



**CITY OF
SWIFT CURRENT**
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**SECTION 13060
IRRIGATION INSTALLATION**

DECEMBER 2015



CONSTRUCTION SPECIFICATIONS

SECTION: 13060 IRRIGATION INSTALLATION

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1 GENERAL

1.1 DESCRIPTION

- 1.1.1 This section includes the supply and installation of automatic irrigation systems within areas required by the City.
- 1.1.2 The Contractor shall provide all labour, products and equipment required for work including, but not limited to:
- Installation of irrigation lines and appurtenances
 - Testing irrigation lines

1.2 RELATED SECTIONS

- 13080 Trees, Shrubs, and Plants
- 13400 Topsoil and Seeding
- 13550 Sodding

1.3 INSPECTION AND TESTING

- 1.3.1 Prior to backfilling at joints and connections, the piping is to be flushed and then filled with water, ensuring that any entrapped air has been completely expelled. The Contractor shall flush the system in the presence of the Project Manager.
- 1.3.2 Once the lines have been completely filled with water, the Contractor is to test the system in the presence of the Project Manager.
- 1.3.3 All pipes, whether main lines or laterals shall be tested for a minimum period of one (1) hour at 100 psi (6.5 kg/cm²) or at the pressure equivalent to the pressure of the water main to which the irrigation system is connected, whichever is higher, and upon visual inspection of all joints, should any leak be found, it shall be repaired and testing continued until all visible leaks have been eliminated from the entire system or the part of the system under test.
- 1.3.4 Adjustment of the sprinkler heads and controllers shall be carried out by the Contractor upon completion of the installation so as to obtain maximum performance from all parts of the system.
- 1.3.5 Adjustment of the controllers shall be done by the Contractor to ensure the system is operating properly. The final commissioning of the system shall be done in the presence of the Project Manager.
- 1.3.6 Flushing of Irrigation System - the Contractor shall, in the presence of the Project Manager, flush all of the irrigation piping, and then fill it with water.
- 1.3.7 Backflow Prevention Assembly Certification
- The Backflow Prevention device must be inspected and approved by the City's Park Department. This testing must be done prior to the activation of the irrigation system.

- Once the device is tested, the certified tester is responsible for attaching a Backflow Prevention Assembly Tag to the device and indicating the results of the test on the tag.

1.3.8 Open Trench Pressure Test

- The Project Manager shall be given one (1) working day notice when an open trench/pressure test inspection is required.
- The following procedures shall be followed when pressure testing an irrigation system:
 - All irrigation systems to be tested from downstream of the backflow preventer.
 - The City of Swift Current is to inspect the installation of the backflow preventer before testing takes place or before the water meter is installed and provide the Contractor with written approval of the installation.
 - The testing of the backflow preventer shall be the responsibility of the Contractor.
 - Before pressure test is to take place, the Contractor shall contact the Public Services Department to confirm that the service valve is in the off position.
 - The Contractor shall NOT operate the service valve. The Contractor shall contact the Infrastructure and Operations Department to operate the service valve.
- Items which must be in place and complete for the open trench/pressure test inspection include:
 - trench depth and alignment
 - bedding material
 - pipe alignment joints and expansion couplers, valves
 - valves and gravel bed
 - fittings/connections and head locations
 - thrust blocking and conduit where specified
 - pressure test without heads
 - confirm pressure on furthest head of the furthest zone
 - electrical wiring
- At the discretion of the Project Manager a pressure gauge shall be placed on any point in the system and a reading shall be taken to confirm expected pressure loss in the system. The pressure gauge shall be provided by the City. The Contractor shall supply all of the connections and requirements to conduct the test.
- Receive, in writing, from the Project Manager, approval of the irrigation system before proceeding with backfill operation.

1.3.9 Irrigation Wiring Inspection

- The Project Manager shall be given one (1) working day notice when an irrigation wiring inspection is required.
- Items which must be in place and complete for the irrigation wiring inspection include:
 - irrigation wire laid in the trench
 - any wire splices must be visible for inspection
 - wire connections at the controller

1.3.10 Irrigation System Inspection (after installation is complete)

- Items which must be in place and complete for the irrigation system include:
 - backfilling
 - irrigation head adjustment
 - valve boxes in place and clear of debris
 - water pressure on and flowing freely through the system
 - all heads activated and operating as per manufacturer's recommendations and the irrigation design.
 - cabinet and controller
- At the Project Manager's discretion, a pressure gauge shall be placed on any point in the system and a reading shall be taken to confirm expected pressure loss in system. The pressure gauge will be supplied by the City. The Contractor shall supply all of the connections and requirements to conduct the test.
- Receive, in writing, from the Project Manager, approval of the irrigation system before proceeding with landscape development.

1.3.11 Total Completion Inspection (prior to acceptance of the project)

- Items which must be in place and complete for the Total Completion Inspection include:
 - Activation of each individual zone
 - Adjustment of any irrigation heads that are improperly adjusted

2 PRODUCTS

2.1 GENERAL

- 2.1.1 Materials shall be new and without flaws or defects of any type.
- 2.1.2 For substitutions, supply material with descriptive literature and samples, at least ten (10) working days before commencement of work. Any substitutions must meet or exceed specifications and performance standards of the proposed system, without any additional cost to the City.
- 2.1.3 All major components used in the system must have all of the manufacturer's identification, i.e. make, model, and serial number clearly shown on the equipment.

Electrical or mechanical equipment used in the system which is subject to Federal, Provincial, or Municipal standards must be installed to comply with the standard and where required, clearly be identified as approved by the **Canadian Standards Association**.

2.2 PIPING AND FITTINGS

- 2.2.1 The piping and fittings at the point of connection at the water service riser to the exit points of the vault shall be galvanized. Exit points include only the piping on the downstream side of the water service components (i.e.) isolation valve or electric zone valve. Fittings shall all be galvanized. The Contractor shall use the manufacturer's recommended fittings to convert from the water service riser to the mainline piping.
- 2.2.2 Irrigation mainline piping shall be C.S.A. high density polyethylene.
- 2.2.3 All Lateral pipes larger than 75 mm (3 inches) shall be C.S.A. high density polyethylene. Lateral pipes smaller than 75 mm (3 inches) shall be C.S.A. low density polyethylene.
- 2.2.4 Irrigation mainline piping for pipes larger than 75 mm (3 inches) shall be C.S.A. high density polyethylene.
- 2.2.5 All lateral lines on the downstream side of the electric zone valves shall be no larger than 50 mm (2 inches) whenever possible.
- 2.2.6 All lateral lines on the downstream side of the electric zone valves shall be C.S.A. low density polyethylene pipe series 75.
- 2.2.7 The use of any size or type of pipe that is different from that specified must be approved by the Project Manager.
- 2.2.8 Any piping and fittings used inside the vault shall be galvanized.

2.3 CONTROLLERS, CABINETS AND CONCRETE BASES

- 2.3.1 All automatic controllers used shall be C.S.A. Certified as a Class II power limiting circuit capable of handling the zones as noted on the drawings.
- 2.3.2 Interior controller mount shall consist of a 19 mm (3/4 inch) thick piece of G1S fir plywood.
- 2.3.3 For exterior installation, the controller shall be mounted in a weatherproof, lockable, 16 gauge stainless steel enclosure.
- 2.3.4 The standard controller cabinet shall be fitted with a single door mounted on stainless steel piano hinges with a mechanism mounted with rivets on both doors capable of securing each door individually in the closed position. The door shall have a 75 mm (3 inch) lip on the bottom and are to be fitted to ensure that the interior of the cabinet is weatherproof. The door is to be fitted with hardware to facilitate locking the cabinet with a key. Closure brackets, hinge attachments and plywood mounts are to be welded from the inside wherever possible to eliminate openings and protrusions. The exterior of the cabinet should be smooth and rounded with no protrusions or sharp edges evident. Any point of entry into the cabinet wall shall be sealed with a waterproof sealer.

- 2.3.5 The size of the irrigation cabinet for a standard controller shall be 450 mm (18 inches) wide, 60 mm (24 inches) tall and 300 mm (12 inches) in depth. Adjustments in size shall be made depending on the number of controllers housed in the cabinet.
- 2.3.6 The Contractor shall provide the following conduits to the standard controller cabinets:
- 1 – 50 mm (2 inch) conduit for wire (Additional conduit may be required depending on number of wires)
 - 1 – 38 mm (1 1/2 inch) conduit for power supply
 - 1 – 25 mm (1 inch) conduit for grounding rod
- 2.3.7 The Contractor is responsible for contacting the Project Manager, prior to the start of the work to confirm the size of the controller box that is required.
- 2.3.8 Concrete mix shall be in accordance with the following:
- Minimum twenty-eight (28) Day Strength..... 25 MPa*
Designated Aggregate Size..... maximum 25 mm (1 inch)
Slump 25-75 mm (1-3 inches)
Air Entrainment..... 5 - 7 %
Cement..... Type 10 Normal Portland Cement
Calcium ChlorideASTM D98, 2% maximum, with
..... Engineer's approval

2.4 SPRINKLER HEADS

- 2.4.1 Sprinkler head type shall be Hunter, or an equivalent approved by the Parks Manager.
- 2.4.2 All full circle (360 degrees) sprinkler heads and all part circle (less than 360 degrees) shall be as indicated on the drawings.
- 2.4.3 Any alternatives must receive prior written approval of the Project Manager and the request for alternatives must be accompanied by documentation indicating matched precipitation rates and coverage and an operating pressure range in the middle of the manufacturer's indicated range. Spacing of the sprinkler heads shall not exceed the manufacturer's minimum specifications and must provide head to head coverage.
- 2.4.4 The specified irrigation heads shall be covered under the manufacturer's warranty against defects in material and workmanship for a period of five (5) years from the date of installation.

2.5 WIRE REQUIREMENTS

- 2.5.1 Wiring to and from controllers and valves shall conform to the Canadian Electrical Code and any other regulatory conditions which govern this type of installation.
- 2.5.2 Control wire used shall be minimum 14 Gauge TWU, Copper, Solid Core.
- 2.5.3 Wire shall be furnished in minimum 762 m (2,500-ft) reels and splicing shall be minimized, with such splices made waterproof with the use of the following:
- **3M DBY** Direct Burial Waterproof splice kit. No alternate is acceptable.

- **3M DBR-6** Direct Burial Waterproof slice kit where three (3) or more wires need to be spliced. No alternative is acceptable.

2.6 DOUBLE CHECK VALVE ASSEMBLY AND WATER METER

- 2.6.1 Double check assemblies must be installed. The double check valve used shall be CSA approved and clearly labelled. The installation must meet all Federal, Provincial and Municipal requirements.
- 2.6.2 All double check valves shall be Watts Series 007-QT.
- 2.6.3 All test cocks are to be removed, once the double check valve assembly has been tested and approved. Each test cock is to be replaced by a brass plug. Test cocks shall then be placed in a plastic bag with the location noted, and shall be passed on to the Project Manager, in a clean condition.

2.7 BALL AND GATE VALVES

- 2.7.1 All ball valves for drainage and flow control shall be Bronze body with replaceable seals, and have a removable handle with a minimum pressure rating of 10-kg/cm² (150 psi). All ball valves shall be full ported.
- 2.7.2 All ball valves shall have standard pipe threaded ends or adapters provided for proper installation in the lines in which they are located. All valves to be of same size as the lines in which they are used.
- 2.7.3 Valves up to 75 mm (3 inches) in diameter shall be 10 kg/cm² (150 psi) Bronze ball valves.
- 2.7.4 Valves 100 mm (4 inches mm) in diameter and larger shall be iron body Bronze or brass mounted gate valves conforming to standard specifications and meeting local standards.

2.8 FITTINGS AND UNIONS

- 2.8.1 All fittings shall be connected to the pipe utilizing the appropriate clamping or gluing method and materials.
- 2.8.2 All fittings for polyethylene pipe shall be either brass saddles, polyethylene insert fittings, or galvanized insert fittings. All fittings for PVC pipe shall be PVC fittings.
- 2.8.3 Swing joints or flexible pigtail connections shall be used to attach the sprinkler heads to the lines.
- 2.8.4 Swing joints shall consist of three 90 degree elbows. They shall have a minimum diameter of 19 mm (3/4 inch) for sprinkler heads with a flow rate of up to 6 gpm, one inch for sprinkler heads with a flow of up to 12 gpm, or as indicated on the drawings for sprinkler heads with flow rates exceeding 12 gpm.
- 2.8.5 All fittings on swing joints shall be P.V.C. Schedule 40 threaded elbows or street elbows.

2.9 ELECTRIC ZONE VALVES

- 2.9.1 Electric zone control shall be C.S.A. Certified as Class II power limiting circuit low voltage (i.e. 24-volt) operated only. Closing time for zone valves shall be not less than 5 seconds.

2.9.2 Zone control valves shall be electrically operated and self-cleaning.

2.9.3 Valves sizes shall be the same size as the line size.

2.10 IRRIGATION ENCLOSURE BOXES

2.10.1 Where manufactured irrigation enclosure boxes are used, they shall be of heavy weight polyolefin and shall be capable of withstanding the weight of a heavy tractor on their surface, and shall have a locking capability.

2.10.2 Zone valves shall be housed in a "Jumbo" sized (500 mm x 350 mm) irrigation enclosure box. The size of the irrigation box shall be such that there is of a minimum of 150 mm (six (6) inches) of vertical and horizontal clearance between the box and any point of the valve.

2.10.3 Gravel bed in boxes or vault shall consist of 300 mm (12 inches) of clean, washed 19 mm (3/4 inch) gravel with area marginally larger than box opening.

2.11 CLAMPING SYSTEMS

2.11.1 All C.S.A. series 75 low density polyethylene pipe 32 mm (1 1/4 inch) or greater is to be double clamped with stainless steel gear clamps.

2.11.2 All C.S.A. series 75 low density polyethylene pipe less than 32 mm (1 1/4 inch) is to be single clamped with stainless steel gear clamps.

2.12 MISCELLANEOUS SYSTEMS COMPONENTS

2.12.1 All miscellaneous systems components such as air relief valves, concrete vaults, meter boxes, shall be of the type and size as indicated on the drawings or details.

2.12.2 Install according to approved manufacturer's directions or at the direction of the Project Manager.

2.13 THRUST BLOCKS

2.13.1 Local conditions shall determine the type and extent of thrust blocking to be used. Approval from the Project Manager on the best method (whether concrete, rock, rebar or a combination of the former) shall be required before proceeding.

2.14 BOOSTER PUMP

2.14.1 Where a water service requires a booster pump, the pump and all the other irrigation water service components shall be installed above grade in a 14 gauge stainless steel or anodized aluminium box.

2.14.2 The booster pump shall be the brand name and model as specified on the drawings.

2.14.3 The enclosure box shall be constructed of 14 gauge stainless steel or anodized aluminium. It shall have vents on 2 sides of the box, with openings not exceeding 100 cm² (16 inches²). The vents shall have stainless steel mesh, attached from the inside and the vents shall have covers installed inside the cabinet which can be manually closed.

- 2.14.4 The door(s) of the enclosure box shall be constructed of the same material. The door(s) are to be mounted/welded with heavy duty pipe hinges. The door(s) shall be lockable and have handles for ease of opening. The door(s) should be weatherproof.
- 2.14.5 The enclosure box and door(s) shall be painted a medium to dark green colour with a rust inhibitive, weather resistant paint.
- 2.14.6 The size of the concrete base for the booster pump will be constructed such that there will be a 100 mm (4 inches) overhang on all sides of the cabinet. The bases shall be installed 50 mm (2 inches) above grade.
- 2.14.7 The concrete base shall be constructed with four (4) 200 mm (8 inch) cardboard tubes (Sono tubes or equivalent) filled with concrete, 600mm (24 inches) in depth.
- 2.14.8 The concrete base shall be formed and shall be a minimum of 150 mm (6 inches) in depth, with wire mesh or rebar in the concrete.
- 2.14.9 The Contractor shall use L - shaped rebar to tie the base and sono tube together.

Concrete mix shall be in accordance with the following:

Minimum twenty-eight (28) Day Strength..... 25 MPa*
 Designated Aggregate Size..... maximum 25 mm (1 inch)
 Slump 25-75 mm (1-3 inches)
 Air Entrainment.....5 - 7 %
 Cement..... Type 10 Normal Portland Cement
 Calcium ChlorideASTM D98, 2% maximum, with
 Engineer's approval

2.15 IRRIGATION VAULT

- 2.15.1 The wooden vault shall be constructed of pressure treated 100 mm x 100 mm (4 inches x 4 inches) lumber, and constructed in continuous lengths with no piecing of any sides of the vault.
- 2.15.2 The vault shall be a minimum of 500 mm in height. The corners should be alternately overlapped for stability. The end cuts of the lumber shall be coated with a wood preservative material. Each layer of 100 mm x 100 mm (4 inches x 4 inches) should be nailed together at regular intervals with 150mm (6 inch) galvanized ardox nails.
- 2.15.3 The lid(s) shall be constructed of 3.18 mm (1/8 inch) checker plate split at 1.22 m (4 feet) intervals and have a bent offset/overlap where a split occurs. A 50 mm x 50 mm (2 inch x 2 inch) angle iron metal support shall be welded into the vault under the split in the lid(s) for support. The lid(s) are to be mounted/welded with heavy duty pipe hinges onto a 75mm x 75mm x 6.35 mm (3 inch x 3 inch x ¼ inch) angled frame dropped over the outside of the frame of the vault and is then lag bolted to the vault at regular intervals. The lids shall be lockable and have recessed handles for ease of opening. The lids and metal frame shall be painted a medium to dark green colour with a rust inhibitive weather resistant paint. The lids shall not be larger than 1.22 m by 1.22 m (4 feet x 4 feet) in size.

- 2.15.4 All piping and conduit openings shall be cut around the pipe or conduit with 50 mm (2 inch) of clearance between the pipe or conduit and the vault. The pipe or conduit shall be centred in the opening. Any patching of the openings shall be done with ¾ inch pressure treated plywood which is to be screwed with wood screws, not nails to the interior of the vault.

2.16 CONDUIT

- 2.16.1 In ground conduit 160 Series PVC shall be a minimum of double the size of the pipe being sleeved.
- 2.16.2 Roadway conduit PVC Series 900 shall be a minimum of double the size of the pipe being sleeved. There shall be two conduits placed for all road crossings, one for the pipe and one for the wire.
- 2.16.3 All irrigation piping or wire running under an asphalt trail, shale trail or concrete sidewalk shall be sleeved with Series 160 PVC.

2.17 BACKFILL MATERIAL

- 2.17.1 Backfill material for irrigation pipe trenches within 150 mm (6 inches) of pipe shall be clean sand or fill, free of organic matter, stones, and sharp objects capable of damaging pipe.

2.18 JOB CONDITIONS

- 2.18.1 Proceed with irrigation installation only during suitable weather conditions.
- 2.18.2 Report to the Project Manager, prior to commencing work, of any conditions or defects encountered on the site upon which work of the section may depend and which may adversely affect the performance of the work.
- 2.18.3 Do not commence work until such conditions or defects have been investigated and corrected.
- 2.18.4 Protect the system from being contaminated during construction by enclosing all open ends on all lines.

2.19 LAYOUT

- 2.19.1 Stake out entire system, including locations of sprinkler heads and/or quick coupler valves. Confirm that lay out is within project boundary and property lines. Heads shall be spaced according to what is specified on the drawing to ensure adequate coverage. Heads shall not be installed any more than 150 mm (6 inches) off the property line.
- 2.19.2 Verify, on-site, the location of all conduit under asphalt, shale and concrete and adjust to suit.
- 2.19.3 Verify the location of all underground utilities and use standard precautions when working near such. Make good all damages to same at Contractor's expense.
- 2.19.4 Have lay out inspected and approved by the Project Manager before commencement of work.

- 2.19.5 Due to changes in landscape elements, it may be necessary to adjust the spacing of the sprinklers in the field. These changes shall be approved by the Project Manager. Such changes that do not require extra materials or labour shall be done at no extra cost to the City. If such changes result in extra cost, all such changes shall be approved, in writing, by the Project Manager before proceeding with work.
- 2.19.6 Water Service Schematic:
- Water Service Schematic (with a booster pump): The irrigation components shall be installed according to the following schematic: water service, main shut off valve (ball valve), galvanized union, hydrometer/ water meter/galvanized metal spool, galvanized union ; double check assembly; galvanized union; booster pump; galvanized union; isolation valve no. 1, quick coupler turf valve and an isolation valve no. 2.
 - Water Service Schematic (without a booster pump): The irrigation components shall be installed according to the following schematic : water service, main shut off valve (ball valve), galvanized union, hydrometer/ water meter/galvanized metal spool; galvanized union; double check assembly, galvanized union, quick coupler turf valve and isolation valve.

3 EXECUTION

3.1 TRENCHING

- 3.1.1 Excavate trenches to 450 mm (18 inches) depth to ensure adequate coverage, regardless of pipe size. Width of trench shall be a minimum of three times the diameter of the pipe.
- 3.1.2 All trenching shall have a level base to ensure proper drainage of the whole irrigation system and minimize trapped water. In the event of over excavation the trench shall be backfilled to the proper elevation and compacted to 85% - 90% Standard Proctor Density prior to installing pipe.
- 3.1.3 All main and lateral lines shall have a depth of 450 mm (18 inches).
- 3.1.4 In the following spring, the Contractor shall repair any settlement of the trenches by bringing them to grade with topsoil and sodding.
- 3.1.5 Place conduit as required to enclose piping under asphalt, shale or concrete. Depths of conduit shall be a minimum of 450 mm (18 inches) under amenity areas, 0.84 metres (36 inches) under roadways.
- 3.1.6 Extend conduit a minimum of 91 m (3 feet) beyond edge of pavement or amenity area. Enclose ends to prevent debris intrusion.

3.2 INSTALLATION

- 3.2.1 Controllers, Cabinets, and Concrete Bases
- Controllers mounted indoors shall be securely mounted inside a lockable, metal enclosure, securely mounted to the wall and easily accessible for maintenance with a minimum of 150 mm (6 inches) of horizontal and vertical clearance

between the walls of the irrigation cabinet and the controller. The size of the plywood will be such that there is 250 mm (10 inches) of clearance around the perimeter of the controller.

- Controllers mounted outdoors shall be installed in a cabinet and securely mounted on a concrete base. The cabinet shall be bolted/anchored on all four corners. The controller shall be easily accessible for maintenance with a minimum of 150 mm (6 inches) of horizontal and vertical clearance between the walls of the irrigation cabinet and the controller. A 3.05 metres (10 foot) copper clad grounding rod with wire connecting to the controller shall be installed. The grounding rod shall protrude a minimum of 100 mm (4 inches) above the top of the concrete base inside the cabinet or outside the cabinet in an irrigation enclosure box, at a location designated by the Project Manager.
- No doubling up of zones on the controller shall be allowed.
- Each controller shall be installed at a location approved by the Project Manager.
- The size of the concrete bases for the controller cabinets will be constructed such that there will be a 100 mm (4 inch) overhang on all sides of the cabinet. The bases shall be installed 50 mm (2 inches) above grade.
- The concrete base for a standard cabinet shall be constructed with 2 (two) 150 mm (6 inch) sono tube filled with concrete, .69m (2 feet) in depth.
- The concrete base shall be formed and shall be a minimum of 150 mm (6 inches) in depth, with wire mesh or rebar in the concrete. The Contractor shall use L - shaped rebar to tie the base and sono tube together.
- Conduit shall stick out 38 mm (1 1/2 inches) above the concrete base and shall be smooth and rounded. Cut cabinet around individual conduits.

3.2.2 110 Volt Electric Wiring

- All 110 volt wiring shall be installed in accordance with local electrical codes.
- 110 volt wiring shall be colour coded to differentiate from 24 volt wire.
- The power supply shall be connected through a ground fault receptacle.

3.2.3 Wire Requirements

- The control wire from the controllers to the zone valves and hydrometer valves shall be placed in the trench alongside or underneath the water line.
- The control wire must be capable of acting as a tracer wire for the main lines from the source of water supply to each of the zone valves.
- A minimum of 900 mm (36 inches) of slack wire must be left at each control valve, the end of every length of wire and at every change in direction and at each junction to allow for ease of maintenance. Lay wire with sufficient slack to accommodate backfill operation.

- White is to be used only as the common wire. The signal wire shall be coloured wire, following the colour coded sequence in these specifications. The use of black wire shall be minimized whenever possible.
- All splices shall be housed in a minimum 350 mm x 475mm (14 inches x 19 inches) irrigation enclosure box or incorporated into the zone valve box.
- The wire in the cabinet shall be neatly bundled with plastic tie wraps at 100 mm (4 inch) intervals, shall be secured with screws that do not penetrate the exterior of the cabinet, shall be secured at every third tie wrap to the cabinet and shall follow the perimeter of the boards and cabinet, allowing a minimum of 300 mm (12 inches) of slack. Zone wires shall be sorted and identified separately from the hydrometer wires.
- One additional wire shall be installed from the controller to the farthest zone. This wire shall be red and shall be identified according to the standards in these specifications. Where the zones split in more than one direction from a controller, an additional wire shall be run in both directions. The wire shall be placed in the zone valve box, with a minimum slack of 1 meter (36 inches) and left bare.
- Wiring within the controller cabinet shall be neatly bundled, securely mounted to cabinet and colour coded according to the following standard:
 - Starting from the furthest station the colour sequence shall be black, red, blue for #12 gauge feeds and black, red, blue, orange, yellow, brown for #14 gauge feeds.
 - Spare zone wire: 1 Red wire
 - The Contractor shall be responsible for confirming correct gauge of wire, prior to the start of work.
 - If and where necessary, the same colour coding sequence shall be repeated. All of the wires shall be marked with numbered tabs to differentiate the zones. The markings will be made with a permanent waterproof marker. No duplicate colours which do not follow the standard, will be allowed.
 - Other equivalent colour coding standards may be approved, subject to prior written approval of the Project Manager.
 - The Contractor shall be responsible for removing and replacing (at no cost to the City), any wire that does not conform to the wire colour coding standards, or where he has not received prior written approval.
 - The two pairs of wires for the hydrometer and 1 spare wire for the hydrometer shall be colour differentiated from the zone wires. The colour coding sequence is as follows:

For the Pulse:

2 Blue wires

For the Valve Control:	1 Yellow wire and 1 White (Common) wire
For the Hydrometer Spare	1 black wire

- A terminal strip shall be supplied and installed for the field wire to terminate in the cabinet, interconnect wiring from terminal strip to the Controller.

3.2.4 Double Check Valve Assembly and Water Meter

- The Contractor is responsible for obtaining the appropriate permits. The double check assembly and the installation shall be approved, in writing, by the Project Manager. All back flow prevention assemblies must be installed in accordance with the Federal, Provincial, and Municipal requirements.
- Double check assemblies and water meters shall be installed with the rest of the water service components in an irrigation vault.
- The double check assembly shall be supported by concrete blocks.

3.2.5 Ball and Gate Valves

- All ball valves shall be installed with the handle parallel to the length of the cover of the enclosure for ease of accessibility, with no obstructions and enough room to operate the valve.
- A ball or butterfly valve shall be installed on the pressurized side of each electric zone valve.
- Ball valves shall be the same size as the electric zone valve in that line.

3.2.6 Fittings & Unions

- A galvanized union shall be installed between the zone isolation valve (ball valve) and the electric zone valve.

3.2.7 Irrigation Heads and Piping

- Make all joints and connections tight in accordance with manufacturer's recommendations. Use expansion couplers where required. Protect system from being contaminated during construction by enclosing all open ends on all lines.
- Install risers with saddle tees as detailed, firmly connected and plumbed.
- All sprinklers are to be adjusted and set flush with final grade using the three street elbow swing joint as detailed. Ensure that horizontal pipe is no more than 45 degrees out of level when setting sprinklers. Where utility easements or property lines preclude the standard assembly, a "pig tail" swing joint shall be used as detailed or specified on the approved irrigation plan.
- Ensure that heads are set at the proper height to ensure adequate coverage.

- Leave a minimum of 1.5 metres (5 feet) from a T-intersection or cross intersection before changing pipe sizes.
- Sprinkler heads shall be set plumb and level with the turf.
- After turf is established and the ground has settled, the Contractor shall, within ten (10) working days of notification, adjust the heads to finished grade.

3.2.8 Irrigation Enclosure Boxes

- The manual ball valves shall be installed with the handle parallel with the length of the cover.
- Top level of gravel in the boxes or vaults shall be kept a minimum of 150 mm (6 inches) below lowest point of irrigation system. Where necessary, the components shall be supported by bricks to prevent any stress on the system.
- All valve enclosure boxes shall be stacked on top of another box for support. Large enough holes must be cut in the boxes to ensure that the boxes do not settle on or rest on the irrigation piping.
- Wherever possible, 2 or more electric zone valves at the same location shall be enclosed in a common enclosure or vault in order to reduce the total number of enclosures at any one Park location.

3.2.9 Thrust Blocks

- Thrust block all changes of direction and pipe endings of all pipe 75mm (3 inch) and larger. If concrete thrust blocks are used protect pipe from concrete spill over.

3.2.10 Tracer Wiring

- Tracer wire (orange wire colour) shall be installed in the trench from each zone valve to the end of each run of pipe.
- The tracer wire shall be marked and identified according to the standard in these specifications.
- The tracer wire is to be left bare rather than being terminated on all bare ends with the specified splice kits. The end in the zone valve box shall be left unattached in the valve box and have a minimum of 900 mm (36 inches) of slack.

3.2.11 Booster Pump

- The piping shall be looped in the enclosure and alignment of the irrigation components shall be installed such that size of the enclosure box is minimized while ensuring a minimum of 0.45 m (1.5 feet) clearance around the perimeter of the components, inside the enclosure box.
- The booster pump shall be bolted to a concrete pad, with the concrete pad overhanging enclosure box by a minimum of 100 mm (4 inches) on all sides. The

concrete pad shall be constructed to the same specifications as a controller box concrete pad.

- The enclosure box shall be bolted to the concrete base such that the entire enclosure box can be removed. The enclosure box should also be locked onto the frame to prevent the accidental movement of the enclosure box.
- All Electrical breakers for the booster pump shall be located in the controller cabinet.

3.2.12 Irrigation Vault

- All irrigation components including the hydrometer or water meter, the double check valve and the blow out quick coupler shall be installed below grade in an irrigation vault.
- The size of the vault shall be as site hardware configuration dictates to ensure that there is 0.3 m (1.0 foot) clearance around all components. Prior to the construction of the vault, the Contractor shall contact the Project Manager to confirm the service configuration and the size of the vault.
- There shall be a minimum of 0.3 metre (1.0 foot) clearance around the vault perimeter between the downstream side of the required components, and the inside of the vault.
- The bottom of the vault shall have 300 mm (12 inches) of 19 mm (3/4 inch) washed gravel with the top of the gravel a minimum of 150 mm (6 inches) below the lowest point of the water service. All water service components shall be supported by bricks.
- The vault shall be level with the finished grade.
- The lids shall not open onto roadways or other obstructions. There shall be a minimum of 2 metres (6.6 feet) clearance between the open lid and any obstructions.

3.2.13 Conduit

- Run all necessary wiring through conduit as required. Conduit must be double the size of the group of wires. Any group of wires that is larger than 50 mm (2 inches) shall be run through two, 50 mm (2 inch) conduit. If located outdoors, ensure that storage chamber is waterproof and lockable.

3.3 BACKFILLING

- 3.3.1 After Open Trench inspection and written approval by the Project Manager, backfill with approved fill. Excavated material may be used for backfilling only when approved by the Project Manager.
- 3.3.2 Place backfill in 150 mm (6 inch) lifts, placing and compacting all lifts until 150 mm (6 inches) below finished grade. Place topsoil, seed or sod as required.

- 3.3.3 Adjust sprinkler heads to the correct spray angle and height to provide adequate coverage without excessive over-spray.
- 3.3.4 The Contractor shall level off any trenches that have slumped, fill with topsoil and reseed the area.
- 3.3.5 All sprinkler heads, valve enclosures and other system component enclosures shall be adjusted to the proper relative elevation relative to the final turf grade by the Contractor.
- 3.3.6 Remove off site all debris and excess material left over from installation at the end of each working day or as required.

3.4 ELECTRICAL SERVICING

- 3.4.1 Contractor to contact the City of Swift Current's Department of Light and Power to confirm service point location and available voltage details.
- 3.4.2 Contractor to apply for a Commercial Service.
- 3.4.3 A service point will normally consist of either a conduit stub, service box, pad mounted transformer or power pole.
- 3.4.4 Contractor to obtain electrical permit and cost of electric permit to be paid for by the Contractor.
- 3.4.5 The Community Services Department shall be responsible for any charges by the Department of Light and Power for the final connection at the service box.
- 3.4.6 The Contractor is responsible for:
 - all trenching, backfilling and compaction to 85-90% Standard Proctor Density. Minimum depth of service cable trench to be 1.0 meters (3.28 feet) below final grade.
 - supply, installation and connecting of main service equipment.
 - supply and installation of electrical service cable from main disconnect in panel to The Department of Light and Power's service point.
 - supply and installation of 2 – 3.05m (10 feet) galvanized or copper clad ground rods or a suitable ground plate at main panel location. This applies to both unmetered and metered services.
 - connection of main service cables at service panel
- 3.4.7 Service conduit, when required to be 50mm (2 inches) rigid PVC, DB-2 or FRE buried at a depth of 1.0 meter (3.28 feet) below final grade.
- 3.4.8 For 30 amp services and less (metered and unmetered), the service conductors are to be 3 - No. 10 copper x-link colour coded or colour taped as follows:
 - black - line for 120 or 240 volt service
 - red - line for 240 volt service
 - white - for neutral 120 volt service

green - ground for both 120 and 240 volt service

If service size is 31 - 60 amps use No. 6 copper x-link conductors.
If service size is 61 - 100 amps use No. 3 copper x-link conductors.
NMW-10 bundled cable can be used instead of single conductors.

- 3.4.9 Contractor to allow 1.0 meter (3.28 feet) length per service conductor for connection at cable stub, submersible service box or pad mount transformer for use by the Department of Light and Power to connect service.
- 3.4.10 Contractor to provide cable, conduit and straps for pole risers. Cable and conduit lengths will be determined in field after contact with the Department of Light and Power.
- 3.4.11 At conduit stub locations:
- Stub location will be indicated with a .61m x 1.22 m (2 foot x 4 foot) above ground and or an electronic cable marker supplied and installed below ground by the Department of Light and Power. Contractor will contact the Department of Light and Power to locate below ground cable marker if 61m x 1.22 m (2 foot x 4 foot) is not visible.
 - Contractor must supply and install adapter (if required) for connecting service conduit to Department of Light and Power's conduit stub.
 - Contractor will dig down and connect his 50mm (2 inch) conduit to the Department of Light and Power's conduit stub.
 - Contractor will pull service cables from main disconnect in controller to service point from which conduit stub originates. Contractor to notify Department of Light and Power forty-eight (48) hours before cable is pulled to arrange for opening of underground service box or pad mount transformer into which service cables will be installed.
 - Contractor will provide additional pulling points, if required, to install the service cables from the main disconnect to the Department of Light and Power's service box or pad mount transformer.
 - The Department of Light and Power will connect service cables at service box or pad mount transformer.
- 3.4.12 At underground service box, pad mount transformer and power pole locations:
- Contractor will contact the Department of Light and Power forty-eight (48) hours prior to installing service cables and conduit at the above locations
 - Contractor will not dig into a service box or pad mount transformer unless under the supervision of the Department of Light and Power.
- 3.4.13 For an unmetered service, the Contractor is responsible for all work which will include but not be limited to:

- supply and install 1-15 amp single pole breaker (main disconnect) to operate at 120 volts single phase.
- supply and install service cables and conduit as required from main disconnect to the Department of Light and Power's service point.
- supply and install grounding.

3.4.14 For a metered service, the Contractor is responsible for all work which will include but not be limited to the following:

- supply and install 60 amp 2-pole main service disconnect to operate at 120/240 volts or 120/208 volts single phase 3-wire.
- supply and install 4-jaw (for 120/240 volt service) or 5-jaw (for 120/208 volt service) Jumbo meter base. Meter base to be located on load side of main disconnect unless special permission given by the Department of Light and Power to install on line side of main disconnect.
- supply and install subpanel as required.
- supply and install booster pump starter.
- supply and install grounding.

4 MEASUREMENT AND PAYMENT

4.1 MEASUREMENT

4.1.1 Measurement for irrigation system installation will be based on as-built drawings, or actual field measurements.

4.2 PAYMENT

4.2.1 Payment for irrigation systems will be made at the unit price specified in the contract and the correlating measurement.

END OF SECTION