City of Winkler Water Supply and Water Treatment Project

WORKING TOWARDS WATER SOLUTIONS

PHASE 2: PROJECT EVALUATION AND PREFERRED PROJECTS
• Winkler currently has two sources of water: the Pembina Valley Water Co-op (35%) and the Winkler Aquifer (65%).
• Water from the Winkler Aquifer is drawn from wells located north west of Winkler.
• PVWC water is drawn from the Red River and Stephenfield Lake, treated at Morris, Letellier, and Stephenfield and piped throughout the region.
• This drawing illustrates a simplified cross-section of the water well supply for Winkler.
• The Winkler Aquifer is partly fresh and partly brackish (salty).
• There is a limited supply of both fresh and saline water; farming uses have already been asked not to use the Winkler Aquifer.
• There are two licenses: one for the fresh water supply and one for the brackish.
• These combined licenses may not be sufficient for the coming decades.
• The Winkler Aquifer needs to be carefully managed and sustained.
• This slide illustrates how the Winkler Aquifer looked and ‘operated’ in 1987.
• The yellow line divides the fresh water from the brackish water.
- This slide illustrates the Winkler Aquifer in 2010.
- The volume of fresh water was smaller than it was in 1987.
• This slide illustrates the use of water and "production" of wastewater.
• There are three sources of wastewater that are overwhelming the lagoon.
• The proposed new wastewater treatment facility will help address these issues.
1. The freshwater recharge area for the aquifer is relatively small.

2. New brackish wells could be more efficient in another location (ie. South of Winkler).

3. There is excess wastewater coming from city households, sump pits, storm water, and water treatment process.

4. The water table south of Winkler is very high and causes trouble for city infrastructure and deep foundations.
• Many people are likely to be either interested or affected by a change to the water supply or the wastewater system.
  – Nearby municipalities including Thompson, Roland, Stanley, Rhineland, and Morden
  – City of Winkler
  – Landowners on or near the Winkler Aquifer (with or without a well)
  – Businesses and agricultural operations
  – Ratepayers
  – Surrounding Water Co-ops (Border Valley PVWC, etc.)
  – Water regulators
  – Environmental advocates
  – Others
Various stakeholder meetings were conducted with the following organizations/individuals:
- RM of Roland
- RM of Stanley
- RM of Rhineland
- RM of Thompson
- City of Winkler
- City of Morden
- Winkler Aquifer Management Board
- Pembina Valley Water Coop
- Provincial Regulators
- Bob Giesbrecht (BG Gravel Ltd.)

Six project meeting sessions were held over a two-day period (November 14 and 15, 2017) for anyone with interest in the project:
- The meetings were advertised in The Winkler Times and The Voice
- 29 participants attended the meetings
- 17 respondents provided feedback on the project
• 94% (16) respondents understood the need for the project, 6% (1) somewhat understood the need:
  – Future growth and development of the City Winkler

• 100% (17) respondents understood the need to manage the aquifer:
  – Future needs
  – Importance of good quality water

• The RM Councils and administration understand the reason for looking at solutions.

• Other comments included:
  – Collecting runoff in a reservoir is a good idea
  – Expanding the Patterson Pit area and pumping runoff into that area is a good idea
  – Protecting existing wells is a concern
  – Keeping current water quality and quantity is essential
  – Electro-dialysis may reduce concentrate/reject water at the water treatment plant
• This chart outlines the project process.
• The goal is for all parties to understand the issues and understand possible solutions, and equip council to make an informed decision.
• The chart on the next slide describes all of the water supply projects that the City of Winkler has considered.

• The **GREEN** cells indicate that an item is better in one project than another; **YELLOW** cells mean an item is about the same as the item in another project, and **RED** means an item is less desirable when compared to other projects.

• The evaluation suggests that the City of Winkler would first pursue Projects 1 to 4.

• Projects 5 to 7 may be pursued at a later time.

• Projects 8 to 10 are not likely to be pursued in the medium term, but could be for long term planning.
<table>
<thead>
<tr>
<th>PRIORITY ORDER:</th>
<th>PROJECT 1</th>
<th>PROJECT 2</th>
<th>PROJECT 3</th>
<th>PROJECT 4</th>
<th>PROJECT 5</th>
<th>PROJECT 6</th>
<th>PROJECT 7</th>
<th>PROJECT 8</th>
<th>PROJECT 9</th>
<th>PROJECT 10</th>
</tr>
</thead>
<tbody>
<tr>
<td>PROJECTS</td>
<td>Continue Treatment Plant Optimization and Water Conservation</td>
<td>Install new brackish wells in the south part of Winkler</td>
<td>Initiate a shelterbelt planning program in the primary aquifer recharge area</td>
<td>Build weirs before Project 2 on the Shannon Creek and/or Deadhorse Creek to increase recharge</td>
<td>Conservation and Utility Rate Pricing</td>
<td>Redirect treated wastewater upstream in Deadhorse Creek</td>
<td>Infiltration Gallery (from storage)</td>
<td>Purchase more water from PVWC</td>
<td>Direct Injection of a water supply into the Aquifer</td>
<td>Draw more water from other existing aquifers (e.g. Miami) or the surface sources (e.g. Red River, Tobacco Creek)</td>
</tr>
</tbody>
</table>

**Description**

- Increased water recovery from RO plant system, and treatment system optimization to reduce wastewater contributions.
- New brackish wells would be installed in an area where the Winkler Aquifer is saline. The new wells would capitalize on saline water and would also reduce the water table in the immediate vicinity to reduce basement water issues.
- Additional tree plantings in the areas immediately above the Winkler Aquifer would be planted so that more snow is available to melt and then percolate into the Winkler Aquifer to enhance recharge.
- New weirs would be built on the creek in the areas immediately above the Winkler Aquifer so that more water is available for a longer period to percolate into the Winkler Aquifer to enhance recharge.
- Provide tiered water use budgets per household to encourage conservation; high water users fund expansion projects.
- The treated water (effluent) from the new wastewater treatment plant would be piped upstream into the Deadhorse Creek, so that more water is available to percolate into the Winkler Aquifer to enhance recharge.
- Construct gravel lined reservoir in order to promote recharge in the area of high recharge.
- More water would be purchased from the existing PVWC supply (Red River treated water)
- Injection a water supply directly into the aquifer.
- Existing fresh water would be drawn from other nearby sources including the Miami Aquifer and the Red River.

**Potential Effect on People**

- None
- Existing wells could be affected, though this risk could be mitigated by careful site selection and interventions with existing wells.
- Potential benefit due to aesthetics. Landowners would be compensated through voluntary agreements as required.
- Certain lands may be more susceptible to flooding, though this risk could be mitigated by careful selection of weir location and height. Potential to reduce commercially available supply downstream.
- Concern for high water user households; could adjust levels based on number of people per household.
- None. Would not be required to pump upstream with high creek flows.
- None likely
- Would reduce the amount of water available to other existing PVWC members due to limited supply.
- None
- If access to the limited water sources were allowed, it would reduce the amount of water available to others.

**Potential Effect on Environment**

- Low
- The brackish wells would draw saline water from the saline part of the aquifer, ‘making room’ for more freshwater.
- Positive
- Trees are generally understood to be a benefit to the environment.
- Low
- The flooded areas would be mainly limited to the existing creek environment.
- Low
- Promotes water conservation provides opportunity for reduced water bill by staying at budgeted water volume.
- Low
- Treated effluent is as clean or cleaner than existing Creek water. Quality approved by the appropriate authorities.
- Low
- Increases ability for natural recharge from creek run-off and peak flow capture.
- Low
- Water quality must be monitored over time; need to regulate nitrogen.
- Low
- Moderate
- Water quality must be monitored over time; need to regulate nitrogen.
- Low
- Proven elsewhere.
- Poor
- Other aquifers are allocated (unavailable).

**Technical Feasibility/Certainty/Effectiveness**

- Good
- Feasibility testing has been completed for an RO concentrator, and testing is currently underway for increased recovery rate.
- Good
- The use of brackish wells is accepted and proven technology.
- Moderate
- Though beneficial, the precise amount of additional recharge will be difficult to measure and would depend on winter precipitation each season.
- Moderate
- Though beneficial, the precise amount of additional recharge will be difficult to measure.
- Good to Moderate
- Has been implemented in other jurisdictions (none in Manitoba to date).
- Good
- Increased recharge is currently proceeding in the City of Morden lagoon release dates.
- Good
- To Moderate
- Technique is proven, however precise location would require testing to identify appropriately.
- Poor
- PVWC members must share a limited supply. Relying heavily on purchased water is not a preferred project.
- Low
- Proven elsewhere.
- Poor
- Other aquifers are allocated (unavailable).

**Cost (Class 4)**

- Low (< $0.5 M)
- Low capital expense, however increased O&M for the RO concentrator would be required.
- Expensive (~ $1.7 M)
- The project would involve testing, well design, well construction, pipeline and licensing.
- Expensive (~ $0.5 M)
- Weirs are generally inexpensive and long-lasting intervention.
- Low
- Complete as part of scheduled rate review.
- Expensive (~ $2 M)
- Pumphouse, 9m forcemain, and easements may be required.
- Moderate (~ $1.1 M)
- Though costly, this technique is comparable to costs associated with lagoon expansion. Carried out in conjunction with Project 1.
- Expensive
- Purchased water is at least 50% more expensive than city developed supply.
- Expensive (~$1-3 M)
- Depending on precedent factors.
- Expensive
- Source dependent.

**Potential concerns of the Regulator**

- Low
- So long as the water is treated and can be monitored for quality.
- Low
- Concerns are unlikely.
- Low
- Concerns are unlikely.
- Low
- Certain due diligence is required to ensure nil effect.
- Moderate/High
- Certain due diligence is required to ensure nil effect.
- Moderate/High
- Water must be equal or better in all categories.
- Moderate
- Certain due diligence is required to ensure nil effect.
- Low
- Concerns are unlikely.
- Low
- High
- Water quality must be monitored over time; need to regularly reduce nitrogen.
- Moderate
- Certain due diligence is required to ensure nil effect.

**Potential Community Concerns**

- Low
- Public not likely to be concerned.
- Moderate
- Local well owners and homeowners may be concerned.
- Low
- Likely seen as a benefit. No plantings would be undertaken without landowner agreement where required.
- Moderate
- Local landowners are likely to be concerned about increased potential for flooding or loss of land.
- Moderate
- Public may be concerned with how this will affect their water use.
- Moderate
- Public concerns typically focus on whether treated wastewater is ‘actually clean’. Public education is required.
- Moderate
- Some members of the public and local landowners may be concerned about potential effect on the environment and on existing water supply.
- Low
- Public not likely to be concerned.
- High
- Some members of the public and local landowners may be concerned about potential effect on the environment and on existing water supply.
- Moderate
- Public may be concerned.

**Overall**

- YES (Already underway)
- YES (Subject to Council decision on cost)
- YES (Low impact, funding is available)
- MAYBE (Confirm Feasibility and Determine Location Projects)
- MAYBE (Subject to Council decision on cost and following WWTF construction)
- YES (High cost-benefit)
- NOT LIKELY (May not be available and is expensive)
- NOT LIKELY (Consider in the future)
- NOT LIKELY (High unknowns and expense)
This chart shows the projects that the City of Winkler would like to pursue as a first phase to improve its water supply.

<table>
<thead>
<tr>
<th>PROJECTS</th>
<th>PROJECT 1</th>
<th>PROJECT 2</th>
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<th>PROJECT 4</th>
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<td>Build weirs on the Shannon Creek and/or Deadhorse Creek to increase recharge</td>
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<td>Description</td>
<td>Increased water recovery from RO plant system, and treatment system optimization to reduce waste water contributions.</td>
<td>New brackish wells would be installed in an area where the Winkler Aquifer is saline. The new wells would capitalize on saline water and would also reduce the water table in the immediate vicinity to reduce basement water issues.</td>
<td>Additional tree plantings in the areas immediately above the Winkler Aquifer would be planted so that more snow is available to melt and then percolate into the Winkler Aquifer to enhance recharge.</td>
<td>New weirs would be built on the creek in the areas immediately above the Winkler Aquifer so that more water is available for a longer period to percolate into the Winkler Aquifer to enhance recharge.</td>
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<td>Potential Effect on People</td>
<td>None</td>
<td>Existing wells could be affected, though this risk could be mitigated by careful site selection and interventions with existing wells.</td>
<td>Potential benefit due to aesthetics. Landowners would be compensated through voluntary agreements as required.</td>
<td>Certain lands may be more susceptible to flooding, though this risk could be mitigated by careful selection of weir location and height. Potential to reduce commercially available supply downstream.</td>
</tr>
<tr>
<td>Potential Effect on Environment</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>Technical Feasibility/ Certainty/ Effectiveness</td>
<td>Good</td>
<td>Good</td>
<td>Moderate</td>
<td>Moderate</td>
</tr>
<tr>
<td>Cost</td>
<td>Low (&lt; $0.5M)</td>
<td>Expensive (~ $1.7M)</td>
<td>Low (Scalable)</td>
<td>Low (~ $0.5M)</td>
</tr>
<tr>
<td>Potential concerns of the Regulator</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>Potential Community Concerns</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
</tbody>
</table>
| | Public not likely to be concerned. | Local well owners and homeowners may be concerned. | Local landowners are likely to be concerned about increased potential for flooding or loss of land.
• This slide illustrates the areas nearby each project component.

**PROJECT 1** Continue treatment plant optimization and water conservation

**PROJECT 2** Install new brackish wells in the south part of Winkler

**PROJECT 3** Initiate a shelterbelt planning program in the primary aquifer recharge area

**PROJECT 4** Build Weirs on the Shannon Creek and/or Deadhorse Creek to enhance recharge
TECHNICAL WORK TO BE UNDERTAKEN

PROJECT 1 – Continue Treatment Plant Optimization and Water Conservation
   1. Continued operational and efficiency review to maximize treatment recovery rate
   2. Treatment Plant – Concentrator Pilot Study review
   3. Treatment Plant – wastewater intervention

PROJECT 2 – New R/O Well Feasibility (Level and Quality Monitoring)
   4. Develop technical plan
   5. Develop regulatory approval approach
   6. Conduct a well inventory in the immediate vicinity of a potential well site

PROJECT 4, 6, 7, 9 – ASR Storage and Recovery
   7. Assess hydrogeology and technical aspects of a proposed ASR plan
   8. Evaluation of the Overall Aquifer Recharge Potential
      a) Map the extent of the recharge area using current level of aquifer extents
      b) Establish two field investigation sites, collect data and report data

PROJECT 4 – Build Weirs on Shannon Creek and Deadhorse Creek to Increase Recharge
   9. Determine most beneficial location for infiltration
   10. Hydraulic analysis of proposed sites for weir effects
This chart shows the proposed set of wastewater solutions that have been evaluated.

<table>
<thead>
<tr>
<th>PROJEC'TS</th>
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</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Further treatment of WTP concentrate stream</td>
<td>Return water treatment concentrate to fractures deep in the bedrock</td>
<td>Construct Evaporator to further treat concentrate for zero liquid discharge</td>
<td>Haul concentrate to Miller Environmental for disposal</td>
</tr>
<tr>
<td>Description</td>
<td>This is a wastewater &amp; Water Supply intervention (versus a water supply intervention only) – leftover highly saline water from RO water treatment would be further concentrated to achieve a higher recovery rate. Increase from 83% to 90-95%.</td>
<td>This is a wastewater intervention (versus a water supply intervention) – leftover highly saline water from RO water treatment would be returned to the ground in a highly saline part of the aquifer.</td>
<td>This is a wastewater intervention (versus a water supply intervention) – leftover highly saline water from RO Concentrator would be further treated to eliminate concentrate stream to sewer system.</td>
<td>This is a wastewater intervention (versus a water supply intervention) – leftover highly saline water from RO Concentrator would be hauled to Miller Environmental for disposal.</td>
</tr>
<tr>
<td>Potential Effect on People</td>
<td>None likely</td>
<td>None likely</td>
<td>None likely</td>
<td>None likely</td>
</tr>
<tr>
<td>Potential Effect on Environment</td>
<td>Low/Moderate Concentrate would continue to discharge to sewer system. Mass balance of total raw water would be maintained. May result in added wastewater treatment requirements.</td>
<td>Low/Moderate If feasible, the saline concentrate would be lower salinity than the repository site.</td>
<td>Low/moderate Makes beneficial use of all available water allocation. By product of process would result in salt and potential contaminants. Other facilities have used as road salt applications.</td>
<td>Low Treatment would fall under Miller Environmental's Responsibility.</td>
</tr>
<tr>
<td>Technical Feasibility/Certainty/Effectiveness</td>
<td>High This technique is proven and is used in many other applications.</td>
<td>Moderate This technique is proven, however precise injection sites would require testing to identify appropriateness.</td>
<td>Moderate This technique is proven in the industrial sector. Limited applications in Australia &amp; US have applied technology to municipal water supply.</td>
<td>High Miller Environmental would be licensed to dispose of required concentrate.</td>
</tr>
<tr>
<td>Cost</td>
<td>Low (&lt; $0.5M) Feasibility study has been completed, and recommended configuration complete. Confirmation and analysis of treatment effectiveness should be confirmed.</td>
<td>Moderate (~ $1.15M) &amp; Moderate O&amp;M Though costly, this technique is comparable to costs associated with lagoon expansion.</td>
<td>High capital cost ($4M) + O&amp;M Though costly, this technique is comparable to costs associated with lagoon expansion.</td>
<td>High operating expense</td>
</tr>
<tr>
<td>Potential concerns of the Regulator</td>
<td>Moderate Certain due diligence is required to ensure nil effect on wastewater system.</td>
<td>Moderate Certain due diligence is required to ensure nil effect.</td>
<td>Moderate Certain due diligence is required to ensure nil effect.</td>
<td>Low/Moderate Would require review of Miller Environmental's ability to received required volume.</td>
</tr>
<tr>
<td>Potential Community Concerns</td>
<td>Low No impact on day to day activities of community.</td>
<td>Higher Some members of the public and local landowners may be concerned about potential effect on the environment and on existing water supply.</td>
<td>Low No impact on day to day activities of community.</td>
<td>Low No impact on day to day activities of community.</td>
</tr>
<tr>
<td>Overall</td>
<td>Yes</td>
<td>Yes, may be required to reduce WW-TDS levels under new license (Requires public education and further due diligence)</td>
<td>Not Likely</td>
<td>Not Likely</td>
</tr>
</tbody>
</table>
Water Supply Project 2 involves testing to make sure new saline wells will not impact other wells in the area.
Two pump test sites have been identified.
An inventory of existing wells in the area will be assembled so that any effects of the pump test can be addressed.
• This map illustrates the network of wells in the vicinity of the similar pump test project in the RM of Springfield.
• This graphic shows the type of wells used in the RM of Springfield study as well as a typical drawdown cone resulting from the pump test.

• The graphic demonstrated that there was virtually no drawdown at about a mile away from the pump test site; the drawdown within one mile was considered normal and acceptable for this site.
The following are some common questions/inquiries from past consultation meetings:

1. Will there be safeguards put in place to prevent the aquifer from being drawn down too much? If yes, what are they?
   This project will not proceed if there are concerns that cannot be mitigated.

2. What guarantees are there that this project would not cause local residents to have water supply issues?
   An extensive analysis is being undertaken that includes water sampling and other scientific studies. If there are water quantity or quality issues, the project will not go ahead.

3. Will there be maximum limits on what the City of Winkler will be able to draw from the aquifer?
   Limits need to be established to reflect the capacity of the aquifer to provide the water. The Province of Manitoba will not allow any groundwater extraction that is not sustainable.

4. If water levels drop and local residents need to drill new or deeper wells, who will pay for this?
   Even though the chances of an issue arising would be extremely low (to be confirmed by the studies), the City of Winkler will be responsible for resolving any such issues. This will be a condition in any Water Rights License. A groundwater interference program would be put in place to deal with the possibility of water supply problems.
• Wastewater Project 1 involves further treatment of the Winkler Water Treatment Plant concentrate stream.
• Wastewater Project 2 involves testing to make sure a new saline concentrate return well will be sustainable.
This slide illustrates the location of the proposed water concentrate return pump test sites.
NEXT STEPS

Next steps include:

1. Continued meetings with stakeholders
2. Prepare well inventory
3. Conduct testing for the proposed sites
4. Meet with Winkler City Council to confirm an implementation plan

CONTACT INFORMATION

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Email: stoews@cityofwinkler.ca

PROJECT WEBSITE

These display boards are available online at landmarkplanning.ca
• This chart illustrates current and anticipated Winkler water conservation practices.
• Winkler’s use of water is relatively low compared to other areas.

## POTENTIAL SOLUTIONS

### Water Conservation

<table>
<thead>
<tr>
<th>AREA</th>
<th>TOTAL WATER USE (L/head/day)</th>
<th>RESIDENTIAL WATER USE (L/head/day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canada (2015)&lt;sup&gt;2&lt;/sup&gt;</td>
<td>447</td>
<td>235</td>
</tr>
<tr>
<td>Manitoba (2015)&lt;sup&gt;2&lt;/sup&gt;</td>
<td>306</td>
<td>174</td>
</tr>
<tr>
<td>Winnipeg (2016)&lt;sup&gt;1&lt;/sup&gt;</td>
<td>221</td>
<td>152 (68.9% of total revenue)</td>
</tr>
<tr>
<td>Winkler (2017)</td>
<td>215</td>
<td>139</td>
</tr>
<tr>
<td>Winkler (2018 est.)</td>
<td>213</td>
<td>n/a</td>
</tr>
</tbody>
</table>

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<sup>1</sup> [www.winnipeg.ca/waterandwaste/water/conservation/conservationreport.stm](http://www.winnipeg.ca/waterandwaste/water/conservation/conservationreport.stm)

<sup>2</sup> [www.statcan.gc.ca/pub/16-403-x/2013001/n017-eng.htm](http://www.statcan.gc.ca/pub/16-403-x/2013001/n017-eng.htm)
There are ways to increase the supply of water to the aquifer. Techniques like these have been used successfully elsewhere:

- For example, aquifer storage and recovery plans have been successfully functioning for many years in Florida, USA. In 'wet' years they treat river water or other surface water then store it in the aquifer for 'dry' times.

- In Perth, Australia, they use the discharge water from their wastewater plant (which is fresh, drinkable water) and inject it 'upstream' of the water supply wells.

- Another approach would be to increase the size and enhance the performance of the recharge area.
• One solution, that has been used elsewhere in Manitoba, is to re-inject saline water into saline aquifers.

• Examples include:
  – MB Hydro (late 1970s)
  – Chemtrade Logistics Inc. (since 1967)
  – Skownan, Manitoba (last summer 2016)
  – Elm Creek, Manitoba (1970s)
This slide illustrates the preferred set of solutions.