6.4 Areas of Groundwater Decline

In order to determine the areas of possible water-level decline in the sand and gravel aquifer(s) and in the upper bedrock aquifer(s), the following approach was attempted. The available non-pumping water-level elevation for each water well was first sorted by location, and then by date of water-level measurement. The dates of measurements were required to differ by at least 365 days. Only the earliest and latest control points at a given location were used. The method of calculating changes in water levels is at best an estimate. Additional data would be needed to verify water-level change.

Of the 399 surficial water wells with a non-pumping water level and date in the County and buffer area, there are 36 water wells with sufficient control to prepare the adjacent map.

Where the earliest water level is at a higher elevation than the latest water level, there is the possibility that some groundwater decline has occurred. The interpretation of the adjacent map should be limited to areas where water-level control points are present. Most of the areas where the map suggests that there has been a decline in NPWL may be a result gridding a limited number of control points. The adjacent map, where sufficient control exists, indicates that there may have been a decline in the NPWL in parts of township 036 and 037, ranges 04 to 06 and townships 040 to 042, ranges 07 to 09, W5M.

Where the earliest water level is at a lower elevation than the latest water level, there is the possibility that the groundwater has risen at that location. The water level may have risen as a result of recharge in wetter years or may be a result of the water well being completed in a different surficial aquifer. Of the 141 groundwater users completed in surficial aquifers that are authorized to divert groundwater, most occur in areas where insufficient control exists.

Estimated Water Well Use Per Section (m³/day)	*% of Area with More than a 5-Metres Projected Decline*
<30	*28*
30 to 50	*11*
>50	*12*
no use	*49*

Table 10. Water-Level Decline in Sand and Gravel Aquifer(s)

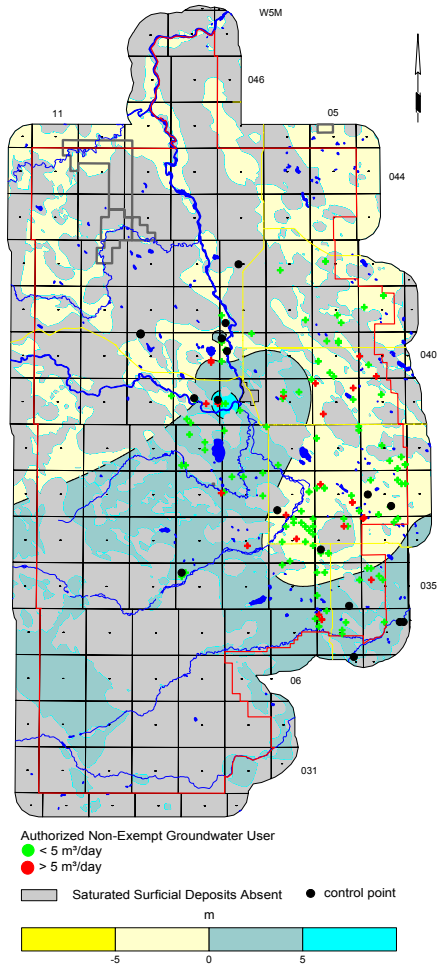

Figure 31. Changes in Water Levels in Surficial Deposits

Figure 31 indicates that in 45% of the County where surficial deposits are present, it is possible that the non-pumping water level has declined. The areas of groundwater decline in the sand and gravel aquifer(s) where there is no estimated water well use suggest that groundwater diversion is not having an impact and that the decline may be due to variations in recharge to the aquifer or because the water wells are not on file with Alberta Environment.

In areas where a water-level decline exists, 49% of the areas has no estimated water well use; 28% of the use is less than 30 m³/day; 11% of the use is between 30 and 50 m³/day per section; and the remaining 12% of the declines occurred where the estimated groundwater use per section is greater than 50 m³/day, as shown above in Table 10.

Of the 6,232 bedrock water wells with a non-pumping water level and date in the County and buffer area, there are 1,960 water wells with sufficient control to prepare the adjacent map. The adjacent map indicates that in the yellow areas where there is sufficient data control, it is possible that the NPWL has declined.

The water level in Obs WW No. 10-07 in 10-07-041-08 W5M was monitored by Mow-Tech Ltd. from 1990 to 1999. The observation water well is completed from 56.7 to 96.9 metres below ground surface in the Dalehurst Aquifer. The location of Obs WW No. 10-07 is in an area where it is possible that a water-level decline has occurred. The water level in Obs WW No. 10-07 has declined in the order of three metres, as shown below in Figure 32.

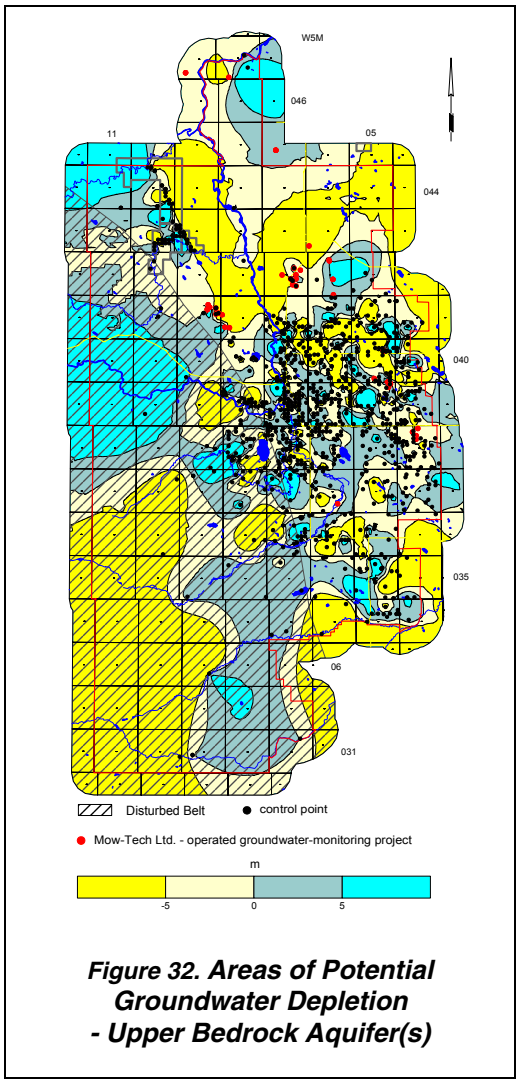

Figure 32. Areas of Potential Groundwater Depletion - Upper Bedrock Aquifer(s)

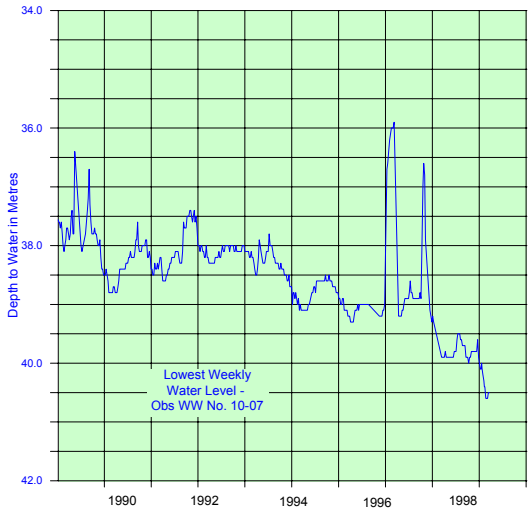

Figure 33. Water Levels in Obs WW No. 10-07

The areas of groundwater decline in the upper bedrock aquifer(s) where there is no estimated water well use suggest that groundwater diversion is not having an impact.

In areas where a water-level decline of more than five metres is indicated, 75% of the area has no estimated water well use; 16% is less than 30 m³/day; 4% is between 30 and 50 m³/day per section; and the remaining 5% of the declines occurred where the estimated groundwater use per section is greater than 50 m³/day, as shown below in Table 11. In the County where a water-level decline is indicated, most of the areas of no estimated water well use are in areas where there is not sufficient control.

Estimated Water Well Use Per Section (m³/day)	*% of Area with More than a 5-Metre Projected Decline*
<10	*11*
10 to 30	*5*
30 to 50	*4*
>50	*5*
no use	*75*

Table 11. Water-Level Decline of More than 5 Metres in Upper Bedrock Aquifer(s)

The areas of groundwater decline in the upper bedrock aquifer(s) where there is no estimated water well use suggest that groundwater production is not having an impact and that the decline may be due to variations in recharge to the aquifer or because the water wells are not on file with Alberta Environment.

6.5 Discussion of Specific Study Areas

6.5.1 Area 1 – Township 037, Range 06 W5M

What is the approximate extent and potential (yield and water quality) of the aquifers in this area? What comments can be made on whether or not there is any evidence of water-level decline in the aquifer underlying township 037, range 06 W5M?

Groundwater resources in Area 1 are mainly being utilized for domestic and stock purposes. There are 44 authorized groundwater users in Area 1, of which one is for agricultural purposes and 43 are registrations, for a total authorized use of 85 m³/day. Groundwater production data are available for a water source well in 12-03-037-06 W5M in 1998 and 1999 and for a water source well in SE 10-037-06 W5M. The water source well in 12-03-037-06 W5M diverted an average of less than two m³/day during its main producing months of May to November in 1998 and 1999. The water source well in SE 10-037-06 W5M (WSW No. SE 10) has diverted an average of 225 m³/day since groundwater production began in December 2001. Clearwater County anticipates that further development in Area 1 may be limited due to groundwater availability.

The flow through the Sand and Gravel Aquifer in Area 1 is estimated to be 820 m³/day and the flow through the Dalehurst Aquifer is estimated to be 650 m³/day. Figure 34 indicates that the estimated water well use per section in township 037, range 06, W5M ranges from less than one to more than 50 m³/day, with groundwater use of more than 30 m³/day per section determined to be in the western two-thirds of the township. In Area 1, there are records for 212 water wells, with 70% drilled for domestic/stock purposes. Ninety-five percent of the 212 water wells have sufficient data to determine the completion aquifer.

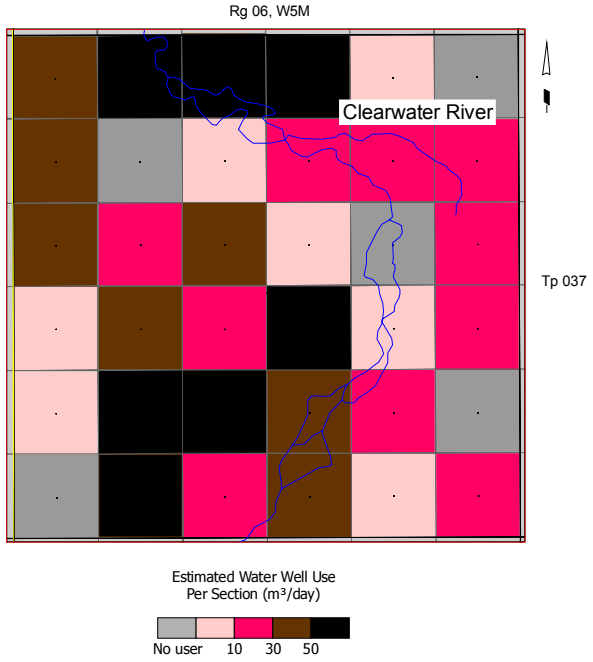

Figure 34. Estimated Water Well Use Per Section – Area 1

Where the Sand and Gravel Aquifer(s) are present in Area 1, the apparent yields for water wells completed in the Sand and Gravel Aquifer(s) are expected to be mainly more than 100 m³/day (see page A-53). Of the 44 groundwater authorizations, four are for water wells completed in the Sand and Gravel Aquifer(s) for a total of 8 m³/day.

Groundwaters from water wells completed in Area 1 in the surficial deposits are expected to be a calcium-magnesium-bicarbonate-type and have TDS concentrations that are less than 1,000 mg/L (see page A-54).

There are indications that there has been a continual decline of less than five metres in the water-level surface in the surficial deposits in most of township 037, range 06, W5M, as shown in Figure 35. Of the 212 water wells in Area 1, 32 (15%) are completed in surficial deposits and only two surficial water wells have sufficient data for determining changes in water levels in surficial deposits.

Water Source Well No. SE 10 is located in the area where a water-level decline may be occurring. The water level in WSW No. SE 10 has been monitored by Mow-Tech Ltd. since December 2001.

Water Source Well No. SE 10 drilled in October 2000, is located adjacent to the Clearwater River, as shown on Figure 35, and is completed from 4.1 to 5.6 metres below ground surface in sand and gravel deposits. The highest and lowest water-level fluctuations in WSW No. SE 10 from November 2002 to August 2003 have been compared to the discharge rate in the Clearwater River recorded near Dovercourt.

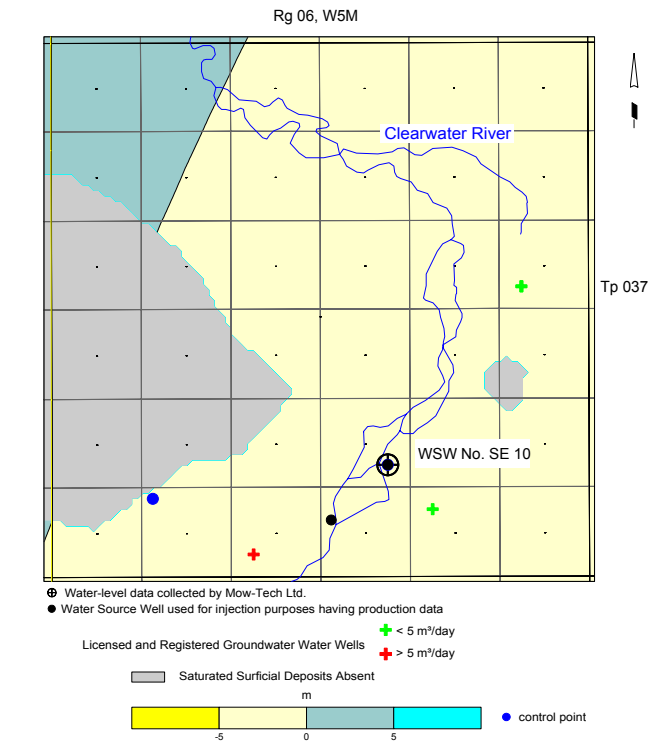

Figure 35. Changes in Water Levels in Surficial Deposits – Area 1

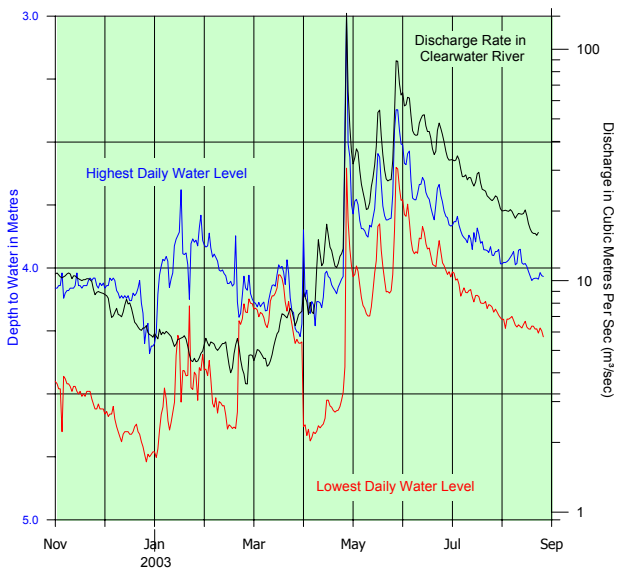

Figure 36. Discharge Rate in Clearwater River and Water-Level Measurements in WSW No. SE 10 – Area 1

The water levels in WSW No. SE 10 mainly mimic the changes in discharge in the Clearwater River except during the winter months of January and February when the discharge continues to decline. On March 31, 2003 there is water-level declne of 0.34 metres as a result of increased groundwater production in WSW No. SE 10. Near the end of April, there is a sharp rise in water levels in WSW No. SE 10, and in the discharge rate in the Clearwater River. This rise can be attributed to spring thaw.

The upper bedrock in Area 1 is the Dalehurst Member. The apparent yield for water wells completed through the Dalehurst Aquifer is expected to be more than ten m³/day (see page A-55).

Groundwaters from water wells completed in Area 1 in the Dalehurst Aquifer are expected to be a sodium-bicarbonate-type and have TDS concentrations that are mainly less than 1,000 mg/L (see page A-56).

There are indications that there has been a continual decline with the water-level surface in the upper bedrock aquifer(s) in most of the southern half and in the extreme northwestern part of township 037, range 06, W5M as shown in the adjacent figure. Of the 212 water wells in Area 1, 171 (80%) are completed in the Dalehurst Aquifer, and six bedrock water wells have sufficient data for determining areas of potential groundwater depletion in the Dalehurst Aquifer.

In the areas where a water-level decline may have occurred, the estimated use per section is mainly greater than 30 m³/day. In the areas where a water-level rise may have occurred, the estimated use per section is mainly less than 30 m³/day.

Of the 44 groundwater authorizations, 40 are for water wells completed in the Dalehurst Aquifer, having a total authorized diversion of 77 m³/day.

Additional groundwater monitoring data would need to be made available in order to provide a reasonable interpretation regarding the apparent water-level decline in Area 1.

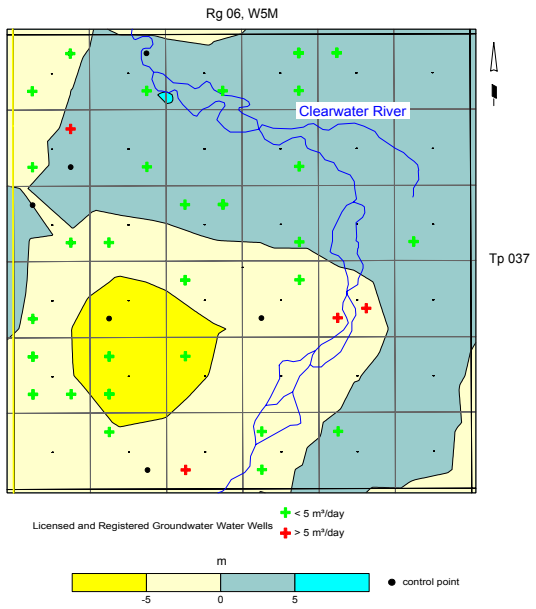

Figure 37. Areas of Potential Groundwater Depletion in Dalehurst Aquifer(s) – Area 1