APPENDIX C – GREEN BUILDING AND SUSTAINABILITY DESIGN APPROACH AND FEASIBILITY STUDY REQUIREMENTS

Design Approach

Below are some specific recommendations that are to be considered and where possible, included in the design:

1. Reduce Heating, Cooling, and Lighting Loads through Climate-Responsive Design and Conservation Practices:
    a. Use passive solar design; orient, size, and specify high-performance, energy efficient windows (e.g. U-0.24 including frame); and locate landscape elements with solar geometry and building load requirements in mind.
    b. Use high-performance building envelopes; select walls (clear field effective value of R-30 or higher), roofs (clear field effective value of R-40 or higher), and other assemblies based on long-term insulation, air barrier performance, and durability requirements.
    c. Limit the fenestration and door area to the maximum allowable as per National Energy Building Code (NECB) 2017, article 3.1.1.6 (Winnipeg 29%)
    d. Consider an integrated landscape design that provides deciduous trees for summer shading, appropriate planting for windbreaks, and attractive outdoor spaces.

2. Specify Efficient HVAC and Lighting Systems:
    a. Use energy efficient HVAC equipment and systems – the expectation is that the design will utilize a ground source or an air to water heat pump system. It is anticipated that natural gas will be employed for supplementary heating, with a view to 100% electrification in the future.
    b. Use lighting systems that consume less than 0.09 watt/square metre for ambient lighting.
    c. Use Energy Star® approved energy efficient appliances.
    d. Run the energy model using a future weather file (for the year 2040) to ensure the predicted cooling loads do not exceed the proposed designs equipment capacities.

3. Optimize Building Performance and System Control Strategies:
    a. Employ energy modelling early in the design process.
    b. Use sensors to control loads based on occupancy, schedule and/or the availability of natural resources such as daylight or natural ventilation if applicable.
    c. Consider the use of modular components such as boilers or chillers to optimize part-load efficiency and maintenance requirements.
    d. Use a comprehensive, building commissioning plan throughout the life of the project.

4. Solar Ready Roof Design:
    a. The roof must be designed to be structurally capable of accommodating the additional loads of a solar PV system. It should be free of obstructions such as self-shading on the south facing portion e.g. from rooftop units, to maximize sun exposure. The roof loads and potential location of a solar PV system should be included into roof plan tender drawings.
    b. At minimum the following is required to incorporate "solar ready" principles:
        i. Designating the area of the roof for future solar PV and making it structurally sound to support it;
        ii. Place HVAC or other rooftop equipment on the north side of the roof, to prevent future shading;
        iii. Provide necessary conduits from roof to enable future electric and communications connection requirements.

Feasibility Studies

Three feasibility studies detailed below are to be completed in the schematic design phase.

Ground Source Heat Pump Feasibility Study

Prepare a ground source heat pump feasibility study which will include the following:

1. Building and site assessment:
    a. The proposed building shall be evaluated using engineering judgement to select the appropriate zone terminal units which would function with a ground source heat pump system.
    b. The proposed borefield location shall be reviewed to verify that a ground source heat pump system is appropriate for the site. Please note that additional buildings will be constructed in future phases, therefore investigate the size limits of the borefield location.
    c. Local ground thermal conductivity shall be investigated through the use of geological surveys and local experts. A test borehole is not required at the feasibility stage.
    d. A reasonable effort shall be made to identify any issues with drilling at the proposed location.
    e. The proposed system shall be described, including the system size, location and sizing of vertical/horizontal geoexchange field, building connection point, heat pump configuration, and sequence of controls.

2. Building energy model:
    a. An energy model shall be created (the same building energy model can be used for this feasibility study and for general building design);
    b. The building energy model and GHX model shall be used to directly inform design. All relevant loads that affect system balancing should be investigated. This may include the DHW load, ventilation loads, fluid cooler, snow melting, etc.

   c. Relevant screen shots illustrating results from the building energy model shall be included in the report.
   d. It is anticipated that natural gas will be employed for supplementary heating, with a view to 100% electrification in the future.

3. GHX model/design/sizing:
   a. GHX sizing shall not be based on rules of thumb
   b. GHX sizing shall be completed using an appropriate software.
   c. A plot illustrating 20-year ground temperature changes shall be included.
   d. Annual heat flows to and from the ground shall be explicitly stated.
   e. A layout for the proposed borefield shall be provided.
   f. Relevant screen shots illustrating results from GHX model shall be included in the report.

4. Energy/Financial/GHG Analysis:
   a. The energy, cost, and GHG savings of a ground source heat pump shall be evaluated and then compared against a reasonable natural gas fired conventional heating system. It is expected that a conventional system would include air heat recovery where applicable.
   b. Provide life cycle costing analysis with net present value (NPV) over a 40-year evaluation period and the payback year if applicable. Current Manitoba Hydro rates are to be used whilst discount and escalation rates will be provided by the City. Operations, maintenance and replacement costs are to be considered. Provide a spreadsheet with the analysis in an attachment to the study.
   c. Identify incentives and incorporate them into the analysis if applicable.
   d. AHRI-rated specifications of proposed equipment shall be used to estimate equipment efficiencies. Efficiency values shall be adjusted to represent expected operating conditions (for example, entering or leaving water temperatures that deviate significantly from rated performance points) and the adjustment should be justified within the report.
   e. Component costs should be traceable and included as separate line items; acceptable sources include either RS means mechanical data and actual equipment quotes for this project or from recent previous projects.
   f. The GHG savings for a ground source heat pump option should be estimated based on current emissions for Manitoba as reported in the National Inventory.

5. Environmental Impact:
   a. Identify any potential ground loop impacts on the local water source and the environment (if any).

6. Report:
   a. Provide a report which clearly indicates/describes methodologies, parameter assumptions (and sources) and findings, to such a degree that City staff can verify all requirements have been met.
   b. Model files and data inputs used to support the analysis to be provided with the report.

Air to Water Heat Pump Feasibility Study

Prepare an air to water source heat pump feasibility study which will include the following:

1. Building and site assessment:
    a. The proposed building shall be evaluated using engineering judgement to select the appropriate zone terminal units which would function with an air to water heat pump system.

2. Building energy model:
    a. An energy model shall be created (the same building energy model can be used for this feasibility study and for general building design);
    b. The building energy model shall be used to directly inform design.
    c. Relevant screen shots illustrating results from the building energy model shall be included in the report.
    d. It is anticipated that natural gas will be employed for supplementary heating, with a view to 100% electrification in the future.

3. Energy/Financial/GHG Analysis:
    a. The energy, cost, and GHG savings of an air to water heat pump shall be evaluated and then compared against a reasonable natural gas fired conventional heating system. It is expected that a conventional system would include air heat recovery where applicable.
    b. Provide life cycle costing analysis with net present value (NPV) over a 40-year evaluation period and the payback year if applicable. Current Manitoba Hydro rates are to be used whilst discount and escalation rates will be provided by the City. Operations, maintenance and replacement costs are to be considered. Provide a spreadsheet with the analysis in an attachment to the study.
    c. Identify incentives and incorporate them into the analysis if applicable.
    d. AHRI-rated specifications of proposed equipment shall be used to estimate equipment efficiencies. Efficiency values shall be adjusted to represent expected operating conditions (for example, entering or leaving water temperatures that deviate significantly from rated performance points) and the adjustment should be justified within the report.
    e. Components costs should be traceable and included as separate line items; acceptable sources include either RS means mechanical data and actual equipment quotes for this project or from recent previous projects.
    f. The GHG savings for an air to water heat pump option should be estimated based on current emissions for Manitoba as reported in the National Inventory Report.

4. Report:
    a. Provide a report which clearly indicates/describes methodologies, parameter assumptions (and sources) and findings, to such a degree that City staff can verify all requirements have been met.

b. Model files and data inputs used to support the analysis to be provided with the report.

Solar Photovoltaic (PV) Panel and Solar Thermal (Air and Water) Feasibility Study

Prepare a solar photovoltaic and solar thermal (air and water) feasibility study which will include the following:

1. Conduct a shading study incorporating existing and permitted building heights and other obstructions;

2. Provide an estimate of the maximum PV system size, and system production using accepted industry solar PV design software and provide that software report as an attachment to the study;

3. Provide a preliminary layout of the potential system taking into account the set-back from roof edges, mechanical equipment and roof drains;

4. Conduct GHG savings analysis;

5. Provide life cycle costing analysis with net present value (NPV) over a 40-year evaluation period and a payback year if applicable. Current Manitoba Hydro rates are to be used whilst discount and escalation rates will be provided by the City of Winnipeg. Operations, maintenance and replacement costs are to be considered. Provide a spreadsheet with the analysis in an attachment to the study.