
# ASSOCIATION OF MANITOBA MUNICIPALITIES
# MANITOBA MUNICIPAL ENERGY AND WATER EFFICIENCY PROJECT
# R.M. OF STANLEY
# FINAL REPORT
# MAY 2006

KGS GROUP

KONTZAMANIS ▪ GRAUMANN ▪ SMITH ▪ MACMILLAN INC.
*CONSULTING ENGINEERS & PROJECT MANAGERS*

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May 30, 2006

File No. 05-1285-01-1000.9

Association of Manitoba Municipalities
1910 Saskatchewan Avenue West
Portage la Prairie, Manitoba
R1N 0P1

ATTENTION: Mr. Tyler MacAfee

RE: Municipal Energy and Water
Efficiency Study for the R.M. of Stanley – Final Report

Dear Mr. MacAfee:

Enclosed is the Final Report of the Manitoba Municipal Energy and Water Efficiency Study for the R.M. of Stanley with all comments incorporated.

Included with this submission are 10 hard copies (3 in colour, 7 in black and white) of the report and 10 copies on compact disk in PDF format with searchable text functionality, as requested in the "Request for Proposal". The PDF file consists of the entire report, including the Executive Summary, Sections 1 to 6, and Appendix A to G.

We thank you for giving us the opportunity to work on this project and look forward to continuing this work with the other Municipalities.

Yours Truly,

for R. B. Bodnar, P.Eng.
Senior Mechanical Engineer/ Department Head

RBB/mg


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# EXECUTIVE SUMMARY

The objective of this study was to determine energy and water efficiency opportunities that could enable the R.M. of Stanley to reduce operating costs, conserve resources, and reduce greenhouse gas emissions.

An energy and water efficiency audit was conducted on two buildings in the R.M. of Stanley. Throughout the course of this audit, water and energy efficiency opportunities were analyzed to determine each building's potential for energy and water savings. The saving opportunities were separated into the following categories:

- Lighting – Replacing the interior and/or exterior lighting with more energy efficient lights and fixtures.
- Envelope – This involves measures that would reduce the heat loss through the building's windows, doors, walls, and roof.
- Motors- Replacing low efficiency motors with higher efficiency motors.
- HVAC- Improving current heating, ventilating, and air conditioning systems.
- Water – Replacing high flow water fixtures with water efficient fixtures.

Table E1 shows the energy and water consumption for both buildings for the period September, 2004 to September, 2005. This year was chosen as it represents a typical year for energy and water consumption. In addition, the most recent year was selected since the conditions of the buildings throughout this time most closely resemble the buildings' current conditions. The buildings included in this audit used natural gas and electricity as their source of energy. The "Energy Density" column in this table is the total energy (electricity and natural gas) consumed in the building divided by the area of the building. This is useful in comparing the energy consumption among the two buildings. The pie chart displays the percentage of total energy density for both buildings.

Tables E2 (a) and (b) show overall energy and water saving opportunities for the two buildings in the R.M. of Stanley. These tables also include approximate product and installation prices for each measure both with and without incentives (refer to Appendix D for a list of Manitoba Hydro incentives) and simple payback years. The "Simple Payback Years" column is the overall payback period and may vary for individual buildings.

From the energy saving opportunities table (Table E2(a)) it can be seen that the total potential for energy savings in both buildings is 142,919 kWh or 48% of the current total energy consumption.

The water saving opportunities table (Table E2(b)) shows the percent water savings, water savings in litres/year, and cost savings. The percentages shown in this table indicate percent water savings that would result from replacing the current water fixtures in all of the buildings with water efficient fixtures. The water savings in litres per year are based on estimates of the various buildings' occupancies. From the water bills for the buildings audited, the cost of water is $1.20 per cubic meter.

In addition to energy, water, and cost savings, other benefits would result from implementing the saving opportunities recommended throughout this report:

- Reduction in $CO_2$ emissions resulting in reduced contribution to climate change– the percent reduction is shown at the bottom of each of the energy saving opportunity tables.
- Lowered maintenance costs – (e.g. replacing the current lights with longer lasting bulbs).
- Improved physical comfort – (e.g. reducing infiltration into buildings).

**Table E1 Energy Consumption for the Period from Sep 2004 – Sep 2005**

| Site | Energy Density ($kWh/m^2$) | Area ($m^2$) | Electricity | | Natural Gas | | TOTAL ENERGY | |
|---|---|---|---|---|---|---|---|---|
| | | | kWh | Cost | kWh | Cost | kWh | Cost |
| Municipal Office Building | 538 | 378 | 29,959 | $2,234 | 173,409 | $7,123 | 203,368 | $9,357 |
| Municipal Shop | 164 | 585 | 47,480 | $3,411 | 48,478 | $2,103 | 95,958 | $5,514 |
| **Totals** | | | 77,439 | $5,645 | 221,887 | $9,226 | 299,326 | $14,871 |

**Percentage of Total Energy Density for Buildings in the R.M. of Stanley**

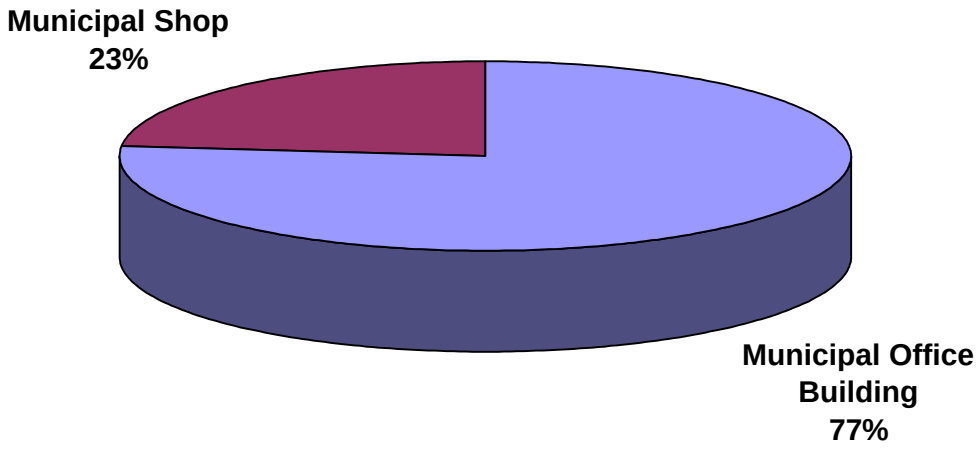

**Table E2 (a) Summary of Energy Saving Opportunities for the R.M. of Stanley** 

| Description | Qty | Installed Cost/Unit ($) | | | Total Cost** ($) | | Estimated Annual Savings | | Simple Payback Years**** | | Related Buildings |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Material (NI*) | Material (WI*) | Labour | NI* | WI* | kWh | $*** | NI* | WI* | |
| **LIGHTING** | | | | | | | | | | | |
| When 4' x 4 T12 fluorescent ballasts burn out, replace them with T8 ballast and tubes. | 48 | $32 | $12 | $0 | $1,772 | $677 | 7,788 | $468 | 3.8 | 1.4 | Municipal Office. |
| When 4' x 2 T12 ballasts burn out, replace them with T8 ballast and tubes. | 15 | $41 | $21 | $0 | $704 | $362 | 1,699 | $102 | 6.9 | 3.6 | Municipal Office and Municipal Shop. |
| When 8' x 2 T12 ballasts burn out, replace them with T8 ballast and tubes. | 64 | $47 | $12 | $0 | $3,451 | $897 | 15,402 | $925 | 3.7 | 1.0 | Municipal Office and Municipal Shop. |
| When interior incandescents burn out, replace them with compact fluorescents. | 3 | $13 | $8 | $0 | $44 | $27 | 772 | $46 | 1.0 | 0.6 | Municipal Shop. |
| **Lighting Subtotal** | | | | | **$5,972** | **$1,965** | **25,661** | **$1,541** | | | |
| **ENVELOPE** | | | | | | | | | | | |
| Weatherstrip and caulk pedestrian doors. | 5 | $15 | $15 | $50 | $371 | $371 | 4429.2 | $202 | 1.8 | 1.8 | Municipal Office and Municipal Shop. |
| Weatherstrip and caulk vehicle doors. | 4 | $30 | $30 | $100 | $593 | $593 | 10248 | $468 | 1.3 | 1.3 | Municipal Shop. |
| Replace 30"x67" double pane windows with 3 pane windows. | 2 | $650 | $546 | $200 | $1,938 | $1,701 | 866 | $40 | 49.0 | 43.0 | Municipal Office. |
| Replace 36"x22" single pane window with 3 pane window. | 1 | $425 | $384 | $200 | $713 | $666 | 421 | $19 | 37.0 | 34.6 | Municipal Office. |
| Replace 62"x25" double pane window with 3 pane window. | 1 | $600 | $520 | $200 | $912 | $821 | 334 | $15 | 59.8 | 53.8 | Municipal Office. |
| Replace 44"x28" double pane window with 3 pane window. | 1 | $530 | $466 | $200 | $832 | $760 | 265 | $12 | 68.6 | 62.6 | Municipal Office. |
| Upgrade wall insulation. | 1 | $9,807 | $9,807 | $9,807 | $22,359 | $22,359 | 9,940 | $454 | 49.2 | 49.2 | Municipal Office. |

**Table E2 (a) Summary of Energy Saving Opportunities for the R.M. of Stanley** 

| Description | Qty | Installed Cost/Unit ($) | | | Total Cost** ($) | | Estimated Annual Savings | | Simple Payback Years**** | | Related Buildings |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Material (NI*) | Material (WI*) | Labour | NI* | WI* | kWh | $*** | NI* | WI* | |
| Upgrade roof insulation when replacing roof. | 1 | $2,035 | $2,035 | $2,035 | $4,640 | $4,640 | 9,283 | $424 | 10.9 | 10.9 | Municipal Office. |
| **Envelope Subtotal** | | | | | **$32,357** | **$31,910** | **35,787** | **$1,635** | | | |
| **HVAC** | | | | | | | | | | | |
| Install programmable thermostat; setback temp to 15°C (59°F). | 2 | $300 | $300 | $300 | $1,368 | $1,368 | 20,505 | $937 | 1.5 | 1.5 | Municipal Office. |
| Replace 2.5 ton RTU (GCS4E-311-90A-1P) with higher efficiency RTU. | 1 | $1,975 | $1,975 | $500 | $2,822 | $2,822 | 9,843 | $450 | 6.3 | 6.3 | Municipal Office. |
| When 3 ton RTU (GCS9-411-120C-2P) requires replacement, replace it with a high efficiency RTU. | 1 | $200 | $200 | $0 | $228 | $228 | 730 | $44 | 5.2 | 5.2 | Municipal Office. |
| When condensing unit requires replacement, replace it with a higher SEER unit. | 1 | $350 | $350 | $0 | $399 | $399 | 837 | $50 | 7.9 | 7.9 | Municipal Office. |
| Install HRV. | 1 | $2,000 | $2,000 | $800 | $3,192 | $3,192 | 5,674 | $341 | 9.4 | 9.4 | Municipal Office. |
| Install $CO_2$ sensor and wire to ventilation. | 1 | $800 | $800 | $200 | $1,140 | $1,140 | 4,255 | $255 | 4.5 | 4.5 | Municipal Office. |
| Install geothermal heating system. | 1 | $48,000 | $48,000 | $32,000 | $91,200 | $91,200 | 36,543 | 1,670 | 54.6 | 54.6 | Municipal Shop. |
| **HVAC Subtotal** | | | | | **$100,349** | **$100,349** | **78,387** | **$3,747** | | | |
| **HOT WATER** | | | | | | | | | | | |
| Install water efficient metering faucets. | 3 | $309 | $309 | $150 | $1,569 | $1,569 | 436 | $40 | 39.0 | 39.0 | Municipal Office. |
| Insulate hot water pipes. | 1 | $50 | $50 | $50 | $114 | $114 | 465 | $28 | 4.1 | 4.1 | Municipal Office. |
| Replace hot water tank with instantaneous water heater.***** | 1 | $300 | $300 | $500 | $912 | $912 | 2,182 | $100 | 9.1 | 9.1 | Municipal Shop. |
| **Water Subtotal** | | | | | **$2,595** | **$2,595** | **3,084** | **$168** | | | |

**Table E2 (a) Summary of Energy Saving Opportunities for the R.M. of Stanley** **Page 3 of 3**

| TOTALS | Energy (kWh) | Cost ($) | $CO_2$ (Tonnes) |
|---|---|---|---|
| Existing Annual Consumption /Costs/Emissions | 299,326 | $14,872 | 42.13 |
| Estimated Annual Savings | 142,919 | $7,091 | 18.48 |
| Percent Savings | 48% | 48% | 44% |

* NI = Cost does not include incentives, WI = Cost includes incentives
** The total cost column includes 14% taxes.
*** The cost assigned to electricity is 0.06004 $/kWh (rate was taken from Manitoba Hydro's website) and the cost of natural gas is 0.0457 $/kWh (as of November 1, 2005)
**** This is the overall payback period and may vary for individual buildings (refer to tables throughout report for payback years for a specific building).
*****Discounted to include the cost of replacement water tank in 10 years.

## Table E2 (b) Summary of Water Saving Opportunities for the R.M. of Stanley

| Description | Qty | Installed Cost/Unit ($) | | Total Cost* ($) | Annual Water Savings (%) | Annual Water Savings (L) | Annual Cost Savings** ($) | Related Buildings |
|---|---|---|---|---|---|---|---|---|
| | | Material | Labour | | | | | |
| Install water efficient metering faucets. | 4 | $309 | $150 | $2,093 | 80% | 13,656 | $16 | Municipal Office and Municipal Shop |
| Install water efficient toilets. | 4 | $284 | $150 | $1,979 | 55% | 112,629 | $135 | Municipal Office and Municipal Shop |

* The total cost column includes 14% taxes.
** The cost of water is $1.20/$m^3$ (rate was taken from water bills).

## MMEP AUDITORS

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## MMEP PARTNERS

Association of Manitoba Municipalities
Manitoba Hydro
Manitoba Conservation
Agriculture and Agri-Food Canada – Prairie Farm Rehabilitation Administration
Manitoba Culture, Heritage, and Tourism

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## ACKNOWLEDGEMENTS

KGS Group and the MMEP partners gratefully acknowledge the valuable contributions the following people have made in providing their time, helpful suggestions, and participation in this energy and water efficiency project:

- Rick Klippenstein, Chief Administrative Officer
- Allan Toews, (Municipal Shop)

## COPYRIGHT

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# 1.0 INTRODUCTION

## 1.1 BACKGROUND

Energy and water conservation is becoming more important as environmental concerns grow and energy costs increase. For this reason it is important to perform energy and water efficiency audits to identify practical efficiency improvement opportunities and determine the capital costs and payback periods associated with these implementations.

An energy and water efficiency audit was conducted on two buildings in the Rural Municipality of Stanley to determine how these buildings could reduce both energy and water consumption.

## 1.2 OBJECTIVE

The objective of this study was to determine energy and water efficiency opportunities that could enable the R.M. of Stanley to reduce operating costs, conserve resources, and reduce greenhouse gas emissions. Both the Municipal Office and the Municipal Shop in the R.M. of Stanley were analyzed separately and the results are presented in separate sections throughout this report.

## 1.3 METHODOLOGY

The buildings were toured on March 1, 2006 by Mr. Joel Lambert of KGS Group Engineering Consultants. These tours involved a walkthrough of the buildings to determine the current condition of the building's envelope (walls, roof, windows, and doors), lighting, water fixtures, motors, and heating, ventilation and air conditioning (HVAC) systems.

During the building tours, the auditor met with the Chief Administrative Officer Rick Klippenstein to discuss the study objectives for identifying energy and water saving opportunities, and to provide information on existing incentive programs. While auditing the buildings, whenever possible, on-site training was done to inform the staff on energy and/or water saving opportunities in specific buildings and to point out maintenance issues where applicable.

Using the information collected during the audit, available drawings of the buildings, historical weather data, and the hydro bills from the past 12 months, calculations were performed to determine how the buildings are consuming energy and water. Several assumptions were made throughout these calculations including occupancies, room temperatures, and envelope conditions (see Inventory Sheets in Appendix A). When no drawings were available, wall/roof R-values were assumed based on discussions with site personnel or based on knowledge of other buildings of similar type/age to the building surveyed.

Energy Saving Opportunities (ESOs) were developed for each building and are presented in tables throughout this report showing energy savings, cost savings, installation costs, and simple payback periods. Simple Payback Periods are calculated as the total installation cost divided by the annual cost savings. The installation costs include the material costs, both with and without incentives (see Appendix D for a list of Manitoba Hydro incentives), and the labour costs for the installation using standard contractor rates. The total energy savings, the percent energy savings, and the associated costs are presented at the end of each ESO table. It should be noted that the energy savings and capital cost estimates are preliminary. For complex measure such as geothermal heating / cooling, a more detailed investigation would be required to confirm material and installation costs for this system.

An environmental benefit that results from reducing energy consumption is a reduction in $CO_2$ emissions. $CO_2$ is a greenhouse gas and thus contributes to global warming. By reducing natural gas and electrical energy consumption, $CO_2$ emissions are reduced. At the bottom of each ESO table, the total $CO_2$ reduction resulting from the energy savings is shown. This was calculated using a $CO_2$ emissions calculator produced by Natural Resources Canada.

Many of the ESOs have low installed costs and payback periods of less than two years. Once the implementation phase begins, these ESOs are the most attractive measures. However, in order to maximize long-term savings and efficiencies for the buildings, implementation of the more capital-intensive measures with the longer payback periods is necessary. These items will become more attractive as energy costs increase in the future. It is recommended that the savings associated with the short payback ESOs be reinvested annually as a means to help finance the more expensive options.

Water Saving Opportunities (WSOs) are also presented in this report. The WSOs include installing water efficient sink faucets and toilets. The water savings are shown as percentages of the current fixtures water consumption and in litres per year (based on estimates of the building's occupancy). Cost savings were also calculated and are shown for individual buildings throughout the report.

# 2.0 MUNICIPAL OFFICE BUILDING

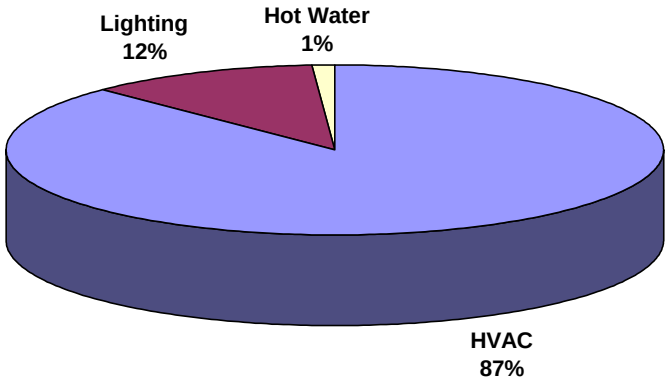
## 2.1 BACKGROUND

The Municipal Office is a brick building constructed in the 1940s. This 4,070 square foot building houses municipal offices and a council chamber for meetings. These offices are open from Monday to Friday for 40 hours/week.


**Photo 1 – Municipal Office Building**

The Office building uses natural gas for heating and electricity for lighting, water heating, and cooling in the summer. There are two rooftop units (RTUs) that provide heating, cooling, and ventilation to the offices. An additional condensing unit helps with the cooling in the summertime. The total natural gas and electrical energy consumption for the previous year were 173,409 kWh and 29,959 kWh, respectively. The pie chart below shows the total energy (natural gas and electricity) breakdown for the Municipal Office.

**Energy Breakdown (% of Total kWh)
for the Municipal Office Building**




The washrooms in the Municipal Office contain a total of 3 toilets and 3 sinks. A 175-litre electric hot water heater heats the water for this facility. The energy used for hot water heating was calculated based on estimates of the current hot water consumption and includes the energy required to offset the heat losses from the storage tank.

## 2.2 ENERGY AND WATER SAVING OPPORTUNITIES

Tables 1 and 2 show a summary of both the energy and water saving opportunities for the Municipal Office. The following assumptions were made in determining the annual savings:

- The Offices are occupied for 40 hours per week year round.
- The temperature of the Office is maintained at 21°C (70°F).
- For the purpose of hot water consumption, the typical occupancy of the office is taken as 10.
- Based on information provided by the office workers, it was assumed that two of the 4' fluorescent lamps are left on overnight and on weekends.

## Table 1 Energy Saving Opportunities for the Municipal Office Building

| Description | Qty | Installed Cost/Unit ($) | | | Total Cost** ($) | | Estimated Annual Savings | | Simple Payback Years | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Material (NI*) | Material (WI*) | Labour | NI* | WI* | kWh | $*** | NI* | WI* |
| **LIGHTING** | | | | | | | | | | |
| When 4' x 4 T12 fluorescent ballasts burn out, replace them with T8 ballast and tubes. | 48 | $32 | $12 | $0 | $1,772 | $677 | 7,788 | $468 | 3.8 | 1.4 |
| When 4' x 2 T12 fluorescent ballasts burn out, replace them with T8 ballast and tubes. | 5 | $41 | $21 | $0 | $235 | $121 | 927 | $56 | 4.2 | 2.2 |
| When 8' x 2 T12 fluorescent ballasts burn out, replace them with T8 ballast and tubes. | 3 | $47 | $12 | $0 | $162 | $42 | 426 | $26 | 6.3 | 1.6 |
| **Lighting Subtotal** | | | | | **$2,168** | **$840** | **9,140** | **$549** | | |
| **ENVELOPE** | | | | | | | | | | |
| Weatherstrip and caulk doors. | 2 | $15 | $15 | $50 | $148 | $148 | 2,692 | $123 | 1.2 | 1.2 |
| Replace 30"x67" double pane windows with 3 pane windows. | 2 | $650 | $546 | $200 | $1,938 | $1,701 | 866 | $40 | 49.0 | 43.0 |
| Replace 36"x22" single pane window with 3 pane window. | 1 | $425 | $384 | $200 | $713 | $666 | 421 | $19 | 37.0 | 34.6 |
| Replace 62"x25" double pane window with 3 pane window. | 1 | $600 | $520 | $200 | $912 | $821 | 334 | $15 | 59.8 | 53.8 |
| Replace 44"x28" double pane window with 3 pane window. | 1 | $530 | $466 | $200 | $832 | $760 | 265 | $12 | 68.6 | 62.6 |
| Upgrade wall insulation. | 1 | $9,807 | $9,807 | $9,807 | $22,359 | $22,359 | 9,940 | $454 | 49.2 | 49.2 |
| Upgrade roof insulation when replacing roof. | 1 | $2,035 | $2,035 | $2,035 | $4,640 | $4,640 | 9,283 | $424 | 10.9 | 10.9 |
| **Envelope Subtotal** | | | | | **$31,542** | **$31,095** | **23,802** | **$1,088** | | |
| **HVAC** | | | | | | | | | | |
| Install programmable thermostat; setback temp to 15°C (59°F). | 2 | $300 | $300 | $300 | $1,368 | $1,368 | 20,505 | $937 | 1.5 | 1.5 |
| Replace 2.5 ton RTU (GCS4E-311-90A-1P) with higher efficiency RTU. | 1 | $1,975 | $1,975 | $500 | $2,822 | $2,822 | 9,843 | $450 | 6.3 | 6.3 |
| When 3 ton RTU (GCS9-411-120C-2P) requires replacement, replace it with a high efficiency RTU. | 1 | $200 | $200 | $0 | $228 | $228 | 730 | $44 | 5.2 | 5.2 |
| When condensing unit requires replacement, replace it with a higher SEER unit. | 1 | $350 | $350 | $0 | $399 | $399 | 837 | $50 | 7.9 | 7.9 |
| Install HRV. | 1 | $2,000 | $2,000 | $800 | $3,192 | $3,192 | 5,674 | $341 | 9.4 | 9.4 |

| Description | Qty | Installed Cost/Unit ($) | | | Total Cost** ($) | | Estimated Annual Savings | | Simple Payback Years | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Material (NI*) | Material (WI*) | Labour | NI* | WI* | kWh | $*** | NI* | WI* |
| Install $CO_2$ sensor and wire to ventilation. | 1 | $800 | $800 | $200 | $1,140 | $1,140 | 4,255 | $255 | 4.5 | 4.5 |
| **HVAC Subtotal** | | | | | **$9,149** | **$9,149** | **41,844** | **$2,077** | | |
| **HOT WATER** | | | | | | | | | | |
| Install water efficient metering faucets. | 3 | $309 | $309 | $150 | $1,569 | $1,569 | 436 | $40 | 39.0 | 39.0 |
| Insulate hot water pipes. | 1 | $50 | $50 | $50 | $114 | $114 | 465 | $28 | 4.1 | 4.1 |
| **Water Subtotal** | | | | | **$1,683** | **$1,683** | **902** | **$68** | | |

| TOTALS | Energy (kWh) | Cost ($) | $CO_2$ (Tonnes) |
|---|---|---|---|
| Existing Annual Consumption /Costs/Emissions | 203,368 | $9,358 | 32.01 |
| Estimated Annual Savings | 75,687 | $3,782 | 11.78 |
| Percent Savings | 37% | 40% | 37% |

* NI = Cost does not include incentives, WI = Cost includes incentives
** The total cost column includes 14% taxes.
*** The cost assigned to electricity is 0.06004 $/kWh (rate was taken from Manitoba Hydro's website) and the cost of natural gas is 0.0457 $/kWh (as of November 1, 2005).

**Table 2 Water Saving Opportunities for the Municipal Office Building**

| Description | Qty | Installed Cost/Unit ($) | | Total Cost* ($) | Annual Water Savings (%) | Annual Water Savings (L) | Annual Cost Savings** ($) |
|---|---|---|---|---|---|---|---|
| | | Material | Labour | | | | |
| Install water efficient metering faucets. | 3 | $309 | $150 | $1,570 | 80% | 11,648 | $14 |
| Install water efficient toilets. | 3 | $284 | $150 | $1,484 | 55% | 65,975 | $79 |

* The total cost column includes 14% taxes.
** The cost of water is $1.20/$m^3$ (rate was taken from water bills).

## 2.3 GENERAL RECOMMENDATIONS

### Lighting

The lighting analysis summary for the Office is shown in Appendix B, Table B.1.3. Consideration should be given to replacing the T12 fluorescent lamps with T8 lamps and ballasts. T8s are slim, high efficient fluorescent lamps that consume 25 to 30% less energy than T12s. Based on the assumptions made in this analysis, replacing these lights could save over $500 annually.

Another reason why these lights should be replaced is that the T12s are expected be obsolete by the Year 2010.

**Envelope**

The walls and roof of the Municipal Office are assumed to have R-12 and R-20 insulation, respectively. The energy savings that would result from upgrading the insulation in the walls to R-20 and in the roof to R-40 are shown in Table 1 above. The recommendation for the roof insulation is to replace the insulation when the roof is re-done. Therefore, the capital cost for this upgrade only includes upgrading the insulation (not replacing the roof).

Energy savings would also result from replacing the windows with triple pane windows. Due to the high installation cost, the payback periods for these upgrades are long.

The most cost-effective opportunity for energy savings in terms of the building's envelope is to install new weather-stripping around the pedestrian doors and to caulk the doorframes. This would eliminate the cold air infiltration through the cracks around these doors. Table B.1.4 in Appendix B shows details on these calculations.

**HVAC**

There are several good opportunities for energy savings in terms of the heating, ventilating, and air conditioning systems. Replacing the rooftop units (RTUs) with new, higher efficiency units would save in both annual heating and cooling costs. The condensing unit could also be upgraded to a more efficient unit to save energy. For the larger 3 ton RTU and the condensing unit, the recommendation is to wait until they reach their lift expectancy before replacing them with more efficient units. The capital costs shown for these upgrades are therefore the incremental costs of installing high efficiency over standard efficiency units.

The rooftop units provide continuous ventilation to the building when they are running. There is a high cost associated with heating this fresh air intake in the wintertime. One opportunity is to close the existing fresh air intake dampers and install a new fresh air intake duct with a heat recovery ventilator (HRV). An HRV will pre-heat the intake air with the warm exhaust air and

save approximately 50% of the energy required to heat this fresh air entering the building. In addition to installing an HRV, a $CO_2$ sensor would reduce the amount of fresh air intake into the building. The $CO_2$ sensor should be wired to the ventilation system such that the office is ventilated only when required.

Installing setbacks on the thermostats could result in energy savings with a very short payback period. The offices are unoccupied for approximately 75% of the time; the thermostats should be programmed such that when the building is unoccupied, the temperature is reduced to 15°C (59°F).

**Water**

Savings in hot water heating would result from replacing the sink faucets with water efficient metering faucets and insulating the hot water pipes.

Table 2 shows the water and cost savings associated with replacing the toilets and sinks with water efficient fixtures.

# 3.0 MUNICIPAL SHOP

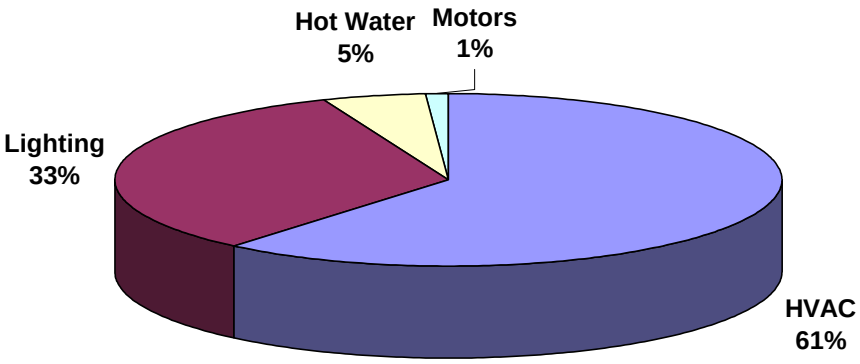
## 3.1 BACKGROUND

The Municipal Shop is a 6,300 square foot building constructed in 1988 of exterior and interior metal cladding with R-28 insulation in the walls and R-30 insulation in the roof. The shop is occupied full time throughout the winter and for 4 hours/day throughout the summer.


**Photo 2 – Municipal Shop**

The Municipal Shop is serviced with both electricity and natural gas. The annual electricity consumption for this building in the previous year was 47,480 kWh and was used for lighting, air conditioning, and to power the motors for the hydronic pumps and the sewage pump. Natural gas is used in the boiler, which heats water for in-floor heating, and in the hot water heater. The total energy consumption through the use of natural gas for the previous year was 48,478 kWh. The pie chart below shows the portions of the total energy consumption used for lighting, water heating, HVAC, and motors.

**Energy Breakdown (% of Total kWh) for the Municipal Shop**




The washroom in the Municipal Shop contains 1 toilet, 1 urinal, 1 tub sink, and 1 shower. A 285-litre natural gas hot water heater heats the water for this facility. The energy used for hot water heating was calculated based on estimates of the current hot water consumption and includes the energy required to offset the heat losses from the storage tank.

## 3.2 ENERGY AND WATER SAVING OPPORTUNITIES

Tables 3 and 4 show a summary of energy and water saving opportunities for the Municipal Shop. The following assumptions were made in the analysis:

- The shop is occupied for 8½ hours per day throughout the winter and for 4 hours per day throughout the summer.
- The temperature of the shop is maintained at 18°C (65°F).
- For the purpose of water consumption, the typical occupancy of this building is 7.

## Table 3 Energy Saving Opportunities for the Municipal Shop

| Description | Qty | Installed Cost/Unit ($) | | | Total Cost** ($) | | Estimated Annual Savings | | Simple Payback Years | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Material (NI*) | Material (WI*) | Labour | NI* | WI* | kWh | $*** | NI* | WI* |
| **LIGHTING** | | | | | | | | | | |
| When 4' x 2 T12 ballasts burn out, replace them with T8 ballast and tubes. | 10 | $41 | $21 | $0 | $470 | $242 | 772 | $46 | 10.1 | 5.2 |
| When 8' x 2 T12 ballasts burn out, replace them with T8 ballast and tubes. | 61 | $47 | $12 | $0 | $3,289 | $855 | 14,977 | $899 | 3.7 | 1.0 |
| When interior incandescents burn out, replace them with compact fluorescents. | 3 | $13 | $8 | $0 | $44 | $27 | 261 | $16 | 2.8 | 1.7 |
| **Lighting Subtotal** | | | | | **$3,803** | **$1,124** | **16,010** | **$961** | | |
| **ENVELOPE** | | | | | | | | | | |
| Weather-strip and caulk pedestrian doors. | 3 | $15 | $15 | $50 | $222 | $222 | 1,737 | $79 | 2.8 | 2.8 |
| Weather-strip and caulk vehicle doors. | 4 | $30 | $30 | $100 | $593 | $593 | 10,248 | $468 | 1.3 | 1.3 |
| **Envelope Subtotal** | | | | | **$815** | **$815** | **11,985** | **$548** | | |
| **HVAC** | | | | | | | | | | |
| Install geothermal heating system. | 1 | $48,000 | $48,000 | $32,000 | $91,200 | $91,200 | 36,543 | $1,670 | 54.6 | 54.6 |
| **HVAC Subtotal** | | | | | **$91,200** | **$91,200** | **36,543** | **$1,670** | | |
| **HOT WATER** | | | | | | | | | | |
| Replace hot water tank with instantaneous water heater.**** | 1 | $300 | $300 | $500 | $912 | $912 | 2,182 | $100 | 9.1 | 9.1 |
| **Water Subtotal** | | | | | **$912** | **$912** | **2,182** | **$100** | | |

| TOTALS | Energy (kWh) | Cost ($) | $CO_2$ (Tonnes) |
|---|---|---|---|
| Existing Annual Consumption /Costs/Emissions | 95,958 | $5,514 | 10.12 |
| Estimated Annual Savings | 66,721 | $3,279 | 6.72 |
| Percent Savings | 70% | 59% | 66% |

* NI = Cost does not include incentives, WI = Cost includes incentives
** The total cost column includes 14% taxes.
*** The cost assigned to electricity is 0.06004 $/kWh (rate was taken from Manitoba Hydro's website) and the cost of natural gas is 0.0457 $/kWh (as of November 1, 2005).
**** Discounted to include the cost of replacement water tank in 10 years.

**Table 4 Water Saving Opportunities for the Municipal Shop**

| Description | Qty | Installed Cost/Unit ($) | | Total Cost* ($) | Annual Water Savings (%) | Annual Water Savings (L) | Annual Cost Savings** ($) |
|---|---|---|---|---|---|---|---|
| | | Material | Labour | | | | |
| Install water efficient metering faucets. | 1 | $309 | $150 | $523 | 20% | 2,008 | $2 |
| Install water efficient toilets. | 1 | $284 | $150 | $495 | 55% | 46,654 | $56 |

* The total cost column includes 14% taxes.
** The cost of water is $1.20/$m^3$ (rate was taken from water bills).

## 3.3 GENERAL RECOMMENDATIONS

### Lighting

The lighting analysis summary for the Municipal Shop is shown in Appendix B, Table B.2.3. The energy saving opportunities include replacing the T12 fluorescent lamps with T8 lamps and ballasts and replacing the indoor incandescent lights with compact fluorescents.

### Envelope

There is a large amount of heat being lost due to cold air infiltrating through the cracks around the vehicle doors. Installing new weather-stripping and caulking would reduce the infiltration and thus reduce the heat losses with a short payback period. Similarly, weather-stripping and caulking the pedestrian doors would also reduce heat losses.

### HVAC

A geothermal heating system was investigated for this facility. The existing natural gas boiler would be replaced with a water-to-water heat pump connected to a closed loop ground source system. The ground loop is needed as a heat exchanger to pull and return heat from the ground. If desired, this system could also be used for cooling. A geothermal heat pump is one of the most energy efficient and environmentally friendly electric heating and cooling systems available.

**Water**

An energy saving opportunity shown in Table 3 is to install an instantaneous water heater. With instantaneous water heater there is no storage tank; therefore, the heat losses that are present with the current water heater's storage tank would be eliminated.

The water and cost savings associated with replacing the current toilet and sink faucet in the Municipal Shop with water efficient fixtures are shown in Table 4.

# 4.0 GENERAL UPGRADES AND MAINTENANCE RECOMMENDATIONS FOR REDUCING ENERGY AND WATER CONSUMPTION

The following energy and water saving opportunities exist in many buildings including those toured in this study. The saving opportunities are generic in nature and include both capital upgrades (Sections 4.1 to 4.5) and maintenance activities (Section 4.6) that will result in energy / water savings for all the buildings.

## 4.1 LIGHTING AND ELECTRICAL

**Light Switches** – Place signs or stickers adjacent to switches to remind occupants to shut off switches when leaving rooms unoccupied. Occupancy sensors can be provided to shut off lights automatically when not in use. Timers can also be used in a similar fashion.

**Fluorescent Lighting Systems** – T12 lights should be upgraded to premium T8 or T5 electronic ballasts and lamps. This may be done when current T12 ballasts need replacement or in a planned retrofit program. T12 light fixtures will become obsolete by 2010. Use cold-weather rated ballasts for retrofits in areas where the temperature is below 15°C (59°F). When selecting T8 electronic ballasts, please refer to Manitoba Hydro's Power Smart Lighting program for current listings of eligible ballasts. Contact Manitoba Hydro for details.

**EXIT Signs** – Replace all incandescent exit signs with 3W LED signs.

**Incandescent Bulbs** – All incandescent bulbs should be converted to compact fluorescents. Compact fluorescent bulbs last approximately 10 times longer than incandescents and save up to 75% of the energy costs.

**Exterior Lights** – Compact fluorescent bulbs do not function at low temperatures, therefore, the exterior lights should be replaced with high-pressure sodium lighting. High-pressure sodium lights are the most energy efficient type of lighting available today. Savings of approximately 50% would result from replacing exterior incandescent fixtures with these high-pressure sodium lights. Photo cells should be considered for automatically shutting off outdoor lights during day light conditions.

**Parking Lot Controllers** – Parking lot controllers save energy by automatically adjusting the power at the car plugs depending on the outside temperature.

**Motors –** When installing new motors, consider using premium efficiency as opposed to standard efficiency motors.

**Other Recommendations** - Dispose of all fluorescent lamps and ballasts through a recycling company to reduce toxins entering the landfills.

Refer to Appendix D for a list of Manitoba Hydro's Power Smart incentives and listings of other incentive programs.

## 4.2 BUILDING ENVELOPE

**Window/Door Infiltration –** Seal drafts on windows and doors. This can be done by installing or upgrading weather-stripping, or with removable silicone caulking such as “Draft Stop” or “Peel and Seal” around the frames. Doors with high usage should be inspected twice per year for damaged weather stripping.

**Window/Door Replacement** – Windows and doors with low R-values should be considered for replacement. Manitoba Hydro offers incentives for new windows.

**Wall / Roof Insulation** – The wall insulation in older buildings typically has a resistance of R-12 or less. Large energy savings would result from upgrading this insulation to R-20. Similarly, roof insulation should be upgraded to R40. In addition to the energy savings, upgrading insulation also extends the life of a building by avoiding the rotting of wood framing from the development of mould and mildew in the walls. Vapour barriers in walls can also be upgraded at the same time to reduce infiltration. Upgrading insulation is typically quite costly. When this is done, more insulation will pay dividends in the future.

**Electrical Outlets** – Install draft-reducing foam pads in all electrical receptacles.

## 4.3 HEATING, VENTILATION, AND AIR CONDITIONING

**Temperature Control** – Use programmable electronic thermostats where appropriate. Use the recommended “set-back” and “set forward” temperatures during unoccupied periods. A 6°C “set-back” over a 12-hour period can reduce heating costs by 8%. Reduce room temperature at night in the winter to as low as comfort conditions permit (typically 15°C in occupied buildings) and 10°C in unoccupied buildings). Terminate ventilation during un-occupied periods.

**Furnaces –** Replace standard efficiency furnaces with premium efficiency furnaces. Old standard efficiency furnaces can be as low as 60% efficient. Replacing these with 95% efficient furnaces would save 35% of the annual energy consumed for heating.

**Air Conditioning** – Reduce the cooling load on the air conditioner by keeping the facility a few degrees warmer and using fans at workstations to augment cooling of personnel. Provide an economizer to supply “free cooling” when it is cool outside and air conditioning is required.

Remove or insulate wall or window-mounted air conditioners for the winter season.

When replacing condensing units or rooftop units, install high efficiency units.

**$CO_2$ Sensors** – Install $CO_2$ sensors to control ventilation. $CO_2$ sensors monitor the level of carbon dioxide in the air. Once the level exceeds an accepted limit, the ventilation system will turn on. This will ensure that the room is ventilated only when required and will thus save in energy required for heating and/or cooling.

**Vehicle Emission Sensors** – For garages and fire halls, a vehicle emission sensor will monitor the level of vehicle emissions in the air and could be set up to control the ventilation such that the room is ventilated only when required. This is an energy saving feature and provides increased safety for occupants.

**Motorized Dampers** – Backdraft dampers on intake and exhaust ducts are often leaky and let cold air into the building on windy days. Insulated motorized dampers provide a better seal when they are closed and drastically reduce the cold air infiltration into the building throughout the winter.

**Heating Recovery Ventilators (HRVs)** – An HRV moves stale contaminated air from inside the building to outside while at the same time it draws fresh air from outside and distributes it throughout the building. When intake and exhaust air pass through the HRV they do not mix. In the wintertime, the air passes on either side of an aluminum heat exchange core, which transfers heat from the outgoing air to the incoming air. In the summertime, the HRV works in reverse and transfers heat from the incoming air to the exhaust air.

**Solar Wall** – Another option for pre-heating ventilation air is to install a solar wall. A solar wall is installed on the south wall of the building and uses free heating from the sun to heat the make up air. In addition, a solar wall reduces building heat losses during the winter. Heat lost to the cavity between the building and the exterior metal panels of the solar wall is captured by the incoming air and returned to the building. In summer, the solar wall is ventilated naturally thus reducing the wall temperature, which saves air conditioning energy costs.

**Geothermal Heating** - A geothermal heat pump is one of the most energy efficient heating and cooling systems available. Compared to electrical heat, a heat pump decreases energy consumption by 50 – 70%. In the wintertime, the heat pump moves heat from the earth into your building and in the summertime the heat is moved from inside the building back into the earth. Geothermal systems are most effective in arenas where they are used to make ice. The waste heat obtained from ice making can be used to heat a nearby building using little energy.

**HVAC Ductwork** – Seal duct joints with duct tape to reduce losses of heated or cooled air where the ducts traverse cold or hot areas respectively. Insulate ductwork passing through unconditioned spaces.

**Thermostat Equipped Electric Baseboard Heaters** – Mark the thermostat “normal” setting to provide a visual cue as to when they are on or set too high.

## 4.4 WATER CONSUMPTION

Excessive water usage wastes energy, increases water / sewage treatment costs and further risks damage to the environment.

**Toilet Tanks –** Install flush volume reduction devices in existing toilet tanks to reduce the quantity of water used per flush by about 25%. “Early closing flapper valves” are inexpensive and are easily installed**.**

**Toilets –** When replacing older toilets or installing new ones, use high efficiency, dual-flush volume models that use either 6 L (1.6 Imp. gal.) or 3 L (0.8 Imp. gal.) per flush. These toilets reduce water usage by over 70% compared with the traditional 13 L, and by 40% over a "low flush" 6 L toilet. Refer to the toilet and drainline reports on the Canadian Water and Wastewater Association (CWWA) website for advice in selecting a toilet that will perform well.

**Urinals** – Waterless urinals function on gravity flow and use absolutely no water. These urinals resemble conventional wall-hung urinals but do not require a water supply or a flush valve.

**Hot Water** – In facilities where large volumes of hot water are not required, set the hot water tank thermostat to 55°C (131°F). A reduction from 60°C to the recommended value of 55°C saves approximately 3% of the energy related to hot water generation. Insulate the first 2 meters (6 ft) of the cold water line and as much of the hot water distribution lines as practical, particularly where hot water lines traverse cold spaces.

**Shower Controls** – In facilities where large amounts of water are used, consider retrofitting single actuator, short cycle (adjustable), self-closing control valves, with pressure-balancing temperature controls to reduce water consumption. These controls limit flow and allow for a preset water temperature (recommended 40°C) for the showers in order to reduce water heating costs and wastage of water.

**Auto-Shut Off Fixtures** - Consider using spring loaded fixtures that automatically shut off water flow in public areas.

**Tankless Water Heaters** – Consider replacing the hot water storage tanks with instantaneous water heaters to avoid storage tank losses and save energy.

## 4.5 ICE RINKS

**Ventilate Rink** - Natural ventilation of the rink in the winter saves energy by reducing the run time of the compressors/heat pumps.

**Quality of Ice** - Ensure that the water used for flooding is pure – salts lower the freezing point of water and air in water acts like an insulation, making it harder for the glycol in the slab to freeze the top layer of the ice.

**Ice Thickness** - Keep the ice thin (1 inch thick) because excessive ice thickness increases the load on the compressor. Shaving ice helps to reduce the ice thickness and removes concentrations of impurities.

**Melt Ice Outdoors** - When shaving ice, take the ice shavings outside to be melted as opposed to melting the shavings in a heated area of the building. This will eliminate the energy consumed to melt this ice.

**High Efficiency Boilers** – Use high efficiency boilers for zamboni water heating. Annual energy savings for zamboni water heating of up to 30% can be achieved by upgrading to high efficiency boiler systems.

**Specific Gravity of Brine** - Maintain the brine at a specific gravity of 1.2 to 1.22 for optimum energy use and maintain the brine temperature as high as possible.

**Heat Recovery** - Significant amounts of energy can be saved by recovering heat from the refrigeration equipment and using it for flood water heating, space heating, domestic water heating, or ice melting.

## 4.6 MAINTENANCE

Maintenance activities are important to ensure that the equipment in a building is operating efficiently and to reduce the potential for future equipment breakdown. One option is to hire a maintenance contractor to perform inspections four times annually to clean, lubricate, test, and adjust the building's HVAC.

The following is a list of HVAC maintenance procedures that should be performed two to four times annually:

### Heating/Ventilation Systems

- Change filters
- Inspect belts
- Inspect and clean heating coils
- Inspect operation of blower
- Inspect and lubricate motor and fan bearings
- Inspect and lubricate fresh air, exhaust air, and return air dampers

### Air Conditioning/Ice Plant Systems

- Clean outdoor condensers
- Clean filters
- Check refrigerant and oil levels
- Inspect and lubricate motorized and back draft dampers
- Inspect A/C operation and adjust as required

# 5.0 IMPLEMENTATION OF ENERGY AND WATER SAVING OPPORTUNITIES

## 5.1 IMPLEMENTATION

The energy and water saving opportunities suggested in this report range from simply changing a light bulb to installing a geothermal heating system. Some of the simpler recommended upgrades can be completed in-house while others would require hiring a contractor to complete the work. Major renovation projects will require a consulting engineer to design and help implement the upgrade. The various energy/water saving opportunities discussed throughout this report are separated into three levels of implementation: (1) in-house implementations, (2) contractor implementations, and (3) consulting engineer implementations. The following sections discuss which upgrades fall into each of these three categories.

### In-House Implementations

Some of the energy saving opportunities can be completed in-house. Replacing the incandescent light bulbs with compact fluorescent bulbs involves simply replacing the bulb and could easily be done by one of the building's janitors. Installing weather-stripping around the doors and sealing the windows could also be done in-house. For the saving opportunities that involve replacing the doors, some could be done in-house while for others, such as the vehicle doors, it is best to hire a contractor.

### Contractor Implementations

The majority of the energy saving opportunities will require a contractor. In terms of lighting, replacing the T12s with T8s requires replacing the ballast as well as the bulbs. An electrician should be hired to complete this function. Replacing the exterior incandescent lights with high-pressure sodium lights and replacing the exit incandescent lamps with LED modules involve replacing the fixture and will therefore require an electrician.

Upgrades on a building's envelope not mentioned in the "In-House Implementations" section should be done by a contractor. This includes replacing windows and vehicle doors, and upgrading the wall and/or roof insulation.

In terms of HVAC, a contractor should be hired to install programmable thermostats, $CO_2$ sensors, heating recovery ventilators (HRVs), new rooftop units, and new air conditioner units.

For the water saving opportunities involving installing low-flow water fixtures, a contractor will likely be required. Insulating the hot water tank, and installing an instantaneous water heater will also require a contractor.

**Consulting Engineer Implementations**

The only energy saving opportunity for the R.M. of Stanley that requires a consultant to implement is the geothermal heating system for the Municipal Shop. This will require a detailed site investigation, bore hole testing, and energy modeling of the building to property size the geothermal system.

Consulting services should be considered for any major upgrades to buildings and services.

## 5.2 FINANCING

There are several incentive programs listed in Appendix D of this report that will help finance the implementation of the energy and water saving opportunities. In the "Energy Saving Opportunity" tables throughout this report, the capital costs are listed both with and without incentives. The incentives in these tables are from Manitoba Hydro's Power Smart Incentives and apply to energy efficient lighting and windows, wall insulation upgrades, and geothermal heating systems. For more information on these incentives, contact your local Manitoba Hydro Energy Services Coordinator or the contact listed in Table D.1.

Table D.2 lists other incentive programs that are available for energy saving upgrades. These programs are:

- Energy Innovators Initiative: Energy Retrofit Assistance (ERA)
- Municipal Rural Infrastructure Fund (MRIF)
- Renewable Energy Development Initiative (REDI)
- Community Places Program
- Sustainable Development Innovations Fund (SDIF)

For further information on these programs refer to the website listed in the table.

Members of the Association of Manitoba Municipalities also have the option of purchasing products and services in bulk at reduced prices through the Municipalities Trading Company of Manitoba Ltd. (MTCML). Details on this can be found in Appendix G of this report.

## 5.3 POLITICAL FRAMEWORK

### General Municipal Environment in Manitoba

In Manitoba, municipal elections are set every 4 years. The next municipal election will be in October 2006, which may mean that some councils will see a change in members. However, we do not expect this to have a major impact on the plans to implement the recommendations of this report.

There are currently no Provincial or Federal targets or goals set that municipalities must achieve. 'Green Projects' have become common in Manitoba and often programs like the Municipal Rural Infrastructure Fund (MRIF) targets such projects. Details of this program are included in Appendix D of this report. Manitoba has been a leader in energy efficiency and many municipalities have partnered with other levels of government and companies like Manitoba Hydro on innovative projects. We believe the MMEP project is an excellent example of an innovative project and believe all of the participating communities are receptive to innovative ideas because they have agreed to participate.

A recent trend in municipal government has been toward longer-term planning. This is seen with the recent changes to the provincial Planning Act and the requirements for community sustainability plans in the New Deal agreement. The recommendations in this report certainly complement this direction.

### Political Environment in Stanley

This is the first energy and water efficiency study to take place in the R.M. of Stanley. There are currently plans for renovations and an addition to the Municipal Office. The knowledge gained from this study will therefore be useful in these development projects and the saving

opportunities discussed throughout this report can be implemented, resulting in energy and water efficient buildings.

The Chief Administrative Officer of Stanley expressed a great deal of interest in this study and in implementing some of the more cost-effective measures in the coming year. In particular, there are plans to upgrade the T12 lighting to T8s once the audit is complete.

A potential barrier that could affect the implementation of the opportunities discussed throughout this report is a change in council members. It is important that the information gained here be passed on as new members enter the council and current members leave.

# 6.0 PERFORMANCE VERIFICATION

Following the implementation of the recommended energy and water saving opportunities, it is important to continuously monitor the annual energy consumption to keep a record of the resulting energy savings.

Appendix F contains a spreadsheet and graph for both of the buildings audited. These spreadsheets should be used as a tool to monitor the energy consumption on a monthly basis. The first five columns in each spreadsheet are for year 2004-2005 and have already been completed.

Following the implementation of the measures discussed in this report, the energy consumption should be recorded. The year headings may need to be re-entered, depending on when the implementations are completed. The monthly electrical energy consumption in kWh taken from the building's electricity bill should be recorded in the "Billed Elec. Energy" column and the monthly gas consumption in $m^3$ should be recorded in the "Billed Natural Gas" column. The monthly energy consumption for heating depends on the outdoor temperatures for that month. The "Billed Energy Consumption" is therefore normalized to the year 2004-2005 such that a fair comparison can be made.

The normalized energy consumption is determined as follows:

$$NEC = TEC \times (\%\ Energy\ Used\ \ for\ Heating) \times \left( \frac{HDD(present)}{HDD(2004-2005)} \right) + TEC \times (1 - \%\ Energy\ Used\ \ for\ Heating)$$

Where *NEC* is the Energy Normalized to year 2004-2005, *TEC* is the total energy consumption and *HDD* is the heating degree-days.

The heating degree-days (HDD) for a given day are the number of Celsius degrees that the mean temperature is below 18°C. This data can be found for Morden on the following website:

http://www.climate.weatheroffice.ec.gc.ca/climateData/dailydata_e.html?timeframe=2&Prov=CA&StationID=29593&Year=2006&Month=1&Day=1

Once the "Billed Elec Energy", the "Billed Natural Gas", and "HDD" columns are filled in, the "Energy Normalized to 2004-2005" column is automatically calculated and the graph is updated. From this graph, the energy consumption can be monitored on a monthly basis to ensure that the upgrades are resulting in a reduction in energy consumption.

# APPENDIX A

# INVENTORY SHEETS

# TABLE OF CONTENTS – APPENDIX A

# BUILDING INSPECTION INVENTORY
**Revision 2**

| | |
|---|---|
| **Municipality: Stanley** | **Date: March 1, 2006** |
| **Toured By: Joel Lambert** | **Construction Date: 1940's** |
| **Building: Municipal Office Building** | **Renovations: Planning an addition and renovation to portion of existing. Also planning a lighting upgrade.** |
| **Address: 379 Stephen Morden** | |
| **L x W x H: 55' x 74' x 12'8"** **Area: 4,070 ft$^2$** | |
| **Building Capacity: 9 workers plus clients** | |
| **Building Floor Plan:** | **Occupied Times: 9-5, 5 days per week.** |

| |
|---|
| **ARCHITECHTURAL/STRUCTURAL** |
| **Wall type/R-value:** Brick exterior, drywall interior. |
| **Roof Type/R-value:** Flat roof. |
| **Door Type/weather stripping:** Front door: Solid wood door with double pane glass windows. Can see light through bottom crack. The door seems warped – should be replaced. Back door: Goon, newer insulated door.<br>Door to MSTW: Newer door, seems well insulated but needs weather-stripping. |
| **Window type/caulking:** 4 x 108" x 82" triple pane (1984) – good. 2 x 30" x 67" double pane (1960) – replace. 2 x 30"x 23" double pane (1960) – replace. 1 x 36" x 22" single pane above door is operable – replace. 1 x 62" x 25" old double pane with very thin glass – replace. 1 x 42" x 25" old double pane with very thin glass – replace. 1 x 44" x 28" old double pane with very thin glass – replace. 2 x 60" x 88" triple pane (1960)-good. |
| **Other:** |
| **MECHANICAL** |
| **Heating System:** 2 Natural gas RTUs. Vault heated with electric baseboard with wall stat (quite warm) with fan coil Inside. |
| **Cooling System:** 1 Lennox split cu 1.5 tons (quite old). 1 Lennox RTU gas heat/elec cool, 90MBH in, 68.94 MBH out - GCS4E-311-90A-1P. 1 Lennox RTU gas heat/elec cool, 120MBH in, 90MBH out – GCS9-411-120C-2P. |
| **Ventilation System:** Ventilation on RTUs. |
| **HVAC Controls**: 2 Auto changeover Heat/Cool stats for RTUs. 1 manual Heat/Cool stat for fan coil.. |
| **HVAC Maintenance/Training**: |
| **Water Supply System**: Water meter/town water. |
| **Domestic Hot Water System**: 175 L electric HWT, no pipe insulation. |
| **Water Fixtures:** 3 high flow sinks, 3 high flow toilets. |

| ELECTRICAL |
| --- |
| **Indoor Lighting:** 48 – 4’ x 4 T12 fluorescents, 5 – 4’ x 2 T12 fluorescents, 3 – 8’ x 2 T12 fluorescents. |
| **Outdoor Lighting:** 14 incandescent floodlights on sentinel, 1 HPS or Mercury vapour on sentinel. |
| **Exit Signs:** None |
| **Motors:** None |
| **Parking Lot Plugs:** 4 plugs for 8 cars. |
| **OTHER BUILDING SYSTEMS** |
| None |
| **PROCESS SYSTEMS** |
| None |
| **BUILDING SERVICES (Hydro, Gas, Oil, Water, etc.)** |
| Hydro, gas, water |
| **NOTES** |
| NE storage room has no heating in it and gets quite cold (9’x14’). |

# BUILDING INSPECTION INVENTORY
**Revision 2**

| | |
|---|---|
| **Municipality: Stanley** | **Date: March 1, 2006** |
| **Toured By: Joel Lambert** | **Construction Date: 1988** |
| **Building: Municipal Shop** | **Renovations: Have considered geothermal but abandoned it due to costs - may consider it with proper incentive.** |
| **Address: NW 1 3 5W** | |
| **L x W x H: 90' x 70' x 18'** **Area: 6,300 ft$^2$** | |
| **Building Capacity: 7** | |
| **Building Floor Plan:** | **Occupied Times: Dec 1 – March 31: 8am – 4:30pm. Rest of year: 4 hours/day** |

| **ARCHITECHTURAL/STRUCTURAL** |
|---|
| **Wall type/R-value:** Metal clad exterior, R-28 insulation, metal clad interior. |
| **Roof Type/R-value:** Metal clad standing seam ext (1:12 slope). R-30 insulation, metal clad interior. |
| **Door Type/weather stripping:** Overhead doors – 1 x 14' x 14' insulated, 3 x 16' x 14' insulated, all 4 overhead doors need weather-stripping. 1 x 12' x 16' new insulated door with good weather-stripping. Pedestrian doors – 3 x 3' x 7' x 1 ¾ " (type H.M.?) welded frame, need weather-stripping. |
| **Window type/caulking:** 2 x 46" x 46" triple pane in good condition. |
| **Other:** |
| **MECHANICAL** |
| **Heating System:** In floor heating. A.O. Smith Boiler Copper HW 399_7945 Nat. Gas. Has motorized damper on combustion air duct. 399MBH in, 319.2MBH out. |
| **Cooling System:** Small window air conditioner for office. |
| **Ventilation System:** 2 HRVs on humidistats – Summeraire approx 700 cfm each. |
| **HVAC Controls**: Wall stats: 1 for in-floor heating – don't want setbacks. 3 wall stats for electric baseboards. |
| **HVAC Maintenance/Training**: |
| **Water Supply System**: Municipal water with meter. |
| **Domestic Hot Water System**: Natural gas DWH, 75 US Gal, 360MBH input used to be used for pressure washer but now only used for domestic water. |
| **Water Fixtures:** 1 toilet – 13.25 lpf, 1 low flow urinal, 1 shower – never used, 1 tub sink – very high flow, 1 single kitchen sink. |

| ELECTRICAL |
| --- |
| **Indoor Lighting:** 61 – 2x 8' T12s, 10 – 2x4' T12s, 3 – 60W Incandescents (2 of which are seldom on). |
| **Outdoor Lighting:** 4 High pressure sodiums. |
| **Exit Signs:** None. |
| **Motors:** 2 x 1/3 HP motors for hydronic pumps. 1 x 1/3 HP motors for sewage pump. |
| **Parking Lot Plugs:** 3 |
| **OTHER BUILDING SYSTEMS** |
| 5 Ceiling Fans<br>1 2 speed exhaust fan with bdd and outlet hood on timer. |
| **PROCESS SYSTEMS** |
| Compressed air – compressor runs 1 hr/day max.<br>Kerosene heated pressure washer. ALKOTA SN 220749. |
| **BUILDING SERVICES (Hydro, Gas, Oil, Water, etc.)** |
| Hydro, gas, municipal water, septic field. |
| **NOTES** |
| Keep shop at 65 F but equipment does not fully thaw and floor does not dry overnight. They want to add 1 or 2 overhead radiant heaters that can be used for recovery and to thaw equipment. |

# APPENDIX B

# TABLES TO CALCULATE ENERGY SAVINGS

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**Table B.1.1 - Energy Breakdown for Municipal Office Building**

| | Energy Consumption (kWh) | % of Total Energy Consumption |
|---|---|---|
| HVAC | 178,195 | 88% |
| Lighting | 23,464 | 12% |
| Hot Water | 1,709 | 1% |
| **Total** | **203,368** | |

**Table B.1.2 (a) - Electricity Usage for Municipal Office Building**

| | Consumption Data | | | Calculated Costs | | |
|---|---|---|---|---|---|---|
| Month (2004-2005) | Maximum KVA | Billed KVA | Energy (kWh) | Demand Charge | Energy Charge | Total Charge |
| September | 0 | 0 | 1,784 | $0 | $105 | $137 |
| October | 0 | 0 | 3,201 | $0 | $188 | $232 |
| November | 0 | 0 | 2,340 | $0 | $137 | $174 |
| December | 0 | 0 | 3,499 | $0 | $205 | $252 |
| January | 0 | 0 | 3,425 | $0 | $201 | $247 |
| February | 0 | 0 | 2,151 | $0 | $126 | $162 |
| March | 0 | 0 | 3,034 | $0 | $178 | $221 |
| April | 0 | 0 | 2,168 | $0 | $127 | $166 |
| May | 0 | 0 | 2,825 | $0 | $170 | $211 |
| June | 0 | 0 | 1,408 | $0 | $85 | $114 |
| July | 0 | 0 | 2,622 | $0 | $157 | $198 |
| August | 0 | 0 | 1,502 | $0 | $90 | $121 |
| **TOTAL** | | **0** | **29,959** | **$0** | **$1,768** | **$2,234** |

**Table B.1.2 (b) - Natural Gas Consumption for Municipal Office Building**

| Month (2004-2005) | Gas ($m^3$) | Gas (kWh) | Total Charge |
|---|---|---|---|
| September | 120 | 1,242 | $63 |
| October | 700 | 7,245 | $313 |
| November | 1,430 | 14,800 | $613 |
| December | 3,803 | 39,360 | $1,607 |
| January | 3,780 | 39,122 | $1,598 |
| February | 4,147 | 42,920 | $1,708 |
| March | 1,657 | 17,149 | $676 |
| April | 716 | 7,410 | $315 |
| May | 139 | 1,439 | $75 |
| June | 0 | 0 | $0 |
| July | 176 | 1,822 | $103 |
| August | 87 | 900 | $52 |
| **TOTAL** | **16,755** | **173,409** | **$7,123** |

**Notes**

There is no charge for the first 50 KVA of monthly demand; a charge of $8.32 is applied to each KVA above 50.

The Total Charge column includes the energy charge, the demand charge, the monthly basic charge, and 14% taxes.

**Table B.1.3 - Lighting Analysis Summary for Municipal Office Building**

| Description | Quantity | Current Conditions | | After Improvements | |
|---|---|---|---|---|---|
| | | Annual Energy Consumption (kWh) | Annual Cost | Annual Energy Consumption (kWh) | Annual Cost |
| Fluorescents - Convert 4' T12s to 4' T8s (5x2) | 10 | 2,328 | $140 | 1,402 | $84 |
| Fluorescents - Convert 4' T12s to 4' T8s (48x4) | 192 | 19,569 | $1,175 | 11,781 | $707 |
| Fluorescents - Convert 8' T12s to 8' T8s (3x2) | 6 | 799 | $48 | 373 | $22 |
| Install Parking Lot Controllers | 4 | 768 | $46 | 384 | $23 |
| **TOTALS** | | **23,464** | **$1,409** | **13,940** | **$837** |

| | |
|---|---|
| **Annual Energy Savings (kWh)** | **9,524** |
| **Annual Cost Savings** | **$572** |
| **Percent Annual Energy Savings** | **41%** |

These calculations are assuming that the Municipal Office Building is occupied for 40 hours a week.

The outdoor lights are assumed to be on 12 hours per day, 365 days per year.

**Table B.1.4 (a) Window and Door Infiltration Calculations for Municipal Office Building**

| Description | Existing | | | | New | | | Savings | |
|---|---|---|---|---|---|---|---|---|---|
| | Area ($ft^2$) | R-Value ($^oF\ ft^2hr/BTU$) | Annual Heat Loss (kWh) | Cost | R-Value ($^oF\ ft^2hr/BTU$) | Annual Heat Loss (kWh) | Cost | Energy (kWh) | Cost |
| 2 - 30"x67" double pane windows - replace with triple panes. | 28 | 2.000 | 1,273 | $58 | 6.25 | 407 | $19 | 866 | $40 |
| 2 - 30"x23" double pane windows - replace with triple panes. | 10 | 2.000 | 437 | $20 | 6.25 | 140 | $6 | 297 | $14 |
| 1 - 36"x22" single pane above door - replace with triple pane. | 6 | 1.000 | 502 | $23 | 6.25 | 80 | $4 | 421 | $19 |
| 1 - 62"x25" double pane window - replace with triple pane. | 11 | 2.000 | 491 | $22 | 6.25 | 157 | $7 | 334 | $15 |
| 1 - 42"x25" double pane window - replace with triple pane. | 7 | 2.000 | 333 | $15 | 6.25 | 106 | $5 | 226 | $10 |
| 1 - 44"x28" double pane window - replace with triple pane. | 9 | 2.000 | 390 | $18 | 6.25 | 125 | $6 | 265 | $12 |
| **TOTALS** | | | **3,426** | **$157** | | **1,016** | **$46** | **2,410** | **$110** |

**Table B.1.4 (b) Window and Door Infiltration Calculations for Municipal Office Building**

| Description | Crack Length (ft) | Crack Width (in) | Leakage on typical door (cfm) | Leakage on these doors (cfm) | Annual Heat Loss (BTU) | Annual Heat Loss (kWh) | Cost |
|---|---|---|---|---|---|---|---|
| Front door (1) | 3 | 0.05 | 125 | 10 | 3,444,835 | 1,010 | $46 |
| Door to MSTW (1) | 5 | 0.05 | 125 | 17 | 5,741,392 | 1,683 | $77 |
| **TOTALS** | | | | | | **2,692** | **$123** |

**Table B.1.4 (c) Wall/Roof Insulation Upgrade for Municipal Office Building**

| Description | Existing | | | | New | | | Savings | |
|---|---|---|---|---|---|---|---|---|---|
| | Area ($ft^2$) | R-Value ($^oF\ ft^2hr/BTU$) | Annual Heat Loss (kWh) | Cost | R-Value ($^oF\ ft^2hr/BTU$) | Annual Heat Loss (kWh) | Cost | Energy (kWh) | Cost |
| Upgrade roof insulation | 4,070 | 20.000 | 18,565 | $848 | 40.00 | 9,283 | $424 | 9,283 | $424 |
| Ugrade wall insulation | 3,269 | 12.000 | 24,851 | $1,136 | 20.00 | 14,911 | $681 | 9,940 | $454 |
| **TOTALS** | | | **43,416** | **$1,984** | | **24,193** | **$1,106** | **19,223** | **$878** |

The crack length around the doors is a quarter of the perimeter
The crack length around the windows is a quarter of the perimter
The office is assumed to be kept at 70 F

**Table B.1.5 - Water Usage for Municipal Office Building**

| Fixtures | Qty | Est. # of Uses/Hr/ Fixture | Est. # of Uses/Yr | Current Flow (LPF or LPC) | Current Water Usage (L/Yr) | New Flow (LPF or LPC) | New Water Usage (L/Yr) | Water Saved (L/Yr) | Hot Water Savings (kWh) | Cost Savings |
|---|---|---|---|---|---|---|---|---|---|---|
| Sinks | 3 | 1 | 9,100 | 1.60 | 14,560 | 0.32 | 2,912 | 11,648 | 436 | $26 |
| Toilets | 3 | 1 | 9,100 | 13.25 | 120,575 | 6.00 | 54,600 | 65,975 | NA | NA |
| **Total** | | | | | **135,135** | | **57,512** | **77,623** | **436** | **$26** |

| Frequency at Which Fixtures are Used | | | |
|---|---|---|---|
| | Females | Males | Totals |
| Number of People | 5 | 5 | |
| Number of Toilet Uses/day | 3 | 4 | |
| Number of Toilets | 3 | 3 | |
| Toilet Uses/hour/fixture | 0.625 | 0.833333 | 1.458333 |
| Number of Sinks | 3 | 3 | |
| Number of Sink Uses/day | 3 | 4 | |
| Sink Uses/hr/fixture | 0.625 | 0.833333 | 1.458333 |

| Current Hot Water Usage (kWh) | | |
|---|---|---|
| Fixture | L/Yr | kWh |
| Sinks | 14,560 | 546 |
| **Total** | **14,560** | **546** |

The current sinks are assumed to consume 2.5 gpm and the new sinks are 0.5 gpm

The current toilets are assumed to use 3.5 gallons per flush and the new toilets use 1.5 gallons per flush

**Table B.1.6 Energy Savings with Heating, Ventilating, and Air Conditioning for Municipal Office Building**

| Description | % of Time Unoccupied | HDD below 70 F | HDD below 59 F | Current Energy Used to Heat | Heat Savings (kWh) |
|---|---|---|---|---|---|
| Setback thermostats to 59 F | 76% | 9,728 | 8,219 | 173,409 | 20,505 |

| Description | Quantity | Current Heating Efficiency | New Heating Efficiency | Energy Savings for Heating(kWh) | Increase in Cooling Efficiency | Energy Savings for Cooling (kWh) | Total Energy Savings (kWh) |
|---|---|---|---|---|---|---|---|
| Replace 2.5 ton RTUs with higher efficiency RTUs. | 1 | 75% | 80% | 8,670 | 49% | 1,172 | 9,843 |
| Replace 3 ton RTUs with higher efficiency RTUs. | 1 | NA | NA | NA | 15% | 730 | 730 |
| Replace condensing units with higher efficiency unit. | 1 | NA | NA | NA | 35% | 837 | 837 |

| Description | Quantity | Air Flow (cfm) | Heat Loss for 1 (kWh) | Heat Savings for 1 (kWh) | Heat Savings for 2 (kWh) |
|---|---|---|---|---|---|
| Install HRVs and close damper for fresh air intake to RTUs. | 2 | 240 | 5,674 | 2,837 | 5,674 |

| Description | Quantity | Air flow reduction | Energy Savings (kWh) |
|---|---|---|---|
| Install $CO_2$ sensor and hook up to ventilation | 1 | 180 | 4,255 |

**Table B.2.1 - Energy Breakdown for the Municipal Shop**

| | Energy Consumption (kWh) | % of Total Energy Consumption |
|---|---|---|
| HVAC | 60,905 | 63% |
| Lighting | 31,332 | 33% |
| Hot Water | 2,568 | 3% |
| Motors | 1,153 | 1% |
| **Total** | **95,958** | |

**Table B.2.2 (a) - Electricity Usage for Municipal Shop**

| | Consumption Data | | | Calculated Costs | | |
|---|---|---|---|---|---|---|
| Month (2004-2005) | Maximum KVA | Billed KVA | Energy (kWh) | Demand Charge | Energy Charge | Total Charge |
| September | 0 | 0 | 2,750 | $0 | $161 | $202 |
| October | 0 | 0 | 2,720 | $0 | $159 | $200 |
| November | 0 | 0 | 3,370 | $0 | $197 | $243 |
| December | 0 | 0 | 4,700 | $0 | $275 | $332 |
| January | 0 | 0 | 4,310 | $0 | $253 | $306 |
| February | 0 | 0 | 9,370 | $0 | $549 | $644 |
| March | 0 | 0 | 3,220 | $0 | $189 | $233 |
| April | 0 | 0 | 5,120 | $0 | $300 | $364 |
| May | 0 | 0 | 3,380 | $0 | $203 | $249 |
| June | 0 | 0 | 2,630 | $0 | $158 | $198 |
| July | 0 | 0 | 2,290 | $0 | $137 | $175 |
| August | 0 | 0 | 3,620 | $0 | $217 | $266 |
| **TOTAL** | | **0** | **47,480** | **$0** | **$2,799** | **$3,411** |

**Table B.2.2 (b) - Natural Gas Consumption for Municipal Shop**

| Month (2004-2005) | Gas ($m^3$) | Gas (kWh) | Total Charge |
|---|---|---|---|
| September | 53 | 549 | $34 |
| October | 176 | 1,822 | $87 |
| November | 175 | 1,811 | $85 |
| December | 1,282 | 13,268 | $549 |
| January | 979 | 10,132 | $422 |
| February | 758 | 7,845 | $326 |
| March | 624 | 6,458 | $266 |
| April | 437 | 4,523 | $189 |
| May | 0 | 0 | $0 |
| June | 194 | 2,008 | $118 |
| July | 0 | 0 | $0 |
| August | 6 | 62 | $25 |
| **TOTAL** | **4,684** | **48,478** | **$2,103** |

**Notes**

There is no charge for the first 50 KVA of monthly demand; a charge of $8.32 is applied to each KVA above 50.

The Total Charge column includes the energy charge, the demand charge, the monthly basic charge, and 14% taxes.

**Table B.2.3 - Lighting Analysis Summary for Municipal Shop**

| Description | Quantity | Current Conditions | | After Improvements | |
|---|---|---|---|---|---|
| | | Annual Energy Consumption (kWh) | Annual Cost | Annual Energy Consumption (kWh) | Annual Cost |
| Indoor Fluorescents - Convert 8' T12s to 8' T8s (61x2) | 122 | 28,021 | $1,682 | 13,044 | $783 |
| Indoor 60 W Incandescents - Convert to Compact Fluorescents | 3 | 356 | $21 | 95 | $6 |
| Indoor Fluorescents - Convert 4' T12s to 4' T8s (10x2) | 20 | 1,940 | $117 | 1,168 | $70 |
| Outdoor High Pressure Sodium lights - no upgrade recommended. | 1 | 438 | $26 | 219 | $13 |
| Parking lot plug-ins | 3 | 576 | $35 | 288 | $17 |
| **TOTALS** | | **31,332** | **$1,881** | **14,814** | **$889** |

| | |
|---|---|
| **Annual Energy Savings (kWh)** | **16,517** |
| **Annual Cost Savings** | **$992** |
| **Percent Annual Energy Savings** | **53%** |

The Municipal Shop is occupied from 8-4:30 for 4 months of the year and for 4 hours a day the rest of the year.

The outdoor lights are assumed to be on 12 hours per day, 365 days per year.

**Table B.2.4 (a) Window and Door Infiltration Calculations for Municipal Shop**

| Description | Crack Length (ft) | Crack Width (in) | Leakage on typical door (cfm) | Leakage on these doors (cfm) | Annual Heat Loss (BTU) | Annual Heat Loss (kWh) | Cost |
|---|---|---|---|---|---|---|---|
| Overhead doors (4) | 30 | 0.05 | 125 | 101 | 34,968,010 | 10,248 | $468 |
| Pedestrian doors (3) | 5 | 0.05 | 125 | 17 | 5,926,781 | 1,737 | $79 |
| **TOTALS** | | | | | | **11,985** | **$548** |

The crack length around the doors is taken as an eighth of the perimeter

The shop is assumed to be kept at 65 F and the other rooms at 50 F

**Table B.2.5 - Water Usage for Municipal Shop**

| Fixtures | Qty | Est. # of Uses/Hr/ Fixture | Est. # of Uses/Yr | Current Flow (LPF or LPC) | Current Water Usage (L/Yr) | New Flow (LPF or LPC) | New Water Usage (L/Yr) | Water Saved (L/Yr) | Hot Water Savings (kWh) | Cost Savings |
|---|---|---|---|---|---|---|---|---|---|---|
| Sinks | 1 | 3.3 | 6,435 | 1.60 | 10,296 | 1.29 | 8,288 | 2,008 | 75 | $5 |
| Urinals | 1 | 0.2 | 413 | 3.8 | 1,568 | 3.80 | 1,568 | 0 | NA | NA |
| Toilets | 1 | 3.3 | 6,435 | 13.25 | 85,264 | 6.00 | 38,610 | 46,654 | NA | NA |
| **Total** | | | | | **97,127** | | **48,466** | **48,661** | **75** | **$5** |

| Frequency at Which Fixtures are Used | | | |
|---|---|---|---|
| | Females | Males | Totals |
| Number of People | 2 | 5 | |
| Number of Toilet Uses/day | 3 | 4 | |
| Number of Toilets | 1 | 1 | |
| Toilet Uses/hour/fixture | 0.75 | 2.5 | 3.25 |
| Number of Sinks | 1 | 1 | |
| Number of Sink Uses/day | 3 | 4 | |
| Sink Uses/hr/fixture | 0.75 | 2.5 | 3.25 |
| Number of Urinal Uses/day | 0 | 3 | |
| Number of Urinals | 1 | 1 | |
| Urinal Uses/hour/fixture | 0 | 0.21 | 0.21 |

| Current Hot Water Usage (kWh) | | |
|---|---|---|
| Fixture | L/Yr | kWh |
| Sinks | 10,296 | 386 |
| **Total** | | **386** |

The current toilets are assumed to use 3.5 gallons per flush and the new toilets use 1.5 gallons per flush

The current faucets are assumed to consume 2.5 gpm and the new faucets are 1.7 gpm

The low flow urinals consume 1 gpm

**Table B.2.6 Energy Savings with Heating, Ventilating, and Air Conditioning for Municipal Shop**

| Description | Annual Energy Savings (kWh) | Annual Cost Savings ($) | Installation Cost | Simple Payback Years |
|---|---|---|---|---|
| Install geothermal heating system. | 36,543 | $1,670 | $91,200 | 54.61 |

# APPENDIX C

# WATER EFFICIENCY

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## Leaks

- A leak of one drop per second wastes 10,000 litres of water per year. A toilet that runs after a flush can waste 200,000 litres of water per year. Fixing a hot water leak will save energy as well as water.

- Check for differing water meter readings at bedtime and in the morning. If no water has been intentionally used, a difference in meter readings indicates a leak.
- If a few drops of food colouring put in your toilet tank seep into the toilet bowl (without flushing), check the flapper valve, valve seat and flapper lift chain for the source of the leak.
- Conduct a periodic "leak check" a minimum of twice a year on water using fixtures and appliances, including outside hose connections. Replace worn washers, O-rings and faulty fixtures.

## On-Site Wastewater Systems

- Wise water management is necessary. All septic systems have limitations and water conservation should be practiced.
- Do not use substitutes for toilet paper. These products may not decompose in the tank and could clog the system.
- Perform regular maintenance checks on your entire system, including regular pump outs of the septic tank and inspection of the disposal field for signs of saturation or leakage.

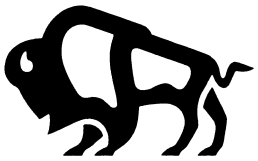
## For More Information, Please Contact:


Water Efficiency Coordinator
Pollution Prevention
Manitoba Conservation
123 Main Street, Suite 160
Winnipeg MB R3C 1A5

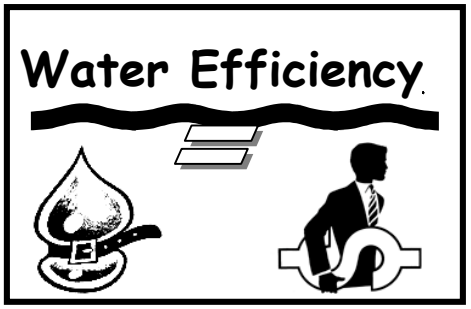
Phone: (204) 945-8980 or
1-800-282-8069 ext. 8980
Fax: (204) 945-1211
E-mail: lliebgott@gov.mb.ca



**Publication Number: 98-06E**

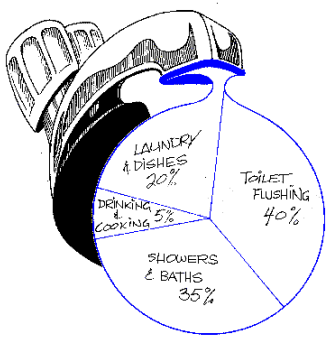

**Pollution Prevention**
Manitoba Conservation

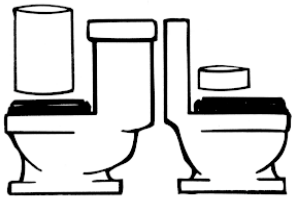

# Water Use

### How you can reduce yours!

- Save money.
- Delay the need to expand our water and wastewater treatment plants.
- Prolong the life of in-ground sewage disposal systems, i.e., septic fields.
- Protect our water sources.



## Bathroom




- Replace toilets that flush 13 to 26 litres of water with 6 litre or dual flush toilets, cutting water used by toilets by half or more. See www.cwwa.ca for toilet performance ratings. In the mean time, reduce water per flush in toilets by up to 35% by installing early closure devices (don't use bricks – as they break down, pieces interfere with the flapper seal).
- Refrain from using the toilet to dispose of trash.
- A partially filled tub uses less water than a long shower; a short shower uses less than a full tub.
- Replace your 20 litre per minute showerhead with a low-flow 9.5 litre per minute showerhead. You'll use less than half the water.
- Make it a habit to be finished your shower in less than 5 minutes.
- Install a water conserving 3.5 litre per minute aerator on your bathroom tap.
- When shaving, rinse the razor in a cup or a partially filled sink instead of letting the tap run.
- Brush teeth using a glass of water to rinse.

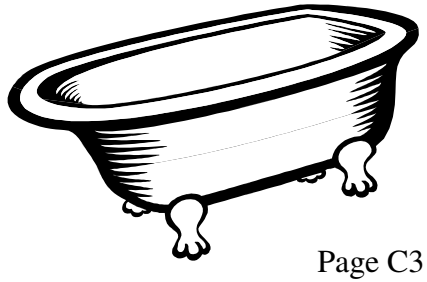
## Kitchen & Laundry

- Install a water saving 9 litre per minute aerator on the kitchen tap.
- Rinse dishes in a stoppered sink or basin, not with running water.
- Wash vegetables in a basin or stoppered sink, then quickly rinse using running water.
- Keep drinking water in the fridge. Wash the container and change the water every few days.
- Thaw food in the fridge rather than under a running tap. This conserves both energy and water.

- Compost organic wastes instead of using a sink garbage disposal.
- Buy a low water use dishwasher to save on energy, water and detergent costs.
- Wash only full loads of laundry and dishes.
- Front loading washing machines use less water than top-loading washers do. If unavailable, choose a clothes washer with a suds saver, and water saving cycle.

## General Water Use

- Only use water treatment or softening systems, if required. If possible, only use softened water for bathing and cleaning – use unsoftened water for cooking, drinking and watering plants.
- Ensure a water softener regenerates only when the resin is exhausted.
- Turn the system off if you will be away for more than a few days.
- Insulate hot water tank and pipes to reduce the need to run water until it is hot. Install a heat trap on the pipe above your water heater to save energy and water.
- Know location of sink, toilet and main shut off valves in case a pipe or water heater blows, or so you can turn off your water when you are away.
- If your water pipes tend to freeze, do not let the tap run continuously. This wastes water, and overloads sewer systems. Instead, install heat tape or connect a pump-back reservoir system (discuss options with your plumber, electrician or call Manitoba Conservation).



# APPENDIX D

# INCENTIVE PROGRAMS

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**Table D.1 Manitoba Hydro Power Smart Incentives**

| Item | Incentives | Contacts |
|---|---|---|
| Compact Fluorescents | $5 - Non-reflectorized screw in lamp, $10 - Reflectorized screw-in lamp, $45 - New hard wired fixture | Kelly Epp at kepp@hydro.mb.ca or 204-474-3615 |
| T8 Electronic Fluorescents | T8 Premium Ballast - $20, T8 Standard Ballast - $15, T8 Dimmable Ballast - $60, 8 Foot T8 Ballast - $35 | Kelly Epp at kepp@hydro.mb.ca or 204-474-3615 |
| LED Exit Signs | $45 per new sign | Kelly Epp at kepp@hydro.mb.ca or 204-474-3615 |
| High Pressure Sodium Lighting | The lesser of $500 per kilowatt saved or $100 of lighting fixture cost | Kelly Epp at kepp@hydro.mb.ca or 204-474-3615 |
| Parking Lot Controllers | $25 for each controlled circuit | May Arason-Li at marasonli@hydro.mb.ca or 204-474-7813 |
| Air Barrier System | $0.46 per square foot or $5 per square meter of net wall area | May Arason-Li at marasonli@hydro.mb.ca or 204-474-7813 |
| Windows | Depends on replacement window's U-Value and net window area | May Arason-Li at marasonli@hydro.mb.ca or 204-474-7813 |
| Geothermal Heat Pump | Manitoba Hydro will pay up to half the cost of a feasabillity study to help decide whether a geothermal heat pump is the right choice for you building. Manitoba Hydro also offers a custom incentive towards the capital cost of your heat pump system, based on the energy savings calculated in the feasability study. | Domenic Marinelli at dmarinelli@hydro.mb.ca or 204-474-4273 |
| High Efficiency Furnaces | $245 for each furnace installed. | Jamie Hopkins at jhopkins@hydro.mb.ca or 204-474-4018 |
| Condensing Boilers | Boilers < 300MBH, Manitoba Hydro will pay $500 + $5/MBH input. Boilers > 300MBH, Manitoba Hydro will pay $2000 + $8/MBH input (retrofits) and $2000 + $5/MBH input (new construction). | Jamie Hopkins at jhopkins@hydro.mb.ca or 204-474-4018 |
| Air Conditioners | Depends on the EER, the cooling capacity, and the incentive factor. | Jamie Hopkins at jhopkins@hydro.mb.ca or 204-474-4018 |

Notes
For general information and information kits contact:
Power Smart for Business
Phone: 474-3676
Email Address: powersmartforbusiness@hydro.mb.ca

**Table D.2. Other Incentive Programs**

| Program Name | Eligibility | What Type of Projects are Available | Ref. Page | Available Funding | Funding Maximums | Deadline For Applications | Prospect of Funding | Project Sponsor | Contact | Email | Website |
|---|---|---|---|---|---|---|---|---|---|---|---|
| EnerGuide for Existing Buildings (EEB) | Comm. & Institutional Bldgs. Aboriginal, northern, rural or remote communities may receive special consideration. | Projects that reduce energy consumption. Includes costs for project planning and development, materials and labour, monitoring and tracking and staffing training and awareness. | 13 | $7.50/GJ (277.8 kW H) | up to 25% of costs based on energy savings ($250,000 max) | On-going | Good | NRCan | MarieLynn Tremblay | Marie_Lyne.Tremblay@nrcan-rncan.gc.ca | http://oee.nrcan.gc.ca/commercial/existing.cfm?attr=20 |
| Municipal Rural Infrastructure Fund (MRIF) | All MB local governments | Projects that construct, restore or improve infrastructure that ensures sustainable use and management of water and wastewater resources. Projects that construct, restore or improve public arts and heritage infrastructure, such as museums, heritage sites, sites for performings arts, and cultural or community centres. - See detailed program info for more info. Program has many requirements and caveats. | 23, 46, 54 | | 2/3 of the approved costs | On-going | Good | Canada-Manitoba Infrastructure Programs | | infra@gov.mb.ca | http://www.infrastructure.mb.ca/e/index.html |
| Renewable Energy Development Initiative (REDI) | …Municipalities…, solar air/water heating, biomass | Projects involving solar air or water heating and clean burning biomass combustion projects. | 25 | 25% of purchase and install of qualifying system | $80,000 | 31-Mar-07 | | NRCan | | redi.penser@nrcan.gc.ca | http://www2.nrcan.gc.ca/es/erb/erb/english/View.asp?x=455 |
| Community Places Program | Non-profit community organizations in MB, except public schools, universities, hospitals, nursing homes, monnercial coops, federal, provincial and city of Winnipeg departments. | Projects involving the upgrading, construction or acquisition of community facilities available to the general community. Priority given to proposals for critical repairs to extend the life of existing well-used facilities. Projects must provide lasting, long-term benefits to the community. | | Up to 50% of first $15,000 and 1/3 of the rest of project | $50,000 | | | Manitoba Culture, Heritage and Tourism | Varies by region | www.gov.mb.ca/chc/grants | http://www.gov.mb.ca/chc/grants |
| Sustainable Development Innovations Fund (SDIF) | Municipal corporations, local governments, private and non-profit organizations and businesses | Sustainable community development, Eco-efficiency initiatives, environmental stewardship. Emphasis on youth involvement, first nations and northern communities. | 55 | | $50,000 (usually $25,000 or less) | | fair | Manitoba Conservation | | sdif@gov.mb.ca | http://www.gov.mb.ca/conservation/pollutionprevention/sdif/index.html |

# APPENDIX E

# TRANSPORTATION AND EQUIPMENT EFFICIENCY

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**Transportation and Equipment Efficiency for Small Municipalities (< 10,000 population).**

Municipal governments may wish to:

- Assess Regulatory, Standards & Industry "Best Practices" to ensure compliance and demonstrated "Due Diligence". Includes Provincial, Federal, Society of Automotive Engineers (SAE), Canadian Standards Association (CSA), American National Standards Institute (ANSI), Workplace Safety & Health audits, Safety inspections, Workplace Hazardous Materials Information System (WHMIS), Transportation of Dangerous Goods regulation (TDG), etc.

- Review current fuelling habits & education on "economical operation" (Driver training, minimal idling, proper lubricants for seasonal operation etc.)

- Review "Alternative Fuel" options, e.g., Diesel and Biodiesel, Propane, Compressed Natural Gas (CNG). Note: Electric Vehicles are not an option yet due to initial cost and the prevailing ambient temperatures experienced in Manitoba

- Consider recycling initiatives for disposal of Fleet Waste Stream products, eg. tires, lubricating oil, anti-freeze, aerosol cans, paints, controlled products, ferrous & non-ferrous scrap metal, plastics etc.

**Other Opportunities:**

***Transportation Demand Management***

- Education & awareness programs on ride-sharing, telecommuting & teleconferencing

***Encouragement of Alternative Modes of Transportation***

- Possibility of van based transit or "pool" operations for commuting within towns & outlying areas. May be viable for transporting groups of employees to & from work locations

- Provision of bike racks, lockable bike containers or small fenced compounds at key locations

- Education & awareness programs on vehicle emissions, "fuel saving" driving habits etc.

***Traffic & Parking Management***

- Possibility of synchronizing traffic lights (if installed) and implementing parking fees etc. to manage parking

## CHOOSING A VEHICLE

### Vehicle Construction

The following points are important when considering fuel efficiency.

- A five speed manual transmission is about 5% more efficient than an automatic.
- Smaller engines use less fuel.
- Front wheel drive vehicles are lighter and therefore more fuel efficient than rear wheel drive vehicles
- SUV's tend to have low fuel efficiency
- Front wheel drive vehicles provide better traction than rear wheel drive in most cases.
- Small engines with a turbocharger can help make up the power difference between large and small engines by using energy from hot exhaust.

### Vehicle Ratings

The Office of Energy Efficiency of Natural Resources Canada, issues a list of the most fuel efficient vehicles in each of a number of categories. See their website for the latest list.

### Extra Features

Air conditioning, power steering, and roof racks are some of the big energy using extras. Air conditioning can increase your fuel consumption by 10 to 20 percent in city driving. A fully loaded roof rack can add 25% to your fuel costs. Even empty, it will add about 1% due to wind resistance

## DRIVING ECONOMICALLY

Driving technique is critical to fuel economy.

- Maintain recommended tire pressure to maximize fuel efficiency and tire life.
- Keep your engine well tuned and maintained.
- One minute of idling uses more fuel than restarting the engine.
- Avoid jack-rabbit starts.
- An open sun roof and open windows increase air resistance, especially on the highway. Use the car's ventilation system instead.
- Most cars use 10% less fuel when driven at 55 miles per hour as opposed to 62, or 90 kilometers as opposed to 100.
- Adjust your speed in advance of changes in traffic flow. Take your foot off the accelerator and progressively gear down rather than accelerating up to a stop sign and breaking hard.

## ENGINE BLOCK HEATERS - IS THERE A SAVINGS?

- In sub-freezing temperatures, the first 15 to 20 minutes of driving, after a cold start cause the engine to use about 30% more fuel than a warm engine.
- A timer can be installed for your vehicle's block heater to start warming the engine a couple hours before you head out.
-

- With the cost of electricity accounted for, you should still come out ahead, over the course of a winter.

**FUEL OPTIONS**

- Diesel engines are more fuel efficient than gasoline engines, as Diesel contains 10% more energy per unit volume than gasoline. Higher diesel engine costs are offset by increased fuel economy and engine life.
- Many fleet operators are converting their vehicles to biodiesel for cost advantages and a cleaner burn.
- There are many advantages to a dual-fuel system, which allows you to switch between gasoline and propane or natural gas with the flick of a switch.
- Hybrid vehicles…

From the Office of Energy Efficiency, Natural Resources Canada:

# Buying a Fuel-Efficient Vehicle

- Fuel consumption can vary widely from one vehicle to the next. Whether you're buying new or used, the choices you make today will either save you money (through reduced fuel consumption) or cost you money for years to come.

- How big is big enough? It's always a good idea to avoid buying more vehicle than you need. Larger vehicles tend to be heavier and have bigger and more powerful engines, so consider buying the most fuel-efficient vehicle that meets your everyday needs.

- If you're buying a new vehicle, check the EnerGuide label for its fuel consumption rating. EnerGuide labels are now affixed to all new light-duty vehicles sold in Canada.

- Fuel consumption ratings for all new cars, light-duty trucks and vans sold in Canada are also available in the free Fuel Consumption Guide. You can download a PDF version of the Guide, or call 1 800 387-2000 to order your free copy. Past editions are available, so you can also check fuel consumption ratings for used vehicles.

- Have a look at the list of the most recent winners of the EnerGuide Awards, presented each model year to the manufacturers of the most fuel-efficient vehicles in different classes – two-seater, subcompact, compact, mid-sized and large cars, as well as station wagons, vans, pickup trucks and special purpose vehicles.

- Your choice of transmission will directly affect the cost of the vehicle and its fuel consumption. As a general rule, a manual transmission is more fuel efficient than an automatic, assuming you shift properly. If you buy an automatic, the more gears, the better.

- Four-wheel drive and all-wheel drive offer superior traction and braking under slippery conditions, but the weight and friction of additional drivetrain parts can increase fuel consumption by 5 to 10 percent compared with two-wheel drive vehicles. How often would you need to use this option, and is it worth the extra fuel cost for as long as you own the vehicle?

- Under normal driving conditions, smaller engines deliver better fuel economy than larger engines. Choose the smallest engine that meets your everyday needs.

- Are you willing to pay a fuel penalty for as long as you own your vehicle just to have the convenience of options such as power windows, seats and mirrors? Many options increase fuel consumption by adding weight, increasing aerodynamic drag, or drawing extra power from the engine.

- Do you really need an air conditioner? Operating an air conditioner in hot weather can increase fuel consumption by more than 20 percent in city driving. Consider using the car's ventilation system and options such as a sunroof and tinted glass.

- For most drivers, cruise control saves fuel on the highway by keeping your speed constant and avoiding inadvertent speeding.

- Explore your fuel options. Will a fuel-efficient diesel vehicle meet your needs? What about propane or natural gas, which produce fewer greenhouse gas emissions and are cheaper to use than gasoline or diesel fuel? Ethanol fuel blends are also widely used by Canadian motorists. And hybrid vehicles, which use a combination of high-power batteries and an internal combustion engine, are beginning to appear on the North American market.

Please note – this list of websites is not comprehensive. They have not been reviewed for accuracy, but may provide ideas and options appropriate for some municipalities.

Other vehicle and equipment information can be found on the Internet at:
http://oee.nrcan.gc.ca/publications/infosource/home/index.cfm?act=category&PrintView=N&Text=N

http://www.betterroads.com/articles/NewProds/oct05bid.htm

http://www.edmunds.com/advice/specialreports/articles/102946/article.html

http://www.betterroads.com/articles/NewProds/oct05bid.htm

http://snow.grounds-mag.com/ar/grounds_maintenance_september_2/

http://www.missoulian.com/articles/2003/11/15/news/local/news03.txt

http://rocktoroad.com/grader.html

http://news.thomasnet.com/fullstory/29180/3281

http://www.forester.net/gx_0501_graders.html

http://www.epa.gov/greenkit/quick_start.htm#greenfleet

Self Audit

**Municipal Operations -Efficiency Survey**

**(Transportation, Road Repair, Snow Clearance, Waste Disposal, etc.)**

Name of Organisation: _____
Address: _____
_____
_____
Contact Name: _____
Phone No. _____
Name of person completing form: _____
Date: _____

| **Vehicles and Construction Equipment** | | | | | | |
|---|---|---|---|---|---|---|
| | **Gasoline** | **Diesel** | **CNG** | **Propane** | **Other** | **Total** |
| **Total Fuel Usage L/Year** | | | | | | |
| **Greenhouse Gas Emissions (tonnes)** | | | | | | |

**Fuel Use Minimization Considerations**

 What type of vehicles/equipment, if any, are you planning to replace in the next few years?_____
_____
_____

 Can you downsize these vehicles/equipment?
Comments:_____
_____
_____

 Can you make process or other changes to minimize use of, or eliminate these vehicles/equipment? Comments:_____
_____
_____

 Do you have a policy in place to make fuel efficiency one of the vehicle/equipment purchase requirements? Yes ___ No ___

 Have you made operational changes such as reducing idling time of vehicles and equipment, and using block heaters and timers to reduce warm up time?
Yes ___ No ___

 Have you encouraged more energy efficient driving behaviour through training, policies, and ongoing reminders? Yes ___ No ___

 Do you have procedures in place to detect and rectify leakage of above-ground and under-ground fuel storage tanks? Yes __ No ___

 Do you use automatic shut-off fill nozzles at pumps? Yes ___ No ___

**Comments**

_____
_____
_____
_____
_____
_____

# APPENDIX F

# ENERGY CONSUMPTION MONITORING SPREADSHEETS AND GRAPHS

# TABLE OF CONTENTS – APPENDIX F

**Table F.1 - Energy Consumption Monitoring Data for the Municipal Office Building**

| | 2004-2005 | | | | | 2005-2006 | | | | | 2006-2007 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Month** | **Billed Elect Energy (kWh)** | **Billed Natural Gas Energy ($m^3$)** | **Total Energy Consumption (kWh)** | **HDD (°C days/ mo)** | **Energy Normalized to 2004-2005 (kWh)** | **Billed Elect Energy (kWh)** | **Billed Natural Gas Energy ($m^3$)** | **Total Energy Consumption (kWh)** | **HDD (°C days/ mo)** | **Energy Normalized to 2004-2005 (kWh)** | **Billed Elect Energy (kWh)** | **Billed Natural Gas Energy ($m^3$)** | **Total Energy Consumption (kWh)** | **HDD (°C days/ mo)** | **Energy Normalized to 2004-2005 (kWh)** |
| September | 1,784 | 120 | 3,026 | 108.8 | 3,026 | | | 0 | | #DIV/0! | | | 0 | | #DIV/0! |
| October | 3,201 | 700 | 10,446 | 347.4 | 10,446 | | | 0 | | #DIV/0! | | | 0 | | #DIV/0! |
| November | 2,340 | 1,430 | 17,140 | 498.2 | 17,140 | | | 0 | | #DIV/0! | | | 0 | | #DIV/0! |
| December | 3,499 | 3,803 | 42,859 | 912 | 42,859 | | | 0 | | #DIV/0! | | | 0 | | #DIV/0! |
| January | 3,425 | 3,780 | 42,547 | 1072 | 42,547 | | | 0 | | #DIV/0! | | | 0 | | #DIV/0! |
| February | 2,151 | 4,147 | 45,071 | 800 | 45,071 | | | 0 | | #DIV/0! | | | 0 | | #DIV/0! |
| March | 3,034 | 1,657 | 20,183 | 736.9 | 20,183 | | | 0 | | #DIV/0! | | | 0 | | #DIV/0! |
| April | 2,168 | 716 | 9,578 | 299.9 | 9,578 | | | 0 | | #DIV/0! | | | 0 | | #DIV/0! |
| May | 2,825 | 139 | 4,264 | 230.1 | 4,264 | | | 0 | | #DIV/0! | | | 0 | | #DIV/0! |
| June | 1,408 | 0 | 1,408 | 43.7 | 1,408 | | | 0 | | #DIV/0! | | | 0 | | #DIV/0! |
| July | 2,622 | 176 | 4,444 | 21.9 | 4,444 | | | 0 | | #DIV/0! | | | 0 | | #DIV/0! |
| August | 1,502 | 87 | 2,402 | 32 | 2,402 | | | 0 | | #DIV/0! | | | 0 | | #DIV/0! |
| **TOTAL** | 29,959 | 16,755 | 203,368 | 5103 | 203,368 | 0 | 0 | 0 | 0 | #DIV/0! | 0 | 0 | 0 | 0 | #DIV/0! |

| | 2007-2008 | | | | | 2008-2009 | | | | | 2009-2010 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Month** | **Billed Elect Energy (kWh)** | **Billed Natural Gas Energy ($m^3$)** | **Total Energy Consumption (kWh)** | **HDD (°C days/ mo)** | **Energy Normalized to 2004-2005 (kWh)** | **Billed Elect Energy (kWh)** | **Billed Natural Gas Energy ($m^3$)** | **Total Energy Consumption (kWh)** | **HDD (°C days/ mo)** | **Energy Normalized to 2004-2005 (kWh)** | **Billed Elect Energy (kWh)** | **Billed Natural Gas Energy ($m^3$)** | **Total Energy Consumption (kWh)** | **HDD (°C days/ mo)** | **Energy Normalized to 2004-2005 (kWh)** |
| September | | | 0 | | #DIV/0! | | | 0 | | #DIV/0! | | | 0 | | #DIV/0! |
| October | | | 0 | | #DIV/0! | | | 0 | | #DIV/0! | | | 0 | | #DIV/0! |
| November | | | 0 | | #DIV/0! | | | 0 | | #DIV/0! | | | 0 | | #DIV/0! |
| December | | | 0 | | #DIV/0! | | | 0 | | #DIV/0! | | | 0 | | #DIV/0! |
| January | | | 0 | | #DIV/0! | | | 0 | | #DIV/0! | | | 0 | | #DIV/0! |
| February | | | 0 | | #DIV/0! | | | 0 | | #DIV/0! | | | 0 | | #DIV/0! |
| March | | | 0 | | #DIV/0! | | | 0 | | #DIV/0! | | | 0 | | #DIV/0! |
| April | | | 0 | | #DIV/0! | | | 0 | | #DIV/0! | | | 0 | | #DIV/0! |
| May | | | 0 | | #DIV/0! | | | 0 | | #DIV/0! | | | 0 | | #DIV/0! |
| June | | | 0 | | #DIV/0! | | | 0 | | #DIV/0! | | | 0 | | #DIV/0! |
| July | | | 0 | | #DIV/0! | | | 0 | | #DIV/0! | | | 0 | | #DIV/0! |
| August | | | 0 | | #DIV/0! | | | 0 | | #DIV/0! | | | 0 | | #DIV/0! |
| **TOTAL** | 0 | 0 | 0 | 0 | #DIV/0! | 0 | 0 | 0 | 0 | #DIV/0! | 0 | 0 | 0 | 0 | #DIV/0! |

**Notes**

* Energy consumption should be recorded following the implementation of the energy saving opportunities.

1. Enter the year in row 3 of this table (starting in column E,F,G).
2. Enter the "Billed Elec Energy" (in kWh) and the "Billed Natural Gas Energy" in ($m^3$) taken from the electricity and natural gas bills, respectively next to the appropriate month.
3. Go to the following website to collect information on the Heating Degree Days for Morden, Manitoba: http://www.climate.weatheroffice.ec.gc.ca/climateData/dailydata_e.html?timeframe=2&Prov=XX&StationID=29593&Year=2005&Month=8
4. Once you've arrived at this website, select the appropriate month and click the mouse on "GO"
5. From this website, record the last number highlighted in blue (refer to page F6) in the column "Heat Deg Days". This number should be entered under the heading HDD of this table, next to the appropriate month.
6. The "Energy Normalized to 2004-2005" will be calculated automatically and this point will show up on the Energy Consumption graph.

**Figure F.1 - Energy Consumption Monitoring Graph for the Municipal Office Building**

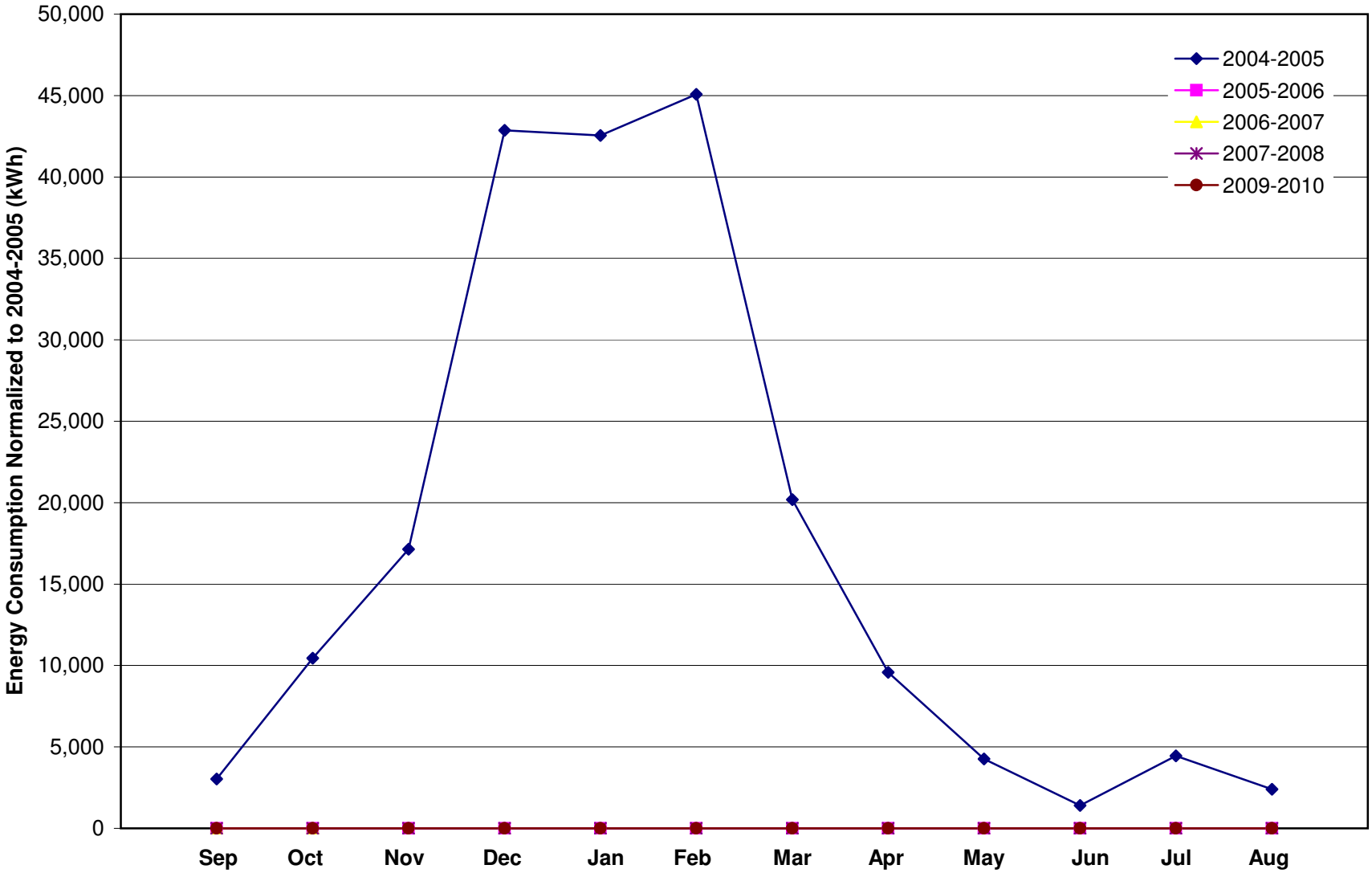


**Table F.2 - Energy Consumption Monitoring Data for the Municipal Shop**

| | 2004-2005 | | | | | 2005-2006 | | | | | 2006-2007 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Month** | **Billed Elect Energy (kWh)** | **Billed Natural Gas Energy ($m^3$)** | **Total Energy Consumption (kWh)** | **HDD (°C days/ mo)** | **Energy Normalized to 2004-2005 (kWh)** | **Billed Elect Energy (kWh)** | **Billed Natural Gas Energy ($m^3$)** | **Total Energy Consumption (kWh)** | **HDD (°C days/ mo)** | **Energy Normalized to 2004-2005 (kWh)** | **Billed Elect Energy (kWh)** | **Billed Natural Gas Energy ($m^3$)** | **Total Energy Consumption (kWh)** | **HDD (°C days/ mo)** | **Energy Normalized to 2004-2005 (kWh)** |
| September | 2,750 | 53 | 3,299 | 108.8 | 3,299 | | | 0 | | #DIV/0! | | | 0 | | #DIV/0! |
| October | 2,720 | 176 | 4,542 | 347.4 | 4,542 | | | 0 | | #DIV/0! | | | 0 | | #DIV/0! |
| November | 3,370 | 175 | 5,181 | 498.2 | 5,181 | | | 0 | | #DIV/0! | | | 0 | | #DIV/0! |
| December | 4,700 | 1,282 | 17,968 | 912 | 17,968 | | | 0 | | #DIV/0! | | | 0 | | #DIV/0! |
| January | 4,310 | 979 | 14,442 | 1072 | 14,442 | | | 0 | | #DIV/0! | | | 0 | | #DIV/0! |
| February | 9,370 | 758 | 17,215 | 800 | 17,215 | | | 0 | | #DIV/0! | | | 0 | | #DIV/0! |
| March | 3,220 | 624 | 9,678 | 736.9 | 9,678 | | | 0 | | #DIV/0! | | | 0 | | #DIV/0! |
| April | 5,120 | 437 | 9,643 | 299.9 | 9,643 | | | 0 | | #DIV/0! | | | 0 | | #DIV/0! |
| May | 3,380 | 0 | 3,380 | 230.1 | 3,380 | | | 0 | | #DIV/0! | | | 0 | | #DIV/0! |
| June | 2,630 | 194 | 4,638 | 43.7 | 4,638 | | | 0 | | #DIV/0! | | | 0 | | #DIV/0! |
| July | 2,290 | 0 | 2,290 | 21.9 | 2,290 | | | 0 | | #DIV/0! | | | 0 | | #DIV/0! |
| August | 3,620 | 6 | 3,682 | 32 | 3,682 | | | 0 | | #DIV/0! | | | 0 | | #DIV/0! |
| **TOTAL** | 47,480 | 4,684 | 95,958 | 5103 | 95,958 | 0 | 0 | 0 | 0 | #DIV/0! | 0 | 0 | 0 | 0 | #DIV/0! |

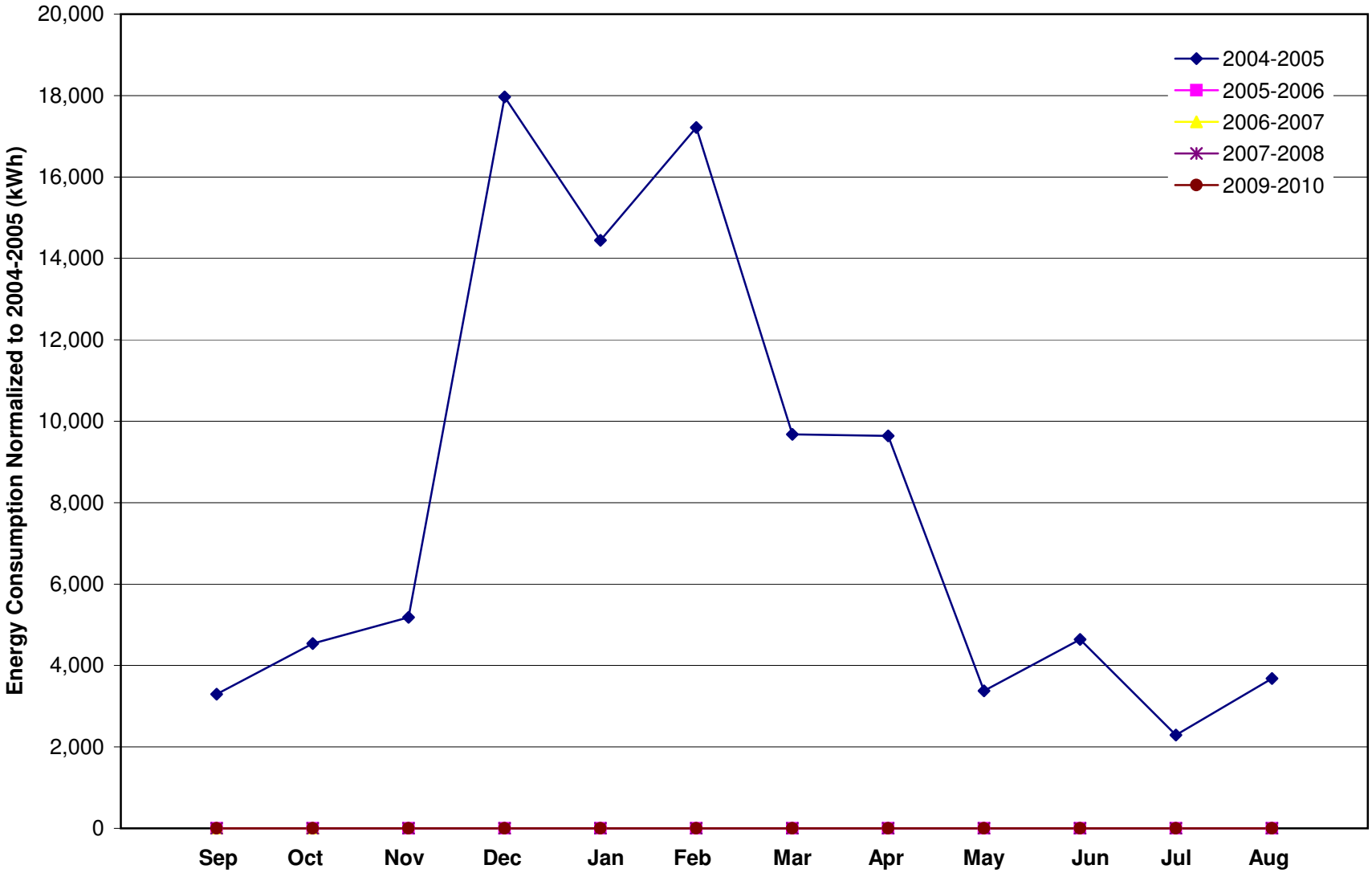
| | 2007-2008 | | | | | 2008-2009 | | | | | 2009-2010 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Month** | **Billed Elect Energy (kWh)** | **Billed Natural Gas Energy ($m^3$)** | **Total Energy Consumption (kWh)** | **HDD (°C days/ mo)** | **Energy Normalized to 2004-2005 (kWh)** | **Billed Elect Energy (kWh)** | **Billed Natural Gas Energy ($m^3$)** | **Total Energy Consumption (kWh)** | **HDD (°C days/ mo)** | **Energy Normalized to 2004-2005 (kWh)** | **Billed Elect Energy (kWh)** | **Billed Natural Gas Energy ($m^3$)** | **Total Energy Consumption (kWh)** | **HDD (°C days/ mo)** | **Energy Normalized to 2004-2005 (kWh)** |
| September | | | 0 | | #DIV/0! | | | 0 | | #DIV/0! | | | 0 | | #DIV/0! |
| October | | | 0 | | #DIV/0! | | | 0 | | #DIV/0! | | | 0 | | #DIV/0! |
| November | | | 0 | | #DIV/0! | | | 0 | | #DIV/0! | | | 0 | | #DIV/0! |
| December | | | 0 | | #DIV/0! | | | 0 | | #DIV/0! | | | 0 | | #DIV/0! |
| January | | | 0 | | #DIV/0! | | | 0 | | #DIV/0! | | | 0 | | #DIV/0! |
| February | | | 0 | | #DIV/0! | | | 0 | | #DIV/0! | | | 0 | | #DIV/0! |
| March | | | 0 | | #DIV/0! | | | 0 | | #DIV/0! | | | 0 | | #DIV/0! |
| April | | | 0 | | #DIV/0! | | | 0 | | #DIV/0! | | | 0 | | #DIV/0! |
| May | | | 0 | | #DIV/0! | | | 0 | | #DIV/0! | | | 0 | | #DIV/0! |
| June | | | 0 | | #DIV/0! | | | 0 | | #DIV/0! | | | 0 | | #DIV/0! |
| July | | | 0 | | #DIV/0! | | | 0 | | #DIV/0! | | | 0 | | #DIV/0! |
| August | | | 0 | | #DIV/0! | | | 0 | | #DIV/0! | | | 0 | | #DIV/0! |
| **TOTAL** | 0 | 0 | 0 | 0 | #DIV/0! | 0 | 0 | 0 | 0 | #DIV/0! | 0 | 0 | 0 | 0 | #DIV/0! |

**Notes**

* Energy consumption should be recorded following the implementation of the energy saving opportunities.

1. Enter the year in row 3 of this table (starting in column E,F,G).
2. Enter the "Billed Elec Energy" (in kWh) and the "Billed Natural Gas Energy" in ($m^3$) taken from the electricity and natural gas bills, respectively next to the appropriate month.
3. Go to the following website to collect information on the Heating Degree Days for Morden, Manitoba: http://www.climate.weatheroffice.ec.gc.ca/climateData/dailydata_e.html?timeframe=2&Prov=XX&StationID=29593&Year=2005&Month=8
4. Once you've arrived at this website, select the appropriate month and click the mouse on "GO"
5. From this website, record the last number highlighted in blue (refer to page F6) in the column "Heat Deg Days". This number should be entered under the heading HDD of this table, next to the appropriate month.
6. The "Energy Normalized to 2004-2005" will be calculated automatically and this point will show up on the Energy Consumption graph.

**Figure F.2 - Energy Consumption Monitoring Graph for the Municipal Shop**



Environment Canada Environnement Canada

[français] [Back]

# Daily Data Report for August 2005

***Notes on Data Quality.***

## MORDEN CDA CS
## MANITOBA

**Latitude:** 49° 10' N **Longitude:** 98° 4' W **Elevation:** 297.50 m
**Climate ID:** 5021849 **WMO ID:** 71564 **TC ID:** XMD

**Daily Data Report for August 2005**

| Day | Max Temp °C | Min Temp °C | Mean Temp °C | Heat Deg Days C | Cool Deg Days C | Total Rain mm | Total Snow cm | Total Precip mm | Snow on Grnd cm | Dir of Max Gust 10's Deg | Spd of Max Gust km/h |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 01 | 32.4 | 15.3 | 23.9 | 0.0 | 5.9 | 0.0 | 0.0 | 0.0 | 0 | | |
| 02 | 32.7 | 19.3 | 26.0 | 0.0 | 8.0 | 0.2 | 0.0 | 0.2 | 0 | | |
| 03 | 25.7 | 16.3 | 21.0 | 0.0 | 3.0 | 0.0 | 0.0 | 0.0 | 0 | | |
| 04 | 25.7 | 13.9 | 19.8 | 0.0 | 1.8 | 0.2 | 0.0 | 0.2 | 0 | | |
| 05 | 30.6 | 13.9 | 22.3 | 0.0 | 4.3 | 0.0 | 0.0 | 0.0 | 0 | | |
| 06 | 32.4 | 17.6 | 25.0 | 0.0 | 7.0 | 0.0 | 0.0 | 0.0 | 0 | | |
| 07 | 31.0 | 13.2 | 22.1 | 0.0 | 4.1 | 0.0 | 0.0 | 0.0 | 0 | | |
| 08 | 26.8 | 17.1 | 22.0 | 0.0 | 4.0 | 0.2 | 0.0 | 0.2 | 0 | | |
| 09 | 24.8 | 11.2 | 18.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | | |
| 10 | 25.5 | 10.5 | 18.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | | |
| 11 | 19.7 | 13.4 | 16.6 | 1.4 | 0.0 | 6.0 | 0.0 | 6.0 | 0 | | |
| 12 | 19.7 | 11.4 | 15.6 | 2.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | | |
| 13 | 20.4 | 10.6 | 15.5 | 2.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | | |
| 14 | 24.4 | 10.8 | 17.6 | 0.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | | |
| 15 | 22.7 | 13.2 | 18.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | | |
| 16 | 22.3 | 12.6 | 17.5 | 0.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | | |
| 17 | 17.9 | 11.7 | 14.8 | 3.2 | 0.0 | 9.8 | 0.0 | 9.8 | 0 | | |
| 18 | 21.6 | 15.1 | 18.4 | 0.0 | 0.4 | 1.4 | 0.0 | 1.4 | 0 | | |
| 19 | 23.3 | 13.4 | 18.4 | 0.0 | 0.4 | 0.0 | 0.0 | 0.0 | 0 | | |
| 20 | 19.9 | 10.0 | 15.0 | 3.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | | |
| 21 | 18.8 | 7.9 | 13.4 | 4.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | | |
| 22 | 22.0 | 4.8 | 13.4 | 4.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | | |
| 23 | 24.8 | 10.2 | 17.5 | 0.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | | |
| 24 | 21.5 | 14.9 | 18.2 | 0.0 | 0.2 | 14.2 | 0.0 | 14.2 | 0 | | |
| 25 | 24.8 | 13.9 | 19.4 | 0.0 | 1.4 | 0.0 | 0.0 | 0.0 | 0 | | |
| 26 | 20.2 | 11.3 | 15.8 | 2.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | | |
| 27 | 22.0 | 12.0 | 17.0 | 1.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | | |
| 28 | 21.9 | 13.2 | 17.6 | 0.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | | |
| 29 | 23.3 | 10.7 | 17.0 | 1.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | | |
| 30 | 24.1 | 9.3 | 16.7 | 1.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0 | | |
| 31 | 18.8 | 11.2 | 15.0 | 3.0 | 0.0 | 1.0 | 0.0 | 1.0 | 0 | | |
| **Sum** | | | | **32.0** | **40.5** | **33.0** | **0.0** | **33.0** | | | |
| **Avg** | **23.9** | **12.6** | **18.3** | | | | | | | | |
| **Xtrm** | **32.7** | **4.8** | | | | | | | | | |

## Legend

[empty] = No data available
M = Missing

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# APPENDIX G

# THE MUNICIPALITIES TRADING COMPANY OF MANITOBA LTD. REPORT

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# MEMBER SERVICES

*The Municipalities Trading Company of Manitoba Ltd. (MTCML) allows AMM members to purchase products and services at lower prices through the power of bulk buying. This year was another great success. Sales remained consistent and the stable pool of official suppliers continued to change and grow. The products sales have consistently remained between 6.5 and 7.4 million dollars for the last 4 years.*

*The MTCML provides a major source of revenue for the AMM and allows the AMM membership dues to remain one of the lowest in Canada. This past year, the MTCML was able to rebate another $350,000 to our members based on their MTCML sales, bringing the cumulative rebate over the past four years to $1,250,000.*

## MTCML Official Suppliers

Official Suppliers are very important to the success of the MTCML. These suppliers offer hundreds of products and services that municipalities use. The Trading Company has individual contracts with each of these suppliers that ensure the best possible pricing for the purchasing members. In return, suppliers have direct contact with Manitoba's municipal market and can be a part of regular marketing opportunities through the AMM (mailings, Convention, trade shows, etc.) Each of our suppliers has shown long term commitment to the MTCML, creating a stable purchasing environment for the members of the AMM.

## Corporate Members

At present fourteen companies make up the Corporate Members list of the AMM, five of these new for 2004/2005. These members assist the buying group in providing many services and hosting various events throughout the year.

*Last year, the MTCML was able to rebate **$350,000** to our members based on their MTCML sales, bringing the total rebate over the past four years to **$1,250,000**.*

## Major Programs

There are also two major buying programs offered by the Trading Company. These programs are owned by the AMM membership, managed by the AMM and each administered by a company that has expertise in the program area.

## Petroleum Products Buying Group (PPBG)

AMM has entered into contracts with both Imperial Oil and Petro Canada, on behalf of all of our participating Members, for the supply of gasoline, diesel and lubricants. Our objective is to combat one-sided pricing advantages enjoyed by petroleum suppliers and to assist our Members to purchase fuel at a lower cost while still supporting the local fuel dealers. Currently there are 77 AMM Members who purchase over 6,000,000 litres of fuel each year and about 130 other municipalities in Saskatchewan and Alberta who purchase an additional 29,000,000 litres of fuel annually.

The concept of AMM purchasing large volumes of fuel on behalf of our Members and the careful analysis of industry pricing means fuel savings for member municipalities in all three provinces. At the same time, local fuel dealers are supported. The program is administered by Prairie Fuel Advisors Inc., who also act as our purchasing agent.

The only cost for joining the PPBG is 1.2¢ per litre for the fuel purchased and 10¢ per litre for lubricants. A municipality may withdraw from the PPBG at any time, and there is no cost to withdraw.

M.T.C.M.L.

# MEMBER SERVICES

M.T.C.M.L.

## Insurance

All AMM members outside of Winnipeg participate in the insurance program, administered by Hayhurst Elias Dudek on behalf of the AMM. Coverage includes property/road machinery and equipment; crime (loss of money); comprehensive general liability; errors and omissions liability; environmental impairment (pollution) liability; fire vehicle insurance; plus accident insurance for Councils, fire departments, ambulance services, and other 'volunteers'.

A major part of the program is the $3,500,000 annual self-insurance loss pool that keeps premiums much lower than if individual municipalities purchased their own coverage. Insurance is purchased from various providers for coverage in excess of the $3,500,000 annual loss pool amount, to provide complete protection. This allows the opportunity for significant refunds in low-claims years.

Last year, the AMM was able to offer an average 5% reduction in our insurance rates. As well, as a result of excellent risk management by municipalities, the AMM was able to refund $918,000 to municipalities out of the insurance loss pool.

*Official Suppliers have shown long-term commitment to the MTCML.*

## MTCML Official Suppliers

*Acklands Grainger Inc.*
*Airmaster Sales*
*Armtec*
*Bridgestone Canada Inc.*
*CD Awards*
*Darwen Road Technologies Ltd.*
*Denray Tire*
*Dust Free Road Maintenance*
*Fort Distributors Ltd.*
*Grand & Toy*
*Guardian Traffic Services Manitoba Ltd.*
*Hayhurst Elias Dudek Inc.*
*Kal Tire*
*MTS*
*Michelin*
*Norquay Printers Ltd.*
*PCO Orkin Swat Team*
*Prairie Fuel Advisors Inc.*
*Shippam & Associates Inc.*
*Souris Rock Shop*
*Tirecraft*
*Westcon Equipment & Rentals*
*Westman Steel Industries*

## AMM Corporate Members

*Borland Construction*
*Cochrane Engineering*
*Guertin Equipment*
*Hayhurst Elias Dudek*
*Innovative Municipal Products Inc.*
*Manitoba Aboriginal and Northern Affairs*
*Manitoba Heavy Construction Association*
*Manitoba Hydro*
*Manitoba Mixed Concrete Association*
*Manitoba Pork Council*
*Mazer Group Construction Equipment*
*Robert Watson, Attorney*
*Strong-Coley & Associates*
*Westcon Equipment & Rentals Ltd.*