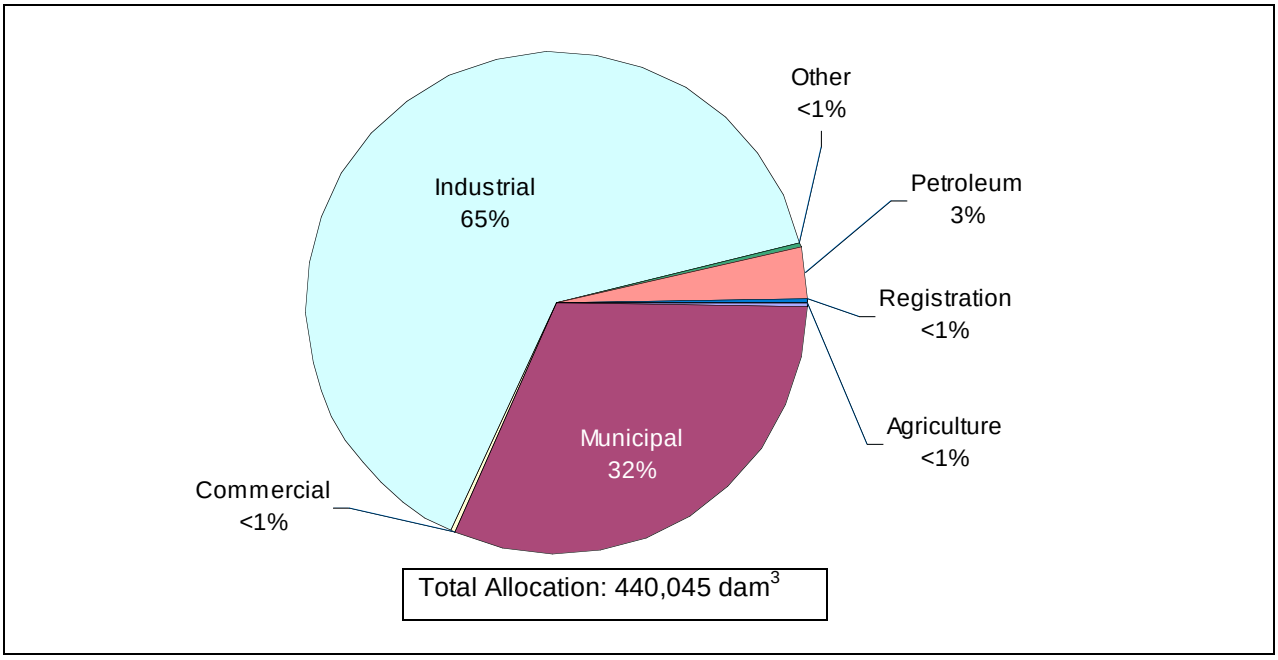
8.0 STRAWBERRY

The Strawberry Sub-basin is about 3,100 km^2 in area and occupies approximately nearly 6 percent of the North Saskatchewan Basin. In 2005, the sub-basin had a population of about 303,000 people, which represents about 26 percent of the Basin population, with a population density of 97.6 people per square kilometer. The Strawberry Sub-basin consists all or parts of nine urban municipalities, five rural municipalities, one specialized municipality and one Aboriginal Settlement.

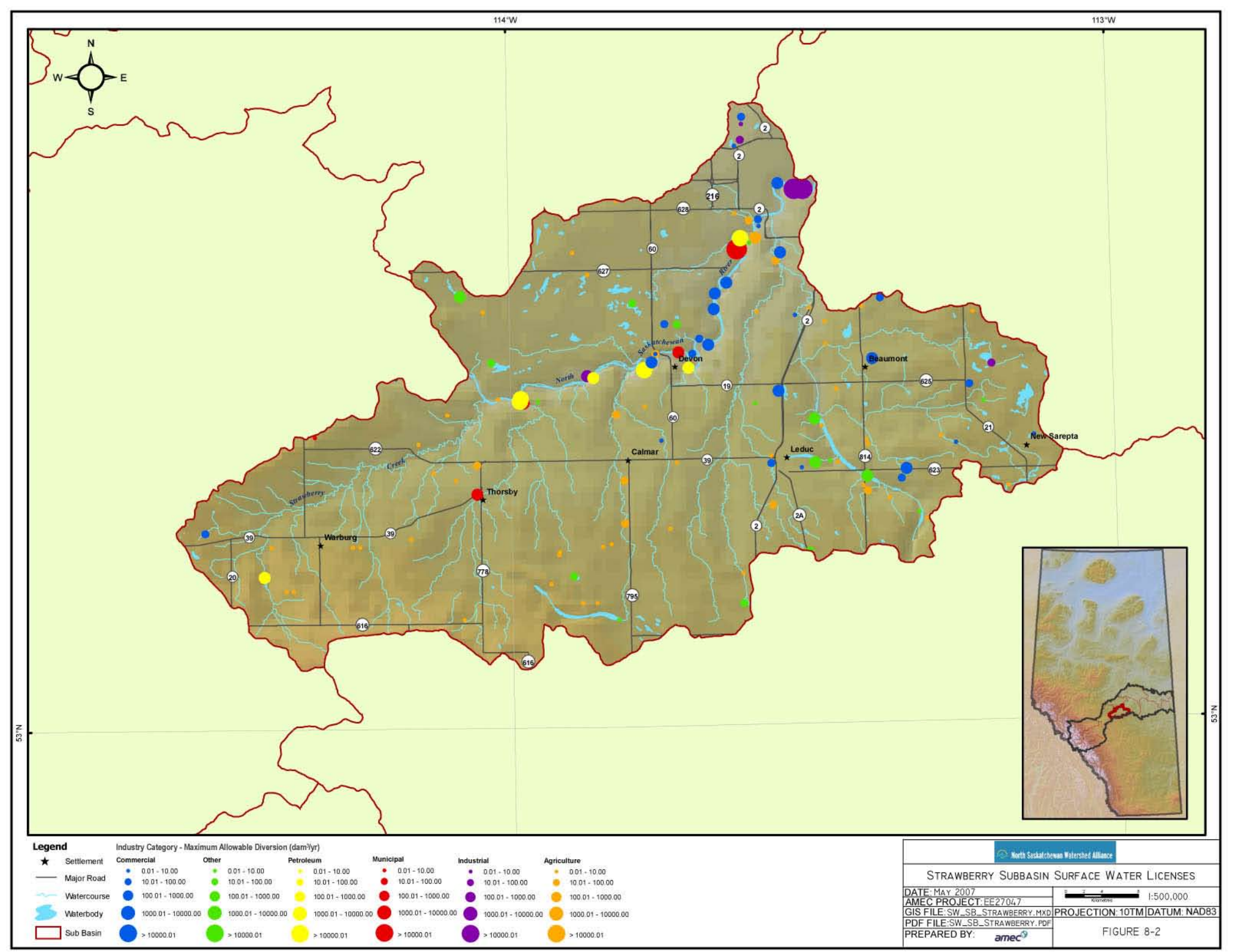
An overview of current surface and groundwater allocations is provided in Figure 8-1. It shows that the industrial sector accounts for 65 percent of total allocations or 281,956 dam^3 and the municipal sector accounts for 32 percent of total allocations or 137,778 dam^3 in 2005. The remaining allocations are for agricultural (including registrations), commercial, petroleum and other sectors. Total allocations in the sub-basin in 2005 were 440,045 dam^3, and groundwater allocations (2,151 dam^3) accounted for less than 0.5 percent of the total.

Figure 8-1 Distribution of Active Water Allocations in the Strawberry Sub-basin



Figures 8-2 and 8-3 show the location, allocation and sector of all active water licences in the Strawberry Sub-basin. The locations of registrations issued in this sub-basin are provided in Figure 8-4.

Figure 8-2 Strawberry Sub-basin Surface Water Licences



Legend

- Settlement
- Major Road
- Watercourse
- Waterbody
- Sub Basin

Industry Category - Maximum Allowable Diversion (dam³/yr)

Commercial	Other	Petroleum	Municipal	Industrial	Agriculture
0.01 - 10.00	0.01 - 10.00	0.01 - 10.00	0.01 - 10.00	0.01 - 10.00	0.01 - 10.00
10.01 - 100.00	10.01 - 100.00	10.01 - 100.00	10.01 - 100.00	10.01 - 100.00	10.01 - 100.00
100.01 - 1000.00	100.01 - 1000.00	100.01 - 1000.00	100.01 - 1000.00	100.01 - 1000.00	100.01 - 1000.00
1000.01 - 10000.00	1000.01 - 10000.00	1000.01 - 10000.00	1000.01 - 10000.00	1000.01 - 10000.00	1000.01 - 10000.00
> 10000.01	> 10000.01	> 10000.01	> 10000.01	> 10000.01	> 10000.01

North Saskatchewan Watershed Alliance

Strawberry Subbasin Surface Water Licenses

DATE: May 2007	1:500,000
AMEC PROJECT: EE27047	
GIS FILE: SW_SB_Strawberry.mxd	PROJECTION: 10TM | DATUM: NAD83
PDF FILE: SW_SB_Strawberry.pdf	
PREPARED BY: amec	FIGURE 8-2

Figure 8-3 Strawberry Sub-basin Groundwater Licences

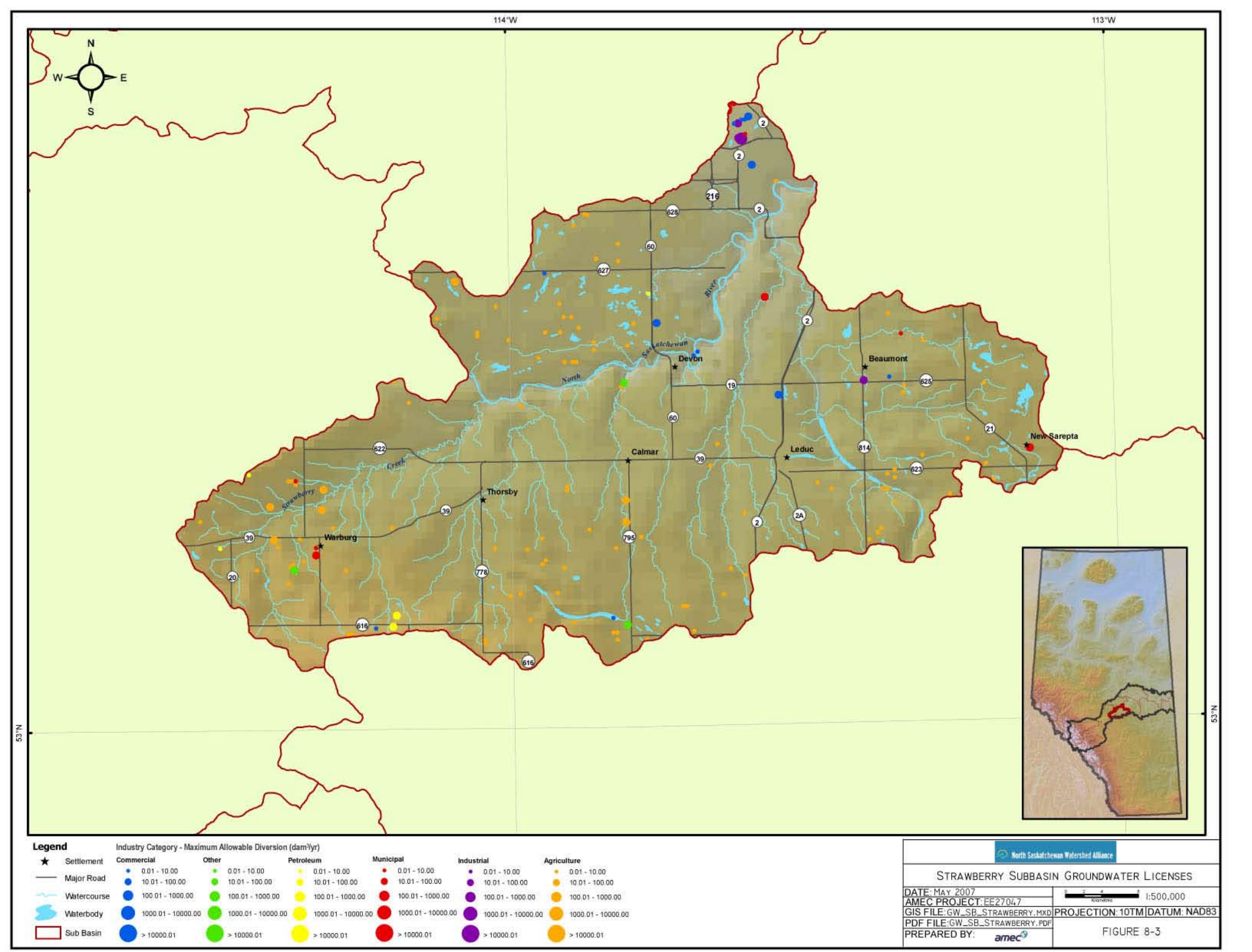
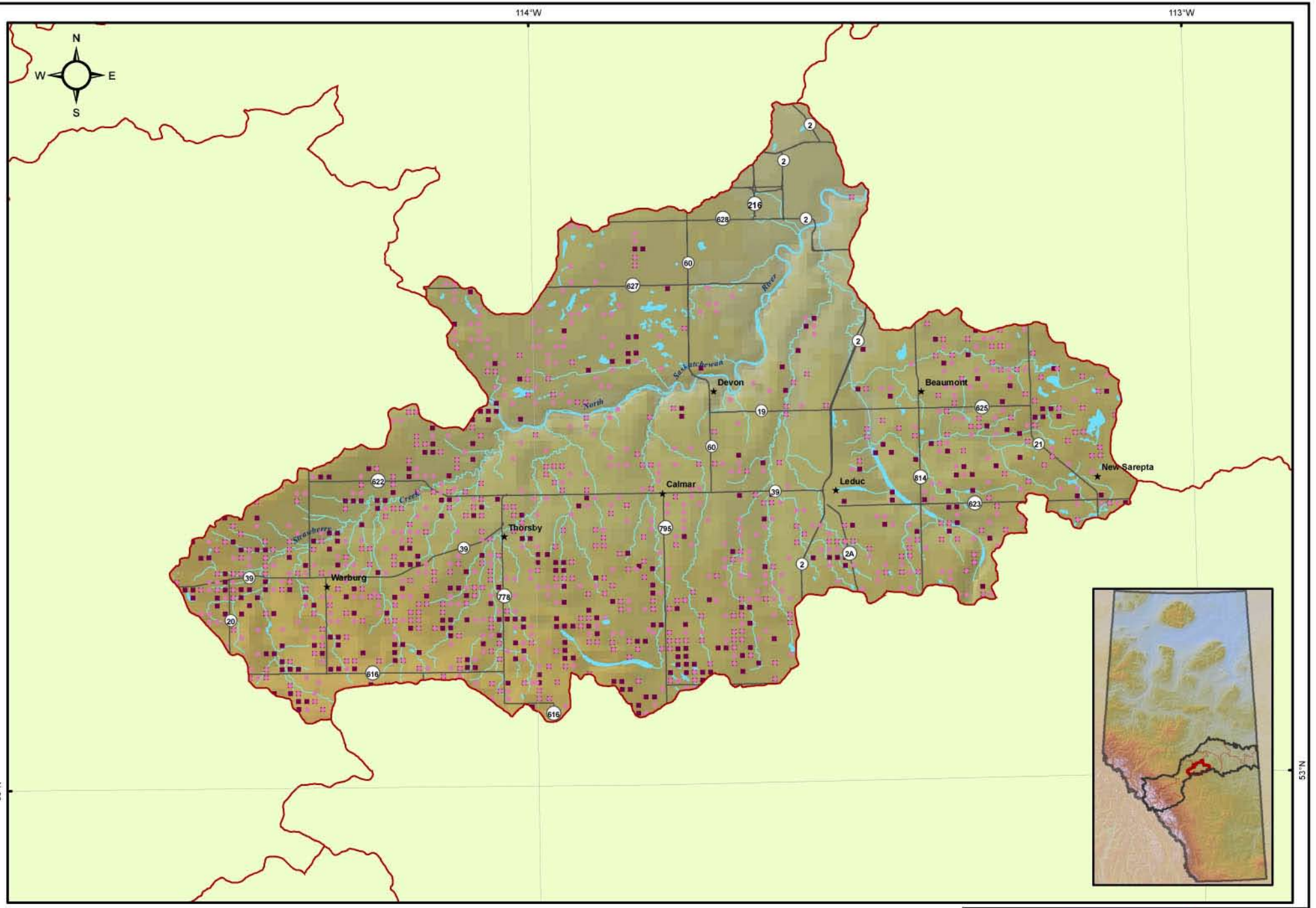

114°W
113°W
53°N
N
W
E
S
Devon
Beaumont
Calmar
Leduc
New Sarepta
Thorsby
Warburg
North Saskatchewan River
Strawberry Creek
Legend
Settlement
Major Road
Watercourse
Waterbody
Sub Basin
Industry Category - Maximum Allowable Diversion (dam³/yr)
Commercial
Other
Petroleum
Municipal
Industrial
Agriculture
0.01 - 10.00
10.01 - 100.00
100.01 - 1000.00
1000.01 - 10000.00
> 10000.01
North Saskatchewan Watershed Alliance
STRAWBERRY SUBBASIN GROUNDWATER LICENSES
DATE: MAY 2007
AMEC PROJECT: EE27047
GIS FILE: GW_SB_STRAWBERRY.MXD
PDF FILE: GW_SB_STRAWBERRY.PDF
PREPARED BY: amec
1:500,000
PROJECTION: 10TM | DATUM: NAD83
FIGURE 8-3

Figure 8-4 Strawberry Sub-basin Registrations



Legend

- Settlement
- Major Road
- Watercourse
- Waterbody
- Sub Basin

Industry Category - Maximum Allowable Diversion (dam^3/yr)

Groundwater Registrations

- 0.01 - 6.25

Surface Water Registrations

- 0.01 - 6.25

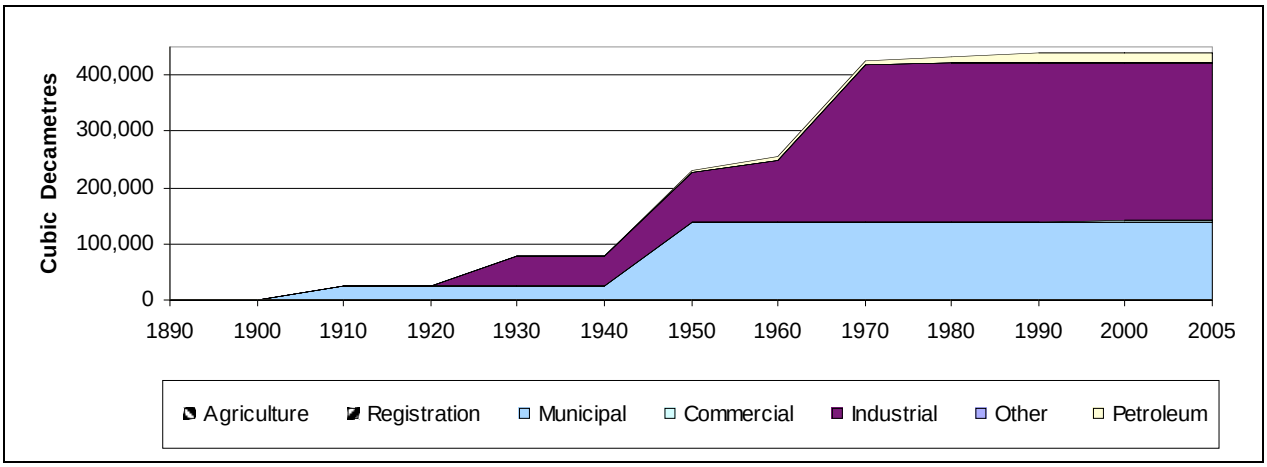
North Saskatchewan Watershed Alliance

Strawberry Subbasin Registrations

DATE: May 2007	0 2 4 8 Kilometres 1:500,000
AMEC PROJECT: EE27047	
GIS FILE: RG_SB_Strawberry.mxd	PROJECTION: 10TM | DATUM: NAD83
PDF FILE: RG_SB_Strawberry.pdf	
PREPARED BY: amec	FIGURE 8-4

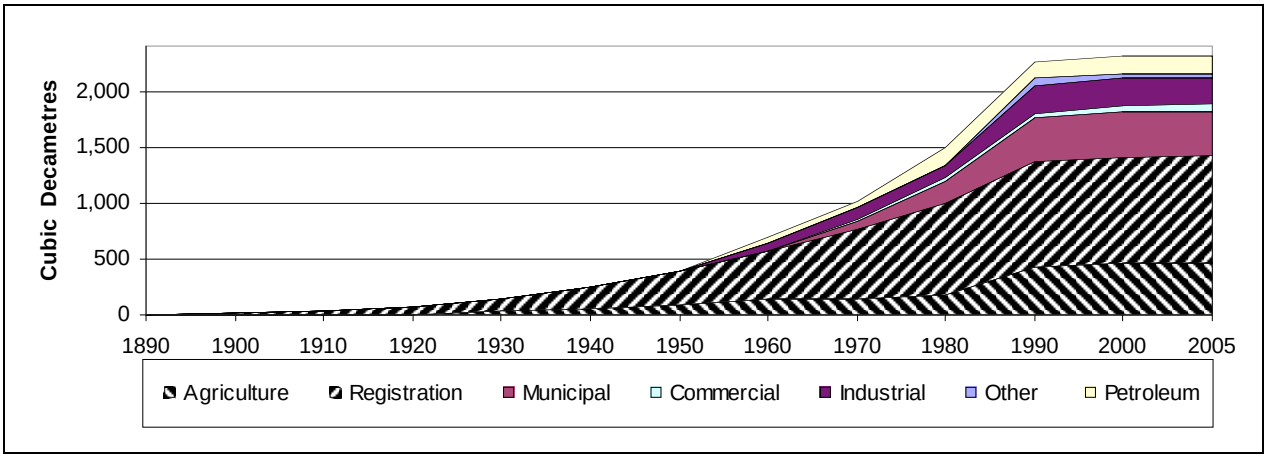
An historical perspective on water allocated among the sectors is provided in Figure 8-5 (surface water) and Figure 8-6 (groundwater).

Figure 8-5 Historical Trends in Surface Water Allocation in the Strawberry Sub-basin



The two largest allocations for surface water in the Strawberry Sub-basin are for the municipal and industrial sectors. Allocations for the industrial sector began in the 1920s and have undergone sharp increases followed by periods of relative stability, likely associated with the construction of thermal power plants with large cooling water requirements. Since the 1970s, industrial allocations have remained unchanged. Surface water allocations for the municipal sector were first issued in the 1900s but remained unchanged until the 1940s. Allocations increased substantially during the 1950s but have remained unchanged since then. Agriculture (including registrations), commercial, other and other sectors are also allocated surface water in the sub-basin and some of these allocations were first issued in the 1890s. Petroleum sector allocations, while relatively small, have increased substantially since the 1940s.

Figure 8-6 Historical Trends in Groundwater Allocation in the Strawberry Sub-basin



The largest allocations for groundwater are for registrations and agriculture. Allocations for these purposes have priority dates in the early 1900s and allocations have grown substantially since then. Allocations for these purposes have remained unchanged since 1990.

8.1 Municipal and Residential Sector

8.1.1 Population

The population of Strawberry Sub-basin is predominantly urban, as shown in Table 8-1. Ninety-four percent of the population lives in urban municipalities in and around the southern and western side of Edmonton. Rural municipalities contain 5 percent of the population within the sub-basin. A very small portion of the mixed urban and rural specialized municipality of Strathcona County is within the sub-basin. There is one First Nation in the Strawberry Sub-basin and it accounts for less than 1 percent of the population, although it had the highest growth rate from 2001 to 2006 at almost 29 percent. The specialized and urban municipalities grew by almost 15 and 11 percent, respectively over the inter-censal period, while the rural population grew much more slowly, at less than 3 percent.

Table 8-1 Population Distribution and Growth in the Strawberry Sub-basin

	2006		2001	2001 to 2006 Population Change
	Population	**Percent**	**Population**	**Percent**
Urban Municipality	286,191	94.4%	258,718	10.6%
Specialized Municipality	102	0.0%	89	14.6%
Rural Municipality	15,301	5.0%	14,902	2.7%
First Nations and Métis Settlements	1,418	0.5%	1,100	28.9%
Total	**303,012**	**100.0%**	**274,809**	**10.3%**

Table 8-2 lists all municipalities situated in the Strawberry Sub-basin, the estimated 2006 population for those parts of the communities within the sub-basin, and a summary of their water licence information. The major population centres are Edmonton (249,992), the City of Leduc (16,967) and the towns of Beaumont (8,961) and Devon (6,256). Leduc County has the largest population of the rural municipalities (12,386), and Enoch Cree Nation, the sole Aboriginal settlement, has a population of 1,418 residents.

It should be noted that about 92 percent of the population in the sub-basin obtains its water from the Edmonton Capital Region and about 24,950 people obtain their water from other sources.

Table 8-2 Municipal Populations and Water allocations within Strawberry Sub-basin

Municipal Name		2006 Population	Source	2005 Allocation (dam^3)
Urban	CITY OF EDMONTON	249,992	SURFACE	135,802.5
	CITY OF LEDUC	16,967		
	TOWN OF BEAUMONT	8,961		
	TOWN OF DEVON	6,256	SURFACE	1,233.5
	TOWN OF CALMAR	1,959		
	VILLAGE OF THORSBY	945	SURFACE	497.3
	VILLAGE OF WARBURG	621	GROUNDWATER	81.4
	VILLAGE OF NEW SAREPTA	410	GROUNDWATER	130.8
	CITY OF ST. ALBERT	80		
Specialized	STRATHCONA COUNTY	102		
Rural	LEDUC COUNTY	12,386		
	PARKLAND COUNTY	2,886		
	COUNTY OF WETASKIWIN NO. 10	16	GROUNDWATER	11.1
	BRAZEAU COUNTY	12		
	CAMROSE COUNTY	0		
Aboriginal	ENOCH CREE NATION	1,418		

8.1.2 Allocations

As of 2005, 16 municipal water licences had been issued to nine licensees in the Strawberry Sub-basin. These licences allow maximum withdrawals of 137,778 dam^3 per year. As shown in Figure 8-1, the municipal sector accounts for 31 percent of the total allocations in the basin. Ninety-nine percent of the municipal allocation is for Edmonton, which distributes treated water from the EPCOR-operated Rossdale and E. L. Smith water treatment plants throughout the city and to eight regional water commissions serving 45 communities in the Capital Region (Environment Canada, 2007). According to the EMS database, the latitude and longitude coordinates and sub-basin classification of the two Edmonton licences correspond to the E. L. Smith Water Treatment Plant, which is located in the Strawberry Sub-basin. However, the City also draws water at the Rossdale treatment plant which is actually located in the Beaverhill Sub-basin.

Because of the complexity of water withdrawals and return flows in the Edmonton Capital Region, as discussed in Section 2.2.1, this assessment assumes that all water withdrawals for the Capital region are drawn from the mainstem of the North Saskatchewan River within the Strawberry Sub-basin.

While the Town of Millet has water licences that the EMS database has assigned to the Strawberry Sub-basin, these licences were not included in this analysis because their source location is Pipestone Creek, which is a tributary of the Battle River. Water use by the Town of Millet in the Battler River water use assessment by Watrecon (2005).

Surface water licences account for almost 100 percent of total municipal water allocations. The maximum amount of surface water that can be withdrawn in Strawberry Sub-basin by the municipal sector is 137,533 dam^3. Urban municipal licences account for all surface water allocations.

Groundwater licences represent 0.2 percent of total municipal water allocations. Licences allow withdrawals of up to 245 dam^3 and include an allowance for using 60 dam^3. Rural users can withdraw up to 25 dam^3 of groundwater and other users are allocated withdrawals of 8 dam^3.

Licensees that are not municipalities but have municipal water use licences within the Strawberry Sub-basin are shown in Table 8-3.

Table 8-3 Additional Municipal Water Use Licensees in the Strawberry Sub-basin

Licensee	Water Source	Allocation (dam^3)
COUNTRY CORRAL ENTERPRISES LTD.	GROUNDWATER	14.2
ALBERTA MORTGAGE & HOUSING CORPORATION	GROUNDWATER	7.4
QUANTAMIRA HOLDINGS INC.	GROUNDWATER	0.2

8.1.3 Licensed Water Use

Under the terms of municipal licences issued for the Strawberry Sub-basin, it is expected that up to 37,441 dam^3 will be used (i.e. 27 percent of allocations will be consumed and/or lost) with the remainder (73 percent or 100,338 dam^3) being returned. Allowances for return flow account for 80 percent of urban groundwater allocations, 78 percent of other groundwater allocations, and 73 percent of other urban surface water allocations, but only 35 percent of rural groundwater allocations.

8.1.4 Actual Water Use

Information provided by EPCOR, the City of Edmonton and the NSWA indicates that, in 2005, the Edmonton Capital Region actually returned more water to the North Saskatchewan River than it withdrew. As shown in Table 8-4, about 127,012 dam^3 were withdrawn by EPCOR and supplied to the City of Edmonton, the City of St. Alberta, communities in five water services commissions, and various other communities in the region. However, discharges from the two wastewater treatment plants (City of Edmonton (Goldbar) and Capital Region Wastewater Treatment Plant) totaled 128,008 dam^3, exceeding withdrawals by 996 dam^3.

Table 8-4 Licensed Municipal Allocations and Use and Estimated Actual Use, Strawberry Sub-basin

Water Use	Source	Number of Licences	Licensed Allocation and Use (dam^3)			Estimated Actual Water Use (dam^3)		
			Allocation	Water Use	Return Flow	Diversion	Estimated Use	Return Flow
Edmonton Capital Region	Surface	2	135,803	37,033	98,770	127,012	-996	128,008
	Groundwater	0	0	0	0	0	0	0
	Subtotal	**2**	**135,803**	**37,033**	**98,770**	**127,012**	**-996**	**128,008**
Other Urban*	Surface	5	1,730	347	1,383	1,337	69	1,268
	Groundwater	5	212	42	170	164	8	156
	Subtotal	**10**	**1,942**	**389**	**1,553**	**1,500**	**77**	**1,424**
Rural**	Surface	0	0	0	0	0	0	0
	Groundwater	2	25	16	9	19	11	8
	Subtotal	**2**	**25**	**16**	**9**	**19**	**11**	**8**
Other***	Surface	0	0	0	0	0	0	0
	Groundwater	2	8	2	6	6	1	5
	Subtotal	**2**	**8**	**2**	**6**	**6**	**1**	**5**
Total	Surface	7	137,533	37,380	100,153	128,349	-927	129,276
	Groundwater	9	245	60	185	189	20	169
	Total	**16**	**137,778**	**37,440**	**100,338**	**128,538**	**-907**	**129,445**

* Urban includes villages, summer villages, towns, cities, hamlets;

** Rural includes condominiums / townhouses / mobile homes / complexes, hotels / motels, cooperatives, farmsteads, single-multi homes, colonies and subdivisions

*** Other includes camps, institutions, senior/correctional centres, nursing/children's homes, hospitals

As explained in Section 2.2.1, return flows exceed withdrawals because the wastewater treatment plants also treat storm water and groundwater that infiltrates the wastewater collection systems. In discussions with representatives of the wastewater treatment systems, 2005 was considered to be a wet year and this resulted in return flows exceeding withdrawals. Using information for a dry year, it was estimated that stormwater flows that entered the wastewater system amounted to about 7,700 dam^3. On this assumption, actual water use in the Edmonton Capital Region amounted to 5,267 dam^3. The assessment of current wand future water use in the Edmonton Capital Region is based on this number.

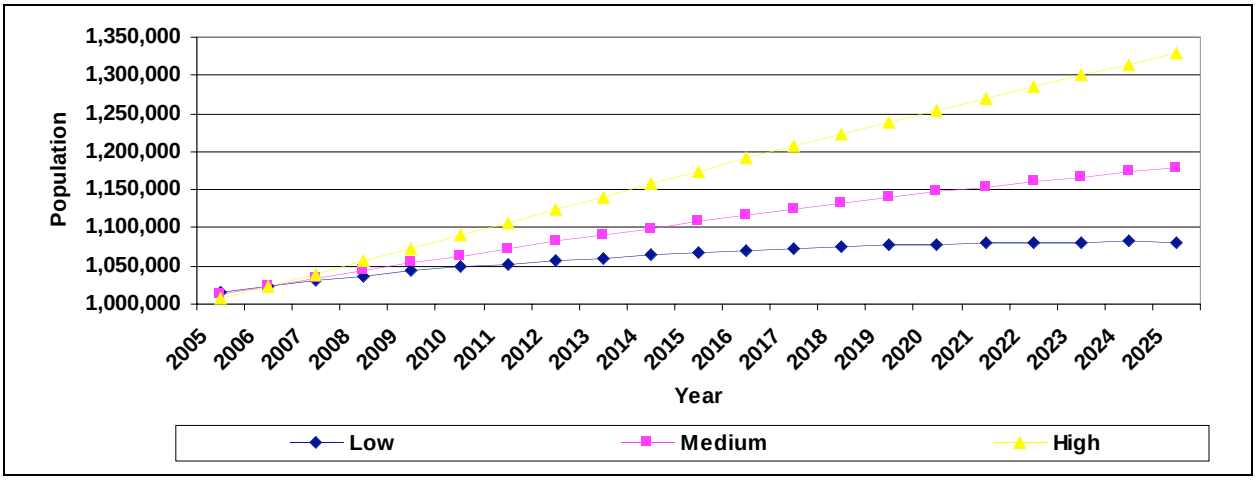
Water use estimates for people living outside the Edmonton Capital region were based on MWWS flow data for the Parkland County. Parkland Country MWWS data indicates per capita water use of 76 m^3. Although MWWS data was also available for the Town of Devon, this information was not used because the community, which has its own water treatment plant, reported water use of –23 m^3 per capita and there is no information to adjust this estimate to correct for stormwater and groundwater effects. By combining population estimates with the per capita water use information, estimated actual water use for the portion of Strawberry Sub-basin outside the Capital Region water distribution system is 89 dam^3 (22 percent of licensed use). This corresponds to withdrawals of 1,526 dam^3 and returns of 1,437 dam^3.

Overall, total water use in the Strawberry sub-basin is estimated to be 5,356 dam^3, consisting of 5,336 of surface water and 20 dam^3 of groundwater.

8.1.5 Future Water Use Forecasts

Figure 8-7 shows low, medium and high population projection scenarios for the Edmonton Capital Region based on Alberta Finance Census Division projections. The population forecasts in Figure 8-7 have been used to predict future municipal surface and groundwater use. The resulting forecasts of water use are provided in Table 8-5, and are based on the estimated per capita water use in 2005.

Figure 8-7 Edmonton Capital Region Population Growth Forecasts



Based on the regional population forecasts, water use in the Edmonton Capital Region in 2025 is estimated to be about 16 percent greater than water use in 2005 under the Medium Growth scenario. These increases could be as high as 32 percent under the High Growth scenario and as small as 6 percent under the low growth scenario.

Table 8-5 Projected Municipal Water Use in the Capital Region Sub-basins

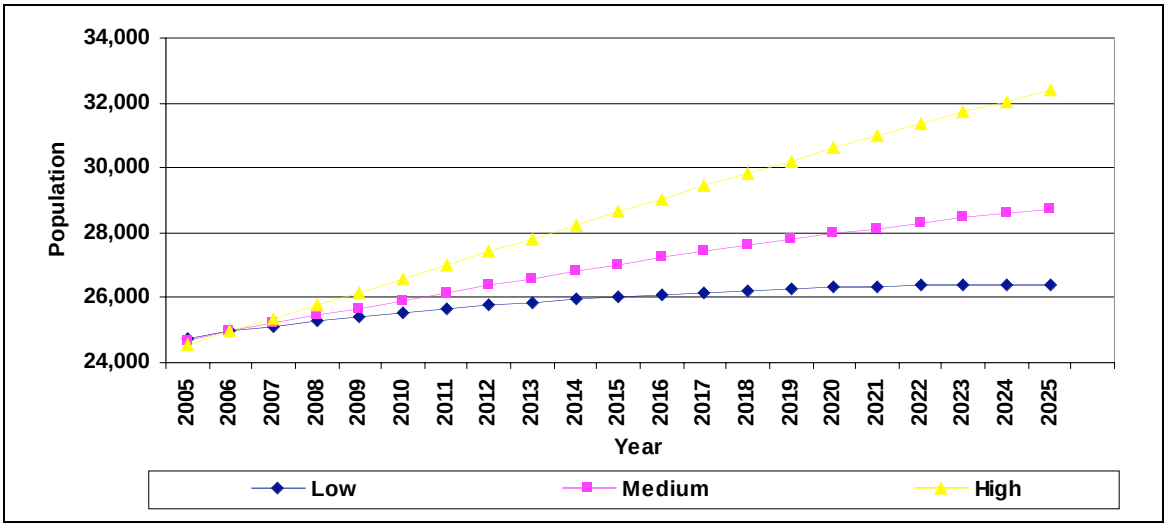
(dam^3)

Scenario	Source	2005	2010	2015	2020	2025
Low Population Growth	Surface	5,267	5,436	5,535	5,594	5,609
	Groundwater	0	0	0	0	0
	Total	**5,267**	**5,436**	**5,535**	**5,594**	**5,609**
Medium Population Growth	Surface	5,267	5,528	5,763	5,965	6,127
	Groundwater	0	0	0	0	0
	Total	**5,267**	**5,528**	**5,763**	**5,965**	**6,127**
High Population Growth	Surface	5,267	5,699	6,140	6,560	6,946
	Groundwater	0	0	0	0	0
	Total	**5,267**	**5,699**	**6,140**	**6,560**	**6,946**

The low, medium and high population projection scenarios for the population of the Strawberry Sub-basin outside the Edmonton Capital Region are shown in Figure 8-8 and are also based on

Alberta Finance Census Division projections. The population forecasts in Figure 8-8 have been used to predict future municipal surface and groundwater use. The resulting forecasts of water use are provided in Table 8-6, and are based on the estimated per capita water use in 2005.

Figure 8-8 Strawberry Sub-basin Population Growth Forecasts



The growth rates for the population of the Strawberry Sub-basin outside the Edmonton Capital Region are about the same as for the Capital Region itself. Thus, municipal water use in the rest of the Strawberry Sub-basin in 2025 is predicted to increase by 16 percent over current levels under the Medium Growth scenario. Under the Low Growth scenario, the increase would only be 6 percent but could be as high as 31 percent under the High Growth scenario.

Table 8-6 Projected Municipal Water Use in the Strawberry Sub-basin (Outside the Capital Region)

(dam^3)

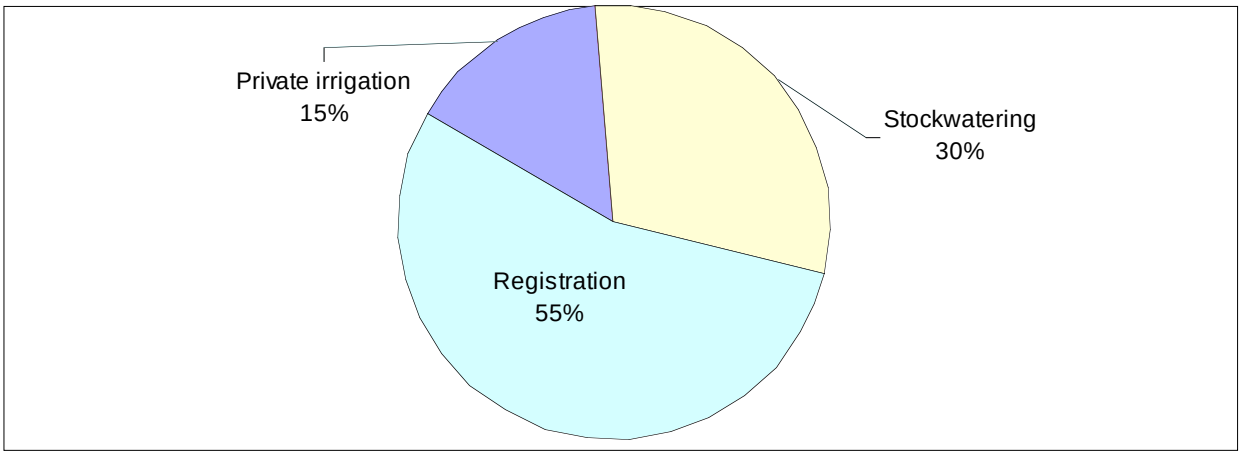
Scenario	Source	2005	2010	2015	2020	2025
Low Population Growth	Surface	69	71	72	73	73
	Groundwater	20	20	21	21	21
	Total	**89**	**91**	**93**	**94**	**94**
Medium Population Growth	Surface	69	72	75	78	80
	Groundwater	20	21	22	22	23
	Total	**89**	**93**	**97**	**100**	**103**
High Population Growth	Surface	69	75	80	86	91
	Groundwater	20	21	23	25	26
	Total	**89**	**96**	**103**	**110**	**117**

8.2 Agriculture Sector

As of December 2005 a total of 2,338 dam^3 had been allocated to the agricultural sector in the Strawberry Sub-basin. This includes 1,835 registrations representing 1,274 dam^3 and 180 licences representing 1,065 dam^3 of water. Water allocated to agriculture accounts for less than one percent of all allocation in the Strawberry Sub-basin.

Figure 8-9 shows how this water is distributed among the different agricultural activities in the sub-basin. The largest allocation is for registration (68 percent). Stockwatering accounts for the 28 percent and private irrigation accounts for four percent of total allocations.

Figure 8-9 Water Allocation for Agricultural Activities in the Strawberry Sub-basin, 2005



A total of 803 registrations and 63 licences allow withdrawal of up to 924 dam^3 of surface water; this accounts for 40 percent of water allocations for the agricultural sector. Groundwater accounts for the other 60 percent of allocations, with 1,414 dam^3 being allocated through 107 licences and 1,132 registrations.

8.2.1 Overview of Agriculture

Based on information from the 2001 Census of Agriculture, there were about 1,469 farms in the Strawberry Sub-basin (12 percent of North Saskatchewan total) with an average size of 392 acres. At the North Saskatchewan Basin level there are about 12,300 farms with an average size of 625 acres. Farms in the Strawberry Sub-basin cover an area of nearly 575,000 acres; this is equivalent to about 2,330 km^2 or about 78 percent of the sub-basin. As shown in Table 8-7, 61 percent of the land in the basin is used to raise crops. About 30 percent of agricultural land is pasture. The rest of the lands are in summer fallow or other uses.

Table 8-7 Agricultural Land Use in the Strawberry Sub-basin, 2001

Land Use	Acres	Percent
Crop Land	349,251	60.7%
Summerfallow	13,238	2.3%
Tame/Seeded Pasture	92,195	16.0%
Natural Pasture	78,245	13.6%
Other	42,788	7.4%
Total	**575,716**	**100.0%**

The types of farming activity vary within the sub-basin. Table 8-8 shows the classification of farms based on the commodity groups that accounted for 51 percent or more of total gross farm receipts. The table shows that the Strawberry Sub-basin accounts for 12 percent of total farms in the North Saskatchewan. About 46 percent of the farms in the sub-basin raise beef cattle and about 16 percent are speciality farms. Grain and oilseed farms make up about 13 percent of the farms. Like the North Saskatchewan, cattle (beef) farms are the most common type of farm in the sub-basin. The general mix of other types of farms is similar for both Strawberry and North Saskatchewan with the exception of dairy farms which account for higher proportion and grain and oilseed farms which account for lower proportion of total farms in the sub-basin as compared to North Saskatchewan.

Table 8-8 Classifications of Farms in the Strawberry Sub-basin and North Saskatchewan, 2001

Farm Type (Farms with Gross Receipts >$2,500)	Percent of Farms in the Sub-basin	Percent Share of North Saskatchewan	North Saskatchewan Farm Type (Percent)
Dairy Farms	6.7%	41.0%	1.9%
Cattle (beef) Farms	45.8%	11.9%	45.8%
Hog Farms	1.4%	11.2%	1.4%
Poultry & Egg Farms	1.4%	15.1%	1.1%
Wheat Farms	2.8%	7.9%	4.2%
Grain & Oilseed Farms	12.7%	7.7%	19.6%
Field Crop Farms	8.5%	11.7%	8.6%
Fruit Farms	0.2%	13.1%	0.2%
Misc. Specialty Farms	16.0%	14.7%	12.9%
Sum of Livestock Comb. Farms	2.7%	12.6%	2.6%
Sum of Vegetable Farms	0.5%	40.1%	0.1%
Sum of Other Comb Farms	1.4%	11.4%	1.5%
Total	**100%**	**12.0%**	**100%**

8.2.2 Stockwatering

As noted in Table 8-8 about 53 percent of farms in the Strawberry Sub-basin were classified as livestock operations, primarily cattle. Estimated livestock populations for major species are provided in Table 8-9. The table shows that there are about 100,000 cattle and calves which, together, accounted for about 65 percent of the livestock population. Other livestock in the sub-basin included poultry, pigs, sheep and lamb, horses and ponies, bison, deer and elk.

Table 8-9 Estimated Livestock Populations in the Strawberry Sub-basin, 2001

Livestock Species	Strawberry	North Saskatchewan	% North Saskatchewan
Hens and Chicken	219,280	3,090,930	7.1%
Turkey	2,011	41,519	4.8%
Cattle	73,944	990,169	7.5%
Calves	27,618	365,725	7.6%
Pigs	15,963	232,169	6.9%
Sheep and Lamb	4,765	55,204	8.6%
Horse and Ponies	3,215	35,172	9.1%
Bison	1,692	18,906	8.9%
Deer	44	2,864	1.5%
Elk	801	6,426	12.5%

8.2.2.1 Water Allocation

Overall, 1,998 licences and registrations have been issued for livestock watering with total allocation amounting to 1,980 dam^3. In addition to these allocations, farmers are able to obtain up to 1,250 m^3 of water for household purposes. The numbers of such households in the sub-basin is not known. Furthermore, the numbers of "exempted agricultural" users are also not known in the sub-basin.

Table 8-10 summarizes current water licences and registrations issued for livestock according to the water source. It shows that surface water accounts for about 30 percent of allowable diversions for livestock and that registrations account for about 64 percent of the allocations.

8.2.2.2 Licensed Water Use

Table 8-10 shows that all licences and registration assume that all water withdrawals will be used and that there will be no return flow.

8.2.2.3 Actual Water Use

There is no information in Alberta Environment's WURS that indicates the extent to which water allocations are actually used in the Strawberry Sub-basin. However, a reasonable estimate of water use can be derived using the actual animal population in the basin shown in Table 8-9. Based on livestock populations for the Strawberry Sub-basin in 2001, the total water required for livestock was estimated to be 1,076 dam^3, or about 54 percent of the licensed allocation.[1] The calculations for this estimate are provided in Table 8-11 which shows livestock populations in the basin and the daily water requirements for various livestock species as provided by Alberta Environment in its "Guide to Calculate Quantities for Water for Raising Animals".[2] In terms of water requirements by species, cattle accounts for about 87 percent of the total, about 4 percent is required by pigs, and all other species accounted for the remaining 9 percent.

[1] This approach to estimating water use for stockwatering was employed in the 1986 Battle River Basin water use study undertaken by Stanley Associates in 1985.

[2] http://www3.gov.ab.ca/env/water/Legislation/Approvals_Licences/CalculationChart.doc.

Table 8-10 Summary of Water Licences and Registrations Issued for Livestock Watering in the Strawberry Sub-basin,

Activity	Source	Number of Licences/ Registrations	Licensed Allocation and Use (dam^3)			Reported Actual Water Use	
			Allocation	Water Use	Return	Licensees Reporting	Reported Use (dam^3)
Registration	Surface	803	328.1	328.1	0.0	0	N/A
	Groundwater	1,032	945.5	945.5	0.0	0	N/A
	Subtotal	1,835	1,273.6	1,273.6	0.0	**0**	**N/A**
Stockwatering	Surface	**46**	**237.1**	**237.1**	**0.0**	0	N/A
	Groundwater	117	468.9	468.9	0.0	0	N/A
	Subtotal	163	706.0	706.0	0.0	**0**	**N/A**
Total	Surface	849	565.2	565.2	0.0	0	N/A
	Groundwater	1,149	1,414.3	1,414.3	0.0	0	N/A
	Total	**1,998**	**1,979.5**	**1,979.5**	**0.0**	**0**	**N/A**

Table 8-11 Estimated Livestock Water Requirements for 2001

Livestock Species	Animal Population	Daily Consumption (gallons)	Annual Use (dam^3)
Hens and Chickens	219,280	0.045	16.4
Turkey	2,011	0.15	0.5
Bulls	1,437	9.0	21.5
Milk Cows	4,770	30.0	237.3
Beef Cows	27,825	9.0	415.3
Heifers	9,757	6.0	97.1
Steers	2,537	6.0	25.2
Calves	27,618	3.0	137.4
Boars	154	6.5	1.7
Sows and Gilts - Breeding	1,512	6.5	16.3
Nursing and Weaner Pigs	5,205	0.5	4.3
Grower and Finishing Pigs	9,092	1.5	22.6
Sheep and Lambs	4,765	2.0	15.8
Horse and Ponies	3,215	10.0	53.3
Bison	1,692	2.0	5.6
Deer	44	10.0	0.7
Elk	801	3.5	4.6
Total			**1,075.6**

The estimated actual consumption (1,076 dam^3) based on livestock populations shown in Table 8-11 however, do not include an allowance for the evaporative and seepage losses associated with storing water for livestock use. Typically, licensed consumption accounts for only 35 percent of surface water allocated for livestock use while losses account for 65 percent (Watrecon 2005).

Since 71 percent of livestock water consumption comes from groundwater (no losses) and the balance comes from surface water with 65 percent losses, a total allocation of 1,242 dam^3 would be required to support the animal populations in Table 8-8. This water requirement is about 63 percent of the water allocation through licences and registrations.

8.2.2.4 Forecasts of Future Stockwatering Water Use

Future water use is dependent on future livestock population in the sub-basin. Information from the NRCB indicates that, as of December 31, 2005, there had been no applications from farmers throughout the sub-basin for major new or expanded cattle and dairy operations. A dairy operation in the sub-basin, upstream of Town of Devon, was proposed in early 2007. A study undertaken by Alberta Agriculture in the late 1990s also provides some insights regarding the potential for expansion of cattle. Figures 2-3 and 2-4 in Section 2.3 show areas where there is capability of supporting a 5,000-head back grounding operation and a 20,000-head operation. The figures show that there are some townships that meet all of the criteria for backgrounding operations only. For townships that meet some of the criteria limiting factors include groundwater and landscape. Based on Alberta Agriculture's assessment, it would appear that there are some opportunities for backgrounding operations in the Strawberry Sub-basin. Table 8-12 shows water use projections to 2025. By 2025, relative to 2005, water use is expected to 11 percent, 30 percent and 60 percent higher under Low, Medium and High Growth Scenarios respectively**.**

Table 8-12 Projected Water Use for Livestock in the Strawberry Sub-basin, (dam^3)

Scenario	Source	2005	2010	2015	2020	2025
Low Growth	Surface	473	484	497	511	525
	Groundwater	769	787	808	831	853
	Total	**1,242**	**1,271**	**1,306**	**1,341**	**1,378**
Medium Growth	Surface	473	503	536	571	609
	Groundwater	769	817	871	929	990
	Total	**1,242**	**1,320**	**1,407**	**1,500**	**1,599**
High Growth	Surface	473	530	595	668	750
	Groundwater	769	861	968	1,087	1,219
	Total	**1,242**	**1,391**	**1,563**	**1,755**	**1,969**

8.2.3 Irrigation

The other major use of water for agricultural purposes is irrigation or crop watering. Irrigation in this basin is done by private irrigators who have their own water licences and divert water using their own pumps and water distribution equipment.

When aggregate information from the 2001 Census of Agriculture for individual counties and municipal districts is modified to reflect river basin boundaries, the resulting estimates suggest that about 388 acres of land in the Strawberry Sub-basin were irrigated in 2001. Another approach for estimating irrigated acres involves dividing water allocations by irrigation water requirement of about 450 mm (18 inches) per acre. Based on this method it is estimated that water allocations are sufficient to support irrigation on about 295 acres. There is no information on the mix of crops grown by private irrigators; however, AAFRD has indicated that most private irrigation in Alberta is used to raise supplemental forages to feed livestock.

8.2.3.1 Water Allocation

There are 17 licences that allocate approximately 360 dam^3 for irrigation purposes. All of this allocation is from surface water.

8.2.3.2 Licensed Use

Table 8-13 shows that licences issued for irrigation assume that all withdrawals will be used and there will be no return flow after use.

Table 8-13 Irrigation Allocations and Use and Reported Actual Water Use, Strawberry Sub-basin

Activity	Source	Number of Licences/ Registrations	Licensed Allocation and Use (dam^3)			Reported Actual Water Use (dam^3)	
			Allocation	Water Use	Return	Licensees Reporting	Reported Use
Private irrigation	Surface	17	358.8	358.8	0.0	0	N/A
	Groundwater	0	0.0	0.0	0.0	0	N/A
	Subtotal	**17**	**358.8**	**358.8**	**0.0**	**0**	**N/A**
Total	Surface	17	358.8	358.8	0.0	0	N/A
	Groundwater	0	0.0	0.0	0.0	0	N/A
	Total	**17**	**358.8**	**358.8**	**0.0**	**0**	**N/A**

8.2.3.3 Forecasts of Future Irrigation Water Use

With expansion of livestock, additional demand for livestock forage is expected. However, due to climatic conditions and poor returns on forage production additional forage production is not expected. It is assumed that available forage will be able to support modest increases in livestock populations. Irrigation water use is projected remain at 359 dam^3 over the forecast period.

8.2.4 Summary

In summary, current agricultural water use in the Strawberry Sub-basin is estimated to be about 1,601 dam^3, of which 78 percent is for stockwatering and 22 percent is for irrigation. In the future, agricultural water demand in the sub-basin is expected to increase as a result of expansion of livestock populations. Irrigation water use is expected to remain constant. Table 8-14 shows a summary of future agricultural water use.

Table 8-14 Projected Water Use for Agriculture in the Strawberry Sub-basin
(dam^3)

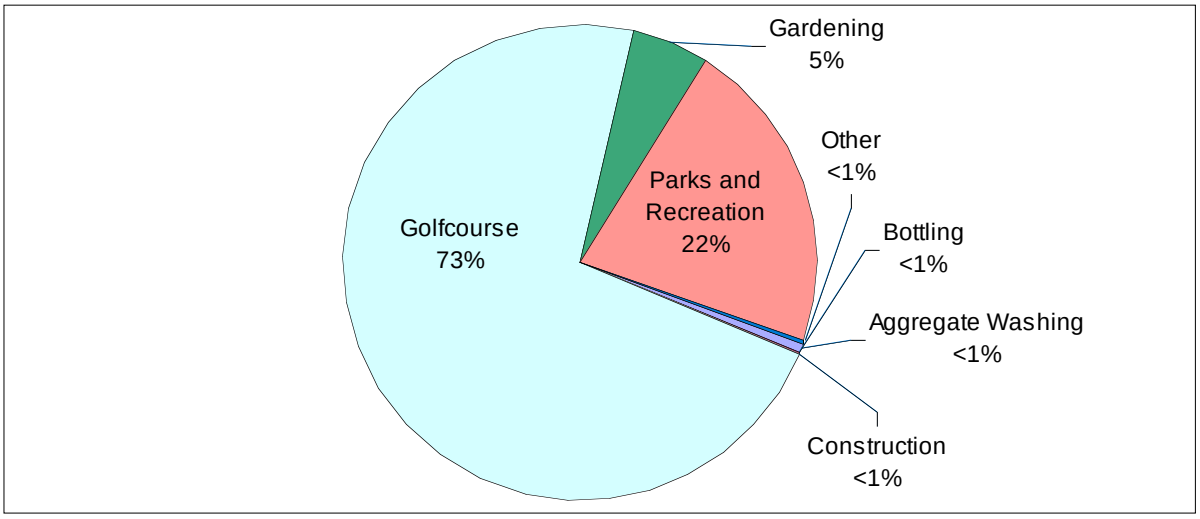
Scenario	Source	2005	2010	2015	2020	2025
Low Growth	Surface	832	843	856	870	884
	Groundwater	769	787	808	831	853
	Total	**1,601**	**1,630**	**1,665**	**1,700**	**1,737**
Medium Growth	Surface	832	862	895	930	968
	Groundwater	769	817	871	929	990
	Total	**1,601**	**1,679**	**1,766**	**1,859**	**1,958**
High Growth	Surface	832	889	954	1,027	1,109
	Groundwater	769	861	968	1,087	1,219
	Total	**1,601**	**1,750**	**1,922**	**2,114**	**2,328**

Agricultural water use in 2025 would be about 1,737 dam^3 (an increase of nine percent from 2005) under the Low Growth. Under High Growth, water use is projected to be 2,328 dam^3 by 2025; this represents (an increase of 45 percent from 2005). For the Medium Growth, agricultural water use in 2025 is expected to increase by 22 percent over current levels.

8.3 Commercial Sector

There are 38 licences that allow diversion of 2,051 dam^3 of water in the Strawberry sub-basin. This allocation accounts for less than one percent of total allocations in the sub-basin.

Figure 8-10 Water Allocation for Commercial Activities in the Strawberry Sub-basin



8.3.1 Water Allocations

Figure 8-10 shows how this allocation is distributed among the various commercial sector activities, including golf courses (73 percent), parks and recreation (22 percent), and gardening (5 percent). Aggregate washing, bottling, construction and other activities together account for about 1 percent of the total allocations. Surface water accounts for 97 percent of allocations and the largest allocation is for golf courses. Groundwater accounts for the remaining 3 percent of allocations and the largest allocation is also for golf courses.

8.3.2 Licensed Water Use

Table 8-15 provides a summary of licensed allocations, use and return for various activities within the commercial sector in the Strawberry sub-basin. The table shows that licences issued for most commercial purposes assume that all water withdrawals will be used so there will be no return flow. However, licences issued for parks and recreation purposes assume that 238 dam^3 will be returned. Overall it is expected that 89 percent of withdrawals will be consumed or lost.

8.3.3 Actual Water Use

At the present time Alberta Environment's Water Use Reporting System contains no information on actual water use in 2005 by any of the licensees in the commercial sector in the Strawberry sub-basin. Given the lack of information on actual water use, it is assumed that all licensees are withdrawing and using the full amount of water to which they are entitled. Although this assumption will overstate the actual commercial sector water use, this sector accounts for less than 1 percent of total allocations in the sub-basin so overall water use estimates are not likely to be greatly affected.

Table 8-15 Licensed Commercial Allocations, Reported and Actual Water Use, Strawberry Sub-basin

Activity	Source	Number of Licences	Licensed Allocation and Use (dam^3)			Reported Actual Water Use (dam^3)		
			Allocation	Water Use	Return	Licensees Reporting	Reported Use	Percent of Allocation
Aggregate Washing	Surface	2	8.6	8.6	0.0	0	N/A	N/A
	Groundwater	0	0.0	0.0	0.0	0	N/A	N/A
	Subtotal	**2**	**8.6**	8.6	**0.0**	**0**	**N/A**	**N/A**
Bottling	Surface	0	0.0	0.0	0.0	0	N/A	N/A
	Groundwater	1	8.6	8.6	0.0	0	N/A	N/A
	Subtotal	**1**	**8.6**	8.6	**0.0**	**0**	**N/A**	**N/A**
Construction	Surface	1	2.5	2.5	0.0	0	N/A	N/A
	Groundwater	0	0.0	0.0	0.0	0	N/A	N/A
	Subtotal	**1**	**2.5**	2.5	**0.0**	**0**	**N/A**	**N/A**
Gardening	Surface	3	105.2	105.2	0.0	0	N/A	N/A
	Groundwater	1	0.6	0.6	0.0	0	N/A	N/A
	Subtotal	**4**	**105.8**	105.8	**0.0**	**0**	**N/A**	**N/A**
Golf Course	Surface	12	1,455.3	1,455.3	0.0	0	N/A	N/A
	Groundwater	1	25.4	25.4	0.0	0	N/A	N/A
	Subtotal	**13**	**1,480.7**	1,480.7	**0.0**	**0**	**N/A**	**N/A**
Other	Surface	1	6.2	6.2	**0.0**	0	N/A	N/A
	Groundwater	1	1.2	1.2	**0.0**	0	N/A	N/A
	Subtotal	**2**	**7.4**	7.4	**0.0**	**0**	**N/A**	**N/A**
Parks and Recreation	Surface	9	418.1	180.1	**238.1**	0	N/A	N/A
	Groundwater	6	19.7	19.7	**0.0**	0	N/A	N/A
	Subtotal	**15**	**437.9**	199.8	**238.1**	**0**	**N/A**	**N/A**
Total	Surface	28	1,995.9	1,757.8	238.1	0	N/A	N/A
	Groundwater	10	55.6	55.6	0.0	0	N/A	N/A
	Total	**38**	**2,051.5**	**1,813.4**	**238.1**	**0**	**N/A**	**N/A**

8.3.4 Future Water Use Forecasts

Since most of the allocation (95 percent) is for two activities – golf courses, and parks and recreation, forecasts of future demand will focus on those activities.

8.3.4.1 Golf Courses

The water demand forecast for golf courses follows the approach outlined in Watrecon (2005) which assumes that water demands will increase based on expansion of golf courses which will occur as a result of population growth. However, the population growth must reach a specified threshold before one additional nine hole course is constructed (*i.e.*. golf course expansion is not linearly related to population growth). For the Medium and High Growth scenarios, the population growth rate is enough to support development of a number of additional golf courses over the forecast period. For the Low Growth scenario, the growth rate is enough to support one expansion up to 2015 after which time water use is expected to remain unchanged. The resulting projections in Table 8-16 show that water use under the Low Growth scenario is expected to increase to 1,764 dam^3 by 2025, a 19 percent increase from current use. Using the High Growth scenario, water demand for golf courses is projected to increase to 3,276 dam^3 by 2025 which is a 120 percent increase from current use. Water use is expected to be 62 percent higher by 2025 under Medium Growth.

Table 8-16 Projected Water Use for Golf Course, Strawberry Sub-basin
(dam^3)

Scenario	Source	2005	2010	2015	2020	2025
Low Growth	Surface	1,455	1,605	1,729	1,729	1,729
	Groundwater	26	33	35	35	35
	Total	**1,481**	**1,638**	**1,764**	**1,764**	**1,764**
Medium Growth	Surface	1,455	1,729	1,976	2,223	2,346
	Groundwater	26	35	40	45	48
	Total	**1,481**	**1,764**	**2,016**	**2,268**	**2,394**
High Growth	Surface	1,455	1,976	2,470	2,840	3,210
	Groundwater	26	40	50	58	66
	Total	**1,481**	**2,016**	**2,520**	**2,898**	**3,276**

8.3.4.2 Parks and Recreation

Future water use is expected to increase as a result of regional population growth. Projections are based on 0.3 percent annual growth for the Low Growth scenario, 0.8 percent for the Medium Growth scenario and 1.6 percent for the High Growth scenario. The resulting projections are shown in Table 8-17**.** Although some of the licences are scheduled to expire between 2012 and 2016, these licences are expected to be renewed.

Table 8-17 Projected Water Use for Parks and Recreation, Strawberry Sub-basin
(dam^3)

Scenario	Source	2005	2010	2015	2020	2025
Low Growth	Surface	180	183	185	188	191
	Groundwater	20	20	21	21	21
	Total	**200**	**203**	**206**	**209**	**212**
Medium Growth	Surface	180	187	195	203	211
	Groundwater	20	21	22	23	23
	Total	**200**	**208**	**217**	**225**	**235**
High Growth	Surface	180	195	211	228	247
	Groundwater	20	22	23	25	27
	Total	**200**	**217**	**234**	**254**	**275**

Water use is expected to be 212 dam^3 under Low Growth which is a six percent increase from current use. Under High Growth, water use is expected to be 275 dam^3 which is a 37 percent increase. Water use is expected to be 17 percent higher by 2025 under Medium Growth.

8.3.5 Summary

A summary of the projected water demand for the commercial sector in the Strawberry Sub-basin is provided in Table 8-18. Note that this forecast combines the estimates for golf course, and parks and recreation, (which together account for 95 percent of allocation in the sub-basin), with the assumption that all of the water use allowed for the remaining commercial activities is being fully utilized.

Under the Low Growth scenario, water use is projected to rise to 2,108 dam^3, which is a 16 percent increase from current levels by 2025. Under the High Growth scenario, water use is projected to rise to 3,683 dam^3, which is a 103 percent increase by 2025. Water use is projected to increase by 52 percent from the current level by 2025 under Medium Growth.

Table 8-18 Projected Water Use for the Commercial Sector, Strawberry
(dam^3)

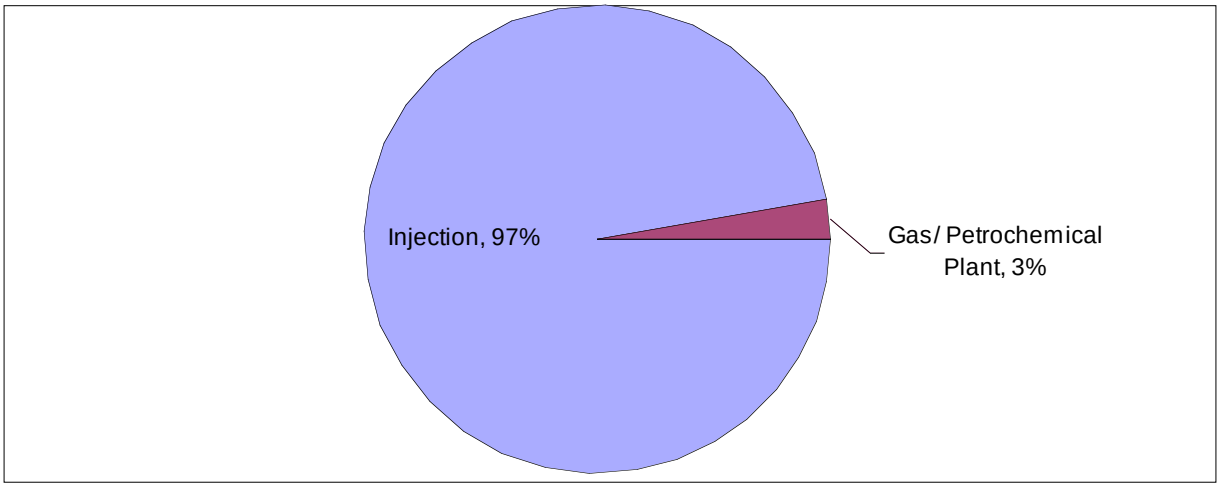
Scenario	Source	2005	2010	2015	2020	2025
Low Growth	Surface	1,758	1,911	2,037	2,040	2,043
	Groundwater	55	62	65	65	65
	Total	**1,813**	**1,973**	**2,102**	**2,105**	**2,108**
Medium Growth	Surface	1,758	2,039	2,294	2,549	2,680
	Groundwater	55	65	71	77	80
	Total	**1,813**	**2,104**	**2,365**	**2,625**	**2,761**
High Growth	Surface	1,758	2,294	2,804	3,191	3,580
	Groundwater	55	71	82	92	102
	Total	**1,813**	**2,365**	**2,886**	**3,284**	**3,683**

8.4 Petroleum Sector

In the Strawberry Sub-basin, there are 17 active licences which allocate 15,080 dam^3 of water to the petroleum sector. Petroleum allocations account for just over 3 percent of total allocations in the sub-basin. Almost all of the water allocated is for surface water (14,925 dam^3).

Water licences have been issued to three types of petroleum activities including injection, gas and petrochemical plants, and other petroleum (Figure 8-11).

Figure 8-11 Petroleum Water Allocation by Use in the Strawberry Sub-basin



8.4.1 Injection

Fourteen water licences have been issued for injection activities in the Strawberry Sub-basin. They allow withdrawals of up to 14,493 dam^3 of surface water and 151 dam^3 of groundwater. Injection water allocations commenced in the 1950s for surface water and the 1960s for groundwater, and allocations for both sources have increased since then. Licensees are expected to consume all of the groundwater they withdraw but are expected to return 361 dam^3 of surface water withdrawals.

8.4.1.1 Actual Water Use

Detailed summaries of reported water used for injection in the Strawberry Sub-basin have been prepared by Geowa based on EUB data and are presented in Table 8-19. In 2005, an estimated 211 dam^3 of fresh water was diverted for injection purposes. This volume includes 204 dam^3 of surface water and 7 dam^3 of groundwater. Based on the data, injection activities in the sub-basin are currently diverting and using approximately 2 percent of their total licensed allocations and use, including 1 percent of their surface water allocations and 5 percent of their groundwater allocations. About 112 dam^3 of saline water was also used for injection.

Table 8-19 Licensed Allocations, Estimated Actual Water Use for the Petroleum Sector, Strawberry Sub-basin

Water Use	Source	Number of Licences	Licensed Allocation and Use (dam^3)			Estimated Water Use (dam^3)		
			Allocation	Water Use	Return	Water Use	Percent of Licensed Use	Percent of Allocation
Injection	Surface	9	14,493.4	14,132.0	361.4	204	1%	1%
	Groundwater	5	150.5	150.5	0.0	7	5%	5%
	Subtotal	**14**	**14,643.9**	**14,282.5**	**361.4**	**211***	**2%**	**1%**
Gas/ Petrochemical Plant	Surface	1	431.7	431.7	0.0	34	8%	8%
	Groundwater	1	0.5	0.5	0.0	1	100%	100%
	Subtotal	**2**	**432.2**	**432.2**	**0.0**	**35****	**8%**	**8%**
Other Petroleum	Surface	0	0.0	0.0	0.0	0		
	Groundwater	1	3.7	3.7	0.0	4	100%	100.0%
	Subtotal	**1**	**3.7**	**3.7**	**0.0**	**3*****	**100%**	**100.0%**
Total	Surface	10	14,925.1	14,563.7	361.4	238	2%	2%
	Groundwater	7	154.7	154.7	0.0	12	8%	8%
	Total	**17**	**15,079.8**	**14,718.4**	**361.4**	**250**	**2%**	**2%**

* EUB water use data provided by GEOWA.
** Estimates based on WURS data.
*** Estimated water use assumes licensees are consuming the full entitlement of their licences.

8.4.1.2 Forecasts

The general trend in Alberta is for conventional crude oil production to decline as existing fields mature and there are fewer new finds. The most recent forecast from the EUB and CAPP have oil production decreasing by between 30 and 38 percent between 2005 and 2015, and a further decline of about 23 percent by 2020. Oil production in the North Saskatchewan Basin is expected to follow the overall Alberta production trend since most of the basin's production is from existing wells. The forecast of future water use for injection in the Strawberry Sub-basin in Table 8-20 assumes declining rates of water use required that match the rates at which oil production in Alberta is expected to decline.

Table 8-20 Forecast of Injection Water Use in the Strawberry Sub-basin

(dam^3)

Scenario	Source	2005	2010	2015	2020	2025
Low Production	Surface	204	204	119	119	71
	Groundwater	7	7	4	4	3
	Total	**211**	**211**	**124**	**124**	**74**
Medium Production	Surface	204	204	126	126	75
	Groundwater	7	7	5	5	3
	Total	**211**	**211**	**130**	**130**	**78**
High Production	Surface	204	204	143	143	85
	Groundwater	7	7	5	5	3
	Total	**211**	**211**	**148**	**148**	**88**

No petroleum forecasts are available for 2010 and 2020, so for the purposes of this analysis it is assumed that production for these time periods is the same as the previous five years. Forecasts also assume that the current ratio of surface to groundwater consumption will remain the same. Under the Low Production scenario, water use for injection in 2025 will decline by 65 percent from current levels. Under the High Production scenario, the decline will be 58 percent.

8.4.2 Gas/Petrochemical Plants

In the Strawberry Sub-basin, one surface water licence and one groundwater licence have been issued for gas and petrochemical plant activities. The licences allow for withdrawals of up to 432 dam^3 of surface water and less than 1 dam^3 of groundwater. Gas and petrochemical plant water allocations commenced in the 1940s for surface water and 2005 for groundwater. Licensees are expected to consume all of the groundwater they withdraw.

The surface water licence holder reported using 34 dam^3 in 2005, which is less than 8 percent of their allocation. There is no information on the actual groundwater diversions and consumption for the single gas and petrochemical plant licence. For purposes of this analysis, it is assumed that the licence holder is using their full allocation. Thus, gas and petrochemical plants are estimated to have used 35 dam^3 in 2005.

In the absence of information about this component of the petroleum sector, it is assumed that water used by gas and petrochemical plants in the Strawberry Sub-basin will remain constant for the forecast period.

8.4.3 Other Petroleum

One groundwater licence has been issued in the Strawberry Sub-basin for other petroleum activities. The single groundwater licence allows for withdrawals of nearly 4 dam^3 of groundwater. Other petroleum water allocations commenced in the 1950s and have remained the same since. The licensee is expected to consume all of the groundwater it is allowed withdraw.

There is no information on the actual water diversions and consumption for the single other petroleum water licence and, for purposes of this analysis, it is assumed that the licence holder is using the full allocation. In the absence of information about this component of the petroleum sector, it is assumed that water used by other petroleum activities in the Strawberry Sub-basin will remain constant for the forecast period.

8.4.4 Summary

Relatively little water has been allocated to the petroleum sector in the Strawberry Sub-basin. The majority of allocation is for injection activities which account for 97 percent of allocations and 85 percent of actual water use in 2005. Water use data shows that although water licences allow up to 14,283 dam^3 of water to be consumed for injection purposes, licensees are using less than 2 percent of this amount.

It is expected that in the future there will be a slight decline in water requirements for injection activities as oil production from existing oilfields decline. Water requirements for gas and petrochemical facilities and other petroleum activities in the Strawberry Sub-basin are not expected to change in the forecast period. The overall water use projections for the petroleum sector are provided in Table 8-21.

Table 8-21 Forecast of Petroleum Water Use in the Strawberry Sub-basin
(dam^3)

Scenario	Source	2005	2010	2015	2020	2025
Low Production	Surface	238	238	153	153	105
	Groundwater	12	12	9	9	7
	Total	**250**	**250**	**162**	**162**	**112**
Medium Production	Surface	238	238	160	160	109
	Groundwater	12	12	9	9	7
	Total	**250**	**250**	**168**	**168**	**116**
High Production	Surface	238	238	177	177	119
	Groundwater	12	12	9	9	7
	Total	**250**	**250**	**186**	**186**	**126**

Under the Low Production scenario, water use for petroleum activities in 2025 will decline by 55 percent from current levels. Under the High Production scenario, the decline will be 49 percent.

8.5 Industrial Sector

In the Strawberry Sub-basin, 12 active licences allocate 281,958 dam^3 of water to the industrial sector. Industrial allocations account for just over 64 percent of total allocations in the sub-basin and 14 percent of the total allocations in the North Saskatchewan River Basin. Almost all of the water allocated is for surface water (281,715 dam^3).

The industrial sector water allocations are almost entirely for cooling associated with thermal power production. Small amount of water have been allocated to manufacturing and mining other than coal.

8.5.1 Cooling

8.5.1.1 Water Allocations

Almost all of the industrial allocations are for cooling purposes for thermal power generation or cooling such as air conditioning (281,445 dam^3). Details of the licences issued to the industrial sector in the Strawberry Sub-basin are provided in Table 8-22. The table shows that five licences have been issued for cooling purposes, with all of these allocations being for surface water. Water use for cooling commenced in the 1930s and grew until the 1980s.

8.5.1.2 Licensed Water Use

As shown in Table 8-22, the licences issued for cooling purposes assume that about 25 percent of surface water allocations will be used and then remainder (211,378 dam^3) wll be returned after use.

8.5.1.3 Actual Water Use

There only two licence holders in the Strawberry Sub-basin: the EPCOR (Rossdale plant) and the University of Alberta. A review of the WURS database and consultation with the licensees, it was determined that there was no water used by cooling activities in 2005. EPCOR currently has an agreement to continue to use the Rossdale Plant to provide ongoing transmission reliability for the City of Edmonton and back-up generating capacity for the Province of Alberta, but the plant is due to be decommissioned in 2009 (EPCOR, 2006)

8.5.1.4 Forecasts of Future Water Use

Given that the existing licence holders are not expected to change their water use, the Rossdale Plant is to be decommissioned in 2009, and that there are no known plans for new water licence applications, it is assumed that water used by cooling in the Strawberry Sub-basin will remain constant for the forecast period.

Table 8-22 Licensed Allocations and Estimated Water Use for the Industrial Sector, Strawberry Sub-basin

Water Use	Source	Number of licences	Licensed Allocation and Use (dam^3)			Estimated Water Use (dam^3)		
			Allocation	Water Use	Return	Water Use	Percent of Licensed Use	Percent of Allocation
Cooling	Surface	5	281,443.5	70,066.0	211,377.5	0	0%	0%
	Groundwater	0	0.0	0.0	0.0	0		
	Subtotal	**5**	**281,443.5**	**70,066.0**	**211,377.5**	**0***	**0%**	**0%**
Manufacturing	Surface	2	148.0	148.0	0.0	148	100%	100%
	Groundwater	4	243.0	243.0	0.0	243	100%	100%
	Subtotal	**6**	**391.0**	**391.0**	**0.0**	**391****	**100%**	**100%**
Mine-other	Surface	1	123.4	0.0	123.4	0	100%	100%
	Groundwater	0	0.0	0.0	0.0	0		
	Subtotal	**1**	**123.4**	0.0	**123.4**	**0****	**100%**	**100%**
Total	Surface	8	281,714.8	70,214.0	211,500.8	148	0.2%	0.1%
	Groundwater	4	243.0	243.0	0.0	243	100%	100%
	Total	**12**	**281,957.8**	**70,457.0**	**211,500.8**	**391**	**0.6%**	**0.1%**

* Actual water use is estimated using WURS and information provided by the licence holder.
** Actual water use assumes that licence holders are using the full entitlement of their licences.

8.5.2 Manufacturing

Six licences have been issued for manufacturing activities in the Strawberry Sub-basin, all to cement companies like Consolidated Costain Cement Co., Consolidated Concrete Limited and Lehigh Inland Cement Limited. They allow withdrawals of up to 391 dam^3 including 148 dam^3 of surface water and 243 dam^3 of groundwater. Manufacturing water allocations commenced in the 1960s and have increase since. Licensees are expected to consume all of the water they withdraw.

There is no information on actual water diversions and consumption for the manufacturing sector. For purposes of this analysis, it is assumed that licensees are using their full entitlement (391 dam^3). In the absence of information about this component of the industrial sector, it is assumed that water used by manufacturing activities in the Strawberry Sub-basin will remain constant for the forecast period.

8.5.3 Mining other than Coal

One surface water licence has been issued in the Strawberry Sub-basin for mining other than coal for 123 dam^3. The licence was issued in the 1980s and it expects the licensee will return all of the water it withdraws.

There is no information on actual water diversions and consumption for the mining other than coal sector. For purposes of this analysis, it is assumed that the licensee is using its full entitlement (0 dam^3). In the absence of information about this component of the industrial sector, it is assumed that water used by mining other than coal activities in the Strawberry Sub-basin will remain constant for the forecast period.

8.5.4 Summary

The industrial sector in the Strawberry Sub-basin is dominated by water allocated for cooling plants. While these plants account for almost 100 percent of allocations, they did not actually consume any water in 2005. In the absence of information that indicates other wise, it is assumed that water used by the industrial sector in the Strawberry Sub-basin will remain constant for the forecast period (Table 8-23).

Table 8-23 Projected Water Use for the Industrial Sector, Strawberry

(dam^3)

Scenario	Source	2005	2010	2015	2020	2025
Low Growth	Surface	148	148	148	148	148
	Groundwater	243	243	243	243	243
	Total	**391**	**391**	**391**	**391**	**391**
Medium Growth	Surface	148	148	148	148	148
	Groundwater	243	243	243	243	243
	Total	**391**	**391**	**391**	**391**	**391**
High Growth	Surface	148	148	148	148	148
	Groundwater	243	243	243	243	243
	Total	**391**	**391**	**391**	**391**	**391**

8.6 Other Sector

In the Strawberry Sub-basin 16 active licences allocate 838 dam^3 of water to the other sector. These licences assume 56 percent of the water will be used and 44 percent will be returned. The other sector activities account for 0.2 percent of licensed water use in the Strawberry Sub-basin. Almost all of the water allocated is for surface water (801 dam^3). Other sector uses include water management for flood control and lake stabilization, fish, wildlife and habitat enhancement, and other use specified by the director (Figure 8-12).

Water licences have been issued to City of Edmonton (one), Ducks Unlimited (six), Edmonton Regional Airports Authority (one), Leduc County (two), Leduc Regional Landfill (one), Samson Tribal Enterprise (one), and private individuals (four).

Figure 8-12 Other Sector Water Allocation by Use in the Strawberry Sub-basin

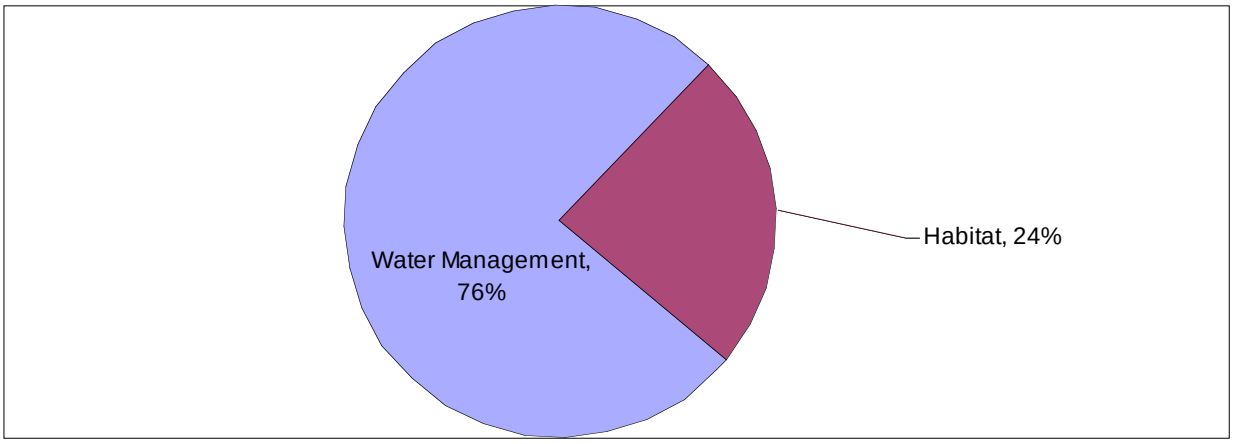


Table 8-24 summarizes the water allocation, use, and return associated with the licences for each activity in the Strawberry Sub-basin.

Table 8-24 Licensed Allocations and Estimated Actual Water Use for the Other Sector, Strawberry Sub-basin

Water Use	Source	Number of Licences	Licensed Allocation and Use (dam^3)			Estimated Water Use (dam^3)		
			Allocation	Water Use	Return	Water Use	Percent of Licensed Use	Percent of Allocation
Water Management	Surface	9	636.5	295.5	341.0	296	100%	46%
	Groundwater	0	0.0	0.0	0.0	0		
	Subtotal	**9**	**636.5**	**295.5**	**341.0**	**296***	**100%**	**46%**
Habitat	Surface	4	164.1	164.1	0.0	164	100%	100%
	Groundwater	2	37.0	9.2	27.8	9	100%	25%
	Subtotal	**6**	**201.1**	**173.3**	**0.0**	**173***	**100%**	**100%**
Specified	Surface	1	0.2	0.2	0.0	0.2	100%	100%
	Groundwater	0	0.0	0.0	0.0	0.0		
	Subtotal	**1**	**0.2**	**0.2**	**0.0**	**0.2***	**100%**	**100%**
Total	Surface	14	800.8	459.8	341.0	460	100%	57%
	Groundwater	2	37.0	9.2	27.8	9	100%	25%
	Total	**16**	**837.8**	**469.0**	**368.8**	**469**	**100%**	**56%**

* Estimated water use assumes licensees are using the full entitlement of their licences.

8.6.1 Water Management

In the Strawberry Sub-basin, nine surface water licences have been issued for water management activities. The licences allow for withdrawals of up to 637 dam^3 of water. Water management allocations commenced in the 1920s and increased over time. Licences expect that up to 296 dam^3 will be used and 341 dam^3 will be returned after use (Table 8-24).

There is no information on the actual water diversions and consumption for water management licences. For purposes of this analysis, it is assumed that the licensees are using their full allocation.

In the absence of information about this component of the other sector, it is assumed that water used for water management projects in the Strawberry Sub-basin will remain constant for the forecast period.

8.6.2 Habitat Enhancement

In the Strawberry Sub-basin, four surface water licences and two groundwater licence have been issued for wildlife and habitat enhancement projects. The licences allow withdrawals of up to 164 dam^3 of surface water and 37 dam^3 of groundwater. Habitat enhancement allocations commenced in the 1980s, surface water allocations have increased since that time while groundwater licences have remained the same. Licences assume that 86 percent of the licensed withdrawal will be consumed and 28 dam^3 will be returned.

There is no information on the actual water diversions and consumption for habitat enhancement licences. For purposes of this analysis, it is assumed that licensees are using their full entitlement.

In the absence of information about this component of the other sector, it is assumed that water used for habitat enhancement projects in the Strawberry Sub-basin will remain constant for the forecast period. Although one surface water licence is scheduled to expire in 2025, it is assumed that this licence will be renewed (Table 8-25).

Table 8-25 Forecast of Habitat Enhancement Water Use in the Strawberry Sub-basin
(dam^3)

Scenario	Source	2005	2010	2015	2020	2025
	Surface	164	164	164	164	164
	Groundwater	9	9	9	9	9
	Total	**173**	**173**	**173**	**173**	**173**

8.6.3 Specified Use

In the Strawberry Sub-basin, one surface water licence has been issued to a private individual for a use specified by a director. The licence allows withdrawals of less than 1 dam^3 and was issued in the early 2000s. The licensee is expected to consume all of the water it withdrawals.

There is no information on the actual water diversions and consumption for specified use licences. For purposes of this analysis, it is assumed that the licence holder is using its full allocation. In the absence of information about this component of the other sector, it is assumed that water used by specified use projects in the Strawberry Sub-basin will remain constant for the forecast period.

8.6.4 Summary

The other sector in the Strawberry Sub-basin is dominated by water allocated for water management. Water management projects account for 76 percent of the water allocation and 63 percent of the licensed water use.

In the absence of information about the other sector, it is assumed that water used by the other sector projects in the Strawberry Sub-basin will remain constant for the forecast period. Although one surface water licence is scheduled to expire in 2025, it is assumed that this licence will be renewed. The resulting forecast is provided in Table 8-26.

Table 8-26 Forecast of Other Sector Use in the Strawberry Sub-basin
(dam^3)

Scenario	Source	2005	2010	2015	2020	2025
	Surface	460	460	460	460	460
	Groundwater	9	9	9	9	9
	Total	**469**	**469**	**469**	**469**	**469**

8.7 Summary

Table 8-27 provides a summary of licensed allocations and estimated water use for each of the water use sectors in the Strawberry Sub-basin. In total, existing licences and registrations allow a maximum of 440,045 dam^3 of water to be withdrawn. Of this total 29 percent (127,219 dam^3) is expected to be used and 71 percent is to be returned. This high return flow allowance reflects the large allocation issued to municipalities and thermal power plants, each of which only actually consumes a small portion of what they actually withdraw. The very large municipal allocation reflects that diversion from the mainstem of the North Saskatchewan within this sub-basin supply water to the entire Edmonton Capital Region.

Figure 8-13 shows the allocations, licensed use and actual use for the different sectors. Actual use (9,880 dam^3) is about 8 percent of licensed use. The largest water user is the municipal sector, which accounted for 54 percent of total use. While this percentage is very high compared to other sub-basins, water diverted from the Strawberry Sub-basin is used to service 84 percent of the population of the entire North Saskatchewan River basin. Figure 8-14 shows the forecasts to 2025 for all of the sectors under Medium Growth. By 2025 water use is expected to increase by about 7 percent under Low Growth (Table 8-28), about 21 percent under Medium Growth (Table 8-29), and about 42 percent under High Growth (Table 8-30).

Table 8-27 Summary of Allocations and Estimated Water Use, Strawberry Sub-basin

Sector		Licensed Allocation and Use (dam^3)				Estimated Water Use (dam^3)		
		Allocation	Water Use	Return	Percent of Total Use	Use	Percent of Licensed Use	Percent of Total Use
Municipal		137,778	37,422	100,323	29%	5,356	14%	54%
Agricultural	Stockwatering	1,980	1,980	0	2%	1,242	63%	13%
	Irrigation	359	359	0	0%	359	100%	4%
Commercial		2,052	1,813	239	1%	1,813	100%	18%
Petroleum		15,080	14,719	361	12%	250	2%	3%
Industrial		281,958	70,457	211,501	55%	391	1%	4%
Other		838	469	369	0%	469	100%	5%
Total		**440,045**	**127,219**	**312,793**	**100%**	**9,880**	**8%**	**100%**