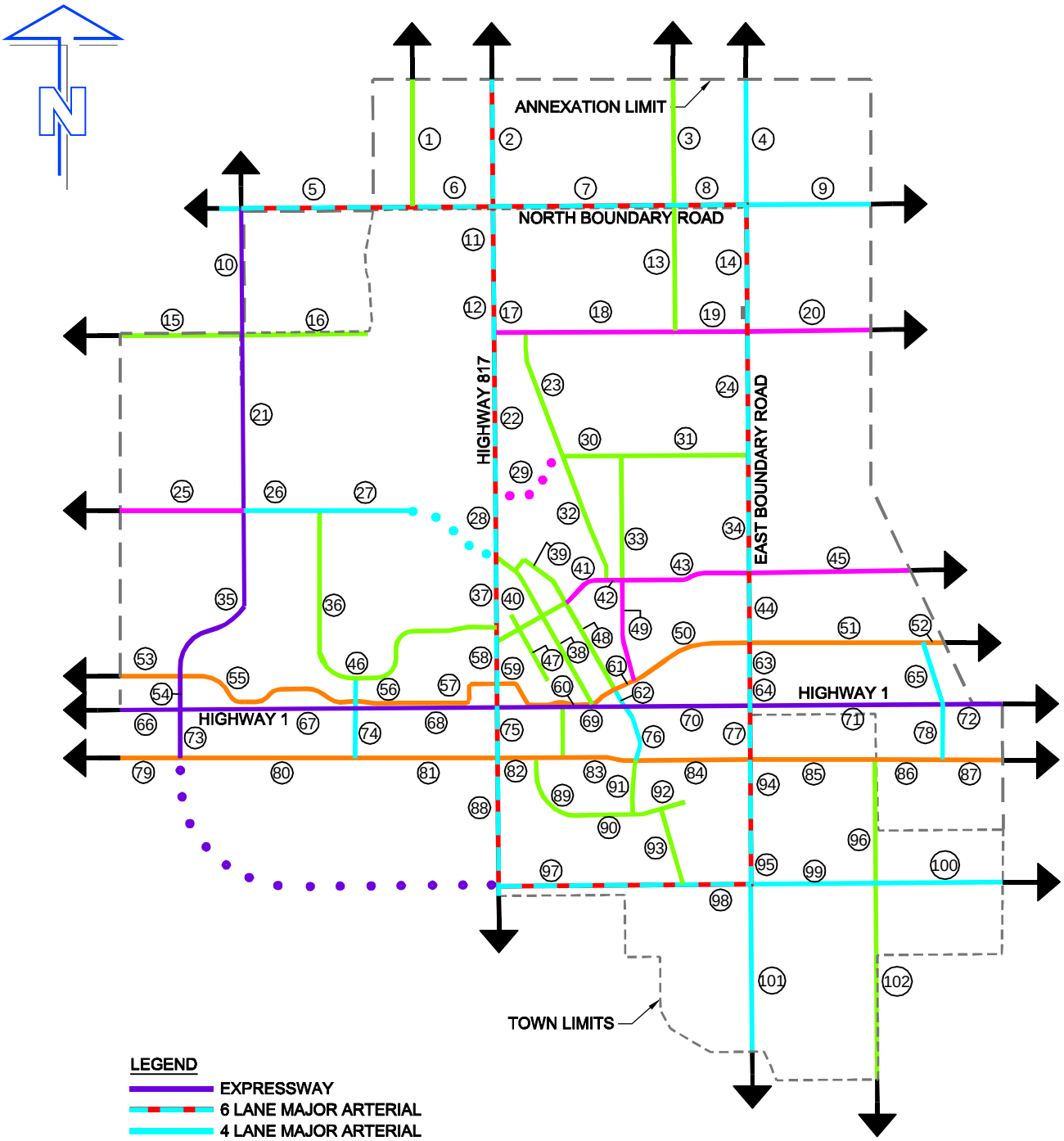
Table 8.21: Traffic Signal Infrastructure Capital Cost

Traffic Light ID	Located at Intersection of		Proposed or Existing	Cost Estimate* (in 2007 $)
TL 1	West Boundary Road	North Boundary Road	Proposed	$ 230,000
TL 2	North Boundary Road	Hillview Gate	Proposed	$ 230,000
TL 3	North Boundary Road	Highway 817	Proposed	$ 300,000
TL 4	North Boundary Road	Strathford Boulevard	Proposed	$ 230,000
TL 5	North Boundary Road	East Boundary Road	Proposed	$ 230,000
TL 6	Highway 817	Hillview Drive	Proposed	$ 300,000
TL 7	West Boundary Road	Brent Boulevard	Proposed	$ 230,000
TL 8	Highway 817	Brent Boulevard	Proposed	$ 300,000
TL 9	East Boundary Road	Brent Boulevard	Proposed	$ 230,000
TL 10	Highway 817	East Lake Road	Proposed	$ 300,000

Traffic Light ID	Located at Intersection of		Proposed or Existing	Cost Estimate* (in 2007 $)
TL 11	East Boundary Road	East Lake Road	Proposed	$ 230,000
TL 12	West Boundary Road	West Avenue	Proposed	$ 230,000
TL 13	Westmount Drive	West Avenue	Proposed	$ 230,000
TL 14	Highway 817	West Avenue	Proposed	$ 300,000
TL 15	Lakeside Boulevard	Park Lane Drive	Proposed	$ 230,000
TL 16	East Boundary Road	Park Lane Drive	Proposed	$ 230,000
TL 17	Highway 817	Westmount Drive	Proposed	$ 300,000
TL 18	Highway 817	Second Avenue	Proposed	$ 300,000
TL 19	West Boundary Road	North Service Road	Proposed	$ 230,000
TL 20	Highway 817	North Service Road	Existing	
TL 21	Lakeside Boulevard	North Service Road	Proposed	$ 230,000
TL 22	Centre Street	North Service Road	Proposed	$ 230,000
TL 23	East Boundary Road	North Service Road	Proposed	$ 230,000
TL 24	East of East Boundary Road	North Service Road	Proposed	$ 230,000
TL 25	West Boundary Road	Highway 1	Proposed	$ 300,000
TL 26	Westmount Road	Highway 1	Proposed	$ 300,000
TL 27	Highway 817	Highway 1	Existing	
TL 28	Lakeside Boulevard	Highway 1	Existing	
TL 29	East Boundary Road	Existing North Service Road	Existing	
TL 30	East Boundary Road	Highway 1	Existing	
TL 31	East of East Boundary Road	Highway 1	Proposed	$ 300,000
TL 32	West Boundary Road	South Service Road	Proposed	$ 230,000
TL 33	Westmount Road	South Service Road	Proposed	$ 230,000
TL 34	Highway 817	South Service Road	Proposed	$ 300,000
TL 35	Spruce Park Drive	South Service Road	Proposed	$ 230,000
TL 36	East Boundary Road	South Service Road	Proposed	$ 230,000
TL 37	SE Street	South Service Road	Proposed	$ 230,000
TL 38	East of East Boundary Road	South Service Road	Proposed	$ 230,000
TL 39	Highway 817	South Boundary Road	Proposed	$ 300,000
TL 40	Slater Way	South Boundary Road	Proposed	$ 230,000
TL 41	East Boundary Road	South Boundary Road	Proposed	$ 230,000
TL 42	SE Street	South Boundary Road	Proposed	$ 230,000
**** Cost Estimated includes a 30% Engineering and Contingency***			**TOTAL**	**$ 9,350,000**

Table 8.22: Total Infrastructure Capital Cost

Description	Cost Estimate (in 2007 $)
Roadways	$ 104,091,000
Bridges and Structures	$ 7,407,400
Signal Lights	$ 9,350,000
Total	**$ 120,848,400**



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Town of Strathmore
Master Servicing Study
Annexation 2006

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Capital Costing of Major Roadways
Figure - 8.1