ASSOCIATION OF MANITOBA MUNICIPALITIES
MANITOBA MUNICIPAL ENERGY, WATER AND WASTE WATER EFFICIENCY PROJECT
CITY OF FLIN FLON
FINAL REPORT
NOVEMBER 2006

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

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CONSULTING ENGINEERS & PROJECT MANAGERS

November 24, 2006

File No. 05-1285-01-1000.14

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

RE: Municipal Energy, Water, and Wastewater Efficiency Study for the City of Flin Flon – Final Report

Dear Mr. Tyler MacAfee:

Enclosed is the Final Report of the Manitoba Municipal Energy, Water and Wastewater Efficiency Study for the City of Flin Flon.

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 17, and Appendix A to G.

We thank you for giving us the opportunity to work on this project.

Yours truly,

Meghan Guyot

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

RBB/mg
Enclosure

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EXECUTIVE SUMMARY

The objective of this study was to determine energy, water, and wastewater efficiency opportunities that could enable the City of Flin Flon to reduce operating costs, conserve resources, and reduce greenhouse gas emissions.

An energy and water efficiency audit was conducted on seventeen buildings in the City of Flin Flon. An audit was also done on the water distribution and wastewater collection systems. Throughout the course of these audits, water, wastewater, and energy efficiency opportunities were analyzed to determine the City'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.
- Process Equipment: Potential upgrades to ice plants and water / waste water treatment plants
- Water – Replacing high flow water fixtures with water efficient fixtures.

Table E1 shows the energy and water consumption for each of the buildings for the period from October 2004 to October 2005. This year was selected 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. Six of the buildings included in this audit use electricity exclusively for energy while the other six buildings use both electricity and natural gas. The "Energy Density" column in this table is the total energy consumed in the building divided by the area of the building. This is useful in comparing the energy consumption among the different buildings in Flin Flon. The pie chart displays the percentage of total energy density for each of the buildings. It ranges from a high of 37.1% for the Heating Plant #2 to a low of 0.5% for the City Hall and the Community Centre.

Tables E2 (a) and (b) show overall energy and water saving opportunities for all seventeen buildings in the Town of Flin Flon. 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 all seventeen buildings is 4,041,077 kWh, or 30% 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. The cost of water is taken as $1 per cubic meter.

The results and recommendations from the water and wastewater audit are shown in Section 19 of this report. From the water system audit, it was determined that Flin Flon's Water Treatment Plant produced an average of 1,610,000 m^3/day of water in 2005, while only 996,000 m^3/day of this water was consumed. An estimated 168,000 m^3/day of water was consumed by bleeders throughout the distribution system to prevent the lines from freezing in the winter. The remaining 446,000 m^3/day of water is considered water losses due to either leakage in the system, inaccurate water meters, or unauthorized water use. Reducing the water losses will reduce chemical costs required for water treatment, reduce electrical energy consumed by the pumps, and extend the life of the facility.

Very little information was provided on the Wastewater Distribution System in Flin Flon. There are at least two lift stations throughout the collection system that pump collected wastewater through the system. From the information provided by the City, the sewer system is experiencing significant infiltration and inflow, approaching 21 to 24%. The City could potentially decrease infiltration and inflows by sealing manholes, lining pipes, and disconnecting rain leaders, sump pumps and weeping tiles from the sanitary sewer system.

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).
- Delayed need to increase water and wastewater treatment plant capacities

Table E1 Energy Consumption for the Period from October 2004 – October 2005

Site	Energy Density (kWh/m^2)	% of Total Energy Density	Area (m^2)	Electricity		Propane/Oil		TOTAL ENERGY	
				kWh	Cost	kWh	Cost	kWh	Cost
Airport Terminal	719	1.3%	292	40,864	$3,058	169,329	$11,974	210,193	$15,032
Airport Garage	529	0.9%	281	26,800	$2,023	121,838	$8,602	148,638	$10,625
Sweeper Building and Sand Storage	2,124	3.8%	221	408,600	$22,660	60,082	$4,239	468,682	$26,899
Whitney Forum (Arena)	1,025	1.8%	2,868	1,116,000	$78,935	1,823,677	$102,617	2,939,677	$181,552
Community Centre	275	0.5%	2,212	199,680	$13,975	407,944	$22,955	607,624	$36,930
Aqua Centre (Fitness Centre)	902	1.6%	1,050	859,320	$43,866	87,851	$6,188	947,171	$50,054
Flin Flon Public Library	517	0.9%	417	158,480	$10,047	56,830	$3,769	215,310	$13,816
Public Safety Building - RCMP Offices	468	0.8%	1,074	502,740	$26,801	0	$0	502,740	$26,801
City Hall	255	0.5%	1,051	268,320	$15,711	0	$0	268,320	$15,711
Sewage Treatment Plant	615	1.1%	841	205,620	$12,824	311,435	$21,855	517,055	$34,679
Cliff Lake - Water Treatment Plant	7,109	12.6%	67	478,440	$28,147	0	$0	478,440	$28,147
Heating Plant #1	19,661	35.0%	168	396,100	$20,300	2,899,030	$163,126	3,295,130	$183,426
Heating Plant #2	4,103	37.1%	134	549,000	$28,916	2,245,812	$126,370	2,794,812	$155,286
Heating Plant #3	1,163	2.1%	146	170,110	$10,927	0	$0	170,110	$10,927
Totals	56,249			5,380,074	$318,190	8,183,828	$471,695	13,563,902	$789,885

Percentage of Total Energy Density for Buildings in Flin Flon

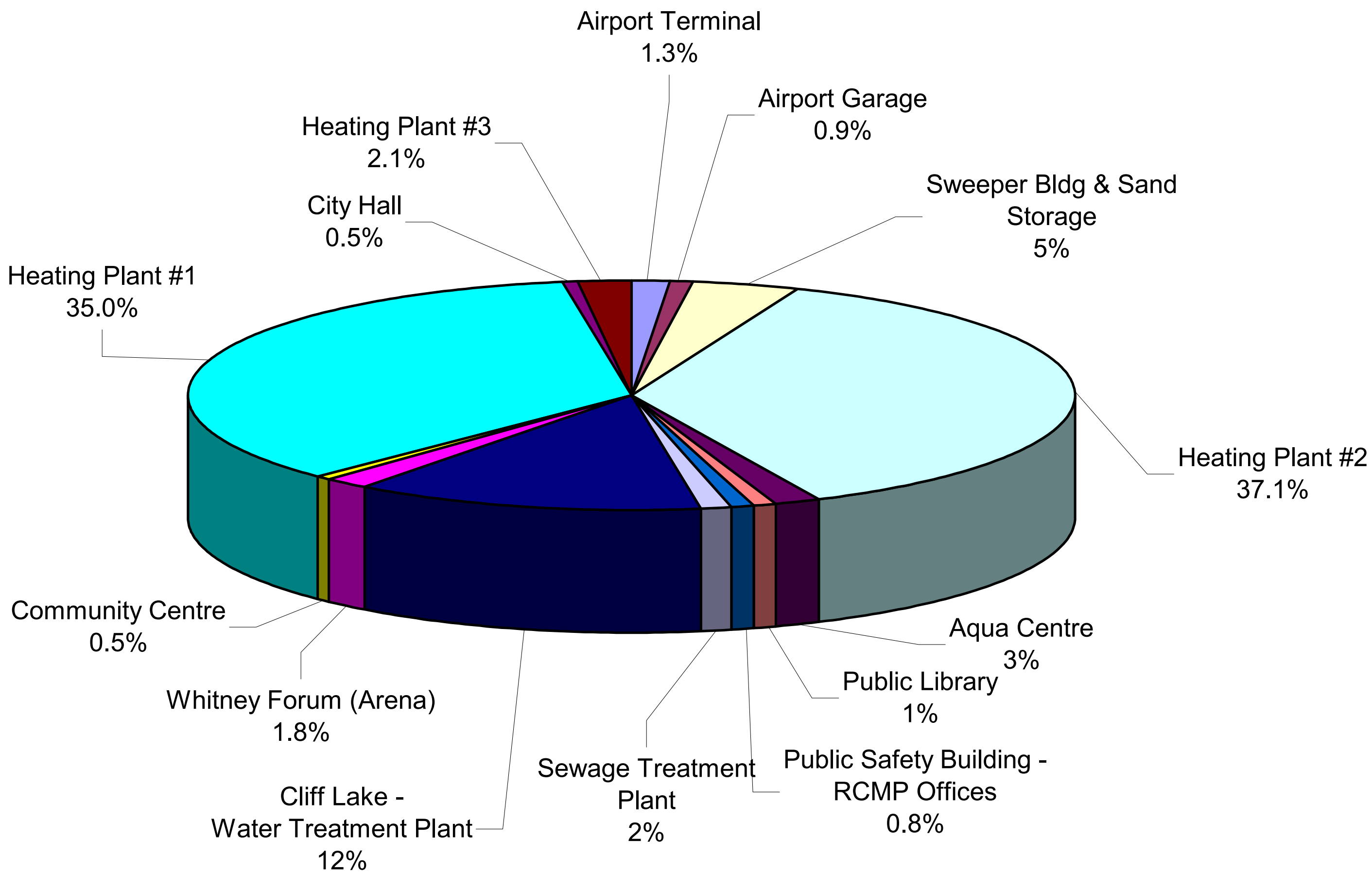

Table E2 (a) Summary of Energy Saving Opportunities for all 17 Buildings in Flin Flon **Page 1 of 5**

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 & PARKING LOT CONTROLLERS											
When 4' x 1 T12 fluorescent ballasts burn out, replace them with T8 ballasts and tubes.	281	$26	$16	$0	$8,145	$4,969	13,402	$805	10.1	6.2	Airport Terminal & City Hall.
When 4' x 2 T12 fluorescent ballasts burn out, replace them with T8 ballasts and tubes.	312	$41	$21	$0	$14,522	$7,471	61,812	$3,711	3.9	2.0	Airport Terminal, Sand Storage, Arena, Community Centre, Aqua Centre, Library, Public Safety Building & Heating Plants 1, 2 & 3.
When 4' x 4 T12 fluorescent ballasts burn out, replace them with T8 ballasts and tubes.	113	$32	$12	$0	$4,137	$1,583	31,954	$1,919	2.2	0.8	Community Centre, Aqua Centre, Library, Public Safety Building & City Hall.
When 8' x 2 T12 fluorescent ballasts burn out, replace them with T8 ballast and tubes.	90	$47	$12	$0	$4,810	$1,251	46,739	$2,806	1.7	0.4	Airport Terminal, Airport Garage, Sweeper Building, Arena & Heating Plants 1, 2 & 3.
Replace interior incandescents (≤ 150W) with compact fluorescents.	137	$15	$10	$13	$4,335	$3,561	41,452	$2,489	1.7	1.4	Airport Terminal, Arena, Community Centre, Aqua Centre, Library, Public Safety Building & City Hall.
Replace interior incandescents (> 150W) with compact fluorescents.	1	$20	$15	$13	$37	$32	106	$6	5.9	5.0	Heating Plant #1.
Replace 400W mercury vapour lights with metal halides.	5	$300	$255	$300	$3,390	$3,136	12,230	$734	4.6	4.3	Public Safety Building.
Replace incandescent exit signs with LED modules.	35	$50	$5	$80	$5,142	$3,362	8,278	$497	10.3	6.8	Airport Terminal, Arena, Community Centre, Aqua Centre & Library.
Install occupancy sensors.	7	$75	$75	$50	$989	$989	7,382	$443	2.2	2.2	Arena, Community Centre.

Table E2 (a) Summary of Energy Saving Opportunities for all 17 Buildings in Flin Flon

Page 2 of 5

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*	
Install photocells on outdoor lights.	16	$25	$25	$65	$1,627	$1,627	8,410	$505	3.2	3.2	Library & Public Safety Building.
Install parking lot controllers.	25	$100	$75	$150	$7,063	$6,356	16,080	$965	7.3	6.6	Airport Terminal, Aqua Centre, Library, Public Safety Building & City Hall.
Lighting & Parking Lot Controllers Subtotal					**$54,196**	**$34,336**	**247,845**	**$14,881**			
ENVELOPE											
Replace pedestrian doors.	7	$350	$350	$100	$3,560	$3,560	4,282	$277	12.8	12.8	Arena & Heating Plants 1, 2 & 3.
Replace double loading doors.	3	$700	$700	$200	$3,051	$3,051	3,535	$212	14.4	14.4	Heating Plants 1, 2 & 3.
Weather-strip pedestrian doors.	66	$15	$15	$50	$4,848	$4,848	105,354	$9,266	0.5	0.5	Airport Terminal, Airport Garage, Sweeper Building, Sand Storage, Arena, Community Centre, Aqua Centre, Library, Public Safety Building, Water Treatment Plant & Heating Plants 1, 2 & 3.
Weather-strip double loading doors.	3	$30	$30	$100	$441	$441	5,384	$323	1.4	1.4	Heating Plants 1, 2 & 3.
Weather-strip vehicle doors.	6	$100	$100	$200	$2,034	$2,034	27,519	$1,758	1.2	1.2	Airport Garage & Sand Storage.
Caulk pedestrian doors.	54	$5	$5	$25	$1,831	$1,831	24,524	$1,462	1.3	1.3	Sweeper Building, Sand Storage, Arena, Community Centre, Library, Public Safety Building & City Hall.
Caulk vehicle doors.	9	$5	$5	$25	$305	$305	21,178	$1,339	0.2	0.2	Airport Garage, Sweeper Building, Sand Storage & Public Safety Building.
Replace windows with triple pane windows.	36	$666	$509	$275	$38,271	$31,875	21,440	$1,282	29.9	24.9	Airport Garage, Arena, Community Centre, Aqua Centre, Library & Heating Plant #3.
Caulk windows.	17	$5	$5	$25	$576	$576	11,505	$691	0.8	0.8	Aqua Centre, Library & City Hall.

Table E2 (a) Summary of Energy Saving Opportunities for all 17 Buildings in Flin Flon

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 wall insulation.	5	$6,216	$4,920	$7,932	$79,939	$72,617	72,752	$4,598	17.4	15.8	Airport Garage, Sand Storage, Heating Plant 1, 2 & 3.
Upgrade roof insulation.	9	$5,556	$3,077	$2,774	$84,719	$59,508	252,499	$15,284	5.5	3.9	Airport Terminal, Airport Garage, Sweeper Building, Sand Storage, Community Centre, Library, Heating Plant 1, 2 & 3.
Fill gap in wall at truck fill line.	1	$50	$50	$50	$113	$113	2,204	$132	0.9	0.9	Heating Plant #1.
Envelope Subtotal					**$219,687**	**$180,758**	**552,175**	**$36,626**			
HVAC											
Install programmable thermostat; setback temp to 15°C (59°F).	11	$300	$300	$300	$7,458	$7,458	202,035	$12,227	0.6	0.6	Airport Terminal, Airport Garage, Sweeper Building & Sand Storage, Arena, City Hall & Sewage Treatment Plant.
Install temperature controls for remaining unit heater in rink; reduce temp by 10°F.	1	$1,500	$1,500	$1,500	$3,390	$3,390	126,325	$7,112	0.5	0.5	Arena.
Replace electric unit heaters with radiant heaters; reduce temperature setting to 15°C (59°F).	3	$1,100	$1,100	$1,000	$7,119	$7,119	10,369	$623	11.4	11.4	Public Safety Building.
Reduce temperature setting.	5	$0	$0	$0	$0	$0	150,598	$9,168	0.0	0.0	Public Safety Building, Water Treatment Plant & Heating Plants 1, 2 & 3.
Install motorized dampers.	10	$300	$300	$300	$6,780	$6,780	62,936	$3,585	1.9	1.9	Arena, Community Centre & Heating Plant #1.
Install manual insulated dampers on air intake and exhaust vents.	4	$500	$500	$500	$4,520	$4,520	35,263	$2,117	2.1	2.1	Water Treatment Plant.
Install CO_2 sensor to control outdoor air damper.	3	$500	$500	$3,000	$11,865	$11,865	60,987	$3,475	3.4	3.4	Community Centre & City Hall.

Table E2 (a) Summary of Energy Saving Opportunities for all 17 Buildings in Flin Flon

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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*	
When condensing units require replacement, replace them with high efficiency condensing units.	4	$314	$314	$0	$1,418	$1,418	11,919	$716	2.0	2.0	Community Centre & Library.
Replace Trane condensing unit in Fire Hall with high efficiency unit.	1	$4,500	$4,500	$1,000	$6,215	$6,215	11,103	$667	9.3	9.3	Public Safety Building.
When rooftop unit requires replacement, replace it with a high efficiency rooftop unit.	2	$525	$525	$0	$1,187	$1,187	3,115	$187	6.3	6.3	Library.
Replace unit heaters with high efficiency furnaces.	4	$3,300	$4	$540	$17,357	$2,458	30,292	$2,120	8.2	1.2	Airport Garage & Sweeper Building & Sand Storage.
Install countdown timer on greasehood exhaust fan.	1	$100	$100	$75	$198	$198	165,293	$9,306	0.0	0.0	Arena.
Replace boiler with electric boilers.	3	$10,000	$7,280	$10,000	$67,800	$58,579	163,178	$9,187	7.4	6.4	Community Centre.
When boiler requires replacement, replace it with a high efficiency boiler.	1	$4,475	$1,855	$3,000	$8,447	$5,486	20,319	$1,422	5.9	3.9	Airport Terminal.
HVAC Subtotal					**$143,753**	**$116,673**	**1,053,733**	**$61,912**			
HOT WATER											
Install instantaneous water heaters (small).*****	8	$300	$300	$500	$7,232	$7,232	8,217	$503	14.4	14.4	Airport Terminal, Airport Garage, Library, Sewage Treatment Plant & Heating Plant #1.
Install instantaneous water heater (large).	1	$3,500	$3,500	$2,000	$6,215	$6,215	3,032	$212	29.3	29.3	Aqua Centre.
Insulate hot water piping.	5	$100	$100	$100	$1,130	$1,130	4,653	$289	3.9	3.9	Airport Garage, Arena, Community Centre, Aqua Centre & Library.
Re-insulate domestic hot water tank.	1	$750	$750	$1,000	$1,978	$1,978	3,032	$182	10.9	10.9	Arena.

Table E2 (a) Summary of Energy Saving Opportunities for all 17 Buildings in Flin Flon

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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*	
Install water efficient showerheads.	14	$21	$21	$50	$1,123	$1,123	28,969	$1,978	0.5	0.5	Airport Garage, Community Centre, Aqua Centre & Public Safety Building.
Install water efficient metering faucets.	12	$309	$309	$150	$6,224	$6,224	4,400	$288	21.6	21.6	Aqua Centre and Public Safety Building.
Water Subtotal					**$23,902**	**$23,902**	**52,303**	**$3,453**			
MOTORS											
When fan motors require replacement, replace them with high efficiency motors.	2	$236	$236	$0	$533	$533	1,989	$119	4.5	4.5	Aqua Centre.
When 75HP motors require replacement, replace them with high efficiency motors.	2	$1,850	$1,850	$0	$4,181	$4,181	8,206	$493	8.5	8.5	Water Treatment Plant.
Motor Subtotal					**$4,714**	**$4,714**	**10,195**	**$612**			
OTHER											
Insulate utilidors in water distribution system	2	$15,000	$15,000	$15,000	$67,800	$67,800	1,065,719	$60,000	1.1	1.1	Heating Plant #1 & #2.
Automated control of water re-circulation heating system.	2	$17,500	$17,500	$17,500	$79,100	$79,100	1,065,719	$60,000	1.3	1.3	Heating Plant #1 & #2.
Other Subtotal					**$146,900**	**$146,900**	**2,131,439**	**$120,000**			

TOTALS	Energy (kWh)	Cost ($)	CO_2 (Tonnes)
Existing Annual Consumption/Cost/Emissions	13,563,901	$789,883	2,337
Estimated Annual Savings	4,041,077	$237,265	889
Percent Savings	30%	30%	38%

* NI = Cost does not include incentive, WI = Cost includes incentive.

** The total cost column includes 13% taxes.

*** The cost assigned to electricity is 0.06004 $/kWh (rate was taken from Manitoba Hydro's website), the cost of propane is taken as 0.07 $/kWh and the cost of oil is 0.014 $/kWh (taken from propane and oil bills).

**** 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 hot water tank in 10 years.

Table E2 (b) Summary of Water Saving Opportunities for the City of Flin Flon

Description	**Qty**	**Installed Cost/Unit ($)**		**Total Cost* ($)**	**Annual Water Savings (%)**	**Annual Water Savings (L)**	**Annual Cost Savings ($)**	**Related Buildings**
		Material	**Labour**					
Install water efficient dual flush toilets.	62	$284	$150	$30,406	75%	1,048,862	$1,049	Airport Terminal, Airport Garage, Arena, Community Centre, Aqua Centre, Library, Public Safety Building, City Hall, Sewage Treatment Plant & Heating Plants 1 & 3.
Install water efficient metering faucets.	61	$309	$150	$31,639	80%	329,841	$330	Airport Terminal, Arena, Community Centre, Aqua Centre, Library, Public Safety Building, City Hall, Sewage Treatment Plant & Heating Plants 1 & 3.
Install water efficient urinals.	14	$344	$200	$8,606	60%	297,537	$298	Community Centre, Aqua Centre, Library, Public Safety Building & City Hall.
Install water efficient showerheads.	15	$21	$50	$1,203	29%	790,291	$790	Airport Garage, Community Centre, Aqua Centre, Public Safety Building & Sewage Treatment Plant.

* The total cost column includes 13% taxes.

MMEP AUDITORS

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Manitoba Conservation
Agriculture and Agri-Food Canada - Prairie Farm Rehabilitation Administration
Manitoba Culture, Heritage, and Tourism

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- Marc Kolt, Chief Administrative Officer
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- Phyllis Stadnick (Library)
- Jim Petrie (Public Safety Building)
- Rick Bacon (City Hall)
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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, water, and wastewater 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 seventeen buildings in the City of Flin Flon to determine how to reduce both energy and water consumption in each of these buildings. In addition, the water distribution and wastewater collection systems were audited to determine what opportunities exist for improving the systems' efficiencies.

1.2 OBJECTIVE

The objective of this study was to determine energy, water, and waste water efficiency opportunities that could enable the City of Flin Flon to reduce operating costs, conserve resources, and reduce greenhouse gas emissions. The Sweeper Building and Sand Storage were analyzed together and are presented in one section since they share the same electrical service. Similarly, the Headworks, SBR and Decanter buildings that make up the Sewage Treatment Plant were also analyzed together and are presented in the same section. The remaining twelve buildings were analyzed separately and the results are presented in separate sections throughout this report. The water and wastewater systems are discussed in Section 19.

1.3 METHODOLOGY

The buildings were toured on June 1st and 2nd, 2006 by Mr. Ray Bodnar, P.Eng. and Mr. Tibor Takach, P.Eng., both of KGS Group Consulting Engineers and Project Managers. Tibor toured the Water Treatment Plant, the Sewage Treatment Plant, and the three Heating Plants to study the water and wastewater systems while Ray toured the other ten buildings to perform the water and energy efficiency audits. The water and energy efficiency audits involved a walkthrough of each of the buildings to determine the current condition of the building's envelope (walls, roof, windows, and doors), lighting, water fixtures, heating, ventilation and air conditioning (HVAC) systems, and motors.

During the building tours, the auditors met with the City's Chief Administrative Officer Marc Kolt and Mr. Rick Bacon, Town Engineer, to discuss the study objectives for identifying energy, water, and wastewater saving opportunities, and to provide information on existing incentive programs. At this time, it was determined that there are potential plans for reconstruction of the Heating Plants 1 & 2 and the Public Safety Building sometime in the future. 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, propane, and oil bills from the past 12 months, calculations were performed to determine how each of 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 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 measures such as geothermal heating/cooling and major building envelope upgrades, a more detailed investigation would be required to confirm capital 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, propane, oil, 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, toilets, urinals, and showers. 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.

The water and wastewater systems in the City of Flin Flon were analyzed and results and recommendations are discussed in Section 19 of this report. In addition to an overview of the water and wastewater systems, several recommendations are made to help the Town monitor water consumption and losses and reduce operating costs.

2.0 AIRPORT TERMINAL

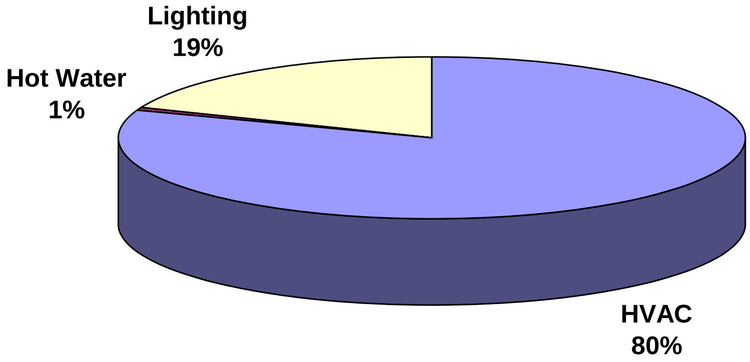
2.1 BACKGROUND

The Airport Terminal, constructed in 1969, is 3,100 square feet with brick exterior walls and R12 insulation. The roof of this building was replaced approximately 5 years ago but the insulation was not upgraded at this time and still has a resistance of R12. The Airport Terminal is occupied from Sunday to Friday from 5:30am – 9pm and on Saturdays from 5:30am – 6pm.

Photo 1 – Airport Terminal

The Airport Terminal uses both electricity and propane for energy. Electricity is used for the lighting and air conditioning and propane is consumed by the domestic hot water heater and the hot water boiler for building heat. From October 2004 – October 2005, the total propane and electrical energy consumption was 169,329 kWh and 40,864 kWh, respectively. The majority of this energy was used for heating as can be seen in the following pie chart.

Energy Breakdown (% of Total kWh)
for the Airport Terminal



The washrooms in the Airport Terminal contain a total of 6 toilets, 5 sinks and 1 urinal, all with electronic fixtures. A 125-Litre 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 makeup for 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 Airport Terminal. The following assumptions were made in determining the annual savings:

- The Airport Terminal is occupied from Sunday – Friday, 5:30am – 9:00pm and on Saturdays from 5:30am – 6:00pm.
- The temperature of the building is maintained at 21°C (70°F).
- For the purpose of water consumption, the typical occupancy is taken as 6.
- The parking lot plugs are used for 100 days/year, 12 hours/day.

Table 1 Energy Saving Opportunities for the Airport Terminal

Description	**Qty**	**Installed Cost/Unit ($)**			**Total Cost** ($)**		**Estimated Annual Savings**		**Simple Payback Years**	
		Material (NI*)	**Material (WI*)**	**Labour**	**NI***	**WI***	**kWh**	**$*****	**NI***	**WI***
LIGHTING & PARKING LOT CONTROLLERS										
When 4' x 1 T12 fluorescent ballasts burn out, replace them with T8 ballasts and tubes.	54	$26	$16	$0	$1,565	$955	3,159	$190	8.3	5.0
When 4' x 2 T12 fluorescent ballasts burn out, replace them with T8 ballasts and tubes.	17	$41	$21	$0	$791	$407	1,989	$119	6.6	3.4
When 8' x 2 T12 fluorescent ballasts burn out, replace them with T8 ballast and tubes.	4	$47	$12	$0	$214	$56	1,488	$89	2.4	0.6
Replace interior incandescents with compact fluorescents.	17	$15	$10	$13	$538	$442	2,244	$135	4.0	3.3
Replace incandescent exit signs with LED modules.	2	$50	$5	$80	$294	$192	473	$28	10.3	6.8
Install parking lot controllers.	14	$100	$75	$150	$3,955	$3,560	10,080	$605	6.5	5.9
Lighting & Parking Lot Controllers Subtotal					**$7,357**	**$5,611**	**19,433**	**$1,167**		
ENVELOPE										
Weather-strip pedestrian doors.	6	$15	$15	$50	$441	$441	12,377	$866	0.5	0.5
When replacing roof, upgrade roof insulation to R-40.	1	$3,538	$3,129	$1,179	$5,331	$4,869	20,519	$1,436	3.7	3.4
Envelope Subtotal					**$5,771**	**$5,309**	**32,896**	**$2,303**		
HVAC										
Install programmable thermostat to control boiler pumps; setback temp to 15°C (59°F).	1	$300	$300	$300	$678	$678	15,841	$1,109	0.6	0.6
Replace boiler with high efficiency boiler.	1	$11,907	$9,287	$3,000	$16,845	$13,884	20,319	$1,422	11.8	9.8
HVAC Subtotal					**$17,523**	**$14,562**	**36,160**	**$2,531**		
HOT WATER										
Install instantaneous water heaters.****	2	$300	$300	$500	$1,808	$1,808	1,001	$70	25.8	25.8
Water Subtotal					**$1,808**	**$1,808**	**1,001**	**$70**		

TOTALS	**Energy (kWh)**	**Cost ($)**	**CO$_2$ (Tonnes)**
Existing Annual Consumption/Cost/Emissions	210,193	$15,032	39.42
Estimated Annual Savings	89,490	$6,071	16.21
Percent Savings	43%	40%	41%

* NI = Cost does not include incentive, WI = Cost includes incentive.

** The total cost column includes 13% taxes.

*** The cost assigned to electricity is 0.06004 $/kWh (rate was taken from Manitoba Hydro's website) and the cost assigned to propane was taken as $0.07/kWh (taken from building's propane bills).

**** Discounted to include the cost of replacement water tank in 10 years.

Table 2 Water Saving Opportunities for the Airport Terminal

Description	Qty	Installed Cost/Unit ($)		Total Cost* ($)	Annual Water Savings (%)	Annual Water Savings (L)	Annual Cost Savings ($)
		Material	Labour				
Install water efficient metering faucets.	5	$309	$150	$2,593	80%	10,080	$10
Install water efficient dual flush toilets.	6	$284	$150	$2,943	70%	41,715	$42

* The total cost column includes 13% taxes.

2.3 GENERAL RECOMMENDATIONS

Lighting & Parking Lot Controllers

The lighting analysis summary for the Airport Terminal is shown in Appendix B, Table B.1.3. Since this building is occupied for such long hours, there is a large potential for energy savings by replacing the T12 fluorescent lighting with T8s. It is recommended that this upgrade be done when the T12 ballasts burn out and require replacement. T8s are slim, high efficient lamps that generate more light per watt than conventional lighting. These lamps are an excellent replacement for T12s, which are expected to become obsolete by year 2010. Another opportunity for energy savings is to replace the indoor incandescent bulbs with energy efficient compact fluorescents. Consideration should also be given to replacing the incandescent exit signs with LED exit signs. LEDs consume 10% of the energy consumed by an incandescent exit sign.

Installing parking lot controllers on the car plugs in the parking lot would save 50% of the current energy consumed by cars' block heaters throughout the winter. Parking lot controllers save energy by automatically adjusting the power to the car plug depending on the outdoor temperature. This is particularly attractive for the Airport Terminal building for vehicles that are left plugged in while clients fly out of town for days at a time.

Envelope

The pedestrian doors to this building have good caulking but require new weather-stripping. This upgrade would cost very little to implement and would reduce the cold air infiltration into the building throughout the winter.

The insulation in the roof is approximately R-12. When the roof requires replacement, this insulation should be upgraded to R-40. Table B.1.4 in Appendix B shows details of these calculations.

HVAC

Installing a programmable thermostat to control the boiler circulation pumps would help to save energy used for heating when the terminal is unoccupied. The thermostats should be set up such that the room temperature is reduced to 15°C (59°F) when the building is unoccupied.

Another energy saving opportunity is to replace the hot water boiler with a high efficiency boiler. This would save approximately 12% of the energy consumed by the boiler for heating.

Water

Replacing the water heater with two instantaneous water heaters would eliminate the energy required to make-up for heat losses from the storage tank. Another benefit of an instantaneous water heater is that they last much longer and will thus save in the cost of a replacement water heater every 10 years.

Table 2 above shows the water savings and cost savings that would result from replacing the current fixtures with water efficient fixtures. More detailed calculations can be found in Table B.1.5 in Appendix B.

3.0 AIRPORT GARAGE

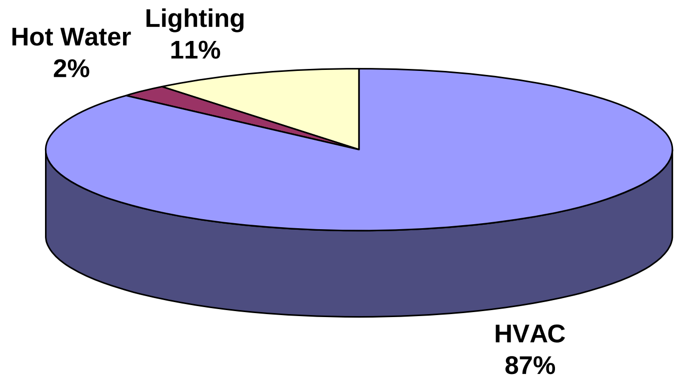
3.1 BACKGROUND

The Airport Garage is a 3,024 square foot pre-engineered building constructed in approximately 1970. The walls are constructed of metal framing with metal paneling on the exterior and plywood interior walls. The garage is open for the same hours as the terminal but is only occupied occasionally by the workers.

Photo 2 – Airport Garage

The garage is heated using propane unit heaters. The annual propane and electrical energy consumption for the Airport Garage in the previous year was 121,838 kWh and 26,800 kWh, respectively. The pie chart below shows the portions of the total energy consumption used for lighting, water heating, and building heat.

**Energy Breakdown (% of Total kWh)
for the Airport Garage**



The washroom in the Airport Garage contains a total of 1 toilet, 1 sink, and 1 shower. An 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 makeup for 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 Airport Garage. The following assumptions were made in the analysis:

- The lighting in the garage is assumed to be on from Sunday to Friday, 5:30am – 9:00pm and on Saturdays from 5:30am – 6:00pm.
- The temperature of the garage is maintained at 21°C (70°F).
- For the purpose of water consumption, the typical occupancy of the garage is 3.

Table 3 Energy Saving Opportunities for the Airport Garage

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 8' x 2 T12 fluorescent ballasts require replacement, replace them with T8 ballast and tubes.	13	$47	$12	$0	$695	$181	8,550	$513	1.4	0.4
Lighting Subtotal					**$695**	**$181**	**8,550**	**$513**		
ENVELOPE										
Weather-strip pedestrian doors.	1	$15	$15	$50	$73	$73	1,776	$124	0.6	0.6
Weather-strip vehicle doors.	5	$100	$100	$200	$1,695	$1,695	10,653	$746	2.3	2.3
Caulk vehicle doors.	5	$5	$5	$25	$170	$170	6,818	$477	0.4	0.4
Replace broken window.	1	$500	$420	$160	$746	$655	647	$45	16.5	14.5
Upgrade roof insulation to R40.	1	$4,990	$3,221	$6,804	$13,327	$11,328	16,981	$1,189	11.2	9.5
Upgrade wall insulation to R16.	1	$8,717	$7,515	$15,821	$27,727	$26,369	23,104	$1,617	17.1	16.3
Envelope Subtotal					**$43,738**	**$40,290**	**59,978**	**$4,198**		
HVAC										
Install programmable thermostat; setback temp to 15°C (59°F).	2	$300	$300	$300	$1,356	$1,356	12,087	$846	1.6	1.6
Replace unit heaters with high efficiency furnaces.	2	$3,400	$3,155	$500	$8,814	$8,260	18,276	$1,279	6.9	6.5
HVAC Subtotal					**$10,170**	**$9,616**	**30,362**	**$2,125**		
HOT WATER										
Install instantaneous water heater.****	2	$300	$300	$500	$1,808	$1,808	1,213	$73	24.8	24.8
Insulate hot water piping.	1	$50	$50	$50	$113	$113	465	$28	4.0	4.0
Install water efficient showerhead.	1	$21	$21	$50	$80	$80	554	$33	2.4	2.4
Water Subtotal					**$2,001**	**$2,001**	**2,232**	**$134**		

TOTALS	**Energy (kWh)**	**Cost ($)**	**CO_2 (Tonnes)**
Existing Annual Consumption/Cost/Emissions	148,638	$10,625	28.30
Estimated Annual Savings	101,123	$6,971	24.15
Percent Savings	68%	66%	85%

* NI = Cost does not include incentive, WI = Cost includes incentive.

** The total cost column includes 13% taxes.

*** The cost assigned to electricity is 0.06004 $/kWh (rate was taken from Manitoba Hydro's website) and the cost of propane is taken as 0.07 $/kWh (taken from building's propane bills).

**** Discounted to include cost of replacement water tank in 10 years.

Table 4 Water Saving Opportunities for the Airport Garage

Description	Qty	Installed Cost/Unit ($)		Total Cost* ($)	Annual Water Savings (%)	Annual Water Savings (L)	Annual Cost Savings ($)
		Material	Labour				
Install water efficient dual flush toilets.	1	$284	$150	$490	70%	26,512	$27
Install water efficient showerheads.	1	$21	$50	$80	29%	14,781	$15

* The total cost column includes 13% taxes.

3.3 GENERAL RECOMMENDATIONS

Lighting

The lighting analysis table for this building is shown in Appendix B as Table B.2.3. The only opportunity for energy savings is to replace the T12 fluorescents with T8 ballasts and tubes when the T12 ballasts burn out.

Envelope

The pedestrian door to the garage has no weather-stripping and therefore, cold air is infiltrating through the cracks around these doors throughout the winter. Similarly, the five vehicle doors have very poor weather-stripping and no caulking. It is recommended that all these doors be weather-stripped and caulked to reduce the cold air infiltrating through the cracks around these doors and thus reduce the heat load for this building in the winter.

The window on the back of the garage is broken and should replaced. The energy savings and payback period for replacing this window with a triple pane window is shown in Table 3 above.

The walls and roof of this building are poorly insulated with R8 and R12 insulation, respectively. It is recommended that a spray-on insulation be applied to the interior walls to increase the R-value to 16 followed by interior metal cladding. Insulation could also be added to the ceiling to increase the resistance to R-40. Details on calculations for energy savings with upgrading the building’s envelope can be found in Appendix B, Table B.2.4.

HVAC

An energy saving opportunity for this building is to install programmable thermostats for the unit heaters that are programmed such that the temperature is automatically setback to 15°C (59°F) during unoccupied times. This would help to reduce the annual heating requirements for this building.

The propane unit heaters are old and inefficient. One recommendation is to replace these unit heaters with high efficiency furnaces. This would save 15% of the current energy consumed by these unit heaters to heat the garage.

Water

Installing an instantaneous water heater would eliminate the energy required to offset the heat losses from the hot water tank. Savings would also result from insulating the hot water piping and replacing the showerhead with a water efficient showerhead.

The water analysis summary is shown in Table B.2.5 in Appendix B. Replacing the high flow fixtures with water efficient fixtures would save between 29 and 70% of their current water consumption.

Other Issues

The metal liner on the exterior walls of this garage is peeling away from the walls in some locations. These sections should be repaired to better protect the insulation in the walls.

4.0 SWEEPER BUILDING AND SAND STORAGE

4.1 BACKGROUND

The Sweeper Building at the airport was built approximately 35 year ago and consists of a garage and an office. This 1,296 square foot building has metal clad exterior walls, straw insulation, and an interior metal liner. This garage is occupied from Sunday to Friday, 5:30am – 9pm and on Saturdays, 5:30am – 6pm.

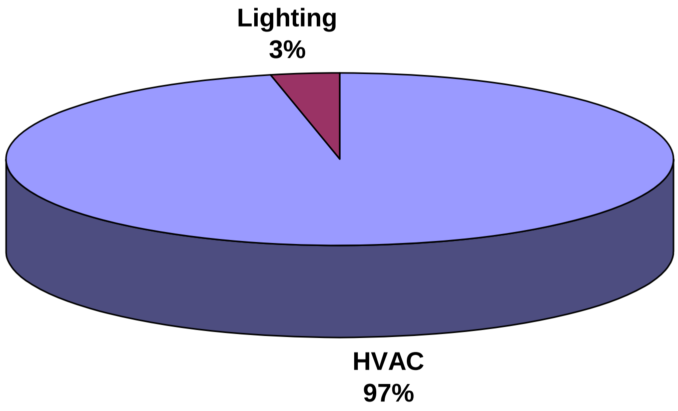
Photo 3 – Sweeper Building

The Sand Storage Building is similar to the Sweeper Building but slightly smaller. This building is only 1,080 square feet and is used to store both sand and a front-end loader. The walls of this garage have exterior metal cladding with 2” of fiberglass insulation (R8). The occupied times for this building are the same as for the Sweeper Building.

Photo 4 – Sand Storage

The Sweeper and Sand Storage Buildings use electricity for lighting and for some of the heating and propane for the remainder of the building heat. In the previous year, the total propane and electrical energy consumed by the two facilities was 60,082 kWh and 408,600 kWh, respectively. The breakdown of the total energy consumption for the two facilities is shown in the following pie chart.

Energy Breakdown (% of Total kWh)
for the Sweeper Building and Sand Storage



There is no hot water at either of these facilities.

4.2 ENERGY AND WATER SAVING OPPORTUNITIES

Table 5 shows the energy saving opportunities for the Sweeper Building and Sand Storage. The following assumptions were made in the calculations:

- These buildings are both occupied Sunday to Friday, from 5:30 am to 9 pm and on Saturdays from 5:30am to 6pm.
- The temperature of both the Sweeper Building and Sand Storage is maintained at 21°C (70°F).
- The exterior lights are on 12 hours per day year round.

Table 5 Energy Saving Opportunities for the Sweeper Building and Sand Storage

Description	Qty	Installed Cost/Unit ($)			Total Cost** ($)		Estimated Annual Savings		Simple Payback Years	
		Material (NI*)	Material (WI*)	Labour	NI*	WI*	kWh	$***	NI*	WI*
LIGHTING										
Sweeper Building										
When 8' x 2 T12 fluorescents require replacement, replace them with T8 ballast and tubes.	4	$47	$12	$0	$214	$56	2,631	$158	1.4	0.4
Sand Storage										
When 4' x 2 T12 fluorescents require replacement, replace them with T8 ballast and tubes.	21	$41	$21	$0	$977	$503	4,344	$261	3.7	1.9
Lighting					**$1,191**	**$563**	**6,975**	**$419**		
ENVELOPE										
Sweeper Building										
Weather-strip pedestrian door.	1	$15	$15	$50	$73	$73	2,008	$121	0.6	0.6
Caulk pedestrian door.	1	$5	$5	$25	$34	$34	643	$39	0.9	0.9
Caulk vehicle door.	1	$5	$5	$25	$34	$34	2,602	$156	0.2	0.2
Upgrade roof insulation to R40.	1	$850	$150	$700	$1,752	$961	24,690	$1,482	1.2	0.6
Sand Storage										
Weather-strip pedestrian door.	1	$15	$15	$50	$73	$73	2,008	$121	0.6	0.6
Caulk pedestrian door.	1	$5	$5	$25	$34	$34	643	$39	0.9	0.9
Weather-strip vehicle door.	1	$100	$100	$200	$339	$339	16,866	$1,013	0.3	0.3
Caulk vehicle door.	1	$5	$5	$25	$34	$34	10,794	$648	0.1	0.1
Upgrade wall insulation to R20.	1	$2,587	$1,737	$4,066	$7,518	$6,557	10,059	$604	12.4	10.9
Upgrade roof insulation to R40.	1	$1,782	$1,182	$2,430	$4,760	$4,082	2,939	$176	27.0	23.1
Envelope Subtotal					**$14,650**	**$12,221**	**73,251**	**$4,398**		
HVAC										
Sweeper Building & Sand Storage										
Install programmable thermostat; setback temp to 15°C (59°F).	2	$300	$300	$300	$1,356	$1,356	3,372	$236	5.7	5.7
Replace unit heaters with high efficiency furnaces.	2	$3,200	$2,955	$500	$8,362	$7,808	12,016	$841	9.9	9.3
HVAC Subtotal					**$9,718**	**$9,164**	**15,389**	**$1,077**		

TOTALS	**Energy (kWh)**	**Cost ($)**	**CO_2 (Tonnes)**
Existing Annual Consumption/Cost/Emissions	468,682	$26,899	25.78
Estimated Annual Savings	95,615	$5,894	5.89
Percent Savings	20%	22%	23%

* NI = Cost does not include incentive, WI = Cost includes incentive.

** The total cost column includes 13% taxes.

*** The cost assigned to electricity is 0.06004 $/kWh (rate was taken from Manitoba Hydro's website) and the cost of propane is taken as 0.07 $/kWh (taken from building's propane bills).

4.3 GENERAL RECOMMENDATIONS

Lighting

The lighting analysis results for the Sweeper Building and the Sand Storage can be found in Appendix B, Table B.3.3. The only lighting to replace in these buildings are the T12 fluorescent lamps. These lights should be replaced with energy efficient T8s once the T12 ballasts burn out.

Envelope

The pedestrian doors to both buildings have poor stripping and no caulking. To reduce the cold air infiltrating through the cracks around these doors in the winter, it is recommended that new weather-stripping and caulking be installed. Similarly, the vehicle door to the Sand Storage Building requires new weather-stripping and the vehicle doors to both buildings should be caulked.

The insulation in the roof of the Sweeper Building could be upgraded very easily and for very little cost by adding blow-in insulation in the attic. The walls of this building on the other hand are insulated with straw and could not be upgraded very easily.

Another opportunity that was looked at was upgrading both the wall and roof insulation in the Sand Storage Building. This would involve adding more insulation followed by an interior metal liner. Details on the energy saving calculations for the envelopes of these buildings is shown in Appendix B, Table B.3.4.

HVAC

For both the Sweeper and Sand Storage Buildings, it is recommended that programmable thermostats be installed on the unit heaters. These thermostats should be programmed such that the temperature is reduced to 15°C (59°F) when the buildings are unoccupied.

Another opportunity for both buildings is to replace the unit heaters with high efficiency furnaces. This would reduce the propane consumed by the unit heaters by over 15%.

Other Issues

Both the Sweeper and Sand Storage Buildings have damaged metal cladding on the walls. This should be repaired to reduce the cold air infiltration through the walls and protect the insulation.

5.0 WHITNEY FORUM (ARENA)

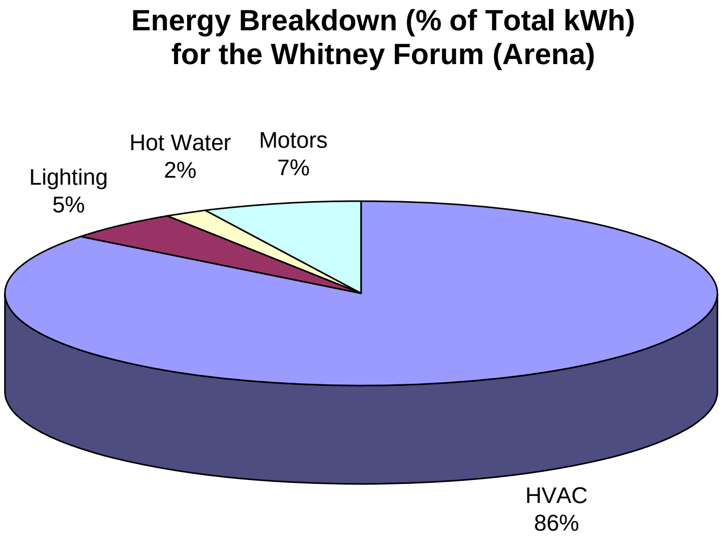
5.1 BACKGROUND

The Whitney Forum is a 30,873 square foot arena with an ice rink, a lobby, and dressing rooms. It is attached to the Curling Rink on the east end but the Curling Rink is not included in this study. The arena was built in 1960 of concrete block walls and the insulation in the walls and roof were recently upgraded to R20 and R30 insulation, respectively. Throughout the wintertime, the Whitney Forum is occupied for 16 hours/day, 7 days/week and throughout the summer, it is occupied for 8 hours/day, 5 days/week.

Photo 5 – Whitney Forum (Arena)

The Whitney Forum is heated with 2 oil-fired steam boilers. The primary boiler is rated at 60HP and was installed in 1998. It is well maintained and was recently tested at an efficiency of 80%. The backup boiler is rated at 40HP and dates back to 1979. A heat recovery ventilator provides ventilation for the dressing rooms and pre-heats the cool outdoor intake air in the wintertime with the dressing room’s exhaust air. The arena uses electricity for lighting, water heating, and to run the ice plant motors. Fuel oil is used for the steam boilers for heating. From October 2004 to October 2005, the total oil and electrical energy consumed by the arena was

1,823,677 kWh and 1,116,000 kWh, respectively. The total energy breakdown is shown in the following pie chart.



The washrooms in the Whitney Forum contain a total of 25 toilets, 10 sinks, 18 urinals, and 20 showers. Three old 450-Litre electric hot water heaters and four new 450-Litre electric hot water heaters heat 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 makeup for heat losses from the storage tanks. The hot water consumption shown in the pie chart above does not include the energy used to heat the zamboni water.

5.2 ENERGY AND WATER SAVING OPPORTUNITIES

Tables 6 and 7 show the energy and water saving opportunities for the Whitney Forum. The following assumptions were made in the calculations:

- For 8 months of the year, the Whitney Forum is occupied for 16 hrs/day, 7 days/week and for 4 months of the year, the Whitney Forum is occupied for 8 hrs/day, 5 days/week.
- The temperature of the rink area is maintained at 7.2°C (45°F) and the lobby and dressing rooms are maintained at 21°C (70°F).
- For the purpose of water consumption, the typical occupancy is taken as 50.

Table 6 Energy Saving Opportunities for the Whitney Forum (Arena)

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 8' x 2 T12 fluorescent ballasts require replacement, replace them with T8 ballasts and tubes.	59	$44	$17	$0	$2,950	$1,117	33,166	$1,991	1.5	0.6
When 4' x 2 T12 fluorescent ballasts require replacement, replace them with T8 ballasts and tubes.	20	$41	$21	$0	$931	$479	3,536	$212	4.4	2.3
Replace 100W incandescents with compact fluorescents.	20	$15	$10	$13	$633	$520	6,528	$392	1.6	1.3
Replace incandescent exit signs with LED modules.	14	$50	$5	$80	$2,057	$1,345	3,311	$199	10.3	6.8
Install occupancy sensor for lights in dressing room.	4	$75	$75	$50	$565	$565	6,687	$401	1.4	1.4
Lighting Subtotal					**$7,135**	**$4,025**	**53,228**	**$3,196**		
ENVELOPE										
Weather-strip exterior doors.	16	$15	$15	$50	$1,175	$1,175	30,118	$1,808	0.6	0.6
Caulk exterior doors	16	$5	$5	$25	$542	$542	9,638	$579	0.9	0.9
Weather-strip interior doors to rink.	12	$15	$15	$50	$881	$881	8,878	$533	1.7	1.7
Caulk interior doors to rink.	12	$5	$5	$25	$407	$407	710	$43	9.5	9.5
Replace old wood doors to rink.	4	$350	$350	$100	$2,034	$2,034	1,631	$98	20.8	20.8
Replace 4' x 2' single pane window with triple pane window.	1	$500	$420	$200	$791	$701	686	$41	19.2	17.0
Replace rink windows with triple pane windows.	8	$400	$320	$150	$4,972	$4,249	2,306	$138	35.9	30.7
Envelope Subtotal					**$10,803**	**$9,989**	**53,967**	**$3,240**		
HVAC										
Install programmable thermostat on 2 rink unit heaters; setback temp by 10°F.	2	$300	$300	$300	$1,356	$1,356	126,325	$7,112	0.2	0.2
Install temperature controls for remaining unit heater in rink; reduce temperature by 10°F.	1	$1,500	$1,500	$1,500	$3,390	$3,390	126,325	$7,112	0.5	0.5
Install motorized dampers on exhaust fans in rink.	4	$300	$300	$300	$2,712	$2,712	12,246	$689	3.9	3.9
Install motorized dampers on exhaust fans in mechanical room.	2	$300	$300	$300	$1,356	$1,356	33,059	$1,861	0.7	0.7
Install countdown timer on greasehood exhaust fan.	1	$100	$100	$75	$198	$198	165,293	$9,306	0.0	0.0
HVAC Subtotal					**$9,012**	**$9,012**	**463,248**	**$26,081**		

Description	Qty	Installed Cost/Unit ($)			Total Cost** ($)		Estimated Annual Savings		Simple Payback Years	
		Material (NI*)	Material (WI*)	Labour	NI*	WI*	kWh	$***	NI	WI
HOT WATER										
Insulate hot water piping.	1	$250	$250	$250	$565	$565	2,326	$140	4.0	4.0
Re-insulate domestic hot water tanks.	1	$750	$750	$1,000	$1,978	$1,978	3,032	$182	10.9	10.9
Water Subtotal					**$2,543**	**$2,543**	**5,358**	**$322**		

TOTALS	Energy (kWh)	Cost ($)	CO_2 (Tonnes)
Existing Annual Consumption/Cost/Emissions	2,939,677	$181,551	526.56
Estimated Annual Savings	575,801	$32,839	141.65
Percent Savings	20%	18%	27%

* NI = Cost does not include incentive, WI = Cost includes incentive.

** The total cost column includes 13% taxes.

*** The cost assigned to electricity is 0.06004 $/kWh (rate was taken from Manitoba Hydro's website) and the cost of oil is 0.056 $/kWh (from building's oil bills).

Table 7 Water Saving Opportunities for the Whitney Forum (Arena)

Description	Qty	Installed Cost/Unit ($)		Total Cost* ($)	Annual Water Savings (%)	Annual Water Savings (L)	Annual Cost Savings ($)
		Material	Labour				
Install water efficient 6 LPF toilets.	15	$284	$150	$7,348	55%	332,775	$333
Install water efficient metering faucets.	10	$309	$150	$5,187	80%	130,560	$131

* The total cost column includes 13% taxes.

5.3 GENERAL RECOMMENDATIONS

Lighting

Some of the lighting in the Whitney Forum including the T8 fluorescents in the dressing rooms and the metal halides in the rink area have already been upgraded to energy efficient lighting. There are however several T12s remaining that should be upgraded to T8 lamps and ballasts when the T12 ballasts burn out. Another opportunity for energy savings is to replace the 100W incandescent bulbs with compact fluorescents. Some of the exit signs have been upgraded to LEDs but there are still some incandescent signs remaining. It is recommended that these signs be upgraded to LEDs, which consume 90% less energy than the incandescents. The last recommendation shown in Table 6 above is to install occupancy sensors on the dressing room lights. This would significantly reduce the run-time of these lights. The lighting analysis table for the Whitney Forum is shown in Appendix B, Table B.4.3.

Envelope

The pedestrian doors to this building require new weather-stripping and caulking. This would help to reduce the cold air infiltrating through the cracks around these doors and doorframes. Several of the doors from the lobby to the rink area are old wood doors with no weather-stripping or caulking. Replacing these doors would reduce the heat losses from the lobby and dressing rooms; however, the payback period is quite long. Weather-stripping and caulking these doors would be less expensive and would result in energy savings with a short payback period. The last two energy saving opportunities shown in Table 6 for this building's envelope are to replace the exterior and rink windows with triple pane windows. The payback periods for these upgrades are long due to the high capital cost.

HVAC

An excellent opportunity for energy savings for the arena is to install a programmable thermostat on one of the steam heaters in the rink area. This steam heater currently has no thermostat to control its operation and therefore, a large amount of energy is being used to heat the rink above its desired temperature. The energy savings calculated for this upgrade were based on the assumption that by installing a thermostat, the temperature setting could be reduced by 10°F. Programmable thermostats should also be installed to control the temperature of the other two unit heaters in the rink area.

Another opportunity is to replace the backdraft dampers on the rink and mechanical room exhaust fans with motorized dampers. Backdraft dampers do not provide a tight seal and thus allow cold air to seep into the building all winter. Installing motorized dampers would eliminate this cold air infiltration and save in heating costs.

The greasehood exhaust fan currently runs all the time and provides continuous ventilation to the kitchen even when the kitchen is not in use, which is a large waste of heating energy. In order to ensure that the kitchen is ventilated only when required and thus reduce the heat consumption, consideration should be given to installing a countdown timer on the greasehood exhaust fan. It was assumed that by installing a countdown timer, the greasehood exhaust fan would run 50% of the time.

Water

To save in energy consumed to heat the water, the old domestic hot water tank and the hot water piping should be insulated.

Table 7 shows the water savings that would result from replacing the toilets with water efficient toilets and by replacing the sink faucets with water efficient metering faucets.

6.0 COMMUNITY CENTRE

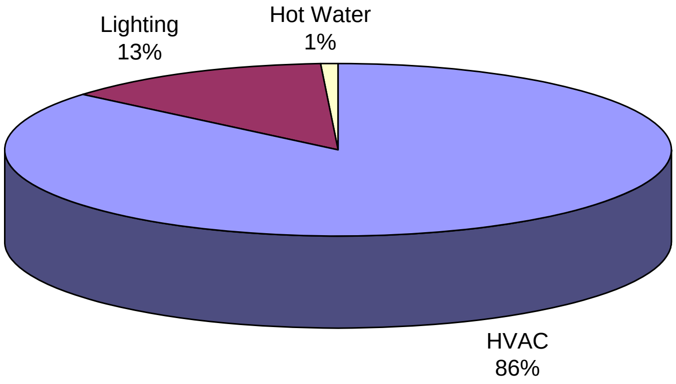
6.1 BACKGROUND

The Community Centre, constructed in 1958, is a 23,810 square foot building with brick and concrete block exterior walls and drywall interior walls. The windows were upgraded in the building in 1985. The main floor of this building contains offices, a seniors centre, and an auditorium. A meeting room is located on the second floor.

Photo 6 – Community Centre

The Community Centre uses electricity for HVAC, lighting, and hot water and oil is used for the majority of the heating. The building is under-insulated with common wall and roof R-values of R6. The oil fired boiler is past its life expectancy at an age of 50 years old. The total annual oil and electrical energy consumption from October 2004 – October 2005 was 407,944 kWh and 199,680 kWh, respectively. The following pie chart shows the energy breakdown for the Community Centre.

**Energy Breakdown (% of Total kWh)
for the Community Centre**



The washrooms in the Community Centre contain a total of 14 toilets, 18 sinks, 8 urinals, and 2 showers. One 284-Litre hot water heater and two 225-Litre hot water tanks heat 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 makeup for heat losses from the storage tanks.

6.2 ENERGY SAVING OPPORTUNITIES

Tables 8 and 9 below show summaries of the energy and water saving opportunities for the Community Centre. The following assumptions were made in the calculations:

- The offices and weight room are occupied for 7 days/week from 9am-10pm.
- The Auditorium is occupied from 6pm-10pm for 5 days/week and for 10 hours/week throughout the day.
- The meeting room is occupied for 4 hours/week throughout the day and for 10 hours/week during the evenings.
- The temperature is maintained at 21°C (70°F).
- For the purpose of water consumption, the typical occupancy is assumed to be 30.

Table 8 Energy Saving Opportunities for the Community Centre

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 require replacement, replace them with T8 ballasts and tubes.	11	$32	$12	$0	$403	$154	4,060	$244	1.7	0.6
When 4' x 2 T12 fluorescent ballasts require replacement, replace them with T8 ballasts and tubes.	115	$41	$21	$0	$5,353	$2,754	21,223	$1,274	4.2	2.2
Replace 150W incandescents with compact fluorescents.	9	$15	$10	$13	$285	$234	4,770	$286	1.0	0.8
Replace incandescent exit signs with LED modules.	6	$50	$5	$80	$881	$576	1,419	$85	10.3	6.8
Install sensors on washroom lights.	3	$75	$75	$50	$424	$424	696	$42	10.1	10.1
Lighting Subtotal					**$7,345**	**$4,142**	**32,168**	**$1,931**		
ENVELOPE										
Replace 6' x 2' windows in seniors centre with triple pane windows.	8	$600	$480	$150	$6,780	$5,695	3,331	$194	35.0	29.4
Replace 3' x 5' windows on main floor with triple pane windows.	6	$650	$500	$150	$5,424	$4,407	3,123	$182	29.8	24.2
Weather-strip pedestrian doors.	9	$15	$15	$50	$661	$661	16,941	$986	0.7	0.7
Caulk pedestrian doors.	9	$5	$5	$25	$305	$305	5,421	$316	1.0	1.0
Upgrade roof insulation to R40.	1	$21,565	$9,565	$8,847	$34,366	$20,806	135,861	$7,907	4.3	2.6
Envelope Subtotal					**$47,537**	**$31,875**	**164,678**	**$9,584**		
HVAC										
Replace backdraft dampers with motorized dampers.	3	$300	$300	$300	$2,034	$2,034	13,224	$770	2.6	2.6
When condensing unit in senior's room requires replacement, replace it with a high efficiency unit.	1	$295	$295	$0	$333	$333	6,603	$396	0.8	0.8
When condensing unit in senior's room requires replacement, replace it with a high efficiency unit.	1	$315	$315	$0	$356	$356	2,201	$132	2.7	2.7
Install CO_2 sensor to control hall MUA Unit.	1	$500	$500	$3,000	$3,955	$3,955	49,985	$2,814	1.4	1.4
Replace boiler with electric boilers.	3	$10,000	$7,380	$10,000	$67,800	$58,918	163,178	$9,187	7.4	6.4
HVAC Subtotal					**$74,478**	**$65,597**	**235,190**	**$13,299**		

Description	**Qty**	**Installed Cost/Unit ($)**			**Total Cost** ($)**		**Estimated Annual Savings**		**Simple Payback Years**	
		Material (NI*)	**Material (WI*)**	**Labour**	**NI***	**WI***	**kWh**	**$*** **	**NI**	**WI**
HOT WATER										
Install water efficient showerheads.	2	$21	$21	$50	$160	$160	277	$18	9.0	9.0
Insulate hot water piping.	1	$50	$50	$50	$113	$113	465	$28	4.0	4.0
Water Subtotal					**$273**	**$273**	**742**	**$46**		

TOTALS	**Energy (kWh)**	**Cost ($)**	**CO_2 (Tonnes)**
Existing Annual Consumption/Cost/Emissions	607,624	$36,930	116.25
Estimated Annual Savings	432,778	$24,861	91.93
Percent Savings	71%	67%	79%

* NI = Cost does not include incentive, WI = Cost includes incentive.
** The total cost column includes 13% taxes.
*** The cost assigned to electricity is 0.06004 $/kWh (rate was taken from Manitoba Hydro's website) and the cost of oil is 0.056 $/kWh (from building's oil bills).

Table 9 Water Saving Opportunities for the Community Centre

Description	**Qty**	**Installed Cost/Unit ($)**		**Total Cost* ($)**	**Annual Water Savings (%)**	**Annual Water Savings (L)**	**Annual Cost Savings ($)**
		Material	**Labour**				
Install water efficient dual flush toilets.	14	$284	$150	$6,858	70%	108,518	$109
Install water efficient metering faucets.	18	$309	$150	$9,336	80%	26,208	$26
Install water efficient urinals.	8	$344	$200	$4,918	60%	50,018	$50
Install water efficient showerheads.	2	$21	$21	$95	29%	7,391	$7

* The total cost column includes 13% taxes.

Lighting

The lighting analysis summary for this building is shown in Appendix B, Table B.5.3. There are several T12 fluorescent lights in the Community Centre that could be replaced with T8 lamps and ballasts to save energy. T8s are slim, energy efficient lamps that produce more light per watt than T12s. In addition, the T12s are expected to become obsolete by the year 2010 and will no longer be available. Energy savings would also result from replacing the incandescent lights with compact fluorescents. The incandescent exit signs are on for 24 hours/day and therefore consume a large amount of electricity. Replacing these signs with LEDs would save 90% of the current energy consumed by these lights. Another opportunity is to install occupancy sensors in the washrooms to control the lights. This would help to ensure that the lights are turned off when the washrooms are unoccupied.

Envelope

The windows on the main floor of this building are double pane windows with good caulking around the frames. The energy savings and payback period for replacing these windows with triple pane windows is shown in Table 8. Due to the high installation cost associated with these upgrades, the payback periods are long. The pedestrian doors to this building have poor caulking and weather-stripping. Replacing the weather-stripping and caulking would save energy by reducing the cold air infiltrating through the cracks around these doors. Another recommendation is to upgrade the roof insulation when the roof requires replacement. This would drastically reduce the heat losses through the building's ceiling.

HVAC

Several of the wall exhaust fans have poor backdraft dampers that allow cold air to leak into the building. These dampers should be replaced with insulated motorized dampers to eliminate the cold air infiltration. Another recommendation is to install premium efficiency condensing units in the weight room and senior's centre when the current units require replacement. This would save approximately 20% of the energy consumed by these condensers.

Installing a CO_2 sensor on the make-up air unit for the hall would reduce the ventilation requirements by ventilating the hall only when required. This would save in the energy required to heat the supply air to the hall.

Another energy saving opportunity that was studied was to replace the old oil boiler with three electric boilers. Assuming that the oil boiler is 60% efficient, there is a large potential for energy savings by replacing these boilers with electric boilers. The approximate energy savings and payback period for this upgrade is shown in Table 8 above.

Water

Replacing the showerheads with water efficient showerheads and insulating the hot water piping would help to save in energy required for heating the hot water.

Table 9 shows the water saving opportunities for this building. Replacing the toilets, sink faucets, showerheads, and urinals with water efficient fixtures would save between 29% and 80% of the current fixtures' water consumption.

7.0 AQUA CENTRE

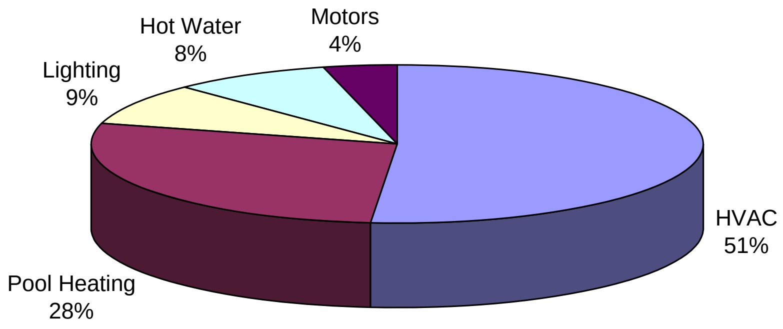
7.1 BACKGROUND

The Aqua Centre, constructed in 1974, is an 11,302 square foot building that houses a swimming pool, dressing rooms, and a weight room upstairs. This building was constructed of concrete block walls with R16 insulation.

Photo 7 – Aqua Centre

The Aqua Centre uses electricity for HVAC, lighting, motors, and to heat the pool. The domestic water heater consumes propane for water heating. Air conditioning is provided for the weight room only. The total propane and electrical energy consumption for this building from October 2004 – October 2005 was 87,851 kWh and 859,320 kWh, respectively. The total energy breakdown is shown in the following pie chart.

**Energy Breakdown (% of Total kWh)
for the Aqua Centre**



The washrooms in the Aqua Centre contain a total of 7 toilets, 6 sinks, 1 urinal, and 8 showers. A propane hot water heater heats the domestic 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 makeup for heat losses from the storage tanks.

7.2 ENERGY AND WATER SAVING OPPORTUNITIES

Tables 10 and 11 show the energy and water saving opportunities for the Aqua Centre. The following assumptions were made in the analysis:

- The Aqua Centre is occupied for 598 hours/month.
- The temperature of the centre is maintained at 21°C (70°F).
- For the purpose of calculating water consumption, the typical occupancy over 598 hours/month was assumed to be 16.

Table 10 Energy Saving Opportunities for the Aqua Centre

Description	Qty	Installed Cost/Unit ($)			Total Cost** ($)		Estimated Annual Savings		Simple Payback Years	
		Material (NI*)	Material (WI*)	Labour	NI*	WI*	kWh	$***	NI	WI
LIGHTING & PARKING LOT CONTROLLERS										
When 4' x 2 T12 fluorescent ballasts require replacement, replace them with T8 ballasts and tubes.	29	$41	$21	$0	$1,350	$694	8,116	$487	2.8	1.4
When 4' x 4 T12 fluorescent ballasts require replacement, replace them with T8 ballasts and tubes.	6	$32	$12	$0	$220	$84	3,358	$202	1.1	0.4
Replace 100W incandescents with compact fluorescents.	20	$15	$10	$13	$633	$520	10,333	$620	1.0	0.8
Replace incandescent exit signs with LED modules.	5	$50	$5	$80	$735	$480	1,183	$71	10.3	6.8
Install parking lot controllers.	2	$100	$75	$150	$565	$509	960	$58	9.8	8.8
Lighting and Parking Lot Controllers Subtotal					**$3,502**	**$2,287**	**23,950**	**$1,438**		
ENVELOPE										
Weather-strip pedestrian doors.	6	$15	$15	$50	$441	$441	9,035	$542	0.8	0.8
Caulk windows.	2	$5	$5	$25	$68	$68	964	$58	1.2	1.2
Replace 3' x 5' windows with triple pane windows.	2	$750	$600	$150	$2,034	$2,034	833	$50	40.7	33.9
Envelope Subtotal					**$2,543**	**$2,204**	**10,832**	**$650**		
MOTORS										
When fan motors require replacement, replace them with high efficiency motors.	2	$236	$236	$0	$533	$533	1,989	$119	4.5	4.5
Motor Subtotal					**$533**	**$533**	**1,989**	**$119**		
HOT WATER										
Install instantaneous water heater.	1	$3,500	$3,500	$2,000	$6,215	$6,215	3,032	$212	29.3	29.3
Insulate hot water piping.	1	$100	$100	$100	$226	$226	930	$65	3.5	3.5
Replace showerheads with water efficient showerheads.	8	$21	$21	$50	$642	$642	20,384	$1,427	0.4	0.4
Install water efficient metering faucets.	6	$309	$309	$150	$3,112	$3,112	2,409	$169	18.5	18.5
Water Subtotal					**$10,195**	**$10,195**	**26,756**	**$1,873**		

TOTALS	Energy (kWh)	Cost ($)	CO_2 (Tonnes)
Existing Annual Consumption/Cost/Emissions	947,171	$50,054	45.41
Estimated Annual Savings	63,527	$4,081	6.50
Percent Savings	7%	8%	14%

* NI = Cost does not include incentive, WI = Cost includes incentive.

** The total cost column includes 13% taxes.

*** The cost assigned to electricity is 0.06004 $/kWh (rate was taken from Manitoba Hydro’s website) and the cost of propane was taken as 0.07 $/kWh (taken from propane bills for this building).

Table 11 Water Saving Opportunities for the Aqua Centre

Description	Qty	Installed Cost/Unit ($)		Total Cost* ($)	Annual Water Savings (%)	Annual Water Savings (L)	Annual Cost Savings ($)
		Material	Labour				
Install water efficient dual flush toilets.	7	$284	$150	$3,429	70%	266,230	$266
Install water efficient metering faucets.	6	$309	$150	$3,112	80%	64,297	$64
Install water efficient urinals.	1	$344	$200	$615	60%	13,634	$14
Install water efficient showerheads.	8	$21	$21	$380	29%	543,941	$544

* The total cost column includes 13% taxes.

7.3 GENERAL RECOMMENDATIONS

Lighting & Parking Lot Controllers

The lighting analysis summary for this building is shown in Appendix B, Table B.6.3. The lighting in the pool area consists of metal halides, which are already energy efficient and do not need to be replaced. The recommendations for this facility in terms of lighting are to replace the T12 fluorescents lamps with T8s when the T12 ballasts burn out and to replace the incandescents with compact fluorescents.

Another energy saving opportunity is to replace the incandescent exit signs with LED modules. LEDs consume 90% less energy than the incandescent exit signs. Parking lot controllers are also recommended for this building. These save energy by automatically reducing the power to the car plugs depending on the outdoor air temperature.

Envelope

The pedestrian doors have good caulking around the frames but poor weather-stripping. Replacing this weather-stripping would save energy by reducing the cold air infiltration around the doors. The energy savings that would result from replacing the windows with triple pane windows are shown in Table 10. The high installation cost for this upgrade would result in a long payback period. Another more appealing opportunity is to caulk the frames around the windows. This would save energy with a very short payback period.

Observations on the exterior of the building indicate moisture penetration to the exterior cladding as noted by rusty sections in the cladding. This indicates the wall insulation may be damaged and could be a source of high energy consumption. This is not uncommon for pool buildings of this age. Further investigation of the wall system is recommended to determine the extent of damage.

Motors

Table 10 shows the energy savings for replacing the fan motors with high efficiency motors when the current ones require replacement. The cost associated with this upgrade is the cost difference between installing a standard versus a premium efficiency motor.

Water

A large amount of energy is consumed by the domestic water heater. The best opportunity for hot water savings is to replace the showerheads with water efficient showerheads. Since showers in a public swimming pool are used so often, the payback period for this upgrade is short. Other opportunities include installing an instantaneous water heater, insulating the hot water piping and replacing the sink faucets with water efficient metering faucets.

Water savings for replacing the current fixtures in the washrooms with water efficient fixtures are shown in Table 11. More details on the water analysis can be found in Appendix B, Table B.6.5.

8.0 PUBLIC LIBRARY

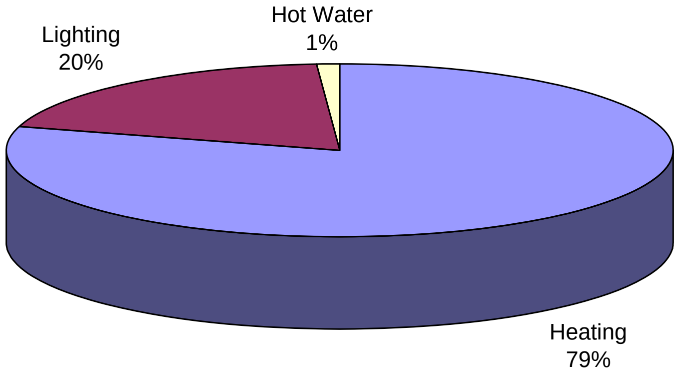
8.1 BACKGROUND

The Public Library is a 4,585 square foot concrete block building with R12 wall and roof insulation. The library was constructed in 1967. In 1989, renovations were done to the interior; however, none of these renovations improved the building's energy efficiency. In the summer, the library is occupied for 56 hours/week and throughout the winter it is occupied for 44 hours/week.

Photo 8 – Public Library

The library is heated with two electric rooftop units, an electric furnace and a propane furnace. In the previous year, the library consumed 158,480 kWh of electricity for lighting, HVAC, and hot water and 56,830 kWh of energy was consumed by the propane furnace. The breakdown of this energy is shown in the following pie chart.

**Energy Breakdown (% of Total kWh)
for the Public Library**



8.2 ENERGY AND WATER SAVING OPPORTUNITIES

Tables 12 and 13 show the energy and water saving opportunities for the Public Library. The following assumptions were made in the analysis:

- The Public Library is occupied for 56 hours/week throughout the summer and for 44 hours/week throughout the winter.
- The temperature of this facility is maintained at 21°C (70°F).
- For the purpose of water consumption, the typical occupancy of the library is assumed to be 12.
- The exit signs and outdoor lights are assumed to be on for 24 hours/day.

Table 12 Energy Saving Opportunities for the Public Library

Description	Qty	Installed Cost/Unit ($)			Total Cost** ($)		Estimated Annual Savings		Simple Payback Years	
		Material (NI*)	Material (WI*)	Labour	NI*	WI*	kWh	$***	NI	WI
LIGHTING & PARKING LOT CONTROLLERS										
When 4' x 2 T12 fluorescent ballasts require replacement, replace them with T8 ballasts and tubes.	28	$41	$21	$0	$1,303	$670	2,983	$179	7.3	3.7
When 4' x 4 T12 fluorescent ballasts require replacement, replace them with T8 ballasts and tubes.	31	$41	$21	$0	$1,443	$742	6,606	$397	3.6	1.9
Replace 100W incandescents with compact fluorescents.	17	$15	$10	$13	$538	$538	3,344	$201	2.7	2.2
Replace 60W incandescents with compact fluorescents.	24	$15	$10	$13	$759	$759	2,885	$173	4.4	3.6
Install photocells on outdoor lights.	12	$25	$25	$65	$1,220	$1,220	3,154	$189	6.4	6.4
Replace incandescent exit signs with LED modules.	8	$50	$5	$80	$1,175	$768	1,892	$114	10.3	6.8
Install parking lot controllers.	1	$100	$75	$150	$283	$254	480	$29	9.8	8.8
Lighting Parking Lot Controllers Subtotal					**$6,721**	**$4,721**	**21,344**	**$1,281**		
ENVELOPE										
Replace 6' x 10' windows with triple pane windows.	4	$1,700	$1,100	$200	$8,588	$5,876	8,328	$500	17.2	11.8
Replace 3' x 2' windows with triple pane windows.	3	$425	$365	$150	$1,949	$1,746	625	$38	52.0	46.6
Weather-strip pedestrian doors.	2	$15	$15	$50	$147	$147	3,765	$226	0.6	0.6
Caulk pedestrian doors.	2	$5	$5	$25	$68	$68	1,205	$72	0.9	0.9
Caulk windows.	7	$5	$5	$25	$237	$237	4,759	$286	0.8	0.8
When roofing is re-done, upgrade roof insulation to R-40.	1	$8,250	$5,650	$2,000	$11,583	$8,645	26,701	$1,603	7.2	5.4
Envelope Subtotal					**$22,572**	**$16,718**	**45,382**	**$2,725**		
HVAC										
When 2-ton condensing unit requires replacement, replace it with a high efficiency unit.	1	$315	$315	$0	$356	$356	1,038	$62	5.7	5.7
When 4-ton condensing unit requires replacement, replace it with a high efficiency unit.	1	$330	$330	$0	$373	$373	2,077	$125	3.0	3.0
When 4-ton rooftop units require replacement, replace them with a high efficiency unit.	2	$525	$525	$0	$1,187	$1,187	3,115	$187	6.3	6.3
HVAC Subtotal					**$1,915**	**$1,915**	**6,231**	**$374**		
HOT WATER										
Install instantaneous water heaters.****	2	$300	$300	$500	$1,808	$1,808	1,455	$87	20.7	20.7

Description	Qty	Installed Cost/Unit ($)			Total Cost** ($)		Estimated Annual Savings		Simple Payback Years	
		Material (NI*)	Material (WI*)	Labour	NI*	WI*	kWh	$***	NI	WI
Insulate hot water piping.	1	$50	$50	$50	$113	$113	465	$28	4.0	4.0
Water Subtotal					**$1,921**	**$1,921**	**1,921**	**$115**		

TOTALS	Energy (kWh)	Cost ($)	CO$_2$ (Tonnes)
Existing Annual Consumption/Cost/Emissions	215,310	$13,815	16.72
Estimated Annual Savings	74,878	$4,496	6.36
Percent Savings	35%	33%	38%

* NI = Cost does not include incentive, WI = Cost includes incentive.

** The total cost column includes 13% taxes.

*** The cost assigned to electricity is 0.06004 $/kWh (rate was taken from Manitoba Hydro's website) and the cost of propane is taken as 0.07 $/kWh (taken from the building's propane bills).

**** Discounted to include cost of replacement water tank in 10 years.

Table 13 Water Saving Opportunities for the Public Library

Description	Qty	Installed Cost/Unit ($)		Total Cost* ($)	Annual Water Savings (%)	Annual Water Savings (L)	Annual Cost Savings ($)
		Material	Labour				
Install water efficient dual flush toilets.	5	$284	$150	$2,449	70%	76,018	$76
Install water efficient metering faucets.	5	$309	$150	$2,593	80%	18,359	$18
Install water efficient urinals.	1	$344	$200	$615	60%	35,038	$35

* The total cost column includes 13% taxes.

8.3 GENERAL RECOMMENDATIONS

Lighting & Parking Lot Controllers

The lighting analysis summary for this building is shown in Appendix B, Table B.7.3. The indoor lighting consists of T12 fluorescent lamps and incandescent bulbs. When the T12 fluorescent ballasts burn out, they should be replaced with T8 lamps and ballasts to save energy. Energy savings would also result from replacing the incandescent bulbs with compact fluorescents.

The exterior lights are currently on for 24 hours/day. Installing photocells on these lights would automatically shut the lights off throughout the day.

Other opportunities for the lighting in the library include replacing the incandescent exit signs with LEDs and installing parking lot controllers on the parking lot plugs.

Envelope

The windows in the library are dual pane with poor caulking around the frames. There is a large potential for energy savings with replacing the 6' x 10' windows with triple pane windows and caulking around the frames. The pedestrian doors to this building have poor weather-stripping and no caulking. Installing new weather-stripping and caulking would reduce the cold air infiltration around the frames in the winter and save in annual heating requirements.

The last recommendation for the building's envelope is to upgrade the roof insulation to R40. To save money, this upgrade should be done when the roof is replaced.

HVAC

When the two condensers require replacement, they should be replaced with units with a high SEER (Seasonal Energy Efficiency Rating) to save in annual electricity consumed for cooling. Similarly, the rooftop units should be replaced with high efficiency units when the current units require replacement. Although premium heating efficiency rooftop units are not available, they are available with a higher cooling efficiency, which will help to reduce electricity consumption in the summertime.

Water

Installing instantaneous water heaters to replace the storage tank would reduce energy consumption by eliminating the annual heat losses from storage tank. Another energy saving opportunity that would reduce heat losses is to insulate the hot water piping.

The water saving opportunities for the Public Library are shown in Table 13. These opportunities include installing dual flush, water efficient toilets, installing water efficient metering faucets on the sinks and installing water efficient urinals.

9.0 PUBLIC SAFETY BUILDING

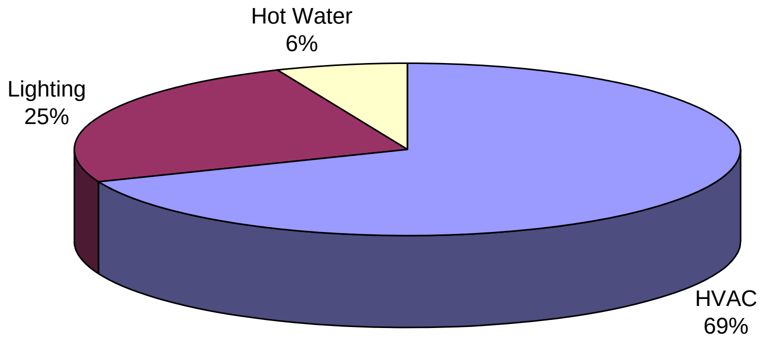
9.1 BACKGROUND

The Public Safety Building, constructed in 1980, is an 11,560 square foot building. This 2 storey concrete block building houses both the fire hall and the RCMP offices including holding cells, a truck bay, and bedrooms for the Fire Hall. The RCMP offices are occupied for 20 hours/day and the Fire Hall is occupied for 24 hours/day.

Photo 9 – Public Safety Building

The Public Safety Building uses electricity exclusively for lighting, HVAC, and hot water. From October 2004 to October 2005, the total electrical energy consumption was 502,740 kWh. The energy breakdown is shown in the pie chart below.

Energy Breakdown (% of Total kWh)
for the Public Safety Building



The washrooms in the Public Safety Building contain a total of 5 toilets, 6 sinks, 2 urinals, and 3 showers. In addition, there are 6 water efficient toilets inside the holding cells. There is one 280-Litre electric water heater that 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 makeup for heat losses from the storage tanks.

9.2 ENERGY AND WATER SAVING OPPORTUNITIES

Tables 14 and 15 show a summary of both the energy and water saving opportunities for the Centennial Arena. The following assumptions were made in determining the annual savings:

- The Fire Hall is occupied for 24 hours/day, 7 days/week and the RCMP offices are occupied for 20 hours/day, 7 days/week.
- The temperature of the Public Safety Building including the Fire Hall and RCMP is maintained at 21°C (70°F).
- For the purpose of water consumption, the typical occupancy is taken as 10.
- The exit lamps and the outdoor lights are on 24 hours per day year round.

Table 14 Energy Saving Opportunities for the Public Safety 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 & PARKING LOT CONTROLLERS										
Fire Hall										
When 4' x 2 T12 fluorescent ballasts require replacement, replace them with T8 ballasts and tubes.	30	$41	$21	$0	$1,396	$718	10,221	$614	2.3	1.2
Replace 400W mercury vapor lights with metal halides.	5	$300	$255	$300	$3,390	$3,136	12,230	$734	4.6	4.3
Replace 100W incandescents with compact fluorescents.	6	$15	$10	$13	$190	$156	3,774	$227	0.8	0.7
RCMP										
When 4' x 2 T12 fluorescent ballasts require replacement, replace them with T8 ballasts and tubes.	31	$41	$21	$0	$1,443	$742	8,802	$528	2.7	1.4
When 4' x 4 T12 fluorescent ballasts require replacement, replace them with T8 ballasts and tubes.	16	$32	$12	$0	$585	$224	9,085	$545	1.1	0.4
Replace 100W incandescents with compact fluorescents.	10	$15	$10	$13	$316	$260	5,242	$315	1.0	0.8
Install photocells on outdoor lights.	4	$25	$25	$65	$407	$407	5,256	$316	1.3	1.3
Install parking lot controllers.	1	$100	$75	$150	$283	$254	1,200	$72	3.9	3.5
Lighting & Parking Lot Controllers Subtotal					**$8,010**	**$5,897**	**55,810**	**$3,351**		
ENVELOPE										
Weather-strip pedestrian doors.	7	$15	$15	$50	$514	$514	10,541	$633	0.8	0.8
Caulk pedestrian doors.	7	$5	$5	$25	$237	$237	3,373	$203	1.2	1.2
Caulk vehicle doors.	2	$5	$5	$50	$124	$124	964	$58	2.1	2.1
Envelope Subtotal					**$876**	**$876**	**14,878**	**$893**		
HVAC										
Reduce temperature setting in RCMP garage to 7°C (45°F).	1	$0	$0	$0	$0	$0	6,475	$389	0.0	0.0
Replace unit heaters in fire hall with radiant heaters; reduce temperature setting to 15°C (59°F).	3	$1,100	$1,100	$1,000	$7,119	$7,119	10,369	$623	11.4	11.4
Replace Trane condensing unit in Fire Hall with high efficiency unit.	1	$4,500	$4,500	$1,000	$6,215	$6,215	11,103	$667	9.3	9.3
HVAC Subtotal					**$13,334**	**$13,334**	**27,948**	**$1,678**		

HOT WATER

Description	Qty	Installed Cost/Unit ($)			Total Cost** ($)		Estimated Annual Savings		Simple Payback Years	
		Material (NI*)	Material (WI*)	Labour	NI*	WI*	kWh	$***	NI	WI
Install water efficient metering faucet.	6	$309	$309	$150	$3,112	$3,112	1,990	$120	26.0	26.0
Install water efficient showerheads.	3	$21	$21	$50	$241	$241	7,755	$500	0.5	0.5
Water Subtotal					**$3,353**	**$3,353**	**9,745**	**$620**		

TOTALS	Energy (kWh)	Cost ($)	CO$_2$ (Tonnes)
Existing Annual Consumption/Cost/Emissions	502,740	$26,801	14.98
Estimated Annual Savings	108,381	$6,542	3.23
Percent Savings	22%	24%	22%

* NI = Cost does not include incentive, WI = Cost includes incentive.
** The total cost column includes 13% taxes.
*** The cost assigned to electricity is 0.06004 $/kWh (rate was taken from Manitoba Hydro's website).

Table 15 Water Saving Opportunities for the Public Safety Building

Description	Qty	Installed Cost/Unit ($)		Total Cost* ($)	Annual Water Savings (%)	Annual Water Savings (L)	Annual Cost Savings ($)
		Material	Labour				
Install water efficient dual flush toilets.	5	$284	$150	$2,449	70%	64,453	$64
Install water efficient metering faucets.	6	$309	$150	$3,112	80%	53,115	$53
Install water efficient urinals.	2	$344	$200	$1,229	60%	149,386	$149
Install water efficient showerheads.	3	$21	$21	$142	29%	206,934	$207

* The total cost column includes 13% taxes.

9.3 GENERAL RECOMMENDATIONS

Lighting & Parking Lot Controllers

The lighting analysis summary for the Public Safety Building is shown in Appendix B, Table B.8.3. The T12 fluorescents in both the Fire Hall and the RCMP offices should be replaced with energy efficient T8 lamps and ballasts. This upgrade should be done when the T12 ballasts burn out. Another energy saving opportunity for both the Fire Hall and the RCMP offices is to replace the 100W incandescent bulbs with compact fluorescents. For the same light output, a compact fluorescent consumes 70% less energy than an incandescent.

The mercury vapor lights in the Fire Hall consume 400 Watts each. It is recommended that these lights be replaced with metal halides. Since metal halides have a higher light output than mercury vapors, the 8 lights could be replaced with only 5, 360W metal halides.

Four of the outdoor lights are left on throughout the day. Photocells should be installed on these lights such that they automatically shut off during the daytime.

Consideration should also be given to installing a parking lot controller on the car plug. This would save energy by automatically adjusting the power at the car plug depending on the outdoor temperature.

Envelope

The pedestrian doors to the Public Safety Building have poor weather-stripping and caulking. These doors should be sealed with new weather-stripping and caulking to reduce the cold air infiltration throughout the winter. Similarly, two of the vehicle doors to the RCMP garage require new caulking.

HVAC

There is a large potential for energy savings with decreasing the temperature settings in both the Fire Hall and the RCMP garage. It is recommended that the temperature in the RCMP garage be reduced to 7°C (45°F) throughout the winter. The recommendation for the fire hall is to replace the electric unit heaters with radiant heaters. This would allow the air temperature to be kept cooler while still maintaining everything in the room at the same temperature.

The condenser for the fire hall is old and inefficient. Replacing this unit with a higher efficiency unit would save approximately 20% of the current electricity consumed by this unit.

Water

Replacing the sink faucets and showerheads with water efficient fixtures would save in both water and energy used for hot water. Table 15 shows the annual water savings that would result from replacing the current high flow fixtures with water efficient fixtures. More detailed calculations can be found in Table B.8.5 in Appendix B.

10.0 CITY HALL

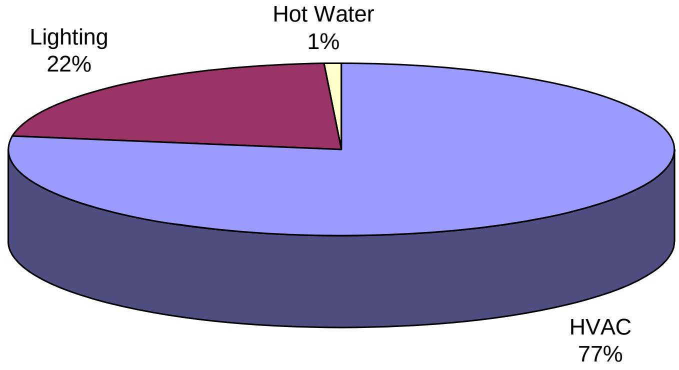
10.1 BACKGROUND

City Hall was constructed in 1983 of brick exterior walls with R30 insulation and drywall interior walls. The roof of this building is well insulated with 9” of styrofoam. This 11,300 square foot building consists of offices and a council chamber. These offices are occupied Monday to Friday, from 8:30am to 5:00pm.

Photo 10 – City Hall

Electricity is used exclusively for lighting, HVAC, and hot water. The total electricity consumed from October 2004 to October 2005 was 268,320kWh. The pie chart below shows the portions of the total energy consumption used for lighting, water heating, and HVAC.

Energy Breakdown (% of Total kWh)
for City Hall



The washrooms in City Hall contain a total of 6 toilets, 8 sinks, and 2 urinals. An 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 makeup for heat losses from the storage tank.

10.2 ENERGY AND WATER SAVING OPPORTUNITIES

Tables 16 and 17 show a summary of energy and water saving opportunities for City Hall. The following assumptions were made in the analysis:

- City Hall is occupied Monday-Friday from 8:30am – 5:00pm and for 4 extra hours twice a month.
- The temperature of City Hall is maintained at 21°C (70°F) year round.
- For the purpose of water consumption, the average occupancy is 20.
- The exit lamps are on 24 hours per day year round and the outdoor lights are on 12 hours per day year round.

Table 16 Energy Saving Opportunities for City Hall

Description	Qty	Installed Cost/Unit ($)			Total Cost** ($)		Estimated Annual Savings		Simple Payback Years	
		Material (NI*)	Material (WI*)	Labour	NI*	WI*	kWh	$***	NI	WI
LIGHTING & PARKING LOT CONTROLLERS										
When 4' x 1 T12 fluorescent ballasts require replacement, replace them with T8 ballasts and tubes.	227	$26	$16	$0	$6,579	$4,014	10,243	$615	10.7	6.5
When 4' x 4 T12 fluorescent ballasts require replacement, replace them with T8 ballasts and tubes.	49	$32	$12	$0	$1,793	$685	8,844	$531	3.4	1.3
Replace 100W incandescents with compact fluorescents.	14	$15	$10	$13	$443	$364	2,333	$140	3.2	2.6
Install parking lot controllers.	7	$100	$75	$150	$1,978	$1,780	3,360	$202	9.8	8.8
Lighting & Parking Lot Controllers Subtotal					**$10,793**	**$6,843**	**24,780**	**$1,488**		
ENVELOPE										
Caulk pedestrian doors.	6	$5	$5	$25	$203	$203	2,891	$174	1.2	1.2
Caulk windows.	8	$5	$5	$25	$271	$271	5,783	$347	0.8	0.8
Envelope Subtotal					**$475**	**$475**	**8,674**	**$521**		
HVAC										
Install CO_2 control on Carrier RTU.	1	$500	$500	$200	$791	$791	6,876	$413	1.9	1.9
Install CO_2 control on York RTU.	1	$500	$500	$200	$791	$791	4,126	$248	3.2	3.2
Install programmable thermostats; setback temperature to 15°C (59°F).	2	$300	$300	$300	$1,356	$1,356	18,512	$1,111	1.2	1.2
HVAC Subtotal					**$2,938**	**$2,938**	**29,514**	**$1,772**		

TOTALS	Energy (kWh)	Cost ($)	CO_2 (Tonnes)
Existing Annual Consumption/Cost/Emissions	268,320	$15,711	8.00
Estimated Annual Savings	62,968	$3,781	1.88
Percent Savings	23%	24%	24%

* NI = Cost does not include incentive, WI = Cost includes incentive.
** The total cost column includes 13% taxes.
*** The cost assigned to electricity is 0.06004 $/kWh (rate was taken from Manitoba Hydro's website).

Table 17 Water Saving Opportunities for City Hall

Description	Qty	Installed Cost/Unit ($)		Total Cost* ($)	Annual Water Savings (%)	Annual Water Savings (L)	Annual Cost Savings ($)
		Material	Labour				
Install water efficient dual flush toilets.	6	$284	$150	$2,939	70%	107,312	$107
Install water efficient metering faucets.	8	$309	$150	$4,149	80%	25,917	$26
Install water efficient urinals.	2	$344	$200	$1,229	60%	49,462	$49

* The total cost column includes 13% taxes.

10.3 GENERAL RECOMMENDATIONS

Lighting & Parking Lot Controllers

The lighting analysis summary table is shown in Appendix B as Table B.9.3. For the indoor lighting, it is recommended that when the T12 ballasts burn out, they be replaced with T8 ballasts and tubes. T8s are much more efficient than T12s and the T12s are expected to be obsolete by the year 2010. The interior incandescents should also be replaced with energy efficient compact fluorescents when they burn out.

Another energy saving opportunity is to install parking lot controllers on the parking lot plugs. This would save approximately 50% of the current electricity consumed to heat cars' block heaters throughout the winter.

Envelope

The walls and roof of this building are very well insulated, the windows are triple pane and the weather-stripping around the doors is in good condition. Therefore, the only recommendations for this building's envelope are to caulk around the window and doorframes. This will reduce the cold air infiltrating through the cracks around the frames throughout the winter.

HVAC

To save energy in heating, programmable thermostats should be installed to control the two rooftop units. The thermostats should be setback to 15°C (59°F) when the building is not used.

Another opportunity is to install CO_2 sensors to control the quantity of ventilation air supplied to the building. Each of the two rooftop units will require it's own CO_2 sensor, which will control the outdoor air intake damper to the units. This will save energy by reducing the amount of ventilation air to the building and thus save in energy required to heat this ventilation air.

Water

The water analysis summary is shown in Table B.9.5 in Appendix B. Replacing the high flow fixtures with water efficient fixtures would save between 60 and 80% of their current water consumption.

11.0 SEWAGE TREATMENT PLANT

11.1 BACKGROUND

There are three buildings that make up the Sewage Treatment Plant: Headworks; SBR Building; and Decanter Buildings 1 and 2. All three of these buildings were constructed in 2005 and are in excellent condition. Photos 11 and 12 show pictures of the Headworks Building and the SBR Building, respectively. Headworks is approximately 4,800 square feet and the SBR Building is approximately 3,670 square feet. More details on the Sewage Treatment Plant can be found in Section 19.

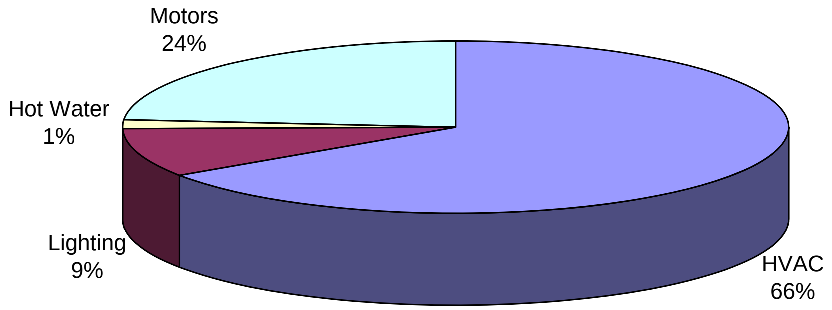
Photo 11 – Sewage Treatment Plant – Headworks

Photo 12 – Sewage Treatment Plant – SBR Building

The Decanter Building, shown in Photo 13, is a small 560 square foot building that contains two decanters that are responsible for separating the sludge from the wastewater.

Photo 13 – Sewage Treatment Plant – Decanter Building

**Energy Breakdown (% of Total kWh)
for the Sewage Treatment Plant**



The washroom in the Sewage Treatment Plant contains 1 toilet, 1 sink, and 1 shower. There is a 450-Litre hot water tank in the SBR Building, an electric water heater in Headworks, and instantaneous water heaters for the chemical feed system in the SBR Building. The energy used for hot water heating was calculated based on estimates of the current hot water consumption and includes the energy required to makeup for heat losses from the storage tanks.

11.2 ENERGY AND WATER SAVING OPPORTUNITIES

Tables 18 and 19 show summaries of the energy and water saving opportunities for the Sewage Treatment Plant. The following assumptions were made in the analysis:

- The Sewage Treatment Plant is occupied for 70 hours per week.
- For the purpose of water consumption, the average occupancy is 2.

Table 18 Energy Saving Opportunities for the Sewage Treatment Plant

Description	Qty	Installed Cost/Unit ($)			Total Cost** ($)		Estimated Annual Savings		Simple Payback Years	
		Material (NI*)	Material (WI*)	Labour	NI*	WI*	kWh	$***	NI*	WI*
HVAC										
Install programmable thermostats to control boiler pump and furnace in SBR Building; setback temperature to 15°C (59°F).	2	$300	$300	$300	$1,356	$1,356	25,898	$1,813	0.7	0.7
HVAC Subtotal					**$1,356**	**$1,356**	**25,898**	**$1,813**		
HOT WATER										
Replace hot water tank in SBR Building with instantaneous water heater.	1	$300	$300	$500	$904	$904	3,638	$218	4.1	4.1
Hot Water Subtotal					**$904**	**$904**	**3,638**	**$218**		

TOTALS	**Energy (kWh)**	**Cost ($)**	**CO_2 (Tonnes)**
Existing Annual Consumption/Cost/Emissions	517,055	$34,679	76.43
Estimated Annual Savings	29,536	$2,031	5.96
Percent Savings	6%	6%	8%

* NI = Cost does not include incentive, WI = Cost includes incentive.

** The total cost column includes 13% taxes.

*** The cost assigned to electricity is 0.06004 $/kWh (rate was taken from Manitoba Hydro's website) and the cost of propane is 0.07 $/kWh (rate taken from building's propane bills).

**** Discounted to include cost of replacement water tank in 10 years.

Table 19 Water Saving Opportunities for the Sewage Treatment Plant

Description	Qty	Installed Cost/Unit ($)		Total Cost* ($)	Annual Water Savings (%)	Annual Water Savings (L)	Annual Cost Savings ($)
		Material	Labour				
Install water efficient dual flush toilets.	1	$284	$150	$490	70%	21,101	$21
Install water efficient metering faucets.	1	$309	$150	$519	80%	371	$0.37
Install water efficient showerheads.	1	$21	$21	$47	29%	17,245	$17

* The total cost column includes 13% taxes.

11.3 GENERAL RECOMMENDATIONS

Since these buildings were constructed in 2005, their envelopes are in excellent condition and are built to current standards. In addition, the lighting is all energy efficient lighting and the HVAC systems and motors are brand new. Therefore, there are very few recommendations for energy savings.

HVAC

The only recommendation for reducing energy consumed by the building's HVAC system is to install programmable thermostats in the SBR building to control the boiler pump and the furnace. The thermostats should be setup such that the temperature setting is automatically reduced to 15°C (59°F) when the building is unoccupied. Similarly, it is recommended that the temperature setting be manually reduced in the Headworks building during unoccupied times.

Water

Consideration should be given to replacing the 450-Litre hot water tank (used for emergency showers and sink) in the SBR Building with an instantaneous water heater. This would eliminate the energy required to offset the heat losses from this storage tank.

The water analysis summary is shown in Table B.10.5 in Appendix B. Replacing the high flow fixtures with water efficient fixtures would save between 29 and 80% of their current water consumption.

12.0 WATER TREATMENT PLANT

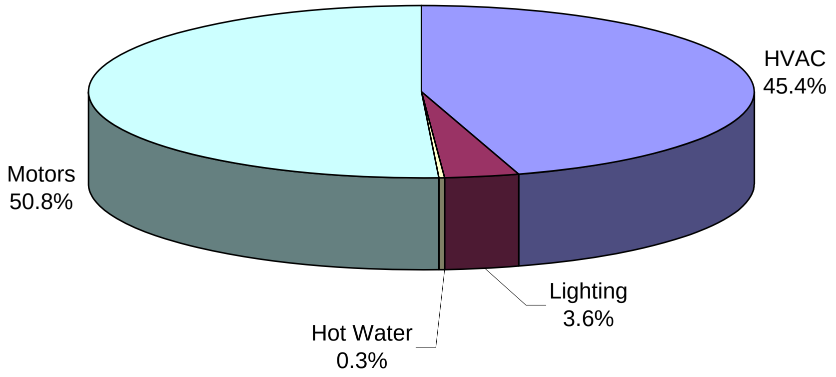
12.1 BACKGROUND

The Water Treatment Plant is a 724 square foot building that was constructed in the early 1950s. The walls of this building have R-30 insulation with exterior aluminum siding and drywall interior walls. The roof is also well insulated with R-40 batt insulation, plywood sheeting and asphalt shingles. The Water Treatment Plant is occupied daily for servicing.

Photo 14 – Water Treatment Plant

The Water Treatment Plant is heated using 3 electric unit heaters. From October 2004 to October 2005, the total electrical energy consumption was 478,440 kWh. This total energy was split between lighting, HVAC, hot water, and pump motors as shown in the pie chart below.

**Energy Breakdown (% of Total kWh)
for the Water Treatment Plant**



12.2 ENERGY AND WATER SAVING OPPORTUNITIES

Table 20 shows a summary of the energy saving opportunities for the Water Treatment Plant. The following assumptions were made in the analysis:

- The lights in the Water Treatment Plant are on for 24 hours/day.
- The temperature of the Water Treatment Plant is maintained at 21°C (70°F).

Table 20 Energy Saving Opportunities for the Water Treatment Plant

Description	Qty	Installed Cost/Unit ($)			Total Cost** ($)		Estimated Annual Savings		Simple Payback Years	
		Material (NI*)	Material (WI*)	Labour	NI*	WI*	kWh	$***	NI*	WI*
ENVELOPE										
Weather-strip pedestrian doors.	2	$15	$15	$50	$147	$147	3,012	$181	0.8	0.8
Envelope Subtotal					**$147**	**$147**	**3,012**	**$181**		
HVAC										
Reduce temperature setting to 15°C (59°F).	1	$0	$0	$0	$0	$0	30,917	$1,856	0.0	0.0
Install manual insulated dampers on air intake and exhaust vents.	4	$500	$500	$500	$4,520	$4,520	35,263	$2,117	2.1	2.1
HVAC Subtotal					**$4,520**	**$4,520**	**$66,179**	**$3,973**		
MOTORS										
When 75HP motors require replacement, replace them with high efficiency motors.	2	$1,850	$1,850	$0	$4,181	$4,181	8,206	$493	8.5	8.5
Motor Subtotal					**$4,181**	**$4,181**	**8,206**	**$493**		

TOTALS	**Energy (kWh)**	**Cost ($)**	**CO_2 (Tonnes)**
Existing Annual Consumption/Cost/Emissions	478,440	$28,147	14.26
Estimated Annual Savings	77,397	$4,647	2.31
Percent Savings	16%	17%	16%

* NI = Cost does not include incentive, WI = Cost includes incentive.
** The total cost column includes 13% taxes.
*** The cost assigned to electricity is 0.06004 $/kWh (rate was taken from Manitoba Hydro's website).

12.3 GENERAL RECOMMENDATIONS

Envelope

There are no windows in this building and the walls and roof are well insulated. The two pedestrian doors to this building however have no weather-stripping to reduce infiltration in the winter. Therefore, the only recommendation for improving this building's envelope is to install weather-stripping on the two pedestrian doors.

HVAC

The Water Treatment Plant is maintained at 21°C (70°F) throughout the winter. An energy saving opportunity for the HVAC system is to reduce the temperature setting to 15°C (59°F). This would drastically reduce the annual heating requirements for this building.

For cooling in the summertime, the Water Treatment Plant has two air intakes and two exhaust towers that allow outdoor air to blow through the building to help reduce the temperature. However, the present dampers on these vents do not completely block the cold air from infiltrating into the building in the winter. It is recommended that insulated, manually operated dampers be installed on both air intakes and exhaust vents to reduce heat loss due to both conduction through the dampers and infiltration between the damper blades.

Motors

The two 75HP motors for the vertical turbine pumps are only standard efficiency units. When the motors break down and require replacement, it is recommended that high efficiency motors be installed. The cost associated with this upgrade represents the cost difference between installing a high versus a standard efficiency motor.

13.0 HEATING PLANTS

13.1 BACKGROUND

There are three heating plants that were audited in this study. The purpose of the heating plants is to prevent the City's water in the distribution system from freezing and to boost pressure in the city water supply system. The heating plants contain water supply pressure booster pumps and boilers for heating re-circulated water for the City of Flin Flon. Booster pumps increase the supply water pressure for certain parts of the water piping system located at high elevations. Much of the water piping is not buried due to the pipe placement on solid rock. The piping is contained inside wooden utilidors to protect the piping from freezing in winter. Piping is insulated inside the utilidors with wood shavings.

Oil-fired steam boilers are provided at Heating Plants #1 and #2 for heating the water loops that are re-circulated. Steam is supplied to heat exchangers for water heating; one heat exchanger for each piping loop. Steam heating for the water loops is manually controlled.

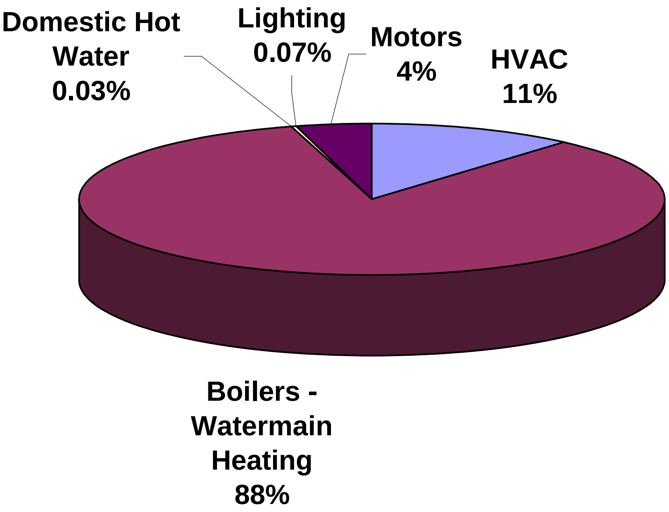
Heating Plant #1

Heating Plant #1 is an 1,800 square foot building that holds two 3000 MBH Cleaver Brooks Model 5 steam boilers. The maximum efficiency of these boilers is estimated at 83%. The steam produced in the boilers is used to heat the City's water through the use of a tube and shell heat exchanger. The building was constructed in the early 1950s of 2" x 6" studs with stucco exterior walls. This heating plant is occupied approximately 3 times every day for servicing.

Photo 15 – Heating Plant #1

The Heating Plant #1 uses electricity for lighting, HVAC and hot water and the two boilers run on oil. The annual oil and electrical energy consumption for the Heating Plant #1 from October 2004 to October 2005 was high at 2,899,030 kWh and 396,100 kWh, respectively. The pie chart below shows the portions of the total energy consumption used for lighting, water heating, HVAC, motors, and for heating the water in the distribution system (boilers). From this chart it can be seen that the boilers account for the majority of the building's annual energy consumption.

Energy Breakdown (% of Total kWh)
for the Heating Plant #1



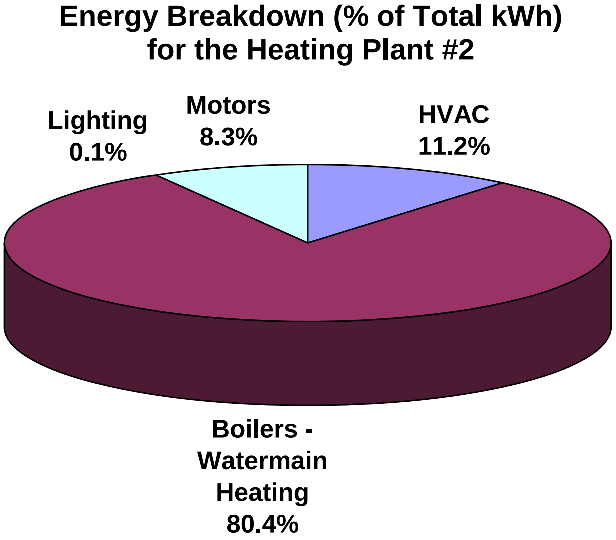
The washroom in the Heating Plant #1 contains 1 toilet and 1 sink. A 114-Litre hot water heater heats the water for this facility. The energy used for hot water heating was calculated based on estimates of the current hot water consumption and includes the energy required to makeup for heat losses from the storage tank.

Heating Plant #2

The Heating Plant #2, constructed in the early 1950s, is a 1,440 square foot building constructed of 2" x 6" studs with stucco exterior walls. There is one 3,000 MBH boiler and one 2,000 MBH boiler in this building to heat the water in the distribution system. The maximum efficiency of these boilers is estimated at 83%. This building is occupied approximately 3 times every day for servicing.

Photo 16 – Heating Plant #2

An electric unit heater is used for heating in this building. Aside from heating, electricity is also used for lighting and to power the pump motors. The total electricity consumed from October 2004 to October 2005 was 549,000 kWh and the oil boilers consumed a total of 2,245,812 kWh. The energy breakdown for this building is shown in the following pie chart.



There are no washrooms in this building and therefore, no hot water consumption.

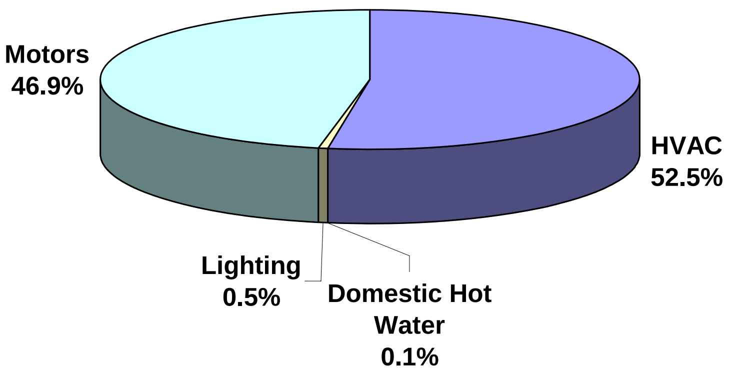
Heating Plant #3

The Heating Plant #3 was constructed in the early 1950s. This 1,575 square foot building was constructed of 2" x 6" studs with stucco exterior walls. Heating Plant #3 does not have a boiler and heat exchanger for heating the water in the distribution system like the other two heating plants. This plant acts as a booster pump station and contains two booster pumps, a sewage lift pump and a storm sewage pump.

Photo 17 – Heating Plant #3

A propane-fired boiler heats this building through the use of a steam unit heater. The annual electrical energy consumption for this heating plant from October 2004 to October 2005 was 170,110 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 Heating Plant #3**



The washroom in the Heating Plant #3 contains 1 toilet and 1 sink. A 19-Litre 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 makeup for heat losses from the storage tank.

13.2 ENERGY AND WATER SAVING OPPORTUNITIES

Heating Plant #1

Tables 21 to 25 show summaries of the energy and water saving opportunities for Heating Plants #1, #2 and #3. The following assumptions were made in the analysis:

- The heating plants are occupied for an average of 2 hours every day.
- The temperature of the heating plants is maintained at 21°C (70°F).
- For the purpose of water consumption, the typical occupancy of the heating plants is 1.
- The exterior lights are assumed to be on for 12 hours every night.

Table 21 Energy Saving Opportunities for the Heating Plant #1

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 fluorescent ballasts burn out, replace them with T8 ballasts and tubes.	10	$41	$21	$0	$465	$239	285	$17	27.2	14.0
When 8' x 2 T12 fluorescent ballasts burn out, replace them with T8 ballasts and tubes.	2	$47	$12	$0	$107	$28	180	$11	9.9	2.6
Replace 200W interior incandescents with compact fluorescents.	1	$20	$15	$13	$37	$32	106	$6	5.9	5.0
Lighting Subtotal					**$610**	**$299**	**570**	**$34**		
ENVELOPE										
Upgrade wall insulation to R-20.	1	$6,780	$5,255	$6,780	$15,323	$13,600	12,482	$749	20.4	18.1
Upgrade roof insulation to R-40.	1	$3,375	$1,795	$1,125	$5,085	$3,300	8,573	$515	9.9	6.4
Replace pedestrian door.	1	$350	$350	$100	$509	$509	816	$49	10.4	10.4
Replace double loading door.	1	$700	$700	$200	$1,017	$1,017	1,088	$65	15.6	15.6
Weather-strip pedestrian door.	1	$15	$15	$50	$73	$73	1,506	$90	0.8	0.8
Weather-strip double loading door.	1	$30	$30	$100	$147	$147	1,656	$99	1.5	1.5
Fill gap in wall at truck fill line.	1	$50	$50	$50	$113	$113	2,204	$132	0.9	0.9
Envelope Subtotal					**$22,267**	**$18,758**	**28,325**	**$1,701**		
HVAC										
Reduce temperature setting to 15°C (59°F).	1	$0	$0	$0	$0	$0	55,865	$3,354	0.0	0.0
Install motorized damper on exhaust opening.	1	$300	$300	$300	$678	$678	4,408	$265	2.6	2.6
HVAC Subtotal					**$678**	**$678**	**60,273**	**$3,619**		
HOT WATER										
Install instantaneous water heater.****	1	$300	$300	$500	$904	$904	910	$55	16.6	16.6
Hot Water Subtotal					**$904**	**$904**	**910**	**$55**		
OTHER										
Insulate utilidors in water distribution system.	1	$15,000	$15,000	$15,000	$33,900	$33,900	532,860	$30,000	1.1	1.1
Automated control of water re-circulation heating system.	1	$17,500	$17,500	$17,500	$39,550	$39,550	532,860	$30,000	1.3	1.3
Other Subtotal					**$73,450**	**$73,450**	**1,065,719**	**$60,000**		

TOTALS	**Energy (kWh)**	**Cost ($)**	**CO_2 (Tonnes)**
Existing Annual Consumption/Cost/Emissions	3,295,130	$183,425	795.91
Estimated Annual Savings	1,155,797	$65,408	290.82
Percent Savings	35%	36%	36%

* NI = Cost does not include incentive, WI = Cost includes incentive.

** The total cost column includes 13% taxes.

*** The cost assigned to electricity is 0.06004 $/kWh (rate was taken from Manitoba Hydro's website) and the cost of oil is 0.056 $/kWh (from building's oil bills).

**** Discounted to include cost of replacement water tank in 10 years.

Table 22 Water Saving Opportunities for the Heating Plant #1

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	$519	80%	467	$0.47
Install water efficient dual flush toilets.	1	$284	$150	$490	70%	3,384	$3

* The total cost column includes 13% taxes.

Table 23 Energy Saving Opportunities for the Heating Plant #2

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 fluorescent ballasts burn out, replace them with T8 ballasts and tubes.	4	$41	$21	$0	$186	$96	114	$7	27.2	14.0
When 8' x 2 T12 fluorescent ballasts burn out, replace them with T8 ballasts and tubes.	6	$47	$12	$0	$321	$83	543	$33	9.8	2.6
Lighting Subtotal					**$507**	**$181**	**657**	**$39**		
ENVELOPE										
Upgrade wall insulation to R-20.	1	$6,084	$4,725	$6,084	$13,750	$12,214	11,201	$673	20.4	18.2
When replacing roof, upgrade roof insulation to R-40.	1	$2,700	$1,433	$900	$4,068	$2,636	6,858	$412	9.9	6.4
Replace pedestrian door.	1	$350	$350	$100	$509	$509	816	$49	10.4	10.4
Replace double loading doors.	1	$700	$700	$200	$1,017	$1,017	1,088	$65	15.6	15.6
Weather-strip pedestrian door.	1	$15	$15	$50	$73	$73	1,506	$90	0.8	0.8

Description	**Qty**	**Installed Cost/Unit ($)**			**Total Cost** ($)**		**Estimated Annual Savings**		**Simple Payback Years**	
		Material (NI*)	**Material (WI*)**	**Labour**	**NI***	**WI***	**kWh**	**$*****	**NI***	**WI***
Weather-strip double loading door.	1	$30	$30	$100	$147	$147	1,656	$99	1.5	1.5
Envelope Subtotal					**$19,564**	**$16,596**	**23,125**	**$1,388**		
HVAC										
Setback temperature to 15°C (59°F).	1	$0	$0	$0	$0	$0	44,631	$2,680	0.0	0.0
HVAC Subtotal					**$0**	**$0**	**44,631**	**$2,680**		
OTHER										
Insulate utilidors in water distribution system.	1	$15,000	$15,000	$15,000	$33,900	$33,900	532,860	$30,000	1.1	1.1
Automated control of water re-circulation heating system.	1	$17,500	$17,500	$17,500	$39,550	$39,550	532,860	$30,000	1.3	1.3
Other Subtotal					**$73,450**	**$73,450**	**1,065,719**	**$60,000**		

TOTALS	**Energy (kWh)**	**Cost ($)**	**CO_2 (Tonnes)**
Existing Annual Consumption/Cost/Emissions	2,794,812	$155,286	623.76
Estimated Annual Savings	1,134,132	$64,107	290.24
Percent Savings	41%	41%	47%

* NI = Cost does not include incentive, WI = Cost includes incentive.

** The total cost column includes 13% taxes.

*** The cost assigned to electricity is 0.06004 $/kWh (rate was taken from Manitoba Hydro's website) and the cost of oil is 0.056 $/kWh (from building's oil bills).

Table 24 Energy Saving Opportunities for the Heating Plant #3

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 fluorescent ballasts burn out, replace them with T8 ballasts and tubes.	7	$41	$21	$0	$326	$168	199	$12	27.2	14.0
When 8' x 2 T12 fluorescent ballasts burn out, replace them with T8 ballasts and tubes.	2	$47	$12	$0	$107	$28	181	$11	9.8	2.6
Lighting Subtotal					**$433**	**$196**	**380**	**$23**		
ENVELOPE										
Upgrade wall insulation to R-20.	1	$6,912	$5,368	$6,912	$15,621	$13,877	15,907	$955	16.4	14.5
When replacing roof, upgrade roof insulation to R-40.	1	$2,953	$1,567	$984	$4,449	$2,883	9,377	$563	7.9	5.1

Description	Qty	Installed Cost/Unit ($)			Total Cost** ($)		Estimated Annual Savings		Simple Payback Years	
		Material (NI*)	Material (WI*)	Labour	NI*	WI*	kWh	$***	NI*	WI*
Replace double loading doors.	1	$700	$700	$200	$1,017	$1,017	1,359	$82	12.5	12.5
Replace pedestrian door.	1	$350	$350	$100	$509	$509	1,020	$61	8.3	8.3
Weather-strip pedestrian doors.	1	$15	$15	$50	$73	$73	1,882	$113	0.6	0.6
Weather-strip double loading doors.	1	$30	$30	$100	$147	$147	2,071	$124	1.2	1.2
Replace windows with triple pane windows.	3	$500	$460	$150	$2,204	$2,068	1,561	$94	23.5	22.1
Envelope Subtotal					**$24,020**	**$20,574**	**33,177**	**$1,992**		
HVAC										
Setback temperature to 15°C (59°F).	1	$0	$0	$0	$0	$0	12,710	$890	0.0	0.0
HVAC Subtotal					**$0**	**$0**	**12,710**	**$890**		

TOTALS	Energy (kWh)	Cost ($)	CO$_2$ (Tonnes)
Existing Annual Consumption/Cost/Emissions	170,110	$10,927	5.07
Estimated Annual Savings	46,267	$2,904	1.38
Percent Savings	27%	27%	27%

* NI = Cost does not include incentive, WI = Cost includes incentive.
** The total cost column includes 13% taxes.
*** The cost assigned to electricity is 0.06004 $/kWh (rate was taken from Manitoba Hydro's website).

Table 25 Water Saving Opportunities for the Heating Plant #3

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	$519	80%	467	$0.47
Install water efficient dual flush toilets.	1	$284	$150	$490	70%	846	$0.85

* The total cost column includes 13% taxes.

13.3 GENERAL RECOMMENDATIONS

Lighting

There is very little potential for energy savings with the lighting in these three buildings since the lights are on for so few hours every day. The opportunities for these buildings include replacing the T12 fluorescent lights and ballasts with T8s when the T12 ballasts burn out and replacing the interior incandescent with a compact fluorescent. The lighting analysis summary tables for Heating Plants #1, #2 and #3 are shown in Appendix B as Tables B.12.3, B.13.3 and B.14.3, respectively.

Envelope for Heating Plant #1

The walls and roof of Heating Plant #1 have 2" and 3" of rock wool batt insulation, respectively. The energy savings and payback periods for upgrading the insulation to R-20 in the walls and R-40 in the roof are shown in Table 21 above. For the roof, it is recommended that the insulation upgrade be done when the roof is replaced. At the time of the inspection there was a hole in the ceiling where the exhaust fan used to be and there was a gap in the wall at the truck fill line. It is recommended that these be repaired to reduce infiltration through this building's envelope.

Although the window in this building is only dual pane, the payback period for replacing it with a triple pane window is too long to make this upgrade worthwhile. The best opportunities for energy savings with this building's envelope are to weather-strip the pedestrian and double loading doors. This costs very little to do and will reduce infiltration around the doors throughout the winter. Replacing these doors would also reduce heat losses; however, the payback period for this upgrade is long due to the higher installation cost.

Envelope for Heating Plant #2

Upgrading the wall and roof insulation in Heating Plant #2 to R-20 and R-40, respectively, would reduce the heat loss through the building's envelope in the wintertime and thus save in heating requirements. The cost assigned to upgrading the roof insulation assumes that this upgrade will be done when the roof is being replaced.

Other energy saving opportunities for the envelope of this building are to replace and install weather-stripping on the pedestrian and vehicle doors. Replacing the doors with insulated doors will reduce the heat losses through these doors in the winter and weather-stripping will eliminate the cold air infiltration around these doors. Both these opportunities will save in annual heating costs.

Envelope for Heating Plant #3

The walls of this building are insulated with 2" of rock wool batt insulation and the roof is insulated with 3" of insulation. Energy savings and payback periods for upgrading the insulation in the walls and roof to R-20 and R-40, respectively, are shown in Table 24. The payback period for upgrading the roof insulation is much shorter since the cost for this recommendation does not include the cost to remove and replace the roof.

The pedestrian and double loading doors to this building have no insulation or weather-stripping. Consideration should be given to replacing these doors with insulated doors and installing weather-stripping to reduce the infiltration around these doors.

The last recommendation for this building's envelope is to replace the double pane windows with triple pane windows. The payback period for this upgrade is long due to the high installation cost.

HVAC

An excellent opportunity for the heating plants is to reduce the temperature setting to 15°C (59°F). There is no cost associated with this opportunity and the energy savings are very high. The only other opportunities for the HVAC systems in the heating plants is to install a motorized damper on the exhaust opening of Heating Plant #1. Installing a motorized damper would reduce the infiltration through the opening and save in energy used for heating in the winter.

Water

Replacing the hot water tank in Heating Plant #1 with an instantaneous water heater would eliminate the energy required to make-up for storage losses from the tank. In addition, an instantaneous water heater has a much longer life and would save in the cost of a replacement hot water tank every 10 years.

The water analysis summary for Heating Plants #1 and #3 are shown in Tables B.12.5 and B.14.5, respectively. Replacing the high flow fixtures with water efficient fixtures would save between 70 and 80% of their current water consumption.

Other

The heating plants are by far the largest consumers of energy in the buildings that were toured. The buildings are over 40 years old with low levels of insulation making the buildings themselves inefficient. However, the largest heating load is for the water loops that consume 95% of the energy consumed in the buildings.

Unfortunately, the heating plants were not included in the original scope of work for this study. They were added to the study during the site visits at the time of the tour. As such, there was insufficient time allowed to complete a detailed assessment of these facilities. Never the less, the following summarises energy saving opportunities for these buildings over and above that indicated in the tables.

Water Re-circulation Heating System

Since this system is the largest energy consumer in the City, it is important that it is operated at peak efficiency at all times. Water treatment should be provided for the boilers regularly to ensure that heat transfer surfaces do not become fouled. Boilers should be maintained regularly according to manufacturer's recommendations to provide peak operating efficiency.

Boiler steam is supplied to heat exchangers that heat water re-circulated in the water mains to keep them from freezing. Typically, this system heats the water from 35°F to 38°F, a temperature rise of 3°F. A lower heating demand exists in the spring and the fall when the outdoor temperatures are not so cold. Heating demand increases in the winter as outdoor temperatures drop.

The heat supplied to the water system is manually controlled by the operator by adjusting a valve, one on each water loop, only when he visits the building. This practice is very inefficient and often results in overheating the water loop. This occurs often since the operator provides limited supervision of the water heating system. We recommend that this system be automated to provide improved control for the heating system in response to demand. If automation of the heating system reduces the temperature difference from 6°F to 3°F, a 50% energy saving will be realized during these periods when the loop is overheated.

The proposed automated system would include modulating steam control valves, one for each heat exchanger, temperature sensors in each water supply loop and a control system.

A 1 or 2°F improvement in the heating control for this system may seem insignificant but can result in large energy cost savings. Energy savings provided by this control system are difficult to calculate but could easily be in the order of $30,000 per year or higher.

Water Distribution System

Many of the water mains in town are run above grade inside wooden box enclosures. The piping inside the enclosures is insulated with wood shavings. Based on discussions with the operator, insulation on some of the lines has become deteriorated over time. Insulation is damaged in some areas and the piping is exposed in other areas. This is a source of high heat loss and wasteful from an energy consumption perspective. We recommend that a program be established to inspect and repair pipe insulation wherever piping is exposed and has easy access. Energy savings again are difficult to quantify but could be in the 25 to 50% range.

14.0 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 13.1 to 13.5) and maintenance activities (Section 13.6) that will result in energy / water savings for all the buildings.

14.1 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.

14.2 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.

14.3 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.

14.4 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.

14.5 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.

14.6 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 equipment.

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 ice plant and refrigerant piping for leaks
- Inspect and lubricate brine pumps
- Inspect and lubricate motorized and back draft dampers
- Inspect A/C operation and adjust as required

15.0 IMPLEMENTATION OF ENERGY AND WATER SAVING OPPORTUNITIES

15.1 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 maintenance personnel. 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 involves 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 and motorized dampers.

Electricians should be hired to replace motors with high-efficiency motors.

For the water saving opportunities involving installing water efficient 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 energy saving opportunities for the City of Flin Flon that require a consultant to implement are the conversion from oil to electric boilers in the Community Centre and the installation of a sewage to water heater exchanger to reclaim heat from the City's wastewater collection system.

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

15.2 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 Municipality Trading Company of Manitoba Limited. Details of this can be found in Appendix G of this report.

15.3 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 Flin Flon

The City of Flin Flon has several plans for new facilities in the future. The knowledge gained from this efficiency study will therefore be useful in future development projects. The following projects are expected to occur in Flin Flon in the near future:

- The construction of a new Public Safety Building to replace the existing building
- Reconstruction of two of the heating plants.

The saving opportunities discussed throughout this report can be implemented into these new projects, resulting in energy and water efficient buildings.

The Chief Administrative Officer of Flin Flon expressed a great deal of interest in this study and in implementing some of the more cost-effective measures in the coming year. The City has already shown its interest in building environmentally friendly infrastructure. This was evident in the upgrades made to the Sewage Treatment Plant and the installation of heat recovery ventilator and T8 lighting in the Whitney Forum.

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.

16.0 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 each 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 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 Flin Flon on the following website:

http://www.climate.weatheroffice.ec.gc.ca/climateData/dailydata_e.html?timeframe=2&Prov=CA&StationID=3857&Year=2006&Month=1&Day=7

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.

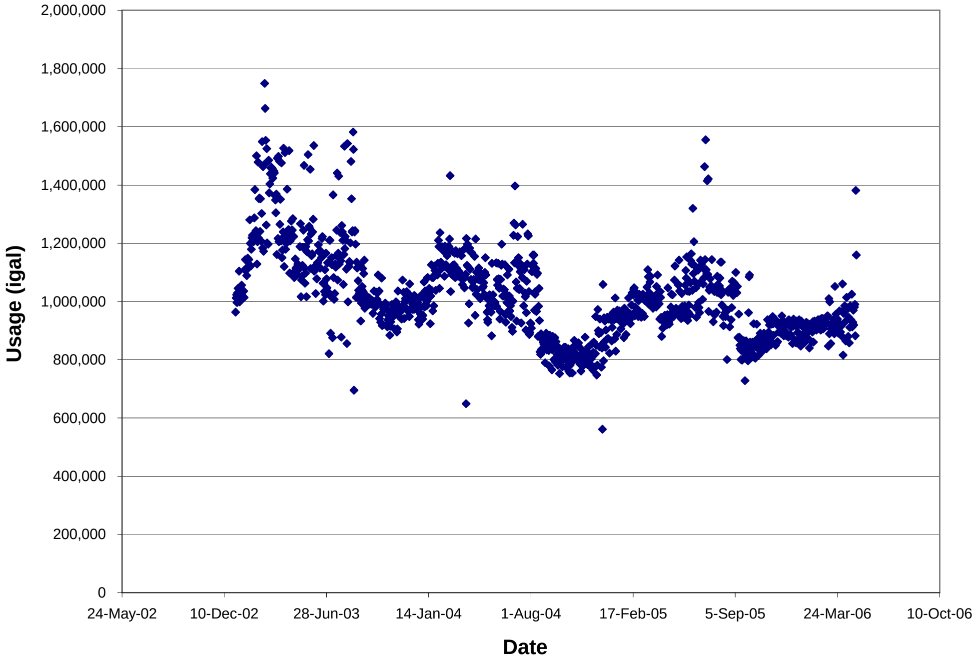
17.0 WATER DISTRIBUTION AND WASTEWATER COLLECTION SYSTEM AUDITS

17.1 WATER DISTRIBUTION SYSTEM OVERVIEW

Water from Cliff Lake is pumped to the Cliff Lake Pump House, from where the water is disinfected via chlorination and supplied to the City of Flin Flon. After the water has been treated, it is stored in a reservoir with a capacity of 3,865 m^3 (850,000 igal). There are two 75 horsepower vertical turbine pumps located in the Cliff Lake Pump House that pump water into the distribution system. One pump is coupled to a six-cylinder diesel engine, which can be used in the event of a power outage.

Based on information provided, the average amount of water produced at the water treatment plant is approximately 3,600 m^3 (800,000 igal) per day with a maximum daily flow of approximately 5,450 m^3 (1,200,000 igal) during the summer months. From the information received, it appears that the average water pumped was 4,410 m^3/day (970,000 igal/day) in 2005 while the maximum was 7,070 m^3/day (1,555,400 igal/day). In 2004, it appears that the average water pumped in a day was 4,460 m^3 (981,000 igal) while the maximum was 6,510 m^3 (1,432,000 igal).

Figure 1 Water Usage



Insufficient data was available to determine the length of the distribution system, or the types of piping.

No information was available to determine whether there is a program in place for replacing old distribution piping. It is believed that the distribution system is repaired and replaced as breaks occur.

Insufficient information was available to accurately determine the water usage throughout the system. However, based on typical usage numbers 450 lpcd (100 igpcd) and a population of 6,000 (Stats Canada), it is estimated that the average household water usage in the City of Flin Flon is 2,730 m^3 (600,000 igal) per day.

Table 26 Unaccounted-For Water Loss Cost

Year	Annual Water Production	Calculated Demand	Bleeders (estimate)	Un-accounted For Water	Percent Unaccounted For
2004	358,124,836	219,000,000	37,000,000	102,124,836	29%
2005	354,094,400	219,000,000	37,000,000	98,094,400	28%

Note: All values in imperial gallons

The water rates in the City of Flin Flon are published as being $94.48 quarterly for residential properties and $4.55/1000 gallons for commercial residents. Based on unaccounted for water equaling 28% of the water produced, the City could have recovered approximately an additional $446,000 of revenue in 2005 if this unaccounted for water was sold at quoted commercial rates ($4.55/1000 gallons). Please note that production costs were not available to be used to estimate the value of the unaccounted for water. However, this lost revenue amount is not completely accurate, since the homeowner consumption is estimated on theoretical numbers and other authorized uses of water are ignored, such as water main flushing, actual bleeder usage, and fire department practice. In addition, as mentioned earlier, it is uncertain whether the meter readings provided are for raw water or treated water and whether these readings include recirculation water. However, this gives an indication of the very real cost to the municipality for unaccounted for water.

It should be noted that very little information was available to complete the Water Distribution System audit.

Water Meters

Age can have a significant impact on the accuracy of water meters. According to data published in the American Water and Wastewater Association journal, meters with plastic components that are 15 years old have an accepted accuracy of 95.12%. If the meters were constructed of all-brass components, the accuracy would be 99.0%. In the event that some service connections are un-metered, it should be noted that some studies have shown that installing water meters can reduce consumption by up to 20%.

Maintenance Programs

No information was supplied regarding scheduled maintenance programs.

17.2 WATER DISTRIBUTION SYSTEM AUDIT RESULTS

In general, community water rates should be set at a level that covers the cost of supplying water to clients, including treating the water, distributing the water, maintaining the treatment and distribution systems, and replacing key pumping and process equipment. Reducing the amount of water lost can have an impact on the overall cost of water treatment.

By reducing water loss, the City will realize savings through reduced chemical costs related to treating the water, and reduced electrical costs associated with a reduction in the amount of pumping required to supply the water. The overall life of the facility and major process components can be extended, reducing the replacement frequency and equipment maintenance requirements.

A program for checking meter accuracy can also increase revenues for the City by ensuring that customers are being billed for the actual amount of water they use. This program will not actually change the amount of water a client uses, it simply allows the City to bill for the correct amount and recover production costs that would otherwise be attributed to unaccounted losses. Although it is believed that the City repairs leaks in the distribution system as they are detected, a program of regular scheduled leak detection can help prevent water loss from occurring in the future.

All the water produced is either consumed or lost. The water that is consumed falls into one of two categories: billed authorized consumption or unbilled authorized consumption. Billed authorized consumption includes metered uses, such as metered service connections, and un-metered water uses, such as bulk sales. Unbilled authorized water usage includes activities such as water main flushing and fire department practice. Water that is lost can be attributed to either real or apparent losses. Apparent losses are items such as unauthorized consumption and meter inaccuracies while real losses include leakage in the mains, at storage reservoirs or on service connections prior to the meter. In order to complete a water audit each of these areas must be examined in detail so that appropriate remedial actions can be planned.

Further to the categories above, water usage can be split into accounted for and unaccounted for categories. Accounted for water includes water from any of the previously discussed categories, such as authorized consumption or water losses, that can be quantified. Unaccounted for water is essentially water where it cannot be determined what it's usage was. In this particular instance, insufficient information was available to definitively account for any of the water usage, however typically much of the unaccounted for water is related to losses in the system.

17.2.1 Unaccounted-For Water Loss

Based on theoretical calculations, it appears that the City has an unaccounted-for water loss of approximately 28% for the year 2005.

There are several factors that could account for this water loss:

Leakage

All distribution systems experience a certain amount of leakage. According to Environment Canada, municipalities that have an unaccounted-for water loss exceeding 10 to 15 percent find that a leak detection program is cost-effective. Environment Canada reports that some studies have shown that for every $1.00 spent in communities with leak detection programs, up to $3.00 can be saved. Since Flin Flon appears to be well above the 10 to 15 percent range, it is recommended that the City develop a leak detection program for use in the near future.

At the present time, since the City is not completely aware of the amount of water lost from the system, it would be very difficult to develop a comprehensive leakage prevention program.

Bleeders

According to supplied information, bleeders are used throughout the system during the winter in an effort to prevent water mains from freezing. The number and type of bleeders is unknown therefore estimation of the quantities becomes very difficult. In addition, it is possible that a number of service connections utilize bleeders to prevent service lines from freezing. However, based on typical numbers, it is expected that at least 169,111 m^3 (37,200,000 igal) or 2.4% of the total water is used during the winter to prevent freezing. If bleeders were to be operated from December 15th until March 1st of each year, this would equate to 2,225 m^3/day (489,500 igpd).

Meter Accuracy

As previously mentioned, it is important to check not only client water meters, but the water meters at the treatment plant as well. If the production water meter is inaccurate, the City will not have reliable data on the amount of water it is treating. This may lead to problems when trying to assess the amount of unaccounted-for water leaving the system, since more water will be leaving the system than is actually recorded.

Ensuring the client meters are accurate will increase revenues for the City since clients will be paying for the actual amount of water used. Accurate client meters will also allow the City to better assess the amount of unaccounted-for water leaving the system, since water that would be unaccounted-for if the meters were inaccurate would actually be included in water consumption data.

Authorized Un-Metered Water Usage

Authorized un-metered water usage is water used for authorized purposes but not accounted for. This includes activities such as fire department training and practice, un-metered pool filling and rink flooding, street sweeping and other like activities. Activities such as this should be recorded and the amount of water used estimated.

Other

Other sources of unaccounted-for water loss can be due to unauthorized consumption. Meter bypasses, and non-permitted use of hydrants and abandoned service connections can all contribute to unauthorized consumption. If this type of water usage is occurring, it can be very difficult to identify.

17.2.2 Maintenance Program

It is suggested that the City develop a program for testing the accuracy of client water meters. One cost-effective method would be to hire a summer student that would test the accuracy of the meters.

The City should inspect the main water treatment plant meters and complete meter calibration on a routine basis. This will allow them to have accurate records pertaining to total water production, giving some indication as to whether leaks or breaks have occurred in the distribution system. Breaks and leaks would be evidenced through an increase in overall water production without a corresponding increase in water consumption.

Required Information for Future Water Distribution System Audits

In order to provide the City with a more complete water audit in the future, certain information would be required, such as:

Treatment System

- The annual operating and maintenance costs of the water treatment plant, including but not limited to chemical and electrical costs.
- Chemical dosage rates.
- A description of the treatment unit processes and an estimate of the water usage, if any. In particular, unit processes that send water to waste such as filtration.

- Location, type and readings from any water meters and a description of the flows that are metered by each particular meter.
- Description of the maintenance programs for the treatment facility.
- Size of the clearwell.

Distribution System

- The length and type of piping used in the distribution system.
- Records of the number of breaks in the system, and an estimate of the amount of water lost.
- A detailed description of the flow regime through the system including the operation of the recirculation system (flow rates, etc).
- The annual operations and maintenance costs of the distribution system.
- The most recent installation date and the models of the water meters throughout the distribution system.
- Readings from all meters in the distribution system.
- Heating oil and propane usage by the boilers.
- A description of the maintenance activities such as flushing, bleeders etc as well as an estimate of the water usage and specific details where water is used.
- Freezing prevention methods beyond the boilers and bleeders, such as private homes where the water is left running, and an estimate of the water usage.
- Location, size and purpose of water storage systems including frequency of overflows and an estimate of the water used.
- Water conservation measures that are in place such as lawn watering rules.
- Water charge rates.
- A list of known authorized un-metered water usage as well as an estimate of the water volume used by each and the frequency of use. This may include but is not limited to activities such as fire department practice, swimming pool filling, rink flooding, street sweeping, park irrigation, and municipal building usage.

17.2.3 Saving Opportunities

The preferred method of calculating potential cost savings for the City of Flin Flon involves determining the savings associated with using less energy and chemicals for treating and distributing the water. According to information received, the City of Flin Flon’s water treatment and distribution system appears to have a significant amount of unaccounted for water. It may be possible for the City to cost effectively reduce the amount of unaccounted-for water loss in the system, since, Flin Flon's unaccounted for water loss of 29% falls above the 10-15% range where a leakage detection and prevention program may become economically advisable according to Environment Canada. For each 1% reduction of unaccounted for water loss, the City could save a significant amount of money annually based on the cost of producing, pumping and heating the water as well as treating the associated wastewater.

The accuracy of water meters throughout the City should be tested. Since it is uncertain whether the meters have brass or plastic components and how many service connection meters are present, a meter replacement program may or may not be economically feasible. If the client water meters have brass components, the estimated accuracy would be approximately 99%. With an error of 1%, clients would have consumed approximately 2,190 Mgal (9,960 m^3) of water that they were not billed for in 2005, corresponding to a loss of revenue to the City based on the current water charge rates. If the water meters had plastic components instead of brass components, the estimated accuracy of the meters would be only 95.12%. With an error of 4.88%, clients would have consumed approximately 10,700 Mgal (48,600 m^3) of water that they were not billed for in 2005.

17.3 WASTEWATER COLLECTION SYSTEM OVERVIEW

Very little information was available from the City of Flin Flon on the Wastewater Collection System. The following information was not available and therefore is not included in this report:

- Function of wastewater system – Whether or not the wastewater collection system is a combined system that collects both storm water and wastewater.
- Current length and type of piping in the collection system.
- Number of manholes and type of construction.
- Annual operation and maintenance costs for the wastewater system.

There are at least two lift stations along the distribution system that pump the City's wastewater through the system. These stations are Lift Station Number 4 and Lift Station Number 7. The City's treatment system consists of a sequencing batch reactor and sludge treatment. The treated effluent is disinfected by an ultraviolet light system prior to discharge.

Infiltration and Inflow

Even in sewage collection systems that are separate from the storm water drainage systems, inflow and infiltration may be occurring. Inflow is defined as storm water runoff that is directed into the sanitary sewer from areas such as weeping tiles, foundation drains or eaves troughs. Infiltration refers to water entering the collection system from the ground via defective pipes, pipe joints, and manholes. Some infiltration into the system is likely occurring at the manholes and elsewhere in the system.

Sewer Rates

It is believed that sewer rates are included in the water rates as previously discussed.

Maintenance Programs

It is uncertain if there is a scheduled maintenance program in place for the collection system.

17.4 WASTEWATER COLLECTION SYSTEM AUDIT RESULTS

The City of Flin Flon operates a sanitary sewer system that appears to collect and treat significant amount of inflow and infiltration.

The base wastewater flow was calculated by observing the flow rate through Lift Station Number 4 and Lift Station Number 7 during the winter months as inflow and infiltration will be minimal. Subtracting the typical wastewater flow volume for one year from the total actual annual flow gives an estimate of inflow and infiltration. The base flow should equal the portion of the drinking water produced that reaches the sewer system. Volumes above this flow are likely due to infiltration and inflow. Typically approximately 65% to 85% of the drinking water produced reaches the wastewater system. The calculations performed showed the base flow as approximately 80% of the total water produced, which is within the typical values.

Typical infiltration and inflow rates for a system such as Flin Flon's can vary greatly. From information provided by the City of Flin Flon, it appears that the sewer system is experiencing significant infiltration and inflow, approaching approximately 21 to 24 percent of the total annual flow through the sewer system as a worst-case scenario. The City could potentially decrease infiltration and inflows to the sewer system by sealing manholes; lining pipes; and disconnecting rain leaders, sump pumps, and weeping tiles from the sanitary sewer system. Further studies should be conducted to determine the feasibility of these infiltration reduction options, since they may not be cost effective in this specific case.

Figure 2 Lift Station Number 4 Flow Rate

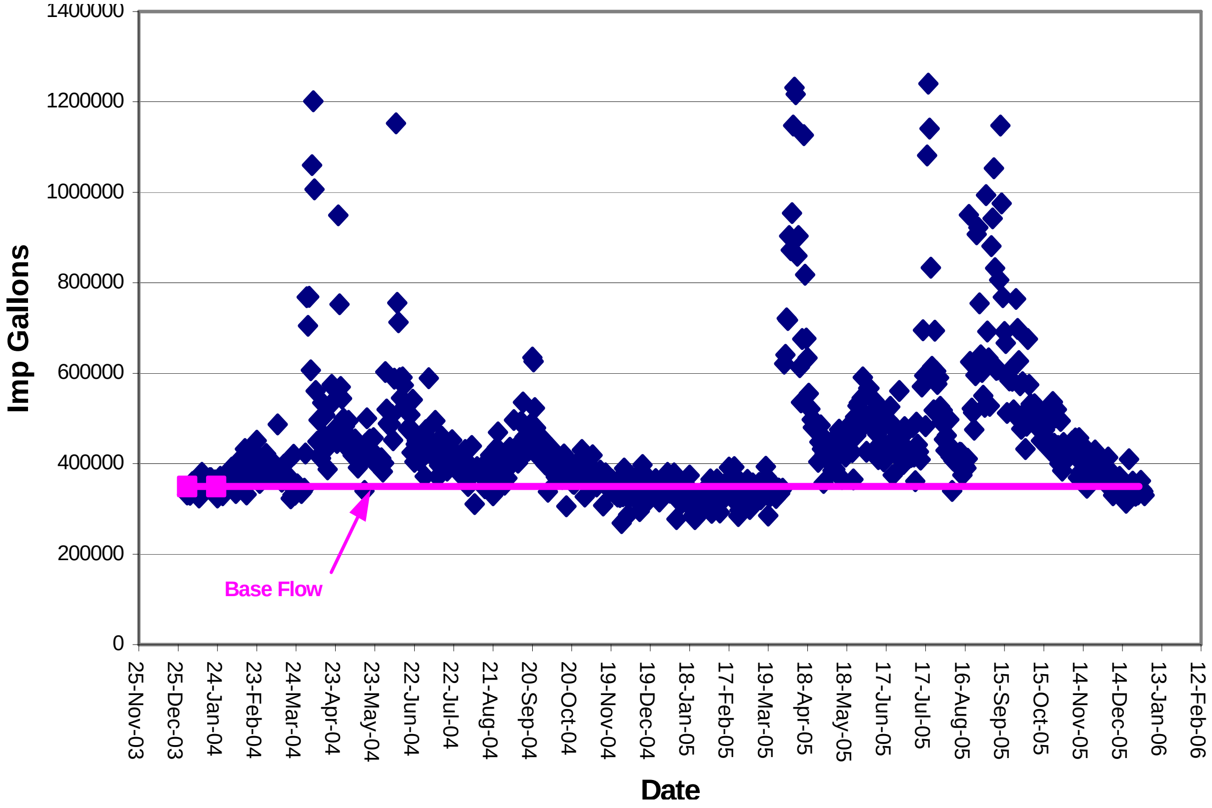
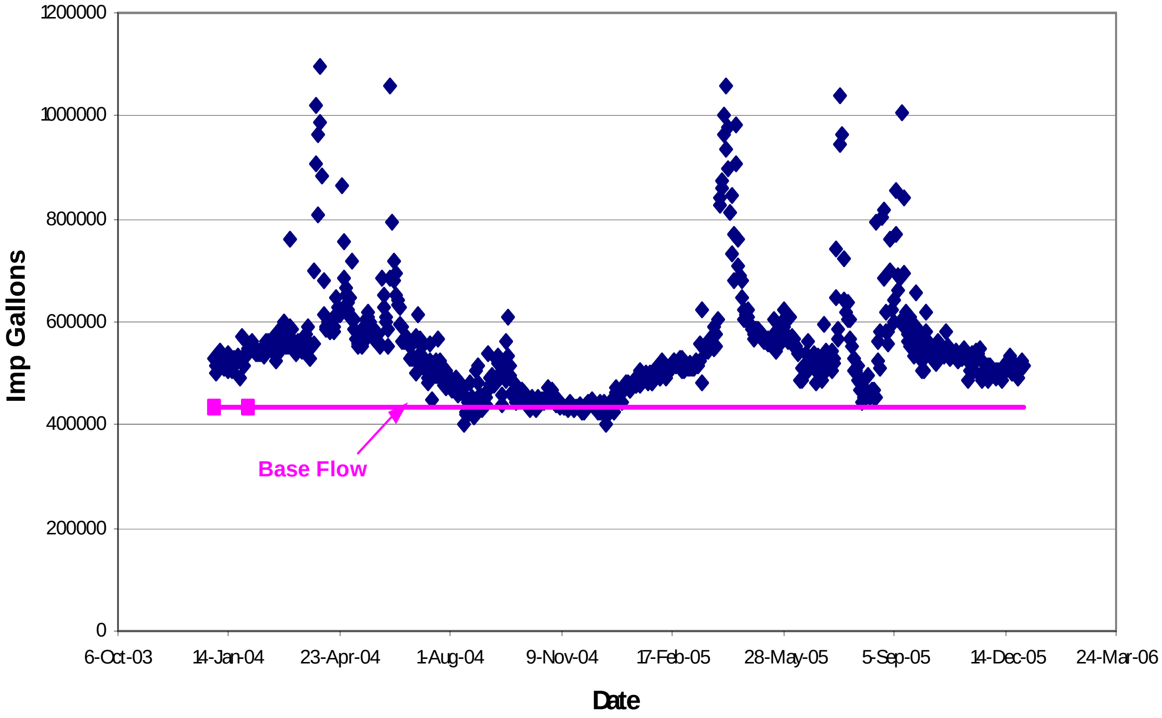


Figure 3 Lift Station Number 7 Flow Rate



The calculated infiltration volume for 2005 was 418,000 m^3 (91,930,000 igal). Based on the 2005 results, the inflow and infiltration water appears to be 24% of the effluent and therefore accounts for approximately 24% of the operating budget of the wastewater collection and treatment system. However, although the administration and infrastructure is a fixed cost, reducing the inflow and infiltration water would result in annual savings related to a reduction in chemical usage and electricity. Additional yearly savings will be realized by a decreased amount of maintenance and parts for infrastructure, as less flow results in less wear and tear. In addition, reducing the infiltration and inflow create excess capacity in the system which will allow the City to defer expensive capacity upgrades to the treatment and collection systems. Table 27 demonstrates the infiltration and inflow volumes for 2004 and 2005.

Table 27 Wastewater Flows

Year	Parameter	Lift Station No. 4 (igal)	Lift Station No 7 (igal)	Headworks (igal)	Base Flow (igal)	Inflow/Infiltration	
						Volume (igal)	% I/I
2004	Average Day	416,581	529,516	990,163	785,000	205,163	21%
	Maximum Day	1,201,200	1,094,060	3,499,760			
2005	Average Day	471,959	564,908	1,036,867[A]	785,000	251,867	24%
	Maximum Day	1,239,920	1,059,080	Unknown			

[A] No information available but number inferred from the addition of volumes from the two lift stations

The City should conduct a study in order to determine feasible options to deal with the extraneous storm water sources. This study should include a detailed review of manholes within the system and the televising of the sewage collection system.

Maintenance Program

The City may wish to start a scheduled maintenance program, such as actively replacing sections of old pipe, to help minimize potential problems with the sewer system and to spread out the cost.

17.5 BY-LAWS

In order to limit the amount of storm water entering the sewer system, the City should consider instituting a by-law that prohibits any future hook-ups of sump pumps or weeping tiles to the sewer system. This may require the expansion of the existing storm sewer system, but it will greatly decrease the amount of water entering the treatment system, and will decrease pumping costs since less water will be flowing through the sanitary sewer system.

Required Information for Future Wastewater Collection Audits

In order to provide the City with a more complete sewer audit in the future, the following information would be required:

- A general description of the sewage collection and treatment system including locations of lift stations, treatment processes and discharge location.

- Daily flows through the sewer system including confirmation of approximate number of eaves troughs, sump pumps, weeping tile systems, etc that are connected to the collection system.

- The location and type of each meter in the collection and treatment system as well as readings from each location.

- The rated flows and head of the pumps used in the lift stations.

- The length and type of pipe used in the collection system.

- The number of manholes along the collection system.

- A description of the maintenance procedures followed for the wastewater collection system including an estimate of any water used for activities such as flushing.

- Annual operation and maintenance costs of the collection, pumping, and treatment systems including but not limited to chemical and electrical costs.

17.6 PUBLIC EDUCATION

Providing public education will create a better understanding of the water and wastewater treatment systems. If residents are aware of the processes and costs involved with treating and distributing drinking water and collecting and treating sewage, they will be more accepting of cost reduction efforts. A program that highlights the environmental and monetary benefits of water use reduction can help the community gain support for the following initiatives:

- Installing water meters, low flush toilets, or water saving showerheads.
- Fixing leaky taps and toilets.
- Only watering lawns once per week.
- Using drip irrigation for trees and shrubs.

17.7 RECOMMENDATIONS

It is recommended that the City:

1. Collect the information requested in previous sections of the report in order to have a detailed water audit completed.

2. Ensure that all flows through the water treatment plant (production and recirculation) are provided separate meters and the readings recorded daily.

3. Develop a program for assessing the accuracy of water meters at the water treatment plant, as well as client water meters.

4. Develop a program for scheduled leak detection of the water distribution system.

5. Keep track of the dates when breaks or flushing occur and meter all authorized municipal water use in order to accurately estimate the amount of water loss within the distribution system.

6. Commence determining the annual unaccounted-for water loss percentage to determine when a leakage prevention program would be justified.

7. Conduct a study on the feasibility of options for reducing infiltration and inflow to the sewage collection system. This may include sealing manholes, lining pipes, televising the system and developing a staged collection system upgrade strategy.

8. Install flow meters at the wastewater treatment plant and take daily meter readings so that the influence of storm water and runoff on the overall flow through the system can be more accurately determined.

9. Establish a by-law that prevents the connection of sump pumps or diversion of water from weeping tiles into the sewer system.

10. Provide public education to create a better understanding of the water and wastewater treatment systems.

APPENDIX A

INVENTORY SHEETS

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BUILDING INSPECTION INVENTORY

Revision 2

Municipality: Flin Flon		**Date: June 2, 2006**
Toured By: Ray Bodnar,		**Construction Date: 1969**
Building: Airport Terminal		**Renovations: Roof replaced 5 yrs ago, no insulation upgrade.**
Address: Bakers Narrows, Hwy #10		
L x W x H: 37' x 85'	**Area: 3,145 ft^2**	
Building Capacity: 12 during travel times, otherwise 3		
Building Floor Plan: 1 storey.		**Occupied Times: Sun-Fri: 5:30am – 9pm** **Sat: 5:30am-6pm**

ARCHITECHTURAL/STRUCTURAL

Wall type/R-value: Brick exterior. 3" batt inside, 6" walls – R-12.

Roof Type/R-value: 2" Rigid insulation approx R-12.

Door Type/weather stripping: Good caulking, poor stripping on pedestrian doors (6). Vehicle door good.

Window type/caulking: Good caulking. Many large 2 pane windows.

Other:

MECHANICAL

Heating System: Weil Mclain propane hot water boiler, 650MBH input with Grundfos pumps. Unit heaters in baggage, baseboards elsewhere.

Cooling System: 2 ductless split A/C and 1 window A/C.

Ventilation System: 3 Washroom exhaust fans.

HVAC Controls: Standard stats (2)

HVAC Maintenance/Training:

Water Supply System:

Domestic Hot Water System: 33 gallon, 33MBH propane water tank.

Water Fixtures: 6-13lpf toilets (not electric), 1-3.8lpf urinal (electric), 5 high flow sinks (electric).

ELECTRICAL
Indoor Lighting: 17- 60W Incandescents, 17 – 4’x2 T12s, 4 – 8’x2 T12s, 54 – 4’x1 T12s.
Outdoor Lighting:
Exit Signs: 2 incandescents.
Motors:
Parking Lot Plugs: 4 for employees, 10 for customers.
OTHER BUILDING SYSTEMS
PROCESS SYSTEMS
BUILDING SERVICES (Hydro, Gas, Oil, Water, etc.)
NOTES

BUILDING INSPECTION INVENTORY
Revision 2

Municipality: Flin Flon		**Date: June 2, 2006**
Toured By: Ray Bodnar		**Construction Date: 1970**
Building: Airport Garage		**Renovations: None**
Address: Bakers Narrows, Hwy. #10		
L x W x H: 84' x 36'	**Area: 3,024 ft^2**	
Building Capacity:		
Building Floor Plan:		**Occupied Times: Sun-Fri: 5:30am – 9pm** **Sat: 5:30am-6pm**

ARCHITECHTURAL/STRUCTURAL
Wall type/R-value: Metal clad exterior with plywood liner inside. Metal frame with 2" fibreglass (R8). Damage to Metal liner and insulation. Air leakage through walls.
Roof Type/R-value: 3" Fibreglass (R12)
Door Type/weather stripping: 1 ped door with no stripping (gaps). 5 vehicle doors no caulking and poor Stripping – 2 – 12'x14', 2-12'x12', 1-10'x10'.
Window type/caulking: 1 – 4'x2' double pane broken outside pane.
Other:
MECHANICAL
Heating System: 2 old Reznor propane unit heaters (150/170MBH)
Cooling System: None
Ventilation System: 2 small washroom exhaust fans
HVAC Controls: No stats?
HVAC Maintenance/Training:
Water Supply System:
Domestic Hot Water System: 1 – 40 gal electric tank – no pipe insulation at all – exposed.
Water Fixtures: 1 6lfp toilet, 1 sink low flow, 1 high flow shower.

ELECTRICAL

Indoor Lighting: 13-8’x2 flourescent fixtures.

Outdoor Lighting:

Exit Signs: None

Motors:

Parking Lot Plugs:

OTHER BUILDING SYSTEMS

PROCESS SYSTEMS

BUILDING SERVICES (Hydro, Gas, Oil, Water, etc.)

NOTES

BUILDING INSPECTION INVENTORY

Revision 2

Municipality: Flin Flon

Date: June 2, 2006

Toured By: Ray Bodnar

Construction Date: 1970

Building: Sweeper Building

Renovations: None

Address: 200 Channing Drive

L x W x H: 54’ x 24’ x 13’

Area: 1296 ft^2

Building Capacity: 5

Building Floor Plan: Garage and Office

Occupied Times: Sun-Fri: 5:30am – 9pm
Sat: 5:30am-6pm

ARCHITECHTURAL/STRUCTURAL

Wall type/R-value: Metal clad exterior and interior metal liner. 4” straw insulation – R7. Some damaged cladding.

Roof Type/R-value: Open attic, strawboard, approx 2” thick (R5). Easy to insulate.

Door Type/weather stripping: 1 ped door – poor stripping, no caulking.
1 Vehicle door – 18’ x 18’ – good stripping, no caulking.

Window type/caulking: 30” x 24” new 3 pane.

Other:

MECHANICAL

Heating System: Clare, 80MBH propane unit heater – old. Electric baseboard in office.

Cooling System: None

Ventilation System: None

HVAC Controls: Standard stat

HVAC Maintenance/Training:

Water Supply System:

Domestic Hot Water System: None

Water Fixtures: None

ELECTRICAL
Indoor Lighting: 21-4’x2 T12 fluorescents.
Outdoor Lighting:
Exit Signs: None
Motors:
Parking Lot Plugs: None
OTHER BUILDING SYSTEMS
PROCESS SYSTEMS
BUILDING SERVICES (Hydro, Gas, Oil, Water, etc.)
NOTES

BUILDING INSPECTION INVENTORY
Revision 2

Municipality: Flin Flon		**Date: June 2, 2006**
Toured By: Ray Bodnar		**Construction Date: 1970**
Building: Sand Storage		**Renovations: None**
Address: 200 Channing Drive		
L x W x H: 36' x 30' x 14'	**Area: 1080 ft^2**	
Building Capacity: None		
Building Floor Plan: Sand Storage and Front End Loader		**Occupied Times: Sun-Fri: 5:30am – 9pm** **Sat: 5:30am-6pm**

ARCHITECHTURAL/STRUCTURAL

Wall type/R-value: Metal clad exterior with exposed insulation inside, bottom 2/3 protected. 2" Fibreglass R8. Some damaged cladding.

Roof Type/R-value: 3" Fibreglass R12.

Door Type/weather stripping: No caulking, poor stripping on 1 ped door and on 1 vehicle door (12'x14').

Window type/caulking: None

Other:

MECHANICAL

Heating System: 1 Modine propane unit heater – older.

Cooling System: None

Ventilation System: None

HVAC Controls: Standard Stat

HVAC Maintenance/Training:

Water Supply System:

Domestic Hot Water System:

Water Fixtures:

ELECTRICAL
Indoor Lighting: 4 – 8' x 2 T12s
Outdoor Lighting:
Exit Signs:
Motors:
Parking Lot Plugs:
OTHER BUILDING SYSTEMS
PROCESS SYSTEMS
BUILDING SERVICES (Hydro, Gas, Oil, Water, etc.)
NOTES

BUILDING INSPECTION INVENTORY

Revision 2

Municipality: Flin Flon

Date: June 1, 2006

Toured By: Ray Bodnar

Construction Date: 1960

Building: Whitney Forum (Arena)

Address: 57 Memorial Drive

L x W x H: 123’ x 251’

Area: 30,873 ft^2

Building Capacity: 150 – 200

Renovations: New dressing rooms added in 1999. Upgraded roof insulation.

Building Floor Plan: Ice Rink, lobby, and dressing rooms.

Occupied Times: 8 months: 16 hrs/day, 7 days/week. 4 months: 5 days/week, 8 hrs/day.

ARCHITECHTURAL/STRUCTURAL

Wall type/R-value: 8” Block walls. 6” of wall insulation added later.

Roof Type/R-value: 2” Rigid insulation, approx R12. Upgraded to R30.

Door Type/weather stripping: 4 old wood doors to rink from lobby – no stripping, large gap. Strip and caulk doors to outside – 16. Dressing room doors to rink are old wood with no stripping – 8.

Window type/caulking: 4’ x 2’ window in office – single pane. 44” x 28” rink windows – single pane – 8.

Other:

MECHANICAL

Heating System: Steam heating in old dressing rooms c/w stats. Electric force flows in new dressing rooms. 2 oil fired boilers – steam, 1 - 60 HP, 80% eff (1998), 1 - 40 HP, 75% eff (1971) for backup – tested and clean. 2 large steam heaters for rink c/w old 10HP motors – 1 has no stat, 1 has setback stat.

Cooling System: None

Ventilation System: 4 propeller exhaust fans c/w wide open backdraft dampers in rink – can’t run to make ice. Rink kept at 45°F. HRV in dressing rooms. Large HRV c/w Tamco dampers run all the time on timeclock – can’t shut down due to odors and mould issues.

HVAC Controls: Standard Stat

HVAC Maintenance/Training:

Water Supply System:

Domestic Hot Water System: 3 – 120 gal old electric water tanks. No pipe insulation. No recirculation pump!
4 – 120 gal new electric tanks in dressing rooms – 54 kW each, c/w demand control.

Water Fixtures: Mostly low flow with auto shut-off fixtures. 25 toilets, 18 urinals, 10 sinks, 20 showers.

ELECTRICAL

Indoor Lighting: 20 – 4’ x 2 T12s, 59 – 8’ x 2 T12s, 38 – 360W high eff. metal halides in rink, 50 – 4’x2 T8s in dressing rooms, 20 – 100W incandescents, some compact fluorescents.

Outdoor Lighting:

Exit Signs: Some upgraded, 14 incandescents.

Motors:

Parking Lot Plugs:

OTHER BUILDING SYSTEMS

Steam heated zamboni water tank.

Ice dumped outside.

Steam unit heaters c/w stats.

3 HP spray water pump – low eff.

2 wall fans c/w leaky bdd in ice plant room.

2 HP sanitary pump

3000 cfm greasehood exhaust fan on all the time.

PROCESS SYSTEMS

Ice plant upgraded 2 – 75HP compressors – 1 95% eff., 1 old motor. 2 – Brine pumps – 2 – 30 + 120, 92% eff. Brine pumps on ice temp sensor. 1 – 70HP condenser fan, high eff. Ave = 12 hrs/day operation – combined with curling rink.

BUILDING SERVICES (Hydro, Gas, Oil, Water, etc.)

NOTES

BUILDING INSPECTION INVENTORY

Revision 2

Municipality: Flin Flon		**Date: June 2, 2006**
Toured By: Ray Bodnar		**Construction Date: 1958**
Building: Community Centre		**Renovations: 1985 – internal renovations – windows replaced.**
Address: 2 North Avenue		
L x W x H: 128’ x 96’ + 16’x24’	**Area: 12,672 ft^2**	
Building Capacity:		
Building Floor Plan: 2 storey (no basement). Main floor – offices + seniors center, auditorium. Second floor – meeting room.		**Occupied Times: Offices + weight room: 9am-10pm, 7 days/week. Main floor Aud.: 6pm-10pm, 5 days/week + 10 hrs/week day.** **2nd floor meeting rm: 4 hrs/week day, 10 hrs/week eve.**

ARCHITECHTURAL/STRUCTURAL

Wall type/R-value: 1.5” Rigid insulation in 1957. Brick and block, drywall interior.

Roof Type/R-value: 1.5” insulation in 1957.

Door Type/weather stripping: Poor caulking and stripping on doors – 9.

Window type/caulking: 1985 2 pane in seniors center – 6’x2’ – 8 seniors + 3’x5’ – 6 main floor. Good caulking.

3 pane sliders on third floor – ok.

Other:

MECHANICAL

Heating System: Large AHU for seniors centre c/w economizer. Small AHU for weightroom c/w DX (damper disconnected). Electric heat + DX. Old oil steam boiler – 1960. Eng. Air unit for meeting room with countdown timer and open-air damper + DX control. ICE MUA for hall c/w countdown timer electric heat + DX.

Cooling System:

Ventilation System: 1 HP weight room exhaust fan, 2 HP shop exhaust, washroom exhaust w poor bdd,

kitchen exhaust with poor bdd, 2 wall exhaust fans with poor bdd.

HVAC Controls: Standard stats

HVAC Maintenance/Training: Owner doesn’t know how HVAC works – contractor.

Water Supply System:

Domestic Hot Water System: 284 Liter electric tank, 4500W - no pipe insulation for hall dishwasher.

2 – 60L, 4500W – rest of building – no pipe insulation.

Water Fixtures: 14 toilets, 2 showers, 18 sinks, 8 urinals – high flow.

ELECTRICAL

Indoor Lighting: 6 – 150W incandescents. 11 – 4' x 4 T12s. 14 Metal Halides. 115 – 4'x2 T12s.

Outdoor Lighting:

Exit Signs: 13

Motors:

Parking Lot Plugs:

OTHER BUILDING SYSTEMS

PROCESS SYSTEMS

Kiln used 2 times/year.

BUILDING SERVICES (Hydro, Gas, Oil, Water, etc.)

NOTES

BUILDING INSPECTION INVENTORY
Revision 2

Municipality: Flin Flon		**Date: June 1, 2006**
Toured By: Ray Bodnar		**Construction Date: 1974**
Building: Aqua Centre		**Renovations: None**
Address: 101 Oak Avenue		
L x W x H: 110' x 60' + 94'x25'	**Area: 8,950 ft^2**	
Building Capacity: 60		
Building Floor Plan: Swimming room, dressing rooms, and viewing room upstairs.		**Occupied Times: 598 hours/mo.**

ARCHITECHTURAL/STRUCTURAL
Wall type/R-value: 6" Concrete block + 4" block + 2" rigid insulation – approx. R16.
Roof Type/R-value: Built up roof with 2" rigid insulation – approx. R16.
Door Type/weather stripping: Good caulking, poor stripping – 6 ped doors.
Window type/caulking: 2 pane insulated 2 – 3'x5' with poor caulking.
Other:
MECHANICAL
Heating System: Eng Air AHU with 90 kW electric heat. Blanchard Ness dehumidifier for pool. Amenities AHU.
Cooling System: Only weight room has A/C – approx. 2 ton fan coil + DX.
Ventilation System: Old 5 HP fan motor x 2 on air handlers.
HVAC Controls: Old, working?
HVAC Maintenance/Training:
Water Supply System:
Domestic Hot Water System: Propane heater, 365,000 input. Holding tank is heater, no pipe insulation.
Water Fixtures: 7 high flow toilets, 1 urinal, 6 sinks, and 8 very high flow showers.

ELECTRICAL

Indoor Lighting: Metal halide in pool – 20. 29 – 4'x2 T12s. 20 – 100W incandescents, 6 – 4'x4 T12s.

Outdoor Lighting:

Exit Signs: 5 Incandescents

Motors:

Parking Lot Plugs: 2

OTHER BUILDING SYSTEMS

PROCESS SYSTEMS

5 HP pool circulating pump – low eff. Electric pool heater – 54kW.

BUILDING SERVICES (Hydro, Gas, Oil, Water, etc.)

Propane for DHW, electric for space heating.

NOTES

BUILDING INSPECTION INVENTORY

Revision 2

Municipality: Flin Flon		**Date: June 1, 2006**
Toured By: Ray Bodnar, Phyllis Stadnick		**Construction Date: 1967**
Building: Public Library		**Renovations: 1989 internal renovations. No energy upgrades.**
Address: 58 Main Street		
L x W x H: 69' x 65' x 12'	**Area: 4,485 ft^2**	
Building Capacity:		
Building Floor Plan: Basement and main floor. Full basement – evening meetings only.		**Occupied Times: Winter hours: Mon–Thu, 9am – 7pm, Friday and Sat – 9am-5pm. Summer hours: Mon-Thu, 9am-6pm, Fri – 9am-5pm.**

ARCHITECHTURAL/STRUCTURAL
Wall type/R-value: 4" brick and 6" concrete block with 2" batt = R12.
Roof Type/R-value: Built up roof with 2" rigid insulation = R12.
Door Type/weather stripping: 2 ped doors – no caulking, poor stripping.
Window type/caulking: 4 - 6' x 10' + 3 – 3' x 2' – double pane, poor caulking.
Other:
MECHANICAL
Heating System: RTU 1 – 4 ton cooling, 17kW electric heat with economizer – 1500cfm. RTU 2 – Same as 1 but 1800 cfm. 2 existing furnaces in basement. Claire Mega save propane furnace for main floor. Carrier electric furnace for basement. Dri-steam humidifier in basement. Economizer system on furnaces.
Cooling System: 2 Outside condensing units – old Carriers.
Ventilation System:
HVAC Controls: 7 day time clock on all A/C units.
HVAC Maintenance/Training:
Water Supply System:
Domestic Hot Water System: 184 Liter electric water tank, 4500W, no pipe insulation.
Water Fixtures: 3 toilets, 3 sinks on main floor – high flow. 2 sinks, 2 toilets, and 1 urinal in basement.

ELECTRICAL

Indoor Lighting: Main floor – 31 – 4’x4 T12s, 10 – 4’x2 T12s, 24 - 60W incandescents. Basement – 17 - 100W inc., 18 – 4’x2 T12s, 12 – 60W incandescents on all day.

Outdoor Lighting:

Exit Signs: 8

Motors:

Parking Lot Plugs: 2

OTHER BUILDING SYSTEMS

PROCESS SYSTEMS

BUILDING SERVICES (Hydro, Gas, Oil, Water, etc.)

NOTES

BUILDING INSPECTION INVENTORY

Revision 2

Municipality: Flin Flon		**Date: June 1, 2006**
Toured By: Ray Bodnar, Jim Petrie		**Construction Date: 1980**
Building: Public Safety Building		**Renovations: No renovations to RCMP**
Address: 96 Hapnot Street		
L x W x H: 108' x 82'	**Area: 8,856 ft^2**	
Building Capacity: 8 + 2 holding cells		
Building Floor Plan: RCMP, Firehall, Holding cells, Truck bay, Offices, Bedrooms for firehall		**Occupied Times: Winter hours: 20 hrs/day/week RCMP, 24 hrs/7days Firehall**

ARCHITECHTURAL/STRUCTURAL

Wall type/R-value: 8" concrete block + 3" rigid insulation – approx. R20.

Roof Type/R-value: 6" insulation – approx. R30.

Door Type/weather stripping: Poor stripping and caulking on ped doors (7). Vehicle doors good – poor caulking – 2 – 12'x12'.

Window type/caulking: Triple pane, good caulking.

Other:

MECHANICAL

Heating System: RCMP: Electric unit heaters in garage (2) with integral stat – keep cool. Electric baseboards on second floor. Forced air in office and electric baseboards. Fire Hall: Electric unit heater in garage. AHU c/w economizer + dx A/C + electric heat.

Cooling System: RCMP: A/C controlled in fire hall – overcools office and electric heat comes on. Fire Hall: Common A/C for both - old Trane condenser on roof RAVA-1005A – 3 fans, 2 compressors.

Ventilation System: RCMP: Countdown timer on washroom exhaust fans. Fire Hall: Ceiling fans. Truck bay exhaust c/w motorized dampers to intake. Tower exhaust and dampers.

HVAC Controls: Standard stats

HVAC Maintenance/Training: Maintenance schedule.

Water Supply System:

Domestic Hot Water System: In fire hall – 280L electric tank – 4500W

Water Fixtures: 6 sinks, 2 urinals, 5 high flow toilets, 3 showers, 6 toilets inside cell blocks – low flow.

ELECTRICAL

Indoor Lighting: 16 – 100W incandescents, 16 – 4’x4 T12s, 61 – 4’x2 T12s, 8 – 400W MV high bay.

Outdoor Lighting: 4 – 300W left on during the day.

Exit Signs: New style

Motors:

Parking Lot Plugs: 1

OTHER BUILDING SYSTEMS

Truck bay kept at 65℉ – 70℉. ICE MUA.

PROCESS SYSTEMS

BUILDING SERVICES (Hydro, Gas, Oil, Water, etc.)

NOTES

BUILDING INSPECTION INVENTORY

Revision 2

Municipality: Flin Flon

Date: May 31, 2006

Toured By: Ray Bodnar, Rick Bacon

Construction Date: 1983

Building: City Hall

Renovations:

Address: 20 First Avenue

L x W x H: 30.6mx23.2m + 5.9mx11m + 12mx23m

Area: 1,051 m^2

Building Capacity: approx 20

Building Floor Plan: Offices and council chamber. Full basement.

Occupied Times: Winter hours: 8:30-5:00, Mon-Fri + 4 hrs twice/mo.

ARCHITECHTURAL/STRUCTURAL

Wall type/R-value: R-30, brick and drywall. 6” batt + 1.5” insulation.

Roof Type/R-value: Built up roof, 9” styrofoam = R49 on drawing.

Door Type/weather stripping: Poor caulking on 6 doors – stripping good.

Window type/caulking: 3-pane – some need caulking - 8 – 96” x 84”.

Other:

MECHANICAL

Heating System: Office – York RTU, model DM090COOP5AAA 3A – newer c/w economizer. Chambers – Carrier RTU Model 50DP0141006C c/w economizers. Electric baseboards in council chamber, hotel heat/cool units in offices.

Cooling System: Fluid cooler closed circuit.

Ventilation System: Several washroom exhaust fans c/w backdraft dampers (5).

HVAC Controls: Standard stats on RTUs. Integral stats on hotel units. Wall stats for baseboards.

HVAC Maintenance/Training: Electric room intake filter plugged.

Water Supply System:

Domestic Hot Water System:

Water Fixtures: 6 toilets, 8 sinks, 2 urinals – very high flow.

ELECTRICAL

Indoor Lighting: 14 – 100W incandescents, 49 – 4’x4 T12s, 227 - 4’x1 T12s.

Outdoor Lighting:

Exit Signs: New style

Motors:

Parking Lot Plugs: 7 – doubles = 14.

OTHER BUILDING SYSTEMS

PROCESS SYSTEMS

BUILDING SERVICES (Hydro, Gas, Oil, Water, etc.)

NOTES

BUILDING INSPECTION INVENTORY

Revision 2

Municipality: Flin Flon		**Date:** June 1, 2006
Toured By: Tibor Takach		**Construction Date:** 2005
Building: Sewage Treatment Plant - Headworks		**Renovations:** Facility is brand new and has just been commissioned.
Address: 9 Boundary Avenue		
L x W x H: 12.67m x 35.37m	**Area: 448.14m^2**	
Building Capacity:		
Building Floor Plan: External building dimensions, 12.67 m x 35.37 m; ceiling height above grade is approximately 4 m		**Occupied Times:** 70 per week occupancy, eight hour shifts

ARCHITECHTURAL/STRUCTURAL

Wall type/R-value:

- 100 mm split face concrete block the near.
- Vent space
- RSI 2.0 (50 mm max), rigid insulation.
- Membrane air/vapor barrier.
- 200 mm concrete block.
- Height to ceiling, 4 m

Roof Type/R-value:

- Prefinished metal roof deck.
- Building paper.
- 13 mm exterior grade plywood sheeting.
- RSI 6.8 (200 mm max), rigid foam insulation in two 100 mm layers.
- Two alternating layers galvanized the Z.-ties at 24 inches on center.
- 13 mm exterior grade plywood sheeting.
- Metal deck notes.
- Open web steel joists.

Door Type/weather stripping:

- Three- 10 x 10 overhead doors, metal, insulated, door sweeps, 1900 mm width.
- Three-metal insulated, man doors, 36 inch width.
- One-double set, steel, insulated, man door

Window type/caulking:

-

Other:

Foundation Cladding

- 20 mm parging on wire lath to 150 mm below grade
- 10 mm treated plywood protection board.
- 38 x 38, treated wood to strapping at 600 on center vertical.
- 38 rigid foam insulation.
- Membrane air/vapor barrier.
- Concrete grade beam

MECHANICAL

Heating System:

- Makeup air unit #1; 5 hp plus 5 hp, 6.6 amp, 600 V, three-phase; FVNR starter
- Makeup air unit #2; 5 hp plus 5 hp, 6.6 amp, 600 V, three-phase; FVNR starter
- Duct heater; 10 kW, 16.7 amp, 600 V, three-phase; FVNR starter.
- Humidifier; 2 kW, 9.6 amp, 208 V.
- Forced air heater #1; 6 kW, 10 amp, six hundredfold, single phase
- Forced air heater #2; 2 kW, 3.3 and, six hundredfold, single phase.
- Baseboard heater; to kill what, 9.6 amp, 208 V, single phase.
- Unit heater 1; 1/20 hp, 120 V, single phase, manual start.
- Unit heater 2; 1/20 hp, 120 V, single phase, manual start.
- Unit heater 3; 1/20 hp, 120 V, single phase, manual start.
- Unit heater 4; 2 kW, 5.6 amp, 208 V, three-phase.

Cooling System:

- Condensing unit; 15.5 amps, 208 V, three-phase

Ventilation System:

- Exhaust fan 1; wall exhauster, Carnes, model VWBK06, 145 L per second, 31 SP, 1/6 hp, 4.4 amp, 120 V, single phase, manual start.
- Exhaust fan 2; Cabinet ceiling, Carnes, model VCDB015, 70 L per second, 31 SP, 1/6 hp, 4.4 amp, 120 V, single phase, manual start.
- Exhaust fan 3; Cabinet ceiling, Carnes, model VCDB010, 50 L per second, 31 SP, 1/12 hp, 120 V, single phase, manual start.
- Exhaust fan 4; Cabinet ceiling, Carnes, model VCDB015, 70 L per second, 31 SP, 1/6 hp, 4.4 amp, 120 V, single phase, manual start.
- Exhaust fan 5; Cabinet ceiling, Carnes, model VCDB030, 125 L per second, 62 SP, 1/4 hp, 5.8 amp, 120 V, single phase, manual start.
- Exhaust fans 6; Cabinet ceiling, Carnes, model VWBK06, 250 m per second, 31 SP, 1/6 hp, 4.4 amp, 120 V, single phase, manual start.
- Supply fan; in-line, Carnes, model V1BK06, 140 L per second, 62 SP, 1/6 hp, 4.4 amp, 120 V, single phase, manual start.
- Louver L-1, Ventex Hi Pro, size 500 x 300 mm, free area, 0.04 m^2.
- Louver L-2, Ventex Hi Pro, size 1120 x 1425 mm, free area 0.08 m^2.
- Louver L-3, Ventex Hi Pro, size 500 x 300 mm, free area 0.07 m^2.
- Louver L-4, Ventex Hi Pro, size 600 x 500 mm, free area 0.16 m^2.
- Louver L-5, Ventex Hi Pro, size 500 x 300 mm, free area 0.04 m^2.
- Louver L-6, Ventex Hi Pro, size 300 x 400 mm, free area 0.04 m^2

HVAC Controls:

- Thermostat control.
- Temperature in office area and change room maintained at approximately 70°F all year round.
- Temperature in process area maintained at approximately 65°F throughout the year.
- Lights are kept off in the main process areas. Only lights in office area and change rooms are kept on during working hours.

HVAC Maintenance/Training:

Water Supply System:

- Domestic water supply

Domestic Hot Water System:

- 4500 W, 2 element water heater

Water Fixtures:

- 1-13.25 L flush toilet.
- 1-shower in washroom/change room
- 1-sink in washroom/change room
- 1-sink in coffee room.
- One double sink in laboratory

ELECTRICAL

Indoor Lighting:

- 30 - surface/suspended fluorescent; 2 x 32 W, T8, rapid start; 1220 mm long.
- 10 - surface/suspended mounted industrial luminaire; 2 x 32 W, T8 rapid start; 1220 mm long.
- 12 - recessed fluorescent troffer; 4 x 32 W, T8, rapid start; 610 x 1220 mm.
- 2 - recessed mounted fluorescent troffer; 2 x 17 W, rapid start; 610 x 610 mm.
- 3 - recessed fluorescent troffer; 2 x 32 W; T8, rapid start; 1220 mm long

Outdoor Lighting:

- 7- Wallpak; 150 W HPS (high-pressure sodium); 400 x 410 x 241 mm

Exit Signs:

- Universal ceiling light, manufacturer Aimlite, 1 W LED light source

Motors:

- Gorman Rupp T3 Grit removal pump; 7.5 hp, nine A, 600 V, three-phase, FVNR starter.
- Gorman Rupp T4 Septage waste transfer pump #1; 7.5 hp, 9 A, 600 V, three-phase, FVNR starter.
- Gorman Rupp T4 Septage waste transfer pump #2; 7.5 hp, 9 A, 600 V, three-phase, FVNR starter.
- Screen grit motor; 2 hp, 2.7 amp, 600 V, three-phase; FVR starter.
- Paddle drive gear motor; 0.75 hp, 1.1 amp, 600 V, three-phase; FVNR starter.
- Booster pump; 3 hp, 3.9 amp, 600 V, three-phase; FVNR starter.
- Grit dewatering gear motor; 1 hp, 1.4 amp, six hundredfold, three-phase, FVNR starter.

Parking Lot Plugs:

- 4 -external electrical outlets

OTHER BUILDING SYSTEMS

PROCESS SYSTEMS

BUILDING SERVICES (Hydro, Gas, Oil, Water, etc.)

NOTES

BUILDING INSPECTION INVENTORY

Revision 2

Municipality: Flin Flon		**Date:** June 1, 2006
Toured By: Tibor Takach		**Construction Date:** 2005
Building: Sewage Treatment Plant - SBR Building		**Renovations:** None, facility is newly constructed.
Address: 9 Boundary Avenue		
L x W x H: see below	**Area:** 341 m^2	
Building Capacity:		
Building Floor Plan: Exterior building dimensions, 19.455 m x 17.530 m, ceiling height above grade 4000 mm, ceiling height below grade 6750 mm.		**Occupied Times:** Daily

ARCHITECHTURAL/STRUCTURAL

Wall type/R-value:

Exterior Wall Construction

- 90 mm architectural concrete block.
- 25 mm airspace.
- 75 mm rigid insulation, R15.
- Air/vapor barrier
- wire reinforcing every second course.
- 20M vertical bar in 1000 mm on center.
- 15M vertical bar tucked each side of window and door openings and corners. Solid concrete feel in cores.

Concrete Tank Wall Construction

- 50 mm rigid insulation (R10).
- Metal furring at 400 mm on center.
- Galvanized expanded wire metal mesh
- 3 coats, cement paste plaster

Roof Type/R-value:

- Pre-engineered roof trusses at 600 mm on center
- 16 mm thick tongue and groove plywood sheeting.
- 15 pound felt paper.
- Prefinished standing seam metal roof panels, complete with ridge vents.
- R40 insulation and attic
- vapor barrier.
- 38 x 89 strapping at 600 mm on center.
- Metal ceiling

Door Type/weather stripping:

- One double door set, metal slab door, width 1220 mm, height 2134 mm, thickness 45 mm, insulated doors, thermally broken frame.
- One man door, width 914 mm, height 2134 mm, thickness of 45 mm, tempered glass glazing, insulated door, thermally broken frame, window size 150 x 908 mm, dual pane glazing.

Window type/caulking:

- None

Other:

-

MECHANICAL

Heating System:

- Unit heater - 1; Engineered Air, model H1, heating capacity 8.62 kW, heating media flow rate 0.134 L per second, motor 0.25 hp, 1500 rpm.
- Unit heater - 2; Engineered Air, modelH2, heating capacity 11.11 kW, heating media flow rate 0.173 L per second, motor 0.25 hp, 1500 rpm.
- Unit heater - 3; Engineered Air, model H4, heating capacity 16.6 5 kW, heating media flow rate 0.260 L per second, motor 0.25 hp, 1500 rpm.
- Unit heater - 4; Engineered Air, model H2, heating capacity 11.11 kW, heating media flow rate 0.173 L per second, motor 0.25 hp, 1500 rpm.
- Unit heater - 5; Engineered Air, model H1 heating capacity 8.62 kW, heating media flow rate 0.134 L per second, motor 0.25 hp, 1500 rpm.
- Unit heater -6; Engineered Air, model H1, heating capacity 8.6 2 kW, heating media flow rate 0.134 L per second, motor 0.25 hp, 1500 rpm.
- Unit heater - 7; Engineered Air, model H1, heating capacity 8.62 kW, heating media flow rate 0.134 L per second, motor 0.25 hp, 1500 rpm.
- Burnham propane fired boiler, model 805B, gas input 77 kW, output 62 kW, circulation 1.26 L per second, two-stage control.
- Furnace F-1; Lennox model G243/4-1205, gas input 35.14 kW at 75 Pa standard pressure, air capacity 800 CFM, 0.5 hp, 120 V, single phase, 60 Hz.

Cooling System:

-

Ventilation System:

- Service fan - 1; Delhi model 218, 4000 CFM, 1 hp, 208 V, 0.25 WC.
- Exhaust fan - 1; Cook model ACWB210, 5307 CFM, 1.25 hp, 208 V, 0.5 WC.
- Exhaust fan - 2; Cook model ACWB 180, 3500 CFM, 0.5 hp, 0.13 WC.
- Exhaust fan - 3, Cook model ACWB 100, 508 CFM, 0.17 hp, 0.13 WC.
- Exhaust fan - 4; Canaarm model S8-B2, 255 CFM, 0.13 WC, fractional horsepower.
- Exhaust fan - 5; Cook model ACWB 195, 4000 CFM, 0.25 WC, 0.75 hp.

HVAC Controls:

- Makeup air unit-1; Engineered Air, model HE-70, 257.05 kW gas input at 187 pascals standard pressure, 6935 CFM, motor 7.5 hp, 575 V, three phase, 60 Hz.
- Makeup air unit- 2; Engineered Air, model HE-40, 152.12 kW gas input at 125 pascals standard pressure, 4000 CFM, motor 3 hp, 575 V, three phase, 60 Hz.

HVAC Maintenance/Training:

-

Water Supply System:

- Domestic water supply

Domestic Hot Water System:

- State EWH-1, model CSB 120 9 1FE, 450 L capacity, 9 kW.
- Note: tankless water heaters are in place for chemical feed systems.

Water Fixtures:

- Hose bibbs throughout building for cleaning purposes.

ELECTRICAL

Indoor Lighting:

- 70 - high bay, industrial luminaire, manufacturer Cooper, lamps 250 W metal halide.
- 22 - industrial fluorescent, 300 x 2400 mm, 4 lamp in tandem, manufacturer Cooper, 4-32 W T8
- 3 - industrial fluorescent of 300 mm x 1200 mm, manufacturer Cooper, 2-32 W T8.
- 5 - wall mounted industrial luminaire, manufacturer Cooper, 150 W high-pressure sodium.
- 4 - industrial fluorescent, 300 x 1200 mm, 2-32 W lamps

Outdoor Lighting:

- 6 - wall mounted metal halide, manufacturer Appleton, 175 W metal halide.

Exit Signs:

- Universal ceiling light, manufacturer Aimlite, 1 W LED light source

Motors:

- Sump pump: 1/2 hp, 203 V, single phase.
- Effluent pressure pump: 2 hp, 600 V, three phase.
- Automatic effluent sampler: 120 V, single phase.
- Waste sludge pump: 2.3 hp, 600 V, three phase.
- Waste sludge pump: 2.3 hp, 600 V, three phase.
- Alum metering pump: 120 V, single phase.
- Alum metering pump: 120 V, single phase.
- Thickener feed pump: 3 hp, 600 V, three phase, VFD control.
- Thickener feed pump: 3 hp, 600 V, three phase, VFD control.
- Sludge recirculation pump: 3.7 hp, 600 V, three phase.
- Sludge recirculation pump: 2.7 hp, 600 V, three phase.
- Grinder: 3 hp, 600 V, three phase.
- Sludge transfer pump: 3 hp, 600 V, three phase, VFD control.
- Sludge transfer pump: 3 hp, 600 V, three phase, VFD control.
- Blower-1: 125 hp, 600 V, three phase, VFD control.
- Blower-2: 125 hp, 600 V, three phase, VFD control.
- Blower-3: 60 hp, 600 V, three phase, soft start.
- Blower-4: 60 hp, 600 V, three phase, soft start.
- Drum thickener: 0.5 hp and 0.33 hp, 600 V, three phase.
- Thickened sludge transfer pump: 10 hp, 600 V, three phase, VFD control.
- Screw conveyor-1: 4 hp, 600 V, three phase.
- Screw conveyor-2: 4 hp, 600 V, three phase.
- Centrifuge-1: 30 hp, 600 V, three phase.
- Centrifuge-2: 30 hp, 600 V, three phase.
- Digester circulation pump-1: 0.33 hp, 600 V, three phase.
- Digester circulation pump-2: 0.33 hp, 600 V, three phase.

Parking Lot Plugs:

- To be confirmed

OTHER BUILDING SYSTEMS

PROCESS SYSTEMS

Ultraviolet light disinfection consists of a Trojan 4000 UV system.

BUILDING SERVICES (Hydro, Gas, Oil, Water, etc.)

- 600 amp, 600 V, three phase main service

NOTES

It is assumed that all motors for this facility or high-efficiency units, however this needs to be confirmed with the operator.

BUILDING INSPECTION INVENTORY

Revision 2

Municipality: Flin Flon		**Date:** June 1, 2006
Toured By: Tibor Takach		**Construction Date:** 2005
Building: Decanter Building 1 and 2		**Renovations:** None, facility is newly constructed.
Address: 9 Boundary Avenue		
L x W x H: see below	**Area:** 52 m^2	
Building Capacity:		
Building Floor Plan: Exterior building dimensions, 11.33 m x 4.61 m, ceiling height above grade 4000 mm.		**Occupied Times:** Daily

ARCHITECHTURAL/STRUCTURAL

Wall type/R-value:

Exterior Wall Construction

- 90 mm architectural concrete block.
- 25 mm airspace.
- 75 mm rigid insulation, R15.
- Air/vapor barrier
- wire reinforcing every second course.
- 20M vertical bar in 1000 mm on center.
- 15M vertical bar tucked each side of window and door openings and corners. Solid concrete feel in cores.

Concrete Tank Wall Construction

- 50 mm rigid insulation (R10).
- Metal furring at 400 mm on center.
- Galvanized expanded wire metal mesh
- 3 coats, cement paste plaster

Roof Type/R-value:

- Pre-engineered roof trusses at 600 mm on center
- 16 mm thick tongue and groove plywood sheeting.
- 15 pound felt paper.
- Prefinished standing seam metal roof panels, complete with ridge vents.
- R40 insulation and attic
- vapor barrier.
- 38 x 89 strapping at 600 mm on center.
- Metal ceiling

Door Type/weather stripping:

- One man door, width 914 mm, height 2134 mm, thickness of 45 mm, tempered glass glazing, insulated door, thermally broken frame, window size 150 x 908 mm, dual pane glazing.

Window type/caulking:

- None

Other:

-

MECHANICAL

Heating System:

- Unit heater

Cooling System:

- None

Ventilation System:

- Service fan - 2; Cook model AWD- 16, 1400 CFM, 0.25 hp, 0.25 WC.
- Service fan - 3; Cook model AWD- 16, 1400 CFM, 0.25 hp, 0.25 WC.

HVAC Controls:

- thermostat

HVAC Maintenance/Training:

-

Water Supply System:

- Domestic

Domestic Hot Water System:

- None

Water Fixtures:

- Hose Bibb

ELECTRICAL

Indoor Lighting:

- See SBR lighting schedule

Outdoor Lighting:

- See SBR lighting schedule

Exit Signs:

- Universal ceiling light, manufacturer Aimlite, 1 W LED light source

Motors:

- Decanter-1: 0.75 hp, 600 V, three phase.
- Decanter-2: 0.75 hp, 600 V, three phase.

Parking Lot Plugs:

-

OTHER BUILDING SYSTEMS

PROCESS SYSTEMS

- ABJ decanter's

BUILDING SERVICES (Hydro, Gas, Oil, Water, etc.)

- Main service is 600 amp, 600 V, three phase

NOTES

BUILDING INSPECTION INVENTORY

Revision 2

Municipality: Flin Flon	**Date:** June 1, 2006
Toured By: Tibor Takach	**Construction Date:** Early 50s
Building: Cliff Lake Pumphouse	**Renovations:** No major renovations
Address: Cliff Lake	
L x W x H: see below **Area:** 67.265 square meters	
Building Capacity:	
Building Floor Plan: 10.35m x 6.5m external building dimensions. Above grade ceiling height approximately 3.3 m.	**Occupied Times:** Occupied daily for brief periods of time.

ARCHITECHTURAL/STRUCTURAL

Wall type/R-value:

- Below grade walls are concrete with a layer of blue rigid insulation beneath the parging. It could not be determined out far the insulation extended below grade.
- Above grade wall construction consists of: aluminum siding, building paper, 7.5 mm plywood sheeting, 38 x 140 mm stunts, batt insulation (RSI 30), vapor barrier, 13 mm drywall.

Roof Type/R-value:

- Roof construction consists of: 13 mm drywall, vapor barrier, batt insulation (RSI 7), plywood sheeting, asphalt shingles.

Door Type/weather stripping:

- 2 - mandoors, 36 inch width, solid wood core, no weather stripping or door sweeps present.

Window type/caulking:

- None

Other:

-

MECHANICAL

Heating System:

- 1 - 5 kW suspended unit heater.
- 1- 5 kW suspended unit heater in lower-level.
- 1 - wall mounted, force flow, 3 kW, heater.

Cooling System:

- None

Ventilation System:

- 2 – 3 ½ ‘ x 2 ½’ louvers
- 2 – 4’ by 4’ passive roof vents
- 1 -1/3 horsepower exhaust fan in lower-level.

HVAC Controls:

- One makeup air unit is shown in pictures. Additional information for this unit has to be confirmed.
- Unit has motorized dampers on the air intake.

HVAC Maintenance/Training:

-

Water Supply System:

- Domestic water supply system

Domestic Hot Water System:

- Two element, 3000 W up or, 3000 W lower, capacity 175 L, Cascade 4 water heater.

Water Fixtures:

-

ELECTRICAL

Indoor Lighting:

- 5 - high bay sodium lighting on main processing floor.
- 4 - high bay sodium lights in lower level.
- Lights are kept on 24/7 because of the time it takes for the lights to come on when entering the building. Operations personnel conduct three visits per day to check on the system. Visits are brief in nature.

Outdoor Lighting:

- 2 - metal halide exterior lamps, wattage unknown.

Exit Signs:

- None observed.

Motors:

- 2 - 75 hp, 60 Hz, three phase, 1765 rpm, 550 V, 71 amp, Fairbanks Morse vertical turbine pumps. One pump also has a coupling to six cylinder diesel engine which can be used in the event of a power outage. The pump itself is powered by electricity under normal operation.
- The pumps are not high efficiency units.
- Pumps are supplied with soft start/stop control.

Parking Lot Plugs:

- None

OTHER BUILDING SYSTEMS

PROCESS SYSTEMS

Sewage Pumps:

-

BUILDING SERVICES (Hydro, Gas, Oil, Water, etc.)

-

NOTES

- The pumphouse pumps on average approximately 800,000 imperial gallons per day with a peak of 1.2 million imperial gallons per day at peak summer periods.
- System pressure at discharge ranges from 100 to 120 psi.
- Temperature within the building is maintained at approximately 70°F and during the winter months. A lot of heat is obtained from the motors, however, the unit heater appears to run full-time during this period.

BUILDING INSPECTION INVENTORY

Revision 2

Municipality: Flin Flon

Date: June 1, 2006

Toured By: Tibor Takach

Construction Date: early 1950s

Building: Heating Plant #1

Address: 90 Ross Street

L x W x H: see below

Area: 167.6 m^2

Building Capacity:

Renovations:

No significant recent renovations.

Building Floor Plan:

15.24m x 11m exterior building dimensions. Ceiling height approximately 4 m.

Occupied Times:

Periodically approximately 3 times per day.

ARCHITECHTURAL/STRUCTURAL

Wall type/R-value:

- One-inch shiplap, building paper, wire mesh, stucco, 2 x 6 studs, 2 inch rock wool batt insulation, 2 ply vapor barrier, 3/16 inch asbestos flex board.

Roof Type/R-value:

- Five ply built-up roofing, 15 year bond, one-inch shiplap, 2 x 12 joists, 3 inch rock wool batt insulation, 2 ply vapor barrier, 1/8 inch asbestos flex board.

Door Type/weather stripping:

- 1-36 inch solid wood core door, no insulation, weather stripping or door sweeps.
- 1 - double loading door set, 4 x 7 foot wood loading doors, no insulation, weather stripping or door sweeps. Some gaps visible.

Window type/caulking:

- 1 - 3 x 2 foot dual pane window in office, swing open casement window.

Other:

- There is a big gap in the wall at the truck fill line.
- Roof leak caused exhaust fan to be taken down. Whole remains in the ceiling where the exhaust fan used to be attached to.

MECHANICAL

Heating System:

- 1-4800 W unit heater in the office
- 1-5 kW unit heater in the process area, 1/4 hp electric motor.
- Note: a lot of space heating is obtained from the boilers during the winter months, however, unit heaters do operate for significant portions of the time.

Cooling System:

-

Ventilation System:

- 1-4 x 4 foot louver, manual open.
- Damper for former exhaust fan used to have a motorized damper which has subsequently been removed. Gaps were visible on the side of the duct.

HVAC Controls:

- Thermostat

HVAC Maintenance/Training:

-

Water Supply System:

- Domestic water supply system

Domestic Hot Water System:

- 3000 W upper element, 3000 W lower element, 240 V, 30 imperial gallon domestic water heater.

Water Fixtures:

- 1 - standard flush toilet
- 1 - sink

ELECTRICAL

Indoor Lighting:

- 10-4 foot fluorescent to lamp fixtures, T12.
- 2-8 foot fluorescent, 2 - lamp, T12, fluorescent fixtures.
- 1-200 W incandescent fixture.

Outdoor Lighting:

- 2 - metal halide exterior lights. Wattage unknown.

Exit Signs:

-

Motors:

- 2-25 hp Goulds recirculation pumps, 575 V, 25.7 amp, 1750 rpm, 89.5% nominal efficiency, 81% PF. Pump model 3656M, impeller diameter 10.5, size 4 x 6-13 centrifugal pump.
- 1-20 hp Goulds recirculation pump, 575 V, 20 amp, 1750 rpm, 88.5 % nominal efficiency, 84% PF.
- 1 - ceiling fan for air movement.

Parking Lot Plugs:

-

OTHER BUILDING SYSTEMS

- 1 - diesel fired fire pump used during power outages.
- 1 - propane fired, six-cylinder, 30 kilowatt standby generator set used to run accessories on boilers only during power outages as well as a few lights.

PROCESS SYSTEMS

Recirculation Boilers:

- 2 - Cleaver Brooks model 5, 40 hp. Controls are high/low and auto.
- Depending on the amount of snowfall, either one or two boilers are run at the same time. When snowfall is low, two boilers are operated. One boiler is operated when there is higher snowfall.
- Steam is used to heat the water through the use of tube and shell heat exchangers with 3/4" copper tubing.
- Three heat exchangers are located on the system with each heat exchanger and dedicated to an individual loop. Steam is regulated to each heat exchanger by a control valve to each heat exchanger.
- Temperature of the water entering the heating plant ranges from 35 to 36°F and is raised to temperature of 39 to 40°F for a total temperature rise of 4°F.
- The tanks for the boilers are filled approximately twice per day. Approximately 700 gallons per day can be used in all heating plants during winter months.
- A chlorine feed system is in place to provide additional chlorine residual within the distribution system. This consists of the diaphragm type chemical feed pump, 120 V.

BUILDING SERVICES (Hydro, Gas, Oil, Water, etc.)
• Main service is a 200 amp, 600 V, three phase power supply
NOTES

BUILDING INSPECTION INVENTORY

Revision 2

Municipality: Flin Flon

Date: June 1, 2006

Toured By: Tibor Takach

Construction Date: early 1950s

Building: Heating Plant #2

Address: 102 Oak Avenue

L x W x H: see below

Area: 1440 ft^2

Building Capacity:

Renovations:

No significant recent renovations.

Building Floor Plan:

48 x 30 foot exterior building dimensions. Ceiling height approximately 4 m.

Occupied Times:

Periodically approximately 3 times per day. Interior lighting is on all the time.

ARCHITECHTURAL/STRUCTURAL

Wall type/R-value:

- One-inch shiplap, building paper, wire mesh, stucco, 2 x 6 studs, 2 inch rock wool batt insulation, 2 ply vapor barrier, 3/16 inch asbestos flex board.

Roof Type/R-value:

- Five ply built-up roofing, 15 year bond, one-inch shiplap, 2 x 12 joists, 3 inch rock wool batt insulation, 2 ply vapor barrier, 1/8 inch asbestos flex board.

Door Type/weather stripping:

- 1-36 inch solid wood core door, no insulation, weather stripping or door sweeps.
- 1 - double loading door set, 4 x 7 foot wood loading doors, no insulation, weather stripping or door sweeps. Some gaps visible.

Window type/caulking:

- None

Other:

- Roof was rebuilt approximately 15 years ago. Roof is leaking

MECHANICAL

Heating System:

- 1-7.5 kW unit heater in the process area, 1/4 hp electric motor.
- Note: a lot of space heating is obtained from the boilers during the winter months, however, unit heaters operate for significant portions of the time.

Cooling System:

- None

Ventilation System:

- None other than louver
- 1-3 by 3 foot louver closed with plywood covers.

HVAC Controls:

- Thermostat

HVAC Maintenance/Training:

-

Water Supply System:

- Domestic water supply system
-

Domestic Hot Water System:

- None

Water Fixtures:

- None

ELECTRICAL

Indoor Lighting:

- 4-4 foot fluorescent to lamp fixtures, T12.
- 6-8 foot fluorescent, 2 - lamp, T12, fluorescent fixtures.

Outdoor Lighting:

- 3 -150 W incandescent.

Exit Signs:

- None

Motors:

- 1-20 hp booster pump, 91% nominal efficiency, runs 24/7. Maintains a system pressure of approximately 120 psi.
- 3-40 hp recirculation pumps, 91.7% nominal efficiency, all pumps are approximately 2 years old.
- 1-25 hp Cliff Lake Pumphouse circulating pump, 89.4% nominal efficiency.

Parking Lot Plugs:

-

OTHER BUILDING SYSTEMS

- 1 - gasoline fired standby pump used for emergency purposes during power outages.
- 1 - propane fired, six-cylinder, 30 kilowatt standby generator set used to run accessories on boilers only during power outages as well as a few lights.

PROCESS SYSTEMS

Recirculation Boilers:

- 1- Cleaver Brooks model 5, 40 hp. Controls are high/low and auto.
- 1 - Cleaver Brooks 60 hp recirculation boiler and accessories.
- Depending on the amount of snowfall, either one or two boilers are run at the same time. When snowfall is low, two boilers are operated. One boiler is operated when there is higher snowfall.
- Steam is used to heat the water through the use of tube and shell heat exchangers with 3/4" stainless steel tubing.
- Three heat exchangers are located on the system with each heat exchanger and dedicated to an individual loop. Steam is regulated to each heat exchanger by a control valve to each heat exchanger.
- Temperature of the water entering the heating plant ranges from 35 to 36°F and is raised to temperature of 39 to 40°F for a total temperature rise of 4°F.
- The tanks for the boilers are filled approximately twice per day. Approximately 700 gallons per day can be used in all heating plants during winter months.
- A chlorine feed system is in place to provide additional chlorine residual within the distribution system. This consists of the diaphragm type chemical feed pump, 120 V.

BUILDING SERVICES (Hydro, Gas, Oil, Water, etc.)

- Main service is a 400 amp, 600 V, three phase power supply

BUILDING INSPECTION INVENTORY

Revision 2

Municipality: Flin Flon

Date: June 1, 2006

Toured By: Tibor Takach

Construction Date: early 1950s

Building: Heating Plant #3

Address: 142 Main Street

L x W x H: see below

Area: 1575 ft^2

Building Capacity:

Renovations:

No significant recent renovations.

Building Floor Plan:

75 x 21 foot exterior building dimensions. Ceiling height approximately 3-4 m.

Occupied Times:

Periodically approximately 3 times per day. Interior lighting is on all the time.

ARCHITECHTURAL/STRUCTURAL

Wall type/R-value:

- One-inch shiplap, building paper, wire mesh, stucco, 2 x 6 studs, 2 inch rock wool batt insulation, 2 ply vapor barrier, 3/16 inch asbestos flex board.
- Recently added to buy for interior wall with batt insulation and vapor barrier.

Roof Type/R-value:

- Five ply built-up roofing, 15 year bond, one-inch shiplap, 2 x 12 joists, 3 inch rock wool batt insulation, 2 ply vapor barrier, 1/8 inch asbestos flex board.
- Roof is experiencing significant leaks.

Door Type/weather stripping:

- 1-36 inch solid wood core door, no insulation, weather stripping or door sweeps.
- 1 - double loading door set, 4 x 7 foot wood loading doors, no insulation, weather stripping or door sweeps. Some gaps visible.

Window type/caulking:

- 3-3 by 5 foot double pane window. Windows do not open.

Other:

- Roof was rebuilt approximately 15 years ago. Roof is leaking

MECHANICAL

Heating System:

- 1-Cochran heating boiler in process area, size W04, propane fired, supplies steam unit heater.
- 4800 W steam unit heater in pump room.

Cooling System:

- None

Ventilation System:

- 1 - 4 x 4 foot louvered opening in storage room.
- 4-3 by 3 foot louvered openings in genset room. Louvers have motorized dampers.

HVAC Controls:

- Thermostat
- Internal temperature maintained approximately 20° C. during winter.

HVAC Maintenance/Training:

-

Water Supply System:

- Domestic water supply system

Domestic Hot Water System:

- 1-5 gallon electric water heater

Water Fixtures:

- 1 - sink
- 1 - toilet standard flush.

ELECTRICAL

Indoor Lighting:

- 7-4 foot fluorescent to lamp fixtures, T12.
- 2-8 foot fluorescent, 2 - lamp, T12, fluorescent fixtures.

Outdoor Lighting:

- None

Exit Signs:

- None

Motors:

- 1-20 hp booster pump, 93% nominal efficiency.
- 1 - 7.5 hp Gorman Rupp booster pump, model T4A3SB, 89.5% nominal efficiency.
- 1-5 hp Westinghouse sewage lift pump.
- 1 -7 1/2 horsepower storm sewage pump.
- 1-125 hp, Canadian General electric induction motor, low efficiency unit.
- 1 - 1/3 horsepower vent fan.
- Note: pumps without stated efficiency are assumed to be low efficiency units.

Parking Lot Plugs:

-

OTHER BUILDING SYSTEMS

- 1 - Kohler 300 power system, diesel fired.

PROCESS SYSTEMS

BUILDING SERVICES (Hydro, Gas, Oil, Water, etc.)

- Main service is a 200 amp, 600 V, three phase power supply

NOTES

APPENDIX B

TABLES TO CALCULATE ENERGY SAVINGS

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Table B.1.1 Annual Energy Consumption for the Airport Terminal

	Energy Consumption (kWh)	**% of Total Energy Consumption**
HVAC	169,245	81%
Hot Water	1,473	1%
Lighting	39,475	19%
Total	**210,193**	

Table B.1.2 (a) - Electricity Usage for the Airport Terminal

	Consumption Data			Calculated Costs		
Month (2004-2005)	Maximum KVA	Billed KVA	Energy (kWh)	Demand Charge	Energy Charge	Total Charge
October	0	0	3,022	$0	$177	$227
November	0	0	3,232	$0	$189	$241
December	0	0	4,292	$0	$252	$312
January	0	0	5,122	$0	$300	$367
February	0	0	3,682	$0	$216	$271
March	0	0	3,172	$0	$186	$237
April	0	0	3,252	$0	$191	$244
May	0	0	2,522	$0	$151	$198
June	0	0	3,582	$0	$215	$270
July	0	0	2,692	$0	$162	$209
August	0	0	3,572	$0	$214	$270
September	0	0	2,722	$0	$163	$212
TOTALS		**0**	**40,864**	**$0**	**$2,416**	**$3,058**

Table B.1.2 (b) - Propane Consumption for the Airport Terminal

Month (2004-2005)	Propane (L)	Energy (kWh)	Total Charge
October	1,593	11,304	$798
November	2,555	18,131	$1,279
December	3,955	28,070	$1,981
January	3,902	27,690	$1,954
February	3,399	24,125	$1,702
March	3,367	23,897	$1,686
April	1,657	11,759	$830
May	1,892	13,428	$947
June	331	2,352	$166
July	86	607	$43
August	299	2,124	$150
September	823	5,842	$439
TOTAL	**23,859**	**169,329**	**$11,974**

Notes

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 the Airport Terminal

Description	Quantity	Current Conditions		After Improvements	
		Annual Energy Consumption (kWh)	Annual Cost	Annual Energy Consumption (kWh)	Annual Cost
4'x1 T12 Fluorescents - Convert to T8s (54).	54	7,938	$477	4,779	$287
4'x2 T12 Fluorescents - Convert to T8s (17).	34	4,998	$300	3,009	$181
8'x2 T12 Fluorescents - Convert to T8s (4).	8	2,794	$168	1,306	$78
60W Incandescent - Convert to compact fluorescent.	17	3,060	$184	816	$49
Incandescent Exit Signs - Convert to LEDs.	2	526	$32	53	$3
Parking lot plugs - Install parking lot controllers.	28	20,160	$1,210	10,080	$605
TOTALS		**39,475**	**$2,370**	**20,042**	**$1,203**

Annual Energy Savings (kWh)	**19,433**
Annual Cost Savings	**$1,167**
Percent Annual Energy Savings	**49%**

These calculations are assuming that this building is occupied for 15 hrs/day, Sun-Fri and 12 hrs/day on Sat.

The parking lot plugs are assumed to be used 100 days of the year for 12 hrs/day.

Table B.1.4 (a) Window and Door Infiltration Calculations for the Airport Terminal

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**
Weather-strip pedestrian doors.	30	0.05	125	102	42,232,630	12,377	$743
TOTALS						**12,377**	**$743**

Table B.1.4 (b) Upgrade Wall/Roof Insulation for the Airport Terminal

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 to R40.	3145	12.000	29,312	$1,760	40.00	8,794	$528	20,519	$1,232
TOTALS			**29,312**	**$1,760**		**8,794**	**$528**	**20,519**	**$1,232**

The terminal is assumed to be kept at 21℃.

The crack lengths are taken as a quarter the perimeter of the door

Table B.1.5 - Water Usage for the Airport Terminal

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	5	0.525	7,875	1.60	12,600	0.32	2,520	10,080	378	$23
Toilets	6	0.250	4,500	13.25	59,625	3.98	17,910	41,715	NA	NA
Urinals	1	0.023	70	3.80	267	3.80	267	0	NA	NA
Total					**72,492**		**20,697**	**51,795**	**378**	**$23**

Frequency at Which Fixtures are Used			
	Females	**Males**	**Totals**
Number of People	3	3	
Number of Toilets	6	6	
Number of Toilet Uses/day	3	1	
Toilet Uses/hour/fixture	0.1875	0.0625	0.250
Number of Sinks	5	5	
Number of Sink Uses/day	3	4	
Sink Uses/hr/fixture	0.225	0.3	0.525
Number of Urinals	0	1	
Number of Urinal Uses/day	0	3	
Urinal Uses/hr/fixture	0	0.023438	0.023

Current Hot Water Usage (kWh)		
Fixture	**L/Yr**	**kWh**
Sinks	12,600	472
Total		**472**

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 dual flush toilets use either 1.6 or 0.8 gallons per flush.
The current urinals are water efficient and consume 1 gallon per flush.

Table B.1.6 Energy Savings with Heating, Ventilating, and Air Conditioning for the Airport Terminal

Description	% of Time Unoccupied	Heating Degree Days below 64.4 F	Heating Degree Days below 59 F	Current Energy Used to Heat (kWh)	Energy Savings (kWh)
Setback Thermostats to 59 F	65.75%	11607.8	9956.34	169,329	15,841

Description	Efficiency of Standard Efficiency Boiler	Efficiency of Premium Efficiency Boiler	Current Energy Used for Heating (kWh)	Energy Savings (kWh)
Replace boiler with high efficiency boiler.	73%	85%	169,329	20,319

Table B.2.1 Annual Energy Consumption for the Airport Garage

	Energy Consumption (kWh)	% of Total Energy Consumption
HVAC	128,902	87%
Hot Water	3,684	2%
Lighting	16,052	11%
Total	**148,638**	

Table B.2.2 (a) - Electricity Usage for the Airport Garage

	Consumption Data			Calculated Costs		
Month (2004-2005)	Maximum KVA	Billed KVA	Energy (kWh)	Demand Charge	Energy Charge	Total Charge
October	0	0	1,560	$0	$91	$122
November	0	0	1,870	$0	$110	$143
December	0	0	2,360	$0	$138	$176
January	0	0	3,380	$0	$198	$244
February	0	0	2,570	$0	$151	$190
March	0	0	2,660	$0	$156	$196
April	0	0	3,520	$0	$206	$256
May	0	0	2,630	$0	$158	$198
June	0	0	2,100	$0	$126	$162
July	0	0	1,440	$0	$86	$117
August	0	0	1,570	$0	$94	$126
September	0	0	1,140	$0	$68	$96
TOTALS		**0**	**26,800**	**$0**	**$1,583**	**$2,023**

Table B.2.2 (b) - Propane Consumption for the Airport Garage

Month (2004-2005)	Propane (L)	Energy (kWh)	Total Charge
October	1,603	11,380	$803
November	2,191	15,552	$1,097
December	3,602	25,566	$1,804
January	3,250	23,063	$1,627
February	2,405	17,069	$1,204
March	2,245	15,931	$1,124
April	877	6,221	$439
May	738	5,235	$369
June	86	607	$43
July	0	0	$0
August	21	152	$11
September	150	1,062	$80
TOTAL	**17,168**	**121,838**	**$8,602**

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 the Airport Garage

Description	Quantity	Current Conditions		After Improvements	
		Annual Energy Consumption (kWh)	Annual Cost	Annual Energy Consumption (kWh)	Annual Cost
8' T12 Fluorescents - Convert to T8s (13x2).	26	16,052	$964	7,502	$450
TOTALS		**16,052**	**$964**	**7,502**	**$450**

Annual Energy Savings (kWh)	**8,550**
Annual Cost Savings	**$513**
Percent Annual Energy Savings	**53%**

These calculations are assuming that this building is occupied for 15 hrs/day, Sun-Fri and 12 hrs/day on Sat.

Table B.2.4 (a) Window and Door Replacement Calculations for the Airport Garage

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
Replace broken window with triple pane window.	8.00	1.000	770	$46	6.25	123	$7	647	$39
TOTALS			**770**	**$46**		**123**	**$7**	**647**	**$39**

Table B.2.4 (b) Window and Door Infiltration Calculations for the Airport Garage

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
Weather-strip pedestrian doors.	5	0.05	125	17	6,058,328	1,776	$107
Weather-strip vehicle doors.	30	0.05	125	102	36,349,969	10,653	$640
Caulk vehicle doors.	240	0.005	10	66	23,263,980	6,818	$409
TOTALS						**19,247**	**$1,156**

Table B.2.4 (c) Upgrade Wall/Roof Insulation for the Airport Garage

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 to R40.	3024	12.000	24,259	$1,456	40.00	7,278	$437	16,981	$1,020
Upgrade Wall Insulation to R16.	3840	8.000	46,207	$2,774	16.00	23,104	$1,387	23,104	$1,387
TOTALS			**70,466**	**$4,231**		**30,381**	**$1,824**	**40,085**	**$2,407**

The garage is assumed to be kept at 21℃.

The crack length around the ped door is taken as a quarter of the perimeter and the crack lengths around the vehicle doors is taken as an eighth of the perimeter.

Table B.2.5 - Water Usage for the Airport Garage

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	1.4	2,860	0.32	915	0.32	915	0	0	$0
Toilets	1	1.4	2,860	13.25	37,895	3.98	11,383	26,512	NA	NA
Shower	1	0.4	780	66.25	51,675	47.30	36,894	14,781	554	$33
Total					**90,485**		**49,192**	**41,293**	**554**	**$33**

Frequency at Which Fixtures are Used			
	Females	Males	Totals
Number of People	1	2	
Number of Toilet Uses/day	3	4	
Number of Toilets	1	1	
Toilet Uses/hour/fixture	0.375	1	1.375
Number of Sinks	1	1	
Number of Sink Uses/day	3	4	
Sink Uses/hr/fixture	0.375	1	1.375
Shower Uses/hour/fixture	0.125	0.25	0.375

Current Hot Water Usage (kWh)		
Fixture	L/Yr	kWh
Sinks	915	34
Showers	51,675	1,936
Total		**1,971**

The current sinks are assumed to consume 0.5 gpm

The current toilets are assumed to use 3.5 gallons per flush and the new dual flush toilets use either 1.6 or 0.8 gallons per flush.

The current showers are assumed to use 3.5 gpm and the new showers use 2.5 gpm.

Table B.2.6 Energy Savings with Heating, Ventilating, and Air Conditioning for the Airport Garage

Description	% of Time Unoccupied	Heating Degree Days below 64.4 F	Heating Degree Days below 59 F	Current Energy Used to Heat (kWh)	Energy Savings (kWh)
Setback Thermostats to 59 F	69.73%	11607.8	9956.34	121,838	12,087

Description	Efficiency of Standard Efficiency Boiler	Efficiency of Premium Efficiency Boiler	Current Energy Used for Heating (kWh)	Energy Savings (kWh)
Replace unit heaters with high efficiency furnaces.	80%	95%	121,838	18,276

Table B.3.1 Annual Energy Consumption for the Sweeper Building and Sand Storage

	Energy Consumption (kWh)	% of Total Energy Consumption
HVAC	452,827	97%
Lighting	15,855	3%
Total	**468,682**	

Table B.3.2 (a) - Electricity Usage for the Sweeper Building and Sand Storage

	Consumption Data			Calculated Costs		
Month (2004-2005)	Maximum KVA	Billed KVA	Energy (kWh)	Demand Charge	Energy Charge	Total Charge
October	72	22	11,400	$183	$662	$981
November	117	67	42,600	$557	$1,515	$2,381
December	129	79	65,250	$657	$2,045	$3,099
January	141	91	86,700	$757	$2,547	$3,784
February	141	91	64,200	$757	$2,021	$3,184
March	141	91	57,300	$757	$1,859	$3,001
April	123	73	28,050	$607	$1,175	$2,075
May	93	43	19,950	$358	$1,009	$1,576
June	75	25	10,050	$208	$603	$943
July	30	0	7,650	$0	$459	$542
August	27	0	8,100	$0	$486	$572
September	45	0	7,350	$0	$441	$521
TOTALS	**1134**	**582**	**408,600**	**$4,842**	**$14,823**	**$22,660**

Table B.3.2 (b) - Propane Consumption for Sweeper Building and Sand Storage

Month (2004-2005)	Propane (L)	Energy (kWh)	Total Charge
October	631	4,476	$316
November	1,187	8,421	$594
December	1,817	12,897	$910
January	1,657	11,759	$830
February	1,358	9,635	$680
March	1,518	10,773	$760
April	299	2,122	$150
May	0	0	$0
June	0	0	$0
July	0	0	$0
August	0	0	$0
September	0	0	$0
TOTAL	**8,466**	**60,082**	**$4,239**

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.3.3 - Lighting Analysis Summary for the Sweeper Building and Sand Storage

Description	Quantity	Current Conditions		After Improvements	
		Annual Energy Consumption (kWh)	Annual Cost	Annual Energy Consumption (kWh)	Annual Cost
Sand Storage: 4' T12 Fluorescents - Convert to T8s (21x2).	42	10,916	$655	6,572	$395
Sweeper Building: 8' T12 Fluorescents - Convert to T8s (4x2).	8	4,939	$297	2,308	$139
TOTALS		**15,855**	**$952**	**8,880**	**$533**

Annual Energy Savings (kWh)	**6,975**
Annual Cost Savings	**$419**
Percent Annual Energy Savings	**44%**

These calculations are assuming that this building is occupied for 15 hrs/day, Sun-Fri and 12 hrs/day on Sat.

Table B.3.4 (a) Window and Door Infiltration Calculations for the Sweeper Building and Sand Storage

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
Sweeper Building							
Weatherstrip pedestrian door.	5	0.05	125	17	6,851,071	2,008	$121
Caulk pedestrian door.	20	0.005	10	5	2,192,343	643	$39
Caulk vehicle door.	81	0.005	10	22	8,878,988	2,602	$156
Sand Storage							
Weatherstrip pedestrian door.	5	0.05	125	17	6,851,071	2,008	$121
Caulk pedestrian door.	20	0.005	10	5	2,192,343	643	$39
Weatherstrip vehicle door.	42	0.05	125	143	57,548,998	16,866	$1,013
Caulk vehicle door.	336	0.005	10	92	36,831,359	10,794	$648
TOTALS						**35,563**	**$2,135**

Table B.3.4 (b) Upgrade Wall/Roof Insulation for the Sweeper Building and Sand Storage

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
Sweeper Building									
Upgrade Roof Insulation to R40.	1296	5.000	28,217	$1,694	40.00	3,527	$212	24,690	$1,482
Upgrade Wall Insulation to R20.	2028	7.000	31,539	$1,894	20.00	11,039	$663	20,500	$1,231
Sand Storage									
Upgrade Roof Insulation to R40.	1080	12.000	9,798	$588	40.00	2,939	$176	6,858	$412
Upgrade Wall Insulation to R20.	1848	8.000	25,147	$1,510	20.00	10,059	$604	15,088	$906
TOTALS			**94,700**	**$5,686**		**27,564**	**$1,655**	**67,136**	**$4,031**

These buildings are assumed to be kept at 21 ^oC.

The crack lengths are taken as a quarter the perimeter of the ped door and an eighth of the perimeter of the vehicle door.

Table B.3.5 Energy Savings with Heating, Ventilating, and Air Conditioning for the Sweeper Building and Sand Storage

Description	% of Time Unoccupied	Heating Degree Days below 64.4 F	Heating Degree Days below 59 F	Current Energy Used to Heat (kWh)	Energy Savings (kWh)
Setback Thermostats to 59 F	39.45%	11607.8	9956.34	60,082	3,372

Description	Efficiency of Standard Efficiency Boiler	Efficiency of Premium Efficiency Boiler	Current Energy Used for Heating (kWh)	Energy Savings (kWh)
Replace unit heaters with high efficiency furnaces.	75%	95%	60,082	12,016

Table B.4.1 - Energy Breakdown for Whitney Forum Arena

	Energy Consumption (kWh)	**% of Total Energy Consumption**
HVAC	2,514,197	86%
Lighting	159,287	5%
Hot Water	53,236	2%
Motors	212,958	7%
Total	**2,939,677**	

Table B.4.2 (a) - Electricity Usage for the Whitney Forum Arena

	Consumption Data			Calculated Costs		
Month (2005-2006)	Maximum KVA	Billed KVA	Energy (kWh)	Demand Charge	Energy Charge	Total Charge
September	228	178	137,280	$1,481	$3,730	$8,083
October	281	231	140,040	$1,922	$3,794	$7,664
November	263	213	130,320	$1,772	$3,567	$7,237
December	400	350	126,600	$2,912	$3,480	$7,324
January	412	362	153,600	$3,012	$4,112	$9,405
February	401	351	128,640	$2,920	$3,528	$8,494
March	370	320	148,080	$2,662	$3,983	$8,776
April	348	298	70,200	$2,479	$2,237	$6,062
May	298	248	24,000	$2,063	$1,108	$4,051
June	302	252	19,080	$2,097	$988	$3,947
July	302	252	19,080	$2,097	$988	$3,947
August	302	252	19,080	$2,097	$988	$3,947
TOTAL		**3307**	**1,116,000**	**$27,514**	**$32,503**	**$78,935**

Table B.4.2 (b) - Oil Consumption for the Whitney Forum Arena

Month (2004-2005)	Oil (L)	Energy (kWh)	Total Charge
October	13,648	143,031	$8,048
November	33,457	350,629	$19,730
December	30,498	319,619	$17,985
January	21,935	229,879	$12,935
February	18,879	197,852	$11,133
March	23,468	245,945	$13,839
April	15,767	165,238	$9,298
May	0	0	$0
June	0	0	$0
July	0	0	$0
August	3,784	39,656	$2,231
September	12,579	131,828	$7,418
TOTAL	**174,015**	**1,823,677**	**$102,617**

Notes

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

No electricity consumption data was available for the months of July or August. The consumption for these months was therefore taken as the consumption in June.

Table B.4.3 - Lighting Analysis Summary for the Whitney Forum Arena

Description	Quantity	Current Conditions		After Improvements	
		Annual Energy Consumption (kWh)	Annual Cost	Annual Energy Consumption (kWh)	Annual Cost
4' x 2 T8 fluorescent lamps (50) - no upgrade recommended.	100	13,373	$803	13,373	$803
8' x 2 T12 fluorescent lamps (59) - convert to T8 fluorescents.	118	62,266	$3,738	29,100	$1,747
4' x 2 T12 fluorescent lamps (20) - convert to T8 fluorescents.	40	8,885	$533	5,349	$321
100W Indoor incandescents - convert to compact fluorescents.	20	9,067	$544	2,539	$152
360W Metal halides in rink - no upgrade recommended.	38	62,016	$3,723	62,016	$3,723
Incandescent Exit Signs - Replace with LEDs.	14	3,679	$221	368	$22
TOTALS		**159,287**	**$9,564**	**112,746**	**$6,769**

Annual Energy Savings (kWh)	**46,541**
Annual Cost Savings	**$2,794**
Percent Annual Energy Savings	**29%**

The arena is assumed to be occupied for 16 hrs/d, 7 ds/wk for 8 mos and 8 hrs/d, 5 ds/wk for 4 mos.

Table B.4.4 (a) Window and Door Replacement Calculations for Whitney Forum Arena

Description	Existing				New			Savings	
	Area (ft^2)	R-Value (°F ft^{2}hr/BTU)	Annual Heat Loss (kWh)	Cost	R-Value (°F ft^{2}hr/BTU)	Annual Heat Loss (kWh)	Cost	Energy (kWh)	Cost
Replace old rink doors (4).	84.00	1.578	2,136	$128	6.67	505	$30	1,631	$98
Replace rink windows.	68.44	1.000	2,746	$165	6.25	439	$26	2,306	$138
Replace window to outside.	8.00	1.000	816	$49	6.25	131	$8	686	$41
TOTALS			**5,698**	**$342**		**1,075**	**$65**	**4,623**	**$278**

Table B.4.4 (b) Window and Door Infiltration Calculations for Whitney Forum Arena

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
Weatherstrip rink doors (12).	60	0.05	125	205	30,294,408	8,878	$406
Caulk rink doors (12).	60	0.005	10	16	2,423,553	710	$32
Weatherstrip outside doors (16).	80	0.05	125	273	102,766,067	30,118	$1,376
Caulk outside doors (16).	320	0.005	10	87	32,885,142	9,638	$440
TOTALS						**49,344**	**$2,255**

The crack lengths around the doors is taken as a quarter of the perimeter.

The temperature is maintained at 21°C (70°F) except the rink area is maintained at 7.2°C (45°F).

Table B.4.5 - Water Usage for the Whitney Forum Arena

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	10	2.25	102,000	1.60	163,200	0.32	32,640	130,560	4,893	$294
Toilets	10	0.30	13,600	6.00	81,600	6.00	81,600	0	NA	NA
Toilets	15	0.68	45,900	13.25	608,175	6.00	275,400	332,775	NA	NA
Urinals	18	0.63	51,000	3.80	193,800	3.80	193,800	0	NA	NA
Showers	20	0.08	7,083	47.30	335,042	47.30	335,042	0	0	$0
Total					**1,381,817**		**918,482**	**463,335**	**4,893**	**$294**

Frequency at Which Fixtures are Used			
	Females	**Males**	**Totals**
Average Number of People	20	30	
Number of Toilet Uses/day	3	1	
Number of Toilets	25	25	
Toilet Uses/hour/fixture	0.30	0.15	0.45
Number of Urinal Uses/day	0	3	
Number of Urinals	0	18	
Urinal Uses/hour/fixture	0	0.63	0.63
Number of Sinks	10	10	
Number of Sink Uses/day	3	4	
Sink Uses/hr/fixture	0.75	1.50	2.25
Number of Showers	20	20	
Number of Shower Uses/day	1	1	
Shower Uses/hr/fixture	0.03	0.05	0.08

Current Hot Water Usage (kWh)		
Fixture	**L/Yr**	**kWh**
Sinks	163,200	6,116
Showers	335,042	12,555
Total		**18,671**

The toilets are assumed to consume 1.6 gallons per flush and the water efficient toilets consume 1.5 gpf

The high flow sinks consume 2.5 gallons per minute and the water efficient sinks consume 0.5 gpm

The urinals are assumed to consume 1 gpf.

The current showers are assumed to use 2.5 gpm

Table B.4.6 Energy Savings with Heating, Ventilating, and Air Conditioning for Whitney Forum Arena

Description	Heating Degree Days below 50F	Heating Degree Days below 40F	Current Energy Used to Heat Rink (kWh)	Energy Savings (kWh)
Install programmable thermostat on 1 rink steam heater; setback by 10°F.	7562.0	5379.42	437,683	126,325
Install programmable thermostat for remaining 2 rink unit heaters; setback temperature by 10°F.	7562.0	5379.42	437,683	126,325

Description	Quantity	Heating Efficiency	HDD below 64.4F or 45F	Flow Rate (cfm)	Energy Savings (kWh)
Install motorized dampers on mechanical room fans.	6	80%	11,608	50	33,059
Install motorized dampers on rink exhaust fans.	4	80%	6,450	50	12,246
Install countdown timer for greasehood exhaust fan.	1	80%	11,608	3000	165,293

Table B.4.7 Energy Consumption and Savings Calculations for Motors in Whitney Forum Arena

Description	Rated HP	Required HP	# of hours	Current Motor		
				Actual HP	kW	kWh
Compressor	50	40	2,880	44.40	33.11	95,354
Spray Pump	5	4	2,880	4.44	3.31	9,535
Brine Pump	25	20	5,760	22.20	16.55	95,354
Condenser Fan 1	10	8	960	8.88	6.62	6,357
Condenser Fan 2	5	4	960	4.44	3.31	3,178
Condenser Fan 3	5	4	960	4.44	3.31	3,178
TOTALS						**212,958**

Table B.5.1 - Energy Breakdown for Community Centre

	Energy Consumption (kWh)	% of Total Energy Consumption
HVAC	524,027	86%
Lighting	79,128	13%
Hot Water	4,470	1%
Total	**607,624**	

Table B.5.2 (a) - Electricity Usage for the Community Centre

	Consumption Data			Calculated Costs		
Month (2004-2005)	Maximum KVA	Billed KVA	Energy (kWh)	Demand Charge	Energy Charge	Total Charge
October	54	4	12,480	$33	$703	$865
November	43	0	13,920	$0	$759	$890
December	61	11	22,560	$92	$1,047	$1,322
January	65	15	27,840	$125	$1,170	$1,501
February	57	7	20,640	$58	$1,002	$1,233
March	59	9	17,760	$75	$907	$1,144
April	59	9	19,200	$75	$962	$1,222
May	90	40	13,920	$333	$777	$1,291
June	54	4	11,520	$33	$683	$841
July	95	45	18,720	$374	$966	$1,553
August	92	42	11,040	$349	$663	$1,179
September	73	23	10,080	$191	$605	$933
TOTAL		**209**	**199,680**	**$1,739**	**$10,244**	**$13,975**

Table B.5.2 (b) - Oil Consumption for the Community Centre

Month (2004-2005)	Oil (L)	Energy (kWh)	Total Charge
October	1624	17,020	$958
November	2908	30,476	$1,715
December	5399	56,582	$3,184
January	20212	211,822	$11,919
February	5103	53,479	$3,009
March	3680	38,566	$2,170
April	0	0	$0
May	0	0	$0
June	0	0	$0
July	0	0	$0
August	0	0	$0
September	0	0	$0
TOTAL	**38,926**	**407,944**	**$22,955**

Notes

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

Table B.5.3 - Lighting Analysis Summary for the Community Centre

Description	Quantity	Current Conditions		After Improvements	
		Annual Energy Consumption (kWh)	Annual Cost	Annual Energy Consumption (kWh)	Annual Cost
4' x 2 T12 fluorescent lamps (115) - convert to T8 fluorescents.	230	53,330	$3,202	32,107	$1,928
4' x 4 T12 fluorescent lamps (11) - convert to T8 fluorescents.	44	10,202	$613	6,142	$369
Metal Halides - No upgrades recommended.	16	6,240	$375	6,240	$375
150W Incandescents - Convert to compact fluorescents.	9	6,388	$384	1,618	$97
Incandescent Exit Signs - convert to LEDs.	6	1,577	$95	158	$9
Install occupancy sensors on washroom lights.	3	1,391	$84	696	$42
TOTALS		**79,128**	**$4,751**	**46,960**	**$2,820**

Annual Energy Savings (kWh)	**32,168**
Annual Cost Savings	**$1,931**
Percent Annual Energy Savings	**41%**

The auditorium is assumed to be occupied for 30 hours/week.
The offices and weight room are assumed to be occupied from 9am - 10pm for 7 days/week.
The 2nd floor is assumed to be occupied for 14 hours/week.

Table B.5.4 (a) Window and Door Replacement Calculations for the Community Centre

Description	Existing				New			Savings	
	Area (ft^2)	R-Value (°F ft^{2}hr/BTU)	Annual Heat Loss (kWh)	Cost	R-Value (°F ft^{2}hr/BTU)	Annual Heat Loss (kWh)	Cost	Energy (kWh)	Cost
Replace 6' x 2' windows in seniors centre with triple pane windows (8).	96.00	2.000	4,899	$181	6.25	1,568	$58	3,331	$123
Replace 3' x 5' windows on main floor with triple pane windows (6).	90.00	2.000	4,593	$170	6.25	1,470	$54	3,123	$116
TOTALS			**9,491**	**$351**		**3,037**	**$112**	**6,454**	**$239**

Table B.5.4 (b) Window and Door Infiltration Calculations for the Community Centre

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
Weatherstrip pedestrian doors (9).	45	0.05	125	154	57,806,710	16,941	$627
Caulk pedestrian doors (9).	180	0.005	10	49	18,498,147	5,421	$201
TOTALS						**22,363**	**$828**

Table B.5.4 (c) Wall/Roof Insulation Upgrade Calculations for the Community Centre

Description	Existing				New			Savings	
	Area (ft^2)	R-Value (°F ft^{2}hr/BTU)	Annual Heat Loss (kWh)	Cost	R-Value (°F ft^{2}hr/BTU)	Annual Heat Loss (kWh)	Cost	Energy (kWh)	Cost
Upgrade roof insulation to R-40.	12288.00	7.500	167,214	$6,190	40.00	31,353	$1,161	135,861	$5,030
TOTALS			**167,214**	**$6,190**		**31,353**	**$1,161**	**135,861**	**$5,030**

The crack lengths around the doors is taken as a quarter of the perimeter.
The temperature is maintained at 21°C (70°F).

Table B.5.5 - Water Usage for the Community Centre

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	18	0.7	20,475	1.60	32,760	0.32	6,552	26,208	982	$59
Toilets	14	0.5	11,700	13.25	155,025	3.98	46,508	108,518	NA	NA
Urinals	8	0.7	8,775	9.50	83,363	3.80	33,345	50,018	NA	NA
Showers	2	0.1	390	66.25	25,838	47.30	18,447	7,391	277	$17
Total					**296,985**		**104,852**	**192,134**	**1,259**	**$76**

Frequency at Which Fixtures are Used			
	Females	**Males**	**Totals**
Number of People	15	15	
Number of Toilet Uses/day	3	1	
Number of Toilets	14	14	
Toilet Uses/hour/fixture	0.40	0.13	0.54
Number of Urinal Uses/day	0	3	
Number of Urinals	0	8	
Urinal Uses/hour/fixture	0	0.70	0.70
Number of Sinks	18	18	
Number of Sink Uses/day	3	4	
Sink Uses/hr/fixture	0.31	0.42	0.73
Number of Showers	2	2	
Number of Shower Uses/day	1	1	
Shower Uses/hr/fixture	0.06	0.06	0.13

Current Hot Water Usage (kWh)		
Fixture	**L/Yr**	**kWh**
Sinks	32,760	1,228
Showers	25,838	968
Total		**2,196**

The high flow toilets consume 3.5 gallons per flush and the water efficient toilets consume 1.5 / 0.8 gpf
The high flow sinks consume 2.5 gallons per minute and the water efficient sinks consume 0.5 gpm
The current urinals consume 2.5 gpf and the low flow urinals consume 1 gpf.
The current showers are assumed to use 3.5 gpm and the new showers use 2.5 gpm

Table B.5.6 Energy Savings with Heating, Ventilating, and Air Conditioning for Community Centre

Description	Quantity	Heating Efficiency	HDD below 70 F	Flow Rate (cfm)	Energy Savings (kWh)
Replace backdraft dampers with motorized dampers.	3	80%	11,608	40	13,224
Install CO_2 sensor to control ventilation to hall.	1	100%	11,608	3500	49,985

Description	% Improvement in Cooling Efficiency	Current Energy Used for Cooling (kWh)	Energy Savings (kWh)
Replace seniors room condenser with higher efficiency condenser.	21%	31,442	6,603
Replace weight room condenser with higher efficiency condenser.	21%	10,481	2,201

Description	Current Efficiency	New Efficiency	Current Energy Consumed by Boiler (kWh)	Energy Savings (kWh)
Replace boiler with electric hot water boilers.	60%	100%	407,944	163,178

Table B.6.1 - Energy Breakdown for the Aqua Centre

	Energy Consumption (kWh)	**% of Total Energy Consumption**
HVAC	487,292	51%
Pool Heating	262,388	28%
Lighting	82,299	9%
Hot Water	77,306	8%
Motors	37,886	4%
Total	**947,171**	

Table B.6.2 (a) - Electricity Usage for the Aqua Centre

	Consumption Data			Calculated Costs		
Month (2004-2005)	Maximum KVA	Billed KVA	Energy (kWh)	Demand Charge	Energy Charge	Total Charge
October	173	123	70,200	$1,023	$2,161	$3,655
November	169	119	83,700	$990	$2,477	$3,977
December	180	130	106,200	$1,082	$3,003	$4,681
January	185	135	98,100	$1,123	$2,813	$4,513
February	173	123	86,220	$1,023	$2,536	$4,082
March	176	126	79,200	$1,048	$2,371	$3,923
April	181	131	72,360	$1,090	$2,211	$4,491
May	159	109	65,520	$907	$2,123	$3,479
June	140	90	48,600	$749	$1,709	$2,827
July	122	72	47,520	$599	$1,683	$2,627
August	127	77	43,560	$641	$1,586	$2,564
September	135	85	58,140	$707	$1,943	$3,046
TOTAL		**1320**	**859,320**	**$10,982**	**$26,617**	**$43,866**

Table B.6.2 (b) - Propane Consumption for the Aqua Centre

Month (2004-2005)	Propane (L)	Energy (kWh)	Total Charge
October	1175.86	8,345	$564
November	1111.72	7,890	$557
December	1047.58	7,435	$525
January	962.06	6,828	$482
February	1133.1	8,042	$567
March	1507.23	10,697	$755
April	1175.86	8,345	$589
May	1603.44	11,380	$803
June	897.93	6,373	$450
July	630.69	4,476	$316
August	684.13	4,855	$343
September	448.96	3,186	$239
TOTAL	**12,379**	**87,851**	**$6,188**

Notes

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

Table B.6.3 - Lighting Analysis Summary for the Aqua Centre

Description	Quantity	Current Conditions		After Improvements	
		Annual Energy Consumption (kWh)	Annual Cost	Annual Energy Consumption (kWh)	Annual Cost
Metal Halides in pool - no upgrade recommended.	20	35,880	$2,154	35,880	$2,154
4' x 2 T12 fluorescent lamps (29) - convert to T8 fluorescents.	58	20,394	$1,224	12,278	$737
4' x 4 T12 fluorescent lamps (6) - convert to T8 fluorescents.	24	8,439	$507	5,081	$305
100W Indoor incandescents - convert to compact fluorescents.	20	14,352	$862	4,019	$241
Incandescent Exit Signs - Convert to LED modules.	5	1,314	$79	131	$8
Parking lot plugs.	4	1,920	$115	960	$58
TOTALS		**82,299**	**$4,941**	**58,349**	**$3,503**

Annual Energy Savings (kWh)	**23,950**
Annual Cost Savings	**$1,438**
Percent Annual Energy Savings	**29%**

The pool is assumed to be occupied for 598 hours/month.

Table B.6.4 (a) Window and Door Replacement Calculations for the Aqua Centre

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
Replace 3' x 5' windows with triple pane windows (2).	30.00	2.000	1,225	$74	6.25	392	$24	833	$50
TOTALS			**1,225**	**$74**		**392**	**$24**	**833**	**$50**

Table B.6.4 (b) Window and Door Infiltration Calculations for the Aqua Centre

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
Weatherstrip pedestrian doors (6).	30	0.05	125	102	30,830,245	9,035	$413
Caulk windows (2).	40	0.005	10	11	3,288,559	964	$44
TOTALS						**9,999**	**$457**

The crack lengths around the doors is taken as a quarter of the perimeter.

The temperature is maintained at 21°C (70°F).

Table B.6.5 - Water Usage for the Aqua Centre

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	6	1.2	50,232	1.60	80,371	0.32	16,074	64,297	2,409	$145
Toilets	7	0.6	28,704	13.25	380,328	3.98	114,098	266,230	NA	NA
Urinals	1	0.3	2,392	9.50	22,724	3.80	9,090	13,634	NA	NA
Showers	8	0.5	28,704	66.25	1,901,640	47.30	1,357,699	543,941	20,384	$1,223
Total					**2,385,063**		**1,496,961**	**888,102**	**22,793**	**$1,368**

Frequency at Which Fixtures are Used			
	Females	**Males**	**Totals**
Number of People	8	8	
Number of Toilet Uses/day	3	1	
Number of Toilets	7	7	
Toilet Uses/hour/fixture	0.43	0.14	0.57
Number of Urinal Uses/day	0	1	
Number of Urinals	0	3	
Urinal Uses/hour/fixture	0	0.33	0.33
Number of Sinks	6	6	
Number of Sink Uses/day	3	4	
Sink Uses/hr/fixture	0.50	0.67	1.17
Number of Showers	8	8	
Number of Shower Uses/day	1	1	
Shower Uses/hr/fixture	0.25	0.25	0.50

Current Hot Water Usage (kWh)		
Fixture	**L/Yr**	**kWh**
Sinks	80,371	3,012
Showers	1,901,640	71,262
Total		**74,274**

The high flow toilets consume 3.5 gallons per flush and the water efficient toilets consume 1.5 / 0.8 gpf
The high flow sinks consume 2.5 gallons per minute and the water efficient sinks consume 0.5 gpm
The urinals are assumed to consume 2.5 gallons per flush and the new urinals consume 1 gpf.
The current showers are assumed to use 3.5 gpm and the new showers use 2.5 gpm

Table B.6.6 Energy Consumption and Savings Calculations for Motors in the Aqua Centre

Description	Rated HP	Required HP	# of hours	Current Motor			Energy Savings of a High Efficiency Motor		
				Actual HP	kW	kWh	Actual HP	kW	kWh
Fan Motor 1	5	4	3,588	4.72	3.52	12,629	0.11	0.08	994
Fan Motor 2	5	4	3,588	4.72	3.52	12,629	0.11	0.08	994
Pool Circulating Pump	5	4	3,588	4.72	3.52	12,629	0.11	0.08	994
TOTALS						**37,886**			**2,983**

Table B.7.1 - Energy Breakdown for the Public Library

	Energy Consumption (kWh)	**% of Total Energy Consumption**
Heating	170,950	79%
Lighting	42,044	20%
Hot Water	2,315	1%
Total	**215,310**	

Table B.7.2 (a) - Electricity Usage for the Public Library

	Consumption Data			Calculated Costs		
Month (2004-2005)	Maximum KVA	Billed KVA	Energy (kWh)	Demand Charge	Energy Charge	Total Charge
October	40	0	8,560	$0	$502	$597
November	39	0	17,120	$0	$882	$1,030
December	56	6	18,480	$50	$934	$1,147
January	55	5	25,600	$42	$1,118	$1,347
February	50	0	17,280	$0	$888	$1,038
March	48	0	14,640	$0	$787	$922
April	49	0	13,680	$0	$750	$890
May	38	0	10,160	$0	$610	$720
June	40	0	8,800	$0	$528	$627
July	27	0	8,560	$0	$514	$611
August	31	0	9,040	$0	$543	$644
September	24	0	6,560	$0	$394	$474
TOTAL		**11**	**158,480**	**$92**	**$8,449**	**$10,047**

Table B.7.2 (b) - Propane Consumption for the Public Library

Month (2004-2005)	Propane (m^3)	Energy (kWh)	Total Charge
November	158.5752	4,128	$268
December	563.5083	14,668	$951
January	495.5475	12,899	$836
February	396.438	10,319	$669
March	365.2893	9,508	$616
April	59.4657	1,548	$125
May	96.2778	2,506	$203
June	0	0	$0
July	0	0	$0
August	0	0	$0
September	0	0	$0
October	48.1389	1,253	$101
TOTAL	**2,183**	**56,830**	**$3,769**

Notes

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

Table B.7.3 - Lighting Analysis Summary for the Public Library

Description	Quantity	Current Conditions		After Improvements	
		Annual Energy Consumption (kWh)	Annual Cost	Annual Energy Consumption (kWh)	Annual Cost
4' x 4 T12 fluorescent lamps (31) - convert to T8 fluorescents.	124	16,600	$997	9,994	$600
Main Floor 4' x 2 T12 fluorescent lamps (28) - convert to T8 fluorescents.	56	7,497	$450	4,513	$271
100W Indoor incandescents - convert to compact fluorescents.	17	4,644	$279	1,300	$78
60W Indoor incandescents - convert to compact fluorescents.	24	3,934	$236	1,049	$63
Outdoor lights - Install photocells on lights.	12	6,307	$379	3,154	$189
Incandescent Exit Signs - Replace with LEDs.	8	2,102	$126	210	$13
Install parking lot controllers.	2	960	$58	480	$29
TOTALS		**42,044**	**$2,524**	**20,700**	**$1,243**

Annual Energy Savings (kWh)	**21,344**
Annual Cost Savings	**$1,281**
Percent Annual Energy Savings	**51%**

The library is occupied for 44 hours/week in the summer and 56 hours/week in the winter.

Table B.7.4 (a) Window and Door Replacement Calculations for Public Library

Description	Existing				New			Savings	
	Area (ft^2)	R-Value (°F ft^{2}hr/BTU)	Annual Heat Loss (kWh)	Cost	R-Value (°F ft^{2}hr/BTU)	Annual Heat Loss (kWh)	Cost	Energy (kWh)	Cost
Replace 6' x 10' windows with triple pane windows (4).	240.00	2.000	12,247	$735	6.25	3,919	$235	8,328	$500
Replace 3' x 2' windows with triple pane windows (3).	18.00	2.000	919	$55	6.25	294	$18	625	$38
TOTALS			**13,166**	**$790**		**4,213**	**$253**	**8,953**	**$538**

Table B.7.4 (b) Window and Door Infiltration Calculations for Public Library

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
Weatherstrip pedestrian doors (2).	10	0.05	125	34	12,845,935	3,765	$172
Caulk pedestrian doors (2).	40	0.005	10	11	4,110,699	1,205	$55
Caulk windows (7).	158	0.005	10	43	16,237,262	4,759	$217
TOTALS						**9,728**	**$445**

Table B.7.4 (c) Wall/Roof Insulation Upgrade Calculations for Public Library

Description	Existing				New			Savings	
	Area (ft^2)	R-Value (°F ft^{2}hr/BTU)	Annual Heat Loss (kWh)	Cost	R-Value (°F ft^{2}hr/BTU)	Annual Heat Loss (kWh)	Cost	Energy (kWh)	Cost
Upgrade roof insulation to R40.	4485.00	12.000	38,145	$2,290	40.00	11,443	$687	26,701	$1,603
TOTALS			**38,145**	**$2,290**		**11,443**	**$687**	**26,701**	**$1,603**

The crack lengths around the doors is taken as a quarter of the perimeter.

The temperature is maintained at 21°C (70°F).

Table B.7.5 - Water Usage for the Public Library

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	5	1.1	14,343	1.60	22,949	0.32	4,590	18,359	688	$41
Toilets	5	0.6	8,196	13.25	108,597	3.98	32,579	76,018	NA	NA
Urinals	1	2.3	6,147	9.50	58,397	3.80	23,359	35,038	NA	NA
Total					**189,942**		**60,527**	**129,415**	**688**	**$41**

Frequency at Which Fixtures are Used			
	Females	**Males**	**Totals**
Number of People	6	6	
Number of Toilet Uses/day	3	1	
Number of Toilets	5	5	
Toilet Uses/hour/fixture	0.45	0.15	0.60
Number of Urinal Uses/day	0	3	
Number of Urinals	0	1	
Urinal Uses/hour/fixture	0	2.25	2.25
Number of Sinks	5	5	
Number of Sink Uses/day	3	4	
Sink Uses/hr/fixture	0.45	0.60	1.05

Current Hot Water Usage (kWh)		
Fixture	**L/Yr**	**kWh**
Sinks	22,949	860
Total		**860**

The high flow toilets consume 3.5 gallons per flush and the water efficient toilets consume 1.5 / 0.8 gpf
The high flow sinks consume 2.5 gallons per minute and the water efficient sinks consume 0.5 gpm
The urinals are assumed to consume 2.5 gallons per flush and the water efficient urinals consume 1 gpf.

Table B.7.6 Energy Savings with Heating, Ventilating, and Air Conditioning for the Public Library

Description	Quantity	% Savings in Cooling Efficiency	Energy Used for Cooling (kWh)	Energy Savings (kWh)
When 2-ton condensing unit requires replacement, replace it with a high efficiency unit.	1	21%	4,945	1,038
When 4-ton condensing unit requires replacement, replace it with a high efficiency unit.	1	21%	9,890	2,077
When 4-ton RTUs requires replacement, replace it with a high efficiency RTU.	2	21%	14,836	3,115

Table B.8.1 - Energy Breakdown for the Public Safety Building

	Energy Consumption (kWh)	% of Total Energy Consumption
HVAC	346,963	69%
Lighting	124,177	25%
Hot Water	31,600	6%
Total	**502,740**	

Table B.8.2 (a) - Electricity Usage for the Public Safety Building

	Consumption Data			Calculated Costs		
Month (2004-2005)	**Maximum KVA**	**Billed KVA**	**Energy (kWh)**	**Demand Charge**	**Energy Charge**	**Total Charge**
October	32	0	23,580	$0	$1,070	$1,568
November	27	0	34,920	$0	$1,336	$2,079
December	32	0	58,500	$0	$1,887	$2,869
January	35	0	85,320	$0	$2,515	$3,679
February	28	0	64,260	$0	$2,022	$3,127
March	25	0	44,820	$0	$1,567	$2,400
April	35	0	52,380	$0	$1,744	$2,668
May	30	0	36,720	$0	$1,419	$2,202
June	33	0	32,580	$0	$1,318	$2,040
July	29	0	22,860	$0	$1,080	$1,370
August	33	0	25,020	$0	$1,133	$1,440
September	28	0	21,780	$0	$1,054	$1,359
TOTAL		**0**	**502,740**	**$0**	**$18,146**	**$26,801**

Notes

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

Table B.8.3 - Lighting Analysis Summary for the Public Safety Building

Description	Quantity	Current Conditions		After Improvements	
		Annual Energy Consumption (kWh)	Annual Cost	Annual Energy Consumption (kWh)	Annual Cost
Fire Hall: 4'x2 T12 fluorescent lamps (30) - convert to T8 fluorescents.	60	25,684	$1,542	15,463	$928
Fire Hall: 400W Mercury Vapor Lights - Replace with metal halides.	8	27,955	$1,678	15,725	$944
Fire Hall: 100W incandescents - convert to compact fluorescents.	6	5,242	$315	1,468	$88
RCMP: 4'x2 T12 fluorescent lamps (31) - convert to T8 fluorescents.	62	22,117	$1,328	13,315	$799
RCMP: 4'x4 T12 fluorescent lamps (16) - convert to T8 fluorescent lamps.	64	22,830	$1,371	13,745	$825
RCMP: 100W Incandescents - convert to compact fluorescents.	10	7,280	$437	2,038	$122
Outdoor lights - install photocells.	4	10,512	$631	5,256	$316
LED Exit Signs - no upgrade recommended.	6	158	$9	158	$9
Parking lot plugs.	2	2,400	$144	1,200	$72
TOTALS		**124,177**	**$7,456**	**68,367**	**$4,105**

Annual Energy Savings (kWh)	**55,810**
Annual Cost Savings	**$3,351**
Percent Annual Energy Savings	**45%**

The RCMP is assumed to be occupied for 20 hours/day, 7 days/week.
The Fire Hall is assumed to be occupied for 24 hours/day, 7 days/week.

Table B.8.4 (a) Window and Door Infiltration Calculations for the Public Safety 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
Weatherstrip pedestrian doors (7).	35	0.05	125	120	35,968,619	10,541	$482
Caulk pedestrian doors (7).	140	0.005	10	38	11,509,958	3,373	$154
Caulk vehicle doors (2).	40	0.005	10	11	3,288,559	964	$44
TOTALS						**10,541**	**$482**

The crack lengths around the doors is taken as a quarter of the perimeter.

The temperature is maintained at 21℃ (70℉).

Table B.8.5 - Water Usage for the Public Safety 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	6	0.8	41,496	1.60	66,394	0.32	13,279	53,115	1,990	$119
Toilets - High Flow	5	0.2	6,949	13.25	92,075	3.98	27,623	64,453	NA	NA
Toilets - Low Flow	6	0.2	8,339	3.98	33,147	3.98	33,147	0	NA	NA
Urinals	2	1.5	26,208	9.50	248,976	3.80	99,590	149,386	NA	NA
Showers	3	0.4	10,920	66.25	723,450	47.30	516,516	206,934	7,755	$465
Total					**1,164,042**		**690,155**	**473,887**	**9,745**	**$585**

Frequency at Which Fixtures are Used			
	Females	**Males**	**Totals**
Number of People	2	8	
Number of Toilet Uses/day	3	1	
Number of Toilets	11	11	
Toilet Uses/hour/fixture	0.07	0.09	0.16
Number of Urinal Uses/day	0	3	
Number of Urinals	0	2	
Urinal Uses/hour/fixture	0	1.50	1.50
Number of Sinks	6	6	
Number of Sink Uses/day	3	4	
Sink Uses/hr/fixture	0.13	0.67	0.79
Number of Showers	3	3	
Number of Shower Uses/day	1	1	
Shower Uses/hr/fixture	0.08	0.33	0.42

Current Hot Water Usage (kWh)		
Fixture	**L/Yr**	**kWh**
Sinks	66,394	2,488
Showers	723,450	27,111
Total		**29,599**

The high flow toilets consume 3.5 gallons per flush and the water efficient toilets consume 1.5 / 0.8 gpf
The high flow sinks consume 2.5 gallons per minute and the water efficient sinks consume 0.5 gpm
The urinals are assumed to consume 2.5 gallons per flush and the new urinals consume 1 gpf.
The current showers are assumed to use 3.5 gpm and the new showers use 2.5 gpm

Table B.8.6 Energy Savings with Heating, Ventilating, and Air Conditioning for the Public Safety Building

Description	Heating Efficiency	HDD below 64.4°F	HDD below 45 or 59°F	Current Energy Used for Heating (kWh)	Energy Savings (kWh)
Reduce temperature in RCMP garage to 45°F.	100%	11,608	6450	14,572	6,475
Reduce temperature in Fire Hall to 59°F.	100%	11,608	9956	72,862	10,369

Description	% Reduction in Cooling Efficiency	Current Energy Consumed by Unit (kWh)	Energy Savings (kWh)
Replace trane condensing unit with high efficiency unit.	20%	55,514	11,103

Table B.9.1 - Energy Breakdown for City Hall

	Energy Consumption (kWh)	% of Total Energy Consumption
HVAC	207,971	78%
Lighting	57,922	22%
Hot Water	2,427	1%
Total	**268,320**	

Table B.9.2 (a) - Electricity Usage for City Hall

	Consumption Data			Calculated Costs		
Month (2004-2005)	**Maximum KVA**	**Billed KVA**	**Energy (kWh)**	**Demand Charge**	**Energy Charge**	**Total Charge**
October	64	14	18,480	$116	$934	$1,223
November	58	8	23,280	$67	$1,063	$1,313
December	84	34	33,600	$283	$1,305	$1,835
January	84	34	41,040	$283	$1,479	$2,033
February	79	29	28,560	$241	$1,187	$1,653
March	66	16	23,280	$133	$1,063	$1,389
April	57	7	24,480	$58	$1,092	$1,354
May	40	0	17,520	$0	$919	$1,073
June	48	0	12,720	$0	$730	$857
July	37	0	16,800	$0	$891	$1,040
August	59	9	14,880	$75	$815	$1,040
September	46	0	13,680	$0	$768	$900
TOTAL		**151**	**268,320**	**$1,256**	**$12,246**	**$15,711**

Notes

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

Table B.9.3 - Lighting Analysis Summary for City Hall

Description	Quantity	Current Conditions		After Improvements	
		Annual Energy Consumption (kWh)	Annual Cost	Annual Energy Consumption (kWh)	Annual Cost
4' x 1 T12 fluorescent lamps (227) - convert to T8 fluorescents.	227	25,739	$1,545	15,496	$930
4' x 4 T12 fluorescent lamps (49) - convert to T8 fluorescents.	196	22,224	$1,334	13,380	$803
100W Indoor incandescents - convert to compact fluorescents.	14	3,240	$195	907	$54
Parking lot plugs.	14	6,720	$403	3,360	$202
TOTALS		**57,922**	**$3,478**	**33,142**	**$1,990**

Annual Energy Savings (kWh)	**24,780**
Annual Cost Savings	**$1,488**
Percent Annual Energy Savings	**43%**

City Hall is occupied Mon-Fri, 8:30 - 5:00 and for 4 extra hrs twice a month.

Table B.9.4 Window and Door Infiltration Calculations for City Hall

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
Caulk pedestrian doors (6).	120	0.005	10	33	9,865,678	2,891	$174
Caulk windows (8).	240	0.005	10	66	19,731,357	5,783	$347
TOTALS						**8,674**	**$521**

The crack lengths around the windows and doors is taken as the perimeter.

The temperature is maintained at 21℃ (70℉).

Table B.9.5 - Water Usage for City Hall

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	8	1.1	20,248	1.60	32,396	0.32	6,479	25,917	971	$58
Toilets	6	0.8	11,570	13.25	153,303	3.98	45,991	107,312	NA	NA
Urinals	2	1.9	8,678	9.50	82,436	3.80	32,975	49,462	NA	NA
Total					**268,135**		**85,444**	**182,690**	**971**	**$58**

Frequency at Which Fixtures are Used			
	Females	**Males**	**Totals**
Number of People	10	10	
Number of Toilet Uses/day	3	1	
Number of Toilets	6	6	
Toilet Uses/hour/fixture	0.63	0.21	0.83
Number of Urinal Uses/day	0	3	
Number of Urinals	0	2	
Urinal Uses/hour/fixture	0	1.88	1.88
Number of Sinks	8	8	
Number of Sink Uses/day	3	4	
Sink Uses/hr/fixture	0.47	0.63	1.09

Current Hot Water Usage (kWh)		
Fixture	**L/Yr**	**kWh**
Sinks	32,396	1,214
Total		**1,214**

The high flow toilets consume 3.5 gallons per flush and the water efficient toilets consume 1.5 / 0.8 gpf
The high flow sinks consume 2.5 gallons per minute and the water efficient sinks consume 0.5 gpm
The high flow urinals are assumed to consume 2.5 gallons per flush and the water efficient urinals consume 1 gpf.

Table B.9.6 Energy Savings with Heating, Ventilating, and Air Conditioning for City Hall

Description	**% Improvement in Cooling Efficiency**	**Current Energy Used for Cooling (kWh)**	**Energy Savings (kWh)**
Replace Carrier RTU with high efficiency unit.	5%	20,797	1,040
Replace York RTU with high efficiency unit.	8%	12,478	998

Description	**Flow (CFM)**	**HDD below 64.4℉**	**Current Energy Consumtpion (kWh)**	**Energy Savings (kWh)**
Install CO_2 control on Carrier RTU.	750	11,608	17,191	6,876
Install CO_2 control on York RTU.	450	11,608	10,314	4,126

Description	**% of Time Unoccupied**	**Current Energy Used for Heating (kWh)**	**HDD below 64.4℉**	**HDD below 59℉**	**Energy Savings (kWh)**
Install programmable thermostats; setback temperature to 15℃ (59℉).	74%	176,776	11,608	9,956	18,512

Table B.10.1 - Energy Breakdown for the Sewage Treatment Plant

	Energy Consumption (kWh)	% of Total Energy Consumption
HVAC	339,719	66%
Lighting	47,663	9%
Hot Water	7,128	1%
Motors	122,544	24%
Total	**517,055**	

Table B.10.2 (a) - Electricity Usage for Sewage Treatment Plant

	Consumption Data			Calculated Costs		
Month (2004-2005)	Maximum KVA	Billed KVA	Energy (kWh)	Demand Charge	Energy Charge	Total Charge
October	0	0	11,250	$0	$656	$773
November	0	0	21,770	$0	$1,028	$1,235
December	0	0	28,200	$0	$1,179	$1,517
January	0	0	32,700	$0	$1,284	$1,714
February	0	0	25,500	$0	$1,115	$1,398
March	0	0	20,170	$0	$991	$1,164
April	0	0	19,390	$0	$969	$1,148
May	0	0	13,860	$0	$775	$908
June	0	0	11,070	$0	$665	$783
July	0	0	10,650	$0	$639	$754
August	0	0	620	$0	$37	$68
September	118	68	10,440	$566	$627	$1,363
TOTAL		**68**	**205,620**	**$566**	**$9,965**	**$12,824**

Table B.10.2 (b) - Propane Consumption for the Sewage Treatment Plant

Month (2004-2005)	Propane (L)	Energy (kWh)	Total Charge
October	5,585	39,639	$2,677
November	4,104	29,128	$2,055
December	12,501	88,720	$6,260
January	5,582	39,612	$2,795
February	7,632	54,161	$3,822
March	5,117	36,315	$2,562
April	2,662	18,894	$1,333
May	0	0	$0
June	0	0	$0
July	0	0	$0
August	700	4,967	$350
September	0	0	$0
TOTAL	**43,883**	**311,435**	**$21,855**

Notes

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

Table B.10.3 - Lighting Analysis Summary for the Sewage Treatment Plant

Description	Quantity	Current Conditions		After Improvements	
		Annual Energy Consumption (kWh)	Annual Cost	Annual Energy Consumption (kWh)	Annual Cost
Headworks					
4' x 2 T8 fluorescent lamps (43) - no upgrade recommended.	86	2,504	$150	2,504	$150
4' x 4 T8 fluorescent lamps (12) - no upgrade recommended.	48	5,591	$336	5,591	$336
2' x 2 T8 fluorescent lamps (2) - no upgrade recommended.	4	248	$15	248	$15
150W Outdoor high pressure sodium - no upgrade recommended.	7	4,599	$276	4,599	$276
LED Exit Signs - no upgrade recommended.	1	26	$2	26	$2
SBR Building					
250W Metal halides - no upgrade recommended.	70	15,925	$956	15,925	$956
4' x 4 T8 fluorescents (22) - no upgrade recommended.	88	10,250	$615	10,250	$615
4' x 2 T8 fluorescent lamps (5) - no upgrade recommended.	10	1,165	$70	1,165	$70
150W Interior high pressure sodium - no upgrade recommended.	5	2,730	$164	2,730	$164
Exterior 175W metal halides - no upgrade recommended.	6	4,599	$276	4,599	$276
LED Exit Signs - no upgrade recommended.	1	26	$2	26	$2
TOTALS		**47,663**	**$2,862**	**47,663**	**$2,862**

Annual Energy Savings (kWh)	**0**
Annual Cost Savings	**$0**
Percent Annual Energy Savings	**0%**

The sewage treatment plant is assumed to be occupied for 70 hours/week.
The lights in the process area are assumed to be on only 25% of the time the building is occupied.

Table B.10.4 - Water Usage for the Sewage Treatment Plant

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	0.1	290	1.60	463	0.32	93	371	14	$1
Toilets	1	0.6	2,275	13.25	30,144	3.98	9,043	21,101	NA	NA
Showers	1	0.3	910	66.25	60,288	47.30	43,043	17,245	646	$39
Total					**90,895**		**52,179**	**38,716**	**660**	**$40**

Frequency at Which Fixtures are Used			
	Females	**Males**	**Totals**
Number of People	1	1	
Number of Toilet Uses/day	1	4	
Number of Toilets	1	1	
Toilet Uses/hour/fixture	0.13	0.50	0.63
Number of Sinks	11	11	
Number of Sink Uses/day	3	4	
Sink Uses/hr/fixture	0.03	0.05	0.08
Number of Showers	1	1	
Number of Shower Uses/day	1	1	
Shower Uses/hr/fixture	0.13	0.13	0.25

Current Hot Water Usage (kWh)		
Fixture	**L/Yr**	**kWh**
Sinks	463	17
Showers	60,288	2,259
Total		**2,277**

The high flow toilets consume 3.5 gallons per flush and the water efficient toilets consume 1.5 / 0.8 gpf
The high flow sinks consume 2.5 gallons per minute and the water efficient sinks consume 0.5 gpm
The current showers are assumed to use 3.5 gpm and the new showers use 2.5 gpm

Table B.10.5 Energy Savings with Heating, Ventilating, and Air Conditioning for the Sewage Treatment Plant

Description	% of Time Unoccupied	Heating Degree Days below 64.4 F	Heating Degree Days below 59 F	Current Energy Used to Heat (kWh)	Energy Savings (kWh)
Setback Thermostats to 59 F for SBR Building	58.45%	11607.8	9956.34	311,435	25,898

Table B.10.6 Energy Consumption and Savings Calculations for Motors in the Sewage Treatment Plant

Description	Rated HP	Required HP	# of hours	Current Motor		
				Actual HP	kW	kWh
Headworks						
Grit removal pump	7.5	6.0	364	6.66	4.97	1,808
Septage waste transfer pump #1	7.5	6.0	364	6.66	4.97	1,808
Septage waste transfer pump #2	7.5	6.0	364	6.66	4.97	1,808
Screen grit motor	2.0	1.6	364	1.78	1.32	482
Paddle drive gear motor	0.8	0.6	364	0.67	0.50	181
Booster pump	3.0	2.4	364	2.66	1.99	723
Grit dewatering gear motor	1.0	0.8	364	0.89	0.66	241
SBR Building						
Sump pump	0.5	0.4	364	0.44	0.33	121
Effluent pressure pump	2.0	1.6	364	1.78	1.32	482
Automatic effluent sampler	0.5	0.4	364	0.44	0.33	121
Waste sludge pump	2.3	1.8	364	2.04	1.52	554
Waste sludge pump	2.3	1.8	364	2.04	1.52	554
Alum metering pump	0.5	0.4	364	0.44	0.33	121
Alum metering pump	0.5	0.4	364	0.44	0.33	121
Thickening feed pump	3.0	2.4	364	2.66	1.99	723
Thickening feed pump	3.0	2.4	364	2.66	1.99	723
Sludge recirculation pump	3.7	3.0	364	3.29	2.45	892
Sludge recirculation pump	2.7	2.2	364	2.40	1.79	651
Grinder	3.0	2.4	364	2.66	1.99	723
Sludge transfer pump	3.0	2.4	364	2.66	1.99	723
Sludge transfer pump	3.0	2.4	364	2.66	1.99	723
Blower-1	125.0	100.0	364	111.00	82.77	30,129
Blower-2	125.0	100.0	364	111.00	82.77	30,129
Blower-3	60.0	48.0	364	53.28	39.73	14,462
Blower-4	60.0	48.0	364	53.28	39.73	14,462
Drum thicknener	0.5	0.4	364	0.44	0.33	121
Thickened sludge transfer pump	10.0	8.0	364	8.88	6.62	2,410
Screw conveyor	4.0	3.2	364	3.55	2.65	964
Screw conveyor	4.0	3.2	364	3.55	2.65	964
Centrifuge	30.0	24.0	364	26.64	19.87	7,231
Centrifuge	30.0	24.0	364	26.64	19.87	7,231
Digester circulation pump	0.3	0.3	364	0.29	0.22	80
Digester circulation pump	0.3	0.3	364	0.29	0.22	80
Decanter Building						
Decanter 1	0.8	0.6	364	0.67	0.50	181
Decanter 2	0.8	0.6	364	0.67	0.50	181
TOTALS						**122,544**

Table B.11.1 - Energy Breakdown for the Cliff Lake Water Treatment Plant

	Energy Consumption (kWh)	% of Total Energy Consumption
HVAC	217,240	45.4%
Lighting	17,082	3.6%
Hot Water	1,213	0.3%
Motors	242,905	50.8%
Total	**478,440**	

Table B.11.2 (a) - Electricity Usage for the Cliff Lake Water Treatment Plant

	Consumption Data			Calculated Costs		
Month (2004-2005)	Maximum KVA	Billed KVA	Energy (kWh)	Demand Charge	Energy Charge	Total Charge
October	31	0	35,640	$0	$1,353	$1,908
November	32	0	36,000	$0	$1,361	$1,918
December	31	0	36,360	$0	$1,369	$2,070
January	32	0	42,120	$0	$1,504	$2,157
February	28	0	37,080	$0	$1,386	$2,222
March	26	0	35,640	$0	$1,353	$2,250
April	35	0	48,240	$0	$1,647	$2,696
May	29	0	37,800	$0	$1,445	$2,356
June	30	0	39,240	$0	$1,481	$2,538
July	32	0	51,840	$0	$1,789	$2,889
August	33	0	43,560	$0	$1,586	$2,659
September	29	0	34,920	$0	$1,375	$2,484
TOTAL		**0**	**478,440**	**$0**	**$17,649**	**$28,147**

Notes

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

Table B.11.3 - Lighting Analysis Summary for the Cliff Lake Water Treatment Plant

Description	Quantity	Current Conditions		After Improvements	
		Annual Energy Consumption (kWh)	Annual Cost	Annual Energy Consumption (kWh)	Annual Cost
High bay sodium lighting - no upgrade recommended.	9	15,768	$947	15,768	$947
Exterior metal halides - no upgrade recommended.	2	1,314	$79	1,314	$79
TOTALS		**17,082**	**$1,026**	**17,082**	**$1,026**

Annual Energy Savings (kWh)	**0**
Annual Cost Savings	**$0**
Percent Annual Energy Savings	**0%**

The lights are left on 24/7.

Table B.11.4 Window and Door Infiltration Calculations for Cliff Lake Water Treatment Plant

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
Weatherstrip pedestrian doors (2).	10	0.05	125	34	10,276,748	3,012	$181
TOTALS						**3,012**	**$181**

The crack lengths around the doors is taken as a quarter of the perimeter.

The temperature is maintained at 21℃ (70℉).

Table B.11.5 Energy Savings with Heating, Ventilating, and Air Conditioning for Cliff Lake Water Treatment Plant

Description	Heating Efficiency	HDD below 64.4°F	HDD below 59°F	Current Energy Used for Heating (kWh)	Energy Savings (kWh)
Reduce temperature setting to 15°C (59°F).	100%	11,608	9956	217,240	30916.71349

Description	Quantity	Heating Efficiency	HDD below 64.4F or 45F	Flow Rate (cfm)	Energy Savings (kWh)
Install manual insulated dampers.	2	100%	11,608	200	35,263

Table B.11.6 Energy Consumption and Savings Calculations for Motors in the Cliff Lake Water Treatment Plant

Description	Rated HP	Required HP	# of hours	Current Motor			Energy Savings with High Eff. Motor		
				Actual HP	kW	kWh	Actual HP	kW	kWh
Vertical turbine pump 1	75	60	2,446	66.60	49.66	121,452	2.25	1.68	4,103
Vertical turbine pump 2	75	60	2,446	66.60	49.66	121,452	2.25	1.68	4,103
TOTALS						**242,905**			**8,206**

Table B.12.1 Annual Energy Consumption for the Heating Plant #1

	Energy Consumption (kWh)	% of Total Energy Consumption
HVAC	392,654	12%
Boilers	2,899,030	88%
Hot Water	931	0.0%
Lighting	2,514	0.1%
Motors	145,018	4%
Total	**3,295,130**	

Table B.12.2 (a) - Electricity Usage for the Heating Plant #1

	Consumption Data			Calculated Costs		
Month (2004-2005)	**Maximum KVA**	**Billed KVA**	**Energy (kWh)**	**Demand Charge**	**Energy Charge**	**Total Charge**
October	60	10	27,400	$83	$1,160	$1,442
November	64	14	36,200	$116	$1,366	$1,715
December	84	34	37,200	$283	$1,389	$1,931
January	84	34	42,000	$283	$1,501	$2,059
February	84	34	38,800	$283	$1,426	$1,974
March	82	32	41,800	$266	$1,497	$2,035
April	73	23	33,200	$191	$1,295	$1,761
May	76	26	35,500	$216	$1,389	$1,855
June	52	2	24,000	$17	$1,108	$1,307
July	54	4	26,400	$33	$1,167	$1,393
August	54	4	28,500	$33	$1,218	$1,452
September	56	6	25,100	$50	$1,135	$1,376
TOTALS		**223**	**396,100**	**$1,855**	**$15,652**	**$20,300**

Table B.12.2 (b) - Oil Consumption for the Heating Plant #1

Month (2004-2005)	Oil (L)	Energy (kWh)	Total Charge
October	16,917	177,290	$9,976
November	7,063	74,020	$4,165
December	38,568	404,193	$22,744
January	50,720	531,546	$29,910
February	59,420	622,722	$35,040
March	81,412	853,198	$48,009
April	22,525	236,062	$13,283
May	0	0	$0
June	0	0	$0
July	0	0	$0
August	0	0	$0
September	0	0	$0
TOTAL	**276,625**	**2,899,030**	**$163,126**

Notes

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

Table B.12.3 - Lighting Analysis Summary for the Heating Plant #1

Description	Quantity	Current Conditions		After Improvements	
		Annual Energy Consumption (kWh)	Annual Cost	Annual Energy Consumption (kWh)	Annual Cost
4' x 2 T12 Fluorescents - Convert to T8s (10).	20	715	$43	431	$26
8' x 2 T12 Fluorescents - Convert to T8s (2)	4	339	$20	159	$10
200W Incandescent - Convert to compact fluorescents.	1	146	$9	40	$2
Exterior metal halides - no upgrade recommended.	2	1,314	$79	1,314	$79
TOTALS		**2,514**	**$151**	**1,944**	**$117**

Annual Energy Savings (kWh)	**570**
Annual Cost Savings	**$34**
Percent Annual Energy Savings	**23%**

These calculations are assuming that this building is occupied 3 times daily for a total of 2 hrs/day.

Table B.12.4 (a) Window and Door Replacement Calculations for the Heating Plant #1

Description	**Existing**				**New**			**Savings**	
	Area (ft^{2})	**R-Value (^{o}F ft^{2}hr/BTU)**	**Annual Heat Loss (kWh)**	**Cost**	**R-Value (^{o}F ft^{2}hr/BTU)**	**Annual Heat Loss (kWh)**	**Cost**	**Energy (kWh)**	**Cost**
Replace 3'x2' dual pane window with triple pane window.	6	2.00	245	$15	6.25	78	$5	167	$10
Replace pedestrian door with insulated door.	21	1.60	1,072	$64	6.70	256	$15	816	$49
Replace double loading doors with insulated doors.	28	1.60	1,429	$86	6.70	341	$20	1,088	$65
TOTALS			**2,745**	**$165**		**675**	**$41**	**2,070**	**$124**

Table B.12.4 (b) Window and Door Infiltration Calculations for the Heating Plant #1

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**
Weather-strip pedestrian door (1).	5	0.05	125	17	5,138,303	1,506	$90
Weather-strip double loading door (1).	5.5	0.05	125	19	5,652,134	1,656	$99
TOTALS						**3,162**	**$190**

Table B.12.4 (c) Wall/Roof Insulation Upgrade Calculations for the Heating Plant #1

Description	**Existing**				**New**			**Savings**	
	Area (ft^{2})	**R-Value (^{o}F ft^{2}hr/BTU)**	**Annual Heat Loss (kWh)**	**Cost**	**R-Value (^{o}F ft^{2}hr/BTU)**	**Annual Heat Loss (kWh)**	**Cost**	**Energy (kWh)**	**Cost**
Upgrade wall insulation to R-20.	2260	8.50	21,708	$1,303	20.00	9,226	$554	12,482	$749
Upgrade roof insulation to R-40.	1800	12.00	12,247	$735	40.00	3,674	$221	8,573	$515
TOTALS			**33,955**	**$2,039**		**12,900**	**$775**	**21,055**	**$1,264**

The heating plant is assumed to be kept at 21℃.
The crack lengths are taken as a quarter the perimeter of the door

Table B.12.5 - Water Usage for the Heating Plant #1

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	0.500	365	1.60	584	0.32	117	467	18	$1
Toilets	1	0.500	365	13.25	4,836	3.98	1,453	3,384	NA	NA
Total					**5,420**		**1,570**	**3,851**	**18**	**$1**

Frequency at Which Fixtures are Used			
	Females	**Males**	**Totals**
Number of People	0	1	
Number of Toilets	1	1	
Number of Toilet Uses/day	3	4	
Toilet Uses/hour/fixture	0	0.5	0.500
Number of Sinks	1	1	
Number of Sink Uses/day	3	4	
Sink Uses/hr/fixture	0	0.5	0.500

Current Hot Water Usage (kWh)		
Fixture	**L/Yr**	**kWh**
Sinks	584	22
Total		**22**

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 dual flush toilets use either 1.6 or 0.8 gallons per flush.

Table B.12.6 Energy Savings with Heating, Ventilating, and Air Conditioning for the Heating Plant #1

Description	% of Time Unoccupied	Heating Degree Days below 64.4 F	Heating Degree Days below 59 F	Current Energy Used to Heat (kWh)	Energy Savings (kWh)
Setback Thermostats to 59 F	100.00%	11607.8	9956.34	392,654	55,865

Description	Quantity	Heating Efficiency	HDD below 64.4F	Flow Rate (cfm)	Energy Savings (kWh)
Install motorized dampers on exhaust.	1	100%	11,608	50	4,408

Description	Leakage (cfm)	Annual Heat Loss (BTU)	Annual Heat Loss (kWh)	Cost
Fill gap in the wall at truck fill line	25	7,521,880	2,204	$132

Table B.12.7 Energy Consumption and Savings Calculations for Motors in the Heating Plant #1

Description	Rated HP	Required HP	# of hours	Current Motor		
				Actual HP	kW	kWh
Recirculation pump 1	25	20	4,380	22.20	16.55	72,509
Recirculation pump 2	25	20	4,380	22.20	16.55	72,509
Recirculation pump 3	20	16	4,380	17.76	13.24	58,007
TOTALS						**145,018**

Table B.13.1 Annual Energy Consumption for the Heating Plant #2

	Energy Consumption (kWh)	**% of Total Energy Consumption**
HVAC	313,695	11%
Lighting	3,277	0%
Boilers	2,245,812	80%
Motors	232,028	8%
Total	**2,794,812**	

Table B.13.2 (a) - Electricity Usage for the Heating Plant #2

	Consumption Data			Calculated Costs		
Month (2004-2005)	**Maximum KVA**	**Billed KVA**	**Energy (kWh)**	**Demand Charge**	**Energy Charge**	**Total Charge**
October	92	42	34,600	$349	$1,328	$1,937
November	132	82	46,800	$682	$1,614	$2,642
December	136	86	62,800	$716	$1,988	$3,107
January	156	106	61,000	$882	$1,946	$3,248
February	136	86	51,600	$716	$1,726	$2,808
March	136	86	54,200	$716	$1,787	$2,877
April	131	81	59,700	$674	$1,915	$3,043
May	128	78	46,800	$649	$1,665	$2,663
June	64	14	45,900	$116	$1,643	$2,031
July	7	0	18,500	$0	$974	$1,117
August	67	17	31,800	$141	$1,299	$1,667
September	68	18	35,300	$150	$1,384	$1,774
TOTALS		**696**	**549,000**	**$5,791**	**$19,269**	**$28,916**

Table B.13.2 (b) - Oil Consumption for the Heating Plant #2

Month (2004-2005)	Oil (L)	Energy (kWh)	Total Charge
October	17,501	183,410	$10,320
November	6,931	72,637	$4,087
December	26,833	281,210	$15,823
January	20,665	216,569	$12,186
February	59,527	623,843	$35,103
March	58,913	617,408	$34,741
April	23,925	250,734	$14,109
May	0	0	$0
June	0	0	$0
July	0	0	$0
August	0	0	$0
September	0	0	$0
TOTAL	**214,295**	**2,245,812**	**$126,370**

Notes

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

Table B.13.3 - Lighting Analysis Summary for the Heating Plant #2

Description	Quantity	Current Conditions		After Improvements	
		Annual Energy Consumption (kWh)	Annual Cost	Annual Energy Consumption (kWh)	Annual Cost
4'x2 T12 Fluorescents - Convert to T8s (4).	8	286	$17	172	$10
8'x2 T12 Fluorescents - Convert to T8s (6).	12	1,020	$61	477	$29
150W Outdoor Incandescent - No upgrade recommended.	3	1,971	$118	1,971	$118
TOTALS		**3,277**	**$197**	**2,620**	**$157**

Annual Energy Savings (kWh)	**657**
Annual Cost Savings	**$39**
Percent Annual Energy Savings	**20%**

These calculations are assuming that this building is occupied for 2 hrs/day.

Table B.13.4 (a) Window and Door Replacement Calculations for the Heating Plant #2

Description	Existing				New			Savings	
	Area (ft^2)	R-Value (^{o}F ft^{2}hr/BTU)	Annual Heat Loss (kWh)	Cost	R-Value (^{o}F ft^{2}hr/BTU)	Annual Heat Loss (kWh)	Cost	Energy (kWh)	Cost
Replace pedestrian door with insulated door.	21	1.60	1,072	$64	6.70	256	$15	816	$49
Replace double loading doors with insulated doors.	28	1.60	1,429	$86	6.70	341	$20	1,088	$65
TOTALS			**2,500**	**$150**		**597**	**$36**	**1,903**	**$114**

Table B.13.4 (a) Window and Door Infiltration Calculations for the Heating Plant #2

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
Weather-strip pedestrian door.	5	0.05	125	17	5,138,303	1,506	$90
Weather-strip double loading door.	5.5	0.05	125	19	5,652,134	1,656	$99
TOTALS						**3,162**	**$190**

Table B.13.4 (c) Wall/Roof Insulation Upgrade Calculations for the Heating Plant #2

Description	Existing				New			Savings	
	Area (ft^2)	R-Value (^{o}F ft^{2}hr/BTU)	Annual Heat Loss (kWh)	Cost	R-Value (^{o}F ft^{2}hr/BTU)	Annual Heat Loss (kWh)	Cost	Energy (kWh)	Cost
Upgrade wall insulation to R-20.	2028	8.50	19,480	$1,170	20.00	8,279	$497	11,201	$673
Upgrade roof insulation to R-40.	1440	12.00	9,798	$588	40.00	2,939	$176	6,858	$412
TOTALS			**29,277**	**$1,758**		**11,218**	**$674**	**18,059**	**$1,084**

The heating plant is assumed to be kept at 21℃.

The crack lengths are taken as a quarter the perimeter of the door

Table B.13.5 Energy Savings with Heating, Ventilating, and Air Conditioning for the Heating Plant #2

Description	% of Time Unoccupied	Heating Degree Days below 64.4 F	Heating Degree Days below 59 F	Current Energy Used to Heat (kWh)	Energy Savings (kWh)
Setback Thermostats to 59 F	100.00%	11607.8	9956.34	313,695	44,631

Table B.13.6 Energy Consumption and Savings Calculations for Motors in the Heating Plant #2

Description	Rated HP	Required HP	# of hours	Current Motor		
				Actual HP	kW	kWh
Recirculation pump 1	40	32	4,380	35.52	26.49	116,014
Recirculation pump 2	40	32	4,380	35.52	26.49	116,014
Recirculation pump 3	40	32	4,380	35.52	26.49	116,014
Circulating Pump	25	20	4,380	22.20	16.55	72,509
Booster Pump	20	16	8,760	17.76	13.24	116,014
TOTALS						**232,028**

Table B.14.1 Annual Energy Consumption for the Heating Plant #3

	Energy Consumption (kWh)	% of Total Energy Consumption
HVAC	89,336	52.5%
Hot Water	173	0.1%
Lighting	841	0.5%
Motors	79,760	46.9%
Total	**170,110**	

Table B.14.2 (a) - Electricity Usage for the Heating Plant #3

	Consumption Data			Calculated Costs		
Month (2004-2005)	**Maximum KVA**	**Billed KVA**	**Energy (kWh)**	**Demand Charge**	**Energy Charge**	**Total Charge**
October	0	0	12,850	$0	$718	$843
November	0	0	17,310	$0	$889	$1,039
December	0	0	14,620	$0	$786	$921
January	0	0	12,870	$0	$718	$844
February	0	0	21,430	$0	$1,020	$1,220
March	0	0	11,050	$0	$648	$763
April	0	0	13,810	$0	$755	$896
May	0	0	16,040	$0	$861	$1,006
June	0	0	12,710	$0	$730	$857
July	0	0	13,300	$0	$753	$883
August	0	0	12,200	$0	$710	$834
September	0	0	11,920	$0	$699	$821
TOTALS		**0**	**170,110**	**$0**	**$9,285**	**$10,927**

Notes

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

Table B.14.3 - Lighting Analysis Summary for the Heating Plant #3

Description	Quantity	Current Conditions		After Improvements	
		Annual Energy Consumption (kWh)	Annual Cost	Annual Energy Consumption (kWh)	Annual Cost
4'x2 T12 Fluorescents - Convert to T8s (7).	14	501	$30	301	$18
8'x2 T12 Fluorescents - Convert to T8s (2).	4	340	$20	159	$10
TOTALS		**841**	**$50**	**460**	**$28**

Annual Energy Savings (kWh)	**380**
Annual Cost Savings	**$23**
Percent Annual Energy Savings	**45%**

These calculations are assuming that this building is occupied for 2 hrs/day.

Table B.14.4 (a) Upgrade Window and Door Insulation for the Heating Plant #3

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
Replace windows with triple pane window.	45	2.000	2,296	$138	6.25	735	$44	1,561	$94
Replace pedestrian door with insulated pedestrian door.	21	1.600	1,340	$80	6.70	320	$19	1,020	$61
Replace double door with insulated doors.	28	1.600	1,786	$107	6.70	427	$26	1,359	$82
TOTALS			**5,422**	**$326**		**1,481**	**$89**	**3,941**	**$237**

Table B.14.4 (b) Window and Door Infiltration Calculations for the Heating Plant #3

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
Weather-strip pedestrian doors.	5	0.05	125	17	6,422,879	1,882	$113
Weather-strip double doors.	5.5	0.05	125	19	7,065,167	2,071	$124
TOTALS						**3,953**	**$237**

Table B.14.4 (c) Wall/Roof Insulation Upgrade Calculations for the Heating Plant #3

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 wall insulation to R-20.	2304	8.50	27,664	$1,661	20.00	11,757	$706	15,907	$955
Upgrade roof insulation to R-40.	1575	12.00	13,395	$804	40.00	4,019	$241	9,377	$563
TOTALS			**41,059**	**$2,465**		**15,776**	**$947**	**25,283**	**$1,518**

The heating plant is assumed to be kept at 21℃.

The crack lengths are taken as a quarter the perimeter of the door

Table B.14.5 - Water Usage for the Heating Plant #3

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	0.500	365	1.60	584	0.32	117	467	18	$1
Toilets	1	0.125	91	13.25	1,209	3.98	363	846	NA	NA
Total					**1,793**		**480**	**1,313**	**18**	**$1**

Frequency at Which Fixtures are Used			
	Females	**Males**	**Totals**
Number of People	0	1	
Number of Toilets	1	1	
Number of Toilet Uses/day	3	1	
Toilet Uses/hour/fixture	0	0.125	0.125
Number of Sinks	1	1	
Number of Sink Uses/day	3	4	
Sink Uses/hr/fixture	0	0.5	0.500

Current Hot Water Usage (kWh)		
Fixture	**L/Yr**	**kWh**
Sinks	584	22
Total		**22**

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 dual flush toilets use either 1.6 or 0.8 gallons per flush.

Table B.14.6 Energy Savings with Heating, Ventilating, and Air Conditioning for the Heating Plant #3

Description	% of Time Unoccupied	Heating Degree Days below 64.4 F	Heating Degree Days below 59 F	Current Energy Used to Heat (kWh)	Energy Savings (kWh)
Setback Thermostats to 59 F	100.00%	11607.8	9956.34	89,336	12,710

Table B.14.7 Energy Consumption and Savings Calculations for Motors in the Heating Plant #3

Description	Rated HP	Required HP	# of hours	Current Motor		
				Actual HP	kW	kWh
Booster Pump	20	16	4,380	17.76	13.24	58,007
Booster Pump	8	6	4,380	6.66	4.97	21,753
Sewage Lift Pump	5	4	4,380	4.44	3.31	14,502
Storm Sewage Pump	8	6	4,380	6.66	4.97	21,753
GE Induction Motor	125	100	4,380	111.00	82.77	362,544
Ventilation Fan	0.3	0.3	4,380	0.30	0.22	966
TOTALS						**79,760**

APPENDIX C

WATER EFFICIENCY

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Water Use Brochure C2

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.

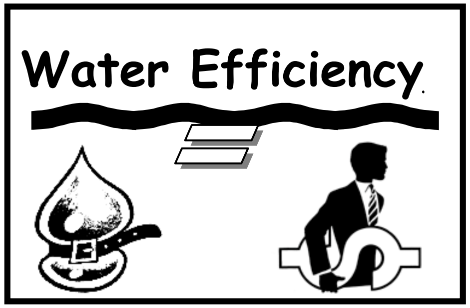
For More Information, Please Contact:

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

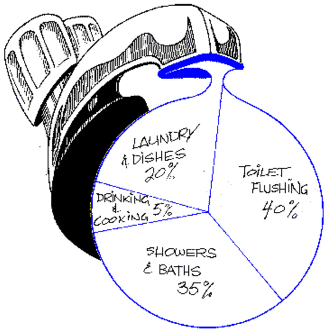
Pollution Prevention
Manitoba Conservation



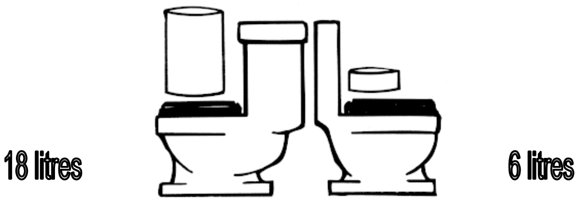
Water Use

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.

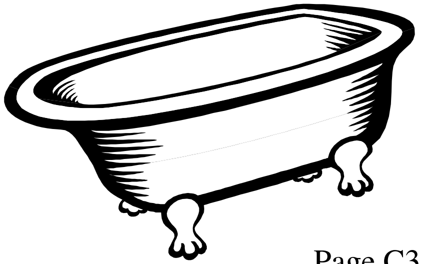
- Ensure a water softener regenerates only when the resin is exhausted.

- 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 D2

Table D.2 Other Incentive Programs D3

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 204-474-4051
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 204-474-4051
LED Exit Signs	$45 per new sign	Kelly Epp at kepp@hydro.mb.ca or 204-474-4051
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 204-474-4051
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

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	Available Funding	Funding Maximums	Deadline For Applications	Prospect of Funding	Project Sponsor	Contact	Email	Website
Energy Innovators Initiative: Energy Retrofit Assistance (ERA)	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.	$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/financial-assistance/existing/retrofits/implementation.cfm?attr=0
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.		2/3 of the approved costs	On-going	Good	Canada-Manitoba Infrastructure Programs		infra@gov.mb.ca	http://www.infrastructure.mb.ca/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% 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.		$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 E2

Buying a Fuel Efficient Vehicle E5

Self Audit E7

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

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Weather Data for Flin Flon, Manitoba F30

Table F.1 - Energy Consumption Monitoring Data for the Airport Terminal

	2004-2005					2005-2006					2006-2007				
Month	**Billed Elect Energy (kWh)**	**Billed Propane (L)**	**Total Energy Consumption (kWh)**	**HDD (°C days/ mo)**	**Energy Normalized to 2004-2005 (kWh)**	**Billed Elect Energy (kWh)**	**Billed Propane (L)**	**Total Energy Consumption (kWh)**	**HDD (°C days/ mo)**	**Energy Normalized to 2004-2005 (kWh)**	**Billed Elect Energy (kWh)**	**Billed Propane (L)**	**Total Energy Consumption (kWh)**	**HDD (°C days/ mo)**	**Energy Normalized to 2004-2005 (kWh)**
October	3,022	1,593	14,326	474.4	14,326			0		#DIV/0!			0		#DIV/0!
November	3,232	2,555	21,363	673.1	21,363			0		#DIV/0!			0		#DIV/0!
December	4,292	3,955	32,362	1196.9	32,362			0		#DIV/0!			0		#DIV/0!
January	5,122	3,902	32,812	1187.8	32,812			0		#DIV/0!			0		#DIV/0!
February	3,682	3,399	27,807	874.9	27,807			0		#DIV/0!			0		#DIV/0!
March	3,172	3,367	27,069	806.7	27,069			0		#DIV/0!			0		#DIV/0!
April	3,252	1,657	15,011	399.1	15,011			0		#DIV/0!			0		#DIV/0!
May	2,522	1,892	15,950	266.3	15,950			0		#DIV/0!			0		#DIV/0!
June	3,582	331	5,934	103.8	5,934			0		#DIV/0!			0		#DIV/0!
July	2,692	86	3,299	33.4	3,299			0		#DIV/0!			0		#DIV/0!
August	3,572	299	5,696	77.8	5,696			0		#DIV/0!			0		#DIV/0!
September	2,722	823	8,564	202.9	8,564			0		#DIV/0!			0		#DIV/0!
TOTAL	40,864	23,859	210,193	6297	210,193	0	0	0	0	#DIV/0!	0	0	0	0	#DIV/0!

	2007-2008					2008-2009					2009-2010				
Month	**Billed Elect Energy (kWh)**	**Billed Propane (L)**	**Total Energy Consumption (kWh)**	**HDD (°C days/ mo)**	**Energy Normalized to 2004-2005 (kWh)**	**Billed Elect Energy (kWh)**	**Billed Propane (L)**	**Total Energy Consumption (kWh)**	**HDD (°C days/ mo)**	**Energy Normalized to 2004-2005 (kWh)**	**Billed Elect Energy (kWh)**	**Billed Propane (L)**	**Total Energy Consumption (kWh)**	**HDD (°C days/ mo)**	**Energy Normalized to 2004-2005 (kWh)**
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!
September			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 Propane" in (L) taken from the electricity and propane bills, respectively next to the appropriate month.
3. Go to the following website to collect information on the Heating Degree Days for Flin Flon, Mb: http://www.climate.weatheroffice.ec.gc.ca/climateData/dailydata_e.html?timeframe=2&Prov=CA&StationID=3857&Year=2006&Month=1&
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 F30) 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 Airport Terminal

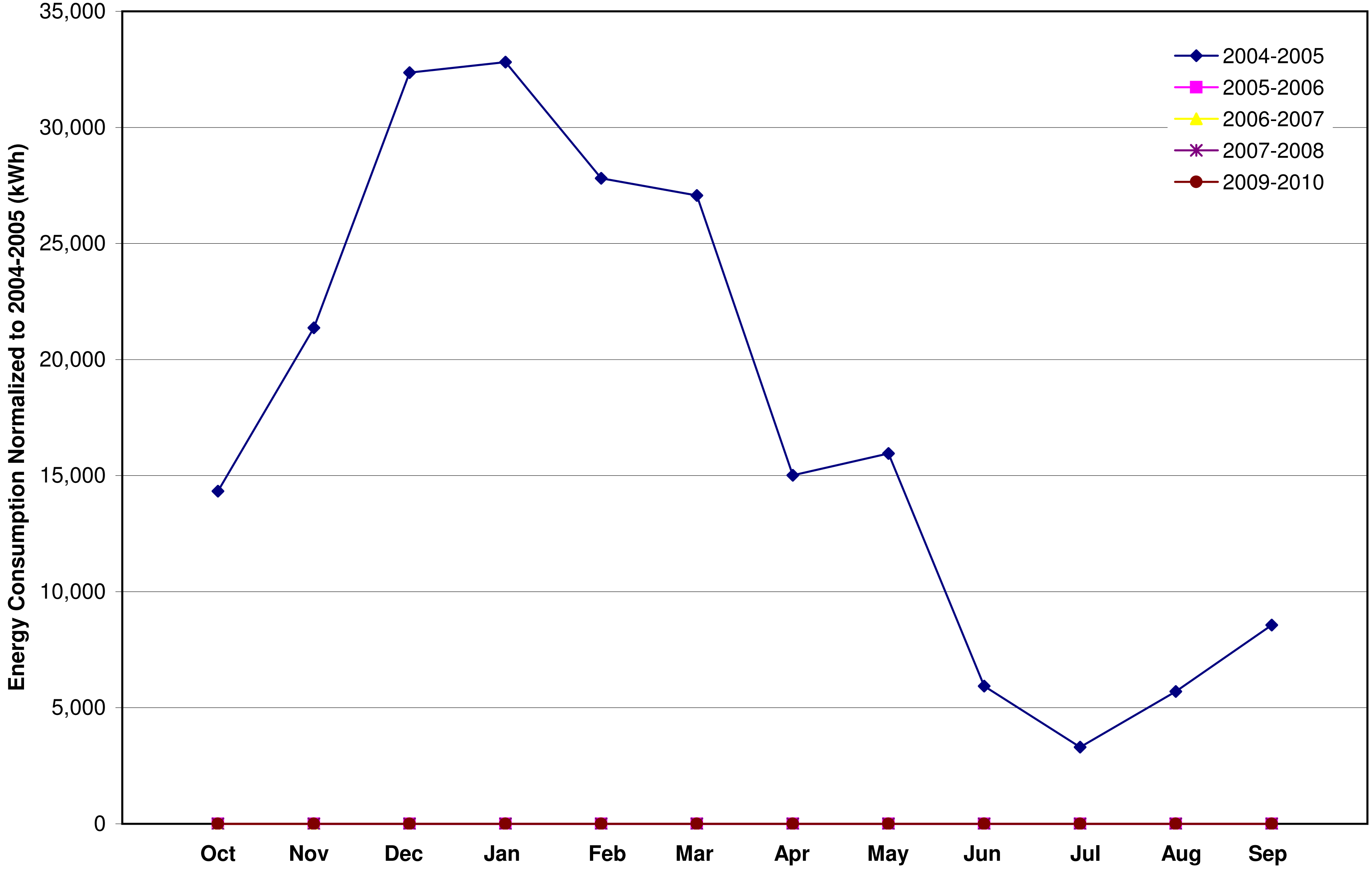


Table F.2 - Energy Consumption Monitoring Data for the Airport Garage

	2004-2005					2005-2006					2006-2007				
Month	**Billed Elect Energy (kWh)**	**Billed Propane (L)**	**Total Energy Consumption (kWh)**	**HDD (^{o}C days/ mo)**	**Energy Normalized to 2004-2005 (kWh)**	**Billed Elect Energy (kWh)**	**Billed Propane (L)**	**Total Energy Consumption (kWh)**	**HDD (^{o}C days/ mo)**	**Energy Normalized to 2004-2005 (kWh)**	**Billed Elect Energy (kWh)**	**Billed Propane (L)**	**Total Energy Consumption (kWh)**	**HDD (^{o}C days/ mo)**	**Energy Normalized to 2004-2005 (kWh)**
October	1,560	1,603	12,940	474.4	12,940			0		#DIV/0!			0		#DIV/0!
November	1,870	2,191	17,422	673.1	17,422			0		#DIV/0!			0		#DIV/0!
December	2,360	3,602	27,926	1196.9	27,926			0		#DIV/0!			0		#DIV/0!
January	3,380	3,250	26,443	1187.8	26,443			0		#DIV/0!			0		#DIV/0!
February	2,570	2,405	19,639	874.9	19,639			0		#DIV/0!			0		#DIV/0!
March	2,660	2,245	18,591	806.7	18,591			0		#DIV/0!			0		#DIV/0!
April	3,520	877	9,741	399.1	9,741			0		#DIV/0!			0		#DIV/0!
May	2,630	738	7,865	266.3	7,865			0		#DIV/0!			0		#DIV/0!
June	2,100	86	2,707	103.8	2,707			0		#DIV/0!			0		#DIV/0!
July	1,440	0	1,440	33.4	1,440			0		#DIV/0!			0		#DIV/0!
August	1,570	21	1,722	77.8	1,722			0		#DIV/0!			0		#DIV/0!
September	1,140	150	2,202	202.9	2,202			0		#DIV/0!			0		#DIV/0!
TOTAL	26,800	17,168	148,638	6297	148,638	0	0	0	0	#DIV/0!	0	0	0	0	#DIV/0!

	2007-2008					2008-2009					2009-2010				
Month	**Billed Elect Energy (kWh)**	**Billed Propane (L)**	**Total Energy Consumption (kWh)**	**HDD (^{o}C days/ mo)**	**Energy Normalized to 2004-2005 (kWh)**	**Billed Elect Energy (kWh)**	**Billed Propane (L)**	**Total Energy Consumption (kWh)**	**HDD (^{o}C days/ mo)**	**Energy Normalized to 2004-2005 (kWh)**	**Billed Elect Energy (kWh)**	**Billed Propane (L)**	**Total Energy Consumption (kWh)**	**HDD (^{o}C days/ mo)**	**Energy Normalized to 2004-2005 (kWh)**
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!
September			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 Propane" in (L) taken from the electricity and propane bills, respectively next to the appropriate month.
3. Go to the following website to collect information on the Heating Degree Days for Flin Flon, Mb: http://www.climate.weatheroffice.ec.gc.ca/climateData/dailydata_e.html?timeframe=2&Prov=CA&StationID=3857&Year=2006&Month=1&
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 F30) 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 Airport Garage

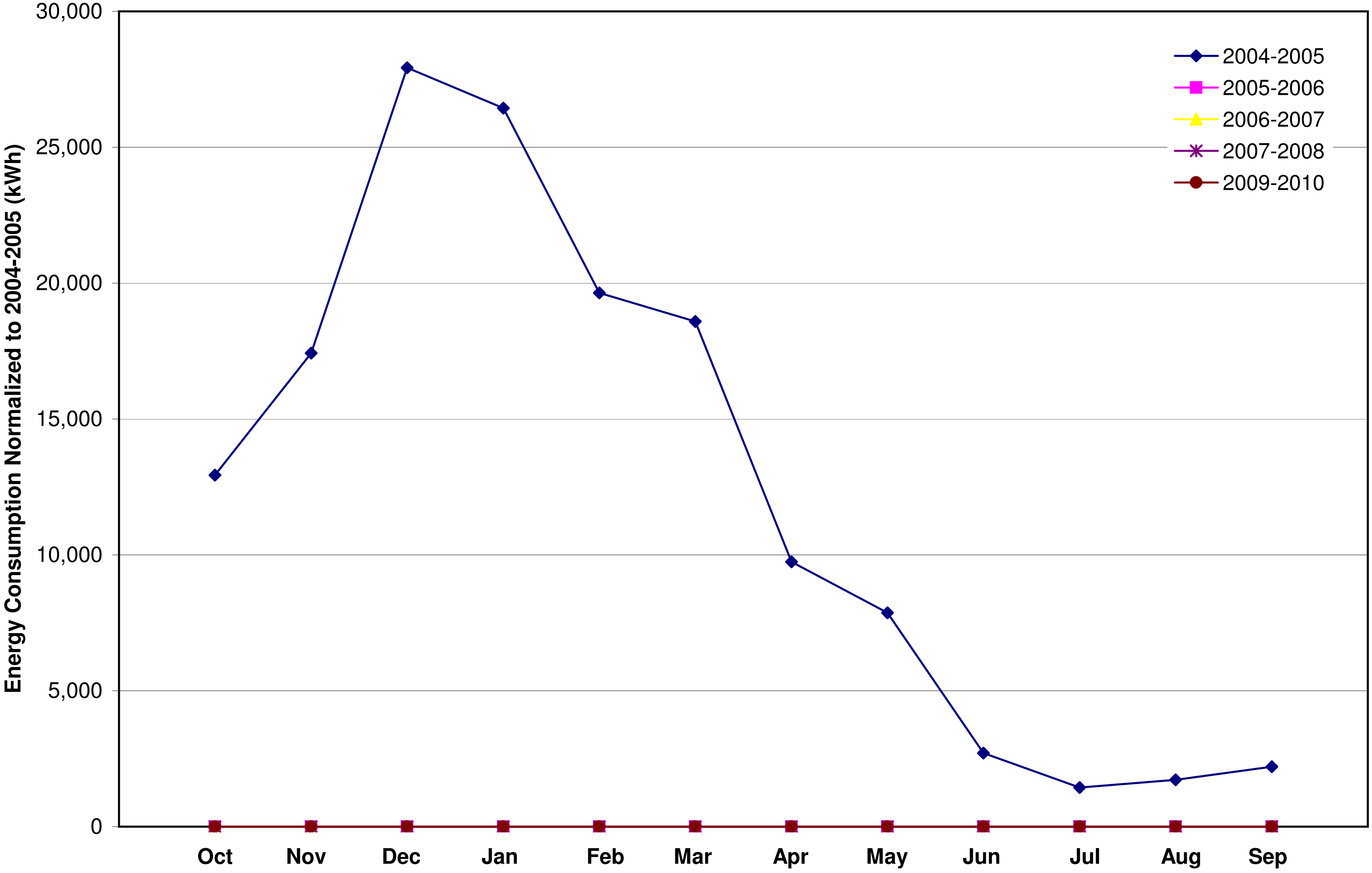


Table F.3 - Energy Consumption Monitoring Data for the Sweeper Building & Sand Storage

	2004-2005					2005-2006					2006-2007				
Month	**Billed Elect Energy (kWh)**	**Billed Propane (L)**	**Total Energy Consumption (kWh)**	**HDD (^oC days/ mo)**	**Energy Normalized to 2004-2005 (kWh)**	**Billed Elect Energy (kWh)**	**Billed Propane (L)**	**Total Energy Consumption (kWh)**	**HDD (^oC days/ mo)**	**Energy Normalized to 2004-2005 (kWh)**	**Billed Elect Energy (kWh)**	**Billed Propane (L)**	**Total Energy Consumption (kWh)**	**HDD (^oC days/ mo)**	**Energy Normalized to 2004-2005 (kWh)**
October	11,400	631	15,876	474.4	15,876			0		#DIV/0!			0		#DIV/0!
November	42,600	1,187	51,021	673.1	51,021			0		#DIV/0!			0		#DIV/0!
December	65,250	1,817	78,147	1196.9	78,147			0		#DIV/0!			0		#DIV/0!
January	86,700	1,657	98,459	1187.8	98,459			0		#DIV/0!			0		#DIV/0!
February	64,200	1,358	73,835	874.9	73,835			0		#DIV/0!			0		#DIV/0!
March	57,300	1,518	68,073	806.7	68,073			0		#DIV/0!			0		#DIV/0!
April	28,050	299	30,172	399.1	30,172			0		#DIV/0!			0		#DIV/0!
May	19,950	0	19,950	266.3	19,950			0		#DIV/0!			0		#DIV/0!
June	10,050	0	10,050	103.8	10,050			0		#DIV/0!			0		#DIV/0!
July	7,650	0	7,650	33.4	7,650			0		#DIV/0!			0		#DIV/0!
August	8,100	0	8,100	77.8	8,100			0		#DIV/0!			0		#DIV/0!
September	7,350	0	7,350	202.9	7,350			0		#DIV/0!			0		#DIV/0!
TOTAL	408,600	8,466	468,682	6297	468,682	0	0	0	0	#DIV/0!	0	0	0	0	#DIV/0!

	2007-2008					2008-2009					2009-2010				
Month	**Billed Elect Energy (kWh)**	**Billed Propane (L)**	**Total Energy Consumption (kWh)**	**HDD (^oC days/ mo)**	**Energy Normalized to 2004-2005 (kWh)**	**Billed Elect Energy (kWh)**	**Billed Propane (L)**	**Total Energy Consumption (kWh)**	**HDD (^oC days/ mo)**	**Energy Normalized to 2004-2005 (kWh)**	**Billed Elect Energy (kWh)**	**Billed Propane (L)**	**Total Energy Consumption (kWh)**	**HDD (^oC days/ mo)**	**Energy Normalized to 2004-2005 (kWh)**
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!
September			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 Propane" in (L) taken from the electricity and propane bills, respectively next to the appropriate month.
3. Go to the following website to collect information on the Heating Degree Days for Flin Flon, Mb: http://www.climate.weatheroffice.ec.gc.ca/climateData/dailydata_e.html?timeframe=2&Prov=CA&StationID=3857&Year=2006&Month=1&
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 F30) 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.3 - Energy Consumption Monitoring Graph for the Sweeper Building & Sand Storage

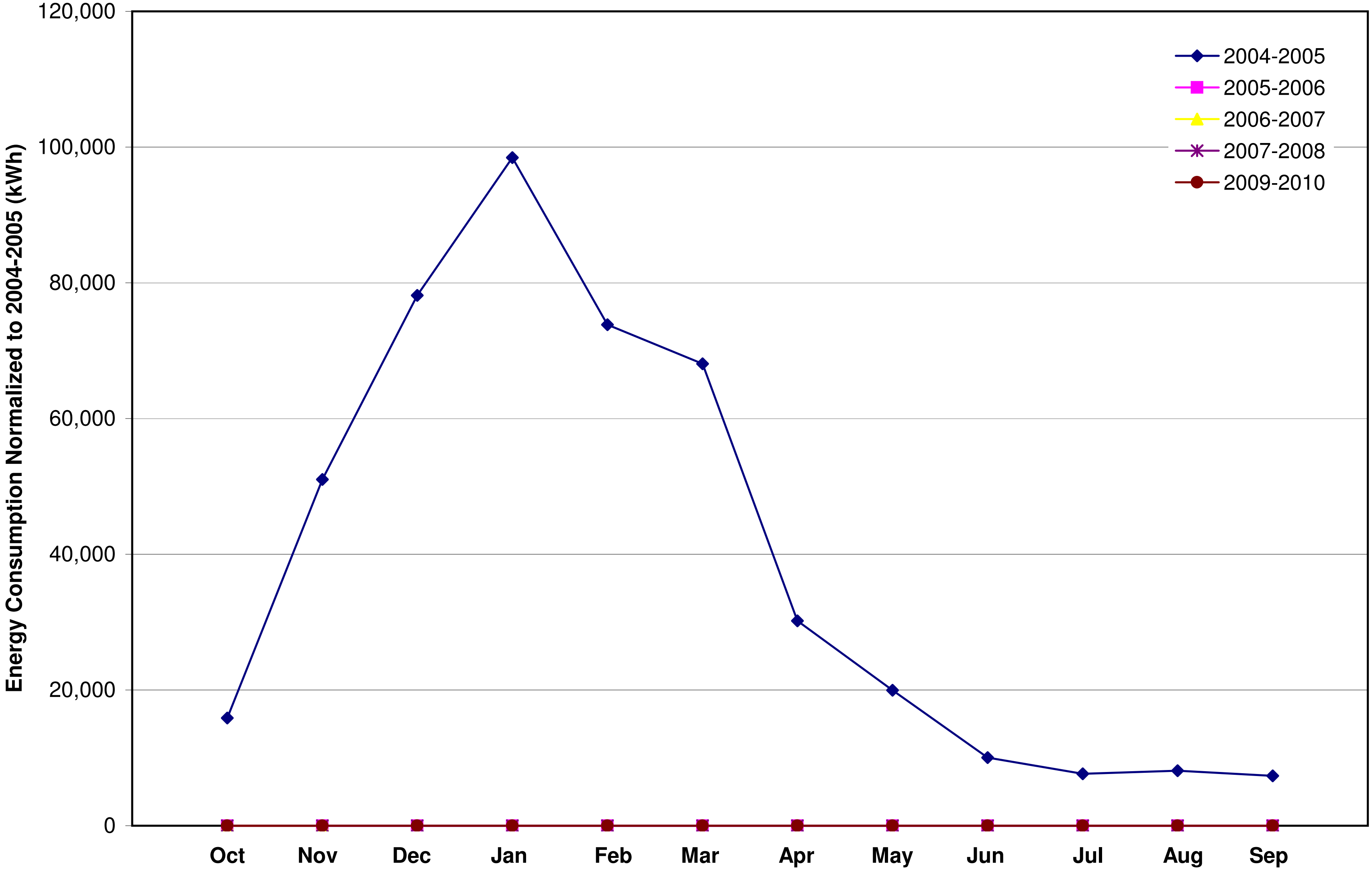


Table F.4 - Energy Consumption Monitoring Data for the Whitney Forum Arena

	2004-2005					2005-2006					2006-2007				
Month	**Billed Elect Energy (kWh)**	**Billed Oil (L)**	**Total Energy Consumption (kWh)**	**HDD (°C days/ mo)**	**Energy Normalized to 2004-2005 (kWh)**	**Billed Elect Energy (kWh)**	**Billed Oil (L)**	**Total Energy Consumption (kWh)**	**HDD (°C days/ mo)**	**Energy Normalized to 2004-2005 (kWh)**	**Billed Elect Energy (kWh)**	**Billed Oil (L)**	**Total Energy Consumption (kWh)**	**HDD (°C days/ mo)**	**Energy Normalized to 2004-2005 (kWh)**
October	137,280	13,648	280,311	474.4	280,311			0		#DIV/0!			0		#DIV/0!
November	140,040	33,457	490,669	673.1	490,669			0		#DIV/0!			0		#DIV/0!
December	130,320	30,498	449,939	1196.9	449,939			0		#DIV/0!			0		#DIV/0!
January	126,600	21,935	356,479	1187.8	356,479			0		#DIV/0!			0		#DIV/0!
February	153,600	18,879	351,452	874.9	351,452			0		#DIV/0!			0		#DIV/0!
March	128,640	23,468	374,585	806.7	374,585			0		#DIV/0!			0		#DIV/0!
April	148,080	15,767	313,318	399.1	313,318			0		#DIV/0!			0		#DIV/0!
May	70,200	0	70,200	266.3	70,200			0		#DIV/0!			0		#DIV/0!
June	24,000	0	24,000	103.8	24,000			0		#DIV/0!			0		#DIV/0!
July	19,080	0	19,080	33.4	19,080			0		#DIV/0!			0		#DIV/0!
August	19,080	3,784	58,736	77.8	58,736			0		#DIV/0!			0		#DIV/0!
September	19,080	12,579	150,908	202.9	150,908			0		#DIV/0!			0		#DIV/0!
TOTAL	1,116,000	174,015	2,939,677	6297	2,939,677	0	0	0	0	#DIV/0!	0	0	0	0	#DIV/0!

	2007-2008					2008-2009					2009-2010				
Month	**Billed Elect Energy (kWh)**	**Billed Oil (L)**	**Total Energy Consumption (kWh)**	**HDD (°C days/ mo)**	**Energy Normalized to 2004-2005 (kWh)**	**Billed Elect Energy (kWh)**	**Billed Oil (L)**	**Total Energy Consumption (kWh)**	**HDD (°C days/ mo)**	**Energy Normalized to 2004-2005 (kWh)**	**Billed Elect Energy (kWh)**	**Billed Oil (L)**	**Total Energy Consumption (kWh)**	**HDD (°C days/ mo)**	**Energy Normalized to 2004-2005 (kWh)**
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!
September			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 Oil" in (L) taken from the electricity and propane bills, respectively next to the appropriate month.
3. Go to the following website to collect information on the Heating Degree Days for Flin Flon, Mb: http://www.climate.weatheroffice.ec.gc.ca/climateData/dailydata_e.html?timeframe=2&Prov=CA&StationID=3857&Year=2006&Month=1&
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 F30) 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.4 - Energy Consumption Monitoring Graph for the Whitney Forum Arena

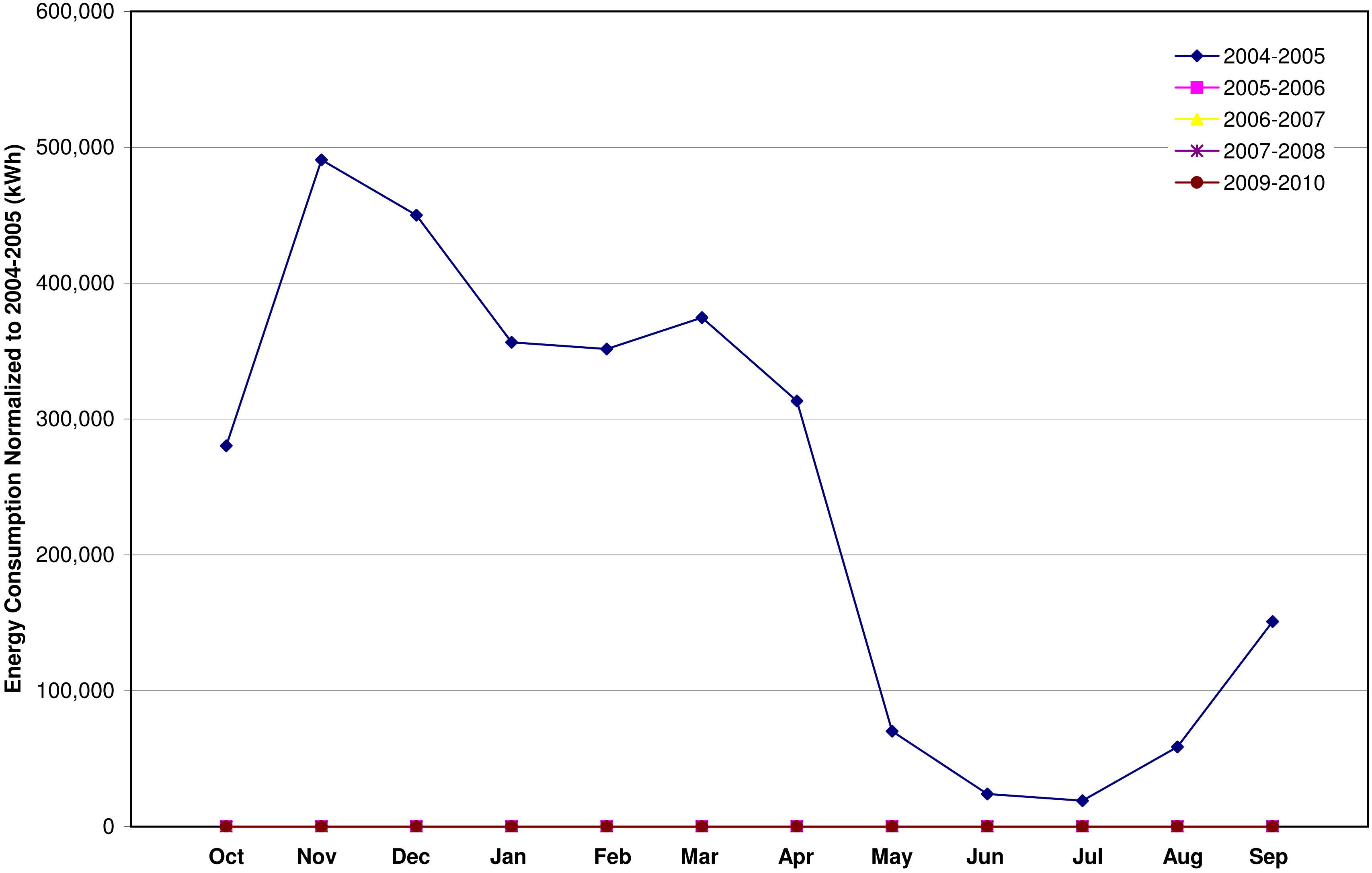


Table F.5 - Energy Consumption Monitoring Data for the Community Centre

	2004-2005					2005-2006					2006-2007				
Month	**Billed Elect Energy (kWh)**	**Billed Oil (L)**	**Total Energy Consumption (kWh)**	**HDD (°C days/ mo)**	**Energy Normalized to 2004-2005 (kWh)**	**Billed Elect Energy (kWh)**	**Billed Oil (L)**	**Total Energy Consumption (kWh)**	**HDD (°C days/ mo)**	**Energy Normalized to 2004-2005 (kWh)**	**Billed Elect Energy (kWh)**	**Billed Oil (L)**	**Total Energy Consumption (kWh)**	**HDD (°C days/ mo)**	**Energy Normalized to 2004-2005 (kWh)**
October	12,480	1,624	29,500	474.4	29,500			0		#DIV/0!			0		#DIV/0!
November	13,920	2,908	44,396	673.1	44,396			0		#DIV/0!			0		#DIV/0!
December	22,560	5,399	79,142	1196.9	79,142			0		#DIV/0!			0		#DIV/0!
January	27,840	20,212	239,662	1187.8	239,662			0		#DIV/0!			0		#DIV/0!
February	20,640	5,103	74,119	874.9	74,119			0		#DIV/0!			0		#DIV/0!
March	17,760	3,680	56,326	806.7	56,326			0		#DIV/0!			0		#DIV/0!
April	19,200	0	19,200	399.1	19,200			0		#DIV/0!			0		#DIV/0!
May	13,920	0	13,920	266.3	13,920			0		#DIV/0!			0		#DIV/0!
June	11,520	0	11,520	103.8	11,520			0		#DIV/0!			0		#DIV/0!
July	18,720	0	18,720	33.4	18,720			0		#DIV/0!			0		#DIV/0!
August	11,040	0	11,040	77.8	11,040			0		#DIV/0!			0		#DIV/0!
September	10,080	0	10,080	202.9	10,080			0		#DIV/0!			0		#DIV/0!
TOTAL	199,680	38,926	607,624	6297	607,624	0	0	0	0	#DIV/0!	0	0	0	0	#DIV/0!

	2007-2008					2008-2009					2009-2010				
Month	**Billed Elect Energy (kWh)**	**Billed Oil (L)**	**Total Energy Consumption (kWh)**	**HDD (°C days/ mo)**	**Energy Normalized to 2004-2005 (kWh)**	**Billed Elect Energy (kWh)**	**Billed Oil (L)**	**Total Energy Consumption (kWh)**	**HDD (°C days/ mo)**	**Energy Normalized to 2004-2005 (kWh)**	**Billed Elect Energy (kWh)**	**Billed Oil (L)**	**Total Energy Consumption (kWh)**	**HDD (°C days/ mo)**	**Energy Normalized to 2004-2005 (kWh)**
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!
September			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 Oil" in (L) taken from the electricity and propane bills, respectively next to the appropriate month.
3. Go to the following website to collect information on the Heating Degree Days for Flin Flon, Mb: http://www.climate.weatheroffice.ec.gc.ca/climateData/dailydata_e.html?timeframe=2&Prov=CA&StationID=3857&Year=2006&Month=1&
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 F30) 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.5 - Energy Consumption Monitoring Graph for the Community Centre

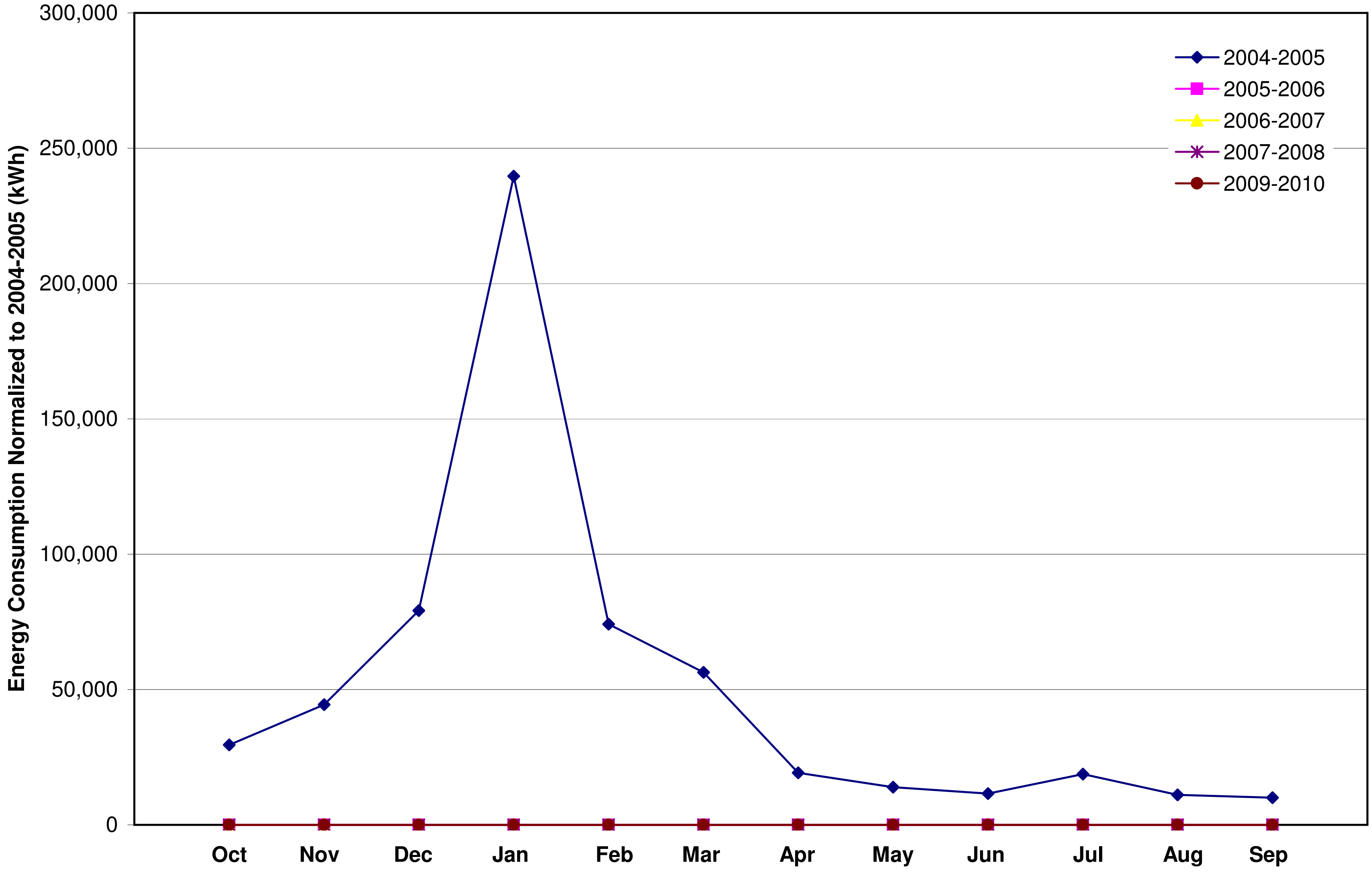


Table F.6 - Energy Consumption Monitoring Data for the Aqua Centre

	2004-2005					2005-2006					2006-2007				
Month	**Billed Elect Energy (kWh)**	**Billed Propane (L)**	**Total Energy Consumption (kWh)**	**HDD (^{o}C days/ mo)**	**Energy Normalized to 2004-2005 (kWh)**	**Billed Elect Energy (kWh)**	**Billed Propane (L)**	**Total Energy Consumption (kWh)**	**HDD (^{o}C days/ mo)**	**Energy Normalized to 2004-2005 (kWh)**	**Billed Elect Energy (kWh)**	**Billed Propane (L)**	**Total Energy Consumption (kWh)**	**HDD (^{o}C days/ mo)**	**Energy Normalized to 2004-2005 (kWh)**
October	70,200	1175.86	78,545	474.4	78,545			0		#DIV/0!			0		#DIV/0!
November	83,700	1111.72	91,590	673.1	91,590			0		#DIV/0!			0		#DIV/0!
December	106,200	1047.58	113,635	1196.9	113,635			0		#DIV/0!			0		#DIV/0!
January	98,100	962.06	104,928	1187.8	104,928			0		#DIV/0!			0		#DIV/0!
February	86,220	1133.1	94,262	874.9	94,262			0		#DIV/0!			0		#DIV/0!
March	79,200	1507.23	89,897	806.7	89,897			0		#DIV/0!			0		#DIV/0!
April	72,360	1175.86	80,705	399.1	80,705			0		#DIV/0!			0		#DIV/0!
May	65,520	1603.44	76,900	266.3	76,900			0		#DIV/0!			0		#DIV/0!
June	48,600	897.93	54,973	103.8	54,973			0		#DIV/0!			0		#DIV/0!
July	47,520	630.69	51,996	33.4	51,996			0		#DIV/0!			0		#DIV/0!
August	43,560	684.13	48,415	77.8	48,415			0		#DIV/0!			0		#DIV/0!
September	58,140	448.96	61,326	202.9	61,326			0		#DIV/0!			0		#DIV/0!
TOTAL	859,320	12,379	947,171	6297	947,171	0	0	0	0	#DIV/0!	0	0	0	0	#DIV/0!

	2007-2008					2008-2009					2009-2010				
Month	**Billed Elect Energy (kWh)**	**Billed Propane (L)**	**Total Energy Consumption (kWh)**	**HDD (^{o}C days/ mo)**	**Energy Normalized to 2004-2005 (kWh)**	**Billed Elect Energy (kWh)**	**Billed Propane (L)**	**Total Energy Consumption (kWh)**	**HDD (^{o}C days/ mo)**	**Energy Normalized to 2004-2005 (kWh)**	**Billed Elect Energy (kWh)**	**Billed Propane (L)**	**Total Energy Consumption (kWh)**	**HDD (^{o}C days/ mo)**	**Energy Normalized to 2004-2005 (kWh)**
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!
September			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 Propane" in (L) taken from the electricity and propane bills, respectively next to the appropriate month.
3. Go to the following website to collect information on the Heating Degree Days for Flin Flon, Mb: http://www.climate.weatheroffice.ec.gc.ca/climateData/dailydata_e.html?timeframe=2&Prov=CA&StationID=3857&Year=2006&Month=1&
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 F30) 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.6 - Energy Consumption Monitoring Graph for the Aqua Centre

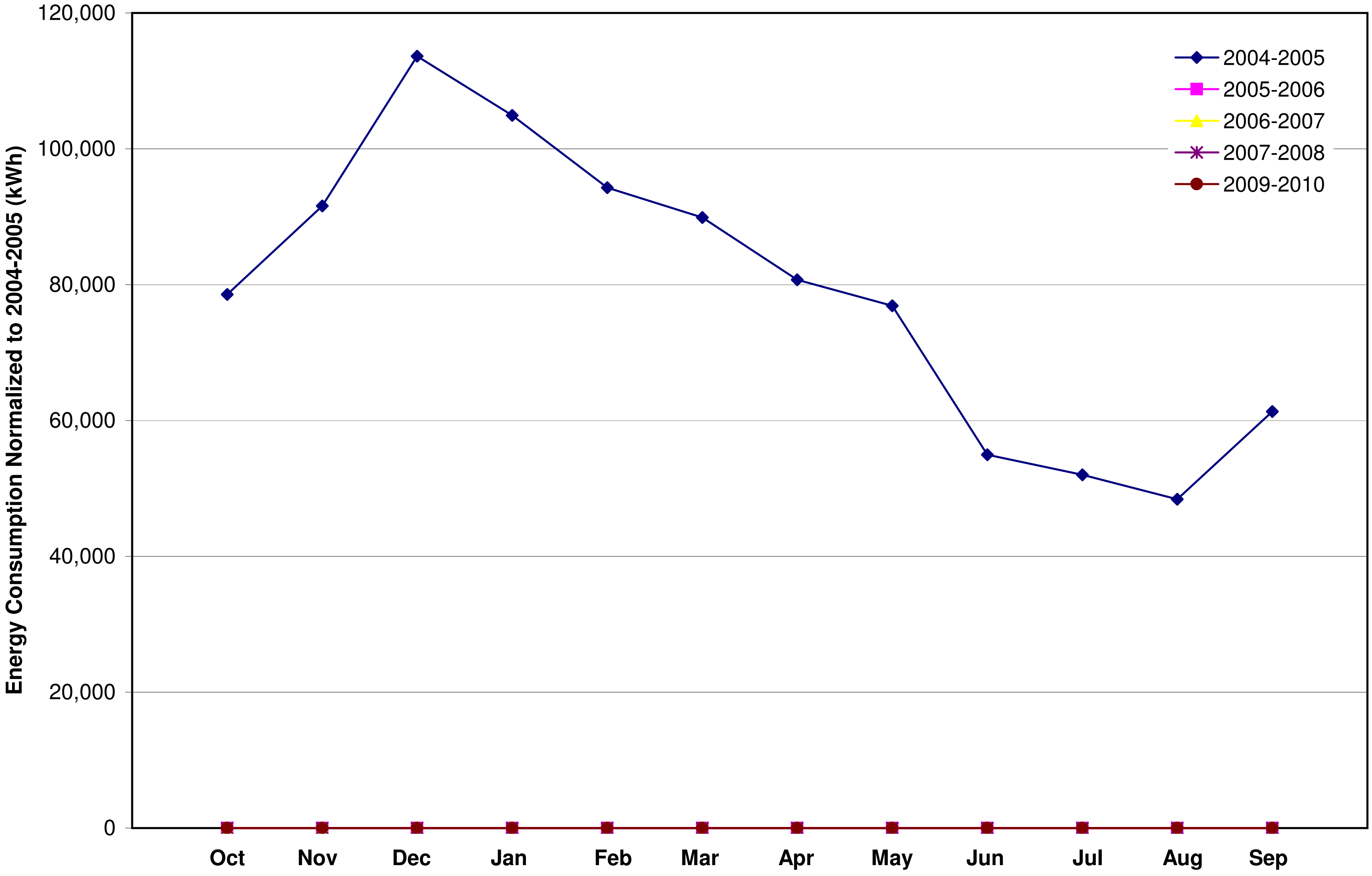


Table F.7 - Energy Consumption Monitoring Data for the Public Library

	2004-2005					2005-2006					2006-2007				
Month	**Billed Elect Energy (kWh)**	**Billed Propane (m^3)**	**Total Energy Consumption (kWh)**	**HDD (°C days/ mo)**	**Energy Normalized to 2004-2005 (kWh)**	**Billed Elect Energy (kWh)**	**Billed Propane (m^3)**	**Total Energy Consumption (kWh)**	**HDD (°C days/ mo)**	**Energy Normalized to 2004-2005 (kWh)**	**Billed Elect Energy (kWh)**	**Billed Propane (m^3)**	**Total Energy Consumption (kWh)**	**HDD (°C days/ mo)**	**Energy Normalized to 2004-2005 (kWh)**
October	8,560	158.5752	12,688	474.4	12,688			0		#DIV/0!			0		#DIV/0!
November	17,120	563.5083	31,788	673.1	31,788			0		#DIV/0!			0		#DIV/0!
December	18,480	495.5475	31,379	1196.9	31,379			0		#DIV/0!			0		#DIV/0!
January	25,600	396.438	35,919	1187.8	35,919			0		#DIV/0!			0		#DIV/0!
February	17,280	365.2893	26,788	874.9	26,788			0		#DIV/0!			0		#DIV/0!
March	14,640	59.4657	16,188	806.7	16,188			0		#DIV/0!			0		#DIV/0!
April	13,680	96.2778	16,186	399.1	16,186			0		#DIV/0!			0		#DIV/0!
May	10,160	0	10,160	266.3	10,160			0		#DIV/0!			0		#DIV/0!
June	8,800	0	8,800	103.8	8,800			0		#DIV/0!			0		#DIV/0!
July	8,560	0	8,560	33.4	8,560			0		#DIV/0!			0		#DIV/0!
August	9,040	0	9,040	77.8	9,040			0		#DIV/0!			0		#DIV/0!
September	6,560	48.1389	7,813	202.9	7,813			0		#DIV/0!			0		#DIV/0!
TOTAL	158,480	2,183	215,310	6297	215,310	0	0	0	0	#DIV/0!	0	0	0	0	#DIV/0!

	2007-2008					2008-2009					2009-2010				
Month	**Billed Elect Energy (kWh)**	**Billed Propane (m^3)**	**Total Energy Consumption (kWh)**	**HDD (°C days/ mo)**	**Energy Normalized to 2004-2005 (kWh)**	**Billed Elect Energy (kWh)**	**Billed Propane (m^3)**	**Total Energy Consumption (kWh)**	**HDD (°C days/ mo)**	**Energy Normalized to 2004-2005 (kWh)**	**Billed Elect Energy (kWh)**	**Billed Propane (m^3)**	**Total Energy Consumption (kWh)**	**HDD (°C days/ mo)**	**Energy Normalized to 2004-2005 (kWh)**
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!
September			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 Propane" in (m^3) taken from the electricity and propane bills, respectively next to the appropriate month.
3. Go to the following website to collect information on the Heating Degree Days for Flin Flon, Mb: http://www.climate.weatheroffice.ec.gc.ca/climateData/dailydata_e.html?timeframe=2&Prov=CA&StationID=3857&Year=2006&Month=1&
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 F30) 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.7 - Energy Consumption Monitoring Graph for the Public Library

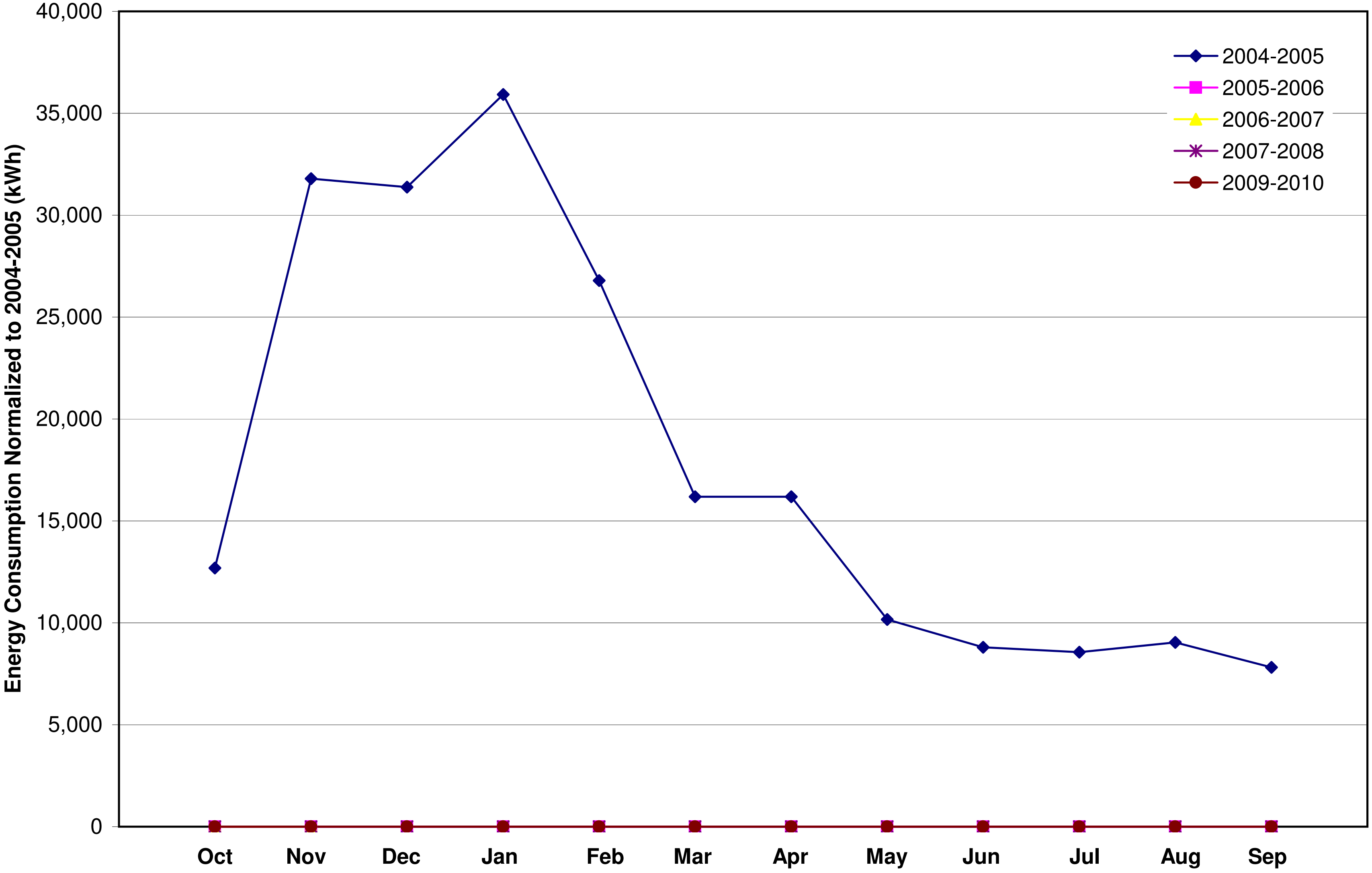


Table F.8 - Energy Consumption Monitoring Data for the Public Safety Building

	2004-2005					2005-2006					2006-2007				
Month	**Billed Elect Energy (kWh)**	**Billed Propane (L)**	**Total Energy Consumption (kWh)**	**HDD (^{o}C days/ mo)**	**Energy Normalized to 2004-2005 (kWh)**	**Billed Elect Energy (kWh)**	**Billed Propane (L)**	**Total Energy Consumption (kWh)**	**HDD (^{o}C days/ mo)**	**Energy Normalized to 2004-2005 (kWh)**	**Billed Elect Energy (kWh)**	**Billed Propane (L)**	**Total Energy Consumption (kWh)**	**HDD (^{o}C days/ mo)**	**Energy Normalized to 2004-2005 (kWh)**
October	23,580	0	23,580	474.4	23,580		0	0		#DIV/0!		0	0		#DIV/0!
November	34,920	0	34,920	673.1	34,920		0	0		#DIV/0!		0	0		#DIV/0!
December	58,500	0	58,500	1196.9	58,500		0	0		#DIV/0!		0	0		#DIV/0!
January	85,320	0	85,320	1187.8	85,320		0	0		#DIV/0!		0	0		#DIV/0!
February	64,260	0	64,260	874.9	64,260		0	0		#DIV/0!		0	0		#DIV/0!
March	44,820	0	44,820	806.7	44,820		0	0		#DIV/0!		0	0		#DIV/0!
April	52,380	0	52,380	399.1	52,380		0	0		#DIV/0!		0	0		#DIV/0!
May	36,720	0	36,720	266.3	36,720		0	0		#DIV/0!		0	0		#DIV/0!
June	32,580	0	32,580	103.8	32,580		0	0		#DIV/0!		0	0		#DIV/0!
July	22,860	0	22,860	33.4	22,860		0	0		#DIV/0!		0	0		#DIV/0!
August	25,020	0	25,020	77.8	25,020		0	0		#DIV/0!		0	0		#DIV/0!
September	21,780	0	21,780	202.9	21,780		0	0		#DIV/0!		0	0		#DIV/0!
TOTAL	502,740	0	502,740	6297	502,740	0	0	0	0	#DIV/0!	0	0	0	0	#DIV/0!

	2007-2008					2008-2009					2009-2010				
Month	**Billed Elect Energy (kWh)**	**Billed Propane (L)**	**Total Energy Consumption (kWh)**	**HDD (^{o}C days/ mo)**	**Energy Normalized to 2004-2005 (kWh)**	**Billed Elect Energy (kWh)**	**Billed Propane (L)**	**Total Energy Consumption (kWh)**	**HDD (^{o}C days/ mo)**	**Energy Normalized to 2004-2005 (kWh)**	**Billed Elect Energy (kWh)**	**Billed Propane (L)**	**Total Energy Consumption (kWh)**	**HDD (^{o}C days/ mo)**	**Energy Normalized to 2004-2005 (kWh)**
October		0	0		#DIV/0!		0	0		#DIV/0!		0	0		#DIV/0!
November		0	0		#DIV/0!		0	0		#DIV/0!		0	0		#DIV/0!
December		0	0		#DIV/0!		0	0		#DIV/0!		0	0		#DIV/0!
January		0	0		#DIV/0!		0	0		#DIV/0!		0	0		#DIV/0!
February		0	0		#DIV/0!		0	0		#DIV/0!		0	0		#DIV/0!
March		0	0		#DIV/0!		0	0		#DIV/0!		0	0		#DIV/0!
April		0	0		#DIV/0!		0	0		#DIV/0!		0	0		#DIV/0!
May		0	0		#DIV/0!		0	0		#DIV/0!		0	0		#DIV/0!
June		0	0		#DIV/0!		0	0		#DIV/0!		0	0		#DIV/0!
July		0	0		#DIV/0!		0	0		#DIV/0!		0	0		#DIV/0!
August		0	0		#DIV/0!		0	0		#DIV/0!		0	0		#DIV/0!
September		0	0		#DIV/0!		0	0		#DIV/0!		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 Propane" in (L) taken from the electricity and propane bills, respectively next to the appropriate month.
3. Go to the following website to collect information on the Heating Degree Days for Flin Flon, Mb: http://www.climate.weatheroffice.ec.gc.ca/climateData/dailydata_e.html?timeframe=2&Prov=CA&StationID=3857&Year=2006&Month=1&
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 F30) 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.8 - Energy Consumption Monitoring Graph for the Public Safety Building

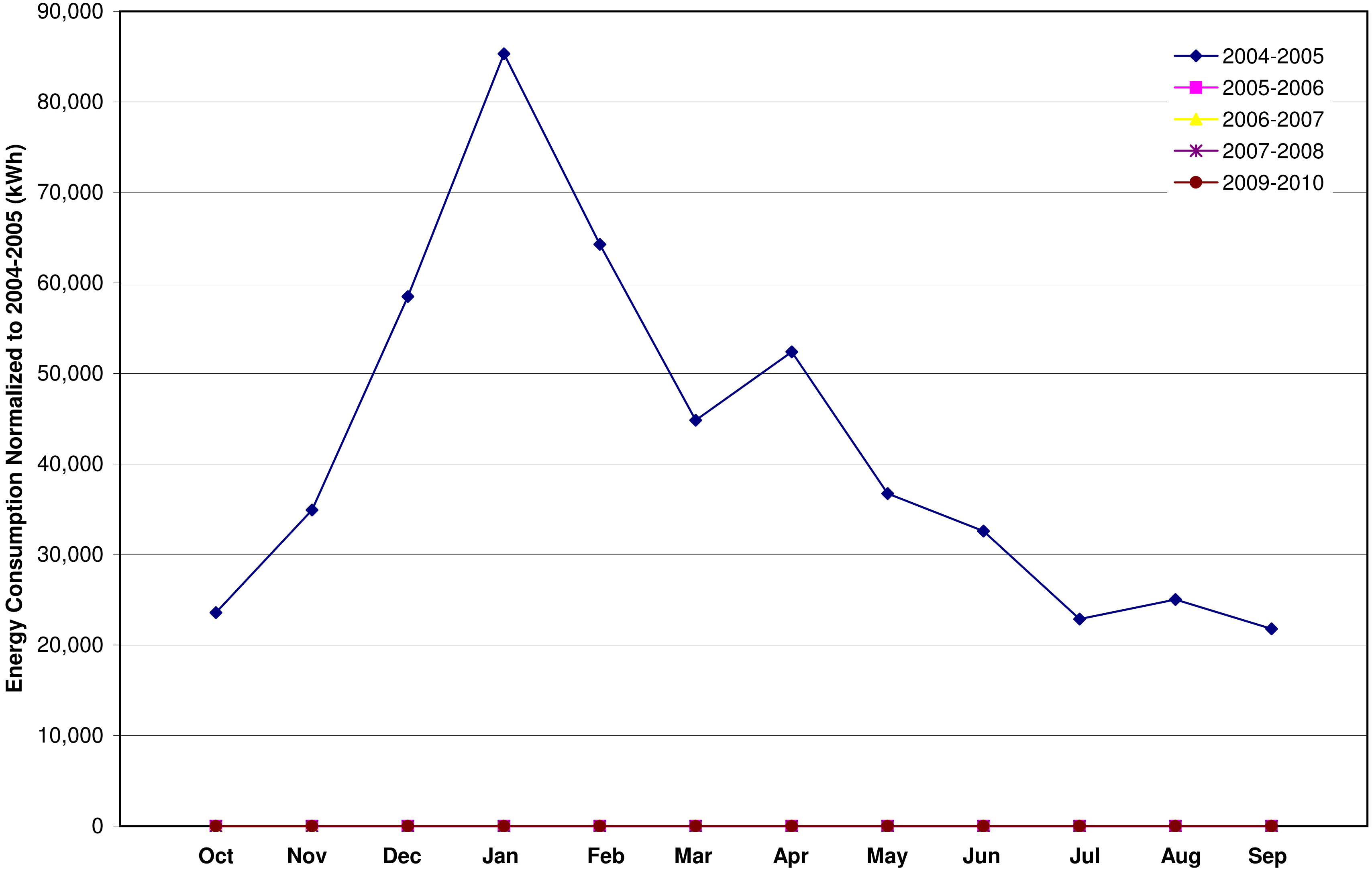


Table F.9 - Energy Consumption Monitoring Data for City Hall

	2004-2005					2005-2006					2006-2007				
Month	**Billed Elect Energy (kWh)**	**Billed Propane (L)**	**Total Energy Consumption (kWh)**	**HDD (^{o}C days/ mo)**	**Energy Normalized to 2004-2005 (kWh)**	**Billed Elect Energy (kWh)**	**Billed Propane (L)**	**Total Energy Consumption (kWh)**	**HDD (^{o}C days/ mo)**	**Energy Normalized to 2004-2005 (kWh)**	**Billed Elect Energy (kWh)**	**Billed Propane (L)**	**Total Energy Consumption (kWh)**	**HDD (^{o}C days/ mo)**	**Energy Normalized to 2004-2005 (kWh)**
October	18,480	0	18,480	474.4	18,480		0	0		#DIV/0!		0	0		#DIV/0!
November	23,280	0	23,280	673.1	23,280		0	0		#DIV/0!		0	0		#DIV/0!
December	33,600	0	33,600	1196.9	33,600		0	0		#DIV/0!		0	0		#DIV/0!
January	41,040	0	41,040	1187.8	41,040		0	0		#DIV/0!		0	0		#DIV/0!
February	28,560	0	28,560	874.9	28,560		0	0		#DIV/0!		0	0		#DIV/0!
March	23,280	0	23,280	806.7	23,280		0	0		#DIV/0!		0	0		#DIV/0!
April	24,480	0	24,480	399.1	24,480		0	0		#DIV/0!		0	0		#DIV/0!
May	17,520	0	17,520	266.3	17,520		0	0		#DIV/0!		0	0		#DIV/0!
June	12,720	0	12,720	103.8	12,720		0	0		#DIV/0!		0	0		#DIV/0!
July	16,800	0	16,800	33.4	16,800		0	0		#DIV/0!		0	0		#DIV/0!
August	14,880	0	14,880	77.8	14,880		0	0		#DIV/0!		0	0		#DIV/0!
September	13,680	0	13,680	202.9	13,680		0	0		#DIV/0!		0	0		#DIV/0!
TOTAL	268,320	0	268,320	6297	268,320	0	0	0	0	#DIV/0!	0	0	0	0	#DIV/0!

	2007-2008					2008-2009					2009-2010				
Month	**Billed Elect Energy (kWh)**	**Billed Propane (L)**	**Total Energy Consumption (kWh)**	**HDD (^{o}C days/ mo)**	**Energy Normalized to 2004-2005 (kWh)**	**Billed Elect Energy (kWh)**	**Billed Propane (L)**	**Total Energy Consumption (kWh)**	**HDD (^{o}C days/ mo)**	**Energy Normalized to 2004-2005 (kWh)**	**Billed Elect Energy (kWh)**	**Billed Propane (L)**	**Total Energy Consumption (kWh)**	**HDD (^{o}C days/ mo)**	**Energy Normalized to 2004-2005 (kWh)**
October		0	0		#DIV/0!		0	0		#DIV/0!		0	0		#DIV/0!
November		0	0		#DIV/0!		0	0		#DIV/0!		0	0		#DIV/0!
December		0	0		#DIV/0!		0	0		#DIV/0!		0	0		#DIV/0!
January		0	0		#DIV/0!		0	0		#DIV/0!		0	0		#DIV/0!
February		0	0		#DIV/0!		0	0		#DIV/0!		0	0		#DIV/0!
March		0	0		#DIV/0!		0	0		#DIV/0!		0	0		#DIV/0!
April		0	0		#DIV/0!		0	0		#DIV/0!		0	0		#DIV/0!
May		0	0		#DIV/0!		0	0		#DIV/0!		0	0		#DIV/0!
June		0	0		#DIV/0!		0	0		#DIV/0!		0	0		#DIV/0!
July		0	0		#DIV/0!		0	0		#DIV/0!		0	0		#DIV/0!
August		0	0		#DIV/0!		0	0		#DIV/0!		0	0		#DIV/0!
September		0	0		#DIV/0!		0	0		#DIV/0!		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 Propane" in (L) taken from the electricity and propane bills, respectively next to the appropriate month.
3. Go to the following website to collect information on the Heating Degree Days for Flin Flon, Mb: http://www.climate.weatheroffice.ec.gc.ca/climateData/dailydata_e.html?timeframe=2&Prov=CA&StationID=3857&Year=2006&Month=1&
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 F30) 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.9 - Energy Consumption Monitoring Graph for the City Hall

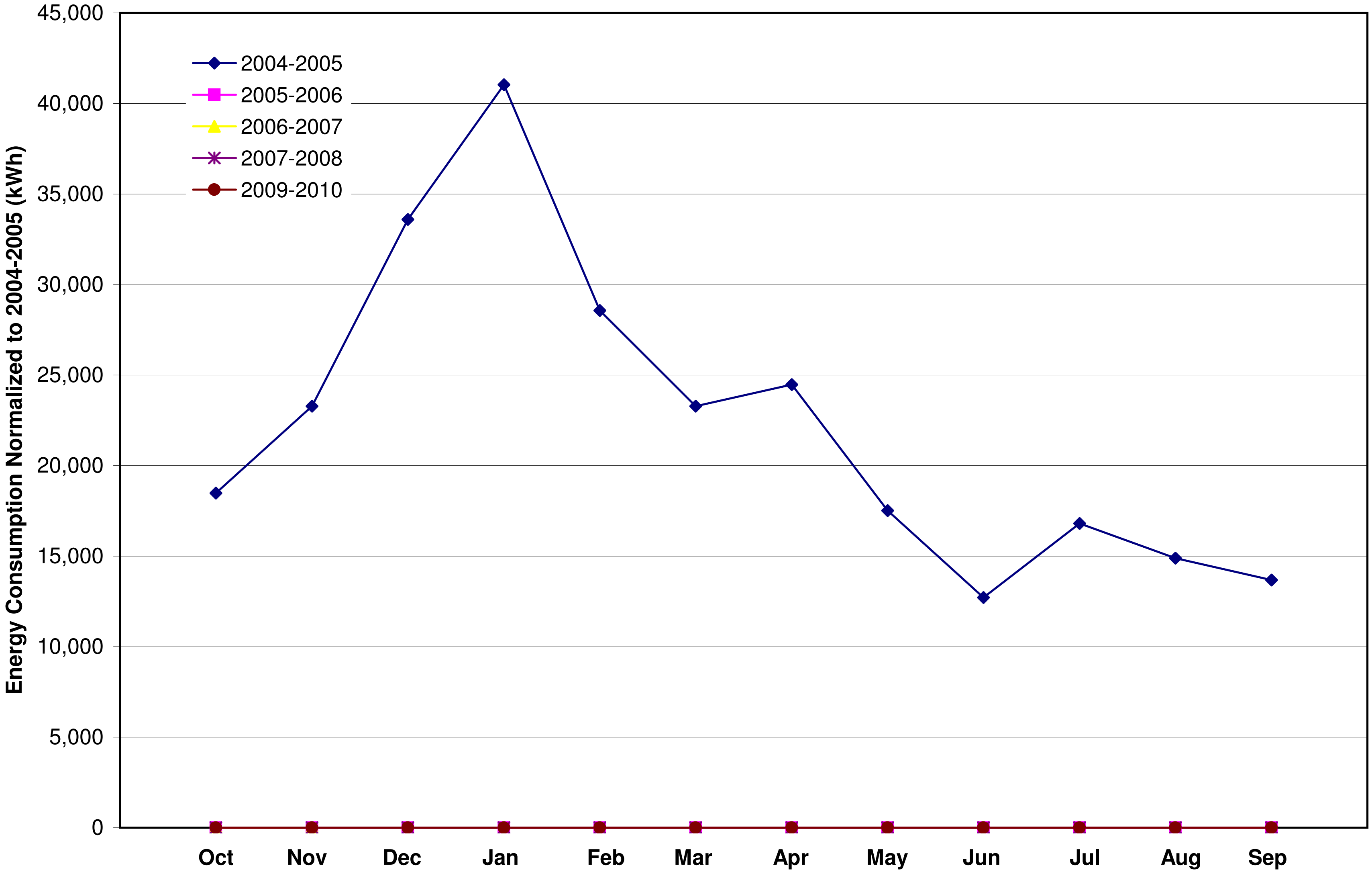


Table F.10 - Energy Consumption Monitoring Data for the Sewage Treatment Plant

	2004-2005					2005-2006					2006-2007				
Month	**Billed Elect Energy (kWh)**	**Billed Propane (L)**	**Total Energy Consumption (kWh)**	**HDD (°C days/ mo)**	**Energy Normalized to 2004-2005 (kWh)**	**Billed Elect Energy (kWh)**	**Billed Propane (L)**	**Total Energy Consumption (kWh)**	**HDD (°C days/ mo)**	**Energy Normalized to 2004-2005 (kWh)**	**Billed Elect Energy (kWh)**	**Billed Propane (L)**	**Total Energy Consumption (kWh)**	**HDD (°C days/ mo)**	**Energy Normalized to 2004-2005 (kWh)**
October	11,250	5,585	50,889	474.4	50,889			0		#DIV/0!			0		#DIV/0!
November	21,770	4,104	50,898	673.1	50,898			0		#DIV/0!			0		#DIV/0!
December	28,200	12,501	116,920	1196.9	116,920			0		#DIV/0!			0		#DIV/0!
January	32,700	5,582	72,312	1187.8	72,312			0		#DIV/0!			0		#DIV/0!
February	25,500	7,632	79,661	874.9	79,661			0		#DIV/0!			0		#DIV/0!
March	20,170	5,117	56,485	806.7	56,485			0		#DIV/0!			0		#DIV/0!
April	19,390	2,662	38,284	399.1	38,284			0		#DIV/0!			0		#DIV/0!
May	13,860	0	13,860	266.3	13,860			0		#DIV/0!			0		#DIV/0!
June	11,070	0	11,070	103.8	11,070			0		#DIV/0!			0		#DIV/0!
July	10,650	0	10,650	33.4	10,650			0		#DIV/0!			0		#DIV/0!
August	620	700	5,587	77.8	5,587			0		#DIV/0!			0		#DIV/0!
September	10,440	0	10,440	202.9	10,440			0		#DIV/0!			0		#DIV/0!
TOTAL	205,620	43,883	517,055	6297	517,055	0	0	0	0	#DIV/0!	0	0	0	0	#DIV/0!

	2007-2008					2008-2009					2009-2010				
Month	**Billed Elect Energy (kWh)**	**Billed Propane (L)**	**Total Energy Consumption (kWh)**	**HDD (°C days/ mo)**	**Energy Normalized to 2004-2005 (kWh)**	**Billed Elect Energy (kWh)**	**Billed Propane (L)**	**Total Energy Consumption (kWh)**	**HDD (°C days/ mo)**	**Energy Normalized to 2004-2005 (kWh)**	**Billed Elect Energy (kWh)**	**Billed Propane (L)**	**Total Energy Consumption (kWh)**	**HDD (°C days/ mo)**	**Energy Normalized to 2004-2005 (kWh)**
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!
September			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 Propane" in (L) taken from the electricity and propane bills, respectively next to the appropriate month.
3. Go to the following website to collect information on the Heating Degree Days for Flin Flon, Mb: http://www.climate.weatheroffice.ec.gc.ca/climateData/dailydata_e.html?timeframe=2&Prov=CA&StationID=3857&Year=2006&Month=1&
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 F30) 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.10 - Energy Consumption Monitoring Graph for the Sewage Treatment Plant

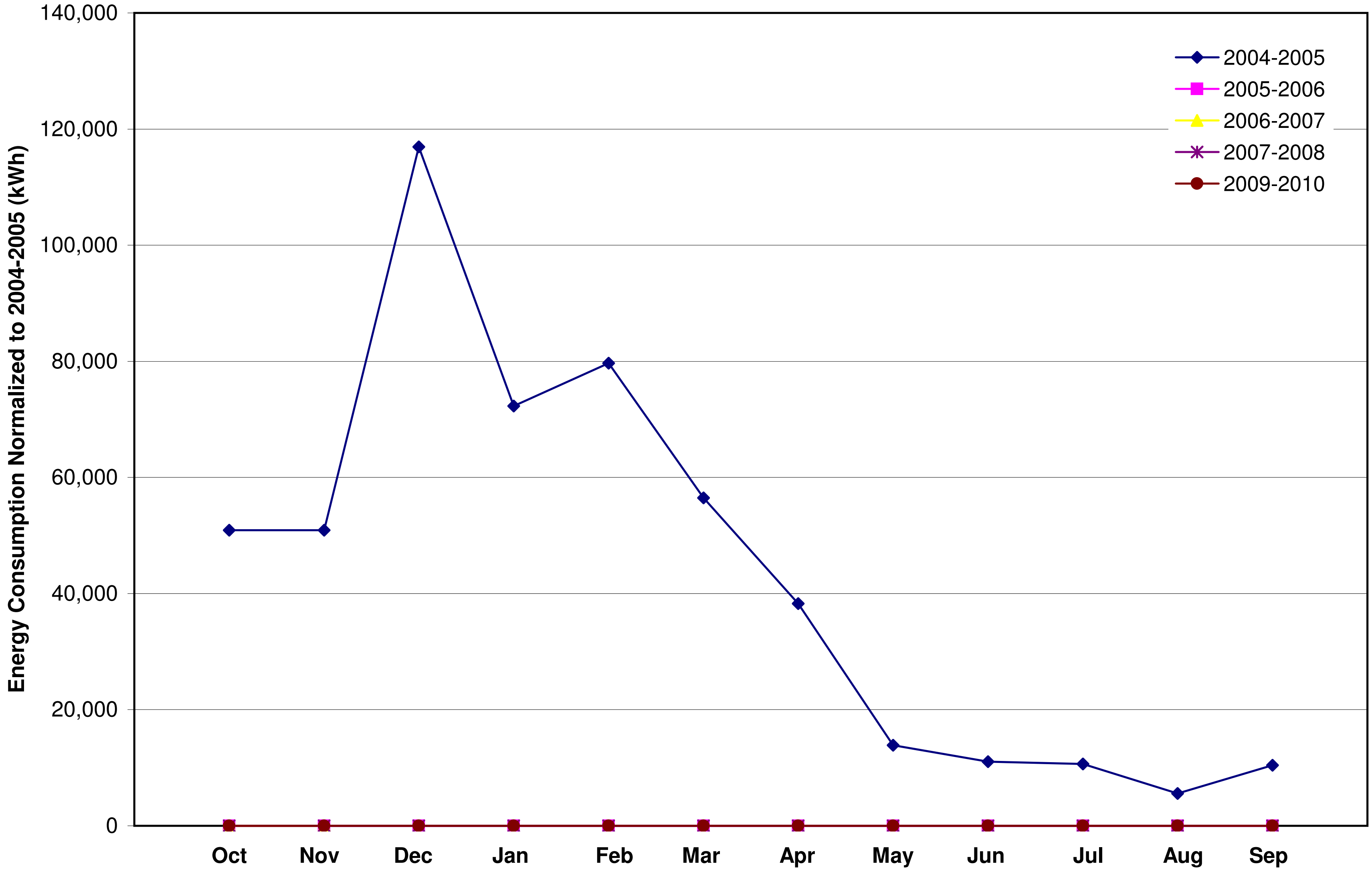


Table F.11 - Energy Consumption Monitoring Data for the Cliff Lake Water Treatment Plant

	2004-2005					2005-2006					2006-2007				
Month	**Billed Elect Energy (kWh)**	**Billed Propane (L)**	**Total Energy Consumption (kWh)**	**HDD (°C days/ mo)**	**Energy Normalized to 2004-2005 (kWh)**	**Billed Elect Energy (kWh)**	**Billed Propane (L)**	**Total Energy Consumption (kWh)**	**HDD (°C days/ mo)**	**Energy Normalized to 2004-2005 (kWh)**	**Billed Elect Energy (kWh)**	**Billed Propane (L)**	**Total Energy Consumption (kWh)**	**HDD (°C days/ mo)**	**Energy Normalized to 2004-2005 (kWh)**
October	35,640	0	35,640	474.4	35,640		0	0		#DIV/0!		0	0		#DIV/0!
November	36,000	0	36,000	673.1	36,000		0	0		#DIV/0!		0	0		#DIV/0!
December	36,360	0	36,360	1196.9	36,360		0	0		#DIV/0!		0	0		#DIV/0!
January	42,120	0	42,120	1187.8	42,120		0	0		#DIV/0!		0	0		#DIV/0!
February	37,080	0	37,080	874.9	37,080		0	0		#DIV/0!		0	0		#DIV/0!
March	35,640	0	35,640	806.7	35,640		0	0		#DIV/0!		0	0		#DIV/0!
April	48,240	0	48,240	399.1	48,240		0	0		#DIV/0!		0	0		#DIV/0!
May	37,800	0	37,800	266.3	37,800		0	0		#DIV/0!		0	0		#DIV/0!
June	39,240	0	39,240	103.8	39,240		0	0		#DIV/0!		0	0		#DIV/0!
July	51,840	0	51,840	33.4	51,840		0	0		#DIV/0!		0	0		#DIV/0!
August	43,560	0	43,560	77.8	43,560		0	0		#DIV/0!		0	0		#DIV/0!
September	34,920	0	34,920	202.9	34,920		0	0		#DIV/0!		0	0		#DIV/0!
TOTAL	478,440	0	478,440	6297	478,440	0	0	0	0	#DIV/0!	0	0	0	0	#DIV/0!

	2007-2008					2008-2009					2009-2010				
Month	**Billed Elect Energy (kWh)**	**Billed Propane (L)**	**Total Energy Consumption (kWh)**	**HDD (°C days/ mo)**	**Energy Normalized to 2004-2005 (kWh)**	**Billed Elect Energy (kWh)**	**Billed Propane (L)**	**Total Energy Consumption (kWh)**	**HDD (°C days/ mo)**	**Energy Normalized to 2004-2005 (kWh)**	**Billed Elect Energy (kWh)**	**Billed Propane (L)**	**Total Energy Consumption (kWh)**	**HDD (°C days/ mo)**	**Energy Normalized to 2004-2005 (kWh)**
October		0	0		#DIV/0!		0	0		#DIV/0!		0	0		#DIV/0!
November		0	0		#DIV/0!		0	0		#DIV/0!		0	0		#DIV/0!
December		0	0		#DIV/0!		0	0		#DIV/0!		0	0		#DIV/0!
January		0	0		#DIV/0!		0	0		#DIV/0!		0	0		#DIV/0!
February		0	0		#DIV/0!		0	0		#DIV/0!		0	0		#DIV/0!
March		0	0		#DIV/0!		0	0		#DIV/0!		0	0		#DIV/0!
April		0	0		#DIV/0!		0	0		#DIV/0!		0	0		#DIV/0!
May		0	0		#DIV/0!		0	0		#DIV/0!		0	0		#DIV/0!
June		0	0		#DIV/0!		0	0		#DIV/0!		0	0		#DIV/0!
July		0	0		#DIV/0!		0	0		#DIV/0!		0	0		#DIV/0!
August		0	0		#DIV/0!		0	0		#DIV/0!		0	0		#DIV/0!
September		0	0		#DIV/0!		0	0		#DIV/0!		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 Propane" in (L) taken from the electricity and propane bills, respectively next to the appropriate month.
3. Go to the following website to collect information on the Heating Degree Days for Flin Flon, Mb: http://www.climate.weatheroffice.ec.gc.ca/climateData/dailydata_e.html?timeframe=2&Prov=CA&StationID=3857&Year=2006&Month=1&
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 F30) 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.11 - Energy Consumption Monitoring Graph for the Cliff Lake Water Treatment Plant

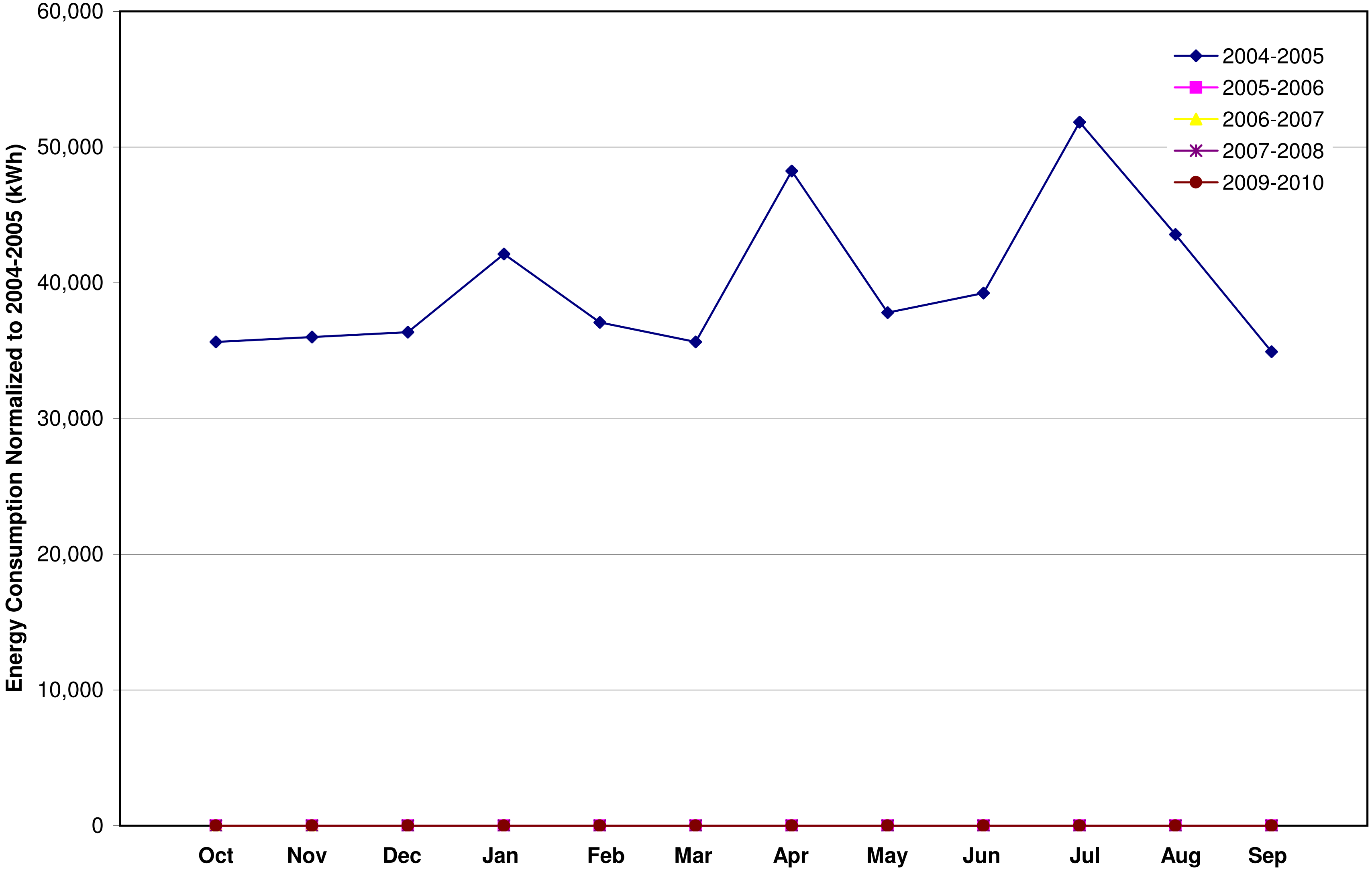


Table F.12 - Energy Consumption Monitoring Data for the Heating Plant #1

	2004-2005					2005-2006					2006-2007				
Month	**Billed Elect Energy (kWh)**	**Billed Oil (L)**	**Total Energy Consumption (kWh)**	**HDD (°C days/ mo)**	**Energy Normalized to 2004-2005 (kWh)**	**Billed Elect Energy (kWh)**	**Billed Oil (L)**	**Total Energy Consumption (kWh)**	**HDD (°C days/ mo)**	**Energy Normalized to 2004-2005 (kWh)**	**Billed Elect Energy (kWh)**	**Billed Oil (L)**	**Total Energy Consumption (kWh)**	**HDD (°C days/ mo)**	**Energy Normalized to 2004-2005 (kWh)**
October	27,400	16,917	204,690	474.4	204,690			0		#DIV/0!			0		#DIV/0!
November	36,200	7,063	110,220	673.1	110,220			0		#DIV/0!			0		#DIV/0!
December	37,200	38,568	441,393	1196.9	441,393			0		#DIV/0!			0		#DIV/0!
January	42,000	50,720	573,546	1187.8	573,546			0		#DIV/0!			0		#DIV/0!
February	38,800	59,420	661,522	874.9	661,522			0		#DIV/0!			0		#DIV/0!
March	41,800	81,412	894,998	806.7	894,998			0		#DIV/0!			0		#DIV/0!
April	33,200	22,525	269,262	399.1	269,262			0		#DIV/0!			0		#DIV/0!
May	35,500	0	35,500	266.3	35,500			0		#DIV/0!			0		#DIV/0!
June	24,000	0	24,000	103.8	24,000			0		#DIV/0!			0		#DIV/0!
July	26,400	0	26,400	33.4	26,400			0		#DIV/0!			0		#DIV/0!
August	28,500	0	28,500	77.8	28,500			0		#DIV/0!			0		#DIV/0!
September	25,100	0	25,100	202.9	25,100			0		#DIV/0!			0		#DIV/0!
TOTAL	396,100	276,625	3,295,130	6297	3,295,130	0	0	0	0	#DIV/0!	0	0	0	0	#DIV/0!

	2007-2008					2008-2009					2009-2010				
Month	**Billed Elect Energy (kWh)**	**Billed Oil (L)**	**Total Energy Consumption (kWh)**	**HDD (°C days/ mo)**	**Energy Normalized to 2004-2005 (kWh)**	**Billed Elect Energy (kWh)**	**Billed Oil (L)**	**Total Energy Consumption (kWh)**	**HDD (°C days/ mo)**	**Energy Normalized to 2004-2005 (kWh)**	**Billed Elect Energy (kWh)**	**Billed Oil (L)**	**Total Energy Consumption (kWh)**	**HDD (°C days/ mo)**	**Energy Normalized to 2004-2005 (kWh)**
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!
September			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 Oil" in (L) taken from the electricity and propane bills, respectively next to the appropriate month.
3. Go to the following website to collect information on the Heating Degree Days for Flin Flon, Mb: http://www.climate.weatheroffice.ec.gc.ca/climateData/dailydata_e.html?timeframe=2&Prov=CA&StationID=3857&Year=2006&Month=1&
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 F30) 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.12 - Energy Consumption Monitoring Graph for the Heating Plant #1

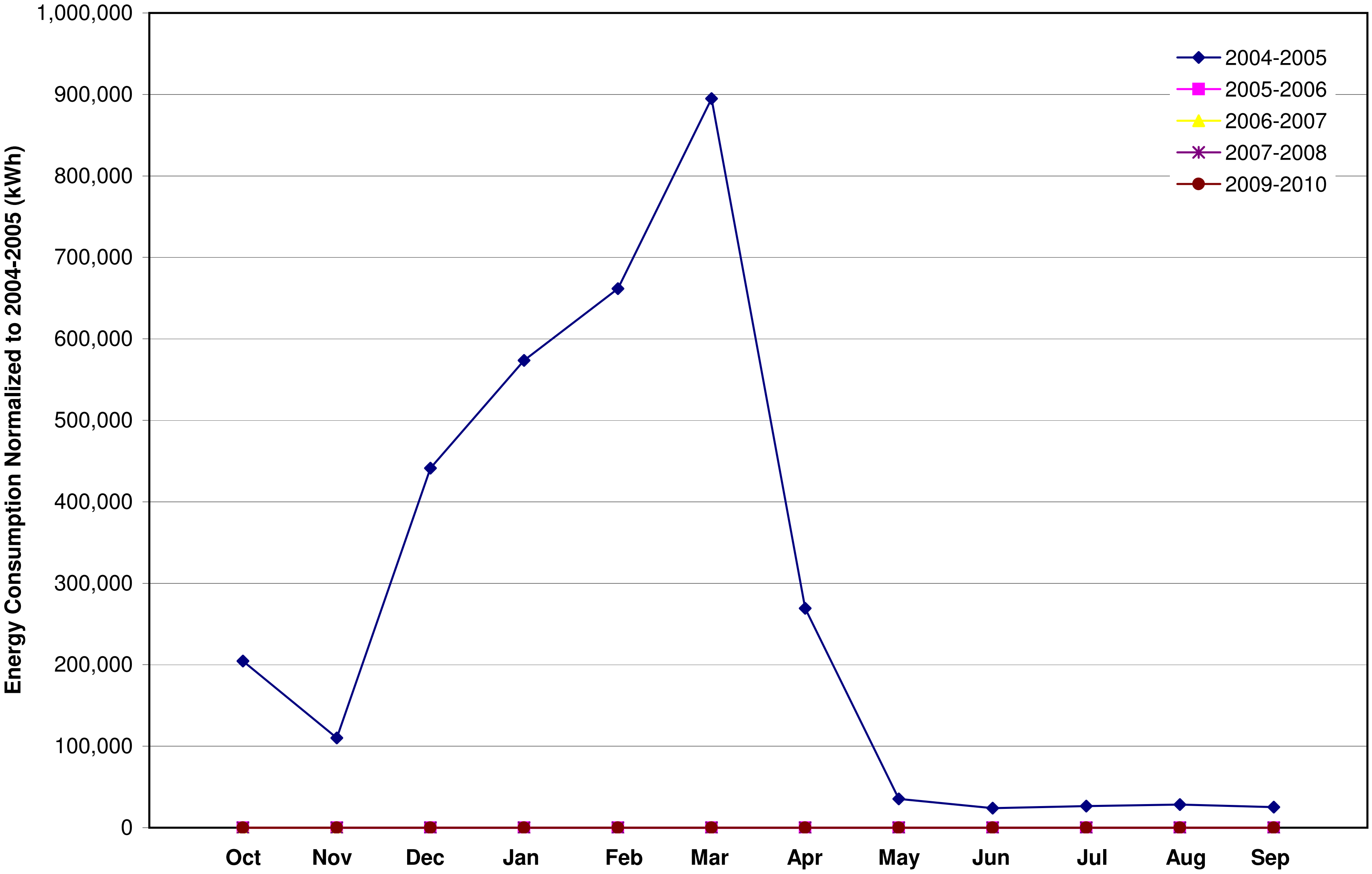


Table F.13 - Energy Consumption Monitoring Data for the Heating Plant #2

	2004-2005					2005-2006					2006-2007				
Month	**Billed Elect Energy (kWh)**	**Billed Oil (L)**	**Total Energy Consumption (kWh)**	**HDD (°C days/ mo)**	**Energy Normalized to 2004-2005 (kWh)**	**Billed Elect Energy (kWh)**	**Billed Oil (L)**	**Total Energy Consumption (kWh)**	**HDD (°C days/ mo)**	**Energy Normalized to 2004-2005 (kWh)**	**Billed Elect Energy (kWh)**	**Billed Oil (L)**	**Total Energy Consumption (kWh)**	**HDD (°C days/ mo)**	**Energy Normalized to 2004-2005 (kWh)**
October	34,600	17,501	218,010	474.4	218,010			0		#DIV/0!			0		#DIV/0!
November	46,800	6,931	119,437	673.1	119,437			0		#DIV/0!			0		#DIV/0!
December	62,800	26,833	344,010	1196.9	344,010			0		#DIV/0!			0		#DIV/0!
January	61,000	20,665	277,569	1187.8	277,569			0		#DIV/0!			0		#DIV/0!
February	51,600	59,527	675,443	874.9	675,443			0		#DIV/0!			0		#DIV/0!
March	54,200	58,913	671,608	806.7	671,608			0		#DIV/0!			0		#DIV/0!
April	59,700	23,925	310,434	399.1	310,434			0		#DIV/0!			0		#DIV/0!
May	46,800	0	46,800	266.3	46,800			0		#DIV/0!			0		#DIV/0!
June	45,900	0	45,900	103.8	45,900			0		#DIV/0!			0		#DIV/0!
July	18,500	0	18,500	33.4	18,500			0		#DIV/0!			0		#DIV/0!
August	31,800	0	31,800	77.8	31,800			0		#DIV/0!			0		#DIV/0!
September	35,300	0	35,300	202.9	35,300			0		#DIV/0!			0		#DIV/0!
TOTAL	549,000	214,295	2,794,812	6297	2,794,812	0	0	0	0	#DIV/0!	0	0	0	0	#DIV/0!

	2007-2008					2008-2009					2009-2010				
Month	**Billed Elect Energy (kWh)**	**Billed Oil (L)**	**Total Energy Consumption (kWh)**	**HDD (°C days/ mo)**	**Energy Normalized to 2004-2005 (kWh)**	**Billed Elect Energy (kWh)**	**Billed Oil (L)**	**Total Energy Consumption (kWh)**	**HDD (°C days/ mo)**	**Energy Normalized to 2004-2005 (kWh)**	**Billed Elect Energy (kWh)**	**Billed Oil (L)**	**Total Energy Consumption (kWh)**	**HDD (°C days/ mo)**	**Energy Normalized to 2004-2005 (kWh)**
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!
September			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 Oil" in (L) taken from the electricity and propane bills, respectively next to the appropriate month.
3. Go to the following website to collect information on the Heating Degree Days for Flin Flon, Mb: http://www.climate.weatheroffice.ec.gc.ca/climateData/dailydata_e.html?timeframe=2&Prov=CA&StationID=3857&Year=2006&Month=1&
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 F30) 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.13 - Energy Consumption Monitoring Graph for the Heating Plant #2

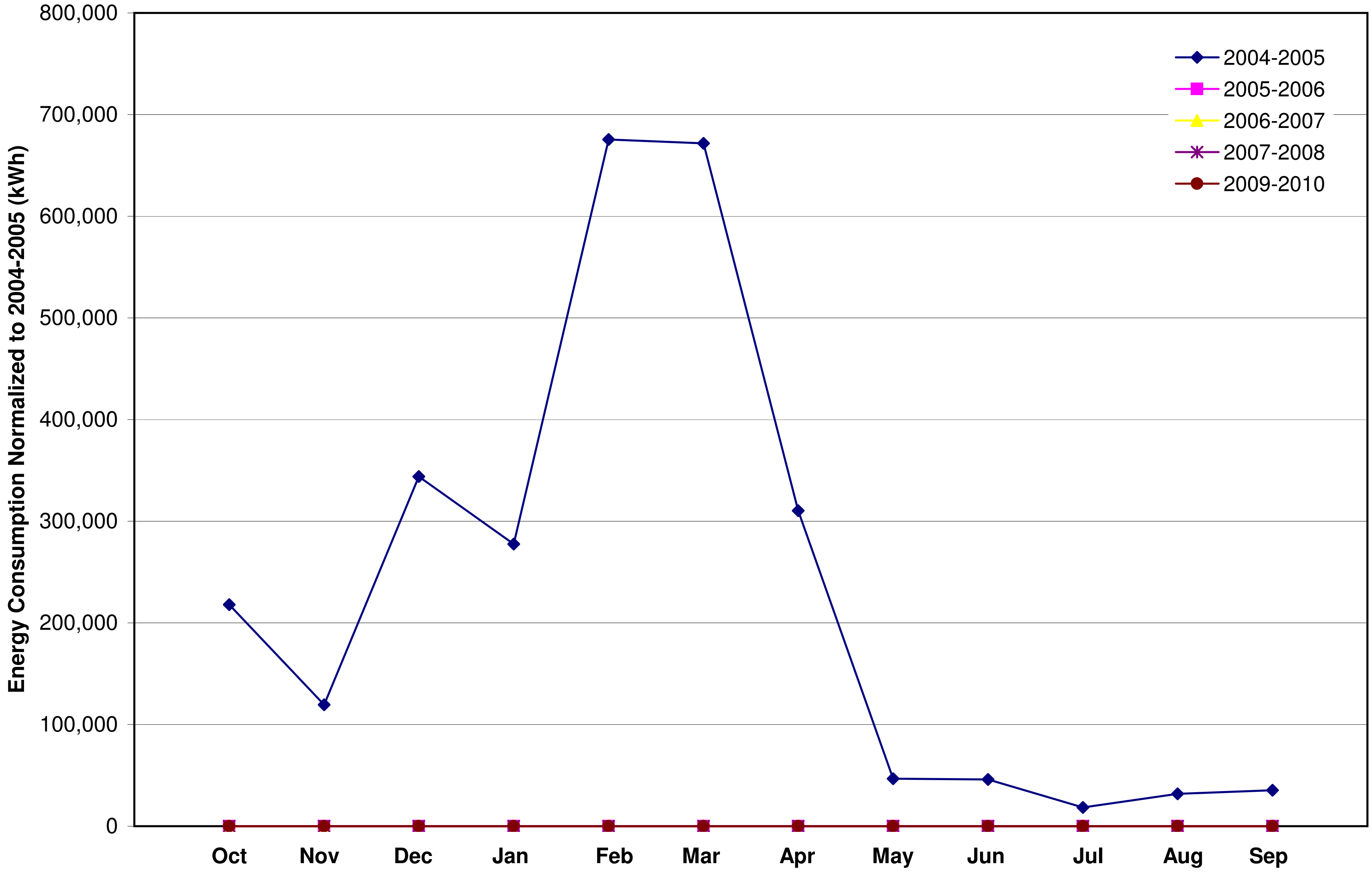


Table F.14 - Energy Consumption Monitoring Data for the Heating Plant #3

	2004-2005					2005-2006					2006-2007				
Month	**Billed Elect Energy (kWh)**	**Billed Oil (L)**	**Total Energy Consumption (kWh)**	**HDD (°C days/ mo)**	**Energy Normalized to 2004-2005 (kWh)**	**Billed Elect Energy (kWh)**	**Billed Oil (L)**	**Total Energy Consumption (kWh)**	**HDD (°C days/ mo)**	**Energy Normalized to 2004-2005 (kWh)**	**Billed Elect Energy (kWh)**	**Billed Oil (L)**	**Total Energy Consumption (kWh)**	**HDD (°C days/ mo)**	**Energy Normalized to 2004-2005 (kWh)**
October	12,850	0	12,850	474.4	12,850			0		#DIV/0!			0		#DIV/0!
November	17,310	0	17,310	673.1	17,310			0		#DIV/0!			0		#DIV/0!
December	14,620	0	14,620	1196.9	14,620			0		#DIV/0!			0		#DIV/0!
January	12,870	0	12,870	1187.8	12,870			0		#DIV/0!			0		#DIV/0!
February	21,430	0	21,430	874.9	21,430			0		#DIV/0!			0		#DIV/0!
March	11,050	0	11,050	806.7	11,050			0		#DIV/0!			0		#DIV/0!
April	13,810	0	13,810	399.1	13,810			0		#DIV/0!			0		#DIV/0!
May	16,040	0	16,040	266.3	16,040			0		#DIV/0!			0		#DIV/0!
June	12,710	0	12,710	103.8	12,710			0		#DIV/0!			0		#DIV/0!
July	13,300	0	13,300	33.4	13,300			0		#DIV/0!			0		#DIV/0!
August	12,200	0	12,200	77.8	12,200			0		#DIV/0!			0		#DIV/0!
September	11,920	0	11,920	202.9	11,920			0		#DIV/0!			0		#DIV/0!
TOTAL	170,110	0	170,110	6297	170,110	0	0	0	0	#DIV/0!	0	0	0	0	#DIV/0!

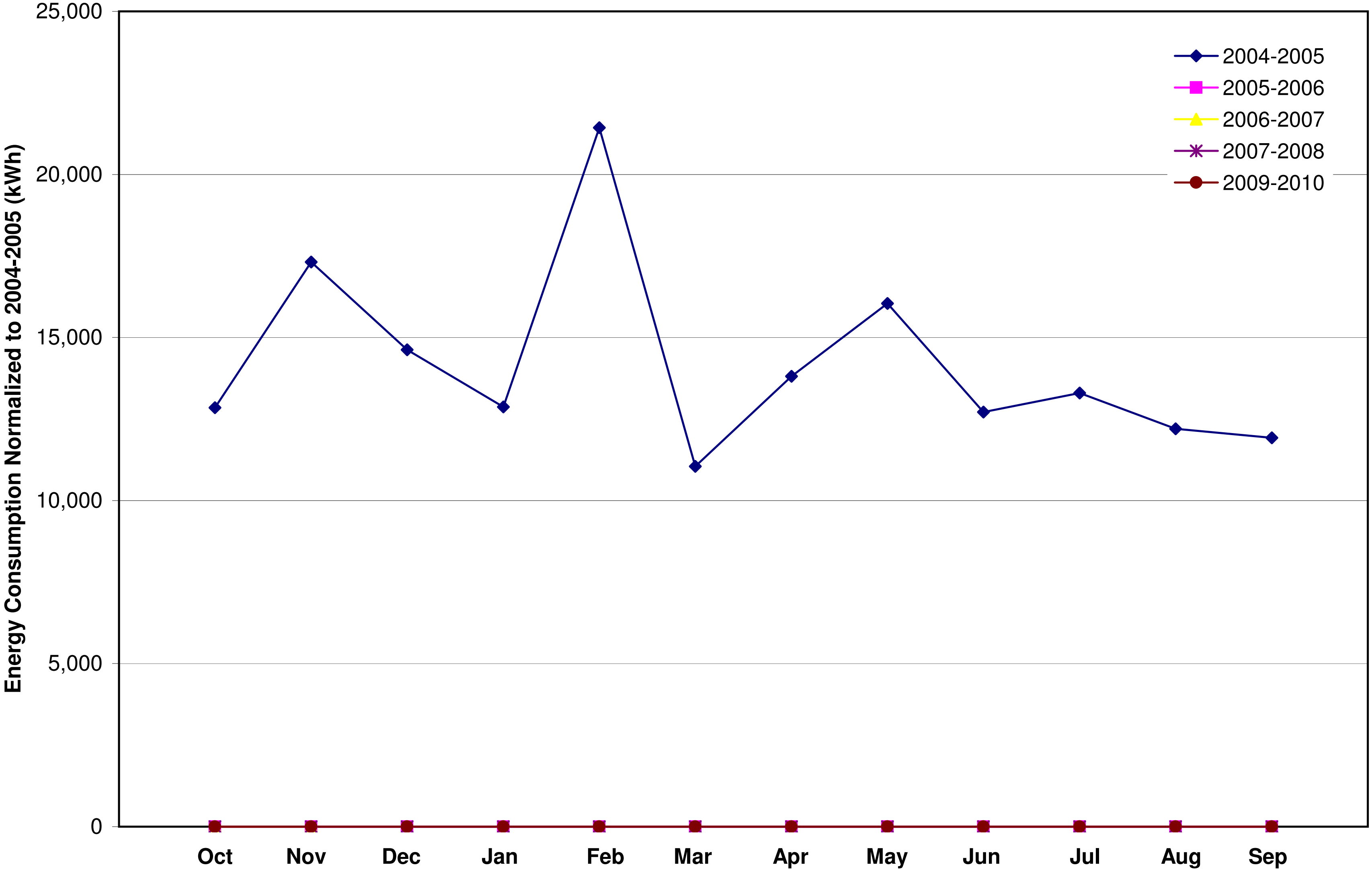
	2007-2008					2008-2009					2009-2010				
Month	**Billed Elect Energy (kWh)**	**Billed Oil (L)**	**Total Energy Consumption (kWh)**	**HDD (°C days/ mo)**	**Energy Normalized to 2004-2005 (kWh)**	**Billed Elect Energy (kWh)**	**Billed Oil (L)**	**Total Energy Consumption (kWh)**	**HDD (°C days/ mo)**	**Energy Normalized to 2004-2005 (kWh)**	**Billed Elect Energy (kWh)**	**Billed Oil (L)**	**Total Energy Consumption (kWh)**	**HDD (°C days/ mo)**	**Energy Normalized to 2004-2005 (kWh)**
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!
September			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 Oil" in (L) taken from the electricity and propane bills, respectively next to the appropriate month.
3. Go to the following website to collect information on the Heating Degree Days for Flin Flon, Mb: http://www.climate.weatheroffice.ec.gc.ca/climateData/dailydata_e.html?timeframe=2&Prov=CA&StationID=3857&Year=2006&Month=1&
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 F30) 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.14 - Energy Consumption Monitoring Graph for the Heating Plant #3



Environment Canada **Environnement Canada** [français] [Back]

Daily Data Report for January 2006

Notes on Data Quality.

FLIN FLON
MANITOBA

Latitude: 54° 46' N **Longitude:** 101° 52' W **Elevation:** 320.00 m

Climate ID: 5050920 **WMO ID:** **TC ID:**

Daily Data Report for January 2006

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	-5.5	-8.0	-6.8	24.8	0.0	0.0	0.0	0.0	14		
02	-4.0	-7.0	-5.5	23.5	0.0	0.0	1.0	1.0	14		
03	-2.0	-6.0	-4.0	22.0	0.0	0.0	0.0	0.0	14		
04	-2.5	-4.0	-3.3	21.3	0.0	0.0	0.0	0.0	15		
05	-4.0	-5.0	-4.5	22.5	0.0	0.0	1.0	1.0	15		
06	-4.0	-6.5	-5.3	23.3	0.0	0.0	0.0	0.0	15		
07	-5.0	-6.0	-5.5	23.5	0.0	0.0	0.0	0.0	15		
08	-4.5	-11.5	-8.0	26.0	0.0	0.0	0.0	0.0	15		
09	-4.0	-14.0	-9.0	27.0	0.0	0.0	8.0	8.0	15		
10	-3.0	-6.5	-4.8	22.8	0.0	0.0	0.0	0.0	23		
11	-7.5	-8.0	-7.8	25.8	0.0	0.0	1.0	1.0	23		
12	-6.5	-9.5	-8.0	26.0	0.0	0.0	T	T	23		
13	-12.5	-17.0	-14.8	32.8	0.0	0.0	0.0	0.0	23		
14	-11.5	-14.0	-12.8	30.8	0.0	0.0	0.0	0.0	23		
15	-12.0	-16.0	-14.0	32.0	0.0	0.0	6.0	6.0	23		
16	-10.5	-15.5	-13.0	31.0	0.0	0.0	2.0	2.0	29		
17	-14.5	-18.5	-16.5	34.5	0.0	0.0	0.0	0.0	31		
18	-15.5	-23.0	-19.3	37.3	0.0	0.0	4.0	4.0	31		
19	-15.5	-17.5	-16.5	34.5	0.0	0.0	0.0	0.0	35		
20	-20.0	-35.0	-27.5	45.5	0.0	0.0	0.0	0.0	35		
21	-17.0	-36.0	-26.5	44.5	0.0	0.0	0.0	0.0	35		
22	-8.0	-27.0	-17.5	35.5	0.0	0.0	3.0	3.0	35		
23	-1.0	-11.5	-6.3	24.3	0.0	0.0	0.0	0.0	31		
24	-9.5	-12.0	-10.8	28.8	0.0	0.0	0.0	0.0	30		
25	-6.5	-14.0	-10.3	28.3	0.0	0.0	0.0	0.0	30		
26	-2.5	-10.5	-6.5	24.5	0.0	0.0	4.0	4.0	29		
27	-16.0	-19.0	-17.5	35.5	0.0	0.0	0.0	0.0	32		
28	-13.5	-26.0	-19.8	37.8	0.0	0.0	1.0	1.0	31		
29	-10.0	-16.0	-13.0	31.0	0.0	0.0	1.0	1.0	31		
30	-5.5	-14.0	-9.8	27.8	0.0	0.0	6.0	6.0	32		
31	-7.0	-9.5	-8.3	26.3	0.0	0.0	4.0	4.0	38		
Sum				**911.2**	**0.0**	**0.0**	**42.0**	**42.0**			
Avg	**-8.4**	**-14.3**	**-11.4**								
Xtrm	**-1.0**	**-36.0**									

Legend

[empty] = No data available

M = Missing

APPENDIX G

THE MUNICIPALITIES TRADING COMPANY OF MANITOBA LTD. REPORT

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AMM Annual Report – M.T.C.M.L. G2

MEMBER SERVICES

M.T.C.M.L.

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.

MEMBER SERVICES

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.