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Government

IRRIGATION 09D

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INFRASTRUCTURE
TECHNICAL
SPECIFICATION
09 - LANDSCAPE

Transport Canberra and
City Services

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1. IRRIGATION

1.1 General

This Specification comprises the minimum materials and requirements for the construction of irrigation systems within the jurisdiction of and to be handed over to for ownership and maintenance by *Transport Canberra and City Services (TCCS)*.

1.1.1 Responsibilities

Requirement: The contractor shall provide for all works and activities associated with the supply and installation of irrigation systems to meet the requirements of the project, and shall meet industry best practise.

1.1.2 Cross references

1.1.2.1 ACT Legislation

General: The following documents are related to this Specification:

Environmental Protection Act

Work Health and Safety Act

Waste Minimisation Act

1.1.2.2 Specifications

Requirement: Conform to the following:

MITS 00	Preliminaries
MITS 02	Earthworks
MITS 03	Underground services
MITS 06	Concrete kerbs, footpaths and minor works
MITS 09	Landscape
MITS 10	Concrete Works

1.1.2.3 Design Standards

General: The following Design Standards are related to this Specification:

MIS 16	Urban Open Space
MIS 17	Shopping Centre and Commercial Areas
MIS 18	Irrigation
MIS 19	Sports Ground Design
MIS 21	Recreation Facilities

1.1.2.4 TCCS Reference Documents

General: The following TCCS reference documents are related to this specification:

- Reference document 04 Protection of public landscape assets
- Reference document 07 Operational acceptance submissions
- Reference document 08 Works as executed quality records
- Reference document 09 Final acceptance submissions
- Reference document 10 Landscape consolidation
- Reference document 11 Drafting Standard for Civil and Landscape works

1.1.3 Referenced documents

1.1.3.1 Standards

General: The following documents are incorporated into this Specification by reference but limited to:

- AS/ANZ 3500.1 Plumbing and Drainage water services
- AS/NZS 1477 PVC pipes and fittings for pressure applications
- AS/NZS 2845.1 Fittings for polyethylene (PE) pipes for pressure applications
- AS 2032 Code of practice for installation of UPVC pipe systems
- AS/NZS 4130 Polyethylene (PE) pipes for pressure applications
- AS 2033 Installation of polyethylene pipe systems
- AS/NZS 4129 Water supply - Backflow prevention devices Materials, design and performance requirements
- AS 3795 Copper alloy tubes for plumbing and drainage applications
- AS 3688 Water supply - Copper and copper alloy body compression and capillary fittings and threaded-end connectors
- AS/NZS 4680 Hot-dip galvanized (zinc) coatings on fabricated ferrous articles
- AS 1379 Specification and supply of concrete

1.1.3.2 Other publications

Proprietary products: To *TCCS Products previously considered for use list*

1.1.4 Interpretation

1.1.4.1 Abbreviations

General: For the purposes of this Specification the following abbreviations apply:

MPa:	Megapascal
kPa:	Kilopascal
uPVC:	Unplasticised polyvinyl chloride
MDPE:	Medium Density Polyethylene pipe type PE100
LDPE:	Low Density Polyethylene pipe Type 30
TCCS:	Transport Canberra and City Services, ACT Government, and its successors.
NATA:	National Association of Testing Authorities
Du:	Distribution Uniformity.
Sc:	Scheduling coefficient.
POC:	Point of irrigation connection to a water supply.
Headworks:	Major items such as valves, meters, pumps, filters and other sensor equipment located at the start of an irrigation system near to or at the POC.

1.1.4.2 Definitions

General: For the purposes of this work section the definitions given below applies:

Authorised person: PAP/ Superintendent/Client of the Works/Client Appointed Technical representative.

Select Fill: Backfill material with known properties and grading placed and compacted in layers.

Inadequate foundation material: Material beneath or adjacent to the proposed irrigation structures with insufficient strength to support the structure and loads on the structure or material with characteristics that would adversely affect the performance or construction.

POC: The Irrigation System Point of Connection to a water supply or supplies.

Headworks: Equipment which may include but not limited to Water meter, backflow prevention device, master valve, system pulse flow meter or flow sensor and or where required may also include pump/s and filtration equipment.

Distribution Uniformity: Primary performance or measurement for how even water is applied between a given set of sprinklers in perfect and still conditions.

Scheduling coefficient: Secondary system performance measurement for the time required to bring the average of the driest 5% of a given area between a set of nominated sprinklers up to the system average.

Application rate: Typically a system is to able to apply an average of a minimum 33mm per week to turf grass. Less than 33mm per week shall only be by approval on a case by case basis.

Water Window: Maximum allowable time to achieve peak summer application rate typically 33mm per week. Water window shall not exceed 4 nights per week x 7 hours per night without specific approval. That is, shall not be greater than $4 \times 7 = 28$ hrs.

1.1.5 Hold points and or witness points

1.1.5.1 Notice

General: Give notice so that the documented inspection and submissions may be made to the **Hold point table**.

Table 9D-1 Hold point table

Item	Clause title	Requirement	Notice for Inspection	Release By
Pre-Construction Planning				
9D.1	Works permit and plan certification	Supply local authority “works approval permit” and approved plans	Prior to commencement of irrigation installation	Contractor and Local Water Authority
9D.2	Point of connection	Test and confirm system design flow and pressure requirement	At commencement of project prior to commencement of irrigation installation	Authorised person
9D.3	Shop drawings	Provide details of proposed key equipment and or shop drawings, Controller, Tanks, pumps, Cabinets, Equipment sheds etc	2 (two) weeks prior to commencement of installation	Authorised person
9D.4	System Set out	Peg proposed key system locations (valve pits etc), Mark proposed trench routes.	1 (one) week prior to commencement of irrigation installation	Authorised person
9D.5	Headworks	Mark out and confirm final location of key equipment at POC and demonstrate componentry.	At commencement of project	Authorised person
Materials				
9D.6	Quality control samples of sprinklers, valves, valve pits, cable, cable joints, drip line (where approved), saddles, swing arms, solenoid valve assembly.	Supply or show samples for, records inspection and approval.	At site establishment and before commencement of installation of irrigation equipment	Authorised person
Execution				
9D.7	Excavation	Sample trench excavation, depth, bedding and backfill material and re-compaction	Commencement of installation of initial pipe work	Authorised person

Item	Clause title	Requirement	Notice for Inspection	Release By
9D.8	Initial solenoid valve / Isolation valve/ QCV valve pit installation	Initial valve installation to confirm final finished levels or depths and inspect materials clearances etc	1 (one) week prior to commencement of installation	Authorised person
9D.9	Pipe Pressure test	Flush pipes, Purge all air and seal pipe, apply pressure as required and observe/ document results	Upon completion of the entire system or sections of main that can be isolated	Authorised person
9D.10	Initial system flush, sprinkler fit off and test	Flush all lines and fit off sprinklers.	1 (one) week prior to commencement of sprinkler fitting	Authorised person
9D.11	Final and full system test and commissioning	Demonstration of all stations (sprinklers and valves) working electrically from the controller as per design intent.	Two (2) weeks prior Commissioning	Authorised person

Completion

9D.12	Operation and Maintenance Manuals & Irrigation Compliance Certificate	Submit compliance certifications, warranty and maintenance manuals	Prior to Operational Acceptance	Authorised person
9D.13	WAE plans	Provide WAE plans for cross checking approval and acceptance	Minimum 48hrs Prior to Operational Acceptance Inspection	Authorised person
9D.14	Operational Acceptance Inspection	Submit statement of irrigation compliance. Full system operational demonstration	Minimum One (1) week prior to or as negotiated & agreed	Authorised person

Table 9D-2 Witness point table

Item	Clause title	Requirement	Notice for Inspection
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Completion

9D.1	WAE plans	Provide daily record of As Constructed changes.	Progressive
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1.2 Preconstruction planning

1.2.1 Submissions

1.2.1.1 Irrigation Design

General:

Submission and approval of design documents: Prior to commencement on site procure works permit and plan approval from local water authority.

This is a **HOLD POINT**.

Requirement: Provide the following documentation upon approval of works permit:

- > Provide documentation and or perform physical test and written confirmation that water supply meets or exceeds system design requirements or provide detail of other measures taken to ensure design parameters are meet.

This is a **HOLD POINT**.

- > Provide Shop drawings for approval on items as required by or to meet the design completion such as Controllers, Tanks, Pump systems, Cabinets, Equipment sheds and the like.

This is a **HOLD POINT**.

- > System Set Out: Peg proposed key system locations (valve pits etc), Mark proposed of trench routes for review and approval. Identify any latent site conditions or potential conflicts.

This is a **HOLD POINT**.

- Written confirmation or notice:
- For any known delays or likely delays due to site conditions, machinery or equipment procurement.
- Likely or known delay's due to relocation or provision of existing or new services to be provided, either by the contractor or by others.
- Request for approval for "special conditions" or equipment alternatives.
- Confirmation of lead times for equipment and program for delivery to site.

1.3 Materials

1.3.1 Pipework

1.3.1.1 Pipework - Mains

General: Pipe selection shall be in accordance with the design. MDPE pipe shall be used for pressure mainline supply below ground. Irrigation pipework above ground from mains supply shall typically be copper to plumbing codes or stainless steel heavy wall pipe. Spiral wound or light weight tubing will be rejected.

Standards: All pipework to conform to the relevant Australian standard. Installation methods shall comply with the relevant Australian Standard or where there is no standard, industry best practise for commercial grade irrigation systems shall be the minimum requirement.

Requirement: Pipework on all irrigation systems downstream from the POC and or from the headworks shall be MDPE pipe either straight black or may contain lilac striping. MDPE pipe containing blue colouring will be rejected. uPVC may be used in limited applications and must be white.

Requirement: Irrigation Main line Pipework connected to potable mains shall be of a minimum class approved by the local water authority. In the case of MDPE pipe PN 16 or PN12.5 or minimum Class 18 in the case of uPVC. Where copper is used it shall be minimum Type B. Copper shall generally be used when the service is exposed (not laid in the ground) in accordance to *National plumbing standards AS3500*. MDPE may be used above ground in pump stations when not directly connected to mains supply.

Mainline pipework connected to alternative water supplies (other than potable supply) shall be minimum PN12.5 in MDPE or Class 12 for uPVC unless the system design and or working pressure maybe subject to pressures greater than 800kPa in which case the pressure rating is to be increased to minimum of 1.5x the system design working pressure and not less than possible pressures that the system may be subjected to.

Where the water supply is or maybe proposed in the future to be from treated effluent the pipework must be lilac or contain lilac striping and Lilac ID tape also applied to the pipe.

1.3.1.2 ID Marker Tape

General: Irrigation ID marker/warning tape is to be applied over all mainlines is to incorporate a trace wire.

Requirement: Where the water supply is from potable water the tape shall be blue for irrigation and contain marking such as "WARNING IRRIGATION MAINS BELOW".

Requirement: Where the water supply is from reclaimed water (treated effluent) or other secondary water supply the ID tape must be lilac in colour with marking "WARNING RECYCLED WATER BELOW".

1.3.1.3 Pipework – Laterals

General: Pipe selection shall be in accordance with the design. Lateral pipework shall be minimum MDPE PN12.5 or uPVC Class 12. LDPE for dripline use, to be minimum Type 30.

Standards: All pipework to conform to the relevant Australian standard. Installation methods shall comply with the relevant Australian Standard or where there is no standard, industry best practise for commercial grade irrigation systems shall be the minimum requirement.

Requirement: Lateral pipework on all irrigation systems downstream from station solenoid valve shall be MDPE pipe minimum PN12.5 either straight black or may contain lilac striping or uPVC. When used uPVC must be white minimum Class 12. LDPE Type 30 maybe used for temporary establishment on drip systems only where approved. Pipe containing blue colouring will be rejected.

1.3.2 Valves

1.3.2.1 Solenoid valves

General: Solenoid valves are to be new and an approved brand and model to be used for the entire system. Brands are not to be mixed within a system where sizes permit.

Requirement: Solenoid valves to be fitted with 24vac 50Hz or DC low voltage latching coils compatible with the control system in use.

Requirement: Solenoid control valves are to be of the size and type shown on approved plans.

Requirement: Solenoid valves are to be fitted with pressure regulation where the system operating pressure may exceed the design pressure of the sprinklers or drip line. Valves are to be regulated by the pressure regulator and NOT the flow stem or flow control.

Solenoid valve sample assembly.

This a **HOLD POINT**

1.3.2.2 Isolation valves

General: Control Isolation valves up to 80mm diameter shall be full bore stainless steel ball valves. 80mm diameter and above shall be resilient seat flanged gate valves. 80mm valves either valve option maybe used.

Requirement: Ball valves are to have:

- > Stainless Steel body, stem & handle;
- > Chrome plated metal ball;
- > Teflon seat;
- > Markings to indicate direction of operation for closure; and
- > BSP threaded ends.

Requirement: Gate valves are to have:

- > Metal body with bolted metal bonnet;
- > Rising or non-rising metal stem to suit installation;
- > Resilient seat;
- > Clockwise closing
- > Markings to indicate direction of operation for closure; and
- > Flanged ends for bolted connection to pipework.

Isolation valve sample prior to installation.

This a **HOLD POINT**.

1.3.2.3 Quick Coupling Valves (QCV)

General: QCV's shall be 25mm brass valves equal to Rainspray and fitted with a rubber cover.

Requirement: Where the water supply is from potable water the rubber cover shall be yellow and where water supply is from harvested or potential reclaimed water supply the cover is to be lilac.

Requirement: QCV'S shall include the supply of one (1) compatible brass key with a brass hose swivel for every 5 valves installed.

QCV sample assembly.

This a **HOLD POINT**.

1.3.3 Sprinklers

1.3.3.1 Sprinklers

General: Sprinklers are to be commercial grade pop up gear drive type with stainless steel riser, rubber caps and adjustable to the arc as required.

Requirement: Sprinklers shall use nozzles in accordance with the design and offer matched precipitation or be like arc setting with the same nozzle on a station allowing for reduced operation time.

Requirement: Sprinklers shall be the type model brand or performance as noted on the design. Sprinklers shall be from the approved range of sprinklers refer to *MIS 18 Irrigation*.

Requirement: Sprinklers in grass shall of minimum 100mm pop up

Requirement: Garden sprinkler shall offer minimum 150mm to 300mm pop up or as a shrub head on a restrained riser minimum 600mm when located in gardens among plant foliage and in non-vandalism areas or areas closed to the general public.

Sprinkler samples to be provided.

This is a **HOLD POINT**.

1.3.4 Controllers

1.3.4.1 General

General: Controllers are to be approved by TCCS for the site and generally they are to "link" to TCCS computerised irrigation management system. (CIMS) On small systems approval may be granted to omit connection to the (CIMS). Where systems are NOT required to be connected to the CIMS an approved stand alone controller maybe used. **Currently preferred stand alone controllers include Hunter iCore.**

General: With approval, small area street scapes and car parks with no readily available power supply that maybe of 1-4 stations and no ability for expansion may be a Hunter Hybrid Battery operated unit.

Requirement: **The CIMS is to be confirmed with the client and currently is the RainBird IQ Cloud ™system.**

Requirement: Controllers are to include rain sensing device which is to be to be either wireless or wired type. Wired Hunter stainless steel vandal proof model is preferred.

This is a **HOLD POINT**.

1.3.5 Headworks

1.3.5.1 Headworks

General: Headworks is considered as all the necessary equipment as described or shown in the design which is required at the point of connection (POC).

Requirements: All equipment including, valves, backflow prevention, pressure reduction, master valve, local reference flow meter or pulse meter, flow sensor, master valve or other required equipment is to be shown on a shop drawing which is to be submitted and approved by local authorities and the client prior to procurement and installation. Pump systems may include tanks the pumping system, filtration equipment etc.

Requirement: Headworks shall be as necessary and in accordance with the design criteria refer to *MIS 18 Irrigation*, P.O.C. and Headworks shop drawings including final location approval on site.

This is a **HOLD POINT**.

1.3.5.2 Pumps

General: Pumps are to be constructed where required and designed. Final pump system layouts and inclusions shall conform with the design and in accordance with *MIS 18 Irrigation*. Refer to *MIS 18 Irrigation* for pump station typical applications, layouts sizing, inclusions and housing.

Requirement: Where pumps are to be installed on systems and the water supply is from a local water authority the authority will be the determining authority on any additional equipment that maybe required in the pump system design and installation.

1.3.5.3 Pump Housing.

General: Pump system housing shall generally comply with *MIS 18 Irrigation*. Pump station housing is to be approved by the client prior to ordering and construction. Approvals by other authorities may also be required. Contractor to ensure all local authorities approve of any structure and the client has approved shop drawings prior to construction.

This is a **HOLD POINT**.

1.4 Installation

1.4.1 Pipe

1.4.1.1 General

General: All pipework shall be securely capped or plugged to prevent the entry of foreign matter. Pipes are to be sealed, capped or taped and protected when work is not expressly being carried out on a pipe. Pipelines shall be installed using the longest practical length to eliminate unnecessary jointing and shall follow the manufacturer's recommended installation practise.

1.4.2 Pipework cover and ID marker tape

1.4.2.1 Cover Over Pipework - Mainlines:

General: Minimum cover shall not be less than 450mm for mainlines.

1.4.2.2 Trench Base Bedding And Backfill – Mainlines

Requirement: Mainline pipework shall include a smooth level flat or continuous graded trench base free of foreign objects, sharp edges of any kind, stones roots or other debris. Pipes 50mm - 90mm shall be laid on an imported clean washed fill sand bedding layer of minimum 75mm and shall include a sand side support and initial cover of imported clean washed fill sand to a cover of minimum 75mm Pipework above 90mm bedding and initial backfill layer shall be minimum 100mm.

This is a **HOLD POINT**.

1.4.2.3 ID Marker Tape

General: All mainlines associated with any irrigation system is to have an ID marker tape installed above the pipe.

Requirement: Mainline pipework shall incorporate in the final backfill layer between 150mm and 200mm below ground an irrigation ID marker/warning tape.

Requirement: When the water supply is from treated effluent a Lilac ID tape is also to be placed directly on and taped to the pipe with duct tape at maximum each 3m.

1.4.2.4 Cover Over Pipework - Laterals:

General: Minimum cover for laterals shall not be less than 400mm unless approved otherwise.

1.4.2.5 Trench Base Bedding And Backfill - Laterals

Requirement: Lateral pipework shall be laid on a suitable excavated smooth level, flat or continuous graded trench base and free of foreign objects, sharp edges of any kind, stones roots or other debris. Where the excavated material is unsuitable and leaves a broken or rough stony trench base an imported layer of clean washed fill sand is to be used to bed and for initial backfilling as for mainlines. Where excavated material is suitable it may be used for bedding and back fill material.

1.4.2.6 Cover Over Pipework - Dripline:

Requirement: Where Dripline is approved, Dripline pipes maybe laid on ground under an approved mulch layer or up to 100mm below ground and must be pegged with a minimum 400mm long galvanised U or V shaped dripper peg not greater than 2.0m apart and at each fitting or change of direction.

1.4.3 Trenching, base and backfill

1.4.3.1 General

General: All mainline trenches are to be excavated to a depth to allow for the necessary cover over the pipe as noted above. All trenching shall be by open trench method, hand, chain type trenching machines and or bucket type machines, unless specific written approval is granted for other methods. Any rock that may be encountered may be removed by rock hammer type machine.

Requirement: All trenches are to be inspected for sharp and or foreign objects and a smooth level or graded base formed prior to the laying of pipe.

This is a **HOLD POINT**.

Requirement: Pipework 90mm and above shall be bedded on an imported washed clean fill sand to a minimum depth of 75mm. Imported washed clean fill sand to be used for side support and initial minimum 75mm of cover.

Select excavated material shall be placed and compacted in layers no greater than 200mm to complete the backfilling of the trench. Select backfill shall not include roots or stones larger than 40mm (golf ball size) or any other foreign debris.

Final top dressing of trenches shall be with an approved top soil and seeded with an approved seed mix, or as otherwise detailed.

1.4.3.2 Pipe Joints

General: All pipes shall be joined using the method suitable for the pipe material and in accordance with manufactures requirements and recommendations.

All joints of any kind are to be conducted by trained personnel or under direct instruction by an experienced and trained person only.

All threaded joints shall incorporate "plumbers tape" as necessary to eliminate leaks. Brass fittings are to be "roughened" prior to application of tape and pipe seal may also be applied.

Joints are to be avoided under asphalt, concrete and or any area or pavement that is subject to vehicular access or traffic of any kind.

1.4.3.3 MDPE – Medium and large bore pipe

General: MDPE pipe 90mm and larger shall be joined using either electrofusion or butt weld methods by trained and certified staff.

Requirement: Each fitting shall be logged in a site diary as required showing as a minimum: the time of day; conditions of the day (e.g. sunny/overcast/ rainy); general ambient temperature; person who carried out the joint other site specific information as relevant.

1.4.3.4 MDPE – Small bore pipe

General: MDPE pipe 75mm and less may be either electrofusion or mechanical joint.

Requirement: Mechanical joint shall be undertaken by trained personnel. Where electrofusion is used the same requirement for **Pipe joints** above is required.

1.4.3.5 uPVC – Medium and large bore pipe

Requirement: Where uPVC mains 80mm or greater are designed RRJ pipe is to be used with correctly calculated and constructed concrete thrust blocks against virgin ground and shall not be completely encased.

Pipe cleaning and witness points are to be specifically adhered to as set out by the pipe manufacturer.

1.4.3.6 uPVC – Small bore pipe

Requirement: Mainlines uPVC joints up to and including 50mm are to be solvent weld joints. Lateral pipe uPVC joints solvent weld joints may be up to 80mm. All pipe is to be cut square clean, primed and contact cement applied to both surfaces. Components are to be held still and in place while the solvent cement “goes off” and not allow to “relax” upon initial joining.

1.4.3.7 Copper tubing joints

Copper tube is to be joined using either copper or brass silver soldered manufacturer fittings or “crimp” sealing joints may also be utilised.

1.4.4 Valves

1.4.4.1 Solenoid valves

General: Solenoid valves are to be installed in approved valve box assemblies. In high profile areas, high risk or potential high vandalism areas, solenoid valve box covers are to be buried below finished surface level. Refer to approved design for final levels. Solenoid valves are not to be located directly in open play spaces or on any sporting field surface.

Solenoid Valves are to be installed in a valve box which is to provide a minimum of 50mm clearance under the pit cover to the top of the flow control stem when fully extended and or to the highest part of the valve to ensure that any minor valve box sinkage does not apply pressure or direct contact to the valve.

All solenoid valves are to be installed with a preceding service isolation valve of equal or greater in size and which shall also be housed in the valve box. Solenoid valves are not to be deeper than 450mm to the top of the valve when located in turf areas and not deeper than 300mm to the top of the valve when located in garden beds.

Solenoid valves are not to be operated by the valve bleed screw other than for initial flushing and set up or in an emergency. Valves are to be operated by the controller or remote access device or point for all general operation and for normal service and maintenance. Solenoid valve flow stem or flow control is to be set at commissioning to minimise valve closing time but not to restrict flow or to reduce pressure through the valve.

This is a **HOLD POINT**.

1.4.4.2 Isolation valves

General: Service or control Isolation valves are to be installed in strategic locations as per the design to enable system isolation at major branch lines and or for draining of system where appropriate. The contractor may add extra valves at their cost and discretion to aid in installation and or servicing of the system, Any extra valves to be clearly identified on WAE plans.

Isolation valves are to be installed as before each solenoid valve and Quick Coupling valve for service and maintenance purposes. All control isolation valves are to be housed in a suitable sized commercial lip over style valve box cover with securing bolt in the cover.

Requirement: System Service and isolation Control Isolation valves not associated with a solenoid valve are to have their valve box cover to be flush with surrounding finished soil level.

This a **HOLD POINT**.

1.4.4.3 Quick Coupling Valves (QCV)

General: Quick coupling valves (QCV) are to be installed where required by the design or requested by the client to enable temporary manual irrigation for establishment of dryland planting, manual watering of larger unirrigated mature trees, path wash down or other uses as required or requested.

- > QCV's shall be fitted with a stabilizing plate or brace.
- > QCV's shall be preceded with a control isolation service valve of equal size
- > QCV's shall be mounted to a manufactured high-pressure uPVC O-Ring swing arm joint.

Requirement: QCV's are to be installed in a round 9" lip over style commercial valve box with bolt down cover and flush with surrounding surface level. The valve shall be set at the correct level to enable the key to be inserted with sufficient clearance for correct safe insertion and removal without interference by the valve box.

Initial QCV installation: This is a **HOLD POINT**.

1.4.4.4 Air valves

General: Air valves are required on large diameter and long lengths of main lines at high points.

Requirement: Mains over 90mm in diameter and over 400m in length and or where there are undulations in the system between branch lines or valves must include air valves installed at high points to prevent hydraulic restrictions and flow limitations within the system.

Requirement: Air valves on main lines shall be ARI or equal and preceded by a control isolation valve of the same size and housed in a commercial valve box with bolt down lid finished flush with final soil level.

Requirement: Air valve sizing and final placement is to be closely monitored and final location and installation authorised by an experienced contractor on site. Take off to air valves shall be fitted to the top invert of the pipe at a graded and high point of the pipe work.

Requirement: Other areas where air valves are required such as in pump stations or large filters are to be installed as necessary and also where recognised by industry best practise.

1.4.4.5 Mini-Air Valves and Filters on Approved Drip Systems

General: Mini air valves for use in drip system are required at high points of drip system to allow air in and out of driplines to prevent clogging and maintain correct function of drip system. Mini air valves on approved drip system may be in a light duty valve box with a "Tek screw" to secure the cover. Mini air valves in drip systems do not need preceding isolation valves and are to be installed as recommended by the manufacturer.

General: Minor filters for approved drip systems are to be installed immediately downstream from a station solenoid valve and shall incorporate pressure regulation device as necessary to ensure the system pressure is below 350kPa. Filters would typically be 20mm, 25mm or 40mm. Filters shall be disc type equal to Arkal and minimum 120mesh. They shall be located in a valve pit of suitable size such that the body can be removed and replaced with ease and the internal cartridge removed for cleaning and inspection. Generally filters should be installed with the body to the side or at 45° facing downward so that when cleaning any loose debris does not enter the system accidentally.

Minor filters are to be installed with 2 unions one before and one after to enable complete removal of the whole filter and to enable the body to be rotated to the correct orientation. Filters are to be down stream of solenoid valves.

1.4.4.6 Other speciality valves

General: From time to time system designs may also include other speciality valves such as scour valves, sustaining valves, pressure reducing valves, pressure relief valves or others

Requirement: Where speciality valves are required installation shall be in accordance with the design requirements and in accordance with manufacturer's recommendations and requirements.

1.4.5 Valve boxes and component pits

1.4.5.1 Valve Boxes.

General: Control isolation valves, Solenoid valves, Air valves and QCV's are all to be installed in commercial polypropylene, lip over style irrigation valve box. All boxes shall include a galvanised or stainless steel bolt and nut to secure and retain the valve box cover where they are to be at ground level.

All valve boxes are to be clear of pipes passing through or under by a minimum of 25mm and a minimum of 80mm from the underside of the cover to equipment within. (qcv's to be at depth as necessary to insert the key fully).

Requirement: All valve boxes are to be set on minimum 75mm deep 10mm washed gravel base and lined with geofabric or plastic which is to be wrapped up and taped to the out sides of the valve box to prevent the ingress of surrounding soil and allow for excess water to drain from the box. Final valve box construction shall withstand, without collapse, the necessary expected mowing and maintenance vehicles which it maybe reasonably be expected to be subjected to. Manufactured concrete or other type of valve box extension maybe used to increase the depth or height of a valve box.

Solenoid valves shall be located in minimum size box with a nominal dimension of: Length: 21.8 inches (55, 4 cm) Width: 16.6 inches (42, 2 cm) Height: 12.0 inches (30, 5 cm). Valve boxes housing over solenoid valves in sports field turf systems are to be buried 200mm below finished surface level. Where boxes are underground they shall incorporate a 100mm square x 1mm thick steel plate secured to the top of the valve box lid for future location. Valves boxes are to be covered by turf sod to the disturbed area to a minimum of 2m². Valves boxes for solenoid valves and mini air and flush valves in approved drip systems and where located in garden beds maybe at soil level with a mulch layer covering.

QCV, Control isolation valve, and Air valves shall be installed in minimum round nominal 9 inch (22.5cm) round valve box. Larger boxes are required where necessary to fit the equipment being housed with sufficient room to carry out all normal operation and service and general maintenance activity. Note: Domestic rated thin black polyethylene style boxes or shallow boxes are not acceptable.

1.4.5.2 Major Component pits (Meter Pits and or Headworks Pits)

General: Headworks pits may include but are not limited to: Main isolation valves, dirt box, ICON or water supply authority water meter, backflow prevention device, pressure reduction valves, flow sensors, local reference or pulse flow meter, master valve.

This is a **HOLD POINT**.

General: Construct large component pits (50mm meter assemblies and backflow devices, or larger) in inground structures with reinforced concrete floor and walls to ICON standards. Medium and small (25mm - 40mm) may be in other approved commercial valve pits or prefab concrete pits with suitable bolt down or lockable covers.

Requirement: Assemble water meter pit components in accordance with current *ICON Water Supply and Sewerage Standards* and provide a small hinged flap to allow the water meter to be read without lifting the covers. Refer *ICON Water Supply and Sewerage Standards*.

Requirement: Major Component pits are to include drainage to nearest stormwater line (preferred) or to a soakage pit.

1.4.5.3 Final Pit location

Requirement: All valve boxes and component pit final locations are to be approved on site prior to installation.

This is a **HOLD POINT**.

1.4.6 Sprinklers

1.4.6.1 General.

General: Sprinklers are to be commercial grade pop up gear drive type with stainless steel riser, rubber caps and adjusted to the required arc setting as required. Sprinklers shall use nozzles in accordance with the design and offer matched precipitation or be of the same arc setting with the same nozzle on a station allowing for reduced operation time. Sprinklers shall be the type model brand or performance as noted on the design. Sprinklers shall be from the approved range of sprinklers refer to *MIS 18 Irrigation*.

General: Sprinklers shall generally attach to pipe work with a threaded fitting to the side of a lateral pipe or at the end of a pipe attached to a threaded elbow fitting.

Requirement: All sprinklers shall be mounted to manufactured swing arm assembly of equal or larger size to the thread on the inlet to the sprinkler and shall be not greater than 30° against the horizontal and which shall allow the sprinkler to be +/- 10mm of soil level.

Requirement: Sprinkler locations to perimeter of areas and or adjacent to pathways, kerbs, buildings, fences or other hard edges shall not be closer than 80mm and not greater than 150mm.

Requirement: All sprinklers are to be installed in a true and vertical position and compacted to ensure they maintain a vertical position.

Requirement: Sprinklers located within gardens

Sprinkler flush and fit off: This is a **HOLD POINT**.

1.4.7 Controllers including cabinets and cabling, cable conduiting

1.4.7.1 Controllers

General: All Controllers are to be located at eye height for ease of operation and programming unless directed and approved otherwise. Controllers shall include a minimum of 2 spare stations with a spare station for every 5 used stations. Eg 20 used stations, controller to be minimum 24 stations.

The controller installation shall include connection to 240vAC power twin GPO within the cabinet where it can be locked and not easily accessed or switched off.

Requirements: Controllers are to be straight and shall include the following components and connections:

- > Master solenoid valve.
- > Flow sensor (Note: Only where a flow sensor, as opposed to a pulse flow meter, is required to connect to the CIMS).
- > A local reference flow meter or flow meter with pulse output. Note: A reference flow meter is to be fitted in all cases. A pulse type meter is to be fitted where a flow sensor is not required. Pulse output should be maximum 1 pulse per litre up to and including 50mm meters; 1 pulse per 10 litres for meters 80mm and greater.
- > Local rain sensor.
- > Requirement: Final trench level to have a tolerance of +/-15mm when measured perpendicular across a trench with a straight edge resting on natural or designed surrounding finished surface levels.

All equipment connected to the controller shall be fully compatible and approved by the manufacturer of the control system.

GPRS (Data sim card and modem) connectivity. The client shall provide the sim card or where a sim card is supplied with the controller the sim card shall be registered with TCCS as the owner of the sim card and system unless requested otherwise in writing. The controller is to include all programming and loading of initial data, testing and calibration and verification of flow sensor and station "learned flow", flow rates. Rain sensors are to be vandal resistant and mounted in discrete and or tamper resistant locations.

1.4.7.2 General Cabinets and Controller Housing

General: Mount the controller in a pump house (if available), in a building service cupboard or other existing housing with external access (if available) or otherwise in a freestanding cabinet not less than 1200 high and generally not greater than 1800 high.

Requirement: Locate controller housings in unobtrusive locations:

- > Easily accessible for maintenance and operation;
- > Clear of sprinkler overspray; and
- > Providing the operator with a substantial view of the watered area from the controller.

Requirement: External Controller Cabinets are to be:

- > Constructed of brushed or matt finish stainless steel or powder coated steel with ventilation to the sides and to be vandal resistant complete with double or triple locking “hidden” swing padlock style lever handle; and
- > Sized to allow for the controller and other components to be operated & maintained from a standing position (or as otherwise required by current *Workplace Health & Safety regulations*).
- > When freestanding, cabinets may be powder coated steel to a colour as nominated by the Authorised Person. Free standing cabinets shall be on a suitable concrete plinth clear of the surrounding ground level by 80mm and extending minimum 150mm beyond the cabinet base with a bevel edge to ensure water does not run under or pool in the base of the cabinet. Spare conduits to be included when free standing and all conduits to enter and exit through a base slab with sweep bends. All accesses plugged with either a cap, expanda foam or silicone plug to prevent vermin entry. Free standing cabinets shall include internal bolting system sealed and firmly affixed to the concrete plinth.

Cabinets and or controllers are to incorporate a suitable line surge protector to provide lightning protection for controllers, master valves and valve wiring and ground earthing in accordance with the controller manufacturer.

Cabinets which require external access to the side or top for rain sensor mounting or external aerials etc shall include a grommet and silicone seal to eliminate water ingress. Generally wiring should enter and exit the cabinet via a conduit through the base or bottom of a cabinet.

1.4.7.3 Cable, Cable Conduit and pits

General: Controllers to be either conventional 24vac and individually wired or 2 wire decoder type. Controller cable is to be installed in conduit for additional protection. Conduit maybe omitted either: where noted on the design or when instructed by the client in writing.

Requirement: All cabling and cable joints are to be new and unblemished, undamaged and ends of cables inspected for any signs of corrosion damage or degradation prior to installation. Any signs or poor-quality or damaged cable shall be rejected, quarantined and removed from site at the first available opportunity.

Pits are to be installed at each 100m interval should there be no solenoid valves or system control isolation valve boxes between and a minimum of a 1m length to be looped in the pit. Cable pits shall be Viscount P2 pits with concrete lids. Pits are to be installed at cable ‘T’ junctions and any bends more than 90° where there are no nearby valve boxes where the cable junction could otherwise be made. Cable maybe looped in a solenoid valve box or control isolation valve bow where present in lieu of separate P2 Pits.

Cables are not to be stretched or pulled under excessive loads that could damage or kink the cable. The cable is to be fully inspected along the entire length as the cable is installed. Joints in the cable shall only be carried out by experienced personnel using a cable joint that is fully waterproof, Cables up to 1.5mm may use Gel-Tite connectors. Cables over 1.5mm shall use industry standards DBYR or other recognised gel filled cable jointing system. Heat shrink is not acceptable.

Cable ends are to be sealed at all times to prevent damage and water ingress. Heat shrink may be used as a temporary cover to cable ends and later cut off and discarded. Surge arrestors and grounding as required by the control system manufacturer is to be strictly followed.

1.4.7.4 Decoder cabling

Requirement: Where controllers are 2 wire decoder style, only decoder cable supplied and or approved by the manufacturer of the decoders and the control system is to be used. Cable is to be double insulated and is to be laid in the ground where possible beside, and in the shadow of the irrigation main line and laid in a poly or light duty electrical or communication conduit of minimum 32mm.

Joints in the cable shall only be carried out by approved and trained personnel using a cable joint that is fully waterproof and approved by the controller manufacturer DBYR or other industry recognised joint or supplied by the controller manufacturer, cable jointing system. Trained persons are to be noted and a statement of their training by the manufacturer acknowledged.

1.4.7.5 Conventional 24VAC Cabled Systems.

General: Conventional cabled 24VAC systems shall be wired with multi strand, multicore cable with minimal voltage drop. Voltage drop shall generally not be greater than 20% or less than 21.5volts at the furthest valve. Multicore cable shall be 3, 5, 7, 9 or 13 core. 0.5mm cable is not to be used in any system.

Requirement: The below sizes are a guide and to be checked and confirmed by the contractor for each situation given the final system installation cable route and are based on only one valve being operated at a time.

- > Typically minimum 1.0mm cable shall be used in runs up to 250m.
- > Typically 1.5mm cable maybe used in runs up to 400m.
- > Runs over 400m or where multiple valves are to be operated at once, a separate twin common cable maybe used in 2.5mm or 4.0mm to increase the run length and ensure minimum voltage drop requirements are maintained.

Only Black cables are to be used for the common. Active wires shall be any other colour. A minimum of 2 spare wires or more are to be available at the extremities of any system and 1 spare for every 5 wires used (excluding the common wire). Cable ends are to be sealed with either heat shrink or gel tite or other sealing device at all times to prevent damage and water ingress. All final cable joins are to be fully water proof in a suitable industry and commercial available cable joint such as Gel Tite or DBY joiners. All cable is to be double insulated and is to be laid in the ground where possible beside, and, in the shadow of the irrigation main line. It may be direct buried where adjacent to mainlines.

Where cables deviate away from irrigation pipes it is to be installed in a heavy duty orange electrical conduit of suitable size with minimum 450mm cover. Where cables are NOT in conduit they are to enter and exit solenoid valve pits through a low density or flex conduit cable sleeve and a minimum of a 1m length to be looped in the pit.

Cable pits: Cable Pits are to be installed at "T" junctions and any bends more than 95°. Cable pits shall be Viscount P2 pits with concrete lids or standard 9" round valve boxes may be used with a 225mm stormwater extension sleeve under. A coil of minimum 1 meter of cable is to be looped and placed in the pits at junctions.

Requirement: Cables are not to be stretched or pulled under excessive loads that could damage or kink the cable. Cables are to be fully inspected along the entire length as the cable is installed.

Requirement: Heat shrink "BB" and screw clip style electrical or "Telstra" cable joiners are not acceptable for any cable joining. Heat shrink may be used above ground in a cabinet and where water cannot access the joint.

1.4.8 Headworks

1.4.8.1 General

General: Headworks equipment shall be as required by the design in accordance with *MIS 18 Irrigation* and or as may be required by the local water authority to meet any current regulations or site-specific conditions, *AS3500*: and/or *ICON water*. The local water authority shall be the determining authority on any equipment required in the final headworks design and installation.

Requirement: Installation of the final installation of pits, meters and approvals shall be set out and approved prior to the installation. Shop drawings of any equipment buildings, cabinets etc are to be supplied by the contractor and approved by the client prior to construction.

1.5 Execution

1.5.1 Provision for traffic

1.5.1.1 General

Requirement: When working beside or near public pathways and roadways, kerb side or within road medians, Conform to *MITS 01 Traffic Management*.

1.5.2 Site establishment

1.5.2.1 Survey

General: Confirm site final design, site survey and determined final finished surface levels and benchmarks prior to set out. Allow for establishment and maintain any required survey or reference points to enable the installation and set out of the entire proposed design.

Requirement: Confirm the site set out against the plan and note any major discrepancy with any proposed solution and variation cost should such be necessary. Minor site changes are considered part and parcel of the work to be performed and minor changes do not require to be notified if there is no impact to sprinkler locations zoning or the system e=performance. Any and all changes to the proposed planned design are to be noted and recorded on a Work as executed document.

1.5.3 Proprietary equipment

1.5.3.1 Materials and Equipment

General: Order all required materials and equipment with sufficient lead time to achieve agreed program dates.

Requirement: The contractor is responsible for coordination with suppliers and meeting agreed construction timetables.

1.5.4 Excavations and unsuitable ground materials

1.5.4.1 Excavation and Trench Preparation

Clearing, Survey and Marking: Identify and pot hole (ground proof) all identified and or known existing or potential utilities and services.

Requirement: Coordinate with all other trades and services to be constructed.

Requirement: Carry out trench cut and fill as required to achieve the documented design.

1.5.4.2 Removal of unsuitable material:

General: Remove from site any excess, soft, weak, saturated or organic material within the trenched area and replace with suitable material. Imported bedding and initial backfill sand to be used on all major mainlines and areas of unsatisfactory ground material.

Requirement: Trimming: trim and shape level trench bases suitable for the installation of the pipework.

Requirement: On major pipe lines 80mm and above maintain grades between outlets and or installed air valves to ensure air entrapment is eliminated from large diameter pipes under pressure.

1.5.5 Testing

1.5.5.1 Trench Finished Levels

Requirement: All final trenches to be firmly compacted and top dressed with approved top dressing and finished heights which after settlement shall be +/-15mm when measured perpendicular across a trench with a straight edge resting on natural or the designed surrounding surface levels.

1.5.5.2 Testing

General: The whole system is generally to be fully tested and checked by the contractor prior to any requirement for inspection by any required authorised person. The contractor should be fully satisfied that the system is installed as designed and documented and is in every way completed to the standard required and as complete as possible for the section or the entire system prior to being inspected.

Requirement: Carry out pressure tests on mains in accordance with industry best practise and document.

This is a **HOLD POINT**.

Requirement: Test operation of all solenoid valves from the controller and set pressure regulation where fitted and adjust flow control. Check for suitable opening and closing times. Buried valves are to be fully tested and inspected and approved prior to final covering.

Requirement: Check and adjust all sprinklers for correct vertical straightness, height, compaction, arc setting, nozzles rotation and coverage.

Requirement: Where applicable conduct station "learned flows" and then set parameters within controller programming.

Requirement: On drip stations flush thoroughly before final sealing of each zone. Check and set pressure regulation and clean filters from any debris from line flushing. Check for leaks and damage and then record station flow rate.

Requirement: Check and adjust all final levels of all valve pits All at ground level pits to be flush +/-15mm of the immediate surrounding soil level.

Requirement: Undertake any modifications or adjustments necessary to address any unsatisfactory workmanship or materials or non compliances.

Requirement: A full system test, inspection and operation from the control system is required and any defects documented for rectification.

Full System inspection: This is a **HOLD POINT**.

1.6 Completion

1.6.1 Operation and Maintenance Documents

Requirement: Provide the following documents at completion:

- > Manufacturers / Suppliers Certificates certifying equipment has been installed in compliance with any Australian standards relevant (eg backflow devices, meter pits, electrical work etc) and meets the design requirements.
- > Installers certificate certifying equipment has been installed in compliance with the design and design performance
- > Warranty certificates
- > Manufacturers / Suppliers inspection, maintenance and operation manuals.
- > Certificate Of Compliance: Provide and written statement on a business letterhead stating the system has been installed witnessed and complies with the design and installation standards. The certificate shall provide the date the system reached practical completion (was operational generally in full from the control system) and signed by the principle responsible person for system installation.

This is a **HOLD POINT**.

1.6.2 Submissions

Work as Executed Records: To *MITS 00B Quality Requirements*.

This is a **HOLD POINT**.

Changes: Any and all changes made during the installation of the system that differs from the original design are to be documented daily. The final system is to be surveyed and changes are made on the original design or the entire system redrawn.

This is a **WITNESS POINT**.

Coordinates: All buried solenoid valves and any unavoidable cable junctions shall include triangulation measurements to aid in future location.

1.6.3 Operational Acceptance and Final Inspection

Testing: Ensure that full system access and operation can be demonstrated in the presence of any required or requested client representative(s).

This is a **HOLD POINT**.

2. MEASUREMENT AND PAYMENT

2.1 Measurement

2.1.1 General

Payments made to the Bill of Quantities: To *MIT5 00A General requirements*, this Specification, the drawings and **Pay items**.

2.1.2 Methodology

The following methodology will be applied for measurement and payment:

- > Allow for all work, materials, testing and quality assurance requirements in each Pay Item.
- > Schedule of rates scope: All pay items include coordination, supply, installation, excavation backfilling compaction topsoiling placement of all propriety equipment as designed and to the minimum requirements of this Specification.
- > Water supply mains, ties and meters: To *MIT5 03E Water Supply Reticulation*.

2.2 Pay items

Table 9D-3 Pay items table

Item No	Pay items	Unit of Measurement	Schedule of rates scope
9D.1	Headworks	Item	All activities associated with the approval, procurement and installation of a water supply connection to an Icon Water meter or other approved water supply source as specified.
9D.2	Control system	Number of control systems	All activities associated with the supply and installation of the control system including connection to existing electrical and telecommunications infrastructure and commissioning.
9D.3	Control system cabling	Linear metre of control system cabling	All activities associated with the supply and installation of electrical cable and conduits, including excavation of trenches in all types of material encountered including rock, supply and laying of conduits and supply and pulling of cable, jointing, backfilling, compaction and connection to the control system and commissioning of the cable.
9D.4	Pipe work	Linear metre of pipe work	All activities associated with construction of pipe work for irrigation systems including excavation of trenches in all types of material encountered including rock, over excavation for bedding, supply and laying of pipes, additional excavation at structures, bedding, jointing, markers, fittings, backfilling, compaction and flushing. This pay item shall also include pipe cutting and connection to existing and/or new pipes. Separate pay items shall be included in the Contract for each pipe material, class of pipe and pipe diameter.

Item No	Pay items	Unit of Measurement	Schedule of rates scope
9D.5	Valves	Number of valves	<p>All activities associated with the construction of valves for irrigation systems including excavation of trenches in all types of material encountered including rock, supply and installation of valves, bedding, backfilling, compaction and flushing.</p> <p>Separate pay items shall be included in the Contract for each valve material, class of pipe and valve type.</p>
9D.6	Sprinklers	Number of sprinklers	<p>All activities associated with the construction of sprinklers for irrigation systems including excavation of trenches in all types of material encountered including rock, supply and installation of sprinklers, bedding, backfilling, compaction and flushing.</p> <p>Separate pay items shall be included in the Contract for each sprinkler material, class of pipe and sprinkler type.</p>
9D.7	Pumps and filters, housing etc	Item	<p>All activities associated with approval procurement and installation of water supply and connection thereto including excavation, removal of material, construction backfill, topsoil and reinstatement.</p>
9D.8	Operations manual and WAE plans, warranties certificates of compliance	Item	<p>All activities associated with the preparation and TCCS acceptance of system documentation, including the operation manual, warranties, QA records and Work As Executed documentation.</p>



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