Rocky View County

Final Draft Report

Springbank ASP Servicing Strategy

October 2020

ISL Engineering and Land Services Ltd. is an award-winning full-service consulting firm dedicated to working with all levels of government and the private sector to deliver planning and design solutions for transportation, water, and land projects.

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October 29, 2020

Our Reference: 26981

Rocky View County
262075 Rocky View Point
Rocky View County, Alberta
T4A 0X2

Attention: Noor Mirza, P.Eng. – Senior Municipal Engineer

Dear Sir:

Reference: Springbank ASP Servicing Strategy – Final Draft Report

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Enclosed is the Final Draft Report for the Springbank ASP Servicing Strategy. We trust that it meets your expectations.

The key objectives of this project are to review water and wastewater servicing options for the study area, to determine which are feasible, and to recommend servicing systems. The Servicing Strategy will provide the County with direction on various infrastructure implementation alternatives to service the projected population. This information will provide solutions for efficient, economic, and sustainable municipal services to residents.

We sincerely appreciate the opportunity to undertake this project on your behalf. Should you have any questions or concerns, please do not hesitate to contact the undersigned at 403-254-0544.

Sincerely,

Geoffrey Schulmeister, P.Eng., SCPM
Manager, Water and Environment

Corporate Authorization

This document entitled “Springbank ASP Servicing Strategy” has been prepared by ISL Engineering and Land Services Ltd. (ISL) for the use of Rocky View County. The information and data provided herein represent ISL’s professional judgment at the time of preparation. ISL denies any liability whatsoever to any other parties who may obtain this report and use it, or any of its contents, without prior written consent from ISL.

Krista Kruschel, P.Eng.
Technical Author

Geoffrey Schulmeister, P.Eng,. SCPM
Engineer of Record

Executive Summary

Introduction

Rocky View County (the County) has commissioned ISL Engineering and Land Services Ltd. (ISL) to complete a Servicing Strategy encompassing water and wastewater infrastructure to support the preparation of the North Springbank Area Structure Plan and South Springbank Area Structure Plan (ASP), which are considered to be a combined Springbank ASP area for the purposes of this Servicing Strategy. The creation of these ASPs is meant to reflect the changing community dynamics since the Moddle, Central Springbank, and North Springbank ASPs in the late 1990's and early 2000's. The ultimate intent of the Servicing Strategy is to provide a framework for the future water and wastewater servicing systems in the area as well as to provide necessary parameters for the design, including recommendations for water supply and treatment as well as wastewater treatment and disposal. The Servicing Strategy represents an investment in the infrastructure of the Springbank community and will help support sustainable and cost-effective growth in the Springbank ASP plan area.

The Springbank ASP area is comprised of approximately 10,650 ha (26,315 ac) of land in west Rocky View County. Bounded by the Bow River to the north, The City of Calgary to the east, the Elbow River to the south and the community of Harmony to the west. The project boundary encompasses the areas included in the Moddle, Central Springbank, and North Springbank ASPs as well as additional area west of the Central Springbank ASP boundary.

A ridge running approximately along Highway 1 divides the area, draining a portion north to the Bow River and the remainder south to the Elbow River. The setting of the Study Area, being situated on The City of Calgary boundary, introduces a number of servicing opportunities and constraints from technical, social, and political perspectives. These constraints will be addressed as part of this Servicing Strategy. Additionally, the Springbank ASP has committed to follow a sustainable path. This will be accomplished by ensuring all impacts to the environment are considered during the decision-making process, and that its residents are well informed on green initiatives, such as water conservation and stormwater re-use.

The current population within the ASP area is 5,832 with the potential to increase to a population of 19,396 under current land use policies. The Calgary regional population is projected to grow to 1.9 million by 2026 and Rocky View County anticipates that the demand for rural residential housing will continue to increase alongside growth in Calgary, placing an increased burden on existing infrastructure. Cost-effectively, socially, politically, and environmentally conscious servicing options will become crucial to support the increasing population density in the plan area.

Establishing a unified regional approach to servicing is an investment in the future of the Springbank area and its residents. A key objective of the Servicing Strategy is to align growth and servicing objectives of the Springbank ASP area with the County Plan adopted by Rocky View County in 2013. A sound servicing strategy is useful for both administration and elected officials in carrying out both short- and long-term infrastructure planning and budgeting.

Study Objectives

The purpose of developing a Servicing Strategy for Rocky View County is outlined below:

- To access feasible system options that will provide water and wastewater servicing for the Study Area.
- To assess existing available and potential water sources and the feasibility of utilizing these sources as water supply for the Study Area.
- To assess existing available and potential wastewater service providers, particularly with respect to treatment and disposal.
- To consider sensitivities stemming from proximity to existing water and wastewater service providers.
- To layout potential water distribution and wastewater collection infrastructure based on recommended servicing schemes.
- To consider both traditional and alternative water and wastewater treatment options.
- To assess potential reuse/recycling of wastewater effluent as a means of disposal.
- To assess the use of stormwater to address a portion of the water supply needs of the area.

The completed Servicing Strategy provides a guiding document for future development of the study are that can be used in preparation of future more detailed studies such as Subdivision Servicing Reports.

Study Area

The Springbank ASP area includes approximately 10,650 ha (26,315 ac) within west Rocky View County. The area is bounded by the Bow River to the north and the Elbow River to the south. The City of Calgary is situated to the east along the Study Area boundary. The community of Harmony is located to the north of Highway 1 along the west Study Area boundary.

The Study Area encompasses the areas from the Moddle, Central Springbank, and North Springbank ASPs as well as additional area west of the Central Springbank ASP boundary. Approximately 7,460 ha (18,430 ac) of the Study Area is considered developable area. The undevelopable area is considered not to possess any opportunity for future growth.

A ridge that runs roughly along Highway 1 divides the drainage of the Study Area, with a portion of the area draining north to the Bow River and the remainder drains south to the Elbow River. Within the Study Area, elevations range from a high point of approximately 1,280 m to low points of approximately 1,100 m at the Bow River and Elbow River.

Future Water Servicing Strategy

The following options for water servicing for the Springbank ASP area were considered for feasibility:

- Connection to the Community of Harmony
- Connection to The City of Calgary
- Connection to Calalta Waterworks Ltd.
- New Raw Water Intake
- Deep Water Aquifer

It should be noted that the connection to Calata Waterworks Ltd. was considered only for the area within the County's current Franchise Agreement area. Therefore, two options were selected by the County for further evaluation based on the available wastewater servicing options for the entire focused service area. These options are:

- Connection to the Community of Harmony
- Connection to The City of Calgary

The TBL analysis resulted in the Connection to the Community of Harmony being the highest scored water servicing option, although the weighted scores are similar for both options. Therefore, it is recommended that the County pursue the connection to Harmony's WTP for the entire proposed service area.

This recommended option offers a number of benefits in terms of:

- Allows for more flexibility in terms of staging of improvements to support development progression.
- Eliminates annual fees charged by The City of Calgary based on the Fixed and Variable Fees as per the Cost of Service Study for regional customers, thus potential for increase in the whole life cycle costs.
- Provides a County controlled system thus providing an assurance that the system is properly maintained over the lifecycle of the infrastructure thus ensuring that there is no impact on the downstream reach of the watershed.

These water servicing options correlate to the preferred wastewater servicing options. Therefore, these options were evaluated based on the focused service area applied to the proposed wastewater system, which prioritizes those lands along the TCH Corridor as well as the Special Planning Areas along the east Study Area boundary. This was further delineated into near-term and full build-out areas to prioritize the TCH Corridor area. Development outside of the focused service area has not been considered for incorporation into the ASP's regional water system at this time. It is noted that limited growth may be supported via existing private systems in the Study Area. Lower-density residential development outside of the focused service area is to be locally serviced. Options such as connections to the local water co-ops/private water utilities or local cisterns remain available for these developments.

Additional water servicing options were prepared based on two potential development area scenarios of the County's Franchise Agreement with Calalta. Under these scenarios, portions of the service area are serviced by the Calalta WTP with raw water from the Elbow River and the remainder serviced by the Harmony WTP with raw water from the Bow River. It should be noted that the Franchise Agreement was adopted as of September 1, 2020.

It is noted that based on the current understanding of water licensing for Calalta that their licenses do not have a return to the Elbow River requirement. However, the license currently held by Bow Water and Land that may be used in the future, does have a return to source requirement. Additionally, the Bow Water and Land license stipulates that a minimum river flow of 3.0 m^3/s must be met during the winter to be able to draw from the Elbow River. Based on the Water Survey of Canada data, the river flow dropped below this threshold in the winter of 2018 for example. Raw water storage requirements for larger scale servicing would need to be satisfied.

Conclusions and Recommendations

Conclusions and recommendations for the overall water servicing system for the Study Area can be summarized as follows:

- The proposed water servicing options were prepared to service a total developable area of 831 ha and a population of 30,024 people under full build-out conditions. This can be compared to near-term conditions, which service a total developable area of 192 ha and a population of 4,070 people.
- Feasible water supply options include a connection to the Community of Harmony's WTP and a connection to The City of Calgary's water distribution system.
- The recommended County controlled water system includes reservoirs, distribution system infrastructure, and upgrades to Harmony's existing WTP. The Calalta area is serviced by Calalta's existing WTP with the incorporation of the County's Franchise Agreement.
- The cost of implementing the recommended water servicing concept under full build-out conditions is $341 million. This translates to $11,310 per person or $195,577 per hectare of serviced area. Given this includes operating costs, it is not unrealistically high when compared to off-site levy costs in numerous municipalities where full cost recovery is desired.
- The cost of implementing the recommended water servicing concept under full build-out conditions with incorporation of the County's Franchise Agreement with Calalta is $386 million to $392 million. This translates to up to $12,096 per person or $178,051 per hectare of serviced area. Given this includes operating costs, it is not unrealistically high when compared to off-site levy costs in numerous municipalities where full cost recovery is desired. This total cost is significantly higher than without Calalta's service area; however, the expanded area reduces the per hectare costs.
- The cost of implementing the recommended water servicing concept under near-term conditions is $101 million. This translates to $25,567 per person or $139,586 per hectare of serviced area. Given this includes operating costs, it is not unrealistically high when compared to off-site levy costs in numerous municipalities where full cost recovery is desired.
- The cost of implementing the recommended water servicing concept under near-term conditions with incorporation of the County's Franchise Agreement with Calalta is $135 million to $150 million. This translates to up to $36,877 per person or $208,455 per hectare of serviced area. Given this includes operating costs, it is not unrealistically high when compared to off-site levy costs in numerous municipalities where full cost recovery is desired.

- The proposed distribution system proves to be adequate under ADD, PHD, and MDD+FF scenarios. Localized pressure reducing valves or pumping may be required for those areas outside of the design pressure envelopes. Additionally, it is recommended that sprinklers be installed to reduce the fire flow requirements, especially in those areas with low available fire flow.
- Infrastructure staging to full build-out should be reviewed at the near-term design stage based on current and future needs in order to plan for incremental upgrades as needed.
- Consideration of water consumption reduction measures should be made.
- The development outside of the focused service area is to be locally serviced. Options such as connections to the local water co-ops/private water utilities or local cisterns remain available for development outside of the Springbank ASP water system service area. Connections of low-density areas to the main water network may be considered depending on availability of capacity and cost implications.

Future Wastewater Servicing Strategy

The following options for wastewater servicing for the Springbank ASP area were considered for feasibility:

- Connection to the Community of Harmony
- Connection to The City of Calgary
- New Outfall to the Bow River
- New Outfall to the Elbow River
- Sewage Lagoon
- Spray Effluent Disposal

It should be noted that the new outfall to the Elbow River was considered only for the area within Calalta and the County's Franchise Agreement area. Two options were selected by the County for further evaluation based on the feasible wastewater servicing options for the entire focused service area. These options are:

- Connection to the Community of Harmony
- Connection to The City of Calgary

The TBL analysis resulted in the Connection to the Community of Harmony being the highest scored wastewater servicing option, although the weighted scores are similar for both options. Therefore, it is recommended that the County pursue the connection to Harmony's WWTP via the TCH corridor for the entire proposed service area.

This recommended option offers a number of benefits in terms of:

- Allows for more flexibility in terms of staging of improvements to support development progression.
- Eliminates annual fees charged by The City of Calgary based on the Fixed and Variable Fees as per the Cost of Service Study for regional customers, thus potential for increase in the whole life cycle costs.

- Provides a County controlled system thus providing an assurance that the system is properly maintained over the lifecycle of the infrastructure thus ensuring that there is no impact on the downstream reach of the watershed.

These options were further evaluated based on the focused service area applied to the proposed wastewater system, which prioritizes those lands along the TCH Corridor as well as the Special Planning Areas along the east Study Area boundary. Development outside of these service areas has not been considered for incorporation into the ASP's regional water system at this time. It is noted that limited growth may be supported via existing private systems in the Study Area. Lower-density residential development outside of the focused service area is to be locally serviced. Options such as connections private/local sewage systems and communal wastewater systems remain available for development outside of the Springbank ASP wastewater system service area.

Additional wastewater servicing options were prepared based on two potential development area scenarios of the County's Franchise Agreement with Calalta. Under these scenarios, portions of the service area are serviced by Calalta with the remainder serviced by the Harmony WWTP. A high-level feasibility review was completed for the Calalta service area options including Bow River discharge, Elbow River discharge, on-site disposal, private sewage treatment systems, and wastewater hauling.

It is recommended that the County evaluate the wastewater servicing options for the Harmony and Calalta systems and determine future studies and analyses to be undertaken. In order to provide a recommendation for the Franchise Agreement service area, in terms of wastewater treatment and disposal, a more detailed assessment of the area and these high-level options is required.

It is recommended that these lower-density areas be serviced through the use of communal septic systems owned and operated as per the County's bylaws. This provides assurance that the systems are properly maintained over the lifecycle of the facilities thus ensuring that there is no impact on the downstream reach of the watershed. As such, conversion from the local sewage treatment systems, otherwise to be located on private lands, will address the concerns raised by stakeholders. The communal septic systems will therefore meet the County's standards, which are more stringent that those stipulated in the Alberta Private Sewage System Standard of Practice (Safety Codes Council, 2015).

Conclusions and Recommendations

Conclusions and recommendations for the overall wastewater servicing system for the Study Area can be summarized as follows:

- The proposed wastewater servicing options were prepared to service a total developable area of 831 ha and a population of 30,024 people under full build-out conditions. This can be compared to near-term conditions, which service a total developable area of 192 ha and a population of 4,024 people.
- Feasible wastewater servicing options include a connection the Community of Harmony's WWTP and a connection to The City of Calgary's sanitary system via the Glenmore Sanitary Trunk
- The recommended County controlled wastewater system includes gravity sewers, forcemains, lift stations, and upgrades to the existing Harmony WWTP.

- Feasible options to provide wastewater servicing to the Calata Franchise Agreement area in addition to the focused service area incorporate a connection of this area to Harmony's WWTP or a new outfall to the Elbow River with a Calalta WWTP.
- The cost of implementing the Harmony wastewater servicing concept under full build-out conditions is $229 million. This translates to $7,641 per person or $131,618 per hectare of serviced area. Given this includes operating costs, it is not unrealistically high when compared to off-site levy costs in numerous municipalities where full cost recovery is desired.
- The cost of implementing the Harmony wastewater servicing concept under full build-out conditions with incorporation of the County's Franchise Agreement with Calalta ranges from $281 million to $288 million for the more conservative Bow River option via Harmony. This translates to up to $8,903 per person or $131,041 per hectare of serviced area. These costs are similar to those without the Calalta service area; however, it should be noted that unknowns associated with future treatment requirements are expected to increase costs significantly if the Elbow River were to be used as a discharge point.
- The cost of implementing the Harmony wastewater servicing concept under near-term conditions is $57 million. This translates to up to $14,044 per person or $79,389 per hectare of serviced area. Given this includes operating costs, it is not unrealistically high when compared to off-site levy costs in numerous municipalities where full cost recovery is desired.
- The cost of implementing the Harmony wastewater servicing concept under near-term conditions with incorporation of the County's Franchise Agreement with Calalta ranges from $79 million to $90 million for the more conservative Bow River option via Harmony. This translates to up to $22,217 per person or $121,051 per hectare of serviced area. These costs are similar to those without the Calalta service area; however, it should be noted that unknowns associated with future treatment requirements are expected to increase costs significantly if the Elbow River were to be used as a discharge point.
- Infrastructure staging to full build-out should be reviewed at the near-term design stage based on current and future needs in order to plan for incremental upgrades as needed.
- Consideration of wastewater flow reduction measures should be made.
- The development outside of the focused service area is to be locally serviced. Options such as connections private/local sewage systems and communal wastewater systems remain available for the development outside of the Springbank ASP wastewater system service area. Connections of low-density areas to the main wastewater network may be considered depending on availability of capacity and cost implications.

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LIST OF ACRONYMS

Acronym	Meaning	Acronym	Meaning
ADD	Average Day Demand	PHD	Peak Hour Demand
ADF	Average Daily Flow	PRV	Pressure Reducing Valve
ADWF	Average Dry Weather Flow	PSTS	Private Sewage Treatment Systems
AEP	Alberta Environment and Parks	PWWF	Peak Wet Weather Flow
ASP	Area Structure Plan	ROW	Right-of-Way
COC	City of Calgary	SSRB	South Saskatchewan River Basin
DWF	Dry Weather Flow	TBL	Triple Bottom Line
FF	Fire Flow	TCH	Trans-Canada Highway
I-I	Inflow-Infiltration	UPA	Units per Acre
ICI	Industrial, Commercial, Institutional	WTP	Water Treatment Plant
MDD	Maximum Day Demand	WWTP	Wastewater Treatment Plant
MDF	Maximum Daily Flow	WWF	Wet Weather Flow
PDWF	Peak Dry Weather Flow		

1.0 Introduction

1.1 Authorization

Rocky View County (the County) has commissioned ISL Engineering and Land Services Ltd. (ISL) to complete a Servicing Strategy encompassing water and wastewater infrastructure to support the preparation of the North Springbank Area Structure Plan and South Springbank Area Structure Plan (ASP), which are considered to be a combined Springbank ASP area for the purposes of this Servicing Strategy. The creation of these ASPs is meant to reflect the changing community dynamics since the Moddle, Central Springbank, and North Springbank ASPs in the late 1990's and early 2000's. The ultimate intent of the Servicing Strategy is to provide a framework for the future water and wastewater servicing systems in the area as well as to provide necessary parameters for the design, including recommendations for water supply and treatment as well as wastewater treatment and disposal. The Servicing Strategy represents an investment in the infrastructure of the Springbank community and will help support sustainable and cost-effective growth in the Springbank ASP plan area.

1.2 Background

The Springbank ASP area is comprised of approximately 10,650 ha (26,315 ac) of land in the western part of Rocky View County. Generally speaking, the ASP area is bounded by the Bow River to the north, The City of Calgary to the east, the Elbow River to the south and the community of Harmony to the west. The project boundary encompasses the areas included in the Moddle, Central Springbank, and North Springbank ASPs as well as additional area west of the Central Springbank ASP boundary.

A ridge running approximately along Highway 1 divides the area into two discrete catchment areas with one draining north to the Bow River and the remainder draining south to the Elbow River. The setting of the Study Area, being situated on The City of Calgary boundary, introduces a number of servicing opportunities and constraints from technical, social, and political perspectives. These constraints will be addressed as part of this Servicing Strategy. Additionally, the Springbank ASP has committed to follow a sustainable path. This will be accomplished by ensuring all impacts to the environment are considered during the decision-making process, and that its residents are well informed on green initiatives, such as water conservation and stormwater re-use.

The current population within the ASP area is 5,832 with the potential to increase to a population of 19,396 under current land use policies. The Calgary regional population is projected to grow to 1.9 million by 2026 and Rocky View County anticipates that the demand for rural residential housing will continue to increase alongside growth in Calgary, placing an increased burden on existing infrastructure. Cost-effectively, socially, politically, and environmentally conscious servicing options will become crucial to support the increasing population density in the plan area.

Establishing a unified regional approach to servicing is an investment in the future of the Springbank area and its residents. A key objective of the Servicing Strategy is to align growth and servicing objectives of the Springbank ASP area with the County Plan adopted by Rocky View County in 2013. A sound servicing strategy is useful for both administration and elected officials in carrying out both short- and long-term infrastructure planning and budgeting.

1.3 Purpose of Study

The purpose of developing a Servicing Strategy for Rocky View County is outlined below:

- To assess feasible system options that will provide water and wastewater servicing for the Study Area.
- To assess existing available and potential water sources and the feasibility of utilizing these sources as water supply for the Study Area.
- To assess existing available and potential wastewater service providers, particularly with respect to treatment and disposal.
- To consider sensitivities stemming from proximity to existing water and wastewater service providers.
- To layout potential water distribution and wastewater collection infrastructure based on recommended servicing schemes.
- To consider both traditional and alternative water and wastewater treatment options.
- To assess potential reuse/recycling of wastewater effluent as a means of disposal.
- To assess the potential use of stormwater to address a portion of the water supply needs of the area.

2.0 Study Area

2.1 Location

The Springbank ASP area includes approximately 10,650 ha (26,315 ac) within the western portion of Rocky View County. The area is bounded by the Bow River to the north and the Elbow River to the south. The City of Calgary is situated to the east along the Study Area boundary. The community of Harmony is located to the north of Highway 1 along the west Study Area boundary. The extent of the Study Area is illustrated in Figure 2.1.

The Study Area encompasses the areas from the Moddle, Central Springbank, and North Springbank ASPs as well as additional area west of the Central Springbank ASP boundary. Approximately 7,460 ha (18,430 ac) of the Study Area is considered developable area. The undevelopable area is considered not to possess any opportunity for future growth.

A ridge that runs roughly along Highway 1 divides the drainage of the Study Area, with a portion of the area draining north to the Bow River and the remainder drains south to the Elbow River. Within the Study Area, elevations range from a high point of approximately 1,280 m to low points of approximately 1,100 m at the Bow River and Elbow River. The Study Area topography is shown in Figure 2.2.

2.2 Existing Development

The majority of the existing developed areas within the estimated 10,650 ha area consist of residential development. This type of land use exists throughout the Study Area and is primarily within Service Areas A and H, where future residential development is intended in the areas surrounding the existing developments.

Additional existing development includes, industrial, commercial as well as institutional and community services. These developments are generally located in close proximity to Highway 1 or The City of Calgary boundary. The Springbank Airport is also located within the Study Area but is not intended to be serviced under the Springbank ASP.

A substantial portion of the Study Area is currently undeveloped and comprises largely of agricultural land. Some currently undeveloped areas are intended to remain undeveloped under the Springbank ASP. These areas are located primarily along the south project boundary adjacent to the Elbow River.

2.3 Future Development

Future developable lands as per the Springbank ASP consist of 11 land use types and further divided into 14 Service Areas as shown in Figure 2.3. The remainder of the Study Area is considered undevelopable; this is due to existing development or the intent to keep the area undeveloped as noted in the previous section.

Some service areas are intended solely for one land use type, while others are divided between residential and other land uses. Service Areas C, I-1, I-2, J, and K are divided between residential and business development, while service areas D, E, F, and G are entirely non-residential development. These service areas with no residential development are located primarily along Highway 1.

The majority of the Study Area contains residential development, including all or a portion of Service Areas A, B, C, H, I-1, I-2, I-3, I-4, J, and K. Population densities were determined on a per service area basis and provided by the County for use in this study. The future residential development varies in density from low to high within the Study Area. Figure 2.4 shows the future residential development density for the Springbank ASP area. It should be noted that a gross density of 8 UPA was considered to be high-density residential, 2-4 UPA was considered to be medium-density residential and less than 2 UPA was considered to be low-density residential for illustrative purposes.

Service Areas I and K possess the largest gross density at 8 UPA. This corresponds to be the service areas with the highest future population. Service Area H has the second highest population as it is the largest developable service area. A summary of the residential densities and populations per service area are summarized in Table 2.1 below. An ultimate future population of 43,335 may be expected within the Study Area.

Table 2.1: Summary of Future Development Populations per Service Area

Land Use Block	Description	Total Developable Area		Net Developable Area[1]		Density	Population[2]
		ha	ac	ha	ac	UPA	Capita
A	Country Residential Infill	1,174.45	2,902.13	822.12	2,031.49	0.5	3,920
B	Cluster Live-Work	84.08	207.76	58.85	145.43	2	1,122
C	Future Expansion Area	693.90	1,714.66	485.73	1,200.26	4	4,629
D	Business Industrial/Commercial	133.94	330.97	93.76	231.68	0	0
E	Business Transition	21.77	53.79	15.24	37.65	0	0
F	Institutional & Community Services	198.27	489.93	138.79	342.95	0	0
G	Business Commercial	363.01	897.02	254.11	627.91	0	0
H[3]	Cluster Residential	857.06	3,025.50	599.94	1,482.49	1.5	8,577
I	Special Planning Areas	378.08	934.24	264.65	653.97	8	17,656
J	Hamlet Interface Area	50.91	125.80	35.64	88.06	4	684
K	Urban Interface Area	164.26	405.90	114.98	284.13	8	6,747
Total		**4,120**	**10,180**	**2,884**	**7,126**		**43,335**

[1] Net developable area is considered 70% of the total developable area.
[2] Population is based on a unit density of 2.7capita/unit.
[3] The cluster residential developable area noted accounts for the 30% designated to Open Space Areas and then an additional 30% designated for infrastructure, environmental reserve, etc. in determining the net developable area.

It should be noted that differences between the information above and the data presented in the ASPs is due to iterations of the land use areas and populations over time as plans were refined. Updates to the digital land use files were completed to account for road right-of ways along legal section boundaries and the TransCanada Highway, as these were accounted for in some service areas but not in others, as well as the removal of those areas within the floodway of the Elbow River. It should also be noted that the areas and populations highlighted in Table 2.1 are considered conservative compared to the estimates provided in the ASPs.

Although options to service the entire Study Area were initially reviewed as part of this Servicing Strategy, the County's servicing priority was those lands along the Trans-Canada Highway (TCH) Corridor as well as the Special Planning Areas along the east Study Area boundary. This focused servicing area was further delineated into full build-out development areas and near-term development areas. These areas were delineated based on location and land use as well as topography for wastewater connection to promote gravity conveyance where possible.

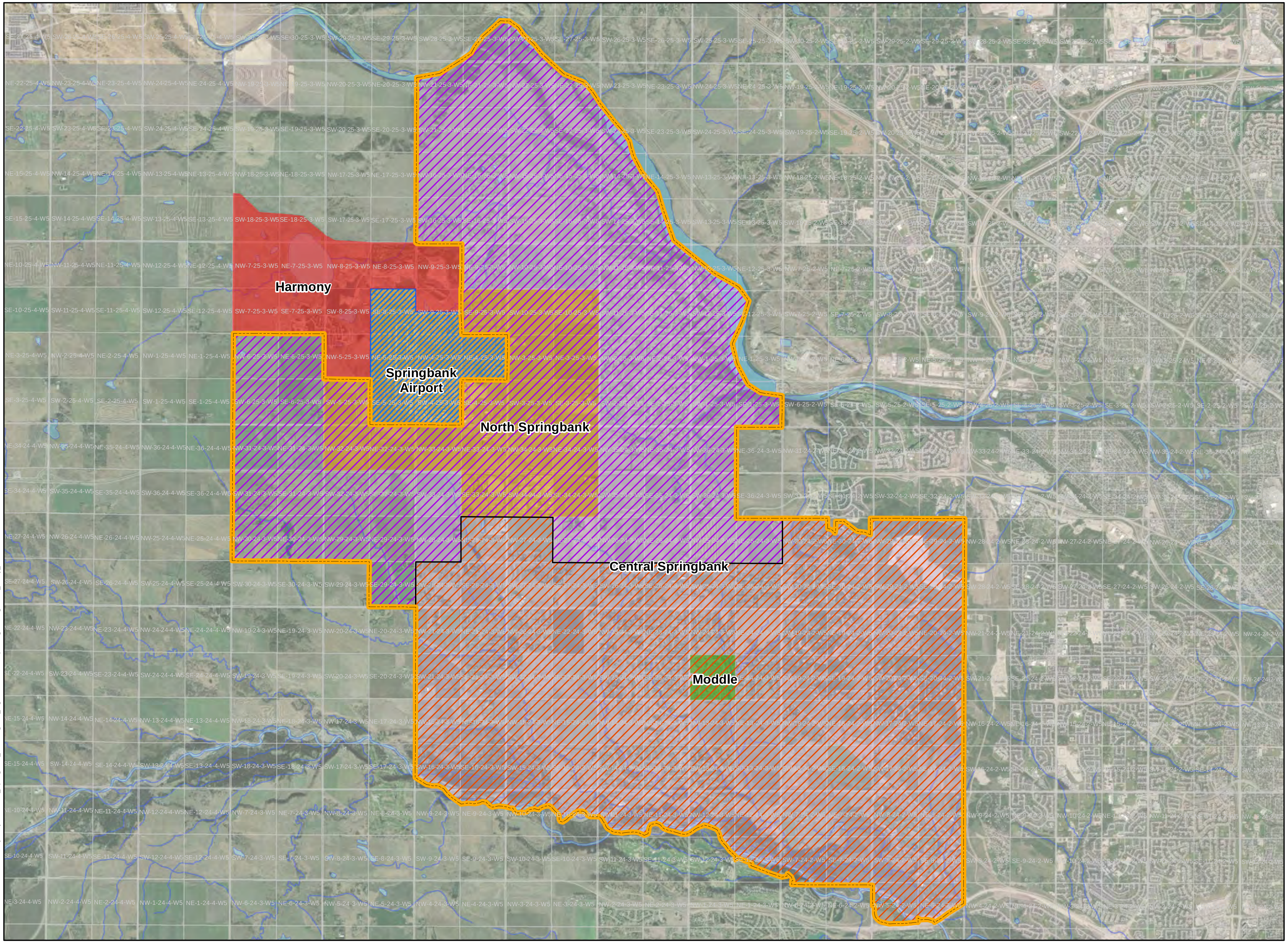
These areas are shown in Figure 2.5. The areas and associated populations for both phases are outlined in Table 2.2 below.

Table 2.2: Summary of Focused Service Area Populations

Land Use Block	Description	Near-Term			Full Build-Out		
		Net Developable Area[1]		Population[2]	Net Developable Area[1]		Population[2]
		ha	ac	Capita	ha	ac	Capita
A	Country Residential Infill	16.14	39.88	76	75.53	186.63	251
B	Cluster Live-Work	28.31	69.95	540	40.44	99.94	540
C	Future Expansion Area	0.00	0.00	0	441.94	1,092.05	2,948
D	Business Industrial/Commercial	65.01	160.64	0	92.87	229.48	0
E	Business Transition	15.24	37.65	0	21.77	53.79	0
F	Institutional & Community Services	6.90	17.05	0	14.56	35.98	0
G	Business Commercial	238.56	589.51	0	340.81	842.15	0
H[3]	Cluster Residential	43.69	107.96	625	121.96	301.36	1,221
I	Special Planning Areas	0.00	0.00	0	377.64	933.16	7,608
J	Hamlet Interface Area	35.64	88.06	684	50.91	125.80	1,615
K	Urban Interface Area	54.63	134.99	2,145	164.26	405.90	7,391
Total		**504**	**1,246**	**4,070**	**1,220**	**3,014**	**30,024**

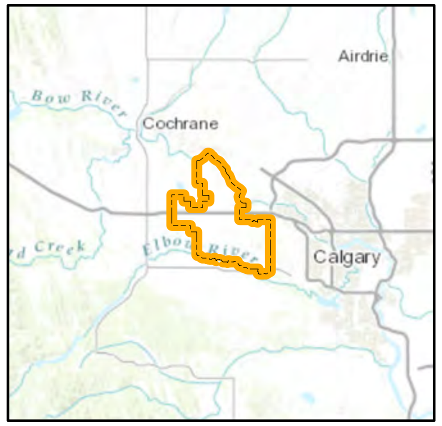
[1] Net developable area is considered 70% of the total developable area.
[2] Population is based on a unit density of 2.7capita/unit.
[3] The cluster residential developable area noted accounts for the 30% designated to Open Space Areas and then an additional 30% designated for infrastructure, environmental reserve, etc. in determining the net developable area.

It should be noted that the feasible servicing options for both water and wastewater as outlined in this Servicing Strategy are based on the full build-out development areas of the focused servicing area. The near-term development scenario is discussed in detail in Section 9 as this is based on the recommended full build-out scenario.



Legend

- Watercourse
- Water Body
- Springbank Airport
- Harmony Conceptual Scheme
- Central Springbank ASP
- North Springbank ASP
- Moddle ASP
- New North Springbank ASP
- New South Springbank ASP
- City of Calgary Boundary
- Study Area Boundary



Coordinate System:
CANA83-3TM114

1:65,000

0 750 1,500 3,000 Meters

FIGURE 2.1
STUDY AREA
SPRINGBANK AREA STRUCTURE PLAN
SERVICING STRATEGY

ROCKY VIEW COUNTY
Cultivating Communities

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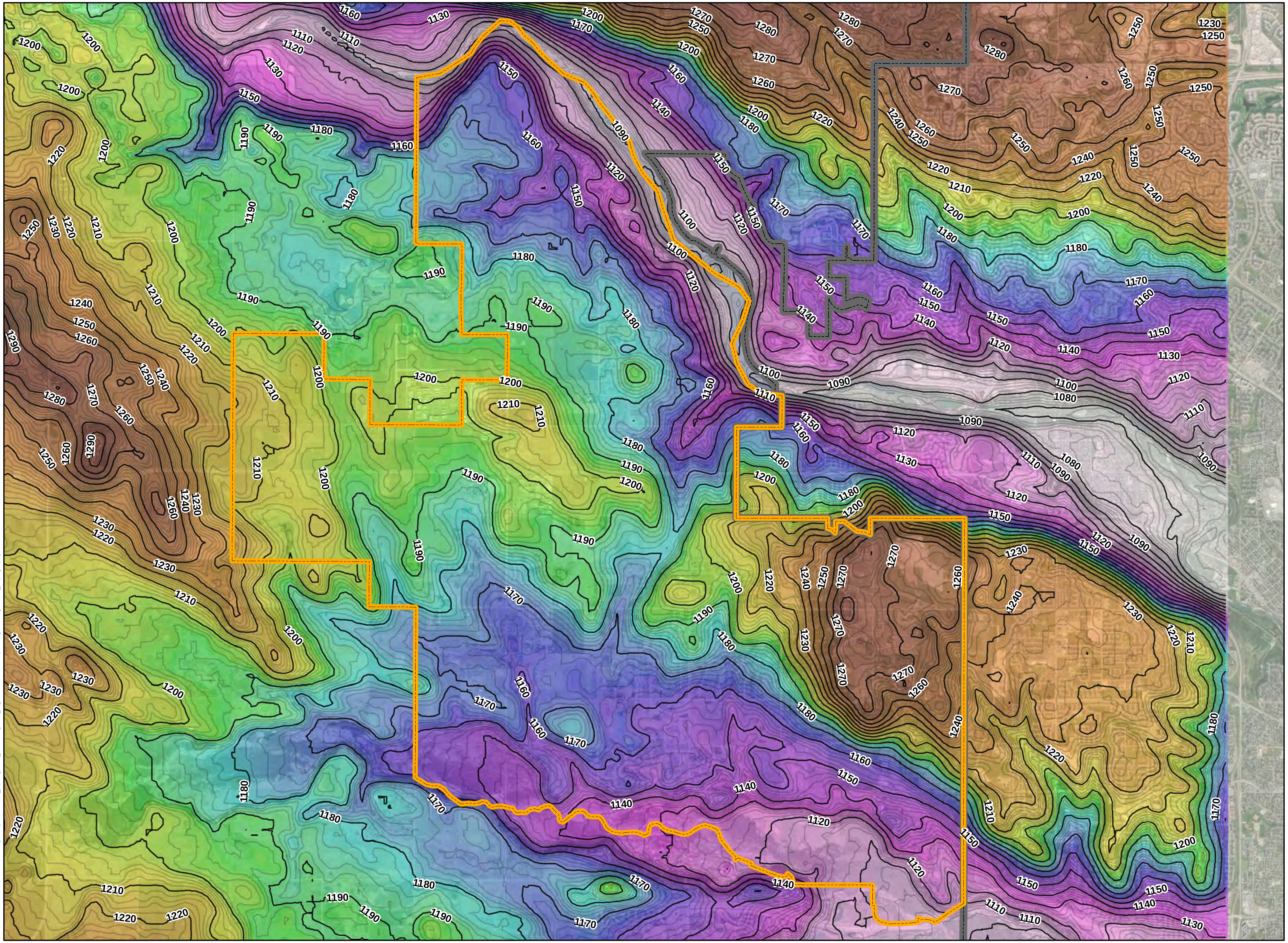

FIGURE 2.2
TOPOGRAPHY
SPRINGBANK AREA STRUCTURE PLAN
SERVICING STRATEGY

Rocky View County
Cultivating Communities

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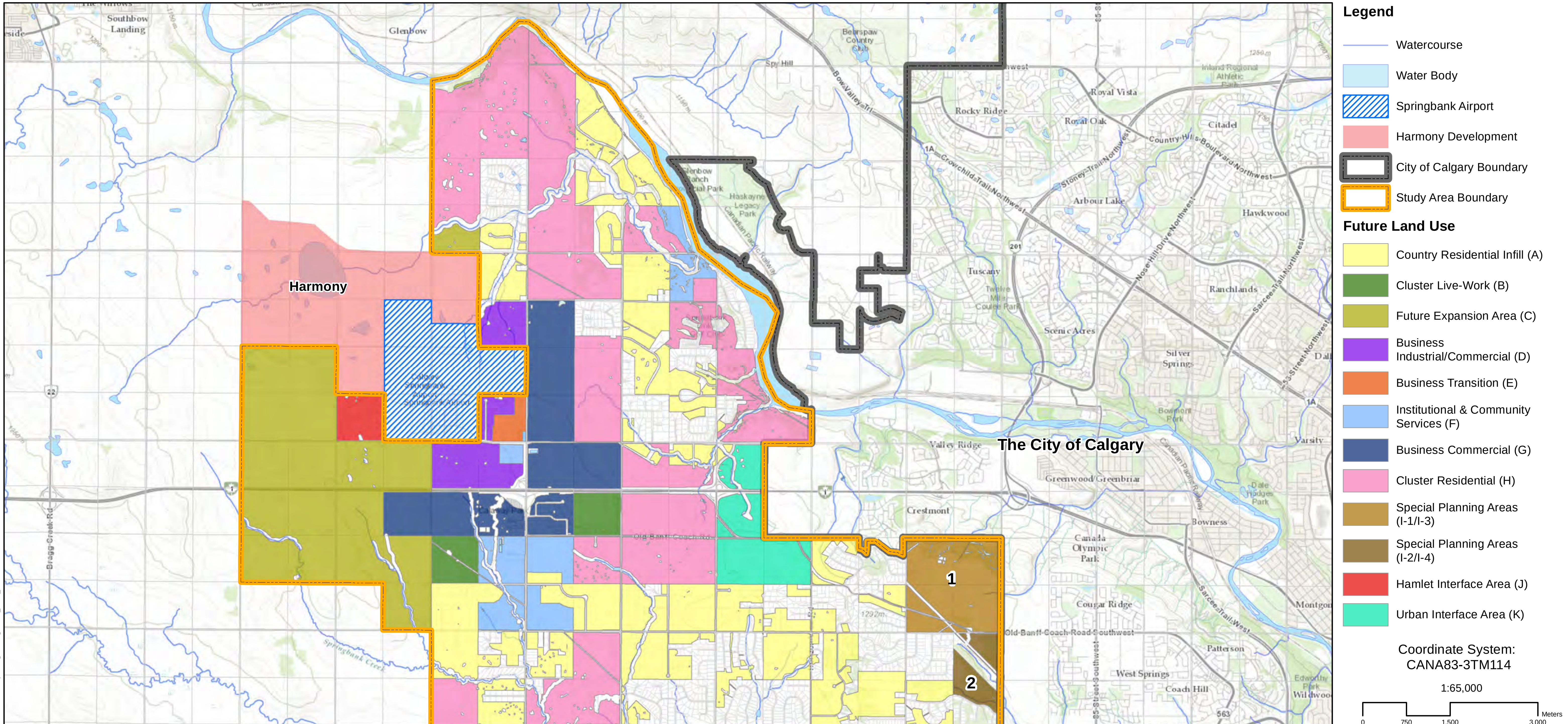

FIGURE 2.3
FUTURE LAND USE SCENARIO
SPRINGBANK AREA STRUCTURE PLAN
SERVICING STRATEGY

ROCKY VIEW COUNTY
Cultivating Communities

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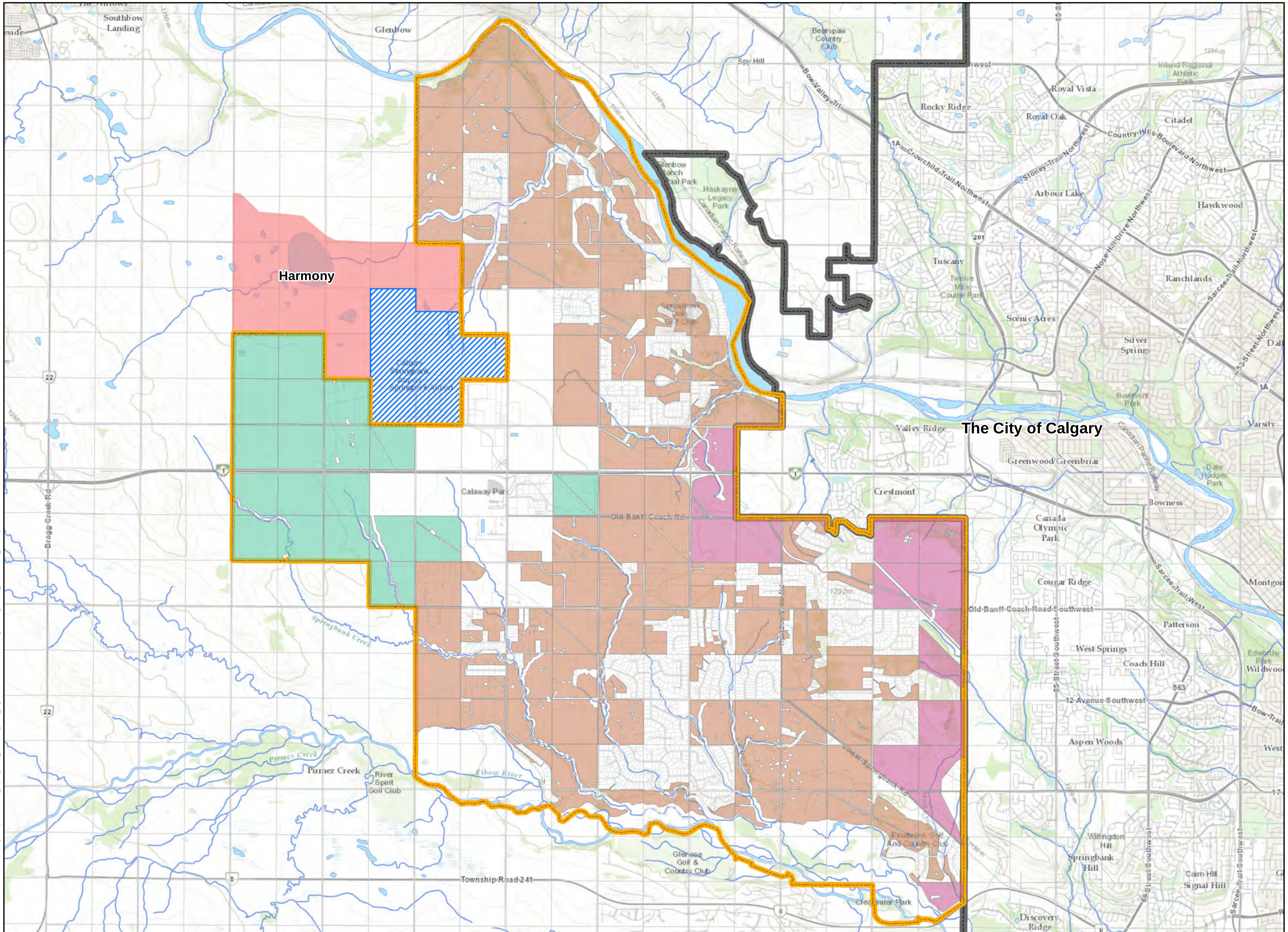

Legend

- Watercourse
- Water Body
- Springbank Airport
- Harmony Conceptual Scheme
- City of Calgary Boundary
- Study Area Boundary

Residential Density

- Low Density (Less than 2 UPA)
- Medium Density (2-4 UPA)
- High Density (8 UPA)

Coordinate System: CANA83-3TM114

1:65,000

0 750 1,500 3,000 Meters

FIGURE 2.4
FUTURE RESIDENTIAL DENSITY
SPRINGBANK AREA STRUCTURE PLAN
SERVICING STRATEGY

ROCKY VIEW COUNTY
Cultivating Communities

ISL

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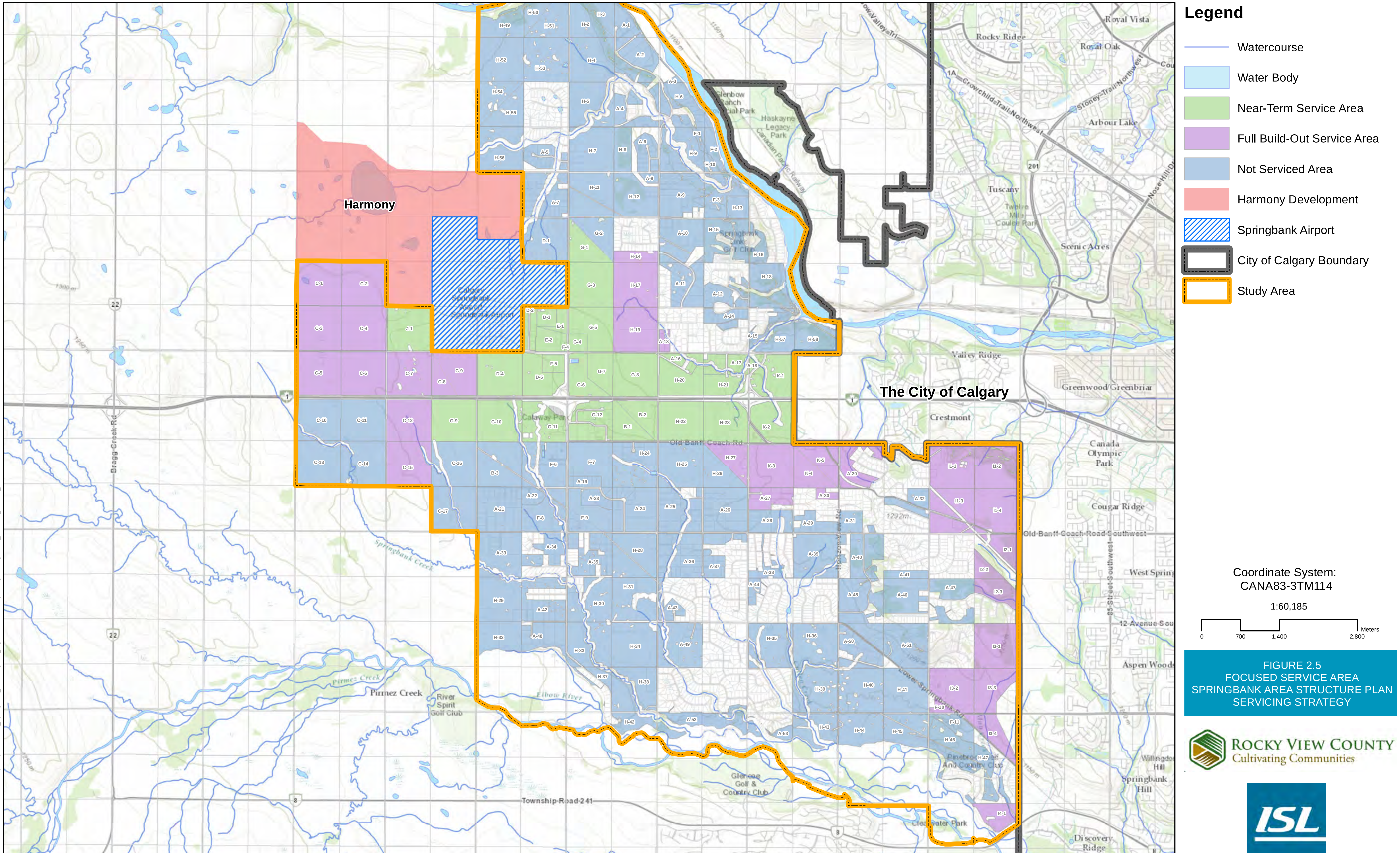

FIGURE 2.5
FOCUSED SERVICE AREA
SPRINGBANK AREA STRUCTURE PLAN
SERVICING STRATEGY

ROCKY VIEW COUNTY
Cultivating Communities

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Date: 8/24/2020

3.0 Existing Infrastructure

3.1 Existing Water Sources

Existing developed water sources within or within close proximity to the Study Area were reviewed. Potential sources included surface water diversions as well as groundwater diversions. Information relating to existing licensed water diversions was obtained from Alberta Environment and Parks. Licenses within the Study Area, as well as those within relatively close proximity outside the Study Area were reviewed. It should be noted that the City of Calgary, University of Calgary, Town of Cochrane, Town of Strathmore, Municipal District of Foothills No.31, Tsuu T'ina Nation, and Rocky View County licenses that are owned locally were excluded.

Since 2006, the South Saskatchewan River Basin (SSRB) has been closed to new water license applications with a few exceptions such as First Nations, Water Conservation Objectives and water storage projects. Consequently, the moratorium resulted in the establishment of the first market-based system to transfer (trade) water licenses in Canada. The transfer program is administered by the Government of Alberta through the enacted provisions of the Water Act. According to the water allocation transfer under a license provision, a willing seller and willing buyer can trade (re-distribute) the existing water allocation licenses.

3.1.1 Licensed Surface Water Diversions

For the purpose of the study, surface water diversions licensed by Alberta Environment and Parks were reviewed. A total of 40 surface water diversions were identified within the Springbank ASP area from sources including the Elbow River, Jumpingpound Creek and Nose Creek. Adjacent to the Study Area, 194 surface water diversions were also identified. The licensed diversions are identified in Appendix A. Please note that the licenses only within the immediate surroundings of the Study Area were included for illustrative purposes.

3.1.2 Licensed Groundwater Diversions

Similarly, groundwater diversions licensed by Alberta Environment and Parks were also reviewed. A total of 36 groundwater diversions within the Springbank ASP area plus 196 diversions adjacent to the area were identified. The licensed diversions are identified in Appendix A. It is noted that small local wells are also present in the area, generally serving a single lot or farm. These wells are not generally licensed by Alberta Environment and Parks and unless licensed, cannot be used to service development of the area. Similarly to the surface water diversions, only licenses within the immediate surroundings of the Study Area were included, for illustrative purposes.

3.1.3 Summary of Licensed Diversions

Table 3.1 summarizes the annual volumes from each of the broader areas (within the Springbank ASP area, plus north, south, east and west of the stipulated area), for surface water and groundwater diversions. As previously noted, The City of Calgary, University of Calgary, Town of Cochrane, Town of Strathmore, Municipal District of Foothills No.31, Tsuut'ina Nation and Rocky View County licenses were excluded. The surface water and groundwater diversions that were included are illustrated in Figure 3.1.

Table 3.1: Summary of Annual Diversion Volumes per Area

Location	Source		Total Annual Volume[2]
	Surface Water Annual Volume	Groundwater Annual Volume	
	m^3/year	m^3/year	m^3/year
Within Study Area	**2,650,287**	**903,879**	**3,554,166**
North of Study Area	8,230,073	377,675	8,607,748
South of Study Area	16,453,186	439,478	16,892,664
East of Study Area	6,439,470	63,928	6,503,398
West of Study Area	1,604,741	120,175	1,724,916
Within Surrounding Areas[1]	**32,727,471**	**1,001,255**	**33,728,726**
Total	**35,377,758**	**1,905,134**	**37,282,892**

[1] Within an arbitrary selected distance, which was done for illustrative purposes.
[2] The total annual volume shown is the consumptive volume rather than the gross volume.

In comparison, the full build-out of the focused service area requires a potable water volume of 26,340 m^3/day as discussed in the following sections, equivalent to 9,613,925 m^3/year, to make the development viable. The near-term service area requires a potable water volume of 11,065 m^3/day, equivalent to 4,038,801 m^3/yr. These values exceed the total annual volume available to be diverted from a groundwater source but are only a portion of the total surface annual volume. It is important to note that the annual surface volume within the overall Study Area accounts for larger water users such as the Rocky View Water Co-Op Ltd. and Harmony Development Inc; therefore, availability of water licenses would need to be confirmed to accommodate the volumetric demand. The required volume would be the largest annual volume in the Springbank area. It should also be noted that the volumes above are for total diversion quantity allowable for each license compared to the volume currently being diverted under each license.

Durum Bow Water & Land (Durum) currently owns two quarter sections of land within the project boundary (SE-33-24-W5 and SW-34-24-03-W5), located north of Highway 1 and west of Callaway Park. Durum is in the process of transferring a surface water diversion license to the Springbank Community. This license accounts for a gross annual diversion volume of 1,332,158 m^3 for recreation and irrigation uses. There may be opportunity to convert this diversion license to municipal in the future to utilize this volume for consumption.

A Franchise Agreement between Calalta Waterworks Ltd. (Calalta) and the County exists for Calalta to supply water exclusively to approximately 64 quarter sections of land. Approximately 38 of these quarter sections are located within the Study Area boundary, with the remaining Exclusive Service Area located west of the Study Area. Additionally, approximately four quarter sections of the six within the Non-Exclusive Service Area are located within the Study Area. The implications of this Franchise Agreement are discussed in detail in Section 10.

There may be opportunities to connect portions of the Study Area to other water co-ops/private water utilities in the area such as Calalta Waterworks Ltd., Emerald Bay Water & Sewer Co-Op Ltd., North Springbank Water Co-op Ltd., Poplar View Utilities Ltd., and Westridge Water Utilities Inc. it should be noted that some of the existing developments within the Study Area are already serviced by these water co-ops or private water utilities.

Conventional rural servicing is to be maintained for those areas outside of the focused service area.

3.2 Existing Water Infrastructure

There are no existing regional water distribution systems within the Study Area. As such, all existing development is currently serviced by individual water wells, water co-ops, or private water utilities (MPE, 2013). Existing regional water distribution infrastructure is located within the Community of Harmony and The City of Calgary, which are located northwest and east of the Study Area, respectively. Existing water infrastructure is shown in Figure 3.2.

3.3 Existing Wastewater Collection Infrastructure

There are no existing regional wastewater collection or disposal systems within the Study Area. As such, existing development is serviced by private sewage treatment systems (PSTS) and septic fields as well as pump out tanks for non-residential developments.

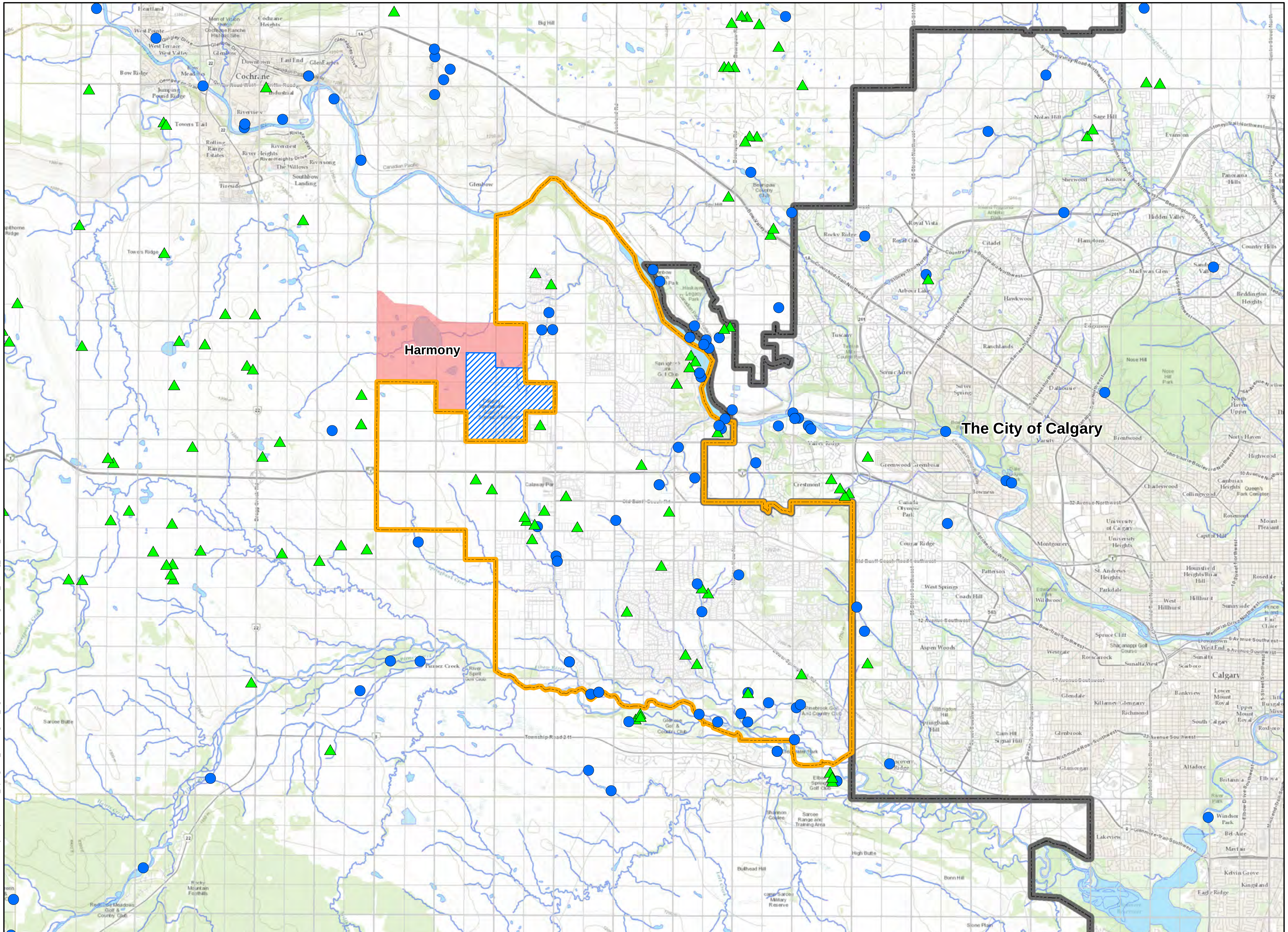
The communities of Aventerra Estates, Grandview Park, Morgans Rise, Morning Vista Estates, Swift Creek, and Windhorse Manor are currently developed and therefore not considered to be further developable. That said, due to the existing sanitary "ghost" infrastructure, these areas may be incorporated into a regional wastewater system. "Ghost" infrastructure refers to that which is constructed, but not currently in use or connected to an overall system. These areas are not considered in the prioritized service area within the Study Area; therefore, this infrastructure and these areas have not been included in the assessments discussed herein. However, a summary of the area and current populations per service area for these existing developments is outlined in Table 3.2 for reference.

Table 3.2: Summary of Existing Development Populations per Service Area

Service Area	Existing Development	Total Developable Area		Population
		ha	ac	capita
EX-N1[1]	Residential	48.5	119.8	127
EX-S1[2]	Residential	115.0	284.2	270
EX-S2[3]	Residential	192.0	474.4	467
Total		**355.5**	**878.5**	**864**

[1] Service Area EX-N1 includes the community of Aventerra Estates.
[2] Service Area EX-S1 includes the communities of Morgans Rise and Morning Vista Estates.
[3] Service Area EX-S2 includes the communities of Grandview Park, Swift Creek and Windhorse Manor.

Outside of the Study Area, formal wastewater treatment and disposal systems are available immediately east in The City of Calgary as well as northwest of the Study Area in the Community of Harmony. The existing wastewater system is shown in Figure 3.3.



Legend

- Surface Water Licences
- Groundwater Licences
- Watercourse
- Water Body
- Springbank Airport
- Harmony Conceptual Scheme
- City of Calgary Boundary
- Study Area Boundary

Coordinate System:
CANA83-3TM114

1:100,000

0 1,200 2,400 4,800 Meters

FIGURE 3.1
EXISTING WATER DIVERSION LICENCES
SPRINGBANK AREA STRUCTURE PLAN
SERVICING STRATEGY

ROCKY VIEW COUNTY
Cultivating Communities

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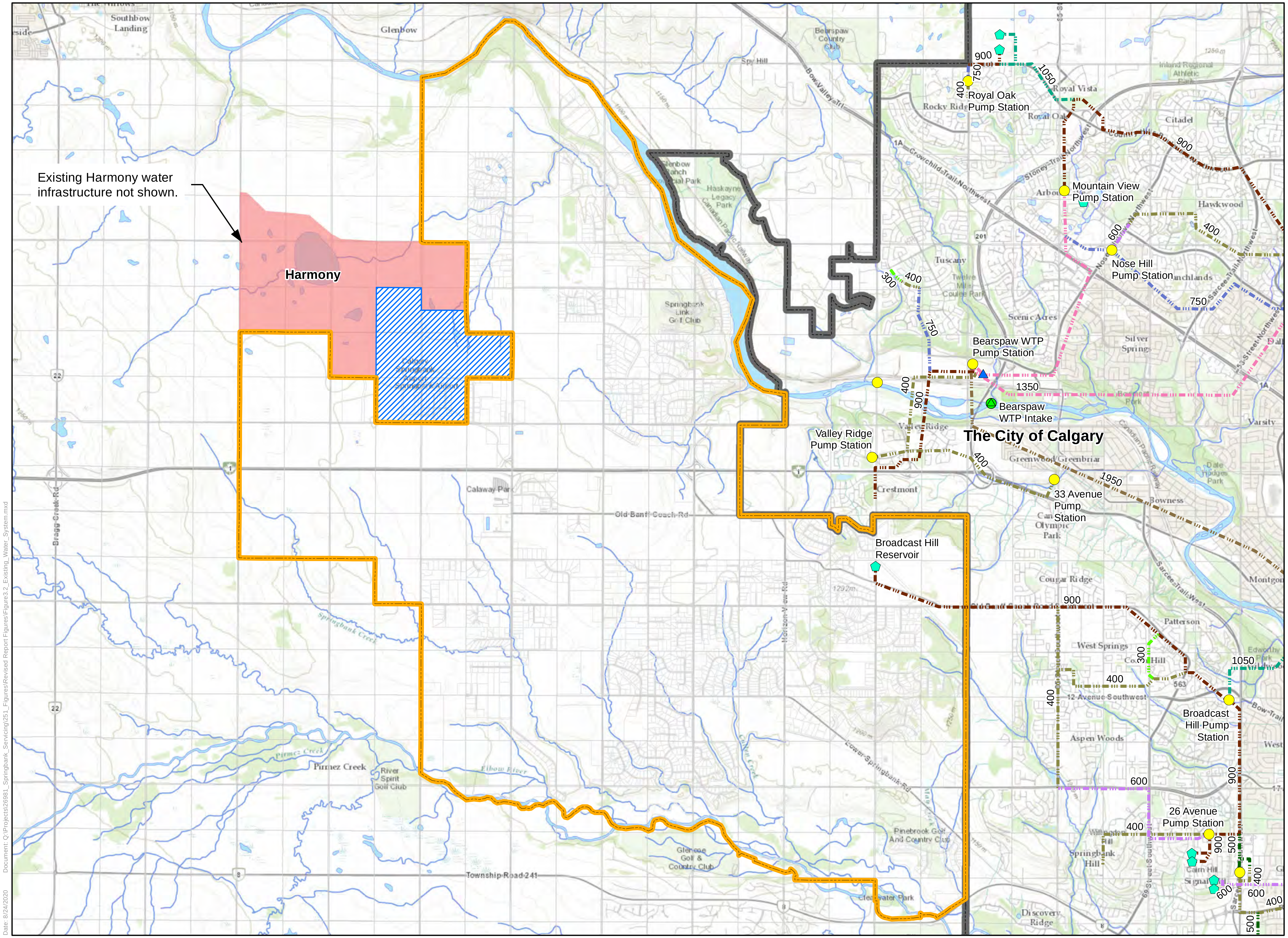

FIGURE 3.2
EXISTING WATER SYSTEM
SPRINGBANK AREA STRUCTURE PLAN
SERVICING STRATEGY

Rocky View County
Cultivating Communities

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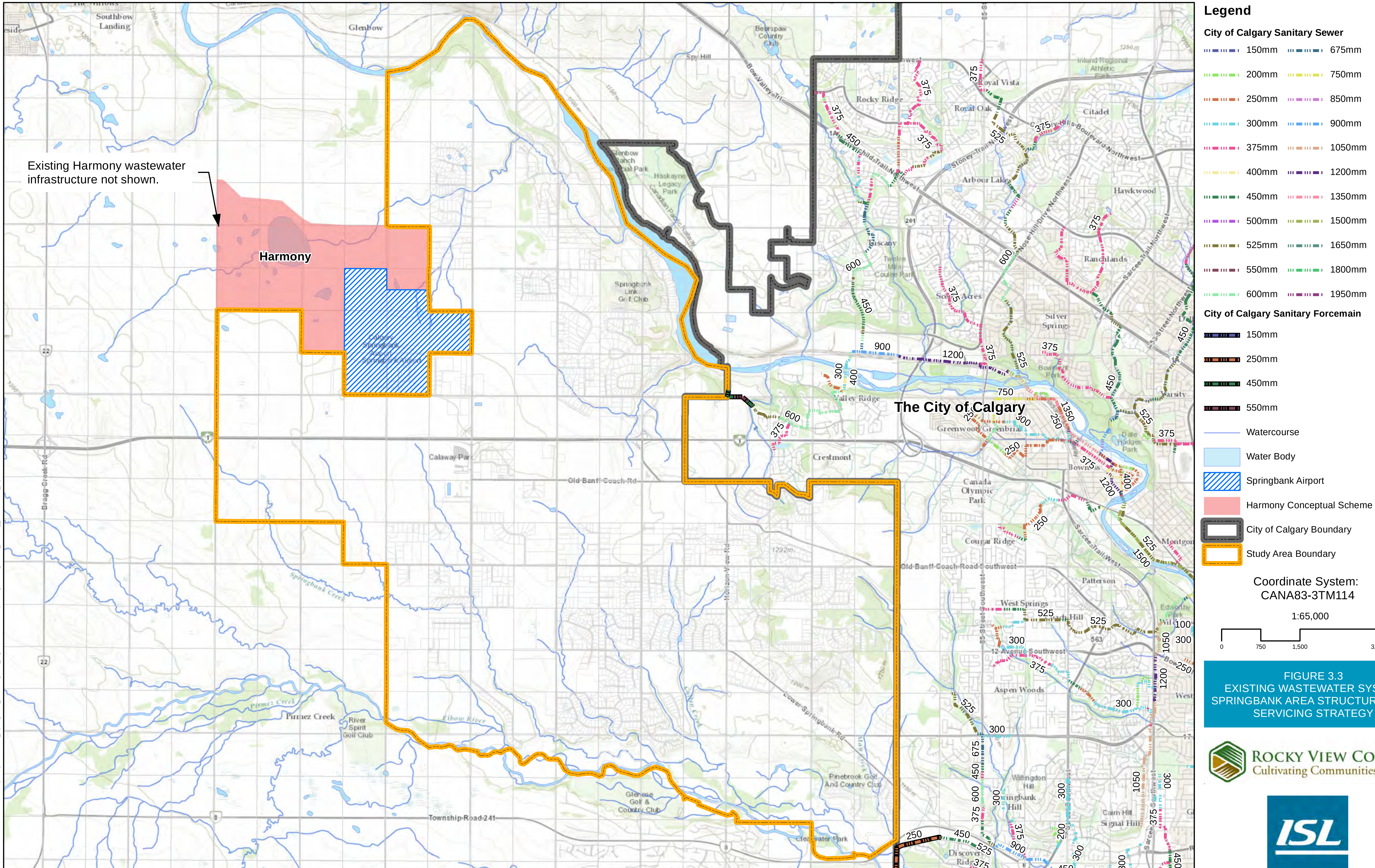

FIGURE 3.3
EXISTING WASTEWATER SYSTEM
SPRINGBANK AREA STRUCTURE PLAN SERVICING STRATEGY

ROCKY VIEW COUNTY
Cultivating Communities

ISL

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Date: 8/24/2020

4.0 Review of Existing Capacities

4.1 Review of Existing Water Capacities

Existing water supply sources within proximity to the Study Area were reviewed in order to determine if any capacity in key components of the existing systems exist that could be utilized to service future growth areas within the Springbank ASP Study Area.

The review focused on the following key water sources near the Study Area:

- The water production, supply line, and pumping capacities at the Harmony Water Treatment Plant (WTP).
- The potable water production capacities at the Calalta WTP.
- The capacity of The City of Calgary's water distribution system at the potential tie-in location to The City's Broadcast Hill Reservoir.

The following sections expand on each of the above potential water sources.

It is noted that other private systems in the area either were determined to have limited supply for growth or did not reply to requests to confirm their actual capacity. While it is possible to serve smaller parts of the Study Area from these systems, they do not pose a global solution (or anything remotely close to one) and are, hence not covered in detail herein.

4.1.1 Harmony Water Treatment Plant

Stage 1 of the Harmony WTP has been constructed to accommodate a population of 6,768 with an average day demand (ADD) of 2.3 ML and a maximum day demand (MDD) of 5.1 ML. Based on 2018 census information, the population is currently 249 people (Rocky View County, 2018). Therefore, there is significant capacity available within Stage 1. That being said, the Ultimate stage of the WTP is intended to accommodate 15,726 people with an ADD of 5.7 ML and an MDD of 13.6 ML (USL, 2016). This population is significantly smaller than the intended population of the Springbank ASP area. As such, major upgrades would be required to accommodate the ultimate Harmony and Springbank ASP populations. There may be opportunity to stage these upgrades based on development within the Springbank ASP area in conjunction with growth in Harmony. However, only one expansion step was intended from Stage 1 to Ultimate for the WTP (USL, 2016).

4.1.2 Calalta Water Treatment Plant

Based on the letter from Calalta Waterworks Ltd. to Rocky View County dated June 25, 2020, the Calalta WTP consists of an Ultra Membrane Filtration System with a current production capacity 9.4 L/s for each of the two trains utilizing seven modules per train, which is approximately 1.6 ML/day total. If the three expansion modules per train were to be added, the production capacity may be increased to 13.4 L/s per train, which is approximately 2.3 ML/day total. The WTP was constructed to ultimately double the above capacity by adding an additional skid with two trains and ten modules per train. This provides an approximate production capacity of 4.6 ML/day.

4.1.3 City of Calgary Water Distribution System

The City of Calgary's Broadcast Hill Reservoir (113) is located within the Study Area near the intersection of Old Banff Coach Road and Range Road 25 and was constructed in 2004. This reservoir has 26.4 ML of storage volume. This reservoir is supplied by a 900 mm feedermain from the Broadcast Hill Pump Stations (44/45) which were constructed in 1978. Based on this storage volume and an average day demand of 315 L/c/d, the theoretical serviceable residential population is approximately 84,000 people. It should be noted that this includes The City of Calgary, as such this volume has been assumed to be allocated elsewhere within The City. However, there is a possibility to expand this if sufficient capacity to feed an expanded service area exists or could be developed.

4.2 Review of Existing Wastewater Capacities

Existing wastewater systems within proximity to the Study Area were reviewed in order to determine if any capacity in key components of the existing systems exist that could be utilized to service future growth areas within the Springbank ASP.

The review focused on the following key water sources near the Study Area:

- The treatment and disposal capacity of the Harmony Wastewater Treatment Plant (WWTP).
- The capacity of The City of Calgary's wastewater collection system at the potential tie-in location to the Glenmore Sanitary Trunk.

The following sections expand on each of the above potential wastewater systems.

4.2.1 Harmony Wastewater Treatment Plant

Stage 1 of the Harmony WWTP has been constructed to accommodate a population of 6,768 with an average daily flow (ADF) of 2.3 ML and a maximum daily flow (MDF) of 3.6 ML. Based on 2018 census information, the population is currently 249 people (Rocky View County, 2018). Therefore, there is significant capacity available within Stage 1. That being said, the Ultimate stage of the WWTP is intended to accommodate 15,726 people with an ADF of 4.6 ML and an MDF of 7.3 ML (USL, 2016). This population is significantly smaller than the intended population of the Springbank ASP area. As such, major upgrades would be required to accommodate the ultimate Harmony and Springbank ASP populations. However, there is opportunity to stage these upgrades based on development within the Springbank ASP area in conjunction with growth in Harmony.

4.2.2 City of Calgary Wastewater Collection System

There is a connection to the West Memorial Drive trunk along the east Study Area boundary north of the Trans-Canada Highway; however, major wastewater system capacity constraints exist in the West Memorial Drive Trunk based on the 2013 West Memorial Drive Trunk Study (ISL, 2013). Regardless of recent upgrades in Bowness, constraints exist downstream along the majority of the trunk, meaning a tie-in would have little capacity to leverage and could require substantial upgrades.

Alternatively, the Glenmore Sanitary Trunk has a potential connection point at the southeast corner of the Study Area. The Glenmore Sanitary Trunk has significant available capacity to accommodate an additional service population of up to 100,000 people if development is well distributed throughout service area (ISL, 2010). A notable exception is the upstream end of the trunk, which consists of a 250 mm forcemain, immediately downstream of the Elbow Valley Lift Station. This is connected to a 450 mm/525 mm gravity sewer, which ultimately connects to a 900 mm gravity sewer across Highway 8. The 450 mm/525 mm sewer has limited capacity; however, the available capacity begins at the 900 mm sewer. Therefore, upgrades may be required to the 900 mm trunk to accommodate the Study Area wastewater flows.

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5.0 Design Parameters

5.1 Water System Design Criteria

The design criteria used when considering the water servicing options were derived from the Rocky View County's Servicing Standards, Alberta Parks and Environment Standards and Guidelines as well as typical municipal servicing standards in the Province of Alberta.

5.1.1 Water Consumption Rates

The 2013 County Servicing Standards stipulate a residential consumption rate of 340 L/capita/day. It is noted that the development within the Springbank ASP Study Area, and other growth areas within the County, is planned to incorporate a number of water conservation and water re-use measures to fulfill the overarching mandate of sustainable growth.

Based on this, it is proposed to reduce the aforementioned residential consumption rate to 315 L/capita/day to reflect the anticipated reduction in water use and increase in water re-use in the future. The anticipated reduction in water consumption will be manifested as more efficient and advanced engineering solutions and water fixtures are widely implemented due to the conservation policies, bylaws and the public awareness becoming more prominent.

The stipulated rate of 315 L/capita/day was determined based on the wastewater generation rate, due to the relationship that exists between water consumption and sewage generation.
For this, the future residential consumption rate was derived by assuming the water rate is 125% (invert of 80%) of the sanitary residential generation rate, in accordance with typical expectations. The proposed sanitary generation rate (described further below in Section 1.2) is 255 L/capita/day for residential areas.

This residential water consumption rate was already proposed and subsequently adopted by the County for the Glenbow Ranch ASP Servicing Strategy (ISL, 2017). In addition, the review of residential rates adopted for the County's other servicing studies and design briefs indicate that residential rates as low as 175 L/capita/day were considered, with an adopted average rate of 225 L/capita/day (Harmony IWSMP, 2011).

The non-residential consumption rate was adopted from the County Servicing Standards and is equal to 0.15 L/s (12,960 L/d) per gross hectare. The County confirmed that no high-water users are planned for the Springbank ASP Study Area as no process manufacturing type industries are anticipated.

The design water demands are critical in that they define the average day demand for the water system design. Table 5.1 lists water consumption data for a number of communities for comparison and illustrative purposes. As shown below, the demand unit rates proposed for this study are in line with the rates used for various servicing studies within the County and other municipalities.

Table 5.1: Water Consumption Rates Summary

Source	Water Consumption Rates	
	Residential	Non-Residential
	L/c/d	L/ha/d
Springbank ASP Study Area	315	12,960
Harmony Development (RVC)	175-275 (225)[1]	10,553[2]
Watermark Development (RVC)	271[3]	n/a
Glenbow Ranch ASP (RVC)	315	12,960
Bingham Development (RVC)	340	12,960
Balzac West Development (RVC)	340	12,960
City of Calgary	300 L/c/d[4]	
Airdrie Utility Master Plan	315	5,425[5]

[1] The Harmony Integrated Water Systems Master Plan (USL, 2011) stipulates average day demand rates ranging from 175 L/c/d to 275 L/c/d for low and high demand scenarios, respectively, with the proposed average value of 225 L/c/d as per Table 3.2 of the IWSMP.

[2] Indicates the converted capita-based water consumption rate of 225 L/c/d based on the commercial population density of 46.9 capita/ha as per *Table 3.1 – W4 Master Parameter Table* in Appendix A of the Harmony Integrated Water Systems Master Plan (USL, 2011)

[3] Indicates the projected water consumption rate based on the water to wastewater return ratio of 125% and the adopted wastewater generation rate of 217 L/c/d as per the Bearspaw Regional Wastewater Treatment Plant Application Letter (Worley Parsons, May 2011)

[4] The City of Calgary per capita 2034 consumption rate does not separate the ICI water demands from the residential water demands, thus the residential and non-residential rates have been combined.

[5] Indicates the projected area-based water consumption rate based on the adopted capita –based employment wastewater generation rate of 155 L/c/d and the water to wastewater return ratio of 125% with the corresponding employment-population density of 28 capita/ha as per the Airdrie Utility Master Plan (ISL, 2016)

5.1.2 Water Demand Peaking Factors

The water consumption peaking factors were adopted from the County Servicing Standards and are summarized below.

Residential Development

The following factors used to establish maximum day demand and peak hour demand the proposed development are as follows:

- Maximum Day Demand – 2.0 x Average Day Demand
- Peak Hour Demand – 4.0 x Average Day Demand

Non-Residential Development

The County Servicing Standards stipulate a peaking factor formula expressed as $\underline{\mathbf{P_f = 10Q^{-0.45}}}$ where Q is defined as average flow in litres per second. The acceptable range of peaking factor values ranges 2.5 to 25.

Given the fact that the to-be-calculated MDD and PHD peaking factors would yield the same value based on the presented relationship, and the fact that the aforementioned residential peaking factors for MDD and PHD conditions of 2 and 4, respectively, agree well with typically observed peaking factors, a number of previous RVC reports and studies, and other municipal standards, it is proposed that the County adopts the residential peaking factors for the entire Study Area regardless of the land use zone designation. As a result, MDD and PHD peaking factors of 2 and 4, respectively, are proposed to be adopted for this Servicing Strategy.

5.1.3 Reservoir Storage Requirements

Reservoir storage volumes were calculated according to the formulas recommended by the County's Servicing Standards and Alberta Environment and Parks.

Rocky View County *(County Servicing Standards: Table 600B)*

$$Volume = (FF + MDD)\ x\ Duration$$

Where,

Volume = Total storage requirement, m^3
FF = Design Fire Flow, L/s
MDD = Instantaneous Maximum Day Demand, L/s

Alberta Environment and Parks *(Standards and Guidelines for Municipal Waterworks, Wastewater and Stormwater Drainage Systems)*

$$S = A + B + (\text{the greater of } C \text{ or } D)$$

Where,

S = Total storage requirement, m^3
A = Fire storage, m^3
B = Equalization storage (25% of Maximum Day Demand), m^3
C = Emergency storage (minimum of 15% of Average Day Demand), m^3
D = Disinfection contact time storage to meet CT requirements, m^3

City of Calgary *(Water Long Range Plan)*

Storage volume shall be the greater of:

- Sufficient Active Storage to balance out the instantaneous projected Maximum Day Demand without depleting total storage by more than half.
- Sufficient to supply the Average Day Demand for one day without pumping to the zone.
- Sufficient to meet the Canadian Fire Underwriters Survey recommendations.

5.1.4 Fire Flow Protection Requirements

Fire flow criteria was based on the County Servicing Standards, which outlines the minimum required capacity to deliver required fire flows. Below in Table 5.2 are the fire flow rates, durations and storage volumes required for various development types.

Table 5.2: Fire Flow Requirements

Land Use Type	Fire Flow Required	Duration	Fire Storage Required
		hours	m^3
Country Residential	50 L/s	1.5	270
Single Family Dwellings	100 L/s	2	720
Multi-Family Residential	166 L/s	2	1,200
Light Commercial	166 L/s	2	1,200
Heavy Commercial	255 L/s	3.5	3,150
Industrial[1]	10,000 L/m - 15,000 L/m	3.5	3,150

[1] Please note that a fire flow of 10,000 L/m for a duration of 3.5 hours has been adopted for this study due to some areas having a commercial and industrial land use designation.

Please note that the fire flow requirements can typically be reduced by up to 50% for facilities equipped with sprinkler systems as per the Fire Underwriters Survey recommendations.

5.1.5 Distribution Pressure Requirements

The future water system was assessed using the following criteria based on a variety of standards, including those stipulated by Alberta Environment and Parks:

- Normal pressure range in the system under Average Day Demand of 350 kPa to 550 kPa.
- Minimum residual pressure in the system under Peak Hour Demand of 300 kPa.
- Minimum residual pressure in the system under Maximum Day Demand plus Fire Flow of 150 kPa.

5.1.6 Maximum Velocity Requirements

Water Supply System

Maximum velocities in the water transmission lines/feeder mains supplying raw or potable water to the Study Area should not exceed 2.0 m/s, and preferably be equal to or lower than 1.5 m/s.

Water Distribution System

Maximum flow velocities should not exceed 4.0 m/s as per the County Servicing Standards, and preferably be below 2.0 m/s, if possible, based on the best industry practice, during peak flow conditions and maximum day plus fire flow conditions.

5.2 Water System Demands

Following the determination of the water design criteria that would be used throughout the Servicing Strategy, water demands were derived for the focused service area under near-term and full build-out conditions. A summary of these water demands is shown in Tables 5.3 and 5.4.

5.3 Wastewater Design Criteria

5.3.1 Dry Weather Flow Conditions

The dry weather flow generation rates applied when considering the potential wastewater servicing options were generally employed from The City of Calgary's projected sanitary sewer per capita flow rates; Table 5.5.

Table 5.5: City of Calgary's Per Capita Flow Rates

Modelling Scenario Year	Residential Flow Rate	Residential to ICI Conversion Rate[1]	ICI Flow Rate
	L/day/cap		L/day/cap
2014	315	0.61	191
2019	290	0.61	176
2024	275	0.61	167
2029	262	0.61	159
2034	255	0.61	155
2039	255	0.61	155
2076	255	0.61	155

[1] This conversion ratio is based on the analysis of water billing data of an average ICI water consumption per employee (180 L/day/cap) to an average water consumption rate by a residential customer (297 L/day/cap) for the West Calgary Pressure Zone (2007). This ratio can be used to convert existing or future employment population to an equivalent residential population defined as Equivalent Residential Population = Employment Population x (297/180)

Table 5.5 above shows that the projected residential generation rates range from 315 L/p/d to 255 L/p/d for the existing and beyond 2034 conditions, respectively. In order to follow the County's goal of implementing "Environmentally Preferred" products and services, it is also assumed that its residents will follow a more sustainable lifestyle. For this reason, a rate of 255 L/p/d is considered suitable, once again assuming that the public will become more aware of water conservation techniques. This rate is also in line with the observed flow rates within the County's other recent development such as the Watermark Development, as the derived influent rates were determined to be 221 L/p/d and 210 L/p/d for 2014 and 2015, respectively.

The non-residential rate was not assumed from The City of Calgary's projected flow rates, but instead by utilizing the County Servicing Standards. Typically, the sanitary discharge volume is approximately 20% less than the consumption volume, equaling a rate of 80%. The non-residential water demand of 0.15 L/s (12,960 L/d) per gross hectare was multiplied by 80% to derive a non-residential sewage generation rate of 0.12 L/s/ha (10.37 m^3/ha/d).
To demonstrate the validity of the derived wastewater generation rates, a comparison of typical rates for a number of communities in Alberta is made in Table 5.6. As shown below, the recommended rate utilized throughout the study are in line with the rates used for various servicing studies within the County and in other southern parts of the Province.

Table 5.6: Wastewater Generation Rates

Source	Wastewater Generation Rate	
	Residential (L/p/d)	Non-Residential (L/ha/d)
Springbank ASP Study Area	255	10,368
Harmony Development (RVC)	175-275 (225)[1]	10,553[2]
Watermark Development (RVC)	217[3]	n/a
Glenbow Ranch ASP (RVC)	255	10,368
Bingham Development (RVC)	250[4]	28,000[4]
Balzac West Development (RVC)	340	12,960
City of Calgary - Short Term	315	10,505
City of Calgary - Long Term	255	8,525
Airdrie Utility Master Plan	255	4,340
Alberta Environment and Parks	n/a	30,000-40,000[5]

[1] The Harmony Integrated Water Systems Master Plan (USL, 2011) stipulates average wastewater generation rates ranging from 175L/c/d to 275L/c/d for low and high demand scenarios, respectively, with the proposed average value of 225L/c/d as per Table 4.22 of the IWSMP.

[2] Indicates the converted capita-based wastewater consumption rate of 225L/c/d based on the commercial population density of 46.9 capita/day as per Table 3.1 – W4 Master Parameter Table in Appendix A of the Harmony Integrated Water Systems Master Plan (USL, 2011)

[3] As per the Bearspaw Regional Wastewater Treatment Plant Application Letter (Worley Parsons, May 2011).

[4] As per the Wastewater Pumping, Treatment & Disposal – Predesign Draft Report prepared for Bingham Crossing Properties Inc. (USL, 2013)

[5] As per the Alberta Environment and Parks' Wastewater Systems Guidelines, a non-residential water generation rate is 0.35L/s/ha for industrial land use and 0.46L/s/ha for commercial land use.

It should be noted that the wastewater generation rates for industrial and commercial land uses as per the Provincial standards are considered to be extremely over conservative based on the typically measured non-residential flows and ISL's previous experience. Inadvertently, the stipulated generation rates would yield cost-prohibitive infrastructure requirements.

5.3.2 Wastewater Flow Peaking Factors

Peaking factors for the future wastewater system were calculated according to the guidelines published by Alberta Environment and Parks. These include the following:

Residential Development

Peaking factors derived based on Harmon's formula for residential areas:

$$PF = 1 + \frac{14}{4 + P^{\frac{1}{2}}}$$

- Where, P is the contributing design population in thousands.
- It is noted that PF must be at least 2.5.

Non-Residential Development

Peaking factor for non-residential areas:

$$PF = 6.659(Q_{Ave}^{-0.168})$$

- It is noted that PF can have a maximum value of 5.0.

5.3.3 Wet Weather Flow Conditions (Inflow-Infiltration)

A constant inflow-infiltration allowance of 0.28L/s/ha as per the Alberta Environment and Parks' guidelines was applied to each planned growth area to simulate the wet weather response.

5.4 Wastewater System Flows

Following the determination of the wastewater design criteria that would be used throughout the Servicing Strategy, wastewater flows were derived for the focused service area under near-term and full build-out conditions. A summary of these wastewater flows is shown in Tables 5.7 and 5.8.

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Table 5.3: Estimated Study Area Water Demands – Focused Service Area (Near-Term)

Service Area	Net Developable Area			Residential Population	Water Consumption		Average Day Demand				MDD		PHD	
	Residential	Non-Residential	Total		Residential	Non-Residential	Residential	Non-Residential	Total		(2 x ADD)		(4.0 x ADD)	
	ha	ha	ha	capita	L/p/d	L/s/ha	L/s	L/s	L/s	m^3/d	L/s	m^3/d	L/s	m^3/d
A	23.05	0.00	23.05	76	315	0.15	0.28	0.00	0.28	23.94	0.55	47.88	1.11	95.76
B	40.44	0.00	40.44	540	315	0.15	1.97	0.00	1.97	170.10	3.94	340.20	7.88	680.40
C	0.00	0.00	0.00	0	315	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
D	0.00	92.87	92.87	0	315	0.15	0.00	19.90	19.90	1,719.41	39.80	3,438.82	79.60	6,877.64
E	0.00	21.77	21.77	0	315	0.15	0.00	4.66	4.66	403.02	9.33	806.04	18.66	1,612.08
F	0.00	9.86	9.86	0	315	0.15	0.00	2.11	2.11	182.48	4.22	364.95	8.45	729.90
G	0.00	340.81	340.81	0	315	0.15	0.00	73.03	73.03	6,309.79	146.06	12,619.58	292.12	25,239.16
H	62.41	0.00	62.41	625	315	0.15	2.28	0.00	2.28	196.88	4.56	393.75	9.11	787.50
I-1	0.00	0.00	0.00	0	315	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
I-2	0.00	0.00	0.00	0	315	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
I-3	0.00	0.00	0.00	0	315	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
I-4	0.00	0.00	0.00	0	315	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
J	25.64	25.27	50.91	684	315	0.15	2.49	5.42	7.91	683.36	15.82	1,366.72	31.64	2,733.44
K	40.20	37.84	78.04	2,145	315	0.15	7.82	8.11	15.93	1,376.24	31.86	2,752.48	63.71	5,504.96
Total	**191.75**	**528.41**	**720.16**	**4,070**			**14.84**	**113.23**	**128.07**	**11,065**	**256.14**	**22,130**	**512.28**	**44,261**

Table 5.4: Estimated Study Area Water Demands – Focused Service Area (Full Build-Out)

Service Area	Net Developable Area			Residential Population	Water Consumption		Average Day Demand				MDD		PHD	
	Residential	Non-Residential	Total		Residential	Non-Residential	Residential	Non-Residential	Total		(2 x ADD)		(4.0 x ADD)	
	ha	ha	ha	capita	L/p/d	L/s/ha	L/s	L/s	L/s	m^3/d	L/s	m^3/d	L/s	m^3/d
A	75.53	0.50	76.03	251	315	0.15	0.92	0.00	0.92	79.07	1.83	158.13	3.66	316.26
B	40.44	2.00	42.44	540	315	0.15	1.97	0.00	1.97	170.10	3.94	340.20	7.88	680.40
C	110.48	4.00	114.48	2,948	315	0.15	10.75	71.03	81.77	7,065.22	163.55	14,130.44	327.09	28,260.88
D	0.00	0.00	0.00	0	315	0.15	0.00	19.90	19.90	1,719.41	39.80	3,438.82	79.60	6,877.64
E	0.00	0.00	0.00	0	315	0.15	0.00	4.66	4.66	403.02	9.33	806.04	18.66	1,612.08
F	0.00	0.00	0.00	0	315	0.15	0.00	3.12	3.12	269.58	6.24	539.17	12.48	1,078.34
G	0.00	0.00	0.00	0	315	0.15	0.00	73.03	73.03	6,309.79	146.06	12,619.58	292.12	25,239.16
H	121.96	1.50	123.46	1,221	315	0.15	4.45	0.00	4.45	384.62	8.90	769.23	17.81	1,538.46
I-1	142.55	8.00	150.55	7,608	315	0.15	27.74	6.33	34.06	2,943.13	68.13	5,886.27	136.26	11,772.54
I-2	30.25	8.00	38.25	1,615	315	0.15	5.89	3.80	9.69	837.21	19.38	1,674.41	38.76	3,348.82
I-3	138.47	8.00	146.47	7,391	315	0.15	26.95	0.00	26.95	2,328.17	53.89	4,656.33	107.79	9,312.66
I-4	19.10	8.00	27.10	1,019	315	0.15	3.72	0.00	3.72	320.99	7.43	641.97	14.86	1,283.94
J	25.64	4.00	29.64	684	315	0.15	2.49	5.42	7.91	683.36	15.82	1,366.72	31.64	2,733.44
K	126.42	8.00	134.42	6,747	315	0.15	24.60	8.11	32.71	2,825.87	65.41	5,651.74	130.83	11,303.48
Total	**830.84**	**52.00**	**882.84**	**30,024**			**109.46**	**195.39**	**304.86**	**26,340**	**609.71**	**52,679**	**1,219.42**	**105,358**

Table 5.7: Estimated Study Area Wastewater Flows – Focused Service Area (Near-Term)

Service Area	Cumulative Developable Area			Cumulative Population	DWF Generation Rate		Average DWF				Peaking Factor		PDWF		I-I Rate	I-I Flow		Peak WWF	
	Res	Non-Res	Total		Res	Non-Res	Res	Non-Res	Total		Res	Non-Res							
	ha	ha	ha	capita	L/p/d	L/d/ha	L/s	L/s	L/s	m³/d			L/s	m³/d	L/s	L/s	m³/d	L/s	m³/d
A	23.05	0.00	23.05	76	255	10,368	0.2	0.0	0.2	19	4.3	0.0	1.0	83	0.28	6.5	558	7.4	641
B	63.50	0.00	63.50	616	255	10,368	1.8	0.0	1.8	157	4.0	0.0	7.2	622	0.28	17.8	1,536	25.0	2,158
C	63.50	0.00	63.50	616	255	10,368	1.8	0.0	1.8	157	4.5	0.0	8.2	707	0.28	17.8	1,536	26.0	2,243
D	63.50	92.87	156.37	616	255	10,368	1.8	11.1	13.0	1,120	4.5	4.4	57.7	4,983	0.28	43.8	3,783	101.5	8,766
E	63.50	114.64	178.13	616	255	10,368	1.8	13.8	15.6	1,346	4.5	4.3	67.2	5,802	0.28	49.9	4,309	117.0	10,111
F	63.50	124.49	187.99	616	255	10,368	1.8	14.9	16.8	1,448	4.5	4.2	71.3	6,164	0.28	52.6	4,548	124.0	10,712
G	63.50	465.30	528.80	616	255	10,368	1.8	55.8	57.7	4,981	4.5	3.5	203.6	17,592	0.28	148.1	12,793	351.7	30,384
H	125.91	465.30	591.21	1,241	255	10,368	3.7	55.8	59.5	5,141	3.9	3.5	209.8	18,126	0.28	165.5	14,303	375.3	32,429
I-1	125.91	465.30	591.21	1,241	255	10,368	3.7	55.8	59.5	5,141	4.5	3.5	211.9	18,309	0.28	165.5	14,303	377.4	32,611
I-2	125.91	465.30	591.21	1,241	255	10,368	3.7	55.8	59.5	5,141	4.5	3.5	211.9	18,309	0.28	165.5	14,303	377.4	32,611
I-3	125.91	465.30	591.21	1,241	255	10,368	3.7	55.8	59.5	5,141	4.5	3.5	211.9	18,309	0.28	165.5	14,303	377.4	32,611
I-4	125.91	465.30	591.21	1,241	255	10,368	3.7	55.8	59.5	5,141	4.5	3.5	211.9	18,309	0.28	165.5	14,303	377.4	32,611
J	151.55	490.57	642.12	1,925	255	10,368	5.7	58.9	64.6	5,577	3.9	3.5	228.2	19,716	0.28	179.8	15,534	408.0	35,251
K	191.75	528.41	720.16	4,070	255	10,368	12.0	63.4	75.4	6,516	3.6	3.5	264.7	22,872	0.28	201.6	17,422	466.4	40,294
Total	**191.75**	**528.41**	**720.16**	**4,070**	**255**	**10,368**	**12.0**	**63.4**	**75.4**	**6,516**	**3.6**	**3.5**	**264.7**	**22,872**	**0.28**	**201.6**	**17,422**	**466.4**	**40,294**

Table 5.8: Estimated Study Area Wastewater Flows – Focused Service Area (Full Build-Out)

Service Area	Cumulative Developable Area			Cumulative Population	DWF Generation Rate		Average DWF				Peaking Factor		PDWF		I-I Rate	I-I Flow		Peak WWF	
	Res	Non-Res	Total		Res	Non-Res	Res	Non-Res	Total		Res	Non-Res							
	ha	ha	ha	capita	L/p/d	L/d/ha	L/s	L/s	L/s	m³/d			L/s	m³/d	L/s	L/s	m³/d	L/s	m³/d
A	75.53	0.00	75.53	251	255	10,368	0.7	0.0	0.7	64	4.1	0.0	3.0	263	0.28	21.1	1,827	24.2	2,090
B	115.97	0.00	115.97	791	255	10,368	2.3	0.0	2.3	202	4.0	0.0	9.2	798	0.28	32.5	2,806	41.7	3,604
C	226.45	331.45	557.91	3,739	255	10,368	11.0	39.8	50.8	4,390	3.4	3.6	180.7	15,613	0.28	156.2	13,497	336.9	29,110
D	226.45	424.32	650.78	3,739	255	10,368	11.0	50.9	62.0	5,353	4.5	3.5	227.9	19,688	0.28	182.2	15,744	410.1	35,432
E	226.45	446.09	672.54	3,739	255	10,368	11.0	53.5	64.6	5,579	4.5	3.5	237.0	20,478	0.28	188.3	16,270	425.3	36,748
F	226.45	460.65	687.10	3,739	255	10,368	11.0	55.3	66.3	5,729	4.5	3.5	243.1	21,007	0.28	192.4	16,622	435.5	37,629
G	226.45	801.46	1,027.91	3,739	255	10,368	11.0	96.2	107.2	9,263	4.5	3.5	386.3	33,374	0.28	287.8	24,867	674.1	58,241
H	348.41	801.46	1,149.87	4,960	255	10,368	14.6	96.2	110.8	9,574	3.7	3.5	391.4	33,817	0.28	322.0	27,818	713.4	61,634
I-1	490.96	830.98	1,321.94	12,568	255	10,368	37.1	99.7	136.8	11,820	3.1	3.5	462.9	39,998	0.28	370.1	31,980	833.1	71,979
I-2	521.21	848.72	1,369.93	14,183	255	10,368	41.9	101.8	143.7	12,416	3.7	3.5	509.5	44,021	0.28	383.6	33,141	893.1	77,163
I-3	659.68	848.72	1,508.41	21,574	255	10,368	63.7	101.8	165.5	14,301	3.1	3.5	552.8	47,763	0.28	422.4	36,491	975.2	84,255
I-4	678.78	848.72	1,527.51	22,593	255	10,368	66.7	101.8	168.5	14,561	3.8	3.5	609.5	52,661	0.28	427.7	36,953	1037.2	89,614
J	704.42	874.00	1,578.42	23,277	255	10,368	68.7	104.9	173.6	14,997	3.9	3.5	635.0	54,866	0.28	442.0	38,185	1077.0	93,052
K	830.84	911.83	1,742.68	30,024	255	10,368	88.6	109.4	198.0	17,110	2.5	3.5	604.5	52,229	0.28	487.9	42,159	1092.5	94,388
Total	**830.84**	**911.83**	**1,742.68**	**30,024**	**255**	**10,368**	**88.6**	**109.4**	**198.0**	**17,110**	**2.5**	**3.5**	**604.5**	**52,229**	**0.28**	**487.9**	**42,159**	**1092.5**	**94,388**

6.0 Possible Servicing Option Feasibility

6.1 Water Servicing Options

Based upon the design water demands of 315 L/p/d and 0.15 L/s/ha, the estimated total required water demand for the focused service area is approximately 10 million m^3/yr at full build-out.

The following options for water servicing for the Springbank ASP area were considered for feasibility:

- Connection to the Community of Harmony
- Connection to The City of Calgary
- Connection to Calalta Waterworks Ltd.
- New Raw Water Intake
- Deep Water Aquifer

In Table 6.1, options are reviewed for feasibility, with the feasible options reviewed in further detail below in Section 7.1. Those options not reviewed in further detail herein, were evaluated in the March 2018 Servicing Option Technical Memorandum based on the previous land use scenario and proposed service area. This memorandum is included in Appendix B. Additionally, the potential for use of a groundwater source to service the Study Area was evaluated as part of the Hydrogeological Desktop Analysis Technical Memorandum, which is included in Appendix C.

Based on these documents and the high-level feasibility review, a new raw water intake is not preferred due to the requirement for a new raw water intake along the Bow River as well as a new WTP. However, this would provide the service area with an entirely stand-alone system. Additionally, the utilization of a deep-water aquifer source is not considered feasible to accommodate the demands of the Study Area based on the Hydrogeological Desktop Analysis Technical Memorandum.

It should be noted that the connection to Calata Waterworks Ltd. was considered only for the area within the County's current Franchise Agreement area and is discussed in detail in Section 10.1. Therefore, two options have been selected by the County for further evaluation based on available water servicing options for the entire focused service area. These options are:

- Connection to the Community of Harmony
- Connection to The City of Calgary

As noted, these water servicing options correlate to the feasible wastewater servicing options. Therefore, these options were evaluated based on the full build-out focused service area applied to the proposed wastewater system, which prioritizes those lands along the TCH Corridor as well as the Special Planning Areas along the east Study Area boundary. Development outside of these service areas has not been considered for incorporation into the ASP's regional water system at this time. It is again noted that limited growth may be supported via existing private systems in the Study Area. Lower-density residential development outside of the focused service area is to be locally serviced. Options such as connections to the local water co-ops/private water utilities or local cisterns remain available for these developments.

6.2 Wastewater Servicing Options

The second item required for servicing the Study Area is wastewater treatment and disposal. To this end, a wastewater discharge point is required; either discharge of treated effluent to a receiving body of water or another municipal system with a discharge point, or discharge of untreated wastewater to another municipal system that has a treatment system included in its process train.

The following options for wastewater servicing for the Springbank ASP area were considered for feasibility:

- Connection to the Community of Harmony
- Connection to The City of Calgary
- New Outfall to the Bow River
- New Outfall to the Elbow River
- Sewage Lagoon
- Spray Effluent Disposal

In Table 6.2 below, options are reviewed for feasibility, with the feasible options reviewed in further detail below in Section 7.2. Those options not reviewed in further detail herein, were evaluated in the March 2018 memorandum based on the previous land use scenario and proposed service area. This memorandum is included in Appendix B.

Based on this 2018 Servicing Option Technical Memorandum and the high-level feasibility review, a new outfall to the Bow River in order to provide sufficient dilution for effluent discharge would require Alberta Environment and Parks' approval and rigorous consultation with downstream stakeholders. This option also requires a new WWTP; however, this would provide the County with a stand-alone system for the service area. A wastewater lagoon is not preferred as it requires significant setback requirements; therefore, this would sterilize a large portion of developable land unless land outside the Study Area may be utilized for this purpose. Spray effluent disposal has stringent setback requirements for development, which would sterilize a large portion of developable land and/or limit potential land uses in the area. As such, this option is not preferred. An outfall to the Elbow River would face similar rigor as a new outfall to the Bow River; however, there are much higher risks with an outfall here, owing to the fact that it is a much lower volume river and drains into the Glenmore Reservoir, which provides much of Calgary's drinking water.

In addition to the above evaluations, a 2019 Revised Wastewater Servicing Concepts Technical Memorandum was prepared to further assess the potential wastewater servicing options based on the revised land use scenario and potential service areas. The results of this technical memorandum are contained herein as the feasible County options are carried forward in this analysis. This technical memorandum is provided in Appendix D.

It should be noted that the new outfall to the Elbow River was considered only for the area within Calalta and the County's Franchise Agreement area and is discussed in detail in Section 10.2. Therefore, in summary of the above, two feasible options for the entire focused service area have been selected by the County for further evaluation. These options are:

- Connection to the Community of Harmony (though noting this might require an outfall to the Bow River)
- Connection to The City of Calgary

These options were further evaluated based on the full build-out focused service area applied to the proposed wastewater system, which prioritizes those lands along the TCH Corridor as well as the Special Planning Areas along the east Study Area boundary. Development outside of these service areas has not been considered for incorporation into the ASP's regional water system at this time. It is again noted that limited growth may be supported via existing private systems in the Study Area. Lower-density residential development outside of the focused service area is to be locally serviced. Options such as connections private/local sewage systems and communal wastewater systems remain available for development outside of the Springbank ASP wastewater system service area.

It is recommended that these lower-density areas be serviced through the use of communal septic systems owned and operated as per the County's bylaws. This provides assurance that the systems are properly maintained over the lifecycle of the facilities thus ensuring that there is no impact on the downstream reach of the watershed. As such, conversion from the local sewage treatment systems, otherwise to be located on private lands, will address the concerns raised by stakeholders. The communal septic systems will therefore meet the County's standards, which are more stringent that those stipulated in the Alberta Private Sewage System Standard of Practice (Safety Codes Council, 2015).

6.3 Other Measures to Assist in Servicing

In conjunction with the servicing options noted above, several other measures were reviewed to assist with the above noted feasible options. These measures assist in such areas as reduction of water demand requirements for new water sources and reduction of total volume of wastewater for disposal. Measures reviewed include the following:

- Stormwater Re-Use
- Treated Wastewater Effluent Re-Use
- Use of Snowfluent for Wastewater Effluent Disposal
- Treatment Wetlands for Wastewater Effluent Disposal
- Groundwater Recharge for Wastewater Effluent Disposal

None of these measures would change the feasibility of the above reviewed water and wastewater servicing alternatives. Any of these measures would, however, assist in reducing system requirements, and hence, costs.

Of the five measures mentioned above that would assess in servicing, four correlate to wastewater effluent. Given the potential challenges of finding outlets to discharge treated wastewater effluent, alternative discharge methods could assist in reducing the volume of treated effluent for disposal and as a corollary, reduce the cost of effluent disposal. The measures are expanded upon in Table 6.3.

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Table 6.1: Review of Possible Water Servicing Options

Servicing Option	Overview	Opportunities	Constraints	Feasibility
Connection to the Community of Harmony	• Water could be obtained via the Community of Harmony's water distribution system.	• Presents a County controlled system option that does not require another raw water intake. • Allows the County to utilize existing WTP capacity and offers cost-sharing opportunities for expansion/upgrades depending on staging. • Allows for flexibility in staging costs to support development.	• The existing WTP requires upgrades to service the proposed are population under full build-out. • Requires coordination with the community regarding capacities, staging, cost-sharing, etc.	• This option is considered feasible to accommodate the proposed demands and provides the County control over the system.
Connection to the City of Calgary	• Water could be obtained from the City of Calgary by connecting to its water distribution system along the east side of the study area.	• Could meet the full water demand for the study area. • Promotes regional relationship between the County and the City.	• The City imposes fixed and variable rates on water customers. • May require upgrades to the City's systems.	• This option is considered feasible to accommodate the demands.
Connection to Calalta Waterworks Ltd.[1]	• Water could be obtained from Calalta Waterworks Ltd. by connecting to its WTP within the Franchise Agreement area.	• Presents a County controlled system option that does not require another raw water intake. • Allows the County to utilize existing WTP capacity and offers cost-sharing opportunities for expansion/upgrades depending on staging. • Allows for flexibility in staging costs to support development.	• The existing WTP requires upgrades to service the proposed focused area population. • Requires coordination with Calalta regarding capacities, staging, cost-sharing, etc.	• This option is considered feasible to accommodate the proposed demands of the Calalta Franchise Agreement service area and provides the County control over the system.
New Raw Water Intake	• Existing surface water licences within or adjacent to the study area that could meet water supply needs.	• Existing water licenses can be transferred to the County, thus providing water supply for the development regardless of the moratorium on surface water withdrawals in the SSRB. • Allows County to manage and control allocations that are transferred in support of development submissions. • Allows for flexibility in staging costs to support development (i.e. allocations transferred over time and not required to be in place until developed).	• Very complex and potentially costly system to obtain water from possibly dozens of sources and transfer it to the study area. • Government regulations may not allow acquisition of some individual water licenses depending on the type of use (e.g. recreational may not be allowed to become consumptive use). • Requires a new intake along the Bow River as well as a new WTP.	• This option is considered feasible to accommodate the demands.
New Deep-Water Aquifer Source	• A deep-water aquifer could be considered to supply water.	• A groundwater source that is not under the direct influence of surface water (Non-GWUDI) does not require water license purchase, only water licence registration.	• Further study required to determine if a viable deep-water source can be accessed at a reasonable depth and how many wells would be required to meet the proposed water demand. • A Water Treatment Plant would be required to treat the raw water prior to distribution.	• Provided a Non-GWUDI source can be located at a reasonable depth and well yields can sustain the required total annual demand, this option could be feasible. • Based on the Hydrogeological Desktop Analysis, this option is not considered feasible to accommodate the demands of the Study Area.

[1] It should be noted that this servicing option was only considered for the Calalta Franchise Agreement service area rather than the overall ASP focused service area.

Table 6.2: Review of Possible Wastewater Servicing Options

Servicing Option	Overview	Opportunities	Constraints	Feasibility
Connection to the Community of Harmony	• Wastewater treatment and disposal could be provided by the Harmony WWTP, which would discharge to the Bow River.	• Relatively simple concept to convey flows to the WWTP. • Offers a County controlled wastewater system.	• Lacking capacity in the existing facility to service all of the service areas. • Expansion to the WWTP is costly.	• This option would be costly to implement, but is considered feasible and offers a County controlled servicing option.
Connection to the City of Calgary	• Wastewater treatment and disposal could be provided by the City of Calgary to the east, meaning that treatment would be provided downstream in the City of Calgary, ultimately discharging to the Bow River.	• Could potentially meet full wastewater servicing requirements for the study area. • Opportunity to utilize additional capacity in the Glenmore Sanitary Trunk. • Would support regional cooperation through implementing a regional system.	• Potentially costly upgrades required to convey flows to the City, and to cost share the future Trans-Canada Highway trunk and upgrades to the West Memorial Trunk in the City. • Potential costly connection fees to the wastewater system.	• This option is considered feasible for wastewater servicing of the area.
New Outfall Bow River	• A new tertiary WWTP could be implemented for wastewater treatment in the study area. A discharge point for the effluent would be required to the Bow River. The plant would likely be a combination of BNR - MBR and UV processes.	• Could potentially meet full wastewater servicing requirements for the study area. • MBR treatment plants are currently a new golden standard in water / wastewater treatment and are commonly accepted by the public. • Would not require as much land as a lagoon treatment system.	• Discharge point could be difficult to achieve owing to sufficient dilution requirements. • Consultation with downstream stakeholders would be required to satisfy concerns. • MBR treatment plants are typically more costly to operate and maintain than comparable lagoon treatment systems.	• While costly, this option effectively provides wastewater treatment for the study area. Thus, it has been deemed feasible for wastewater servicing of the study area.
New Outfall Elbow River[1]	• A new tertiary WWTP could be implemented for wastewater treatment in the study area. A discharge point for the effluent would be required, likely to the Bow River. The plant would likely be a combination of BNR - MBR and UV processes.	• Could potentially meet full wastewater servicing requirements for the study area. • MBR treatment plants are currently a new golden standard in water / wastewater treatment and are commonly accepted by the public. • Would not require as much land as a lagoon treatment system.	• Discharge point could be difficult to achieve owing to sufficient dilution requirements. • Consultation with downstream stakeholders would be required to satisfy concerns. • Treatment costs are currently unknown and may be significantly higher than typical WWTP costs.	• While costly, this option may be feasible depending on the results of a detailed receiving water assessment of the viability of the Elbow River as an outfall location. • This option has been considered feasible for the Calalta Franchise Agreement service area for the purpose of this study.
New Sewage Lagoon	• A new lagoon system could be implemented for wastewater treatment in the study area. The lagoon system could consist of anaerobic, facultative, and storage cells or could be an aerated system consisting of completely mixed cells, partially mixed cells, and storage cells.	• Could potentially meet the full wastewater treatment needs for the study area. • Lagoon systems are typically cheaper than mechanical wastewater treatment plants. • Relatively easy to obtain an approval under the Code of Practice. • Operator with a Level 1 Wastewater Treatment Certificate required, as opposed to more rigorous certification required in case of mechanically operated systems.	• Large amounts of land required. • Lagoons are not viewed positively by the public. • Setback requirements would sterilize a large amount of potentially developable land. • Unable to discharge to the Elbow River; therefore, south flows would need to be pumped back to a discharge point on the Bow River.	• This option effectively provides wastewater treatment for the study area. Thus, it has been deemed feasible for wastewater servicing of the study area.
Spray Effluent Disposal	• A new tertiary WWTP could be implemented for wastewater treatment in the study area. In addition, a cell with a capacity of a six-month storage volume would be required along with a suitable size and uptake landmass to facilitate effluent spray disposal.	• Could potentially meet full wastewater servicing requirements for the study area. • Provides wastewater re-use opportunities for the County.	• Setback requirements would sterilize a large amount of potentially developable land. • Spray effluent is not necessarily viewed positively by the public. • A large footprint of suitable land would be required to dispose of the treated effluent	• This option effectively provides wastewater treatment for the study area. Thus, it has been deemed feasible for wastewater servicing of the study area.

[1] It should be noted that this servicing option was only considered for the Calalta Franchise Agreement service area rather than the overall ASP focused service area.

Table 6.3: Summary of Other Options to Assist in Servicing

Option	Methods of Implementation	Opportunities	Constraints
Stormwater Re-Use	• Individual on-lot or on-site cisterns/tanks etc. to harvest rainwater for irrigation purposes. • Communal use of stormwater for irrigation, either by using communal cisterns / tanks, or else use of water from stormwater management facilities. • Collection of stormwater for non-potable household water use. This would require collection systems, potentially treatment systems, and a purple pipe system that could be combined with a system for treated wastewater effluent re-use.	• Would reduce the stormwater runoff volume thus meeting current or potentially future runoff volume targets. • Reduction in overall water demand. • Use of recycled greywater would reduce the amount of potable water required, thus reducing costs and GHG emissions. • Difficulty of obtaining water in Southern Alberta makes any solution that increases water supply positive. • Stormwater pollutants primarily retained by storage ponds.	• Could be challenging to get the public to accept reuse of treated stormwater. • Costly to implement treatment facilities to ensure pathogens are removed before re-use. • Implemented technologies would only be effective in warmer months, thus the cost to benefit ratio is reduced. • Barriers with provincial regulations within AEP, due to the absence of a formal policy.

Treated Wastewater Effluent Re-Use	• Non-potable uses such as:
	  • Surface irrigation
	  • Sub-surface irrigation
	  • Toilet flushing
	  • Laundry
	  • Fire fighting
	  • Industrial process water
		• Reduce volume of treated effluent for disposal.
		• Low risk applications such as subsurface irrigation only viable option at present.
			• Could require implementation of a purple pipe system.
			• Barriers with provincial regulations within AEP, due to the absence of a formal policy.
			• Typically, strict treatment regulations to comply by.
			• Could be challenging to get the public to accept reuse of treated wastewater.

Use of Snowfluent for Wastewater Effluent Disposal	• Take fully treated wastewater and discharge it into the air as water droplets in the winter, thus creating snow.	• Enhancement of wastewater treatment as the freezing of any remaining microorganisms would rupture their cell walls. • Potentially increase the in-situ soil moisture when snow melts in the spring, improving growing conditions.	• Deemed only useful for small to moderate amounts of effluent. • Increased runoff to watercourses potentially in areas where lower runoff volumes are needed to protect watercourses.

Treatment Wetlands for Wastewater Effluent Disposal	• Opportunity for reduction in effluent volume through:
	  • Biological uptake
	  • Infiltration
	  • Evaporation
		• Wetlands would act as a tertiary treatment process, thus improving the quality of any wastewater effluent from the downstream end of the wetland.	• Amount of land potentially required for the wetlands.
			• Only useful for small to moderate volumes of effluent.
			• Introduces point source that may concern the City and other downstream users.

Groundwater Recharge for Wastewater Effluent Disposal	• Injection of wastewater effluent into the ground to supply aquifers.	• Could enhance long-term groundwater supply in the area.	• The study area has high infiltration / percolation rates due to the abundance of gravel in the area. As a result, treated effluent would drain through the subsurface to the Bow River. • Effluent would need time in the ground to undergo additional treatment to reach the quality levels of existing groundwater. • Injection would need to be done in areas without existing wells to prevent contamination of existing higher quality groundwater. • May not be viewed favourably by society and regulatory authorities. • Only useful for small to moderate amounts of effluent.

7.0 Analysis and Recommendations of Feasible Servicing Options

7.1 Analysis of Feasible Water Servicing Options

As described in Section 6.1, two servicing options for the entire focused service area were selected by the County for further evaluation. These options are:

- Connection to the Community of Harmony
- Connection to The City of Calgary

The distribution system of the two concepts remains relatively consistent. The distribution system consists of a number of 250 mm and 300 mm watermains forming a looped water system. A typical looped network was utilized, in order to add resiliency to the system in the case of a watermain break or failure. This aligns with the County Servicing Standards, which state that distribution mains shall be continuous wherever possible. The proposed distribution system would be primarily gravity-fed to leverage the abundance of grade within the Study Area. As a result, 82 pressure reducing valves were proposed in the Study Area (the number is illustrative in nature, reflecting the high degree of terrain variance in the area). Three reservoirs are proposed: one along the west Study Area boundary (West Reservoir), one at a high point near the Springbank Airport (Central Reservoir), and another at a high point near the east boundary of the Study Area (East Reservoir). It is noted that some jurisdictions require one reservoir per pressure zone. To have three reservoirs against an estimated eight pressure zones, many zones would be fed through PRVs and have no local reservoir. If the County desired the higher degree of resiliency, then more reservoirs could be implemented.

Reservoir Storage

The volume of water storage required in the service area was determined using the formula provided by the County's Servicing Standards, Alberta Environment and Parks as well as by The City of Calgary's storage planning criteria as outlined in Section 5.1.

For the County's storage volume criteria, a light commercial/industrial land use type was assumed, resulting in a required volume of approximately 2,100 m^3 plus MDD for the duration of the design fire flow as discussed in Section 5.1. This land use was chosen in order to be the most conservative value, reflecting the development in Service Area D.

In terms of AEP's calculation criteria, the fire flow rate was chosen as 166 L/s (10,000 L/min) for 3.5 hours. This rate represents a light commercial/industrial development and was chosen in order to be relatively conservative during calculations. It was assumed that only one fire flow requirement was needed in the Study Area. The equalization storage (B) and emergency storage (C) parameters were calculated using the demands from the entire service area.

Alternatively, The City of Calgary's storage planning criteria could be adopted. The City of Calgary's criteria states that reservoir size shall be the greater of the Sufficient Active Storage to balance out the instantaneous projected Maximum Day Demand without depleting total storage by more than half or the Average Day Demand. In this case, since the Maximum Day Demand is twice the Average Day Demand, the two values are equal, thus, the Average Day Demand was assumed. Table 7.1 summarizes the storage requirements for the County's criteria, AEP's criteria and The City of Calgary's criteria.

Table 7.1: Proposed Reservoir Storage Requirements

Reservoir m^3	Fire Storage[1]	ADD	MDD[2]	RVC Storage[3]	AEP Storage	COC Storage
	m^3	m^3	m^3	m^3	m^3	m^3
East	2,092	9,361	18,721	4,822	8,176	9,361
West	2,092	11,629	26,258	5,921	10,400	11,629
Central	2,092	5,351	10,702	3,652	5,570	5,351
Total	**6,275**	**26,340**	**52,680**	**13,957**	**23,396**	**26,340**

[1] Fire storage required determined based on 166 L/s for 3.5 hours (i.e. commercial/industrial development)
[3] MDD for RVC storage was calculated based on a fire flow duration of 3.5 hours as per the methodology in Section 5.1.

Shown above, the storage requirements calculated as per the County's Servicing Standards is 13,957 m^3, this constitutes approximately 50% of the derived provincial requirement of 23,396 m^3. As a result, at a minimum the proposed reservoir should be sized to meet the provincial standard.

Furthermore, when a direct comparison between the AEP and COC requirements is made, it is apparent that the Alberta Environment and Parks' formula is more conservative when the ADD in the Study Area are lower than 6,000 m^3 as shown in Figure 7.1.This is due to a constant fire storage volume of approximately 2,100 m^3 required before the ADD is being applied. The derived converging point of 6,000 m^3 corresponds to an equivalent population of approximately 19,000, after which The City of Calgary's criteria becomes more conservative. As the ADD of the developable areas within the Harmony system is 26,340 m^3, The City of Calgary formula governs. Please note that equivalent populations were calculated by applying a residential demand of 315 L/p/d.

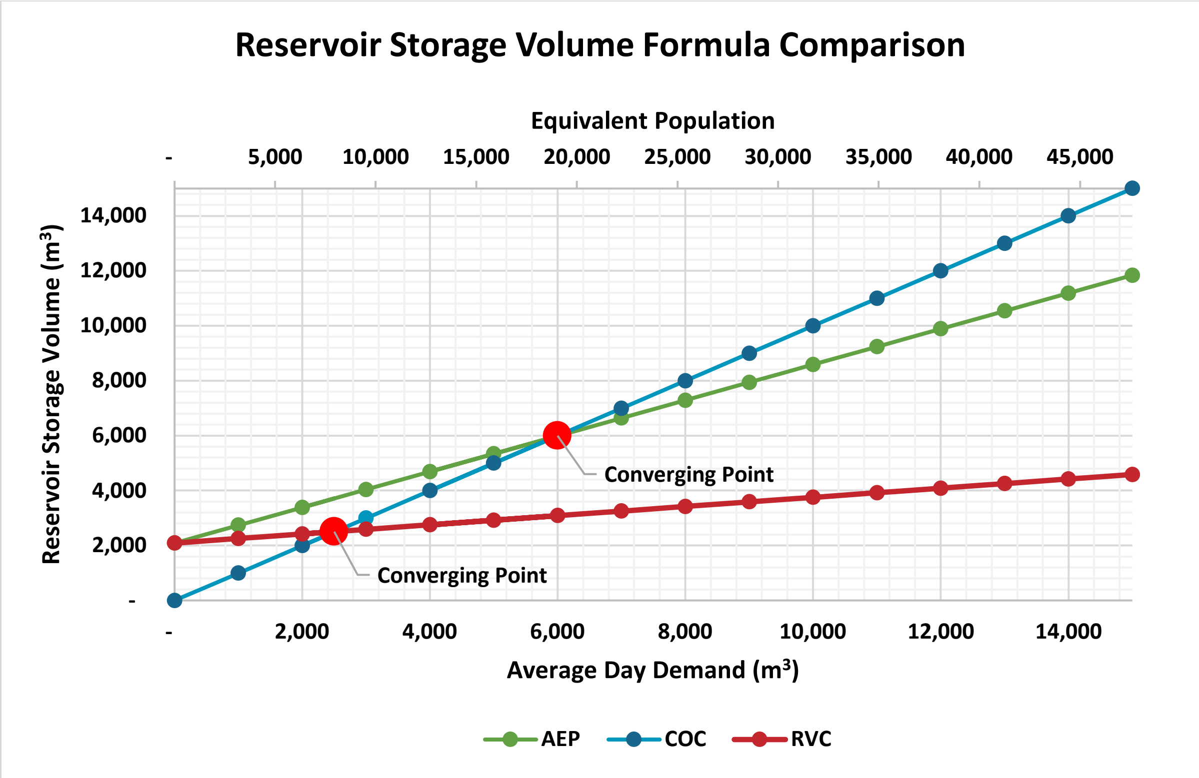


Figure 7.1: Reservoir Storage Volume Formula Comparison

The following sections describe the two conceptual proposed wastewater systems in detail.

7.1.1 Connection to the Community of Harmony

In this option the Central Reservoir is connected to the Harmony WTP via a 900 mm reservoir fill line. The West and East Reservoirs are connected to the Central Reservoir via dedicated reservoir fill lines. Potable water flows from the three reservoirs through the distribution system to the service areas. This option is shown in Figure 7.2. This does not show needed upgrades to feed the water to the Harmony WTP.

7.1.2 Connection to The City of Calgary

In this option the East Reservoir is connected The City of Calgary's system at the Broadcast Hill Reservoir via a 900 mm reservoir fill line. The West and Central Reservoirs are connected to the East Reservoir via dedicated reservoir fill lines. Potable water flows from the three reservoirs through the distribution system to the service areas. This option is shown in Figure 7.3. This does not show any necessitated off-site infrastructure to feed water to Broadcast Hill, though this potential is acknowledged.

7.1.3 Infrastructure Summary

Table 7.2 below summarizes the parameters associated with implementing the infrastructure in each presented option.

Table 7.2: Water Servicing Strategy Parameter Summary

Infrastructure	Unit	Harmony Connection	City of Calgary Connection
WTP Upgrades Required		Yes	No
250mm Watermain	m	30,535	30,535
300mm Watermain	m	84,729	84,729
350mm Watermain	m	4,065	4,065
400mm Watermain	m	2,053	2,053
500mm Watermain	m	403	403
450mm Reservoir Fill Line	m	0	1,215
550mm Reservoir Fill Line	m	8,640	0
600mm Reservoir Fill Line	m	5,670	5,670
700mm Reservoir Fill Line	m	1,215	8,640
750mm Reservoir Fill Line	m	0	0
900mm Reservoir Fill Line	m	4,600	305
Reservoir Storage	m^3	26,340	26,340
Pressure Reducing Valves	item	82	82

7.1.4 Cost Estimates

Cost estimates were prepared for the proposed water system options. The costs of watermains, supply lines, reservoirs and WTP upgrades were included. Table 7.3 reviews the costs of each of the proposed concepts, with a more detailed cost breakdown provided in Appendix E.

Table 7.3: Comparison of Water Servicing Concept Costs

Parameter	Cost	
	Harmony Connection	Calgary Connection
Water Licenses	$67,720,000	$67,720,000
Watermains	$73,380,000	$73,380,000
Supply Lines	$23,600,000	$23,980,000
Reservoirs/Pumphouses	$40,240,000	$19,140,000
Pressure Reducing Valves	$5,950,000	$5,950,000
Harmony WTP Upgrades	$113,060,000	$0
Total Capital Cost	**$323,950,000**	**$190,170,000**
Per Serviceable Hectare Capital Cost	**$180,479**	**$105,948**
Per Cubic Metre Per Day	**$12,299**	**$7,220**
Additional Annual Cost[1]	**$500,000**	**$4,920,000**
25-Year Aggregated Annual Cost	**$16,940,000**	**$165,810,000**
Total Cost (Capital + 25-Year Annual)	**$340,890,000**	**$355,980,000**
Total Cost Per Serviceable Hectare	**$195,577**	**$494,417**
Total Cost Per Cubic Metre Per Day[2]	**$12,924**	**$13,496**
Total Cost Per Cubic Metre[3]	**$1.42**	**$1.48**
Total Cost Per Person	**$11,310**	**$11,810**

[1] Additional Annual Costs refers to the reservoir/pumphouse operation and maintenance costs as well as The City of Calgary service charges for customers outside of the city limits.
[2] The cost per cubic metre per day refers to the cost per cubic metre per day of water consumed under ADD conditions over the 25 years.
[3] The cost per cubic metre refers to the cost per cubic metre of water consumed under ADD conditions over the 25 years.

As shown in Table 7.3, approximate annual operations and maintenance cost for the reservoirs/pumphouses and supply lines considered to be 10% of the total cost for this infrastructure. As such, an aggregated 25-year operations and maintenance capital cost, accounting for 2% inflation per year is approximated.

For the option to connect to The City of Calgary, monthly charges for customers outside of the limits also apply. Annually, this amounts to approximately $4.9 million based on the 2020 service charges and usage rates. This cost aggregated over 25-years, accounting for an inflation rate of 2% per year, amounts to $165 million.

The Harmony WTP upgrade costs are based on the Stage 1 costs from 2012 of $14 million. The overall service population of the WTP at Stage 1 is 6,768. Therefore, the cost was scaled based on the proposed Springbank ASP population for each option and inflated by a factor of approximately 1.2 to account for inflation since the 2012 costs were calculated.

7.1.5 Triple Bottom Line Analysis

Further review of these options is found below, focusing on considering additional items in a triple bottom line analysis considering cost, environmental, and social factors to consider a composite view of each alternative.

Connection to the Community of Harmony

Financial Impacts

- Significant cost to construct an expansion of the existing WTP and raw water intake infrastructure.
- Significant cost associated with acquiring existing water licenses.

Environmental Impacts

- No major environmental issues are anticipated.

Social Impacts

- Stakeholder influence.

Connection to The City of Calgary

Financial Impacts

- Significant cost associated with acquiring existing water licenses, unless The City of Calgary will allow use of its licenses.
- Significant cost of annual fixed and variable fees.

Environmental Impacts

- No major environmental issues are anticipated.

Social Impacts

- Stakeholder influence.

Triple Bottom Line Summary

A summary of the TBL analysis is shown in Table 7.4 below, a full matrix evaluating the above discussion has been included in Appendix F.

Table 7.4: Summary of Water TBL Analysis

Concept	Weighted Score	Rank
1: Connection to the Community of Harmony	0.68	1
2: Connection to The City of Calgary	0.61	2

The TBL analysis resulted in the Connection to the Community of Harmony being the highest scored water servicing option, although the weighted scores are similar for both options. Therefore, it is recommended that the County pursue the connection to Harmony's WTP for the entire proposed service area.

This recommended option offers a number of benefits in terms of:

- Allows for more flexibility in terms of staging of improvements to support development progression.
- Eliminates annual fees charged by The City of Calgary based on the Fixed and Variable Fees as per the Cost of Service Study for regional customers, thus potential for increase in the whole life cycle costs.
- Provides a County controlled system thus providing an assurance that the system is properly maintained over the lifecycle of the infrastructure thus ensuring that there is no impact on the downstream reach of the watershed.

7.2 Analysis of Feasible Wastewater Servicing Options

As described in Section 6.2, two servicing options for the entire focused service area were selected by the County for further evaluation. These options are:

- Connection to the Community of Harmony
- Connection to The City of Calgary

The proposed sanitary servicing system within the Study Area was sized using a spreadsheet approach based on the dry-weather residential and ICI generation rates, peaking factors, as well as the I-I allowance rate outlined Section 5.3.

Generally, the conveyance system drains from the northwest to southeast. The specified pipe sizes are the smallest possible determined based on the required minimum design slope to provide a self-cleansing full-pipe velocity, under the derived peak wet weather flows, based on the roughness coefficient (n) of 0.013 as per Table IV-C3 of The City of Calgary's Design Guidelines for Subdivision Servicing as presented in Table 7.5.

Table 7.5: Minimum Design Slopes for Sewers

Nominal Pipe Size	Minimum Design Slope		Full Pipe Velocity	Full Pipe Capacity
mm	%	m/m	m/s	L/s
200	0.80	0.0080	0.93	29.3
250	0.40	0.0040	0.77	37.6
300	0.32	0.0032	0.77	54.7
375	0.24	0.0024	0.78	85.9
450	0.18	0.0018	0.76	121.0
525	0.16	0.0016	0.79	172.0
600	0.12	0.0012	0.75	212.7
675	0.10	0.0010	0.74	265.8
750	0.10	0.0010	0.80	352.0
900	0.10	0.0010	0.90	572.5
1050	0.10	0.0010	1.00	863.5
1200	0.10	0.0010	1.09	1,232.9

If flatter slopes are preferred or required at the detailed design stages, this can be reviewed, though it would have negative repercussions. If this was acceptable, the determined pipe sizes would need to be increased to meet the specified design flows as presented in Table 7.6.

With regards to pumped flows, a new forcemain is typically designed to operate between 1.1 m/s to 2.0 m/s with a preferred velocity of 1.5 m/s. This approach was utilized to size the new forcemains for the purpose of developing future servicing options to minimize the resulting head losses which in turn would yield savings on the energy consumption front.

The following sections describe the two conceptual proposed wastewater systems in detail.

7.2.1 Connection to the Community of Harmony

This option includes conveyance of wastewater flows, via gravity sewers and localized forcemains, for those high-density areas northeast of Lower Springbank Road to a centralized lift station (LS-6). Flows to the south of this lift station are conveyed south or pumped north to another major lift station (LS-7), which pumps flows north to the centralized lift station (LS-6). These combined wastewater flows are pumped from the south centralized lift station to the TCH Corridor system via a 525 mm forcemain. The TCH Corridor system conveys wastewater flows to a lift station (LS-5), which pumps these flows to the Harmony Wastewater Treatment Plant (WWTP) via a 1050 mm forcemain. This option is shown in Figure 7.4.

7.2.2 Connection to The City of Calgary

This option is a hybrid option of the Harmony connection, which utilizes gravity conveyance and localized pumping systems to connect the south servicing area to a single major lift station (LS-6) in the southeast corner of the ASP area. These wastewater flows are pumped to The City of Calgary's Glenmore Sanitary Trunk system via a 600 mm forcemain. The TCH Corridor system is conveyed to a central lift station (LS-5) and pumped to the Harmony WWTP via a 900 mm forcemain. This option is shown in Figure 7.5.

7.2.3 Infrastructure Summary

Table 7.7 below summarizes the parameters associated with implementing the infrastructure in each presented option.

Table 7.7: Wastewater Servicing Strategy Parameter Summary

Infrastructure	Unit	Harmony Connection	City of Calgary Connection
250mm Gravity Sewer	m	8,793	10,418
300mm Gravity Sewer	m	4,806	4,806
375mm Gravity Sewer	m	2,051	2,051
525mm Gravity Sewer	m	2,042	2,042
600mm Gravity Sewer	m	4,850	4,850
675mm Gravity Sewer	m	3,316	2,832
750mm Gravity Sewer	m	827	2,072
900mm Gravity Sewer	m	7,322	5,882
1050mm Gravity Sewer	m	0	1,617
1200mm Gravity Sewer	m	1,617	0
100mm Forcemain	m	815	815
200mm Forcemain	m	1,801	1,801
250mm Forcemain	m	803	803
375mm Forcemain	m	3,590	1,625
600mm Forcemain	m	4,678	2,561
900mm Forcemain	m	0	7,964
1050mm Forcemain	m	7,964	0
Lift Stations	item	7	6

7.2.4 Cost Estimates

Cost estimates were prepared for the proposed wastewater system options. The costs of gravity sewers, forcemains, lift stations, and WWTP upgrades were included. Table 7.8 reviews the costs of each of the proposed concepts, with a more detailed cost breakdown provided in Appendix E.

Table 7.8: Comparison of Wastewater Servicing Concept Costs

Parameter	Cost	
	Harmony Connection	Calgary Connection
Gravity Sewers	$43,630,000	$42,380,000
Forcemains	$31,040,000	$23,980,000
Lift Stations	$40,240,000	$34,870,000
Harmony WWTP Upgrades	$100,950,000	$42,680,000
Total Capital Cost	**$215,860,000**	**$143,910,000**
Per Serviceable Hectare Capital Cost	**$123,844**	**$82,565**
Per Cubic Metre Per Day	**$12,616**	**$8,411**
Additional Annual Cost[1]	**$400,000**	**$3,740,000**
25-Year Aggregated Annual Cost	**$13,550,000**	**$125,920,000**
Total Cost (Capital + 25-Year Annual)	**$229,410,000**	**$269,830,000**
Total Cost Per Serviceable Hectare	**$131,618**	**$154,808**
Total Cost Per Cubic Metre Per Day[2]	**$13,408**	**$15,770**
Total Cost Per Cubic Metre[3]	**$1.47**	**$1.73**
Total Cost Per Person	**$7,641**	**$8,987**

[1] Additional Annual Costs refers to the lift station operation and maintenance costs as well as The City of Calgary service charges for customers outside of the city limits.
[2] The cost per cubic metre refers to the cost per cubic metre per day of wastewater generated under ADWF conditions over the 25 years.
[3] The cost per cubic metre refers to the cost per cubic metre of wastewater generated under ADWF conditions over the 25 years.

As shown in Table 7.8, approximate annual operations and maintenance cost for the lift stations is considered to be 10% of the total cost for the lift stations. As such, an aggregated 25-year operations and maintenance capital cost, accounting for 2% inflation per year is approximated.

For the option to connect to The City of Calgary, their monthly charges for customers outside of the limits also apply. Annually, this amounts to approximately $3.7 million based on the 2020 service charges and usage rates. This cost aggregated over 25-years, accounting for an inflation rate of 2% per year, amounts to $126 million.

The Harmony WWTP upgrade costs are based on the Stage 1 costs from 2012 of $12.5 million. The overall service population of the WWTP at Stage 1 is 6,768. Therefore, the cost was scaled based on the proposed Springbank ASP population for each option and inflated by a factor of approximately 1.2 to account for inflation since the 2012 costs were calculated.

Based on the cost per hectare for wastewater service, it is not unrealistically high when compared to off-site levy costs in numerous municipalities where full cost recovery is desired. It is somewhat higher, but not unachievably so.

7.2.5 Triple Bottom Line Analysis

Further review of these options is found below, focusing on considering additional items in a triple bottom line analysis considering cost, environmental, and social factors to consider a composite view of each alternative.

Connection to the Community of Harmony

Financial Impacts

- Significant cost to construct an expansion of the existing WWTP and outfall infrastructure.
- Significant cost to construct and maintain three major lift stations.
- Significant operations and maintenance costs associated with the three major lift stations.

Environmental Impacts

- The proposed lift stations and WWTP expansions pose a minor odor risk.
- The WWTP discharges high-quality effluent.
- New outfall to the Bow River would be required.

Social Impacts

- Neutral public perception as treatment is near by.
- Minimal sterilization of land.

Connection to The City of Calgary

Financial Impacts

- Significant cost to construct an expansion of the existing water treatment plant and outfall infrastructure.
- Significant cost to construct and maintain two major lift stations.
- Significant operations and maintenance costs associated with the two major lift stations.
- Significant cost of annual fixed and variable fees.

Environmental Impacts

- The proposed lift stations and WWTP expansions pose a minor odor risk.
- The WWTP and The City discharge high-quality effluent.

Social Impacts

- Neutral/positive public perception as treatment is near by and off-site.
- Minimal sterilization of land.

Triple Bottom Line Summary

A summary of the TBL analysis is shown in Table 7.9 below, a full matrix evaluating the above discussion has been included in Appendix F.

Table 7.9: Summary of Wastewater TBL Analysis

Concept	Weighted Score	Rank
1: Connection to the Community of Harmony	0.63	1
2: Connection to The City of Calgary	0.63	1

The TBL analysis resulted in both options achieving the same score. That said, it is recommended that the County pursue the connection to Harmony's WWTP via the TCH corridor for the entire proposed service area for consistency with the recommended water system.

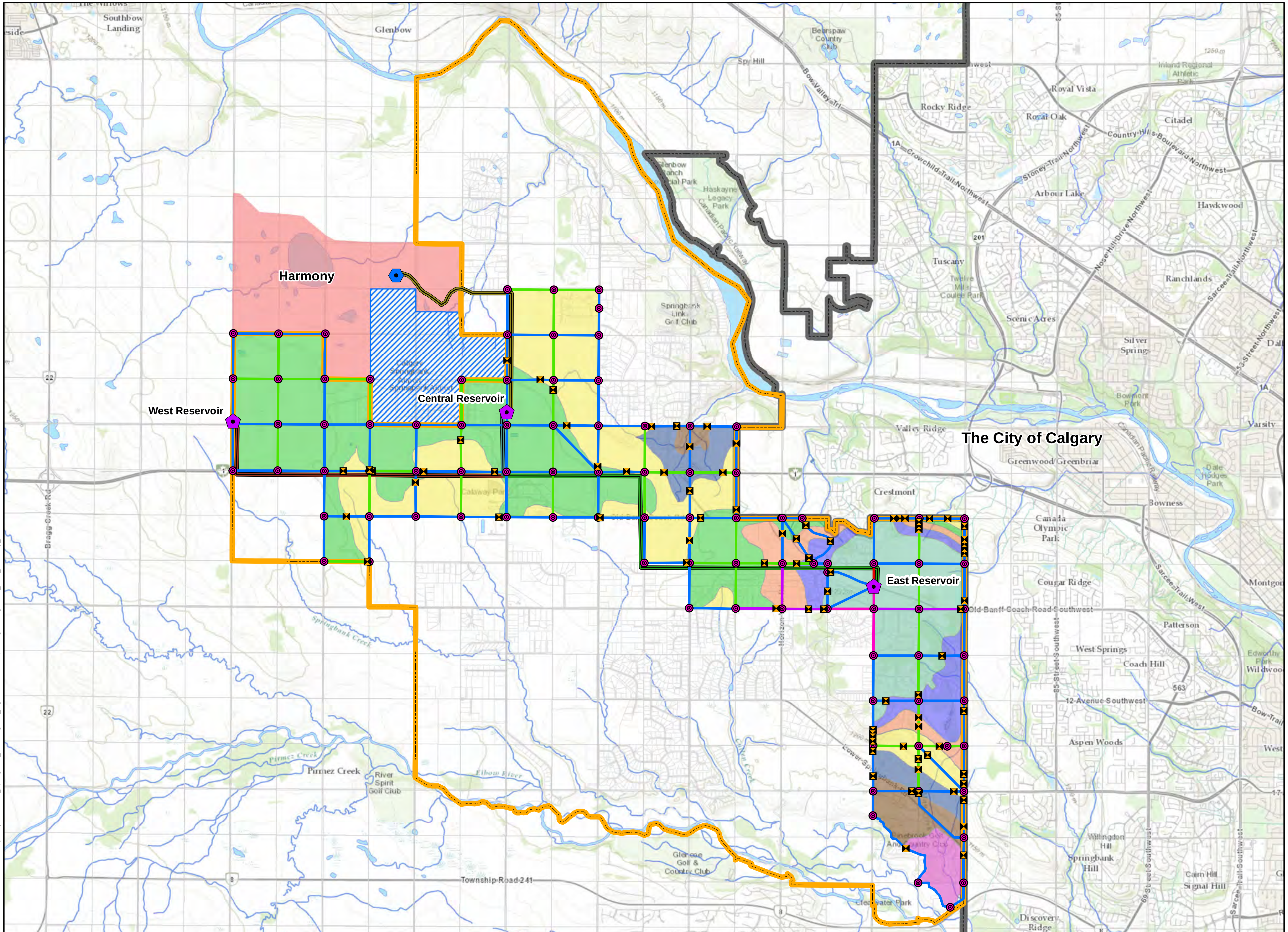
This recommended option offers a number of benefits in terms of:

- Allows for more flexibility in terms of staging of improvements to support development progression.
- Eliminates annual fees charged by The City of Calgary based on the Fixed and Variable Fees as per the Cost of Service Study for regional customers, thus potential for increase in the whole life cycle costs.
- Provides a County controlled system thus providing an assurance that the system is properly maintained over the lifecycle of the infrastructure thus ensuring that there is no impact on the downstream reach of the watershed.

Table 7.6: Wastewater Conveyance System Sizing

Contributing Area		Peak WWF	Gravity Sewer Sizing											Forcemain Sizing					
			System Type	Pipe Roughness	Min. Slope	Design Flow (Q_{PWWF}/0.86)	Actual Pipe Size	Design Pipe Size	Pipe Size/Min. Slope Check	Full-Flow Capacity	Full-Flow Pipe Area	Full-Flow Velocity	Design Q Capacity Check	Design Flow (Q_{PWWF})	Design Velocity	Actual Pipe Size	Design Pipe Size	Resultant Pipe Area	Resultant Velocity
No.	Downstream Of	L/s		"n"	m/m	L/s	mm	mm		L/s	m^2	m/s		L/s	m/s	mm	mm	m^2	m/s
1	C1-1	37.52	Gravity	0.013	0.0032	43.6	275.6	300	OK	54.7	0.071	0.77	OK	-	-	-	-	-	-
2	C1-2	70.53	Forcemain	0.013	0.0024	-	-	-	-	-	-	-	-	70.53	1.5	244.7	250	0.049	1.44
3	C1-3	37.83	Gravity	0.013	0.0032	44.0	276.5	300	OK	54.7	0.071	0.77	OK	-	-	-	-	-	-
4	C1-4	133.11	Gravity	0.013	0.0016	154.8	504.6	525	OK	172.0	0.216	0.79	OK	-	-	-	-	-	-
5	J-1	164.97	Gravity	0.013	0.0012	191.8	577.2	600	OK	212.7	0.283	0.75	OK	-	-	-	-	-	-
6	C1-5	36.83	Gravity	0.013	0.0032	42.8	273.7	300	OK	54.7	0.071	0.77	OK	-	-	-	-	-	-
7	C1-6	69.05	Gravity	0.013	0.0024	80.3	365.6	375	OK	85.9	0.110	0.78	OK	-	-	-	-	-	-
8	J-1/CI-6	226.72	Gravity	0.013	0.0010	263.6	672.9	675	OK	265.8	0.358	0.74	OK	-	-	-	-	-	-
9	C1-7/CI-8	258.98	Gravity	0.013	0.0010	301.1	707.3	750	OK	352.0	0.442	0.80	OK	-	-	-	-	-	-
10	C1-12/C1-15/G-9	339.10	Gravity	0.013	0.0010	394.3	782.6	900	OK	572.5	0.636	0.90	OK	-	-	-	-	-	-
11	D-2/E-2/F-4	25.12	Gravity	0.013	0.0040	29.2	227.4	250	OK	37.6	0.049	0.77	OK	-	-	-	-	-	-
12	CI-9	27.06	Gravity	0.013	0.0040	31.5	233.8	250	OK	37.6	0.049	0.77	OK	-	-	-	-	-	-
13	G-4/G-6	27.25	Gravity	0.013	0.0040	31.7	234.4	250	OK	37.6	0.049	0.77	OK	-	-	-	-	-	-
14	D-4/D-5/F-5	128.64	Gravity	0.013	0.0012	149.6	525.8	600	OK	212.7	0.283	0.75	OK	-	-	-	-	-	-
15	G-10/G-11	509.70	Gravity	0.013	0.0010	592.7	911.8	1050	OK	863.5	0.866	1.00	OK	-	-	-	-	-	-
16	B-1/G-12	537.31	Gravity	0.013	0.0010	624.8	930.0	1050	OK	863.5	0.866	1.00	OK	-	-	-	-	-	-
17	B-2	546.11	Gravity	0.013	0.0010	635.0	935.7	1050	OK	863.5	0.866	1.00	OK	-	-	-	-	-	-
18	H-22	554.59	Gravity	0.013	0.0010	644.9	941.1	1050	OK	863.5	0.866	1.00	OK	-	-	-	-	-	-
19	I1-1	38.80	Gravity	0.013	0.0032	45.1	279.1	300	OK	54.7	0.071	0.77	OK	-	-	-	-	-	-
20	I1-3	35.81	Gravity	0.013	0.0032	41.6	270.8	300	OK	54.7	0.071	0.77	OK	-	-	-	-	-	-
21	I1-4	73.66	Gravity	0.013	0.0024	85.7	374.6	375	OK	85.9	0.110	0.78	OK	-	-	-	-	-	-
22	I1-2	147.96	Forcemain	0.013	0.0032	-	-	-	-	-	-	-	-	147.96	1.5	354.4	375	0.110	1.34
23	I1-2	168.30	Gravity	0.013	0.0012	195.7	581.5	600	OK	212.7	0.283	0.75	OK	-	-	-	-	-	-
24	I2-1/I2-2	179.49	Gravity	0.013	0.0012	208.7	595.8	600	OK	212.7	0.283	0.75	OK	-	-	-	-	-	-
25	I2-3	192.86	Gravity	0.013	0.0010	224.3	633.3	675	OK	265.8	0.358	0.74	OK	-	-	-	-	-	-
26	I3-1	223.51	Gravity	0.013	0.0010	259.9	669.3	675	OK	265.8	0.358	0.74	OK	-	-	-	-	-	-
27	I3-3	28.29	Gravity	0.013	0.0040	32.9	237.7	250	OK	37.6	0.049	0.77	OK	-	-	-	-	-	-
28	F-10/I3-2	65.43	Gravity	0.013	0.0024	76.1	358.3	375	OK	85.9	0.110	0.78	OK	-	-	-	-	-	-

Contributing Area		Peak WWF	Gravity Sewer Sizing											Forcemain Sizing					
			System Type	Pipe Roughness	Min. Slope	Design Flow (Q_{PWWF}/0.86)	Actual Pipe Size	Design Pipe Size	Pipe Size/Min. Slope Check	Full-Flow Capacity	Full-Flow Pipe Area	Full-Flow Velocity	Design Q Capacity Check	Design Flow (Q_{PWWF})	Design Velocity	Actual Pipe Size	Design Pipe Size	Resultant Pipe Area	Resultant Velocity
No.	Downstream Of	L/s		"n"	m/m	L/s	mm	mm		L/s	m^2	m/s		L/s	m/s	mm	mm	m^2	m/s
29	I3-4	19.23	Gravity	0.013	0.0040	22.4	205.7	250	OK	37.6	0.049	0.77	OK	-	-	-	-	-	-
30	I4-1	36.13	Forcemain	0.013	0.0040	-	-	-	-	-	-	-	-	36.13	1.5	175.1	200	0.031	1.15
31	F-10/I3-2/I4-1	116.40	Gravity	0.013	0.0016	135.3	479.8	525	OK	172.0	0.216	0.79	OK	-	-	-	-	-	-
32	F-10/I3-2/I4-1	116.40	Forcemain	0.013	0.0024	-	-	-	-	-	-	-	-	116.40	1.5	314.3	375	0.110	1.05
33	A-30/K-4	353.30	Gravity	0.013	0.0010	410.8	794.7	900	OK	572.5	0.636	0.90	OK	-	-	-	-	-	-
34	A-27	389.44	Gravity	0.013	0.0010	452.8	824.3	900	OK	572.5	0.636	0.90	OK	-	-	-	-	-	-
35	A-20	7.81	Forcemain	0.013	0.0040	-	-	-	-	-	-	-	-	7.81	1.5	81.4	100	0.008	0.99
36	A-20	7.86	Gravity	0.013	0.0040	9.1	147.1	250	OK	37.6	0.049	0.77	OK	-	-	-	-	-	-
37	K-6	26.00	Gravity	0.013	0.0040	30.2	230.4	250	OK	37.6	0.049	0.77	OK	-	-	-	-	-	-
38	H-27/K-3	949.48	Gravity	0.013	0.0010	1104.1	1151.3	1200	OK	1232.9	1.131	1.09	OK	-	-	-	-	-	-
39	H-23/K-2	1016.71	Gravity	0.013	0.0010	1182.2	1181.3	1200	OK	1232.9	1.131	1.09	OK	-	-	-	-	-	-
40	G-1	21.19	Gravity	0.013	0.0040	24.6	213.3	250	OK	37.6	0.049	0.77	OK	-	-	-	-	-	-
41	H-14	2.17	Gravity	0.013	0.0040	2.5	90.7	250	OK	37.6	0.049	0.77	OK	-	-	-	-	-	-
42	D-3/E-1	15.78	Gravity	0.013	0.0040	18.4	191.0	250	OK	37.6	0.049	0.77	OK	-	-	-	-	-	-
43	G-3	68.18	Gravity	0.013	0.0024	79.3	363.9	375	OK	85.9	0.110	0.78	OK	-	-	-	-	-	-
44	H-17	10.97	Gravity	0.013	0.0040	12.8	166.6	250	OK	37.6	0.049	0.77	OK	-	-	-	-	-	-
45	G-5/G-7	109.16	Gravity	0.013	0.0016	126.9	468.4	525	OK	172.0	0.216	0.79	OK	-	-	-	-	-	-
46	A-13/H-19/G-8	160.64	Gravity	0.013	0.0012	186.8	571.5	600	OK	212.7	0.283	0.75	OK	-	-	-	-	-	-
47	A-16/H-20	168.84	Gravity	0.013	0.0012	196.3	582.2	600	OK	212.7	0.283	0.75	OK	-	-	-	-	-	-
48	Discharge to Harmony WWTP	1092.95	Forcemain	0.013		-	-	-	-	-	-	-	-	1092.45	1.5	963.0	1050	0.866	1.26



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Legend

- Junction
- Pressure Reducing Valve
- ProposedReservoir & Pumphouse
- Harmony Water Treatment Plant

Proposed Water Lines

- 250mm Watermain
- 300mm Watermain
- 350mm Watermain
- 400mm Watermain
- 500mm Watermain
- 550mm Fill Line
- 600mm Fill Line
- 700mm Fill Line
- 900mm Fill Line

Pressure Zone

- 1: Greater than 1255m
- 2: 1235-1255m
- 3: 1215-1235m
- 4: 1195-1215m
- 5: 1175-1195m
- 6:1155-1175m
- 7: 1135-1155m
- 8:1115-1135m
- Harmony Development
- Springbank Airport
- City of Calgary Boundary
- Study Area Boundary

Coordinate System:
CANA83-3TM114

1:65,000

0 750 1,500 3,000 Meters

FIGURE 7.2
FULL BUILD-OUT WATER SERVICING CONCEPTS HARMONY CONNECTION SPRINGBANK AREA STRUCTURE PLAN SERVICING STRATEGY

ROCKY VIEW COUNTY
Cultivating Communities

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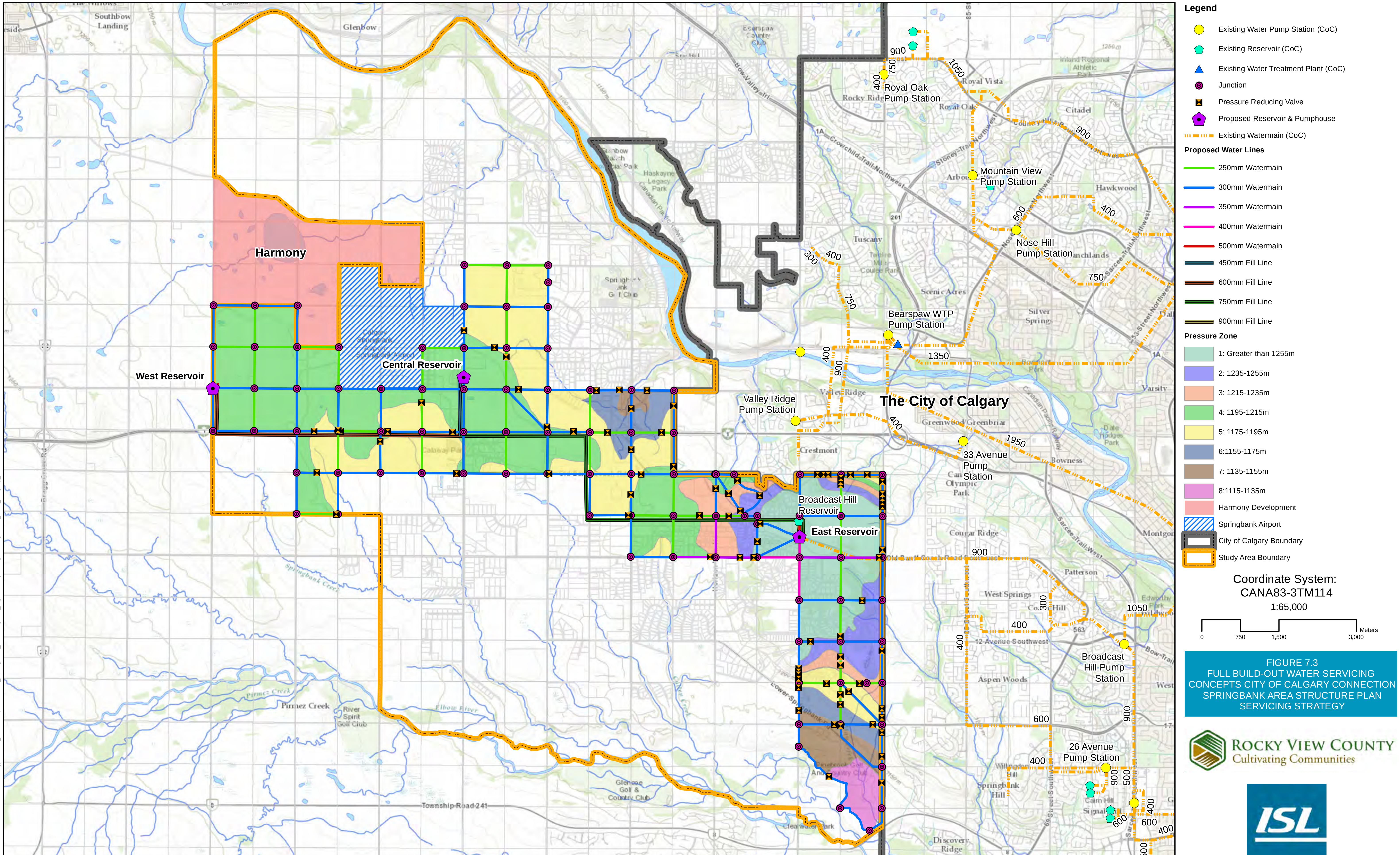

FIGURE 7.3
FULL BUILD-OUT WATER SERVICING CONCEPTS CITY OF CALGARY CONNECTION
SPRINGBANK AREA STRUCTURE PLAN SERVICING STRATEGY

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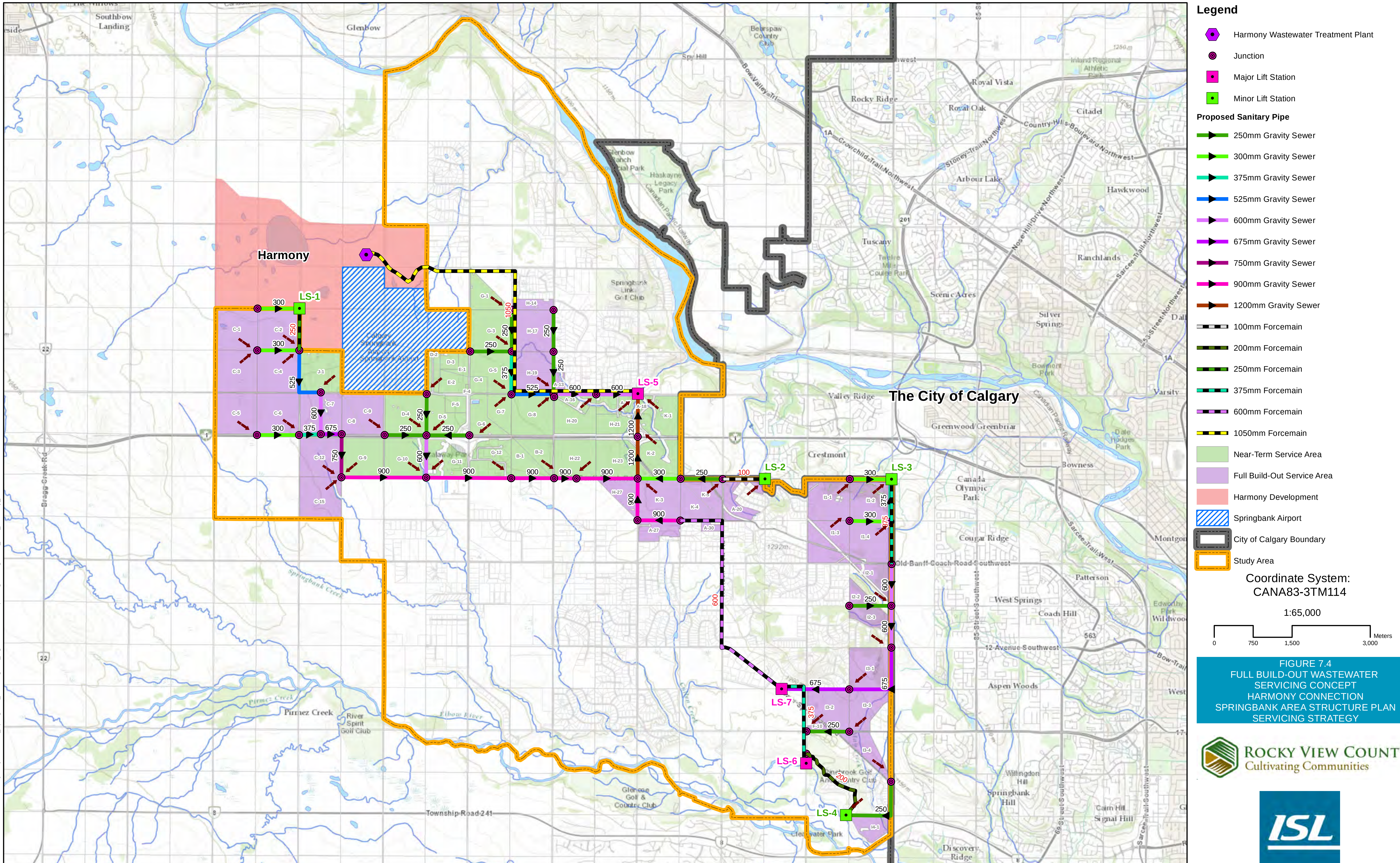
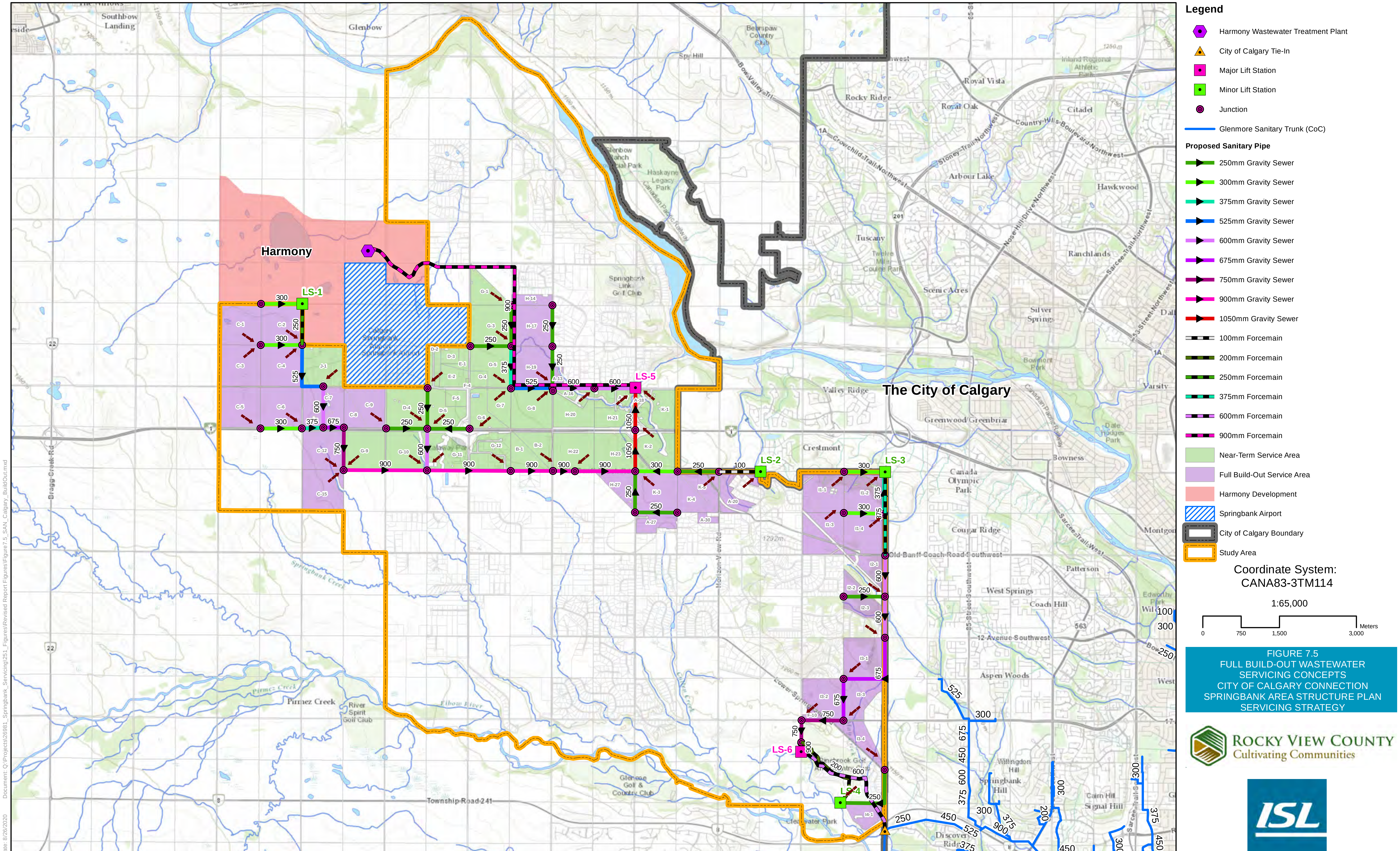


FIGURE 7.4
FULL BUILD-OUT WASTEWATER SERVICING CONCEPT
HARMONY CONNECTION
SPRINGBANK AREA STRUCTURE PLAN
SERVICING STRATEGY



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8.0 Recommended Servicing Infrastructure Assessment

8.1 Proposed Water Servicing System

The recommended water servicing option for the Study Area is shown in Figure 8.1, based on the analysis completed in the preceding section. The figure shows the primary water mains as 250 mm and 300 mm diameter in size. Three reservoirs are proposed: one along the west Study Area boundary, one at a high point near the Springbank Airport, and another at a high point near the east boundary of the Study Area. These reservoirs are supplied with potable water by the Harmony WTP via a 900 mm fill line to the Central Reservoir, which supplies the East Reservoir and West Reservoir. The Harmony WTP is supplied by a raw water intake on the Bow River.

The proposed distribution system was planned to leverage gravity flow from higher to lower pressure zones for the majority of the Harmony system to take advantage of the unique topography of the Study Area. As a result, 82 PRVs were incorporated. While, the highest elevated service areas in the northwest of the Harmony system would require the potable water to be boosted at the WTP and reservoir. This would ensure that the minimum pressure requirements are met under static and dynamic conditions. Service areas excluded from the Harmony system are expected to be serviced by existing local systems. It is again noted that a reservoir per zone could be implemented at additional cost, if higher system resiliency was desired.

Bentley's WaterCAD CONNECT Edition was used in order to assess the proposed water distribution system. WaterCAD is a powerful analysis tool that hydrodynamically routes flows through the physical distribution system. In this manner, pressure results are obtained, and available fire flow at any location in the water distribution system can be estimated. The network was assessed under average day demand, peak hour demand, and maximum day demand plus fire flow to analyze the performance of the proposed system. Results are shown in Figures 8.2 to 8.4, for ADD, PHD, and MDD + FF, respectively.

8.1.1 Average Day Demand Conditions

Average day demand results for the proposed water distribution system are depicted in Figure 8.2. Simulation results suggest that the County is capable of supplying potable water through the service area with the proposed distribution system under ADD. Pressures generally range from 350 kPa to 550 kPa. Some areas experience pressures that are greater than the design maximum of 550 kPa due to the terrain of the area; however, no areas experience pressures greater than 700 kPa. In these high-pressure locations, it is recommended that connections to the watermain are implemented at locations of pressure lower than this value. If this is not feasible, it is recommended that a localized PRV be implemented at the connection of the subdivision to ensure that pressures beyond this value are not reached at the service connections.

8.1.2 Peak Hour Demand Conditions

Results from the peak hour demand conditions for the proposed water distribution system are shown in Figure 8.3. In this scenario, pressures range from 300 kPa to 550 kPa. In some localized areas, specifically near reservoirs, there are pressures below the design minimum residual pressure of 300 kPa; however, no locations experience pressures below 275 kPa.

Therefore, it is recommended that connections to the watermain are implemented at locations of pressure greater than this value. If this is not feasible, it is recommended that localized booster pumps be implanted at the connection of the subdivision to ensure that adequate pressure is provided at the service connection.

8.1.3 Fire Flow Conditions

The results from the maximum day demand plus fire flow scenario are shown in Figure 8.4. Fire flow analysis was performed on all nodes in the model in an iterative manner using a minimum pressure constraint of 150 kPa. Any nodes with a pressure less than the minimum pressure constraint are not included in the fire flow analysis, consequently receiving a fire flow of 0 L/s. It is, however, noted that in this case, all nodes met the minimum pressure requirements, thus no node was assigned an available fire flow value of 0 L/s.

Available fire flow ranges between 50 L/s and 500 L/s. This low fire flow area is located at the northeast corner of the service area. Other areas with low fire flows are also located on the edges of the service area at the southwest corner and along the west boundary of the service area on The City of Calgary boundary. It is recommended that sprinklers be installed at these low fire flow locations in order to reduce the required fire flow by 50%. Alternatively, watermains may be upsized further to provide additional fire flow although this is a more costly option.

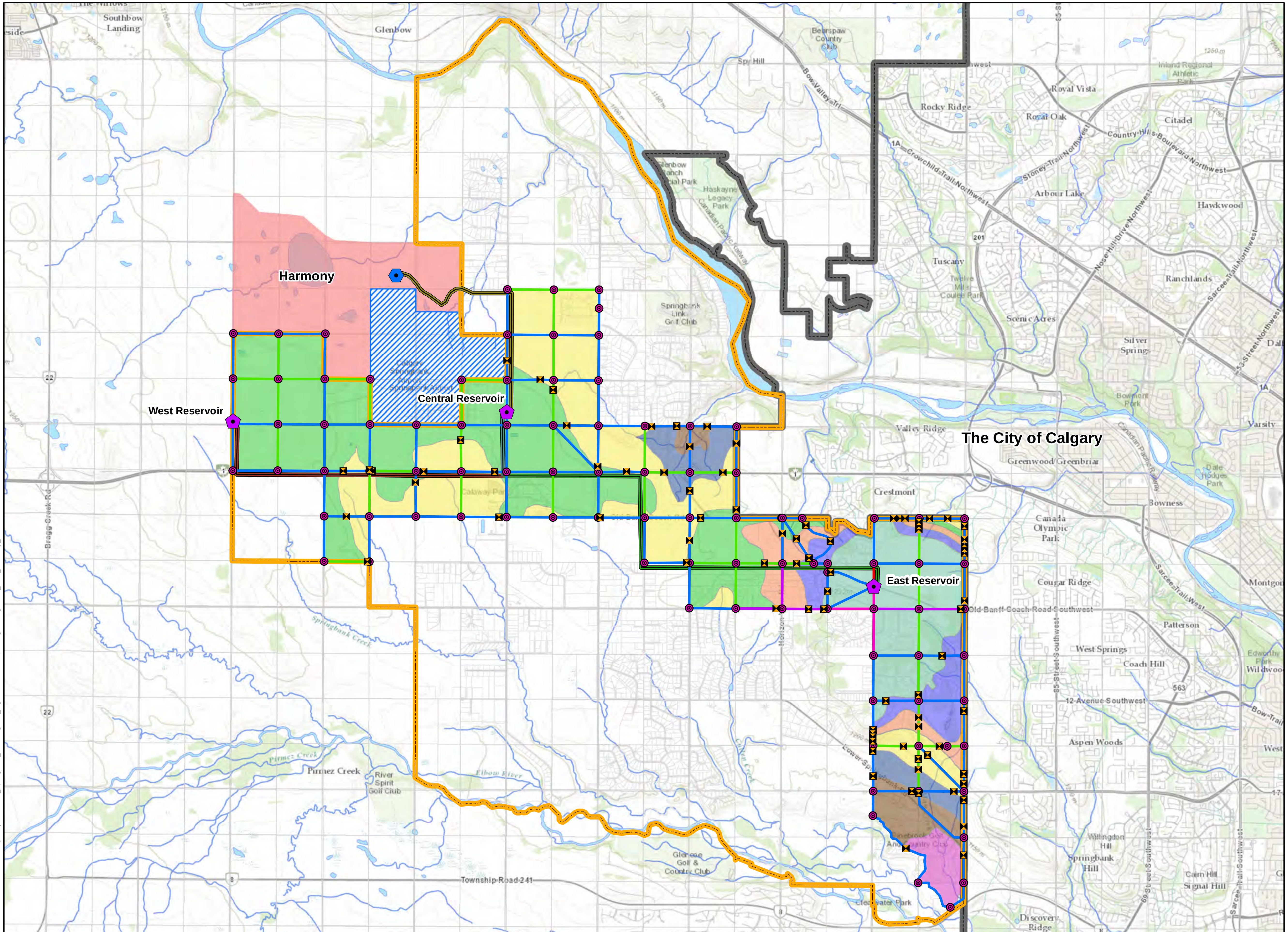
8.1.4 Conclusions from the Water Assessment

Analysis of the proposed water distribution system has made it evident that implementation of the proposed infrastructure would be deemed acceptable for pressure and fire flow requirements. It is therefore recommended that the County pursues this water servicing strategy. It is also recommended that the County consider stormwater harvesting for irrigation and/or non-potable household water uses and to encourage residents to apply water conservation measures.

8.2 Proposed Wastewater Servicing System

The recommended wastewater servicing option for the Study Area is shown in Figure 8.5. Wastewater flows are conveyed via gravity sewers and localized forcemains for the high-density areas northeast of Lower Springbank Road to a centralized lift station (LS-7). Flows to the south of this lift station are conveyed south or pumped north to another major lift station (LS-6), which pumps flows north to the centralized lift station (LS-7). These combined wastewater flows are pumped from the south centralized lift station to the TCH Corridor system via a 600 mm forcemain. The TCH Corridor system conveys wastewater flows to a lift station (LS-5), which pumps these flows to the Harmony WWTP via a 1050 mm forcemain. The effluent is treated at the Harmony WWTP and discharged to the Bow River.

It is therefore recommended that the County pursues this wastewater servicing option based on the analysis completed in the previous section. It is also recommended that the County consider stormwater harvesting for irrigation and/or non-potable household water uses and to encourage residents to apply water conservation measures.



Legend

- Junction
- Pressure Reducing Valve
- ProposedReservoir & Pumphouse
- Harmony Water Treatment Plant

Proposed Water Lines

- 250mm Watermain
- 300mm Watermain
- 350mm Watermain
- 400mm Watermain
- 500mm Watermain
- 550mm Fill Line
- 600mm Fill Line
- 700mm Fill Line
- 900mm Fill Line

Pressure Zone

- 1: Greater than 1255m
- 2: 1235-1255m
- 3: 1215-1235m
- 4: 1195-1215m
- 5: 1175-1195m
- 6:1155-1175m
- 7: 1135-1155m
- 8:1115-1135m
- Springbank Airport
- Harmony Development
- City of Calgary Boundary
- Study Area

Coordinate System:
CANA83-3TM114

1:65,000

0 750 1,500 3,000 Meters

FIGURE 8.1
FULL BUILD-OUT RECOMMENDED WATER SERVICING CONCEPT
HARMONY CONNECTION
SPRINGBANK AREA STRUCTURE PLAN
SERVICING STRATEGY

ROCKY VIEW COUNTY
Cultivating Communities

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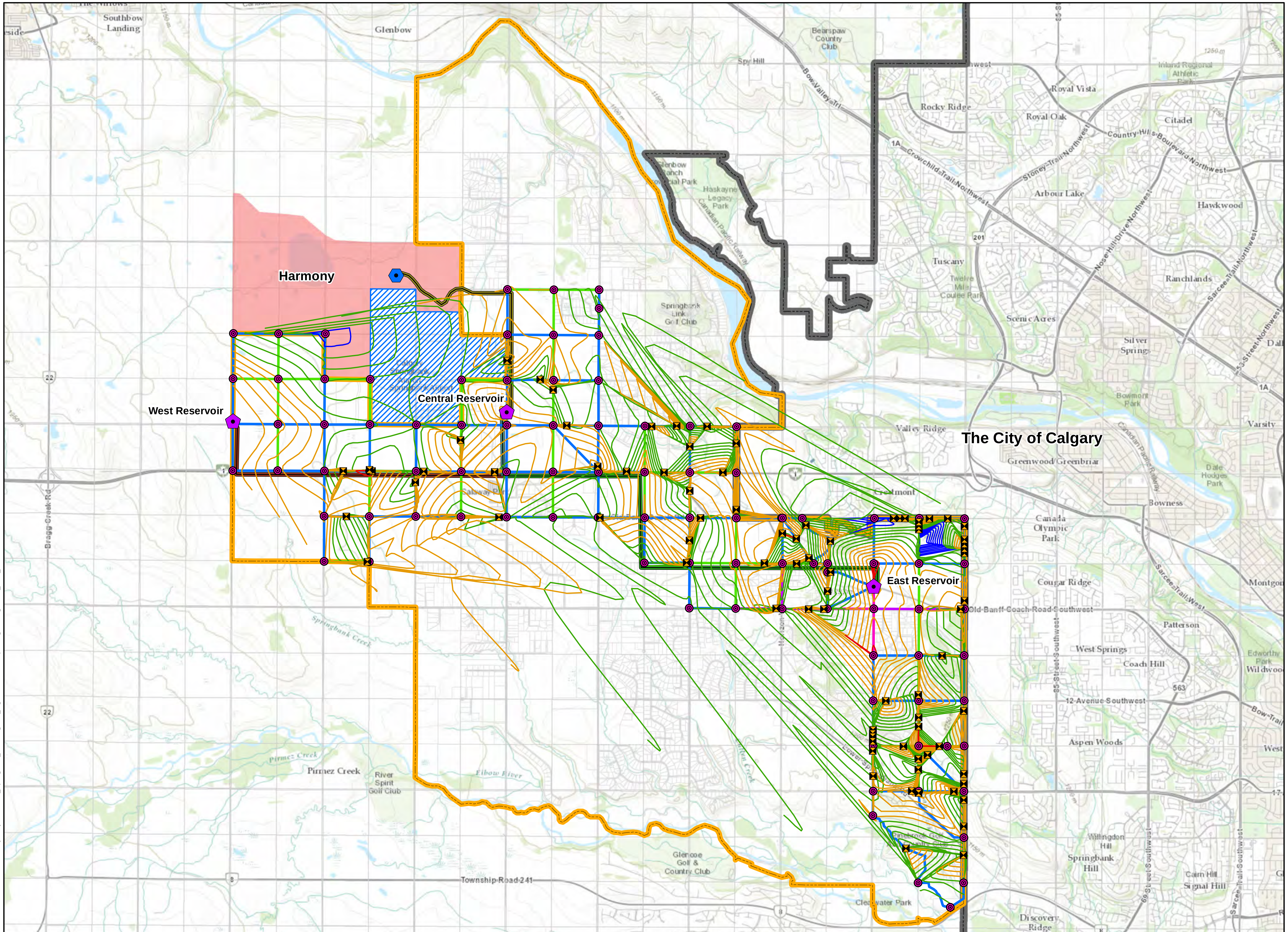

FIGURE 8.2
FULL BUILD-OUT RECOMMENDED WATER SERVICING CONCEPT
AVERAGE DAY DEMAND
SPRINGBANK AREA STRUCTURE PLAN SERVICING STRATEGY

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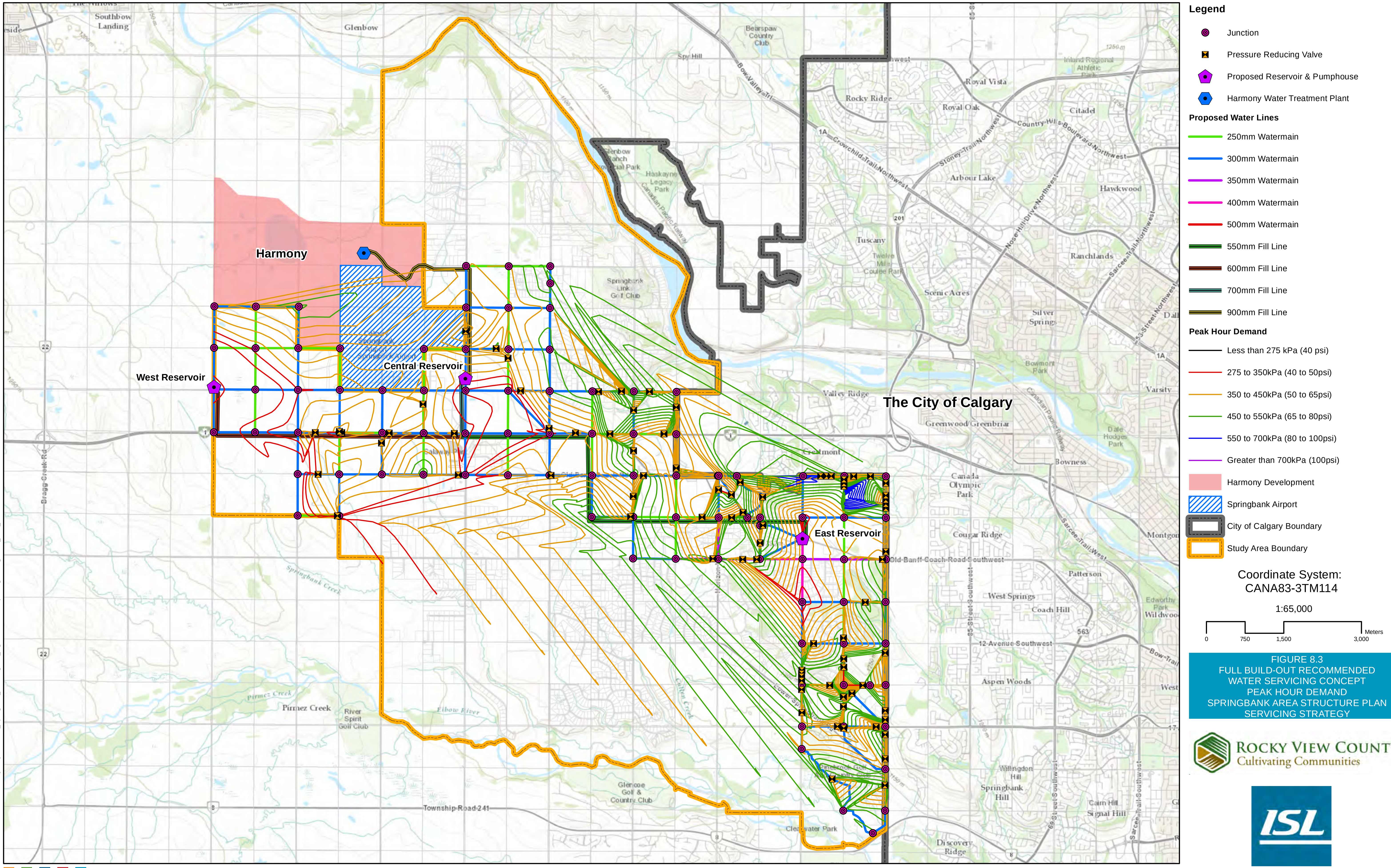

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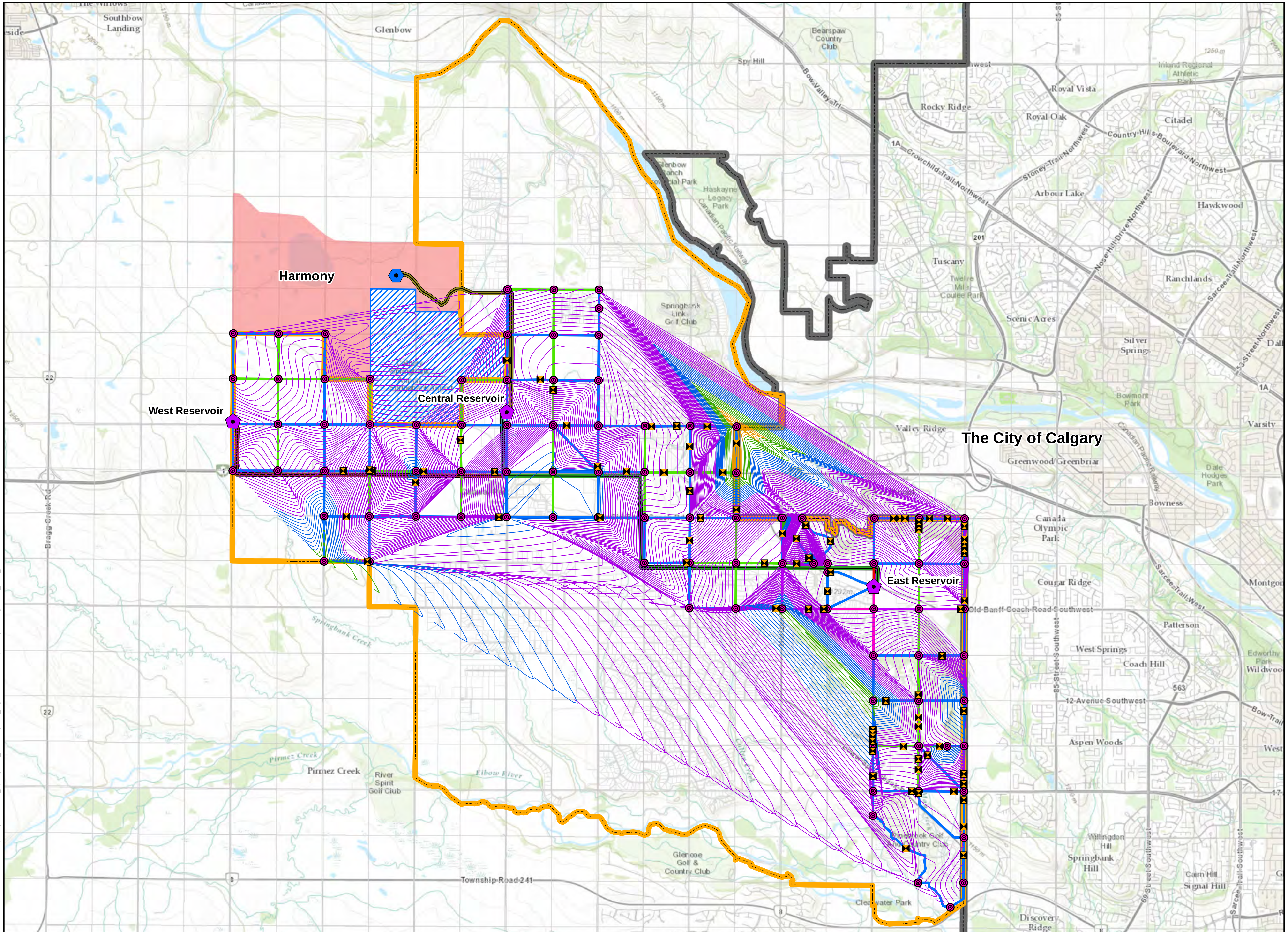

Legend

- Junction
- Pressure Reducing Valve
- Proposed Reservoir & Pumphouse
- Harmony Water Treatment Plant

Proposed Water Lines

- 250mm Watermain
- 300mm Watermain
- 350mm Watermain
- 400mm Watermain
- 500mm Watermain
- 550mm Fill Line
- 600mm Fill Line
- 700mm Fill Line
- 900mm Fill Line

Available Fire Flow

- Less than 50 L/s (Fails All Criteria)
- 50 to 100 L/s (Country Residential)
- 100 to 166 L/s (Single Family Residential)
- 166 to 255 L/s (Multi-Family Residential / Light Commercial)
- Greater than 255 L/s (Heavy Commercial)
- Harmony Development
- Springbank Airport
- City of Calgary Boundary
- Study Area Boundary

Coordinate System: CANA83-3TM114

1:65,000

0 750 1,500 3,000 Meters

FIGURE 8.4
FULL BUILD-OUT RECOMMENDED WATER SERVICING CONCEPT
MAXIMUM DAY DEMAND + FIRE FLOW
SPRINGBANK AREA STRUCTURE PLAN SERVICING STRATEGY

ROCKY VIEW COUNTY
Cultivating Communities

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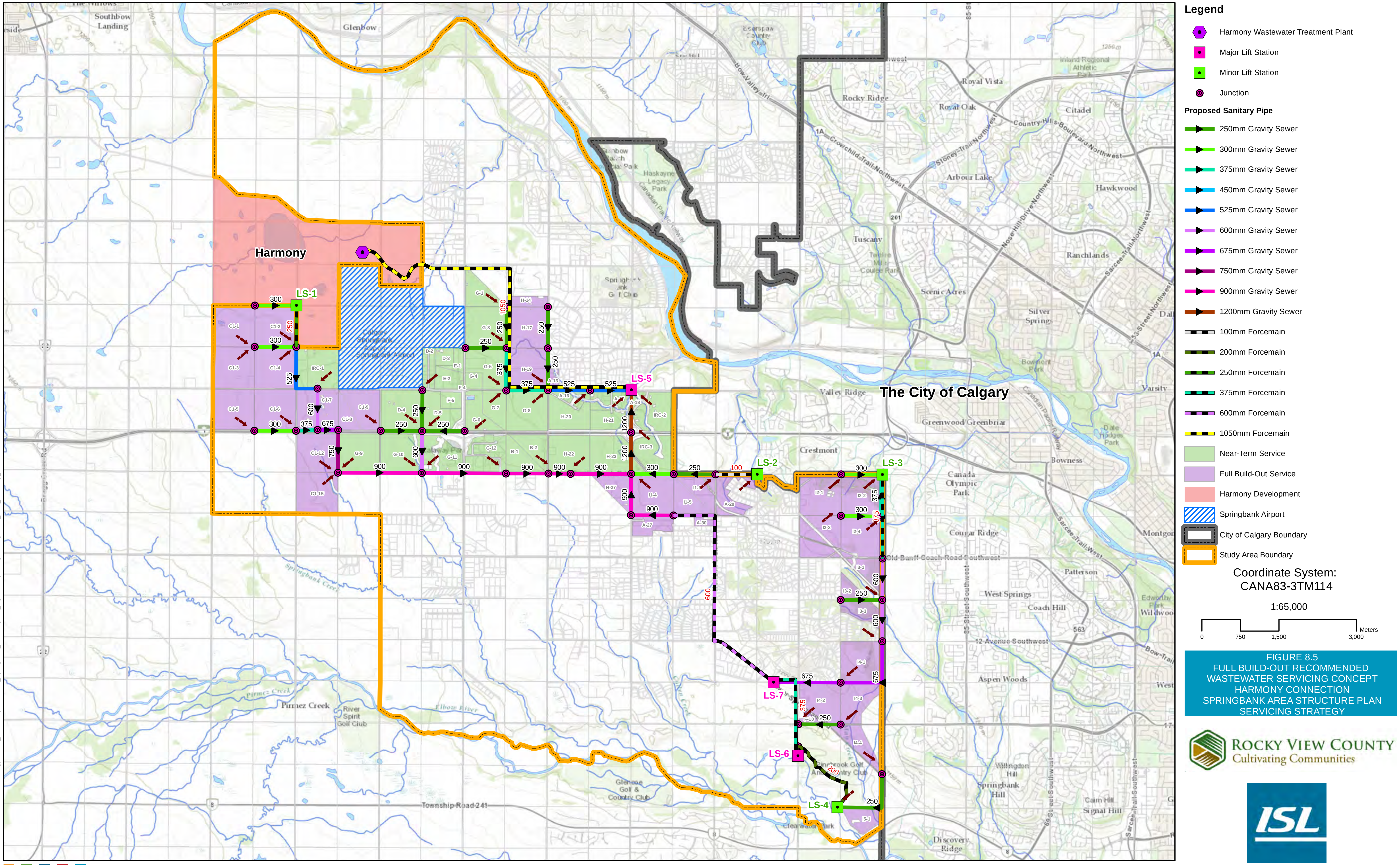


FIGURE 8.5
FULL BUILD-OUT RECOMMENDED WASTEWATER SERVICING CONCEPT
HARMONY CONNECTION
SPRINGBANK AREA STRUCTURE PLAN SERVICING STRATEGY

9.0 Near-Term Assessment

As previously noted, the recommendations pertaining to the proposed water and wastewater servicing systems are based on the focused service area under full build-out conditions. Therefore, these recommended systems were adapted to suit the service areas and populations under near-term conditions.

It should be noted that infrastructure upgrade staging was not evaluated from near-term to full build-out conditions. It is recommended that staging of required upgrades be evaluated at the near-term design phase based on current and future needs in order to plan for incremental upgrades as needed.

9.1 Proposed Water Servicing System

The proposed water servicing system under near-term conditions includes the Central Reservoir, which is connected to the Harmony WTP via a reservoir fill line. Potable water flows from this reservoir through the distribution system to the service areas. This is shown in Figure 9.1. A comparison of the costs under full build-out and near-term conditions is shown in Table 9.1.

Table 9.1: Comparison of Water Servicing Costs for Development Phases

Parameter	Cost	
	Full Build-Out	Near-Term
Water Licenses	$67,720,000	$28,486,492
Watermains	$73,380,000	$29,116,921
Supply Lines	$23,600,000	$7,203,600
Reservoirs/Pumphouses	$40,240,000	$13,340,000
Pressure Reducing Valves	$5,950,000	$1,812,500
WTP Upgrades	$113,060,000	$16,052,411
Total Capital Cost	**$323,950,000**	**$96,011,924**
Per Serviceable Hectare Capital Cost	**$180,479**	**$128,546**
Per Cubic Metre Per Day	**$12,299**	**$8,677**
Additional Annual Cost[1]	**$500,000**	**$130,000**
25-Year Aggregated Annual Cost	**$16,940,000**	**$4,490,000**
Total Cost (Capital + 25-Year Annual)	**$340,890,000**	**$100,501,924**
Total Cost Per Serviceable Hectare	**$195,577**	**$139,586**
Total Cost Per Cubic Metre Per Day[2]	**$12,924**	**$9,119**
Total Cost Per Cubic Metre[3]	**$1.42**	**$1.00**
Total Cost Per Person	**$11,310**	**$25,567**

[1] Additional Annual Costs refers to the reservoir/pumphouse operation and maintenance costs.

[2] The cost per cubic metre per day refers to the cost per cubic metre per day of water consumed under ADD conditions over the 25 years.
[3] The cost per cubic metre refers to the cost per cubic metre of water consumed under ADD conditions over the 25 years.

9.2 Proposed Wastewater Servicing System

The proposed wastewater servicing system under near-term conditions includes conveyance of wastewater flows, via gravity sewers to a lift station (LS-5), which pumps these flows to the Harmony Wastewater Treatment Plant (WWTP) via a forcemain. This is shown in Figure 9.2. A comparison of the costs under full build-out and near-term conditions is shown in Table 9.2.

Table 9.2: Comparison of Wastewater Servicing Costs for Development Phases

Parameter	Cost	
	Full Build-Out	Near-Term
Gravity Sewers	$43,630,000	$18,490,000
Forcemains	$31,040,000	$12,130,000
Lift Stations	$40,240,000	$9,790,000
Harmony WWTP Upgrades	$100,950,000	$13,450,000
Total Capital Cost	**$215,860,000**	**$53,860,000**
Per Serviceable Hectare Capital Cost	**$123,844**	**$30,901**
Per Cubic Metre Per Day	**$12,616**	**$3,148**
Additional Annual Cost[1]	**$400,000**	**$100,000**
25-Year Aggregated Annual Cost	**$13,550,000**	**$3,300,000**
Total Cost (Capital + 25-Year Annual)	**$229,410,000**	**$57,160,000**
Total Cost Per Serviceable Hectare	**$131,618**	**$79,389**
Total Cost Per Cubic Metre Per Day[2]	**$13,408**	**$8,772**
Total Cost Per Cubic Metre[3]	**$1.47**	**$0.96**
Total Cost Per Person	**$7,641**	**$14,044**

[1] Additional Annual Costs refers to the lift station operation and maintenance costs.
[2] The cost per cubic metre refers to the cost per cubic metre per day of wastewater generated under ADWF conditions over the 25 years.
[3] The cost per cubic metre refers to the cost per cubic metre of wastewater generated under ADWF conditions over the 25 years.

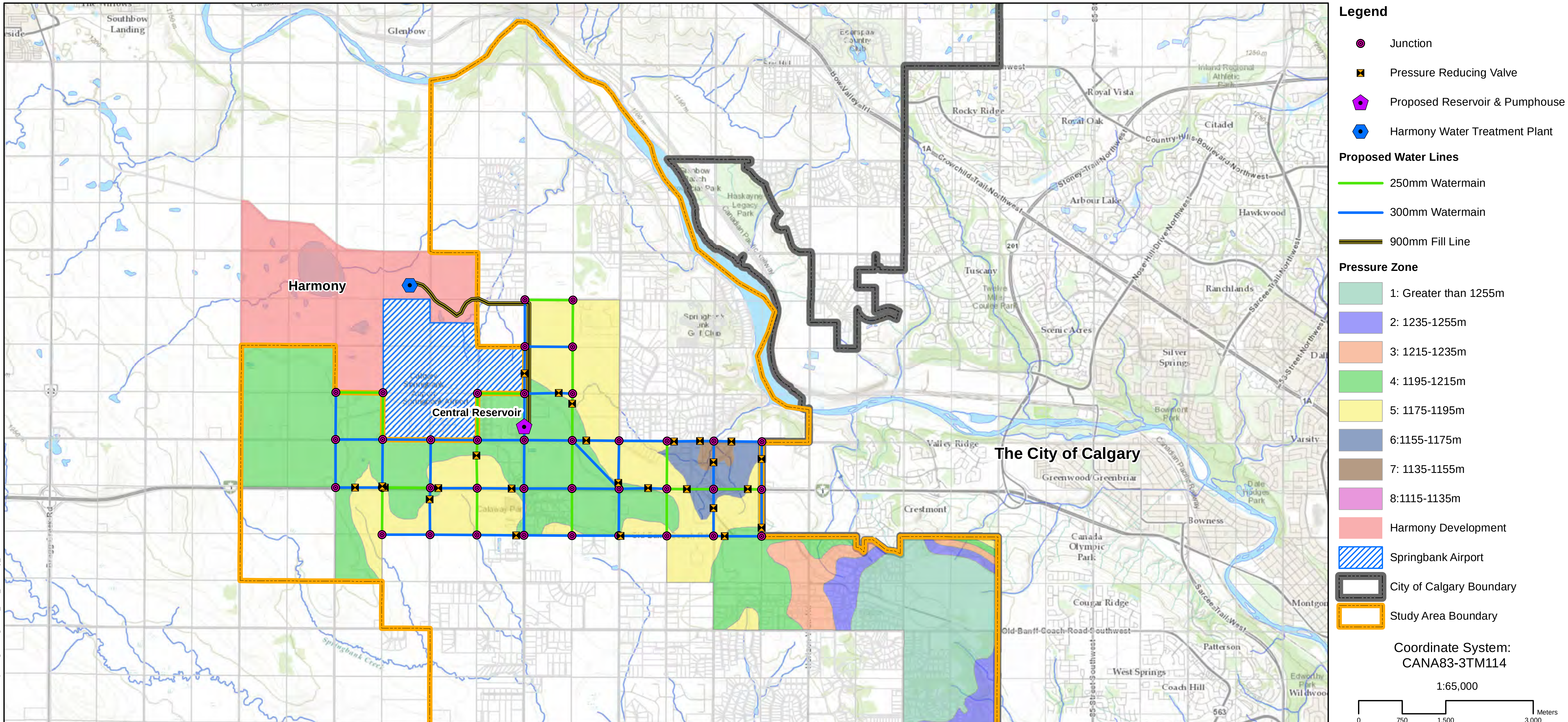
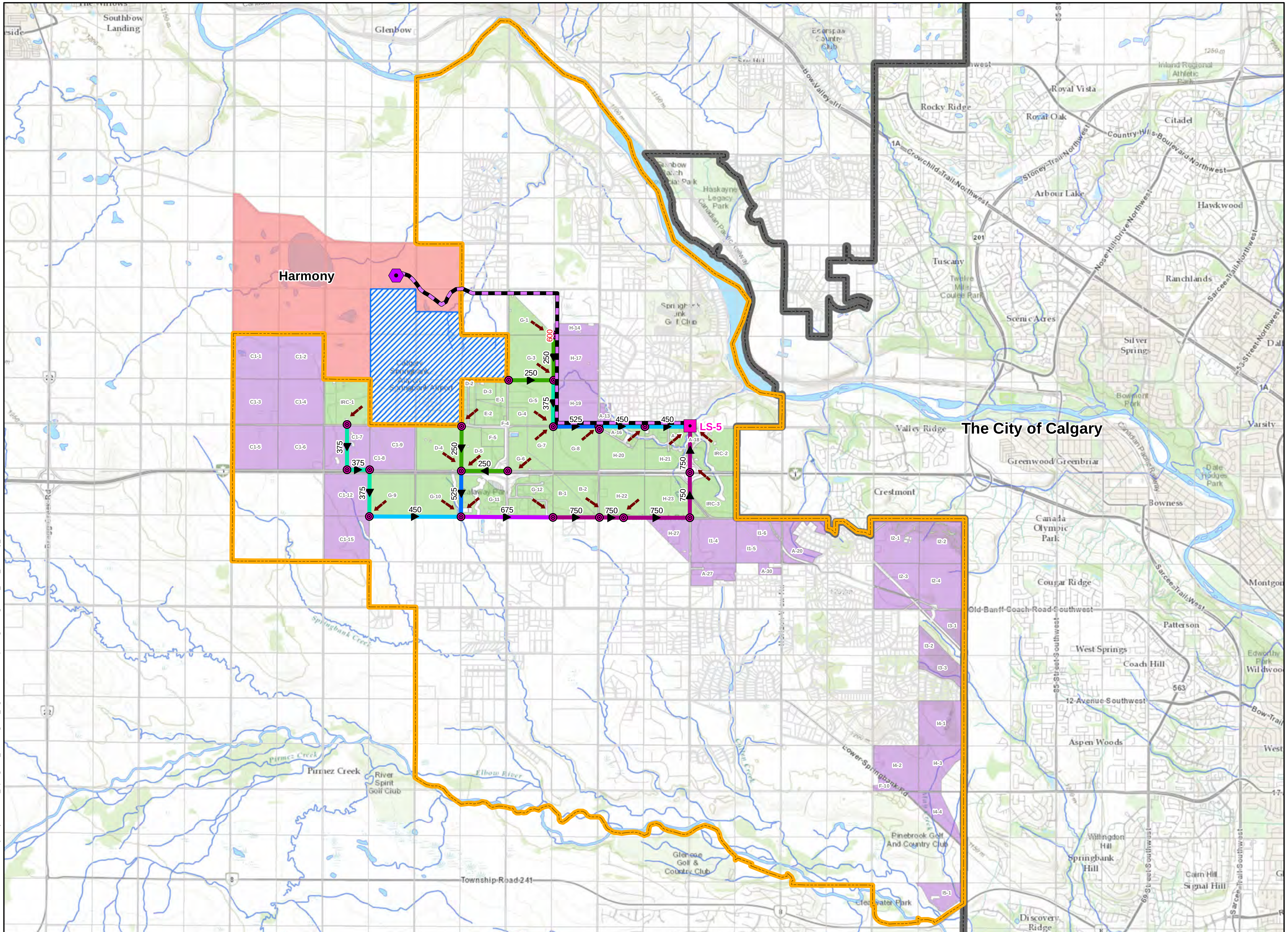


FIGURE 9.1
NEAR-TERM RECOMMENDED
WATER SERVICING CONCEPT
HARMONY CONNECTION
SPRINGBANK AREA STRUCTURE PLAN
SERVICING STRATEGY

ROCKY VIEW COUNTY
Cultivating Communities

ISL

Document: Q:\Projects\26981_Springbank_Servicing\251_Figures\Revised Report Figures\Figure9.1_WAT_Harmony_NearTerm.mxd
Date: 8/31/2020



Legend

- Harmony Wastewater Treatment Plant
- Major Lift Station
- Junction

Proposed Sanitary Pipe

- 250mm Gravity Sewer
- 375mm Gravity Sewer
- 450mm Gravity Sewer
- 525mm Gravity Sewer
- 675mm Gravity Sewer
- 750mm Gravity Sewer
- 600mm Forcemain
- Near-Term Service
- Full Build-Out Service
- Harmony Development
- Springbank Airport
- City of Calgary Boundary
- Study Area

Coordinate System:
CANA83-3TM114

1:65,000

0 750 1,500 3,000 Meters

FIGURE 9.2
NEAR-TERM RECOMMENDED WASTEWATER SERVICING CONCEPT
HARMONY CONNECTION
SPRINGBANK AREA STRUCTURE PLAN SERVICING STRATEGY

ROCKY VIEW COUNTY
Cultivating Communities

ISL

Integrated Expertise. Locally Delivered.

Service Layer Credits: Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community

10.0 Calalta Franchise Agreement Servicing

As previously noted, a Franchise Agreement between Calalta Waterworks Ltd. (Calalta) and the County exists for Calalta to supply water exclusively to approximately 64 quarter sections of land. Approximately 38 of these quarter sections are located within the Study Area boundary, with the remaining Exclusive Service Area located west of the Study Area. Additionally, approximately four quarter sections of the six within the Non-Exclusive Service Area are located within the Study Area. The County requested that the preferred water scenario be reviewed to see how it might be modified to take the Calalta service area into account even if this deviates from the globally preferred servicing scenario.

The focused servicing area under these scenarios has been expanded to include the non-residential and medium density residential quarter sections within the Franchise Agreement's Exclusive Service Area. These areas are shown in Figure 10.1.

Water and wastewater servicing options have been prepared based on two potential development scenarios. Scenario 1 involves the servicing of the Franchise Agreement's Exclusive Service Area by Calalta, with the remainder of the area being serviced by Harmony. Scenario 2 involves the servicing of both Franchise Agreement's Exclusive Service Area and Non-Exclusive Area by Calalta, with the remainder of the area being serviced by Harmony.

It should be noted that low density residential areas were not considered in the assessment of the main water and wastewater servicing networks within the Franchise Agreement area. However, these lands may be connected to the proposed networks in the future if adequate capacity is available.

10.1 Proposed Water Servicing System

The water servicing concepts for both development scenarios under both full build-out and near-term conditions are shown in Figures 10.2 to 10.5. The figure shows the primary water mains as 250 mm and 300 mm diameter in size. Three reservoirs are proposed within the Harmony service area and two reservoirs are proposed within the Calalta service area. These reservoirs are supplied with potable water by either the Harmony WTP via a fill line to the Central Reservoir, which supplies the East Reservoir and West Reservoir, or the Calalta WTP via fill lines to Calalta Reservoirs 1 and 2. The Harmony WTP is supplied by a raw water intake on the Bow River with the Calalta WTP being supplied by a raw water intake on the Elbow River. Water demands for both development scenarios under both full build-out and near-term conditions are provided in Tables 10.1 to 10.4.

It is noted that based on the current understanding of water licensing for Calalta that their licenses do not have a return to the Elbow River requirement. However, the license currently held by Durum Bow Water & Land that may be used in the future, does have a return to source requirement. Additionally, the Durum license stipulates that a minimum river flow of 3.0 m^3/s must be met during the winter to be able to draw from the Elbow River. Based on the Water Survey of Canada data, the river flow dropped below this threshold in the winter of 2018 for example. Raw water storage requirements for larger scale servicing would need to be satisfied.

The proposed distribution system was planned to leverage gravity flow from higher to lower pressure zones for the majority of the system to take advantage of the unique topography of the Study Area. As a result, 90 PRVs were incorporated. While, the highest elevated service areas in the northwest of the Harmony system would require the potable water to be boosted at the WTP and reservoir. This would ensure that the minimum pressure requirements are met under static and dynamic conditions. Service areas excluded from the system are expected to be serviced by existing local systems. It is again noted that a reservoir per zone could be implemented at additional cost if higher system resiliency was desired.

10.1.1 Cost Estimates

Cost estimates were prepared for the proposed water system options. The costs of watermains, supply lines, reservoirs and WTP upgrades were included. Tables 10.5 and 10.6 review the costs of the proposed concepts under full build-out and near-term conditions, with a more detailed cost breakdown provided in Appendix E.

Table 10.5: Comparison of Water Servicing Costs – Calalta Scenario 1

Parameter	Cost	
	Full Build-Out	Near-Term
Water Licenses	$84,829,031	$28,486,492
Watermains	$89,843,718	$35,512,617
Supply Lines	$26,900,835	$12,781,714
Reservoirs/Pumphouses	$40,240,000	$31,610,000
Pressure Reducing Valves	$6,525,000	$1,957,500
WTP Upgrades	$121,794,013	$29,099,390
Total Capital Cost	**$370,132,598**	**$139,447,713**
Per Serviceable Hectare Capital Cost	**$168,242**	**$193,677**
Per Cubic Metre Per Day	**$11,204**	**$12,603**
Additional Annual Cost[1]	**$640,000**	**$320,000**
25-Year Aggregated Annual Cost	**$21,580,000**	**$10,640,000**
Total Cost (Capital + 25-Year Annual)	**$391,712,598**	**$150,087,713**
Total Cost Per Serviceable Hectare	**$178,051**	**$208,455**
Total Cost Per Cubic Metre Per Day[2]	**$11,857**	**$13,564**
Total Cost Per Cubic Metre[3]	**$1.30**	**$1.49**
Total Cost Per Person	**$12,096**	**$36,877**

[1] Additional Annual Costs refers to the reservoir/pumphouse operation and maintenance costs.
[2] The cost per cubic metre per day refers to the cost per cubic metre per day of water consumed under ADD conditions over the 25 years.
[3] The cost per cubic metre refers to the cost per cubic metre of water consumed under ADD conditions over the 25 years.

Table 10.6: Comparison of Water Servicing Costs – Calalta Scenario 2

Parameter	Cost	
	Full Build-Out	Near-Term
Water Licenses	$84,829,031	$28,486,492
Watermains	$70,874,137	$33,794,106
Supply Lines	$27,555,184	$11,906,168
Reservoirs/Pumphouses	$63,365,000	$22,475,000
Pressure Reducing Valves	$5,655,000	$1,957,500
WTP Upgrades	$112,196,618	$29,099,390
Total Capital Cost	**$364,474,970**	**$127,718,655**
Per Serviceable Hectare Capital Cost	**$165,670**	**$177,387**
Per Cubic Metre Per Day	**$11,033**	**$11,543**
Additional Annual Cost[1]	**$630,000**	**$220,000**
25-Year Aggregated Annual Cost	**$21,340,000**	**$7,570,000**
Total Cost (Capital + 25-Year Annual)	**$385,814,970**	**$135,288,655**
Total Cost Per Serviceable Hectare	**$175,370**	**$187,901**
Total Cost Per Cubic Metre Per Day[2]	**$11,679**	**$12,227**
Total Cost Per Cubic Metre[3]	**$1.28**	**$1.34**
Total Cost Per Person	**$11,914**	**$33,240**

[1] Additional Annual Costs refers to the reservoir/pumphouse operation and maintenance costs.
[2] The cost per cubic metre per day refers to the cost per cubic metre per day of water consumed under ADD conditions over the 25 years.
[3] The cost per cubic metre refers to the cost per cubic metre of water consumed under ADD conditions over the 25 years.

There is a notable increase in costs associated with the Calalta scenarios compared to only Harmony connection options. Under full build-out conditions the cost increase is approximately 15% for Scenario 1 and 13% for Scenario 2. Whereas, the cost increases are approximately 49% for Scenario 1 and 34% for Scenario 2 under near-term conditions. It should be noted that the Calalta scenarios do account for an increased service area, resulting in decreases in costs per hectare, cubic metre, and person under full build-out conditions. That said, these percent increases in cost are maintained under near-term conditions, as the expanded Calalta area does not impact the near-term service area.

10.1.2 Conclusions from the Water Assessment

Analysis of the proposed water distribution system has made it evident that implementation of the proposed infrastructure would be deemed acceptable for pressure and fire flow requirements. It is recommended that the County consider stormwater harvesting for irrigation and/or non-potable household water uses and to encourage residents to apply water conservation measures. As noted, there are substantial increases in cost to incorporate the Calalta Franchise Area scenarios. It is recommended that these cost implications taken into consideration when determining the preferred water servicing scenario for the Springbank ASP area.

10.2 Proposed Wastewater Servicing

The proposed wastewater servicing scenarios incorporate servicing of the Harmony service area by the Harmony WTP as in previous scenarios. Wastewater flows are conveyed via gravity sewers and localized forcemains for the high-density areas northeast of Lower Springbank Road to a centralized lift station (LS-7). Flows to the south of this lift station are conveyed south or pumped north to another major lift station (LS-6), which pumps flows north to the centralized lift station (LS-7). These combined wastewater flows are pumped from the south centralized lift station to the TCH Corridor system via a 600 mm forcemain. The TCH Corridor system conveys wastewater flows to a lift station (LS-5), which pumps these flows to the Harmony WWTP via a forcemain. The effluent is treated at the Harmony WWTP and discharged to the Bow River.

Wastewater for the Calalta service area are conveyed by gravity sewers and localized lift stations and forcemains to a centralized confluence point at the south boundary of the focused service area. Wastewater flows were derived for both Franchise Agreement scenarios under both near-term and full build-out conditions. A summary of these wastewater flows is shown in Tables 10.7 to 10.10.

A high-level feasibility review was completed for potential servicing options for the Calalta service area. Wastewater flows are conveyed via gravity sewers and localized forcemains to a confluence point within the Calalta service area. This confluence point is intended to be a WWTP where the below options require it. The review of these potential servicing options is provided below.

10.2.1 Bow River Discharge

This option involves the Calalta service area being incorporated into the Harmony wastewater system for treatment and disposal. The Calalta service area flows are conveyed via gravity sewers and a localized lift station and forcemain southeast to a lift station (LS-11). These flows are pumped to the proposed Harmony wastewater system via a 675 mm forcemain. The effluent is treated at the Harmony WWTP and discharged to the Bow River. This option is considered feasible and is shown in Figures 10.6 to 10.9.

10.2.2 Elbow River Discharge

This option involves a Calalta WWTP, which conveys treated effluent to a discharge point along the Elbow River. Although this option may be feasible, there are number of considerations that must be accounted for in the determination of this option's viability.

Based simply on the minimum required 10:1 dilution factor and the minimum monthly mean river flow of 2.37 m^3/s, there is adequate dilution to accommodate an approximate residential population of 10,000 people under peak wet weather conditions in order to be conservative. However, this assumes no other discharge to the Elbow, which is not the case as both Bragg Creek and Redwood Meadows, among others contribute. Although the proposed residential population currently slated for this area is not greater than this value, there is not adequate dilution to accommodate the proposed non-residential and residential areas in the focused ASP service area within the franchise boundary under peak wet weather conditions.

A detailed receiving waters assessment of the viability of the Elbow River as an outfall location for any portion of the Franchise Agreement area would need to be completed. From a regulatory perspective, any new wastewater discharge requires an assessment, which will need to be completed to determine effluent limits as part of its application.

As the Glenmore Reservoir is one of the main drinking water supplies for The City, this is likely to result in stringent limits imposed on any discharge upstream. These limits may prove to be cost-prohibitive. Related to this, The City of Calgary has flagged a concern with source water protection, including the potential impact of pharmaceuticals. There are no regulations/limits on pharmaceuticals at this time; however, it is likely that these will be brought into practice in the future. The treatment requirements for this may prove to be cost-prohibitive for the County.

The raw water quality must be assessed to determine the required treatment process as the current raw water quality within the Elbow River must be maintained. Therefore, the addition of a new point load to the Glenmore Reservoir supply could result in treatment applications/upgrades for The City's Water Treatment Plant as well.

For the purpose of this study, this option has been considered feasible and is shown in Figures 10.10 to 10.13 for both development scenarios under both full build-out and near-term conditions. It should be noted that costs for this option have been provided on a comparative basis to those considered for upgrades to the Harmony WWTP; however, this wastewater servicing option carries high uncertainty and risk. Therefore, significantly higher treatment costs are anticipated for this option beyond the comparative costs provided.

10.2.3 On-Site Disposal

This option incorporates a WWTP and treated effluent storage, with treated effluent being utilized for spray irrigation purposes. The area required to facilitate this irrigation was assessed. This option for both Franchise Agreement scenarios under full build-out and near-term conditions is shown in Figures 10.14 to 10.17.

This option is considered feasible; however, it should be noted that this option sterilizes a large portion of land for the Franchise Agreement due to the required 100m setback from any occupied dwellings. Additionally, based on the water license stipulations of returning wastewater to the Elbow River, a more detailed assessment of this option and regulatory implications of spray irrigation within the same watershed is required.

A more detailed assessment of the infrastructure required to facilitate this as well as the incorporation of land costs for sterilized land would need to be incorporated to provide cost estimates for this option. It is believed that this may be available on a small-scale application for the Calalta water service area.

10.2.4 Private Sewage Treatment Systems

This option incorporates a private sewage treatment system (PSTS) for each lot rather than larger communal systems, in order to put responsibility for maintenance of the system/hauling of wastewater on each property owner. Therefore, the proposed conveyance network shown in previous figures is not required.

As stipulated in the Rocky View County Servicing Standards document (RVC, 2013), residential PSTS systems are not supported where there are more than 60 existing lots within a 600 m radius of the development. It should also be noted that “the County does not support the use of sewage holding tanks for residential subdivisions or developments”. All residential lots between one and four acres in size are required to use a packaged sewage treatment system. Additionally, “the use of PSTS on residential lots less than 1 acre will not be permitted, unless the lot creation approval occurred prior to adoption of these Development Standards.” In terms of industrial, commercial, and institutional developments, septic fields may be used if they are fully engineered in accordance with the Alberta Private Sewage Systems Standard of Practice. Further to this, Rocky View County’s Policy #499 stipulates that for any lots less than 4 acres and within the 600 m radius of 60 proposed, approved, or existing lots, PSTS systems are not supported.

This option is not considered feasible at this time as it may decrease the viability of some developments in terms of lot size as well as treatment and disposal costs for property owners. A detailed assessment of each development would be recommended as development proceeds if this option were to be implemented.

The cost of each unit required to service one average household is approximately $35,000 for supply and install. It should be noted that this does not include any maintenance or cleaning out of the unit.

10.2.5 Wastewater Hauling

This option directs flows to communal holding tanks. Wastewater would be vacuumed out and hauled to The City of Calgary for disposal as needed depending on the tank size, wastewater generation, etc. As noted above, “the County does not support the use of sewage holding tanks for residential subdivisions or developments”.

The costs for this depend on distance, which is dependent on wastewater quality and the level of treatment required prior to disposal. In order to reduce disposal costs, treatment costs increase. This option is not considered feasible long-term based on the combination of hauling costs as well as disposal/treatment construction and operation and maintenance costs.

10.2.6 City of Calgary Connection

This option directs flows to confluence point and conveys flows southeast toward The City of Calgary's Glenmore Sanitary Trunk. As previously noted, this Trunk has significant available capacity to accommodate an additional service population of up to 100,000 people if development is well distributed throughout service area (ISL, 2010). However, this option is not considered to be feasible at this time due to the lack of servicing infrastructure being provided for the low-density development in the south portion of the Study Area and the considerable length (approximately 12km) of sewer that would be required to facilitate this connection.

10.2.7 Cost Estimates

Cost estimates were prepared for the feasible wastewater system options. The costs of gravity sewers, forcemains, and lift stations. Tables 10.11 and 10.12 review the costs of each of the proposed concepts under full build-out and near-term conditions, with a more detailed cost breakdown provided in Appendix E.

Table 10.11: Comparison of Wastewater Servicing Costs – Calalta Scenario 1 – Bow River Discharge

Parameter	Cost	
	Full Build-Out	Near-Term
Gravity Sewers	$49,450,000	$21,370,000
Forcemains	$43,340,000	$18,430,000
Lift Stations	$66,190,000	$19,140,000
Harmony WWTP	$107,020,000	$13,450,000
Total Capital Cost	**$266,000,000**	**$72,390,000**
Per Serviceable Hectare Capital Cost	**$120,909**	**$96,908**
Per Cubic Metre Per Day	**$12,639**	**$11,110**
Additional Annual Cost[1]	**$660,000**	**$190,000**
25-Year Aggregated Annual Cost	**$22,290,000**	**$6,440,000**
Total Cost (Capital + 25-Year Annual)	**$288,290,000**	**$78,830,000**
Total Cost Per Serviceable Hectare	**$131,041**	**$105,529**
Total Cost Per Cubic Metre Per Day[2]	**$13,698**	**$12,098**
Total Cost Per Cubic Metre[3]	**$1.50**	**$1.33**
Total Cost Per Person	**$8,903**	**$19,369**

[1] Additional Annual Costs refers to the lift station operation and maintenance costs.
[2] The cost per cubic metre refers to the cost per cubic metre per day of wastewater generated under ADWF conditions over the 25 years.
[3] The cost per cubic metre refers to the cost per cubic metre of wastewater generated under ADWF conditions over the 25 years.

Table 10.12: Comparison of Wastewater Servicing Costs – Calalta Scenario 2 – Bow River Discharge

Parameter	Cost	
	Full Build-Out	Near-Term
Gravity Sewers	$49,020,000	$18,700,000
Forcemains	$42,300,000	$33,660,000
Lift Stations	$63,730,000	$18,415,000
Harmony WWTP	$107,020,000	$13,450,000
Total Capital Cost	**$262,070,000**	**$84,225,000**
Per Serviceable Hectare Capital Cost	**$119,123**	**$112,751**
Per Cubic Metre Per Day	**$12,452**	**$12,926**
Additional Annual Cost[1]	**$640,000**	**$180,000**
25-Year Aggregated Annual Cost	**$21,460,000**	**$6,200,000**
Total Cost (Capital + 25-Year Annual)	**$283,530,000**	**$90,425,000**
Total Cost Per Serviceable Hectare	**$128,877**	**$121,051**
Total Cost Per Cubic Metre Per Day[2]	**$13,472**	**$13,877**
Total Cost Per Cubic Metre[3]	**$1.48**	**$1.52**
Total Cost Per Person	**$8,756**	**$22,217**

[1] Additional Annual Costs refers to the lift station operation and maintenance costs.
[2] The cost per cubic metre refers to the cost per cubic metre per day of wastewater generated under ADWF conditions over the 25 years.
[3] The cost per cubic metre refers to the cost per cubic metre of wastewater generated under ADWF conditions over the 25 years.

It should be noted that treatment costs for the Elbow River options have been provided on a comparative basis only to the proposed costs for the Harmony WWTP upgrades required. It is anticipated that stringent treatment limits for an outfall to the Elbow River will result in significantly increased treatment costs compared to those provided below.

Table 10.13: Comparison of Wastewater Servicing Costs – Calalta Scenario 1 – Elbow River Discharge

Parameter	Cost	
	Full Build-Out	Near-Term
Gravity Sewers	$48,470,000	$20,100,000
Forcemains	$31,820,000	$12,350,000
Lift Stations	$45,750,000	$14,500,000
WWTP	$107,020,000	$13,450,000
Total Capital Cost	**$233,060,000**	**$60,400,000**
Per Serviceable Hectare Capital Cost	**$105,936**	**$80,857**
Per Cubic Metre Per Day	**$11,074**	**$9,269**
Additional Annual Cost[1]	**$460,000**	**$150,000**
25-Year Aggregated Annual Cost	**$15,400,000**	**$4,880,000**
Total Cost (Capital + 25-Year Annual)	**$248,460,000**	**$65,280,000**
Total Cost Per Serviceable Hectare	**$112,936**	**$87,390**
Total Cost Per Cubic Metre Per Day[2]	**$11,806**	**$10,018**
Total Cost Per Cubic Metre[3]	**$1.29**	**$1.10**
Total Cost Per Person	**$7,673**	**$16,039**

[1] Additional Annual Costs refers to the lift station operation and maintenance costs.
[2] The cost per cubic metre refers to the cost per cubic metre per day of wastewater generated under ADWF conditions over the 25 years.
[3] The cost per cubic metre refers to the cost per cubic metre of wastewater generated under ADWF conditions over the 25 years.

Table 10.14: Comparison of Wastewater Servicing Costs – Calalta Scenario 2 – Elbow River Discharge

Parameter	Cost	
	Full Build-Out	Near-Term
Gravity Sewers	$47,550,000	$17,430,000
Forcemains	$29,370,000	$12,420,000
Lift Stations	$41,910,000	$13,780,000
WWTP	$107,020,000	$13,450,000
Total Capital Cost	**$225,850,000**	**$57,080,000**
Per Serviceable Hectare Capital Cost	**$102,659**	**$76,412**
Per Cubic Metre Per Day	**$10,731**	**$8,760**
Additional Annual Cost[1]	**$420,000**	**$140,000**
25-Year Aggregated Annual Cost	**$14,110,000**	**$4,640,000**
Total Cost (Capital + 25-Year Annual)	**$239,960,000**	**$61,720,000**
Total Cost Per Serviceable Hectare	**$109,073**	**$82,624**
Total Cost Per Cubic Metre Per Day[2]	**$11,402**	**$9,472**
Total Cost Per Cubic Metre[3]	**$1.25**	**$1.04**
Total Cost Per Person	**$7,410**	**$15,165**

[1] Additional Annual Costs refers to the lift station operation and maintenance costs.
[2] The cost per cubic metre refers to the cost per cubic metre per day of wastewater generated under ADWF conditions over the 25 years.
[3] The cost per cubic metre refers to the cost per cubic metre of wastewater generated under ADWF conditions over the 25 years.

There are notable changes in the costs associated with the Calalta scenarios compared to the Harmony connection options only. Under full build-out conditions the change in cost is up to approximately 26% for Scenario 1 and 22% for Scenario 2. Whereas, the cost increases are up to approximately 38% for Scenario 1 and 58% for Scenario 2 under near-term conditions. It should be noted that the Calalta scenarios do account for an increased service area, resulting in significantly smaller cost increases per hectare, cubic metre, and person under full build-out conditions. That said, these percent increases in cost are maintained under near-term conditions, as the expanded area does not impact the near-term service area.

10.2.8 Conclusions from the Wastewater Servicing Assessment

It is recommended that the County evaluate the wastewater servicing options for the Harmony and Calalta systems and determine future studies and analyses to be undertaken. In order to provide a recommendation for the Franchise Agreement service area, in terms of wastewater treatment and disposal, a more detailed assessment of the area and these high-level options is required.

As noted, there are increases in costs to incorporate the Calalta Franchise Area scenarios. It is recommended that these cost implications be taken into consideration when determining the preferred wastewater servicing scenario for the Springbank ASP area.

It should be noted that treatment costs for the Elbow River options have been provided on a comparative basis only to the proposed costs for the Harmony WWTP upgrades required. It is anticipated that stringent treatment limits for an outfall to the Elbow River will result in significantly increased treatment costs compared to those provided herein.

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11.0 Conclusions and Recommendations

Objectives of the Springbank ASP Servicing Strategy are as follows:

- To review water servicing options, determine feasible options, and recommend a preferred solution. The water servicing system includes water supply and distribution infrastructure.
- To review wastewater servicing options, determine feasible options, and recommend a preferred solution. The wastewater servicing system includes conveyance, treatment, and disposal.
- To review other measures to assist in servicing the Study Area including items such as wastewater effluent re-use and stormwater harvesting.

The completed Servicing Strategy will provide a guiding document for future development of the Study Area that can be used in preparation of future more detailed studies such as Subdivision Servicing Reports.

11.1 Conclusions and Recommendations for Water Servicing

Conclusions and recommendations for the overall water servicing system for the Study Area can be summarized as follows:

- The proposed water servicing options were prepared to service a total developable area of 831 ha and a population of 30,024 people under full build-out conditions. This can be compared to near-term conditions, which service a total developable area of 192 ha and a population of 4,070 people.
- Feasible water supply options for the entire focused service area include a connection to the Community of Harmony's WTP and a connection to The City of Calgary's water distribution system.
- The recommended County controlled water system includes reservoirs, distribution system infrastructure, and upgrades to Harmony's existing WTP. The Calalta area is serviced by Calalta's existing WTP with the incorporation of the County's Franchise Agreement.
- The cost of implementing the recommended water servicing concept under full build-out conditions is $341 million. This translates to $11,310 per person or $195,577 per hectare of serviced area. Given this includes operating costs, it is not unrealistically high when compared to off-site levy costs in numerous municipalities where full cost recovery is desired.
- The cost of implementing the recommended water servicing concept under full build-out conditions with incorporation of the County's Franchise Agreement with Calalta is $386 million to $392 million. This translates to up to $12,096 per person or $178,051 per hectare of serviced area. Given this includes operating costs, it is not unrealistically high when compared to off-site levy costs in numerous municipalities where full cost recovery is desired. This total cost is significantly higher than without Calalta's service area; however, the expanded area reduces the per hectare costs.
- The cost of implementing the recommended water servicing concept under near-term conditions is $101 million. This translates to $25,567 per person or $139,586 per hectare of serviced area. Given this includes operating costs, it is not unrealistically high when compared to off-site levy costs in numerous municipalities where full cost recovery is desired.

- The cost of implementing the recommended water servicing concept under near-term conditions with incorporation of the County's Franchise Agreement with Calalta is $135 million to $150 million. This translates to up to $36,877 per person or $208,455 per hectare of serviced area. Given this includes operating costs, it is not unrealistically high when compared to off-site levy costs in numerous municipalities where full cost recovery is desired.
- The proposed distribution system proves to be adequate under ADD, PHD, and MDD+FF scenarios. Localized pressure reducing valves or pumping may be required for those areas outside of the design pressure envelopes. Additionally, it is recommended that sprinklers be installed to reduce the fire flow requirements, especially in those areas with low available fire flow.
- Infrastructure staging to full build-out should be reviewed at the near-term design stage based on current and future needs in order to plan for incremental upgrades as needed.
- Consideration of water consumption reduction measures should be made.
- The development outside of the focused service area is to be locally serviced. Options such as connections to the local water co-ops/private water utilities or local cisterns remain available for development outside of the Springbank ASP water system service area. Connections of low-density areas to the main water network may be considered depending on availability of capacity and cost implications.

11.2 Conclusions and Recommendations for Wastewater Servicing

Conclusions and recommendations for the overall wastewater servicing system for the Study Area can be summarized as follows:

- The proposed wastewater servicing options were prepared to service a total developable area of 831 ha and a population of 30,024 people under full build-out conditions. This can be compared to near-term conditions, which service a total developable area of 192 ha and a population of 4,024 people.
- Feasible wastewater servicing options for the entire focused service area include a connection the Community of Harmony's WWTP and a connection to The City of Calgary's sanitary system via the Glenmore Sanitary Trunk.
- The recommended County controlled wastewater system includes gravity sewers, forcemains, lift stations, and upgrades to the existing Harmony WWTP.
- Feasible options to provide wastewater servicing to the Calata Franchise Agreement area in addition to the focused service area incorporate a connection of this area to Harmony's WWTP or a new outfall to the Elbow River with a Calalta WWTP.
- The cost of implementing the Harmony wastewater servicing concept under full build-out conditions is $229 million. This translates to $7,641 per person or $131,618 per hectare of serviced area. Given this includes operating costs, it is not unrealistically high when compared to off-site levy costs in numerous municipalities where full cost recovery is desired.

- The cost of implementing the Harmony wastewater servicing concept under full build-out conditions with incorporation of the County's Franchise Agreement with Calalta ranges from $281 million to $288 million, for the more conservative Bow River option via Harmony. This translates to up to $8,903 per person or $131,041 per hectare of serviced area. These costs are similar to those without the Calalta service area; however, it should be noted that unknowns associated with future treatment requirements are expected to increase costs significantly if the Elbow River were to be used as a discharge point.
- The cost of implementing the Harmony wastewater servicing concept under near-term conditions is $57 million. This translates to up to $14,044 per person or $79,389 per hectare of serviced area. Given this includes operating costs, it is not unrealistically high when compared to off-site levy costs in numerous municipalities where full cost recovery is desired.
- The cost of implementing the Harmony wastewater servicing concept under near-term conditions with incorporation of the County's Franchise Agreement with Calalta ranges from $79 million to $90 million, for the more conservative Bow River option via Harmony. This translates to up to $22,217 per person or $121,051 per hectare of serviced area. These costs are similar to those without the Calalta service area; however, it that unknowns associated with future treatment requirements are expected to increase costs significantly if the Elbow River were to be used as a discharge point.
- Infrastructure staging to full build-out should be reviewed at the near-term design stage based on current and future needs in order to plan for incremental upgrades as needed.
- Consideration of wastewater flow reduction measures should be made.
- The development outside of the focused service area is to be locally serviced. Options such as connections to private/local sewage systems and communal wastewater systems remain available for the development outside of the Springbank ASP wastewater system service area. Connections of low-density areas to the main wastewater network may be considered depending on availability of capacity and cost implications.

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Table 10.1: Estimated Study Area Water Demands – Harmony Connection/Calalta Scenario 1 (Full Build-Out)

Service Area	Net Developable Area			Residential Population	Water Consumption		Average Day Demand				MDD		PHD	
	Residential	Non-Residential	Total		Residential	Non-Residential	Residential	Non-Residential	Total		(2 x ADD)		(4.0 x ADD)	
	ha	ha	ha	capita	L/p/d	L/s/ha	L/s	L/s	L/s	m^3/d	L/s	m^3/d	L/s	m^3/d
A	104.15	0.00	104.15	347	315	0.15	1.27	0.00	1.27	109.31	2.53	218.61	5.06	437.22
C	84.08	0.00	84.08	1,122	315	0.15	4.09	0.00	4.09	353.43	8.18	706.86	16.36	1,413.72
	173.47	520.42	693.90	4,629	315	0.15	16.88	111.52	128.40	11,093.43	256.79	22,186.86	513.58	44,373.72
D	0.00	92.87	92.87	0	315	0.15	0.00	19.90	19.90	1,719.41	39.80	3,438.82	79.60	6,877.64
E	0.00	21.77	21.77	0	315	0.15	0.00	4.66	4.66	403.02	9.33	806.04	18.66	1,612.08
F	0.00	147.17	147.17	0	315	0.15	0.00	31.54	31.54	2,724.72	63.07	5,449.45	126.14	10,898.90
G	0.00	340.81	340.81	0	315	0.15	0.00	73.03	73.03	6,309.79	146.06	12,619.58	292.12	25,239.16
H	121.96	1.50	123.46	1,221	315	0.15	4.45	0.00	4.45	384.62	8.90	769.23	17.81	1,538.46
I-1	142.55	29.52	172.08	7,608	315	0.15	27.74	6.33	34.06	2,943.13	68.13	5,886.27	136.26	11,772.54
I-2	30.25	17.74	47.99	1,615	315	0.15	5.89	3.80	9.69	837.21	19.38	1,674.41	38.76	3,348.82
I-3	138.47	0.00	138.47	7,391	315	0.15	26.95	0.00	26.95	2,328.17	53.89	4,656.33	107.79	9,312.66
I-4	19.10	0.00	19.10	1,019	315	0.15	3.72	0.00	3.72	320.99	7.43	641.97	14.86	1,283.94
J	25.64	25.27	50.91	684	315	0.15	2.49	5.42	7.91	683.36	15.82	1,366.72	31.64	2,733.44
K	126.42	37.84	164.26	6,747	315	0.15	24.60	8.11	32.71	2,825.87	65.41	5,651.74	130.83	11,303.48
Total	**768.91**	**53.50**	**822.41**	**28,911**			**105.40**	**114.96**	**220.37**	**19,040**	**440.74**	**38,080**	**881.47**	**76,159**
A	28.62	0.00	28.62	96	315	0.15	0.35	0.00	0.35	30.24	0.70	60.48	1.40	120.96
B	84.08	0.00	84.08	1,122	315	0.15	4.09	0.00	4.09	353.43	8.18	706.86	16.36	1,413.72
C	84.48	253.43	337.91	2,254	315	0.15	8.22	54.31	62.52	5,402.15	125.05	10,804.30	250.10	21,608.59
D	0.00	72.61	72.61	0	315	0.15	0.00	15.56	15.56	1,344.38	31.12	2,688.76	62.24	5,377.52
E	0.00	0.00	0.00	0	315	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F	0.00	141.84	141.84	0	315	0.15	0.00	30.39	30.39	2,626.12	60.79	5,252.23	121.58	10,504.46
G	0.00	229.03	229.03	0	315	0.15	0.00	49.08	49.08	4,240.33	98.16	8,480.66	196.31	16,961.32
H	0.00	0.00	0.00	0	315	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
I-1	0.00	0.00	0.00	0	315	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
I-2	0.00	0.00	0.00	0	315	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
I-3	0.00	0.00	0.00	0	315	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
I-4	0.00	0.00	0.00	0	315	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
J	0.00	0.00	0.00	0	315	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
K	0.00	0.00	0.00	0	315	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Calalta	**197.18**	**696.92**	**894.10**	**3,472**			**12.66**	**149.34**	**162.00**	**13,997**	**324.00**	**27,993**	**647.99**	**55,987**
Total	**966.09**	**750.42**	**1,716.51**	**32,383**			**118.06**	**264.30**	**382.37**	**33,036**	**764.73**	**66,073**	**1,529.46**	**132,146**

Table 10.2: Estimated Study Area Water Demands – Harmony Connection/Calalta Scenario 2 (Full Build-Out)

Service Area	Net Developable Area			Residential Population	Water Consumption		Average Day Demand				MDD		PHD	
	Residential	Non-Residential	Total		Residential	Non-Residential	Residential	Non-Residential	Total		(2 x ADD)		(4.0 x ADD)	
	ha	ha	ha	capita	L/p/d	L/s/ha	L/s	L/s	L/s	m³/d	L/s	m³/d	L/s	m³/d
A	75.53	0.00	75.53	251	315	0.15	0.92	0.00	0.92	79.07	1.83	158.13	3.66	316.26
C	0.00	2.00	2.00	0	315	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	89.00	4.00	93.00	1,208	315	0.15	4.40	29.09	33.50	2,894.25	67.00	5,788.50	133.99	11,577.00
D	0.00	4.00	4.00	0	315	0.15	0.00	4.34	4.34	375.03	8.68	750.06	17.36	1,500.12
E	0.00	0.00	0.00	0	315	0.15	0.00	4.66	4.66	403.02	9.33	806.04	18.66	1,612.08
F	0.00	0.00	0.00	0	315	0.15	0.00	1.14	1.14	98.61	2.28	197.22	4.57	394.43
G	0.00	0.00	0.00	0	315	0.15	0.00	23.95	23.95	2,069.46	47.90	4,138.92	95.81	8,277.84
H	121.96	1.50	123.46	1,221	315	0.15	4.45	0.00	4.45	384.62	8.90	769.23	17.81	1,538.46
I-1	142.55	1.50	144.05	7,608	315	0.15	27.74	6.33	34.06	2,943.13	68.13	5,886.27	136.26	11,772.54
I-2	30.25	8.00	38.25	1,615	315	0.15	5.89	3.80	9.69	837.21	19.38	1,674.41	38.76	3,348.82
I-3	138.47	8.00	146.47	7,391	315	0.15	26.95	0.00	26.95	2,328.17	53.89	4,656.33	107.79	9,312.66
I-4	19.10	8.00	27.10	1,019	315	0.15	3.72	0.00	3.72	320.99	7.43	641.97	14.86	1,283.94
J	25.64	8.00	33.64	684	315	0.15	2.49	5.42	7.91	683.36	15.82	1,366.72	31.64	2,733.44
K	126.42	8.00	134.42	6,747	315	0.15	24.60	8.11	32.71	2,825.87	65.41	5,651.74	130.83	11,303.48
Total	**768.91**	**53.00**	**821.91**	**27,744**			**101.15**	**86.84**	**187.99**	**16,243**	**375.99**	**32,486**	**751.98**	**64,971**
A	28.62	0.00	28.62	96	315	0.15	0.35	0.00	0.35	30.24	0.70	60.48	1.40	120.96
B	84.08	0.00	84.08	1,122	315	0.15	4.09	0.00	4.09	353.43	8.18	706.86	16.36	1,413.72
C	84.48	253.43	337.91	3,421	315	0.15	12.47	82.43	94.90	8,199.18	189.80	16,398.36	379.59	32,796.72
D	0.00	72.61	72.61	0	315	0.15	0.00	15.56	15.56	1,344.38	31.12	2,688.76	62.24	5,377.52
E	0.00	0.00	0.00	0	315	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F	0.00	141.84	141.84	0	315	0.15	0.00	30.39	30.39	2,626.12	60.79	5,252.23	121.58	10,504.46
G	0.00	229.03	229.03	0	315	0.15	0.00	49.08	49.08	4,240.33	98.16	8,480.66	196.31	16,961.32
H	0.00	0.00	0.00	0	315	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
I-1	0.00	0.00	0.00	0	315	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
I-2	0.00	0.00	0.00	0	315	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
I-3	0.00	0.00	0.00	0	315	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
I-4	0.00	0.00	0.00	0	315	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
J	0.00	0.00	0.00	0	315	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
K	0.00	0.00	0.00	0	315	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Calalta	**197.18**	**696.92**	**894.10**	**4,639**			**16.91**	**177.46**	**194.37**	**16,794**	**388.74**	**33,587**	**777.48**	**67,175**
Total	**966.09**	**749.92**	**1,716.01**	**32,383**			**118.06**	**264.30**	**382.37**	**33,036**	**764.73**	**66,073**	**1,529.46**	**132,146**

Table 10.3: Estimated Study Area Water Demands – Harmony Connection/Calalta Scenario 1 (Near-Term)

Service Area	Net Developable Area			Residential Population	Water Consumption		Average Day Demand				MDD		PHD	
	Residential	Non-Residential	Total		Residential	Non-Residential	Residential	Non-Residential	Total		(2 x ADD)		(4.0 x ADD)	
	ha	ha	ha	capita	L/p/d	L/s/ha	L/s	L/s	L/s	m^3/d	L/s	m^3/d	L/s	m^3/d
A	23.05	0.00	23.05	76	315	0.15	0.28	0.00	0.28	23.94	0.55	47.88	1.11	95.76
C	0.00	0.00	0.00	0	315	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0	315	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
D	0.00	20.26	20.26	0	315	0.15	0.00	4.34	4.34	375.03	8.68	750.06	17.36	1,500.12
E	0.00	21.77	21.77	0	315	0.15	0.00	4.66	4.66	403.02	9.33	806.04	18.66	1,612.08
F	0.00	0.62	0.62	0	315	0.15	0.00	0.13	0.13	11.50	0.27	23.00	0.53	46.00
G	0.00	111.78	111.78	0	315	0.15	0.00	23.95	23.95	2,069.46	47.90	4,138.92	95.81	8,277.84
H	62.41	0.00	62.41	625	315	0.15	2.28	0.00	2.28	196.88	4.56	393.75	9.11	787.50
I-1	0.00	0.00	0.00	0	315	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
I-2	0.00	0.00	0.00	0	315	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
I-3	0.00	0.00	0.00	0	315	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
I-4	0.00	0.00	0.00	0	315	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
J	25.64	25.27	50.91	684	315	0.15	2.49	5.42	7.91	683.36	15.82	1,366.72	31.64	2,733.44
K	40.20	37.84	78.04	2,145	315	0.15	7.82	8.11	15.93	1,376.24	31.86	2,752.48	63.71	5,504.96
Total	**151.31**	**217.53**	**368.84**	**3,530**			**12.87**	**46.61**	**59.48**	**5,139**	**118.97**	**10,279**	**237.94**	**20,558**
A	0.00	0.00	0.00	0	315	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B	40.44	0.00	40.44	540	315	0.15	1.97	0.00	1.97	170.10	3.94	340.20	7.88	680.40
C	0.00	0.00	0.00	0	315	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
D	0.00	72.61	72.61	0	315	0.15	0.00	15.56	15.56	1,344.38	31.12	2,688.76	62.24	5,377.52
E	0.00	0.00	0.00	0	315	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F	0.00	9.23	9.23	0	315	0.15	0.00	1.98	1.98	170.98	3.96	341.95	7.92	683.90
G	0.00	229.03	229.03	0	315	0.15	0.00	49.08	49.08	4,240.33	98.16	8,480.66	196.31	16,961.32
H	0.00	0.00	0.00	0	315	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
I-1	0.00	0.00	0.00	0	315	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
I-2	0.00	0.00	0.00	0	315	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
I-3	0.00	0.00	0.00	0	315	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
I-4	0.00	0.00	0.00	0	315	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
J	0.00	0.00	0.00	0	315	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
K	0.00	0.00	0.00	0	315	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Calalta	**40.44**	**310.88**	**351.32**	**540**			**1.97**	**66.62**	**68.59**	**5,926**	**137.17**	**11,852**	**274.34**	**23,703**
Total	**191.75**	**528.41**	**720.16**	**4,070**			**14.84**	**113.23**	**128.07**	**11,065**	**256.14**	**22,130**	**512.28**	**44,261**

Table 10.4: Estimated Study Area Water Demands – Harmony Connection/Calalta Scenario 2 (Near-Term)

Service Area	Net Developable Area			Residential Population	Water Consumption		Average Day Demand				MDD		PHD	
	Residential	Non-Residential	Total		Residential	Non-Residential	Residential	Non-Residential	Total		(2 x ADD)		(4.0 x ADD)	
	ha	ha	ha	capita	L/p/d	L/s/ha	L/s	L/s	L/s	m³/d	L/s	m³/d	L/s	m³/d
A	23.05	0.00	23.05	76	315	0.15	0.28	0.00	0.28	23.94	0.55	47.88	1.11	95.76
C	0.00	0.00	0.00	0	315	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0	315	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
D	0.00	20.26	20.26	0	315	0.15	0.00	4.34	4.34	375.03	8.68	750.06	17.36	1,500.12
E	0.00	21.77	21.77	0	315	0.15	0.00	4.66	4.66	403.02	9.33	806.04	18.66	1,612.08
F	0.00	0.62	0.62	0	315	0.15	0.00	0.13	0.13	11.50	0.27	23.00	0.53	46.00
G	0.00	111.78	111.78	0	315	0.15	0.00	23.95	23.95	2,069.46	47.90	4,138.92	95.81	8,277.84
H	62.41	0.00	62.41	625	315	0.15	2.28	0.00	2.28	196.88	4.56	393.75	9.11	787.50
I-1	0.00	0.00	0.00	0	315	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
I-2	0.00	0.00	0.00	0	315	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
I-3	0.00	0.00	0.00	0	315	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
I-4	0.00	0.00	0.00	0	315	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
J	25.64	25.27	50.91	684	315	0.15	2.49	5.42	7.91	683.36	15.82	1,366.72	31.64	2,733.44
K	40.20	37.84	78.04	2,145	315	0.15	7.82	8.11	15.93	1,376.24	31.86	2,752.48	63.71	5,504.96
Total	**151.31**	**217.53**	**368.84**	**3,530**			**12.87**	**46.61**	**59.48**	**5,139**	**118.97**	**10,279**	**237.94**	**20,558**
A	0.00	0.00	0.00	0	315	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
B	40.44	0.00	40.44	540	315	0.15	1.97	0.00	1.97	170.10	3.94	340.20	7.88	680.40
C	0.00	0.00	0.00	0	315	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
D	0.00	72.61	72.61	0	315	0.15	0.00	15.56	15.56	1,344.38	31.12	2,688.76	62.24	5,377.52
E	0.00	0.00	0.00	0	315	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
F	0.00	9.23	9.23	0	315	0.15	0.00	1.98	1.98	170.98	3.96	341.95	7.92	683.90
G	0.00	229.03	229.03	0	315	0.15	0.00	49.08	49.08	4,240.33	98.16	8,480.66	196.31	16,961.32
H	0.00	0.00	0.00	0	315	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
I-1	0.00	0.00	0.00	0	315	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
I-2	0.00	0.00	0.00	0	315	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
I-3	0.00	0.00	0.00	0	315	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
I-4	0.00	0.00	0.00	0	315	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
J	0.00	0.00	0.00	0	315	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
K	0.00	0.00	0.00	0	315	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Calalta	**40.44**	**310.88**	**351.32**	**540**			**1.97**	**66.62**	**68.59**	**5,926**	**137.17**	**11,852**	**274.34**	**23,703**
Total	**191.75**	**528.41**	**720.16**	**4,070**			**14.84**	**113.23**	**128.07**	**11,065**	**256.14**	**22,130**	**512.28**	**44,261**

Table 10.7: Estimated Study Area Wastewater Flows – Harmony Connection/Calalta Scenario 1 (Full Build-Out)

Service Area	Cumulative Developable Area			Cumulative Population	DWF Generation Rate		Average DWF				Peaking Factor		PDWF		I-I Rate	I-I Flow		Peak WWF	
	Res	Non-Res	Total		Res	Non-Res	Res	Non-Res	Total		Res	Non-Res							
	ha	ha	ha	capita	L/p/d	L/d/ha	L/s	L/s	L/s	m³/d			L/s	m³/d	L/s	L/s	m³/d	L/s	m³/d
A	75.53	0.00	75.53	251	255	10,368	0.7	0.0	0.7	64	4.1	0.0	3.0	263	0.28	21.1	1,827	24.2	2,090
B	75.53	0.00	75.53	251	255	10,368	0.7	0.0	0.7	64	4.5	0.0	3.3	288	0.28	21.1	1,827	24.5	2,115
C	164.52	266.99	431.52	2,626	255	10,368	7.8	32.0	39.8	3,438	3.5	3.7	146.5	12,657	0.28	120.8	10,439	267.3	23,096
D	164.52	287.25	451.77	2,626	255	10,368	7.8	34.5	42.2	3,648	4.5	3.7	161.5	13,955	0.28	126.5	10,929	288.0	24,884
E	164.52	309.02	473.54	2,626	255	10,368	7.8	37.1	44.8	3,874	4.5	3.6	169.4	14,640	0.28	132.6	11,456	302.0	26,096
F	164.52	314.34	478.87	2,626	255	10,368	7.8	37.7	45.5	3,929	4.5	3.6	171.4	14,807	0.28	134.1	11,585	305.5	26,391
G	164.52	426.12	590.64	2,626	255	10,368	7.8	51.1	58.9	5,088	4.5	3.5	213.8	18,476	0.28	165.4	14,289	379.2	32,765
H	286.48	426.12	712.60	3,847	255	10,368	11.4	51.1	62.5	5,399	3.7	3.5	221.5	19,134	0.28	199.5	17,239	421.0	36,373
I-1	429.03	455.64	884.68	11,455	255	10,368	33.8	54.7	88.5	7,645	3.1	3.5	295.2	25,506	0.28	247.7	21,402	542.9	46,908
I-2	459.28	473.38	932.67	13,070	255	10,368	38.6	56.8	95.4	8,241	3.7	3.5	339.9	29,363	0.28	261.1	22,563	601.0	51,927
I-3	597.75	473.38	1,071.14	20,461	255	10,368	60.4	56.8	117.2	10,126	3.1	3.5	385.0	33,268	0.28	299.9	25,913	685.0	59,181
I-4	616.85	473.38	1,090.24	21,480	255	10,368	63.4	56.8	120.2	10,385	3.8	3.5	439.4	37,963	0.28	305.3	26,375	744.7	64,338
J	642.49	498.66	1,141.15	22,164	255	10,368	65.4	59.8	125.3	10,822	3.9	3.5	464.6	40,139	0.28	319.5	27,607	784.1	67,746
K	768.91	536.50	1,305.41	28,911	255	10,368	85.3	64.4	149.7	12,935	2.5	3.5	438.6	37,899	0.28	365.5	31,580	804.2	69,480
Harmony	**768.91**	**536.50**	**1,305.41**	**28,911**	**255**	**10,368**	**85.3**	**64.4**	**149.7**	**12,935**	**2.5**	**3.5**	**438.6**	**37,899**	**0.28**	**365.5**	**31,580**	**804.2**	**69,480**
A	28.62	0.00	28.62	96	255	10,368	0.3	0.0	0.3	24	4.2	0.0	1.2	104	0.28	8.0	692	9.2	796
B	112.70	0.00	112.70	1,218	255	10,368	3.6	0.0	3.6	311	3.8	0.0	13.5	1,170	0.28	31.6	2,726	45.1	3,897
C	197.18	253.43	450.61	3,472	255	10,368	10.2	30.4	40.7	3,513	3.5	3.8	150.4	12,997	0.28	126.2	10,901	276.6	23,898
D	197.18	326.05	523.22	3,472	255	10,368	10.2	39.1	49.4	4,266	4.5	3.6	186.8	16,142	0.28	146.5	12,658	333.3	28,800
E	197.18	326.05	523.22	3,472	255	10,368	10.2	39.1	49.4	4,266	4.5	3.6	186.8	16,142	0.28	146.5	12,658	333.3	28,800
F	197.18	467.89	665.07	3,472	255	10,368	10.2	56.1	66.4	5,736	4.5	3.5	242.6	20,963	0.28	186.2	16,089	428.8	37,052
G	197.18	696.92	894.10	3,472	255	10,368	10.2	83.6	93.9	8,111	4.5	3.5	338.8	29,274	0.28	250.3	21,630	589.2	50,904
H	197.18	696.92	894.10	3,472	255	10,368	10.2	83.6	93.9	8,111	4.5	3.5	338.8	29,274	0.28	250.3	21,630	589.2	50,904
I-1	197.18	696.92	894.10	3,472	255	10,368	10.2	83.6	93.9	8,111	4.5	3.5	338.8	29,274	0.28	250.3	21,630	589.2	50,904
I-2	197.18	696.92	894.10	3,472	255	10,368	10.2	83.6	93.9	8,111	4.5	3.5	338.8	29,274	0.28	250.3	21,630	589.2	50,904
I-3	197.18	696.92	894.10	3,472	255	10,368	10.2	83.6	93.9	8,111	4.5	3.5	338.8	29,274	0.28	250.3	21,630	589.2	50,904
I-4	197.18	696.92	894.10	3,472	255	10,368	10.2	83.6	93.9	8,111	4.5	3.5	338.8	29,274	0.28	250.3	21,630	589.2	50,904
J	197.18	696.92	894.10	3,472	255	10,368	10.2	83.6	93.9	8,111	4.5	3.5	338.8	29,274	0.28	250.3	21,630	589.2	50,904
K	197.18	696.92	894.10	3,472	255	10,368	10.2	83.6	93.9	8,111	4.5	3.5	338.8	29,274	0.28	250.3	21,630	589.2	50,904
Calalta	**197.18**	**696.92**	**894.10**	**3,472**			**10.2**	**83.6**	**93.9**	**8,111**			**338.8**	**29,274**		**250.3**	**21,630**	**589.2**	**50,904**
Total	**966.09**	**1,233.41**	**2,199.51**	**32,383**			**95.6**	**148.0**	**243.6**	**21,046**			**777.5**	**67,173**		**615.7**	**53,210.5**	**1,393.3**	**120,384**

Table 10.8: Estimated Study Area Wastewater Flows – Harmony Connection/Calalta Scenario 2 (Full Build-Out)

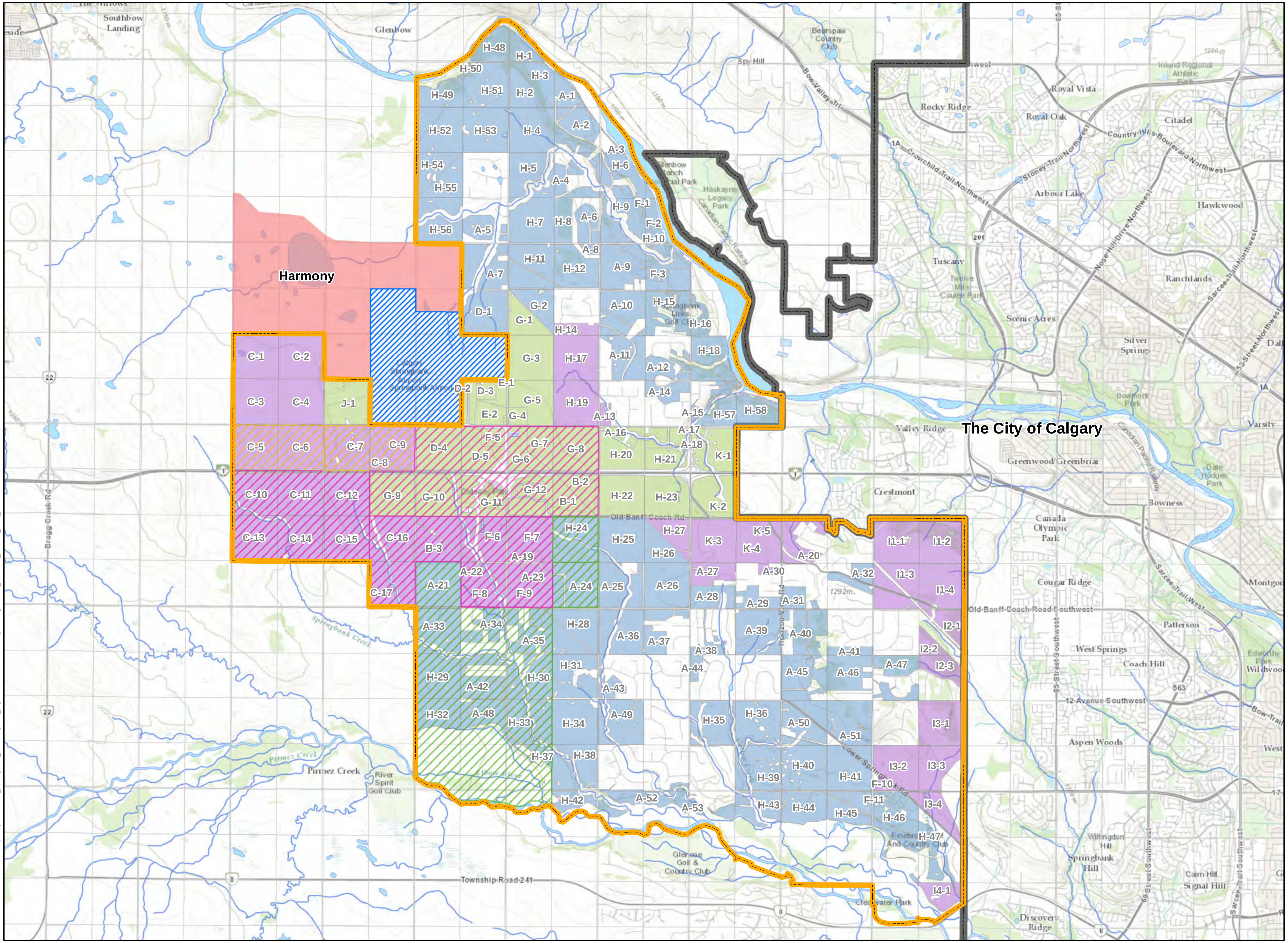
Service Area	Cumulative Developable Area			Cumulative Population	DWF Generation Rate		Average DWF				Peaking Factor		PDWF		I-I Rate	I-I Flow		Peak WWF	
	Res	Non-Res	Total		Res	Non-Res	Res	Non-Res	Total		Res	Non-Res							
	ha	ha	ha	capita	L/p/d	L/d/ha	L/s	L/s	L/s	m³/d			L/s	m³/d	L/s	L/s	m³/d	L/s	m³/d
A	75.53	0.00	75.53	251	255	10,368	0.7	0.0	0.7	64	4.1	0.0	3.0	263	0.28	21.1	1,827	24.2	2,090
B	75.53	0.00	75.53	251	255	10,368	0.7	0.0	0.7	64	4.5	0.0	3.3	288	0.28	21.1	1,827	24.5	2,115
C	120.78	135.77	256.56	1,459	255	10,368	7.8	32.0	39.8	3,438	3.7	4.2	84.0	7,259	0.28	71.8	6,207	155.9	13,466
D	120.78	156.03	276.81	1,459	255	10,368	7.8	34.5	42.2	3,648	4.5	4.1	95.6	8,259	0.28	77.5	6,697	173.1	14,956
E	120.78	177.80	298.58	1,459	255	10,368	7.8	37.1	44.8	3,874	4.5	4.0	104.3	9,015	0.28	83.6	7,223	187.9	16,238
F	120.78	183.12	303.91	1,459	255	10,368	7.8	37.7	45.5	3,929	4.5	4.0	106.5	9,197	0.28	85.1	7,352	191.5	16,550
G	120.78	294.90	415.68	1,459	255	10,368	7.8	51.1	58.9	5,088	4.5	3.7	148.8	12,858	0.28	116.4	10,056	265.2	22,914
H	286.48	426.12	712.60	3,847	255	10,368	11.4	51.1	62.5	5,399	3.7	3.5	221.5	19,134	0.28	199.5	17,239	421.0	36,373
I-1	429.03	455.64	884.68	11,455	255	10,368	33.8	54.7	88.5	7,645	3.1	3.5	295.2	25,506	0.28	247.7	21,402	542.9	46,908
I-2	459.28	473.38	932.67	13,070	255	10,368	38.6	56.8	95.4	8,241	3.7	3.5	339.9	29,363	0.28	261.1	22,563	601.0	51,927
I-3	597.75	473.38	1,071.14	20,461	255	10,368	60.4	56.8	117.2	10,126	3.1	3.5	385.0	33,268	0.28	299.9	25,913	685.0	59,181
I-4	616.85	473.38	1,090.24	21,480	255	10,368	63.4	56.8	120.2	10,385	3.8	3.5	439.4	37,963	0.28	305.3	26,375	744.7	64,338
J	642.49	498.66	1,141.15	22,164	255	10,368	65.4	59.8	125.3	10,822	3.9	3.5	464.6	40,139	0.28	319.5	27,607	784.1	67,746
K	768.91	536.50	1,305.41	28,911	255	10,368	85.3	64.4	149.7	12,935	2.5	3.5	438.6	37,899	0.28	365.5	31,580	804.2	69,480
Harmony	**768.91**	**536.50**	**1,305.41**	**28,911**	**255**	**10,368**	**85.3**	**64.4**	**149.7**	**12,935**	**2.5**	**3.5**	**438.6**	**37,899**	**0.28**	**365.5**	**31,580**	**804.2**	**69,480**
A	28.62	0.00	28.62	96	255	10,368	0.3	0.0	0.3	24	4.2	0.0	1.2	104	0.28	8.0	692	9.2	796
B	112.70	0.00	112.70	1,218	255	10,368	3.6	0.0	3.6	311	3.8	0.0	13.5	1,170	0.28	31.6	2,726	45.1	3,897
C	240.92	384.65	625.57	4,639	255	10,368	13.7	46.2	59.8	5,171	3.4	3.5	208.0	17,972	0.28	175.2	15,134	383.2	33,106
D	240.92	457.27	698.18	4,639	255	10,368	13.7	54.9	68.6	5,924	4.5	3.5	253.7	21,917	0.28	195.5	16,890	449.2	38,807
E	240.92	457.27	698.18	4,639	255	10,368	13.7	54.9	68.6	5,924	4.5	3.5	253.7	21,917	0.28	195.5	16,890	449.2	38,807
F	240.92	599.11	840.03	4,639	255	10,368	13.7	71.9	85.6	7,394	4.5	3.5	313.2	27,064	0.28	235.2	20,322	548.4	47,386
G	240.92	828.14	1,069.06	4,639	255	10,368	13.7	99.4	113.1	9,769	4.5	3.5	409.4	35,375	0.28	299.3	25,863	708.8	61,237
H	240.92	828.14	1,069.06	4,639	255	10,368	13.7	99.4	113.1	9,769	4.5	3.5	409.4	35,375	0.28	299.3	25,863	708.8	61,237
I-1	240.92	828.14	1,069.06	4,639	255	10,368	13.7	99.4	113.1	9,769	4.5	3.5	409.4	35,375	0.28	299.3	25,863	708.8	61,237
I-2	240.92	828.14	1,069.06	4,639	255	10,368	13.7	99.4	113.1	9,769	4.5	3.5	409.4	35,375	0.28	299.3	25,863	708.8	61,237
I-3	240.92	828.14	1,069.06	4,639	255	10,368	13.7	99.4	113.1	9,769	4.5	3.5	409.4	35,375	0.28	299.3	25,863	708.8	61,237
I-4	240.92	828.14	1,069.06	4,639	255	10,368	13.7	99.4	113.1	9,769	4.5	3.5	409.4	35,375	0.28	299.3	25,863	708.8	61,237
J	240.92	828.14	1,069.06	4,639	255	10,368	13.7	99.4	113.1	9,769	4.5	3.5	409.4	35,375	0.28	299.3	25,863	708.8	61,237
K	240.92	828.14	1,069.06	4,639	255	10,368	13.7	99.4	113.1	9,769	4.5	3.5	409.4	35,375	0.28	299.3	25,863	708.8	61,237
Calalta	**240.92**	**828.14**	**1,069.06**	**4,639**			**13.7**	**99.4**	**113.1**	**9,769**			**409.4**	**35,375**		**299.3**	**25,863**	**708.8**	**61,237**
Total	**966.09**	**1,233.41**	**2,199.51**	**32,383**			**95.6**	**148.0**	**243.6**	**21,046**			**777.5**	**67,173**		**615.9**	**53,210**	**1,393.3**	**120,384**

Table 10.9: Estimated Study Area Wastewater Flows – Harmony Connection/Calalta Scenario 1 (Near-Term)

Service Area	Cumulative Developable Area			Cumulative Population	DWF Generation Rate		Average DWF				Peaking Factor		PDWF		I-I Rate	I-I Flow		Peak WWF	
	Res	Non-Res	Total		Res	Non-Res	Res	Non-Res	Total		Res	Non-Res							
	ha	ha	ha	capita	L/p/d	L/d/ha	L/s	L/s	L/s	m^3/d			L/s	m^3/d	L/s	L/s	m^3/d	L/s	m^3/d
A	23.05	0.00	23.05	76	255	10,368	0.2	0.0	0.2	19	4.3	0.0	1.0	83	0.28	6.5	558	7.4	641
B	23.05	0.00	23.05	76	255	10,368	0.2	0.0	0.2	19	4.5	0.0	1.0	87	0.28	6.5	558	7.5	645
C	23.05	0.00	23.05	76	255	10,368	0.2	0.0	0.2	19	4.5	0.0	1.0	87	0.28	6.5	558	7.5	645
D	23.05	20.26	43.31	76	255	10,368	0.2	2.4	2.7	229	4.5	5.7	15.0	1,292	0.28	12.1	1,048	27.1	2,340
E	23.05	42.02	65.08	76	255	10,368	0.2	5.0	5.3	455	4.5	5.1	26.6	2,298	0.28	18.2	1,574	44.8	3,872
F	23.05	42.65	65.70	76	255	10,368	0.2	5.1	5.3	462	4.5	5.1	26.9	2,325	0.28	18.4	1,589	45.3	3,915
G	23.05	154.42	177.48	76	255	10,368	0.2	18.5	18.8	1,620	4.5	4.1	76.6	6,616	0.28	49.7	4,294	126.3	10,909
H	85.47	154.42	239.89	701	255	10,368	2.1	18.5	20.6	1,780	3.9	4.1	83.7	7,230	0.28	67.2	5,803	150.8	13,033
I-1	85.47	154.42	239.89	701	255	10,368	2.1	18.5	20.6	1,780	4.5	4.1	84.9	7,333	0.28	67.2	5,803	152.0	13,136
I-2	85.47	154.42	239.89	701	255	10,368	2.1	18.5	20.6	1,780	4.5	4.1	84.9	7,333	0.28	67.2	5,803	152.0	13,136
I-3	85.47	154.42	239.89	701	255	10,368	2.1	18.5	20.6	1,780	4.5	4.1	84.9	7,333	0.28	67.2	5,803	152.0	13,136
I-4	85.47	154.42	239.89	701	255	10,368	2.1	18.5	20.6	1,780	4.5	4.1	84.9	7,333	0.28	67.2	5,803	152.0	13,136
J	111.11	179.69	290.80	1,385	255	10,368	4.1	21.6	25.7	2,216	3.9	4.0	101.7	8,783	0.28	81.4	7,035	183.1	15,818
K	151.31	217.53	368.84	3,530	255	10,368	10.4	26.1	36.5	3,156	3.6	3.8	137.6	11,888	0.28	103.3	8,923	240.9	20,811
Harmony	**151.31**	**217.53**	**368.84**	**3,530**	**255**	**10,368**	**10.4**	**26.1**	**36.5**	**3,156**	**3.6**	**3.8**	**137.6**	**11,888**	**0.28**	**103.3**	**8,923**	**240.9**	**20,811**
A	0.00	0.00	0.00	0	255	10,368	0.0	0.0	0.0	0	4.5	0.0	0.0	0	0.28	0.0	0	0.0	0
B	40.44	0.00	40.44	540	255	10,368	1.6	0.0	1.6	138	4.0	0.0	6.3	545	0.28	11.3	978	17.6	1,523
C	40.44	0.00	40.44	540	255	10,368	1.6	0.0	1.6	138	4.5	0.0	7.2	620	0.28	11.3	978	18.5	1,598
D	40.44	72.61	113.06	540	255	10,368	1.6	8.7	10.3	891	4.5	4.6	47.5	4,104	0.28	31.7	2,735	79.2	6,839
E	40.44	72.61	113.06	540	255	10,368	1.6	8.7	10.3	891	4.5	4.6	47.5	4,104	0.28	31.7	2,735	79.2	6,839
F	40.44	81.85	122.29	540	255	10,368	1.6	9.8	11.4	986	4.5	4.5	51.7	4,469	0.28	34.2	2,958	86.0	7,428
G	40.44	310.88	351.32	540	255	10,368	1.6	37.3	38.9	3,361	4.5	3.6	142.4	12,305	0.28	98.4	8,499	240.8	20,804
H	40.44	310.88	351.32	540	255	10,368	1.6	37.3	38.9	3,361	4.5	3.6	142.4	12,305	0.28	98.4	8,499	240.8	20,804
I-1	40.44	310.88	351.32	540	255	10,368	1.6	37.3	38.9	3,361	4.5	3.6	142.4	12,305	0.28	98.4	8,499	240.8	20,804
I-2	40.44	310.88	351.32	540	255	10,368	1.6	37.3	38.9	3,361	4.5	3.6	142.4	12,305	0.28	98.4	8,499	240.8	20,804
I-3	40.44	310.88	351.32	540	255	10,368	1.6	37.3	38.9	3,361	4.5	3.6	142.4	12,305	0.28	98.4	8,499	240.8	20,804
I-4	40.44	310.88	351.32	540	255	10,368	1.6	37.3	38.9	3,361	4.5	3.6	142.4	12,305	0.28	98.4	8,499	240.8	20,804
J	40.44	310.88	351.32	540	255	10,368	1.6	37.3	38.9	3,361	4.5	3.6	142.4	12,305	0.28	98.4	8,499	240.8	20,804
K	40.44	310.88	351.32	540	255	10,368	1.6	37.3	38.9	3,361	4.5	3.6	142.4	12,305	0.28	98.4	8,499	240.8	20,804
Calalta	**40.44**	**310.88**	**351.32**	**540**			**1.6**	**37.3**	**38.9**	**3,361**			**142.4**	**12,305**		**98.4**	**8,499**	**240.8**	**20,804**
Total	**191.75**	**528.41**	**720.16**	**4,070**			**12.0**	**63.4**	**75.4**	**6,516**			**280.0**	**24,193**		**201.6**	**17,422**	**481.7**	**41,615**

Table 10.10: Estimated Study Area Wastewater Flows – Harmony Connection/Calalta Scenario 2 (Near-Term)

Service Area	Cumulative Developable Area			Cumulative Population	DWF Generation Rate		Average DWF				Peaking Factor		PDWF		I-I Rate	I-I Flow		Peak WWF	
	Res	Non-Res	Total		Res	Non-Res	Res	Non-Res	Total		Res	Non-Res							
	ha	ha	ha	capita	L/p/d	L/d/ha	L/s	L/s	L/s	m³/d			L/s	m³/d	L/s	L/s	m³/d	L/s	m³/d
A	23.05	0.00	23.05	76	255	10,368	0.2	0.0	0.2	19	4.3	0.0	1.0	83	0.28	6.5	558	7.4	641
B	23.05	0.00	23.05	76	255	10,368	0.2	0.0	0.2	19	4.5	0.0	1.0	87	0.28	6.5	558	7.5	645
C	23.05	0.00	23.05	76	255	10,368	0.2	0.0	0.2	19	4.5	0.0	1.0	87	0.28	6.5	558	7.5	645
D	23.05	20.26	43.31	76	255	10,368	0.2	2.4	2.7	229	4.5	5.7	15.0	1,292	0.28	12.1	1,048	27.1	2,340
E	23.05	42.02	65.08	76	255	10,368	0.2	5.0	5.3	455	4.5	5.1	26.6	2,298	0.28	18.2	1,574	44.8	3,872
F	23.05	42.65	65.70	76	255	10,368	0.2	5.1	5.3	462	4.5	5.1	26.9	2,325	0.28	18.4	1,589	45.3	3,915
G	23.05	154.42	177.48	76	255	10,368	0.2	18.5	18.8	1,620	4.5	4.1	76.6	6,616	0.28	49.7	4,294	126.3	10,909
H	85.47	154.42	239.89	701	255	10,368	2.1	18.5	20.6	1,780	3.9	4.1	83.7	7,230	0.28	67.2	5,803	150.8	13,033
I-1	85.47	154.42	239.89	701	255	10,368	2.1	18.5	20.6	1,780	4.5	4.1	84.9	7,333	0.28	67.2	5,803	152.0	13,136
I-2	85.47	154.42	239.89	701	255	10,368	2.1	18.5	20.6	1,780	4.5	4.1	84.9	7,333	0.28	67.2	5,803	152.0	13,136
I-3	85.47	154.42	239.89	701	255	10,368	2.1	18.5	20.6	1,780	4.5	4.1	84.9	7,333	0.28	67.2	5,803	152.0	13,136
I-4	85.47	154.42	239.89	701	255	10,368	2.1	18.5	20.6	1,780	4.5	4.1	84.9	7,333	0.28	67.2	5,803	152.0	13,136
J	111.11	179.69	290.80	1,385	255	10,368	4.1	21.6	25.7	2,216	3.9	4.0	101.7	8,783	0.28	81.4	7,035	183.1	15,818
K	151.31	217.53	368.84	3,530	255	10,368	10.4	26.1	36.5	3,156	3.6	3.8	137.6	11,888	0.28	103.3	8,923	240.9	20,811
Harmony	**151.31**	**217.53**	**368.84**	**3,530**	**255**	**10,368**	**10.4**	**26.1**	**36.5**	**3,156**	**3.6**	**3.8**	**137.6**	**11,888**	**0.28**	**103.3**	**8,923**	**240.9**	**20,811**
A	0.00	0.00	0.00	0	255	10,368	0.0	0.0	0.0	0	4.5	0.0	0.0	0	0.28	0.0	0	0.0	0
B	40.44	0.00	40.44	540	255	10,368	1.6	0.0	1.6	138	4.0	0.0	6.3	545	0.28	11.3	978	17.6	1,523
C	40.44	0.00	40.44	540	255	10,368	1.6	0.0	1.6	138	4.5	0.0	7.2	620	0.28	11.3	978	18.5	1,598
D	40.44	72.61	113.06	540	255	10,368	1.6	8.7	10.3	891	4.5	4.6	47.5	4,104	0.28	31.7	2,735	79.2	6,839
E	40.44	72.61	113.06	540	255	10,368	1.6	8.7	10.3	891	4.5	4.6	47.5	4,104	0.28	31.7	2,735	79.2	6,839
F	40.44	81.85	122.29	540	255	10,368	1.6	9.8	11.4	986	4.5	4.5	51.7	4,469	0.28	34.2	2,958	86.0	7,428
G	40.44	310.88	351.32	540	255	10,368	1.6	37.3	38.9	3,361	4.5	3.6	142.4	12,305	0.28	98.4	8,499	240.8	20,804
H	40.44	310.88	351.32	540	255	10,368	1.6	37.3	38.9	3,361	4.5	3.6	142.4	12,305	0.28	98.4	8,499	240.8	20,804
I-1	40.44	310.88	351.32	540	255	10,368	1.6	37.3	38.9	3,361	4.5	3.6	142.4	12,305	0.28	98.4	8,499	240.8	20,804
I-2	40.44	310.88	351.32	540	255	10,368	1.6	37.3	38.9	3,361	4.5	3.6	142.4	12,305	0.28	98.4	8,499	240.8	20,804
I-3	40.44	310.88	351.32	540	255	10,368	1.6	37.3	38.9	3,361	4.5	3.6	142.4	12,305	0.28	98.4	8,499	240.8	20,804
I-4	40.44	310.88	351.32	540	255	10,368	1.6	37.3	38.9	3,361	4.5	3.6	142.4	12,305	0.28	98.4	8,499	240.8	20,804
J	40.44	310.88	351.32	540	255	10,368	1.6	37.3	38.9	3,361	4.5	3.6	142.4	12,305	0.28	98.4	8,499	240.8	20,804
K	40.44	310.88	351.32	540	255	10,368	1.6	37.3	38.9	3,361	4.5	3.6	142.4	12,305	0.28	98.4	8,499	240.8	20,804
Calalta	**40.44**	**310.88**	**351.32**	**540**			**1.6**	**37.3**	**38.9**	**3,361**			**142.4**	**12,305**		**98.4**	**8,499**	**240.8**	**20,804**
Total	**191.75**	**528.41**	**720.16**	**4,070**			**12.0**	**63.4**	**75.4**	**6,516**			**280.0**	**24,193**		**201.6**	**17,422**	**481.7**	**41,615**



Legend

- Watercourse
- Water Body
- Near-Term Service Area
- Full Build-Out Service Area
- Not Serviced Area
- Calalta Exclusive Service Area
- Calalta Non-Exclusive Service Area
- Calalta Exclusive Area within ASP Boundary
- Harmony Development
- Springbank Airport
- City of Calgary Boundary
- Study Area

Coordinate System:
CANA83-3TM114

1:65,000

0 750 1,500 3,000 Meters

FIGURE 10.1
CALALTA FRANCHISE SERVICE AREA
SPRINGBANK AREA STRUCTURE PLAN
SERVICING STRATEGY

ROCKY VIEW COUNTY
Cultivating Communities

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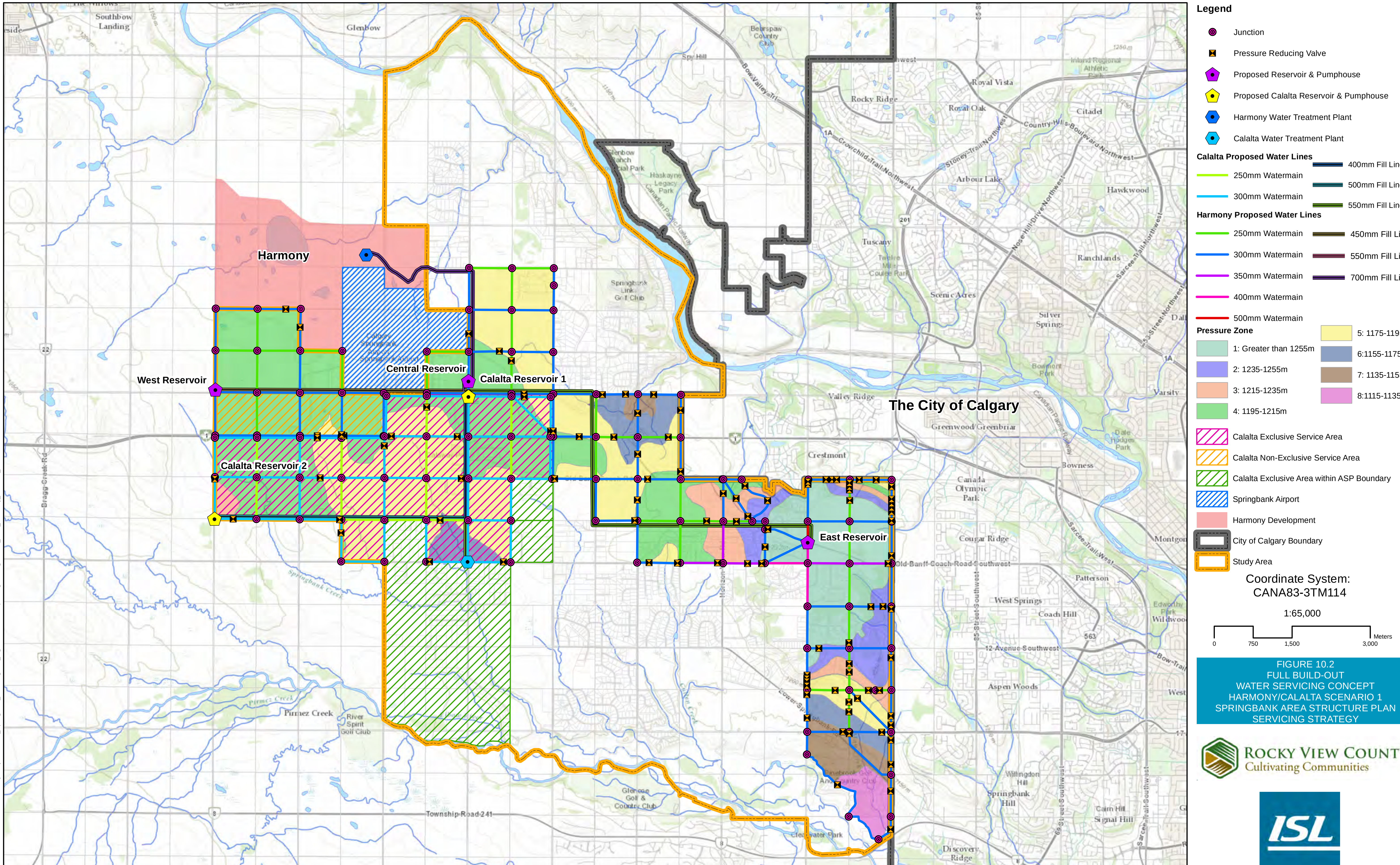

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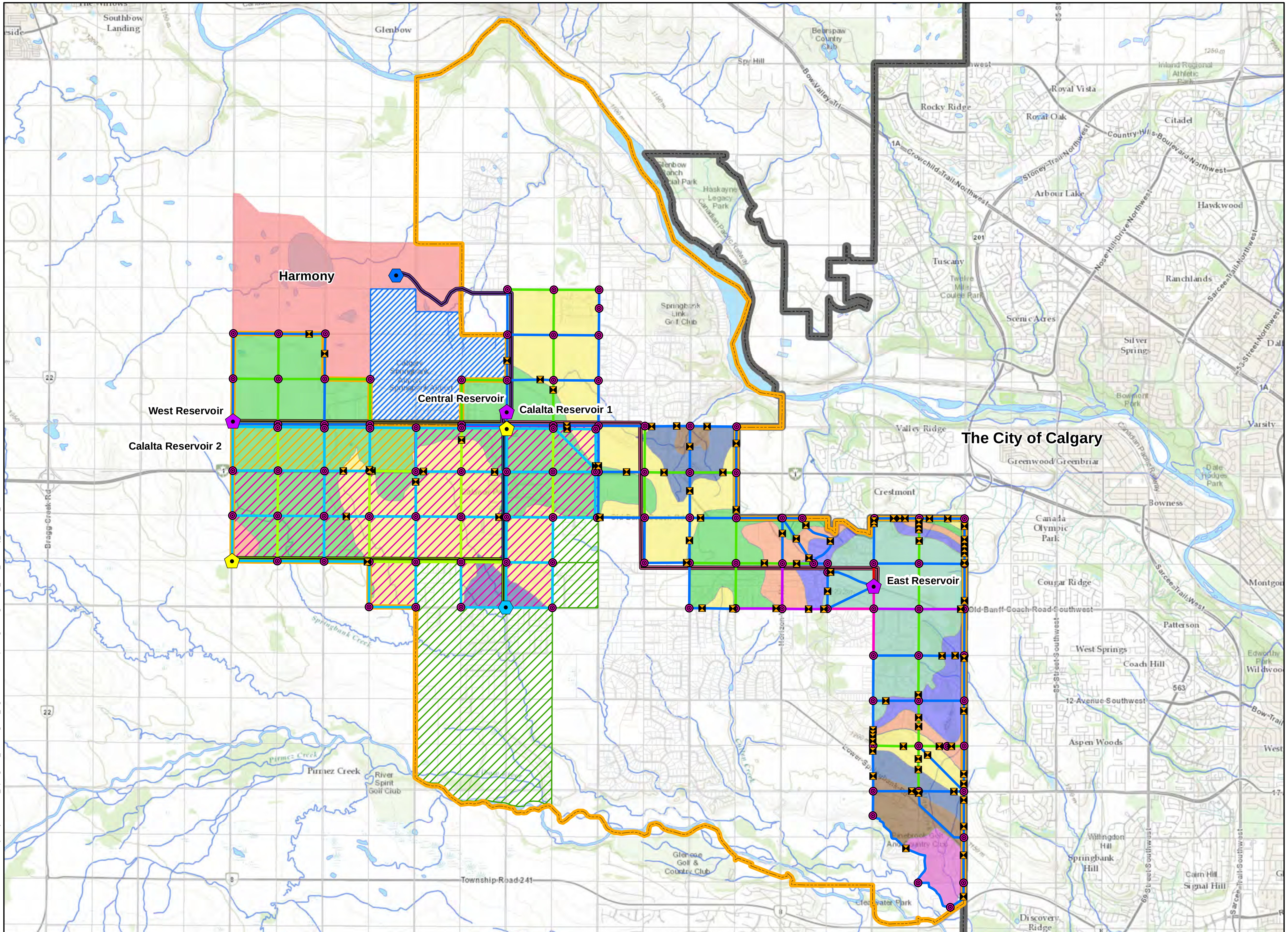

Legend

- Junctions
- Pressure Reducing Valve
- Proposed Reservoir & Pumphouse
- Proposed Calalta Reservoir & Pumphouse
- Harmony Water Treatment Plant
- Cal-Alta Water Treatment Plant

Calalta Proposed Water Lines

- 250mm Watermain
- 300mm Watermain
- 300mm Fill Line
- 550mm Fill Line
- 700mm Fill Line

Harmony Proposed Water Lines

- 250mm Watermain
- 300mm Watermain
- 350mm Watermain
- 400mm Watermain
- 500mm Watermain
- 350mm Fill Line
- 550mm Fill Line
- 700mm Fill Line

Pressure Zone

- 1: Greater than 1255m
- 2: 1235-1255m
- 3: 1215-1235m
- 4: 1195-1215m
- 5: 1175-1195m
- 6:1155-1175m
- 7: 1135-1155m
- 8:1115-1135m
- Calalta Exclusive Service Area
- Calalta Non-Exclusive Service Area
- Calalta Exclusive Area within ASP Boundary
- Springbank Airport
- Harmony Development
- City of Calgary Boundary
- Study Area

Coordinate System: CANA83-3TM114

1:65,000

0 750 1,500 3,000 Meters

FIGURE 10.3
FULL BUILD-OUT
WATER SERVICING CONCEPT
HARMONY/CALALTA SCENARIO 2
SPRINGBANK AREA STRUCTURE PLAN
SERVICING STRATEGY

Rocky View County
Cultivating Communities

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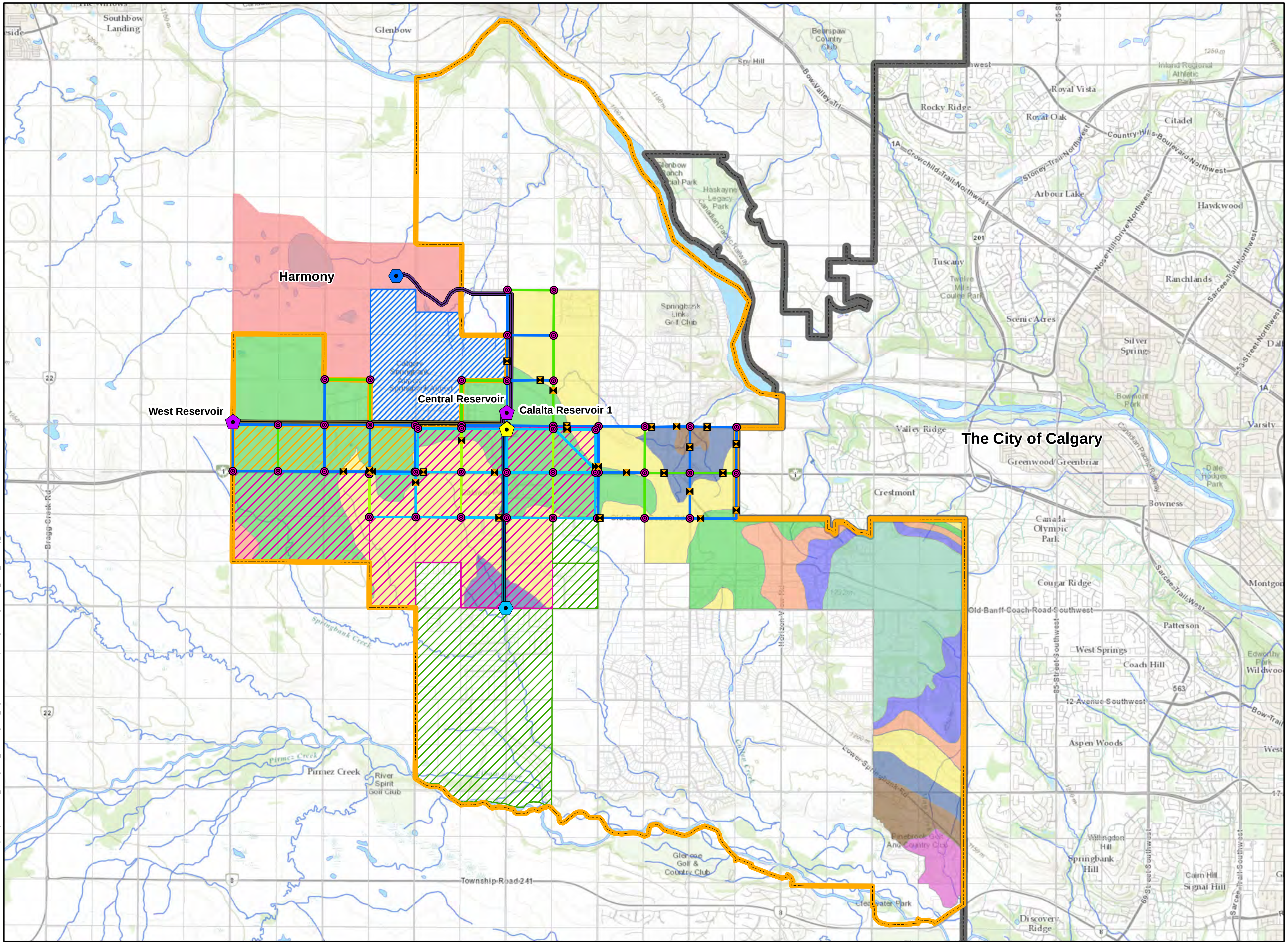

FIGURE 10.4
NEAR-TERM
WATER SERVICING CONCEPT
HARMONY/CALALTA SCENARIO 1
SPRINGBANK AREA STRUCTURE PLAN
SERVICING STRATEGY

ROCKY VIEW COUNTY
Cultivating Communities

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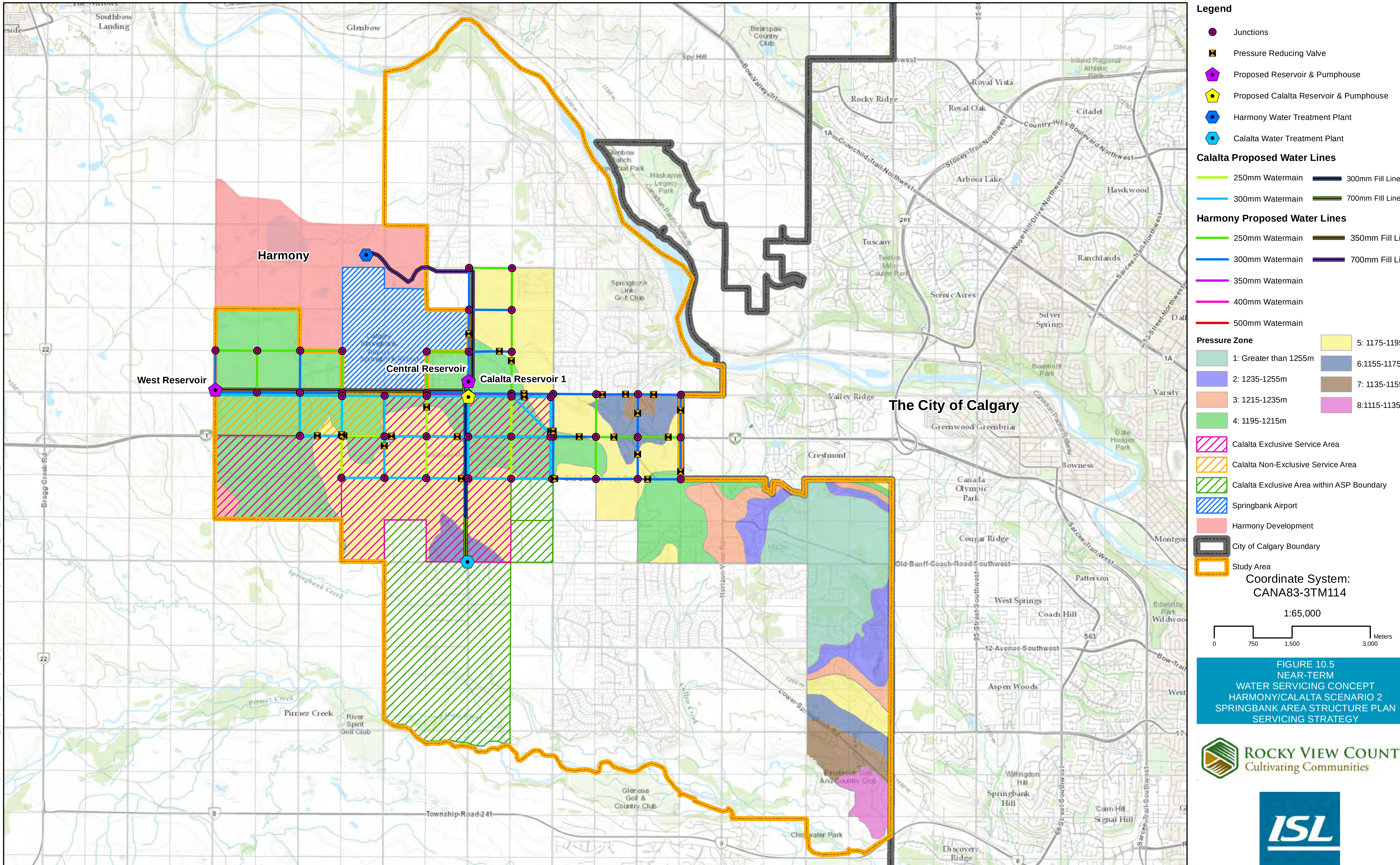

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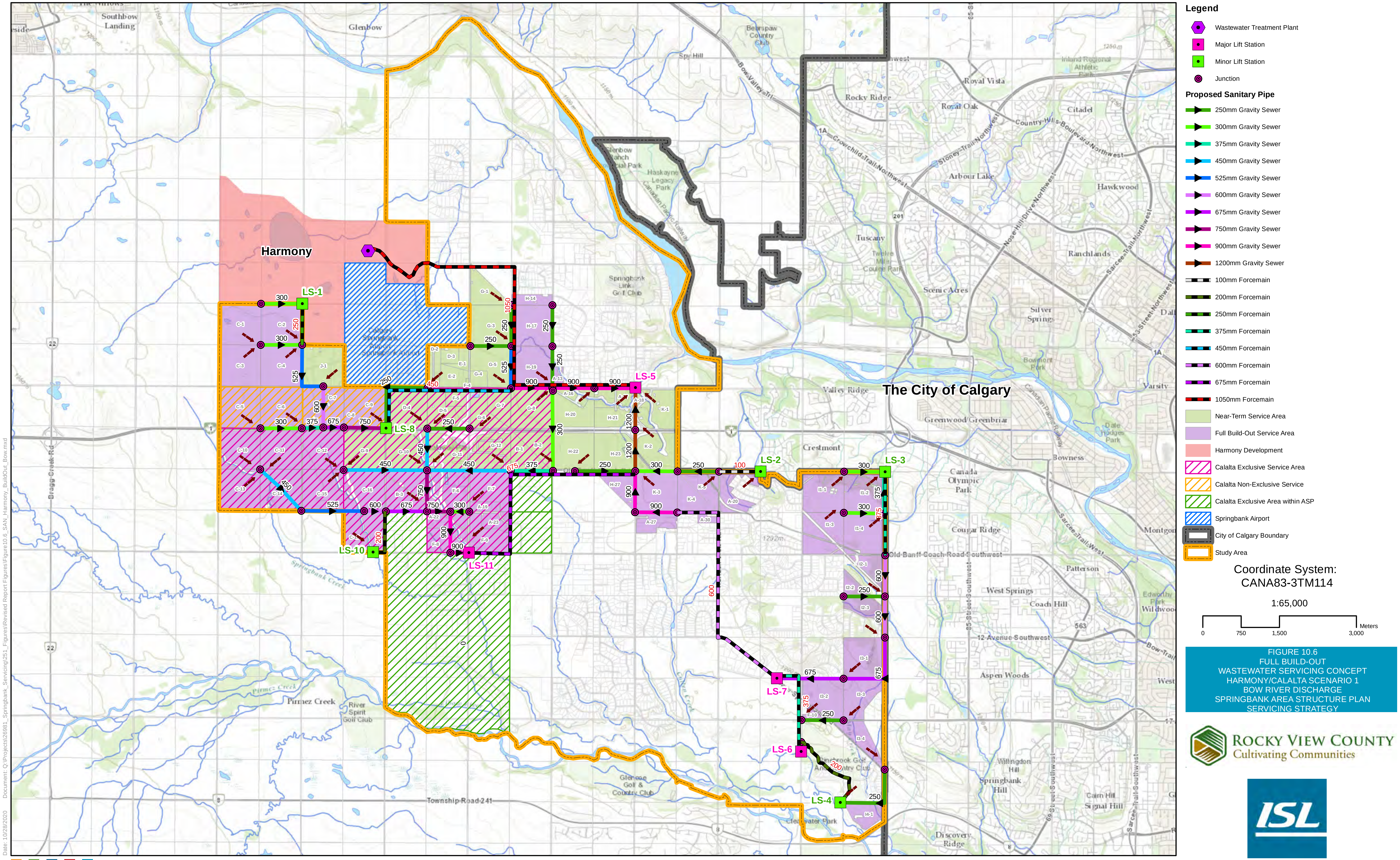

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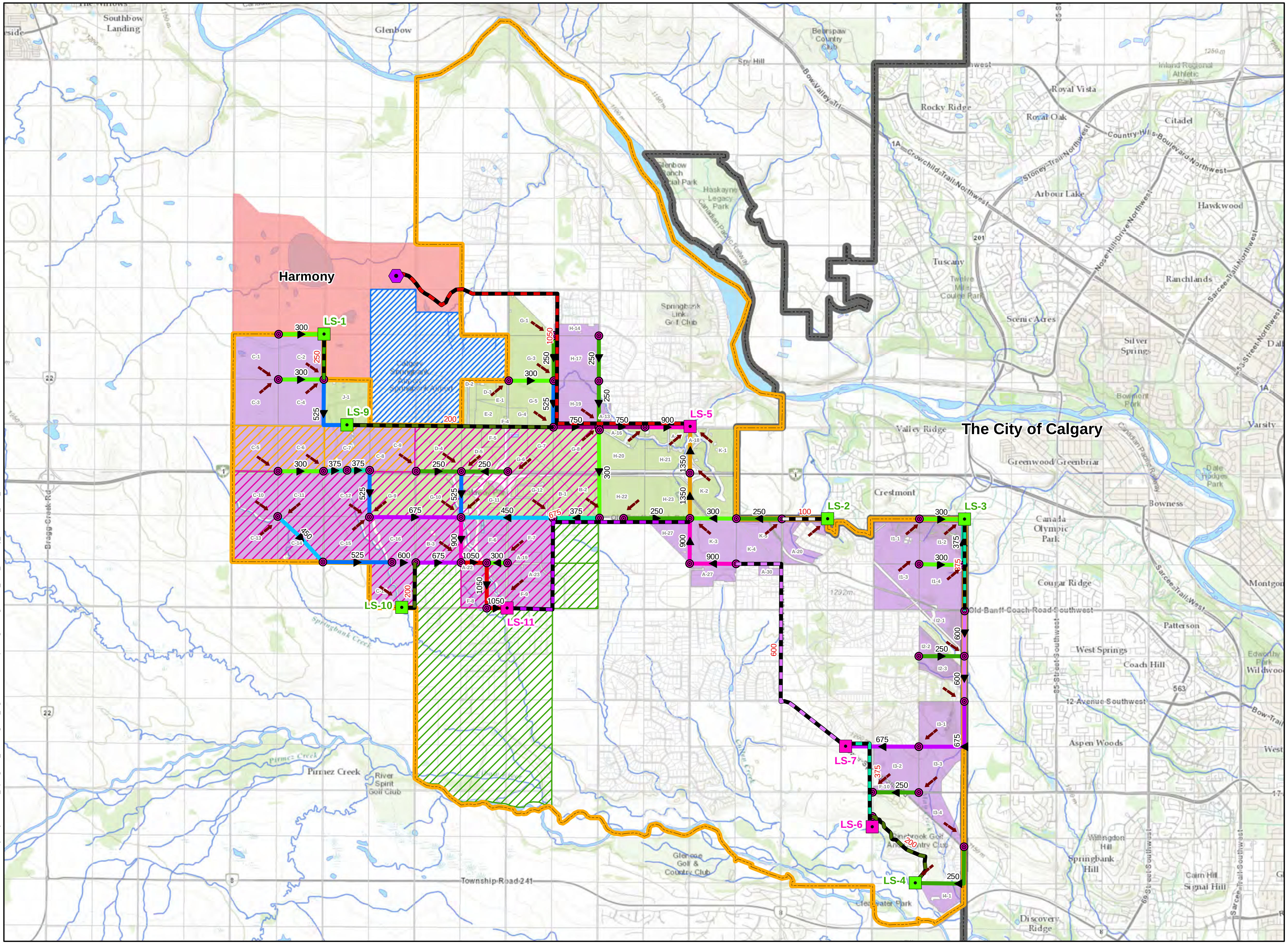

FIGURE 10.7
FULL BUILD-OUT
WASTEWATER SERVICING CONCEPT
HARMONY/CALALTA SCENARIO 2
BOW RIVER DISCHARGE
SPRINGBANK AREA STRUCTURE PLAN
SERVICING STRATEGY

ROCKY VIEW COUNTY
Cultivating Communities

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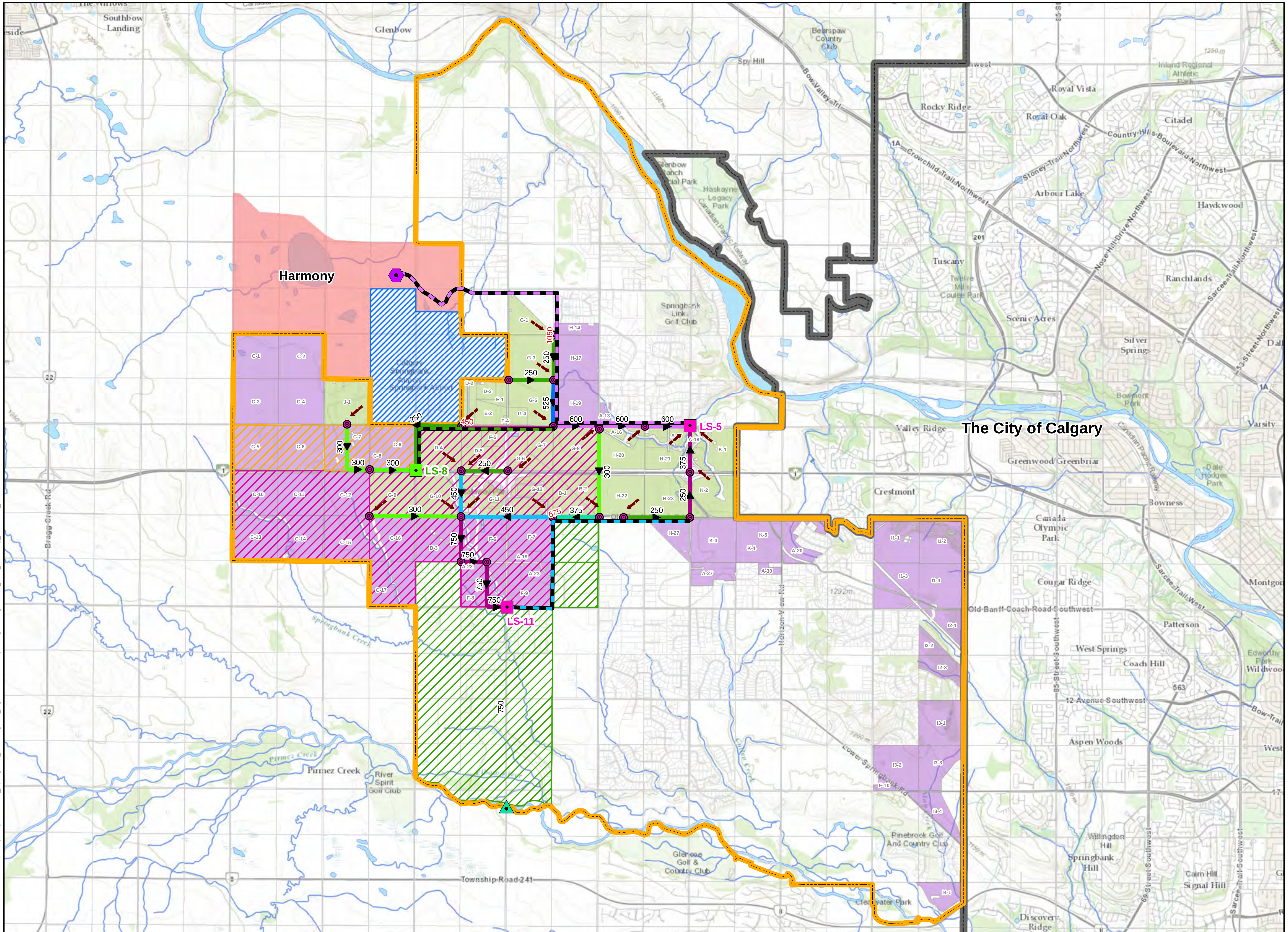

Legend

- Wastewater Treatment Plant
- Major Lift Station
- Minor Lift Station
- Junction

Proposed Sanitary Pipe

- 250mm Gravity Sewer
- 300mm Gravity Sewer
- 375mm Gravity Sewer
- 450mm Gravity Sewer
- 525mm Gravity Sewer
- 600mm Gravity Sewer
- 675mm Gravity Sewer
- 750mm Gravity Sewer
- 250mm Forcemain
- 450mm Forcemain
- 600mm Forcemain
- Near-Term Service
- Full Build-Out Service
- Harmony Development
- Calalta Exclusive Service
- Calalta Non-Exclusive Service
- Calalta Exclusive Area within ASP Boundary
- Springbank
- City of Calgary Boundary
- Study Area

Coordinate System: CANA83-3TM114

1:65,000

0 750 1,500 3,000 Meters

FIGURE 10.8
NEAR-TERM
WASTEWATER SERVICING CONCEPT
HARMONY/CALALTA SCENARIO 1
BOW RIVER DISCHARGE
SPRINGBANK AREA STRUCTURE PLAN
SERVICING STRATEGY

ROCKY VIEW COUNTY
Cultivating Communities

ISL

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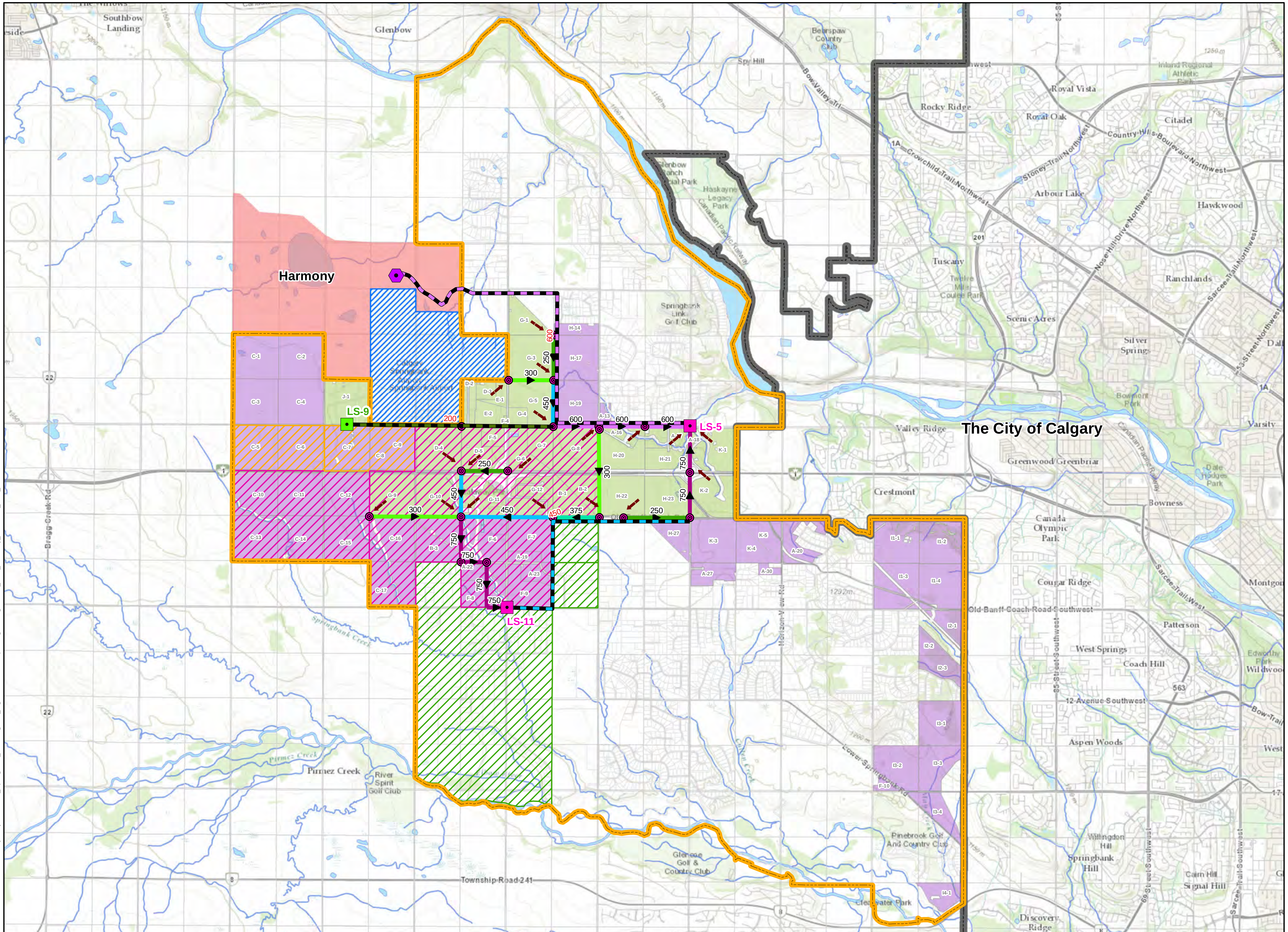

Legend

- Wastewater Treatment Plant
- Major Lift Station
- Minor Lift Station
- Junction

Proposed Sanitary Pipe

- 250mm Gravity Sewer
- 300mm Gravity Sewer
- 375mm Gravity Sewer
- 450mm Gravity Sewer
- 525mm Gravity Sewer
- 600mm Gravity Sewer
- 675mm Gravity Sewer
- 750mm Gravity Sewer
- 200mm Forcemain
- 450mm Forcemain
- 600mm Forcemain
- Near-Term Service
- Full Build-Out Service
- Harmony Development
- Calalta Exclusive Service
- Calalta Non-Exclusive Service
- Calalta Exclusive Area within ASP
- Springbank
- City of Calgary Boundary
- Study Area

Coordinate System: CANA83-3TM114

1:65,000

0 750 1,500 3,000 Meters

FIGURE 10.9
NEAR-TERM
WASTEWATER SERVICING CONCEPT
HARMONY/CALALTA SCENARIO 2
BOW RIVER DISCHARGE
SPRINGBANK AREA STRUCTURE PLAN
SERVICING STRATEGY

ROCKY VIEW COUNTY
Cultivating Communities

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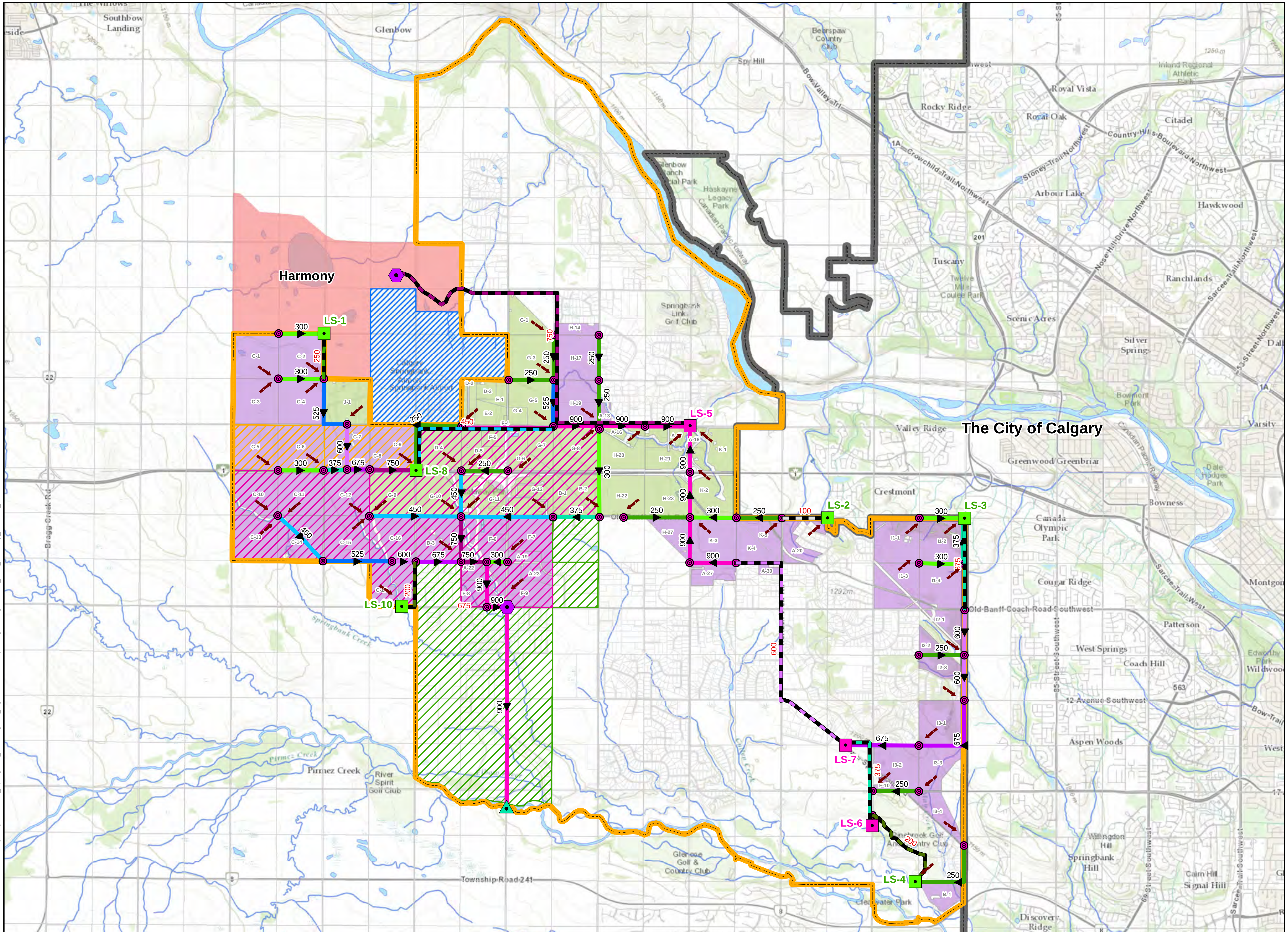

Legend

- Wastewater Treatment Plant
- Elbow River Discharge
- Major Lift Station
- Minor Lift Station
- Junction

Proposed Sanitary Pipe

- 250mm Gravity Sewer
- 300mm Gravity Sewer
- 375mm Gravity Sewer
- 450mm Gravity Sewer
- 525mm Gravity Sewer
- 600mm Gravity Sewer
- 675mm Gravity Sewer
- 750mm Gravity Sewer
- 900mm Gravity Sewer
- 1200mm Gravity Sewer
- 100mm Forcemain
- 200mm Forcemain
- 250mm Forcemain
- 375mm Forcemain
- 450mm Forcemain
- 600mm Forcemain
- 750mm Forcemain
- Near-Term Service
- Full Build-Out Service
- Harmony Development
- Calalta Exclusive Service
- Calalta Non-Exclusive Service
- Calalta Exclusive Area within ASP
- Springbank
- City of Calgary Boundary
- Study

Coordinate System:
CANA83-3TM114

1:65,000

0 750 1,500 3,000 Meters

FIGURE 10.10
FULL BUILD-OUT
WASTEWATER SERVICING CONCEPT
HARMONY/CALALTA SCENARIO 1
ELBOW RIVER DISCHARGE
SPRINGBANK AREA STRUCTURE PLAN
SERVICING STRATEGY

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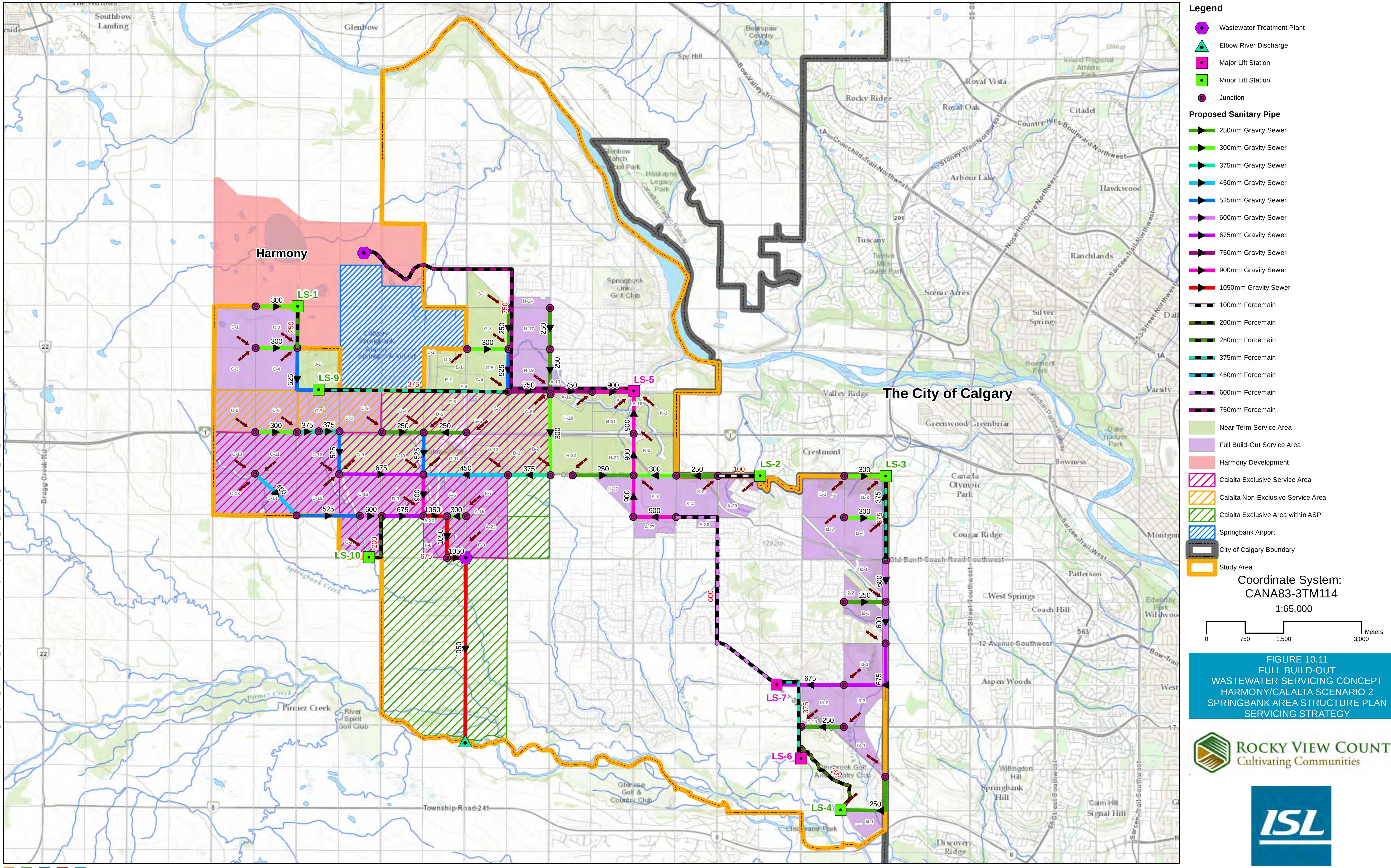

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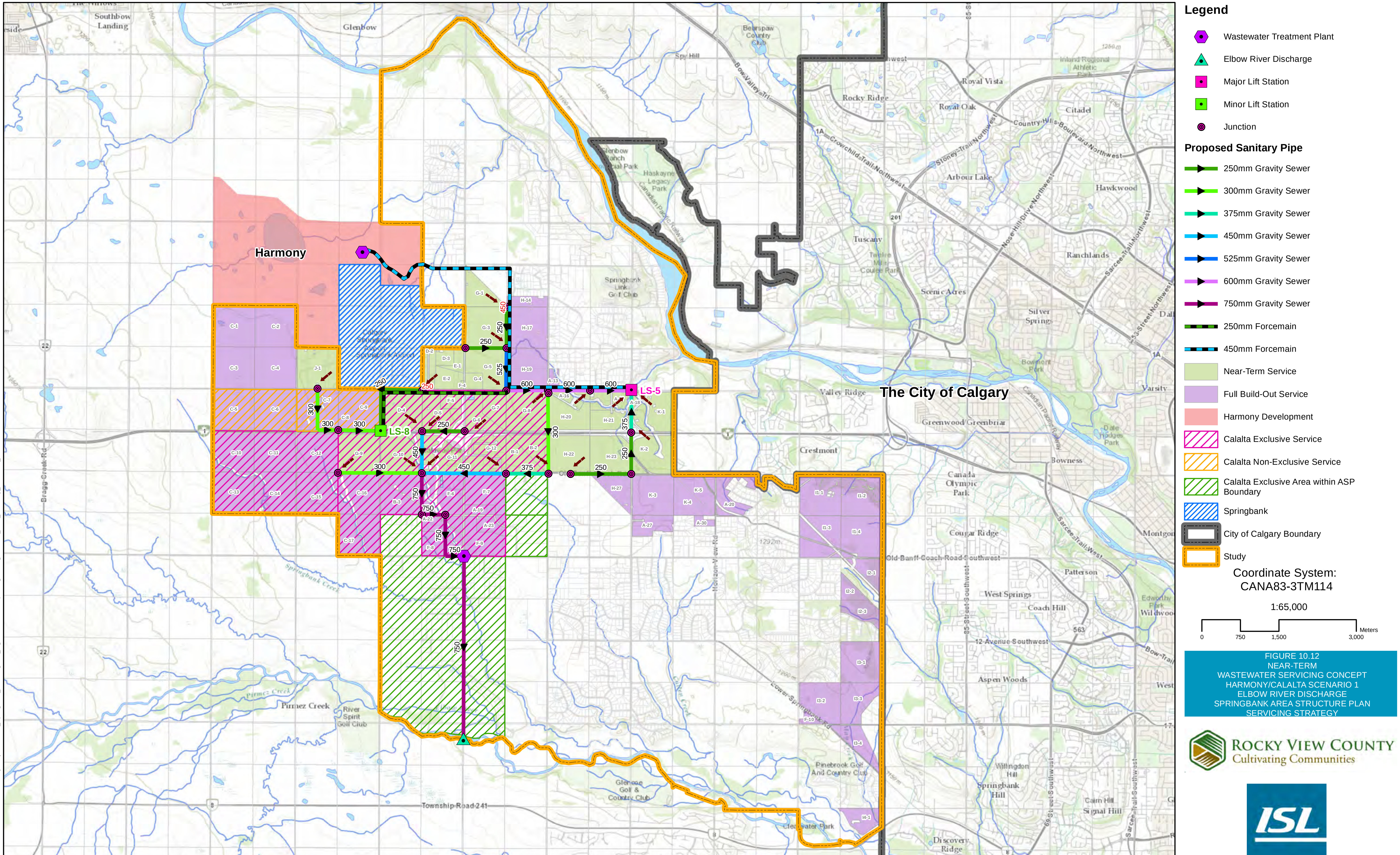

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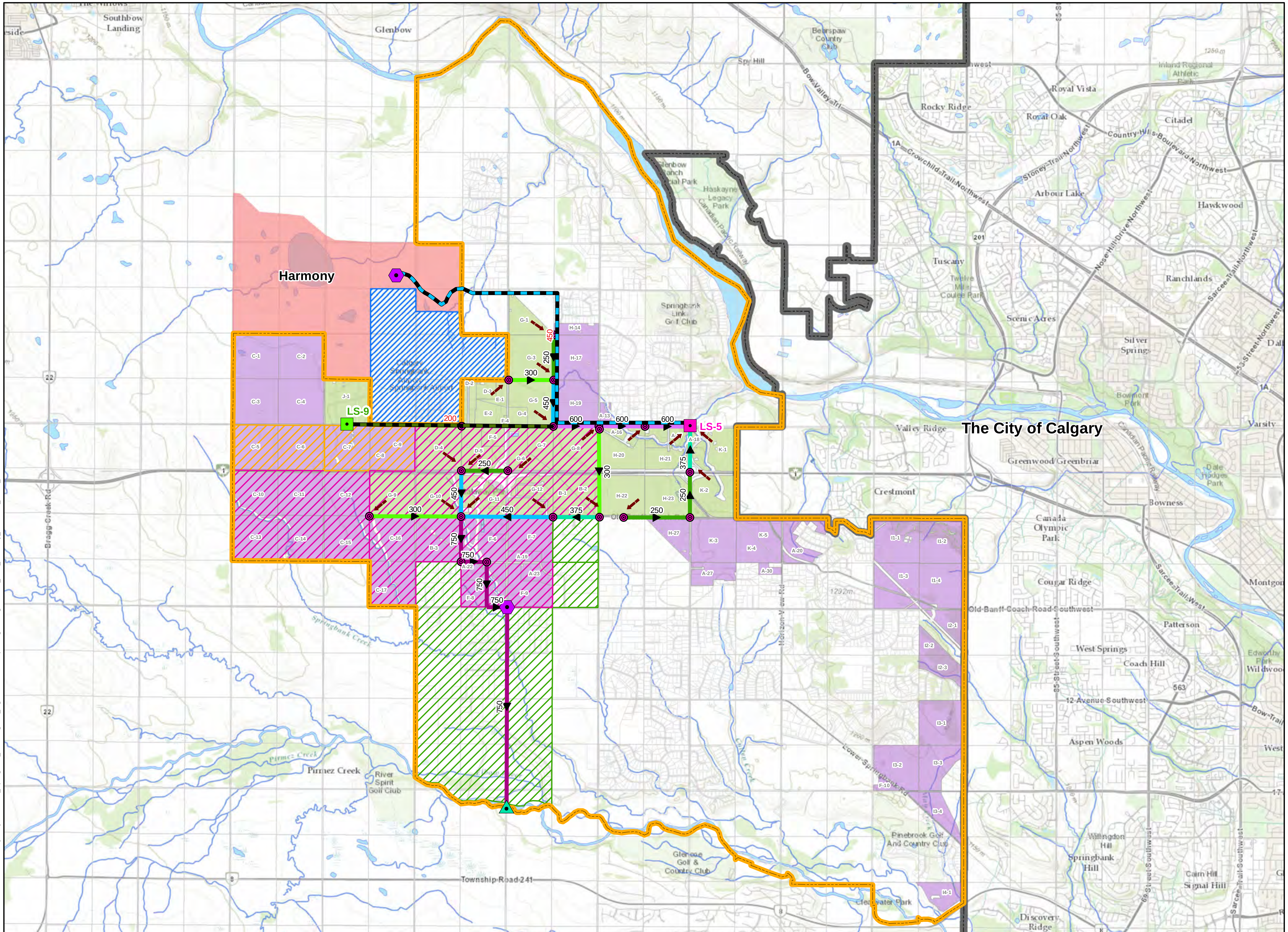

Legend

- Wastewater Treatment Plant
- Elbow River Discharge
- Major Lift Station
- Minor Lift Station
- Junction

Proposed Sanitary Pipe

- 250mm Gravity Sewer
- 300mm Gravity Sewer
- 375mm Gravity Sewer
- 450mm Gravity Sewer
- 525mm Gravity Sewer
- 600mm Gravity Sewer
- 750mm Gravity Sewer
- 200mm Forcemain
- 450mm Forcemain
- Near-Term Service Area
- Full Build-Out Service Area
- Harmony Development
- Calalta Exclusive Service Area
- Calalta Non-Exclusive Service Area
- Calalta Exclusive Area within ASP
- Springbank Airport
- City of Calgary Boundary
- Study Area

Coordinate System: CANA83-3TM114

1:65,000

0 750 1,500 3,000 Meters

FIGURE 10.13
NEAR-TERM
WASTEWATER SERVICING CONCEPT
HARMONY/CALALTA SCENARIO 2
ELBOW RIVER DISCHARGE
SPRINGBANK AREA STRUCTURE PLAN
SERVICING STRATEGY

ROCKY VIEW COUNTY
Cultivating Communities

ISL

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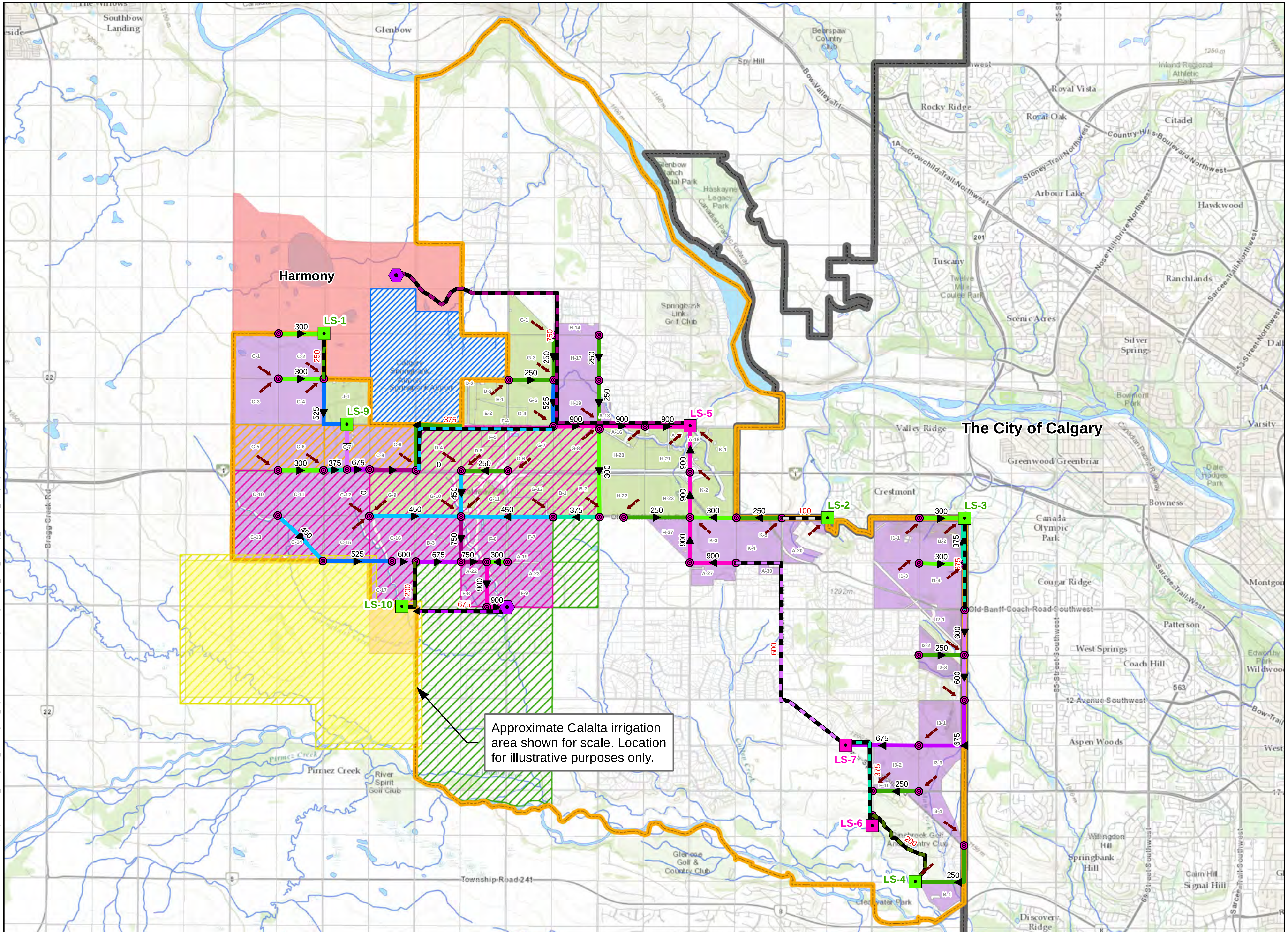

FIGURE 10.14
FULL BUILD-OUT
WASTEWATER SERVICING CONCEPT
HARMONY/CALALTA SCENARIO 1
EFFLUENT SPRAY IRRIGATION
SPRINGBANK AREA STRUCTURE PLAN
SERVICING STRATEGY

ROCKY VIEW COUNTY
Cultivating Communities

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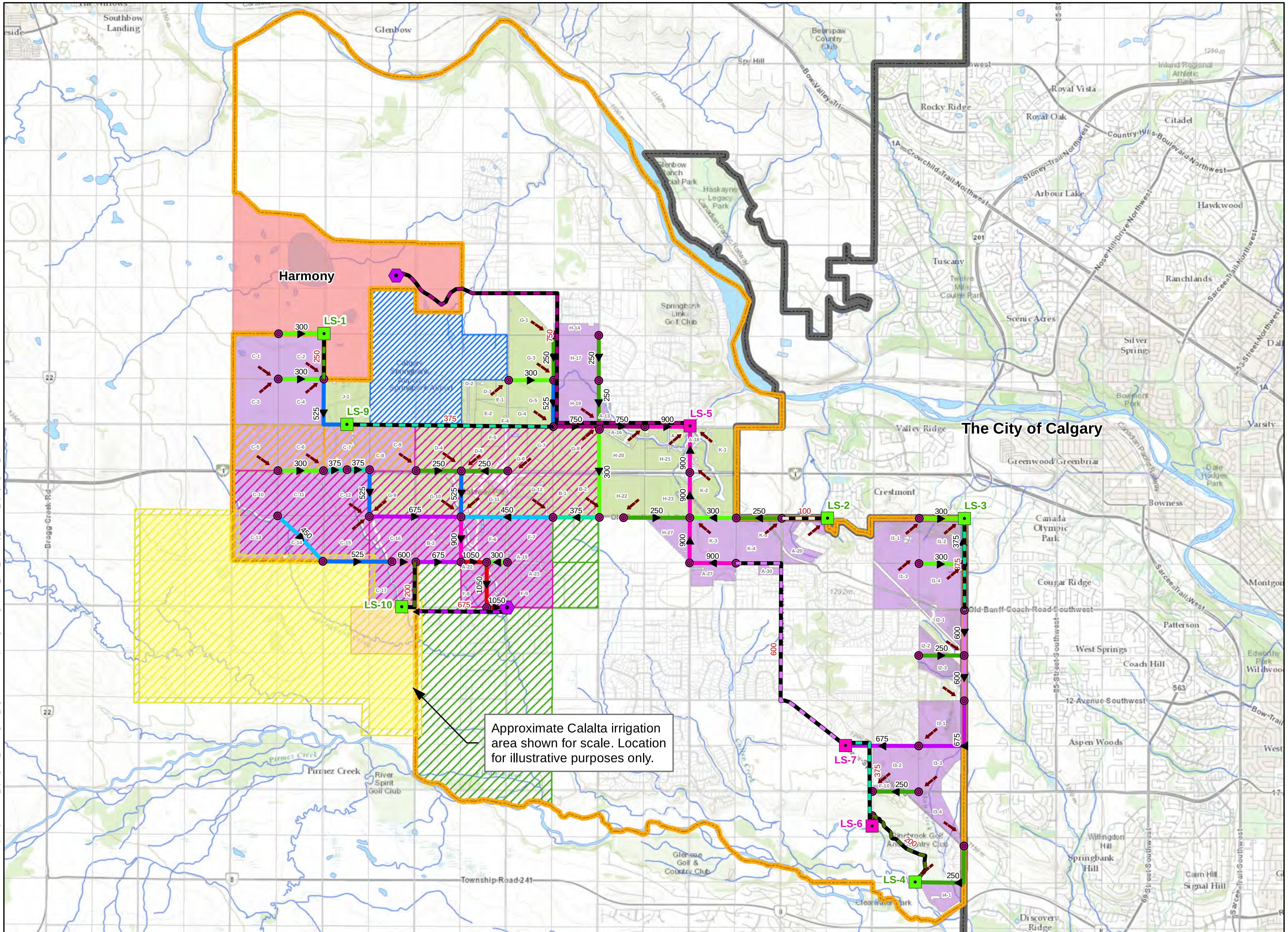

Legend

- Wastewater Treatment Plant
- Major Lift Station
- Minor Lift Station
- Junction

Proposed Sanitary Pipe

- 250mm Gravity Sewer
- 300mm Gravity Sewer
- 375mm Gravity Sewer
- 450mm Gravity Sewer
- 525mm Gravity Sewer
- 600mm Gravity Sewer
- 675mm Gravity Sewer
- 750mm Gravity Sewer
- 900mm Gravity Sewer
- 1050mm Gravity Sewer
- 100mm Forcemain
- 600mm Forcemain
- 200mm Forcemain
- 675mm Forcemain
- 250mm Forcemain
- 750mm Forcemain
- 375mm Forcemain
- Proposed Spray Effluent Irrigation Area Extent
- Treated Effluent Storage Cell (Six Months)
- Proposed 100m Setback
- Near-Term Service Area
- Full Build-Out Service Area
- Harmony Development
- Calalta Exclusive Service
- Calalta Non-Exclusive Service
- Calalta Exclusive Area within ASP
- Springbank Airport
- City of Calgary Boundary
- Study Area

Coordinate System:
CANA83-3TM114
1:65,000

0 750 1,500 3,000 Meters

FIGURE 10.15
FULL BUILD-OUT
WASTEWATER SERVICING CONCEPT
HARMONY/CALALTA SCENARIO 2
EFFLUENT SPRAY IRRIGATION
SPRINGBANK AREA STRUCTURE PLAN
SERVICING STRATEGY

ROCKY VIEW COUNTY
Cultivating Communities

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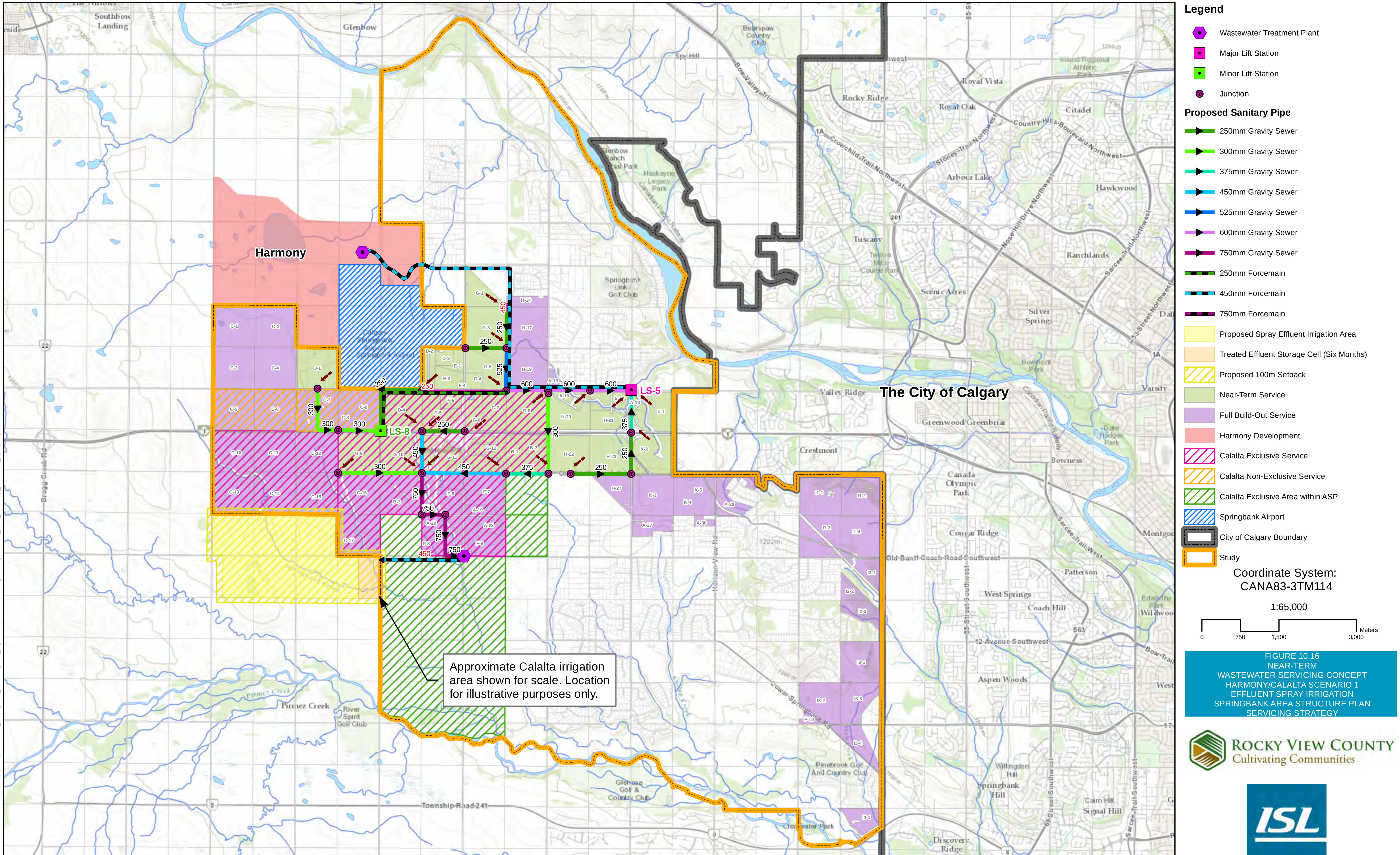

FIGURE 10.16
NEAR-TERM
WASTEWATER SERVICING CONCEPT
HARMONY/CALALTA SCENARIO 1
EFFLUENT SPRAY IRRIGATION
SPRINGBANK AREA STRUCTURE PLAN
SERVICING STRATEGY

ROCKY VIEW COUNTY
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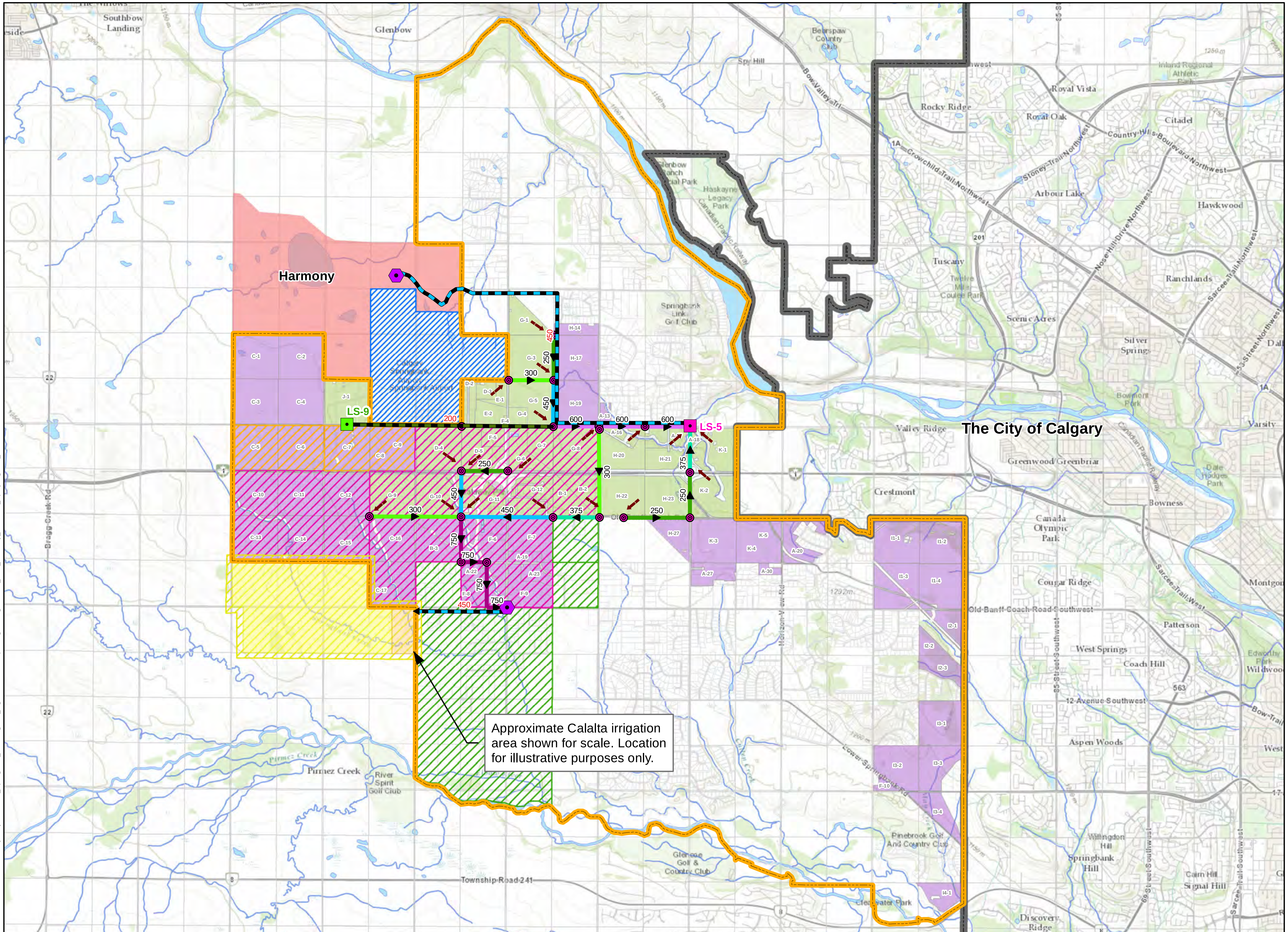

Legend

- Wastewater Treatment Plant
- Major Lift Station
- Minor Lift Station
- Junction

Proposed Sanitary Pipe

- 250mm Gravity Sewer
- 300mm Gravity Sewer
- 375mm Gravity Sewer
- 450mm Gravity Sewer
- 525mm Gravity Sewer
- 600mm Gravity Sewer
- 750m Gravity Sewer
- 200mm Forcemain
- 450mm Forcemain
- Proposed Spray Effluent Irrigation Area Extent
- Treated Effluent Storage Cell (Six Months)
- Proposed 100m Setback
- Near-Term Service Area
- Full Build-Out Service Area
- Harmony Development
- Calalta Exclusive Service Area
- Calalta Non-Exclusive Service Area
- Calalta Exclusive Area within ASP Boundary
- Springbank Airport
- City of Calgary Boundary
- Study Area

Coordinate System: CANA83-3TM114

1:65,000

0 750 1,500 3,000 Meters

FIGURE 10.17
NEAR-TERM
WASTEWATER SERVICING CONCEPT
HARMONYCALALTA SCENARIO 2
EFFLUENT SPRAY IRRIGATION
SPRINGBANK AREA STRUCTURE PLAN
SERVICING STRATEGY

ROCKY VIEW COUNTY
Cultivating Communities

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