

1.0 GENERAL - SCOPE

- .1 This section refers to those portions of the work that are unique to the complete installation of a fully automatic underground irrigation system including all necessary preparatory work and all electrical, wiring and plumbing connections, and maintenance work during the guarantee period. This section must be referenced to and interpreted simultaneously with all other sections pertinent to the works described herein.
- .2 Any items not specifically noted, but reasonably necessary for the installation of a complete and functioning irrigation system shall be furnished as part of the work.
- .3 The completed system shall efficiently and uniformly irrigate all areas and perform as required by these specifications.
- .4 All locations of heads, pipe and valves must be: coordinated with the landscaping, building and physical features; confirmed with The Village of Slocan Public Works Department prior to installation.
- .5 The Contract Administrator must authorize any and all changes to these specifications in writing.

1.1 Codes and Permits

- .1 All work shall be done in strict accordance with applicable plumbing, health and electrical codes and other codes as applicable. Requirements of these specifications not conflicting therewith, but exceeding code requirements shall govern.
- .2 Contractor shall be responsible for obtaining all necessary permits and approvals required to undertake and complete the work and shall include costs for such permits and approvals in the tendered prices.

1.2 Definitions

- .1 In this Section, and unless otherwise stated or qualified, the word "Drawings" includes Contract Drawings of the irrigation system and/or approved Shop Drawings of the irrigation system.
- .2 In addition to and for the purposes of this Section, the word "site" shall mean contiguous public land adjacent to the place of work that is or will be landscaped, whether it is part of this Contract or it is other work.

**1.3 Irrigation System
Design Standards**

- .1 The irrigation system shall be designed to provide complete irrigation coverage and be compatible with the work of this Contract and with other work on the site.

- .2 Site specific requirements for the design of the irrigation system shall be obtained from The Village of Slocan Public Works Department.
- .3 The irrigation system shall be designed to operate properly and within the requirements of this section based on a 20% reduction in the point of connection water main static pressure.
- .4 The irrigation system shall be sized and designed to operate properly and within the requirements of this section based on a 20% increase in the landscape areas to be irrigated.
- .5 The irrigation system shall be sized and designed to apply a minimum of 7mm of water per day over 100% of the landscaped areas of the site within a nightly watering window period of up to 10 hours duration.
- .6 Unless otherwise required by The Village of Slocan Public Works Department or the water utility having jurisdiction over the site, the irrigation system shall be provided with a metered water service, including a plumbing permit, backflow prevention device, backflow prevention test results and establishment of water accounts with the utility provider.
- .7 Unless otherwise required by The Village of Slocan Public Works Department or the electrical utility having jurisdiction over the site, the irrigation system shall be provided with a 120V power supply, breaker box, duplex receptacle, including an electrical permit and establishment of account with the utility provider.
- .8 The location of the water service, controller cabinet and irrigation vault shall be coordinated with The Village of Slocan Public Works Department and shown on the drawings. Locate the controller in a location that allows for maximum viewing of the irrigation system in operation.
- .9 Do not locate cabinets, vaults or boxes in hard surface areas or features, except as approved by the Contract Administrator. Where possible locate cabinets, vaults or boxes in planting beds or, if none are suitably located, in turf or grass areas. The entire cabinet, vault or box shall be located within said area.

- .10 A backflow prevention device is required for all water service connections. An approved double check valve assembly (DCVA) shall be used as the backflow prevention device, except where a reduced pressure principle backflow assembly (RPBA) is required.
- .11 Calculate the allowable voltage drop on common and zone signal wires. Maximum voltage loss shall be five (5) per cent. Indicate wire locations, sizes on the Shop Drawing.
- .12 Irrigation sleeves shall be used for running irrigation lines under hard surfaces and features. The end of sleeves shall be marked with stakes and with a piece of detectable metal below grade at each end of the sleeve. Extend 1m beyond the limit of hard surfaces.
- .13 Pipes shall be sized to allow for a maximum flow velocity of 5ft/sec (1.5m/sec).
- .14 The valves of the irrigation system shall be of the same brand throughout the project scope.
- .15 The sprinklers of the irrigation system shall be of the same brand throughout the project scope.
- .16 Sprinklers shall be grouped into like zones that provide coverage for the same landscape type (e.g., lawn, planting bed, restoration area) and shall have the same precipitation rates, matched through their arcs of coverage.
- .17 Sprinklers shall provide head-to-head coverage of landscaped areas within the zone, with no overspray outside of the landscape area.
- .18 Irrigation design must ensure that completed irrigation works conform to the BC Plumbing Code and the BC Electrical Code.

1.4 Quality Assurance

- .1 All irrigation work shall be done by an experienced and competent Irrigation Contractor having the capabilities and personnel necessary for all phases of the work specified.
- .2 The irrigation designer and the irrigation installer shall be a member in good standing of the Irrigation Industry Association of British Columbia (IIABC). The Contractor must provide proof of membership and have a min. of five (5) yrs. experience in the industry. Provide a list of client's projects of similar size and scope. Proof of Low Voltage Electrical Ticket, CIT 2 cert. Certified Contractor certification and be familiar with the installation of large-scale Irrigation Systems.

- .3 Obtain field assistance from pipe manufacturer or supplier as necessary to ensure correct installation and adhesive techniques are used on joints.
- .4 Do not cement pipe and fittings under wet or muddy conditions and follow the manufacturer's recommendations.
- .5 All materials shall be new and without flaws and of quality and performance as specified. All equipment from various manufacturers shall be compatible with other equipment in the system.
- .6 Waste and excess material shall remain the property of the Contractor and shall be removed from the site prior to issuance of Substantial Performance.

1.5 Substitutions

- .1 Where materials are specified by brand name and model number, such specifications shall be deemed to facilitate a description of the materials and material quality and shall establish a standard for performance and quality against which proposed substitutes will be evaluated.
- .2 Proposed substitutes, including sufficient descriptive literature and product samples to permit evaluation, must be submitted to the Contract Administrator at least two weeks prior to tender closing time or two weeks prior to proposed installation.
- .3 Purchase or installation of materials that are not specified will not be paid for unless they have been:
 - 1. Reviewed and approved by the Contract Administrator and The Village of Slocan Public Works Department as an *Approved Equal*.
 - 2. Reviewed and approved by the Contract Administrator and The Village of Slocan Public Works Department as a *Change Order*.

NOTE: The installation of materials that are not specified and have not been approved as an equal shall be removed and replaced with the specified material at the Contractors expense.

- .4 The irrigation system is to be installed as designed. Changes made to the installation without prior approval by the irrigation designer and our Contract Administrator will not be accepted and made the responsibility of the Contractor to correct.

1.6 Submittals

- .1 Shop Drawings of the irrigation system are required for all, and any aspect of the irrigation system not included in the Contract Drawings. Shop Drawings shall be prepared in AutoCAD 2013 or equivalent format.

Shop drawings to be a to-scale base plan of the site and shall provide the following information:

1. Name and contact information of irrigation designer.
2. Name and contact information of water utility provider.
3. Name and contact information of electrical utility provider.
4. Extent and location of grass and plant material, as well as hard surfaces, civil structures and utilities.
5. Location, sizing and material descriptions of service connection(s) and related components, controllers and control system components, mainline and lateral piping, control valves, isolation valves, quick coupling valves and irrigation heads.
6. Static water pressure at the water service connection downstream of the water meter.
7. Coverage area for each zone, including a table that describes the dynamic water pressure, precipitation rate and water consumption for each zone (total gallons per minute).

NOTE: Shop Drawings shall be submitted to the Contract Administrator, for review, comment and approval by The Village of Slocan Public Works Department.

- .2 As-Built drawings shall be maintained. A final record drawing of the irrigation construction is to be submitted to the Contract Administrator prior to Total Performance. The drawings shall be prepared by a surveyor retained by the Contractor to survey and record the exact location of all surface features of the work and indicate the alignment of all underground pipes and wiring between those surface features. The drawings shall identify each zone numerically, complete with the precipitation rate and U.S. gallons per minute per zone. Provide Contract Administrator with a neat and legible original hard copy and digital copies (in Adobe *.pdf and AutoCAD *.dwg formats) of As-constructed Drawings suitable as a permanent record.
- .3 Prior to Total Performance, prepare and submit an Operating Manual to the Contract Administrator. Provide (2) two three ring binders with the manual included in tabbed sections. The sections are to include equipment operating instructions, maintenance instructions including winterization procedure, product literature, parts lists, irrigation schedule, and other related material. Submission to also include two (2) sets of all special tools, keys, and equipment required to commission or maintain the system.

- .4 Provide Contract Administrator with product warranty documentation for all controllers, meters, electronic, components and valves. Date the warranties with the date of Substantial Completion.
- .5 Provide Contract Administrator with signed and approved copies of all required permits, including the following:
 1. Water service connection permit.
 2. Electrical service connection permit.
 3. Backflow test report.
 4. Electrical permits, inspection report and electrical utility account information.
 5. Plumbing permits, inspection reports and water utility account information.
 6. Low voltage declarations.
- .6 Provide Contract Administrator with unit price quote for replacement of each type of irrigation head damaged by vandalism or abuse during the guarantee period.

1.7 Scheduling

- .1 Coordinate and schedule work such that no damage occurs to materials or work before or after installation.
- .2 Coordinate work schedule with that of other trades on-site.
- .3 Prior to starting work verify the location of the water supply and electrical supply and obtain necessary permits for connection to same.
- .4 Plan, schedule and execute work to ensure a supply of water for landscape establishment and maintenance purposes at adequate times, in adequate amounts and pressures, for satisfactory irrigation of all landscaped areas.

1.8 Measurement for Payment

- .1 Supply and installation of the water service will be measured as a lump sum. The work shall include the supply, installation, testing and adjustment of the connection to water source, master valves, water meters, flow sensors, backflow prevention device, blowouts, vaults, lids, fittings, permits, fees, excavation, backfill, restoration work and incidentals necessary for the proper installation and operation of a complete water service to the irrigation system. This item shall be paid upon completion of the said work and submission of permits and account information.

- .2 Supply and installation of the electrical service will be measured as a lump sum. The work shall include the permits, fees, supply, installation and testing of the connection to electrical source, excavation, backfill, restoration work and incidents necessary for the proper installation and operation of a complete electrical service to the irrigation system.
- .3 Supply and installation of the control system will be measured as a lump sum. The work shall include the supply, installation, testing and adjustment of the irrigation controllers, conduits, cabinets, concrete boxes, lids, fittings, permits, fees, excavation, backfill, restoration work and incidentals necessary for the proper installation and operation of a complete irrigation control system, including necessary testing, programming and adjusting the irrigation system, shall be included under Control System.
- .4 Supply and installation of the pipes and valves will be measured as a lump sum. The work shall include the supply, installation, testing and adjustment of irrigation pipe, sleeves, zone control valves, control wire, drain valves, isolation valves, pressure regulators, swing joint assemblies, sprinklers, emitters, fittings, boxes, lids, excavation, backfill, restoration work and incidentals necessary for the proper installation and operation of a complete irrigation system.
- .5 Payment for As-constructed Drawings will be measured as a lump sum.
- .6 Payment for a completed and operational irrigation system operation will be measured as a lump sum.

1.9 Inspections and Testing

- .1 Regular, weekly installation inspections will be conducted by the Owner, or the Owners representative based on the Contractors completion of various components of the irrigation system. Such as Mainline, Wiring, Valves, Head Placement, Piping and Controls.
- .2 Prior to issuance of Substantial Performance the Contractor shall, in the presence of the Contract Administrator, conduct the following tests:
 1. Mainline Pressure test.
 2. Sprinkler Head Coverage test; and
 3. Overall System test, inc. Controller operations.

2.0 PRODUCTS

2.1 Water Service and Meter

- .1 For water service supplied by The Village of Slocan Public Works Department, the water meter shall be supplied by the Village's water utility unless specified otherwise.
- .2 For water service supplied by a utility other than The Village of Slocan's water utility, the water meter shall be supplied as required by that utility.
- .3 Water meter shall be sized to conform to the mainline diameter.

2.2 Electric Service

- .1 Except as specified otherwise the electric service shall be a surge protected minimum 15-amp service and shall include a duplex plug receptacle.

2.3 Backflow Prevention Device

- .1 Acceptable double check valve assemblies (DCVA) include the following:
 1. Conbraco 40-100 Series or 4S Series c/w NRS; or
 2. Watts Series 007, c/w NRS (up to 50mm), Watts Series 709, c/w NRS (63mm and larger)
- .2 Acceptable reduced pressure backflow assemblies (RPBA) include the following:
 1. Conbraco 40-200 Series c/w NRS; or
 2. Watts Series 909 c/w NRS

2.4 Blow-out Device

- .1 Blow-out devices shall be as follows:
 1. For mainline diameter 19mm to 50mm, supply a 25mm brass quick coupler valve complete with a 25mm by 300mm long SCH40 PVC swing joint consisting of triple st.90 configuration, o-ring type joints, and a brass male threaded end.
 2. For mainline diameter 63mm and larger supply a branch tee with a 50mm female thread and plug inserted horizontally

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- 2.5 Pressure Reducing Valve** .1 Acceptable water pressure reducing valves include the following:
1. Watts Series LF25AUB-Z3 (Up to 2")
 2. Cla-Val or Singer PRV (2-1/2" or larger)
- 2.6 Master Valve** .1 Acceptable master valve(s) shall be the same model and brand as the rest of the irrigation system electric control valves installed in the irrigation system.
- 2.7 Concrete Vaults** .1 Acceptable concrete vaults include but are not limited to the following models: (Model # by Kon Kast Products)
1. #1102
 2. #1031
 3. #1032
 4. #1060
 5. #1060R
- 2.8 Concrete Vaults** .2 Acceptable concrete vault lids include but are not limited to the following models: (Model # by Excel Metals)
1. #3974-2
 2. #4840-1
 3. #11040-1
 4. #2436-5
 5. #2436-5
- 2.9 Irrigation Cabinet** .1 Acceptable irrigation cabinets shall include the following:
1. Lockable steel or aluminum cabinet
 2. Weather resistant seal around entire lid or door
 3. White powder coated rust resistant finish.
 4. The cabinet should have adequate space for all wiring required for the irrigation system.
- 2.10 Irrigation Controller** .1 Irrigation controller(s) shall be the model(s) specified on the irrigation drawings. The controller(s) must be capable of operating all zone valves designated for each controller and include additional spare stations available for future upgrades.
- .2 Acceptable spare stations to be a total of 10% of the total station capacity of the irrigation controller.

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- 2.11 Solenoid Valve** .1 Acceptable 24V electric solenoid valves shall be:
1. Globe/Angle installation capability.
 2. Minimum 200 PSI operating PSI.
 3. FIPT threaded connection.
 4. Same size and pressure rating as specified on the irrigation drawings.
 5. Glass Filled Nylon construction.
 6. Optional pressure reduction control.
 7. Internal and External Manual Bleed.
 8. 24 Volt Electric operation.
- 2.12 Pressure Regulating Module** .1 Acceptable pressure regulating modules shall be the same brand as the Solenoid Valve.
- 2.13 Isolation Valve** .1 Acceptable isolation valves include the following:
1. Red & White model 206A.
- 2.14 Valve Box(s)** .1 Acceptable valve boxes and matching lids shall be Carson/Brooks, NDS or Rainbird VB series and include the following:
1. # 1419-12, # 1320-12, Standard, Jumbo
 2. # 1324-12, # 1324-15, Super Jumbo
 3. # 1730-12, # 1730-15, # 1730-18, Maxi Jumbo
- .2 Irrigation Valve box(s) & or lid(s) shall be green in color. Rainbird PVB, Any Econo or Dura brand valve boxes will not be accepted.
- .3 Locking device of lid shall be stainless steel bolts with appropriate washers or a captive L-bolt lock.
- 2.15 Control Wire** .1 Wire, breakers, conduits and related materials that comprise the electrical supply to the controller shall be CSA approved.
- .2 Control wire from controller to valve shall be #14-gauge direct burial type, CSA approved TWU-40 wire. Wire shall be consistently any color other than white, green, blue or red.
- .3 Common wire from controller to valve shall be #12-gauge direct burial type, CSA approved TWU-40 wire. **Wire shall be consistently white only in color.**

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- .4 Master valve wire from the controller to the valve shall be #14-gauge direct burial type, CSA approved TWU-40 wire. The wire shall be consistently (red) color.
- .5 Spare wire(s) shown on plans from the controller to the end of the mainline run(s) shall be #14-gauge direct burial type, CSA approved TWU-40 wire. The wire shall be consistently (blue) color.
- .6 All connectors shall be new, CSA approved for watertight applications and assembled according to the manufacturer's recommendations. The only acceptable connectors are either: 3M DBY/R or Rainbird WC-20.
- 2.16 Wire Splice Box** .1 Acceptable wire splice boxes include the following:
1. Carson L series #1419-12 c/w #1419-3B, with grey lids indicating electrical connections.
- 2.17 Quick Coupler Valve** .1 Acceptable quick coupler valves shall be type and model specified on the irrigation drawings.
- 2.18 Polyvinyl Chloride (PVC) Pipe** .1 All pipes shall conform to CSA Standard B137.3-93. All pipes shall be in new condition, extruded from virgin, high impact materials, solvent weld able with belled ends, and continually and permanently marked showing manufacturers name, material, size and pressure rating.
- .2 All Lateral piping from 25mm up to and including 75mm shall be Schedule 40 PVC – Solvent Weld.
- .3 All Mainline piping 38mm in diameter and greater shall be Schedule 40 PVC – Solvent Weld.
- .4 Where pipe is not specified otherwise on irrigation drawings, use Schedule 40 PVC – Solvent Weld.
- 2.19 Polyethylene Pipe** .1 All pipe shall be in new condition, extruded form virgin, materials and continually and permanently marked showing manufacturers name, material, size and pressure rating.

2.20 Fittings

- .1 Fittings shall be GSR Schedule 40 PVC conforming to ASTM D-2466-97 (and F438-97 for CPVC) standards and be of the same material as the pipe. Fittings shall be designed for solvent welding to PVC pipe except where valves and risers require threaded joints.
- .2 DURA Brand PVC Fittings and or Valve Boxes will NOT be accepted.
- .3 Threaded nipples shall be Schedule 80 PVC and be manufactured from the same material specified for the pipe. Teflon tape is required for all plastic threaded fittings.
- .4 At the point where the supply source changes from metal to PVC pipe, the metal end of the pipe must be an FIPT adapter and the PVC fitting a SCH80 PVC threaded Nipple.

2.21 Copper Pipe and Fittings

- .1 All pipes in and through the interior of buildings shall be copper.

2.22 Pipe Solvent and Primer

- .1 PVC pipe cement and primer combinations shall be recommended by the manufacturer to be suitable for the materials and application. The ONLY allowed solvent cements are 704/705 Clear or 711 Grey. The ONLY allowed primer is P70 purple. P70 clear or P75 Wet & Dry primer will not be allowed for inspection purposes.
- .2 The use of wet and dry solvent and or red hot one step solvents are NOT permitted at all. The use of these products on the piping system will be cause to have the joint(s) or pipe(s) replaced and re-cemented with the correct solvent and primer at the Contractors expense.

2.23 Irrigation Sleeve

- .1 Irrigation sleeve conduit shall be Schedule 40 PVC pipe.
- .2 Conduit diameter shall be minimum 100mm or twice the diameter of the main or lateral line running through it, whichever is greater.
- .3 Control wire conduit shall be a minimum 50mm diameter non-metallic DB2 PVC pipe.

2.24 Thrust Blocks

- .1 Acceptable thrust block material includes:
 - 1. Poured in place concrete (Preferred); and
 - 2. Pre-cast concrete block. (Where approved).

2.25 Sprinklers

- .1 All sprinklers shall be new, with the size, manufacturer, and features as specified or as indicated on the irrigation drawings.

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- .2 All sprinklers in grass areas of sport fields shall be equipped with a factory-supplied rubber cover.
- 2.26 Swing-joint Assembly**
- .1 All sprinklers shall be attached to a lateral PVC pipe with a SCH40 PVC triple swing-joint assembly, fabricated with three threaded Schedule 40 PVC elbows and one threaded Schedule 80 PVC nipple with Teflon Tape.
- .2 Schedule 80 PVC nipples shall be 300mm (12") long permit the installed sprinkler to be set level at a finished grade. All threads to receive (3) wraps of Teflon Tape.
- 2.27 Rotor Sprinkler**
- .1 Acceptable Pop-up rotors sprinklers shall be provided with and be capable of the following:
1. 25mm female-threaded inlet.
 2. Minimum 100mm pop-up height.
 3. Standard Rubber Cover.
 4. Top-Arc Adjustable or pre-adjusted Arc.
 5. Separate Part-Circle and Full-Circle operation.
 6. Operating radius of 45-65'.
 7. Operating pressure range of 50-90 PSI.
 8. Flow rate between 6 up to 25 U.S.G.P.M.
 9. Available in a variety of angles and nozzle sizes.
 10. Standard rubber check valve.
 11. Minimum 2-year warranty.
- 2.28 Water**
- .1 Free of impurities that would inhibit germination and growth or may be harmful to the environment.
- 3.0 EXECUTION**
- 3.1 General**
- .1 Requirements, approvals and accounts for water and electrical service connections from the utility having jurisdiction over the site shall be the responsibility of the Contractor.
- 3.2 Existing Conditions**
- .1 Verify locations of underground utilities prior to commencing excavation and conduct work so as to prevent interruption and damage to services and utilities. Make good all damages to same at Contractor's cost.

- .2 Verify the location of all services in building walls before boring or drilling holes for the supply outlet, controls or other work. Make good all damages to same at Contractor's cost.
- .3 Report existing conditions at variance with the Drawings to the Contract Administrator.
- .4 Protect all existing conditions and completed work from disturbance during excavation. The contractor shall make good all damage occurring to existing improvements and completed work during the course of this work.
- .5 Adjustments to installation of irrigation system to avoid existing improvements, completed work and utilities will be permitted as approved by the Contract Administrator.

3.3 Excavation

- .1 All excavation shall be unclassified. Report material that cannot be excavated by normal mechanical means to the Contract Administrator.
- .2 Remove and dispose of buried debris, including decommissioned irrigation materials, which may impede the proper installation and operation of the irrigation system.

3.4 Layout

- .1 Layout and stake the entire system per the Drawings, including locations of sprinkler heads, and confirm that:
 - 1. Layout is within project boundary and property lines and that grades are correct; and
 - 2. Minimum horizontal and vertical clearances from electrical and other utilities are not exceeded.
- .2 Verify on site the location of all sleeving under hard surfaces and improvements and adjust to suit.
- .3 Have layout inspected and approved by the Contract Administrator before commencement of work.
- .4 Due to changes during construction it may be necessary to adjust the spacing of the sprinklers in the field. Field changes shall be approved by the Contract Administrator.

3.5 Water Service

- .1 Obtain service account from water utility provider prior to starting work.
- .2 Connect to the utility's water source as per the Drawings and the requirements of the water utility.
- .3 Restore disturbed areas and improvements to original condition.

3.6 Electrical Service

- .1 Obtain service account from electrical utility provider prior to starting work.
- .2 Connect to the utility's electrical source as per the Drawings and the requirements of the electric utility.
- .3 Install service and electrical connections in accordance with local, provincial and national electrical codes.
- .4 Install a minimum 15-amp surge-protected service, including breaker, in irrigation cabinet. Include installation of a duplex plug receptacle.
- .5 All 120V AC power wire shall be mechanically protected by the mainline or lateral piping. Any deviation from the piping system will require the 120V AC to be installed in electrical conduit.
- .6 Restore disturbed areas and improvements to original condition.

3.7 Irrigation Cabinet

- .1 The irrigation cabinet is to be installed as specified in the location shown on the irrigation drawings.

3.8 Backflow Prevention Device

- .1 Double Check Valve Assemblies and Reduced Pressure Backflow Assemblies shall be installed in a lockable enclosure and in accordance with all applicable codes and bylaws, with positive drainage and room for servicing.
- .2 All assemblies 63mm and larger shall use two scissor jacks or screw jacks for blocking supports on a 300mm x 300mm x 50mm concrete slab. Consult the manufacturer for recommended locations of the supports.

	.3	Locate assembly in enclosure to provide sufficient room for easy access and maintenance to the assembly and its components.
3.9 Master Valve	.1	Install as specified on the irrigation drawings.
3.10 Isolation Valve	.1	Install as specified on the irrigation drawings.
3.11 Pressure Regulating Module	.1	Install as specified on the irrigation drawings.
3.12 Flow Sensor	.1	Install as specified on the irrigation drawings.
	.2	Follow manufacturer's instructions for installation and wiring of flow sensor.
3.13 Blow-out Device	.1	Install the blow-out device in the irrigation vault.
3.14 Irrigation Vault(s)	.1	The piping and valve assembly within the vault must be adequately supported and braced using a minimum of 2 adjustable riser type supports and 2 side wall supports, complete with riser, pipe clamps, galvanized metal and stainless-steel bolts.
	.2	All piping inside the vault is to be SCH80 PVC or pre-approved equal and is to extend a minimum of 300mm outside the vault on the downstream side and a minimum of 150mm on the upstream side.
	.3	The top of the piping will be 600 mm from the top of the lid. The service vault will be filled with 25mm minus drain rock to within 300mm of the bottom of the pipe. Contractor to install a 100mm PVC drainpipe, complete with a backwater valve.
	.4	The vertical section of the drainpipe is to be perforated and terminating with a grate that is flush with the surface of the drain rock. The drainpipe is to run (minimum of 0.5% slope) into a catch basin or approved drainage system.

3.15 Irrigation Controller

- .5 PVC Connections to brass outside the vault on the downstream side are to be made with schedule 80 PVC female adapters.
- .6 All piping to vault from city service is to be copper or pre-approved equal. Inside vault piping to be SCH80 PVC including drains and blow out connections.
- .1 Furnish and install the irrigation controller in the irrigation cabinet as specified on the irrigation drawings.
- .2 Coordinate controller installation with that of other electrical components.
- .3 All wiring shall be installed in accordance with local, provincial and national electrical codes.
- .4 Install and test the ground grid to ensure the earth resistance to ground does not exceed 10 ohms.
- .5 Provide the 120V AC electrical supply to the time clock. Co-ordinate the electrical work prior to selecting a location for the irrigation controller and cabinet.

3.16 Control Wire

- .1 Electrical control wire shall be buried at a minimum depth of 600mm as the BC Electrical Code and, in no case, less than the bottom side of the parallel pipe. Multiple lengths of wire shall be bundled together at maximum 6m intervals. Install wire with minimum 150mm slack at all changes of direction.
- .2 All wires shall be sand bedded with 100mm of clean rock free sand. Where the wires are in the same trench as the pipes, place the wires under the pipe but separate the wires from the pipes with an additional 50mm of sand.
- .3 Wrap control wires sharing a trench or conduit with electrical tape at 1.0m intervals.
- .4 All wire splices shall be looped and installed in an existing ECV valve box or a new electrical wire splice box.
- .5 **Do not** splice or bury any wire connections in a trench or anywhere outside of a wire splice box.

- .6 The length of coiled wire to extend out of the wire splice box shall be at least 300mm before connected with approved watertight connectors.
- .7 Provide a minimum of 450mm of wire neatly coiled at connections to control valve solenoid.
- .8 #12-gauge White wire only shall be used consistently as the common wire.
- .9 Any color other than white, green, blue or red to be used for the control wires from the valve to the controller.
- .10 Install spare (blue) hot wires, in quantity noted on the irrigation drawings, to the wire splice box at the end of each mainline branch leaving a one-meter coil for future use.
- .11 Provide 600mm of coiled wire for expansion purposes at all changes in direction in trench.

3.17 Pipe Installation

- .1 Verify that all pipes, fittings, primers and cements are compatible for proper installation.
- .2 Trenches shall not be closer than 300mm to any hard surface or feature.
- .3 Minimum burial depths for mainline pipe, measured from the top of the pipe to the surface of the ground immediately above it, shall be 600mm.
- .4 Irrigation lines may occupy the same trench provided they are installed on the same plane and the following clearances are achieved:
 - 1. Main line: 150mm
 - 2. Lateral line: 50mm
- .5 Trenches shall be hand or machine excavated. **Pulling pipes with a vibratory plough is not allowed.**
- .6 Install pipe in a manner so as to provide for expansion and contraction of pipe in the trench. Follow manufacturer's recommended procedures.
- .7 Install thrust blocks at all changes in direction of PVC pipe 75mm in diameter or greater, and for any change in direction of gasketed pipe, to prevent water hammer damage to irrigation system components.

- .8 Keep the inside of pipe clean at all times. Open pipe ends shall be capped or plugged.
 - .9 PVC pipe ends shall be cut 90 degrees to the pipe length and cleaned of all cutting burrs using approved reaming tool prior to cementing. Pipe ends shall be wiped clean with a rag lightly wetted with PVC P70 PURPLE PRIMER.
 - .10 PVC 704/705 or 711 GREY CEMENT shall be applied with a light coat on the inside of the fitting and a heavier coat on the outside of the pipe. Pipe shall be inserted into the fitting and given a quarter turn to seat the cement. Excess cement shall be wiped from the outside of the pipe. DO NOT cement pipe under wet, frozen or muddy conditions.
 - .11 Use of a ONE-STEP Red or Blue Cement/Primer or 725/P75 WET & DRY Cement/Primer is NOT allowed.
 - .12 All plastic to metal joints shall be made with plastic SCH80 PVC nipples and SCH80 PVC nipples. Liquid Teflon or Pipe Compound is allowed on any metal fitting connections.
 - .13 All male threads on fittings shall be wrapped with minimum (3) wraps of Teflon tape immediately prior to making connection.
 - .14 All irrigation pipes shall be flushed out in a satisfactory manner to remove accumulation of dirt and other deleterious matter. Flush all laterals in a manner approved by the manufacturer to prevent clogging of sprinkler screens or nozzles.
 - .15 Notify Contract Administrator 24 hours prior to backfilling main lines. Main lines shall be inspected and approved by the Contract Administrator prior to backfilling.
 - .16 For pipe within the growing medium of planting beds or lawn areas, the same growing medium shall be carefully placed over the pipe and tamped by hand in lifts to match the adjacent grade and achieve compaction equal to the adjacent growing medium.
 - .17 For pipe within native soil, sub-surface fill or aggregate base material, the pipe shall be carefully backfilled with 100mm depth of bedding sand. The remainder of trench backfill to finish grade shall be made in lifts with suitable material under 25mm in size and free of materials that could result in settling or damage to pipe or surface improvements.
- 3.18 Valve Boxes**
- .1 All manual and automatic control valves shall be installed in valve boxes, or a concrete vault as indicated on the Drawings or within the specifications.

- .2 Size valve boxes to provide minimum 50mm clearance around valves and equipment for ease of future maintenance.
- .3 Maximum (1) 38mm valve to be installed in a standard rectangular box (1419-12). Maximum (2) 38mm valves to be installed in a jumbo rectangular box (1320-12). Each larger valve shall be installed alone in its own standard rectangular valve box.
- .4 Valve boxes shall be lockable with bolt down lids and be installed flush to finish grade. Arrange in a neat and orderly manner and locate for ease of access, maintenance, and testing.
- .5 Valve boxes shall be installed with adequate clearance above the pipe and on a compacted base so as not to contact the pipe with settlement of upon being depressed. Valve boxes shall be supported with masonry blocks and able to support the weight of expected traffic.
- .6 All valve boxes to be installed on and wrapped with 3.2-ounce woven filter fabric. Cover bottom of valve box fabric with 150mm of 12mm pea gravel. Provide minimum 50mm clearance between bottom of valve and top of gravel.

3.19 Wire Splice Boxes

- .1 Wire splice boxes shall be installed flush to finish grade and arranged in a neat and orderly manner and shall be located for ease of access, maintenance, and testing.
- .2 Wire splice boxes shall be supported in the same manner as regular valve boxes above.
- .3 No underground wire splices are to be made and directly buried unless enclosed in an accessible valve box and lid.

3.20 Zone Valve Electric Control

- .1 Install as specified on the irrigation drawings.

3.21 Zone Valves Manual Control

- .1 Install as specified on the irrigation drawings.

3.22 Sprinkler Heads

- .1 Location of heads as illustrated on the irrigation drawings is intended as a guide to layout of heads. The Contractor shall establish actual head locations in the field to ensure complete and adequate coverage of all areas to be irrigated and no overspray onto adjacent surfaces and improvements. Spacing of heads shall not exceed dimensions recommended and shall provide "head to head" coverage of landscaped area.

- .2 Minimum horizontal setback of sprinkler heads from adjacent hard surface or improvement is 50mm. Heads adjacent to the hard surface shall be set 13mm below the grade of the hard surface.
- .3 Adjust arc, radius of coverage and flow at each sprinkler to achieve even coverage of area to be irrigated with minimum overspray onto other surfaces.

3.23 Swing Joints

- .1 All pop-up heads shall be mounted on a SCH40 PVC triple swing-joint bottom of the sprinklers and not the side inlet. Adjust the swing assembly to set the sprinkler flush with finish grade.
- .2 Threads of PVC fittings shall be taped with (3) wraps of Teflon Tape and made hard-hand tight. Liquid Teflon is not to be used.
- .3 The triple swing-joint assembly shall be connected to the bottom inlet of the sprinklers and not the side inlet.

3.24 Quick Coupler Valve

- .1 Install quick coupler valves in upright position with a SCH40 Tripple Swing Joint Assembly with female threads and 300mm long SCH80 PVC nipple.
- .2 Quick couplers shall be installed inside a valve box. Ensure the top of quick coupler valve is installed a maximum of 50mm below lid of valve box.
- .3 Install non-corrosive metal clamp on quick coupler valve to prevent uninhibited turning of the valve. Support with 12mm rebar driven into the ground. See details.

3.25 Irrigation Sleeve

- .1 Install irrigation sleeve 450mm below finished grade and extend end of sleeve 1m beyond limit of hard surface or improvement.
- .2 Bed sleeve with 75mm of bedding sand placed under the sleeve and 100mm of bedding sand covering the sleeve.
- .3 Cap irrigation sleeve with removable plug or cover. Maintain plug until pipe or wire is ready to be placed in sleeve.
- .4 Stake location of each end of sleeve prior to backfilling such that top of stake is 300mm above finished grade. Label exposed end of stake with the word "sleeve".
- .5 Remove stake after submission of As-constructed Drawings.

3.26 Clean-up and Restoration

- .1 Remove all debris resulting from irrigation installation from site.
- .2 Restore all disturbed surfaces to their original condition, including turf areas and repair all trench settlement as necessary.

3.27 Owners Instructions

- .1 Contractor is to instruct a designated representative of The Village of Slocan Public Works Department in the complete operating and maintenance procedures for the irrigation system, including start up, winterization and programming; and review As-built drawings, manuals, and irrigation schedule.

3.28 Inspections

- .1 Notify the Contract Administrator a minimum of two (2) working days prior to required inspections or testing. Failure to provide such notice or proceed with work without receiving approval from the Contract Administrator is sufficient grounds for withholding payment or removal and replacement of work at the Contractor's expense.
- .2 All work is to remain uncovered for inspection of workmanship and materials. All buried work that has not been inspected and approved will have to be totally uncovered, inspected, and re-buried at the Contractor's expense.
- .3 Ensure that the exposed pipe is properly restrained prior to being pressurized.

3.29 As-Constructed Drawings

- .1 Upon receipt of Substantial Performance the Contractor shall employ a surveyor to survey and the as-constructed irrigation system and prepare As-constructed Drawings.
- .2 Submit as-constructed Drawings to Contract Administrator prior to receipt of Total Performance.

3.30 Water Line Flushing

- .1 Flush all lines prior to sprinkler installation to prevent clogging of sprinkler screens and nozzles.

3.31 Testing

- .1 Pressure and Leakage Test
 1. The Contractor shall request in writing the presence of the Consultant and owners' representative at least (2) working days – 48 hours in advance of testing.
 2. Subject Mainline Water Pipe to hydrostatic pressure of 2x the design pressure or maximum 75% of the pipes maximum pressure rating after the mainline has been filled with water for 24 hours and all the air has been expelled.
 3. Supply all necessary equipment (ie: pumps, connections, gauges etc.) required to perform this test.
 4. Perform this test for a period of 2 hours.
 5. Apart from visual inspections, this leakage test will consist of monitoring pressure drop at the pressure gauges installed on the pipeline.
 6. If pressure remains steady within 5% for 2 hours, then no leakage will be indicated on the test report.
 7. Contractor is responsible for replacement of all defective materials.
 8. Contractor will be responsible for providing the water necessary for this pressure test.

3.32 Guarantee

- .1 Contractor shall submit a written guarantee, in approved form, stating that all work showing defects in materials, workmanship or operation will be repaired or replaced at no cost to The Village of Slocan Public Works Department for a period of one year from the date of Total Performance.
- .2 Guarantee includes the supply of labor, materials, and equipment necessary for the repair and replacement of damaged or defective materials and workmanship. Guarantee also includes start-up, winterization, maintenance, necessary testing, program corrections or adjustments and restoration of settled trenches.

- .3 Guarantee will not apply to materials or workmanship damaged after Total Performance by causes beyond the Contractor's control, such as vandalism or abuse. The guarantee will cover materials or workmanship supplied and installed by the Contractor to replace those damaged by vandalism or abuse.

- .4 The Village of Slocan reserves the right to withhold no more than 15% of the total value of the entire contract from the substantial completion lump sum payment. This holdback will be kept by the Village for a period of (1) year from the date of substantial completion. This is to guarantee that all deficiencies and /or sub-standard workmanship has been dealt with by the Contractor and The Village of Slocan's Public Works Department. Upon signing off on the Total Performance for the project, The Village of Slocan will pay as a lump sum the remainder of funds remaining in the holdback account.

END OF SECTION