DOW Centennial Centre
Equipment Assessment

Prepared for:

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1.0 GENERAL

1.1 PURPOSE OF THE REPORT

This report is a summary of the visual inspection performed by Reinbold Engineering Group for the DOW Centennial Centre, Fort Saskatchewan, Alberta. DOW Centennial Centre is a multi-use facility comprising of recreational sports (soccer and ice) arenas, art and pottery studios, 538 seat theatre as well as banquet and meeting rooms. The centre was originally constructed in 2004 and is approximately 15,800m^2,

The intent of the inspection was to determine areas of the mechanical system that have visually evident deterioration and are in need of repair or replacement. The mandate was also to determine in a general way, the overall condition of the mechanical system and identify potential items or issues inherent in the system for consideration.

1.2 METHODOLOGY

The report incorporates a review of available drawings, operations and maintenance manuals, and visual inspection performed on January 21st, 2015 in conjunction with information provided by the facility operators.

Additional information was also obtained from the 2014 TSE Consulting/Koldworks report titled DOW Centennial Centre Mechanical Systems Study. This report outlines operational problems of the Eco-Chill ice plant heat recovery system and the building HVAC system, and proposes several options to resolve these issues. The report recommends the separation of the ice plant from the building HVAC system to simply operation, operational and maintenance costs; we concur with this recommendation.

1.3 LIMITATIONS

1. Inspections were performed on a random basis with no attempt to review or inspect every element or portion of the building. Our comments are not a guarantee or warranty of any aspect of the condition of the building whatsoever.
2. The available mechanical record drawings were limited and certain information related to the Eco-Chill heat recovery system was not available.
3. It should be noted that the City of Fort Saskatchewan Facilities does not report any major issues with the building and site drainage.
4. Cost estimates in this report are typically based on preliminary information, which are influenced by factors such as market conditions. The opinions of probable costs are based on current dollars and subject to change due to market conditions.
5. Where available, equipment age was determined from equipment labels, drawings, maintenance manuals or comments from maintenance personnel. Where no information was available assumptions were made based on the equipment's general condition. Equipment ages cannot be guaranteed.
6. Location and identification of asbestos containing materials is beyond the scope of this report.

1.4 CODES AND STANDARDS

For the purpose of this report, the following applicable codes and standards will be used for evaluation of the building systems:

1. Alberta Building Code 2006
2. Alberta Fire Code 2006
3. National Plumbing Code 2005
4. Local Building By-Laws
5. Workers Compensation Board
6. Canadian Standards Association (CSA)
7. Canadian Gas Code B-149.1
8. Boiler and pressure vessel Act.
9. National Fire Protection Association (NFPA)
10. Underwriters' Laboratories of Canada (ULC)
11. American Society of Heating Refrigeration and Air Conditioning Engineers (ASHRAE)

1.5 BUILDING OVERVIEW

The DOW Centennial Centre is a 15,800m^2 two story high building incorporating a soccer pitch, ice arena, gymnasium, fitness track, leisure rink, pottery studios, a 540 seat theatre, banquet and meeting rooms that was constructed in 2004. With a high level of care of maintenance from the facilities operators the equipment are generally in fair to good condition.

Operational problems with the Eco-Chill ice plant heat recovery system continues to persist since the building opened. Heat transfer from the ice plant compressors in winter does not provide sufficient heat for the air handling units it is connected to and in the spring/fall the system cannot dissipate excess heat from the system because the cooling tower is undersized causing the ice plant to overheat and leading to the system to shutdown. With the dedication from the facilities operators the facility operators have learned to minimized the shutdowns, thus minimizing the impact to the operations of the facility.

1.6 EQUIPMENT LIFE EXPECTANCY

The Followong contains an excerpt table of median equipment life expectancy table produced by ASHRAE. Facilities which undergo high levels of operation and maintenance of mechanical systems and equipment can allow for longer equipment service lifespan in comparison the tabulated median life spans indicated in the table. Throughout the reports comments regarding the life expectancy of a piece of equipment will be made with respect to the ASHRAE table.

Table 1: Comparison of Service Life Estimates

Table 4 Comparison of Service Life Estimates

Equipment Item	Median Service Life, Years: Abramson et al. (2005)	Median Service Life, Years: Akalin (1978)
Air Conditioners		
Window unit	N/A*	10
Residential single or split package	N/A*	15
Commercial through-the-wall	N/A*	15
Water-cooled package	>24	15
Heat pumps		
Residential air-to-air	N/A*	15[b]
Commercial air-to-air	N/A*	15
Commercial water-to-air	>24	19
Roof-top air conditioners		
Single-zone	N/A*	15
Multizone	N/A*	15
Boilers, Hot-Water (Steam)		
Steel water-tube	>22	24 (30)
Steel fire-tube		25 (25)
Cast iron	N/A*	35 (30)
Electric	N/A*	15
Burners	N/A*	21
Furnaces		
Gas- or oil-fired	N/A*	18
Unit heaters		
Gas or electric	N/A*	13
Hot-water or steam	N/A*	20
Radiant heaters		
Electric	N/A*	10
Hot-water or steam	N/A*	25
Air Terminals		
Diffusers, grilles, and registers	N/A*	27
Induction and fan-coil units	N/A*	20
VAV and double-duct boxes	N/A*	20
Air washers	N/A*	17
Ductwork	N/A*	30
Dampers	N/A*	20
Fans	N/A*	
Centrifugal	N/A*	25
Axial	N/A*	20
Propeller	N/A*	15
Ventilating roof-mounted	N/A*	20
Coils		
DX, water, or steam	N/A*	20
Electric	N/A*	15
Heat Exchangers		
Shell-and-tube	N/A*	24
Reciprocating compressors	N/A*	20
Packaged Chillers		
Reciprocating	N/A*	20
Centrifugal	>25	23
Absorption	N/A*	23
Cooling Towers		
Galvanized metal	>22	20
Wood	N/A*	20
Ceramic	N/A*	34
Condensers		
Air-cooled	N/A	20
Evaporative	N/A*	20
Insulation		
Molded	N/A*	20
Blanket	N/A*	24
Pumps		
Base-mounted	N/A*	20
Pipe-mounted	N/A*	10
Sump and well	N/A*	10
Condensate	N/A*	15
Reciprocating engines	N/A*	20
Steam turbines	N/A*	30
Electric motors	N/A*	18
Motor starters	N/A*	17
Electric transformers	N/A*	30
Controls		
Pneumatic	N/A*	20
Electric	N/A*	16
Electronic	N/A*	15
Valve actuators		
Hydraulic	N/A*	15
Pneumatic	N/A*	20
Self-contained		10

*N/A: Not enough data yet in Abramson et al. (2005). Note that data from Akalin (1978) for these categories may be outdated and not statistically relevant. Use these data with caution until enough updated data are accumulated in Abramson et al.

2.0 SYSTEM DESCRIPTION

2.1 PLUMBING SYSTEMS

1. Gas Service

    1. The gas service, pressure reducing/relief valve and meter is located in the north mechanical room 1108. The piping and pressure reducing/relief valve appear to be in good condition.

2. Drainage Systems

    1. Storm Drainage Systems

        The roof structure is sloped to the roof drains which enters the facility via rainwater leaders and drain by gravity to the back of the facility where it is splashed to grade, with the runoff draining to a local retention pond to the south (back) of the building.

        The maintenance staff has advised that the existing east rain water leader discharge floods the area around the cooling tower and during the spring and fall this flooded area freezes. This frozen area is also the path used by people to walk to the overflow parking area and poses a slipping hazard. Potentially, this area could be re-landscaped to re-direct the rainwater runoff.

    2. Sanitary Drainage Systems

        Drainage from the washrooms, locker/dressing rooms, activity rooms and kitchen drains are collected into the sanitary sewer. The facility is serviced with five connections to three manholes that drain to a 200mm diameter sanitary service. At the time of the site review there was no evidence of any problems with the existing sanitary sewer service.

3. Domestic Water Cold Water and Fire Protection

    The DOW Centre has two 150mm diameter water service, one for domestic water and the second for fire protection, both services enter the complex in the north mechanical room 1108.

    1. The domestic water service is 150mm that is reduced in size to 75mm before passing through a water meter and then a backflow prevention device before servicing the facility. The backflow prevention device appears to be in good condition.
    2. The fire protection water flows through a backflow prevention device before connecting to a fire and jockey pump and then the sprinkler tree. The pumps and controller appear in good condition.

4. Domestic Hot Water

    There are three main domestic hot water plants in the DOW Centre Complex, located in the west, north (with a booster system for the kitchen) and east mechanical rooms.

    1. West Mechanical Room Rm 1442: The west domestic hot water system supplies the paint and pottery studios, theatre washrooms and the soccer pitch dressing rooms. Domestic hot water is generated by a single Viessmann Vitocell indirect hot water heater (DHW-3) with a 450L storage capacity each, with a recovery rate of 590L/hr when the heating water supply is 50C. The heating water source is a single Viessmann Vitodens 200 high efficiency low mass gas-fired boiler (B-8), with a gas input of 67kW and an output of 60kW. The boiler is coupled with its own circulating pump (P-8) which is a Grundfos TP32-160 0.75HP pumps, operating at 2.5L/s at 115kPa.

The incoming city water is pre-warmed before it heated by the water heater by a single Viessmann Vitocell 300 (PHT-1) indirect hot water heater, with the pre-heat glycol supplied from the Eco-Chill heat recovery system. Information on the Eco-Chill system was not available. The maintenance staff has modified the system and installed an intermediate brazed plate heat exchanger and circulator pump to maintain an indirect (ie, double wall) connection between the heating glycol and the domestic water. This modification was completed about 3 years ago.

The boilers, tanks, plate and frame heat exchangers and pumps appear to be in good condition.

2. North Mechanical Room 1108: The north domestic hot water system supplies the kitchen, washrooms adjacent to the administration offices, gymnasium change rooms CR1 and CR2, men and women washroom next to the childrens play room. Domestic hot water is generated by two (2) Viessmann Vitocell 100 indirect hot water heaters (DHW-1, 2) each with a 450L storage capacity each, with a recovery rate of 590L/hr when the heating water supply is 50C. The heating water source is three Viessmann Vitodens 200 high efficiency low mass gas-fired boilers (B-1, 2, 3), with a gas input of 67kW and an output of 60kW. Each boiler is coupled with its own circulating pump (P-1, 2, 3) which are Grundfos TP32-160 0.75HP pumps, operating at 2.5L/s at 115kPa.

   The kitchen has two hot water boosters that increases the domestic temperature for the kitchen equipment. The first one boosts the temperature for the entire kitchen and the second booster serves only for the dishwasher. Maintenance advised that both heaters have been replaced approximately 3-4 years ago.

   The incoming city water is pre-warmed before it heated by the water heaters by a single Viessmann Vitocell 300 (PHT-2) indirect hot water heater, with the pre-heat glycol supplied from the Eco-Chill heat recovery system. Information on the Eco-Chill system was not available. The maintenance staff has modified the system and installed an intermediate brazed plate heat exchanger and pump to maintain an indirect (ie, double wall) connection between the heating glycol and the domestic water. This modification was completed about 3 years ago.

   The boilers, tanks, plate and frame heat exchangers and pumps appear to be in good condition.

3. East Mechanical Room 1204: The east domestic hot water system supplies the ice rink dressing rooms, washrooms, the ice plant and the Zamboni room. Domestic hot water is generated by a single Viessmann Vitocell 100 indirect hot water heater (DHW-4), with a recovery rate of 590L/hr when the heating water supply is 50C. The heating water source is a single Viessmann Vitodens 200 (B-13) high efficiency low mass gas-fired boilers, with a gas input of 67 kW and an output of 60 kW, coupled to its own circulating pump (P-13) which is Grundfos TP32-160 0.75HP pumps, operating at 2.5L/s at 115kPa.

   The incoming city water is pre-warmed before it heated by the water heaters by a single Viessmann Vitocell 300 (PHT-3, 4) indirect hot water heater, with the pre-heat glycol supplied from the Eco-Chill heat recovery system. Information on the Eco-Chill system was not available. The maintenance staff has modified the system and installed an intermediate brazed plate heat exchanger and pump to maintain an indirect (ie, double wall) connection between the heating glycol and the domestic water. This modification was completed about 3 years ago.

   Hot water for the Zamboni is generated by a two (2) Viessmann Vitocell 300 (ZHT-1, 2) indirect hot water heater, with a recovery rate of 739 L/hr when the heating water supply is 70C. The heating water source is a single Viessmann Vitogas 050 (B-14) cast iron sectional

gas-fired boiler, with a gas input of 308 kW and an output of 225 kW, coupled to its own circulating pump (P-14) which is Grundfos TP40-240 2.0HP pump, operating at 2.5L/s at 140kPa.

The incoming city water is pre-warmed before it heated by the domestic and Zamboni water heaters by two (2) Viessmann Vitocell 300 (PHT-3, 4) indirect hot water heaters, with the pre-heat glycol supplied from the Eco-Chill heat recovery system. Information on the Eco-Chill system was not available. For the domestic water only (not the Zamboni system) the maintenance staff has modified the system and installed an intermediate plate and frame brazed heat exchanger and pump to maintain an indirect (ie, double wall) connection between the heating glycol and the domestic water. This modification was completed about 3 years ago.

The boilers, tanks, plate and frame heat exchangers and pumps appear to be in good condition.

4. Domestic hot water re-circulation systems is provided to ensure timely delivery of hot water to the plumbing fixtures. The system is distributed throughout the facility and extends out the furthest public washrooms. As there are no hot water mixing valves for the plumbing fixtures in the facility, domestic water is set at approximately 41C. The re-circulation systems mirror the domestic hot water systems with recirculation pumps DHWRC-1, 2, 3 located in the north, east and west mechanical rooms. These pumps are Grundfos TP32-160, operating at 2.5L/s at 115kPa. The pumps appear to be in good condition.

5. Plumbing Fixtures

    1. Electronic (flush valve) water closets are used in the locker/change rooms and public washrooms. The maintenance staff has advised that the water closets are in fair to good condition.

       There are three floor mounted tank flush water closets in the facility. These are located near the Scotia Bank Room, the pottery studios, children play area and the ice rink referee rooms. These are also in fair to good condition.

    2. Electronic (flush valve) urinals are located in the Men's Locker room. The maintenance staff has advised that the urinals are in fair to good condition.

    3. Porcelain enameled steel lavatories and automatic faucets are used in the locker and change rooms, and the public washrooms. The infrared faucets appear to be in fair condition. Some minor chipping was evident on some of the lavatory basins. As part of preventative maintenance, the chips can be filled periodically to mitigate the chops from spreading. Several of the Bradley faucets have been replaced over the years with Waltec faucets. The maintenance staff has advised that the lavatories are in fair to good condition.

    4. The locker/change rooms incorporates shower stalls located throughout the facility. The shower stalls are built up and are equipped with electronic metering shower valves. The maintenance staff has advised that the showers are in fair to good condition.

    Note, the maintenance staff has advised that there are no mixing valves installed for any of the showers or faucets in the facility.

6. Solids and Grease Interceptors

Solids and grease interceptors are used through the complex to minimize the amount of debris and grease from entering the sanitary system that could create blockages in the piping.

.1 Solid interceptors are used in the Scotia Bank Room (formerly the paint studio) and pottery rooms. The interceptors are both under counter and recessed in the floor to collect solids from the sinks and floor drains. The maintenance staff has advised that the solids interceptors are in fair to good condition.

.2 A grease interceptor is used in the dishwashing room to collect grease from the three compartment sink. The maintenance staff has advised that the grease interceptor is in fair to good condition.

7. Sump Pump Systems

There are several sump pump systems in the complex that serves various requirements for the building. The sump systems are as follows:

1. Sump-1: This sump serves a weeping tile system that surrounds the Theatre Stage 1437 and is pumped to the sanitary system. The pump (SP-1) is a Myers SPD50H, which the maintenance staff has advised is in fair operating condition.
2. Sump-2: This sump serves a weeping tile system that surrounds the Family Leisure Zone and is pumped to the sanitary system. The pump (SP-2) is a Myers SPD50H, which the maintenance staff has advised is in fair operating condition.
3. Sump-3: This sump pit and pump was not found in the location shown on the drawings. This sump was to have served a weeping tile system that surrounds the Ice Rink Arena 1212 and is to have pumped to the sanitary system.
4. Sump-4: This sump is located under the theatre stage and serves the theatre curtain deluge sprinkler system. Should the sprinkler system activate and discharge water, then the floor drains below the stage collects the water and direct it to the sump which is then pumped to the sanitary system. However, maintenance has advised that when they went to test the sump and pump system a few years ago, the pump activated, but the discharge pipe appeared to be blocked.

   After scoping the discharge pipe it was determined that the discharged pipe did not connect to any drainage system. The sump pit was abandoned and the pump removed. The pump (SP-4) was a Myers SPD50H, which the maintenance staff has advised was in fair operating condition when it was removed.
5. Sump-5: This sump serves the sink in Storage 1406 and is pumped to the sanitary system. The pump (SP-5) is a Myers SPD50H, which the maintenance staff has advised is in fair operating condition.
6. Sump-6: This sump serves Elevator #2 next to Theatre House 1138 and is pumped to the sanitary system. The pump (SP-6) is a Myers SW33, which the maintenance staff has advised is in fair operating condition.
7. Sump-7: This sump serves Elevator #1 next to Gymnasium 1109 and is pumped to the sanitary system. The pump (SP-7) is a Myers SW33, which the maintenance staff has advised is in fair operating condition.

2.2 HEATING VENTILATION AND AIR CONDITIONING (HVAC)

The majority of the HVAC systems including air systems, boilers, domestic hot water, pumps and accessories were originally installed when the building was constructed in 2004. During construction a glycol recovery loop (Eco-Chill) was installed with the intention to recover heat from the ice plant compressors. This low temperature heat (approximately 40C) is used to pre-heat the domestic hot water and provide heat for air handling units AHU-01, RTU-12, 14, 15 and HRV-1, 2 and 3.

The HVAC system is compartmentalized into four main areas: theatre building, administration and gymnasium, soccer pitch and ice arena with fans located throughout the facility. Hydronic heating systems are based in the three mechanical rooms.

1. Theatre Building HVAC: The theatre building HVAC comprises of the following air systems:
    1. AHU-01: This is an Engineered Air unit that supplies air to the theatre, stage, foyer and stairs #10 and #11. This unit is capable of 8,750L/s with an indirect gas-fired heating section and hydronic heating and cooling coils. The gas-fired heating section provides primary heating for the unit with the hydronic heating coil providing supplementary heating from the Eco-Chill system. The maintenance staff has advised that the unit is in fair to good condition.
    2. RTU-01: This is a Carrier 48TME005 rooftop unit with 33kW gas-fired heating section and a 4 nominal ton DX cooling that serves meeting room #3. The maintenance staff has advised that the unit is in fair to good condition.
    3. RTU-02: This is a Carrier 48TME004 rooftop unit 48TME005 rooftop unit with 22kW gas-fired heating section and a 3 nominal ton DX cooling that serves the Scotia Bank meeting room (formerly the paint studio). The maintenance staff has advised that the unit is in fair to good condition.
    4. RTU-03: This is a Carrier 48TMN016 unit 48TME005 rooftop unit with 105kW gas-fired heating section and a 16 nominal ton DX cooling that serves the pottery studio. The maintenance staff has advised that the unit is in fair to good condition.
    5. RTU-04: This is a Carrier 48TMF012 rooftop unit with 73kW gas-fired heating section and a 10 nominal ton DX cooling that serves meeting room #1. The maintenance staff has advised that the unit is in fair to good condition.
    6. RTU-05: This is a Carrier 48TMF009 rooftop unit with 64kW gas-fired heating section and 8.5 nominal ton DX cooling that serves meeting room #2. The maintenance staff has advised that the unit is in fair to good condition.
    7. RTU-06: This is a Carrier 48TMF009 rooftop unit with 64kW gas-fired heating section and 8.5 nominal ton DX cooling that serves the kitchen/dishwashing rooms. The maintenance staff has advised that the unit is in fair to good condition.
    8. MUA-01: This is an Engineered Air unit that provides makeup air for the kitchen and is interlocked with exhaust fan EF-13. This unit is capable of 2,400L/s with a 161kW direct gas-fired heating section, no cooling. Unit is in good condition. The maintenance staff has advised that the unit is in fair to good condition.

2. Administration and Gymnasium HVAC: The administration and gymnasium HVAC comprises of the following air systems:
    1. RTU-07: This is a Carrier 48TME009 rooftop unit with 52kW gas-fired heating section and 8.5 nominal ton DX cooling that serves the Gymnasium. The maintenance staff has advised that the unit is in fair to good condition.
    2. RTU-08: Upper floor fitness. This is a Carrier 48AJN030D rooftop unit with 154kW gas-fired heating section and a 30 nominal ton DX cooling that serves the upper floor fitness area. The maintenance staff has advised that the unit is in fair to good condition

3. RTU-09: This is a Carrier 48TME012 rooftop unit with 65kW gas-fired heating section and a 12 nominal ton DX cooling that serves the upper floor fitness, reception and washrooms. The maintenance staff has advised that the unit is in fair to good condition.
4. RTU-10: This is a Carrier 48TME020 rooftop unit with 71kW gas-fired heating section and a 20 nominal ton DX cooling that serves the gymnasium. The maintenance staff has advised that the unit is in fair to good condition.
5. RTU-11: This is a Carrier 48TME020 rooftop unit with 71kW gas-fired heating section and a 20 nominal ton DX cooling that serves the gymnasium. The maintenance staff has advised that the unit is in fair to good condition.
6. RTU-12: This is an Engineered Air unit that supplies air to the flex gym. This unit is capable of 3,300L/s with a hydronic heating and cooling coils. The maintenance staff has advised that the unit is in fair to good condition.
7. RTU-13: This is a Carrier 48TME012 rooftop unit with 65kW gas-fired heating section and a 12 nominal ton DX cooling that serves the upper floor fitness. The maintenance staff has advised that the unit is in fair to good condition.
8. RTU-17: This is a Carrier 48TMF009 rooftop unit with 64kW gas-fired heating section and 8.5 nominal ton DX cooling that serves the second floor tenant space. The maintenance staff has advised that the unit is in fair to good condition
9. RTU-18: This is a Carrier 48TMF009 rooftop unit with 64kW gas-fired heating section and 8.5 nominal ton DX cooling that serves the physiotherapy centre. The maintenance staff has advised that the unit is in fair to good condition
10. MUA-02: This is an Engineered Air unit that supplies air to the leisure area. This unit is capable of 6,150L/s with a 71kW direct gas-fired heating section and a regenerative section to dehumidify. The maintenance staff has advised that the unit is in fair to good condition.
11. MUA-03: This is an Engineered Air unit that supplies air to the soccer pitch. This unit is capable of 6,150L/s with a 71kW direct gas-fired heating section and a regenerative section to dehumidify. The maintenance staff has advised that the unit is in fair to good condition.
12. HRV-2: This is an Engineered Air plate and frame heat recovery unit that supplies air to the second floor fitness washrooms. This unit is capable of 2,900L/s supply air and 3,500L/s exhaust air with a hydronic coil, which is supplied from the Eco-Chill system. The maintenance staff has advised that the unit is in fair to good condition.
13. HRV-3: This is an Engineered Air plate and frame heat recovery unit that supplies air to the second floor fitness area. This unit is capable of 2,600L/s supply air and 2,600L/s exhaust air with a hydronic coil which is supplied from the Eco-Chill system. The maintenance staff has advised that the unit is in fair to good condition.
14. VR-2: These are gas-fired infrared heaters located over the soccer bleachers. The maintenance staff has advised that the infrared heaters are in fair to good condition.

3. Soccer Arena HVAC: The soccer arena HVAC comprises of the following air systems:
    1. RTU-14: This is an Engineered Air unit that supplies air to the soccer pitch. This unit is capable of 3,800L/s with a hydronic heating (80kW) and cooling (60kW) coils. A gas-fired humidifier is connected to the unit. The hydronic heating coil is feed from the Eco-Chill system. The maintenance staff has advised that the unit is in fair to good condition.
    2. RTU-15: This is an Engineered Air unit that supplies air to the soccer pitch. This unit is capable of 3,800L/s with a hydronic heating (80kW) and cooling (60kW) coils. A gas-fired humidifier is connected to the unit. The hydronic heating coil is feed from the Eco-Chill system. The maintenance staff has advised that the unit is in fair to good condition.

3. HRV-1: This is an Engineered Air plate and frame heat recovery unit that supplies air to the soccer arena dressing rooms. This unit is capable of 3,000L/s supply air and 3,500L/s exhaust air with a hydronic (190kW) coil which is feed from the Eco-Chill system. The maintenance staff has advised that the unit is in fair to good condition.

4. Ice Arena HVAC: The ice arena HVAC comprises of the following air systems:
   1. Infrared heaters: These units are used to provide heat to the spectator seating areas. The maintenance staff has advised that the unit is in fair to good condition.
   2. RTU-16: This is a Carrier 48TMN016 unit 48TME005 rooftop unit with 105kW gas-fired heating section and a 16 nominal ton DX cooling that serves the Zamboni area. The maintenance staff has advised that the unit is in fair to good condition.

5. Fans: There are numerous supply and exhaust fans throughout the complex serving washrooms, kitchen exhausts, transfer air and supply air. Maintenance has advised that these are all in fair to good operating condition.

6. Hydronic heating: Hydronic heating is based in the three (west, north and east) mechanical rooms.

   West Mechanical Room 1442: The west hydronic heating glycol system supplies heat to unit heaters, force flows and inslab heating system. The heating glycol is generated in two Viessmann Vitodens 200 high efficiency low mass gas-fired boilers (B-7, 8), with a gas input of 67kW and an output of 60kW. Each boiler is coupled with its own circulating pump (P-7 and 8) which are Grundfos TP32-160 0.75HP pumps, operating at 2.5L/s at 115kPa that pumps to a low loss header. Pumping from the low loss header to the terminal units is pump LLHP-3 which is an Armstrong 4360-1.5B pump capable of 2.3L/s at 60kPa. The hydronic system is also connected to the Eco-Chill heat recovery system, providing heat when available from the chiller through pump LGHP-16. The boilers and pumps appear to be in good condition.

   North Mechanical Room 1108: The north hydronic heating glycol system supplies heat to unit heaters, force flows and inslab heating system. The heating glycol is generated in two Viessmann Vitodens 200 high efficiency low mass gas-fired boilers (B-4, 5), with a gas input of 67kW and an output of 60kW. Each boiler is coupled with its own circulating pump (P-4, 5) which are Grundfos TP32-160 0.75HP pumps, operating at 2.5L/s at 115kPa that pumps to a low loss header. Pumping from the low loss header to the terminal units is pump LLHP-2 which is an Armstrong 4360-1.5B pump capable of 2.3L/s at 60kPa. The hydronic system is also connected to the Eco-Chill heat recovery system, providing heat when available from the chiller through pump LGHP-14. The boilers and pumps appear to be in good condition.

   East Mechanical Room 1204: The east hydronic heating glycol system supplies heat to unit heaters, force flows and inslab heating system. The heating glycol is generated in two Viessmann Vitodens 200 high efficiency low mass gas-fired boilers (B-11, 12), with a gas input of 67kW and an output of 60kW. Each boiler is coupled with its own circulating pump (P-11, 12) which are Grundfos TP32-160 0.75HP pumps, operating at 2.5L/s at 115kPa that pumps to a low loss header. Pumping from the low loss header to the terminal units is pump LLHP-1 which is an Armstrong 4360-1.5B pump capable of 2.3L/s at 60kPa. The hydronic system is also connected to the Eco-Chill heat recovery system, providing heat when available from the chiller through pump LGHP-12. The boilers and pumps appear to be in good condition.

7. Inslab heating system:
    1. Snow melt: Inslab snow melt is used in the entry to the building. The heating glycol for this system is from the north mechanical room. The maintenance staff has advised that this system has failed and is no longer operational.
    2. Room heating: Inslab room heating is used in the art gallery, soccer dressing rooms, soccer track, fitness area, children play area and the ice rink dressing rooms. The maintenance staff has advised that this system has failed and is no longer operational, except for the ice rink dressing rooms which still operates.

8. Building Controls

    The building controls incorporates two Building Management Systems (BMS), one for the building automation and the second for the ice plant. There is some overlap of controls when the Eco-Chill (compressor heat recovery) system operates on the ice plant side, taking over control of air units AHU-1, RTU-12, 14, 15 and HRV-1, 2, 3 and the water pre-heat system on the building side. This overlap is not streamlined or optimized leading to some operational problems.

    .1 The building BMS system was created by ESC Automation that monitors and controls the facilities HVAC units, boilers, pumps, heat exchangers and control valves. This system has been modified by CIMCO Refrigeration and does not appear to operate as intended by the maintenance staff. In the last 2 years, the maintenance staff has modified some of the ESC BMS in an attempted to restore the system to its previous operation; this is ongoing.

    .2 The ice plant BMS system is a proprietary system created by CIMCO Refrigeration that controls the ice plant system including the Eco-Chill heat recovery system. Basic parameters and set points can be viewed and appears to be in operating order. However, the CIMCO system cannot be modified and only viewed, as the maintenance operators do not have the password to change any parameters of the system.

    .3 Part of the ice plant BMS is the Eco-Chill heat recovery system that removes low grade heat from the ice plant compressors and transfers the heat to several air handlers (AHU-1, RTU-12, 14, 15 and HRV-1, 2, 3) and preheats the domestic hot water (PHTs and ZHTs). When heat is available, the system takes over several of the air handlers from the ESC building BMS, which sometime conflicts with what the maintenance operates intend. See section 2.7 for additional information on the ice plant.

2.3 FIRE PROTECTION

1. The building has an automatic fire sprinkler system throughout the building but no fire hose cabinets. There is a fire pump to boost the water pressure to the building which is an Armstrong 5x5x8 20HP pump capable of 31.5L/s at 120kPa. The jockey pump is an Armstrong VMS 1503 1 HP pump capable of 0.31L/s at 150kPa. Located through the complex are portable hand held fire extinguishers.
2. There is a deluge sprinkler system for the theatre stage area that protects the seating area from the stage in the event of a fire.

2.4 SAUNA (WET AND DRY) ROOMS

1. The sauna rooms have been rebuilt in the past 2-3 years to repair humidity damage. The heater and the steam generators are operating and are in fair to good condition.

2.5 COAT ROOM

1. The existing Coat Room 1423 was converted to an office in 2014. This room has no ventilation, but a Mitsubishi heat pump was installed to provide heating and cooling to the room. Ventilation air is required to be provided to the room to meet the building code.

2.6 ZAMBONI ICE MELT SYSTEM

1. The Zamboni ice melt system failed about 2-3 years ago. The maintenance staff have created a new system that uses heating glycol from the east mechanical room to run a new system which included a plate and frame heat exchanger, pump, new piping in the ice melt pit, new thermostat in the ice pit and local controls. The maintenance staff has advised that the Zamboni ice melt system is operating and in good condition.

2.7 ICE PLANT

1. The existing ice plant was constructed/created by CIMCO Refrigeration. The ice plant is operational and produces ice when required. The system comprises of a chiller, cooling tower, pumps, expansion tanks, equalizer tanks, heat exchangers, ice storage and compressors.

   The ice plant also incorporates the Eco-Chill heat recovery system which is a glycol loop that transfers low temperature heat (43C) from the compressors which can be pumped into the building to provide heat to air handling units (AHU-1, RTU-12, 14, 15, HRV-1, 2, 3), in addition to pre-heating water (PHT-1, 2, 3, 4) to the domestic water to domestic water system. This heat recovery system has reduced the size of the ice plant cooling tower.

   Winter operation: The maintenance staff has advised that in winter the ice plant does not have to operate frequently and therefore the amount of heat recovered is minor. However, on warm winter days when the ice plant runs more frequently and the compressors produces more heat than the undersized cooling tower can dissipate. Without dissipating the heat, the compressors safety devices shutdown the compressors to protect them from high head pressures and/or high oil temperature. To maintain operation of the ice plant/compressors, the maintenance staff has to activate the Eco-Chill system to dump heat into the theater (AHU-1), soccer pitch (RTU-14, 15), and flex gym (RTU-12), causing the theatre, soccer pitch and flex gym cooling system to operate.

   Additionally, in winter when heat is required for the air handling systems, the maintenance staff must turn on the ice plant to generate heat for the Eco-Chill system, even though cooling is not required for the ice rink or ice storage tanks; this is an inefficient and expensive way of creating heat.

   Spring/Fall operation: The ice plant operates more frequently than in winter and produces more heat than can be recovered and the excess heat cannot be released because of the undersized cooling tower. The maintenance staff must manually operate the Eco-Chill system to dump the excess heat into the theatre, soccer pitch and the flex gym, as done in the winter operation.

   Summer operation: The facility currently does not operate the ice rink/plant during the summer. However, if they do wish to operate the ice rinks/plant during the summer, heat dissipation must be considered as the cooling tower is undersized and dumping excess heat into the building is not efficient or recommended.

   A report titled "2014 Dow Centennial Centre Mechanical Systems Study, May 2014 Revision 1" by TSE Consulting and Koldworks proposed several options that addressed the above issues and recommended separating the ice plant and HVAC systems to unify controls, simplify operation and operational and maintenance costs. The options recommended were cooling option 2 (abandon/remove the existing ice storage system and install a small 70 ton air cooled chiller package) and heating option 1 (abandon the heat recovery from the ice plant and install an

independent heating system with about 3,000 MBH capacity). In both cases, building and ice plant controls be changed to remove proprietary and to unify controls. See attached opinion of probable costs matrix in Appendix A.

System pressure: The chilled glycol system was operated at a system pressure of over 40psi which caused one of the thermal equalizer tank to "bulge out" in one of the tank wall. The maintenance staff reduced the operating pressure to 14psi to maintain pressure equal to the tank rating. As the equalizer tank is a pressure vessel the bulge in the tank indicates that it that the pressure rating has been compromised and the tank must be replaced. Additionally, the chilled glycol system relief valve is set to 50psi which is quite high for the system. The relief valve setting should be reviewed for safety.

2.8 RETRO COMMISSIONING OF THE FACILITY

1. The facility has not been operating as intended since the building was opened in 2004. The over the years, several system modifications have been implemented in an attempt to address functional and operational issues, with some success. It is recommended that consideration for a retro commissioning for the facility be completed to and document where the mechanical equipment are operating at and to aid in addressing recurrent issues. See attached opinion of probable costs matrix in Appendix A.

3.0 COSTS

See the Appendix A for Capital Reserve Table – Opinion of Probable Cost Matrix.

4.0 EXPANDABILITY TO THE FACILITY

Relative to the existing mechanical spaces, there is limited space to accommodate new mechanical equipment to support a large expansion to the facility. Smaller expansions may be accommodated that have heating and ventilation requirements that the existing plant can accommodate.

Any major additions for the complex will have to be coordinated with the owner/architect to establish new minimum space requirements for mechanical systems.

5.0 APPENDICES

APPENDIX A
Capital Reserve Table – Opinion of Probable Cost Matrix

Appendix A- Capital Reserve Table
Opinion of Probable Cost Matrix

Project information	Dow Community Centre, Ft. Saskatchewan			Threshold	x,xxxx
Total Gross Sq. m.		Year Built		Reserve Term (Years)	xx
Number of Buildings	1	Age	0	Assumed inflation	xx

* Unit rate is for equipment only budgetary purposes +/-30%.

Identified Costs

Report Section	Building Component	Year Installed	Expected Useful Life	Effective or Actual Age	Remaining Useful Life	Quantity	Unit Rate*	Event Type	Event Year														Total Reserve
									Immediate (<60-90days)	Year 0 (2015)	Short Term (year 1-5)					Long Term (year 6-10)					Long Term (year 11-25)		
											2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026-2030	2031-2035	2035-2040	
				2004																				
	MECHANICAL																							
2.2	AHU 1	2004	2024	11	9	1	260,000												X					
2.2	Air Conditioning Unit	2004	2024	11	9	1	5,000												X					
2.2	HRV 1	2004	2024	11	9	1	100,000												X					
2.2	HRV 2	2004	2024	11	9	1	100,000												X					
2.2	HRV 3	2004	2024	11	9	1	100,000												X					
2.2	MUA 1	2004	2024	11	9	1	13,000												X					
2.2	MUA 2	2004	2024	11	9	1	10,000												X					
2.2	MUA 3	2004	2024	11	9	1	10,000												X					
2.2	Roof Top Unit 1	2004	2024	11	9	1	6,000												X					
2.2	Roof Top Unit 2	2004	2024	11	9	1	5,500												X					
2.2	Roof Top Unit 3	2004	2024	11	9	1	15,000												X					
2.2	Roof Top Unit 4	2004	2024	11	9	1	10,000												X					
2.2	Roof Top Unit 5	2004	2024	11	9	1	10,000												X					
2.2	Roof Top Unit 6	2004	2024	11	9	1	10,000												X					
2.2	Roof Top Unit 7	2004	2024	11	9	1	10,000												X					
2.2	Roof Top Unit 8	2004	2024	11	9	1	5,000												X					
2.2	Roof Top Unit 9	2004	2024	11	9	1	12,000												X					
2.2	Roof Top Unit 10	2004	2024	11	9	1	20,000												X					
2.2	Roof Top Unit 11	2004	2024	11	9	1	20,000												X					
2.2	Roof Top Unit 12	2004	2024	11	9	1	30,000												X					
2.2	Roof Top Unit 13	2004	2024	11	9	1	12,000												X					
2.2	Roof Top Unit 14	2004	2024	11	9	1	30,000												X					
2.2	Roof Top Unit 15	2004	2024	11	9	1	30,000												X					
2.2	Roof Top Unit 16	2004	2024	11	9	1	6,000												X					
2.2	Roof Top Unit 17	2004	2024	11	9	1	10,000												X					
2.2	Roof Top Unit 18	2004	2024	11	9	1	10,000												X					
2.2	Entrance Heater	2004	2024	11	9	1	1500												X					
2.2	Entrance Heater	2004	2024	11	9	1	1500												X					
2.2	Heater	2004	2024	11	9	1	1500												X					
2.2	Heater	2004	2024	11	9	1	1500												X					
2.2	Heater	2004	2024	11	9	1	1500												X					
2.2	Heater	2004	2024	11	9	1	1500												X					
2.2	ESC AUTOMATION	2004	2024	11	9	1	-												X					
2.2	EXHAUST FAN 1	2004	2024	11	9	1	900												X					
2.2	EXHAUST FAN 2	2004	2024	11	9	1	900												X					
2.2	EXHAUST FAN 3	2004	2024	11	9	1	1,000												X					
2.2	EXHAUST FAN 4	2004	2024	11	9	1	300												X					
2.2	EXHAUST FAN 5	2004	2024	11	9	1	1,000												X					
2.2	EXHAUST FAN 6	2004	2024	11	9	1	1,100												X					
2.2	EXHAUST FAN 7	2004	2024	11	9	1	1,100												X					
2.2	EXHAUST FAN 8	2004	2024	11	9	1	300												X					
2.2	EXHAUST FAN 9	2004	2024	11	9	1	5,700												X					
2.2	EXHAUST FAN 10	2004	2024	11	9	1	5,700												X					
2.2	EXHAUST FAN 11	2004	2024	11	9	1	5,700												X					
2.2	EXHAUST FAN 12	2004	2024	11	9	1	5,700												X					
2.2	EXHAUST FAN 13	2004	2024	11	9	1	1,900												X					
2.2	EXHAUST FAN 14	2004	2024	11	9	1	1,900												X					
2.2	EXHAUST FAN 15	2004	2024	11	9	1	1,000												X					
2.2	EXHAUST FAN 16	2004	2024	11	9	1	900												X					
2.2	EXHAUST FAN 17	2004	2024	11	9	1	900												X					
2.2	EXHAUST FAN 18	2004	2024	11	9	1	900												X					
2.2	EXHAUST FAN 19	2004	2024	11	9	1	900												X					
2.2	EXHAUST FAN 20	2004	2024	11	9	1	1,600												X					
2.2	EXHAUST FAN 21	2004	2024	11	9	1	900												X					
2.2	EXHAUST FAN 22	2004	2024	11	9	1	900												X					
2.2	EXHAUST FAN 23	2004	2024	11	9	1	3,800												X					
2.2	EXHAUST FAN 24	2004	2024	11	9	1	3,800												X					

2.2	EXHAUST FAN 25	2004	2024	11	9	1	3,800											X					
2.2	EXHAUST FAN 26	2004	2024	11	9	1	1,300											X					
2.2	EXHAUST FAN 27	2004	2024	11	9	1	1,500											X					
2.2	EXHAUST FAN 28	2004	2024	11	9	1	900											X					
2.2	EXHAUST FAN 29	2004	2024	11	9	1	100											X					
2.2	EXHAUST FAN 30	2004	2024	11	9	1	900											X					
2.2	EXHAUST FAN 31	2004	2024	11	9	1	1,300											X					
2.2	EXHAUST FAN 32	2004	2024	11	9	1	3,500											X					
2.2	EXHAUST FAN 33	2004	2024	11	9	1	3,500											X					
2.2	EXHAUST FAN 34	2004	2024	11	9	1	1,200											X					
2.2	EXHAUST FAN THEATRE WASHROOM	2004	2024	11	9	1	5,200											X					
2.2	EXHAUST FAN THEATRE WASHROOM	2004	2024	11	9	1	5,200											X					
2.2	TRANSFER FAN 1	2004	2024	11	9	1	5,000											X					
2.2	TRANSFER FAN 2	2004	2024	11	9	1	1,200											X					
2.2	Transfer Fan	2004	2024	11	9	1	1,200											X					
2.2	Humidifiers	2004	2024	11	9	1	15,000											X					
2.2	Humidifiers	2004	2024	11	9	1	15,000											X					
2.7	ICE PLANT COMPRESSOR #1	2004	2014	11	-1	1	-			X													
2.7	ICE PLANT COMPRESSOR #2	2004	2014	11	-1	1	-			X													
2.2	Infrared Heaters	2004	2029	11	14	3	3000													X			
2.3	FIRE PUMP	2004	2034	11	19	1	20,000														X		
2.3	JOCKEY PUMP	2004	2034	11	19	1	5,000														X		
2.1/2.2	BOILER B 1	2004	2034	11	19	1	8,000														X		
2.1/2.2	BOILER B 2	2004	2034	11	19	1	8,000														X		
2.1/2.2	BOILER B 3	2004	2034	11	19	1	8,000														X		
2.1/2.2	BOILER B 4	2004	2034	11	19	1	8,000														X		
2.1/2.2	BOILER B 5	2004	2034	11	19	1	8,000														X		
2.1/2.2	BOILER B 6	2004	2034	11	19	1	8,000														X		
2.1/2.2	BOILER B 7	2004	2034	11	19	1	8,000														X		
2.1/2.2	BOILER B 8	2004	2034	11	19	1	8,000														X		
2.1/2.2	BOILER B 11	2004	2034	11	19	1	8,000														X		
2.1/2.2	BOILER B 12	2004	2034	11	19	1	8,000														X		
2.1/2.2	BOILER B 13	2004	2034	11	19	1	8,000														X		
2.1/2.2	BOILER B 14 (ZAMBONI)	2004	2034	11	19	1	7,500														X		
2.1/2.2	PUMP BP1	2004	2009	11	-6	1	3,500			X													
2.1/2.2	PUMP BP2	2004	2009	11	-6	1	3,500			X													
2.1/2.2	PUMP BP3	2004	2009	11	-6	1	3,500			X													
2.1/2.2	PUMP BP4	2004	2009	11	-6	1	3,500			X													
2.1/2.2	PUMP BP5	2004	2009	11	-6	1	3,500			X													
2.1/2.2	PUMP BP6	2004	2009	11	-6	1	3,500																
2.1/2.2	PUMP BP7	2004	2009	11	-6	1	3,500																
2.1/2.2	PUMP BP8	2004	2009	11	-6	1	3,500																
2.1/2.2	PUMP BP11	2004	2009	11	-6	1	3,500																
2.1/2.2	PUMP BP12	2004	2009	11	-6	1	3,500																
2.1/2.2	PUMP BP13	2004	2009	11	-6	1	3,500																
2.1/2.2	PUMP BP14	2004	2009	11	-6	1	3,750																
2.1	PUMP DHWRP 1	2004	2009	11	-6	1	3,500																
2.1	PUMP DHWRP 2	2004	2009	11	-6	1	3,500																
2.1	PUMP DHWRP 3	2004	2009	11	-6	1	3,500																
2.7	PUMP IP1	2004	2014	11	-1	1	3,000			X													
2.7	PUMP IP5	2004	2014	11	-1	1	10,000			X													
2.7	PUMP IP6	2004	2014	11	-1	1	5,000			X													
2.7	PUMP IP7	2004	2014	11	-1	1	4,500			X													
2.7	PUMP IP8	2004	2014	11	-1	1	12,000			X													
2.7	PUMP IP9	2004	2014	11	-1	1	15,000			X													
2.7	PUMP IP10	2004	2014	11	-1	1	10,000			X													
2.7	PUMP IP11	2004	2014	11	-1	1	10,000			X													
2.7	PUMP LLHP1	2004	2009	11	-6	1	1,500			X													
2.7	PUMP LLHP 2	2004	2009	11	-6	1	1,500																
2.7	PUMP LLHP 3	2004	2009	11	-6	1	1,500																
2.7	PUMP VFD1P2	2004	2014	11	-1	1				X													
2.7	Reheat Coil RHC 1	2004	2024	11	9	1												X					
2.1/2.2	PHT-1	2004	2034	11	19	1	4,700														X		
2.1/2.2	PHT-2	2004	2034	11	19	1	4,700														X		
2.1/2.2	PHT-3	2004	2034	11	19	1	4,700														X		
2.1/2.2	PHT-4	2004	2034	11	19	1	4,700														X		
2.1/2.2	DWH-1	2004	2024	11	9	1	3,400																
2.1/2.2	DWH-2	2004	2024	11	9	1	3,400																
2.1/2.2	DWH-3	2004	2024	11	9	1	3,400																
2.1/2.2	DWH-4	2004	2024	11	9	1	3,400																
2.1/2.2	TANK	2004	2024	11	9	1	3400																
2.3	Theatre Deluge System	2004	2024	11	9	1	-											X					

2.7	THERMAL EQUALIZER	2004	2034	11	19	1	-															X	
2.1.2.1	Storm drainage to the east.					1	8,500															X	
2.5	Ventilation for the coat room/office.					1	4,000															X	
2.7	Replace one equalizer tank.					1	15,000																
2.7	Separtion of the ice plant and building HVAC systems - Option 1					1	692,000															X	
	Cooling option #2 - new piping and air cooled chiller					1	(275,000)																
	Heating option #1 - abondon heat recovery and add new boilers					1	(342,000)															X	
	Consulting					1	(75,000)																
																						X	
2.8	Retro Commissioning of Facility and Engineering for Ice Plant Recovery					1	35,000															X	

Capital Reserve Analysis

	inflated	*uninflated*
Average Cost/Year		
Average Cost/Year/Sq. M.		

	Immediate	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026-2030	2031-2035	2035-2040	Reserve Totals
$CAD																
$CAD																

Notes

LCR= Lifecycle Replacement

FR= Failure Replacement