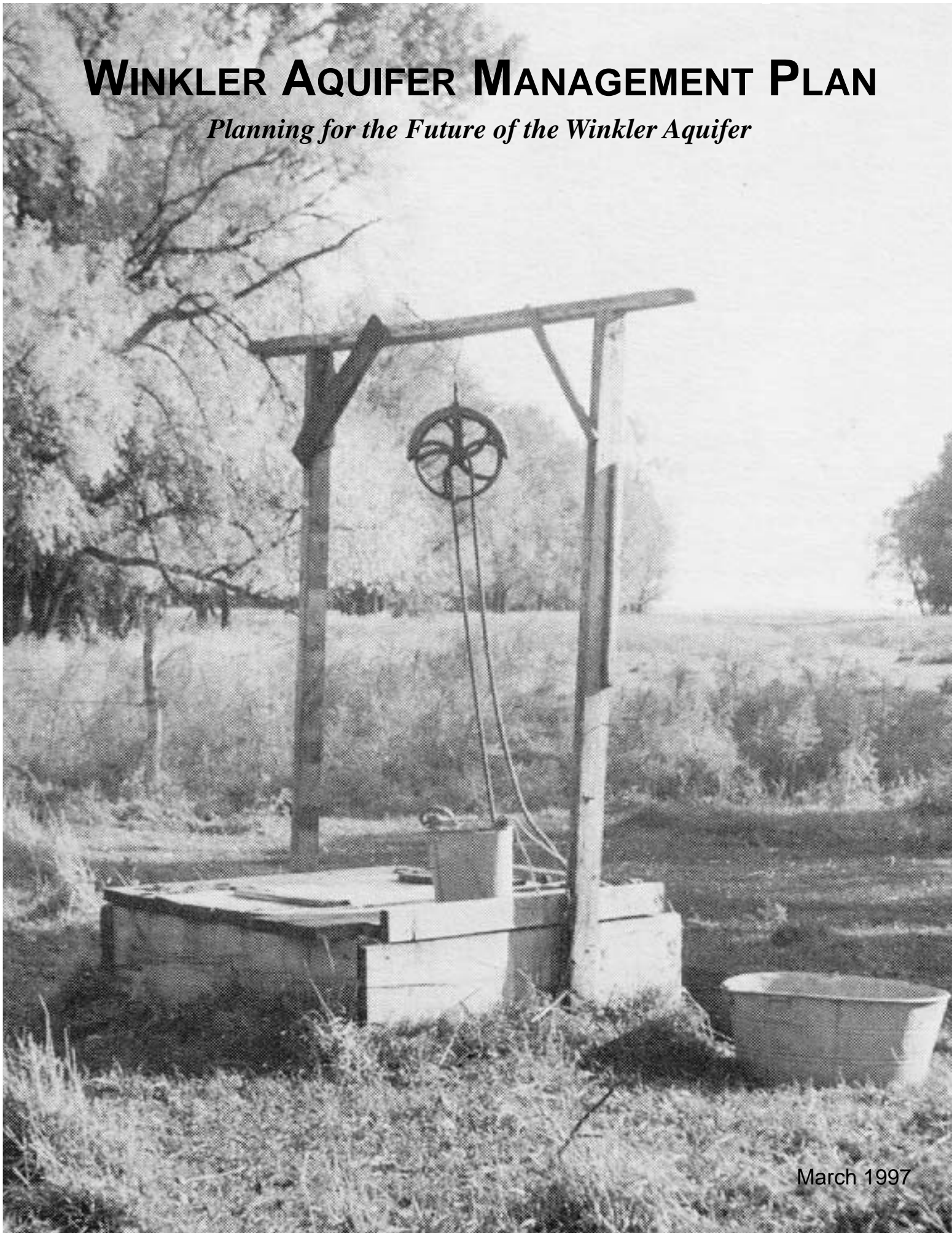


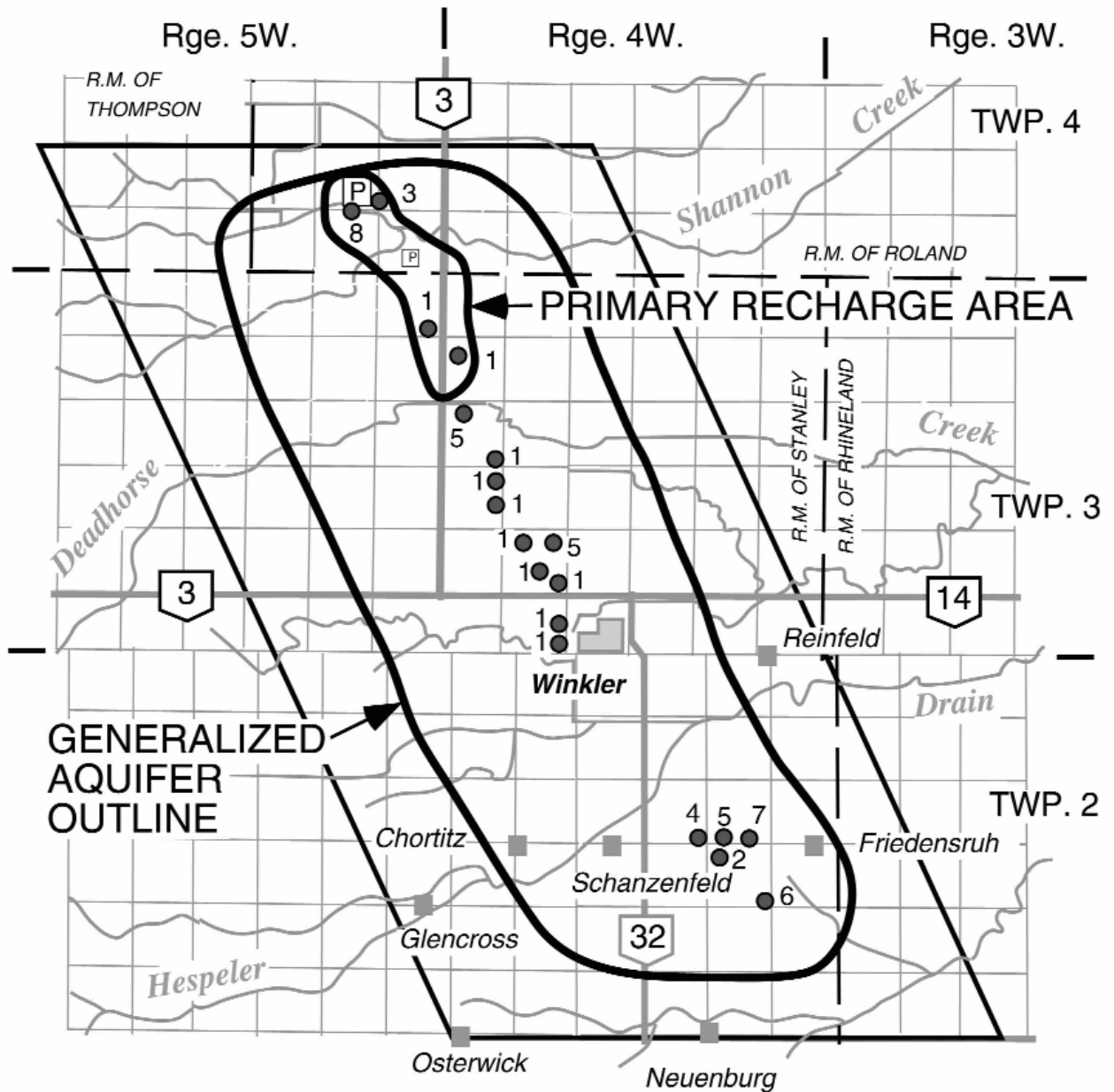
WINKLER AQUIFER MANAGEMENT PLAN

Planning for the Future of the Winkler Aquifer



March 1997

STUDY AREA



LEGEND		
● Licensed Wells	Ⓟ Gravel Pit	- - R. M. Boundary
■ Community	— Highway	— Study Area Boundary

WELL USER KEY		
1 Winkler	4 Schanzenfeld	7 Friedensruh
2 Blumengart Colony	5 Loading Station	8 Kroeker Farms
3 Roland	6 K-Line Hog Farms	

WINKLER AQUIFER MANAGEMENT PLAN



March 1997

Director
Water Resources Branch
Department of Natural Resources

Dear Mr. Topping

The Winkler aquifer is currently the sole developed source of domestic water supply for approximately 8000 people. This water supply is used for industrial, municipal and agricultural purposes. In response to concerned water users and as facilitated by your Branch, a stakeholder Round Table and a Technical Advisory Group have worked for the last year to develop a plan to protect the aquifer.

We began the task by studying the available information and by discussing the issues and their potential solution options. Next we compiled a draft plan which outlined the information considered and recommended a course of action to protect the sustainable capacity and the water quality of the aquifer. To obtain public input, the plan was distributed for comment to the water user community and it was presented and reviewed at open houses and public meetings.

The plan outlines the objectives of a set of five initiatives. It also suggests an organizational strategy whereby private and government representatives would work together to coordinate the actions needed to implement and sustain the initiatives.

There is a common understanding among the aquifer water users, owners and managers on the value of this water supply. It is hoped this shared value in conjunction with your leadership, will facilitate the stewardship needed to protect the aquifer's potential long term water supply capability. Thank you for the planning assistance of your Branch.

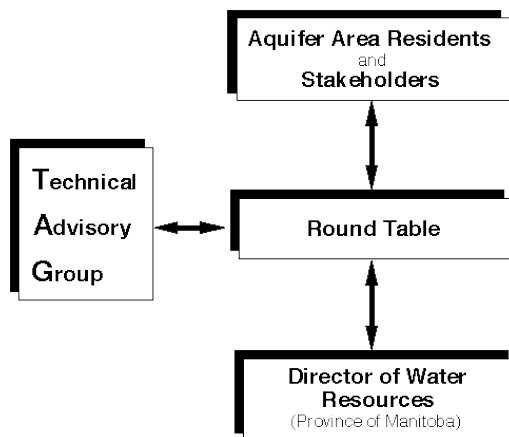
Yours truly,

John Krahn
Round Table Chairperson
Winkler Aquifer Management Plan

PLAN DEVELOPMENT

In July 1995, Manitoba Water Resources Branch initiated a consensus building process among stakeholders for the development of a management plan for the Winkler Aquifer. This was done largely in response to concerns and as requested by representatives of the Town of Winkler. A Technical Advisory Group (TAG) comprised of 14 representatives from various provincial and federal agencies was established in October 1995 to provide technical support for plan development.

A Round Table comprised of 10 people representing the major stakeholders was established on December 5, 1995. The Round Table worked jointly with the TAG and with local resource owners and users in developing the plan.



The Winkler Aquifer management planning process required the Round Table and the TAG to identify the issues, prepare a draft plan, obtain public input and incorporate that input into a final plan. The final plan was to be submitted to the Director of the Water Resources Branch, Department of Natural Resources, Province of Manitoba by the end of 1996.

ROUND TABLE METHOD OF OPERATION

- THE ROUND TABLE SHALL REQUEST THE COORDINATOR TO MAKE AVAILABLE SUCH EMPLOYEES OF THE DEPARTMENTS AS MAY BE REQUIRED TO PROVIDE TECHNICAL ADVICE AND INFORMATION ON VARIOUS ISSUES RELATING TO THE AQUIFER.
- THE ROUND TABLE SHALL ELECT FROM ITS MEMBERSHIP A CHAIRPERSON AND A VICE-CHAIRPERSON.
- MEMBERS OF THE ROUND TABLE SHALL RECEIVE NO REMUNERATION OR COMPENSATION FOR OUT-OF-POCKET EXPENDITURES INCURRED WHILE ATTENDING MEETINGS.

ROUND TABLE TERMS OF REFERENCE

- THE ROUND TABLE SHALL WORK TOGETHER WITH THE OTHER RESOURCE OWNERS, USERS AND MANAGERS AS A TEAM TO FORMULATE AN AQUIFER MANAGEMENT PLAN THAT WILL PRESENT GUIDELINES FOR MANAGING, PROTECTING AND USING THE GROUNDWATER RESOURCE IN THE AQUIFER.
- THE ROUND TABLE IN CONJUNCTION WITH THE TECHNICAL ADVISORY GROUP (TAG) SHALL PROVIDE TECHNICAL AND EDUCATIONAL INFORMATION TO LOCAL RESIDENTS ON THE ISSUES AND OPPORTUNITIES REGARDING THE AQUIFER.
- THE ROUND TABLE IN CONJUNCTION WITH TAG SHALL SOLICIT AND SYNTHESIZE LOCAL INPUT ON AQUIFER ISSUES AND OPPORTUNITIES.
- THE ROUND TABLE IN CONJUNCTION WITH TAG SHALL APPLY THE MANITOBA WATER POLICIES DURING THE DEVELOPMENT OF THE AQUIFER MANAGEMENT PLAN.



Round Table Members

Back Row (Left to right): Ron Neufeld, Dave Waldner, Albert Peters, Ted Dyck and John Krahn.

Front Row (Left to right): Sam Schellenberg, Larry Whitney, Art Petkau and Wayne Rempel.

Missing: Brian Janick.

Formulating the Winkler Aquifer Management Plan has to date included the following planning activities. The TAG prepared a background report on the aquifer and submitted it to the Round Table in January 1996. A Draft Winkler Aquifer Management Plan was jointly compiled, accepted by the TAG and the Round Table, printed in booklet form and distributed among the aquifer water users in September 1996. The draft plan was presented at advertised open houses and public meetings in November 1996. The inputs received through this process were incorporated into the plan. This plan is now given to the Director of the Water Resources Branch for implementation.

The plan is seeking to foster long term stewardship. In the short term, implementing the plan and accomplishing its objectives will require the establishment of a management advisory board and several working groups to carry out activities.

ROUND TABLE

Name	Address	Representing
Ron Neufeld	Winkler	Town of Winkler
Ted Dyck	Winkler	R.M. of Stanley
Brian Janick	Roland	R.M. of Roland
John Krahn	Winkler	M.S.T.W. Planning District
Sam Schellenberg	Altona	Pembina Valley Water Cooperative
Wayne Rempel	Winkler	Agassiz Irrigation Association
Albert Peters	Winkler	Stanley Soil Management Assoc.
Art Petkau	Morden	Manitoba Cattle Producers Assoc.
Dave Waldner	Morris	Manitoba Pork
Larry Whitney	Winnipeg	Manitoba Natural Resources

TECHNICAL ADVISORY GROUP

Name	Address	Representing
Les Ciapala	Brandon	Manitoba Rural Development
John Oosterveen	Winnipeg	PFRA
Garry Haggerty	Morden	Manitoba Rural Development
Bruce Shewfelt	Morden	PFRA
Garth Stone	Carman	Manitoba Agriculture
Ray Bodnaruk	Winnipeg	Manitoba Natural Resources
Bruce Webb	Winnipeg	Manitoba Environment
Dwight Williamson	Winnipeg	Manitoba Environment
Glenn Ritchie	Winkler	Manitoba Environment
Heather Groom	Winnipeg	Manitoba Energy and Mines
Dan Sie	Winnipeg	Manitoba Natural Resources
Brian Nedohin	Morden	Manitoba Agriculture
Frank Render	Winnipeg	Manitoba Natural Resources
John Arthur	Winnipeg	Manitoba Natural Resources

The consensus building process was facilitated by:

John Towle	Winnipeg	Manitoba Natural Resources
Barry Oswald	Winnipeg	Manitoba Natural Resources

THE STUDY AREA

GEOGRAPHY

The study area is located in south central Manitoba near the western edge of the Red River Valley. It comprises 125 square miles of land overlying and immediately surrounding the aquifer. The Town of Winkler is located near the centre of the study area.

The topography of the former lake plain generally slopes to the northeast at a rate of about 10 feet per mile. This landscape was once tall grass prairie with poorly developed drainage and abundant wetlands. Now the area is intensively farmed. Headwater channels on the escarpment to the west are connected through the study area by four waterways that drain eastward to the Red River.

The population within the study area is approximately 9,200. The Winkler Aquifer is the sole developed source of drinking water for 7,500 of these people and an additional 550 people from beyond the study area. Some communities within the study area draw water from small local aquifers.

1996 STUDY AREA STATISTICS

User Community	Pop.	Livestock Numbers	
Winkler	7,100	Horses	300
Roland*	440	Cattle	5,050
Schanzenfeld	180	Hogs	12,000
Friedensruh	45	Chickens	48,000
Blumengart Colony*	130	Crop Types	
Rural residents	150	Cereals	Fodder
TOTAL	8,045	Pulses	Special
		Vegetables	

* These communities are located beyond the study area but they depend on the aquifer for their piped water supply.

WATER RESOURCES

Surface water and groundwater resources are in short supply in this region of Manitoba. Average summer rainfall is 16 inches. Average snowfall is equivalent to 5 inches of water. Snowfall during 95/96 was equivalent to 6 inches of water. There are no lakes or wetlands in the study area. Waterways generally contain streamflow only during the spring runoff period or after heavy rainfall events.

Bedrock aquifers in the area are salty. Some small sand aquifers exist within the till but water quality is generally poor. The Winkler Aquifer is the most significant sand and gravel aquifer in the area.

Water resources are allocated by the granting of water rights licences. The reliable streamflow in the area is almost fully allocated. Allocations from the Winkler Aquifer (1,057 acre-feet per year) exceed reliable recharge by a factor of three. Most licence holders use their entire allocation.

WATER DEMAND

Water demand has been projected to increase significantly. The lack of water resources is a recognized concern throughout the region. A proposal by the Pembina Valley Water Cooperative (PVWC) includes plans to obtain water from the Red River (30 miles east). A previous proposal to obtain water from the Assiniboine River (50 miles north) was never implemented.

The Round Table and the TAG estimate that, if no alternate water supply is developed, demand from the Winkler Aquifer will reach 1,700 acre-feet per year by the year 2020.

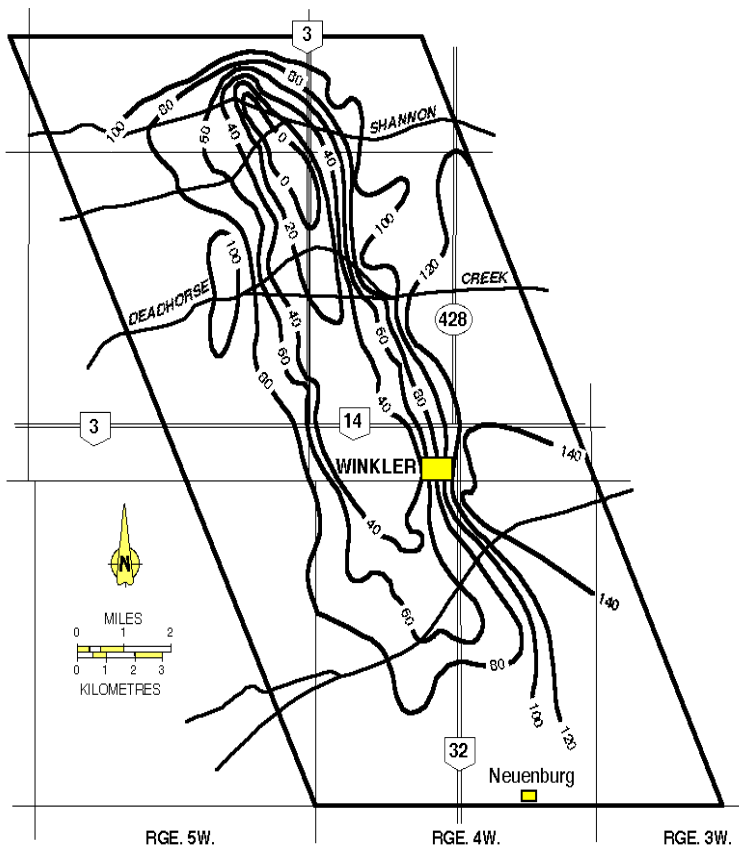
THE AQUIFER

PHYSICAL ENVIRONMENT

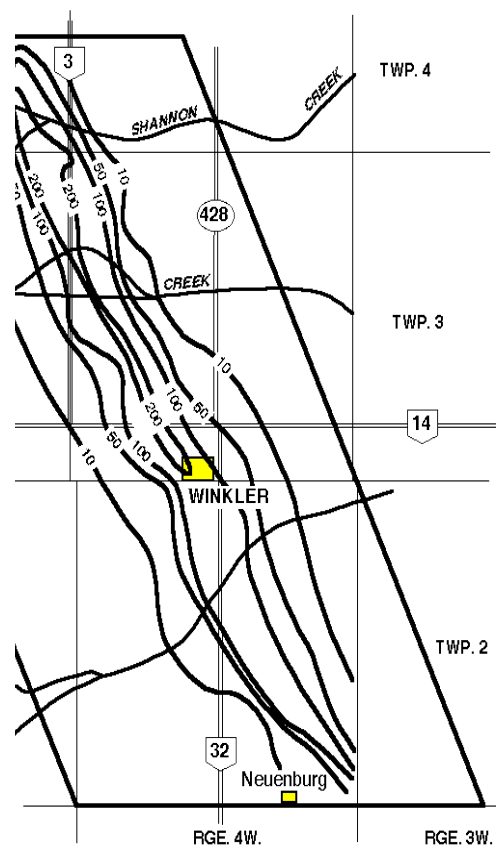
The Winkler Aquifer is a water bearing deposit of sand and gravel. It is approximately 17 miles long and varies from one to three miles wide. Its thickness varies to a maximum of 200 feet. The northern tip of the aquifer is exposed where it is mined as a valuable local source of sand and gravel resources. A three square mile area near the northern end of the aquifer has no clay cover. This is the primary recharge area, where a large portion of fresh water enters the aquifer. The rest of the aquifer is covered by

clay soils and glacial till. Near Neuenburg, the southern tip of the aquifer is about 100 feet below the surface.

Aquifer data have been obtained since the early 1960s. Much of the information on the aquifer's location, size, shape and capacity was obtained during extensive hydrogeologic investigations in the early 1990s. A network of approximately 55 monitoring wells is used to obtain water level and water quality data.



AQUIFER CONFINEMENT
CLAY COVER THICKNESS (FEET)



AQUIFER DIMENSION
SAND AND GRAVEL THICKNESS (FEET)

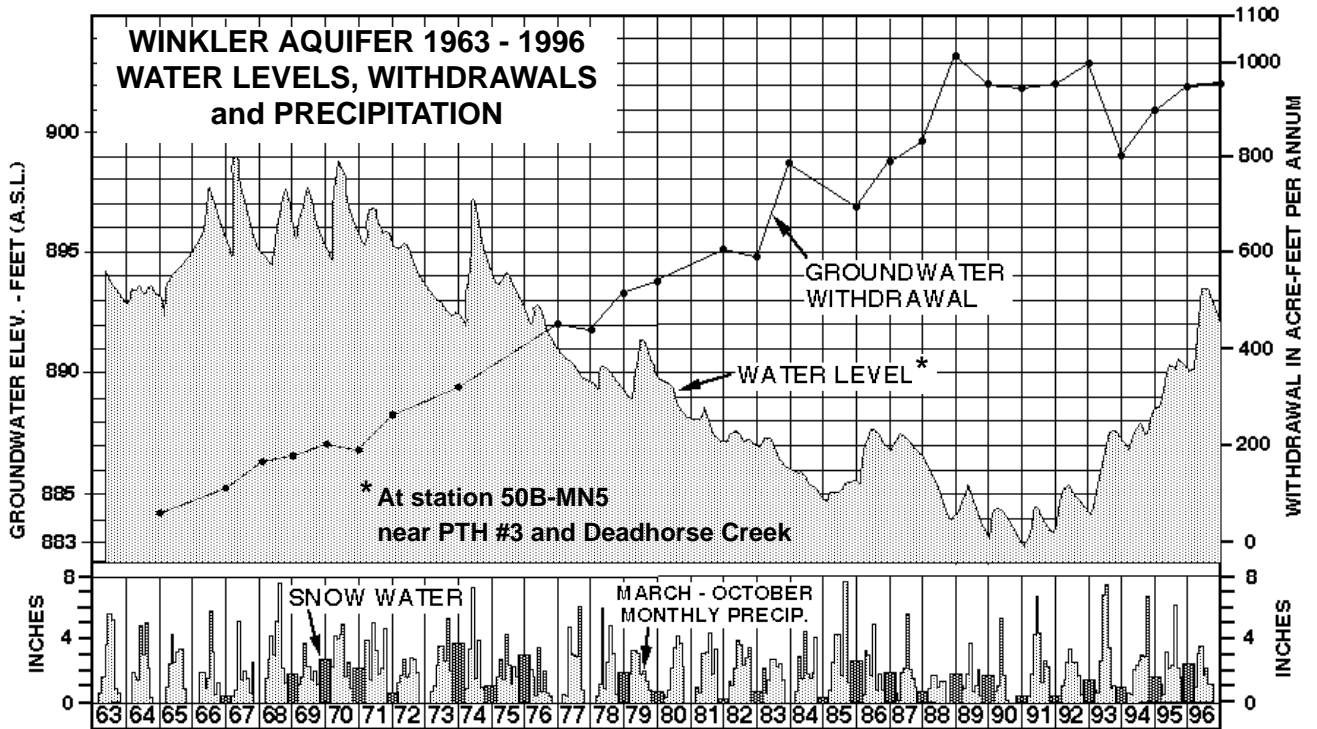
DEVELOPMENT HISTORY

The first shallow wells into the aquifer were likely developed in the 1870s. To date eleven licences have been issued for withdrawals from the Winkler Aquifer and one licence is pending. The use of the Winkler Aquifer as a source of water supply has increased from 100 acre-feet in 1960 to approximately 1,000 acre-feet in 1996. During this period water levels were observed to decline from 896 feet above sea level to 883 feet above sea level. Since 1990 the water level in the aquifer has been rising. In October of 1996, the water level was 893 feet above sea level.

WATER QUALITY

Water quality in the Winkler Aquifer varies with location and has decreased over time. The lower portion of the aquifer contains salt water, the upper portion fresh water. In general, the fresh water quality deteriorates with depth. Water quality indicators, such as dissolved solids, chloride, sodium, hardness, specific conductivity and iron, indicate that fresh water quality improves toward the north end of the aquifer and deteriorates towards the south end.

Some households at the north end of the aquifer are able to use water without treatment. The Town of Roland water treatment process uses only chlorine. The Town of Winkler water treatment process uses chlorine and lime soda ash. This process reduces hardness from 560 to 125 milligrams of calcium carbonate per litre.



The communities of Schanzenfeld and Friedensruh near the south end of the aquifer are currently considering treatment to improve their water quality. The lime soda ash treatment process will not be effective, however, because of the high salt content of the aquifer water in the vicinity. A reverse osmosis process is being considered.

TOTAL WATER BUDGET

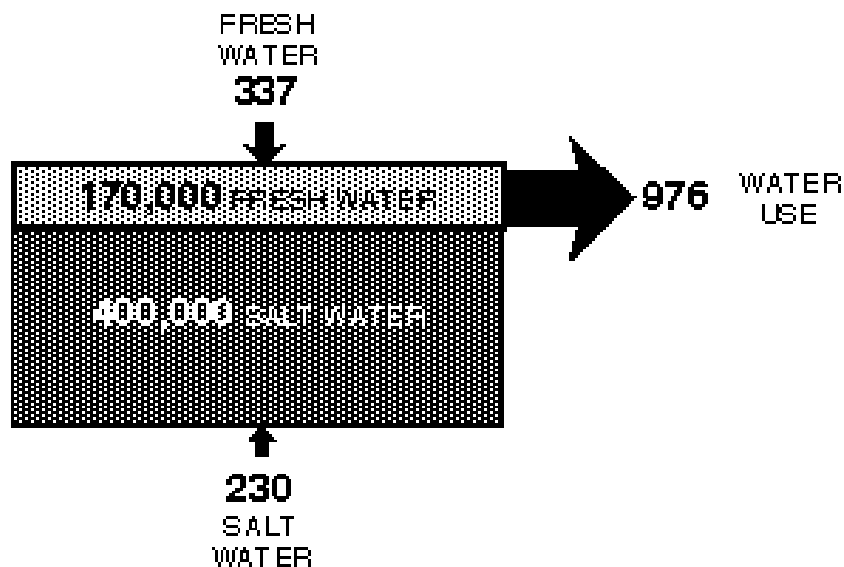
The aquifer generally contains 170,000 acre-feet of fresh water floating on 400,000 acre-feet of salt water. The fresh water portion varies in thickness from nearly 200 feet at the north end to only 20 feet at the south end. The fresh water is used at a rate of 976 acre-

feet per year. The fresh water volume is charged at an average rate of 337 acre-feet per year by the percolation of rain and snow melt water through the geological materials and soils overlying and surrounding the aquifer.

The salt water volume is charged at a rate of approximately 230 acre-feet per year by the continental groundwater regime. The salt water is not used.

The sustainable fresh water supply capacity of the Winkler Aquifer is considered to be equal to the average annual fresh water recharge of 337 acre-feet.

**AVERAGE ANNUAL
TOTAL WATER BUDGET
IN ACRE-FEET**

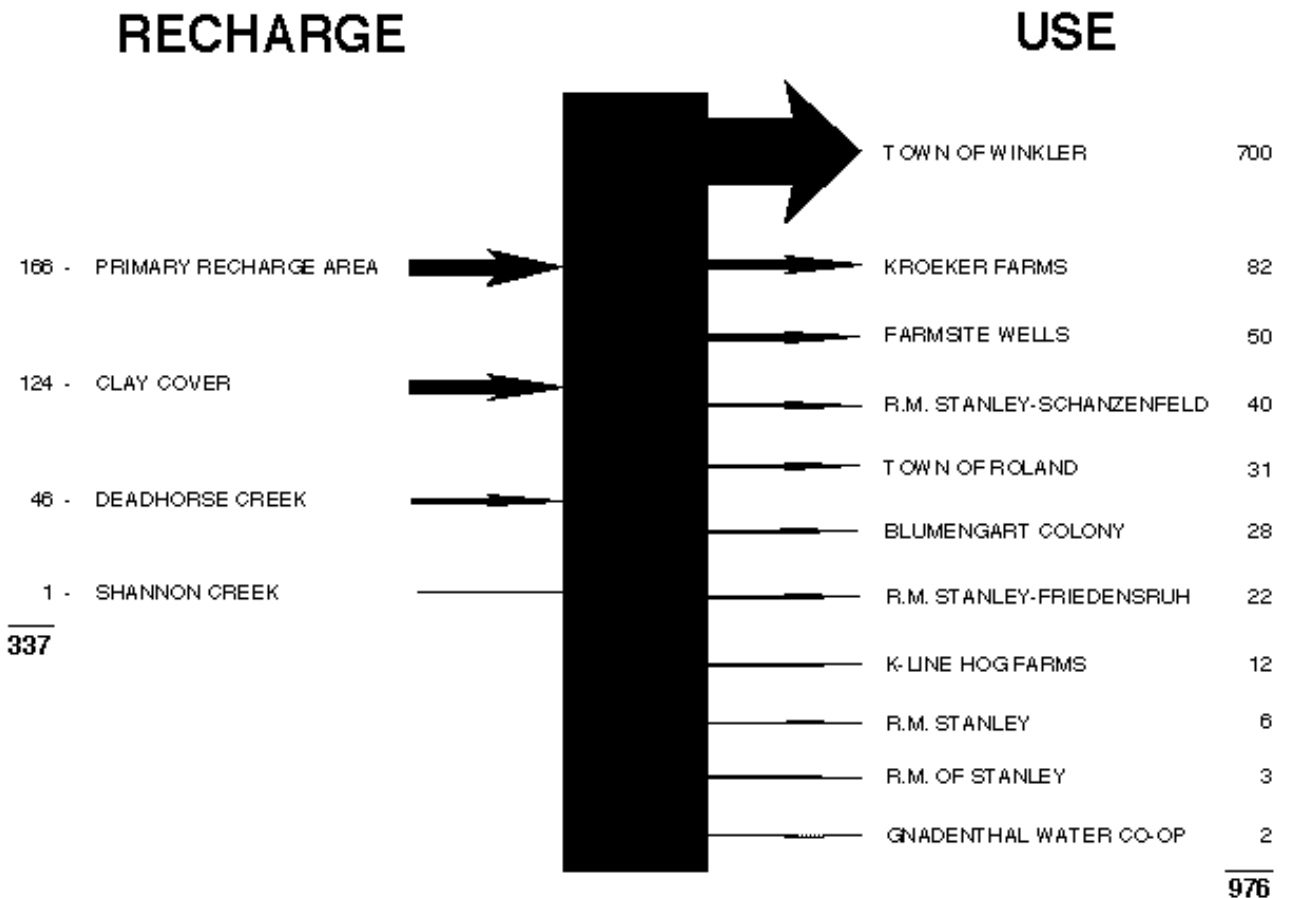


FRESH WATER BUDGET

The annual fresh water recharge of the aquifer varies with the weather and with land and water management practices in the recharge area. The average annual fresh water recharge is estimated to be 337 acre-feet. Approximately 50 percent of this recharge originates from the three square mile primary recharge area. About 15 percent comes from Deadhorse Creek and 35 percent from the clay cover over the rest of the aquifer.

Annual aquifer use, including licensed wells and farmsites, is estimated to be 976 acre-feet. If use continues to increase at the rate it has for the last 30 years, the fresh water volume of the Winkler Aquifer could be depleted by the end of the 21st century. In the southern portion of the aquifer, water quality problems could be experienced sooner.

**AVERAGE ANNUAL
FRESH WATER BUDGET
IN ACRE-FEET**



AQUIFER ISSUES

After studying the information available on the Winkler Aquifer, we believe the major issues can be summarized in the following two topic areas.

WATER USE

Water use issues arise from the fact that the aquifer is the sole developed source of drinking water for approximately 8,000 people and it is being overused. This jeopardizes its long term use. The long term sustainable yield of the aquifer is considered to be equal to the aquifer's average annual recharge. Annual withdrawals in excess of the average annual recharge are not sustainable.

Annual use from the Winkler Aquifer has been greater than the average annual recharge for the last twenty years. For the last ten years, annual use has been three times the long term average annual recharge. To balance aquifer use and recharge would require a reduction in use by more than half.

WATER QUALITY

As water quality decreases, treatment can become prohibitively expensive, even impossible. There is no formal protection plan for the Winkler Aquifer. The aquifer continues to be susceptible to contamination from polluted recharge water and from saline groundwater intrusion.

Non-point source pollution from agricultural chemicals or wastes and point sources of pollution, such as residential, municipal and industrial wastes or accidental spills of contaminants, may be carried to the aquifer in the recharge water.

High risk pollution areas exist mainly within the primary recharge area at the north end of the aquifer, where clay cover is thin and recharge is large.

Nitrates are common pollutants of aquifers located below intensive agricultural areas. High nitrate levels have been found in wells west of the aquifer and in some shallow wells located at the north end of the aquifer. There is no organized program of testing for nitrates or pesticides.

Gravel pits exist in the primary recharge area. The sand and gravel mined from these pits is being removed directly from the aquifer deposit. A contaminant spill here would enter the aquifer immediately. However, the Patterson Pit has operated for several decades without contaminating the aquifer. Due to the scarcity of aggregate in the region, this pit is a highly valuable source of sand and gravel.

Saline groundwater is another potential source of contamination. The dynamics of the regional salt water flow are not fully understood. Rapid or excessive pumping of wells in the overlying fresh water encourages intrusion of the salt water into the fresh water. Currently, well pumping rates are managed to avoid or minimize this effect.

OPTIONS CONSIDERED

A variety of options, summarized below, were considered to initiate action to deal with the issues. Some options were considered undesirable because they were impractical or uneconomical at this time. The desirable options were incorporated into the initiatives recommended in the following section of this booklet.

WATER QUANTITY

Maintain the Status Quo

Land and water use could continue in the current ad hoc fashion until the aquifer is depleted or until water quality is degraded to an unusable level.

This option was considered undesirable because the water supply was considered worth sustaining and protecting.

Reduce Water Use from the Aquifer

Annual water use could be reduced to balance with average annual recharge.

This option was considered desirable because, in conjunction with successful protection measures, it could ensure sustainability of the aquifer. Allocations could be reduced gradually over a transition period (possibly 10 years). Within a couple of years, if the PVWC plans proceed, the Town of Winkler could obtain 1,200 acre-feet of treated water per year via pipeline from the Red River.

Enhance Natural Recharge

Land and water management practices that increase the infiltration of good quality water within the primary recharge area could be encouraged. Such practices include low risk agriculture, shelterbelts, contour cultivation and contour dyking.

This option was considered desirable because it would increase aquifer recharge and improve quality. Over a period of 10 to 20 years, judicious management could increase the average annual recharge from 337 acre-feet to 450 acre-feet.

Encourage Water Conservation

Water conservation information could be extended throughout the user community to encourage wise water use.

This option was considered desirable because it could reduce the demand for water throughout the region and from the aquifer.

Future water conservation efforts, if required, could include the use of additional metering and pricing techniques.

WATER QUALITY PROTECTION

Direct Artificial Recharge

Water from Shannon and Deadhorse Creeks could be used to increase aquifer recharge. Water from Shannon Creek could be diverted directly into the aquifer by constructing a channel from the creek to a gravel pit.

This option was considered undesirable because it has the potential to degrade aquifer water quality. The limited existing data on Shannon and Deadhorse Creek water quality indicate the presence of pesticides and other pollutants. Manitoba Environment discourages activities that may degrade groundwater quality. Protection must be ensured for rural water users who use untreated water from the Winkler Aquifer.

Indirect Artificial Recharge

Water from Shannon and Deadhorse Creeks could be diverted into a storage facility, then tested and treated, if necessary, before being allowed to enter the aquifer.

This option was considered undesirable at present because of the uncertainty regarding water quality impacts but it was considered worthy of additional investigation.

Maintain the Status Quo

The current approach to aquifer protection could be relied upon.

This option was considered undesirable because the area's ongoing development has increased the aquifer pollution potential, and there has been no corresponding increase in aquifer protection measures. Allowing this situation to continue risks accidental pollution and loss of a water supply that could have been protected.

Implement an Aquifer Protection Plan

The risks to groundwater quality associated with various activities could be evaluated, and an aquifer protection plan that discourages high risk activities and encourages low risk activities could be developed and implemented.

This option was considered desirable because at present there is no formal, comprehensive protection plan for the Winkler Aquifer.

Establish a Dedicated Monitoring Plan

The current aquifer monitoring activities could be reviewed to coordinate and redesign them, focusing on the comprehensive protection of the Winkler Aquifer.

This option was considered desirable because maintaining accurate information on the aquifer is considered essential for judicious management and because the monitoring carried out by several agencies and groups is not coordinated.

Manage Pollution Risks in Gravel Pits

Activities carried out in gravel pits within the primary recharge area present a variety of risks to aquifer water quality. The risks associated with these activities could be assessed and, where required, action taken to manage them as part of an aquifer protection plan.

This option was considered desirable because of the wide variety of activities taking place. Some activities are already regulated, while others require assessment to determine what type of management is appropriate.

Current activities include viewing, fishing, target shooting, cattle ranging and feeding, aggregate mining and asphalt production.

Reduce Incoming Salt Water

The regional salt water flow to the aquifer could possibly be intercepted by installing a set of wells west of the aquifer.

This option was considered undesirable because of the costs and potential complications. Disposing of the salt water is a major concern. The salt water could be extracted from the interceptor wells and then disposed of, either by releasing it into the surface water system or by re-injecting it into the ground beyond the aquifer. This option could cost in excess of \$5 million.

PUBLIC INPUT

Public review of the draft Winkler Aquifer Management Plan was obtained during open houses and public meetings and from the draft plan survey.

In summary the respondents;

- expressed interest in the information provided and appreciation for the process being followed.
- considered the identification of the aquifer issues and the potential solution options to have been comprehensive. No new initiatives were suggested.
- suggested that a conservation district authority could be established to help carry out the recommended initiatives.
- supported the Water Use Plan regarding the need to balance long term withdrawal and recharge. Some people suggested the plan be more detailed including provisions to allow additional withdrawals when the aquifer water level is high and to reduce withdrawals when the aquifer water level is low.
- supported the Aquifer Protection Plan regarding the need to establish a comprehensive inventory of the existing water quality and the need to protect the aquifer. Some people expressed concern with the potential for overdoing regulation.
- supported the Recharge Enhancement Plan with respect to natural and artificial recharge. Some people advised against direct artificial recharge.
- supported the Monitoring Plan.
- supported the Education Plan. Some people suggested additional emphasis be placed on the aspects of water conservation.



RECOMMENDED INITIATIVES

Subsequent to our review of the aquifer information, issues and options, we believe action is needed to protect and manage the Winkler Aquifer as a long term source of water for the people in the area. Aquifer use needs to be reduced to prevent the fresh water volume from being depleted. Water quality degradation needs to be avoided.

While there is no single solution, we believe the following five initiatives would ensure the maximum sustainable use of the aquifer. The order in which they are presented does not imply relative importance.

WATER USE PLAN

A secure fresh water supply is essential for the existing and ongoing development of the region. The development of the Winkler Aquifer occurred before its capacity was fully understood. Current use rates are not sustainable. In order to achieve sustainability, use must balance long term recharge.

This initiative would seek to:

- establish an aquifer water use plan that would, over the next ten years, reduce the average annual use from 976 to 450 acre-feet. (The recharge enhancement plan would seek to increase annual recharge from 337 to 450 acre-feet)
- determine if this use rate is sustainable by continual monitoring and evaluation.
- recommend adjustments to the water use rate as necessary and as possible.

Reducing annual use to 450 acre-feet would require a reduction of use by 526 acre-feet. It is hoped this reduction could be arranged with the two largest water users - the Town of Winkler and Kroeker Farms.

The Town of Winkler would be encouraged to reduce its annual use of aquifer water from the current 700 to 256 acre-feet. Winkler could do this by purchasing water from the Pembina Valley Water Cooperative, which is expected to have water available by 1998.

Kroeker Farms would be encouraged to reduce its annual use of the aquifer from 82 acre-feet to zero. This could be accomplished by allocating Kroeker Farms a comparable volume of water from Shannon Creek.



Once average annual aquifer use is balanced with average annual recharge, the aquifer water supply will be sustainable. Consideration could then be given to managing the aquifer more intensively by allowing increased use during periods of increased recharge and by restricting use during periods of reduced recharge.



AQUIFER PROTECTION PLAN

Once degraded, aquifer water quality may be practically impossible to restore. The natural surface water purifying actions of sunlight and microbes do not function within the aquifer. Protection activities should be concentrated in the three square mile primary recharge area.



This initiative would seek to:

- inventory existing water quality throughout the Winkler Aquifer, including parameters for nitrates and pesticides.
- determine the factors that influence aquifer water quality.
- establish and implement an aquifer protection plan to prevent degradation of the existing aquifer water quality.
- encourage, by incentives, land and water management practices within the primary recharge area that enhance aquifer water quality.
- discourage, by legislation and enforcement, land and water management practices within the primary recharge area that degrade aquifer water quality.



RECHARGE ENHANCEMENT PLAN

The quantity of the water in the Winkler Aquifer is to a large degree determined by the water management practised in the primary recharge area. It is estimated that employing judicious land and water management techniques here could improve the average annual recharge and therefore the

aquifer's sustainable yield from 337 to 450 acre-feet per year.

This initiative would seek to:

- identify the main factors that influence infiltration and recharge within the primary recharge area.
- encourage, by incentives, land and water management practices within the primary recharge area that maximize the infiltration of good quality water.
- investigate the potential for artificial recharge of the Winkler Aquifer by using water from Shannon and Deadhorse Creeks.



Countour Dyking reduces runoff



Cultivating down slope increases runoff

MONITORING PLAN

Accurate and timely scientific knowledge will be an essential component of a successful aquifer management plan. Data must be diligently collected, collated and interpreted to acquire this knowledge. Currently, the Town of Winkler and several government agencies monitor various aspects of the aquifer in accordance with their interests and mandates.



This initiative would seek to:

- maintain and enhance monitoring activities to support judicious long term development and protection of the aquifer.
- integrate the various monitoring activities to ensure priority information is collected and evaluated.
- use the information collected to evaluate the plans for water use, aquifer protection, recharge enhancement and aquifer education.

AQUIFER EDUCATION PLAN

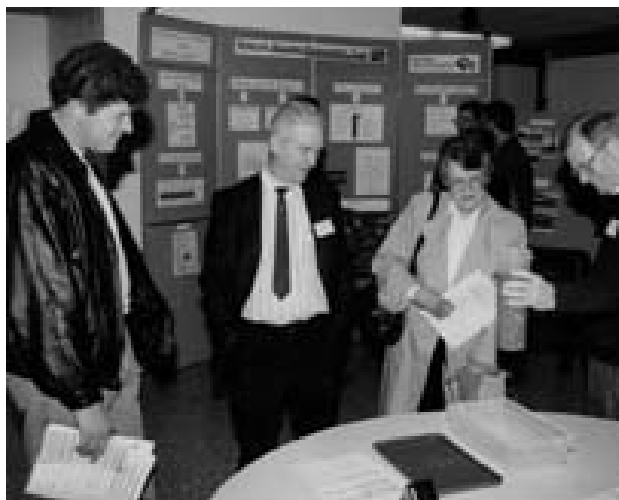
The potential long term success of this management plan depends on the understanding and cooperation of a diverse group of people. It is believed that a better informed group makes better decisions. Only common understanding will engender the cooperation needed to formulate, implement and maintain a successful long term stewardship plan for the Winkler Aquifer.

There is a lot to be learned about the Winkler Aquifer. Additional study is required to achieve a better understanding. Extension education is required to make knowledge gained available to all area residents.

The existing data provide a basis to initiate research funding submissions to obtain additional information and to develop educational material.

This initiative would seek to:

- encourage study of the Winkler Aquifer and its fresh water regime.
- encourage water use efficiency and the adoption of the best available technology for all water uses from the aquifer.
- extend aquifer knowledge to the entire user, owner and manager community



PLAN IMPLEMENTATION

Many ideas and opportunities have been identified through the Round Table process used to develop the Winkler Aquifer Management Plan (WAMP). A strategy is needed to effectively move from ideas to action. Plan implementation is a dynamic process requiring continual monitoring and evaluation. This section provides some direction for implementing the WAMP.

Implementation is expected to occur at two levels: 1) the organizational level and 2) the project level. The objectives and actions itemized below represent the first level - an organizational strategy. This is an outline of the immediate requirements for implementing the WAMP. The second level, the project level, is expected to result from implementation of the organizational strategy and will be determined, in large part, by initiative action groups.

ORGANIZATIONAL STRATEGY

The goal of the organizational strategy is to establish a management advisory board to implement, maintain, review and update the plan.

Objective 1: achieve sufficient organizational capacity to enable plan implementation.

Objective 2: ensure adequate and fair representation of stakeholder and government interests.

Action: establish a Winkler Aquifer Management Advisory Board.

- Since the Round Table will be dissolved the first action needed in the WAMP is the establishment of a Winkler Aquifer Management Advisory Board. This Board should serve as the central organizing force for all WAMP development activities. The Board should provide the necessary links among the residents of the region, local and provincial government, regional development organizations and other groups.

- The Board should comprise a balance of representatives from various levels of government, local organizations and the private sector. This will help ensure that lines of communication are open. This will also serve to focus efforts and help ensure that input from all stakeholders produces the desired results.

Objective 3: gain support of public, private and government sectors with regard to the general direction of the WAMP.

Action: establish consensus and involvement among all sectors.

- Members of the Management Advisory Board should strive to ensure that the people they represent actively endorse the Winkler Aquifer Management Plan.

Objective 4: maintain activities (initiatives) at a manageable level.

Action: establish priorities.

- The Round Table process was instrumental in identifying many ideas and opportunities. It is unrealistic to realize all of them immediately. It is important, therefore, to be selective in choosing activities to be pursued in the short term. The Winkler Aquifer Management Advisory Board should prioritize initiatives and action items.

Action: establish initiative action groups.

- Once priorities are identified, the Board should assume responsibility for identifying and mobilizing individuals and organizations with the appropriate interests, skills and abilities to undertake and implement strategies for particular initiatives.

Objective 5: develop an effective means of linking actions and resources

Action: establish and maintain effective working relationships.

- As driving force of the WAMP, the Board must facilitate effective working relationships among all parties involved. The Board should assist with identifying appropriate available resources for each action group to fulfill its responsibilities.

Objective 6: recommend aquifer management changes.

Action: monitor and evaluate aquifer status and management plan progress.

- To accomplish their original objectives the Plan's initiatives may, through time and changing circumstances, need adjustments by the Board.
- When initiatives require considerable change or when initiatives with different objectives are required or desired the Board should seek public input.

The Board's responsibilities are greatest at the start of activities. As the action groups gain momentum and grow more comfortable with their purpose, the role of the Board is expected to change. It is expected the Board will be able to respond to the circumstances that prevail.

WATER MEASUREMENT

Various aspects of water management involve various water measurement units. The preference for certain units often arises because of the large differences in volume being considered over different time frames. A small continuous flow of water per minute represents a large volume of water over a period of months or years.

For example, many Winkler town wells are pumped at a rate of 50 imperial gallons per minute. At this rate, if operated continuously for one year, an individual pump would move a total volume of 26,300,000 gallons of water. Some find this large volume easier to understand when considered as 97.2 acre-feet.

Some conversion factors are listed below to facilitate conversion of water volumes to different units for individual working preference.

1 cubic foot = 6.23 imperial gallons
1 acre-foot = 43,560 cubic feet
1 acre-foot = 271,379 imperial gallons
1 imperial gallon of water = 10.02 pounds

1 cubic metre = 1,000 litres
1 cubic decametre = 1,000 cubic metres
1 cubic decametre = 1,000,000 litres

1 imperial gallon = 4.55 litres
1 acre-foot = 1.23 cubic decametres

The current annual withdrawal from the Winkler Aquifer is 976 acre-feet. This volume is equal to an average daily withdrawal of 2.7 acre-feet or 733,000 gallons (90 gallons per capita). The Winkler swimming pool holds approximately 250,000 gallons.

A typical highway tanker truck can haul 105,000 pounds or 10,500 gallons of water. To haul the annual withdrawal from the Winkler Aquifer would require 70 tanker truckloads of water each day.

INITIATIVES SUMMARY

WATER USE PLAN

This initiative will seek to protect the long term water supply capacity of the aquifer by controlling average annual aquifer use and balancing it with average annual recharge.

AQUIFER PROTECTION PLAN

This initiative will seek to assess the quality of the water in the aquifer and then to protect it by encouraging activities that enhance water quality and by discouraging activities that degrade it.

RECHARGE ENHANCEMENT PLAN

This initiative will seek to maximize aquifer recharge with good quality water by encouraging beneficial land and water management practices and by investigating the potential to use streamflow.

MONITORING PLAN

This initiative will seek to maintain a current and comprehensive scientific database on the aquifer by collecting, compiling and evaluating data.

EDUCATION PLAN

This initiative will seek to study the Winkler aquifer water supply and to extend the knowledge gained to the area residents.