

APPENDIX C (R4)

1. ELECTRICAL SYSTEMS NARRATIVE

1.1 INTRODUCTION

- .1 Existing electrical systems in the existing building are all inadequate for the proposed project and shall be removed and replaced/upgrades.

1.2 CODES AND STANDARDS

- .1 The electrical work shall meet or exceed the minimum requirements of the latest applicable codes, rules and regulations including the following:
 - .1 Canadian Electrical Code
 - .2 Manitoba Fire Code
 - .3 Manitoba Building Code
 - .4 Manitoba Energy Code for Buildings
 - .5 CSA Standards
 - .6 IEEE Standards
 - .7 Illuminating Engineering Society (IES) Standards
 - .8 ASHRAE Standards
 - .9 Governing Authority having jurisdiction
 - .10 National Energy Code for Buildings
 - .11 Universal Accessibility Guidelines
 - .12 All products shall be CSA approved.
 - .13 Engineering “Best Practices” shall be utilized for efficient electrical design and energy savings.

1.3 DESIGN SUMMARY OVERVIEW

.1 The following electrical connected load has been calculated:

Electrical Load Description (Approximate)	Electrical Connected Load
Interior/building mounted exterior lighting	2kW
Exterior lighting	2kW
Branch circuit power	1kW
Water heaters	9kW
Unit heater in mechanical rooms	10kW (fall/winter load, duty/standby)
Exhaust fans	0.5kW
Splash pad equipment (to be confirmed by actual equipment vendor): 10hp pump 3hp pump 2 x fractional hp pumps UV lamp	16kW
TOTAL (Summer load)	40.5kW 169A at 120/240V 1-phase, 3-wire

.2 All loads indicated above are undiversified, preliminary and are to be confirmed by the Bidder.

.3 The new electrical demand is in excess of the existing utility service rating. The demand of the new building shall be serviced from a new (upgraded) utility service.

.4 Discussions have occurred with Manitoba Hydro, and early indications are that a 3-phase service would be impractical. The Bidder shall arrange and pay for a new 120/240V 1-phase, 3-wire service, provided by Manitoba Hydro.

.5 Site Services

.1 A new overhead utility service connection shall be provided

.2 A new overhead telephone service shall be provided.

.6 The interior of the building shall be lit with LED light fixtures

.7 The exterior shall be lit with LED fixtures mounted on the building on three sides.

.8 A separate price shall be provided for the replacement of 8-existing globe light fixtures and lamp standards with new LED light fixtures and lamp standards, fed from the existing wiring currently connected to the building.

.9 Receptacles & Power

- .1 Receptacles and power connections shall be located in all areas as required to suit the room's intended purpose.
- .2 Mechanical equipment connections shall be provided including connections to pool equipment.
- .10 Systems
 - .1 A voice connection shall be provided at the mechanical room for remote access and at a telephone located in the mechanical room.

1.4 SITE SERVICES

- .1 The existing utility service to the building is inadequate and requires replacement. A new service shall be provided (size of service to be determined and confirmed by the Bidder), initially sized as follows:
 - .1 120/240V 1-phase, 3-wire 400A.
Service sizes shall be adequate to allow simultaneous starting of a 10hp and 3hp pump, lighting and water heater after power failure. Coordinate with Manitoba Hydro.
 - .2 The existing telephone service shall be replaced with a new service to a new BIX block located adjacent to the new service entrance panel board. The utility access cable shall be terminated in to the BIX, and two field located phone lines installed. Coordinate with MTS Allstream.

1.5 SERVICE ENTRANCE PANELBOARD

- .1 A new service entrance panel board shall be provided, which shall at least match the utility service size. The new service shall be coordinated with Manitoba Hydro. The service shall enter the building via a meter socket and meter (overhead or underground) and shall be terminated in the new service entrance panel board. The panel board shall incorporate a main 400A service entrance circuit breaker and branch circuit breakers as required.

The Bidder shall coordinate with Manitoba Hydro and the pool/splash pad equipment vendor for the appropriate electrical service arrangement and size and provide service equipment as is necessary.

Provide a new service/source ground as required.
- .2 Panelboard shall be provided with lockable doors, 10% spare breakers and 15% space for future breakers (total 25% space/spare).
- .3 Locate the panelboard in the mechanical room.
- .4 Distribution busses to be copper.
- .5 Provide GFCI breakers as required by code.
- .6 All wiring shall be copper, and shall be predominantly enclosed in a conduit raceway.

1.6 EMERGENCY POWER

- .1 No emergency power is required for the building or site.

1.7 INTERIOR LIGHTING GENERAL

- .1 Individual rooms and open spaces shall have local switching via occupancy sensors.

- .2 Exterior lighting shall be controlled by a new photocell, mounted on the exterior of the building.
- .3 Energy efficient LED lighting shall be utilized. Lamp color shall be 3500 deg.K. All lighting shall be powered at 120 Volts.
- .4 Approximately 20% of lighting fixtures shall be wired as unswitched "night lights" for security.
- .5 Lighting levels shall be designed to the upper-range (>65 year of age group) of the Illumination Engineering Society (IES) recommended levels.
- .6 Light fixtures shall be selected to be eligible for the Manitoba Hydro "Power Smart Rebate" program wherever possible.

1.8 INTERIOR LIGHTING – NON-PUBLIC AREAS

- .1 Non-public, back of house lighting in equipment/storage rooms shall be gasketted vapourtight LED fixtures.

1.9 PUBLIC AREA LIGHTING

- .1 The public areas shall be lit with LED fixtures which are both visually appealing and vandal resistant. Standard of acceptance: Cooper HVL8 or similar.
- .2 Consideration shall be given to security within the building, and light levels shall meet the requirements of IES.

1.10 EXTERIOR BUILDING MOUNTED LIGHTING

- .1 The exterior of the building shall be lit with LED fixtures which are both visually appealing and vandal resistance. Standard of acceptance: Cooper Crosstour Maxx LED Wallpack or similar.
- .2 Consideration shall be given to security around the building, and light levels shall meet the requirements of IES. As a minimum, light fixtures shall be located above entrance doors and on three sides of the building.
- .3 Consideration shall also be given to light egress from the site in to neighbouring properties. All fixtures shall be full cut off.

1.11 EXTERIOR SPLASH PAD/WADING POOL LIGHTING

- .1 The splash pad/wading pool area shall be illuminated by pole mounted LED fixtures as indicated in the landscape architect's site plan. Fixtures shall be installed on 4.5m tall poles. Fixtures shall be LED and shall be both visually appealing and vandal resistant. Standard of acceptance: Cooper MSA Mesa LED, pole and screw foundation.
- .2 Consideration shall be given to security around the building, and light levels shall meet the requirements of IES.
- .3 Consideration shall also be given to light egress from the site in to neighbouring properties. All fixtures shall be full cut off.
- .4 Bond all lighting poles to ground.

1.12 EXIT AND EMERGENCY LIGHTING

- .1 Running man style LED type exit lighting shall be provided at all exit doors. Connect to a dedicated circuit.
- .2 Provide emergency lighting (locate battery pack in mechanical room).

1.13 RECEPTACLES AND POWER OUTLETS

- .1 Receptacles and power outlets shall be provided in keeping with the functional requirements of the space and specifically as follows:
 - .1 Convenience receptacles shall be provided throughout the building.
 - .2 Dedicated GFI receptacles shall be provided in washrooms (counters)
 - .3 Dedicated 20A 120V receptacle shall be provided in the mechanical room.
- .2 All receptacles in public areas shall be tamper-proof.
- .3 Door operators shall be wired.
- .4 In washrooms, hand driers and electric toilet flush valves and faucets shall be wired. Receptacles shall be provided at counters (GFCI).
- .5 A receptacle, mounted in a weatherproof, vandal resistant lockable box shall be provided on the exterior of the building for exterior events.
- .6 A quadplex, dedicated receptacle and a duplex receptacle shall be provided in the office.
- .7 Provide two 120V receptacles, one at the BIX and one at the voice/data equipment cabinet.
- .8 Wiring shall be copper type RW90, minimum #12 AWG, installed in EMT conduit inside building and rigid PVC conduit where underground.
- .9 Type "BX" cable shall be used for drops from outlet boxes to individual lighting fixtures and for branch circuit wiring in steel stud partitions; all home runs to panels shall be in conduit.

1.14 GROUNDING AND BONDING

- .1 Grounding and bonding conductors shall be provided.
- .2 Bond the wading pool. Route a #4 ground out to the wading pool, and route around its perimeter. Bond all metallic objects, including lighting poles.
- .3 Bonding conductors shall be provided in all conduit runs.
- .4 Provide a service/source ground as required by Code.
- .5 All underground connections shall be compression type or thermal welded.

1.15 MECHANICAL EQUIPMENT

- .1 All mechanical equipment shall be wired and connected
- .2 All equipment mounted on the exterior of the building shall be weatherproof.
- .3 Supply, wire and connect two 240/208V single phase unit heaters, each with built-in thermostat in each mechanical room. Do not use construction heaters.

- .4 Connections to include but not limited to the following:
 - .1 Exhaust fans
 - .2 Water heaters
 - .3 Electronic Faucets
 - .4 Pool pumps and peripherals (provide combination starters for pool pumps).
 - .5 Electric unit heater

1.16 VOICE AND DATA CABLING SYSTEM

- .1 Provide a BIX mounted on a plywood backboard in the equipment room.
- .2 Provide two voice outlets (one for remote access to pool equipment and one to a wall mounted telephone in the mechanical room).
- .3 Provide a telephone outlet in the office.
- .4 Provide a data outlet in the office, routed to a location adjacent to the BIX panel for data.
- .5 Provide a wall mounted equipment cabinet for data equipment in the mechanical room.
- .6 Wire using CAT 3 in conduit.

1.17 GENERAL ITEMS TO BE PROVIDED

- .1 Provide adequate moisture and corrosion protection of all electrical equipment.
- .2 Provide operations and maintenance manuals for all electrical equipment and systems.
- .3 Provide digital-based as builts, with record drawing information incorporated from the trade's on-site drawings. These as-builts shall also reflect all approved change orders (Client Scope Changes) during construction.
- .4 Provide training of operations staff.
- .5 Provide a 1 year warranty (parts and labour).
- .6 Electrical panels shall be tagged with a building wide naming system.
- .7 All wire shall be in conduit, and shall be copper, unless otherwise indicated.

2. ELECTRICAL OUTLINE SPECIFICATIONS

2.1 ELECTRICAL GENERAL REQUIREMENTS

- .1 All panels, motor disconnects, Motor Control Centres, ceiling junction boxes, and power outlets shall be identified with mechanically fastened lamacoid nameplates.
- .2 All outlet mounting heights shall be to suit their intended purposes and coordinated with architectural and tenant details.
- .3 Fireproofing of electrical cables, conduits, trays, etc. passing through fire barriers shall conform to local codes and inspection authorities.
- .4 Upon completion of the project, demonstrate the operation of all equipment in the presence of the Owner, or his representative, and the Consultant. Obtain signed certification from the Owner and the Consultant that such equipment is fully operational and that all necessary operating instructions have been provided.
- .5 Arrange and pay for services of manufacturer's factory service engineer to supervise start-up of installation, check, adjust, balance and calibrate components as specified in subsequent sections.
- .6 Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant with all aspects of its care and operation.
- .7 Identify wiring with permanent indelible identifying markings, either numbered or colored plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring.
- .8 Maintain phase sequence and colour coding throughout.
- .9 Colour Code: To CSA C22.1.
- .10 Use colour coded wires in communication cables, matched throughout system. Colour coding used shall be documented by individual systems in Maintenance Manuals.
- .11 Insulated grounding conductors shall have a green finish and shall be used only as a grounding conductor. A ground shall be provided in all conduits.
- .12 Colour code conduits, boxes and metallic sheathed cable.
- .13 Code with plastic tape or paint at points where conduit or cable enters wall, ceiling, or floor, and at 15m intervals.
- .14 Colours: 25mm wide prime colour and 20mm wide auxiliary colour.

	<u>Prime</u>	<u>Auxiliary</u>
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Up to 250 V	Yellow	
Telephone	green	
Control	blue	

- .15 Other conduit systems as directed on site; all conduit systems shall be identified.

- .16 Color outlet box covers to color designated and show circuit numbers in black felt marker on inside of covers.
- .17 Provide operation and maintenance data for incorporation into operation and maintenance manuals specified.
- .18 Include in operations and maintenance data:
 - .1 Details of design elements, construction features, component function and maintenance requirements, to permit effective start-up, operation, maintenance, repair, modification, extension, and expansion of any portion or feature of the electrical installation.
 - .2 Technical data, product data, supplemented by bulletins, component illustrations, exploded views, technical descriptions of items, and parts lists. Advertising or sales literature alone is not acceptable.
 - .3 Wiring and schematic diagrams and performance curves.
 - .4 Names and addresses of local suppliers.
 - .5 Copy of reviewed shop drawings.
- .19 As work progresses, record on one (1) set of drawings, any changes to conduit layout as well as any approved changes and deviations from the original contract and/or working drawings, including outlets, equipment and panel locations. At completion of work, submit to the Owner, at the contractor's costs, electronic CADD "Record Drawings". The contract shall not be considered complete and no final payment shall be made until these drawings are accepted by the Consultant. (Provide separate drawings for each system so as not to "crowd" drawings).
- .20 Acceptable manufacturers of distribution equipment:
 - .1 Cutler-Hammer
 - .2 Schneider Electric
 - .3 Siemens Canada

2.2 CONDUITS, FITTINGS AND FASTENINGS

- .1 Rigid PVC conduits shall be installed for underground conduits leaving the building for main Hydro high voltage service, main telephone service, main fibre optic cable service and remote mechanical equipment.
- .2 Electrical metallic tubing (EMT) conduits shall be used for all cable raceways with watertight fittings shall be installed for panel and branch circuit feeds.
- .3 All conduits shall be recessed in office and public areas and exposed in electrical, mechanical and similar spaces. Conduits to be fastened with appropriate straps, beam clamps or U channel strut frame supports as required.
- .4 All conduit system junction boxes to be properly labelled to their specific system.
- .5 Minimum sizes – 19mm unless branch circuit from junction box, when 1/2" shall be permitted.

2.3 WIRES AND CABLES

- .1 Conductors in conduits to be solid copper #10 AWG and smaller, and stranded #8 AWG and larger. Insulation cross link polyethylene RW-90 (RWU-90 underground) 90°C, minimum 600V as required.
- .2 Armoured cables to be solid copper #10 AWG and smaller, and stranded #8 AWG and larger. Insulation cross link polyethylene (XLPE) AC-90, 600V as required. Cable to be utilized for luminaire drop connections and receptacles in metal stud walls only.
- .3 Armoured cables (Teck) to be solid copper #10 AWG and smaller, and stranded #8 AWG and larger. Insulation cross link polyethylene (RW-90) 90°C, 1000V, FT4 flame rating as required. Cable to be utilized for large feeders and mechanical equipment connection for vibration isolation and weatherproofing as required (Watertight flex conduits can also be utilized).
- .4 Colour coded wires shall be as follows:

Phase A - red	Neutral - white
Phase B - black	Ground - green
Phase C - blue	Isolated Ground - green and orange trace

2.4 OUTLET BOXES AND FITTINGS

- .1 Size boxes in accordance with CSA C22.1.
- .2 Gang boxes where wiring devices are grouped.
- .3 Provide blank cover plates for boxes without wiring devices.
- .4 Combination boxes with barriers where outlets for more than one system are grouped.
- .5 In finished areas, blank cover plates, switch, convenience receptacle, and telephone outlet coverplates shall be stainless steel. In finished area ceilings, junction and pull boxes shall be solid covers, painted to match the finish of the adjacent surface.
- .6 In moist or dusty areas, gasketed watertight or dust-tight boxes and covers shall be provided.
- .7 102mm square or octagonal outlet boxes for lighting fixture outlets.
- .8 102mm square outlet boxes with extension and plaster rings for flush mounting devices in finished plaster and tile walls.
- .9 Electro-galvanized steel masonry single and multi-gang boxes for devices flush mounted in exposed block walls.
- .10 Electro-galvanized sheet steel concrete type boxes for flush mount in concrete with matching extension and plaster rings as required.
- .11 Concrete tight electro-galvanized sheet steel floor boxes with gasket, floor plate, levelling screws, and adjustable finishing rings to suit floor finish with brass faceplate. Device mounting plate to accommodate short or long ear duplex receptacles.
- .12 Cast FS or FD ferrous alloy boxes with factory-threaded hubs and mounting feet for surface wiring of switches and receptacle where exposed to moisture.

2.5 WIRING DEVICES

- .1 Switches to be toggle operated general purpose AC switches 15A 120V AC single pole, double pole, three-way and four-way switches as indicated, with the following features:
 - .1 Terminal holes approved for No. 10 AWG wire.
 - .2 Silver alloy contacts.
 - .3 Urea moulding.
 - .4 Suitable for back and side wiring.
 - .5 Brown toggle.
 - .6 Fully rated for tungsten filament and fluorescent lamps, and up to 80% of rated capacity of motor loads.Switches of one manufacturer throughout project.
Switches to be premium specification grade.
Acceptable manufacturers: Hubbell, Leviton and Cooper.
- .2 Receptacles shall be as indicated below:
 - .1 Duplex receptacles, CSA type 5-15 R, 125V AC, 15A, U-ground, with following features:
 - .1 Nylon face, brown for normal power, red for emergency power.

- .2 Suitable for #10 AWG for back and side wiring.
- .3 Break-off links for use as split receptacles.
- .4 Double wipe contacts and rivetted grounding contacts.
- .2 Single receptacles CSA type 5-15 R, 125V AC, 15A, U-ground with following features:
 - .1 Nylon face, brown.
 - .2 Suitable for #10 AWG for back and side wiring.
- .3 Receptacles of one manufacturer throughout project.
- .4 Acceptable Manufacturers: Hubbell; Leviton; Cooper. Catalogue No. 5262 for all manufacturers.
- .3 Cover Plates:
 - .1 Cover plates from one manufacturer throughout project.
 - .2 Stainless steel coverplates for wiring devices mounted in flush-mounted outlet boxes to be minimum plate thickness of 1.0mm.
 - .3 Sheet steel utility box cover for wiring devices installed in surface-mounted utility boxes.
 - .4 Cast gasketed coverplates for wiring devices mounted in surface-mounted FS or FD type conduit boxes.
 - .5 Weatherproof double lift spring-loaded cast aluminum coverplates, complete with gaskets for duplex receptacles in high moisture areas and parking areas.
 - .6 Weatherproof plates complete with gaskets for single receptacles or switches as indicated.

2.6 MECHANICAL EQUIPMENT CONNECTIONS

- .1 Provide complete electrical power and control connections for mechanical equipment, except as noted herein.
- .2 Include motor starters, disconnects, conduit, wire, fittings, interlocks, outlet boxes, junction boxes, and all associated equipment required to provide power wiring for mechanical equipment, unless otherwise indicated.
- .3 Include pushbutton stations, motor protective switches, interlocks, conduit, wire, devices, and fittings required to provide control wiring for mechanical equipment except for temperature/humidity control systems.
- .4 Unless otherwise noted, motors and control devices shall be supplied by Div. 15. Motor horsepower ratings shall be as per Div. 25.
- .5 All equipment mounted on the exterior of the building shall be weatherproof.
- .6 Install power feeders, starters, disconnect switches and associated equipment and make connections to all mechanical equipment.
- .7 Install branch circuit wiring for mechanical systems control panels, time clocks and control transformers.
- .8 Install main power feeders to starter/control panels furnished by Div. 15. Install branch wiring from motors, electric coils, etc.

- .9 Install all electrical controls except low voltage temperature controls, unless otherwise noted herein. Controls which have both electrical and mechanical connections shall be installed by the trade supplying the control.
- .10 Wire and connect line voltage remote thermostats and P/E switches for force flows, prop fans, unit heaters, and small exhaust fans.
- .11 Wire and connect float switches, pressure switches, alternators, alarms, etc. for sump pumps, sewage pumps, hot water recirculating pumps, booster pumps, jockey pumps, and compressors.

2.7 GROUNDING - PRIMARY

- .1 Rod electrodes: copper clad steel, 19mm dia. by 3m long or as required.
- .2 Conductors: bare, stranded, tinned soft annealed copper wire, size No. 4/0 AWG for ground bus, electrode interconnections, metal structures, gradient control mats, transformers, switchgear, motors, ground connections.

2.8 SERVICE ENTRANCE PANELBOARDS

- .1 250V branch circuit panelboards: Bus and breakers rated for 10 kA (symmetrical) interrupting capacity minimum or as required by utility fault level.
- .2 Wiring in panelboards shall be neat and set in as if laced. All neutral conductors shall be identified in the panel with their associated circuit numbers by means of Brady Markers.
- .3 Panels shall be c/w 10% spare breakers and 20% space for future breakers.
- .4 Enclosure:
 - .1 Wall mounted, totally enclosed sheet steel enclosure with steel frame.
 - .2 Hinged access panels with captive knurled thumb screws.
 - .3 High conductivity copper bus.
 - .4 Bus from load terminals of main breaker via metering sections to main lugs of distribution section.
 - .5 Identify phases with colour coding.
 - .6 Sprinklerproof construction.
- .5 Main Breaker Section:
 - .1 The main circuit breaker shall be an electrically operated fixed type moulded case circuit breaker (service entrance rated).
- .6 Grounding:
 - .1 Copper ground bus extending full width of cubicles and located at bottom.
 - .2 Lugs at each end sized for grounding cable.
- .7 Utility metering – provide wall mounted meter socket on the exterior of the building.

2.9 GROUNDING - SECONDARY

- .1 Grounding Equipment:
 - .1 Grounding conductors, system, circuit and equipment, grounding to be bare stranded copper sized in accordance with the Canadian Electrical Code.

- .2 Clamps for grounding of conductor, size as required to electrically conductive ground grid as required.
- .3 System and circuit, equipment, grounding conductors, bare stranded copper, tinned, soft annealed, sized as indicated.
- .4 Insulated grounding conductors: Green, type RW-90.
- .5 Ground Bus: Copper, size 50mm by 6mm by 300mm long complete with insulated supports, fastenings, connectors.
- .6 Non-corroding accessories necessary for grounding system, type, size, material as indicated, including but not necessarily limited to:
 - .1 Grounding and bonding bushings.
 - .2 Protective type clamps.
 - .3 Bolted type conductor connectors.
 - .4 Thermit welded type conductor connectors.
 - .5 Bonding jumpers, straps.
 - .6 Pressure wire connectors.
- .2 Install complete permanent, continuous, system and circuit, equipment, grounding systems including electrodes, conductors, connectors, accessories, as indicated, to conform to requirements of local authority having jurisdiction over installation.
- .3 Make buried connections, and connections to conductive water main, electrodes, using copper welding by Thermit process or Burndy "HYGround" compression conductors.
- .4 Install grounding connections to typical equipment included in, but not necessarily limited to following list; service equipment, frames of motors, building steel work, pool equipment and structures, panels, outdoor lighting.

2.10 MOTOR STARTERS

- .1 Three phase combination magnetic motor starters shall have MCP circuit breaker, solenoid operated contactor, rapid action type, overload protection for each phase, power and control termination. Each starter assembly to have its own control transformer, HOA selector switch, 2 NO and 2 NC auxiliary contacts and be EEMAC rated. Full size starters only shall be provided.