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Appendix A

Population Projections and Forecasts of Future Land Requirements

Inputs to the Turner Valley and Black Diamond Joint Growth Strategy:

Population Projections and Forecasts of Future Land Requirements

Draft
18 January 2016

Prepared for:
Town of Turner Valley and Town of Black Diamond

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1.0 Introduction

1.1 Scope of Work

The Town of Turner Valley and the Town of Black Diamond are preparing a Joint Growth Strategy to provide a coordinated and shared vision for the long-term growth of the two Towns. The vision in the Joint Growth Strategy will become the foundation for the Towns to individually review and update their Municipal Development Plans and to work together with the Municipal District of Foothills No. 31 to review and update the Inter-Municipal Development Plan. It will also inform future annexation processes, as the Towns have limited capacity for further growth within their existing boundaries.

The Towns retained a team led by O2 Planning + Design Inc. to assist with preparing the Joint Growth Strategy. Coriolis Consulting Corp. was included on the team to provide population projections and forecasts of future land requirements by major land use (residential, commercial, and industrial) for two 30 year periods: 2015 to 2045 and 2045 to 2075. This report documents our analysis and forecasts.

1.2 Professional Disclaimer

This document may contain estimates and forecasts of future growth and urban development prospects, estimates of the financial performance of possible future urban development projects, opinions regarding the likelihood of approval of development projects, and recommendations regarding development strategy or municipal policy. All such estimates, forecasts, opinions, and recommendations are based in part on forecasts and assumptions regarding population change, economic growth, policy, market conditions, development costs and other variables. The assumptions, estimates, forecasts, opinions, and recommendations are based on interpreting past trends, gauging current conditions, and making judgments about the future. As with all judgments concerning future trends and events, however, there is uncertainty and risk that conditions change or unanticipated circumstances occur such that actual events turn out differently than as anticipated in this document, which is intended to be used as a reasonable indicator of potential outcomes rather than as a precise prediction of future events.

Nothing contained in this report, express or implied, shall confer rights or remedies upon, or create any contractual relationship with, or cause of action in favor of, any third party relying upon this document.

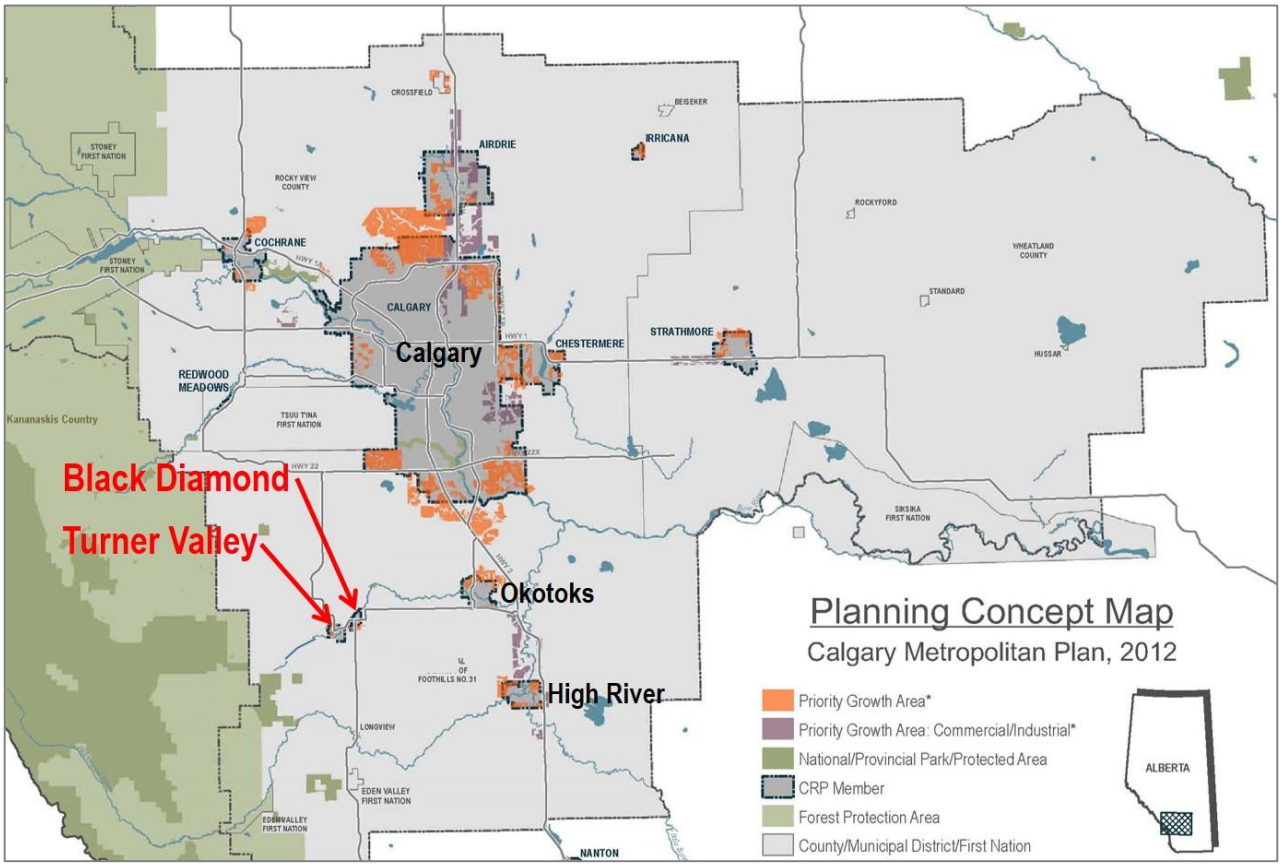
In no event shall Coriolis Consulting Corp. be liable to the Town of Turner Valley, the Town of Black Diamond, or any third party for any indirect, incidental, special, or consequential damages whatsoever, including lost revenues or profits.

2.0 Location and Context

Turner Valley and Black Diamond are located in close proximity to each other (with their boundaries as close as 800 metres in some locations), along the Sheep River. The Towns are southwest of Calgary, west of Okotoks, and northwest of High River (see Exhibit 1). Both of the Towns are part of the Calgary Regional Partnership, which is a collaborative network of 14 municipalities that voluntarily work together to ensure growth in the Calgary region occurs in a sustainable manner.[1]

Combined, Turner Valley and Black Diamond have a 2015 population of about 5,100 people[2], which is relatively small compared to nearby Okotoks (about 28,000[3] people) and High River (about 13,000[4] people). For context, the City of Calgary has a population of about 1,231,000[5] people.

Exhibit 1: Location in Regional Context



Source: Base map from Calgary Regional Partnership, "Calgary Metropolitan Plan." June 2012, page 52. Labels added by Coriolis.

[1] The Calgary Regional Partnership includes Airdrie, Banff, Black Diamond, Calgary, Canmore, Chestermere, Cochrane, High River, Irricana, Nanton, Okotoks, Redwood Meadows, Strathmore, and Turner Valley.

[2] As described in more detail in Section 3.2 of this report.

[3] Based on the Town of Okotoks' 2015 municipal census.

[4] The Town of High River has not completed a recent municipal census and indicated that it uses the 2011 federal census figure as its current population estimate.

[5] Based on the City of Calgary's 2015 municipal census.

3.0 Remaining Capacity for Growth

Exhibit 2 summarizes the amount of land remaining to accommodate urban growth in Turner Valley and Black Diamond (holding aside land ear-marked for schools), based on information provided by the Towns about land use plans and remaining developable lands (which are illustrated in Exhibits 3 and 4 on the following page). As indicated in Exhibit 2:

- Turner Valley has a total of about 263.9 acres of land available for urban development, including about 257.5 acres of residential land and 6.4 acres of commercial land. There is no remaining land designated for industrial development. Based on information provided by the Town, we assume that residential development will achieve an average density of 5.5 units per acre from 2015 to 2035 and 6.5 units per acre from 2035 to 2045, or an overall average of 5.85 units per acre over the next 30 years. At this targeted average density[6], there is remaining capacity for about 1,506 more residential units within Turner Valley's existing boundary.
- Black Diamond has a total of about 84.5 acres of land available for urban development, including about 64.4 acres of residential land, 11.6 acres of commercial land, and 8.5 acres of industrial land. The amount of vacant residential land remaining in Black Diamond will likely be developed within the next 20 years[7], so at a targeted average residential density of 5.5 units per acre there is capacity for about 354 more residential units within Black Diamond's existing boundary.

In our land requirement forecasts, we calculate total growth potential and then deduct the remaining capacity for growth within the Towns' boundaries to provide an estimate of the amount of additional land (outside the Towns' current boundaries) required to accommodate anticipated market-driven growth.

Exhibit 2: Remaining Capacity for Growth in Turner Valley and Black Diamond

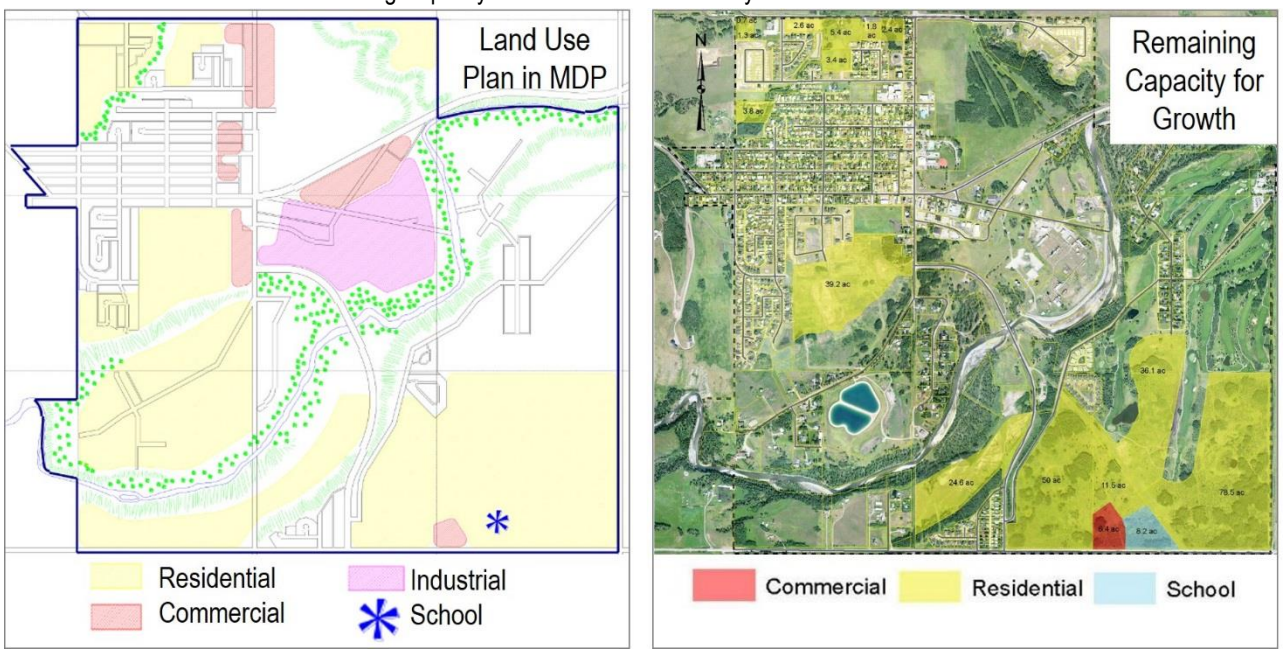
	Residential		Commercial Land (in acres)	Industrial Land (in acres)	Land Available for Urban Development (in acres)
	Land (in acres)	Estimated Number of Residential Units			
Turner Valley	257.5 acres	1,506 units[a]	6.4 acres	0.0 acres	263.9 acres
Black Diamond	64.4 acres	354 units[b]	11.6 acres	8.5 acres	84.5 acres
Total	321.9 acres	1,860 units	18.0 acres	8.5 acres	348.4 acres

Source: Coriolis, based on information provided by Turner Valley and Black Diamond.
Note a: Assumes a density of 5.85 units per gross acre based on information provided by the Town of Turner Valley.
Note b: Assumes a density of 5.5 units per gross acre based on information provided by the Town of Black Diamond.

[6] This average density assumes that the residential lands in Turner Valley build-out over the next 30 years or so, which is reasonable given our residential development forecasts (see Section 5.0).

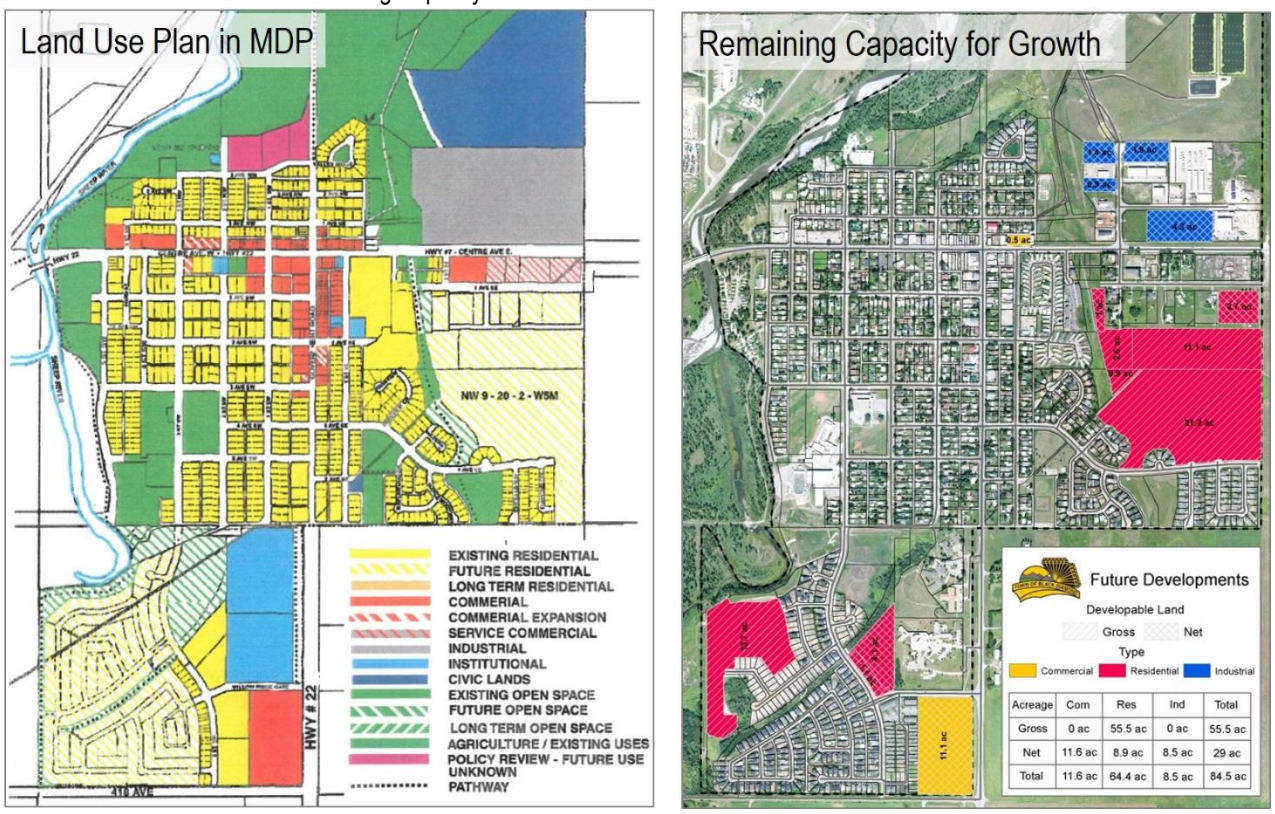
[7] The residential lands in Black Diamond will build-out within the next 20 years based on our residential development forecasts (see Section 5.0).

Exhibit 3: Land Use Plan and Remaining Capacity for Growth in Turner Valley



Source: Land Use Map is from the Town of Turner Valley, "Municipal Development Plan", Bylaw #04-891, Adopted 20 September 2004. Remaining Capacity for Growth map was provided by the Town of Turner Valley in July 2015. Note that the areas shown on the Remaining Capacity for Growth map sum to 261.3 acres but the Town indicated that the total land available is 257.5 acres.

Exhibit 4: Land Use Plan and Remaining Capacity for Growth in Black Diamond



Source: Land Use Map is from the Town of Black Diamond, "Municipal Development Plan", Bylaw #01-14, Adopted 3 October 2001. Remaining Capacity for Growth map was provided by the Town of Black Diamond in October 2015.

4.0 Population Forecast

A key input to our forecasts of future residential, commercial, and industrial growth is a forecast of future population growth. Looking at past trends and available forecasts, we produced a forecast of population growth in the two Towns as well as the surrounding trade area. Residential development in Turner Valley and Black Diamond will be driven by population growth within the Towns, but commercial and industrial development in Turner Valley and Black Diamond is tied to population growth in the Towns and in the surrounding rural area that businesses in Turner Valley and Black Diamond draw customers from.

4.1 Historic Population Growth

4.1.1 Turner Valley and Black Diamond

According to the federal census, the population of Turner Valley grew from 1,608 people in 2001 to 2,167 people in 2011, or by an average growth rate of about 3.0% over the ten-year period (see Exhibit 5). Black Diamond grew from about 1,866 people to 2,373 people over the same period, which is equivalent to an average annual growth rate of about 2.4% over the ten-year timeframe. Combined, therefore, the Towns grew from 3,474 people in 2001 to 4,540 in 2011, which is equivalent to an average growth rate of 2.7% per year and an average annual increment of 107 people per year. As shown in the exhibit, the Towns experienced faster growth from 2001 to 2011 than during the previous decade.

The average annual rate of population growth in Turner Valley and Black Diamond combined (2.7%) was slightly higher than the rate of population growth in the Calgary Regional Partnership region (2.5%) from 2001 to 2011.

Exhibit 5: Historic Population Growth in Turner Valley, Black Diamond, and Calgary Regional Partnership Region, 1991 to 2011

	Population from Statistics Canada Census					Average Annual Growth Rate			Average Annual Increment		
						10 years	10 years	20 years	10 years	10 years	20 years
	1991	1996	2001	2006	2011	1991-2001	2001-2011	1991-2011	1991-2001	2001-2011	1991-2011
Turner Valley	1,352	1,527	1,608	1,908	2,167	1.75%	3.03%	2.39%	26	56	41
Black Diamond	1,623	1,811	1,866	1,900	2,373	1.40%	2.43%	1.92%	24	51	38
Subtotal	2,975	3,338	3,474	3,808	4,540	1.56%	2.71%	2.14%	50	107	78
Calgary Regional Partnership region	765,110	836,928	970,684	1,108,021	1,252,096	2.41%	2.58%	2.49%	20,557	28,141	24,349

Source: Statistics Canada, census data.

4.1.2 Primary Commercial Trade Area

Businesses in Turner Valley and Black Diamond serve residents of the two Towns, plus residents of the surrounding rural areas. The boundaries of the primary commercial trade area for the two Towns is south of Priddis, north of Longview, west of about the mid-point between Black Diamond and Okotoks, and east of Sheep River Provincial Park in Kananaskis.

According to the federal census, the population of this defined trade area grew from a total of 7,557 people in 2006 to a total of 8,352 people in 2011 (see Exhibit 6). Deducting the populations of Turner Valley and Black Diamond indicates that the population of the surrounding rural areas was about 3,749 people in 2006 and about 3,812 people in 2011. This is equivalent to an average annual increment of 13 people per year or an average annual growth rate of about 0.33% per year over the five year period, so the population in the surrounding rural portions of the trade area was relatively stable during this timeframe.

Exhibit 6: Historic Population Growth in the Surrounding Rural Areas, 2006 to 2011

	2006	2011	Average Annual Growth Rate 2006-2011	Average Annual Increment 2006-2011
Trade Area	7,557	8,352	2.02%	159
Turner Valley/Black Diamond	3,808	4,540	3.58%	146
Surrounding rural areas	3,749	3,812	0.33%	13

Source: We estimated the total population of the trade area using PCensus, which produces population data for user-defined areas based on Statistics Canada census data.

4.2 Estimate of 2015 Population

Turner Valley completed a municipal census in 2015, which indicated that the Town has a population of 2,511 people.

Black Diamond has not completed a recent municipal census, so we estimated population growth in Black Diamond from 2011 to 2015 based on the number of residential units approved in building permits over this timeframe and the average household size in the Town. We then added this estimated population growth to the 2011 federal census population for the Town. Based on this approach, we estimate that Black Diamond has a population of 2,577 people as of 2015.

For the surrounding rural areas, we assumed that average annual population growth from 2011 to 2015 was about the same as these areas experienced from 2006 to 2011 (i.e. 0.33% per year on average). Based on this approach, we estimate that the surrounding rural portions of the trade area have a population of about 3,863 people as of 2015.

Combined, therefore, the two Towns have an estimated total population 5,088 people as of 2015 (see Exhibit 7) and the trade area as a whole has an estimated total population of 8,951 people as of 2015. This suggests that the Towns have grown at a slightly faster pace over the past four years (2.9% per year on average) than from 2001 to 2011 (when growth averaged 2.7% per year).

For context, Exhibit 7 also shows growth in the City of Calgary's population from 2011 to 2015 based on its municipal census. The data shows that the City grew by an average annual rate of about 3% per year over this period. Therefore, population growth in Turner Valley and Black Diamond combined was similar to the rate of population growth in the City of Calgary over the past four years.

Exhibit 7: 2015 Population Estimate for Turner Valley, Black Diamond, Trade Area, and City of Calgary

	2011	2015	Average Annual Growth Rate 2011-2015	Average Annual Increment 2011-2015
Turner Valley	2,167	2,511	3.75%	86
Black Diamond	2,373	2,577	2.08%	51
Subtotal for the Towns	4,540	5,088	2.89%	137
Surrounding rural areas	3,812	3,863	0.33%	13
Trade area total	8,352	8,951	1.75%	150
City of Calgary	1,090,936	1,230,915	3.06%	34,995

Source: 2011 figures for Turner Valley, Black Diamond, and the trade area are from Statistics Canada, census data, and 2011 figure for the City of Calgary is from Calgary's municipal census. The 2015 figures for Turner Valley and the City of Calgary are from their municipal censuses and the 2015 figures for Black Diamond and the surrounding rural portions of the trade area were estimated by Coriolis.

4.3 Population Forecasts

4.3.1 Forecast Period for Our Analysis

The forecast period for our work is a 60 year horizon broken into two 30 year periods:

- 2015 to 2045.
- 2045 to 2075.

4.3.2 Regional Forecasts

We reviewed previous studies that include forecasts of population growth for the Calgary region:

- Forecasts for the Calgary Metropolitan Area produced in 2014 by the Alberta Treasury Board and Finance Ministry. These forecasts are for the period from 2011 to 2041 and are for a region that is larger than the Calgary Regional Partnership.
- Forecasts for the communities in the Calgary Regional Partnership produced in 2012 as input to the Calgary Metropolitan Plan. These forecasts are for the period from 2019 to 2076 and are for the region made up of the 14 municipalities working together on regional planning.

Exhibits 8a and 8b show these available population forecasts. The exhibits suggest that the rate of population growth in the Calgary region as a whole is expected to slow over the long term.

Exhibit 8a: Available Population Forecasts for the Calgary Metropolitan Area, 2011 to 2041

	Population Estimate & Forecasts					Average Annual Growth Rate			
	2011	2014	2021	2031	2041	2011-2014	2014-2021	2021-2031	2031-2041
Calgary Metropolitan Area	1,363,607	1,518,800	1,783,610	2,110,740	2,416,865	3.7%	2.3%	1.7%	1.4%

Source: Statistics Canada, census data (2011) and Alberta Treasury Board and Finance Ministry Medium Scenario (as published in June 2014).

Exhibit 8b: Available Population Forecasts for the Communities in the Calgary Regional Partnership, 2019 to 2076

	Population Estimates & Projections					Average Annual Growth Rates		
	2006	2019	2029	2039	2076	2006-2019	2019-2039	2039-2076
Calgary Regional Partnership Area	1,109,597	1,511,844	1,770,993	1,987,386	2,640,236	2.4%	1.4%	0.8%

Source: Calgary Metropolitan Plan.

4.3.3 Key Assumptions for Turner Valley and Black Diamond Population Forecasts

We incorporate the following main assumptions into our population forecasts:

1. Available long range forecasts suggest a slowing rate of growth in the Calgary region over the long term, so we incorporate this trend into our forecasts and assume that growth rates in Black Diamond and Turner Valley slow over the 60 year forecast period.
2. As context, we assume that overall population growth in the communities that make up the Calgary Regional Partnership averaged about 3% per year from 2011 to 2015, matching average growth in the City of Calgary over this timeframe (as shown in Exhibit 7). We assume that overall population growth in

the Calgary region will average 1.4% per year from 2015 to 2045 and 0.8% per year from 2045 to 2071, based on the forecasts prepared as input to the Calgary Metropolitan Plan (as shown in Exhibit 8b).

3. We run two scenarios for population growth in Turner Valley and Black Diamond:
   a) A "lower" scenario based on the trajectory of past population growth trends in the two Towns (with a slowing growth rate over the long term).
   b) and a "higher" scenario assuming a slightly increased rate of growth in each Town compared to past trends (with a slowing growth rate over the long term). We considered this higher growth rate scenario because it is possible that Black Diamond and Turner Valley will face increasing residential growth due to a variety of factors, such as:
      - Increasing single family home prices in Calgary. This could shift purchasers who are interested in single detached homes out of Calgary into the surrounding communities (including the two Towns).
      - Improved road connections to Calgary due to the planned completion of the Southwest Ring Road. If this is completed, it will likely make commuting from Turner Valley and Black Diamond to parts of Calgary more convenient.
      - Increasing densities and congestion in Okotoks. Okotoks has experienced rapid growth and urbanization over the past decade (or more). Buyers who are looking for a new home in a smaller town to the South of Calgary may increasingly consider Turner Valley and Black Diamond rather than Okotoks.
4. We assume that population growth in the surrounding rural parts of the commercial trade area will continue to average about 0.33% per year over the long term, matching the recent pace of population growth in these areas (as shown in Exhibit 6).

4.3.4 Population Forecasts Used for Our Analysis

Exhibit 9a shows our population forecasts for Turner Valley and Black Diamond and Exhibit 9b shows our population forecast for the primary trade area as a whole. As illustrated in these exhibits:

- Our forecasts suggest that the population of Turner Valley will grow from 2,511 in 2015 to on the order of 5,140 people (lower) to 5,959 people (higher) by 2045 and on the order of 9,541 people (lower) to 12,785 people (higher) by 2075.
- Our forecasts suggest that the population of Black Diamond will grow from 2,577 in 2015 to on the order of 5,275 people (lower) to 6,105 people (higher) by 2045 and on the order of 9,792 people (low) to 13,121 people (high) by 2075.
- Combined, therefore, the Towns of Turner Valley and Black Diamond are projected to grow from about 5,088 people in 2015 to on the order of 10,415 people (low) to 12,053 people (high) by 2045 and on the order of 19,333 people (lower) to 25,906 people (higher) by 2075. This is equivalent to an overall average annual growth rate of about 2.25% per year (lower) to 2.75% per year (higher) over the entire timeframe in the two Towns combined, compared to historic population growth of about 2.7% per year from 2001 to 2011 (as was illustrated in Exhibit 5).
- The trade area as a whole is projected to grow from about 8,951 in 2015 to on the order of 14,679 people (lower) to 16,317 people (higher) as of 2045 and on the order of 24,040 people (lower) to 30,613 people (higher) as of 2075.

Exhibit 9a: Population Forecasts Used in our Analysis for Towns of Turner Valley and Black Diamond

Calgary Regional Partnership Area

	2011	2015	2045	2075
CRP Popuation	1,252,096	1,409,245	2,138,578	2,716,071
	2011-2015	2015-2045	2045-2075	
CRP Annual Growth Rate	3.0%	1.4%	0.8%	

Turner Valley and Black Diamond Population Projections - Scenario 1: Lower - "Trend"

	2015	2025	2035	2045	2055	2065	2075
Turner Valley	2,511	3,214	4,115	5,140	6,421	7,827	9,541
Black Diamond	2,577	3,299	4,223	5,275	6,590	8,033	9,792
Total	5,088	6,513	8,337	10,415	13,010	15,860	19,333

	2015-2025	2025-2035	2035-2045	2045-2055	2055-2065	2065-2075
Turner Valley	2.50%	2.50%	2.25%	2.25%	2.00%	2.00%
Black Diamond	2.50%	2.50%	2.25%	2.25%	2.00%	2.00%

	2015-2045	2045-2075	2015-2075
Turner Valley	2.42%	2.08%	2.25%
Black Diamond	2.42%	2.08%	2.25%
Total	2.42%	2.08%	2.25%

Turner Valley and Black Diamond Population Projections - Scenario 2: Higher - "Increased Growth"

	2015	2025	2035	2045	2055	2065	2075
Turner Valley	2,511	3,375	4,535	5,949	7,802	9,988	12,785
Black Diamond	2,577	3,463	4,654	6,105	8,007	10,250	13,121
Total	5,088	6,838	9,189	12,053	15,810	20,238	25,906

	2015-2025	2025-2035	2035-2045	2045-2055	2055-2065	2065-2075
Turner Valley	3.00%	3.00%	2.75%	2.75%	2.50%	2.50%
Black Diamond	3.00%	3.00%	2.75%	2.75%	2.50%	2.50%

	2015-2045	2045-2075	2015-2075
Turner Valley	2.92%	2.58%	2.75%
Black Diamond	2.92%	2.58%	2.75%
Total	2.92%	2.58%	2.75%

Source: Coriolis Consulting.

Exhibit 9b: Population Forecasts for Our Analysis, Turner Valley and Black Diamond Trade Area

	Scenario 1 - Lower ("Trend")			Scenario 2 - Higher ("Increased Growth")		
	2015	2045	2075	2015	2045	2075
Turner Valley (from above)	2,511	5,140	9,541	2,511	5,949	12,785
Black Diamond (from above)	2,577	5,275	9,792	2,577	6,105	13,121
Subtotal - Turner Valley & Black Diamond (from above)	5,088	10,415	19,333	5,088	12,053	25,906
Rural portions of the trade area - at 0.33% per year	3,863	4,264	4,707	3,863	4,264	4,707
Trade Area Total	8,951	14,679	24,040	8,951	16,317	30,613

Source: Coriolis Consulting.

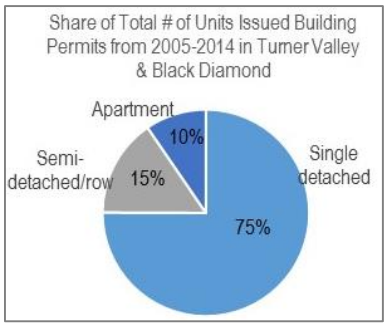
5.0 Residential Development Outlook

5.1 Past Residential Development Trends and Indicators

A total of about 700 new residential units were issued building permits from 2005 to 2014 in Turner Valley and Black Diamond combined, or an average of about 70 units per year (see Exhibit 10). Residential development was split almost evenly between Turner Valley and Black Diamond over this ten year period.

Almost all residential development in Turner Valley during this timeframe was in the form of single detached dwellings, with a small number of semi-detached units. Single family development also accounted for most of the residential development in Black Diamond, but Black Diamond also experienced some semi-detached/row housing and apartment development.

From 2005 to 2014, about 75% of the residential units issued building permits in Turner Valley and Black Diamond were single detached dwellings, 15% were semi-detached/row housing, and 10% were apartment units.



For comparison, Exhibit 11 shows the share of housing starts by unit type for the past five to seven years (depending on data availability) in Okotoks, High River, and Cochrane. As in Turner Valley and Black Diamond, single detached units accounted for the largest share of residential development in these towns (about 60% in High River and Cochrane and over 90% in Okotoks). There is very little apartment development in these communities.

Exhibit 10: Historic Residential Building Permits, 2005 to 2014

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	Total 2005-2014	Annual Average 2005-2014
Turner Valley - # of units:												
Single Detached	23	63	44	22	19	9	11	16	30	59	296	30
Semi Detached	6	0	0	10	0	0	0	6	0	0	22	2
Row House	0	0	0	0	0	0	0	0	0	0	0	0
Apartment Unit	0	0	0	0	0	0	0	0	0	0	0	0
Total	29	63	44	32	19	9	11	22	30	59	318	32
Black Diamond - # of units:												
Single Detached	27	47	49	15	17	16	16	12	15	17	231	23
Semi Detached	10	10	20	2	8	2	0	2	0	0	54	5
Row House	10	0	10	0	0	12	0	0	0	0	32	3
Apartment Unit	0	28	0	0	16	0	23	0	0	0	67	7
Total	47	85	79	17	41	30	39	14	15	17	384	38
Towns Combined - # of units:												
Single Detached	50	110	93	37	36	25	27	28	45	76	527	53
Semi Detached	16	10	20	12	8	2	0	8	0	0	76	8
Row House	10	0	10	0	0	12	0	0	0	0	32	3
Apartment Unit	0	28	0	0	16	0	23	0	0	0	67	7
Total	76	148	123	49	60	39	50	36	45	76	702	70
Towns Combined - share of total:												
Single Detached	66%	74%	76%	76%	60%	64%	54%	78%	100%	100%	75%	
Semi Detached	21%	7%	16%	24%	13%	5%	0%	22%	0%	0%	11%	
Row House	13%	0%	8%	0%	0%	31%	0%	0%	0%	0%	5%	
Apartment Unit	0%	19%	0%	0%	27%	0%	46%	0%	0%	0%	10%	
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	

Source: Building permit data provided by Turner Valley and Black Diamond.

Exhibit 11: Comparison of Residential Development by Unit Type in Turner Valley & Black Diamond and Other Nearby Towns

	Turner Valley and Black Diamond 2005-2014	Okotoks 2008-2014	High River 2008-2014	Cochrane 2010-2014
Single detached	75%	92%	60%	58%
Semi-detached/row	15%	6%	40%	35%
Apartment	10%	1%	0%	7%
Total	100%	100%	100%	100%

Source: Building permit data provided by Turner Valley and Black Diamond and CMHC Housing Start data for the other towns.

According to the federal census, the average household size in Turner Valley and Black Diamond was 2.4 people per household as of 2006 and 2011 (see Exhibit 12). This is down slightly from 2001 (when the average household size was 2.5). The average household size in Turner Valley and Black Diamond is slightly lower than in the Calgary CMA, which has had an average household size of 2.6 over the past decade or so.

Exhibit 12: Average Household Size, 2001 to 2011

	2001	2006	2011
Turner Valley	2.5	2.4	2.4
Black Diamond	2.5	2.4	2.4
Calgary CMA	2.6	2.6	2.6

Source: Statistics Canada, census data.

5.2 Projected Residential Demand by Housing Type and Residential Land Requirements

We complete our forecast of residential land requirements in 4 main steps:

1. **Household Forecast**: We take our forecasts of population growth (the lower and higher scenarios) and apply an assumed average household size to generate the total estimated number of households in each Town as of 2015, 2045, and 2075. We assume an average household size of 2.4 to match the average household size in the Towns as of 2006 and 2011 (from Exhibit 12).

2. **Projected Residential Growth by Unit Type**: We calculate the total growth in the number of households in each Town and apply an assumed split by housing type to yield a forecast of residential development by unit type for 2015 to 2045 and 2045 to 2075. Turner Valley and Black Diamond will continue to be suburban satellite communities in the Calgary Region over the forecast period and, while single detached housing is likely to account for a decreasing share of total housing demand over the longer term due to a combination of demographics, increasing house prices, and lifestyle reasons, our forecasts assume that single detached homes will remain the primary housing type. From 2005 to 2014, 75% of housing starts in Turner Valley and Black Diamond were single detached units, 15% were semi-detached/row units, and 10% were apartment units (as was shown in Exhibit 11). We assume that multi-family development makes up a slightly increasing share of total housing development over the 60 year time period. For the first 30 years of the forecast period, we assume that 70% of new residential units are single detached, 15% are attached (e.g. duplex, row housing), and 15% are apartment units. We assume this shifts to 65% single detached, 15% attached, and 20% apartments for the second half of the forecast period.

3. **Comparison of Forecasted Residential Development with Existing Capacity Inside Town's Existing Boundary**: We deduct the remaining capacity for residential development (as described in Section 3.0 of this report) from our forecasts of demand to calculate the amount of unmet demand during 2015 to 2045 and 2045 to 2075 based on the Towns' existing boundaries.

4. **Additional residential land requirements**: We calculate the amount of additional land (in terms of gross acres taking into account allowances for land for items such as roads, municipal reserves for parks and schools, environmentally sensitive areas, stormwater, and community services) based on an overall assumed residential density per acre for new development. Based on input from the Towns, we assume an overall average gross residential density of:

   a) 5.5 units per acre for the first 20 years and 6.5 units per acre for the following 10 years, which results in 5.85 units per acre on average over the first 30 years of the forecast period.

   b) 8.0 units per acre for residential development over the second half of the forecast period.

   These densities are significantly higher than the existing average residential density in Turner Valley and Black Diamond, but reflect the Town's aspirations to achieve higher residential densities over time. Achieving an average density of 8 units per acre in years 31 to 60 will require a significant increase in achievable residential densities (across all types of units) in the long run.

Exhibits 13a (Turner Valley) and 13b (Black Diamond) show our housing demand and residential land requirements forecasts based on our lower population growth scenario and Exhibits 14a (Turner Valley) and 14b (Black Diamond) show our housing demand and residential land requirements forecasts based on our higher population growth scenario. The forecasts suggest that:

1. Total housing demand in Turner Valley and Black Diamond combined will average in the range of 74 to 97 units per year from 2015 to 2045 and in the range of 124 to 192 units per year from 2045 to 2075. This represents total housing demand in the range of about 5,900 to 8,700 units over the entire forecast period (2015 to 2075).
2. Single detached units will remain the primary housing type in Turner Valley and Black Diamond during the entire forecast period, but the single detached share of new residential development will decline gradually from 70% on average during 2015 to 2045 to about 65% on average during 2045 to 2075. The average annual demand for new single detached units is, therefore, projected to be in the range of 52 to 67 units per year from 2015 to 2045 and 81 to 125 units per year from 2045 to 2075. This would yield a total of about 3,900 to 5,800 single detached units during the entire forecast period.
3. Attached units will account for about 15% of total housing demand over the entire forecast period. This represents an average of about 11 to 14 units per year from 2015 to 2045 and 18 to 29 units per year from 2045 to 2075. This would yield a total of about 900 to 1,300 attached units during the entire forecast period.
4. Apartments units will account for a higher share of housing demand over time, increasing from a share of about 15% during 2015 to 2045 to a share of about 20% during 2045 to 2075. The average annual demand for new apartment units is projected to be about 11 to 14 units per year from 2015 to 2045 and 25 to 38 units per year from 2045 to 2075. This would yield a total of about 1,100 to 1,600 apartment units in the Towns during the entire forecast period.
5. Based on the assumptions about remaining residential development capacity inside the existing boundaries of the two Towns and the Towns' goals for achieving higher average densities in new residential development, our forecasts suggest that (combined), the Towns will need an additional:

   a) 132 to 191 acres (beyond the Towns' existing boundaries) to accommodate residential development between 2015 and 2045 plus

   b) 413 to 712 acres (beyond the Towns' existing boundaries) to accommodate residential development between 2045 and 2075.

   c) A total residential land requirement (outside the Towns' existing boundaries) of 545 to 903 acres over the entire forecast period.

Exhibit 13a: Residential Land Requirements Forecast – Turner Valley – Scenario 1 (Lower Growth)

Turner Valley Residential Land Requirements Forecast - Scenario 1 - Low Growth			
Section 1 - Population and Household Forecasts			
1.1 Population	2015	2045	2075
Calgary Regional Partnership	1,409,245	2,138,578	2,716,071
Turner Valley	2,511	5,140	9,541
1.2 Population Growth Rates	2011-2015	2015-2045	2045-2075
Calgary Regional Partnership Growth Rate		1.40%	0.80%
Turner Valley Growth Rate		2.42%	2.08%
1.3 Average Household Size	2015	2045	2075
Turner Valley	2.4	2.4	2.4
1.4 Households	2015	2045	2075
Turner Valley	1,046	2,142	3,975
Section 2 - Growth			
2.1 Population	Average Annual Increment		Total Increment
Population	2015-2045	2045-2075	2015-2075
Turner Valley	88	147	7,030
Population - Average Annual Growth Rate (%)	2015-2045	2045-2075	2015-2075
Turner Valley	2.42%	2.08%	2.25%
Population - Share of Regional Partnership Growth (%)	2015-2045	2045-2075	2015-2075
Turner Valley	0.4%	0.8%	0.5%
2.2 Households	Average Annual Increment		Total Increment
Households	2015-2045	2045-2075	2015-2075
Turner Valley	37	61	2,929
2.3 Units	Average Annual Increment		Total Increment
Share by type in Turner Valley (%)	2015-2045	2045-2075	2015-2075
Single-Detached	70%	65%	67%
Attached (Duplex, Townhouse, Row and Semi-Detached)	15%	15%	15%
Apartment	15%	20%	18%
Total	100%	100%	100%
Number by type in Turner Valley	2015-2045	2045-2075	2015-2075
Single-Detached	26	40	1,959
Attached (Duplex, Townhouse, Row and Semi-Detached)	5	9	439
Apartment	5	12	531
Total	37	61	2,929
2.4 Total Forecasted Units by Tme Period	Total Increment		
Turner Valley	2015-2045	2045-2075	2015-2075
Single-Detached	767	1,192	1,959
Attached (Duplex, Townhouse, Row and Semi-Detached)	164	275	439
Apartment	164	367	531
Total	1,095	1,834	2,929
Section 3 - Comparison of Forecasted Development with Existing Capacity inside Existing Town Boundaries			
Turner Valley	2015-2045	2045-2075	2015-2075
Projected Residential Opportunity (units) per time period	1,095	1,834	2,929
Estimated Existing Residential Capacity	1,095	411	1,506
Unmet Capacity (units per time period)	0	1,423	1,423
Assumed Unmet Capacity by Unit Type	2015-2045	2045-2075	2015-2075
Single-Detached	0	925	925
Attached (Duplex, Townhouse, Row and Semi-Detached)	0	213	213
Apartment	0	285	285
Total	0	1,423	1,423
Section 4 - Additional Land Requirements (Gross Acres - includes roads, MR, storm water, community services, etc)			
4.1 Density (Units per Acre)	2015-2045	2045-2075	2015-2075
Residential	5.85	8.00	8.0
4.2 Total Land Requirements (in Acres) - Full Period	2015-2045	2045-2075	2015-2075
Total	0	178	178

Exhibit 13b: Residential Land Requirements Forecast – Black Diamond – Scenario 1 (Lower Growth)

Black Diamond Residential Land Requirements Forecast - Scenario 1 - Low Growth			
Section 1 - Population and Household Forecasts			
1.1 Population	2015	2045	2075
Calgary Regional Partnership	1,409,245	2,138,578	2,716,071
Black Diamond	2,577	5,275	9,792
1.2 Population Growth Rates	2011-2015	2015-2045	2045-2075
Calgary Regional Partnership Growth Rate		1.40%	0.80%
Black Diamond Growth Rate		2.42%	2.08%
1.3 Average Household Size	2015	2045	2075
Black Diamond	2.4	2.4	2.4
1.4 Households	2015	2045	2075
Black Diamond	1,074	2,198	4,080
Section 2 - Growth			
2.1 Population	Average Annual Increment		Total Increment
Population	2015-2045	2045-2075	2015-2075
Black Diamond	90	151	7,215
Population - Average Annual Growth Rate (%)	2015-2045	2045-2075	2015-2075
Black Diamond	2.42%	2.08%	2.25%
Population - Share of Regional Partnership Growth (%)	2015-2045	2045-2075	2015-2075
Black Diamond	0.4%	0.8%	0.6%
2.2 Households	Average Annual Increment		Total Increment
Households	2015-2045	2045-2075	2015-2075
Black Diamond	37	63	3,006
2.3 Units	Average Annual Increment		Total Increment
Share by type in Black Diamond (%)	2015-2045	2045-2075	2015-2075
Single-Detached	70%	65%	67%
Attached (Duplex, Townhouse, Row and Semi-Detached)	15%	15%	15%
Apartment	15%	20%	18%
Total	100%	100%	100%
Number by type in Black Diamond	2015-2045	2045-2075	2015-2075
Single-Detached	26	41	2,010
Attached (Duplex, Townhouse, Row and Semi-Detached)	6	9	451
Apartment	6	13	545
Total	37	63	3,006
2.4 Total Forecasted Units by Tme Period	Total Increment		
Black Diamond	2015-2045	2045-2075	2015-2075
Single-Detached	787	1,223	2,010
Attached (Duplex, Townhouse, Row and Semi-Detached)	169	282	451
Apartment	169	376	545
Total	1,124	1,882	3,006
Section 3 - Comparison of Forecasted Development with Existing Capacity inside Existing Town Boundaries			
Black Diamond	2015-2045	2045-2075	2015-2075
Projected Residential Opportunity (units) per time period	1,124	1,882	3,006
Estimated Existing Residential Capacity	354	0	354
Unmet Capacity (units per time period)	770	1,882	2,652
Assumed Unmet Capacity by Unit Type	2015-2045	2045-2075	2015-2075
Single-Detached	539	1,223	1,762
Attached (Duplex, Townhouse, Row and Semi-Detached)	116	282	398
Apartment	116	376	492
Total	770	1,882	2,652
Section 4 - Additional Land Requirements (Gross Acres - includes roads, MR, storm water, community services, etc)			
4.1 Density (Units per Acre)	2015-2045	2045-2075	2015-2075
Residential	5.85	8.00	7.2
4.2 Total Land Requirements (in Acres) - Full Period	2015-2045	2045-2075	2015-2075
Total	132	235	367

Exhibit 14a: Residential Land Requirements Forecast – Turner Valley – Scenario 2 (Higher Growth)

Turner Valley Residential Land Requirements Forecast - Scenario 2 - High Growth			
Section 1 - Population and Household Forecasts			
1.1 Population	2015	2045	2075
Calgary Regional Partnership	1,409,245	2,138,578	2,716,071
Turner Valley	2,511	5,949	12,785
1.2 Population Growth Rates	2011-2015	2015-2045	2045-2075
Calgary Regional Partnership Growth Rate		1.40%	0.80%
Turner Valley Growth Rate		2.92%	2.58%
1.3 Average Household Size	2015	2045	2075
Turner Valley	2.4	2.4	2.4
1.4 Households	2015	2045	2075
Turner Valley	1,046	2,479	5,327
Section 2 - Growth			
2.1 Population	Average Annual Increment		Total Increment
Population	2015-2045	2045-2075	2015-2075
Turner Valley	115	228	10,274
Population - Average Annual Growth Rate (%)	2015-2045	2045-2075	2015-2075
Turner Valley	2.92%	2.58%	2.75%
Population - Share of Regional Partnership Growth (%)	2015-2045	2045-2075	2015-2075
Turner Valley	0.5%	1.2%	0.8%
2.2 Households	Average Annual Increment		Total Increment
Households	2015-2045	2045-2075	2015-2075
Turner Valley	48	95	4,281
2.3 Units	Average Annual Increment		Total Increment
Share by type in Turner Valley (%)	2015-2045	2045-2075	2015-2075
Single-Detached	70%	65%	67%
Attached (Duplex, Townhouse, Row and Semi-Detached)	15%	15%	15%
Apartment	15%	20%	18%
Total	100%	100%	100%
Number by type in Turner Valley	2015-2045	2045-2075	2015-2075
Single-Detached	33	62	2,854
Attached (Duplex, Townhouse, Row and Semi-Detached)	7	14	642
Apartment	7	19	785
Total	48	95	4,281
2.4 Total Forecasted Units by Tme Period	Total Increment		
Turner Valley	2015-2045	2045-2075	2015-2075
Single-Detached	1,003	1,852	2,854
Attached (Duplex, Townhouse, Row and Semi-Detached)	215	427	642
Apartment	215	570	785
Total	1,432	2,849	4,281
Section 3 - Comparison of Forecasted Development with Existing Capacity inside Existing Town Boundaries			
Turner Valley	2015-2045	2045-2075	2015-2075
Projected Residential Opportunity (units) per time period	1,432	2,849	4,281
Estimated Existing Residential Capacity	1,432	74	1,506
Unmet Capacity (units per time period)	0	2,775	2,775
Assumed Unmet Capacity by Unit Type	2015-2045	2045-2075	2015-2075
Single-Detached	0	1,804	1,804
Attached (Duplex, Townhouse, Row and Semi-Detached)	0	416	416
Apartment	0	555	555
Total	0	2,775	2,775
Section 4 - Additional Land Requirements (Gross Acres - includes roads, MR, storm water, community services, etc)			
4.1 Density (Units per Acre)	2015-2045	2045-2075	2015-2075
Residential	5.85	8.00	8.0
4.2 Total Land Requirements (in Acres) - Full Period	2015-2045	2045-2075	2015-2075
Total	0	347	347

Exhibit 14b: Residential Land Requirements Forecast – Black Diamond – Scenario 2 (Higher Growth)

Black Diamond Residential Land Requirements Forecast - Scenario 2 - High Growth			
Section 1 - Population and Household Forecasts			
1.1 Population	2015	2045	2075
Calgary Regional Partnership	1,409,245	2,138,578	2,716,071
Black Diamond	2,577	6,105	13,121
1.2 Population Growth Rates	2011-2015	2015-2045	2045-2075
Calgary Regional Partnership Growth Rate		1.40%	0.80%
Black Diamond Growth Rate		2.92%	2.58%
1.3 Average Household Size	2015	2045	2075
Black Diamond	2.4	2.4	2.4
1.4 Households	2015	2045	2075
Black Diamond	1,074	2,544	5,467
Section 2 - Growth			
2.1 Population	Average Annual Increment		Total Increment
Population	2015-2045	2045-2075	2015-2075
Black Diamond	118	234	10,544
Population - Average Annual Growth Rate (%)	2015-2045	2045-2075	2015-2075
Black Diamond	2.92%	2.58%	2.75%
Population - Share of Regional Partnership Growth (%)	2015-2045	2045-2075	2015-2075
Black Diamond	0.5%	1.2%	0.8%
2.2 Households	Average Annual Increment		Total Increment
Households	2015-2045	2045-2075	2015-2075
Black Diamond	49	97	4,393
2.3 Units	Average Annual Increment		Total Increment
Share by type in Black Diamond (%)	2015-2045	2045-2075	2015-2075
Single-Detached	70%	65%	67%
Attached (Duplex, Townhouse, Row and Semi-Detached)	15%	15%	15%
Apartment	15%	20%	18%
Total	100%	100%	100%
Number by type in Black Diamond	2015-2045	2045-2075	2015-2075
Single-Detached	34	63	2,929
Attached (Duplex, Townhouse, Row and Semi-Detached)	7	15	659
Apartment	7	19	805
Total	49	97	4,393
2.4 Total Forecasted Units by Tme Period	Total Increment		
Black Diamond	2015-2045	2045-2075	2015-2075
Single-Detached	1,029	1,900	2,929
Attached (Duplex, Townhouse, Row and Semi-Detached)	220	439	659
Apartment	220	585	805
Total	1,470	2,923	4,393
Section 3 - Comparison of Forecasted Development with Existing Capacity inside Existing Town Boundaries			
Black Diamond	2015-2045	2045-2075	2015-2075
Projected Residential Opportunity (units) per time period	1,470	2,923	4,393
Estimated Existing Residential Capacity	354	0	354
Unmet Capacity (units per time period)	1,116	2,923	4,039
Assumed Unmet Capacity by Unit Type	2015-2045	2045-2075	2015-2075
Single-Detached	781	1,900	2,681
Attached (Duplex, Townhouse, Row and Semi-Detached)	167	439	606
Apartment	167	585	752
Total	1116	2,923	4,039
Section 4 - Additional Land Requirements (Gross Acres - includes roads, MR, storm water, community services, etc)			
4.1 Density (Units per Acre)	2015-2045	2045-2075	2015-2075
Residential	5.85	8.00	7.3
4.2 Total Land Requirements (in Acres) - Full Period	2015-2045	2045-2075	2015-2075
Total	191	365	556

6.0 Commercial Development Outlook

We forecast future requirements for commercial land (retail, service and office) in Turner Valley and Black Diamond using this approach:

- We review the kinds of businesses that are located in the Towns.
- We calculate the existing commercial floorspace per capita ratio (i.e. the amount of commercial floorspace in Turner Valley and Black Diamond per trade area resident). We use a per capita ratio per trade area resident because businesses in Turner Valley and Black Diamond serve residents in the Towns plus surrounding rural areas.
- We consider whether the role of Turner Valley and Black Diamond as a commercial centre is likely to change over the forecast period.
- We forecast future commercial floorspace development in the Towns using a per capita ratio approach (i.e. we apply a commercial floorspace per capita ratio to our forecast of population growth).
- Based on an assumed average density of development, we translate our forecast of future commercial floorspace growth into an estimate of commercial land requirements. We then deduct the existing capacity for commercial growth within the Towns, resulting in an estimate of future commercial land requirements outside the Towns' existing boundaries.

6.1 Business Inventory

Appendix 1 (Turner Valley) and Appendix 2 (Black Diamond) list the commercial businesses located in each Town. Based on the business inventories and our fieldwork, all of the retail, service, and office space in Turner Valley and Black Diamond is occupied by locally-oriented retail and service businesses that meet the day-to-day needs of residents in the Towns and nearby surrounding rural areas, such as a grocery store (Country Food Mart), pharmacy, convenience stores, liquor stores, restaurants/cafes, bank, pubs, laundromat, and gas stations.

There are no regionally-oriented retail and service businesses in Turner Valley and Black Diamond, such as department stores, large format ("big box") retailers, major chain clothing stores, or specialty stores. These kinds of businesses tend to locate in major commercial centres or in locations that offer convenient vehicular access to a large regional or sub-regional trade area population (often 50,000 customers or more). Okotoks and South Calgary contain all of the major region-serving businesses that we would expect to see in a large commercial centre, such as Canadian Tire, Wal-mart Supercentre, Home Depot, Winners, Costco, Staples, and others.

6.2 Existing Commercial Floorspace Inventory and Per Capita Ratio

As of 2015, there was a total of 238,435 square feet of commercial floorspace in Turner Valley and Black Diamond.[8] This figure includes retail, service, and office space. As noted in Section 4.1.1, we defined a commercial trade area that includes Turner Valley, Black Diamond, and the surrounding rural area that is south of Priddis, north of Longview, west of about the mid-point between Black Diamond and Okotoks, and east of Sheep River Provincial Park in Kananaskis.

[8] Based on floorspace inventory data provided by the Towns.

The trade area has a total of about 8,951 people, so there is about 26.6 square feet of existing commercial space in Turner Valley and Black Diamond per trade area resident (see Exhibit 15).

Exhibit 15: Existing Commercial Floorspace Per Capita in Turner Valley and Black Diamond

	2015
Commercial floorspace inventory	238,435 sq.ft.
Trade area population:	
Turner Valley & Black Diamond	5,088 people
Remainder of Local Trade Area[a]	3,863 people
Total Trade Area Population	8,951 people
Commercial floorspace per capita ratio	26.6 sq.ft. per capita

Source: Based on information provided by the Towns of Turner Valley and Black Diamond.

Based on our work in other parts of Western Canada:

- Communities tend to support about 20 square feet per capita of local convenience-oriented retail (e.g. supermarket, pharmacy, liquor) and services (e.g. food/beverage, hair, financial institutions, cleaners).
- Communities tend to support about 25 square feet per capita of regional destination or comparison retail space (e.g. department store, furniture, home improvement, clothing, jewelry).
- Smaller communities that are not regional business centres tend to support about 6 to 10 square feet per capita of local-oriented office space (e.g. medical/dental, insurance, real estate).

Based on the existing patterns of commercial development in Turner Valley, Black Diamond, Okotoks, and Calgary:

- Turner Valley and Black Diamond are probably retaining almost all of their local convenience retail and personal services demand; the communities have a large enough array of businesses that there would be little leakage of convenience purchases.
- Turner Valley and Black Diamond trade area residents likely export almost all of their regional destination and comparison shopping demand to Calgary and Okotoks.
- Turner Valley and Black Diamond probably retain a share of their locally-oriented office business demand, but some of this demand (e.g. medical/dental, insurance, accounting and legal business) is likely exported to Calgary and Okotoks.

Based on this assessment, we would expect Turner Valley and Black Diamond to have on the order of about 20 square feet per capita of locally-serving retail and service floorspace and about 6 to 8 square feet of locally-serving office space, so the existing ratio of 26.6 square feet per capita appears to be reasonable given the size of the commercial trade area and its proximity to other regional commercial destinations.

6.3 Forecast of Commercial Floorspace Development and Land Requirements

6.3.1 Role of Turner Valley and Black Diamond Over the Forecast Period

Turner Valley and Black Diamond are not likely to attract regionally-oriented retail and service businesses over the forecast period, as Okotoks and South Calgary are already filling this role and the combined population of Turner Valley and Black Diamond is not large enough to support most (if not all) regional

oriented retail businesses. However, the two Towns will continue to attract additional retail and service businesses that serve residents of the Towns and the nearby rural areas.

As the local trade area area population grows (due to residential development), the demand for locally-oriented retail and personal service businesses will grow. We assume that the Turner Valley and Black Diamond trade area will continue to support about 27 square feet of retail, service, and office space per capita and this growth will be focused within the two Towns (not the surrounding rural areas).

6.3.2 Forecast of Commercial Floorspace Growth and Commercial Land Requirements

Our population projections suggest that the trade area will grow from about 8,951 people in 2015 to on the order of 14,679 people (low) to 16,317 people (high) as of 2045 and on the order of 24,040 people (low) to 30,613 people (high) as of 2075.

Applying a commercial floorspace per capita ratio of about 27 sq.ft. to the projected trade area population results in potential commercial floorspace growth of about:

- 158,000 to 202,000 square feet from 2015 to 2045.
- 253,000 to 386,000 square feet from 2045 to 2075.

Over the entire forecast period, therefore, total commercial floorspace growth is projected to be on the order of about 411,000 to 588,000 square feet.

We use an assumed average density for new commercial development of 0.30 Floor Area Ratio (FAR) on the net developable land area. This assumes that most of the commercial floorspace development is for retail and service space with surface parking (at about 0.25 to 0.30 FAR) with some higher density office development.

We also assume that 35% of the land is required for municipal reserves (parks and schools), environmentally sensitive areas, roads, and stormwater.

Based on these assumptions, Exhibits 16a (low scenario) and 16b (high scenario) show our forecasts of future commercial land requirements in Turner Valley and Black Diamond. The forecasts indicate that:

- The total gross commercial land requirements will be in the range of 19 to 24 acres in the short-medium term (2015-2045) and in the range of 30 to 45 acres in the long-term (2045-2075), totaling 48 to 69 acres over the entire forecast period.
- Combined, the Towns have about 18 acres of commercial land remaining for development, so an additional 30 to 51 acres are required (i.e. outside the Towns' existing boundaries) to accommodate market-driven commercial growth over the forecast period.

Exhibit 16a: Commercial Land Requirements Forecast – Turner Valley & Black Diamond – Scenario 1 (Lower Growth)

Turner Valley & Black Diamond - Commercial Land Requirements Forecast
Lower Growth Scenario

pink shaded cells are inputs

Section 1 - Projected commercial floorspace demand in Turner Valley and Black Diamond			
	2015	2045	2075
Population:			
Turner Valley & Black Diamond	5,088	10,415	19,333
Remainder of Local Trade Area - assumed to grow at an average annual rate of 0.33%	3,863	4,264	4,707
Total Local Trade Area	8,951	14,679	24,040
Supportable Commercial Floorspace Per Capita	26.6	27.0	27.0
Total Supportable Commercial Floorspace in Black Diamand and Turner Valley	238,435	396,327	649,068
Section 2 - Forecast of future commercial land requirements in Turner Valley and Black Diamond (net of roads, reserves, ESAs, etc)			
	2015 to 2045	2045 to 2075	2015 to 2075
Growth in Commercial Floorspace (sf)	157,892	252,741	410,633
Assumed FAR for New Commercial Development	0.30	0.30	0.30
Commercial Land Requirement (in net acres)	12	19	31
Section 3 - Forecast of future commercial land requirements in Turner Valley and Black Diamond (gross acres including roads, MR, storm, etc)			
	2015 to 2045	2045 to 2075	2015 to 2075
Commercial Land Requirement (in net acres)	12	19	31
Assumed gross up allowance	35%	35%	35%
Commercial Land Requirement (in gross acres)	19	30	48
Less Commercial Land Available for Development within the Towns' existing boundaries	18	0	18
Requirement for additional commercial land	1	30	30

Source: Coriolis Consulting Corp.

Exhibit 16b: Commercial Land Requirements Forecast – Turner Valley & Black Diamond – Scenario 2 (Higher Growth)

Turner Valley & Black Diamond - Commercial Land Requirements Forecast
Higher Growth Scenario

pink shaded cells are inputs

Section 1 - Projected commercial floorspace demand in Turner Valley & Black Diamond			
	2015	2045	2075
Population:			
Turner Valley & Black Diamond	5,088	12,053	25,906
Remainder of Local Trade Area 0.33%	3,863	4,264	4,707
Total Local Trade Area	8,951	16,317	30,613
Supportable Commercial Floorspace Per Capita	26.6	27.0	27.0
Total Supportable Commercial Floorspace in Black Diamand and Turner Valley	238,435	440,566	826,554
Section 2 - Forecast of future commercial land requirements in Turner Valley & Black Diamond (net of roads, reserves, ESAs, etc)			
	2015 to 2045	2045 to 2075	2015 to 2075
Growth in Commercial Floorspace (sf)	202,131	385,988	588,119
Assumed FAR for New Commercial Development	0.30	0.30	0.30
Commercial Land Requirement (in net acres)	15	30	45
Section 3 - Forecast of future commercial land requirements in Turner Valley & Black Diamond (gross acres including roads, MR, storm, etc)			
	2015 to 2045	2045 to 2075	2015 to 2075
Commercial Land Requirement (in net acres)	15	30	45
Assumed gross up allowance	35%	35%	35%
Commercial Land Requirement (in gross acres)	24	45	69
Less Commercial Land Available for Development within the Towns' existing boundaries	18	0	18
Requirement for additional commercial land	6	45	51

Source: Coriolis Consulting Corp.

7.0 Industrial Development Outlook

In this section, we describe the existing industrial situation in Turner Valley and Black Diamond, forecast future industrial floorspace growth, and translate this into future industrial land requirements for the short/medium term (2015 to 2045) and long term (2045 to 2075).

7.1 Existing Industrial Situation

As of 2015, there was a total of about 96,900 square feet of industrial space in Turner Valley and Black Diamond, of which about half is located in JKR Business Park in Black Diamond (see Exhibit 17). This industrial development has occurred over the past 30 years or so and, based on building permit data, there has been little recent industrial development in the Towns.

Turner Valley and Black Diamond have vacant, zoned, serviced industrial land available for development, so the slow pace of industrial development has likely been due to limited demand for new space, not a lack of vacant land supply. Demand for industrial development has likely been limited because the Towns are not on a major highway corridor and there are other locations (such as the Highway 2 industrial corridor in Okotoks) that have been attracting a significant amount of industrial development.

Industrial space in Turner Valley and Black Diamond is occupied by businesses that appear to be mainly serving the businesses and residents of the local trade area, such as building material suppliers, automotive sales and service, trades workshops (e.g. cabinet maker, welding shop), professional services (e.g. environmental engineering), mini-storage, and recycling and waste disposal services. There are few businesses serving the regional, provincial or broader markets.

Exhibit 17: Industrial Floorspace Inventory in Turner Valley and Black Diamond, 2015

	Industrial Floorspace as of 2015
Black Diamond:	
Business Park	*50,483 sq.ft.*
Rest of Town	*10,495 sq.ft.*
Total	60,978 sq.ft.
Turner Valley	35,930 sq.ft.
Towns Combined	96,908 sq.ft.

Source: Based on information provided by the Towns of Turner Valley and Black Diamond.

7.2 Forecast of Industrial Floorspace Development and Land Requirements

We considered the following regional context in producing our industrial floorspace growth projections:

- Turner Valley and Black Diamond will remain a suburban community in the Calgary Region and its share of regional employment will likely remain stable over time.
- The City of Calgary will continue to capture the largest share of regional employment growth.
- The City of Calgary has a large amount of vacant industrial-designated land, especially in the North/Northeast and Southeast sectors (which is the nearest area to Turner Valley and Black Diamond), and will continue to accommodate the vast majority of industrial development in the Calgary Region.

- Okotoks and the Highway 2A Industrial Corridor play a large role in the industrial market outside of Calgary and will continue to capture most of the industrial businesses that require convenient access to the regional highway system (such as distribution centres and logistics companies) and that are interested in a location to the South of the City of Calgary.

Based on this competitive context, we do not expect Turner Valley and Black Diamond to attract a significant number of industrial businesses that serve regional, provincial or broader markets. We would expect future industrial floorspace growth in Turner Valley and Black Diamond to mainly be linked to the overall pace of growth in the two Towns (as in the existing situation).

Exhibit 18 shows our forecast of industrial growth assuming the role that Tuner Valley and Black Diamond play within the regional industrial market does not change over the long term and local industrial growth is driven by business and residential growth in the nearby trade area. We assume:

- Industrial floorspace in Turner Valley and Black Diamond will grow by an average of about 2% per year.
- The average density for new industrial development will be 0.25 FAR on the net developable land area.
- An allowance of 35% for municipal reserves, environmentally sensitive areas, roads, and stormwater.

Based on these assumptions, the forecasts suggest that Turner Valley and Black Diamond will need about 11 acres of industrial land to accommodate growth in the short-medium term (2015 to 2045) plus an additional 20 acres of industrial land over the long term (2045 to 2075), or a total of about 30 acres over the entire forecast period. The Towns have 8.5 acres remaining for industrial development, so they will need an additional 23 acres (outside the Towns' existing boundaries) to accommodate industrial growth linked to business and residential growth over the next 60 years.

Exhibit 18: Industrial Land Requirements Forecast – Turner Valley & Black Diamond

Turner Valley & Black Diamond - Industrial Land Requirements Forecast
For Industrial Businesses Servicing Local Area

pink shaded cells are inputs

1. Existing Industrial floorspace in Black Diamond and Turner Valley

	2015
Total amount of Industrial floorspace in sq.ft.	96,908

2. Estimate of Future Growth in Turner Valley & Black Diamond Trade Area

	2015	2045	2075
Population (low scenario):			
Turner Valley & Black Diamond	5,088	10,415	19,333
Surrounding areas	3,863	4,264	4,707
Local trade area total (low scenario)	8,951	14,679	24,040
Population (high scenario):			
Turner Valley & Black Diamond	5,088	12,053	25,906
Surrounding areas	3,863	4,264	4,707
Local trade area total (high scenario)	8,951	16,317	30,613
Average Annual Trade Area Population Growth Rate:	2015 to 2045	2045 to 2075	2015 to 2075
Low Scenario	1.66%	1.66%	1.66%
High Scenario	2.02%	2.12%	2.07%

3. Forecast of future Industrial land requirement for businesses serving the local area (net of roads, MR, storm, etc)

	2015 to 2045	2045 to 2075	2015 to 2075
Assumed Annual Growth in Industrial Floorspace	2.0%	2.0%	2.0%

	2015	2045	2075
Projected Total Industrial Floorspace	96,908	175,535	317,958

	2015 to 2045	2045 to 2075	2015 to 2075
Industrial Floorspace at End of Period	175,535	317,958	317,958
Industrial Floorspace at Beginning of Period	96,908	175,535	96,908
Additional Industrial Floorspace	78,627	142,423	221,050
Assumed Average FAR	0.25	0.25	0.25
Estimated Industrial Additional Land Requirement (net acres)	7.2	13.1	20.3

4. Forecast of future industrial land requirements in Turner Valley & Black Diamond (gross acres including roads, MR, storm, etc)

	2015 to 2045	2045 to 2075	2015 to 2075
Industrial Land Requirement (in net acres)	7.2	13.1	20.3
Assumed gross up allowance	35%	35%	35%
Industriall Land Requirement (in gross acres)	11.1	20.1	31.2
Less Industrial Land Available for Development within the Towns' existing boundaries	8.5	0	8.5
Requirement for additional industrial land	2.6	20.1	22.7

Source: Coriolis Consulting Corp.

8.0 Potential Additional Land Requirements

The commercial and industrial land requirement forecasts in Sections 6.0 and 7.0 are based on our expectation that Turner Valley and Black Diamond's role within the overall regional commercial and industrial markets does not change significantly over time. However, it is possible that our forecasts could understate potential commercial and industrial growth over the forecast period because:

- The forecasts span 60 years. Over this length of time there could be changes in transportation networks or market conditions (that cannot be anticipated at this point in time) which will affect the commercial and industrial prospects for the two Towns.
- The two Towns have economic development objectives to significantly increase the amount of commercial and industrial development. It is possible that industrial development in Turner Valley and Black Diamond could exceed our market-based forecasts over the forecast period if the Towns are successful at growing their economic base beyond the types of commercial and industrial businesses that mainly serve local residents and businesses.

To attract a larger share of the regional commercial and industrial market, Turner Valley and Black Diamond would likely need to offer vacant land in a location that offers a convenient connection to the regional highway system (Highway 2), is flat, and is affordable to service. However, given the unpredictable nature of the demand for any industrial and commercial land beyond our forecasts, we do not suggest pre-servicing land for this kind of opportunity.

9.0 Summary of Forecasts of Land Requirements

Exhibit 19 summarizes our lower and higher forecasts of the gross amount of land required by Turner Valley and Black Diamond outside the Towns' existing boundaries to accommodate market-driven residential, commercial, and industrial growth to 2075. The forecasts indicate that:

- *Gross Residential Land Requirements*: A total of about 132 to 191 acres are needed to accommodate expected residential demand in the short-medium term (2015 to 2045) plus an additional 413 to 712 acres in the long-term, totalling on the order of 545 to 903 gross acres during the entire forecast period.
- *Gross Commercial Land Requirements*: In addition to commercial land still available for development within the Towns' boundaries (about 18 acres in total), about 1 to 6 acres are needed to accommodate projected population-driven commercial growth in the short-medium term (2015 to 2045) plus an additional 30 to 45 acres are needed in the long-term. This suggests a total requirement for additional commercial land (i.e. outside the Towns' current boundaries) on the order of 30 to 51 acres during the entire forecast period.
- *Gross Industrial Land Requirements*: In additional to industrial land still available for development within the Towns' boundaries (about 8.5 acres in total), about 3 acres are needed to accommodate projected industrial growth in the short-medium term (2015 to 2045) and an additional 20 acres are needed in the long-term (2045 to 2075), totalling on the order of 23 acres during the entire forecast period.
- *Total Gross Land Requirements*: The total land requirement (i.e., the sum of residential, commercial, and industrial land requirements) is forecasted to be about 135 to 199 acres in the short-medium term (2015 to 2045) and an additional 463 to 778 acres in the long-term (2045 to 2075) totalling on the order of 598 to 977 gross acres over the entire forecast period. These are gross land requirements outside the Towns' existing boundaries, so they already include take into account remaining capacity for development within Turner Valley and Black Diamond and include allowances for municipal reserves (parks and schools), roads, stormwater, environmentally sensitive areas, and community services (but they do not include land for other public services).

Exhibit 19: Summary of Forecasted Land Requirements for Turner Valley and Black Diamond, 2015 to 2075

	Low Scenario			High Scenario		
	2015-2045	2045-2075	Total	2015-2045	2045-2075	Total
Turner Valley Residential	*0*	*178*	178	*0*	*347*	*347*
Black Diamond Residential	*132*	*235*	367	*191*	*365*	*556*
Total Residential	132	413	545	191	712	903
Commercial (local market only)*	1	30	30	6	45	51
Industrial (local market only)*	3	20	23	3	20	23
Total (gross acres required outside the Towns' existing boundaries)	135	463	598	199	778	977

* Does not include land that may be needed to accommodate economic development opportunities.

These forecasts do not allow for additional commercial or industrial land to meet each Town's economic development objectives (beyond those needed from a market-driven perspective), so additional land could be identified to accommodate any unforeseen commercial and industrial opportunities that arise over time.

10.0 Appendices

Appendix 1: Business Inventory for Turner Valley

Town of Turner Valley Business Inventory

Address	Business
103 Edgar Avenue NW	Daisies & Dirt Greenhouse
104 Main Street NW	RBC Royal Bank
108 Main Street NW	LAB
112 Main Street NW	Home Hardware
118 Main Street NW	Children's Place, WFG Insurance, Granny's Pizza, Laundromat
140 Main Street NW	Valley Central Business, Office building
202 Main Street NW	Coyote Moon Restaurant
206 Main Street NW	Valley Cold Beer & Liquor Store Ltd.
208 Main Street SW	Subway
220 Main Street NW	Ben's Thrift Store
302 Main Street NW	Planet Auto Inc. (Automotive)
101 Sunset Boulevard SE	Esso Fuel Station/mini mart/ family restaurant
104 Sunset Boulevard SW	Bottle Depot/Liqor Store
105 Sunset Boulevard SE	Chuckwagon Café
111 Sunset Boulevard SW	Tasting Room (Brew Pub)
113 Sunset Boulevard SW	Production Room (Brew Pub)
117 Sunset Boulevard SW	Cougar's Sports Bar & Grill
117 Sunset Boulevard SE	Feed Store (rear)
202 Sunset Boulevard SE	MotorRad (Automotive)

Appendix 2: Business Inventory for Black Diamond

Town of Black Diamond Business Inventory

Company Name	Industry Group	Industry Group (Detailed Level 1)	HQ Status
Hortscape Limited	Agriculture	Agricultural Services	Single Location
Vale'S Greenhouse Ltd	Agriculture	Agricultural Production - Crops	Single Location
Eastern Slopes Veterinary Services Ltd	Agriculture	Agricultural Services	Single Location
Foothills Poultry Farm	Agriculture	Agricultural Production - Livestock And Animal Specialties	Single Location
Growco Yardcare Ltd	Agriculture	Agricultural Services	Single Location
Lilyfer Poultry Farms (Black Diamond) Ltd	Agriculture	Agricultural Production - Livestock And Animal Specialties	Single Location
T & T Disposal Services	Communications and Utilities	Electric, Gas and Sanitary Services	Single Location
Blue Torch Mechanical Inc	Construction	Special Trade Construction	Single Location
Bremen Electric Ltd	Construction	Special Trade Construction	Single Location
Image Electric	Construction	Special Trade Construction	Single Location
Ridgeline Electrical	Construction	Special Trade Construction	Single Location
Sheep Valley Heating And	Construction	Special Trade Construction	Single Location
Trinity Mechanical Inc	Construction	Special Trade Construction	Single Location
Voltel Electric Ltd	Construction	Special Trade Construction	Single Location
Blue Ridge Construction Cl Inc	Construction	Building Construction	Single Location
Canadian Timber Products	Construction	Building Construction	Single Location
Sure-Fit Mechanical Ltd	Construction	Special Trade Construction	Single Location
Silver Eagle Concrete Construction	Construction	Special Trade Construction	Single Location
1143676 Alberta Ltd	Construction	Special Trade Construction	Single Location
Scorpio Contracting	Construction	Building Construction	Single Location
Davista Homes Ltd	Construction	Building Construction	Single Location
J.K.R. Excavating Ltd	Construction	Special Trade Construction	Single Location
Alberta Treasury Branches	Finance, Insurance & Real Estate	Depository Institutions	Branch
Z69115 Alberta Ltd	Finance, Insurance & Real Estate	Real Estate	Branch
351914 Alberta Ltd	Finance, Insurance & Real Estate	Holding And Other Investment Offices	Single Location
Maxwell City Central	Finance, Insurance & Real Estate	Real Estate	Single Location
Zac'S Ventures Inc	Finance, Insurance & Real Estate	Nondepository Credit Institutions	Single Location
All About Packing Ltd	Manufacturing	Industrial and Commercial Machinery and Equipment	Single Location
First Place Feeds Ltd	Manufacturing	Food and Kindred Products	Single Location
Black Diamond- Town Of	Public Administration	Executive, Legislative & General Government, Except Finance	Branch
Black Diamond- Town Of	Public Administration	Executive, Legislative & General Government, Except Finance	Head Quarters
Alberta Health Services	Services	Health Services	Branch
Black Diamond- Town Of	Services	Amusement And Recreation Services	Branch
Foothills School Division No. 38	Services	Educational Services	Branch
Minnedosa Medical Group	Services	Social Services	Branch
Banner Enviromental Enginering Consultants Ltd	Services	Engineering Accounting Research Management & Related Svcs	Single Location
Garage Storage Solutions	Services	Automotive Repair Services And Parking	Single Location
Jmx Consulting Inc	Services	Engineering Accounting Research Management & Related Svcs	Single Location
Kid'S Stop Children Centre Ltd	Services	Social Services	Single Location
Non Typical Taxidermy	Services	Miscellaneous Repair Services	Single Location
Region 3 Family Base Care Society	Services	Social Services	Single Location
Thorhaug Consulting Service Ltd	Services	Engineering Accounting Research Management & Related Svcs	Single Location
Church Of God Mission Ltd	Services	Membership Organizations	Single Location
Chin Gordon Professional Dental Corp	Services	Health Services	Single Location
Diamond Valley Vision Care	Services	Health Services	Single Location
Mountain View Dental Hygiene	Services	Health Services	Single Location
Aritzi Beauty Lounge	Services	Personal Services	Single Location
Sweet Escape	Services	Personal Services	Single Location
Diamond Fitness And Wellness Inc	Services	Amusement And Recreation Services	Single Location
Klipperzzz	Services	Personal Services	Single Location
Pops Barbershop Ltd	Services	Personal Services	Single Location
Rav'N About Styles	Services	Personal Services	Single Location
Foot Hills Family Medical Centre	Services	Health Services	Single Location
Diamond Oasis Salon & Day Spa	Services	Personal Services	Single Location

(continued on following page)

Town of Black Diamond Business Inventory - CONTINUED

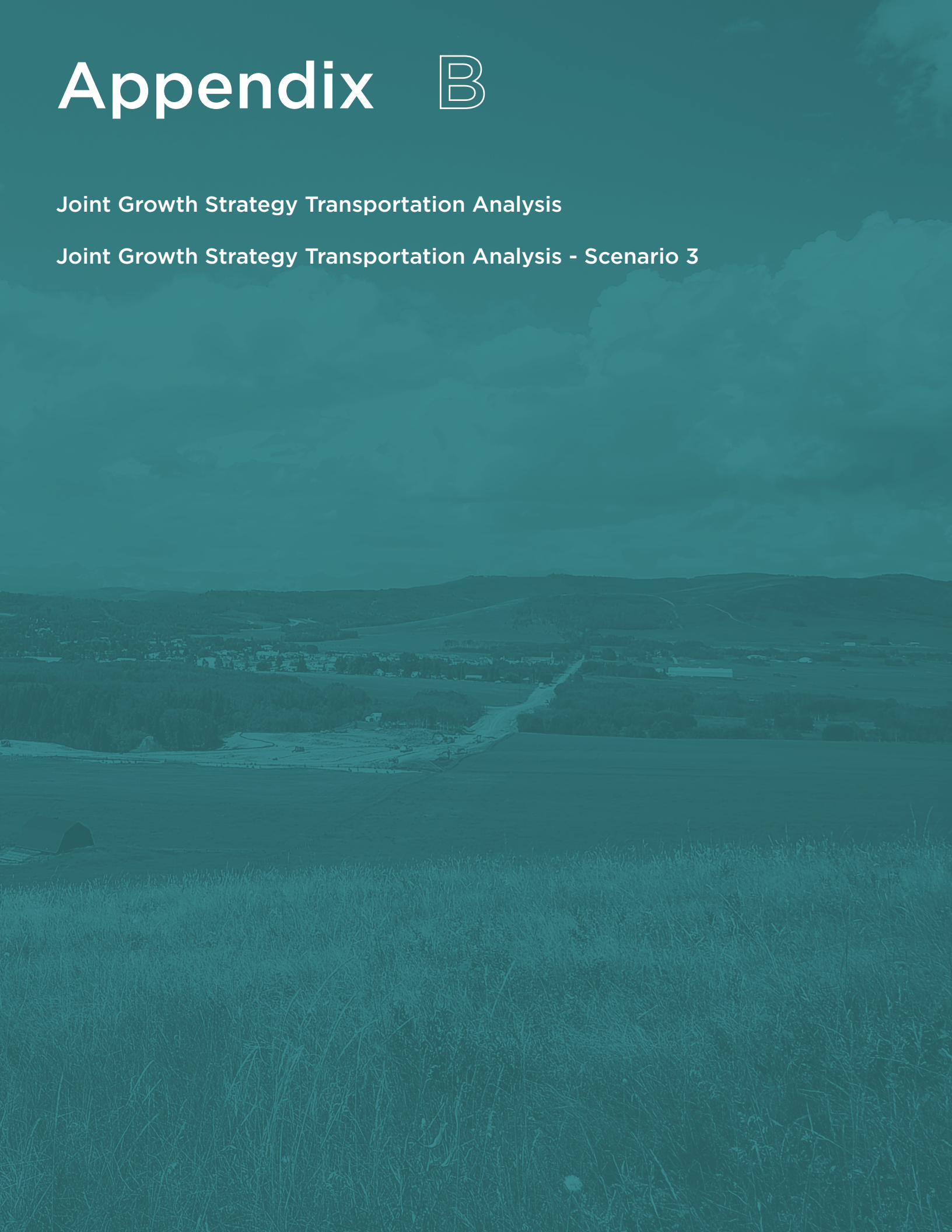
Company Name	Industry Group	Industry Group (Detailed Level 1)	HQ Status
Cowboy Trail Apartment Motel	Services	Hotels & Lodging Places	Single Location
Heirloom Oriental Rug Cleaning Ltd	Services	Personal Services	Single Location
Black Diamond Gospel Chapel	Services	Membership Organizations	Single Location
Webby Inc	Services	Business Services	Single Location
Black Diamond Eye Clinic	Services	Health Services	Single Location
Pioneer Enterprises	Services	Miscellaneous Repair Services	Single Location
800549 Alberta Ltd	Services	Legal Services	Single Location
Diamond Valley Clothing Co	Services	Business Services	Single Location
Idea Garden- The	Services	Business Services	Single Location
Equus Video Inc	Services	Motion Pictures	Single Location
Packer Inc	Services	Engineering Accounting Research Management & Related Svcs	Single Location
Boys And Girls Club Of Diamond Valley	Services	Membership Organizations	Single Location
Schwartz- Lisa Registered Massage Therapist	Services	Personal Services	Single Location
Sheep River Community Library	Services	Educational Services	Single Location
High Country Video Ltd	Services	Motion Pictures	Single Location
Oilfield Curling Club	Services	Amusement And Recreation Services	Single Location
Morgan Valve Repair (1996) Inc	Services	Miscellaneous Repair Services	Single Location
330810 Alberta Ltd	Services	Automotive Repair Services And Parking	Single Location
Carington Morris Professional Corporation	Services	Health Services	Single Location
True Grit Welding Ltd	Services	Miscellaneous Repair Services	Single Location
Journey'S Family Development Program	Services	Social Services	Single Location
Ted'S Autobody & Towing	Services	Automotive Repair Services And Parking	Single Location
Absolute Dentistry	Services	Health Services	Single Location
Diamond Valley Tune Up Ltd	Services	Automotive Repair Services And Parking	Single Location
All-Rite Towing	Services	Automotive Repair Services And Parking	Single Location
Anchor D Guiding & Outfitting Ltd	Services	Hotels & Lodging Places	Single Location
298007 Alberta Ltd	Services	Hotels & Lodging Places	Single Location
High Country Lodge	Services	Engineering Accounting Research Management & Related Svcs	Single Location
Oilfields General Hospital	Services	Health Services	Single Location
Sunrise Transport Ltd	Transportation	Motor Freight Transportation	Branch
693394 Alberta Ltd	Transportation	Local & Suburban Transit & Interurban Highway Transportation	Single Location
Roadstar Express Inc	Transportation	Motor Freight Transportation	Single Location
Corporation La Senza	Wholesale & Retail Trade	Apparel and Accessory Stores	Branch
Rona Inc	Wholesale & Retail Trade	Building Materials, Hardware, Garden Supplies & Mobile Homes	Branch
Subway Developments 2000 Inc	Wholesale & Retail Trade	Eating and Drinking Places	Branch
Chinook Windz Healthy Pet Supplies	Wholesale & Retail Trade	Food Stores	Single Location
Navntoft Motorsport	Wholesale & Retail Trade	Automotive Dealers and Gasoline Service Stations	Single Location
Pharmasave	Wholesale & Retail Trade	Miscellaneous Retail	Single Location
Saigon Moon Restaurant	Wholesale & Retail Trade	Eating and Drinking Places	Single Location
Grillos Pizzeria Ltd	Wholesale & Retail Trade	Eating and Drinking Places	Single Location
Fifth Avenue Collection	Wholesale & Retail Trade	Miscellaneous Retail	Single Location
Tumbleweed Mercantile	Wholesale & Retail Trade	Miscellaneous Retail	Single Location
Foothills Pizza & Pasta	Wholesale & Retail Trade	Eating and Drinking Places	Single Location
Marv'S Classic Soda Shop	Wholesale & Retail Trade	Eating and Drinking Places	Single Location
Maryanne'S Eden	Wholesale & Retail Trade	Miscellaneous Retail	Single Location
Canadian Bdx Inc	Wholesale & Retail Trade	Wholesale Trade - Durable Goods	Single Location
Terra Cotta Gallery	Wholesale & Retail Trade	Home Furniture, Furnishings and Equipment Stores	Single Location
Black Diamond Bakery (1985) Ltd	Wholesale & Retail Trade	Food Stores	Single Location
Gateway Gazette	Wholesale & Retail Trade	Wholesale Trade - Nondurable Goods	Single Location
370733 Alberta Inc	Wholesale & Retail Trade	Miscellaneous Retail	Single Location
10810 Alberta Ltd	Wholesale & Retail Trade	Automotive Dealers and Gasoline Service Stations	Single Location
Lee Park Investments Enterprises	Wholesale & Retail Trade	Automotive Dealers and Gasoline Service Stations	Single Location
Country Food Mart	Wholesale & Retail Trade	Food Stores	Single Location
Sandul'S Pharmacy Ltd	Wholesale & Retail Trade	Miscellaneous Retail	Single Location
Sure Fit Mechanical	Wholesale & Retail Trade	Wholesale Trade - Durable Goods	Single Location
Three Point Holdings Inc	Wholesale & Retail Trade	Food Stores	Single Location

Source: Town of Black Diamond.

Appendix B

Joint Growth Strategy Transportation Analysis

Joint Growth Strategy Transportation Analysis - Scenario 3



MEMORANDUM

Date:	December 10, 2015
To:	Andrew Palmiere, O2 Planning and Design Inc.
cc:	Meghan Aebig, P.Eng
From:	Chun Man, P.Eng
File:	4033.0001.01
Subject:	Joint Growth Strategy Transportation Analysis

1.0 BACKGROUND

Urban Systems was retained by O2 Planning and Design Inc. (O2) to complete the conceptual transportation analysis related to the Town of Black Diamond and the Town of Turner Valley's Joint Growth Strategy (the Study).

The purpose of the technical memo is to provide a summary of the assumptions and findings for the transportation planning component of the Study. The document will identify the potential deficiencies in the existing network and the improvements required to support the future 2075 growth scenarios.

1.1 Baseline - Network

The traffic volumes on the baseline network were compiled from data made available from Alberta Transportation and the Town of Black Diamond. It was noted during the transportation evaluation for the Study that the Town of Turner Valley did not have recent data on its major roads and will require additional evaluation as proposed improvements are taken into consideration.

The existing network in the study area is comprised of two-lane roadways. For the purposes of the study, our focus will be on highway class corridors.

Two highways exist within the study area:

- Highway 22
- Highway 7

Highway 22 provides a significant north-south link in the Town of Black Diamond and is also known as Government Road. The Highway 22 north-south link terminates at Highway 7 and heads west across Sheep River into the Town of Turner Valley terminating at Highway 546 (Sunset Boulevard NW) before heading north to form Main Street and Cowboy Trail. Highway 22 is a two lane corridor with residential, agricultural and commercial land uses fronting onto the roadway.

Highway 7 provides an east-west connection east of Government Road ultimately connecting to Highway 2. The majority of development along Highway 7 is limited to acreage developments and businesses.

2.0 Growth Scenarios

Four scenarios were provided by O2 Planning for analysis. The scenarios contain a mix of employment, residential and industrial land uses. In addition to the forecasted requirements the scenarios also provided a contingency supply to support growth beyond current estimates.

For the purposes of the transportation analysis, the total supply (demand and contingency) will be evaluated to understand the pressures from the future land uses. The growth scenarios are as follows:

Table 2-1: Proposed Supply for Growth Scenarios

OPTION 1A			
	Units	**Strategic Contingency Supply**	**Demand Support Supply**
Employment	sqf	834,285	221,050
Gateway Employment	sqf	185,397	-
Residential (Unconstrained)	acres	287	545
River Valley	acres	197	-
Commercial	sqf	-	410,633
OPTION 1B			
	Units	**Strategic Contingency Supply**	**Demand Support Supply**
Employment	sqf	891,330	221,050
Residential (Unconstrained)	acres	157	545
River Valley	acres	197	-
Commercial	sqf	-	410,633
OPTION 2A			
	Units	**Strategic Contingency Supply**	**Demand Support Supply**
Employment	sqf	221,050	221,050
Residential (Unconstrained)	acres	94	545
River Valley	acres	197	-
Commercial	sqf	-	410,632
Gateway Commercial	sqf	222,425	
OPTION 2B			
	Units	**Strategic Contingency Supply**	**Demand Support Supply**
Employment	sqf	1,140,904	221,050
Residential (Unconstrained)	acres	47	545
River Valley	acres	-	385
Commercial	sqf	-	410,632
Gateway Commercial	sqf	119,768	-

3.0 Model and Assumptions

3.1 Forecast

The current development density in the Town of Turner Valley is 4.5 units per acre (upa) and the Town of Black Diamond estimates a development density of 5.5 units per acre (upa). The Joint Growth Strategy is using an average 7.4 upa to support the forecasted growth demand.

For this analysis, we evaluated the approximate number of single family units based on the density requirements in the proposed residential growth areas to determine the future traffic volume on the existing network. It should be noted that to be conservative, we assumed 100% of the trips generated will be personal vehicle trips. Future studies should evaluate the travel mode share within the study areas to determine an accurate representation on how people move in the community.

3.2 Carrying Capacities

Based on the scenarios for the Joint Growth Study, upgrades to the road network were developed based on the following criteria:

- Functional carrying capacity
- V/C Ratio greater than 0.90

Volume to Capacity ratio (v/c ratio) compares roadway demand (vehicle volumes) with roadway supply (carrying capacity). This measure indicates the amount of congestion for each lane group. V/C ratios greater than or equal to 1 indicate that the approach is operating at or above capacity. Alberta Transportations generally finds v/c ratios of 0.90 or less acceptable.

The carrying capacity is a function of accessibility and provides an estimate on the number of vehicles a roadway can accommodate.

The variables dependent on determining the level of service will influence the functional capacity for a corridor and is summarized in Table 3-1.

Table 3-1: Functional Carrying Capacity

FACILITY	CAPACITY (Vehicles per hour per lane)
Collector	800
Arterial	800
Freeway	1,800

Widening of the Highway within Black Diamond's downtown core will be a significant challenge as the existing mature area currently includes on-street parking and businesses fronting onto the

Highway. The challenges associated with upgrades to Highway 7 are reduced outside the current municipal boundaries where there has been less development along the highway.

Highway 22 (Government Street) provides a local and regional north-south connection. As users enter Black Diamond's Town boundaries, the rural highway transitions into a residential corridor with homes fronting onto Government Street. Widening along Highway 22 would also be challenging as it would impact established businesses and residents.

As users enter the Town of Turner Valley on Highway 22 (Main Street), development is primarily located on the west side of the Highway. Although the concentration of development is much lower on the east side of the Highway, widening of the Highway would potentially impact several important institutions such as the library, RCMP office and fire hall.

3.3 Transportation Improvement Cost

Potential improvements to the network include intersection upgrades and options to either widen the existing road network to support the additional growth volumes or build new links.

After discussions with O2, the Town of Black Diamond and the Town of Turner Valley, it was determined that widening the highways to increase the capacity would be a last resort due to the challenges associated with widening, including the impact on existing residents, businesses and institutions and the removal of on-street parking. The estimated improvement costs provided in this study only account for new road alignment and locations where traffic signals maybe required; property and other impacts have not been accounted into the costing exercise.

A functional evaluation must be completed to understand the extent of the community impacts to support the proposed growth scenario. The functional evaluation will also detail the environmental and geotechnical requirements for the study area. The public will also be engaged as part of the functional study to understand the community concerns

In addition to the upgrades to intersections at Highway 7 and 22 required to support the potential growth in 2075, existing arterial class road alignment can also be used which includes:

- Township Road 201
- Township Road 200 (16 Avenue)
- Imperial Drive
- Decalta Road

A study will be required to determine the cost required to improve the existing network to support the additional volume and frequency of vehicles operating on the corridors. It will be important to understand the existing road structure and its current life cycle prior to ensure the corridor can support the additional volume.

Intersections in the study area identified for new construction or upgrades will need to consider the appropriate roundabout or traffic signal treatment. Additional traffic impact assessment will be

required to select the appropriate treatment to ensure operational, safety and property requirements are met.

It should be noted that the cost provided in this study should only be used for comparisons purposes only. Using the planning level cost estimate for budgetary or cost to construct is not appropriate. Should cost to construct or detailed cost estimates be required, a functional study or detailed design exercise should be completed as the next stage in the process.

3.4 Transportation Accessibility

In order to allow for maximum connectivity and access it is recommended for any proposed major roads required supporting the growth area should be modeled after the grid network to allow maximum connectivity and access. It should be understood that areas identified as environmentally sensitive will require additional measures to mitigate the potential impacts. The costs and measures associated with these environmentally sensitive areas were not included in this study.

4.0 General Network Performance

4.1 Baseline Horizon

The study area contains two locations where the Provincial Highways meet:

- Highway 22/Highway 7 (Town of Black Diamond)
- Highway 546/Highway 22 (Town of Turner Valley)

The traffic analysis illustrate additional capacity was available during the peak period while the study location in Turner Valley revealed the intersection exceeds capacity during the afternoon peak period. The remaining intersection analyses during the afternoon period are summarized in Table 4-1. It should be noted that not all intersections are accounted for due to data deficiencies.

Table 4-1: Afternoon Intersection Level of Service

INTERSECTION	CONTROL TYPE	INTERSECTION LOS	V/C
Highway 22 & Highway 546	Unsignalized	E	1.02
Highway 22 & 3 St SW/NW	Unsignalized	A	0.14
Highway 22 & Highway 7	Unsignalized	B	0.48
Highway 7 & 3 St SE/NE	Unsignalized	A	0.14
Highway 7 & 1 Ave SE	Unsignalized	A	0.30
Highway 7 & Range Road 23	Unsignalized	A	0.11

4.2 2075 Growth Horizon

At the 60 year horizon, the model assembled included the following parameters:

- Baseline Traffic Conditions
- Forecasted population Growth within Turner Valley

- Forecasted population Growth within Black Diamond
- Demand Support Supply
- Strategic Contingency Supply

To be conservative, the projected population within the municipal boundaries was converted to single family homes using an estimated 2.4 occupants per home. The analysis evaluated the overall magnitude of growth along the existing highway corridors and compared the results against the functional carrying capacity for the specific road classification.

Table 4-2 summaries the magnitude of additional growth for each scenario.

Table 4-2: Estimated Magnitude of Growth per Scenario

	Option 1A	Option 1B	Option 2A	Option 2B
Highway 7 *(East of Government Road)*	9	8	7	8
Highway 22 *(Government Road)*	18	18	12	11
Highway 22 *(West of Government Road)*	4	4	5	6
Highway 22 *(North of Highway 546)*	6	5	5	8

Intersections improvements are typically required before corridor upgrades. The additional interactions and coordination at an intersection typically exceeds that of a corridor.

Understanding those requirements, existing intersections should be planned for upgrades as the growth within the study area is achieved. Based on the planning level daily traffic volumes Table 4-3 summarizes the corridors that may need to be widen to support the future growth scenarios if no additional roads were constructed.

Table 4-3: Potential Corridor Upgrades

LOCATION	OPTION 1A	OPTION 1B	OPTION 2A	OPTION 2B
Highway 7 *(East of Government Road)*	Widen	Widen	Widen	Widen
Highway 22 *(Government Road)*	Widen	Widen	Widen	Widen
Highway 22 *(West of Government Road)*	Widen	Widen	Widen	Widen
Highway 22 *(North of Highway 546)*	-	-	-	Widen

As discussed in the previous section, widening may be a potential challenging understanding the community impacts. We therefore assumed that a secondary option would be required to provide alternative routes to service the growth area.

5.0 Option Evaluation

The following option evaluates the four growth scenarios with an expanded road network and intersection improvements. As note previously, the solutions provide to support the growth scenarios assumed 100% of the future trips to be vehicle based. It should also be noted that the planning level cost shown for each option is only used to illustrate "order of magnitude". The true cost required to provide the proposed infrastructure may be vastly different between planning and detail design. The planning level cost estimate should not be used for budgetary purposes or cost to construct.

5.1 Option 1A

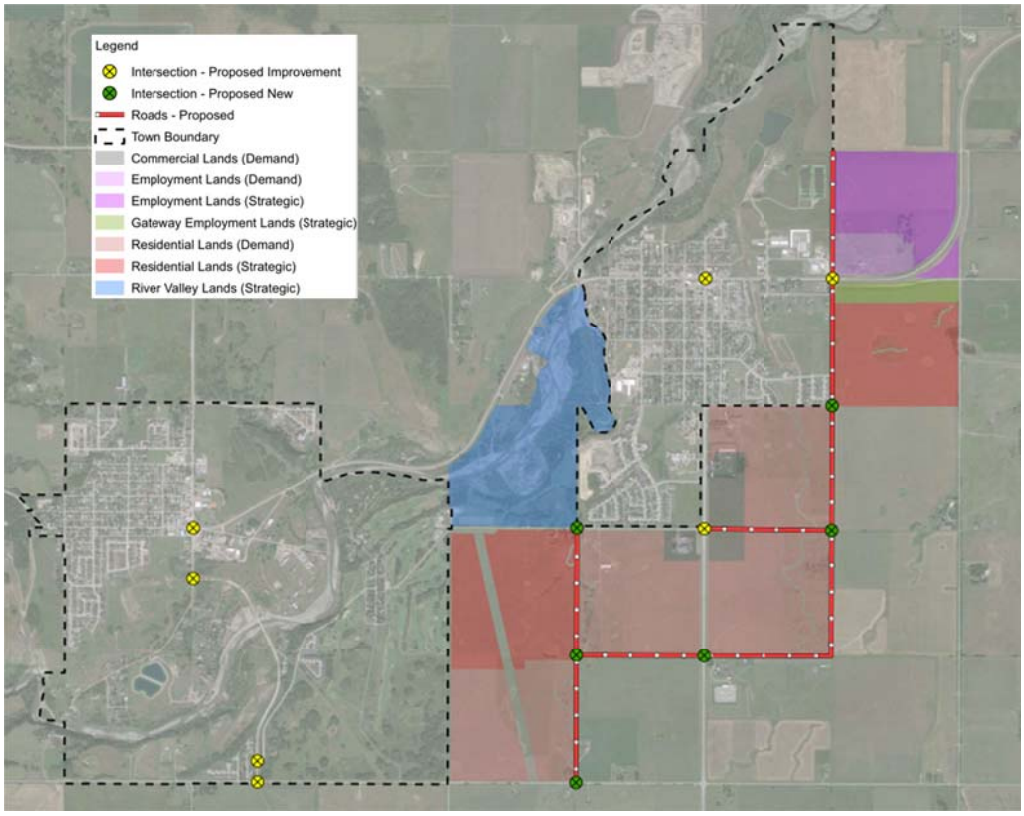


Figure 5-1: Option 1A

The following elements will need to be considered to support Option 1A:

- 13 (seven existing, six new) intersection improvements along the proposed and existing network
- 7.4 km of additional road required to support the growth scenario
- Potential terrain challenges may increase project cost
- Magnitude of traffic growth on existing highway network between 4 and 18
- Planning level estimate for proposed improvements *$30.7M*

5.2 Option 1B

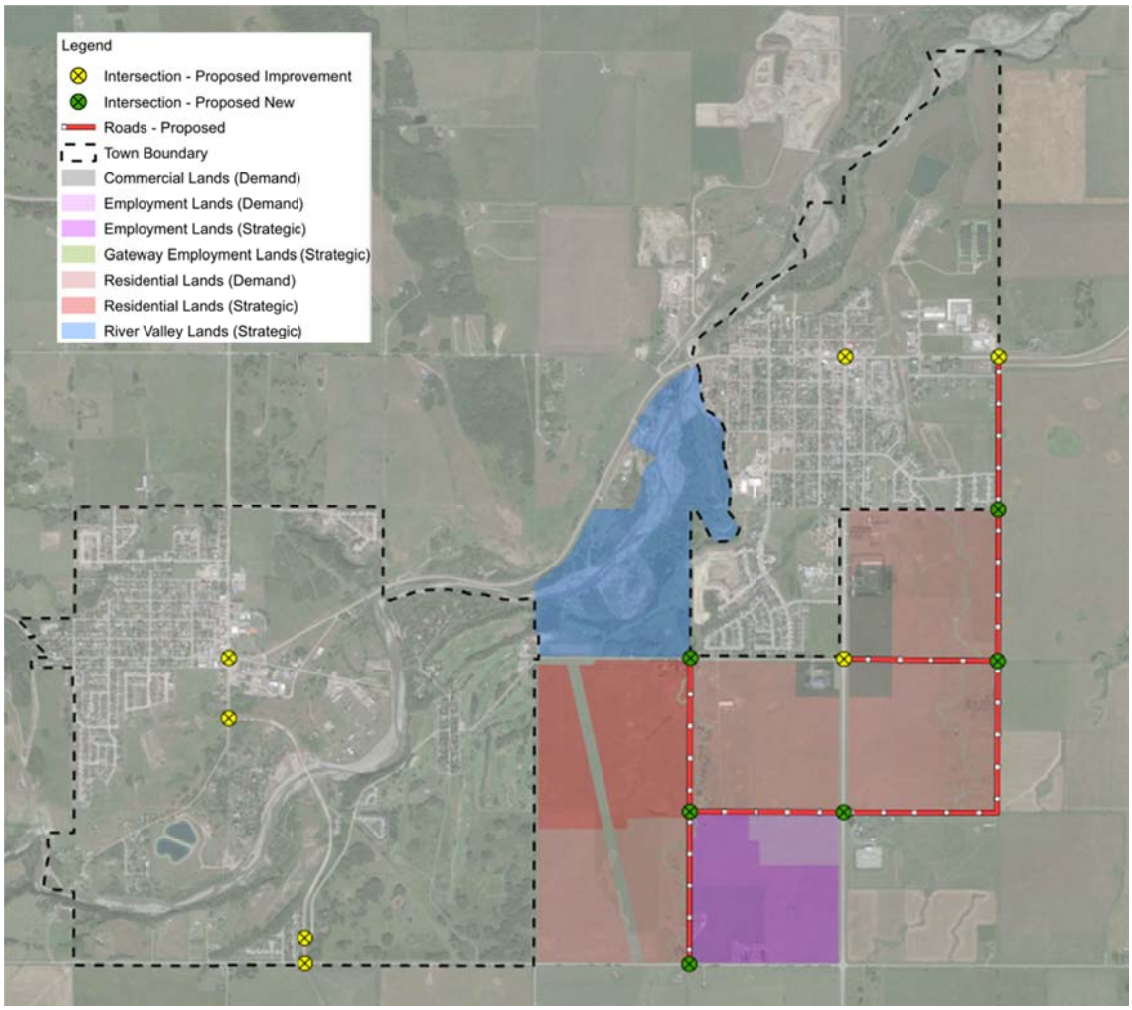


Figure 5-2: Option 1B

The following elements will need to be considered to support Option 1B:

- 13 (seven existing, six new) intersection improvements along the proposed and existing network
- 6.6 km of additional road required to support the growth scenario
- Magnitude of traffic growth on existing highway network between 4 and 18
- Planning level estimate for proposed for improvements *$27.9M*

5.3 Option 2A

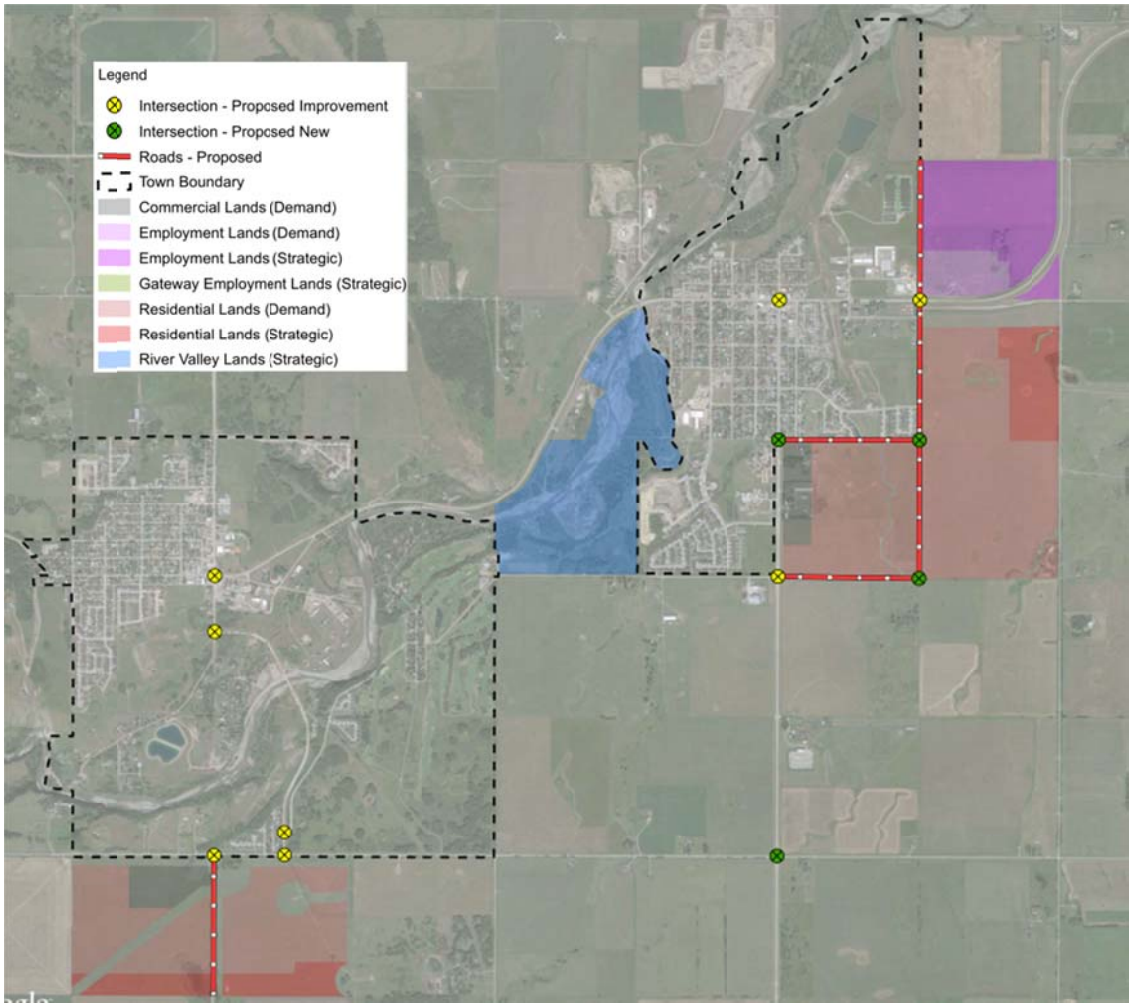


Figure 5-3: Option 2A

The following elements will need to be considered to support Option 2A:

- 12 (eight existing, four new) intersection improvements along the proposed and existing network
- 6.6 km of additional road required to support the growth scenario
- Potential terrain challenges may increase project cost
- Magnitude of traffic growth on existing highway network between 5 and 12
- Planning level estimate for proposed for improvements *$27.6M*

5.4 Option 2B

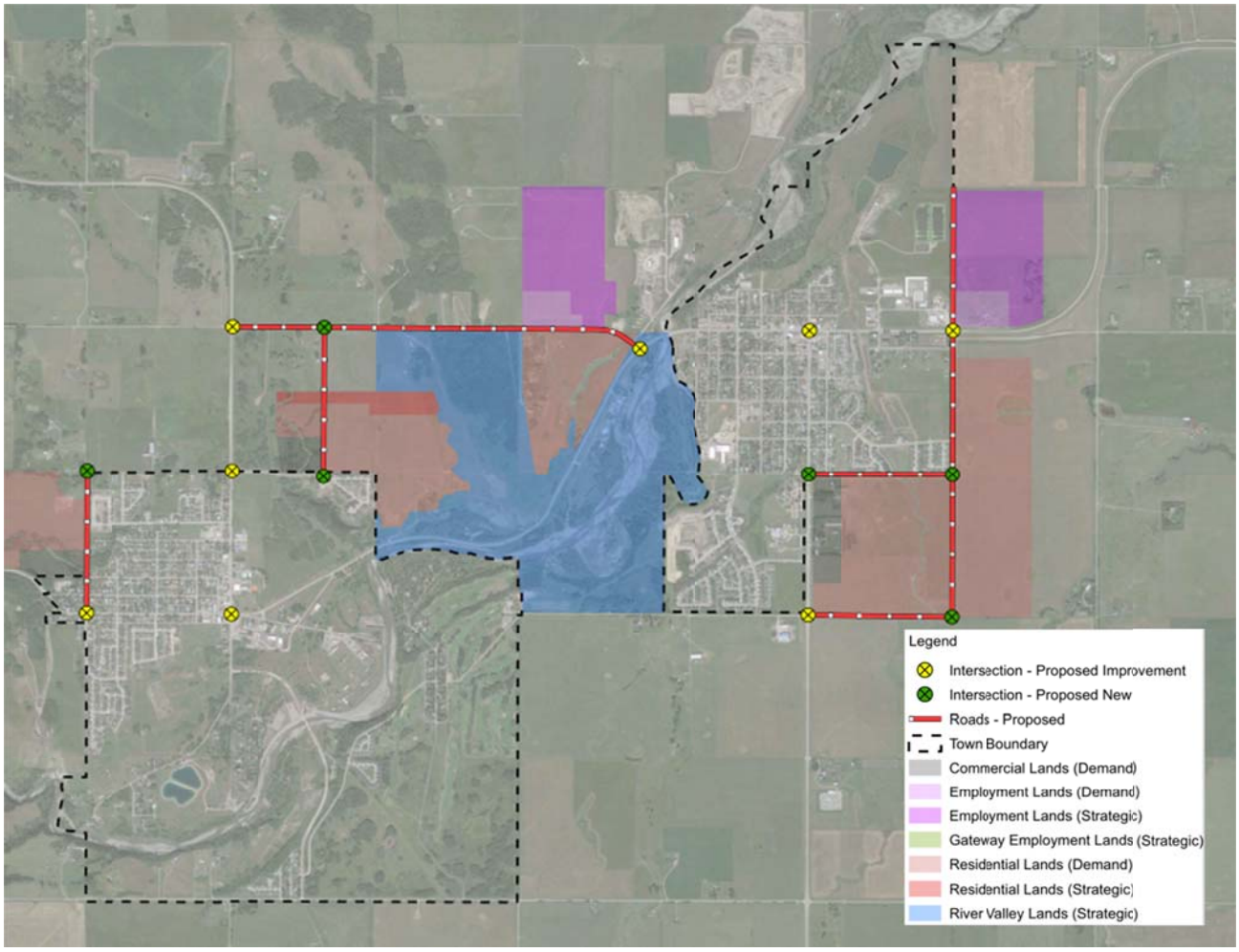


Figure 5-4: Option 2B

The following elements will need to be considered to support Option 2B:

- 14 (eight existing, six new) intersection improvements along the proposed and existing network
- 8.1 km of additional road required to support the growth scenario
- Potential terrain challenges may increase project cost
- Magnitude of traffic growth on existing highway network between 6 and 11
- Planning level estimate for proposed for improvements *$33.3M*

6.0 Summary and Future Requirements

Table 6-1 summarizes the evaluation for each growth scenario. The planning level cost estimate should not be used for budgetary purposes or cost to construct.

Table 6-1: Transportation Summary

	OPTION 1A	OPTION 1B	OPTION 2A	OPTION 2B
Magnitude of Growth (On existing network)	4 to 18	4 to 18	5 to 12	6 to 11
Intersection Improvements (Only signals – no property or other impacts included in cost)	13	13	12	14
Grade Challenges (Not included in cost)	Yes	No	Yes	Yes
New Roads (m)	7,400	6,600	6,600	8,100
Total Area (Hectares)	*430*	*380*	*350*	*410*
Cost per Hectare	*$71,000*	*$73,000*	*$79,000*	*$81,000*
Cost (Planning level)	***$30.7M***	***$27.9M***	***$27.6M***	***$33.3M***

In additional to the planning level cost estimate provided in Appendix B, additional studies will need to be completed to understand the scope of the future improvements on the following roadways:

- Township Road 201
- Township Road 200 (16 Avenue)
- Imperial Drive
- Decalta Road

Additional evaluations will be required to understand the detailed requirements and capital investments to support the Joint Growth Strategy for Town of Turner Valley and Black Diamond. These studies include:

Transportation Master Plan – is prepared as a long term plan to guide the development of transportation infrastructure to support goal and objectives of the Community. The TMP evaluates current travel conditions, forecasts future travel conditions and develops appropriate long-term transportation strategies for the community to consider.

Functional Road Study – this document is prepared to understand the "ground-level" conditions by provide detailed technical analysis and design to support future road alignments ensuring environmental, geotechnical, community and property considerations are evaluated.

Data Collection – the Communities in the study area should allocate resources for traffic data collection on priority corridor to identify changing travel patterns and demand period. The data provides can useful insights to make traffic management decisions such as when to implement traffic calming measures, road improvements and traffic and parking regulations.

Sincerely,

URBAN SYSTEMS LTD.

Chun Man, P.Eng
Transportation Engineer

/cm

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MEMORANDUM

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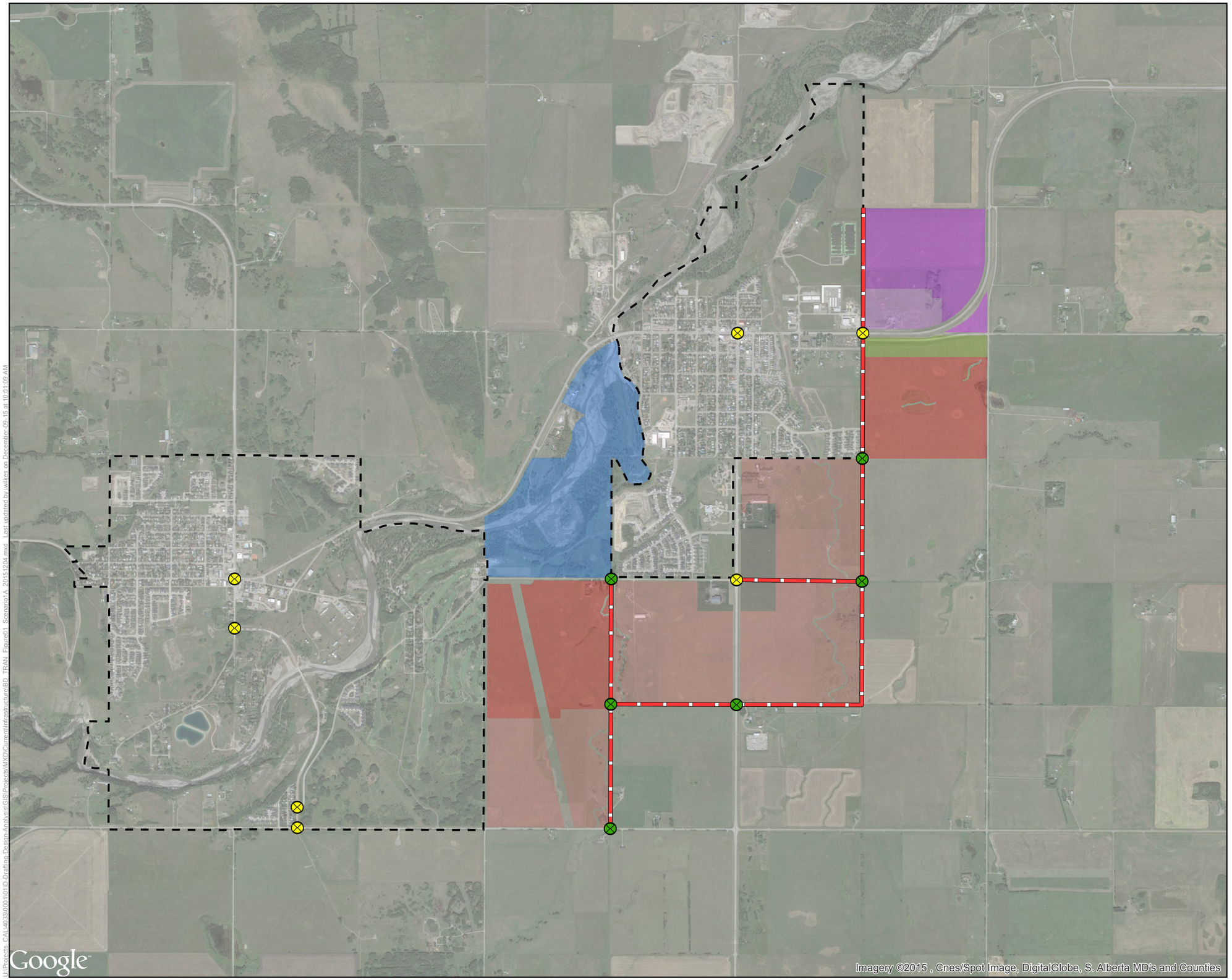
Appendix A - Figures



Town of Turner Valley
Back to Nature

TOWN OF BLACK DIAMOND

Town of Turner Valley
Town of Black Diamond

Growth Scenarios

Transportation Scenario 1A

Legend

- Intersection - Proposed Improvement
- Intersection - Proposed New
- Roads - Proposed
- Town Boundary
- Commercial Lands (Demand)
- Employment Lands (Demand)
- Employment Lands (Strategic)
- Gateway Employment Lands (Strategic)
- Residential Lands (Demand)
- Residential Lands (Strategic)
- River Valley Lands (Strategic)

250 125 0 250 500
Metres

N

Coordinate System:
NAD 1983 3TM 114

Scale:
1:24,000

Data Sources:
- Data provided by the Town of Black Diamond

Project #:	4033.0001.01
Author:	JW
Checked:	LC
Status:	~ DRAFT ~
Revision:	A
Date:	2015 / 12 / 9

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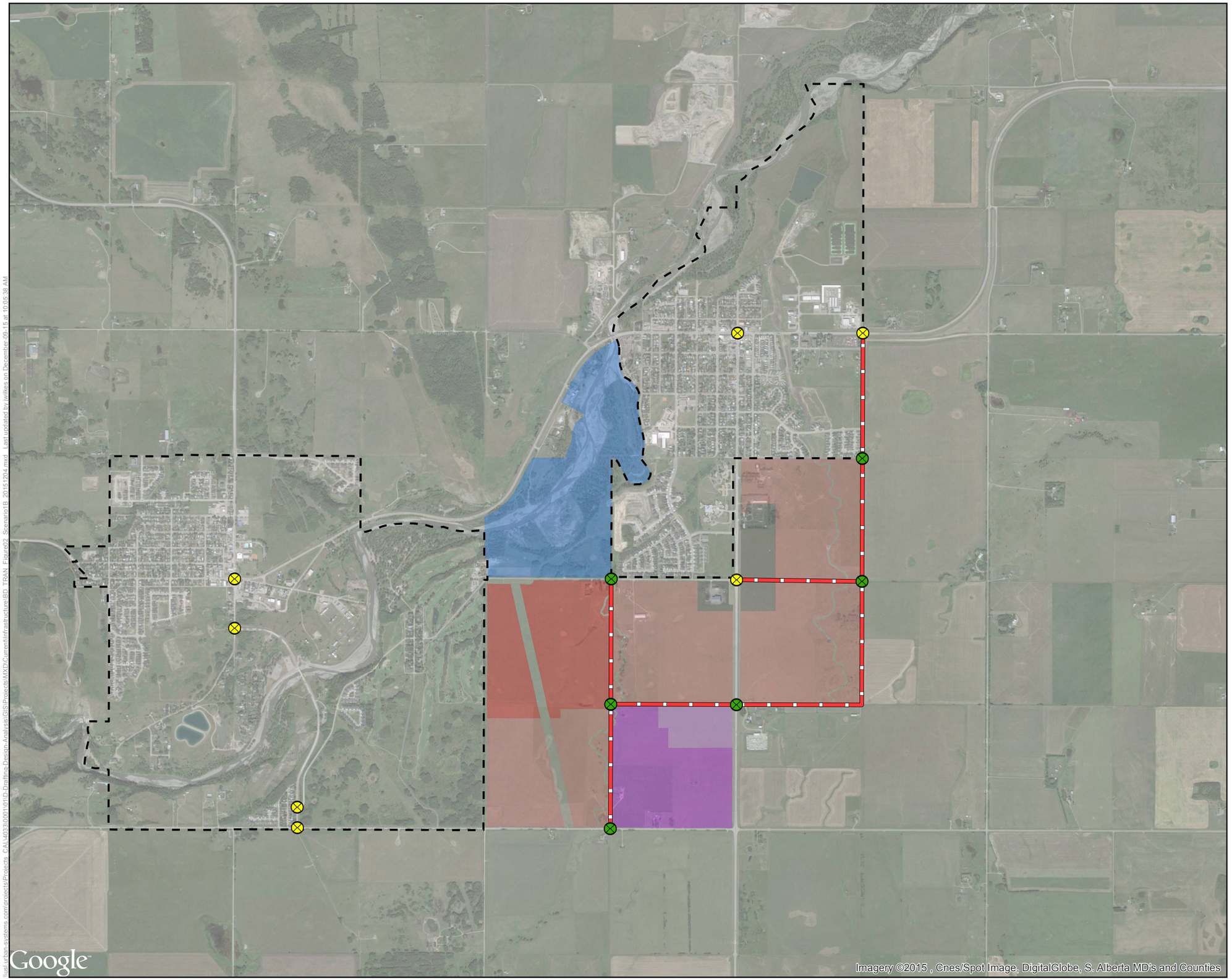
FIG. 1 BD-TRAN



Town of Turner Valley
Back to Nature

TOWN OF BLACK DIAMOND

Town of Turner Valley
Town of Black Diamond

Growth Scenarios

Transportation
Scenario 1B

Legend

- Intersection - Proposed Improvement
- Intersection - Proposed New
- Roads - Proposed
- Town Boundary
- Commercial Lands (Demand)
- Employment Lands (Demand)
- Employment Lands (Strategic)
- Gateway Employment Lands (Strategic)
- Residential Lands (Demand)
- Residential Lands (Strategic)
- River Valley Lands (Strategic)

250 125 0 250 500
Metres

N

Coordinate System:
NAD 1983 3TM 114

Scale:
1:24,000

Data Sources:
- Data provided by the Town of Black Diamond

Project #:	4033.0001.01
Author:	JW
Checked:	LC
Status:	~ DRAFT ~
Revision:	A
Date:	2015 / 12 / 9

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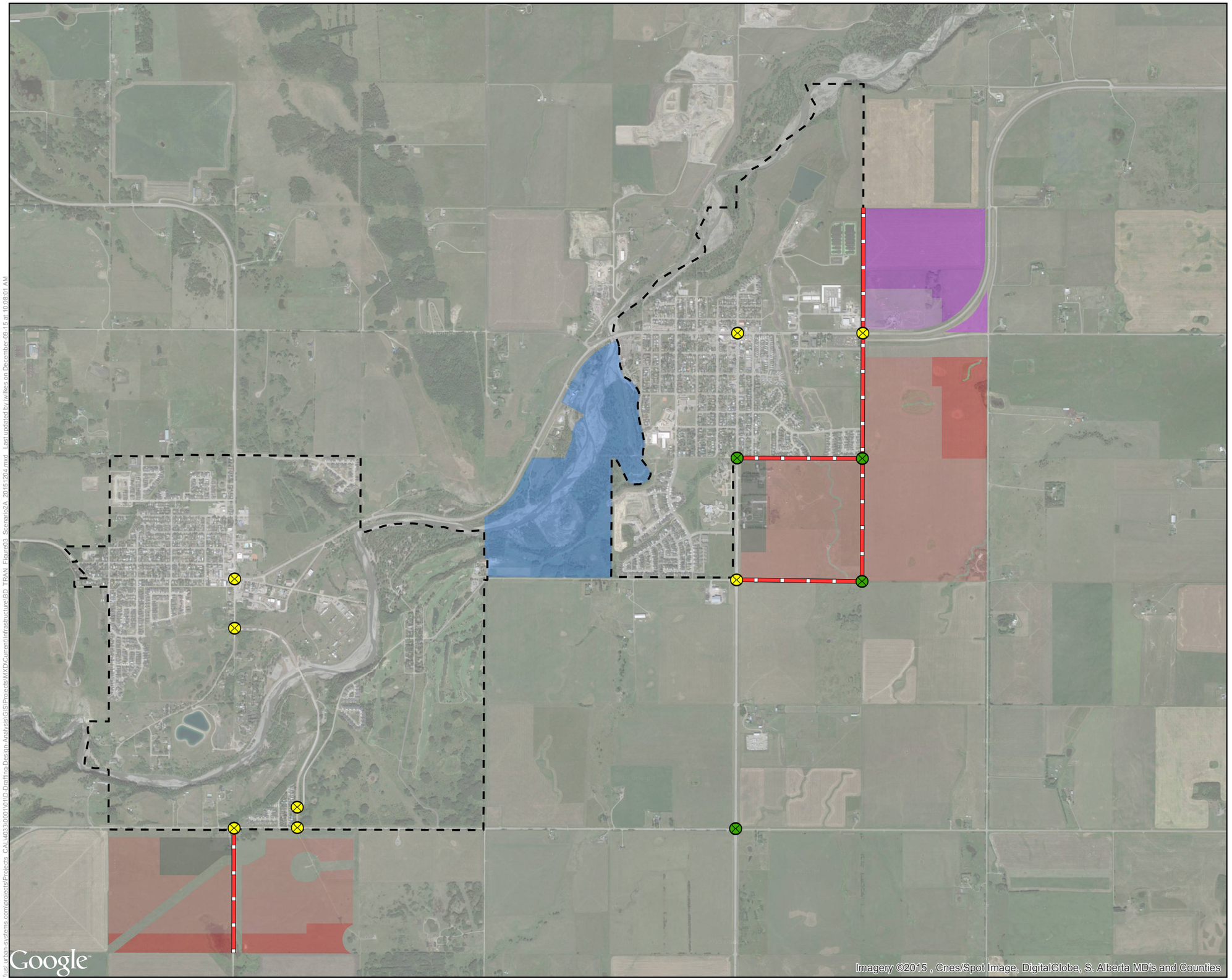
FIG. 2 BD-TRAN



Town of Turner Valley
Back to Nature

TOWN OF BLACK DIAMOND

Town of Turner Valley
Town of Black Diamond

Growth Scenarios

Transportation
Scenario 2A

Legend

- Intersection - Proposed Improvement
- Intersection - Proposed New
- Roads - Proposed
- Town Boundary
- Commercial Lands (Demand)
- Employment Lands (Demand)
- Employment Lands (Strategic)
- Gateway Employment Lands (Strategic)
- Residential Lands (Demand)
- Residential Lands (Strategic)
- River Valley Lands (Strategic)

250 125 0 250 500
Metres

N

Coordinate System:
NAD 1983 3TM 114

Scale:
1:24,000

Data Sources:
- Data provided by the Town of Black Diamond

Project #:	4033.0001.01
Author:	JW
Checked:	LC
Status:	~ DRAFT ~
Revision:	A
Date:	2015 / 12 / 9

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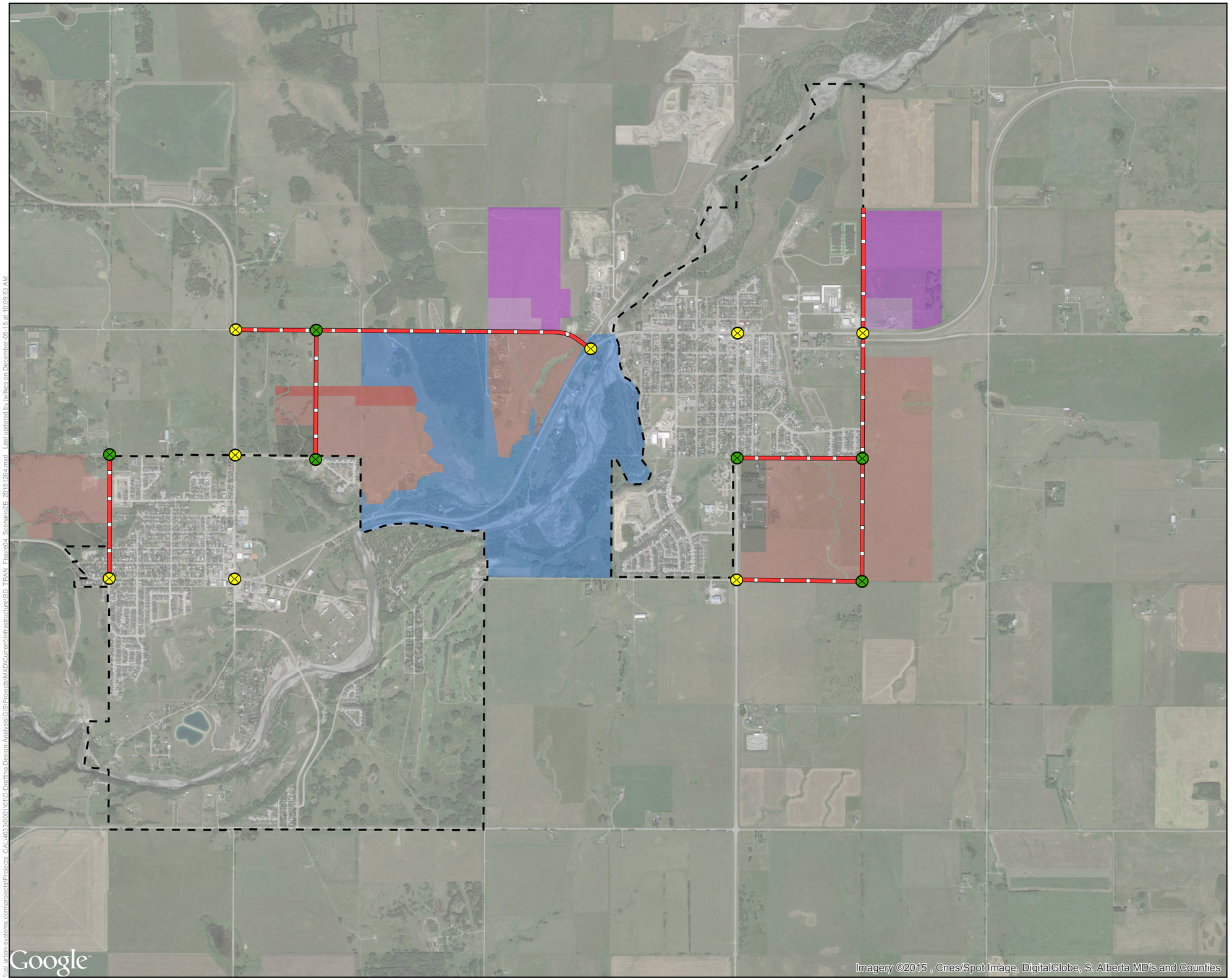
FIG. 3 BD-TRAN



Town of Turner Valley
Back to Nature

TOWN OF BLACK DIAMOND

Town of Turner Valley
Town of Black Diamond

Growth Scenarios

Transportation
Scenario 2B

Legend

- Intersection - Proposed Improvement
- Intersection - Proposed New
- Roads - Proposed
- Town Boundary
- Commercial Lands (Demand)
- Employment Lands (Demand)
- Employment Lands (Strategic)
- Gateway Employment Lands (Strategic)
- Residential Lands (Demand)
- Residential Lands (Strategic)
- River Valley Lands (Strategic)

250 125 0 250 500
Metres

N

Coordinate System:
NAD 1983 3TM 114

Scale:
1:24,000

Data Sources:
- Data provided by the Town of Black Diamond

Project #:	4033.0001.01
Author:	JW
Checked:	LC
Status:	~ DRAFT ~
Revision:	A
Date:	2015 / 12 / 9

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FIG. 4 BD-TRAN

MEMORANDUM

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Appendix B – Planning Level Cost Estimate

Suite 101 - 2716 Sunridge Way NE, Calgary, AB T1Y 0A5 | T: 403.291.1193

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PLANNING LEVEL COST ESTIMATE

Cost provided in this study should only be used for comparisons purposes only. Using the planning level cost estimate for budgetary or cost to construct is not appropriate. Should cost to construct or detailed cost estimates be required, a functional study or detailed design exercise should be completed as the next stage in the process.

Table A summarizes the cost of new road alignments and traffic signals only. Property, utility impacts, environmental, geotechnical, etc have not been accounted for in the cost estimate.

Contingency and engineering have been applied to the planning level costs. As the functional and detail design is completed, the assumed rate will be decreased to correspond with the increase level of accuracy.

Table A – Planning Level Cost Estimate

	Option 1A	Option 1B	Option 2A	Option 2B
New Road Alignments	$17,260,000	$15,430,000	$15,420,000	$18,790,000
Traffic Signals	$3,250,000	$3,250,000	$3,000,000	$3,250,000
Contingency *(30%)*	$6,160,000	$5,610,000	$5,530,000	$6,620,000
Engineering (*15%)*	$4,010,000	$3,650,000	$3,600,000	$4,300,000
Cost*	***$30,680,000***	***$27,940,000***	***$27,550,000***	***$32,960,000***

MEMORANDUM

URBAN systems

Date:	January 12, 2016
To:	Andrew Palmiere, O2 Planning and Design Inc.
cc:	Meghan Aebig, P.Eng
From:	Chun Man, P.Eng
File:	4033.0001.01
Subject:	Joint Growth Strategy Transportation Analysis – Scenario 3

1.0 BACKGROUND

Urban Systems was retained by O2 Planning and Design Inc. (O2) to complete the conceptual transportation analysis related to the Town of Black Diamond and the Town of Turner Valley's Joint Growth Strategy (the Study).

The purpose of the technical memo is to provide a transportation evaluation on Growth Scenario 3 developed as part of Joint Advisory Committee meetings. Scenario 3 was developed after reviewing the initial four scenarios (1A, 1B, 2A, 2B). The document will identify the potential deficiencies in the existing network and the improvements required to support the future 2075 growth scenarios.

2.0 Growth Scenarios

For the purposes of the transportation analysis, the total supply (demand and contingency) will be evaluated to understand the pressures from the future land uses. The growth scenarios are as follows:

Table 2-1: Proposed Supply for Growth Scenarios

Scenario 3			
	Units	**Strategic Contingency Supply**	**Demand Support Supply**
Employment	sqf	834,285	221,050
Gateway Employment	sqf	185,397	-
Residential (Unconstrained)	acres	373	545
River Valley	acres	197	-
Commercial	sqf	-	410,633

For Scenario 3, the proposed land use includes Strategic Gateway Lands which was excluded for Table 2-1 understanding no population or employment have been assigned to the specific area.

Additional evaluation will be required once the specific uses are determined for the Strategic Gateway Lands.

3.0 Model and Assumptions

3.1 2075 Growth Horizon

At the 60-year horizon, the model assembled included the following parameters:

- Baseline Traffic Conditions
- Forecasted population Growth within Turner Valley
- Forecasted population Growth within Black Diamond
- Demand Support Supply
- Strategic Contingency Supply

To be conservative, the projected population within the municipal boundaries was converted to single family homes using an estimated 2.4 occupants per home. The analysis evaluated the overall magnitude of growth along the existing highway corridors and compared the results against the functional carrying capacity for the specific road classification. Table 3-1 summaries the magnitude of additional growth for each scenario.

Table 3-1: Estimated Magnitude of Growth

	Scenario 3
Highway 7 *(East of Government Road)*	9
Highway 22 *(Government Road)*	18
Highway 22 *(West of Government Road)*	5
Highway 22 *(North of Highway 546)*	8

Intersections improvements are typically required before corridor upgrades(widening). The additional interactions and coordination at an intersection typically exceeds that of a corridor.

Understanding those requirements, existing intersections should be planned for upgrades as the growth within the study area is achieved. Based on the planning level daily traffic volumes Table 3-2 summarizes the corridors that may need to be widen to support the future growth scenarios if no additional roads were constructed.

Table 3-2: Potential Corridor Upgrades

Location	Scenario 3
Highway 7 *(East of Government Road)*	Widen
Highway 22 *(Government Road)*	Widen
Highway 22 *(West of Government Road)*	Widen
Highway 22 *(North of Highway 546)*	Widen

4.0 Option Evaluation

The following evaluates Scenario 3 with an expanded road network and intersection improvements. As note previously, the solutions provided to support the growth scenarios assumed 100% of the future trips to be vehicle based. It should also be noted that the planning level cost shown for each option is only used to illustrate "order of magnitude". The true cost required to provide the proposed infrastructure may be vastly different between planning and detail design. The planning level cost estimate should not be used for budgetary purposes or cost to construct.

4.1 Scenario 3

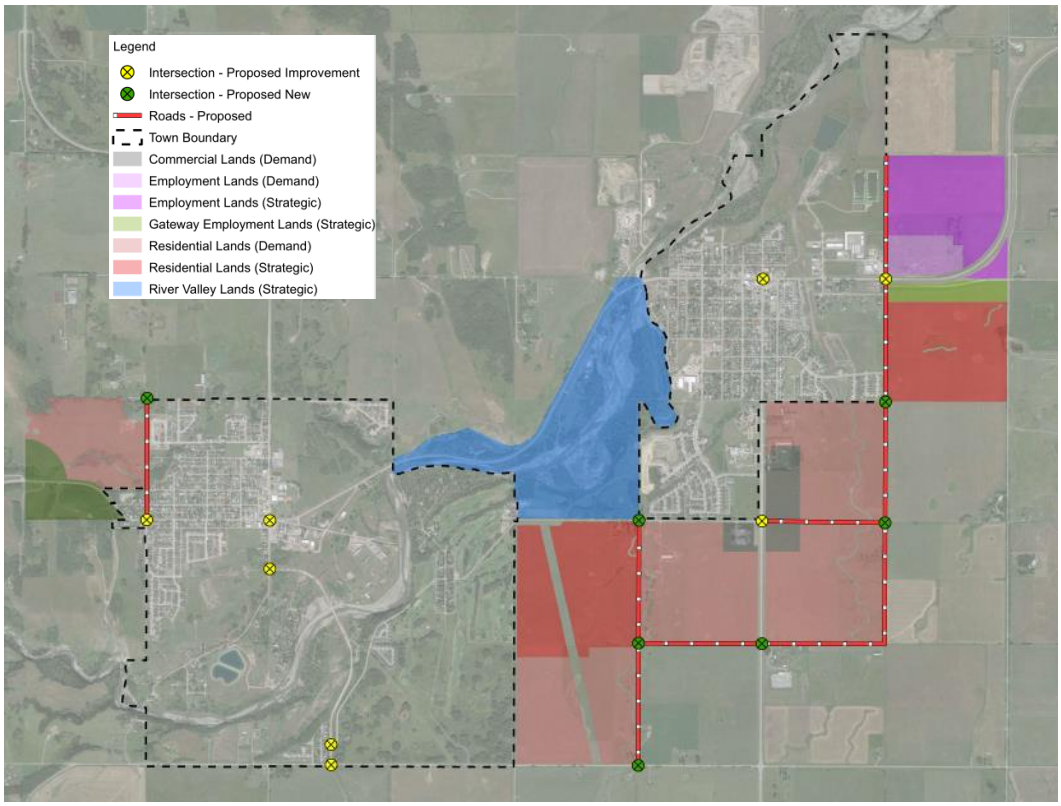

Figure 4-1: Scenario 3

The following elements will need to be considered to support Scenario 3:

- 15 (eight existing, seven new) intersection improvements along the proposed and existing network
- 8.2 km of additional road required to support the growth scenario
- Potential terrain challenges may increase project cost
- Magnitude of traffic growth on existing highway network between 5 and 18
- Planning level estimate for proposed improvements *$34.1M*

5.0 Summary and Future Requirements

Table 5-1 summarizes the evaluation for each growth scenario. The planning level cost estimate should not be used for budgetary purposes or cost to construct.

Table 5-1: Scenario 3 - Transportation Summary

	Scenario 3
Magnitude of Growth (On existing network)	5 to 18
Intersection Improvements (Only signals – no property or other impacts included in cost)	15
Grade Challenges (Not included in cost)	Yes
New Roads (m)	8,200
Total Area (Hectares)	*465*
Cost per Hectare	*$73,000*
Cost (Planning level)	***$34.1M***

Sincerely,

URBAN SYSTEMS LTD.

Chun Man, P.Eng
Transportation Engineer

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Appendix C

Joint Growth Strategy Water, Wastewater and Stormwater Conceptual Analysis

Joint Growth Strategy Water, Wastewater and Stormwater Conceptual Analysis - Scenario 3

MEMORANDUM

URBAN systems

Date:	December 10, 2015
To:	Andrew Palmiere, O2 Planning and Design Inc.
cc:	Meghan Aebig, P.Eng.
From:	Leigh Chmilar, P.Eng., Ariane Sauter, M.Sc., PL (Eng)
File:	4033.0001.01
Subject:	DRAFT – Black Diamond and Turner Valley Joint Growth Strategy Water, Wastewater and Stormwater Conceptual Analysis

1.0 Black Diamond Water and Wastewater Conceptual Servicing Background

USL was retained to complete a conceptual servicing analysis for Water and Wastewater for the Town of Black Diamond, using the growth scenarios provided by O2. MPE was retained to conduct the same analysis for Turner Valley. USL coordinated with MPE Engineering (MPE) to ensure the demand and flow assumptions were aligned, since Turner Valley supplies potable water to Black Diamond, and Black Diamond provides wastewater treatment to Turner Valley. USL coordinated with MPE to divide the supply areas between the towns based on proximity and serviceability.

For each growth scenario provided by O2, only residential growth was considered to occur within the Town boundary. The projected future flows and demands were based on total future population (as provided), so the flows include existing demands within the Town boundary. Only growth that was specified to be within the boundary was used for infrastructure that is existing. Any growth beyond the capacity of the existing systems were assumed to require new infrastructure outside the Town boundary.

2.0 Potable Water Servicing

USL calculated the potable water demands for each growth scenario provided by O2 using the criteria in Table 2.1. As previously mentioned, the scenarios provide contingency supply lands to support growth beyond current projections. To remain conservative in our conceptual servicing analysis, USL included the total supply (demand and contingency) in the analysis to ensure that servicing would be available for future land use. It can be seen in Table 2.1 that the average water consumption per person has been applied to both residential and commercial/employment lands at the same rate. There is wide variability in commercial/employment demands however the rates used reflect relatively conservative values for the expected land uses. The MDD and PHD ratios were based on typical factors in other communities nearby.

Table 2.1. - Potable Demand Criteria

CRITERIA	VALUE	UNITS
Average Water Consumption[1]	315	l/c/day
Commercial/Employment Ratio	315	l/c/day
MDD:ADD Ratio	2.2	-
PHD:ADD Ratio	**4.0**	-

[1] Total community demand projected for 2076. CRP Regional Water and Wastewater Servicing Masterplan, May 2014.

The total potable demand for each scenario are shown in Table 2.2.

Table 2.2. – Potable Water Demand Summary

GROWTH SCENARIO	RESIDENTIAL POPULATION	EMPLOYMENT	MDD (MLD)	PHD (L/s)	MIN. FIRE FLOW REQUIREMENTS (L/s)	MIN. STORAGE REQUIRED (m^3)
Scenario 1A	13,451	2,807	11.3	237	197 L/s	5,716
Scenario 1B	11,119	1,156	8.5	179	197 L/s	4,750
Scenario 2A	10,607	1,787	8.6	181	197 L/s	4,779
Scenario 2B	9,792	1,633	8.7	183	197 L/s	4,883

Each of the scenarios below were analysed using the criteria in Table 2.1 to determine the peak flows per catchment. The Fire Underwriters Survey for Black Diamond (2013) was used to estimate the minimum required fire flows for the town and each scenario. The required reservoir storage was calculated following the Alberta Environment and Parks (AEP) Standards and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage Systems. Please note that the proposed infrastructure is not exhaustive of what may be required to service the growth scenarios in the future. They are intended to show conceptually the infrastructure that may be required to allow the existing system to provide flow and adequate pressure to the associated catchments, while maintaining service within the Town boundary. USL recommends that a detailed analysis be conducted once a scenario is selected for further study.

USL analysed each demand scenario using a WaterCAD model of the Town's water distribution system. The Town receives its potable water from the water treatment plant in Turner Valley via the Sheep River Utilities Regional transmission main, which was installed in 2013 after the flood. The sections below describe the recommendations to service each scenario.

Please note the following:

- The recommendations are not exhaustive, and further detailed review of existing site conditions and a detailed development plan would be required to provide a conceptual design.
- Note that the existing water license has not been reviewed in detail, and will likely not support the full build-out of the growth scenarios. Further study and review will be required to ensure adequate water is available for future growth.

- All of the scenarios assume that treated water will be supplied by the Town of Turner Valley, and adequate supply will be provided. MPE is providing costs for a WTP upgrade required to supply the demands of both towns in each scenario. The alignment of the Twin line is currently assumed to follow close to the current alignment however this will require review to confirm that adequate right of way exists.

2.1 Scenario 1A

Refer to Figure BD-PW-01 for the peak flow demands in each catchment and the locations of proposed infrastructure:

- Secure sufficient water license capacity and twin the distribution transmission main from Turner Valley to Black Diamond.
- Upgrade source capacity, treatment plant and pumps in TV WTP to increase flow from Turner Valley to the potable water reservoir in Black Diamond (MPE to provide costs)
- Reservoir upgrade to accommodate an additional 1,200 m3 of storage
- Replace reservoir pump station
- Upsize the distribution pipe from the reservoir to the distribution system
- A PRV station to manage the system pressures
- Add a booster station to increase flow to Catchment B
- Various distribution mains to loop the system to provide adequate pressure, flow and redundancy

2.2 Scenario 1B

Refer to BD-PW-02 for the peak flow demands in each catchment and the locations of proposed infrastructure:

- Secure sufficient water license capacity and twin the distribution transmission main from Turner Valley to Black Diamond
- Upgrade source capacity, treatment plant and pumps in TV WTP to increase flow from Turner Valley to the potable water reservoir in Black Diamond (MPE to provide costs)
- Reservoir upgrade to accommodate an additional 200 m3 of storage
- Replace reservoir pump station
- Various distribution mains to loop the system to provide adequate pressure, flow and redundancy

2.3 Scenario 2A

Refer to BD-PW-03 for the peak flow demands in each catchment and the locations of proposed infrastructure:

- Secure sufficient water license capacity, and twin the distribution transmission main from Turner Valley to Black Diamond
- Upgrade source capacity, treatment plant and pumps in TV WTP to increase flow from Turner Valley to the potable water reservoir in Black Diamond (MPE to provide costs)
- Reservoir upgrade to accommodate an additional 250 m3 of storage
- Replace reservoir pump station
- A new pump station required to boost flow to Catchment B.
- Two PRV stations to manage the system pressures in Catchments B and C
- Various distribution mains to loop the system to provide adequate pressure, flow and redundancy

2.4 Scenario 2B

Refer to BD-PW-04 for the peak flow demands in each catchment and the locations of proposed infrastructure:

- Secure sufficient water license capacity, twin of the distribution transmission main from Turner Valley to Black Diamond
- Upgrade source capacity, treatment plant and pumps in TV WTP to increase flow from Turner Valley to the potable water reservoir in Black Diamond (MPE to provide costs)
- Reservoir upgrade to accommodate an additional 350 m3 of storage
- Replace reservoir pump station
- Upsize the distribution pipe from the reservoir to the distribution system
- Dedicated transmission watermain to carry flow from reservoir across the river to Catchment D
- New booster station to boost flow to Catchment D
- One pipeline river crossing to convey from Black Diamond to Catchment D
- Two PRV stations to manage the system pressures in Catchment D
- Various distribution mains to loop the system to provide adequate pressure, flow and redundancy
- Two PRV stations to manage the system pressures in Catchments B and C

3.0 Wastewater Servicing

USL calculated the sanitary flows for each growth scenario provided by O2 using the criteria in Table 3.1. As previously mentioned, the scenarios provide contingency supply lands to support growth beyond current projections. To remain conservative in our conceptual servicing analysis, USL included the total supply (demand and contingency) in the analysis to ensure that servicing would be available for future land use. It can be seen in Table 3.1 that the wastewater flow is an average for the community, meaning it

encompasses estimated flows from all land uses (residential, commercial, institutional), and includes inflow and infiltration. For that reason it was applied to all land uses. The numbers in the table below were taken from the Foothills Regional Wasterwater Collaborative (FRWWC) Regional Servicing Study currently being completedby USL and MPE (to be completed early 2016).

Table 3.1 – Wastewater Flow Equivalents

POPULATION FLOW EQUIVALENTS	VALUE	UNITS
Total Community Wastewater Flow	264	L/c/d
MDF:ADF Ratio	2.2	--
PHF:ADF Ratio	5.0	--
Westend Forcemain Capacity	134	L/s

Wastewater from the Town of Turner Valley is treated at the Westend wastewater treatment plant in Black Diamond, and sent via the Westend Sanitary Forcemain. The total calculated sanitary flows for each scenario therefore included the sanitary flows from TV, which were provided by MPE. Flows generated in TV will fill the Westend Forcemain to capacity (134 L/s), and excess flows will be sent to Black Diamond, as can be seen in BD-WW-01 to BD-WW-04. The wastewater treatment costs assume that the Westend Regional Wastewater Commission lagoon system will be upgraded to a mechanical tertiary treatment plant in order to meet high quality effluent standards currently being reviewed as part of the Foothills Regional Wastewater Collaborative study (to be completed in early 2016). This option will require a receiving environment study to confirm that the Sheep River has adequate capacity to receive these flows. We have not reviewed the option of piping the wastewater to Okotoks or other regional plant which is currently under review in the FRWWC study.

The total sanitary demands for each growth scenario, including Turner Valley are shown in Table 3.2.

Table 3.2. – Wastewater Flow Summary

GROWTH SCENARIO	ADF (m^3/d)	MDF (m^3/d)	PHF (L/s)
Scenario 1A	7,400	16,300	1,550
Scenario 1B	6,800	14,900	1,410
Scenario 2A	6,200	13,600	1,290
Scenario 2B	6,100	13,400	1,270

USL analysed each demand scenario against Town's existing collection system. The Town receives wastewater from Turner Valley via the Westend Regional forcemain, which was re-aligned in 2013 after the flood, and transitions into a gravity main that runs North through the Town to the lagoons. The gravity main had been sized for future growth (total capacity 280 L/s), and was used to convey additional flows when possible. The sections below describe the recommendations to service each scenario.

Please note the following:

- The recommendations are not exhaustive, and further detailed review of existing site conditions and a detailed development plan would be required to provide a conceptual design.

3.1 Scenario 1A

Refer to BD-WW-01 for the peak flow demands in each catchment and the locations of proposed infrastructure:

- Flow from TV will connect into the BD system at the West side of Catchment B.
- A new WWTP with a MDF of 13,400 m^3/d will be required to treat the flow to HQ criteria
- A 375 mm gravity line will carry the flow from the TV/BD boundary on Catchment B, North through Catchments C and D, and connect into the new WWTP
- A new effluent outfall

3.2 Scenario 1B

Refer to BD-WW-02 for the peak flow demands in each catchment and the locations of proposed infrastructure:

- Flow from TV will connect into the BD system at the West side of Catchment B.
- A new WWTP with a MDF of 14,900 m3/d will be required to treat the flow to HQ criteria
- 375 mm gravity line will carry the flow from the TV/BD boundary on Catchment B, North along the Town boundary, and connect into the new WWTP
- A new effluent outfall

3.3 Scenario 2A

Refer to BD-WW-03 for the peak flow demands in each catchment and the locations of proposed infrastructure:

- Flow from TV will connect into the BD system at the Southwest side of Catchment B.
- A new WWTP with a MDF of 13,600 m3/d will be required to treat the flow to HQ criteria
- 375 mm gravity line will carry the flow from the TV/BD boundary on Catchment B, North along the Town boundary through Catchment C, and connect into the new WWTP
- A new effluent outfall

3.4 Scenario 2B

Refer to BD-WW-04 for the peak flow demands in each catchment and the locations of proposed infrastructure:

- Flow from TV will connect into the BD system at the Southwest side of Catchment B.
- A new WWTP with a MDF of 13,400 m3/d will be required to treat the flow to HQ criteria
- 300 mm gravity line will carry the flow from the TV/BD boundary on Catchment B, North through Catchment C, and connect into the new WWTP

- 250 mm gravity line will carry flow from Catchment D North and East under the river to the new WWTP
- A new effluent outfall

4.0 Stormwater Servicing

It is anticipated that stormwater will be attenuated at strategic locations by the means of stormwater detention facilities (ponds). For each scenario, potential locations of stormwater facilities were identified based on the existing ground contours. These facilities can be wet or dry depending on the requirements and the ground condition. These facilities will attenuate post-development stormwater flow and release into their respective outlets at the pre-development rate.

The locations of the outlets were identified using existing drainage contours. Where possible, the ponds and outlets are adjacent to receiving drainage courses to mimic the predevelopment drainage patterns. It is anticipated that at some location ditches will have to be created to discharge stormwater into a watercourse. The ultimate main receiving body is the Sheep River. Below is a summary of stormwater facilities required for the proposed scenarios.

Please note the following

- The recommendations are not exhaustive, and further detailed review of existing site conditions and a detailed development plan would be required to provide a conceptual design.
- The proposed layout of the catchment and ponds can vary significantly based on factors such as planning design, desired site grading, environmental impact, and geotechnical conditions. Catchment and pond layouts will need to be verified through a Master Drainage Plan (MDP) and a Regional Plan or Section Plan, including hydrogeological reports, geotechnical reports, and biophysical inventory & environmental assessment reports.
- Anticipated stormwater facility excavation costs are based upon experience with a typical greenfield development with a wet pond. This assumes that excavated volume can be balanced across each site, there is no bedrock encountered, and the ponds are lined. Excavation costs can vary significantly depending on soil type, bedrock depth, groundwater table, and other factors.
- Inlet and outlet costs are dependent on minor system design and tie-in conditions, as well as potential water quality treatments.
- Landscaping costs were assumed to include some wetland plantings around the perimeter of the pond, but no park features or pathways.
- The stormwater costs as presented here additionally do not include the costs of the drainage system within each catchment, which would be specified during the detailed design stage.
- Considering these factors, the final cost will need to be determined in conjunction with detailed site design and investigation. The cost as presented is merely to indicate an order of magnitude to assist in comparing the scenarios within this report.

4.1 Scenario 1A

Refer to Figure BD-SWM-01 for the proposed catchments, ponds and drainage patterns based on existing contours.

- Based on existing contours, eight catchments, each with a stormwater detention facility, are proposed to attenuate storm flow.
- Stormwater detention facilities will generally discharge into the existing creeks nearby.
- A drainage ditch and an outfall from the north pond to the Sheep River and a ditch from the east pond to the nearby creek will be required. These ditches will require drainage easements along adjacent property lines or roads, and may require culverts under secondary highways.
- The southwest pond will require a drainage connection to the south pond, or the creek.
- The northwest pond will drain west along the existing highway ditch. This may require expanding the ditch.

4.2 Scenario 1B

Refer to Figure BD-SWM-02 for the proposed catchments, ponds and drainage patterns based on existing contours.

- Five catchments, each with a stormwater detention facility, are proposed to attenuate storm flow.
- Stormwater detention facilities will generally discharge into the existing creeks nearby.
- The southwest pond will require a drainage connection to the adjacent south pond, or the creek.

4.3 Scenario 2A

Refer to Figure BD-SWM-03 for the proposed catchments, ponds and drainage patterns based on existing contours.

- Seven catchments, each with a stormwater detention facility, are proposed to attenuate storm flow.
- Stormwater detention facilities will generally discharge into the existing creeks nearby.
- The north pond will require a drainage ditch and outfall to the Sheep River. These ditches will require drainage easements along adjacent property lines or roads, and may require culverts under secondary highways.
- The east pond will require a drainage ditch to the adjacent southeast pond, or the creek.
- The northwest pond will drain west along the existing highway ditch. This may require expanding the ditch.

4.4 Scenario 2B

Refer to Figure BD-SWM-04 for the proposed catchments, ponds and drainage patterns based on existing contours.

- Nine catchments, each with a stormwater detention facility, are proposed to attenuate storm flow.
- The south ponds will discharge into the existing creek nearby.
- Three ponds to the north will require drainage ditches and outfalls to the sheep river. These ditches will require drainage easements along adjacent property lines or roads, and may require culverts under secondary highways.
- The two ponds to the east will require drainage ditches to the nearby creek. These ditches will require drainage easements along adjacent property lines or roads, and may require culverts under secondary highways.
- The northwest pond will drain west along the existing highway ditch. This may require expanding the ditch.

5.0 Scenario Cost Comparison

The planning level estimate proposed for water, wastewater and stormwater infrastructure that may be required to service each scenario are presented in Table 5.1.

It should be noted that the infrastructure and servicing costs for each scenario will be shared between future private developers, and between the Towns of Black Diamond and Turner Valley. Future agreements will be required to determine which portions of the costs below will be assumed by each party depending on the detailed design of the communities.

The estimates assume the following:

- The costs are order of magnitude, to be used for comparison purposes between scenarios
- The receiving environment should be assessed and confirmed prior to design of the WWTP
- Land acquisition costs are not included
- The cost to acquire additional water license is not included
- Detailed costs are subject to actual site conditions and community layout (detailed design) – the proposed infrastructure layouts are subject to change
- The costs do not include underground network piping outside of the main transmission and trunk mains
- WTP expansion costs are carried in Turner Valley costs

Table 5.1. – Cost Comparison Summary*

INFRASTRUCTURE	SCENARIO 1A	SCENARIO 1B	SCENARIO 2A	SCENARIO 2B
Twin Potable Transmission Main from TV	$ 6,100,000	$ 6,100,000	$ 6,100,000	$ 6,100,000
Potable Water Reservoir and Pump Stations	$ 4,000,000	$ 1,500,000	$ 2,000,000	$ 3,800,000
Potable Distribution Mains and tie-ins	$ 2,800,000	$ 1,600,000	$ 4,200,000	$ 6,700,000
Water Subtotal	$ 12,900,000	$ 9,200,000	$ 12,300,000	$ 16,600,000
WWTP and Outfall Upgrade	$ 31,900,000	$ 30,200,000	$ 28,600,000	$ 28,300,000
Sanitary Trunk Mains and Tie-ins	$ 3,100,000	$ 2,900,000	$ 2,400,000	$ 5,600,000
Wastewater Subtotal	$ 35,000,000	$ 33,100,000	$ 31,000,000	$ 33,900,000
Earthworks and Landscaping	$ 13,600,000	$ 7,300,000	$ 10,700,000	$ 14,600,000
Inlet	$ 1,900,000	$ 1,200,000	$ 1,700,000	$ 2,100,000
Outlet	$ 1,400,000	$ 900,000	$ 1,300,000	$ 1,600,000
Drainage Ditches	$ 100,000	$ 40,000	$ 100,000	$ 180,000
Stormwater Subtotal	$ 17,600,000	$ 9,440,000	$ 13,800,000	$ 18,480,000
SUBTOTAL	$ 66,000,000	$ 52,000,000	$ 57,000,000	$ 69,000,000
Construction Contingency (30%)	$ 19,800,000	$ 15,600,000	$ 17,100,000	$ 20,700,000
Engineering (15%)	$ 12,900,000	$ 10,100,000	$ 11,100,000	$ 13,500,000
TOTAL	**$ 98,700,000**	**$ 77,700,000**	**$ 85,200,000**	**$ 103,200,000**

*The opinion of cost above is based on major infrastructure, and is a high level estimate designed for planning only. In order to provide a detailed itemized breakdown of the costs and infrastructure required (including site servicing and network piping), a detailed design of the community would be required.

Table 5.2 indicates the total water, wastewater and stormwater costs above per hectare of growth area for Black Diamond as per the catchment boundaries shown in Figures BD-PW-01 to BD-PW-04.

Table 5.2. – Cost per Area Summary for Comparison

SCENARIO	TOTAL DEVELOPABLE AREA (HA)	UNIT COST ($/HA)	TOTAL COST
Scenario 1A	316	$310,000	$98,700,000
Scenario 1B	193	$400,000	$77,700,000
Scenario 2A	248	$340,000	$85,200,000
Scenario 2B	242	$430,000	$103,200,000

Sincerely,

URBAN SYSTEMS LTD.

Leigh Chmilar, P.Eng.
Water and Wastewater Engineer

Ariane Sauter, M.Sc., P.L.(Eng)
Senior Water Resources Specialist

/lc/as/ts
Enclosure

cc: Meghan Aebig, USL, Steve Brubacher, USL

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MEMORANDUM

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Appendix A - Figures

BD-PW-01 – Water Servicing - Scenario 1A

BD-PW-02 – Water Servicing - Scenario 1B

BD-PW-03 – Water Servicing - Scenario 2A

BD-PW-04 – Water Servicing - Scenario 2B

BD-WW-01 – Sanitary Servicing - Scenario 1A

BD-WW-02 – Sanitary Servicing - Scenario 1B

BD-WW-03 – Sanitary Servicing - Scenario 2A

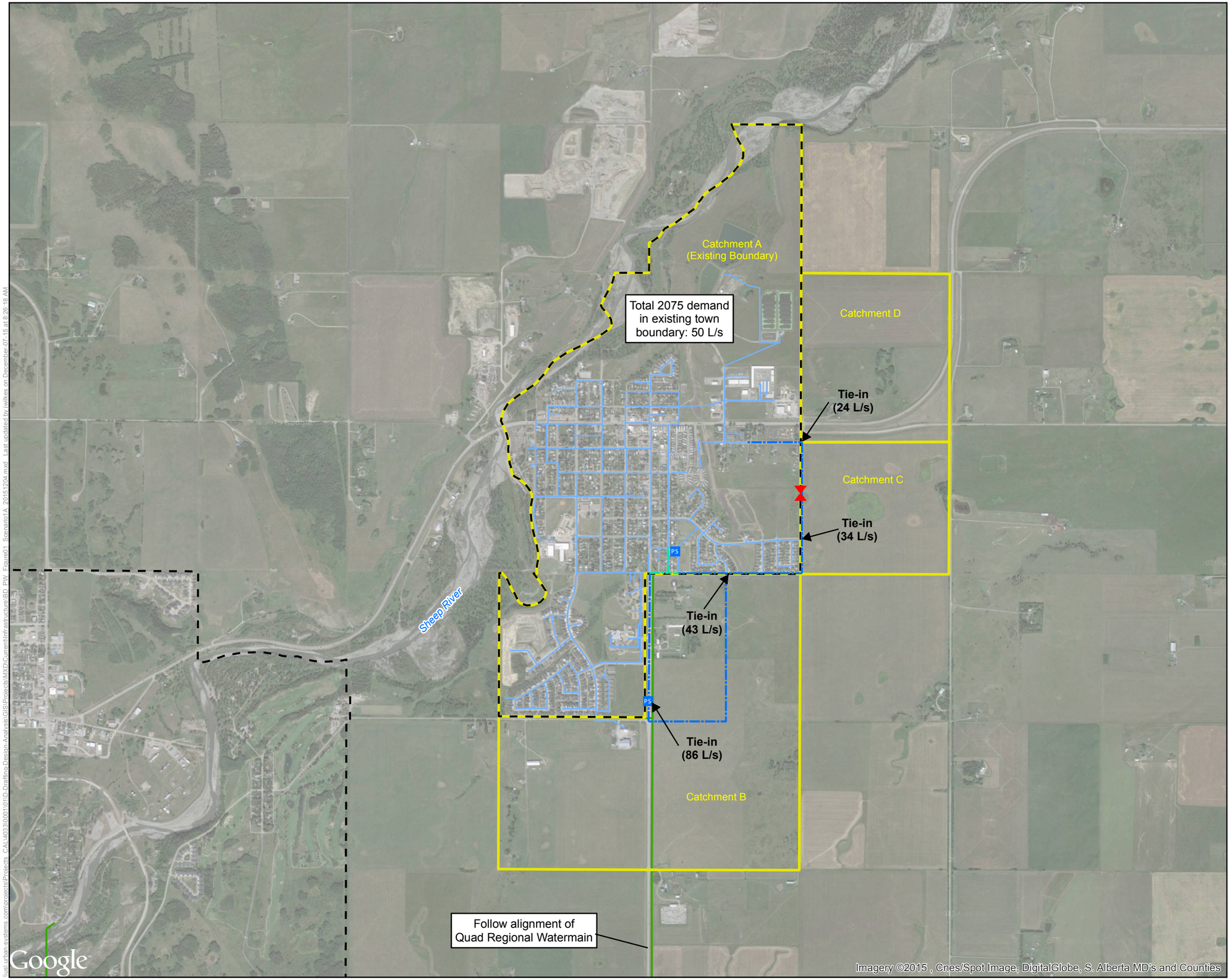
BD-WW-04 – Sanitary Servicing - Scenario 2B

BD-SWM-01 – Catchments – Scenario 1A

BD-SWM-02 – Catchments – Scenario 1B

BD-SWM-03 – Catchments – Scenario 2A

BD-SWM-04 – Catchments – Scenario 2B



Town of Turner Valley
Back to Nature

TOWN OF BLACK DIAMOND

Town of Turner Valley
Town of Black Diamond

Growth Scenarios

Water Servicing
Scenario 1A

Legend

- Pump Station - Proposed
- PRV - Proposed
- Watermain - Proposed
- Watermain - Existing (Upsize)
- Watermain - Existing
- Twin Quad Regional Main
- Catchments
- Town Boundary

200 100 0 200 400
Metres

N

Coordinate System:
NAD 1983 3TM 114

Scale:
1:20,000

Data Sources:
- Data provided by the Town of Black Diamond

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Author:	JW
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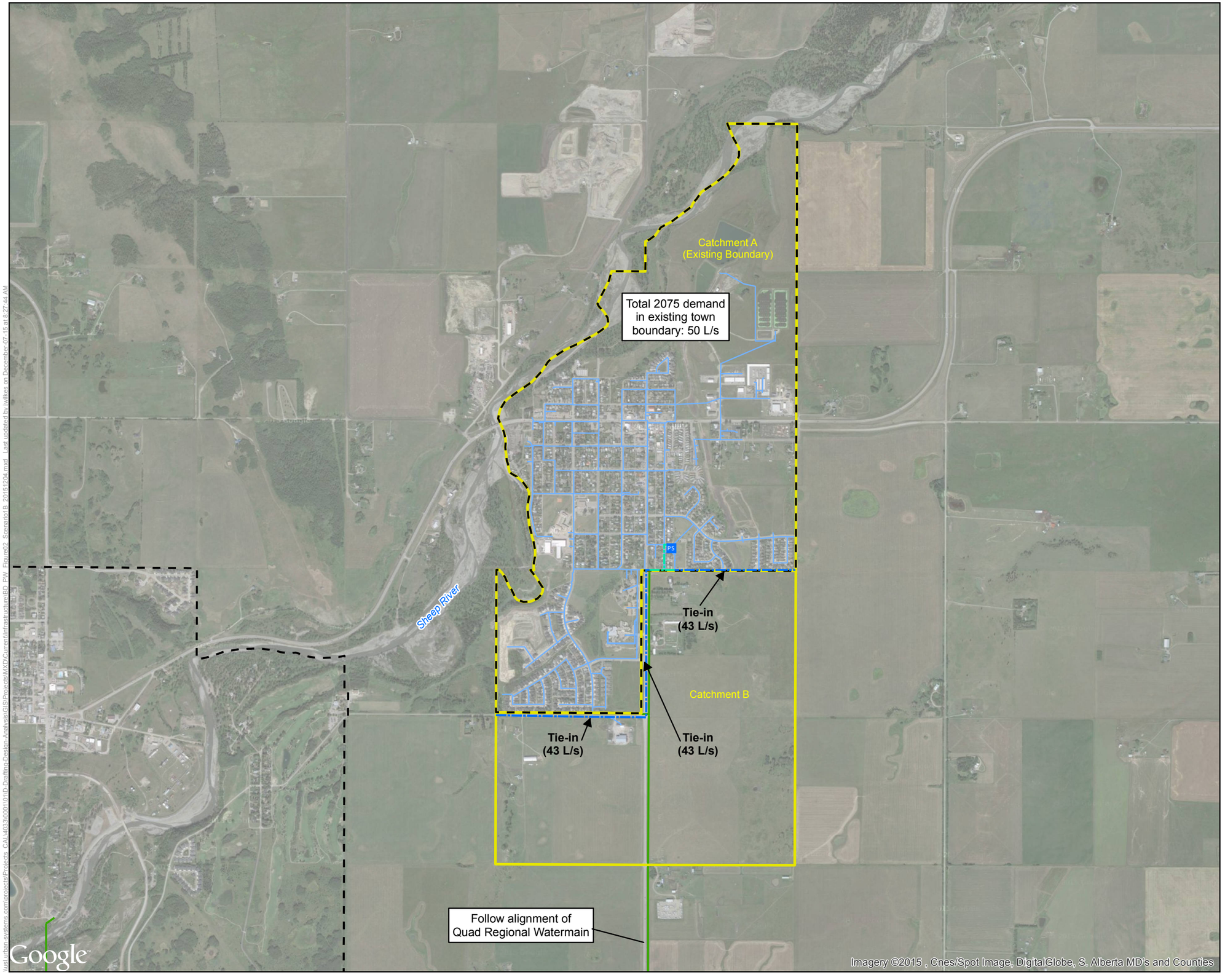
FIG. 1 BD-PW



\\wst.urban-systems.com\projects\Projects_CAL\4033\0001\01\D-Drafting\Design Analysis\GIS\Projects\MXD\Current\Infrastructure\BD_PW_Figure02_Scenario1B_20151204.mxd Last updated by jwilkes on December 07, 15 at 9:27:44 AM

Town of Turner Valley
Back to Nature

TOWN OF BLACK DIAMOND

Town of Turner Valley
Town of Black Diamond

Growth Scenarios

Water Servicing Scenario 1B

Legend

- Pump Station - Proposed
- PRV - Proposed
- Watermain - Proposed
- Watermain - Existing (Upsize)
- Watermain - Existing
- Twin Quad Regional Main
- Catchments
- Town Boundary

The accuracy & completeness of information shown on this drawing is not guaranteed. It will be the responsibility of the user of the information shown on this drawing to locate & establish the precise location of all existing information whether shown or not.

200 100 0 200 400
Metres

N

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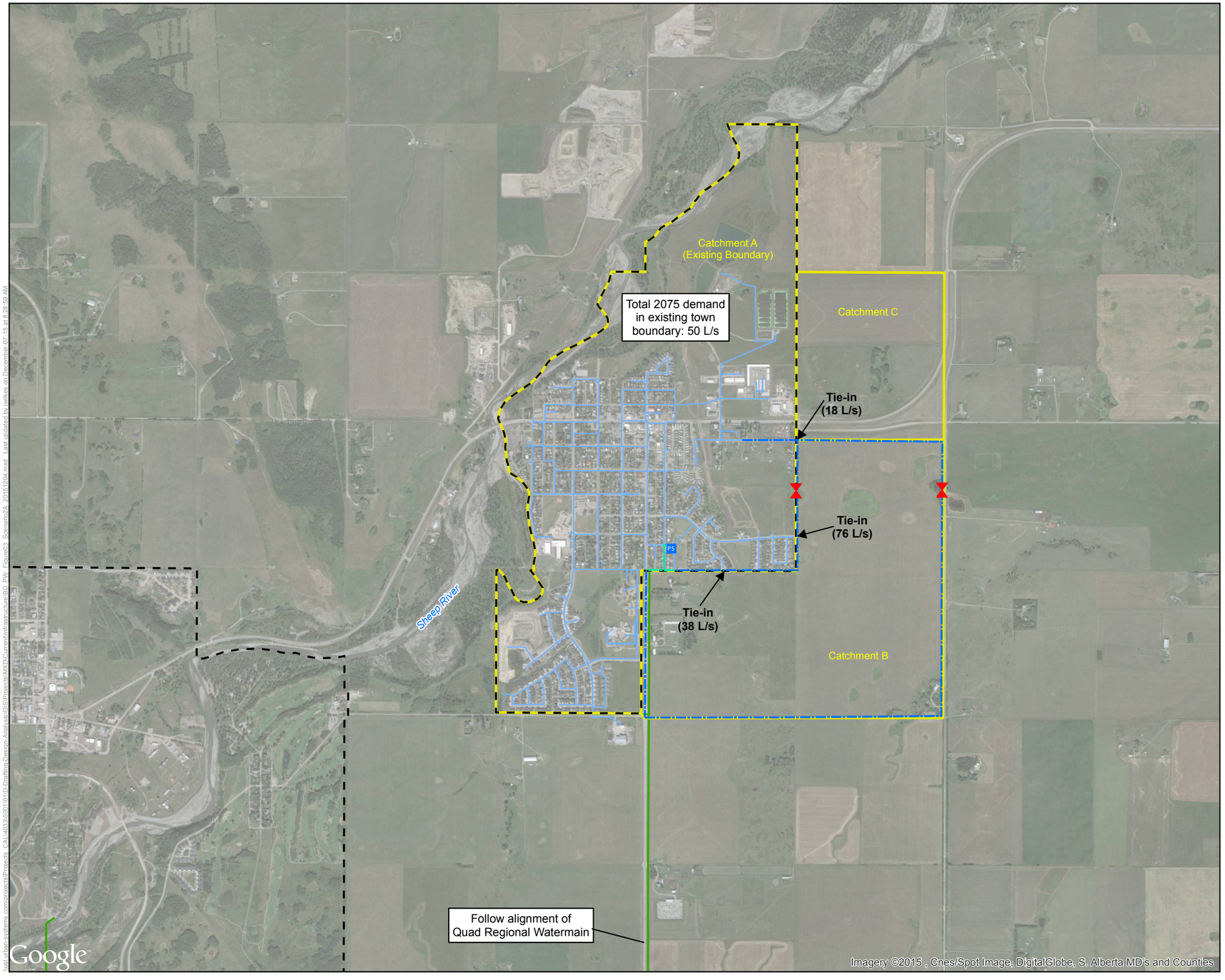
FIG. 2 BD-PW



Town of Turner Valley
Back to Nature

TOWN OF BLACK DIAMOND

Town of Turner Valley
Town of Black Diamond

Growth Scenarios

Water Servicing
Scenario 2A

Legend

- Pump Station - Proposed
- PRV - Proposed
- Watermain - Proposed
- Watermain - Existing (Upsize)
- Watermain - Existing
- Twin Quad Regional Main
- Catchments
- Town Boundary

200 100 0 200 400
Metres

N

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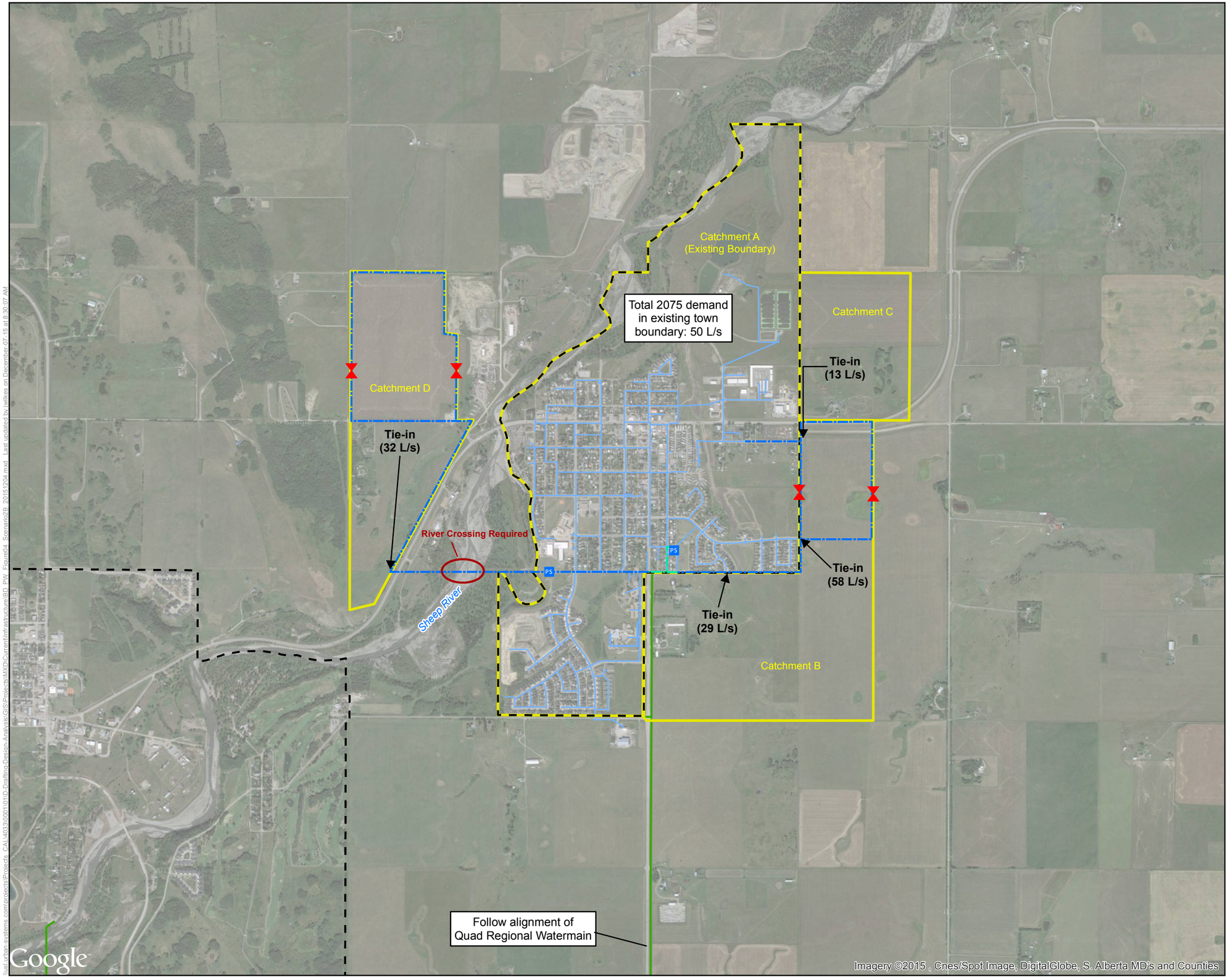
FIG. 3 BD-PW



Town of Turner Valley
Back to Nature

TOWN OF BLACK DIAMOND

Town of Turner Valley
Town of Black Diamond

Growth Scenarios

Water Servicing
Scenario 2B

Legend

- Pump Station - Proposed
- PRV - Proposed
- Watermain - Proposed
- Watermain - Existing (Upsize)
- Watermain - Existing
- Twin Quad Regional Main
- Catchments
- Town Boundary

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200 100 0 200 400
Metres

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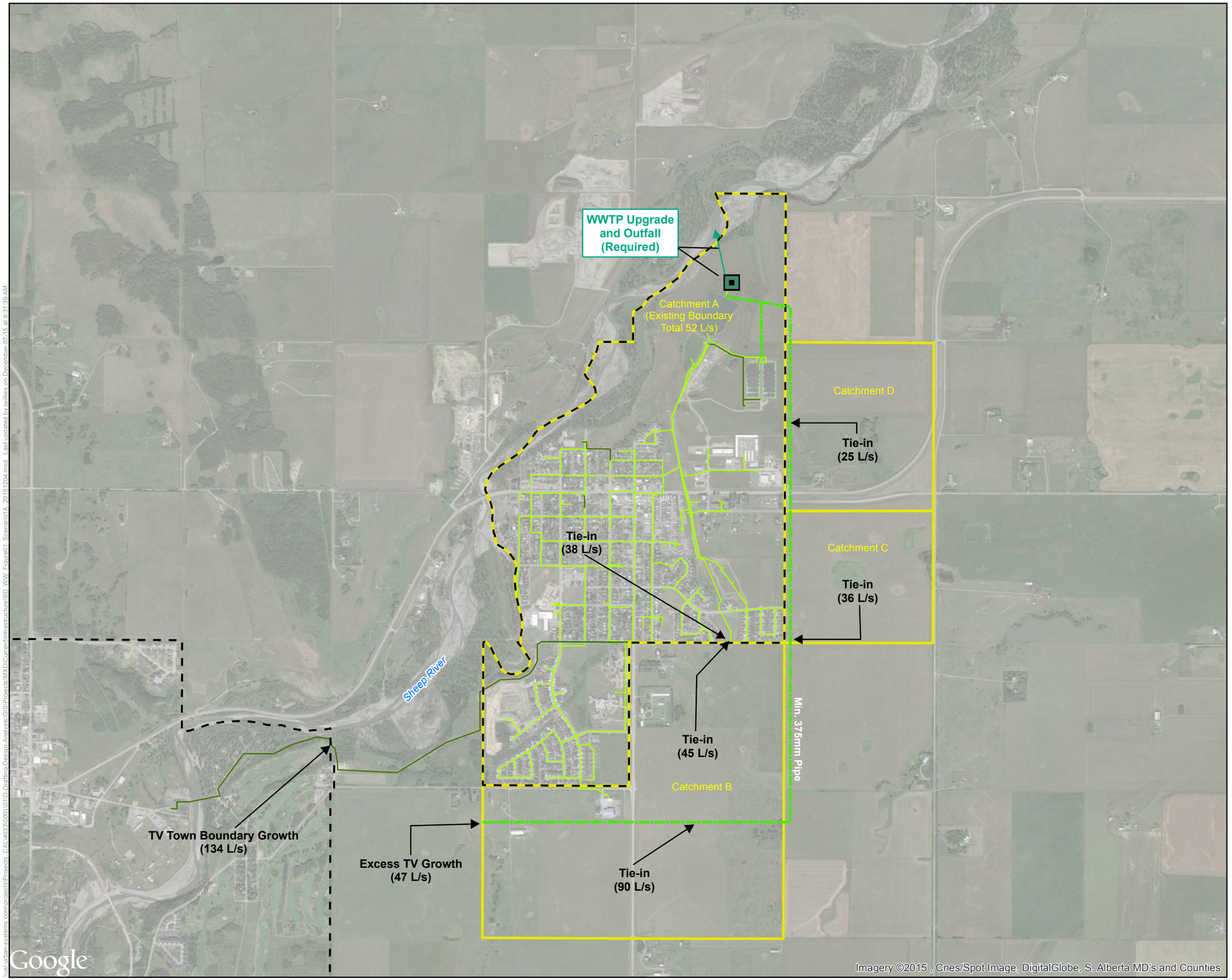
FIG. 4 BD-PW



Town of Turner Valley
Back to Nature

TOWN OF BLACK DIAMOND

Town of Turner Valley
Town of Black Diamond

Growth Scenarios

Sanitary Servicing Scenario 1A

Legend

- Forcemain - Existing
- Gravity Main - Existing
- Sanitary - Proposed
- Catchments
- Town Boundary

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200 100 0 200 400
Metres

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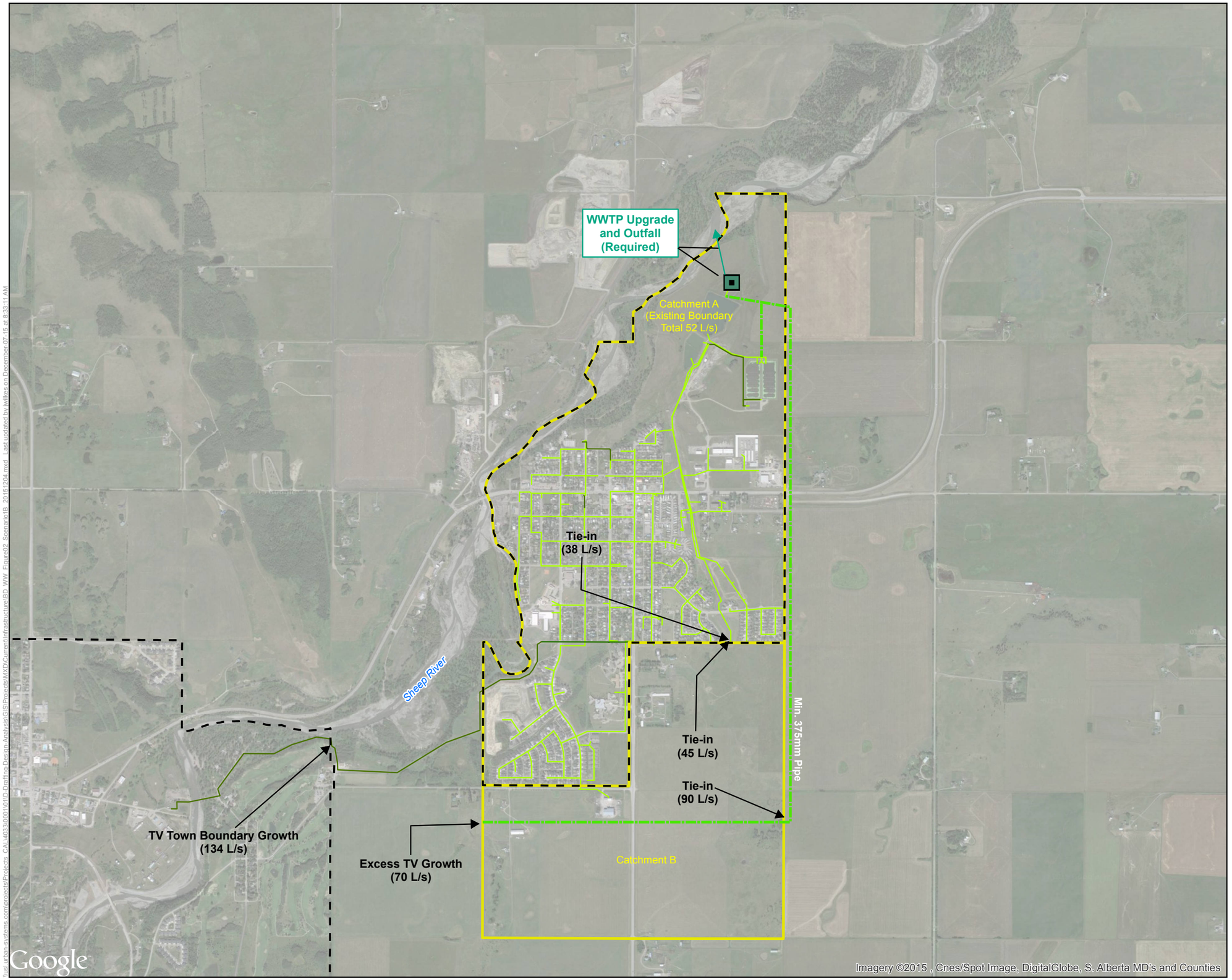
FIG. 1 BD-WW



Town of Turner Valley
Back to Nature

TOWN OF BLACK DIAMOND

Town of Turner Valley
Town of Black Diamond

Growth Scenarios

Sanitary Servicing Scenario 1B

Legend

- Forcemain - Existing
- Gravity Main - Existing
- Sanitary - Proposed
- Catchments
- Town Boundary

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200 100 0 200 400
Metres

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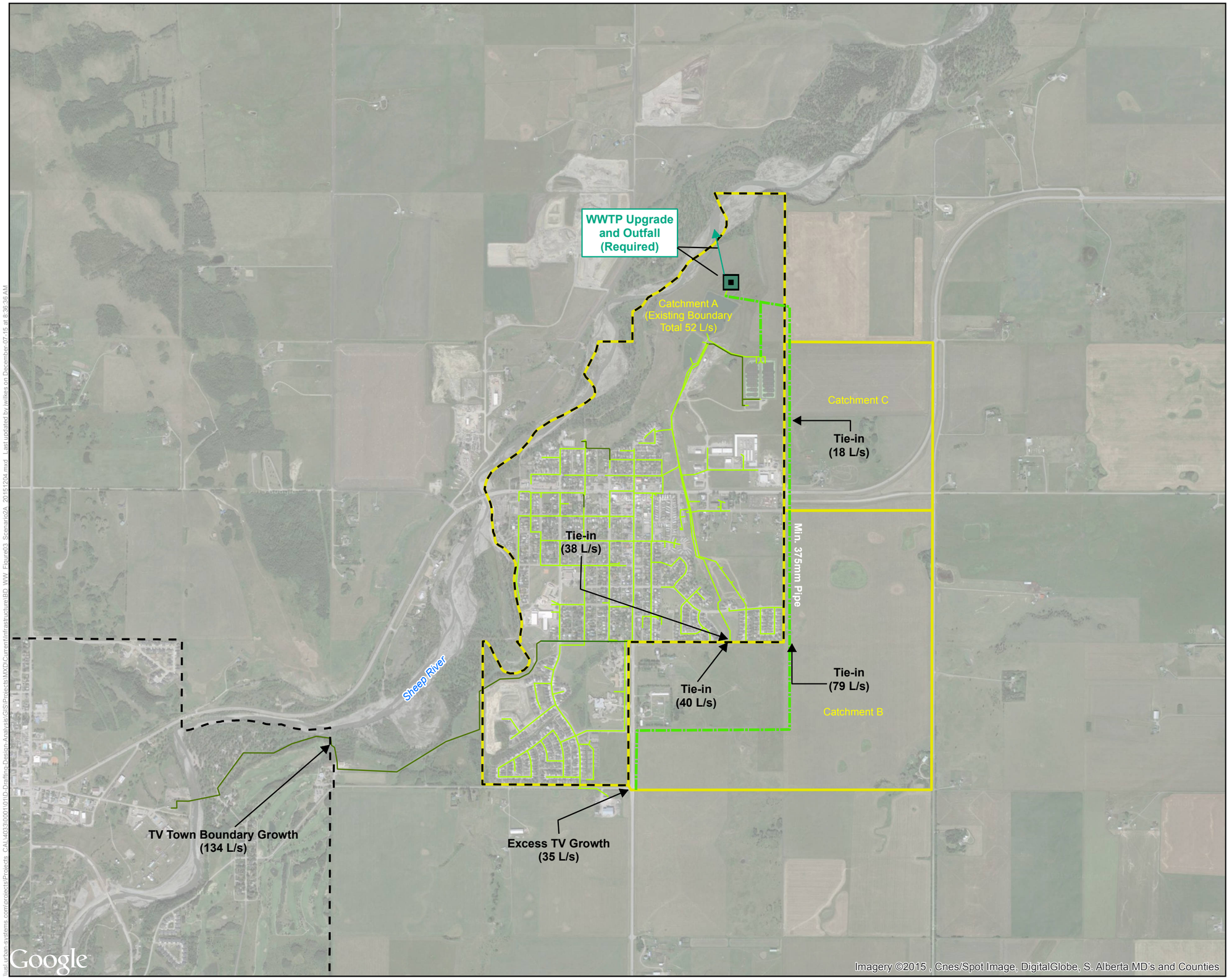
FIG. 2 BD-WW



Town of Turner Valley
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TOWN OF BLACK DIAMOND

Town of Turner Valley
Town of Black Diamond

Growth Scenarios

Sanitary Servicing Scenario 2A

Legend

- Forcemain - Existing
- Gravity Main - Existing
- Sanitary - Proposed
- Catchments
- Town Boundary

200 100 0 200 400
Metres

N

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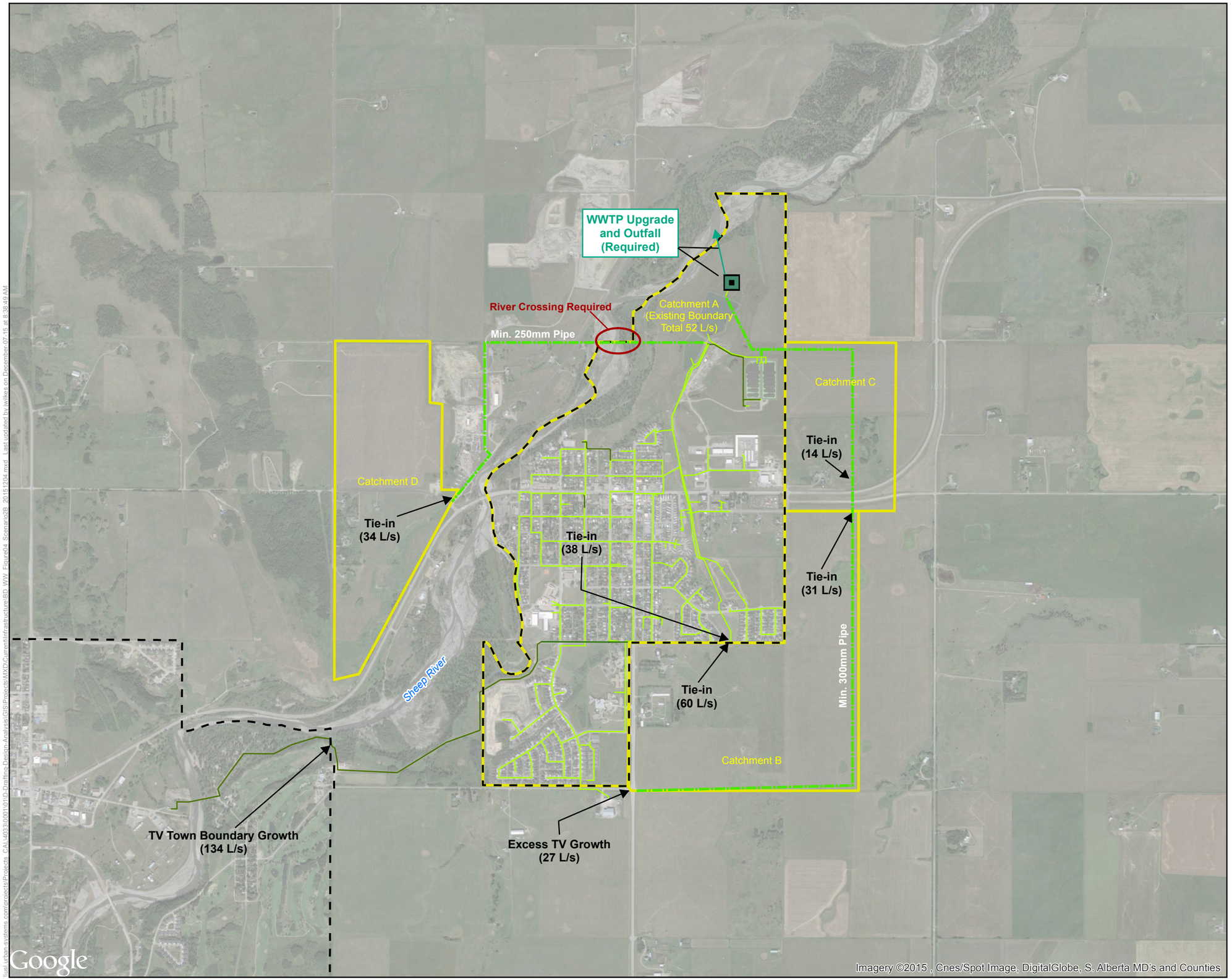
FIG. 3 BD-WW



Town of Turner Valley
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TOWN OF BLACK DIAMOND

Town of Turner Valley
Town of Black Diamond

Growth Scenarios

Sanitary Servicing Scenario 2B

Legend

- Forcemain - Existing
- Gravity Main - Existing
- Sanitary - Proposed
- Catchments
- Town Boundary

200 100 0 200 400
Metres

N

Coordinate System:
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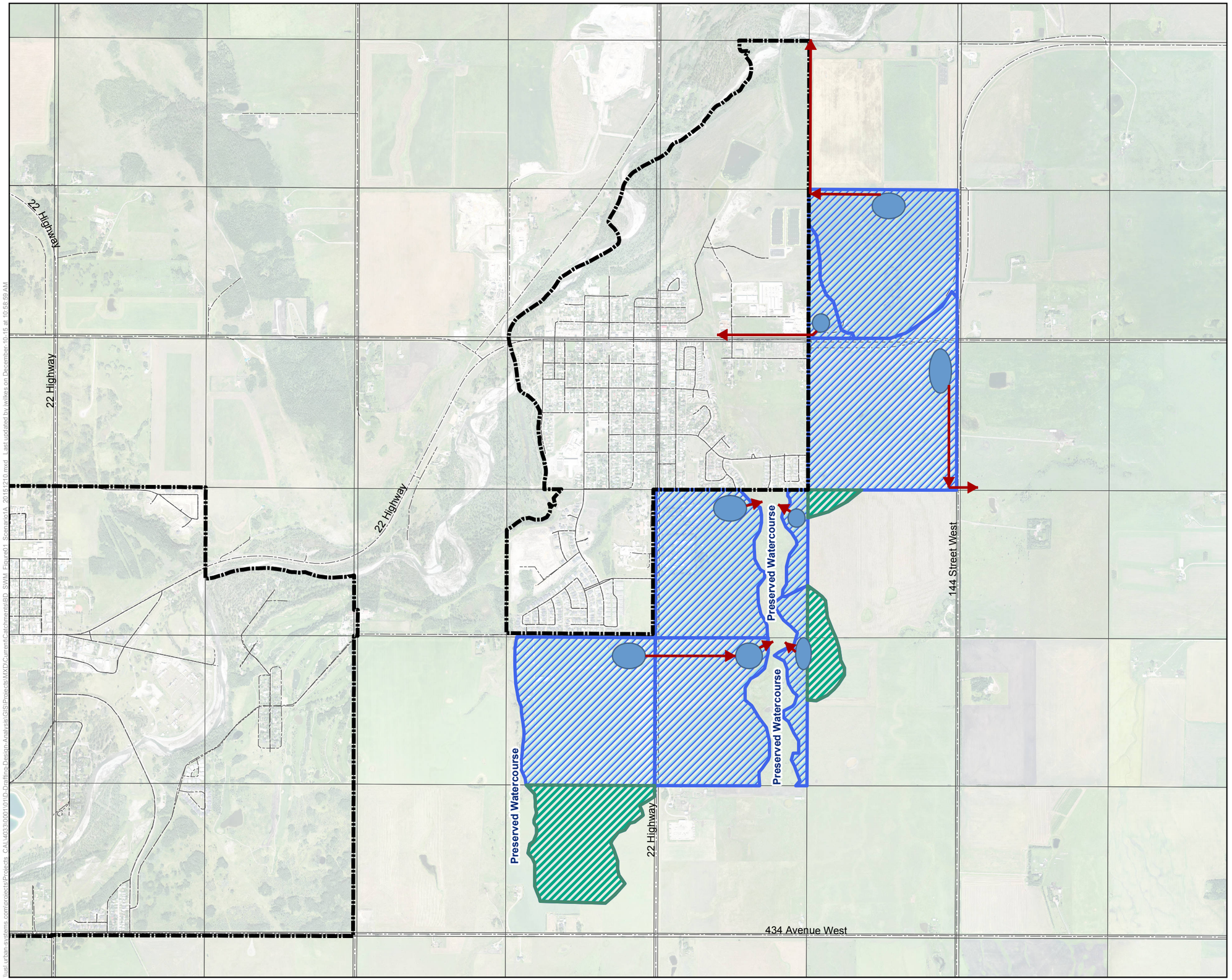
FIG. 4 BD-WW



Town of Turner Valley
Back to Nature

TOWN OF BLACK DIAMOND

Town of Turner Valley
Town of Black Diamond

Growth Strategy

Catchments - Scenario 1A

Legend

- Drainage Ditches - Proposed
- Ponds - Proposed
- Catchments - Proposed
- Upstream Catchments Naturally Draining to Development Area
- Town Boundary
- Quarter Sections

200 100 0 200 400
Metres

N

Coordinate System:
NAD 1983 3TM 114

Scale:
1:20,000

Data Sources:
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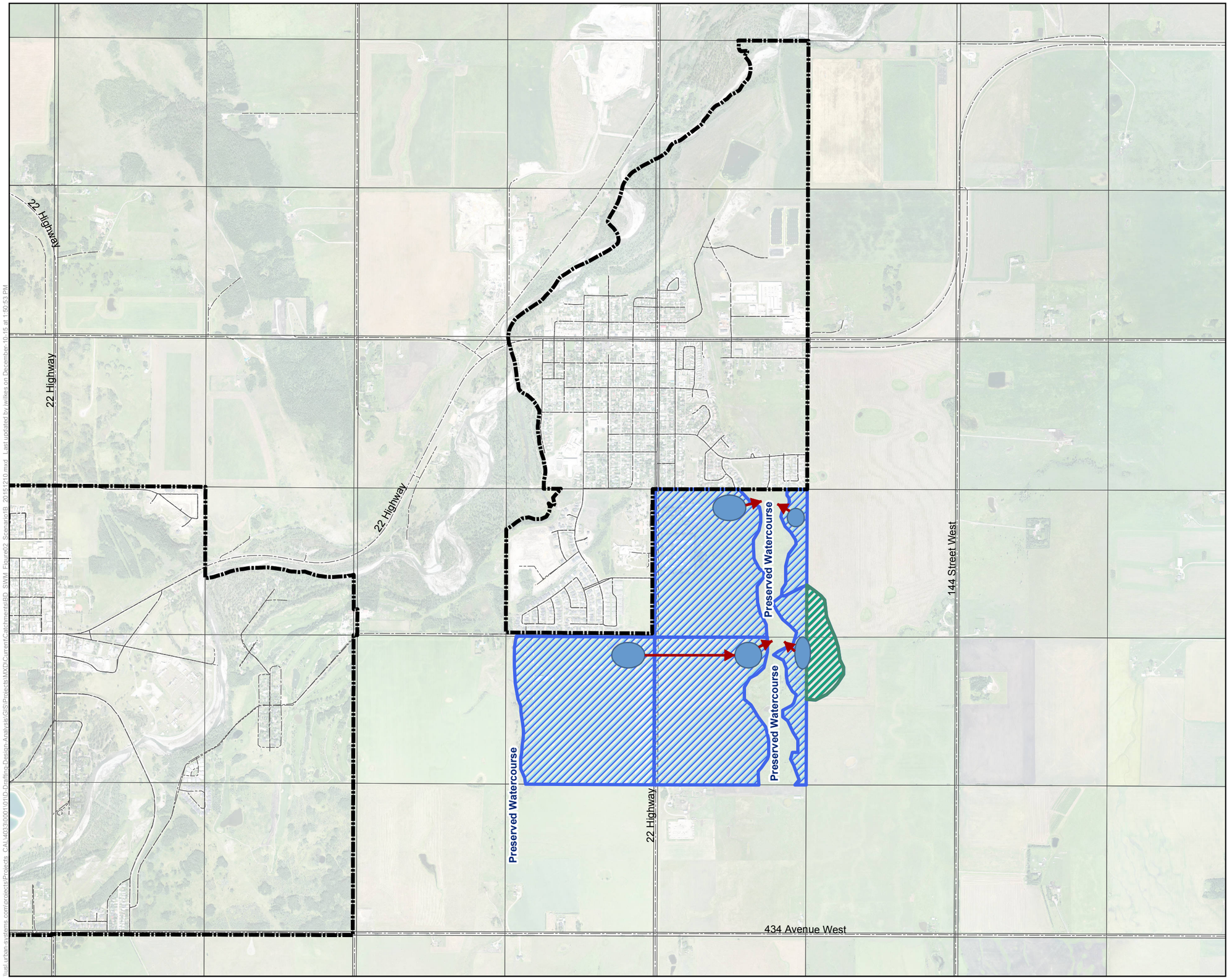
FIG. 1 BD-SWM



Town of Turner Valley
Back to Nature

TOWN OF BLACK DIAMOND

Town of Turner Valley
Town of Black Diamond

Growth Strategy

Catchments - Scenario 1B

Legend

- Drainage Ditches - Proposed
- Ponds - Proposed
- Catchments - Proposed
- Upstream Catchments Naturally Draining to Development Area
- Town Boundary
- Quarter Sections

200 100 0 200 400
Metres

N

Coordinate System:
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Scale:
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Data Sources:
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FIG. 2 BD-SWM

Town of Turner Valley
Back to Nature

TOWN OF BLACK DIAMOND

Town of Turner Valley
Town of Black Diamond

Growth Strategy

Catchments - Scenario 2A

Legend

- Drainage Ditches - Proposed
- Ponds - Proposed
- Catchments - Proposed
- Upstream Catchments Naturally Draining to Development Area
- Town Boundary
- Quarter Sections

200 100 0 200 400
Metres

N

Coordinate System:
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Scale:
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Data Sources:
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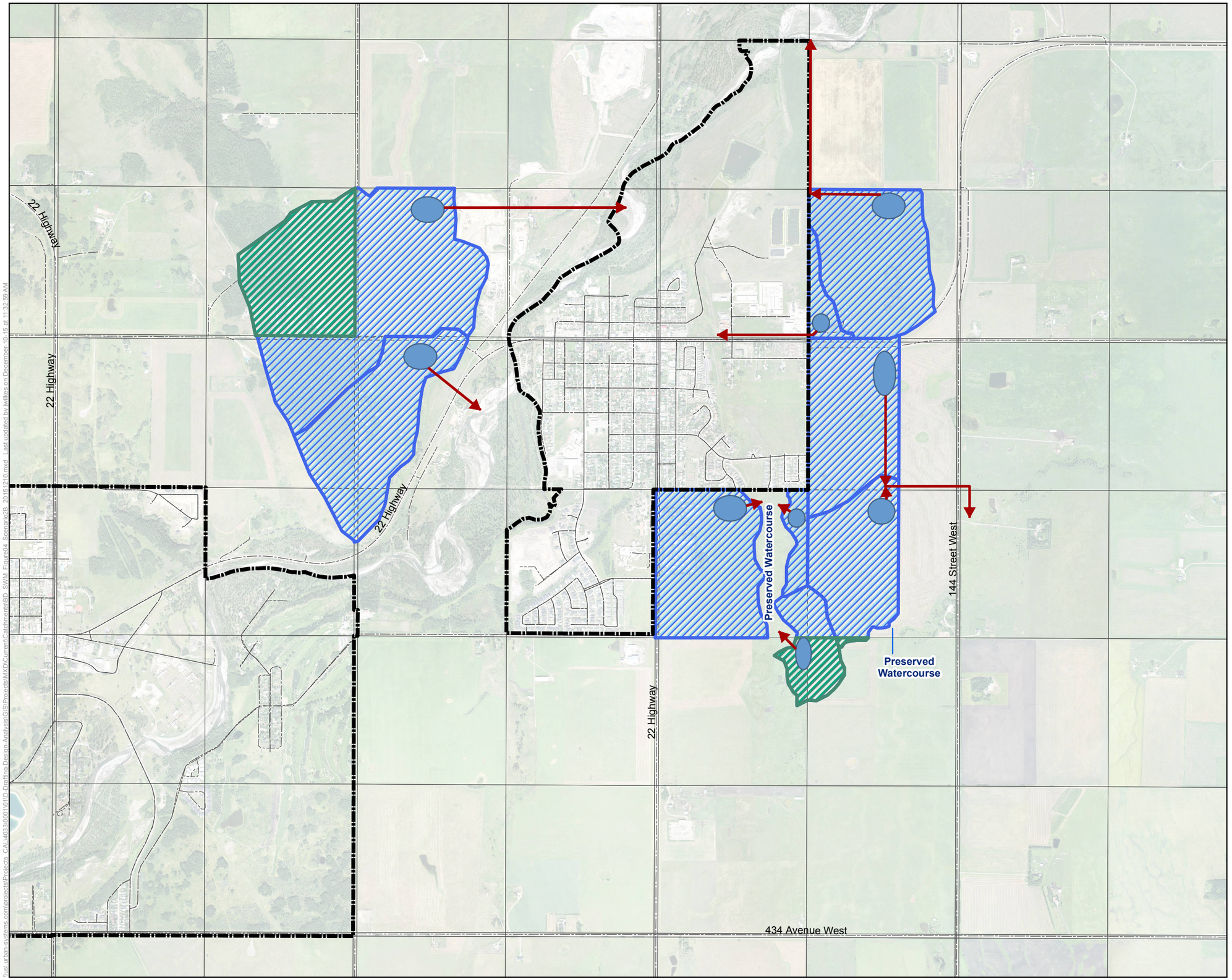
FIG. 3 BD-SWM

22 Highway
22 Highway
22 Highway
22 Highway
434 Avenue West
Preserved Watercourse
Preserved Watercourse
144 Street West



Town of Turner Valley
Back to Nature

TOWN OF BLACK DIAMOND

Town of Turner Valley
Town of Black Diamond

Growth Strategy

Catchments - Scenario 2B

Legend

- Drainage Ditches - Proposed
- Ponds - Proposed
- Catchments - Proposed
- Upstream Catchments Naturally Draining to Development Area
- Town Boundary
- Quarter Sections

200 100 0 200 400
Metres

N

Coordinate System:
NAD 1983 3TM 114

Scale:
1:20,000

Data Sources:
- Town of Black Diamond

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Author:	JW
Checked:	TS
Status:	~ DRAFT ~
Revision:	A
Date:	2015 / 12 / 10

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FIG. 4 BD-SWM

MEMORANDUM

URBAN systems

Date:	January 12, 2016
To:	Andrew Palmiere, O2 Planning and Design Inc.
cc:	Meghan Aebig, P.Eng.
From:	Leigh Chmilar, P.Eng., Ariane Sauter, M.Sc., PL (Eng)
File:	4033.0001.01
Subject:	Black Diamond and Turner Valley Joint Growth Strategy Water, Wastewater and Stormwater Conceptual Analysis – Scenario 3 - DRAFT

1.0 Black Diamond Water and Wastewater Conceptual Servicing Background

USL was retained to complete a conceptual servicing analysis for Water and Wastewater for the Town of Black Diamond (BD), using the growth scenarios provided by O2. MPE was retained to conduct the same analysis for Turner Valley (TV). USL coordinated with MPE Engineering (MPE) to ensure the demand and flow assumptions were aligned, since Turner Valley supplies potable water to Black Diamond, and Black Diamond provides wastewater treatment to Turner Valley. USL coordinated with MPE to divide the supply areas between the towns based on proximity and serviceability. Analysis of four growth scenarios (Scenario 1A, 2A, 1B and 2B) was provided in the Black Diamond and Turner Valley Joint Growth Strategy Water, Wastewater and Stormwater Conceptual Analysis Technical Memorandum – DRAFT (USL 2015).

For each growth scenario provided by O2, only residential growth was considered to occur within the Town boundary. The projected future flows and demands were based on total future population (as provided), so the flows include existing demands within the Town boundary. Only growth that was specified to be within the boundary was used for infrastructure that is existing. Any growth beyond the capacity of the existing systems were assumed to require new infrastructure outside the Town boundary.

O2 presented Scenario's 1A, 2A, 1B and 2B, to both Turner Valley and Black Diamond's councils and the group's preference was a combination of Scenario 1A and 2B (Scenario 3) (Appendix B). This option adds growth to the west side of Turner Valley, which would not affect the potable water servicing of Black Diamond. Growth to Turner Valley adds additional wastewater servicing requirements to the Westend System, operated by the Town of Black Diamond, as explained in Section 3.0. The following provides a summary of the water, wastewater and stormwater servicing requirements for Scenario 3.

2.0 Potable Water Servicing

USL calculated the potable water demands for Scenario 3 provided by O2 using the criteria in Table 2.1. As previously mentioned, the scenarios provide contingency supply lands to support growth beyond current projections. To remain conservative in our conceptual servicing analysis, USL included the total supply (demand and contingency) in the analysis to ensure that servicing would be available for future land use. It can be seen in Table 2.1 that the average water consumption per person has been applied to both residential and commercial/employment lands at the same rate. There is wide variability in commercial/employment demands however the rates used reflect relatively conservative values for the expected land uses. The MDD and PHD ratios were based on typical factors in other communities nearby.

Table 2.1. - Potable Demand Criteria

CRITERIA	VALUE	UNITS
Average Water Consumption[1]	315	l/c/day
Commercial/Employment Ratio	315	l/c/day
MDD:ADD Ratio	2.2	-
PHD:ADD Ratio	**4.0**	-

[1] Total community demand projected for 2076. CRP Regional Water and Wastewater Servicing Masterplan, May 2014.

The total potable demand for Scenario 3 is shown in Table 2.2. There was no difference in the potable water demands for the Town Black Diamond between Scenario 1A and Scenario 3, as the additional growth for Scenario 3 is in Turner Valley (not analyzed here).

Table 2.2. – Scenario 3 Potable Water Demand Summary

GROWTH SCENARIO	RESIDENTIAL POPULATION	EMPLOYMENT	MDD (MLD)	PHD (L/s)	MIN. FIRE FLOW REQUIREMENTS (L/s)	MIN. STORAGE REQUIRED (m^3)
Scenario 3	13,451	2,807	11.3	237	197 L/s	5,716

Scenario 3 was analysed using the criteria in Table 2.1 to determine the peak flows per catchment. The Fire Underwriters Survey for Black Diamond (2013) was used to estimate the minimum required fire flows for the town and each scenario. The required reservoir storage was calculated following the Alberta Environment and Parks (AEP) Standards and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage Systems. Please note that the proposed infrastructure is not exhaustive of what may be required to service the growth scenarios in the future. They are intended to show conceptually the infrastructure that may be required to allow the existing system to provide flow and adequate pressure to the associated catchments, while maintaining service within the Town boundary. USL recommends that a detailed analysis be conducted once a scenario is selected for further study.

USL analysed each demand scenario using a WaterCAD model of the Town's water distribution system. The Town receives its potable water from the water treatment plant in Turner Valley via the Sheep River Utilities Regional transmission main, which was installed in 2013 after the flood. The section below describes the recommendations to service Scenario 3.

Please note the following:

- The recommendations are not exhaustive, and further detailed review of existing site conditions and a detailed development plan would be required to provide a conceptual design.

- Note that the existing water license has not been reviewed in detail, and will likely not support the full build-out of the growth scenarios. Further study and review will be required to ensure adequate water is available for future growth.
- It is assumed that treated water will be supplied by the Town of Turner Valley, and adequate supply will be provided. MPE is providing costs for a WTP upgrade required to supply the demands of both towns in each scenario. The alignment of the Twin line is currently assumed to follow close to the current alignment however this will require review to confirm that adequate right of way exists.

2.1 Scenario 3

Refer to Figure BD-PW-05 for the peak flow demands in each catchment and the locations of proposed infrastructure:

- Secure sufficient water license capacity and twin the distribution transmission main from Turner Valley to Black Diamond.
- Upgrade source capacity, treatment plant and pumps in TV WTP to increase flow from Turner Valley to the potable water reservoir in Black Diamond (MPE to provide costs).
- Reservoir upgrade to accommodate an additional 1,200 m3 of storage.
- Replace reservoir pump station.
- Upsize the distribution pipe from the reservoir to the distribution system.
- A PRV station to manage the system pressures.
- Add a booster station to increase flow to Catchment B.
- Various distribution mains to loop the system to provide adequate pressure, flow and redundancy.

3.0 Wastewater Servicing

USL calculated the sanitary flows for Scenario 3 using the criteria in Table 3.1. As previously mentioned, the scenarios provide contingency supply lands to support growth beyond current projections. To remain conservative in our conceptual servicing analysis, USL included the total supply (demand and contingency) in the analysis to ensure that servicing would be available for future land use. It can be seen in Table 3.1 that the wastewater flow is an average for the community, meaning it encompasses estimated flows from all land uses (residential, commercial, institutional), and includes inflow and infiltration. For that reason it was applied to all land uses. The numbers in the table below were taken from the Foothills Regional Wastewater Collaborative (FRWWC) Regional Servicing Study currently being completed by USL and MPE (to be completed early 2016).

Table 3.1 – Wastewater Flow Equivalents

POPULATION FLOW EQUIVALENTS	VALUE	UNITS
Total Community Wastewater Flow	264	L/c/d
MDF:ADF Ratio	2.2	--

POPULATION FLOW EQUIVALENTS	VALUE	UNITS
PHF:ADF Ratio	5.0	--
Westend Forcemain Capacity	134	L/s

Wastewater from the Town of Turner Valley is treated at the Westend wastewater treatment plant in Black Diamond, and sent via the Westend Sanitary Forcemain. The total calculated sanitary flows therefore include the sanitary flows from TV, which were provided by MPE. Flows generated in TV will fill the Westend Forcemain to capacity (134 L/s), and excess flows will be sent to Black Diamond, as can be seen in BD-WW-05. The wastewater treatment costs assume that the Westend Regional Wastewater Commission lagoon system will be upgraded to a mechanical tertiary treatment plant in order to meet high quality effluent standards currently being reviewed as part of the Foothills Regional Wastewater Collaborative study (to be completed in early 2016). This option will require a receiving environment study to confirm that the Sheep River has adequate capacity to receive these flows. The option of piping the wastewater to Okotoks or other regional plant is currently under review in the FRWWC study.

The total sanitary demands for Scenario 3, including Turner Valley are shown in Table 3.2.

Table 3.2. – Scenario 3 Wastewater Flow Summary

GROWTH SCENARIO	ADF (m^3/d)	MDF (m^3/d)	PHF (L/s)
Scenario 3	7,800	17,200	454

USL analysed each demand scenario against Town's existing collection system. The Town receives wastewater from Turner Valley via the Westend Regional forcemain, which was re-aligned in 2013 after the flood, and transitions into a gravity main that runs North through the Town to the lagoons. The gravity main had been sized for future growth (total capacity 280 L/s), and was used to convey additional flows when possible. The sections below describe the recommendations to service each scenario.

Please note the following:

- The recommendations are not exhaustive, and further detailed review of existing site conditions and a detailed development plan would be required to provide a conceptual design.

3.1 Scenario 3

Refer to BD-WW-05 for the peak flow demands in each catchment and the locations of proposed infrastructure:

- Flow from TV will connect into the BD system at the West side of Catchment B.
- A new WWTP with a MDF of 17,200 m^3/d will be required to treat the flow to HQ criteria.
- A 400 mm gravity line will carry the flow from the TV/BD boundary on Catchment B, North through Catchments C and D, and connect into the new WWTP.
- A new effluent outfall.

4.0 Stormwater Servicing

It is anticipated that stormwater will be attenuated at strategic locations by the means of stormwater detention facilities (ponds). For Scenario 3, potential locations of stormwater facilities were identified based on the existing ground contours. These facilities can be wet or dry depending on the requirements and the ground condition. These facilities will attenuate post-development stormwater flow and release into their respective outlets at the pre-development rate.

The locations of the outlets were identified using existing drainage contours. Where possible, the ponds and outlets are adjacent to receiving drainage courses to mimic the predevelopment drainage patterns. It is anticipated that at some location ditches will have to be created to discharge stormwater into a watercourse. The ultimate main receiving body is the Sheep River. Below is a summary of stormwater facilities required for the proposed scenarios.

Please note the following

- The recommendations are not exhaustive, and further detailed review of existing site conditions and a detailed development plan would be required to provide a conceptual design.
- The proposed layout of the catchment and ponds can vary significantly based on factors such as planning design, desired site grading, environmental impact, and geotechnical conditions. Catchment and pond layouts will need to be verified through a Master Drainage Plan (MDP) and a Regional Plan or Section Plan, including hydrogeological reports, geotechnical reports, and biophysical inventory & environmental assessment reports.
- Anticipated stormwater facility excavation costs are based upon experience with a typical greenfield development with a wet pond. This assumes that excavated volume can be balanced across each site, there is no bedrock encountered, and the ponds are lined. Excavation costs can vary significantly depending on soil type, bedrock depth, groundwater table, and other factors.
- Inlet and outlet costs are dependent on minor system design and tie-in conditions, as well as potential water quality treatments.
- Landscaping costs were assumed to include some wetland plantings around the perimeter of the pond, but no park features or pathways.
- The stormwater costs as presented here additionally do not include the costs of the drainage system within each catchment, which would be specified during the detailed design stage.
- Considering these factors, the final cost will need to be determined in conjunction with detailed site design and investigation. The cost as presented is merely to indicate an order of magnitude to assist with comparison of growth options.

4.1 Scenario 3

Refer to Figure BD-SWM-05 for the proposed catchments, ponds and drainage patterns based on existing contours.

- Based on existing contours, eight catchments, each with a stormwater detention facility, are proposed to attenuate storm flow.
- Stormwater detention facilities will generally discharge into the existing creeks nearby.
- A drainage ditch and an outfall from the north pond to the Sheep River and a ditch from the east pond to the nearby creek will be required. These ditches will require drainage easements along adjacent property lines or roads, and may require culverts under secondary highways.
- The southwest pond will require a drainage connection to the south pond, or the creek.
- The northwest pond will drain west along the existing highway ditch. This may require expanding the ditch.

5.0 Scenario 3 Planning Level Estimate

The planning level estimate proposed for water, wastewater and stormwater infrastructure that may be required to service Scenario 3 is presented in Table 5.1. A planning level estimate is a preliminary estimate which, due to little or no site information indicates the approximate order of magnitude cost of the proposed project, based on broad requirements. This overall estimate is derived from lump sum or unit costs associated with other recent similar projects, and may be used to obtain approval in principle and for discussion purposes. A contingency allowance of 30% plus 15% allowance for engineering and design is appropriate for this level of estimate.

It should be noted that the infrastructure and servicing costs for each scenario will be shared between future private developers, and between the Towns of Black Diamond and Turner Valley. Future agreements will be required to determine which portions of the costs below will be assumed by each party depending on the detailed design of the communities.

The estimates assume the following:

- The costs are order of magnitude, to be used for comparison purposes between scenarios.
- The receiving environment should be assessed and confirmed prior to design of the WWTP.
- Land acquisition costs are not included.
- The cost to acquire additional water license is not included.
- Detailed costs are subject to actual site conditions and community layout (detailed design) – the proposed infrastructure layouts are subject to change.
- The costs do not include underground network piping outside of the main transmission and trunk mains.
- WTP expansion costs are carried in Turner Valley costs.

Table 5.1. – Cost Comparison Summary*

INFRASTRUCTURE	SCENARIO 3
Twin Potable Transmission Main from TV	$ 6,100,000
Potable Water Reservoir and Pump Stations	$ 4,000,000
Potable Distribution Mains and tie-ins	$ 2,800,000
Water Subtotal	$ 12,900,000
WWTP and Outfall Upgrade	$ 33,100,000
Sanitary Trunk Mains and Tie-ins	$ 3,100,000[1]
Wastewater Subtotal	$ 36,200,000
Earthworks and Landscaping	$ 14,200,000
Inlet	$ 1,900,000
Outlet	$ 1,400,000
Drainage Ditches	$ 100,000
Stormwater Subtotal	$ 17,600,000
SUBTOTAL	$ 67,000,000
Construction Contingency (30%)	$ 20,100,000
Engineering (15%)	$ 13,1,000
TOTAL	**$ 100,200,000**

[1]**The difference in costs between scenario 1A and and 3 are negligible with a slight increase in pipe size.**

*The opinion of cost above is based on major infrastructure, and is a high level estimate designed for planning only. In order to provide a detailed itemized breakdown of the costs and infrastructure required (including site servicing and network piping), a detailed design of the community would be required.

Sincerely,

URBAN SYSTEMS LTD.

Leigh Chmilar, P.Eng.
Water and Wastewater Engineer

Ariane Sauter, M.Sc., P.L.(Eng)
Senior Water Resources Specialist

/lc/as/ts
Enclosure

cc: Meghan Aebig, USL, Steve Brubacher, USL

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MEMORANDUM

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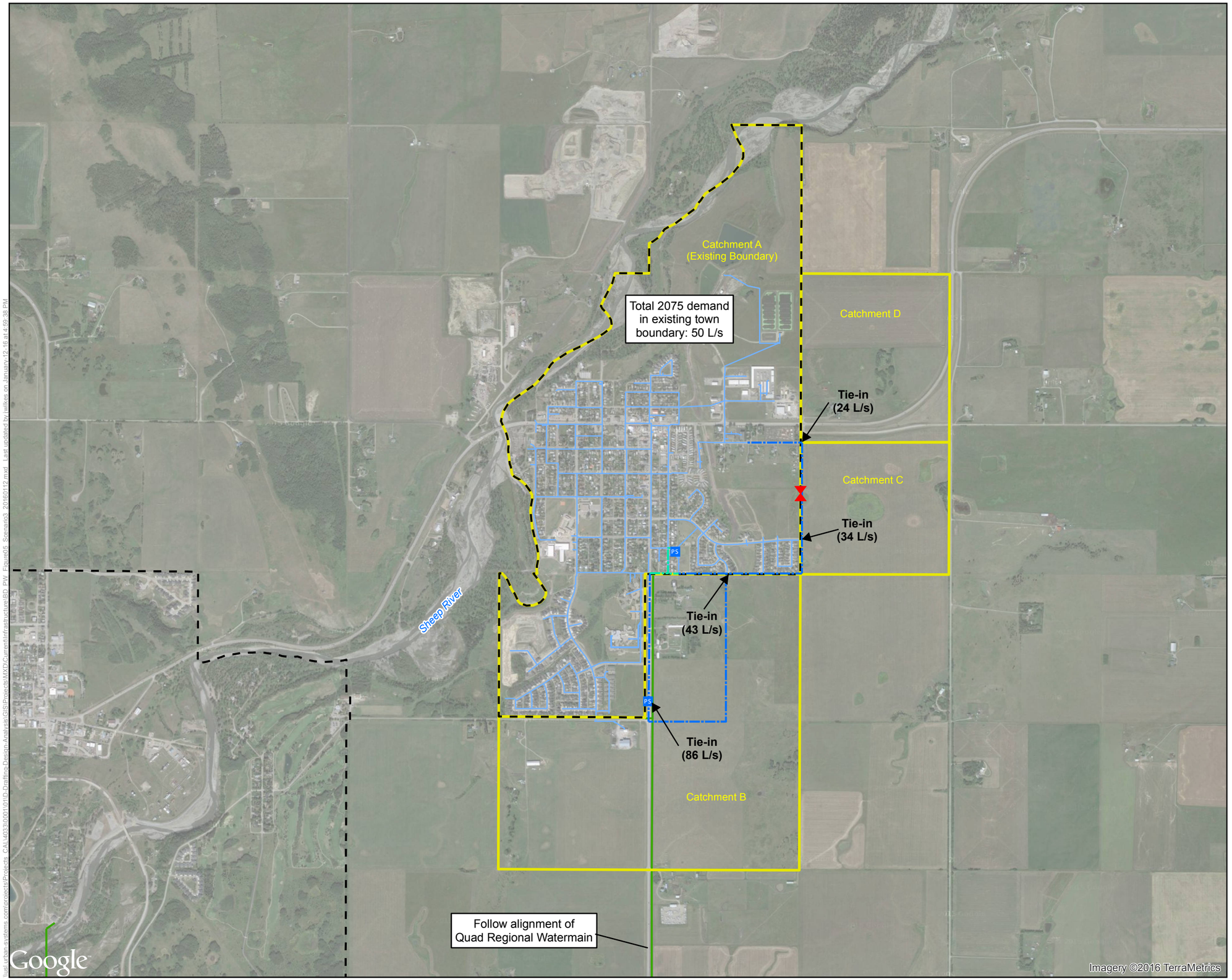
Appendix A - Figures

BD-PW-05 – Water Servicing - Scenario 3

BD-WW-05 – Sanitary Servicing - Scenario 3

BD-SWM-05 – Catchments – Scenario 3



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Town of Turner Valley
Back to Nature

TOWN OF BLACK DIAMOND

Town of Turner Valley
Town of Black Diamond

Growth Scenarios

Water Servicing
Scenario 3

Legend

- Pump Station - Proposed
- PRV - Proposed
- Watermain - Proposed
- Watermain - Existing (Upsize)
- Watermain - Existing
- Twin Quad Regional Main
- Catchments
- Town Boundary

200 100 0 200 400
Metres

N

Coordinate System:
NAD 1983 3TM 114

Scale:
1:20,000

Data Sources:
- Data provided by the Town of Black Diamond

Project #:	4033.0001.01
Author:	JW
Checked:	LC
Status:	~ DRAFT ~
Revision:	A
Date:	2016 / 1 / 12

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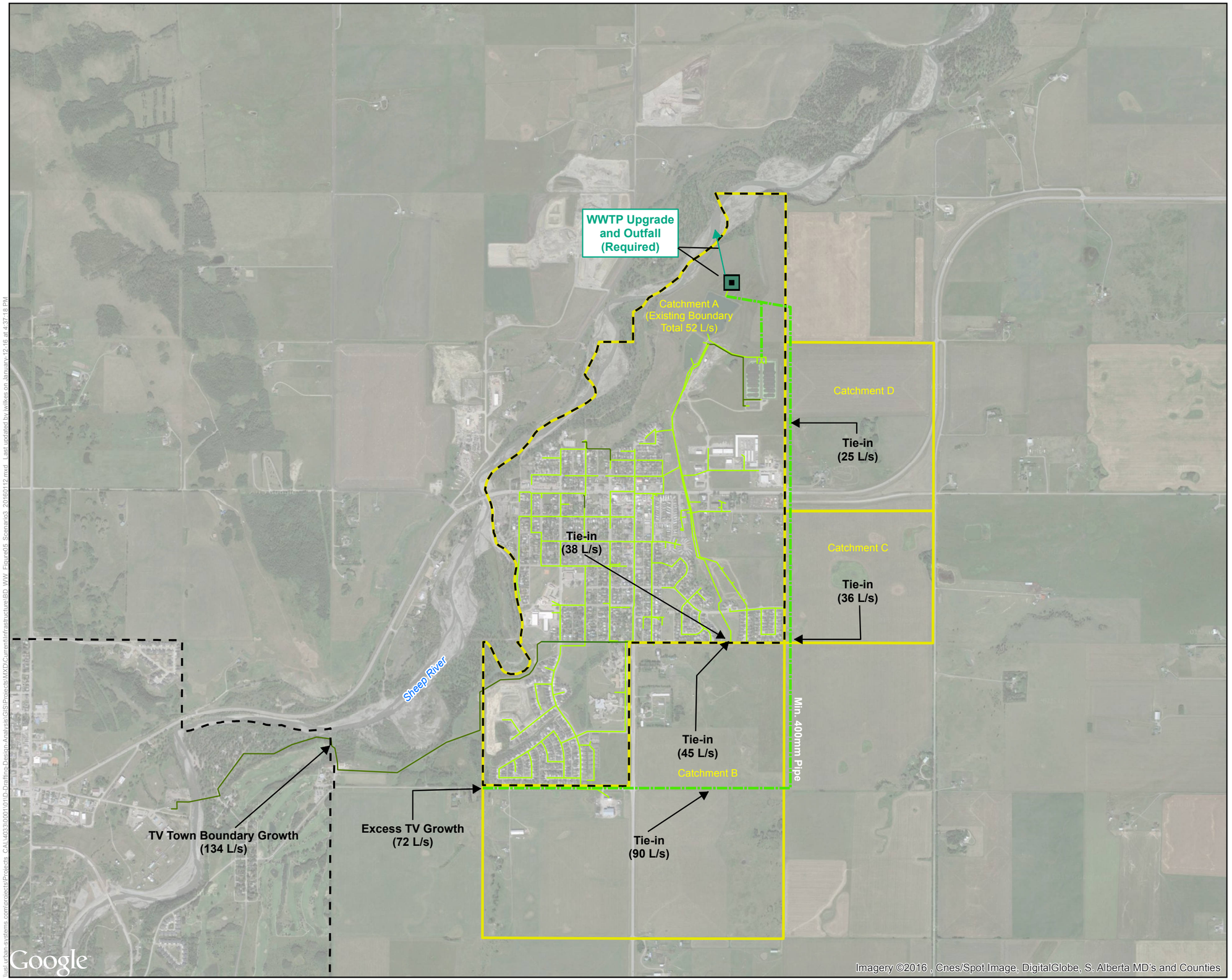
FIG. 5 BD-PW



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Town of Turner Valley
Back to Nature

TOWN OF BLACK DIAMOND

Town of Turner Valley
Town of Black Diamond

Growth Scenarios

Sanitary Servicing Scenario 3

Legend

- Forcemain - Existing
- Gravity Main - Existing
- Sanitary - Proposed
- Catchments
- Town Boundary

The accuracy & completeness of information shown on this drawing is not guaranteed. It will be the responsibility of the user of the information shown on this drawing to locate & establish the precise location of all existing information whether shown or not.

200 100 0 200 400
Metres

N

Coordinate System:
NAD 1983 3TM 114

Scale:
1:20,000

Data Sources:
- Data provided by the Town of Black Diamond

Project #:	4033.0001.01
Author:	JW
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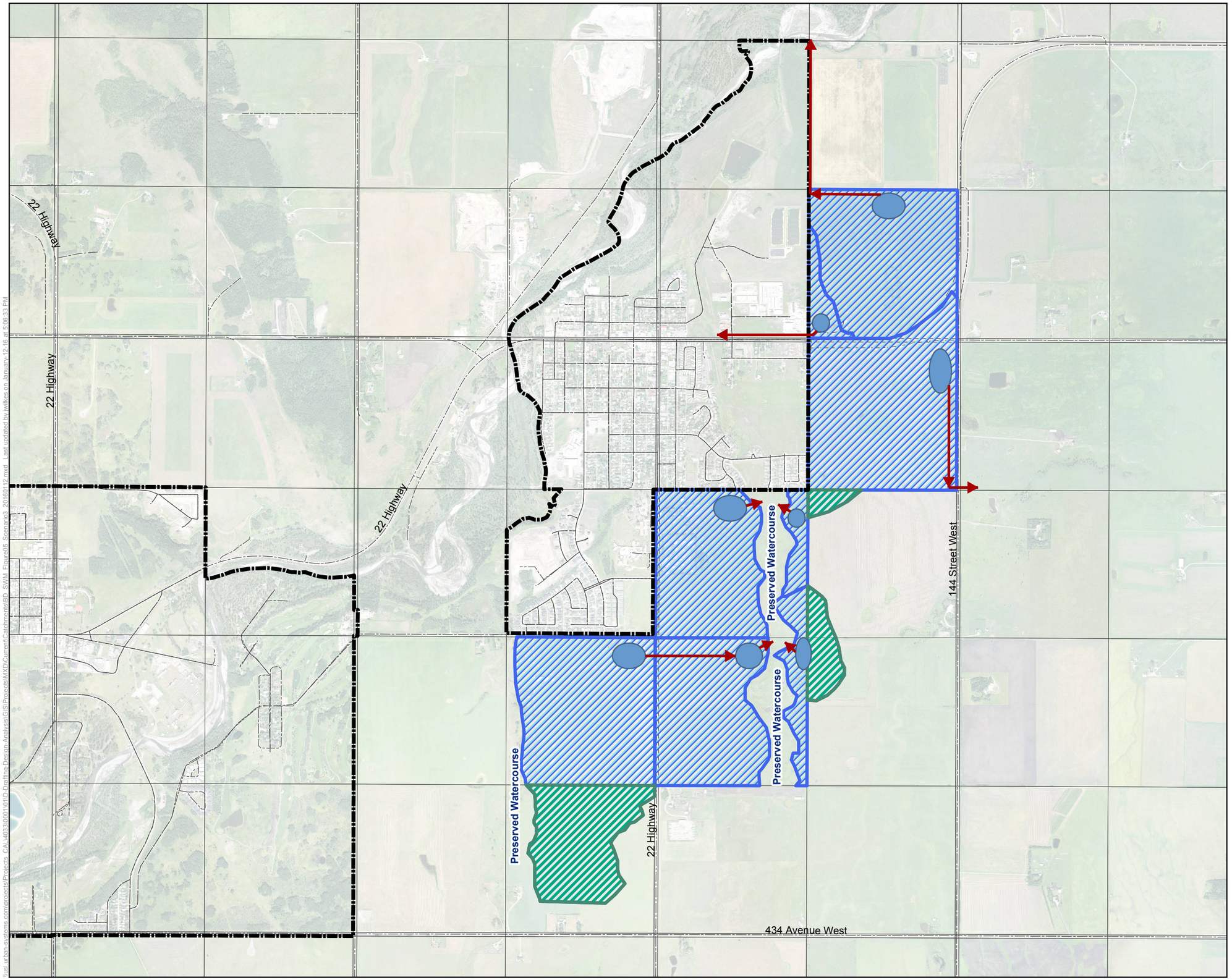
FIG. 5 BD-WW



Town of Turner Valley
Back to Nature

TOWN OF BLACK DIAMOND

Town of Turner Valley
Town of Black Diamond

Growth Strategy

Catchments - Scenario 3

Legend

- Drainage Ditches - Proposed
- Ponds - Proposed
- Catchments - Proposed
- Upstream Catchments Naturally Draining to Development Area
- Town Boundary
- Quarter Sections

200 100 0 200 400
Metres

N

Coordinate System:
NAD 1983 3TM 114

Scale:
1:20,000

Data Sources:
- Town of Black Diamond

Project #:	4033.0001.01
Author:	JW
Checked:	TS
Status:	~ DRAFT ~
Revision:	A
Date:	2016 / 1 / 12

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FIG. 5 BD-SWM

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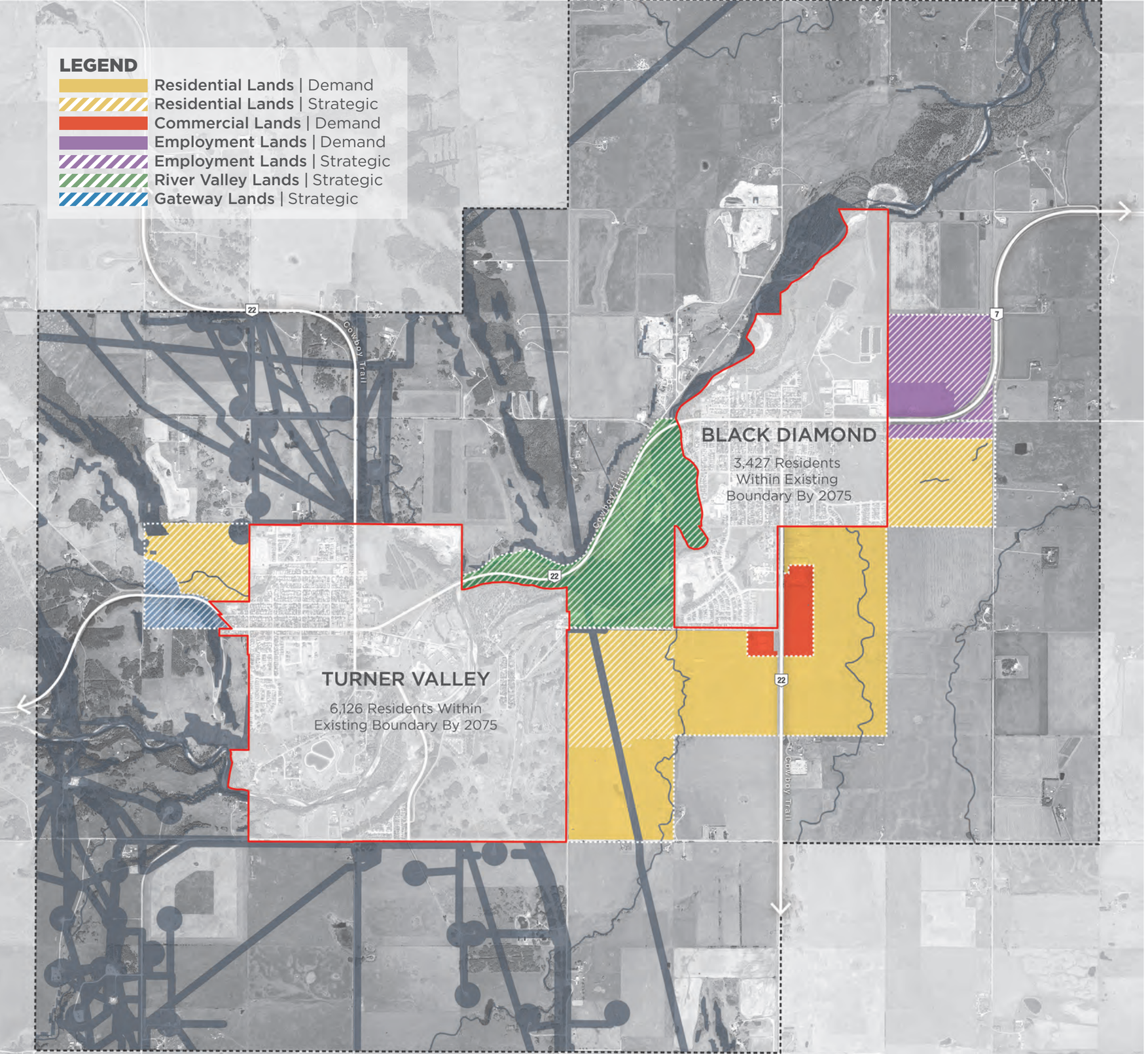
Appendix B – Scenario 3

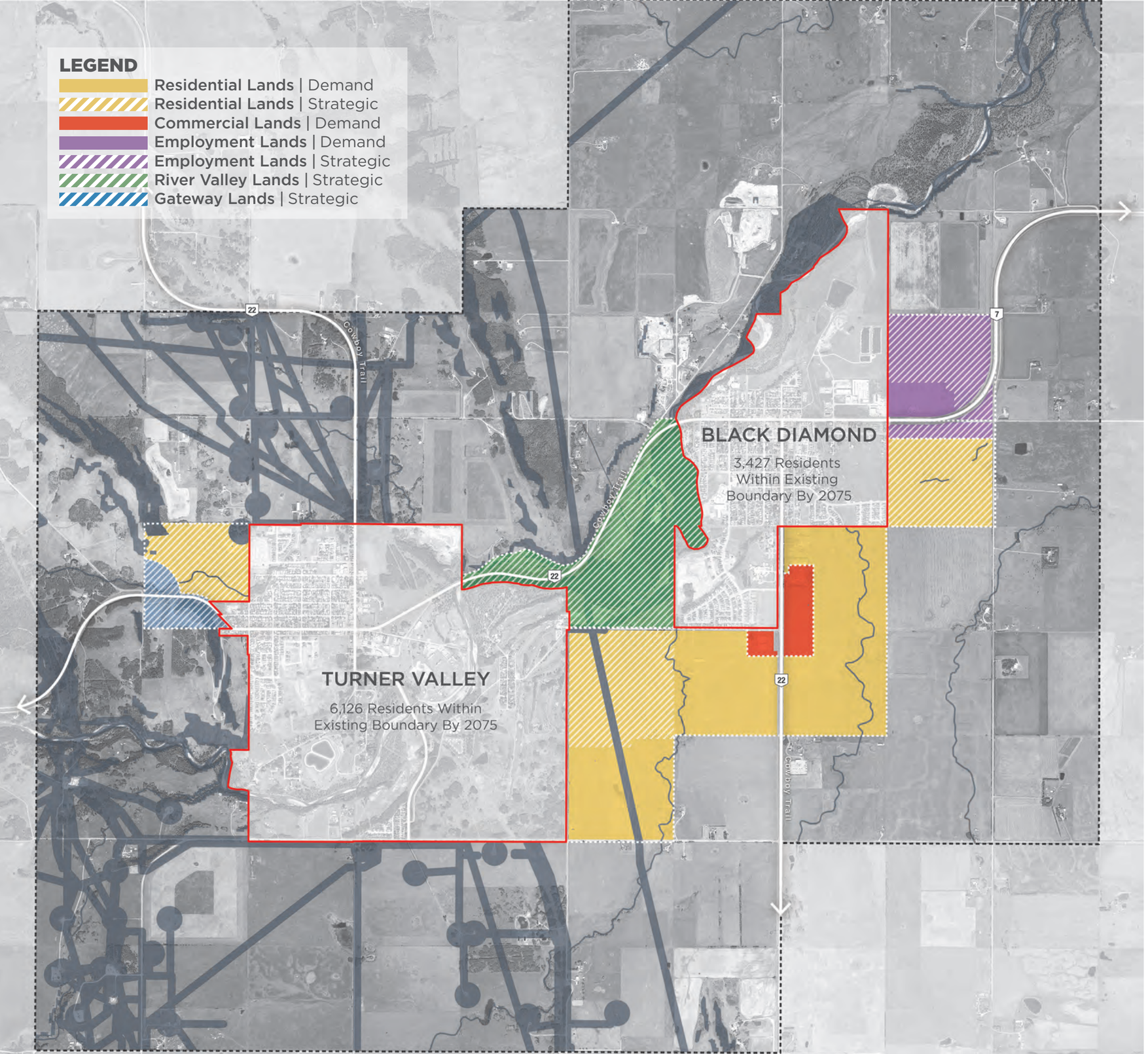


SCENARIO **3**

JOINT ADVISORY COMMITTEE DIRECTION

Concept Summary

- Indistinguishable borders
- Future growth concentrated in the least constrained lands
- Expanded River Valley Lands create an important environmental and open space connection between the Towns while maintaining highway control
- Creation of a new commercial node along Highway 22
- Concentration of Employment Lands along Highway 7
- Substantial contingency land supply



SCENARIO 3

JOINT ADVISORY COMMITTEE DIRECTION

Concept Statistics

GROWTH AREA TYPE	ACRES	PEOPLE / JOBS
Residential Lands | Demand	545	9,780
Residential Lands | Strategic	386	6,927
Commercial Lands | Demand	48	1,156
Employment Lands | Demand	31	294
Employment Lands | Strategic	143	1,357
River Valley Lands | Strategic	292	-
Gateway Lands | Strategic	50	-
Subtotal | Developable Lands	1,153	19,514
TOTAL | All Growth Area Lands	1,561	19,514

Appendix D

Joint Growth Strategy - Scenario 3 Phasing

MEMORANDUM

Date:	February 17, 2016
To:	Andrew Palmiere, O2 Planning and Design Inc.
From:	Meghan Aebig, P.Eng.
File:	4033.0001.01
Subject:	Joint Growth Strategy – Scenario 3 Phasing

Urban Systems was retained by O2 Planning and Design Inc. (O2) to complete the conceptual analysis related to the Town of Black Diamond and the Town of Turner Valley's Joint Growth Strategy (the Study).

The purpose of the technical memo is to provide a very high level summary of the preferred phasing for Scenario 3 from just a servicing perspective for the areas surrounding Black Diamond. It is understood that MPE addressed the phasing for the areas around Turner Valley and therefore those areas are not included in this summary.

Attached is a sketch of Scenario 3. It is preferable to develop Area A first, followed by Area B and then Area C for the following reasons:

Area A

The Town plans to install a watermain this year that will connect the watermain on 1st Avenue NE to the watermain on 4 Avenue SE. For Development of Area A, the developer would be able to easily tie into this watermain.

Area A is also the closest to the Town of Black Diamond's wastewater lagoon and therefore only a small section of sanitary sewer will need to be constructed to service this area.

In terms of transportation, the proposed north-south road on the west side of Area A (shown on the conceptual drawing that was provided in the transportation memo for Scenario 3) is all that is required for access to this area.

Area B

For construction of Area B, watermain looping and the construction of a pump station will be required.

The proposed sanitary sewer would need to be extended from Area B to the lagoon. If Area A were to be developed first, a portion of the sanitary sewer will have already been constructed.

For access to the site, the proposed north-south road, will need to be extended further south (assuming a portion of this road was constructed when Area A was developed) and east-west roads will be required to ensure connectivity.

Area C

For construction of Area C, most of the larger watermains will have been constructed as part of the phasing for development of Area's A and B.

The sanitary sewer would be extended from Area's A and B.

The roads would be extended from Area B to the west.

If Areas B or C were constructed prior to Area A, the watermains required to service these areas could be easily constructed. However, based on the conceptual alignment of the sanitary sewer and the roads, in order to service Areas B and C, the sanitary sewer for the area would need to connect to the wastewater lagoon, north of the Highway. The roads to connect to the highways would also be required.

Sincerely,

URBAN SYSTEMS LTD.

Meghan Aebig, P.Eng
Project Engineer

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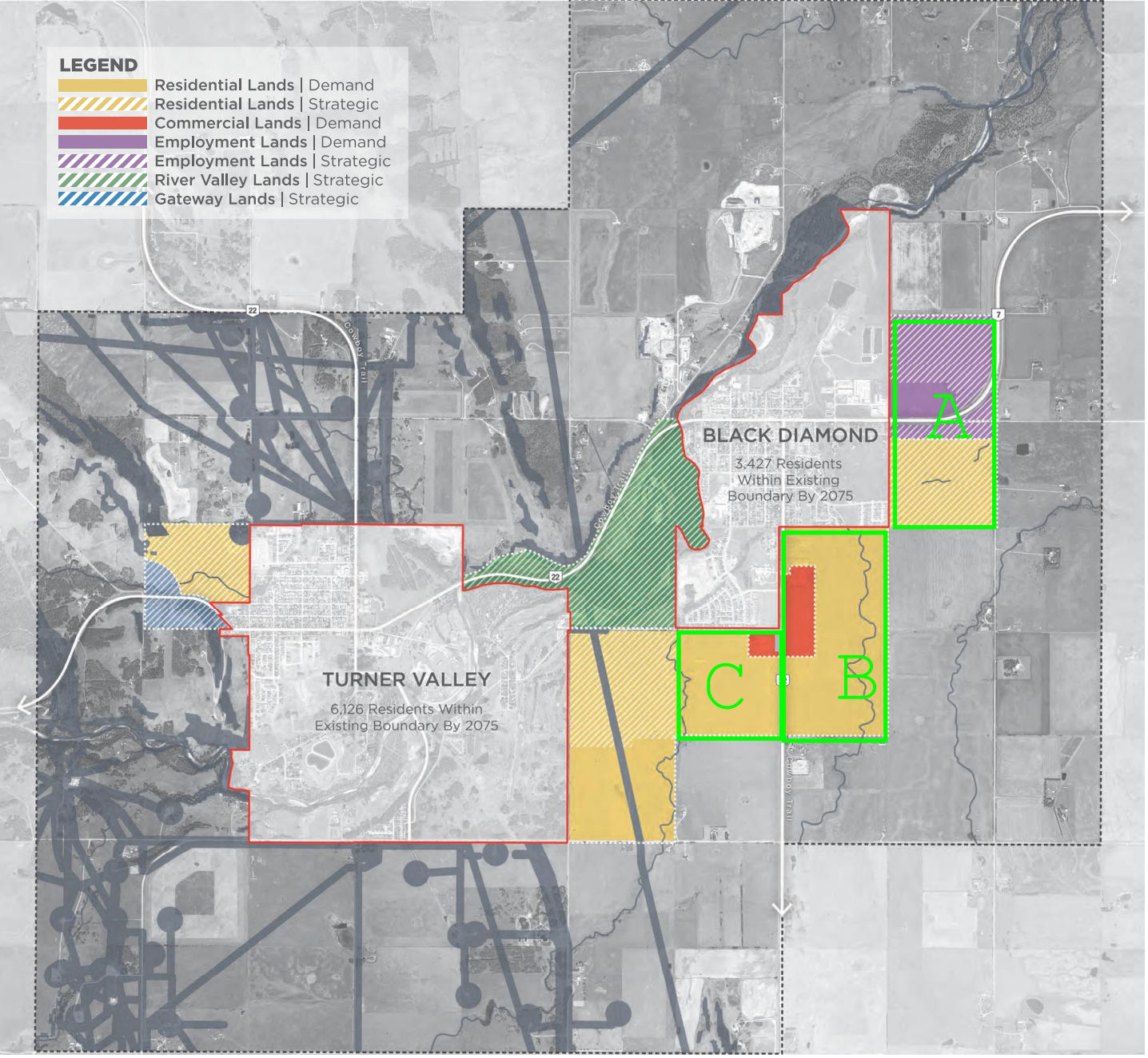

SCENARIO 3

JOINT ADVISORY COMMITTEE DIRECTION

Concept Summary

- Indistinguishable borders
- Future growth concentrated in the least constrained lands
- Expanded River Valley Lands create an important environmental and open space connection between the Towns while maintaining highway control
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- Concentration of Employment Lands along Highway 7
- Substantial contingency land supply